PW4152, PW4152 (-3), PW4156A, PW4156A (-3), PW4158, PW4158 (-3)

(SEE INTRODUCTION SECTION FOR APPLICABLE ENGINE CONFIGURATIONS)

TURBOFAN ENGINES

ENGINE MANUAL

PART NO. 50A443

RELATED ENGINE CLEANING
INSPECTION AND REPAIR (CIR) MANUAL
PART NO. 51A357

VOLUME NO. 1
OF
8 VOLUMES

INITIAL ISSUE DATE
MARCH 1/86

REVISED JANUARY 1/08

FAA APPROVED/ACCEPTED

The Federal Aviation Administration (FAA) has reviewed the Instructions for Continued Airworthiness (ICA) submitted pursuant to FAA Part 33 for the engine models listed. The ICA were found to be acceptable and the Airworthiness Limitations Section contained therein is hereby approved.

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NOTE: REFERENCED STANDARD PRACTICE MANUAL PROCEDURES CAN NOW BE ACCESSED VIA THE PRATT & WHITNEY ONLINE SERVICES WEBSITE BY CLICKING ON THE ASSOCIATED HYPERLINK. INTERNET ACCESS AND AN ONLINE SERVICE ID ARE REQUIRED. CLICK HERE FOR MORE INFORMATION ON HOW TO REGISTER.

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MAIN

SEARCH

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Pratt & Whitney
400 Main Street
East Hartford, CT 06108

Pratt & Whitney
A United Technologies Company

JAN 1/08

Subject: PW4000 Engine Manual, Part Number 50A443, Revision Number 85, dated January 1, 2008

Please put these revision pages in the manual and remove the superseded pages as shown in the applicable List of Effective Pages.

Make a record on the Record of Revisions Sheet that this revision was put in the manual.

A document evaluation form is included with this revision to assist us in improving the quality of our technical manuals. Please distribute this form to the end-user of this document for completion.

Each revision to this manual will include a "PW4000 Supplemental Consumable Materials Index". The supplemental index provides information concerning materials which have just been added to this manual. These new materials will be included in the next revision to the master index.

If there is a question on manual content, send it to Thomas M. Mann, Supervisor, Technical Writing, Maintenance Data Engineering. The telephone number is (860) 565-2994 and the fax number is (860) 565-4503.

To be sure that revision service is continuous, please send any change in address or revision requirements to me.

Sincerely,

Joan C. Olson
Supervisor, Distribution
Maintenance Data Engineering

TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 85 DATED JANUARY 1, 2008

HIGHLIGHTS - POWER PLANT GENERAL - TESTING

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
71-00-00 TESTING-09	1335	Revised the procedure to Check Filters to add a step to look for bronze contamination in the fuel filters. (IEN07KC819)	CONFIG-1 ALL
71-00-00 TESTING-09	1339	Revised the procedure to Check Filters to add a step to look for bronze contamination in the fuel filters. (IEN07KC819)	CONFIG-2 ALL
71-00-00 TESTING-09	1336	Revised the procedure to Check Filters to add a step to look for bronze contamination in the fuel filters. (IEN07KC819)	CONFIG-3 ALL
71-00-00 TESTING-09	1340	Revised the procedure to Check Filters to add a step to look for bronze contamination in the fuel filters. (IEN07KC819)	CONFIG-5 ALL

TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 85 DATED JANUARY 1, 2008

HIGHLIGHTS - ENGINE GENERAL

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-00-00 INSP/CHK-01E	802 -817 820 -834	Relocated material and revised borescope inspection limits and related figures for the Stage 1 HPT vanes. (IEN 06KC957B) Revised the table format. (Editorial)	CONFIG-1 4152 4152-3 4156A 4156A-3 4158 4158-3
72-00-00 INSP/CHK-01E	803 805 -819 822 -836	Relocated material and revised borescope inspection limits and related figures for the Stage 1 HPT vanes. (IEN 06KC957B) Revised the table format. (Editorial)	CONFIG-2 4152 4152-3 4156A 4156A-3 4158 4158-3

TO: RECIPIENTS OF PW4152, PW4152−3, PW4156A, PW4156A−3,
PW4158, PW4158−3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 85 DATED JANUARY 1, 2008

HIGHLIGHTS − ENGINE GENERAL − DIFFUSER AND COMBUSTOR

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72−00−41 INSTALL−07	401 −402	Added a caution for thread lubricant and added reference to clean the boss threads. (PSAF07KC464)	ALL

Pratt & Whitney

PW4000 SERIES ENGINE MANUAL (PN 50A443)

TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 85 DATED JANUARY 1, 2008

HIGHLIGHTS - ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT)

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-00-52 INSP/CHK-03	801 -811/ 812	Added a new permeability inspection check for internal sulfidation distress. (IEN07KC498)	ALL
72-00-52 INSP/CHK-10	804	Revised to add a new permeability inspection requirement. (IEN07KC498)	ALL

Pratt & Whitney
PW4000 SERIES ENGINE MANUAL (PN 50A443)

TO: RECIPIENTS OF PW4152, PW4152−3, PW4156A, PW4156A−3,
PW4158, PW4158−3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 85 DATED JANUARY 1, 2008

HIGHLIGHTS − LOW PRESSURE COMPRESSOR (LPC)

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72−31−00 INSP/CHK−04	808 815 −816	Revised Reverence Number 1581 to add a NOTE concerning the hub oversized tierod hole diameters and revised task numbers. (Reference IEN99KA127, Editorial)	ALL

Pratt & Whitney
PW4000 SERIES ENGINE MANUAL (PN 50A443)

TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 85 DATED JANUARY 1, 2008

HIGHLIGHTS - HIGH PRESSURE COMPRESSOR (HPC)

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-35-00 ASSEMBLY-06	1009	Revised Figure 1002 to add marking area. (EDITORIAL)	CONFIG-1 4152 4152-3 4156A 4156A-3 4158 4158-3
72-35-01 INSP/CHK-03	802 -803	Added new blade tip coating chip limits. Items re-numbered. (IEN07KC150, 07KC163, Reference)	ALL
72-35-01 ASSEMBLY-02	1002 1004 1010	Revised the balance procedure to delete the service bulletin application and Figure 1003 (Sheet 1) and renumbered Figure 1003. (IEN95KCF45)	CONFIG-1 4152 4156A 4158
72-35-01 ASSEMBLY-02	1001 -1002 1004 1010	Revised the balance procedure to delete the service bulletin application and Figure 1003 (Sheet 1) and renumbered Figure 1003. (IEN95KCF45)	CONFIG-2 4152-3 4156A-3 4158-3

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-35-01 ASSEMBLY-21	1002 1013 1017 1019 1035 1039 -1040 1061 -1062	Added drum rotors PN 54H803-002, 56H013-001, and 58H236-01 (Post PW4ENG 72-750). Revised the text and figure captions. Revised Figure 1010 (Sheet 1) and Figure 1016 (Sheet 1) to relocate Index 2 at the 10 o'clock position. (Editorial)	CONFIG-2 4152-3 4156A-3 4158-3
72-35-01 ASSEMBLY-23	1002 1013 1017 1019 1036 1038	Added drum rotors PN 54H803-002, 56H013-001, and 58H236-01. (Post PW4ENG 72-750) Revised the text and figure captions. (Editorial)	CONFIG-2 4152-3 4156A-3 4158-3
72-35-02 ASSEMBLY-01	1001 1022 1024 1026 -1028	Revised the text and related figure to add the PWA 102728 Gage (Post SB PW4ENG 72-743) to check that the vane arm is assembled correctly. (TDS 102728) Revised the text. (Editorial)	CONFIG-2 4152 4152-3 4156A 4156A-3 4158 4158-3

TO: RECIPIENTS OF PW4152, PW4152−3, PW4156A, PW4156A−3,
PW4158, PW4158−3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 85 DATED JANUARY 1, 2008

HIGHLIGHTS − LOW PRESSURE TURBINE (LPT)

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72−53−06 DISASSY−01	501	Corrected the quantity of blade locks. (CACTUSR7207−Q59168)	ALL

TO: RECIPIENTS OF PW4152, PW4152−3, PW4156A, PW4156A−3,
PW4158, PW4158−3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 85 DATED JANUARY 1, 2008

HIGHLIGHTS − MAIN GEARBOX

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72−61−00 ASSEMBLY−01	1023 −1025	Added steps to lubricate the idler gear bearing inner diameter. (CACTUSC3337−G29581) Relocated material. (Editorial)	ALL

TO: RECIPIENTS OF PW4000 SERIES ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 085 DATED JAN 01/08

TEMPORARY REVISION HIGHLIGHTS

INACTIVE

The following Temporary Revisions are now inactive and should be removed from your PRINTED MANUALS and from the file of Temporary Revisions used in conjunction with MICROFILM.

Temp. No.	Rev.	Manual Location	Remarks	Effectivity
None				

ACTIVE

Revision No. 085 Dated JAN 01/08

The following Temporary Revisions and any issued after OCT 19/07 are still active.

Any succeeding Temporary Revisions must be retained in PRINTED MANUALS and the file of Temporary Revisions used in cunjunction with MICROFILM until otherwise directed by subsequent filing instructions.

Temp. No.	Rev.	Manual Location	Remarks	Effectivity
None				

INTRODUCTION

INTRODUCTION

1. General

   A. This supplemental index lists the consumable materials which have been added to this manual since the last revision of the Master Consumable Materials Index PN 50A542.

   B. This supplement should be used with the Master Consumable Materials Index until the next revision to that document. The next revision to the Master Consumable Materials Index will incorporate the information contained in this supplement.

   C. Refer to the PW4000/PW6000 Series Master Consumable Materials Index PN 50A542 for more information.

2. Supplier Code Address List

   A. The addresses of the material manufacturers which are not included in the current published revision of the PW4000/PW6000 Series Master Consumable Materials Index PN 50A542 are listed in the following table.

Supplier Code	Name/Address

No supplemental information is required for this revision. Refer to the Master Consumable Materials Index, Part Number 50A542.

SUPPLEMENTAL CONSUMABLE MATERIALS LIST

SUPPLEMENTAL CONSUMABLE MATERIALS LIST

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE

No supplemental information is required for this revision. Refer to the Master Consumable Materials Index, Part Number 50A542.

SERVICE BULLETIN LIST--NACELLE

NACELLE

Service Bulletins listed are those applicable to engine models covered in this manual. For those bulletins listed as incorporated, the manual provides information on engine parts or configurations for both before and after bulletin compliance.

"RETROFIT": Intent of the Service Bulletin has been incorporated in the manual and that, because the configuration prior to the Service Bulletin does not exist in service, the prior configuration is not covered in the manual.

"NO EFFECT": No change to the manual was necessary as a result of the Service Bulletin issue. (If no separate entry appears for the CIR MANUAL PN 51A357, the term "NO EFFECT" means that no change was necessary to either the Engine Manual or the CIR Manual.)

"CANCELED": Service Bulletin has been canceled. Parts or configurations introduced by the bulletin are not covered in the manual.

"CIR": New part numbers introduced by the Service Bulletin have been incorporated into the CIR MANUAL - PN 51A357.

SB NO.	DATE INCORP	SB NO.	DATE INCORP
PW4NAC 23-1	NO EFFECT	PW4NAC 36-6 R2	10-15-89
PW4NAC 24-2	NO EFFECT	PW4NAC 36-7 R3	NO EFFECT
PW4NAC 26-2	NO EFFECT	PW4NAC 36-8 R2	10-15-89
PW4NAC 26-3 R3	NO EFFECT	PW4NAC 36-9	10-15-89
PW4NAC 26-4	NO EFFECT	PW4NAC 36-10	NO EFFECT
PW4NAC 26-5	NO EFFECT	PW4NAC 36-11 R1	NO EFFECT
PW4NAC 26-6 R1	NO EFFECT	PW4NAC 36-12 R1	NO EFFECT
PW4NAC 26-7 R3	NO EFFECT	PW4NAC 71-1 R2	NO EFFECT
PW4NAC 29-1 R1	NO EFFECT	PW4NAC 71-6 R1	NO EFFECT
PW4NAC 29-2	NO EFFECT	PW4NAC 71-13	NO EFFECT
PW4NAC 29-3 R2	NO EFFECT	PW4NAC 71-16	NO EFFECT
PW4NAC 29-5 R1	NO EFFECT	PW4NAC 71-17 R2	NO EFFECT
PW4NAC 29-7 R1	NO EFFECT	PW4NAC 71-19	NO EFFECT
PW4NAC 30-4 R1	NO EFFECT	PW4NAC 71-22	NO EFFECT
PW4NAC 30-6	NO EFFECT	PW4NAC 71-28	NO EFFECT
PW4NAC 30-7 R2	NO EFFECT	PW4NAC 71-30 R1	NO EFFECT
PW4NAC 30-8 R3	NO EFFECT	PW4NAC 71-32	NO EFFECT
PW4NAC 30-9	NO EFFECT	PW4NAC 71-36	NO EFFECT
PW4NAC 30-10	NO EFFECT	PW4NAC 71-37 R1	NO EFFECT
PW4NAC 36-4 R1	10-15-89	PW4NAC 71-38 R1	NO EFFECT
PW4NAC 36-5 R6	NO EFFECT	PW4NAC 71-40 R1	NO EFFECT

SERVICE BULLETIN LIST--NACELLE

SB NO.	DATE INCORP	SB NO.	DATE INCORP
PW4NAC 71-41	NO EFFECT	PW4NAC 71-99 R1	NO EFFECT
PW4NAC 71-42	NO EFFECT	PW4NAC 71-100	06-15-93
PW4NAC 71-44 R1	NO EFFECT	PW4NAC 71-101	NO EFFECT
PW4NAC 71-45	NO EFFECT	PW4NAC 71-102 R1	NO EFFECT
PW4NAC 71-46 R1	NO EFFECT	PW4NAC 71-103	NO EFFECT
PW4NAC 71-47 R2	NO EFFECT	PW4NAC 71-104 R2	NO EFFECT
PW4NAC 71-48	NO EFFECT	PW4NAC 71-105 R2	NO EFFECT
PW4NAC 71-51 R2	NO EFFECT	PW4NAC 71-106	NO EFFECT
PW4NAC 71-52	NO EFFECT	PW4NAC 71-107 R1	NO EFFECT
PW4NAC 71-53	NO EFFECT	PW4NAC 71-108 R1	NO EFFECT
PW4NAC 71-54	NO EFFECT	PW4NAC 71-109 R1	NO EFFECT
PW4NAC 71-55	NO EFFECT	PW4NAC 71-110	NO EFFECT
PW4NAC 71-56	NO EFFECT	PW4NAC 71-111 R2	NO EFFECT
PW4NAC 71-57 R2	NO EFFECT	PW4NAC 71-113 R1	NO EFFECT
PW4NAC 71-58	NO EFFECT	PW4NAC 71-114	NO EFFECT
PW4NAC 71-59	NO EFFECT	PW4NAC 71-115	NO EFFECT
PW4NAC 71-60 R2	NO EFFECT	PW4NAC 71-116 R2	NO EFFECT
PW4NAC 71-62	NO EFFECT	PW4NAC 71-119	NO EFFECT
PW4NAC 71-63	NO EFFECT	PW4NAC 71-121 R1	NO EFFECT
PW4NAC 71-65	NO EFFECT	PW4NAC 71-124	NO EFFECT
PW4NAC 71-66 R1	NO EFFECT	PW4NAC 71-127	NO EFFECT
PW4NAC 71-68	NO EFFECT	PW4NAC 71-128 R1	NO EFFECT
PW4NAC 71-69	NO EFFECT	PW4NAC 71-129 R1	NO EFFECT
PW4NAC 71-70 R3	06-15-93	PW4NAC 71-140 R2	NO EFFECT
PW4NAC 71-72 R1	NO EFFECT	PW4NAC 71-148	NO EFFECT
PW4NAC 71-73 R2	NO EFFECT	PW4NAC 71-152	NO EFFECT
PW4NAC 71-75 R1	NO EFFECT	PW4NAC 73-1 R2	NO EFFECT
PW4NAC 71-76 R1	NO EFFECT	PW4NAC 73-2	NO EFFECT
PW4NAC 71-77 R3	NO EFFECT	PW4NAC 73-3 R3	NO EFFECT
PW4NAC 71-78 R3	NO EFFECT	PW4NAC 73-4 R2	NO EFFECT
PW4NAC 71-79	NO EFFECT	PW4NAC 73-5 R1	NO EFFECT
PW4NAC 71-80 R3	06-15-93	PW4NAC 73-6 R3	NO EFFECT
PW4NAC 71-81	NO EFFECT	PW4NAC 73-7	NO EFFECT
PW4NAC 71-82 R1	NO EFFECT	PW4NAC 73-8 R1	NO EFFECT
PW4NAC 71-84	NO EFFECT	PW4NAC 73-9	NO EFFECT
PW4NAC 71-85 R1	NO EFFECT	PW4NAC 74-7	NO EFFECT
PW4NAC 71-86 R1	NO EFFECT	PW4NAC 74-8	NO EFFECT
PW4NAC 71-87	NO EFFECT	PW4NAC 75-2	NO EFFECT
PW4NAC 71-88 R1	NO EFFECT	PW4NAC 75-3 R2	NO EFFECT
PW4NAC 71-89 R2	NO EFFECT	PW4NAC 75-4 R1	NO EFFECT
PW4NAC 71-90 R1	NO EFFECT	PW4NAC 75-5 R1	NO EFFECT
PW4NAC 71-92	NO EFFECT	PW4NAC 75-6 R2	NO EFFECT
PW4NAC 71-93	NO EFFECT	PW4NAC 75-7	NO EFFECT
PW4NAC 71-94	NO EFFECT	PW4NAC 75-8 R1	NO EFFECT
PW4NAC 71-97	NO EFFECT	PW4NAC 75-9 R1	NO EFFECT
PW4NAC 71-98 R1	NO EFFECT	PW4NAC 75-10	NO EFFECT

SERVICE BULLETIN LIST--NACELLE

SB NO.	DATE INCORP	SB NO.	DATE INCORP
PW4NAC 75-11 R1	NO EFFECT	PW4NAC 78-56	NO EFFECT
PW4NAC 75-12 R1	NO EFFECT	PW4NAC 78-59 R1	NO EFFECT
PW4NAC 75-101 R1	NO EFFECT	PW4NAC 78-60	NO EFFECT
PW4NAC 77-1	NO EFFECT	PW4NAC 78-62 R1	NO EFFECT
PW4NAC 77-15 R1	NO EFFECT	PW4NAC 78-63	NO EFFECT
PW4NAC 78-3 R5	NO EFFECT	PW4NAC 78-64	NO EFFECT
PW4NAC 78-6 R1	NO EFFECT	PW4NAC 78-78	NO EFFECT
PW4NAC 78-9	NO EFFECT	PW4NAC 78-117	NO EFFECT
PW4NAC 78-12	NO EFFECT	PW4NAC 78-118	NO EFFECT
PW4NAC 78-13 R1	NO EFFECT	PW4NAC 79-1	NO EFFECT
PW4NAC 78-19	NO EFFECT	PW4NAC 79-4	NO EFFECT
PW4NAC 78-20 R1	NO EFFECT	PW4NAC 79-5 R3	NO EFFECT
PW4NAC 78-21 R3	NO EFFECT	PW4NAC 79-7 R1	NO EFFECT
PW4NAC 78-23	NO EFFECT	PW4NAC 79-8	NO EFFECT
PW4NAC 78-24 R2	NO EFFECT	PW4NAC 79-9 R1	NO EFFECT
PW4NAC 78-25 R2	NO EFFECT	PW4NAC 79-10 R3	NO EFFECT
PW4NAC 78-29	NO EFFECT	PW4NAC 79-11 R1	NO EFFECT
PW4NAC 78-30 R1	NO EFFECT	PW4NAC 79-13 R1	NO EFFECT
PW4NAC 78-31 R1	NO EFFECT	PW4NAC 79-14 R3	NO EFFECT
PW4NAC 78-32 R2	NO EFFECT	PW4NAC 79-15	NO EFFECT
PW4NAC 78-33 R3	NO EFFECT	PW4NAC 79-16	NO EFFECT
PW4NAC 78-37 R2	NO EFFECT	PW4NAC 79-17	NO EFFECT
PW4NAC 78-38 R1	NO EFFECT	PW4NAC 79-18 R1	NO EFFECT
PW4NAC 78-39 R1	NO EFFECT	PW4NAC 79-53 R1	NO EFFECT
PW4NAC 78-40 R1	NO EFFECT	PW4NAC 79-68	NO EFFECT
PW4NAC 78-41	NO EFFECT	PW4NAC 79-69	NO EFFECT
PW4NAC 78-43	NO EFFECT	PW4NAC 79-73	NO EFFECT
PW4NAC 78-44 R1	NO EFFECT	PW4NAC 79-75	03-15-96
PW4NAC 78-45 R2	NO EFFECT	PW4NAC 79-76	06-15-96
PW4NAC 78-46 R1	CANCELLED	PW4NAC 80-2	NO EFFECT
PW4NAC 78-49 R1	NO EFFECT	PW4NAC 80-3	NO EFFECT
PW4NAC 78-50	NO EFFECT	PW4NAC 80-4	NO EFFECT
PW4NAC 78-51	NO EFFECT	PW4NAC 80-5	NO EFFECT
PW4NAC 78-53	NO EFFECT	PW4NAC 80-6	NO EFFECT
PW4NAC 78-54	NO EFFECT	PW4NAC 80-7 R1	NO EFFECT
PW4NAC 78-55 R6	NO EFFECT	PW4NAC 80-10 R1	NO EFFECT

SERVICE BULLETIN LIST--ENGINE

ENGINE

Service Bulletins listed are those applicable to engine models covered in this manual. For those bulletins listed as incorporated, the manual provides information on engine parts or configurations for both before and after bulletin compliance.

"RETROFIT": Intent of the Service Bulletin has been incorporated in the manual and that, because the configuration prior to the Service Bulletin does not exist in service, the prior configuration is not covered in the manual.

"NO EFFECT": No change to the manual was necessary as a result of the Service Bulletin issue. (If no separate entry appears for the CIR MANUAL, PN 51A357, the term "NO EFFECT" means that no change was necessary to either the Engine Manual or the CIR Manual.)

"CANCELED": Service Bulletin has been canceled. Parts or configurations introduced by the bulletin are not covered in the manual.

"CIR": New part numbers introduced by the Service Bulletin have been incorporated into the CIR MANUAL - PN 51A357.

SB NO.	DATE INCORP	SB NO.	DATE INCORP
238 R62	NO EFFECT	PW4ENG 72-1 R2	NO EFFECT
2016 R29	NO EFFECT	PW4ENG 72-1 R3	NO EFFECT
P0351 R12	NO EFFECT	PW4ENG 72-1 R4	NO EFFECT
PW4ENG 24-2	03-01-86	PW4ENG 72-2	RETROFIT
PW4ENG 24-3	RETROFIT	PW4ENG 72-2 R1	RETROFIT
PW4ENG 24-4	07-15-89	PW4ENG 72-3	RETROFIT
PW4ENG 24-5	NO EFFECT	PW4ENG 72-3 R1	RETROFIT
PW4ENG 24-6	NO EFFECT	PW4ENG 72-4	RETROFIT
PW4ENG 24-6 R1	NO EFFECT	PW4ENG 72-4 R1	RETROFIT
PW4ENG 24-7	NO EFFECT	PW4ENG 72-5	RETROFIT
PW4ENG 24-7 R1	NO EFFECT	PW4ENG 72-5 R1	RETROFIT
PW4ENG 24-7 R2	NO EFFECT	PW4ENG 72-6	RETROFIT
PW4ENG 24-8	NO EFFECT	PW4ENG 72-6 R1	RETROFIT
PW4ENG 24-8 R1	NO EFFECT	PW4ENG 72-7	RETROFIT
PW4ENG 24-8 R2	NO EFFECT	PW4ENG 72-7 R1	RETROFIT
PW4ENG 24-9	12-15-96	PW4ENG 72-7 R2	RETROFIT
PW4ENG 24-9 R1	12-15-96	PW4ENG 72-7 R3	RETROFIT
PW4ENG 24-10	03-15-97	PW4ENG 72-7 R4	RETROFIT
PW4ENG 24-11	NO EFFECT	PW4ENG 72-7 R5	RETROFIT
PW4ENG 72-1	NO EFFECT	PW4ENG 72-7 R6	RETROFIT
PW4ENG 72-1 R1	NO EFFECT	PW4ENG 72-8	RETROFIT

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SB NO.	DATE INCORP
PW4ENG 72-8 R1	RETROFIT
PW4ENG 72-9	RETROFIT
PW4ENG 72-9 R1	RETROFIT
PW4ENG 72-10	RETROFIT
PW4ENG 72-11	RETROFIT
PW4ENG 72-11 R1	RETROFIT
PW4ENG 72-12	RETROFIT
PW4ENG 72-12 R1	RETROFIT
PW4ENG 72-13	RETROFIT
PW4ENG 72-13 R1	RETROFIT
PW4ENG 72-13 R2	RETROFIT
PW4ENG 72-16	NO EFFECT
PW4ENG 72-17	RETROFIT
PW4ENG 72-17 R1	RETROFIT
PW4ENG 72-17 R2	RETROFIT
PW4ENG 72-17 R3	RETROFIT
PW4ENG 72-17 R4	RETROFIT
PW4ENG 72-17 R5	NO EFFECT
PW4ENG 72-18	RETROFIT
PW4ENG 72-18 R1	RETROFIT
PW4ENG 72-18 R2	NO EFFECT
PW4ENG 72-19	RETROFIT
PW4ENG 72-19 R1	RETROFIT
PW4ENG 72-19 R2	RETROFIT
PW4ENG 72-21	RETROFIT
PW4ENG 72-21 R1	RETROFIT
PW4ENG 72-22	RETROFIT
PW4ENG 72-22 R1	RETROFIT
PW4ENG 72-22 R2	RETROFIT
PW4ENG 72-23	RETROFIT
PW4ENG 72-23 R1	RETROFIT
PW4ENG 72-26	RETROFIT
PW4ENG 72-26 R1	RETROFIT
PW4ENG 72-27	RETROFIT
PW4ENG 72-27 R1	RETROFIT
PW4ENG 72-28	RETROFIT
PW4ENG 72-28 R1	RETROFIT
PW4ENG 72-28 R2	RETROFIT
PW4ENG 72-29	RETROFIT
PW4ENG 72-29 R1	RETROFIT
PW4ENG 72-30	03-01-86
PW4ENG 72-30 R1	03-01-86
PW4ENG 72-31	RETROFIT
PW4ENG 72-32	01-15-88
PW4ENG 72-33	RETROFIT
PW4ENG 72-34	RETROFIT
PW4ENG 72-34 R1	NO EFFECT
PW4ENG 72-35	07-15-87
PW4ENG 72-36	RETROFIT
PW4ENG 72-37	RETROFIT
PW4ENG 72-37 R1	NO EFFECT
PW4ENG 72-38	RETROFIT
PW4ENG 72-38 R1	RETROFIT
PW4ENG 72-38 R2	RETROFIT
PW4ENG 72-39	RETROFIT
PW4ENG 72-40	07-15-87
PW4ENG 72-41	RETROFIT
PW4ENG 72-41 R1	RETROFIT
PW4ENG 72-42	04-15-87
PW4ENG 72-43	RETROFIT
PW4ENG 72-43 R1	RETROFIT
PW4ENG 72-44	RETROFIT
PW4ENG 72-44 R1	RETROFIT
PW4ENG 72-44 R2	RETROFIT
PW4ENG 72-45	RETROFIT
PW4ENG 72-45 R1	RETROFIT
PW4ENG 72-46	03-01-86
PW4ENG 72-46 R1	NO EFFECT
PW4ENG 72-47	RETROFIT
PW4ENG 72-47 R1	RETROFIT
PW4ENG 72-48	01-15-88
PW4ENG 72-48 R1	01-15-88
PW4ENG 72-48 R2	01-15-88
PW4ENG 72-48 R3	04-15-90
PW4ENG 72-48 R4	04-15-90
PW4ENG 72-49	04-15-91
PW4ENG 72-50	07-15-88
PW4ENG 72-51	07-15-87
PW4ENG 72-51 R1	07-15-87
PW4ENG 72-53	RETROFIT
PW4ENG 72-53 R1	RETROFIT
PW4ENG 72-54	RETROFIT
PW4ENG 72-54 R1	RETROFIT
PW4ENG 72-55	RETROFIT
PW4ENG 72-56	RETROFIT
PW4ENG 72-56 R1	RETROFIT
PW4ENG 72-58	NO EFFECT
PW4ENG 72-59	03-01-86
PW4ENG 72-60	RETROFIT
PW4ENG 72-60 R1	RETROFIT
PW4ENG 72-61	RETROFIT
PW4ENG 72-61 R1	RETROFIT

SB NO.	DATE INCORP	SB NO.	DATE INCORP
PW4ENG 72-61 R2	RETROFIT	PW4ENG 72-85	07-15-87
PW4ENG 72-62	RETROFIT	PW4ENG 72-86	07-15-88
PW4ENG 72-63	RETROFIT	PW4ENG 72-86 R1	NO EFFECT
PW4ENG 72-63 R1	RETROFIT	PW4ENG 72-87	RETROFIT
PW4ENG 72-64	01-15-88	PW4ENG 72-87 R1	NO EFFECT
PW4ENG 72-64 R1	01-15-88	PW4ENG 72-88	03-01-86
PW4ENG 72-64 R2	01-15-88	PW4ENG 72-89	03-01-86
PW4ENG 72-65	RETROFIT	PW4ENG 72-90	03-01-86
PW4ENG 72-65 R1	RETROFIT	PW4ENG 72-90 R1	03-01-86
PW4ENG 72-65 R2	NO EFFECT	PW4ENG 72-91	03-01-86
PW4ENG 72-65 R3	RETROFIT	PW4ENG 72-92	03-01-86
PW4ENG 72-66	NO EFFECT	PW4ENG 72-93	RETROFIT
PW4ENG 72-67	RETROFIT	PW4ENG 72-93 R1	RETROFIT
PW4ENG 72-68	RETROFIT	PW4ENG 72-93 R2	NO EFFECT
PW4ENG 72-68 R1	RETROFIT	PW4ENG 72-94	03-01-86
PW4ENG 72-69	RETROFIT	PW4ENG 72-94 R1	03-01-86
PW4ENG 72-69 R1	RETROFIT	PW4ENG 72-95	RETROFIT
PW4ENG 72-69 R2	NO EFFECT	PW4ENG 72-95 R1	RETROFIT
PW4ENG 72-70	03-01-86	PW4ENG 72-96	NO EFFECT
PW4ENG 72-71	RETROFIT	PW4ENG 72-97	04-15-88
PW4ENG 72-71 R1	RETROFIT	PW4ENG 72-98	RETROFIT
PW4ENG 72-72	RETROFIT	PW4ENG 72-99	07-15-87
PW4ENG 72-73	07-15-87	PW4ENG 72-100	03-01-86
PW4ENG 72-73 R1	07-15-87	PW4ENG 72-100 R1	03-01-86
PW4ENG 72-74	03-01-86	PW4ENG 72-101	03-01-86
PW4ENG 72-74 R1	NO EFFECT	PW4ENG 72-102	NO EFFECT
PW4ENG 72-74 R2	NO EFFECT	PW4ENG 72-103	RETROFIT
PW4ENG 72-75	RETROFIT	PW4ENG 72-104	RETROFIT
PW4ENG 72-76	RETROFIT	PW4ENG 72-104 R1	10-15-88
PW4ENG 72-76 R1	RETROFIT	PW4ENG 72-105	RETROFIT
PW4ENG 72-76 R2	RETROFIT	PW4ENG 72-106	03-01-86
PW4ENG 72-76 R3	NO EFFECT	PW4ENG 72-106 R1	03-01-86
PW4ENG 72-77	RETROFIT	PW4ENG 72-106 R2	NO EFFECT
PW4ENG 72-78	RETROFIT	PW4ENG 72-106 R3	NO EFFECT
PW4ENG 72-79	RETROFIT	PW4ENG 72-106 R4	NO EFFECT
PW4ENG 72-80	RETROFIT	PW4ENG 72-106 R5	NO EFFECT
PW4ENG 72-80 R1	RETROFIT	PW4ENG 72-106 R6	NO EFFECT
PW4ENG 72-81	RETROFIT	PW4ENG 72-107	04-15-88
PW4ENG 72-82	RETROFIT	PW4ENG 72-107 R1	04-15-88
PW4ENG 72-82 R1	RETROFIT	PW4ENG 72-107 R2	NO EFFECT
PW4ENG 72-82 R2	RETROFIT	PW4ENG 72-107 R3	NO EFFECT
PW4ENG 72-83	NO EFFECT	PW4ENG 72-107 R4	NO EFFECT
PW4ENG 72-83 R1	NO EFFECT	PW4ENG 72-107 R5	NO EFFECT
PW4ENG 72-83 R2	NO EFFECT	PW4ENG 72-108	RETROFIT
PW4ENG 72-83 R3	NO EFFECT	PW4ENG 72-108 R1	RETROFIT
PW4ENG 72-84	RETROFIT	PW4ENG 72-109	03-01-86

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SB NO.	DATE INCORP
PW4ENG 72-109 R1	03-01-86
PW4ENG 72-110	RETROFIT
PW4ENG 72-111	RETROFIT
PW4ENG 72-112	NO EFFECT
PW4ENG 72-113	03-01-86
PW4ENG 72-113 R1	NO EFFECT
PW4ENG 72-114	04-15-88
PW4ENG 72-114 R1	NO EFFECT
PW4ENG 72-115	RETROFIT
PW4ENG 72-115 R1	RETROFIT
PW4ENG 72-116	01-15-88
PW4ENG 72-116 R1	01-15-88
PW4ENG 72-117	03-01-86
PW4ENG 72-120	01-15-88
PW4ENG 72-120 R1	NO EFFECT
PW4ENG 72-120 R2	NO EFFECT
PW4ENG 72-120 R3	NO EFFECT
PW4ENG 72-123	NO EFFECT
PW4ENG 72-125	NO EFFECT
PW4ENG 72-126	03-01-86
PW4ENG 72-127	03-01-86
PW4ENG 72-128	03-01-86
PW4ENG 72-130	RETROFIT
PW4ENG 72-131	07-15-89
PW4ENG 72-131 R1	NO EFFECT
PW4ENG 72-131 R2	NO EFFECT
PW4ENG 72-131 R3	NO EFFECT
PW4ENG 72-132	NO EFFECT
PW4ENG 72-132	CIR
PW4ENG 72-132 R1	NO EFFECT
PW4ENG 72-132 R2	NO EFFECT
PW4ENG 72-132 R3	NO EFFECT
PW4ENG 72-132 R4	04-15-90
PW4ENG 72-132 R5	NO EFFECT
PW4ENG 72-134	10-15-89
PW4ENG 72-134 R1	NO EFFECT
PW4ENG 72-134 R2	NO EFFECT
PW4ENG 72-134 R3	NO EFFECT
PW4ENG 72-134 R4	NO EFFECT
PW4ENG 72-139	CANCELLED
PW4ENG 72-142	10-15-88
PW4ENG 72-143	RETROFIT
PW4ENG 72-143 R1	NO EFFECT
PW4ENG 72-143 R2	NO EFFECT
PW4ENG 72-143 R3	NO EFFECT
PW4ENG 72-144	NO EFFECT
PW4ENG 72-144 R1	NO EFFECT
PW4ENG 72-144 R2	NO EFFECT
PW4ENG 72-145	07-15-89
PW4ENG 72-148	RETROFIT
PW4ENG 72-150	10-15-88
PW4ENG 72-150 R1	NO EFFECT
PW4ENG 72-150 R2	NO EFFECT
PW4ENG 72-150 R3	NO EFFECT
PW4ENG 72-151	NO EFFECT
PW4ENG 72-153	07-15-89
PW4ENG 72-153 R1	NO EFFECT
PW4ENG 72-153 R2	NO EFFECT
PW4ENG 72-154	10-15-89
PW4ENG 72-154 R1	01-15-90
PW4ENG 72-154 R2	NO EFFECT
PW4ENG 72-154 R3	NO EFFECT
PW4ENG 72-155	NO EFFECT
PW4ENG 72-156	10-15-89
PW4ENG 72-156 R1	10-15-89
PW4ENG 72-156 R2	NO EFFECT
PW4ENG 72-156 R3	NO EFFECT
PW4ENG 72-157	10-15-88
PW4ENG 72-157 R1	NO EFFECT
PW4ENG 72-157 R2	NO EFFECT
PW4ENG 72-158	07-15-89
PW4ENG 72-159	CANCELLED
PW4ENG 72-160	NO EFFECT
PW4ENG 72-160 R1	NO EFFECT
PW4ENG 72-161	10-15-91
PW4ENG 72-161 R1	NO EFFECT
PW4ENG 72-161 R2	07-15-92
PW4ENG 72-161 R3	NO EFFECT
PW4ENG 72-161 R4	NO EFFECT
PW4ENG 72-162	NO EFFECT
PW4ENG 72-163	NO EFFECT
PW4ENG 72-165	NO EFFECT
PW4ENG 72-165 R1	NO EFFECT
PW4ENG 72-167	RETROFIT
PW4ENG 72-168	NO EFFECT
PW4ENG 72-169	RETROFIT
PW4ENG 72-170	NO EFFECT
PW4ENG 72-174	01-15-89
PW4ENG 72-174 R1	01-15-91
PW4ENG 72-174 R2	NO EFFECT
PW4ENG 72-175	07-15-89
PW4ENG 72-175 R1	NO EFFECT

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SB NO.	DATE INCORP
PW4ENG 72-175 R2	NO EFFECT
PW4ENG 72-176	04-15-89
PW4ENG 72-176 R1	NO EFFECT
PW4ENG 72-176 R2	NO EFFECT
PW4ENG 72-176 R3	NO EFFECT
PW4ENG 72-179	10-15-90
PW4ENG 72-179 R1	NO EFFECT
PW4ENG 72-179 R2	NO EFFECT
PW4ENG 72-179 R3	NO EFFECT
PW4ENG 72-180	NO EFFECT
PW4ENG 72-181	01-15-89
PW4ENG 72-181 R1	NO EFFECT
PW4ENG 72-183	07-15-89
PW4ENG 72-185	NO EFFECT
PW4ENG 72-185 R1	NO EFFECT
PW4ENG 72-186	10-15-91
PW4ENG 72-186 R1	NO EFFECT
PW4ENG 72-186 R2	NO EFFECT
PW4ENG 72-186 R3	NO EFFECT
PW4ENG 72-186 R4	NO EFFECT
PW4ENG 72-187	10-15-89
PW4ENG 72-187 R1	NO EFFECT
PW4ENG 72-188	CANCELLED
PW4ENG 72-189	10-15-89
PW4ENG 72-189 R1	NO EFFECT
PW4ENG 72-189 R2	NO EFFECT
PW4ENG 72-190	RETROFIT
PW4ENG 72-194	10-15-89
PW4ENG 72-194 R1	10-15-89
PW4ENG 72-194 R2	10-15-89
PW4ENG 72-194 R3	10-15-89
PW4ENG 72-194 R4	10-15-89
PW4ENG 72-195	NO EFFECT
PW4ENG 72-196	07-15-91
PW4ENG 72-197	NO EFFECT
PW4ENG 72-197 R1	NO EFFECT
PW4ENG 72-197 R2	NO EFFECT
PW4ENG 72-197 R3	NO EFFECT
PW4ENG 72-197 R4	NO EFFECT
PW4ENG 72-199	RETROFIT
PW4ENG 72-200	NO EFFECT
PW4ENG 72-200 R1	NO EFFECT
PW4ENG 72-200 R2	NO EFFECT
PW4ENG 72-201	01-15-89
PW4ENG 72-201 R1	NO EFFECT
PW4ENG 72-201 R2	NO EFFECT
PW4ENG 72-201 R3	NO EFFECT
PW4ENG 72-201 R4	NO EFFECT
PW4ENG 72-201 R5	NO EFFECT
PW4ENG 72-202	04-15-89
PW4ENG 72-202 R1	NO EFFECT
PW4ENG 72-202 R2	NO EFFECT
PW4ENG 72-204	01-15-91
PW4ENG 72-204 R1	NO EFFECT
PW4ENG 72-204 R2	NO EFFECT
PW4ENG 72-204 R3	01-15-91
PW4ENG 72-205	NO EFFECT
PW4ENG 72-205 R1	NO EFFECT
PW4ENG 72-206	10-15-89
PW4ENG 72-206 R1	NO EFFECT
PW4ENG 72-206 R2	NO EFFECT
PW4ENG 72-206 R3	NO EFFECT
PW4ENG 72-206 R4	NO EFFECT
PW4ENG 72-207	NO EFFECT
PW4ENG 72-208	07-15-89
PW4ENG 72-208 R1	NO EFFECT
PW4ENG 72-209	04-15-89
PW4ENG 72-209 R1	NO EFFECT
PW4ENG 72-210	10-15-89
PW4ENG 72-210 R1	NO EFFECT
PW4ENG 72-211	10-15-89
PW4ENG 72-211 R1	NO EFFECT
PW4ENG 72-211 R2	NO EFFECT
PW4ENG 72-212 R2	NO EFFECT
PW4ENG 72-213	01-15-90
PW4ENG 72-213 R1	NO EFFECT
PW4ENG 72-213 R2	NO EFFECT
PW4ENG 72-214	NO EFFECT
PW4ENG 72-215	04-15-91
PW4ENG 72-215	CIR
PW4ENG 72-215 R1	NO EFFECT
PW4ENG 72-215 R2	NO EFFECT
PW4ENG 72-215 R3	NO EFFECT
PW4ENG 72-216	10-15-89
PW4ENG 72-217	01-15-90
PW4ENG 72-217 R1	NO EFFECT
PW4ENG 72-218	NO EFFECT
PW4ENG 72-218 R1	NO EFFECT
PW4ENG 72-218 R2	NO EFFECT
PW4ENG 72-218 R3	NO EFFECT
PW4ENG 72-219	10-15-90
PW4ENG 72-219 R1	NO EFFECT

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SB NO.	DATE INCORP
PW4ENG 72-219 R2	NO EFFECT
PW4ENG 72-220	01-15-91
PW4ENG 72-221	01-15-90
PW4ENG 72-222	NO EFFECT
PW4ENG 72-222 R1	NO EFFECT
PW4ENG 72-223	10-15-90
PW4ENG 72-223 R1	NO EFFECT
PW4ENG 72-223 R2	NO EFFECT
PW4ENG 72-224	01-15-90
PW4ENG 72-224 R1	NO EFFECT
PW4ENG 72-226	NO EFFECT
PW4ENG 72-227	04-15-90
PW4ENG 72-227 R1	04-15-90
PW4ENG 72-229	01-15-90
PW4ENG 72-229 R1	NO EFFECT
PW4ENG 72-229 R2	NO EFFECT
PW4ENG 72-229 R3	NO EFFECT
PW4ENG 72-232	NO EFFECT
PW4ENG 72-232 R1	NO EFFECT
PW4ENG 72-232 R2	NO EFFECT
PW4ENG 72-233	01-15-90
PW4ENG 72-233 R1	NO EFFECT
PW4ENG 72-234	04-15-90
PW4ENG 72-234 R1	04-15-90
PW4ENG 72-234 R2	NO EFFECT
PW4ENG 72-236	NO EFFECT
PW4ENG 72-236 R1	NO EFFECT
PW4ENG 72-236 R2	NO EFFECT
PW4ENG 72-239	01-15-90
PW4ENG 72-240	10-15-89
PW4ENG 72-240 R1	NO EFFECT
PW4ENG 72-241	10-15-90
PW4ENG 72-241 R1	NO EFFECT
PW4ENG 72-241 R2	NO EFFECT
PW4ENG 72-242	NO EFFECT
PW4ENG 72-242 R1	NO EFFECT
PW4ENG 72-242 R2	NO EFFECT
PW4ENG 72-243	10-15-90
PW4ENG 72-245	10-15-91
PW4ENG 72-246	04-15-91
PW4ENG 72-246 R1	04-15-91
PW4ENG 72-247	NO EFFECT
PW4ENG 72-248	04-15-90
PW4ENG 72-248 R1	NO EFFECT
PW4ENG 72-251	NO EFFECT
PW4ENG 72-253	01-15-90
PW4ENG 72-253 R1	NO EFFECT
PW4ENG 72-254	04-15-90
PW4ENG 72-254 R1	NO EFFECT
PW4ENG 72-255	01-15-90
PW4ENG 72-255 R1	NO EFFECT
PW4ENG 72-255 R2	NO EFFECT
PW4ENG 72-256	01-15-90
PW4ENG 72-256 R1	NO EFFECT
PW4ENG 72-256 R2	NO EFFECT
PW4ENG 72-256 R3	06-15-93
PW4ENG 72-257	01-15-90
PW4ENG 72-257 R1	NO EFFECT
PW4ENG 72-257 R2	NO EFFECT
PW4ENG 72-258	07-15-90
PW4ENG 72-259	07-15-90
PW4ENG 72-261	10-15-89
PW4ENG 72-261 R1	NO EFFECT
PW4ENG 72-262	04-15-91
PW4ENG 72-262 R1	NO EFFECT
PW4ENG 72-263	NO EFFECT
PW4ENG 72-263 R1	NO EFFECT
PW4ENG 72-266	NO EFFECT
PW4ENG 72-267	07-15-92
PW4ENG 72-268	07-15-90
PW4ENG 72-268 R1	NO EFFECT
PW4ENG 72-268 R2	NO EFFECT
PW4ENG 72-268 R3	NO EFFECT
PW4ENG 72-269	04-15-91
PW4ENG 72-269 R1	NO EFFECT
PW4ENG 72-269 R2	NO EFFECT
PW4ENG 72-270	04-15-90
PW4ENG 72-271	NO EFFECT
PW4ENG 72-272	NO EFFECT
PW4ENG 72-274	NO EFFECT
PW4ENG 72-274 R1	NO EFFECT
PW4ENG 72-274 R2	NO EFFECT
PW4ENG 72-274 R3	NO EFFECT
PW4ENG 72-275	07-15-91
PW4ENG 72-278	07-15-90
PW4ENG 72-279	NO EFFECT
PW4ENG 72-279 R1	NO EFFECT
PW4ENG 72-280	NO EFFECT
PW4ENG 72-280 R1	NO EFFECT
PW4ENG 72-281	NO EFFECT
PW4ENG 72-282	07-15-91
PW4ENG 72-282 R1	NO EFFECT

SB NO.	DATE INCORP
PW4ENG 72-283	NO EFFECT
PW4ENG 72-285	NO EFFECT
PW4ENG 72-286	NO EFFECT
PW4ENG 72-286 R1	NO EFFECT
PW4ENG 72-286 R2	NO EFFECT
PW4ENG 72-287	NO EFFECT
PW4ENG 72-288	NO EFFECT
PW4ENG 72-288 R1	NO EFFECT
PW4ENG 72-288 R2	NO EFFECT
PW4ENG 72-289	NO EFFECT
PW4ENG 72-290	01-15-91
PW4ENG 72-291	04-15-91
PW4ENG 72-291 R1	NO EFFECT
PW4ENG 72-291 R2	10-15-91
PW4ENG 72-291 R3	NO EFFECT
PW4ENG 72-291 R4	NO EFFECT
PW4ENG 72-292	07-15-91
PW4ENG 72-292 R1	NO EFFECT
PW4ENG 72-292 R2	NO EFFECT
PW4ENG 72-298	04-15-91
PW4ENG 72-298 R1	NO EFFECT
PW4ENG 72-298 R2	NO EFFECT
PW4ENG 72-299	NO EFFECT
PW4ENG 72-299 R1	NO EFFECT
PW4ENG 72-300	04-15-91
PW4ENG 72-300 R1	NO EFFECT
PW4ENG 72-300 R2	01-15-92
PW4ENG 72-301	07-15-92
PW4ENG 72-301 R1	NO EFFECT
PW4ENG 72-302	NO EFFECT
PW4ENG 72-303	NO EFFECT
PW4ENG 72-304	07-15-91
PW4ENG 72-304 R1	NO EFFECT
PW4ENG 72-304 R2	NO EFFECT
PW4ENG 72-304 R3	NO EFFECT
PW4ENG 72-305	07-15-91
PW4ENG 72-305 R1	07-15-91
PW4ENG 72-306	04-15-91
PW4ENG 72-306 R1	NO EFFECT
PW4ENG 72-306 R2	NO EFFECT
PW4ENG 72-306 R3	NO EFFECT
PW4ENG 72-307	10-15-91
PW4ENG 72-307 R1	NO EFFECT
PW4ENG 72-307 R2	NO EFFECT
PW4ENG 72-307 R3	NO EFFECT
PW4ENG 72-309	NO EFFECT
PW4ENG 72-309 R1	NO EFFECT
PW4ENG 72-312	NO EFFECT
PW4ENG 72-312 R1	NO EFFECT
PW4ENG 72-313	01-15-92
PW4ENG 72-314	01-15-92
PW4ENG 72-314 R1	NO EFFECT
PW4ENG 72-315	10-15-92
PW4ENG 72-315 R1	NO EFFECT
PW4ENG 72-317	07-15-91
PW4ENG 72-317 R1	07-15-91
PW4ENG 72-318	NO EFFECT
PW4ENG 72-319	NO EFFECT
PW4ENG 72-321	NO EFFECT
PW4ENG 72-321 R1	NO EFFECT
PW4ENG 72-322	07-15-91
PW4ENG 72-322 R1	10-15-91
PW4ENG 72-322 R2	NO EFFECT
PW4ENG 72-322 R3	NO EFFECT
PW4ENG 72-322 R4	NO EFFECT
PW4ENG 72-322 R5	NO EFFECT
PW4ENG 72-324	NO EFFECT
PW4ENG 72-324 R1	NO EFFECT
PW4ENG 72-325	RETROFIT
PW4ENG 72-325 R1	NO EFFECT
PW4ENG 72-325 R2	NO EFFECT
PW4ENG 72-326	01-15-91
PW4ENG 72-326 R1	NO EFFECT
PW4ENG 72-326 R2	NO EFFECT
PW4ENG 72-328	NO EFFECT
PW4ENG 72-329	NO EFFECT
PW4ENG 72-333	NO EFFECT
PW4ENG 72-333 R1	NO EFFECT
PW4ENG 72-333 R2	NO EFFECT
PW4ENG 72-334	NO EFFECT
PW4ENG A72-335	01-15-91
PW4ENG A72-335 R1	NO EFFECT
PW4ENG A72-335 R2	NO EFFECT
PW4ENG 72-336	10-15-91
PW4ENG 72-337	NO EFFECT
PW4ENG 72-338	NO EFFECT
PW4ENG 72-339	NO EFFECT
PW4ENG 72-339 R1	NO EFFECT
PW4ENG 72-339 R2	NO EFFECT
PW4ENG 72-340	07-15-91
PW4ENG 72-341	NO EFFECT
PW4ENG 72-341 R1	NO EFFECT

SB NO.	DATE INCORP	SB NO.	DATE INCORP
PW4ENG 72-342	NO EFFECT	PW4ENG 72-369 R2	NO EFFECT
PW4ENG 72-343	10-15-91	PW4ENG 72-369 R3	NO EFFECT
PW4ENG 72-343 R1	NO EFFECT	PW4ENG 72-370	07-15-92
PW4ENG 72-344	10-15-91	PW4ENG 72-370 R1	NO EFFECT
PW4ENG 72-344 R1	NO EFFECT	PW4ENG 72-370 R2	NO EFFECT
PW4ENG 72-344 R2	NO EFFECT	PW4ENG 72-370 R3	NO EFFECT
PW4ENG 72-345	NO EFFECT	PW4ENG 72-371	10-15-88
PW4ENG 72-346	07-15-91	PW4ENG 72-371 R1	NO EFFECT
PW4ENG 72-346	CIR	PW4ENG 72-373	RETROFIT
PW4ENG 72-346 R1	NO EFFECT	PW4ENG 72-373 R1	RETROFIT
PW4ENG 72-346 R2	NO EFFECT	PW4ENG 72-373 R2	NO EFFECT
PW4ENG 72-346 R3	NO EFFECT	PW4ENG 72-373 R3	NO EFFECT
PW4ENG 72-346 R4	CIR	PW4ENG 72-374	NO EFFECT
PW4ENG 72-346 R5	NO EFFECT	PW4ENG 72-374 R1	NO EFFECT
PW4ENG 72-347	NO EFFECT	PW4ENG 72-375	03-15-93
PW4ENG 72-347 R1	NO EFFECT	PW4ENG 72-375 R1	NO EFFECT
PW4ENG 72-347 R2	NO EFFECT	PW4ENG 72-375 R2	NO EFFECT
PW4ENG 72-347 R3	NO EFFECT	PW4ENG 72-375 R3	NO EFFECT
PW4ENG 72-349	NO EFFECT	PW4ENG 72-375 R4	NO EFFECT
PW4ENG 72-349 R1	NO EFFECT	PW4ENG 72-376	NO EFFECT
PW4ENG 72-349 R2	NO EFFECT	PW4ENG 72-376 R1	NO EFFECT
PW4ENG 72-350	NO EFFECT	PW4ENG 72-376 R2	NO EFFECT
PW4ENG 72-352	RETROFIT	PW4ENG 72-377	01-15-92
PW4ENG 72-352 R1	NO EFFECT	PW4ENG 72-378	NO EFFECT
PW4ENG 72-352 R2	NO EFFECT	PW4ENG 72-379	04-15-91
PW4ENG 72-353	10-15-91	PW4ENG 72-379 R1	NO EFFECT
PW4ENG 72-354	NO EFFECT	PW4ENG 72-380	NO EFFECT
PW4ENG 72-355	NO EFFECT	PW4ENG 72-380	CIR
PW4ENG 72-356 R1	NO EFFECT	PW4ENG 72-380 R1	NO EFFECT
PW4ENG 72-357	10-15-91	PW4ENG 72-381	NO EFFECT
PW4ENG 72-358	NO EFFECT	PW4ENG 72-383	NO EFFECT
PW4ENG 72-358 R1	NO EFFECT	PW4ENG 72-384	01-15-92
PW4ENG 72-358 R2	NO EFFECT	PW4ENG 72-385	01-15-92
PW4ENG 72-359	NO EFFECT	PW4ENG 72-386	10-15-91
PW4ENG 72-359 R1	NO EFFECT	PW4ENG 72-387	NO EFFECT
PW4ENG 72-363	NO EFFECT	PW4ENG 72-387 R1	NO EFFECT
PW4ENG 72-363 R1	NO EFFECT	PW4ENG 72-388	NO EFFECT
PW4ENG 72-364	NO EFFECT	PW4ENG 72-389	10-15-91
PW4ENG 72-364 R1	NO EFFECT	PW4ENG 72-390	10-15-91
PW4ENG 72-365	NO EFFECT	PW4ENG 72-391	01-15-92
PW4ENG 72-366	10-15-91	PW4ENG 72-392	01-15-92
PW4ENG 72-366 R1	NO EFFECT	PW4ENG 72-392 R1	NO EFFECT
PW4ENG 72-367	NO EFFECT	PW4ENG 72-392 R2	NO EFFECT
PW4ENG 72-368	NO EFFECT	PW4ENG 72-393	NO EFFECT
PW4ENG 72-369	10-15-91	PW4ENG 72-393 R1	NO EFFECT
PW4ENG 72-369 R1	NO EFFECT	PW4ENG 72-393 R2	NO EFFECT

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SB NO.	DATE INCORP
PW4ENG 72-394	07-15-92
PW4ENG 72-394 R1	NO EFFECT
PW4ENG 72-394 R2	NO EFFECT
PW4ENG 72-395	NO EFFECT
PW4ENG 72-395 R1	NO EFFECT
PW4ENG 72-395 R2	NO EFFECT
PW4ENG 72-396	01-15-92
PW4ENG 72-396 R1	NO EFFECT
PW4ENG 72-397	01-15-92
PW4ENG 72-397 R1	NO EFFECT
PW4ENG 72-397 R2	NO EFFECT
PW4ENG 72-398	NO EFFECT
PW4ENG 72-399	04-15-92
PW4ENG 72-400	01-15-92
PW4ENG 72-402	01-15-92
PW4ENG 72-402 R1	NO EFFECT
PW4ENG 72-403	01-15-92
PW4ENG 72-403 R1	NO EFFECT
PW4ENG 72-404	NO EFFECT
PW4ENG 72-404 R1	NO EFFECT
PW4ENG 72-404 R2	NO EFFECT
PW4ENG 72-405	01-15-92
PW4ENG 72-406	01-15-92
PW4ENG 72-406 R1	10-15-92
PW4ENG 72-408	NO EFFECT
PW4ENG 72-408 R1	NO EFFECT
PW4ENG 72-409	10-15-91
PW4ENG 72-409 R1	01-15-92
PW4ENG 72-410	04-15-92
PW4ENG 72-410 R1	NO EFFECT
PW4ENG 72-410 R2	NO EFFECT
PW4ENG 72-415	07-15-92
PW4ENG 72-415 R1	NO EFFECT
PW4ENG 72-415 R2	NO EFFECT
PW4ENG 72-415 R3	NO EFFECT
PW4ENG 72-415 R4	NO EFFECT
PW4ENG 72-415 R5	NO EFFECT
PW4ENG 72-417	NO EFFECT
PW4ENG 72-418	04-15-92
PW4ENG 72-418 R1	10-15-92
PW4ENG A72-419	NO EFFECT
PW4ENG A72-419 R1	NO EFFECT
PW4ENG A72-419 R2	NO EFFECT
PW4ENG A72-419 R3	NO EFFECT
PW4ENG 72-420	NO EFFECT
PW4ENG 72-420 R1	07-15-92
PW4ENG 72-421	NO EFFECT
PW4ENG 72-421 R1	NO EFFECT
PW4ENG 72-422	NO EFFECT
PW4ENG 72-422 R1	NO EFFECT
PW4ENG 72-422 R2	NO EFFECT
PW4ENG 72-422 R3	NO EFFECT
PW4ENG 72-422 R4	NO EFFECT
PW4ENG 72-423	NO EFFECT
PW4ENG 72-423 R1	NO EFFECT
PW4ENG 72-423 R2	NO EFFECT
PW4ENG 72-424	01-15-93
PW4ENG 72-424 R1	NO EFFECT
PW4ENG A72-425	NO EFFECT
PW4ENG A72-425 R1	NO EFFECT
PW4ENG A72-425 R2	NO EFFECT
PW4ENG 72-426	07-15-92
PW4ENG 72-426 R1	NO EFFECT
PW4ENG 72-426 R2	NO EFFECT
PW4ENG 72-426 R3	NO EFFECT
PW4ENG 72-426 R4	NO EFFECT
PW4ENG 72-426 R5	NO EFFECT
PW4ENG 72-427	NO EFFECT
PW4ENG 72-427 R1	NO EFFECT
PW4ENG 72-428	NO EFFECT
PW4ENG 72-430	NO EFFECT
PW4ENG 72-430 R1	NO EFFECT
PW4ENG 72-431	NO EFFECT
PW4ENG 72-431 R1	NO EFFECT
PW4ENG 72-431 R2	NO EFFECT
PW4ENG 72-432	07-15-92
PW4ENG 72-432 R1	NO EFFECT
PW4ENG 72-432 R2	NO EFFECT
PW4ENG 72-432 R3	NO EFFECT
PW4ENG 72-432 R4	NO EFFECT
PW4ENG 72-433	07-15-92
PW4ENG 72-434	10-15-92
PW4ENG 72-434	CIR
PW4ENG 72-435	07-15-92
PW4ENG 72-435 R1	NO EFFECT
PW4ENG 72-435 R2	NO EFFECT
PW4ENG 72-435 R3	NO EFFECT
PW4ENG A72-436	NO EFFECT
PW4ENG A72-436 R1	NO EFFECT
PW4ENG A72-436 R2	NO EFFECT
PW4ENG A72-436 R3	NO EFFECT
PW4ENG A72-436 R4	NO EFFECT

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PW4ENG A72-436 R5	NO EFFECT
PW4ENG A72-436 R6	NO EFFECT
PW4ENG 72-437	NO EFFECT
PW4ENG 72-438	10-15-96
PW4ENG 72-439	NO EFFECT
PW4ENG 72-439 R1	NO EFFECT
PW4ENG 72-439 R2	NO EFFECT
PW4ENG 72-439 R3	NO EFFECT
PW4ENG 72-440	10-15-92
PW4ENG 72-440	CIR
PW4ENG 72-440 R1	NO EFFECT
PW4ENG 72-440 R2	NO EFFECT
PW4ENG 72-441	07-15-92
PW4ENG 72-441 R1	NO EFFECT
PW4ENG 72-441 R2	NO EFFECT
PW4ENG 72-441 R3	NO EFFECT
PW4ENG 72-442	NO EFFECT
PW4ENG 72-443	NO EFFECT
PW4ENG 72-443	CIR
PW4ENG 72-444	NO EFFECT
PW4ENG 72-444	CIR
PW4ENG 72-445	NO EFFECT
PW4ENG 72-445 R1	NO EFFECT
PW4ENG 72-446	03-15-93
PW4ENG 72-446 R1	NO EFFECT
PW4ENG 72-446 R2	NO EFFECT
PW4ENG 72-447	03-15-93
PW4ENG 72-449	NO EFFECT
PW4ENG 72-449 R1	NO EFFECT
PW4ENG 72-449 R2	NO EFFECT
PW4ENG 72-449 R3	NO EFFECT
PW4ENG 72-450	NO EFFECT
PW4ENG 72-450 R1	NO EFFECT
PW4ENG 72-450 R2	NO EFFECT
PW4ENG 72-450 R3	NO EFFECT
PW4ENG 72-450 R4	NO EFFECT
PW4ENG 72-450 R5	NO EFFECT
PW4ENG 72-450 R6	NO EFFECT
PW4ENG 72-451	03-15-93
PW4ENG 72-451 R1	NO EFFECT
PW4ENG 72-451 R2	NO EFFECT
PW4ENG 72-451 R3	NO EFFECT
PW4ENG 72-452	03-15-93
PW4ENG 72-452	CIR
PW4ENG 72-452 R1	NO EFFECT
PW4ENG 72-453	10-15-92
PW4ENG 72-453 R1	NO EFFECT
PW4ENG 72-454	NO EFFECT
PW4ENG 72-454 R1	NO EFFECT
PW4ENG 72-454 R2	NO EFFECT
PW4ENG 72-455	NO EFFECT
PW4ENG 72-455 R1	NO EFFECT
PW4ENG 72-455 R2	NO EFFECT
PW4ENG 72-455 R3	NO EFFECT
PW4ENG 72-456	06-15-93
PW4ENG 72-456 R1	NO EFFECT
PW4ENG 72-456 R2	NO EFFECT
PW4ENG 72-456 R3	NO EFFECT
PW4ENG 72-456 R4	NO EFFECT
PW4ENG 72-457	NO EFFECT
PW4ENG 72-457 R1	NO EFFECT
PW4ENG 72-458	NO EFFECT
PW4ENG 72-458 R1	NO EFFECT
PW4ENG 72-459	NO EFFECT
PW4ENG 72-459 R1	NO EFFECT
PW4ENG 72-459 R2	NO EFFECT
PW4ENG 72-460	NO EFFECT
PW4ENG 72-460 R1	NO EFFECT
PW4ENG 72-460 R2	NO EFFECT
PW4ENG 72-460 R3	NO EFFECT
PW4ENG 72-460 R4	NO EFFECT
PW4ENG 72-461	NO EFFECT
PW4ENG 72-461 R1	NO EFFECT
PW4ENG 72-461 R2	NO EFFECT
PW4ENG 72-461 R3	NO EFFECT
PW4ENG 72-461 R4	NO EFFECT
PW4ENG 72-461 R5	NO EFFECT
PW4ENG 72-462	09-15-9
PW4ENG 72-462 R1	NO EFFECT
PW4ENG 72-462 R2	NO EFFECT
PW4ENG 72-462 R3	NO EFFECT
PW4ENG 72-463	09-15-93
PW4ENG 72-463 R1	NO EFFECT
PW4ENG 72-463 R2	NO EFFECT
PW4ENG 72-463 R3	NO EFFECT
PW4ENG 72-463 R4	NO EFFECT
PW4ENG 72-463 R5	NO EFFECT
PW4ENG 72-463 R6	NO EFFECT
PW4ENG 72-464	09-15-93
PW4ENG 72-464 R1	NO EFFECT
PW4ENG 72-464 R2	NO EFFECT
PW4ENG 72-464 R3	NO EFFECT

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SB NO.	DATE INCORP	SB NO.	DATE INCORP
PW4ENG 72-464 R4	NO EFFECT	PW4ENG 72-477	06-15-94
PW4ENG 72-465	NO EFFECT	PW4ENG 72-478	NO EFFECT
PW4ENG 72-465 R1	NO EFFECT	PW4ENG 72-478	CIR
PW4ENG 72-465 R2	NO EFFECT	PW4ENG 72-478 R1	NO EFFECT
PW4ENG 72-465 R3	NO EFFECT	PW4ENG 72-478 R2	NO EFFECT
PW4ENG 72-465 R4	NO EFFECT	PW4ENG 72-479	NO EFFECT
PW4ENG 72-466	09-15-93	PW4ENG 72-480	NO EFFECT
PW4ENG 72-466 R1	NO EFFECT	PW4ENG 72-481	NO EFFECT
PW4ENG 72-466 R2	NO EFFECT	PW4ENG 72-483	03-15-94
PW4ENG 72-467	NO EFFECT	PW4ENG 72-483 R1	NO EFFECT
PW4ENG 72-467	CIR	PW4ENG 72-483 R2	NO EFFECT
PW4ENG 72-468	06-15-95	PW4ENG 72-484	03-15-94
PW4ENG 72-468 R1	NO EFFECT	PW4ENG 72-484 R1	NO EFFECT
PW4ENG 72-468 R2	NO EFFECT	PW4ENG 72-484 R2	NO EFFECT
PW4ENG 72-469	NO EFFECT	PW4ENG 72-484 R3	NO EFFECT
PW4ENG 72-470	NO EFFECT	PW4ENG 72-485	03-15-95
PW4ENG 72-470 R1	NO EFFECT	PW4ENG 72-485	CIR
PW4ENG 72-470 R2	NO EFFECT	PW4ENG 72-485 R1	NO EFFECT
PW4ENG 72-471	09-15-93	PW4ENG 72-485 R2	NO EFFECT
PW4ENG 72-471 R1	NO EFFECT	PW4ENG 72-485 R2	CIR
PW4ENG 72-471 R2	NO EFFECT	PW4ENG 72-485 R3	NO EFFECT
PW4ENG 72-471 R3	NO EFFECT	PW4ENG 72-486	NO EFFECT
PW4ENG 72-471 R4	NO EFFECT	PW4ENG 72-486 R1	NO EFFECT
PW4ENG 72-472	09-15-93	PW4ENG 72-486 R2	NO EFFECT
PW4ENG 72-472 R1	NO EFFECT	PW4ENG 72-487	03-15-94
PW4ENG 72-472 R2	NO EFFECT	PW4ENG 72-488	NO EFFECT
PW4ENG 72-472 R3	NO EFFECT	PW4ENG 72-488 R1	NO EFFECT
PW4ENG 72-472 R4	NO EFFECT	PW4ENG 72-488 R2	NO EFFECT
PW4ENG 72-472 R5	NO EFFECT	PW4ENG 72-489	NO EFFECT
PW4ENG 72-473	09-15-93	PW4ENG 72-489	CIR
PW4ENG 72-473 R1	NO EFFECT	PW4ENG 72-489 R1	NO EFFECT
PW4ENG 72-474	NO EFFECT	PW4ENG 72-489 R2	NO EFFECT
PW4ENG 72-474 R1	NO EFFECT	PW4ENG 72-489 R3	NO EFFECT
PW4ENG 72-474 R2	NO EFFECT	PW4ENG 72-491	06-15-95
PW4ENG 72-474 R3	NO EFFECT	PW4ENG 72-491	CIR
PW4ENG 72-475	NO EFFECT	PW4ENG 72-491 R1	NO EFFECT
PW4ENG 72-475	CIR	PW4ENG 72-491 R2	NO EFFECT
PW4ENG 72-475 R1	NO EFFECT	PW4ENG 72-491 R3	NO EFFECT
PW4ENG 72-475 R2	NO EFFECT	PW4ENG 72-491 R4	12-15-96
PW4ENG 72-475 R2	CIR	PW4ENG 72-491 R5	12-15-96
PW4ENG 72-475 R3	NO EFFECT	PW4ENG 72-492	NO EFFECT
PW4ENG 72-476	NO EFFECT	PW4ENG 72-492 R1	NO EFFECT
PW4ENG 72-476 R1	NO EFFECT	PW4ENG 72-492 R2	NO EFFECT
PW4ENG 72-476 R2	NO EFFECT	PW4ENG 72-493	03-15-94
PW4ENG 72-476 R3	NO EFFECT	PW4ENG 72-493	CIR
PW4ENG 72-476 R4	NO EFFECT	PW4ENG 72-493 R1	NO EFFECT

SB NO.	DATE INCORP
PW4ENG 72-493 R2	NO EFFECT
PW4ENG 72-494	NO EFFECT
PW4ENG 72-494 R1	NO EFFECT
PW4ENG 72-495	NO EFFECT
PW4ENG 72-495 R1	NO EFFECT
PW4ENG 72-496	06-15-94
PW4ENG 72-496	CIR
PW4ENG 72-496 R1	NO EFFECT
PW4ENG 72-496 R1	CIR
PW4ENG 72-496 R2	CIR
PW4ENG 72-497	NO EFFECT
PW4ENG 72-497	CIR
PW4ENG 72-497 R1	NO EFFECT
PW4ENG 72-497 R2	NO EFFECT
PW4ENG 72-497 R3	NO EFFECT
PW4ENG 72-498	06-15-95
PW4ENG 72-498 R1	NO EFFECT
PW4ENG 72-498 R2	NO EFFECT
PW4ENG 72-500	12-15-94
PW4ENG 72-501	NO EFFECT
PW4ENG 72-501 R1	NO EFFECT
PW4ENG 72-502	NO EFFECT
PW4ENG 72-502	CIR
PW4ENG 72-502 R1	NO EFFECT
PW4ENG 72-502 R2	NO EFFECT
PW4ENG 72-503	NO EFFECT
PW4ENG 72-503	CIR
PW4ENG 72-503 R1	NO EFFECT
PW4ENG 72-503 R2	NO EFFECT
PW4ENG 72-505	12-15-94
PW4ENG 72-505 R1	NO EFFECT
PW4ENG 72-506	NO EFFECT
PW4ENG 72-506 R1	NO EFFECT
PW4ENG 72-506 R2	NO EFFECT
PW4ENG 72-507	06-15-95
PW4ENG 72-507 R1	NO EFFECT
PW4ENG 72-507 R2	NO EFFECT
PW4ENG 72-508	NO EFFECT
PW4ENG 72-508 R1	NO EFFECT
PW4ENG 72-508 R2	NO EFFECT
PW4ENG 72-509	NO EFFECT
PW4ENG 72-509 R1	NO EFFECT
PW4ENG 72-510	09-15-95
PW4ENG 72-510	CIR
PW4ENG 72-510 R1	NO EFFECT
PW4ENG 72-510 R2	NO EFFECT
PW4ENG 72-511	NO EFFECT
PW4ENG 72-511 R1	NO EFFECT
PW4ENG 72-513	NO EFFECT
PW4ENG 72-513 R1	NO EFFECT
PW4ENG 72-514	06-15-95
PW4ENG 72-514	CIR
PW4ENG 72-514 R1	12-15-96
PW4ENG 72-514 R2	NO EFFECT
PW4ENG 72-514 R3	NO EFFECT
PW4ENG 72-515	06-15-95
PW4ENG 72-515	CIR
PW4ENG 72-515 R1	NO EFFECT
PW4ENG 72-515 R1	CIR
PW4ENG 72-515 R2	NO EFFECT
PW4ENG 72-516	NO EFFECT
PW4ENG 72-516 R1	NO EFFECT
PW4ENG 72-516 R2	NO EFFECT
PW4ENG 72-517	NO EFFECT
PW4ENG 72-517 R1	NO EFFECT
PW4ENG 72-517 R2	NO EFFECT
PW4ENG 72-518	NO EFFECT
PW4ENG 72-518 R1	NO EFFECT
PW4ENG 72-518 R2	NO EFFECT
PW4ENG 72-519	NO EFFECT
PW4ENG 72-519	CIR
PW4ENG 72-519 R1	NO EFFECT
PW4ENG 72-522	NO EFFECT
PW4ENG 72-522 R1	NO EFFECT
PW4ENG 72-523	09-15-95
PW4ENG 72-523 R1	NO EFFECT
PW4ENG 72-524	06-15-95
PW4ENG 72-524 R1	12-15-95
PW4ENG 72-524 R2	NO EFFECT
PW4ENG 72-524 R3	NO EFFECT
PW4ENG 72-524 R4	NO EFFECT
PW4ENG 72-524 R5	NO EFFECT
PW4ENG 72-525	06-15-95
PW4ENG 72-525 R1	NO EFFECT
PW4ENG 72-525 R2	NO EFFECT
PW4ENG 72-525 R3	NO EFFECT
PW4ENG 72-525 R4	NO EFFECT
PW4ENG 72-525 R5	NO EFFECT
PW4ENG 72-525 R6	NO EFFECT
PW4ENG 72-525 R7	NO EFFECT
PW4ENG 72-526	06-15-95
PW4ENG 72-526 R1	NO EFFECT

SB NO.	DATE INCORP	SB NO.	DATE INCORP
PW4ENG 72-527	09-15-95	PW4ENG 72-544 R1	NO EFFECT
PW4ENG 72-527 R1	NO EFFECT	PW4ENG 72-544 R2	NO EFFECT
PW4ENG 72-527 R2	NO EFFECT	PW4ENG 72-545	NO EFFECT
PW4ENG 72-528	NO EFFECT	PW4ENG 72-545	CIR
PW4ENG 72-528 R1	NO EFFECT	PW4ENG 72-545 R1	NO EFFECT
PW4ENG 72-529	NO EFFECT	PW4ENG 72-546	06-15-95
PW4ENG 72-529 R1	NO EFFECT	PW4ENG 72-546	CIR
PW4ENG 72-529 R2	NO EFFECT	PW4ENG 72-546 R1	NO EFFECT
PW4ENG 72-529 R3	NO EFFECT	PW4ENG 72-547	NO EFFECT
PW4ENG 72-531	NO EFFECT	PW4ENG 72-547 R1	NO EFFECT
PW4ENG 72-531	CIR	PW4ENG 72-548	NO EFFECT
PW4ENG 72-531 R1	NO EFFECT	PW4ENG 72-548	CIR
PW4ENG 72-531 R2	NO EFFECT	PW4ENG 72-548 R1	NO EFFECT
PW4ENG A72-532	NO EFFECT	PW4ENG 72-548 R2	NO EFFECT
PW4ENG A72-532 R1	NO EFFECT	PW4ENG 72-550	NO EFFECT
PW4ENG A72-532 R2	NO EFFECT	PW4ENG 72-550	CIR
PW4ENG 72-533	NO EFFECT	PW4ENG 72-550 R1	NO EFFECT
PW4ENG 72-533 R1	NO EFFECT	PW4ENG 72-550 R2	NO EFFECT
PW4ENG 72-533 R2	NO EFFECT	PW4ENG 72-550 R3	NO EFFECT
PW4ENG 72-534	09-15-95	PW4ENG 72-550 R4	NO EFFECT
PW4ENG 72-534 R1	NO EFFECT	PW4ENG 72-551	03-15-97
PW4ENG 72-534 R2	NO EFFECT	PW4ENG 72-551 R1	NO EFFECT
PW4ENG 72-535	09-15-95	PW4ENG 72-552	NO EFFECT
PW4ENG 72-535 R1	NO EFFECT	PW4ENG 72-552 R1	NO EFFECT
PW4ENG 72-535 R2	NO EFFECT	PW4ENG 72-553	NO EFFECT
PW4ENG 72-536	NO EFFECT	PW4ENG 72-553 R1	NO EFFECT
PW4ENG 72-536	CIR	PW4ENG 72-556	03-15-95
PW4ENG 72-536 R1	NO EFFECT	PW4ENG 72-556 R1	NO EFFECT
PW4ENG 72-536 R2	NO EFFECT	PW4ENG 72-556 R2	NO EFFECT
PW4ENG 72-536 R3	NO EFFECT	PW4ENG 72-557	NO EFFECT
PW4ENG 72-536 R4	NO EFFECT	PW4ENG 72-557	CIR
PW4ENG 72-537	09-15-95	PW4ENG 72-557 R1	NO EFFECT
PW4ENG 72-537 R1	NO EFFECT	PW4ENG 72-557 R2	NO EFFECT
PW4ENG 72-537 R2	NO EFFECT	PW4ENG 72-557 R3	NO EFFECT
PW4ENG 72-538	09-15-95	PW4ENG 72-558	NO EFFECT
PW4ENG 72-538 R1	NO EFFECT	PW4ENG 72-558	CIR
PW4ENG 72-539	NO EFFECT	PW4ENG 72-558 R1	NO EFFECT
PW4ENG 72-539 R1	NO EFFECT	PW4ENG 72-560	03-15-95
PW4ENG 72-541	06-15-95	PW4ENG 72-560	CIR
PW4ENG 72-541 R1	NO EFFECT	PW4ENG 72-560 R1	NO EFFECT
PW4ENG 72-542	09-15-95	PW4ENG 72-561	09-15-95
PW4ENG 72-542	CIR	PW4ENG 72-561 R1	NO EFFECT
PW4ENG 72-542 R1	NO EFFECT	PW4ENG 72-562	09-15-95
PW4ENG 72-543	09-15-95	PW4ENG 72-562 R1	NO EFFECT
PW4ENG 72-543 R1	NO EFFECT	PW4ENG 72-562 R2	NO EFFECT
PW4ENG 72-544	NO EFFECT	PW4ENG 72-562 R3	NO EFFECT

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PW4ENG 72-563	03-15-97	PW4ENG 72-579	NO EFFECT
PW4ENG 72-563 R1	NO EFFECT	PW4ENG 72-579	CIR
PW4ENG 72-563 R2	NO EFFECT	PW4ENG 72-579 R1	NO EFFECT
PW4ENG 72-564	NO EFFECT	PW4ENG 72-579 R2	NO EFFECT
PW4ENG 72-565	12-15-95	PW4ENG 72-579 R3	NO EFFECT
PW4ENG 72-565	CIR	PW4ENG 72-580	NO EFFECT
PW4ENG 72-565 R1	NO EFFECT	PW4ENG 72-580	CIR
PW4ENG 72-565 R2	NO EFFECT	PW4ENG 72-580 R1	NO EFFECT
PW4ENG 72-565 R3	NO EFFECT	PW4ENG 72-582	NO EFFECT
PW4ENG 72-565 R4	NO EFFECT	PW4ENG 72-582 R1	NO EFFECT
PW4ENG 72-566	NO EFFECT	PW4ENG 72-582 R2	NO EFFECT
PW4ENG 72-566	CIR	PW4ENG 72-583	12-15-96
PW4ENG 72-566 R1	NO EFFECT	PW4ENG 72-583 R1	NO EFFECT
PW4ENG 72-566 R2	NO EFFECT	PW4ENG 72-584	NO EFFECT
PW4ENG 72-566 R3	NO EFFECT	PW4ENG 72-584	CIR
PW4ENG 72-567	12-15-97	PW4ENG 72-584 R1	NO EFFECT
PW4ENG 72-567	CIR	PW4ENG 72-584 R2	NO EFFECT
PW4ENG 72-568	NO EFFECT	PW4ENG 72-584 R3	NO EFFECT
PW4ENG 72-568	CIR	PW4ENG 72-585	NO EFFECT
PW4ENG 72-568 R1	NO EFFECT	PW4ENG 72-585 R1	NO EFFECT
PW4ENG 72-568 R2	NO EFFECT	PW4ENG 72-586	03-15-96
PW4ENG 72-570	03-15-96	PW4ENG 72-586 R1	NO EFFECT
PW4ENG 72-570 R1	NO EFFECT	PW4ENG 72-587	NO EFFECT
PW4ENG 72-571	NO EFFECT	PW4ENG 72-587	CIR
PW4ENG 72-571	CIR	PW4ENG 72-587 R1	NO EFFECT
PW4ENG 72-571 R1	NO EFFECT	PW4ENG 72-589	NO EFFECT
PW4ENG 72-572	06-15-00	PW4ENG 72-589	CIR
PW4ENG 72-573	NO EFFECT	PW4ENG 72-589 R1	NO EFFECT
PW4ENG 72-573	CIR	PW4ENG 72-590	NO EFFECT
PW4ENG 72-573 R1	NO EFFECT	PW4ENG 72-590	CIR
PW4ENG 72-574	12-15-95	PW4ENG 72-590 R1	NO EFFECT
PW4ENG 72-574	CIR	PW4ENG 72-591	NO EFFECT
PW4ENG 72-574 R1	NO EFFECT	PW4ENG 72-591	CIR
PW4ENG 72-575	12-15-95	PW4ENG 72-591 R1	NO EFFECT
PW4ENG 72-575	CIR	PW4ENG 72-591 R1	CIR
PW4ENG 72-575 R1	NO EFFECT	PW4ENG 72-592	NO EFFECT
PW4ENG 72-575 R2	NO EFFECT	PW4ENG 72-592 R1	NO EFFECT
PW4ENG 72-576	NO EFFECT	PW4ENG 72-592 R2	NO EFFECT
PW4ENG 72-576	CIR	PW4ENG 72-593	NO EFFECT
PW4ENG 72-576 R1	NO EFFECT	PW4ENG 72-593	CIR
PW4ENG 72-577	NO EFFECT	PW4ENG 72-593 R1	NO EFFECT
PW4ENG 72-577 R1	NO EFFECT	PW4ENG 72-593 R2	NO EFFECT
PW4ENG 72-578	NO EFFECT	PW4ENG 72-594	NO EFFECT
PW4ENG 72-578	CIR	PW4ENG 72-594	CIR
PW4ENG 72-578 R1	NO EFFECT	PW4ENG 72-594 R1	NO EFFECT
PW4ENG 72-578 R2	NO EFFECT	PW4ENG 72-595	NO EFFECT

SB NO.	DATE INCORP	SB NO.	DATE INCORP
PW4ENG 72-595 R1	NO EFFECT	PW4ENG 72-615	NO EFFECT
PW4ENG 72-596	NO EFFECT	PW4ENG 72-615	CIR
PW4ENG 72-596	CIR	PW4ENG 72-615 R1	NO EFFECT
PW4ENG 72-596 R1	NO EFFECT	PW4ENG 72-616	12-15-96
PW4ENG 72-597	NO EFFECT	PW4ENG 72-617	NO EFFECT
PW4ENG 72-597	CIR	PW4ENG 72-617 R1	NO EFFECT
PW4ENG 72-597 R1	NO EFFECT	PW4ENG 72-618	12-15-96
PW4ENG 72-598	NO EFFECT	PW4ENG 72-618	CIR
PW4ENG 72-598 R1	NO EFFECT	PW4ENG 72-618 R1	12-15-96
PW4ENG 72-599	09-15-96	PW4ENG 72-619	NO EFFECT
PW4ENG 72-599	CIR	PW4ENG 72-619 R1	NO EFFECT
PW4ENG 72-599 R1	NO EFFECT	PW4ENG 72-619 R2	NO EFFECT
PW4ENG 72-600	NO EFFECT	PW4ENG 72-621	NO EFFECT
PW4ENG 72-600 R1	NO EFFECT	PW4ENG 72-622	NO EFFECT
PW4ENG 72-600 R2	NO EFFECT	PW4ENG 72-622	CIR
PW4ENG 72-600 R3	NO EFFECT	PW4ENG 72-622 R1	NO EFFECT
PW4ENG 72-601	09-15-96	PW4ENG 72-622 R1	CIR
PW4ENG 72-601	CIR	PW4ENG 72-623	03-15-97
PW4ENG 72-601 R1	NO EFFECT	PW4ENG 72-625 R1	NO EFFECT
PW4ENG 72-602	09-15-96	PW4ENG 72-626	NO EFFECT
PW4ENG 72-602	CIR	PW4ENG 72-626	CIR
PW4ENG 72-604	NO EFFECT	PW4ENG 72-627	03-15-97
PW4ENG 72-604	CIR	PW4ENG 72-627	CIR
PW4ENG 72-604 R1	NO EFFECT	PW4ENG 72-627 R1	NO EFFECT
PW4ENG 72-605	NO EFFECT	PW4ENG 72-627 R2	NO EFFECT
PW4ENG 72-605	CIR	PW4ENG A72-628	03-15-97
PW4ENG 72-605 R1	NO EFFECT	PW4ENG A72-628	CIR
PW4ENG 72-606	NO EFFECT	PW4ENG A72-628 R1	NO EFFECT
PW4ENG 72-606	CIR	PW4ENG 72-629	NO EFFECT
PW4ENG 72-606 R1	NO EFFECT	PW4ENG 72-629	CIR
PW4ENG 72-606 R2	NO EFFECT	PW4ENG 72-632	NO EFFECT
PW4ENG 72-607	NO EFFECT	PW4ENG A72-632 R1	NO EFFECT
PW4ENG 72-607 R1	NO EFFECT	PW4ENG 72-633	NO EFFECT
PW4ENG 72-608	NO EFFECT	PW4ENG 72-633 R1	NO EFFECT
PW4ENG 72-608	CIR	PW4ENG 72-634	09-15-97
PW4ENG 72-608 R1	NO EFFECT	PW4ENG 72-635	12-15-96
PW4ENG 72-608 R2	NO EFFECT	PW4ENG 72-636	NO EFFECT
PW4ENG 72-610	NO EFFECT	PW4ENG 72-636	CIR
PW4ENG 72-610	CIR	PW4ENG 72-637	09-15-97
PW4ENG 72-610 R1	NO EFFECT	PW4ENG 72-637	CIR
PW4ENG 72-611	03-15-98	PW4ENG 72-637 R1	NO EFFECT
PW4ENG 72-611	CIR	PW4ENG 72-638	NO EFFECT
PW4ENG 72-612	NO EFFECT	PW4ENG 72-639	NO EFFECT
PW4ENG 72-612 R1	NO EFFECT	PW4ENG 72-639	CIR
PW4ENG 72-613	NO EFFECT	PW4ENG 72-640	12-15-96
PW4ENG 72-614	NO EFFECT	PW4ENG 72-640	CIR

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SB NO.	DATE INCORP	SB NO.	DATE INCORP
PW4ENG 72-641	CIR	PW4ENG 72-662 R1	12-15-98
PW4ENG 72-642	CIR	PW4ENG 72-662 R2	NO EFFECT
PW4ENG 72-642 R1	NO EFFECT	PW4ENG 72-663	NO EFFECT
PW4ENG 72-642 R2	NO EFFECT	PW4ENG 72-663 R1	NO EFFECT
PW4ENG 72-643	12-15-97	PW4ENG 72-663 R2	NO EFFECT
PW4ENG 72-644	06-15-97	PW4ENG 72-664	09-15-98
PW4ENG 72-644	CIR	PW4ENG 72-664	CIR
PW4ENG 72-645	NO EFFECT	PW4ENG 72-664 R1	NO EFFECT
PW4ENG 72-646	NO EFFECT	PW4ENG 72-664 R2	NO EFFECT
PW4ENG 72-647	NO EFFECT	PW4ENG 72-665	NO EFFECT
PW4ENG 72-648	03-15-98	PW4ENG 72-665 R1	NO EFFECT
PW4ENG 72-649	NO EFFECT	PW4ENG 72-665 R2	NO EFFECT
PW4ENG 72-651	NO EFFECT	PW4ENG 72-666	NO EFFECT
PW4ENG 72-651	CIR	PW4ENG 72-666	CIR
PW4ENG 72-651 R1	NO EFFECT	PW4ENG 72-667	NO EFFECT
PW4ENG 72-652	03-15-98	PW4ENG 72-667	CIR
PW4ENG 72-652	CIR	PW4ENG 72-667 R1	NO EFFECT
PW4ENG 72-652 R1	12-15-98	PW4ENG 72-669	NO EFFECT
PW4ENG 72-652 R2	NO EFFECT	PW4ENG 72-669	CIR
PW4ENG 72-653	03-15-98	PW4ENG 72-670	NO EFFECT
PW4ENG 72-653	CIR	PW4ENG 72-670 R1	NO EFFECT
PW4ENG 72-653 R1	NO EFFECT	PW4ENG 72-670 R2	NO EFFECT
PW4ENG 72-654	NO EFFECT	PW4ENG 72-671	NO EFFECT
PW4ENG 72-654	CIR	PW4ENG 72-672	NO EFFECT
PW4ENG 72-654 R1	NO EFFECT	PW4ENG 72-672	CIR
PW4ENG 72-654 R2	NO EFFECT	PW4ENG 72-673	03-15-98
PW4ENG 72-655	NO EFFECT	PW4ENG 72-673	CIR
PW4ENG 72-655	CIR	PW4ENG 72-673 R1	NO EFFECT
PW4ENG 72-655 R1	NO EFFECT	PW4ENG 72-674	NO EFFECT
PW4ENG 72-655 R2	NO EFFECT	PW4ENG 72-674 R1	NO EFFECT
PW4ENG A72-656	NO EFFECT	PW4ENG 72-674 R2	NO EFFECT
PW4ENG A72-656	CIR	PW4ENG 72-674 R3	NO EFFECT
PW4ENG A72-656 R1	NO EFFECT	PW4ENG 72-674 R4	NO EFFECT
PW4ENG A72-656 R2	NO EFFECT	PW4ENG 72-677	NO EFFECT
PW4ENG A72-656 R3	NO EFFECT	PW4ENG 72-678	NO EFFECT
PW4ENG 72-657	03-15-98	PW4ENG 72-678 R1	NO EFFECT
PW4ENG 72-657	CIR	PW4ENG 72-678 R2	NO EFFECT
PW4ENG 72-658	12-15-97	PW4ENG 72-679	NO EFFECT
PW4ENG 72-658	CIR	PW4ENG 72-679 R1	NO EFFECT
PW4ENG 72-659	03-15-98	PW4ENG 72-679 R3	NO EFFECT
PW4ENG 72-659 R1	NO EFFECT	PW4ENG 72-679	CIR
PW4ENG 72-660	CIR	PW4ENG 72-679 R1	NO EFFECT
PW4ENG 72-660 R1	NO EFFECT	PW4ENG 72-680	12-15-98
PW4ENG A72-661	NO EFFECT	PW4ENG A72-681 R1	NO EFFECT
PW4ENG 72-662	NO EFFECT	PW4ENG 72-682	NO EFFECT
PW4ENG 72-662	CIR	PW4ENG 72-683	NO EFFECT

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PW4ENG 72-684	NO EFFECT
PW4ENG 72-684	CIR
PW4ENG 72-685 R1	NO EFFECT
PW4ENG A72-686	NO EFFECT
PW4ENG 72-687	06-15-99
PW4ENG 72-687 R1	NO EFFECT
PW4ENG 72-689	NO EFFECT
PW4ENG 72-690	NO EFFECT
PW4ENG 72-691	NO EFFECT
PW4ENG 72-691	CIR
PW4ENG 72-691 R2	NO EFFECT
PW4ENG 72-694	12-15-99
PW4ENG 72-694	CIR
PW4ENG 72-694 R1	NO EFFECT
PW4ENG 72-694 R2	NO EFFECT
PW4ENG 72-695	12-15-99
PW4ENG 72-695 R1	NO EFFECT
PW4ENG 72-697	03-15-00
PW4ENG 72-699	09-15-00
PW4ENG 72-700 R1	CIR
PW4ENG 72-702	06-15-00
PW4ENG 72-703	06-15-00
PW4ENG 72-704	NO EFFECT
PW4ENG 72-705	NO EFFECT
PW4ENG 72-706	09-15-00
PW4ENG A72-707	NO EFFECT
PW4ENG A72-707 R1	NO EFFECT
PW4ENG 72-709	03-15-01
PW4ENG 72-711	NO EFFECT
PW4ENG 72-712 R1	NO EFFECT
PW4ENG 72-713	NO EFFECT
PW4ENG 72-714	NO EFFECT
PW4ENG 72-714 R1	NO EFFECT
PW4ENG 72-714 R2	NO EFFECT
PW4ENG 72-715	NO EFFECT
PW4ENG 72-716	12-15-00
PW4ENG 72-717	NO EFFECT
PW4ENG 72-718	NO EFFECT
PW4ENG 72-718 R1	NO EFFECT
PW4ENG 72-721	NO EFFECT
PW4ENG A72-722	NO EFFECT
PW4ENG A72-722 R1	NO EFFECT
PW4ENG 72-723	12-15-00
PW4ENG A72-724	NO EFFECT
PW4ENG 72-730	NO EFFECT
PW4ENG 72-730 R1	NO EFFECT
PW4ENG 72-731	NO EFFECT
PW4ENG 72-732	NO EFFECT
PW4ENG 72-736	NO EFFECT
PW4ENG 72-736 R1	NO EFFECT
PW4ENG 72-738	12-15-01
PW4ENG 72-740	NO EFFECT
PW4ENG 72-742	CIR
PW4ENG 72-745	NO EFFECT
PW4ENG 72-745 R1	NO EFFECT
PW4ENG 72-745 R2	NO EFFECT
PW4ENG 72-751	12-15-04
PW4ENG 72-756	06-15-03
PW4ENG 72-756 R1	NO EFFECT
PW4ENG 72-758	12-15-03
PW4ENG 72-759	12-15-03
PW4ENG 72-759 R1	NO EFFECT
PW4ENG 72-761	NO EFFECT
PW4ENG 72-761 R1	NO EFFECT
PW4ENG 72-762	NO EFFECT
PW4ENG 72-762 R1	NO EFFECT
PW4ENG 72-764	NO EFFECT
PW4ENG 72-765	NO EFFECT
PW4ENG 72-766	NO EFFECT
PW4ENG 72-767	NO EFFECT
PW4ENG 72-767 R1	NO EFFECT
PW4ENG 72-768	NO EFFECT
PW4ENG 72-769	12-15-04
PW4ENG 73-1	NO EFFECT
PW4ENG 73-1 R1	NO EFFECT
PW4ENG 73-1 R2	NO EFFECT
PW4ENG 73-1 R3	NO EFFECT
PW4ENG 73-2	RETROFIT
PW4ENG 73-2 R1	RETROFIT
PW4ENG 73-2 R2	RETROFIT
PW4ENG 73-3	RETROFIT
PW4ENG 73-3 R1	RETROFIT
PW4ENG 73-3 R2	RETROFIT
PW4ENG 73-3 R3	RETROFIT
PW4ENG 73-6	RETROFIT
PW4ENG 73-6 R1	RETROFIT
PW4ENG 73-6 R2	RETROFIT
PW4ENG 73-7	RETROFIT
PW4ENG 73-7 R1	RETROFIT
PW4ENG 73-10	RETROFIT
PW4ENG 73-10 R1	RETROFIT
PW4ENG 73-11	RETROFIT

SB NO.	DATE INCORP	SB NO.	DATE INCORP
PW4ENG 73-11 R1	RETROFIT	PW4ENG 73-38	01-01-86
PW4ENG 73-12	RETROFIT	PW4ENG 73-38 R1	03-01-86
PW4ENG 73-12 R1	RETROFIT	PW4ENG 73-41	07-15-89
PW4ENG 73-13	RETROFIT	PW4ENG 73-41 R1	NO EFFECT
PW4ENG 73-13 R1	RETROFIT	PW4ENG A73-42	NO EFFECT
PW4ENG 73-15	RETROFIT	PW4ENG A73-42 R1	NO EFFECT
PW4ENG 73-15 R1	RETROFIT	PW4ENG 73-43	CANCELLED
PW4ENG 73-17	NO EFFECT	PW4ENG 73-43 R1	CANCELLED
PW4ENG 73-17 R1	NO EFFECT	PW4ENG 73-46	NO EFFECT
PW4ENG 73-18	RETROFIT	PW4ENG 73-46 R1	NO EFFECT
PW4ENG 73-18 R1	RETROFIT	PW4ENG 73-48	07-15-89
PW4ENG 73-18 R2	RETROFIT	PW4ENG 73-48 R1	NO EFFECT
PW4ENG 73-19	RETROFIT	PW4ENG 73-49	NO EFFECT
PW4ENG 73-19 R1	RETROFIT	PW4ENG 73-49 R1	NO EFFECT
PW4ENG 73-19 R2	RETROFIT	PW4ENG 73-49 R2	NO EFFECT
PW4ENG 73-19 R3	RETROFIT	PW4ENG 73-49 R3	NO EFFECT
PW4ENG 73-20	RETROFIT	PW4ENG 73-50	CANCELLED
PW4ENG 73-20 R1	RETROFIT	PW4ENG 73-51	NO EFFECT
PW4ENG 73-20 R2	RETROFIT	PW4ENG 73-51 R1	NO EFFECT
PW4ENG 73-21	04-15-88	PW4ENG 73-52	10-15-89
PW4ENG 73-23	RETROFIT	PW4ENG 73-52 R1	NO EFFECT
PW4ENG 73-24	07-15-88	PW4ENG 73-53	NO EFFECT
PW4ENG 73-24 R1	07-15-88	PW4ENG 73-55	NO EFFECT
PW4ENG 73-24 R2	NO EFFECT	PW4ENG 73-55 R1	NO EFFECT
PW4ENG 73-24 R3	NO EFFECT	PW4ENG 73-56	NO EFFECT
PW4ENG 73-25	NO EFFECT	PW4ENG 73-57	NO EFFECT
PW4ENG 73-26	03-01-86	PW4ENG 73-58	NO EFFECT
PW4ENG 73-26 R1	NO EFFECT	PW4ENG 73-61	CANCELLED
PW4ENG 73-27	NO EFFECT	PW4ENG 73-62	NO EFFECT
PW4ENG 73-28	NO EFFECT	PW4ENG 73-63	07-15-90
PW4ENG 73-29	RETROFIT	PW4ENG 73-63 R1	NO EFFECT
PW4ENG 73-29 R1	RETROFIT	PW4ENG 73-63 R2	NO EFFECT
PW4ENG 73-30	RETROFIT	PW4ENG 73-63 R3	NO EFFECT
PW4ENG 73-30 R1	NO EFFECT	PW4ENG 73-63 R4	NO EFFECT
PW4ENG 73-31	03-01-86	PW4ENG 73-65	NO EFFECT
PW4ENG 73-33	NO EFFECT	PW4ENG 73-70	07-15-89
PW4ENG 73-34	RETROFIT	PW4ENG 73-70 R1	NO EFFECT
PW4ENG 73-35	RETROFIT	PW4ENG 73-71	NO EFFECT
PW4ENG 73-35 R1	RETROFIT	PW4ENG 73-72	NO EFFECT
PW4ENG 73-35 R2	10-15-88	PW4ENG 73-72 R1	NO EFFECT
PW4ENG 73-35 R3	NO EFFECT	PW4ENG 73-72 R2	NO EFFECT
PW4ENG 73-36	NO EFFECT	PW4ENG 73-72 R3	NO EFFECT
PW4ENG 73-36 R1	NO EFFECT	PW4ENG 73-72 R4	NO EFFECT
PW4ENG 73-36 R2	NO EFFECT	PW4ENG 73-73	NO EFFECT
PW4ENG A73-37	NO EFFECT	PW4ENG 73-73 R1	NO EFFECT
PW4ENG A73-37 R1	NO EFFECT	PW4ENG 73-74	NO EFFECT

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SB NO.	DATE INCORP	SB NO.	DATE INCORP
PW4ENG 73-74 R1	NO EFFECT	PW4ENG 73-110 R1	NO EFFECT
PW4ENG 73-75	07-15-90	PW4ENG 73-111	NO EFFECT
PW4ENG 73-75 R1	NO EFFECT	PW4ENG 73-111 R1	NO EFFECT
PW4ENG 73-75 R5	NO EFFECT	PW4ENG 73-111 R2	NO EFFECT
PW4ENG 73-78	NO EFFECT	PW4ENG 73-113	10-15-91
PW4ENG 73-78 R1	NO EFFECT	PW4ENG 73-114	NO EFFECT
PW4ENG 73-79	NO EFFECT	PW4ENG 73-114 R1	NO EFFECT
PW4ENG 73-79 R1	NO EFFECT	PW4ENG 73-114 R2	NO EFFECT
PW4ENG 73-81	07-15-90	PW4ENG 73-117	NO EFFECT
PW4ENG 73-82	04-15-90	PW4ENG 73-118	NO EFFECT
PW4ENG 73-82 R1	NO EFFECT	PW4ENG 73-118 R1	06-15-93
PW4ENG 73-82 R2	NO EFFECT	PW4ENG 73-118 R2	NO EFFECT
PW4ENG 73-82 R3	07-15-92	PW4ENG 73-118 R3	NO EFFECT
PW4ENG 73-82 R4	NO EFFECT	PW4ENG 73-120	NO EFFECT
PW4ENG 73-83	04-15-90	PW4ENG 73-120 R1	NO EFFECT
PW4ENG 73-83 R1	NO EFFECT	PW4ENG 73-121	07-15-92
PW4ENG 73-83 R2	NO EFFECT	PW4ENG 73-121 R1	NO EFFECT
PW4ENG 73-83 R3	NO EFFECT	PW4ENG 73-122	NO EFFECT
PW4ENG 73-84	04-15-90	PW4ENG 73-122 R1	NO EFFECT
PW4ENG 73-84 R1	NO EFFECT	PW4ENG 73-125	NO EFFECT
PW4ENG 73-84 R2	NO EFFECT	PW4ENG 73-125 R1	NO EFFECT
PW4ENG 73-84 R3	NO EFFECT	PW4ENG 73-126	NO EFFECT
PW4ENG 73-85	01-15-91	PW4ENG 73-127	01-15-93
PW4ENG 73-85 R1	NO EFFECT	PW4ENG 73-127 R1	NO EFFECT
PW4ENG 73-86	10-15-90	PW4ENG 73-127 R2	NO EFFECT
PW4ENG 73-88	01-15-91	PW4ENG 73-127 R3	NO EFFECT
PW4ENG 73-88 R1	NO EFFECT	PW4ENG 73-130	NO EFFECT
PW4ENG 73-91	NO EFFECT	PW4ENG 73-132	06-15-93
PW4ENG 73-96	NO EFFECT	PW4ENG 73-133	06-15-93
PW4ENG 73-96 R1	NO EFFECT	PW4ENG 73-133 R1	NO EFFECT
PW4ENG 73-96 R2	NO EFFECT	PW4ENG 73-133	06-15-93
PW4ENG 73-97	NO EFFECT	PW4ENG 73-134	06-15-93
PW4ENG 73-97 R1	NO EFFECT	PW4ENG 73-134 R1	NO EFFECT
PW4ENG 73-98	NO EFFECT	PW4ENG 73-137	03-15-96
PW4ENG 73-99	NO EFFECT	PW4ENG 73-137 R1	03-15-96
PW4ENG 73-100	04-15-91	PW4ENG 73-137 R2	03-15-96
PW4ENG 73-101	04-15-91	PW4ENG 73-138	NO EFFECT
PW4ENG 73-101 R1	NO EFFECT	PW4ENG 73-139	NO EFFECT
PW4ENG 73-102	NO EFFECT	PW4ENG 73-139 R1	NO EFFECT
PW4ENG 73-104	10-15-91	PW4ENG 73-141	NO EFFECT
PW4ENG 73-104 R1	NO EFFECT	PW4ENG 73-141 R1	NO EFFECT
PW4ENG 73-104 R2	NO EFFECT	PW4ENG 73-141 R2	NO EFFECT
PW4ENG 73-106	10-15-91	PW4ENG 73-141 R3	NO EFFECT
PW4ENG 73-106 R1	NO EFFECT	PW4ENG 73-142	NO EFFECT
PW4ENG 73-106 R2	NO EFFECT	PW4ENG 73-143	03-15-96
PW4ENG 73-110	NO EFFECT	PW4ENG 73-143 R1	NO EFFECT

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SB NO.	DATE INCORP
PW4ENG 73-143 R2	NO EFFECT
PW4ENG 73-148	NO EFFECT
PW4ENG 73-148 R1	NO EFFECT
PW4ENG 73-148 R2	NO EFFECT
PW4ENG 73-149	NO EFFECT
PW4ENG 73-149 R1	NO EFFECT
PW4ENG 73-149 R2	NO EFFECT
PW4ENG 73-150	06-15-95
PW4ENG 73-150 R1	NO EFFECT
PW4ENG 73-150 R2	NO EFFECT
PW4ENG 73-151	NO EFFECT
PW4ENG 73-151 R1	NO EFFECT
PW4ENG 73-152	NO EFFECT
PW4ENG 73-152 R1	NO EFFECT
PW4ENG 73-155	NO EFFECT
PW4ENG 73-155 R1	NO EFFECT
PW4ENG 73-156	NO EFFECT
PW4ENG 73-156 R1	NO EFFECT
PW4ENG 73-158	NO EFFECT
PW4ENG 73-158 R1	NO EFFECT
PW4ENG 73-161	03-15-96
PW4ENG 73-161 R1	NO EFFECT
PW4ENG 73-161 R2	NO EFFECT
PW4ENG 73-161 R3	NO EFFECT
PW4ENG 73-162	NO EFFECT
PW4ENG 73-162 R1	NO EFFECT
PW4ENG 73-162 R2	NO EFFECT
PW4ENG 73-163	06-15-96
PW4ENG 73-163 R1	NO EFFECT
PW4ENG 73-163 R2	NO EFFECT
PW4ENG 73-167	12-15-96
PW4ENG 73-167 R1	NO EFFECT
PW4ENG 73-167 R2	NO EFFECT
PW4ENG 73-168	NO EFFECT
PW4ENG 73-169	06-15-97
PW4ENG 73-169 R1	NO EFFECT
PW4ENG 73-170	06-15-97
PW4ENG 73-170 R1	NO EFFECT
PW4ENG 73-172	NO EFFECT
PW4ENG 73-173	NO EFFECT
PW4ENG 73-174	NO EFFECT
PW4ENG 73-175	NO EFFECT
PW4ENG A73-176	NO EFFECT
PW4ENG 73-178	NO EFFECT
PW4ENG 73-179	09-15-99
PW4ENG 73-180	NO EFFECT
PW4ENG 73-180 R1	NO EFFECT
PW4ENG 73-181	NO EFFECT
PW4ENG 73-183	NO EFFECT
PW4ENG 73-184	NO EFFECT
PW4ENG 73-184 R1	NO EFFECT
PW4ENG 73-185	NO EFFECT
PW4ENG 73-187	NO EFFECT
PW4ENG 73-187 R1	NO EFFECT
PW4ENG 73-190	NO EFFECT
PW4ENG 73-191	NO EFFECT
PW4ENG 73-192	06-15-01
PW4ENG 73-193	09-15-01
PW4ENG 73-193 R1	NO EFFECT
PW4ENG 73-194	09-15-01
PW4ENG 73-195	NO EFFECT
PW4ENG 74-1	RETROFIT
PW4ENG 74-1 R1	RETROFIT
PW4ENG 74-2	RETROFIT
PW4ENG 74-2 R1	RETROFIT
PW4ENG 74-3	03-01-86
PW4ENG 74-3 R1	NO EFFECT
PW4ENG 74-3 R2	NO EFFECT
PW4ENG 74-4	NO EFFECT
PW4ENG 74-5	NO EFFECT
PW4ENG 74-6	NO EFFECT
PW4ENG 74-8 R1	NO EFFECT
PW4ENG 74-9	NO EFFECT
PW4ENG 75-1	RETROFIT
PW4ENG 75-2	RETROFIT
PW4ENG 75-2 R1	RETROFIT
PW4ENG 75-6	07-15-87
PW4ENG 75-6 R1	07-15-87
PW4ENG 75-6 R2	07-15-87
PW4ENG 75-6 R3	07-15-87
PW4ENG 75-7	RETROFIT
PW4ENG 75-7 R1	RETROFIT
PW4ENG 75-8	RETROFIT
PW4ENG 75-8 R1	RETROFIT
PW4ENG 75-8 R2	NO EFFECT
PW4ENG 75-9	RETROFIT
PW4ENG 75-9 R1	RETROFIT
PW4ENG 75-9 R2	RETROFIT
PW4ENG 75-10	RETROFIT
PW4ENG 75-10 R1	RETROFIT
PW4ENG 75-12	RETROFIT
PW4ENG 75-12 R1	RETROFIT

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PW4ENG 75-12 R2	RETROFIT	PW4ENG 75-43	NO EFFECT
PW4ENG 75-14	RETROFIT	PW4ENG 75-43 R1	NO EFFECT
PW4ENG 75-14 R1	RETROFIT	PW4ENG 75-44	NO EFFECT
PW4ENG 75-14 R2	RETROFIT	PW4ENG 75-45	07-15-90
PW4ENG 75-15	03-01-86	PW4ENG 75-45 R1	NO EFFECT
PW4ENG 75-16	RETROFIT	PW4ENG 75-45 R2	NO EFFECT
PW4ENG 75-16 R1	RETROFIT	PW4ENG 75-45 R3	NO EFFECT
PW4ENG 75-17	RETROFIT	PW4ENG 75-46	NO EFFECT
PW4ENG 75-18	01-15-88	PW4ENG 75-47	NO EFFECT
PW4ENG 75-18 R1	01-15-88	PW4ENG 75-47 R1	NO EFFECT
PW4ENG 75-19	RETROFIT	PW4ENG 75-49	NO EFFECT
PW4ENG 75-20	RETROFIT	PW4ENG 75-49 R1	NO EFFECT
PW4ENG 75-21	CANCELLED	PW4ENG A75-51	NO EFFECT
PW4ENG 75-22	04-15-88	PW4ENG A75-51 R1	NO EFFECT
PW4ENG 75-23	RETROFIT	PW4ENG A75-51 R2	NO EFFECT
PW4ENG 75-23 R1	NO EFFECT	PW4ENG A75-51 R3	NO EFFECT
PW4ENG 75-24	03-01-86	PW4ENG A75-51 R4	NO EFFECT
PW4ENG 75-25	03-01-86	PW4ENG A75-51 R5	NO EFFECT
PW4ENG 75-28	10-15-88	PW4ENG A75-51 R6	NO EFFECT
PW4ENG 75-28 R1	10-15-88	PW4ENG A75-51 R7	NO EFFECT
PW4ENG 75-28 R2	NO EFFECT	PW4ENG A75-51 R8	NO EFFECT
PW4ENG 75-28 R3	NO EFFECT	PW4ENG A75-51 R9	NO EFFECT
PW4ENG 75-28 R4	NO EFFECT	PW4ENG A75-51 R10	NO EFFECT
PW4ENG 75-29	03-01-86	PW4ENG A75-51 R11	NO EFFECT
PW4ENG 75-29 R1	NO EFFECT	PW4ENG A75-51 R12	NO EFFECT
PW4ENG 75-32	RETROFIT	PW4ENG 75-52	07-15-91
PW4ENG 75-34	NO EFFECT	PW4ENG 75-52 R1	07-15-91
PW4ENG 75-34 R1	NO EFFECT	PW4ENG 75-53	04-15-90
PW4ENG 75-34 R2	NO EFFECT	PW4ENG 75-53 R1	NO EFFECT
PW4ENG 75-34 R3	NO EFFECT	PW4ENG 75-53 R2	NO EFFECT
PW4ENG 75-34 R4	NO EFFECT	PW4ENG 75-54	NO EFFECT
PW4ENG 75-35	10-15-88	PW4ENG 75-54 R1	NO EFFECT
PW4ENG 75-35 R1	10-15-88	PW4ENG 75-55	NO EFFECT
PW4ENG 75-37	NO EFFECT	PW4ENG 75-56	RETROFIT
PW4ENG 75-37 R1	NO EFFECT	PW4ENG 75-57	04-15-91
PW4ENG 75-37 R2	NO EFFECT	PW4ENG 75-57 R1	04-15-91
PW4ENG 75-39	07-15-89	PW4ENG 75-57 R2	04-15-91
PW4ENG 75-39 R1	NO EFFECT	PW4ENG 75-57 R3	04-15-91
PW4ENG 75-39 R2	NO EFFECT	PW4ENG 75-57 R4	04-15-91
PW4ENG 75-40	RETROFIT	PW4ENG 75-57 R5	NO EFFECT
PW4ENG 75-40 R1	RETROFIT	PW4ENG 75-57 R6	NO EFFECT
PW4ENG 75-41	01-15-90	PW4ENG 75-58	NO EFFECT
PW4ENG 75-41 R1	NO EFFECT	PW4ENG 75-59	10-15-90
PW4ENG 75-41 R2	NO EFFECT	PW4ENG 75-59 R1	NO EFFECT
PW4ENG 75-41 R3	NO EFFECT	PW4ENG 75-59 R2	NO EFFECT
PW4ENG 75-42	NO EFFECT	PW4ENG 75-60	NO EFFECT

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PW4ENG 75-60 R1	NO EFFECT
PW4ENG 75-61	NO EFFECT
PW4ENG 75-61 R1	NO EFFECT
PW4ENG 75-62 R2	RETROFIT
PW4ENG 75-63	10-15-91
PW4ENG 75-63 R1	NO EFFECT
PW4ENG 75-64	NO EFFECT
PW4ENG 75-64 R1	NO EFFECT
PW4ENG 75-65	NO EFFECT
PW4ENG 75-65 R1	NO EFFECT
PW4ENG 75-66	NO EFFECT
PW4ENG 75-66 R1	NO EFFECT
PW4ENG 75-67	01-15-91
PW4ENG 75-67 R1	NO EFFECT
PW4ENG 75-68	NO EFFECT
PW4ENG 75-68 R1	NO EFFECT
PW4ENG 75-68 R2	NO EFFECT
PW4ENG 75-68 R3	NO EFFECT
PW4ENG 75-69	NO EFFECT
PW4ENG 75-71	NO EFFECT
PW4ENG 75-72	NO EFFECT
PW4ENG 75-72 R1	NO EFFECT
PW4ENG 75-73	NO EFFECT
PW4ENG 75-73 R1	NO EFFECT
PW4ENG 75-73 R2	NO EFFECT
PW4ENG 75-74	04-15-91
PW4ENG 75-75	04-15-90
PW4ENG 75-76	NO EFFECT
PW4ENG 75-76 R1	NO EFFECT
PW4ENG 75-77	07-15-91
PW4ENG 75-78	NO EFFECT
PW4ENG 75-80	NO EFFECT
PW4ENG 75-81	NO EFFECT
PW4ENG 75-82	NO EFFECT
PW4ENG 75-83	NO EFFECT
PW4ENG 75-83 R1	NO EFFECT
PW4ENG 75-83 R2	NO EFFECT
PW4ENG 75-84	10-15-91
PW4ENG 75-84 R1	NO EFFECT
PW4ENG 75-84 R2	NO EFFECT
PW4ENG 75-85	09-15-91
PW4ENG 75-85 R1	NO EFFECT
PW4ENG 75-86	NO EFFECT
PW4ENG 75-87	NO EFFECT
PW4ENG 75-87 R1	NO EFFECT
PW4ENG 75-88	NO EFFECT
PW4ENG 75-89	NO EFFECT
PW4ENG 75-89 R1	NO EFFECT
PW4ENG 75-90	NO EFFECT
PW4ENG 75-90 R1	NO EFFECT
PW4ENG 75-90 R2	NO EFFECT
PW4ENG 75-92	NO EFFECT
PW4ENG 75-92 R1	NO EFFECT
PW4ENG 75-93	NO EFFECT
PW4ENG 75-94	NO EFFECT
PW4ENG 75-94 R1	NO EFFECT
PW4ENG 75-94 R2	NO EFFECT
PW4ENG 75-95	10-15-92
PW4ENG 75-95 R1	NO EFFECT
PW4ENG 75-95 R2	NO EFFECT
PW4ENG 75-96	NO EFFECT
PW4ENG 75-97	NO EFFECT
PW4ENG 75-97 R1	NO EFFECT
PW4ENG 75-98	NO EFFECT
PW4ENG 75-98 R1	NO EFFECT
PW4ENG 75-98 R2	NO EFFECT
PW4ENG 75-99	NO EFFECT
PW4ENG 75-99 R1	NO EFFECT
PW4ENG 75-99 R2	NO EFFECT
PW4ENG 75-100	NO EFFECT
PW4ENG 75-100 R1	NO EFFECT
PW4ENG 75-100 R2	NO EFFECT
PW4ENG 75-101	NO EFFECT
PW4ENG 75-101 R1	NO EFFECT
PW4ENG 75-101 R2	NO EFFECT
PW4ENG 75-101 R3	NO EFFECT
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PW4ENG 75-103	NO EFFECT
PW4ENG 75-103 R1	NO EFFECT
PW4ENG 75-103 R2	NO EFFECT
PW4ENG 75-104	NO EFFECT
PW4ENG 75-104 R1	NO EFFECT
PW4ENG 75-104 R2	NO EFFECT
PW4ENG 75-104 R3	NO EFFECT
PW4ENG 75-104 R4	NO EFFECT
PW4ENG 75-105	NO EFFECT
PW4ENG 75-105 R1	NO EFFECT
PW4ENG 75-106	NO EFFECT
PW4ENG 75-106 R1	NO EFFECT
PW4ENG 75-106 R2	NO EFFECT
PW4ENG 75-107	03-15-96

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PW4ENG 75-107 R2	NO EFFECT
PW4ENG 75-107 R3	NO EFFECT
PW4ENG 75-108	NO EFFECT
PW4ENG 75-108 R1	NO EFFECT
PW4ENG 75-109	NO EFFECT
PW4ENG 75-109 R1	NO EFFECT
PW4ENG 75-109 R2	NO EFFECT
PW4ENG 75-110	NO EFFECT
PW4ENG 75-110 R1	NO EFFECT
PW4ENG 75-111	NO EFFECT
PW4ENG 75-111 R1	NO EFFECT
PW4ENG 75-112	NO EFFECT
PW4ENG 75-112 R1	NO EFFECT
PW4ENG 75-113	NO EFFECT
PW4ENG 75-113 R1	NO EFFECT
PW4ENG 75-114	03-15-96
PW4ENG 75-114 R1	NO EFFECT
PW4ENG 75-114 R2	NO EFFECT
PW4ENG 75-115	NO EFFECT
PW4ENG 75-115 R1	NO EFFECT
PW4ENG 75-115 R2	NO EFFECT
PW4ENG 75-115 R3	NO EFFECT
PW4ENG 75-115 R4	NO EFFECT
PW4ENG 75-116	03-15-96
PW4ENG 75-116 R1	12-15-96
PW4ENG 75-116 R2	NO EFFECT
PW4ENG 75-117	NO EFFECT
PW4ENG 75-117 R1	NO EFFECT
PW4ENG 75-117 R2	NO EFFECT
PW4ENG 75-118	NO EFFECT
PW4ENG 75-118 R1	NO EFFECT
PW4ENG 75-118 R2	NO EFFECT
PW4ENG 75-119	NO EFFECT
PW4ENG 75-119 R1	NO EFFECT
PW4ENG 75-119 R2	NO EFFECT
PW4ENG 75-120	NO EFFECT
PW4ENG 75-120 R1	NO EFFECT
PW4ENG 75-120 R2	NO EFFECT
PW4ENG 75-121	NO EFFECT
PW4ENG 75-121 R1	NO EFFECT
PW4ENG 75-121 R2	NO EFFECT
PW4ENG 75-122	NO EFFECT
PW4ENG 75-122 R1	NO EFFECT
PW4ENG 75-122 R2	NO EFFECT
PW4ENG 75-122 R3	NO EFFECT
PW4ENG 75-123	NO EFFECT
PW4ENG 75-123 R1	NO EFFECT
PW4ENG 75-123 R2	NO EFFECT
PW4ENG 75-124	NO EFFECT
PW4ENG 75-124 R1	NO EFFECT
PW4ENG 75-125	12-15-96
PW4ENG 75-126	03-15-97
PW4ENG 75-127	NO EFFECT
PW4ENG 75-127 R1	NO EFFECT
PW4ENG 75-129	NO EFFECT
PW4ENG 75-129 R1	NO EFFECT
PW4ENG 75-129 R2	NO EFFECT
PW4ENG 75-130	NO EFFECT
PW4ENG 75-132	NO EFFECT
PW4ENG 75-132 R1	NO EFFECT
PW4ENG 75-132 R2	NO EFFECT
PW4ENG 75-132 R3	NO EFFECT
PW4ENG 75-133	NO EFFECT
PW4ENG 75-134	NO EFFECT
PW4ENG 75-135	NO EFFECT
PW4ENG 75-136 R1	NO EFFECT
PW4ENG 75-137	NO EFFECT
PW4ENG 75-138	NO EFFECT
PW4ENG 75-138 R1	NO EFFECT
PW4ENG 75-138 R2	NO EFFECT
PW4ENG 75-139	NO EFFECT
PW4ENG 75-140	NO EFFECT
PW4ENG 75-144	03-15-01
PW4ENG 75-147	12-15-03
PW4ENG 75-147 R1	NO EFFECT
PW4ENG 77-1	RETROFIT
PW4ENG 77-1 R1	RETROFIT
PW4ENG 77-3	RETROFIT
PW4ENG 77-4	RETROFIT
PW4ENG 77-4 R1	RETROFIT
PW4ENG 77-4 R2	NO EFFECT
PW4ENG 77-5	RETROFIT
PW4ENG 77-6	RETROFIT
PW4ENG 77-7	RETROFIT
PW4ENG 77-7 R1	RETROFIT
PW4ENG 77-9	NO EFFECT
PW4ENG 77-9 R1	NO EFFECT
PW4ENG 77-9 R2	NO EFFECT
PW4ENG 77-11	04-15-91
PW4ENG 77-11 R1	NO EFFECT
PW4ENG 77-12	NO EFFECT
PW4ENG 77-12 R1	NO EFFECT

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PW4ENG 77-12 R2	NO EFFECT
PW4ENG 77-13	NO EFFECT
PW4ENG 77-13 R1	NO EFFECT
PW4ENG 77-14	03-15-93
PW4ENG 77-14 R1	NO EFFECT
PW4ENG 77-15	NO EFFECT
PW4ENG 77-16	NO EFFECT
PW4ENG 77-16	CIR
PW4ENG 77-16 R1	NO EFFECT
PW4ENG 77-16 R2	NO EFFECT
PW4ENG 77-16 R3	NO EFFECT
PW4ENG 77-16 R4	NO EFFECT
PW4ENG 77-17	03-15-97
PW4ENG 77-17 R1	NO EFFECT
PW4ENG 77-19	03-15-01
PW4ENG 79-1	NO EFFECT
PW4ENG 79-1 R1	NO EFFECT
PW4ENG 79-1 R2	NO EFFECT
PW4ENG 79-4	RETROFIT
PW4ENG 79-4 R1	RETROFIT
PW4ENG 79-4 R2	RETROFIT
PW4ENG 79-4 R3	RETROFIT
PW4ENG 79-4 R4	RETROFIT
PW4ENG 79-5	RETROFIT
PW4ENG 79-5 R1	RETROFIT
PW4ENG 79-5 R2	RETROFIT
PW4ENG 79-5 R3	RETROFIT
PW4ENG 79-6	RETROFIT
PW4ENG 79-6 R1	RETROFIT
PW4ENG 79-7	RETROFIT
PW4ENG 79-8	RETROFIT
PW4ENG 79-10	10-15-88
PW4ENG 79-10 R1	10-15-88
PW4ENG 79-10 R2	10-15-88
PW4ENG 79-10 R3	NO EFFECT
PW4ENG 79-10 R4	NO EFFECT
PW4ENG 79-11	RETROFIT
PW4ENG 79-12	RETROFIT
PW4ENG 79-13	RETROFIT
PW4ENG 79-14	03-01-86
PW4ENG 79-14 R1	NO EFFECT
PW4ENG 79-15	RETROFIT
PW4ENG 79-15 R1	NO EFFECT
PW4ENG 79-16	NO EFFECT
PW4ENG 79-16 R1	RETROFIT
PW4ENG 79-16 R2	RETROFIT
PW4ENG 79-16 R3	NO EFFECT
PW4ENG 79-16 R4	NO EFFECT
PW4ENG 79-16 R5	NO EFFECT
PW4ENG 79-17	NO EFFECT
PW4ENG 79-17 R1	NO EFFECT
PW4ENG 79-17 R2	NO EFFECT
PW4ENG 79-17 R3	NO EFFECT
PW4ENG 79-18	07-15-89
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PW4ENG 79-18 R2	NO EFFECT
PW4ENG 79-19	07-15-89
PW4ENG 79-19 R1	07-15-89
PW4ENG 79-19 R2	NO EFFECT
PW4ENG 79-19 R3	07-15-91
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PW4ENG 79-20 R1	07-15-88
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PW4ENG 79-21	03-01-86
PW4ENG 79-21 R1	03-01-86
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PW4ENG 79-21 R3	07-15-91
PW4ENG 79-22	RETROFIT
PW4ENG 79-23	10-15-88
PW4ENG 79-23 R1	NO EFFECT
PW4ENG 79-24	NO EFFECT
PW4ENG 79-24 R1	NO EFFECT
PW4ENG 79-24 R2	NO EFFECT
PW4ENG 79-27	NO EFFECT
PW4ENG 79-28	NO EFFECT
PW4ENG 79-28 R1	NO EFFECT
PW4ENG 79-28 R2	NO EFFECT
PW4ENG 79-29	RETROFIT
PW4ENG 79-29 R1	NO EFFECT
PW4ENG 79-32	NO EFFECT
PW4ENG 79-33	01-15-90
PW4ENG 79-33 R1	NO EFFECT
PW4ENG 79-34	04-15-89
PW4ENG 79-34 R1	NO EFFECT
PW4ENG 79-34 R2	04-15-89
PW4ENG 79-34 R3	NO EFFECT
PW4ENG 79-34 R4	07-15-92
PW4ENG 79-35	NO EFFECT
PW4ENG 79-36	10-15-89
PW4ENG 79-36 R1	NO EFFECT
PW4ENG 79-36 R2	NO EFFECT
PW4ENG A79-38	NO EFFECT

SB NO.	DATE INCORP	SB NO.	DATE INCORP
PW4ENG A79-38 R1	NO EFFECT	PW4ENG 79-58 R2	NO EFFECT
PW4ENG A79-38 R2	NO EFFECT	PW4ENG 79-59	03-15-93
PW4ENG A79-39	10-15-89	PW4ENG 79-59 R1	NO EFFECT
PW4ENG 79-40	NO EFFECT	PW4ENG 79-59 R2	NO EFFECT
PW4ENG 79-41	NO EFFECT	PW4ENG 79-59 R3	NO EFFECT
PW4ENG 79-42	NO EFFECT	PW4ENG 79-60	NO EFFECT
PW4ENG 79-42 R1	NO EFFECT	PW4ENG 79-60 R1	NO EFFECT
PW4ENG 79-43	10-15-90	PW4ENG 79-60 R2	NO EFFECT
PW4ENG 79-43 R1	NO EFFECT	PW4ENG 79-60 R3	NO EFFECT
PW4ENG 79-43 R2	NO EFFECT	PW4ENG 79-61	NO EFFECT
PW4ENG 79-43 R3	NO EFFECT	PW4ENG 79-62	NO EFFECT
PW4ENG 79-44	07-15-90	PW4ENG 79-62 R1	NO EFFECT
PW4ENG 79-45	NO EFFECT	PW4ENG 79-64	NO EFFECT
PW4ENG 79-46	01-15-91	PW4ENG 79-66	NO EFFECT
PW4ENG 79-46 R1	NO EFFECT	PW4ENG 79-66 R1	NO EFFECT
PW4ENG 79-46 R2	NO EFFECT	PW4ENG 79-66 R2	NO EFFECT
PW4ENG 79-46 R3	NO EFFECT	PW4ENG 79-67	NO EFFECT
PW4ENG 79-46 R4	NO EFFECT	PW4ENG 79-67 R1	NO EFFECT
PW4ENG 79-47	07-15-90	PW4ENG 79-67 R2	NO EFFECT
PW4ENG 79-47 R1	NO EFFECT	PW4ENG 79-68 R1	NO EFFECT
PW4ENG 79-47 R2	NO EFFECT	PW4ENG 79-68 R2	NO EFFECT
PW4ENG 79-47 R3	NO EFFECT	PW4ENG 79-71	NO EFFECT
PW4ENG 79-48	10-15-91	PW4ENG 79-71 R1	NO EFFECT
PW4ENG 79-48 R1	NO EFFECT	PW4ENG 79-72	NO EFFECT
PW4ENG 79-49	10-15-91	PW4ENG 79-72 R1	03-15-98
PW4ENG 79-49 R1	10-15-91	PW4ENG 79-73	NO EFFECT
PW4ENG 79-49 R2	10-15-91	PW4ENG 79-73 R1	NO EFFECT
PW4ENG 79-49 R3	NO EFFECT	PW4ENG 79-73 R2	NO EFFECT
PW4ENG 79-50	10-15-91	PW4ENG 79-73 R3	NO EFFECT
PW4ENG 79-50 R1	NO EFFECT	PW4ENG 79-74	03-15-96
PW4ENG 79-51	10-15-91	PW4ENG 79-74 R1	NO EFFECT
PW4ENG 79-51 R1	NO EFFECT	PW4ENG 79-75	03-15-96
PW4ENG 79-51 R2	NO EFFECT	PW4ENG 79-75 R1	NO EFFECT
PW4ENG 79-52	10-15-92	PW4ENG 79-75 R2	NO EFFECT
PW4ENG 79-52 R1	NO EFFECT	PW4ENG 79-76	09-15-96
PW4ENG 79-52 R2	NO EFFECT	PW4ENG 79-76	CIR
PW4ENG 79-52 R3	NO EFFECT	PW4ENG 79-76 R1	NO EFFECT
PW4ENG 79-53	07-15-92	PW4ENG 79-76 R2	NO EFFECT
PW4ENG 79-54	01-15-92	PW4ENG 79-76 R3	NO EFFECT
PW4ENG 79-54 R1	NO EFFECT	PW4ENG 79-78	09-15-96
PW4ENG 79-54 R2	NO EFFECT	PW4ENG 79-78 R1	NO EFFECT
PW4ENG 79-54 R3	NO EFFECT	PW4ENG 79-79	12-15-96
PW4ENG 79-56	NO EFFECT	PW4ENG 79-79 R1	NO EFFECT
PW4ENG 79-57	NO EFFECT	PW4ENG 79-81	12-15-96
PW4ENG 79-58	01-15-93	PW4ENG 79-81	CIR
PW4ENG 79-58 R1	NO EFFECT	PW4ENG 79-81 R1	NO EFFECT

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PW4ENG 79-84	NO EFFECT	SPN P3093	CIR
PW4ENG 79-85	NO EFFECT	SPN P3045	NO EFFECT
PW4ENG 79-87	NO EFFECT	SPN P3051 R10	NO EFFECT
PW4ENG 79-88	06-15-01	SPN P3080	NO EFFECT
PW4ENG 79-89	NO EFFECT	SPN P3109	NO EFFECT
SPN P3001	NO EFFECT	SPN P3112	NO EFFECT
SPN P3001	CIR	SPN P3121	NO EFFECT
SPN P3003	NO EFFECT	SPN P3121	CIR
SPN P3003	CIR	SPN P3125	NO EFFECT
SPN P3013	NO EFFECT	SPN P3130	NO EFFECT
SPN P3042	NO EFFECT	SPN P3144	NO EFFECT
SPN P3059	NO EFFECT	SPN 3179	NO EFFECT

Pratt & Whitney

PW4000 SERIES ENGINE MANUAL (PN 50A443)

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2	OCT 15/86	42	DEC 15/96	82	DEC 15/06		
3	JAN 15/87	43	MAR 15/97	83	MAY 1/07		
4	APR 15/87	44	JUN 15/97	84	SEP 1/07		
5	JUL 15/87	45	SEP 15/97	85	JAN 1/08		
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26	JAN 15/93	66	DEC 15/02				
27	MAR 15/93	67	MAR 15/03				
28	JUN 15/93	68	JUN 15/03				
29	SEP 15/93	69	SEP 15/03				
30	DEC 15/93	70	DEC 15/03				
31	MAR 15/94	71	MAR 15/04				
32	JUN 15/94	72	JUN 15/04				
33	SEP 15/94	73	SEP 15/04				
34	DEC 15/94	74	DEC 15/04				
35	MAR 15/95	75	MAR 15/05				
36	JUN 15/95	76	JUN 15/05				
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LIST OF EFFECTIVE SECTIONS

The current date levels of Lists of Effective Pages in this manual are specified in this List of Effective Sections. Revised or added sections for this revision are indicated by an "R" mark.

This List of Effective Sections records not only the dates of sections revised or added in this revision, but also the dates of all other List of Effective Pages remaining in the manual that are not revised or added. If there is a question about the correct date level of a section in this manual, it is recommended that all Lists of Effective Pages be examined to see if they have the correct dates as specified below.

This list is revised with each revision of the manual.

R		Introduction	JAN 1/08
		How To Use	JUN 15/03
		Time Limits	DEC 15/06
	71-00-00 POWER PLANT GENERAL	Power Plant General	DEC 15/97
	71-00-00 FAULT ISOLATION	Power Plant General - Fault Isolation	SEP 15/97
	71-00-00 STORAGE TRANSPORT	Power Plant General - Storage/Transport	DEC 15/06
R	71-00-00 TESTING	Power Plant General - Testing	JAN 1/08
	71-00-33	Power Plant General - Fan Case	DEC 15/06
	71-00-34	Power Plant General - Intermediate Case	MAR 15/94
	71-00-35	Power Plant General - High Pressure Compressor (HPC)	MAR 15/06
	71-00-41	Power Plant General - Diffuser And Combustor	MAR 15/06
	71-00-52	Power Plant General - High Pressure Turbine (HPT)	JUN 15/93
	71-00-53	Power Plant General - Low Pressure Turbine (LPT)	JUN 15/93

	71−00−54	Power Plant General − Turbine Exhaust Case	DEC 15/03
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R	72−00−00	Engine General	JAN 1/08
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	72−00−32	Engine General − LPC/LPT Coupling	MAY 1/07
	72−00−33	Engine General − Fan Case	DEC 15/06
	72−00−34	Engine General − Intermediate Case	DEC 15/06
	72−00−35	Engine General − High Pressure Compressor (HPC)	SEP 1/07
R	72−00−41	Engine General − Diffuser And Combustor	JAN 1/08
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R	72−00−52	Engine General − High Pressure Turbine (HPT)	JAN 1/08
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Introduction

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INTRODUCTION

1. Engine Model Application

A. This document is the property of United Technologies Corporation (UTC). UTC produces this document for the purpose of supporting engine certification requirements and, of providing information related to the proper use, maintenance, inspection, repair, servicing, and parts application of Pratt & Whitney engine products and services. By accepting this document the recipient agrees to limit copying the document, or any information in it, solely for distribution within the recipient's company or to a third party to carry out UTC's stated purpose for the document and any information in it. You cannot possess, use, copy, or disclose this document or any information in it for any purpose other than that stated above, without UTC's express written permission. Violation of these restrictions may result in criminal and/or civil liability.

B. This manual contains procedures which are applicable to these engine models and models with configuration identifiers:

PW4152, PW4152 (-1C/-1E), PW4152 (-3A), PW4152 (-3),
PW4156A, PW4156A (-1C/-1E), PW4156A (-3A), PW4156A (-3),
PW4158, PW4158 (-1C/-1E), PW4158 (-3A), PW4158 (-3)

C. The material that follows is applicable to engine models with configuration identifiers for engines that were obtained by conversion after original manufacture.

(1) These engine configurations (intermix engines), come from service bulletins. They are identified by a configuration identifier such as (-1C) and (-3E) after the basic engine model on the engine data plate.

(2) Only the basic engine models in the list that follows are shown for the page effectivity in this manual. These engine configurations use all data that is applicable to the basic engine model unless specified in other instructions.

(3) The list that follows specifies the correct basic model to use for each of the above engine configurations (intermix engines).

PW4152 (−1C/−1E) ... Refer to Basic Model PW4152
PW4152 (−3A) ... Refer to Basic Model PW4152 (−3)
PW4156A (−1C/−1E) ... Refer to Basic Model PW4156A
PW4156A (−3A) ... Refer to Basic Model PW4156A (−3)
PW4158 (−1C/−1E) ... Refer to Basic Model PW4158
PW4158 (−3A) ... Refer to Basic Model PW4158 (−3)

2. General

A. This publication is compiled and issued by the Product Support Department of Pratt & Whitney, Commercial Products Division, East Hartford, Connecticut 06108−0969 U.S.A. It includes approved and recommended procedures required for uninstalled maintenance of PW4000 Series engines.

B. Phase III engines are identified by a space (−3) following the applicable model. An example is PW4152 (−3). These engines are correctly shown on the Title Page of this manual. However, the List of Effective Pages and page Effectivity, in this manual, will have this engine listed as PW4152−3, without the space and the ( ). This is done because of computer space limits.

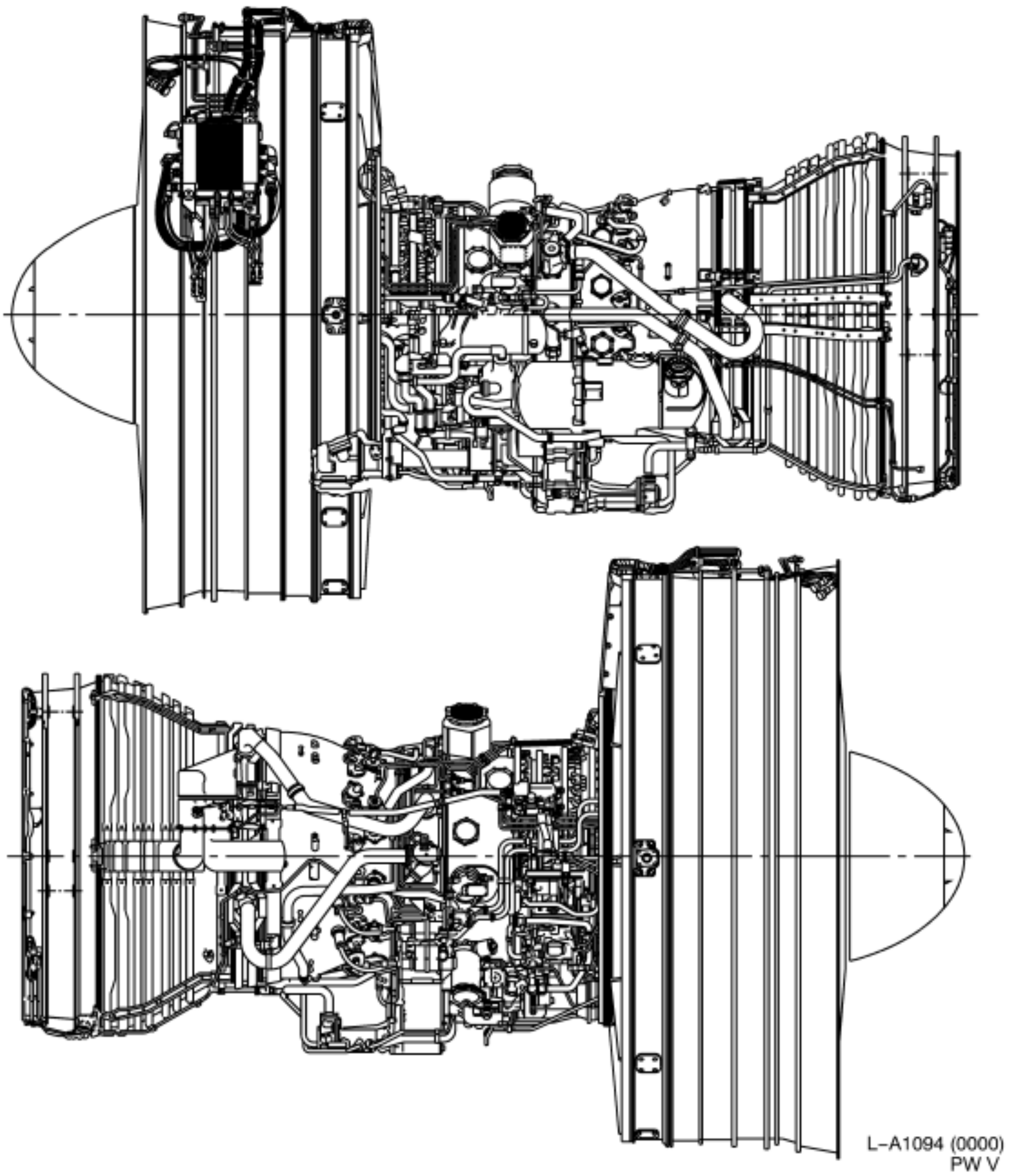
C. The information and instructions contained herein are based upon actual experience acquired under varied and exacting conditions. The utmost in dependable engine performance will be gained by conforming to these instructions. General reference left and right side views of the engine are shown in Figure 1.

D. Unusual problems concerning engine maintenance should be presented to the Product Support Department either through its field representatives or by direct contact. All possible assistance will be provided toward the solution of these problems.

E. Requests for pertinent information not covered by this publication, and suggestions for modification or amplification of these instructions so as to increase their usefulness, will be welcomed by the Pratt & Whitney Product Support Department.

F. This publication will be revised as necessary to incorporate the latest approved data.

INTRODUCTION


L-A1094 (0000)
PW V

Engine Side Views
Figure 1

3. Supplementary Publications

A. It is recommended that personnel concerned with engine maintenance also familiarize themselves with the following publications:

B. Engine Cleaning Inspection And Repair PW4000 Series CIR, PN 51A357 − This manual gives the recommended cleaning, inspection and repair procedures for individual parts that have been disassembled and removed from the engine. It will also have a small number of disassembly, assembly and test procedures that are necessary to support the cleaning, inspection and repair of the removed parts.

C. Illustrated Parts Catalog PW4152 Series IPC, PN 50A445 − This catalog lists and illustrates all salable parts of the engine covered in this manual.

The Illustrated Parts Catalog has been sectionalized and tab divided to be compatible with the Chapter/Section divisions of the Engine Manual. The illustrated Parts Catalog may, at the users discretion, be maintained in the same binders with the Engine Manual. The tab divided sections of the Illustrated Parts Catalog may be located in the Engine Manual binders following the corresponding Chapter/Section of the Engine Manual.

D. Engine Component Maintenance Manuals (P&W) − These manuals provide maintenance instructions for the component, as well as inspection limits, repairs, diagnostic tests and disassembly/assembly instructions. See the "Index of P&W Commercial Jet Engine Manuals And Parts Catalogs" for listing of P&W engine component maintenance manuals.

E. Engine Component Maintenance Manuals (Vendor) − These manuals provide maintenance instructions for the component, as well as inspection limits, repairs, diagnostic test and disassembly/assembly instructions.

Subsequent to initial distribution to airline operators, component maintenance manuals and illustrated parts catalogs covering vendor engine accessories listed in the "Index Of P&W Commercial Jet Engine Manuals And Parts Catalogs" should be ordered directly from the vendor. When ordering publications from the vendors listed, please indicate the part number of the component for which publications is required.

F. Nacelle Component Maintenance Manuals − These manuals provide maintenance instructions for the component, as well as inspection limits, repairs, diagnostic tests and disassembly/assembly instructions. See the "Index Of P&W Commercial Jet Engine Manuals And Parts Catalogs" for listing of these manuals. These documents may be ordered directly from Pratt & Whitney.

G. Illustrated Tool And Equipment Manual (PN 51A009) − This manual (ITEM) includes illustrations and corresponding data for all Pratt & Whitney special support tools and equipment required to Assemble/Disassemble, Maintain, Inspect, Repair, and Test the parts and assemblies of the PW4000 Series Engine.

H. Support Equipment Numerical Index (PN 50A557) − This document is used in conjunction with the engine manual and support equipment design and master sheet aperture cards. This document numerically lists, by maintenance level, all Pratt & Whitney special support equipment required to disassemble, assemble, inspect, repair, troubleshoot and test the power plant.

I. Service Bulletins − Service Bulletins will be issued as required to provide information or instructions for modifying earlier production engines or parts to the latest configuration.

Service Bulletins applicable to the engine models covered by this manual are reflected in the List of Service Bulletins.

J. Maintenance Advisory Notices (MAN's) − These documents are issued as required to provide help in on−wing or off−wing maintenance of the engine. It is not the intention of the MAN's to replace the engine manual, service bulletins or other maintenance documents approved by the regulatory authorities. The MAN's, along with the engine and nacelle service bulletin management documents, are designed to help the airlines and overhaul shops make an overall maintenance plan for PW4000 Series Engines.

Maintenance Advisory Notices applicable to engine models covered in this manual are shown in the List of Maintenance Advisory Notices.

INTRODUCTION

K. Standard Practices Manual, PN 585005 - This manual contains approved and recommended standard practices information, instructions, and procedures used repeatedly on various engines manufactured by Pratt & Whitney.

NOTE: If thread lubricant and torque values are not specified when required, refer to Standard Practices Manual, PN 585005, Assembly-01 (Task 70-52-00-400-101).

L. Power Plant Illustrated Parts Catalog - This catalog includes part information pertaining to line replaceable units and maintenance spares for the propulsion system.

M. Power Plant Buildup Manual - This manual provides Quick Engine Change (QEC) component buildup instructions for a basic testable engine to configure it to a fully positionalized power plant ready for installation on the aircraft.

N. Structural Repair Manual - This manual provides instructions and data relative to repair of the nacelle primary and secondary structure.

O. Thrust Reverser Manual - This manual provides all necessary data for maintenance of the Thrust Reverser in the shop. It includes instructions for disassembly, assembly, cleaning, inspection and repair.

P. Inlet Cowl Manual - This manual provides maintenance instructions for the inlet cowl including service limits, repairs and disassembly/assembly instructions.

Q. Fan Cowl Doors (L.H. and R.H.) - These manuals provide maintenance instructions including disassembly, assembly, cleaning, inspection and repair of the fan cowl doors.

R. Engine Mounts (Forward And Aft) - These manuals provide maintenance instructions including disassembly, assembly, cleaning, inspection and repair of the engine mounts.

S. Exhaust Nozzle And Plug - These manuals provide maintenance instructions including disassembly, assembly, cleaning, inspection and repair of the nozzle and plug.

WARNING: BEFORE YOU USE ANY OF THE MATERIALS SHOWN IN THE CONSUMABLE MATERIALS INDEX. YOU MUST KNOW ALL OF THE PRECAUTIONS RECOMMENDED BY THE MANUFACTURER OF THE SUPPLIER.

THESE PRECAUTIONS TELL YOU HOW TO:

- USE THE MATERIAL SAFELY
- KEEP THE MATERIAL SAFELY
- DISCARD THE MATERIAL SAFELY

YOU MUST READ THE MATERIAL SAFETY DATA SHEETS (OSHA FORM 20 OR EQUIVALENT) TO LEARN THE RECOMMENDED PRECAUTIONS, THE SAFETY/DATA SHEETS ARE SUPPLIED BY THE MANUFACTURER OR THE SUPPLIER OF THE MATERIAL.

T. Consumable Material Index - This document contains information concerning consumable materials which are specified in the Engine Manual and in engine accessory Component Maintenance Manuals.

U. A section has been added to the Pratt & Whitney Standard Practices Manual, PN 585005 (Section 70-00-00, General-02) that contains a listing of previously approved technical data that has been superseded by Pratt & Whitney with current technical data or is technical data that Pratt & Whitney will no longer support for the maintenance of Pratt & Whitney products. Before the use of this technical data, you must make sure that the document number is not contained within the subject listing.

4. Inspection Requirements For Engines Not Inducted Into An Engine Repair Facility

A. Maintenance Review Board Repair (MRB) tasks, Airworthiness Directives (AD Notes), Aircraft Maintenance Manuals and other FAA accepted documents, for example Certification Maintenance Requirements (CMR) satisfy the inspection requirements for continued airworthiness for engines not inducted into an engine repair facility.

5. Minimum Inspection Requirements For Engines Inducted Into An Engine Repair Facility

A. General

(1) The Information that follows is being provided to clarify Engine Manual requirements for continued airworthiness for owners and operators without an approved maintenance/reliability program.

(2) Engine Repair Facility definition: An engine repair facility is a FAA approved Engine Repair Station (or equivalent) that is capable of compliance with the minimum inspection requirements defined by this section. The engine is considered induced into the repair facility when the engine is accepted by the repair facility for any type of work regardless of whether the work is performed on a charge or no charge basis.

(3) At one time, some engine parts contained asbestos fibers and it is possible that some of these parts continue in service. Refer to the commercial engine service bulletins for a listing of parts that once contained asbestos. In some parts, the material that contains asbestos may be within an adhesive. It is important to use correct precautions during work with these parts. Operators must obey all local regulations and employer work policies when parts that contain asbestos are handled or discarded. The asbestos used in Pratt & Whitney engine parts was usually encapsulated and will not release dust unless the parts are ground, sanded, drilled, scraped, cut, or broken. While it is our experience that these operations do not usually generate asbestos at levels in excess of permissible exposure limits, operators must use all applicable precautions when handling such parts.

B. Requirements

(1) The following items define the minimum requirements that Pratt and Whitney series engines must comply with following induction into an engine repair facility to ensure the continued airworthiness of the engine. It is recognized that individual owner/operators or repair agencies may desire to go beyond these requirements to perform inspections, repairs, modifications,

and/or conversions to address the economics of engine operation and maintenance.

NOTE: All performed cleaning, disassembly, assembly, inspections, repairs, modifications, tests, storage, preservation and other tasks must adhere to the requirements defined in the Engine Manual (EM) and the Cleaning Inspection And Repair Manual (CIR) and in supporting FAA accepted documents such as the Illustrated Parts Catalog, Standard Practices Manual and Service Bulletins.

(a) Engine Testing, which is defined by the EM based on the extent of disassembly, must be performed per the testing shown in Chapter/Section 71−00−00 Testing−00.

(b) All applicable requirements of Airworthiness Directives (AD Notes) must be complied with. See Chapter/Section 05−10−00 for all necessary Airworthiness Directives (AD Notes) issued by the United States FAA and other regulatory agencies against the models of P&W engines covered by the EM and CIR.

(c) All parts installed on the engine must be in compliance with the specific engine model build list and manufactured in accordance with Original Engine Manufacturer (OEM) and/or FAA requirements/approved data.

(d) Regardless of the extent of disassembly, no parts which exceed their life limits as defined in Chapter/Section 05−10−00 Instructions for Continued Airworthiness may be present in the engine following repair.

(e) Regardless of the extend of disassembly, all applicable Maintenance Review Board Report (MRB) tasks must be complied with.

NOTE: The Maintenance Review Board Report tasks are summarized in PW4000 Maintenance Advisory Notice Number MAN−PW4000−1−93.

(f) All gaspath sections of the engine which are not disassembled for visual or more detailed inspections must receive a complete borescope inspection and must be repaired as necessary as defined in the EM and CIR.

(g) For engines inducted into an engine repair facility, the reason for the induction must be corrected.

(h) Parts/components/modules accessed during the engine repair or configuration (engine repair not associated with an operational discrepancy) require visual inspection to the appropriate part/component/module limits per the EM and CIR and Item (f) above.

(i) Parts/components/modules with unacceptable conditions must be repaired or replaced. All replacement parts/components/modules must meet the fits/clearances requirements directly affected by that part/component/module.

(j) All life limited parts that are removed from the engine and disassembled to the individual part level for overhaul must be non destructive inspected (NDI) per the EM and CIR. Specific NDI procedures called out by AD Notes and Service Bulletins must also be complied with.

(k) Approval of a part for continued service is not permitted until all necessary inspections specified in section 05−10−00 are done.

(l) For engines with Electronic Engine Control (EEC), all "Fault Level A" messages reported by the EEC during engine testing must be addressed.

6. Parts And Service

A. Service

(1) Pratt & Whitney maintains a Product Support Department to assist its customers in the operation, maintenance and overhaul of Pratt & Whitney engines. Product Support Department representatives maintain contact with operators and engine service activities and are available for the investigation of any specific difficulty or problem. Any request for assistance should be addressed directly to the Product Support Department, Pratt & Whitney, Commercial Products Division, East Hartford, Connecticut 06108−0969, U.S.A.

B. Ordering Parts

(1) Whenever possible, refer to the appropriate Illustrated Parts Catalog, when ordering parts. In case a parts list is not available, give engine model, manufacturer's engine serial number, and a full description of the part and where it is used. All spare parts orders should be addressed directly to the Commercial Parts Support Department, Pratt & Whitney, Commercial Products Division, East Hartford, Connecticut 06108−0969 U.S.A.

(2) Because some parts require special or expensive equipment for assembling and cannot be fabricated except in a specially equipped shop, they are not furnished individually and must be purchased as assemblies. If an order is received for a unit of an assembly coming under this classification, the complete assembly will be shipped.

C. Returning Parts

(1) Material for investigation:

(a) All material sent back to Pratt & Whitney for investigation goes to one of these addresses.

(b) All material sent back to Pratt & Whitney for investigation must have a number five (5) copy of a Request for Support Allowance (RSA) with it.

NOTE: The Request for Material Return (RMR) number must be referenced on the Request for Support Allowance (RSA).

USA Based Operators

PRATT & WHITNEY
Receiving Well No. 5
Customer Parts Return (CPR) (D Bldg, Col G1−15)
Attn: Service Material Investigation

400 Main Street
East Hartford, CT 06108

Non−USA Based Operators

UNITED TECHNOLOGIES INTERNATIONAL
C/O PRATT & WHITNEY

Receiving Well No. 5
Customer Parts Return (CPR)
(D Bldg, Col G1−15)
Attn: Service Material Investigation
400 Main Street
East Hartford, CT 06108 USA

(2) Engines and modules for Service Policy Benefits that are sent to Pratt & Whitney Eagle Services:

(a) Engines and modules sent back to Pratt & Whitney Eagle Services, for Service Policy Benefits, goes to one of these addresses.

(b) All engines and modules sent back to Pratt & Whitney must have a number five (5) copy of a Request for Support Allowance (RSA) with it.

(c) Engines and modules sent back with this procedure must have the operator's charge purchase order to get the correct billing.

USA Based Operators

PRATT & WHITNEY Eagle Services
Cheshire Engine Center
500 Knotter Drive
Cheshire, CT 06410

Non−USA Based Operators

UNITED TECHNOLOGIES INTERNATIONAL
c/o
PRATT & WHITNEY Eagle Services
Cheshire Engine Center
500 Knotter Drive
Cheshire, CT 06410

(3) Individual parts returned for Service Policy Benefits:

(a) Refer to the Repair Vendors List that is in the Introduction Section of Engine Cleaning Inspection Repair Manual (PN 51A357).

1 Refer to Pratt & Whitney Eagle Services (Source Code 8N802) on the Vendor Repair List.

2 Individual parts, sent back for Service Policy Benefits, are sent to the Pratt & Whitney Eagle Services (Source Code 8N802), specified, or other vendors as specified in that source code.

NOTE: Choose the address and vendor by the product line they service. Refer all questions to the Eagle Services, East Hartford, at the number or address given in the Repair Vendors List.

(b) All individual parts sent back must have a number five (5) copy of a Request for Support Allowance (RSA) with it.

(c) Individual parts sent back with this procedure must have the operator's charge purchase order to get the correct billing.

(4) Use sufficient protection on parts to prevent damage while they are shipped.

(5) Put individual part tags on parts which are removed from more than one engine or which have different part times, and prepare individual RSA'S for these parts.

D. Vendor Services

(1) The names of any companies provided in this publication as a possible source for required services or supplies are furnished for information purposes only. Except for the work or supplies to be performed or furnished by Pratt & Whitney, it is understood that Pratt & Whitney does not endorse the work performed by the company or companies names herein or any other company and does not accept responsibility to any degree for the selection of such company or companies for the performance of any work or procurement of supplies. Pratt & Whitney does not endorse the work performed or supplies procured from these companies. Further, Pratt & Whitney does not accept responsibility, to any degree, for the selection of such companies for such work performed nor supplies procured.

7. Parts Cleaning/Inspection/Repair Sequence

A. It is possible that repair procedures will have a "Prerequisite" section with these or similar statements:

(1) Refer to Repair−00 for part numbers to which this repair is applicable.

NOTE: The purpose of this prerequisite is to make sure that a repair is applicable to a part number before that repair is started.

(2) Make sure (verify) that all cleaning and inspection procedures are done before this repair.

(a) For parts that will get inspections in accordance with all applicable Engine Manual or Cleaning, Inspection and Repair (CIR) Manual inspections (parts which will get overhaul):

1 Before a repair or multiple repairs are started, be sure that all applicable cleaning, coating removals, and inspections are done in the order that follows:

a Clean. (Refer to the applicable CIR Manual or Engine Manual ATA Chapter.)

b Remove coating as needed. (Refer to the Standard Practices Manual 70−32−00 and 70−33−00 for coating removal requirements.)

c Do all applicable inspections. (Refer to the applicable CIR Manual or Engine Manual ATA Chapter.)

d Repair. (Refer to the applicable CIR Manual or Engine Manual ATA Chapter.)

(b) For parts that will get inspections in accordance with an approved owner's / operator's maintenance plan in which full compliance with all Engine Manual or Cleaning, Inspection and Repair (CIR) Manual inspections are not necessary (limited workscopes): inspection requirements of the approved owner's / operator's maintenance plan are applicable.

NOTE: Repeated or cumulative applications of limited workscopes are not intended to be, nor are they acceptable as a substitute for the overhaul of a part or component.

1 When a repair is applicable in local areas, clean the local repair area(s) of the part by the Engine Manual or Cleaning, Inspection and Repair (CIR) Manual requirements.

NOTE: Typical examples of local repairs are blend, weld, detail replacement, cold work, touch−up (and there can be more). Tank stripping, plating, and plasma coating, for example, do not have the definition of local repairs. If there are questions about whether a local repair is applicable, send questions to the Customer Technical Service Department either through its field representatives or by direct contact.

NOTE: When SPOP 203 or SPOP 18 and SPOP 209 are specified (see SPM 70−20−00; Selection of Cleaning Procedures), a local application of SPOP 209 or SPOP 208 only is sufficient before the initial FPI or FMPI.

2 Visually examine and do non−destructive inspections (if applicable to the part) by the Overhaul Manual, Engine Manual or Cleaning, Inspection and Repair (CIR) Manual requirements on the area for which the repair is necessary. Other cleaning and/or dimensional inspection of the repair area(s) can be necessary as the result of the visual inspection or processing requirements. Local cleaning and inspection must be as specified in the Standard Practices Manual and Engine Manual or Cleaning, Inspection and Repair (CIR) Manual.

NOTE: SPOP 70 is permitted for local repairs. The local fluorescent penetrant sensitivity level must agree with the sensitivity level of the fluorescent penetrant inspection requirements (SPOP 62, SPOP 82, or SPOP 84) specified in the Fluorescent Penetrant Inspection parts list of detail parts in the Overhaul Manual, Engine Manual or Cleaning, Inspection and Repair (CIR) Manual for the part to get repaired.

3 If in addition to 4.A. (2), there are other prerequisites to a repair (detail removal, coating removal, etc.), it will be necessary to do these operations.

4 Repair the part by the procedure steps in the applicable Overhaul Manual, Engine Manual or Cleaning, Inspection, and Repair (CIR) Manual repair.

B. At one time, some engine parts contained asbestos fibers and it is possible that some of these parts continue in service. Refer to the commercial engine service bulletins for a listing of parts that once contained asbestos. In some parts, the material that contains asbestos may be within an adhesive. It is important to use correct precautions during work with these parts. Operators must obey all local regulations and employer work policies when parts that contain asbestos are handled or discarded. The asbestos used in Pratt & Whitney engine parts was usually encapsulated and will not release dust unless the parts are ground, sanded, drilled, scraped, cut or broken. While it is our experience that these operations do not usually generate asbestos at levels in excess of permissible exposure limits, operators must use all applicable precautions when handling such parts.

8. Parts And Processes Certified By Pratt & Whitney

A. Federal Aviation Regulations require that each type certificate holder provide "Instructions For Continued Airworthiness". The information contained in this manual is a part of the data provided by Pratt & Whitney to meet this requirement. The information contained in this manual applies only to parts and processes certified by Pratt & Whitney. The information contained in this manual does not apply to parts and processes not certified by Pratt & Whitney. An example of a part/process not certified by Pratt & Whitney would include parts manufactured under a parts manufacturer approval (PMA) even though the use of such parts may be authorized by the Federal Aviation

Administration. Accordingly owners, operators, and repairers (overhaulers) of Pratt & Whitney products should obtain the required instructions for continued airworthiness for parts and processes not certified by Pratt & Whitney from the manufacturer or holder of the authority for the use of such parts and processes.

9. Repair Vendors

A. Master Repair Vendors List

(1) For the master list of repair vendors, refer to Section 70-40-00, General-01 (Task 70-40-00-990-001) in the Standard Practices Manual, PN 585005.

NOTE: Except for work or supplies to be performed or furnished by Pratt & Whitney, Pratt & Whitney does not endorse the work performed by the company or companies identified herein or any other company and does not accept responsibility to any degree for the selection of such company or companies for the performance of any work or procurement of supplies.

B. Supplemental Repair Vendors List

(1) This supplemental list contains repair source code information that is new or revised since the last issued revision of the Standard Practices Manual, PN 585005. See Table 1.

(2) This supplemental list must be used with the Standard Practices Manual, PN 585005 until the next revision to that document. The next revision to the Standard Practices Manual will incorporate the information contained in this supplemental list.

(3) Due to the critical nature of a source demonstration repair, repair sources must demonstrate to Pratt & Whitney their capability to perform the repair and be licensed by Pratt & Whitney. If you are interested in being considered by Pratt & Whitney for a license to perform a source demonstration repair, contact the address given in Figure 2.

R (4) Repair sources must be licensed by Pratt & Whitney to
R perform a proprietary repair. If you are interested in
R being considered by Pratt & Whitney for a license to
R perform a proprietary repair, contact the address given
R in Figure 2.

R NOTE: Contact information for source demonstration
R or proprietary repairs provided in Figure 2
R supersedes different addresses previously
R published in source demonstration or proprietary
R repairs.

R Source Code Vendor Name/Address

R No new source code information has been added
R since the last revision of the Standard Practices
R Manual, PN 585005.

R Supplemental Source Code And Vendor Name/Address
R Table 1

10. Explanation Of Manual Format

A. Specification

(1) This manual has been prepared per ATA Specification No. 100 as established by the Air Transport Association of America.

(2) The element numbering system employed in this manual corresponds with that employed in the Illustrated Parts Catalog. Details on how elements have been assigned are given in the How To Use Section of this manual.

11. Equivalent Tools, Fixtures, Test Equipment

A. In accordance with federal regulations (14CFR43.13), anyone performing work on an engine covered by this manual under the jurisdiction and authority of the Federal Aviation Administration (FAA) must use tools, equipment, and test apparatus which will assure that such work will be completed in accordance with industry standards. If Pratt & Whitney recommends special equipment or test apparatus, each person performing the work must use that equipment or apparatus or its equivalent that is acceptable to the Administrator of the FAA. Special provisions of the FAA regulations regarding tools, equipment, and test apparatus apply to holders of certain air carriers' operating certificates and

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E–FAX: (860) 557–7197

L–D3496 (0806)
PW V

Pratt & Whitney Address
Figure 2

certificates issued under certain specified parts of those regulations.

B. The expendable parts necessary to accomplish a task are listed at the beginning of each task in the Expendable Parts List. The IPC locations (Chapter−Section−Figure−Item Number) are given to locate the parts in the IPC. You must determine the applicable Item Number Alpha variant and the correct part number based on the effectivity and model codes in the IPC. The IPC and applicable SBs provide part number effectivity and usage.

12. Corporate Trademarks

A. The following words, acronyms, or designs are trademarks of
R United Technologies Corporation. See Figure 3.

B. The following words or acronyms are other trademarks: TURBOFIX

13. Weights And Measures

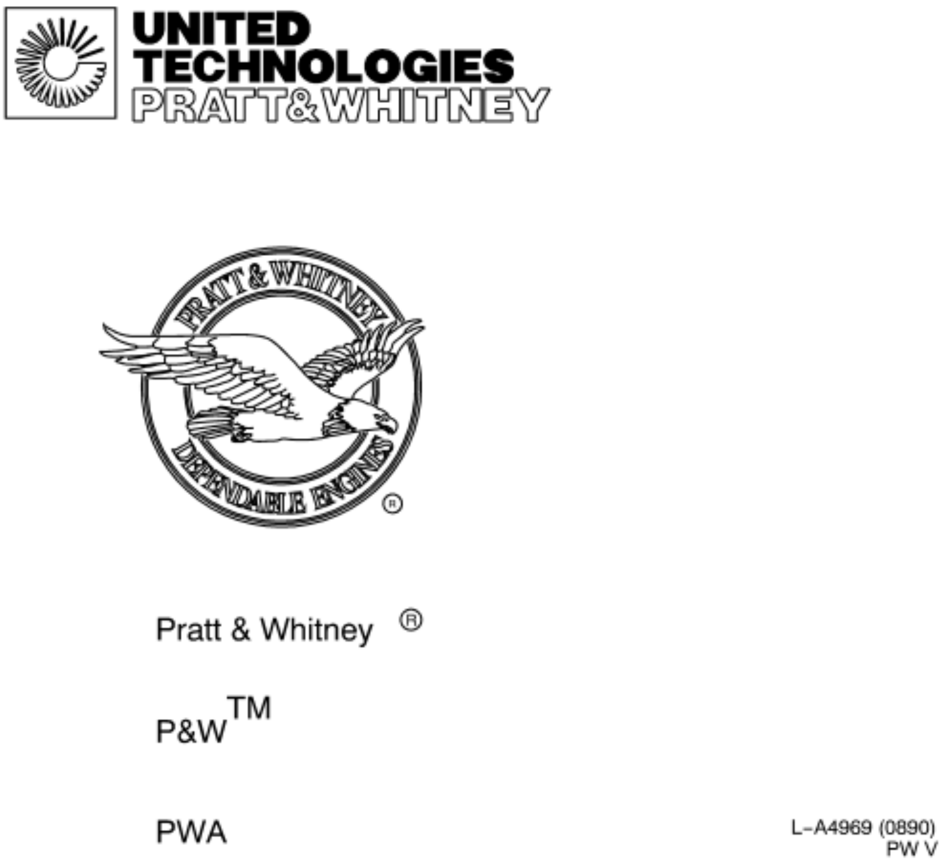
A. Weights and measures are provided for both U.S. customary and SI − metric measurement systems. The SI − metric measurement value will appear in parenthesis immediately following the U.S. customary system equivalent. SI − metric equivalents for equal U.S. customary system values may differ slightly, depending on application as well as procedures utilized in the automated conversion program.

14. Directional References

A. Directional references such as right and left, clockwise and counterclockwise, upper and lower are applicable to the engine as seen from the rear with the engine in the horizontal position and with the accessory (gearbox) section at the bottom of the engine (unless otherwise stated).

15. Abbreviations

A. The use of abbreviations has been avoided as much as possible. In some instances however, such consideration as space limitations, common usage, etc., have made the use of abbreviations preferable to the use of the applicable longer
R terms. Abbreviations used are defined in Table 2 and Table
R 3.


UNITED
TECHNOLOGIES
PRATT&WHITNEY
PRATT & WHITNEY
DEPENDABLE ENGINES
Pratt & Whitney ®
P&W™
PWA
L-A4969 (0890)
PW V

Corporate Trademarks
R Figure 3

INTRODUCTION

Abbreviations	Definitions
ACC	Active Clearance Control
ADC	Air Data Computer
AMS	Aerospace Material Specification
AOC	Air Oil Cooler
Assy	Assembly
ATA	Air Transport Association
CCW	Counterclockwise
CG	Center of Gravity
dia	diameter
dim	dimension
EBU	Engine Built-up Unit
EEC	Electronic Engine Control
EGT	Exhaust Gas Temperature
FOD	foreign object damage
FIR	full indicator reading
FMU	Fuel Metering Unit
HPT	High Pressure Turbine
HPC	High Pressure Compressor
HX	Heat Exchanger
ID	inside diameter
IDG	Integrated Drive Generator
IDGS	Integrated Drive Generator System
LPC	Low Pressure Compressor
LH	left hand
LPT	Low Pressure Turbine
LVDT	Linear Variable Differential Transformer
max	maximum
MIN	minute
min	minimum
No.	number
OD	outside diameter
OCL	Oil Cooler
PD	pitch diameter
PDIU	Propulsion Discrete Interface Unit
PERF	Performance
PPH	pounds per hour
PMA	Permanent Magnet Alternator
PN	part number
PPM	parts per million
psia	pounds per square inch absolute
psig	pounds per square inch gage
P&W	Pratt & Whitney
ref	reference
RFS	Regardless of Feature Size
RH	right hand
RVDT	Rotary Variable Differential Transformer
rpm	revolutions per minute

R General Abbreviations
R Table 2

Abbreviations	Definitions
SB	Service Bulletin
SEL	Selector
SPMC	service process material control
SPOP	service process operation procedure
SPS	service process solution
SOL	Solenoid
SVA	Stator Vane Actuator
TCA	Turbine Cooling Air
TCC	Turbine Case Cooling
TEMP	Temperature
TRA	Thrust Resolver Angle
TRC	Thermal Rotor Control
T/M	Torque Motor
TSFC	Thrust Specific Fuel Consumption
W/A	Wrap Around
XFR	Transfer

R General Abbreviations
R Table 2 (Continued)

U.S. Customary System		SI-Metric Measurement System	
Abbreviation	Definition	Abbreviation	Definition
°F	Degrees Fahrenheit	°C	Degrees Celsius
ft	Foot	m	Meter
ft^3	Cubic Foot	m^3	Cubic Meter
gal	Gallon	l	Liter
in.	Inch	mm	Millimeter
in^2	Square Inch	mm^2	Square Millimeter
in^3	Cubic Inch	mm^3	Cubic Millimeter
lb	Pound	kg	Kilogram
lbf	Pound-Force	N	Newton
lb-ft	Pound-Force-Foot (Torque)	N.m	Newton Meter
lb/ft^2	Pound/Square Foot	Pa	Pascal
lb/ft^3	Pound/Cubic Foot	kg/m^3	Kilogram/Cubic Meter
lb/gal	Pound/Gallon	kg/m^3	Kilogram/Cubic Meter
lb-in.	Pound-Force-Inch (Torque)	N.m	Newton Meter
lb/in^2	Pound/Square Inch	k Pa	Kilpascal
oz	Ounce (Fluid)	ml	Milliliter

Weights And Measures Abbreviations
Table 3

U.S. Customary System		SI-Metric Measurement System	
Abbreviation	Definition	Abbreviation	Definition
(CONTINUED)			
oz	Ounce (Weight)	g	Gram
oz/gal	Ounce/Gallon	kg/m^3	Kilogram/Cubic Meter
oz-in.	Ounce-Inch (Balance Limits)	g.mm	Gram-Millimeter
oz-in.	Ounce-Force-Inch (Torque)	N.m	Newton Meter
oz/in^3	Ounce/Cubic Inch	kg/m^3	Kilogram/Cubic Meter
T	Short Ton	kg	Kilogram

Weights And Measures Abbreviations
Table 3 (Continued)

16. Tube Function Numbers

A. Tube function numbers are added to the tube nomenclatures and figures in the various sectionalization chapters. The tube function numbers help positively identify tubes with common nomenclatures, help cross reference between the Engine Manual and Illustration Parts Catalog, and help to identify the tube function. These numbers do not change with part progression as the tube part numbers do. The tube function numbers also relate to the tables, schematics, and installation locations that are provided in Chapter/Section
R 72-09-71. See Table 4.

Tube Function Numbers	
A	Air System
(AA##)	Air Actuation System
(AC##)	Air Cooling System
(AP##)	Air Pressurizing System
(AS##)	Air Sense System
C	Hydraulic Control System
(CP##)	Hydraulic Control Pressure System
(CR##)	Hydraulic Control Return System
F	Fuel System

R Tube Function Numbers
R Table 4

Tube Function Numbers	
(FM##)	Fuel Main Supply System
(FS##)	Fuel Supply to Injector System
L	Lubrication System
(LB##)	Lubrication Breather System
(LD##)	Lubrication Drain System
(LP##)	Lubrication Pressure System
(LR##)	Lubrication Return Scavenge System
(LS##)	Lubrication IDG System

NOTE: See 72−09−71, Description And Operation for related information and schematics for the different systems.

R Tube Function Numbers
R Table 4 (Continued)

Previous Pageblock Return to Previous Menu Next Pageblock

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

Title

List Of Revisions

Record Of Revisions

Record Of Temporary Revisions

List of Service Bulletins - Engine

1	JUN 15/05
2	JUN 15/05
3	JUN 15/05
4	JUN 15/05
5	JUN 15/05
6	JUN 15/05
7	JUN 15/05
8	JUN 15/05
9	JUN 15/05
10	JUN 15/05
11	JUN 15/05
12	JUN 15/05
13	JUN 15/05
14	JUN 15/05
15	JUN 15/05
16	JUN 15/05
17	JUN 15/05
18	JUN 15/05
19	JUN 15/05
20	JUN 15/05
21	JUN 15/05
22	JUN 15/05
23	JUN 15/05
24	JUN 15/05
25	JUN 15/05
26	JUN 15/05

List of Service Bulletins - Nacelle

1	JUN 15/05
2	JUN 15/05
3	JUN 15/05

Tab Separator - Introduction

List of Effective Pages - Introduction
See end of list.

Table of Contents - Introduction

01-00-00	R	01/ 02		MAY 1/07
01-00-00				
01-00-00		001	ALL	MAR 15/04
INTRO		002		MAR 15/04
		003		MAR 15/04
		004		MAR 15/04
		005		MAR 15/04
		006		MAR 15/04
		007		JUN 15/06
		008		JUN 15/06
		009		JUN 15/06
		010		JUN 15/06
		011		JUN 15/06
		012		JUN 15/06
		013		DEC 15/06
		014		DEC 15/06
		015		DEC 15/06
		016		DEC 15/06
	R	017		MAY 1/07
	R	018		MAY 1/07
	R	019		MAY 1/07
	R	020		MAY 1/07
	R	021		MAY 1/07
	R	022		MAY 1/07
	A	023		MAY 1/07
	A	024		MAY 1/07
	A	025/026		MAY 1/07

TO: RECIPIENTS OF PW4152, PW4152−3, PW4156A, PW4156A−3,
PW4158, PW4158−3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 83 DATED MAY 1, 2007

HIGHLIGHTS − INTRODCUTION

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
INTRO	017 −025/ 026	Revised to add new paragraph for repair vendors, source demonstration and proprietary repair data and Pratt & Whitney address. Added a new figure and table and renumbered figures and tables.(PSAF06MC146)	ALL

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INTRODUCTION

TABLE OF CONTENTS

	SUBJECT	CHP/SEC/SUB	PAGE	EFFECTIVITY
	INTRODUCTION			
	Introduction		001	ALL
	Engine Model Application		001	
	General		002	
	Supplementary Publications		004	
	Inspection Requirements For Engines Not Inducted Into An Engine Repair Facility		007	
	Minimum Inspection Requirements For Engines Inducted Into An Engine Repair Facility		008	
	Parts And Service		010	
	Parts And Processes Certified By Pratt & Whitney		016	
R	Repair Vendors		017	
R	Explanation Of Manual Format		018	
R	Equivalent Tools, Fixtures, Test Equipment		018	
R	Corporate Trademarks		020	
R	Weights And Measures		020	
R	Directional References		020	
R	Abbreviations		020	
R	Tube Function Numbers		024	

Return to Previous Menu

How To Use

	LIST OF EFFECTIVE PAGES
	HIGHLIGHTS
	TABLE OF CONTENTS
	HOW TO USE MANUAL • HOW TO USE THIS MANUAL • ORGANIZATION OF DATA • TIME LIMITS − CHAPTER 05 • POWER PLANT − CHAPTER 71 • ENGINE − CHAPTER 72 • ENGINE SECTION IDENTIFICATION • TAB SEPARATED SECTIONS OF THE ENGINE MANUAL • MANUAL NUMBERING SYSTEM • PAGE FOOTING • ENGINE MODEL EFFECTIVITY • FUNCTION TITLES AND PAGE BLOCK NUMBERS • DATA LOCATING GUIDELINES • TASK NUMBERING SYSTEM • MAINTENANCE RESOURCES • CHAPTER/SECTION/SUBJECT NUMBERING OUTLINE

Previous Pageblock Return to Previous Menu Next Pageblock

HOW TO USE MANUAL

1. HOW TO USE THIS MANUAL

This section describes the PW4000 Series Engine Manual organization. In addition, certain guidelines are provided to assist data location.

This publication provides specific information concerning the engine and the demountable (Quick Engine Change - QEC) power plant. The demountable power plant is defined as the engine including the nacelle parts which are engine mounted and are removed from the aircraft as a unit.

Procedures contained in this manual assume the power plant includes (but is not limited to) the following major parts and systems:

Engine
Inlet Cowl
Exhaust Nozzle
Exhaust Plug
Engine Mounted Pneumatic Supply System
Engine Driven Accessories
Accessory Drain System
Engine Mounted Fire And Overheat Detectors

2. ORGANIZATION OF DATA

The manual is organized into three (3) major chapters; Chapter 05 Time Limits, Chapter 71 Power Plant, and Chapter 72 Engine. See Manual Numbering, System for an explanation of the Chapter/Section/Subject numbering system is used in this manual.

3. TIME LIMITS - CHAPTER 05

Chapter 05 provides the service life limits for specific engine parts.

4. POWER PLANT - CHAPTER 71

Chapter 71 provides the procedures for the demountable power plant which are required to support shop maintenance of the power plant.

HOW TO USE MANUAL

71−00−00 Four (4) tab separated sections contain data which is applicable to the entire power plant. Information provided in this section includes (but is not limited to) the following:

Procedures for removal of various power plant components.

Fault isolation procedures.

Procedures for transporting the engine by truck, to prepare the power plant for split−shipment, and to assemble a replacement power plant.

NOTE: Procedures for engine preservation and depreservation are covered in 72−00−00, Storage/Transporation.

Testing Procedures.

71−00−XX Twelve (12) tab separated sections contain data which is applicable to specific sections of the complete power plant. These sections provide the following:

Procedures required to gain access for separation of engine sections from the power plant.

EXAMPLE: Nacelle parts removal/disconnect procedures required to gain access for removal of the turbine exhaust case section of the engine are located in 71−00−54, Removal−01. This manual section is referenced as a prerequisite procedure in 72−00−54, Removal−01 for removal of the turbine exhaust case section from the power plant.

Procedures required to gain access to specific sections of the engine after removal from the power plant.

EXAMPLE: Nacelle parts removal procedure required prior to the disassembly of the turbine exhaust case section of the engine is located in 71−00−54, Disassembly−01. This manual section is referenced as a prerequisite procedure in 72−54−00, Disassembly−01 for

(CONTINUED)

disassembly of the turbine exhaust case.

Procedures required to replace individual nacelle components on a complete power plant. These procedures are located in the appropriate 71−00−XX manual section.

EXAMPLE: The procedure for removal of the inlet cowl is located in manual section 71−00−33, Removal−02.

These procedures may be used to support specific nacelle parts replacement. They may also be referenced as prerequisite or postrequisite procedures for other shop maintenance requirements in the manual.

5. ENGINE − CHAPTER 72

Chapter 72 provides the procedures for the shop maintenance of the engine. Data in this chapter is divided into tab separated sections for specified areas of the engine.

72−00−00 This tab separated section contains data which is applicable to the entire engine. Information provided in this section includes (but is not limited to) the following:

- Borescope inspection of the engine gaspath.
- Servicing of the engine oil system.
- Preservation/depreservation of the engine.
- Special trunnioning procedures.
- Rigging of engine systems.

72−00−XX Twelve (12) tab separated sections contain data which is applicable to specified sections of the complete engine. Information provided in these sections includes (but is not limited to) the following:

Procedures to remove and install the engine section.

Procedures to remove and install individual external

(CONTINUED)

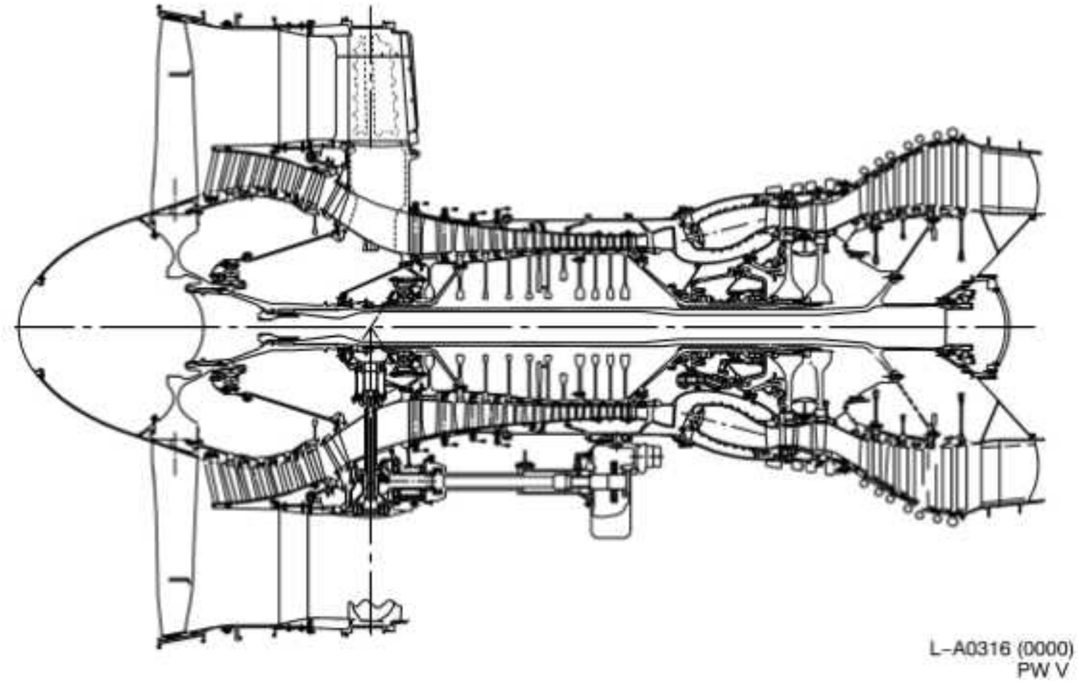
	engine parts/components from an assembled engine. Fits and clearances concerning external parts/ components and internal interface parts between engine sections.
72–09	This tab separated section contains data which is applicable to common parts or to parts not assigned to other engine sections. Information provided in this section includes (but is not limited to) the following: Reference tables for the tube function number to nomenclature relationship, installation location, and actual location on the engine.
72–XX	Twelve (12) tab separated sections contain data which is applicable to specific engine sections after separation from the rest of the engine. Inforamtion provided in these sections includes the following: Procedures to disassemble the engine section. Fits and clearances for the parts of the engine section. Procedures and limits for inspection of the engine section. Procedures for assembly of the engine section.

6. ENGINE SECTION IDENTIFICATION

Figure 1 identifies the engine sections by nomenclature and by Chapter/Section number.

7. TAB SEPARATED SECTIONS OF THE ENGINE MANUAL

The following is a list of tab separator titles used in this manual. Specific sections within the power plant (71–00–XX) portion of the manual will not contain procedural information. These tab separators are provided for continuity with the engine sections only.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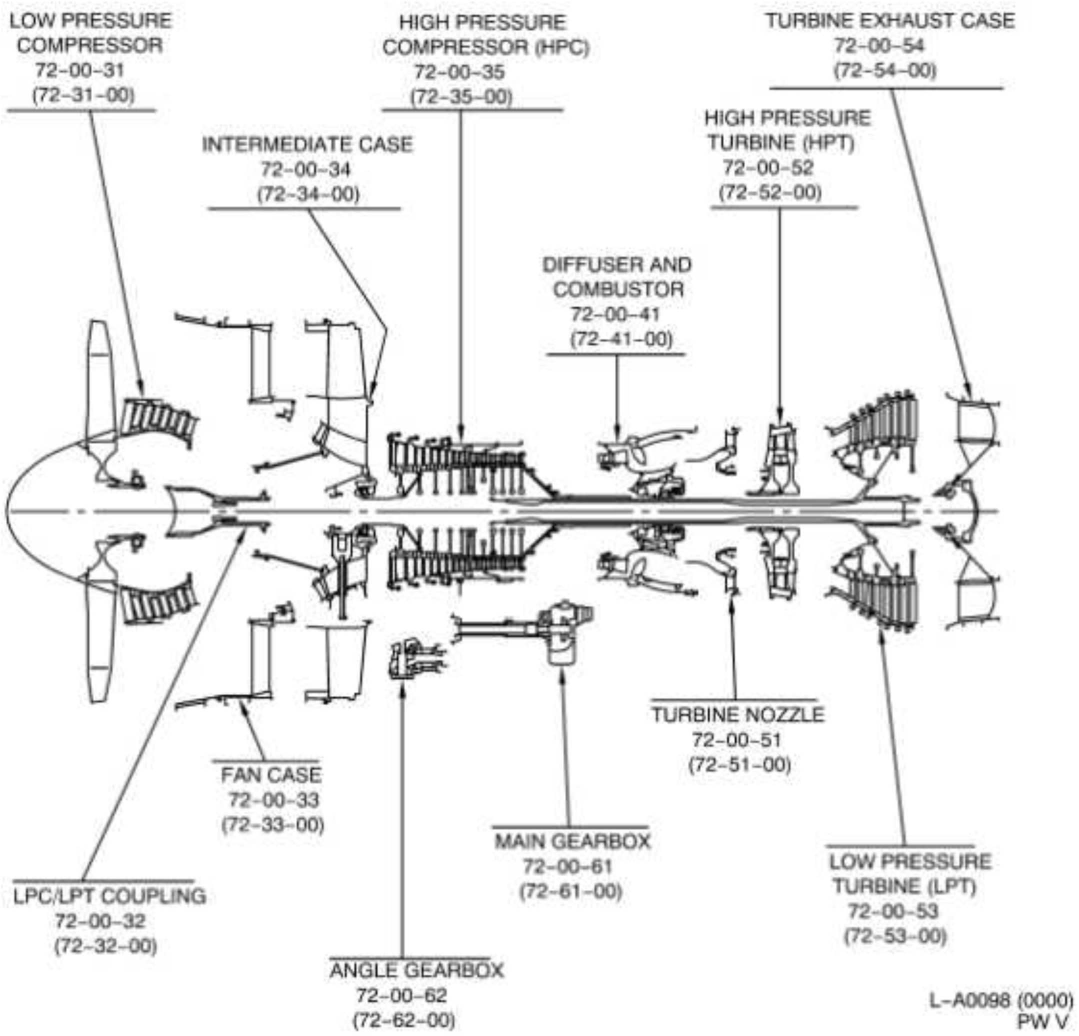
PW V

Engine Sections
Figure 1 (Sheet 1)


LOW PRESSURE COMPRESSOR
72-00-31
(72-31-00)
HIGH PRESSURE COMPRESSOR (HPC)
72-00-35
(72-35-00)
TURBINE EXHAUST CASE
72-00-54
(72-54-00)
INTERMEDIATE CASE
72-00-34
(72-34-00)
HIGH PRESSURE TURBINE (HPT)
72-00-52
(72-52-00)
DIFFUSER AND COMBUSTOR
72-00-41
(72-41-00)
TURBINE NOZZLE
72-00-51
(72-51-00)
FAN CASE
72-00-33
(72-33-00)
MAIN GEARBOX
72-00-61
(72-61-00)
LOW PRESSURE TURBINE (LPT)
72-00-53
(72-53-00)
LPC/LPT COUPLING
72-00-32
(72-32-00)
ANGLE GEARBOX
72-00-62
(72-62-00)
L-A0098 (0000)
PW V

Engine Sections
Figure 1 (Sheet 2)

HOW TO USE MANUAL

FRONT SECTIONS

- INTRODUCTION
- HOW TO USE MANUAL
- 05 TIME LIMITS

POWER PLANT SECTIONS

71−00−00	POWER PLANT GENERAL
71−00−00	POWER PLANT GENERAL − FAULT ISOLATION
71−00−00	POWER PLANT GENERAL − STORAGE/TRANSPORT
71−00−00	POWER PLANT GENERAL − TESTING
71−00−31	POWER PLANT GENERAL − LOW PRESSURE COMPRESSOR (LPC)
71−00−32	POWER PLANT GENERAL − LPC/LPT COUPLING
71−00−33	POWER PLANT GENERAL − FAN CASE
71−00−34	POWER PLANT GENERAL − INTERMEDIATE CASE
71−00−35	POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC)
71−00−41	POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR
71−00−51	POWER PLANT GENERAL − TURBINE NOZZLE
71−00−52	POWER PLANT GENERAL − HIGH PRESSURE TURBINE (HPT)
71−00−53	POWER PLANT GENERAL − LOW PRESSURE TURBINE (LPT)
71−00−54	POWER PLANT GENERAL − TURBINE EXHAUST CASE
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX
71−00−62	POWER PLANT GENERAL − ANGLE GEARBOX

HOW TO USE MANUAL

ENGINE SECTIONS

72-00-00	ENGINE GENERAL
72-00-00	ENGINE GENERAL − STORAGE/TRANSPORT
72-00-31	ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC)
72-00-32	ENGINE GENERAL − LPC/LPT COUPLING
72-00-33	ENGINE GENERAL − FAN CASE
72-00-34	ENGINE GENERAL − INTERMEDIATE CASE
72-00-35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC)
72-00-41	ENGINE GENERAL − DIFFUSER AND COMBUSTOR
72-00-51	ENGINE GENERAL − TURBINE NOZZLE
72-00-52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT)
72-00-53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT)
72-00-54	ENGINE GENERAL − TURBINE EXHAUST CASE
72-00-61	ENGINE GENERAL − MAIN GEARBOX
72-00-62	ENGINE GENERAL − ANGLE GEARBOX
72-09	ENGINE GENERAL − COMMON PARTS
72-31	LOW PRESSURE COMPRESSOR (LPC)
72-32	LPC/LPT COUPLING
72-33	FAN CASE
72-34	INTERMEDIATE CASE
72-35	HIGH PRESSURE COMPRESSOR (HPC)
72-41	DIFFUSER AND COMBUSTOR
72-51	TURBINE NOZZLE
72-52	HIGH PRESSURE TURBINE (HPT)
72-53	LOW PRESSURE TURBINE (LPT)

ENGINE SECTIONS

72−54	TURBINE EXHAUST CASE
72−61	MAIN GEARBOX
72−62	ANGLE GEARBOX

8. MANUAL NUMBERING SYSTEM

A three element Chapter/Section/Subject number has been assigned to each power plant and engine section and to each significant part within the engine. This identifying number appears at the lower right−hand corner of each page adjacent to the page number. These numbers are assigned in accordance with the Air Transport Association (ATA) Specification 100.

The first element of the number identifies the Chapter. This manual contains data applicable to Chapters 05, 71 and 72.

The second element identifies the engine section of the Chapter. Chapter 72 sections are assigned as follows:

72−09	Common Parts
72−31 through 72−35	Compressor
72−41	Diffuser and Combustor
72−51 through 72−54	Turbine
72−61 and 72−62	Gearbox

In the Power Plant General Chapter 71−00 and Engine General Chapter 72−00, the engine section identifiers are used in the third element. These numbers identify data which concerns a specific engine section when that section is still on the complete power plant or engine.

EXAMPLE:

71−00−34

72−00−34

34 Section Identifier − Intermediate Case

72−34−00

See Tab Separated Sections list for specific identification of engine sections.

In Chapter 72 the third element is applied to identify significant parts or units of the specific engine section. See Figure 2.

EXAMPLE

72−31−04

72	Chapter Identifier − Engine
3	Section Identifier − Compressor
1	Subsection Identifier − Low Pressure Compressor (LPC)
04	Subject (Significant Part Or Unit) − Stage 2 LPC Blade

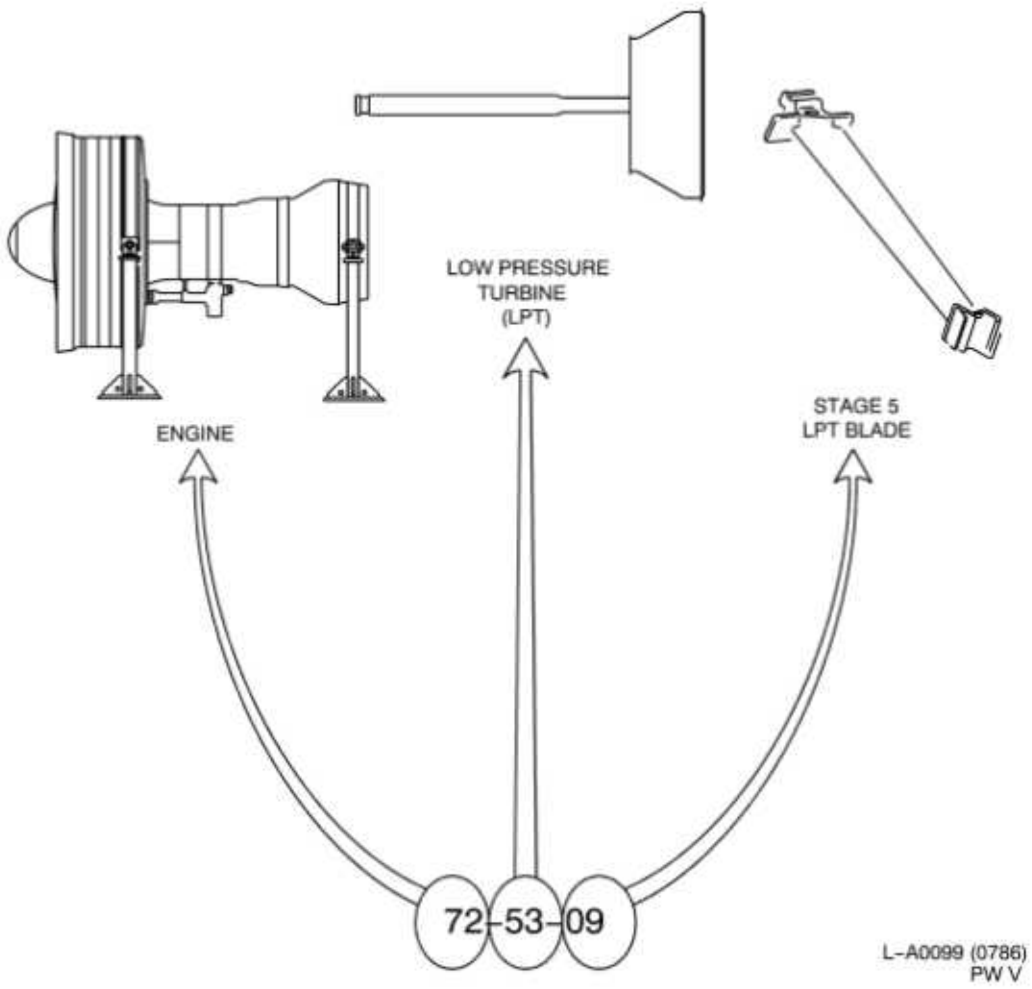
See Chapter/Section/Subject Numbering Outline for specific identification of sections and engine parts or units.

9. PAGE FOOTING

Each manual page contains a unique page footing identifier. See Figure 3.

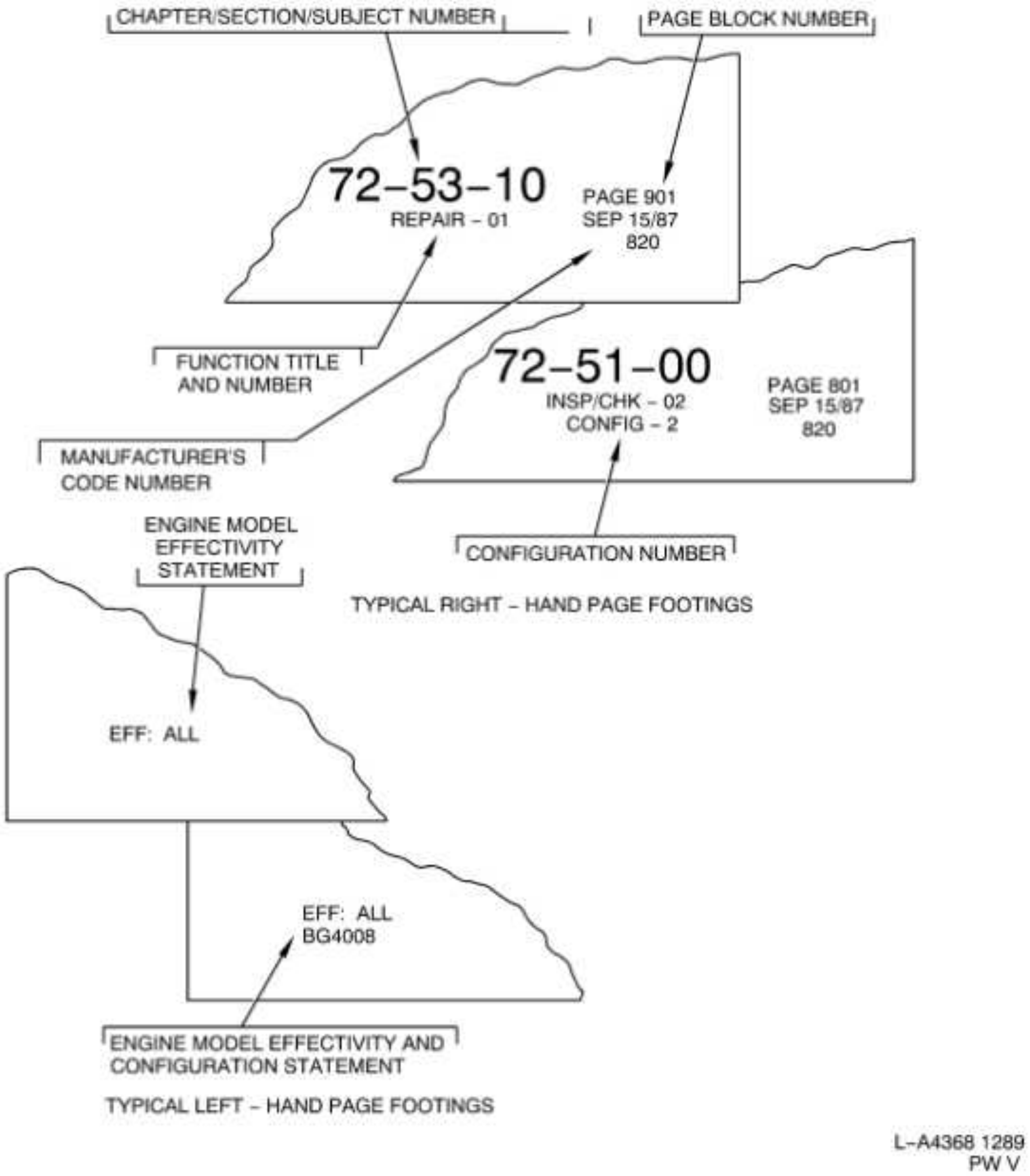
The right−hand page footing contains the Chapter/Section/Subject number, function title, page block number, and page revision date. Configuration designation is located under the function title when applicable.

The left−hand page footing contains the Engine Model Effectivity statement and the configuration descriptive statement when applicable. These elements of the page footing are defined elsewhere in this manual section.


LOW PRESSURE TURBINE (LPT)
ENGINE
STAGE 5 LPT BLADE
72-53-09
L-A0099 (0786)
PW V

Chapter/Section/Subject Numbering
Figure 2

HOW TO USE MANUAL


CHAPTER/SECTION/SUBJECT NUMBER
PAGE BLOCK NUMBER
72–53–10
REPAIR – 01
PAGE 901
SEP 15/87
820
FUNCTION TITLE AND NUMBER
MANUFACTURER'S CODE NUMBER
72–51–00
INSP/CHK – 02
CONFIG – 2
PAGE 801
SEP 15/87
820
CONFIGURATION NUMBER
TYPICAL RIGHT – HAND PAGE FOOTINGS
ENGINE MODEL EFFECTIVITY STATEMENT
EFF: ALL
EFF: ALL
BG4008
ENGINE MODEL EFFECTIVITY AND CONFIGURATION STATEMENT
TYPICAL LEFT – HAND PAGE FOOTINGS
L–A4368 1289
PW V

Page Footing
Figure 3

10. ENGINE MODEL EFFECTIVITY

The engine model effectivity for this manual is established by the models listed on the Title Page.

Manual sections applicable to all of the models listed on the Title Page have an effectivity statement in the page footing that reads:

EFF: ALL

Manual sections applicable to a specific engine model are identified with an effectivity statement in the page footing similar to the following example:

EFF: PW4056

11. FUNCTION TITLES AND PAGE BLOCK NUMBERS

The separation of data in this manual is identified by a function title and a page block number. These identifiers are located at the lower right−hand portion of each page. See the Page Footing paragraph of this section for function and page block examples. Function titles are also printed in the heading on each page. Most function sections are further divided (Inspection/Check−00, Inspection/Check−01, etc.) to allow for specific tasks within a page block.

Function titles and the corresponding page block numbers are organized as follows:

DESCRIPTION AND OPERATION	Page 1 − 99

This functional title is used to provide general background information on location, basic design characteristics and function of the engine section being addressed. The information is intended to be basic and uncomplicated. In The Engine General section, Description and Operation for the entire engine is outlined, with brief descriptions of each major engine section. In the individual engine sections, description and operation for that area is provided in more detail.

FAULT ISOLATION	Page 101 − 199

This section of the manual provides procedures for guiding the user from identification of an engine problem, through possible causes, to isolation of the problem and corrective actions to be taken.

HOW TO USE MANUAL

SPECIAL PROCEDURES Page 201 − 299

This section includes procedures that are normally required as a result of other maintenance actions and do not directly apply to other functional page blocks. This category may include alternate trunnioning procedures and systems rigging procedures. Procedures located in this function are referenced from other functional sections.

REMOVAL Page 301 − 399

This function provides the procedures for removal of a QEC part (from the assembled power plant), an engine section (from the assembled engine), or a part/component (from an assembled engine section).

INSTALLATION Page 401 − 499

This function provides the procedures for installation of a QEC part (to the assembled power plant), an engine section (to the assembled engine), or a part/component (to an assembled engine section).

DISASSEMBLY Page 501 − 599

This function provides the procedures for disassembly of an engine or power plant section into its detail parts. The procedures may be applied for either partial or complete disassembly of an engine section. Disassembly does not include separation of riveted or similarly retained subassemblies.

CLEANING Page 601 − 699

This function provides procedures for engine gaspath cleaning.

INSPECTION/CHECK Page 801 − 899

This function provides the detailed inspection and check procedures which are used to determine the serviceability of a part or unit. The information in this function includes, fits and clearances, borescope inspection, airflow checks, oil flow checks, leak checks, dimensional inspection, visual inspection, and non−destructive inspection (fluorescent penetrant, magnetic particle, X−ray, eddy current, ultrasonic, etc.).

HOW TO USE MANUAL

REPAIR	Page 901 − 999

This function provides the detailed repair procedures authorized for part or unit refurbishment. Each repair procedure is identified to specific part numbers.

ASSEMBLY	Page 1001 − 1099

This function provides the procedures for assembly of the detail parts into an engine section or subsection (subassembly).

SERVICING	Page 1101 − 1199

This function provides the procedures for routine servicing of engine systems. Included in this function is draining and filling of the engine oil system.

STORAGE	Page 1201 − 1299

This function provides the procedures for preservation of the engine during storage and procedures for depreservation after storage. Procedures for packing and unpacking the engine and engine sections are also included in this function.

STORAGE/TRANSPORT	Page 1201 − 1299

This function provides the procedures for preparation before and after split shipment of the power plant or of the engine.

TESTING	Page 1301 − 1399

This function provides the procedures and parameters to ensure the operational integrity of the engine following other maintenance functions.

12. DATA LOCATING GUIDELINES

Specific data concerning an engine part may be located in the manual by the following steps.

- If the part nomenclature and/or general engine location is known, determine the Chapter/Section/Subject number assigned to the part. This may be accomplished by referring to the Chapter/Section/Subject Numbering Outline and the related illustrations.
- If the part nomenclature is uncertain but the part number is known, determine the correct nomenclature by the use of the appropriate Illustrated Parts Catalog (IPC). The IPC may also provide the corresponding Chapter/Section designation.

Using this part nomenclature and Chapter/Section information determine the complete Chapter/Section/Subject number as per step above.

- Locate the tab separator which corresponds to the Chapter/Section portion of the number determined in step above.
- Locate the part in the Table Of Contents for that manual section. The Table Of Contents is arranged in numerical order by Chapter/Section/Subject number.
- Functional requirements for the subject part are listed in the Table Of Contents and are arranged in numerical order by page block numbers and function numbers. See the list of function titles and page block numbers in the section.
- Specific data concerning the subject part is located in the same order as shown in the Table Of Contents.
- If inspection information is required for the part, refer to the part number index in the Inspection/Check−00 for that Chapter/Section/Subject. The index identifies all inspection procedures that are applicable for the specific part number.
- If repair information is required for the part, refer to the part number index in the Repair−00 for that Chapter/Section/Subject. The index identifies all repair procedures that are applicable for the specific part number.

Specific data concerning the complete power plant or engine may be located in the manual by the following steps.

- Determine the functional category for the data.

EXAMPLE

Type Of Data	Functional Category
Borescope Inspection	− Inspection/Check
Rigging	− Special Procedures
Oil Tank Filling	− Servicing

- Locate the functional page block for the data in the Table Of Contents of the appropriate manual section.
- The specific data will be found in the manual in the same order as shown in the Table Of Contents.

13. TASK NUMBERING SYSTEM

See Figure 4 and Table 1.

This manual utilizes a structure which is based on the Air Transport Association (ATA) Specification No. 100, Jet Engine Maintenance Task Oriented Support System (JEMTOSS). The structure which incorporates discrete task and subtask numbers for text, illustrations, and tables allows for adaptation of this manual to an individual user's specific manual or electronic system.

The task numbering system allows for data selection or cross−reference by unique task or subtask numbers. The task numbers provide a precise, unchanging point of reference which is not affected by revisions to page or paragraph numbers.

The functional arrangement of data and the ATA Specification 100 numbering system form the basis for the assignment of maintenance task numbers to each operation described in the manual. The task number contains five (or six) elements. The first three of these elements are the ATA number and reflect the Chapter/Section/Subject number in the conventional manner. The fourth element identifies the function (inspection, repair, test, etc.). See Table 1 for specific fourth element function identification. The fifth element provides a unique identification for each task/subtask within the function. A sixth element may be assigned when necessary to identify configurational differences, or method variations from a basic task.

In addition to basic task numbers, subtask numbers have been assigned to steps within the task. This allows identification of changes in maintenance functions within a task. For example, a repair may require premachining, plating, finish machining and heat treat; subtask numbers would be assigned as necessary to each text unit to show function change.

Each SPOP (Service Process Operation Procedure) has been assigned a Standard Practices Subtask number. The first three elements are the ATA number (expanded to six digits) of the page block in the Standard Practices Manual where the SPOP is located. The fourth and fifth elements have been assigned as explained above. These subtask numbers appear either in tabular format or in procedural text, each time a SPOP is referenced in this manual.

The task numbers are included in the manual to assist the operator in the management of technical data if the system is utilized; however the manual may be used in a conventional manner, since the arrangement of technical data is unaffected.

14. MAINTENANCE RESOURCES

Equipment and materials informational paragraphs are located at the beginning of each task. They contain any Standard Tools, Special Tools, Consumable Material, Expendable Parts, Repair Details, and/or Packaging Equipment required to accomplish the task. Tools already in place such as build stands and fixtures are not included. Consumable materials are identified by a general nomenclature and a unique code number. The procurement information for each coded consumable material is contained in the PW4000 Consumable Materials Index.

000	REMOVAL AND DISASSEMBLY
010	Remove Engine
020	Remove Engine Modular Section
030	Disassemble Engine Modular Section
040	Disassemble Engine Subassembly
050	Remove Accessory Component
060	Disassemble Accessory
070	Disassemble Accessory Subassembly
080	Remove Engine Test Equipment And Instrumentation
090	Disassemble Support Equipment
100	CLEANING
110	Chemical
120	Abrasive
130	Ultrasonic
140	Mechanical
150	Unassigned
160	Miscellaneous Cleaning
200	INSPECTION
210	Check
220	Visual/Dimensional
230	Penetrant
240	Magnetic
250	Eddy Current
260	X−Ray
270	Ultrasonic
280	Special

Task Number Function Code Definitions
Table 1

300	REPAIR
310	Welding And Brazing
320	Machining
330	Stripping And Plating
340	Plasma And Flame Spraying
350	Miscellaneous Repairing
360	Bonding And Molding
370	Heat Treating
380	Surface Treating
390	Machine Riveting And Flaring
400	ASSEMBLY AND INSTALLATION
410	Install Engine
420	Install Engine Modular Section
430	Assemble Engine Modular Section
440	Assemble Engine Subassembly
450	Install Accessory Components
460	Assemble Accessory
470	Assemble Accessory Subassembly
480	Install Engine Test Equipment And Instrumentation
490	Assemble Support Equipment
500	ENGINE AND MATERIAL HANDLING
510	Shipping
520	Receiving
530	Packing
540	Unpacking
550	Storage
560	Marshalling
570	Engine Ferry/Pod Maintenance
600	SERVICING/PRESERVING/LUBRICATING
610	Servicing
620	Preserving
630	Depreserving
640	Lubricating
700	FUNCTIONAL TESTING

Task Number Function Code Definitions
Table 1 (Continued)

710	Oil Flow
720	Airflow
730	Fuel Flow
740	Water Flow
750	Electrical
760	Engine
770	Accessory
780	Pressure Check
790	Leak Check
800	MISCELLANEOUS

Task Number Function Code Definitions
Table 1 (Continued)

15. CHAPTER/SECTION/SUBJECT NUMBERING OUTLINE

The following is a complete listing of the individual Chapter/Section/Section/Subject numbers and specific nomenclatures which have been assigned to the significant engine sections and parts.

Numbers which are not assigned are indicated in the list by one of the following terms:

UNASSIGNED − This designation is for numbers intentially omitted and reserved for possible future use.

NOT USED − This designation is for numbers used for other related engine models which are not, at this time, applicable to the engine models covered by this manual.

TIME LIMITS	05−10−00
POWER PLANT GENERAL	71−00−00
POWER PLANT GENERAL − FAULT ISOLATION	71−00−00
POWER PLANT GENERAL − STORAGE/TRANSPORT	71−00−00
POWER PLANT GENERAL − TESTING	71−00−00
POWER PLANT GENERAL − LOW PRESSURE COMPRESSOR (LPC)	71−00−31
POWER PLANT GENERAL − LPC/LPT COUPLING	71−00−32
POWER PLANT GENERAL − FAN CASE	71−00−33

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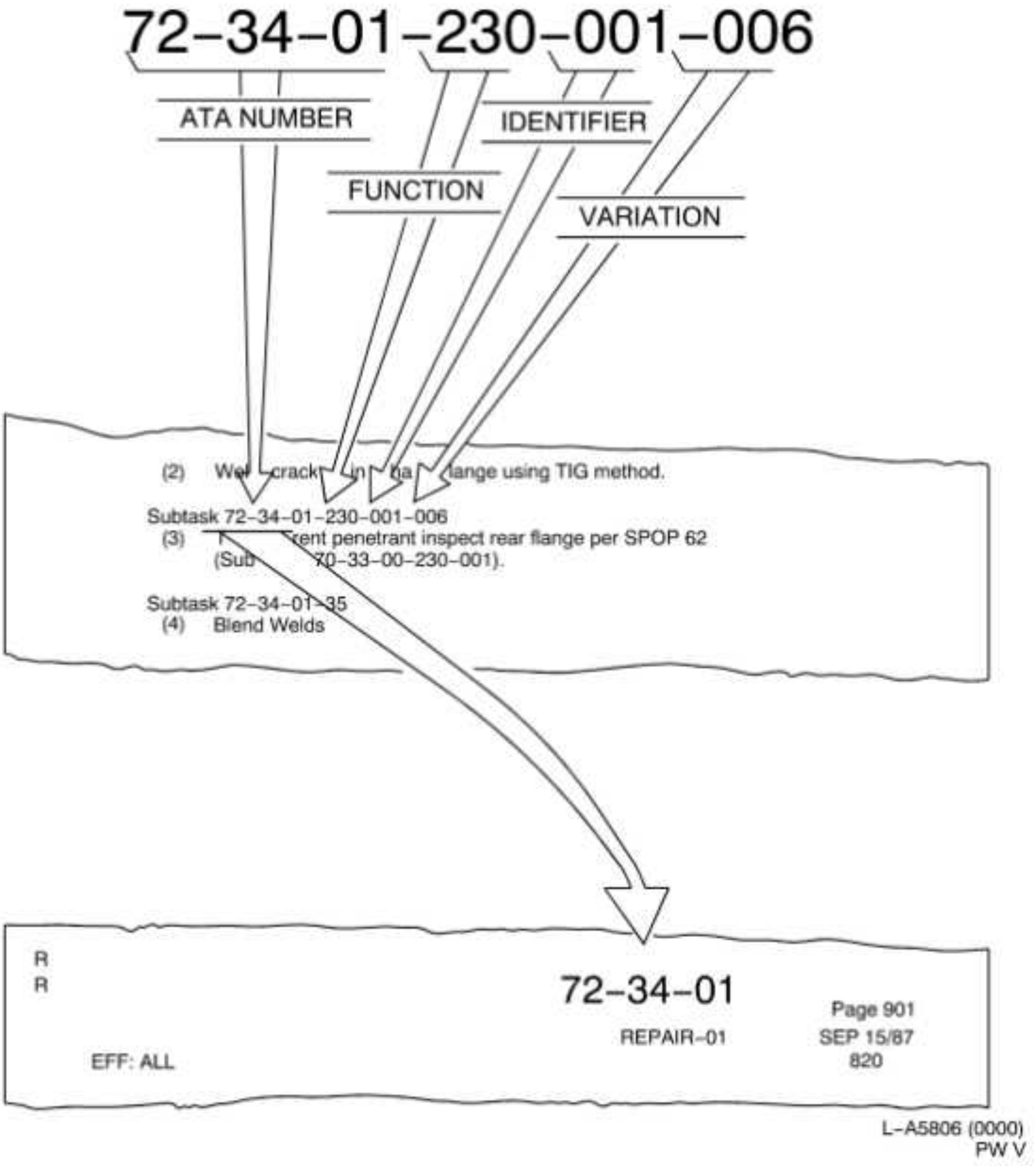
POWER PLANT GENERAL − INTERMEDIATE CASE	71−00−34
POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC)	71−00−35
POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR	71−00−41
POWER PLANT GENERAL − TURBINE NOZZLE	71−00−51
POWER PLANT GENERAL − HIGH PRESSURE TURBINE (HPT)	71−00−52
POWER PLANT GENERAL − LOW PRESSURE TURBINE (LPT)	71−00−53
POWER PLANT GENERAL − TURBINE EXHAUST CASE	71−00−54
POWER PLANT GENERAL − MAIN GEARBOX	71−00−61
POWER PLANT GENERAL − ANGLE GEARBOX	71−00−62
POWER PLANT ENGINE MOUNTS	71−20−00
NOT USED	71−21−01 through 71−22−99
ENGINE GENERAL	72−00−00
ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC)	72−00−31
ENGINE GENERAL − LPC/LPT COUPLING	72−00−32
ENGINE GENERAL − FAN CASE	72−00−33
ENGINE GENERAL − INTERMEDIATE CASE	72−00−34
ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC)	72−00−35
ENGINE GENERAL − DIFFUSER AND COMBUSTOR	72−00−41
ENGINE GENERAL − TURBINE NOZZLE	72−00−51
ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT)	72−00−52
ENGINE GENERAL − LOW PRESSURE TURBINE (LPT)	72−00−53
ENGINE GENERAL − TURBINE EXHAUST CASE	72−00−54
ENGINE GENERAL − MAIN GEARBOX	72−00−61
ENGINE GENERAL − ANGLE GEARBOX	72−00−62


72-34-01-230-001-006
ATA NUMBER
IDENTIFIER
FUNCTION
VARIATION
(2) We crack in ha lange using TIG method.
Subtask 72-34-01-230-001-006
(3) rent penetrant inspect rear flange per SPOP 62
(Sub 70-33-00-230-001).
Subtask 72-34-01-35
(4) Blend Welds
R
R
72-34-01
Page 901
REPAIR-01
SEP 15/87
820
EFF: ALL
L-A5806 (0000)
PW V

Task/Subtask Number Structure
Figure 4

ENGINE GENERAL − COMMON PARTS	72−09−00
ENGINE BEARINGS	72−09−50
BALANCE (TOOL) BEARINGS	72−09−51
ENGINE EXTERNAL TUBES	72−09−71
NOT USED	72−09−72
ENGINE BRACKETS	72−09−73
ENGINE COMPONENT HEATSHIELDS	72−09−74
TURBINE CASE COOLING MANIFOLD (HPT)	72−09−75
TURBINE CASE COOLING MANIFOLD ASSEMBLY (LPT)	72−09−76
TURBINE CASE COOLING DUCT ASSEMBLY	72−09−77
LOW PRESSURE COMPRESSOR (LPC) See Figure 5	72−31−00
AXIAL COMPRESSOR ROTOR ASSEMBLY	72−31−01
NOT USED	72−31−02
STAGE 1.6 LPC BLADE	72−31−03
STAGE 2 LPC BLADE	72−31−04
STAGE 3 LPC BLADE	72−31−05
STAGE 4 LPC BLADE	72−31−06
FRONT COMPRESSOR HUB ASSEMBLY	72−31−07
DRUM ROTOR DISK ASSEMBLY	72−31−08
LPC STAGE 1 COMPRESSOR STATOR ASSEMBLY	72−31−09
LPC (STAGE 1.6, 2, AND 3) COMPRESSOR STATOR ASSEMBLY	72−31−10
LPC STAGE 4 DUCT	72−31−11
LPC (DRUM TO HUB) TIEROD	72−31−12
LPC TIEROD NUT	72−31−13

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NO. 1 BALL BEARING	72-31-14
NO. 1 BEARING (INNER RACE) RETAINING NUT	72-31-15
NO. 1 BEARING SEAL SEAT	72-31-16
NO. 1 BEARING (CARBON) SEAL ASSEMBLY	72-31-17
NO. 1 BEARING FACE SEAL ASSEMBLY	72-31-18
NOT USED	72-31-19 through 72-31-27
NO. 1 BEARING SEAL SUPPORT ASSEMBLY	72-31-28
NOT USED	72-31-29 through 72-31-34
UNASSIGNED	72-31-35 through 72-31-79
COMPRESSOR INLET CONE FRONT SEGMENT	72-31-80
COMPRESSOR INLET CONE (REAR) SEGMENT ASSEMBLY	72-31-81
STAGE 1 LPC BLADE ASSEMBLY	72-31-82
COMPRESSOR BLADE (STAGE 1) LOCK ASSEMBLY	72-31-83
FAN EXIT FAIRING	72-31-84
NOT USED	72-31-85 through 72-31-87
UNASSIGNED	72-31-88 through 72-31-99
LPC/LPT COUPLING See Figure 6	72-32-00
TURBINE SHAFT COUPLING ASSEMBLY	72-32-01
NO. 1.5 ROLLER BEARING	72-32-02

NO. 1.5 BEARING SEAL SEAT	72-32-03
NO. 1.5 BEARING (INNER RACE) RETAINING NUT	72-32-04
UNASSIGNED	72-32-05 through 72-32-79
TURBINE SHAFT (COUPLING RETAINING) NUT	72-32-80
TURBINE SHAFT PLUG	72-32-81
UNASSIGNED	72-32-82 and 72-32-83
TURBINE SHAFT NUT	72-32-84
UNASSIGNED	72-32-85 through 72-32-99
FAN CASE See Figure 7	72-33-00
FAN CASE ASSEMBLY	72-33-01
FAN EXIT CASE AND VANE ASSEMBLY	72-33-02
FAN EXIT (OUTER) CASE	72-33-03
FAN EXIT INNER CASE ASSEMBLY	72-33-04
FAN EXIT BASE AND VANE ASSEMBLY	72-33-05
NOT USED	72-33-06 through 72-33-08
BLEED VALVE ASSEMBLY	72-33-09
ROD END CLEVIS (BLEED VALVE ACTUATOR)	72-33-10
SHOULDER BOLT (BLEED VALVE ACTUATOR CLEVIS)	72-33-11
BLEED VALVE CONNECTING LINK	72-33-12
BLEED VALVE LINKAGE BELL CRANK ASSEMBLY	72-33-13

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BLEED VALVE CAM FOLLOWER	72-33-14
SLEEVE SPACER (CAM FOLLOWER)	72-33-15
BLEED VALVE CAM FOLLOWER DAMPER ASSEMBLY	72-33-16
FAN EXIT (INNER AND OUTER) VANE SPACER	72-33-17
FAN EXIT LINER SEGMENT ASSEMBLY	72-33-18
BLEED VALVE DUCT SCREEN	72-33-19
BELL CRANK BRACKET ASSEMBLY	72-33-20
NOT USED	72-33-21
GROOVED HEADED PIN	72-33-22
SELF RETAINING PIN	72-33-23
UNASSIGNED	72-33-24 through 72-33-76
NOT USED	72-33-77 through 72-33-79
FAN EXIT (INNER) LINER SEGMENT ASSEMBLIES	72-33-80
FAN EXIT (FRONT) LINER SEGMENT ASSEMBLY	72-33-81
FAN EXIT INNER (BIFURCATION) FAIRING ASSEMBLY	72-33-82
FAN EXIT OUTER (BIFURCATION) FAIRING ASSEMBLY	72-33-83
NO. 3 BEARING AIR COOLER ASSEMBLY	72-33-84
NOT USED	72-33-85 through 72-33-92
UNASSIGNED	72-33-93 through 72-33-99

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INTERMEDIATE CASE See Figure 8	72-34-00
COMPRESSOR INTERMEDIATE CASE ASSEMBLY	72-34-01
FAN EXIT CASE FLANGE ASSEMBLY	72-34-02
NOT USED	72-34-03
NO. 2 BEARING AND SEAL ASSEMBLY	72-34-04
NO. 2 BEARING (CARBON) SEAL ASSEMBLY	72-34-05
NO. 2 BEARING SUPPORT ASSEMBLY	72-34-06
NO. 2 BEARING REAR FACE ASSEMBLY	72-34-07
SHOULDER STUD (NO. 2 BEARING DAMPER)	72-34-08
NO. 2 BEARING HOUSING ASSEMBLY	72-34-09
NO. 2 BEARING HOUSING SEAL RING	72-34-10
NO. 2 BEARING (OUTER RACE) RETAINING NUT	72-34-11
GEARBOX DRIVE BEVEL GEAR	72-34-12
SPACER RING	72-34-13
NO. 2 BALL BEARING	72-34-14
NO. 2 BEARING REAR SEAL SEAT	72-34-15
FIFTH STAGE HPC SHROUD RETAINING RING	72-34-16
UNASSIGNED	72-34-17 through 72-34-19
NO. 1.5 BEARING SUPPORT ASSEMBLY	72-34-20
GEARBOX DRIVE BEVEL GEARSHAFT	72-34-21
GEARSHAFT ROLLER BEARING	72-34-22
GEARSHAFT BALL BEARING	72-34-23
GEARBOX DRIVESHAFT COUPLING	72-34-24

MAIN BEARING (OIL) PRESSURE TUBE ASSEMBLY	72−34−25
NO. 2 BEARING (OIL) PRESSURE TUBE	72−34−26
NO. 1.5 AND 2 BEARING TUBE CONNECTOR ASSEMBLY	72−34−27
MAIN BEARING TUBE CONNECTOR ASSEMBLY	72−34−28
NO. 1.5 BEARING (OIL) NOZZLE ASSEMBLY	72−34−29
NO. 2 BEARING (OIL) NOZZLE ASSEMBLY	72−34−30
GEARBOX DRIVE (OIL) PRESSURE TUBE ASSEMBLY	72−34−31
GEARBOX DRIVE (OIL) NOZZLE ASSEMBLY	72−34−32
UNASSIGNED	72−34−33 and 72−34−34
NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY	72−34−35
NO. 1.5 AND 2 BEARING SEAL SUPPORT ASSEMBLY	72−34−36
FRONT NO. 2 BEARING FACE SEAL ASSEMBLY	72−34−37
NO. 1.5 BEARING FACE SEAL ASSEMBLY	72−34−38
UNASSIGNED	72−34−39 through 72−34−41
MAIN BEARING (OUTER) SCAVENGE TUBE ASSEMBLY	72−34−42
MAIN BEARING (INNER) SCAVENGE TUBE ASSEMBLY	72−34−43
UNASSIGNED	72−34−44 through 72−34−49
FOURTH STAGE COMPRESSOR STATOR ASSEMBLY	72−34−50
UNASSIGNED	72−34−51
ANGLE GEARBOX (SUPPORT) BRACKET ASSEMBLY	72−34−52
GEARBOX DRIVESHAFT ASSEMBLY	72−34−53

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NOT USED	72-34-54 through 72-34-66
UNASSIGNED	72-34-67 through 72-34-78
NOT USED	72-34-79
NO. 1 BEARING (OIL) PRESSURE MANIFOLD	72-34-80
NO. 1 BEARING REAR SUPPORT ASSEMBLY	72-34-81
NO. 1 BEARING FRONT SUPPORT	72-34-82
UNASSIGNED	72-34-83
NOT USED	72-34-84 through 72-34-94
UNASSIGNED	72-34-95 through 72-34-98
INTERMEDIATE CASE MISCELLANEOUS PARTS	72-34-99
HIGH PRESSURE COMPRESSOR (HPC) See Figure 9	72-35-00
AXIAL COMPRESSOR ROTOR ASSEMBLY	72-35-01
VARIABLE STATOR VANE AND HPC FRONT CASE ASSEMBLY	72-35-02
HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY	72-35-03
STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET	72-35-04
HPC FRONT HUB	72-35-05
STAGE 5 HPC DISK	72-35-06
HPC DRUM ROTOR (FRONT) DISK ASSEMBLY	72-35-07
HPC DRUM ROTOR (REAR) DISK ASSEMBLY	72-35-08
SHAFT, HPC DRIVE, TURBINE	72-35-09

HPC DRUM ROTOR (REAR) DISK ASSEMBLY	72−35−10
STAGE 5 HPC BLADE	72−35−11
STAGE 6 HPC BLADE	72−35−12
STAGE 7 HPC BLADE	72−35−13
STAGE 8 HPC BLADE	72−35−14
STAGE 9 HPC BLADE	72−35−15
STAGE 10 HPC BLADE	72−35−16
STAGE 11 HPC BLADE	72−35−17
STAGE 12 HPC BLADE	72−35−18
STAGE 13 HPC BLADE	72−35−19
STAGE 14 HPC BLADE	72−35−20
STAGE 15 HPC BLADE	72−35−21
HPC BLADE SEALS	72−35−22
HPC BLADE OUTER AIR SEALS (8−15 STAGES)	72−35−23
STAGE 8 COMPRESSOR STATOR SEGMENT	72−35−24
STAGE 9 COMPRESSOR STATOR SEGMENT	72−35−25
STAGE 10 COMPRESSOR STATOR SEGMENT	72−35−26
STAGE 11 COMPRESSOR STATOR SEGMENT	72−35−27
STAGE 12 COMPRESSOR STATOR SEGMENT	72−35−28
STAGE 13 COMPRESSOR STATOR SEGMENT	72−35−29
STAGE 14 COMPRESSOR STATOR SEGMENT	72−35−30
HPC INLET AIRSEAL	72−35−31
(HPC) DIFFUSER AIRSEAL	72−35−32
DIFFUSER AIRSEAL DAMPER	72−35−33
COMPRESSOR TIERODS	72−35−34

COMPRESSOR TIEROD NUTS	72−35−35
NO. 3 BEARING (INNER REAR HUB) HEAT SHIELD	72−35−36
STAGE 5 HPC DISK AND BLADES ASSEMBLY	72−35−37
DRUM ROTOR AND BLADES (FRONT) ASSEMBLY	72−35−38
DRUM ROTOR AND BLADES (REAR) ASSEMBLY	72−35−39
HPC FRONT CASE/OUTER AIRSEAL SET	72−35−40
HPC INLET SHROUD SEGMENT ASSEMBLY	72−35−41
STAGE 5 HPC SHROUD SEGMENT ASSEMBLY	72−35−42
STAGE 6 HPC SHROUD SEGMENT ASSEMBLY	72−35−43
STAGE 7 HPC SHROUD SEGMENT ASSEMBLY	72−35−44
VANE INNER TRUNNION SLEEVE BEARING AND KEY	72−35−45
VANE OUTER TRUNNION THRUST WASHER	72−35−46
HPC INLET VANE	72−35−47
STAGE 5 HPC VANE	72−35−48
STAGE 6 HPC VANE	72−35−49
STAGE 7 HPC VANE	72−35−50
HPC INLET SYNCHRONIZING RING ASSEMBLIES	72−35−51
STAGE 5 HPC SYNCHRONIZING RING ASSEMBLIES	72−35−52
STAGE 6 HPC SYNCHRONIZING RING ASSEMBLIES	72−35−53
STAGE 7 HPC SYNCHRONIZING RING ASSEMBLIES	72−35−54
HPC SYNCHRONIZING RING CLEVIS ASSEMBLIES	72−35−55
HPC SYNCHRONIZING RING PLATES	72−35−56
NOT USED	72−35−57
HPC SHROUD SEGMENT ASSEMBLY	72−35−58
STAGE 8 COMPRESSOR STATOR SET	72−35−59

STAGE 9 AND 10 COMPRESSOR STATOR SET	72−35−60
STAGE 11 AND 12 COMPRESSOR STATOR SET	72−35−61
STAGE 13 AND 14 COMPRESSOR STATOR SET	72−35−62
HPC STAGE 5 SHROUD SET	72−35−63
HPC STAGE 6 AND 7 OUTER SHROUD ASSEMBLY	72−35−64
HPC SHROUD SETS (STAGE 5, 6, AND 7)	72−35−65
EXIT GUIDE VANE HEAT SHIELD	72−35−66
HPC REAR SUPPORT	72−35−67
HPC INNER REAR CASE ASSEMBLY	72−35−68
HPC (OUTER) REAR CASE ASSEMBLY	72−35−69
HPC EXIT GUIDE VANE SUPPORT	72−35−70
GEARBOX DRIVESHAFT HOUSING SUPPORT CLEVIS	72−35−71
GEARBOX DRIVESHAFT HOUSING SUPPORT LINK	72−35−72
COMPRESSOR STATOR CYLINDER SUPPORT ASSEMBLY	72−35−73
HPC LEVER SET	72−35−74
STAGE 7 HPC LEVER	72−35−75
HPC CLEVISES	72−35−76
INTERNALLY THREADED ADJUSTERS	72−35−77
ROD END BEARINGS	72−35−78
HPC LEVER SET AND ACTUATOR BEARINGS	72−35−79
HPC HEAT SHIELDS	72−35−80
HEAT SHIELD RETAINERS	72−35−81
HPC SPACER SET	72−35−82
STAGE 8 HPC CASE ASSEMBLY	72−35−83
STAGE 9 HPC CASE ASSEMBLY	72−35−84

STAGE 10 HPC CASE ASSEMBLY	72-35-85
STAGE 11 HPC CASE ASSEMBLY	72-35-86
STAGE 12 HPC CASE ASSEMBLY	72-35-87
STAGE 13 HPC CASE ASSEMBLY	72-35-88
STAGE 14 HPC CASE ASSEMBLY	72-35-89
NO. 2 BEARING FRONT SEAL SEAT	72-35-90
PLAIN ROUND NUT (NO. 2 BEARING FRONT SEAL SEAT)	72-35-91
UNASSIGNED	72-35-92
STAGE 8 AIR SEAL SUPPORT SEGMENT SET	72-35-93
GEARBOX DRIVESHAFT HOUSING SUPPORT LINK SPHERICAL BEARINGS	72-35-94
NO. 2 BEARING RETAINING NUT	72-35-95
NO. 2 BEARING NUT LOCK	72-35-96
UNASSIGNED	72-35-97 And 72-35-98
HIGH PRESSURE COMPRESSOR (HPC) MISCELLANEOUS PARTS	72-35-99
DIFFUSER AND COMBUSTOR See Figure 10	72-41-00
DIFFUSER CASE ASSEMBLY	72-41-01
COMPRESSOR EXIT STATOR ASSEMBLY	72-41-02
STAGE 15 HPC AIRSEALING RING ASSEMBLY	72-41-03
STAGE 15 HPC AIRSEAL RING NOZZLE	72-41-04
DIFFUSER AIRSEALING RING ASSEMBLY	72-41-05
NO. 3 BEARING FRONT COOLING DUCT ASSEMBLY	72-41-06
NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY	72-41-07
NO. 3 BEARING (FRONT) SEAL RING HOLDER ASSEMBLY	72-41-08

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NO. 3 BEARING (FRONT) FACE SEAL ASSEMBLY	72-41-09
NO. 3 BEARING HOUSING	72-41-10
OUTER COMBUSTION CHAMBER ASSEMBLY	72-41-11
DOWELED END (COMBUSTION CHAMBER RETAINING) BOLT	72-41-12
NOT USED	72-41-13 and 72-41-14
UNASSIGNED	72-41-15 through 72-41-18
NO. 3 BEARING (BREATHER) TUBE ASSEMBLY	72-41-19
NO. 3 BEARING (OIL) PRESSURE TUBE ASSEMBLY	72-41-20
NO. 3 BEARING PACKING TRANSFER (OIL PRESSURE) TUBE	72-41-21
NO. 3 BEARING AND AIRFRAME (OIL VENT AND TURBINE COOLING AIR DUCT SENSING OUTER) MANIFOLD ASSEMBLIES	72-41-22
TURBINE COOLING DUCT SENSING (INNER AIRFRAME) TUBE ASSEMBLY	72-41-23
NO. 3 BEARING OIL VENT (INNER) TUBE ASSEMBLY	72-41-24
NO. 3 BEARING (SCAVENGE) TUBE ASSEMBLY	72-41-25
NO. 3 BEARING PACKING TRANSFER (BREATHER AND SCAVENGE) TUBES	72-41-26
NO. 3 BEARING (COMPARTMENT) COOLING TUBE ASSEMBLY	72-41-27
SEAL RING TRANSFER (NO. 3 BEARING COOLING FRONT) TUBE	72-41-28
SEAL RING TRANSFER (NO. 3 BEARING COOLING RING) TUBE	72-41-29
NO. 3 BEARING ELBOW ASSEMBLY (NO. 3 BEARING COMPARTMENT COOLING TUBE)	72-41-30
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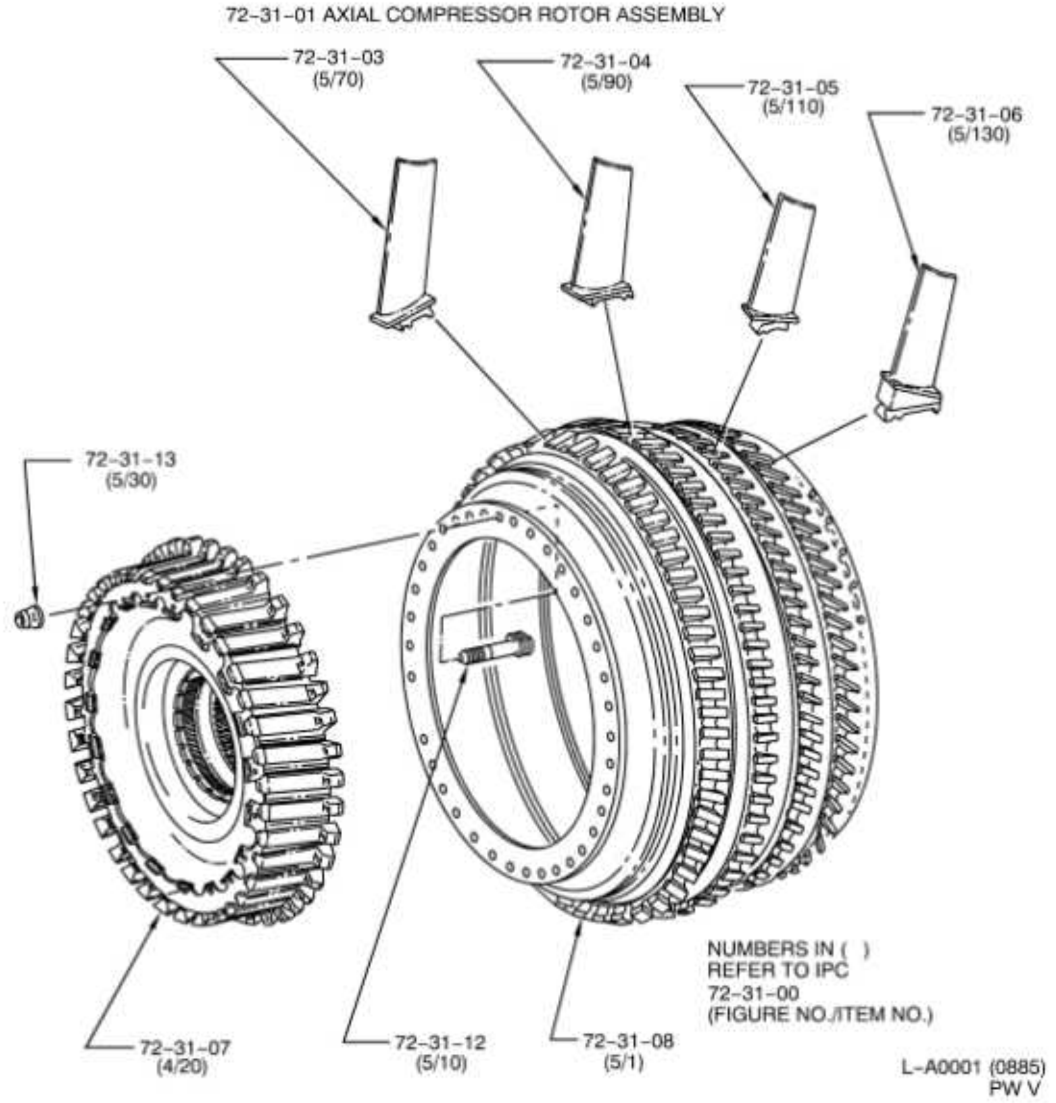
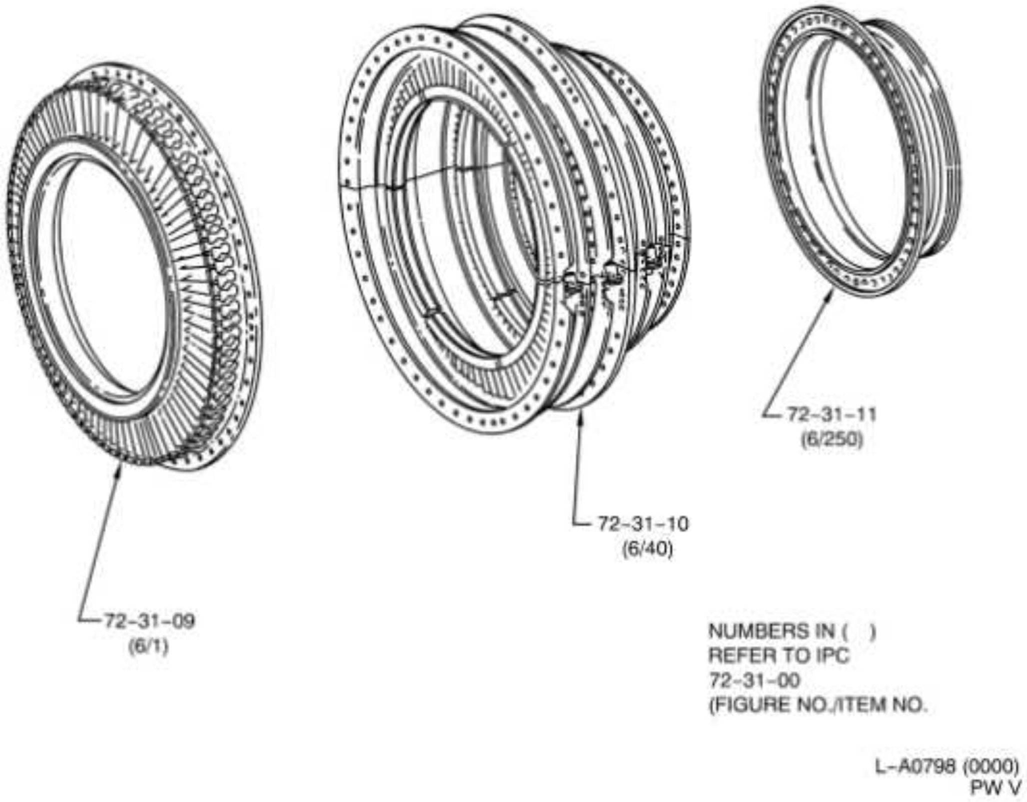

72-31-01 AXIAL COMPRESSOR ROTOR ASSEMBLY
72-31-03 (5/70)
72-31-04 (5/90)
72-31-05 (5/110)
72-31-06 (5/130)
72-31-13 (5/30)
NUMBERS IN ( ) REFER TO IPC 72-31-00 (FIGURE NO./ITEM NO.)
72-31-07 (4/20)
72-31-12 (5/10)
72-31-08 (5/1)
L-A0001 (0885)
PW V

Low Pressure Compressor (LPC)
Figure 5 (Sheet 1)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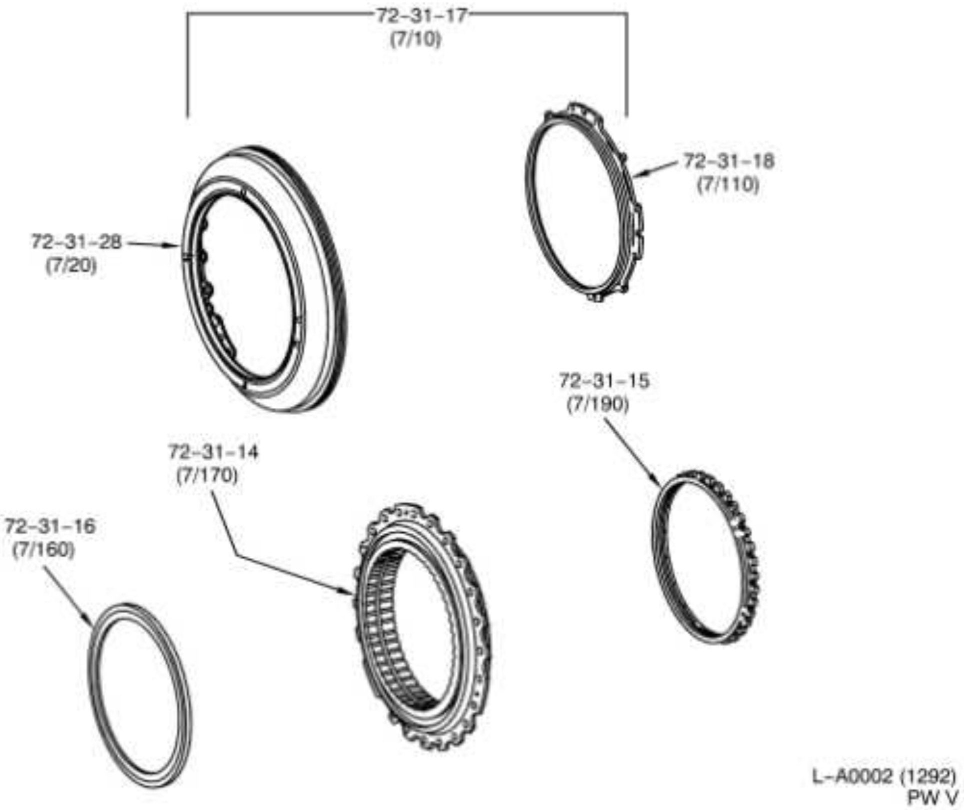
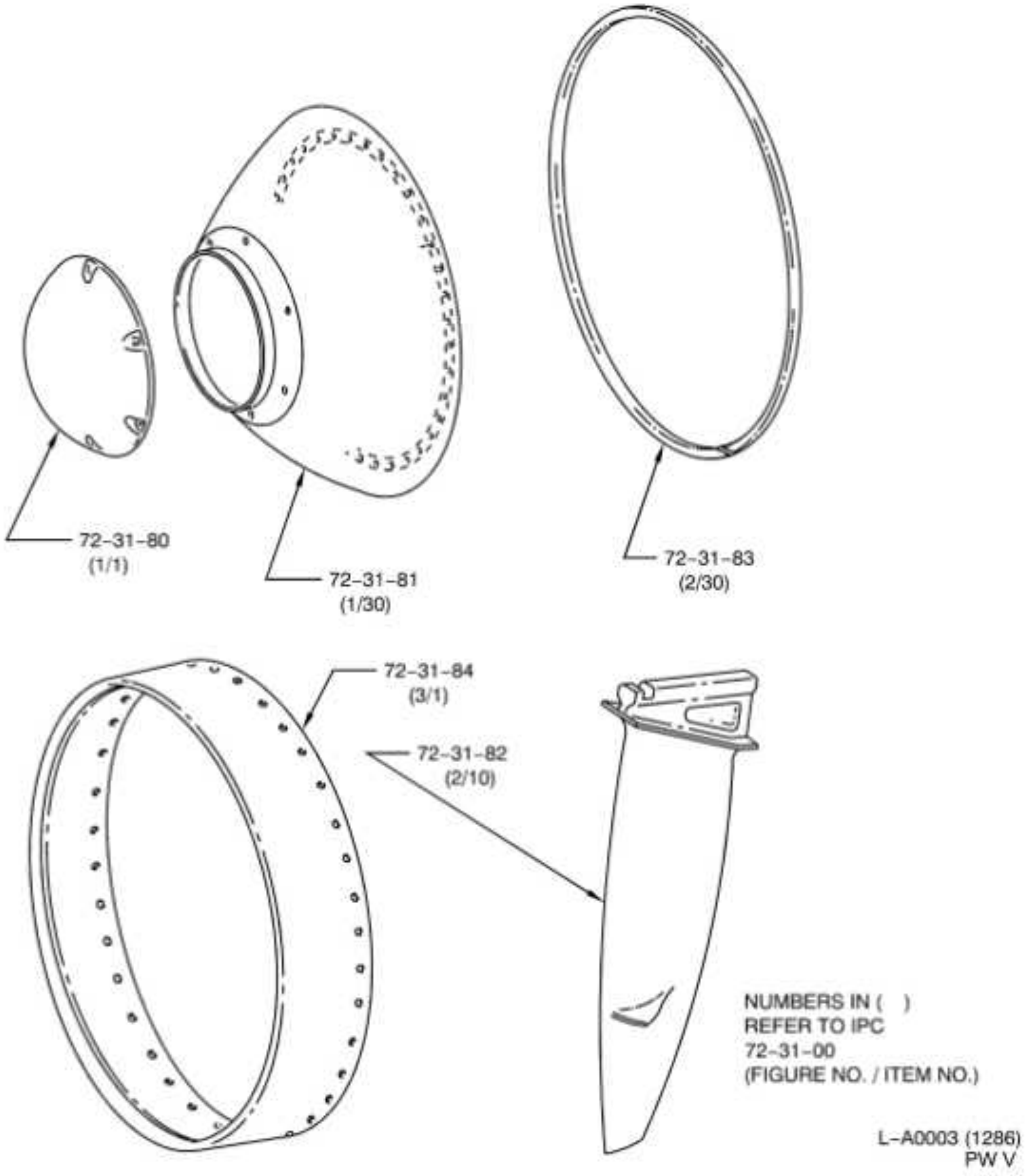
72-31-10
(6/40)
72-31-09
(6/1)
NUMBERS IN ( )
REFER TO IPC
72-31-00
(FIGURE NO./ITEM NO.
L-A0798 (0000)
PW V

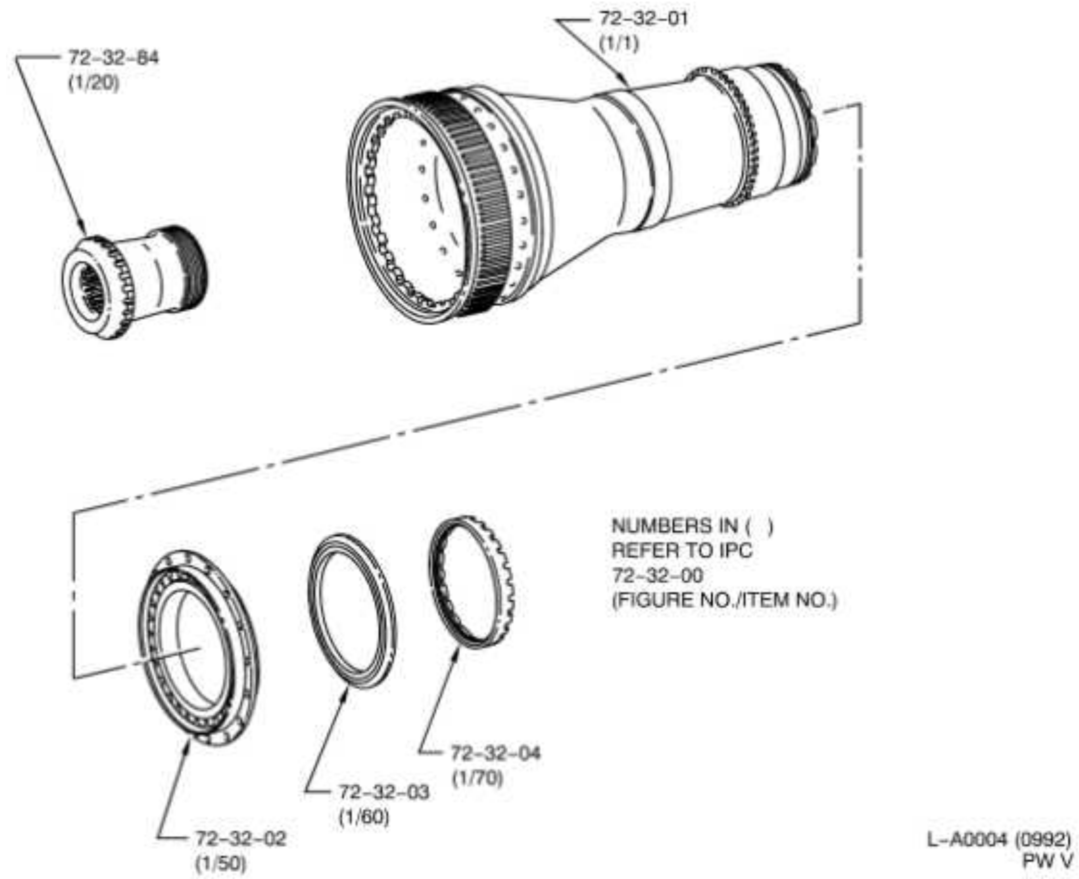
Low Pressure Compressor (LPC)
Figure 5 (Sheet 2)


72-31-17
(7/10)
72-31-18
(7/110)
72-31-28
(7/20)
72-31-15
(7/190)
72-31-14
(7/170)
72-31-16
(7/160)
L-A0002 (1292)
PW V

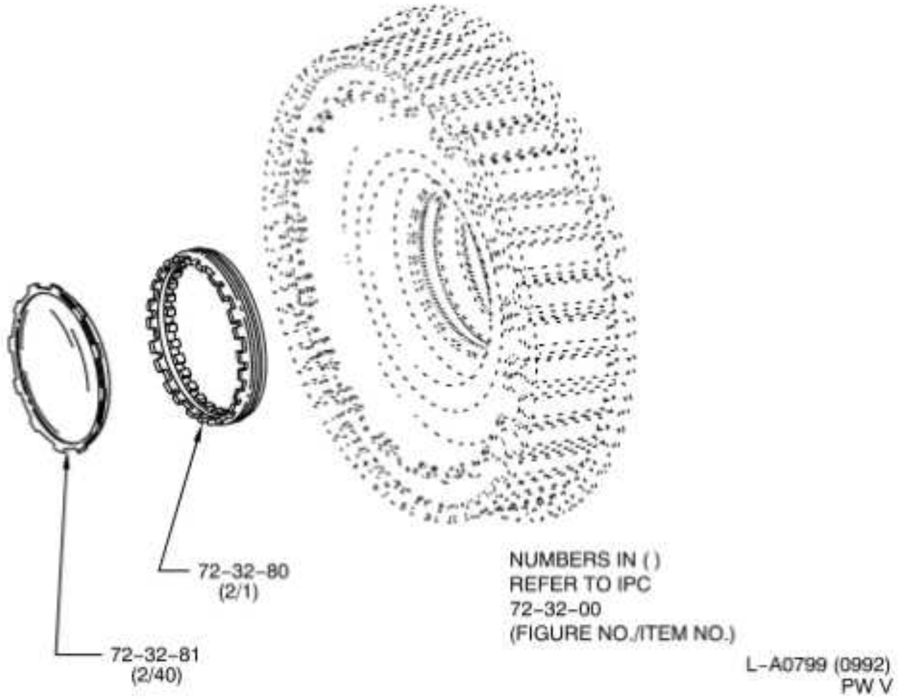
Low Pressure Compressor (LPC)
Figure 5 (Sheet 3)


72-31-80
(1/1)
72-31-81
(1/30)
72-31-83
(2/30)
72-31-84
(3/1)
72-31-82
(2/10)
NUMBERS IN ( )
REFER TO IPC
72-31-00
(FIGURE NO. / ITEM NO.)
L-A0003 (1286)
PW V

Low Pressure Compressor (LPC)
Figure 5 (Sheet 4)


72-32-84
(1/20)
72-32-01
(1/1)
NUMBERS IN ( )
REFER TO IPC
72-32-00
(FIGURE NO./ITEM NO.)
72-32-04
(1/70)
72-32-03
(1/60)
72-32-02
(1/50)
L-A0004 (0992)
PW V

LPC/LPT Coupling
Figure 6 (Sheet 1)


72-32-80
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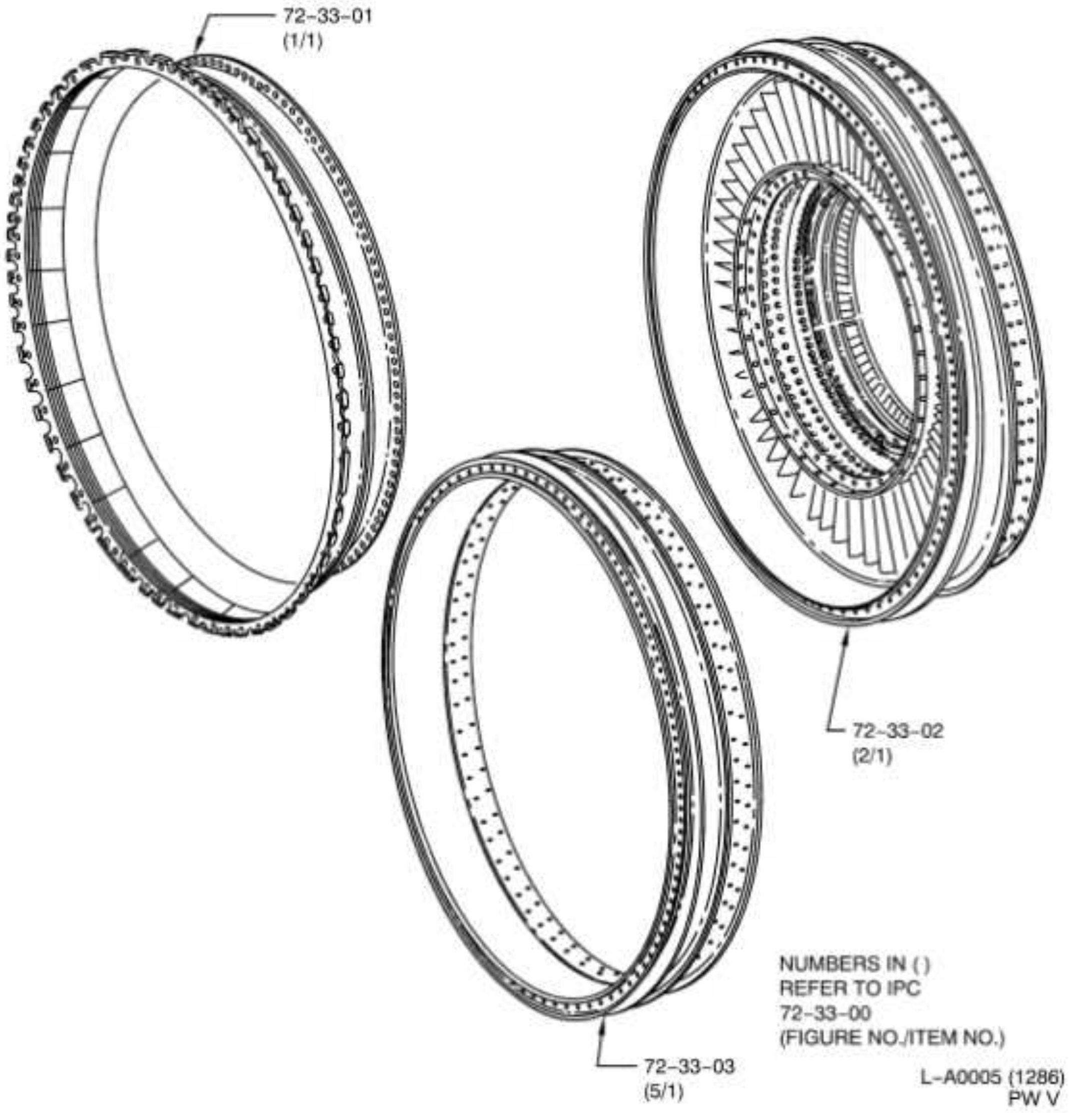
72-32-81
(2/40)
NUMBERS IN ( )
REFER TO IPC
72-32-00
(FIGURE NO./ITEM NO.)
L-A0799 (0992)
PW V

LPC/LPT Coupling
Figure 6 (Sheet 2)


72-33-01
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72-33-02
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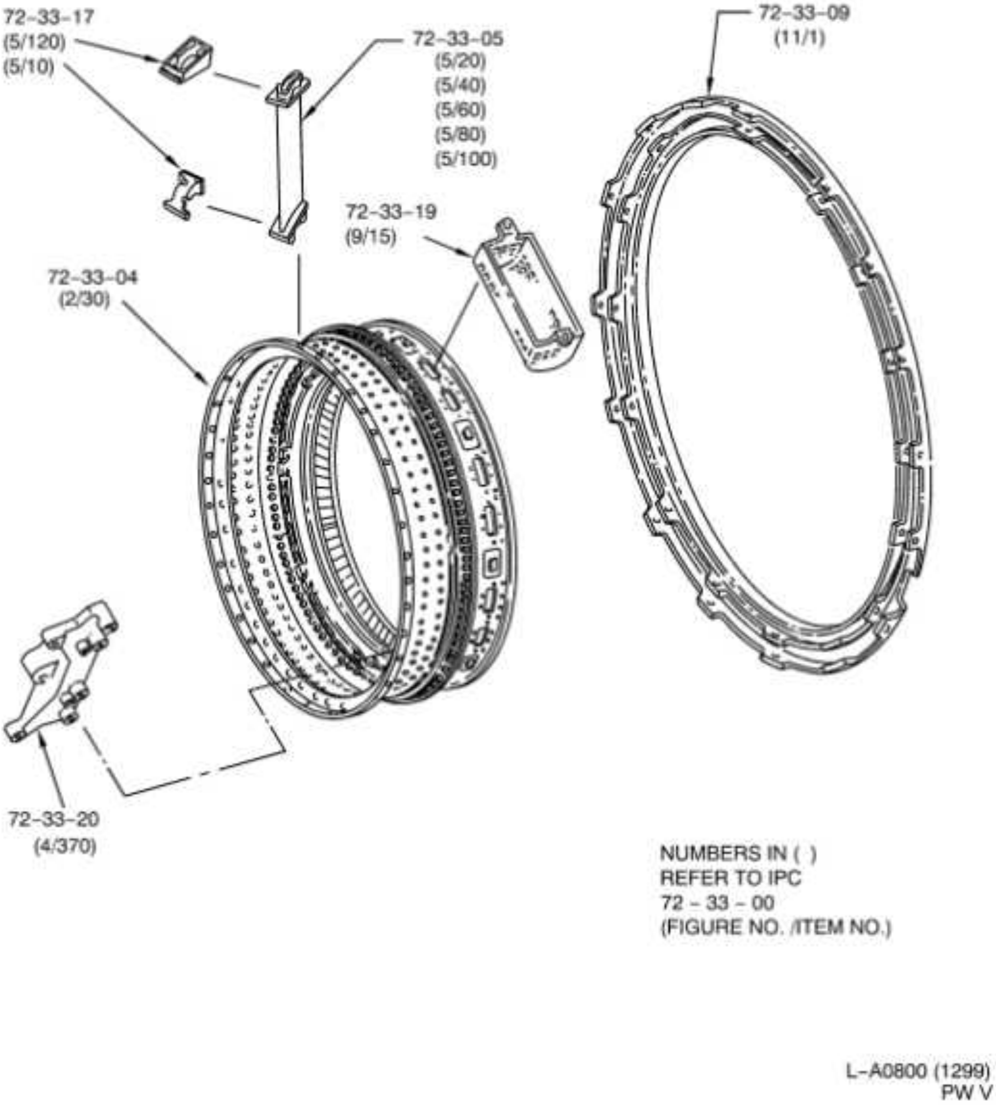
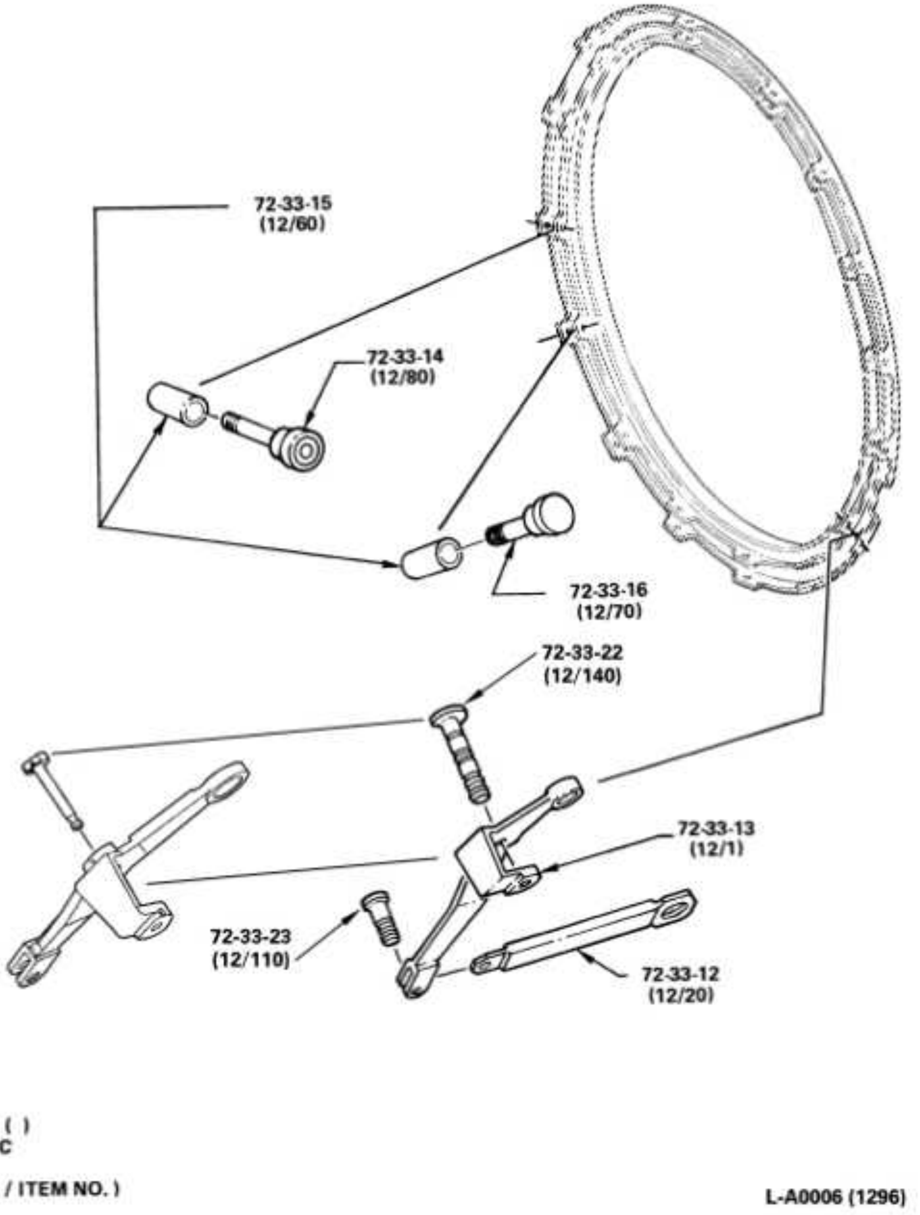
72-33-03
(5/1)
NUMBERS IN ( )
REFER TO IPC
72-33-00
(FIGURE NO./ITEM NO.)
L-A0005 (1286)
PW V

Fan Case
Figure 7 (Sheet 1)

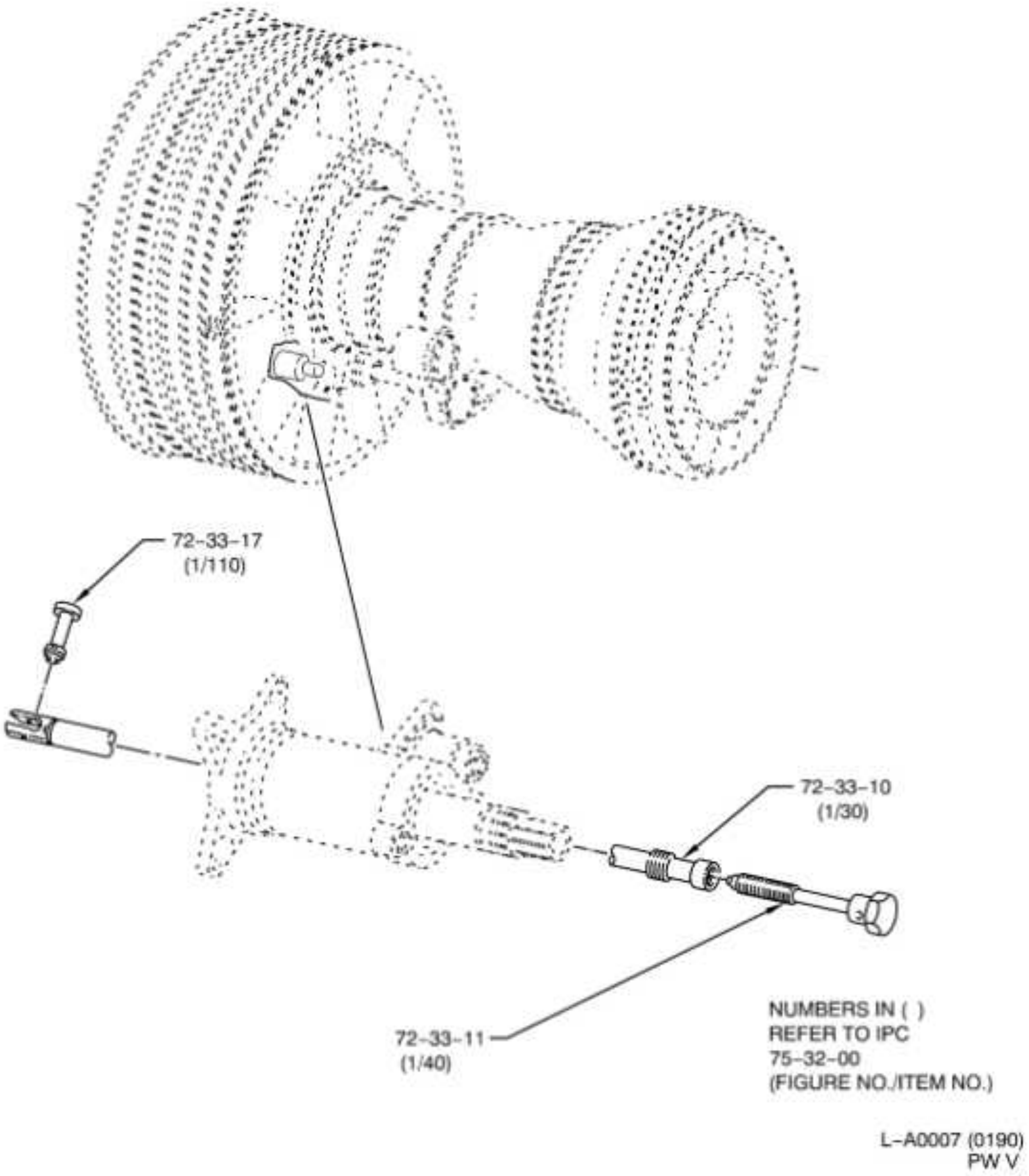

72-33-17
(5/120)
(5/10)
72-33-05
(5/20)
(5/40)
(5/60)
(5/80)
(5/100)
72-33-09
(11/1)
72-33-19
(9/15)
72-33-04
(2/30)
72-33-20
(4/370)
NUMBERS IN ( )
REFER TO IPC
72 - 33 - 00
(FIGURE NO. /ITEM NO.)
L-A0800 (1299)
PW V

Fan Case
Figure 7 (Sheet 2)

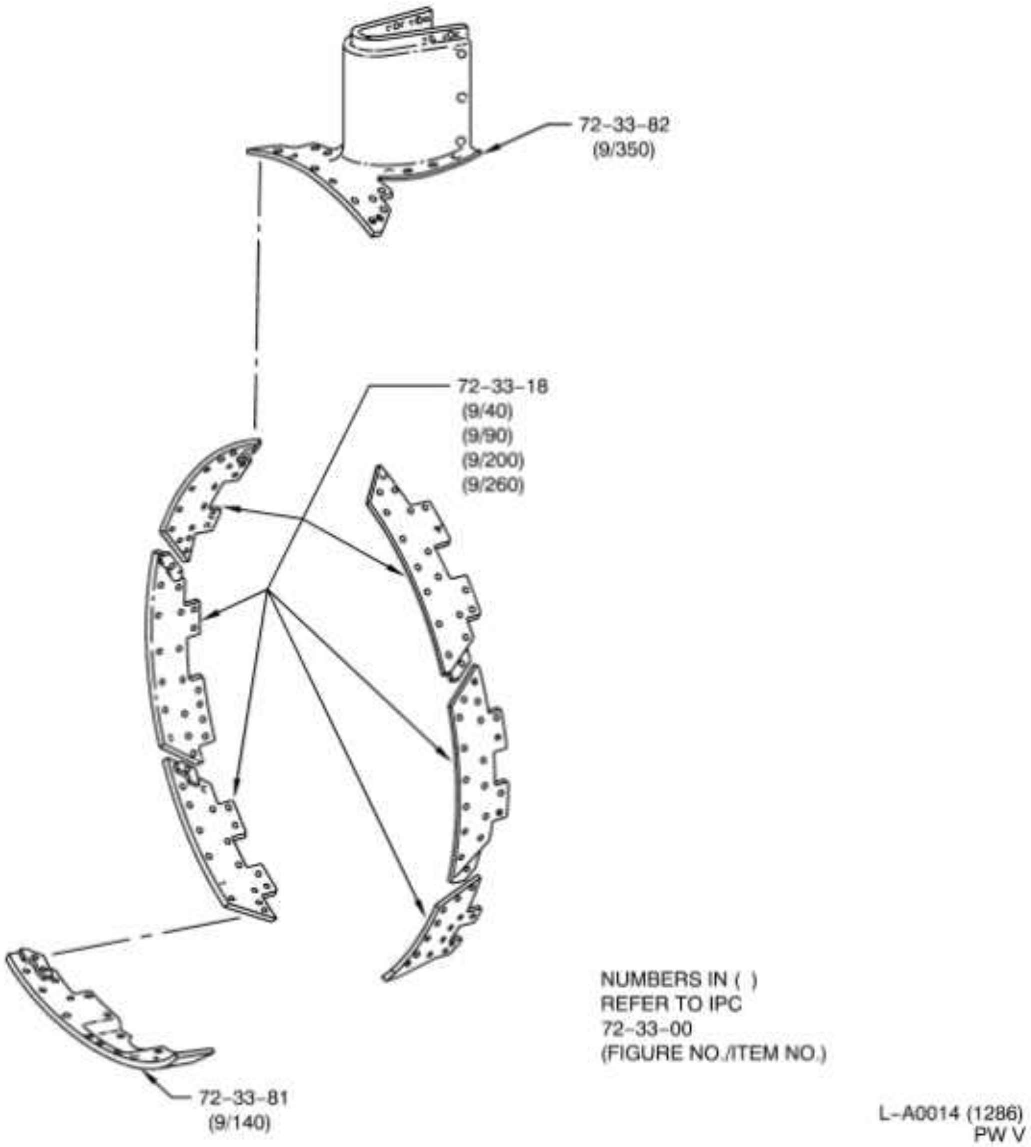

72-33-15
(12/60)
72-33-14
(12/80)
72-33-16
(12/70)
72-33-22
(12/140)
72-33-13
(12/1)
72-33-23
(12/110)
72-33-12
(12/20)
L-A0006 (1296)

NUMBERS IN ( )
REFER TO IPC
72-33-00
(FIGURE NO. / ITEM NO.)

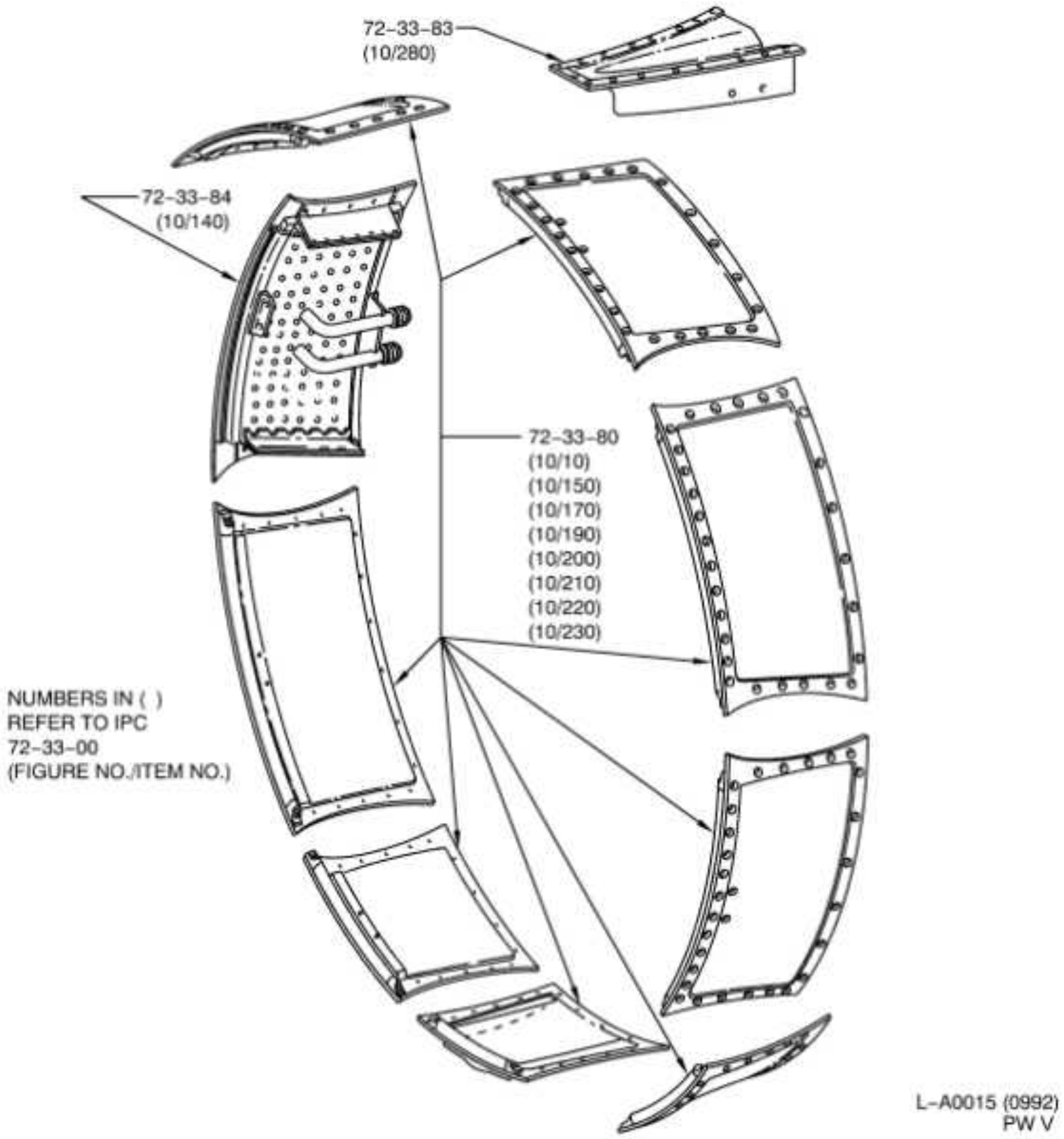
Fan Case
Figure 7 (Sheet 3)


72-33-17
(1/110)
72-33-10
(1/30)
72-33-11
(1/40)
NUMBERS IN ( )
REFER TO IPC
75-32-00
(FIGURE NO./ITEM NO.)
L-A0007 (0190)
PW V

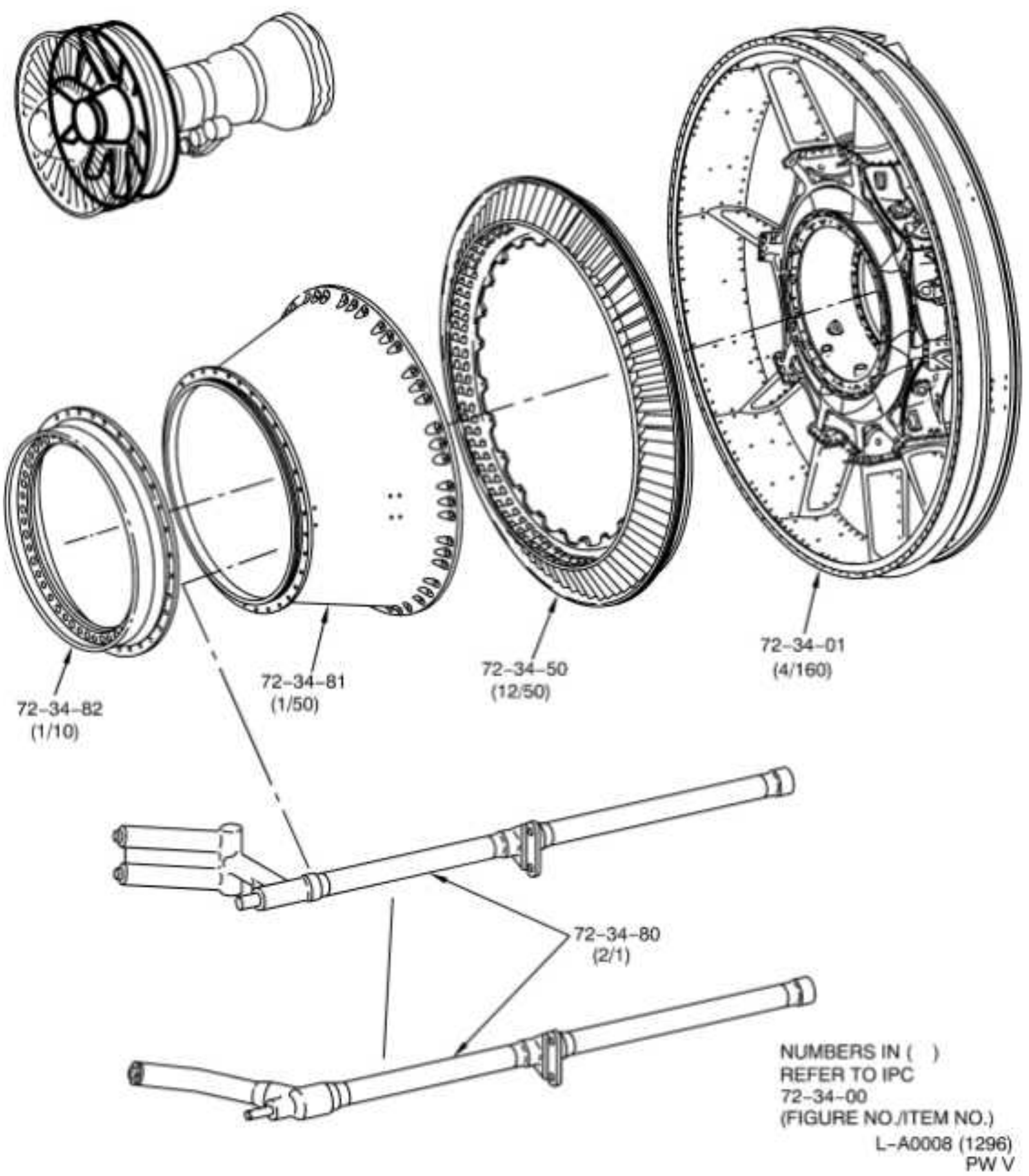
Fan Case
Figure 7 (Sheet 4)


72-33-82
(9/350)
72-33-18
(9/40)
(9/90)
(9/200)
(9/260)
NUMBERS IN ( )
REFER TO IPC
72-33-00
(FIGURE NO./ITEM NO.)
72-33-81
(9/140)
L-A0014 (1286)
PW V

Fan Case
Figure 7 (Sheet 5)


72-33-83
(10/280)
72-33-84
(10/140)
72-33-80
(10/10)
(10/150)
(10/170)
(10/190)
(10/200)
(10/210)
(10/220)
(10/230)
NUMBERS IN ( )
REFER TO IPC
72-33-00
(FIGURE NO./ITEM NO.)
L-A0015 (0992)
PW V

Fan Case
Figure 7 (Sheet 6)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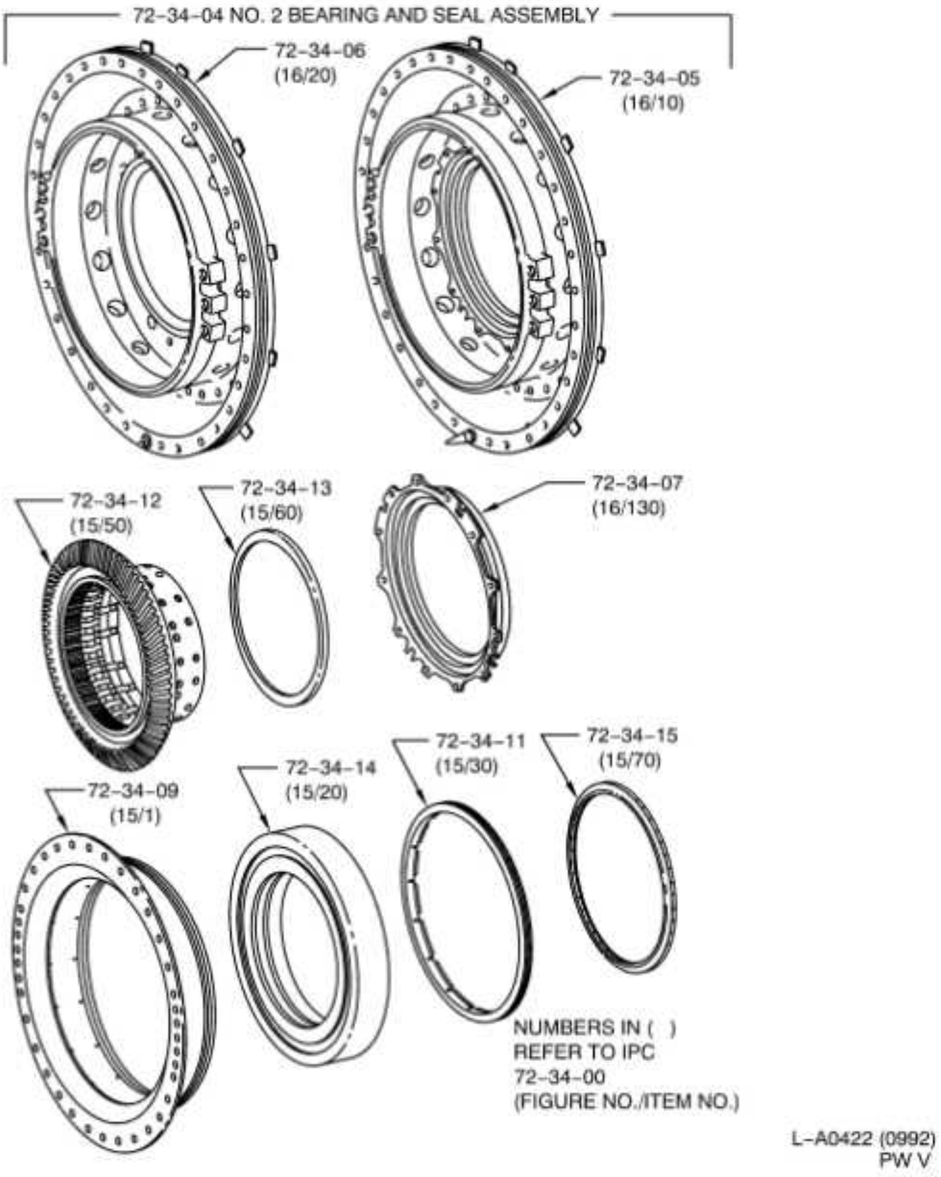
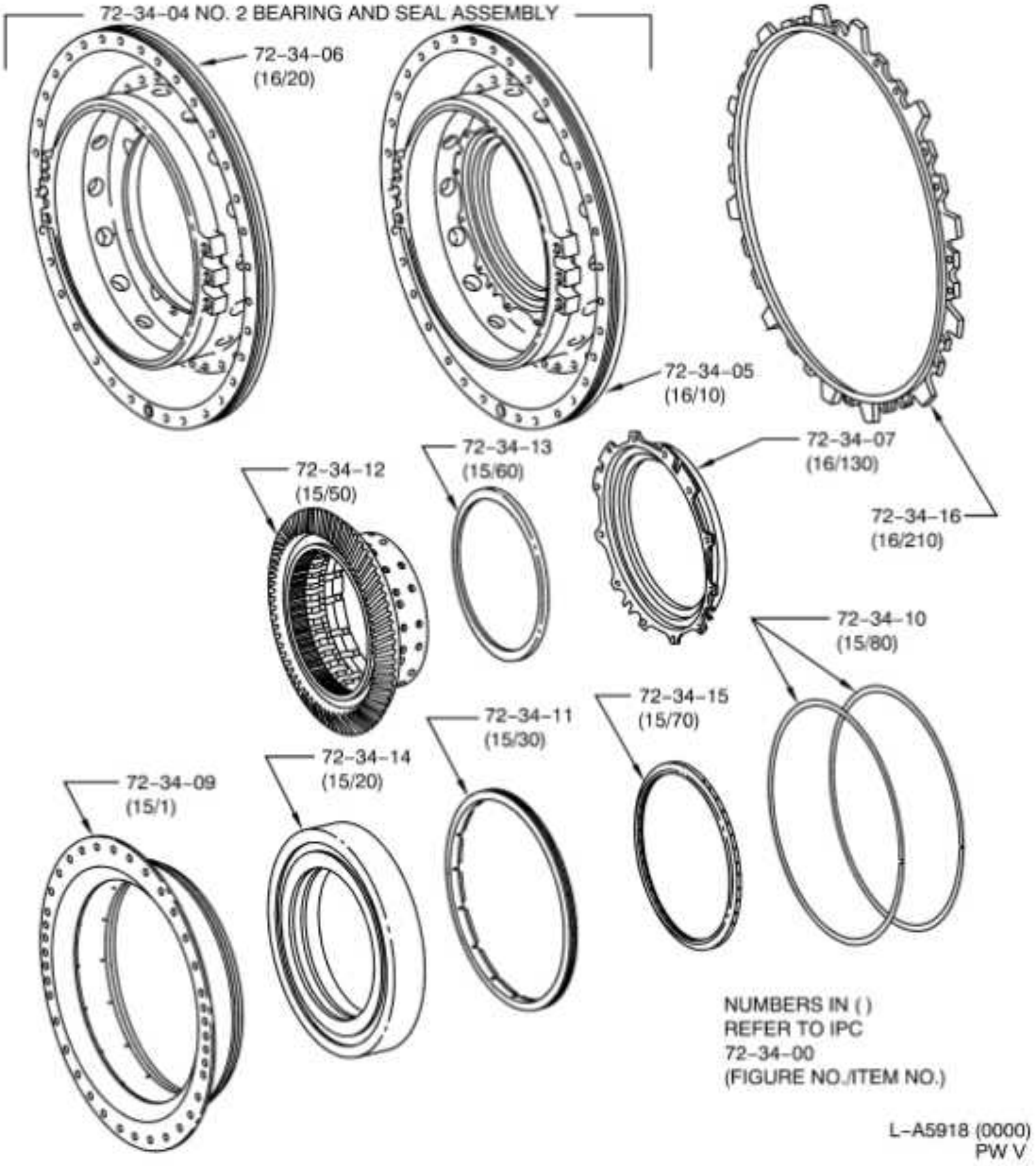
72-34-81
(1/50)
72-34-50
(12/50)
72-34-01
(4/160)
72-34-80
(2/1)
NUMBERS IN ( )
REFER TO IPC
72-34-00
(FIGURE NO./ITEM NO.)
L-A0008 (1296)
PW V

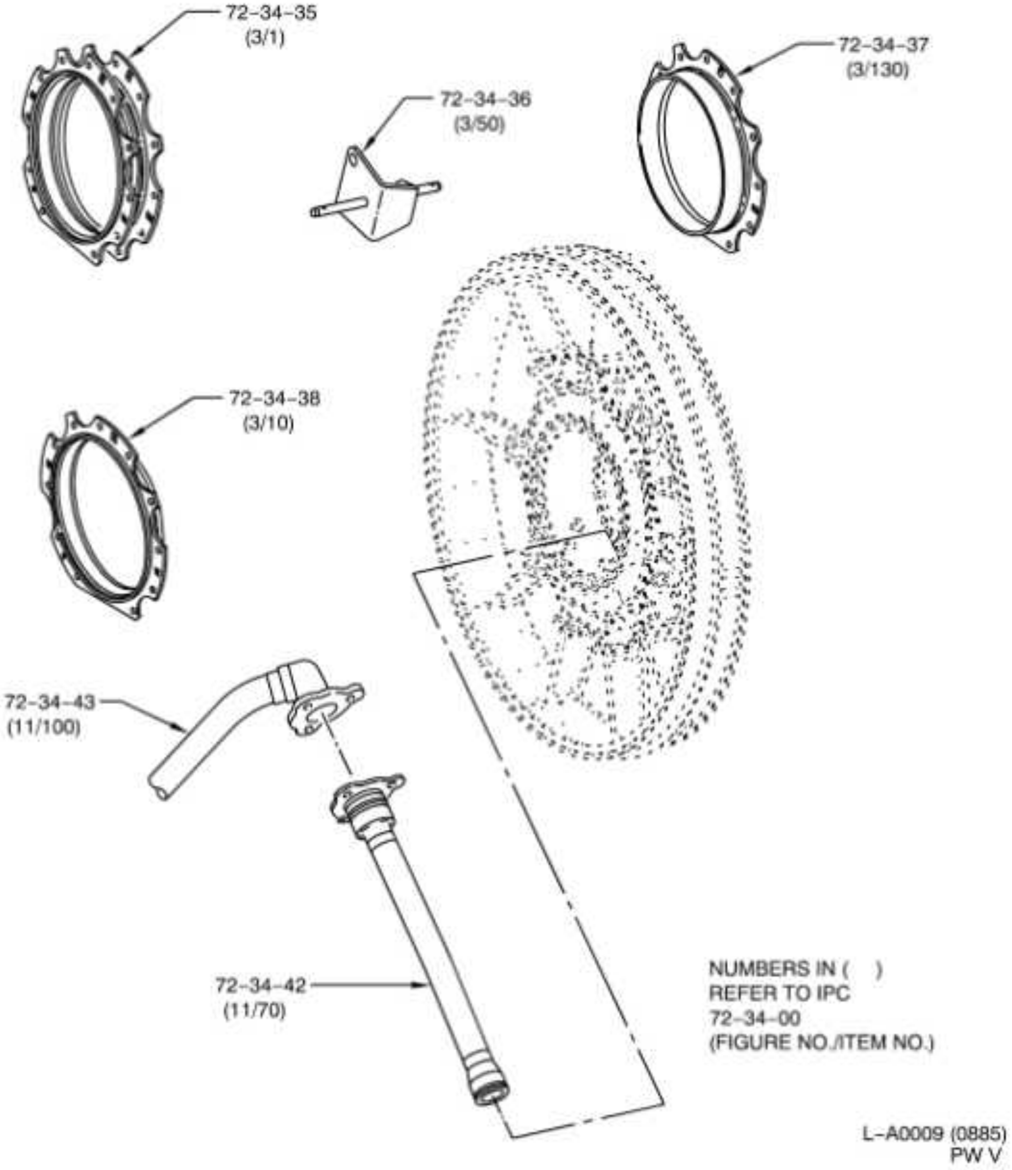
Intermediate Case
Figure 8 (Sheet 1)


72-34-04 NO. 2 BEARING AND SEAL ASSEMBLY
72-34-06
(16/20)
72-34-05
(16/10)
72-34-12
(15/50)
72-34-13
(15/60)
72-34-07
(16/130)
72-34-11
(15/30)
72-34-15
(15/70)
72-34-14
(15/20)
72-34-09
(15/1)
NUMBERS IN ( )
REFER TO IPC
72-34-00
(FIGURE NO./ITEM NO.)
L-A0422 (0992)
PW V

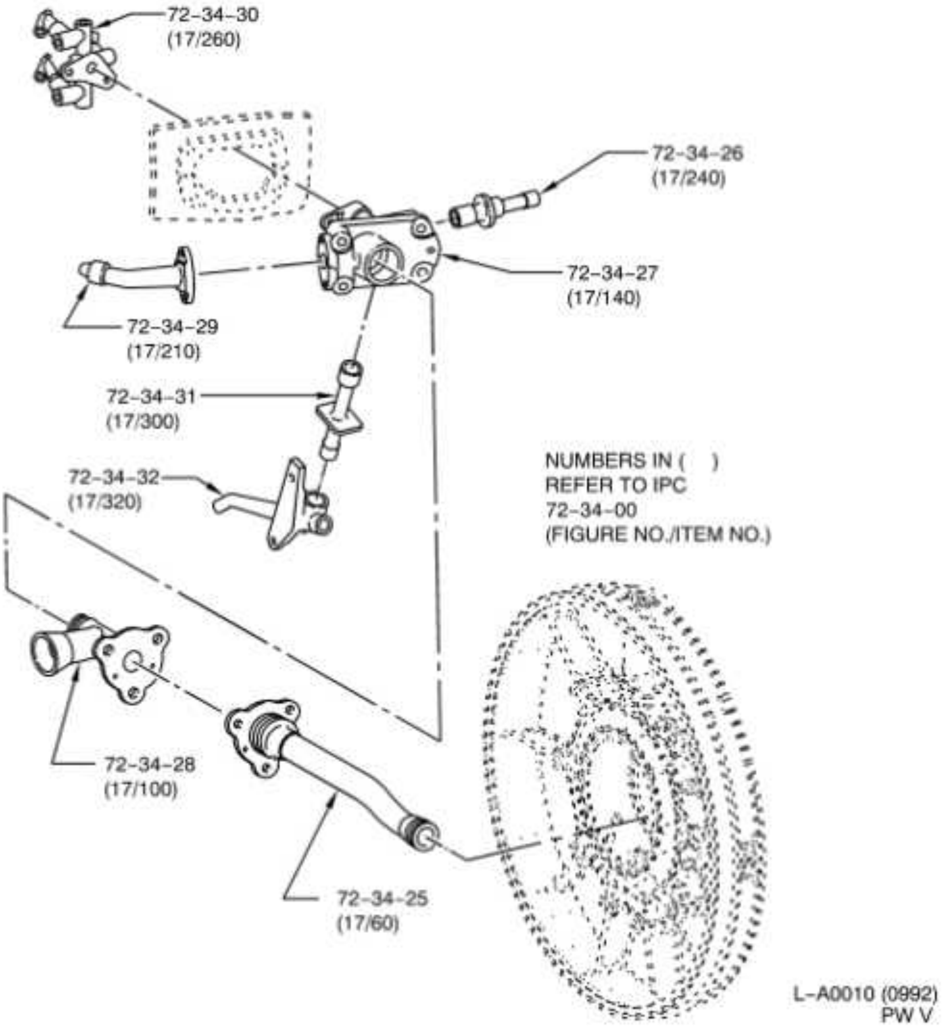
Intermediate Case (Pre SB PW4ENG 72−204)
(With The Integral Retaining Ring)
Figure 8 (Sheet 2)


72-34-04 NO. 2 BEARING AND SEAL ASSEMBLY
72-34-06
(16/20)
72-34-05
(16/10)
72-34-12
(15/50)
72-34-13
(15/60)
72-34-07
(16/130)
72-34-16
(16/210)
72-34-10
(15/80)
72-34-15
(15/70)
72-34-11
(15/30)
72-34-14
(15/20)
72-34-09
(15/1)
NUMBERS IN ( )
REFER TO IPC
72-34-00
(FIGURE NO./ITEM NO.)
L-A5918 (0000)
PW V

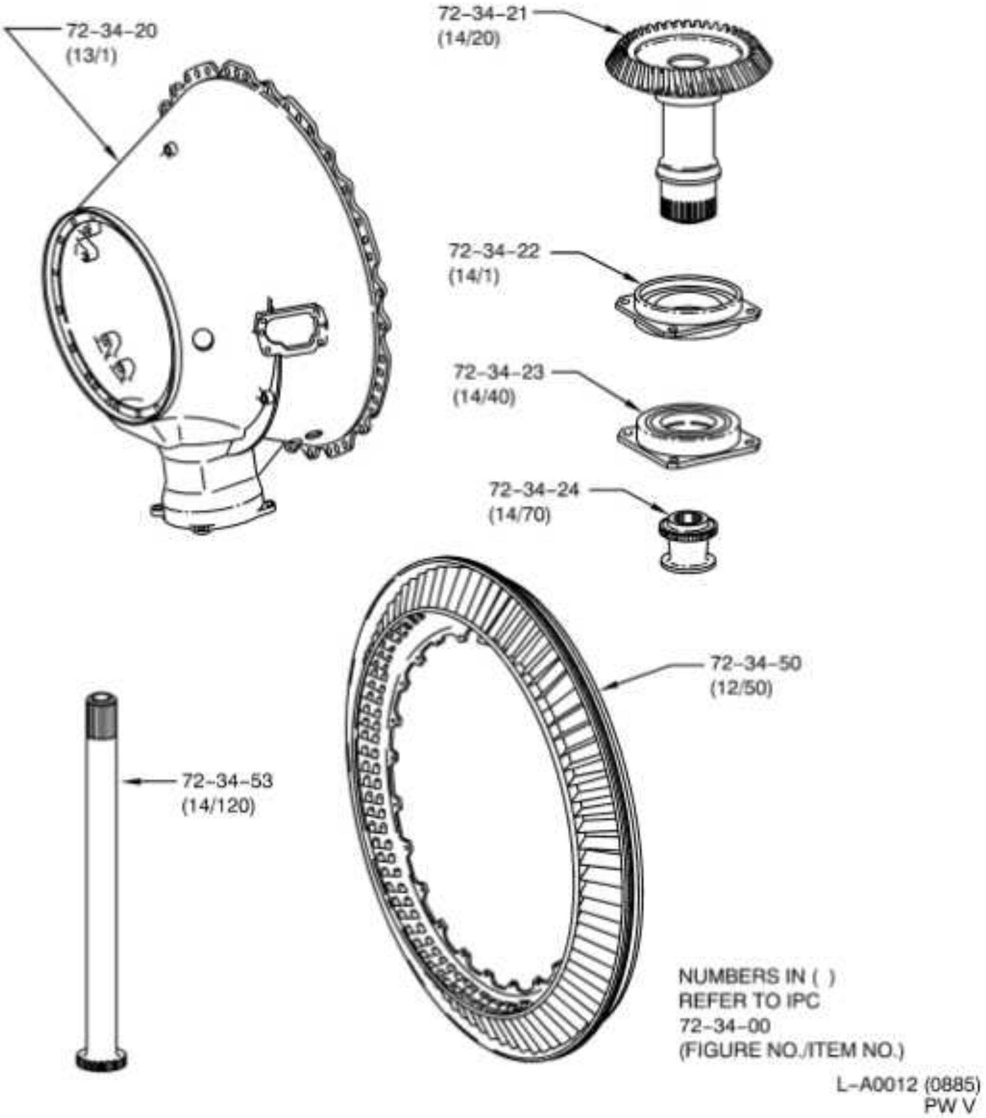
Intermediate Case (Post SB PW4ENG 72−204)
(With The Retaining Ring Bolted On)
Figure 8 (Sheet 3)


72-34-35
(3/1)
72-34-36
(3/50)
72-34-37
(3/130)
72-34-38
(3/10)
72-34-43
(11/100)
72-34-42
(11/70)
NUMBERS IN ( )
REFER TO IPC
72-34-00
(FIGURE NO./ITEM NO.)
L-A0009 (0885)
PW V

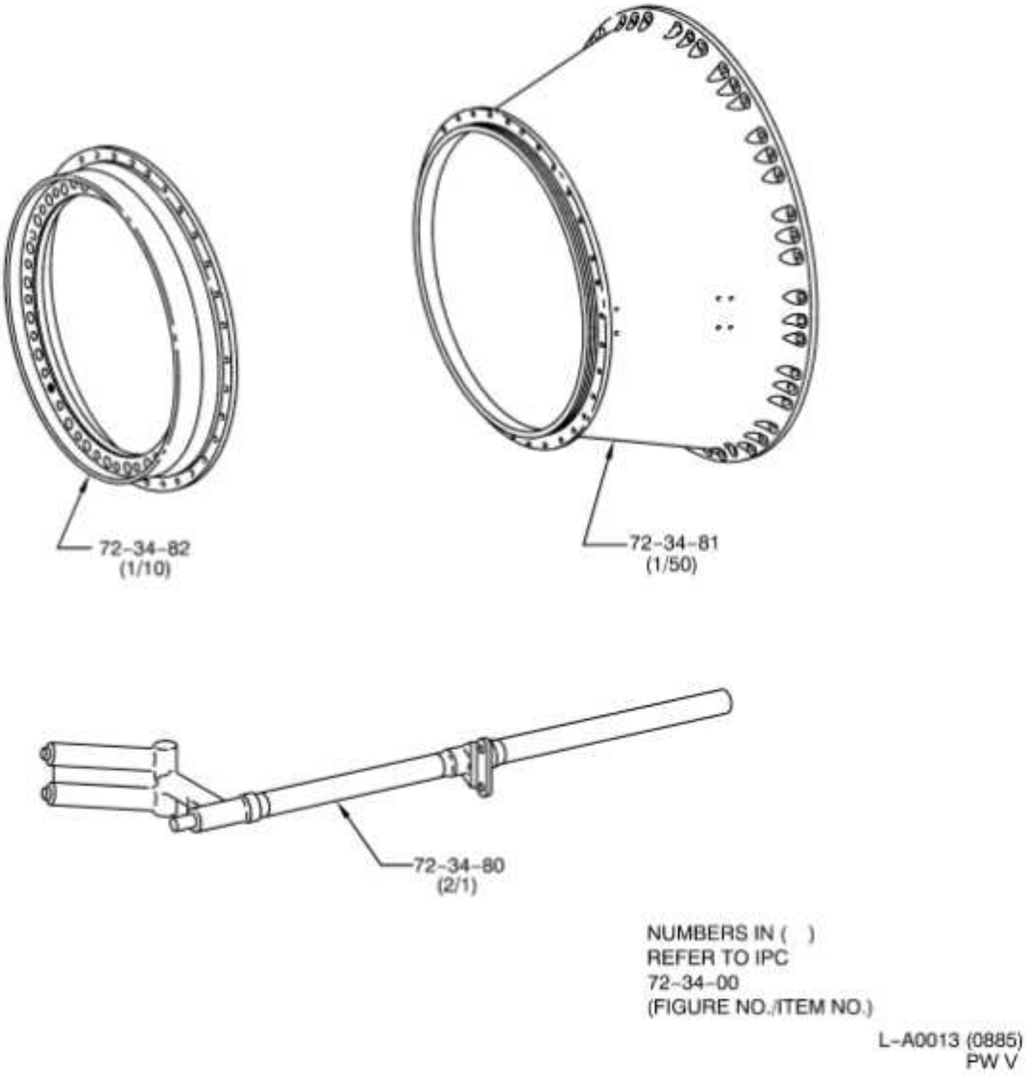
Intermediate Case
Figure 8 (Sheet 4)


72-34-30
(17/260)
72-34-26
(17/240)
72-34-27
(17/140)
72-34-29
(17/210)
72-34-31
(17/300)
72-34-32
(17/320)
NUMBERS IN ( )
REFER TO IPC
72-34-00
(FIGURE NO./ITEM NO.)
72-34-28
(17/100)
72-34-25
(17/60)
L-A0010 (0992)
PW V

Intermediate Case
Figure 8 (Sheet 5)


72-34-20
(13/1)
72-34-21
(14/20)
72-34-22
(14/1)
72-34-23
(14/40)
72-34-24
(14/70)
72-34-50
(12/50)
72-34-53
(14/120)
NUMBERS IN ( )
REFER TO IPC
72-34-00
(FIGURE NO./ITEM NO.)
L-A0012 (0885)
PW V

Intermediate Case
Figure 8 (Sheet 6)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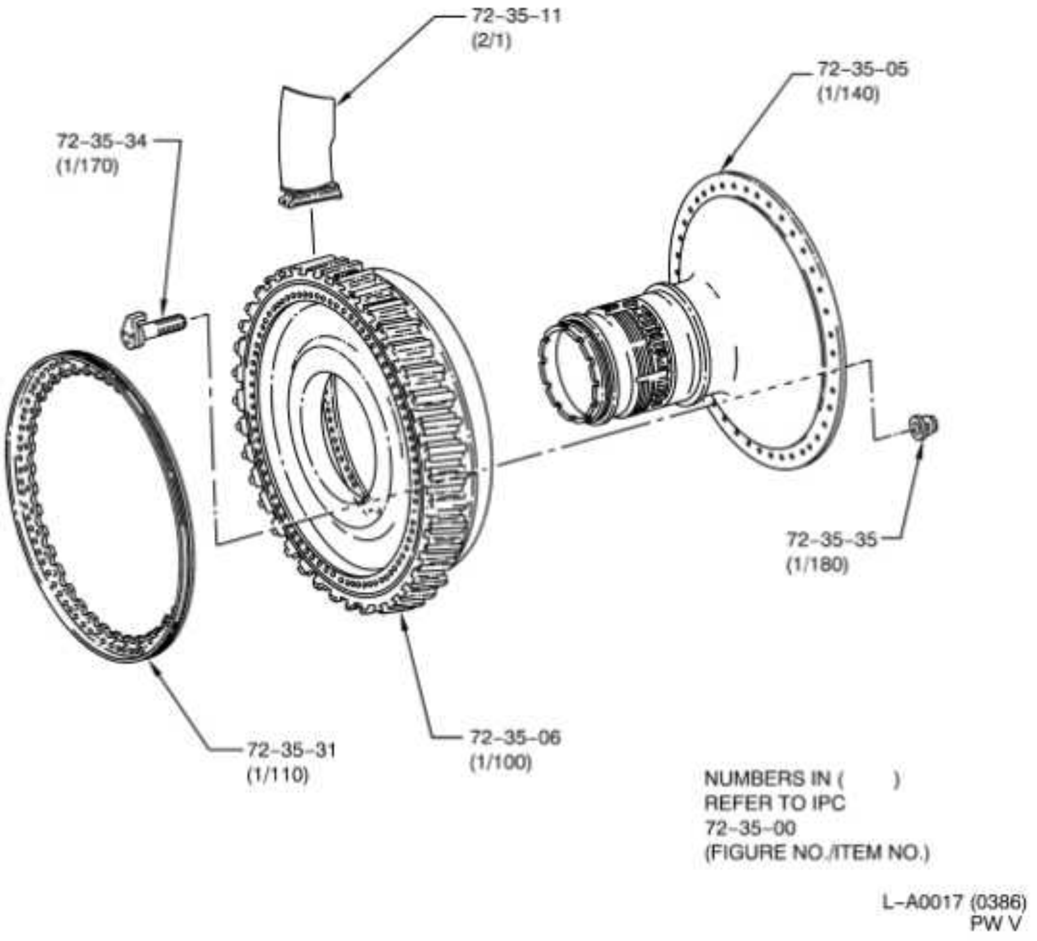
(1/10)
72-34-81
(1/50)
72-34-80
(2/1)
NUMBERS IN ( )
REFER TO IPC
72-34-00
(FIGURE NO./ITEM NO.)
L-A0013 (0885)
PW V

Intermediate Case
Figure 8 (Sheet 7)

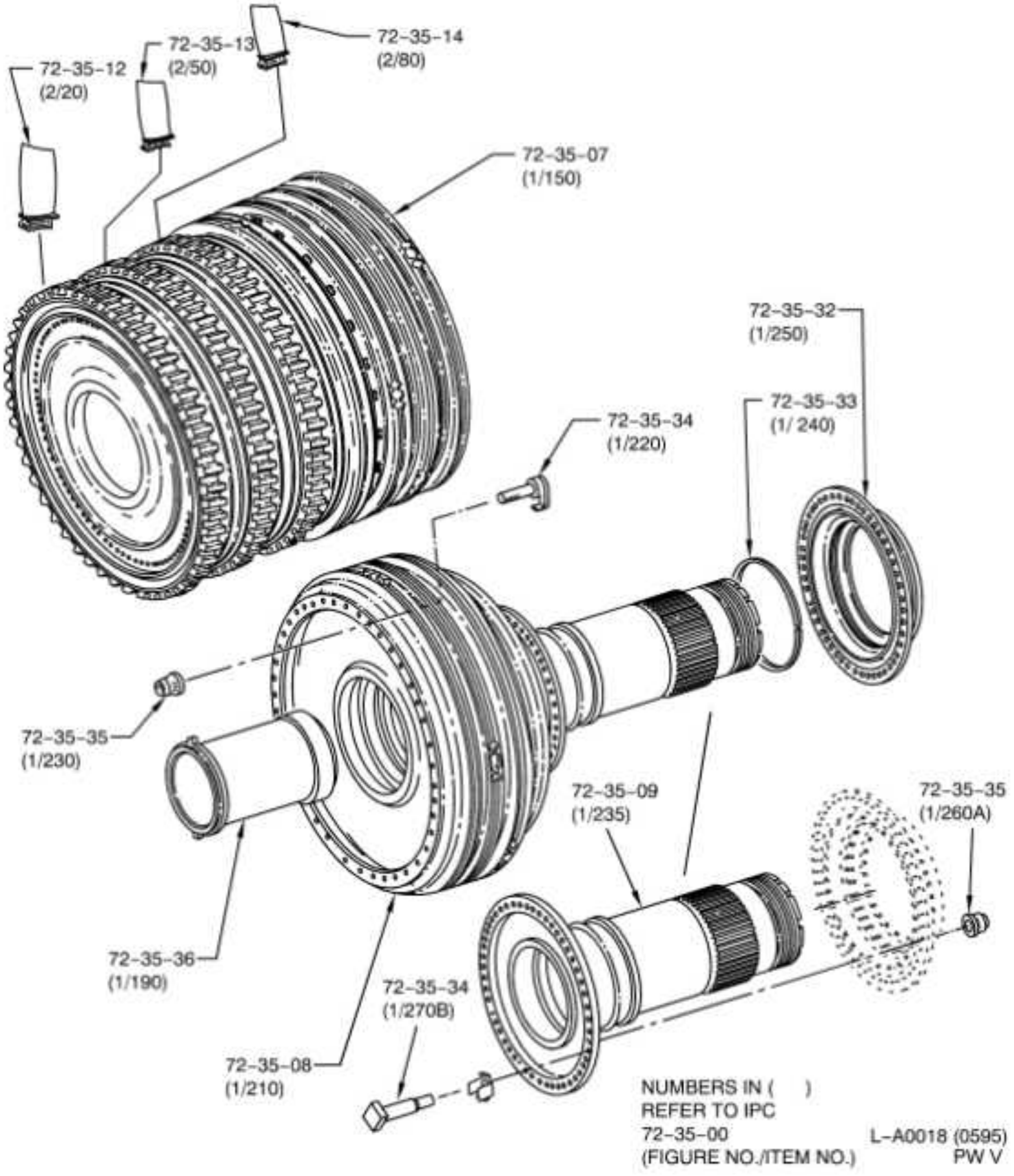
72-35-01 AXIAL COMPRESSOR ROTOR ASSEMBLY
72-35-02 VARIABLE STATOR VANE AND HPC FRONT CASE ASSEMBLY
72-35-03 HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY
72-35-37 STAGE 5 HPC DISK AND BLADES ASSEMBLY
72-35-38 DRUM ROTOR AND BLADES (FRONT) ASSEMBLY
72-35-39 DRUM ROTOR AND BLADES (REAR) ASSEMBLY


72-35-11
(2/1)
72-35-05
(1/140)
72-35-34
(1/170)
72-35-35
(1/180)
72-35-31
(1/110)
72-35-06
(1/100)

NUMBERS IN (   )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)

L-A0017 (0386)
PW V

High Pressure Compressor (HPC)
Figure 9 (Sheet 1)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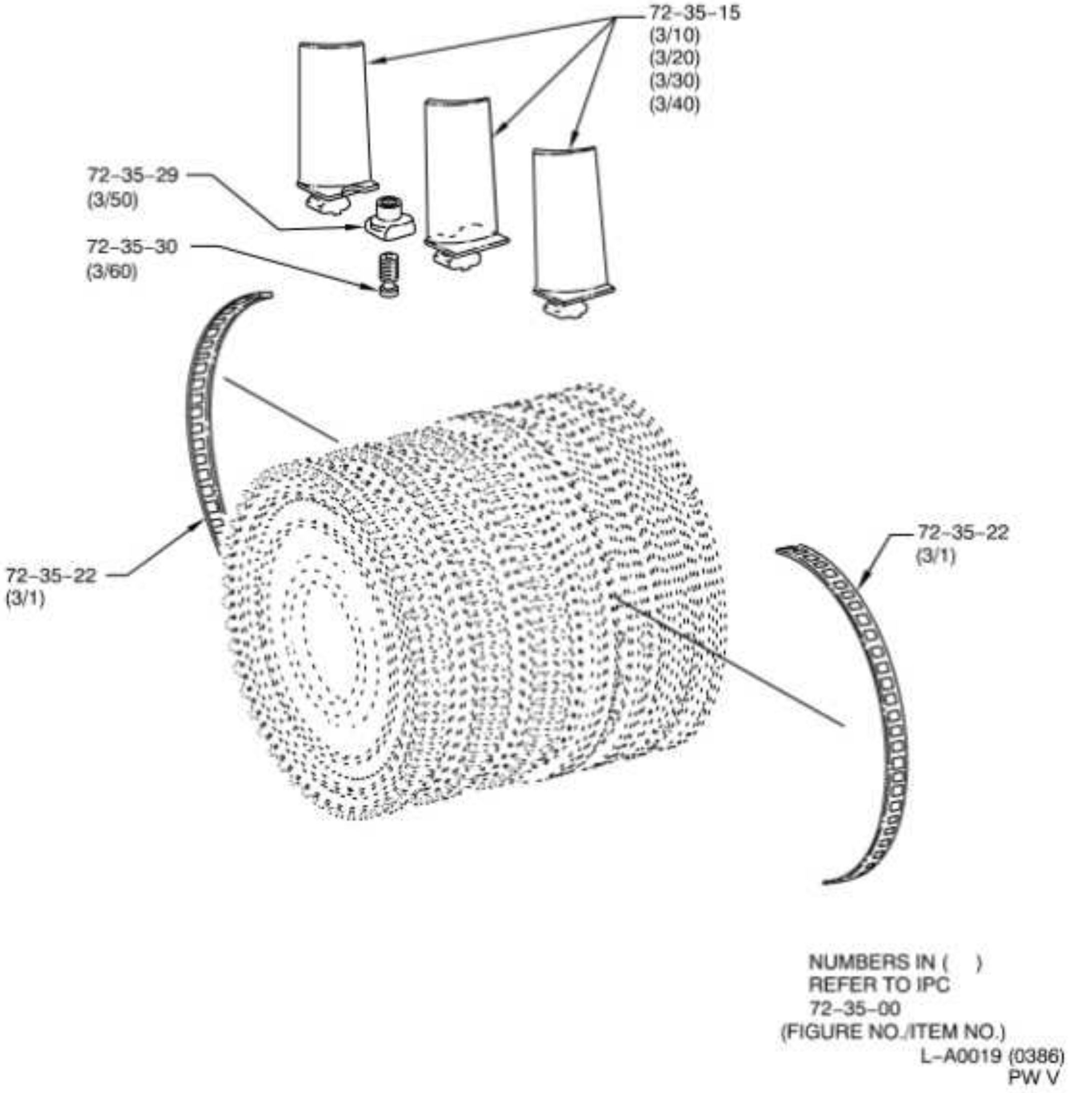
72-35-13
(2/50)
72-35-14
(2/80)
72-35-07
(1/150)
72-35-32
(1/250)
72-35-33
(1/ 240)
72-35-34
(1/220)
72-35-35
(1/230)
72-35-09
(1/235)
72-35-35
(1/260A)
72-35-36
(1/190)
72-35-34
(1/270B)
72-35-08
(1/210)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A0018 (0595)
PW V

High Pressure Compressor (HPC)
Figure 9 (Sheet 2)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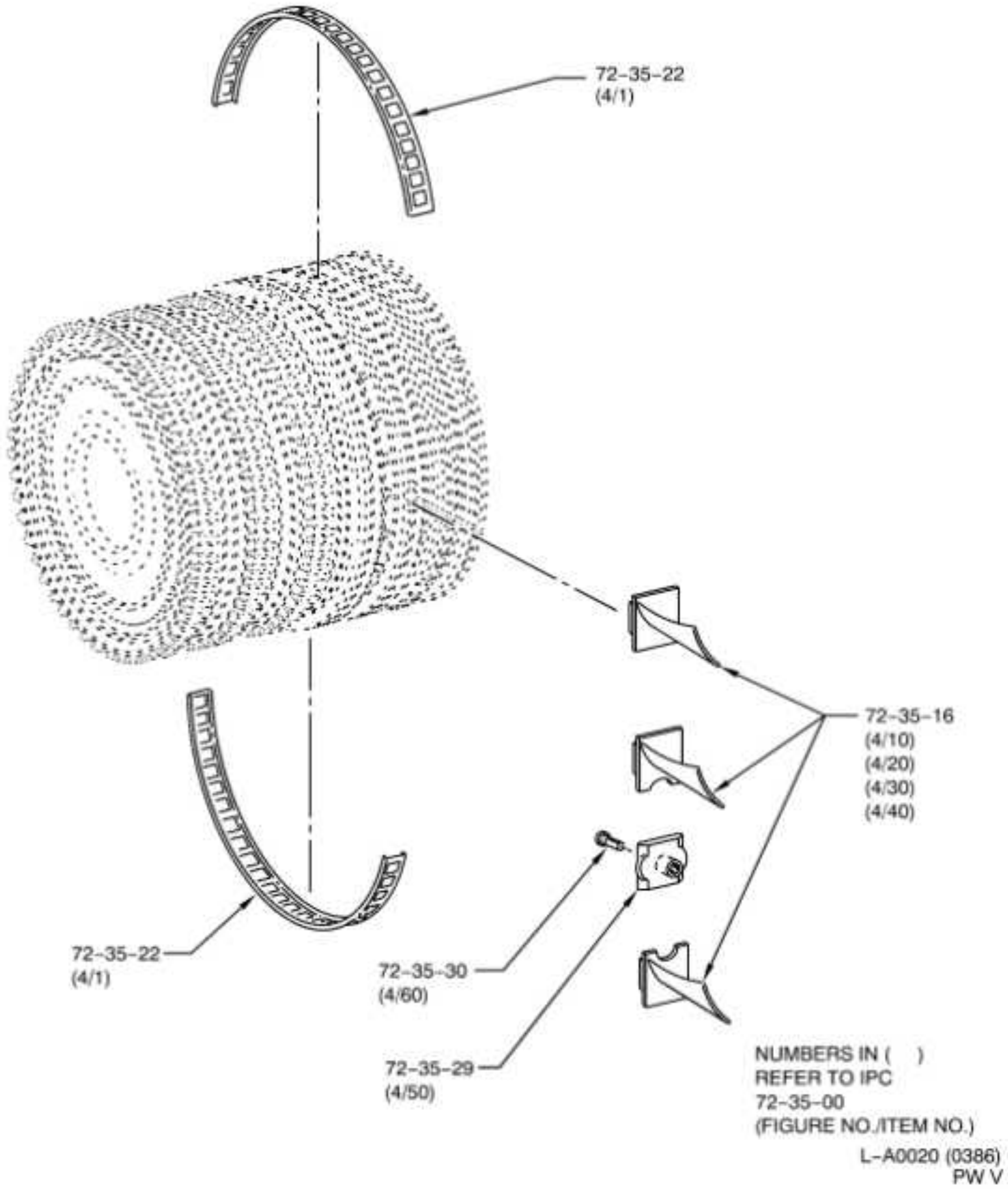
(3/20)
(3/30)
(3/40)
72-35-29
(3/50)
72-35-30
(3/60)
72-35-22
(3/1)
72-35-22
(3/1)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A0019 (0386)
PW V

High Pressure Compressor (HPC)
Figure 9 (Sheet 3)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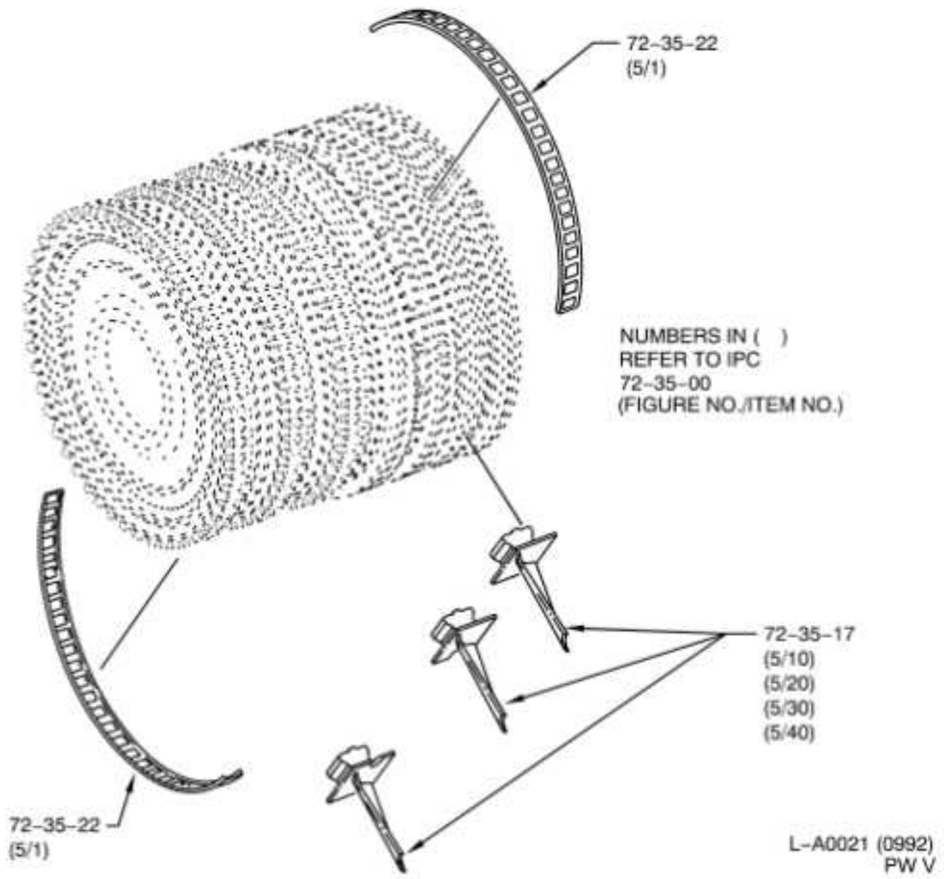
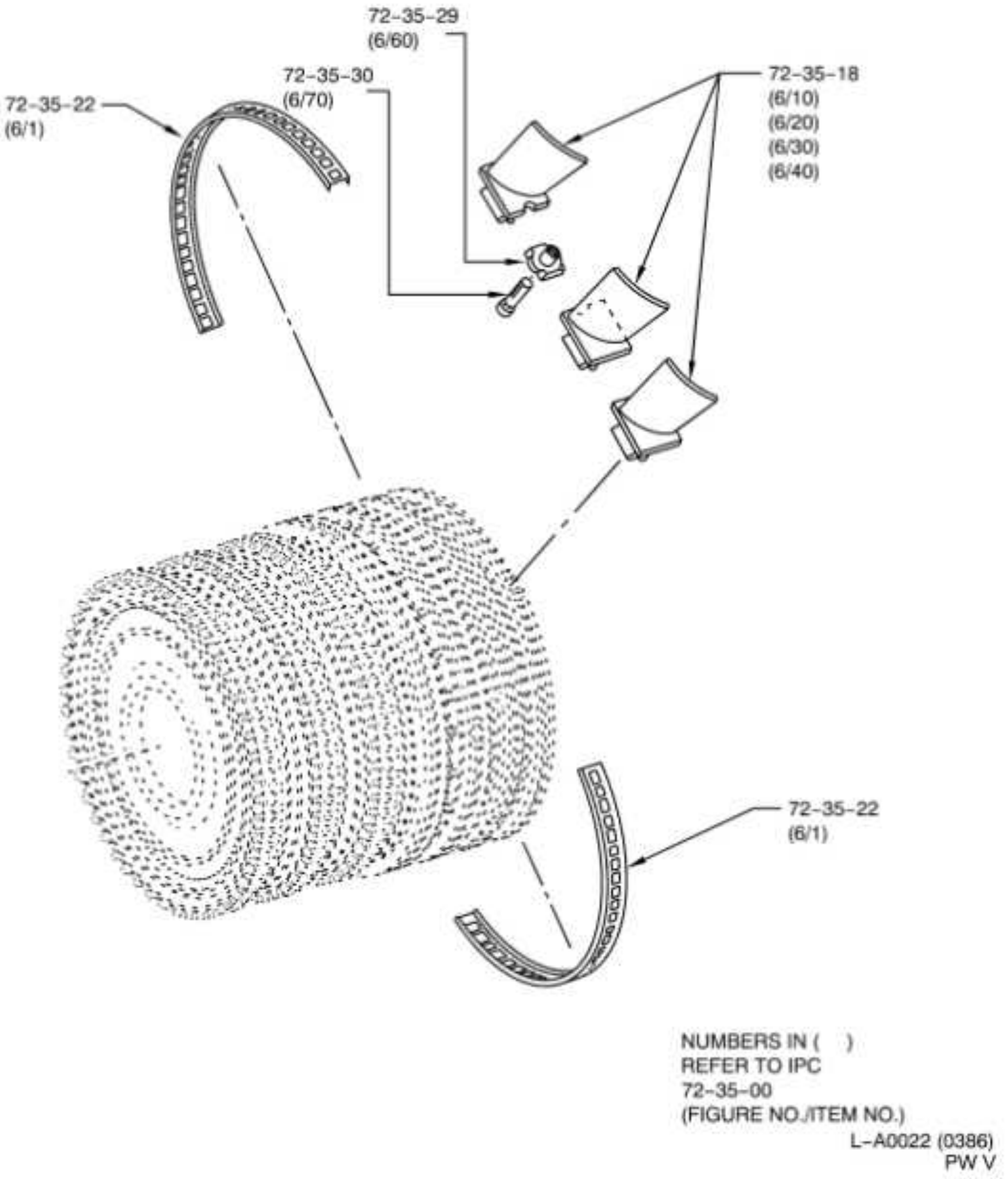
72-35-16
(4/10)
(4/20)
(4/30)
(4/40)
72-35-22
(4/1)
72-35-30
(4/60)
72-35-29
(4/50)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A0020 (0386)
PW V

High Pressure Compressor (HPC)
Figure 9 (Sheet 4)


72-35-22
(5/1)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
72-35-17
(5/10)
(5/20)
(5/30)
(5/40)
72-35-22
(5/1)
L-A0021 (0992)
PW V

High Pressure Compressor (HPC)
Figure 9 (Sheet 5)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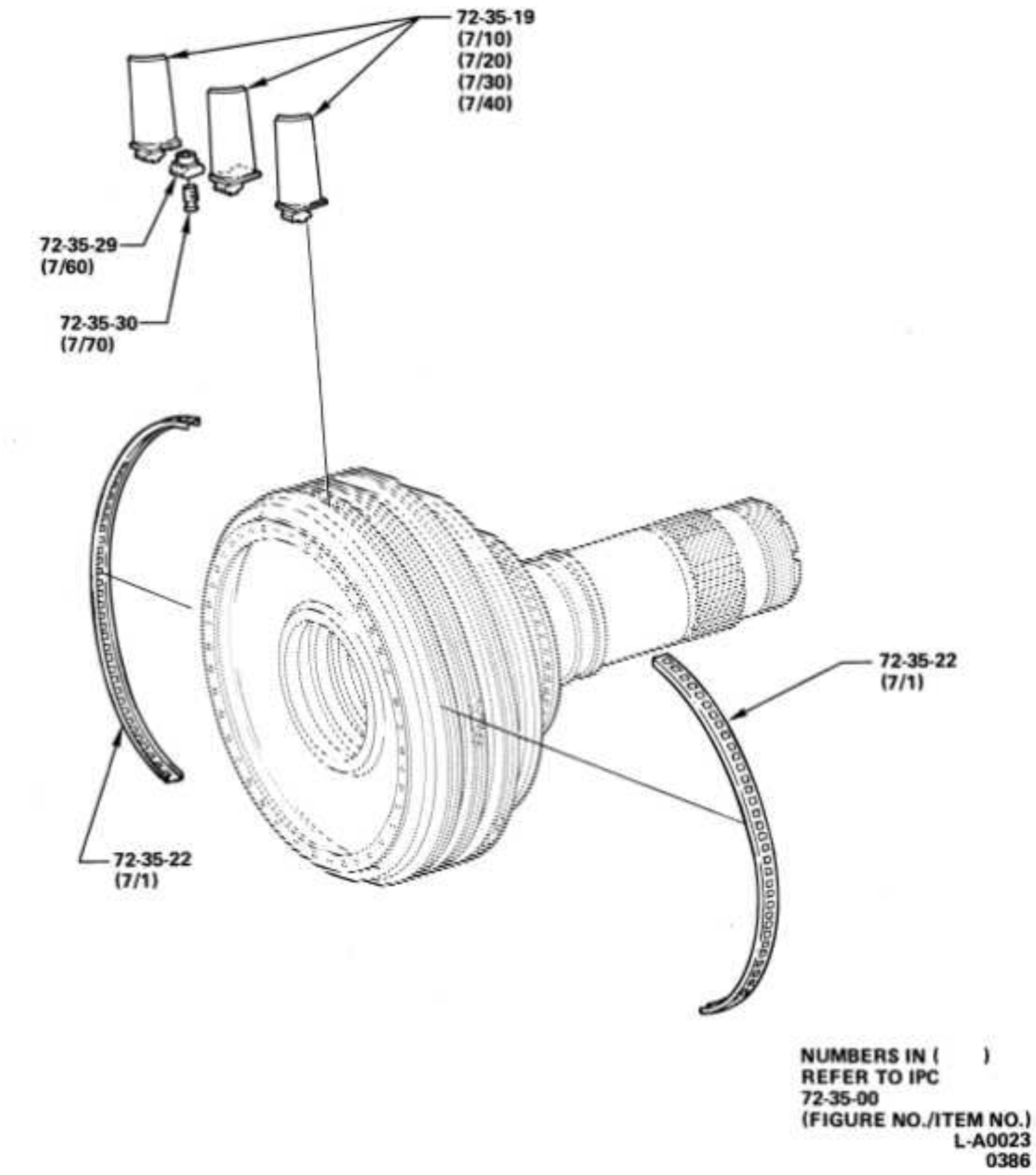
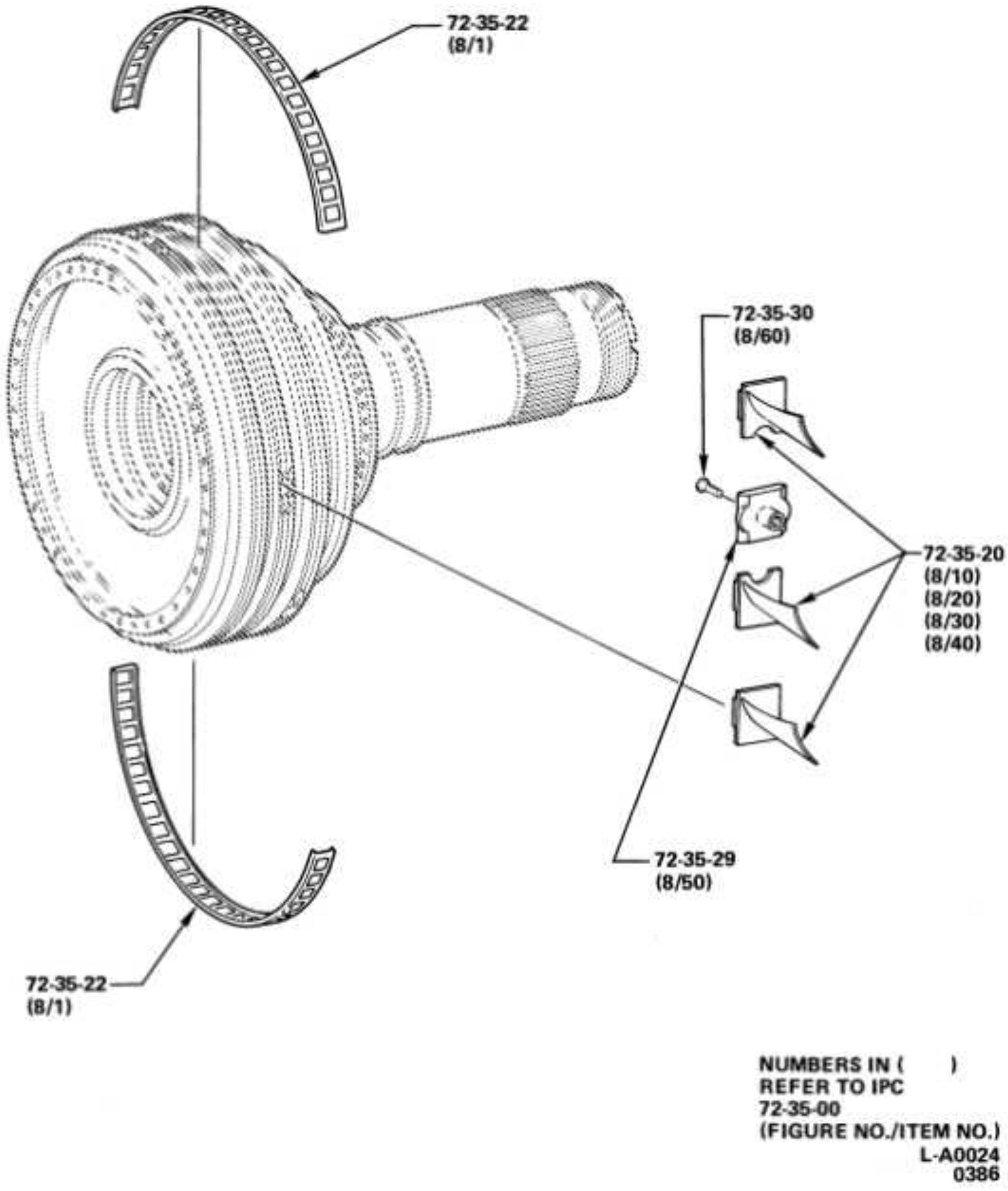
72-35-30
(6/70)
72-35-22
(6/1)
72-35-18
(6/10)
(6/20)
(6/30)
(6/40)
72-35-22
(6/1)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A0022 (0386)
PW V

High Pressure Compressor (HPC)
Figure 9 (Sheet 6)


72-35-19
(7/10)
(7/20)
(7/30)
(7/40)
72-35-29
(7/60)
72-35-30
(7/70)
72-35-22
(7/1)
72-35-22
(7/1)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A0023
0386

High Pressure Compressor (HPC)
Figure 9 (Sheet 7)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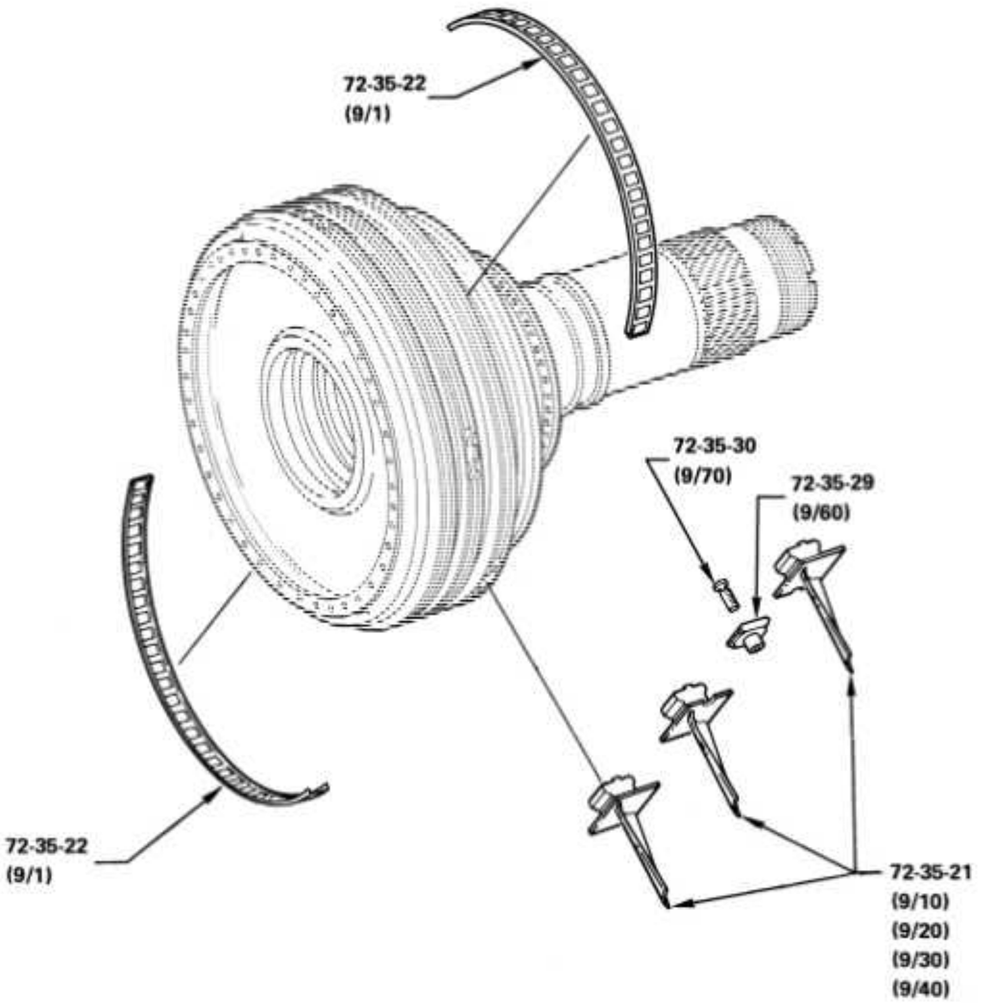
72-35-30
(8/60)
72-35-20
(8/10)
(8/20)
(8/30)
(8/40)
72-35-29
(8/50)
72-35-22
(8/1)
NUMBERS IN (   )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A0024
0386

High Pressure Compressor (HPC)
Figure 9 (Sheet 8)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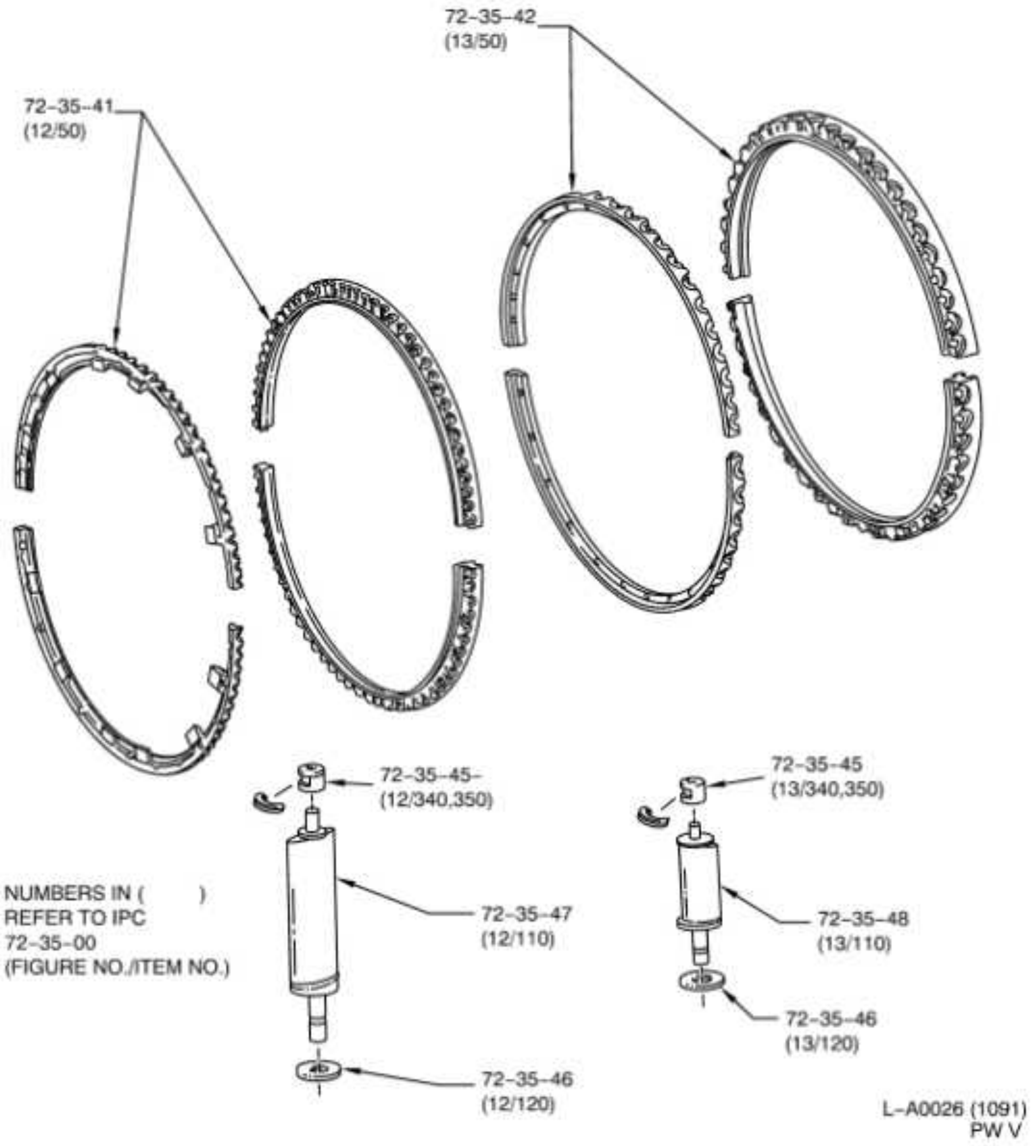
72-35-30
(9/70)
72-35-29
(9/60)
72-35-22
(9/1)
72-35-21
(9/10)
(9/20)
(9/30)
(9/40)

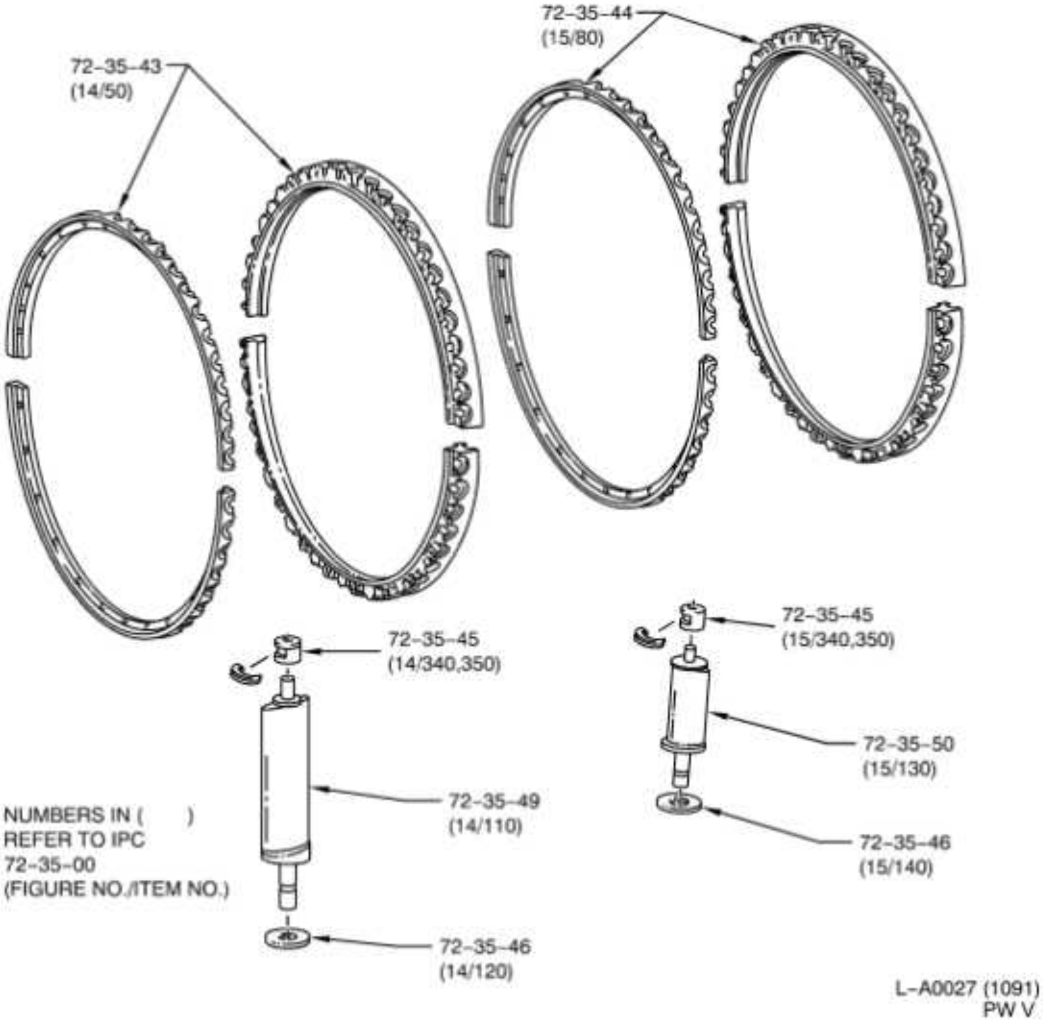
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)

L—A0025
0386

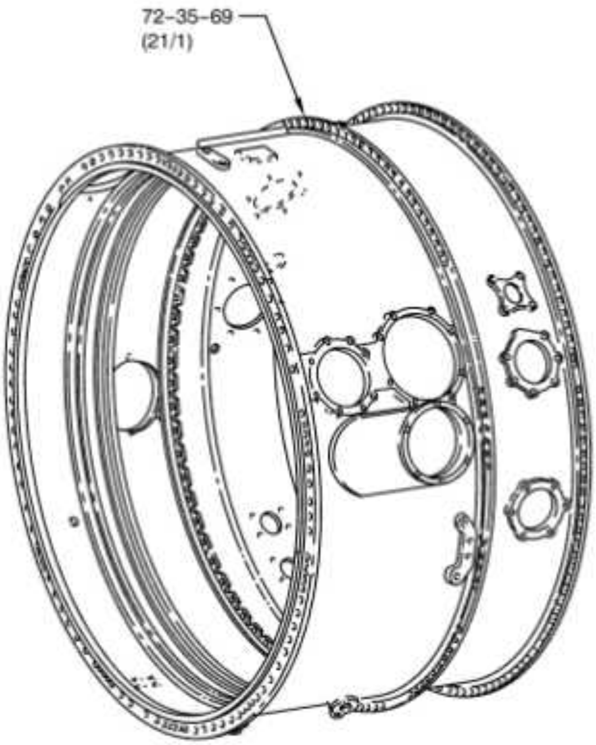
High Pressure Compressor (HPC)
Figure 9 (Sheet 9)


72-35-42
(13/50)
72-35-41
(12/50)
72-35-45-
(12/340,350)
72-35-45
(13/340,350)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
72-35-47
(12/110)
72-35-48
(13/110)
72-35-46
(13/120)
72-35-46
(12/120)
L-A0026 (1091)
PW V

High Pressure Compressor (HPC)
Figure 9 (Sheet 10)


72-35-44
(15/80)
72-35-43
(14/50)
72-35-45
(15/340,350)
72-35-45
(14/340,350)
72-35-50
(15/130)
72-35-49
(14/110)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
72-35-46
(15/140)
72-35-46
(14/120)
L-A0027 (1091)
PW V

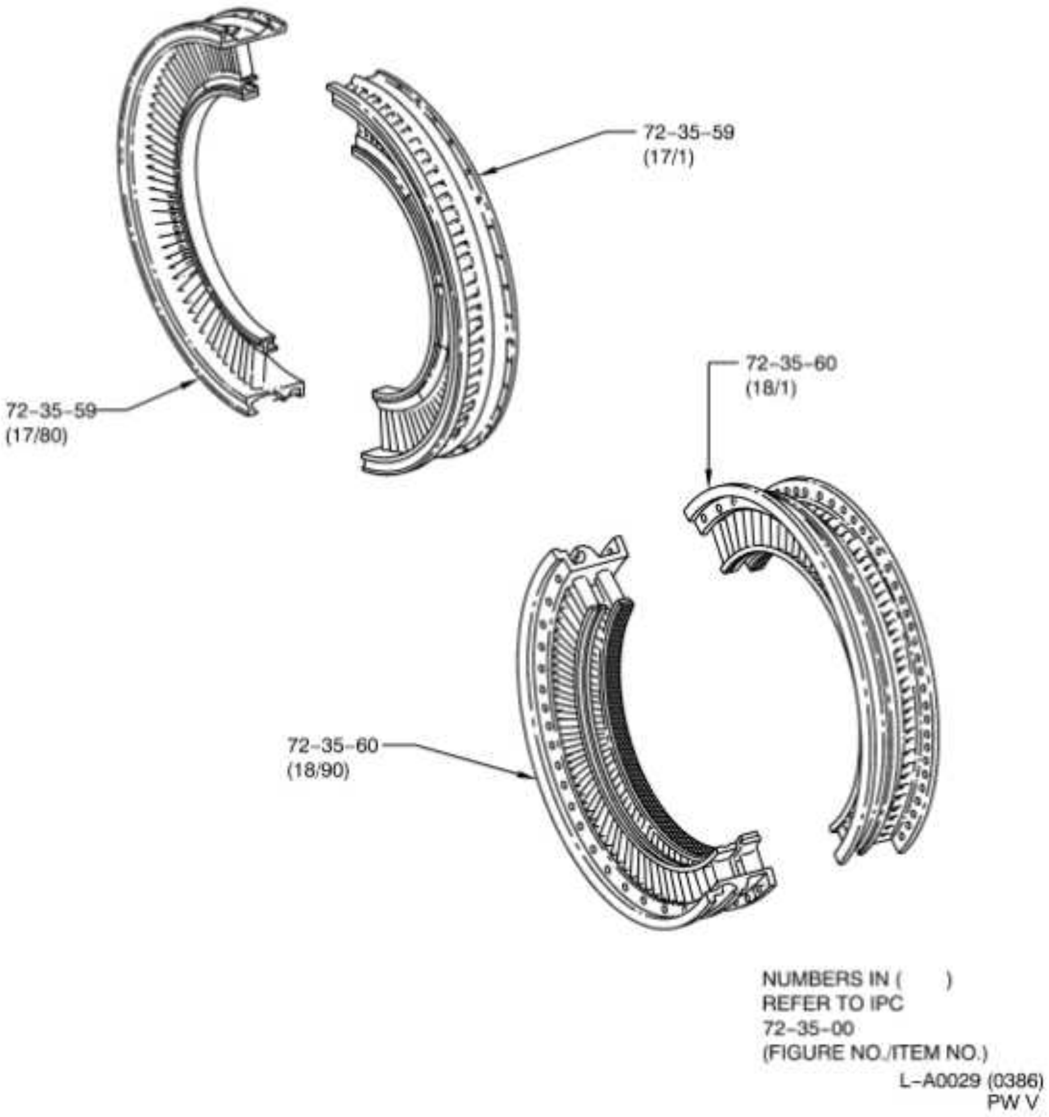
High Pressure Compressor (HPC)
Figure 9 (Sheet 11)



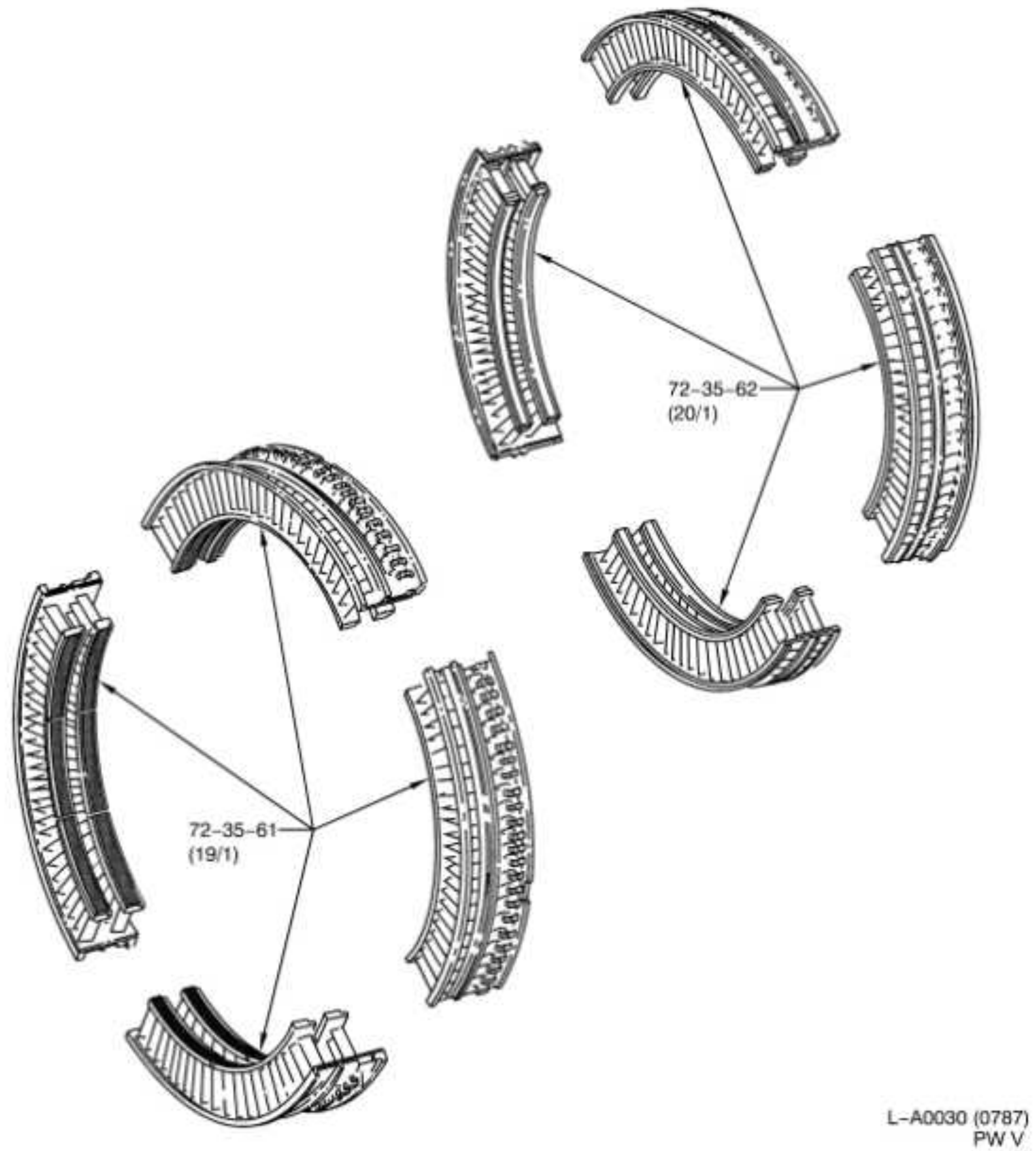
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)

L-A0028 (0386)
PW V

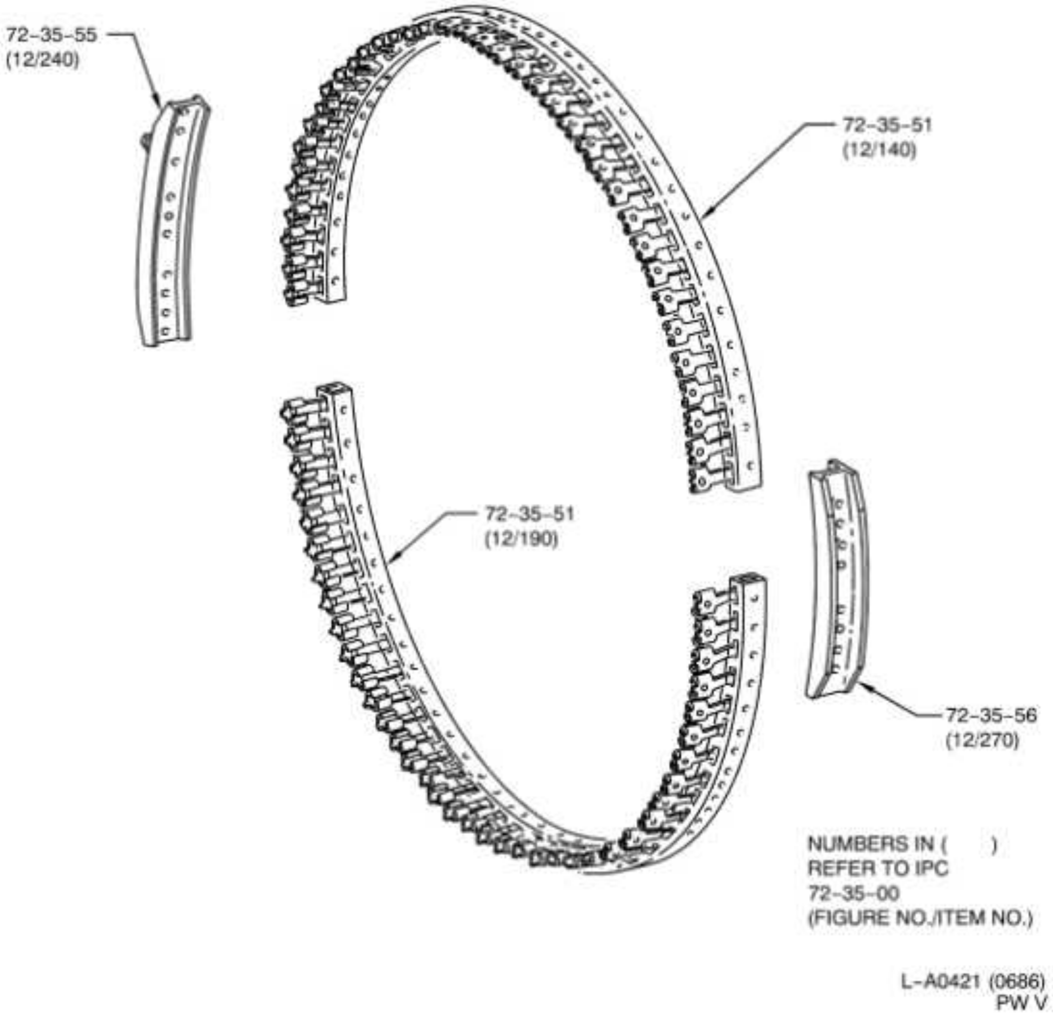
High Pressure Compressor (HPC) (Non−Ring Case Configuration)
Figure 9 (Sheet 12)


72-35-59
(17/1)
72-35-59
(17/80)
72-35-60
(18/1)
72-35-60
(18/90)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A0029 (0386)
PW V

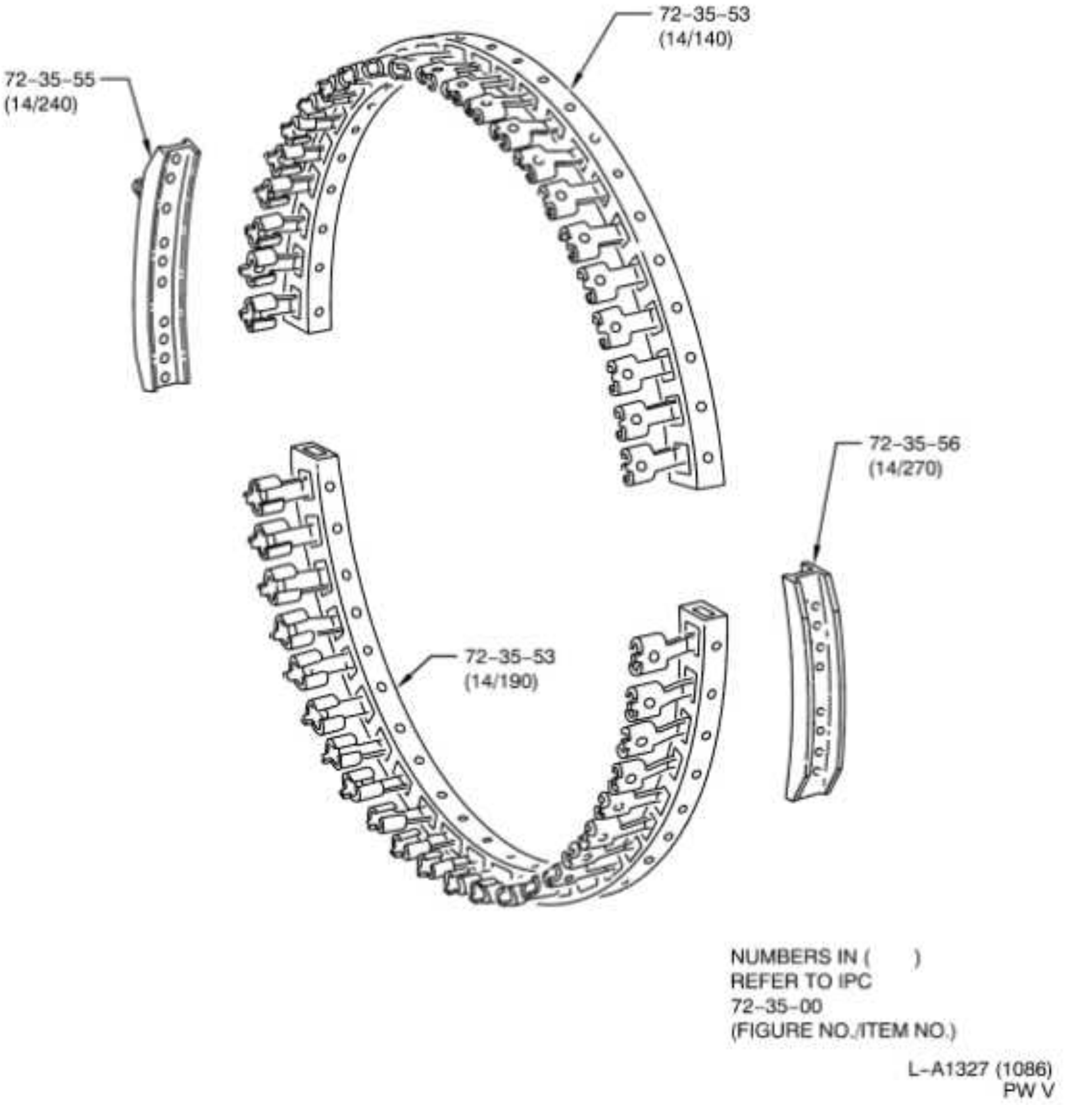
High Pressure Compressor (HPC) (Non−Ring Case Configuration)
Figure 9 (Sheet 13)


72–35–62
(20/1)
72–35–61
(19/1)
L–A0030 (0787)
PW V

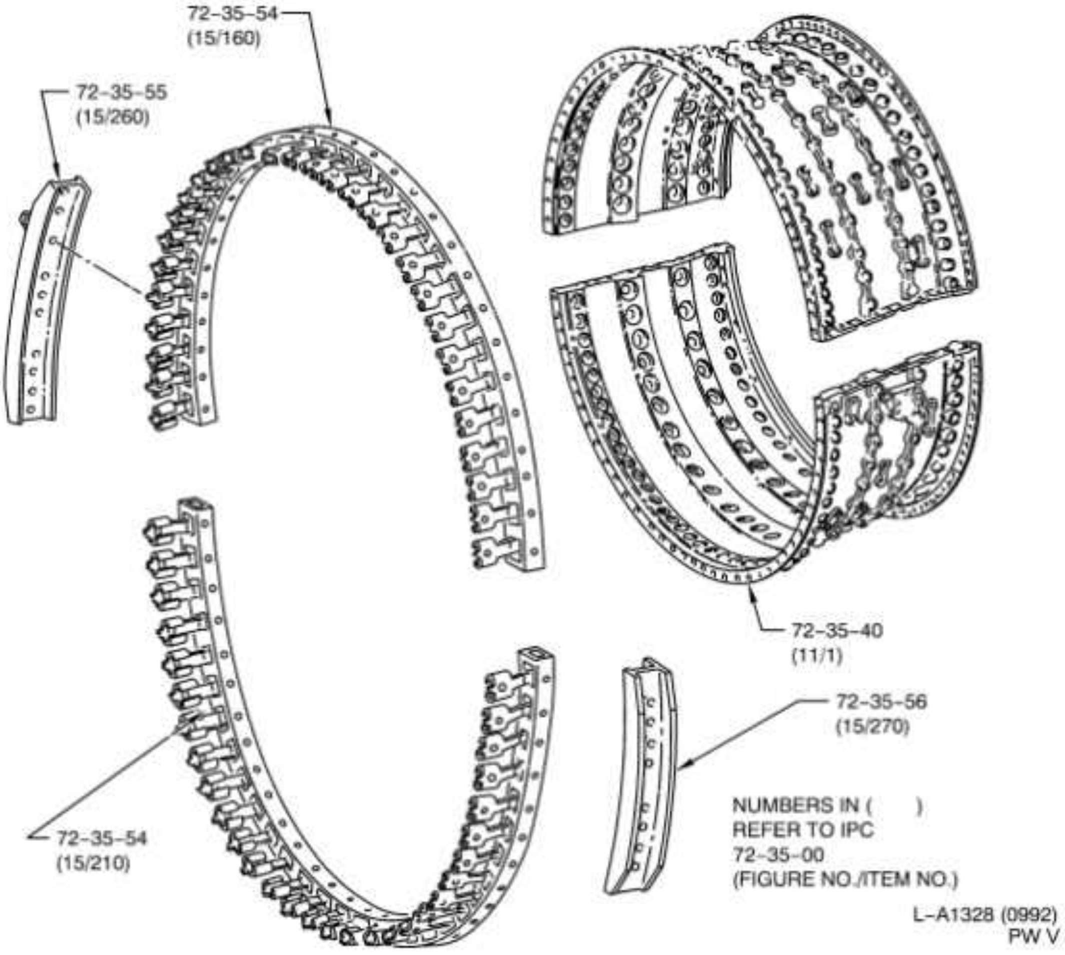
High Pressure Compressor (HPC) (Non–Ring Case Configuration)
Figure 9 (Sheet 14)


72-35-55
(12/240)
72-35-51
(12/140)
72-35-51
(12/190)
72-35-56
(12/270)
NUMBERS IN (   )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A0421 (0686)
PW V

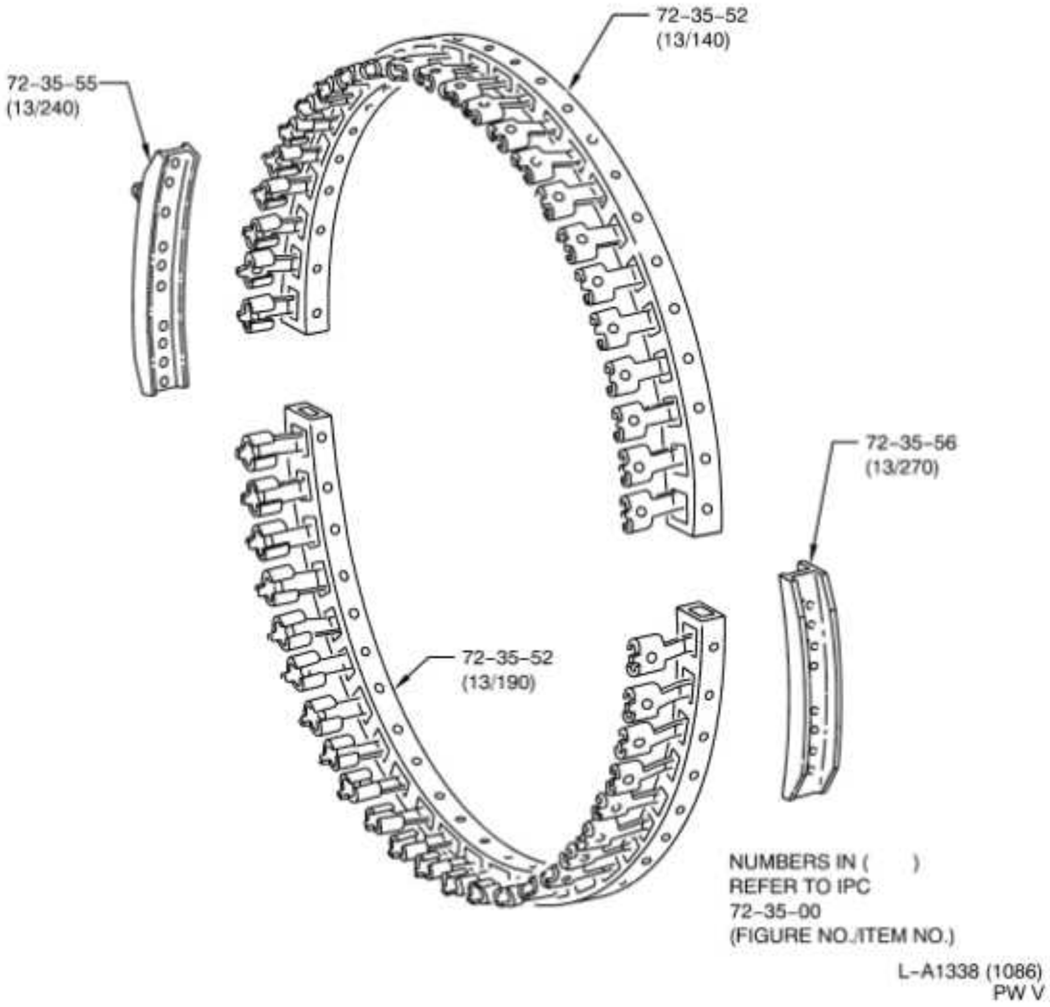
High Pressure Compressor (HPC)
Figure 9 (Sheet 15)


72-35-53
(14/140)
72-35-55
(14/240)
72-35-56
(14/270)
72-35-53
(14/190)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A1327 (1086)
PW V

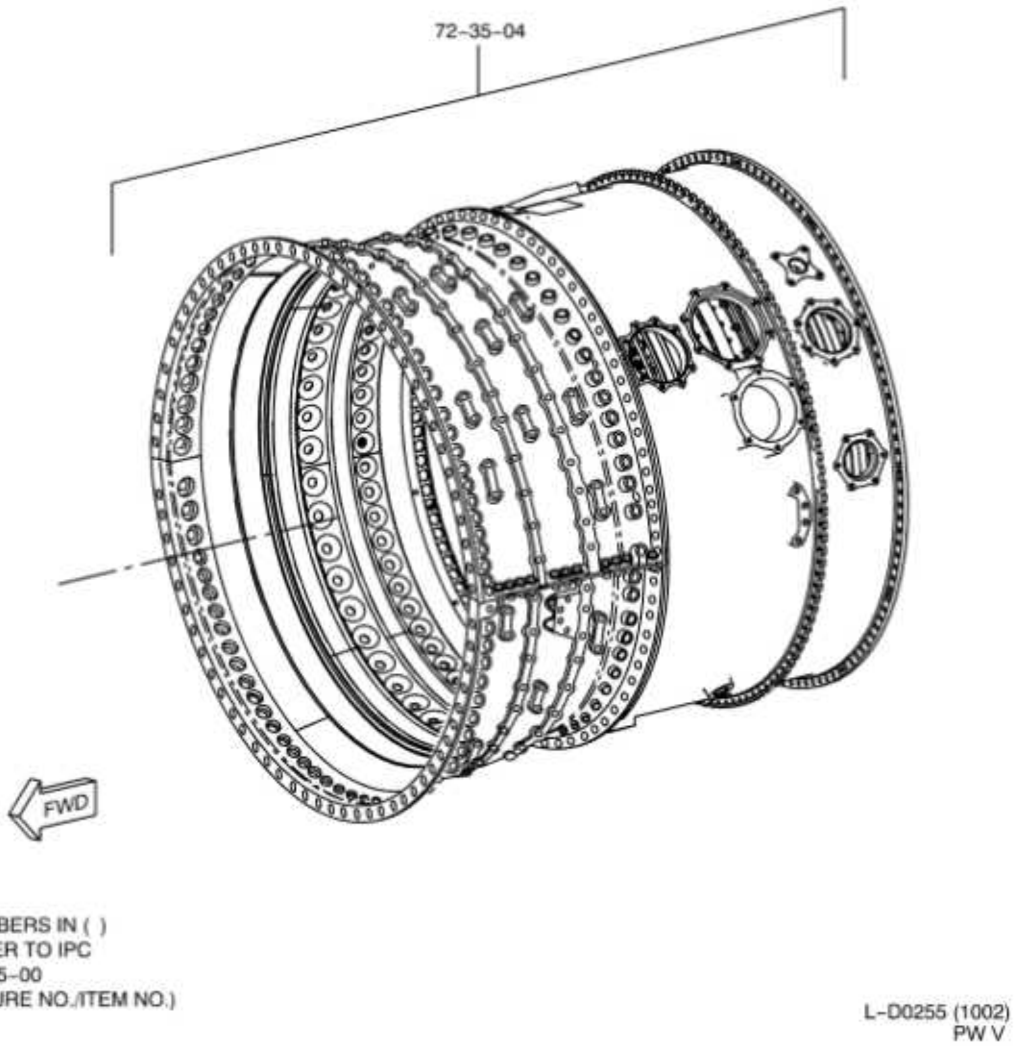
High Pressure Compressor (HPC)
Figure 9 (Sheet 16)


72-35-54
(15/160)
72-35-55
(15/260)
72-35-40
(11/1)
72-35-56
(15/270)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
72-35-54
(15/210)
L-A1328 (0992)
PW V

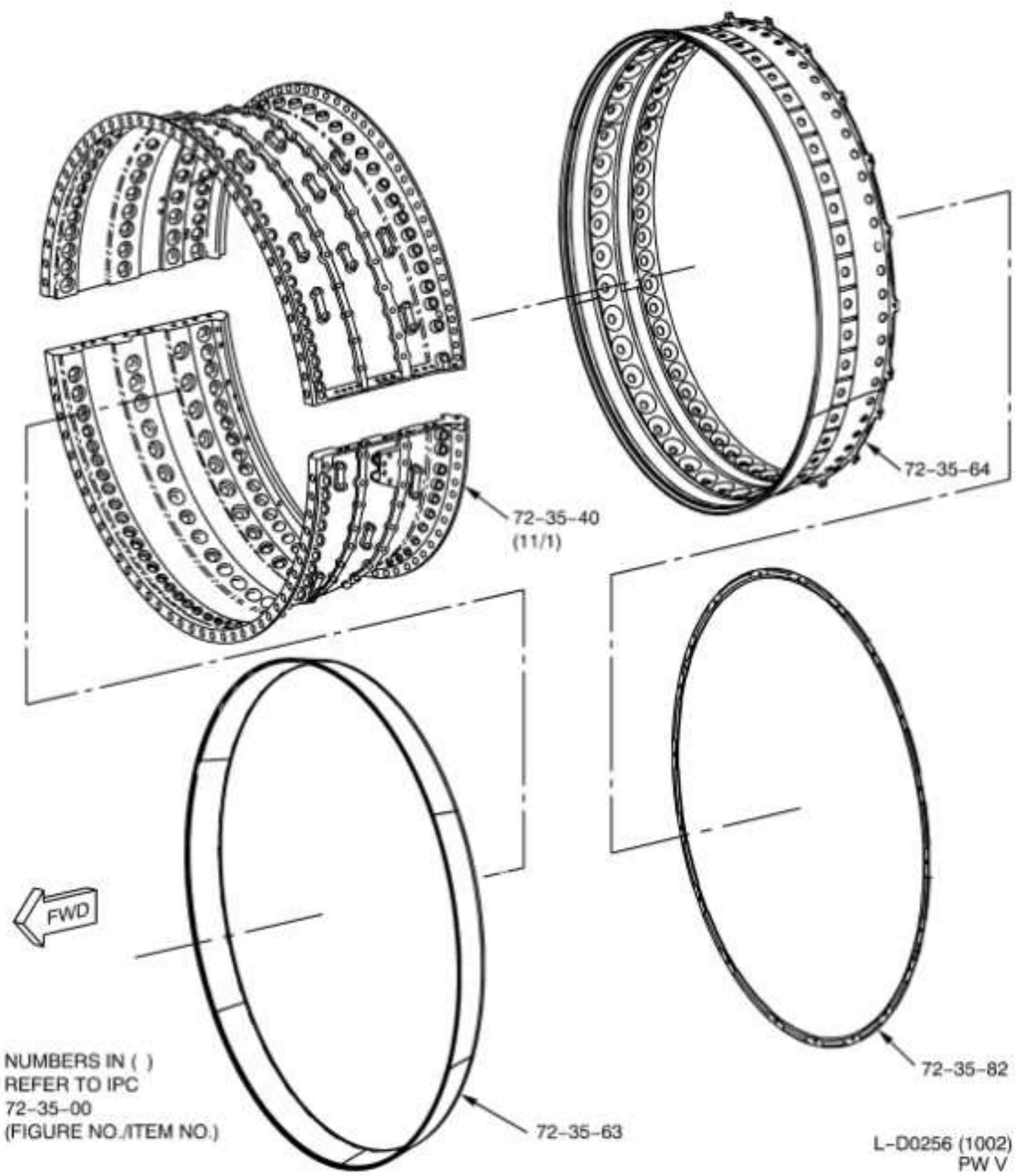
High Pressure Compressor (HPC)
Figure 9 (Sheet 17)


72-35-52
(13/140)
72-35-55
(13/240)
72-35-56
(13/270)
72-35-52
(13/190)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A1338 (1086)
PW V

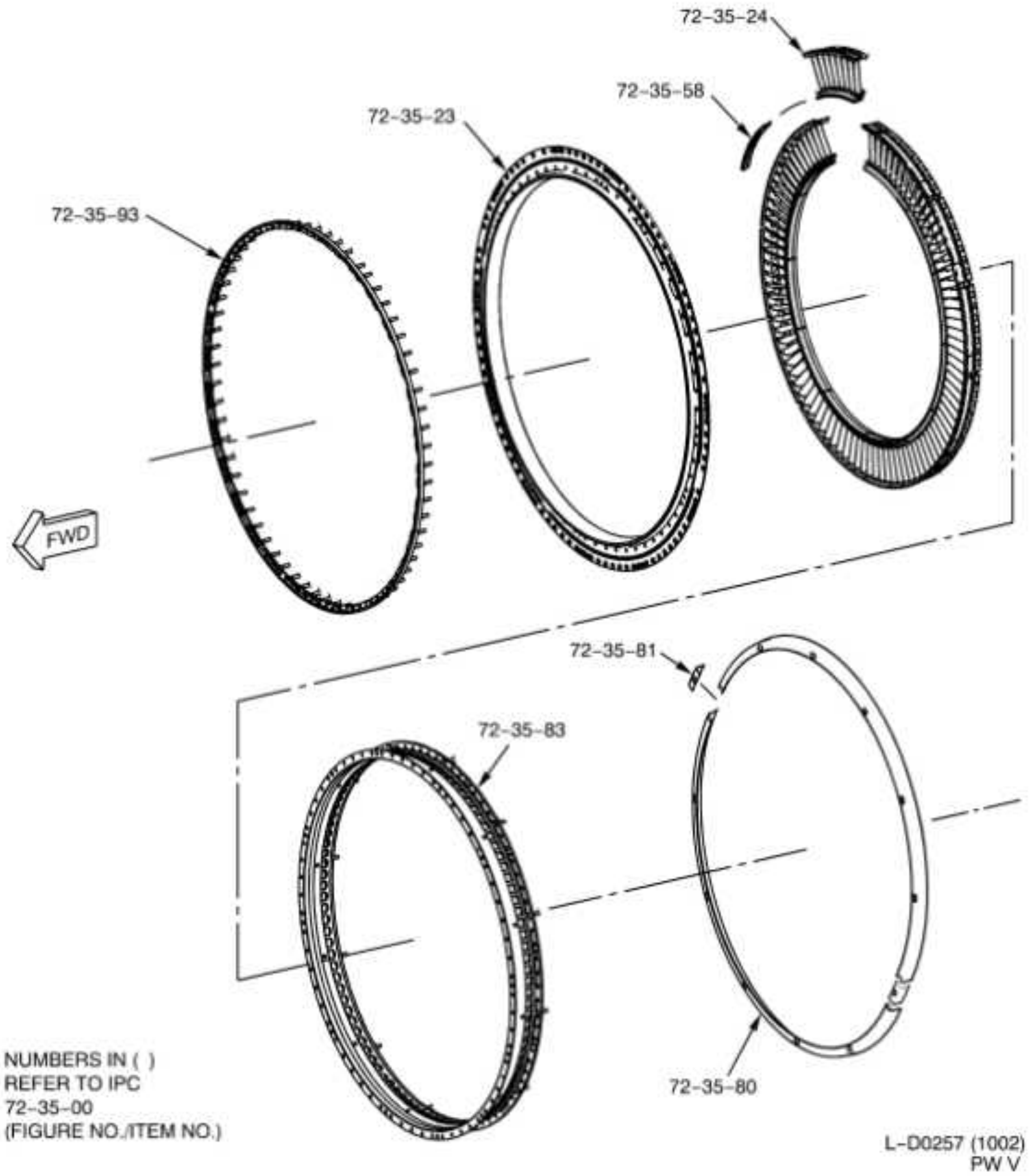
High Pressure Compressor (HPC)
Figure 9 (Sheet 18)


72-35-04
FWD
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-D0255 (1002)
PW V

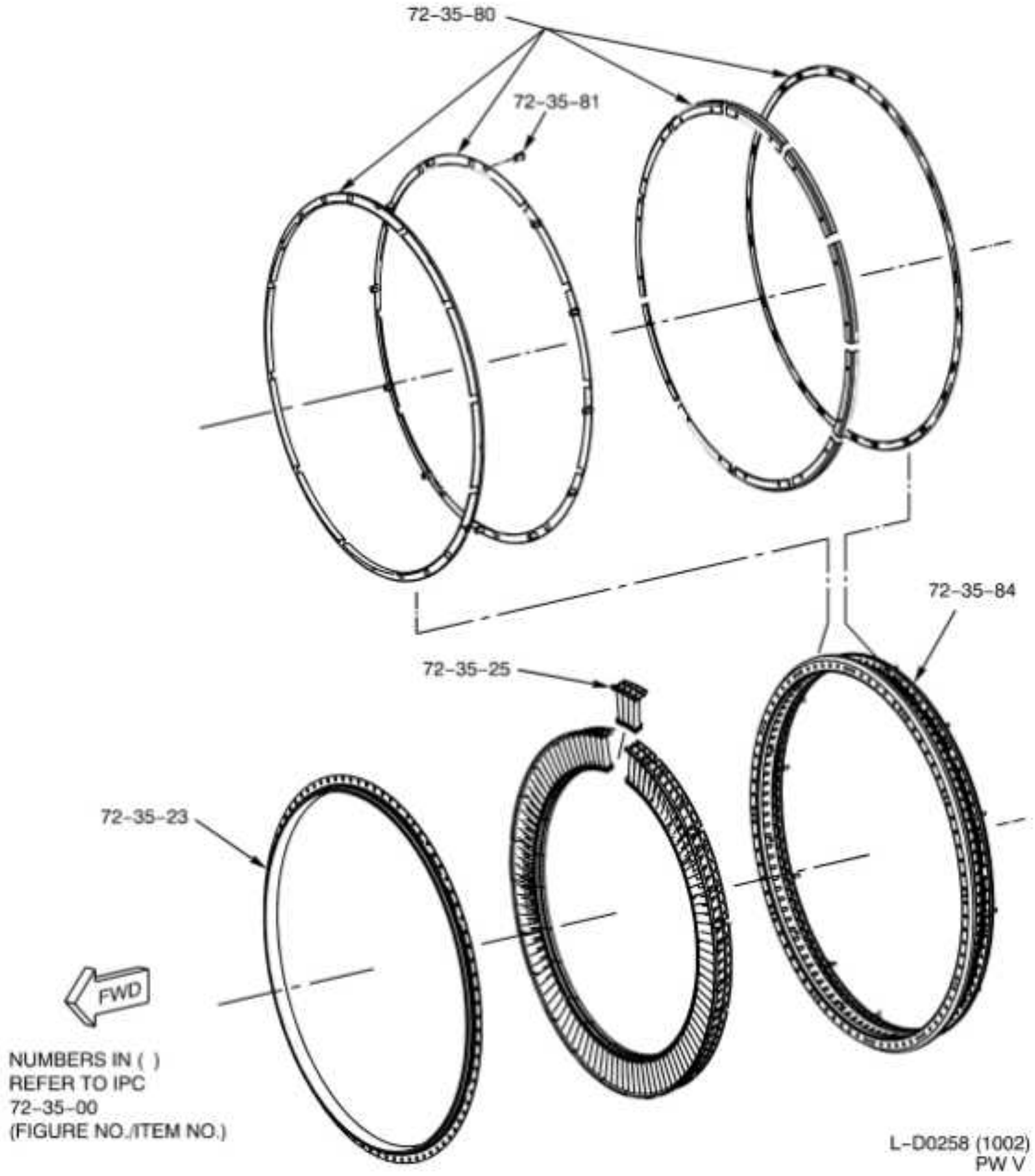
High Pressure Compressor (94 Inch
Fan Models Ring Case Configuration)
Figure 9 (Sheet 19)


72-35-64
72-35-40
(11/1)
FWD
72-35-82
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
72-35-63
L-D0256 (1002)
PW V

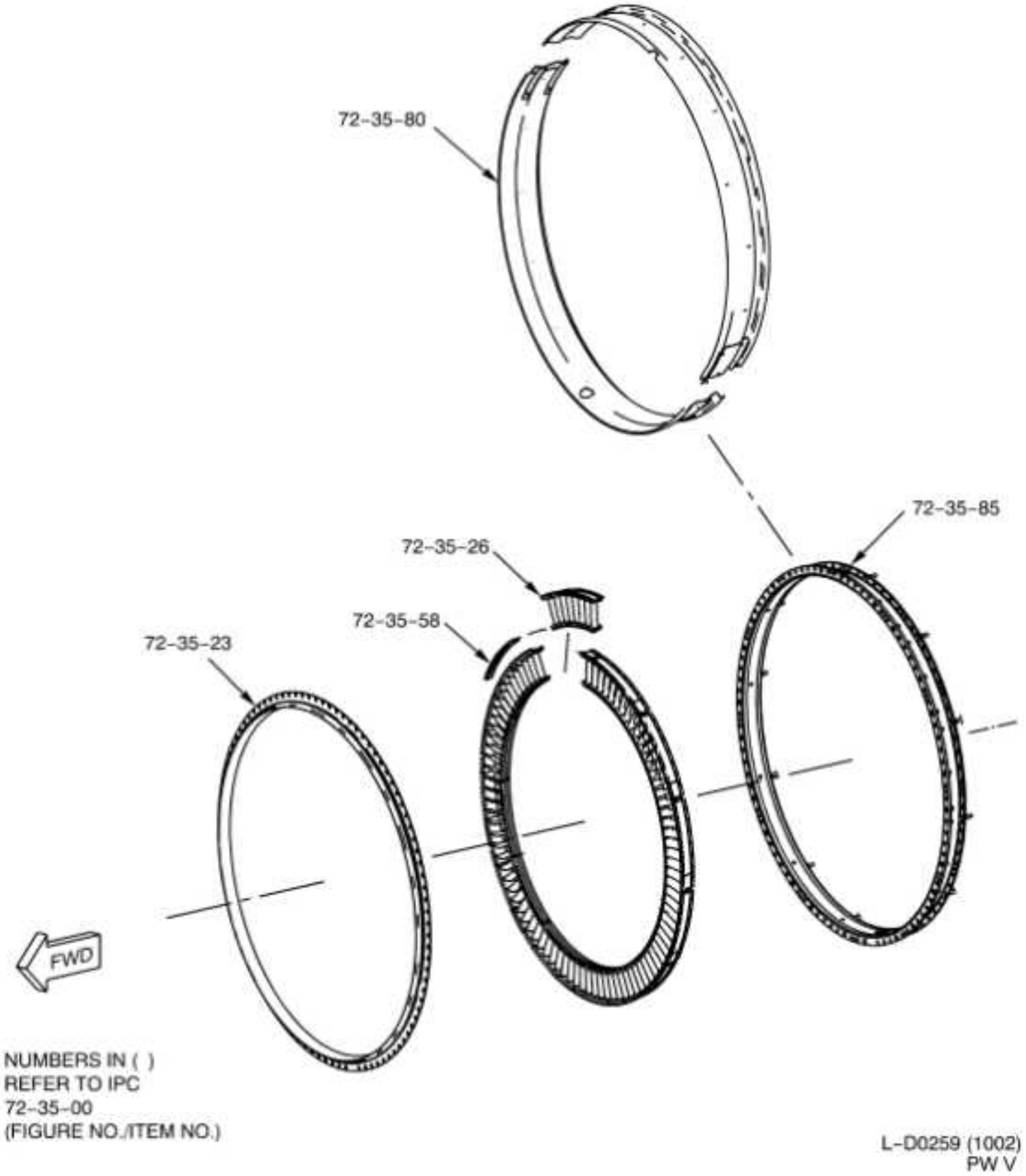
High Pressure Compressor (94 Inch
Fan Models Ring Case Configuration)
Figure 9 (Sheet 20)


72-35-24
72-35-58
72-35-23
72-35-93
FWD
72-35-81
72-35-83
72-35-80
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-D0257 (1002)
PW V

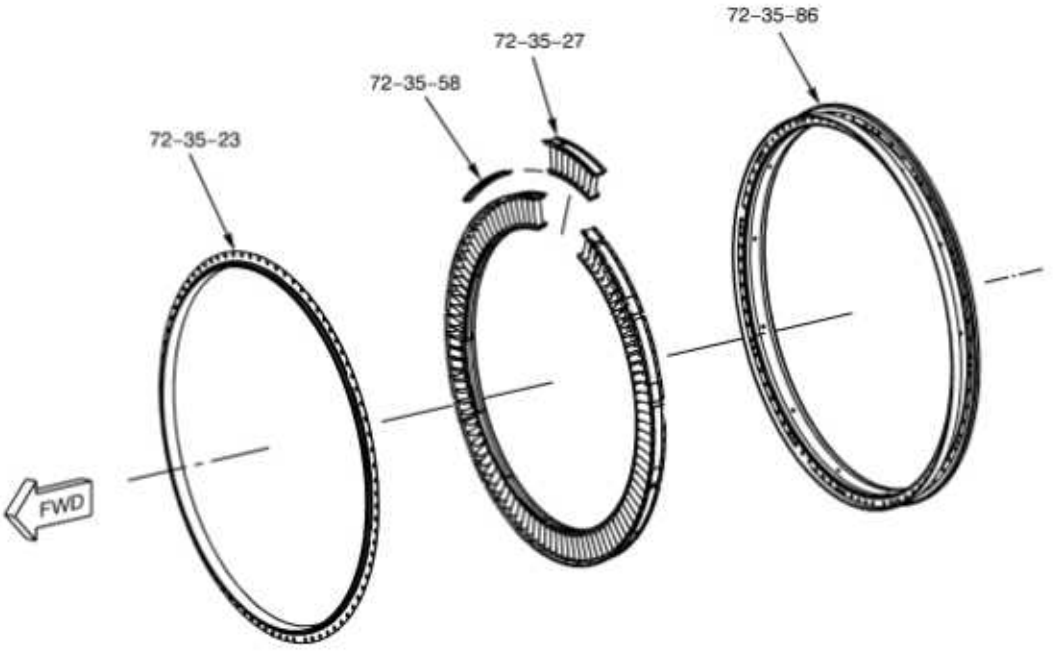
High Pressure Compressor (94 Inch
Fan Models Ring Case Configuration)
Figure 9 (Sheet 21)


72-35-80
72-35-81
72-35-84
72-35-25
72-35-23
FWD
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-D0258 (1002)
PW V

High Pressure Compressor (94 Inch
Fan Models Ring Case Configuration)
Figure 9 (Sheet 22)


72-35-80
72-35-85
72-35-26
72-35-58
72-35-23
FWD
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-D0259 (1002)
PW V

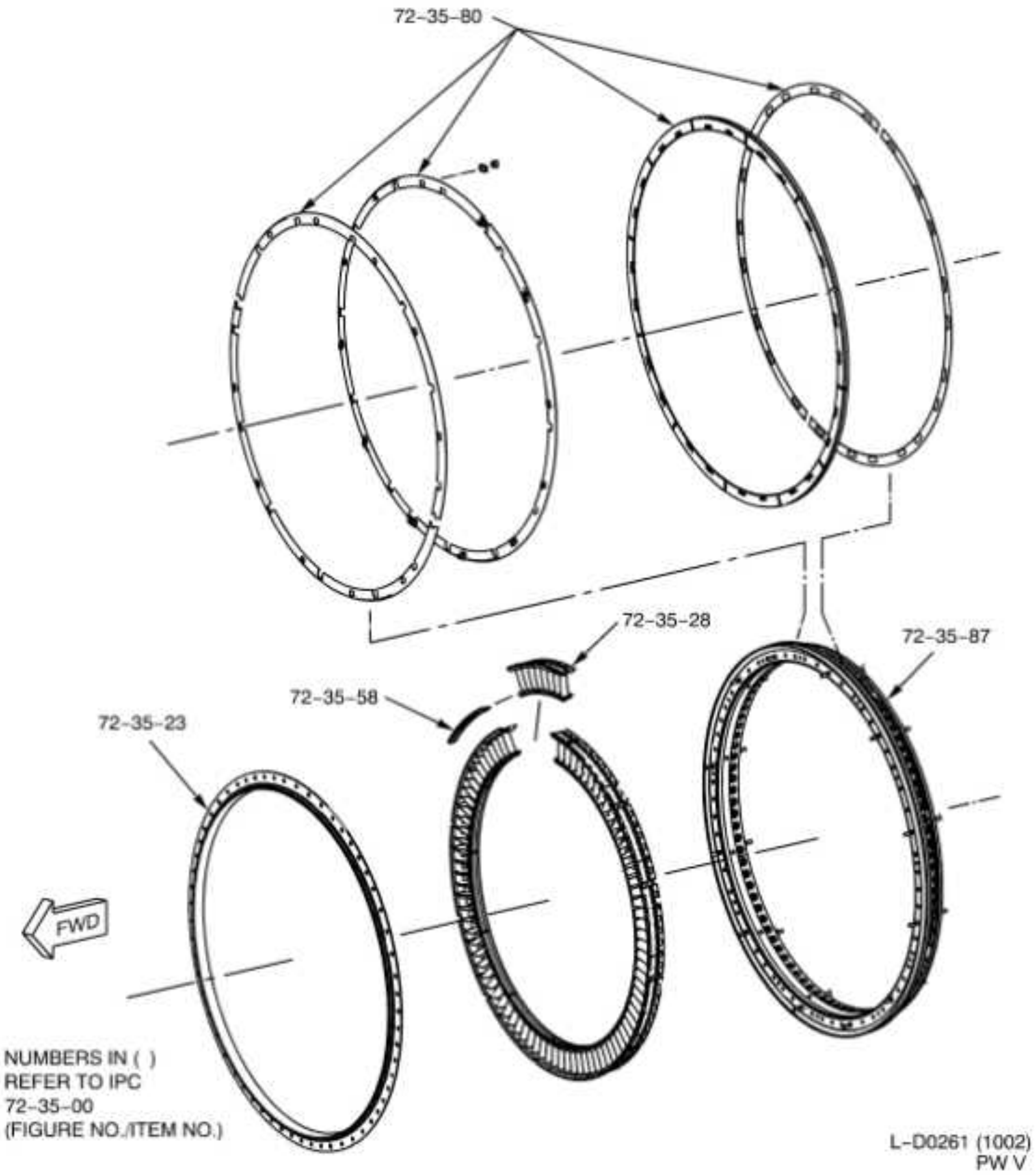
High Pressure Compressor (94 Inch
Fan Models Ring Case Configuration)
Figure 9 (Sheet 23)


72-35-86
72-35-27
72-35-58
72-35-23
FWD

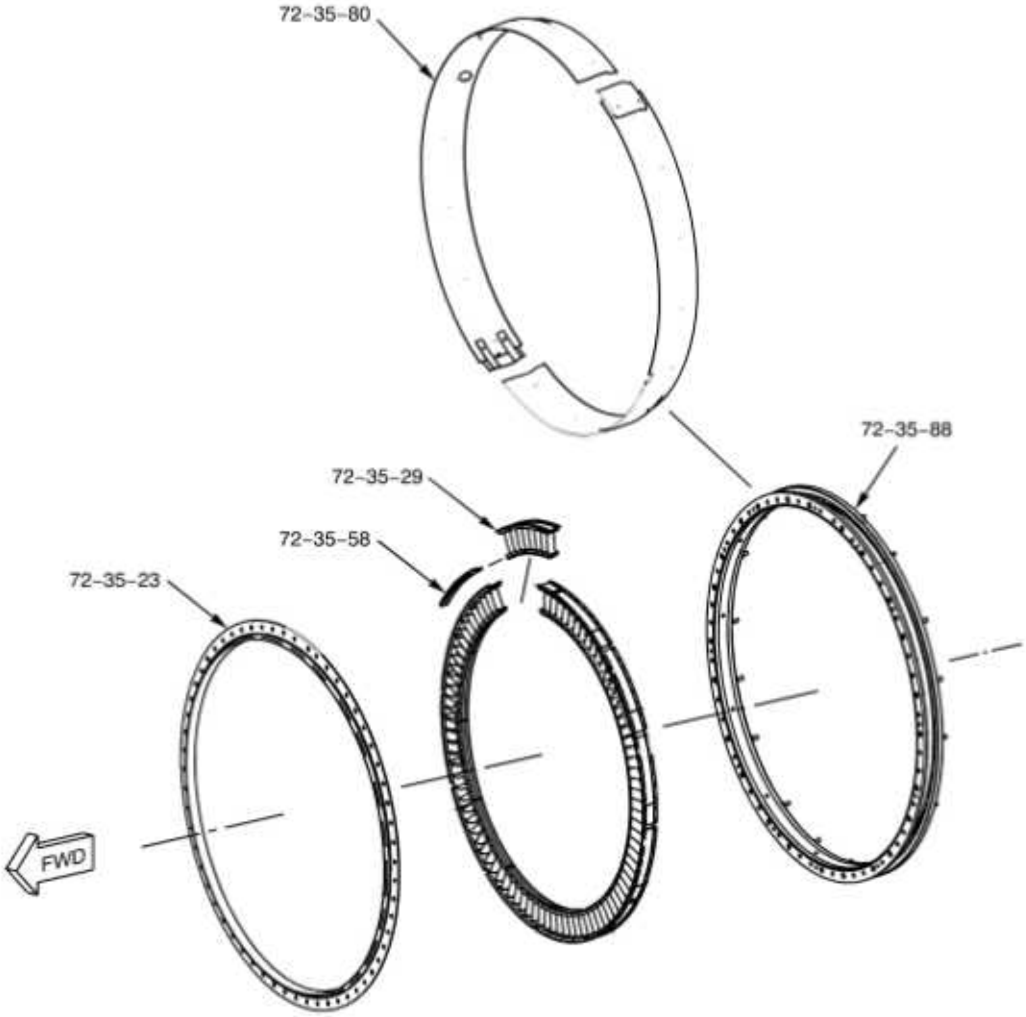
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)

L-D0260 (1002)
PW V

High Pressure Compressor (94 Inch
Fan Models Ring Case Configuration)
Figure 9 (Sheet 24)


72-35-80
72-35-28
72-35-87
72-35-58
72-35-23
FWD
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-D0261 (1002)
PW V

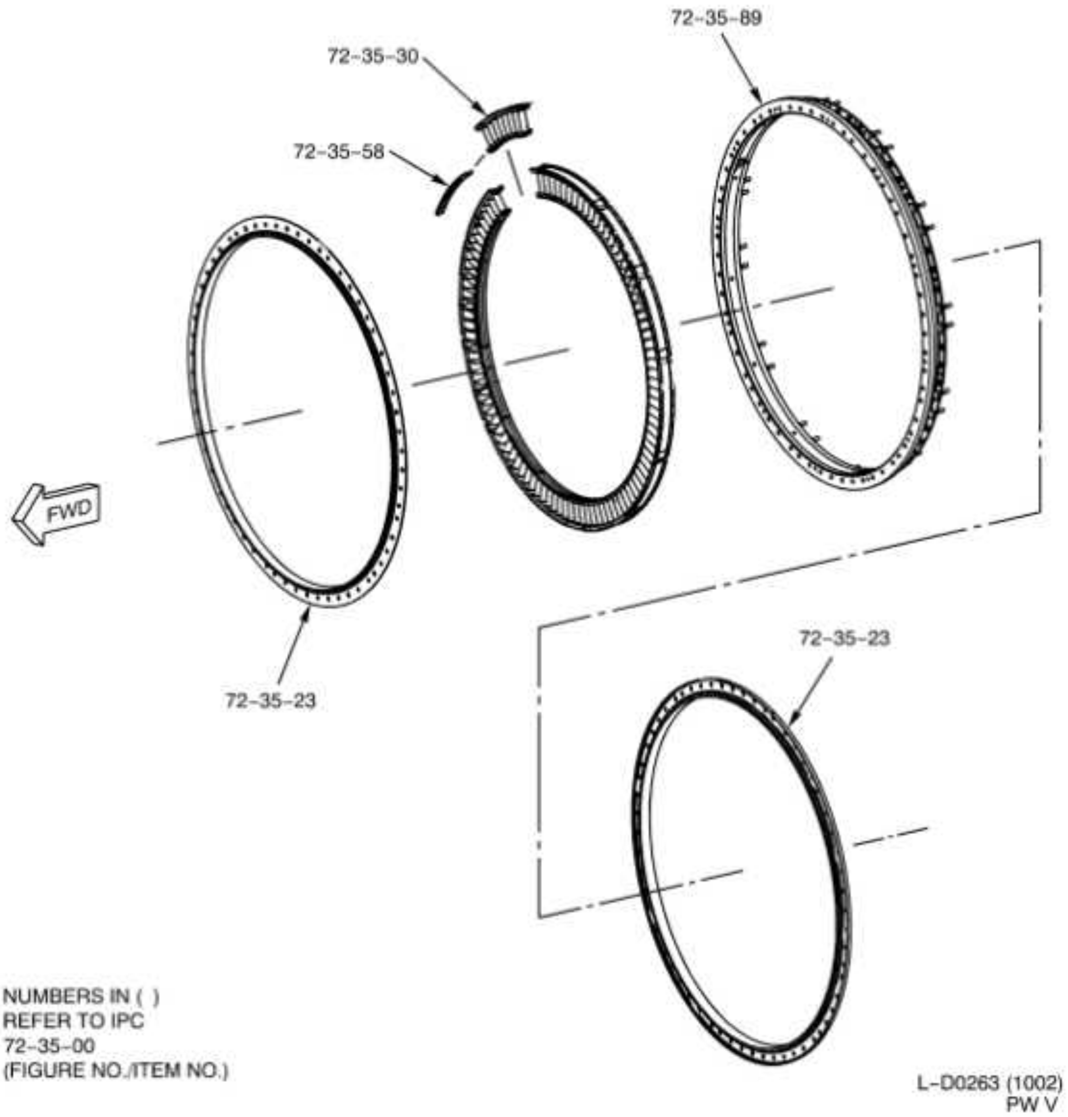
High Pressure Compressor (94 Inch
Fan Models Ring Case Configuration)
Figure 9 (Sheet 25)


72-35-80
72-35-88
72-35-29
72-35-58
72-35-23
FWD

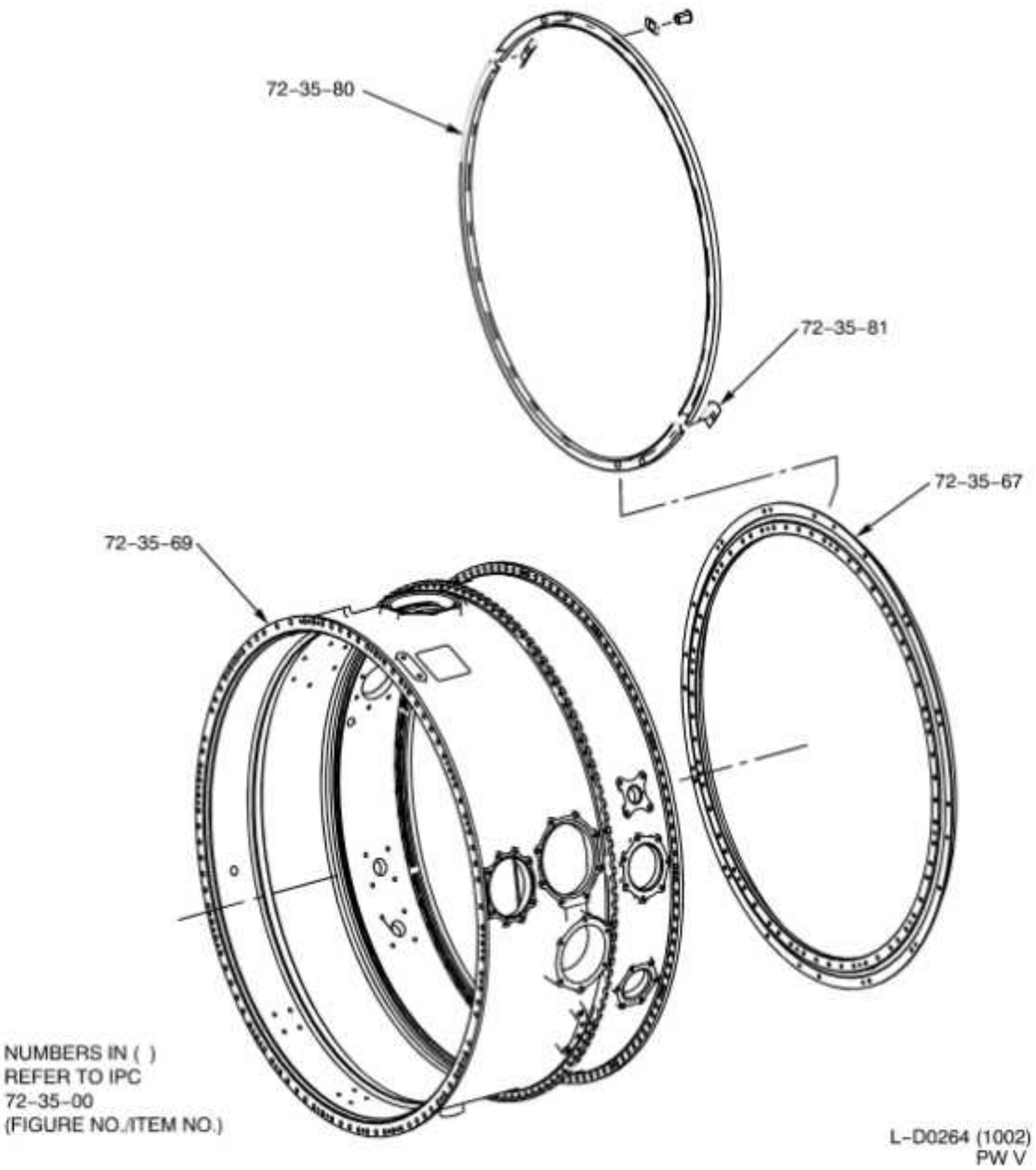
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)

L-D0262 (1002)
PW V

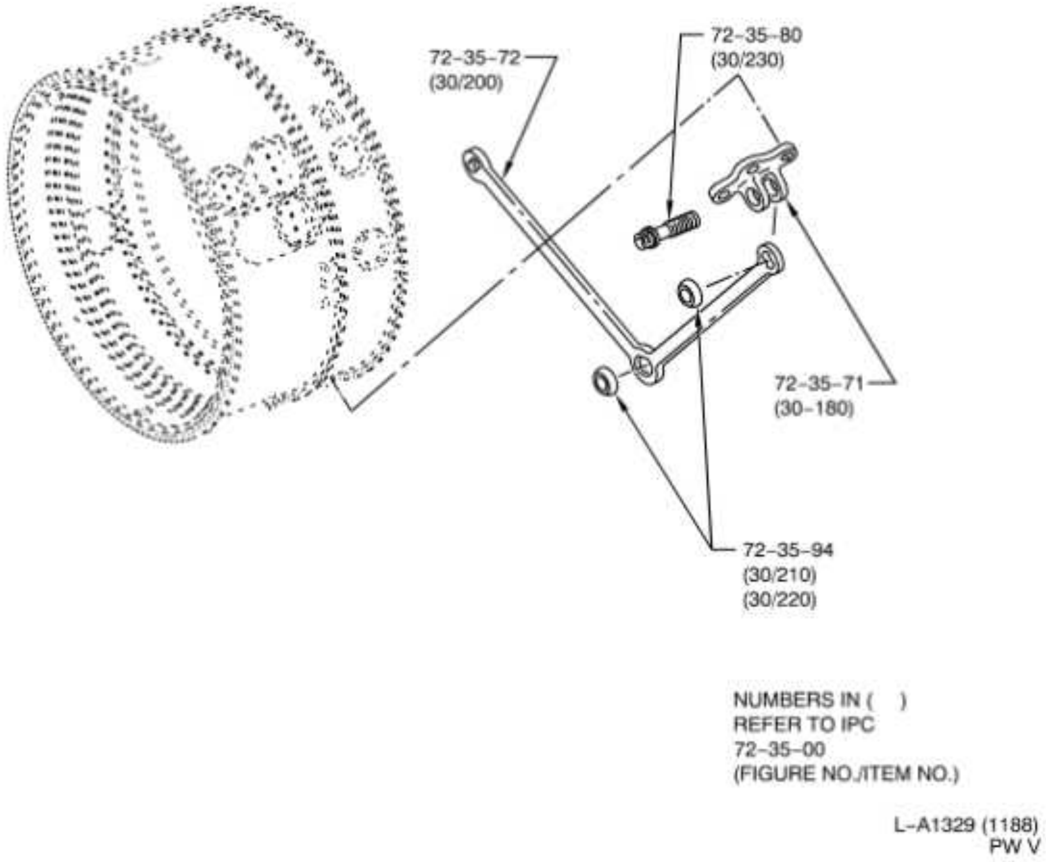
High Pressure Compressor (94 Inch
Fan Models Ring Case Configuration)
Figure 9 (Sheet 26)


72-35-89
72-35-30
72-35-58
FWD
72-35-23
72-35-23
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-D0263 (1002)
PW V

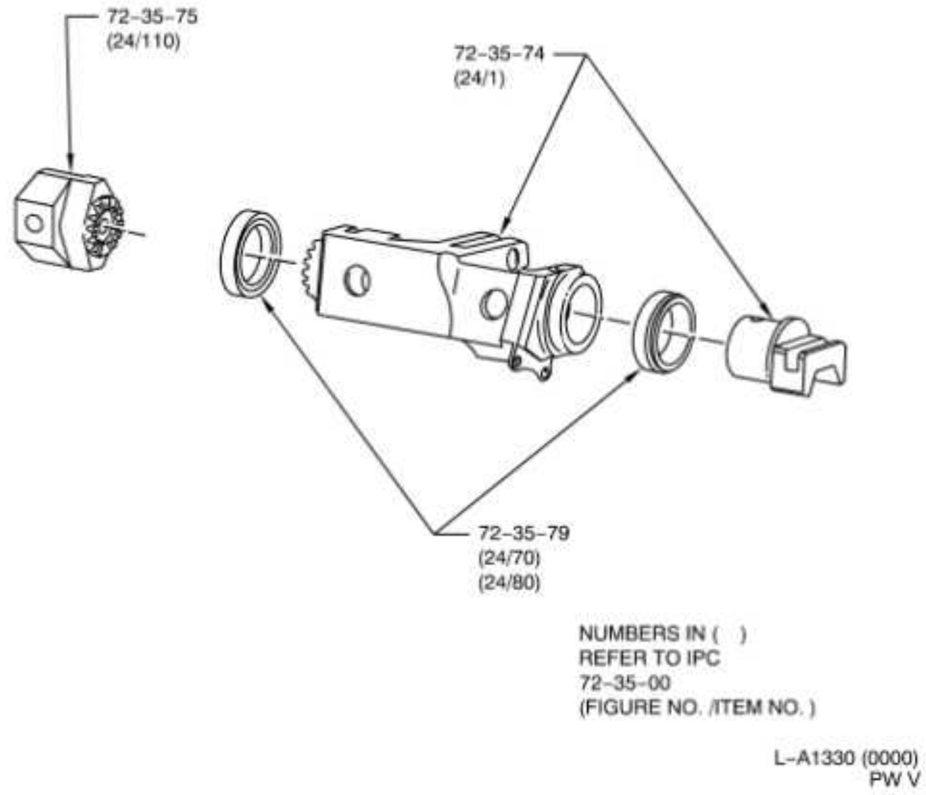
High Pressure Compressor (94 Inch Fan Models Ring Case Configuration)
Figure 9 (Sheet 27)


72-35-80
72-35-81
72-35-67
72-35-69
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-D0264 (1002)
PW V

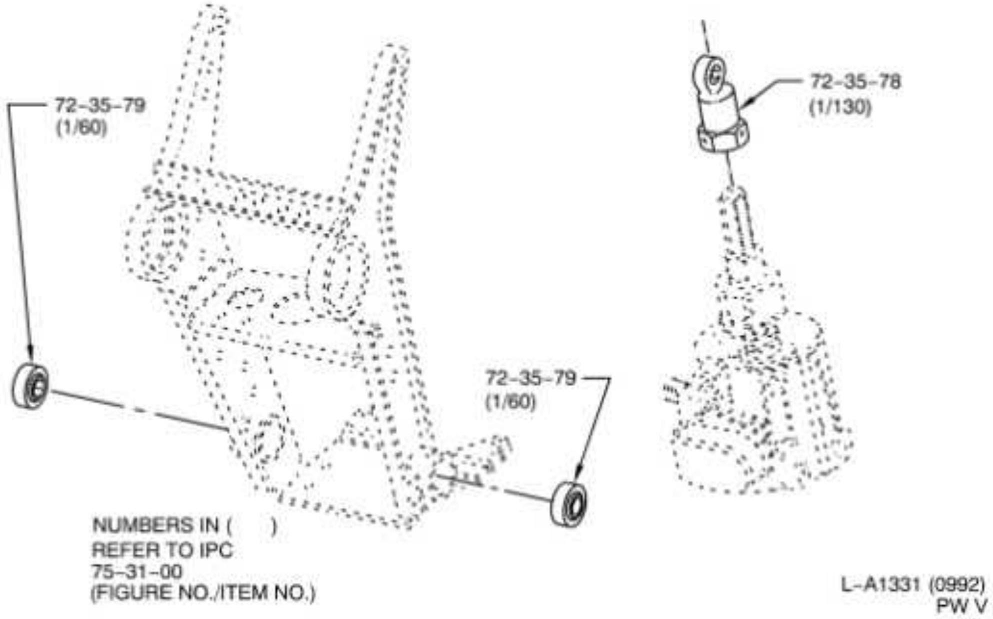
High Pressure Compressor (94 Inch
Fan Models Ring Case Configuration)
Figure 9 (Sheet 28)


72-35-72
(30/200)
72-35-80
(30/230)
72-35-71
(30-180)
72-35-94
(30/210)
(30/220)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A1329 (1188)
PW V

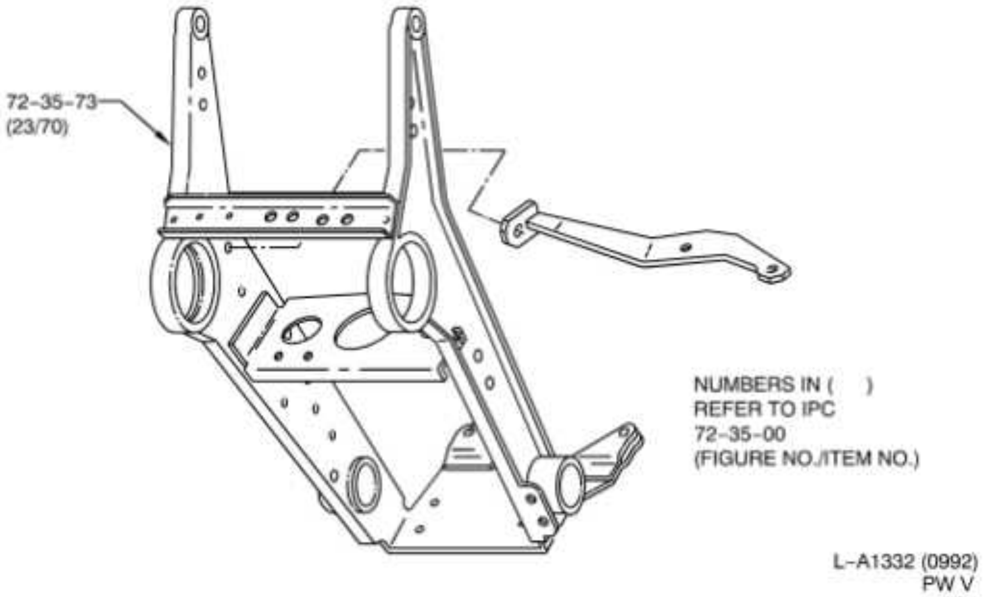
High Pressure Compressor (HPC)
Figure 9 (Sheet 29)


72-35-75
(24/110)
72-35-74
(24/1)
72-35-79
(24/70)
(24/80)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO. /ITEM NO.)
L-A1330 (0000)
PW V

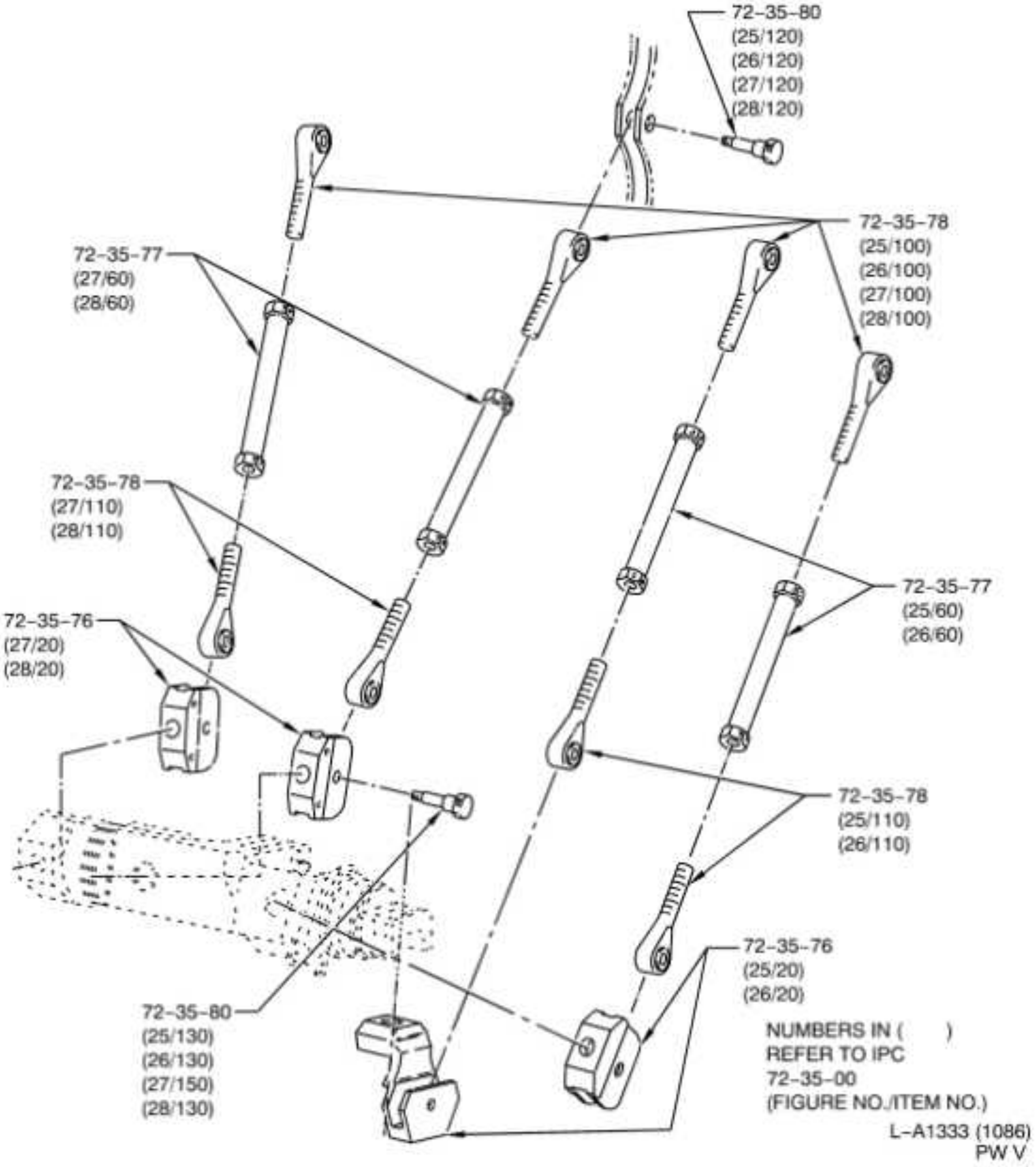
High Pressure Compressor (HPC)
Figure 9 (Sheet 30)


72-35-79
(1/60)
72-35-78
(1/130)
72-35-79
(1/60)
NUMBERS IN ( )
REFER TO IPC
75-31-00
(FIGURE NO./ITEM NO.)
L-A1331 (0992)
PW V

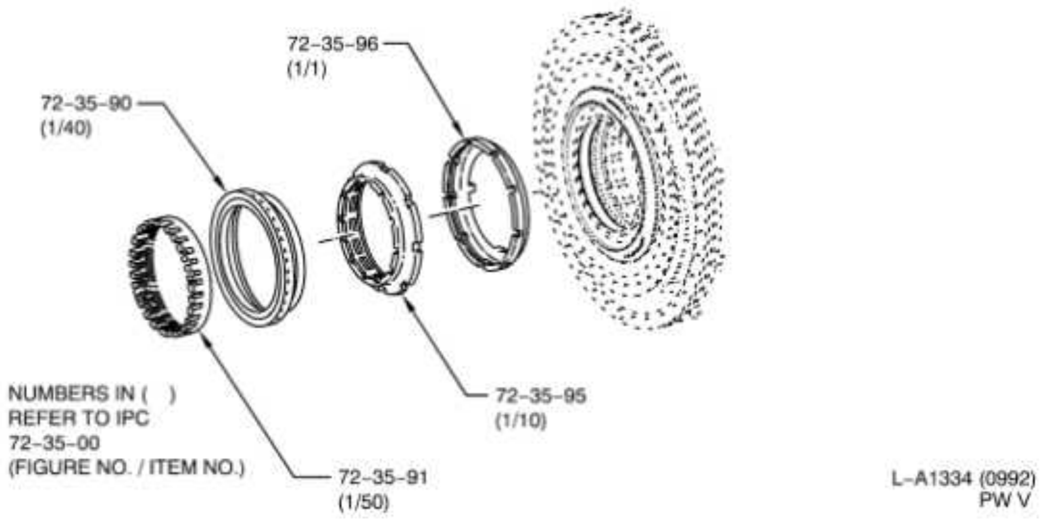
High Pressure Compressor (HPC)
Figure 9 (Sheet 31)


72-35-73
(23/70)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A1332 (0992)
PW V

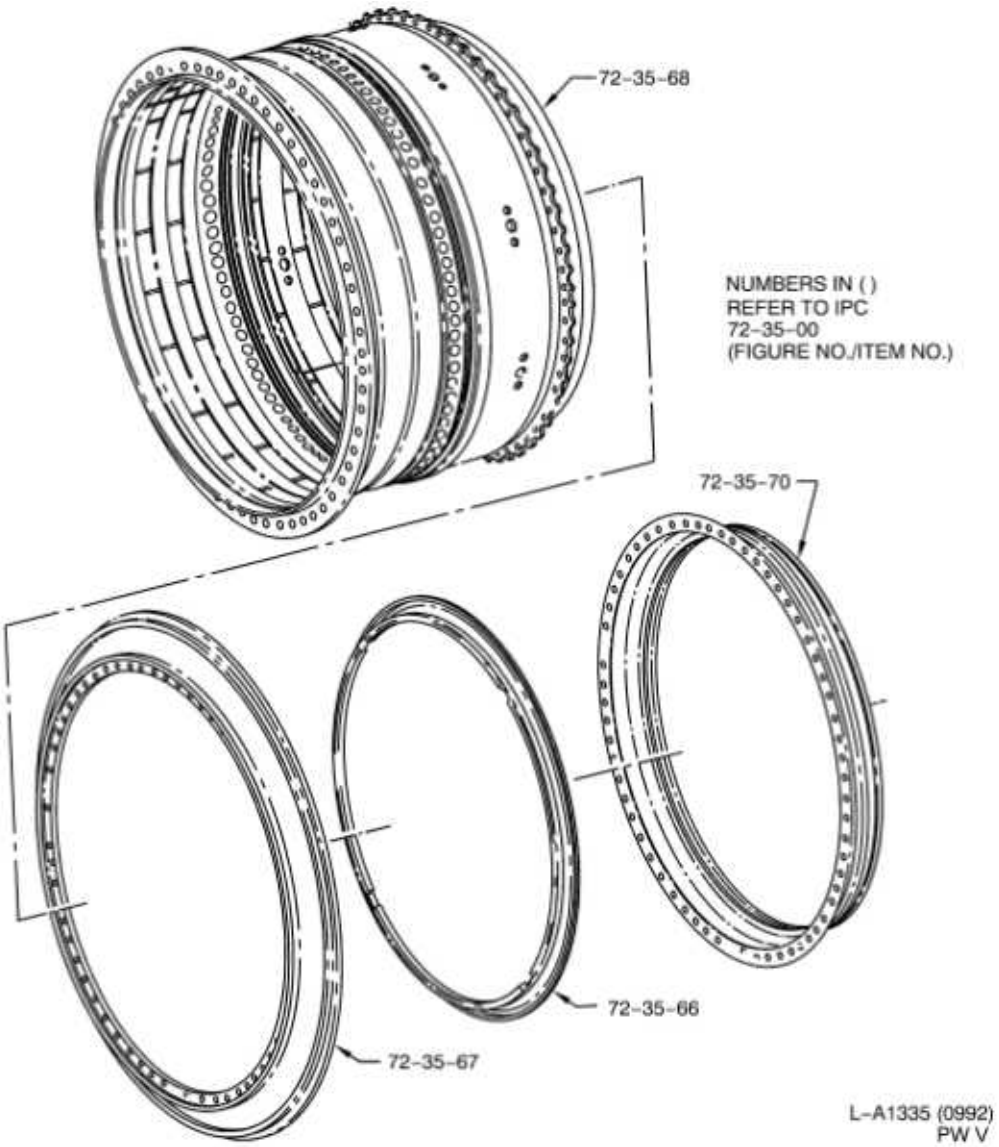
High Pressure Compressor (HPC)
Figure 9 (Sheet 32)


72-35-80
(25/120)
(26/120)
(27/120)
(28/120)
72-35-78
(25/100)
(26/100)
(27/100)
(28/100)
72-35-77
(27/60)
(28/60)
72-35-78
(27/110)
(28/110)
72-35-77
(25/60)
(26/60)
72-35-76
(27/20)
(28/20)
72-35-78
(25/110)
(26/110)
72-35-76
(25/20)
(26/20)
72-35-80
(25/130)
(26/130)
(27/150)
(28/130)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A1333 (1086)
PW V

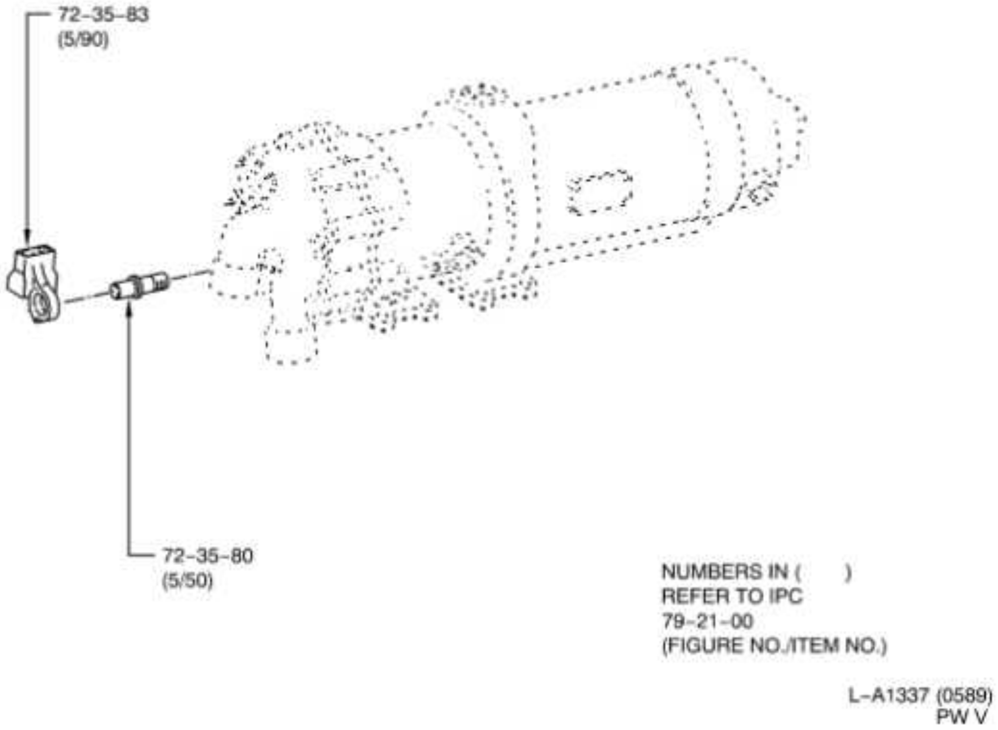
High Pressure Compressor (HPC)
Figure 9 (Sheet 33)


72-35-96
(1/1)
72-35-90
(1/40)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO. / ITEM NO.)
72-35-95
(1/10)
72-35-91
(1/50)
L-A1334 (0992)
PW V

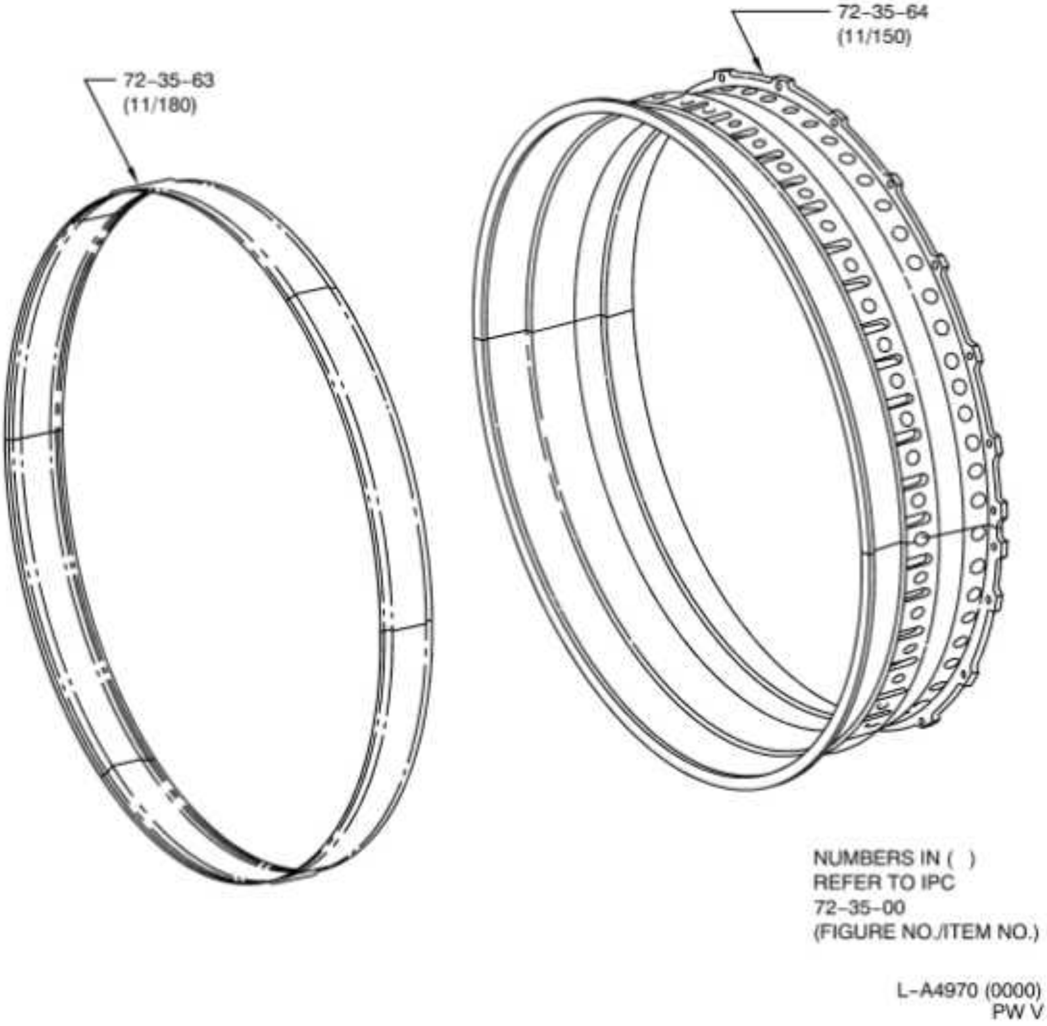
High Pressure Compressor (HPC)
Figure 9 (Sheet 34)


72-35-68
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
72-35-70
72-35-66
72-35-67
L-A1335 (0992)
PW V

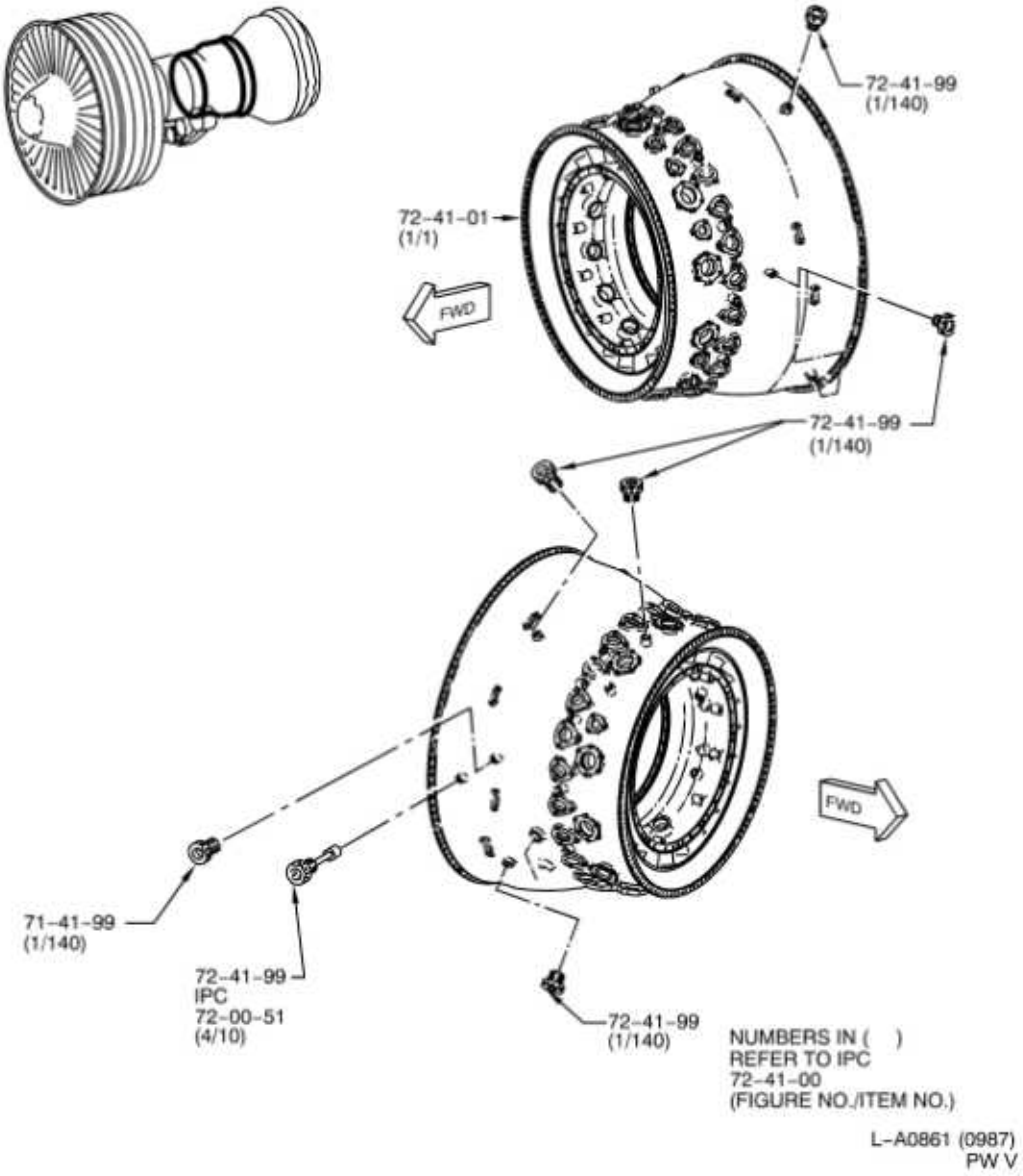
High Pressure Compressor (HPC) (Non−Ring Case Configuration)
Figure 9 (Sheet 35)


72-35-83
(5/90)
72-35-80
(5/50)
NUMBERS IN ( )
REFER TO IPC
79-21-00
(FIGURE NO./ITEM NO.)
L-A1337 (0589)
PW V

High Pressure Compressor (HPC)
Figure 9 (Sheet 36)

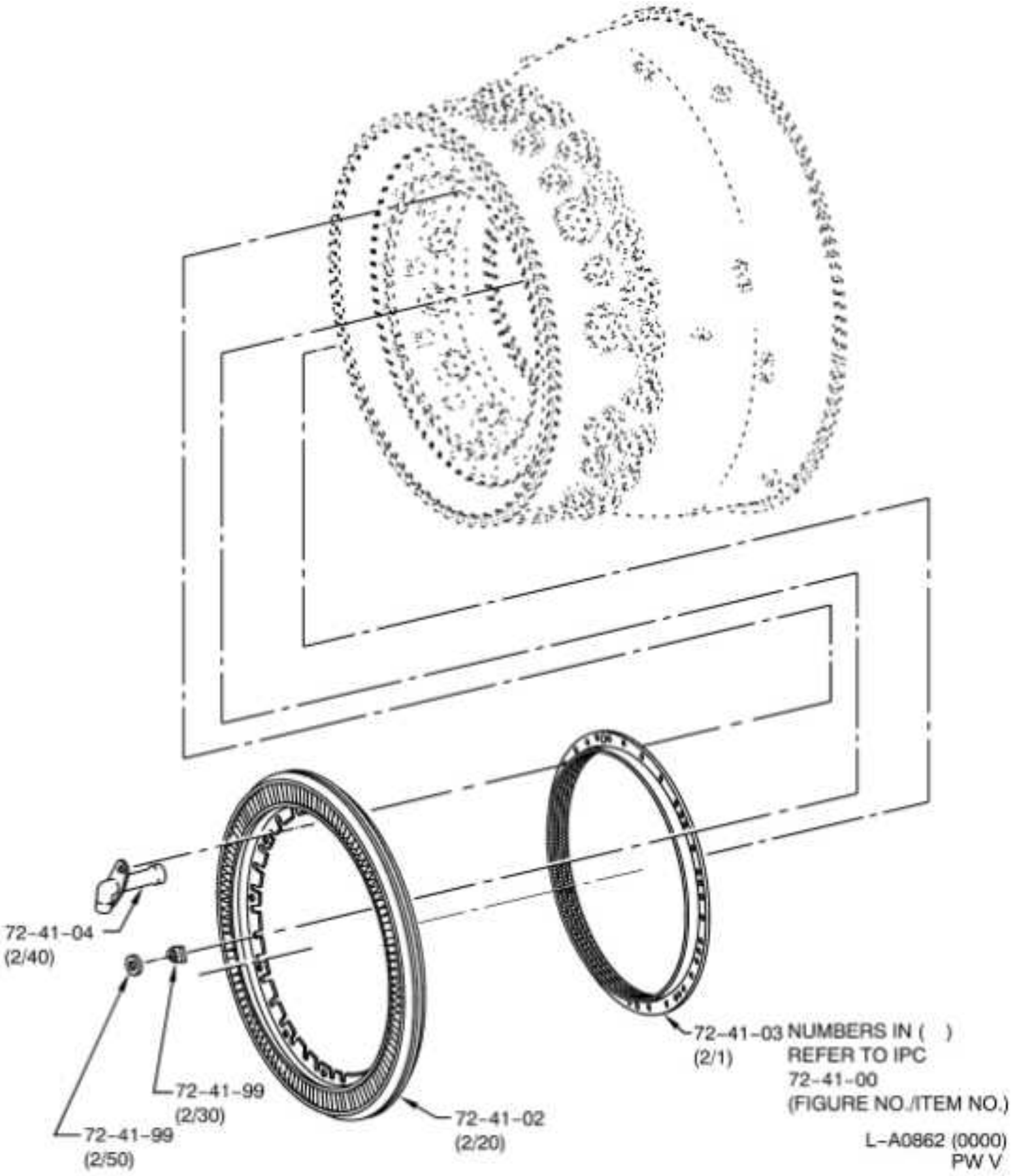

72-35-64
(11/150)
72-35-63
(11/180)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A4970 (0000)
PW V

High Pressure Compressor (HPC) (Non-Ring Case Configuration)
Figure 9 (Sheet 37)

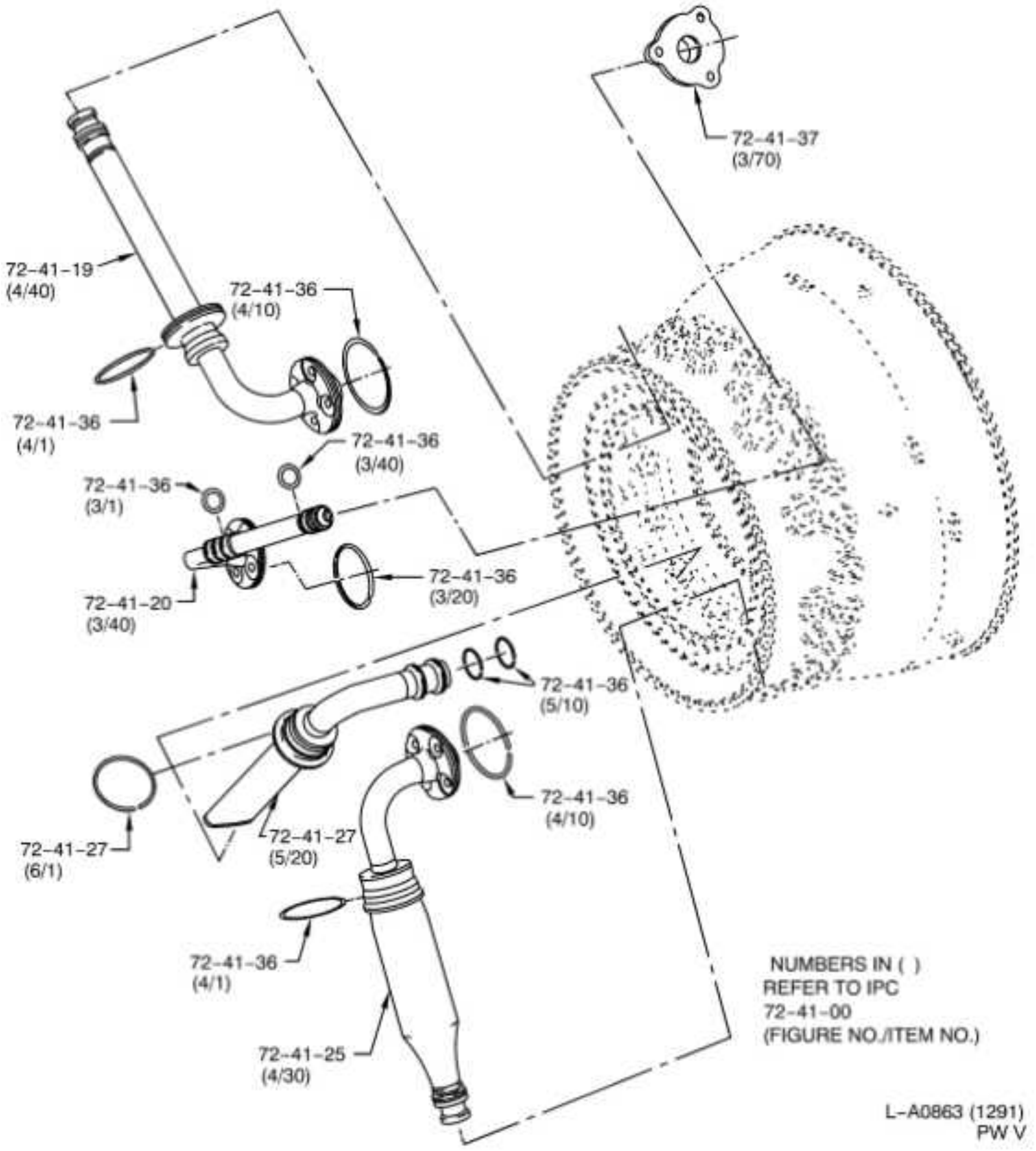

72-41-99
(1/140)
72-41-01
(1/1)
FWD
72-41-99
(1/140)
FWD
71-41-99
(1/140)
72-41-99
IPC
72-00-51
(4/10)
72-41-99
(1/140)
L-A0861 (0987)
PW V

NUMBERS IN ( )
REFER TO IPC
72-41-00
(FIGURE NO./ITEM NO.)

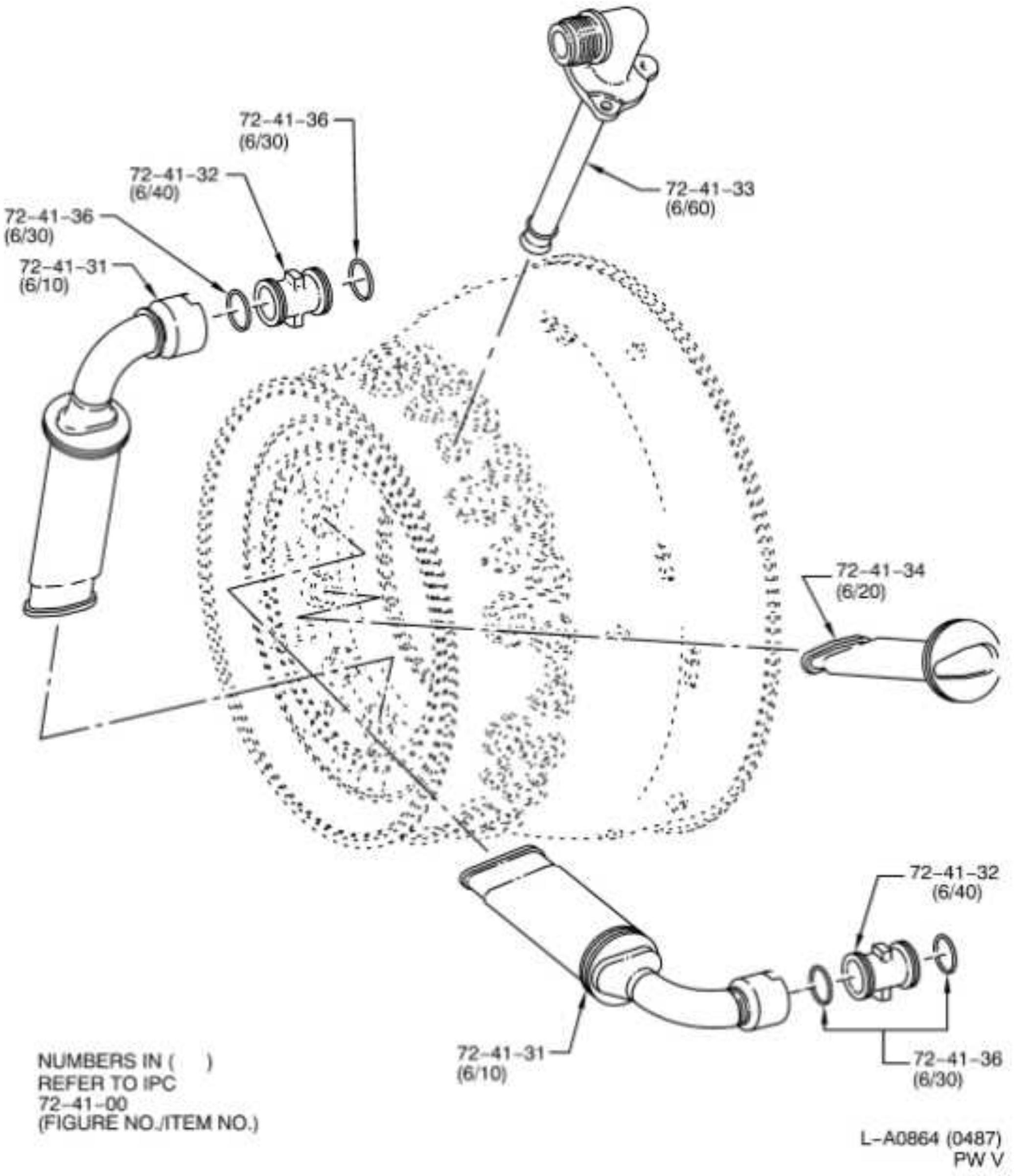
Diffuser And Combustor
Figure 10 (Sheet 1)


72-41-04
(2/40)
72-41-99
(2/30)
72-41-99
(2/50)
72-41-02
(2/20)
72-41-03
(2/1)
NUMBERS IN ( )
REFER TO IPC
72-41-00
(FIGURE NO./ITEM NO.)
L-A0862 (0000)
PW V

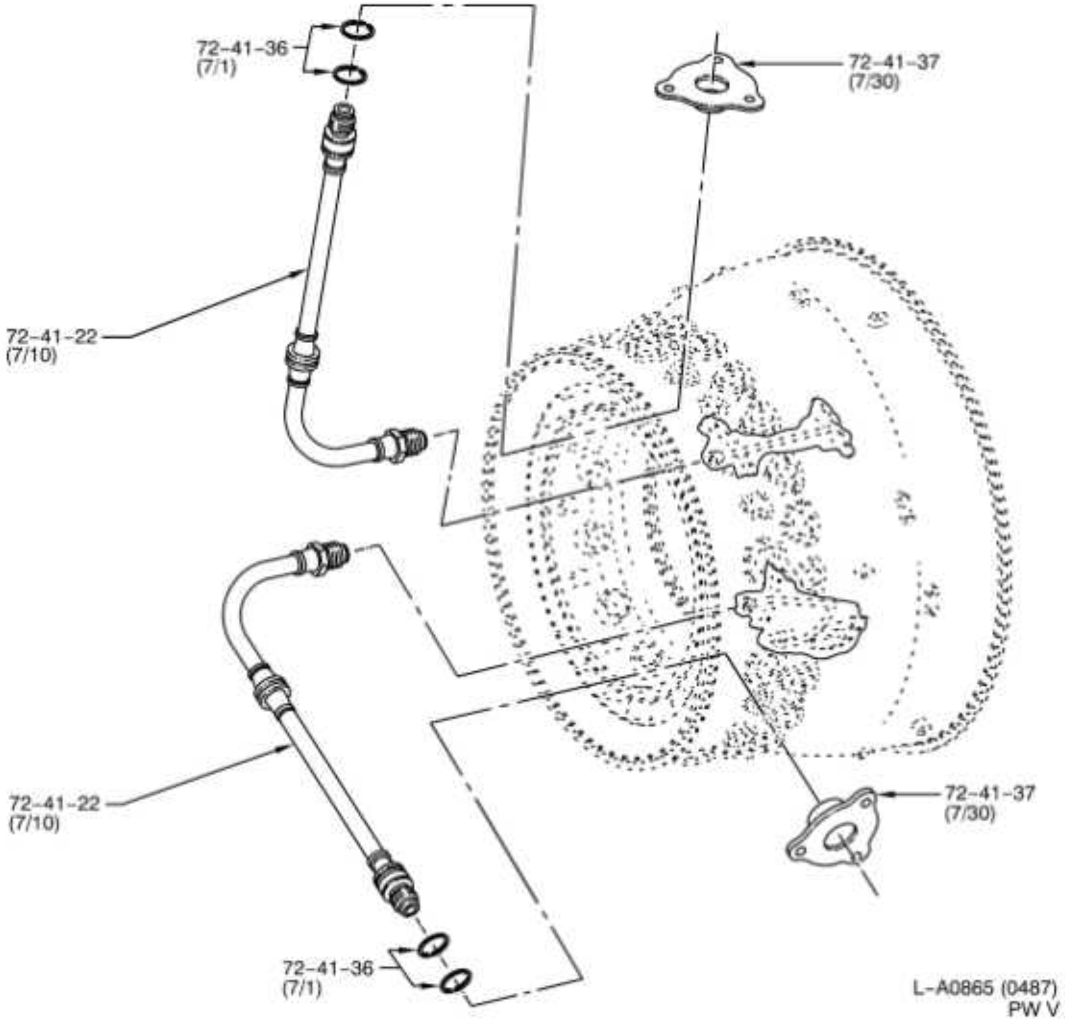
Diffuser And Combustor
Figure 10 (Sheet 2)


72-41-37
(3/70)
72-41-19
(4/40)
72-41-36
(4/10)
72-41-36
(4/1)
72-41-36
(3/40)
72-41-36
(3/1)
72-41-36
(3/20)
72-41-20
(3/40)
72-41-36
(5/10)
72-41-36
(4/10)
72-41-27
(6/1)
72-41-27
(5/20)
72-41-36
(4/1)
72-41-25
(4/30)
NUMBERS IN ( )
REFER TO IPC
72-41-00
(FIGURE NO./ITEM NO.)
L-A0863 (1291)
PW V

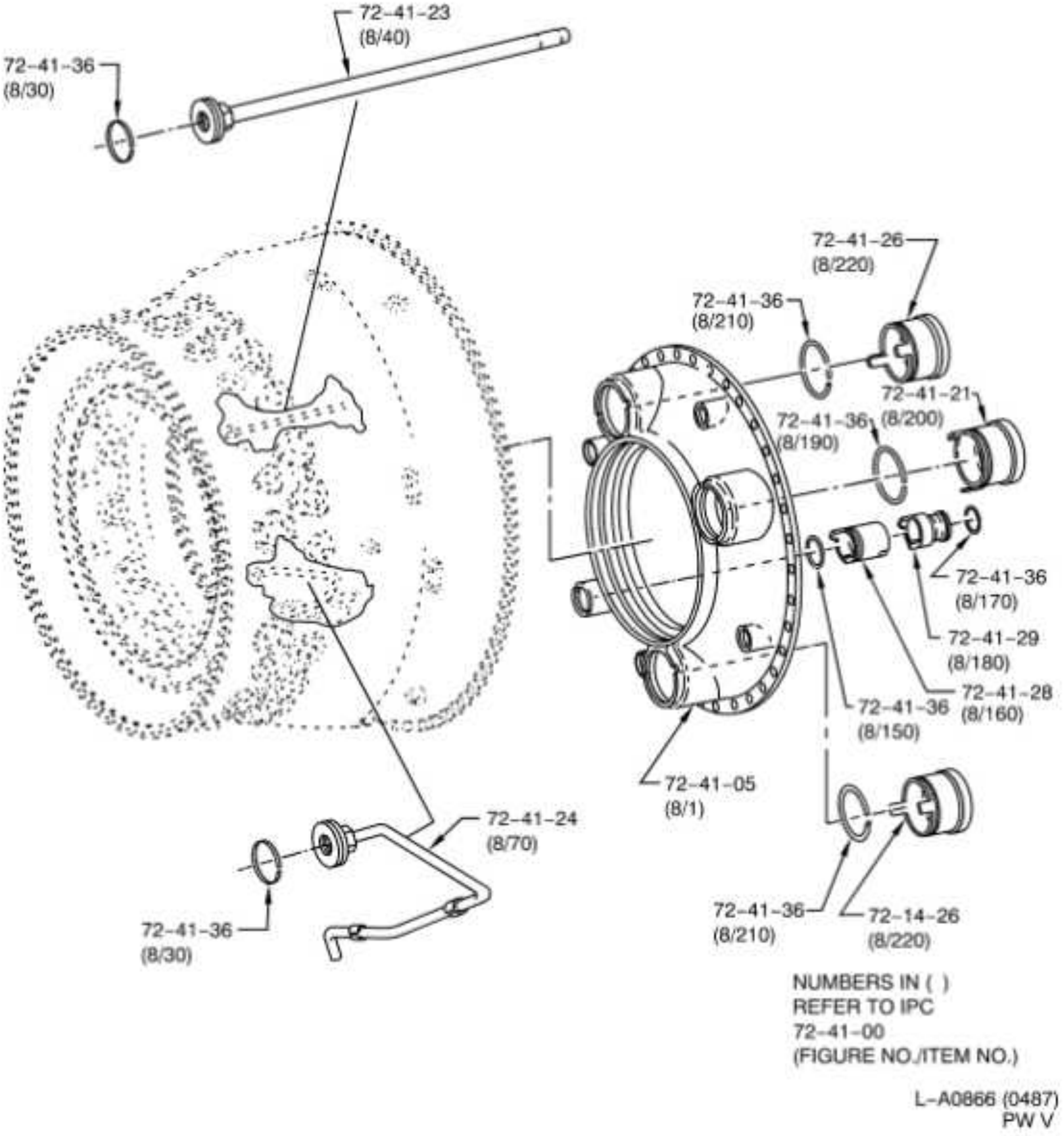
Diffuser And Combustor
Figure 10 (Sheet 3)


72-41-36
(6/30)
72-41-32
(6/40)
72-41-36
(6/30)
72-41-31
(6/10)
72-41-33
(6/60)
72-41-34
(6/20)
72-41-32
(6/40)
72-41-31
(6/10)
72-41-36
(6/30)
NUMBERS IN ( )
REFER TO IPC
72-41-00
(FIGURE NO./ITEM NO.)
L-A0864 (0487)
PW V

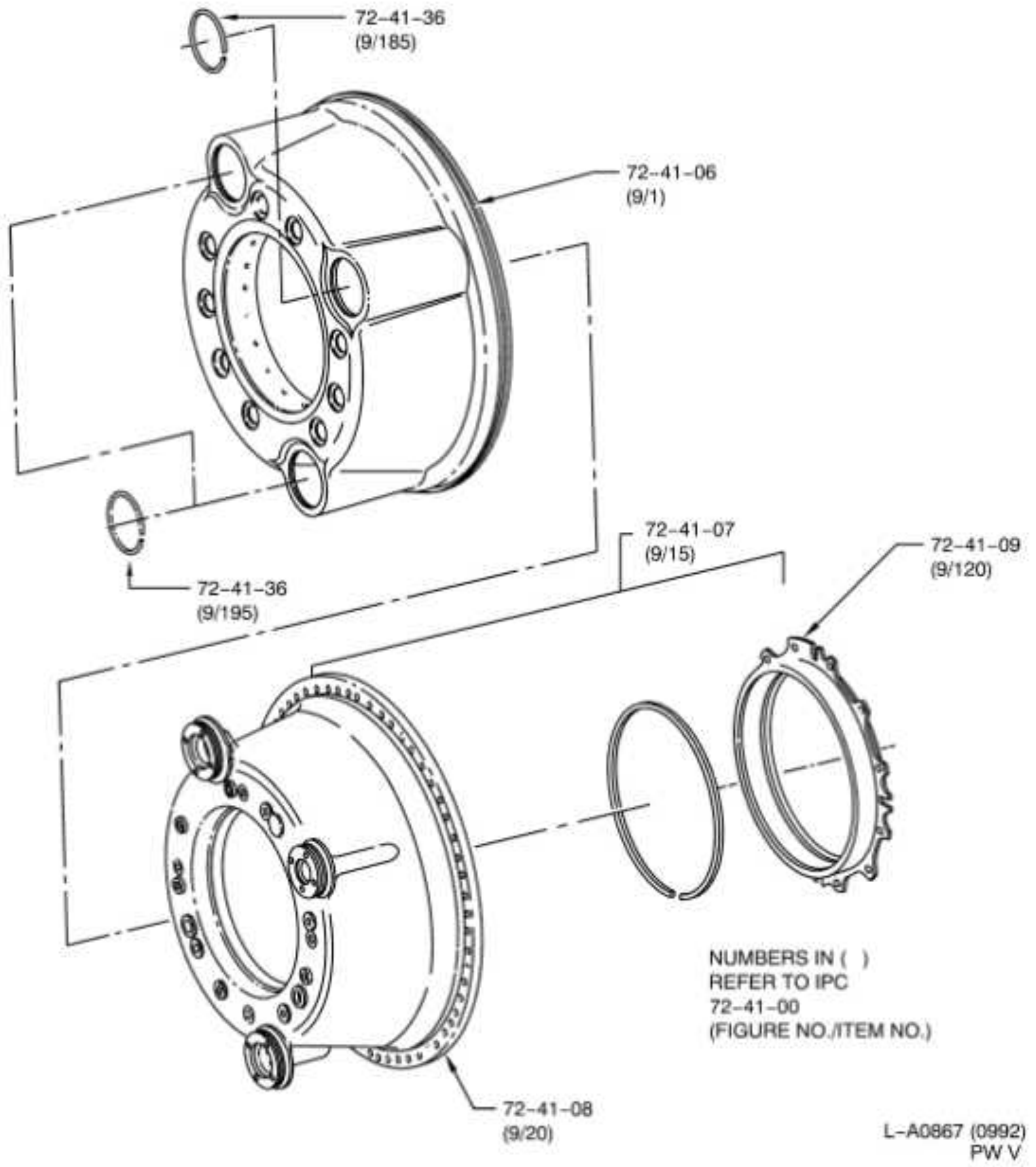
Diffuser And Combustor
Figure 10 (Sheet 4)


72-41-36
(7/1)
72-41-37
(7/30)
72-41-22
(7/10)
72-41-22
(7/10)
72-41-37
(7/30)
72-41-36
(7/1)
L-A0865 (0487)
PW V

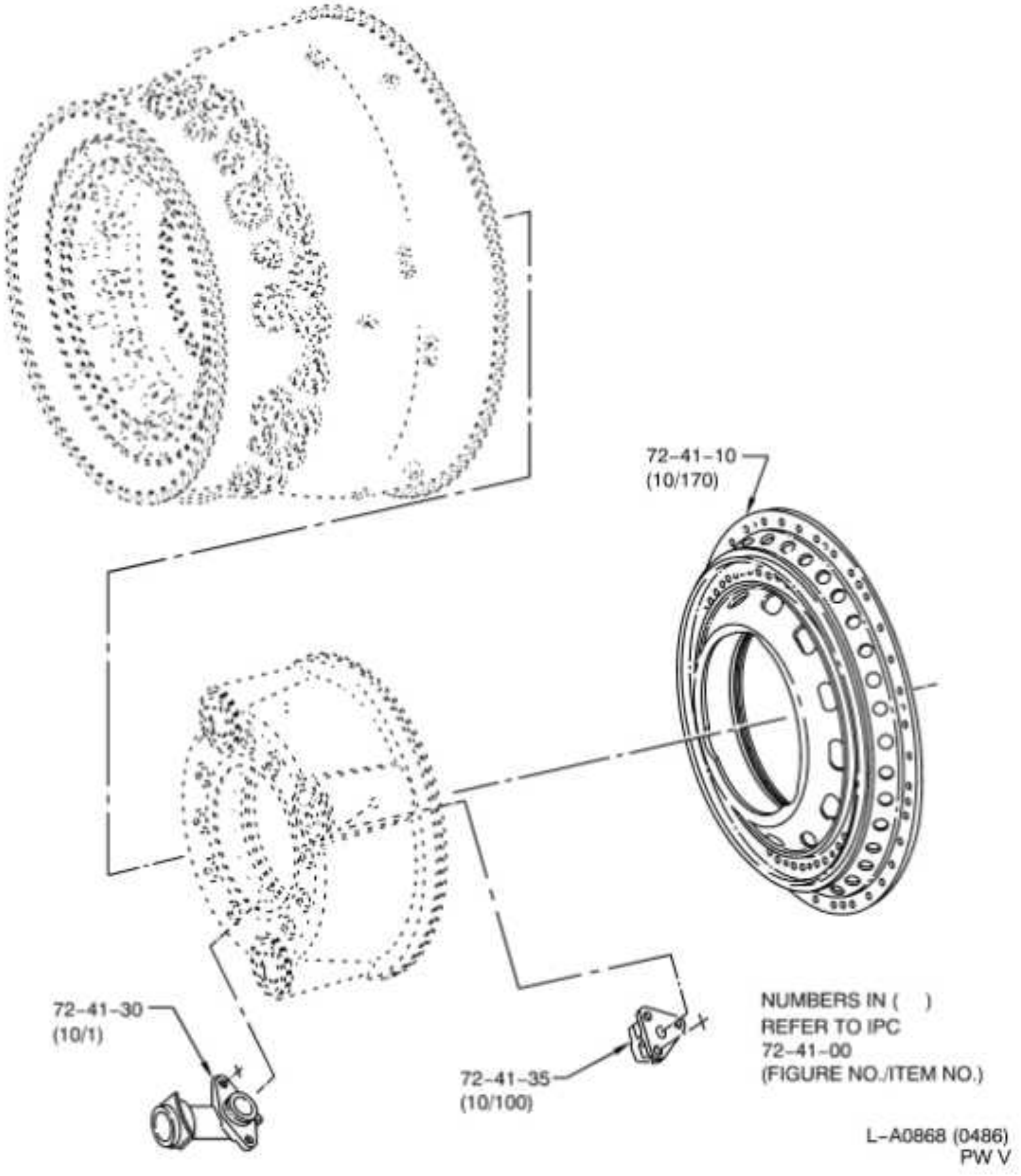
Diffuser And Combustor
Figure 10 (Sheet 5)


72-41-23
(8/40)
72-41-36
(8/30)
72-41-26
(8/220)
72-41-36
(8/210)
72-41-21
(8/200)
72-41-36
(8/190)
72-41-36
(8/170)
72-41-29
(8/180)
72-41-28
(8/160)
72-41-36
(8/150)
72-41-05
(8/1)
72-41-24
(8/70)
72-41-36
(8/30)
72-41-36
(8/210)
72-14-26
(8/220)
NUMBERS IN ( )
REFER TO IPC
72-41-00
(FIGURE NO./ITEM NO.)
L-A0866 (0487)
PW V

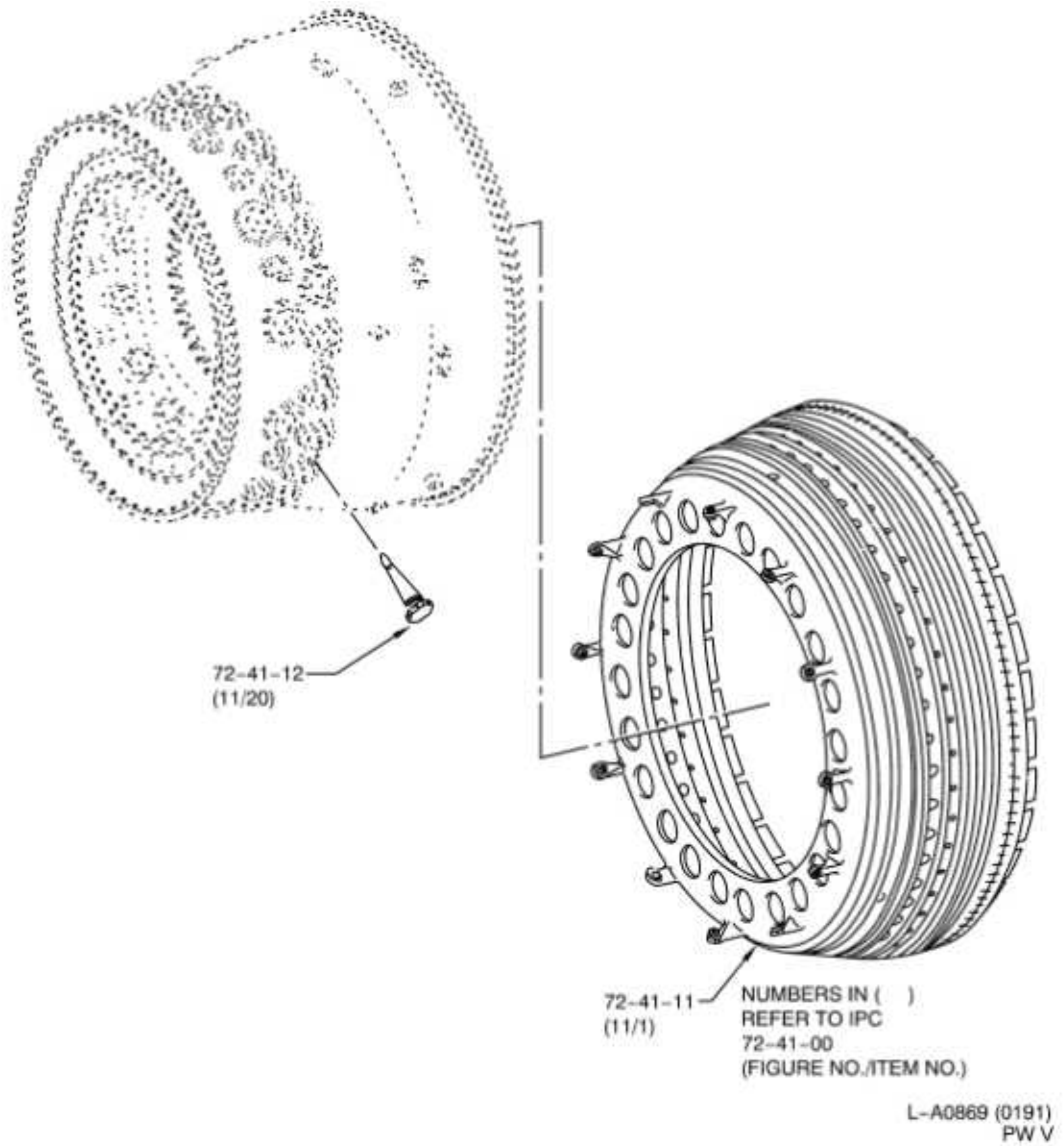
Diffuser And Combustor
Figure 10 (Sheet 6)


72-41-36
(9/185)
72-41-06
(9/1)
72-41-07
(9/15)
72-41-09
(9/120)
72-41-36
(9/195)
NUMBERS IN ( )
REFER TO IPC
72-41-00
(FIGURE NO./ITEM NO.)
72-41-08
(9/20)
L-A0867 (0992)
PW V

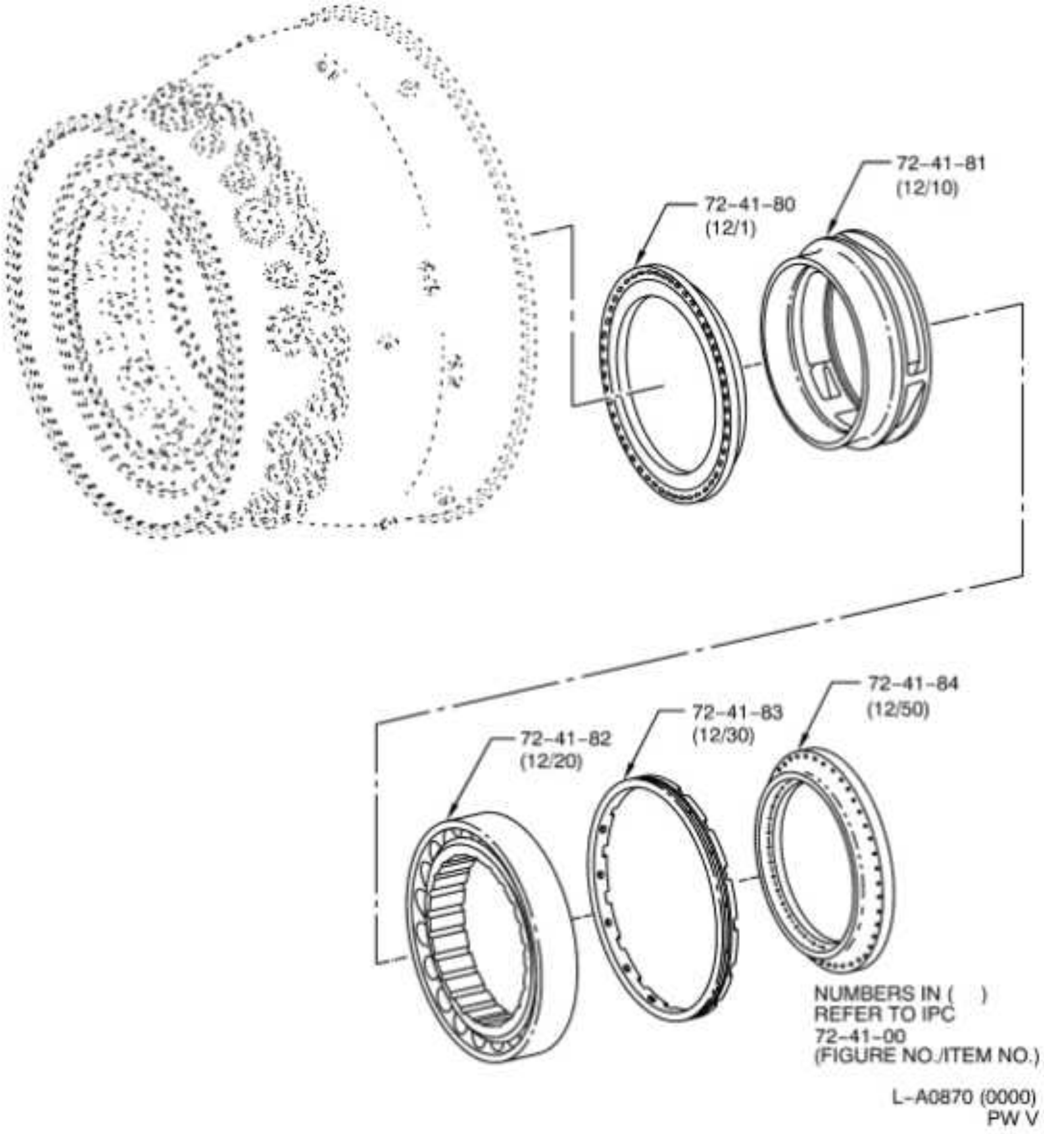
Diffuser And Combustor
Figure 10 (Sheet 7)


72-41-10
(10/170)
72-41-30
(10/1)
72-41-35
(10/100)
NUMBERS IN ( )
REFER TO IPC
72-41-00
(FIGURE NO./ITEM NO.)
L-A0868 (0486)
PW V

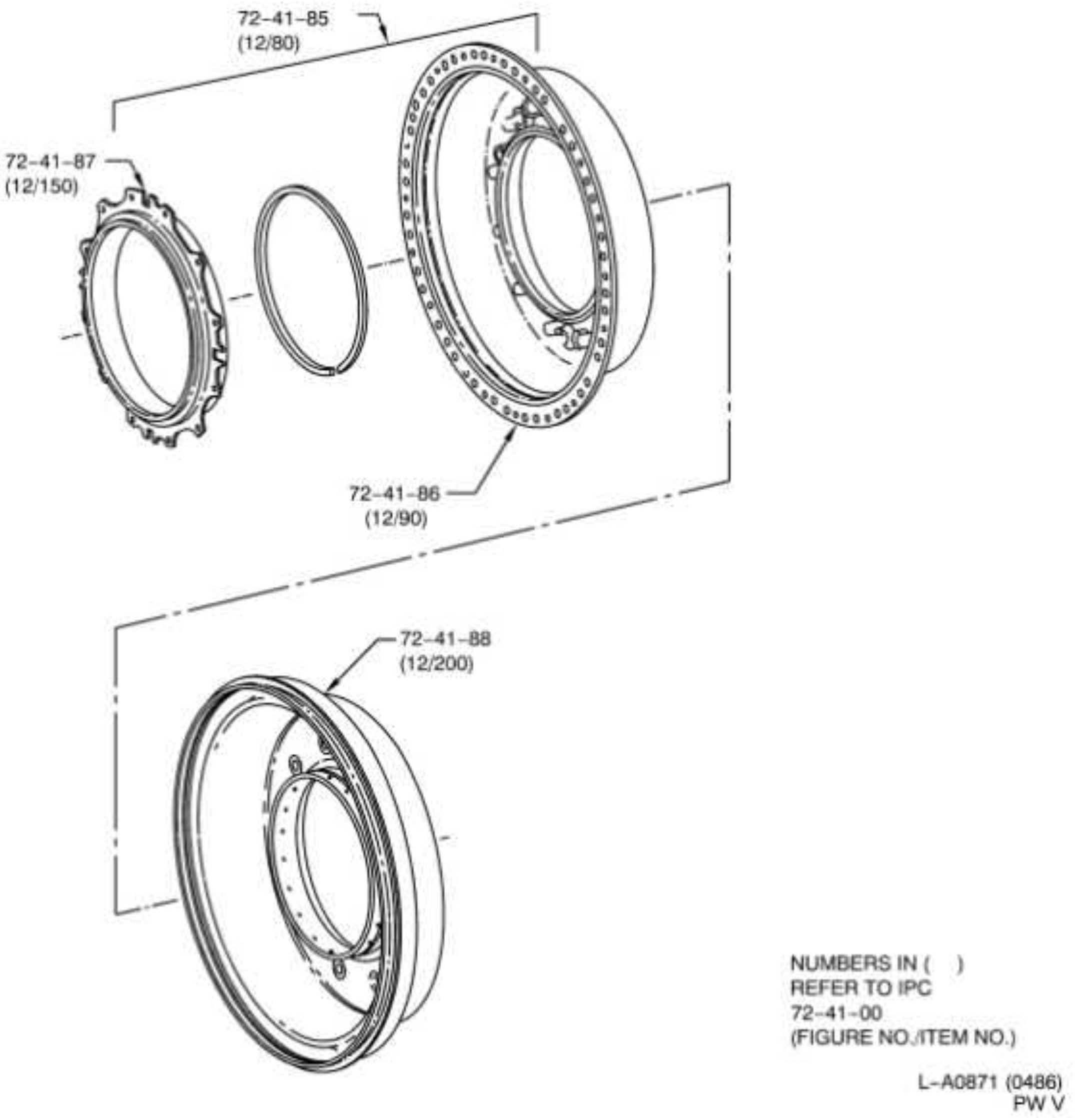
Diffuser And Combustor
Figure 10 (Sheet 8)


72-41-12
(11/20)
72-41-11
(11/1)
NUMBERS IN ( )
REFER TO IPC
72-41-00
(FIGURE NO./ITEM NO.)
L-A0869 (0191)
PW V

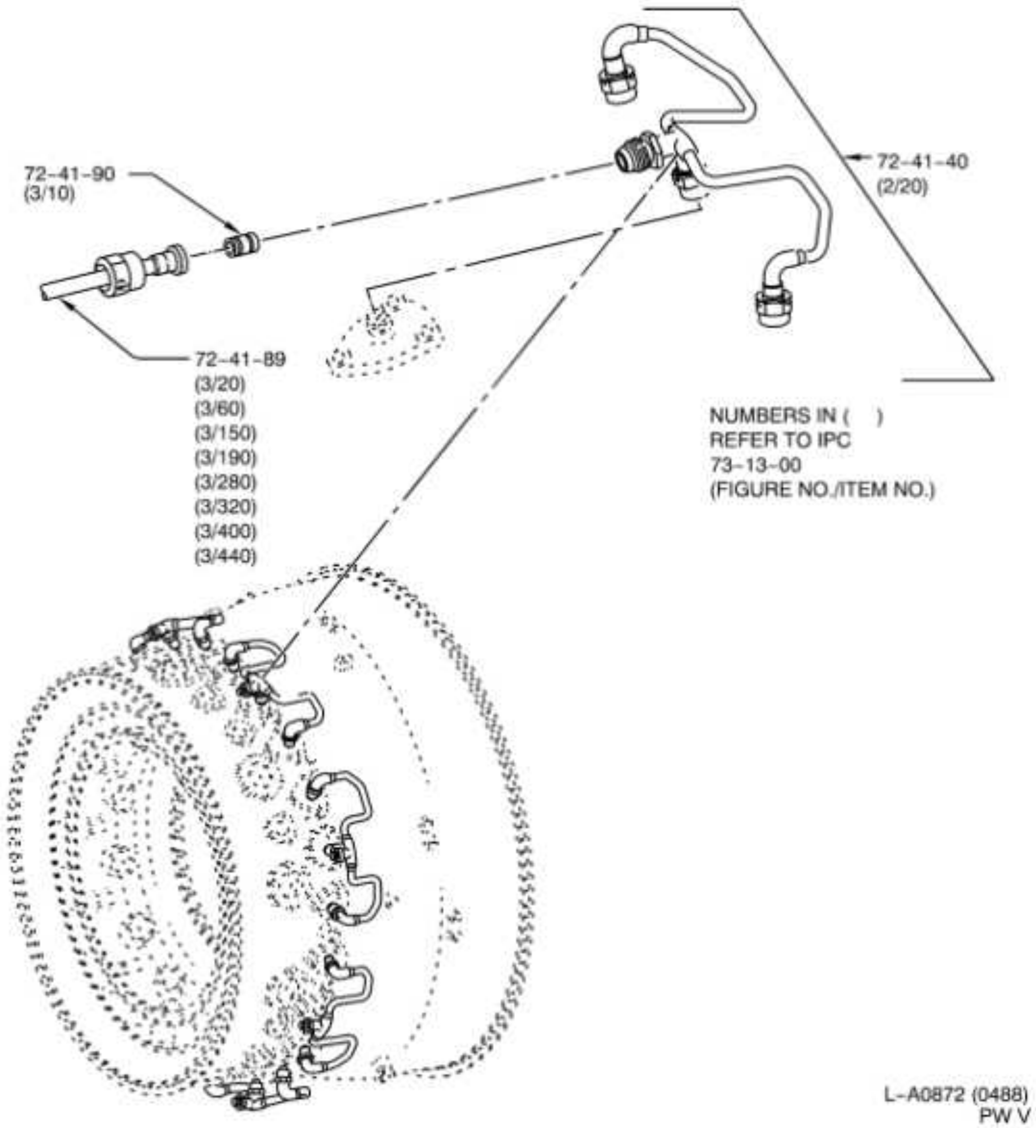
Diffuser And Combustor
Figure 10 (Sheet 9)


72-41-80
(12/1)
72-41-81
(12/10)
72-41-82
(12/20)
72-41-83
(12/30)
72-41-84
(12/50)
NUMBERS IN ( )
REFER TO IPC
72-41-00
(FIGURE NO./ITEM NO.)
L-A0870 (0000)
PW V

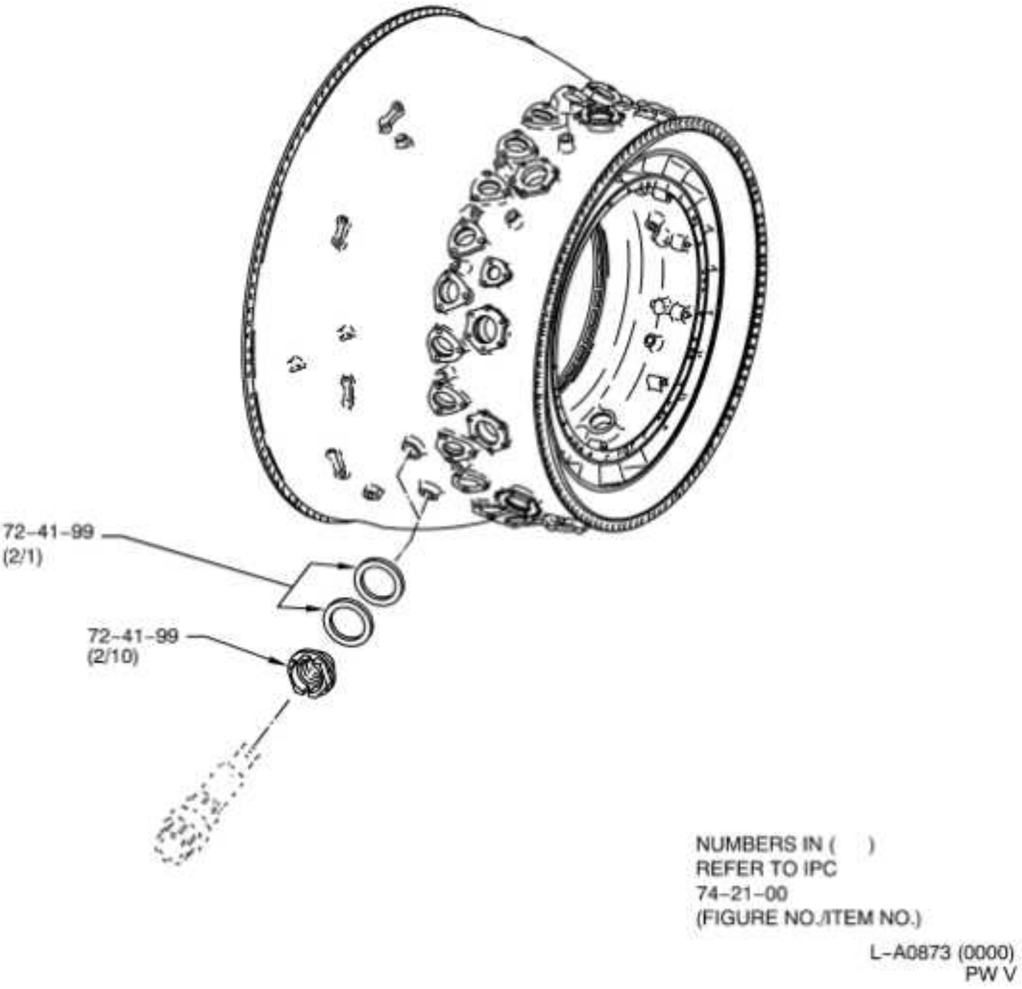
Diffuser And Combustor
Figure 10 (Sheet 10)


72-41-85
(12/80)
72-41-87
(12/150)
72-41-86
(12/90)
72-41-88
(12/200)
NUMBERS IN ( )
REFER TO IPC
72-41-00
(FIGURE NO./ITEM NO.)
L-A0871 (0486)
PW V

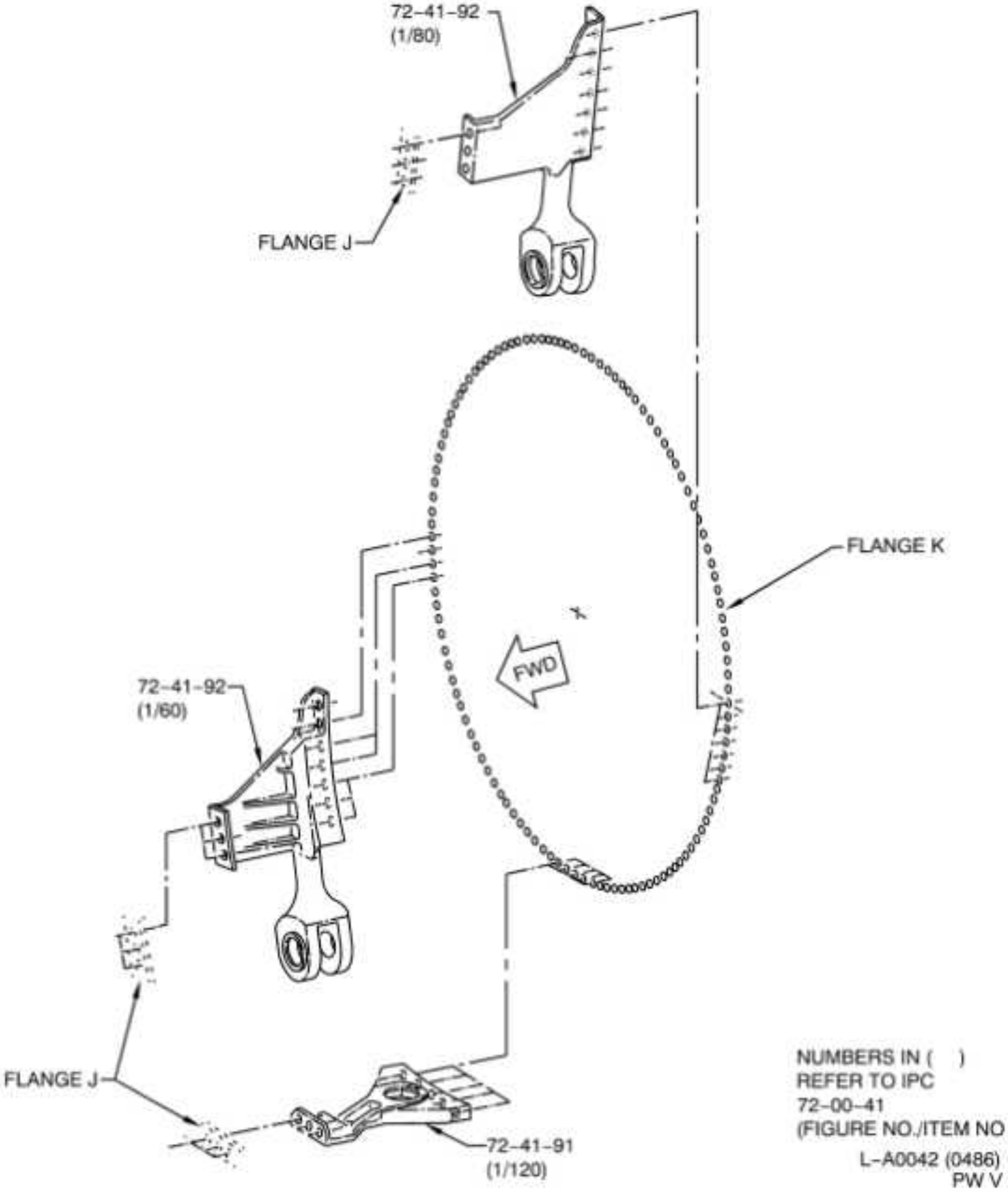
Diffuser And Combustor
Figure 10 (Sheet 11)


72-41-90
(3/10)
72-41-40
(2/20)
72-41-89
(3/20)
(3/60)
(3/150)
(3/190)
(3/280)
(3/320)
(3/400)
(3/440)
NUMBERS IN ( )
REFER TO IPC
73-13-00
(FIGURE NO./ITEM NO.)
L-A0872 (0488)
PW V

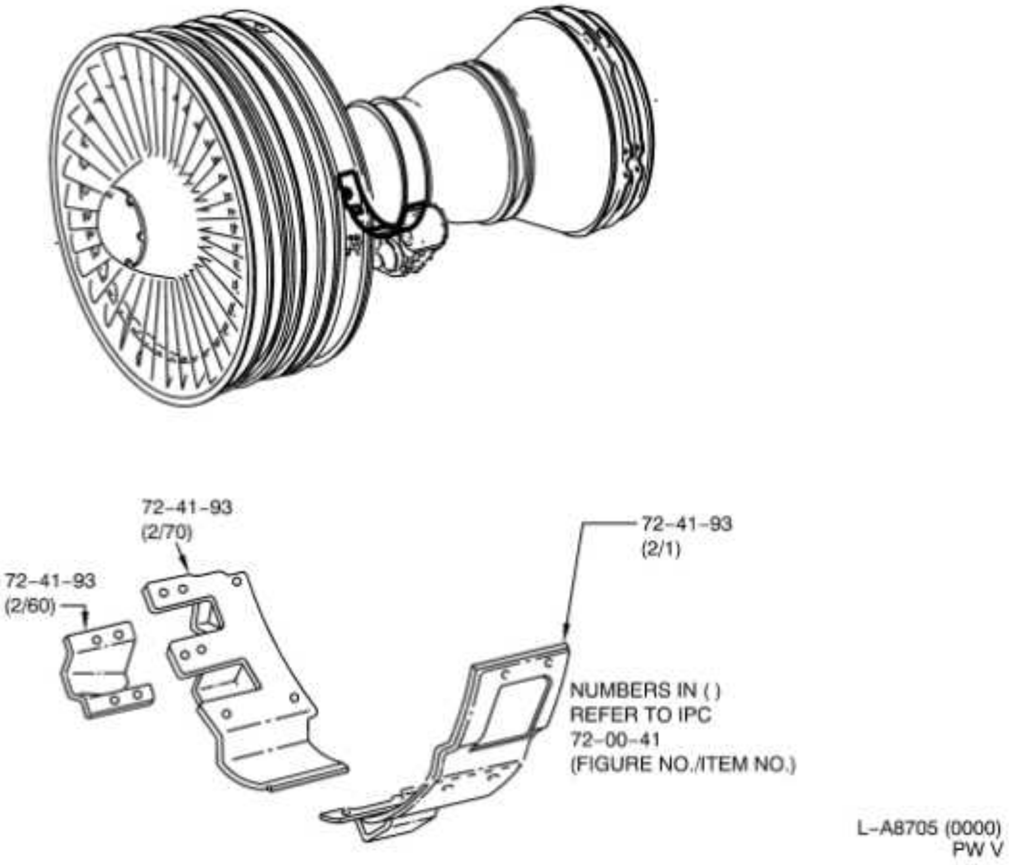
Diffuser And Combustor
Figure 10 (Sheet 12)


72-41-99
(2/1)
72-41-99
(2/10)
NUMBERS IN (   )
REFER TO IPC
74-21-00
(FIGURE NO./ITEM NO.)
L-A0873 (0000)
PW V

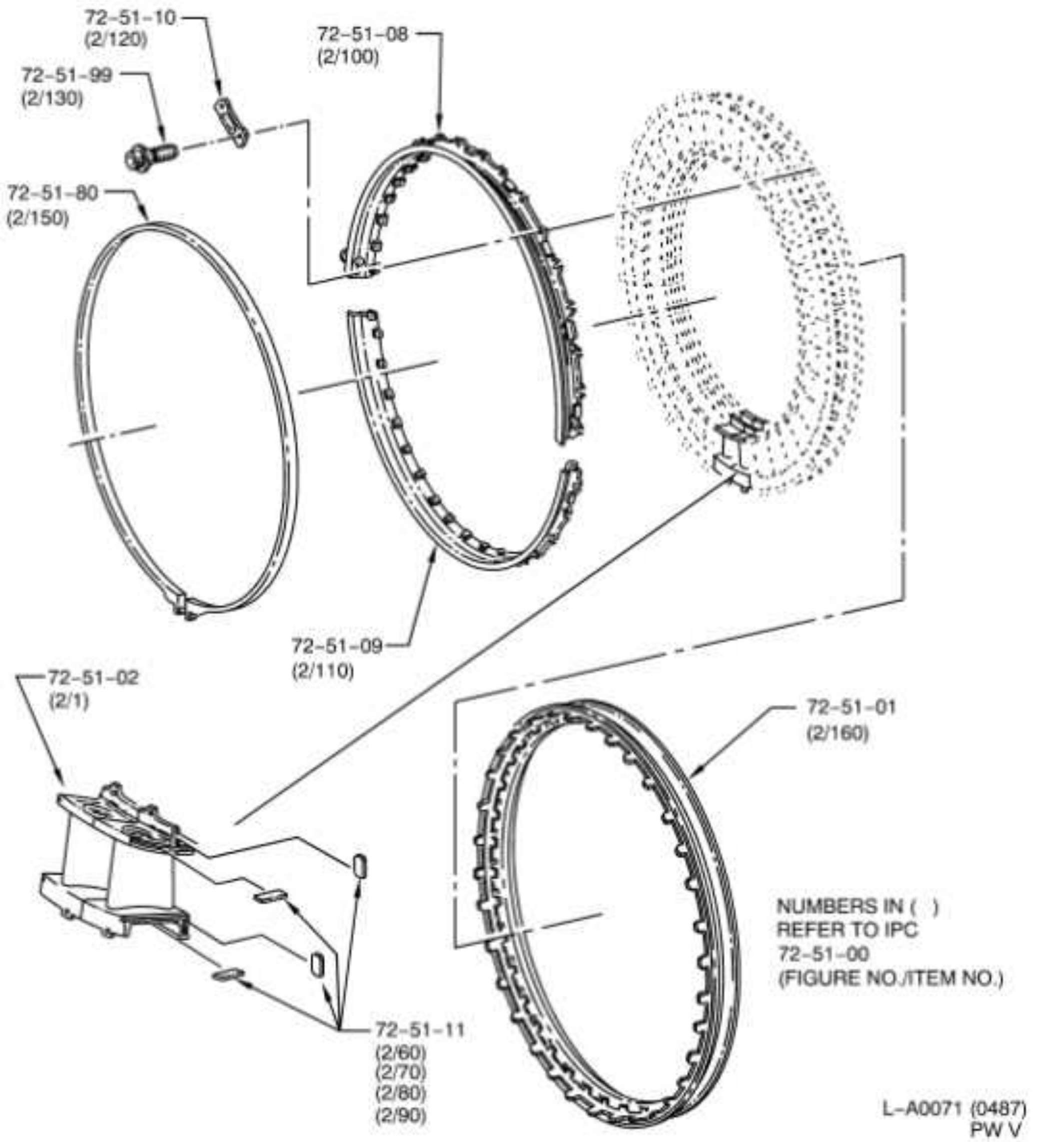
Diffuser And Combustor
Figure 10 (Sheet 13)


72-41-92
(1/80)
FLANGE J
FLANGE K
FWD
72-41-92
(1/60)
FLANGE J
72-41-91
(1/120)
NUMBERS IN ( )
REFER TO IPC
72-00-41
(FIGURE NO./ITEM NO
L-A0042 (0486)
PW V

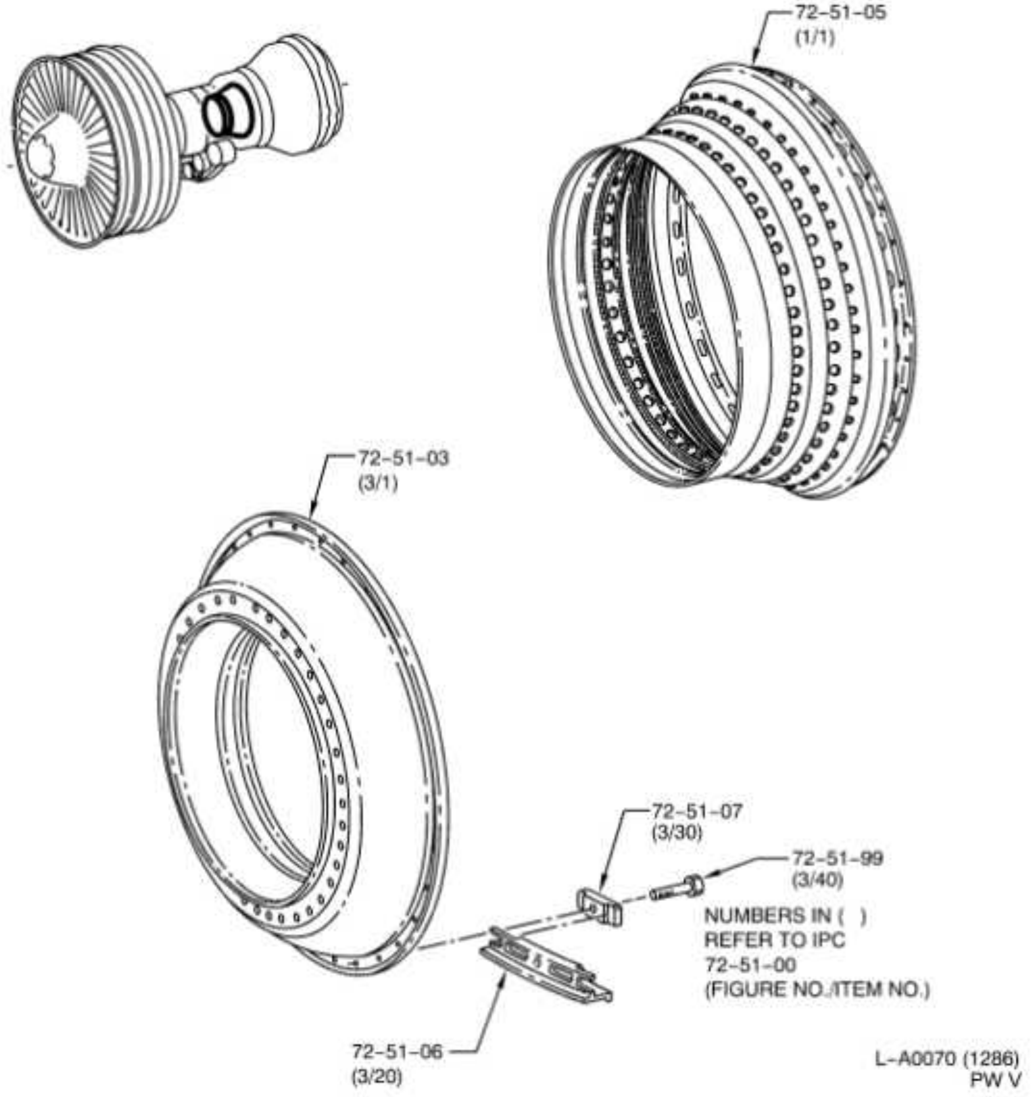
Diffuser And Combustor
Figure 10 (Sheet 14)


72-41-93
(2/70)
72-41-93
(2/60)
72-41-93
(2/1)
NUMBERS IN ( )
REFER TO IPC
72-00-41
(FIGURE NO./ITEM NO.)
L-A8705 (0000)
PW V

Diffuser And Combustor
Figure 10 (Sheet 15)

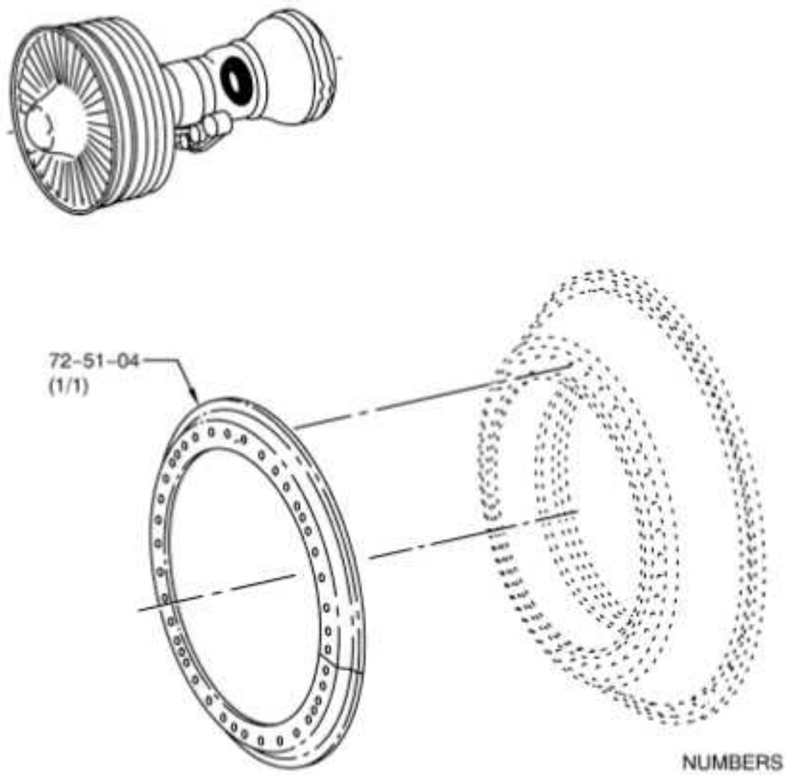

72-51-10
(2/120)
72-51-08
(2/100)
72-51-99
(2/130)
72-51-80
(2/150)
72-51-09
(2/110)
72-51-02
(2/1)
72-51-01
(2/160)
NUMBERS IN ( )
REFER TO IPC
72-51-00
(FIGURE NO./ITEM NO.)
72-51-11
(2/60)
(2/70)
(2/80)
(2/90)
L-A0071 (0487)
PW V

Turbine Nozzle
Figure 11 (Sheet 1)


72-51-05
(1/1)
72-51-03
(3/1)
72-51-07
(3/30)
72-51-99
(3/40)
72-51-06
(3/20)
L-A0070 (1286)
PW V

NUMBERS IN ( )
REFER TO IPC
72-51-00
(FIGURE NO./ITEM NO.)

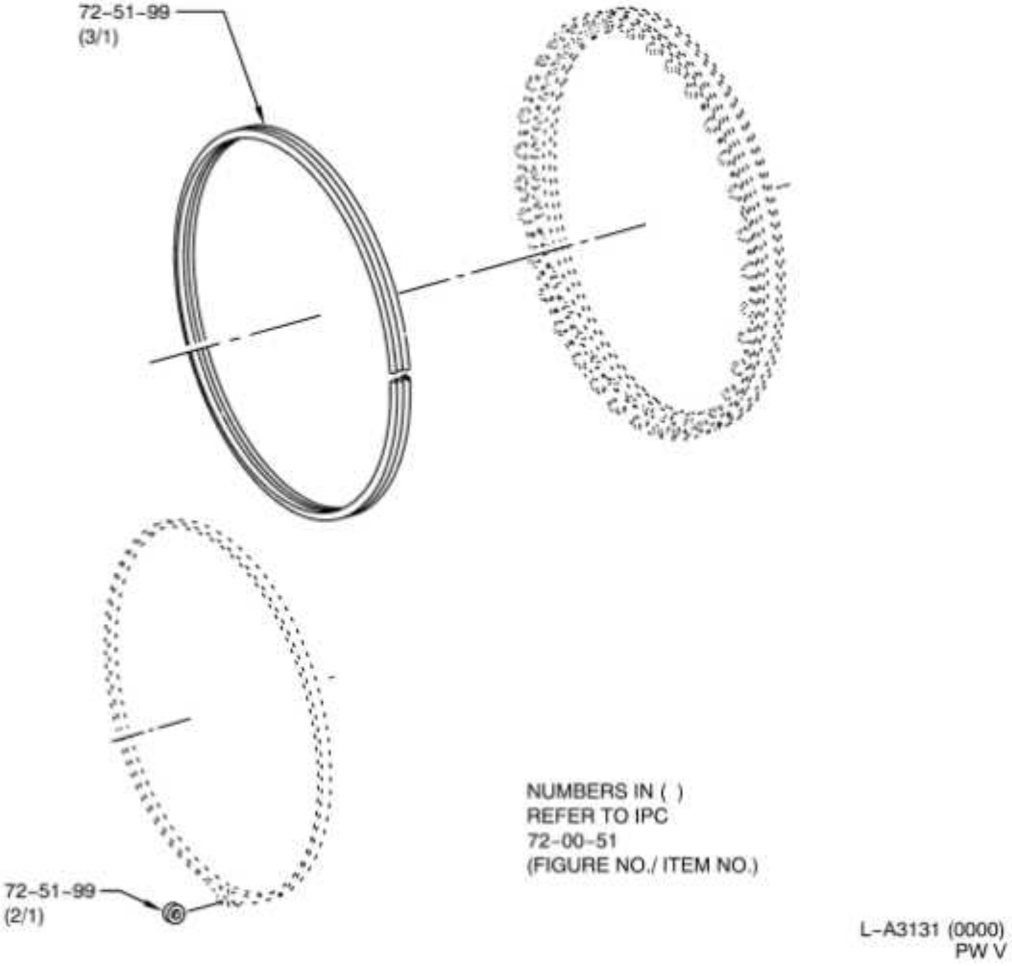
Turbine Nozzle
Figure 11 (Sheet 2)



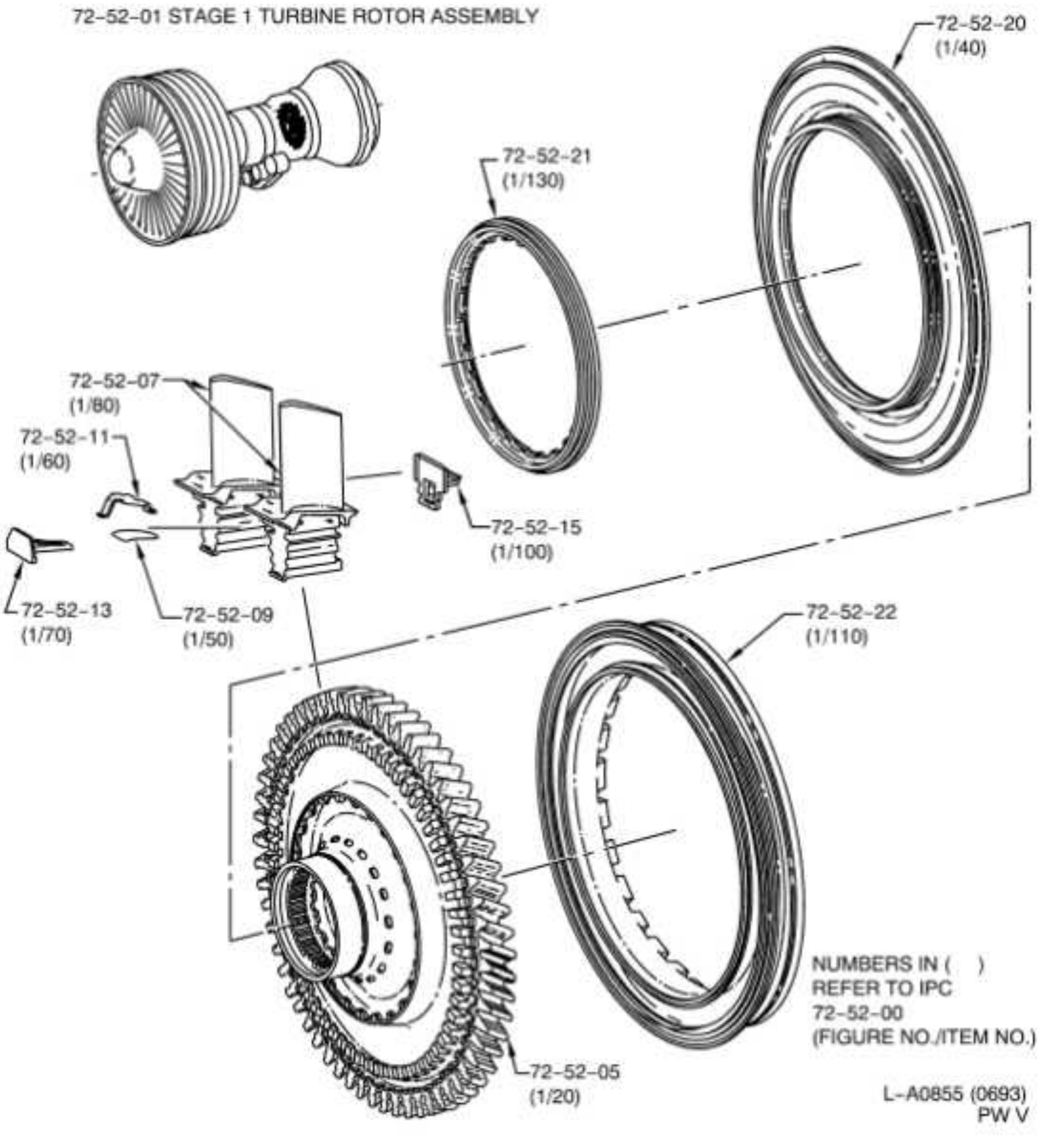
NUMBERS IN ( )
REFER TO IPC
72-00-51
(FIGURE NO. / ITEM NO.)

L-A0883 (0000)
PW V

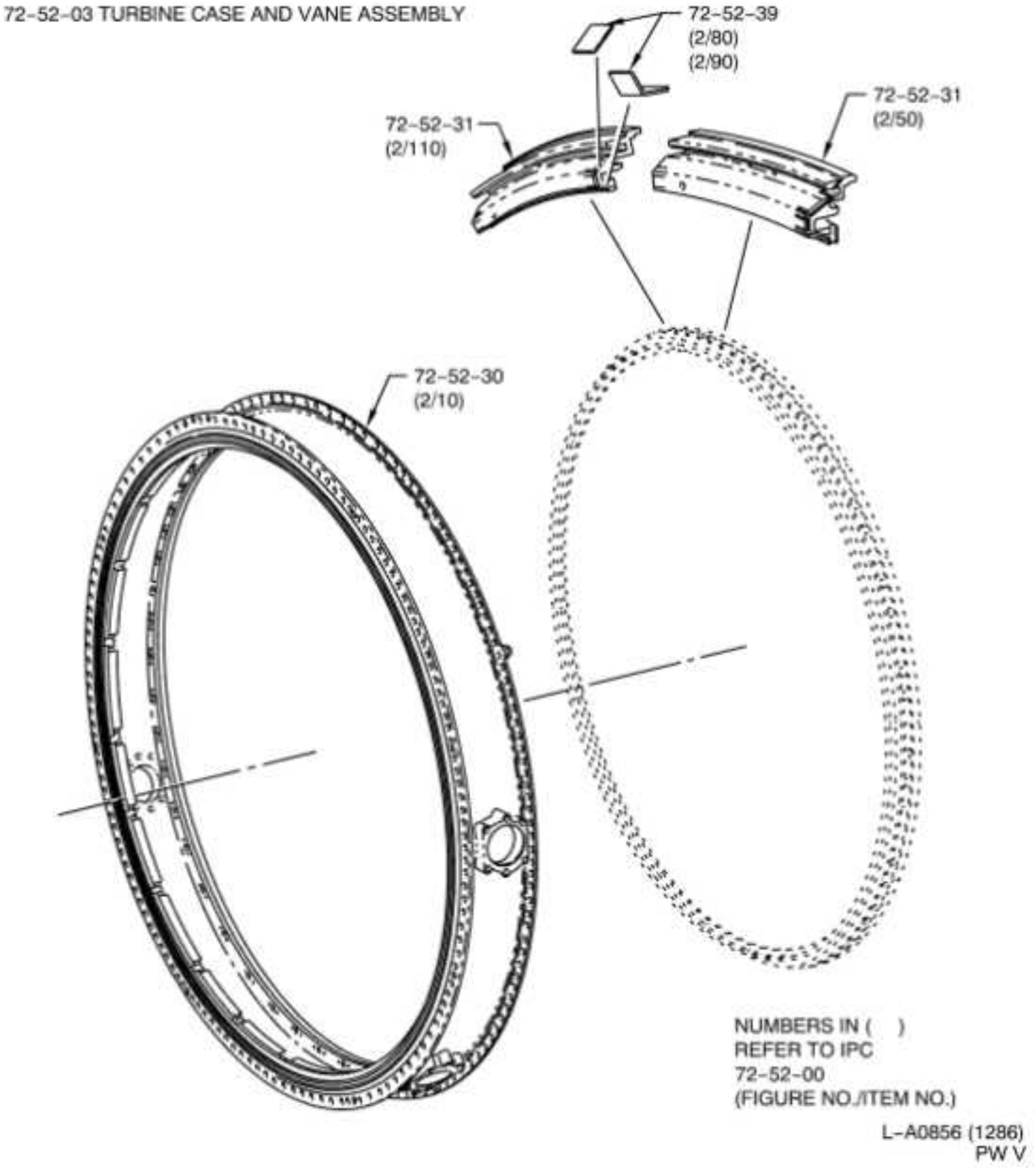
Turbine Nozzle
Figure 11 (Sheet 3)


72-51-99
(3/1)
72-51-99
(2/1)
NUMBERS IN ( )
REFER TO IPC
72-00-51
(FIGURE NO./ ITEM NO.)
L-A3131 (0000)
PW V

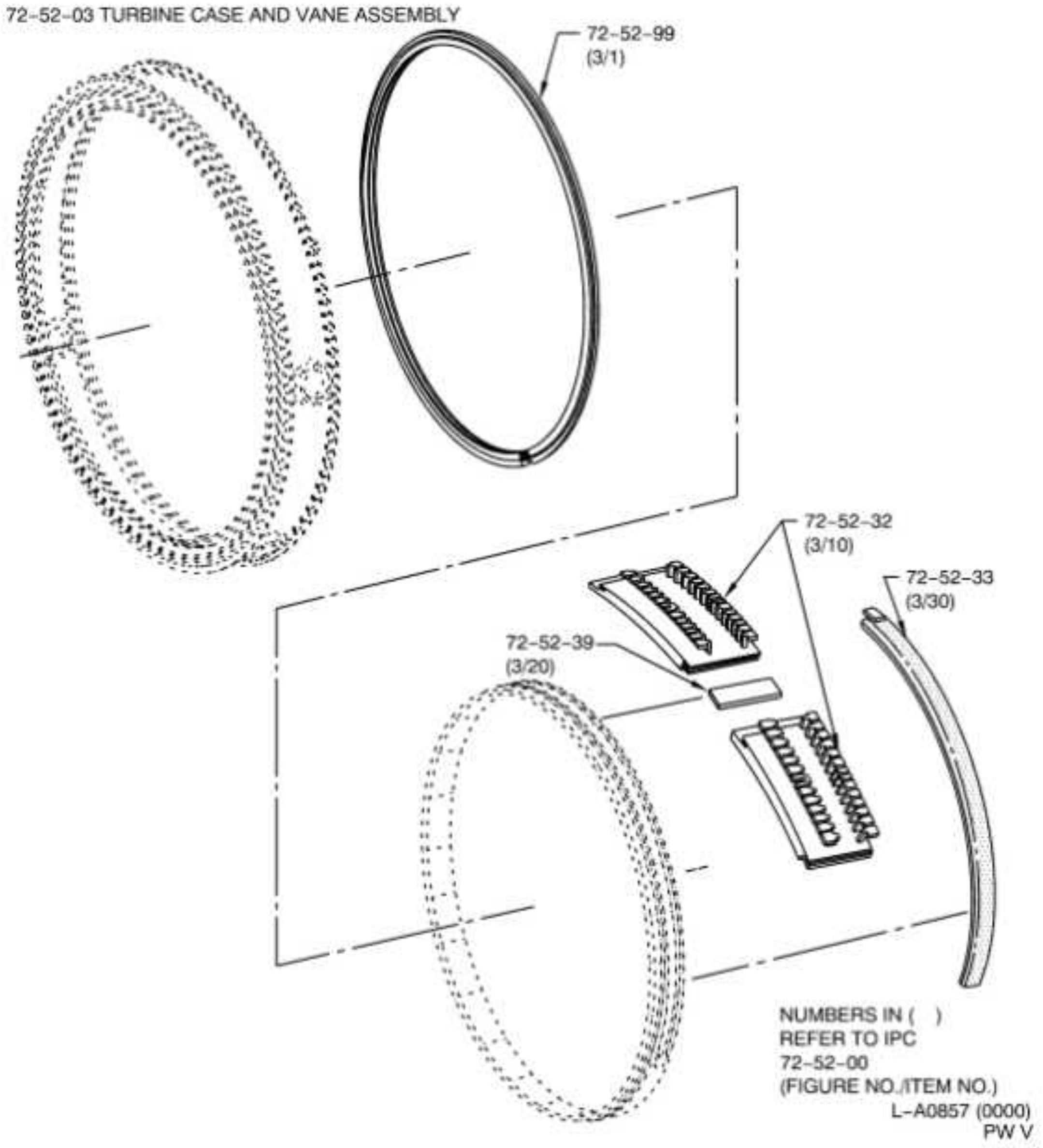
Turbine Nozzle
Figure 11 (Sheet 4)


72-52-01 STAGE 1 TURBINE ROTOR ASSEMBLY
72-52-20
(1/40)
72-52-21
(1/130)
72-52-07
(1/80)
72-52-11
(1/60)
72-52-15
(1/100)
72-52-13
(1/70)
72-52-09
(1/50)
72-52-22
(1/110)
NUMBERS IN ( )
REFER TO IPC
72-52-00
(FIGURE NO./ITEM NO.)
72-52-05
(1/20)
L-A0855 (0693)
PW V

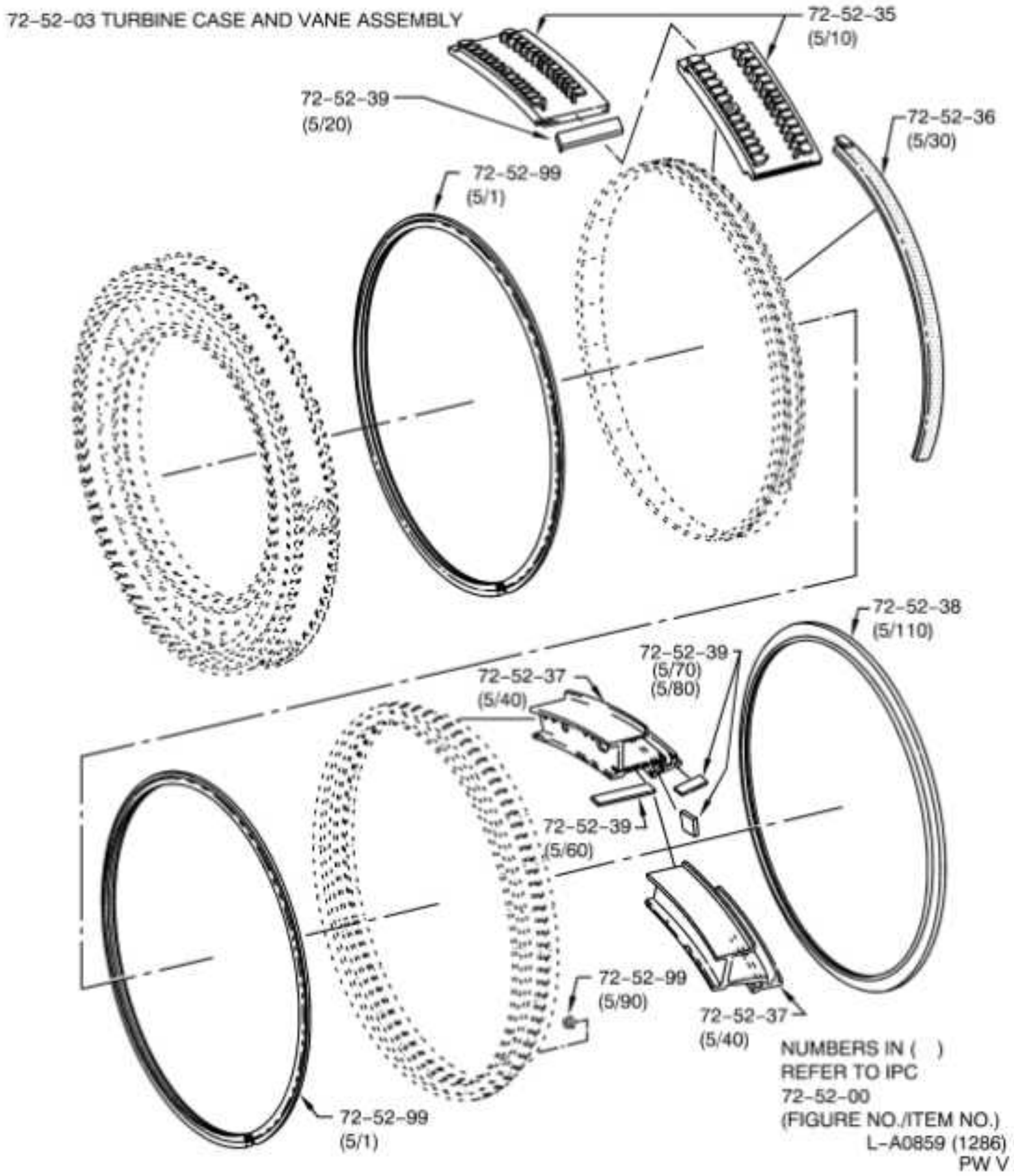
High Pressure Turbine (HPT)
Figure 12 (Sheet 1)


72-52-03 TURBINE CASE AND VANE ASSEMBLY
72-52-39
(2/80)
(2/90)
72-52-31
(2/110)
72-52-31
(2/50)
72-52-30
(2/10)
NUMBERS IN ( )
REFER TO IPC
72-52-00
(FIGURE NO./ITEM NO.)
L-A0856 (1286)
PW V

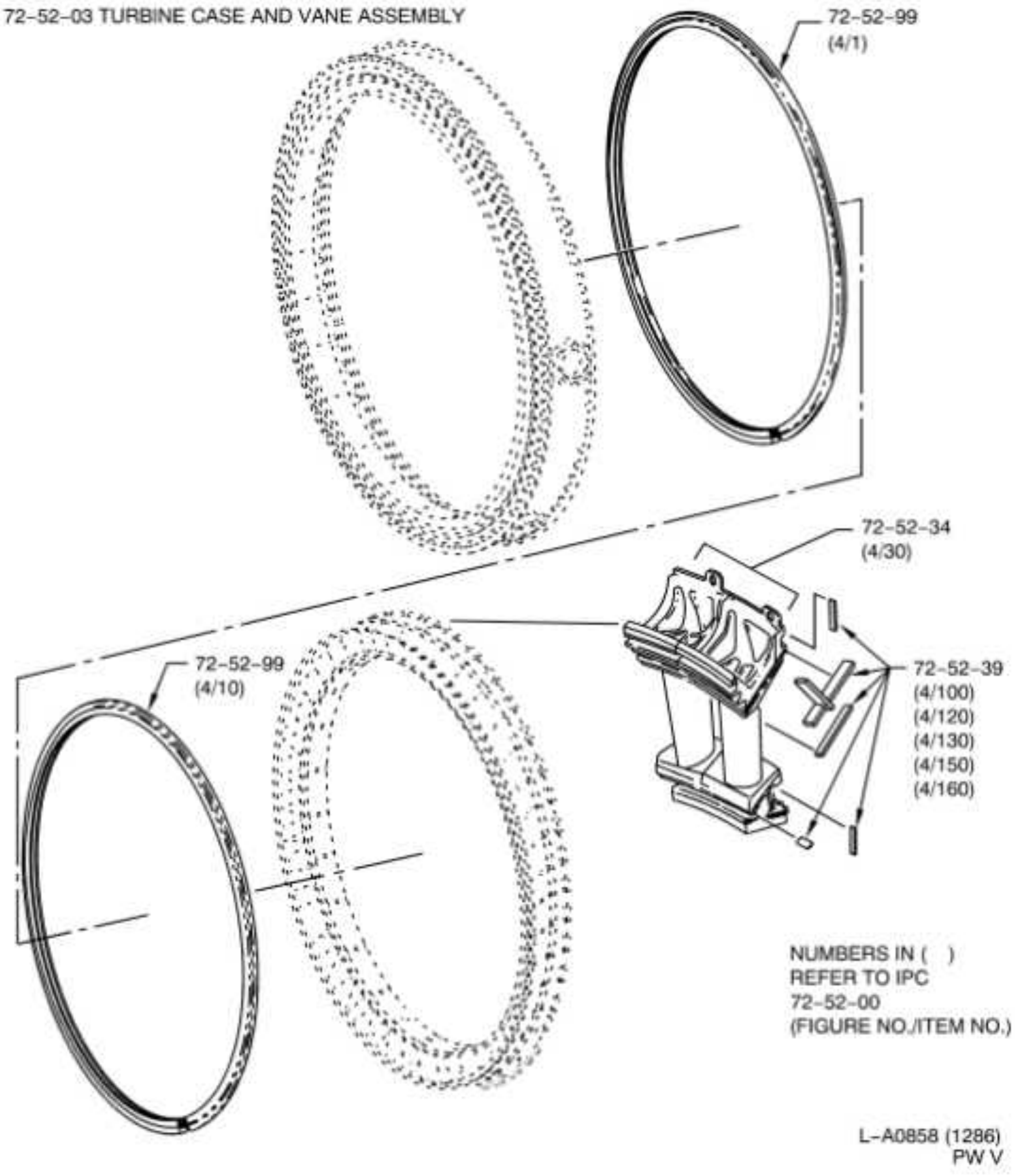
High Pressure Turbine (HPT)
Figure 12 (Sheet 2)


72-52-03 TURBINE CASE AND VANE ASSEMBLY
72-52-99
(3/1)
72-52-32
(3/10)
72-52-33
(3/30)
72-52-39
(3/20)
NUMBERS IN ( )
REFER TO IPC
72-52-00
(FIGURE NO./ITEM NO.)
L-A0857 (0000)
PW V

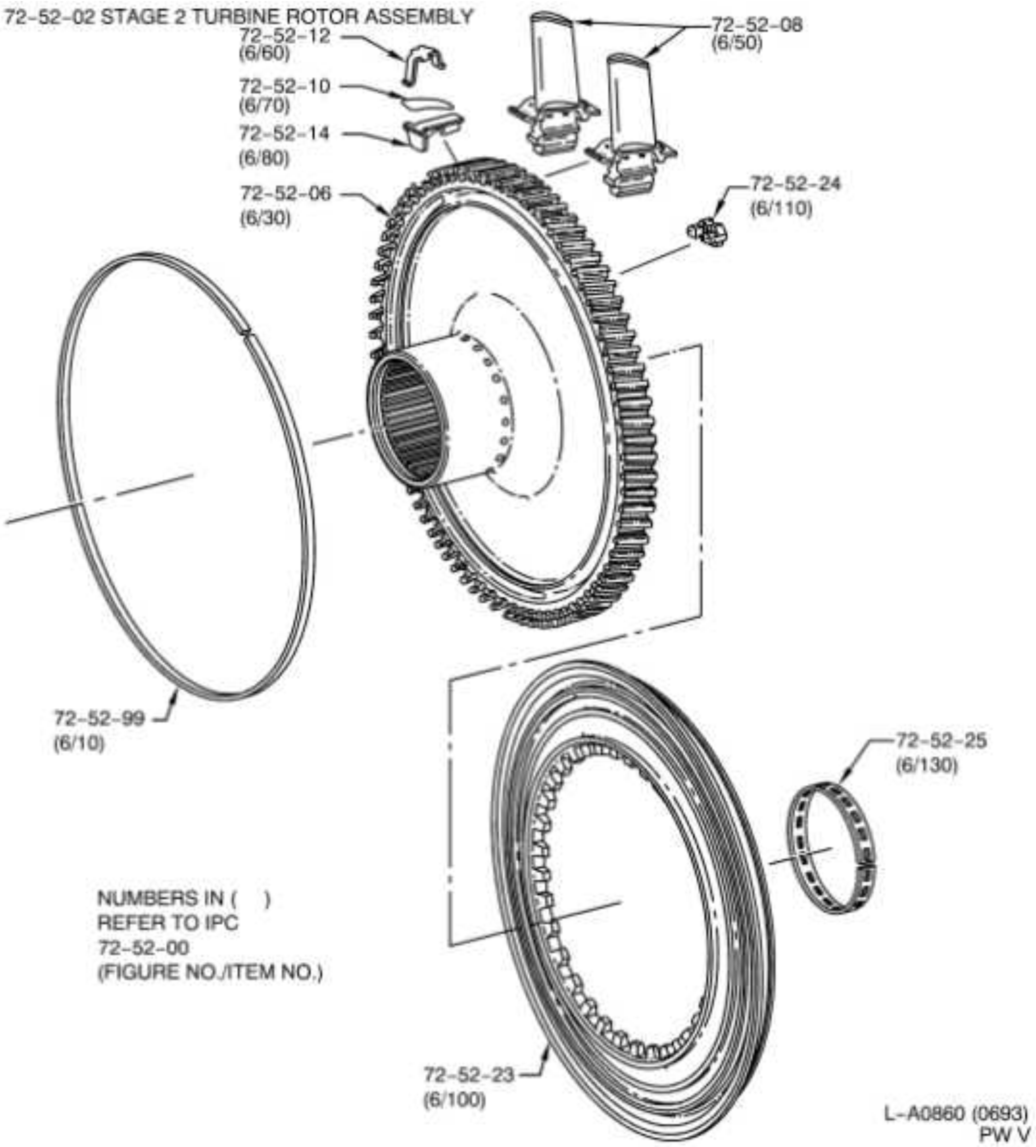
High Pressure Turbine (HPT)
Figure 12 (Sheet 3)


72-52-03 TURBINE CASE AND VANE ASSEMBLY
72-52-35
(5/10)
72-52-39
(5/20)
72-52-36
(5/30)
72-52-99
(5/1)
72-52-38
(5/110)
72-52-39
(5/70)
(5/80)
72-52-37
(5/40)
72-52-39
(5/60)
72-52-99
(5/90)
72-52-37
(5/40)
NUMBERS IN ( )
REFER TO IPC
72-52-00
(FIGURE NO./ITEM NO.)
72-52-99
(5/1)
L-A0859 (1286)
PW V

High Pressure Turbine (HPT)
Figure 12 (Sheet 4)

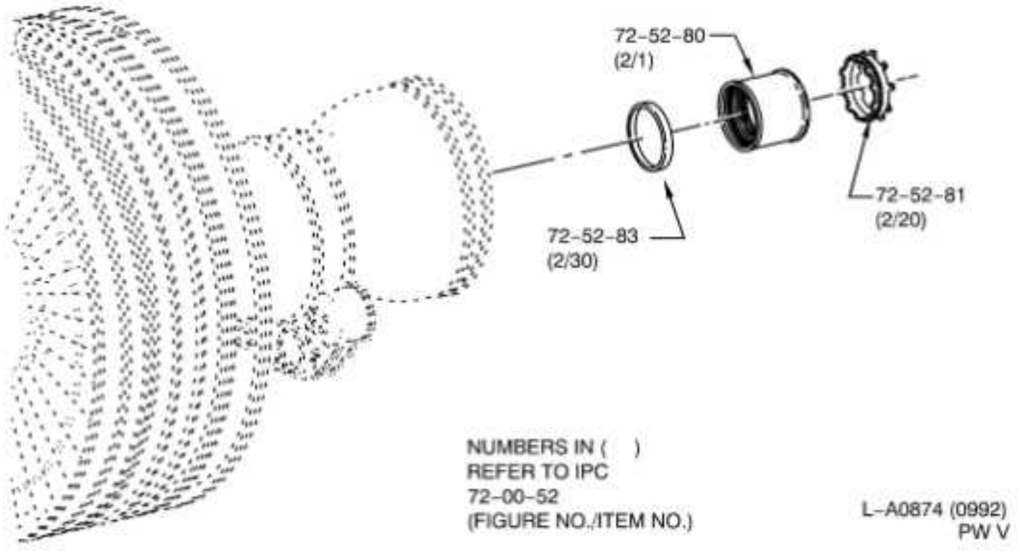

72-52-03 TURBINE CASE AND VANE ASSEMBLY
72-52-99
(4/1)
72-52-34
(4/30)
72-52-99
(4/10)
72-52-39
(4/100)
(4/120)
(4/130)
(4/150)
(4/160)
NUMBERS IN ( )
REFER TO IPC
72-52-00
(FIGURE NO./ITEM NO.)
L-A0858 (1286)
PW V

High Pressure Turbine (HPT)
Figure 12 (Sheet 5)

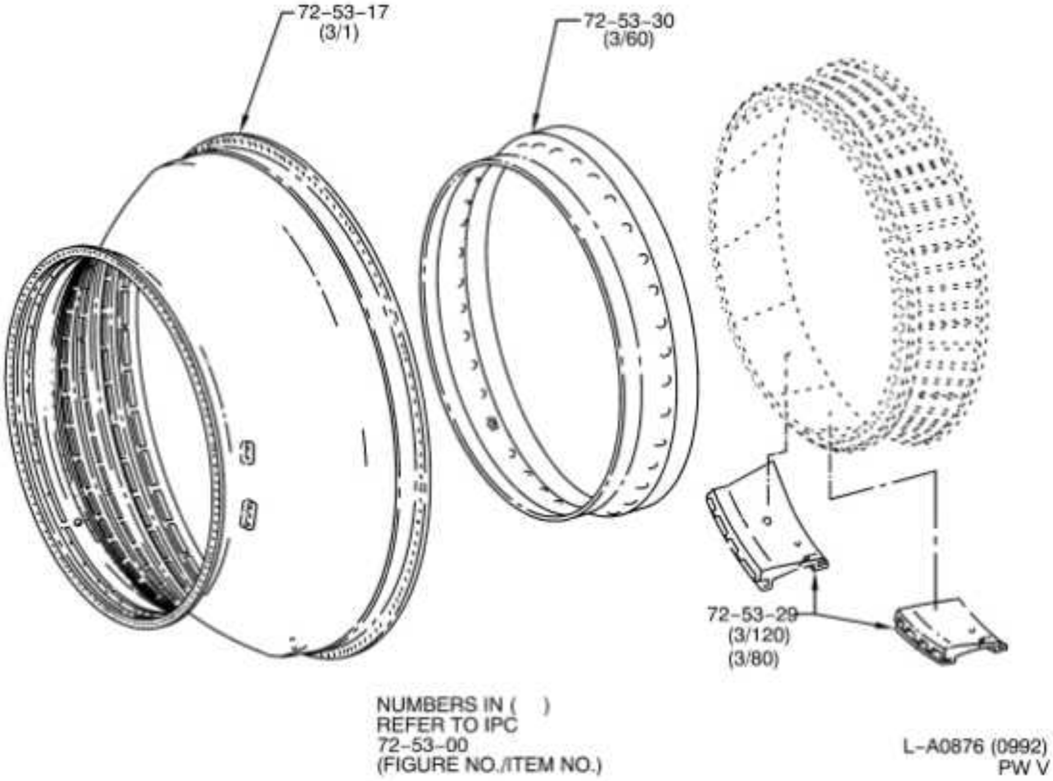

72-52-02 STAGE 2 TURBINE ROTOR ASSEMBLY
72-52-12
(6/60)
72-52-10
(6/70)
72-52-14
(6/80)
72-52-06
(6/30)
72-52-08
(6/50)
72-52-24
(6/110)
72-52-99
(6/10)
72-52-25
(6/130)
NUMBERS IN ( )
REFER TO IPC
72-52-00
(FIGURE NO./ITEM NO.)
72-52-23
(6/100)
L-A0860 (0693)
PW V

High Pressure Turbine (HPT)
Figure 12 (Sheet 6)

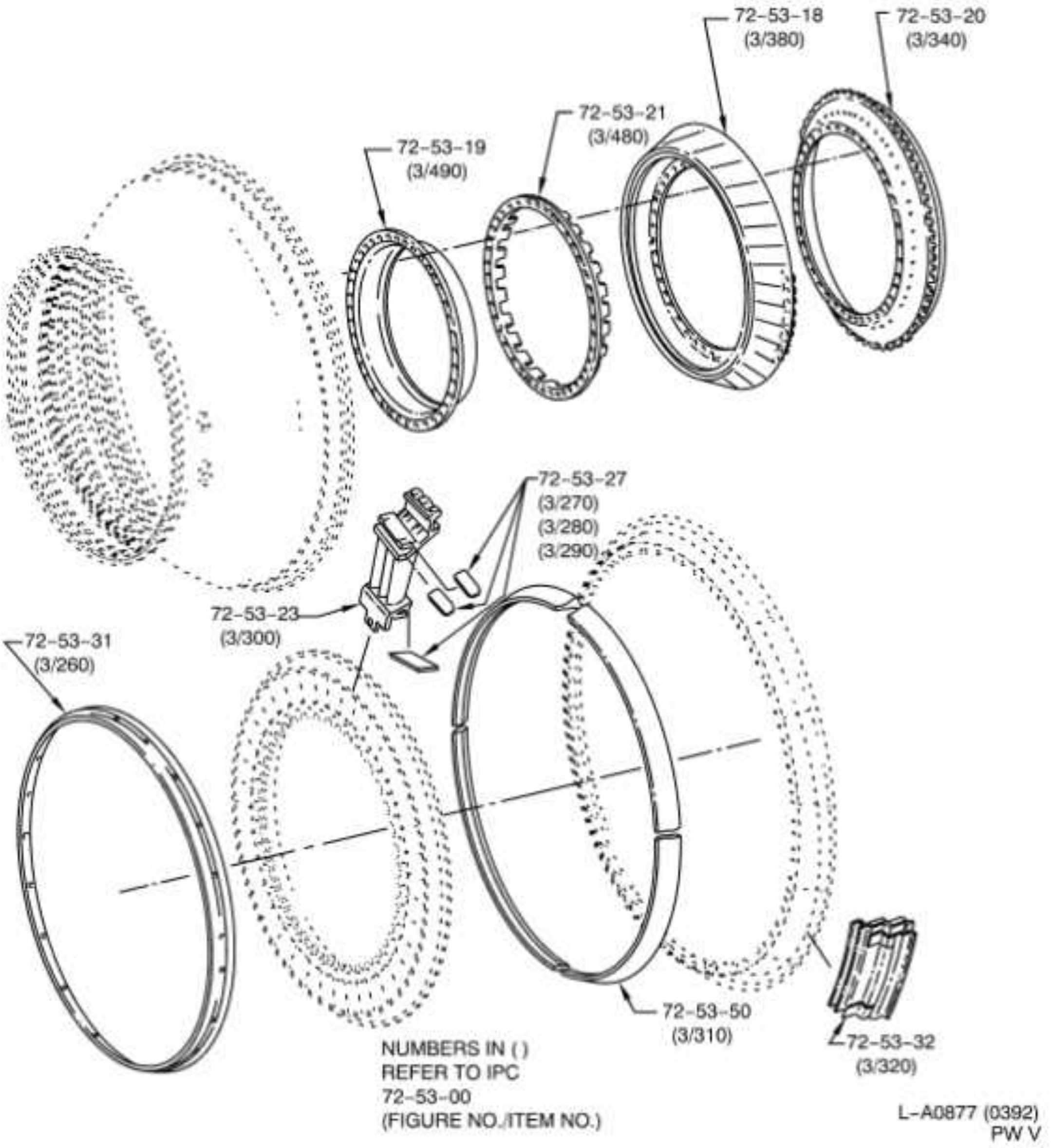
HOW TO USE MANUAL


72-52-80
(2/1)
72-52-81
(2/20)
72-52-83
(2/30)
NUMBERS IN ( )
REFER TO IPC
72-00-52
(FIGURE NO./ITEM NO.)
L-A0874 (0992)
PW V

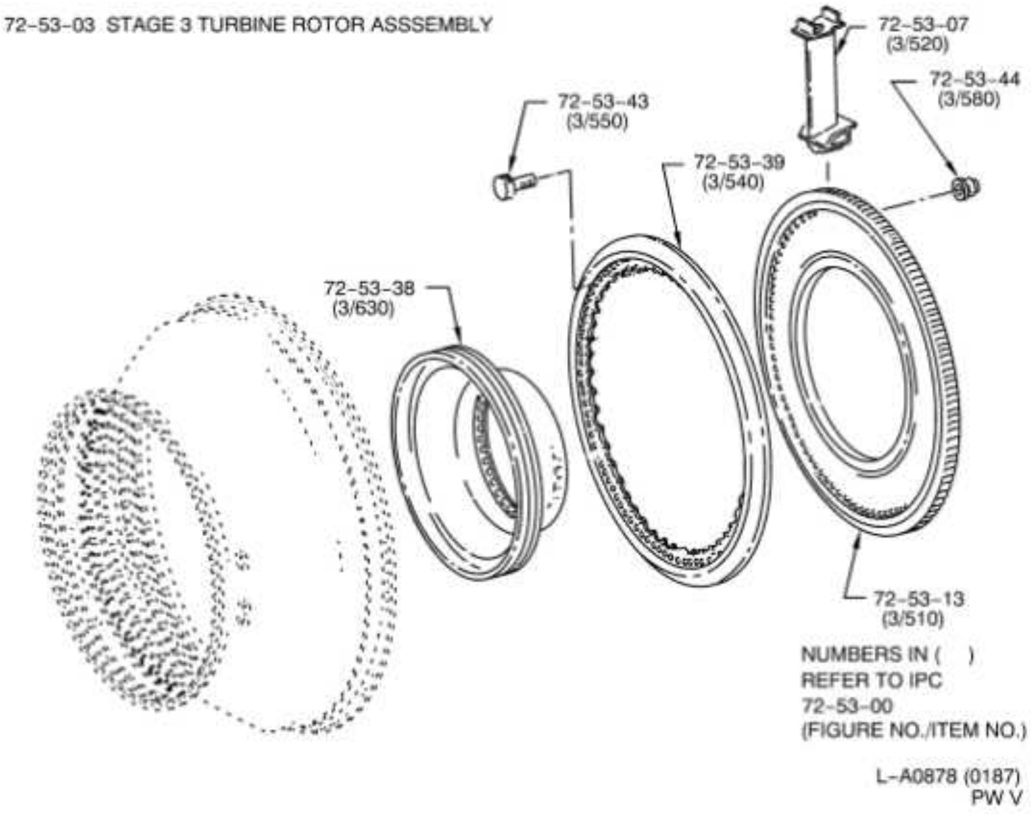
High Pressure Turbine (HPT)
Figure 12 (Sheet 7)


72-53-17
(3/1)
72-53-30
(3/60)
72-53-29
(3/120)
(3/80)
NUMBERS IN ( )
REFER TO IPC
72-53-00
(FIGURE NO./ITEM NO.)
L-A0876 (0992)
PW V

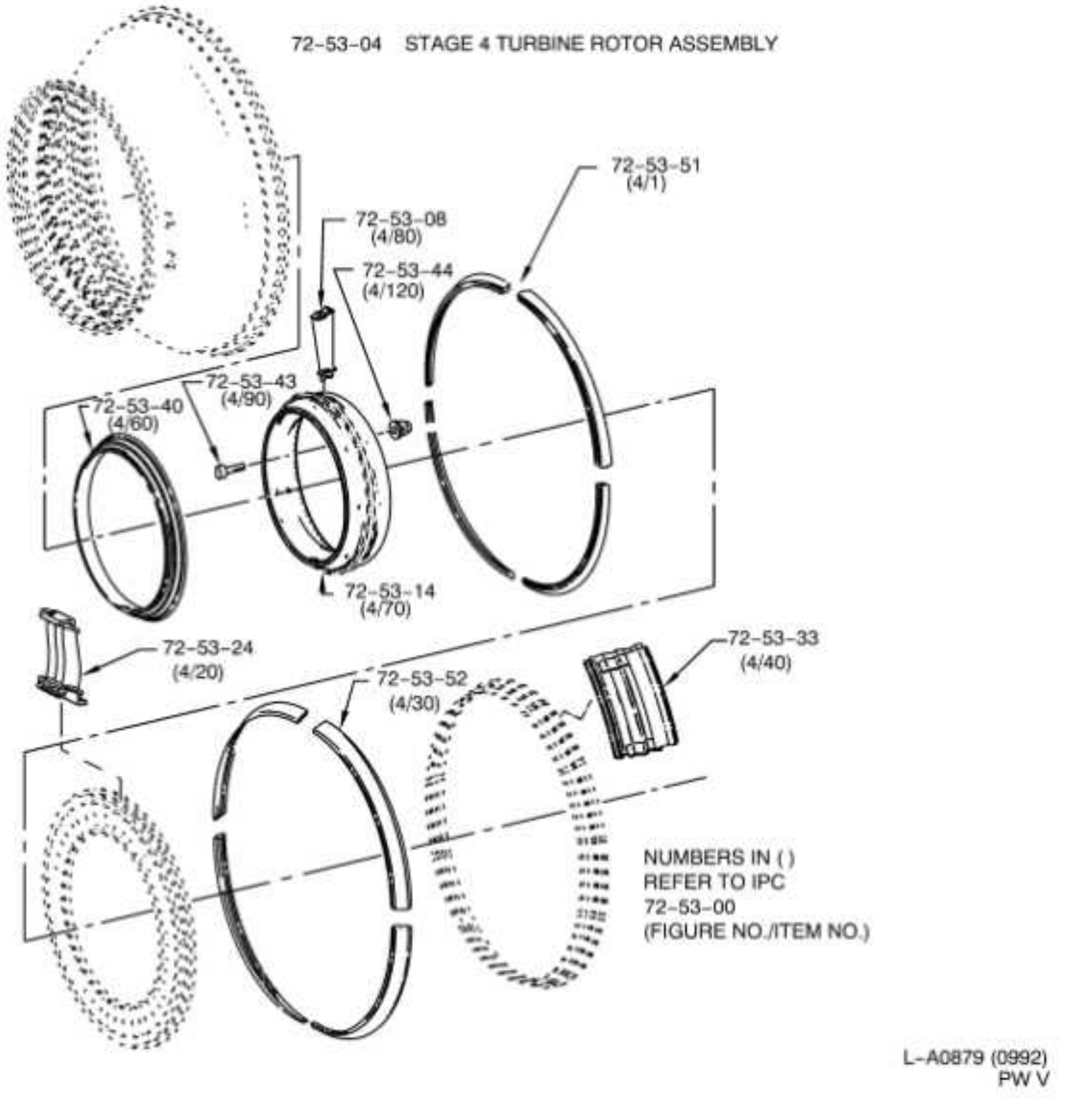
Low Pressure Turbine (LPT)
Figure 13 (Sheet 1)


72-53-18
(3/380)
72-53-20
(3/340)
72-53-21
(3/480)
72-53-19
(3/490)
72-53-27
(3/270)
(3/280)
(3/290)
72-53-23
(3/300)
72-53-31
(3/260)
72-53-50
(3/310)
72-53-32
(3/320)
NUMBERS IN ( )
REFER TO IPC
72-53-00
(FIGURE NO./ITEM NO.)
L-A0877 (0392)
PW V

Low Pressure Turbine (LPT)
Figure 13 (Sheet 2)


72-53-03 STAGE 3 TURBINE ROTOR ASSSEMBLY
72-53-07
(3/520)
72-53-44
(3/580)
72-53-43
(3/550)
72-53-39
(3/540)
72-53-38
(3/630)
72-53-13
(3/510)
NUMBERS IN ( )
REFER TO IPC
72-53-00
(FIGURE NO./ITEM NO.)
L-A0878 (0187)
PW V

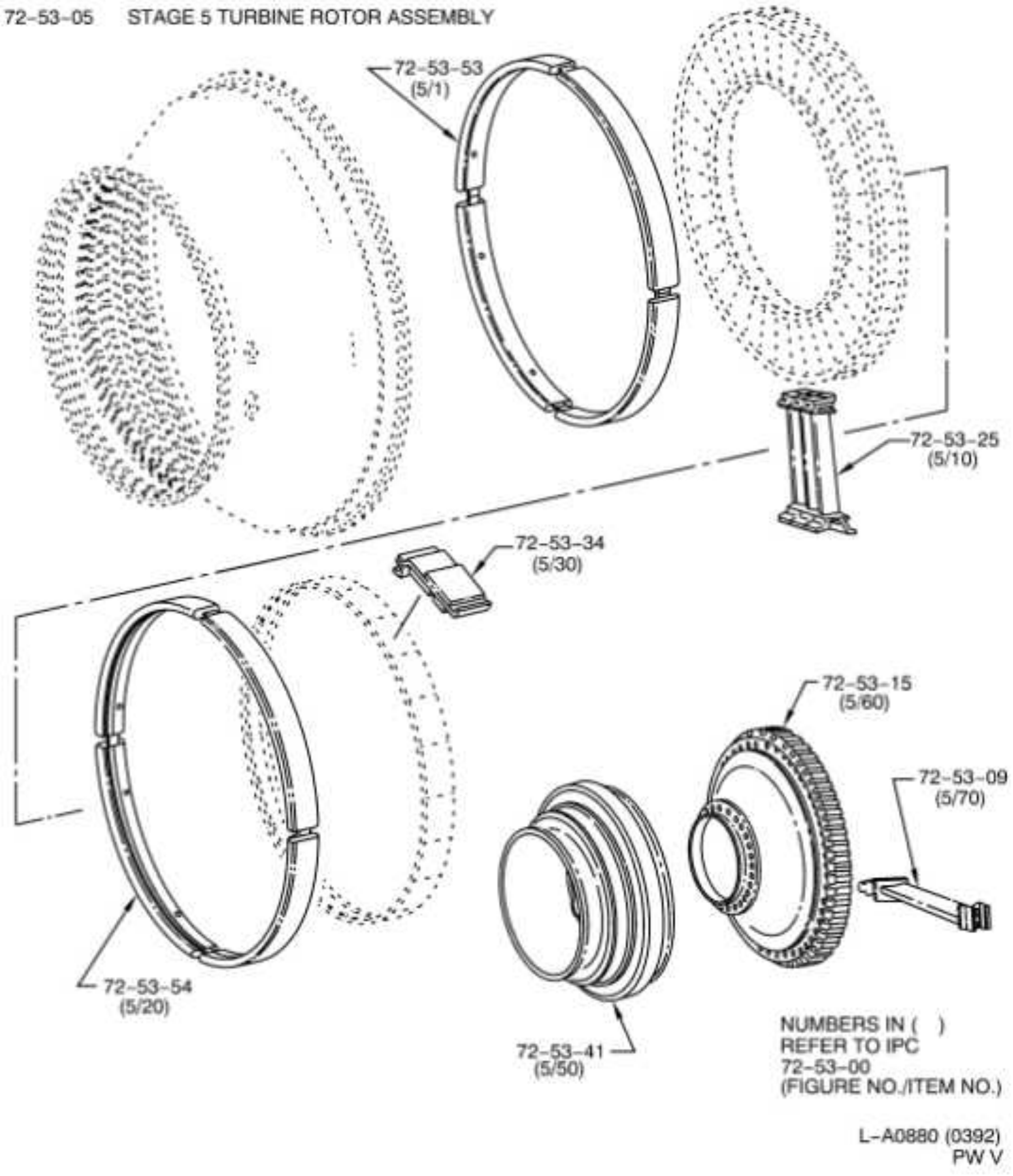
Low Pressure Turbine (LPT)
Figure 13 (Sheet 3)


72-53-04 STAGE 4 TURBINE ROTOR ASSEMBLY
72-53-51
(4/1)
72-53-08
(4/80)
72-53-44
(4/120)
72-53-43
(4/90)
72-53-40
(4/60)
72-53-14
(4/70)
72-53-24
(4/20)
72-53-52
(4/30)
72-53-33
(4/40)

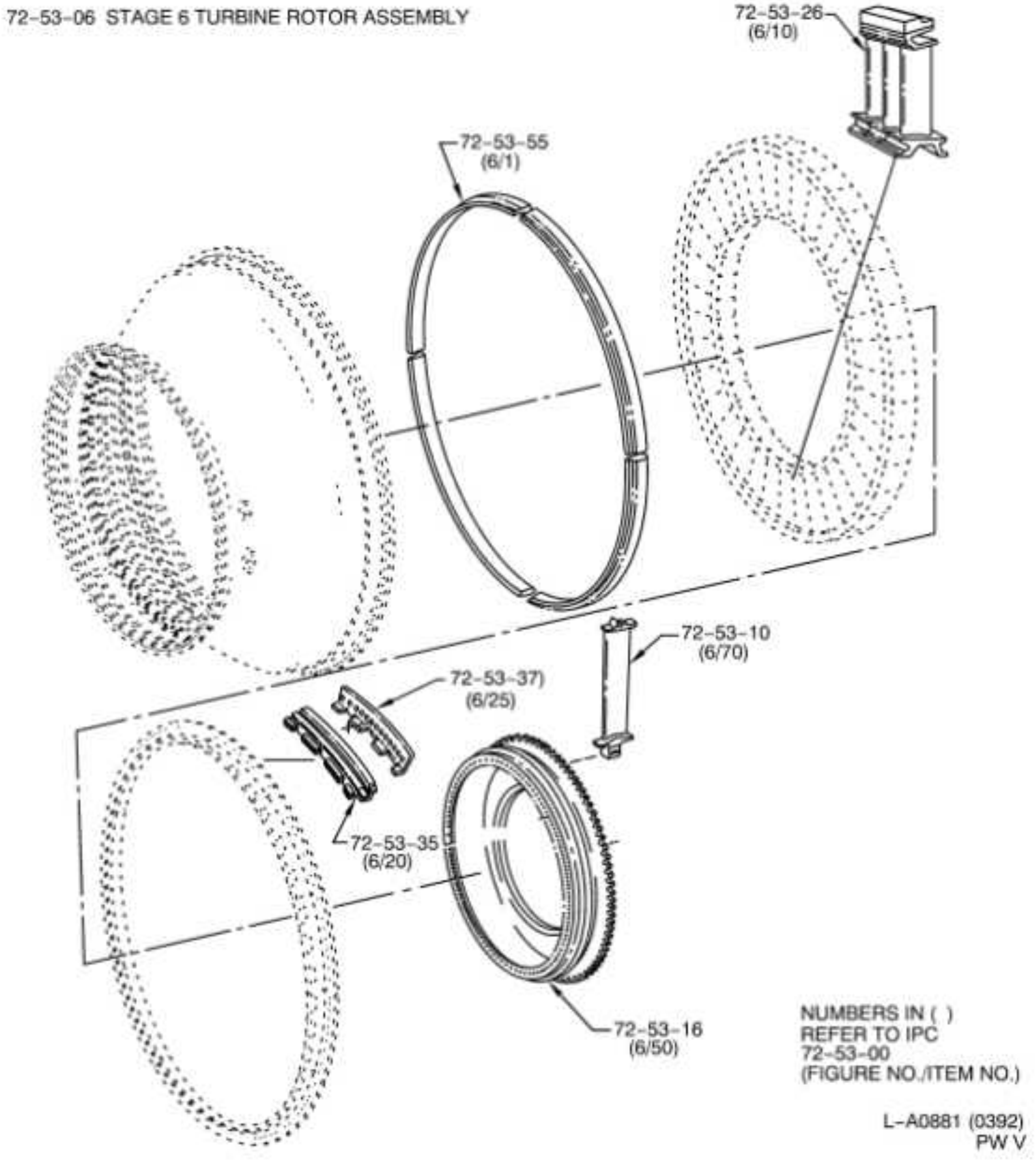
NUMBERS IN ( )
REFER TO IPC
72-53-00
(FIGURE NO./ITEM NO.)

L-A0879 (0992)
PW V

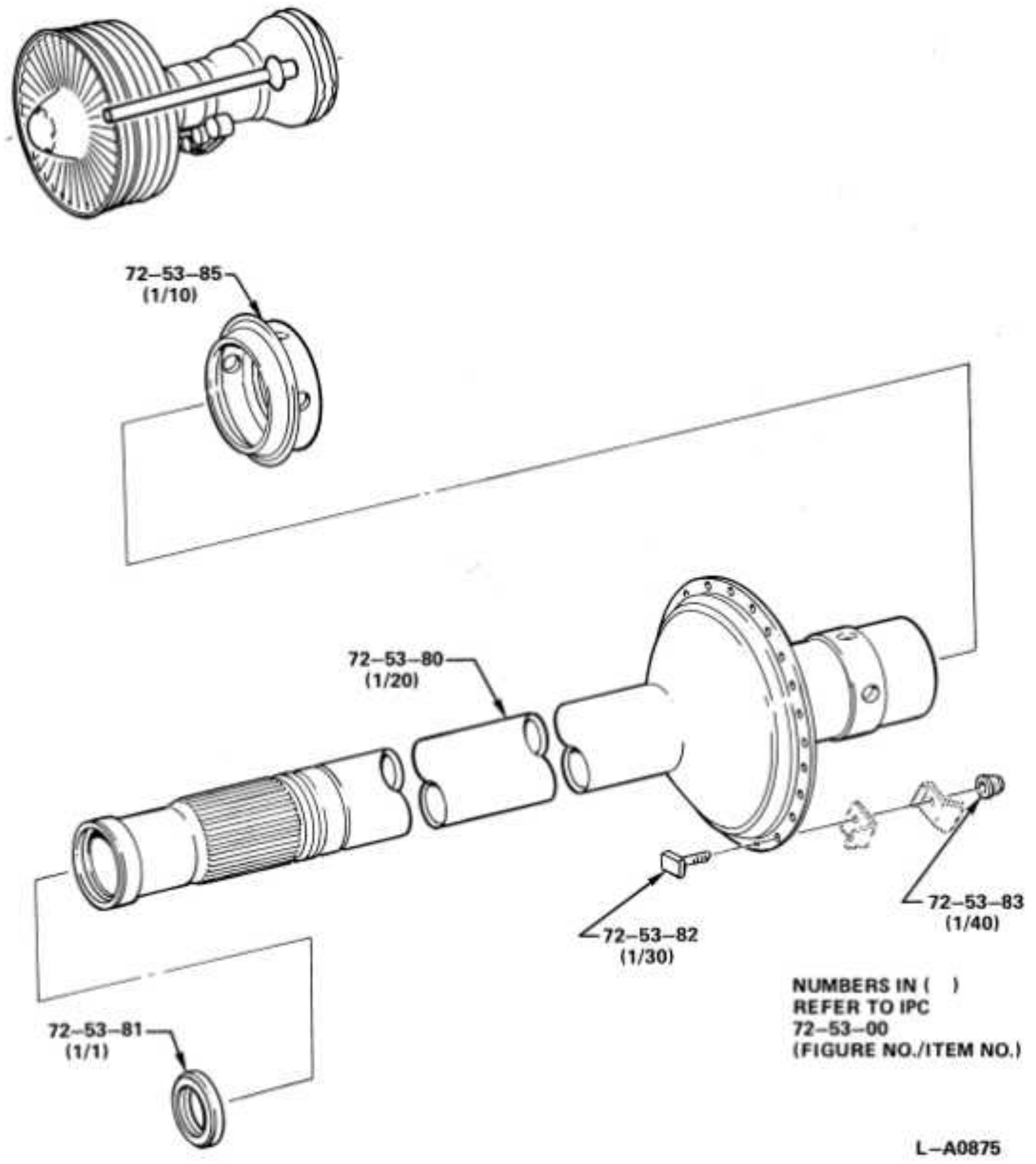
Low Pressure Turbine (LPT)
Figure 13 (Sheet 4)


72-53-05 STAGE 5 TURBINE ROTOR ASSEMBLY
72-53-53
(5/1)
72-53-25
(5/10)
72-53-34
(5/30)
72-53-15
(5/60)
72-53-09
(5/70)
72-53-54
(5/20)
72-53-41
(5/50)
NUMBERS IN ( )
REFER TO IPC
72-53-00
(FIGURE NO./ITEM NO.)
L-A0880 (0392)
PW V

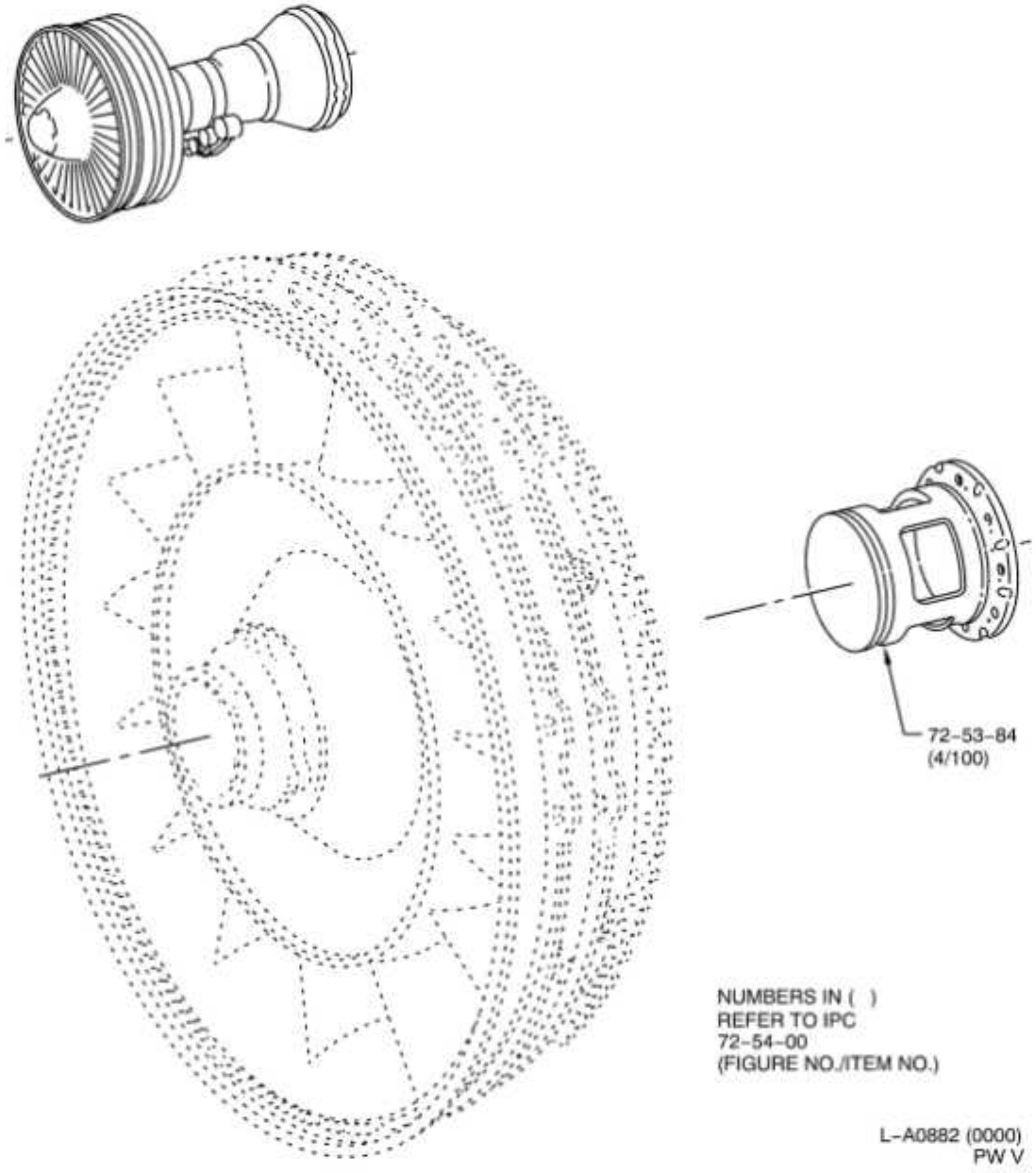
Low Pressure Turbine (LPT)
Figure 13 (Sheet 5)


72-53-06 STAGE 6 TURBINE ROTOR ASSEMBLY
72-53-26
(6/10)
72-53-55
(6/1)
72-53-10
(6/70)
72-53-37)
(6/25)
72-53-35
(6/20)
72-53-16
(6/50)
NUMBERS IN ( )
REFER TO IPC
72-53-00
(FIGURE NO./ITEM NO.)
L-A0881 (0392)
PW V

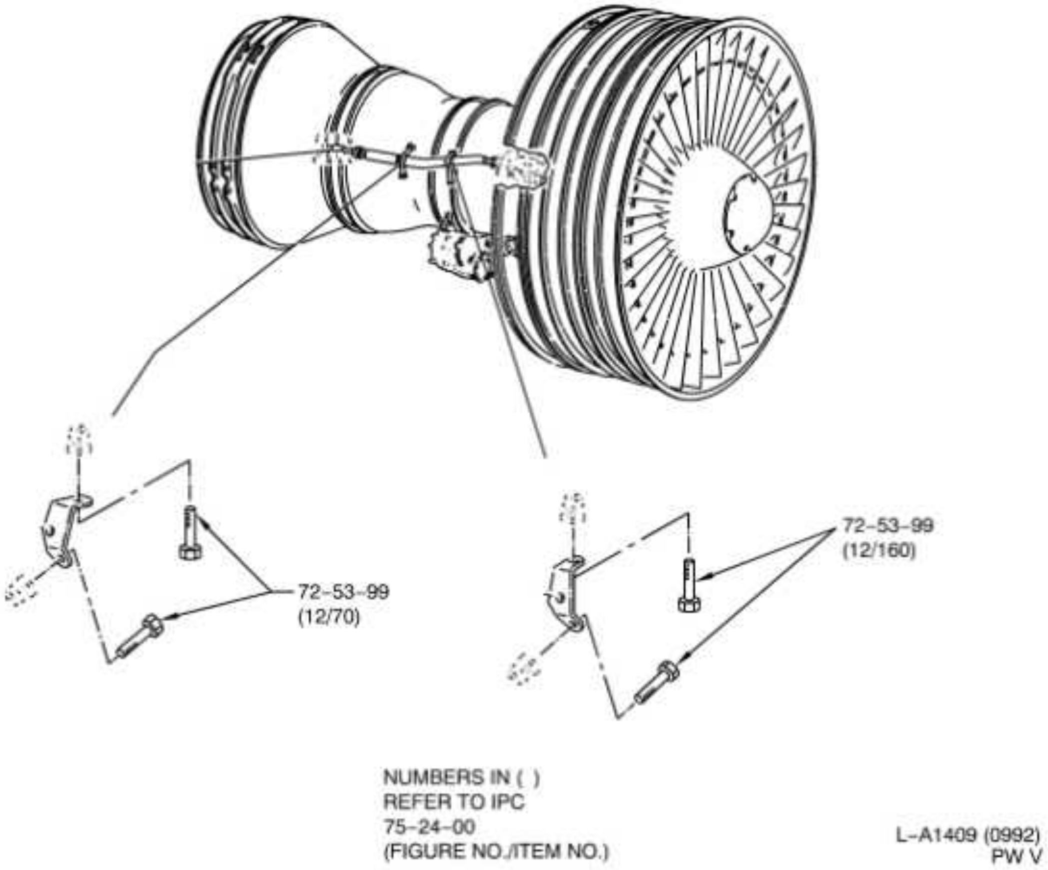
Low Pressure Turbine (LPT)
Figure 13 (Sheet 6)


72–53–85
(1/10)
72–53–80
(1/20)
72–53–83
(1/40)
72–53–82
(1/30)
NUMBERS IN ( )
REFER TO IPC
72–53–00
(FIGURE NO./ITEM NO.)
72–53–81
(1/1)
L–A0875

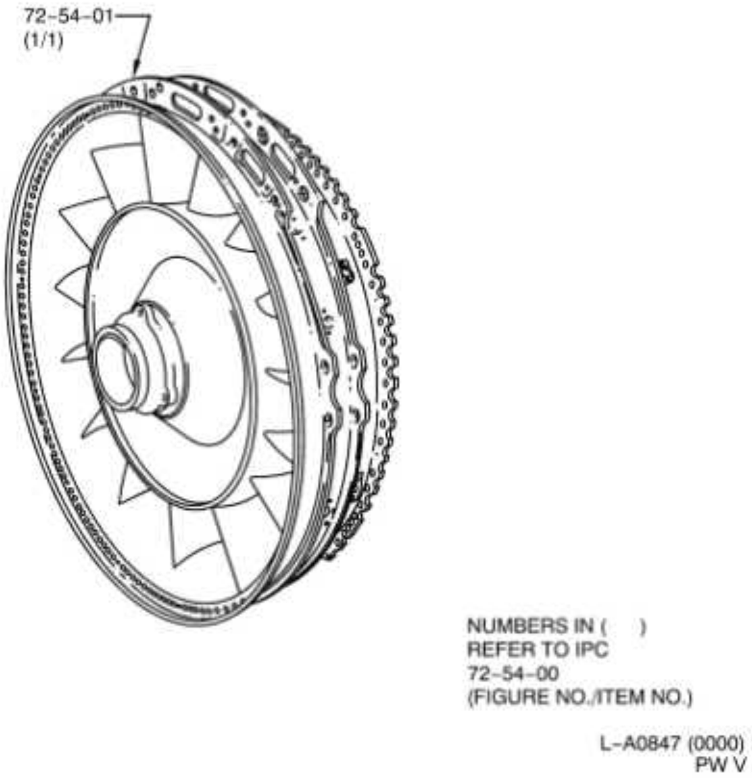
Low Pressure Turbine (LPT)
Figure 13 (Sheet 7)


72-53-84
(4/100)
NUMBERS IN ( )
REFER TO IPC
72-54-00
(FIGURE NO./ITEM NO.)
L-A0882 (0000)
PW V

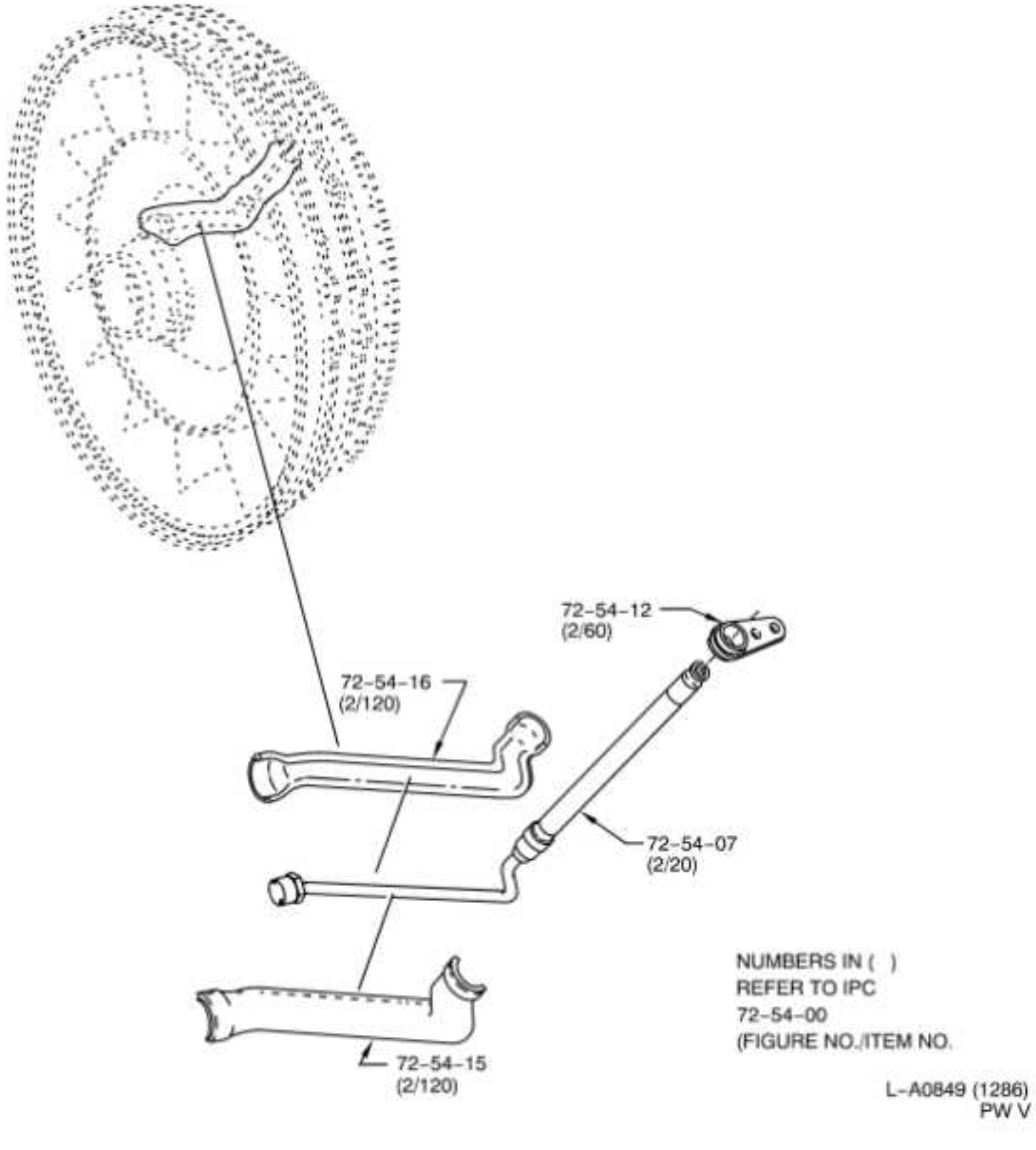
Low Pressure Turbine (LPT)
Figure 13 (Sheet 8)


72-53-99
(12/160)
72-53-99
(12/70)
NUMBERS IN ( )
REFER TO IPC
75-24-00
(FIGURE NO./ITEM NO.)
L-A1409 (0992)
PW V

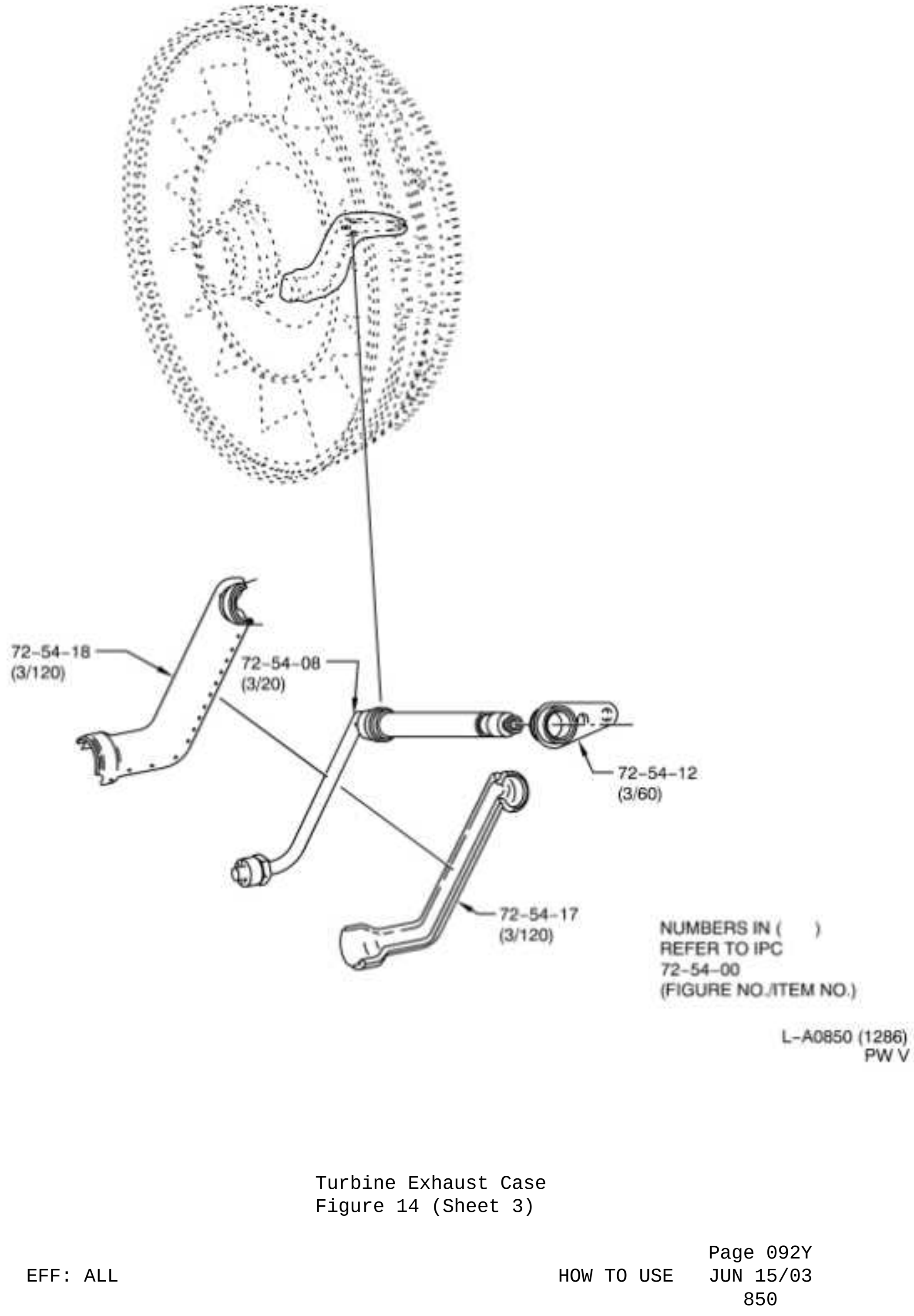
Low Pressure Turbine (LPT)
Figure 13 (Sheet 9)


72-54-01
(1/1)
NUMBERS IN ( )
REFER TO IPC
72-54-00
(FIGURE NO./ITEM NO.)
L-A0847 (0000)
PW V

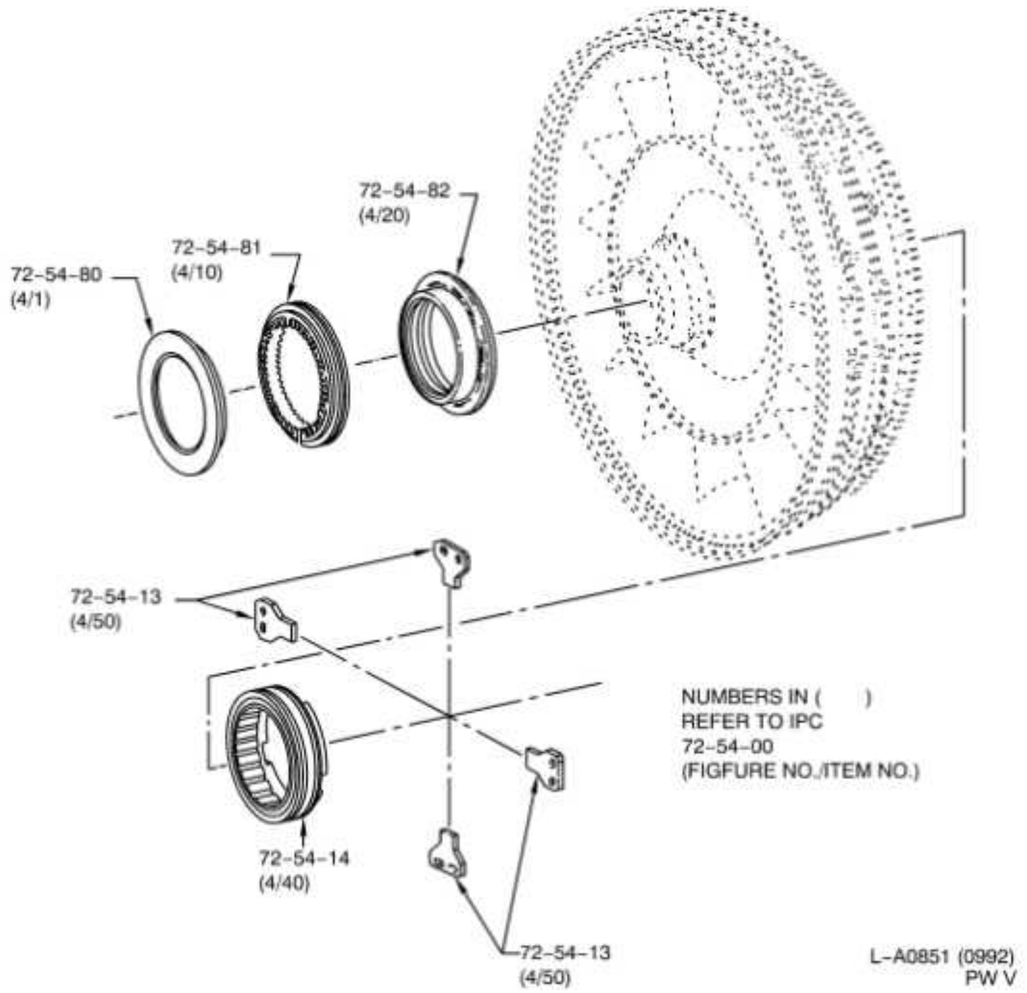
Turbine Exhaust Case
Figure 14 (Sheet 1)


72-54-12
(2/60)
72-54-16
(2/120)
72-54-07
(2/20)
72-54-15
(2/120)
NUMBERS IN ( )
REFER TO IPC
72-54-00
(FIGURE NO./ITEM NO.
L-A0849 (1286)
PW V

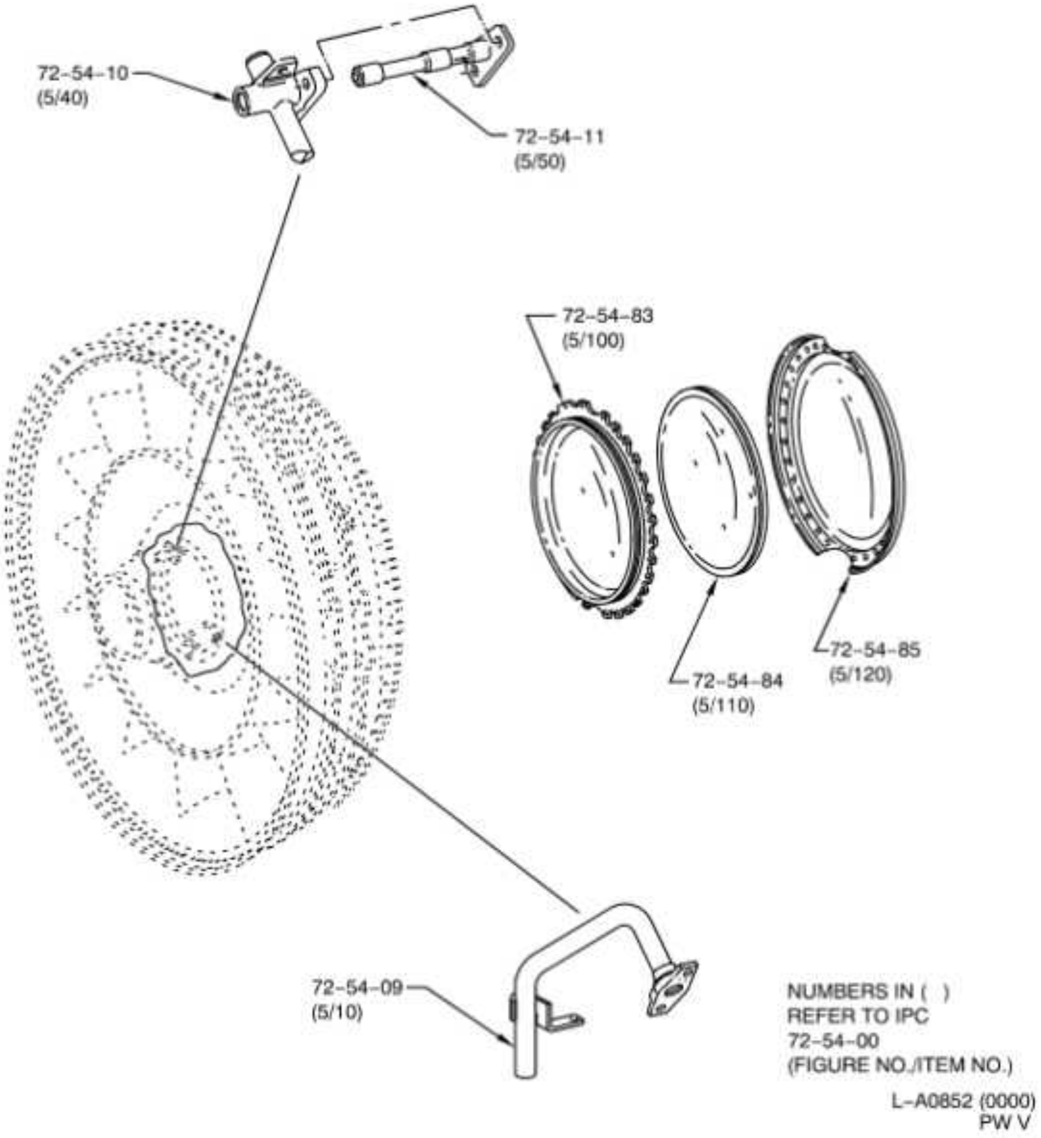
Turbine Exhaust Case
Figure 14 (Sheet 2)


72-54-18
(3/120)
72-54-08
(3/20)
72-54-12
(3/60)
72-54-17
(3/120)
NUMBERS IN ( )
REFER TO IPC
72-54-00
(FIGURE NO./ITEM NO.)
L-A0850 (1286)
PW V

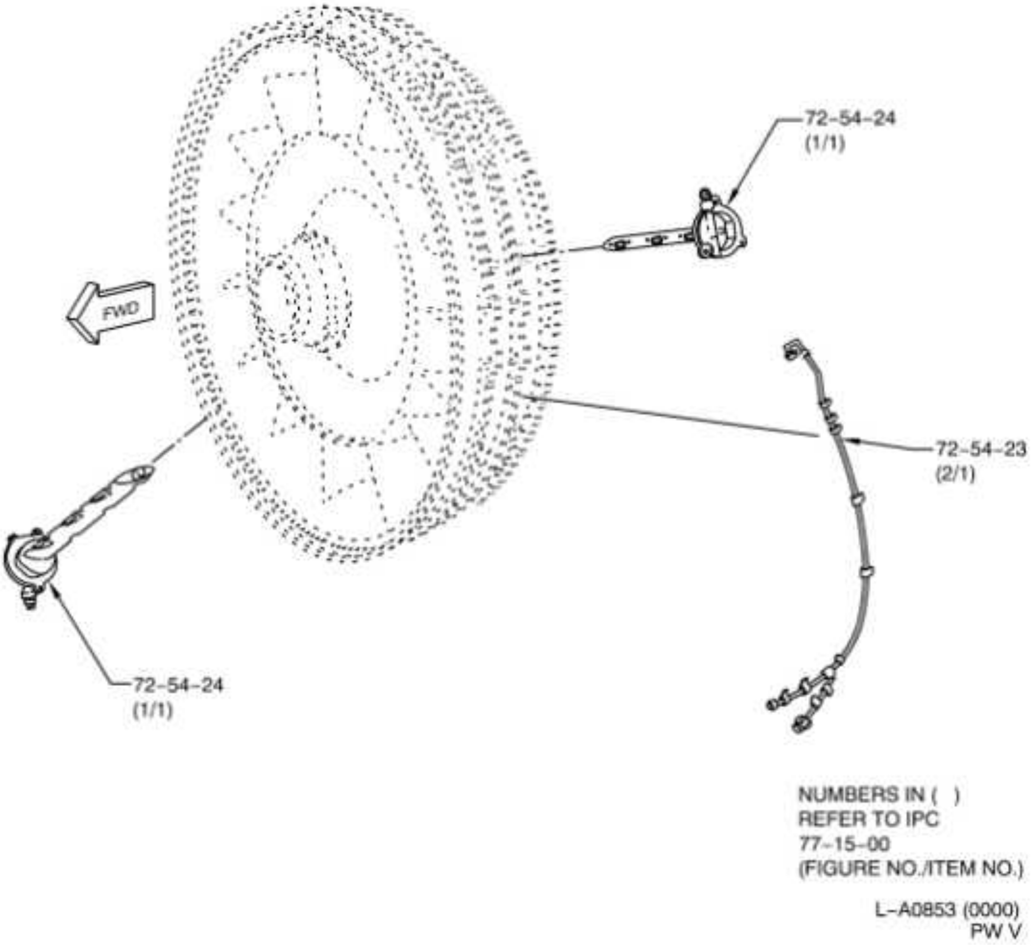
Turbine Exhaust Case
Figure 14 (Sheet 3)


72-54-82
(4/20)
72-54-81
(4/10)
72-54-80
(4/1)
72-54-13
(4/50)
NUMBERS IN ( )
REFER TO IPC
72-54-00
(FIGFURE NO./ITEM NO.)
72-54-14
(4/40)
72-54-13
(4/50)
L-A0851 (0992)
PW V

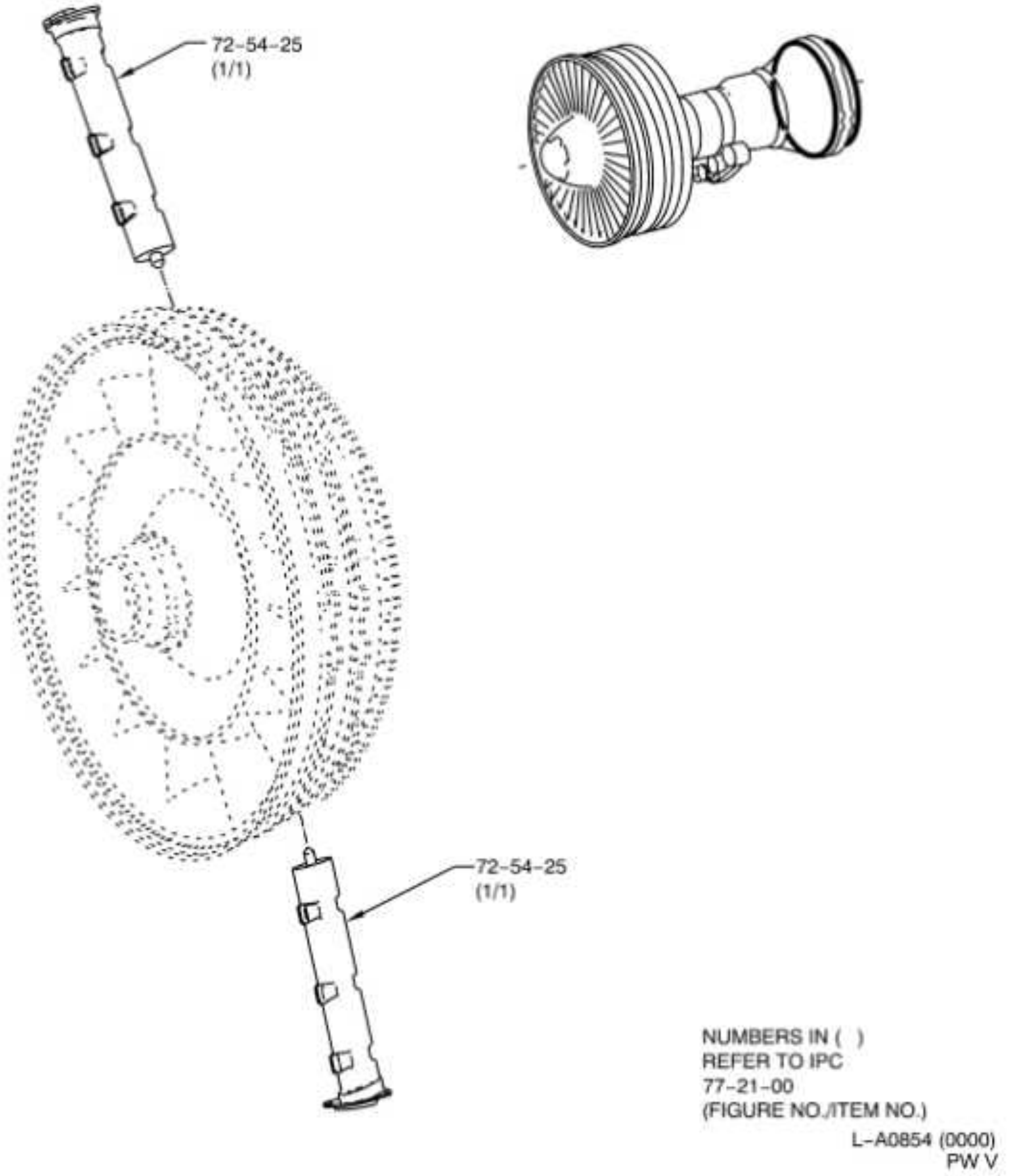
Turbine Exhaust Case
Figure 14 (Sheet 4)


72-54-10
(5/40)
72-54-11
(5/50)
72-54-83
(5/100)
72-54-84
(5/110)
72-54-85
(5/120)
72-54-09
(5/10)
NUMBERS IN ( )
REFER TO IPC
72-54-00
(FIGURE NO./ITEM NO.)
L-A0852 (0000)
PW V

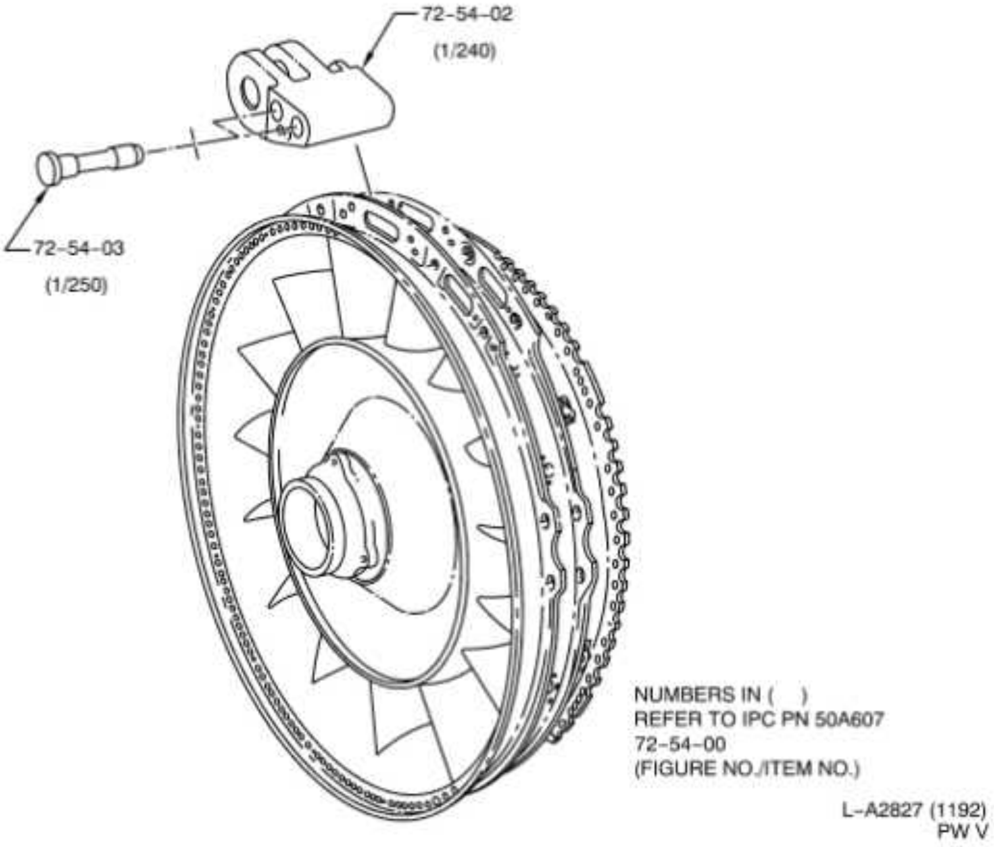
Turbine Exhaust Case
Figure 14 (Sheet 5)


72-54-24
(1/1)
FWD
72-54-23
(2/1)
72-54-24
(1/1)
NUMBERS IN ( )
REFER TO IPC
77-15-00
(FIGURE NO./ITEM NO.)
L-A0853 (0000)
PW V

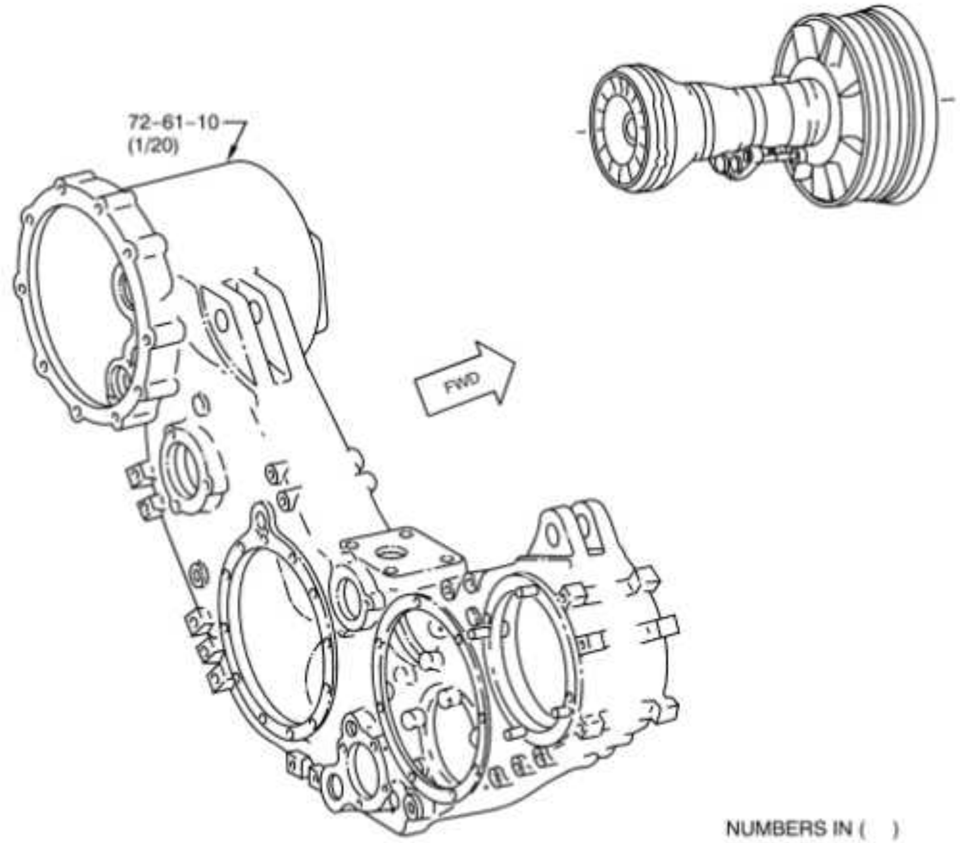
Turbine Exhaust Case
Figure 14 (Sheet 6)


72-54-25
(1/1)
72-54-25
(1/1)
NUMBERS IN ( )
REFER TO IPC
77-21-00
(FIGURE NO./ITEM NO.)
L-A0854 (0000)
PW V

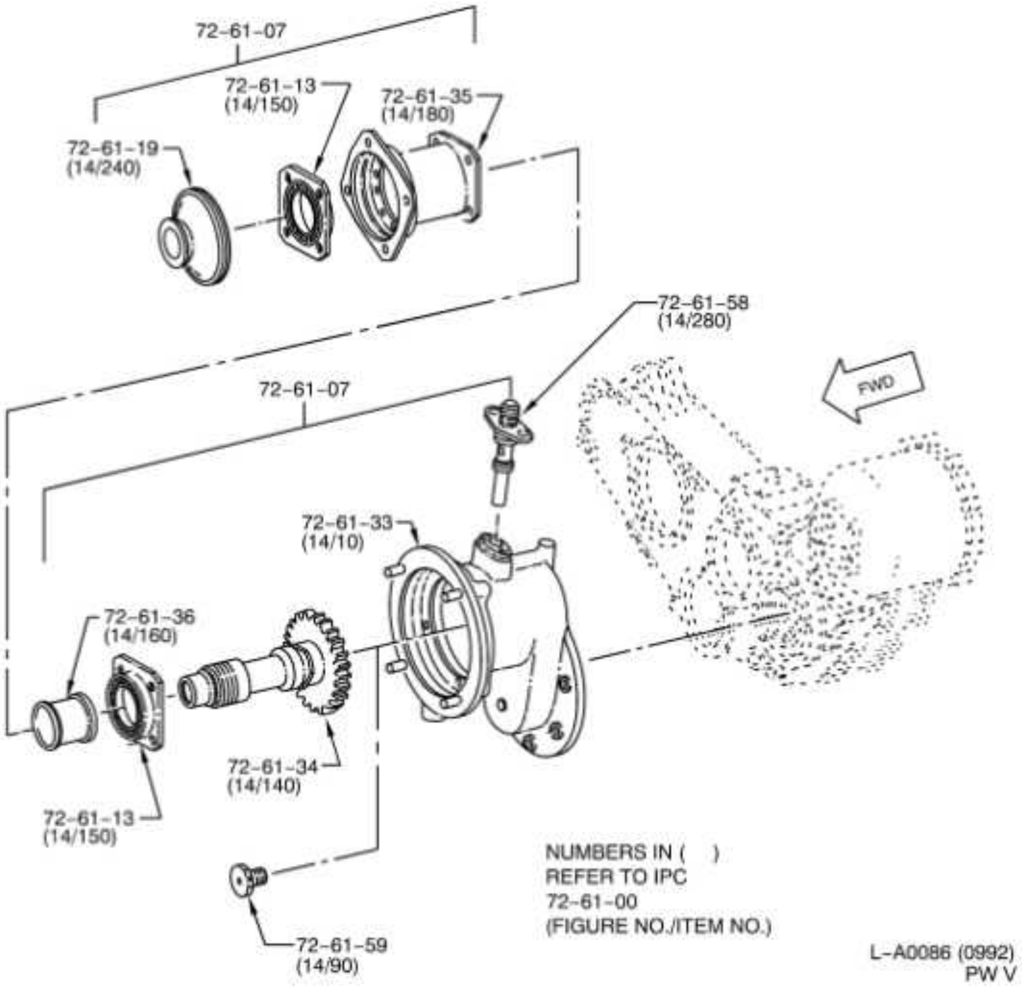
Turbine Exhaust Case
Figure 14 (Sheet 7)


72-54-02
(1/240)
72-54-03
(1/250)
NUMBERS IN ( )
REFER TO IPC PN 50A607
72-54-00
(FIGURE NO./ITEM NO.)
L-A2827 (1192)
PW V

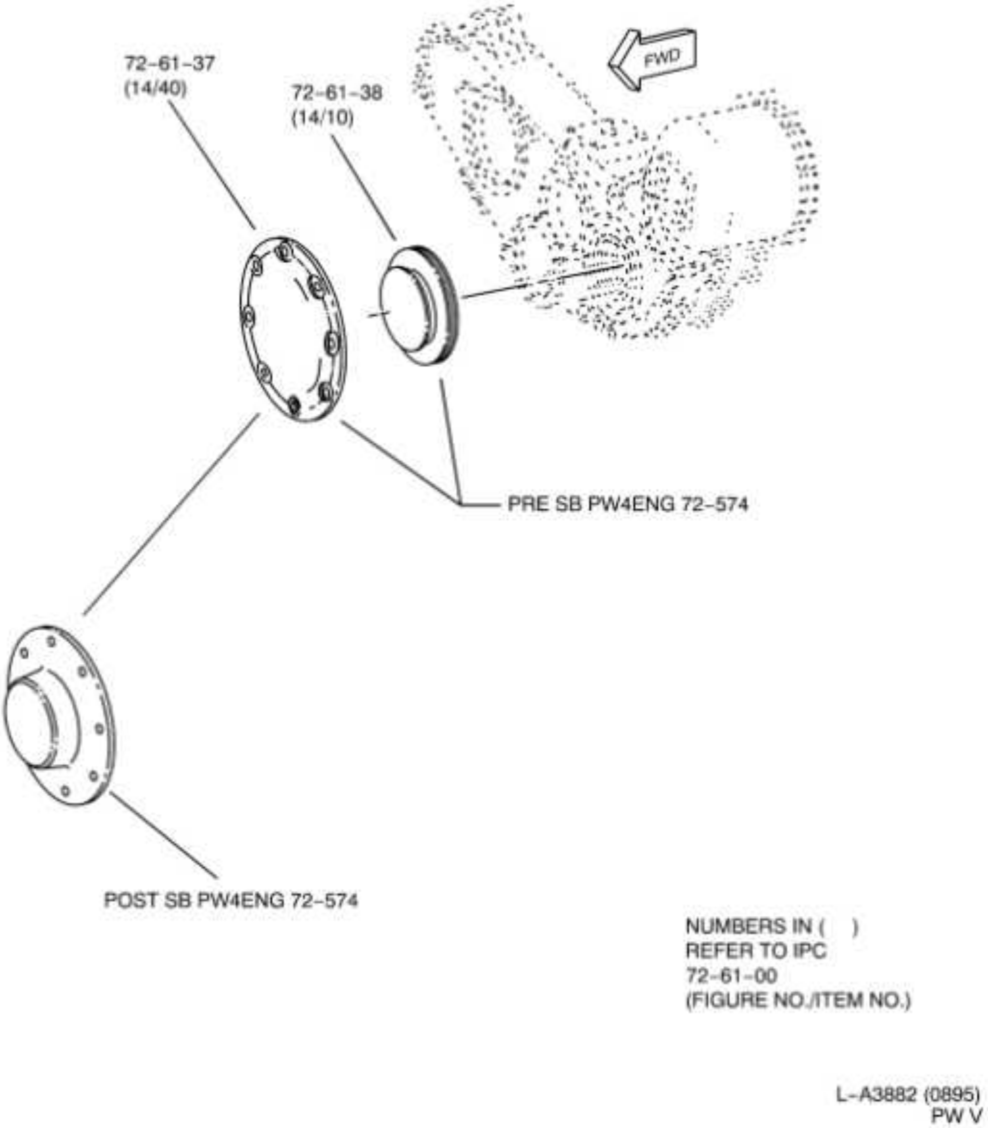
Turbine Exhaust Case
Figure 14 (Sheet 8)


72-61-10
(1/20)
FWD
NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)
L-A0085 (1286)
PW V

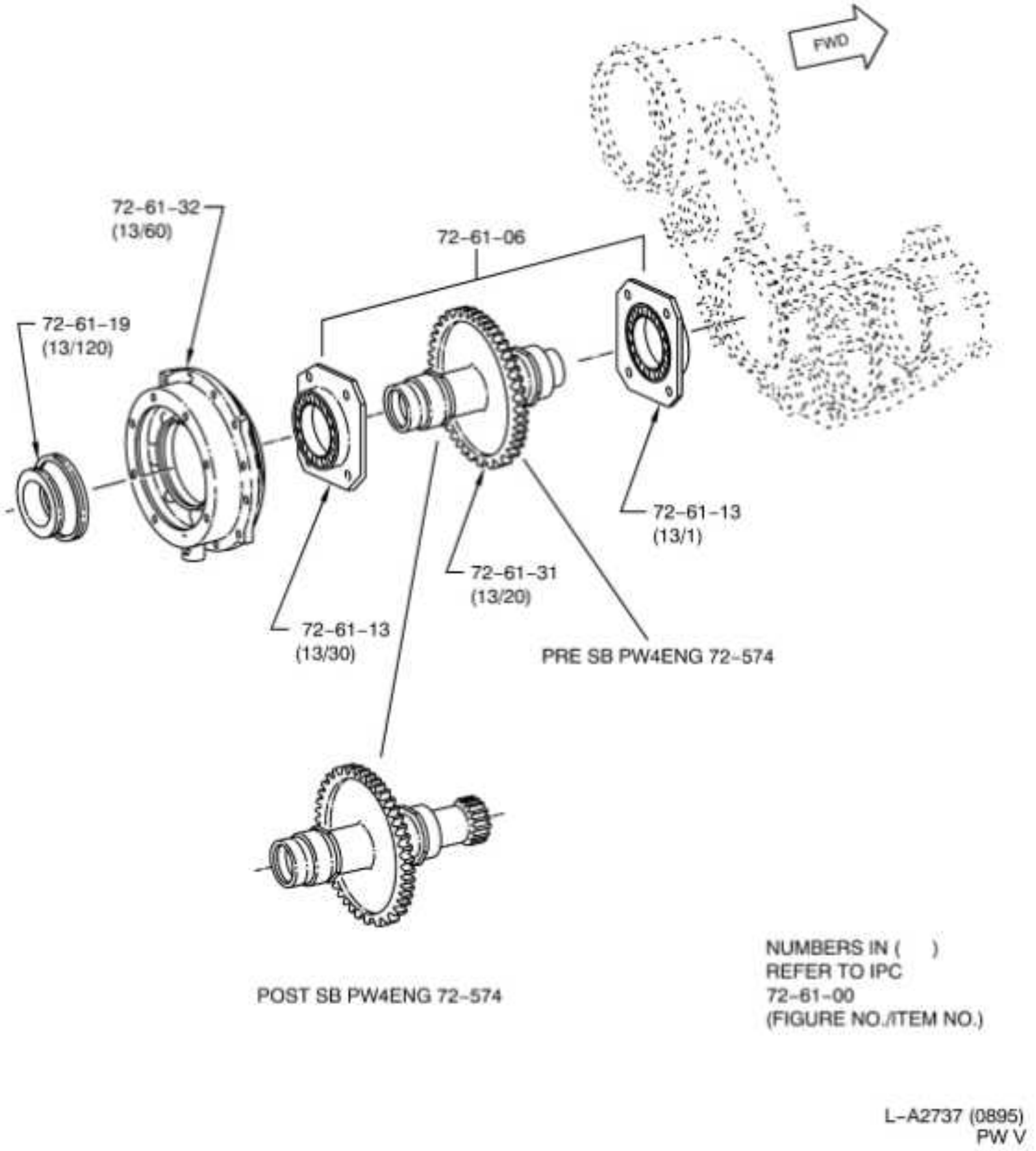
Main Gearbox
Figure 15 (Sheet 1)


72-61-07
72-61-13
(14/150)
72-61-35
(14/180)
72-61-19
(14/240)
72-61-58
(14/280)
FWD
72-61-07
72-61-33
(14/10)
72-61-36
(14/160)
72-61-34
(14/140)
72-61-13
(14/150)
72-61-59
(14/90)
NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)
L-A0086 (0992)
PW V

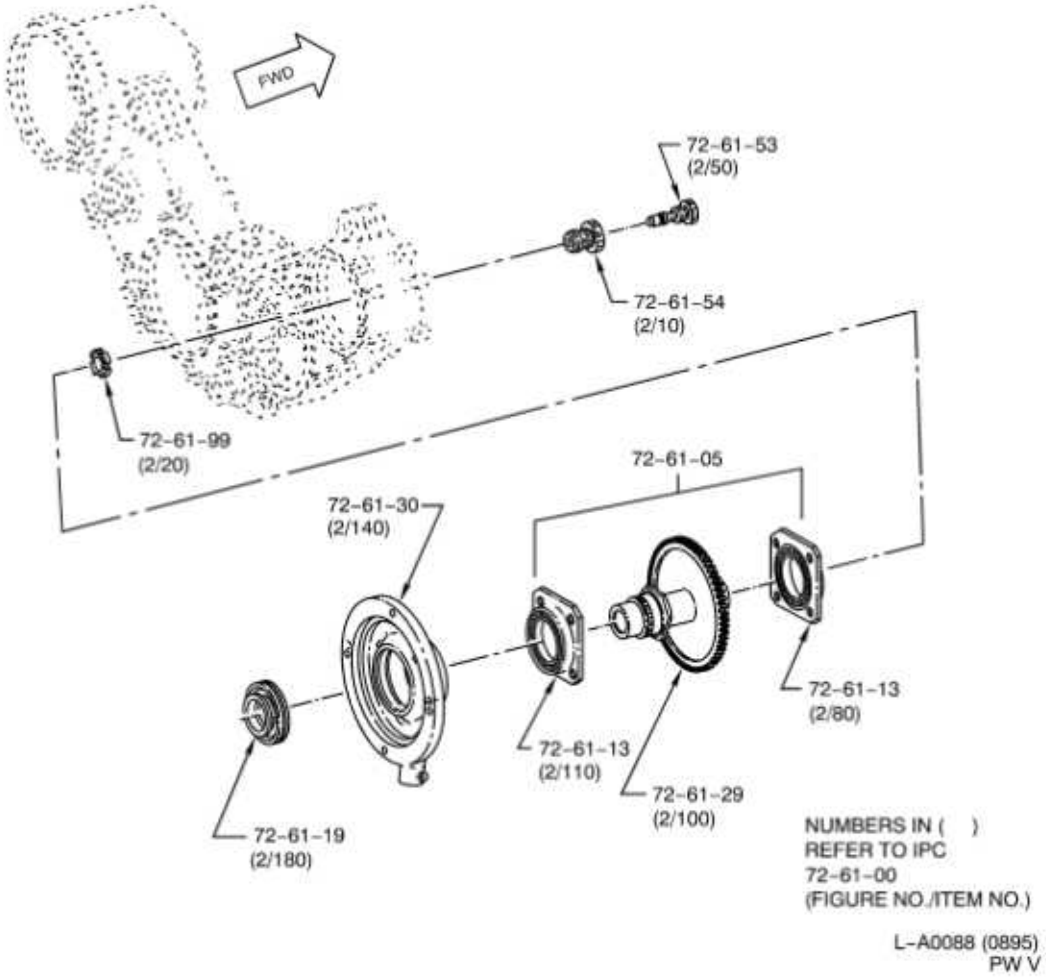
Main Gearbox
Figure 15 (Sheet 2)


72-61-37
(14/40)
72-61-38
(14/10)
FWD
PRE SB PW4ENG 72-574
POST SB PW4ENG 72-574
NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)
L-A3882 (0895)
PW V

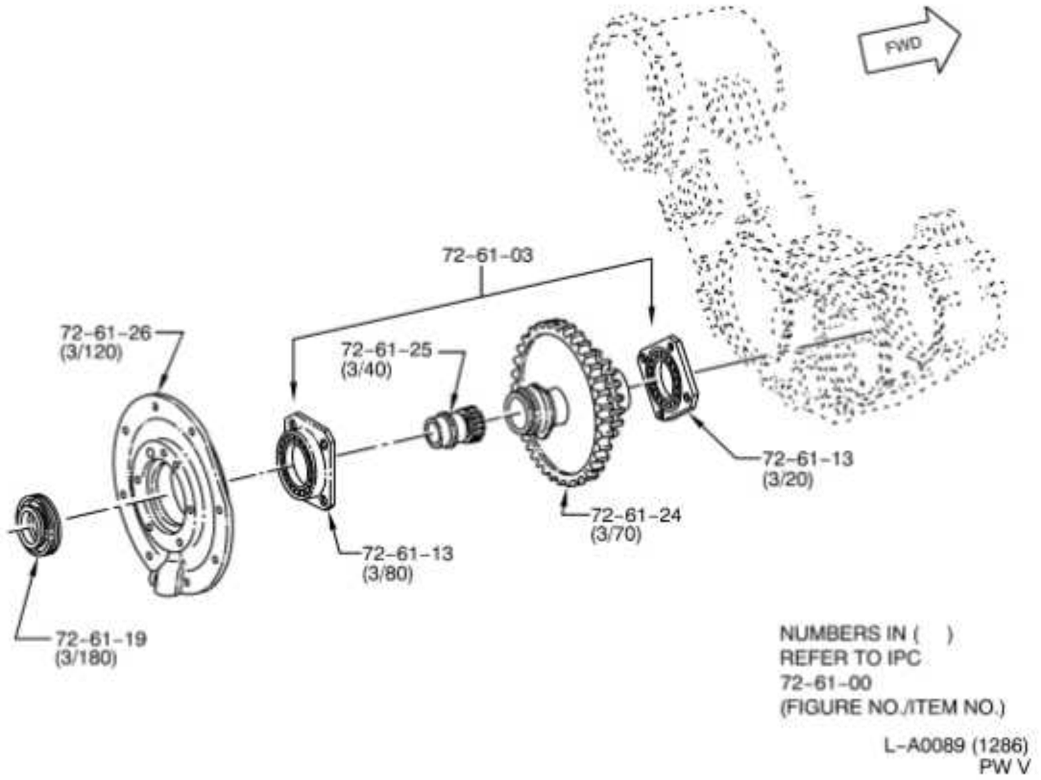
Main Gearbox
Figure 15 (Sheet 3)


FWD
72-61-32
(13/60)
72-61-06
72-61-19
(13/120)
72-61-13
(13/1)
72-61-31
(13/20)
72-61-13
(13/30)
PRE SB PW4ENG 72-574
POST SB PW4ENG 72-574
NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)
L-A2737 (0895)
PW V

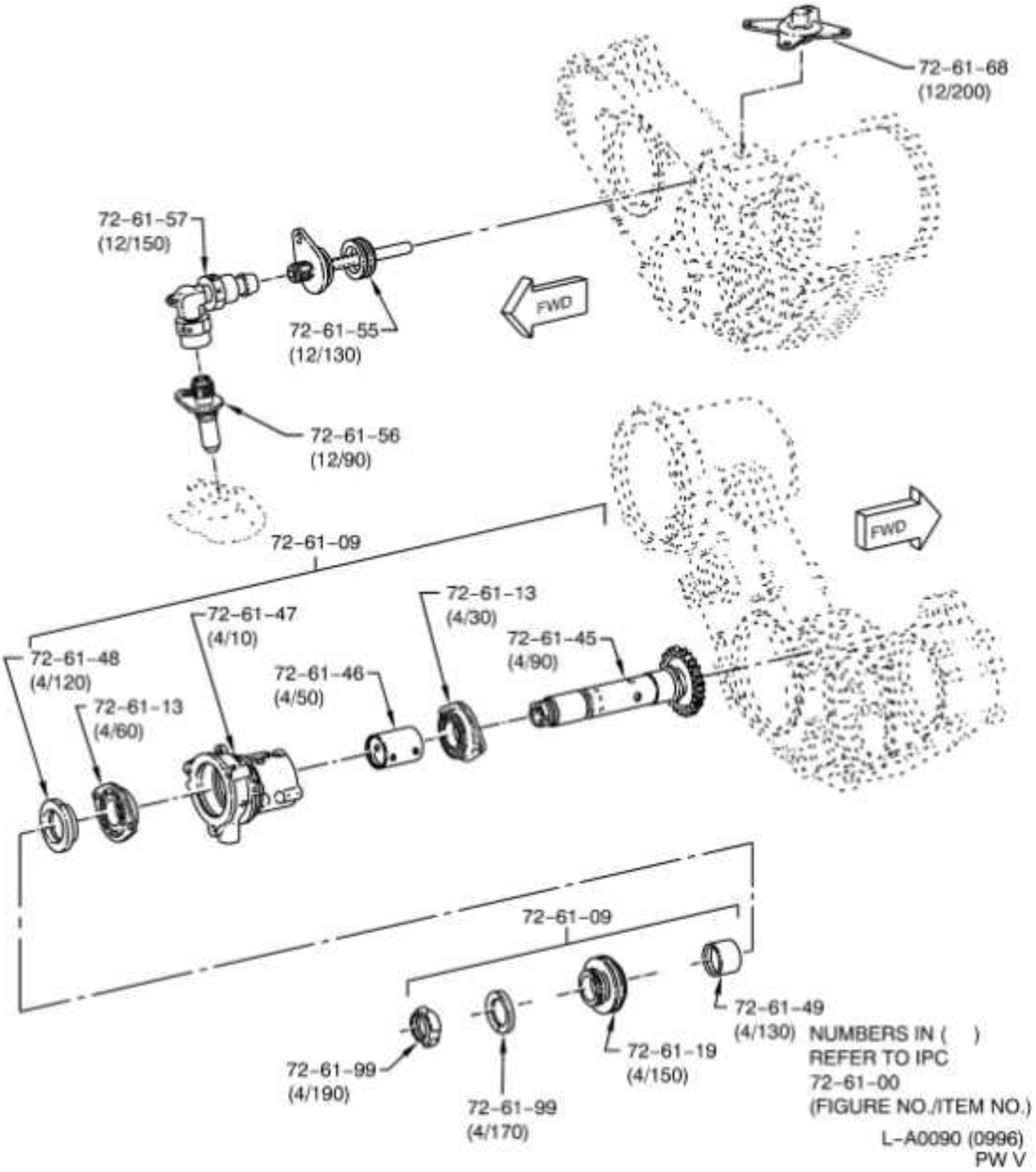
Main Gearbox
Figure 15 (Sheet 4)


FWD
72-61-53
(2/50)
72-61-54
(2/10)
72-61-99
(2/20)
72-61-05
72-61-30
(2/140)
72-61-13
(2/80)
72-61-13
(2/110)
72-61-29
(2/100)
72-61-19
(2/180)
NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)
L-A0088 (0895)
PW V

Main Gearbox
Figure 15 (Sheet 5)

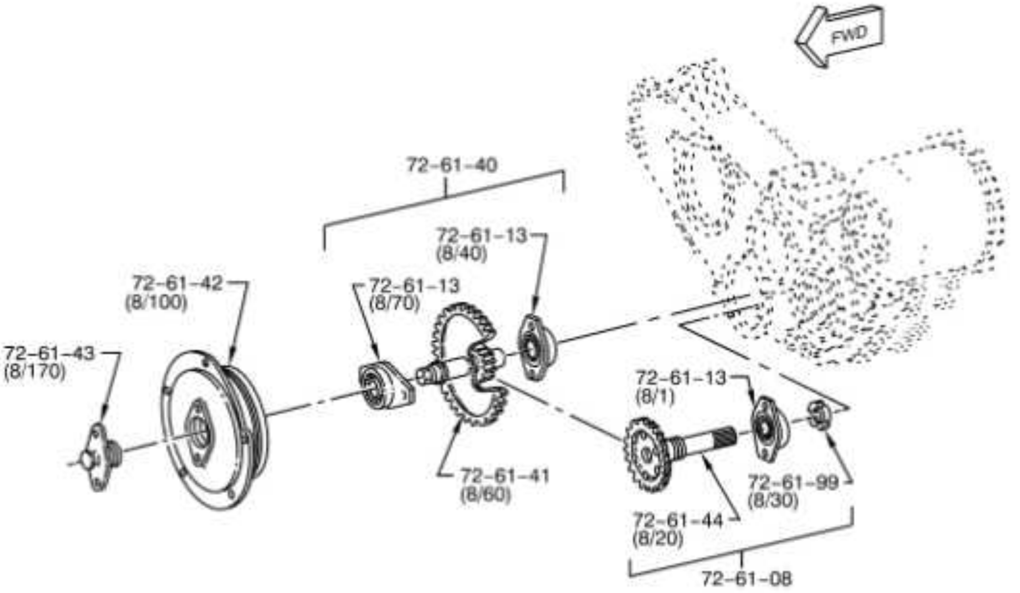

FWD
72-61-03
72-61-26
(3/120)
72-61-25
(3/40)
72-61-13
(3/20)
72-61-24
(3/70)
72-61-13
(3/80)
72-61-19
(3/180)
NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)
L-A0089 (1286)
PW V

Main Gearbox
Figure 15 (Sheet 6)


72-61-68
(12/200)
72-61-57
(12/150)
72-61-55
(12/130)
FWD
72-61-56
(12/90)
72-61-09
FWD
72-61-13
(4/30)
72-61-47
(4/10)
72-61-45
(4/90)
72-61-48
(4/120)
72-61-46
(4/50)
72-61-13
(4/60)
72-61-09
72-61-49
(4/130)
72-61-19
(4/150)
72-61-99
(4/190)
72-61-99
(4/170)
L-A0090 (0996)
PW V

NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)

Main Gearbox
Figure 15 (Sheet 7)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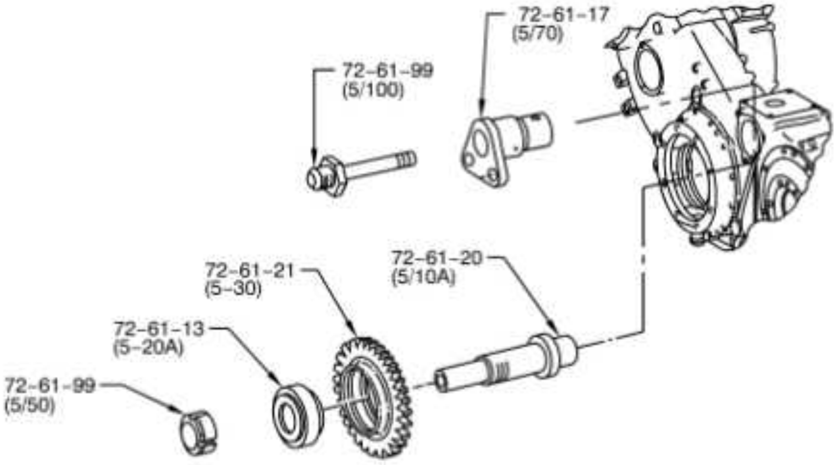
(FIGURE NO./ITEM NO.)

L-A0091 (0996)
PW V

Main Gearbox
Figure 15 (Sheet 8)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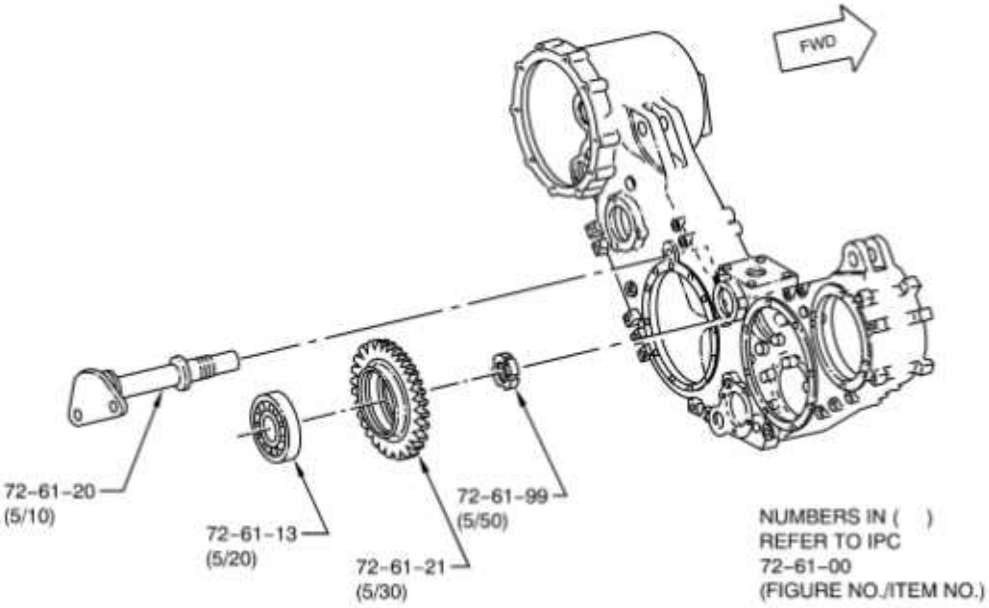
(POST SB PW4ENG 72-491)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REFER TO IPC
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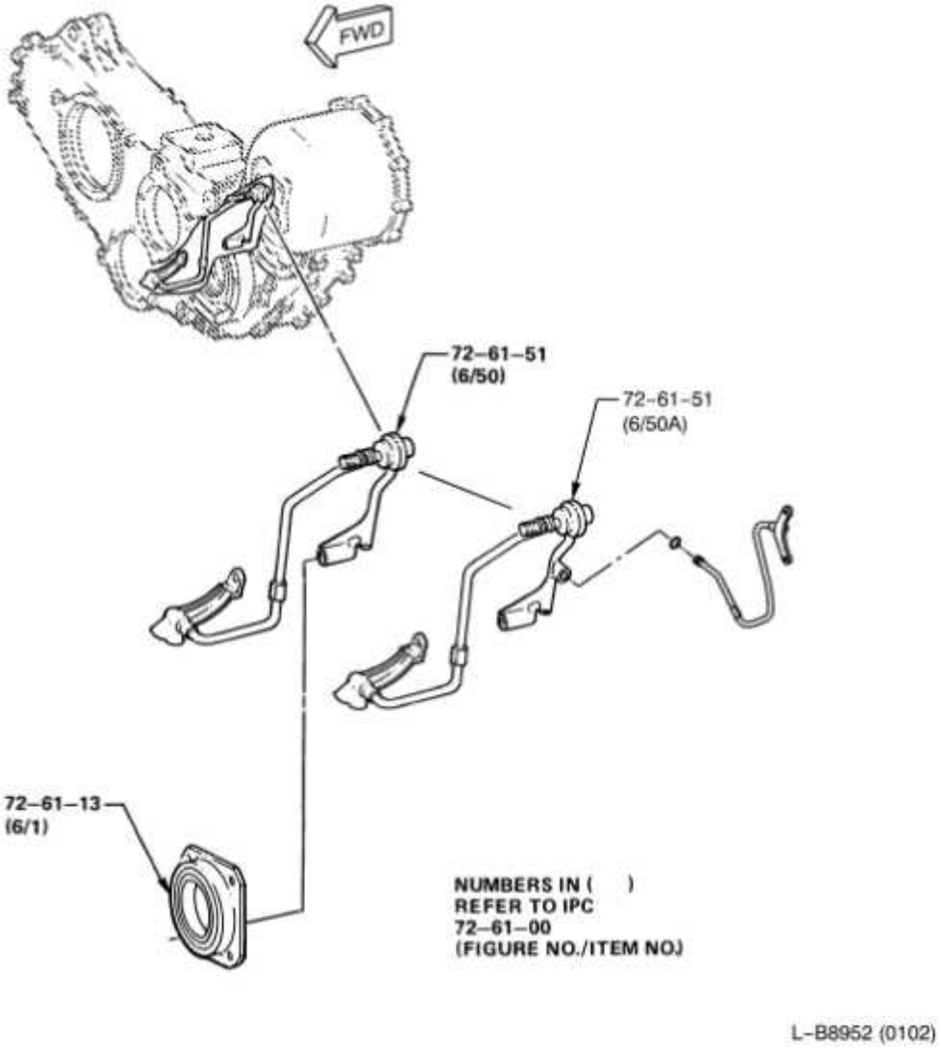
(FIGURE NO./ITEM NO.)

(PPE SB PW4ENG 72-491)

L-A0092 (0895)
PW V

Main Gearbox
Figure 15 (Sheet 9)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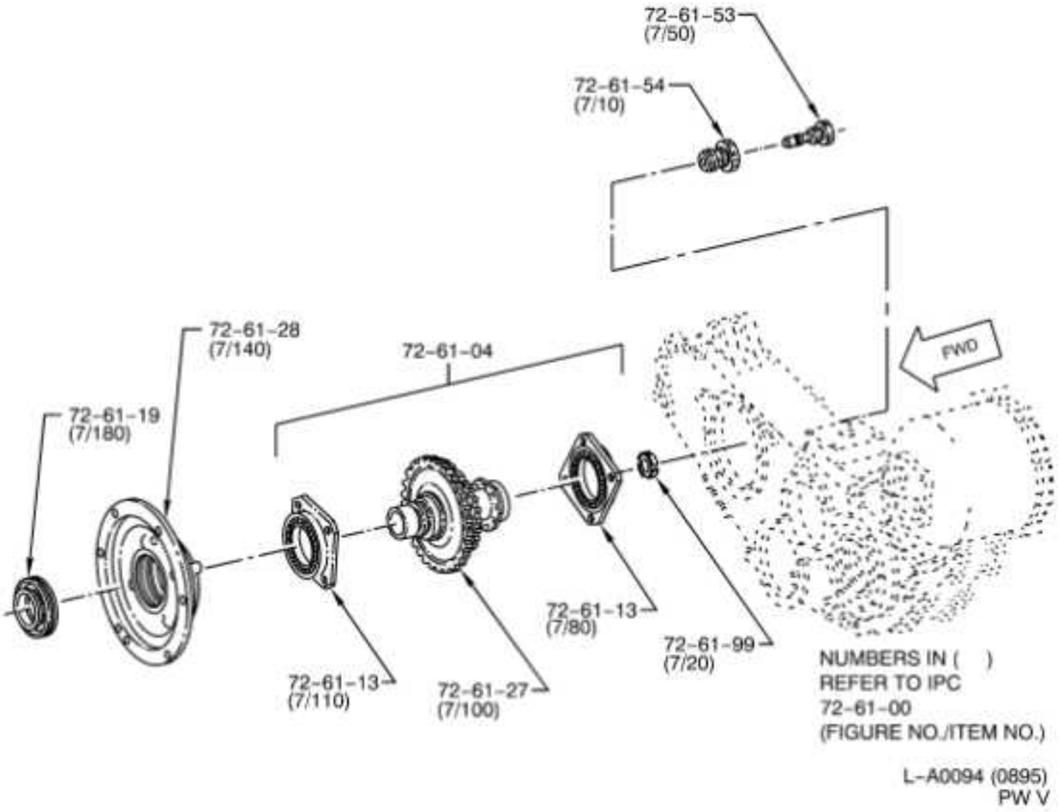
Main Gearbox
Figure 15 (Sheet 10)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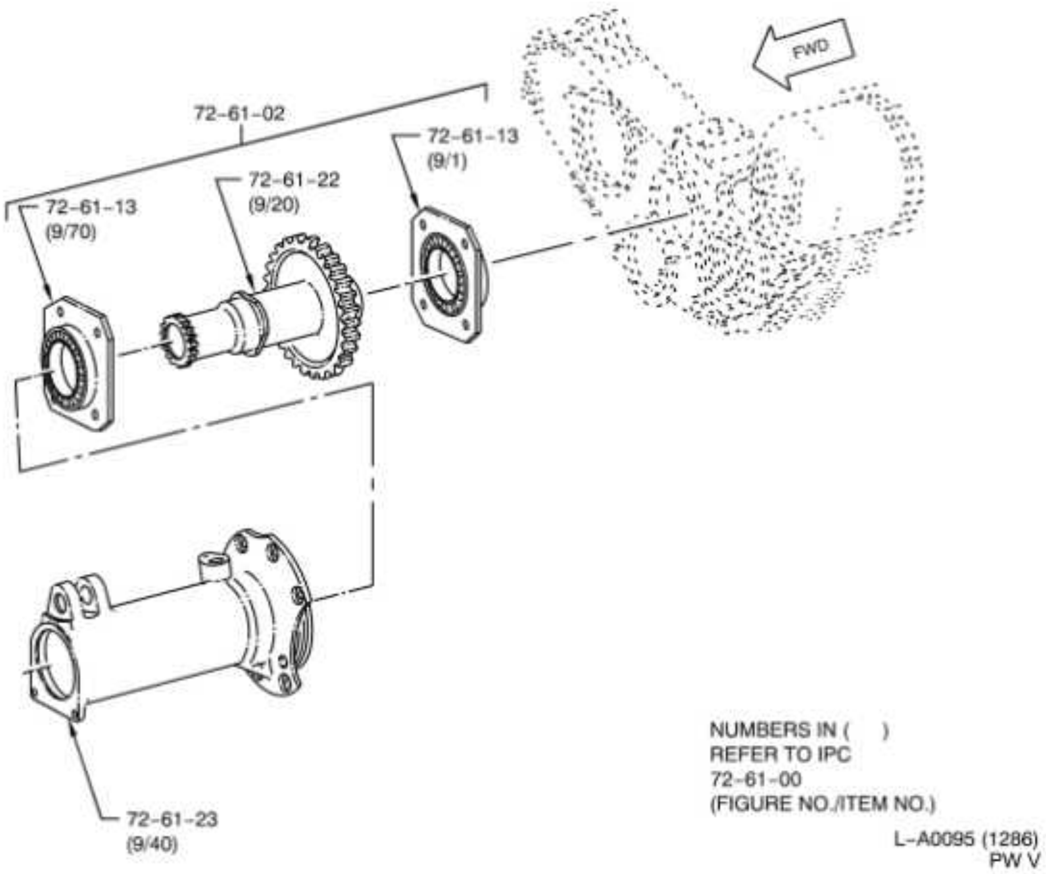
(FIGURE NO./ITEM NO.)
L-A0094 (0895)
PW V

Main Gearbox
Figure 15 (Sheet 11)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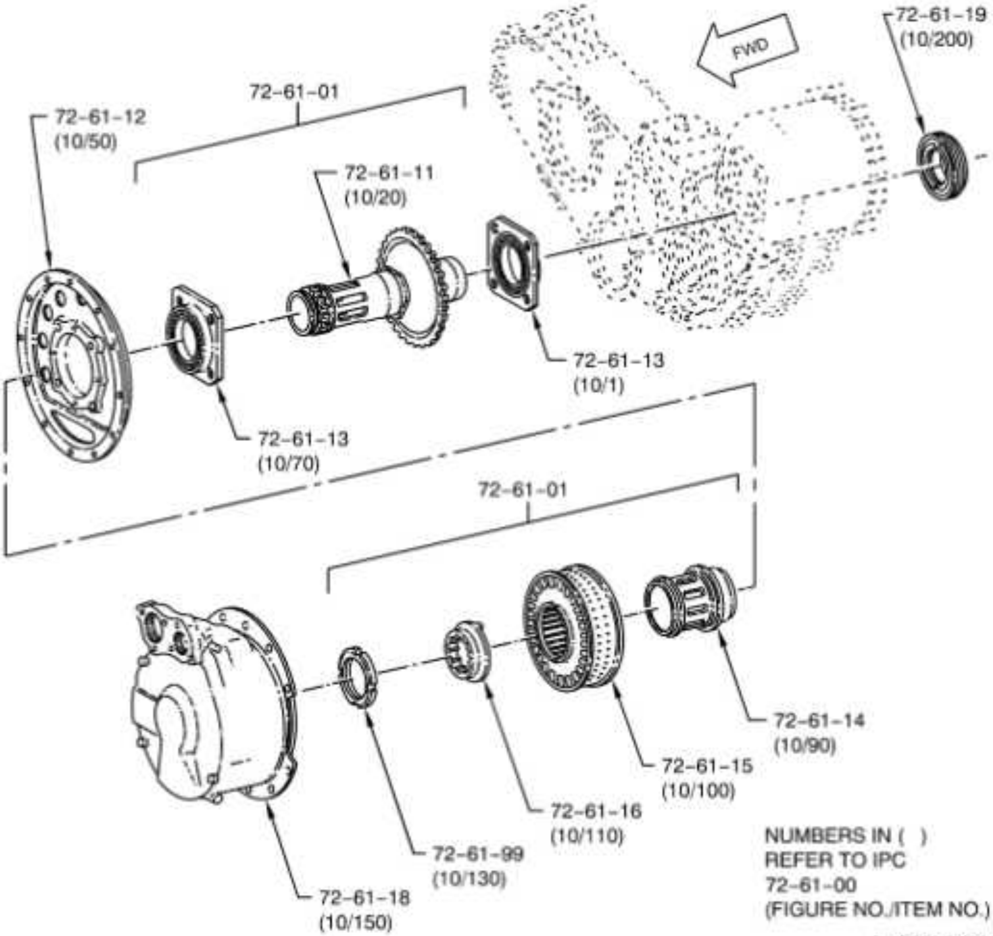
(FIGURE NO./ITEM NO.)
L-A0095 (1286)
PW V

Main Gearbox
Figure 15 (Sheet 12)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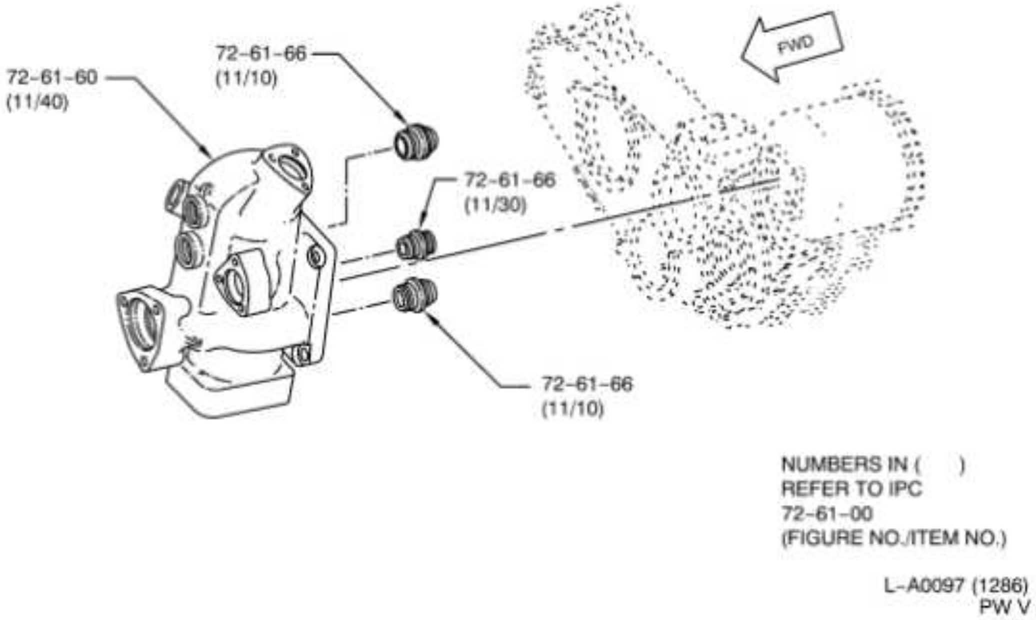
(FIGURE NO./ITEM NO.)

L-A0096 (0895)
PW V

Main Gearbox
Figure 15 (Sheet 13)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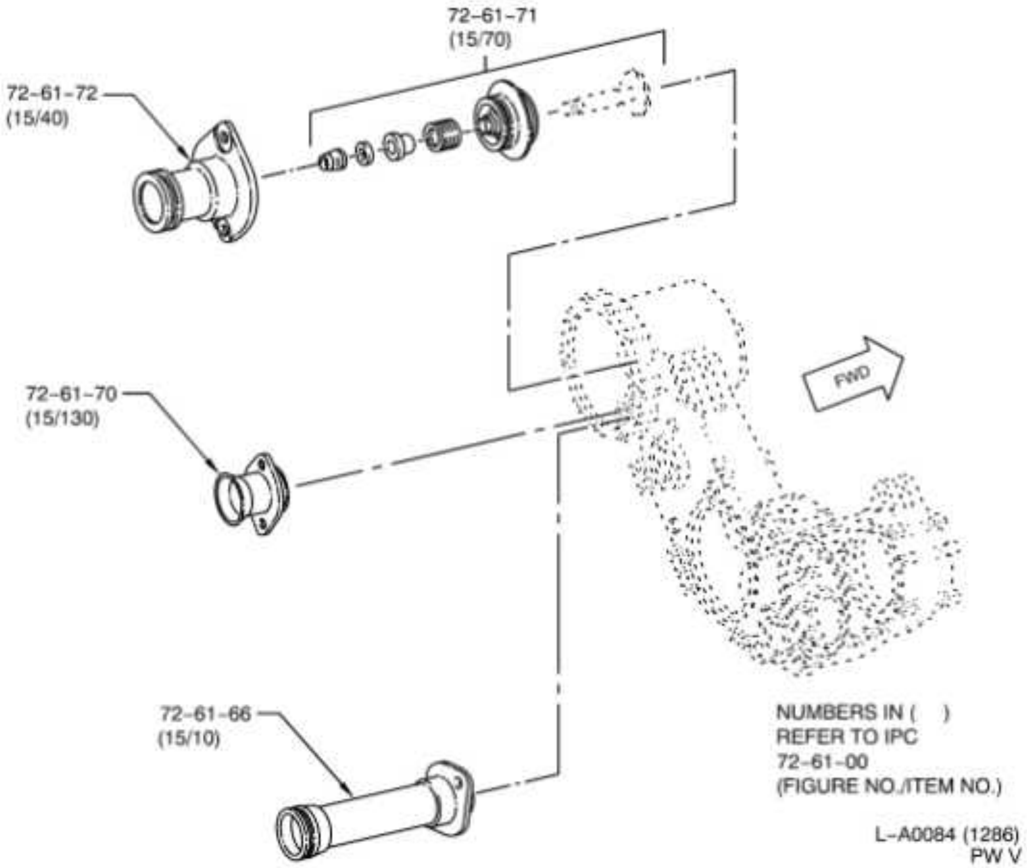
PW V

Main Gearbox
Figure 15 (Sheet 14)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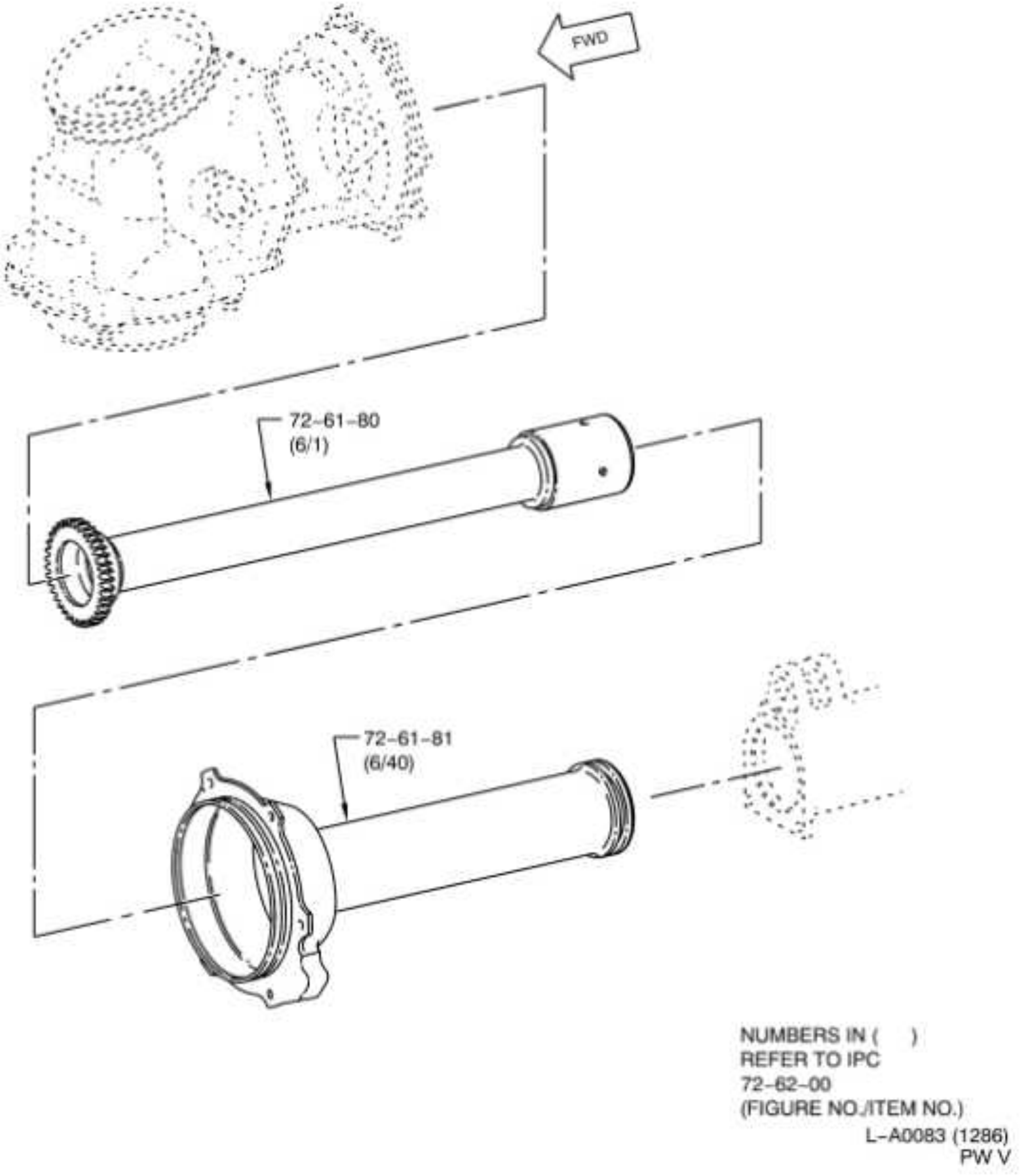
Main Gearbox
Figure 15 (Sheet 15)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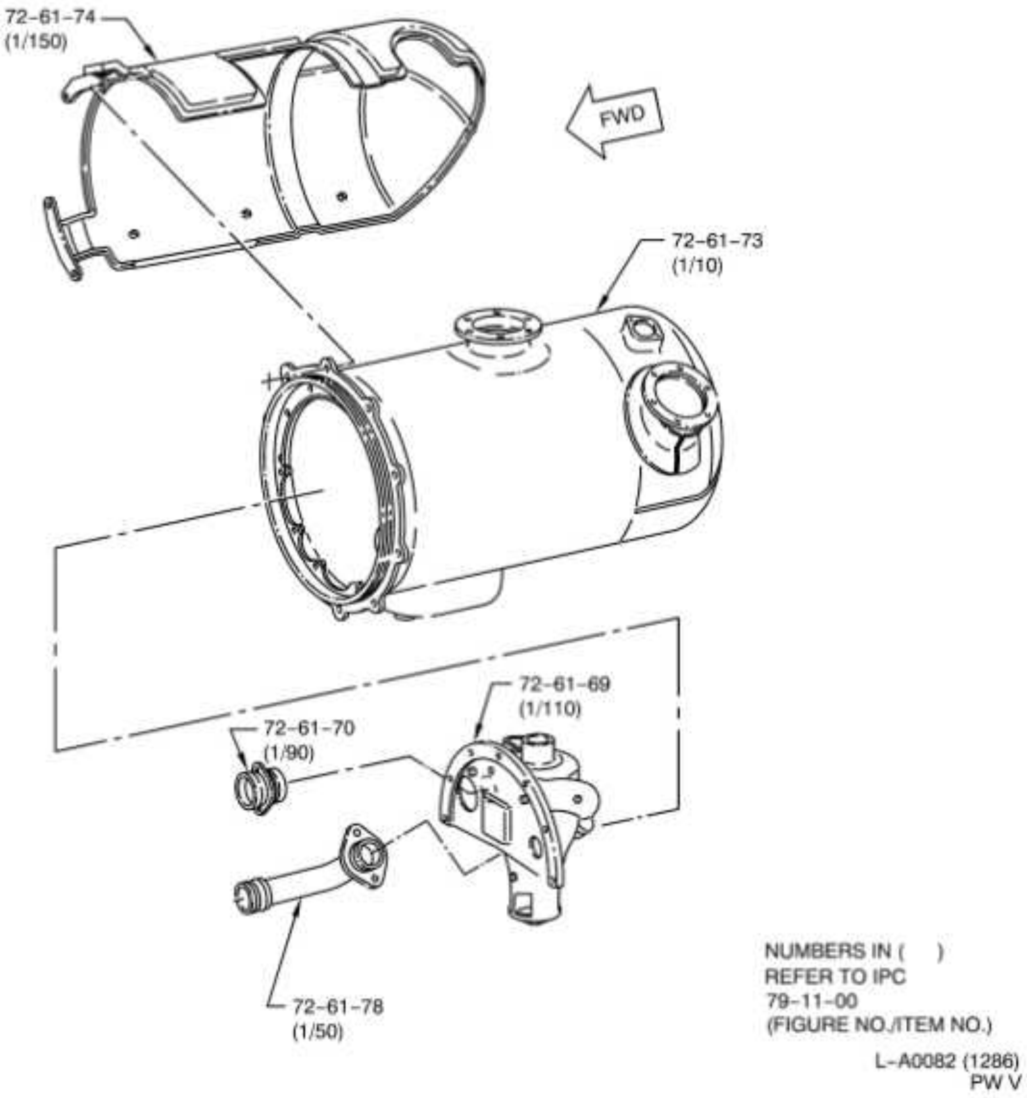
Main Gearbox
Figure 15 (Sheet 16)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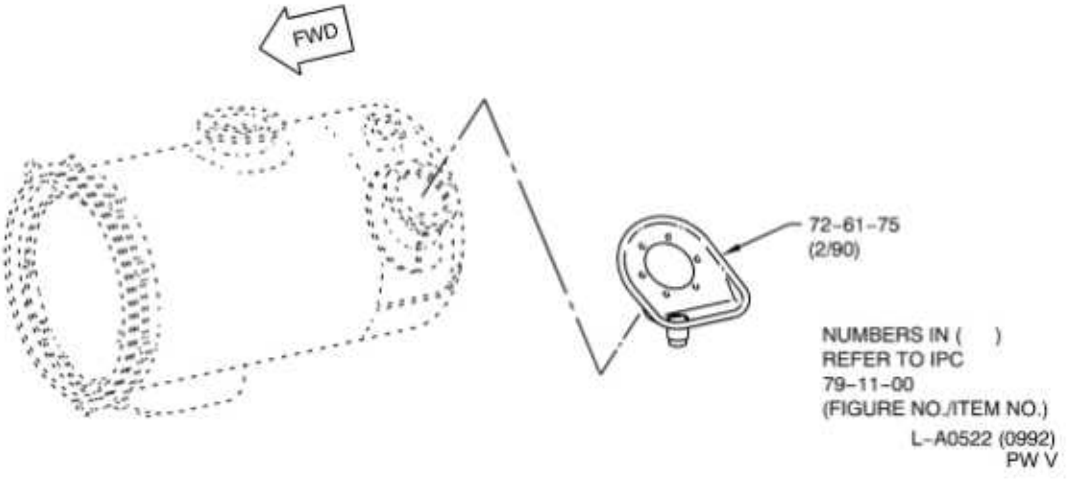
Main Gearbox
Figure 15 (Sheet 17)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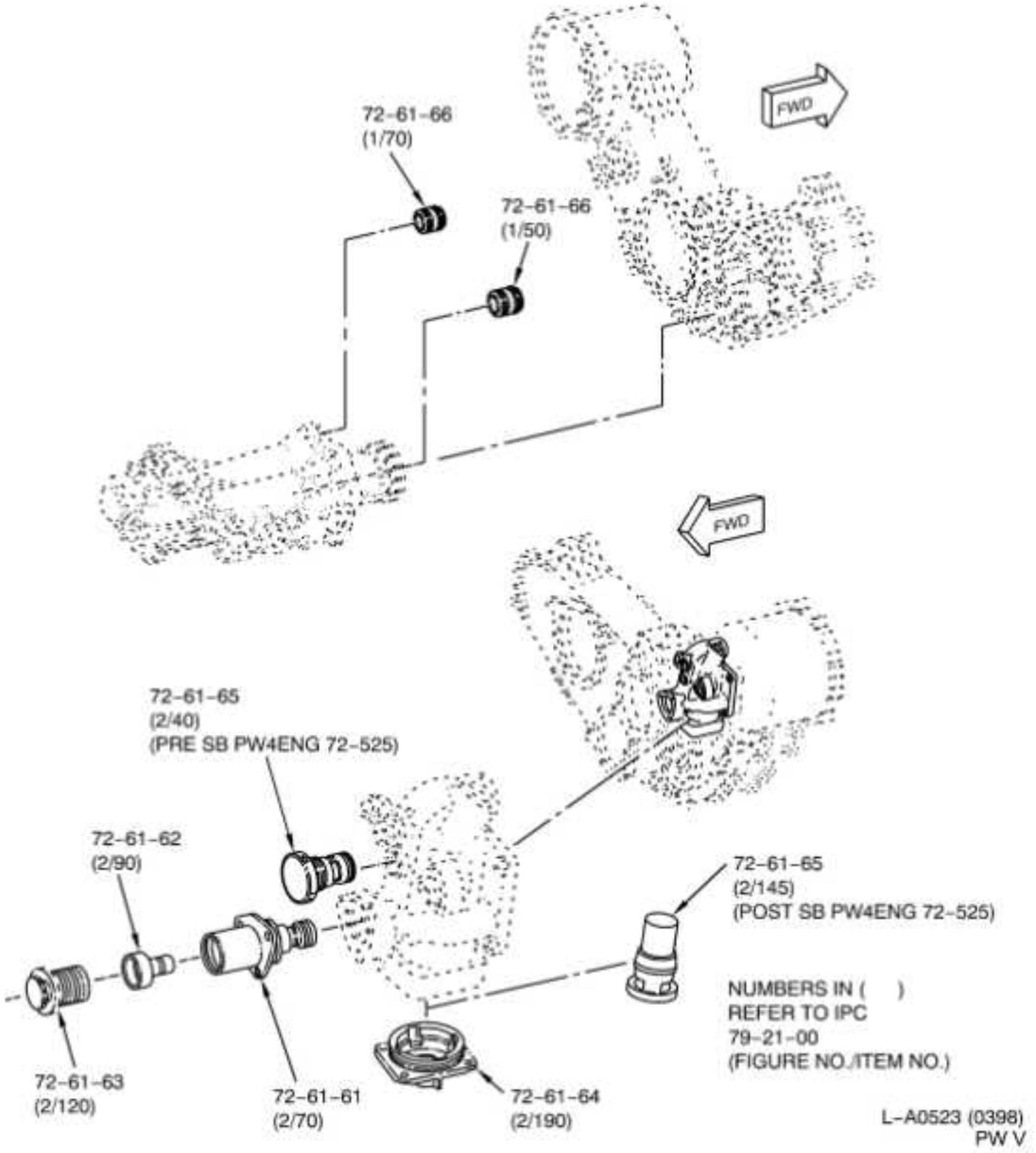
Main Gearbox
Figure 15 (Sheet 18)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72-61-65
(2/145)
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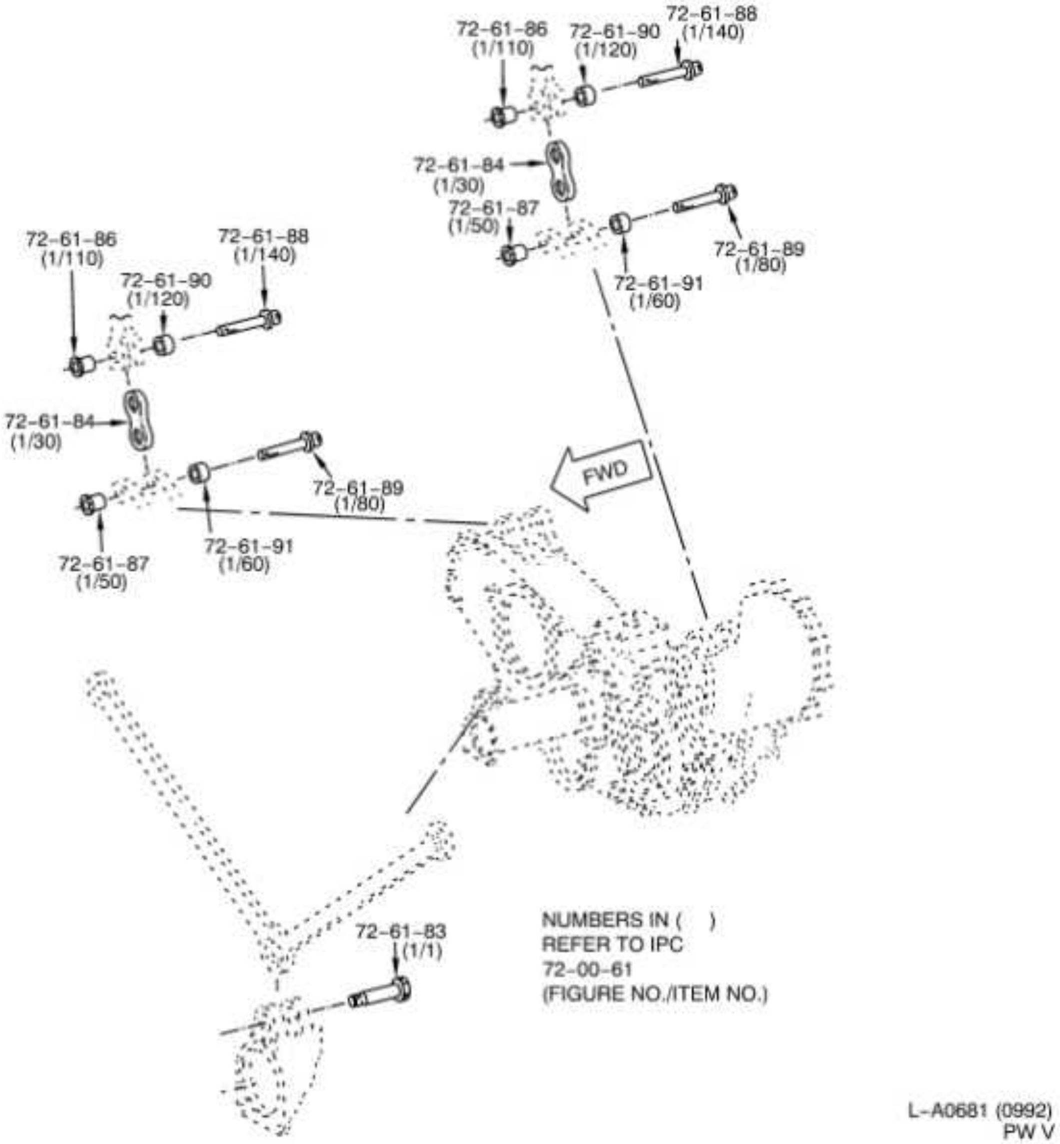
L-A0523 (0398)
PW V

Main Gearbox
Figure 15 (Sheet 19)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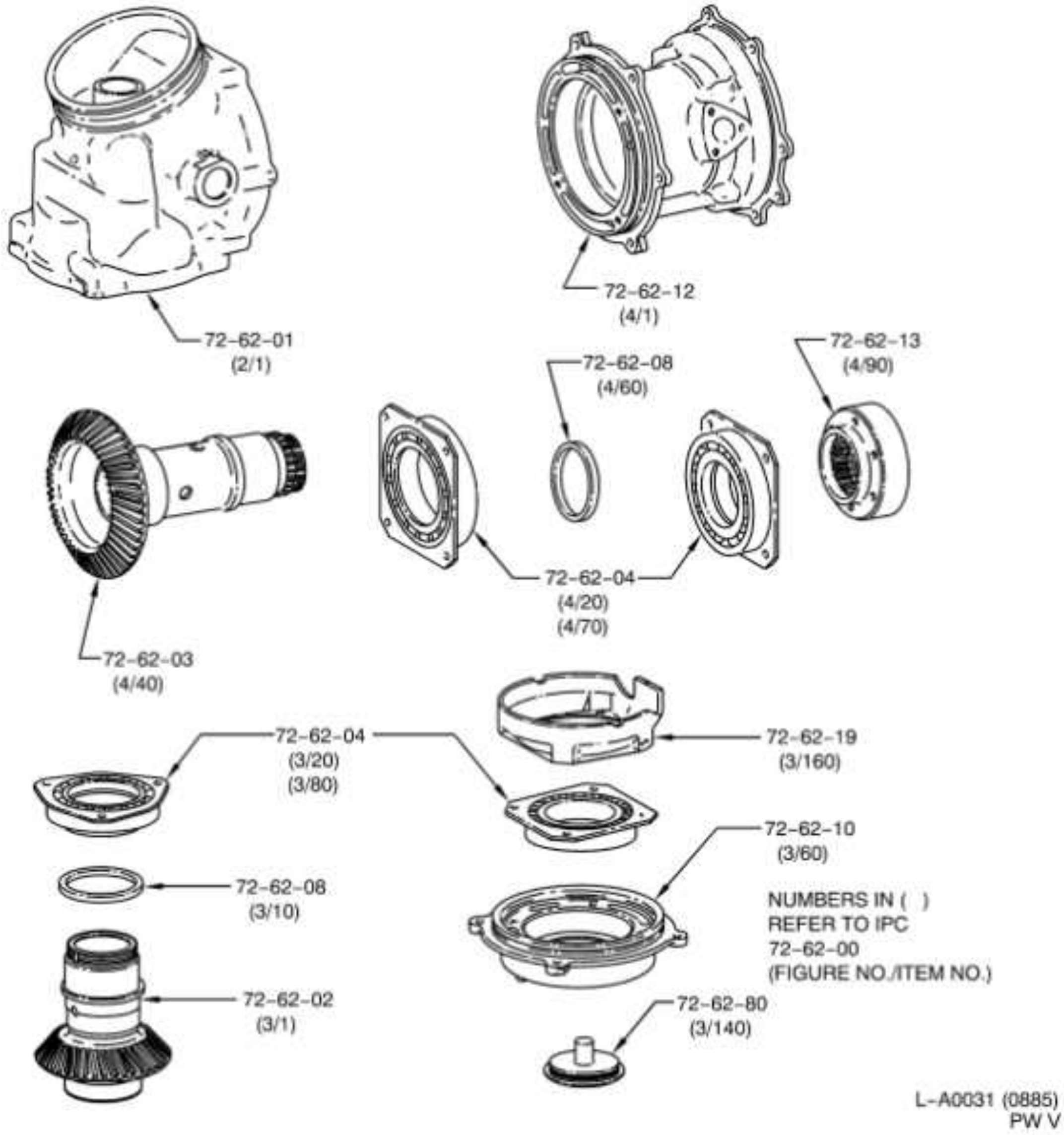
PW V

Main Gearbox
Figure 15 (Sheet 20)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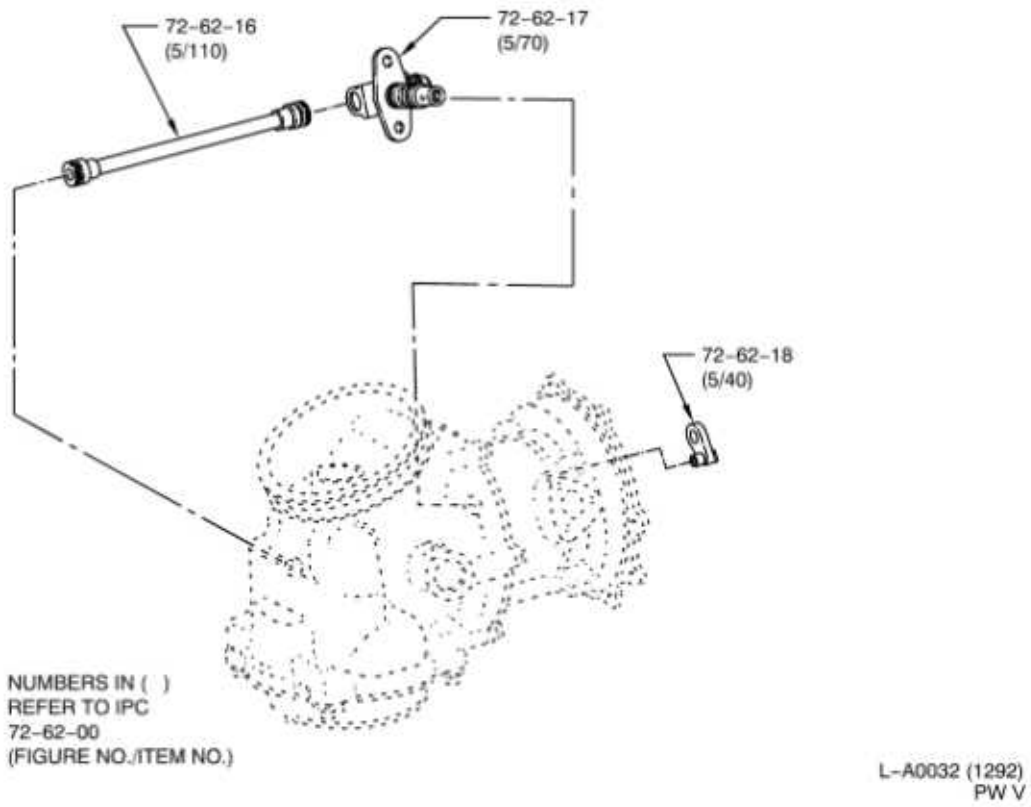
PW V

Angle Gearbox
Figure 16 (Sheet 1)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L-A0032 (1292)
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Angle Gearbox
Figure 16 (Sheet 2)

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                      A  806                        DEC 15/06
                      A  807                        DEC 15/06
                      A  808                        DEC 15/06
                      A  809                        DEC 15/06
                      A  810                        DEC 15/06
                      A  811                        DEC 15/06
                      A  812                        DEC 15/06
                      A  813                        DEC 15/06
                      A  814                        DEC 15/06
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                      A  817/818                    DEC 15/06
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                      A  805                        DEC 15/06
                      A  806                        DEC 15/06
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                      A  804                        DEC 15/06
                      A  805                        DEC 15/06
                      A  806                        DEC 15/06
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TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 82 DATED DECEMBER 15, 2006

HIGHLIGHTS - TIME LIMITS

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
05-10-00 TIME LIMITS	801 -803/ 804	Revised the full procedure. (IEN05KC469A)	4152 4152-3
05-10-00 TIME LIMITS	801 -803/ 804	Revised the full procedure. (IEN05KC469A)	4156A 4156A-3 4158 4158-3
05-10-01 TIME LIMITS	801 -818	Added airworthiness limitations. (IEN05KC469A)	4152 4152-3
05-10-01 TIME LIMITS	801 -817/ 818	Added airworthiness limitations. (IEN05KC469A)	4156A 4156A-3 4158 4158-3
05-10-02 TIME LIMITS	801 -806	Added airworthiness directives. (IEN05KC469A)	4152 4152-3
05-10-02 TIME LIMITS	801 -806	Added airworthiness directives. (IEN05KC469A)	4156A 4156A-3 4158 4158-3
05-10-03 TIME LIMITS	801/ 802	Added time limited dispatch criteria. (IEN05KC469A)	4152 4152-3
05-10-03 TIME LIMITS	801/ 802	Added time limited dispatch criteria. (IEN05KC469A)	4156A 4156A-3 4158 4158-3
05-10-04 TIME LIMITS	801/ 802	Added maintenance advisory notices. (IEN05KC469A)	4152 4152-3

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
05-10-04 TIME LIMITS	801/ 802	Added maintenance advisory notices. (IEN05KC469A)	4156A 4156A-3 4158 4158-3

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TIME LIMITS

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R ## ENGINE - INSTRUCTIONS FOR CONTINUED AIRWORTHINESS - TIME LIMITS

Task 05-10-00-990-013:

R ### 1. Instructions For Continued Airworthiness - General

R A. General

R (1) The information published by Pratt & Whitney in Section 05-10-01, Airworthiness Limitations of this manual identifies the maximum hours and/or cycles that certain parts may operate prior to removal. In addition this section may identify maintenance actions that must be taken at specified intervals. This information is provided in compliance with the United States Code of Federal Regulations, Title 14, Aeronautics and Space, Part 33 - Airworthiness Standards: Aircraft Engines, paragraph 33.4 Appendix A. Paragraph 33.4 Appendix A specifies, in part, that an Airworthiness Limitations section must be provided that is segregated and distinguished from the rest of the text. Information in this section must contain "each mandatory replacement time, structural inspection interval, and related structural inspection procedure, including envelope structural integrity, required for type certification."

R (2) The information supplied by Pratt & Whitney in Section 05-10-01, Airworthiness Limitations of this manual should be utilized in consideration of the clarifying statements provided in paragraph (3)(a). These clarifying statements are consistent with regulatory guidance material provided to all engine manufacturers by the European Aviation Safety Agency. Reference is made to: European Aviation Safety Agency, Certification Specifications for Engines, CS-E Book 2 - Acceptable Means of Compliance, Subpart D - Turbine Engines; Design and Construction, AMC to CS-E515 Engine Critical Parts, effective November 24, 2003.

R (3) Paragraph (3)(a) clarifying statements apply to the life limits provided by Pratt & Whitney in Chapter/Section 05-10-01, Airworthiness Limitations of this manual:

R (a) The following airworthiness limitations have been substantiated based on engineering analysis that assumes this product will be operated and maintained using the procedures and inspections provided in the Instructions for Continued Airworthiness supplied with this product by the Type Certificate holder or its licensees. For engine−critical parts and parts that influence engine−critical parts, any repair, modification, or maintenance procedures not approved by the Type Certificate holder or its licensees, or any substitution of such parts not supplied by the Type Certificate holder or its licensees may materially affect these limits.

CAUTION: THE FOLLOWING STATEMENTS APPLY TO PARTS DEFINED IN CHAPTER/SECTION 05−10−01, AIRWORTHINESS LIMITATIONS AND TO PARTS THAT ARE DIRECTLY ATTACHED TO THE PARTS DEFINED IN CHAPTER/SECTION 05−10−01, AIRWORTHINESS LIMITATIONS.

(4) Pratt & Whitney is unable to state that the information published in Chapter/Section 05−10−01, Airworthiness Limitations of this manual applies to replacement parts, repairs, modifications, or maintenance procedures not developed by, or in partnership with, Pratt & Whitney. Pratt & Whitney does not have access to the approved technical data associated with replacement parts, repairs, modifications, or maintenance procedures not developed by, or in partnership with, Pratt & Whitney. Without analysis of the approved technical data, Pratt & Whitney is unable to state that the data published in Chapter/Section 05−10−01, Airworthiness Limitations of this manual applies. In such situations, the entity responsible for the continued airworthiness of the engine may want to contact the company or person that received approval for the manufacture and /or sale of replacement parts(s) or approval for repairs, modifications, or maintenance procedures, to determine the methodology used to determine that the United States Code of Federal Regulations, Title 14, Aeronautics and Space, Part 33 − Airworthiness Standards: Aircraft Engines continues to be met, and to determine the appropriate life limitations for continued use of the part(s).

R ENGINE − INSTRUCTIONS FOR CONTINUED AIRWORTHINESS − TIME LIMITS

Task 05−10−00−990−015:

R 2. Instructions For Airworthiness Limitations − General

R A. Airworthiness Limitations

R (1) Refer to Chapter/Section 05−10−01 of this Manual for information that sets forth those parts that must be replaced on a mandatory basis upon the expiration of the Flight Cycles stated therein.

R B. Airworthiness Directives

R (1) Refer to Chapter/Section 05−10−02 of this Manual for information on Airworthiness Directives. This section gives information which associates the Airworthiness Directive with the subject matter and the related Pratt & Whitney Service Bulletin. This information is cross−referenced with the use of the tabular format.

R C. Time Limited Dispatch Criteria

R (1) Refer to Chapter/Section 05−10−03 of this Manual for information on Time Limited Dispatch Criteria. These criteria exist as dispatch and maintenance requirements for the engine control system. This section provides restrictions on the maximum operating intervals.

R D. Maintenance Advisory Notices (MANs)

R (1) Refer to Chapter/Section 05−10−04 of this Manual for information on Maintenance Advisory Notices (MANs). This is an advisory (not a mandatory directive) that gives the operator information on recommended maintenance actions of a repetitive nature. It also provides an implementation procedure which cites the necessary material resources.

ENGINE - INSTRUCTIONS FOR CONTINUED AIRWORTHINESS - TIME LIMITS

Task 05-10-00-990-031:

1. Instructions For Continued Airworthiness - General

A. General

(1) The information published by Pratt & Whitney in Section 05-10-01, Airworthiness Limitations of this manual identifies the maximum hours and/or cycles that certain parts may operate prior to removal. In addition this section may identify maintenance actions that must be taken at specified intervals. This information is provided in compliance with the United States Code of Federal Regulations, Title 14, Aeronautics and Space, Part 33 - Airworthiness Standards: Aircraft Engines, paragraph 33.4 Appendix A. Paragraph 33.4 Appendix A specifies, in part, that an Airworthiness Limitations section must be provided that is segregated and distinguished from the rest of the text. Information in this section must contain "each mandatory replacement time, structural inspection interval, and related structural inspection procedure, including envelope structural integrity, required for type certification."

(2) The information supplied by Pratt & Whitney in Section 05-10-01, Airworthiness Limitations of this manual should be utilized in consideration of the clarifying statements provided in paragraph (3)(a). These clarifying statements are consistent with regulatory guidance material provided to all engine manufacturers by the European Aviation Safety Agency. Reference is made to: European Aviation Safety Agency, Certification Specifications for Engines, CS-E Book 2 - Acceptable Means of Compliance, Subpart D - Turbine Engines; Design and Construction, AMC to CS-E515 Engine Critical Parts, effective November 24, 2003.

(3) Paragraph (3)(a) clarifying statements apply to the life limits provided by Pratt & Whitney in Chapter/Section 05-10-01, Airworthiness Limitations of this manual:

(a) The following airworthiness limitations have been substantiated based on engineering analysis that assumes this product will be operated and maintained using the procedures and inspections provided in the Instructions for Continued Airworthiness supplied with this product by the Type Certificate holder or its licensees. For engine-critical parts and parts that influence engine-critical parts, any repair, modification, or maintenance procedures not approved by the Type Certificate holder or its licensees, or any substitution of such parts not supplied by the Type Certificate holder or its licensees may materially affect these limits.

CAUTION: THE FOLLOWING STATEMENTS APPLY TO PARTS DEFINED IN CHAPTER/SECTION 05-10-01, AIRWORTHINESS LIMITATIONS AND TO PARTS THAT ARE DIRECTLY ATTACHED TO THE PARTS DEFINED IN CHAPTER/SECTION 05-10-01, AIRWORTHINESS LIMITATIONS.

(4) Pratt & Whitney is unable to state that the information published in Chapter/Section 05-10-01, Airworthiness Limitations of this manual applies to replacement parts, repairs, modifications, or maintenance procedures not developed by, or in partnership with, Pratt & Whitney. Pratt & Whitney does not have access to the approved technical data associated with replacement parts, repairs, modifications, or maintenance procedures not developed by, or in partnership with, Pratt & Whitney. Without analysis of the approved technical data, Pratt & Whitney is unable to state that the data published in Chapter/Section 05-10-01, Airworthiness Limitations of this manual applies. In such situations, the entity responsible for the continued airworthiness of the engine may want to contact the company or person that received approval for the manufacture and /or sale of replacement parts(s) or approval for repairs, modifications, or maintenance procedures, to determine the methodology used to determine that the United States Code of Federal Regulations, Title 14, Aeronautics and Space, Part 33 − Airworthiness Standards: Aircraft Engines continues to be met, and to determine the appropriate life limitations for continued use of the part(s).

R ENGINE − INSTRUCTIONS FOR CONTINUED AIRWORTHINESS − TIME LIMITS

Task 05−10−00−990−011:

R 2. Instructions For Airworthiness Limitations − General

R A. Airworthiness Limitations

R (1) Refer to Chapter/Section 05−10−01 of this Manual for
R information that sets forth those parts that must be
R replaced on a mandatory basis upon the expiration of
R the Flight Cycles stated therein.

R B. Airworthiness Directives

R (1) Refer to Chapter/Section 05−10−02 of this Manual for
R information on Airworthiness Directives. This section
R gives information which associates the Airworthiness
R Directive with the subject matter and the related Pratt
R & Whitney Service Bulletin. This information is
R cross−referenced with the use of the tabular format.

R C. Time Limited Dispatch Criteria

R (1) Refer to Chapter/Section 05−10−03 of this Manual for
R information on Time Limited Dispatch Criteria. These
R criteria exist as dispatch and maintenance requirements
R for the engine control system. This section provides
R restrictions on the maximum operating intervals.

R D. Maintenance Advisory Notices (MANs)

R (1) Refer to Chapter/Section 05−10−04 of this Manual for
R information on Maintenance Advisory Notices (MANs).
R This is an advisory (not a mandatory directive)
R that gives the operator information on recommended
R maintenance actions of a repetitive nature. It also
R provides an implementation procedure which cites the
R necessary material resources.

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R ENGINE - AIRWORTHINESS LIMITATIONS - TIME LIMITS

R Task 05-10-01-990-001:

R 1. Airworthiness Limitations

R A. The Airworthiness Limitations section is FAA approved
R and specifies maintenance required under sections 43.16
R and 91.403 of the Federal Aviation Regulations unless an
R alternative program has been FAA approved.

R B. See Paragraph 2. for Mixed Model Management Of Rotating
R Parts

R C. See Paragraph 3. for Hourly Limited Parts

R D. See Paragraph 4. for Life Cycles For Models

R E. See Paragraph 5. for Critical Life Limited Part Inspection

R F. See Paragraph 6. for Rotating Part Life Limits

R Task 05-10-01-990-002:

R 2. Mixed Model Management Of Rotating Parts

R A. Service life cycle limits for rotating parts used across
R PW4000 Engine Models can be calculated by one of the
R following methods:

R (1) Method 1. This method requires a record of the PW4000
R Engine Models on which the rotating part was used.
R And, if applicable, the THRUST LEVEL at which those
R engine models were operated.

R (a) In the following tables, find the life cycles
R listed for each of the engine models the part was
R used on. Assign the LOWEST cycle limit to that
R part.

R (b) If the rotating part was operated across PW4000
R engine models at varying THRUST LEVELS, assign the
R life cycle limit for the engine model run at the
R higher THRUST. Remember, the LOWEST life cycle...
R highest THRUST LEVEL prevails, EXCEPT if records
R prove the part was never run on a given model, or
R never subjected to the higher THRUST LEVEL.

R (2) Method 2. This method provides a formula for
R determining, on a prorated basis, the TOTAL life cycle
R limit for a part used on more than one PW4000 Model.
R See Figure 801.

R ENGINE - AIRWORTHINESS LIMITATIONS - TIME LIMITS

$$1.00 - \left[\frac{\text{Model 1 Cycles}}{\text{Model 1 Certified Cycles}}\right] - \left[\frac{\text{Model 2 Cycles}}{\text{Model 2 Certified Cycles}}\right] - \left[\frac{\text{Model N Cycles}}{\text{Model N Certified Cycles}}\right] = 0$$

(a) For example: If a disk has accumulated 6000 Cycles in Model 1 (certified for 20000 Cycles) , and 4500 Cycles in Model 2 (certified for 15000 Cycles) , the remaining life in either model would be determined by transposing the above equation as follows:

- $$\text{Remaining Model 1 Cycles} = \left[\text{Model 1 Certified Cycles}\right] - \left[\frac{(\text{Model 1 Cycles})\ (\text{Model 1 Certified Cycles})}{\text{Model 1 Certified Cycles}}\right] - \left[\frac{(\text{Model 2 Cycles})\ (\text{Model 1 Certified Cycles})}{\text{Model 2 Certified Cycles}}\right]$$

- $$\text{Remaining Model 2 Cycles} = \left[\text{Model 2 Certified Cycles}\right] - \left[\frac{(\text{Model 2 Cycles})\ (\text{Model 2 Certified Cycles})}{\text{Model 2 Certified Cycles}}\right] - \left[\frac{(\text{Model 1 Cycles})\ (\text{Model 2 Certified Cycles})}{\text{Model 1 Certified Cycles}}\right]$$

Inserting proper values for this example:

- $$\text{Remaining Model 1 Cycles} = \left[20000\right] - \left[\frac{(6000)\ (20000)}{20000}\right] - \left[\frac{(4500)\ (20000)}{15000}\right] = 8000$$

- $$\text{Remaining Model 2 Cycles} = \left[15000\right] - \left[\frac{(4500)\ (15000)}{15000}\right] - \left[\frac{(6000)\ (15000)}{20000}\right] = 6000$$

L-D3483 (0806)
PW V

R Mixed Model Rotating Part Life Formula
R Figure 801
R (Task 05-10-01-990-002)

ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

Task 05−10−01−990−003:

3. Hourly Limited Parts

A. In establishing and reporting time on hourly limited parts, time is defined as that accumulated time from the moment an aircraft leaves the surface of the earth until it touches it at the next point of landing.

The cycle limits associated with specific part numbers contained in the following tables were submitted to and accepted by the Federal Aviation Administration (FAA) as part of Pratt & Whitney engine certification documentation for the engine models which utilize these parts. The listed part numbers are either detail parts or part assemblies.

If the part is an assembly, the word "Assy" appears in the PART NO. column. If the part is an assembly, the assembly part number is provided and the associated detail part number appears indented (.xxxx) directly below the assembly part number. This detail part number is the part within the assembly which is structurally associated with the cycle limit even though the cycle limit may appear next to the assembly part number.

If the documentation submitted to the FAA specified the cycle limit next to the assembly part number, the cycle limit will appear next to the assembly part number and the word "Reference" will appear next to the detail part number. In this situation, the detail part number carries the same cycle limit as the assembly part number. If the documentation submitted to the FAA specified the cycle limit next to the detail part number, the cycle limit will appear next to the detail part number and the word "Reference" will appear next to the assembly part number. In this situation, the assembly part number carries the same cycle limit as the detail part number.

Detail parts of assemblies, unless listed in the following tables, do not carry a cycle limit. Example: If a disk assembly has mechanically attached parts such as fasteners, metering plugs or balance weights, the cycle limit tables show a cycle limit for the disk assembly and the detail disk is shown as a "Reference". The attached parts are not listed in the tables and are not cycle limited. The disk assembly and the disk must both comply with the cycle limit shown in the table.

Task 05-10-01-990-004:

4. Life Cycles for Models

A. Hardware found on modified models listed below have the same cyclic life as the corresponding base model or (-3) model, as applicable, unless specified differently.

(1) Life limited hardware used on the base model can also be used on the modified models listed below through the listed service bulletin:

BASE MODEL	MODIFIED MODEL
	SB PW4ENG 72-516
PW4152	PW4152 (-1C/-1E)

(2) Life limited hardware used on Phase III "(-3)" engines as built by Pratt & Whitney can also be used on the modified models listed below through the listed service bulletin:

BASE MODEL	MODIFIED MODEL
Phase III (-3) ENGINES AS BUILT BY PRATT & WHITNEY OR CONVERTED PHASE III ENGINES BY SB PW4ENG 72-572	
	SB PW4ENG 73-150
PW4152 (-3)	PW4152 (-3A)

(3) This document is Part Number/Cycle Max Replace At based and is not base upon engine model designation other than to denote thrust level.

Task 05-10-01-990-005:

5. Critical Life Limited Part Inspection

A. Inspection Requirement

(1) This section has the definitions for the individual engine piece part opportunity and the inspection procedures which are necessary when these parts are removed from the engine.

(2) For the purposes of these mandatory enhanced inspections, piece part opportunity means:

(a) The part is considered completely disassembled when accomplished in accordance with the disassembly instructions in the engine manual to either the part detail or part assembly level part numbers for the parts listed in the Table; and

(b) The part has accumulated more than 100 cycles in service since the last piece part opportunity inspection, provided that the part was not damaged by or related to the cause for its removal from the engine.

(3) The inspections specified in this section do not replace or make not necessary other recommended inspections for these parts or other parts.

B. Parts Requiring Inspection:

DESCRIPTION	PART NUMBER	CIR MANUAL SECTION	CIR MANUAL INSPECTION	CIR MANUAL
Hub, Front Compressor	ALL	72−31−07	I/C−02	PN 51A357

NOTE: FAA Airworthiness Directive 2005−25−09 (Effective June 12,2006) mandates compliance with PW4000 Series Engine CIR Manual (PN 51A357), 72−31−07, Inspection/Check−02 CONFIG−1, (Task 72−31−07−200−002) (Non−Destructive Inspection − Front Compressor Hub Assembly).

DESCRIPTION	PART NUMBER	CIR MANUAL SECTION	CIR MANUAL INSPECTION	CIR MANUAL
Hub, Turbine Front (Stage 1)	ALL	72−52−05	I/C−02	PN 51A357
Hub, Turbine Intermediate Rear (Stage 2)	All	72−52−06	I/C−02	PN 51A357
Disk, Stage 5	All	72−35−06	I/C−02	PN 51A357
Disk, Drum Rotor Stage (6 Thru 12)	All	72−35−07	I/C−02	PN 51A357

(CONTINUED)

DESCRIPTION	PART NUMBER	CIR MANUAL SECTION	CIR MANUAL INSPECTION	CIR MANUAL
Disk, Drum Rotor (Stages 13, 14 And 15)	All	72–35–08 (See Note 1)	I/C–02	PN 51A357
Disk, Drum Rotor (Stages 13, 14 And 15)	All	72–35–10 (See Note 2)	I/C–02	PN 51A357
Disk, LPT Stage 3	All	72–53–13	I/C–02	PN 51A357
Disk, LPT Stage 4	All	72–53–14	I/C–02	PN 51A357
Hub, Rear Turbine Stage 5	All	72–53–15	I/C–02	PN 51A357
Disk, LPT Stage 6	All	72–53–16	I/C–02	PN 51A357

NOTE: (1) Applicable for the PW4152 engine model and engines incorporating SB PW4ENG 72–572 only.

NOTE: (2) Applicable for the PW4152–3 engine model only.

Task 05–10–01–990–006:

6. Rotating Part Life

Table 801, Table 802, Table 803, Table 804, and Table 805.

A. Service life is limited to, and must not exceed the cycles, specified in the following tables. If the rotating part has been used in more than one engine model, refer to Paragraph 4.

R ENGINE - AIRWORTHINESS LIMITATIONS - TIME LIMITS

R B. In establishing and reporting cycles accumulated on cyclically limited parts, cycles are defined as any flight consisting of one take-off and landing regardless of length of flight or whether or not thrust reverser (if so equipped) was used. For further clarification, Refer to Task 70-30-00-200-002, Section 70-30-00, General-01 in the Standard Practices Manual.

R C. In computing rotating part life, calculations must include cycles since time of manufacture. Changes to part life cycle limits resulting from reoperation, use in different thrust level engines, or for any other reason, must be calculated on the basis of total cycles.

R D. All life cycle limits indicate total cycles accumulated prior to and subsequent to reoperation and reidentification.

R E. The information in the following tables is not intended as authority for interchangeability. Refer to applicable service bulletins for interchangeability information.

R ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

	REF NO.	DESCRIPTION	PART NO.	CYCLES MAX REPLACE AT
R	1630	Hub, Front Compressor	50B221 Assy	20,000
R			·50B201 Hub	Reference
R			50B321 Assy	20,000
R			·50B301 Hub	Reference
R			53B021 Assy	20,000
R			·53B201 Hub	Reference
R	1631	Disk, Drum Rotor	50B422	20,000
R		(Stages 1.6, 2, 3 and 4)	51B022−01	20,000
R			(b) 51B022−101	20,000
R			(a) 50B422−001	20,000
R			(a) 50B422−002	20,000
R			(a) 50B422−003	20,000
R			(a) 50B422−004	20,000
R			(b) 50B422−005	20,000
R			53B200−01	20,000
R	1626	Disk, Stage 1.6	·51B816	20,000
R			·51B022−02	20,000
R	1627	Disk, Stage 2	·50B302	20,000
R			·51B022−03	20,000
R			·53B200−03	20,000
R	1628	Disk, Stage 3	·50B403	20,000
R			·51B022−04	20,000
R	1629	Disk, Stage 4	·50B404	20,000
R			·51B022−05	20,000

R NOTE: (a) Part numbers obtained by reidentification in SB PW4ENG 72−738.

R NOTE: (b) Part numbers obtained by reidentification in SB PW4ENG 72−751.

R Low Pressure Compressor (LPC)
R Table 801

R ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

R	REF NO.	DESCRIPTION	PART NO.	CYCLES MAX REPLACE AT
R	2021	Turbine Shaft (LPC/LPT) Coupling	50A281 Assy	30,000
R			·50A210 Coupling	Reference

R LPC/LPT Coupling
R Table 802

R ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

R	REF NO.	DESCRIPTION		PART NO.	CYCLES MAX REPLACE AT
R	1420	Hub, HPC Front		50H470	20,000
R				51H572	20,000
R	1421	Disk, Stage 5		51H905	20,000
R				51H005	20,000
R				54H705	20,000
R				54H405	20,000
R				56H605	20,000
R				56H705	20,000
R			(e)	54H705−001	20,000
R	1433	Disk, Drum Rotor	(a)	50H859	4,000
R		(Stage 6 through 12)	(b)	50H859−001	4,000
R				51H426−01	20,000
R				52H559−01	15,000
R			(g)	52H559−101	15,000
R				52H926−01	20,000
R			(g)	52H926−101	20,000
R				53H676−01	20,000
R			(g)	53H676−101	20,000
R				54H626−01	20,000
R			(g)	54H626−101	20,000
R				54H816−01	20,000
R			(g)	54H816−101	20,000
R				55H106−01	20,000
R			(g)	55H106−101	20,000
R				50S106−01	20,000
R	1422	Disk, Stage 6		·50H106	20,000
R				·53H976−02	20,000
R	1423	Disk, Stage 7		·51H007	20,000
R				·51H426−02	20,000
R				·53H976−03	20,000
R				·54H816−02	20,000
R	1424	Disk, Stage 8		·51H308	20,000
R				·53H976−04	20,000
R				·54H816−03	20,000
R	1425	Disk, Stage 9		·51H609	20,000
R				·53H676−02	20,000
R				·53H976−05	20,000
R				·54H816−04	20,000

R High Pressure Compressor (HPC)
R Table 803

R ENGINE - AIRWORTHINESS LIMITATIONS - TIME LIMITS

	REF NO.	DESCRIPTION		PART NO.	CYCLES MAX REPLACE AT
R	1426	Disk, Stage 10		·51H710	20,000
R				·53H976-06	20,000
R	1427	Disk, Stage 11		·51H711	20,000
R				·54H626-02	20,000
R	1428	Disk, Stage 12		·51H612	20,000
R				·53H676-03	20,000
R				·53H976-08	20,000
R				·55H106-02	20,000
R	1434	Disk, Drum Rotor		50H936	20,000
R		(Stages 13, 14 And 15		53H923-01	20,000
R		And HPC Drive Shaft)	(c)	50H936-002	20,000
R		(Applicable for PW4152	(c)	53H923-001	20,000
R		and engines that			
R		incorporate SB PW4ENG			
R		72-572 only)			
R	1434	Disk, Drum Rotor		53H973-01	7,000
R		(Stages 13, 14 And 15)		54H803-01	20,000
R		(Applicable for PW4152-3		56H013-01	20,000
R		only)	(d)	53H973-001	7,000
R			(d)	54H803-001	20,000
R			(f)	54H803-002	20,000
R			(f)	56H013-001	20,000
R				58H236-01	20,000
R	1429	Disk, Stage 13		·52H013	20,000
R				·53H923-02	20,000
R				·53H973-02	20,000
R				·56H013-02	20,000
R	1430	Disk, Stage 14		·51H914	20,000
R				·53H923-03	20,000
R				·53H973-03	20,000
R				·56H013-03	20,000
R	1431	Disk, Stage 15		·51H615	20,000
R				·53H923-04	20,000
R				·53H973-04	20,000
R				·54H803-03	20,000
R				·56H013-04	20,000

R High Pressure Compressor (HPC)
R Table 803 (Continued)

ENGINE - AIRWORTHINESS LIMITATIONS - TIME LIMITS

REF NO.	DESCRIPTION	PART NO.	CYCLES MAX REPLACE AT
1436	Hub,Stage 15 (Applicable for PW4152-3 only)	·53H973-05 ·54H803-02 ·58H236-02	7,000 20,000 20,000
1432	Shaft, HPC Drive (Applicable for PW4152 and engines that incorporate SB PW4ENG 72-572 only)	·50H445	20,000
1432	Shaft, HPC Drive (Applicable for PW4152-3 only)	53H347 54H767	13,000 20,000
1435	Airseal, HPC Inlet (Applicable for PW4152 and engines that incorporate SB PW4ENG 72-653 only)	50H021 56H279	20,000 20,000

NOTE: These PN's are for the bolted on knife edge HPC airseal.

REF NO.	DESCRIPTION	PART NO.	CYCLES MAX REPLACE AT
1435	Airseal, Diffuser (Applicable for PW4152-3 only)	53H431 54H792	20,000 20,000
1436	Airseal, Diffuser (Applicable for PW4152 and engines that incorporate SB PW4ENG 72-572 only)	50H218 (c) 54H846	20,000 20,000

(a) Can be reoperated by SB PW4ENG 72-201 at or before 4,000 cycles and reidentified to 51H426-01 to extend drum rotor life to 20,000 cycles.

(b) PN 50H859-001 identifies a PN 50H859 drum rotor with SB PW4ENG 72-322 (antigallant compound applied to disk slots). PN 50H859-001 has a limited rotor life of 4000 cycles as it has not been reworked to SB PW4ENG 72-201 (12th stage disk filet modification).

(c) Part number obtained by reidentification in SB PW4ENG 72-572.

(d) Part number obtained by reidentification in SB PW4ENG 72-565.

High Pressure Compressor (HPC)
Table 803 (Continued)

REF NO.	DESCRIPTION	PART NO.	CYCLES MAX REPLACE AT

R (e) Part number obtained by reidentification in SB PW4ENG 72-653.

R (f) Part number obtained by reidentification in SB PW4ENG 72-750.

R (g) Part number obtained by reidentification in SB PW4ENG 72-782.

R High Pressure Compressor (HPC)
R Table 803 (Continued)

R ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

R	REF NO.	DESCRIPTION		PART NO.	CYCLES MAX REPLACE AT
R	1750	Hub, Turbine Front (Stage 1)	(1)	50L501	3,800
R				51L201	20,000
R			(2)	51L601 (For PW4152 Engines)	19,000
R				52L401	20,000
R			(4)	51L201−001	20,000
R			(4)	51L201−021	20,000
R			(4)	51L901	20,000
R			(4)	52L301 Assy	20,000
R				·51L901 Hub	Reference
R	1751	Hub, Turbine Intermediate Rear (Stage 2)		50L602	15,000
R				50L602−001	15,000
R				50L902	20,000
R				52L002	20,000
R			(4)	52L002−021	20,000
R			(4)	50L602−021	15,000
R			(4)	50L602−022	15,000
R			(4)	50L902−021	20,000
R				52L802	20,000
R				52L402	20,000
R			(5)	50L602−023	15,000
R			(5)	50L602−024	15,000
R			(8)	50L602−025	15,000
R			(7)	50L602−026	15,000
R			(7)	50L602−027	15,000
R			(5)	50L902−022	20,000
R			(8)	50L902−023	20,000
R			(5)	53L602	20,000
R	1752	Airseal, HPT Stage 1 (Outer Rotating)		50L011	20,000
R				50L248	20,000
R				50L485	20,000
R				50L879	20,000
R	1753	Plate, HPT Stage 2 Blade Retaining		50L013	15,000
R				50L242	20,000
R	1754	Airseal, HPT Stage 1 (Inner Rotating)		50L014	20,000
R				50L193	20,000
R				50L659	20,000

R High Pressure Turbine (HPT)
R Table 804

R ENGINE - AIRWORTHINESS LIMITATIONS - TIME LIMITS

	REF NO.	DESCRIPTION		PART NO.	CYCLES MAX REPLACE AT
R	1755	Airseal, HPT Stage 2 (Rotating)	(3)	50L156 (For PW4152 Engines)	5,000
R				50L195	20,000
R			(6)	53L027	1,000
R				53L030	20,000

R NOTE: The total cycles that the air seal can accumulate as PN 53L027 is 1,000 cycles but the combined life as PN 50L195 and PN 53L027 can not be more than the life cycles of PN 50L195 as listed.

	REF NO.	DESCRIPTION		PART NO.	CYCLES MAX REPLACE AT
R	1756	Ring, HPT Stage 1 (Airsealing) (Applicable for PW4152-3 and engines that incorporate SB PW4ENG 72-572 only)		50L664	20,000

R NOTE: (1) See SB PW4ENG 72-314 for rework of PN 50L501 and reidentification to PN 51L601 and PW4ENG 72-315 for reidentification of PN 50L501 to PN 51L201.

R NOTE: (2) See SB PW4ENG 72-315 for reidentification instructions for PN 51L601 to PN 51L201.

R NOTE: (3) See SB PW4ENG 75-57 to determine a higher adjusted life for specific parts based on cycles after service bulletin was incorporated.

R NOTE: (4) Part numbers obtained by reidentification in SB PW4ENG 72-572.

R NOTE: (5) Part numbers obtained by reidentification in SB PW4ENG 72-627.

R NOTE: (6) For HPT air sealing ring which has been reworked to remove crack indications and is reidentified to PN 53L027 by Alert Service Bulletin 72-628. PN 53L027 sealing ring may be continued in service for an additional 1000 cycles after which ring must be retired.

R NOTE: (7) Part numbers obtained by incorporation of SB PW4ENG 72-704.

R High Pressure Turbine (HPT)
R Table 804 (Continued)

R ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

R	REF NO.	DESCRIPTION	PART NO.	CYCLES MAX REPLACE AT

R NOTE: (8) Part numbers obtained by reidentification in SB PW4ENG
R 72−716.

R High Pressure Turbine (HPT)
R Table 804 (Continued)

R

ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

R	REF NO.	DESCRIPTION		PART NO.	CYCLES MAX REPLACE AT
R	1220	Disk, LPT Stage 3		50N003	20,000
R				50N803	20,000
R	1221	Disk, LPT Stage 4		50N024	20,000
R				50N724	20,000
R				50N924	20,000
R				51N404	20,000
R			(a)	51N304	20,000
R			(b)	50N924/D	7,500
R	1222	Hub, Rear Turbine Stage 5		50N405	20,000
R				50N505	20,000
R				51N305	20,000
R				51N405	20,000
R				51N505	20,000
R	1223	Disk, LPT Stage 6		50N286	20,000
R				50N486−01	20,000
R				50N666−01	20,000
R	1224	Airseal, LPT Stage 3		50N008	20,000
R				50N521	20,000
R	1225	Airseal, LPT Stage 4		50N009	20,000
R				50N346	20,000
R			(c)	50N478	20,000
R			(d)	50N478−001	20,000
R				51N038	20,000
R	1226	Airseal, LPT Stage 5		50N162	20,000
R				50N324	20,000
R				50N347	20,000
R				50N419	20,000
R	2025	Front Compressor Drive Turbine (LPT) Shaft		50A077	30,000
R	2026	Airseal, LPT Stage 3		50N007	20,000
R				50N381	20,000
R				50N412	20,000

R NOTE: (a) Part number obtained by reidentification in SB PW4ENG
R 72−657.

R Low Pressure Turbine (LPT)
R Table 805

R ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

R	REF NO.	DESCRIPTION	PART NO.	CYCLES MAX REPLACE AT

R NOTE: (b) Disk, PN 50N924 Rev D, see SB PW4ENG 72−657 for the
R applicable serial numbers that have the reduced cycle
R life.

R NOTE: (c) See SB PW4ENG A72−707 to determine a reduced maximum
R cycle limit based on specific engine configuration.

R NOTE: (d) Part number obtained by modification and
R reidentification in SB PW4ENG A72−707.

R Low Pressure Turbine (LPT)
R Table 805 (Continued)

ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

Task 05−10−01−990−007:

1. Airworthiness Limitations

A. The Airworthiness Limitations section is FAA approved and specifies maintenance required under sections 43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved.

B. See Paragraph 2. for Mixed Model Management Of Rotating Parts

C. See Paragraph 3. for Hourly Limited Parts

D. See Paragraph 4. for Life Cycles For Models

E. See Paragraph 5. for Critical Life Limited Part Inspection

F. See Paragraph 6. for Rotating Part Life Limits

Task 05−10−01−990−008:

2. Mixed Model Management Of Rotating Parts

A. Service life cycle limits for rotating parts used across PW4000 Engine Models can be calculated by one of the following methods:

(1) Method 1. This method requires a record of the PW4000 Engine Models on which the rotating part was used. And, if applicable, the THRUST LEVEL at which those engine models were operated.

(a) In the following tables, find the life cycles listed for each of the engine models the part was used on. Assign the LOWEST cycle limit to that part.

(b) If the rotating part was operated across PW4000 engine models at varying THRUST LEVELS, assign the life cycle limit for the engine model run at the higher THRUST. Remember, the LOWEST life cycle... highest THRUST LEVEL prevails, EXCEPT if records prove the part was never run on a given model, or never subjected to the higher THRUST LEVEL.

(2) Method 2. This method provides a formula for determining, on a prorated basis, the TOTAL life cycle limit for a part used on more than one PW4000 Model. See Figure 801.

$$1.00 - \left[\frac{\text{Model 1 Cycles}}{\text{Model 1 Certified Cycles}}\right] - \left[\frac{\text{Model 2 Cycles}}{\text{Model 2 Certified Cycles}}\right] - \left[\frac{\text{Model N Cycles}}{\text{Model N Certified Cycles}}\right] = 0$$

(a) For example: If a disk has accumulated 6000 Cycles in Model 1 (certified for 20000 Cycles) , and 4500 Cycles in Model 2 (certified for 15000 Cycles) , the remaining life in either model would be determined by transposing the above equation as follows:

- Remaining Model 1 Cycles $= \left[\text{Model 1 Certified Cycles}\right] - \left[\frac{(\text{Model 1 Cycles})\ (\text{Model 1 Certified Cycles})}{\text{Model 1 Certified Cycles}}\right] - \left[\frac{(\text{Model 2 Cycles})\ (\text{Model 1 Certified Cycles})}{\text{Model 2 Certified Cycles}}\right]$

- Remaining Model 2 Cycles $= \left[\text{Model 2 Certified Cycles}\right] - \left[\frac{(\text{Model 2 Cycles})\ (\text{Model 2 Certified Cycles})}{\text{Model 2 Certified Cycles}}\right] - \left[\frac{(\text{Model 1 Cycles})\ (\text{Model 2 Certified Cycles})}{\text{Model 1 Certified Cycles}}\right]$

Inserting proper values for this example:

- Remaining Model 1 Cycles $= \left[20000\right] - \left[\frac{(6000)\ (20000)}{20000}\right] - \left[\frac{(4500)\ (20000)}{15000}\right] = 8000$

- Remaining Model 2 Cycles $= \left[15000\right] - \left[\frac{(4500)\ (15000)}{15000}\right] - \left[\frac{(6000)\ (15000)}{20000}\right] = 6000$

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PW V

R Mixed Model Rotating Part Life Formula
R Figure 801
R (Task 05−10−01−990−008)

ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

Task 05−10−01−990−009:

3. Hourly Limited Parts

A. In establishing and reporting time on hourly limited parts, time is defined as that accumulated time from the moment an aircraft leaves the surface of the earth until it touches it at the next point of landing.

The cycle limits associated with specific part numbers contained in the following tables were submitted to and accepted by the Federal Aviation Administration (FAA) as part of Pratt & Whitney engine certification documentation for the engine models which utilize these parts. The listed part numbers are either detail parts or part assemblies.

If the part is an assembly, the word "Assy" appears in the PART NO. column. If the part is an assembly, the assembly part number is provided and the associated detail part number appears indented (.xxxx) directly below the assembly part number. This detail part number is the part within the assembly which is structurally associated with the cycle limit even though the cycle limit may appear next to the assembly part number.

If the documentation submitted to the FAA specified the cycle limit next to the assembly part number, the cycle limit will appear next to the assembly part number and the word "Reference" will appear next to the detail part number. In this situation, the detail part number carries the same cycle limit as the assembly part number. If the documentation submitted to the FAA specified the cycle limit next to the detail part number, the cycle limit will appear next to the detail part number and the word "Reference" will appear next to the assembly part number. In this situation, the assembly part number carries the same cycle limit as the detail part number.

Detail parts of assemblies, unless listed in the following tables, do not carry a cycle limit. Example: If a disk assembly has mechanically attached parts such as fasteners, metering plugs or balance weights, the cycle limit tables show a cycle limit for the disk assembly and the detail disk is shown as a "Reference". The attached parts are not listed in the tables and are not cycle limited. The disk assembly and the disk must both comply with the cycle limit shown in the table.

Task 05−10−01−990−010:

4. Life Cycles for Models

A. Hardware found on modified models listed below have the same cyclic life as the corresponding base model or (−3) model, as applicable, unless specified differently.

(1) Life limited hardware used on the base model can also be used on the modified models listed below through the listed service bulletin:

BASE MODEL	MODIFIED MODEL
	SB PW4ENG 72−516
PW4156A	PW4156A (−1C/−1E)
PW4158	PW4158 (−1C/−1E)

(2) Life limited hardware used on Phase III "(−3)" engines as built by Pratt & Whitney can also be used on the modified models listed below through the listed service bulletin:

BASE MODEL	MODIFIED MODEL
Phase III (−3) ENGINES AS BUILT BY PRATT & WHITNEY OR CONVERTED PHASE III ENGINES BY SB PW4ENG 72−572 SB PW4ENG 73−150	
PW4156A (−3)	PW4156A (−3A)
PW4158 (−3)	PW4158 (−3A)

(3) This document is Part Number/Cycle Max Replace At based and is not base upon engine model designation other than to denote thrust level.

Task 05−10−01−990−011:

5. Critical Life Limited Part Inspection

A. Inspection Requirement

(1) This section has the definitions for the individual engine piece part opportunity and the inspection procedures which are necessary when these parts are removed from the engine.

(2) For the purposes of these mandatory enhanced inspections, piece part opportunity means:

(a) The part is considered completely disassembled when accomplished in accordance with the disassembly instructions in the engine manual to either the part detail or part assembly level part numbers for the parts listed in the Table; and

(b) The part has accumulated more than 100 cycles in service since the last piece part opportunity inspection, provided that the part was not damaged by or related to the cause for its removal from the engine.

(3) The inspections specified in this section do not replace or make not necessary other recommended inspections for these parts or other parts.

B. Parts Requiring Inspection:

DESCRIPTION	PART NUMBER	CIR MANUAL SECTION	CIR MANUAL INSPECTION	CIR MANUAL
Hub, Front Compressor	ALL	72−31−07	I/C−02	PN 51A357

NOTE: FAA Airworthiness Directive 2005−25−09 (Effective June 12,2006) mandates compliance with PW4000 Series Engine CIR Manual (PN 51A357), 72−31−07, Inspection/Check−02 CONFIG−1, (Task 72−31−07−200−002) (Non−Destructive Inspection − Front Compressor Hub Assembly).

DESCRIPTION	PART NUMBER	CIR MANUAL SECTION	CIR MANUAL INSPECTION	CIR MANUAL
Hub, Turbine Front (Stage 1)	ALL	72−52−05	I/C−02	PN 51A357
Hub, Turbine Intermediate Rear (Stage 2)	All	72−52−06	I/C−02	PN 51A357
Disk, Stage 5	All	72−35−06	I/C−02	PN 51A357
Disk, Drum Rotor Stage (6 Thru 12)	All	72−35−07	I/C−02	PN 51A357
Disk, Drum Rotor	All	72−35−08 (See Note	I/C−02	PN 51A357

DESCRIPTION	PART NUMBER	CIR MANUAL SECTION	CIR MANUAL INSPECTION	CIR MANUAL
(CONTINUED) (Stages 13, 14 And 15)		1)		
Disk, Drum Rotor (Stages 13, 14 And 15)	All	72-35-10 (See Note 2)	I/C-02	PN 51A357
Disk, LPT Stage 3	All	72-53-13	I/C-02	PN 51A357
Disk, LPT Stage 4	All	72-53-14	I/C-02	PN 51A357
Hub, Rear Turbine Stage 5	All	72-53-15	I/C-02	PN 51A357
Disk, LPT Stage 6	All	72-53-16	I/C-02	PN 51A357

NOTE: (1) Applicable for the PW4156A and PW4158 engine models and engines incorporating SB PW4ENG 72-572 only.

NOTE: (2) Applicable for the PW4156A-3 and PW4158-3 engine models only.

Task 05-10-01-990-012:

6. Rotating Part Life

Table 801, Table 802, Table 803, Table 804, and Table 805.

A. Service life is limited to, and must not exceed the cycles, specified in the following tables. If the rotating part has been used in more than one engine model, refer to Paragraph 4.

B. In establishing and reporting cycles accumulated on cyclically limited parts, cycles are defined as any flight consisting of one take-off and landing regardless of length of flight or whether or not thrust reverser (if so equipped) was used. For further clarification, Refer to Task 70-30-00-200-002, Section 70-30-00, General-01 in the Standard Practices Manual.

R ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

R C. In computing rotating part life, calculations must include cycles since time of manufacture. Changes to part life cycle limits resulting from reoperation, use in different thrust level engines, or for any other reason, must be calculated on the basis of total cycles.

R D. All life cycle limits indicate total cycles accumulated prior to and subsequent to reoperation and reidentification.

R E. The information in the following tables is not intended as authority for interchangeability. Refer to applicable service bulletins for interchangeability information.

R ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

	REF NO.	DESCRIPTION	PART NO.	CYCLES MAX REPLACE AT
R	1630	Hub, Front Compressor	50B221 Assy	15,000
R			·50B201 Hub	Reference
R			50B321 Assy	15,000
R			·50B301 Hub	Reference
R			53B021 Assy	15,000
R			·53B201 Hub	Reference
R	1631	Disk, Drum Rotor	50B422	15,000
R		(Stages 1.6, 2, 3 and 4)	51B022−01	15,000
R			(b) 51B022−101	15,000
R			(a) 50B422−001	15,000
R			(a) 50B422−002	15,000
R			(a) 50B422−003	15,000
R			(a) 50B422−004	15,000
R			(b) 50B422−005	15,000
R			53B200−01	15,000
R	1626	Disk, Stage 1.6	·51B816	15,000
R			·51B022−02	15,000
R	1627	Disk, Stage 2	·50B302	15,000
R			·51B022−03	15,000
R			·53B200−03	15,000
R	1628	Disk, Stage 3	·50B403	15,000
R			·51B022−04	15,000
R	1629	Disk, Stage 4	·50B404	15,000
R			·51B022−05	15,000

R NOTE: (a) Part numbers obtained by reidentification in SB PW4ENG 72−738.

R NOTE: (b) Part numbers obtained by reidentification in SB PW4ENG 72−751.

R Low Pressure Compressor (LPC)
R Table 801

R ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

R	REF. NO.	DESCRIPTION	PART NO.	CYCLES MAX REPLACE AT
R	2021	Turbine Shaft (LPC/LPT) Coupling	50A281 Assy ·50A210 Coupling	30,000 Reference

R Table 802

R ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

R	REF. NO.	DESCRIPTION	PART NO.	CYCLES MAX REPLACE AT
R	1420	Hub, HPC Front	50H470	15,000
R			51H572	15,000
R	1421	Disk, Stage 5	51H905	15,000
R			51H005	15,000
R			54H705	15,000
R			54H405	15,000
R			56H605	15,000
R			56H705	15,000
R			(e) 54H705−001	15,000
R	1433	Disk, Drum Rotor	(a) 50H859	4,000
R		(Stage 6 Thru 12)	(b) 50H859−001	4,000
R			51H426−01	15,000
R			52H559−01	11,000
R			(g) 52H559−101	11,000
R			52H926−01	15,000
R			(g) 52H926−101	15,000
R			53H676−01	15,000
R			(g) 53H676−101	15,000
R			54H626−01	15,000
R			(g) 54H626−101	15,000
R			54H816−01	15,000
R			(g) 54H816−101	15,000
R			55H106−01	15,000
R			(g) 55H106−101	15,000
R			50S106−01	15,000
R	1422	Disk, Stage 6	·50H106	15,000
R			·53H976−02	15,000
R	1423	Disk, Stage 7	·51H007	15,000
R			·51H426−02	15,000
R			·53H976−03	15,000
R			·54H816−02	15,000
R	1424	Disk, Stage 8	·51H308	15,000
R			·53H976−04	15,000
R			·54H816−03	15,000
R	1425	Disk, Stage 9	·51H609	15,000
R			·53H676−02	15,000
R			·53H976−05	15,000
R			·54H816−04	15,000

R Table 803

R

ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

	REF. NO.	DESCRIPTION		PART NO.	CYCLES MAX REPLACE AT
R	1426	Disk, Stage 10		·51H710	15,000
R				·53H976−06	15,000
R	1427	Disk, Stage 11		·51H711	15,000
R				·54H626−02	15,000
R	1428	Disk, Stage 12		·51H612	15,000
R				·53H676−03	15,000
R				·53H976−08	15,000
R				·55H106−02	15,000
R	1434	Disk, Drum Rotor (Stages 13, 14 And 15 And HPC Drive Shaft) (Applicable for PW4156A PW4158, and engines that incorporate SB PW4ENG 72−572 only)		50H936	15,000
R				53H923−01	15,000
R			(c)	50H936−002	15,000
R			(c)	53H923−001	15,000
R	1434	Disk, Drum Rotor (Stages 13, 14 And 15) (Applicable for PW4156A−3 and PW4158−3 only)		53H973−01	6,000
R				54H803−01	15,000
R				56H013−01	15,000
R			(d)	53H973−001	6,000
R			(d)	54H803−001	15,000
R			(f)	54H803−002	15,000
R			(f)	56H013−001	15,000
R				58H236−01	15,000
R	1429	Disk, Stage 13		·52H013	15,000
R				·53H923−02	15,000
R				·53H973−02	15,000
R				·56H013−02	15,000
R	1430	Disk, Stage 14		·51H914	15,000
R				·53H923−03	15,000
R				·53H973−03	15,000
R				·56H013−03	15,000
R	1431	Disk, Stage 15		·51H615	15,000
R				·53H923−04	15,000
R				·53H973−04	15,000
R				·54H803−03	15,000
R				·56H013−04	15,000

R Table 803 (Continued)

R ENGINE - AIRWORTHINESS LIMITATIONS - TIME LIMITS

	REF. NO.	DESCRIPTION	PART NO.	CYCLES MAX REPLACE AT
R	1436	Hub, Stage 15	·53H973-05	6,000
R			·54H803-02	15,000
R		(Applicable for PW4156A-3 and PW4158-3 only)	·58H236-02	15,000
R	1432	Shaft, HPC Drive (Applicable for PW4156A, PW4158, and engines that incorporate SB PW4ENG 72-572 only)	·50H445	15,000
R	1432	Shaft, HPC Drive	53H347	9,500
R		(Applicable for PW4156A-3 and PW4158-3 only)	54H767	15,000
R	1435	Airseal, HPC Inlet	50H021	15,000
R		(Applicable for PW4156A, PW4158 and engines that incorporate SB PW4ENG 72-653 only)	56H279	15,000
R	NOTE:	These Part numbers are for the bolted on knife edge HPC airseal.		
R	1435	Airseal, Diffuser	53H431	15,000
R		(Applicable for PW4156A-3 and PW4158-3 only)	54H792	15,000
R	1436	Airseal, Diffuser	50H218	15,000
R		(Applicable for PW4156A, PW4158, and engines that incorporate SB PW4ENG 72-572 only)	(c) 54H846	15,000

R (a) Can be reoperated by SB PW4ENG 72-201 at or before 4,000 cycles and reidentified to 51H426-01 to extend drum rotor life to 15,000 cycles.

R (b) PN 50H859-001 identifies a PN 50H859 drum rotor with SB PW4ENG 72-322 (antigallant compound applied to disk slots). PN 50H859-001 has a limited rotor life of 4000 cycles as it has not been reworked to SB PW4ENG 72-201 (12th stage disk filet modification).

R (c) Part number obtained by reidentification in SB PW4ENG 72-572.

R Table 803 (Continued)

R ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

REF. NO.	DESCRIPTION	PART NO.	CYCLES MAX REPLACE AT

R (d) Part number obtained by reidentification in SB PW4ENG 72−565.

R (e) Part number obtained by reidentification in SB PW4ENG 72−653.

R (f) Part number obtained by reidentification in SB PW 4ENG
R 72−750.

R (g) Part number obtained by reidentification in SB PW4ENG 72−782.

R Table 803 (Continued)

R

ENGINE – AIRWORTHINESS LIMITATIONS – TIME LIMITS

R	REF. NO.	DESCRIPTION		PART NO.	CYCLES MAX REPLACE AT
R	1750	Hub, Turbine Front (Stage 1)	(1)	50L501	3,500
R				51L201	15,000
R			(2)	51L601	8,000
R				52L401	15,000
R			(4)	51L201–001	15,000
R			(4)	51L201–021	15,000
R			(4)	51L901	15,000
R			(4)	52L301 Assy	15,000
R				·51L901 Hub	Reference
R	1751	Hub, Turbine Intermediate		50L602	10,000
R		Rear (Stage 2)		50L602–001	10,000
R				50L902	15,000
R				52L002	15,000
R			(4)	52L002–021	15,000
R			(4)	50L602–021	10,000
R			(4)	50L602–022	8,000
R			(4)	50L902–021	15,000
R				52L802	15,000
R				52L402	15,000
R			(5)	50L602–023	8,000
R			(5)	50L602–024	8,000
R			(8)	50L602–025	8,000
R			(7)	50L602–026	8,000
R			(7)	50L602–027	8,000
R			(5)	50L902–022	15,000
R			(8)	50L902–023	15,000
R			(5)	53L602	15,000
R	1752	Airseal, HPT Stage 1		50L011	15,000
R		(Outer Rotating)		50L248	15,000
R				50L485	15,000
R				50L879	15,000
R	1753	Plate, HPT Stage 2		50L013	9,000
R		Blade Retaining		50L242	15,000
R	1754	Airseal, HPT Stage 1		50L014	15,000
R		(Inner Rotating)		50L193	15,000
R				50L659	15,000

R Table 804

ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

REF. NO.	DESCRIPTION	PART NO.	CYCLES MAX REPLACE AT
1755	Airseal, HPT Stage 2 (Rotating)	(3) 50L156	2,400
		50L195	15,000
		(6) 53L027	1,000
		53L030	15,000

NOTE: The total cycles that the air seal can accumulate as PN 53L027 is 1,000 cycles but the combined life as PN 50L195 and PN 53L027 can not be more than the life cycles of PN 50L195 as listed.

REF. NO.	DESCRIPTION	PART NO.	CYCLES MAX REPLACE AT
1756	Ring, HPT Stage 1 (Airsealing) (Applicable for PW4156A−3, PW4158−3 and engines that incorporate SB PW4ENG 72−572 only	50L664	15,000

NOTE: (1) See SB PW4ENG 72−314 for rework of PN 50L501 and reidentification to PN 51L601 and PW4ENG 72−315 for reidentification of PN 50L501 to PN 51L201.

NOTE: (2) See SB PW4ENG 72−315 for reidentification instructions for PN 51L601 to PN 51L201.

NOTE: (3) See SB PW4ENG 75−57 to determine a higher adjusted life for specific parts based on cycles after service bulletin was incorporated.

NOTE: (4) Part numbers obtained by reidentification in SB PW4ENG 72−572.

NOTE: (5) Part numbers obtained by reidentification in SB PW4ENG 72−627.

NOTE: (6) For HPT air sealing ring which has been reworked to remove crack indications and is reidentified to PN 53L027 by Alert Service Bulletin 72−628. PN 53L027 sealing ring may be continued in service for an additional 1000 cycles after which ring must be retired.

NOTE: (7) Part numbers obtained by incorporation of SB PW4ENG 72−704.

NOTE: (8) Part numbers obtained by reidentification in SB PW4ENG 72−716.

Table 804 (Continued)

R ENGINE - AIRWORTHINESS LIMITATIONS - TIME LIMITS

	REF. NO.	DESCRIPTION		PART NO.	CYCLES MAX REPLACE AT
R	1220	Disk, LPT Stage 3		50N003	15,000
R				50N803	15,000
R	1221	Disk, LPT Stage 4		50N024	15,000
R				50N724	15,000
R				50N924	15,000
R				51N404	15,000
R			(a)	51N304	15,000
R			(b)	50N924/D	5,780
R	1222	Hub, Rear Turbine Stage 5		50N405	15,000
R				50N505	15,000
R				51N305	15,000
R				51N405	15,000
R				51N505	15,000
R	1223	Disk, LPT Stage 6		50N286	15,000
R				50N486-01	15,000
R				50N666-01	15,000
R	1224	Airseal, LPT Stage 3		50N008	15,000
R				50N521	15,000
R	1225	Airseal, LPT Stage 4		50N009	15,000
R				50N346	15,000
R			(c)	50N478	15,000
R			(d)	50N478-001	15,000
R				51N038	15,000
R	1226	Airseal, LPT Stage 5		50N162	15,000
R				50N324	15,000
R				50N347	15,000
R				50N419	15,000
R	2025	Front Compressor Drive Turbine (LPT) Shaft		50A077	30,000
R	2026	Airseal, LPT Stage 3		50N007	15,000
R				50N381	15,000
R				50N412	15,000

R NOTE: (a) Part number obtained by reidentification in SB PW4ENG
R 72-657.

R Low Pressure Turbine (LPT)
R Table 805

R ENGINE − AIRWORTHINESS LIMITATIONS − TIME LIMITS

R	REF. NO.	DESCRIPTION	PART NO.	CYCLES MAX REPLACE AT

R NOTE: (b) Disk, PN 50N924 Rev D, see SB PW4ENG 72−657 for the
R applicable serial numbers that have the reduced cycle
R life.

R NOTE: (c) See SB PW4ENG A72−707 to determine a reduced maximum
R cycle limit based on specific engine configuration.

R NOTE: (d) Part number obtained by modification and
R reidentification in SB PW4ENG A72−707.

R Low Pressure Turbine (LPT)
R Table 805 (Continued)

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ENGINE - AIRWORTHINESS DIRECTIVES - TIME LIMITS

Task 05-10-02-990-001:

1. Airworthiness Directives

A. The following Airworthiness Directives listed in Table 801, which affect Pratt & Whitney PW4000 Engines, have been issued by the Federal Aviation Agency. This listing is provided as a historical record for the convenience of PW4000 Engine Operators, and to ensure that all operators are aware of these safety requirements specified for Pratt & Whitney PW4000 Engines.

B. The tabular format is provided as a cross-reference index to associate the Airworthiness Directive with the subject matter and the related Pratt & Whitney Service Bulletin. See the listed documents to establish specific application.

C. Copies of the documents listed in Table 801 will be made available upon request. Please address requests for Airworthiness Directives to:

Manager, Engine Certification Office,
ANE-140 Aircraft Certification Division,
Federal Aviation Administration, New England Region,
12 New England Executive Park,
Burlington, MA 01803 USA

Service Bulletins can be obtained from:

Pratt & Whitney
Attn: Manager Maintenance Data Engineering
400 Main St.
M/S 132-30
East Hartford, CT 06108 USA

Airworthiness Directive	Status	Subject	Effectivity	Applicable Service Bulletin
T88-03-53 (FAA Issued) effective date: 02-03-88	Inactive	FMU removal due to inability to reduce engine thrust	PW4152	PW4ENG ASB 73-37 Revision No. 1

Airworthiness Directives
Table 801

ENGINE - AIRWORTHINESS DIRECTIVES - TIME LIMITS

Airworthiness Directive	Status	Subject	Effectivity	Applicable Service Bulletin
89-NM-09-AD 89-NM-09-AD (FAA Issued) effective date: 03-30-89	Inactive	Replace main fuel supply hose	PW4152	PW4NAC A73-4
90-ANE-27 (FAA Issued) effective date: 10-18-90	Inactive	One time eddy current inspection of the LPT shaft	PW4152, PW4156, PW4158	PW4ENG ASB 72-328
91-05-20 (FAA Issued) effective date: 03-01-91	Inactive (Superseded by 93-08-18)	Anti-ice on below 15,000 feet altitude	PW4152, PW4156, PW4158	(None) (See Airbus Industries Service Info. Ltr 72-001 Rev.1 dated 09-18-90
91-096-121 (B) (DGAC Issued effective date: 05-12-91	Active	Forward and aft engine mount inspections	PW4152, PW4158	PW4NAC71-86* (*See PW Ltr. to all operators PW4000/ 71-00/SS: TJF-0-12-03-1 dated 12-03-90) PW4NAC71-105
92-19-04 (FAA Issued effective date: 11-17-92	Active	(Same subject as above)	PW4152, PW4158	(Same service bulletin as above)
92-231-136 (B) (DGAC Issued) effective date: 11-08-92	Active	Flow check hydraulic pump system for clogging	PW4152, PW4156A, PW4158	MAN PW4000-10-91

Airworthiness Directives
Table 801 (Continued)

ENGINE - AIRWORTHINESS DIRECTIVES - TIME LIMITS

Airworthiness Directive	Status	Subject	Effectivity	Applicable Service Bulletin
92-231-136 (B) R1 (DGAC Issued) effective date: 03-27-93	Active	New carbon seal at green system hydraulic pump pad.	PW4152, PW4156A, PW4158	PW4ENG 72-458
93-08-18	Active	Requires anti-ice on prior to takeoff and for operations below 15,000 feet altitude, only for those engines not equipped with improved EEC's.	PW4152, PW4156, PW4158	
98-19-03	Active	Requirement for fluorescent penetrant and eddy current inspection and incorporation of improved life HPT 2nd stage airseal with modification to existing parts to achieve acceptable seal life.	PW4152, PW4156A, PW4158	PW4ENG A72-628, PW4ENG 72-636, PW4ENG 72-637

Airworthiness Directives
Table 801 (Continued)

ENGINE - AIRWORTHINESS DIRECTIVES - TIME LIMITS

Airworthiness Directive	Status	Subject	Effectivity	Applicable Service Bulletin
98-23-08	Active	Incorporation of modifications to prevent HPC surge.	PW4152, PW4156A, PW4158	PW4ENG 72-484, PW4ENG 72-486, PW4ENG 72-514, PW4ENG 72-575
99-08-15	Inactive	Enhanced inspection of selected critical life-limited parts at each piece-part exposure.	PW4152, PW4156, PW4156A, PW4158	None
99-15-01	Active	LPT 4th stage disk with cooling air holes in lieu of slots, reduced disk life.	PW4152, PW4156A	PW4ENG 72-657
99-17-16	Active	Group 3 surge management.	PW4152, PW4156A, PW4158	None
2000-12-02	Inactive (Super-seded By 2002-03-08)	Enhanced inspection of selected critical life-limited parts at each piece-part exposure.	PW4152, PW4156, PW4156A, PW4158	None

Airworthiness Directives
Table 801 (Continued)

ENGINE - AIRWORTHINESS DIRECTIVES - TIME LIMITS

Airworthiness Directive	Status	Subject	Effectivity	Applicable Service Bulletin
2000-25-06	Inactive (Superseded By 2001-05-07)	Fatigue cracking of LPT 4th stage airseal.	PW4152, PW4156, PW4156A, PW4158	PW4ENG A72-707, PW4ENG 72-657, Rev. 1
2001-05-07	Active	Fatigue cracking of LPT 4th stage airseal.	PW4152, PW4156, PW4156A, PW4158	PW4ENG A72-707, PW4ENG 72-657, Rev. 1
2001-08-52	Inactive (Superseded By 2001-09-07)	Multiple Engine Power Loss	PW4152, PW4156, PW4156A, PW4158	None
2001-09-07	Inactive (Superseded By 2001-15-12)	High Surge Rate Engines (Table 1 & 2)	PW4152, PW4156, PW4156A, PW4158	None
2001-15-12	Inactive (Superseded By 2001-25-11)	Surge Management (Stagger/Hard Time)	PW4152, PW4156, PW4156A, PW4158	None
2001-20-13	Active	HPC 6 - 7 knife edge spacer borescope inspection.	PW4152, PW4156, PW4156A, PW4158	PW4ENG A72-722
2001-25-11	Active	Surge Management (Stagger/Hard Time, Build Standard)	PW4152, PW4156, PW4156A, PW4158	

Airworthiness Directives
Table 801 (Continued)

ENGINE - AIRWORTHINESS DIRECTIVES - TIME LIMITS

Airworthiness Directive	Status	Subject	Effectivity	Applicable Service Bulletin
2002-03-08	Inactive (Superseded By 2005-25-09)	Enhanced inspection of selected critical life-limited parts at each piece-part exposure.	PW4152, PW4156, PW4156A, PW4158	None
2005-25-09	Active	Enhanced inspection of selected critical life-limited parts at each piece-part exposure. (Added Fan Hub Automated Eddy Current Inspection)	PW4152, PW4156, PW4156A, PW4158	None

Airworthiness Directives
Table 801 (Continued)

ENGINE − AIRWORTHINESS DIRECTIVES − TIME LIMITS

Task 05−10−02−990−002:

1. Airworthiness Directives

A. The following Airworthiness Directives listed in Table 801, which affect Pratt & Whitney PW4000 Engines, have been issued by the Federal Aviation Agency. This listing is provided as a historical record for the convenience of PW4000 Engine Operators, and to ensure that all operators are aware of these safety requirements specified for Pratt & Whitney PW4000 Engines.

B. The tabular format is provided as a cross−reference index to associate the Airworthiness Directive with the subject matter and the related Pratt & Whitney Service Bulletin. See the listed documents to establish specific application.

C. Copies of the documents listed in Table 801 will be made available upon request. Please address requests for Airworthiness Directives to:
Manager, Engine Certification Office,
ANE−140 Aircraft Certification Division,
Federal Aviation Administration, New England Region,
12 New England Executive Park,
Burlington, MA 01803 USA

Service Bulletins can be obtained from:

Pratt & Whitney
Attn: Manager Maintenance Data Engineering
400 Main St.
M/S 132−30
East Hartford, CT 06108 USA

Airworthiness Directive	Status	Subject	Effectivity	Applicable Service Bulletin
90−ANE−27 (FAA Issued) effective date: 10−18−90	Inactive	One time eddy current inspection of the LPT shaft	PW4152, PW4156, PW4158	PW4ENG ASB 72−328

Airworthiness Directives
Table 801

ENGINE - AIRWORTHINESS DIRECTIVES - TIME LIMITS

Airworthiness Directive	Status	Subject	Effectivity	Applicable Service Bulletin
91-05-20 (FAA Issued) effective date: 03-01-91	Inactive (Superseded by 93-08-18)	Anti-ice below 15,000 feet altitude	PW4152, PW4156, PW4158	(None) (See Airbus Industries Service Info. Ltr. 72-001 Rev. 1 dated 09-18-90
91-096-121 (B) (DGAC Issued) effective date: 05-12-91	Active	Forward and aft engine mount inspections	PW4152, PW4158	PW4NAC71-86* (*See PW Ltr. to all operators PW4000/71-00/SS: TJF-0-12-03-1 dated 12-03-90) PW4NAC71-105
92-19-04 (FAA Issued) effective date: 11-17-92	Active	(Same subject as above)	PW4152, PW4158	(Same service bulletin as above)
92-231-136 (B) (DGAC Issued) effective date: 11-08-92	Active	Flow check hydraulic pump drain system for clogging	PW4152, PW4156A, PW4158	MAN PW4000-10-91
92-231-136 (B)R1 (DGAC Issued) effective date: 03-27-93	Active	New carbon seal at green system hydraulic pump pad	PW4152, PW4156A, PW4158	PW4ENG 72-458

Airworthiness Directives
Table 801 (Continued)

ENGINE - AIRWORTHINESS DIRECTIVES - TIME LIMITS

Airworthiness Directive	Status	Subject	Effectivity	Applicable Service Bulletin
93-08-18	Active	Requires anti-ice on prior to takeoff and for operations below 15,000 feet altitude, only for those engines not equipped with improved EEC's.	PW4152, PW4156, PW4158	
98-19-03	Active	Requirement for fluorescent penetrant and eddy current inspection and incorporation of improved life HPT 2nd stage airseal with modification to existing parts to achieve acceptable seal life.	PW4152, PW4156A, PW4158	PW4ENG A72-628, PW4ENG 72-636, PW4ENG 72-637
98-23-08	Active	Incorporation of modifications to prevent HPC surge.	PW4152, PW4156A, PW4158	PW4ENG 72-484, PW4ENG 72-486, PW4ENG 72-514, PW4ENG 72-575

Airworthiness Directives
Table 801 (Continued)

ENGINE - AIRWORTHINESS DIRECTIVES - TIME LIMITS

Airworthiness Directive	Status	Subject	Effectivity	Applicable Service Bulletin
99-08-15	Inactive	Enhanced inspection of selected life-limited parts at each piece-part exposure.	PW4152, PW4156, PW4156A, PW4158	None
99-15-01	Active	LPT 4th stage disk with cooling air holes in lieu of slots, reduced disk life.	PW4152, PW4156A	PW4ENG 72-657
99-17-16	Active	Group 3 surge management.	PW4152, PW4156A, PW4158	None
2000-12-02	Inactive (Superseded By 2002-03-08)	Enhanced inspection of selected critical life-limited parts at each piece-part exposure.	PW4152, PW4156, PW4156A, PW4158	None
2000-25-06	Inactive (Superseded By 2001-05-07)	Fatigue cracking of LPT 4th stage airseal.	PW4152, PW4156, PW4156A, PW4158	PW4ENG A72-707, PW4ENG 72-657, Rev. 1
2001-05-07	Active	Fatigue cracking of LPT 4th stage airseal.	PW4152, PW4156, PW4156A, PW4158	PW4ENG A72-707, PW4ENG 72-657, Rev. 1

Airworthiness Directives
Table 801 (Continued)

ENGINE - AIRWORTHINESS DIRECTIVES - TIME LIMITS

Airworthiness Directive	Status	Subject	Effectivity	Applicable Service Bulletin
2001-08-52	Inactive (Superseded By 2001-09-07)	Multiple Engine Power Loss	PW4152, PW4156, PW4156A, PW4158	None
2001-09-07	Inactive (Superseded By 2001-15-12)	High Surge Rate Engines (Table 1 & 2)	PW4152, PW4156, PW4156A, PW4158	None
2001-15-12	Inactive (Superseded By 2001-25-11)	Surge Management (Stagger/Hard Time)	PW4152, PW4156, PW4156A, PW4158	None
2001-20-13	Active	HPC 6 - 7 knife edge spacer borescope inspection.	PW4152, PW4156, PW4156A, PW4158	PW4ENG A72-722
2001-25-11	Active	Surge Management (Stagger/Hard Time, Build Standard)	PW4152, PW4156, PW4156A, PW4158	
2002-03-08	Inactive (Superseded By 2005-25-09)	Enhanced inspection of selected critical life-limited parts at each piece-part exposure.	PW4152, PW4156, PW4156A, PW4158	None

Airworthiness Directives
Table 801 (Continued)

ENGINE - AIRWORTHINESS DIRECTIVES - TIME LIMITS

Airworthiness Directive	Status	Subject	Effectivity	Applicable Service Bulletin
2005-25-09	Active	Enhanced inspection of selected critical life-limited parts at each piece-part exposure. (Added Fan Hub Automated Eddy Current Inspection)	PW4152, PW4156, PW4156A, PW4158	None

Airworthiness Directives
Table 801 (Continued)

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ENGINE - TIME LIMITED DISPATCH CRITERIA - TIME LIMITS

Task 05-10-03-990-001:

1. Time Limited Dispatch Criteria

NOTE: Step A. is "NOTE 19" as excerpted from the "PW4000 TYPE CERTIFICATE DATA SHEET NUMBER E24NE".

A. The PW4000 series engines have been approved to operate with certain faults present in the control system based on satisfaction of FAR 33 requirements and appropriate FAR 25 control system reliability requirements. The following criteria exist as dispatch and maintenance requirements for the engine control system.

This criteria is specified in Pratt & Whitney Report PWA 6139 and PWA 6139 Addendum, which defines the various configurations and maximum operating intervals, as follows.

Faults Levels A, B, and C constitute Pratt & Whitney nomenclature. The airframe manufacturers may use different nomenclature in adapting these fault categories to the aircraft maintenance and display systems, however, the maximum operating intervals are restricted as shown above.

A control system reliability monitoring program has been established with Pratt & Whitney in compliance with the reporting requirements as outlined in the Engine and Propeller Directorate Policy letter, dated October 28, 1993, for Time Limited Dispatch of Engines fitted with FADEC Systems.

B. In Airbus installations Fault Level A produces an ECAM message "FADEC CHANNEL A (or B) FAULT", Fault Level B produces an ECAM message "FADEC MINOR FAULT", and Fault Level C produces no ECAM message. The operational dispatch criteria are defined in the applicable Master Minimum Equipment List (MMEL). The time limitations are defined in the applicable Aircraft Maintenance Manual (AMM) and Troubleshooting Manual (TSM).

R ENGINE − TIME LIMITED DISPATCH CRITERIA − TIME LIMITS

R Task 05−10−03−990−002:

R 1. Time Limited Dispatch Criteria

R NOTE: Step A. is "NOTE 19" as excerpted from the "PW4000 TYPE
R CERTIFICATE DATA SHEET NUMBER E24NE".

R A.
R The PW4000 series engines have been approved to operate with
R certain faults present in the control system based on
R satisfaction of FAR 33 requirements and appropriate FAR 25
R control system reliability requirements. The following
R criteria exist as dispatch and maintenance requirements for
R the engine control system. This criteria is specified in
R Pratt & Whitney Report PWA 6139 and PWA 6139 Addendum, which
R defines the various configurations and maximum operating
R intervals, as follows. Fault Level A − no dispatch allowed.
R Fault Level B − dispatchable; maximum operating interval
R for Fault Level B fault(s) is 20 days. Fault Level C −
R dispatchable; maximum operating interval for Fault Level
R C fault(s) is 1000 operating hours. Review of EEC fault
R data from only the most recent flight leg is sufficient at
R the 1000 hour interval except for the following EEC part
R numbers, P&W PN 50D791, PN 50D824, PN 51D037, PN 50D823, PN
R 51D319 and PN 51D586.
R Faults Levels A, B, and C constitute Pratt & Whitney
R nomenclature. The airframe manufacturers may use different
R nomenclature in adapting these fault categories to the
R aircraft maintenance and display systems, however, the
R maximum operating intervals are restricted as shown above.
R A control system reliability monitoring program has been
R established with Pratt & Whitney in compliance with the
R reporting requirements as outlined in the Engine and
R Propeller Directorate Policy letter, dated October 28, 1993,
R for Time Limited Dispatch of Engines fitted with FADEC
R Systems.

R B. In Airbus installations Fault Level A produces an ECAM
R message "FADEC CHANNEL A (or B) FAULT", Fault Level B
R produces an ECAM message "FADEC MINOR FAULT", and Fault
R Level C produces no ECAM message. The operational dispatch
R criteria are defined in the applicable Master Minimum
R Equipment List (MMEL). The time limitations are defined
R in the applicable Aircraft Maintenance Manual (AMM) and
R Troubleshooting Manual (TSM).

ENGINE - MAINTENANCE ADVISORY NOTICES (MAN) - TIME LIMITS

Task 05-10-04-990-001:

1. Maintenance Advisory Notices

A. General

(1) The Maintenance Advisory Notice (MAN) is an advisory (not a mandatory directive) to provide increased visibility to the airlines for repetitive maintenance actions which include inspections, engine and component build standards, ETOPS requirements, etc. In addition, MANs share the characteristics which follow:

(a) A distinguishable document for each engine model that has its own identification and issue-sequence code for traceability.

(b) A notification that provides recommended maintenance action of a repetitive nature, an implementation procedure and cites the necessary material resources.

(c) An advisory guide that can be utilized as action for P & W supplier and nacelle components as well as the basic engine.

(2) The tabular format is provided as a cross-reference index to associate the Maintenance Advisory Notice with the subject matter and the related Engine Manual ATA Code. See the listed documents to establish a specific application.

ATA Codes	Description	MAN Document	Hours	Cycles	Comments
None					

ENGINE − MAINTENANCE ADVISORY NOTICES (MAN) − TIME LIMITS

Task 05−10−04−990−002:

1. Maintenance Advisory Notices

A. General

(1) The Maintenance Advisory Notice (MAN) is an advisory (not a mandatory directive) to provide increased visibility to the airlines for repetitive maintenance actions which include inspections, engine and component build standards, ETOPS requirements, etc. In addition, MANs share the characteristics which follow:

- (a) A distinguishable document for each engine model that has its own identification and issue−sequence code for traceability.
- (b) A notification that provides recommended maintenance action of a repetitive nature, an implementation procedure and cites the necessary material resources.
- (c) An advisory guide that can be utilized as action for P & W supplier and nacelle components as well as the basic engine.

(2) The tabular format is provided as a cross−reference index to associate the Maintenance Advisory Notice with the subject matter and the related Engine Manual ATA Code. See the listed documents to establish a specific application.

ATA Codes	Description	MAN Document	Hours	Cycles	Comments
None					

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POWER PLANT GENERAL - INSTALLATION-00

Task 71-00-00-990-001:

1. General

A. The procedures in this publication are for an "On-Condition Maintenance Program" and give all the data to do a single maintenance action/task. Each procedure, to remove and install a QEC component, is a complete (stand alone) task. The sequence of all the tasks in this publication is not the sequence to replace all the QEC components on the total engine.

B. If you remove all the QEC components you can use the number sequence on the list that follows to install all the QEC components for a total engine buildup.

C. Each procedure shows the Engine Manual (EM) location and the Power Plant Illustrated Parts Catalog (PPIPC) location. In the PPIPC, at the locations shown, the correct part number configuration for a build-up of a power plant is provided.

NO.	PROCEDURE	EM LOCATION	PPIPC LOCATION
1.	Circumferential Latch Supports	71-00-34 Install-02	71-00-35 Fig 1
2.	Flange P Brackets	71-00-54 Install-04	71-13-20 Fig 1
3.	2.95 Bleed Valve Bellows	71-00-35 Install-04	36-11-01 Fig 1
4.	Fan Cowl Door Hold-Open Rods	71-00-33 Install-02	73-13-10 Fig 1 71-13-15 Fig 1
5.	Inlet Cowl Alignment Pins	71-00-33 Install-21	71-00-10 Fig 1
6.	Exhaust Nozzle Alignment Pins	71-00-54 Install-06	78-11-01 Fig 1
7.	Turbine Case Cooling (TCC) Duct and Bellows	71-00-53 Install-01	36-11-01 Fig 1
8.	Oil Quantity Transmitter	71-00-61 Install-11	79-33-01 Fig 1
9.	Low Oil Pressure Switch and Oil Pressure	71-00-61 Install-07	79-33-01 Fig 1

NO.	PROCEDURE	EM LOCATION	PPIPC LOCATION
(CONTINUED)	Transmitter		
10.	Oil Filter Differential Pressure Switch	71-00-61 Install-08	79-33-01 Fig 1
11.	Oil Temperature Sensor	71-00-61 Install-26	79-33-01 Fig 1
12.	No. 3 Bearing Oil Temperature Sensor	71-00-61 Install-27	79-33-01 Fig 1
13.	Thrust Reverser Splitter Gearbox	71-00-33 Install-13	78-32-12 Fig 2
14.	Pneumatic Drive Unit (PDU)	71-00-33 Install-11	78-32-12 Fig 2
15.	Thrust Reverser Main Drive Flexible Shaft	71-00-33 Install-10	78-32-12 Fig 1
16.	Thrust Reverser Solenoid Operated Selector Valve	71-00-33 Install-12	78-32-12 Fig 2
17.	Thrust Reverser Pressure Regulating And Shutoff Valve	71-00-33 Install-09	36-12-02 Fig 1
18.	Ground Operation Air Transfer Pneumatic Valve	71-00-33 Install-09	78-32-12 Fig 2
19.	Deoiler Vent Duct	71-00-61 Install-16	79-20-01 Fig 1
20.	Fuel Flow Transmitter	71-00-41 Install-06	73-33-05 Fig 1
21.	Main Fuel Supply Line	71-00-61 Install-06	73-11-05 Fig 1
22.	Fuel Pump Interstage Pressure Transmitter	71-00-61 Install-25	73-33-05 Fig 1
23.	Drain Collector	71-00-61	71-70-01 Fig 1

POWER PLANT GENERAL - INSTALLATION-00

NO.	PROCEDURE	EM LOCATION	PPIPC LOCATION
(CONTINUED)	Manifold	Install-18	
24.	Accessory Drain Tubing	71-00-61 Install-19	71-70-01 Fig 1
25.	Pylon Drain Tubing	71-00-41 Install-10	71-70-01 Fig 1
26.	Pylon Drain Mast	71-00-54 Install-05	71-70-01 Fig 1
27.	IDG Quick-Attach-Detach (QAD) Adapter	71-00-61 Install-05	24-11-01 Fig 1
28.	Integrated Drive Generator	71-00-61 Install-05	24-11-01 Fig 1
29.	Fire Extinguisher Tubes	71-00-35 Install-05	26-20-01 Fig 1
29A.	Barometric Switch	71-00-33 Install-25	71-50-02 Fig 1A
30.	Electrical Junction Boxes	71-00-33 Install-22, -23	71-50-02 Fig 1
31.	Fan Case Wire Harness	71-00-33 Install-14	71-50-01 Fig 1 71-50-02 Fig 2
32.	Fan Case Vibration Accelerometer	71-00-33 Install-03	71-50-02 Fig 1
33.	IDG, Starter, and Hydraulic Pump Heatshields	71-00-61 Install-28	71-31-15 Fig 1
34.	Front Hydraulic Pump	71-00-61 Install-12	29-11-01 Fig 1
35.	Rear Hydraulic Pump	71-00-61 Install-13	29-11-01 Fig 1
36.	Starter Assembly And Adapter	71-00-61 Install-14	80-11-01 Fig 1

POWER PLANT GENERAL - INSTALLATION-00

(CONTINUED)

NO.	PROCEDURE	EM LOCATION	PPIPC LOCATION
37.	IDG Cooling Tubes	71-00-35 Install-06	79-20-05 Fig 1
38.	High Stage Temperature Sensor	71-00-41 Install-04	36-20-01 Fig 1
39.	Engine Bleed Air Ducting	71-00-41 Install-05	36-11-01 Fig 1
40.	High Pressure Bleed Control Valve	71-00-35 Install-02	36-11-01 Fig 1
41.	Pressure Regulating Valve	71-00-35 Install-03	36-12-01 Fig 1
42.	Starter Air Supply Duct	71-00-53 Install-02	80-11-01 Fig 1
43.	Starter Shutoff Valve	71-00-61 Install-03	80-11-01 Fig 1
44.	Bleed Air Pneumatic Tubes and Hoses	71-00-35 Install-07	36-11-01 Fig 1
45.	Bifurcation Fire Seal	71-00-33 Install-07	30-21-01 Fig 2
46.	Inlet Cowl Anti-Ice System Ducts	71-00-33 Install-18	30-21-01 Fig 2
47.	Inlet Cowl Anti-Ice Shutoff And Regulating Valve	71-00-33 Install-17	30-21-01 Fig 2
48.	Inlet Cowl Anti-Ice Pressure Switch	71-00-33 Install-05	30-21-01 Fig 2
49.	Heat Diffuser Assembly	71-00-33 Install-20	30-21-01 Fig 3
50.	Nacelle Cooling Tube Assemblies	71-00-33 Install-19	36-25-01 Fig 1
51.	Ignition Cooling Duct and Hoses	71-00-52 Install-01	75-20-05 Fig 1

POWER PLANT GENERAL − INSTALLATION−00

(CONTINUED)

NO.	PROCEDURE	EM LOCATION	PPIPC LOCATION
52.	Starter Control Valve Cooling Tube	71−00−61 Install−29	75−20−05 Fig 1
53.	Permanent Magnet Alternator Cooling Tubes and Hoses	71−00−61 Install−30	75−20−05 Fig 1
54.	TRC Valve Cooling Tube	71−00−25 Install−08	75−20−05 Fig 1
55.	Starter Cooling Tubes	71−00−61 Install−31	75−20−05 Fig 1
56.	Oil System Tubes	71−00−35 Install−09	79−20−01 Fig 1
57.	Engine Oil Tank Pressure Fill System	71−00−61 Install−10	79−11−00 Fig 4
58.	Engine Core Compartment Sensor	71−00−61 Install−09	71−50−02 Fig 1
59.	Engine Core Wiring Harness	71−00−35 Install−01	23−41−01 Fig 1 26−11−01 Fig 2 71−50−01 Fig 1 71−50−02 Fig 1 77−10−01 Fig 2
60.	Engine Pump Case Drain Filter Support Bracket	71−00−52 Install−02	29−11−01 Fig 1
61.	Engine Pump Case Drain Filter Modules	71−00−41 Install−07	29−11−01 Fig 1
62.	Hydraulic Hoses (Abex Pump)	71−00−61 Install−01	29−11−01 Fig 1
63.	Hydraulic Hoses (Sperry−Vickers Pump)	71−00−61 Install−02	29−11−01 Fig 1
64.	Inlet Cowl	71−00−33 Install−01	71−00−01 Fig 1
65.	EEC Inlet Pressure/Temperature	71−00−33 Install−15	71−00−01 Fig 1

POWER PLANT GENERAL - INSTALLATION-00

NO.	PROCEDURE	EM LOCATION	PPIPC LOCATION
(CONTINUED)	(PT2/TT2) Probe		
66.	PS And P2 System Tubing	71-00-33 Install-24	77-10-01 Fig 1
67.	Engine Exhaust Plug	71-00-54 Install-02	78-11-01 Fig 1
68.	Engine Exhaust Nozzle	71-00-54 Install-03	78-11-01 Fig 1
69.	Engine Aft Mount	71-00-54 Install-01	71-20-01 Fig 1
70.	Engine Forward Mount	71-00-34 Install-01	71-20-01 Fig 1

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PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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POWER PLANT GENERAL − FAULT ISOLATION−00

Task 71−00−00−810−001:

1. Engine Fault Isolation Procedures

A. Fault Isolation Procedures

(1) Refer to the Airbus A300−600 and A310 Troubleshooting Manuals for Fault Isolation Procedures.

NOTE: Airbus A300−600 and A310 Troubleshooting Manuals may be obtained from:

Airbus Industrie
Product Support Directorate
Technical Publications
1, rond−point Maurice Bellonte
31707 Blagnac Cedex
France

B. Procedure

(1) Adapt the EEC FAULT MESSAGES to the Airbus A300−600 and A310 Troubleshooting Manual (TSM) as follows:

(a) The EEC transmits FAULT MESSAGES in a "LABEL − HEXIDECIMAL BIT" format.

(b) The Airbus A300−600 and A310 aircraft "Electronic Centralized Aircraft Monitoring" (ECAM) system displays the engine status and faults as "LABEL − HEXIDECIMAL BIT CODE" These codes must be manually converted to LABEL−BIT messages.

(c) The Troubleshooting Manual (TSM) has the conversion procedure and identifies each of the LABEL−BIT MESSAGES. The Troubleshooting Manual (TSM) also lists the corrective action that is necessary to clear the faults.

(2) Adapt the EEC FAULT MESSAGES for the test cell as follows:

(a) The instructions in the Troubleshooting Manual (TSM) are for an engine installed on the aircraft. These instructions must be adapted to the engine configuration and equipment that is used in the test cell.

(b) Some EEC FAULT MESSAGES transmitted in the test cell indicate corrective action that is necessary for hardware that is not normally installed on an engine in a test cell. For this category of FAULT MESSAGE, you must see the specific test cell operating procedures, not the Troubleshooting Manual (TSM).

(c) LABEL−BIT FAULT MESSAGES that have a high probability of being caused by test cell wiring or equipment are shown in the list that follows:

LABEL−BIT	FAULT
350−23	EXTERNAL DISCRETES DISAGREE
350−24	PROBE HEAT OFF
350−27	ADC 1 (LEFT) FAULT
350−28	ADC 2 (RIGHT) FAULT
350−29	SERIAL DIGITAL DATA (THRUST CONTROL COMPUTER) FAILURE
352−25	REVERSER RANGE/RATE
352−26	TRA RANGE/RATE
352−27	TRA OUT OF RANGE HIGH
354−19	28VDC SOLENOID POWER OUT

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PW4000 SERIES ENGINE MANUAL (PN 50A443)

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POWER PLANT GENERAL - STORAGE/TRANSPORT-00

Task 71-00-00-510-001:

1. Transporting Power Plant By Truck

CAUTION: ALL PW4000 SERIES POWER PLANTS BEING TRANSPORTED BY TRUCK, REQUIRE THAT BOTH TRACTOR AND TRAILER BE EQUIPPED WITH AN AIR SUSPENSION SYSTEM REGARDLESS OF DISTANCE TO BE TRANSPORTED. IT IS STRONGLY RECOMMENDED THAT ALL ENGINE TRANSPORT STANDS BE PURCHASED PER 70-80, STANDARD PRACTICES MANUAL.

A. Transport Power Plant By Truck And Trailer, Equipped With An Air Suspension System, After Power Plant Has Been Properly Packaged

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POWER PLANT GENERAL - STORAGE/TRANSPORT-01

Task 71-00-00-510-002:

1. Introduction And General Data - Split-Shipment

A. This section gives instructions for assembly and disassembly of split-shipped power plants at a remote-site.

NOTE: A split-shipment power plant is a complete EBU engine prepared for aircraft installation, but does not include:
- The exhaust nozzle and plug
- The inlet cowl
- The components that attach to the inlet cowl.

B. These instructions for remote on-site work, can be used for disassembly and pre-shipment of serviceable replacement power plants. Use Storage/Transport-02 for preparation of replacement power plant or out-of-service power plant split shipment.

C. Necessary documents for the assembly of some equipment and for the removal/installation of the power plant to the aircraft are referred to in the procedures.

D. Procedure Format

(1) The split-shipment section is put in sequence as follows:

(a) Storage/Transport-01 (Introduction And General Data).

(b) Storage/Transport-02 (Preparation Of Power Plant For Split-Shipment).

(c) Storage/Transport-03 (Assembly Of Serviceable Power Plant At Remote Site After Split-Shipment).

E. Three Pallet System

(1) The serviceable replacement power plant is split-shipped to a remote-site on three pallets.

(2) The first pallet contains:

(a) An erectable gantry system with necessary hoists.

(b) An erectable lightweight trailer.

(c) A tool kit.

(3) The second pallet contains:

(a) The LPC, fan case, and intermediate case as a unit (fan−unit).

(b) The support fixtures for the fan−unit.

(c) A storage compartment.

(4) The third pallet contains:

(a) The HPC,diffuser case, HPT, LPT, and the exhaust case as a unit (core−unit).

(b) The support fixtures for the core−unit.

(c) The transport stand.

F. On−Site General Conditions And Equipment

(1) The on−site general condition must be as follows:

(a) The work area must be level.

(b) The work area must be hard for the total weight of the power plant and gantry system−−approximately 18,000 lbs. (8164.66 kg). The work area must also be hard for the movement of the loaded light−weight trailer or the loaded transport stand.

(c) The work area must have a horizontal clearance of 41 ft (12.5 m) minimum. The work area must also have a vertical height of 20 ft (6.10 m) minimum.

(d) The work area must be as near as possible to the out−of−service aircraft. An indoor area is preferred.

(2) The equipment that follows must be available at the work site:

(a) A 16,500 lb (7484.27 kg) lift capacity fork−lift truck with 6 ft (1.83 m) minimum adjustable tines.

(b) A 20 ft (6.10 m) long stepladder.

(c) A 9 ft (2.74 m) long stepladder.

(d) A one ton (907 kg) capacity lift strap.

(3) Table 1201 gives the minimum standard tools recommended at the remote−site. These tools are not supplied with the split−shipment system, but must be with the work−crew at the remote−site.

NOTE: This list can be changed by the work−crews that do the split−ship procedure.

NOMENCLATURE	SPECIFICATIONS	MINIMUM QUANTITY	NOTES
Extension	1/2 in. Dr. x 6 in.	1	
	3/8 in. Dr. x 3 in.	2	
	3/8 in. Dr. x 6 in.	2	
	3/8 in. Dr. x 12 in.	2	
	1/4 in. Dr. x 3 in.	2	
	1/4 in. Dr. x 6 in.	2	
	1/4 in. Dr. x 12 in.	2	
	1/4 in. Dr. x 24 in.	2	
Files	Assorted	4	Universal handles
Flashlight	Batteries−Bulbs	1	Explosion proof
Gauge, Feeler	Set	1	
Hammer, Ball Peen	2 lb	1	
Hammer, Rawhide Tip/ Plastic	1 lb	1	
Handle, Speed	3/8 in. Drive	1	
Handle, Ratchet	1/2 in. Drive	1	
	3/8 in. Drive	2	
	1/4 in. Drive	2	
Lockwire Pliers	Open Type	1	
Meter	Simpson	1	
Mirror, Inspection	1 in.	1	
Pliers, Diagonal Side Cutting		1	
Pliers, Duck Bill		1	
Pliers, Utility		1	
Pliers, Vise Grip		1	

Table 1201

NOMENCLATURE	SPECIFICATIONS	MINIMUM QUANTITY	NOTES
(CONTINUED)			
Punch	Set	1	
Scale	6 in.	1	
Screwdriver, Standard	Set	1	
Screwdriver, Phillips	Set	1	
Screwdriver, Special	Special Bits/Socket Holder	1	
Socket, Standard-Set	1/2 in. Dr. 1/2 in. - 1 1/4 in.	1	12 point
	3/8 in. Dr. 5/16 in. - 3/4 in.	2	12 point
	1/4 in. Dr. 1/4 in - 1/2 in.	2	12 point
Socket, Universal-Set	3/8 in. Dr. 5/16 in. 1/2 in.	2	12 point
	1/4 in. Dr. 1/4 in. - 1/2 in.	2	12 point
Square, Combination		1	
Strap, Nylon	500 lb. capacity	2	
Strap, Nylon	1000 lb. capacity	2	
Tape, Measuring	6 ft.	1	
Torque Wrench	100 in-lb. Rating	1	
Torque Wrench	200 in-lb. Rating	1	
Torque Wrench	3600 in-lb. Rating	1	
Torque Wrench	400 in-lb. Rating	1	
Wire Twisters		1	
Wrench, Allen-Set	3/64 in.-3/8 in.	1	
Wrench, Box End-Set	3/8 in.-1 in.	1	
Wrench, Open End-Set	3/8 in.-1 in.	1	
Wrench, Adjustable	12 in.	1	
Wrench, Adjustable	12 in.	1	Sidejaw

NOTE: Supply at least four "Snap-On" brand 1/4" Drive 12 point universal sockets for the removal and installation of the Flange E bolts. "Snap-On" brand sockets are needed for clearance reasons.

Table 1201 (Continued)

G. General Data

CAUTION: INSTALL THE PROTECTIVE CAPS OVER THE TUBE ENDS. DO NOT INSTALL THE PROTECTIVE CAPS IN THE TUBE ENDS. ACCIDENTAL ASSEMBLY OF TUBES WITH THE PROTECTIVE CAPS INSTALLED IN THE ENDS, CAN RESULT IN FLOW BLOCKAGE AND ENGINE DAMAGE.

(1) The correct plugs and covers must be used to prevent contamination and damage.

(2) Use necessary precautions to prevent lockwire pieces, nuts, bolts, washers, or other unwanted objects from getting into the engine. The assembly procedure must stop if an unwanted object falls into the engine. The object must be found and removed before the assembly procedure is started again.

(3) Be sure all parts are clean and not damaged before installation. All corrosion preventive compound must be cleaned from all parts.

(4) Use lockwire, lockwashers, tablocks, tabwashers, cotter pins, and packings only one time. Use only corrosion resistant lockwire and cotter pins. All lockwire and cotter pins must attach tightly in their holes. Install all cotter pins with the head in the castellation of the nut. Bend half of the pin over the head of the nut. Bend the other half of the cotter pin down against the flat of the nut.

(5) For tubes with brazed ferrules on one end and loose ferrules and nuts on the other end, tighten the tube as follows:

(a) Install the tube to the engine with any packings needed and tighten by hand.

(b) Install any clamps needed for tube position.

(c) Tighten and torque the end with the brazed on ferrule first.

(d) Tighten and torque the end with the loose ferrule and nut second.

(e) Install lockwire.

(6) Dimensions, torques, weights, and measures are given in US units and SI−metric equivalent. The metric equivalent is in paranthesis and follows the US value.

(7) Standard torque values and special torque values are given in the procedures when necessary.

(8) The clock positions, referred to in the procedures, are as seen from the rear of the power plant or assembly.

H. Procedures Referred To

(1) The publications and procedures given below are needed in addition to these split−shipment instructions (71−00−00, Storage/Transport −02,−03).

(a) Airbus A300−600 Aircraft Maintenance Manual.

(b) Advanced Ground Systems Engineering Instructions (provided with the three−pallet system).

Task 71-00-00-530-001:

1. Prepare Power Plant For Split - Shipment

A. Prerequisites

(1) Remove and assemble the PWA 85650 lightweight trailer from the first pallet. See the Advanced Ground Systems Engineering Instructions.

(2) Remove the out-of-service power plant from the aircraft. Use the lightweight trailer from the first pallet. See the Airbus A300-600 Aircraft Maintenance Manual, 71-00-00, Power Plant - Removal/Installation.

(3) Remove the nose cowl. See the Airbus A300-600 Aircraft Maintenance Manual, 71-11-00, Nose Cowl - Removal/ Installation.

(4) Remove the exhaust nozzle. See the Airbus A300-600 Aircraft Maintenance Manual, 78-11-01, Exhaust Nozzle - Removal/Installation.

(5) Remove the exhaust plug cone. See the Airbus A300-600 Aircraft Maintenance Manual, 78-11-02, Exhaust Plug Cone - Removal/Installation.

(6) Remove the forward engine mount. See the Airbus A300-600 Aircraft Maintenance Manual, 71-21-00, Forward Engine Mount - Removal/Installation.

NOTE: You must examine the engine mount bolts before each installation. See the Airbus A300-600 Maintenance Manual, 71-21-00, Engine Mount Bolts Inspection/Check.

B. Equipment And Materials Required

Standard Tools:

.190-32 Jackscrews, Eight Necessary Per Text
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 85609 Split Engine Transport EBU System (The tools that follow are contained in this system).

.PWA 85610	Change L Tool Kit
..PWA 29389	Hydraulic Pump
..PWA 29614	Wrench (Coupling Nut)
..PWA 29615	Holder (Coupling Nut)
..PWA 29855−7	Aligning Pin (2 Necessary)
..PWA 75174	Lifting Eye (Rear Mount) (Optional to PWA 86415)
..PWA 85260	Guide Pin (2 Necessary)
..PWA 85299	Adapter (Optional to PWA 102460 Adapter)
..PWA 85300	Wrench (Coupling Nut)
..PWA 85301	Adapter (Coupling Nut)
..PWA 85302	Wrench (Coupling Nut)
..PWA 85306	Puller (Coupling Plug)
..PWA 85307	Puller, Jackscrew
..PWA 85390	Lifting Adapter (Front Core)
..PWA 85429	Wrench (Hand−LPT Nut)
..PWA 85452	Lifting Eye (Turbine Exhaust Case)
..PWA 85513	Sling
..PWA 85585	Guide Ring (1.5 Bearing)
..PWA 85632	Puller, Jackscrew (1.5 Bearing)
..PWA 85659	Lifting Eye (Rear Fan)
..PWA 85749	Torque Adapter
..PWA 85769	Fixture, Install/Remove (Coupling)
..PWA 85785	Adapter, Piloting
..PWA 86191	Torque Adapter
..PWA 86203	Guide, Lifting (LPT Shaft)
..PWA 86225	Wrench (Tool Coupling)
..PWA 86415	Lifting Eye (Rear Mount) (Optional to PWA 87275)
..PWA 87275	Lifting Eye (Rear Mount)
..PWA 101848	Puller, Jackscrew (6 Necessary)
..PWA 102460	Adapter
.PWA 85611	Transport System (Core−Unit)
..PWA 85388	Coupling (LPT Shaft/HPC)
..PWA 85389	Support Ring (Core−Unit Front)
..PWA 85614	Transport Stand (Core−Unit)
..PWA 86325	Fixture (LPT Shaft) (Optional to (PWA 86437) Fixture − See Note)
..PWA 86437	Fixture (LPT Shaft)(Optional to (PWA 86325) Fixture − See Note)
..PWA 88222	Fixture, (LPT Shaft) (Optional to PWA 86437)
.PWA 85612	Transport System (Fan−Unit)
..PWA 85380	Fixture (Fan−Unit Front)
..PWA 85381	Shipping Nut (Fan−Unit Front)

Special Tools:

..PWA 85383	Bracket (Fan-Unit To Pallet)
..PWA 85397	Shield (EEC)
..PWA 85492	Adapter (Fan-Unit Rear To Pallet)
..PWA 85615	Pallet (Fan-Unit)
..PWA 85618	Ring Retainer (No. 1.5 Bearing)
..PWA 86355	Shield (SCU)
.PWA 85613	Lightweight Trailer
.PWA 85633	Gantry Assembly
.PWA 86108	Container - Tool Storage
.PWA 86289	Closures - Engine Split Transport, Fan-Unit
.PWA 86290	Closures - Engine Split Transport, Core-Unit
PWA 101359	Puller, Mechanical (Pre SB PW4ENG 73-88)

NOTE: The (PWA 85609) Split Engine Transport EBU System contains all the tools indented below the System. The (PWA 85610) Tool Kit, the (PWA 85611) Transport System, and the (PWA 85612) Transport System contain all the tools indented two spaces below them.

NOTE: You can use the (PWA 86325) Fixture only on exhaust cases with the 30 bolthole rear cover. You can use the (PWA 86437) or (PWA 88222) Fixture on either the 30 or 16 bolthole rear cover configuration.

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-045	Pen, Marking
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-021	Compound, Antigalling (PWA 550-3)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72-61-00/12/270
Packing	1	79-11-00/2/1

C. Procedure

NOTE: Use this procedure for the preparation of out−of−service power plants or serviceable replacement power plants. If you use this procedure in the shop, you can use the shop rails and hoists instead of the PWA gantry system.

(1) Move the out−of−service or replacement power plant from the PWA 85613 Lightweight Trailer to the PWA 85614 Core−Unit Transport Stand as follows. See Figure 1201.

(a) Remove the oil tank overflow tube, bottom anti−ice duct, and forward anti−ice duct (tee) as follows.

1 Disconnect the oil tank overflow tube nut adjacent to the front hydraulic pump. Remove the clamp bolts that attach the tube to the duct and the gearbox bracket. Remove the tube and install the protection covers.

2 Disconnect the tube nut from the top of the forward duct (tee).

3 Remove the three clamps that attach the bottom duct to the top duct and the forward duct (tee) to the two fan case mounted ducts.

4 Hold the ducts and remove the bolt, washer, and nut that attach the support link to the bottom duct. Remove the bottom and the forward ducts together as a unit. Remove and discard the seals. Install the washer, bolt and nut to the link.

5 Install the protection covers.

(b) Put the power plant and lightweight trailer under the gantry.

(c) Use hoist No. 4 and install the PWA 87275 Lifting Eye or PWA 86415 Lifting Eye or PWA 75174 Lifting Eye to the rear flight mount with the bolts that attach the power plant to the aircraft. Put slight tension on the hoist.

(d) Install the PWA 85659 Lifting Eye, with larger swivel rearwards, to the 12 o'clock position boss on the intermediate case. Attach the adapter with the bolts supplied with the adapter. Attach Hoist No. 3 to the larger swivel. Put light tension on the hoist.

(e) Disconnect and lift the power plant from the lightweight trailer. Remove the trailer. Remove the front trailer supports from the engine and put them with the trailer.

(f) Install the core−unit transport stand front supports to the engine. Put the core−unit transport stand under the power plant. Install and attach the power plant to the stand.

(g) Disconnect the hoists.

(2) Drain fluids as follows. See Figure 1202.

(a) Remove the magnetic (chip detector) plugs and valves from the main gearbox and the oil tank. Allow oil to drain into a container.

(b) Install the new packings, PN AS3208−08, to the plug valves. Install the chip detector valves, threads and packing lubricated with Engine Oil P03−001 to the main gearbox and oil tank. Torque the two valves to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(c) Clean the magnetic plugs with a rag. Be sure the packings are on the plugs. Install the plugs by hand.

(3) Remove the EEC speed transducer (N1) with or without the multiplexer input as follows. See Figure 1203.

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE OR INSTALL A LINER SEGMENT. THE WASHERS THAT ARE ATTACHED TO THE LINER BRACKET CAN BECOME DISCONNECTED. ALSO, IF

THE EDGE OF THE LINER SEGMENT HITS SOMETHING, IT CAN DELAMINATE.

(a) Remove the screws/bolts that attach the liner segment and spacer plate to the fan exit case at 5 and 7 o'clock positions. Carefully remove the liner and spacer plate.

NOTE: Classified washers (0 - 3 as necessary) can be installed between the liner and the intermediate case front center attachment bracket. The washers, if used, are needed for the gap between the liner and the bracket. The washers are attached with adhesive compound to the bracket.

NOTE: To remove acoustical liners, it is necessary to first remove the sealant that is on the liner screws. Remove the sealant mechanically.

(b) If the classified washers are loose from the bracket, install lockwire to temporarily attach the washers.

NOTE: If the power plant is a serviceable replacement, re-attach the classified washers per Engine Manual 72-00-33, Installation-01 Task 72-00-33-420-001.

(c) Disconnect the harness connector(s) from the probe.

(d) For engines with the PMUX, remove the lockwire and disconnect the PT2.5 sensing tube nut from the probe. Remove the tube clamp bolt from the Flange E bracket.

(e) If necessary, bend the key washer(s) down that attach the probe to the case. Loosen and remove the bolts and nut (if equipped) equally. Remove the bolts, nut (if equipped) and washers. Discard the key washers if used.

CAUTION: DO NOT TRY AND TURN THE TRANSDUCER PROBE DURING REMOVAL UNTIL PROBE IS DISENGAGED FROM INNER BRACKET.

(f) (Pre SB PW4ENG 73-88) Use PWA 101359 Puller to break the interface between the flange of the transducer probe and the intermediate case.

(g) (Post SB PW4ENG 73-88) Use three .190-32 jackscrews in the transducer flange jackscrew holes to break the interface between the flange of the transducer probe and the intermediate case.

(h) Move the PT2.5 tube and the bracket (if equipped) away and lower and remove the transducer probe. Remove and discard the three packings. Temporarily attach the shim to the probe with lockwire.

(i) Install the protective covers to all the openings.

(4) Disconnect the W1 wiring harness and airframe wiring harness as follows. See Figure 1204.

NOTE: Keep all removed clamp bolts in the clamps or brackets with the self-locking feature of the clamp nut engaged.

(a) Use the PWA 85749 Torque Adapter and disconnect the W1P11 and the W1P10 connectors from the solenoid at 1 o'clock position. Remove the clamp bolts and nuts that attach the W1 harness to the Flange E bracket and the tube clamp at 1 o'clock position.

(b) Disconnect the airframe harness connector from the override pressure switch adjacent to the 1 o'clock position solenoid.

(c) Disconnect the W1P25 connector from the receptacle on the HPC case bracket at 1 o'clock position.

(d) Disconnect the W1P24 connector from the receptacle on the HPC case bracket at 10 o'clock position.

(e) Disconnect the W1P9 connector from the receptacle on the HPC case bracket at 12 o'clock position.

(f) Remove all the clamp bolts that attach the W1 harness to the HPC case brackets and the Flange E bracket.

(g) Temporarily attach the W1 harness to the 12 o'clock strut clear of the core−unit.

(h) Install protective covers to the harness connectors and receptacles.

(5) Disconnect the W2 wiring harness as follows.

NOTE: Keep all removed clamp bolts in the clamps or brackets with the self−locking feature of the clamp nut engaged.

(a) Disconnect the W2P26 connector from the receptacle on the HPC case bracket at 12 o'clock position.

(b) Remove the bolt that attaches the retaining bracket and the W2J9 harness receptacle from the HPC case bracket at 12 o'clock position.

(c) Remove all the clamp bolts that attach the W2 harness to the No. 1, 1.5, and 2 bearing breather tubes and to the Flange E bracket.

(d) Temporarily attach the W2 harness to the 12 o'clock strut clear of the core unit.

(e) Install protective covers to the harness connectors and receptacles.

(6) Disconnect the harness connectors as follows.

(a) Disconnect the airframe harness connector from the IDG heat−exchanger receptacle at 4 o'clock position. Remove the two bolts that attach the retaining bracket and IDG harness receptacle to the HPC case bracket. Remove the receptacle. Install again the retaining bracket and bolts. Tighten the bolts to engage the locking feature of the bracket nuts. Remove the two clamp bolts that attach the IDG harness to the hydraulic tube. Install protective covers.

(b) Use the PWA 85749 Torque Adapter and disconnect the W4P4 and the W5P11 connectors from the solenoid at 5 o'clock position. Install protective covers.

(c) Remove the clamp bolt that attaches the W4 harness (to the EEC speed transducer) to the bleed valve supply tube at 5 o'clock position.

(d) Disconnect the W3P15 connector from the 2.5 bleed valve actuator at 7 o'clock position. Install protective covers.

(e) Disconnect the W3P17 connector from the (engine) air/oil heat exchanger harness receptacle at 7:30 o'clock position. Remove the two bolts that attach the retaining bracket and receptacle to the HPC case bracket. Remove the receptacle from the bracket. Install again the retaining bracket and two bolts to the bracket. Tighten the bolts to engage the locking feature of the bracket nuts. Install protective covers.

(f) Use the PWA 85749 Torque Adapter and disconnect the W3P12 connector from the solenoid at 10 o'clock position.

(g) Disconnect the four large IDG cable clamps from the engine brackets at approximately 9 o'clock position. Move the cables rearward.

(7) Remove the lockwire and disconnect the EEC PB sensing tube (AS19) at 12:30 o'clock position. See Figure 1205.

(8) For engines with PMUX or SCU, remove lockwire and disconnect the PT2.5 sensing tube (AS30) at 12:30 o'clock position. See Figure 1205 (Sheet 1).

(9) Remove lockwire and disconnect the HPC air valve supply tube (AA25) and signal tube (AA01) from the solenoid adapters at 1 o'clock position. See Figure 1205 (Sheet 1).

(10) Remove lockwire and disconnect the two No. 3 bearing air cooler tubes (AP33) and (AP34) from the cooler at 2:30 o'clock position.

(11) Disconnect and remove the tubes from the IDG heat exchanger at 4 o'clock position as follows. See Figure 1205 (Sheet 2).

(a) Remove the lockwire and disconnect the airframe (IDG) cooler outlet oil tube (LS03) nut. Remove the three bolts that attach the tube to the heat exchanger. Remove the tube and discard the packing. Install the protective covers to the tube ends and port with the three bolts. Remove lockwire and disconnect the lower tube (LS06) nut near the fuel metering unit. Remove the clamp bolt that attaches the tube (LS06) to the lever bracket.

NOTE: The lower tube (LS06) is disconnected and the clamp bolt removed for clearance required when the core−unit is put into the lower shipping position.

(b) Remove the three bolts and washers and disconnect the (upper) airframe (IDG) cooler inlet oil tube. Disconnect the (lower) airframe (IDG) cooler inlet oil tube from the (left) tube at approximately 6 o'clock position. Remove the clamp, bolts, nuts, and washers. Remove the upper and lower tube as a unit. Install the protective covers.

(c) Remove the hydraulic drain tube and cross tee from the heat exchanger. Install the protective covers to the tubes, cross tee, and adapter.

(d) Remove the lockwire and remove the (IDG) air/oil cooler valve hydraulic pressure tube (CP13) and return tube (CR12) from the heat exchanger and the manifolds. Install the protective covers to the tubes, manifold tees, and the adapters.

(12) Remove the lockwire and disconnect the compressor stator cylinder hydraulic pressure tube (CP12) and return tube (CR03) from the manifolds and cylinder as follows. See Figure 1205 (Sheet 3).

(a) Remove the clamp bolts that attach the tubes to the Flange E bracket.

(b) Remove the tubes and install the protective covers to the tubes, manifold tees, and adapters.

(13) Remove the hydraulic pressure manifold (CP05) and oil cooler inlet return manifold (CR01) as follows.

(a) Remove the lockwire and disconnect the two hose nuts from the manifolds at 3 o'clock position.

(b) Remove the lockwire and disconnect the two manifolds at the lower tee connections at 5 o'clock position.

(c) Remove the clamp bolts and nut that attach the manifolds to the engine brackets. Remove the manifolds and install the protective covers to the hoses and to the manifold ends.

(14) Remove the fuel distribution valve supply tube (FM09)
R as follows. See Figure 1205 (Sheet 4) or (Sheet 5) as
R applicable.

(a) Remove the lockwire and disconnect each end.

(b) Remove the clamp bolts and nuts that attach the tube to the engine.

(c) Remove the tube and discard the packings and retainers.

(d) Install the protection covers.

(15) Remove the three bleed valve supply tubes (AA26),
R (AA27), and (AA29) as follows. See Figure 1205 (Sheet
R 6) and Figure 1205 (Sheet 7).

(a) Remove the lockwire and disconnect the three tube connections at 2:30 o'clock position.

(b) Remove the lockwire and disconnect the two tube connections to the 5 o'clock position solenoid. Remove the lockwire and disconnect the tube connection at the maintenance break adjacent to the solenoid. Remove the lockwire and disconnect the tube nut from the tee adjacent to the solenoid.

(c) Remove the clamp bolts that attach the tubes to the engine brackets, to each other, and to the harness clamps.

(d) Remove the tubes from the engine. Install the protective covers to all the tube ends and the solenoid adapters.

(16) For engines with 2.5 sensing remove the PT2.5 sensing
R tube (AS30) and manifold (AS31) as follows. See Figure
R 1205 (Sheet 8).

(a) Remove the lockwire and disconnect the upper tube from the lower manifold.

(b) Remove the clamp bolts that attach the tube and manifold to the engine brackets.

(c) Remove the tube and manifold. Install the protective covers.

(17) Remove the lockwire and disconnect the angle gearbox oil pressure tube (LP09) from the angle gearbox at 6
R o'clock position. See Figure 1205 (Sheet 9).

(18) Remove the two bolts that attach the angle gearbox oil scavenge tube (LR01) to the angle gearbox at 6 o'clock position. Loosen the clamp bolts as necessary to disengage the tube from the angle gearbox boss. Remove the packing. Install protective covers.

(19) Remove lockwire and disconnect the (2.5) bleed valve cylinder hydraulic pressure (CP06), return (CR02), and drain tubes from the cylinder and manifolds. See Figure 1205 (Sheet 9). Remove the pressure and return tubes. Remove the drain tube clamp bolt attached to the angle gearbox bracket. Remove the drain tube. Install protective covers to the tubes, adapters, and manifold tees.

(20) Remove the lockwire and disconnect the No. 1, 1.5 and 2 bearing oil scavenge tube (LR03) at 7:30 o'clock
R position. See Figure 1205 (Sheet 11).

(21) Remove the six bolts that attach the air/oil cooler inlet oil tube (LP02) to the main oil filter housing
R and the air/oil heat exchanger. See Figure 1205
R (Sheet 12). Remove the clamp bolt that attaches the
R tube to the HPC case bracket. Move the tube rearward and temporarily attach with lockwire. Discard the packings. Install the protection cover to the filter housing with the bolts.

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH
R CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND
R INSTALL A TUBE WITH A FLEX SEGMENT WITH THE
R SAME PRECAUTION USED FOR A TUBE WITHOUT A
R FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A
R TUBE TO HELP WITH THE INSTALLATION OR REMOVAL
R OF THE TUBE OR AN ATTACHED COMPONENT. IF A
R FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE
R A KINK IN THE EXTERNAL WIRE BRAID AND IN THE
R INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND
R LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(22) Remove the two bolts that attach the air/oil cooler outlet hose and tube assembly (LP03) to the air/oil heat exchanger. Remove the lockwire and disconnect the tube nut from the fuel oil cooler bypass valve adapter. Remove the clamp bolts that attach the tube to the engine. Remove the tube and discard the packings. Install the protection covers with the bolts.

(23) Remove lockwire and disconnect each end of the (left) air/oil cooler hydraulic pressure (CP07), return (CR05), and drain tubes from the air/oil heat exchanger adapters at 8 o'clock position and manifolds. Remove the clamp bolt that attaches the pressure tube to the Flange E bracket. Remove the tubes and install the protective closures.

(24) Remove lockwire and disconnect the main bearing oil pressure tube (LP05) from the strainer housing at 9 o'clock position and the strainer housing at top of the
R fuel/oil cooler. See Figure 1205 (Sheet 13). Remove
the clamp bolts and remove the tube. Discard the packing and retainer. Remove the bolt and clamp that attach the strainer housing to the Flange E bracket. Install protective covers.

(25) Remove lockwire and disconnect the two signal tubes (AA06) and (AA18) and the supply tube (AA22) from the solenoid adapters at 10 o'clock position.

(26) Remove the hose clamp and disconnect the cooling air hose from the cooling air supply tube (AC35) at 10:30 o'clock position.

(27) Remove lockwire and disconnect the main bearing breather tube (LB06) at 11:30 and 9 o'clock positions.
R See Figure 1205 (Sheet 14). Remove the clamp bolts and
remove the tube. Install protective covers.

(28) Remove lockwire and disconnect the EEC PT4.95 tube (AS04) at 11:30 o'clock position. Remove the bolt and clamp that attach the tube to the Flange E bracket. See Figure 1205 (Sheet 14). R

(29) Remove the compressor inlet cone as follows. See Figure 1206.

(a) Use a Marking Pen P05−045, or an equivalent, and make a disassembly vector (DV) mark from the inlet cone front segment to the rear segment. Remove the six bolts and washers that attach the front segment. Remove the inlet cone front segment.

(b) Use a Marking Pen P05−045, or an equivalent, and make a disassembly vector (DV) mark from the inlet cone rear segment to the front hub and plug. Make the mark in line with the previous mark. Remove the 19 bolts and washers that attach the inlet cone rear segment to the front hub. Remove the inlet cone rear segment.

(30) Remove the turbine shaft (coupling/retaining) nut as follows. See Figure 1207.

(a) Remove the retaining ring and key washer from the front hub plug. Use the PWA 85306 Puller and remove the plug and packing. Discard the packing.

(b) Install the PWA 85301 Adapter into the coupling nut and engage the teeth. Slide the three clamps outward and tighten the wingnuts to attach the tool.

(c) Install the PWA 85302 Wrench over the adapter and engage the teeth. Slide the three clamps outward and tighten the wingnuts to attach the tool.

(d) Install the PWA 29614 Mechanical Wrench with the PWA 86191 Torque Adapter and the PWA 29615 Holder. Loosen the turbine shaft (coupling/retaining) nut.

(e) Remove the wrenches and holder. Remove the nut by hand.

NOTE: The turbine shaft (coupling/retaining) nut must have the antigallant replaced per Engine Manual 72−32−80, Repair−01 (Task 72−32−80−300−001) before each installation.

(31) Remove the turbine shaft nut as follows. See Figure 1208.

(a) Remove the retaining ring and key washer from the nut and coupling.

(b) Install the PWA 102460 Adapter or PWA 85299 Adapter into the coupling and engage the teeth. Slide the three wingnuts outward and tighten to attach the tool.

(c) Install the PWA 85300 Wrench to the center of the adapter and engage the teeth to the nut.

(d) Install the PWA 29614 Mechanical Wrench with the PWA 86191 Torque Adapter installed and loosen the turbine shaft nut.

(e) Remove the wrenches and adapter. Use the PWA 85429 Wrench to remove the nut by hand. Remove the washer.

NOTE: The turbine shaft nut must have antigallant replaced per Engine Manual 72-32-84, Repair-01 Task 72-32-84-300-001 before each installation.

(32) (Post SB PW4ENG 79-76) Remove No. 4 bearing (oil) pressure tube. See Figure 1209 (Sheet 1).

NOTE: It is not necessary to remove the (Pre SB PW4ENG 79-76) No. 4 bearing (oil) pressure tube.

(a) Remove the No. 4 pressure tube (1209/10) from the turbine exhaust case at the 4:30 o'clock position.

1 Remove two bolts (1209/1) that attach the tube shield (1209/16) and bracket (1209/2) to the turbine exhaust case.

2 Remove the tube shield (1209/16), bracket (1209/2), thrust wire (1209/18) and nut (1209/17) from the outboard end of the pressure tube.

3 Remove the bolt (1209/6) and nut (1209/12) that attach the tube clamp (1209/7) and tube to the bracket (1209/8).

4 Cut the restraining straps (1209/3) and remove the insulation slide clamp (1209/13) and shield sets (1209/9) and (1209/4) from the tube.

5 Remove the tube nut from the adapter (1209/14) and move the tube radially inward and remove the pressure tube from the case.

(b) Install a protective cover on the adapter (1209/14).

(c) Secure bolts (1209/5) and bracket (1209/8) on the turbine exhaust case.

(33) Remove the No. 4 bearing cover as follows. See Figure 1209 (Sheet 2).

(a) Remove the 30 bolts or the 16 bolts that attach the No. 4 bearing shield and the No. 4 bearing heat shield to the exhaust case. Remove the shields.

(b) For No. 4 bearing cover that has six small threaded holes (Pre SB PW4ENG 72-385), install the PWA 85307 Jackscrew Puller to the rear inner bolt hole flange (Flange T1) of the exhaust case and attach with two bolts, washers and nut details. Install the small plate of the puller to the six threaded holes in the cover and attach with six knurled screw details. Turn the jackscrew to disengage the cover from the exhaust case. Remove the puller and the cover from the exhaust case. Remove the cover from the puller. Discard the packing.

(c) For a cover that has eight jackscrew holes (Post SB PW4ENG 72-385), install and evenly tighten eight 0.190-32 Jackscrews to remove the cover. Discard the packing.

(34) (Pre SB PW4ENG 72-472) Remove the No. 4 bearing (oil) nozzle and No. 4 bearing packing transfer tube from boss in the exhaust case (No. 4 bearing compartment) at 1:30 o'clock position. See Figure 1210.

(a) Remove bolts (1210/8) and key washers (1210/6) and (1210/7) securing No. 4 bearing packing transfer tube (1210/5) to No. 4 bearing nozzle (1210/4). Remove tube.

(b) Remove bolts (1210/1) and key washers (1210/2) and (1210/3) securing No. 4 bearing nozzle (1210/4) to exhaust case. Remove nozzle.

(35) (Post SB PW4ENG 72-472) Remove the No. 4 bearing (oil) nozzle and front No. 4 bearing nozzle. See Figure 1211.

(a) Remove the bolts and key washer (1211/1) that attach the front No. 4 bearing nozzle to the No. 4 bearing support flange at the 12 o'clock position. Discard the key washer.

(b) Move the packing transfer tube (1211/15) into the elbow of the No. 4 bearing damper supply tube (1211/12). Remove the nozzle.

(c) Remove the packing transfer tube from the damper supply tube. Discard the two packings (1211/14).

(d) Remove the bolts and key washers (1211/16) and (1211/17) that attach the No. 4 bearing damper supply tube (1211/12) to the No. 4 bearing oil nozzle (1211/11). Remove the tube.

(e) Remove the bolts and key washers (1211/16) and (1211/17) that attach the No. 4 bearing nozzle (1211/11) to the exhaust case. Remove the nozzle.

(36) Remove the No. 4 bearing oil scavenge (inner) tube. See Figure 1212.

(a) Remove bolts (1212/5 and 1212/6) and key washers (1212/4 and 1212/7). Remove oil scavenge (inner) tube (1212/8) from the turbine exhaust case.

(b) Remove and discard gasket (1212/3).

(c) Cover hole in tube attachment pad on the case with a protective cover.

(37) Remove the eight bolts (1213/1) that attach the No. 4 bearing retaining plate to the front compressor drive shaft (1213/2). See Figure 1213.

(38) Install the PWA 86437 Fixture or PWA 86325 Fixture to hold the low pressure turbine (LPT) in position as follows. See Figure 1214.

NOTE: Use PWA 86325 Fixture with turbine exhaust cases that are (Pre SB PW4ENG 72-456). Use PWA 86437 Fixture with either (Pre or Post SB PW4ENG 72-456) turbine exhaust cases.

(a) Install the inner slide to the ID of the No. 4 bearing retaining plate and attach with eight detail screws.

(b) Install the outer slide over the inner slide, put the slot in the outer slide over the key on the inner slide.

(c) Turn the turbine shaft until the scallops in the flange of the outer slide assembly align with the oil pressure and scavenge tubes protruding from the exhaust case flange. Attach the outer slide to the exhaust case with eight detail bolts.

(d) Tighten the eight cap screws.

(39) Install PWA 88222 Fixture or PWA 86437 Fixture to attach the low pressure turbine shaft to the turbine exhaust case. See Figure 1214.

NOTE: Use PWA 88222 Fixture with (Pre or Post SB PW4ENG 72-456) turbine exhaust cases.

(a) Loosen the locknuts that hold the tube and guide assemblies together and install the fixture to the ID of the turbine exhaust case. The tube assembly detail will mate against the No. 4 bearing retaining plate and the guide assembly detail will mate against the rear inner flange of the exhaust case. Attach the fixture with the captured capscrews of both details.

NOTE: If necessary, turn the LPT rotor to align the holes in the end of the 7th stage disk or LPT shaft, as applicable, with the captured capscrews of the tube assembly detail.

(b) Tighten the capscrews of both details to lock the fixture in position.

(40) Use a Marking Pen P05−045, or an equivalent, and make a disassembly vector (DV) mark from the front hub, to the coupling, and to the LPT shaft. Align the mark with the previous mark.

(41) Remove the coupling assembly as follows. See Figure 1215.

(a) Install the PWA 85769 Coupling Fixture as follows.

1 Install the shaft (detail−35) to the end of the LPT shaft and tighten by hand.

2 Install the body assembly (details−8, 19 and 21) with the adapter (detail−3), arm (detail 1) and eye (detail−2) to the coupling.

3 Retract the locating pin. Turn the plate (detail−21) to position the plate lugs behind the coupling lugs. Release the locating pin to lock the tool to the coupling. If installed Remove the eye (detail−2), arm (detail 1), and adapter (detail−3).

4 Install locator (detail−27) to the hub and tighten by hand. Install backup nut (detail−15), handle end first, and tighten so that is below the forward surface of the locator (detail−27). Install the cover (detail−7) with the six bolts (detail−41). Tighten the bolts. Install two rods (detail−10) to the body assembly. Install the two hydraulic cylinders (detail−12) to the rods and attach with the nuts (detail−11). Tighten the nuts by hand. Turn the backup nut (detail−15) out to contact the cover (detail−7). Install a nut (detail−11) to the center rod and tighten by hand.

(b) Connect the hydraulic hoses to the cylinders and to the PWA 29389 Pump. Operate the pump only enough to disengage the tight fit.

(c) Remove the hoses, nuts (detail−11), cylinders (detail−12), cover (detail−7), and backup nut (detail−15).

(d) Attach the adapter (detail−3) with four bolts (detail−4). Use a hoist and install the arm (detail−1) and eye (detail−2). Remove the coupling from the engine and put aside. Protect the bearing and seal plate.

(e) Remove the arm from the fixture and install the eye for later use.

(f) Remove shaft (detail−35) from the engine.

(42) Remove the 16 bolts, washers, and the bracket that attach the No. 1.5 bearing outer race. Use the PWA 85632 Puller and remove the bearing outer race. See Figure 1216.

(43) Install the PWA 85585 Guide Ring to the support with the detail bolts.

(44) Install the PWA 85388 Coupling (LPT to HPC) as follows. See Figure 1217 (Sheet 1).

(a) Install and tighten by hand the PWA 86203 Guide to the LPT shaft. Use this guide to support the LPT shaft during the installation of the PWA 85388 Coupling.

(b) Use the PWA 86225 Wrench and install the PWA 85388 Coupling to the No. 2 bearing support.

NOTE: If equipped, the four grooves on the PWA 85388 Coupling must be fully rearward of the PWA 85585 Guide Ring front surface. If the grooves are not fully rearward of the ring, the coupling threads is not fully engaged.

(c) Use the same wrench and install and tighten the tool detail nut to the LPT shaft until it touches the LPT shaft spacer.

(45) Install the PWA 85380 Fixture to the front of the engine as follows. See Figure 1217 (Sheet 2).

WARNING: BE SURE THAT CENTER RING IS TIGHT IN THE FIXTURE TO PREVENT AN ACCIDENT. TIGHTEN THE EIGHT POSITION BOLTS IF NECESSARY.

(a) Attach Hoist No. 1 to the PWA 85513 Sling. Attach Hoist No. 2 to the eye of the fixture. Use Hoists No. 1 and 2 and PWA 85513 Sling to lift and turn the fixture. Align the fixture to Flange A and install 60 bolts, nuts, and washers. Tighten the nuts by hand.

(b) At the center, loosen the eight position retaining bolts slightly to allow the center ring to move. Align boltholes with the hub nuts and install the detail−19 bolts. Tighten the 19 bolts.

(c) Tighten the 60 Flange A tool bolts.

(d) Tighten the eight position retaining bolts and use the jamnuts to hold their position. Disconnect Hoist No. 2. Put slight tension on Hoist No. 1.

(46) Disconnect the gearbox driveshaft as follows. See Figure 1218.

(a) Remove the six bolts, nuts, and washers that attach the gearbox driveshaft housing to the angle gearbox. Remove the four bolts that attach the two brackets to the HPC case.

(b) Move the driveshaft housing rearward into the main gearbox. Disengage the driveshaft retaining ring and move the driveshaft rearward into the main gearbox.

(47) Install the PWA 85390 Lifting Adapter to the HPC case 8th stage duct openings as follows. See Figure 1219 and Figure 1220.

(a) Remove the eight bolts that attach the right 8th stage duct elbow to the HPC case.

(b) Remove the coupling that attaches the right 8th stage duct elbow to the right 8th stage check valve.

(c) Remove the right duct elbow and the seals. Install the protection covers.

NOTE: Do not disassemble the harness from the bracket.

(d) Disconnect the tube from the mid−stage duct on the left side of the engine.

(e) Remove the nut, bolt, and washer that attach the link to the mid−stage duct. Install the nut, bolt, and washer (without the duct engaged) to the link. Engage the self−locking feature of the nut.

(f) Remove the three couplings that attach the midstage duct to the check valve, the high pressure bleed valve, and the pressure regulating valve. Remove the mid−stage duct. Discard the seals.

(g) Remove the eight bolts that attach the left 8th stage duct to the HPC case. Remove the duct and check valve as a unit. Discard the gasket. Install protection covers.

NOTE: Do not disassemble the harness from the bracket.

(h) If equipped, remove the two bolts and the cover from the forward side of the right side 2.9 bleed valve.

(i) Use Hoist No. 4 and install the PWA 85390 Lifting Adapter to the HPC 8th stage openings. Use the 16 bolts supplied with the adapter. Tighten the bolts. Put only slight tension on the hoist.

(48) Be sure that the hoists are put in position as shown in Figure 1219 (Sheet 3).

CAUTION: BE SURE THAT YOU CONNECT HOIST NO. 3 TO THE REAR EYE (LARGER EYE) OF THE FAN−UNIT REAR LIFTING EYE.

(49) Put tension on Hoist No. 3 to remove the transport stand front supports from the intermediate case. Remove the supports from the stand.

CAUTION: BE SURE THAT HOISTS NO. 1, 3 AND 4 HAVE THE CORRECT EQUAL TENSION TO PERMIT THE SEPARATION OF THE FAN−UNIT FROM THE CORE−UNIT. DO NOT LET THE WEIGHT OF THE FAN−UNIT REST ON THE TOOL COUPLING OR THE GUIDE INSTALLED TO THE FRONT OF THE HPC SHAFT. TOO MUCH OR TOO LESS TENSION ON ANY OF THE HOISTS CAN CAUSE DAMAGE TO THE ENGINE.

(50) Remove 33 bolts from the rear flange of the No. 1.5 bearing support.

CAUTION: FOR RETAINING BOLTS USE WORKBOLTS WITH DRILLED HEADS WITH A 0.500 INCH (12.700 mm) MAXIMUM SHANK AND THREAD LENGTH. (PN MS9218−05 OR PN MS9218−06 IS RECOMMENDED).

(51) Install four retaining bolts in the holes indicated in Figure 1215 (Sheet 1). Tighten by hand. Tag the bolts "To Be Removed."

(52) Install four jacking bolts in the rear flange of the No. 1.5 bearing support assembly. Tighten by hand. See Figure 1220 (Sheet 1). Tag the bolts "Jacking Bolt".

(53) Remove the Flange E bolts that attach the core−unit to the fan−unit. Install two PWA 85260 Guide Pins at approximately 3 and 9 o'clock positions on Flange E. Install two PWA 29855−7 Aligning Pins at approximately 6 and 12 o'clock positions on Flange E.

NOTE: Flange E has two configurations, the UPS configuration has 72 bolts and the other configuration has 74 bolts.

(a) For engines with the 2.5 bleed actuator support bracket (Post SB PW4ENG 75−84) do the following.

1 Remove the three bolts and nuts that attach the support bracket to a bracket on Flange E.

CAUTION: USE A FLASHLIGHT AND BE SURE THAT ALL THE 33 SUPPORT BOLTS AND ALL THE FLANGE E BOLTS ARE REMOVED. COUNT THE BOLTS. THERE SHOULD BE 72 BOLTS FOR THE UPS CONFIGURATION AND 74 BOLTS FOR THE OTHER CONFIGURATION. BE SURE THAT ALL EXTERNAL PARTS ARE DISCONNECTED AND ARE CLEAR FOR SEPARATION.

(54) Install six PWA 101848 Jackscrew Plates as follows. See Figure 1221.

(a) Remove the two detail screws from each plate.

(b) Put each plate between the intermediate case and the HPC case synchronizing ring bosses. Align the screw holes in each plate with the inserts in the intermediate case.

(c) Install two screws to each plate and tighten by hand.

(d) The plates must be installed equally around Flange E.

(55) Install the PWA 85785 Adapter as follows. See Figure 1217.

(a) Install the PWA 85785 Adapter over the previously installed guide until seated.

(b) Turn the legs outward and engage the rear of the fan hub.

(c) Tighten the detail wing nuts to hold the legs in position.

(56) Separate the fan−unit away from the core−unit as follows.

CAUTION: BE SURE THAT HOISTS NO. 1, 3 AND 4 HAVE THE CORRECT EQUAL TENSION TO PERMIT THE SEPARATION OF THE FAN−UNIT FROM THE CORE−UNIT. TOO MUCH OR TOO LESS TENSION ON ANY OF THE HOISTS CAN CAUSE DAMAGE TO THE ENGINE.

(a) Tighten the jackscrews in the No. 1.5 bearing support flange and the jackscrews of the Flange E jackscrew plates equally for the separation. Be sure to monitor Flange E for equal separation all around. Adjust hoist tension during separation if necessary. Also monitor the separation of all external parts. Separate the fan unit from the core unit only slightly. Use a flashlight and be certain there is clearance between the core−unit tool coupling and the fan−unit No. 2 bearing seal. Remove the fan−unit from the core−unit completely.

(b) Discard the packing on the No. 2 bearing support and the intermediate case Flange E diameter (if used).

(c) Remove the oil transfer tube and discard the two packings if equipped.

(d) Remove the six PWA 101848 Jackscrew Plates.

(e) Remove the four bolts in the No. 1.5 bearing support flange with the tag "Jacking Bolt".

(f) Remove the two PWA 85260 Guide Pins and the two PWA 29855−7 Aligning Pins from Flange E.

NOTE: Be sure that all the Flange E bolthole threads are serviceable. Repair any damaged threads.

(g) Install the Lockwire P05−289 to the PWA 85388 Coupling and detail nut.

(h) Remove the PWA 86203 Guide from the front of the core−unit.

(i) Use the PWA 85429 Wrench and install the washer and LPT shaft nut. Tighten until the nut touches the washer. Install the Lockwire P05−289 from the PWA 85388 Coupling to the tool detail nut.

(57) Install protective covers to all tube and adapter openings as shown. See Figure 1222.

(58) Attach Hoist No. 2 to the smaller swivel of the fan−unit rear lifting eye. Put tension on Hoist No. 2 and remove Hoist No. 3 from the lifting eye. See Figure 1223.

CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE−UNIT BY THE TOOL COUPLING THAT IS INSTALLED ON THE FRONT OF THE CORE−UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE TOOL COUPLING. TOO MUCH STRESS ON THE TOOL COUPLING CAN CAUSE DAMAGE TO THE NO. 2 BEARING SEAL NUT.

(59) Use Hoist No. 3 and install the PWA 85389 Support Ring to the front of the core−unit as follows.

(a) Align the center bolt circle and dowel pin hole in the ring with the No. 2 bearing support and dowel pin. Install the 33 bolts supplied with the ring. Tighten the bolts.

(b) Install the 48 bolts, nuts, and washers that attach the ring to the HPC case front flange. Tighten the bolts.

(c) Install the inlet cone segments to the support ring. Use the ring clamps and hand−knobs to attach the rear segment. Install the front segment to the rear segment with six bolts and washers. Tighten the bolts.

(60) Remove the 16 bolts that attach the PWA 85390 Lifting Adapter to the HPC case. Use Hoist No. 4 to remove the adapter. Install protective covers to the openings.

WARNING: BEFORE DISCONNECTING THE CORE−UNIT FROM THE GANTRY HOIST, BE SURE THAT FAN−UNIT IS CENTERED UNDER THE GANTRY. DO NOT ALLOW THE FAN−UNIT TO MOVE NEAR THE END OF THE GANTRY RAIL OR PERSONAL INJURY CAN RESULT.

CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE−UNIT BY THE TOOL COUPLING THAT IS INSTALLED ON THE FRONT OF THE CORE−UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE TOOL COUPLING. TOO MUCH STRESS ON THE TOOL COUPLING CAN CAUSE DAMAGE TO THE NO. 2 BEARING SEAL NUT.

(61) Install the transport stand support to the front of the stand with four bolts. Lower the front of the core−unit onto the support. Remove Hoist No. 3 from the support ring and remove the core−unit and transport stand from under the gantry.

(62) Remove the PWA 85785 Adapter from the front fan hub. See Figure 1224.

(63) Remove the PWA 85585 Guide Ring from the No. 1.5 bearing support. Keep the bolts with the ring.

(64) Install the PWA 85618 Ring Retainer to the support with the three bolts supplied with the ring.

(65) Install the PWA 85492 Adapter to the rear of the fan−unit. Align the boltholes and install the 19 bolts, lubricated with Antigalling Compound P06−021, to attach the adapter. Tighten the bolts.

WARNING: BEFORE TURNING THE FAN−UNIT, BE SURE THAT THE FAN−UNIT IS CENTERED UNDER THE GANTRY. DO NOT ALLOW THE HOIST TO MOVE NEAR THE END OF THE GANTRY OR PERSONAL INJURY CAN RESULT.

(66) Use Hoists No. 1 and 2 to lift and turn the fan−unit to rear end down position. Keep the hoists near the center of the gantry rail. See Figure 1225.

(67) Move and align the fan−unit pallet under the fan−unit. Disconnect Hoist No. 2 and remove the (PWA 85659) Lifting Eye. Use Hoist No. 1 to lower the fan−unit to the pallet. Align the three PWA 85383 Brackets with the intermediate case bosses and attach with bolts. Adjust the bracket height at each location with the threaded rod. Tighten the bolts. Torque the threaded rod to 200 lb−in. (22.597 N.m) to pull the fan−unit down to the pallet. Tighten the jamnuts. Remove Hoist No. 1 and the PWA 85513 Sling .

NOTE: Position the fan−unit on the pallet so that the EEC is over the tool box.

(68) Install the coupling assembly to the fan−unit as follows. See Figure 1226.

(a) Lubricate the coupling assembly as shown.

(b) Put the coupling assembly, with the PWA 85769 Fixture installed, under the gantry. Attach two lifting eyes, a strap, and hoist. Install the assembly to the fan−unit. Be sure that the coupling splines are aligned and engaged.

(c) Remove the PWA 85769 Fixture.

R
R

(69) Install the PWA 85381 Shipping Nut to hold the coupling. Tighten the nut by hand.

(70) Loosen the jamnuts and positioning bolts at the center of the fan−unit front fixture to permit a rearward load on the No. 1 bearing. Tighten the positioning bolts and jamnuts again to hold the rotor position. Install the cover with the (detail−12) bolts.

(71) Install the PWA 85397 EEC Shield over the EEC. For engines with the SCU, install the PWA 86355 Shield over the SCU. Wrap the fan−unit.

(72) Remove the fan−unit pallet from under the gantry.

(73) Remove the following parts for core−unit clearance in the lower shipping position as follows. See Figure 1227.

(a) Remove the pylon drain mast from the core−unit as follows. See Figure 1227 (Sheet 1).

1 Disconnect the drain tube from the mast.

2 Remove the bolts, nuts, and washers that attach the mast to the Flange P bracket.

3 Remove the mast and install protection covers.

(b) Remove the (rear) deoiler vent duct as follows. See Figure 1227 (Sheet 2).

1 Disconnect the rear duct from the front duct.

2 Remove the bolt and washer that attach the duct to the bracket.

3 Remove the (rear) duct and install the protection covers.

(c) Remove the gearbox mounted drain manifold assembly and drain tubes from the core−unit as follows. See Figure 1227 (Sheet 3) and Figure 1227 Sheet 4).

1 Disconnect all the drain tubes attached to the drain manifold assembly at the closest connection above the manifold assembly.

2 Remove the three bolts and washers that attach the manifold assembly to the main gearbox.

3 Loosen and remove any clamp bolts as necessary to remove the manifold assembly with the drain tubes attached.

4 Remove the manifold assembly and tubes. Install the protective covers.

(d) Remove the IDGS pad drain tube adapter. Remove and discard the packing. Install the protection covers.

(e) Disconnect the harness connector from the starter shutoff valve. Remove the clamp bolts and nuts that attach the harness to the No. 4 bearing oil scavenge tube. Temporarily attach the harness above the tube. Install the protection covers.

(f) Remove (as a unit) the starter valve and ducts as follows. See Figure 1227 (Sheet 5).

1 Remove the cooling air hose from the top of the valve.

2 Remove the harness clamps that attach to the valve.

3 Loosen and remove the coupling that attaches the lower forward duct to the starter. Loosen and remove the coupling that attaches the lower duct to the intermediate duct.

4 Hold the valve and duct unit and remove the nuts, washers, bolts, and bushings that attach the two support links to the flange brackets.

5 Lower the unit and remove the two seals between the duct.

6 Install the protection covers.

7 Install the bolts, bushings, washers, and nuts back into the support link rod ends.

CAUTION: BE SURE AND MONITOR THE BOTTOM OF THE CORE−UNIT FOR CLEARANCE WITH THE TRANSPORT STAND AS YOU LOWER THE CORE−UNIT.

(74) Move and align the core−unit under the gantry. Install the two front core−unit mounts with eight bolts and eight washers. Tighten the bolts. Install the two front core−unit supports to the transport stand with eight bolts and washers. Tighten the bolts. Attach Hoist No. 3 and 4 to the front and rear lifting eyes. Put tension on hoists. Remove the front center support from the transport stand. Disconnect and remove the two rear supports from the transport stand. Carefully examine the bottom of the core−unit for proper clearance and lower the core−unit to the shipping position. Attach the core−unit to the transport stand. See Figure 1228.

(75) Disconnect Hoist No. 3. Use Hoist No. 4 and PWA 87275 Lifting Eye, PWA 86415 Lifting Eye or PWA 75174 Lifting Eye and remove the engine rear flight mount from the exhaust case. See the Airbus A300−600 Maintenance Manual, 71−22−00, Rear Lower Engine Aft Mount − Removal.

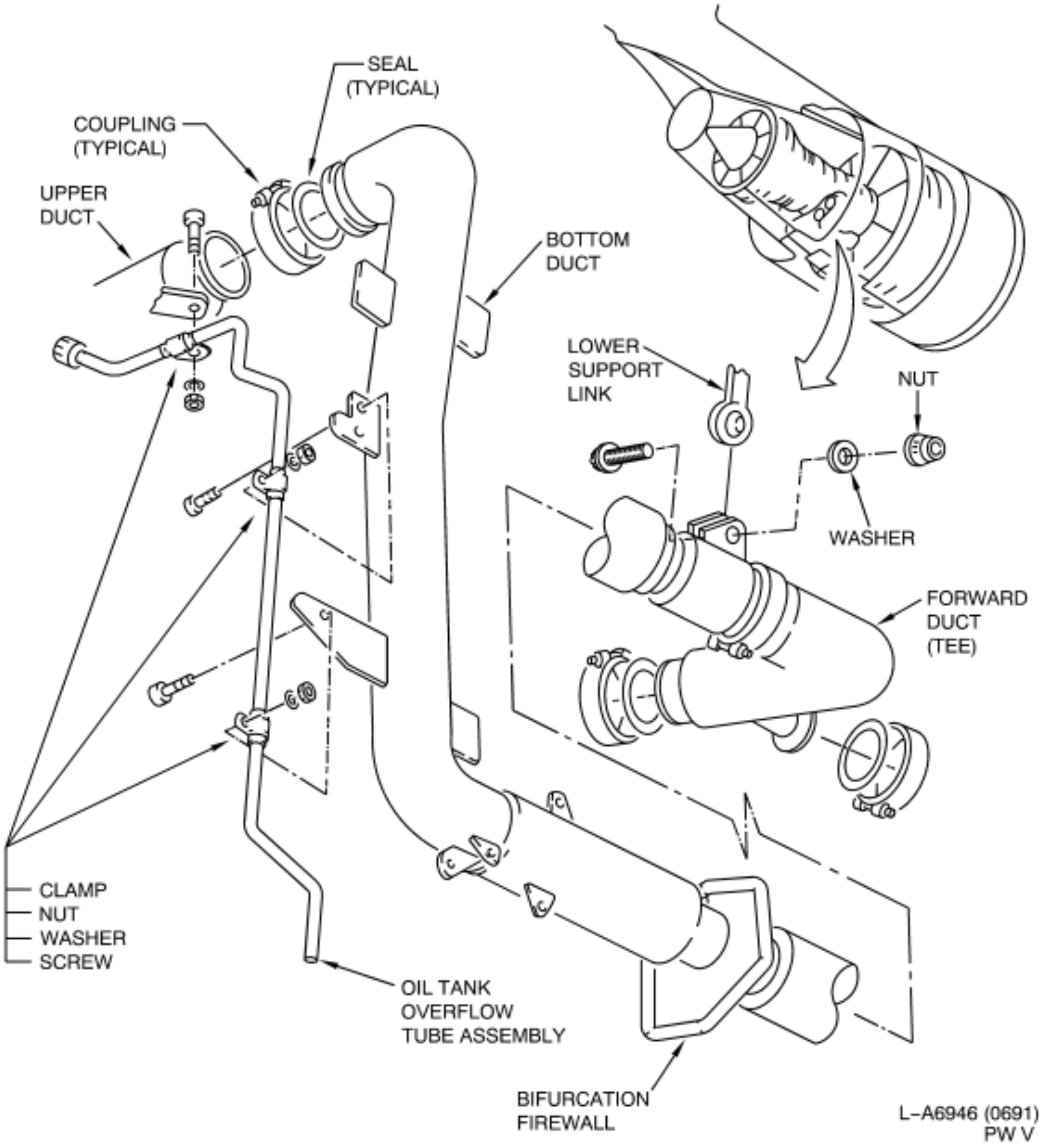
NOTE: The engine mount bolts must be examined before each installation. See the Airbus A300−600 Maintenance Manual, 71−22−00, Engine Aft Mount Bolts − Inspection/Check.

(76) Install protective covers and prepare the pallets for shipment. Lift and lock the wheels.

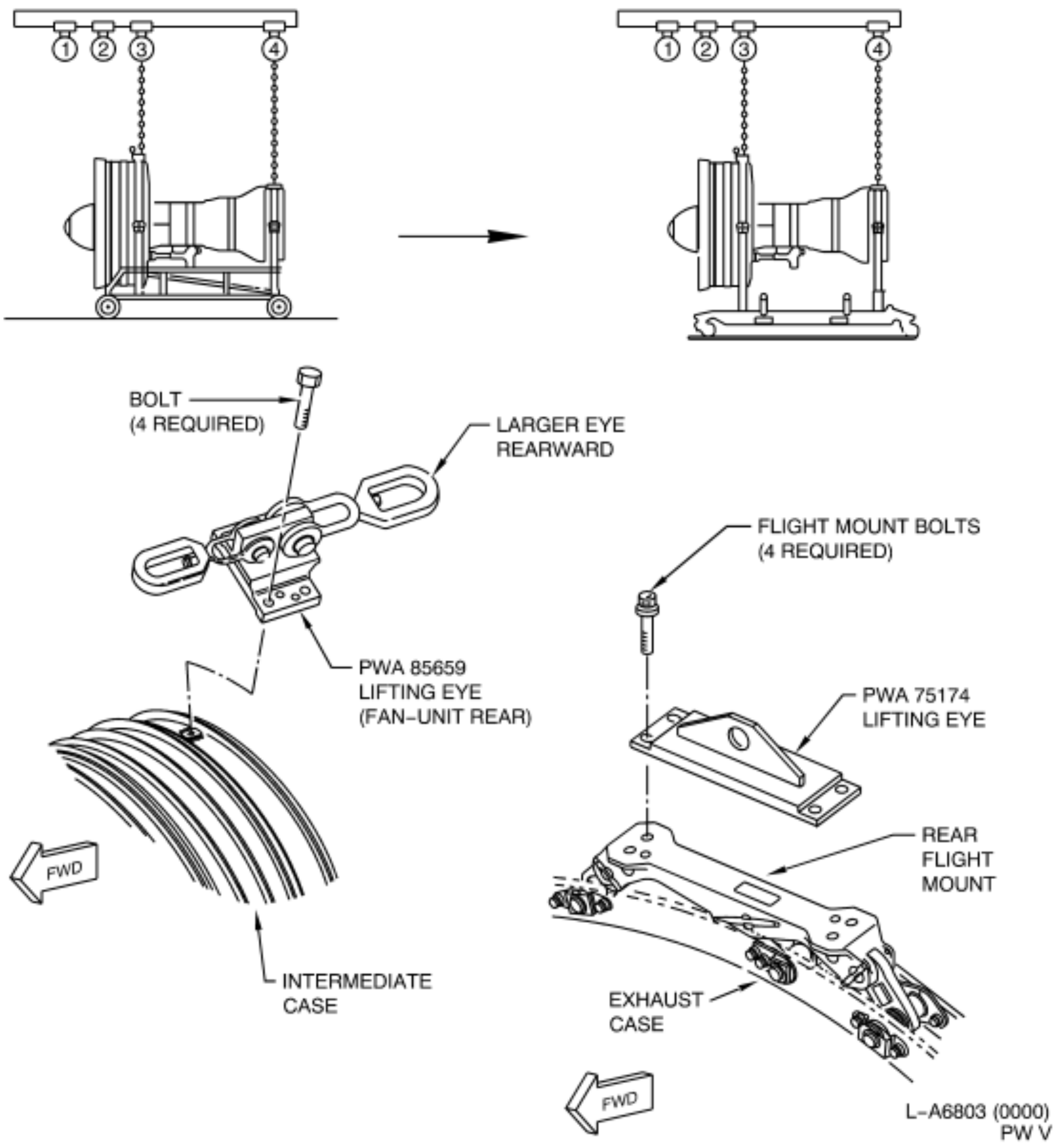
(77) Disassemble the PWA 85633 Gantry and lightweight trailer. Install the gantry and trailer to the pallet. Install the PWA 86108 Container (toolbox) to the pallet. See Figure 1229.

NOTE: Instructions for the disassembly of the gantry and the lightweight trailer are found inside the toolbox. The instructions are supplied by the manufacturer of the split−shipment equipment.

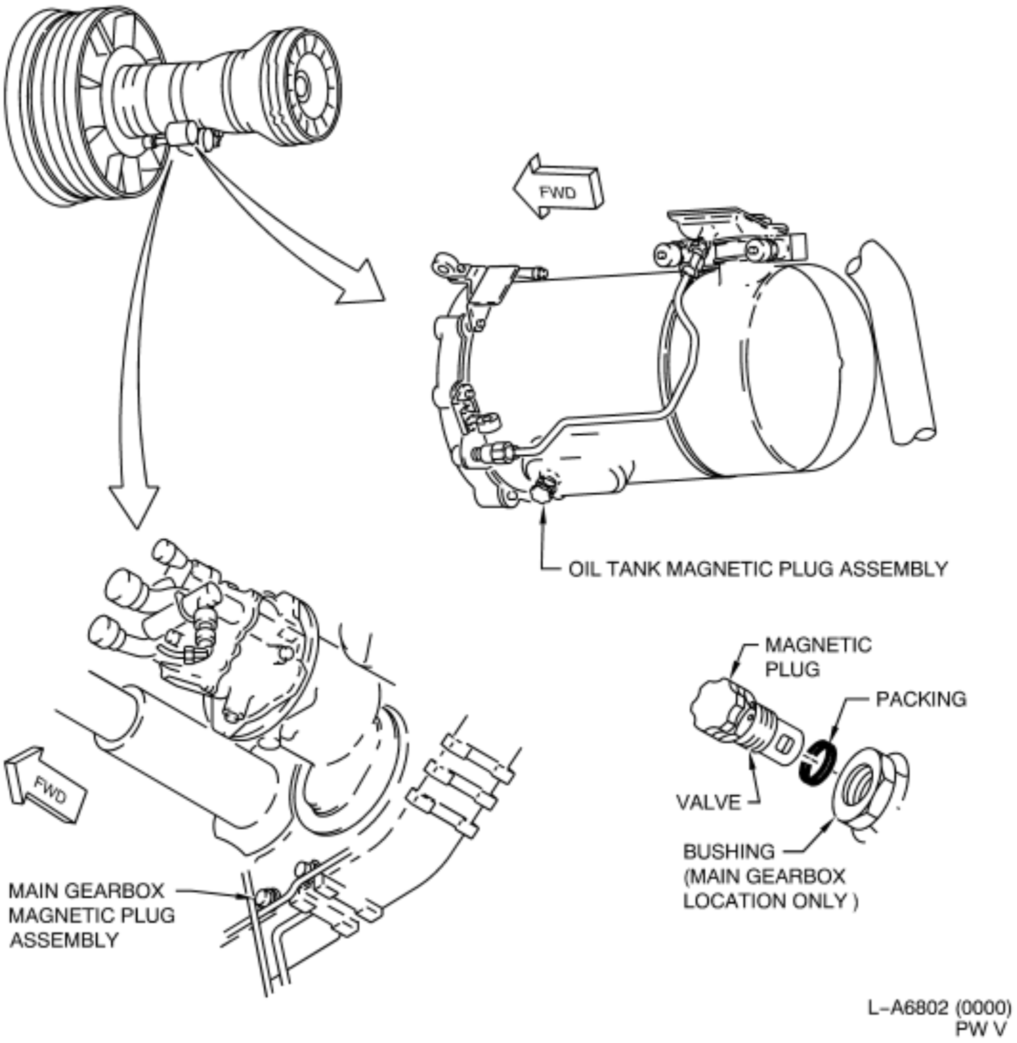
(78) Put the tools and engine parts in the PWA 86108 Container.


SEAL
(TYPICAL)
COUPLING
(TYPICAL)
UPPER
DUCT
BOTTOM
DUCT
LOWER
SUPPORT
LINK
NUT
WASHER
FORWARD
DUCT
(TEE)
CLAMP
NUT
WASHER
SCREW
OIL TANK
OVERFLOW
TUBE ASSEMBLY
BIFURCATION
FIREWALL
L−A6946 (0691)
PW V

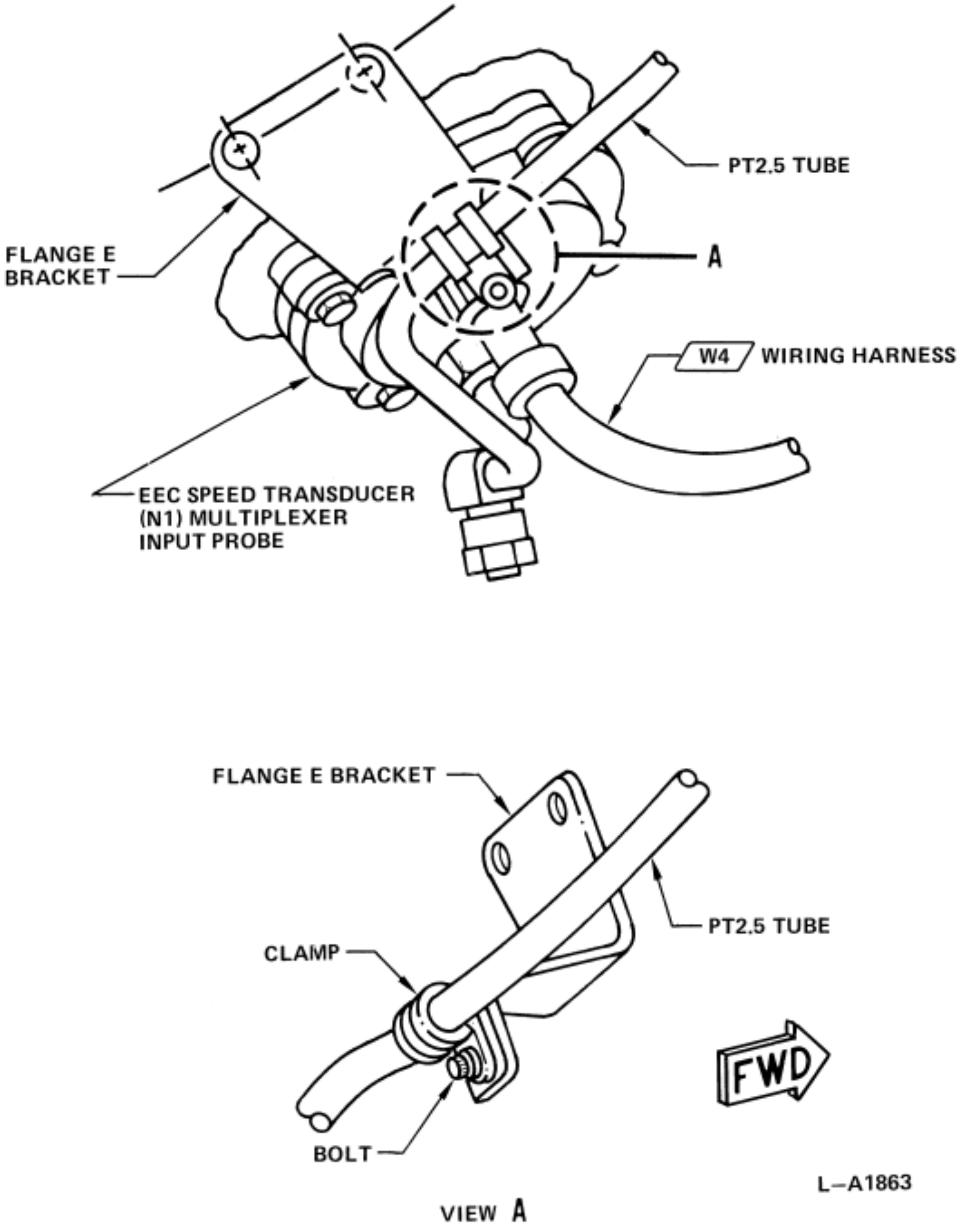
Anti−Ice Duct Removal
Figure 1201 (Sheet 1)
(Task 71−00−00−530−001)


1
2
3
4
1
2
3
4
BOLT
(4 REQUIRED)
LARGER EYE
REARWARD
FLIGHT MOUNT BOLTS
(4 REQUIRED)
PWA 85659
LIFTING EYE
(FAN−UNIT REAR)
PWA 75174
LIFTING EYE
REAR
FLIGHT
MOUNT
FWD
INTERMEDIATE
CASE
EXHAUST
CASE
FWD
L−A6803 (0000)
PW V

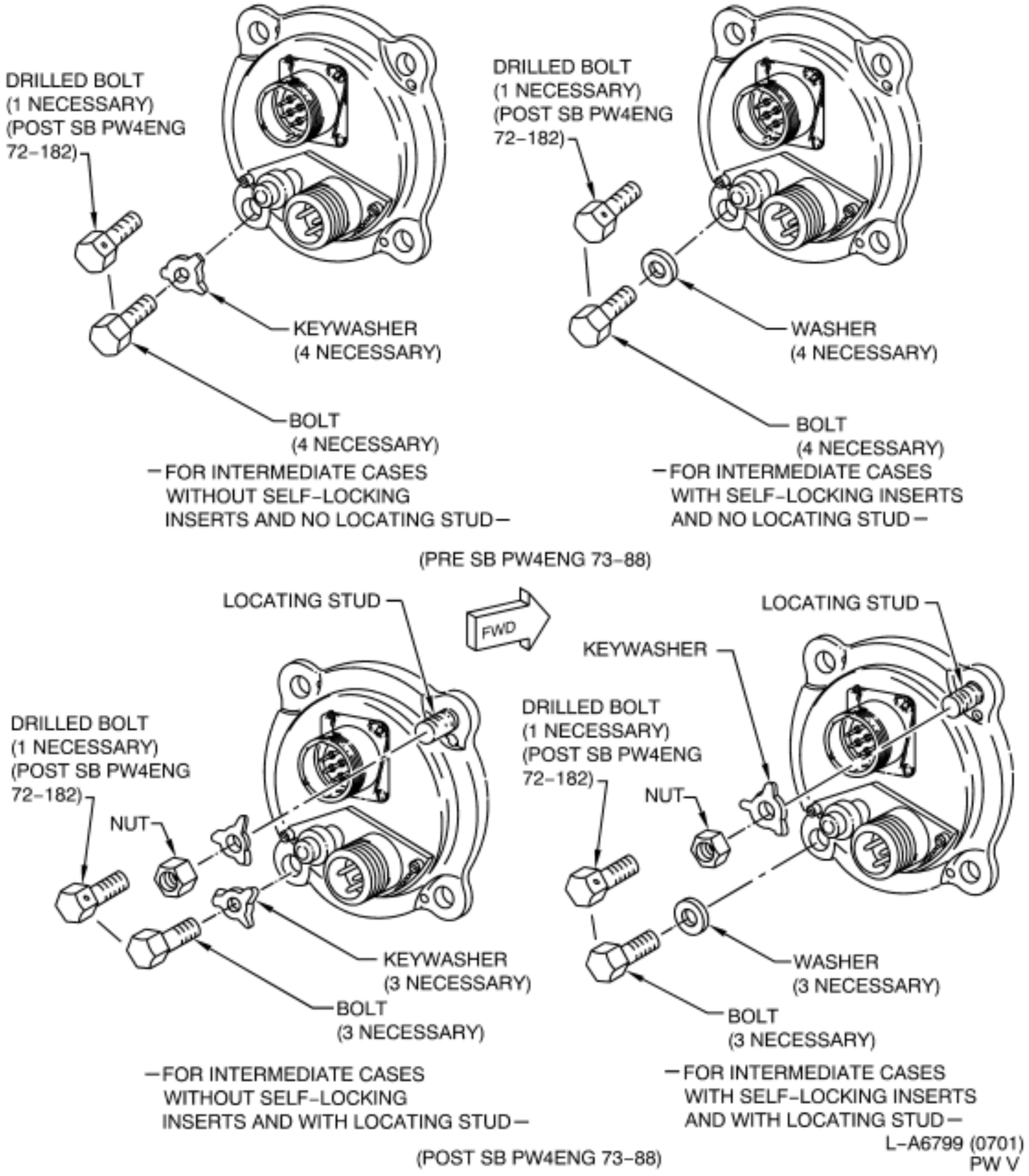
Power Plant Movement From The LightWeight
Trailer Into The Transport Stand
Figure 1201 (Sheet 2)
(Task 71−00−00−530−001)


FWD
OIL TANK MAGNETIC PLUG ASSEMBLY
MAGNETIC PLUG
PACKING
VALVE
BUSHING (MAIN GEARBOX LOCATION ONLY)
FWD
MAIN GEARBOX MAGNETIC PLUG ASSEMBLY
L−A6802 (0000)
PW V

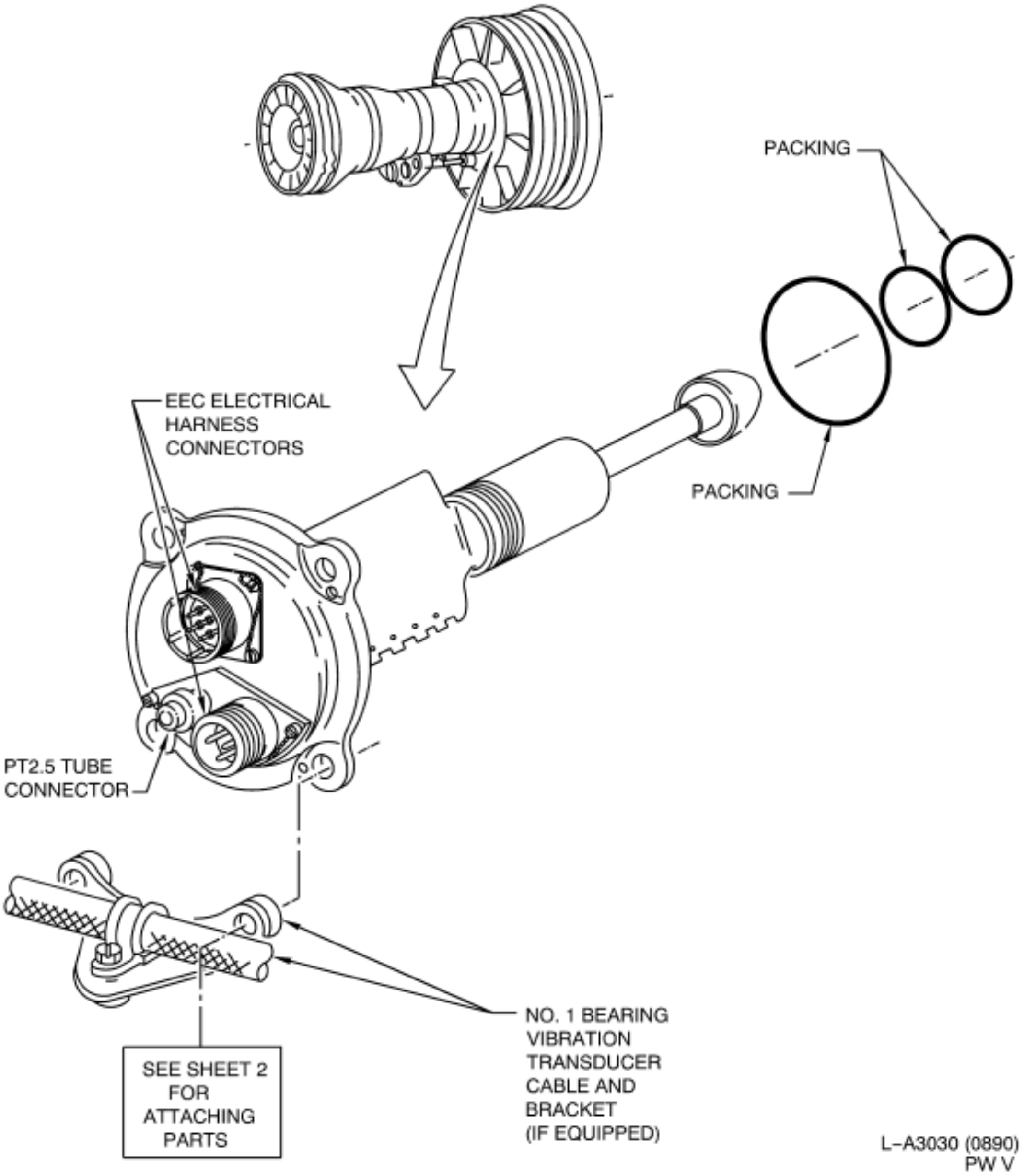
Drain Locations
Figure 1202
(Task 71−00−00−530−001)


PT2.5 TUBE
FLANGE E BRACKET
A
W4 WIRING HARNESS
EEC SPEED TRANSDUCER (N1) MULTIPLEXER INPUT PROBE
FLANGE E BRACKET
PT2.5 TUBE
CLAMP
FWD
BOLT
L–A1863
VIEW A

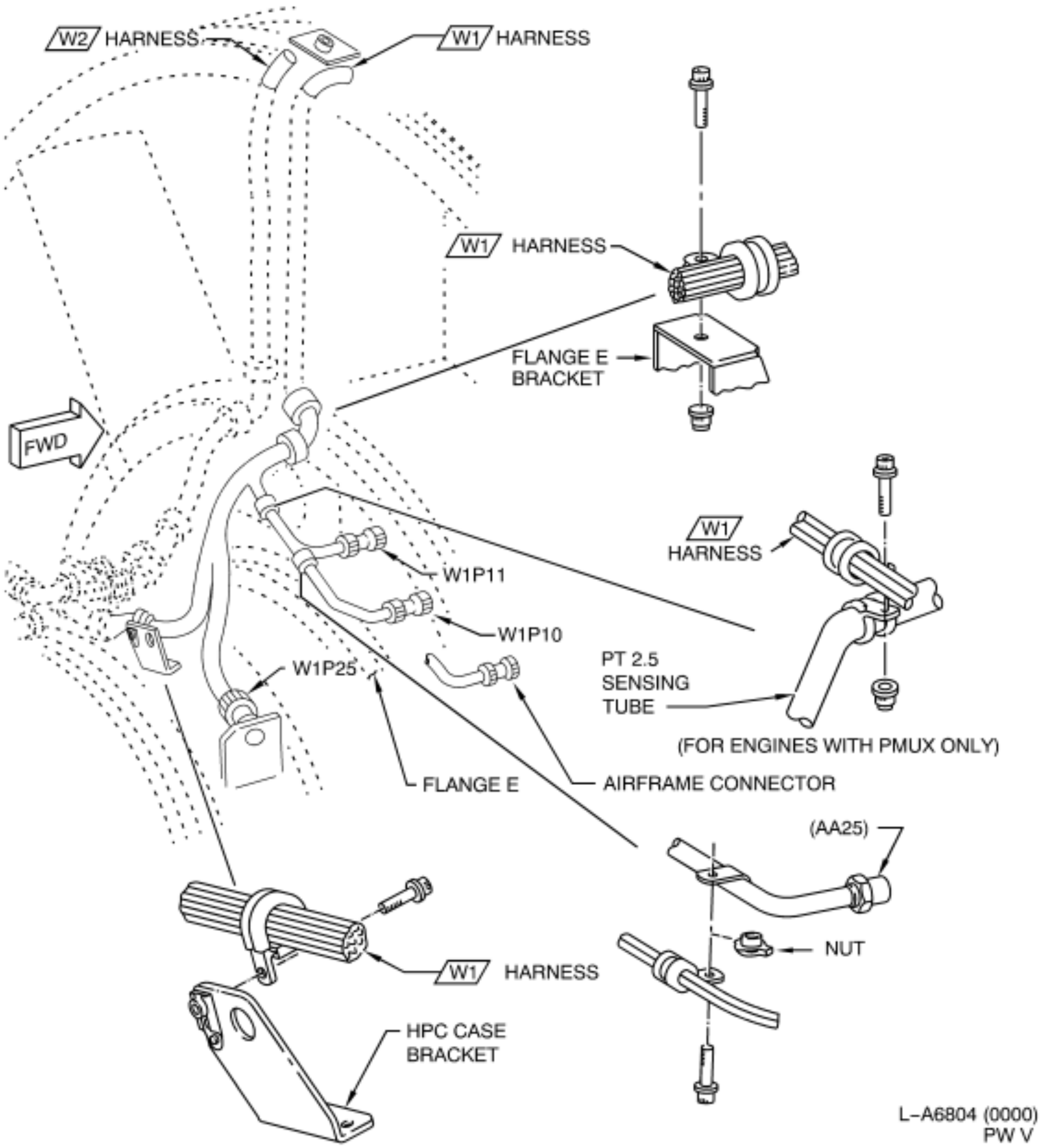
EEC Speed Transducer (N1) (Multiplexer Input Probe)
Figure 1203 (Sheet 1)
(Task 71–00–00–530–001)


DRILLED BOLT
(1 NECESSARY)
(POST SB PW4ENG
72-182)
KEYWASHER
(4 NECESSARY)
BOLT
(4 NECESSARY)
-FOR INTERMEDIATE CASES
WITHOUT SELF-LOCKING
INSERTS AND NO LOCATING STUD-
DRILLED BOLT
(1 NECESSARY)
(POST SB PW4ENG
72-182)
WASHER
(4 NECESSARY)
BOLT
(4 NECESSARY)
-FOR INTERMEDIATE CASES
WITH SELF-LOCKING INSERTS
AND NO LOCATING STUD-
(PRE SB PW4ENG 73-88)
LOCATING STUD
FWD
DRILLED BOLT
(1 NECESSARY)
(POST SB PW4ENG
72-182)
NUT
KEYWASHER
(3 NECESSARY)
BOLT
(3 NECESSARY)
-FOR INTERMEDIATE CASES
WITHOUT SELF-LOCKING
INSERTS AND WITH LOCATING STUD-
LOCATING STUD
KEYWASHER
DRILLED BOLT
(1 NECESSARY)
(POST SB PW4ENG
72-182)
NUT
WASHER
(3 NECESSARY)
BOLT
(3 NECESSARY)
-FOR INTERMEDIATE CASES
WITH SELF-LOCKING INSERTS
AND WITH LOCATING STUD-
(POST SB PW4ENG 73-88)
L-A6799 (0701)
PW V

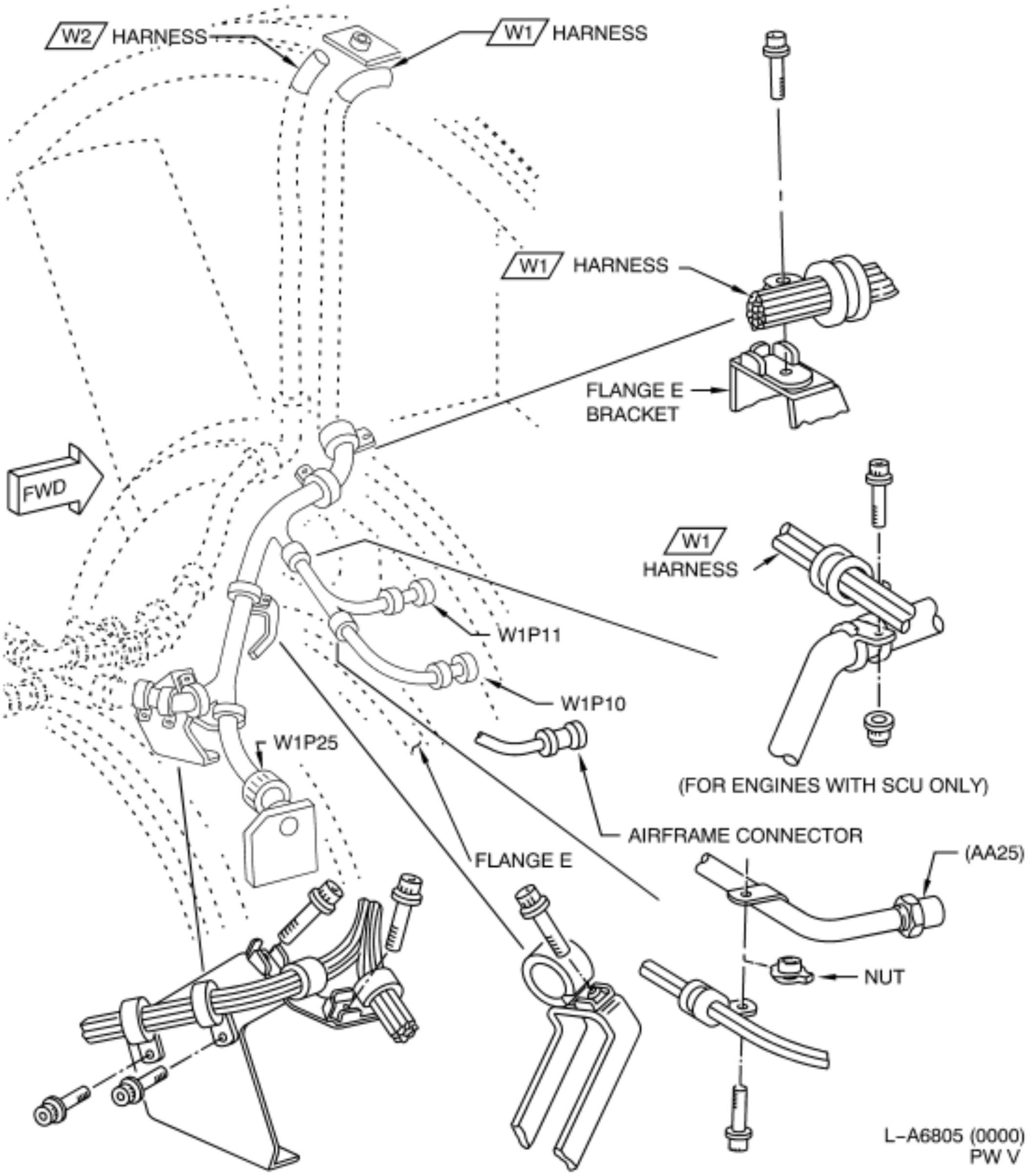
EEC Speed Transducer (N1) (Multiplexer Input Probe)
Figure 1203 (Sheet 2)
(Task 71-00-00-530-001)


PACKING
EEC ELECTRICAL HARNESS CONNECTORS
PACKING
PT2.5 TUBE CONNECTOR
NO. 1 BEARING VIBRATION TRANSDUCER CABLE AND BRACKET (IF EQUIPPED)
SEE SHEET 2 FOR ATTACHING PARTS
L-A3030 (0890)
PW V

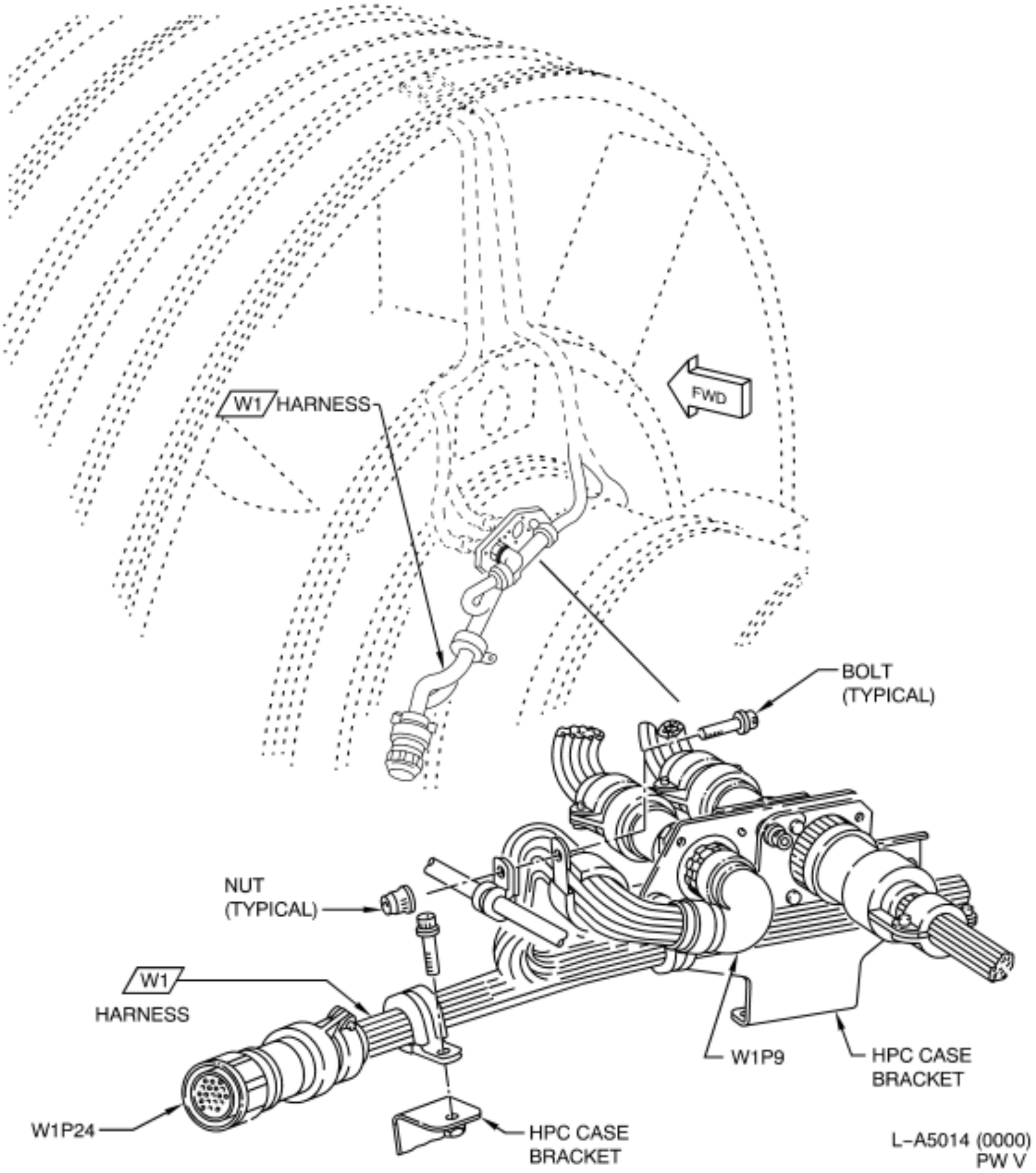
EEC Speed Transducer (N1) (Multiplexer Input Probe)
Figure 1203 (Sheet 3)
(Task 71-00-00-530-001)


W2 HARNESS
W1 HARNESS
W1 HARNESS
FLANGE E
BRACKET
FWD
W1 HARNESS
W1P11
W1P10
W1P25
PT 2.5
SENSING
TUBE
(FOR ENGINES WITH PMUX ONLY)
FLANGE E
AIRFRAME CONNECTOR
(AA25)
NUT
W1 HARNESS
HPC CASE
BRACKET
L−A6804 (0000)
PW V

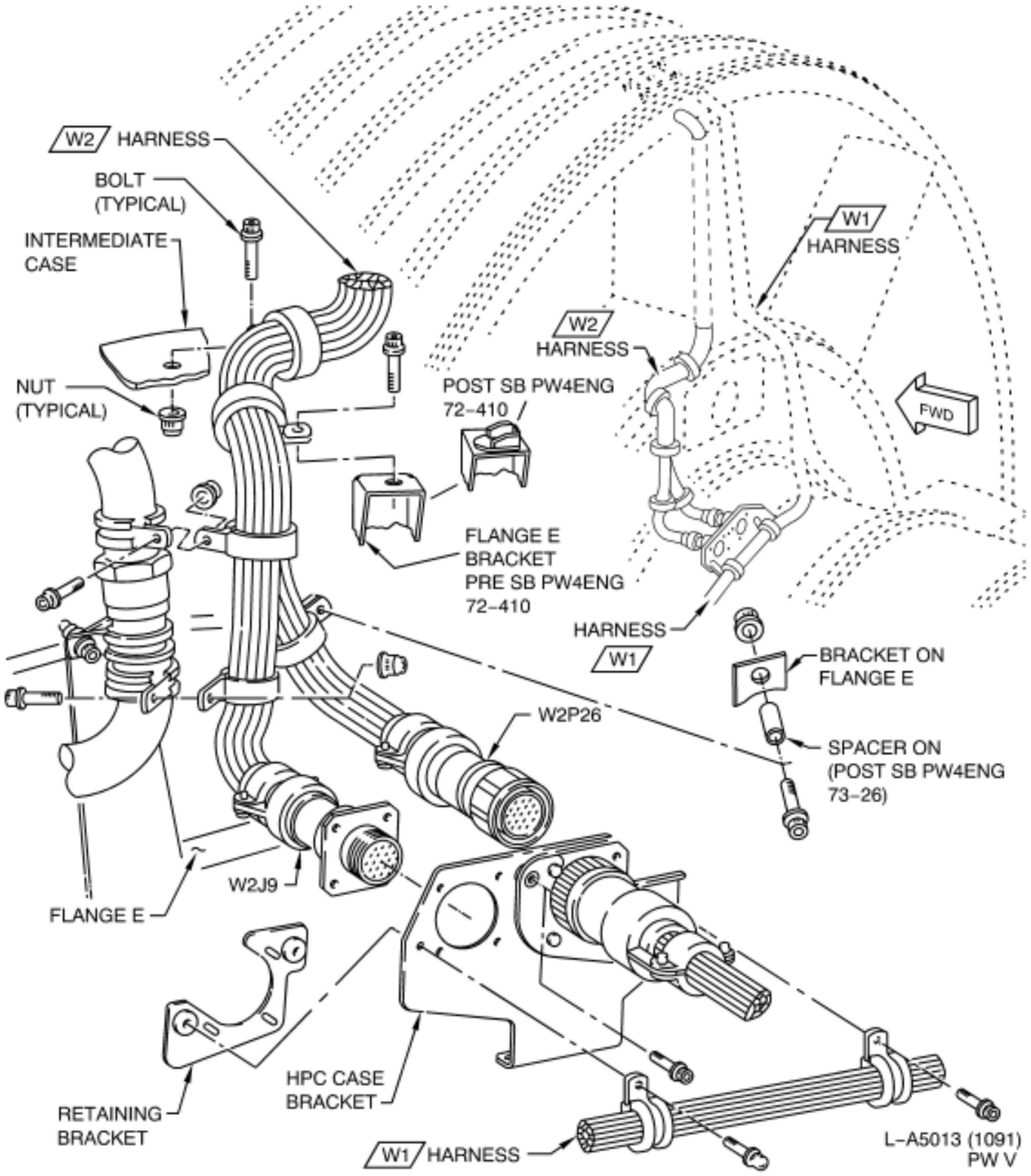
Wiring Harness Disconnect (Pre SB PW4ENG 72−258) (EEC W1 Harness From Core−Unit)
Figure 1204 (Sheet 1)
(Task 71−00−00−530−001)


W2 HARNESS
W1 HARNESS
W1 HARNESS
FLANGE E BRACKET
FWD
W1 HARNESS
W1P11
W1P10
W1P25
(FOR ENGINES WITH SCU ONLY)
AIRFRAME CONNECTOR
FLANGE E
(AA25)
NUT
L-A6805 (0000)
PW V

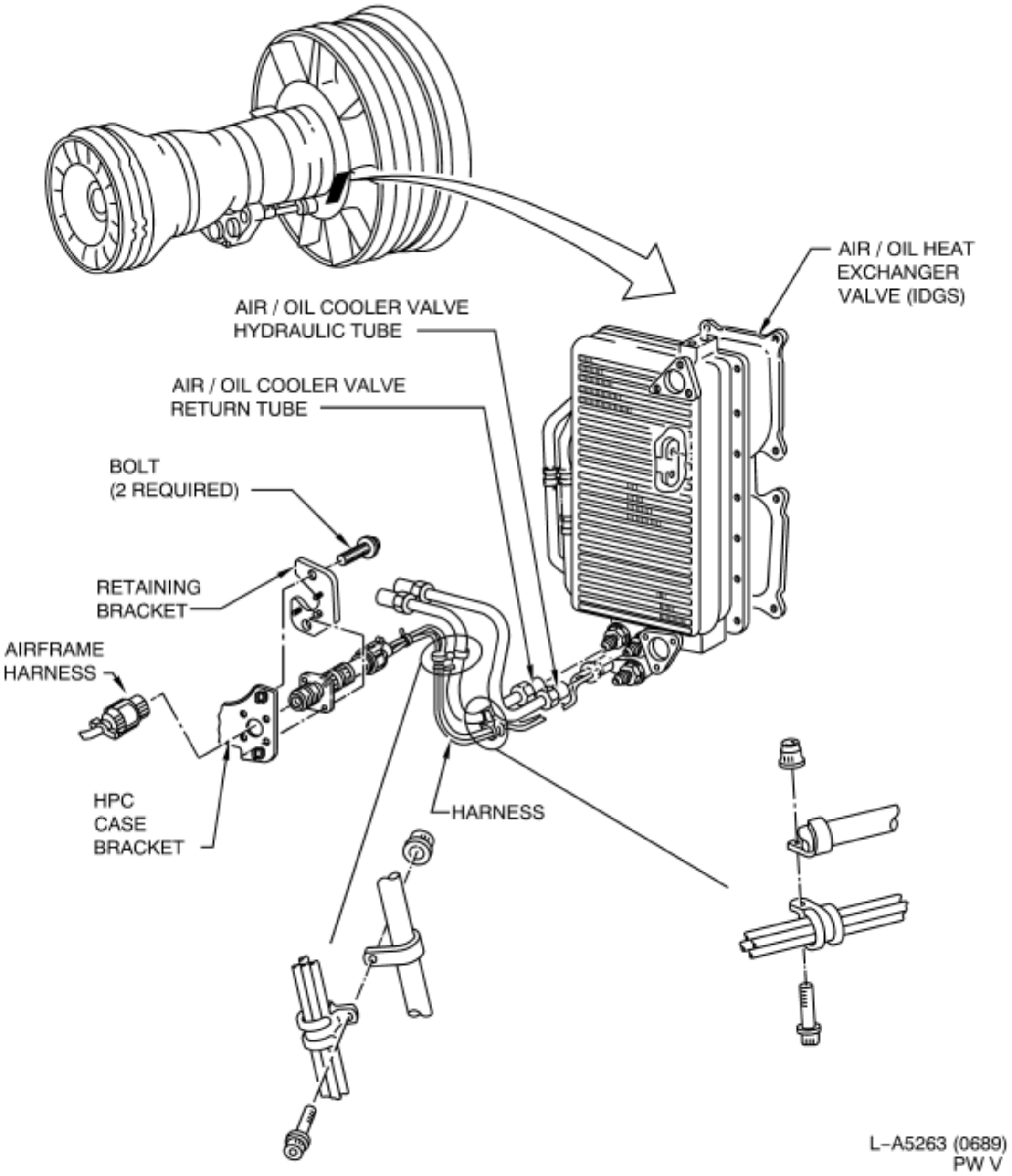
Wiring Harness Disconnect (Post SB PW4ENG 72-258) (EEC W1 Harness From Core-Unit)
Figure 1204 (Sheet 2)
(Task 71-00-00-530-001)


W1 HARNESS
FWD
BOLT (TYPICAL)
NUT (TYPICAL)
W1 HARNESS
W1P9
HPC CASE BRACKET
W1P24
HPC CASE BRACKET
L-A5014 (0000)
PW V

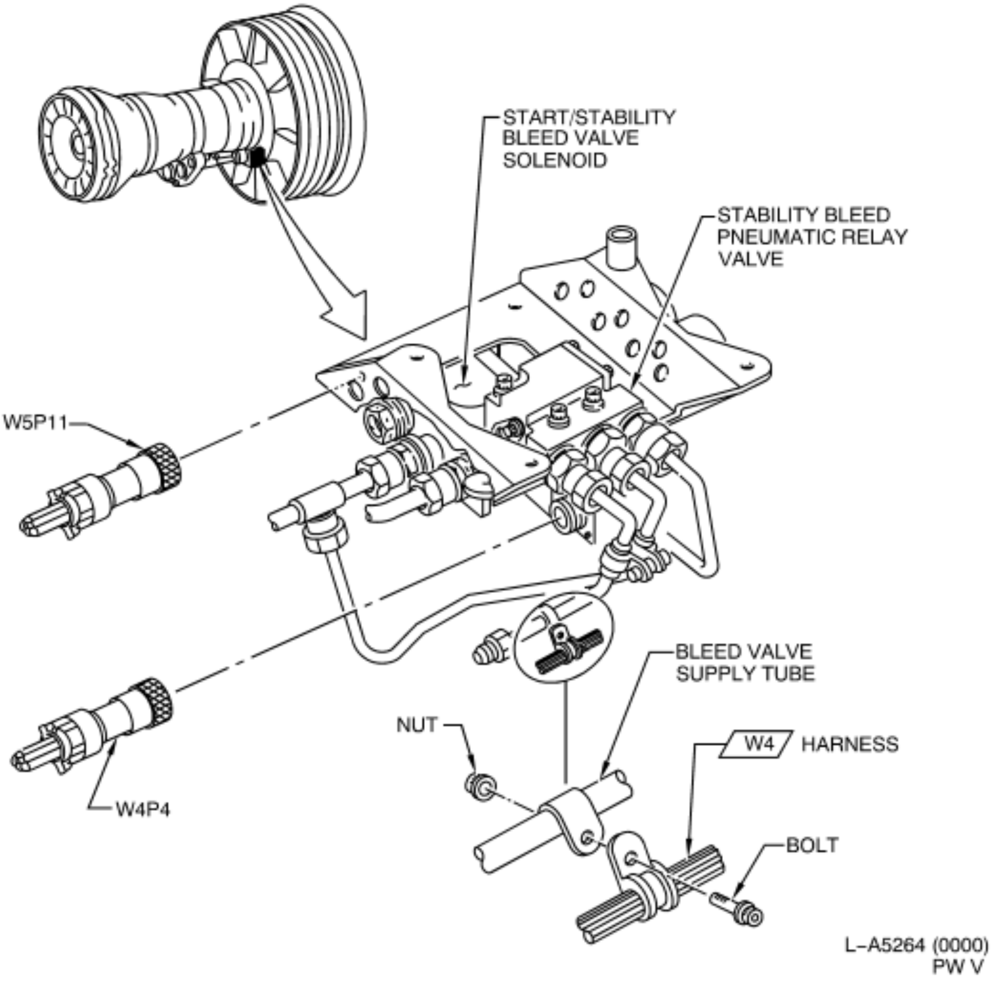
Wiring Harness Disconnect (EEC W1 Harness From Core-Unit)
Figure 1204 (Sheet 3)
(Task 71-00-00-530-001)


W2 HARNESS
BOLT (TYPICAL)
INTERMEDIATE CASE
NUT (TYPICAL)
W1 HARNESS
W2 HARNESS
POST SB PW4ENG 72-410
FWD
FLANGE E BRACKET PRE SB PW4ENG 72-410
HARNESS W1
BRACKET ON FLANGE E
W2P26
SPACER ON (POST SB PW4ENG 73-26)
W2J9
FLANGE E
RETAINING BRACKET
HPC CASE BRACKET
W1 HARNESS
L-A5013 (1091) PW V

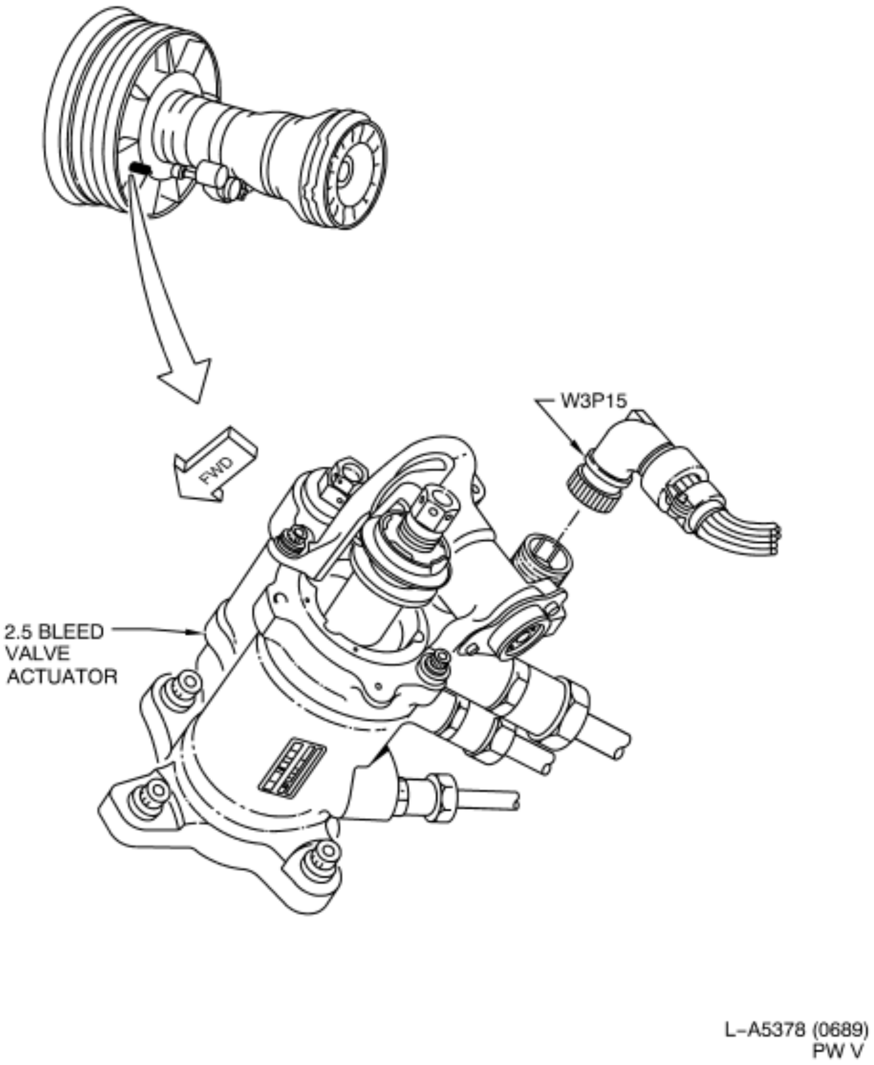
Wiring Harness Disconnect (EEC W2 Harness From Core-Unit)
Figure 1204 (Sheet 4)
(Task 71-00-00-530-001)


AIR / OIL HEAT EXCHANGER VALVE (IDGS)
AIR / OIL COOLER VALVE HYDRAULIC TUBE
AIR / OIL COOLER VALVE RETURN TUBE
BOLT (2 REQUIRED)
RETAINING BRACKET
AIRFRAME HARNESS
HPC CASE BRACKET
HARNESS
L-A5263 (0689)
PW V

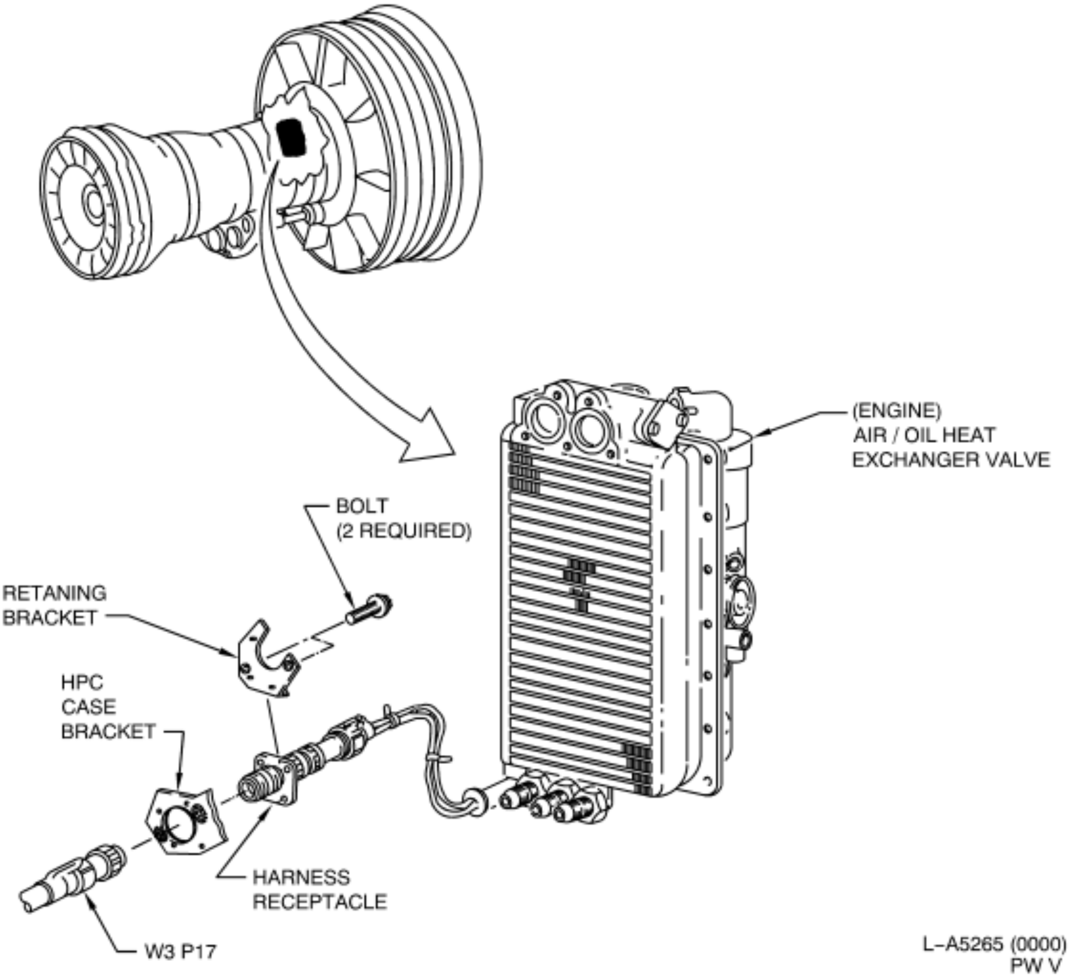
Wiring Harness Disconnect (Airframe
Harness From IDG Air/Oil Heat Exchanger)
Figure 1204 (Sheet 5)
(Task 71-00-00-530-001)


START/STABILITY BLEED VALVE SOLENOID
STABILITY BLEED PNEUMATIC RELAY VALVE
W5P11
BLEED VALVE SUPPLY TUBE
NUT
W4
HARNESS
BOLT
W4P4
L−A5264 (0000)
PW V

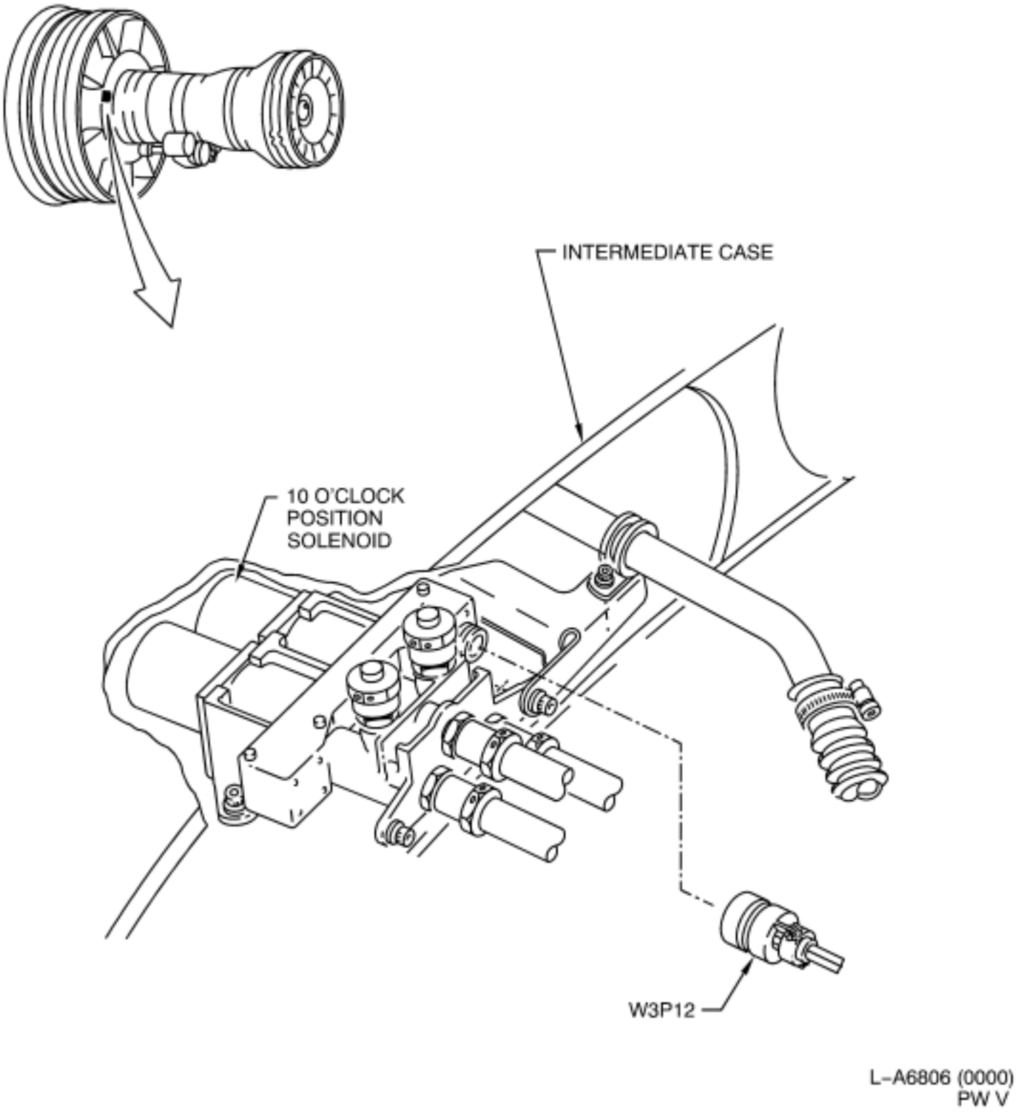
Wiring Harness Disconnect (EEC Harnesses From Solenoid)
Figure 1204 (Sheet 6)
(Task 71−00−00−530−001)


W3P15
FWD
2.5 BLEED VALVE ACTUATOR
L-A5378 (0689)
PW V

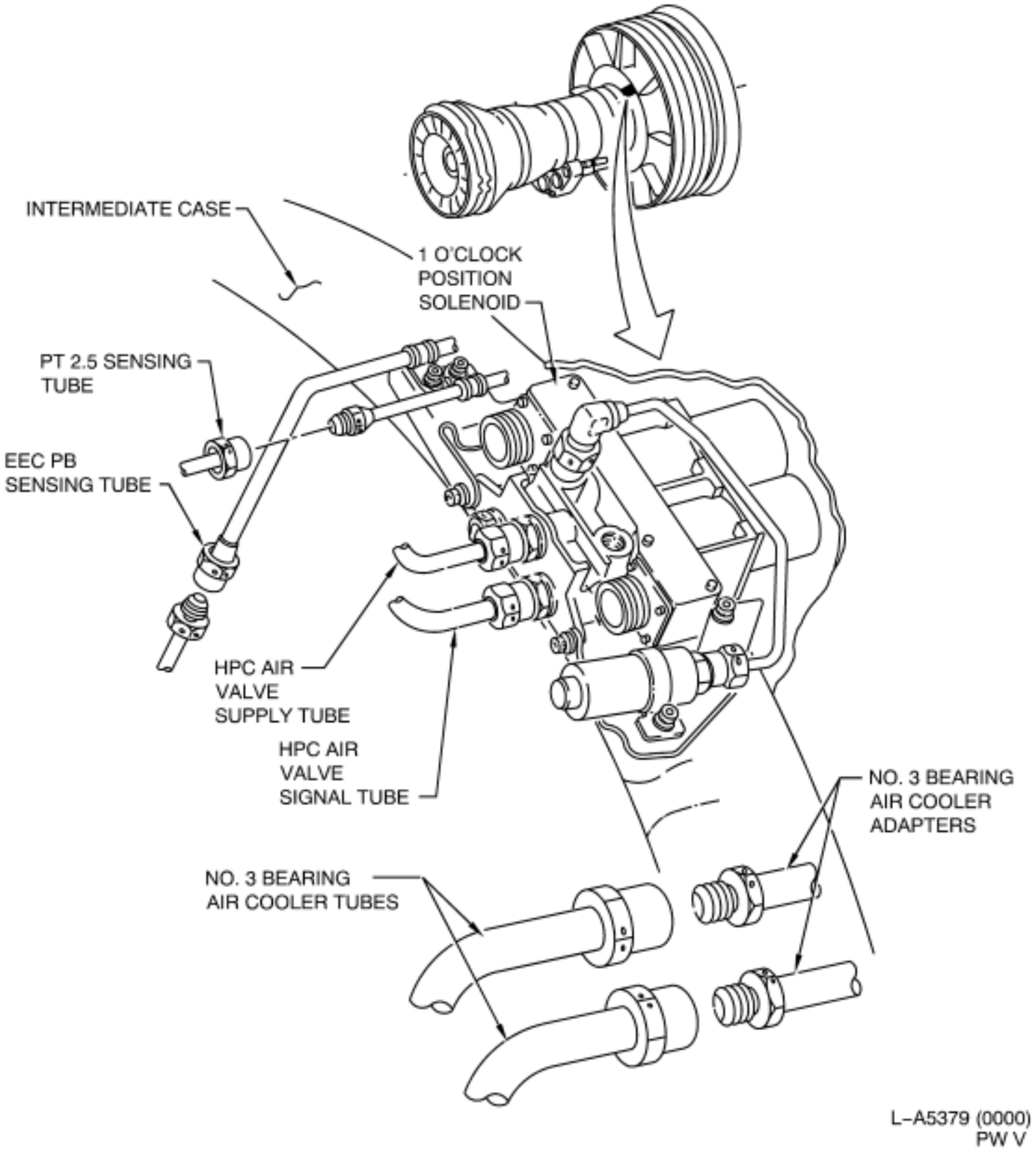
Wiring Harness Disconnect (EEC Harnesses From 2.5 Bleed Valve Actuator)
Figure 1204 (Sheet 7)
(Task 71-00-00-530-001)


(ENGINE)
AIR / OIL HEAT
EXCHANGER VALVE
BOLT
(2 REQUIRED)
RETANING
BRACKET
HPC
CASE
BRACKET
HARNESS
RECEPTACLE
W3 P17
L-A5265 (0000)
PW V

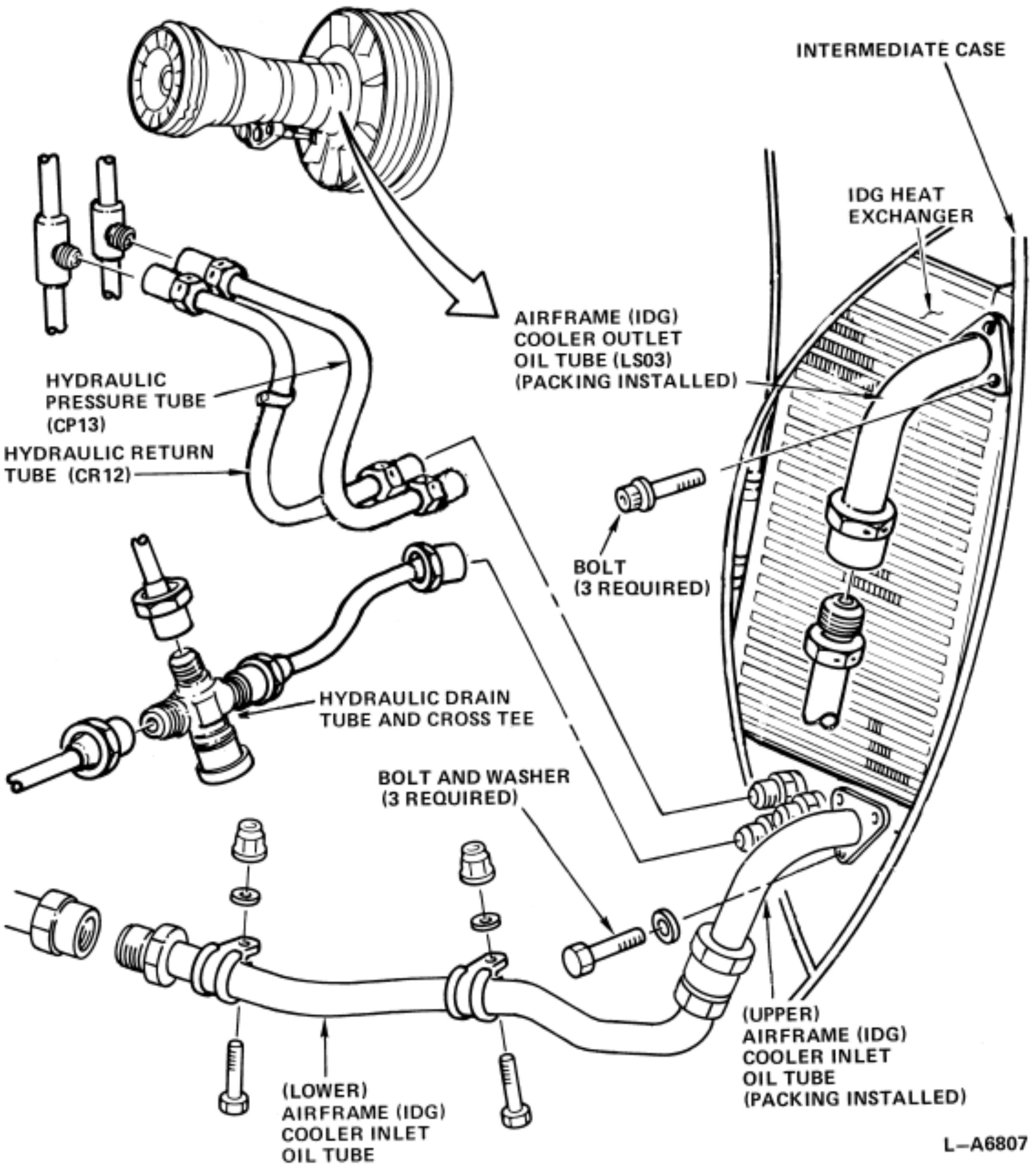
Wiring Harness Disconnect (EEC W3 Harness
From Engine Air/Oil Heat Exchanger)
Figure 1204 (Sheet 8)
(Task 71-00-00-530-001)


INTERMEDIATE CASE
10 O'CLOCK
POSITION
SOLENOID
W3P12
L-A6806 (0000)
PW V

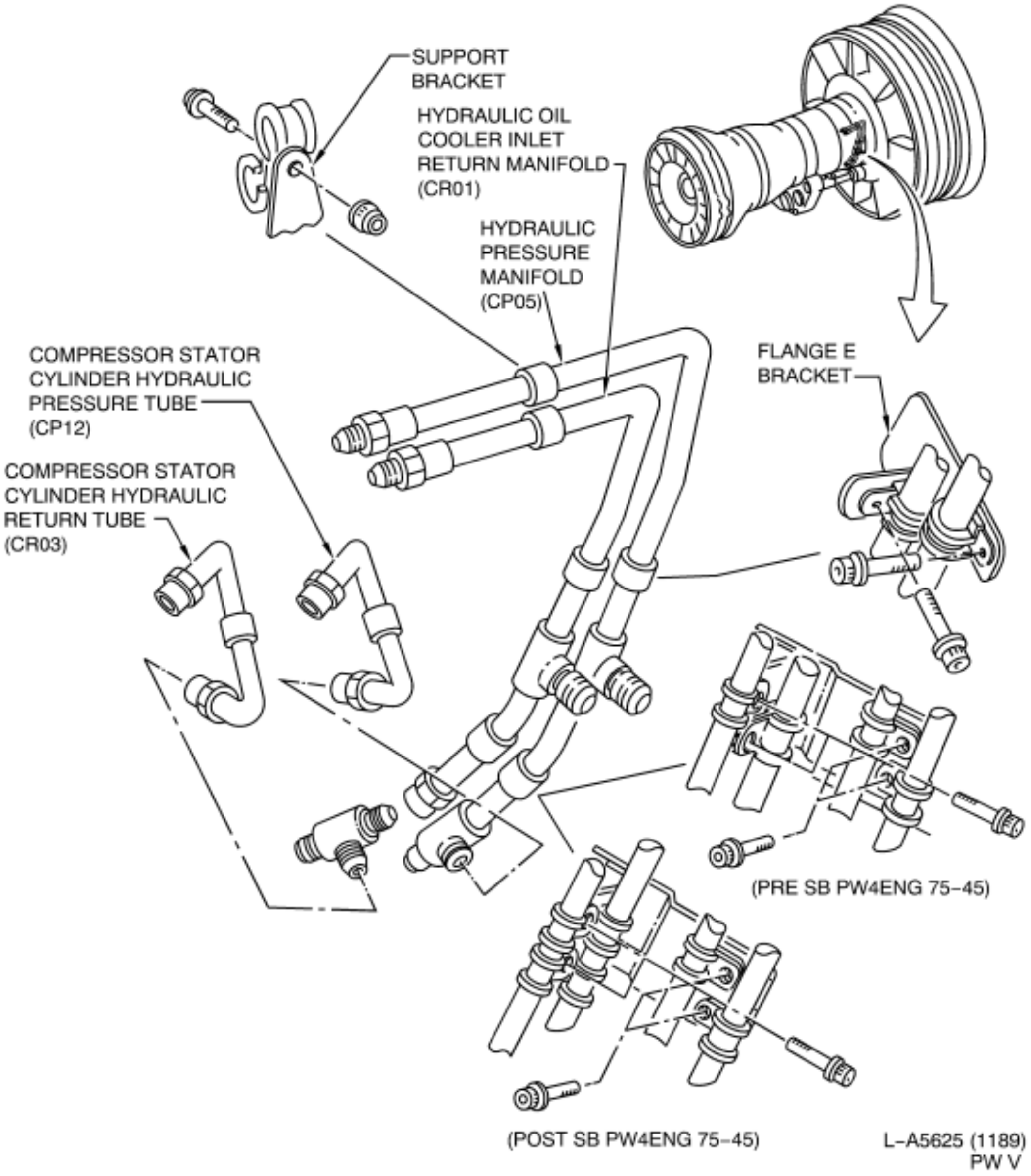
Wiring Harness Disconnect (EEC Harness From Solenoid)
Figure 1204 (Sheet 9)
(Task 71-00-00-530-001)


INTERMEDIATE CASE
1 O'CLOCK
POSITION
SOLENOID
PT 2.5 SENSING
TUBE
EEC PB
SENSING TUBE
HPC AIR
VALVE
SUPPLY TUBE
HPC AIR
VALVE
SIGNAL TUBE
NO. 3 BEARING
AIR COOLER
ADAPTERS
NO. 3 BEARING
AIR COOLER TUBES
L−A5379 (0000)
PW V

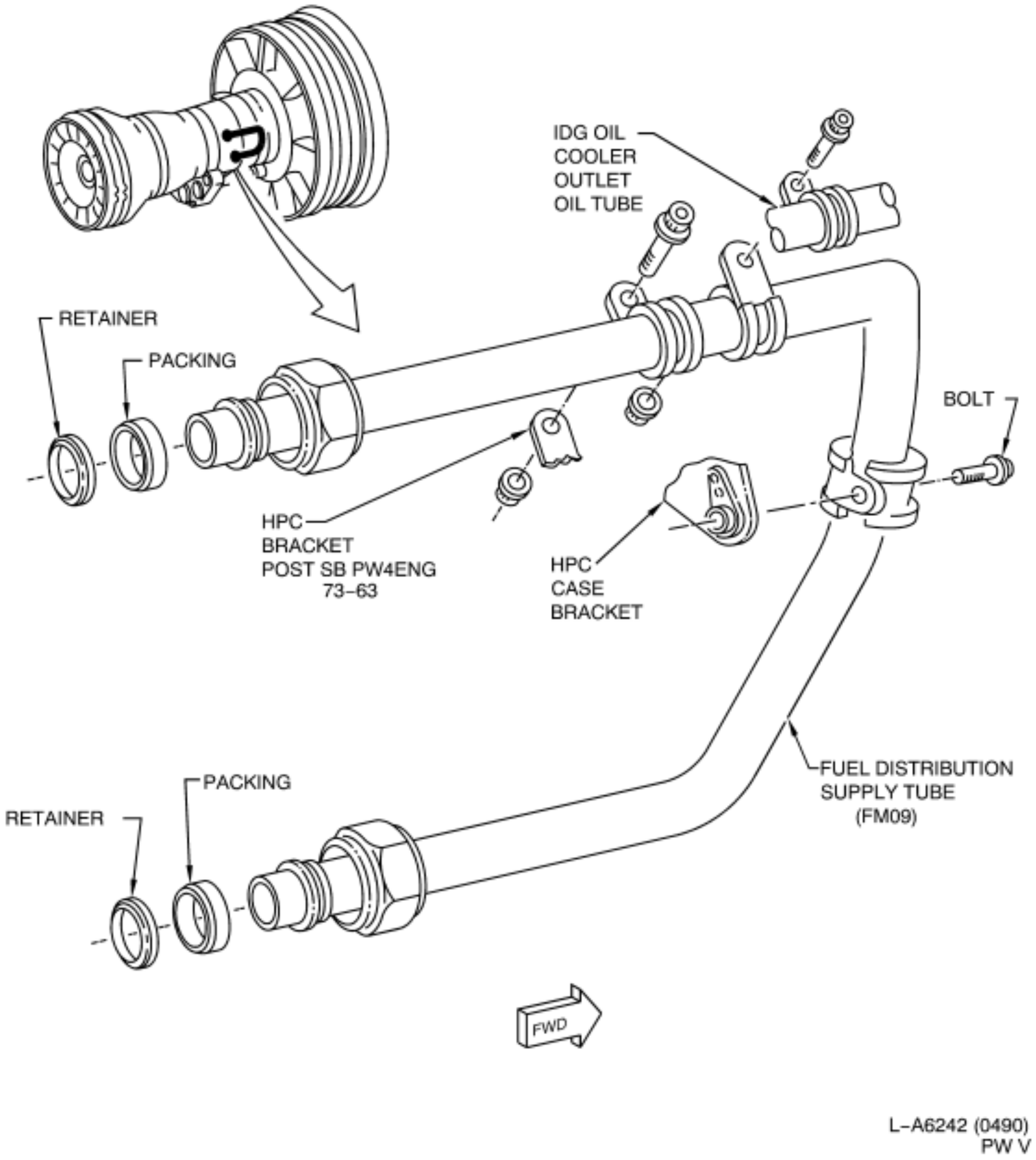
Engine Tube Disconnects And Removals
Figure 1205 (Sheet 1)
(Task 71−00−00−530−001)


INTERMEDIATE CASE
IDG HEAT EXCHANGER
AIRFRAME (IDG) COOLER OUTLET OIL TUBE (LS03) (PACKING INSTALLED)
HYDRAULIC PRESSURE TUBE (CP13)
HYDRAULIC RETURN TUBE (CR12)
BOLT (3 REQUIRED)
HYDRAULIC DRAIN TUBE AND CROSS TEE
BOLT AND WASHER (3 REQUIRED)
(UPPER) AIRFRAME (IDG) COOLER INLET OIL TUBE (PACKING INSTALLED)
(LOWER) AIRFRAME (IDG) COOLER INLET OIL TUBE
L-A6807

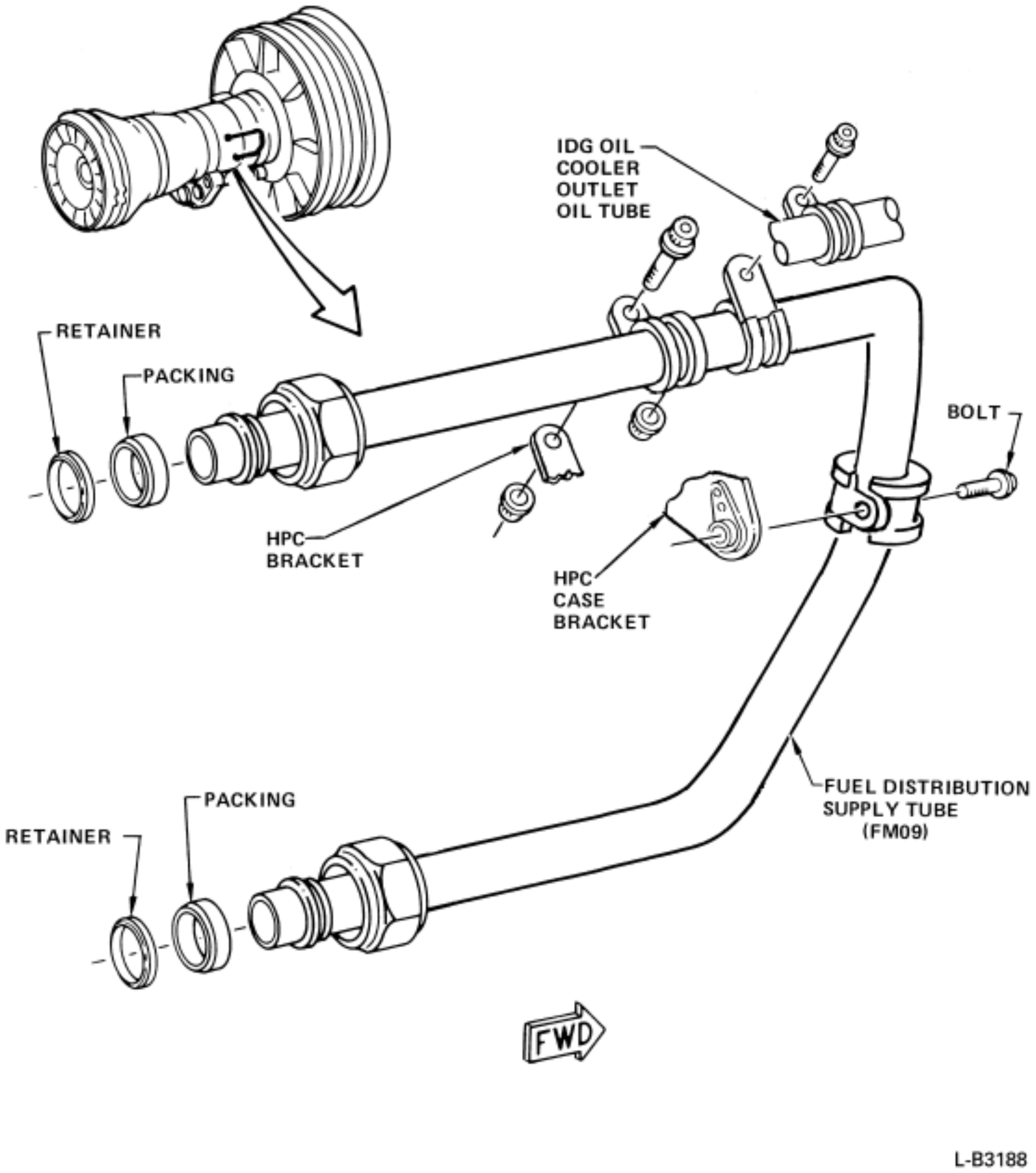
Engine Tube Disconnects And Removals
Figure 1205 (Sheet 2)
(Task 71-00-00-530-001)


SUPPORT BRACKET
HYDRAULIC OIL COOLER INLET RETURN MANIFOLD (CR01)
HYDRAULIC PRESSURE MANIFOLD (CP05)
COMPRESSOR STATOR CYLINDER HYDRAULIC PRESSURE TUBE (CP12)
COMPRESSOR STATOR CYLINDER HYDRAULIC RETURN TUBE (CR03)
FLANGE E BRACKET
(PRE SB PW4ENG 75-45)
(POST SB PW4ENG 75-45)
L-A5625 (1189)
PW V

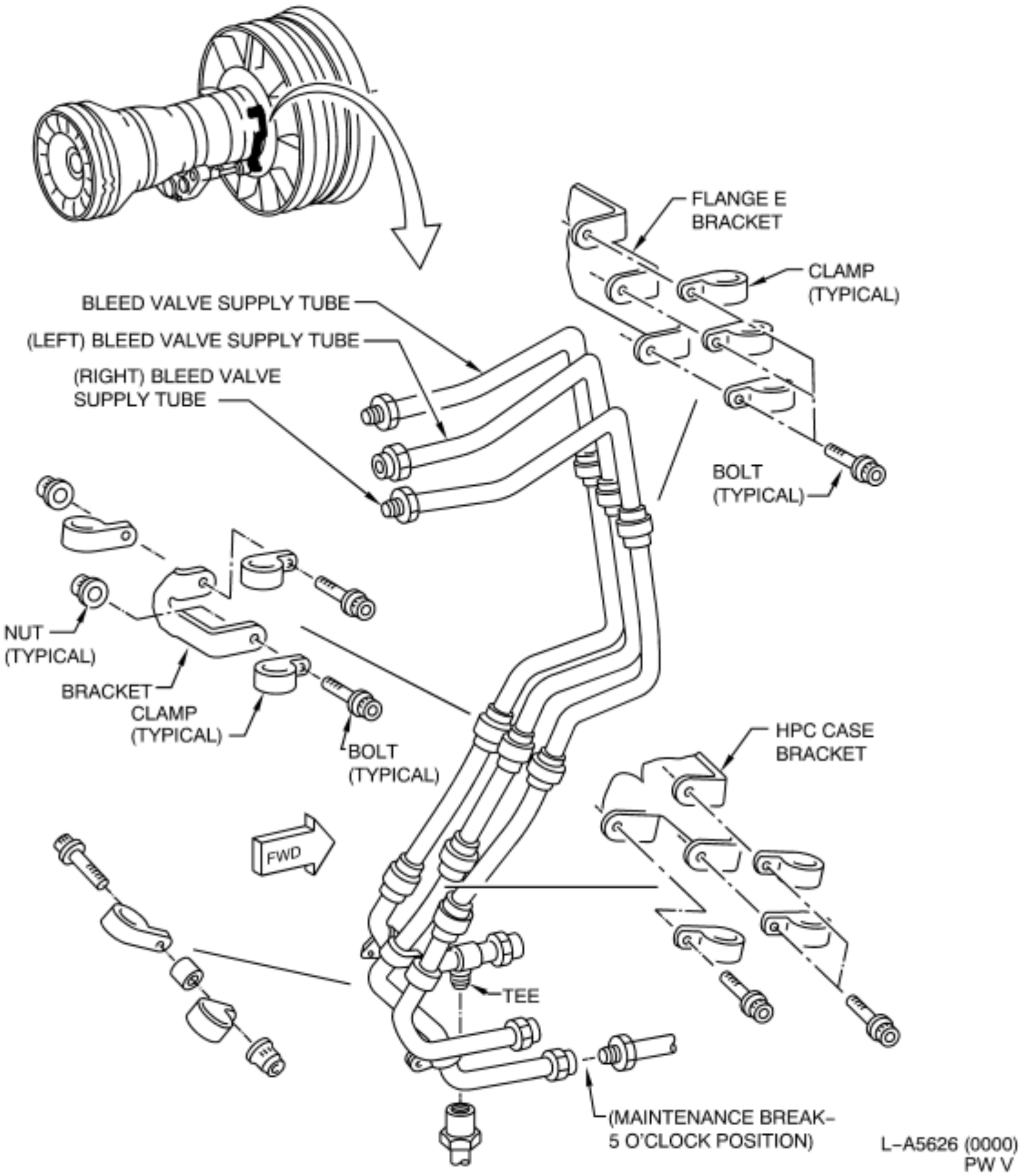
Engine Tube Disconnects And Removals
Figure 1205 (Sheet 3)
(Task 71-00-00-530-001)


IDG OIL COOLER OUTLET OIL TUBE
RETAINER
PACKING
BOLT
HPC BRACKET POST SB PW4ENG 73-63
HPC CASE BRACKET
FUEL DISTRIBUTION SUPPLY TUBE (FM09)
PACKING
RETAINER
FWD
L-A6242 (0490)
PW V

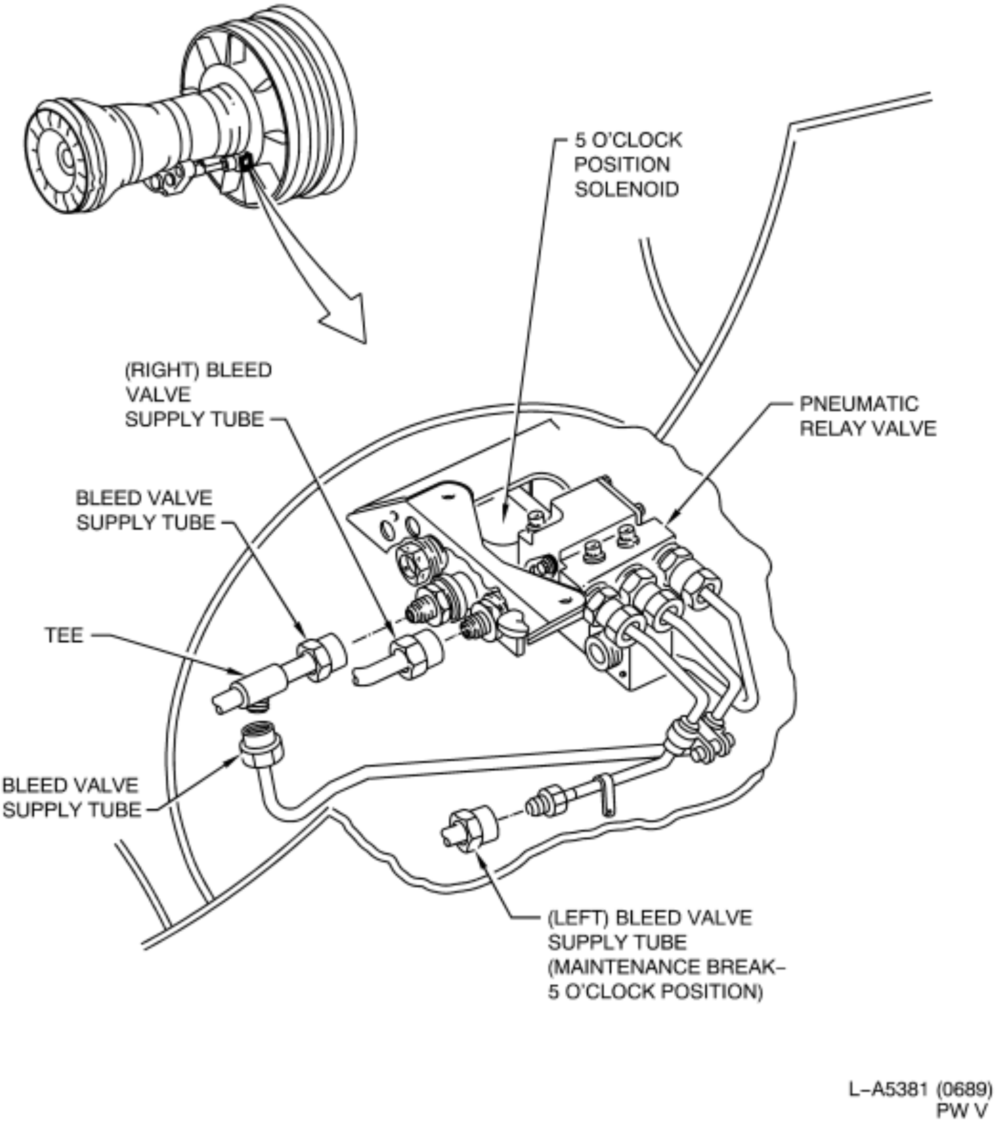
Fuel Distribution Valve Supply Tube
R Figure 1205 (Sheet 4)
(Task 71-00-00-530-001)


IDG OIL COOLER OUTLET OIL TUBE
RETAINER
PACKING
BOLT
HPC BRACKET
HPC CASE BRACKET
FUEL DISTRIBUTION SUPPLY TUBE (FM09)
PACKING
RETAINER
FWD
L-B3188

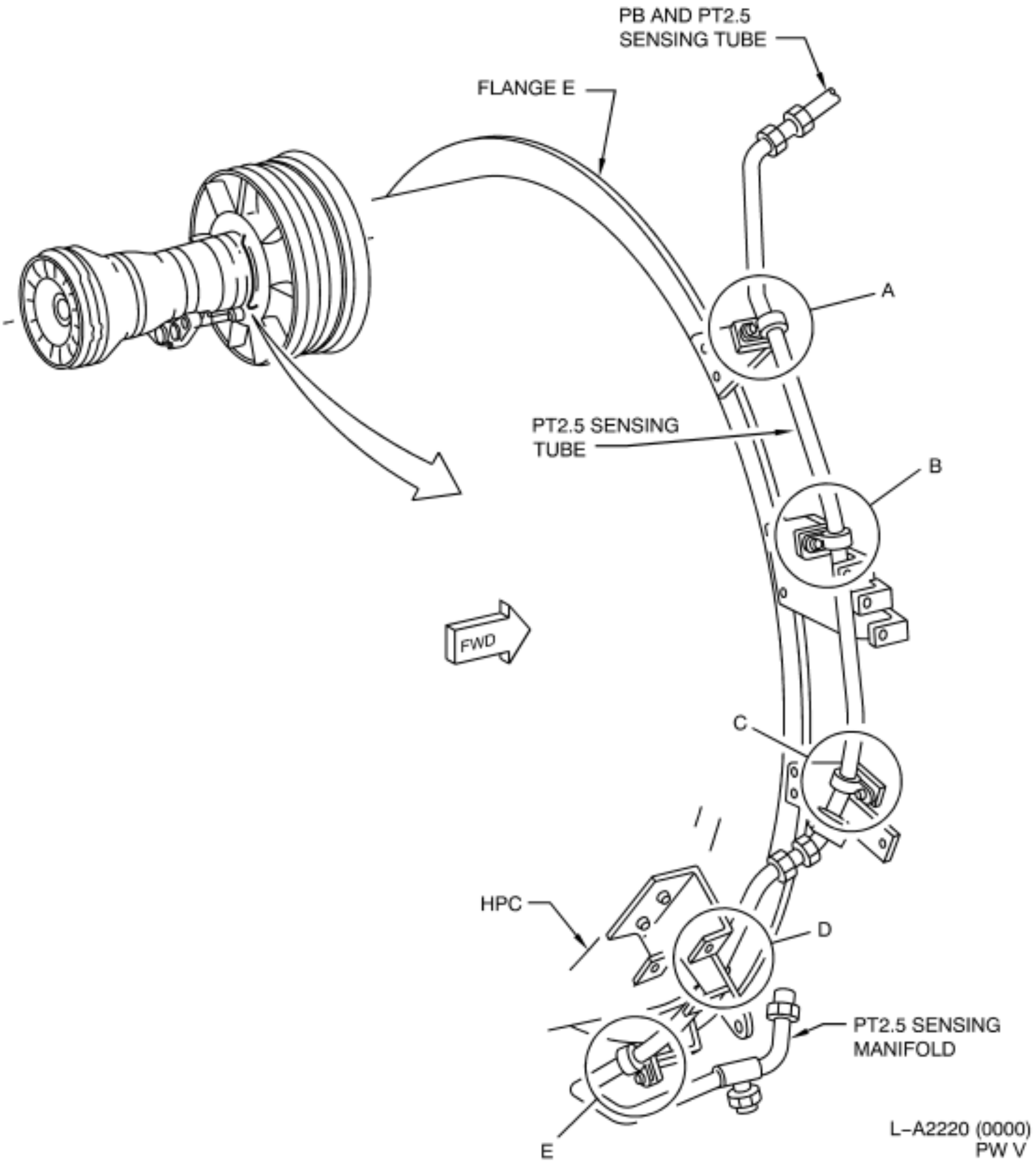
Fuel Distribution Valve Supply Tube
R Figure 1205 (Sheet 5)
(Task 71−00−00−530−001)


FLANGE E BRACKET
CLAMP (TYPICAL)
BLEED VALVE SUPPLY TUBE
(LEFT) BLEED VALVE SUPPLY TUBE
(RIGHT) BLEED VALVE SUPPLY TUBE
BOLT (TYPICAL)
NUT (TYPICAL)
BRACKET
CLAMP (TYPICAL)
BOLT (TYPICAL)
HPC CASE BRACKET
FWD
TEE
(MAINTENANCE BREAK- 5 O'CLOCK POSITION)
L-A5626 (0000)
PW V

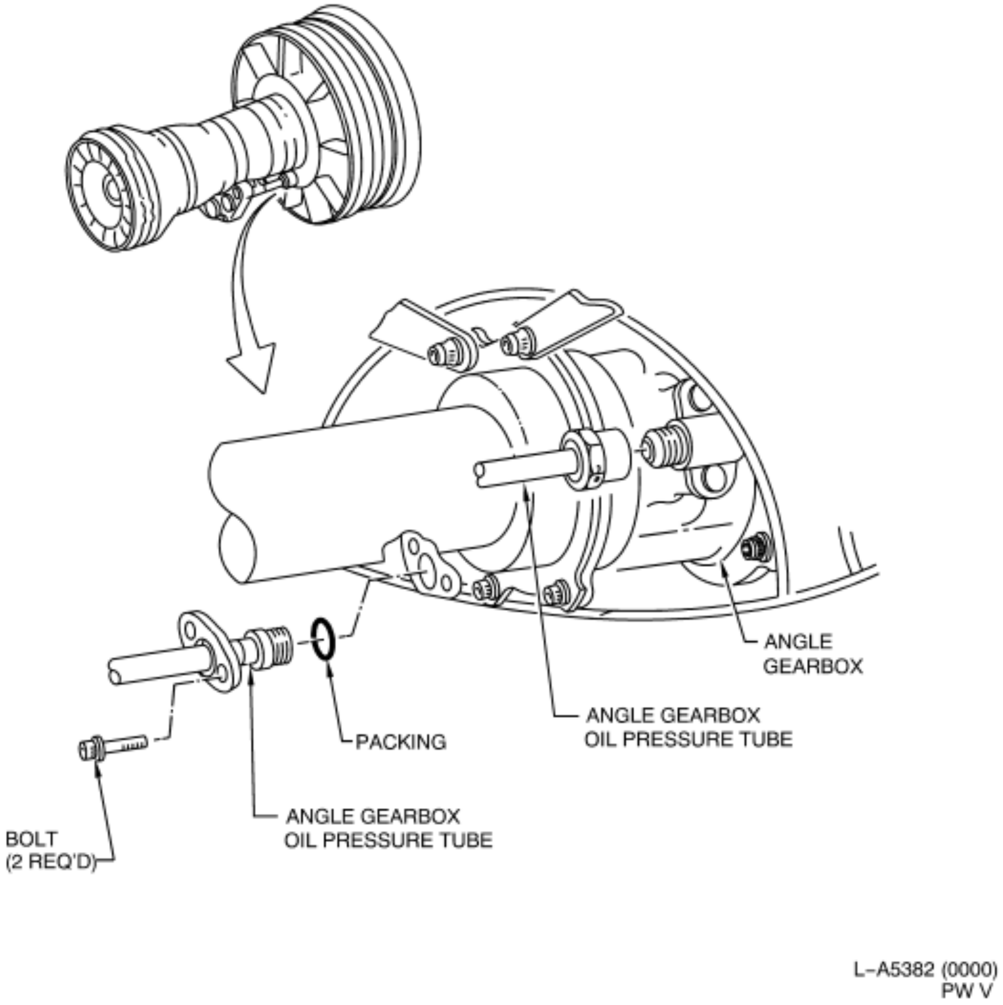
Engine Tube Disconnects And Removals
R Figure 1205 (Sheet 6)
(Task 71-00-00-530-001)


5 O'CLOCK POSITION SOLENOID
(RIGHT) BLEED VALVE SUPPLY TUBE
PNEUMATIC RELAY VALVE
BLEED VALVE SUPPLY TUBE
TEE
BLEED VALVE SUPPLY TUBE
(LEFT) BLEED VALVE SUPPLY TUBE (MAINTENANCE BREAK- 5 O'CLOCK POSITION)
L-A5381 (0689)
PW V

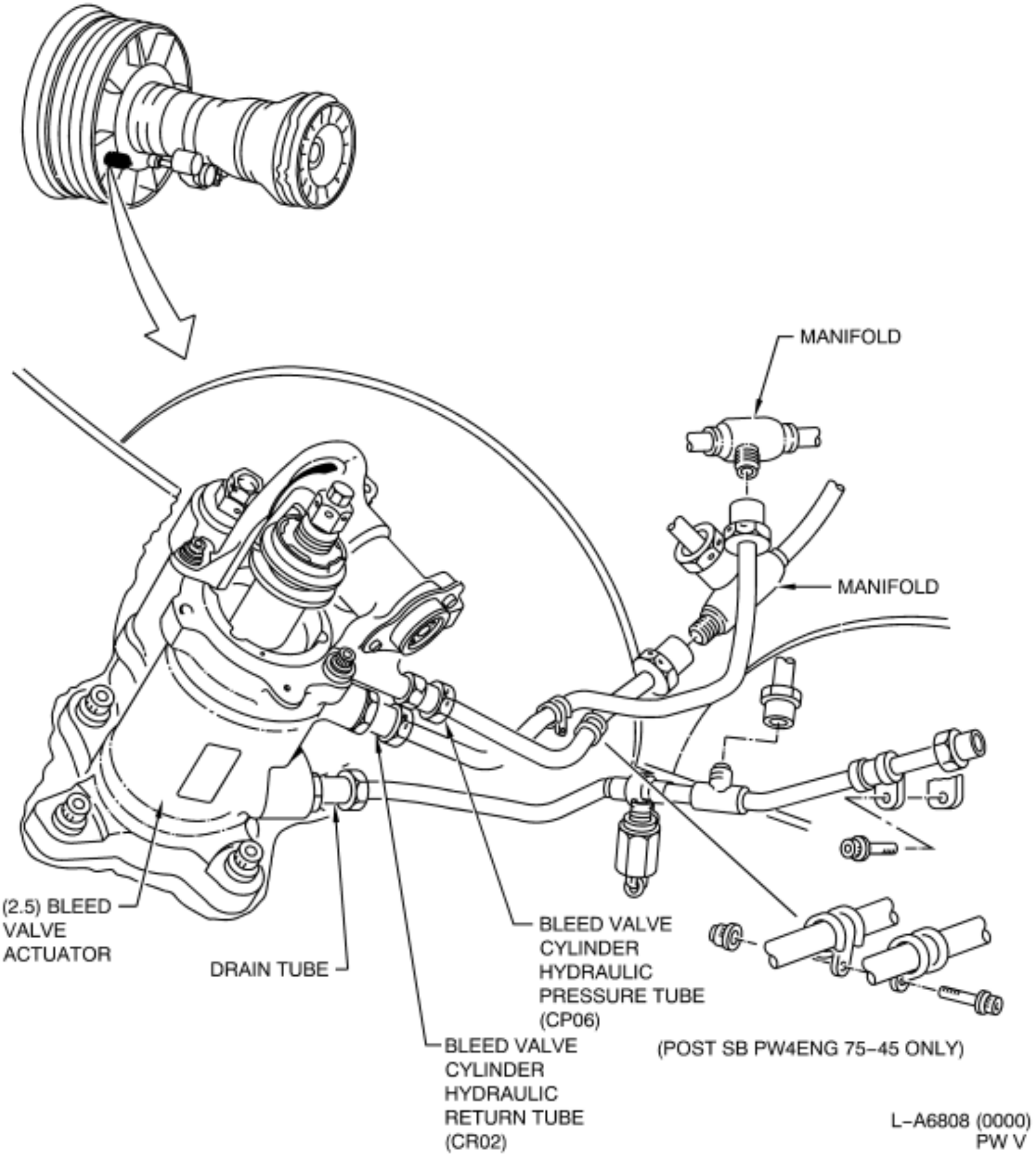
Engine Tube Disconnects And Removals
R Figure 1205 (Sheet 7)
(Task 71-00-00-530-001)


PB AND PT2.5 SENSING TUBE
FLANGE E
A
PT2.5 SENSING TUBE
B
FWD
C
HPC
D
PT2.5 SENSING MANIFOLD
E
L−A2220 (0000)
PW V

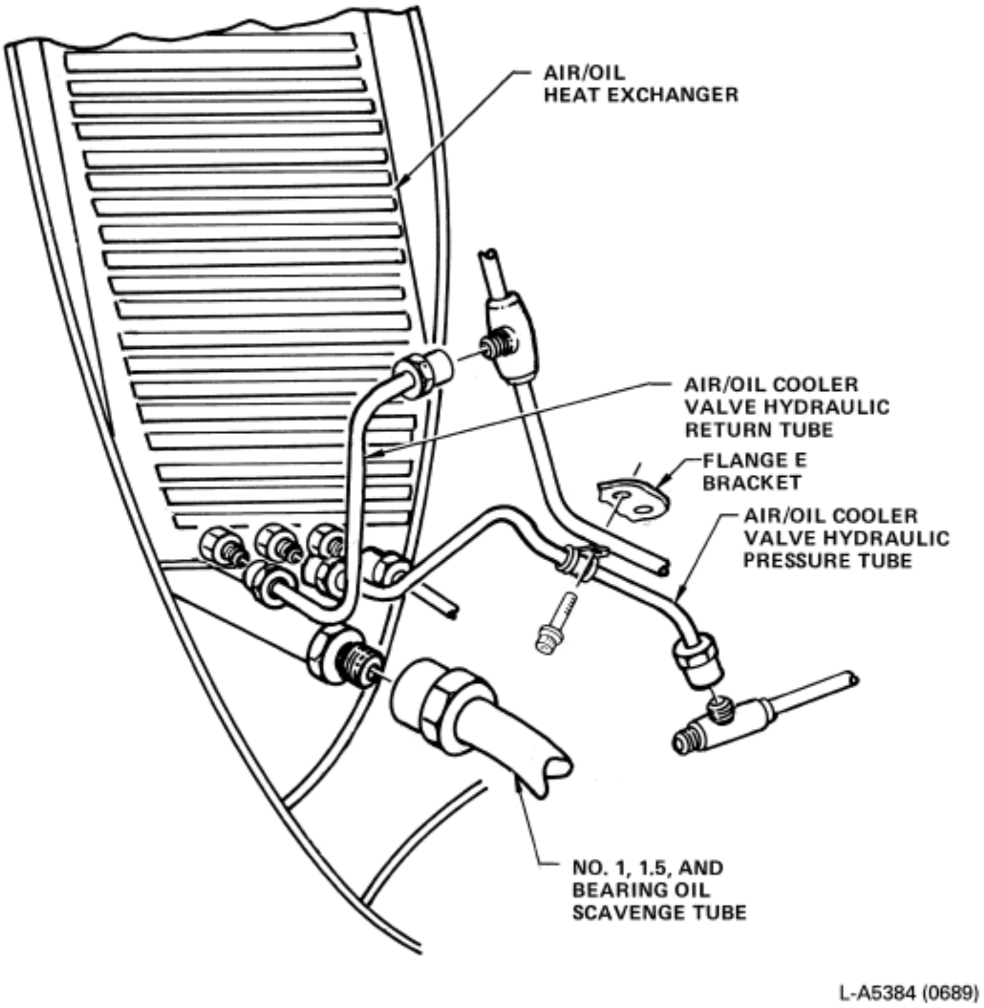
Engine Tube Disconnects And Removals
R Figure 1205 (Sheet 8)
(Task 71−00−00−530−001)


ANGLE GEARBOX
ANGLE GEARBOX OIL PRESSURE TUBE
PACKING
ANGLE GEARBOX OIL PRESSURE TUBE
BOLT (2 REQ'D)
L-A5382 (0000)
PW V

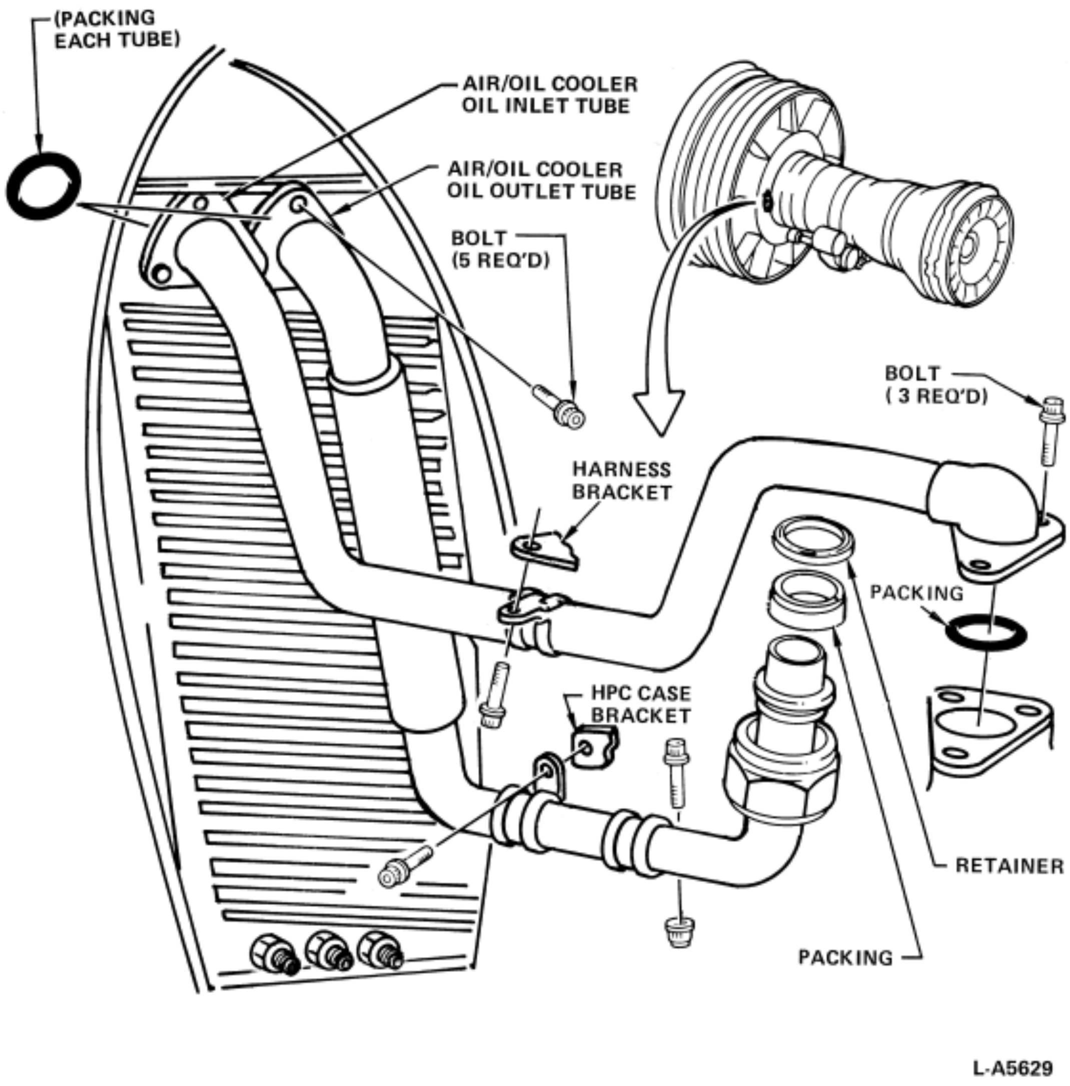
Engine Tube Disconnects And Removals
R Figure 1205 (Sheet 9)
(Task 71-00-00-530-001)


MANIFOLD
MANIFOLD
(2.5) BLEED VALVE ACTUATOR
DRAIN TUBE
BLEED VALVE CYLINDER HYDRAULIC PRESSURE TUBE (CP06)
BLEED VALVE CYLINDER HYDRAULIC RETURN TUBE (CR02)
(POST SB PW4ENG 75-45 ONLY)
L-A6808 (0000)
PW V

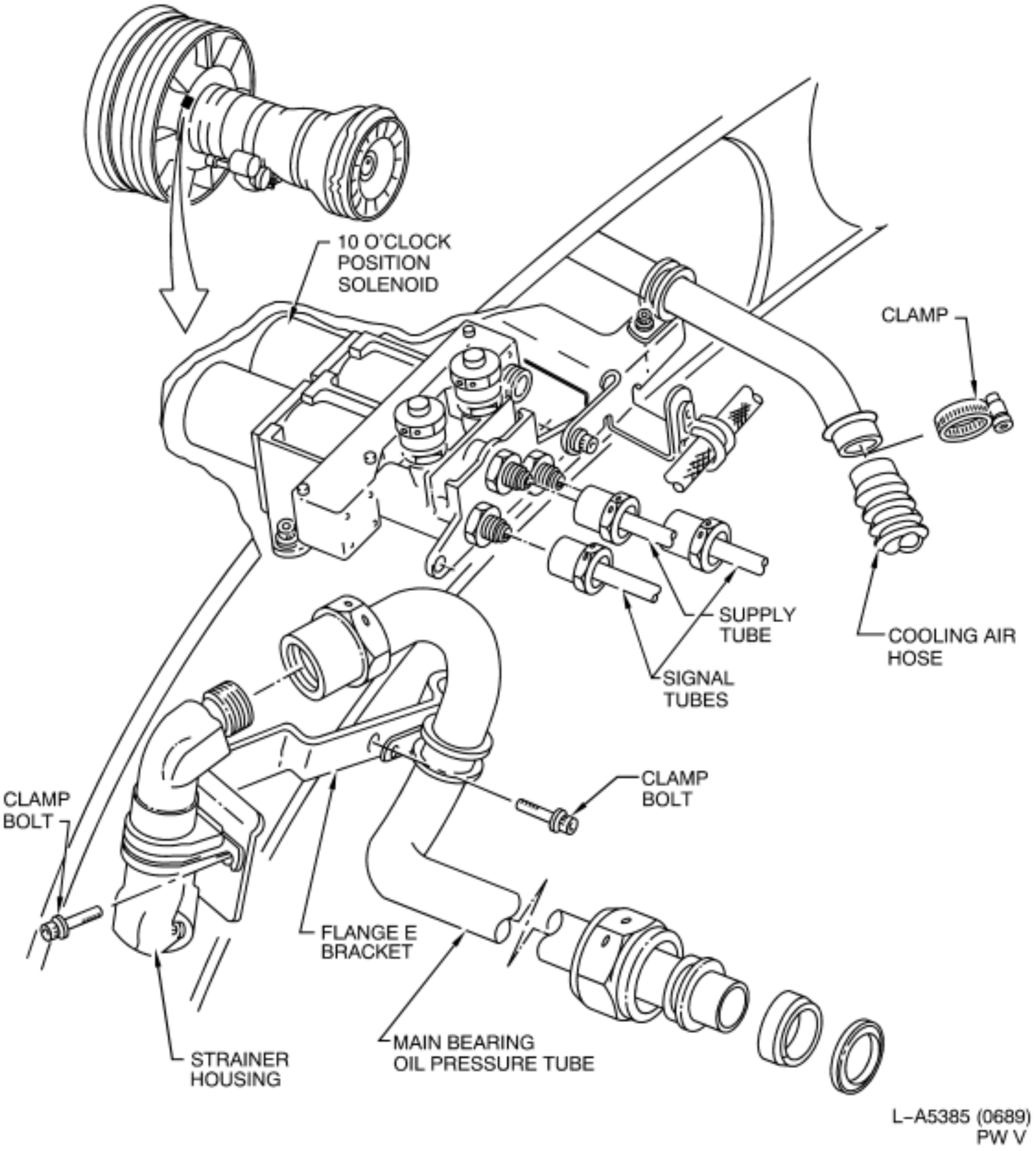
Engine Tube Disconnects And Removals
R Figure 1205 (Sheet 10)
(Task 71−00−00−530−001)


AIR/OIL HEAT EXCHANGER
AIR/OIL COOLER VALVE HYDRAULIC RETURN TUBE
FLANGE E BRACKET
AIR/OIL COOLER VALVE HYDRAULIC PRESSURE TUBE
NO. 1, 1.5, AND BEARING OIL SCAVENGE TUBE
L-A5384 (0689)

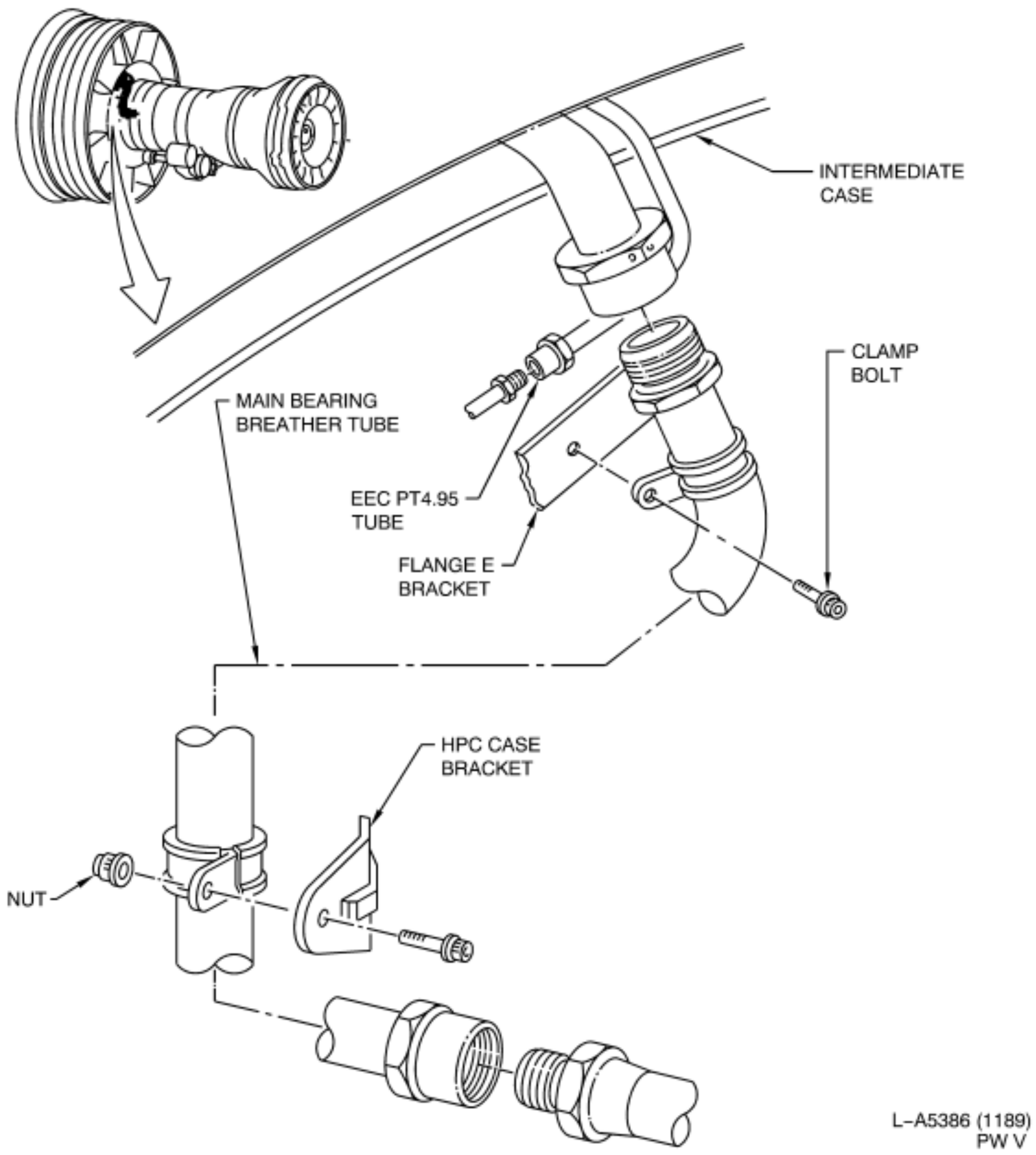
Engine Tube Disconnects And Removals
R Figure 1205 (Sheet 11)
(Task 71-00-00-530-001)


(PACKING EACH TUBE)
AIR/OIL COOLER OIL INLET TUBE
AIR/OIL COOLER OIL OUTLET TUBE
BOLT (5 REQ'D)
BOLT (3 REQ'D)
HARNESS BRACKET
PACKING
HPC CASE BRACKET
RETAINER
PACKING
L-A5629

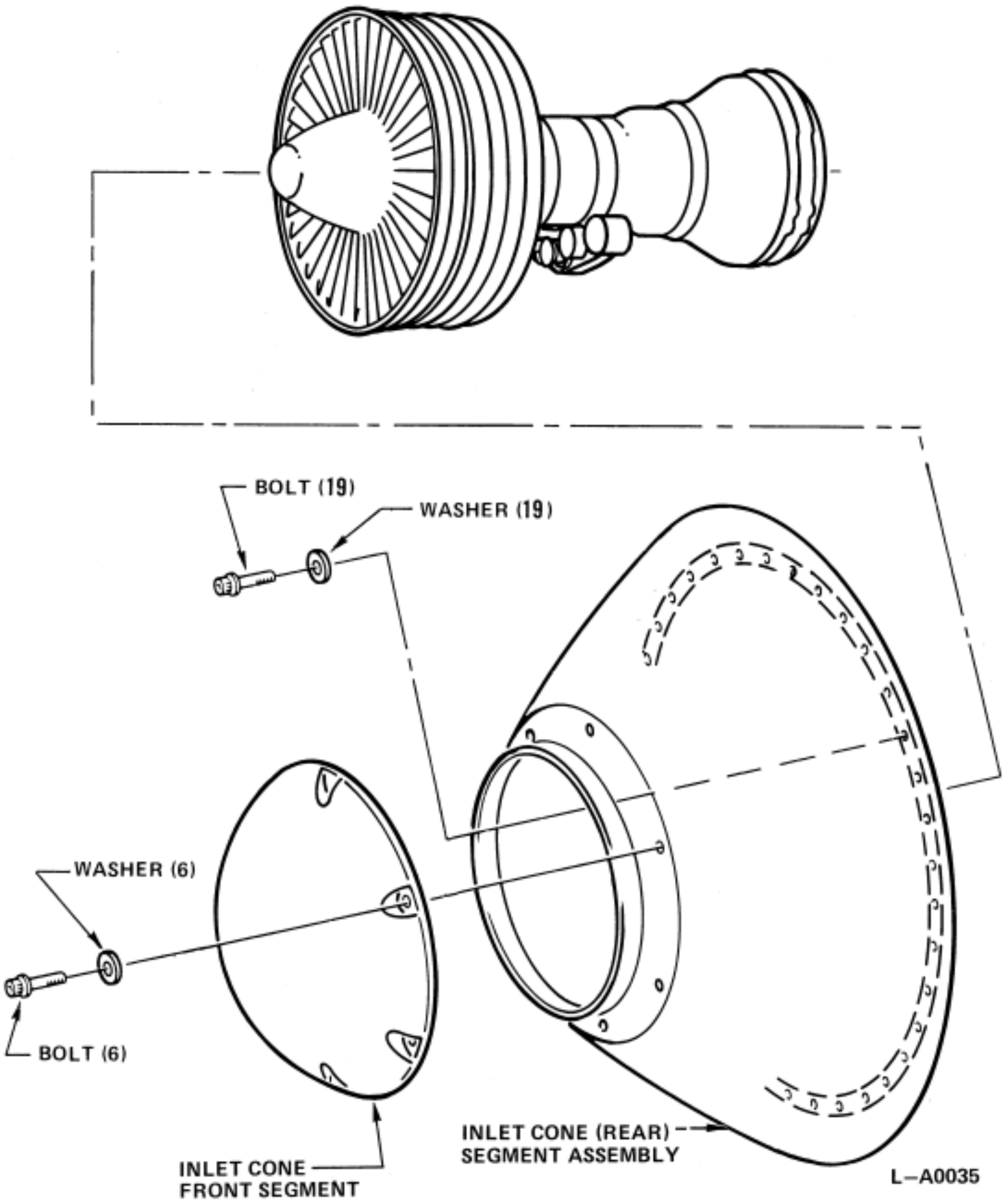
Engine Tube Disconnects And Removals
R Figure 1205 (Sheet 12)
(Task 71−00−00−530−001)


10 O'CLOCK POSITION SOLENOID
CLAMP
SUPPLY TUBE
COOLING AIR HOSE
SIGNAL TUBES
CLAMP BOLT
CLAMP BOLT
FLANGE E BRACKET
STRAINER HOUSING
MAIN BEARING OIL PRESSURE TUBE
L-A5385 (0689)
PW V

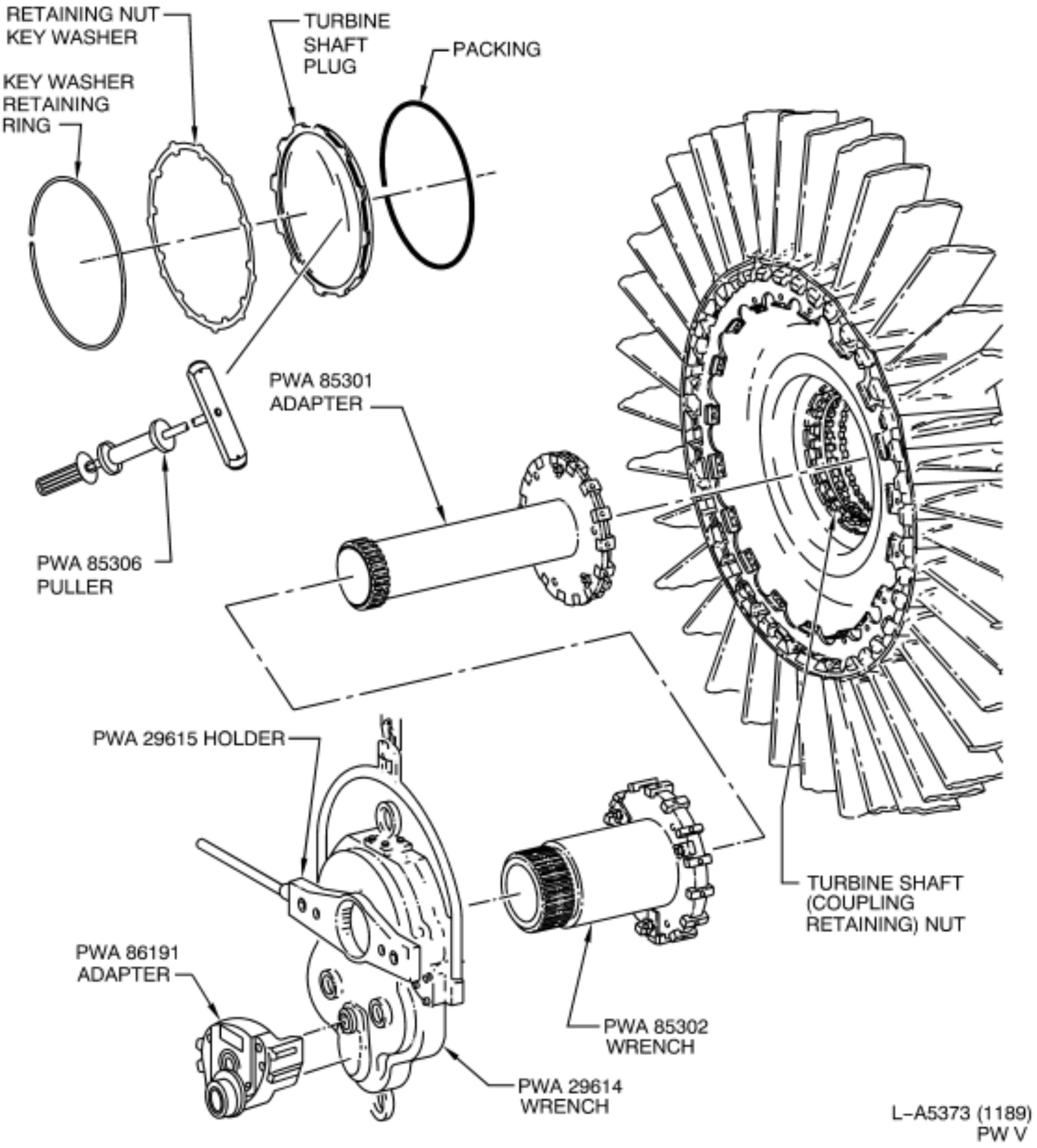
Engine Tube Disconnects And Removals
R Figure 1205 (Sheet 13)
(Task 71-00-00-530-001)


INTERMEDIATE CASE
CLAMP BOLT
MAIN BEARING BREATHER TUBE
EEC PT4.95 TUBE
FLANGE E BRACKET
HPC CASE BRACKET
NUT
L-A5386 (1189)
PW V

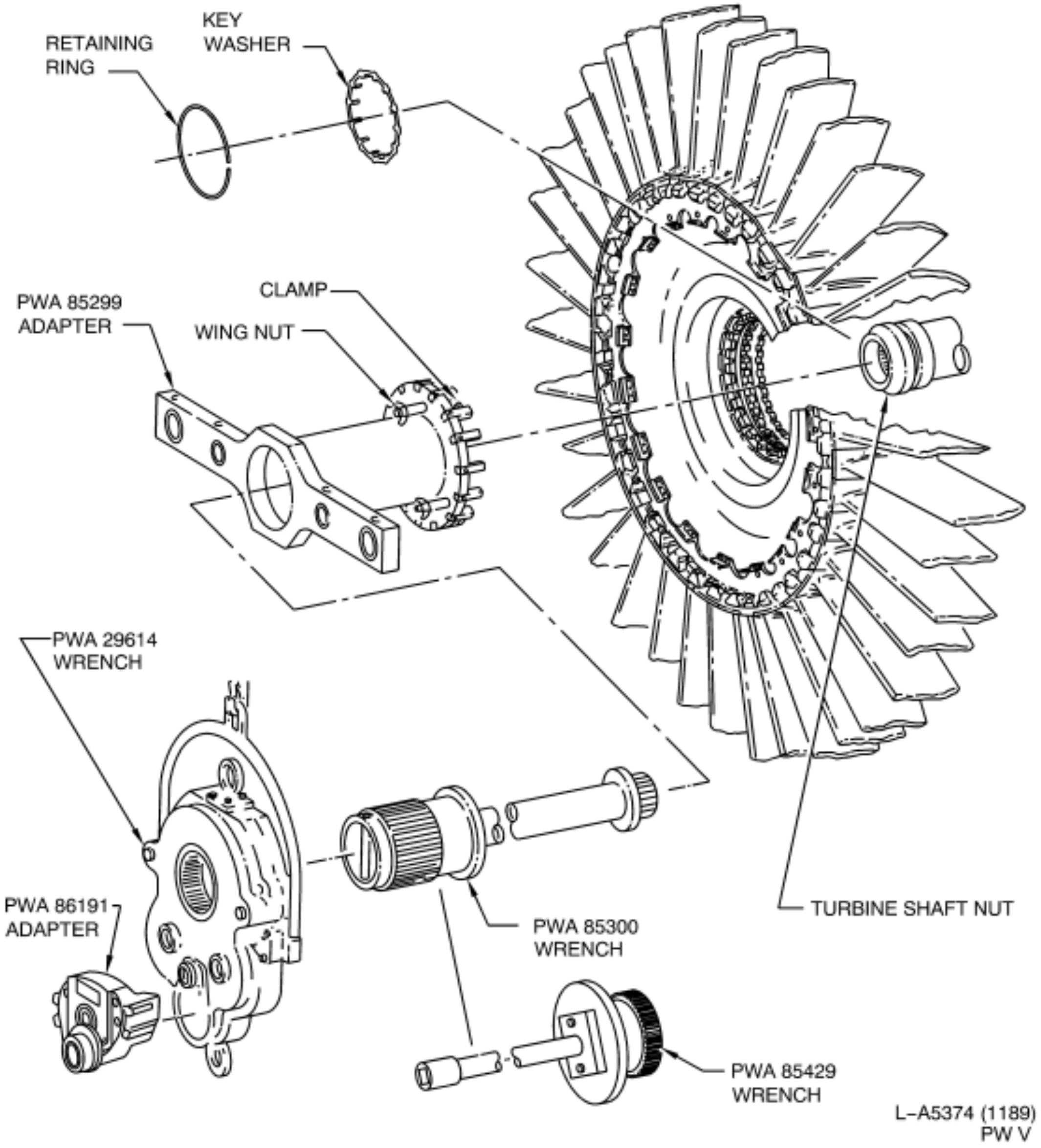
Engine Tube Disconnects And Removals
R Figure 1205 (Sheet 14)
(Task 71-00-00-530-001)


BOLT (19)
WASHER (19)
WASHER (6)
BOLT (6)
INLET CONE FRONT SEGMENT
INLET CONE (REAR) SEGMENT ASSEMBLY
L-A0035

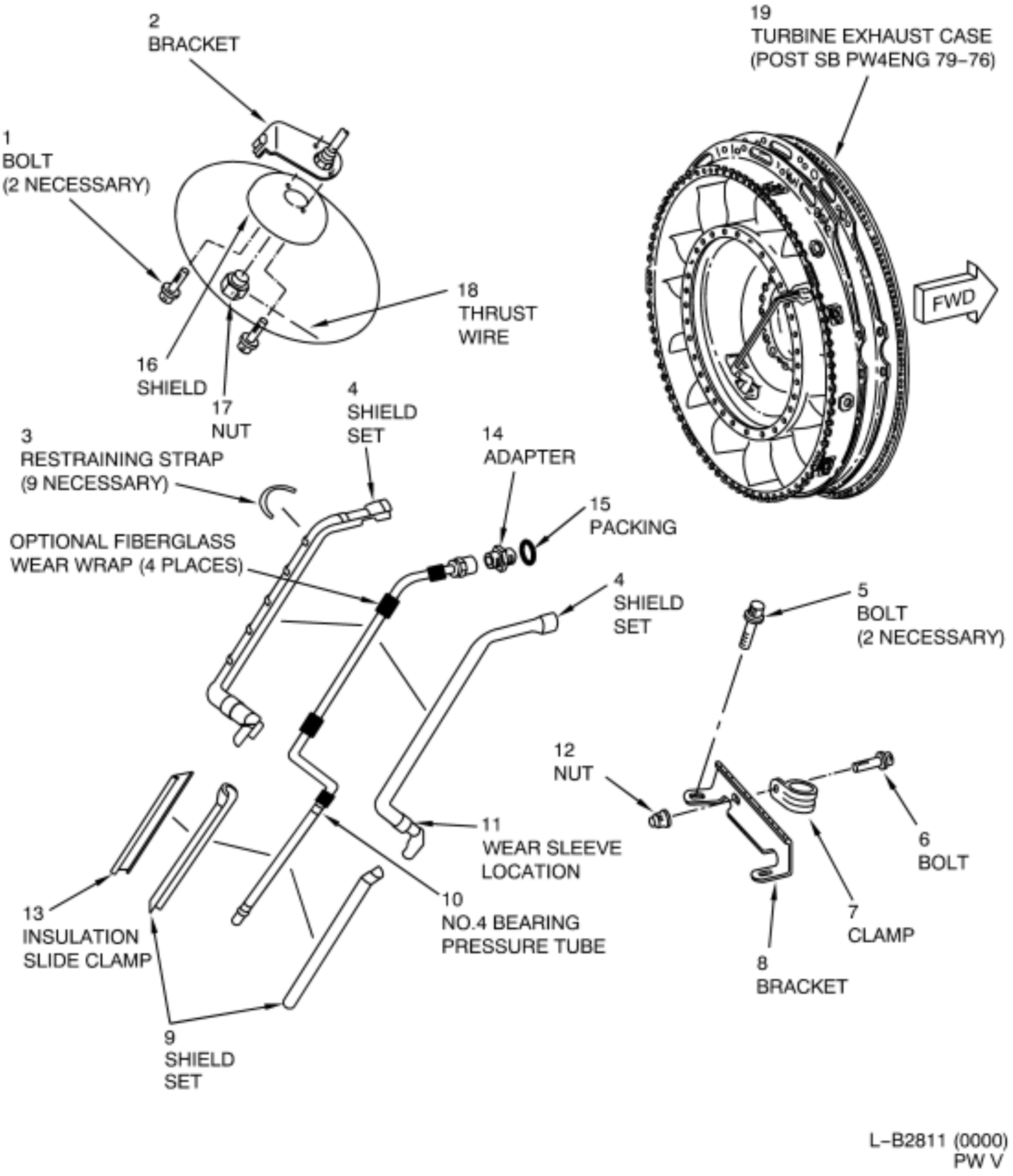
Compressor Inlet Cone Removal
Figure 1206
(Task 71-00-00-530-001)


RETAINING NUT KEY WASHER
TURBINE SHAFT PLUG
PACKING
KEY WASHER RETAINING RING
PWA 85301 ADAPTER
PWA 85306 PULLER
PWA 29615 HOLDER
TURBINE SHAFT (COUPLING RETAINING) NUT
PWA 86191 ADAPTER
PWA 85302 WRENCH
PWA 29614 WRENCH
L-A5373 (1189)
PW V

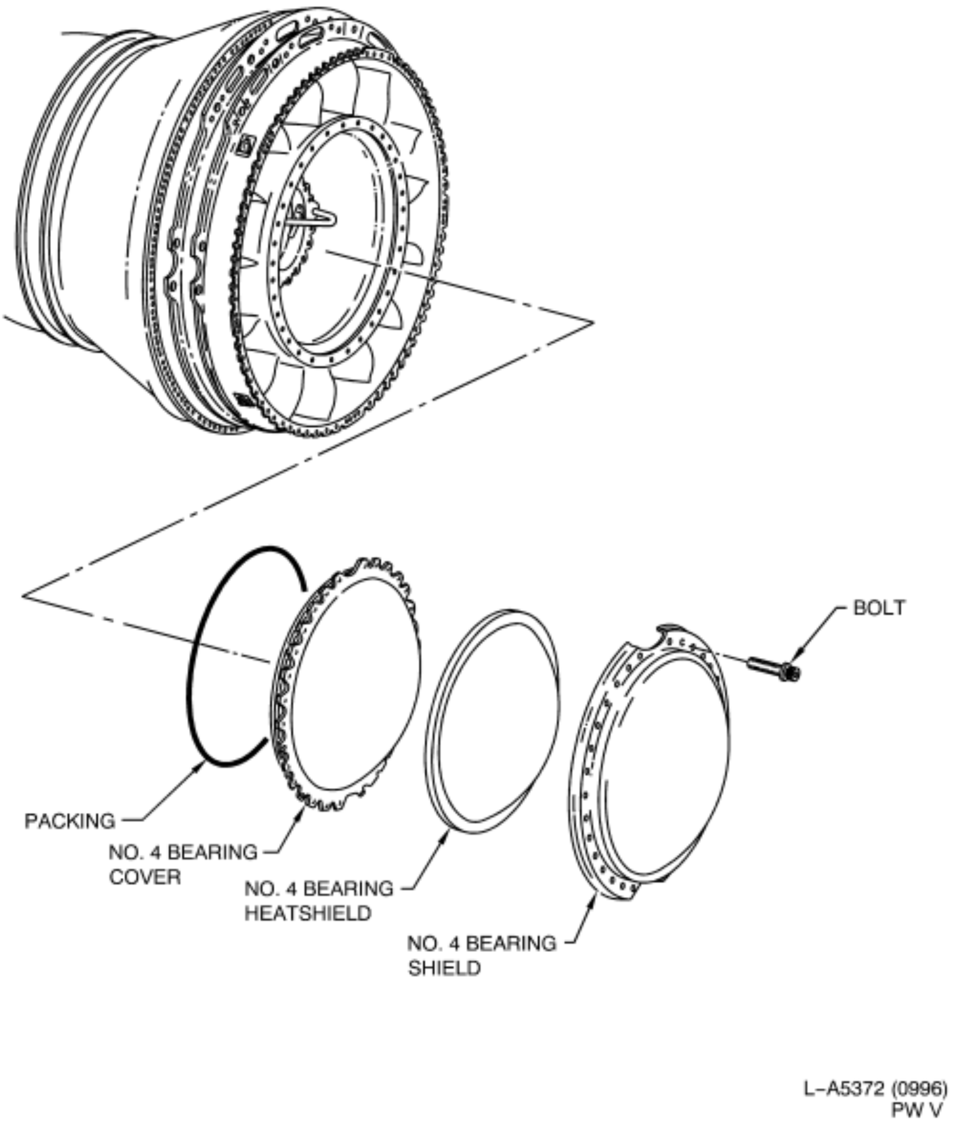
Turbine Shaft (Coupling/Retaining) Nut Removal
Figure 1207
(Task 71-00-00-530-001)


RETAINING RING
KEY WASHER
PWA 85299 ADAPTER
CLAMP
WING NUT
PWA 29614 WRENCH
PWA 86191 ADAPTER
PWA 85300 WRENCH
TURBINE SHAFT NUT
PWA 85429 WRENCH
L-A5374 (1189)
PW V

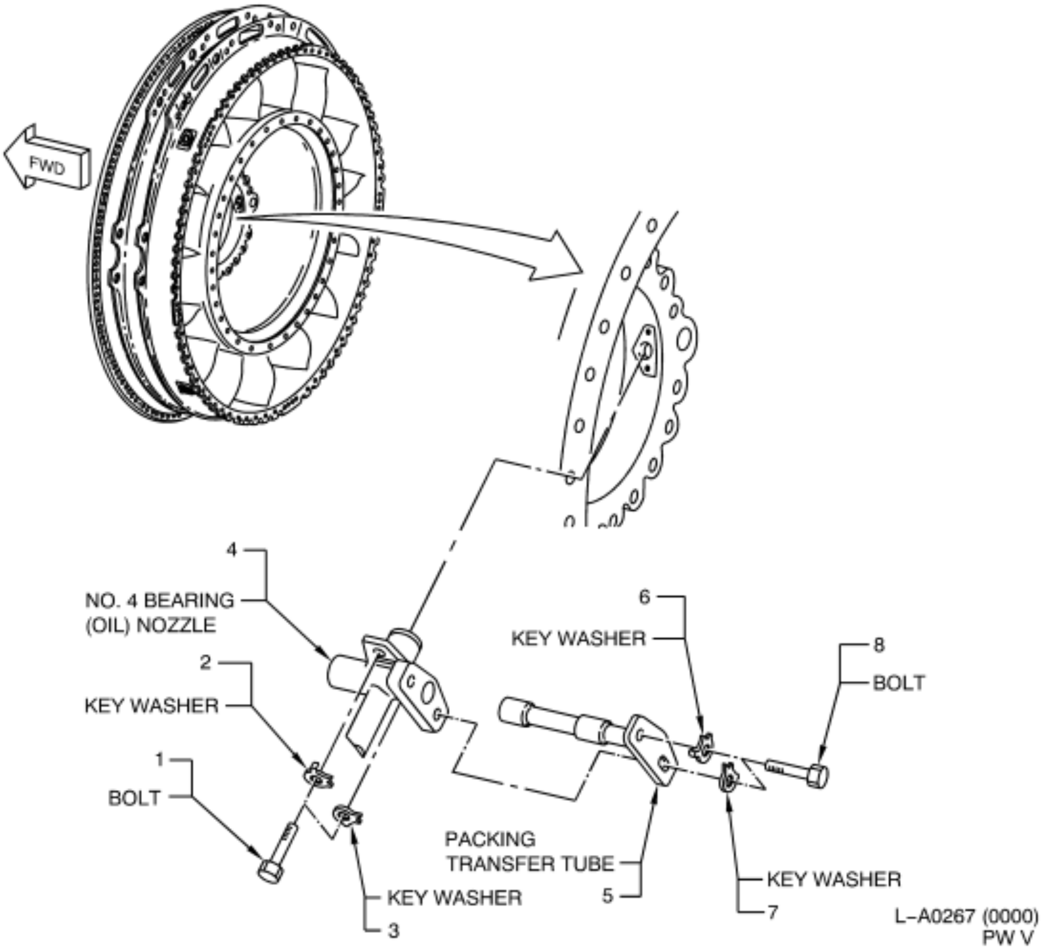
Turbine Shaft Nut Removal
Figure 1208
(Task 71-00-00-530-001)


2
BRACKET
19
TURBINE EXHAUST CASE
(POST SB PW4ENG 79–76)
1
BOLT
(2 NECESSARY)
FWD
18
THRUST
WIRE
16
SHIELD
17
NUT
4
SHIELD
SET
3
RESTRAINING STRAP
(9 NECESSARY)
14
ADAPTER
15
PACKING
OPTIONAL FIBERGLASS
WEAR WRAP (4 PLACES)
4
SHIELD
SET
5
BOLT
(2 NECESSARY)
12
NUT
6
BOLT
11
WEAR SLEEVE
LOCATION
13
INSULATION
SLIDE CLAMP
10
NO.4 BEARING
PRESSURE TUBE
7
CLAMP
8
BRACKET
9
SHIELD
SET
L–B2811 (0000)
PW V

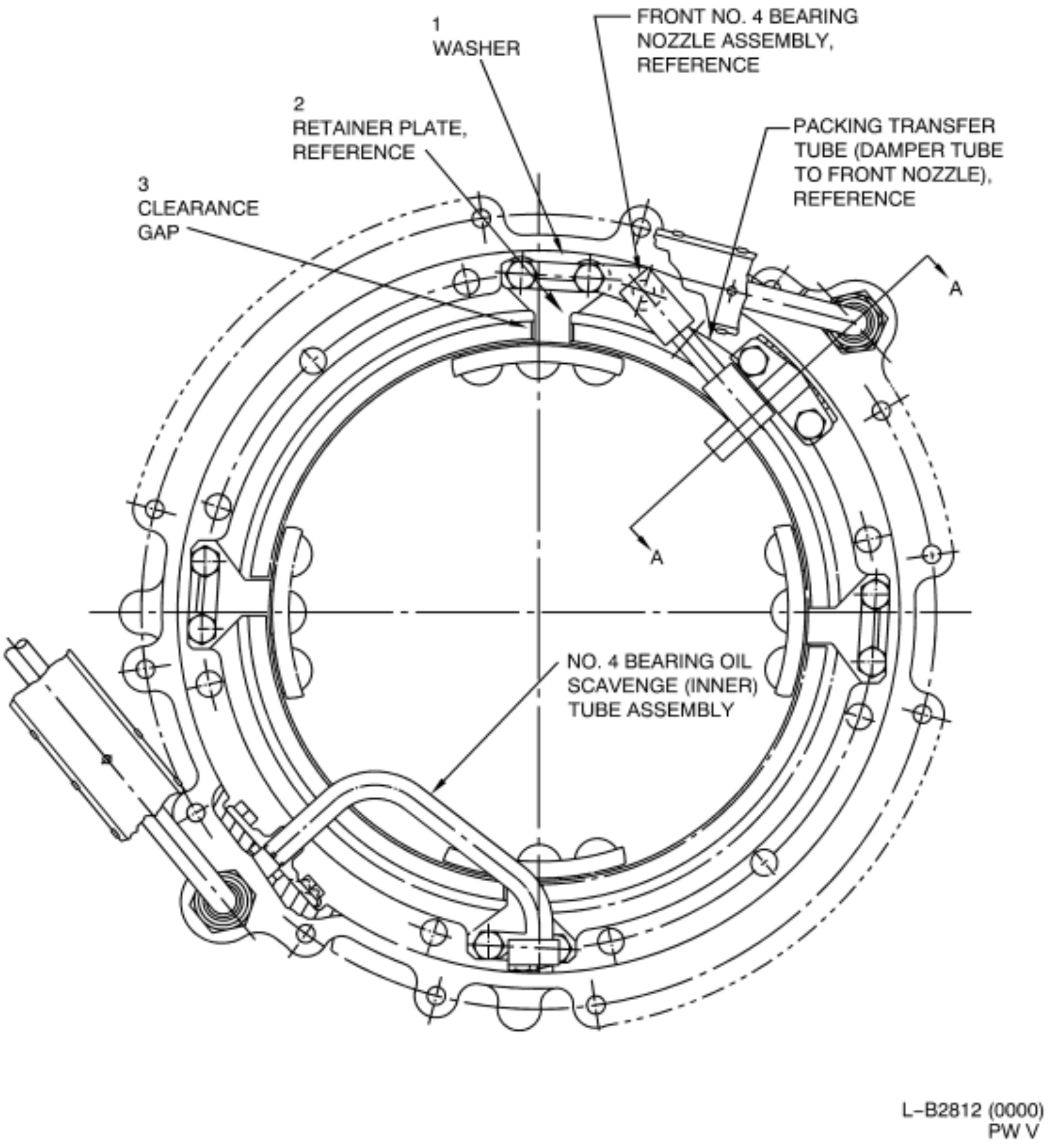
No. 4 Bearing Pressure Tube Removal (Post SB PW4ENG 79–76)
Figure 1209 (Sheet 1)
(Task 71–00–00–530–001)


BOLT
PACKING
NO. 4 BEARING COVER
NO. 4 BEARING HEATSHIELD
NO. 4 BEARING SHIELD
L−A5372 (0996)
PW V

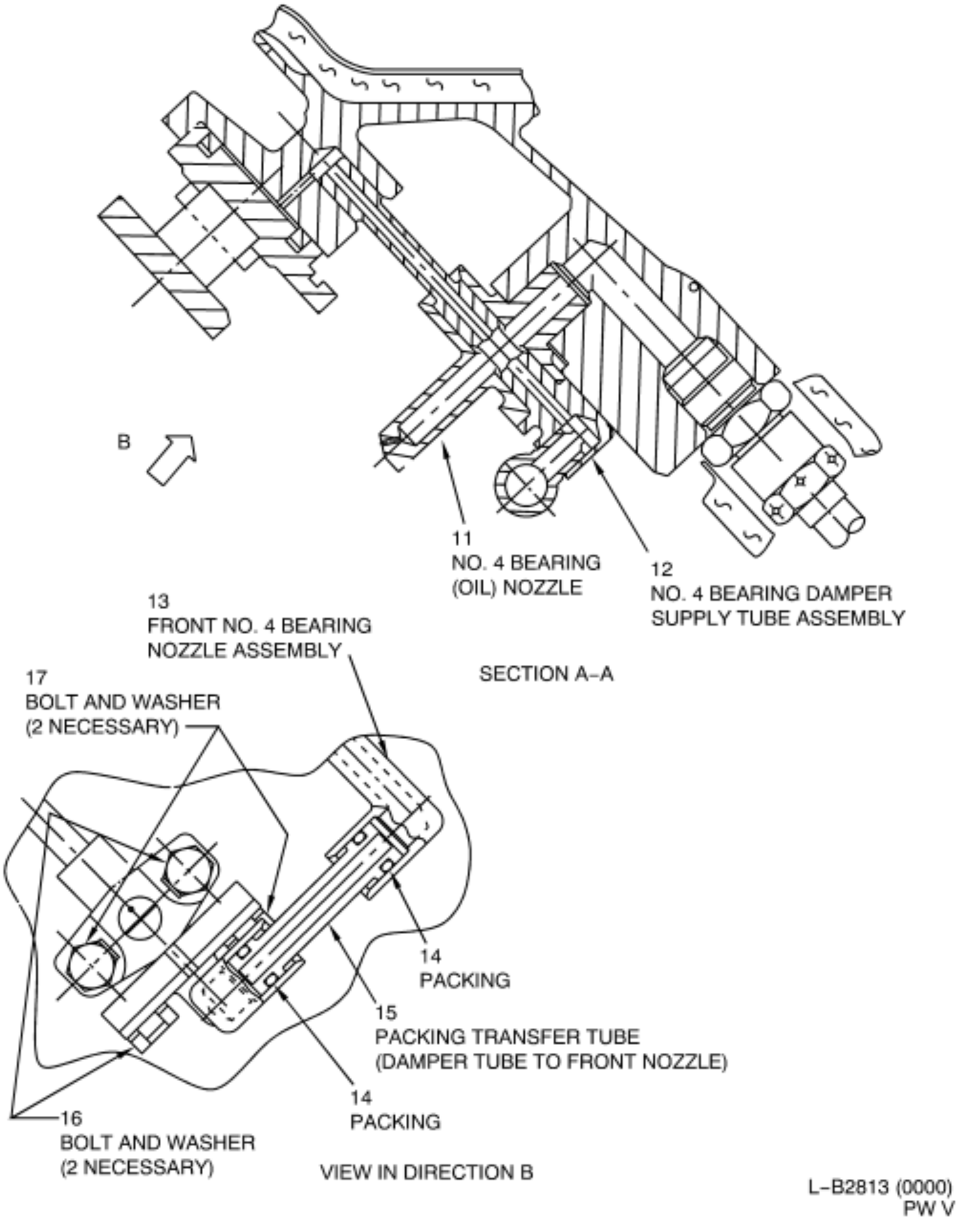
No. 4 Bearing Cover Removal
Figure 1209 (Sheet 2)
(Task 71−00−00−530−001)


FWD
4
NO. 4 BEARING (OIL) NOZZLE
2
KEY WASHER
1
BOLT
6
KEY WASHER
8
BOLT
PACKING
TRANSFER TUBE
5
KEY WASHER
3
KEY WASHER
7
L−A0267 (0000)
PW V

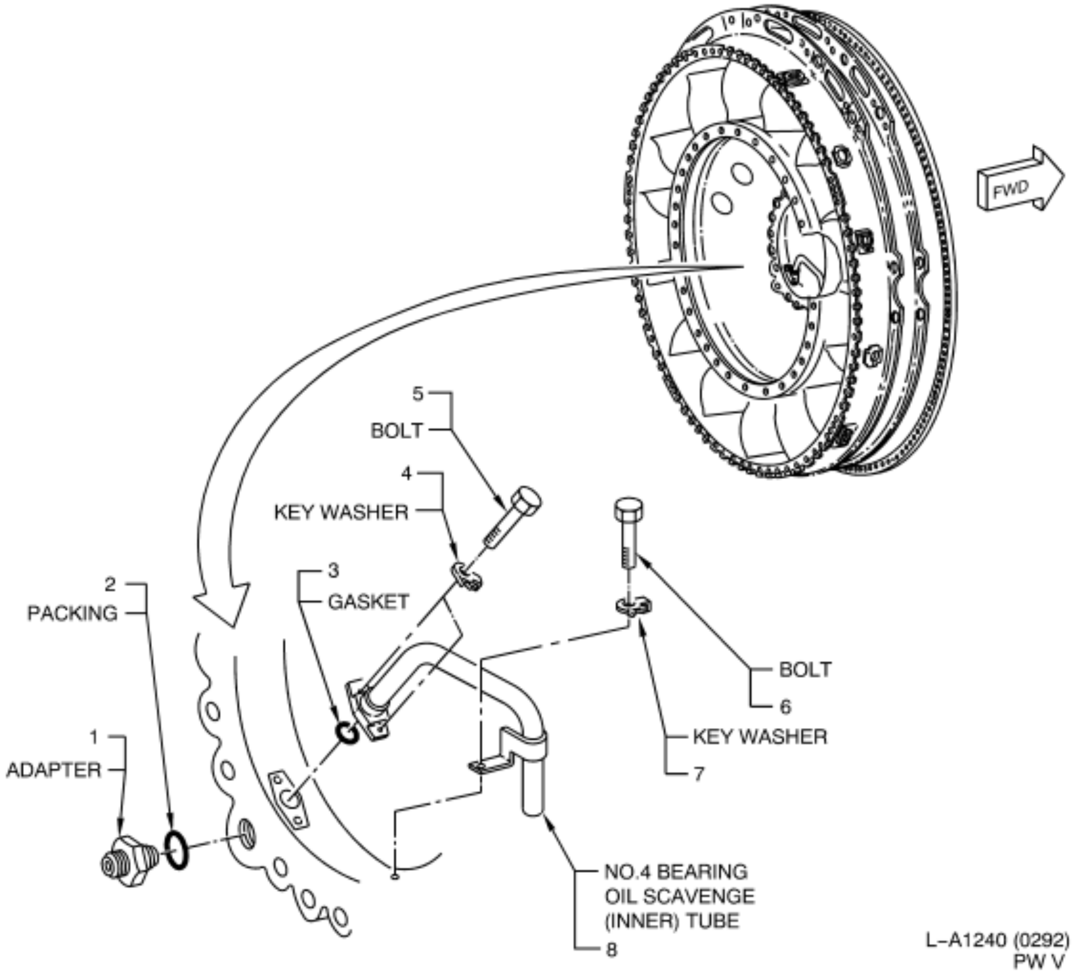
No. 4 Bearing (Oil) Nozzle Removal (Pre SB PW4ENG 72−472)
Figure 1210
(Task 71−00−00−530−001)


1
WASHER
FRONT NO. 4 BEARING NOZZLE ASSEMBLY, REFERENCE
2
RETAINER PLATE, REFERENCE
PACKING TRANSFER TUBE (DAMPER TUBE TO FRONT NOZZLE), REFERENCE
3
CLEARANCE GAP
A
A
NO. 4 BEARING OIL SCAVENGE (INNER) TUBE ASSEMBLY
L-B2812 (0000)
PW V

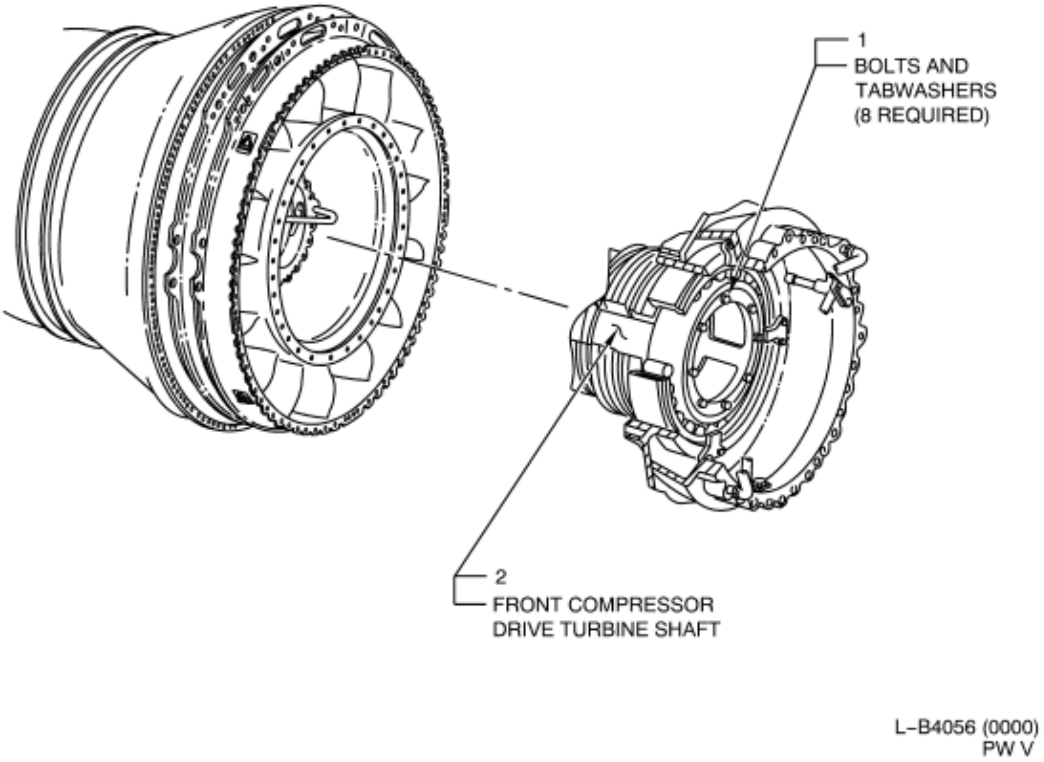
No. 4 Bearing (Oil) Nozzles Removal (Post SB PW4ENG 72-472)
Figure 1211 (Sheet 1)
(Task 71-00-00-530-001)


B
11
NO. 4 BEARING
(OIL) NOZZLE
12
NO. 4 BEARING DAMPER
SUPPLY TUBE ASSEMBLY
13
FRONT NO. 4 BEARING
NOZZLE ASSEMBLY
SECTION A−A
17
BOLT AND WASHER
(2 NECESSARY)
14
PACKING
15
PACKING TRANSFER TUBE
(DAMPER TUBE TO FRONT NOZZLE)
14
PACKING
16
BOLT AND WASHER
(2 NECESSARY)
VIEW IN DIRECTION B
L−B2813 (0000)
PW V

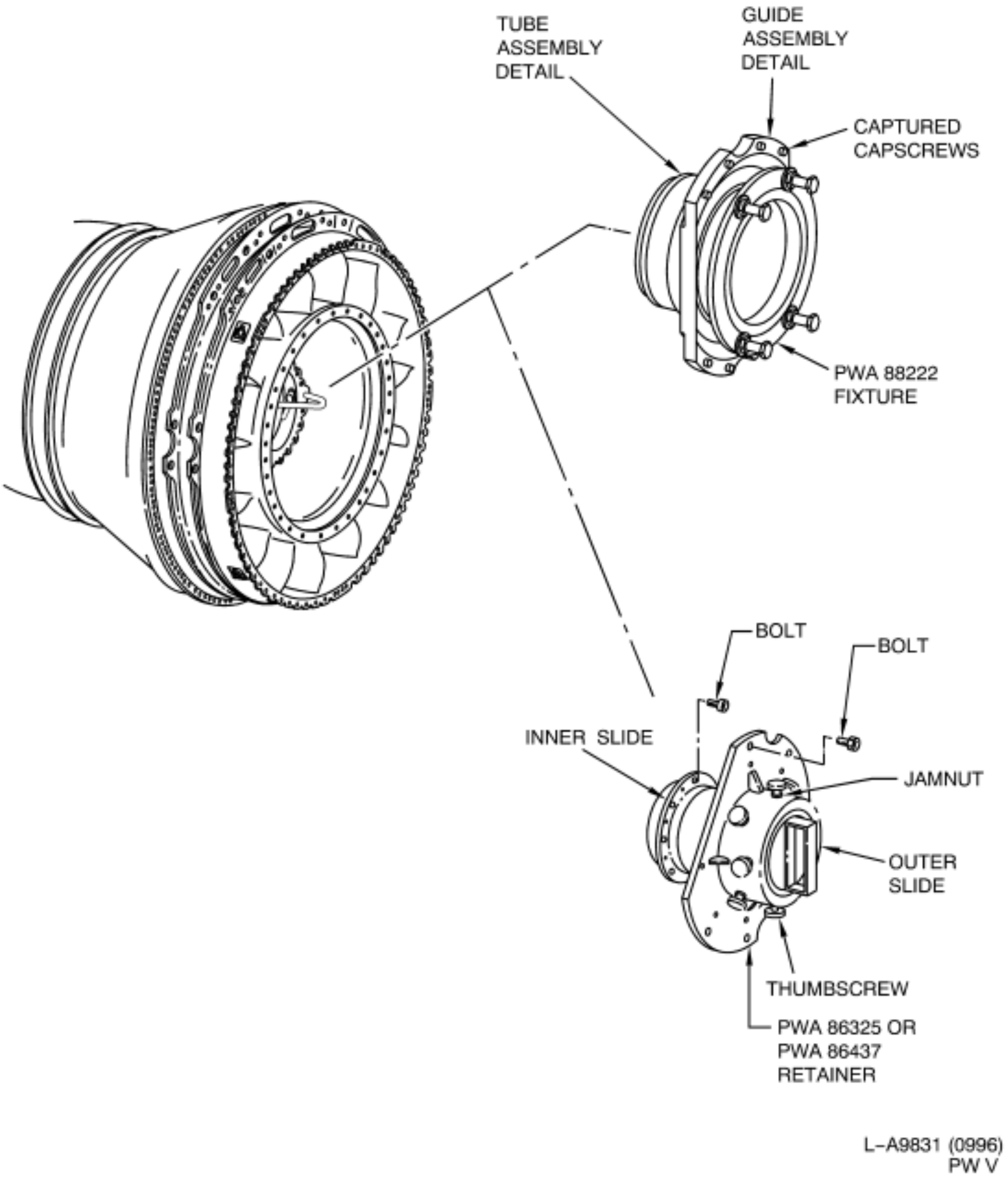
No. 4 Bearing (Oil) Nozzles Removal (Post SB PW4ENG 72−472)
Figure 1211 (Sheet 2)
(Task 71−00−00−530−001)


FWD
5
BOLT
4
KEY WASHER
3
GASKET
2
PACKING
1
ADAPTER
BOLT
6
KEY WASHER
7
NO.4 BEARING
OIL SCAVENGE
(INNER) TUBE
8
L−A1240 (0292)
PW V

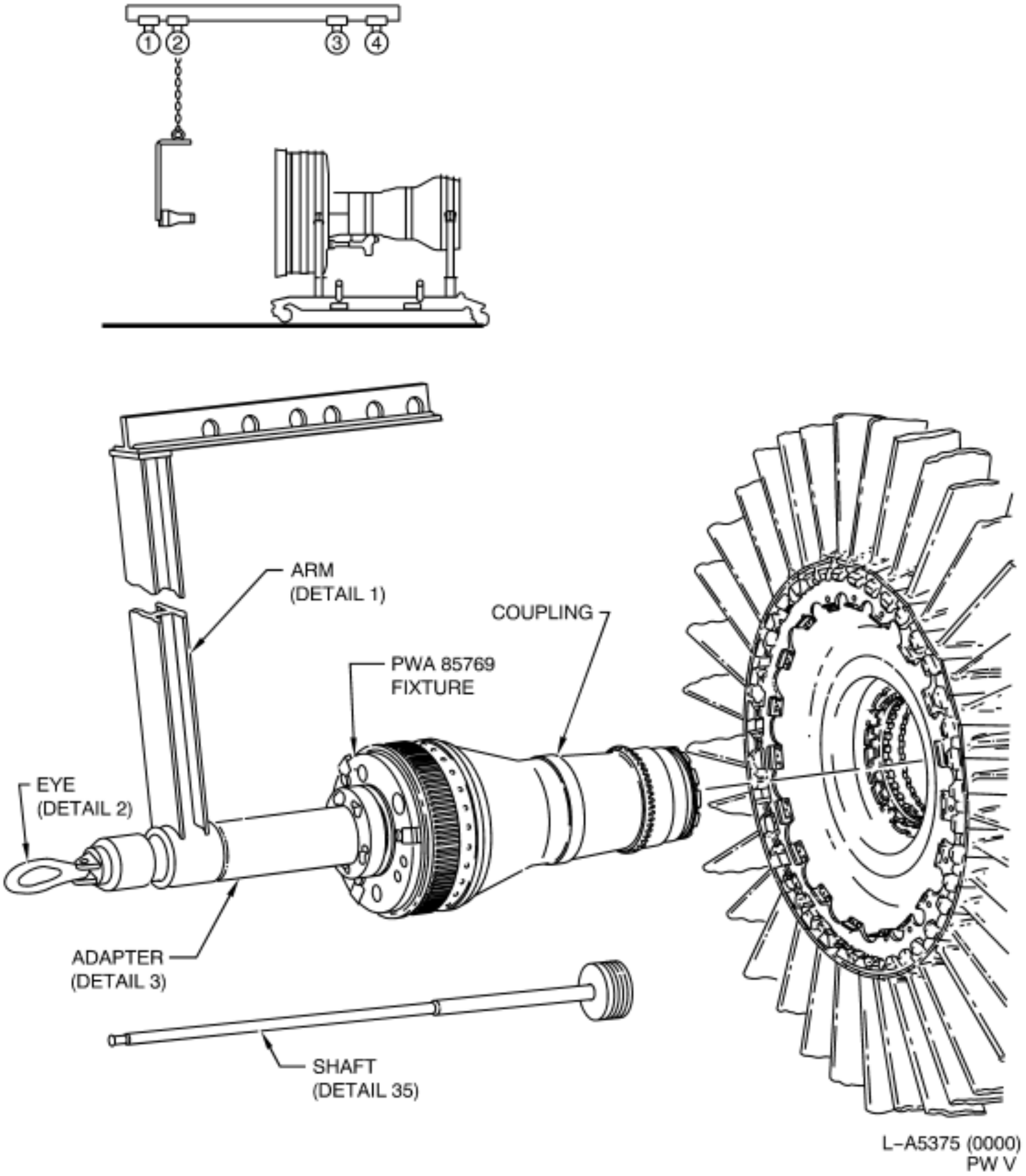
No. 4 Bearing Oil (inner) Savenge Tube Removal
Figure 1212
(Task 71−00−00−530−001)


1
BOLTS AND
TABWASHERS
(8 REQUIRED)
2
FRONT COMPRESSOR
DRIVE TURBINE SHAFT
L-B4056 (0000)
PW V

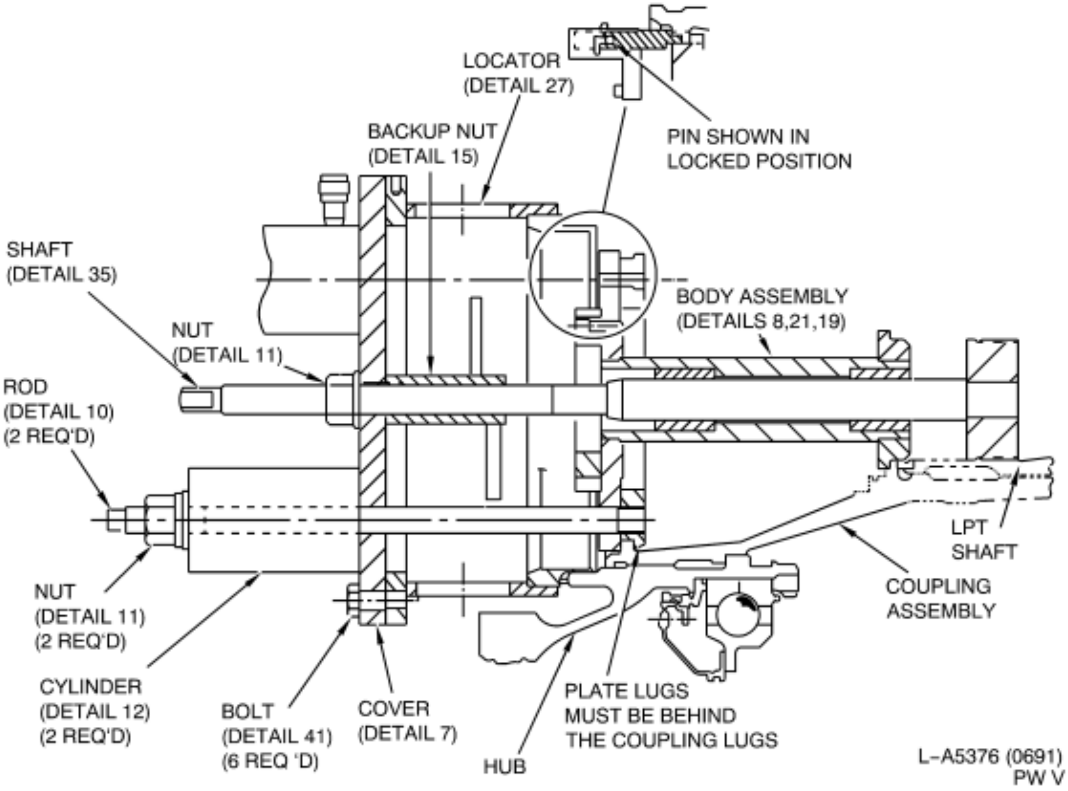
No. 4 Bearing Retaining Plate Bolts And Tabwashers Removal
Figure 1213
(Task 71-00-00-530-001)


TUBE ASSEMBLY DETAIL
GUIDE ASSEMBLY DETAIL
CAPTURED CAPSCREWS
PWA 88222 FIXTURE
BOLT
BOLT
INNER SLIDE
JAMNUT
OUTER SLIDE
THUMBSCREW
PWA 86325 OR PWA 86437 RETAINER
L-A9831 (0996)
PW V

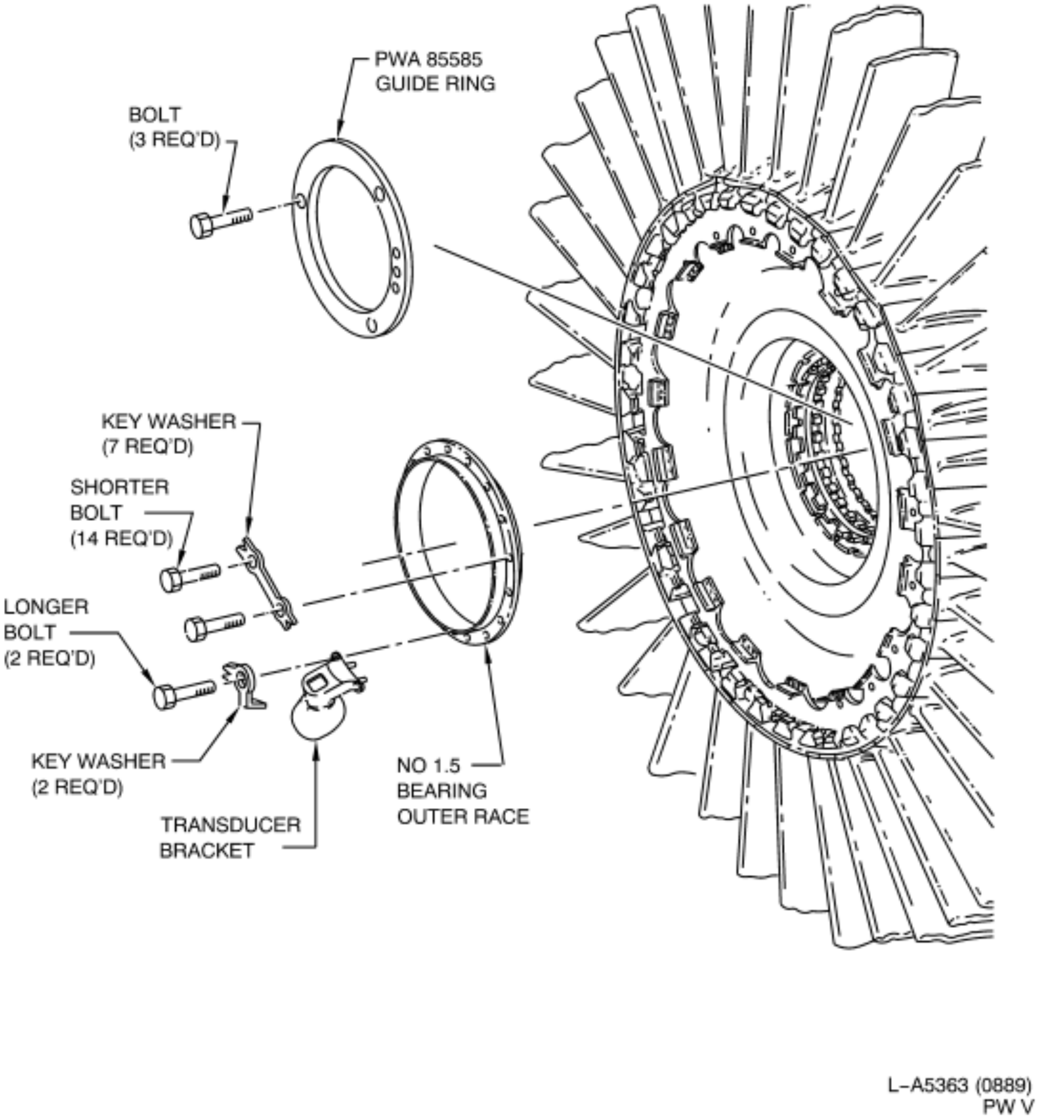
PWA 86235 Or PWA 86437 Or PWA 88222 Fixture Installation
Figure 1214
(Task 71-00-00-530-001)


①
②
③
④
ARM
(DETAIL 1)
COUPLING
PWA 85769
FIXTURE
EYE
(DETAIL 2)
ADAPTER
(DETAIL 3)
SHAFT
(DETAIL 35)
L-A5375 (0000)
PW V

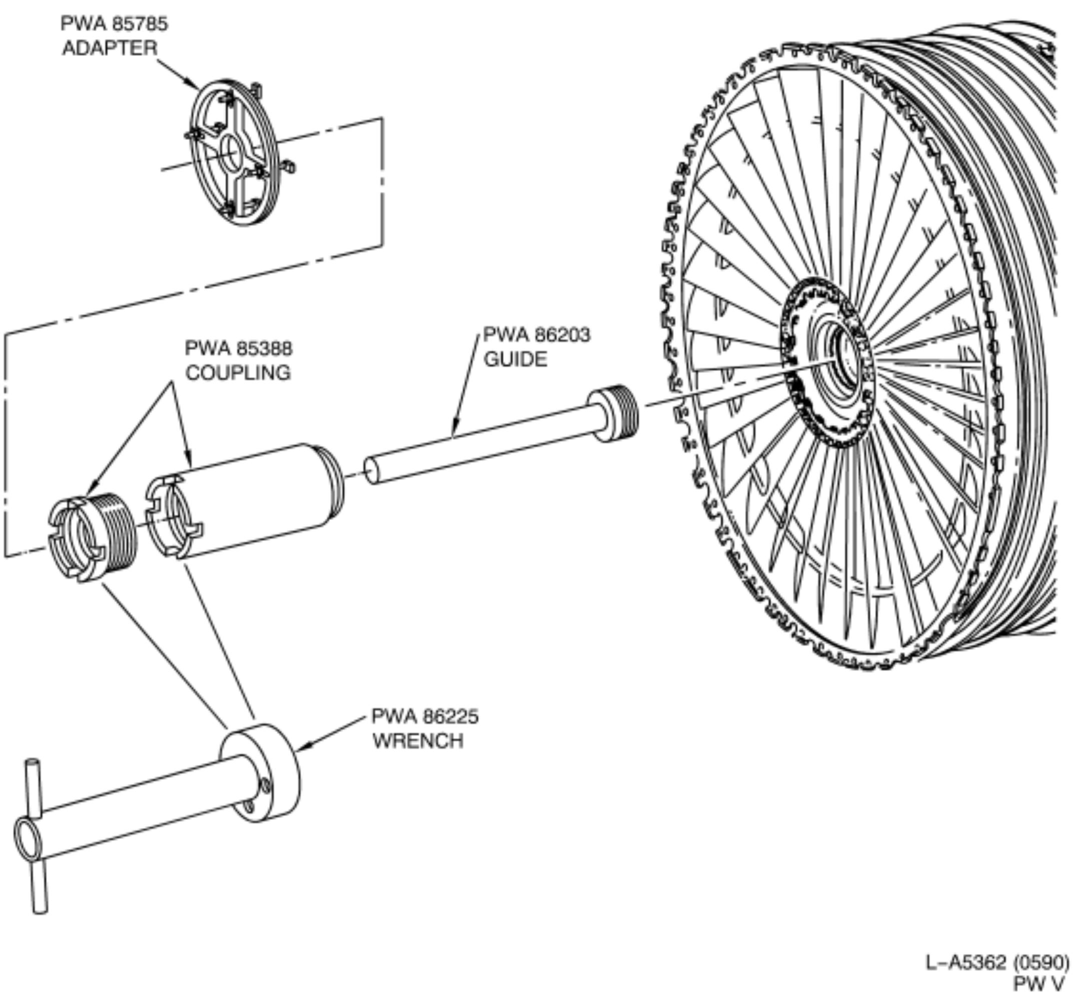
Coupling Assembly Removal
Figure 1215 (Sheet 1)
(Task 71-00-00-530-001)


LOCATOR
(DETAIL 27)
BACKUP NUT
(DETAIL 15)
PIN SHOWN IN
LOCKED POSITION
SHAFT
(DETAIL 35)
BODY ASSEMBLY
(DETAILS 8,21,19)
NUT
(DETAIL 11)
ROD
(DETAIL 10)
(2 REQ'D)
LPT
SHAFT
COUPLING
ASSEMBLY
NUT
(DETAIL 11)
(2 REQ'D)
CYLINDER
(DETAIL 12)
(2 REQ'D)
BOLT
(DETAIL 41)
(6 REQ 'D)
COVER
(DETAIL 7)
PLATE LUGS
MUST BE BEHIND
THE COUPLING LUGS
HUB
L−A5376 (0691)
PW V

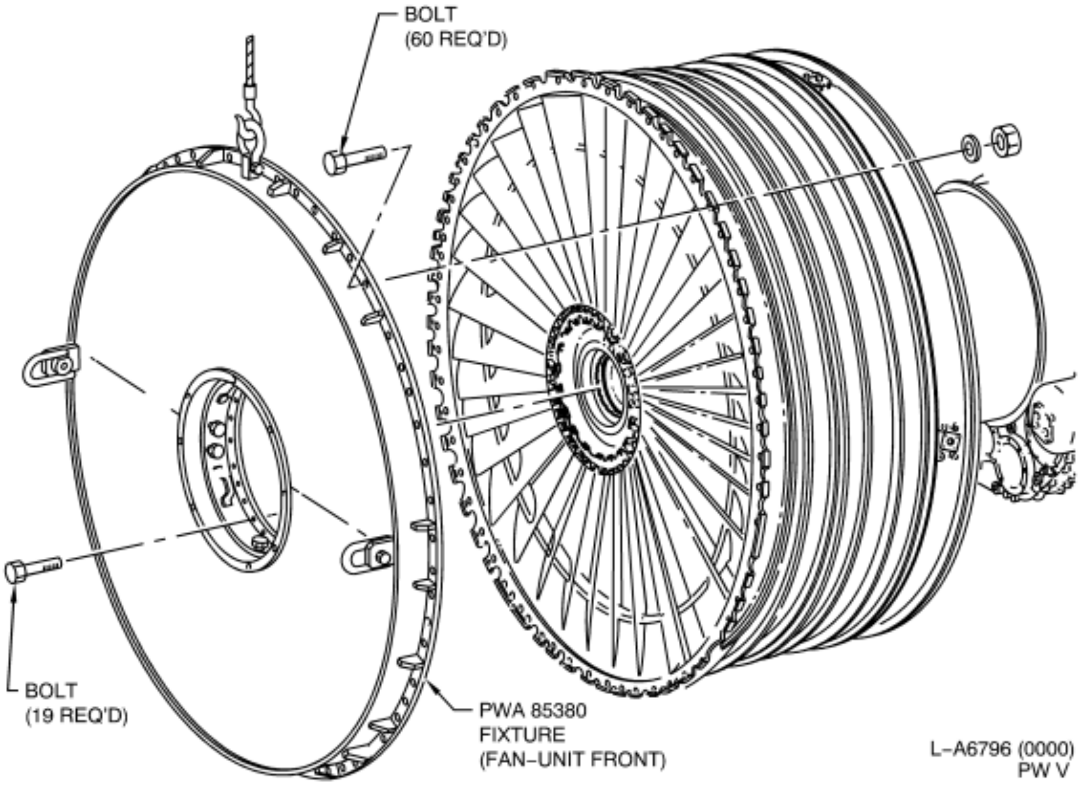
Coupling Assembly Removal (PWA 85769 Fixture Installation)
Figure 1215 (Sheet 2)
(Task 71−00−00−530−001)


PWA 85585
GUIDE RING
BOLT
(3 REQ'D)
KEY WASHER
(7 REQ'D)
SHORTER
BOLT
(14 REQ'D)
LONGER
BOLT
(2 REQ'D)
KEY WASHER
(2 REQ'D)
TRANSDUCER
BRACKET
NO 1.5
BEARING
OUTER RACE
L-A5363 (0889)
PW V

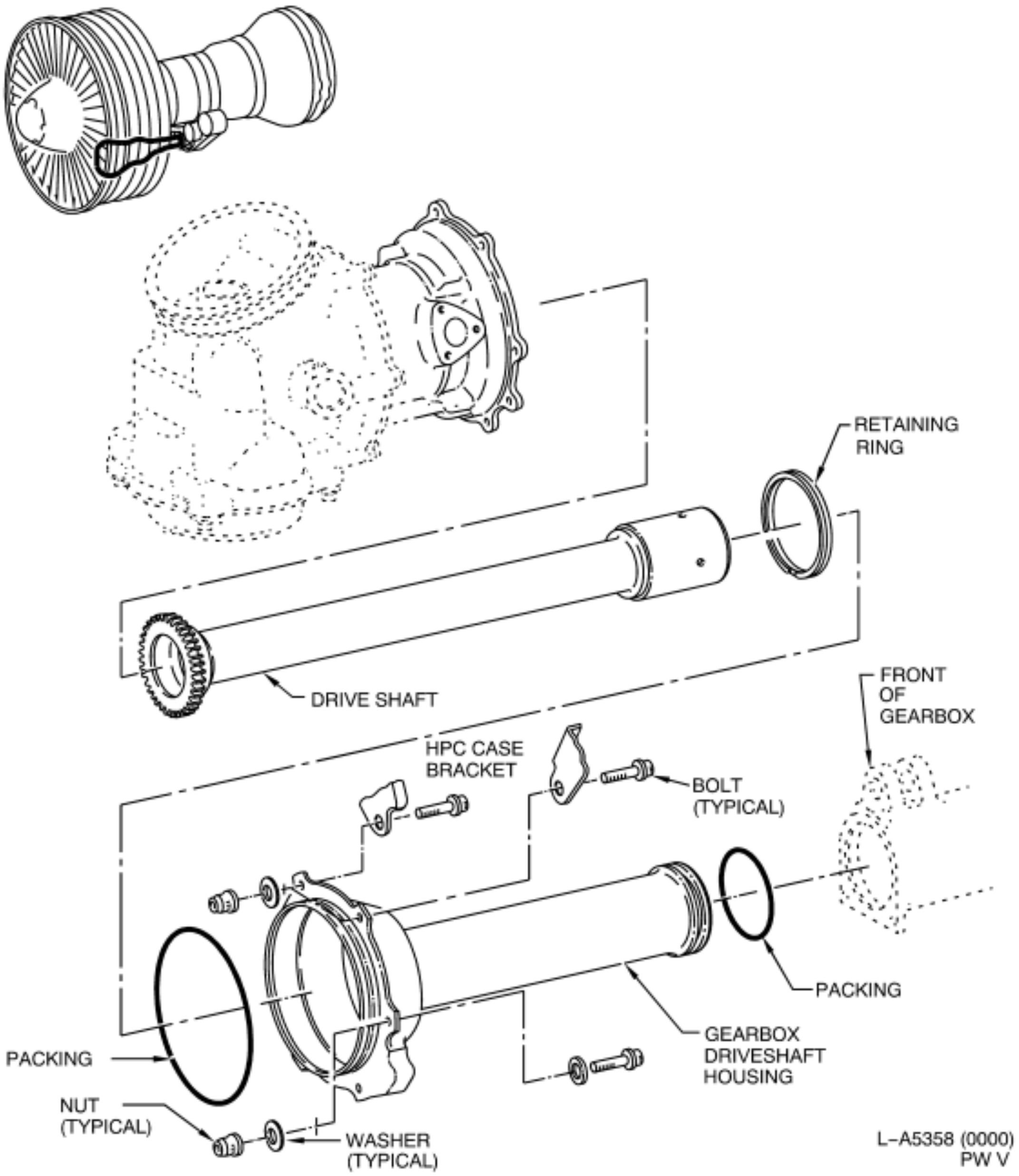
No. 1.5 Bearing Outer Race Removal
Figure 1216
(Task 71-00-00-530-001)


PWA 85785
ADAPTER
PWA 85388
COUPLING
PWA 86203
GUIDE
PWA 86225
WRENCH
L−A5362 (0590)
PW V

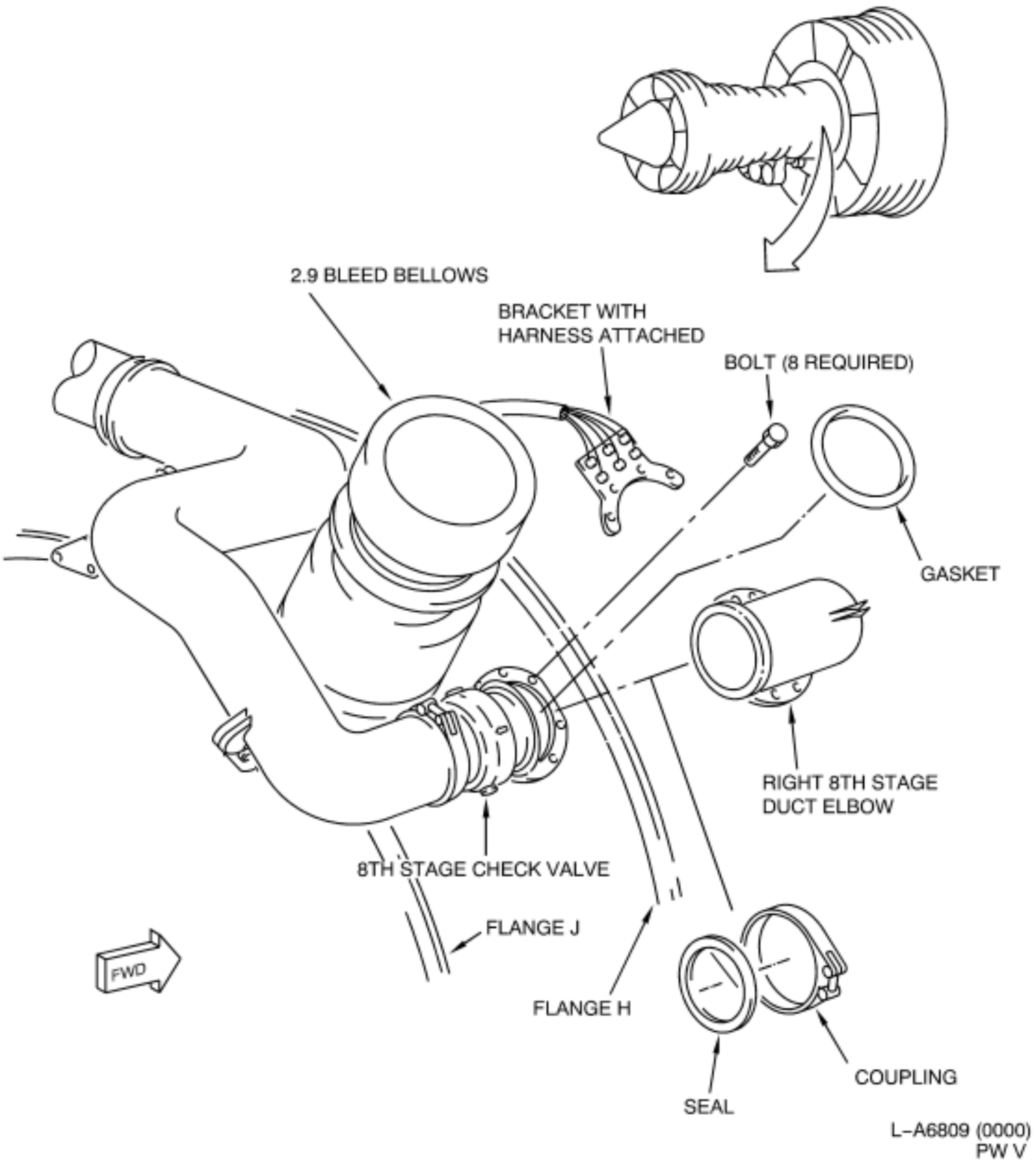
PWA Tooling Installation
Figure 1217 (Sheet 1)
(Task 71−00−00−530−001)


BOLT
(60 REQ'D)
BOLT
(19 REQ'D)
PWA 85380
FIXTURE
(FAN−UNIT FRONT)
L−A6796 (0000)
PW V

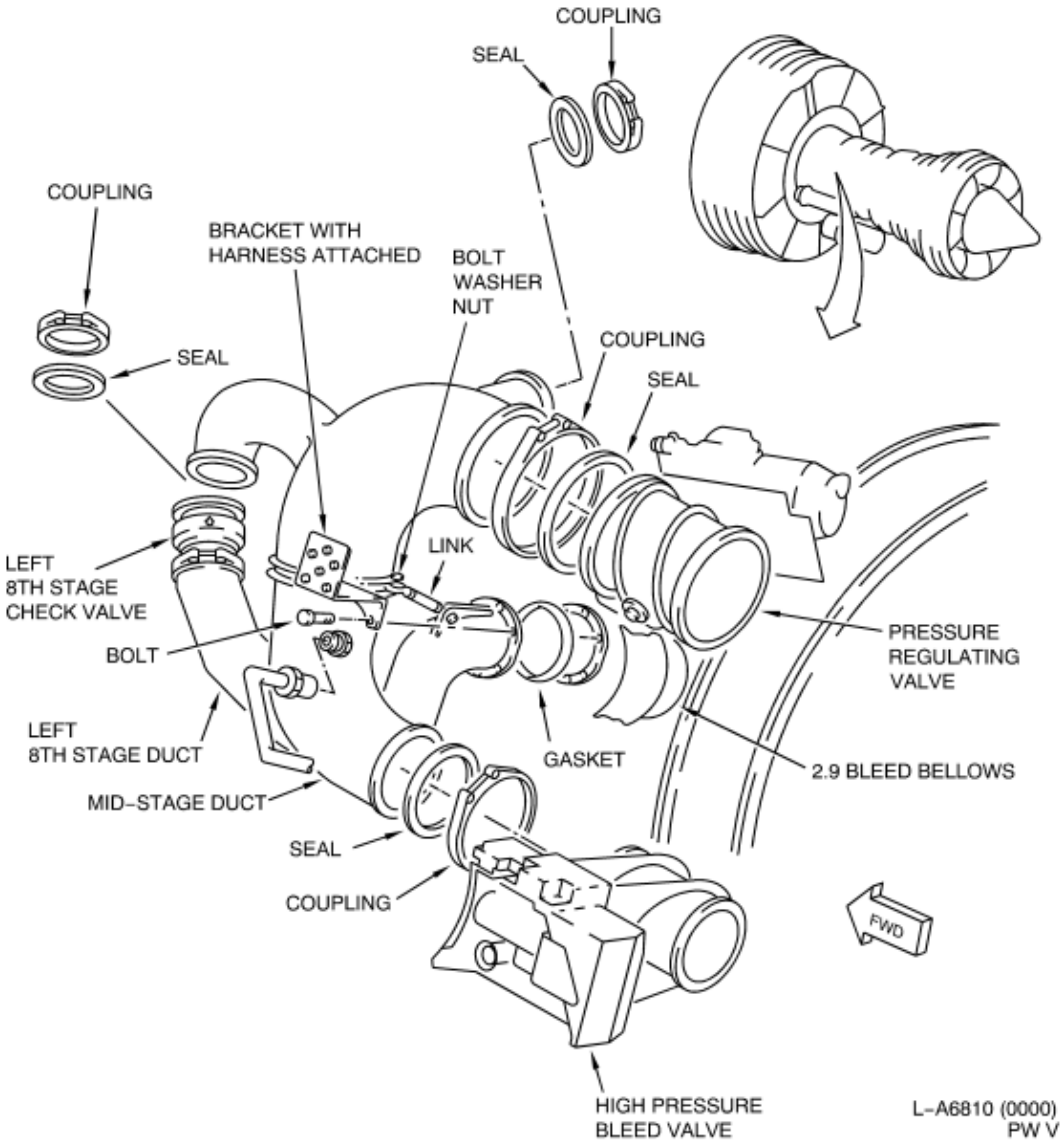
PWA Tooling Installation
Figure 1217 (Sheet 2)
(Task 71−00−00−530−001)


RETAINING RING
DRIVE SHAFT
FRONT OF GEARBOX
HPC CASE BRACKET
BOLT (TYPICAL)
PACKING
GEARBOX DRIVESHAFT HOUSING
PACKING
NUT (TYPICAL)
WASHER (TYPICAL)
L-A5358 (0000)
PW V

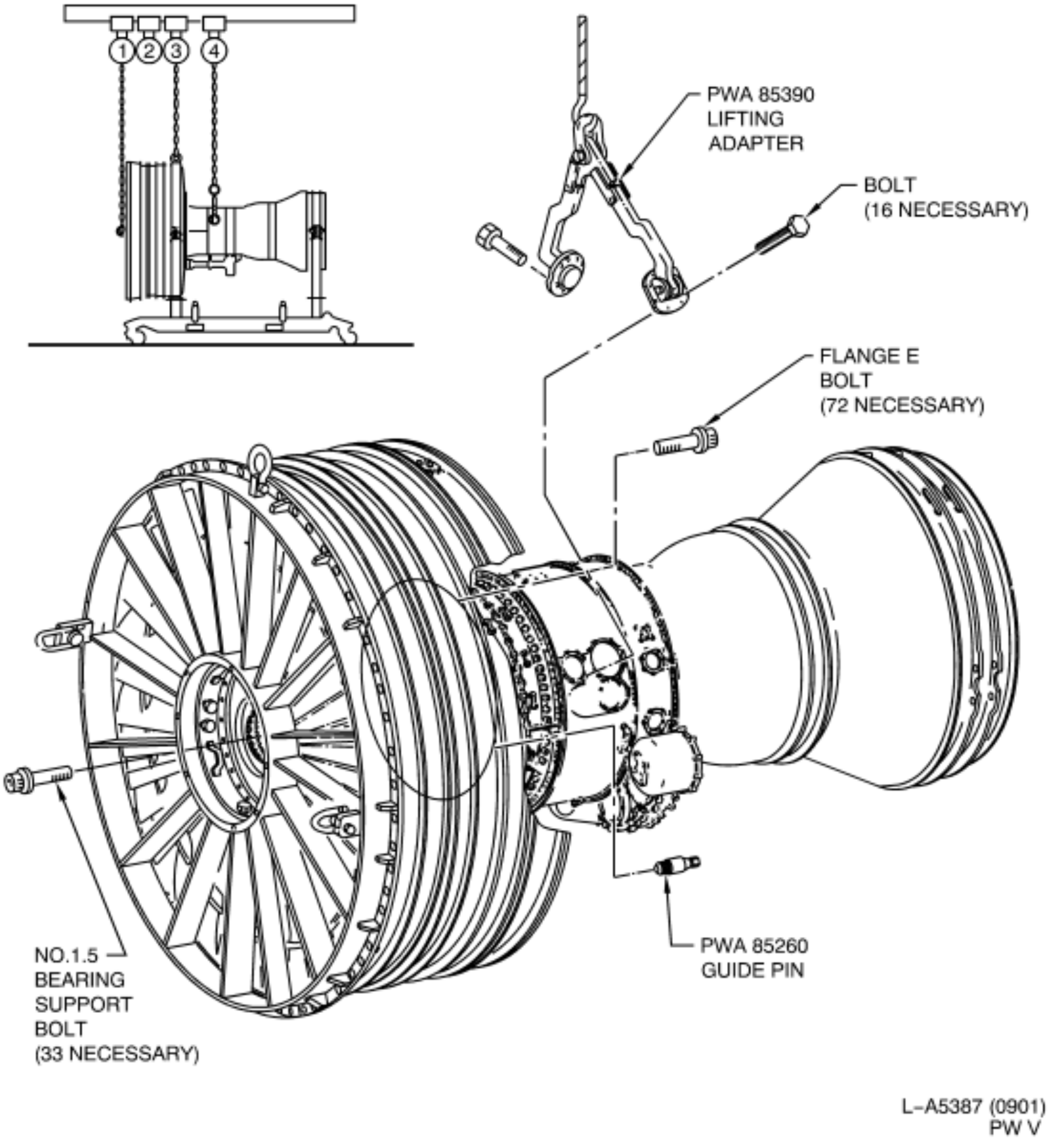
Gearbox Drive Shaft Disassembly
Figure 1218
(Task 71-00-00-530-001)


2.9 BLEED BELLOWS
BRACKET WITH HARNESS ATTACHED
BOLT (8 REQUIRED)
GASKET
RIGHT 8TH STAGE DUCT ELBOW
8TH STAGE CHECK VALVE
FLANGE J
FWD
FLANGE H
COUPLING
SEAL
L−A6809 (0000)
PW V

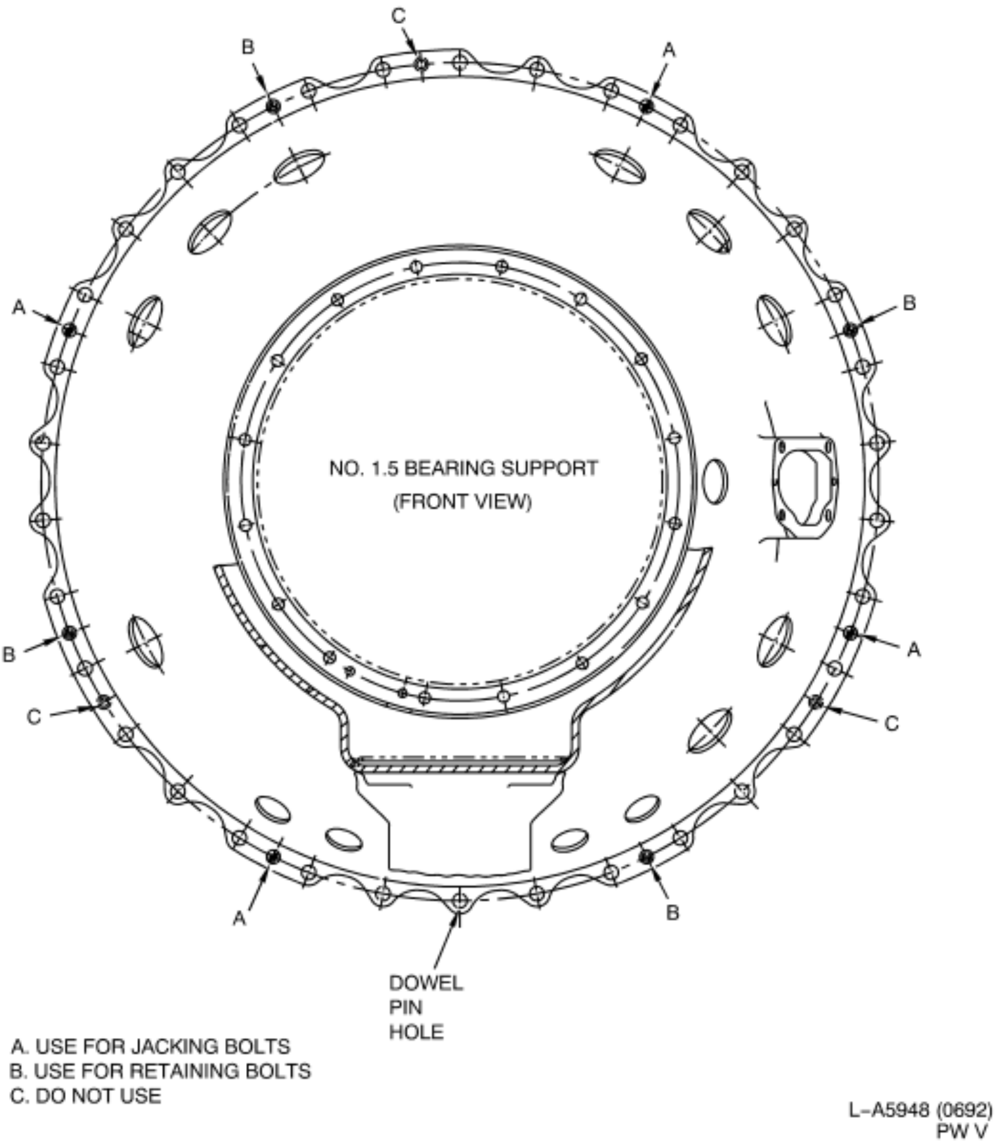
Separation Of Core−Unit From Fan−Unit (8th Stage Duct Removal)
Figure 1219 (Sheet 1)
(Task 71−00−00−530−001)


COUPLING
SEAL
COUPLING
BRACKET WITH HARNESS ATTACHED
BOLT WASHER NUT
COUPLING
SEAL
SEAL
LINK
LEFT 8TH STAGE CHECK VALVE
BOLT
PRESSURE REGULATING VALVE
LEFT 8TH STAGE DUCT
GASKET
2.9 BLEED BELLOWS
MID–STAGE DUCT
SEAL
COUPLING
FWD
HIGH PRESSURE BLEED VALVE
L–A6810 (0000)
PW V

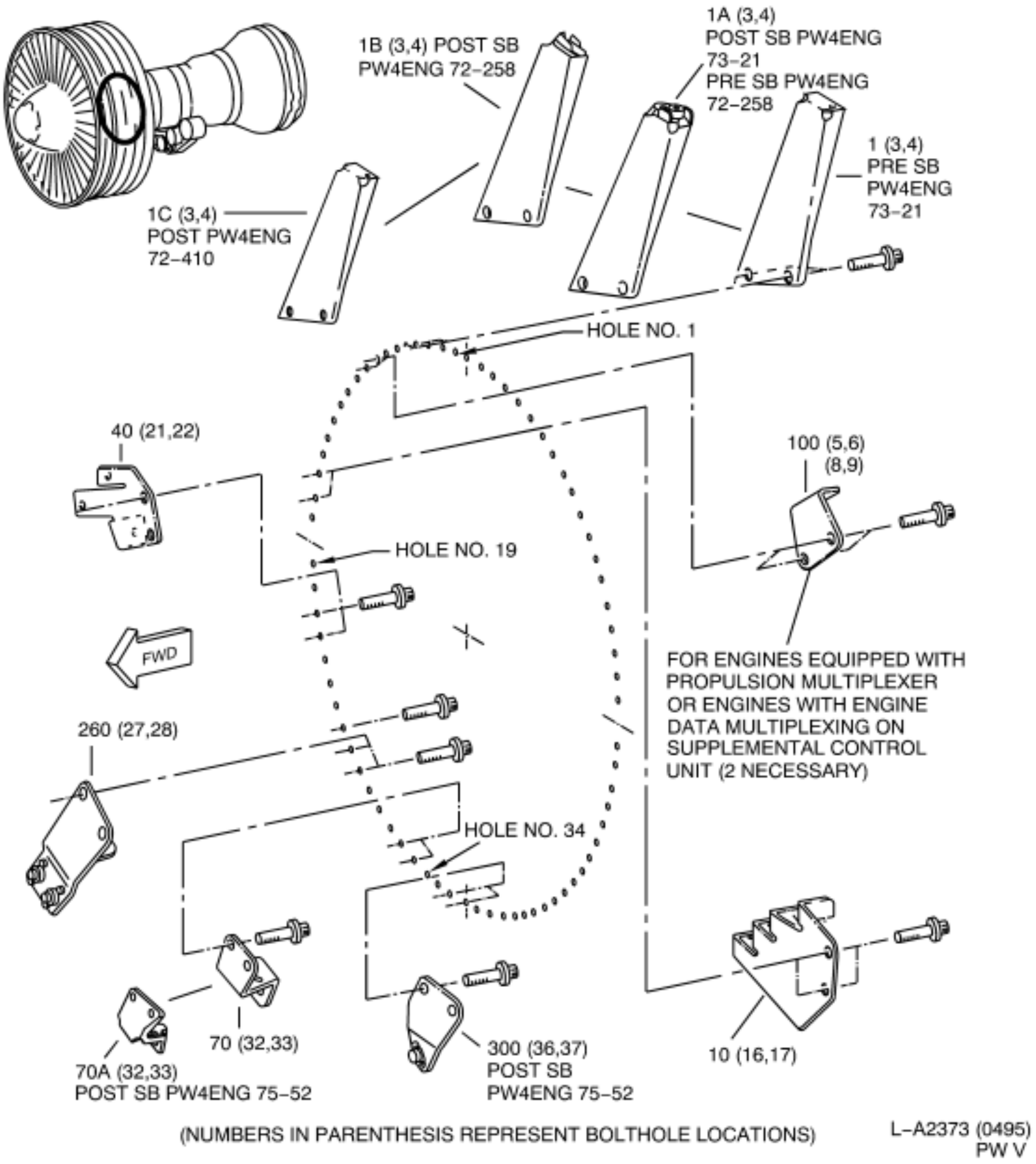
Separation Of Core–Unit From Fan–Unit (8th Stage Duct Removal)
Figure 1219 (Sheet 2)
(Task 71–00–00–530–001)


1
2
3
4
PWA 85390 LIFTING ADAPTER
BOLT (16 NECESSARY)
FLANGE E BOLT (72 NECESSARY)
NO.1.5 BEARING SUPPORT BOLT (33 NECESSARY)
PWA 85260 GUIDE PIN
L−A5387 (0901)
PW V

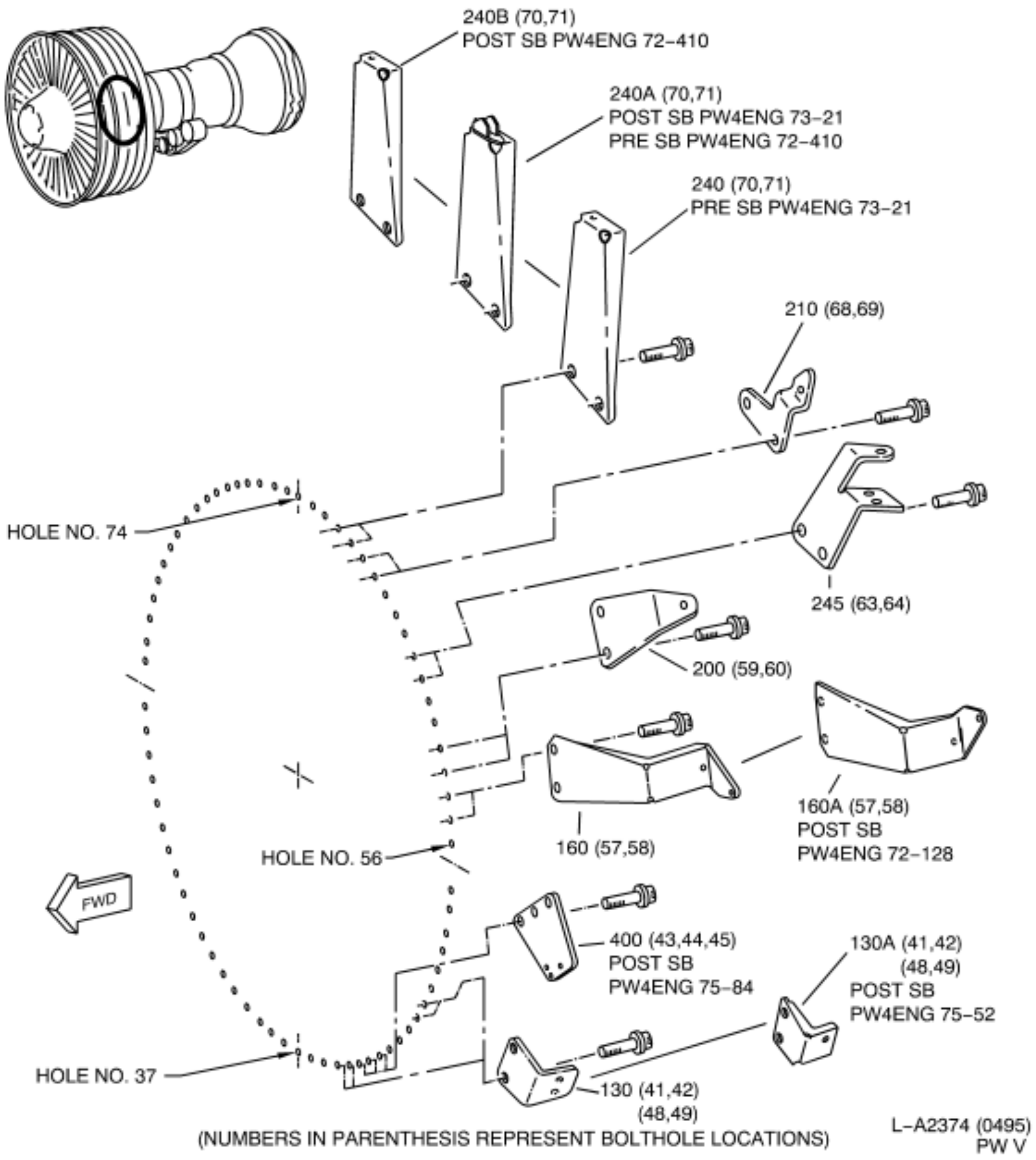
Separation Of Core−Unit From Fan−Unit (PWA 85390 Lifting Adapter)
Figure 1219 (Sheet 3)
(Task 71−00−00−530−001)


C
B
A
A
B
NO. 1.5 BEARING SUPPORT
(FRONT VIEW)
B
A
C
C
A
B
DOWEL
PIN
HOLE
A. USE FOR JACKING BOLTS
B. USE FOR RETAINING BOLTS
C. DO NOT USE
L−A5948 (0692)
PW V

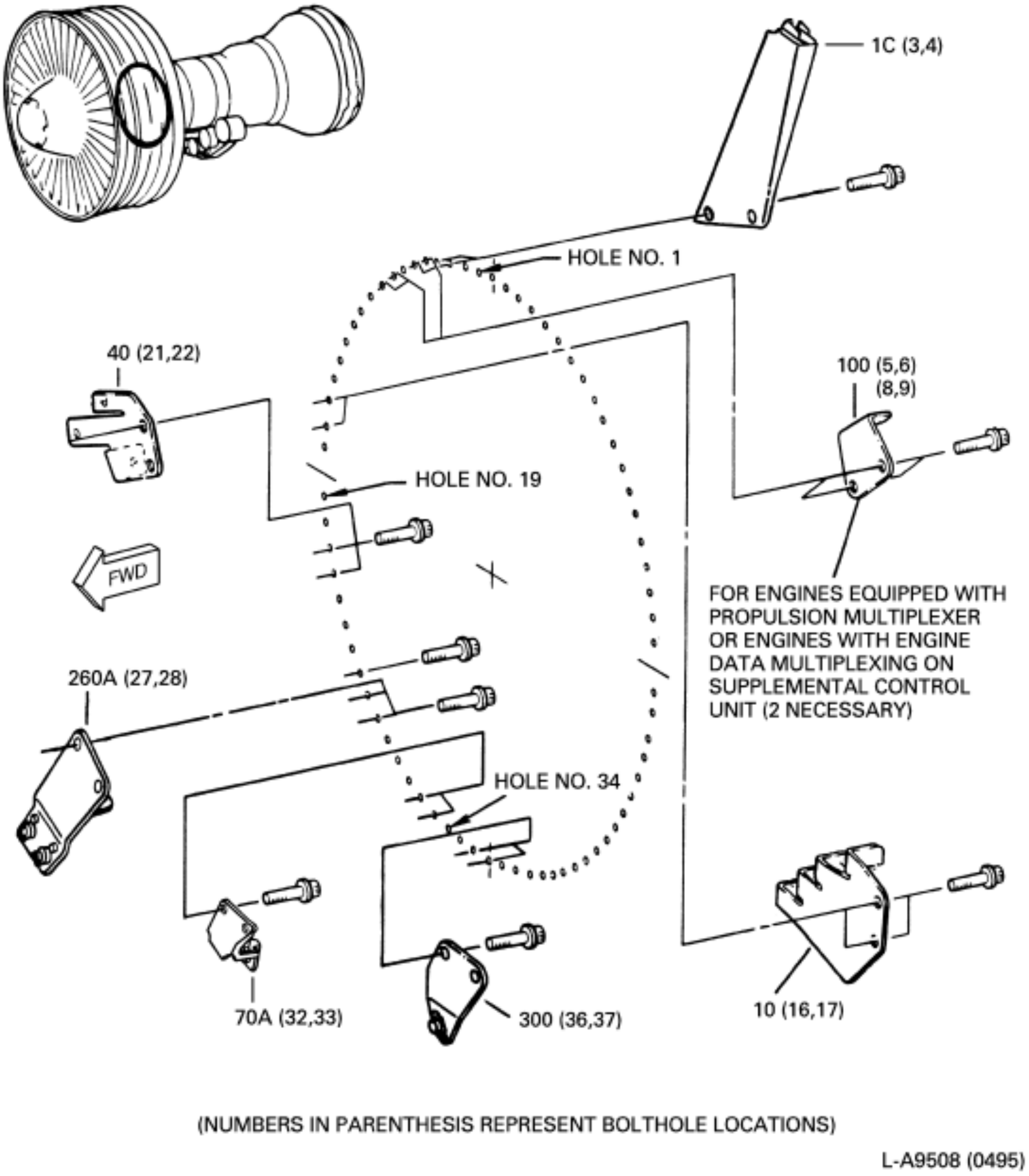
Separation Of Core−Unit From Fan−Unit (Jacking
Bolt And Retaining Bolt Installations)
Figure 1220 (Sheet 1)
(Task 71−00−00−530−001)


1A (3,4)
POST SB PW4ENG
73-21
PRE SB PW4ENG
72-258
1B (3,4) POST SB
PW4ENG 72-258
1 (3,4)
PRE SB
PW4ENG
73-21
1C (3,4)
POST PW4ENG
72-410
HOLE NO. 1
40 (21,22)
100 (5,6)
(8,9)
HOLE NO. 19
FWD
FOR ENGINES EQUIPPED WITH
PROPULSION MULTIPLEXER
OR ENGINES WITH ENGINE
DATA MULTIPLEXING ON
SUPPLEMENTAL CONTROL
UNIT (2 NECESSARY)
260 (27,28)
HOLE NO. 34
70 (32,33)
70A (32,33)
POST SB PW4ENG 75-52
300 (36,37)
POST SB
PW4ENG 75-52
10 (16,17)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L-A2373 (0495)
PW V

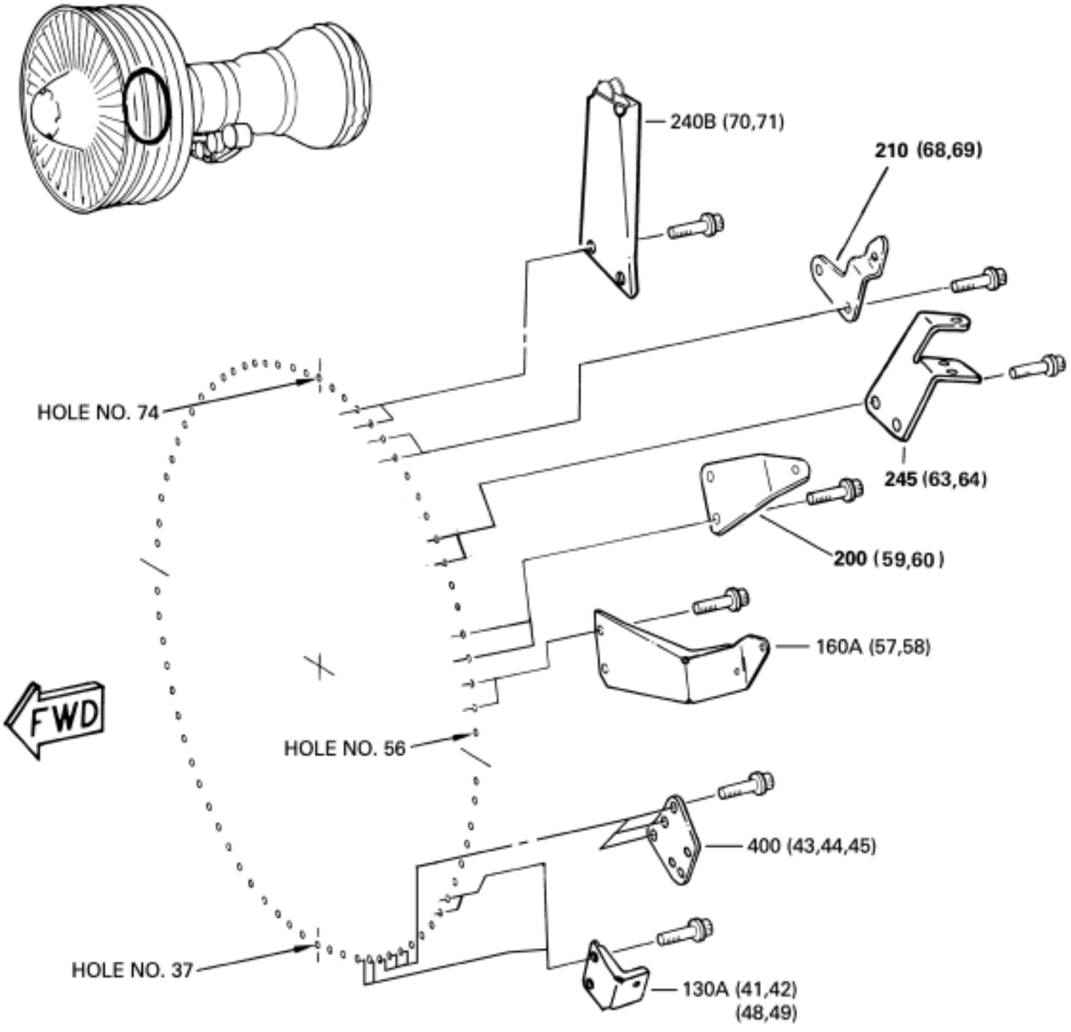
Separation Of Core-Unit From Fan-Unit Flange E Bracket Locations
Figure 1220 (Sheet 2)
(Task 71-00-00-530-001)


240B (70,71)
POST SB PW4ENG 72−410
240A (70,71)
POST SB PW4ENG 73−21
PRE SB PW4ENG 72−410
240 (70,71)
PRE SB PW4ENG 73−21
210 (68,69)
HOLE NO. 74
245 (63,64)
200 (59,60)
160A (57,58)
POST SB
PW4ENG 72−128
160 (57,58)
HOLE NO. 56
FWD
400 (43,44,45)
POST SB
PW4ENG 75−84
130A (41,42)
(48,49)
POST SB
PW4ENG 75−52
HOLE NO. 37
130 (41,42)
(48,49)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L−A2374 (0495)
PW V

Separation Of Core−Unit From Fan−Unit Flange E Bracket Locations
Figure 1220 (Sheet 3)
(Task 71−00−00−530−001)


1C (3,4)
HOLE NO. 1
40 (21,22)
100 (5,6)
(8,9)
HOLE NO. 19
FWD
FOR ENGINES EQUIPPED WITH PROPULSION MULTIPLEXER OR ENGINES WITH ENGINE DATA MULTIPLEXING ON SUPPLEMENTAL CONTROL UNIT (2 NECESSARY)
260A (27,28)
HOLE NO. 34
70A (32,33)
300 (36,37)
10 (16,17)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L-A9508 (0495)

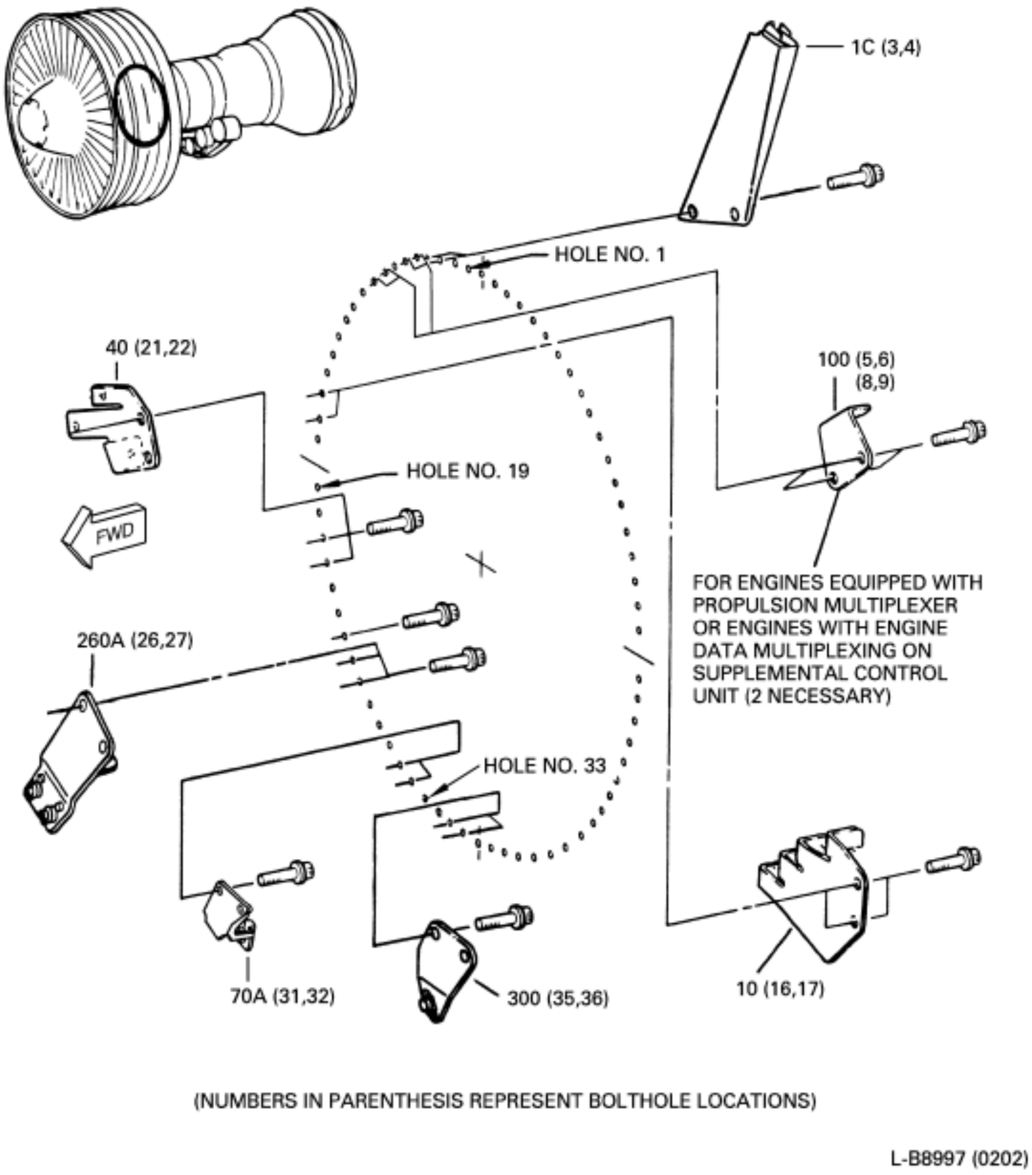
Separation Of Core-Unit From Fan-Unit Flange E
Bracket Locations (For -3 Engines As Built By P&W)
Figure 1220 (Sheet 4)
(Task 71-00-00-530-001)


240B (70,71)
210 (68,69)
HOLE NO. 74
245 (63,64)
200 (59,60)
160A (57,58)
FWD
HOLE NO. 56
400 (43,44,45)
HOLE NO. 37
130A (41,42)
(48,49)

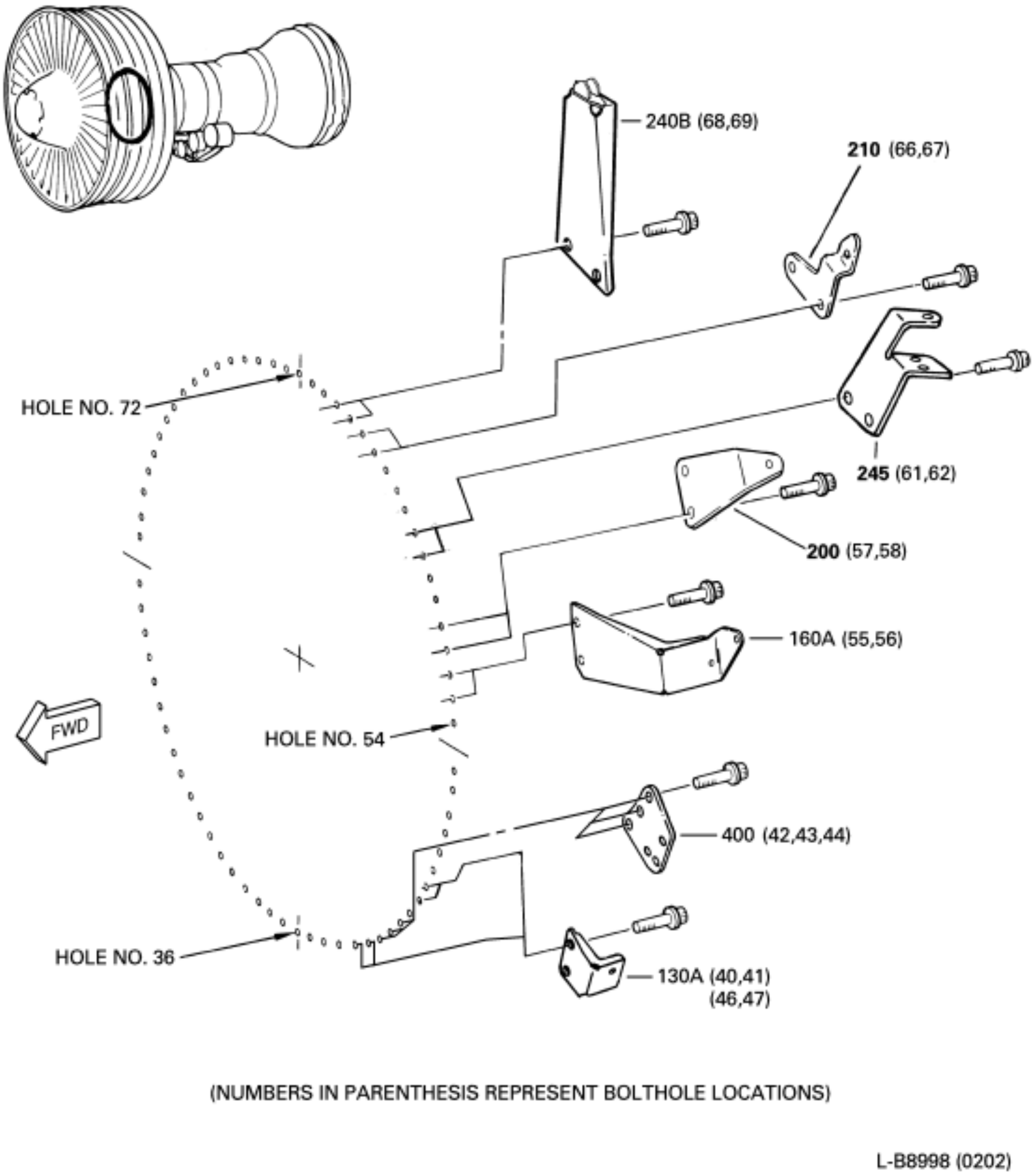
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

L-A9509 (0000)

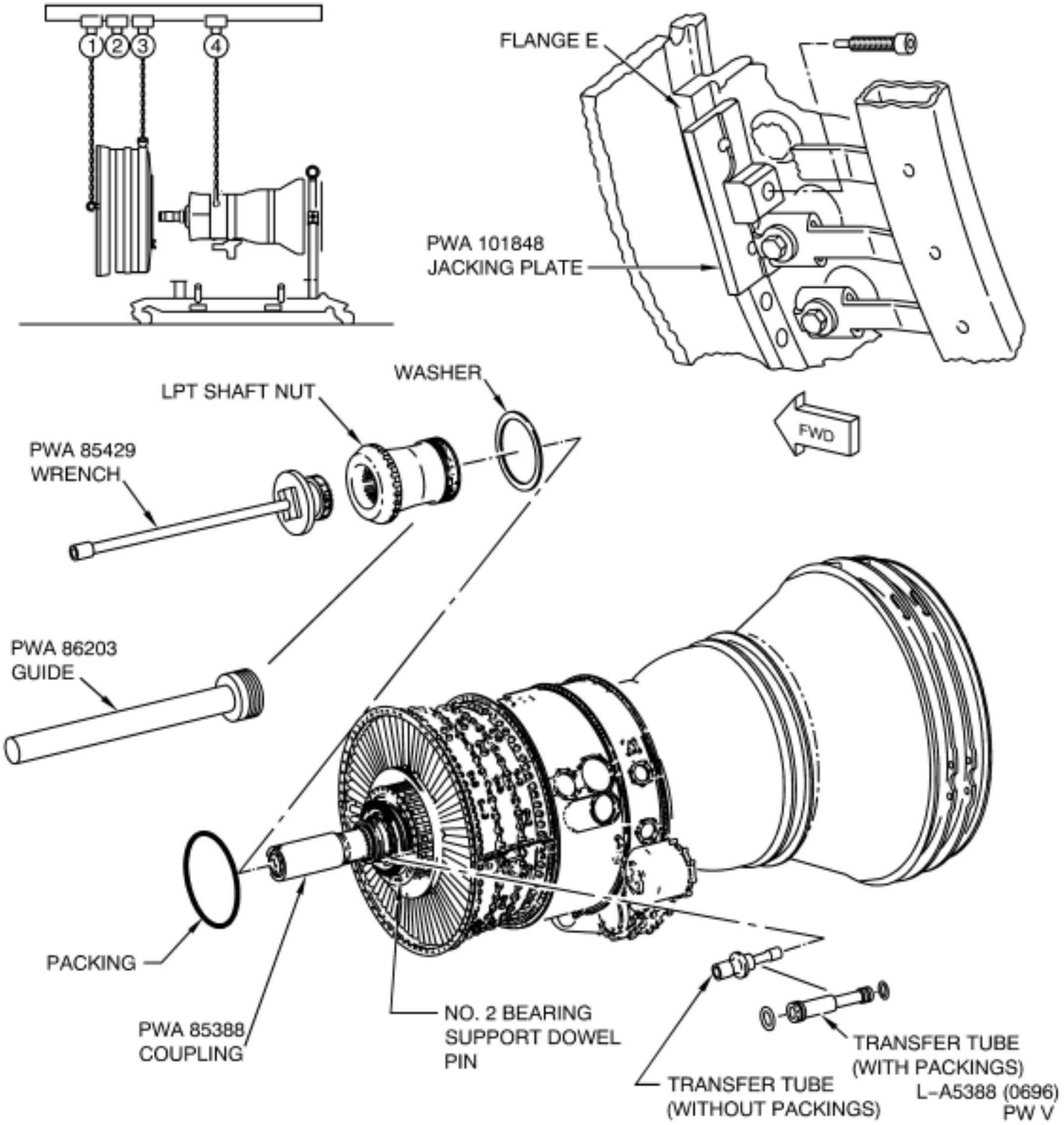
Separation Of Core−Unit From Fan−Unit Flange E
Bracket Locations (For −3 Engines As Built By P&W)
Figure 1220 (Sheet 5)
(Task 71−00−00−530−001)


1C (3,4)
HOLE NO. 1
40 (21,22)
100 (5,6) (8,9)
HOLE NO. 19
FWD
FOR ENGINES EQUIPPED WITH PROPULSION MULTIPLEXER OR ENGINES WITH ENGINE DATA MULTIPLEXING ON SUPPLEMENTAL CONTROL UNIT (2 NECESSARY)
260A (26,27)
HOLE NO. 33
70A (31,32)
300 (35,36)
10 (16,17)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L-B8997 (0202)

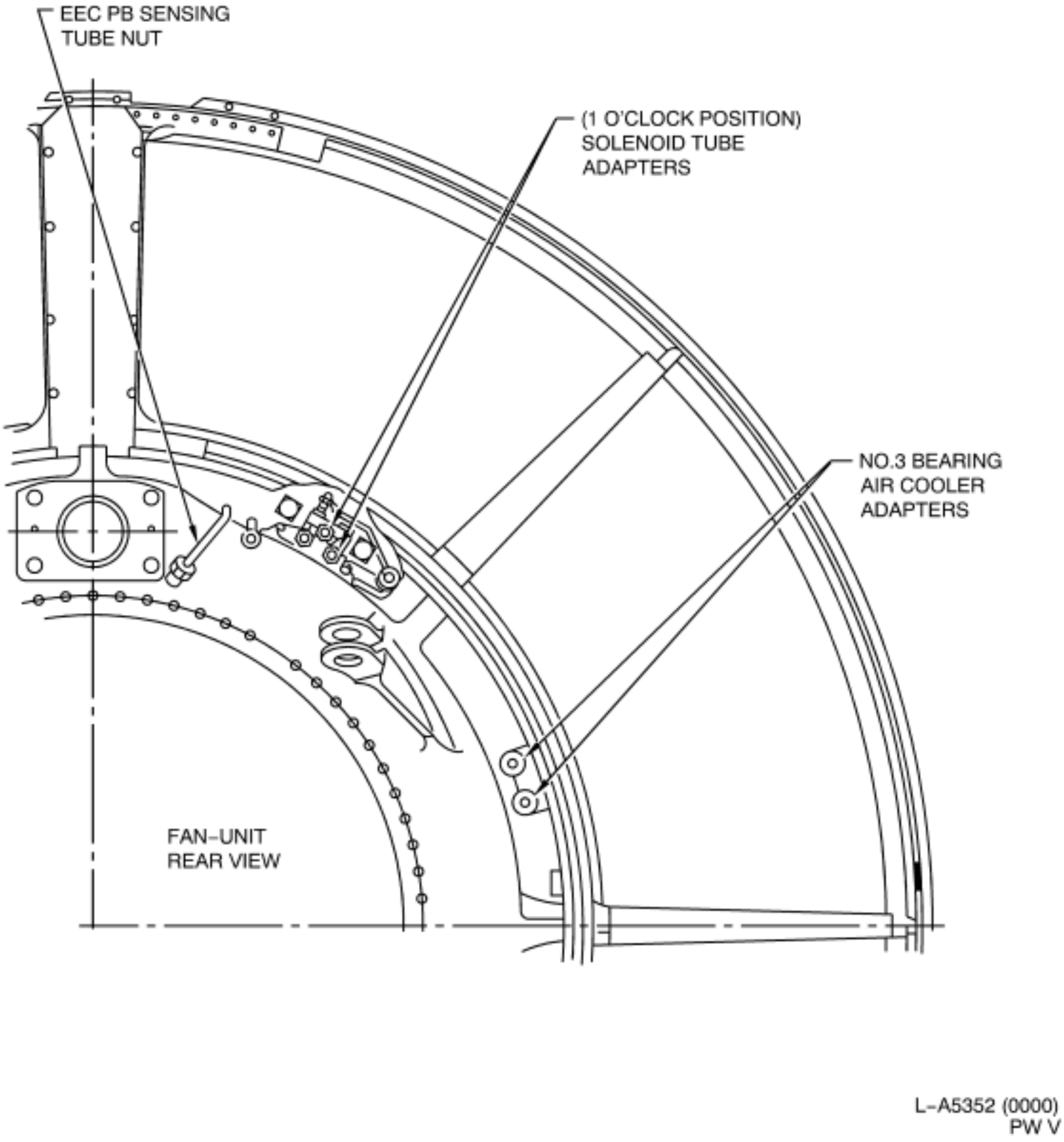
Separation Of Core-Unit From Fan-Unit Flange E Bracket
Locations (For -3 Engines As Built By P&W, UPS Configuration)
Figure 1220 (Sheet 6)
(Task 71-00-00-530-001)


240B (68,69)
210 (66,67)
HOLE NO. 72
245 (61,62)
200 (57,58)
160A (55,56)
FWD
HOLE NO. 54
400 (42,43,44)
HOLE NO. 36
130A (40,41)
(46,47)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L-B8998 (0202)

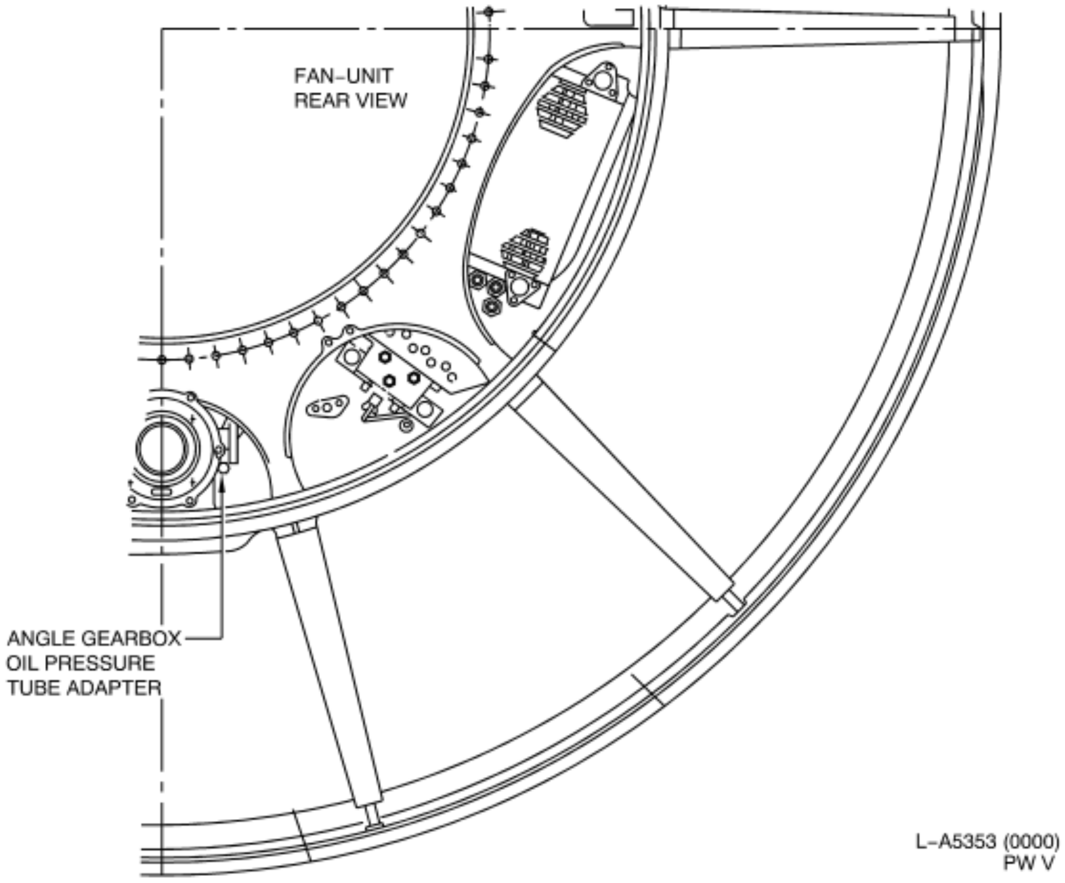
Separation Of Core-Unit From Fan-Unit Flange E Bracket
Locations (For -3 Engines As Built By P&W, UPS Configuration)
Figure 1220 (Sheet 7)
(Task 71-00-00-530-001)


①②③
④
FLANGE E
PWA 101848
JACKING PLATE
FWD
WASHER
LPT SHAFT NUT
PWA 85429
WRENCH
PWA 86203
GUIDE
PACKING
PWA 85388
COUPLING
NO. 2 BEARING
SUPPORT DOWEL
PIN
TRANSFER TUBE
(WITH PACKINGS)
TRANSFER TUBE
(WITHOUT PACKINGS)
L-A5388 (0696)
PW V

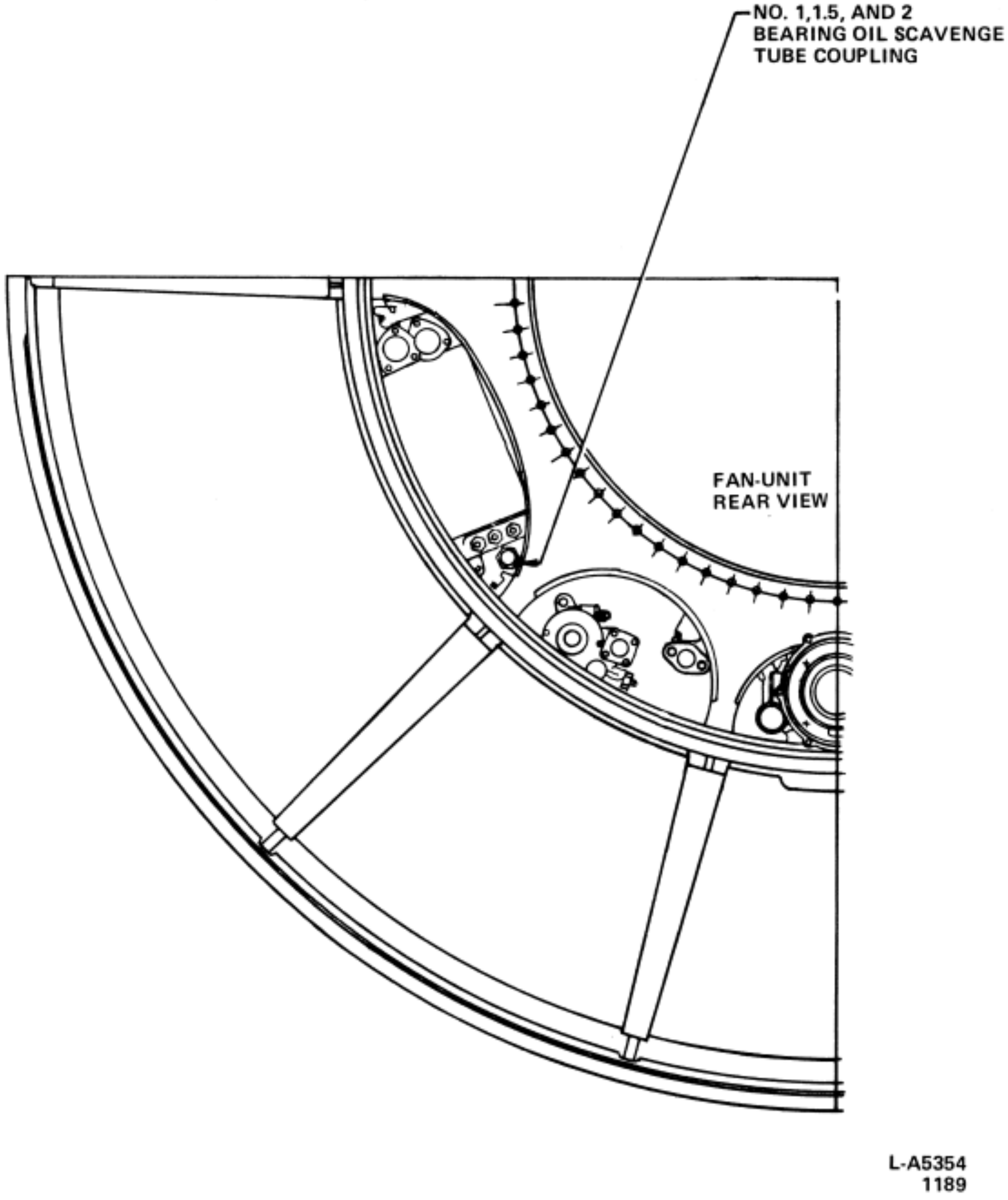
Separation Of Core-Unit From Fan-Unit
Figure 1221
(Task 71-00-00-530-001)


EEC PB SENSING TUBE NUT
(1 O'CLOCK POSITION) SOLENOID TUBE ADAPTERS
NO.3 BEARING AIR COOLER ADAPTERS
FAN−UNIT REAR VIEW
L−A5352 (0000)
PW V

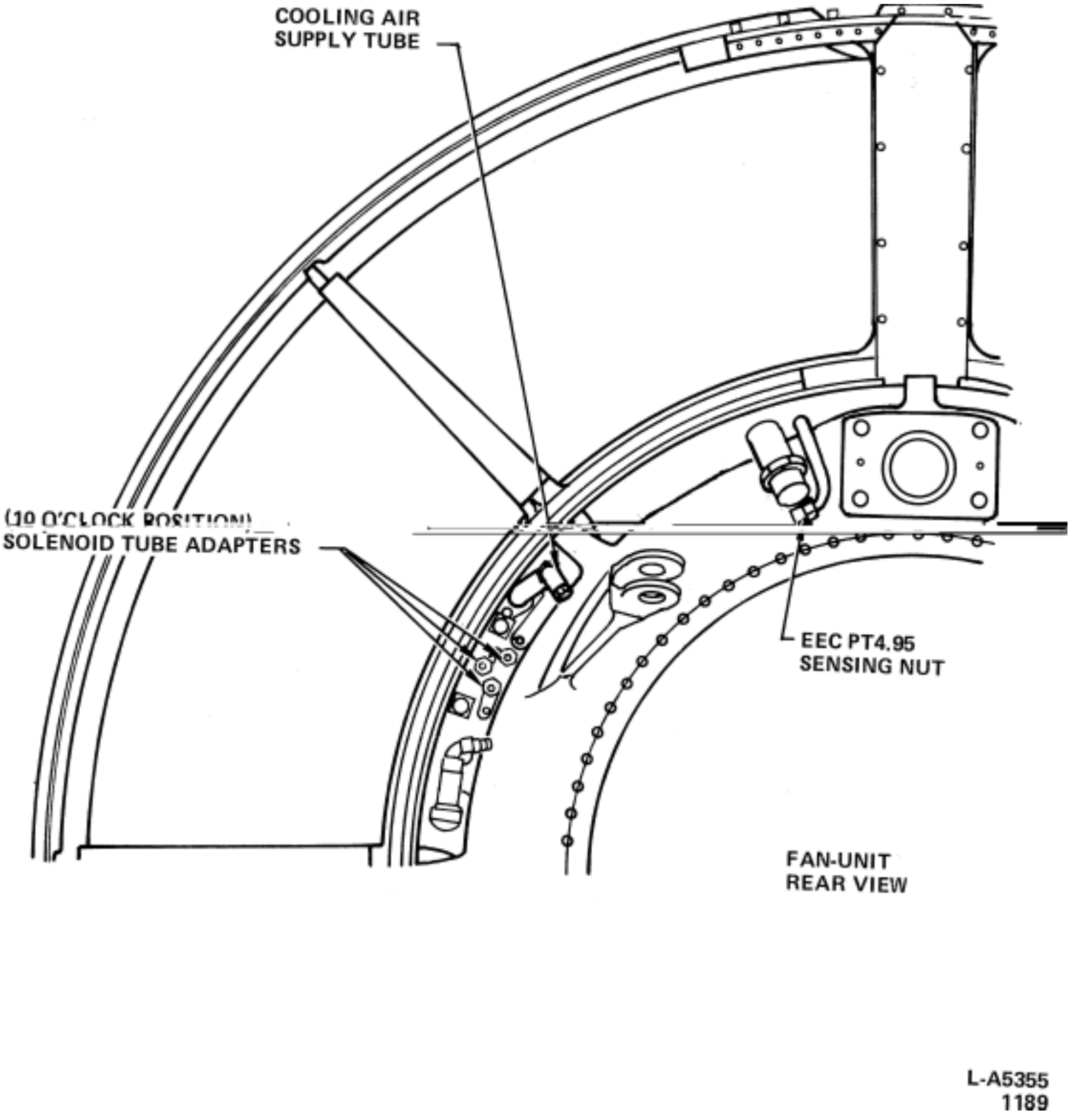
Protective Cover Locations (Fan−Unit)
Figure 1222 (Sheet 1)
(Task 71−00−00−530−001)


FAN−UNIT
REAR VIEW
ANGLE GEARBOX
OIL PRESSURE
TUBE ADAPTER
L−A5353 (0000)
PW V

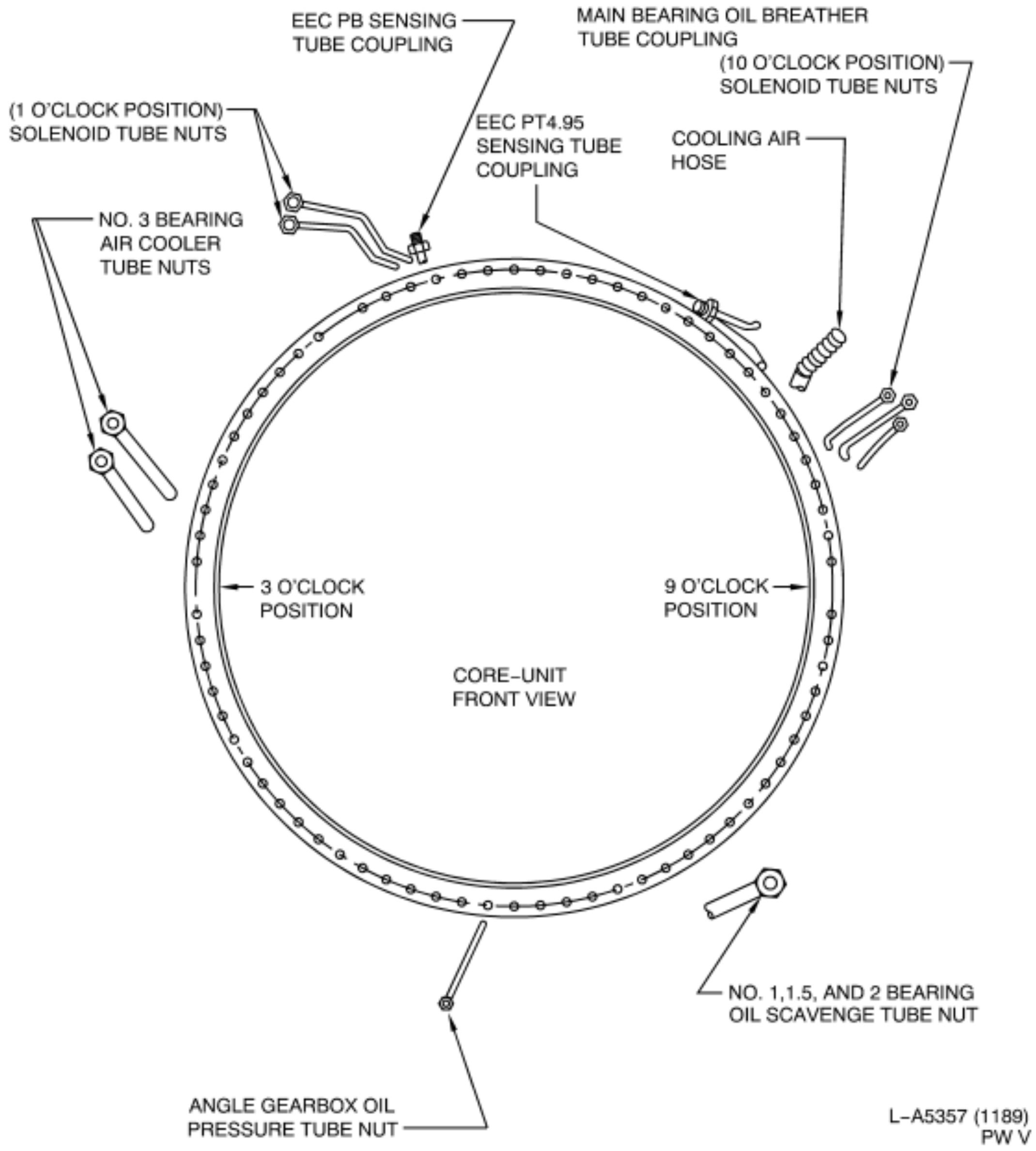
Protective Cover Locations (Fan−Unit)
Figure 1222 (Sheet 2)
(Task 71−00−00−530−001)


NO. 1,1.5, AND 2 BEARING OIL SCAVENGE TUBE COUPLING
FAN-UNIT REAR VIEW
L-A5354
1189

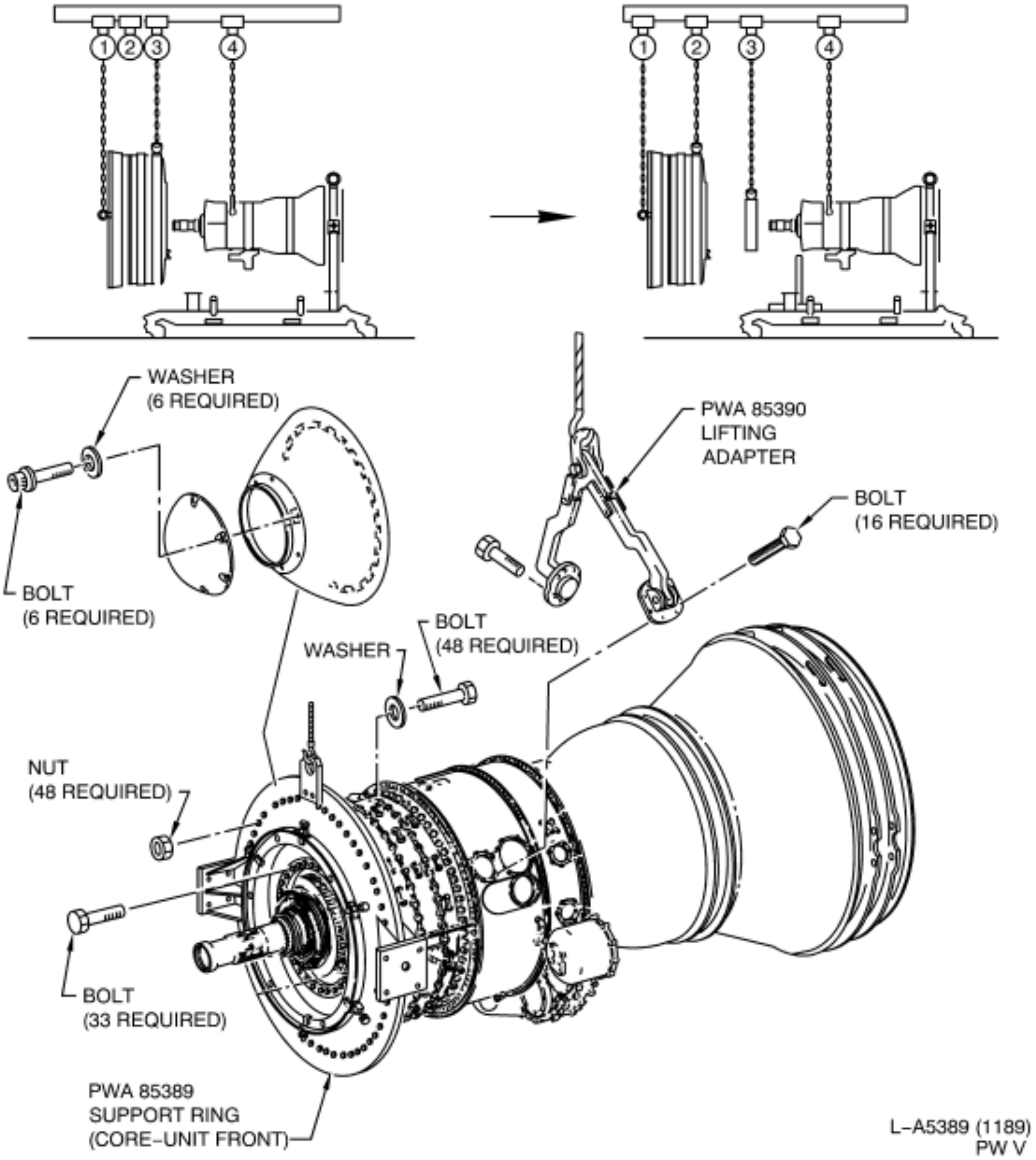
Protective Cover Locations (Fan-Unit)
Figure 1222 (Sheet 3)
(Task 71-00-00-530-001)


COOLING AIR SUPPLY TUBE
(10 O'CLOCK POSITION)
SOLENOID TUBE ADAPTERS
EEC PT4.95 SENSING NUT
FAN-UNIT REAR VIEW
L-A5355
1189

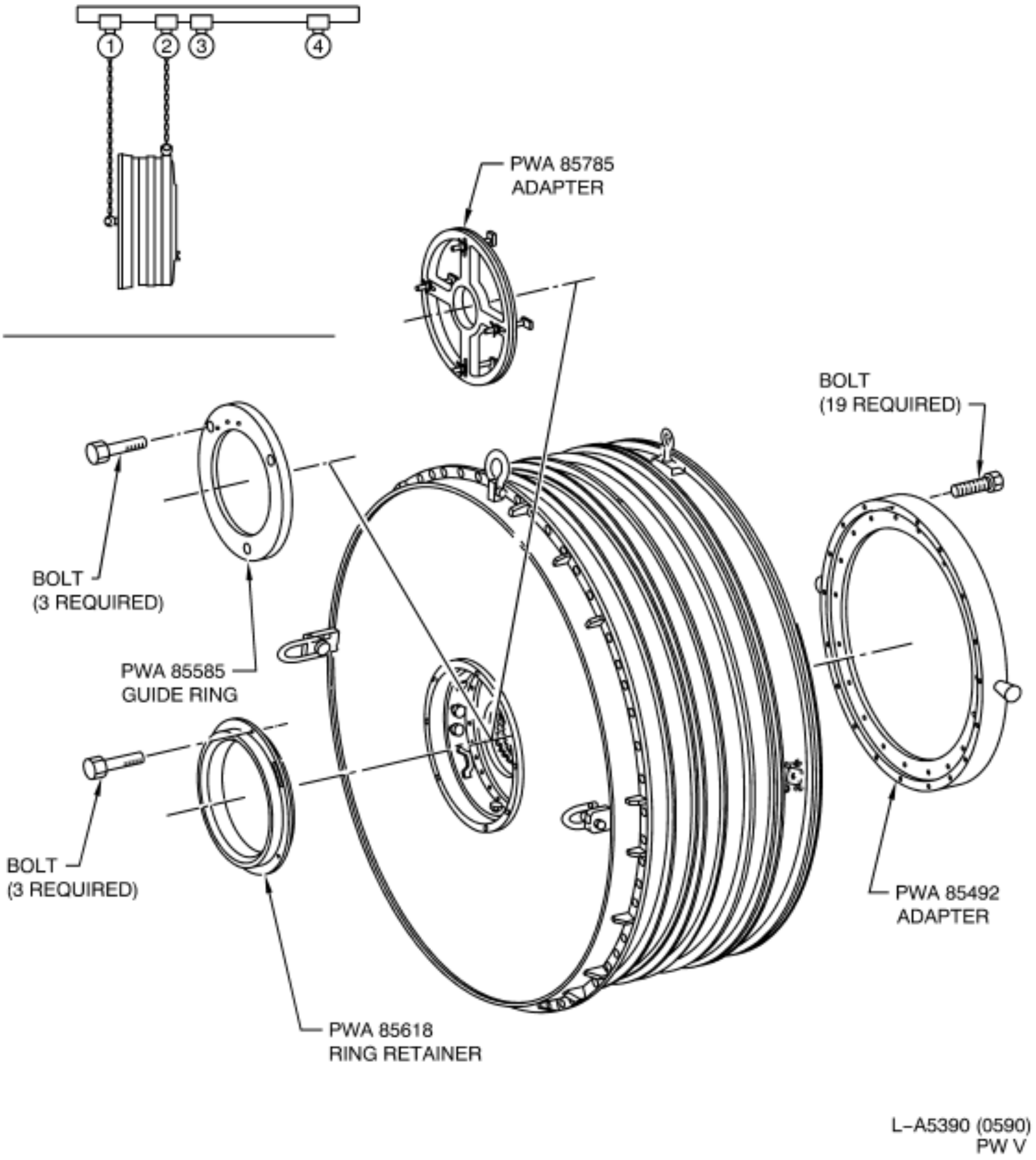
Protective Cover Locations (Fan−Unit)
Figure 1222 (Sheet 4)
(Task 71−00−00−530−001)


EEC PB SENSING TUBE COUPLING
MAIN BEARING OIL BREATHER TUBE COUPLING
(10 O'CLOCK POSITION) SOLENOID TUBE NUTS
(1 O'CLOCK POSITION) SOLENOID TUBE NUTS
EEC PT4.95 SENSING TUBE COUPLING
COOLING AIR HOSE
NO. 3 BEARING AIR COOLER TUBE NUTS
3 O'CLOCK POSITION
9 O'CLOCK POSITION
CORE−UNIT FRONT VIEW
NO. 1,1.5, AND 2 BEARING OIL SCAVENGE TUBE NUT
ANGLE GEARBOX OIL PRESSURE TUBE NUT
L−A5357 (1189)
PW V

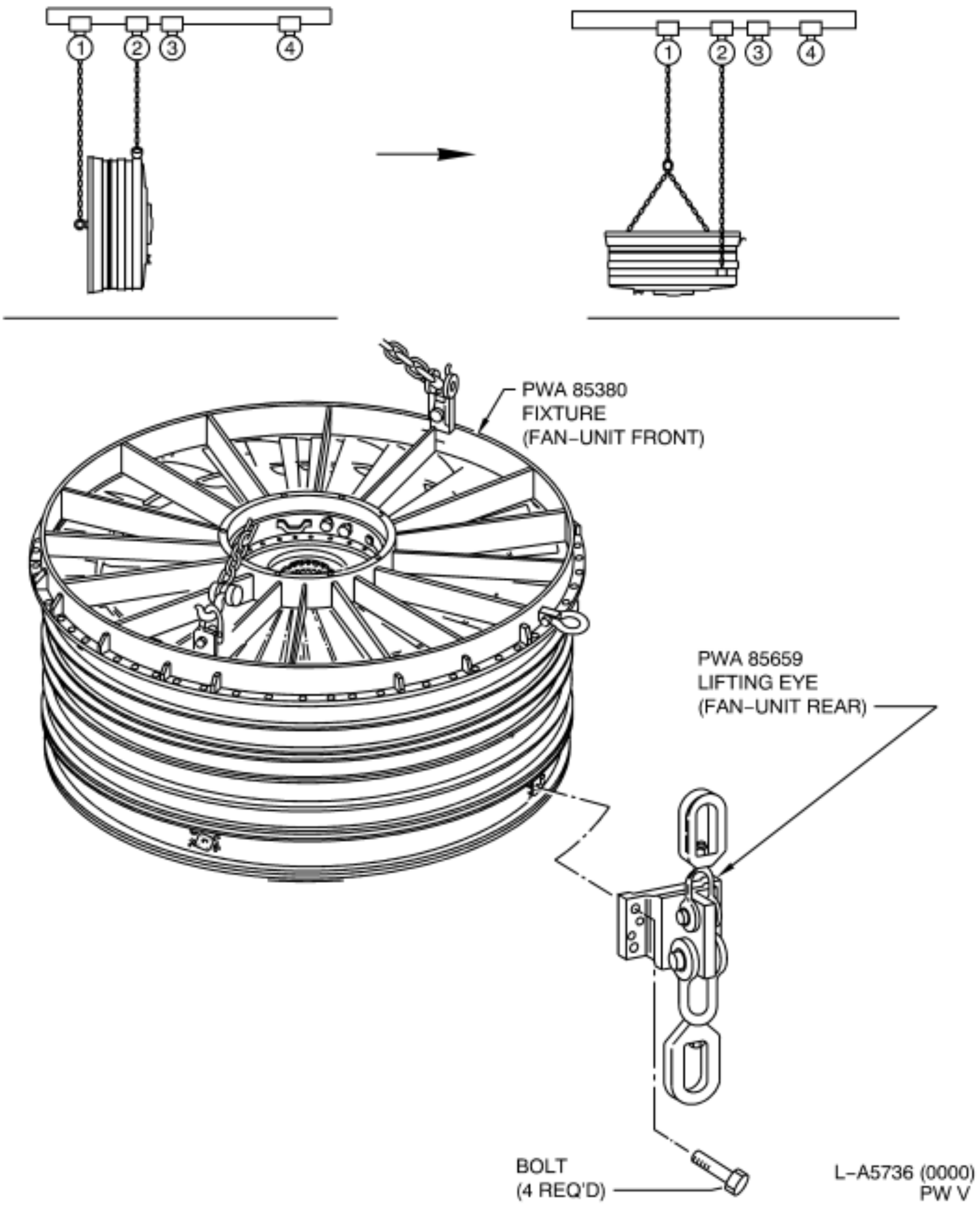
Protective Cover Locations (Core−Unit)
Figure 1222 (Sheet 5)
(Task 71−00−00−530−001)


①
②
③
④
WASHER
(6 REQUIRED)
BOLT
(6 REQUIRED)
PWA 85390
LIFTING
ADAPTER
BOLT
(16 REQUIRED)
BOLT
(48 REQUIRED)
WASHER
NUT
(48 REQUIRED)
BOLT
(33 REQUIRED)
PWA 85389
SUPPORT RING
(CORE-UNIT FRONT)
L-A5389 (1189)
PW V

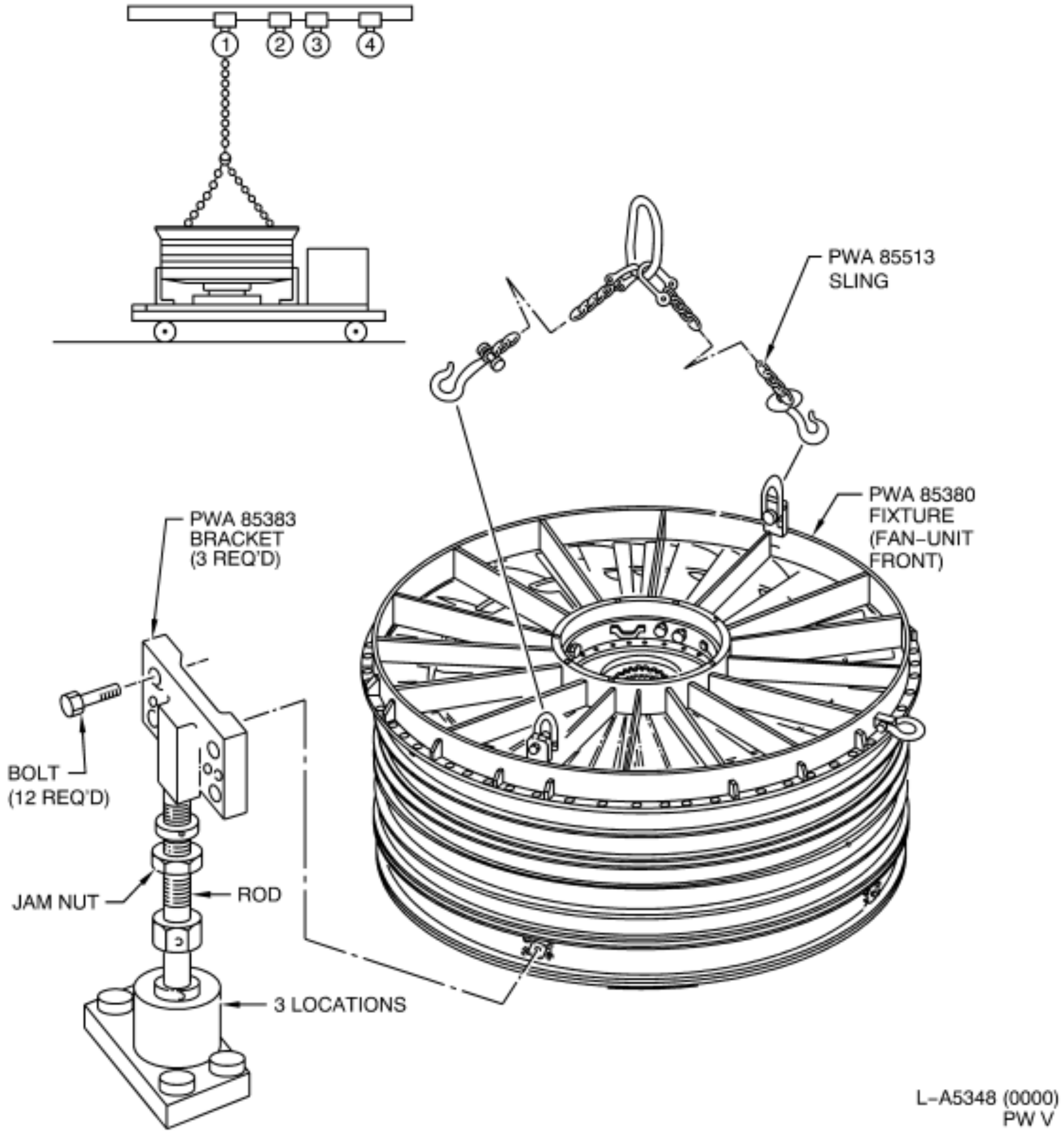
Installation Of Core-Unit To Transport Stand
Figure 1223
(Task 71-00-00-530-001)


1
2
3
4
PWA 85785
ADAPTER
BOLT
(19 REQUIRED)
BOLT
(3 REQUIRED)
PWA 85585
GUIDE RING
BOLT
(3 REQUIRED)
PWA 85492
ADAPTER
PWA 85618
RING RETAINER
L-A5390 (0590)
PW V

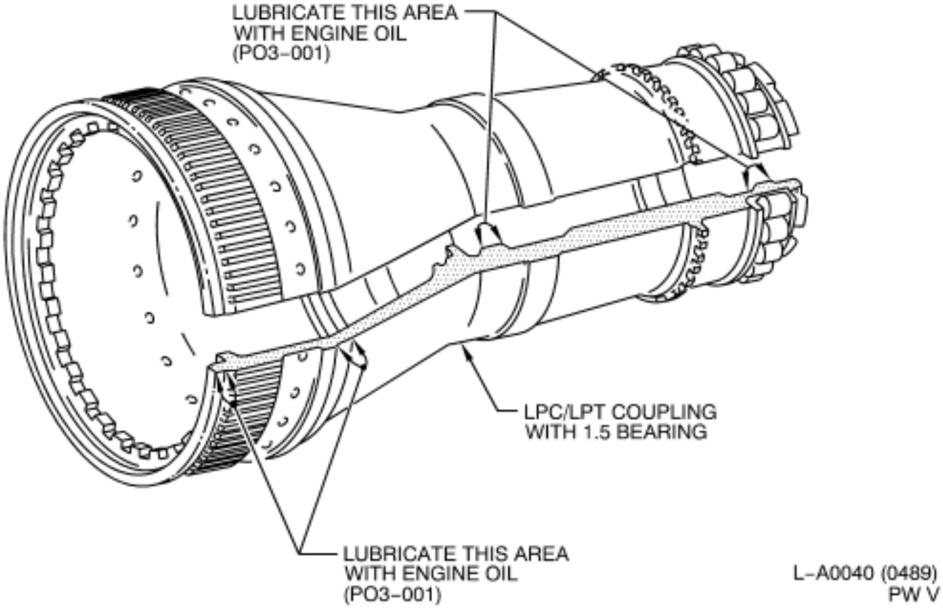
Removal And Installation Of Tools To Fan-Unit
Figure 1224
(Task 71-00-00-530-001)


1
2
3
4
PWA 85380
FIXTURE
(FAN-UNIT FRONT)
PWA 85659
LIFTING EYE
(FAN-UNIT REAR)
BOLT
(4 REQ'D)
L-A5736 (0000)
PW V

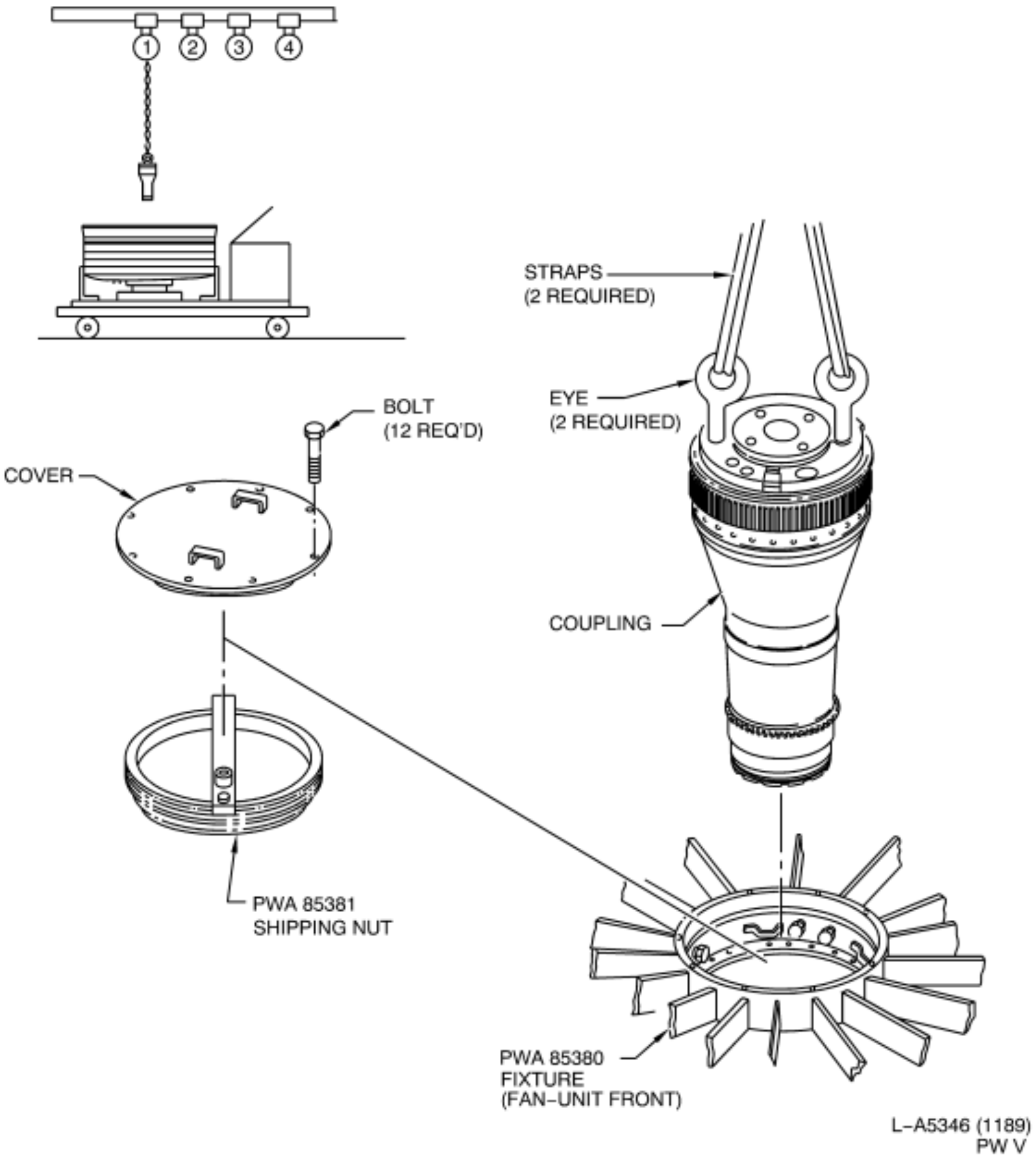
Installation Of Fan-Unit To Pallet
Figure 1225 (Sheet 1)
(Task 71-00-00-530-001)


①
②
③
④
PWA 85513
SLING
PWA 85380
FIXTURE
(FAN−UNIT
FRONT)
PWA 85383
BRACKET
(3 REQ'D)
BOLT
(12 REQ'D)
JAM NUT
ROD
3 LOCATIONS
L−A5348 (0000)
PW V

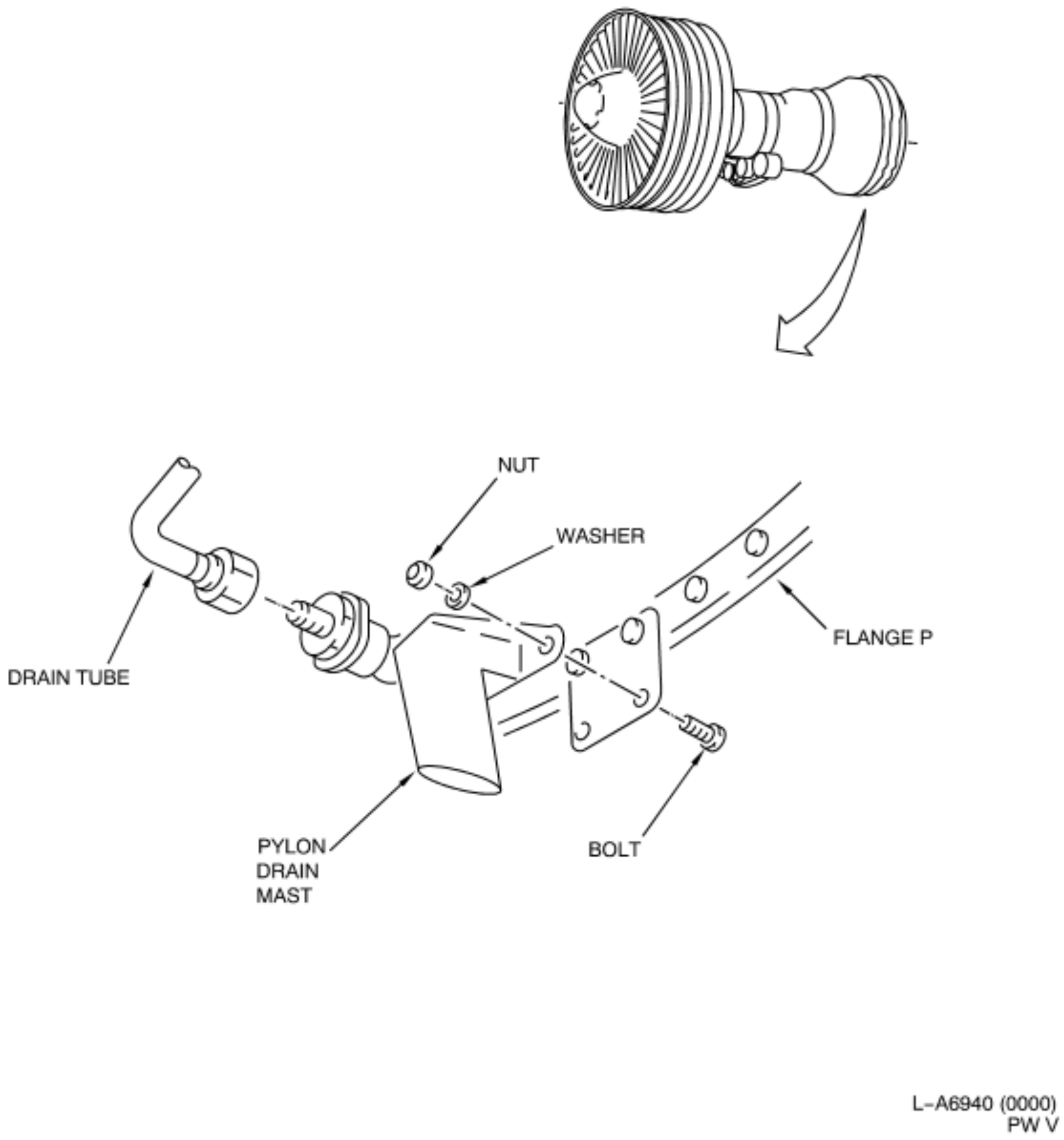
Installation Of Fan−Unit To Pallet
Figure 1225 (Sheet 2)
(Task 71−00−00−530−001)


LUBRICATE THIS AREA
WITH ENGINE OIL
(PO3−001)
LPC/LPT COUPLING
WITH 1.5 BEARING
LUBRICATE THIS AREA
WITH ENGINE OIL
(PO3−001)
L−A0040 (0489)
PW V

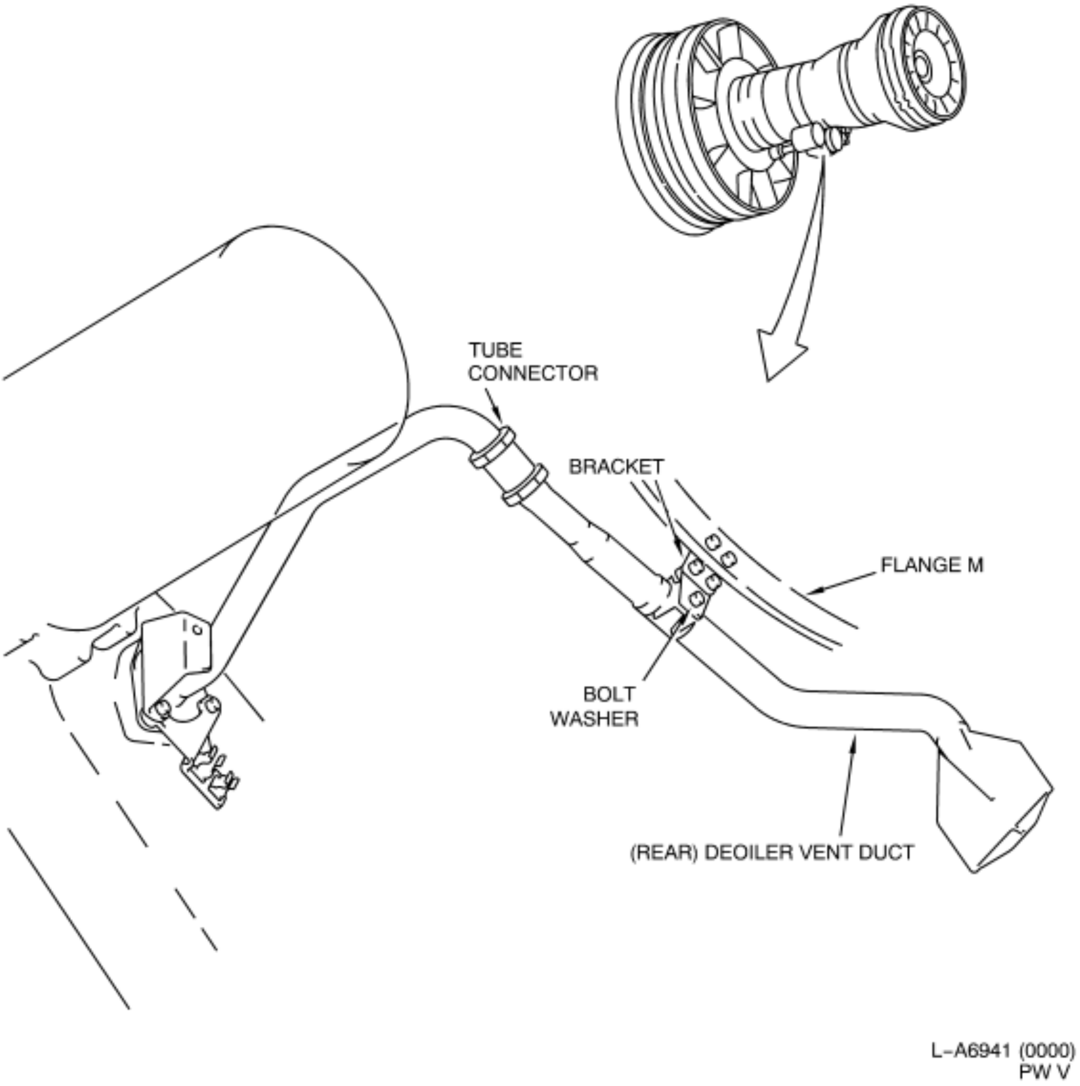
Installation Of Coupling Assembly
Figure 1226 (Sheet 1)
(Task 71−00−00−530−001)


1
2
3
4
STRAPS
(2 REQUIRED)
EYE
(2 REQUIRED)
BOLT
(12 REQ'D)
COVER
COUPLING
PWA 85381
SHIPPING NUT
PWA 85380
FIXTURE
(FAN-UNIT FRONT)
L-A5346 (1189)
PW V

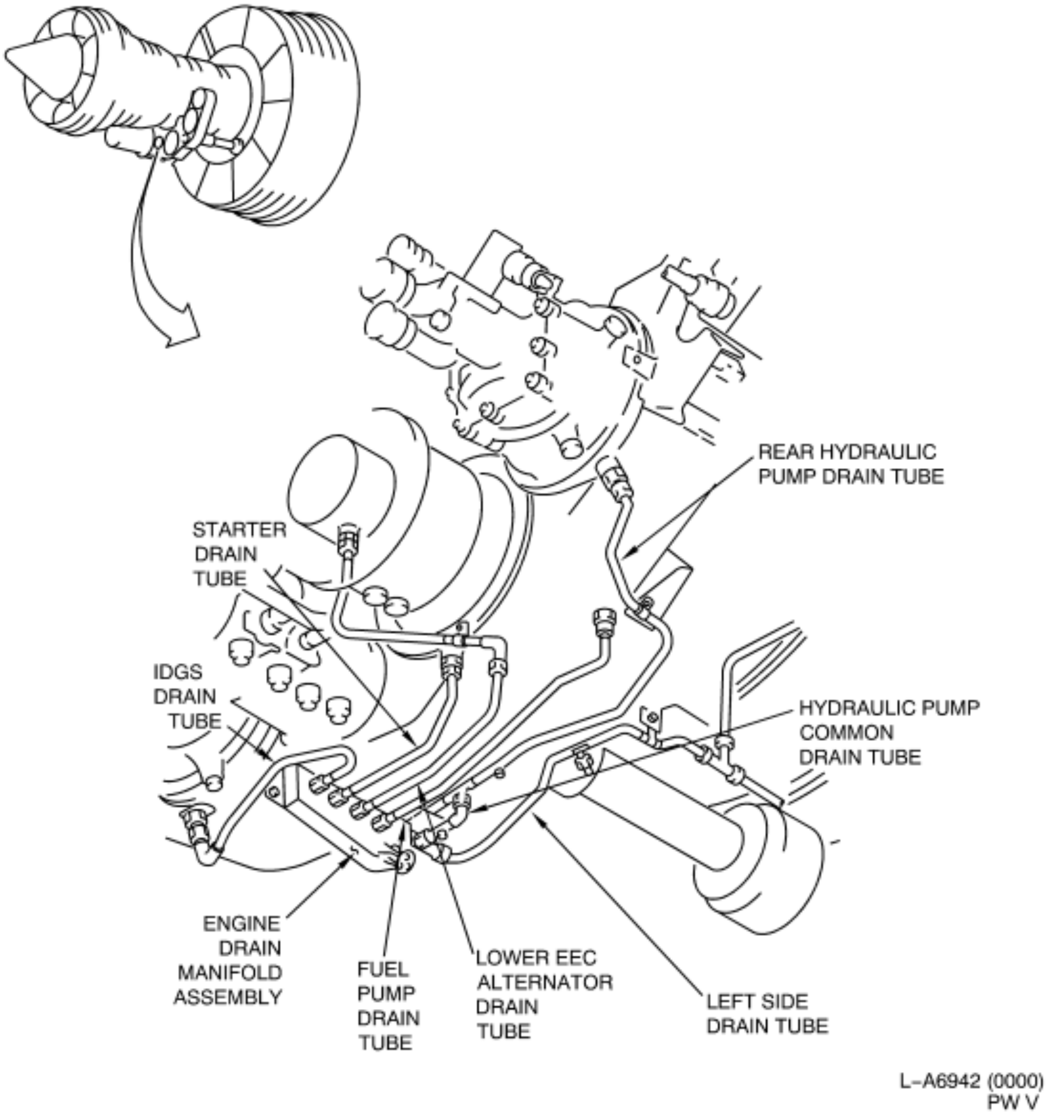
Installation Of Coupling Assembly
Figure 1226 (Sheet 2)
(Task 71-00-00-530-001)


NUT
WASHER
FLANGE P
DRAIN TUBE
PYLON DRAIN MAST
BOLT
L−A6940 (0000)
PW V

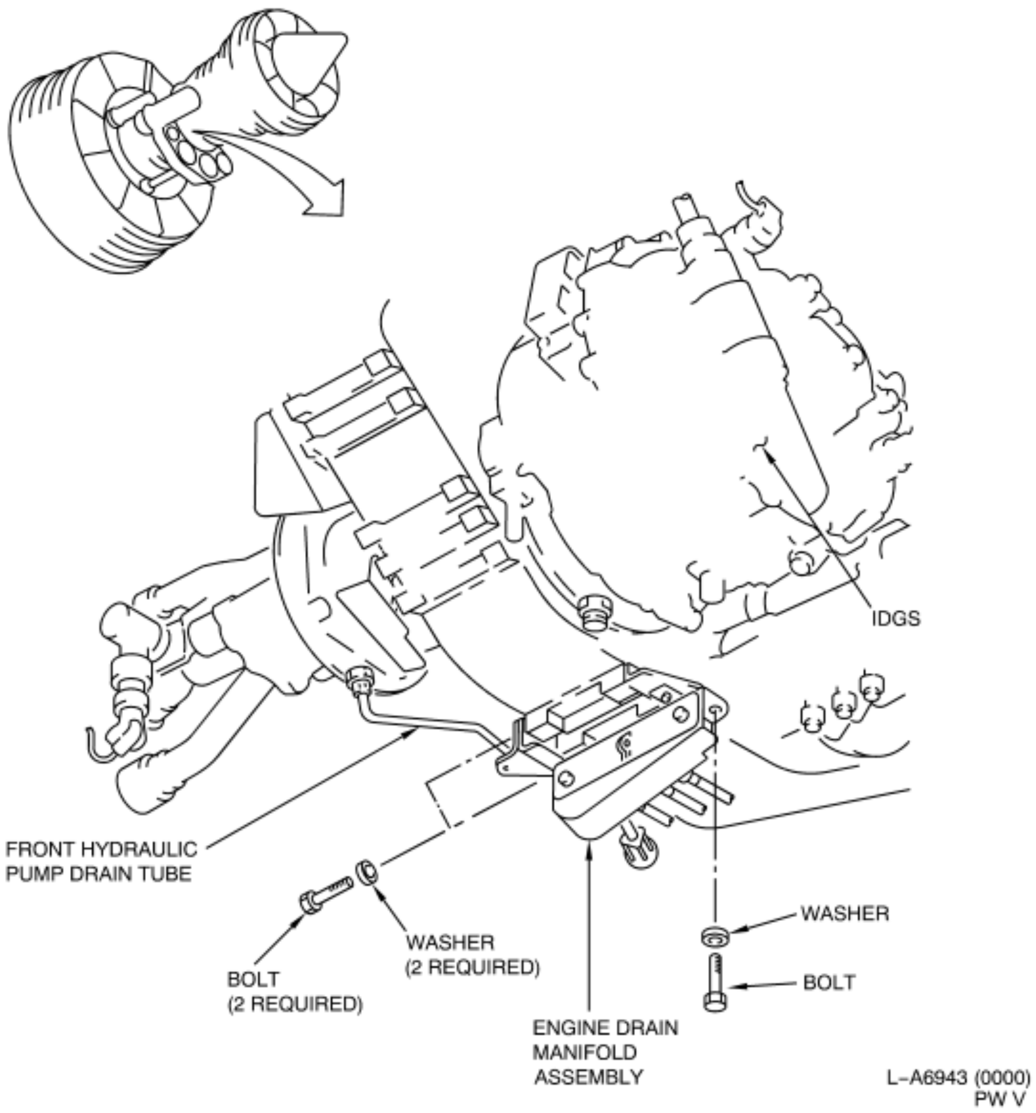
Preparation Of Core−Unit For Shipping (Pylon Drain Mast Removal)
Figure 1227 (Sheet 1)
(Task 71−00−00−530−001)


TUBE CONNECTOR
BRACKET
FLANGE M
BOLT
WASHER
(REAR) DEOILER VENT DUCT
L−A6941 (0000)
PW V

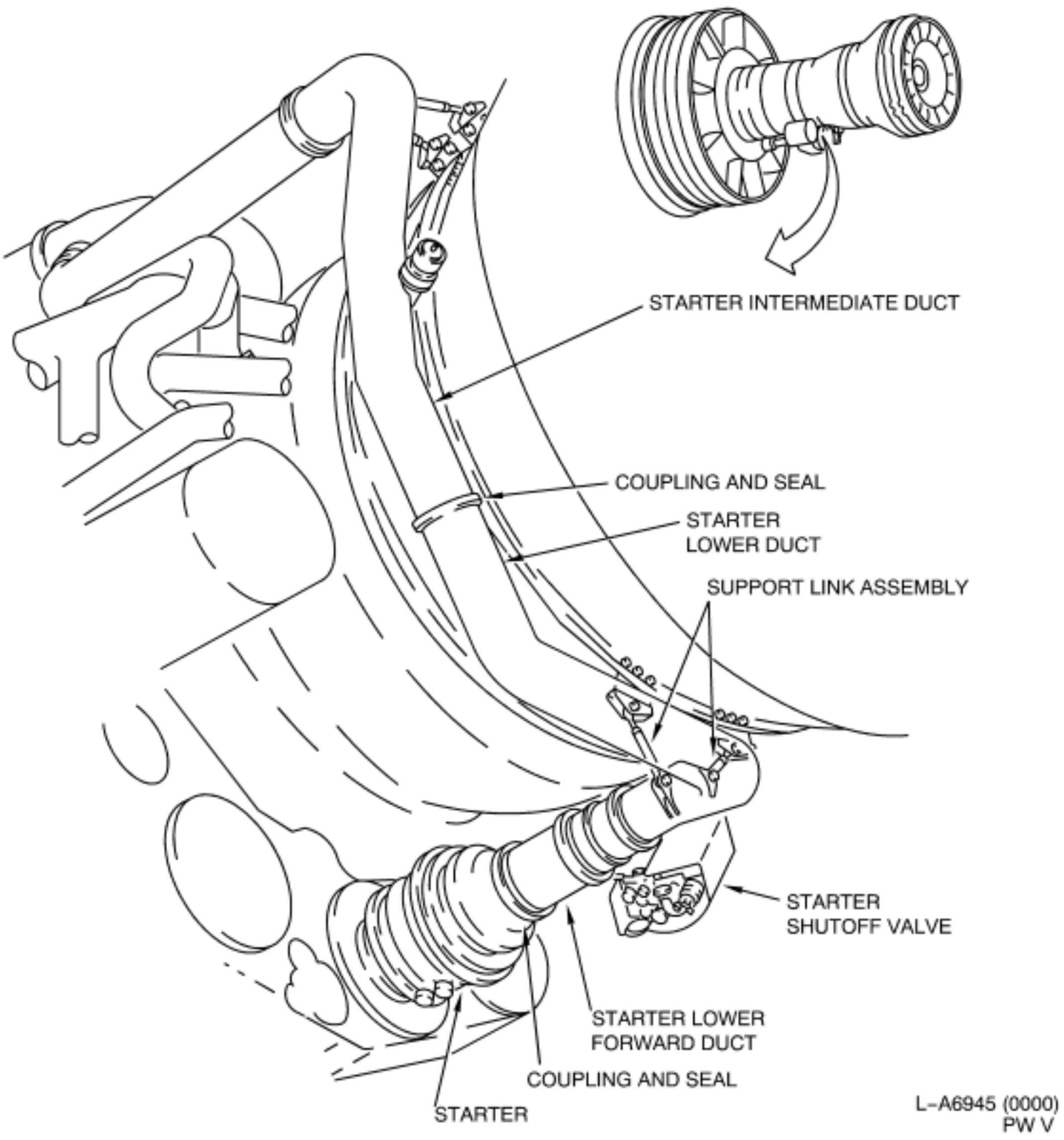
Preparation Of Core−Unit For Shipping (Deoiler Vent Duct Removal)
Figure 1227 (Sheet 2)
(Task 71−00−00−530−001)


REAR HYDRAULIC PUMP DRAIN TUBE
STARTER DRAIN TUBE
IDGS DRAIN TUBE
HYDRAULIC PUMP COMMON DRAIN TUBE
ENGINE DRAIN MANIFOLD ASSEMBLY
FUEL PUMP DRAIN TUBE
LOWER EEC ALTERNATOR DRAIN TUBE
LEFT SIDE DRAIN TUBE
L-A6942 (0000)
PW V

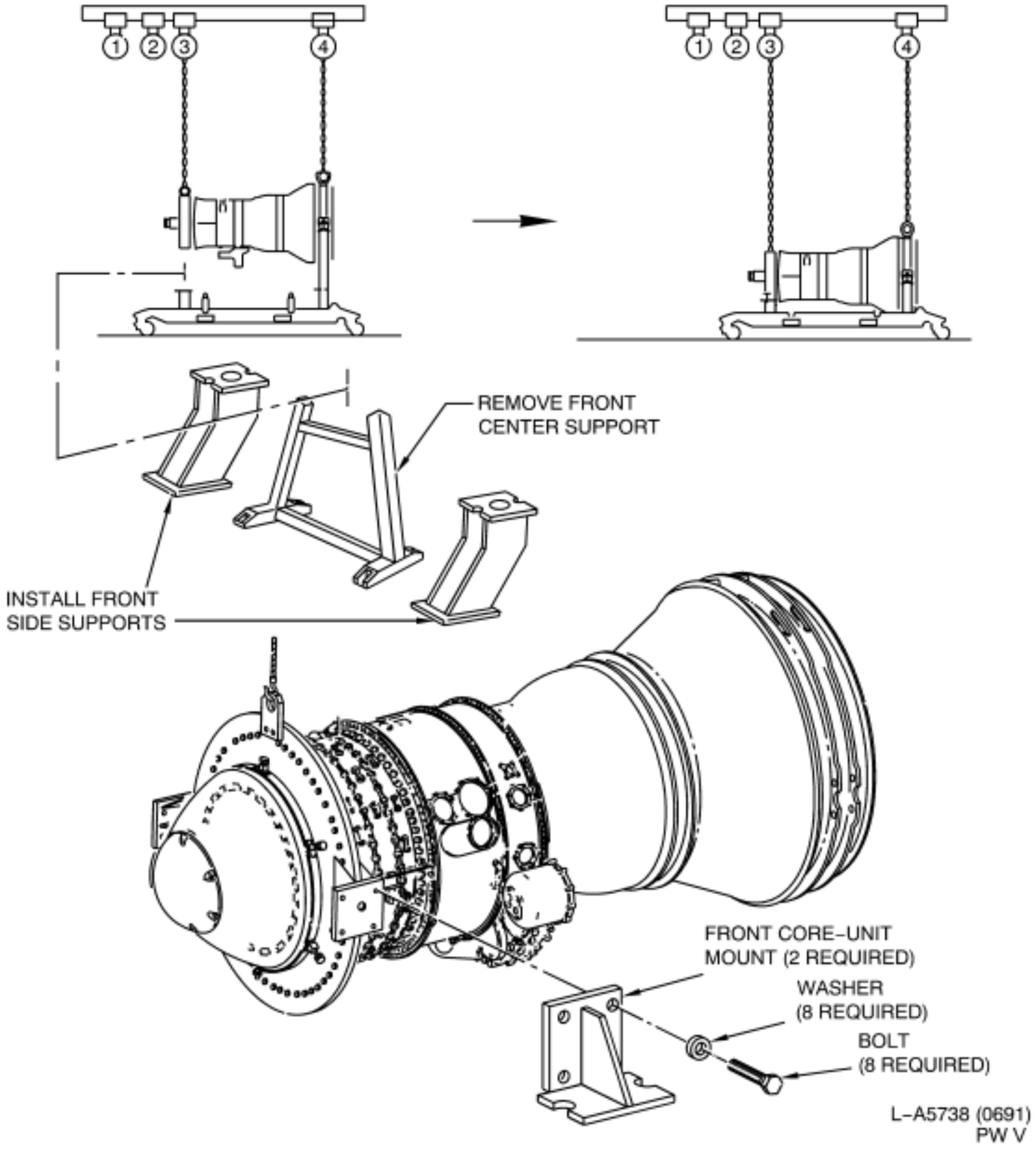
Preparation Of Core-Unit For Shipping
(Drain Manifold And Tube Removal)
Figure 1227 (Sheet 3)
(Task 71-00-00-530-001)


IDGS
FRONT HYDRAULIC PUMP DRAIN TUBE
WASHER
WASHER (2 REQUIRED)
BOLT
BOLT (2 REQUIRED)
ENGINE DRAIN MANIFOLD ASSEMBLY
L−A6943 (0000)
PW V

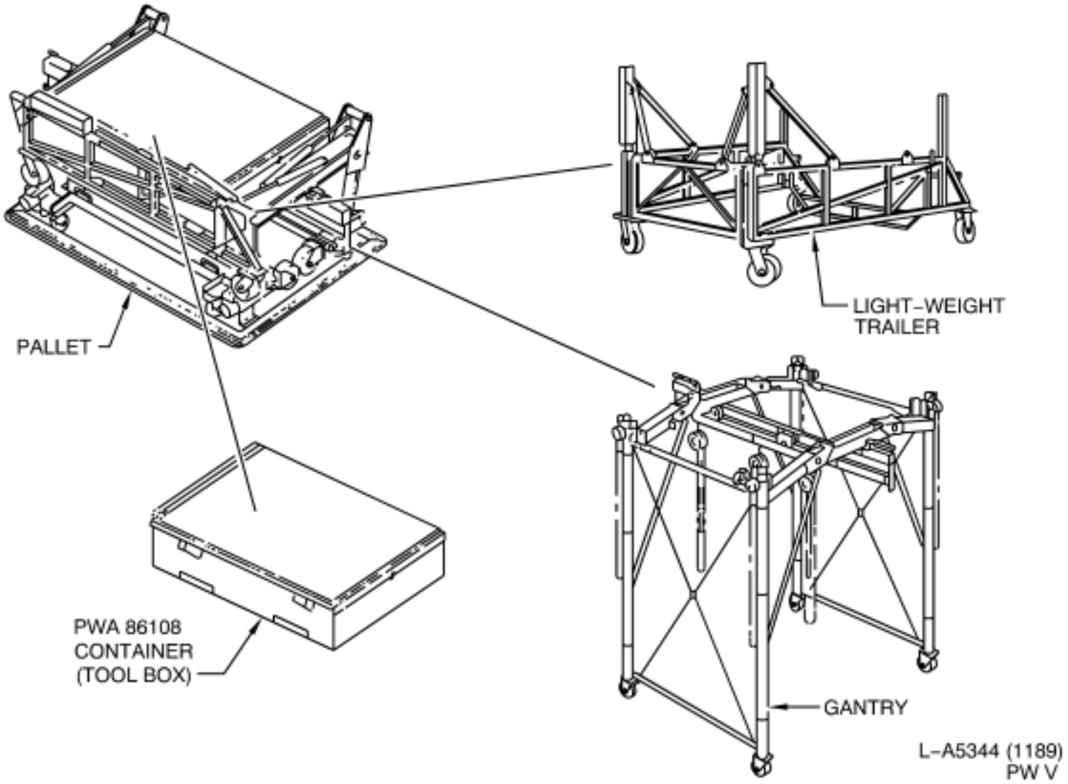
Preparation Of Core−Unit For Shipping
(Drain Manifold And Tube Removal)
Figure 1227 (Sheet 4)
(Task 71−00−00−530−001)


STARTER INTERMEDIATE DUCT
COUPLING AND SEAL
STARTER LOWER DUCT
SUPPORT LINK ASSEMBLY
STARTER SHUTOFF VALVE
STARTER LOWER FORWARD DUCT
COUPLING AND SEAL
STARTER
L−A6945 (0000)
PW V

Preparation Of Core−Unit For Shipping
(Starter Duct And Valve Removal)
Figure 1227 (Sheet 5)
(Task 71−00−00−530−001)


1
2
3
4
1
2
3
4
REMOVE FRONT CENTER SUPPORT
INSTALL FRONT SIDE SUPPORTS
FRONT CORE-UNIT MOUNT (2 REQUIRED)
WASHER (8 REQUIRED)
BOLT (8 REQUIRED)
L-A5738 (0691)
PW V

Core-Unit In Lower Shipping Position
Figure 1228
(Task 71-00-00-530-001)


LIGHT-WEIGHT TRAILER
PALLET
PWA 86108 CONTAINER (TOOL BOX)
GANTRY
L-A5344 (1189)
PW V

Assembly Of First Pallet
Figure 1229
(Task 71-00-00-530-001)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 71-00-00-540-001:

1. Assemble Replacement Power Plant

A. Equipment And Materials Required

Standard Tools:

Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 85609 Split Engine Transport EBU System (The tools that follow are contained in this system)
.PWA 85610 Change L Tool Kit

..PWA 29389	Hydraulic Pump
..PWA 29614	Wrench (Coupling Nut)
..PWA 29615	Holder (Coupling Nut)
..PWA 29855-7	Aligning Pin (2 Necessary)
..PWA 75174	Lifting Eye (Rear Mount) (Optional to PWA 86415)
..PWA 85260	Guide Pin (2 Necessary)
..PWA 85299	Adapter (Coupling Nut) (Optional to PWA 102460)
..PWA 85300	Wrench (Coupling Nut)
..PWA 85301	Adapter (Coupling Nut)
..PWA 85302	Wrench (Coupling Nut)
..PWA 85306	Puller (Coupling Plug)
..PWA 85390	Lifting Adapter (Front Core)
..PWA 85429	Wrench (Hand-LPT Nut)
..PWA 85452	Lifting Eye (Turbine Exhaust Case)
..PWA 85513	Sling
..PWA 85585	Guide Ring (1.5 Bearing)
..PWA 85632	Puller, Jackscrew (1.5 Bearing)
..PWA 85659	Lifting Eye (Rear Fan)
..PWA 85749	Torque Adapter
..PWA 85769	Fixture, Install/Remove (Turbine Shaft Coupling)
..PWA 85785	Adapter, Piloting
..PWA 86191	Torque Adapter
..PWA 86203	Guide, Lifting (LPT Shaft)
..PWA 86225	Wrench (Tool Coupling)
..PWA 86415	Lifting Eye (Rear Mount) (Optional to PWA 87275)
..PWA 87275	Lifting Eye (Rear Mount)
..PWA 101021	Rod, Installation
..PWA 101848	Jackscrew Plate (6 Necessary)

Special Tools:

(CONTINUED)

..PWA 102460	Adapter
.PWA 85611	Transport System (Core-Unit)
..PWA 85388	Coupling (LPT Shaft/HPC)
..PWA 85389	Support Ring (Core-Unit Front)
..PWA 85614	Transport Stand (Core-Unit)
..PWA 86325	Fixture (LPT Shaft) (Optional to (PWA 86437) Fixture - See Note)
..PWA 86437	Fixture (LPT Shaft) (Optional to (PWA 86325) Fixture - See Note)
..PWA 88222	Fixture (LPT Shaft) (Optional to (PWA 86437)
.PWA 85612	Transport System (Fan-Unit)
..PWA 85380	Fixture (Fan-Unit Front)
..PWA 85381	Shipping Nut (Fan-Unit Front)
..PWA 85383	Bracket (Fan-Unit To Pallet)
..PWA 85397	Shield (EEC)
..PWA 85492	Adapter (Fan-Unit Rear To Pallet)
..PWA 85615	Pallet (Fan-Unit)
..PWA 85618	Ring Retainer (No. 1.5 Bearing)
..PWA 86355	Shield (SCU)
.PWA 85613	Lightweight Trailer
.PWA 85633	Gantry Assembly
.PWA 86289	Container - Tool Storage
.PWA 86289	Closures - Engine Split Transport, Fan-Unit
.PWA 86290	Closures - Engine Split Transport, Core-Unit
CTE 5070	Airflow Cart (Optional to CTE 6070)
CTE 6070	Airflow Cart
PWA 85501	Adapter

NOTE: The (PWA 85609) Split Engine Transport EBU System contains all the tools indented below the system. The (PWA 85610) Tool Kit, the (PWA 85611) Transport System, and the (PWA 85612) Transport System contain all the tools indented two spaces below them.

NOTE: You can use the (PWA 86325) Fixture only on exhaust cases with the 30 bolthole rear cover. You can use the (PWA 86437) Fixture on either the 30 or 16 bolthole rear cover configuration.

NOTE: Also needed are the Airbus special tools used for the power plant removal/installation, the nose cowl removal/installation, and the turbine exhaust

Special Tools:

(CONTINUED)

nozzle removal/installation. See the Airbus A300-600 Maintenance Manual, 71-00-00, 71-11-00, 78-11-01, and 78-11-02 for the tool part numbers.

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-136	Fiberglass Wrap (Optional)
	P05-289	Lockwire (AS 3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
	P05-395	Beeswax
	P05-396	Paraffin Wax Blend
R	P06-002	Petrolatum, White (PMC 9609)
	P06-013	Lubricant, Solid Film
	P06-021	Compound, Antigalling (PWA 550)
	P06-023	Silver Goop (PWA 36001)
R	P06-054	Paste, Anti-Seize (PWA 36246)
	P11-009	Alcohol, Denatured Ethyl (AMS 3002)
	P18-003	Primer, Zinc Chromate (AMS 3110)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	2	72-32-00/1/110
Key Washer	7	72-32-00/1/125
Key Washer	3	72-54-00/5/20
Key Washer	2	72-54-00/5/60
Key Washer	2	72-54-00/5/70
Key Washer	8	72-54-00/4/110
Key Washer	4	73-23-00/1/40
Key Washer	1	73-23-00/1/75
Gasket	1	72-54-00/5/1
Packing	1	24-11-00/2/70
Packing	1	72-00-34/1/330
Packing	1	72-32-00/2/30
Packing	1	72-34-00/16/1
Packing	1	72-34-00/17/235
Packing	1	72-34-00/17/245
Packing	1	72-54-00/5/90
Packing	1	72-61-00/8/160
Packing	1	72-62-00/6/20
Packing	1	72-62-00/6/30

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
(CONTINUED)		
Packing	2	73-21-00/3/30
Packing	2	73-23-00/1/1
Packing	1	73-23-00/1/10
Packing	3	79-21-00/8/1
Packing	1	79-21-00/8/120
Packing	1	79-21-00/11/1
Packing	1	79-22-00/1/1
Retainer	2	73-21-00/3/40
Retainer	1	79-21-00/8/130
Retainer	1	79-21-00/11/10
Thrust Wire	1	72-54-00/2/110
Packing, AS3209-109	2	

NOTE: Also needed are the EBU expendable parts that follow:

2873-400 Seal (1)
2873-500 Seal (1)
8757-25 Seal (1)
8757-350 Seal (3)
8757-600 Seal (1)
A0863 Seal (2)
A0944 Seal (1)
A0945 Seal (1)
MS9372-083 Gasket (2)
M83248-1-906 Packing (1)
M83248-2-116 Packing (1)

B. Procedure

(1) With the help of a 16,500 lb. (7484.27 kg) minimum capacity fork-truck, disassemble the first pallet. Remove and position the PWA 86108 Container (toolbox) near the work area. Remove and assemble the PWA 85633 Gantry (And Lightweight Trailer) Assembly. See Figure 1201.

NOTE: Instructions for the assembly of the gantry system and the lightweight trailer are found inside the toolbox. The instructions are supplied by the manufacturer of the split-shipment equipment.

(2) Remove the tools and parts from the PWA 86109 Container. Put tools and parts in order.

(3) After the lightweight trailer is assembled, a second work crew can move the trailer to the out−of−service aircraft. Use the trailer for power plant removal. See Storage/Transport−02 for procedures.

(4) Lower and lock the wheels of the core−unit transport stand and the fan−unit transport stand. Remove shipping wrap.

(5) Move and align the core−unit under the gantry. See Figure 1202.

(6) Install the engine rear flight mount to the exhaust case as follows.

CAUTION: BE CAREFUL WITH THE REAR ENGINE MOUNT. PREVENT DAMAGE TO THE COATING ON THE REAR MOUNT.

(a) Use Hoist No. 4 and install the PWA 87275 Lifting Eye or PWA 86415 Lifting Eye or PWA 75174 Lifting Eye to the mount. Attach the eye with the bolts supplied with the mount.

(b) Use the hoist and lift the rear mount into position.

(c) Install the engine rear mount per the Airbus A300−600 Maintenance Manual, 71−22−00, Engine Aft Mount − Removal/Installation.

NOTE: The engine mount bolts must be examined before each installation. See the Airbus A300−600 Maintenance Manual, 71−22−00, Engine Mount Bolts − Inspection/Check.

CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE−UNIT BY THE TOOL COUPLING THAT IS INSTALLED ON THE FRONT OF THE CORE−UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE TOOL COUPLING. TOO MUCH STRESS ON THE TOOL COUPLING CAN CAUSE DAMAGE TO THE NO. 2 BEARING SEAL NUT.

(7) Install Hoist No. 3 to the lifting eye of the PWA 85389 Support Ring attached to the front of the core−unit. Disconnect the four supports from the stand

and raise the core−unit to the upper assembly position. Remove the two front side supports from the (PWA 85389) Support Ring. Remove the eight bolts and the two front side supports from the transport stand. Use four bolts and install the front center support to the transport stand. Lower the core−unit onto the support in the upper position. Remove the hoists and move the core−unit from under the gantry.

(8) Move and align the fan−unit under the gantry. See Figure 1203.

(9) Remove parts from the storage box attached to the fan−unit pallet. Keep the parts in a clean area.

(10) Remove the twelve bolts and cover from the center of the PWA 85380 Fan−Unit Front Fixture.

(11) Loosen (counterclockwise as viewed from front) and remove the PWA 85381 Shipping Nut from the front of fan−unit.

(12) Remove the turbine shaft coupling assembly from the fan−unit as follows. See Figure 1203.

(a) Install two eyes to the PWA 85769 Coupling Fixture body assembly (detail−8, 21, and 19). Install a strap and lift the tool assembly.

NOTE: Be sure to make a mark on the tool to align with the disassembly vector (DV) mark on the coupling. The mark on the tool must align with the marks on the LPT shaft and the fan hub at assembly.

(b) Install the tool assembly to the coupling with the hoist. Retract the locating pin. Turn the plate (detail−21) to put the plate lugs behind the coupling lugs. Release the locating pin to lock the tool to the coupling.

(c) Remove the coupling and fixture from the fan−unit. Install a protective cover over the No. 1.5 bearing seal plate, and entire coupling. Move the coupling away from the gantry.

WARNING: BEFORE LIFTING THE FAN-UNIT, BE SURE THAT THE FAN-UNIT IS CENTERED UNDER THE GANTRY. DO NOT ALLOW THE HOIST TO MOVE NEAR THE END OF THE GANTRY RAIL OR PERSONAL INJURY CAN RESULT.

(13) Attach the PWA 85513 Sling to Hoist No. 1 and to the two lifting eyes on the PWA 85380 Fan-Unit Front Fixture. Put light tension on the sling. See Figure 1204.

(14) Find the three PWA 85383 Brackets that hold the fan-unit to the pallet. Loosen the jamnut on each bracket. Loosen the threaded rod that attaches the pallet bracket to each case bracket. Remove the four bolts that attach each case bracket to the case and the four bolts that attach the brackets to the pallet. Keep the bolts in the threaded holes of the brackets and pallet.

(15) Install the PWA 85659 Lifting Eye, with larger swivel rearwards, to the 12 o'clock position boss on the intermediate case. Attach the adapter with the bolts supplied with the adapter. Attach Hoist No. 2 to the smaller swivel. Put no tension on the hoist. Remove the PWA 85397 EEC Protector.

(16) Keep the fan-unit near the center of the gantry and use Hoist No. 1 to lift the fan-unit from the pallet. Remove the pallet from under the gantry. Use Hoist No. 1 and No. 2 to turn the fan-unit to assembly position.

(17) Remove the nineteen bolts that attach the PWA 85492 Fan-Unit Rear Fixture to the rear of the fan-unit. Keep the bolts in the threaded holes of the fixture. Remove the fixture and put it with the fan-unit pallet. Remove the PWA 85397 EEC Shield from the fan-unit. Remove the PWA 86355 Shield from the SCU (if equipped). Remove the pallet from the gantry area. See Figure 1205.

NOTE: Be sure that all the Flange E bolthole threads are serviceable. Repair any damaged threads.

(18) Remove the three bolts that attach the PWA 85618 Ring Retainer to the 1.5 bearing support. Remove the ring. Keep the three bolts in the three threaded holes of the ring.

(19) Install the PWA 85585 Guide Ring to the No. 1.5 bearing support with the three bolts kept with the tool.

WARNING: DO NOT ALLOW THE FAN-UNIT TO MOVE NEAR THE END OF THE GANTRY OR PERSONAL INJURY CAN RESULT.

(20) Install the PWA 85785 Adapter to the front fan hub. Turn the legs and engage the rear of the hub. Tighten the detail wing nuts to hold the legs in position.

(21) Move and align the core-unit under the gantry and behind the rear of the fan-unit. See Figure 1206.

(22) Remove protective covers and install the PWA 85390 Lifting Adapter to the two eighth-stage bleed openings. Attach with sixteen tool bolts. Tighten the bolts. Attach Hoist No. 4 to the adapter and put light tension on the hoist. Remove the four bolts that attach the front center support to the front of the pallet. Remove the support.

(23) Remove the six bolts and washers that attach the front inlet cone segment to the inlet cone segment. Remove the front segment. Hold the inlet cone segment and loosen the six hand-knobs of the PWA 85389 Support Ring. Push the end of each clamp in and turn to remove the inlet cone segment.

CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE-UNIT BY THE TOOL COUPLING THAT IS INSTALLED ON THE FRONT OF THE CORE-UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE TOOL COUPLING. TOO MUCH STRESS ON THE TOOL COUPLING CAN CAUSE DAMAGE TO THE NO. 2 BEARING SEAL NUT.

(24) Attach Hoist No. 3 to the PWA 85389 Support Ring on the front of the core-unit. Put light tension on the hoist.

(25) Remove the 33 bolts that attach the No. 2 bearing support to the PWA 85389 Support Ring. Remove the 48 bolts, nuts, and washers that attach Flange E to the ring. Carefully move the ring forward and remove it from the core-unit. Remove Hoist No. 3 from the ring and remove the ring from the gantry area.

(26) Attach Hoist No. 3 to the larger swivel of the PWA 85659 Adapter at the top of the intermediate case. Put tension on Hoist No. 3 to hold the rear of the fan-unit. Disconnect Hoist No. 2 from the adapter.

(27) Prepare the fan-unit for the installation of the core-unit as follows. See Figure 1207.

(a) Remove the protective caps, plugs, and covers from the openings on the rear of the fan-unit at
- the EEC PB sensing tube nut at 12:30 o'clock position
- the tube adapters of the two solenoids at 1 o'clock and 10 o'clock positions
- the No. 3 bearing air cooler adapters at 2:30 o'clock position
- the angle gearbox oil pressure adapter on the angle gearbox at 6 o'clock position
- the 1, 1.5 and 2 main bearing oil scavenge tube coupling at 7:30 o'clock position
- the cooling air supply tube at 10:30 o'clock position
- the EEC PT4.95 sensing tube nut at 11:30 o'clock position.

(b) For engines with a packing groove in the inside diameter of the HPC front case flange (Post SB PW4ENG 72-48), lubricate the new packing, PN 51H252, with White Petrolatum P06-002. Install the packing to the intermediate case Flange E lip. Be sure the packing stays against the Flange E surface.

(c) Install two PWA 85260 Guide Pins at approximately 3 and 9 o'clock positions on Flange E. Install two PWA 29855-7 Aligning Pins at approximately 6 and 12 o'clock positions on Flange E.

CAUTION: EXAMINE THE REAR OF THE FAN-UNIT. BE SURE THE WORKBOLTS THAT ATTACH THE NO. 1.5 BEARING SUPPORT TO THE INTERMEDIATE CASE DO NOT PROTRUDE ABOVE THE NO. 2 BEARING SUPPORT MATING FLANGE.

(d) Use a flashlight and examine the rear inner flange of the fan-unit. Be sure the work bolts that attach the No. 1.5 bearing support to the intermediate case do not protrude above the No. 2 bearing support mating flange.

(28) Prepare the core−unit for the installation of the fan−unit as follows. See Figure 1208.

(a) Remove the protective caps, plugs, and covers from the openings on the front of the core−unit at
- the EEC PB sensing tube coupling at 12:30 o'clock position
- the tube nuts that attach to the two solenoids at 1 o'clock and 10 o'clock positions
- the two No. 3 bearing air cooler tube nuts at 2:30 o'clock position
- the angle gearbox pressure tube nut at 6 o'clock position
- the No. 1, 1.5, and 2 bearing oil scavenge tube nut at 7:30 o'clock position
- the cooling air supply hose at 10:30 o'clock position
- the EEC PT4.95 sensing tube coupling at 11:30 o'clock position.

(b) Install two new packings, PN AS3209−162 and AS3209−334lubricated with Engine Oil P03−001, to the gearbox drive shaft housing. Install the retaining ring to the drive shaft and install the drive shaft into the drive shaft housing. Remove the protective cover and install the housing and drive shaft to the front of the gearbox and move rearward as far as possible. Engage the gearbox gear shaft and push the drive shaft as far rearward as possible.

(c) Install the packing, PN MS9386−388 lubricated with White Petrolatum P06−002, to the No. 2 bearing support packing groove.

CAUTION: BE SURE TO INSTALL THE OIL TRANSFER TUBE AT THIS TIME. FAILURE TO INSTALL THE TUBE WILL RESULT IN ENGINE DAMAGE.

(d) Install the oil transfer tube with two new packings, PN AS3209−010 and PN AS3209−111 (if required), lubricated with Engine Oil P03−001, to the oil nozzle.

CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE−UNIT BY THE TOOL COUPLING THAT IS INSTALLED ON THE FRONT OF THE CORE−UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE TOOL COUPLING. TOO MUCH STRESS ON THE TOOL COUPLING CAN CAUSE DAMAGE TO THE NO. 2 BEARING SEAL NUT.

(e) Be sure that the PWA 85388 Coupling is installed on the HPC and LPT shaft.

CAUTION: BE SURE ALL FLANGES ARE FREE OF ANY UNWANTED OBJECTS.

CAUTION: ONE PERSON MUST MONITOR THE INSTALLATION INSIDE THE BEARING AREA WITH A FLASHLIGHT. OTHERS MUST MONITOR THE EXTERNAL PARTS AND FLANGE E FOR CORRECT MATING.

(f) Remove the lockwire that attaches the PWA 85388 Coupling nut to the coupling on the front of the core−unit.

(g) Use PWA 85429 Wrench and remove the LPT shaft nut and washer. Install the PWA 86203 Guide to the LPT shaft threads and tighten by hand.

CAUTION: BE SURE AND ALIGN THE CORE−UNIT AND FAN−UNIT ACCURATELY. DO NOT PERMIT THE TOOL COUPLING ON THE FRONT OF THE CORE−UNIT TO TOUCH THE NO. 2 BEARING CARBON SEAL. DAMAGE TO THE SEAL CAN RESULT.

(29) Be sure the dowel pin on the front of the No. 2 bearing support is aligned with the dowel pin hole in the No. 1.5 bearing support flange. Carefully align and install the fan−unit to the core−unit until Flange E is almost together. Be sure the distance between the fan−unit and the core−unit at Flange E is approximately the same all around. Be sure the dowel pin on the front of the No. 2 bearing support is in the dowel pin hole in the No. 1.5 bearing support flange. Be sure the bevel gears will engage correctly. Be sure the oil transfer tube will engage.

NOTE: If necessary, rotate the HPC for the alignment of the bevel gears. To rotate the HPC, remove the two bolts, washers, and cover from the front of the gearbox adjacent to the fuel pump. Use a wrench and turn the drive under the cover.

NOTE: If removed, install a new packing (PN AS3209-121), lubricated with Engine Oil P03-001, the cover, washers, and bolts, threads lubricated with Engine Oil P03-001. Torque the bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(30) Attach the fan-unit to the core unit as follows. See Figure 1209.

CAUTION: REMOVE ALL THE WORK BOLTS THAT ATTACH THE NO. 1.5 BEARING SUPPORT TO THE FAN CASE. FAILURE TO DO SO COULD RESULT IN DAMAGE TO THE ENGINE.

(a) Lubricate the 33 bolts with Engine Oil P03-001 that attach the No. 1.5 bearing support and the No. 2 bearing support to the intermediate case. Remove the work bolts that are installed in the No. 1.5 bearing support flange. Install the 33 bolts and tighten by hand only.

(b) Lubricate the bolts with Antigalling Compound P06-021 that attach Flange E. Install the bolts and brackets to Flange E and tighten by hand only.

NOTE: Flange E has two configurations, the UPS configuration has 72 bolts and the other configuration has 74 bolts.

1 For engines with the 2.5 bleed actuator support bracket (Post SB PW4ENG 75-84) do the following.

a Align the three boltholes in the support bracket on the 2.5 bleed actuator with the three boltholes in the bracket on Flange E. Attach the two brackets together with nuts and bolts, threads lubricated with Engine Oil P03-001. Torque the nuts 85 - 95 lb-in. (9.604 - 10.734 N.m).

(c) Tighten the Flange E bolts and the bearing support bolts evenly at the same time to engage the snap diameters. Be sure that bevel gears align. Personnel must also monitor the external parts for correct alignment.

(d) Torque the Flange E bolts to 225 − 250 lb−in. (25.422 − 28.246 N.m). Remove the PWA 85260 Guide Pins and the PWA 29855−7 Aligning Pins and install the Flange E bolts. Torque these bolts to the same limits.

(e) Torque the 33 bearing support bolts to 180 − 200 lb−in. (20.337 − 22.597 N.m).

(31) Lower Hoist No. 1 and No. 4 so that the weight of the engine is on Hoist No. 3. Install the two transportation stand front supports to the intermediate case bosses at 3 and 9 o'clock positions. Attach the two supports to the case and transport stand.

(32) Remove the bolts that attach the PWA 85659 Lifting Adapter to the top of the intermediate case. Keep the bolts in the threaded holes of the adapter. Remove the adapter from the engine and from Hoist No. 3. See Figure 1204 (Sheet 2).

(33) Remove the PWA 85390 Lifting Adapter from the 8th stage duct openings. Install the 8th stage ducts as follows. See Figure 1206 and Figure 1210.

(a) Remove the sixteen bolts that attach the adapter to the openings on the HPC case. Keep the bolts with the adapter. Use Hoist No. 4 and remove the adapter. Install protection covers.

(b) Install the 8th stage ducts as follows. See Figure 1210 (Sheet 1) and Figure 1210 (Sheet 2).

1 Install the new gasket, PN MS9372−083, to the right HPC case opening and attach with Beeswax P05−395 or Paraffin Wax Blend P05−396. Install the new seal, PN 8757−350, to the right 8th stage duct elbow and attach with Beeswax P05−395 or Paraffin Wax Blend P05−396. Install the elbow and electrical bracket to the opening with eight bolts, lubricated with Engine Oil P03−001. Tighten by hand. Lubricate the coupling inside surfaces with Solid Film

Lubricant P06-013. Install the coupling to the elbow and duct. Tighten by hand.

2 Install the new gasket, PN MS9372-083,to the left HPC case opening and attach with Beeswax P05-395 or Paraffin Wax Blend P05-396. Install the left 8th stage duct and bracket to the opening with eight bolts, lubricated with Engine Oil P03-001. Tighten by hand.

3 Install the new seal, PN 8757-600, to the pressure regulating valve and attach with Beeswax P05-395 or Paraffin Wax Blend P05-396. Install the new seal, PN 2873-500, to the bottom opening of the midstage duct and attach with Beeswax P05-395 or Paraffin Wax Blend P05-396. Install the two new seals, PN 8757-350, to the 8th stage duct and left 8th stage check valve and attach with Beeswax P05-395 or Paraffin Wax Blend P05-396. Install the mid-stage duct in position. Attach the duct to the link with the bolt, lubricated with Engine Oil P03-001 washer, and nut. Torque the bolt to 480 - 690 lb-in. (54.233 - 77.960 N.m).

4 Lubricate the inside surfaces of the four couplings with Solid Film Lubricant P06-013. Install the couplings to attach the mid-stage duct to the 8th stage ducts, the high pressure bleed valve, and the pressure regulating valve. Tighten by hand.

5 Torque the bolts that attach the left and right 8th stage ducts to the HPC case openings to 65 - 85 lb-in. (7.344 - 9.604 N.m). For bolts with wire holes, install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

6 Torque all the couplings to the torque you see on each coupling. Tap the outer surface of each coupling with a plastic mallet while you torque the clamp nut.

7 Adjust the support link to a no-preload condition, then add one-half turn of tension adjustment to the support links. Torque the lock nuts to 100 - 140 lb-in. (11.298 - 15.818 N.m).

8 Lubricate the threads of the adapter on the mid-stage duct with Engine Oil P03-001. Connect the tube to the adapter and torque the tube to 180 - 200 lb-in. (20.337 - 22.597 N.m).

(34) Use Hoist No. 4 to remove the PWA 87275 Rear Lifting Eye, PWA 86415 Rear Lifting Eye or PWA 75174 Rear Lifting Eye. Remove the bolts and keep them in the threaded holes of the mount. Remove the adapter from the engine and from Hoist No. 4. See Figure 1202.

(35) Attach Hoist No. 1 to the top lifting eye of the PWA 85380 Fan-Unit Front Fixture. Remove the 19 bolts that attach the center ring to the fan hub. Remove the 60 bolts, nuts, and washers that attach the fixture to Flange A. Move the fixture forward and away from the engine. Remove the fixture from the gantry and put it on the fan-unit pallet. See Figure 1211.

(36) Loosen the legs and remove the PWA 85785 Adapter from the front fan hub. Loosen and remove the PWA 85388 Coupling Nut with the PWA 86225 Wrench. Loosen and remove the PWA 85388 Coupling with the PWA 86225 Wrench. Loosen and remove the PWA 86203 Guide.

NOTE: For ease of the coupling nut removal, loosen the thumbscrews on the PWA 86437 Fixture or PWA 86325 Fixture installed on the rear of the exhaust case. Tighten the thumbscrew again after the removal of the coupling nut.

NOTE: For ease of coupling removal, support the front of the LPT shaft with the end of the PWA 86203 Guide.

(37) Remove the PWA 85585 Guide Ring bolts. Remove the guide and keep the bolts in the threaded holes. See Figure 1212.

(38) Install the No. 1.5 bearing outer race (Post SB PW4ENG 72-253 only) as follows.

CAUTION: THE FRONT OF THE BEARING RACE HAS THE CHAMFER ON THE INSIDE DIAMETER.

(a) Install the transducer bracket dowel pins through the dowel pin holes on the front side of the bearing flange.

(b) Align the bracket dowel pins and install the bearing and bracket to the support.

(c) Install the seven double key washers, PN 51G068, and the fourteen shorter hex bolts, lubricated with Engine Oil P03-001, to the bearing flange boltholes without the bracket. Install the two key washers, PN 51G069, and two longer hex bolts at the bracket locations.

(d) (Reference 981) Tighten the bolts evenly in opposite pairs to engage the bearing to the support. Torque all the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m). Torque all the bolts again until the torque is held. Bend the key washers against the bolt heads.

(39) Install the turbine shaft coupling assembly as follows. See Figure 1213.

(a) Measure and write Dimension AJ of the fan hub assembly and Dimension AK of the coupling. See Figure 1213 (Sheet 1). Subtract Dimension AK from Dimension AJ for Calculated Dimension AL. Keep Dimensions AL for later use.

(b) Make sure the classified spacer is on the end of the LPT shaft.

CAUTION: UNWANTED MATERIAL IN THE NO. 1 AND 2 BEARING SUMP CAUSED AN IN-FLIGHT-SHUTDOWN.

CAUTION: MAKE AN INSPECTION OF THE NO. 1 AND 2 BEARING SUMP AREA BEFORE YOU INSTALL THE COUPLING. USE GLOVES. REMOVE ALL UNWANTED MATERIAL BEFORE YOU INSTALL THE COUPLING. See Figure 1213 (Sheet 2).

(c) Install the coupling assembly to the engine as follows. See Figure 1213 (Sheet 2).

1 Install the PWA 85769 Fixture shaft (detail-35) to the end of the LPT shaft. Tighten by hand.

2 Move the coupling (with fixture installed) under the gentry.

3 Install the arm (detail-1) to the adapter and eye. Attach Hoists No. 1 and 2 to the eye and arm.

4 Lift and turn the coupling to the horizontal position.

5 Apply Engine Oil P03-001 to the seal seat and to the coupling as shown in Figure 1213 (Sheet 3).

6 Install the coupling into the engine over shaft (detail-35). Align the disassembly vector (DV) marks and engage the splines of the coupling to the LPT shaft and fan hub.

7 Remove end cap/lift eye (detail-2) from adapter assembly (detail-3).

8 Install PWA 101021 Rod into the adapter assembly (detail-3) and turn the rod so that it is attached to the shaft assembly (detail-35).

9 Use a standard one inch (or equivalent) wrench to turn PWA 101021 Rod until the coupling is installed onto the LPT shaft.

10 Remove the PWA 101021 Rod, the lift arm assembly (detail-1) and the adapter assembly (detail-3) from the tool.

11 Install the locator (detail-27) to the front fan hub and tighten by hand. See Figure 1213 (Sheet 4).

12 Install and tighten the two rods (detail-36) to the body.

13 Install the two hydraulic cylinders (detail-16) and the two spacers (detail-26) over the rods.

14 Install the cover (detail-7) to the locator (detail-27) and attach with the six bolts (detail-41).

15 Install the nut (detail-11) to the shaft (detail-35) and tighten by hand.

CAUTION: BE SURE AND LOOSEN THE EIGHT THUMBSCREWS ON THE PWA 86437 FIXTURE OR PWA 86325 FIXTURE AT THE REAR OF THE ENGINE BEFORE YOU OPERATE THE PUMP OR DAMAGE TO TOOLS CAN RESULT.

16 Connect the hydraulic hoses to the cylinders and to the PWA 29389 Pump. Loosen the eight capscrews on PWA 86437 Fixture or PWA 86325 Fixture at the rear of the engine. Operate the pump to install the coupling fully.

17 Disconnect the pump and hoses. Remove the nut (detail-11), six bolts (detail-41), and the cover (detail-7). Remove the two spacers (detail-26), hydraulic cylinders, and the rods (detail-36). Remove the locator (detail-27) from the fan hub.

18 Use the hoist and install the adapter (detail-3), arm (detail-1), and eye with the four bolts (detail-4).

19 Retract the locating pin. Turn the plate (detail-21) to put the plate lugs between the coupling lugs. Release the locating pin.

20 Remove the tool. Remove the shaft (detail-35).

(d) Be sure the disassembly vector (DV) marks on the coupling, fan hub, and the LPT shaft align.

(e) (Reference 1008) Measure Dimension AL from the fan hub to the coupling. See Figure 1213 (Sheet 1). Measured Dimension AL must not be more than calculated Dimension AL + 0.003 inch (0.076 mm) nor less than calculated Dimension AL - 0.003 inch (0.076 mm).

(f) At the rear of the engine, remove the 16 tool bolts that attach the PWA 86437 Fixture or PWA 86325 Fixture to the exhaust case and the LPT shaft if used. Remove the retainer and keep the bolts with the threaded holes of the tool.

(g) If PWA 88222 Fixture was used, loosen the captured capscrews on the tube assembly detail and the guide assembly detail. Remove the retainer from the exhaust case.

(h) Apply Antigalling Compound P06-021 to the LPT turbine shaft nut, the coupling, and the LPT shaft as shown in Figure 1214. Permit to dry 5 minutes before installation.

CAUTION: BE SURE THAT THE WASHER IS PROPERLY INSTALLED AND SEATED IN THE COUPLING SHAFT ID. BE SURE THAT THE WASHER IS NOT IN EITHER GROOVE FORWARD OF THE SEAT.

(i) Install the washer and nut to the engine. Use the PWA 85429 Wrench and tighten by hand.

(j) Install the PWA 102460 Adapter or PWA 85299 Adapter into coupling and engage the teeth. Slide the three clamps outward and tighten the wing nuts to attach the tool. See Figure 1215.

(k) Install the PWA 85300 Wrench and engage the spline.

(l) Install the PWA 29614 Mechanical Wrench and PWA 86191 Torque Adapter.

(m) (Reference 971) Torque the LPT shaft nut as follows.

1 Torque the nut to 5000 - 7000 lb-in. (564.924 - 790.894 N.m).

2 Tighten the nut 43 - 47 degrees more.

3 Loosen the nut to zero.

4 Torque the nut to 4000 - 6000 lb-in. (451.939 - 677.909 N.m) and make a mark to refer the nut position to the coupling.

5 Tighten the nut 43 - 47 degrees more.

6 Loosen the nut and torque it again to 4000 - 6000 lb-in. (451.939 - 677.909 N.m).

7 If the nut location mark is aligned with the wrench mark or is beyond by two degrees maximum, add 43 - 47 degrees more.

8 If the marks are not in the limits above, repeat steps 4 through 7.

(n) Remove the tools.

(o) Install the key washer and retaining ring to the coupling and nut.

R
R
R
R
(p) Apply Anti-Seize Paste P06-054 to the turbine shaft (coupling/retaining) nut as shown in Figure 1214. Remove the unwanted paste. It is necessary to let five minutes to dry before installation.

(q) Install the nut and tighten by hand. See Figure 1216.

(r) Install the PWA 85301 Adapter into the coupling nut and engage the teeth. Slide the three clamps outward and tighten the wing nuts to attach the tool.

(s) Install the PWA 85302 Wrench over the adapter and engage the teeth. Slide the three clamps outward and tighten the wing nuts to attach the tool.

(t) Install the PWA 29614 Mechanical Wrench, the PWA 86191 Torque Adapter and the PWA 29615 Holder.

(u) (Reference 970) Torque the turbine shaft (coupling) nut as follows.

1 Torque the nut to 24,200 - 26,800 lb-in. (2734.44 - 3027.993 N.m).

2 Tighten the nut 18 - 20 degrees more.

3 Loosen the nut to zero.

4 Torque the nut again to 24,200 - 26,800 lb-in. (2734.44 - 3027.993 N.m) and make a mark to refer the nut position to the hub.

5 Tighten the nut 18 - 20 degrees more.

6 Loosen the nut and torque it again to 24,200 - 26,800 lb-in. (2734.44 - 3027.993 N.m).

7 If the nut position mark is aligned with the wrench mark or is beyond by two degrees maximum, add 18 - 20 degrees more.

8 If the marks are not in the limits above, repeat steps 4 through 7.

(v) Remove the tools.

(w) Install the new packing, PN MS9386-276 lubricated with White Petrolatum P06-002 and the plug to the coupling and nut. Install the key washer and retaining ring.

NOTE: The retaining ring must be fully in the groove of the turbine shaft (coupling/ retaining) nut, all around, and the ring end gap must be 0.010 inch (0.254 mm) minimum.

(40) Install the compressor inlet cone as follows. See Figure 1217.

(a) Align the disassembly vector (DV) mark on the inlet cone segment to the mark on the hub.

(b) Install the 19 bolts, lubricated with Engine Oil P03-001, and washers. Use a non-metalic blunt object (plastic scrapper or equivalent) and make sure the seal is installed under the fan blade platform leading edge before you tighten the bolts. Tighten and torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(c) Align the disassembly vector (DV) mark on the inlet cone front segment to the mark on the inlet cone.

(d) Install the six bolts, lubricated with Engine Oil P03-001, and washers. Tighten and torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(41) Install the eight bolts, lubricated with Engine Oil P03-001, and key washers, PN MS9276-10, that attach the installed No. 4 bearing retainer. Torque the bolts to 75 - 85 lb-in. (8.474 - 9.604 N.m). Bend the key washer tabs against the bolthead flats. See Figure 1218.

(42) Install No. 4 bearing oil scavenge (inner) tube. See Figure 1219.

(a) Remove protective cover from the mount pad recess in turbine exhaust case rear inner diameter.

(b) Install new gasket (1219/3) in groove in recess in exhaust case rear inner diameter.

(c) Align boltholes in flange of No. 4 bearing oil scavenge tube (1219/8) with boltholes in recessed mount pad in exhaust case rear inner diameter. Align bolthole in detail tube bracket with bolthole in exhaust case rear inner diameter. Secure tube using three bolts (1219/6) lubricated with Engine Oil P03-001 and key washers (1219/7). Torque bolts to 32 - 36 lb-in. (3.616 - 4.067 N.m). Bend tabs of key washers.

(43) (Pre SB PW4ENG 72-472) Install the No. 4 bearing (oil) nozzle and the No. 4 bearing packing transfer tube in the exhaust case No. 4 bearing compartment at the 1:30 o'clock position. See Figure 1220.

(a) Install the nozzle (1220/4) in the exhaust case and secure with key washers (1220/2 and (1220/3) and bolts (1220/1). Bend the tabs on the key washers.

(b) Install the No. 4 bearing packing transfer tube (1220/5) to the No. 4 bearing nozzle (1220/4) and secure with key washers (1220/6 and 1220/7) and bolts (1220/8). Bend the tabs on the key washers.

(44) (Post SB PW4ENG 72-472) Install No. 4 bearing (oil) nozzle and No. 4 bearing damper supply tube. See Figure 1221.

(a) Install the No. 4 bearing nozzle (1221/11) in the port in the pad on the exhaust case rear inner diameter at the 1:30 o'clock position. Install the nozzle with two bolts (1221/16) and (1221/17), with threads lubricated with Engine Oil P03-001, and two washers (1221/16) and (1221/17).

(b) Install the No. 4 bearing damper supply tube (1221/12) through the 0.380 inch (9.652 mm) diameter hole in the nozzle (1221/11) and into the port in the exhaust case rear flange. Install the damper tube with two bolts (1221/16) and (1221/17) with threads lubricated with Engine Oil P03-001, and washers (1221/16) and (1221/17). Torque the bolts that attach the nozzle to the exhaust case and bolts that attach the damper supply tube to the nozzle to 75 - 85 lb-in. (8.474 - 9.604 N.m). Bend the tabs of washers.

(45) (Post SB PW4ENG 72-472) Install No. 4 bearing front nozzle assembly and the packing transfer tube (damper tube to front nozzle). See Figure 1221.

(a) Lubricate two packings (1221/14) with Engine Oil P03-001. Install the packings in the grooves of the packing transfer tube (1221/15). Insert one end of the tube into the port in the front No. 4 bearing nozzle (1221/13).

(b) Align the boltholes in the flange of the front nozzle with the two retainer plate boltholes at the 12 o'clock position; and insert the nozzle through the hole in the No. 4 bearing support flange at the 1:30 o'clock position. Insert the end of the transfer tube in the port in the elbow of the No. bearing damper supply tube. Put the retaining plate (1221/2), chamfered side out, on the retainer plate pad (under the nozzle flange). Put the key washer (1221/1) over the oil nozzle flange, and install two bolts, with threads lubricated with Engine Oil P03-001.

(c) (Reference 90) Make sure that the clearance gap (1221/3) between the retaining plate and the grooves in the bearing outer race is in the limit specified in Index 2, Figure 1222. Torque the bolts that attach the retainer plate to 75 - 85 lb-in. (8.474 - 9.604 N.m). Bend the tabs of washer (1221/1).

CAUTION: YOU MUST APPLY ENGINE OIL FULLY TO THE COVER PACKING OR YOU WILL CUT THE PACKING DURING INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN-FLIGHT SHUTDOWN.

CAUTION: INSTALL THE COVER INTO POSITION USING FOUR WORK BOLTS EQUALLY SPACED AROUND THE COVER. TIGHTEN THE BOLTS EQUALLY IN SMALL INCREMENTS TO PULL THE COVER INTO POSITION EQUALLY. MONITOR THE ENGAGEMENT OF THE COVER TO MAKE SURE THAT THE PACKING IS NOT CUT DURING INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN-FLIGHT SHUTDOWN.

(46) Install the No. 4 bearing cover as follows: See Figure 1222.

(a) Apply Engine Oil P03-001 fully to the new packing PN AS3209-378.

(b) Install the new packing into the groove at the rear flange of the No. 4 bearing cover.

(c) Install the cover into the rear inner flange of the exhaust case.

(d) Install 4 work bolts equally spaced around the cover.

(e) Tighten the bolts equally in small increments to pull the cover into position equally.

(f) Monitor the engagement of the cover to make sure the packing is not cut.

(g) Remove the work bolts.

(47) Install the No. 4 bearing heat shield and (outer) shield over the cover. Align the boltholes. Install the 30 bolts, lubricated with Engine Oil P03-001. Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). See Figure 1223.

(48) (Post SB PW4ENG 79-76) Install No. 4 bearing (oil) pressure tube. See Figure 1224.

(a) Remove protective cover from adapter (1224/5).

NOTE: The No. 4 bearing (oil) pressure tube of (Pre SB PW4ENG 79-76) would not have been removed for split-shipment.

(b) No. 4 bearing pressure tube option to prevent possible wear to the No. 4 bearing pressure tube (1224/14), a fiberglass tape wear Wrap P05-136, (1224/17) is provided as an option.

(c) Install the shield set (1224/15) and the heat shield insulation slide clamp (1224/16) on the elliptical section of the No. 4 scavenge tube (1224/14).

NOTE: The shield is installed on the section of the tube that goes through the strut of the turbine exhaust case.

(d) Install the shield set (1224/7) on the No. 4 pressure tube as follows.

1 Place the two halves over the round section of tube.

2 Install one restraining strap (1224/18) through the loops on the section of the shield that overlaps the shield set (1224/15).

3 Make tight the shield set on the tube by pulling the strap tight. Cut off excess strap material.

4 Put the loop clamp (1224/10) on the wear sleeve of the shield set and secure temporarily with a work bolt and nut.

(e) Attach bracket (1224/11) to the turbine exhaust case with two bolts (1224/8). Torque the bolts to 75 - 85 lb-in. (8.474 - 9.604 N.m).

(f) Install the No. 4 pressure tube through the strut at the 4:30 o'clock position.

1 Attach the tube nut to the adapter (1224/5), handtight.

NOTE: The shield may be separated to attach the tube nut to the adapter.

2 Remove the work bolt and replace with bolt (1224/9) and nut (1224/12) and attach to the bracket (1224/11).

3 Torque the tube nut to the adapter (1224/5) to 225 - 250 lb-in. (25.422 - 28.246 N.m). Safety the tube nut with lockwire.

4 Torque the bolt (1224/9) that attaches the clamp (1224/10) to the bracket (1224/11) to 32 - 36 lb-in. (3.616 - 4.067 N.m).

5 Install the four additional straps (1224/18) to hold the shield in place.

6 Make tight the shield set on the tube by pulling the straps tight. Cut off excess strap material.

7 Install bracket (1224/2) over the outboard end of the tube.

8 Position the nut (1224/4) on the outboard end of the tube and secure the nut to the tube with thrust wire (1224/19).

9 Attach the tube shield (1224/3) to the turbine exhaust case at the 4:30 o'clock position, pushing it on over the nut (1224/4). Line up the shield with the bracket (1224/2).

10 Install two bolts (1224/1) to retain shield and bracket and torque to 32 - 36 lb-in. (3.616 - 4.067 N.m). Safety the bolts with lockwire.

(49) Airflow check No. 4 bearing oil nozzle. See Figure 1225.

(a) Secure PWA 85501 Adapter to No. 4 bearing pressure tube located on outside of exhaust case at 10 o'clock position.

(b) Secure air inlet hose from CTE 5070 Airflow Cart or CTE 6070 to larger threaded hole of adapter.

(c) Secure pressure sensing line to remaining threaded hole on side of adapter.

(d) Airflow check nozzle at 10 psig (68.9 kPa). Airflow rate must be 6 - 20 lb/hr (2.72 - 9.07 kg/hr) for engines (Pre and Post SB PW4ENG 72-472).

(e) After airflow rate limits have been met, remove adapter and airflow cart from exhaust case.

(f) Make sure that the oil passage is not blocked.

(50) Move the gearbox driveshaft forward and engage the splines of the angle gearbox drive-coupling. Install the retaining ring to the ring groove in the angle gearbox. Be sure that the retaining ring is installed all the way in the groove. See Figure 1208 (Sheet 2).

(51) Move the gearbox driveshaft housing forward with the packings installed before. Align the housing with the angle gearbox. Install the two HPC case brackets with the four bolts, lubricated with Engine Oil P03-001 and tighten by hand. Install the six bolts, threads
R lubricated with Anti-Seize Paste P06-054, washers and
R nuts that attach the brackets and the driveshaft
R housing to the angle gearbox. Remove the unwanted
R paste. Ignore the washers against the brackets.
Torque the housing bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m). Torque the HPC bracket bolts to the HPC to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(52) Torque any clamp bolts that were loosened for access to the angle gearbox to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(53) Install the following parts to the bottom of the core-unit that were removed for shipping clearance. See Figure 1226.

(a) Remove the protection covers and install the pylon drain mast to the Flange P bracket. See Figure 1226 (Sheet 1). Attach the mast with two bolts, lubricated with Engine Oil P03-001, washers, and nuts. Torque the bolts to 50 - 70 lb-in. (5.649 - 7.909 N.m). Attach the drain tube, threads lubricated with Engine Oil P03-001 to the mast. Torque the tube to 450 - 500 lb-in. (50.843 - 56.492 N.m).

(b) Remove the protection covers and install the (rear) deoiler vent duct, threads lubricated with Engine Oil P03-001, to the (front) duct. See Figure 1226 (Sheet 2). Attach the tube with the bolt, lubricated with Engine Oil P03-001, and washer. Tighten by hand. Torque the tube nut to 950 - 1050 lb-in. (107.336 - 118.634 N.m). Torque the bolt to 65 - 75 lb-in. (7.344 - 8.474 N.m).

NOTE: The end of the vent duct must align with the centerline of the thrust reverser doors.

(c) Install the new packing, PN M83248-1-906, to the IDG drain tube adapter. Install the IDG drain pad tube adapter, threads lubricated with Engine Oil P03-001, to the IDG drain pad. Torque the adapter to 250 - 300 lb-in. (28.246 - 33.895 N.m).

(d) Remove the protection covers from the drain manifold assembly and the drain tubes and adapters. See Figure 1226 (Sheet 3) and Figure 1226 (Sheet 4). Lubricate the tube adapter threads with Engine Oil P03-001. Install the manifold assembly, with tubes attached to the bottom of the gearbox. Attach the assembly to the gearbox with three bolts, lubricated with Engine Oil P03-001, and washers. Torque the bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m). Attach the tubes to the closest connector above the assembly and tighten by hand. Install the clamp bolts, threads lubricated with Engine Oil P03-001, and washers and attach the drain tube clamps to the gearbox brackets. Torque the clamp bolts to 20 - 25 lb-in. (2.260 - 2.825 N.m). Torque the drain tube nuts to 300 lb-in. (33.895 N.m).

(e) Remove the protection covers from the starter shutoff valve and ducts. See Figure 1226 (Sheet 5). Install a new seal, PN 2873-400, between the intermediate duct and the lower duct. Install the new seal, PN A0863, between the starter and the lower forward duct. Lubricate the inside surface of the two couplings with Dry Solid Lubricant P06-013. Hold the shutoff valve and ducts (as a unit) in position and install the couplings. Tighten the couplings enough to hold the unit in position. Hit the perimeter of the clamps lightly with a plastic mallet while you torque the coupling nut to 120 lb-in. (13.558 N.m). Do this torque procedure again until the torque holds. Attach the two support link assemblies to the flange brackets with bushings, bolts, lubricated with Engine Oil P03-001, washers, and nuts. Torque the nuts to 50 - 70 lb-in. (5.649 - 7.909 N.m). Install the clamps that attach the harnesses to the valve. Install the cooling air hose to the top of the valve.

(f) Remove the protection covers and connect the harness connector to the starter valve receptacle. Tighten the connector by hand. Install the clamp bolts that attach the harness to the No. 4 bearing scavenge tube. Torque the clamp bolts to 32 - 36 lb-in. (3.616 - 4.067 N.m).

(54) Connect the EEC PB sensing tubes (AS19) at 12:30 o'clock position as follows. See Figure 1227.

(a) Do not lubricate the tube threads.

(b) Tighten and torque the tube nut to 135 - 150 lb-in. (15.253 - 16.948 N.m).

(c) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(55) Connect the HPC air valve supply tube (AA25) and signal tube (AA01) to the solenoid adapters at 1 o'clock position as follows.

R (a) Apply Anti-Seize Paste P06-054 to the threads of
R the two solenoid tube adapters. Remove the
R unwanted paste.

(b) Tighten and torque the supply tube nut (larger) to 225 - 250 lb-in. (25.422 - 28.246 N.m).

(c) Tighten and torque the signal tube nut (smaller) to 200 - 225 lb-in. (22.597 - 25.422 N.m).

(d) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(56) Connect the No. 3 bearing air cooler tubes (AP33) and (AP34) to the cooler at 2:30 o'clock position as follows.

(a) Apply Antigalling Compound P06-021 to the threads of both air cooler adapters.

(b) Tighten and torque both tube nuts to 825 - 900 lb-in. (93.212 - 106.686 N.m).

(c) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(57) For engines with PMUX or SCU, install the PT2.5 sensing tube (AS30) and manifold (AS31) as follows. See Figure 1227 (Sheet 2).

(a) Remove the protective covers.

(b) Do not lubricate the tube threads.

(c) Install the upper tube to the tube coupling at 1 o'clock position adjacent to the solenoid.

(d) Install the lower manifold to the upper tube.

(e) Install the six clamp bolts, lubricated with Engine Oil P03-001, and nut that attach the tube and manifold to the brackets. Torque the clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(f) Torque the upper tube nut to the tube coupling at 1 o'clock position to 135 - 150 lb-in. (15.253 - 16.948 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(g) Torque the upper tube to the lower manifold at 4 o'clock position to 135 - 150 lb-in. (15.253 - 16.948 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(58) Install the three bleed valve supply tubes (AA26), (AA27), and (AA29) as follows. See Figure 1227 (Sheet 3) and Figure 1227 (Sheet 4).

(a) Remove the protective covers.

R (b) Lubricate all the tube nut and coupling threads
R with Anti-Seize Paste P06-054. Remove the
R unwanted paste.

(c) Install the inboard tube (supply) to the upper tube nut at 2 o'clock position and to the solenoid adapter at 5 o'clock position. Attach the tube nut to the tube tee adjacent to the solenoid.

(d) Install the middle tube (left supply) to the tube coupling at 2 o'clock position and to the tube coupling adjacent to the solenoid at 5 o'clock position.

(e) Install the outboard tube (right supply) to the tube nut at 2 o'clock position and to the solenoid adapter at 5 o'clock position.

(f) Install the clamp bolts, lubricated with Engine Oil P03-001, spacer, and nut, that attach the tubes to the brackets and to each other. Torque the clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(g) Torque the lower tube nut of the inboard tube to the larger solenoid adapter to 225 - 250 lb-in. (25.422 - 28.246 N.m). Torque all of the remaining tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to all the tube nuts.

(59) Install the fuel distribution valve supply tube (FM09) as follows. See Figure 1227 (Sheet 5) and Figure 1227 (Sheet 6).

(a) Remove the protective covers.

(b) Install the two packings, PN 227433, lubricated with White Petrolatum P06−002, and retainers PN 354120.

(c) Install the tube to fuel flowmeter and to the fuel metering unit. Tighten by hand.

(d) Install the clamp bolts, lubricated with Engine Oil P03−001, and attach the clamps to the HPC case brackets. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque the tube nuts to 100 − 110 lb−in. (11.298 − 12.428 N.m). Loosen the tube nuts and torque them again to the same limits. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(60) Install the hydraulic pressure manifold (CP05) and oil cooler inlet return manifold (CR01) as follows. See Figure 1227 (Sheet 7).

(a) Remove the protective covers.

R (b) Lubricate all the manifold coupling and tube nut
R threads with Anti−Seize Paste P06−054. Remove the
R unwanted paste.

(c) Install the two manifolds to the two hoses at 3 o'clock position and to the manifolds at 5 o'clock position.

(d) Install the clamp bolts, lubricated with Engine Oil P03−001, and nut, that attach the manifolds to the engine brackets. Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque the return manifold nuts (smaller) at each end to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(f) Torque the pressure manifold nuts (larger) at each end to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(61) Install the compressor stator cylinder hydraulic pressure tube (CP12) and return tube (CR03) as follows.

(a) Remove the protective covers.

R R R (b) Lubricate the tube nut threads of the two tubes with Anti-Seize Paste P06-054. Remove the unwanted paste.

(c) Install the two tubes to the manifold tees and the cylinder adapters.

(d) Install the two clamp bolts, lubricated with Engine Oil P03-001, that attach the tubes to the Flange E bracket. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque the return tube nuts (smaller) to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(f) Torque the pressure tube nuts (larger) to 225 - 250 lb-in. (25.422 - 28.246 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

CAUTION: MAKE SURE YOU CONNECT THE TUBES TO THE CORRECT CONNECTORS OR FAULT MESSAGES WILL BE GENERATED.

(62) Install the (IDG) air/oil cooler valve hydraulic pressure tube (CP13) and return tube (CR12) to the IDG heat exchanger at 4 o'clock position as follows. See Figure 1227 (Sheet 8).

(a) Remove the protection covers.

R R R R (b) Lubricate the (IDG) air/oil cooler valve hydraulic pressure and return tube nut threads with Anti-Seize Paste P06-054. Remove the unwanted paste.

(c) Install the two tubes to the manifold tees and heat exchanger adapters.

1 The CR12 tube is installed to the adapter that is furthest from the lower triangular pad on the exchanger. The CP13 tube is installed to the adapter that is closest to the lower triangular pad on the exchanger.

(d) (Reference 256) Torque the two forward tube nuts attached to the heat exchanger tube couplings to 140 - 160 lb-in. (15.818 - 18.078 N.m).

(e) Torque the return tube (CR12) (smaller nut) to the manifold tee to 200 - 225 lb-in. (22.597 - 25.422 N.m).

(f) Torque the pressure tube (CP13) (larger nut) to the manifold tee to 340 - 375 lb-in. (38.415 - 42.369 N.m).

(g) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to all the tube nuts.

(63) Install the (IDG) air/oil cooler valve drain tube as follows.

(a) Remove protection covers.

(b) Install the tube and cross tee to the IDG heat exchanger adapter and drain tubes rearward of Flange E.

(c) Torque the tube nuts to 300 lb-in. (33.895 N.m).

(64) Install the (upper) airframe (IDG) cooler tube (LS02) and the (lower) airframe (IDG) cooler oil tube (LS01) as follows.

(a) Remove protection covers.

(b) Install the new packing, PN M83248-2-116, lubricated with Engine Oil P03-001 to the flanged end of the upper tube.

(c) Install the tubes and tighten the tube nut on the (lower) tube handtight.

(d) Install the three bolts, lubricated with Engine Oil P03-001, and washers that attach the upper tube to the cooler. Torque the three bolts to 70 lb-in. (7.909 N.m).

(e) Install the clamp bolts, lubricated with Engine Oil P03-001, washers, and nuts that attach the tubes to the brackets. Torque the clamp bolts to 25 lb-in. (2.825 N.m).

(f) Torque the tube nut to 1000 lb−in. (112.985 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(65) Install the (upper) airframe IDG cooler outlet oil tube (LS03) as follows.

(a) Remove the protection covers.

(b) Install the packing, PN AS3209−116, lubricated with Engine Oil P03−001 to the packing groove at the flanged end of the tube.

R
R (c) Lubricate the tube nut threads with Anti−Seize Paste P06−054. Remove the unwanted paste.

CAUTION: BE SURE AND TORQUE THE LOWER TUBE NUT OF THE LOWER TUBE NEAR THE FUEL METERING UNIT.

(d) Install the tube with the three bolts, lubricated with Engine Oil P03−001 to the heat exchanger. Tighten the tube nut by hand. Torque the three bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Torque the two tube nuts to 675 − 750 lb−in. (76.265 − 84.739 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292. Install and torque the clamps, and clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(66) Connect the angle gearbox oil pressure tube (LP09) to the angle gearbox at 6 o'clock position as follows. See Figure 1227 (Sheet 9).

R
R
R (a) Apply Anti−Seize Paste P06−054 to the threads of the mating tube adapter on the angle gearbox. Remove the unwanted paste.

(b) Tighten and torque the tube nut to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(67) Connect the angle gearbox oil scavenge tube (LR01) to the angle gearbox at 6 o'clock position as follows.

(a) Remove protection covers. Install the new packing, PN AS3209-014 lubricated with Engine Oil P03-001, to the groove at the flanged end.

(b) Engage the flanged end into the angle gearbox boss. Install the two bolts, lubricated with Engine Oil P03-001. Tighten and torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(c) Install and torque all the clamp bolts that attach the tube to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(68) Install the 2.5 bleed valve cylinder hydraulic pressure tube (CP06), return tube (CR02), and drain tubes at 7 o'clock position as follows. See Figure 1227 (Sheet 10).

(a) Remove protection covers.

(b) Install the bleed valve cylinder drain tube to the forward adapter of the actuator and the drain tube tee. Install the clamp bolt, lubricated with Engine Oil P03-001, washer, and nut that attach the drain tube to the angle gearbox bracket. Torque the clamp bolt to 25 lb-in. (2.825 N.m). Torque all the drain tube nuts to 300 lb-in. (33.895 N.m).

(c) Apply Engine Oil P03-001 to the bleed valve cylinder return tube nut threads (largest diameter tube).

(d) Install the tube. Tighten and torque the tube nuts to 270 - 300 lb-in. (30.506 - 33.895 N.m).

R (e) Apply Anti-Seize Paste P06-054 to the bleed valve
R cylinder hydraulic pressure tube nut threads
R (smaller diameter tube). Remove the unwanted
R paste.

(f) Install the tube. Tighten and torque the tube nuts to 225 - 250 lb-in. (25.422 - 28.246 N.m).

(g) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to both tubes.

(69) Connect the No. 1, 1.5, and 2 bearing oil scavenge tube (LR03) at the 7:30 o'clock position as follows. See Figure 1227 (Sheet 11).

(a) Apply Engine Oil P03-001 to the tubes mating coupling threads.

(b) Tighten and torque the tube nut to 1300 - 1400 lb-in. (146.880 - 158.179 N.m).

(c) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(70) Connect the drain tube to the (left) air/oil heat exchanger as follows.

(a) Connect the drain tube to the inboard coupling at the air/oil heat exchanger. Tighten by hand.

(b) Torque the loose clamp bolts that attach the tube to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Torque the drain tube nuts to 257 - 283 lb-in. (29.037 - 31.975 N.m).

(71) Install the (left) air/oil cooler hydraulic pressure tube (CP07) and the return tube (CR05) as follows.

(a) Remove the protection covers.

R (b) Lubricate the tube nut threads of the pressure
R and return tubes with Anti-Seize Paste P06-054.
R Remove the unwanted paste.

(c) Install both tubes (longer staighter ends) to the heat exchanger adapters and to the manifold tees. Install the clamp bolt, lubricated with Engine Oil P03-001, that attaches the (CP07) tube to the Flange E bracket. Torque the clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Torque the return tube (CR05) and the pressure tube (CP07) forward tube nuts attached to the heat exchanger to 200 - 225 lb-in. (22.597 - 25.422 N.m).

(e) Torque the return tube (CR05) (smaller nut) to the manifold tee to 200 - 225 lb-in. (22.597 - 25.422 N.m).

(f) Torque the pressure tube (CP07) (larger nut) to the manifold tee to 225 - 250 lb-in. (25.422 - 28.246 N.m).

(g) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to all the tube nuts.

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(72) Install the (left) air/oil cooler outlet oil hose and tube assembly (LP03) as follows. See Figure 1227 (Sheet 12).

(a) Remove the protection covers.

(b) Apply wet Zinc Chromate Primer P18-003 to the mating surface of the flange end. Do not apply any primer to the raised portion near the packing groove. Let it air dry for 10 minutes before assembly.

(c) Install the new packing, PN AS3209-217 lubricated with Engine Oil P03-001, to the packing groove at the flanged end.

(d) Install the new packing, PN 414121 lubricated with Engine Oil P03-001, and retainer, PN 354122, to the nut end of the tube.

(e) Lubricate the tube nut threads with Antigalling Compound P06-021 and install the tube to the fuel/oil cooler bypass valve and the air/oil heat exchanger.

(f) Attach the flanged end with the two inboard bolts, lubricated with Engine Oil P03-001. Tighten by hand.

(g) Install the clamp bolt, lubricated with Engine Oil P03−001, that attaches the tube to the HPC case bracket. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(h) Torque the tube nut to 200 − 220 lb−in. (22.597 − 24.857 N.m). Loosen the tube nut and torque it again to the same limit. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

NOTE: Torque the bolts at the forward end with the installation of the oil inlet tube.

(73) Install the (left) air/oil cooler inlet oil tube (LP02) as follows.

(a) Remove the protection covers.

(b) Install the two new packings, PN AS3209−217 lubricated with Engine Oil P03−001, to the tube ends.

(c) Install the tube to the heat exchanger and the main oil filter housing. Install the six bolts, lubricated with Engine Oil P03−001, that attach the tube.

(d) Install the bolt, lubricated with Engine Oil P03−001, and attaches the harness bracket to the tube. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque the eight bolts that attach the two tube flanges to the heat exchanger and the one tube flange to the main oil filter housing to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Install the drain tube and elbow to the front of the fuel/oil cooler and to the oil cooler bypass valve. Torque the tube nuts to 257 − 283 lb−in. (29.037 − 31.975 N.m).

(74) Install the main bearing oil pressure tube (LP05) to the last−chance strainer housing at 9 o'clock position as follows. See Figure 1227 (Sheet 13).

(a) Remove the protection cover.

(b) Install the new packing, PN 389114 lubricated with Engine Oil P03-001, and retainer, PN 354118, to the tube.

R (c) Lubricate the tube nut threads with Anti-Seize Paste P06-054. Remove the unwanted paste.

(d) Install the tube to the strainer housing adjacent to Flange E and above the fuel/oil cooler.

(e) Install the two clamp bolts, lubricated with Engine Oil P03-001, that attach the tube and the strainer housing to Flange E. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(f) Torque the forward tube nut to 675 - 750 lb-in. (76.265 - 84.739 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(g) Torque the rear tube nut to 140 - 160 lb-in. (15.818 - 18.078 N.m). Loosen the tube nut and torque it again to the same limits. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(75) Connect the HPC air valve and air shutoff valve supply tube (AA22) and the signal tubes (AA06) and (AA18) to the solenoid at 10 o'clock position as follows.

R (a) Apply Anti-Seize Paste P06-054 to the adapter threads on the solenoid. Remove the unwanted paste.

(b) Tighten and torque the (largest diameter) supply tube nut to 225 - 250 lb-in. (25.422 - 28.246 N.m).

(c) Tighten and torque the two (smaller diameter) signal tubes to 200 - 225 lb-in. (22.597 - 25.422 N.m).

(d) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(76) Install the cooling air hose to the HPC air valve cooling air tube (AC35) at 10:30 o'clock position as follows.

(a) Remove the protection cover.

(b) Install the hose over the tube.

(c) Install the hose clamp over the hose.

(d) Tighten the hose clamp by hand plus one turn.

(77) Install the main bearing breather tube (LB06) at 11:30 o'clock position as follows. See Figure 1227 (Sheet 14).

R (a) Apply Anti-Seize Paste P06-054 to the tube
R threads. Remove the unwanted paste.

(b) Install the tube and tighten the tube nuts by hand.

(c) Install the clamps and clamp bolts. Torque the clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Tighten and torque the tube nuts to 1150 - 1300 lb-in. (129.933 - 146.880 N.m).

(e) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(78) Connect the EEC PT4.95 tube (AS04) at 11:30 o'clock position as follows.

(a) Do not lubricate tube threads.

(b) Tighten and torque the tube nut to 270 - 300 lb-in. (30.506 - 33.895 N.m).

(c) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

CAUTION: SEE 72-00-00, INSTALLATION-00 FOR NECESSARY GENERAL INSTALLATION INSTRUCTIONS ABOUT THE WIRING HARNESSES, LEADS, AND CABLES.

CAUTION: DO NOT TWIST OR BEND THE HARNESSES BADLY DURING THE INSTALLATION OR DAMAGE TO THE HARNESSES CAN RESULT.

CAUTION: EXAMINE THE HARNESS CONNECTORS AND THE RECEPTACLES FOR BENT PINS AND CONTAMINATION.

CAREFULLY MAKE STRAIGHT ANY BENT PINS AND CLEAN AS REQUIRED.

(79) Connect the W2 harness to the core-unit as follows. See Figure 1228.

(a) Remove the lockwire that attaches the W2 harness to the 12 o'clock strut. Adjust the harness in position. See Figure 1228 (Sheet 1).

(b) Connect the W2P26 harness connector to the HPC case bracket harness receptacle at 12 o'clock position as follows.

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11-009. Let dry.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG-70 Strap Wrench or the Glenair TG-69 Soft-Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight.
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts

are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(c) Attach the W2J9 harness receptacle to the HPC case bracket at 12 o'clock position. Install the retaining bracket and the two bolts, lubricated with Engine Oil P03-001. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Install the clamp bolts, lubricated with Engine Oil P03-001, spacer, and nuts that attach the W2 harness to the Flange E bracket and the No. 1, 1.5 and 2 bearing breather tube. Torque the bolts to 36 - 40 lb-in. (4.007 - 4.519 N.m).

(80) Connect the W1 harness to the core-unit as follows.

(a) Remove the lockwire that attaches the W1 harness to the 12 o'clock strut. Adjust the harness in position. See Figure 1228 (Sheet 3) and Figure 1228 (Sheet 4).

(b) Connect the W1 harness connectors:
- W1P25 connector to the receptacle on the HPC case bracket at 12 o'clock position
- W1P11 and W1P10 connector to the receptacles on the 1 o'clock position solenoid
- airframe harness connector to the override pressure switch receptacle at 1 o'clock position
- W1P24 connector to the receptacle on the HPC case bracket at 10 o'clock position
- W1P9 connector to the receptacle on the HPC case bracket at 12 o'clock position
- W1P12 connector to the receptacle on the 10 o'clock position solenoid as follows. For each connector:

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11-009. Let dry.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG-70Strap Wrench or the Glenair TG-69Soft-Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(c) Install the clamp bolts, lubricated with Engine Oil P03-001, and nuts that attach the W1 harness to the solenoid muscle tube and the Flange E bracket. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Install the clamp bolts, threads lubricated with Engine Oil P03-001, and nuts that attach the W1 harness to the HPC case brackets. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(81) Connect the harnesses as follows.

(a) Attach the IDG heat exchanger harness receptacle to the HPC case bracket at 4 o'clock position. See Figure 1221 (Sheet 5). Install the retaining bracket and the two bolts, lubricated with Engine Oil P03-001. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m). Install the clamp bolts, lubricated with Engine Oil P03-001, and nuts that attach the harness to the hydraulic tube. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(b) Attach the (engine) air/oil heat exchanger harness receptacle to the HPC case bracket at 7:30 o'clock position. See Figure 1221 (Sheet 8). Install the retaining bracket and the two bolts, lubricated with Engine Oil P03-001. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Connect the harness connectors:
- airframe harness connector to the IDG heat exchanger receptacle at 4 o'clock position
- W4P4 and W5P11 connector to the receptacles on the 5 o'clock position solenoid
- W3P15 connector to the receptacle on the 2.5 bleed valve actuator at 7 o'clock position
- W3P17 connector to the (engine) air/oil heat exchanger harness receptacle at 7:30 o'clock position
- W3P12 connector to the receptacle on the 10 o'clock position solenoid as follows. For each connector:

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11-009. Let dry.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG-70Strap Wrench or the Glenair TG-69Soft-Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(d) Put the large IDG cables in position at 9 o'clock position. Install the clamps, screws, washers, and nuts. Torque the nuts to 25 - 35 lb-in. (2.825 - 3.954 N.m).

(82) Install the EEC speed transducer (N1) with or without the multiplexer input as follows. See Figure 1229.

(a) Remove the protective covers. Install the two new packings, PN AS3209-215 lubricated with Engine Oil P03-001 to the transducer shaft grooves. Install one new packing, PN MS9386-039 lubricated with White Petrolatum P06-002 to the transducer flange groove.

(b) Install the shim (attached to the probe) in the machined recess on the end of the transducer probe.

CAUTION: INSTALL THE TRANSDUCER WITH THE LARGE ELECTRICAL CONNECTOR REARWARD AS SHOWN. DO NOT TURN THE TRANSDUCER DURING INSTALLATION OR DAMAGE TO THE TRANSDUCER OR ENGINE CAN RESULT.

(c) Install the transducer to the intermediate case as shown, at approximately 5 o'clock position.

(d) For engines with the No. 1 bearing vibration transducer cable bracket, install the bracket to the two forward halves. Attach the transducer as follows. See Figure 1229 (Sheet 2).

1 Lubricate the bolts with Engine Oil P03-001.

2 Install the bolts and washers (key washers for engines without self-locking inserts). Tighten the bolts evenly by hand.

NOTE: Use the longer bolts at the bracket location (if equipped).

NOTE: (Post SB PW4ENG 72-182) Install the drilled bolt into the mounting hole next to the PT2.5 connection on the transducer.

3 For engines with the locating stud (Post SB PW4ENG 73-88), install the key washer and nut, lubricated with Engine Oil P03-001. Tighten by hand.

4 Torque (as equipped)
- the bolts without the self-locking insert feature to 65 - 85 lb-in. (7.344 - 9.604 N.m).
- the bolts with the self-locking insert feature to 85 - 95 lb-in. (9.604 - 10.734 N.m).
- the nut on the locating stud to 150 - 170 lb-in. (16.948 - 19.207 N.m).

5 Bend the key washer tabs if equipped.

(e) If equipped, install the clamp and bolt, lubricated with Engine Oil P03-001, and attach the No. 1 bearing vibration transducer cable to the bracket. Torque the clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(f) For engines with the PMUX, install the PT2.5 sensing manifold to the probe at 5 o'clock position as follows.

1 Remove the protective covers.

2 Do not lubricate the tube threads.

3 Install the manifold. Tighten and torque the tube nuts to 135 - 150 lb-in. (15.253 - 16.948 N.m).

4 Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

NOTE: (Post SB PW4ENG 72-182) Safety the tube nut to the drilled transducer mount bolt.

(g) Connect the W4P19 and the W4P23 harness connectors to the transducer harness receptacles as follows. For each connector:

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11-009. Let dry.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(h) Install the clamp bolt, lubricated with Engine Oil P03−001, and nut that attach the W4 harness to the bleed valve supply tube adjacent to the 5 o'clock position solenoid. Torque the clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE OR INSTALL A LINER SEGMENT. THE WASHERS THAT ARE ATTACHED TO THE LINER BRACKET CAN BECOME DISCONNECTED.

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ALSO, IF THE EDGE OF THE LINER SEGMENT HITS SOMETHING, IT CAN DELAMINATE.

(83) Install the fan exit (inner) liner segment and the spacer plate to the fan case at 5 and 7 o'clock position. Attach with screws/bolts, lubricated with Engine Oil P03-001. Torque the screws/bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

NOTE: Screws are pre SB PW4ENG 72-107. Bolts are post SB PW4ENG 72-107.

NOTE: If the engine has acoustical liners, refer to 72-00-33, Installation-01 Task 72-00-33-420-001 for their installation.

(84) Install the forward anti-ice duct (tee), bottom anti-ice duct, and the oil tank overflow tube as follows. See Figure 1230.

(a) Remove the protection covers.

(b) Install the new seal, PN A0945, between the top and bottom ducts.

(c) Install the new seals, PN A0944 and PN 8757-250, to the forward anti-ice duct (tee).

(d) Lubricate the inside surface of the couplings with Solid Film Lubricant P06-013.

(e) Hold the ducts in position, with the seals installed, and install the couplings. Tighten the couplings only enough to hold the duct in position.

(f) Install the bolt, lubricated with Engine Oil P03-001, washer, and nut that attach the link to the duct. Torque the bolts to 50 - 70 lb-in. (5.649 - 7.909 N.m).

(g) Hit the perimeter of the couplings lightly while you torque the coupling nut to the value on the coupling. Do this torque procedure again until the torque holds.

(h) Torque the tube, threads lubricated with Engine Oil P03-001, to the adapter located on the top of the forward duct (tee) to 270 - 300 lb-in. (30.506 - 33.895 N.m).

(i) Remove the protection covers from the oil tank overflow tube. Lubricate the tube nut threads with Engine Oil P03-001.

(j) Install the tube to the tube connection adjacent to the front hydraulic pump. Tighten the tube by hand.

(k) Install the clamp bolts, lubricated with Engine Oil P03-001, washers, and nuts. Torque the clamp bolts to 20 - 25 lb-in. (2.260 - 2.825 N.m).

(l) Torque the tube nut to 300 lb-in. (33.895 N.m).

C. Postrequisites

(1) Install the forward engine mount. See the Airbus A300-600 Maintenance Manual, 71-21-01, Forward Engine Mount - Removal/Installation.

NOTE: The engine mount bolts must be examined before each installation. See the Airbus A300-600 Maintenance Manual, 71-21-00, Engine Mount Bolts - Inspection/Check.

(2) Install the exhaust plug cone. See the Airbus A300-600 Maintenance Manual, 78-11-02, Exhaust Plug Cone - Removal/Installation.

(3) Install the exhaust nozzle. See the Airbus A300-600 Maintenance Manual, 78-11-01, Exhaust Nozzle - Removal/Installation.

(4) Install the nose cowl. See the Airbus A300-600 Maintenance Manual, 71-11-00, Nose Cowl - Removal/Installation.

(5) Install the replacement power plant to the aircraft. See the Airbus A300-600 Maintenance Manual, 71-00-00, Power Plant - Removal/Installation.

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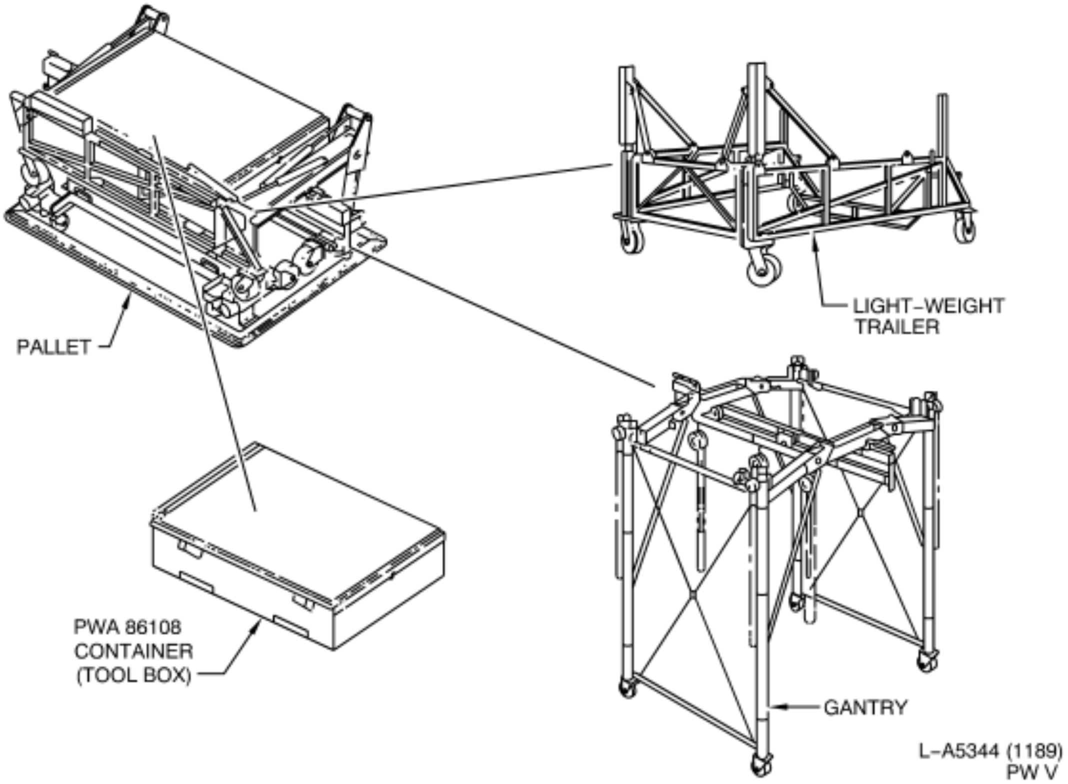
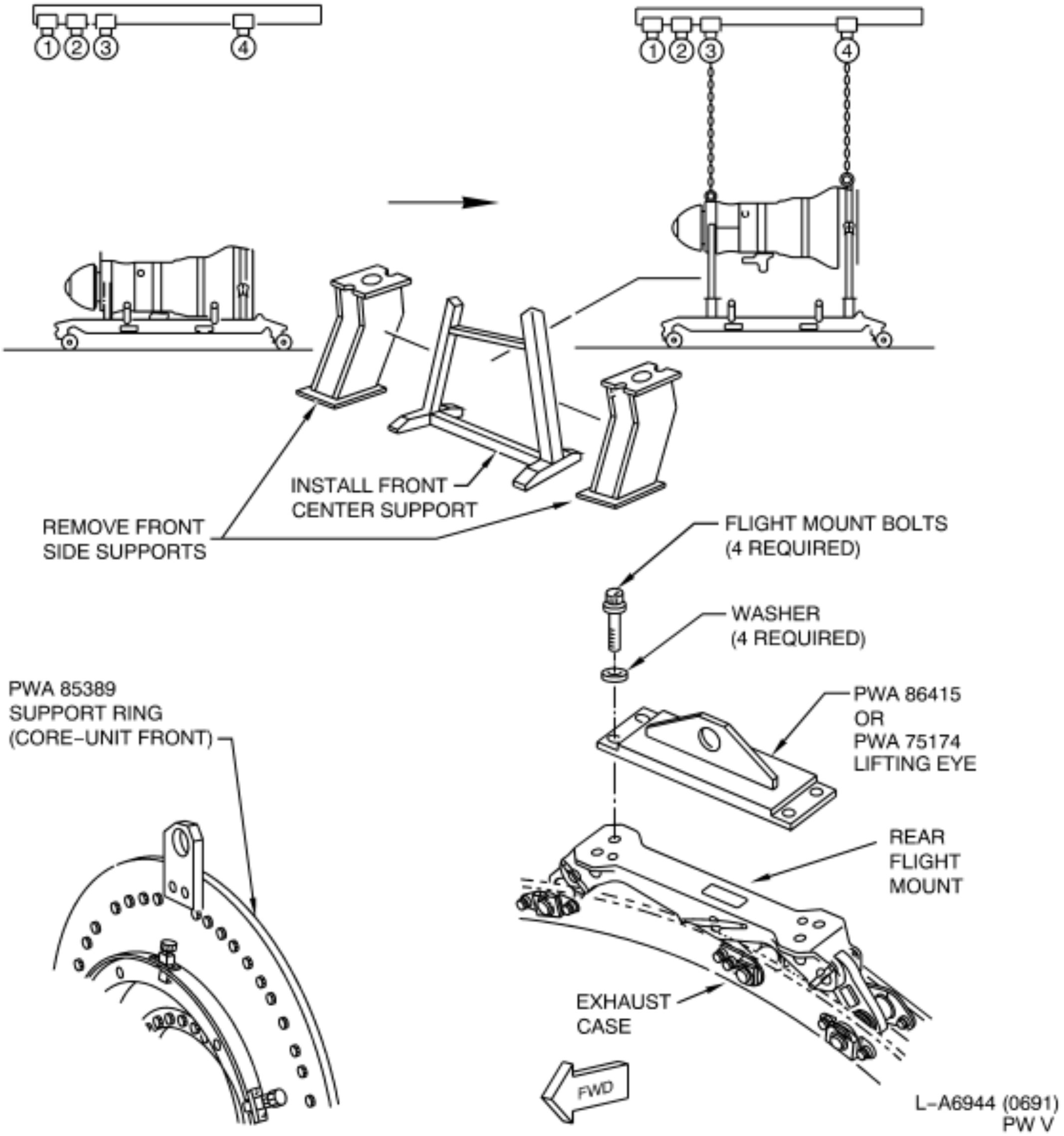
(6) Prepare (service) the replacement engine for power plant test and operation. See the Airbus A300−600 Maintenance Manual, 12−13−24, Servicing−02 − Replenish Or Fill IDG and 12−13−79, Servicing−02 − Fill The Engine Oil System.

(7) Test the replacement power plant. See the Airbus A300−600 Maintenance Manual, 71−00−00, Power Plant − Adjustment/Test. Do Test No. 2, 3, and 10 or 11 as applicable.

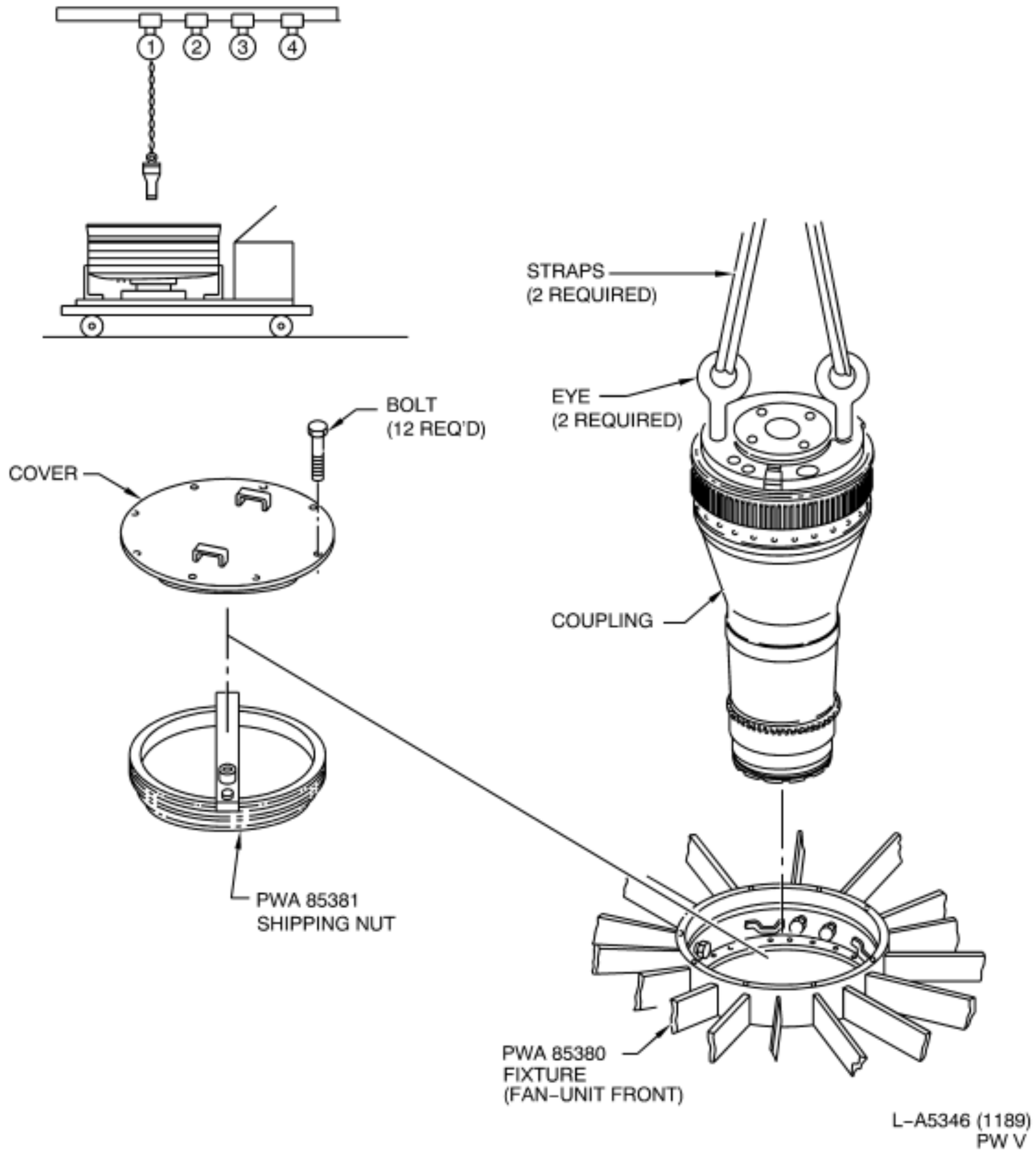

PALLET
LIGHT−WEIGHT TRAILER
PWA 86108 CONTAINER (TOOL BOX)
GANTRY
L−A5344 (1189)
PW V

Disassembly Of The First Pallet
Figure 1201
(Task 71−00−00−540−001)

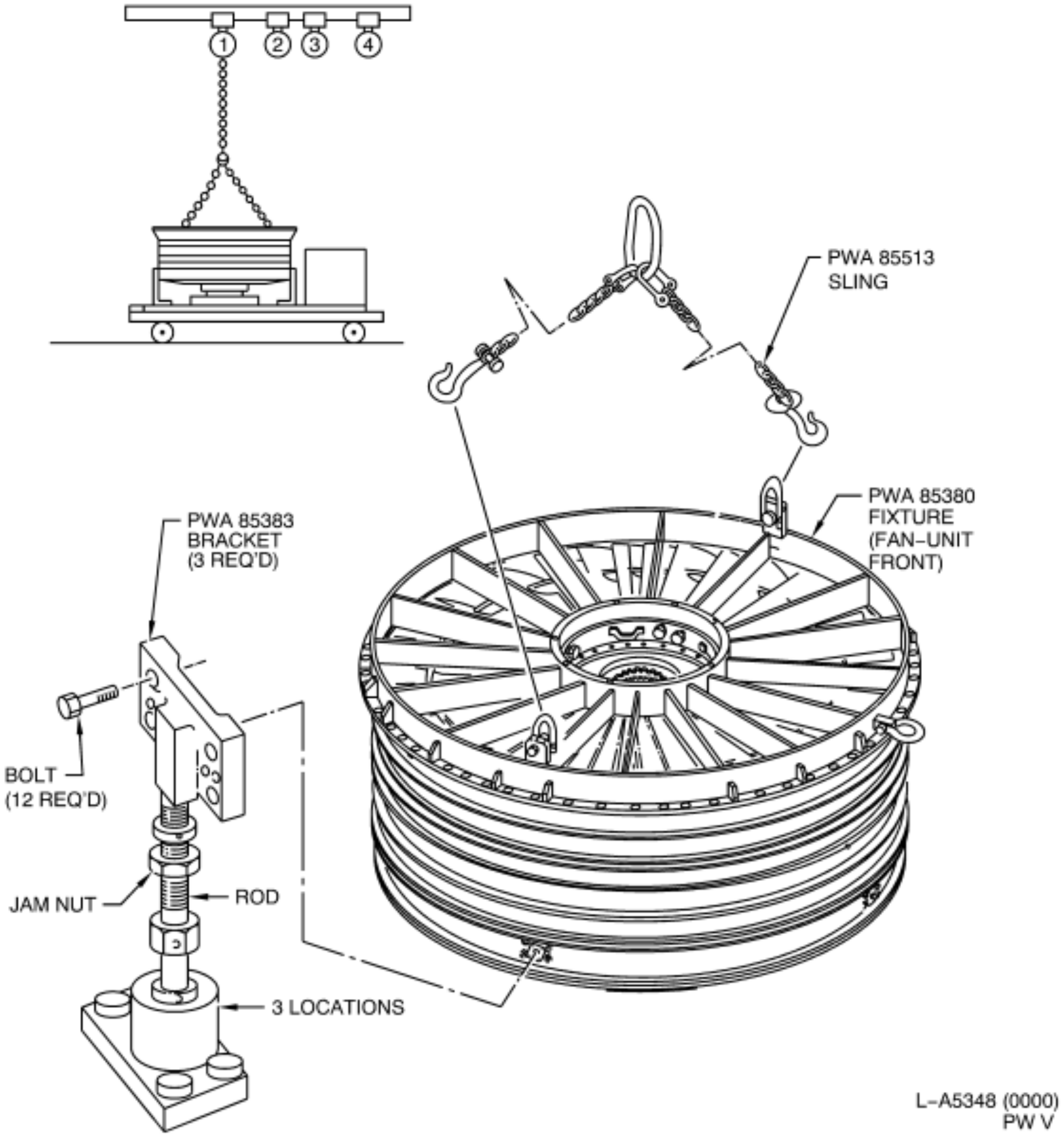
R
R


①
②
③
④
INSTALL FRONT CENTER SUPPORT
REMOVE FRONT SIDE SUPPORTS
FLIGHT MOUNT BOLTS (4 REQUIRED)
WASHER (4 REQUIRED)
PWA 85389 SUPPORT RING (CORE-UNIT FRONT)
PWA 86415 OR PWA 75174 LIFTING EYE
REAR FLIGHT MOUNT
EXHAUST CASE
FWD
L-A6944 (0691)
PW V

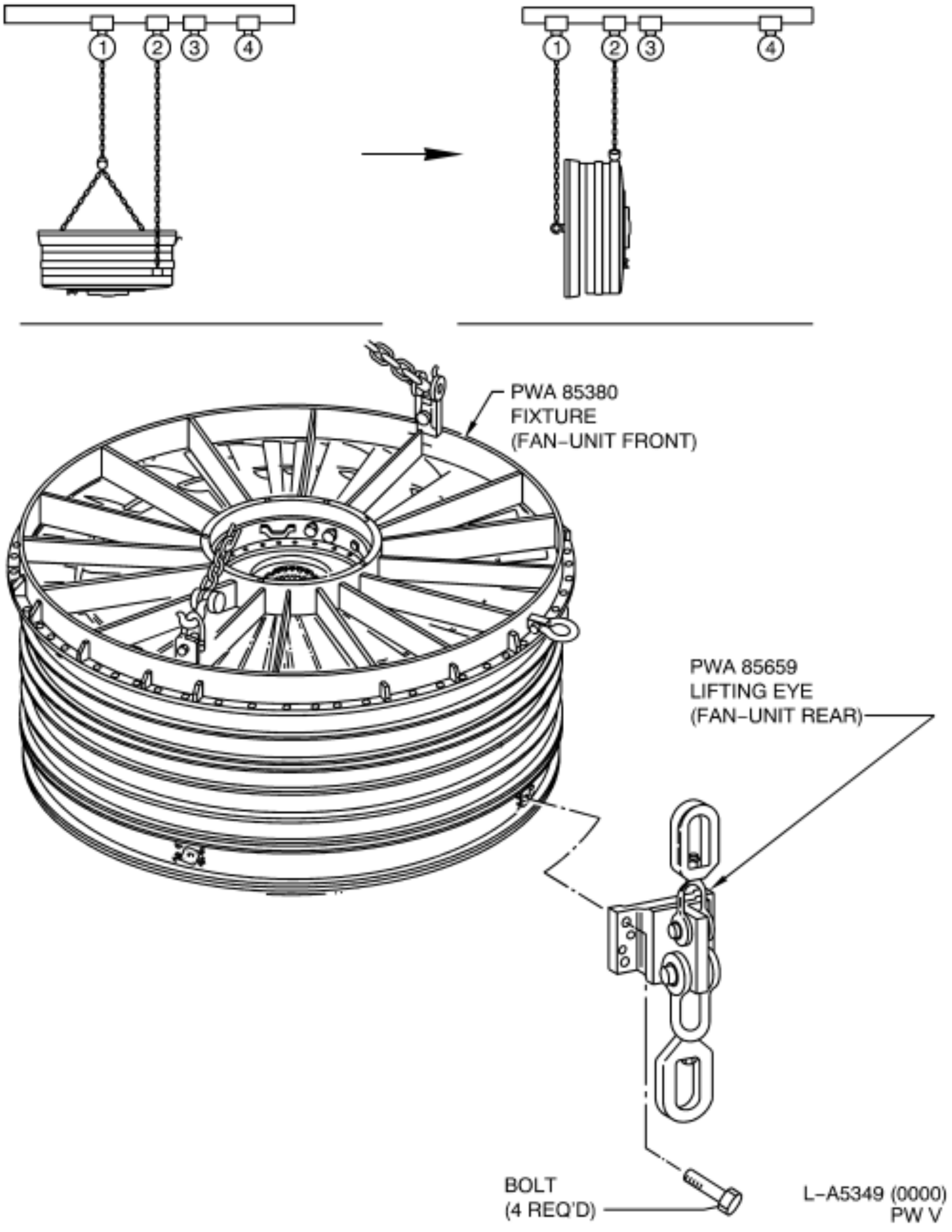
Movement Of The Core-Unit To Assembly Position
Figure 1202
(Task 71-00-00-540-001)


1
2
3
4
STRAPS
(2 REQUIRED)
BOLT
(12 REQ'D)
EYE
(2 REQUIRED)
COVER
COUPLING
PWA 85381
SHIPPING NUT
PWA 85380
FIXTURE
(FAN-UNIT FRONT)
L-A5346 (1189)
PW V

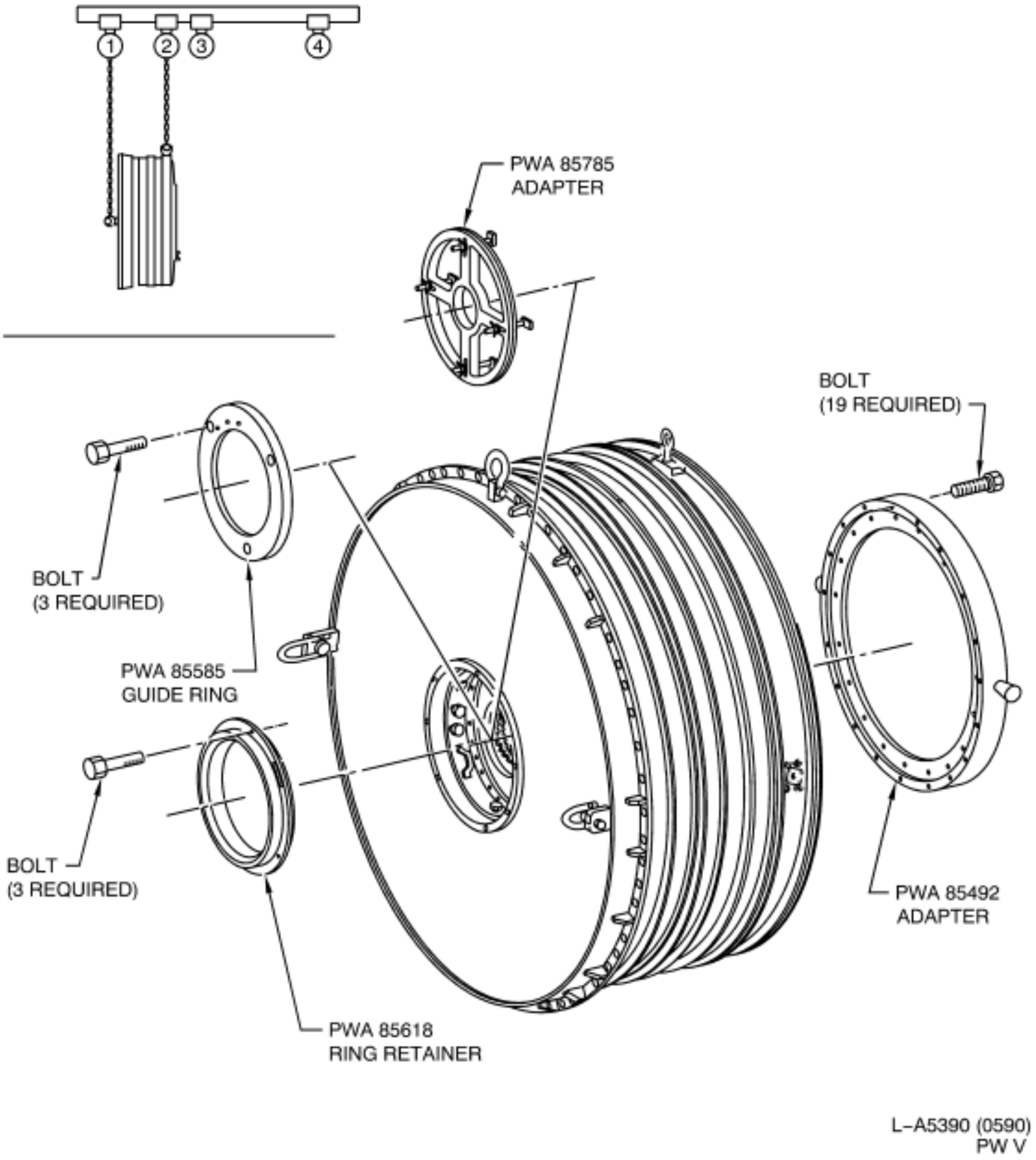
Removal Of The Coupling From The Fan-Unit
Figure 1203
(Task 71-00-00-540-001)


1
2
3
4
PWA 85513
SLING
PWA 85380
FIXTURE
(FAN−UNIT
FRONT)
PWA 85383
BRACKET
(3 REQ'D)
BOLT
(12 REQ'D)
JAM NUT
ROD
3 LOCATIONS
L−A5348 (0000)
PW V

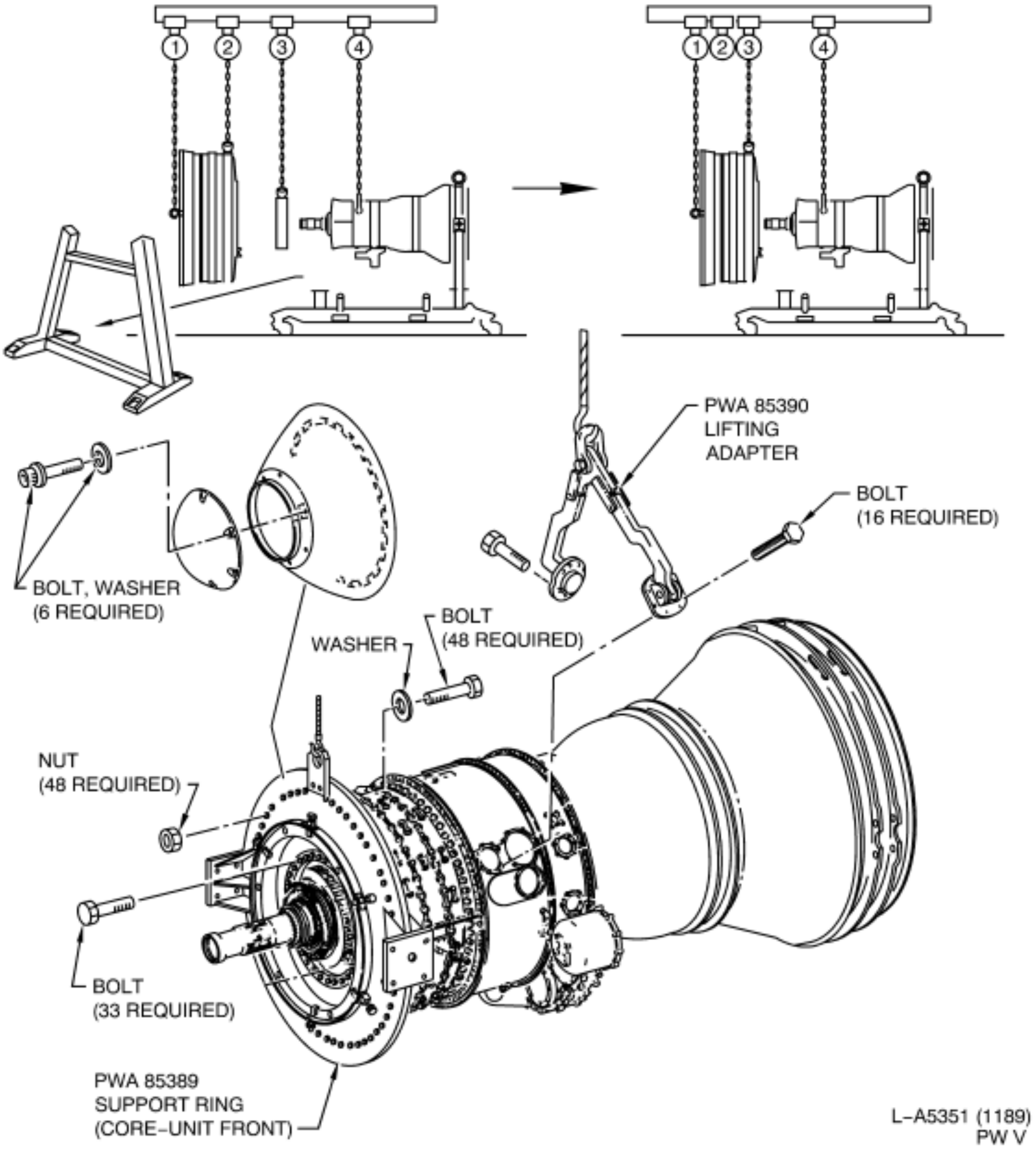
Removal Of The Fan−Unit From The Pallet
Figure 1204 (Sheet 1)
(Task 71−00−00−540−001)


1
2
3
4
1
2
3
4
PWA 85380
FIXTURE
(FAN-UNIT FRONT)
PWA 85659
LIFTING EYE
(FAN-UNIT REAR)
BOLT
(4 REQ'D)
L-A5349 (0000)
PW V

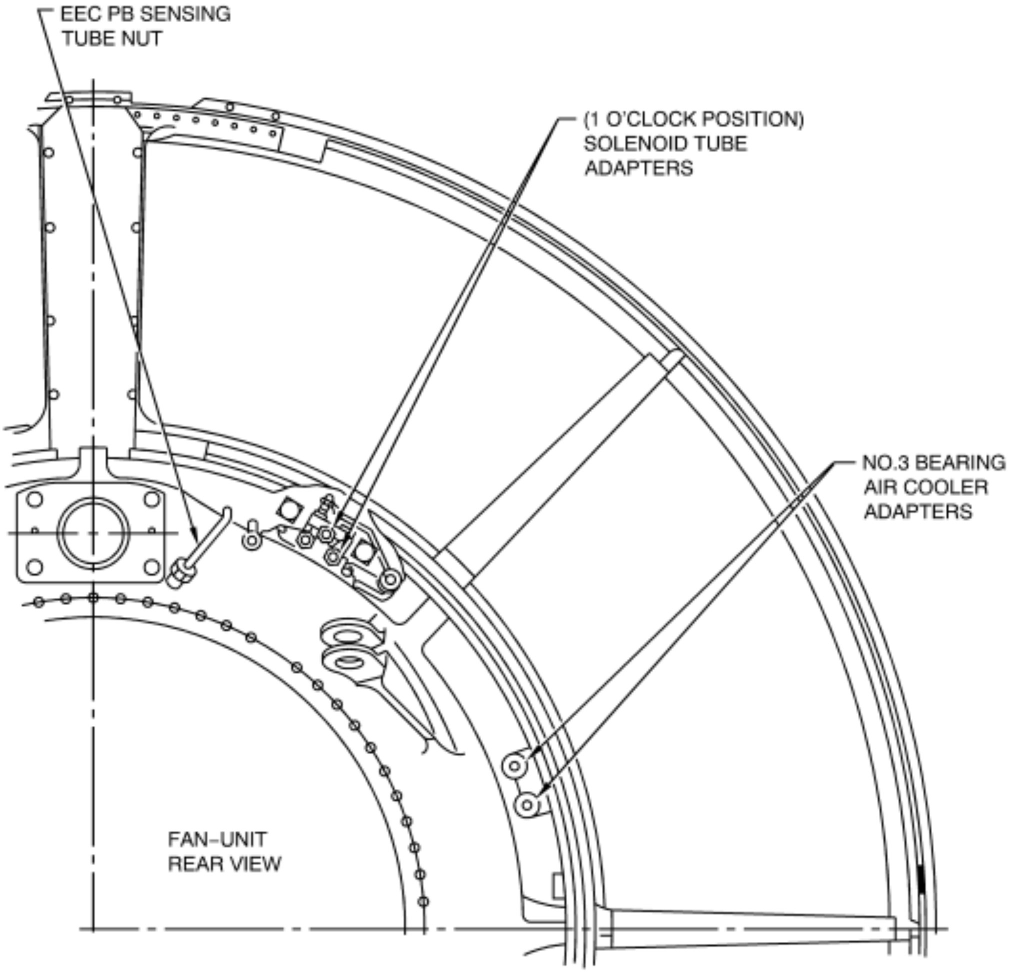
Removal Of The Fan-Unit From The Pallet
Figure 1204 (Sheet 2)
(Task 71-00-00-540-001)


1
2
3
4
PWA 85785
ADAPTER
BOLT
(19 REQUIRED)
BOLT
(3 REQUIRED)
PWA 85585
GUIDE RING
BOLT
(3 REQUIRED)
PWA 85492
ADAPTER
PWA 85618
RING RETAINER
L-A5390 (0590)
PW V

Removal And Installation Of The Fan-Unit Tools
Figure 1205
(Task 71-00-00-540-001)

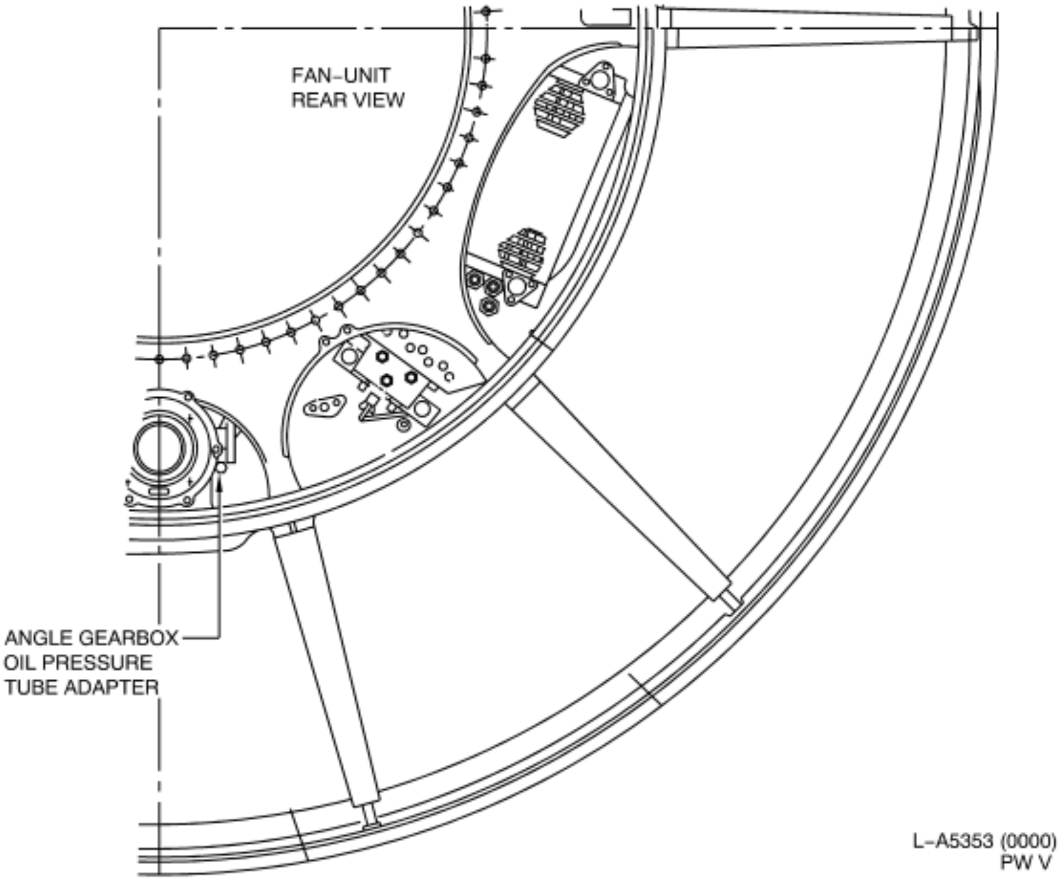

①
②
③
④
①
②
③
④
PWA 85390
LIFTING
ADAPTER
BOLT
(16 REQUIRED)
BOLT, WASHER
(6 REQUIRED)
WASHER
BOLT
(48 REQUIRED)
NUT
(48 REQUIRED)
BOLT
(33 REQUIRED)
PWA 85389
SUPPORT RING
(CORE-UNIT FRONT)
L-A5351 (1189)
PW V

Removal And Installation Of The Core-Unit Tools
Figure 1206
(Task 71-00-00-540-001)

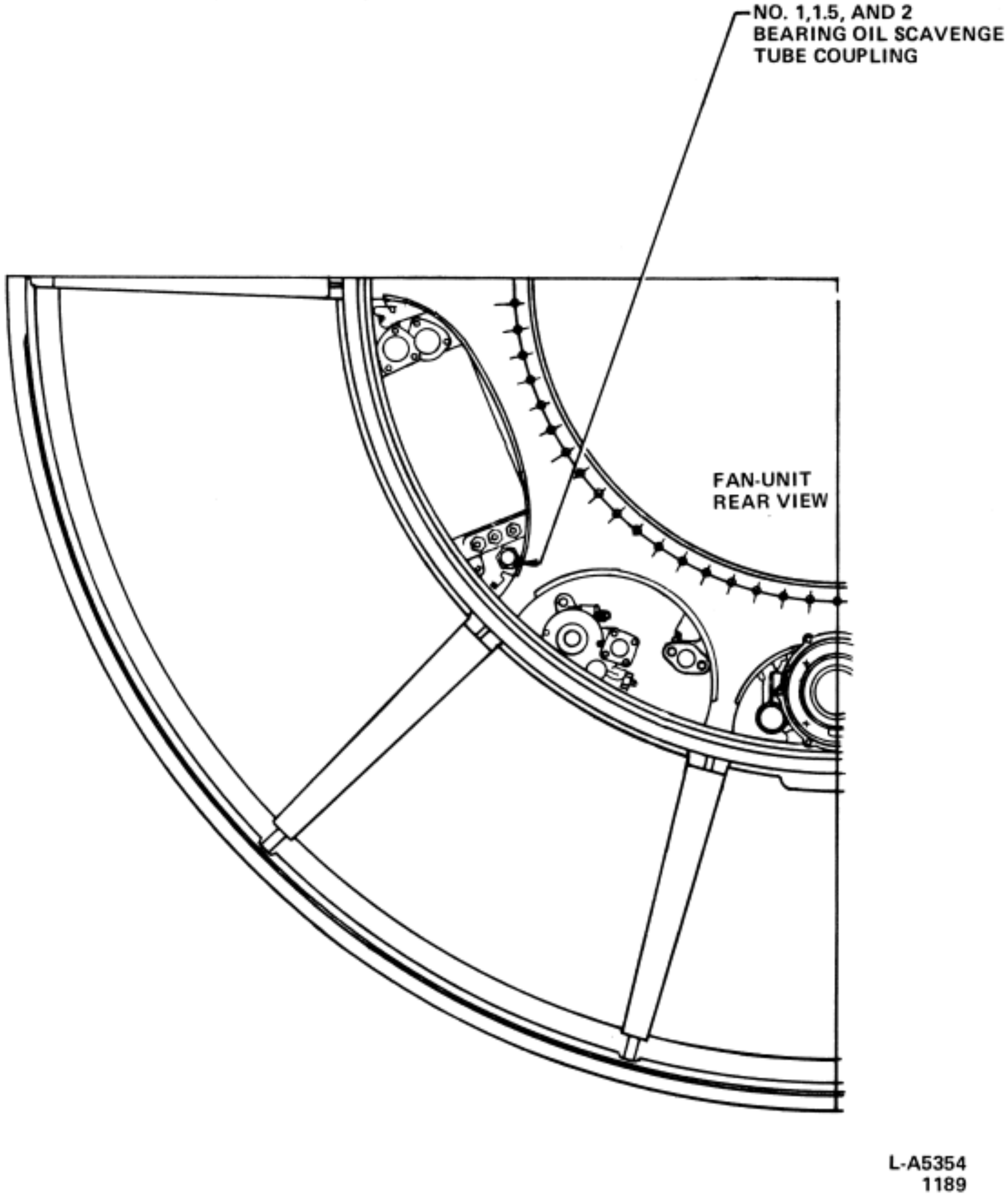

EEC PB SENSING TUBE NUT
(1 O'CLOCK POSITION) SOLENOID TUBE ADAPTERS
NO.3 BEARING AIR COOLER ADAPTERS
FAN−UNIT REAR VIEW

L−A5352 (0000)
PW V

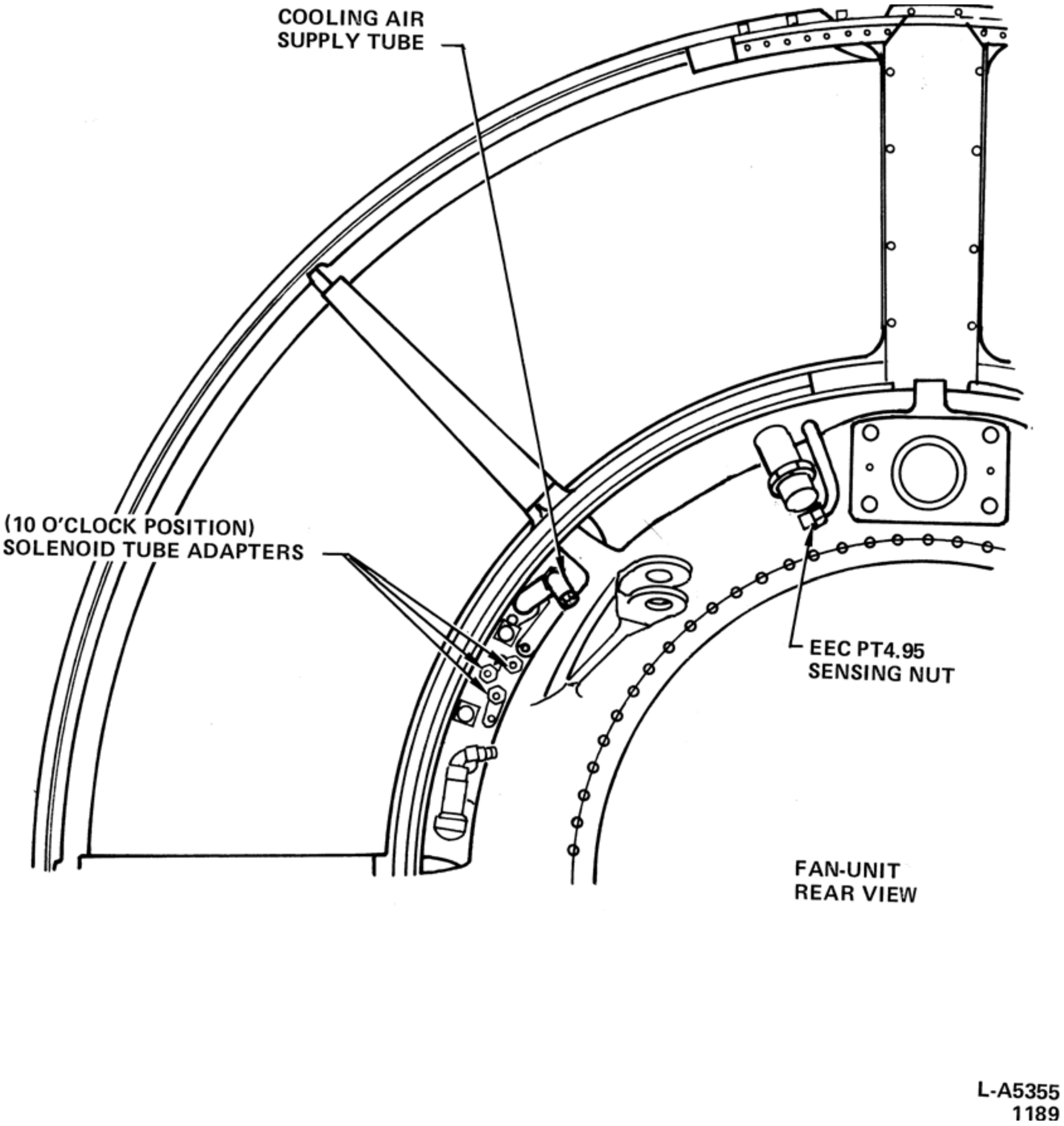
Preparation Of The Fan−Unit
Figure 1207 (Sheet 1)
(Task 71−00−00−540−001)


FAN−UNIT
REAR VIEW
ANGLE GEARBOX
OIL PRESSURE
TUBE ADAPTER
L−A5353 (0000)
PW V

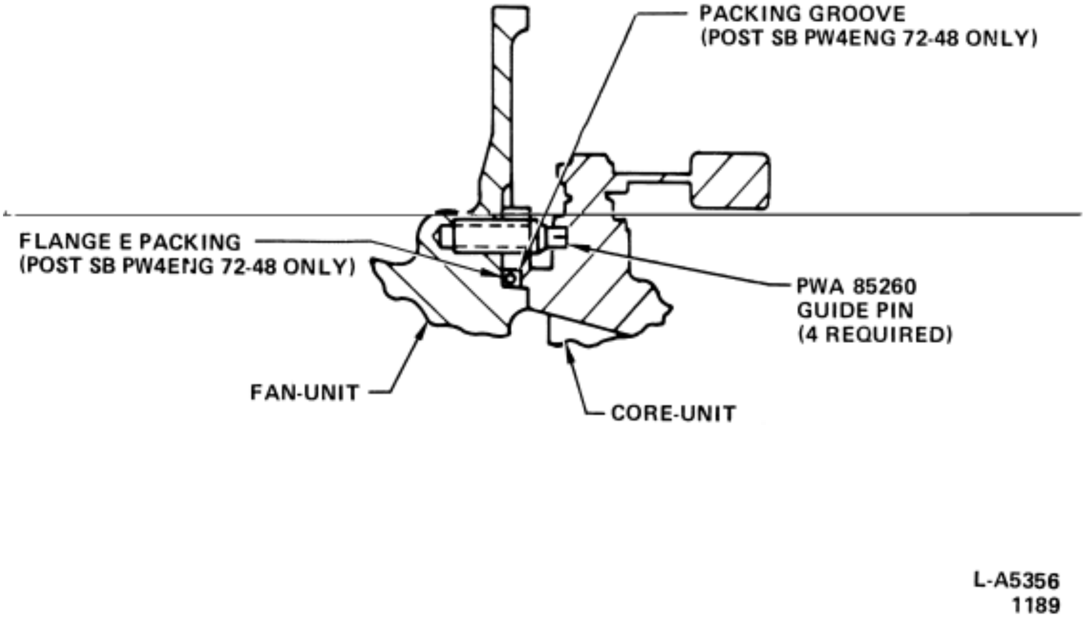
Preparation Of The Fan−Unit
Figure 1207 (Sheet 2)
(Task 71−00−00−540−001)


NO. 1,1.5, AND 2
BEARING OIL SCAVENGE
TUBE COUPLING
FAN-UNIT
REAR VIEW
L-A5354
1189

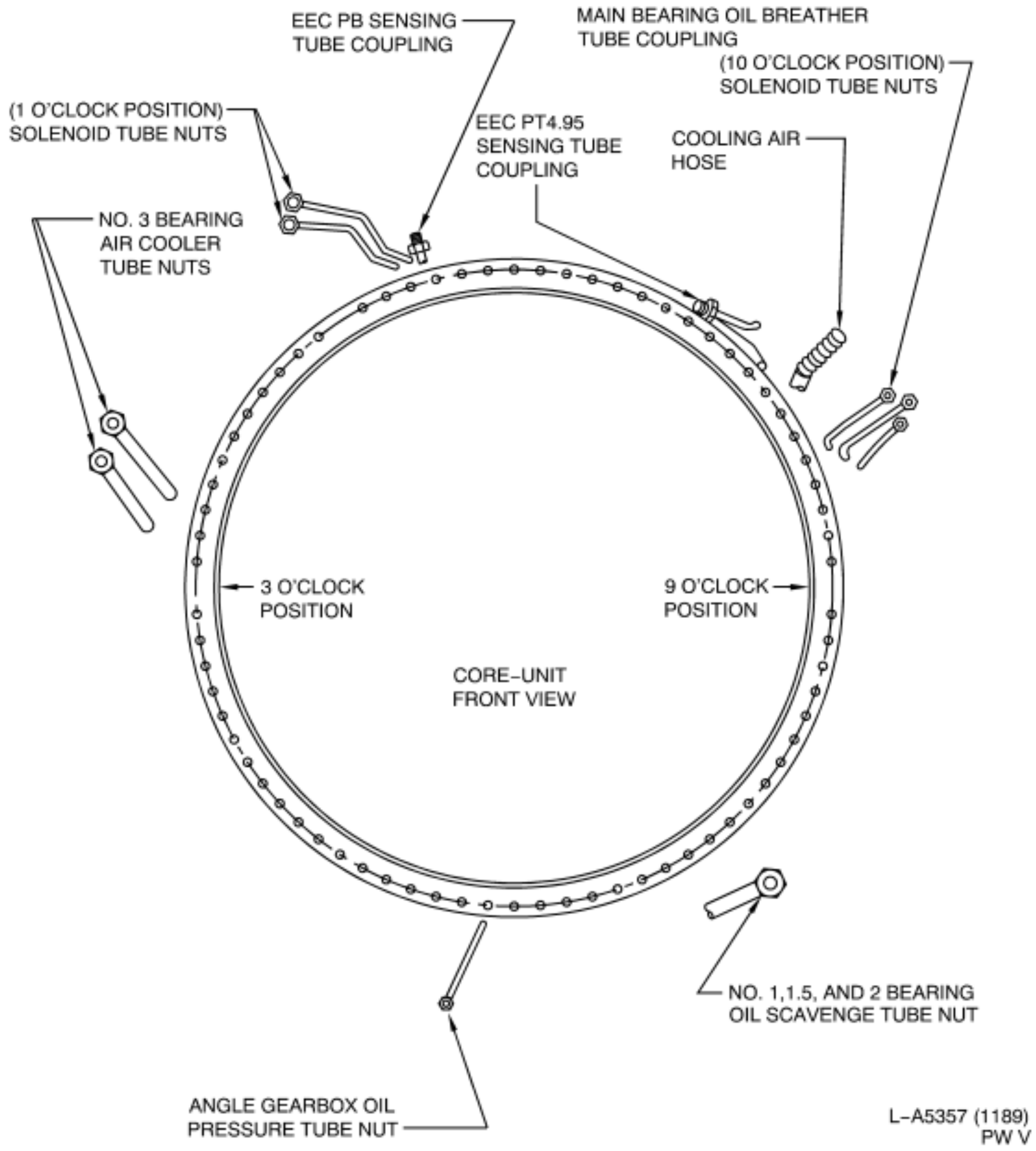
Preparation Of The Fan-Unit
Figure 1207 (Sheet 3)
(Task 71-00-00-540-001)


COOLING AIR SUPPLY TUBE
(10 O'CLOCK POSITION) SOLENOID TUBE ADAPTERS
EEC PT4.95 SENSING NUT
FAN-UNIT REAR VIEW
L-A5355
1189

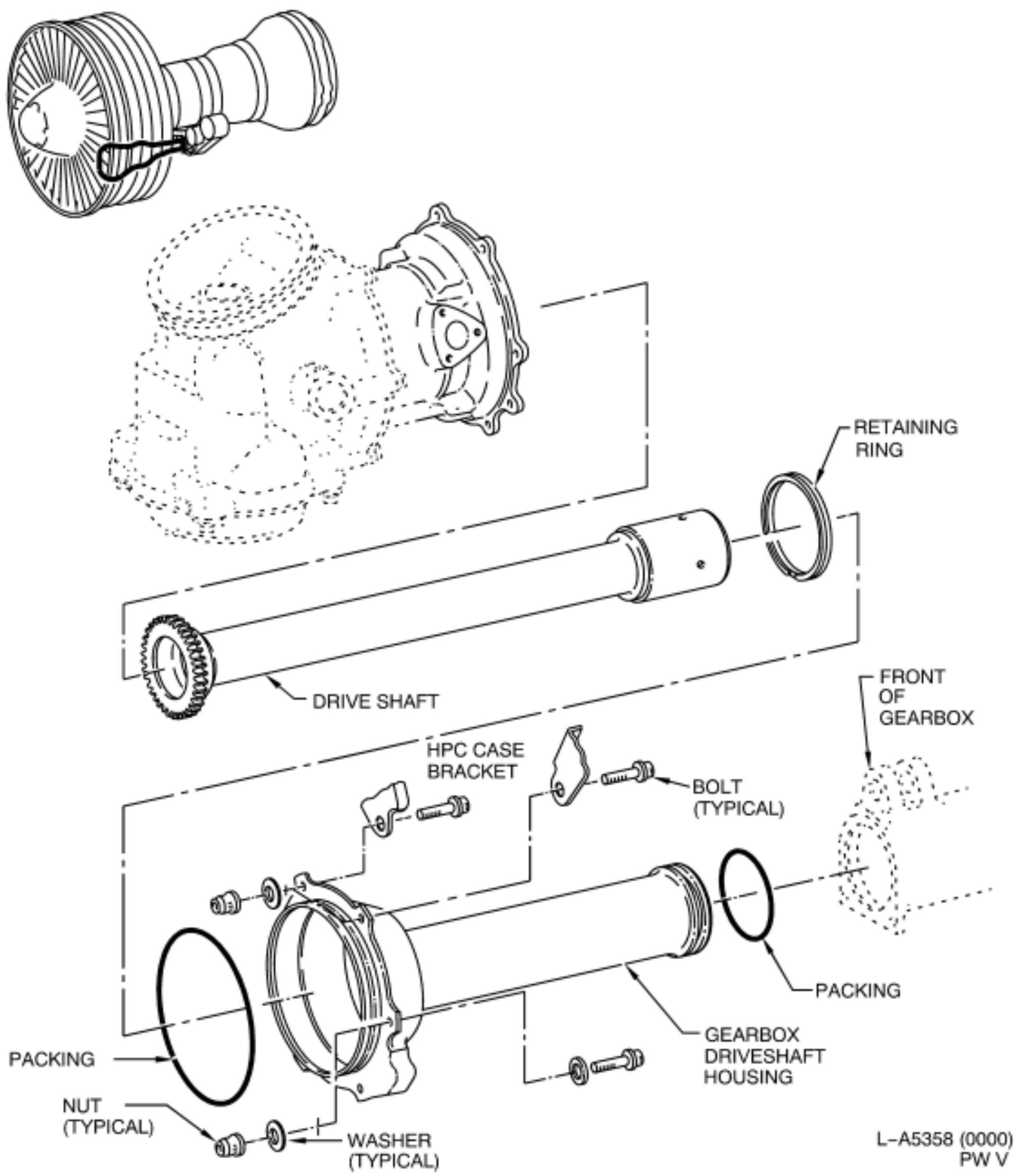
Preparation Of The Fan Unit
Figure 1207 (Sheet 4)
(Task 71−00−00−540−001)


PACKING GROOVE
(POST SB PW4ENG 72-48 ONLY)
FLANGE E PACKING
(POST SB PW4ENG 72-48 ONLY)
PWA 85260
GUIDE PIN
(4 REQUIRED)
FAN-UNIT
CORE-UNIT
L-A5356
1189

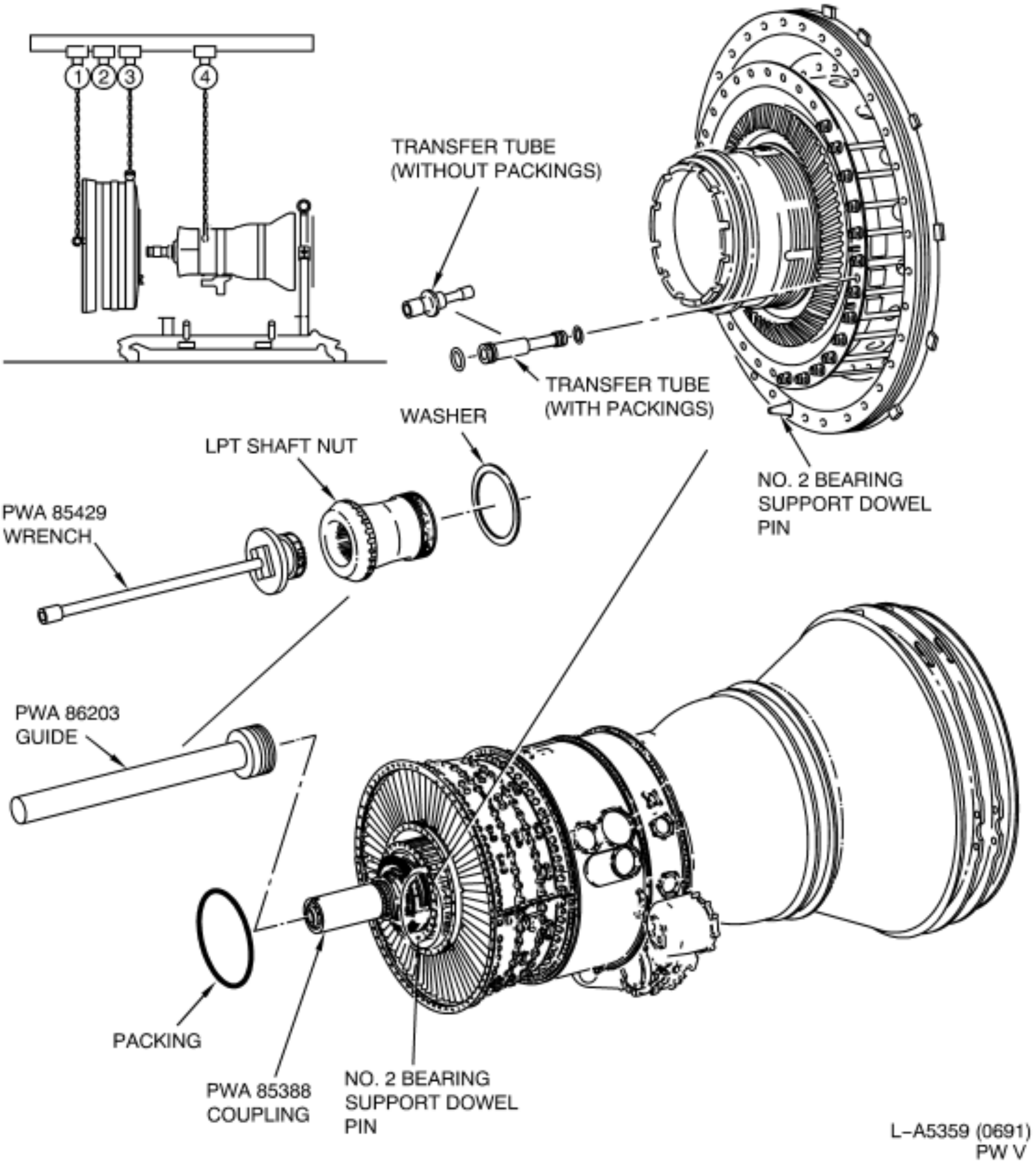
Preparation Of The Fan−Unit
Figure 1207 (Sheet 5)
(Task 71−00−00−540−001)


EEC PB SENSING
TUBE COUPLING
MAIN BEARING OIL BREATHER
TUBE COUPLING
(10 O'CLOCK POSITION)
SOLENOID TUBE NUTS
(1 O'CLOCK POSITION)
SOLENOID TUBE NUTS
EEC PT4.95
SENSING TUBE
COUPLING
COOLING AIR
HOSE
NO. 3 BEARING
AIR COOLER
TUBE NUTS
3 O'CLOCK
POSITION
9 O'CLOCK
POSITION
CORE−UNIT
FRONT VIEW
NO. 1,1.5, AND 2 BEARING
OIL SCAVENGE TUBE NUT
ANGLE GEARBOX OIL
PRESSURE TUBE NUT
L−A5357 (1189)
PW V

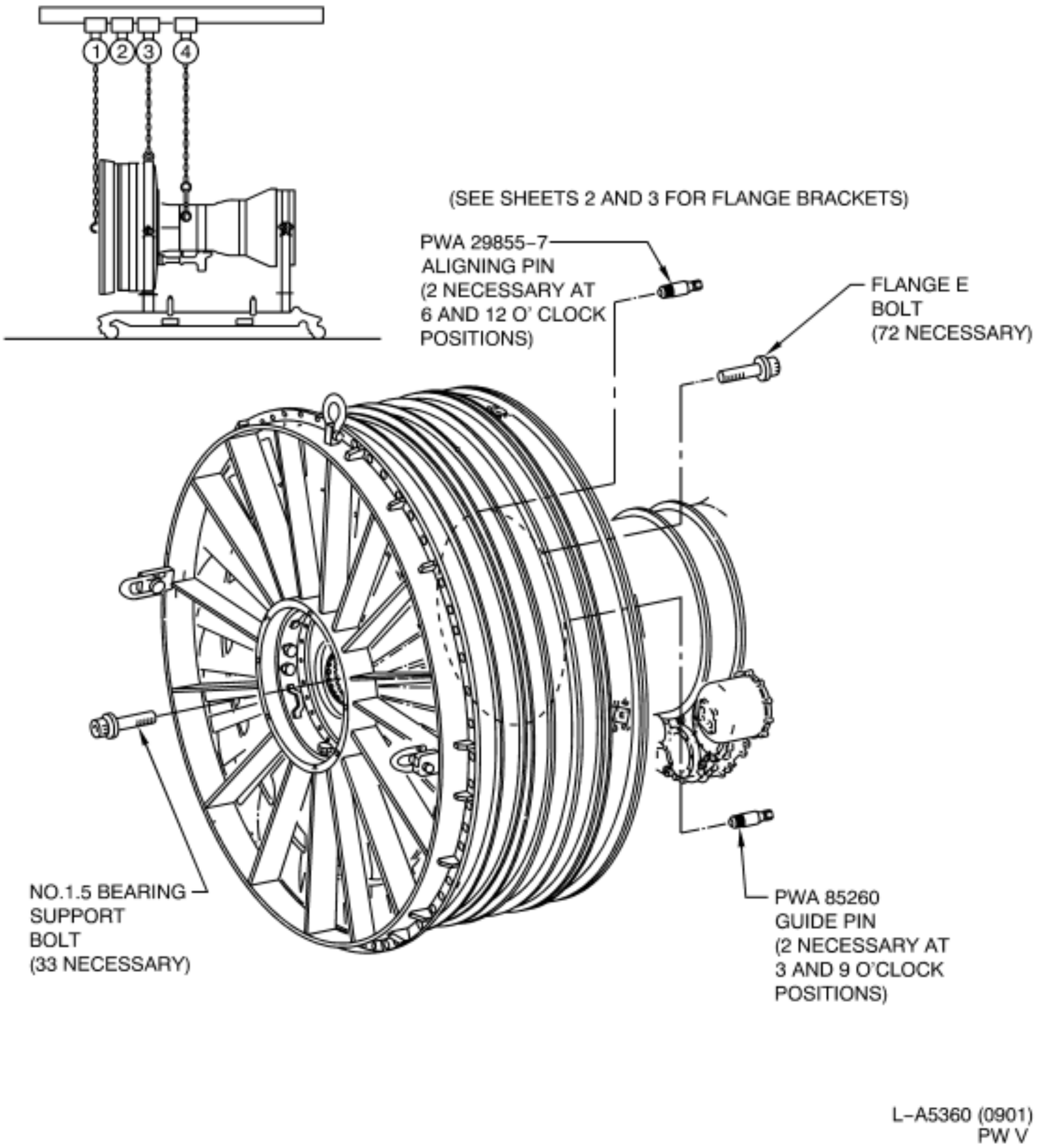
Preparation Of The Core−Unit
Figure 1208 (Sheet 1)
(Task 71−00−00−540−001)


RETAINING RING
DRIVE SHAFT
FRONT OF GEARBOX
HPC CASE BRACKET
BOLT (TYPICAL)
PACKING
GEARBOX DRIVESHAFT HOUSING
PACKING
NUT (TYPICAL)
WASHER (TYPICAL)
L-A5358 (0000)
PW V

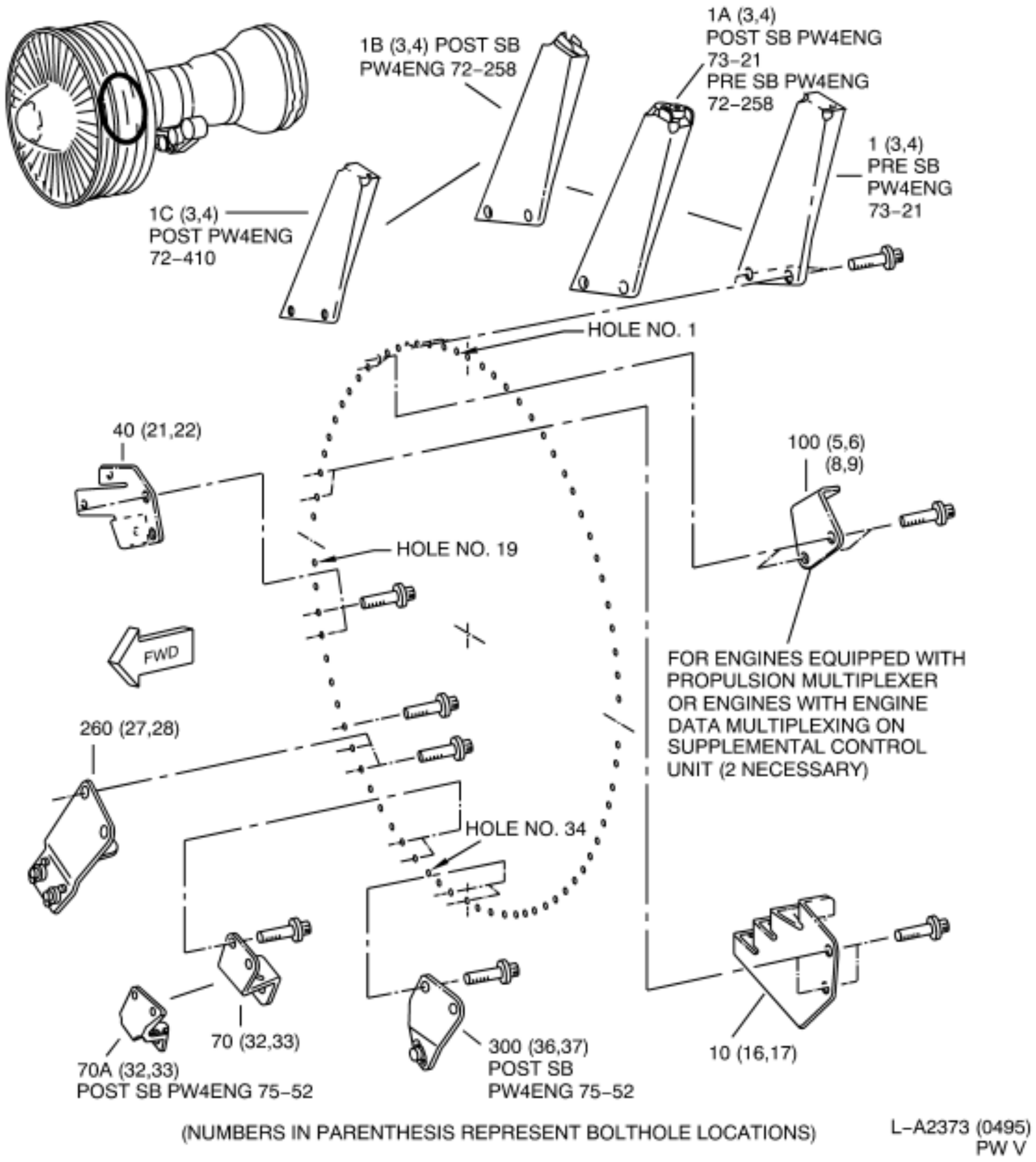
Preparation Of The Core-Unit
Figure 1208 (Sheet 2)
(Task 71-00-00-540-001)


1
2
3
4
TRANSFER TUBE (WITHOUT PACKINGS)
TRANSFER TUBE (WITH PACKINGS)
WASHER
LPT SHAFT NUT
PWA 85429 WRENCH
NO. 2 BEARING SUPPORT DOWEL PIN
PWA 86203 GUIDE
PACKING
PWA 85388 COUPLING
NO. 2 BEARING SUPPORT DOWEL PIN
L-A5359 (0691)
PW V

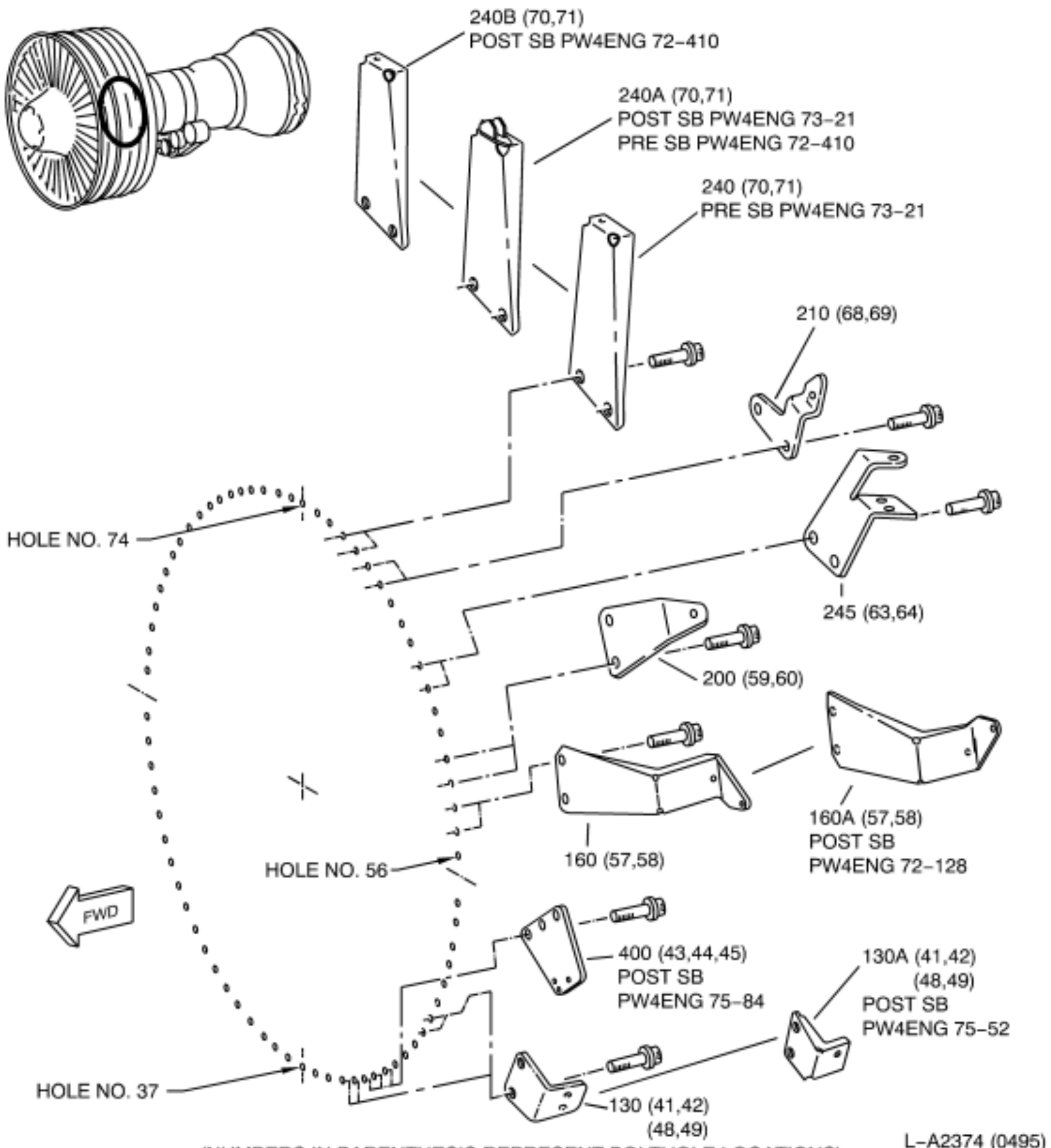
Preparation Of The Core-Unit
Figure 1208 (Sheet 3)
(Task 71-00-00-540-001)


1
2
3
4
(SEE SHEETS 2 AND 3 FOR FLANGE BRACKETS)
PWA 29855-7
ALIGNING PIN
(2 NECESSARY AT
6 AND 12 O' CLOCK
POSITIONS)
FLANGE E
BOLT
(72 NECESSARY)
NO.1.5 BEARING
SUPPORT
BOLT
(33 NECESSARY)
PWA 85260
GUIDE PIN
(2 NECESSARY AT
3 AND 9 O'CLOCK
POSITIONS)
L-A5360 (0901)
PW V

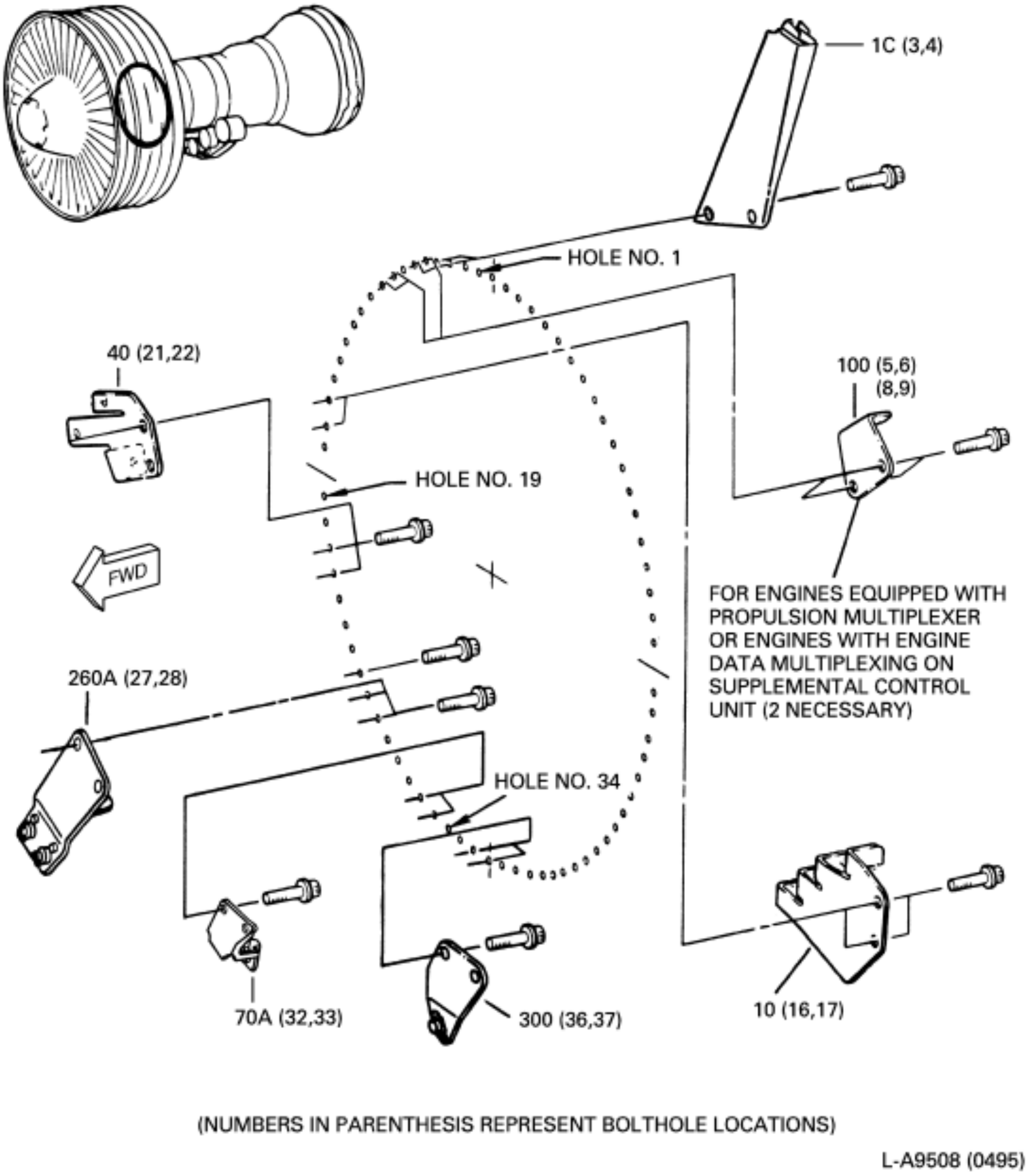
Installation Of The Fan-Unit To The Core-Unit
Figure 1209 (Sheet 1)
(Task 71-00-00-540-001)


1A (3,4)
POST SB PW4ENG
73-21
PRE SB PW4ENG
72-258
1B (3,4) POST SB
PW4ENG 72-258
1 (3,4)
PRE SB
PW4ENG
73-21
1C (3,4)
POST PW4ENG
72-410
HOLE NO. 1
40 (21,22)
100 (5,6)
(8,9)
HOLE NO. 19
FWD
FOR ENGINES EQUIPPED WITH
PROPULSION MULTIPLEXER
OR ENGINES WITH ENGINE
DATA MULTIPLEXING ON
SUPPLEMENTAL CONTROL
UNIT (2 NECESSARY)
260 (27,28)
HOLE NO. 34
70 (32,33)
70A (32,33)
POST SB PW4ENG 75-52
300 (36,37)
POST SB
PW4ENG 75-52
10 (16,17)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L-A2373 (0495)
PW V

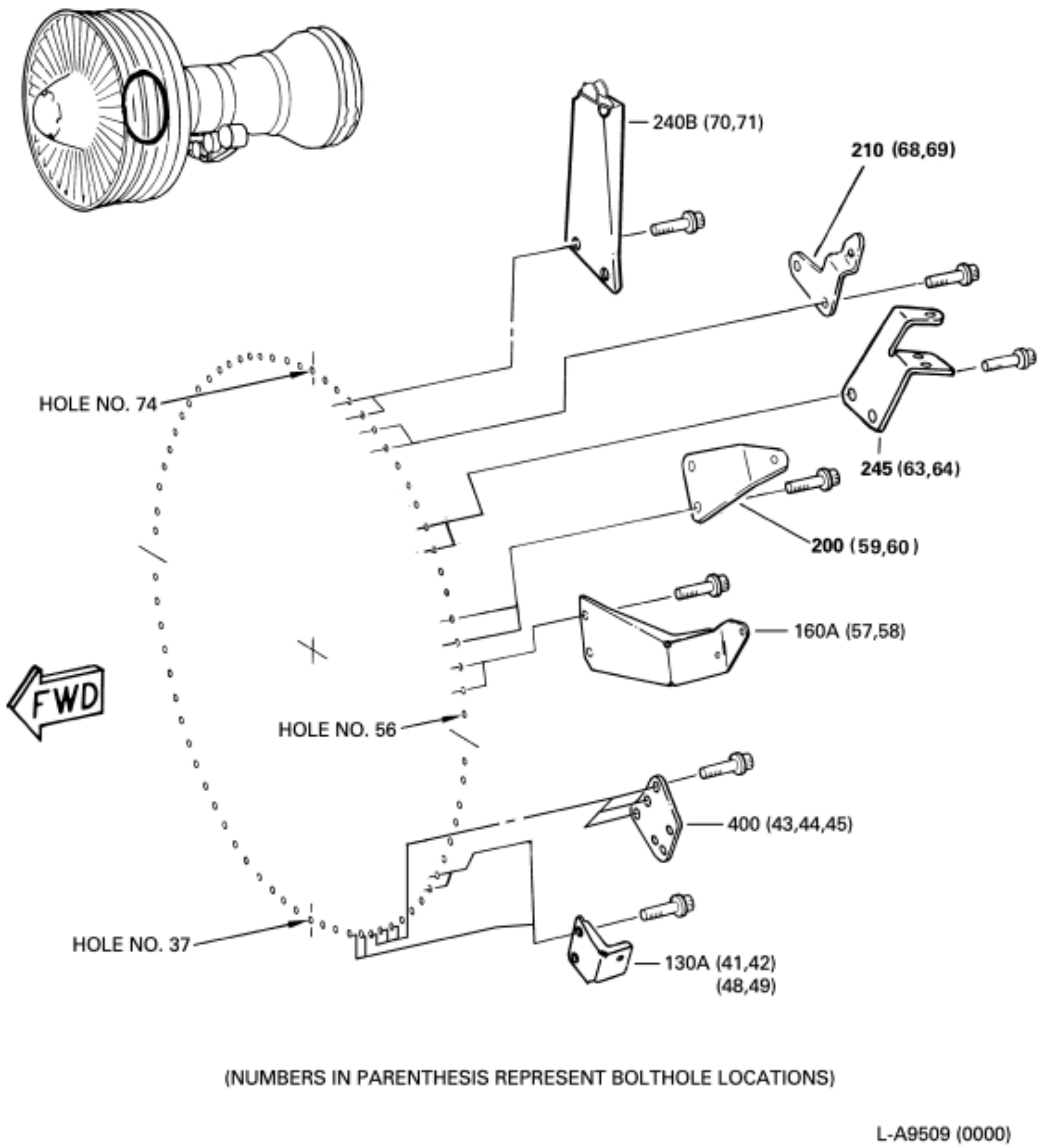
Installation Of The Fan-Unit To The
Core-Unit Flange E Bracket Locations
Figure 1209 (Sheet 2)
(Task 71-00-00-540-001)


240B (70,71)
POST SB PW4ENG 72-410
240A (70,71)
POST SB PW4ENG 73-21
PRE SB PW4ENG 72-410
240 (70,71)
PRE SB PW4ENG 73-21
210 (68,69)
HOLE NO. 74
245 (63,64)
200 (59,60)
160A (57,58)
POST SB
PW4ENG 72-128
160 (57,58)
HOLE NO. 56
FWD
400 (43,44,45)
POST SB
PW4ENG 75-84
130A (41,42)
(48,49)
POST SB
PW4ENG 75-52
HOLE NO. 37
130 (41,42)
(48,49)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L-A2374 (0495)
PW V

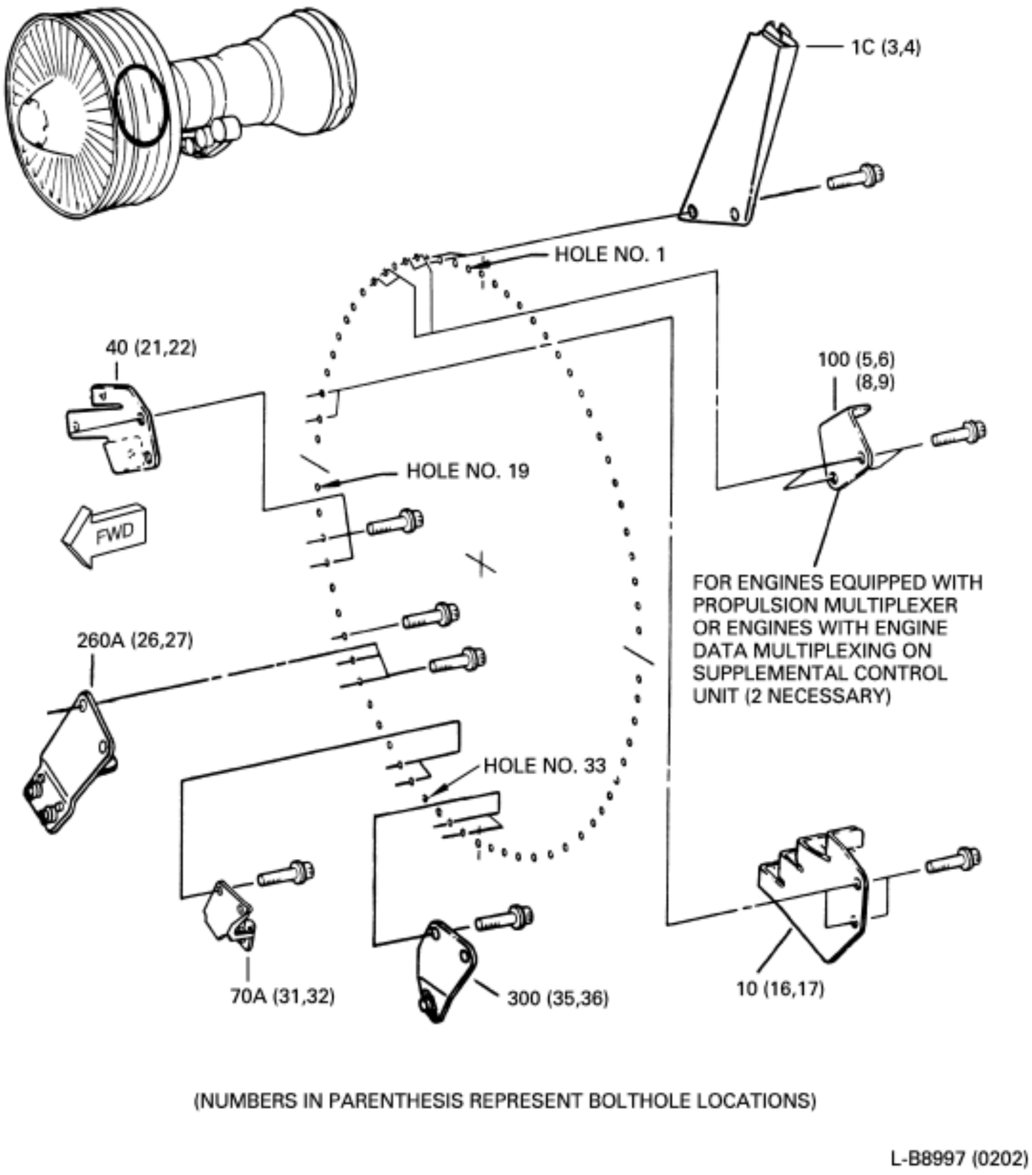
Installation Of The Fan-Unit To The
Core-Unit Flange E Bracket Locations
Figure 1209 (Sheet 3)
(Task 71-00-00-540-001)


1C (3,4)
HOLE NO. 1
40 (21,22)
100 (5,6)
(8,9)
HOLE NO. 19
FWD
FOR ENGINES EQUIPPED WITH PROPULSION MULTIPLEXER OR ENGINES WITH ENGINE DATA MULTIPLEXING ON SUPPLEMENTAL CONTROL UNIT (2 NECESSARY)
260A (27,28)
HOLE NO. 34
70A (32,33)
300 (36,37)
10 (16,17)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L-A9508 (0495)

Installation Of The Fan-Unit To The Core-Unit Flange E
Bracket Locations (For -3 Engines As Built By P&W)
Figure 1209 (Sheet 4)
(Task 71-00-00-540-001)

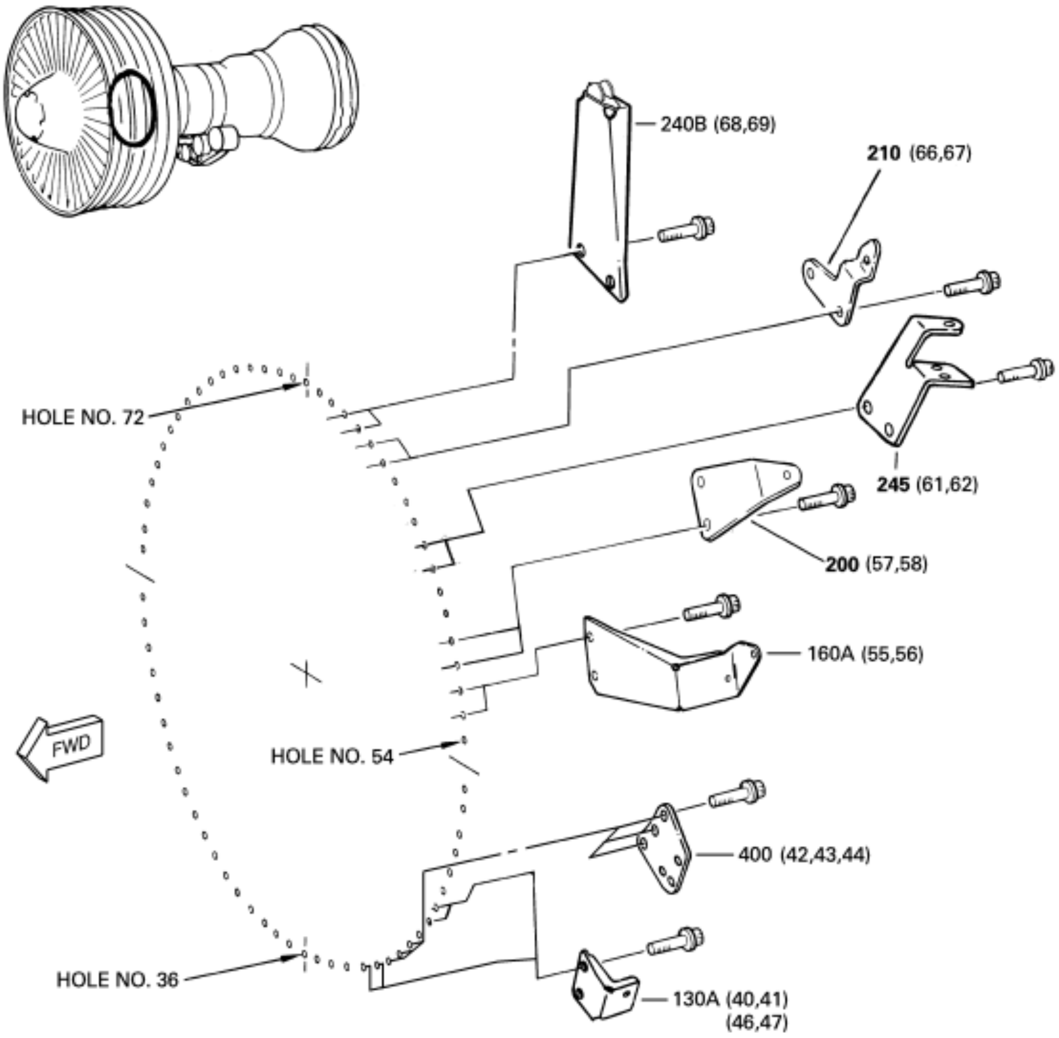

240B (70,71)
210 (68,69)
HOLE NO. 74
245 (63,64)
200 (59,60)
160A (57,58)
FWD
HOLE NO. 56
400 (43,44,45)
HOLE NO. 37
130A (41,42)
(48,49)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L-A9509 (0000)

Installation Of The Fan-Unit To The Core-Unit Flange E
Bracket Locations (For -3 Engines As Built By P&W)
Figure 1209 (Sheet 5)
(Task 71-00-00-540-001)


1C (3,4)
HOLE NO. 1
40 (21,22)
100 (5,6)
(8,9)
HOLE NO. 19
FWD
FOR ENGINES EQUIPPED WITH PROPULSION MULTIPLEXER OR ENGINES WITH ENGINE DATA MULTIPLEXING ON SUPPLEMENTAL CONTROL UNIT (2 NECESSARY)
260A (26,27)
HOLE NO. 33
70A (31,32)
300 (35,36)
10 (16,17)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L-B8997 (0202)

Installation Of The Fan-Unit To The Core-Unit Flange E Bracket
Locations (For -3 Engines As Built By P&W, UPS Configuration)
Figure 1209 (Sheet 6)
(Task 71-00-00-540-001)

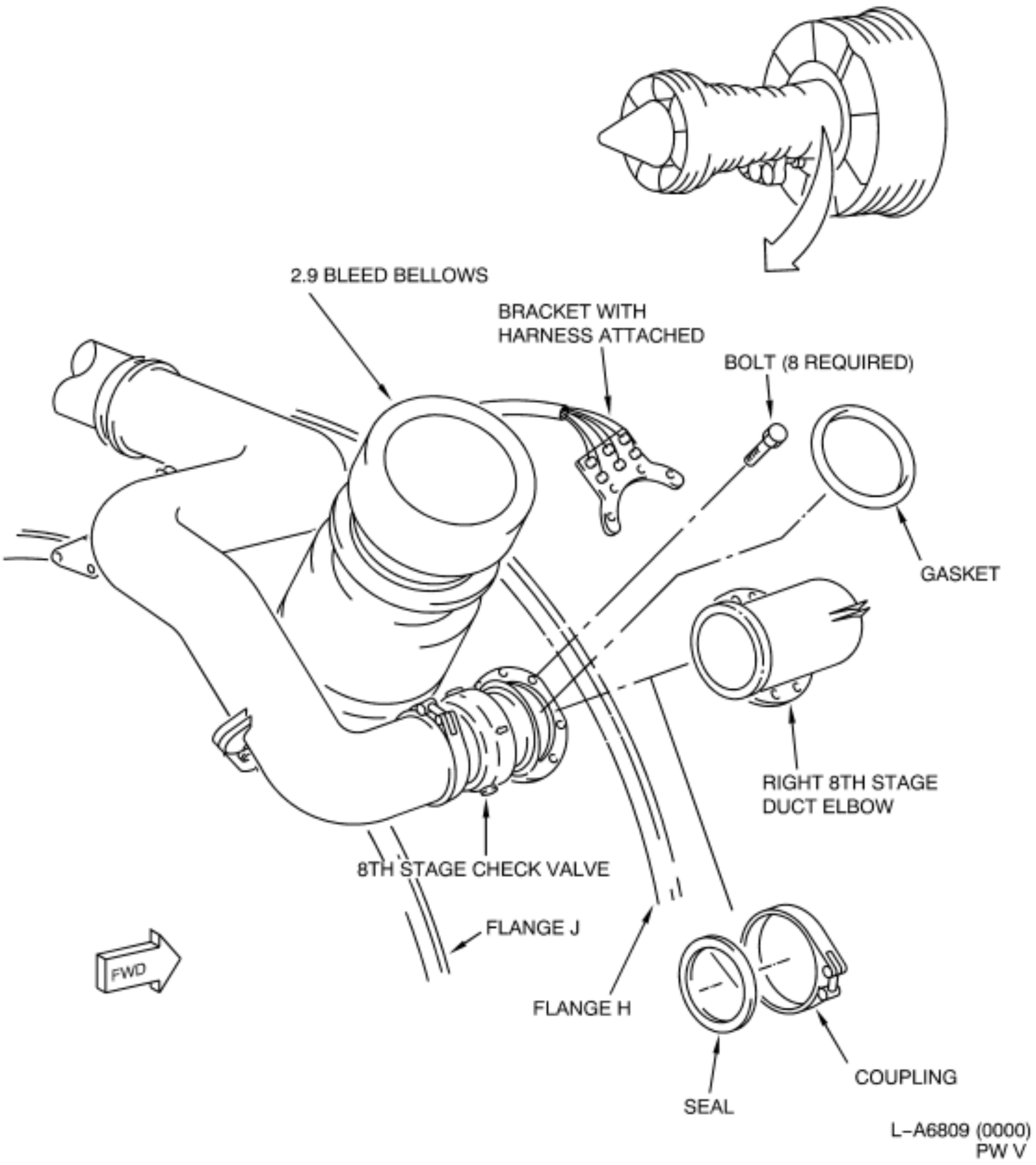
R
R


240B (68,69)
210 (66,67)
HOLE NO. 72
245 (61,62)
200 (57,58)
160A (55,56)
FWD
HOLE NO. 54
400 (42,43,44)
HOLE NO. 36
130A (40,41)
(46,47)

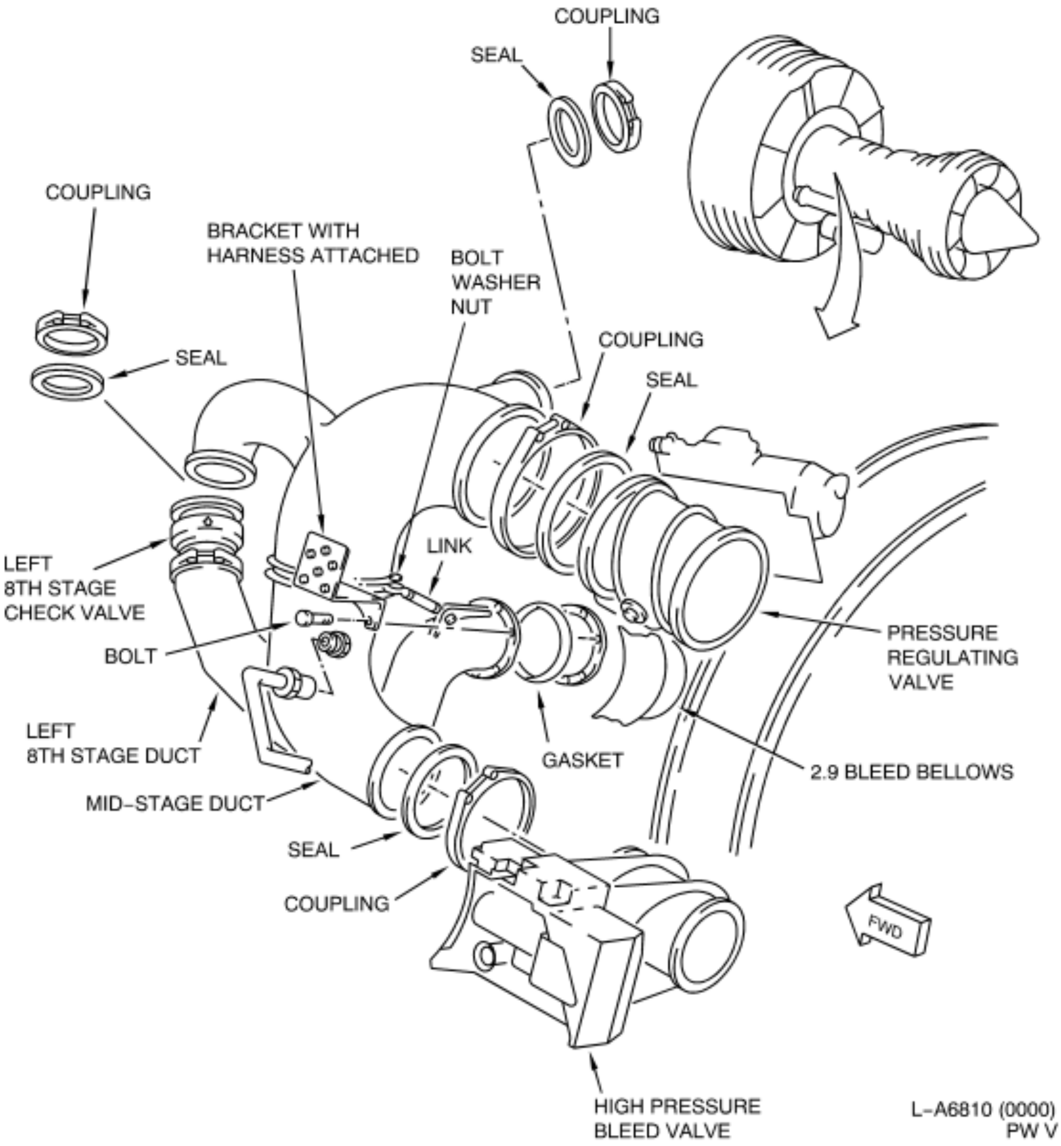
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

L-B8998 (0202)

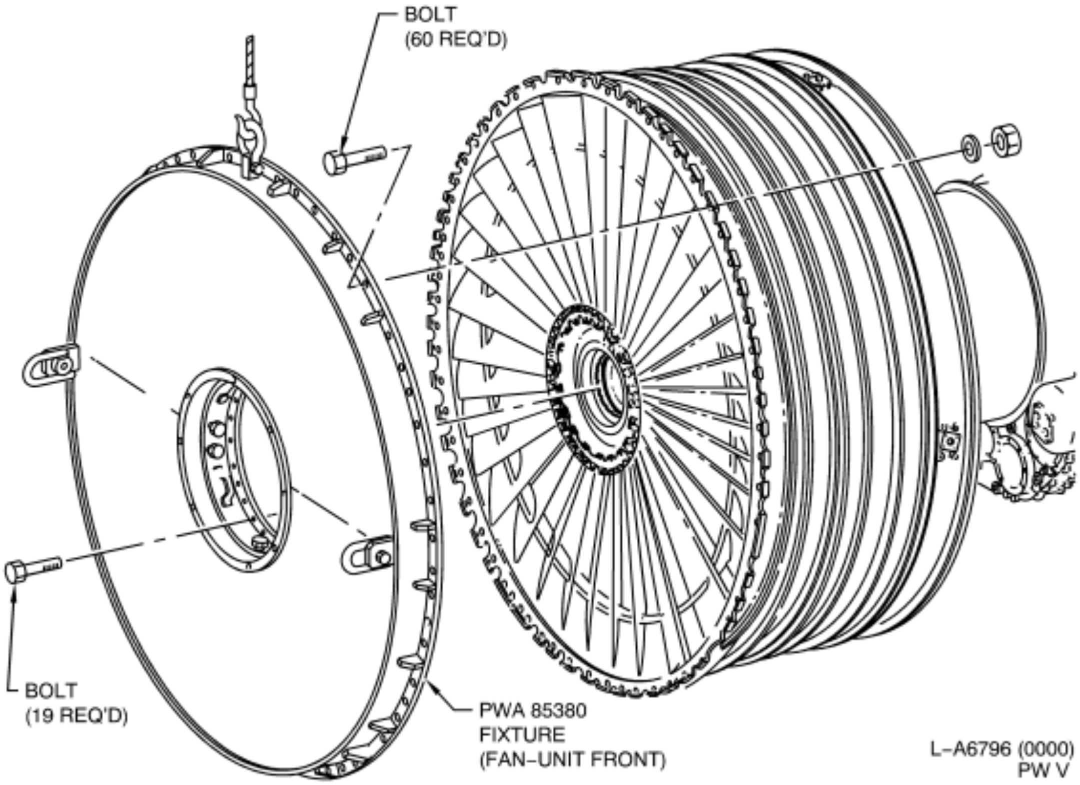
Installation Of The Fan-Unit To The Core-Unit Flange E Bracket Locations (For -3 Engines As Built By P&W, UPS Configuration)
Figure 1209 (Sheet 7)
(Task 71-00-00-540-001)


2.9 BLEED BELLOWS
BRACKET WITH HARNESS ATTACHED
BOLT (8 REQUIRED)
GASKET
RIGHT 8TH STAGE DUCT ELBOW
8TH STAGE CHECK VALVE
FLANGE J
FWD
FLANGE H
COUPLING
SEAL
L−A6809 (0000)
PW V

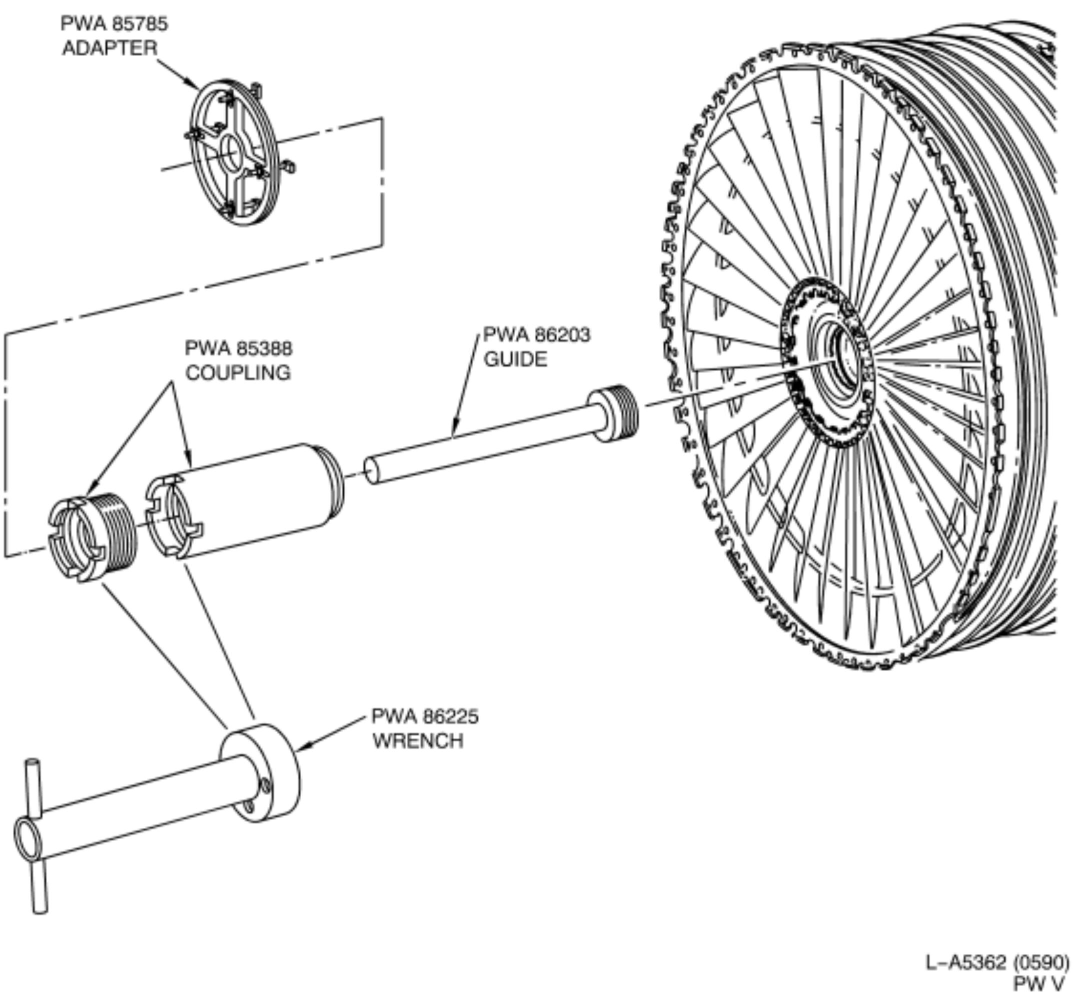
PWA 85390 Adapter Removal (Eighth Stage Duct Installation)
Figure 1210 (Sheet 1)
(Task 71−00−00−540−001)


COUPLING
SEAL
COUPLING
BRACKET WITH HARNESS ATTACHED
BOLT
WASHER
NUT
SEAL
COUPLING
SEAL
LEFT 8TH STAGE CHECK VALVE
LINK
BOLT
PRESSURE REGULATING VALVE
LEFT 8TH STAGE DUCT
GASKET
2.9 BLEED BELLOWS
MID−STAGE DUCT
SEAL
COUPLING
FWD
HIGH PRESSURE BLEED VALVE
L−A6810 (0000)
PW V

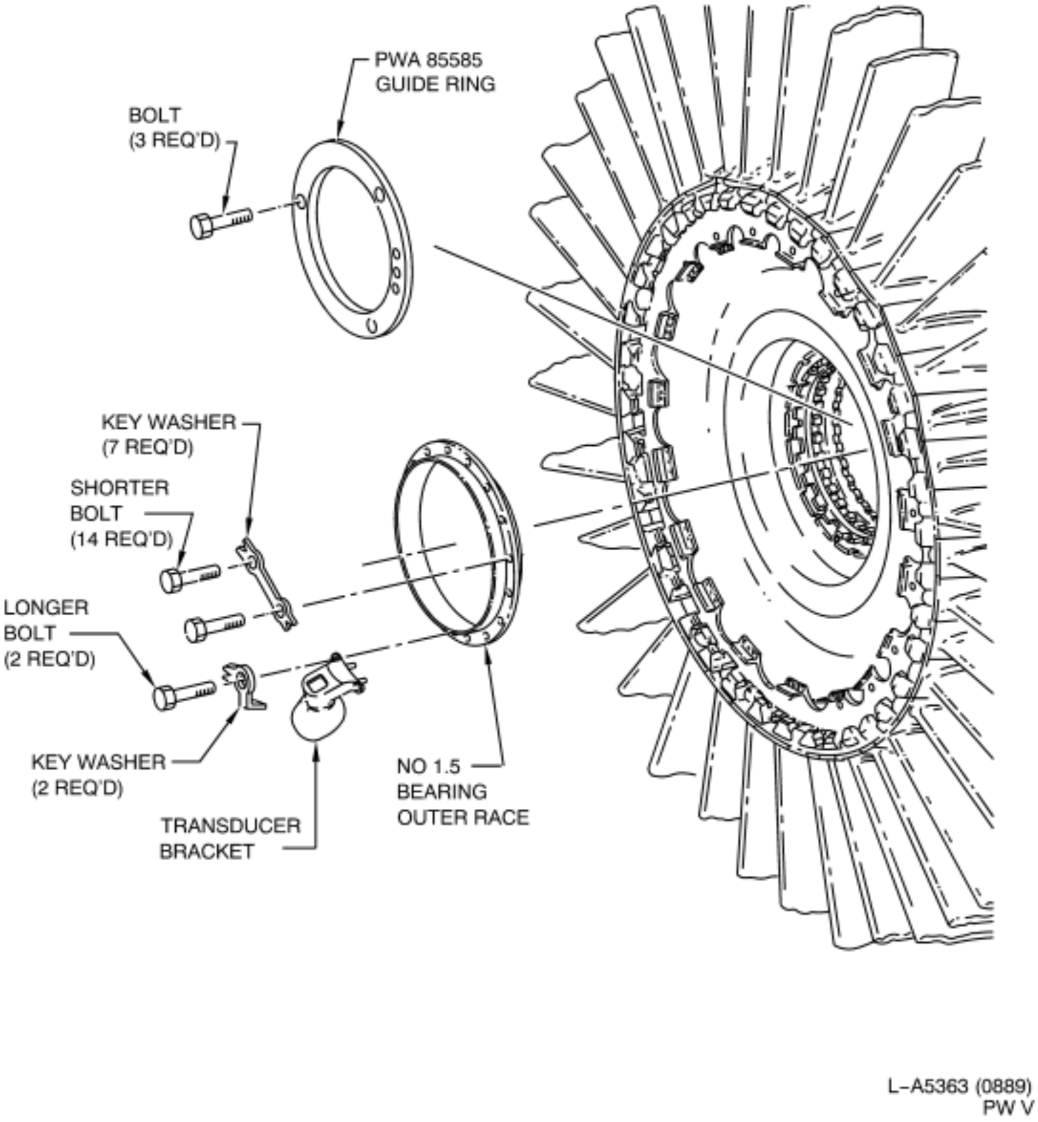
PWA 85390 Adapter Removal (Eighth Stage Duct Installation)
Figure 1210 (Sheet 2)
(Task 71−00−00−540−001)


BOLT
(60 REQ'D)
BOLT
(19 REQ'D)
PWA 85380
FIXTURE
(FAN−UNIT FRONT)
L−A6796 (0000)
PW V

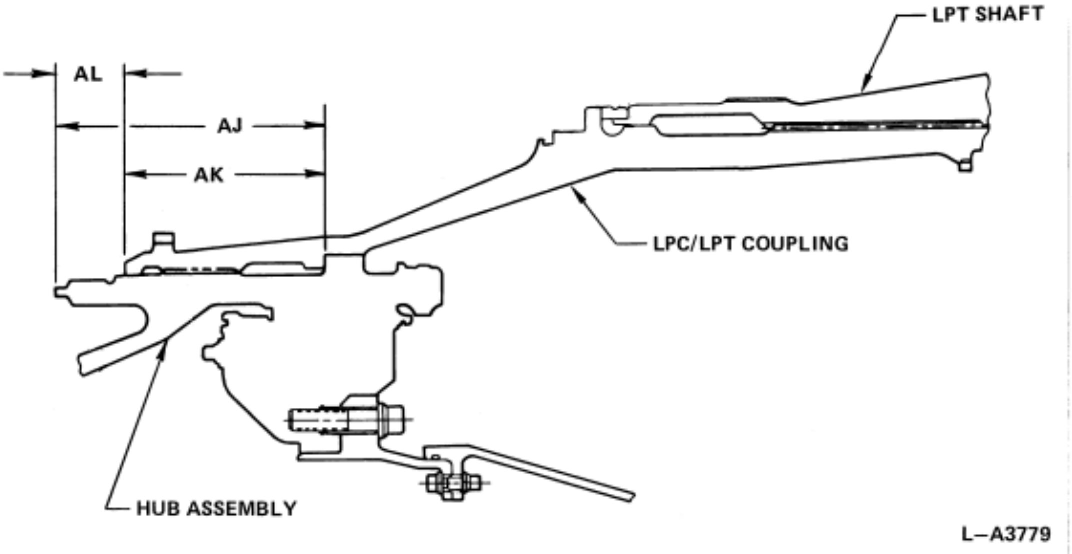
Removal Of The PWA Tools
Figure 1211 (Sheet 1)
(Task 71−00−00−540−001)


PWA 85785
ADAPTER
PWA 85388
COUPLING
PWA 86203
GUIDE
PWA 86225
WRENCH
L−A5362 (0590)
PW V

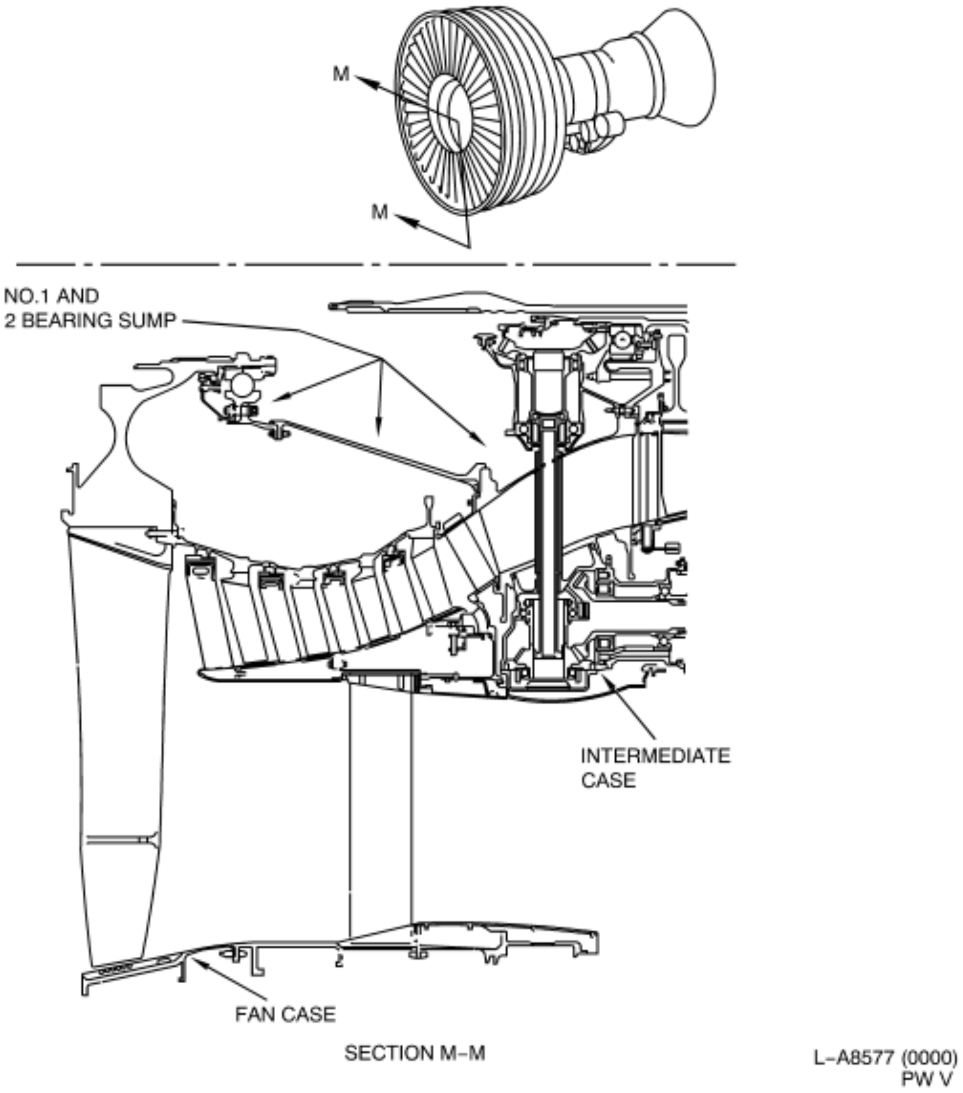
Removal Of The PWA Tools
Figure 1211 (Sheet 2)
(Task 71−00−00−540−001)


PWA 85585
GUIDE RING
BOLT
(3 REQ'D)
KEY WASHER
(7 REQ'D)
SHORTER
BOLT
(14 REQ'D)
LONGER
BOLT
(2 REQ'D)
KEY WASHER
(2 REQ'D)
TRANSDUCER
BRACKET
NO 1.5
BEARING
OUTER RACE
L−A5363 (0889)
PW V

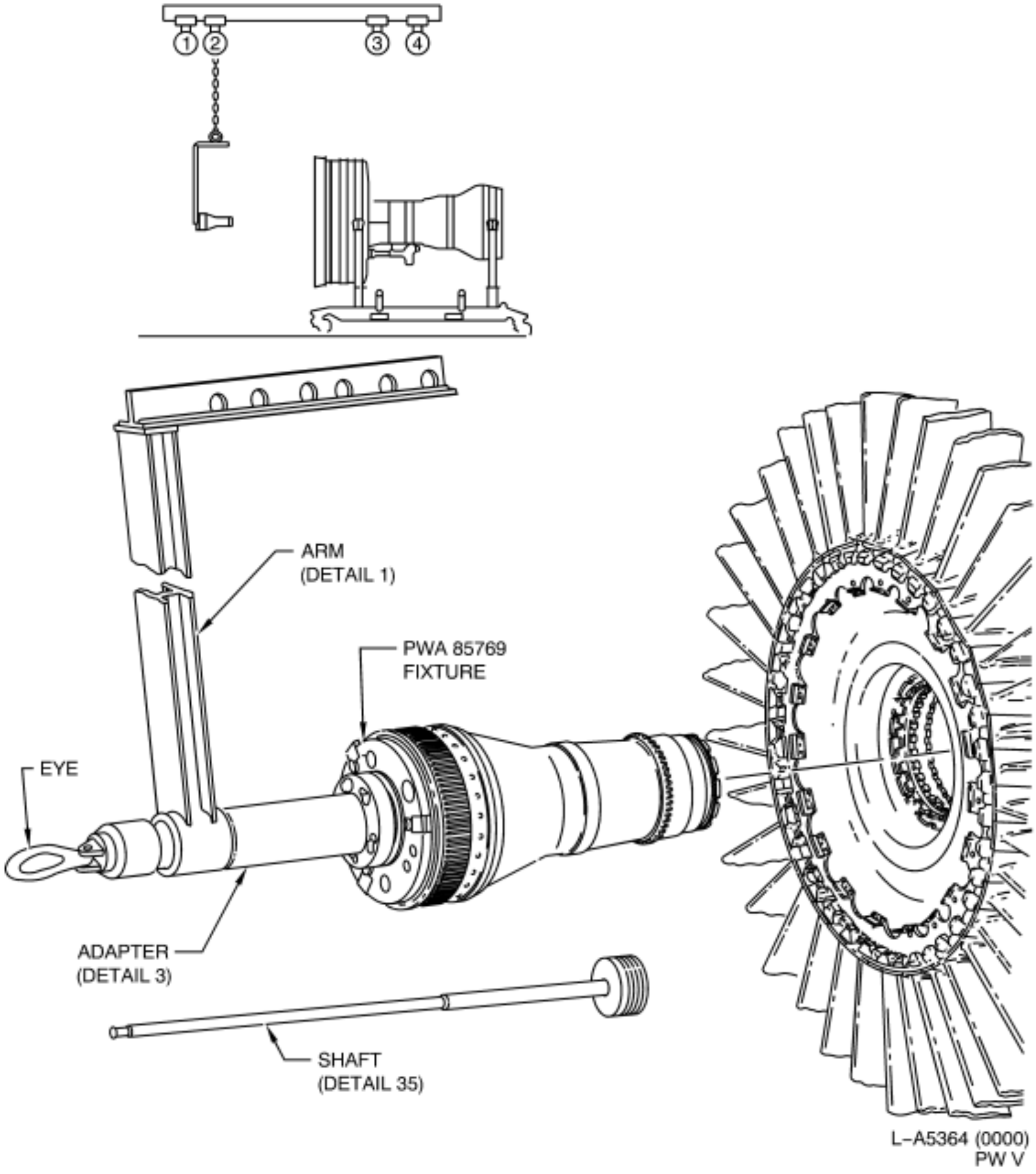
Installation Of The No. 1.5 Bearing Outer Race
Figure 1212
(Task 71−00−00−540−001)


LPT SHAFT
AL
AJ
AK
LPC/LPT COUPLING
HUB ASSEMBLY
L-A3779

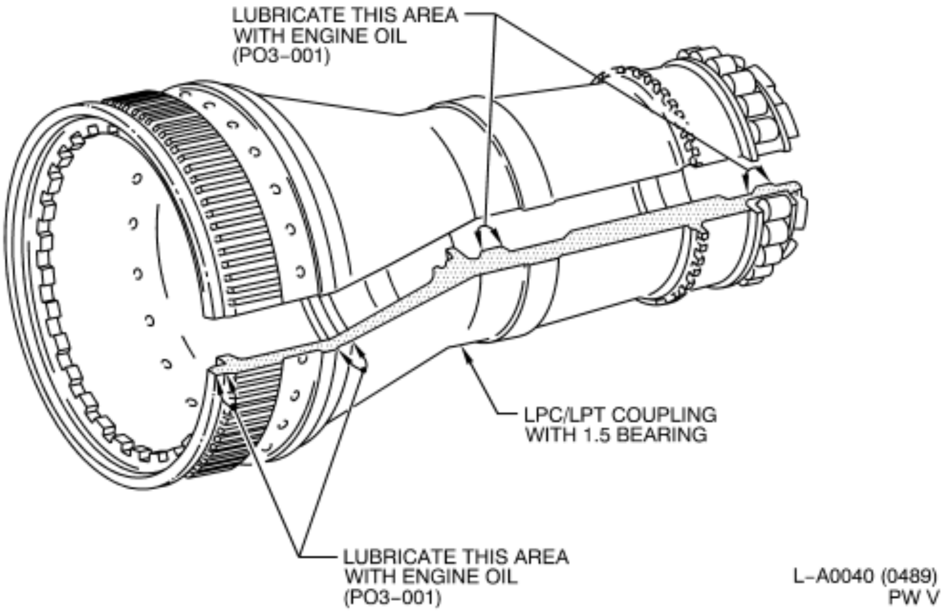
Installation Of The LPC/LPT Coupling (Dimensions)
Figure 1213 (Sheet 1)
(Task 71-00-00-540-001)


M
M
NO.1 AND
2 BEARING SUMP
INTERMEDIATE
CASE
FAN CASE
SECTION M−M
L−A8577 (0000)
PW V

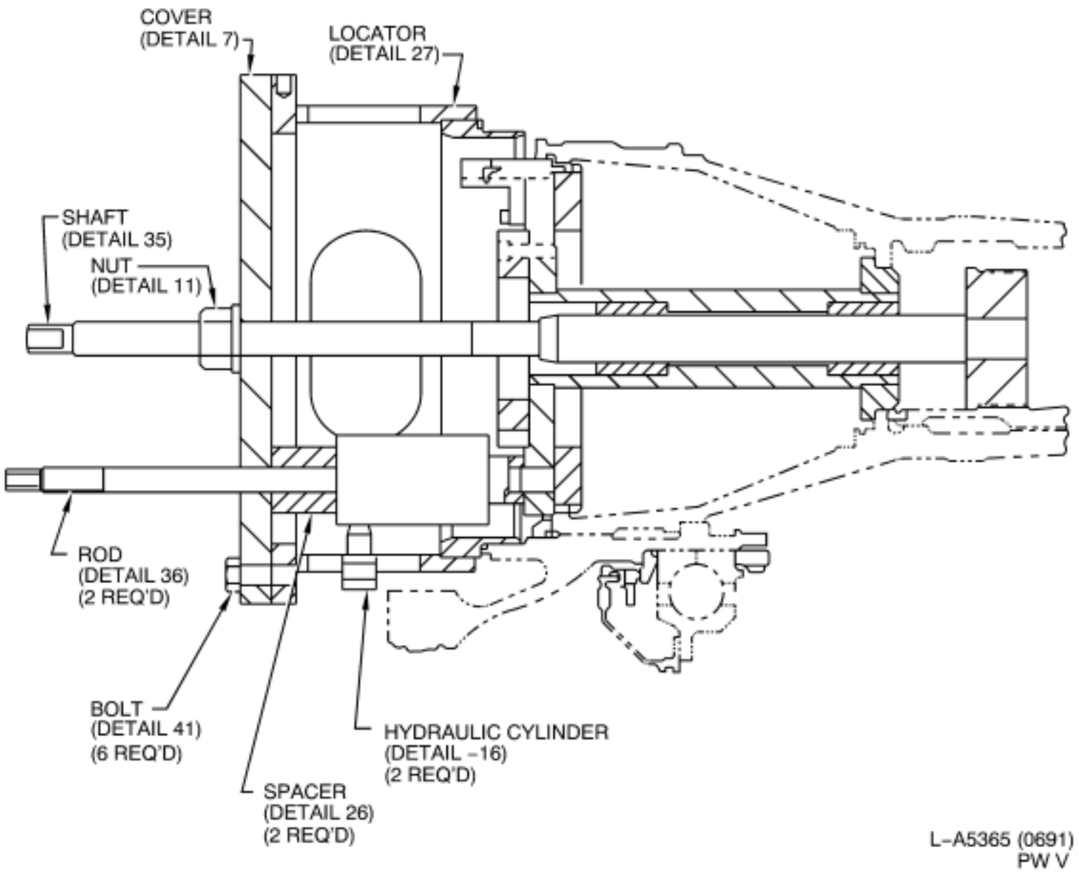
Installation Of The LPC/LPT Coupling
(The No. 1 And 2 Bearing Sump Area)
Figure 1213 (Sheet 2)
(Task 71−00−00−540−001)


①
②
③
④
ARM
(DETAIL 1)
PWA 85769
FIXTURE
EYE
ADAPTER
(DETAIL 3)
SHAFT
(DETAIL 35)
L-A5364 (0000)
PW V

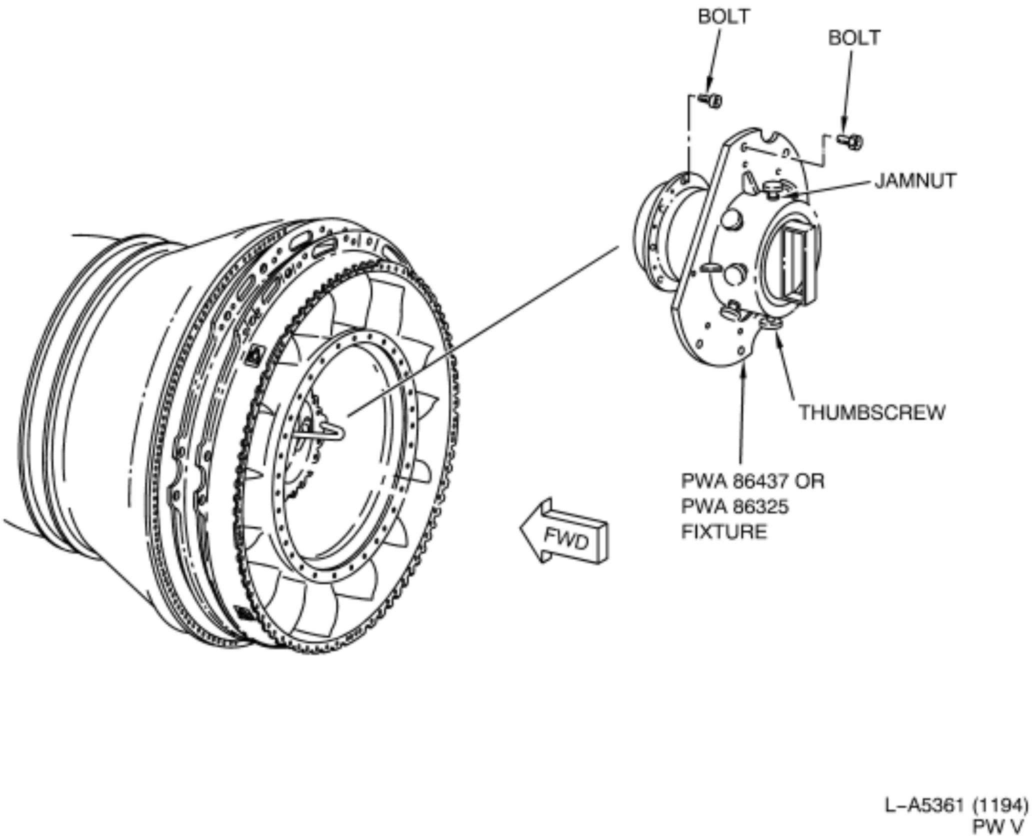
Installation Of The LPC/LPT Coupling
Figure 1213 (Sheet 3)
(Task 71-00-00-540-001)


LUBRICATE THIS AREA
WITH ENGINE OIL
(PO3-001)
LPC/LPT COUPLING
WITH 1.5 BEARING
LUBRICATE THIS AREA
WITH ENGINE OIL
(PO3-001)
L-A0040 (0489)
PW V

Installation Of The LPC/LPT Coupling (Lubrication)
Figure 1213 (Sheet 4)
(Task 71-00-00-540-001)

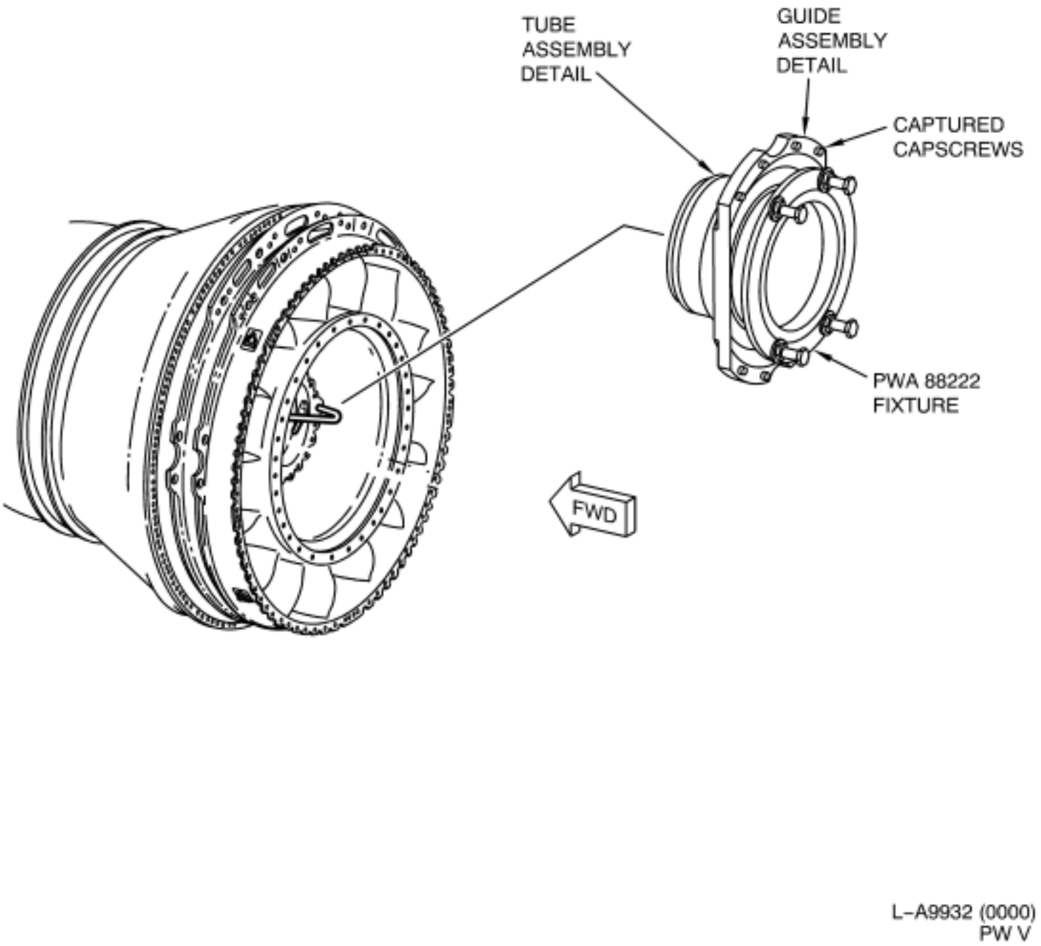

COVER
(DETAIL 7)
LOCATOR
(DETAIL 27)
SHAFT
(DETAIL 35)
NUT
(DETAIL 11)
ROD
(DETAIL 36)
(2 REQ'D)
BOLT
(DETAIL 41)
(6 REQ'D)
HYDRAULIC CYLINDER
(DETAIL −16)
(2 REQ'D)
SPACER
(DETAIL 26)
(2 REQ'D)
L−A5365 (0691)
PW V

Installation Of The LPC/LPT Coupling (PWA 85769 Installation)
Figure 1213 (Sheet 5)
(Task 71−00−00−540−001)

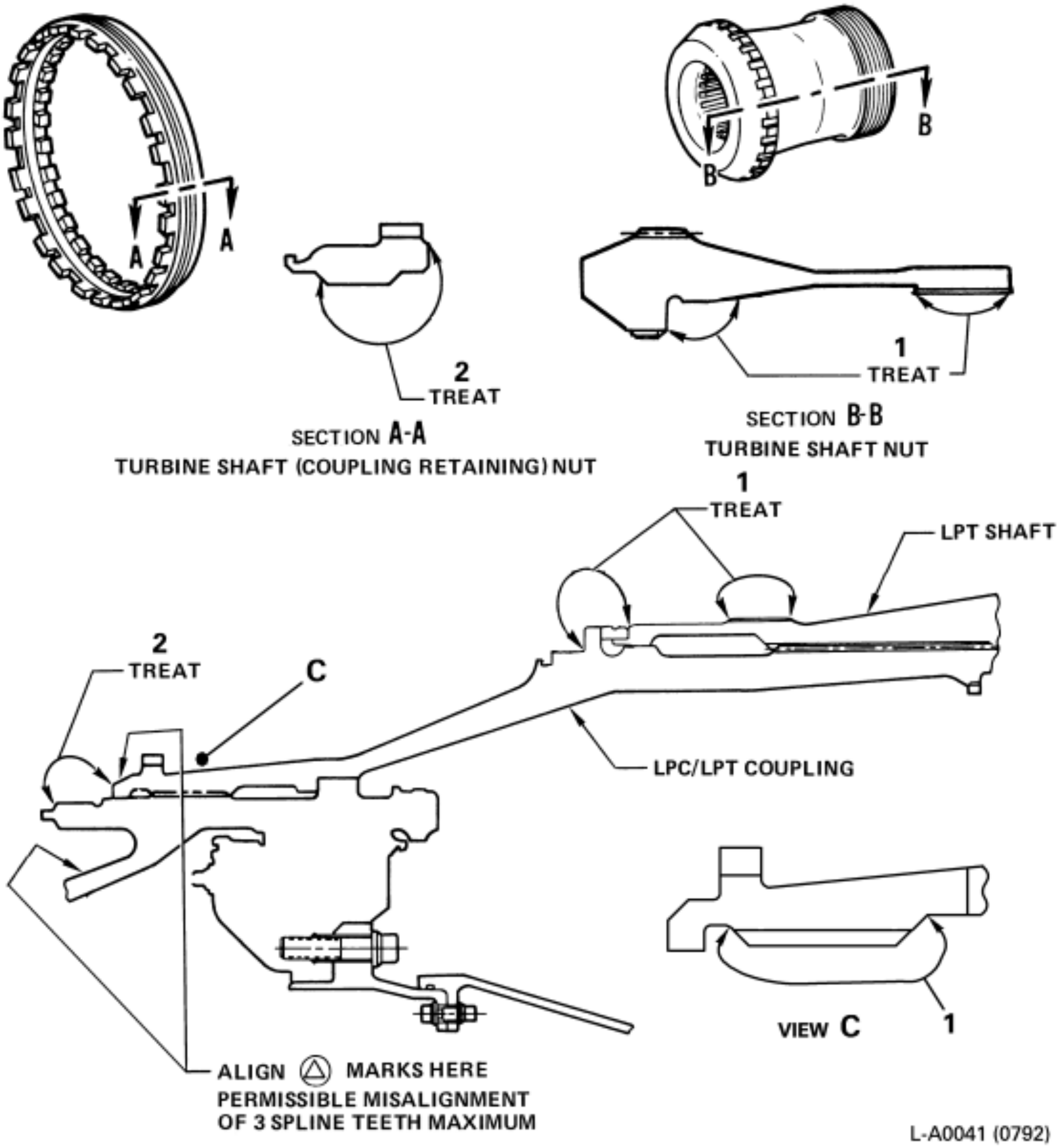

BOLT
BOLT
JAMNUT
THUMBSCREW
PWA 86437 OR
PWA 86325
FIXTURE
FWD
L-A5361 (1194)
PW V

Installation Of The LPC/LPT Coupling
(PWA 86437 Or PWA 86325 Removal)
Figure 1213 (Sheet 6)
(Task 71-00-00-540-001)

R
R

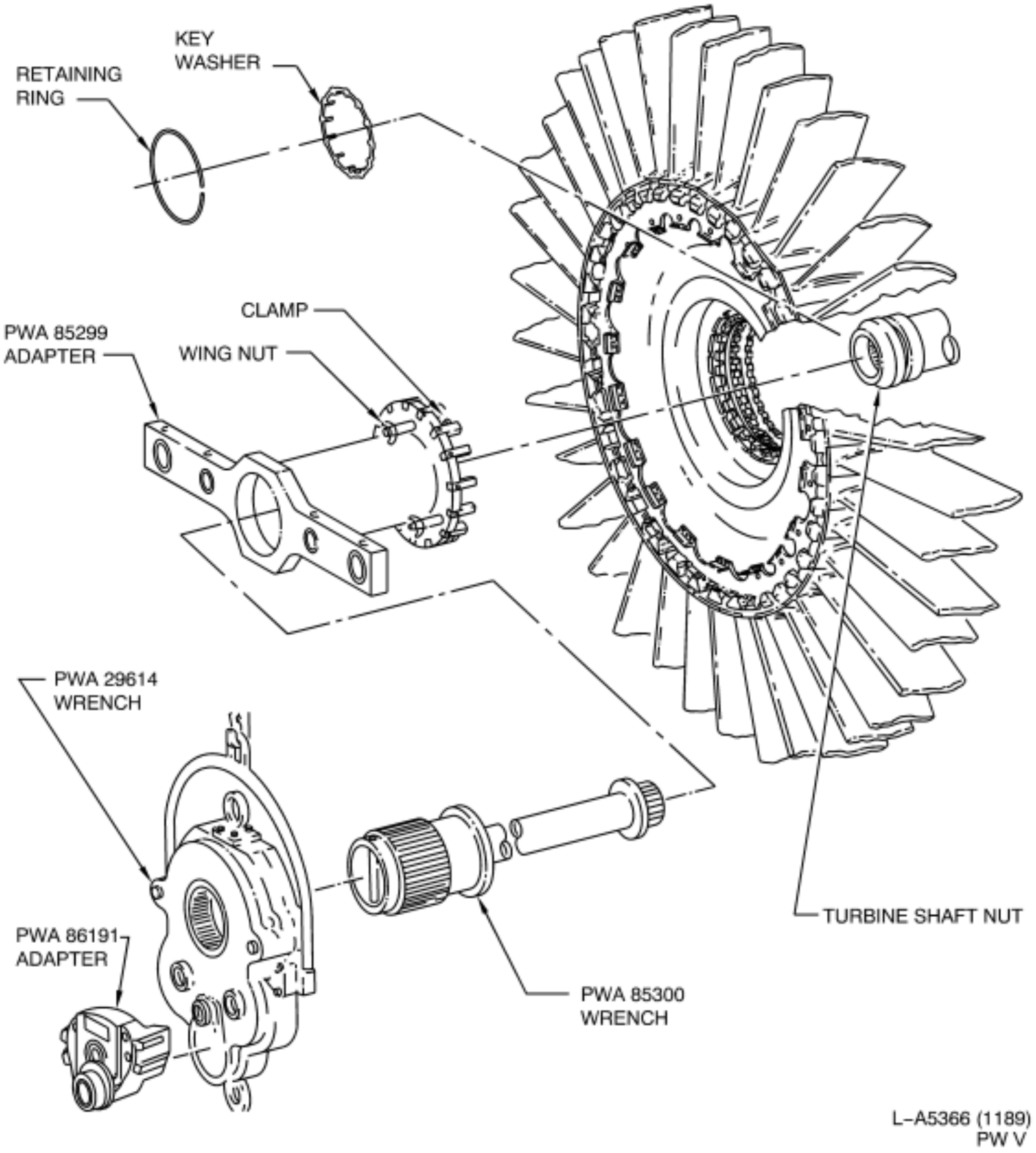

TUBE ASSEMBLY DETAIL
GUIDE ASSEMBLY DETAIL
CAPTURED CAPSCREWS
PWA 88222 FIXTURE
FWD
L-A9932 (0000)
PW V

Installation Of The LPC/LPT Coupling (PWA 88222 Removal)
Figure 1213 (Sheet 7)
(Task 71-00-00-540-001)

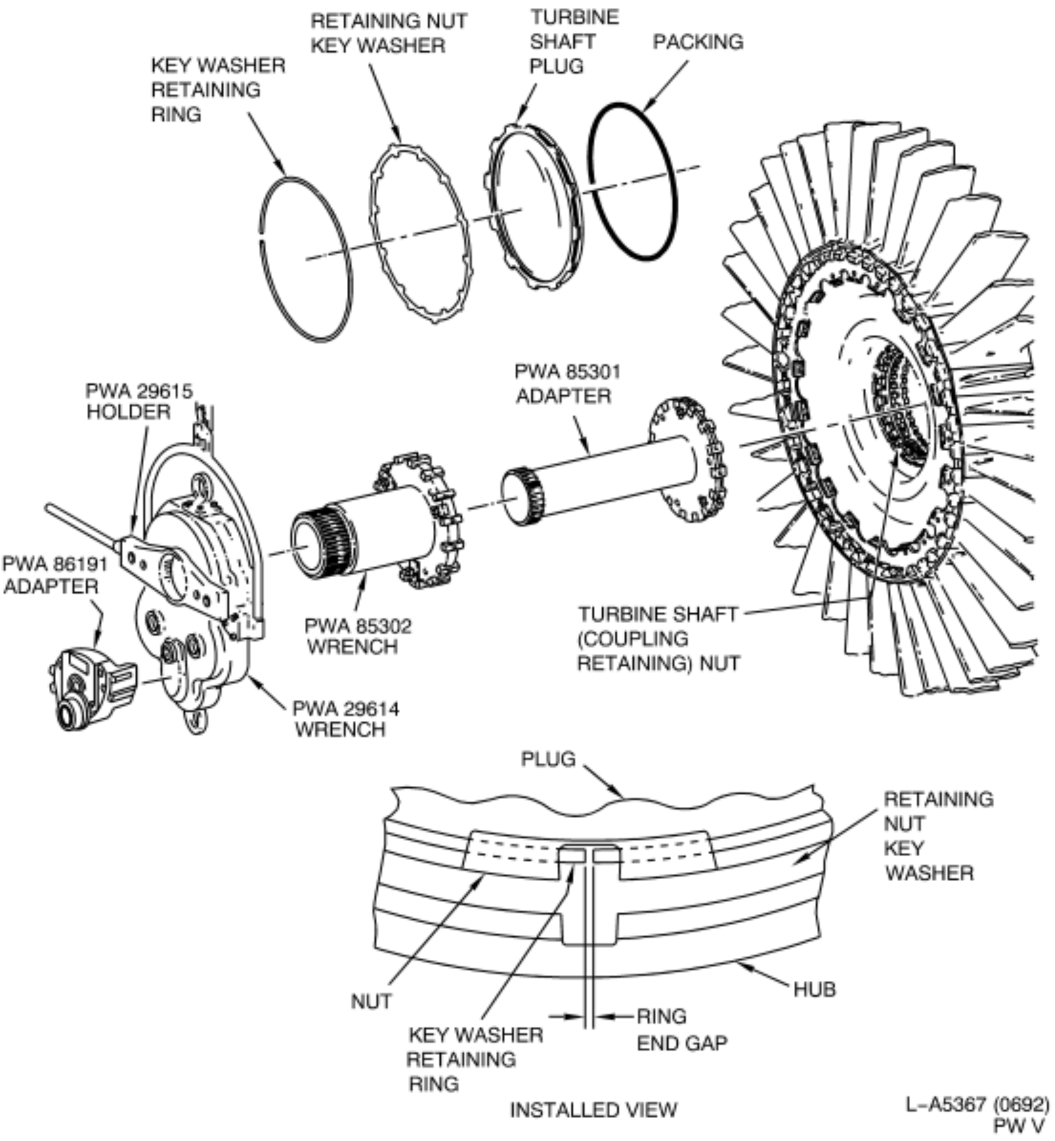

A
A
2
TREAT
SECTION A-A
TURBINE SHAFT (COUPLING RETAINING) NUT
B
B
1
TREAT
SECTION B-B
TURBINE SHAFT NUT
1
TREAT
LPT SHAFT
2
TREAT
C
LPC/LPT COUPLING
VIEW C
1
ALIGN △ MARKS HERE
PERMISSIBLE MISALIGNMENT
OF 3 SPLINE TEETH MAXIMUM
L-A0041 (0792)

R 1. Apply To The Areas Shown With Compound (P06-021)
R 2. Apply To The Areas Shown With Anti-Seize Paste (P06-054)

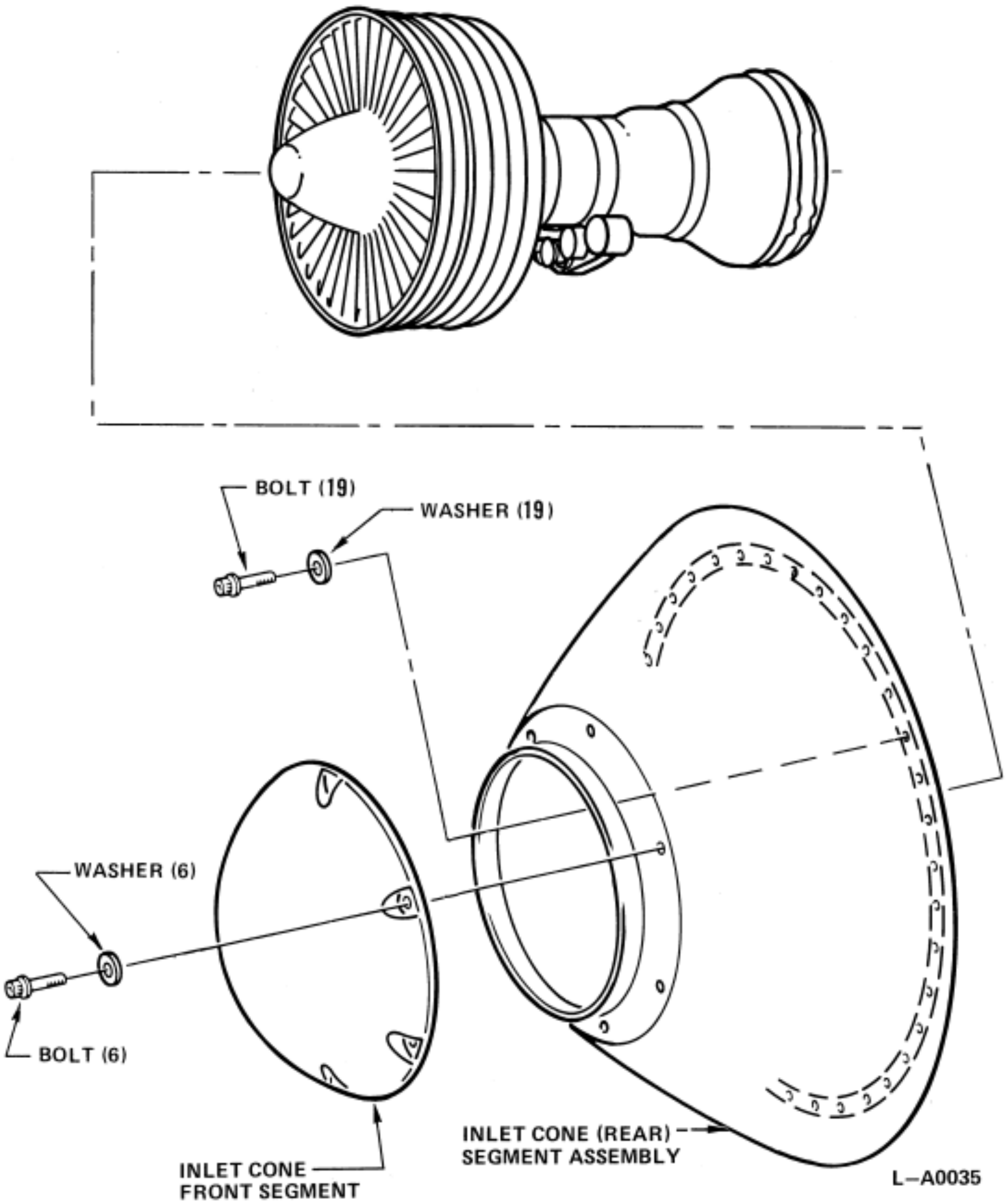
Lubrication Of The Nut Threads And Surfaces
Figure 1214
(Task 71-00-00-540-001)


KEY WASHER
RETAINING RING
CLAMP
PWA 85299 ADAPTER
WING NUT
PWA 29614 WRENCH
PWA 86191 ADAPTER
TURBINE SHAFT NUT
PWA 85300 WRENCH
L-A5366 (1189)
PW V

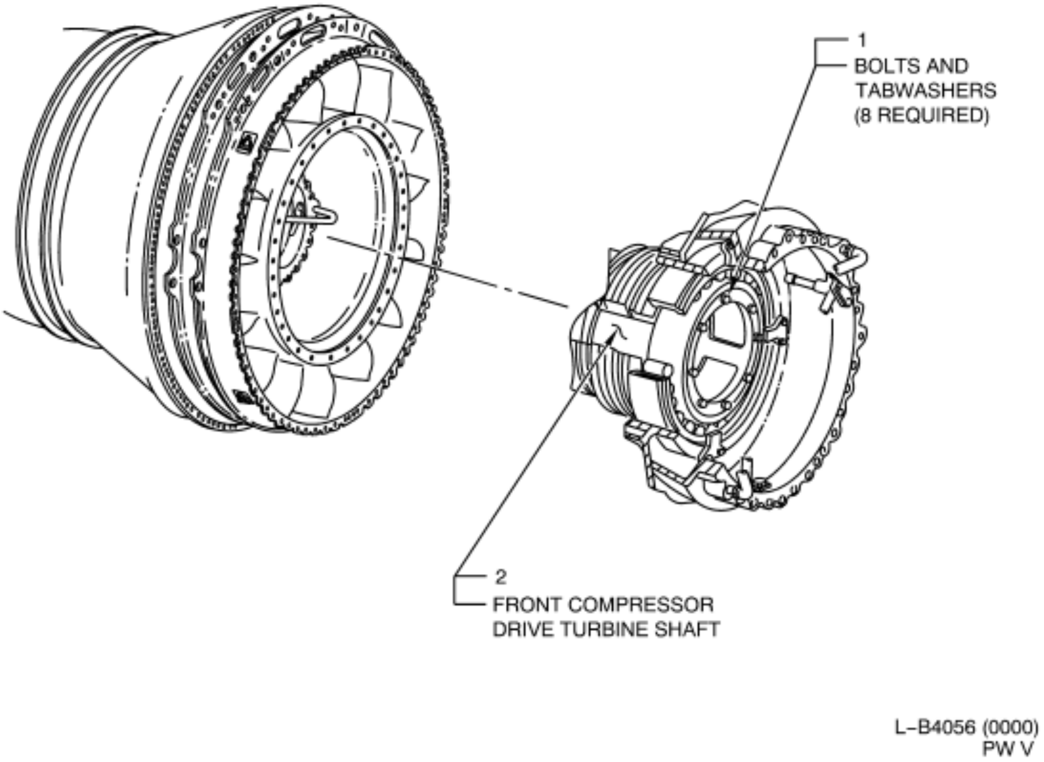
Installation Of The Turbine Shaft Nut
Figure 1215
(Task 71-00-00-540-001)


KEY WASHER RETAINING RING
RETAINING NUT KEY WASHER
TURBINE SHAFT PLUG
PACKING
PWA 29615 HOLDER
PWA 85301 ADAPTER
PWA 86191 ADAPTER
PWA 85302 WRENCH
TURBINE SHAFT (COUPLING RETAINING) NUT
PWA 29614 WRENCH
PLUG
RETAINING NUT KEY WASHER
NUT
HUB
KEY WASHER RETAINING RING
RING END GAP
INSTALLED VIEW
L-A5367 (0692)
PW V

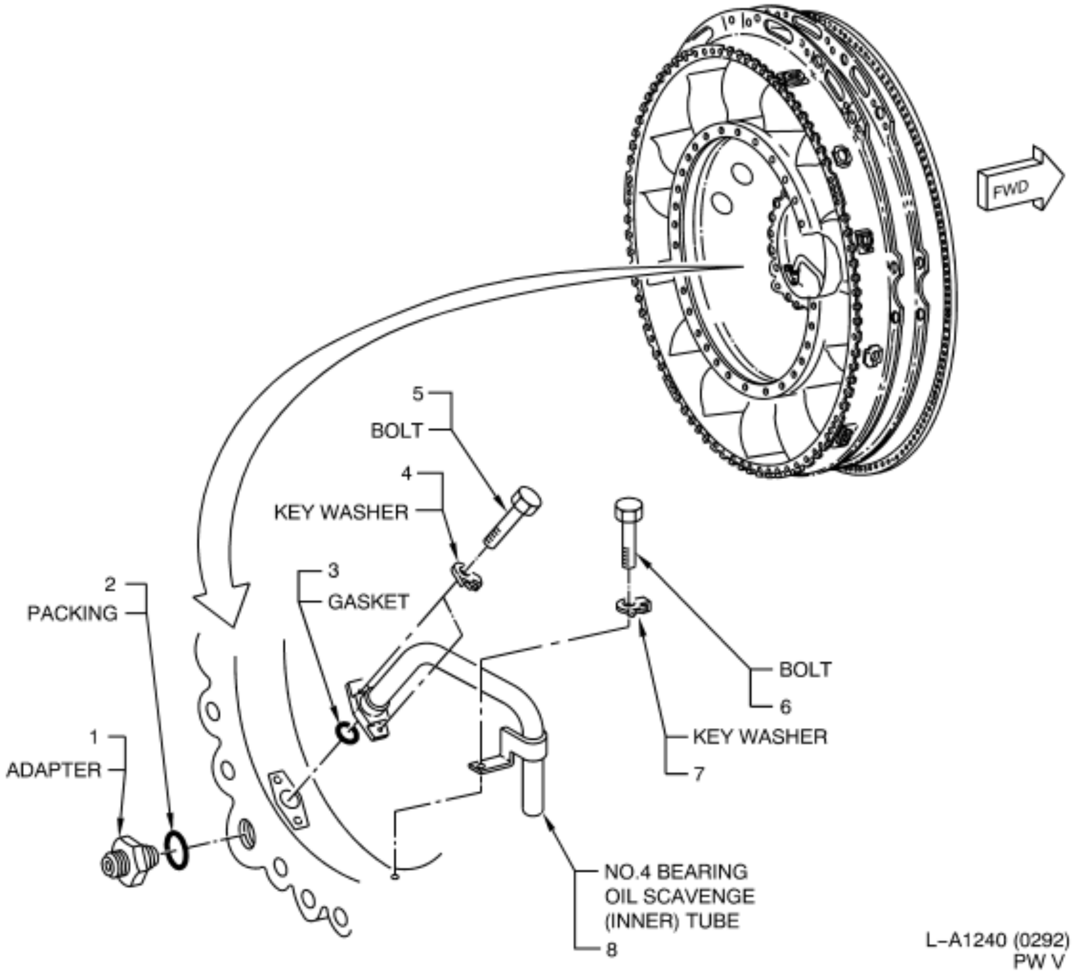
Installation Of The Turbine Shaft (Coupling/Retaining) Nut
Figure 1216
(Task 71-00-00-540-001)


BOLT (19)
WASHER (19)
WASHER (6)
BOLT (6)
INLET CONE (REAR) SEGMENT ASSEMBLY
INLET CONE FRONT SEGMENT
L-A0035

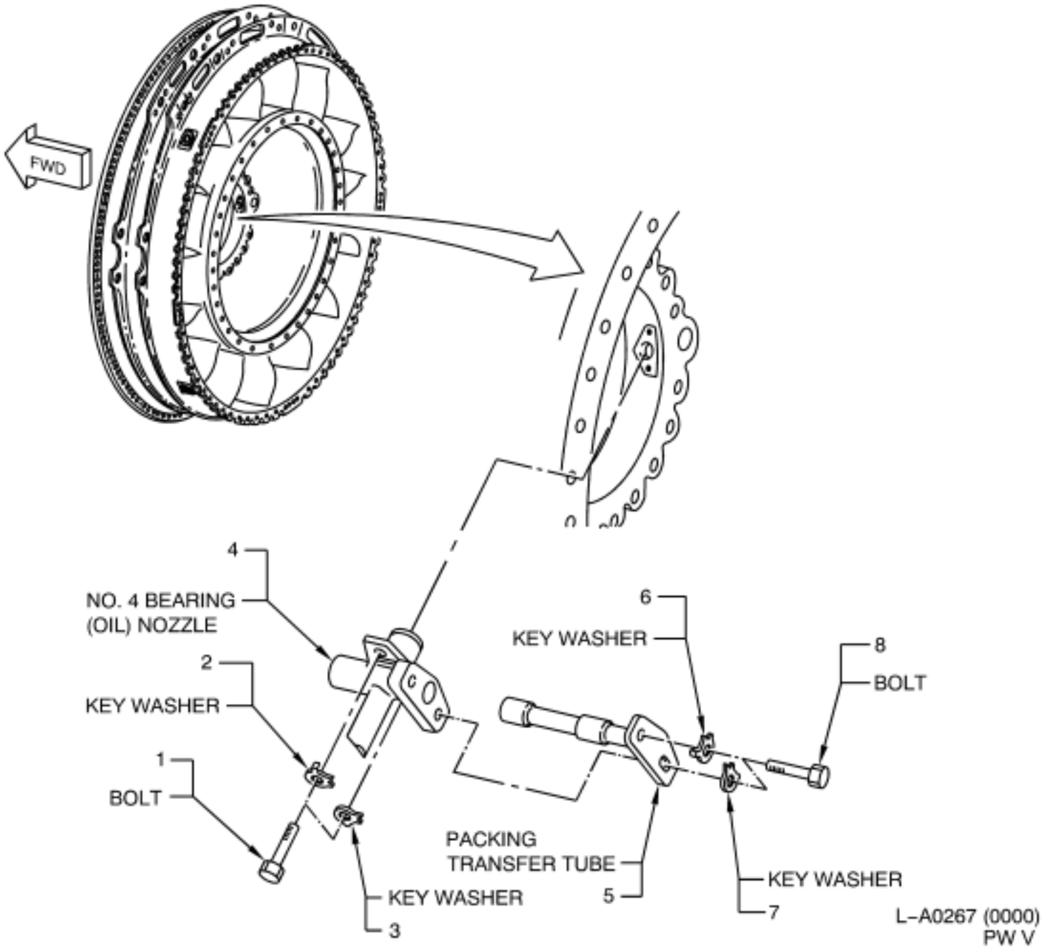
Installation Of The Compressor Inlet Cone
Figure 1217
(Task 71-00-00-540-001)


1
BOLTS AND
TABWASHERS
(8 REQUIRED)
2
FRONT COMPRESSOR
DRIVE TURBINE SHAFT
L-B4056 (0000)
PW V

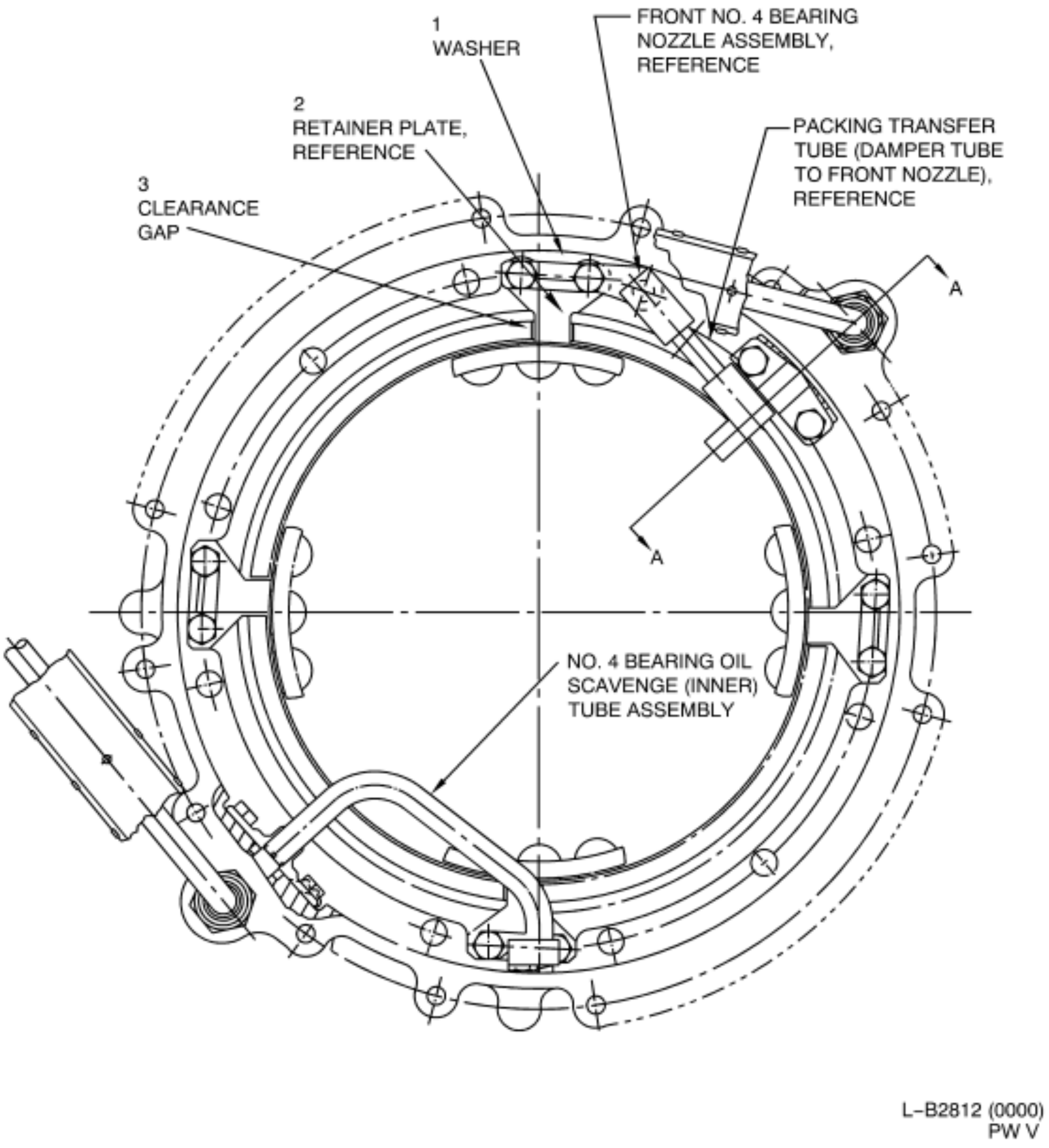
No. 4 Bearing Retaining Plate Bolts And Tabwashers Installation
Figure 1218
(Task 71-00-00-540-001)


FWD
5
BOLT
4
KEY WASHER
3
GASKET
2
PACKING
1
ADAPTER
BOLT
6
KEY WASHER
7
NO.4 BEARING
OIL SCAVENGE
(INNER) TUBE
8
L-A1240 (0292)
PW V

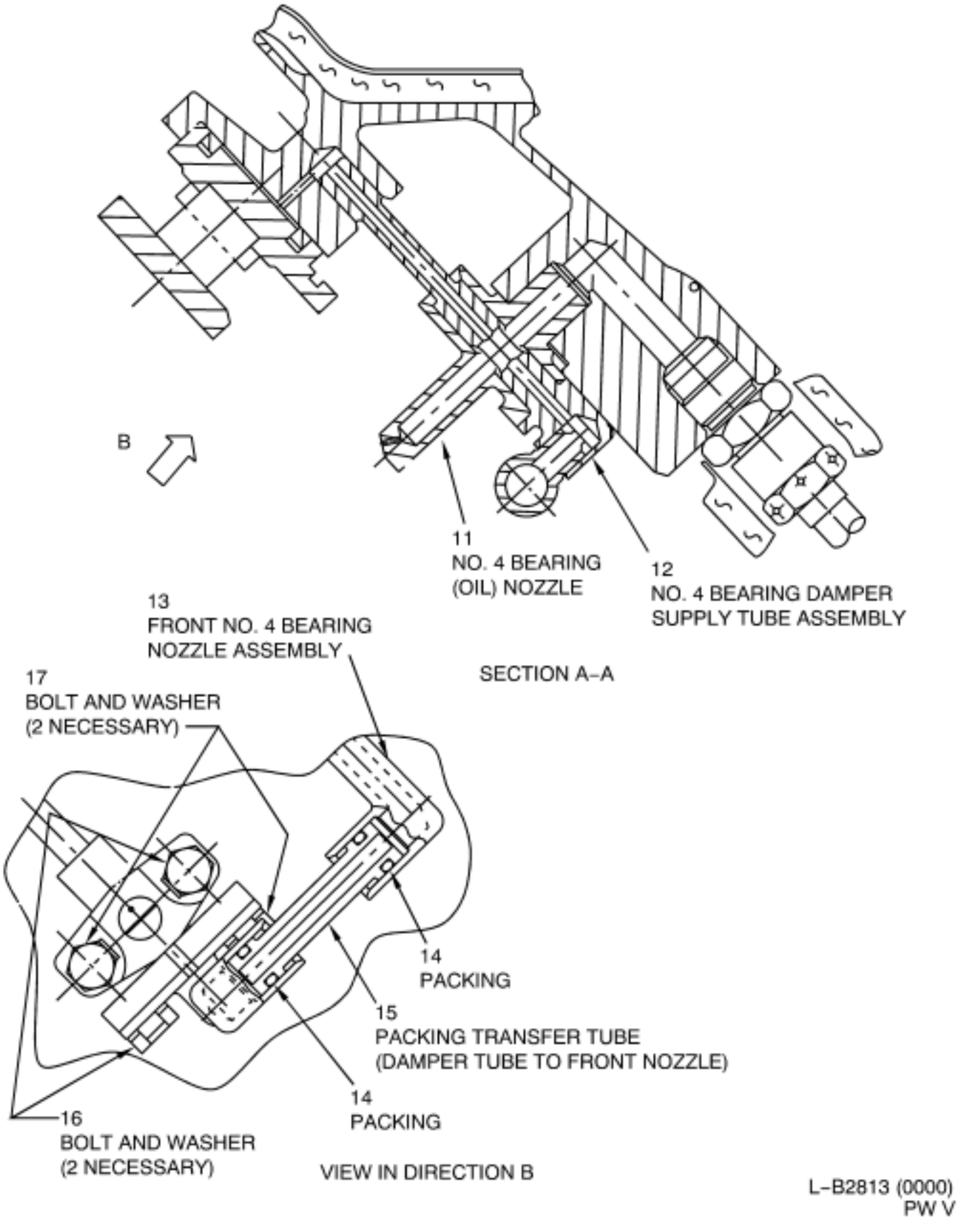
No. 4 Bearing Scavenge Tubes Installation
Figure 1219
(Task 71-00-00-540-001)


FWD
4
NO. 4 BEARING (OIL) NOZZLE
2
KEY WASHER
1
BOLT
6
KEY WASHER
8
BOLT
PACKING TRANSFER TUBE
5
KEY WASHER
3
KEY WASHER
7
L−A0267 (0000)
PW V

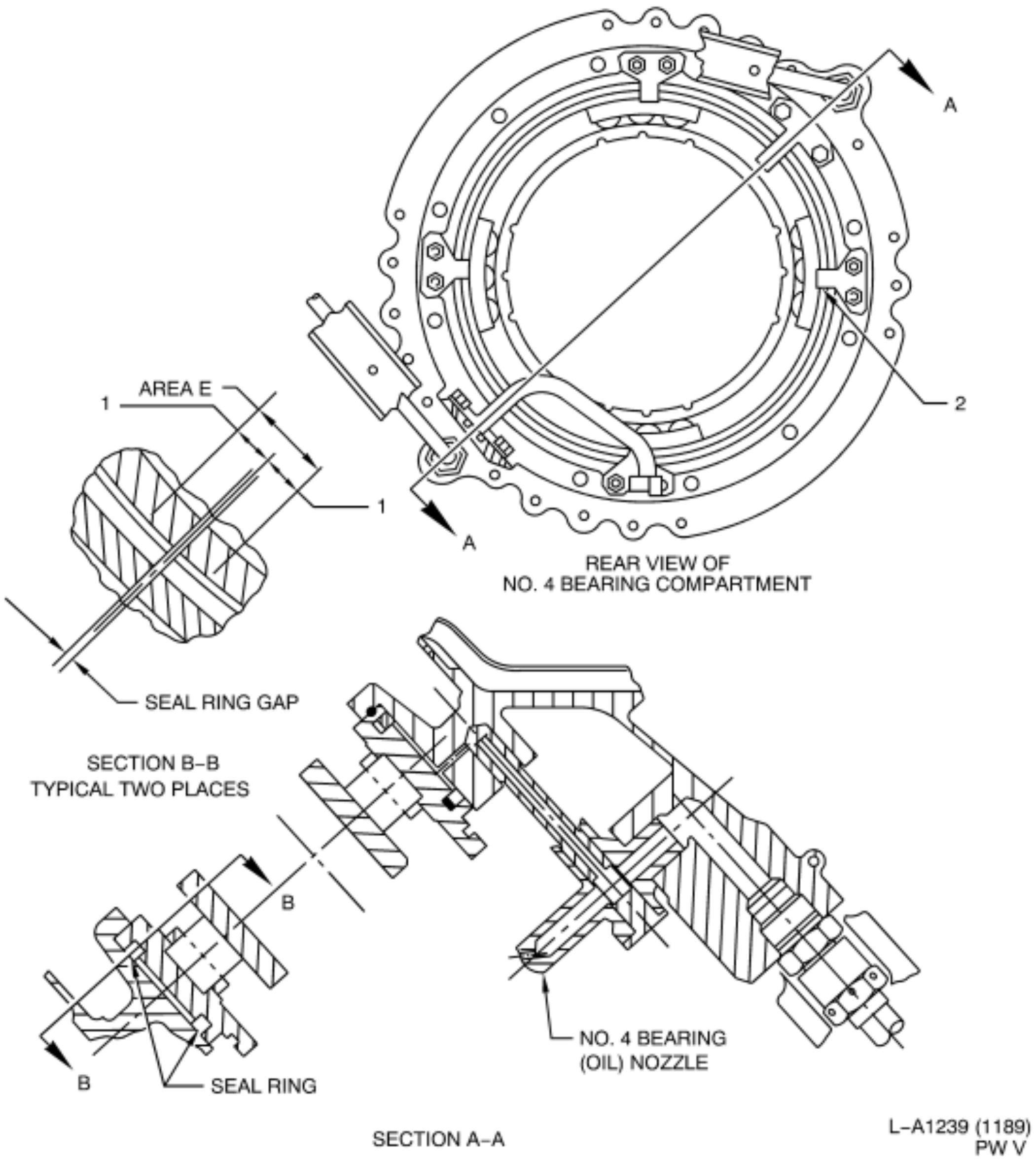
No. 4 Bearing (Oil) Nozzle And Front
Nozzle Installation (Pre SB PW4ENG 72−472)
Figure 1220
(Task 71−00−00−540−001)


1
WASHER
FRONT NO. 4 BEARING
NOZZLE ASSEMBLY,
REFERENCE
2
RETAINER PLATE,
REFERENCE
PACKING TRANSFER
TUBE (DAMPER TUBE
TO FRONT NOZZLE),
REFERENCE
3
CLEARANCE
GAP
A
A
NO. 4 BEARING OIL
SCAVENGE (INNER)
TUBE ASSEMBLY
L-B2812 (0000)
PW V

No. 4 Bearing (Oil) Nozzle And Front
Nozzle Installation (Post SB PW4ENG 72-472)
Figure 1221 (Sheet 1)
(Task 71-00-00-540-001)


B
11
NO. 4 BEARING
(OIL) NOZZLE
12
NO. 4 BEARING DAMPER
SUPPLY TUBE ASSEMBLY
13
FRONT NO. 4 BEARING
NOZZLE ASSEMBLY
SECTION A-A
17
BOLT AND WASHER
(2 NECESSARY)
14
PACKING
15
PACKING TRANSFER TUBE
(DAMPER TUBE TO FRONT NOZZLE)
14
PACKING
16
BOLT AND WASHER
(2 NECESSARY)
VIEW IN DIRECTION B
L-B2813 (0000)
PW V

No. 4 Bearing (Oil) Nozzle And Front
Nozzle Installation (Post SB PW4ENG 72-472)
Figure 1221 (Sheet 2)
(Task 71-00-00-540-001)

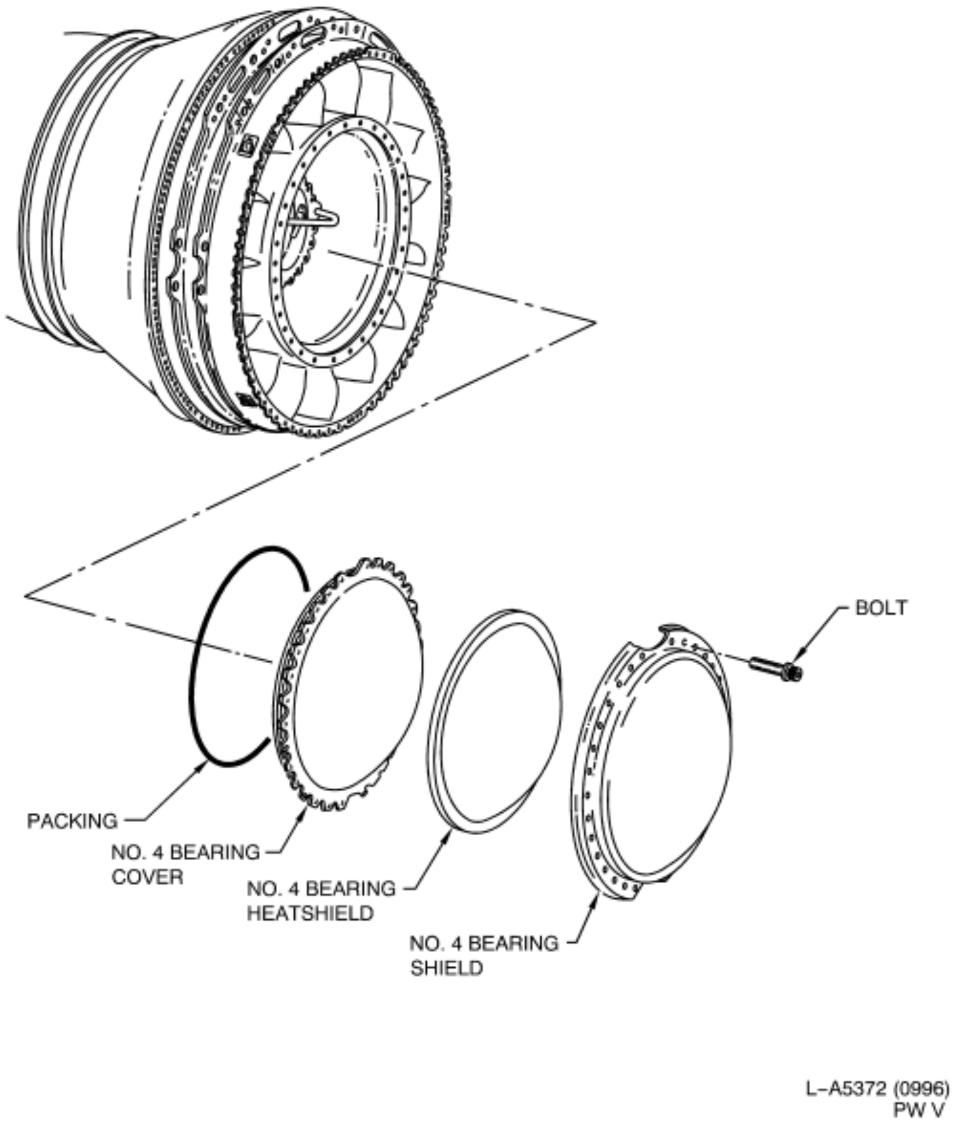

A
2
AREA E
1
1
A
REAR VIEW OF
NO. 4 BEARING COMPARTMENT
SEAL RING GAP
SECTION B-B
TYPICAL TWO PLACES
B
B
SEAL RING
NO. 4 BEARING
(OIL) NOZZLE
SECTION A-A
L-A1239 (1189)
PW V

No. 4 Bearing Outer Race Installation
Figure 1222
(Task 71-00-00-540-001)

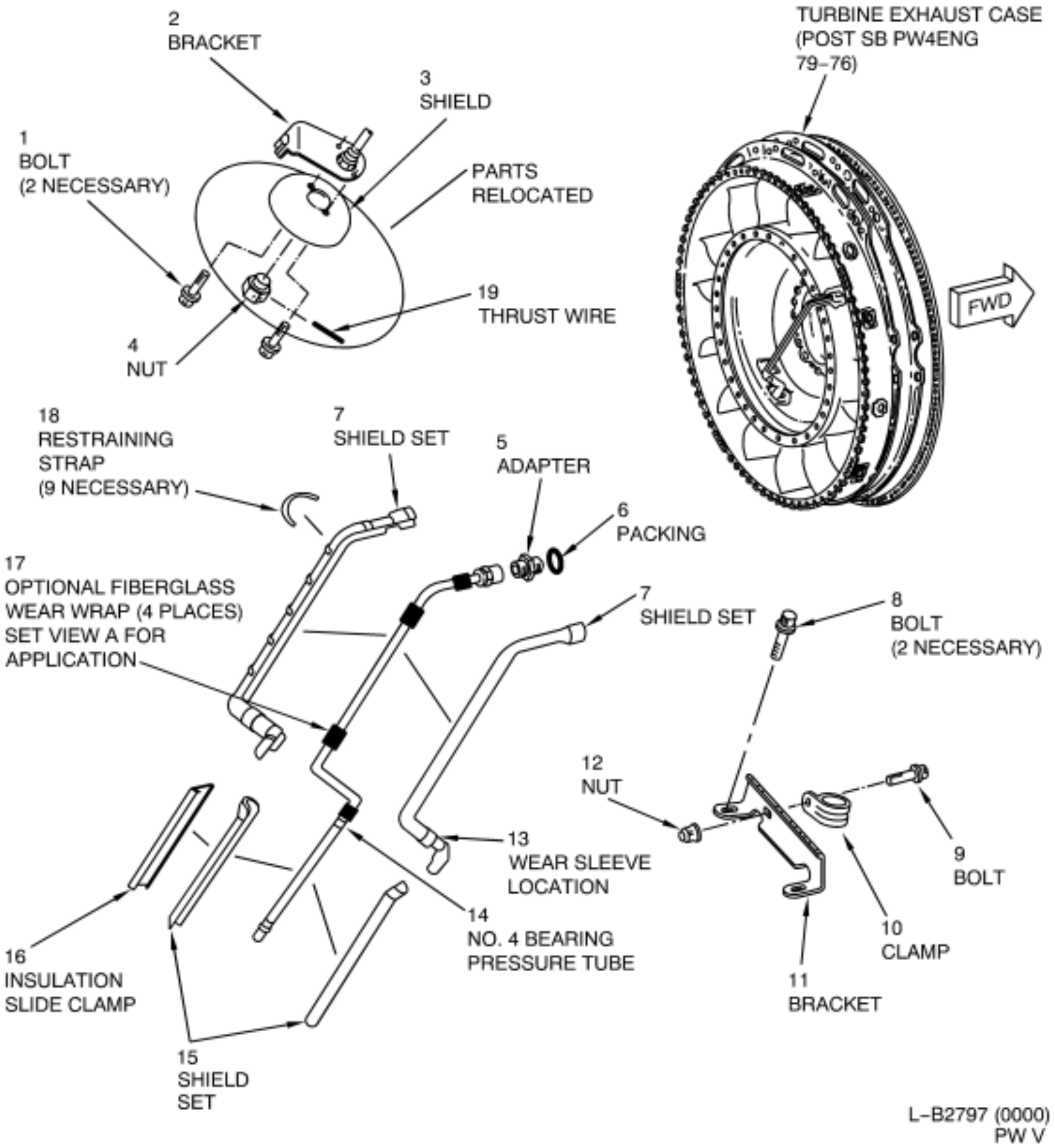
POWER PLANT GENERAL - STORAGE/TRANSPORT-03

1. 0.500 Inch (12.700 mm) Maximum
2. (Reference 90) 0.010 - 0.050 Inch (0.254 - 1.270 mm), Four Locations

Key to Figure 1222


BOLT
PACKING
NO. 4 BEARING COVER
NO. 4 BEARING HEATSHIELD
NO. 4 BEARING SHIELD
L-A5372 (0996)
PW V

No. 4 Bearing Cover And Heat Shield Installation
Figure 1223
(Task 71-00-00-540-001)


2
BRACKET
3
SHIELD
1
BOLT
(2 NECESSARY)
PARTS
RELOCATED
TURBINE EXHAUST CASE
(POST SB PW4ENG
79-76)
FWD
19
THRUST WIRE
4
NUT
18
RESTRAINING
STRAP
(9 NECESSARY)
7
SHIELD SET
5
ADAPTER
6
PACKING
17
OPTIONAL FIBERGLASS
WEAR WRAP (4 PLACES)
SET VIEW A FOR
APPLICATION
7
SHIELD SET
8
BOLT
(2 NECESSARY)
12
NUT
13
WEAR SLEEVE
LOCATION
9
BOLT
14
NO. 4 BEARING
PRESSURE TUBE
10
CLAMP
11
BRACKET
16
INSULATION
SLIDE CLAMP
15
SHIELD
SET
L-B2797 (0000)
PW V

Installation Of The No. 4 Bearing
Pressure Tube (Post SB PW4ENG 79-76)
Figure 1224 (Sheet 1)
(Task 71-00-00-540-001)

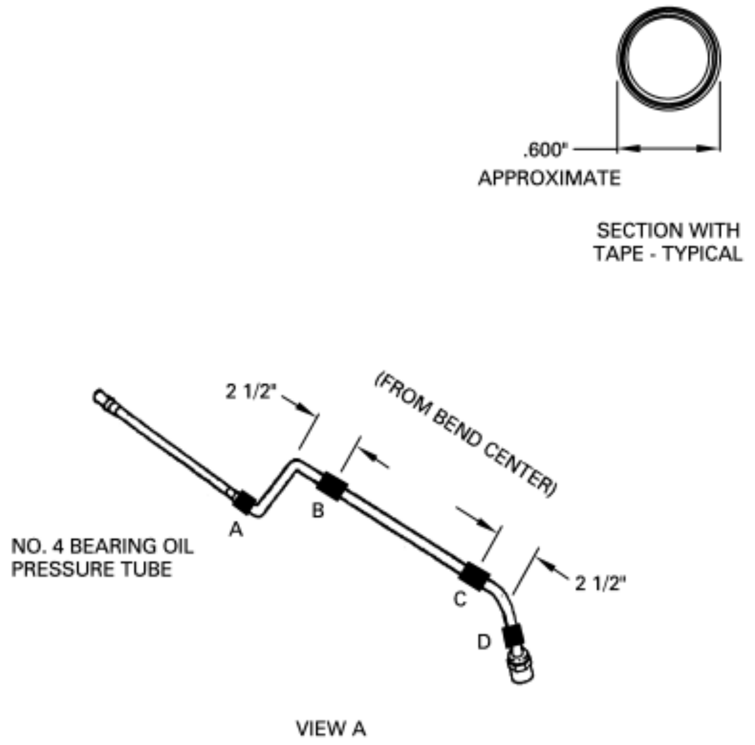
R
R

1. WRAP 1.00 INCH (25.400 mm) WIDE FIBERGLASS TAPE, P05-136, AT FOUR (4) LOCATIONS:

   -A & D AT TUBE ENDS AS SHOWN

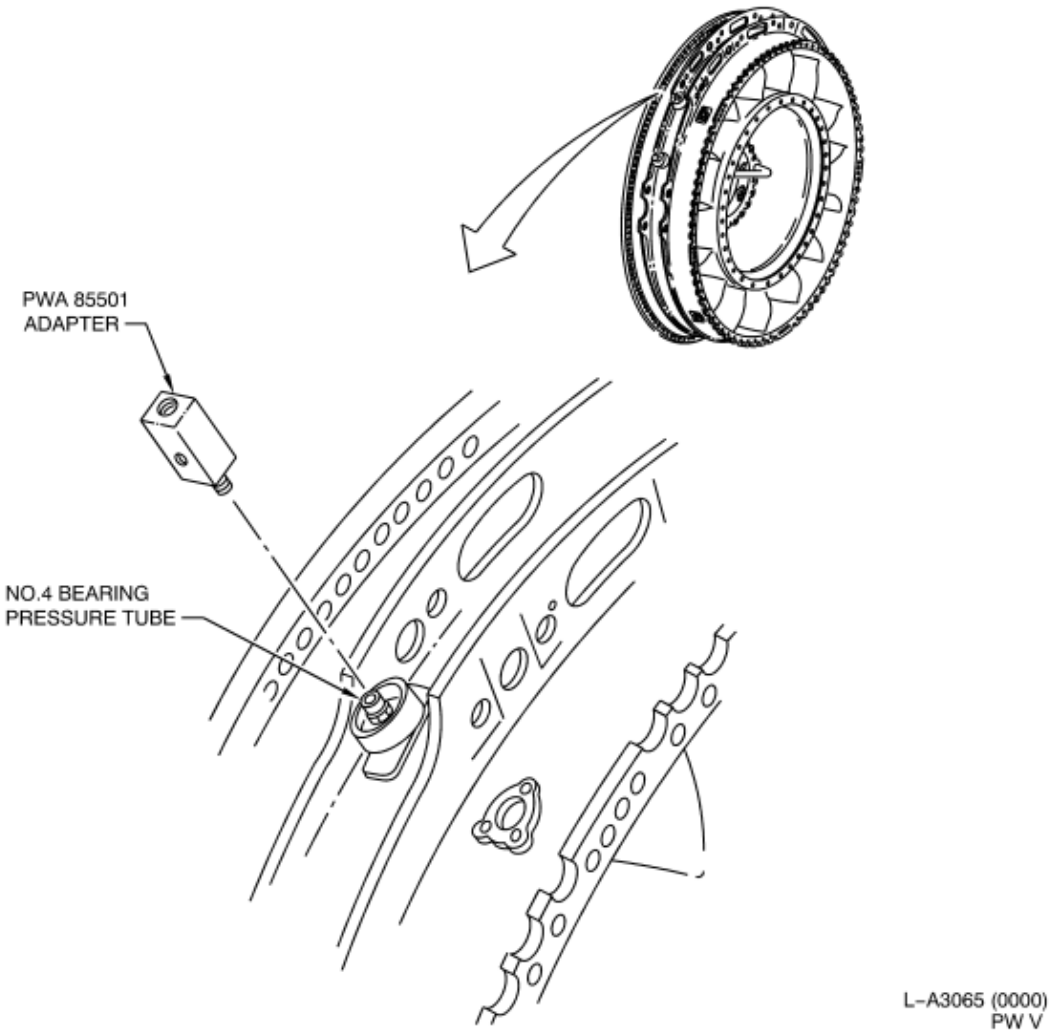
   -B & C AT STRAIGHT SECTION AS SHOWN

2. WRAP TAPE TO BE 0.600 INCH DIAMETER (15.240 mm) AND ABOUT 0.100 INCH (2.54 mm) HEIGHT ABOVE TUBE SURFACE.

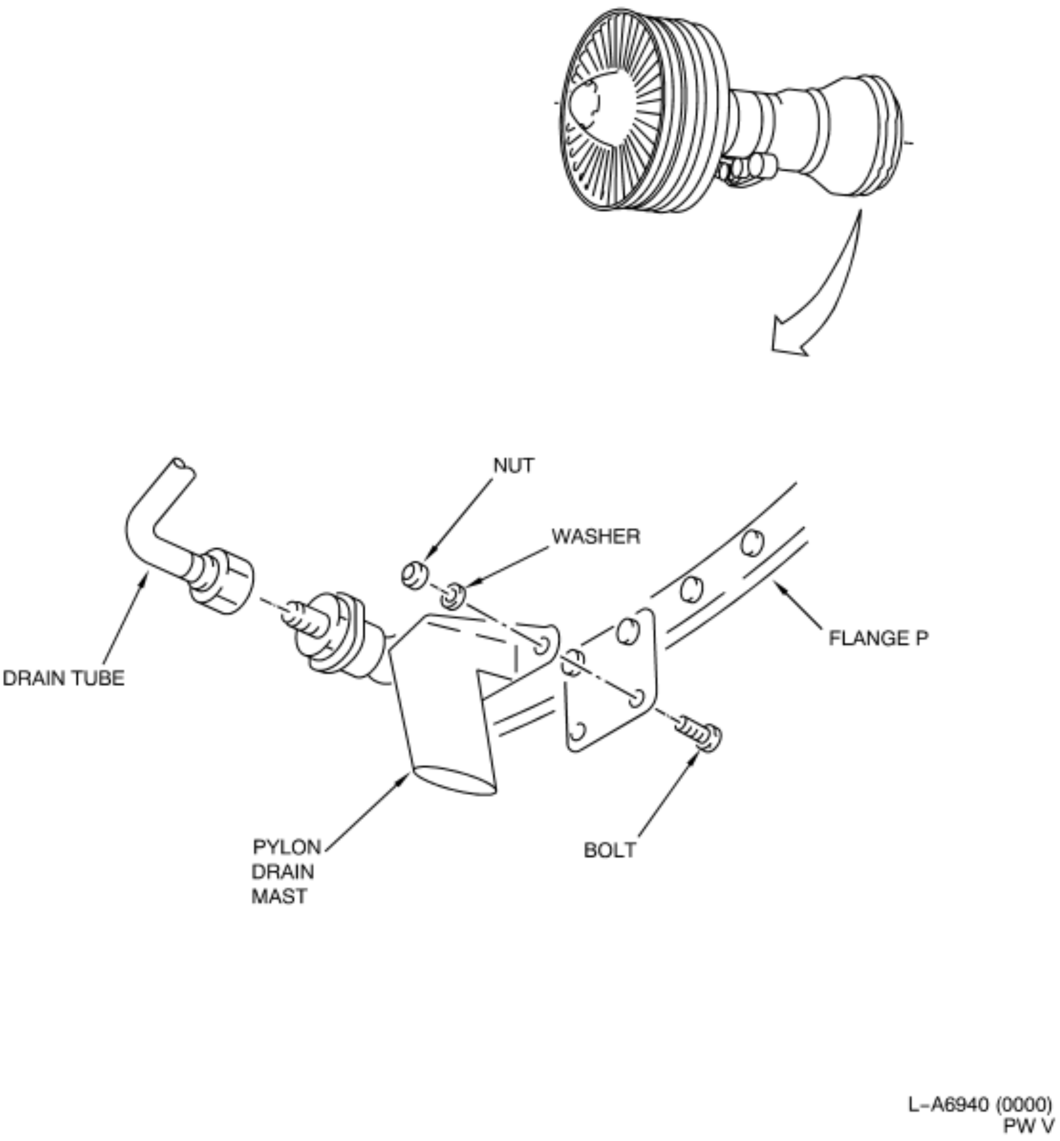

.600"
APPROXIMATE
SECTION WITH
TAPE - TYPICAL
2 1/2"
(FROM BEND CENTER)
A
B
C
D
2 1/2"
NO. 4 BEARING OIL
PRESSURE TUBE
VIEW A

L-B2800 (0000)

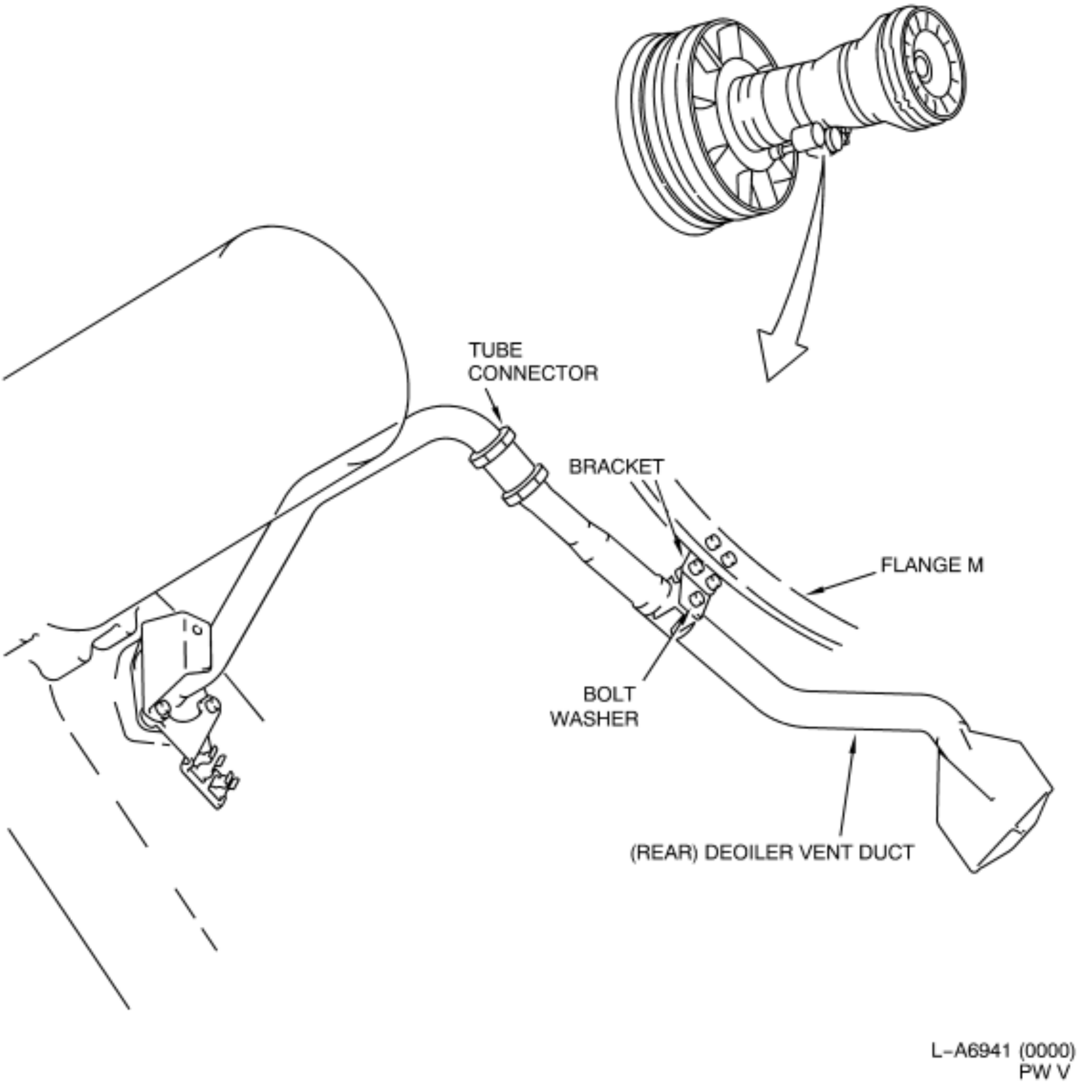
No. 4 Bearing Pressure Tube Installation Optional
Chafing Wear Prevention (Post SB PW4ENG 79-76)
Figure 1224 (Sheet 2)
(Task 71-00-00-540-001)


PWA 85501
ADAPTER
NO.4 BEARING
PRESSURE TUBE
L-A3065 (0000)
PW V

No. 4 Bearing Oil Nozzle Pressure Check
Figure 1225
(Task 71-00-00-540-001)

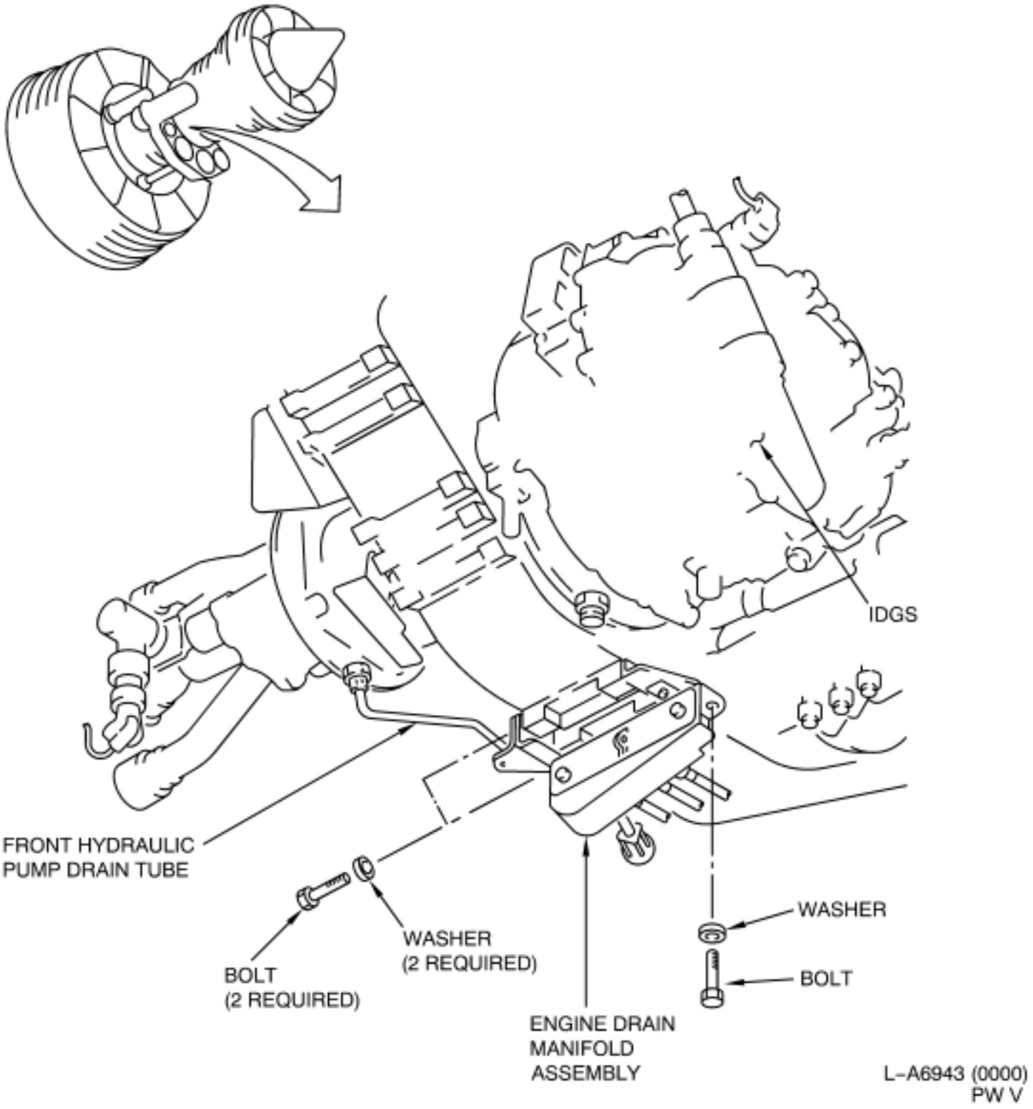

NUT
WASHER
FLANGE P
DRAIN TUBE
PYLON DRAIN MAST
BOLT
L−A6940 (0000)
PW V

Installation Of Core−Unit Parts (Pylon Drain Mast)
Figure 1226 (Sheet 1)
(Task 71−00−00−540−001)


TUBE CONNECTOR
BRACKET
FLANGE M
BOLT
WASHER
(REAR) DEOILER VENT DUCT
L−A6941 (0000)
PW V

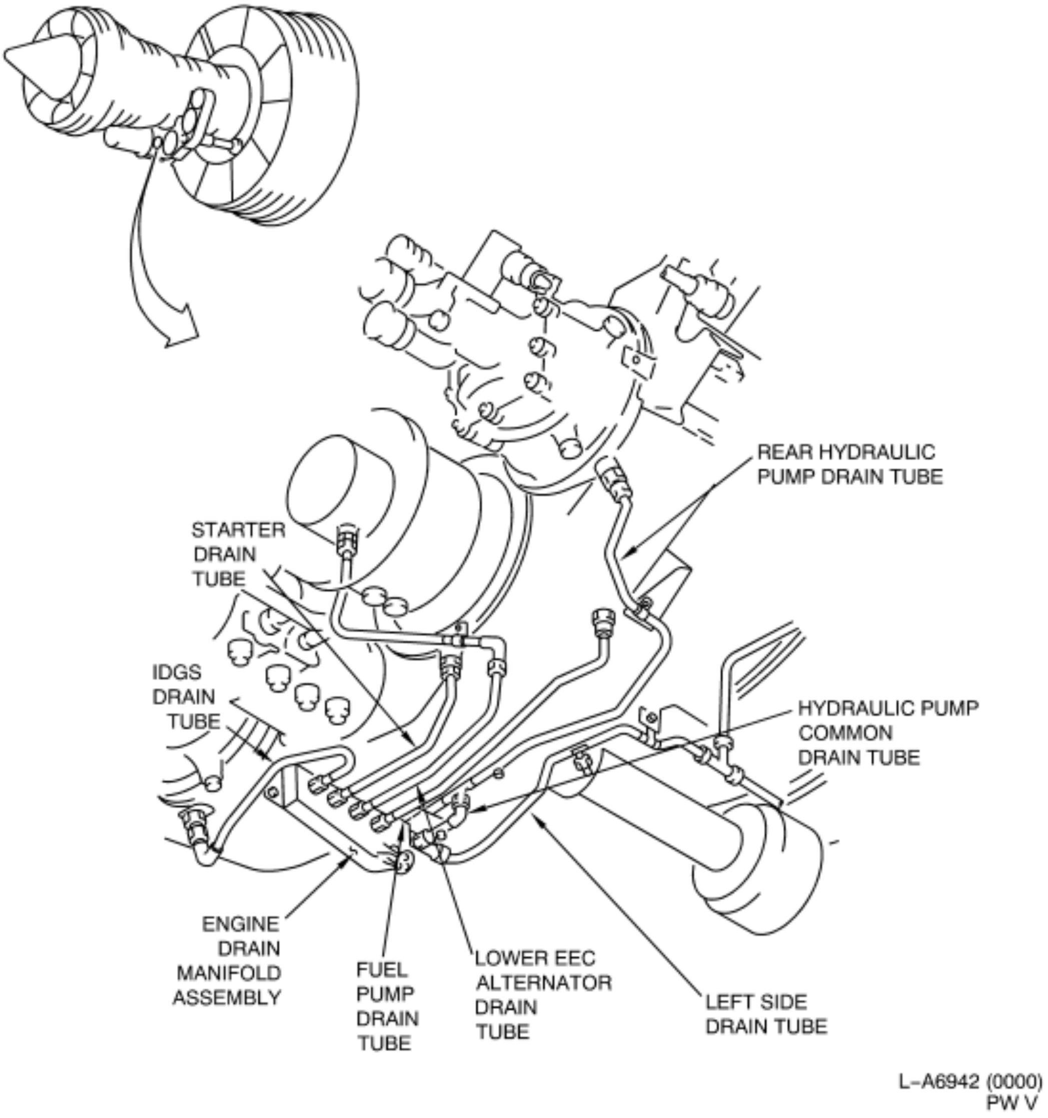
Installation Of Core−Unit Parts (Deoiler Vent Duct)
Figure 1226 (Sheet 2)
(Task 71−00−00−540−001)

R
R

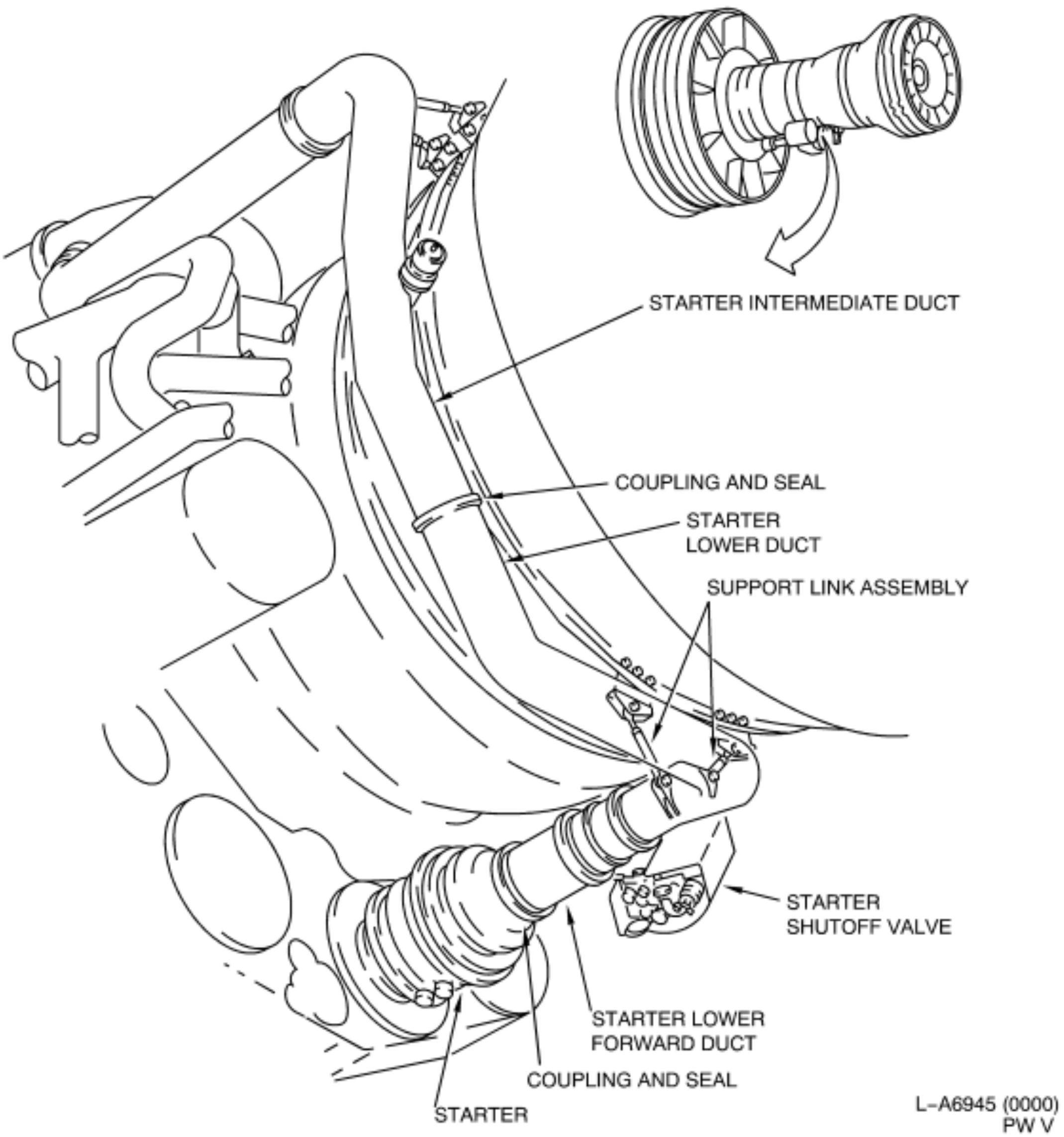

IDGS
FRONT HYDRAULIC PUMP DRAIN TUBE
WASHER
BOLT
WASHER (2 REQUIRED)
BOLT (2 REQUIRED)
ENGINE DRAIN MANIFOLD ASSEMBLY
L−A6943 (0000)
PW V

Installation Of Core−Unit Parts (Drain Manifold Assembly)
Figure 1226 (Sheet 3)
(Task 71−00−00−540−001)

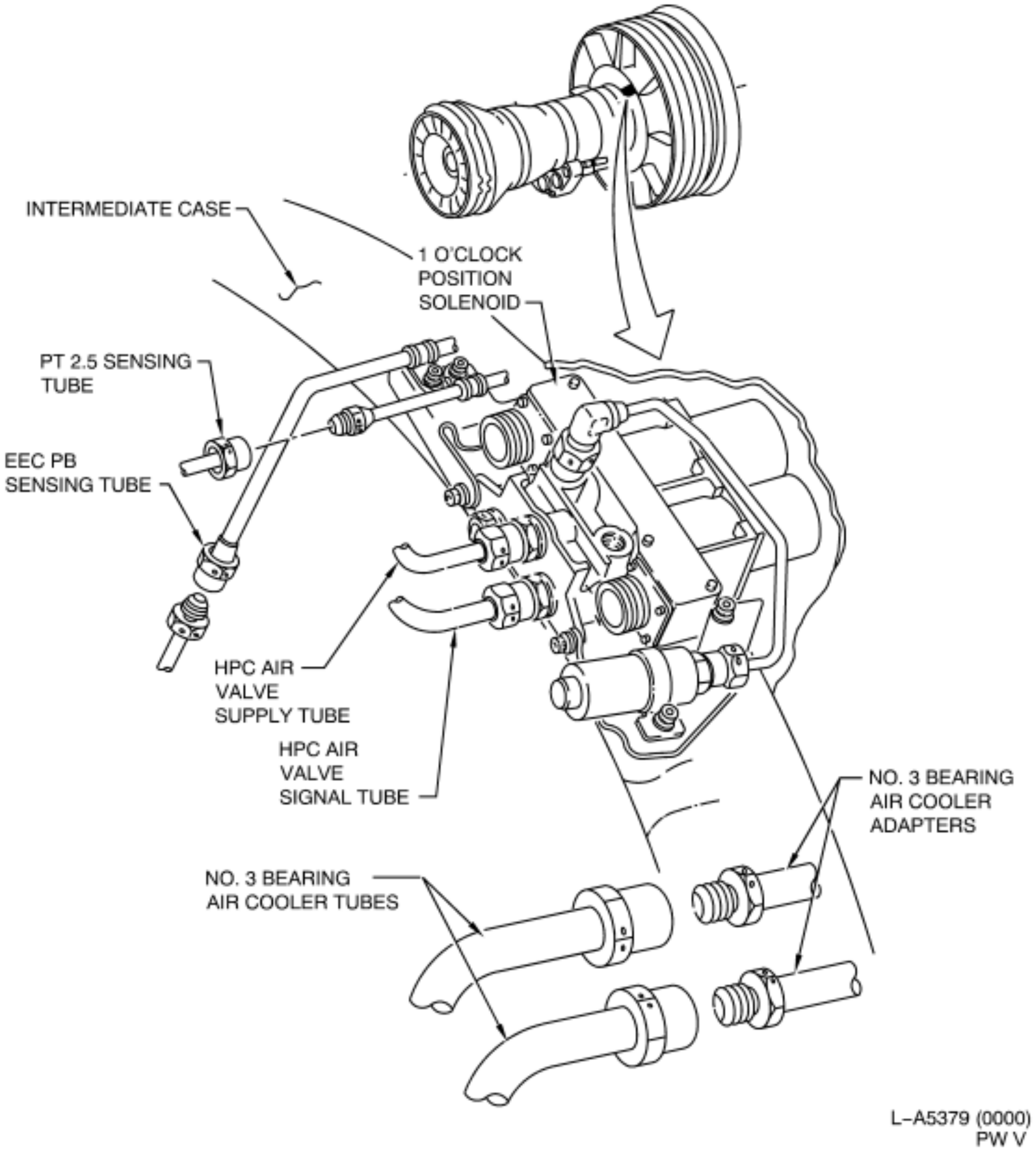
R
R


REAR HYDRAULIC PUMP DRAIN TUBE
STARTER DRAIN TUBE
IDGS DRAIN TUBE
HYDRAULIC PUMP COMMON DRAIN TUBE
ENGINE DRAIN MANIFOLD ASSEMBLY
FUEL PUMP DRAIN TUBE
LOWER EEC ALTERNATOR DRAIN TUBE
LEFT SIDE DRAIN TUBE
L-A6942 (0000)
PW V

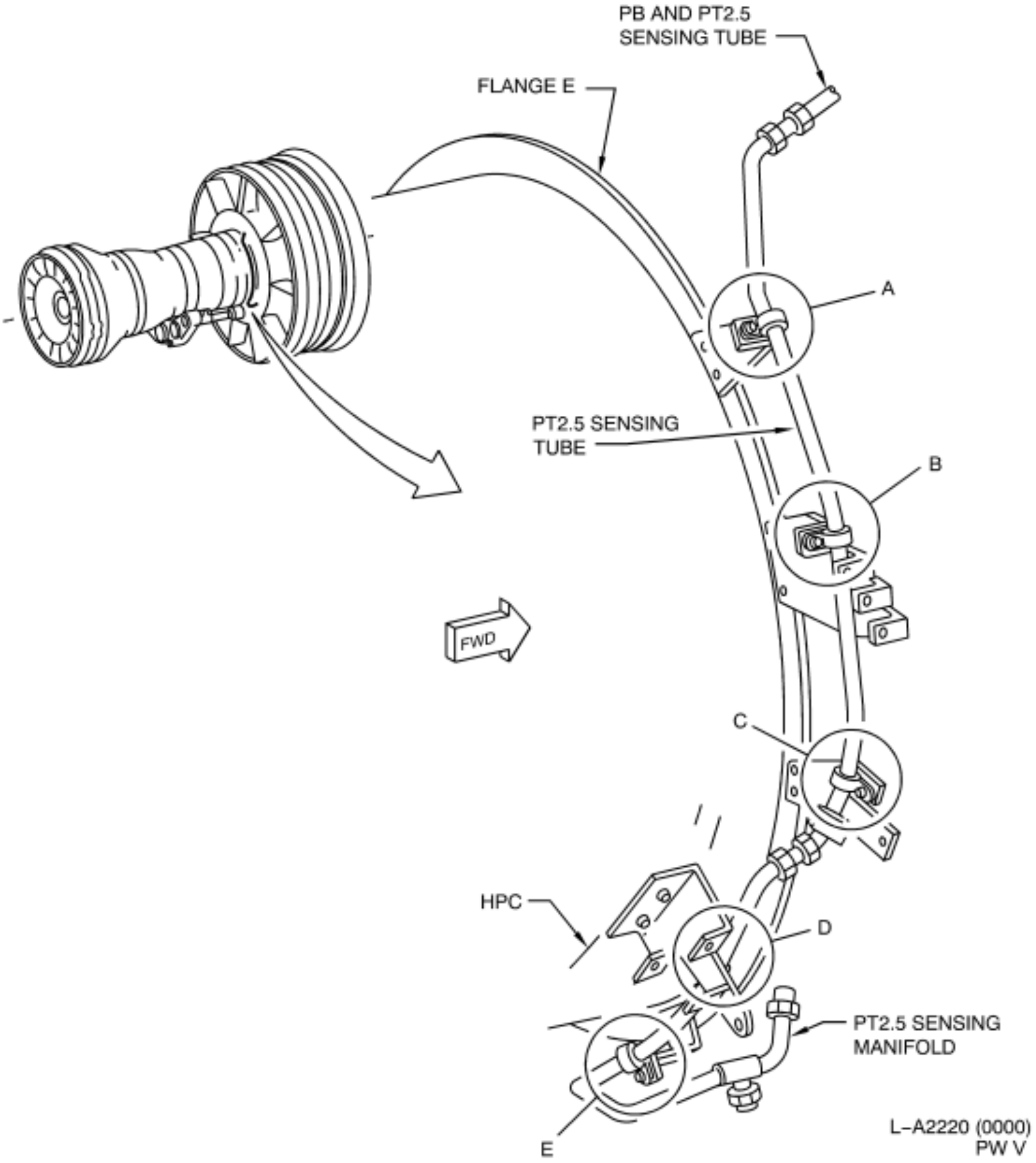
Installation Of Core-Unit Parts (Drain Tubes)
Figure 1226 (Sheet 4)
(Task 71-00-00-540-001)


STARTER INTERMEDIATE DUCT
COUPLING AND SEAL
STARTER LOWER DUCT
SUPPORT LINK ASSEMBLY
STARTER SHUTOFF VALVE
STARTER LOWER FORWARD DUCT
COUPLING AND SEAL
STARTER
L−A6945 (0000)
PW V

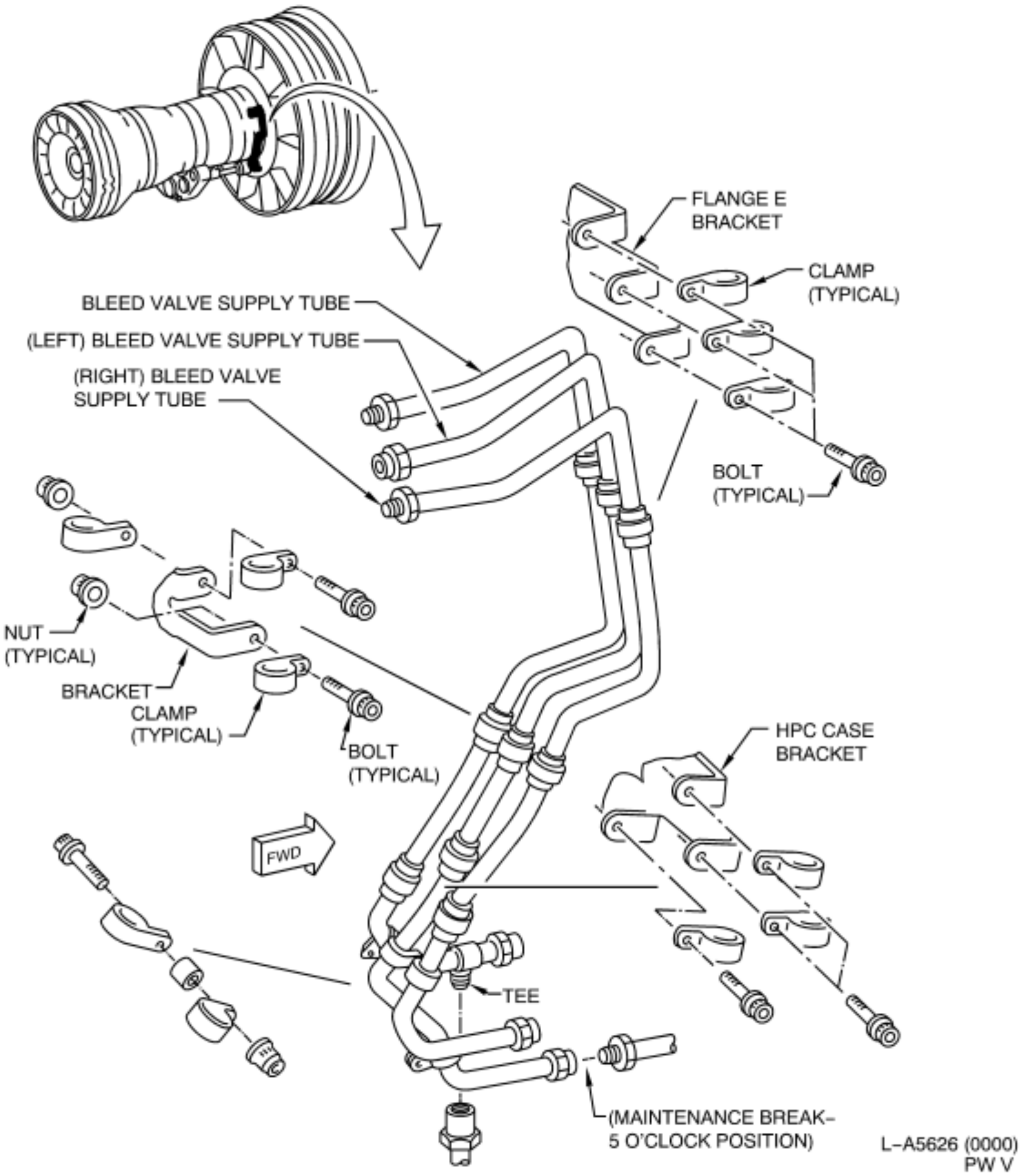
Installation Of Core−Unit Parts (Starter Valve And Duct)
Figure 1226 (Sheet 5)
(Task 71−00−00−540−001)


INTERMEDIATE CASE
1 O'CLOCK POSITION SOLENOID
PT 2.5 SENSING TUBE
EEC PB SENSING TUBE
HPC AIR VALVE SUPPLY TUBE
HPC AIR VALVE SIGNAL TUBE
NO. 3 BEARING AIR COOLER ADAPTERS
NO. 3 BEARING AIR COOLER TUBES
L-A5379 (0000)
PW V

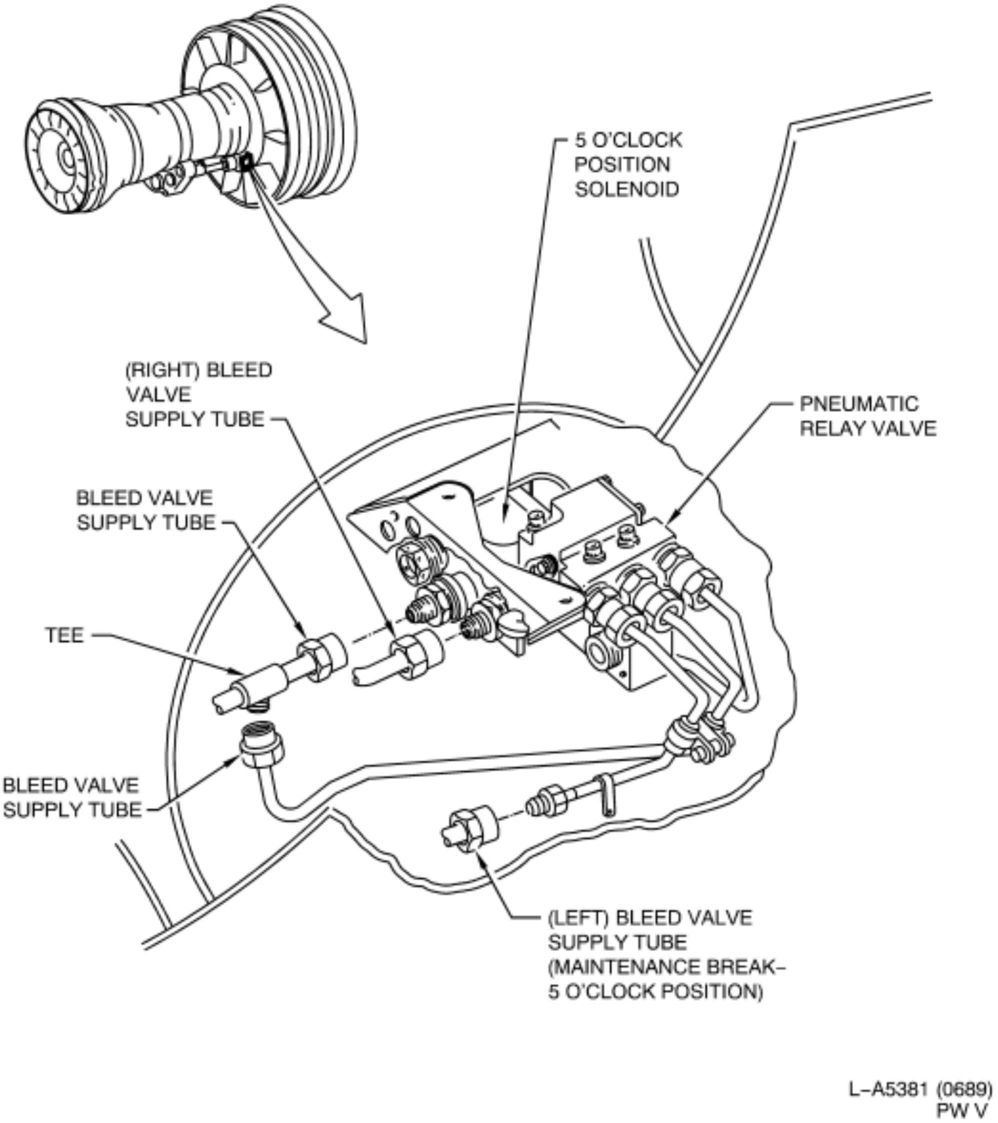
Installation Of The Engine Tubes
Figure 1227 (Sheet 1)
(Task 71-00-00-540-001)


PB AND PT2.5
SENSING TUBE
FLANGE E
A
PT2.5 SENSING
TUBE
B
FWD
C
HPC
D
PT2.5 SENSING
MANIFOLD
E
L-A2220 (0000)
PW V

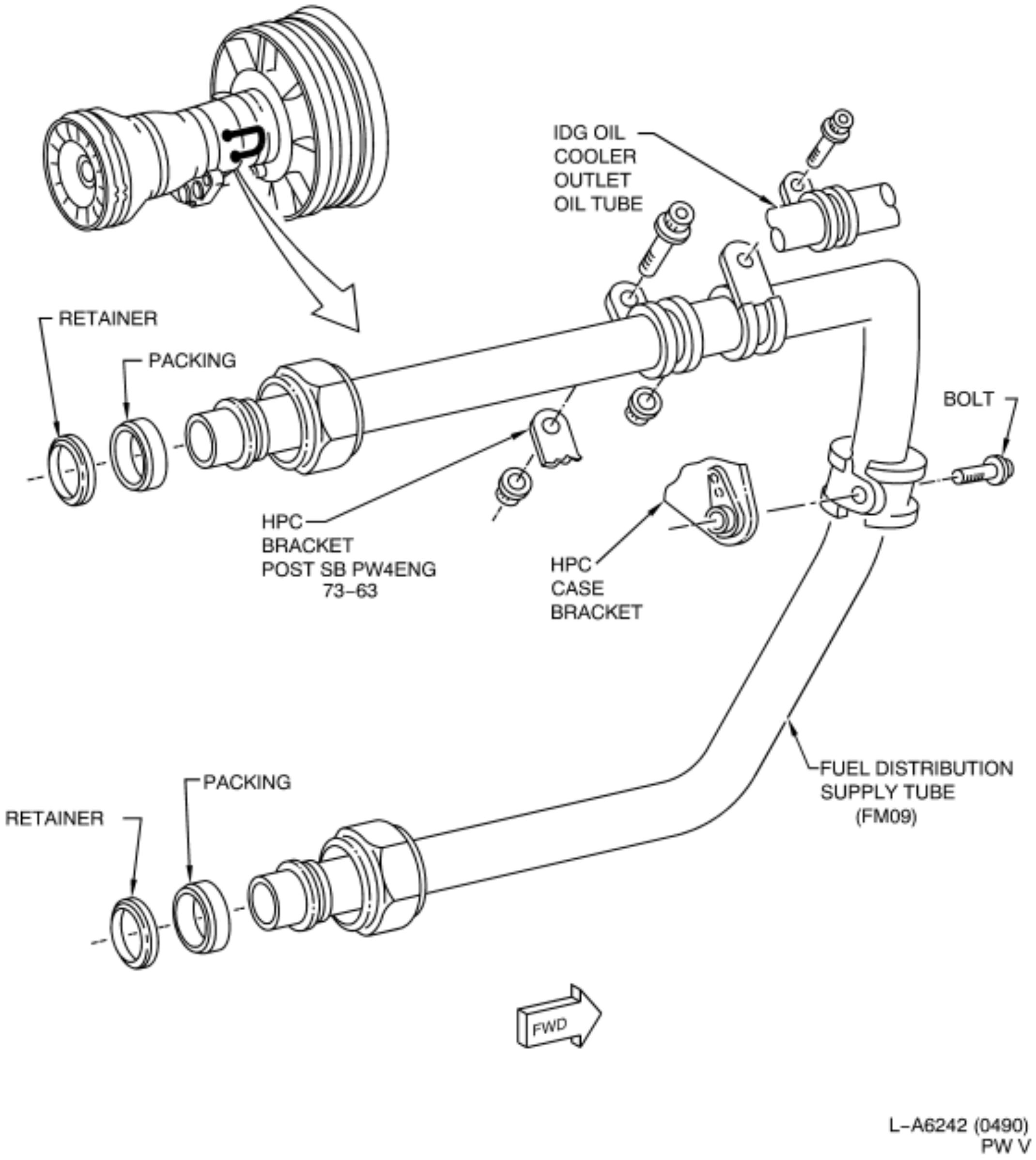
Installation Of The Engine Tubes
Figure 1227 (Sheet 2)
(Task 71-00-00-540-001)


FLANGE E BRACKET
CLAMP (TYPICAL)
BLEED VALVE SUPPLY TUBE
(LEFT) BLEED VALVE SUPPLY TUBE
(RIGHT) BLEED VALVE SUPPLY TUBE
BOLT (TYPICAL)
NUT (TYPICAL)
BRACKET
CLAMP (TYPICAL)
BOLT (TYPICAL)
HPC CASE BRACKET
FWD
TEE
(MAINTENANCE BREAK- 5 O'CLOCK POSITION)
L-A5626 (0000)
PW V

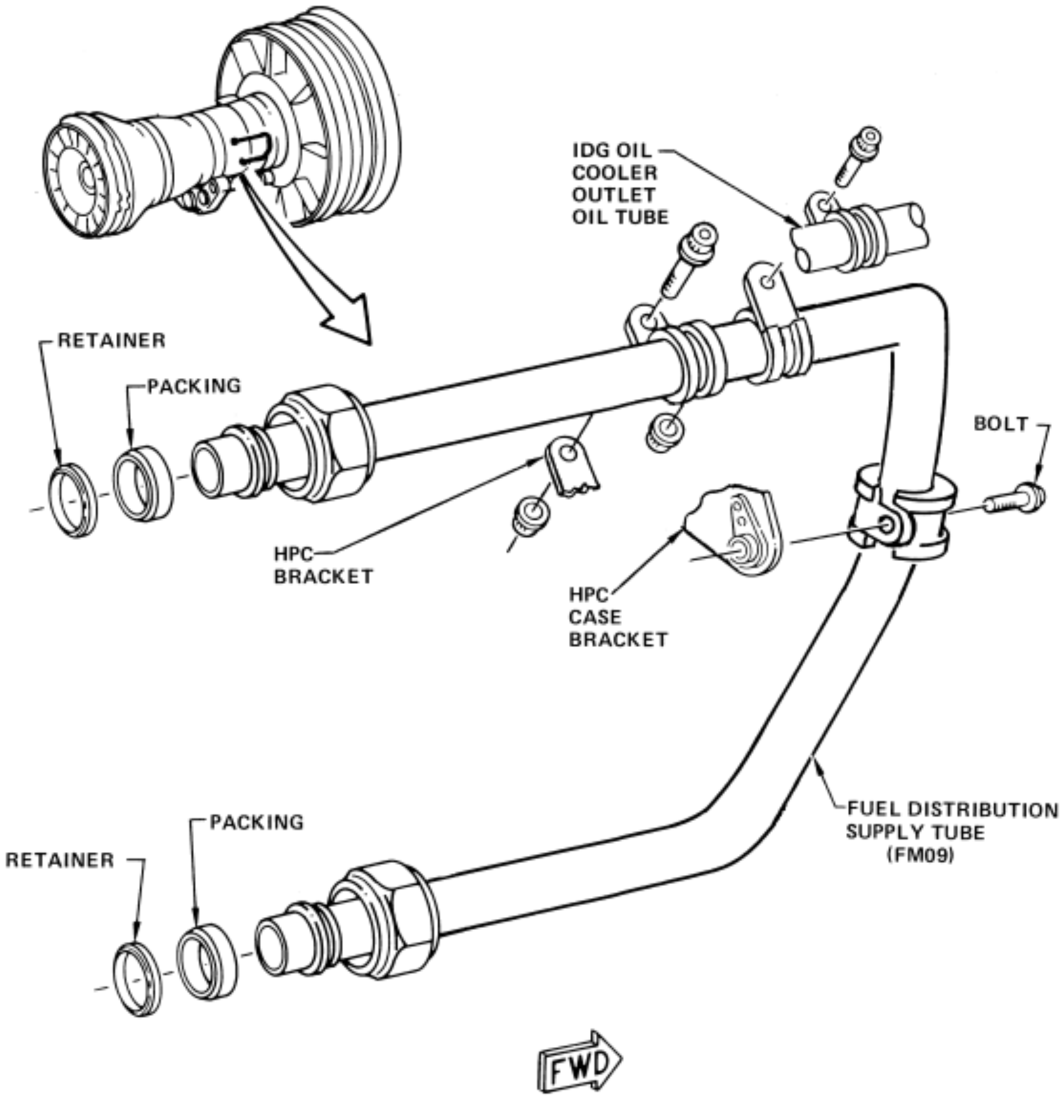
Installation Of The Engine Tubes
Figure 1227 (Sheet 3)
(Task 71-00-00-540-001)


5 O'CLOCK POSITION SOLENOID
(RIGHT) BLEED VALVE SUPPLY TUBE
PNEUMATIC RELAY VALVE
BLEED VALVE SUPPLY TUBE
TEE
BLEED VALVE SUPPLY TUBE
(LEFT) BLEED VALVE SUPPLY TUBE (MAINTENANCE BREAK- 5 O'CLOCK POSITION)
L-A5381 (0689)
PW V

Installation Of The Engine Tubes
Figure 1227 (Sheet 4)
(Task 71-00-00-540-001)

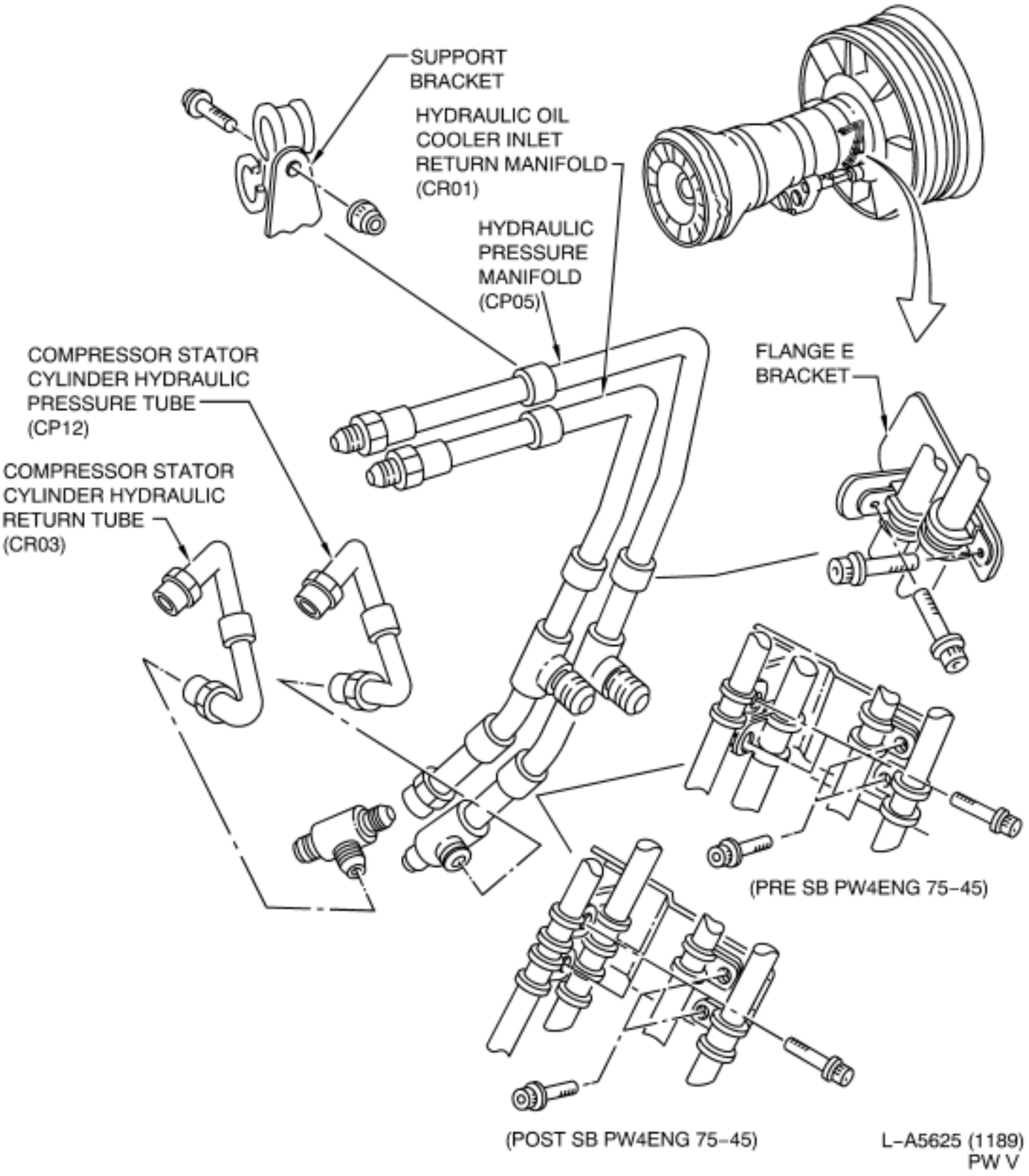

IDG OIL
COOLER
OUTLET
OIL TUBE
RETAINER
PACKING
BOLT
HPC
BRACKET
POST SB PW4ENG
73-63
HPC
CASE
BRACKET
FUEL DISTRIBUTION
SUPPLY TUBE
(FM09)
PACKING
RETAINER
FWD
L-A6242 (0490)
PW V

Installation Of The Engine Tubes
Figure 1227 (Sheet 5)
(Task 71-00-00-540-001)

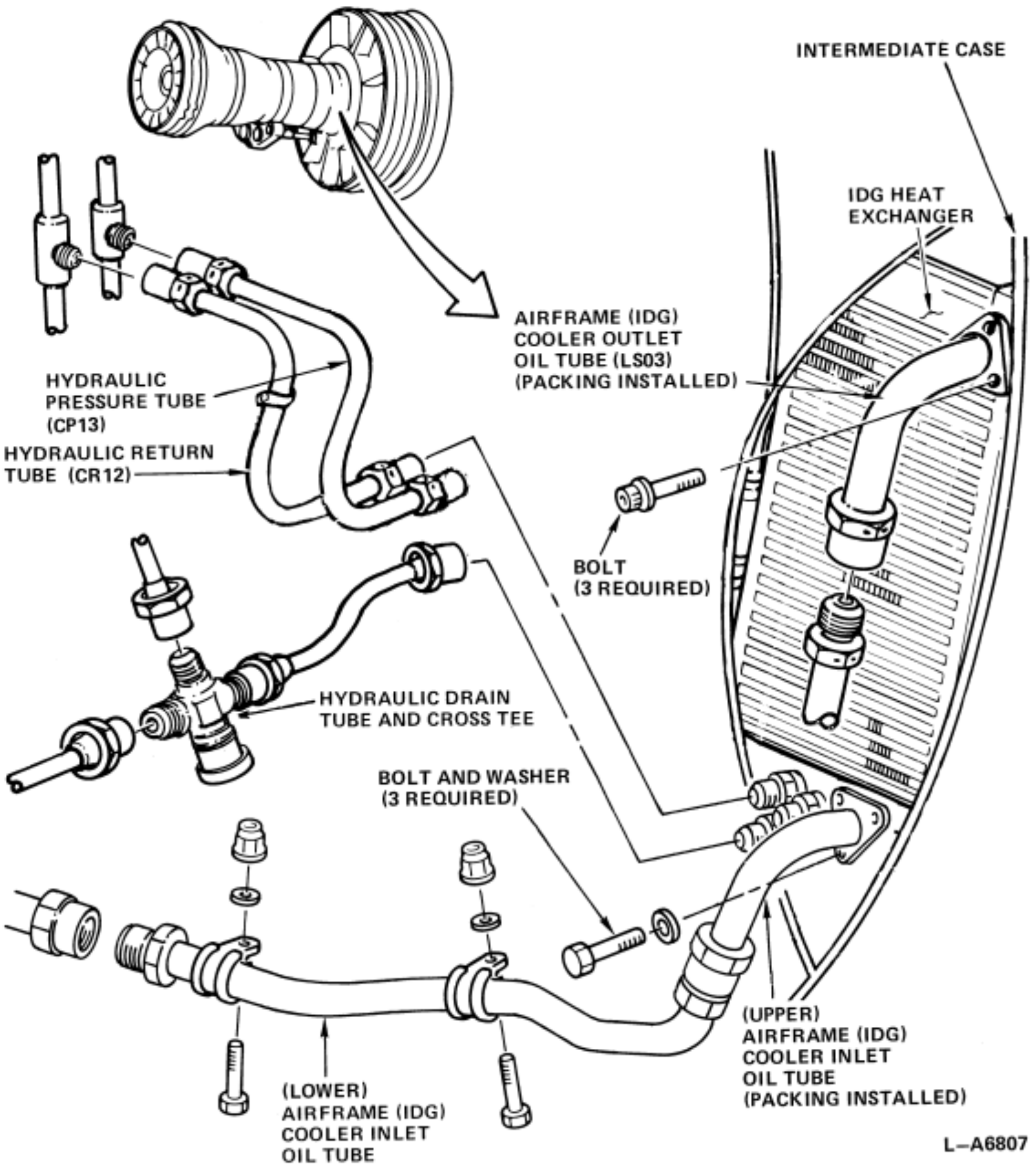

IDG OIL
COOLER
OUTLET
OIL TUBE
RETAINER
PACKING
BOLT
HPC
BRACKET
HPC
CASE
BRACKET
FUEL DISTRIBUTION
SUPPLY TUBE
(FM09)
PACKING
RETAINER
FWD

L-B3188

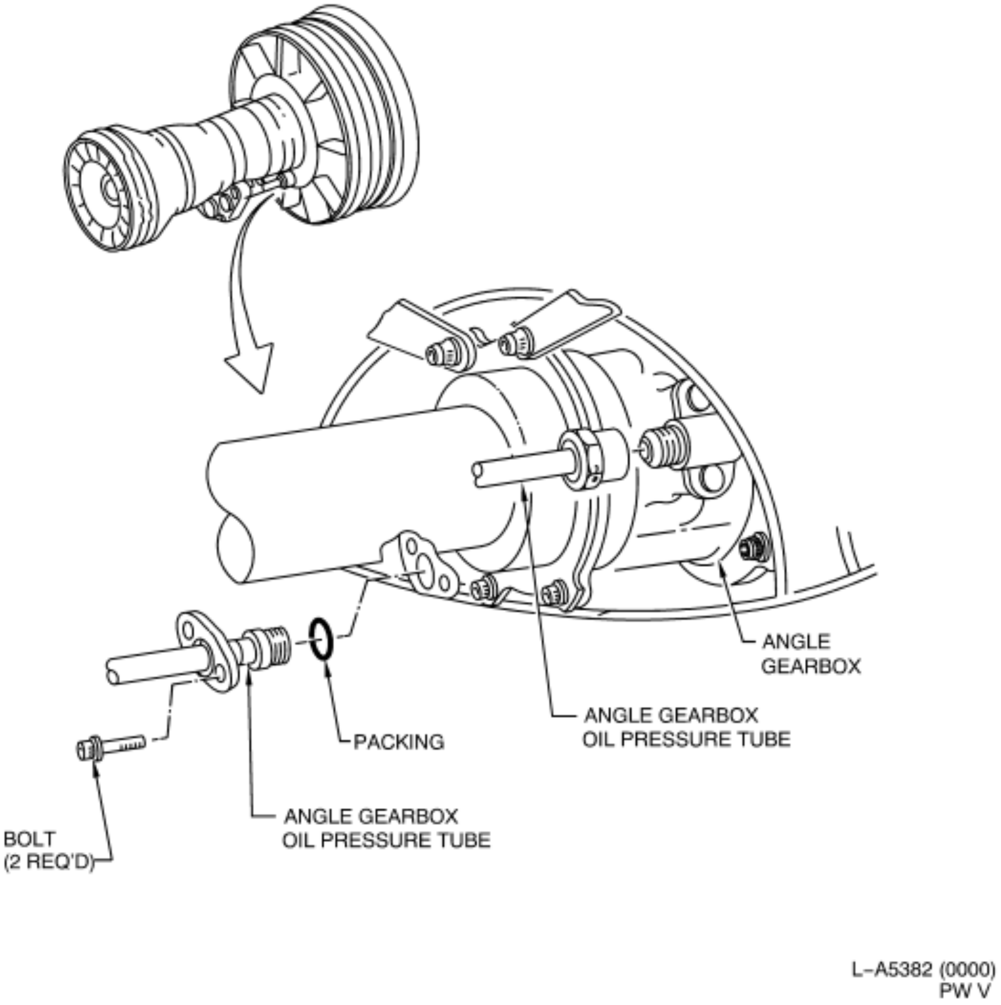
Installation Of The Engine Tubes
Figure 1227 (Sheet 6)
(Task 71−00−00−540−001)


SUPPORT BRACKET
HYDRAULIC OIL COOLER INLET RETURN MANIFOLD (CR01)
HYDRAULIC PRESSURE MANIFOLD (CP05)
COMPRESSOR STATOR CYLINDER HYDRAULIC PRESSURE TUBE (CP12)
COMPRESSOR STATOR CYLINDER HYDRAULIC RETURN TUBE (CR03)
FLANGE E BRACKET
(PRE SB PW4ENG 75-45)
(POST SB PW4ENG 75-45)
L-A5625 (1189)
PW V

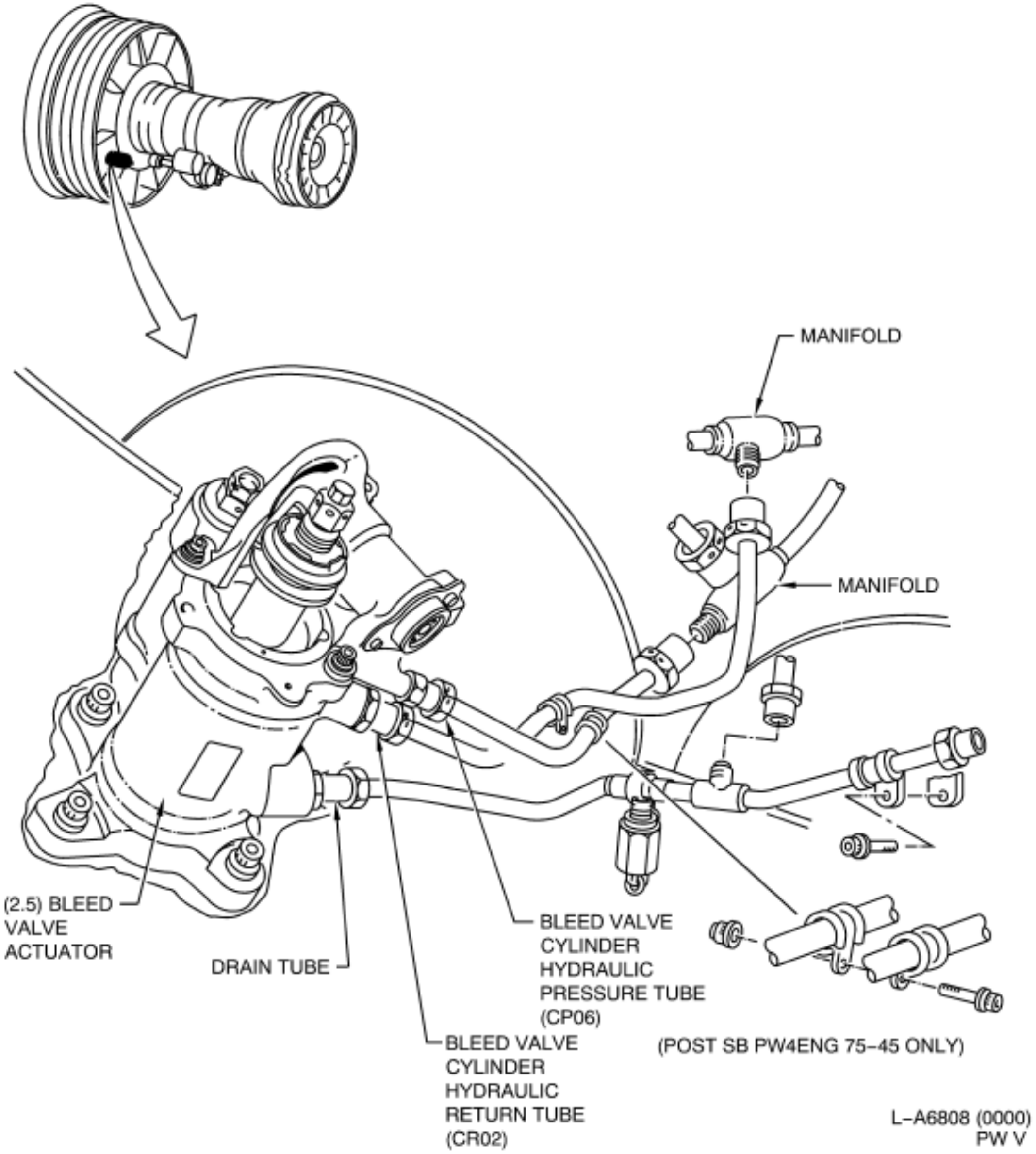
Installation Of The Engine Tubes
Figure 1227 (Sheet 7)
(Task 71-00-00-540-001)


INTERMEDIATE CASE
IDG HEAT EXCHANGER
AIRFRAME (IDG) COOLER OUTLET OIL TUBE (LS03) (PACKING INSTALLED)
HYDRAULIC PRESSURE TUBE (CP13)
HYDRAULIC RETURN TUBE (CR12)
BOLT (3 REQUIRED)
HYDRAULIC DRAIN TUBE AND CROSS TEE
BOLT AND WASHER (3 REQUIRED)
(UPPER) AIRFRAME (IDG) COOLER INLET OIL TUBE (PACKING INSTALLED)
(LOWER) AIRFRAME (IDG) COOLER INLET OIL TUBE
L-A6807

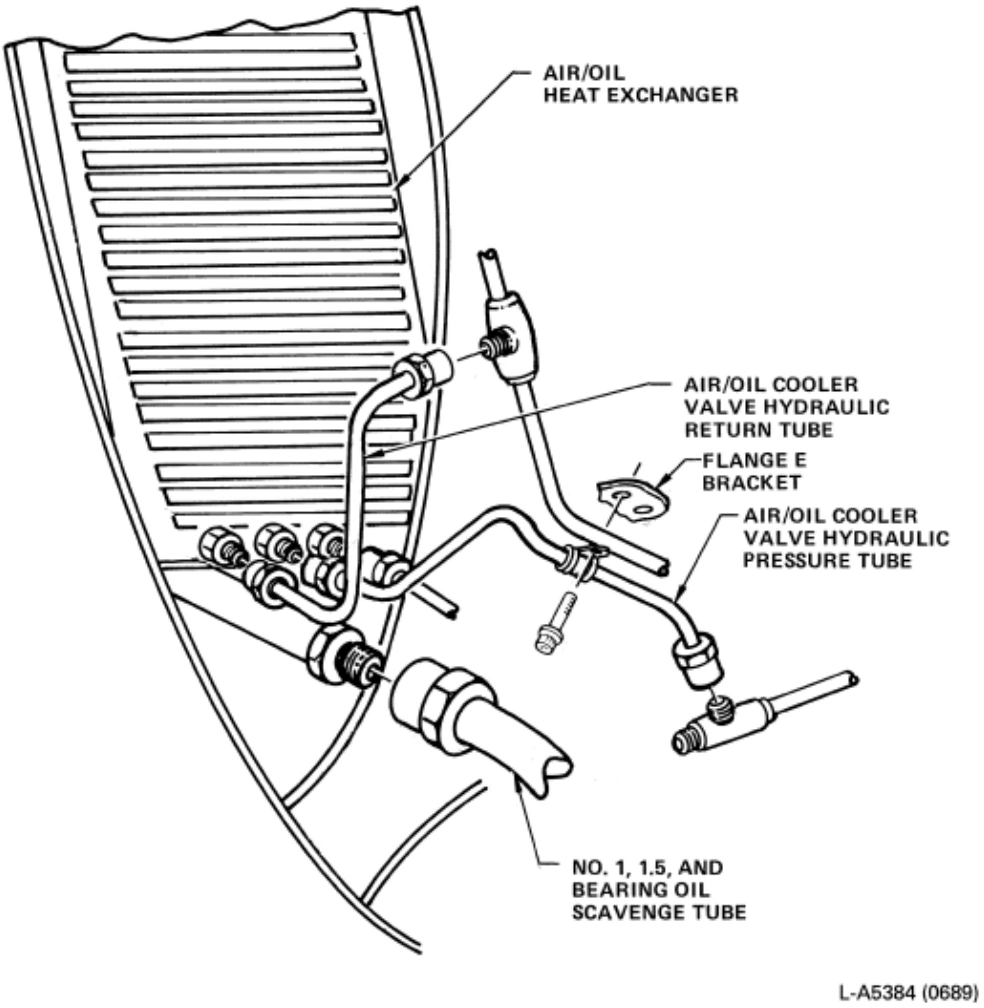
Installation Of The Engine Tubes
Figure 1227 (Sheet 8)
(Task 71-00-00-540-001)


ANGLE GEARBOX
ANGLE GEARBOX OIL PRESSURE TUBE
PACKING
ANGLE GEARBOX OIL PRESSURE TUBE
BOLT (2 REQ'D)
L-A5382 (0000)
PW V

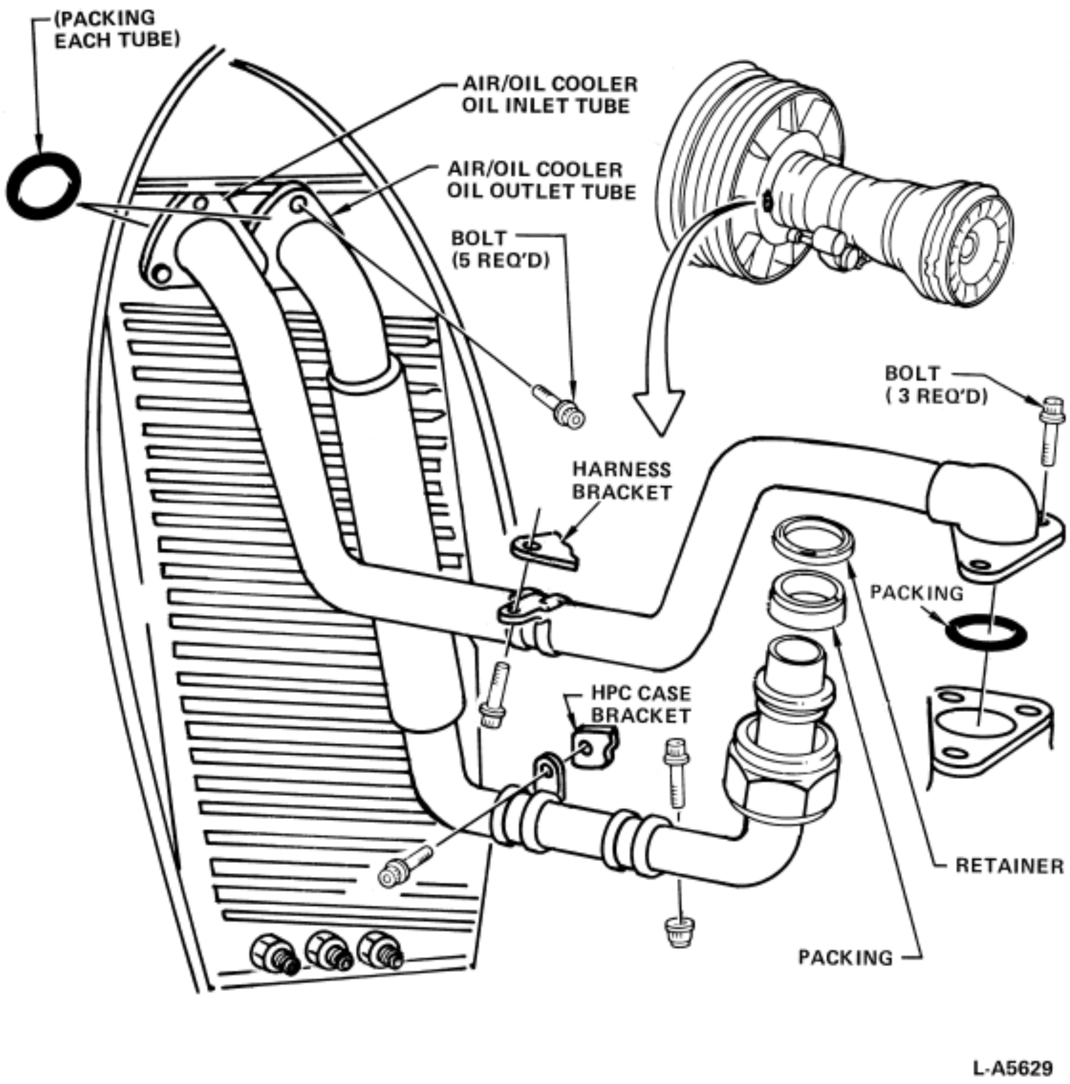
Installation Of The Engine Tubes
Figure 1227 (Sheet 9)
(Task 71-00-00-540-001)


MANIFOLD
MANIFOLD
(2.5) BLEED VALVE ACTUATOR
DRAIN TUBE
BLEED VALVE CYLINDER HYDRAULIC PRESSURE TUBE (CP06)
BLEED VALVE CYLINDER HYDRAULIC RETURN TUBE (CR02)
(POST SB PW4ENG 75-45 ONLY)
L-A6808 (0000)
PW V

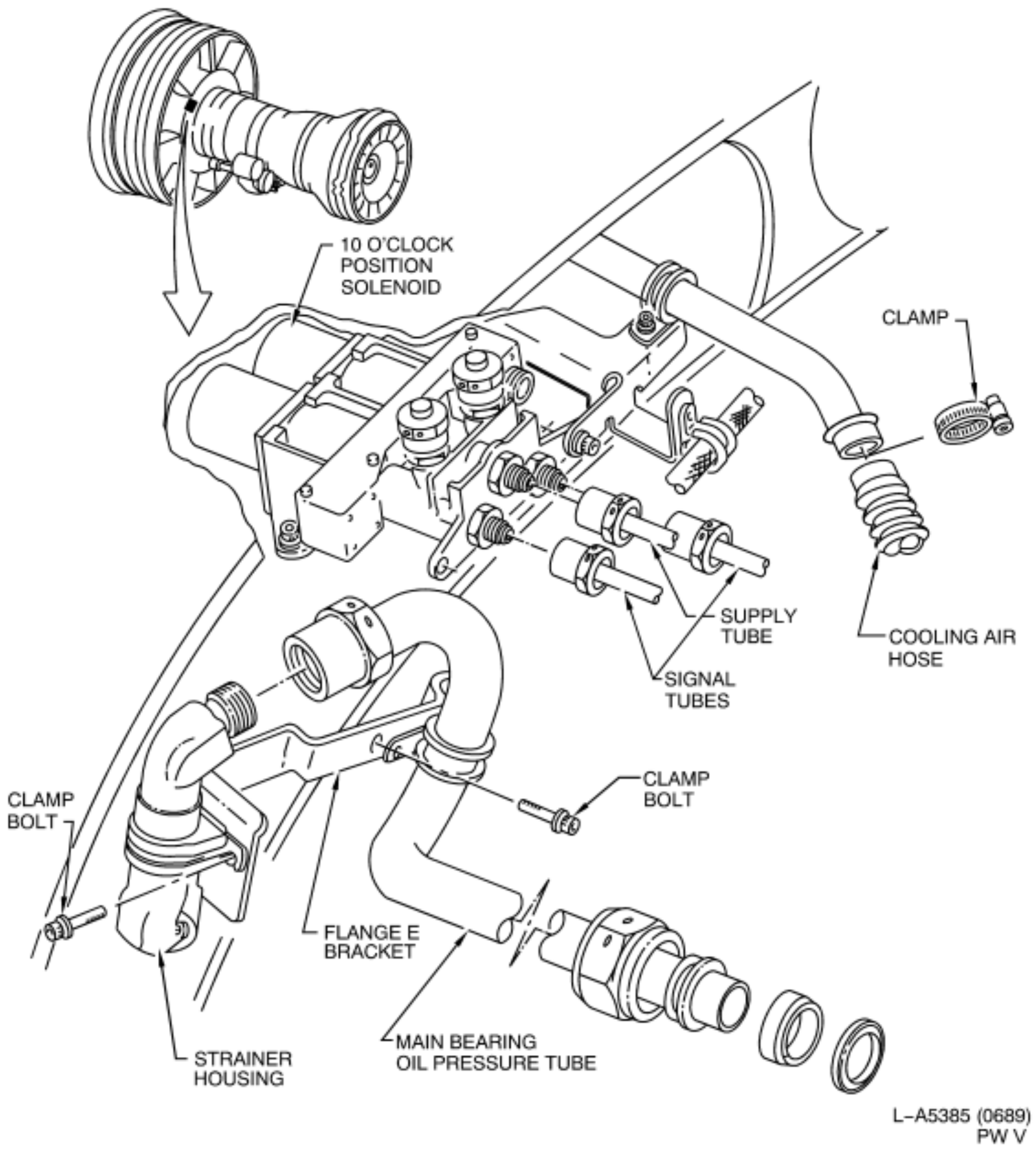
Installation Of The Engine Tubes
Figure 1227 (Sheet 10)
(Task 71-00-00-540-001)


AIR/OIL HEAT EXCHANGER
AIR/OIL COOLER VALVE HYDRAULIC RETURN TUBE
FLANGE E BRACKET
AIR/OIL COOLER VALVE HYDRAULIC PRESSURE TUBE
NO. 1, 1.5, AND BEARING OIL SCAVENGE TUBE
L-A5384 (0689)

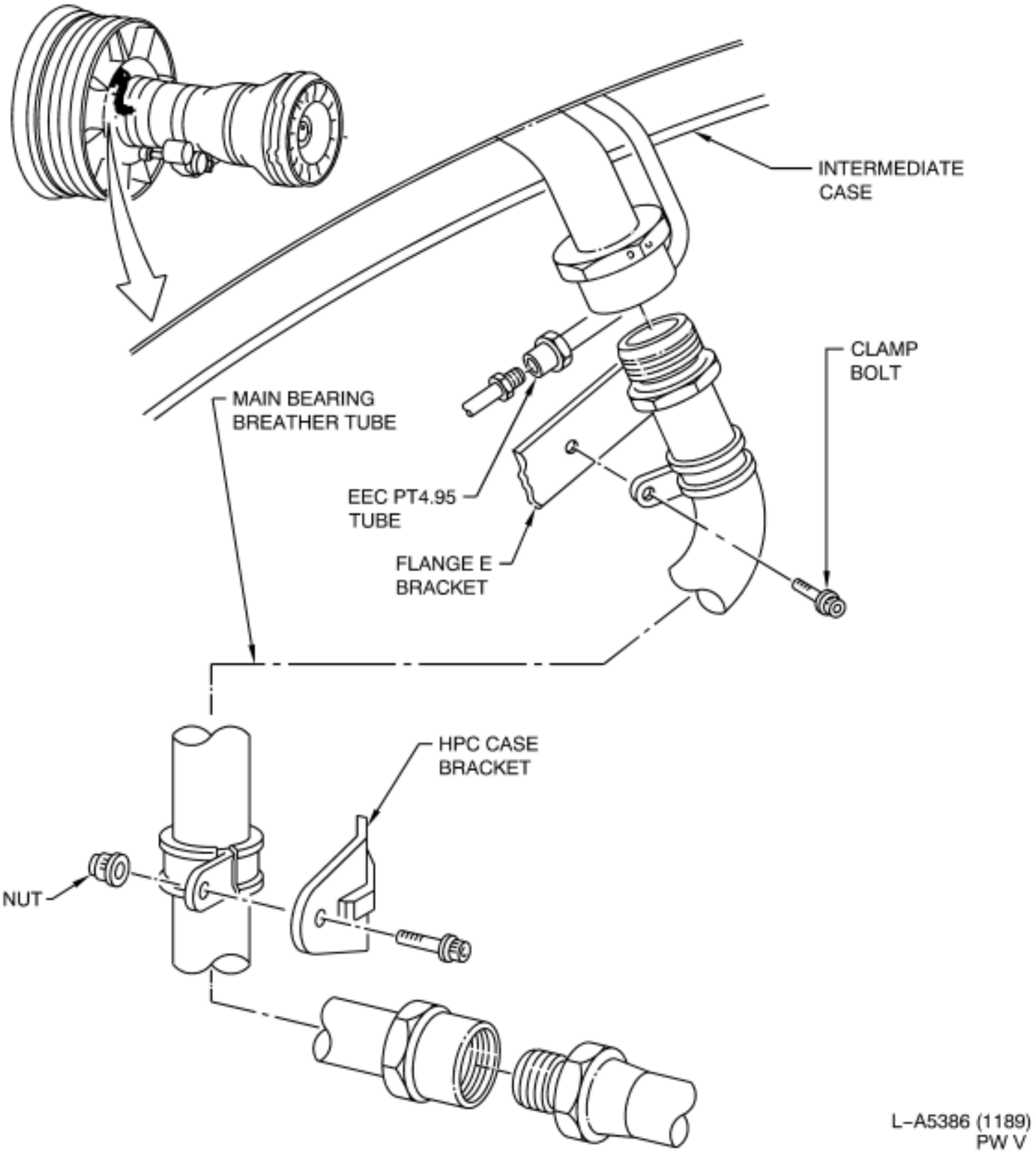
Installation of Engine Tubes
Figure 1227 (Sheet 11)
(Task 71-00-00-540-001)


(PACKING EACH TUBE)
AIR/OIL COOLER OIL INLET TUBE
AIR/OIL COOLER OIL OUTLET TUBE
BOLT (5 REQ'D)
BOLT (3 REQ'D)
HARNESS BRACKET
PACKING
HPC CASE BRACKET
RETAINER
PACKING
L-A5629

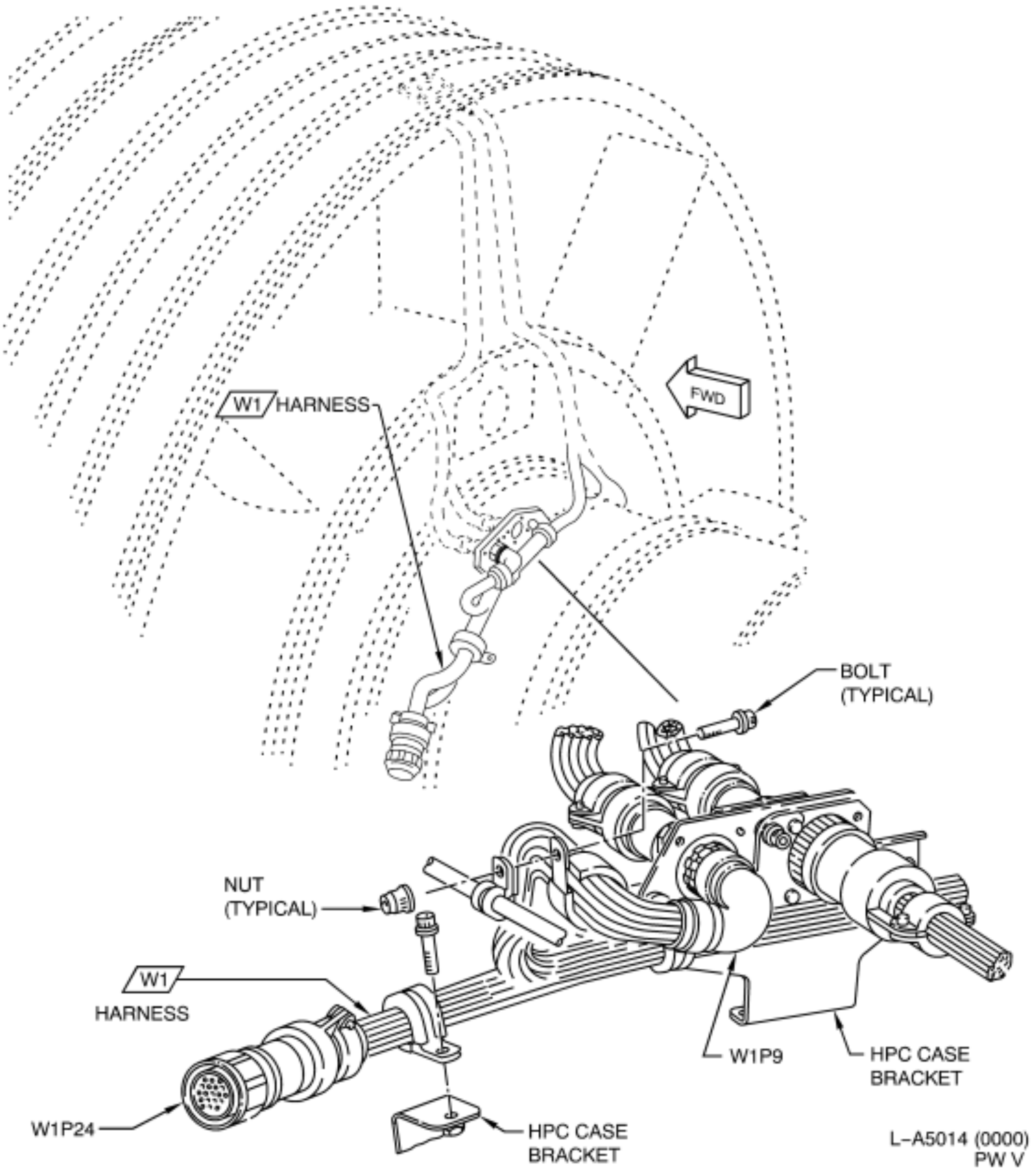
Installation Of Engine Tubes
Figure 1227 (Sheet 12)
(Task 71−00−00−540−001)


10 O'CLOCK POSITION SOLENOID
CLAMP
SUPPLY TUBE
COOLING AIR HOSE
SIGNAL TUBES
CLAMP BOLT
CLAMP BOLT
FLANGE E BRACKET
STRAINER HOUSING
MAIN BEARING OIL PRESSURE TUBE
L-A5385 (0689)
PW V

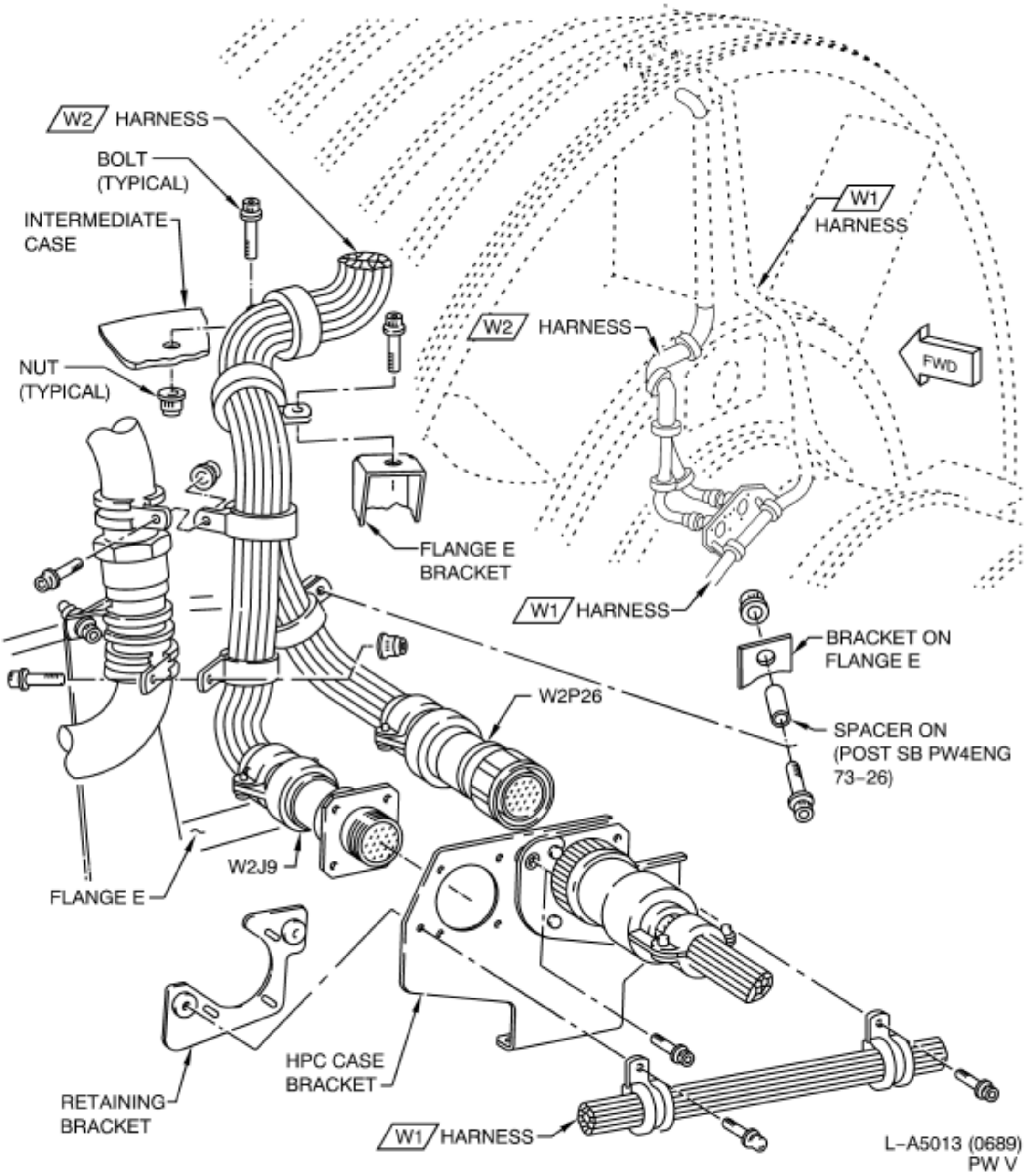
Installation Of Engine Tubes
Figure 1227 (Sheet 13)
(Task 71-00-00-540-001)


INTERMEDIATE CASE
CLAMP BOLT
MAIN BEARING BREATHER TUBE
EEC PT4.95 TUBE
FLANGE E BRACKET
HPC CASE BRACKET
NUT
L-A5386 (1189)
PW V

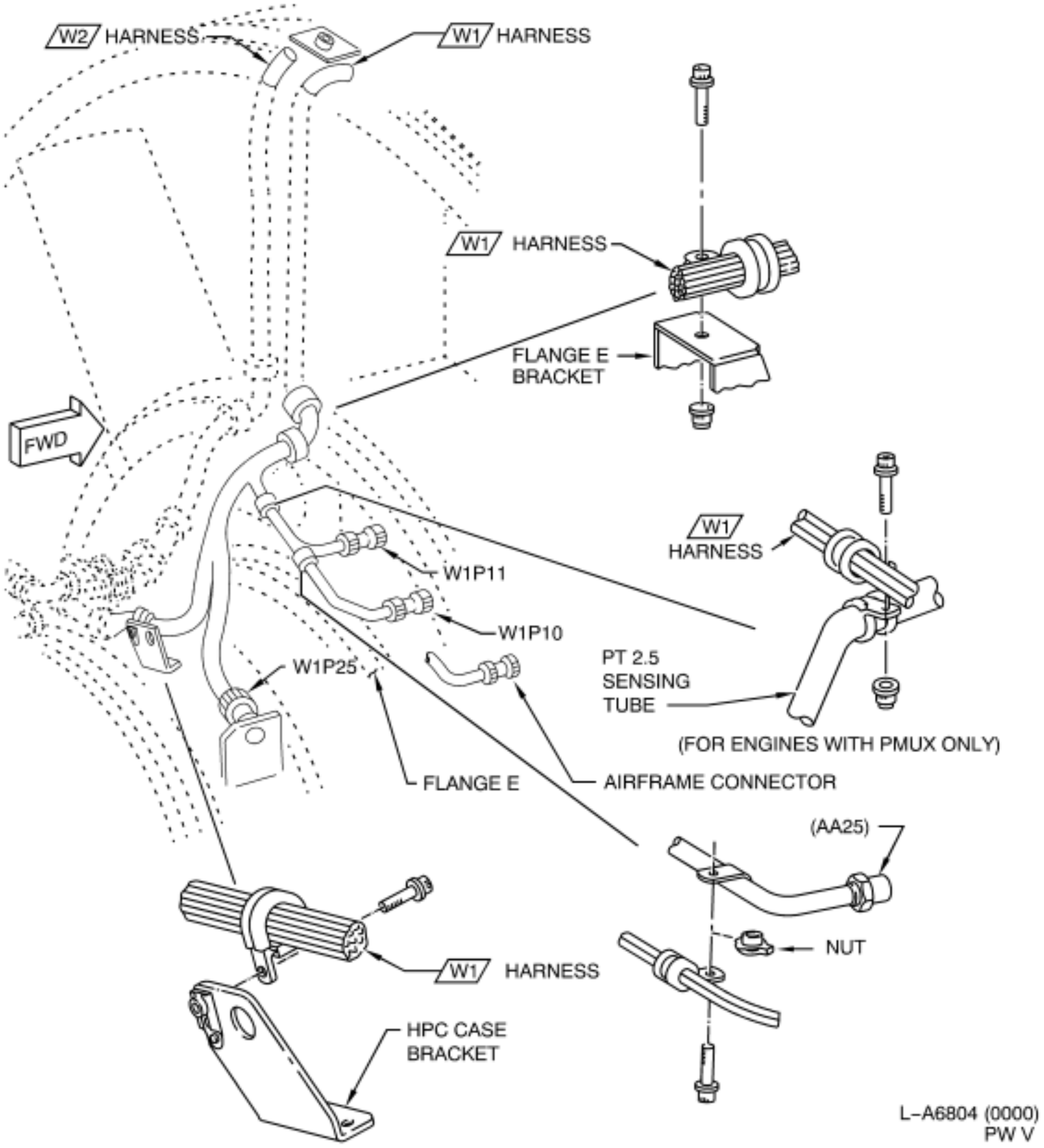
Installation Of Engine Tubes
Figure 1227 (Sheet 14)
(Task 71-00-00-540-001)


W1 HARNESS
FWD
BOLT (TYPICAL)
NUT (TYPICAL)
W1 HARNESS
W1P9
HPC CASE BRACKET
W1P24
HPC CASE BRACKET
L-A5014 (0000)
PW V

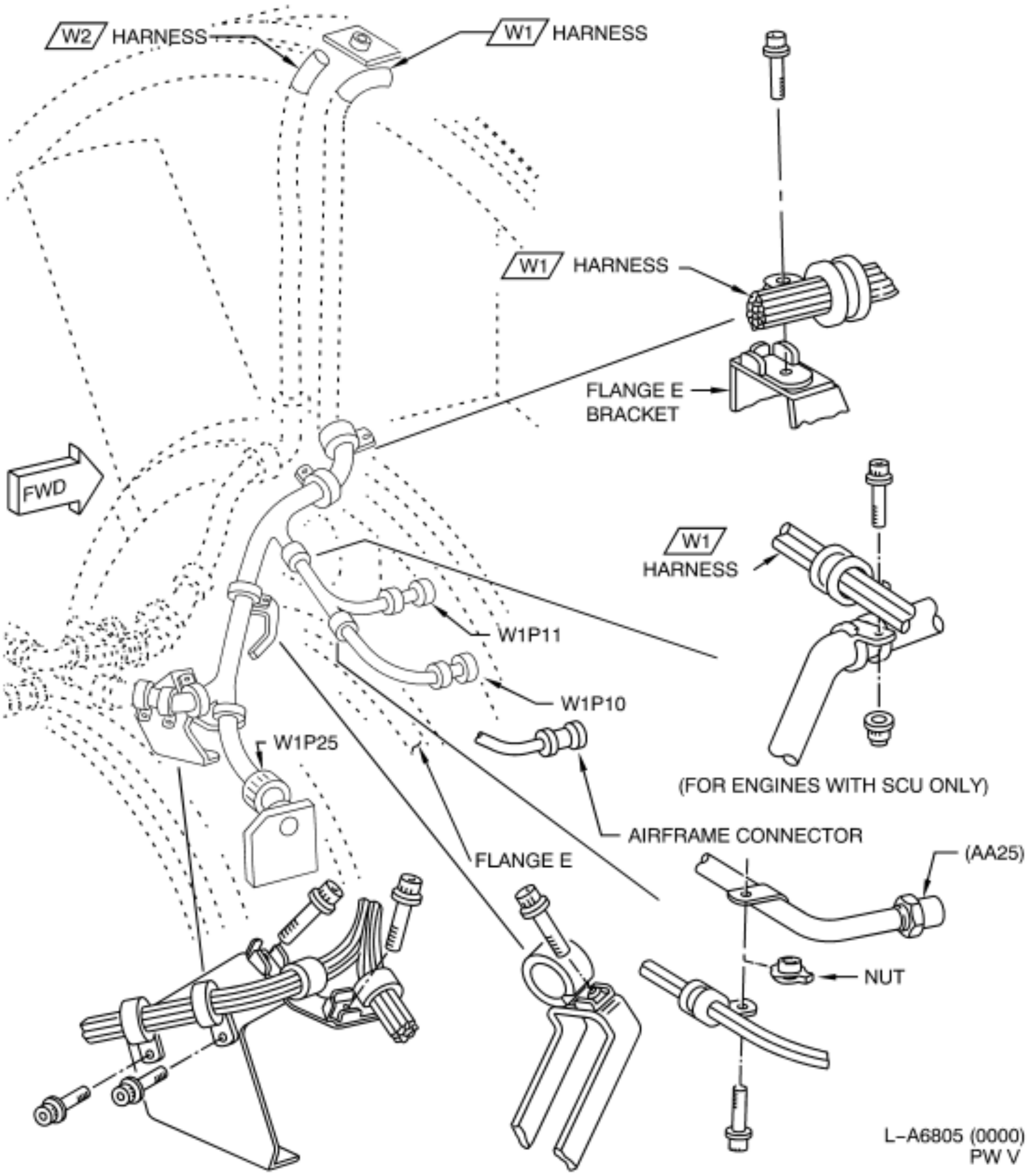
Installation Of Wiring Harnesses
Figure 1228 (Sheet 1)
(Task 71-00-00-540-001)


W2 HARNESS
BOLT (TYPICAL)
INTERMEDIATE CASE
NUT (TYPICAL)
W1 HARNESS
W2 HARNESS
FWD
FLANGE E BRACKET
W1 HARNESS
BRACKET ON FLANGE E
W2P26
SPACER ON (POST SB PW4ENG 73-26)
W2J9
FLANGE E
RETAINING BRACKET
HPC CASE BRACKET
W1 HARNESS
L-A5013 (0689)
PW V

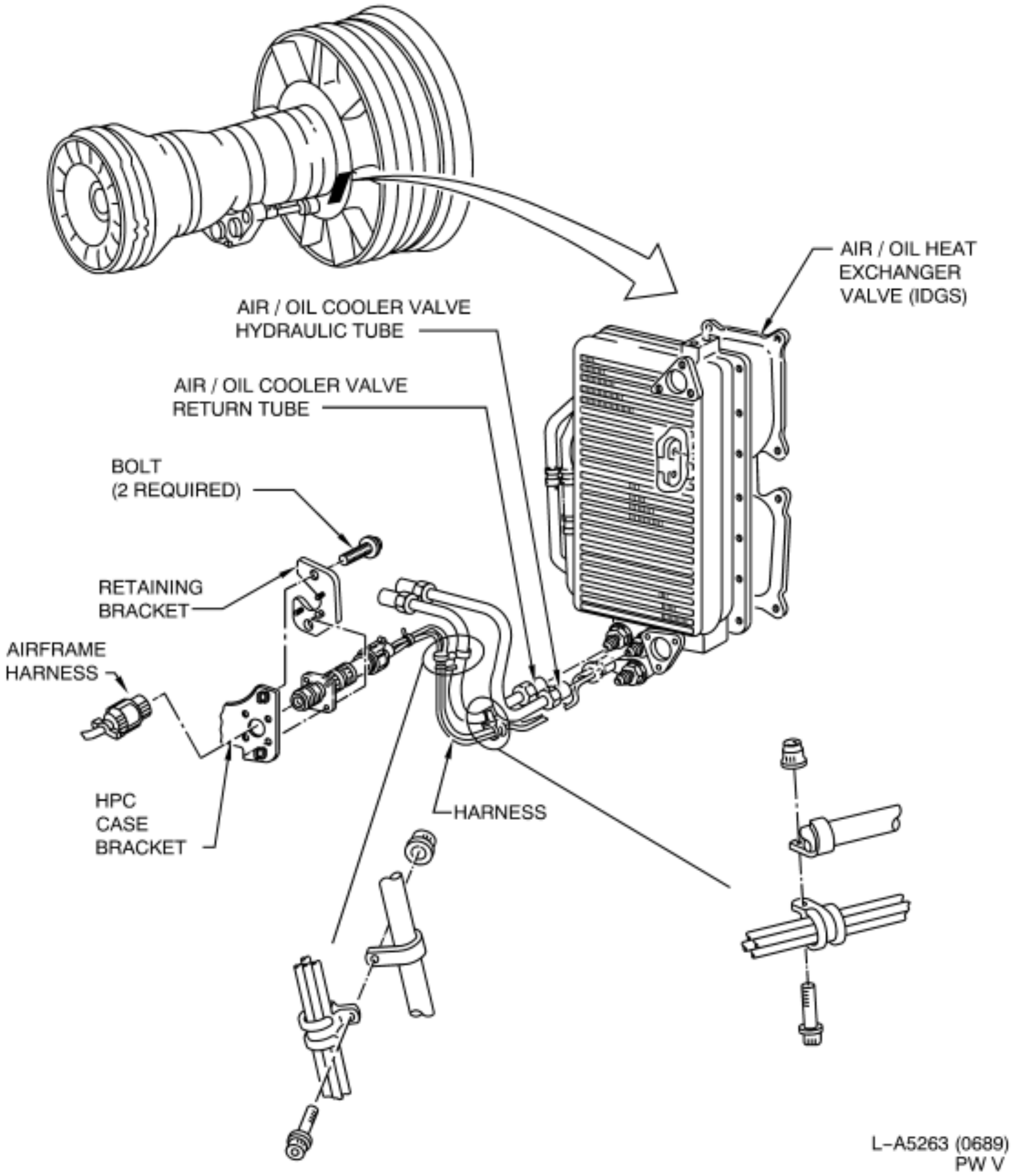
Installation Of Wiring Harnesses
Figure 1228 (Sheet 2)
(Task 71-00-00-540-001)


W2 HARNESS
W1 HARNESS
W1 HARNESS
FLANGE E BRACKET
FWD
W1 HARNESS
W1P11
W1P10
W1P25
PT 2.5 SENSING TUBE
(FOR ENGINES WITH PMUX ONLY)
FLANGE E
AIRFRAME CONNECTOR
(AA25)
NUT
W1 HARNESS
HPC CASE BRACKET
L-A6804 (0000)
PW V

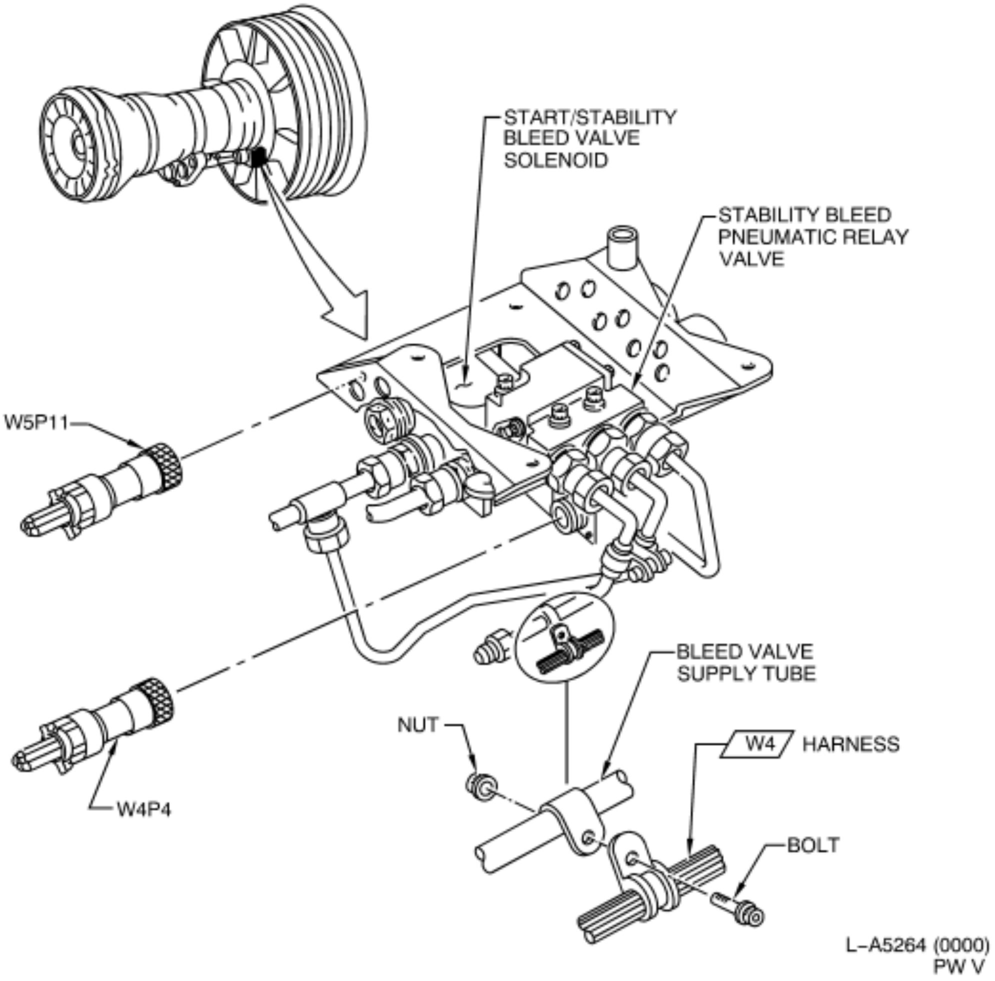
Installation Of Wiring Harnesses (Pre SB PW4ENG 72-258)
Figure 1228 (Sheet 3)
(Task 71-00-00-540-001)


W2 HARNESS
W1 HARNESS
W1 HARNESS
FLANGE E BRACKET
FWD
W1 HARNESS
W1P11
W1P10
W1P25
(FOR ENGINES WITH SCU ONLY)
AIRFRAME CONNECTOR
FLANGE E
(AA25)
NUT
L-A6805 (0000)
PW V

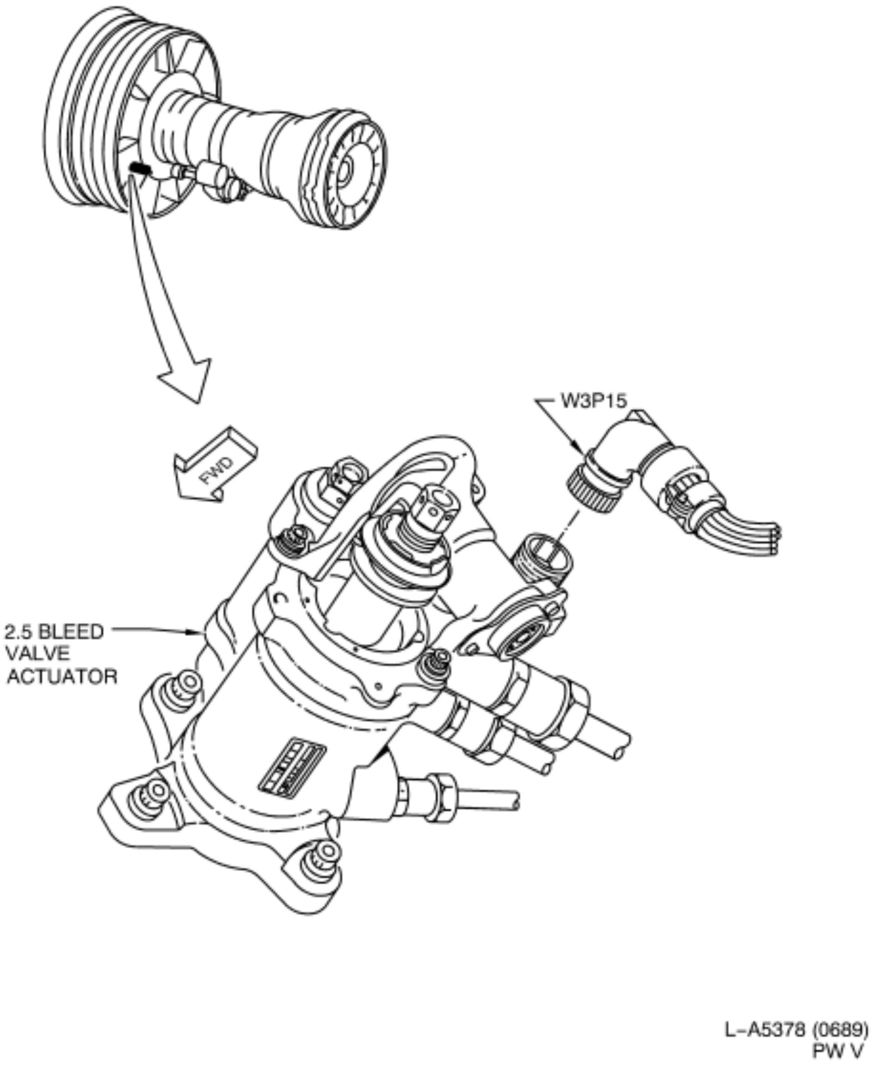
Installation Of Wiring Harnesses (Post SB PW4ENG 72-258)
Figure 1228 (Sheet 4)
(Task 71-00-00-540-001)


AIR / OIL HEAT
EXCHANGER
VALVE (IDGS)
AIR / OIL COOLER VALVE
HYDRAULIC TUBE
AIR / OIL COOLER VALVE
RETURN TUBE
BOLT
(2 REQUIRED)
RETAINING
BRACKET
AIRFRAME
HARNESS
HPC
CASE
BRACKET
HARNESS
L-A5263 (0689)
PW V

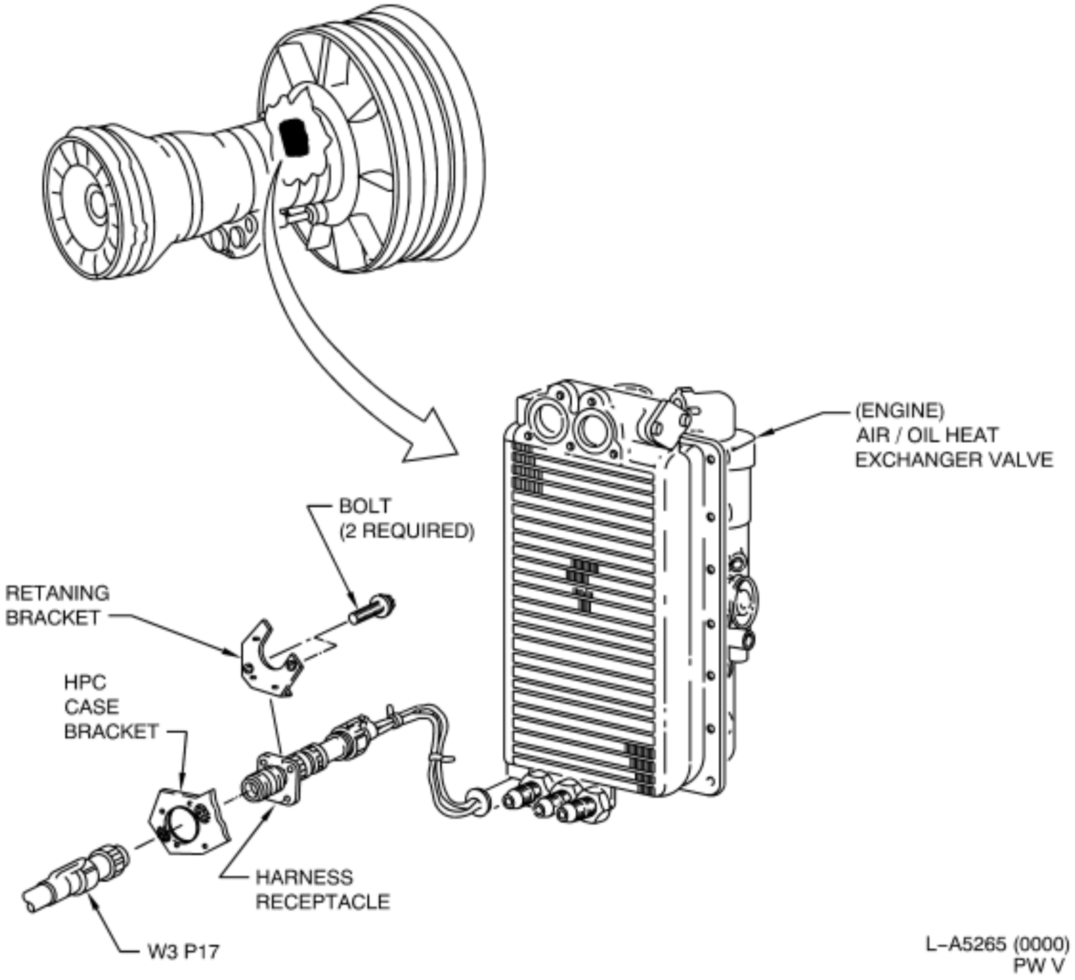
Installation Of Wiring Harnesses
Figure 1228 (Sheet 5)
(Task 71-00-00-540-001)


START/STABILITY BLEED VALVE SOLENOID
STABILITY BLEED PNEUMATIC RELAY VALVE
W5P11
BLEED VALVE SUPPLY TUBE
NUT
W4
HARNESS
BOLT
W4P4
L-A5264 (0000)
PW V

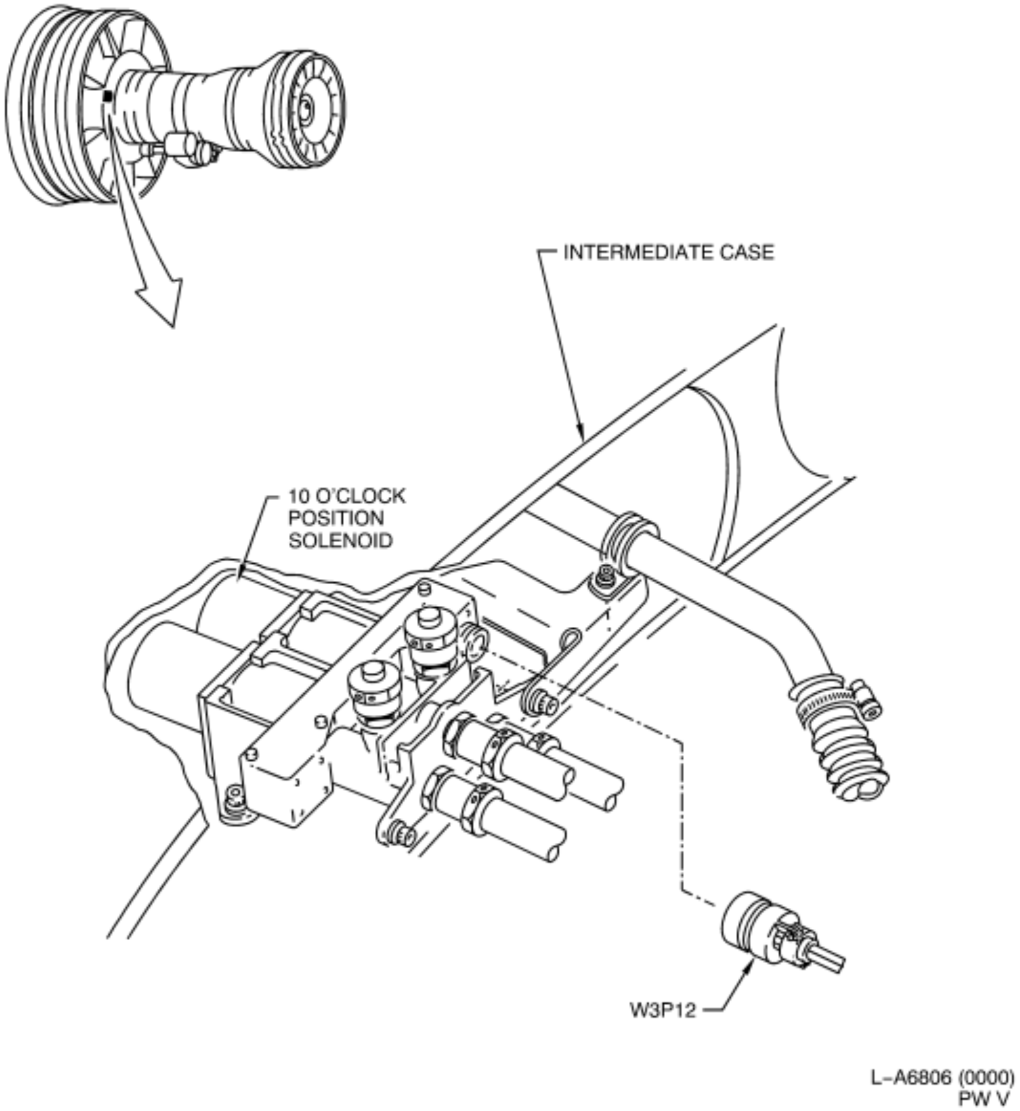
Installation Of Wiring Harnesses
Figure 1228 (Sheet 6)
(Task 71-00-00-540-001)


W3P15
FWD
2.5 BLEED VALVE ACTUATOR
L-A5378 (0689)
PW V

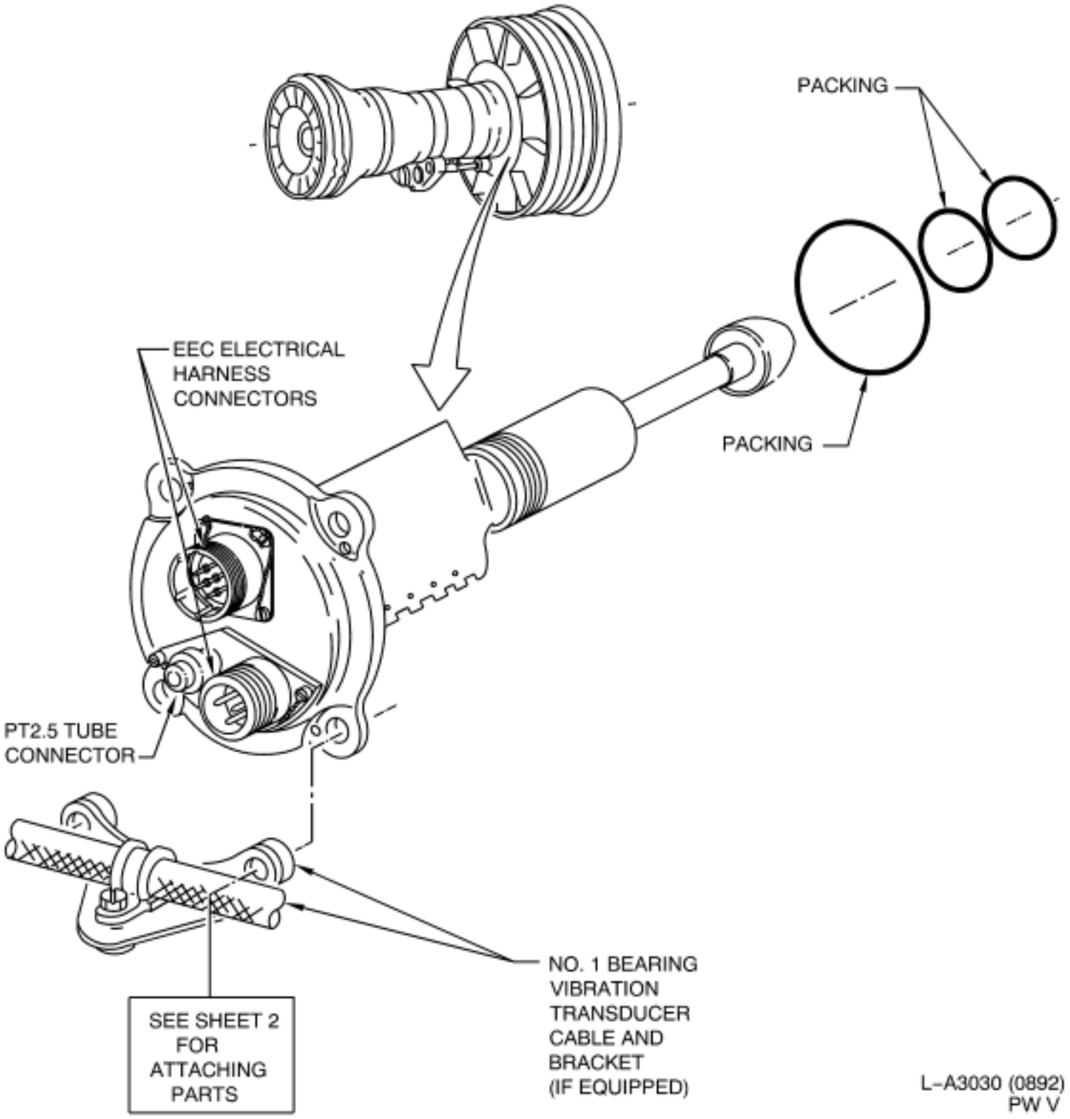
Installation Of Wiring Harnesses
Figure 1228 (Sheet 7)
(Task 71-00-00-540-001)


(ENGINE)
AIR / OIL HEAT
EXCHANGER VALVE
BOLT
(2 REQUIRED)
RETANING
BRACKET
HPC
CASE
BRACKET
HARNESS
RECEPTACLE
W3 P17
L-A5265 (0000)
PW V

Installation Of Wiring Harnesses
Figure 1228 (Sheet 8)
(Task 71-00-00-540-001)

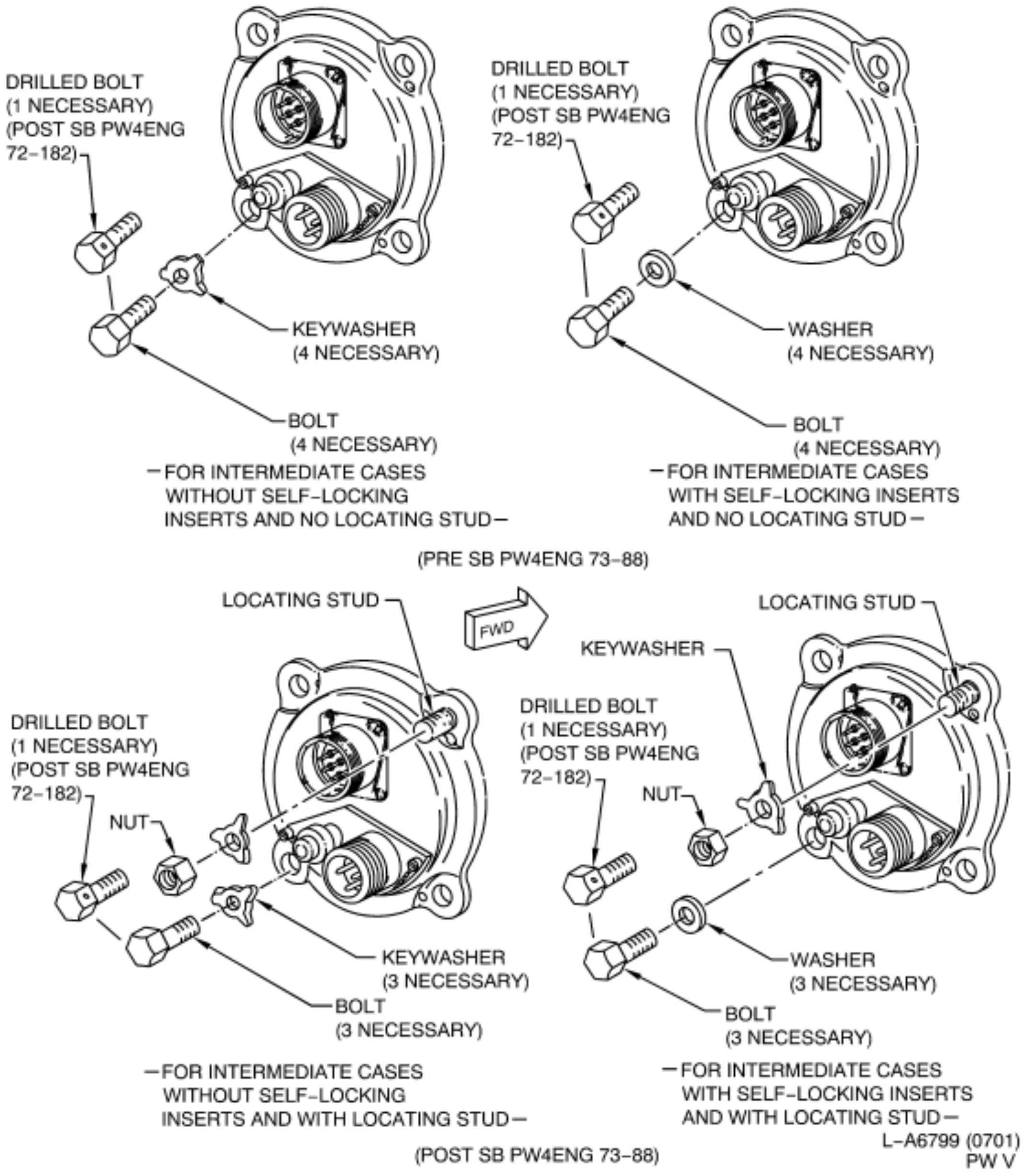

INTERMEDIATE CASE
10 O'CLOCK
POSITION
SOLENOID
W3P12
L−A6806 (0000)
PW V

Installation Of Wiring Harnesses
Figure 1228 (Sheet 9)
(Task 71−00−00−540−001)

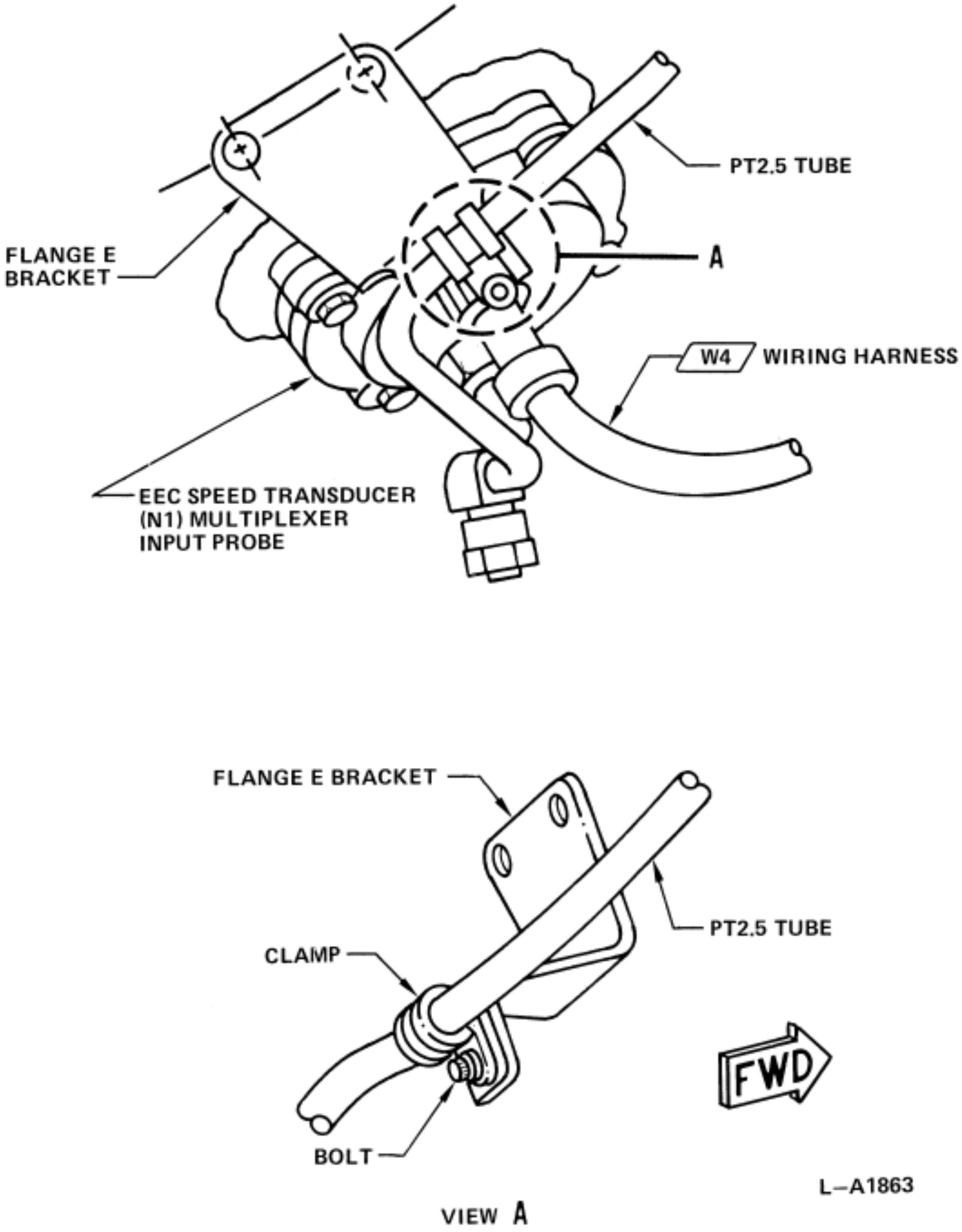

PACKING
EEC ELECTRICAL HARNESS CONNECTORS
PACKING
PT2.5 TUBE CONNECTOR
SEE SHEET 2 FOR ATTACHING PARTS
NO. 1 BEARING VIBRATION TRANSDUCER CABLE AND BRACKET (IF EQUIPPED)
L−A3030 (0892)
PW V

Installation Of The EEC Speed Transducer
(And Multiplexer Input Probe)
Figure 1229 (Sheet 1)
(Task 71−00−00−540−001)

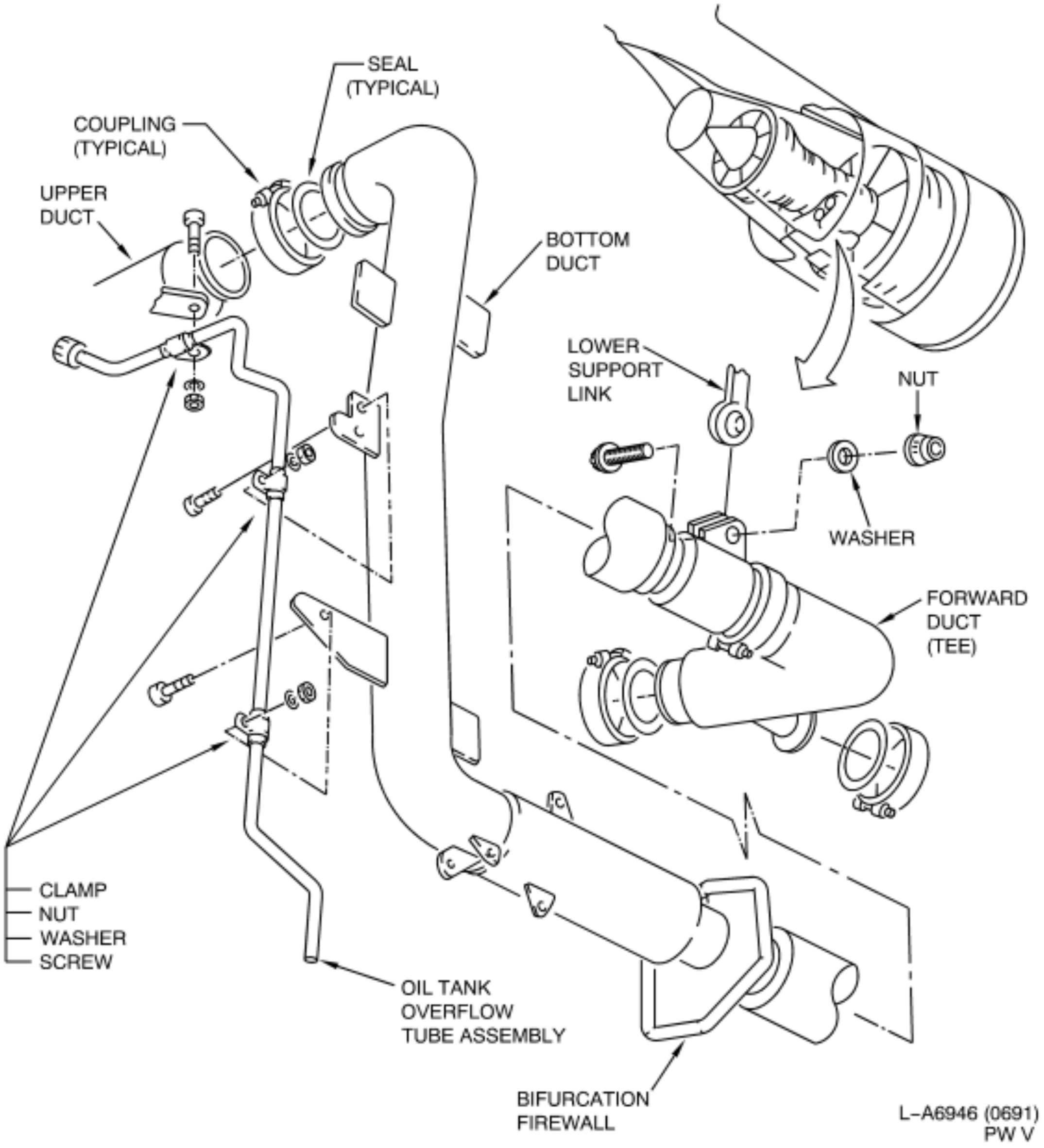
R
R


DRILLED BOLT
(1 NECESSARY)
(POST SB PW4ENG
72-182)
KEYWASHER
(4 NECESSARY)
BOLT
(4 NECESSARY)
-FOR INTERMEDIATE CASES
WITHOUT SELF-LOCKING
INSERTS AND NO LOCATING STUD-
DRILLED BOLT
(1 NECESSARY)
(POST SB PW4ENG
72-182)
WASHER
(4 NECESSARY)
BOLT
(4 NECESSARY)
-FOR INTERMEDIATE CASES
WITH SELF-LOCKING INSERTS
AND NO LOCATING STUD-
(PRE SB PW4ENG 73-88)
LOCATING STUD
FWD
DRILLED BOLT
(1 NECESSARY)
(POST SB PW4ENG
72-182)
NUT
KEYWASHER
(3 NECESSARY)
BOLT
(3 NECESSARY)
-FOR INTERMEDIATE CASES
WITHOUT SELF-LOCKING
INSERTS AND WITH LOCATING STUD-
LOCATING STUD
KEYWASHER
DRILLED BOLT
(1 NECESSARY)
(POST SB PW4ENG
72-182)
NUT
WASHER
(3 NECESSARY)
BOLT
(3 NECESSARY)
-FOR INTERMEDIATE CASES
WITH SELF-LOCKING INSERTS
AND WITH LOCATING STUD-
(POST SB PW4ENG 73-88)
L-A6799 (0701)
PW V

Installation Of The EEC Speed Transducer (And
Multiplexer Input Probe) Attaching Parts
Figure 1229 (Sheet 2)
(Task 71-00-00-540-001)


PT2.5 TUBE
FLANGE E BRACKET
A
W4 WIRING HARNESS
EEC SPEED TRANSDUCER (N1) MULTIPLEXER INPUT PROBE
FLANGE E BRACKET
PT2.5 TUBE
CLAMP
FWD
BOLT
L-A1863
VIEW A

Installation Of The EEC Speed Transducer
(And Multiplexer Input Probe)
Figure 1229 (Sheet 3)
(Task 71-00-00-540-001)


SEAL (TYPICAL)
COUPLING (TYPICAL)
UPPER DUCT
BOTTOM DUCT
LOWER SUPPORT LINK
NUT
WASHER
FORWARD DUCT (TEE)
CLAMP
NUT
WASHER
SCREW
OIL TANK OVERFLOW TUBE ASSEMBLY
BIFURCATION FIREWALL
L-A6946 (0691)
PW V

Installation Of Engine Ducts And Tubes
Figure 1230
(Task 71-00-00-540-001)

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Pratt & Whitney

PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
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REVISION NO. 82 DATED DECEMBER 15, 2006

HIGHLIGHTS - POWER PLANT GENERAL - STORAGE/TRANSPORT

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CHAPTER 71

STORAGE/TRANSPORT

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Task 71-00-00-990-003:

1. Test Requirements After Engine/Module/Component Repair or Replacement

A. Description of Tests

(1) This section will tell you which test procedures are necessary after an engine, module or component is repaired or replaced. These tests are necessary to make sure that the engine operates satisfactorily after the repair or replacement.

(2) Test No. 9 provides for testing after engine has been completely disassembled, repaired and reassembled.

(3) Table 1301 for the list of tests.

TEST NO.	TASK	TEST DESCRIPTION
Test No. 1	Not Used	
Test No. 2	Task 71-00-00-760-029	Engine Motor Leak Test (Dry Method)
Test No. 2A	Task 71-00-00-760-001	Engine Motor Leak Test (Wet Method)
Test No. 3	Task 71-00-00-760-030	Idle Power Test
Test No. 4	Task 71-00-00-760-031	Power Acceleration/Deceleration
Test No. 5	Task 71-00-00-760-033	Oil System Static Leak Test
Test No. 6	Task 71-00-00-760-037	EEC System Idle Check
Test No. 7	Task 71-00-00-760-038	EEC System Static Test
Test No. 8	Task 71-00-00-760-032	Engine Vibration Survey
Test No. 9	Task 71-00-00-760-020, Task 71-00-00-760-060, Task 71-00-00-760-061 or Task 71-00-00-760-063	Engine Acceptance Test
Test No. 10	Not Used	Airframe Manual Only
Test No. 11	Not Used	Airframe Manual Only
Test No. 12	Task 71-00-00-720-003	Engine Oil System Vacuum Test
Test No. 13	Task 71-00-00-760-047	Main Oil Pressure Test and Adjustment
Test No. 14	Task 71-00-00-760-050	P2 System Leak Check)
Test No. 15	Not Used	
Test No. 16	Not Used	
Test No. 17	Not Used	
Test No. 18	Not Used	
Test No. 19	Task 71-00-00-760-043, Task 71-00-00-760-052 or	Trim Balance Procedure and Test

Test Descriptions
Table 1301

TEST NO.	TASK	TEST DESCRIPTION
(CONTINUED)		
	Task 71-00-00-760-057	
Test No. 20	Deleted	
Test No. 21	Task 71-00-00-760-062	Cool Engine Fuel Spike Stability Test

Test Descriptions
Table 1301 (Continued)

B. Test Reference Table - Engine, Modules and Primary Parts

(1) The applicable tests that are necessary after the repair or replacement for each module, primary parts or the engine are listed in Table 1302.

(2) If there is a selection of tests (example: 3 or 2), the first test listed is the recommended test.

(3) If more than one test is listed (example: 2,3,8, and 4), all the tests are necessary and must be done in the sequence shown.

ENGINE/MODULE/PRIMARY PARTS	NECESSARY TESTS
Complete Engine	12, 13, 9, 21* (Test 9 includes 3, 4, 6, 7 and 8)
Fan Blades	8
Fan Case Section	14, 8 and 21
Fan Exit Case Assembly	14 and 8 and 21
Low Pressure Compressor	12, 13, 9 and 21*
Intermediate Case Assembly	12, 13, 9 and 21*
High Pressure Compressor	9 and 21*
Diffuser Case	12, 13, 9 and 21*
Combustion Section	12, 13, 9 and 21*
Turbine Nozzle Assembly	9 and 21*
High Pressure Turbine	9 and 21*
Low Pressure Turbine	9 and 21*
Main Gearbox Assembly	12, and 3
Turbine Exhaust Case	12, 13, 8 and 21

* NOTE: Testing-21 must be done in the correct sequence within Testing-09 as shown in the "Engine Run Schedule" in Testing-09, Figure 1301.

Test Reference Engine, Modules, Primary Parts
Table 1302

ENGINE/MODULE/PRIMARY PARTS NECESSARY TESTS

NOTE: Exception 1 - Testing-21 is not necessary if the HPC Stage 5 through 15 blade tip clearances have been restored to the Fits and Clearances requirements (reference section 72-35-00 Inspection/Check-04), and the mid and rear hook of the HPC inner rear case are within serviceable limits, Indexes 8 - 11 of the PW4000 Series Engine CIR Manual (PN 51A357) Section 72-35-68 Inspection/Check-04 (Revision dated SEP 15/01 or subsequent), or the mid and rear hooks have been repaired or modified respectively, during this shop visit. If over allowable serviceable limits, the HPC inner rear case mid hook must be repaired in accordance with reference PW4000 Series Engine CIR Manual (PN 51A357) Section 72-35-68, Repair-16 and the HPC inner rear case rear hook must be modified in accordance with service bulletin PW4ENG 72-714, dated June 27, 2000, during this shop visit.

NOTE: Exception 2 - Testing-21 is not necessary for engines incorporating the Ring Case HPC configuration in accordance with SB PW4ENG 72-756 or SB PW4ENG 72-759.

NOTE: Exception 3 - Testing-21 is not necessary for engines intended to maintain the airworthiness of the engine between planned shop visits, that requires separation of a major engine flange located between "A" flange and "T" flange, that results in the engine being reassembled with all gas path-related components remaining in the as-removed condition.

NOTE: Exception 4 - Testing-21 is not necessary for engines that successfully passed Testing-21 with zero cycles since test, and are split at Flange "E" for transportation reasons as specified in the applicable Storage/Transport section of the applicable Engine Manual.

Test Reference Engine, Modules, Primary Parts
Table 1302 (Continued)

C. Test Reference Table - Components and Parts

(1) The applicable tests that are necessary after the repair or replacement for each component or part are listed in Table 1303.

(2) If there is a selection of tests (example: 3 or 2), the first test listed is the recommended test.

(3) If more than one test is listed (example: 2,3,8, and 4) all the tests are necessary and must be done in the sequence shown.

(4) If it is necessary to disconnect a tube or electrical connector to remove a component, more tests are necessary as follows:

   (a) If a fuel tube is disconnected, Test 3 is necessary.

   (b) If an oil tube is disconnected, Test 3 or 2 is necessary.

   (c) If an electrical harness is disconnected, Test 6 is necessary.

   (d) If a part is not listed, it is not necessary to do an engine test, (except for the tubes, manifolds and electrical harnesses shown above).

ENGINE/MODULE	NECESSARY TESTS
MAIN GEARBOX (Also see modules)	
Main Gearbox Assembly	12, and 3
Accessory Drive Seals (Any seal)	3
Manual Crank Pad Cover	3 or 5
ANGLE GEARBOX	
R Angle Gearbox Assembly	13 and 3
Cover − Lower Angle Gearbox	2
ELECTRICAL POWER	
Air/Oil Heat Exchanger (IDGS)	3
FUEL SYSTEM	
Alternator − EEC	6
Control − Electronic Engine Control (EEC)	6
Filter − Fuel Pump	2A or 3
Filter − Fuel Distribution Valve	2A or 3
Filter − Fuel Metering Unit	2A or 3
Harness − EEC Wiring	6
Injector and Support − Fuel	4
Manifolds − Fuel	2A or 3
Plug − EEC Data Entry	7
Probe − EEC Fuel Temperature	3
Probe − EEC Oil Temperature	3
Pump − Fuel	2A or 3
Switch − Fuel Pump Filter Differential Pressure	2A or 3

Test Reference Components or Parts
Table 1303

ENGINE/MODULE	NECESSARY TESTS
(CONTINUED)	
Transducer − EEC Speed (N1)	3
Tubes − External Fuel	2A or 3
Unit − Fuel Metering	3
Valve − Fuel Distribution	2A or 3
IGNITION	
Exciter − Ignition	Audible Check
Plug − Ignition	Audible Check
Cable − Ignition	Audible Check
AIR SYSTEMS	
Actuator − Turbine Case Cooling (TCC) Air Valve	6
Air Cooler − No. 3 Bearing Buffer	2 or 3
Cable − Turbine Case Cooling (TCC) Air Valve Control	6
Filters − Air Valve	6
Heat Exchanger And Valve − Air/Oil (Engine)	3
Heat Exchanger And Valve − Air/Oil (IDGS)	3
Solenoid − HPC Secondary Flow Control Valve IDGS Air/Oil Heat Exchanger Valve Override	6
Solenoid − HPC Secondary Flow Control Valve, Turbine Vane And Blade Cooling Air Valve	6
Switch − Turbine Vane And Blade Cooling Air Valve Position	6
Tubes − External Air	2 or 3
Valve− HPC Secondary Flow Control	6
Valve − Turbine Case Cooling (HPT)	6 and 3
Valve − Turbine Vane And Blade Cooling	6 and 3
Valve − Turbine Case Cooling (TCC) Air Shutoff (LPT)	6 and 3
COMPRESSOR CONTROL	
Actuator − Variable Stator Vane (HPC)	4

NOTE: Test No. 4 is not necessary after a Mechanical or Hydraulic Rig Check of the SVA, if no parts were replaced. However, after the Hydraulic Rig Check you must do Test No. 3.

Actuator − 2.5 Bleed Valve	4

NOTE: Test No. 4 is not necessary if the adjustment of the 2.5 bleed actuator was not changed or parts were not replaced

Solenoid − 2.9 Bleed Valve	6
Tubes − Actuator Muscle Pressure	2 or 3
Valve − 2.9 Bleed	6

Test Reference Components or Parts
Table 1303 (Continued)

ENGINE/MODULE	NECESSARY TESTS
INDICATING SYSTEM	
Harness - Engine Exhaust Gas Temperature (EGT)	3
Probe - Engine Exhaust Gas Temperature (EGT)	3
Probe - P2/T2	14 and 6 or 7
Probe - T3 Thermocouple	3
OIL SYSTEM	
Chip Detectors - Magnetic	3
Cooler - Fuel/Oil (Engine)	3
Cooler - Fuel/Oil (IDGS)	3
Filter - Main Oil	3
Heat Exchanger And Valve - Air/Oil (Engine)	3
Heat Exchanger And Valve - Air/Oil (IDGS)	3
Pumps - Lubrication and Scavenge Oil	3, 13
Tank - Engine Oil	3
Tubes - External Oil	3
Valve - Fuel/Oil Cooler Bypass	3
Valve - Main Oil Filter Pressure Relief	3
DIAGNOSTIC COMPONENTS (OPTIONAL)	
Multiplexer - EEC Speed Transducer (N1)	6
Probe - Input	6
Propulsion Multiplexer Unit - (PMUX)	6
Transducer - No. 1 Bearing	6

Test Reference Components or Parts
Table 1303 (Continued)

Task 71-00-00-990-005:

2. Engine Test Data Names

A. General
The abbreviations that follow are used for test data, engine stations and performance parameters. These parameters must be measured and checked during engine tests and calculations. Table 1304.

TEST DATA ABBREVIATION	TEST STATION OR PARAMETER
PAMB	Ambient Pressure
TAMB	Ambient Temperature
TT2	Fan Inlet Total Temperature
PCD	Test Cell Static Pressure
PT2	Fan Inlet Total Pressure
PS2	Fan Inlet Static Pressure
PT2.5	Low Pressure Compressor Discharge Total Pressure
PS3	Burner Case Static Pressure
PS4I	Turbine Cooling Air Static Pressure (Optional)
TT2.5	Low Pressure Compressor Discharge Total Temperature
TT3	High Pressure Compressor Discharge Total Temperature
TT4.95	Turbine Discharge Total Temperature
EGT	Turbine Discharge Total Temperature (EEC Readout)
PT4.95	Engine Pressure Ratio
PT4.95/PT2 − SEE NOTE A	Engine Pressure Ratio
EPR	Engine Pressure Ratio (EEC Readout)
EPR−0	Engine Pressure Ratio (EEC Readout With Neutral Class Data Entry Plug Installed)
TLRA − SEE NOTE B	Thrust Lever Resolver Angle (Signal Into EEC)
WF	Fuel Flow
FN	Net Thrust
TB	True Barometer
N1	Low Pressure Compressor RPM
N2	High Pressure Compressor RPM
SVA	Stator Vane Actuator Angle Position

NOTE A: PT4.95/PT2 is used when referring to the calculated ratio of measured PT4.95 and PT2 and is independent of EEC. EPR is defined as EPR as read from EEC and is to be used for acceptance of engine.

NOTE B: TLRA (Thrust Lever Resolver Angle) provides an electrical signal to EEC.

Engine Test Stations and Parameters
Table 1304

Task 71-00-00-990-002:

3. Test Instrumentation Calibration

A. General
The test instrumentation that is necessary for testing must be calibrated to the limits and tolerances that follow: See Table 1305.

TEST DATA ABBREVIATION	LIMITS AND TOLERANCES
TT2	±1°F (±0.5°C)
PCD	±0.02 psi (± 0.1 kPa)
PT2	±0.01 psi (0.1 kPa)
PS2 - NOTE A	±0.01 psi (0.1 kPa)
PT2.5	±0.06 psi (0.35 kPa)
PAMB	±0.005 psi (±0.03 kPa)
WF	0.75% accuracy for less than 4000 lb/hr (1814.4 kg/hr)
WF	0.4% accuracy for more than 4000 lb/hr (1814.4 kg/hr)
FN	±125 lbf (±556.0 N)
PS3	±0.5 psi (±3.4 kPa)
PS4I	±0.5 psi (±3.4 kPa) (Optional)
TT2.5 - NOTE A	±2.0°F (±1.0°C)
TT3 - NOTE A	±3.0°F (±1.7°C)
TT4.95	±3.0°F (±1.7°C)
PT4.95	±0.02 psi (± 0.1 kPa)
N1	±2 RPM
N2	±4 RPM
Tfuel	±1.4°F (±0.8°C)
TAMB	1.0°F (0.5°C)

NOTE A: When instrumentation is available.

Test Data Limits and Tolerances
Table 1305

Task 71−00−00−480−001:

4. Prepare The Engine/Power Plant For Test In A Test Cell

A. General

(1) This procedure will give the operator the necessary information to prepare and test the engine/power plant satisfactorily in a test cell.

(a) Before you do this procedure, you must assemble and inspect the engine powerplant by the assembly and installation procedures shown in this manual. See the assembly and installation procedures shown in Chapter 72. Also see the powerplant assembly and installation procedures shown in Chapter 71.

(b) Because of the many configurations of test cells and test cell equipment, this procedure will only give the necessary specifications, equipment and connections.

(c) Each operator must use their own experience and the recommendations of Pratt And Whitney Customer Support, to customize this procedure for each test cell.

B. Equipment And Materials

Standard Tools:

Test Cell	Qualified for each PW4000 engine model and thrust level. The test cell must be calibrated for performance measurement.
Test Adapter	Qualified for each PW4000 engine model and thrust level. The test adapter is the interface between the engine/powerplant and the test cell. The test adapter has the hardware necessary to mount and connect the engine/powerplant to the test cell
Drain Bottles And Hoses	Necessary to collect a measurable quantity of drain fluid from the engine drain ports. The hoses must be long enough to exit the bottom of the test adapter through the bottom of the core cowl.
Hoses And Electrical Leads	Necessary to monitor the test parameters during the acceptance test.
Crimpers	Necessary to crimp safety cable and

Standard Tools:

(CONTINUED)

ferrule. Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 26154	Probe, P2 (8 Necessary) (Superseded by PWA 88241)
PWA 29304	Bellmouth
PWA 29972	Seal Segment (Detail of PWA 85202)
PWA 85202	Adapter Ring
PWA 85523	Probe, EEC, Total Pressure and Temperature
PWA 85636	Bracket, Lifting (Bellmouth)
PWA 85703	Accelerometer And Lead Assembly (Flange P)
PWA 85774	Accelerometer Bracket (Flange P)
PWA 85927	Simulator, Thrust Reverser
PWA 86628	Connector (IDG Switch)
PWA 88241	Probe, P2 (8 Necessary) (Supersedes PWA 26154)

Consumable Materials:

Item No.	Designation
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

C. Procedure

(1) Be sure all the EBU is installed correctly including:
- Exhaust nozzle and plug
- Front and rear engine mounts (if required for mounting to the operators' test adapter)
- Deoiler vent duct
- Engine starter, valve, and ducts
- IDG (only for test adapters and test cells capable of IDG operation and test)
- Drain system
- Fire detection loops
- Fuel flowmeter, pressure transmitter, and supply line
- 2.9 bleed valve bellows seals
- All oil indication probes and transmitters
- Oil filter differential pressure switch
- All fuel indication probes and transmitters
- Engine core compartment temperature sensors

- Fuel filter differential pressure switch
- Fan case vibration accelerometer
- TCC duct and bellows seal
- Right and left side accessory cooling manifolds, tubes, and hoses
- Fan case EBU electrical harnesses
- Engine core EBU electrical harnesses
- If necessary, the ECS 8th and 15th stage ducts and valves. Each must use their own test adapter. (Blank off plates must be used if these ducts are not installed for test).

NOTE: All the procedures for the components and hardware listed above are in Chapter 71 of this engine manual.

(2) Do not install the front and rear hydraulic pumps unless the test cell has special equipment to operate the hydraulic pumps.

(3) Do not install the IDG (integrated drive generator) unless the test cell has special equipment to operate these accessories during engine test.

NOTE: Most test cells do not have the necessary equipment to operate these accessories during engine test.

(4) Install the gearbox drive plugs as follows:

(a) Install the IDG drive gearshaft plug, bolt, and cover (only for test adapters and test cells not capable of IDG operation and test). See 72-00-61, Installation-21 Task 72-00-61-430-021.

(b) Install the rear hydraulic pump drive plug and cover. See 72-00-61, Installation-22 Task 72-00-61-430-012.

(c) Install the front hydraulic pump drive plug and cover. See 72-00-61, Installation-23 Task 72-00-61-430-013.

(5) Install the turbine vibration accelerometer to Flange P as follows:

(a) Install the PWA 85774 Bracket to Flange P at boltholes 18 and 19 (clockwise from top).

(b) Install the PWA 85703 Accelerometer And Lead Assembly to the bracket.

(6) If necessary, install the test drain bottles and hoses to the following drain ports, fittings, or tubes. Route the drain hoses so that the test adapter cowl doors can shut without interference.

(a) The IDG air/oil heat exchanger valve drain tube (3:30 o'clock position in the intermediate case).

(b) The 2.5 bleed valve actuator drain − FD19 (7 o'clock position in the intermediate case).

(c) The engine air/oil heat exchanger valve drain tube (8:30 o'clock position in the intermediate case).

(d) The fuel pump pad drain − SD2 (on the fuel pump, front of the main gearbox).

(e) The gearbox front hydraulic pump drive pad − SD4 (front of the main gearbox).

(f) The gearbox IDG drive pad − SD6 (rear of the main gearbox).

(g) The gearbox EEC alternator drive pad − SD8 (rear of the main gearbox).

(h) The gearbox starter drive pad − SD5 (rear of the main gearbox).

(i) The gearbox rear hydraulic pump drive pad − SD3 (rear of the main gearbox).

(j) The IDGS fuel/oil cooler front drain − AP21 (front of the fuel/oil cooler at 9 o'clock position).

(k) The fuel/oil cooler forward drain − AP24 (forward outboard side of the fuel/oil cooler at 9 o'clock position).

(l) The fuel/oil cooler rear drain − AP25 (rear outboard side of the fuel/oil cooler at 9 o'clock position).

(m) The fuel/oil cooler bypass valve drain − AP30 (under the fuel/oil cooler at 9 o'clock position).

(n) The TCC actuator drain − AP14 (on the HPC at 2 o'clock position).

(o) The SVA drain − FD17 (on the HPC at 5 o'clock position).

CAUTION: DO NOT LOWER THE TEST ADAPTER TOO FAR. DO NOT PUT THE WEIGHT OF THE TEST ADAPTER ON THE ENGINE OR DAMAGE TO THE ENGINE CAN OCCUR.

(7) Install the engine/powerplant to the test adapter. Tighten, torque and safety the engine mount bolts.

(8) Connect the engine core section (harnesses, ducts, hoses) to test adapter as follows:

(a) Connect all the necessary core engine harnesses to the test adapter electrical receptacles.

(b) Connect the Flange P turbine vibration accelerometer lead to the test adapter.

NOTE: Install the lead so that it does not touch the hot tubes/ducts or the test adapter doors when closed.

(c) If the bleed air environmental control system (ECS) duct is not installed, connect the starter air duct to the test adapter.

(d) If the bleed air (ECS) duct is installed, connect the bleed air (ECS) duct to the test adapter.

NOTE: If the test adapter does not connect to the bleed air (ECS) duct, be sure that the correct blank−off plates are installed.

(e) Connect the main fuel supply line (FM13) to the test adapter at the 1 o'clock position.

(9) Connect the test adapter leads and hoses to the engine core section as follows.

(a) Remove the EGT (TT4.95) junction box cover and connect the test adapter lead to the two forward studs (on the exhaust case at 6:30 o'clock position).

(b) Remove the PT4.95 plug, install the fitting, and install the test adapter line to the PT4.95 manifold (adjacent to the exhaust case at 6 o'clock position).

(c) Optional, remove the PS4I cap and connect the test adapter line to the diffuser case three bolt pad (11:30 o'clock position).

(d) Remove the PS3 cap and connect the test adapter line (if equipped) to the diffuser case (rear of the fuel injectors at 1 o'clock position).

(e) If used, connect the high temperature sensor test lead and probe to the diffuser case (AP8) port (11 o'clock position).

(f) If the IDG is installed, connect test adapter leads to the IDG Terminals (T0, T1, T2 and T3).

(g) If the IDG is installed, install a PWA 86628 Connector Assembly to the power supply line for the IDG override control switch.

(h) Remove the plug, install the fitting, and connect the MOP test adapter line to the fuel oil cooler outlet manifold (attached to the fuel/oil cooler at 9 o'clock position). LP1 port.

(i) Remove the elbow, install a fitting, and connect the (1, 1.5 and 2) breather pressure test adapter line to the (LB02) breather tube (9 o'clock position in place of the engine low oil pressure switch upper tube).

(j) Install and connect the oil filter differential pressure test adapter lines to the (LOW) forward LP5 port and the (HIGH) rear LP4 port of the switch (forward of the main oil filter housing at 7:30 o'clock position).

(k) Remove the plug, install the fitting, and connect No. 3 breather pressure test adapter line to the No. 3 bearing scavenge manifold (LR04) fitting (adjacent to the oil pump at 5:30 o'clock position).

(l) Remove the cap and install the PT2.5 test adapter line to the PT2.5 test tap (in the intermediate case recess at 5 o'clock position).

(m) If the thrust reverser is not used, attach a PWA 85927 Thrust Reverser Simulator. Connect the power supply cable to the input connector. Connect the EEC cable to the output connector.

(10) Connect the engine fan section to the test adapter as follows:

(a) Connect all the required fan case harnesses to the test adapter electrical receptacles.

(b) Remove the PAMB tube cap (adjacent to Flange A at 1 o'clock position).

(11) Install the special PWA tool adapters and bellmouth shown in Figure 1301 to the engine inlet as follows:

(a) Install the PWA 85202 Adapter Ring to the PWA 29304 Bellmouth with the PWA 29972 Segmented Rubber Seals.

NOTE: Align the adapter ring lifting eye with the bellmouth lifting eye and the adapter ring lifting eye towards the bellmouth.

(b) Secure the adapter ring to the bellmouth with the 16 detail cap screws, washers, and nuts.

(c) Remove the applicable plugs from the adapter ring and install the PWA 88241 PT2/PS2 Probe (supersedes PWA 26154 Probe) Attach the probes with the bolts.

(d) Install the PWA 85636 Lifting Bracket to the bellmouth and adapter ring. Secure bracket to the adapter ring with the four cap screws and to the bellmouth with the two cap screws.

(e) Lift the bellmouth and adapter ring (by the 2.00 inch (50.80 mm) lift hole) and install to the engine inlet. Secure with the detail washers, cap screws, and nuts.

NOTE: Put the washers under the cap screw head and under the nut.

(12) Install the PWA 85523 Probe to the bellmouth as follows:

  (a) Remove the plug from the bellmouth at 11 o'clock position.

    NOTE: The probe can be at a different circumferential location than the 11 o'clock position. The probe must be at the same circumferential location that was used to develop the test cell corrections.

  (b) Install the probe to the opening with the electrical connector rearward.

    NOTE: The probe has an offset bolt hole to ensure correct installation.

  (c) Attach the probe with the four cap screws. Torque the cap screws to 110 lb−in. (12.428 N.m).

(13) Connect the test adapter hoses and leads to the bellmouth connections as follows:

  (a) Connect the test adapter hoses to the eight PT2 probes.

  (b) Install a 4 foot (1.22 m) test hose from the PWA 85523 Probe (11 o'clock position) to the EEC PT2 tube (AS16) (adjacent to Flange A at 12 o'clock position).

  (c) Install the two test adapter leads to the PWA 85523 Probe (11 o'clock position).

(14) Record the EEC part number and serial number. Make sure that the correct EEC is installed

(15) Record the EEC programming plug part number and serial number. Make sure that the correct plug is installed or that the correct test plug is installed.

(16) Lift the test adapter and engine/power plant and transport to the test cell.

(17) Attach the test adapter to the test cell interface and make all the necessary connections.

(18) Service the:

(a) Engine oil

(b) IDG oil (if equipped)

(c) Starter oil.

(19) Inspect the engine fan exit and core areas.

(20) Close the test adapter engine test cowls and secure.

(21) Inspect the front of the engine, the fan exit, and the exhaust areas for possible FOD.

(22) Test the engine/power plant. See 71−00−00, Testing−00 Task 71−00−00−990−003.

Task 71−00−00−990−004:

5. Engine Safety Precautions

A. General
The Air Intake Suction Danger Areas. Figure 1302.

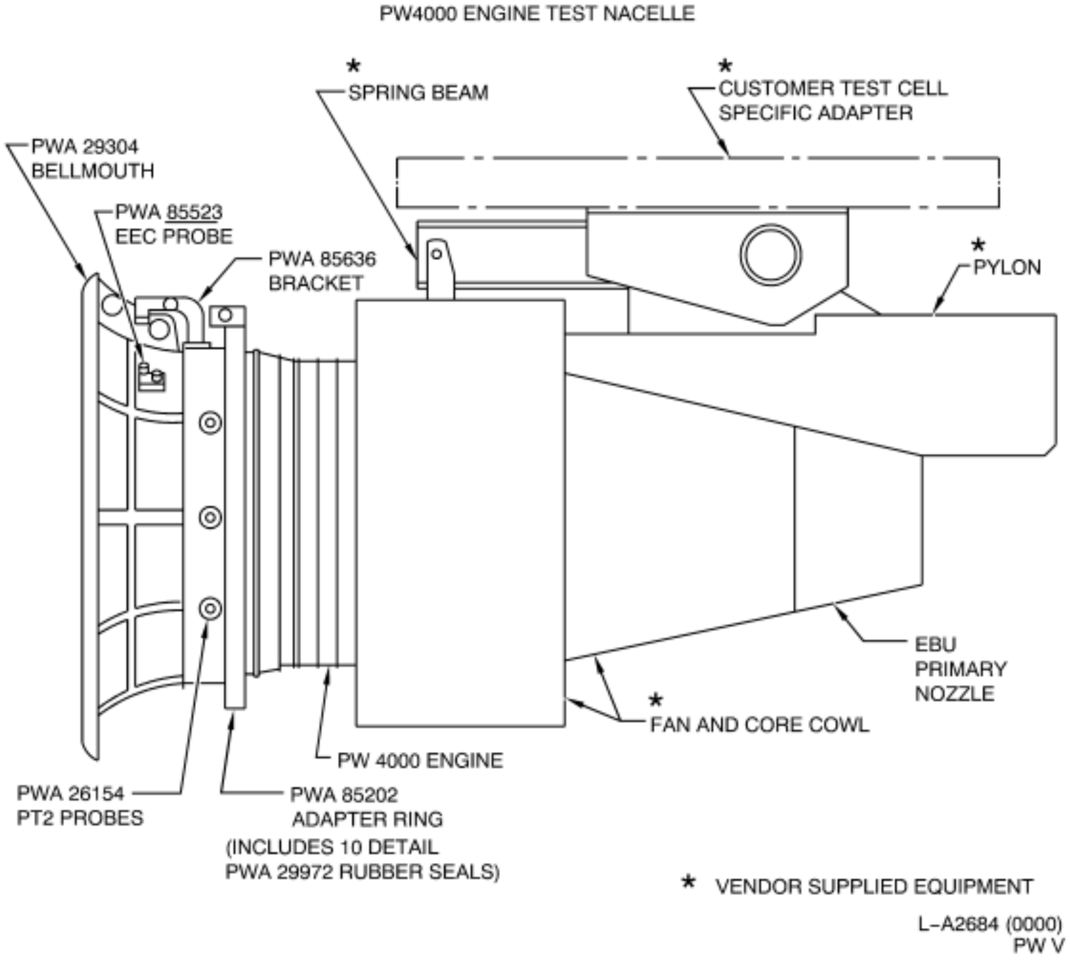
WARNING: STAY AWAY FROM THE DANGER AREAS AT THE FRONT AND THE SIDES OF THE ENGINE DURING OPERATION. THE ENGINE CAN MAKE ENOUGH SUCTION AT THE INLET DUCT TO PULL A PERSON UP TO, OR IN TO (IN PART OR FULLY) THE DUCT. THIS CAN KILL A PERSON OR CAUSE A VERY BAD INJURY.

WARNING: DO NOT GO IN THE TEST CELL WHEN THE ENGINE OPERATES ABOVE IDLE POWER. THE ENGINE SUCTION ABOVE IDLE CAN PULL A PERSON IN TO THE ENGINE INTAKE.

(1) The Air Intake. The air intake is in the front of the engine. There is a strong air suction when the air goes into the engine. The suction is very strong when the engine operates at takeoff power.

B. The Exhaust And Fan Discharge Danger Areas

WARNING: KEEP AWAY FROM THE FAN DISCHARGE AREA WHEN THE ENGINE IS STARTED AND WHILE THE ENGINE OPERATES. THE JET VELOCITY CAN MOVE A PERSON OFF HIS FEET AND CAUSE A BAD INJURY OR KILL A PERSON.


PW4000 ENGINE TEST NACELLE
* SPRING BEAM
* CUSTOMER TEST CELL SPECIFIC ADAPTER
PWA 29304 BELLMOUTH
PWA 85523 EEC PROBE
PWA 85636 BRACKET
* PYLON
EBU PRIMARY NOZZLE
* FAN AND CORE COWL
PW 4000 ENGINE
PWA 26154 PT2 PROBES
PWA 85202 ADAPTER RING (INCLUDES 10 DETAIL PWA 29972 RUBBER SEALS)
* VENDOR SUPPLIED EQUIPMENT
L−A2684 (0000)
PW V

Engine Test Cell Equipment
Figure 1301
(Task 71−00−00−480−001)

WARNING: EYE PROTECTION MUST BE WORN BY ALL PERSONS WHO WORK NEAR THE AIRCRAFT WHILE THE ENGINE OPERATES. AT HIGH ENGINE SPEEDS, THE EXHAUST CAN COLLECT AND BLOW LOOSE DIRT, STONES, SAND, AND OTHER UNWANTED MATERIAL A LONG DISTANCE.

WARNING: KEEP AWAY FROM THE EXHAUST AREA WHEN THE ENGINE IS STARTED AND WHILE THE ENGINE OPERATES. THE EXHAUST GASES HAVE A BAD SMELL AND CAN BE BAD TO BREATHE. THE GAS IS BAD FOR THE EYES. DO NOT BREATHE THE GAS OR LET THE GAS IN YOUR EYES (IN AREAS WHERE THERE IS A HIGH CONCENTRATION).

WARNING: AT SOME TIME, WHEN THE ENGINE IS STARTED, FUEL WHICH HAS NOT BEEN BURNED IN THE COMBUSTION CHAMBER CAN IGNITE IN THE EXHAUST AREA. THIS CAN CAUSE LONG FLAMES TO BLOW OUT OF THE EXHAUST NOZZLE. ALL PERSONS MUST KEEP AWAY FROM THE EXHAUST WHEN THE ENGINE IS STARTED. REMOVE ALL FLAMMABLE MATERIAL FROM THE AREA.

WARNING: THE EXHAUST GAS IS HOT WHEN THE ENGINE OPERATES AT IDLE OR HIGHER POWER. DO NOT GO IN THE PATH OF THE EXHAUST. THE SKIN CAN GET BURNED.

WARNING: DO NOT GO IN THE TEST CELL WHEN THE ENGINE OPERATES ABOVE IDLE POWER. THE ENGINE EXHAUST AND FAN DISCHARGE ABOVE IDLE CAN KILL A PERSON.

(1) The engine exhaust and fan discharge behind the engine is called the jet wake. Do not go behind the engine during engine operation. This area is very dangerous to persons because of the high temperature and high air velocity.

C. Engine Noise

WARNING: EAR PROTECTION MUST BE WORN BY ALL PERSONS WHO WORK NEAR THE ENGINE WHILE THE ENGINE OPERATES. THE LOUD NOISE FROM THE ENGINE CAN CAUSE TEMPORARY OR PERMANENT DAMAGE TO THE EARS.

WARNING: DO NOT GO IN THE TEST CELL WHEN THE ENGINE OPERATES ABOVE IDLE POWER. THE ENGINE NOISE ABOVE IDLE CAN DAMAGE YOUR HEARING WITH EAR PROTECTORS.

(1) You must wear ear protectors if you go in the test cell when the engine operates at idle power. Do not go in the test cell when the engine is operated above idle power.

(2) The loud noise from a jet engine can cause temporary or permanent damage to a person's ears. This damage can happen after a very short time if the ears are not protected. This damage can cause your hearing and sense of balance to decrease.

(3) Engine noise danger areas are provided in Figure 1303 for Ground Idle, Break−Away and Take−Off power settings.

D. The Engine Ignition System High Voltage

WARNING: DO NOT TOUCH ANY PART OF THE ENGINE IGNITION SYSTEM WHILE THE IGNITION OPERATES. THE IGNITION SYSTEM USES HIGH ENERGY WHICH IS DANGEROUS AND CAN MAKE ELECTRIC SHOCKS WHICH CAN CAUSE A BAD INJURY OR KILL A PERSON.

(1) The engine ignition system generates high energy and high voltage electricity. An electrical shock from this system can kill a person.

(2) The ignition system usually operates when the engine starts but the ignition system can also operate when the engine is not operated.

E. Hot Engine Parts

WARNING: DO NOT TOUCH, OR COME IN CONTACT WITH, NO. 3 BEARING BUFFER AIR COOLER OR ASSOCIATED TUBING FOR 3.0 HOURS AFTER ENGINE HAS BEEN SHUT DOWN. FAILURE TO COMPLY CAN RESULT IN SERIOUS BURNS.

(1) After engine operation, do not touch the No. 3 Bearing Buffer Air Cooler for 3 hours after engine shutdown. See Figure 1304. The No. 3 bearing buffer air cooler can reach 510 C (950 F) during high power running and requires 3 hours to cool.

(2) After engine operation, do not work or make an inspection on the hot section or the exhaust areas for 30 minutes, (preferably longer). Other engine parts can be examined sooner.

F. The Compressor Bleed Valve Discharge

WARNING: WHILE THE ENGINE IS IN OPERATION, STAY AWAY FROM THE BLEED VALVE. DURING ENGINE OPERATION, THE BLEED VALVE CAN OPEN. WHEN THE BLEED VALVE OPENS, HIGH PRESSURE AIR AT A HIGH VELOCITY COMES OUT. THIS AIR CAN MOVE A PERSON FROM HIS FEET AND CAUSE INJURY.

(1) During engine operation, the bleed valve can suddenly open and discharge high pressure, high velocity air out the side of the cowl. This air can move a person from their feet and cause an injury.

G. Fuel and Oil

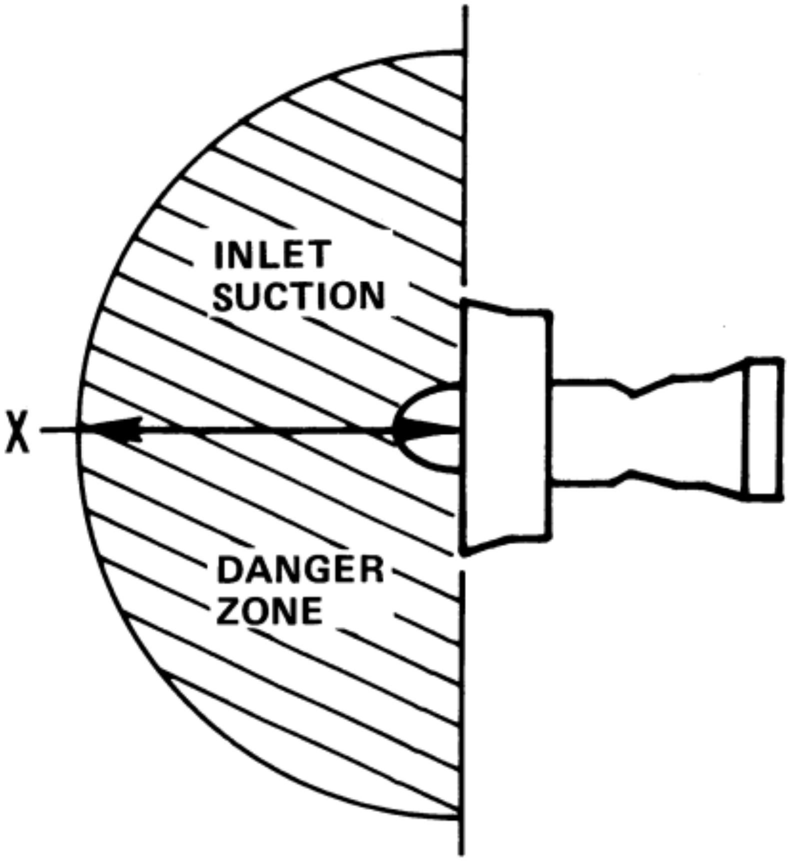
WARNING: FUEL AND OIL CAN CAUSE THE SKIN TO DRY OUT. IF POSSIBLE DO NOT LET THE FUEL AND OIL TOUCH YOUR SKIN.

(1) Engine fuel and oil can make your skin dry if it touches your skin for a long time. If the fuel or oil touches your skin, remove the fuel or oil from your skin as soon as possible.

H. Pressurized Oil System

WARNING: DO NOT OPEN THE OIL TANK CAP FOR A MINIMUM OF FIVE MINUTES AFTER ENGINE SHUTDOWN. IF YOU OPEN THE CAP SOONER, HOT OIL CAN SPRAY ON YOU AND CAN CAUSE BURNS.

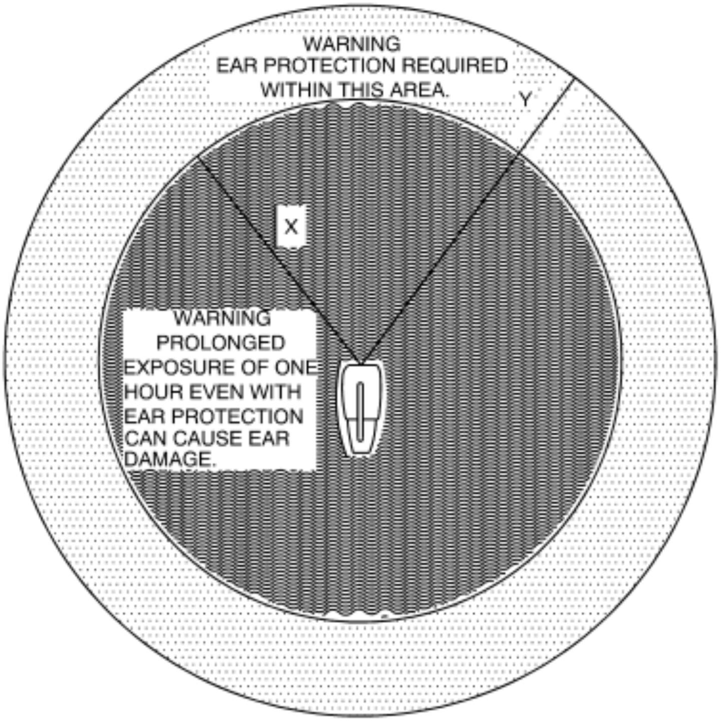
(1) The oil tank is pressurized during operation. The pressure slowly decreases after shutdown. Do not remove the oil tank cap for a minimum of five minutes after engine shutdown.



POWER SETTING	X
TAKE OFF	50FT (15.2m)
IDLE	25FT (7.6m)

L-A1734

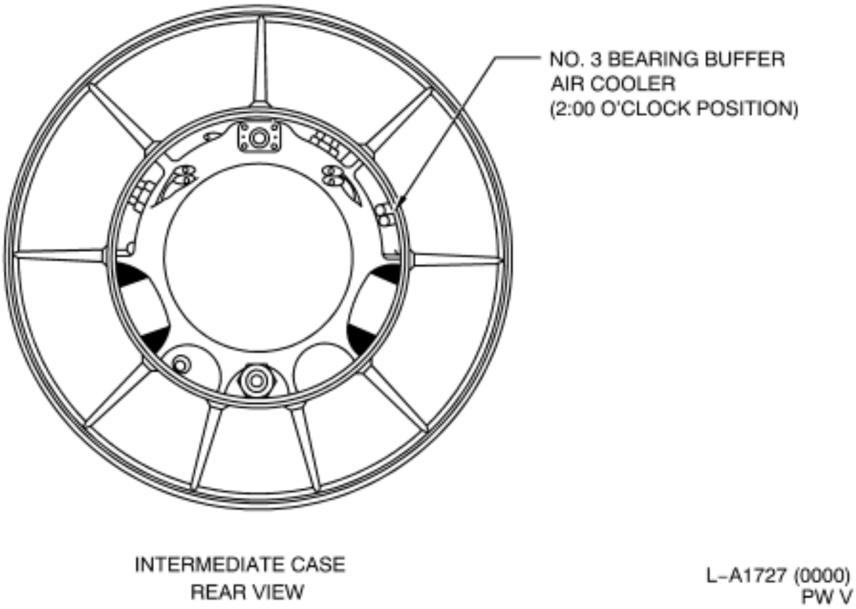
Jet Suction Area - Ground Idle/Take-Off Thrust
Figure 1302
(Task 71-00-00-990-004)


WARNING
EAR PROTECTION REQUIRED
WITHIN THIS AREA.
Y
X
WARNING
PROLONGED
EXPOSURE OF ONE
HOUR EVEN WITH
EAR PROTECTION
CAN CAUSE EAR
DAMAGE.

POWER SETTING	RADIUS X	RADIUS Y
GROUND IDLE	75 FT. (23m)	100 FT (30m)
BREAK AWAY	90 FT (27m)	115 FT (35m)
TAKE-OFF	125 FT (38m)	200 FT (60m)

L-A1748 (0000)
PW V

Engine Noise Danger Areas
Figure 1303
(Task 71-00-00-990-004)


NO. 3 BEARING BUFFER
AIR COOLER
(2:00 O'CLOCK POSITION)
INTERMEDIATE CASE
REAR VIEW
L−A1727 (0000)
PW V

No. 3 Bearing Buffer Air Cooler
Figure 1304
(Task 71−00−00−990−004)

Task 71−00−00−760−002:

6. Precautions and Procedures For Safe And Correct Engine Operation

A. Precautions For The Air Intake

CAUTION: BEFORE THE ENGINE IS OPERATED, DO A CHECK OF THE AIR INTAKE, AND THE AREA NEAR IT. EXAMINE THESE AREAS VERY CAREFULLY FOR LOOSE OBJECTS WHICH COULD BE PULLED IN TO THE ENGINE.

(1) Clean the area in front of the air intake before the engine is operated. All loose objects must be removed.

B. Precautions For Deicing Fluid

WARNING: DO NOT APPLY DEICING FLUID WITH A SPRAY GUN IN TO THE ENGINE WHILE THE ENGINE IS IN OPERATION. THE DEICING FLUID WILL CAUSE CONTAMINATION OF THE AIRFOILS AND DETERIORATION OF PERFORMANCE WILL BE THE RESULT.

(1) Deicing fluid is sprayed on engine nacelles to remove and prevent ice. Do no spray deicing fluid in to the engine gaspath.

C. Precautions For X−rays

CAUTION: THE ELECTRONIC ENGINE CONTROL (EEC) CAN BE DAMAGED BY CONTINUED USE OF X−RAYS. THE EEC MUST BE REMOVED BEFORE THE USE OF X−RAYS.

(1) It is possible to use X−rays for a diagnostic inspection of the important parts inside the engine. The X−rays can damage the electronic engine control (EEC). Remove the EEC before you do any X−ray inspections.

D. Precautions For The Thrust Reverser

CAUTION: THE THRUST REVERSER MUST BE DISCONNECTED IN THE TEST CELL AT ALL TIMES. THE THRUST REVERSER MUST NOT OPERATE IN THE TEST CELL.

(1) If the thrust reverser is installed on the engine in the test cell, it must be disconnected and must not operate. The thrust reverser must not operate if the thrust lever is put in REVERSE.

E. Procedures For Thrust Lever Movement

CAUTION: A DETERIORATION OF THE PERFORMANCE CAN RESULT IF YOU DO NOT OBEY THE INSTRUCTIONS THAT FOLLOW.

(1) When possible, all thrust lever movements must be slow and smooth.

(2) A snap accelerations and decelerations will not cause a deterioration of the engine performance if you obey the instructions which follow:

(a) Before a snap acceleration, operate the engine at MINIMUM IDLE for at least five minutes after the first engine start.

(b) After a fast deceleration, operate the engine at MINIMUM IDLE for at least five minutes before an engine shutdown.

(c) If you operated the engine at high power (higher than 1.4 EPR) for more than 30 seconds (which includes the usual acceleration time), and then operate at MINIMUM IDLE, the idle time must be less than one minute or more than 10 minutes before you make a snap acceleration.

NOTE: It is possible to ignore the above recommendations for times at MINIMUM IDLE if you do a slow acceleration (60 seconds or longer) instead of a snap acceleration.

F. Tailpipe Fires During Engine Start

(1) If a tailpipe fire occurs during engine start, shut off the fuel and motor the engine to blow out the fire and decrease the engine exhaust temperature.

(2) For a tailpipe fire, do not obey the starter time limit. Operate the starter until the fire is out and the exhaust temperature is below the limits.

G. Dry Chemical Fire Extinguishing Agents

CAUTION: USE OF DRY CHEMICAL FIRE EXTINGUISHING AGENTS CAN CAUSE CORROSION OF THE ENGINE PARTS.

(1) Dry chemical fire extinguishing agents are not recommended.

(2) If dry chemical fire extinguishing agents are used, do the steps that follow:

(a) If both rotors are free to turn , and the EGT is less than 500 °C, dry motor the engine to blow the extinguishing agents from the engine.

(b) Do the requirements specified in SPOP 425. See 70-00, Standard Practices Manual, PN 585005.

CAUTION: DO NOT USE WATER TO REMOVE DRY CHEMICAL FIRE EXTINGUISHING AGENTS FROM THE ENGINE. IF WATER IS USED TO REMOVE DRY CHEMICAL FIRE EXTINGUISHING AGENTS, INCREASED CORROSION OF ENGINE PARTS CAN BE THE RESULT.

(3) Water is not recommended to remove dry chemical fire extinguishing agents. These agents are not water-soluble. Water can cause the agents to build-up and bond to the parts. This can cause decreased engine performance, corrosion and more damage if the engine is not cleaned correctly.

Task 71-00-00-990-007:

7. Engine Operation Limits

A. Exhaust Gas Temperature (EGT) Limits, Station 4.9 Harness Average

(1) Maximum Allowable Observed Exhaust Gas Temperature, at Station 4.95 for the applicable operating condition is listed in Table 1306 and Table 1307.

OPERATING CONDITION	TIME LIMIT (FOR PW4152 ENGINES)	MAX HARNESS AVERAGE - TT4.95
Take-Off	10 Minutes	644° C
Max. Continuous	Continuous	619° C
Starting (On Ground)	-	535° C

Maximum Observed EGT (TT4.95)
Table 1306

OPERATING CONDITION	TIME LIMIT (FOR PW4152 ENGINES)	MAX HARNESS AVERAGE - TT4.95
Starting (In Flight)	-	644° C
Acceleration	-	644° C
Max Reverse	-	644° C

Maximum Observed EGT (TT4.95)
Table 1306 (Continued)

OPERATING CONDITION	TIME LIMIT (FOR PW4156A, PW4158 ENGINES)	MAX HARNESS AVERAGE - TT4.95
Take-Off	10 Minutes	654° C
Max. Continuous	Continuous	629° C
Starting (On Ground)	-	535° C
Starting (In Flight)	-	654° C
Acceleration	-	654° C
Max Reverse	-	654° C

Maximum Observed EGT (TT4.95)
Table 1307

(2) EGT (TT4.95 Real as sensed at termocouples/prior to EEC shunt being applied) Certified Redline limits (°C):

(a) PW4152.....644°C (during ground starting, 535°C)

(b) PW4156A.....654°C (during ground starting, 535°C)

(c) PW4158.....654°C (during ground starting, 535°C)

(3) If EGT (TT4.95) from EEC exceeds red line limits given in step (2), the engine has been subjected to an overtemperature condition. Remedial action which must be taken depends on temperature level reached, length of time at temperature and condition at which engine operated at time. Perform applicable inspection as given in step (5).

CAUTION: WHEN TT4.95 LIMITS ARE EXCEEDED, UNDER CONDITIONS OTHER THAN SURGE, ENGINE SHOULD NOT BE SHUT DOWN ON AN EMERGENCY BASIS, BUT SHOULD BE COOLED FIVE MINUTES UNLESS IT IS OBVIOUS THAT CONTINUED OPERATION WILL RESULT IN ADDITIONAL ENGINE DAMAGE. REGARDLESS OF HOW THE ENGINE IS SHUT DOWN, IT SHOULD NOT BE RESTARTED UNTIL INSPECTION SHOWS THAT BOTH ENGINE ROTORS WILL ROTATE NORMALLY AND APPROPRIATE OVERTEMPERATURE INSPECTION REQUIREMENTS HAVE BEEN ACCOMPLISHED PER FOLLOWING STEP.

CAUTION: IF OVERTEMPERATURE IS ENCOUNTERED AS A RESULT OF SURGE, ENGINE MUST BE SHUT DOWN PER EMERGENCY SHUTDOWN PROCEDURE DESCRIBED IN PARAGRAPH TITLED, ENGINE SHUTDOWN PROCEDURE − EMERGENCY.

(4) All overtemperatures exceeding above noted limits must be recorded, including engine serial number, maximum temperature reached and duration. Attempt to determine and to correct the cause of overtemperature and perform a visual inspection. Refer to step (4) for visual or hot section inspections and to additional procedures if required.

(5) To Perform Engine Inspection Following Overtemperature refer to 72−00−00, Inspection/Check−10 Task 72−00−00−210−022.

B. Overtemperature Limits And Overtemperature Inspection Requirements

(1) Figure 1305 has been provided to define overtemperature limits and applicable overtemperature inspection requirements for engine operation during starting.

(2) Figure 1306 (Sheet 1), Figure 1306 (Sheet 2), Figure 1306 (Sheet 3) and Figure 1306 (Sheet 4) has been provided to define overtemperature limits (time versus EGT observed) and applicable overtemperature inspection requirements for engine operation other than start.

(3) All overtemperatures exceeding the base line limit of Figure 1305 and Figure 1306 (Sheet 1), Figure 1306 (Sheet 2), Figure 1306 (Sheet 3) and Figure 1306 (Sheet 4) must be recorded, including engine serial number, maximum temperature reached and duration.

C. Continue-In-Service Limit

NOTE: Continue-In-Service Limits may be applied as outlined in Figure 1305 and Figure 1306 (Sheets 1 through 4) including applicable notes provided:

(1) Area defining "continue-in-service limit" is not exceeded.

(2) Borescope inspection per 72-00-00, Inspection/Check-01F, Task 72-00-00-210-005, of 1st stage turbine blades and 72-00-00 Inspection/Check-01G, Task 72-00-00-210-006, 2nd stage turbine blades indicates they are free of damage (cracks, blistering of coating, elongation, etc.) and visual inspection of tailpipe shows no evidence of turbine failure.

D. Maximum Allowable Operating Speeds

(1) The Maximum Allowable Operating Speeds are listed below:

(a) Low Pressure Rotor, N1 - 4012 RPM (111.4% N1) (PW4152, PW4156A, PW4158, Engines)

(b) High Pressure Rotor, N2 - 10,300 RPM (104% N2) (PW4152 Engines)

(c) High Pressure Rotor, N2 - 10,450 RPM (105.5% N2) (PW4156A, PW4158 Engines)

NOTE: When overspeed limits are exceeded, the engine should be shut down as soon as possible in a normal manner unless it is obvious that continued operation will result in additional engine damage. The engine should not be restarted until the appropriate overspeed inspection requirements have been accomplished per 72-00-00, Inspection/Check-11, Engine Inspection Following Overspeed, Task 72-00-00-210-023.

(2) All overspeed incidents exceeding the limits noted above must be recorded including the engine serial number, maximum N1 or N2 speed reached and the duration over the N1 or N2 limit, if possible.

(3) Perform engine overspeed inspection per 72-00-00, Inspection/Check-11, Inspection/Check-11, Engine Inspection Following Overspeed, Task 72-00-00-210-023.

E. Oil Breather Pressure Limits

(1) No. 1 - 2 Bearing Compartment: For transient engine operation, the maximum breather pressure is 5 psig (34.5 kPa).

(2) No. 1 - 2 Bearing Compartment: For stable engine operation (after two minutes at any power setting), the maximum breather pressure is 3 psig (20.7 kPa).

(3) No. 3 Bearing Compartment: For transient engine operation, the maximum breather pressure is 180 psig (1241.1 kPa).

(4) No. 3 Bearing Compartment: For stable engine operation (after two minutes at any power setting), the maximum breather pressure is 160 psig (1103.2 kPa).

F. Fuel System Limits And Specifications

(1) Normal Fuel System Indications Are:

(a) Normal Fuel Flow Indications At Sea Level

1 Idle - 1200 pph (544 kgph) to 1600 pph (725 kgph)

2 Takeoff - 16,000 pph (7257 kgph) to 22,000 pph (9979 kgph)

NOTE: FUEL FLOW Indications out of above ranges should be investigated and any Necessary Maintenance Actions taken.

(b) Inlet pressure to the engine fuel pump must be:

1 20 − 50 psi (137.9 − 344.7 kPa) during all stabilized engine operations.

2 5 − 50 psi (34.5 − 344.7 kPa) during all transient engine operation conditions.

(2) Fuel System Specifications

(a) Fuel must conform to specifications of SB PW4ENG 2016.

G. Seal Leakage Limits

(1) Limits

(a) Table 1308 lists seal leakage drains provided on engine and indicates maximum drainage expected from each during operation and after shutdown.

COMPONENT SEAL	FLUID	LEAKAGE LIMIT (During operation and after shutdown)
Stator vane actuator drain port (FD17)	Fuel	60 cc/hour (20 drops/minute)
Station 2.5 bleed valve actuator drain port (FD19)	Fuel	60 cc/hour (20 drops/minute)
ENGINE Air/oil heat exchanger valve drain tube (CR09)	Fuel	30 cc/hour (10 drops/minute)
IDG air/oil heat exchanger valve drain tube (CR10)	Fuel	30 cc/hour (10 drops/minute)
TCC actuator drains port (AP14)	Fuel	30 cc/hour (10 drops/minute)
Gearbox Rear Hydraulic Pump Drive Pad Drain Port (SD3)	Oil	20 cc/hour (6 drops/minute)
Gearbox Front Hydraulic Pump Drive Pad Drain Port (SD4)	Oil	20 cc/hour (6 drops/minute)
Gearbox Starter Drive Pad Drain Port (SD5)	Oil	20 cc/hour (6 drops/minute)
Gearbox IDG Drive Pad Drain Port (SD6)	Oil	20 cc/hour (6 drops/minute)
Gearbox EEC Alternator Drive Pad Drain Port (SD8)	Oil	20 cc/hour (6 drops/minute)
Gearbox Fuel pump pad drain port (SD2)	Fuel	60 cc/hour (20 drops/minute)
Gearbox Fuel pump pad drain port (SD2)	Oil	20 cc/hour (6 drops/minute)

Engine Seal Leakage Limits
Table 1308

COMPONENT SEAL	FLUID	LEAKAGE LIMIT (During operation and after shutdown)
(CONTINUED)		
IDG Fuel/Oil Cooler Front Drain Port (AP21)		No measurable leakage
Engine Fuel/Oil Cooler Front Drain Port (AP24)		No measurable leakage
Fuel/Oil Cooler Rear Drain Port (AP25)		No measurable leakage
Fuel/Oil Cooler Bypass Valve Drain Port (AP30)	Oil	10 cc/hour (3 drops/minute)

Engine Seal Leakage Limits
Table 1308 (Continued)

(b) If there is oil weepage from the No. 3 bearing weep tube into the turbine exhaust case (TEC) during test cell runs do the procedure that follows.

1 Clean with a rag to remove residual oil.

2 Perform an Test No. 9 Engine Acceptance Test, (Task 71-00-00-760-020).

3 Clear engine for return to service if oil consumption rate is less than or equal to 0.15 quart/hour and there is no standing oil in the turbine exhaust case.

H. Oil System Limits And Specifications

(1) Main oil pressure: 70 psid (482.6 kPa) Minimum. The main oil pressure is a differential pressure, Oil supply pressure minus No. 1 and No. 2 breather pressure.

(2) The main oil pressure limits that are necessary during engine operation are shown in 71-00-00, Testing-13, Main Oil Pressure Test And Adjustment, (Task 71-00-00-760-047).

(3) Pressure drop across main oil filter - 50 psid (344.7 kPa) Maximum

(4) Main oil temperature limits:

(a) 122°F (50°C) minimum oil temperature at idle before engine operation above idle.

(b) 325°F (162.8°C) maximum oil temperature at steady state continuous engine operation.

(c) 350°F (176.7°C) maximum oil temperature during transient engine operation for a maximum time limit of 20 minutes.

(d) If the oil temperature is more than the permitted limit, shut down the engine and find the cause of the high temperature. See 72-00-00, Inspection/Check-03, Perform Oil Overtemperature Inspection, (Task 72-00-00-280-053).

(e) No. 3 bearing compartment scavenge temperature: 60°F (33.3°C) maximum temperature differential above the main oil temperature.

(f) If the scavenge temperature is above the maximum limit, do a 4 degree/second TRA movement to idle power, then do an engine shutdown. Find the cause of the overtemperature and repair as necessary.

(5) Oil Specifications (See SB 238).

NOTE: Engine must be properly serviced prior to motoring or starting. See 72-00-00, Servicing-03, (Task 72-00-00-610-003).

(a) Approved oils are listed in latest issue of SB 238.

CAUTION: DO NOT MIX DIFFERENT BRANDS OF OIL.

(b) Oil consumption guideline maximum is 0.125 U.S. gal/hr (0.47 liters/hr). A sudden increase or continually increasing trend in oil consumption should be investigated.

NOTE: The oil quantity instrument in the test cell indicates the quantity of oil in the oil tank only. It does not include the quantity of oil in the engine. During operation of the engine, as much as 12 quarts (11.36 l) of oil can go from the oil tank to the engine. This causes the oil quantity indication to decrease by the same quantity. After the engine shuts down, oil drains from the engine back to the oil tank. As the oil returns to the oil tank, the oil quantity indication in the test cell shows an increase in oil quantity.

I. Vibration Limits

(1) The maximum allowable overall vibration levels are shown in Table 1309.

LOCATION	SINGLE AMPLITUDE	VELOCITY
Fan Case Flange A	2.5 mils (0.064 mm)	0.9 IPS (inches per second) (22.860 mm per second).
Turbine Exhaust Case Flange P	2.0 mils (0.051 mm)	0.9 IPS (22.860 mm per second).
If above maximum allowable vibration levels are exceeded, they are considered acceptable provided none of the following rotor related limits are exceeded		
High Rotor Flange A, P		0.8 IPS (20.320 mm per second)
Low Rotor Flange A	2.5 mils (0.064 mm) up to 2500 RPM N1	0.65 IPS (16.5 mm per second) above 2500 RPM N1
Low Rotor Flange P	2.0 mils (0.051 mm) up to 3200 RPM N1	0.65 IPS (16.5 mm per second) above 3200 RPM N1
For all operating conditions except transients. A additional 0.3 mils or 0.1 IPS amplitude is acceptable for each value noted above for transient operation		

Vibration Limits
Table 1309

(a) Highest acceptable level for each location is defined as mean vibration of meter reading after 30 seconds of stabilization at speeds where peaks have shown during acceleration, deceleration and steady stage running in normal operation range.

(b) If vibration average values exceed above vibration limits, a vibration survey should be run per 71-00-00, Adjustment/Test-08 Task 71-00-00-760-032 in that consistently high vibration values may be an indication of internal engine damage, improper rotor balance or engine is improperly assembled.

(2) Optional lower vibration values are shown in Figure 1307 (Sheets 1), Figure 1307 (Sheet 2) and Figure 1308 (Sheet 1), Figure 1308 (Sheet 2). You can use the optional lower vibration values as an alternative to the standard vibration values shown in paragraph (1) above.

(a) The optional reduced vibration values for the test cell will give more satisfactory results when the engine is installed on the aircraft.

Task 71-00-00-760-003:

8. Prime Engine Oil And Fuel System Procedure

NOTE: This procedure should be used whenever engine repair has resulted in oil compartments and/or fuel system being drained.

A. Prime Engine Oil And Fuel System

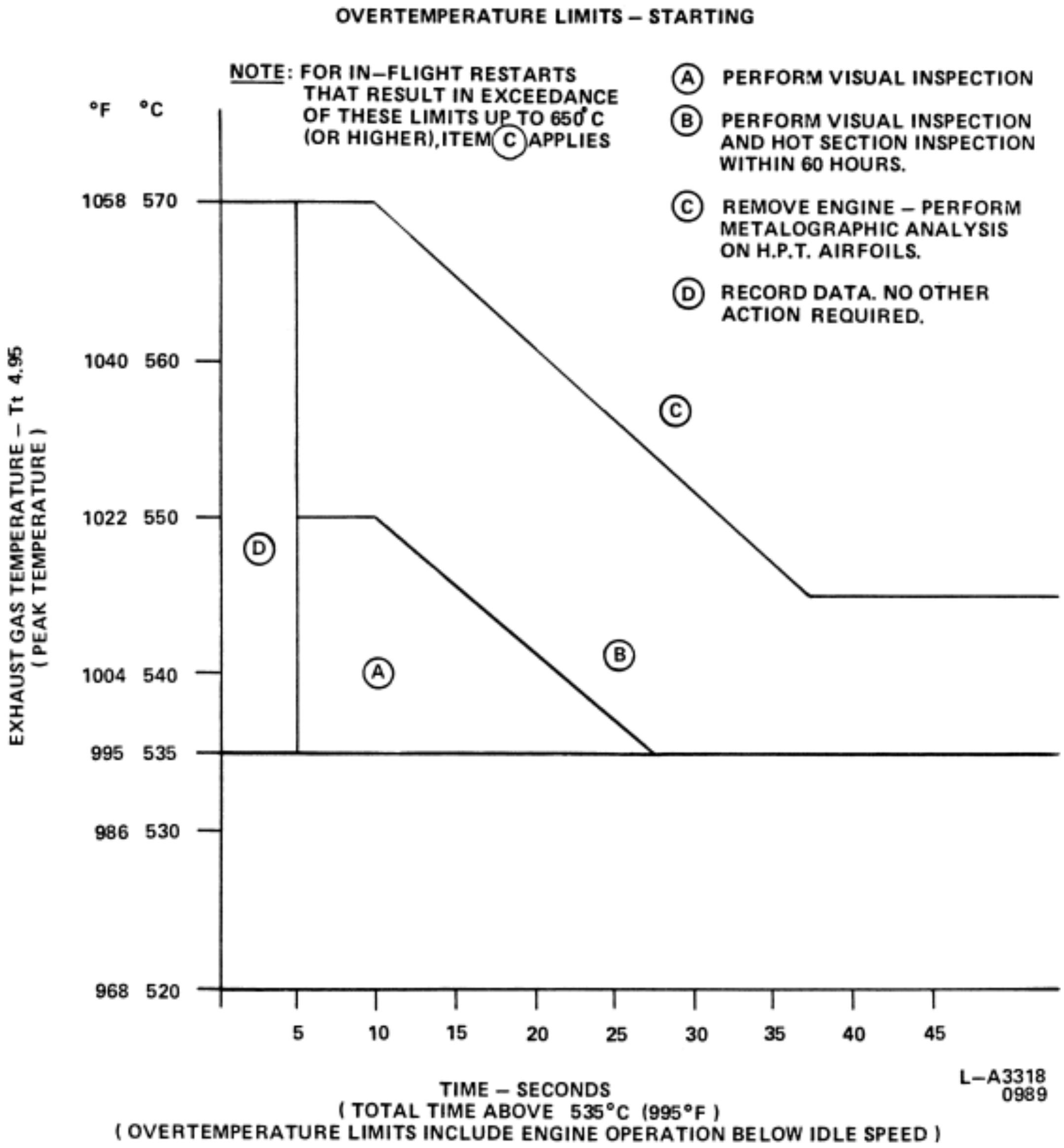
(1) Service oil system per paragraph on Specifications And Operating Limits - Oil System, refer to 72-00-00, Servicing-03, See 72-00-00, Servicing-03, Task 72-00-00-610-003.

(2) With ignition OFF or grounded, test cell fuel system ON, fuel metering unit condition lever in CUTOFF and thrust lever in IDLE motor engine at speed sufficiently high to ensure oil system is fully primed and oil pump maintains steady pressure

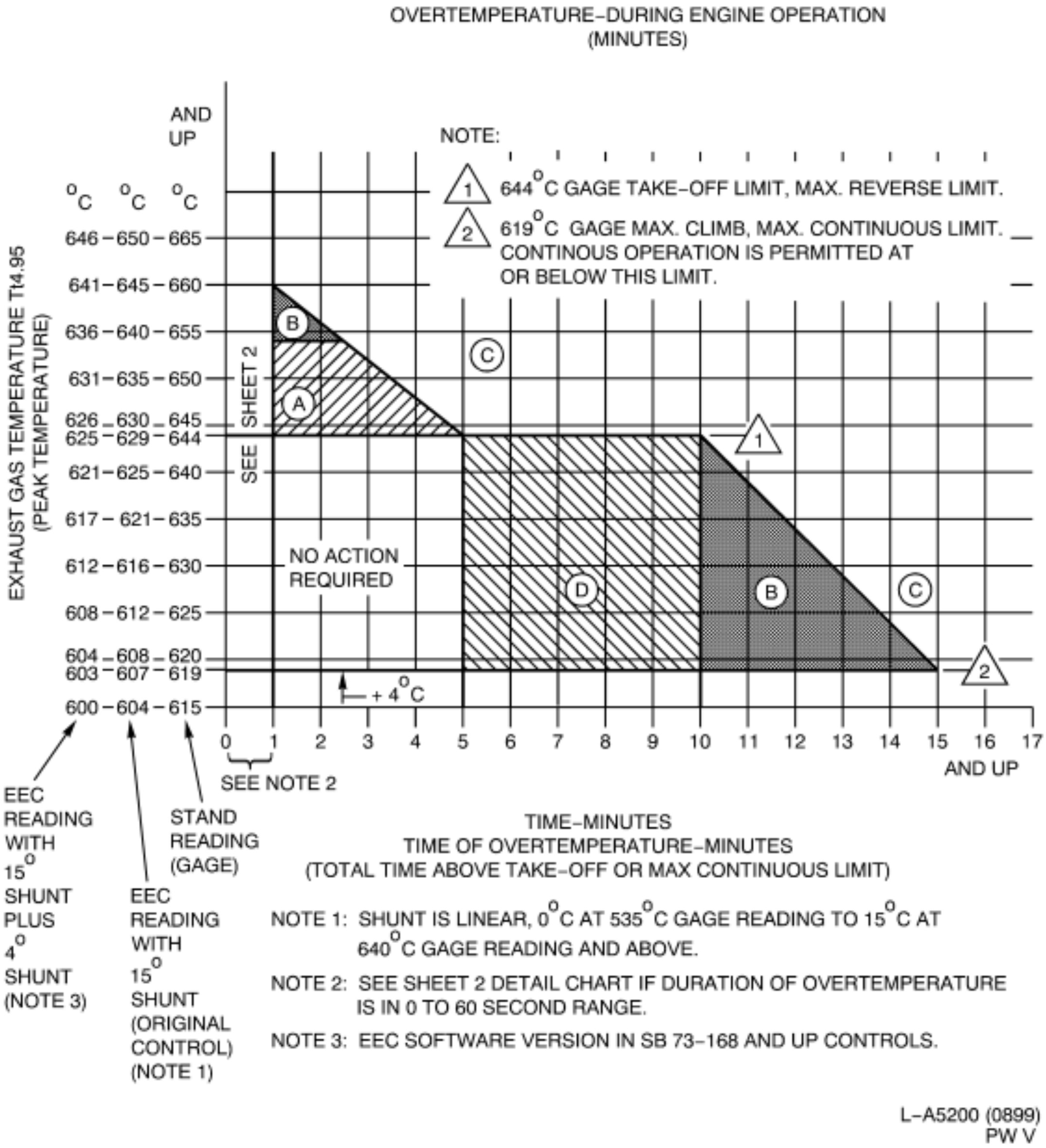
(3) Move condition lever to RUN at approximately 1500 rpm N2 observed for 30 seconds, then return condition lever to CUTOFF. Dry engine by motoring with condition lever at CUTOFF. Check that no fuel or oil is leaking to outside or into fan ducts

CAUTION: A MINIMUM OF FIVE MINUTES SHOULD ELAPSE AFTER ENGINE STOPPAGE BEFORE REMOVING OIL TANK FILLER CAP TO ALLOW TANK PRESSURE TO BLEED OFF.

(4) After priming, recheck oil tank quantity. An oil system that has been completely drained requires approximately 15 quarts of oil to fill plumbing, coolers, pumps and other oil system features. If servicing is required, refer to 72-00-00, Servicing-03, See 72-00-00, Servicing-03, Task 72-00-00-610-003.



Overtemperature Limits For Starting
And Engine Operation Below Idle Speeds
Figure 1305
(Task 71−00−00−990−007)



NOTE:

1 644°C GAGE TAKE–OFF LIMIT, MAX. REVERSE LIMIT.

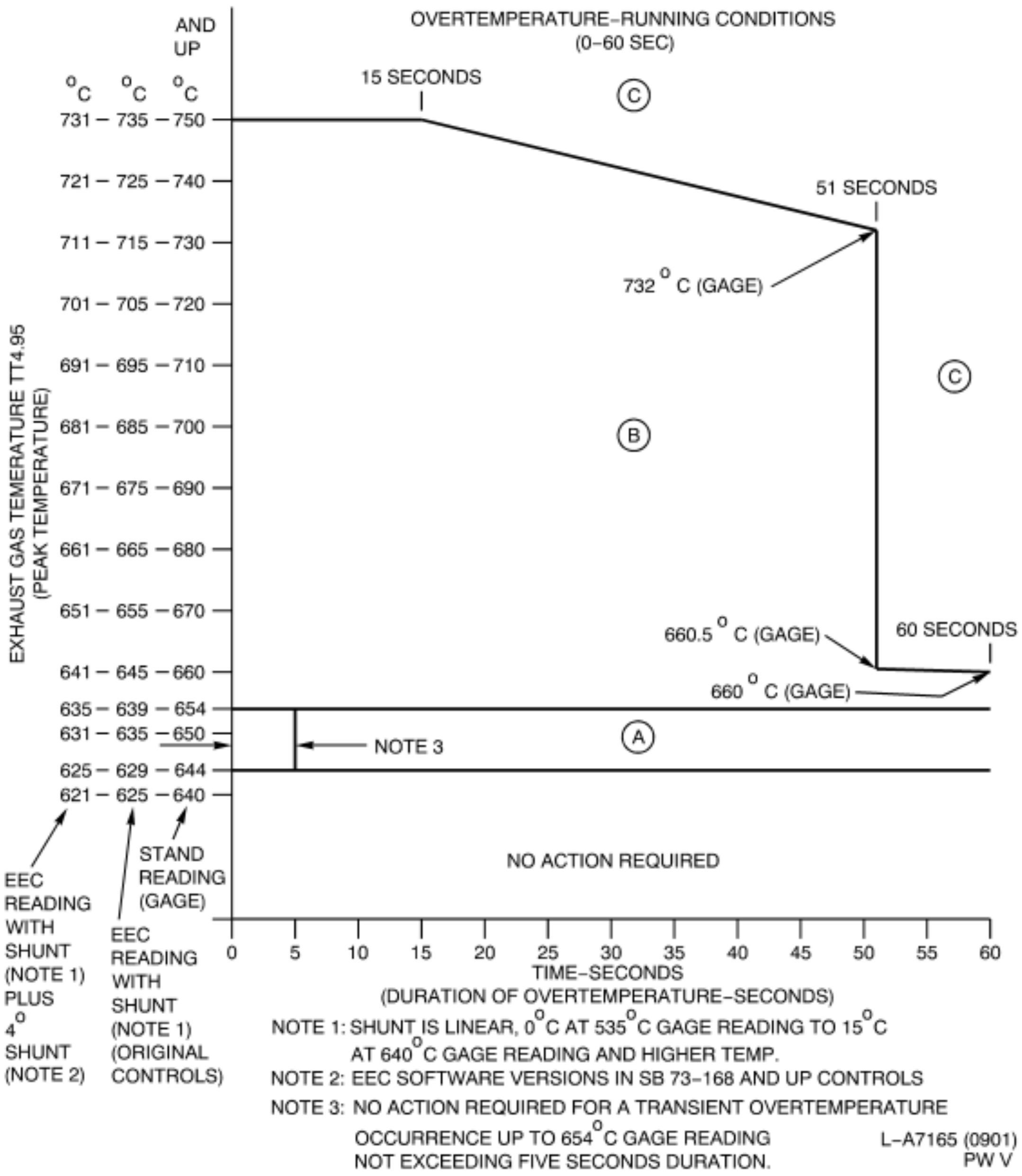
2 619°C GAGE MAX. CLIMB, MAX. CONTINUOUS LIMIT. CONTINOUS OPERATION IS PERMITTED AT OR BELOW THIS LIMIT.

NOTE 1: SHUNT IS LINEAR, 0°C AT 535°C GAGE READING TO 15°C AT 640°C GAGE READING AND ABOVE.

NOTE 2: SEE SHEET 2 DETAIL CHART IF DURATION OF OVERTEMPERATURE IS IN 0 TO 60 SECOND RANGE.

NOTE 3: EEC SOFTWARE VERSION IN SB 73–168 AND UP CONTROLS.

(PW4152) Overtemperature Limits − Running Condition (Minutes)
Figure 1306 (Sheet 1)
(Task 71−00−00−990−007)



NOTE 1: SHUNT IS LINEAR, 0°C AT 535°C GAGE READING TO 15°C AT 640°C GAGE READING AND HIGHER TEMP.

NOTE 2: EEC SOFTWARE VERSIONS IN SB 73-168 AND UP CONTROLS

NOTE 3: NO ACTION REQUIRED FOR A TRANSIENT OVERTEMPERATURE OCCURRENCE UP TO 654°C GAGE READING NOT EXCEEDING FIVE SECONDS DURATION.

(PW4152) Overtemperature Limits - Running Condition (0 - 60 Seconds)
Figure 1306 (Sheet 2)
(Task 71-00-00-990-007)

Chart Area	No. Of Occurrences	Inspection Requirements
A (See Note Below)*	1 − 15	(a) Record: (1) Engine serial no.; (2) Maximum temperature; (3) Time the EGT was over the limit (Takeoff or Max Continuous Limit) (4) Steady−state or surge conditions.
	16	(a) Remove Engine. (b) Record: (1) Engine serial no.; (2) Maximum temperature; (3) Time the EGT was over the limit (Takeoff or Max Continuous Limit) (4) Steady−state or surge conditions. (c) Correct cause of overtemperature. (d) Perform metalographic analysis on HPT airfoils.
B	1 − 7	(a) Record: (1) Engine serial no.; (2) Maximum temperature; (3) Time the EGT was over the limit (Takeoff or Max Continuous Limit) (4) Steady−state or surge conditions. (b) Perform visual inspection per 72−00−00, Inspection/Check−10, Engine Inspection Following Overtemperature, step 1.C. (c) Within 60 hours perform hot section inspection per 72−00−00, Inspection/Check−10 Engine Inspection Following Overtemperature steps 1.D.(1) through (7), Task 72−00−00−210−022. (d) Correct cause of overtemperature.

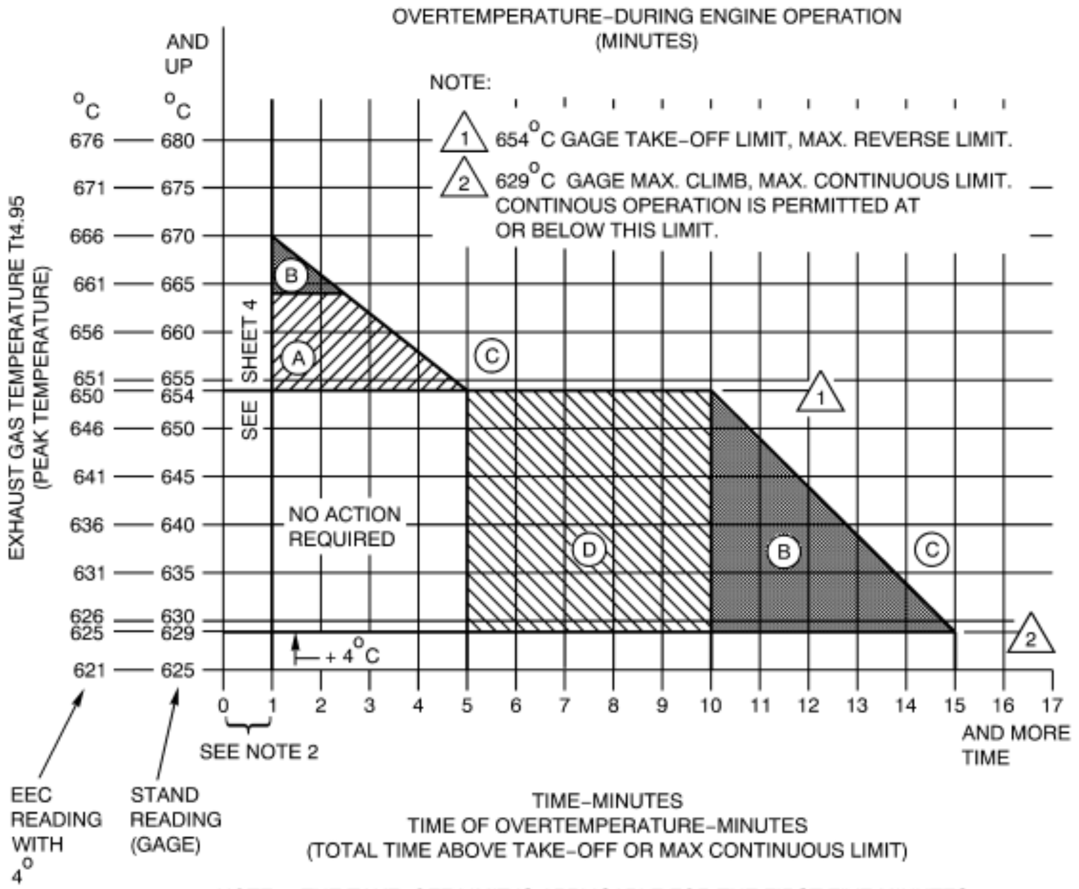
Key To Figure 1306 (Sheet 1 and 2)

Chart Area	No. Of Occurrences	Inspection Requirements
B	8	(a) Remove Engine. (b) Record: (1) Engine serial no.; (2) Maximum temperature; (3) Time the EGT was over the limit (Takeoff or Max Continuous Limit) (4) Steady−state or surge conditions. (c) Correct cause of overtemperature. (d) Perform metalographic analysis on HPT airfoils.
C	1	(a) Remove Engine. (b) Record: (1) Engine serial no.; (2) Maximum temperature; (3) Time the EGT was over the limit (Takeoff or Max Continuous Limit) (4) Steady−state or surge conditions. (c) Correct cause of overtemperature. (d) Perform metalographic analysis on HPT airfoils.
D	ANY AMOUNT	(a) Record: (1) Engine serial no.; (2) Maximum temperature; (3) Time the EGT was over the limit (Takeoff or Max Continuous Limit) (4) Steady−state or surge conditions.

*NOTE: In chart Area A no action required for a transient overtemperature occurrence up to 654°C not exceeding five seconds duration.

Key To Figure 1306 (Sheet 1 and 2)

(Continued)



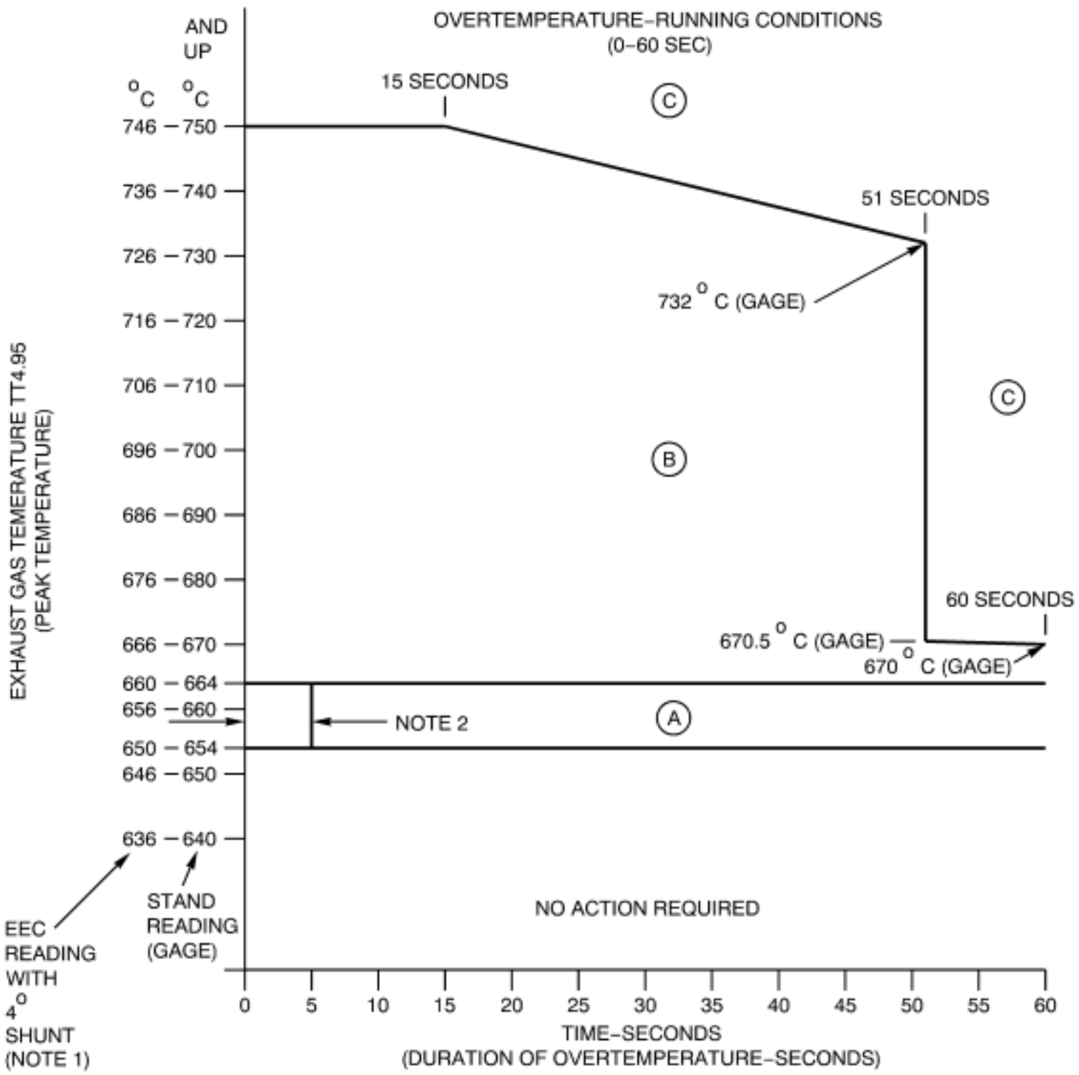
NOTE 1: THE TAKE-OFF LIMIT IS APPLICABLE FOR THE FIRST FIVE MINUTES (FROM THE START OF TAKE-OFF). AFTER FIVE MINUTES, THE MAX CLIMB, MAX CONTINUOUS LIMIT IS APPLICABLE, FOR NORMAL OPERATION. THE TAKE-OFF LIMIT OF 654°C CAN BE EXTENDED FOR 10 MINUTES FOR EMERGENCY IN SERVICE USE.

NOTE 2: SEE SHEET (4) OF THIS FIGURE IF TIME OF OVERTEMPERATURE IS IN THE 0 TO 60 SECOND RANGE.

NOTE 3: EEC SOFTWARE VERSION IN SB 73-168 AND UP CONTROLS.

L-B4999 (0899)
PW V

(PW4156A, PW4158) Overtemperature
Limits - Running Condition (Minutes)
Figure 1306 (Sheet 3)
(Task 71-00-00-990-007)



NOTE 1: EEC SOFTWARE VERSIONS IN SB 73-168 AND UP CONTROLS

NOTE 2: NO ACTION REQUIRED FOR A TRANSIENT OVERTEMPERATURE OCCURRENCE UP TO 664°C GAGE READING NOT EXCEEDING FIVE SECONDS DURATION.

L-B5000 (0899)
PW V

(PW4156A, PW4158) Overtemperature Limits
- Running Condition (0 - 60 Seconds)
Figure 1306 (Sheet 4)
(Task 71-00-00-990-007)

Chart Area	No. Of Occurrences	Inspection Requirements
A (See Note Below)*	1 - 15	(a) Record: (1) Engine serial no.; (2) Maximum temperature; (3) Time the EGT was over the limit (Takeoff or Max Continuous Limit) (4) Steady-state or surge conditions.
	16	(a) Remove Engine. (b) Record: (1) Engine serial no.; (2) Maximum temperature; (3) Time the EGT was over the limit (Takeoff or Max Continuous Limit) (4) Steady-state or surge conditions. (c) Correct cause of overtemperature. (d) Perform metalographic analysis on HPT airfoils.
B	1 - 7	(a) Record: (1) Engine serial no.; (2) Maximum temperature; (3) Time the EGT was over the limit (Takeoff or Max Continuous Limit) (4) Steady-state or surge conditions. (b) Perform visual inspection per 72-00-00, Inspection/Check-10, Engine Inspection Following Overtemperature, step 1.C. Task 72-00-00-210-022. (c) Within 60 hours perform hot section inspection per 72-00-00, Inspection/ Check-10 Engine Inspection Following Overtemperature steps 1.D.(1) through (7), Task 72-00-00-210-022. (d) Correct cause of overtemperature.

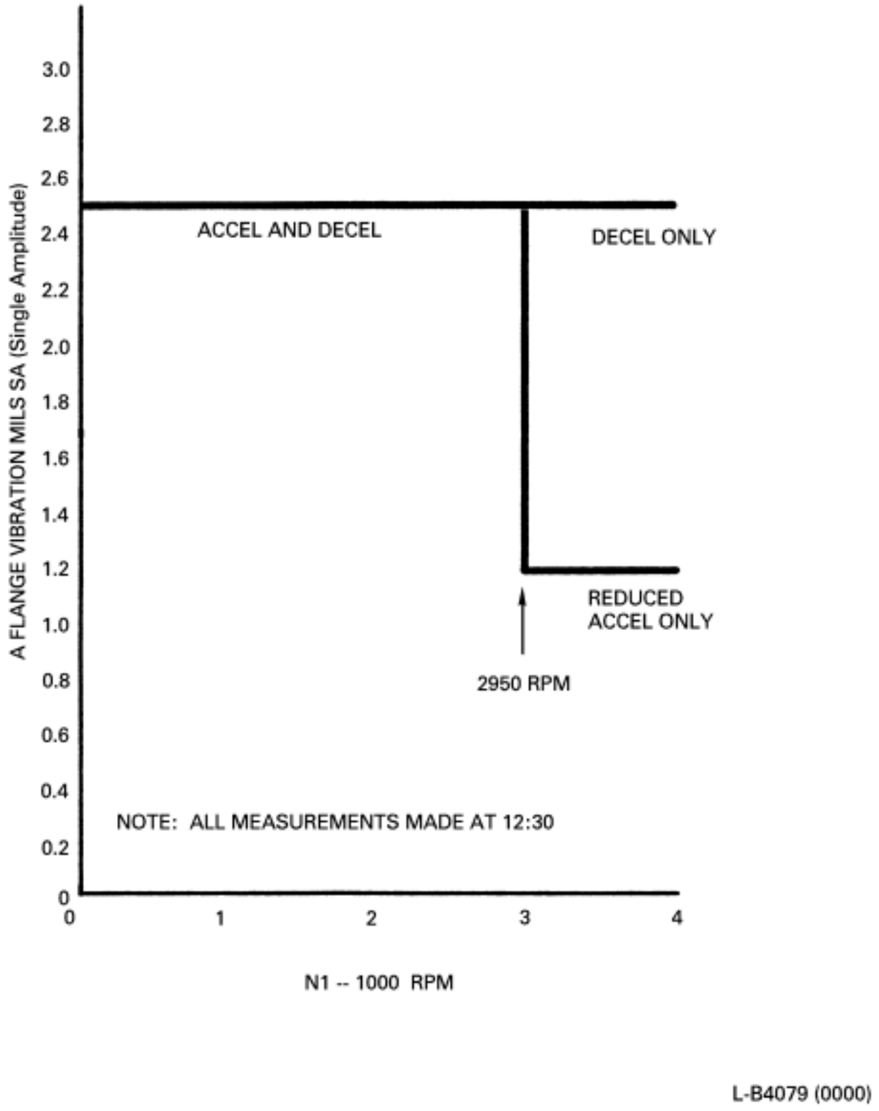
Key To Figure 1306 (Sheet 3 and 4)

Chart Area	No. Of Occurrences	Inspection Requirements
B	8	(a) Remove Engine. (b) Record: (1) Engine serial no.; (2) Maximum temperature; (3) Time the EGT was over the limit (Takeoff or Max Continuous Limit) (4) Steady−state or surge conditions. (c) Correct cause of overtemperature. (d) Perform metalographic analysis on HPT airfoils.
C	1	(a) Remove Engine. (b) Record: (1) Engine serial no.; (2) Maximum temperature; (3) Time the EGT was over the limit (Takeoff or Max Continuous Limit) (4) Steady−state or surge conditions. (c) Correct cause of overtemperature. (d) Perform metalographic analysis on HPT airfoils.
D	ANY AMOUNT	(a) Record: (1) Engine serial no.; (2) Maximum temperature; (3) Time the EGT was over the limit (Takeoff or Max Continuous Limit) (4) Steady−state or surge conditions.

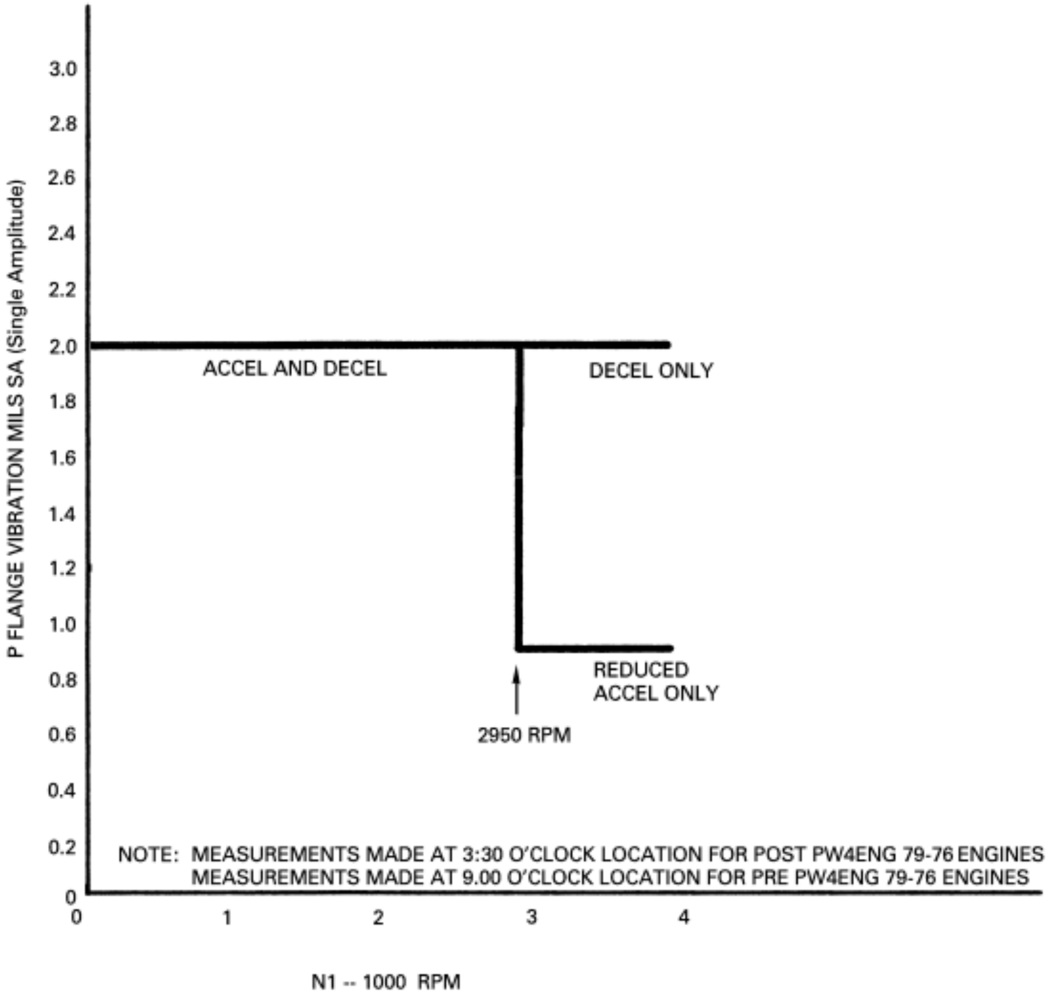
*NOTE: In chart Area A no action required for a transient overtemperature occurrence up to 664° C not exceeding five seconds duration.

Key To Figure 1306 (Sheet 3 and 4)

(Continued)

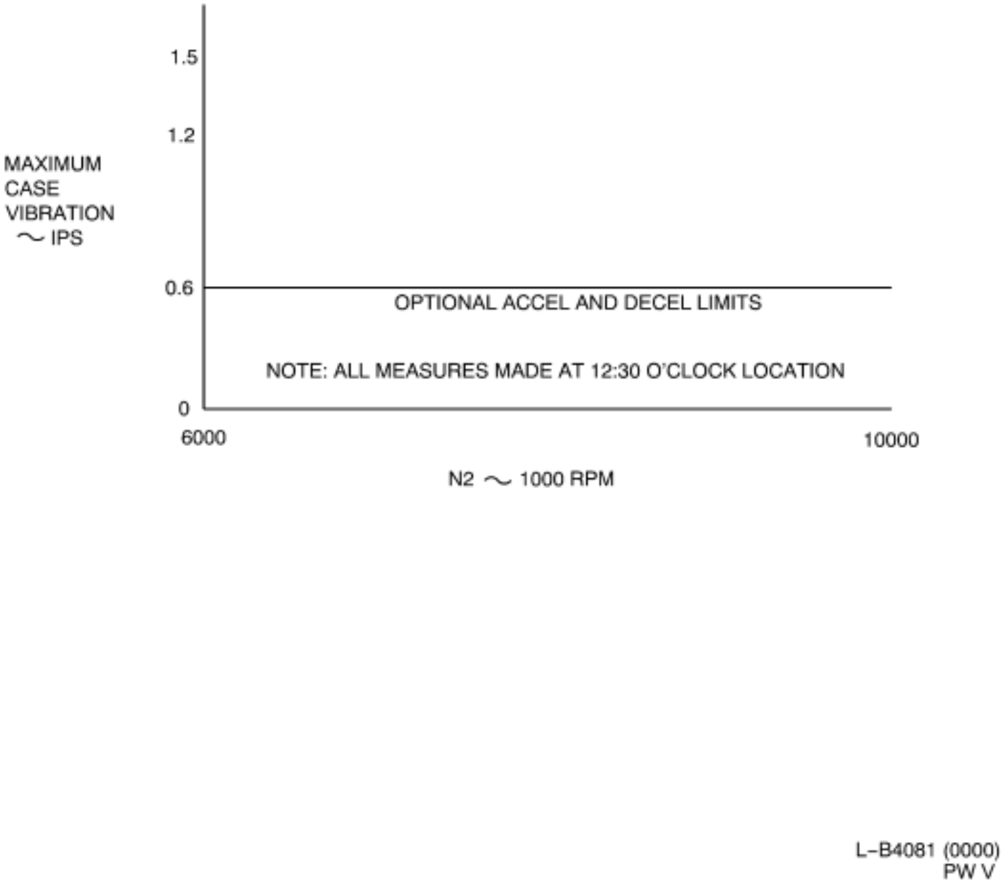


Optional Guideline Limits For Reduced N1 For A Flange Vibration
Figure 1307 (Sheet 1)
(Task 71-00-00-990-007)

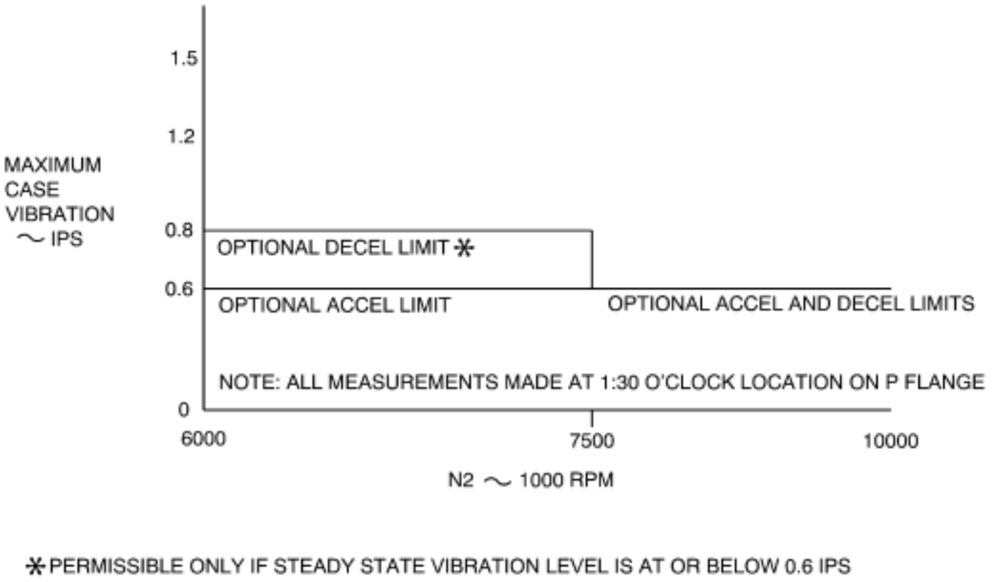


L-B4080 (1296)

Optional Guideline Limits For Reduced N1 For P Flange Vibration
Figure 1307 (Sheet 2)
(Task 71−00−00−990−007)



Optional Guideline Limits For Reduced N2 For A Flange Vibration
Figure 1308 (Sheet 1)
(Task 71-00-00-990-007)



L-B4082 (0000)
PW V

Optional Guideline Limits For Reduced N2 For P Flange Vibration
Figure 1308 (Sheet 2)
(Task 71-00-00-990-007)

Task 71−00−00−760−004:

9. Engine Starting Procedures (Normal)

A. Engine Starting Procedure

CAUTION: BOTH N1 AND N2 ROTORS MUST BE AT A COMPLETE STOP PRIOR TO INITIATING THE FOLLOWING PROCEDURE AND POSITIVE COMMUNICATION BETWEEN PERSONNEL INVOLVED IS MANDATORY TO PRECLUDE PERSONAL INJURY.

(1) Each of the steps below should be performed in sequence. In the event of an aborted start, the entire starting sequence may have to be repeated from the beginning. During starting, accessory loading should be minimized; however, it is acceptable to have bleeds ON.

NOTE: If engine does not respond as indicated below, discontinue start and check for unsatisfactory start reasons. If engine has been pressurized and no light, perform Clear Engine Procedure prior to restart.

(2) Set the prestart conditions that follow:

(a) Set fuel supply (boost pumps) − ON

(b) Set fuel select switch − CUTOFF

(c) Ignition switch − START A OR B

(d) Power lever − MINIMUM IDLE

(3) To begin the start sequence, turn starter motor switch on to start N2 (high pressure rotor) rotation.

NOTE: Discontinue start if the following is observed.

(a) No Rotation − High pressure rotor fails to rotate when starter is pressurized.

(b) Limited Rotation − High pressure compressor rotates but is unable to achieve normal rpm.

(4) Move the Fuel Lever to ON position when N2 reaches maximum motoring speed. Fifteen percent N2 is the minimum acceptable speed for placing the Fuel Lever in the ON position.

NOTE: Maximum motoring speed has been reached when a significant decrease in N2 acceleration is observed.

(5) Observe light-off. Light-off should occur within 20 seconds of pressurization as noticed by an increase in EGT. Engine will accelerate to minimum idle speed. Check EGT for normal temperature rise and N1 and N2 for normal acceleration. Continue to monitor until EGT peaks, decreases and stabilizes.

(6) Record fuel flow at engine light-off. Fuel flow rate must be between 550 and 650 pph (249 and 295 kph) during normal start.

(7) N1 should be rotating immediately prior to fuel pressurization as observed by N1 rpm indicator.

CAUTION: MONITOR BOTH EGT AND N2 CLOSELY DURING START FOR AN IMPENDING HOT START. IF EGT IS CLIMBING RAPIDLY THROUGH 535 C AND N2 ACCELERATION IS SLUGGISH, DISCONTINUE START IMMEDIATELY. CONTINUE TO MOTOR ENGINE UNTIL EGT PEAKS THEN DECREASES.

(8) Monitor the N1, N2 speed carefully during the start procedure.

CAUTION: IF STARTING EGT EXCEEDS 535° C, RECORD PEAK TEMPERATURE IN °C AND DURATION OF OVERTEMPERATURE IN SECONDS. SEE FIGURE 1305 SHOWN IN "ENGINE OPERATION LIMITS", Task 71-00-00-990-007 PARA B "OVERTEMPERATURE LIMITS AND OVERTEMPERATURE INSPECTION REQUIREMENTS".

(9) Monitor the EGT carefully, the EGT must peak less than 535° C.

(10) Monitor the oil pressure carefully, the oil pressure must increase.

(11) Abort the start procedure if any of the condition that follow occur:

(a) No light - burner does not light as evidenced by no rise in EGT within 20 seconds.

(b) Impending hot start - after light has occurred, EGT climbs very rapidly with sluggish or no acceleration of N2.

(c) Slow acceleration or hung start - after light, N2 or EGT increase very sluggishly (more than two minutes to accelerate to idle) or stabilize below idle. an indication of N1 rotation is not obtained prior to fuel pressurization.

(d) If fuel or ignition is inadvertently interrupted

(e) Abnormally high or low fuel flow.

(f) Increasing oil pressure is not observed.

(12) To abort the start, do the steps that follow:

(a) Put the fuel lever to: IDLE CUT-OFF.

(b) Turn the starter ON, (if the starter was disengaged) and dry motor the engine for 30 seconds minimum or until the EGT is less than 180° F (82.2° C).

(c) Dry motor the engine to blow away fuel in the engine that has not burned.

(d) If starter is already disengaged, re-engage when N2 is at or below 20 percent N2 rpm and motor engine as specified above). See Dry Engine Motor Procedure, Task 71-00-00-760-008.

(13) During the start procedure, record the data that follows:

(a) Record the maximum EGT.

(b) Record the maximum fuel flow.

(c) Record the time required to accelerate from pressurize to idle.

(14) Disengage starter motor at approximately 4800 N2 rpm. Observe starter cutout.

NOTE: Starter valve should be closed before engine reaches idle.

(15) During a normal start, turn the igniters OFF as soon as a successful start is assured and should remain off during all maintenance ground running to minimize possibility of overtemperature in event of compressor surge.

Task 71-00-00-760-005:

10. Normal Shutdown Procedure

A. Procedure For Normal Engine Shutdown

(1) Move the thrust lever to: MINIMUM IDLE.

CAUTION: DO NOT SHUTDOWN ENGINE WITHOUT ADEQUATE COOLING. TURBINE ROTOR SEIZURE COULD OCCUR.

(2) Operate the engine at MINIMUM IDLE for five minutes before you do an engine shutdown.

NOTE: Whenever an engine shutdown is to be performed after the engine has been previously run at or above a power setting of Band "D" (see Figure 1302, 71-00-00, Testing-09), the engine should be run at APPROACH IDLE for at least 20 minutes prior to shutdown. The engine may be restarted per the normal starting procedure. See Engine Starting Procedure (Normal), Task 71-00-00-760-004.

(3) After observing the cool-down recommendations stated above make sure the thrust Lever is at - MINIMUM IDLE

(4) Move fuel lever to cut-off position.

CAUTION: MAKE SURE THAT THERE IS AN ENGINE SHUTDOWN AS EVIDENCED BY INDICATION OF FUEL SHUT-OFF VALVE CLOSURE. CONTINUED ENGINE OPERATION AFTER PLACING THE FUEL LEVER IN OFF INDICATES A MALFUNCTION. MAINTENANCE ACTION IS MANDATORY.

(5) Check N2, EGT and fuel flow for immediate indication of engine shutdown.

(6) Check that the N1 and N2 RPM decrease and the rotors do not lock. The rotors must turn slowly and then stop.

(7) During deceleration, observe engine for evidence of internal fire or tailpipe fire. If internal fire or tailpipe fire occurs, perform Dry Engine Motor Procedure, Task 71-00-00-760-008.

(8) Check that the EGT (station 4.9) decreases.

(9) Check that the fuel flow goes to zero flow.

(10) Set the EEC input to: OFF.

(11) After the N2 rotor stops, turn the fuel boost pumps to: OFF.

(12) Confirm that ignition switch is in the OFF position.

Task 71-00-00-760-006:

11. Emergency Shutdown Procedure

NOTE: An emergency shutdown is a shutdown from power levels higher than MINIMUM IDLE. Use this emergency shutdown procedure only after emergency conditions which do not let you use a normal shutdown procedure.

A. Procedure For an Emergency Shutdown

(1) Quickly and immediately move the thrust lever to: MINIMUM IDLE.

(2) Quickly move the fuel lever to: CUT-OFF.

(3) Place starter motor switch ON when N2 rpm drops below 20 percent N2 rpm. See Dry Engine Motor Procedure, Task 71-00-00-760-008, to commence dry motoring cool down unless it is evident that further engine damage will occur.

(4) Continue to dry motor the engine until the EGT is less than 180° C.

(5) If the engine has a tailpipe fire, continue to dry motor the engine with the starter until the fire is out. Do not obey the starter time limits if the engine has a tail pipe fire.

(6) If the shutdown cause was other than a surge, tailpipe fire, or cause requiring a maintenance action, the engine may be restarted within 15 minutes (from the time of shutdown) if the rotors are free and no limits were exceeded. See Start Procedure After An Emergency Shutdown, Task 71−00−00−760−007.

(7) This procedure applies equally to abnormal shutdowns caused by inadvertent fuel supply interruption.

Task 71−00−00−760−007:

12. Start Procedure After An Emergency Shutdown

NOTE: Purpose of this procedure is to minimize damage to turbine blade tip seals if engine is restarted subsequent to an emergency shutdown.

A. Start Procedure After An Emergency Shutdown

(1) If the engine operated within the limits, there was no damage to the engine and if both rotors are free, it is recommended that the engine be started within 15 minutes of shutdown.

NOTE: This procedure will prevent locked turbine rotors and damaged turbine airseals.

(2) Use normal starting procedure previously described except select START/RUN when N2 reaches maximum motoring speed obtainable.

(3) Maintain IDLE speed for minimum of 15 minutes before accelerating to power.

(4) If restart cannot be accomplished within 15 minutes, then period of at least 50 minutes from time of shutdown must be allowed prior to restart attempt. (Attempting restart prior to 50 minute period may damage turbine blade tip seals).

(5) After 50 minutes from shutdown, do the steps that follow:

(a) Make sure both rotors turn freely for 360 degrees, (Turn the gearbox crank pad with a wrench to make sure that the N2 rotor turns a minimum of 360 degrees).

(b) If both rotors turn 360 degrees, dry motor the engine for two minutes by the Dry Engine Motor Procedure, Task 71-00-00-760-008.

(c) Stop the engine for five minutes.

(d) Dry motor the engine again for two minutes by the Dry Engine Motor Procedure, Task 71-00-00-760-008.

(e) Start the engine by the instructions in Engine Starting Procedures (Normal), Task 71-00-00-760-004.

(f) Keep the power at MINIMUM IDLE for 15 minutes before you move the thrust lever. Normal operation can continue after 15 minutes at MINIMUM IDLE.

B. Inspection Procedure After An Emergency Shutdown

CAUTION: WHEN ENGINE SHUTDOWN OCCURS QUICKLY, THE IGNITION LEAD CAN POSSIBLY NOT BE SUFFICIENTLY COOL. DAMAGE TO THE RUBBER BUSHINGS AND INSULATION CAN BE THE RESULT.

(1) Examine the ignition system leads at the terminal end (which is connected to the igniter) for signs of damage caused by high temperature after shutdown before the next start. See 72-00-00 Insp/Chk-10, Engine Inspection Following Overtemperature, Task 72-00-00-210-022.

Task 71-00-00-760-008:

13. Dry Engine Motor Procedure

A. General

(1) Use this procedure to blow away fuel that remains in the engine that has not burned.

(2) Use this procedure to decrease the temperature of the turbines after an emergency shutdown.

(3) Use this procedure for any operation where it is necessary to motor the engine without fuel to the combustion chamber.

B. Procedure For Dry Engine Motor

(1) Move the thrust lever to: MINIMUM IDLE.

(2) Move the fuel lever to: CUT−OFF.

(3) Put the ignition switch to: OFF.

(4) Turn the fuel boost pumps to: ON.

(5) Set the EEC input to: MANUAL START.

(6) Turn the switch for the starter air supply valve to: ON.

(7) Dry motor the engine for 30 seconds to remove the remaining fuel (fuel that was not burned) from the burner and turbines and to decrease the EGT below 180° C.

(8) If a large quantity of fuel remains in the low pressure turbine case, dry motor the engine for three minutes to remove the unwanted fuel.

(9) If the engine has a tailpipe fire, continue to dry motor the engine with the starter until the fire is out. Do not obey the starter time limits if the engine has a tailpipe fire.

(10) Turn the switch for the starter air supply valve to: OFF.

(11) Set the EEC input to: OFF.

(12) After the N2 rotor stops, turn the fuel boost pumps to: OFF.

Task 71−00−00−760−009:

14. Procedure After Engine Surge Or Stall

A. Procedure after engine surge or stall and EGT is in the limits. Do the steps which follow:

CAUTION: IF YOU DO NOT OBEY THE INSTRUCTIONS THAT FOLLOW, DAMAGE TO THE ENGINE CAN BE THE RESULT.

(1) Quickly and immediately move the thrust lever to MINIMUM IDLE.

(2) Operate the engine for five minutes at MINIMUM IDLE and continue the usual engine operation.

B. Procedure after engine surge or stall and EGT is above the limits. Do the steps which follow:

(1) Quickly and immediately (in less than one second) move the thrust lever to: MINIMUM IDLE.

(2) Operate the engine for five minutes at MINIMUM IDLE if:

(a) If the engine does not surge or stall at idle.

(b) If the EGT decreases to the usual idle value.

NOTE: If you know that continued operation will cause more damage or the EGT continues to increase, shutdown the engine immediately.

(3) Move the fuel lever to: CUT-OFF.

(4) Dry motor the engine until the EGT is less than 180° C. See Dry Engine Motor Procedure, Task 71-00-00-760-008.

(5) Make a record of how much time the temperature was more than the limit and the highest temperature for subsequent analysis. See 72-00-00 Insp/Chk-10, Engine Inspection Following Overtemperature, Task 72-00-00-210-022, for overtemperature instructions and analysis.

C. If there is an engine surge or stall where the EGT increases quickly, the rotor speeds decrease suddenly, and the engine operation will not follow thrust lever movement, do the steps which follow:

(1) Quickly and immediately move the thrust lever to: MINIMUM IDLE.

(2) Move the fuel lever to: CUT-OFF.

(3) Dry motor the engine until the EGT is less than 180° C. See Dry Engine Motor Procedure, Task 71-00-00-760-008.

(4) Start the engine again by the instructions in Start Procedure After An Emergency Shutdown, Task 71-00-00-760-007.

Task 71-00-00-760-010:

15. Procedure After Engine (EGT) Overtemperature

A. Procedure after engine overtemperature.

CAUTION: IF YOU DO NOT OBEY THE INSTRUCTIONS THAT FOLLOW, DAMAGE TO THE ENGINE CAN BE THE RESULT.

(1) Move the thrust lever to MINIMUM IDLE.

(2) Operate the engine at MINIMUM IDLE for five minutes unless:

(a) You know that continued operation will cause more damage.

(b) There is no decrease in EGT.

NOTE: If you know that continued operation will cause more damage or the EGT continues to increase, shut the engine immediately.

(3) After five minutes at MINIMUM IDLE, do an engine shutdown.

(4) Write how much time the temperature was more than the limit and the highest temperature for subsequent analysis. This step is very important. See Figure 1306 shown in "Engine Operation Limits", Task 71-00-00-990-007 para B "Overtemperature Limits and Overtemperature Inspection Requirements".

(5) If overtemperature is encountered as a result of surge, engine must be shut down as described in Procedure After Engine Surge Or Stall, Task 71-00-00-760-009.

Task 71-00-00-760-029:

1. Test No. 2 - Engine Motor Leak Test (Dry Method)

A. General

(1) Use this procedure to check the fuel system (except the fuel manifolds and nozzles) and the oil system for leaks. The engine is operated by the starter only for this test.

(2) The dry motor leak test uses the engine starter only to operate the engine for a short time to check for leaks in the fuel or oil system. The ignition system is OFF for this test. The fuel goes to the fuel pump (for pump lubrication) but not to the engine fuel manifolds and nozzles. This procedure is recommended for most motor leak checks unless the wet motor check is specified.

B. Equipment And Tools Necessary

Special Tools:

PWA 102757	Block Wedge (2 Necessary - Optional)

C. Procedure

(1) Make sure the thrust lever is in the OFF position.

(2) Make sure the ignition switch is in the OFF position.

(3) Make sure the oil quantity is correct.

(4) Supply fuel to the main fuel pump. The fuel pressure must be positive at the pump inlet.

(5) If N1 rotation is unwanted, install two PWA 102757 Wedges between two fan blades and the fan case at approximately the 6 o'clock position. The thinnest edge of the wedge must be centered onto the leading edge of the fan blade and then tapped into position, along the blade chord line, until they fit tightly in the fan blade to fan case clearance gap. See Figure 1301.

CAUTION: DO NOT OPERATE THE STARTER FOR MORE THAN THE STARTER TIME LIMIT. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE STARTER.

(6) Open the starter air supply valve. Operate the starter for as long as necessary but do not operate for more than the starter time limit.

(7) Do a check of the main oil pressure. The pressure must be positive.

(8) Do a check of the N1 and N2 speeds. Both of the rotors must turn unless Wedges (PWA 102757) were installed, then only N2 will turn.

(9) While the engine is motored, do a visual check for leaks at the fuel and oil system tubes and joints.

NOTE: This procedure can be used to find a leak at any of the external fuel or oil system tubes and components. This procedure can also be used after a maintenance component remove and replacement procedure. It is only necessary to leak check the tubes, fittings and components that were removed and replaced (or loosened and tightened) at the last maintenance operation.

(10) Close the starter air supply valve.

(11) Stop the air pressure to the starter air supply valve.

(12) If Wedges (PWA 102757) were installed, remove the two wedges from the fan blade to fan case clearance gap.

Task 71−00−00−760−001:

2. Test No. 2A − Engine Motor Leak Test (Wet Method)

A. General

(1) Use this procedure to check the complete fuel system and the oil system for leaks. The engine is operated by the starter only for this test.

(2) The wet motor leak test uses the engine starter only to operate the engine for a short time to check for leaks in the fuel or oil system. The ignition system is OFF for this test. The fuel goes to the fuel pump, the engine fuel manifolds and nozzles. Fuel is then sprayed in the combustion chamber.

POWER PLANT GENERAL − TESTING−02

B. Equipment And Tools Necessary

Special Tools:

PWA 102757	Block Wedge (2 Necessary − Optional)

C. Procedure

(1) Make sure the thrust lever is in the OFF position.

(2) Make sure the ignition switch is in the OFF position.

(3) Make sure the oil quantity is correct.

(4) Supply fuel to the main fuel pump. The fuel pressure must be positive at the pump inlet.

(5) If N1 rotation is unwanted, install two PWA 102757 Wedges between two fan blades and the fan case at approximately the 6 o'clock position. The thinnest edge of the wedge must be centered onto the leading edge of the fan blade and then tapped into position, along the blade chord line, until they fit tightly in the fan blade to fan case clearance gap. See Figure 1301.

CAUTION: DO NOT OPERATE THE STARTER FOR MORE THAN THE STARTER TIME LIMIT. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE STARTER.

(6) Open the starter air supply valve. Operate the starter for as long as necessary but do not operate for more than the starter time limit.

(7) Do a check of the main oil pressure. The pressure must be positive.

(8) Do a check of the N1 and N2 speeds. Both of the rotors must turn unless Wedges (PWA 102757) were installed, then only N2 will turn.

(9) When the N2 speed is 1500 RPM, move the thrust lever forward to the MINIMUM IDLE position.

(10) Operate the starter for 30 seconds maximum with the thrust lever at MINIMUM IDLE, then move the thrust lever to the OFF position. Do not operate the starter for more than the starter time limit.

POWER PLANT GENERAL - TESTING-02

(11) While the engine is motored, do a visual check for leaks at the fuel and oil system tubes and manifolds.

NOTE: This procedure can be used to find a leak at any of the external fuel or oil system tubes and components. This procedure can also be used after a maintenance component remove and replacement procedure. It is only necessary to leak check the tubes, fittings and components that were removed and replaced (or loosened and tightened) at the last maintenance operation.

CAUTION: DO NOT OPERATE THE STARTER FOR MORE THAN THE STARTER TIME LIMIT. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE STARTER. IF NECESSARY STOP THE STARTER FOR 15 MINUTES BEFORE YOU DO THE NEXT STEP.

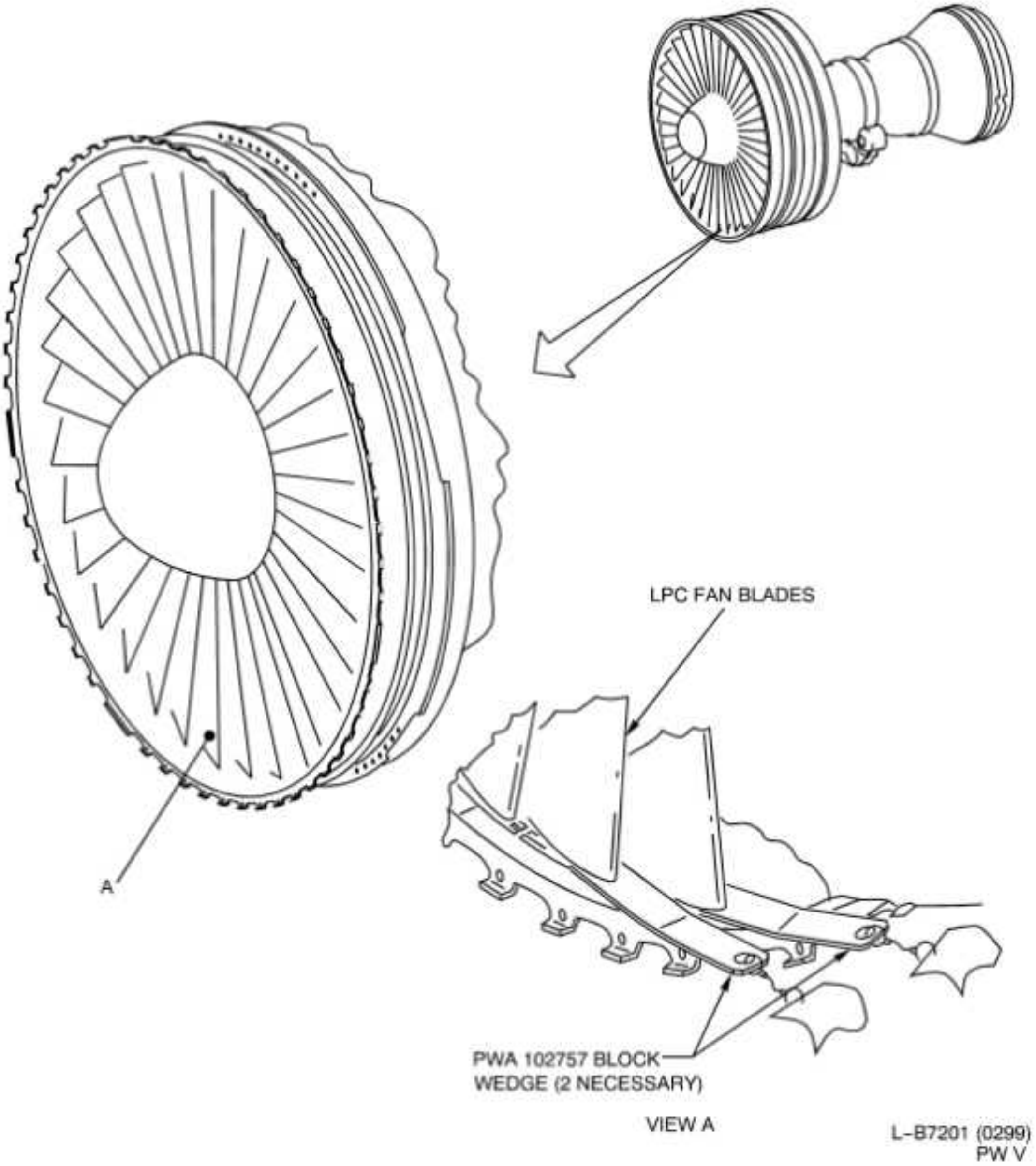
(12) With the thrust lever in the OFF position, operate the starter for 30 seconds. This step will blow the unwanted fuel out of the combustion chamber and turbines.

(13) Do a check of the fuel flow. The fuel flow must be zero.

(14) Close the starter air supply valve.

(15) Stop the air pressure to the starter air supply valve.

(16) If Wedges (PWA 102757) were installed, remove the two wedges from the fan blade to fan case clearance gap.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LPC FAN BLADES
PWA 102757 BLOCK WEDGE (2 NECESSARY)
VIEW A
L−B7201 (0299)
PW V

Installation Of PWA 102757 Block Wedges
Figure 1301
(Task 71−00−00−760−001)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 71-00-00-760-030:

1. Test No. 3 - Idle Power Test

A. General

(1) Use this procedure to do an operation check of the EEC and check the fuel and oil systems for leaks. The engine is operated at IDLE power only for this test.

B. Procedure

(1) Start the engine by the Engine Starting Procedure (Normal), Task 71-00-00-760-004. See 71-00-00 Power Plant General - Testing-00.

NOTE: Monitor the main oil pressure, (MOP), during the start procedure. If you do not see any oil pressure, you must immediately and quickly stop the start procedure.

(2) Let the engine become stable for five minutes at MINIMUM IDLE.

(3) Make sure all the engine parameters are in the permitted limits.

(4) If necessary do an operational check of the EEC at this time. See Test No. 6 - Electronic Engine Control (EEC) Idle Test, Task 71-00-00-760-037.

WARNING: EAR PROTECTION MUST BE WORN BY ALL PERSONS WHO WORK NEAR THE ENGINE WHILE THE ENGINE OPERATES. THE LOUD NOISE FROM THE ENGINE CAN CAUSE TEMPORARY OR PERMANENT DAMAGE TO THE EARS.

WARNING: DO NO GO IN THE TEST CELL WHEN THE ENGINE OPERATES ABOVE IDLE POWER. THE ENGINE NOISE ABOVE IDLE CAN DAMAGE YOUR HEARING WITH EAR PROTECTION.

POWER PLANT GENERAL - TESTING-03

WARNING: DO NOT OPERATE THE ENGINE ABOVE IDLE POWER FOR THIS TEST. PERSONS ARE NOT PERMITTED IN THE TEST CELL ABOVE IDLE POWER.

(5) While the engine operates at idle power, do a visual check of the fuel and oil system tubes, fittings, manifolds and components for leaks.

NOTE: This procedure can be used to find a leak at any of the external fuel or oil system tubes and components. This procedure can also be used after a maintenance component remove and replacement procedure. It is only necessary to leak check the tubes, fittings and components that were removed and replaced (or loosened and tightened) at the last maintenance operation.

(6) Do an engine shutdown by the Normal Shutdown Procedure. See 71-00-00 Power Plant General - Testing-00, Task 71-00-00-760-005.

POWER PLANT GENERAL - TESTING-04

Task 71-00-00-760-031:

1. Test No. 4 - Power Acceleration/Deceleration

A. General

(1) This test checks engine takeoff power, 2.5 bleed valve scheduling and engine limit protection in primary EPR mode.

(2) For engine operation procedures, see 71-00-00 Power Plant General - Testing-00.

B. Procedure

CAUTION: IF AN ENGINE SURGE OCCURS DURING THIS TEST, YOU MUST QUICKLY MOVE THE THRUST LEVER TO MIN IDLE STOP WITHIN ONE SECOND OF THE SURGE. FOLLOW THE PROCEDURE AFTER ENGINE SURGE AND STALL, Task 71-00-00-760-009. FAILURE TO FOLLOW START PROCEDURE FOLLOWING EMERGENCY SHUTDOWN MAY RESULT IN DAMAGE TO TURBINE BLADE TIP SEALS.

(1) Prepare, service and start the engine by the Engine Starting Procedure (Normal), Task 71-00-00-760-004.

NOTE: If the engine is shutdown after a surge, follow the engine Start Procedure After An Emergency Shutdown, Task 71-00-00-760-007. This procedure will prevent engine blade tip rub damage.

(2) Let the engine become stable for 5 minutes at MINIMUM IDLE.

(3) Make sure all the engine parameters are in the permitted limits and make sure that there are no oil and fuel leaks.

(4) After five minutes operation at idle, slowly advance forward thrust lever to obtain 2.5 bleed closure and allow engine to stabilize. Record N1, N2, EGT, oil pressure and oil temperature.

(5) Slowly advance the thrust lever to takeoff thrust. For the takeoff thrust target, see Testing-09, Task 71-00-00-760-020, Task 71-00-00-760-060, Task 71-00-00-760-061 or Task 71-00-00-760-063, Thrust Power Setting Curve, Figure 1304 and use Band A.

(6) Let the engine become stable for 3 minutes and make a record of the engine parameters.

(7) Set the throttle stop for TAKEOFF at this thrust lever position.

(8) Slowly retard thrust lever to idle position and stabilize for five minutes.

(9) Test engine acceleration/deceleration in primary EPR mode as follows, if required:

NOTE: Prior to snap accelerations the engine must be stabilized for 15 minutes at the MINIMUM or APPROACH IDLE position.

(a) Select APPROACH IDLE. Check that idle speed increases to +/− 0.5% (N2) of APPROACH IDLE target.

(b) Verify the EEC is operating in the EPR mode. Snap accelerate (one second or less for thrust lever movement) from APPROACH IDLE to the TLRA stop for takeoff thrust, (that you set before). Record the elapsed time from initiation of the TLRA movement to 90 percent of takeoff thrust target. (See Testing−09, Thrust Power Setting Curve, Figure 1304. Use 90 percent of the lower line of Band A for the 90 percent takeoff thrust target). Continuously monitor thrust and EGT. Thrust and EGT must not exceed the values shown in Table 1301.

MODEL	JET THRUST − LBS (N)	EGT − °C (TT4.95)
PW4152	53000 (235755)	644° C
PW4156A	57000 (253547)	654° C
PW4158	59000 (262444)	654° C

Maximum Observed EGT (TT4.95)
Table 1301

(c) The acceleration time shall not exceed 6.5 seconds. Stabilize for 50 − 55 seconds prior to continuing.

(d) Record engine parameters.

(e) Select MINIMUM IDLE mode.

(f) For PW4152 Model: Snap (one second or less thrust lever movement) decelerate to MINIMUM IDLE. Record the elapsed time from initiation of the thrust lever movement to 25 percent FN/ST2 of the lower line of A Band of Figure 1304 in 71-00-00 Testing-09. Document the deceleration time on final log. The deceleration time shall not exceed 5.5 seconds for the thrust change.

(g) For PW4156A Model: Snap (one second or less thrust lever movement) decelerate to MINIMUM IDLE. Record the elapsed time from initiation of the thrust lever movement to 25 percent FN/ST2 of the lower line of A Band of Figure 1304 in 71-00-00 Testing-09. Document the deceleration time on final log. The deceleration time shall not exceed 5.5 seconds for the thrust change.

(h) For PW4158 Model: Snap (one second or less thrust lever movement) decelerate to MINIMUM IDLE. Record the elapsed time from initiation of the thrust lever movement to 25 percent FN/ST2 of the lower line of A Band of Figure 1304 in 71-00-00 Testing-09. Document the deceleration time on final log. The deceleration time shall not exceed 5.5 seconds for the thrust change.

(i) Check that engine stabilizes at MINIMUM IDLE.

(10) Do a engine shutdown by the Normal Shutdown Procedure, Task 71-00-00-760-005.

Task 71-00-00-760-033:

1. Test No. 5 - Oil System Static Leak Test

A. General

(1) Use this procedure to check the engine oil system for leaks when the engine is not operated (static). The oil system is pressurized with air pressure at the gearbox deoiler for this test.

(2) The static leak test consists of pressurizing the gearbox with air through an external fitting adapted to the gearbox breather vent tube, and checking for leaks. 10 psig (68.9 kPa) of internal pressure is sufficient to determine leakage. Higher pressure may unseat carbon seals in main shaft bearing compartments which are connected to the gearbox via shaft housings or oil lines.

B. Equipment And Materials Necessary

Standard Tools:

(1) A regulated air supply source that can supply air pressure at 10 psig (68.9 kPa).

(2) Air hose and fittings to connect air supply to the adapter on the deoiler vent duct.

(3) One pint plastic bottle (or equivalent) of water.

(4) A short length of rubber hose to fit in the accessory seal drain tubes.

(5) A fluid drain collector/container (capacity 5 US gal (18.93 liter).

Special Tools:

PWA 85844	Adapter
PWA 107038	Adapter, Vacuum/Leak Check (Gearbox Breather), (Optional to PWA 85844)

R
R

Consumable Materials:

Item No.	Designation
P05-007	Leak Check Fluid
P05-068	Nitrogen (PMC 2214)

C. Procedure

R (1) To install the PWA 85844 Adapter do as follows:

R (a) Remove rear portion of deoiler vent duct.

R (b) Install PWA 85844 Adapter and air line at tube coupling on remaining portion of deoiler vent duct.

R (2) To install the optional PWA 107038 Adapter do as
R follows: See Figure 1301.

R (a) Install the clamp assembly on the round section,
R near the end of the deoiler vent duct.

R (b) Put the base assembly on the end of the deoiler
R vent duct.

R (c) Align the slots in the clamp assembly with the two
R eyebolts.

R (d) Install the eyebolts in to the clamp assembly and
R tighten with the two knurled knobs.

R (e) Tighten the knurled knob on the clamp assembly.

R (f) Cap one end fitting and attach filtered shop air
R to the other fitting.

CAUTION: DO NOT EXCEED 10 PSIG (68.9 kPa) PRESSURE IN GEARBOX OR 325°F (163°C) TEMPERATURE IN GEARBOX. DO NOT MOTOR ENGINE DURING TEST. MOTORING ENGINE WHILE OIL SYSTEM IS PRESSURIZED WILL CAUSE OIL CONTAMINATION OF COMPRESSORS AND GASPATH.

R (3) Apply and keep 10 psig (68.9 kPa) regulated pressure in the gearbox. Use a clean dry air supply with a temperature less than 325°F (160°C) or Nitrogen P05-068. Monitor pressure indication to prevent exceeding 10 psig (68.9 kPa) in gearbox.

NOTE: Pressure of less than 7 psig (48.3 kPa) is insufficient to provide adequate results.

R (4) With Leak Check Fluid P05-007 check for leaks at following places:

(a) All gearbox pad seals without overboard drains.

(b) All connections to deoiler.

(c) All gearbox, angle gearbox, and lay shaft connections.

(d) All gearbox housing covers and fittings.

(e) All oil supply lines from oil pump to bearing compartments.

R (5) Connect hose to each gearbox pressure test fitting (four places) in the Drain Manifold/Test Box and immerse free end in pint bottle of water. Some leakage may be expected. In this case it would be possible to slowly count the number of air bubbles. Any seal which leaks sufficient air to vigorously agitate water is unsatisfactory.

R (6) Release pressure from gearbox.

R (7) Repair leaks and retest as necessary.

R (8) Remove the PWA 85844 Adapter or PWA 107038 Adapter and
R air line.

R (9) If removed, reinstall rear portion of deoiler vent
R duct.

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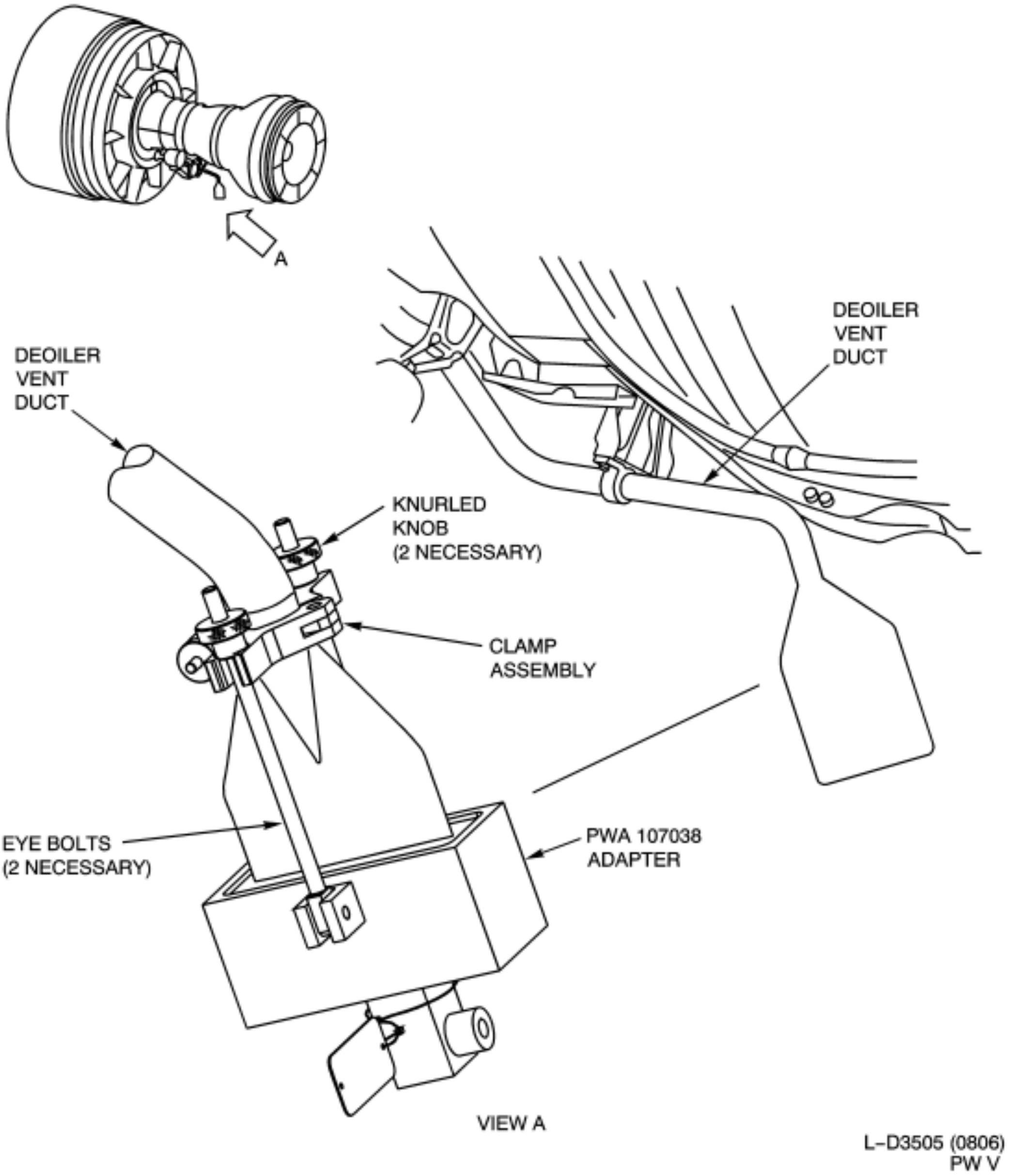
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DEOILER VENT DUCT
DEOILER VENT DUCT
KNURLED KNOB (2 NECESSARY)
CLAMP ASSEMBLY
EYE BOLTS (2 NECESSARY)
PWA 107038 ADAPTER
VIEW A
L-D3505 (0806)
PW V

R PWA 107038 Adapter Installation
R Figure 1301
R (Task 71-00-00-760-033)

Task 71−00−00−760−037:

1. Test No. 6 − Electronic Engine Control (EEC) Idle Test

A. Prerequisites

(1) Do a static operation check of the EEC, Testing−07, Task 71−00−00−760−038 before you start the engine.

B. Equipment And Tools Necessary − None

C. General

(1) Use this procedure to check for the satisfactory operation of the EEC with the engine at idle power.

(2) You can do this test at the same time that you do Test No. 3 − Idle Power Test, Task 71−00−00−760−030.

(3) Following Electronic Engine Control (EEC) outputs should be monitored during all engine testing:

(a) Analog outputs − Low Rotor Speed, N1

1 Minimum Load Impedance − 10 kilohms

2 Signal Source − Magnetic speed pickup through EEC buffer circuit

3 Source Impedance − Less than 150 ohms series resistance
− Less than 100pf shunt capcitance

4 Open Circuit Voltage − 2.0 volt minimum at 200 rpm
− 25 volts at 4400 rpm

5 Frequency to rpm − N1 speed (rpm) = frequency (HZ)

(b) Analog outputs − High Rotor Speed, N2

1 Minimum Load Impedance − 10 kilohms

2 Signal Source − Electrically independent winding on the EEC alternator

3 Source Impedance − 1,000 − 50. ohms

4 Minimum Voltage Range - 5 volts (peak to peak) at 10 percent N2
- 85 volts (peak to peak) at 106 percent N2

5 Frequency to rpm - N2 rpm = 2.837219 x frequency (HZ)

D. Procedure

(1) Start the engine by the Engine Start Procedure (Normal), Task 71-00-00-760-004.

(2) Make sure all the engine parameters are in the permitted limits.

(3) Let the engine become stable for three minutes at MINIMUM IDLE.

(4) Check each channel of the EEC display panel to make sure that a signal is sent for N1, N2, EGT, WF, TRA, SVA, P2 probe and T2 probe.

(5) Do an engine shutdown by the Normal Shutdown Procedure, Task 71-00-00-760-005.

(6) Record maintenance words (Labels 350, 351, 352, 353 and 354 - both channels) which are deposited in EEC interface (EEROM). Decode recorded maintenance words to examine faults which may exist. Refer to 71-00-00, Fault Isolation-00, Task 71-00-00-810-001.

(7) Use the record of fault messages to do any maintenance that is necessary. Refer to 71-00-00, Fault Isolation-00, Task 71-00-00-810-001 for proper procedure and corrective action.

Task 71-00-00-760-038:

1. Test No. 7 - ELECTRONIC Engine Control (EEC) Static Test

A. General

(1) Use the EEC static test to check that the EEC operates correctly before you start the engine. This test will do a self diagnostic check of the EEC. It will also check the torque motor, solenoid and position feedback circuits.

B. Equipment And Tools Necessary - None

C. Procedure

(1) Turn the test cell electrical power to: ON.

(2) Turn the ground electrical power to the EEC to: ON.

(3) Record maintenance words which are deposited in EEC interface. (Labels 350, 351, 352, 353 and 354 - both channels).

(4) Decode recorded maintenance messages to identify faults which may exist. Refer to 71-00-00, Fault Isolation-00, Task 71-00-00-810-001 for proper procedure and corrective action.

CAUTION: MAKE SURE YOU TURN OFF THE GROUND POWER TO THE EEC WHEN THE TEST IS COMPLETED. FAILURE TO TURN OFF GROUND TEST POWER WILL UNNECESSARILY CONSUME EEC OPERATIONAL LIFE.

(5) Turn the ground electrical power to the EEC to: OFF.

(6) Turn the electrical power to the test cell to: OFF.

(7) Use the record of fault messages to do any maintenance that is necessary.

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Task 71-00-00-760-032:

1. Test No. 8 - Engine Vibration Survey

A. General

(1) Use this procedure to check for satisfactory engine vibration from idle power to TAKEOFF power. The vibration is checked for both the acceleration and deceleration operation.

(2) The engine must be thermally stable before you do the vibration survey test. You must do the test steps in the sequence shown to get the engine thermally stable.

B. Procedure

(1) Start the engine by the Engine Start Procedure (Normal) Task 71-00-00-760-004. See 71-00-00 Power Plant General - Testing-00.

(2) Let the engine become stable for five minutes at MINIMUM IDLE.

(3) Make sure all the engine parameters are in the permitted limits and that there are no leaks .

(a) Record N1, N2, vibration, oil pressure and oil temperature.

CAUTION: IF THE ENGINE DOES A SURGE DURING THIS TEST, YOU MUST MOVE THE THRUST LEVER TO MINIMUM IDLE WITH IN ONE SECOND OF THE SURGE. OPERATE THE ENGINE AT MINIMUM IDLE FOR FIVE MINUTES IF THERE IS NO EGT OVERTEMPERATURE. IF THERE IS AN EGT OVERTEMPERATURE, DO AN EMERGENCY SHUTDOWN AND MOTOR THE ENGINE UNTIL THE EGT IS LESS THAN 180 °C.

(4) Slowly move the thrust lever forward to 1.3 EPR and let the engine become stable for 10 minutes.

(5) Move the thrust lever back to MINIMUM IDLE power and let the engine become stable for 5 minutes.

(6) Survey engine vibration by making a slow acceleration at uniform rate from stabilized MINIMUM IDLE to the maximum take off power rating and a slow deceleration at a uniform rate from the maximum take off power

rating to MINIMUM IDLE. Duration of transients should be 90 seconds or greater.

NOTE: During the acceleration and deceleration, the engine vibration will go to one or more vibration peaks. Be prepared to make a record of the N1 and N2 speeds when these vibration peaks occur.

(7) At each speed where peaks have shown during acceleration and deceleration, record the mean vibration level of each pickup after 30 second stabilization.

(8) Slowly move the thrust lever to the IDLE position and operate the engine for 5 minutes.

(9) Do an engine shutdown by the Normal Shutdown Procedure, Task 71-00-00-760-005. See 71-00-00 Power Plant General - Testing-00.

(10) Check the engine vibration levels during this test to make sure that the allowable limits are not exceeded. See 71-00-00, Testing-00, Engine Operation Limits, Task 71-00-00-990-007, Vibration Limits

(11) For engines that exceed the vibration limits, see 71-00-00, Testing-19, Trim Balance, Task 71-00-00-760-043, Task 71-00-00-760-052 or Task 71-00-00-760-057.

Task 71-00-00-760-020:

1. Test No. 9 - Engine Acceptance Test

A. Prerequisite Procedure

CAUTION: ENGINE CONFIGURATION IDENTIFIER MUST BE CAREFULLY DETERMINED. FAILURE TO CORRECTLY IDENTIFY CONFIGURATION COULD RESULT IN RED LINE EXCEEDANCE AND/OR THRUST SHORTFALL

(1) Use Table 1301 to get the necessary Testing-09 configuration. Get the engine configuration from the engine identification data plate. Look for a configuration identification suffix marked after the engine model in the model field.

(a) EXAMPLE 1:

1 If "PW4158 (-3)" is marked on the engine identification plate, the configuration identifier suffix is "(-3)". This corresponds to a Phase 3 configuration as specified in Table 1301. Use TESTING-09, CONFIG-2 to do the acceptance test.

(b) EXAMPLE 2:

1 If "PW4158" is marked on the engine identification plate with no configuration identifier suffix, the configuration is Pre Phase 3 as specified in Table 1301. Use TESTING-09, CONFIG-1 to do the acceptance test.

TESTING-09 CONFIGURATION	ENGINE CONFIGURATION	CONFIGURATION IDENTIFICATION SUFFIX
Config-1	Pre Phase 3	None
Config-2	Phase 3 (Reference SB PW4ENG 72-572)	(-3)
Config-3	Intermix (-1C or -1E) (Reference SB PW4ENG 72-516)	(-1C/-1E)
Config-4	NOT AVAILABLE for Airbus installations	

TESTING-09 CONFIG/ENGINE CONFIGURATION
Table 1301

TESTING-09 CONFIGURATION	ENGINE CONFIGURATION	CONFIGURATION IDENTIFICATION SUFFIX
Config-5	Intermix (-3A) (Reference SB PW4ENG 73-150)	(-3A)

TESTING-09 CONFIG/ENGINE CONFIGURATION
Table 1301 (Continued)

(2) Use this procedure to test the engine for satisfactory performance after one or more components or modules have been replaced or repaired. This test is also used after the engine was fully disassembled, repaired and assembled.

NOTE: It is recommended that you not install large quantities of blended blades, vanes and airseals in one engine. If these parts are blended to the maximum limits in many areas, the result will be low engine performance.

(3) It is possible that other tests are necessary before you do this test, see 71-00-00 Power Plant General - Testing-00, Test Requirements After Engine/Module/Component Repair or Replacement, Task 71-00-00-990-003. This procedure will also give the sequence for the necessary tests.

(4) Special instrumentation must be installed on the engine before the engine is operated for this test.

(5) The engine testing must be done in a test configuration and test cell that has been calibrated. Calibrate to the specifications shown in P&W Publication Report No. 544. All test data must be corrected to the special test cell correction factors before you use the limits and curves in this procedure.

(6) For general safety information, see 71-00-00, Power Plant General - Testing-00, Engine Safety Precautions, Task 71-00-00-990-004.

(7) For safe engine operation, see 71-00-00, Power Plant General - Testing-00, Precautions And Procedures For Safe And Correct Engine Operation, Task 71-00-00-760-002.

(8) For engine operation limits, see 71−00−00, Power Plant General − Testing−00, Engine Operation Limits, Task 71−00−00−990−007.

B. Equipment And Materials Necessary

Standard Tools (See 71−00−00, Power Plant General − Testing−00, Prepare The Engine For Test In A Cell, Task 71−00−00−480−001

(1) Fuel pump drain hose and collection bottle.

(2) Stator vane drain hose and collection bottle.

(3) Station 2.5 compressor bleed actuator drain hose and collection bottle.

(4) Air/oil cooler modulating valve drain hose and collection bottle.

(5) IDG air/oil cooler modulating valve drain hose and collection bottle.

(6) TCC actuator modulating valve drain hose and collection bottle.

(7) Accessory drive fluid power pump drain hose and collection bottle.

(8) Starter drive drain hose and collection bottle.

(9) IDG drain hose and collection bottle.

(10) Accessory drive EEC generator seal drain hose and collection bottle.

(11) Fuel/oil heat exchanger IDGS core drain hose and collection bottle.

(12) Fuel/oil heat exchanger engine oil core drain hose and collection bottle.

(13) Fuel/oil heat exchanger IDG center tube drain hose and collection bottle.

(14) Bypass valve drain hose and collection bottle.

(15) Hydraulic pump drain hose and collection bottle.

C. Test Instrumentation And Test Cell Connections.
Install the special instrumentation and equipment that follows:

(1) PT2 and PS2 (8 locations) − (optional)

(2) PT2/TT2 Rosemount probe − (PWA 85523)

(3) TT2 − Compressor inlet total temperature (8 locations)

(4) Fuel flow (observed)

(5) T Fuel

(6) N1 RPM − (NL)

(7) N2 RPM − (NH)

(8) PT2.5*

(9) PS3

(10) PS4I (Optional)

(11) PT4.95

(12) Main Oil Pressure

(13) Main Oil Temperature

(14) Oil Filter Differential Pressure

(15) Fuel Pump Inlet Pressure

(16) Fuel Pump Pressure

(17) PAMB

(18) TT2.5*

(19) TT3*

(20) Vibration, fan case flange A (vertical)

(21) TT4.95 Harness Average (stand reading) If EEC T49 value is used, adjustment to T4.95 (real without shunt) must be made.

(22) Thrust − (observed)

(23) Thrust Lever and Fuel Select Switch

(24) Ignition Switch

(25) Test Cell Fuel Supply Pressure

(26) ARINC 429 transceiver.

(27) No. 3 Bearing Compartment Breather Pressure

* - A necessary parameter for the module analysis program MAPNET System. Optional unless a MAPNET System analysis is necessary.

D. Thrust Rating and Operation Limits

(1) Ratings at static sea level standard conditions are shown in Table 1302.

ENGINE MODEL	THRUST SETTING	JET THRUST LBS. (N)	TSFC *
PW4152	TAKEOFF	51300 (228194)	0.3384
PW4152	MAX CONTINUOUS	47160 (209778)	0.3318
PW4152	90% MAX CONTINUOUS	42450 (188827)	0.3258
PW4152	70% MAX CONTINUOUS	34200 (152129)	0.3198
PW4156A	TAKEOFF	56440 (251058)	0.3519
PW4156A	90% TAKEOFF	51000 (226859)	0.3398
PW4156A	MAX CONTINUOUS	45790 (203684)	0.3308
PW4156A	90% MAX CONTINUOUS	40940 (182110)	0.3247
PW4158	TAKEOFF	57990 (257952)	0.3567
PW4158	88% TAKEOFF	51000 (226859)	0.3405
PW4158	MAX CONTINUOUS	45490 (202349)	0.3307
PW4158	90% MAX CONTINUOUS	40770 (181354)	0.3242

*NOTE: TSFC (Thrust Specific Fuel Consumption) is for reference only for a new engine and is not necessary for the engine Acceptance Test.

THRUST AND TSFC RATINGS AT SEAL LEVEL STANDARD CONDITIONS
Table 1302

(2) The engine speed limits are shown in 71-00-00, Power Plant General - Testing-00, Engine Operation Limits, Task 71-00-00-990-007.

(3) The engine exhaust gas temperature (EGT) limits for Station 4.9 are shown in 71−00−00, Power Plant General − Testing−00, Engine Operation Limits, Task 71−00−00−990−007.

E. Seal Drain Leakage Limits

(1) During the Acceptance Test, the seal leakage must be measured. See 71−00−00, Power Plant General − Testing−00, Engine Operation Limits, Task 71−00−00−990−007.

(2) Attach a hose to each seal drain connection and put the other end of the hose in a collection bottle. Each bottle must be identified.

F. Multi−Point Instrumentation

(1) Multi−point instrumentation is necessary and is measured during the acceptance test for some parameters. To get satisfactory data, there is a limit for sampling points that do not operate. The necessary multi−point instrumentation and points that do not operate are listed as follows:

(a) TT2 − Eight sampling points are necessary with a maximum limit of two points that do not operate.

(b) Bellmouth pitot static probes (PT2 and PS2) − This parameter is optional. If it is used, eight sampling points are necessary with a maximum limit of two points that do not operate.

(c) Pitot static probes must be installed for test cell correlation testing. See the specifications shown in P&W publication Report No. 544.

(d) PT2 can be calculated for post test cell correlation testing without pitot static probes. Do a correlation of PT2 (pitot static) to: PT2 Rosemount probe, P cell or (PT2/Pamb vs N1 corrected).

G. Acceptance Test General Specifications

(1) Use the definitions that follow during the acceptance test.

(a) EPR−0 = Engine Pressure Ratio from the EEC (Electronic Engine Control) instrumentation system with a zero delta EPR modified (Class 09) Engine Program Plug (EPP) installed in the Electronic Engine Control (EEC).

OR

EPR−0 can be calculated by adding the necessary EPR Modification (delta EPR) used during the test run to the EPR output from the Engine Control (Engine Electronic Control EPR therefore EECEPR).

In the Airbus Engine Control logic EPR modification (delta EPR) is a function of TRA (throttle lever resolver angle). To correctly calculate EPR−0 from EECEPR, EPR class and TRA are necessary.

The Control logic removes the EPR modification (delta EPR) at low power to align the right and left wing engines. This logic is unique to Airbus installations and controls because it occurs in sea level test range, (below "C" band point when the TRA is less than 72 degrees).

Calculation of EPR−0. Because the recommended test configuration is with a class 16/ −0.028 delta EPR modifier, the calculation is shown as follows:

EECEPR = EPR−028

If TRA is equal or greater than 72 degrees,
EPR−0 = EPR−028 + .028

If TRA is between 40.5 and 72 degrees,
EPR−0 = EPR−028 + (1−(72−TRA)/31.5) x .028

If TRA is equal or less than 40.5 degrees,
EPR−0 = EPR−028

For other EPR class modifiers (other than class 16), see Table 1303 for values.

(b) EPR−028 = Engine Pressure Ratio form the EEC (Electronic Engine Control) instrumentation system with a Class 16 (−0.028 delta) EPR modifier Engine Programming Plug (EPP) installed in the EEC.

(c) EPR = Engine Pressure Ratio From the EEC (Electronic Engine Control) instrumentation system with a class EEC programming plug to be calculated. To calculate EPR, (EPR−0 + delta EPR modifier). EPR is the value used in Paragraph Q. Check For Engine Acceptance to check for engine acceptance and to calculate engine margin to the limits.

(d) TRA = Throttle Resolver Angle, position of the EEC thrust control lever as specified by the electrical signal from the EEC.

EPR CLASS	EPR MODIFICATION (DELTA EPR)
01	+ .032
02	+ .028
03	+ .024
04	+ .020
05	+ .016
06	+ .012
07	+ .008
08	+ .004
09	0.0
10	− .004
11	− .008
12	− .012
13	− .016
14	− .020
15	− .024
16	− .028

EEC PROGRAMMING PLUG (EPP) CLASSIFICATION
Table 1303

(2) All Acceptance Test specifications are from the test cell instrumentation except the EPR (Engine Pressure Ratio) which is the EPR value from the EEC. The EEC values for Tt2, N1, N2 can be used if it is shown they are consistent and equal to the stand readings. This must be done during the test cell correlation testing. The EEC values must be within the limits and tolerances of 71−00−00 Testing−00 Table 1305 of Test Instrumentation Calibration (Task 71−00−00−990−002).

Any exceptions to this rule will be specified in the test procedure or correction to the observed section.

CAUTION: IF YOU USE AN INCORRECT EPP PLUG DURING ENGINE TEST, YOU WILL CAUSE ERRORS IN SETTING THE EPR RATING CLASSIFICATION AND IN DETERMINING ENGINE ACCEPTANCE TO LIMITS OF PARAGRAPHS Q. AND R. RESPECTIVELY.

(3) For standardization for all PW4000 engine models and to make sure that the engine will make Takeoff thrust, it is recommended that the Acceptance Testing be done with a class 16 EEC Programming Plug (EPP) installed in the EEC. Refer to SB PW4ENG 73−203 for EEC Programming Plug (EPP) part number for testing.

(4) After the Acceptance Test, the necessary class and part number of EEC programming plug must be selected. You must calculate the necessary class and get the part number from SB PW4ENG 73−203. After you select the necessary EEC programming plug, install it in the EEC. See the Component Maintenance Manual (CMM), − EEC Data Entry Plug, PN 50A450. This manual has the procedure for setting the plug classification.

(5) The EEC has logic for operation in two modes:

(a) EPR = This is the primary mode.

(b) N1 = This is the alternate mode which is the backup mode (default) for the EPR mode.

(c) The Acceptance Test must be done in the EPR mode.

ENGINE HARDWARE CONFIGURATION - PW4152 MODEL

EEC PROGRAMMING PLUG PART NUMBER NOTE 5	EEC PN 51D860 52D349 52D444 52D714 53D652 54D247 OR LATER	EEC PN 54D094	STATOR VANE SCHEDULE 29 N2 BIAS NOTE 1	STATOR VANE SCHEDULE 29-2 N2 BIAS NOTE 4
51D410	X	X	X	
51D411	X	X	X	
54D330	X			X

NOTE 1 It is necessary to correct N2 to the procedures shown in Table 1310A.

NOTE 2 It is necessary to correct N2 to the procedures shown in Table 1310B (NOT Applicable to this model).

NOTE 3 It is necessary to correct N2 to the procedures shown in Table 1310C (NOT Applicable to this model).

NOTE 4 It is necessary to correct N2 to the procedures shown in Table 1310D.

NOTE 5 See SB PW4ENG 73-203 for programming plug part number requirements "EEC Programming Plug Selection Chart".

PW4152 ENGINES EEC PROGRAMMING PLUG PART NUMBER VERSUS SVS CORRECTION REQUIREMENTS
Table 1304

ENGINE HARDWARE CONFIGURATION - PW4156A MODEL

EEC PROGRAMMING PLUG PART NUMBER NOTE 5	EEC PN 51D860 52D349 52D444 52D714 53D652 54D247 or later	EEC PN 54D094	STATOR VANE SCHEDULE 29 N2 BIAS NOTE 1	STATOR VANE SCHEDULE 29-2 N2 BIAS NOTE 4
51D446	X	X	X	
51D447	X	X	X	
54D334	X			X

NOTE 1 It is necessary to correct N2 to the procedures shown in Table 1310A.

NOTE 2 It is necessary to correct N2 to the procedures shown in Table 1310B (NOT Applicable to this model).

NOTE 3 It is necessary to correct N2 to the procedures shown in Table 1310C (NOT Applicable to this model).

NOTE 4 It is necessary to correct N2 to the procedures shown in Table 1310D.

NOTE 5 See SB PW4ENG 73-203 for programming plug part number requirements "EEC Programming Plug Selection Chart".

PW4156A ENGINES EEC PROGRAMMING PLUG PART NUMBER VERSUS SVS CORRECTION REQUIREMENTS
Table 1305

ENGINE HARDWARE CONFIGURATION - PW4158 MODEL

EEC PROGRAMMING PLUG PART NUMBER NOTE 5	EEC PN 51D860 52D349 52D444 52D714 53D652 54D247 or later	EEC PN 54D094	STATOR VANE SCHEDULE 29 N2 BIAS NOTE 1	STATOR VANE SCHEDULE 29-2 N2 BIAS NOTE 4
51D434	X	X	X	
51D435	X	X	X	
54D338	X			X

NOTE 1 It is necessary to correct N2 to the procedures shown in Table 1310A.

NOTE 2 It is necessary to correct N2 to the procedures shown in Table 1310B (NOT Applicable to this model).

NOTE 3 It is necessary to correct N2 to the procedures shown in Table 1310C (NOT Applicable to this model).

NOTE 4 It is necessary to correct N2 to the procedures shown in Table 1310D.

NOTE 5 See SB PW4ENG 73-203 for programming plug part number requirements "EEC Programming Plug Selection Chart".

PW4158 ENGINES EEC PROGRAMMING PLUG PART NUMBER VERSUS SVS CORRECTION REQUIREMENTS
Table 1306

H. Procedures To Prepare For Test

(1) Check that all the test instrumentation is calibrated and that there are no leaks.

(2) Service the engine oil system as shown in the procedures of 72-00-00 Servicing-02 (Task 72-00-00-610-002) or 72-00-00 Servicing-03 (Task 72-00-00-610-003).

(3) Prime the engine. See 71-00-00 Power Plant General-00, Oil and Fuel Systems Priming Procedure, (Task 71-00-00-760-003).

(4) Do the EEC static test. See 71-00-00 Test No. 7 - EEC Static Test, (Task 71-00-00-760-038).

I. Testing Prior to Acceptance Test

(1) Do the EEC idle test. See 71-00-00 Test No. 6 - EEC Idle Test, (Task 71-00-00-760-037).

NOTE: Start the engine with one Igniter A only.

(2) Do the idle leak test. See 71-00-00 Test No. 3 - Idle Power Test, (Task 71-00-00-760-030). Check for leaks, if necessary do an engine shutdown and repair any leaks.

NOTE: You can do Test No. 6 and at the same time.

(3) Let the engine become stable for five minutes at MINIMUM IDLE.

(4) Make sure all the engine parameters are in the permitted limits. See Power Plant General - Testing-00, Engine Operation Limits, (Task 71-00-00-990-007).

(a) Make sure that the main oil pressure is in limits. The oil pressure must also be in the acceptance band shown in 71-00-00, Test No. 13, (Task 71-00-00-760-047).

(b) Make sure that the No. 1 - 2 bearing compartment breather pressure is in limits.

(c) Make sure that the No. 3 bearing compartment breather pressure is in limits.

(d) Make sure that the No. 3 bearing compartment scavenge temperature (T3 SCAV) is in limits.

(e) If the optional PS4I instrumentation is installed, make sure that the turbine cooling air pressure ratio (TCAR) is in the operator's historical range.

NOTE: The turbine cooling air ratio (TCAR) check is removed from all PW4000 engine manuals. Field experience shows that the assembly instructions and TOBI flow checks are sufficient to make sure that the engine will operate correctly. You must obey the assembly and check procedures specified in the engine manual and service bulletins.

(5) Make a record of N1 RPM, N2 RPM, T4.95 (EGT), oil pressure and temperature. Check the EEC for fault messages.

NOTE: It is recommended that a complete set of data be taken at this time to check the data system. The data system must be checked before the Engine Acceptance Test.

(6) Do an engine shutdown by the Normal Shutdown Procedure, (Task 71-00-00-760-005).

(7) Check the EEC status for fault messages. Do any maintenance that is necessary.

(8) Between 5 and 35 minutes after shutdown, fill the oil tank manually as shown in the procedures of 72-00-00 Servicing-02 (Task 72-00-00-610-002) or 72-00-00 Servicing-03 (Task 72-00-00-610-003). This oil fill step will be used to calculate the engine oil consumption. The oil consumption will be calculated in gallons per hour after the Acceptance Test.

NOTE: Do not use a remote engine oil fill system during the Acceptance Test. You must not add engine oil during the Acceptance Test.

J. Acceptance Test Data Records

(1) Make a record on the engine log sheet of the general information and data as follows:

(a) Date of the Acceptance Test.

(b) Engine serial number.

(c) Serial number of modules and major components.

(d) Fuel grade and specific gravity.

(e) Engine oil specification and brand.

(f) Ambient atmospheric conditions (true barometer, wet and dry bulb temperatures).

(g) Total time of the Acceptance Test.

(h) Reasons for any engine shutdowns that are not on the schedule.

(i) Any repairs that were necessary during the Acceptance Test.

(j) If it is applicable, the reason the engine was rejected after the Acceptance Test.

(k) The test operator must sign the engine log.

(l) The test inspector must sign the log.

(2) Make a record of the engine parameters shown in Paragraph C. "Test Instrumentation And Test Cell Connections", during the Acceptance Test. Make a record at each thrust lever position during the test, (except oil consumption).

K. Initial Running

NOTE: The INITIAL RUNNING is for the LPC/HPC break−in cycle and is only necessary if the LPC or HPC or both were replaced, repaired or are new. If the LPC/HPC break−in cycle is not necessary, go to the next testing step, Engine Acceptance Test.

(1) Start the engine by the Engine Start Procedure (Normal), (Task 71−00−00−760−004). Start engine using Igniter B. Determine and record overall time from pressurization until MINIMUM IDLE speed is reached. Record data after five minutes at MINIMUM IDLE.

(a) Record data for all stabilized test points prior to moving thrust lever to the next requirement.

(b) Verify that the main oil pressure and the No. 3 bearing compartment breather pressure are within the limits shown under Testing-00, Operating Limits, (Task 71-00-00-990-007).

(c) If the optional PS4I instrumentation is installed, make sure that the turbine cooling air pressure ratio (TCAR) is in the operator's historical range.

(d) Check EEC status and maintenance words for faults. See 71-00-00, Fault Isolation-00 (Task 71-00-00-810-001).

(2) The acceleration in this section is to be done with reverse TRA. Verify in simulated deployed position that the 2.5 bleed is 100 percent open (88 percent of actuator stroke) throughout reverse operation.

CAUTION: IF AN ENGINE STALL OCCURS DURING THIS TEST, YOU MUST MOVE THE THRUST LEVER TO MINIMUM IDLE WITHIN ONE SECOND OF THE STALL. DO THE PROCEDURES SHOWN IN TESTING-00 "PROCEDURE AFTER ENGINE SURGE OR STALL" (TASK 71-00-00-760-009) AND DO THE "START PROCEDURE AFTER AN EMERGENCY SHUTDOWN" (TASK 71-00-00-760-006). IF YOU DO NOT DO THESE PROCEDURES, YOU CAN DAMAGE THE TURBINE TIP SEALS.

(a) Make a slow acceleration (30 - 60 seconds) to 8000 N2. Stabilize for two minutes at 8000 N2. Record data at the end of the stabilization period.

(b) Continue slow acceleration to 8500 N2. Stabilize for two minutes at 8500 N2. Record data at the end of the stabilization period.

(c) Continue slow acceleration to 8800 N2. Stabilize for two minutes at 8800 N2. Record data at the end of the stabilization period.

(d) Continue slow acceleration to 9000 N2. Stabilize for two minutes at 9000 N2. Record data at the end of the stabilization period.

NOTE: At cold inlet temperature maximum reverse scheduling (fN1C), may restrict the engine from achieving 9000 rpm target.

(e) Continue slow acceleration to max reverse TRA. Stabilize for five minutes at fixed TRA. Record data at the end of the stabilization period.

NOTE: At low inlet temperatures, high N2 speeds may result in high thrusts. DO NOT EXCEED 50000 LBS FN/ST2.

(f) Make a slow deceleration (30 - 60 seconds) to MINIMUM IDLE. Stabilize at MINIMUM IDLE for 0 - 30 seconds. Take the engine out of the simulated reverse position.

(g) Continue normal acceptance running.

L. Engine Acceptance Test (to be run following initial break in running for refurbished engines and all other engines).

(1) The Acceptance Testing-09 cycle is shown in the Engine Run Schedule, Figure 1301.

(2) Start the engine by the Engine Start Procedure (Normal), (Task 71-00-00-760-004).

NOTE: Start the engine with one Igniter B only.

NOTE: Monitor the main oil pressure, (MOP), during the start procedure. If you do not see any oil pressure, you must immediately and quickly stop the start procedure.

(3) Make a record of the time from fuel pressurization to MINIMUM IDLE speed.

(4) Let the engine become stable at MINIMUM IDLE.

(5) Make sure all the engine parameters are in the permitted limits. See Power Plant General - Testing-00, Engine Operation Limits, (Task 71-00-00-990-007).

(6) Operate the engine at MINIMUM IDLE for five minutes.

(7) If the optional PS4I instrumentation is installed, make sure that the turbine cooling air pressure ratio (TCAR) is in the operator's historical range.

(8) Check EEC status and maintenance words for faults. See 71-00-00, Fault Isolation-00 (Task 71-00-00-810-001).

(9) Continue slow acceleration (90 - 120 seconds) from MINIMUM IDLE to the thrust of Band A shown in Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3). Stabilize for three minutes. Record data and install TRA stop.

(10) Do the decel vibration survey as follows.

CAUTION: IF AN ENGINE STALL OCCURS DURING THIS TEST, YOU MUST MOVE THE THRUST LEVER TO MINIMUM IDLE WITHIN ONE SECOND OF THE STALL. DO THE PROCEDURES SHOWN IN TESTING-00 "PROCEDURE AFTER ENGINE SURGE OR STALL" (TASK 71-00-00-760-009) AND DO THE "START PROCEDURE AFTER AN EMERGENCY SHUTDOWN" (TASK 71-00-00-760-006). IF YOU DO NOT DO THESE PROCEDURES, YOU CAN DAMAGE THE TURBINE TIP SEALS.

(a) Make a slow deceleration (60 - 120 seconds) to MINIMUM IDLE, surveying engine vibration.

(b) At each speed where peaks have shown during the deceleration, record the mean vibration level of each pickup after 30 second stabilization.

(c) Check that the engine vibration values are in the permitted limits. See Testing-00, Engine Operation Limits, (Task 71-00-00-990-007).

(d) For engines that are more than the permitted vibration limits, do Testing-19, Trim Balance Procedure And Test, (Task 71-00-00-760-043), (Task 71-00-00-760-052) or (Task 71-00-00-760-057).

(11) Select APPROACH IDLE. Stabilize for 15 minutes. At the end of the stabilization period, record data.

(12) Do the snap acceleration/deceleration test cycle shown in 71-00-00, Testing-04 (Task 71-00-00-760-031) and perform step B.(9)(b) through B.(9)(i) for acceleration/deceleration test). Also see Engine Run Schedule shown in Figure 1301.

NOTE: The snap acceleration/deceleration must be done after the compressor break in cycle shown in above.

(13) Vibration Survey (Acceleration).

(a) An engine vibration survey shall be conducted on an engine that has been thermally stabilized. Completion of step M.(12) above without shutdown will result in a stabilized engine. If shutdown occurs, the engine must be run at thrust Band C, Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) or higher for three minutes and then run for six minutes at MINIMUM IDLE prior to conducting the vibration survey.

(b) Make a slow acceleration (90 - 120 seconds) from MINIMUM IDLE to thrust Band A Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3).

(c) At each speed where peaks have shown during the acceleration, record the mean vibration level of each pickup after 30 second stabilization.

(d) Check the engine vibration levels during this test to make sure that the allowable limits are not exceeded. See 71-00-00, Testing-00, Vibration Limits, (Task 71-00-00-990-007).

(e) For engines that exceed the vibration limits, see 71-00-00, Testing-19, (Task 71-00-00-760-043), (Task 71-00-00-760-052) or (Task 71-00-00-760-057).

(14) Performance Calibration.

(a) Stabilize at thrust Band A Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) for five minutes. At the end of the stabilization period, record data.

(b) Stabilize at thrust Band B Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) for three minutes. At the end of the stabilization period, record data.

(c) Stabilize at thrust Band C Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) for three minutes. At the end of the stabilization period, record data.

(d) Stabilize at thrust Band D Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) for three minutes. At the end of the stabilization period, record data.

(e) Decelerate slowly (60 - 120 seconds) to APPROACH IDLE. Stabilize for 20 minutes.

(15) Engine shutdown procedure.

(a) Do an engine shutdown by the Normal Shutdown Procedure, (Task 71-00-00-760-005).

(b) Check the EEC status for fault messages. Do any maintenance that is necessary.

M. Procedures After Engine Shutdown - Corrections Of Observed Readings

(1) Correct the observed data collected in thrust Bands A, B, C, and D of the performance calibration. Use the procedure defined in Figure 1302 (Sheet 1), Figure 1302 (Sheet 2), Figure 1302 (Sheet 3) and Figure 1302 (Sheet 4).

N. Engine Configuration Determination

(1) Based on the engine configuration identifier suffix in Table 1301, make sure that you are in the appropriate Testing-09 CONFIG section to use to class and check the engine for acceptance.

O. Check Corrected Data

(1) If the optional PS4I instrumentation is installed, make sure that the turbine cooling air pressure ratio (TCAR) is in the operator's historical range.

(2) Values of Corrected Net Thrust versus PT4.95/PT2 corrected N1, corrected N2, and corrected EGT, should fall within the requirements of Figure 1309 (Sheet 1), Figure 1309 (Sheet 2), Figure 1309 (Sheet 3), and Figure 1309 (Sheet 4). The lines on these figures are guidelines only and are not acceptance limits. Points outside these values can suggest that there is a instrumentation and/or other problem that must be identified.

(a) Definitions of terms used in Figure 1309 are as follows:

(b) Complete Refurbishment: Bands are for engines that had all modules repaired or replaced to new engine clearances and airfoil condition.

(c) Minor or No Refurbishment: Bands are for high time service engines that are fully deteriorated without any or only a small quantity of gaspath repair.

(3) Values of corrected PT2.5/PT2 and PS3/PT2.5 versus PT4.95/PT2 should fall within the guidelines of Figure 1309 (Sheet 5) and Figure 1309 (Sheet 6). The lines of these figures are guidelines only and not acceptance limits. Points outside these values can suggest that there is a instrumentation and/or other problem that must be identified.

(4) If a review of the test high power (points generally above 52000 lbf (231307.5 N) thrust, or 1.45 PT4.95/PT2) indicate a change in level relative to the check line shape as shown in Table 1307 below, this can be an indication of abnormal fan operation. This abnormal operation is also accompanied by a noticeable tone change in the engine. This change is triggered at high power by dirty and/or severely eroded fan blade leading edges. Corrective action must be taken. Refer to 72−00−31, Repair−01 (Task 72−00−31−300−001).

(5) Corrected Thrust Specific Fuel Consumption (TSFC) must be compared with the values listed in Table 1302. These values are included for reference to new engine levels only and are not intended as an acceptance requirement.

ABNORMAL FAN OPERATION		
Delta P4.95/PT2	approximately +0.015 to 0.020	at Fn = K
Delta N1C	approximately +80 to +100 RPM	at Fn = K
Delta N2C	approximately −40 RPM	at Fn = K
Delta EGT	approximately −4°C	at Fn = K
Delta PT2.5/PT2	approximately +0.14 ratios	at P4.95/PT2 = K
Delta PS3/PT2.5	approximately −0.5 ratios	at P4.95/PT2 = K

PARAMETER SHIFT WITH ABNORMAL FAN OPERATION
Table 1307

P. Engine Pressure Ratio (EPR) Rating Classification

(1) The necessary EEC programming plug is specified by a part number and EPR class system. The programming plug part number is specified by the engine model and thrust rating. For the necessary EEC programming plug part number, see Table 1304, Table 1305 or Table 1306. The necessary EPR Class must be selected by Engine Pressure Ratio (EPR), see SB PW4ENG 73−203.

(2) The plug part number and class is shown on the engine data plate. If a new part number or class plug is used, you must write (scribe) the new part number and class on the engine data plate.

(3) Make a EEC programming plug selection as follows:

(a) See SB PW4ENG 73−203 for the necessary Engine Programming Plug (EPP) for the engine model and hardware configuration that was tested. Confirm that the appropriate EPP part number was installed during acceptance testing.

NOTE: If the incorrect program plug (EPP) was installed during acceptance testing, contact Pratt & Whitney for assistance in correcting data/or rerun with the correct program plug.

(b) EPR class modifiers are used to make sure that the engine pressure ratio sent to the aircraft is less than the given limits. This will make sure that the engine will always give rated thrust at all possible take−off settings. The EPR limit is called "MAX EPR" and is shown in Table 1308.

NOTE: A PW4152 engine must only use the Bands A, B, and C points for the EPR Modifier classification. The PW4156A and PW4158 engines can use the Bands A, B, C and D points in the calculations.

(c) Use EPR-0 and Corrected Net Thrust from the four performance calibration points to find the EPR modifier class. Find the EPR modifier class which gives the highest EPR value and does not go more than the MAX EPR LIMIT specified by Table 1308. Make a straight line curve to fit between the points shown on Table 1308.

NOTE: To calculate EPR-0, go to Paragraph G.(1), Acceptance Test General Specifications.

NOTE: Make sure that the Stage 2.5 bleed valve is in the closed location. Do not use any data points (D band point) where the Stage 2.5 bleed valve starts to open to calculate the modifier class.

(d) To calculate EPR, use the EPR class defined above where EPR = EPR-0 + EPR Modifier. EPR is the value used in Paragraph Q, Check For Engine Acceptance, to check for engine acceptance and to calculate engine margin to the limits.

(e) If multiple ratings are desired, testing need only be performed to the highest rating desired and with a 3rd order curve fit of the four point acceptance data, other "A" band rating EPR-0 values can be found for EPR classification purposes as follows:

1 Use the four point acceptance data to find the 3rd order fit of thrust EPR-0.

2 Find the value of EPR-0 at the rating desired (use the minimum band thrust from Figure 1304).

3 Use the value of EPR-0 and thrust value calculated in step 2 above as the "A" band point. Find the EPR class requirement with the procedure in step (c) above. (Use the calculated A band point, with B, C, and D band from the data).

(f) An example of the EPR class calculation (for a PW4158 configuration) is shown in Table 1309.

FOR THESE CONFIGURATIONS (PRE PHASE 3): PW4152, PW4156A, PW4158

CORRECTED NET THRUST LBS (N)	MAXIMUM EPR
34000 lbf (151239.5 N)	1.2664
35000 lbf (155687.8 N)	1.2775
36000 lbf (160136.0 N)	1.2885
37000 lbf (164584.2 N)	1.2996
38000 lbf (169032.4 N)	1.3107
39000 lbf (173480.7 N)	1.3219
40000 lbf (177928.9 N)	1.3332
41000 lbf (182377.1 N)	1.3446
42000 lbf (186825.3 N)	1.3563
43000 lbf (191273.5 N)	1.3680
44000 lbf (195721.8 N)	1.3799
45000 lbf (200170.0 N)	1.3921
46000 lbf (204618.2 N)	1.4044
47000 lbf (209066.4 N)	1.4170
48000 lbf (213514.7 N)	1.4299
49000 lbf (217962.9 N)	1.4432
50000 lbf (222411.1 N)	1.4568
51000 lbf (226859.3 N)	1.4709
52000 lbf (231307.5 N)	1.4854
53000 lbf (235755.8 N)	1.5004
54000 lbf (240204.0 N)	1.5159
55000 lbf (244652.2 N)	1.5319
56000 lbf (249100.4 N)	1.5486
57000 lbf (253548.7 N)	1.5659
58000 lbf (257996.9 N)	1.5839
59000 lbf (262445.1 N)	1.6026
60000 lbf (266893.3 N)	1.6220

MAXIMUM EPR
Table 1308

EXAMPLE OF CALCULATING EPR MODIFIER CLASS FOR PW4158 ENGINE CONFIGURATIONS

Step 1.
Start with the four performance calibration points from engine test.

CORRECTED NET THRUST

LBS (N)	(EEC EPR) EPR-028	TLRA	DELTA EPR MOD [SEE PARA. G. (1)]	= EPR-0
58125 lbf (258552.9 N)	1.555	79.8	.028	1.583
51500 lbf (229083.4 N)	1.444	74.2	.028	1.472
46209 lbf (205547.9 N)	1.376	70.1	.026	1.402
41066 lbf (182670.7 N)	1.317	65.7	.022	1.339

Step 2.
At the Corrected Net Thrust level of the four performance calibration points, find the Maximum EPR as shown in Table 1308. Make a straight line curve to fit between the points shown on Table 1308.

CORRECTED NET THRUST

LBS (N)	EPR-MAX
58125 lbf (258552.9 N)	1.5862
51500 lbf (229083.4 N)	1.4782
46209 lbf (205547.9 N)	1.4070
41066 lbf (182670.7 N)	1.3454

Step 3.
Find the delta EPR value for each point of Maximum EPR:

CORRECTED NET THRUST

LBS (N)	EPR-MAX	EPR-0	DELTA EPR

EXAMPLE OF CALCULATING EPR MODIFIER FOR PW4158 ENGINES
Table 1309

EXAMPLE OF CALCULATING EPR MODIFIER
CLASS FOR PW4158 ENGINE CONFIGURATIONS

58125 lbf (258552.9 N)	1.5862	1.583	.0032
51500 lbf (229083.4 N)	1.4782	1.472	.0062
46209 lbf (205547.9 N)	1.4070	1.402	.0006
41066 lbf (182670.7 N)	1.3454	1.339	.0064

Step 4.
To find the EPR Class Number, use the delta EPR value from Step 3. above, and go to Table 1303.

DELTA EPR	CLASS NUMBER	EPR MODIFIER
0.0032	9	+0.000
0.0062	8	+0.004
0.0006	9	+0.000
0.0064	8	+0.004

Step 5.
The EPR Modifier Class 9 will give the highest possible EPR and will not be more than the EPR-Max limit, (highest class number from above). Make a Class 9 modifier selection and then calculate EPR.

EPR-0	EPR MODIFIER	EPR
1.583	0	1.583
1.472	0	1.472
1.402	0	1.402
1.339	0	1.339

EXAMPLE OF CALCULATING EPR MODIFIER FOR PW4158 ENGINES
Table 1309 (Continued)

Q. Check For Engine Acceptance

CAUTION: MAKE SURE THAT THE STAGE 2.5 BLEED VALVE IS IN THE CLOSED LOCATION. DO NOT USE ANY DATA POINTS TO CALCULATE ACCEPTANCE TO THE LIMITS WHERE THE STAGE 2.5 BLEED VALVE STARTS TO OPEN (D BAND POINT).

(1) The steady state values of corrected N2, N1 and TT4.95 (EGT) versus modified engine pressure ratio (EPR = EPR-0 + EPR Modifier) must be below the limits of Figure 1310 (Sheet 1), Figure 1310 (Sheet 2), Figure 1310 (Sheet 3), Figure 1311 (Sheet 1), Figure 1311 (Sheet 2), Figure 1311 (Sheet 3), Figure 1312 (Sheet 1) and Figure 1312 (Sheet 2). All the calibration points (A Band through D Band) must be examined relative to the limit lines. A large difference between the calibration points and the limit line can indicate instrumentation or engine problems. Use A Band thrust levels for NH and NL acceptance. Use A Band and B Band thrust levels for EGT acceptance. Calculate the EGT margin to the limit line, the engine is acceptable if the average of the A Band and B Band margins is positive (greater than zero).

(a) Figure 1312 (Sheet 1) and Figure 1312 (Sheet 2) shows two maximum EGT limit curves. The upper EGT limit curve applies in all cases except when an engine is tested immediately following high turbine refurbishment. The lower EGT limit curve is to be used only after a high turbine refurbishment (turbine clearances restored) and before engine has flown with turbine cooling air system on.

(b) The N1 rotor speed limits are shown in Figure 1311 (Sheet 1),Figure 1311 (Sheet 2) and Figure 1311 (Sheet 3).

(c) Do an N2 Speed Limit Analysis. Figure 1310 (Sheet 1), Figure 1310 (Sheet 2) and Figure 1310 (Sheet 3) presents the corrected rotor speed limits for engines with either SVS 29 N2 BIAS or SVS 29-2 N2 BIAS. Refer to Table 1304 through Table 1306 to determine which SVS N2 limit line to use. Refer to the calculation procedures shown in Figure 1302 (Sheet 2), Item 5. Choose the correct calculation procedure based on the control version that is installed at the time of the test.

NOTE: The EEC incorporates a N2 biased stator vane schedule (SVS). This schedule closes the HPC variable stator vanes 5 degrees for observed N2 rotor speeds less than 9550 N2 RPM and 9830 N2 RPM for RCC. The SVS transitions linearly to either the original OPEN schedule (SVS 29) or a closed (SVS 29-2) 2 degree schedule (HPC RCC post SB 72-756) at N2 rpm's above 10250. Since the N2 Limit Curve Figure 1310 (Sheets 1 through 3) is based on the original OPEN schedule, an adjustment must be made to the N2 data points before they are compared to this N2 Speed Limit Curve, Figure 1310 (Sheets 1 through 3).

(d) Figure 1310 (Sheet 1), Figure 1310 (Sheet 2), and Figure 1310 (Sheet 3) includes the more restrictive speed limits that are necessary for post SB PW4ENG 72-557 engines, (with redesigned 5th stage compressor blade). For simplicity, the more restrictive limits (if they are different) are to be used for both pre and post SB PW4ENG 72-557 engine configurations.

(e) For an example of a N2 Speed Limit Analysis, see Table 1310A for engines running SVS 29 N2 BIAS or see Table 1310B for engines running SVS 29-3 N2 BIAS. An example of a calculation for an engine running SVS 29 N2 BIAS is shown in Table 1311.

EXAMPLE - PROCEDURE TO DO AN N2 SPEED LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29 N2 BIAS

Step 1. Calculate the Corrected Observed N2:

Corrected Observed N2 = Observed N2/SQRT (THETA T2)

Step 2. Calculate FACTOR (Percent difference in N2, SVS 29-5 deg relative to SVS 29):

FACTOR = 1.11244 - 3.93387 x P4.95Q2 + 2.82184 x $P4.95Q2^2$

Where P4.95Q2 = PT4.95/PT2

Step 3. Calculate N2Rcl (Corrected N2 adjusted to SVS 29-5 deg):

If Observed N2 <= 9550 rpm, N2Rcl = Corrected Observed N2

If 9550 < Observed N2 < 10250

N2Rcl = Corrected Observed N2 x [1 + (FACTOR x [Observed N2-9550])/70000]

If Observed N2 >= 10250 rpm, go to step 4b

Step 4. Calculate N2Rop (Corrected N2 adjusted to SVS 29):

(a) If Observed N2 < 10250 rpm, N2Rop = N2Rcl/(1+ FACTOR/100)

(b) If Observed N2 >= 10250 rpm, N2Rop = Corrected Observed N2

Step 5. Calculate Corrected High Rotor Speed - RPM:

Corrected High Rotor Speed = N2Rop/KHN2 + delta N2 (See Figure 1302, (Sheet 4) NOTE 4.

Where KHN2 is found from Figure 1308.

PROCEDURE FOR CALCULATING CORRECTED HIGH ROTOR SPEED (N2) FOR LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29 N2 BIAS
Table 1310A

EXAMPLE − PROCEDURE TO DO AN N2 SPEED LIMIT ANALYSIS
FOR ENGINES RUNNING WITH SVS 29−3 N2 BIAS

ENGINES RUNNING WITH SVS 29−3 N2 BIAS NOT APPLICABLE TO THIS CONFIGURATION

PROCEDURE FOR CALCULATING CORRECTED HIGH ROTOR SPEED (N2) FOR
LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29−3 N2 BIAS
Table 1310B

EXAMPLE − PROCEDURE TO DO AN N2 SPEED LIMIT ANALYSIS
FOR ENGINES RUNNING WITH SVS 29−5 N2 BIAS

ENGINES RUNNING WITH SVS 29−5 N2 BIAS NOT APPLICABLE TO THIS CONFIGURATION

PROCEDURE FOR CALCULATING CORRECTED HIGH ROTOR SPEED (N2) FOR
LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29−5 N2 BIAS
Table 1310C

EXAMPLE - PROCEDURE TO DO AN N2 SPEED LIMIT ANALYSIS
FOR ENGINES RUNNING WITH SVS 29-2 N2 BIAS

Step 1. Calculate the Corrected Observed N2:

Corrected Observed N2 = Observed N2/SQRT (THETA T2)

Step 2. Calculate FACTOR (Percent difference in N2, SVS 29-5 deg relative to SVS 29):

FACTOR = 1.11244 - 3.93387 x P4.95Q2 + 2.82184 x $P4.95Q2^2$
Where P4.95Q2 = P4.95/P2

Step 3. Calculate N2Rcl (Corrected N2 adjusted to SVS 29-5 deg):

If Observed N2 <= 9830 rpm, N2Rcl = Corrected Observed N2

If 9830 < Observed N2 < 10250

N2Rcl = Corrected Observed N2 x [1 + (FACTOR x 0.6 x [Observed N2-9830])/42000]

If Observed N2 >= 10250 rpm, go to step 4(b)

Step 4. Calculate N2Rop (Corrected N2 adjusted to SVS 29):

(a) If Observed N2 < 10250 rpm, N2Rop = N2Rcl/(1+ FACTOR/100)

(b) If Observed N2 >= 10250 rpm, N2Rop = (Corrected Observed N2) / [1+0.4 X (FACTOR)/100]

Step 5. Calculate Corrected High Rotor Speed - RPM:

Corrected High Rotor Speed = N2Rop/KHN2 + delta N2
(See Figure 1302 (Sheet 4) NOTE 4.

Where KHN2 is found from Figure 1308.

PROCEDURE FOR CALCULATING CORRECTED HIGH ROTOR SPEED (N2) FOR LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29-2 N2 BIAS
Table 1310D

EXAMPLE - N2 SPEED LIMIT ANALYSIS - PW4158
ENGINE RUNNING WITH SVS 29 N2 BIAS

Step 1. Calculate the Corrected Observed N2:

Parameter Point	1	2	3	4
Observed N2	9694	9467	9287	9135
T2, deg R	529.4	529.4	529.4	529.4
Sqrt Theta T2	1.010	1.010	1.010	1.010
Corrected Observed N2	9597	9373	9194	9044
P4.95/P2	1.583	1.472	1.402	1.340
FACTOR	1.956	1.4361	1.1438	0.908
N2Rcl	9636	9373	9194	9044
N2Rop	9450	9240	9090	8951
KHN2	1.0019	1.0019	1.0019	1.0019
N2Rop/KHN2	9432	9222	9072	8934
Delta N2 Test Cell/Duct Set Corrections - See Figure 1302, (Sheet 4) NOTE 4.	91	61	46	34
Corrected High Rotor Speed	9523	9283	9118	8968
EPR	1.583	1.472	1.402	1.339
N2 Speed Limit (See Figure 1310 (Sheet 3)	9913	9595	9386	9200
Margin (RPM)	390	312	268	232

EXAMPLE - N2 SPEED LIMIT ANALYSIS - PW4158 ENGINE
Table 1311

R. Procedures Necessary After Testing

(1) Oil consumption.

NOTE: When you do the visual inspection for leaks, it is possible to see a small quantity of remaining oil in the area of the spinner, at the bottom of the fan case, or at the HPC variable vane attach bolts at the bottom of the engine. The source of this oil is either the No. 1 bearing carbon seal assembly or the No. 2 bearing rear carbon seal assembly. After the engine windmills or after a long start procedure (conditions where carbon seal pressure differences are very low or negative), a small quantity of oil can get through the carbon seals and go to the external parts of the engine. This condition is satisfactory and is permitted. All other conditions of the inspection must be satisfactory. A limit for the quantity of oil that is permitted is not given. The limits that should be used when you make an estimate of the quantity of oil is oil consumption level.

(a) Between 10 and 15 minutes after engine shutdown, fill the oil tank manually as shown in the procedures of 72−00−00 Servicing−02 (Task 72−00−00−610−002) or 72−00−00 Servicing−03 (Task 72−00−00−610−003). Use a graduated measuring device and make a record of the quantity of engine oil that is added.

(b) Make a record of the engine oil consumption in gal/hr (l/hr) in the engine logs.

(c) If there is more oil in the oil tank after the Acceptance Test than before (such as oil that comes out the scupper drain), the oil must be checked for fuel by a laboratory.

(2) Seal Leakage Limits.

(a) Measure the quantity of leakage in each seal drain collection bottle. The leakage limits for each seal drain are shown in 71−00−00 Power Plant General − Testing−00, Engine Operation Limits, (Task 71−00−00−990−007).

(3) Check Filters.

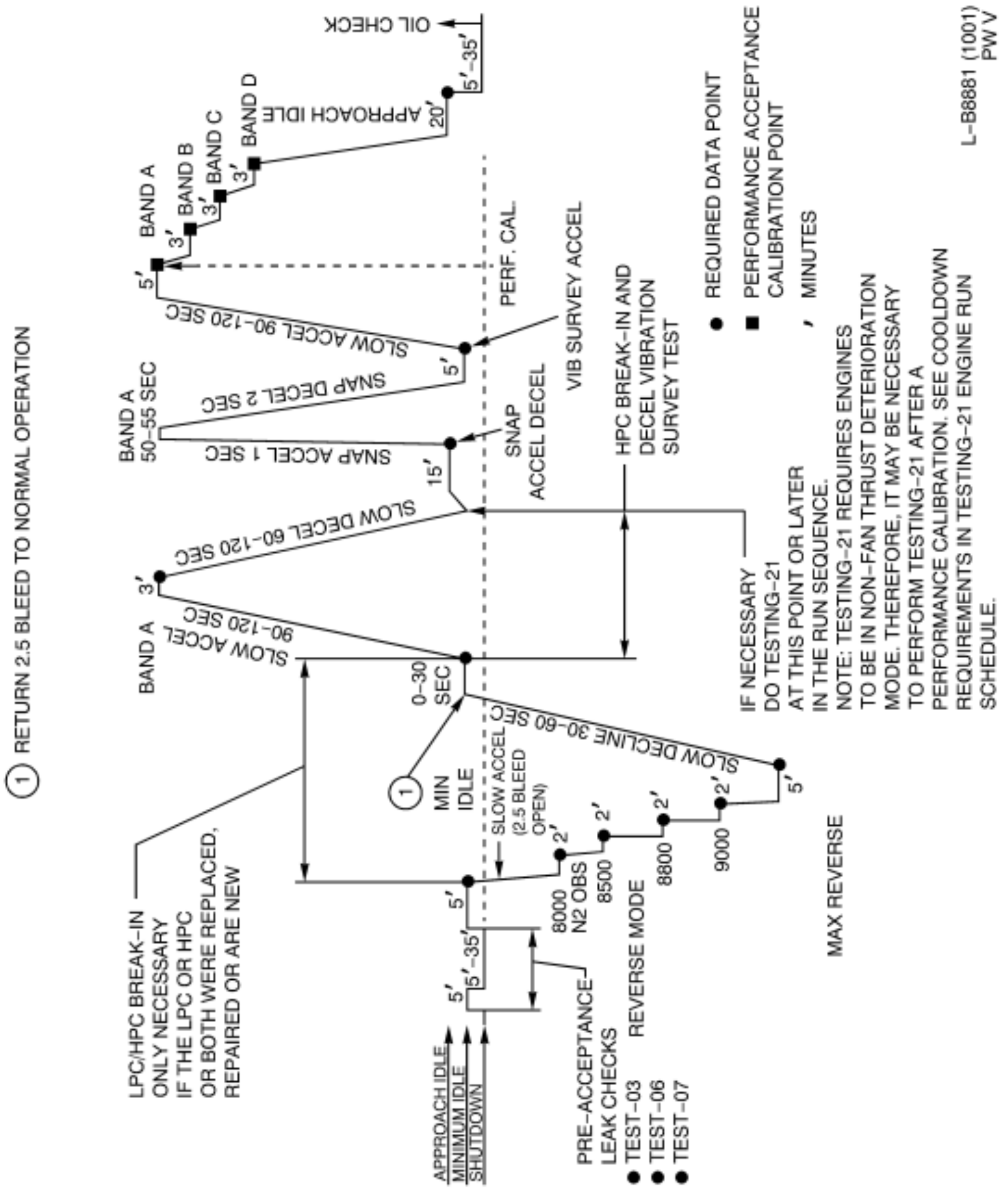
(a) Remove the main oil filter and seals. Examine the filter for pieces of unwanted material (chips) and contamination. Record the results in the engine logs. Install a new main oil filter and seals.

(b) Remove the fuel filters and seals. Examine the filter for pieces of unwanted material (chips) and contamination. Record the results in the engine logs. Install new fuel filters and seals.

R 1 Look for bronze colored particles. If you find
R bronze contamination, you must replace the fuel
R metering unit and the fuel pump.

(4) Preservation.

(a) For engine preservation refer to 72−00−00, Storage/Transport−03, Accomplish Engine Preservation, (Task 72−00−00−620−001).


① RETURN 2.5 BLEED TO NORMAL OPERATION
LPC/HPC BREAK-IN ONLY NECESSARY IF THE LPC OR HPC OR BOTH WERE REPLACED, REPAIRED OR ARE NEW
APPROACH IDLE
MINIMUM IDLE
SHUTDOWN
5′
5′-35′
5′
PRE-ACCEPTANCE LEAK CHECKS
● TEST-03
● TEST-06
● TEST-07
REVERSE MODE
SLOW ACCEL (2.5 BLEED OPEN)
8000 N2 OBS
8500
8800
9000
2′
2′
2′
2′
5′
MAX REVERSE
SLOW DECLINE 30-60 SEC
MIN IDLE
①
0-30 SEC
BAND A
SLOW ACCEL 90-120 SEC
3′
SLOW DECEL 60-120 SEC
15′
SNAP ACCEL 1 SEC
BAND A 50-55 SEC
SNAP DECEL 2 SEC
SNAP ACCEL DECEL
HPC BREAK-IN AND DECEL VIBRATION SURVEY TEST
IF NECESSARY DO TESTING-21 AT THIS POINT OR LATER IN THE RUN SEQUENCE.
5′
SLOW ACCEL 90-120 SEC
VIB SURVEY ACCEL
PERF. CAL.
5′
BAND A
3′
BAND B
3′
BAND C
3′
BAND D
20′
APPROACH IDLE
5′-35′
OIL CHECK
● REQUIRED DATA POINT
■ PERFORMANCE ACCEPTANCE CALIBRATION POINT
′ MINUTES
NOTE: TESTING-21 REQUIRES ENGINES TO BE IN NON-FAN THRUST DETERIORATION MODE. THEREFORE, IT MAY BE NECESSARY TO PERFORM TESTING-21 AFTER A PERFORMANCE CALIBRATION. SEE COOLDOWN REQUIREMENTS IN TESTING-21 ENGINE RUN SCHEDULE.
L-B8881 (1001) PW V

Engine Run Schedule
Figure 1301
(Task 71-00-00-760-020)

CORRECTION OF OBSERVED READINGS (SHEET 1 OF 4)

NOTE: For the Following Calculations:

- THETA T2 $= \theta T2 = \left(\frac{TT2\,^{O}C + 273.16}{288.16} \right)$
- DELTA T2 $= \delta T2 = \frac{PT2\ (IHGA)}{29.92}$
- Note 1 through Note 11 ..... See Sheet 4 Definitions

Item (1) Corrected Net Thrust - lbs

$$\frac{\text{Total (FN)}}{\delta T2} = \left(\frac{\text{Observed Thrust}}{\delta T2} \right) + \text{Delta FN}_{\text{Note 1}}$$

Item (2) Corrected Fuel Flow - lbs/hr

$$\frac{WF}{(\delta T2)\ (KC)\ (KHWF)} = \left(\frac{\text{Observed Fuel Flow}}{(\delta T2)\ (KC)\ (KHWF)} \right) \times \left(\frac{LHV}{18400} \right) + \text{Delta WF}_{\text{Note 2}}$$

KC is defined as $(\theta T2)^{0.59}$

KHWF is determined as follows:

(a) Obtain a value of KH' (min) which is a function of specific humidity (lbs moisture per lb of dry air) from Figure 1307. This value is a minimum correction and will be compared with that obtained in the following step.

(b) Using recorded ambient temperature and Corrected Net Thrust from Item (1) above, obtain values of C1 (Figure 1305), C2, and C3 (Figure 1306). Calculate KH' using the following equation:

$KH' = C1(SH + C2) + C3$, where SH = specific humidity (lbs moisture/lb dry air)

(c) Set KHWF equal to the greater of the values of KH' calculated above in Item (2) (a) and (b).

(d) LHV = Lower Heating Value of fuel in BTU/LBM.

L-A9025 (0597)
PW V

Correction Of Observed Data
Figure 1302 (Sheet 1)
(Task 71-00-00-760-020)

CORRECTION OF OBSERVED READINGS (SHEET 2 OF 4)

Item (3) Corrected Thrust Specific Fuel Consumption (TSFC) – lbs/hr/lb

$$\left(\frac{TSFC}{(KC)\ (KHWF)}\right) = \left(\frac{\text{Corrected Fuel Flow}}{\text{Corrected Net Thrust}}\right) = \left\{\frac{\left[\frac{WF}{(\delta T2)\ (KC)\ (KHWF)}\right]}{\left[\frac{FN}{\delta T2}\right]}\right\}$$

Item (4) Corrected Low Rotor Speed – RPM

$$\left[\frac{N1}{\sqrt{\theta T2}\ (KHN1)}\right] = \left(\frac{\text{Observed N1}}{\sqrt{\theta T2}\ (KHN1)}\right) + \text{Delta N1}_{\text{Note 3}}$$

where KHN1 is found from Figure 1308.

Item (5) Corrected High Rotor Speed – RPM

Engines running with SVS 29 N2 BIAS:
See calculation procedure outlined in Table 1310 A.
Engines running with SVS 29-2 N2 BIAS:
See calculation procedure outlined in Table 1310 D.
Note 1: For an example calculation procedure for SVS 29 N2 BIAS configuration see Table 1311.
Note 2: Refer to Tables 1304 through 1306 determine which SVS N2 BIAS is used.

Item (6) Corrected Exhaust Gas Temperature (EGT) – ^{o}C

$$\left[\frac{TT4.95\,^{o}C}{(\theta T2)^{1.0}\ \ (KHT4.95)}\right] = \left[\frac{\text{Observed TT4.95}\,^{o}C+273.16}{(\theta T2)^{1.0}\ \ (KHT4.95)}\right] - (273.16) + \text{Delta TT4.95}_{\text{Note 5}}$$

where KHT4.95 is found from Figure 1308.

Item (7) Corrected Station 3 Temperature – ^{o}C

$$\left[\frac{TT3\,^{o}C}{(\theta T2)^{0.932}}\right] = \left[\frac{\text{Observed TT3}\,^{o}C + 273.16}{(\theta T2)^{0.932}}\right] - (273.16) + \text{Delta TT3}_{\text{Note 6}}$$

L-B0917 (0403)
PW V

Correction Of Observed Data
Figure 1302 (Sheet 2)
(Task 71-00-00-760-020)

CORRECTION OF OBSERVED READINGS (SHEET 3 OF 4)

Item (8) Corrected Station 2.5 Temperature – °C

$$\left[\frac{\text{TT2.5°C}}{(\theta\text{T2})^{0.985}}\right] = \left[\frac{\text{Observed TT2.5°C} + 273.16}{(\theta\text{T2})^{0.985}}\right] - (273.16) + \text{Delta TT2.5}_{\text{NOTE 7}}$$

Item (9) Test Stand Engine Pressure Ratio $= \left(\frac{\text{PT4.95}}{\text{PT2}}\right)$

Item (10) Corrected Turbine Cooling Air Pressure Ratio
PS4I Instrumentation Optional

$$\left(\frac{\text{PS4I}}{\text{PT3}}\right) = 0.97 \times \left(\frac{\text{PS4I}}{\text{PS3}}\right)$$

Item (11) Corrected Compressor Pressure Ratios:

Low Compressor

$$\left(\frac{\text{PT2.5}}{\text{PT2}}\right) = \left(\frac{\text{Observed PT2.5}}{\text{PT2}}\right) \times (\theta\text{T2})^{0.08} + (\text{Delta PT2.5/PT2}_{\text{NOTE 8}})$$

High Compressor

$$\left(\frac{\text{PS3}}{\text{PT2.5}}\right) = \left(\frac{\text{Observed PS3}}{\text{PT2.5}}\right) \times (\theta\text{T2})^{-0.08} = (\text{Delta PS3/PT2.5}_{\text{NOTE 9}})$$

Overall Compressor

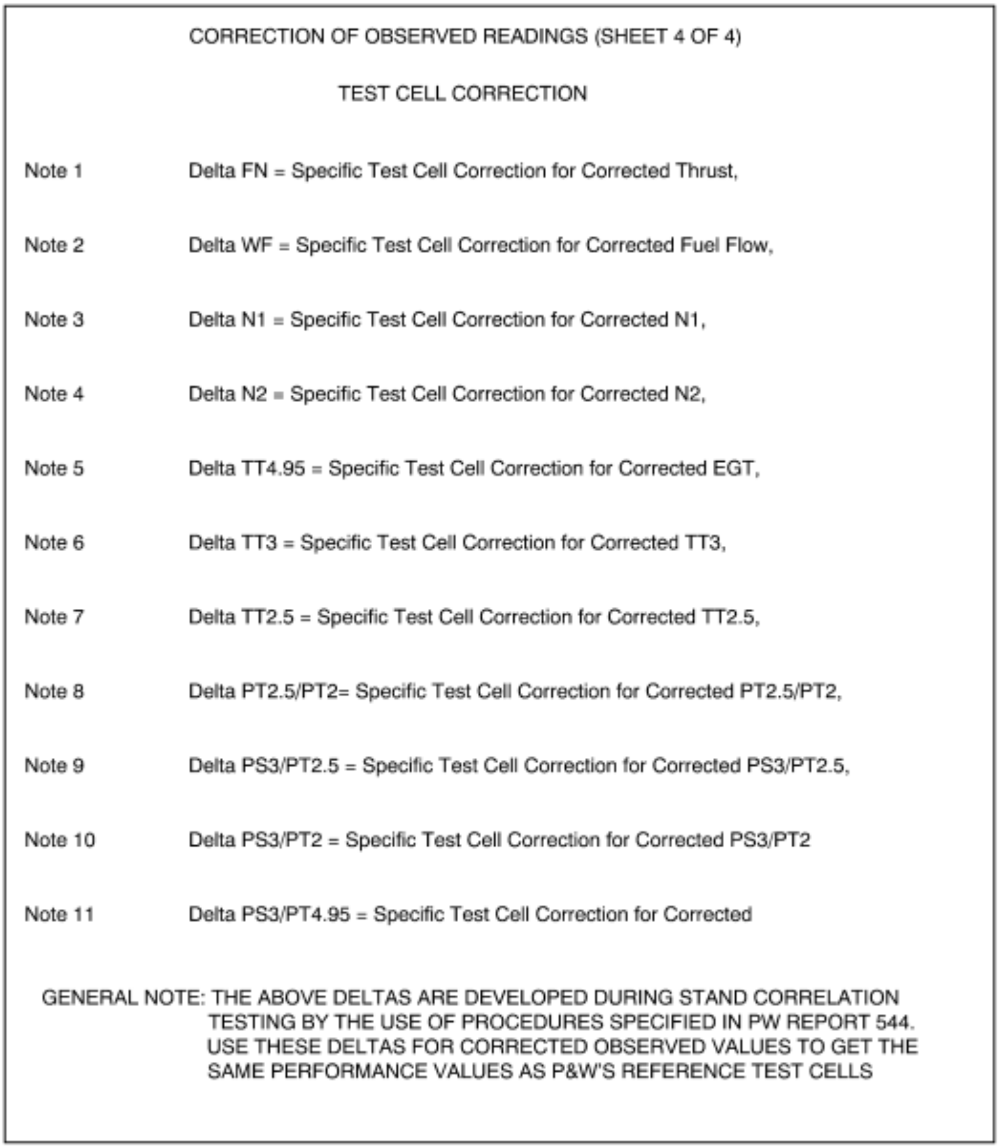
$$\left(\frac{\text{PS3}}{\text{PT2}}\right) = \left(\frac{\text{Observed PS3}}{\text{PT2}}\right) + \text{Delta PS3/PT2}_{\text{NOTE 10}}$$

Item (12) Overall Corrected Turbine Pressure Ratio

$$\left(\frac{\text{PS3}}{\text{PT4.95}}\right) = \left(\frac{\text{Observed PS3}}{\text{PT4.95}}\right) + \text{Delta PS3/PT4.95}_{\text{NOTE 11}}$$

L-B0882 (0705)
PW V

Correction Of Observed Data
Figure 1302 (Sheet 3)
(Task 71-00-00-760-020)



CORRECTION OF OBSERVED READINGS (SHEET 4 OF 4)

TEST CELL CORRECTION

Note 1 Delta FN = Specific Test Cell Correction for Corrected Thrust,

Note 2 Delta WF = Specific Test Cell Correction for Corrected Fuel Flow,

Note 3 Delta N1 = Specific Test Cell Correction for Corrected N1,

Note 4 Delta N2 = Specific Test Cell Correction for Corrected N2,

Note 5 Delta TT4.95 = Specific Test Cell Correction for Corrected EGT,

Note 6 Delta TT3 = Specific Test Cell Correction for Corrected TT3,

Note 7 Delta TT2.5 = Specific Test Cell Correction for Corrected TT2.5,

Note 8 Delta PT2.5/PT2= Specific Test Cell Correction for Corrected PT2.5/PT2,

Note 9 Delta PS3/PT2.5 = Specific Test Cell Correction for Corrected PS3/PT2.5,

Note 10 Delta PS3/PT2 = Specific Test Cell Correction for Corrected PS3/PT2

Note 11 Delta PS3/PT4.95 = Specific Test Cell Correction for Corrected

GENERAL NOTE: THE ABOVE DELTAS ARE DEVELOPED DURING STAND CORRELATION TESTING BY THE USE OF PROCEDURES SPECIFIED IN PW REPORT 544. USE THESE DELTAS FOR CORRECTED OBSERVED VALUES TO GET THE SAME PERFORMANCE VALUES AS P&W'S REFERENCE TEST CELLS

L-A9028 (0696)
PW V

Correction Of Observed Data
Figure 1302 (Sheet 4)
(Task 71-00-00-760-020)

FIGURE NOT USED

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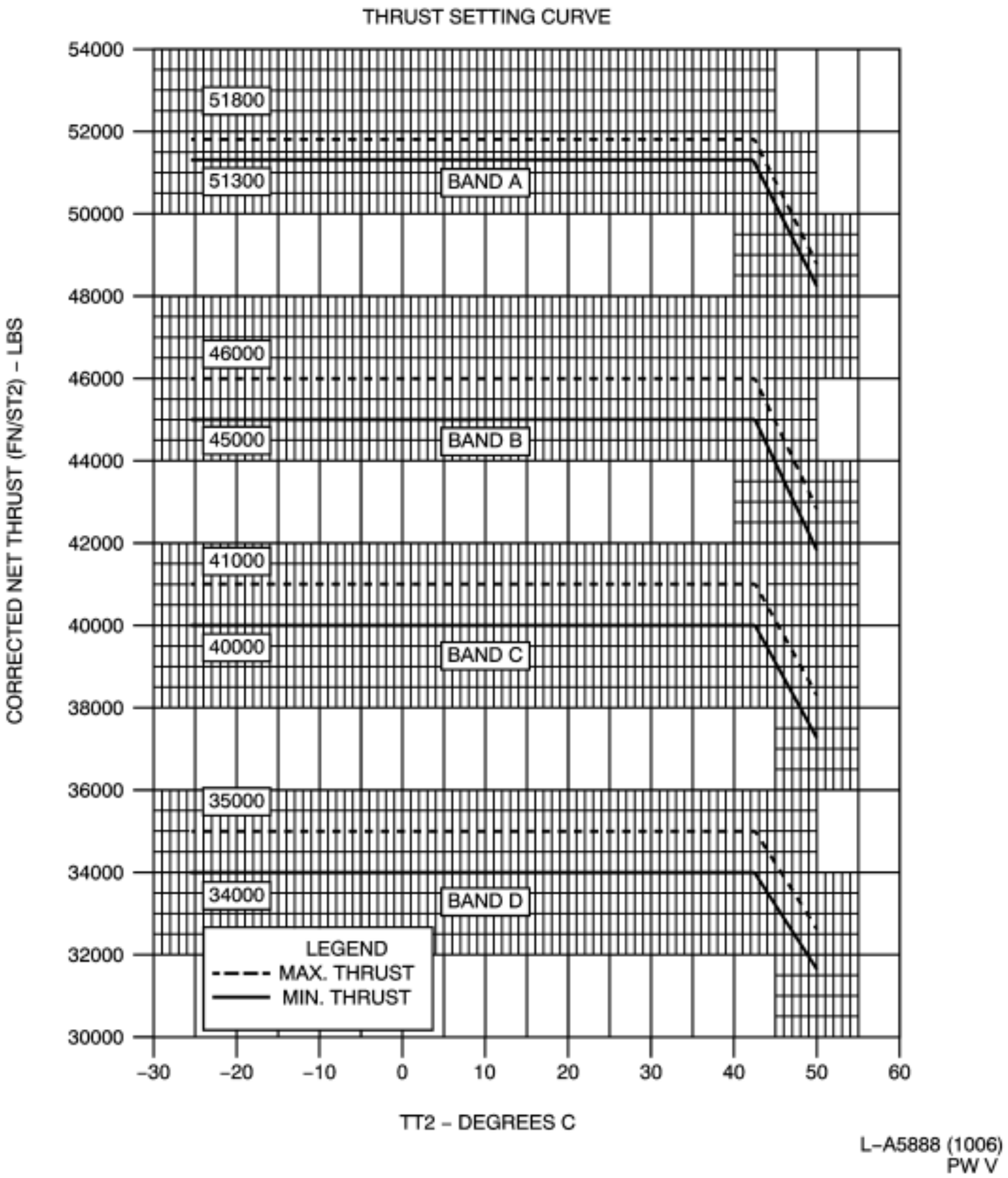
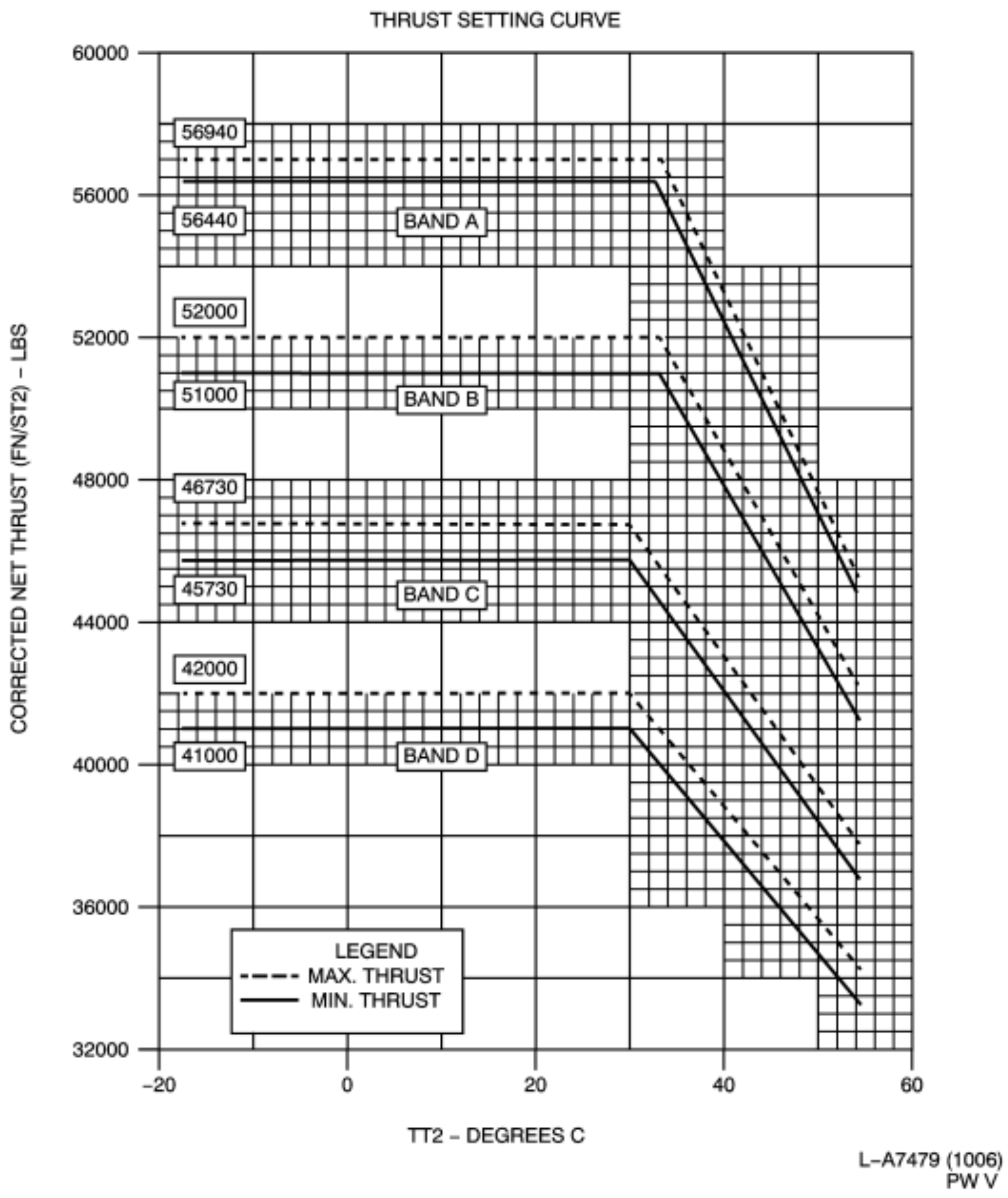
PW V

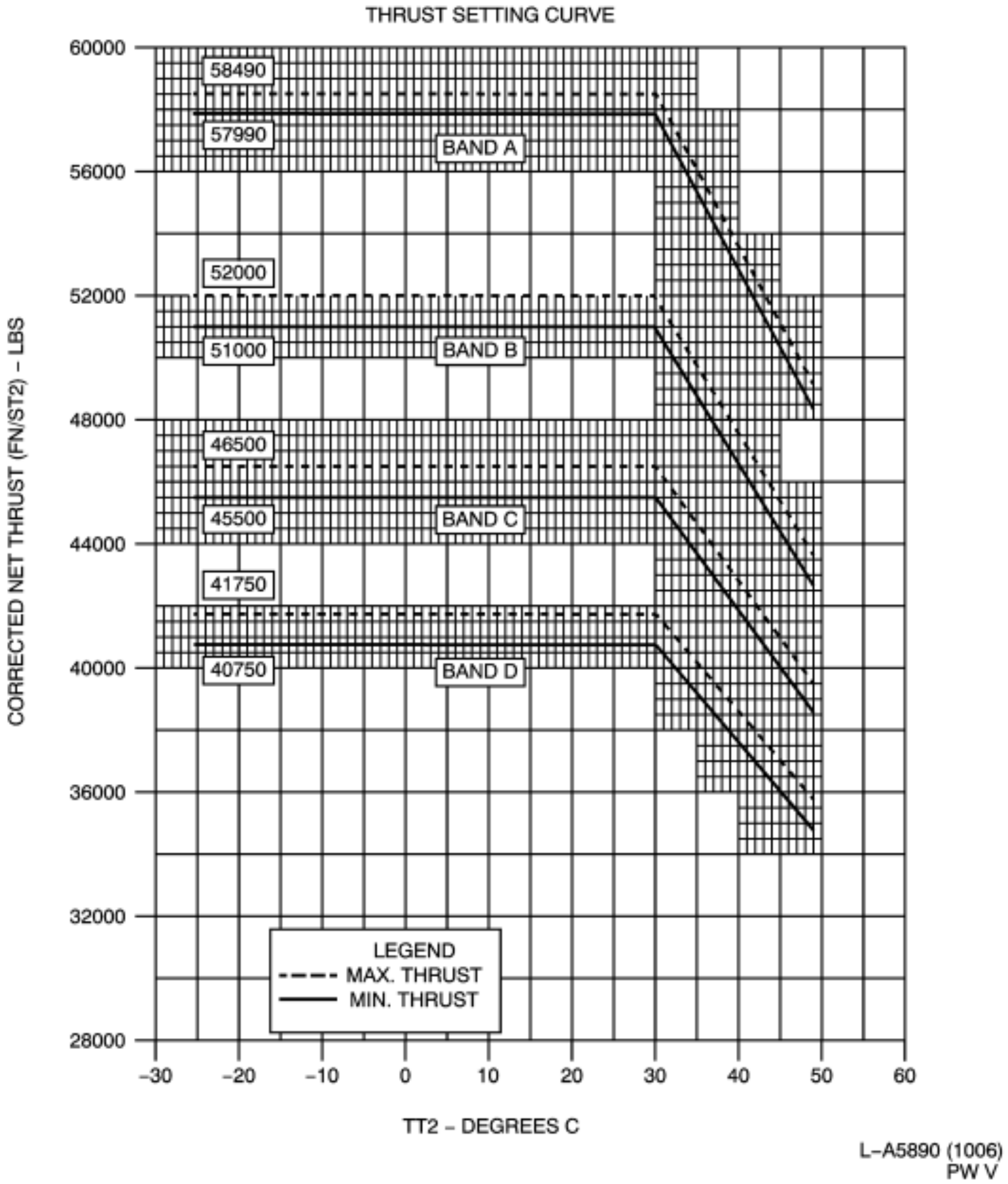
Corrected Turbine Cooling Air Pressure
Figure 1303
(Task 71−00−00−760−020)



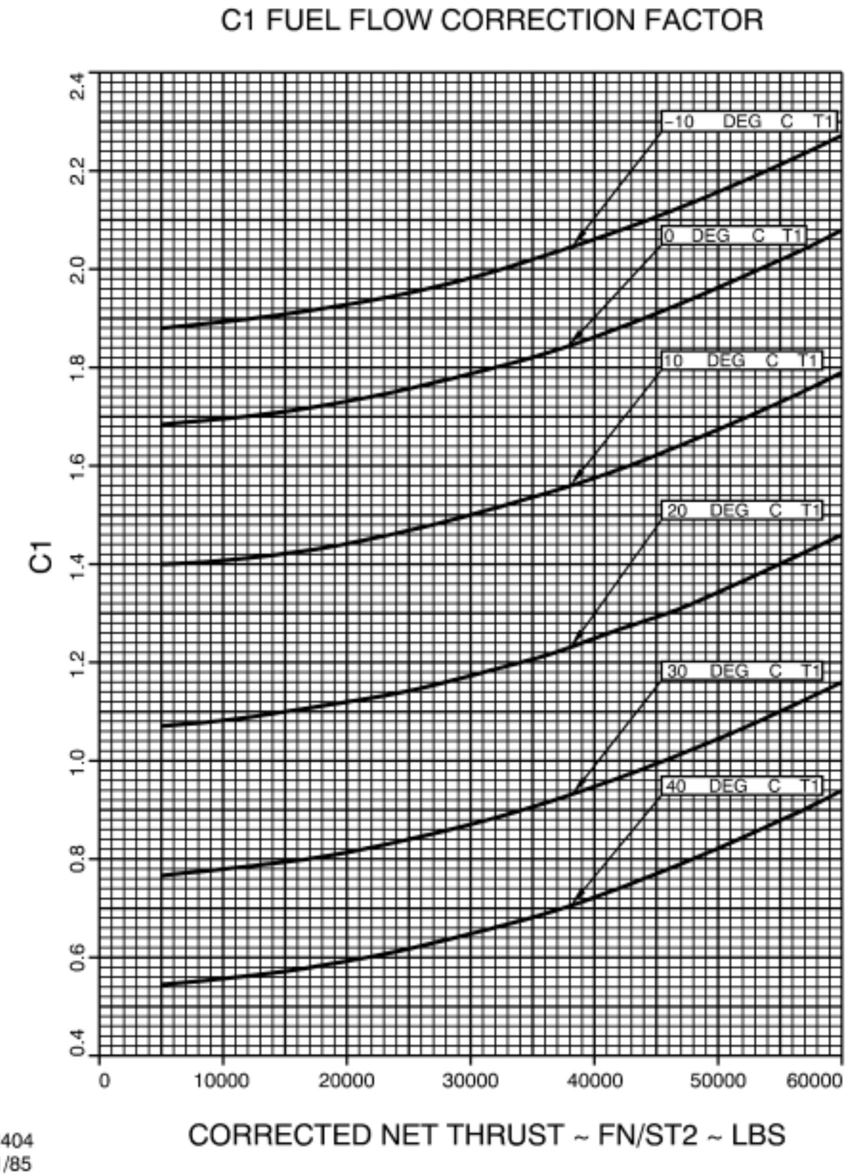
Thrust Power Setting Curve (PW4152 Engines)
Figure 1304 (Sheet 1)
(Task 71−00−00−760−020)



Thrust Power Setting Curve (PW4156A Engines)
Figure 1304 (Sheet 2)
(Task 71-00-00-760-020)



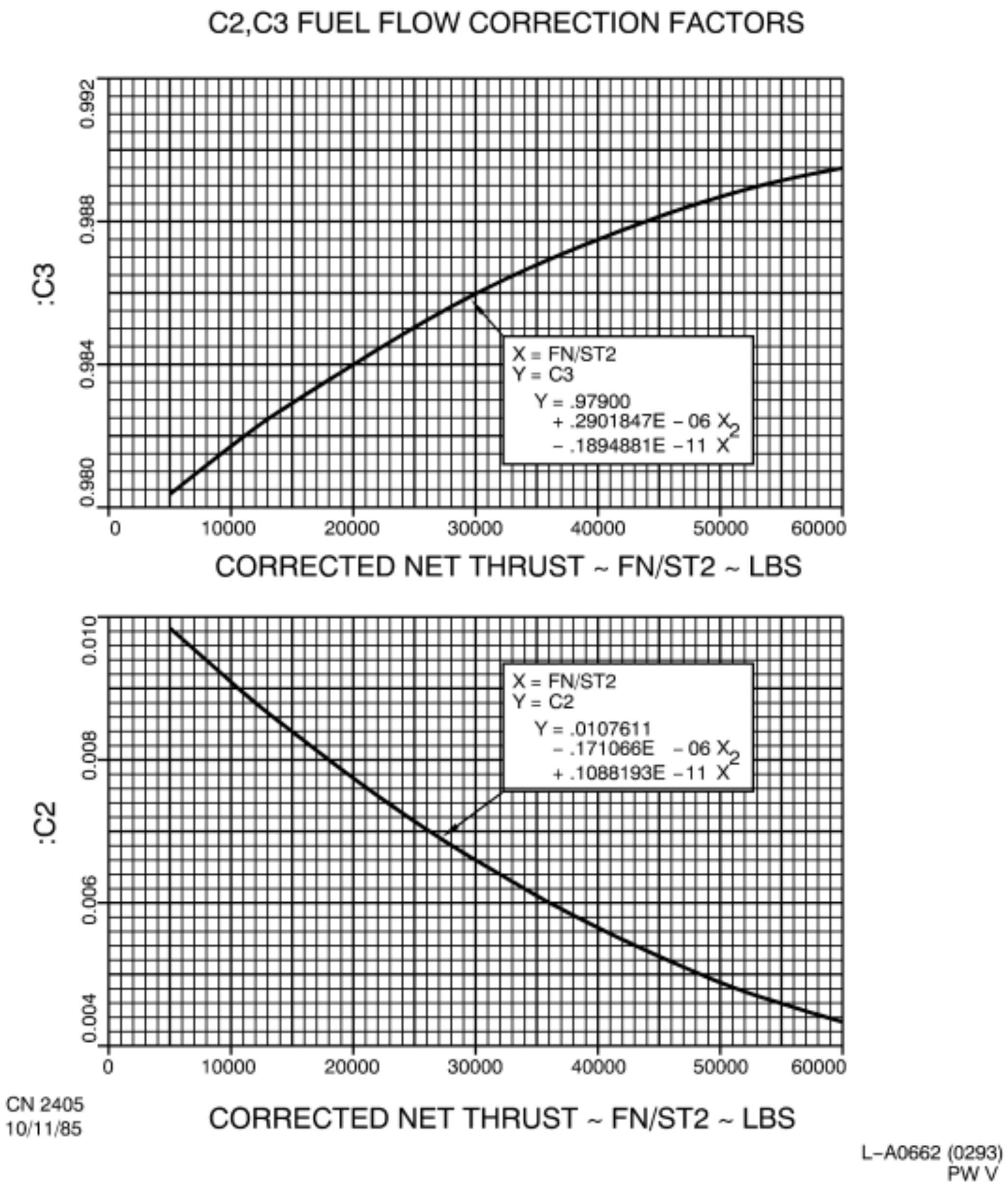
Thrust Power Setting Curve (PW4158 Engines)
Figure 1304 (Sheet 3)
(Task 71-00-00-760-020)



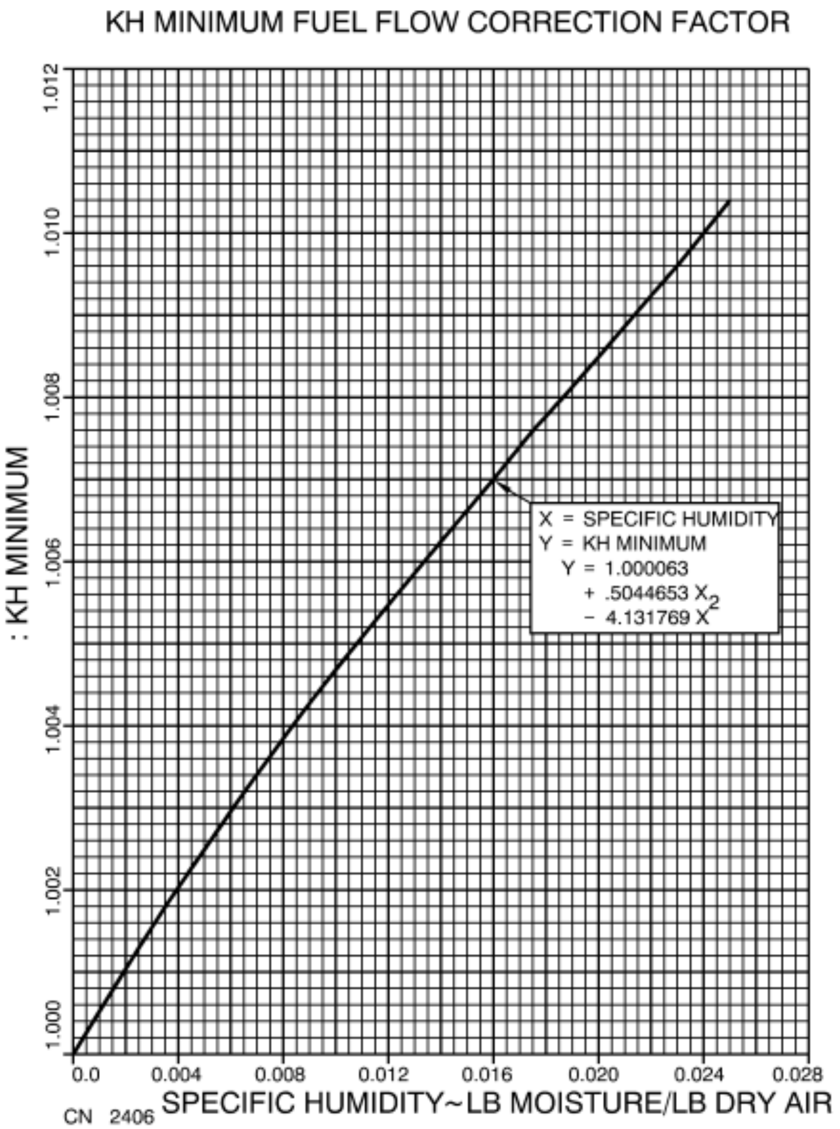
CN 2404
10/11/85

L-A0661 (0690)
PW V

Fuel Flow Correction Factors (KH)
Figure 1305
(Task 71-00-00-760-020)



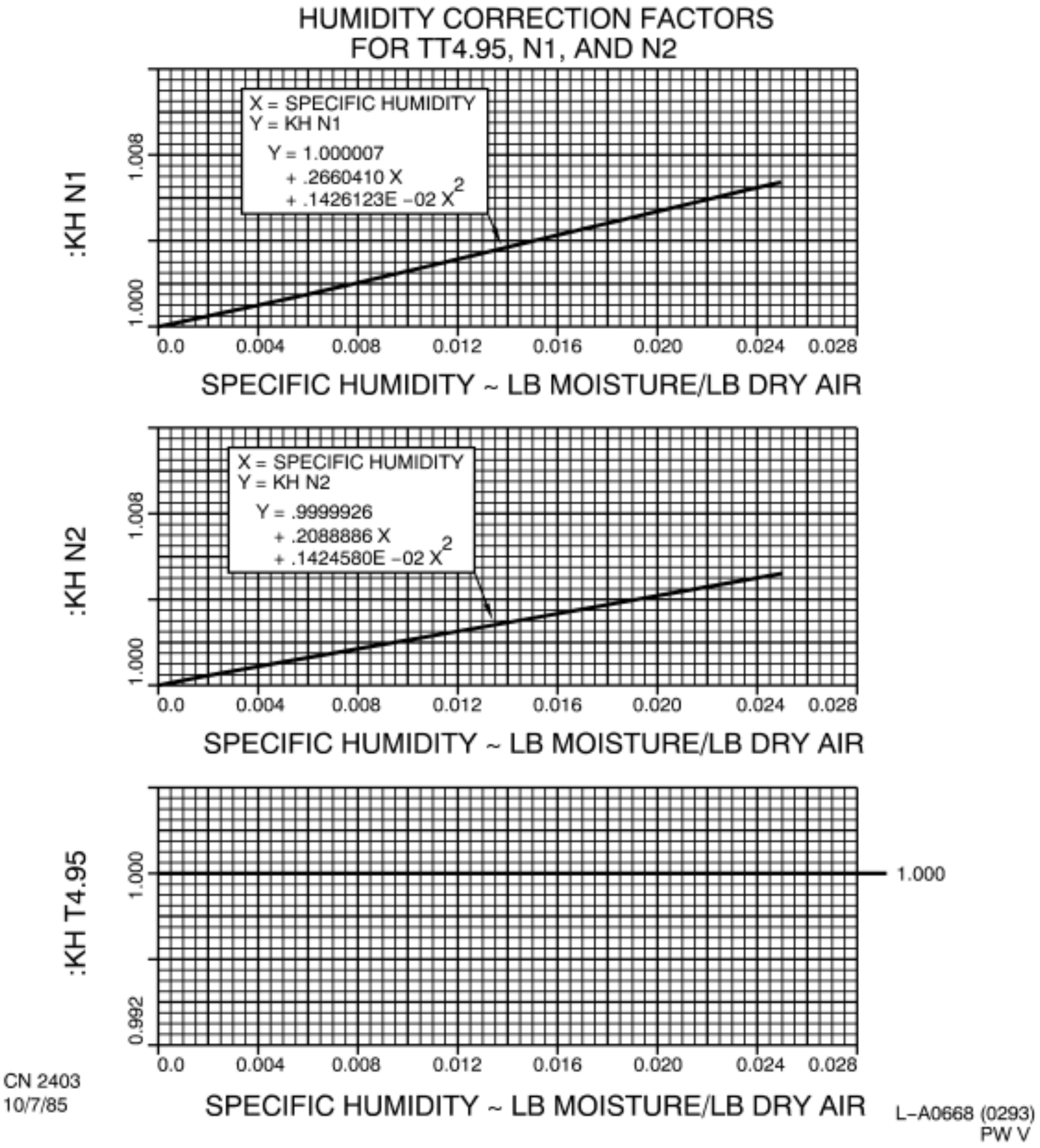
Fuel Flow Correction Factors (KH)
Figure 1306
(Task 71-00-00-760-020)



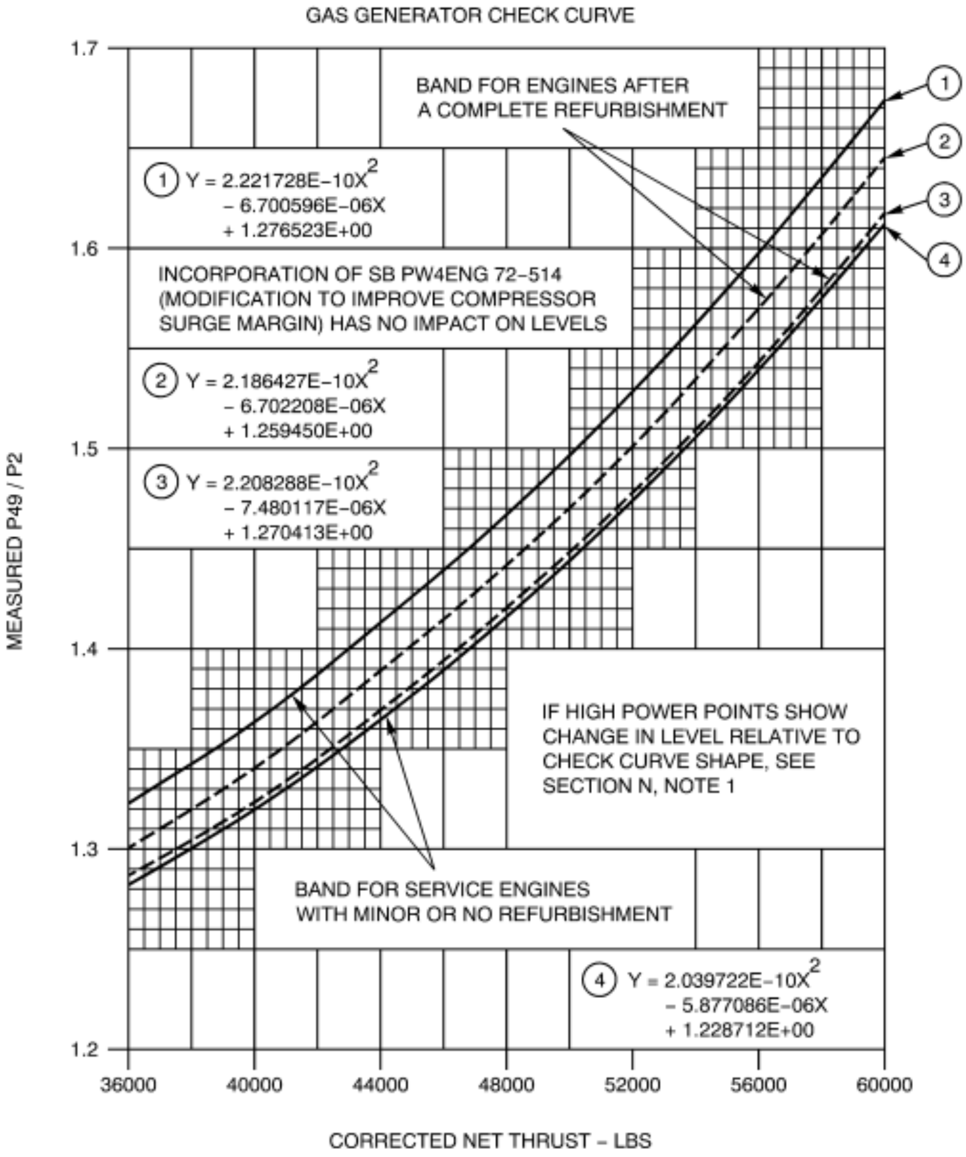
CN 2406
10/11/85

L-A0655 (0492)
PW V

Fuel Flow Correction Factors (KH)
Figure 1307
(Task 71-00-00-760-020)



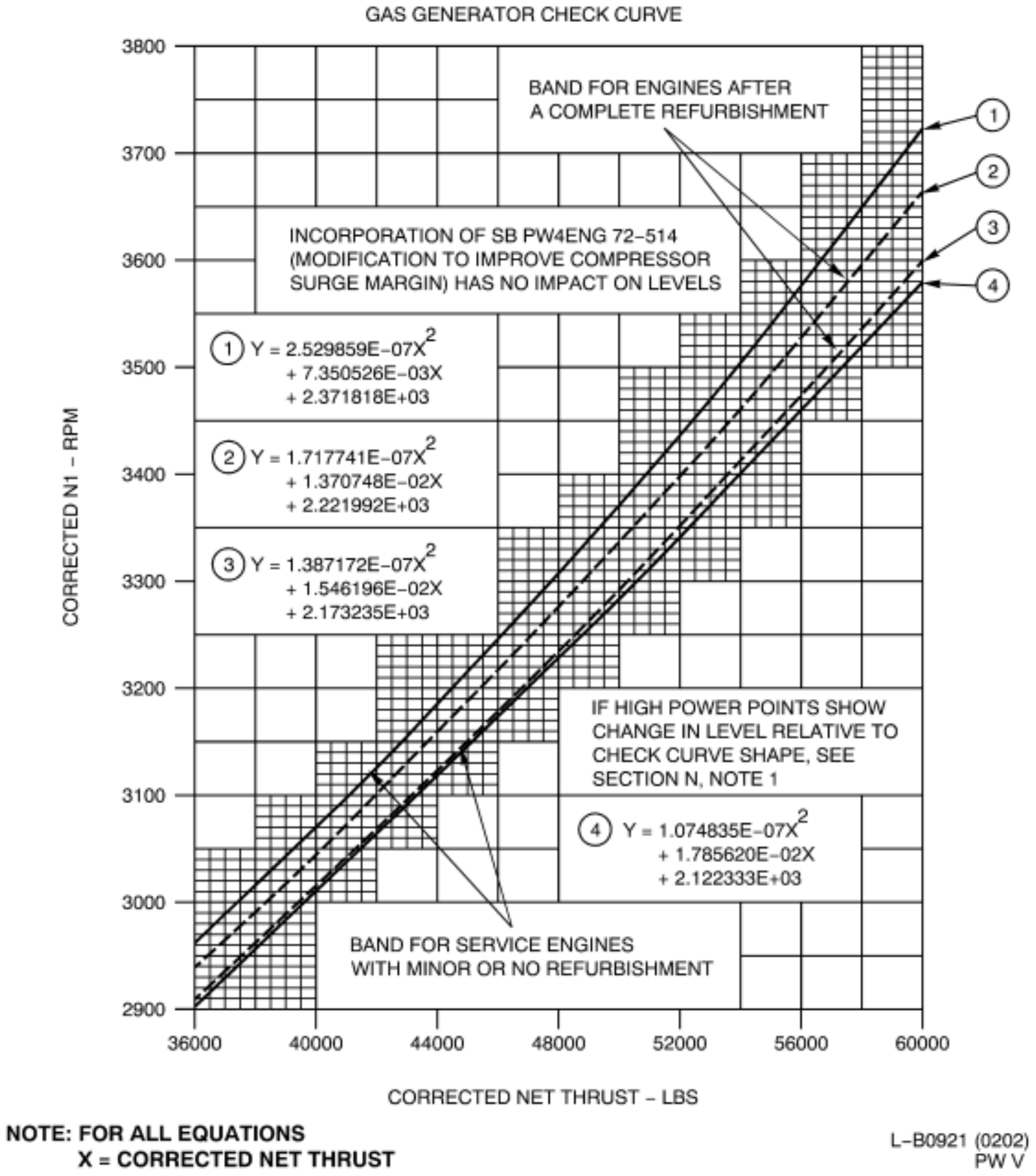
Humidity Correction Factors
Figure 1308
(Task 71−00−00−760−020)



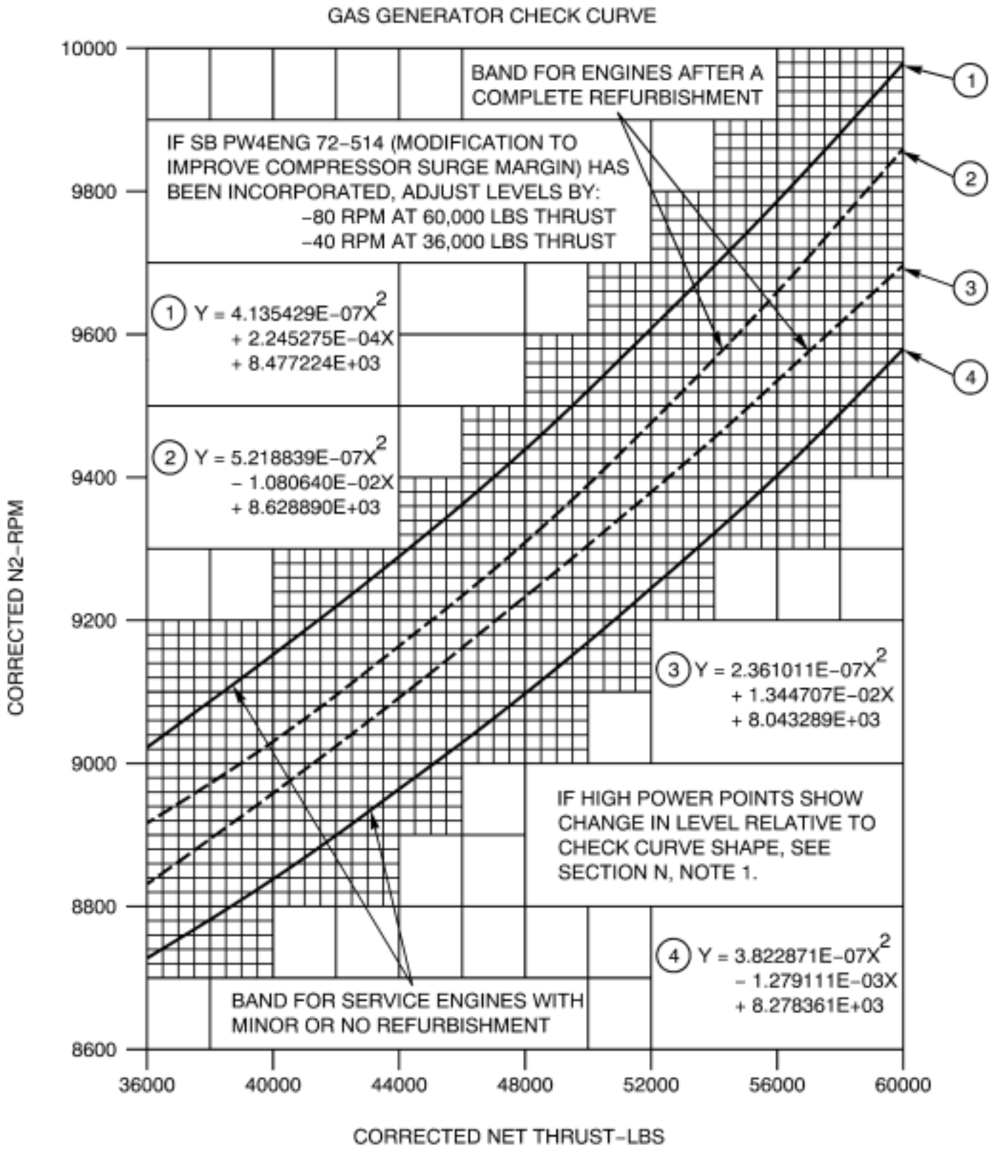
NOTE: FOR ALL EQUATIONS
X = CORRECTED NET THRUST

L-B0920 (0202)
PW V

Gas Generator Check Curves
Figure 1309 (Sheet 1)
(Task 71-00-00-760-020)



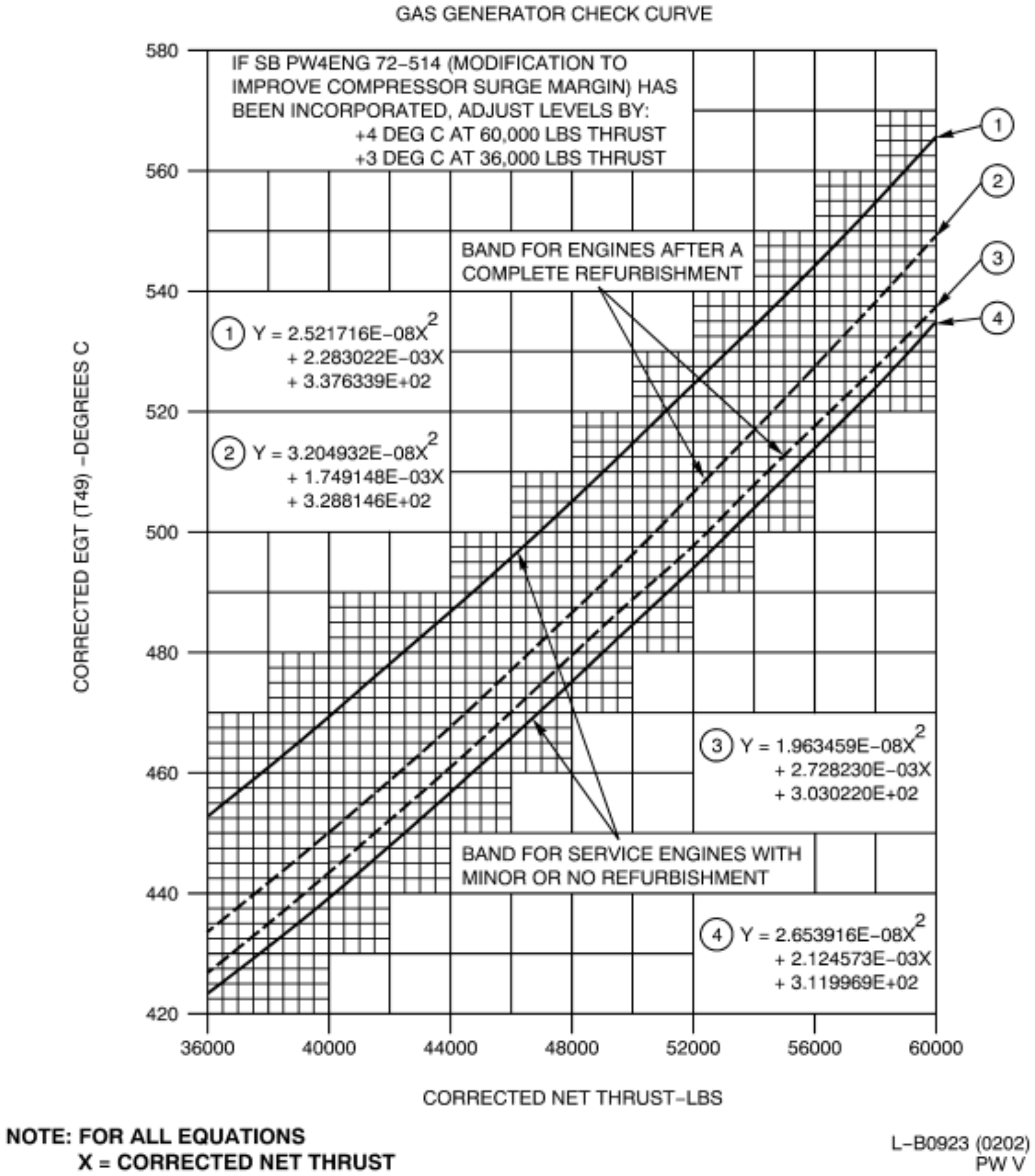
Gas Generator Check Curves
Figure 1309 (Sheet 2)
(Task 71-00-00-760-020)



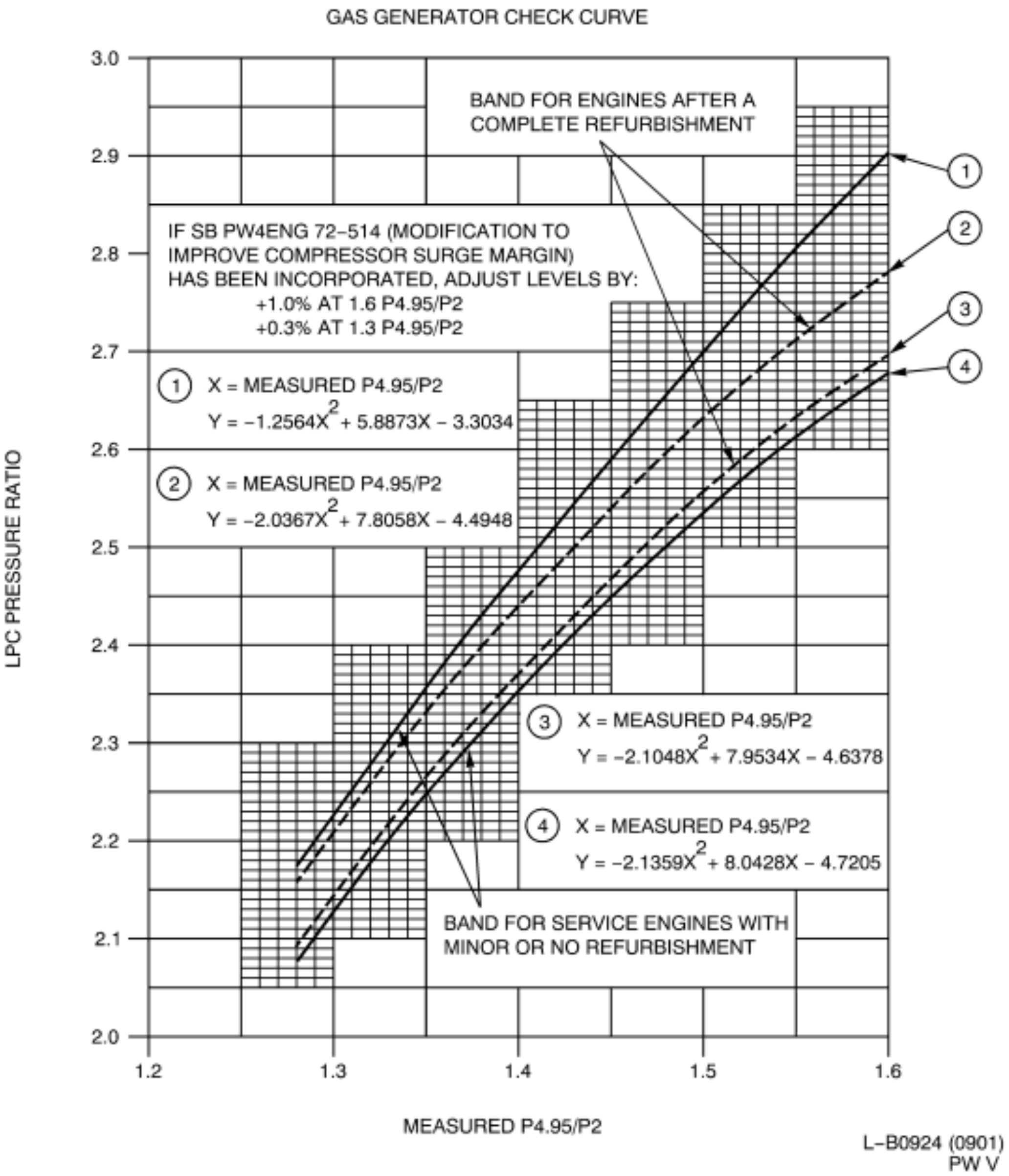
NOTE: FOR ALL EQUATIONS
X = CORRECTED NET THRUST

L−B0922 (0502)
PW V

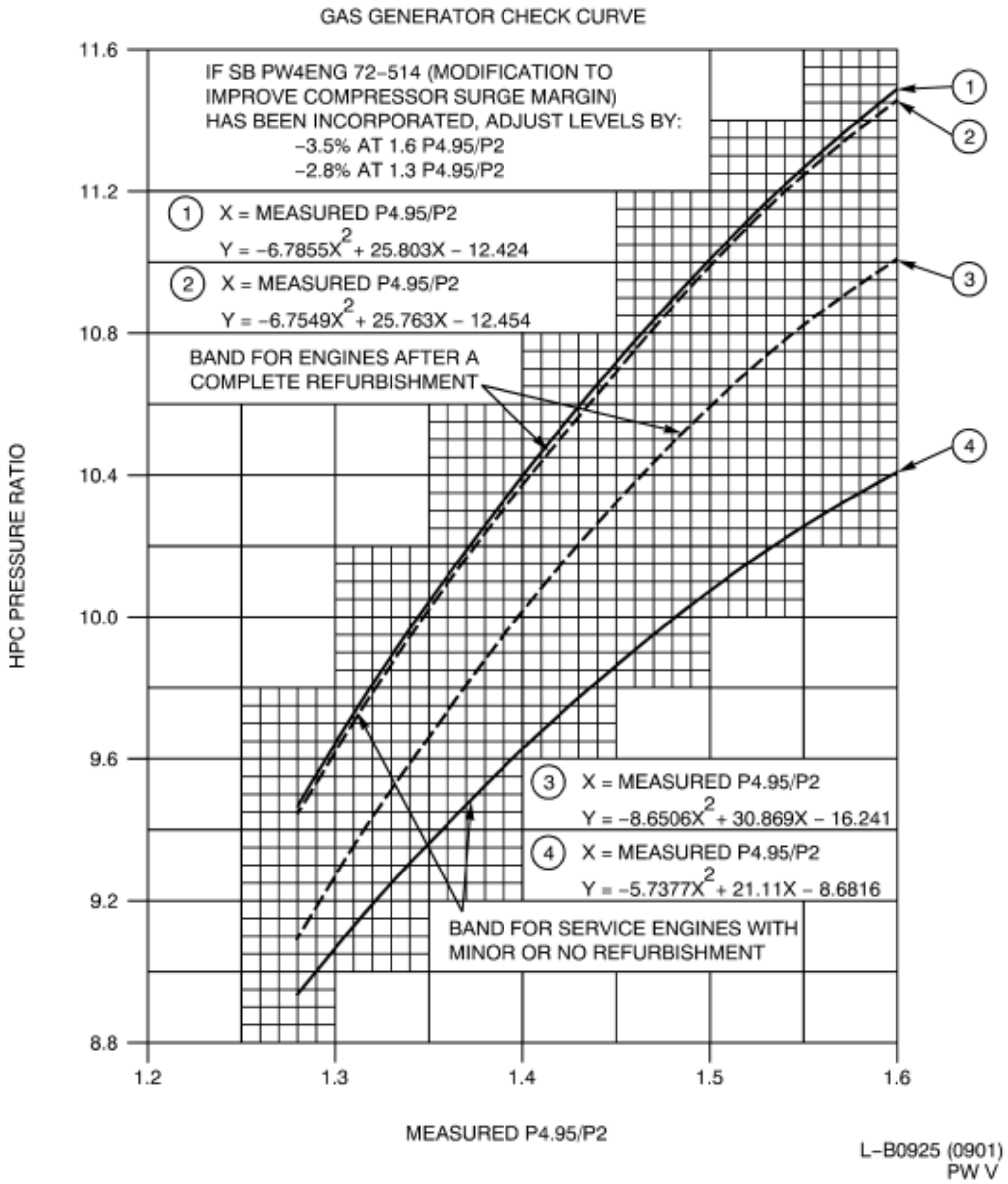
Gas Generator Check Curves
Figure 1309 (Sheet 3)
(Task 71−00−00−760−020)



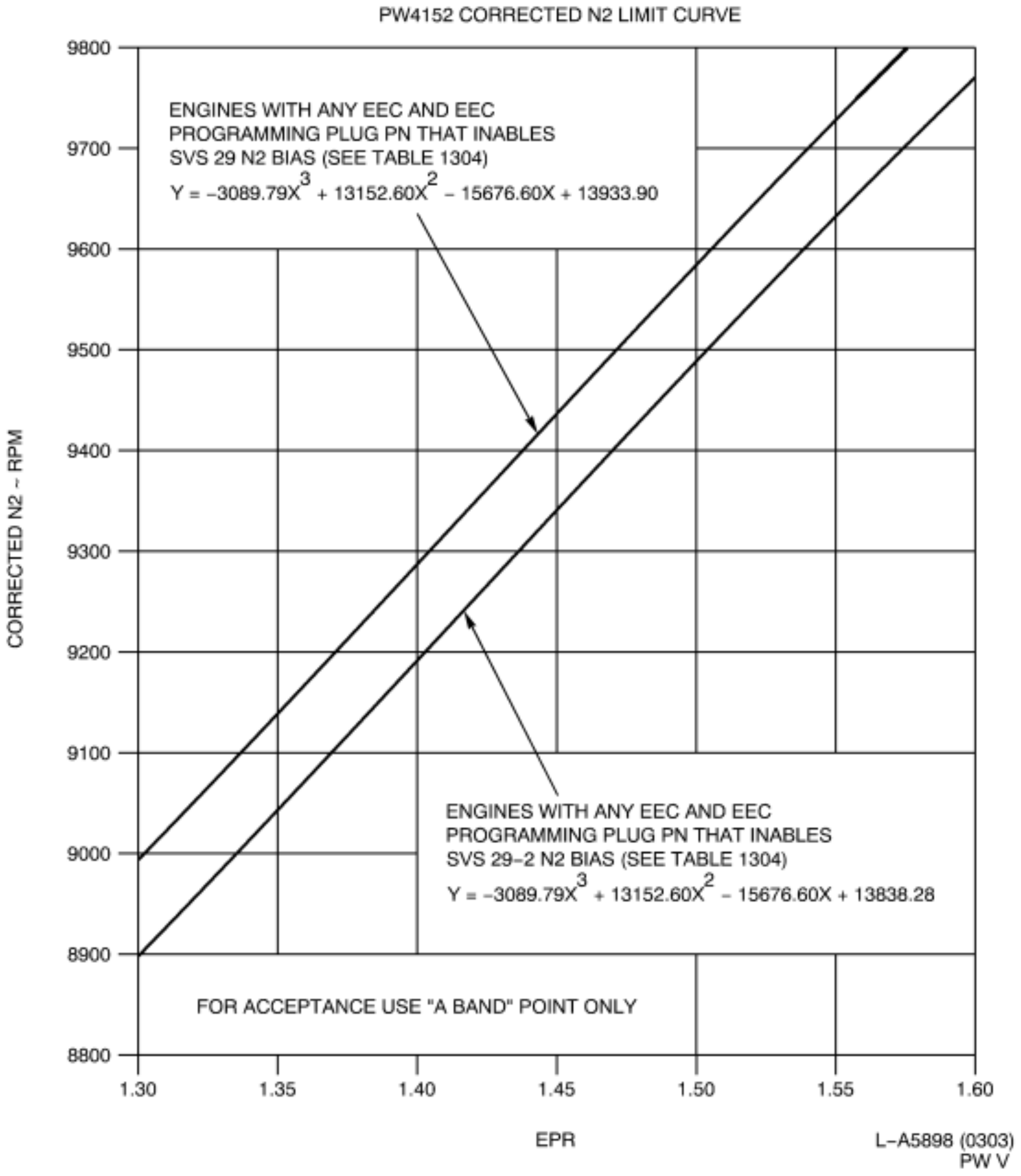
Gas Generator Check Curves
Figure 1309 (Sheet 4)
(Task 71-00-00-760-020)



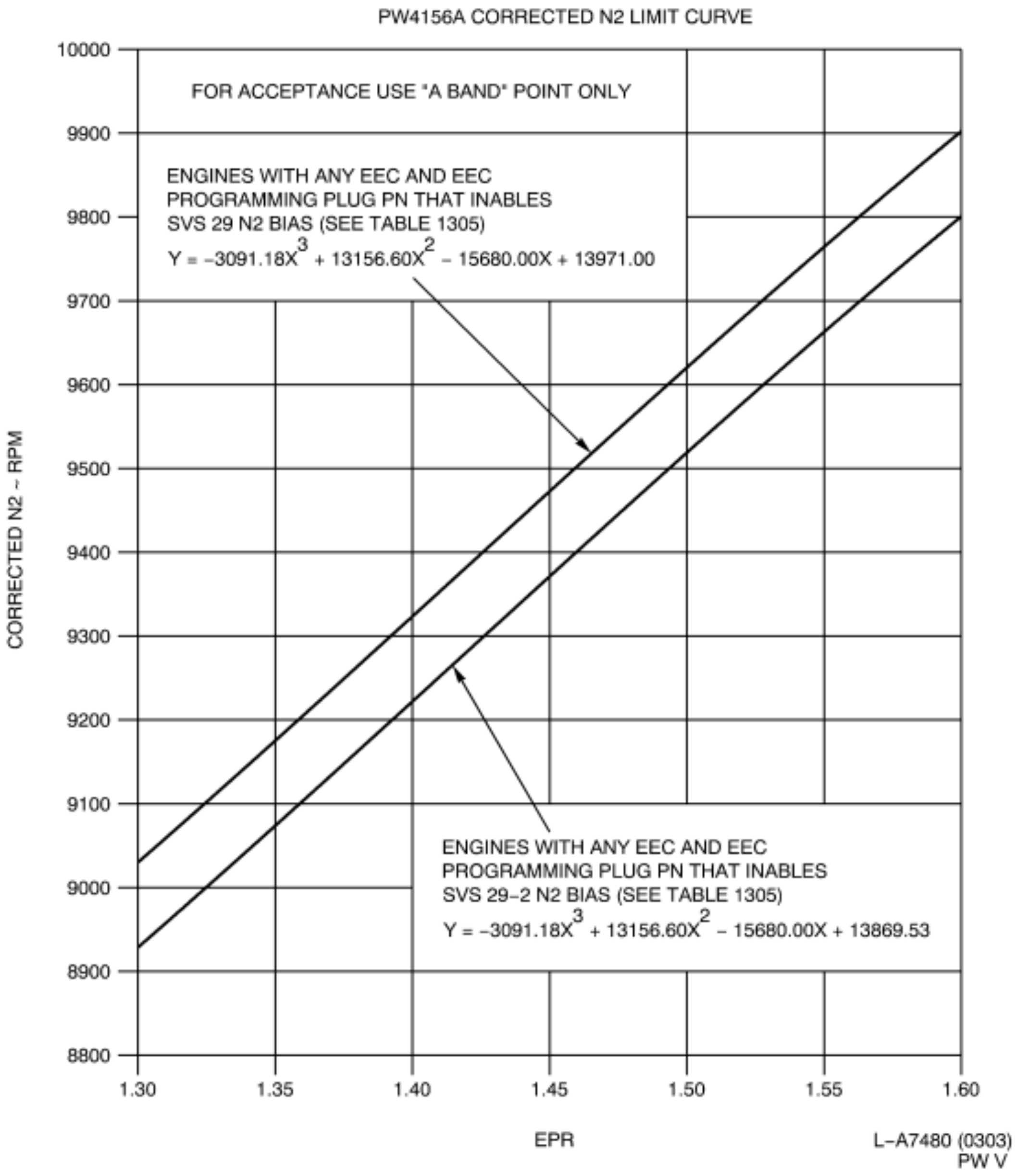
Gas Generator Check Curves
Figure 1309 (Sheet 5)
(Task 71−00−00−760−020)



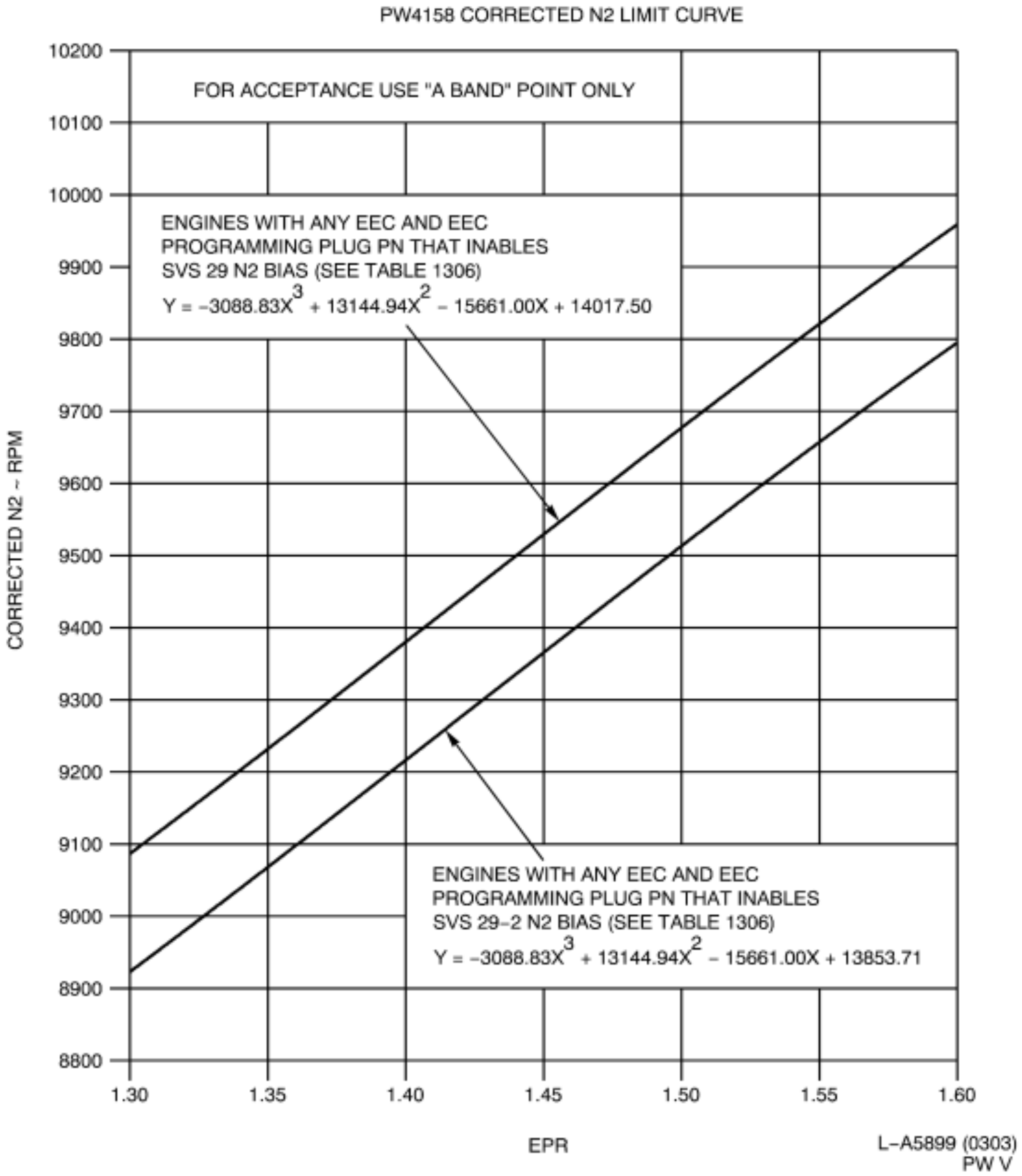
Gas Generator Check Curves
Figure 1309 (Sheet 6)
(Task 71-00-00-760-020)



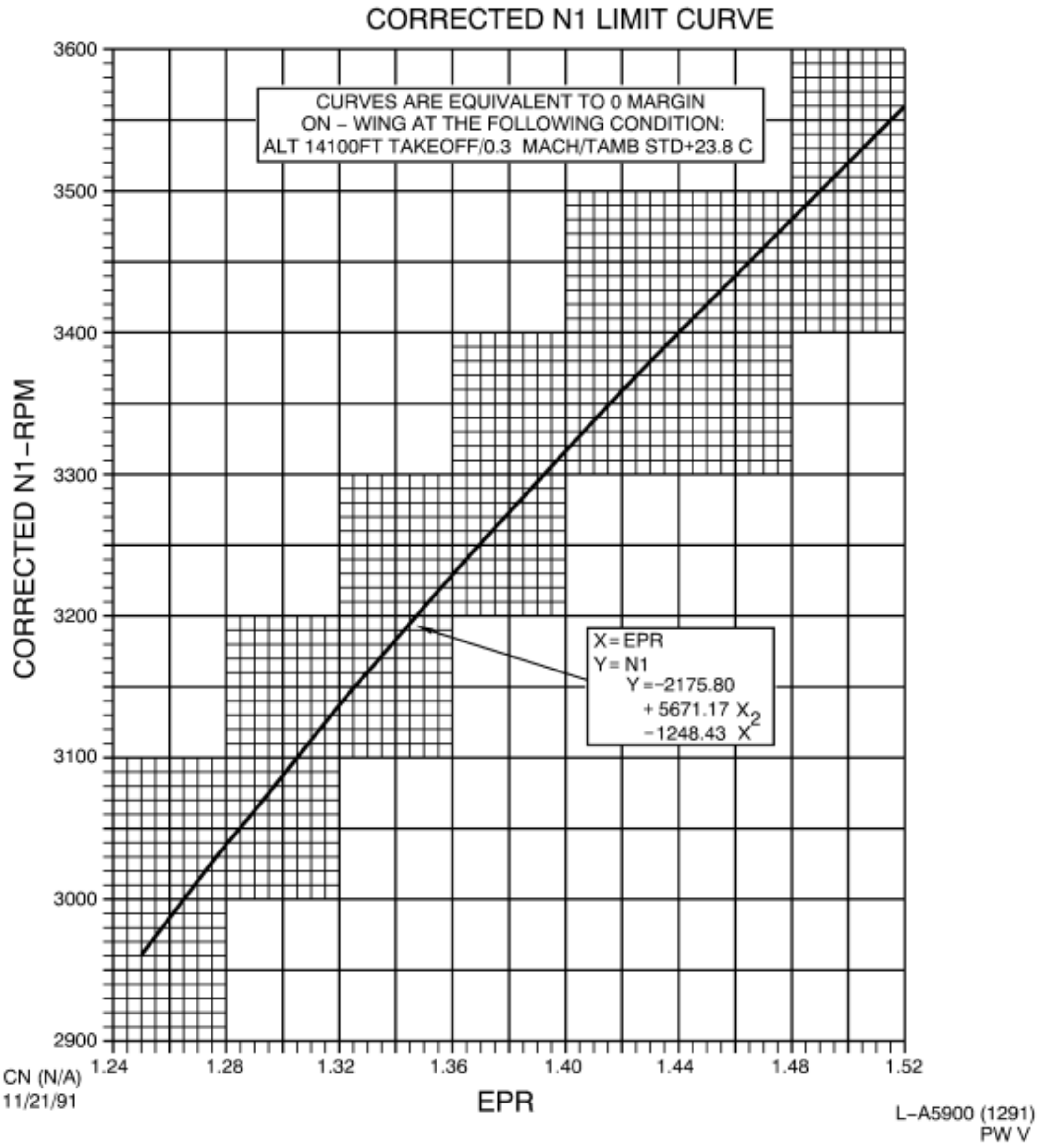
N2 Rotor Speed Limit Curve (PW4152 Engines)
Figure 1310 (Sheet 1)
(Task 71−00−00−760−020)



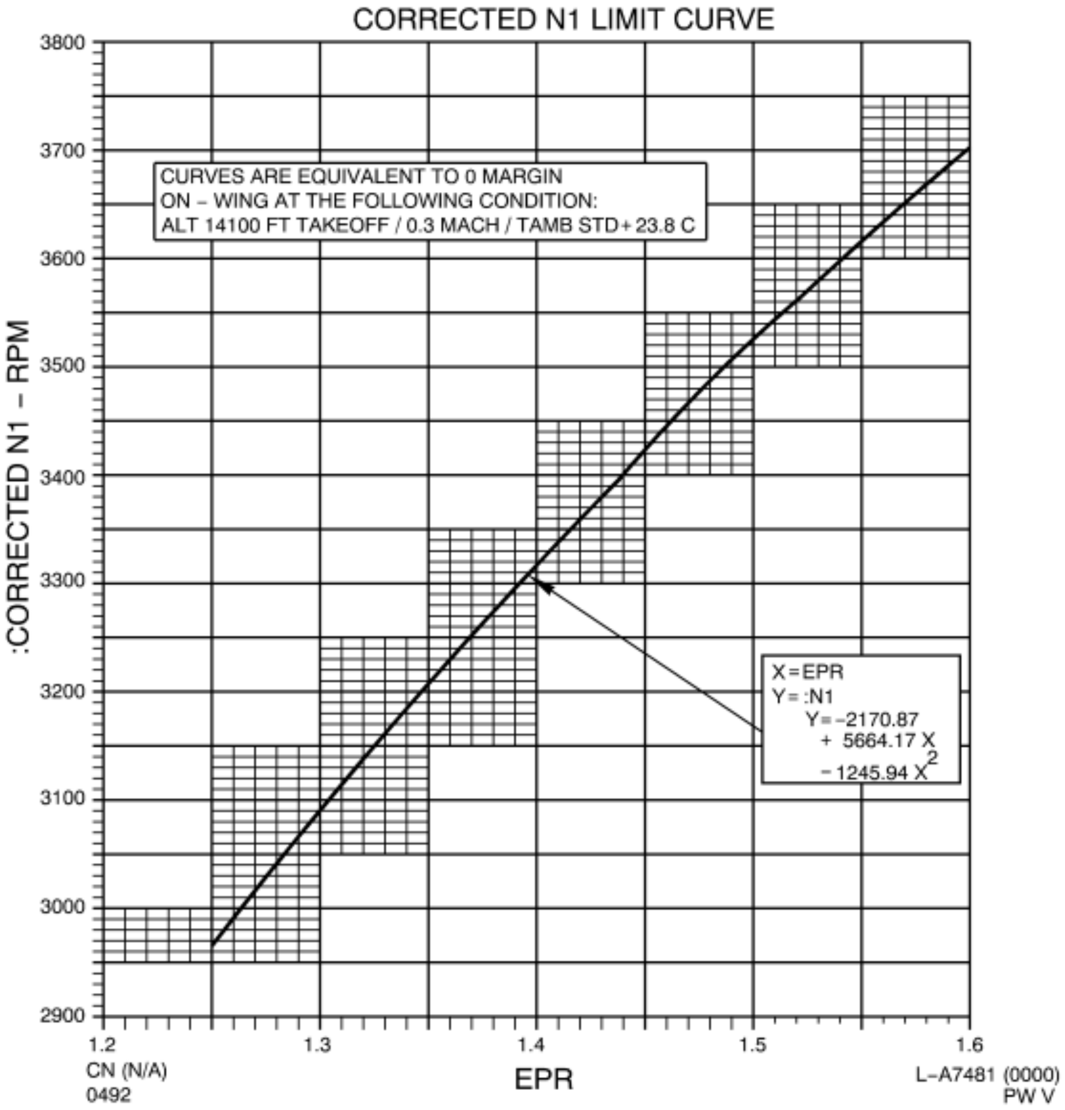
N2 Rotor Speed Limit Curve (PW4156A Engines)
Figure 1310 (Sheet 2)
(Task 71−00−00−760−020)



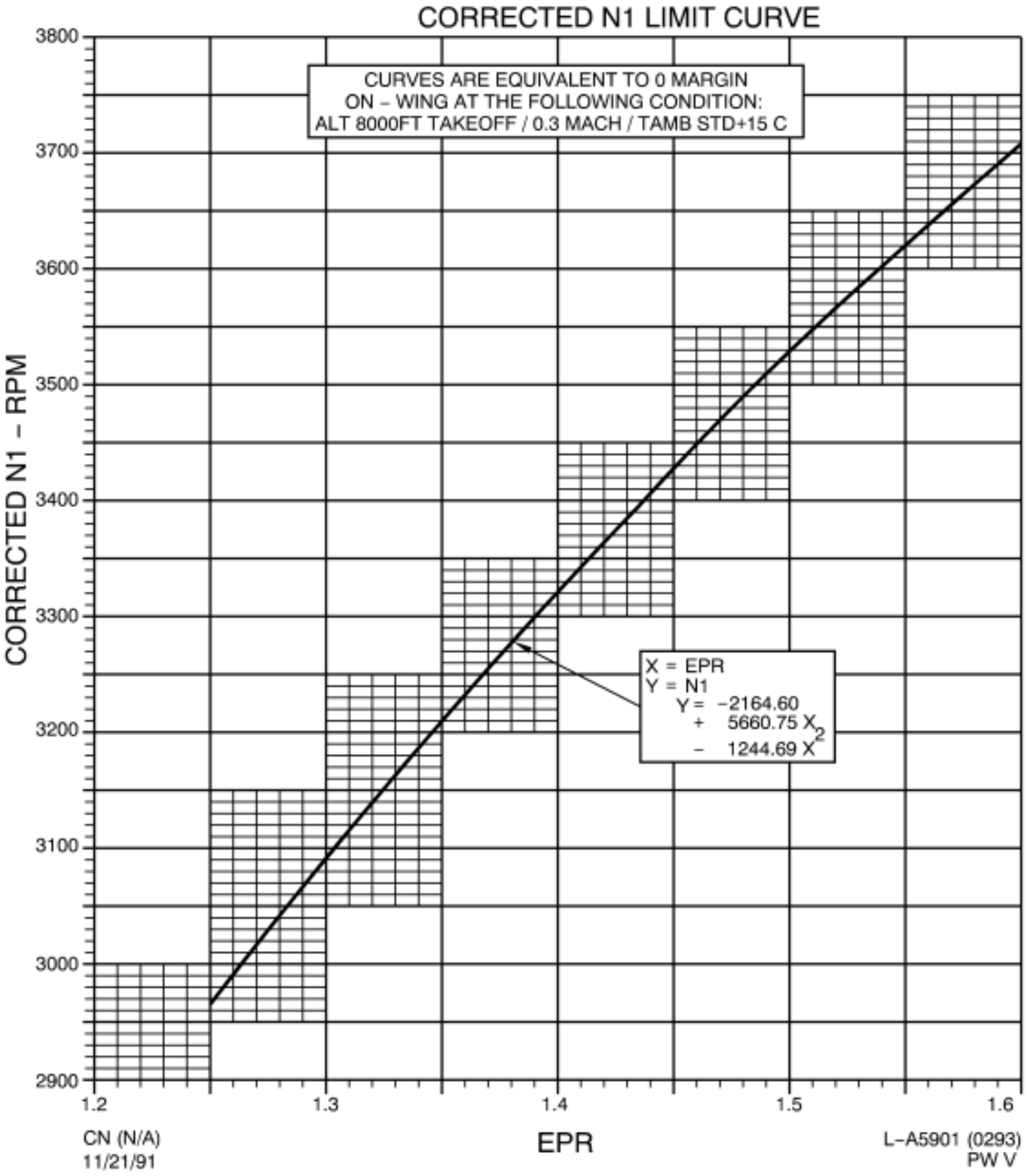
N2 Rotor Speed Limit Curve (PW4158 Engines)
Figure 1310 (Sheet 3)
(Task 71−00−00−760−020)



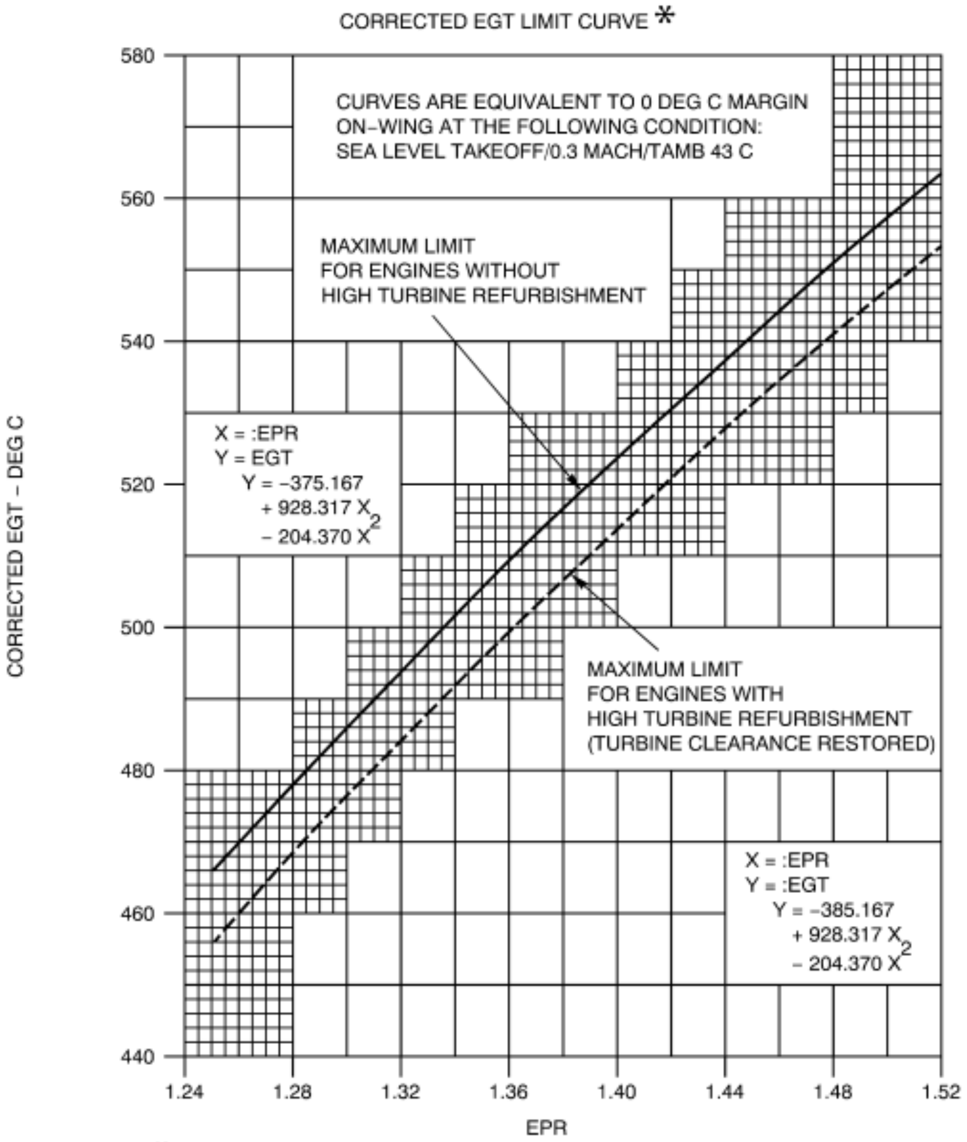
N1 Rotor Speed Limit Curve (PW4152 Engines)
Figure 1311 (Sheet 1)
(Task 71−00−00−760−020)



N1 Rotor Speed Limit Curve (PW4156A Engines)
Figure 1311 (Sheet 2)
(Task 71−00−00−760−020)



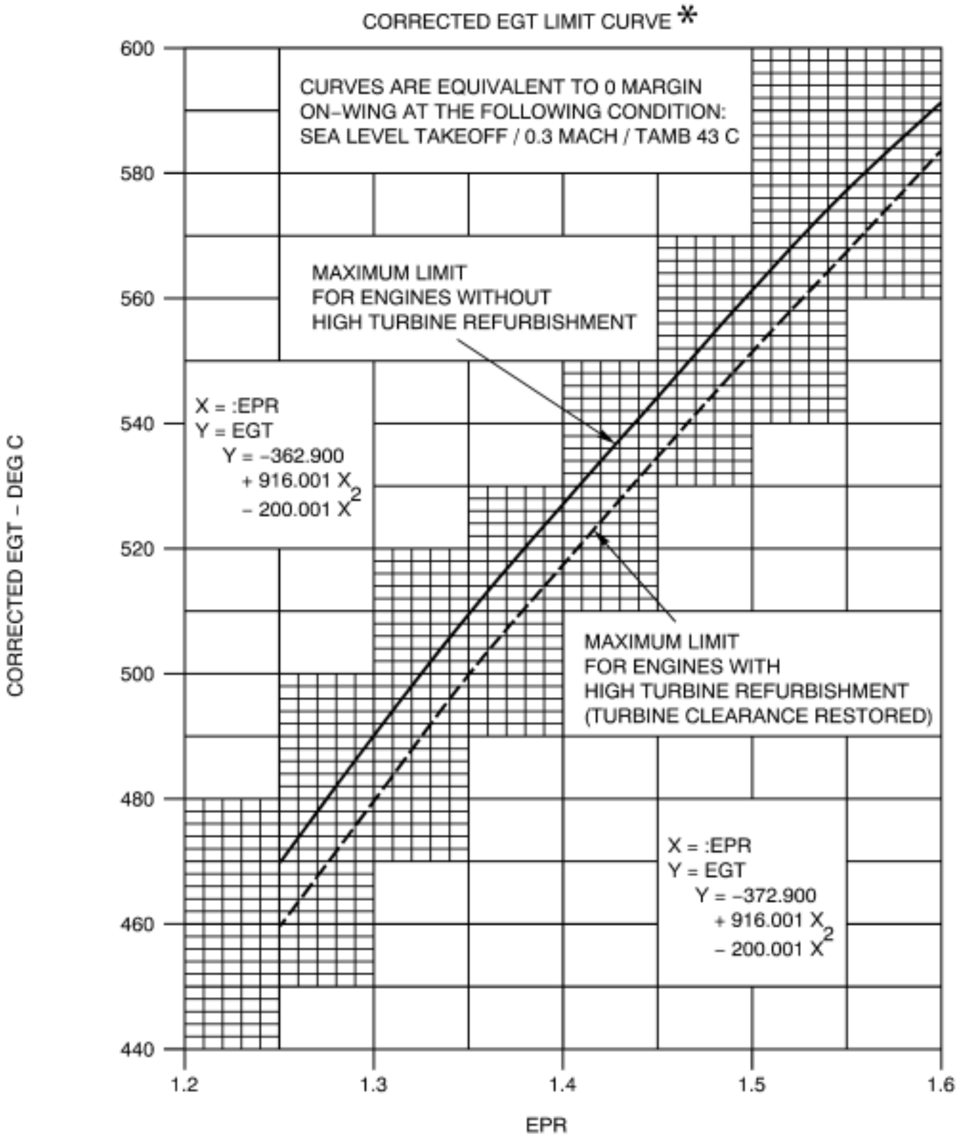
N1 Rotor Speed Limit Curve (PW4158 Engines)
Figure 1311 (Sheet 3)
(Task 71–00–00–760–020)



*NOTE: IF ENGINE IS TO BE INSTALLED WITH EEC SOFTWARE VERSION PER SB 73−168 OR SUBSEQUENT, ADD 4 °C TO LIMIT LINES.

L−A5902 (0697)
PW V

Corrected EGT Limit Curve (PW4152 Engines)
Figure 1312 (Sheet 1)
(Task 71−00−00−760−020)



*NOTE: IF ENGINE IS TO BE INSTALLED WITH EEC SOFTWARE VERSION PER SB 73-168 OR SUBSEQUENT, ADD 4°C TO LIMIT LINES.

L-A5913 (0697)
PW V

Corrected EGT Limit Curve (PW4156A And PW4158 Engines)
Figure 1312 (Sheet 2)
(Task 71-00-00-760-020)

POWER PLANT GENERAL − TESTING−09

Task 71−00−00−760−061:

1. Test No. 9 − Engine Acceptance Test

A. Prerequisite Procedure

CAUTION: ENGINE CONFIGURATION IDENTIFIER MUST BE CAREFULLY DETERMINED. FAILURE TO CORRECTLY IDENTIFY CONFIGURATION COULD RESULT IN RED LINE EXCEEDANCE AND/OR THRUST SHORTFALL

(1) Use Table 1301 to get the necessary Testing−09 configuration. Get the engine configuration from the engine identification data plate. Look for a configuration identification suffix marked after the engine model in the model field.

(a) EXAMPLE 1:

1 If "PW4158 (−3)" is marked on the engine identification plate, the configuration identifier suffix is "(−3)". This corresponds to a Phase 3 configuration as specified in Table 1301. Use TESTING−09, CONFIG−2 to do the acceptance test.

(b) EXAMPLE 2:

1 If "PW4158" is marked on the engine identification plate with no configuration identifier suffix, the configuration is Pre Phase 3 as specified in Table 1301. Use TESTING−09, CONFIG−1 to do the acceptance test.

TESTING−09 CONFIGURATION	ENGINE CONFIGURATION	CONFIGURATION IDENTIFICATION SUFFIX
Config−1	Pre Phase 3	None
Config−2	Phase 3 (Reference SB PW4ENG 72−572)	(−3)
Config−3	Intermix (−1C or −1E) (Reference SB PW4ENG 72−516)	(−1C/−1E)
Config−4	NOT AVAILABLE for Airbus installations	

TESTING−09 CONFIG/ENGINE CONFIGURATION
Table 1301

TESTING-09 CONFIGURATION	ENGINE CONFIGURATION	CONFIGURATION IDENTIFICATION SUFFIX
Config-5	Intermix (-3A) (Reference SB PW4ENG 73-150)	(-3A)

TESTING-09 CONFIG/ENGINE CONFIGURATION
Table 1301 (Continued)

(2) Use this procedure to test the engine for satisfactory performance after one or more components or modules have been replaced or repaired. This test is also used after the engine was fully disassembled, repaired and assembled.

NOTE: It is recommended that you not install large quantities of blended blades, vanes and airseals in one engine. If these parts are blended to the maximum limits in many areas, the result will be low engine performance.

(3) It is possible that other tests are necessary before you do this test, see 71-00-00 Power Plant General - Testing-00, Test Requirements After Engine/Module/Component Repair or Replacement, Task 71-00-00-990-003. This procedure will also give the sequence for the necessary tests.

(4) Special instrumentation must be installed on the engine before the engine is operated for this test.

(5) The engine testing must be done in a test configuration and test cell that has been calibrated. Calibrate to the specifications shown in P&W Publication Report No. 544. All test data must be corrected to the special test cell correction factors before you use the limits and curves in this procedure.

(6) For general safety information, see 71-00-00, Power Plant General - Testing-00, Engine Safety Precautions, Task 71-00-00-990-004.

(7) For safe engine operation, see 71-00-00, Power Plant General - Testing-00, Precautions And Procedures For Safe And Correct Engine Operation, Task 71-00-00-760-002.

(8) For engine operation limits, see 71-00-00, Power Plant General - Testing-00, Engine Operation Limits, Task 71-00-00-990-007.

B. Equipment And Materials Necessary

Standard Tools (See 71-00-00, Power Plant General - Testing-00, Prepare The Engine For Test In A Cell, Task 71-00-00-480-001

(1) Fuel pump drain hose and collection bottle.

(2) Stator vane drain hose and collection bottle.

(3) Station 2.5 compressor bleed actuator drain hose and collection bottle.

(4) Air/oil cooler modulating valve drain hose and collection bottle.

(5) IDG air/oil cooler modulating valve drain hose and collection bottle.

(6) TCC actuator modulating valve drain hose and collection bottle.

(7) Accessory drive fluid power pump drain hose and collection bottle.

(8) Starter drive drain hose and collection bottle.

(9) IDG drain hose and collection bottle.

(10) Accessory drive EEC generator seal drain hose and collection bottle.

(11) Fuel/oil heat exchanger IDGS core drain hose and collection bottle.

(12) Fuel/oil heat exchanger engine oil core drain hose and collection bottle.

(13) Fuel/oil heat exchanger IDG center tube drain hose and collection bottle.

(14) Bypass valve drain hose and collection bottle.

(15) Hydraulic pump drain hose and collection bottle.

C. Test Instrumentation And Test Cell Connections.
Install the special instrumentation and equipment that follows:

(1) PT2 and PS2 (8 locations) − (optional)

(2) PT2/TT2 Rosemount probe − (PWA 85523)

(3) TT2 − Compressor inlet total temperature (8 locations)

(4) Fuel flow (observed)

(5) T Fuel

(6) N1 RPM − (NL)

(7) N2 RPM − (NH)

(8) PT2.5*

(9) PS3

(10) PS4I (Optional)

(11) PT4.95

(12) Main Oil Pressure

(13) Main Oil Temperature

(14) Oil Filter Differential Pressure

(15) Fuel Pump Inlet Pressure

(16) Fuel Pump Pressure

(17) PAMB

(18) TT2.5*

(19) TT3*

(20) Vibration, fan case flange A (vertical)

(21) TT4.95 Harness Average (stand reading) If EEC T49 value is used, adjustment to T4.95 (real without shunt) must be made.

(22) Thrust − (observed)

(23) Thrust Lever and Fuel Select Switch

(24) Ignition Switch

(25) Test Cell Fuel Supply Pressure

(26) ARINC 429 transceiver.

(27) No. 3 Bearing Compartment Breather Pressure

* - A necessary parameter for the module analysis program MAPNET System. Optional unless a MAPNET System analysis is necessary.

D. Thrust Rating and Operation Limits

(1) Ratings at static sea level standard conditions are shown in Table 1302.

ENGINE MODEL	THRUST SETTING	JET THRUST LBS. (N)	TSFC *
PW4152 (-3)	TAKEOFF	51110 (227348)	0.3353
PW4152 (-3)	MAX CONTINUOUS	47160 (209778)	0.3284
PW4152 (-3)	90% MAX CONTINUOUS	42450 (188827)	0.3219
PW4152 (-3)	70% MAX CONTINUOUS	34200 (152129)	0.3154
PW4156A (-3)	TAKEOFF	55950 (248878)	0.3457
PW4156A (-3)	91% TAKEOFF	51000 (226859)	0.3351
PW4156A (-3)	MAX CONTINUOUS	45730 (203417)	0.3262
PW4156A (-3)	90% MAX CONTINUOUS	40940 (182110)	0.3202
PW4158 (-3)	TAKEOFF	57610 (256262)	0.3498
PW4158 (-3)	88% TAKEOFF	51000 (226859)	0.3351
PW4158 (-3)	MAX CONTINUOUS	45490 (202349)	0.3259
PW4158 (-3)	90% MAX CONTINUOUS	40770 (181354)	0.3201

*NOTE: TSFC (Thrust Specific Fuel Consumption) is for reference only for a new engine and is not necessary for the engine Acceptance Test.

THRUST AND TSFC RATINGS AT SEAL LEVEL STANDARD CONDITIONS
Table 1302

(2) The engine speed limits are shown in 71-00-00, Power Plant General - Testing-00, Engine Operation Limits, Task 71-00-00-990-007.

(3) The engine exhaust gas temperature (EGT) limits for Station 4.9 are shown in 71−00−00, Power Plant General − Testing−00, Engine Operation Limits, Task 71−00−00−990−007.

E. Seal Drain Leakage Limits

(1) During the Acceptance Test, the seal leakage must be measured. See 71−00−00, Power Plant General − Testing−00, Engine Operation Limits, Task 71−00−00−990−007.

(2) Attach a hose to each seal drain connection and put the other end of the hose in a collection bottle. Each bottle must be identified.

F. Multi−Point Instrumentation

(1) Multi−point instrumentation is necessary and is measured during the acceptance test for some parameters. To get satisfactory data, there is a limit for sampling points that do not operate. The necessary multi−point instrumentation and points that do not operate are listed as follows:

(a) TT2 − Eight sampling points are necessary with a maximum limit of two points that do not operate.

(b) Bellmouth pitot static probes (PT2 and PS2) − This parameter is optional. If it is used, eight sampling points are necessary with a maximum limit of two points that do not operate.

(c) Pitot static probes must be installed for test cell correlation testing. See the specifications shown in P&W publication Report No. 544.

(d) PT2 can be calculated for post test cell correlation testing without pitot static probes. Do a correlation of PT2 (pitot static) to: PT2 Rosemount probe, P cell or (PT2/Pamb vs N1 corrected).

G. Acceptance Test General Specifications

(1) Use the definitions that follow during the acceptance test.

(a) EPR−0 = Engine Pressure Ratio from the EEC (Electronic Engine Control) instrumentation system with a zero delta EPR modified (Class 09) Engine Program Plug (EPP) installed in the Electronic Engine Control (EEC).

OR

EPR−0 can be calculated by adding the necessary EPR Modification (delta EPR) used during the test run to the EPR output from the Engine Control (Engine Electronic Control EPR therefore EECEPR).

In the Airbus Engine Control logic EPR modification (delta EPR) is a function of TRA (throttle lever resolver angle). To correctly calculate EPR−0 from EECEPR, EPR class and TRA are necessary.

The Control logic removes the EPR modification (delta EPR) at low power to align the right and left wing engines. This logic is unique to Airbus installations and controls because it occurs in sea level test range, (below "C" band point when the TRA is less than 72 degrees).

Calculation of EPR−0. Because the recommended test configuration is with a class 16/ −0.028 delta EPR modifier, the calculation is shown as follows:

EECEPR = EPR−028

If TRA is equal or greater than 72 degrees,
EPR−0 = EPR−028 + .028

If TRA is between 40.5 and 72 degrees,
EPR−0 = EPR−028 + (1−(72−TRA)/31.5) x .028

If TRA is equal or less than 40.5 degrees,
EPR−0 = EPR−028

For other EPR class modifiers (other than class 16), see Table 1303 for values.

(b) EPR-028 = Engine Pressure Ratio form the EEC (Electronic Engine Control) instrumentation system with a class 16 (-0.028 delta) EPR modifier Engine Programming Plug (EPP) installed in the EEC.

(c) EPR = Engine Pressure Ratio From the EEC (Electronic Engine Control) instrumentation system with a class EEC programming plug to be calculated. To calculate EPR, (EPR-0 + delta EPR modifier). EPR is the value used in Paragraph Q. Check For Engine Acceptance to check for engine acceptance and to calculate engine margin to the limits.

(d) TRA = Throttle Resolver Angle, position of the EEC thrust control lever as specified by the electrical signal from the EEC.

EPR CLASS	EPR MODIFICATION (DELTA EPR)
01	+ .032
02	+ .028
03	+ .024
04	+ .020
05	+ .016
06	+ .012
07	+ .008
08	+ .004
09	0.0
10	- .004
11	- .008
12	- .012
13	- .016
14	- .020
15	- .024
16	- .028

EEC PROGRAMMING PLUG (EPP) CLASSIFICATION
Table 1303

(2) All Acceptance Test specifications are from the test cell instrumentation except the EPR (Engine Pressure Ratio) which is the EPR value from the EEC. The EEC values for Tt2, N1, N2 can be used if it is shown they are consistent and equal to the stand readings. This must be done during the test cell correlation testing. The EEC values must be within the limits and tolerances of 71-00-00 Testing-00 Table 1305 of Test Instrumentation Calibration (Task 71-00-00-990-002).

Any exceptions to this rule will be specified in the test procedure or correction to the observed section.

CAUTION: IF YOU USE AN INCORRECT EPP PLUG DURING ENGINE TEST, YOU WILL CAUSE ERRORS IN SETTING THE EPR RATING CLASSIFICATION AND IN DETERMINING ENGINE ACCEPTANCE TO LIMITS OF PARAGRAPHS Q. AND R. RESPECTIVELY.

(3) For standardization for all PW4000 engine models and to make sure that the engine will make Takeoff thrust, it is recommended that the Acceptance Testing be done with a class 16 EEC Programming Plug (EPP) installed in the EEC. Refer to SB PW4ENG 73-203 for EEC Programming Plug (EPP) part number for testing.

(4) After the Acceptance Test, the necessary class and part number of EEC programming plug must be selected. You must calculate the necessary class and get the part number from SB PW4ENG 73-203. After you select the necessary EEC programming plug, install it in the EEC. See the Component Maintenance Manual (CMM), - EEC Data Entry Plug, PN 50A450. This manual has the procedure for setting the plug classification.

(5) The EEC has logic for operation in two modes:

(a) EPR = This is the primary mode.

(b) N1 = This is the alternate mode which is the backup mode (default) for the EPR mode.

(c) The Acceptance Test must be done in the EPR mode.

ENGINE HARDWARE CONFIGURATION - PW4152 (-3) MODEL

EEC PROGRAM- MING PLUG PART NUMBER NOTE 5	EEC PN 51D860 52D349 52D444 52D714 53D652 54D247 OR LATER	EEC PN 54D094	STATOR VANE SCHEDULE 29 N2 BIAS NOTE 1	STATOR VANE SCHEDULE 29-3 N2 BIAS NOTE 2	STATOR VANE SCHEDULE 29-2 N2 BIAS NOTE 4
51D454	X		X		
51D454		X		X	
51D455	X		X		
51D455		X		X	
54D333	X				X

NOTE 1 It is necessary to correct N2 to the procedures shown in Table 1311A.

NOTE 2 It is necessary to correct N2 to the procedures shown in Table 1311B.

NOTE 3 It is necessary to correct N2 to the procedures shown in Table 1311C (NOT Applicable to this model).

NOTE 4 It is necessary to correct N2 to the procedures shown in Table 1311D.

NOTE 5 See SB PW4ENG 73-203 for programming plug part number requirements "EEC Programming Plug Selection Chart".

PW4152 (-3) ENGINES EEC PROGRAMMING PLUG PART NUMBER VERSUS SVS CORRECTION REQUIREMENTS
Table 1304

ENGINE HARDWARE CONFIGURATION - PW4156A
(-3) MODEL WITHOUT ASYMMETRIC HPC CASE

EEC PROGRAMMING PLUG PART NUMBER NOTE 5	EEC PN 51D860 52D349 52D444 52D714 53D652 54D247 OR LATER	EEC PN 54D094	STATOR VANE SCHEDULE 29 N2 BIAS NOTE 1	STATOR VANE SCHEDULE 29-3 N2 BIAS NOTE 2	STATOR VANE SCHEDULE 29-2 N2 BIAS NOTE 4
51D448	X		X		
51D448		X		X	
51D449	X		X		
51D449		X		X	
54D335	X				X

NOTE 1	It is necessary to correct N2 to the procedures shown in Table 1311A.
NOTE 2	It is necessary to correct N2 to the procedures shown in Table 1311B.
NOTE 3	It is necessary to correct N2 to the procedures shown in Table 1311C (NOT Applicable to this model).
NOTE 4	It is necessary to correct N2 to the procedures shown in Table 1311D.
NOTE 5	See SB PW4ENG 73-203 for programming plug part number requirements "EEC Programming Plug Selection Chart".

PW4156A (-3) ENGINES EEC PROGRAMMING PLUG PART NUMBER VERSUS SVS CORRECTION REQUIREMENTS
Table 1305A

ENGINE HARDWARE CONFIGURATION - PW4156A (-3) MODEL
WITH ASYMMETRIC HPC CASE

EEC PROGRAMMING PLUG PART NUMBER NOTE 5	EEC PN 54D094 54D247 OR LATER	STATOR VANE SCHEDULE 29-5 N2 BIAS NOTE 3	STATOR VANE SCHEDULE 29-2 N2 BIAS NOTE 4
51D432	X	X	
51D433	X	X	
54D335	X		X

NOTE 1 It is necessary to correct N2 to the procedures shown in Table 1311A (Not applicable to this configuration).

NOTE 2 It is necessary to correct N2 to the procedures shown in Table 1311B (Not applicable to this configuration).

NOTE 3 It is necessary to correct N2 to the procedures shown in Table 1311C.

NOTE 4 It is necessary to correct N2 to the procedures shown in Table 1311D.

NOTE 5 See SB PW4ENG 73-203 for programming plug part number requirements "EEC Programming Plug Selection Chart".

NOTE: Assy - Asymmetric HPC Case: PN 58H006-01 Front HPC Case Set - Segmented HPC Configuration.

NOTE: Assy - Asymmetric HPC Case: PN 58H007-01 Front HPC Case Set - Ring HPC Configuration.

PW4156A (-3) ENGINES WITH ASYMMETRIC HPC CASE EEC PROGRAMMING PLUG PART NUMBER VERSUS SVS CORRECTION REQUIREMENTS
Table 1305B

ENGINE HARDWARE CONFIGURATION - PW4158
(-3) MODEL WITHOUT ASYMMETRIC HPC CASE

EEC PROGRAM-MING PLUG PART NUMBER NOTE 5	EEC PN 51D860 52D349 52D444 52D714 53D652 54D247 OR LATER	EEC PN 54D094	STATOR VANE SCHEDULE 29 N2 BIAS NOTE 1	STATOR VANE SCHEDULE 29-3 N2 BIAS NOTE 2	STATOR VANE SCHEDULE 29-2 N2 BIAS NOTE 4
51D440	X		X		
51D440		X		X	
51D441	X		X		
51D441		X		X	
54D360	X				X

NOTE 1	It is necessary to correct N2 to the procedures shown in Table 1311A.
NOTE 2	It is necessary to correct N2 to the procedures shown in Table 1311B.
NOTE 3	It is necessary to correct N2 to the procedures shown in Table 1311C (NOT Applicable to this model).
NOTE 4	It is necessary to correct N2 to the procedures shown in Table 1311D.
NOTE 5	See SB PW4ENG 73-203 for programming plug part number requirements "EEC Programming Plug Selection Chart".

PW4158 (-3) ENGINES EEC PROGRAMMING PLUG PART NUMBER VERSUS SVS CORRECTION REQUIREMENTS
Table 1306A

ENGINE HARDWARE CONFIGURATION - PW4158 (-3) MODEL
WITH ASYMMETRIC HPC CASE

EEC PROGRAMMING PLUG PART NUMBER NOTE 5	EEC PN 54D094 54D247 OR LATER	STATOR VANE SCHEDULE 29-5 N2 BIAS NOTE 3	STATOR VANE SCHEDULE 29-2 N2 BIAS NOTE 4
51D408	X	X	
51D409	X	X	
54D360	X		X

NOTE 1 It is necessary to correct N2 to the procedures shown in Table 1311A (Not applicable to this configuration).

NOTE 2 It is necessary to correct N2 to the procedures shown in Table 1311B (Not applicable to this configuration).

NOTE 3 It is necessary to correct N2 to the procedures shown in Table 1311C.

NOTE 4 It is necessary to correct N2 to the procedures shown in Table 1311D.

NOTE 5 See SB PW4ENG 73-203 for programming plug part number requirements "EEC Programming Plug Selection Chart".

NOTE: Assy - Asymmetric HPC Case: PN 58H006-01 Front HPC Case Set - Segmented HPC Configuration.

NOTE: Assy - Asymmetric HPC Case: PN 58H007-01 Front HPC Case Set - Ring HPC Configuration.

PW4158 (-3) ENGINES WITH ASYMMETRIC HPC CASE EEC PROGRAMMING
PLUG PART NUMBER VERSUS SVS CORRECTION REQUIREMENTS
Table 1306B

POWER PLANT GENERAL - TESTING-09

H. Procedures To Prepare For Test

(1) Check that all the test instrumentation is calibrated and that there are no leaks.

(2) Service the engine oil system as shown in the procedures of 72-00-00 Servicing-02 (Task 72-00-00-610-002) or 72-00-00 Servicing-03 (Task 72-00-00-610-003).

(3) Prime the engine. See 71-00-00 Power Plant General-00, Oil and Fuel Systems Priming Procedure, (Task 71-00-00-760-003).

(4) Do the EEC static test. See 71-00-00 Test No. 7 - EEC Static Test, (Task 71-00-00-760-038).

I. Testing Prior to Acceptance Test

(1) Do the EEC idle test. See 71-00-00 Test No. 6 - EEC Idle Test, (Task 71-00-00-760-037).

NOTE: Start the engine with one Igniter A only.

(2) Do the idle leak test. See 71-00-00 Test No. 3 - Idle Power Test, (Task 71-00-00-760-030). Check for leaks, if necessary do an engine shutdown and repair any leaks.

NOTE: You can do Test No. 6 and 3 at the same time.

(3) Let the engine become stable for five minutes at MINIMUM IDLE.

(4) Make sure all the engine parameters are in the permitted limits. See Power Plant General - Testing-00, Engine Operation Limits, (Task 71-00-00-990-007).

(a) Make sure that the main oil pressure is in limits. The oil pressure must also be in the acceptance band shown in 71-00-00, Test No. 13, (Task 71-00-00-760-047).

(b) Make sure that the No. 1 - 2 bearing compartment breather pressure is in limits.

(c) Make sure that the No. 3 bearing compartment breather pressure is in limits.

(d) Make sure that the No. 3 bearing compartment scavenge temperature (T3 SCAV) is in limits.

(e) If the optional PS4I instrumentation is installed, make sure that the turbine cooling air pressure ratio (TCAR) is in the operator's historical range.

NOTE: The turbine cooling air ratio (TCAR) check is removed from all PW4000 engine manuals. Field experience shows that the assembly instructions and TOBI flow checks are sufficient to make sure that the engine will operate correctly. You must obey the assembly and check procedures specified in the engine manual and service bulletins.

(5) Make a record of N1 RPM, N2 RPM, T4.95 (EGT), oil pressure and temperature. Check the EEC for fault messages.

NOTE: It is recommended that a complete set of data be taken at this time to check the data system. The data system must be checked before the Engine Acceptance Test.

(6) Do an engine shutdown by the Normal Shutdown Procedure, (Task 71-00-00-760-005).

(7) Check the EEC status for fault messages. Do any maintenance that is necessary.

(8) Between 5 and 35 minutes after shutdown, fill the oil tank manually as shown in the procedures of 72-00-00 Servicing-02 (Task 72-00-00-610-002) or 72-00-00 Servicing-03 (Task 72-00-00-610-003). This oil fill step will be used to calculate the engine oil consumption. The oil consumption will be calculated in gallons per hour after the Acceptance Test.

NOTE: Do not use a remote engine oil fill system during the Acceptance Test. You must not add engine oil during the Acceptance Test.

J. Acceptance Test Data Records

(1) Make a record on the engine log sheet of the general information and data as follows:

(a) Date of the Acceptance Test.

(b) Engine serial number.

(c) Serial number of modules and major components.

(d) Fuel grade and specific gravity.

(e) Engine oil specification and brand.

(f) Ambient atmospheric conditions (true barometer, wet and dry bulb temperatures).

(g) Total time of the Acceptance Test.

(h) Reasons for any engine shutdowns that are not on the schedule.

(i) Any repairs that were necessary during the Acceptance Test.

(j) If it is applicable, the reason the engine was rejected after the Acceptance Test.

(k) The test operator must sign the engine log.

(l) The test inspector must sign the log.

(2) Make a record of the engine parameters shown in Paragraph C. "Test Instrumentation And Test Cell Connections", during the Acceptance Test. Make a record at each thrust lever position during the test, (except oil consumption).

K. Initial Running

NOTE: The INITIAL RUNNING is for the LPC/HPC break−in cycle and is only necessary if the LPC or HPC or both were replaced, repaired or are new. If the LPC/HPC break−in cycle is not necessary, go to the next testing step, Engine Acceptance Test.

(1) Use the run schedule specified in Figure 1301.

(2) Start the engine by the Engine Start Procedure (Normal), (Task 71−00−00−760−004). Start engine using Igniter B. Determine and record overall time from pressurization until MINIMUM IDLE speed is reached. Record data after five minutes at MINIMUM IDLE.

(a) Record data for all stabilized test points prior to moving thrust lever to the next requirement.

(b) Verify that the main oil pressure and the No. 3 bearing compartment breather pressure are within the limits shown under Testing-00, Operating Limits, (Task 71-00-00-990-007).

(c) If the optional PS4I instrumentation is installed, make sure that the turbine cooling air pressure ratio (TCAR) is in the operator's historical range.

(d) Check EEC status and maintenance words for faults. See 71-00-00, Fault Isolation-00 (Task 71-00-00-810-001).

(3) The acceleration in this section is to be done with reverse TRA. Verify in simulated deployed position that the 2.5 bleed is 100 percent open (88 percent of actuator stroke) throughout reverse operation.

CAUTION: IF AN ENGINE STALL OCCURS DURING THIS TEST, YOU MUST MOVE THE THRUST LEVER TO MINIMUM IDLE WITHIN ONE SECOND OF THE STALL. DO THE PROCEDURES SHOWN IN TESTING-00 "PROCEDURE AFTER ENGINE SURGE OR STALL" (TASK 71-00-00-760-009) AND DO THE "START PROCEDURE AFTER AN EMERGENCY SHUTDOWN" (TASK 71-00-00-760-006). IF YOU DO NOT DO THESE PROCEDURES, YOU CAN DAMAGE THE TURBINE TIP SEALS.

(a) Make a slow acceleration (30 - 60 seconds) to 8000 N2. Stabilize for two minutes at 8000 N2. Record data at the end of the stabilization period.

(b) Continue slow acceleration to 8500 N2. Stabilize for two minutes at 8500 N2. Record data at the end of the stabilization period.

(c) Continue slow acceleration to 8800 N2. Stabilize for two minutes at 8800 N2. Record data at the end of the stabilization period.

(d) Continue slow acceleration to 9000 N2. Stabilize for two minutes at 9000 N2. Record data at the end of the stabilization period.

NOTE: At cold inlet temperature maximum reverse scheduling (fN1C), may restrict the engine from achieving 9000 rpm target.

(e) Continue slow acceleration to max reverse TRA. Stabilize for five minutes at fixed TRA. Record data at the end of the stabilization period.

NOTE: At low inlet temperatures, high N2 speeds may result in high thrusts. DO NOT EXCEED 50000 LBS FN/ST2.

(f) Make a slow deceleration (30 − 60 seconds) to MINIMUM IDLE. Stabilize at MINIMUM IDLE for 0 − 30 seconds. Take the engine out of the simulated reverse position.

(g) Continue normal acceptance running.

L. Engine Acceptance Test (to be run following initial break in running for refurbished engines and all other engines).

(1) The Acceptance Testing−09 cycle is shown in the Engine Run Schedule, Figure 1301.

(2) Start the engine by the Engine Start Procedure (Normal), (Task 71−00−00−760−004).

NOTE: Start the engine with one Igniter B only.

NOTE: Monitor the main oil pressure, (MOP), during the start procedure. If you do not see any oil pressure, you must immediately and quickly stop the start procedure.

(3) Make a record of the time from fuel pressurization to MINIMUM IDLE speed.

(4) Let the engine become stable at MINIMUM IDLE.

(5) Make sure all the engine parameters are in the permitted limits. See Power Plant General − Testing−00, Engine Operation Limits, (Task 71−00−00−990−007).

(6) Operate the engine at MINIMUM IDLE for five minutes.

(7) If the optional PS4I instrumentation is installed, make sure that the turbine cooling air pressure ratio (TCAR) is in the operator's historical range.

(8) Check EEC status and maintenance words for faults. See 71-00-00, Fault Isolation-00 (Task 71-00-00-810-001).

(9) Continue slow acceleration (90 - 120 seconds) from MINIMUM IDLE to the thrust of Band A shown in Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3). Stabilize for three minutes. Record data and install TRA stop.

(10) Do the decel vibration survey as follows.

CAUTION: IF AN ENGINE STALL OCCURS DURING THIS TEST, YOU MUST MOVE THE THRUST LEVER TO MINIMUM IDLE WITHIN ONE SECOND OF THE STALL. DO THE PROCEDURES SHOWN IN TESTING-00 "PROCEDURE AFTER ENGINE SURGE OR STALL" (TASK 71-00-00-760-009) AND DO THE "START PROCEDURE AFTER AN EMERGENCY SHUTDOWN" (TASK 71-00-00-760-006). IF YOU DO NOT DO THESE PROCEDURES, YOU CAN DAMAGE THE TURBINE TIP SEALS.

(a) Make a slow deceleration (60 - 120 seconds) to MINIMUM IDLE, surveying engine vibration.

(b) At each speed where peaks have shown during the deceleration, record the mean vibration level of each pickup after 30 second stabilization.

(c) Check that the engine vibration values are in the permitted limits. See Testing-00, Engine Operation Limits, (Task 71-00-00-990-007).

(d) For engines that are more than the permitted vibration limits, do Testing-19, Trim Balance Procedure And Test, (Task 71-00-00-760-043), (Task 71-00-00-760-052) or (Task 71-00-00-760-057).

(11) Select APPROACH IDLE. Stabilize for 15 minutes. At the end of the stabilization period, record data.

(12) Do the snap acceleration/deceleration test cycle shown in 71-00-00, Testing-04 (Task 71-00-00-760-031) and perform step B.(9)(b) through B.(9)(i) for acceleration/deceleration test). Also see Engine Run Schedule shown in Figure 1301.

NOTE: The snap acceleration/deceleration must be done after the compressor break in cycle shown in above.

(13) Vibration Survey (Acceleration).

(a) An engine vibration survey shall be conducted on an engine that has been thermally stabilized. Completion of step L.(12) above without shutdown will result in a stabilized engine. If shutdown occurs, the engine must be run at thrust Band C, Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) or higher for three minutes and then run for six minutes at MINIMUM IDLE prior to conducting the vibration survey.

(b) Make a slow acceleration (90 - 120 seconds) from MINIMUM IDLE to thrust Band A Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3).

(c) At each speed where peaks have shown during the acceleration, record the mean vibration level of each pickup after 30 second stabilization.

(d) Check the engine vibration levels during this test to make sure that the allowable limits are not exceeded. See 71-00-00, Testing-00, Vibration Limits, (Task 71-00-00-990-007).

(e) For engines that exceed the vibration limits, see 71-00-00, Testing-19 (Task 71-00-00-760-043), (Task 71-00-00-760-052) or (Task 71-00-00-760-057).

(14) Performance Calibration.

(a) Stabilize at thrust Band A Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) for five minutes. At the end of the stabilization period, record data.

(b) Stabilize at thrust Band B Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) for three minutes. At the end of the stabilization period, record data.

(c) Stabilize at thrust Band C Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) for three minutes. At the end of the stabilization period, record data.

(d) Stabilize at thrust Band D Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) for three minutes. At the end of the stabilization period, record data.

(e) Decelerate slowly (60 - 120 seconds) to APPROACH IDLE. Stabilize for 20 minutes.

(15) Engine shutdown procedure.

(a) Do an engine shutdown by the Normal Shutdown Procedure, (Task 71-00-00-760-005).

(b) Check the EEC status for fault messages. Do any maintenance that is necessary.

M. Procedures After Engine Shutdown - Corrections Of Observed Readings.

(1) Correct the observed data collected in thrust Bands A, B, C, and D of the performance calibration. Use the procedure defined in Figure 1302 (Sheet 1), Figure 1302 (Sheet 2), Figure 1302 (Sheet 3) and Figure 1302 (Sheet 4).

N. Engine Configuration Determination

(1) Based on the engine configuration identifier suffix in Table 1301, make sure that you are in the appropriate Testing-09 CONFIG section to use to class and check the engine for acceptance.

O. Check Corrected Data

(1) If the optional PS4I instrumentation is installed, make sure that the turbine cooling air pressure ratio (TCAR) is in the operator's historical range.

(2) Values of Corrected Net Thrust versus PT4.95/PT2 corrected N1, corrected N2, and corrected EGT, should fall within the requirements of Figure 1309 (Sheet 1), Figure 1309 (Sheet 2), Figure 1309 (Sheet 3), and Figure 1309 (Sheet 4). The lines on these figures are guidelines only and are not acceptance limits. Points outside these values can suggest that there is a instrumentation and/or other problem that must be identified.

(a) Definitions of terms used in Figure 1309 are as follows:

(b) Complete Refurbishment: Bands are for engines that had all modules repaired or replaced to new engine clearances and airfoil condition.

(c) Minor or No Refurbishment: Bands are for high time service engines that are fully deteriorated without any or only a small quantity of gaspath repair.

(3) Values of corrected PT2.5/PT2 and PS3/PT2.5 versus PT4.95/PT2 should fall within the guidelines of Figure 1309 (Sheet 5) and Figure 1309 (Sheet 6). The lines of these figures are guidelines only and not acceptance limits. Points outside these values can suggest that there is a instrumentation and/or other problem that must be identified.

(4) If a review of the test high power (points generally above 52000 lbf (231307.5 N) thrust, or 1.45 PT4.95/PT2) indicate a change in level relative to the check line shape as shown in Table 1307 below, this can be an indication of abnormal fan operation. This abnormal operation is also accompanied by a noticeable tone change in the engine. This change is triggered at high power by dirty and/or severely eroded fan blade leading edges. Corrective action must be taken. Refer to 72-00-31, Repair-01 (Task 72-00-31-300-001).

(5) Corrected Thrust Specific Fuel Consumption (TSFC) must be compared with the values listed in Table 1302. These values are included for reference to new engine levels only and are not intended as an acceptance requirement.

ABNORMAL FAN OPERATION

Delta P4.95/PT2	approximately +0.015 to 0.020	at Fn = K
Delta N1C	approximately +80 to +100 RPM	at Fn = K
Delta N2C	approximately −40 RPM	at Fn = K
Delta EGT	approximately −4°C	at Fn = K
Delta PT2.5/PT2	approximately +0.14 ratios	at P4.95/PT2 = K
Delta PS3/PT2.5	approximately −0.5 ratios	at P4.95/PT2 = K

PARAMETER SHIFT WITH ABNORMAL FAN OPERATION
Table 1307

P. Engine Pressure Ratio (EPR) Rating Classification

(1) The necessary EEC programming plug is specified by a part number and EPR class system. The programming plug part number is specified by the engine model and thrust rating. For the necessary EEC programming plug part number, see Table 1304, Table 1305, Table 1306. The necessary EPR Class must be selected by Engine Pressure Ratio (EPR), see SB PW4ENG 73-203.

(2) The plug part number and class is shown on the engine data plate. If a new part number or class plug is used, you must write (scribe) the new part number and class on the engine data plate.

(3) Make a EEC programming plug selection as follows:

(a) See SB PW4ENG 73-203 for the necessary Engine Programming Plug (EPP) for the engine model and hardware configuration that was tested. Confirm that the appropriate EPP part number was installed during acceptance testing.

NOTE: If the incorrect program plug (EPP) was installed during acceptance testing, contact Pratt & Whitney for assistance in correcting data/or rerun with the correct program plug.

(b) EPR class modifiers are used to make sure that the engine pressure ratio sent to the aircraft is less than the given limits. This will make sure that the engine will always give rated thrust at all possible take-off settings. The EPR limit is called "MAX EPR" and is shown in Table 1308 or Table 1309.

NOTE: A PW4152 (-3) engine must only use the Bands A, B, and C points for the EPR Modifier classification. The PW4156A (-3) and PW4158 (-3) engines can use the Bands A, B, C and D points in the calculations.

(c) Use EPR-0 and Corrected Net Thrust from the four performance calibration points to find the EPR modifier class. Find the EPR modifier class which gives the highest EPR value and does not go more than the MAX EPR LIMIT specified by Table 1308 or Table 1309. Make a straight line curve to fit between the points shown on Table 1308 or Table 1309.

NOTE: To calculate EPR-0, go to Paragraph G.(1), Acceptance Test General Specifications.

NOTE: Make sure that the Stage 2.5 bleed valve is in the closed location. Do not use any data points (D band point) where the Stage 2.5 bleed valve starts to open to calculate the modifier class.

(d) To calculate EPR, use the EPR class defined above where EPR = EPR-0 + EPR Modifier. EPR is the value used in Paragraph Q, Check For Engine Acceptance, to check for engine acceptance and to calculate engine margin to the limits.

(e) If multiple ratings are desired, testing need only be performed to the highest rating desired and with a 3rd order curve fit of the four point acceptance data, other "A" band rating EPR-0 values can be found for EPR classification purposes as follows:

1 Use the four point acceptance data to find the 3rd order fit of thrust EPR-0.

2 Find the value of EPR-0 at the rating desired (use the minimum band thrust from Figure 1304).

3 Use the value of EPR-0 and thrust value calculated in step 2 above as the "A" band point. Find the EPR class requirement with the procedure in step (c) above. (Use the calculated A band point, with B, C, and D band from the data).

(f) An example of the EPR class calculation (for a PW4158 (-3) configuration) is shown in Table 1310.

FOR THESE CONFIGURATIONS: PW4152 (-3), PW4156A (-3), PW4158 (-3) WITH SB PW4ENG 72-256 (AERO 2.5 LPT AND SB PW4ENG 72-262 (RECAMBERED FEGV)

CORRECTED NET THRUST LBS (N)	MAXIMUM EPR
34000 lbf (151239.5 N)	1.2588
35000 lbf (155687.8 N)	1.2697
36000 lbf (160136.0 N)	1.2809
37000 lbf (164584.2 N)	1.2923
38000 lbf (169032.4 N)	1.3038
39000 lbf (173480.7 N)	1.3161
40000 lbf (177928.9 N)	1.3285
41000 lbf (182377.1 N)	1.3408
42000 lbf (186825.3 N)	1.3532
43000 lbf (191273.5 N)	1.3660
44000 lbf (195721.8 N)	1.3788
45000 lbf (200170.0 N)	1.3919
46000 lbf (204618.2 N)	1.4052
47000 lbf (209066.4 N)	1.4180
48000 lbf (213514.7 N)	1.4311
49000 lbf (217962.9 N)	1.4447
50000 lbf (222411.1 N)	1.4589
51000 lbf (226859.3 N)	1.4736
52000 lbf (231307.5 N)	1.4888
53000 lbf (235755.8 N)	1.5045
54000 lbf (240204.0 N)	1.5208
55000 lbf (244652.2 N)	1.5375
56000 lbf (249100.4 N)	1.5548
57000 lbf (253548.7 N)	1.5726
58000 lbf (257996.9 N)	1.5910
59000 lbf (262445.1 N)	1.6116
60000 lbf (266893.3 N)	1.6340

MAXIMUM EPR
Table 1308

POWER PLANT GENERAL - TESTING-09

FOR THESE CONFIGURATIONS: PW4152 (-3), PW4156A (-3), PW4158 (-3) WITHOUT SB PW4ENG 72-256 (AERO 2.5 LPT OR SB PW4ENG 72-262 (RECAMBERED FEGV) OR WITHOUT BOTH OF THESE SERVICE BULLETINS

CORRECTED NET THRUST LBS (N)	MAXIMUM EPR
34000 lbf (151239.5 N)	1.2551
35000 lbf (155687.8 N)	1.2659
36000 lbf (160136.0 N)	1.2769
37000 lbf (164584.2 N)	1.2881
38000 lbf (169032.4 N)	1.2995
39000 lbf (173480.7 N)	1.3114
40000 lbf (177928.9 N)	1.3236
41000 lbf (182377.1 N)	1.3358
42000 lbf (186825.3 N)	1.3481
43000 lbf (191273.5 N)	1.3605
44000 lbf (195721.8 N)	1.3732
45000 lbf (200170.0 N)	1.3861
46000 lbf (204618.2 N)	1.3991
47000 lbf (209066.4 N)	1.4120
48000 lbf (213514.7 N)	1.4249
49000 lbf (217962.9 N)	1.4381
50000 lbf (222411.1 N)	1.4519
51000 lbf (226859.3 N)	1.4662
52000 lbf (231307.5 N)	1.4809
53000 lbf (235755.8 N)	1.4962
54000 lbf (240204.0 N)	1.5121
55000 lbf (244652.2 N)	1.5284
56000 lbf (249100.4 N)	1.5452
57000 lbf (253548.7 N)	1.5626
58000 lbf (257996.9 N)	1.5805
59000 lbf (262445.1 N)	1.5996
60000 lbf (266893.3 N)	1.6207

MAXIMUM EPR
Table 1309

EXAMPLE OF CALCULATING EPR MODIFIER CLASS FOR PW4158 (-3) ENGINE CONFIGURATIONS

Step 1.
Start with the four performance calibration points from engine test.

CORRECTED NET THRUST

LBS (N)	(EEC EPR) EPR-028	TLRA	DELTA EPR MOD [SEE PARA. G. (1)]	= EPR-0
58125 lbf (258552.9 N)	1.555	79.8	.028	1.583
51500 lbf (229083.4 N)	1.444	74.2	.028	1.472
46209 lbf (205547.9 N)	1.376	70.1	.026	1.402
41066 lbf (182670.7 N)	1.317	65.7	.022	1.339

Step 2.
At the Corrected Net Thrust level of the four performance calibration points, find the Maximum EPR as shown in Table 1308 or Table 1309. Make a straight line curve to fit between the points shown on Table 1308 or Table 1309.

CORRECTED NET THRUST

LBS (N)	EPR-MAX
58125 lbf (258552.9 N)	1.5936
51500 lbf (229083.4 N)	1.4812
46209 lbf (205547.9 N)	1.4079
41066 lbf (182670.7 N)	1.3416

Step 3.
Find the delta EPR value for each point of Maximum EPR:

CORRECTED NET THRUST

LBS (N)	EPR-MAX	EPR-0	DELTA EPR

EXAMPLE OF CALCULATING EPR MODIFIER FOR PW4158 (-3) ENGINES
Table 1310

EXAMPLE OF CALCULATING EPR MODIFIER CLASS
FOR PW4158 (-3) ENGINE CONFIGURATIONS

58125 lbf (258552.9 N)	1.5936	1.583	.0106
51500 lbf (229083.4 N)	1.4812	1.472	.0092
46209 lbf (205547.9 N)	1.4079	1.402	.0059
41066 lbf (182670.7 N)	1.3416	1.339	.0026

Step 4.
To find the EPR Class Number, use the delta EPR value from Step 3. above, and go to Table 1303.

DELTA EPR	CLASS NUMBER	EPR MODIFIER
0.0106	7	+0.008
0.0092	7	+0.008
0.0059	8	+0.004
0.0026	9	+0.000

Step 5.
The EPR Modifier Class 9 will give the highest possible EPR and will not be more than the EPR-Max limit, (highest class number from above). Make a Class 9 modifier selection and then calculate EPR.

EPR-0	EPR MODIFIER	EPR
1.583	0	1.583
1.472	0	1.472
1.402	0	1.402
1.339	0	1.339

EXAMPLE OF CALCULATING EPR MODIFIER FOR PW4158 (-3) ENGINES
Table 1310 (Continued)

Q. Check For Engine Acceptance

CAUTION: MAKE SURE THAT THE STAGE 2.5 BLEED VALVE IS IN THE CLOSED LOCATION. DO NOT USE ANY DATA POINTS TO CALCULATE ACCEPTANCE TO THE LIMITS WHERE THE STAGE 2.5 BLEED VALVE STARTS TO OPEN (D BAND POINT).

(1) The steady state values of corrected N2, N1 and TT4.95 (EGT) versus modified engine pressure ratio (EPR = EPR-0 + EPR Modifier) must be below the limits of Figure 1310 (Sheets 1 through 3), Figure 1311 (Sheets 1 and 2) and Figure 1312 (Sheets 1 and 2). All the calibration points (A Band through D Band) must be examined relative to the limit lines. A large difference between the calibration points and the limit line can indicate instrumentation or engine problems. Use A Band thrust levels for NH and NL acceptance. Use A Band and B Band thrust levels for EGT acceptance. Calculate the EGT margin to the limit line, the engine is acceptable if the average of the A Band and B Band margins is positive (greater than zero).

(a) Figure 1312 (Sheet 1) and Figure 1312 (Sheet 2) shows two maximum EGT limit curves. The upper EGT limit curve applies in all cases except when an engine is tested immediately following high turbine refurbishment. The lower EGT limit curve is to be used only after a high turbine refurbishment (turbine clearances restored) and before engine has flown with turbine cooling air system on.

(b) The N1 rotor speed limits are shown in Figure 1311 (Sheet 1), Figure 1311 (Sheet 2).

(c) Do an N2 Speed Limit Analysis per the following procedure. Figure 1310 (Sheet 1), Figure 1310 (Sheet 2) and Figure 1310 (Sheet 3) presents the corrected rotor speed limits for engines with SVS 29 N2 BIAS, SVS 29-3 N2 BIAS, or SVS 29-5 N2 BIAS or SVS 29-2 N2 BIAS. Refer to Table 1304 through Table 1306B to determine which SVS N2 limit line to use. Refer to the calculation procedures shown in Figure 1302 (Sheet 2), Item 5. Choose the correct calculation procedure based on the control version that is installed at the time of the test.

NOTE: The EEC incorporates for this engine configuration a fixed SVS 29-5 or a N2 biased stator vane schedules (SVS). For the N2 biased configurations, the schedule closes the HPC variable stator vanes 5 degrees for observed N2 rotor speeds less than 9550 N2 RPM and 9830 N2 RPM for RCC. The SVS transitions linearly to either the original OPEN schedule (SVS 29) or a closed (SVS 29-2) 2 degree schedule (HPC RCC Post SB 72-756 or 72-759) at N2 rpm's above 10250, the SVS 29-5 configuration engines, hold SVS schedule at SVS 29-5 for all N2's. Since the N2 Limit Curve Figure 1310 (Sheet 1), Figure 1310 (Sheet 2) and Figure 1310 (Sheet 3) is based on the original OPEN schedule, an adjustment must be made to the N2 data points before they are compared to this N2 Speed Limit Curve, Figure 1310 (Sheet 1), Figure 1310 (Sheet 2) and Figure 1310 (Sheet 3).

(d) Figure 1310 (Sheet 1, Figure 1310 (Sheet 2) and Figure 1310 (Sheet 3) includes the more restrictive speed limits that are necessary for post SB PW4ENG 72-557 engines, (with redesigned 5th stage compressor blade). For simplicity, the more restrictive limits (if they are different) are to be used for both pre and post SB PW4ENG 72-557 engine configurations.

(e) For an example of a N2 Speed Limit Analysis, see Table 1311A for engines running SVS 29 N2 BIAS or see Table 1311B for engines running SVS 29-3 N2 BIAS or see Table 1311C for engines running SVS 29-5 N2 BIAS. An example of a calculation for an engine running SVS 29 N2 BIAS is shown in Table 1312.

EXAMPLE − PROCEDURE TO DO AN N2 SPEED LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29 N2 BIAS

Step 1. Calculate the Corrected Observed N2:

Corrected Observed N2 = Observed N2/SQRT (THETA T2)

Step 2. Calculate FACTOR (Percent difference in N2, SVS 29−5 deg relative to SVS 29):

FACTOR = 1.11244 − 3.93387 x P4.95Q2 + 2.82184 x $P4.95Q2^2$

Where P4.95Q2 = PT4.95/PT2

Step 3. Calculate N2Rcl (Corrected N2 adjusted to SVS 29−5 deg):

If Observed N2 <= 9550 rpm, N2Rcl = Corrected Observed N2

If 9550 < Observed N2 < 10250

N2Rcl = Corrected Observed N2 x [1 + (FACTOR x [Observed N2−9550])/70000]

If Observed N2 >= 10250 rpm, go to step 4b

Step 4. Calculate N2Rop (Corrected N2 adjusted to SVS 29):

(a) If Observed N2 < 10250 rpm, N2Rop = N2Rcl/(1+ FACTOR/100)

(b) If Observed N2 >= 10250 rpm, N2Rop = Corrected Observed N2

Step 5. Calculate Corrected High Rotor Speed − RPM:

Corrected High Rotor Speed = N2Rop/KHN2 + delta N2 (See Figure 1302, (Sheet 4) NOTE 4)

Where KHN2 is found from Figure 1308.

PROCEDURE FOR CALCULATING CORRECTED HIGH ROTOR SPEED (N2) FOR LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29 N2 BIAS
Table 1311A

EXAMPLE - PROCEDURE TO DO AN N2 SPEED LIMIT ANALYSIS
FOR ENGINES RUNNING WITH SVS 29-3 N2 BIAS

Step 1. Calculate the Corrected Observed N2:

Corrected Observed N2 = Observed N2/SQRT (THETA T2)

Step 2. Calculate FACTOR (Percent difference in N2, SVS 29-5 deg relative to SVS 29):

FACTOR = 1.11244 - 3.93387 x P4.95Q2 + 2.82184 x $P4.95Q2^2$
Where P4.95Q2 = P4.95/P2

Step 3. Calculate N2Rcl (Corrected N2 adjusted to SVS 29-5 deg):

If Observed N2 <= 9550 rpm, N2Rcl = Corrected Observed N2

If 9550 < Observed N2 < 10250

N2Rcl = Corrected Observed N2 x [1 + (FACTOR x 0.4 x [Observed N2-9550])/70000]

If Observed N2 >= 10250 rpm, go to step 4(b)

Step 4. Calculate N2Rop (Corrected N2 adjusted to SVS 29):

(a) If Observed N2 < 10250 rpm, N2Rop = N2Rcl/(1+ FACTOR/100)

(b) If Observed N2 >= 10250 rpm, N2Rop = (Corrected Observed N2) / [1+0.6(Factor)/100]

Step 5. Calculate Corrected High Rotor Speed - RPM:

Corrected High Rotor Speed = N2Rop/KHN2 + delta N2
(See Figure 1302 (Sheet 4) NOTE 4)

Where KHN2 is found from Figure 1308.

PROCEDURE FOR CALCULATING CORRECTED HIGH ROTOR SPEED (N2) FOR
LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29-3 N2 BIAS
Table 1311B

EXAMPLE − PROCEDURE TO DO AN N2 SPEED LIMIT ANALYSIS
FOR ENGINES RUNNING WITH SVS 29−5 N2 BIAS

Step 1. Calculate the Corrected Observed N2:

Corrected Observed N2 = Observed N2/SQRT (THETA T2)

Step 2. Calculate FACTOR (Percent difference in N2, SVS 29−5 deg relative to SVS 29):

FACTOR = 1.11244 − 3.93387 x P4.95Q2 + 2.82184 x P4.95Q2^2
Where P4.95Q2 = P4.95/P2

Step 3. Calculate N2Rop (Corrected N2 adjusted to SVS 29):

N2Rop = (Corrected Observed N2)/(1+ FACTOR/100)

Step 4. Calculate Corrected High Rotor Speed − RPM:

Corrected High Rotor Speed = N2Rop/KHN2 + delta N2
(See Figure 1302 (Sheet 4) NOTE 4)

Where KHN2 is found from Figure 1308.

PROCEDURE FOR CALCULATING CORRECTED HIGH ROTOR SPEED (N2) FOR
LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29−5 N2 BIAS
Table 1311C

EXAMPLE - PROCEDURE TO DO AN N2 SPEED LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29-2 N2 BIAS

Step 1. Calculate the Corrected Observed N2:

Corrected Observed N2 = Observed N2/SQRT (THETA T2)

Step 2. Calculate FACTOR (Percent difference in N2, SVS 29-5 deg relative to SVS 29):

FACTOR = 1.11244 - 3.93387 x P4.95Q2 + 2.82184 x $P4.95Q2^2$
Where P4.95Q2 = P4.95/P2

Step 3. Calculate N2Rcl (Corrected N2 adjusted to SVS 29-5 deg):

If Observed N2 <= 9830 rpm, N2Rcl = Corrected Observed N2

If 9830 < Observed N2 < 10250

N2Rcl = Corrected Observed N2 x [1 + (FACTOR x 0.6 x [Observed N2-9830])/42000]

If Observed N2 >= 10250 rpm, go to step 4(b)

Step 4. Calculate N2Rop (Corrected N2 adjusted to SVS 29):

(a) If Observed N2 < 10250 rpm, N2Rop = N2Rcl/(1+ FACTOR/100)

(b) If Observed N2 >= 10250 rpm, N2Rop = (Corrected Observed N2) / [1+0.4 X (FACTOR)/100]

Step 5. Calculate Corrected High Rotor Speed - RPM:

Corrected High Rotor Speed = N2Rop/KHN2 + delta N2
(See Figure 1302 (Sheet 4) NOTE 4)

Where KHN2 is found from Figure 1308.

PROCEDURE FOR CALCULATING CORRECTED HIGH ROTOR SPEED (N2) FOR LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29-2 N2 BIAS
Table 1311D

EXAMPLE - N2 SPEED LIMIT ANALYSIS - PW4158 (-3) ENGINE RUNNING WITH SVS 29 N2 BIAS

Step 1. Calculate the Corrected Observed N2:

Parameter Point	1	2	3	4
Observed N2	9694	9467	9287	9135
T2, deg R	529.4	529.4	529.4	529.4
Sqrt Theta T2	1.010	1.010	1.010	1.010
Corrected Observed N2	9597	9373	9194	9044
P4.95/P2	1.583	1.472	1.402	1.340
FACTOR	1.956	1.4361	1.1438	0.908
N2Rcl	9636	9373	9194	9044
N2Rop	9450	9240	9090	8951
KHN2	1.0019	1.0019	1.0019	1.0019
N2Rop/KHN2	9432	9222	9072	8934
Delta N2 Test Cell/Duct Set Corrections - See Figure 1302, (Sheet 4) NOTE 4.	91	61	46	34
Corrected High Rotor Speed	9523	9283	9118	8968
EPR	1.583	1.472	1.402	1.339
N2 Speed Limit (See Figure 1310 (Sheet 2)	10020	9757	9591	9447
Margin (RPM)	497	474	472	479

EXAMPLE - N2 SPEED LIMIT ANALYSIS - PW4158 (-3) ENGINE
Table 1312

R. Procedures Necessary After Testing

(1) Oil consumption.

NOTE: When you do the visual inspection for leaks, it is possible to see a small quantity of remaining oil in the area of the spinner, at the bottom of the fan case, or at the HPC variable vane attach bolts at the bottom of the engine. The source of this oil is either the No. 1 bearing carbon seal assembly or the No. 2 bearing rear carbon seal assembly. After the engine windmills or after a long start procedure (conditions where carbon seal pressure differences are very low or negative), a small quantity of oil can get through the carbon seals and go to the external parts of the engine. This condition is satisfactory and is permitted. All other conditions of the inspection must be satisfactory. A limit for the quantity of oil that is permitted is not given. The limits that should be used when you make an estimate of the quantity of oil is oil consumption level.

(a) Between 10 and 15 minutes after engine shutdown, fill the oil tank manually as shown in the procedures of 72-00-00 Servicing-02 (Task 72-00-00-610-002) or 72-00-00 Servicing-03 (Task 72-00-00-610-003). Use a graduated measuring device and make a record of the quantity of engine oil that is added.

(b) Make a record of the engine oil consumption in gal/hr (l/hr) in the engine logs.

(c) If there is more oil in the oil tank after the Acceptance Test than before (such as oil that comes out the scupper drain), the oil must be checked for fuel by a laboratory.

(2) Seal Leakage Limits.

(a) Measure the quantity of leakage in each seal drain collection bottle. The leakage limits for each seal drain are shown in 71-00-00 Power Plant General - Testing-00, Engine Operation Limits, (Task 71-00-00-990-007).

(3) Check Filters.

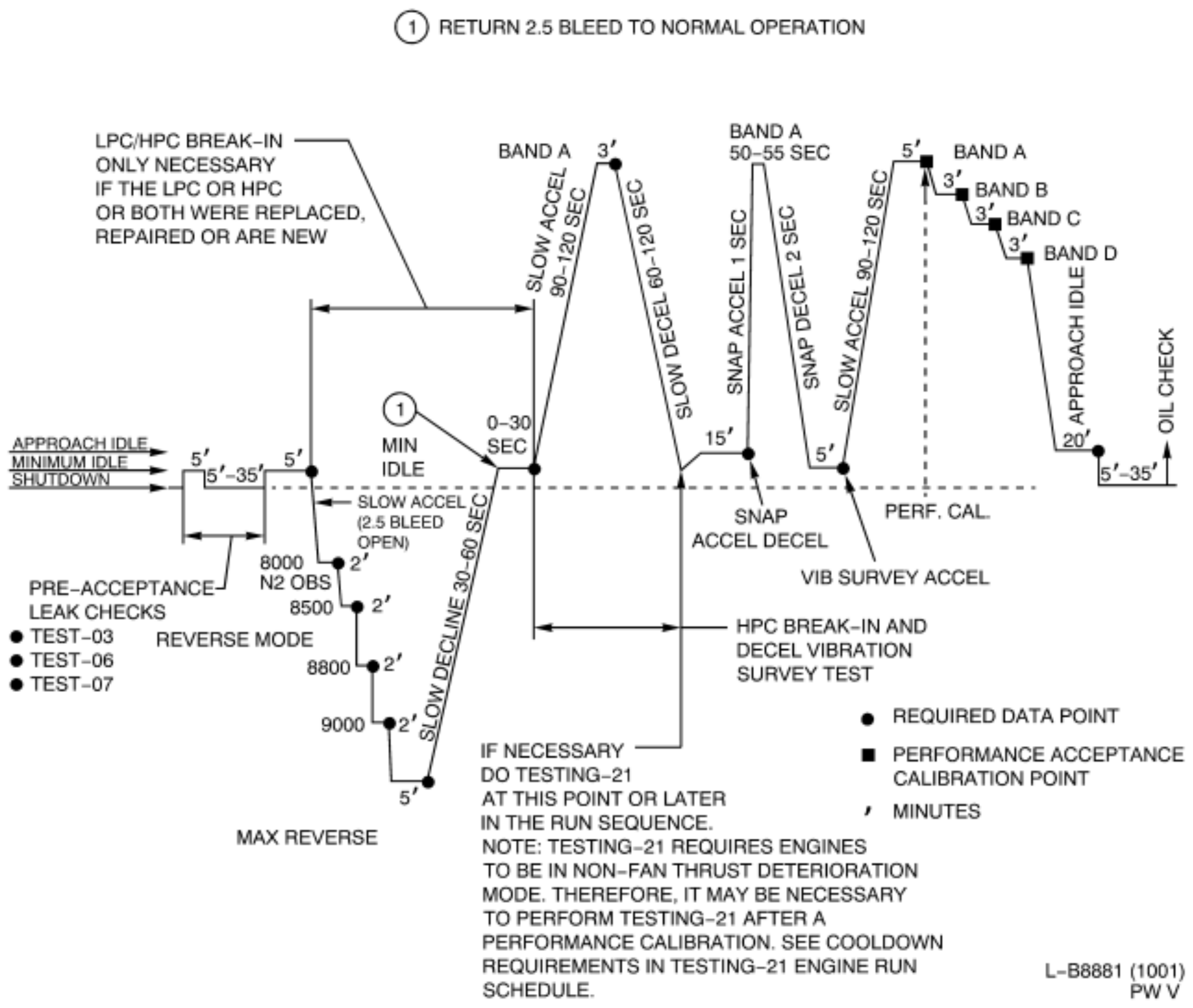
(a) Remove the main oil filter and seals. Examine the filter for pieces of unwanted material (chips) and contamination. Record the results in the engine logs. Install a new main oil filter and seals.

(b) Remove the fuel filters and seals. Examine the filter for pieces of unwanted material (chips) and contamination. Record the results in the engine logs. Install new fuel filters and seals.

R 1 Look for bronze colored particles. If you find
R bronze contamination, you must replace the fuel
R metering unit and the fuel pump.

(4) Preservation.

(a) For engine preservation refer to 72−00−00, Storage/Transport−03, Accomplish Engine Preservation, (Task 72−00−00−620−001).


① RETURN 2.5 BLEED TO NORMAL OPERATION
LPC/HPC BREAK-IN ONLY NECESSARY IF THE LPC OR HPC OR BOTH WERE REPLACED, REPAIRED OR ARE NEW
APPROACH IDLE
MINIMUM IDLE
SHUTDOWN
5′
5′-35′
5′
PRE-ACCEPTANCE LEAK CHECKS
● TEST-03
● TEST-06
● TEST-07
REVERSE MODE
8000 N2 OBS
2′
8500
2′
8800
2′
9000
2′
5′
MAX REVERSE
SLOW ACCEL (2.5 BLEED OPEN)
SLOW DECLINE 30-60 SEC
①
MIN IDLE
0-30 SEC
BAND A
SLOW ACCEL 90-120 SEC
3′
SLOW DECEL 60-120 SEC
15′
SNAP ACCEL 1 SEC
BAND A 50-55 SEC
SNAP DECEL 2 SEC
5′
SNAP ACCEL DECEL
SLOW ACCEL 90-120 SEC
VIB SURVEY ACCEL
5′
BAND A
3′
BAND B
3′
BAND C
3′
BAND D
APPROACH IDLE
20′
5′-35′
OIL CHECK
PERF. CAL.
HPC BREAK-IN AND DECEL VIBRATION SURVEY TEST
IF NECESSARY DO TESTING-21 AT THIS POINT OR LATER IN THE RUN SEQUENCE.
NOTE: TESTING-21 REQUIRES ENGINES TO BE IN NON-FAN THRUST DETERIORATION MODE. THEREFORE, IT MAY BE NECESSARY TO PERFORM TESTING-21 AFTER A PERFORMANCE CALIBRATION. SEE COOLDOWN REQUIREMENTS IN TESTING-21 ENGINE RUN SCHEDULE.
● REQUIRED DATA POINT
■ PERFORMANCE ACCEPTANCE CALIBRATION POINT
′ MINUTES
L-B8881 (1001)
PW V

Engine Run Schedule
Figure 1301
(Task 71-00-00-760-061)

R
R

CORRECTION OF OBSERVED READINGS (SHEET 1 OF 4)

NOTE: For the Following Calculations:

- THETA T2 $= \theta T2 = \left(\frac{TT2\,^{\circ}C + 273.16}{288.16} \right)$
- DELTA T2 $= \delta T2 = \frac{PT2\ (IHGA)}{29.92}$
- Note 1 through Note 11 ..... See Sheet 4 Definitions

Item (1) Corrected Net Thrust – lbs

$$\frac{Total\ (FN)}{\delta T2} = \left(\frac{Observed\ Thrust}{\delta T2} \right) + Delta\ FN_{Note\ 1}$$

Item (2) Corrected Fuel Flow – lbs/hr

$$\frac{WF}{(\delta T2)\ (KC)\ (KHWF)} = \left(\frac{Observed\ Fuel\ Flow}{(\delta T2)\ (KC)\ (KHWF)} \right) \times \left(\frac{LHV}{18400} \right) + Delta\ WF_{Note\ 2}$$

KC is defined as $(\theta T2)^{0.59}$

KHWF is determined as follows:

(a) Obtain a value of KH' (min) which is a function of specific humidity (lbs moisture per lb of dry air) from Figure 1307. This value is a minimum correction and will be compared with that obtained in the following step.

(b) Using recorded ambient temperature and Corrected Net Thrust from Item (1) above, obtain values of C1 (Figure 1305), C2, and C3 (Figure 1306). Calculate KH' using the following equation:

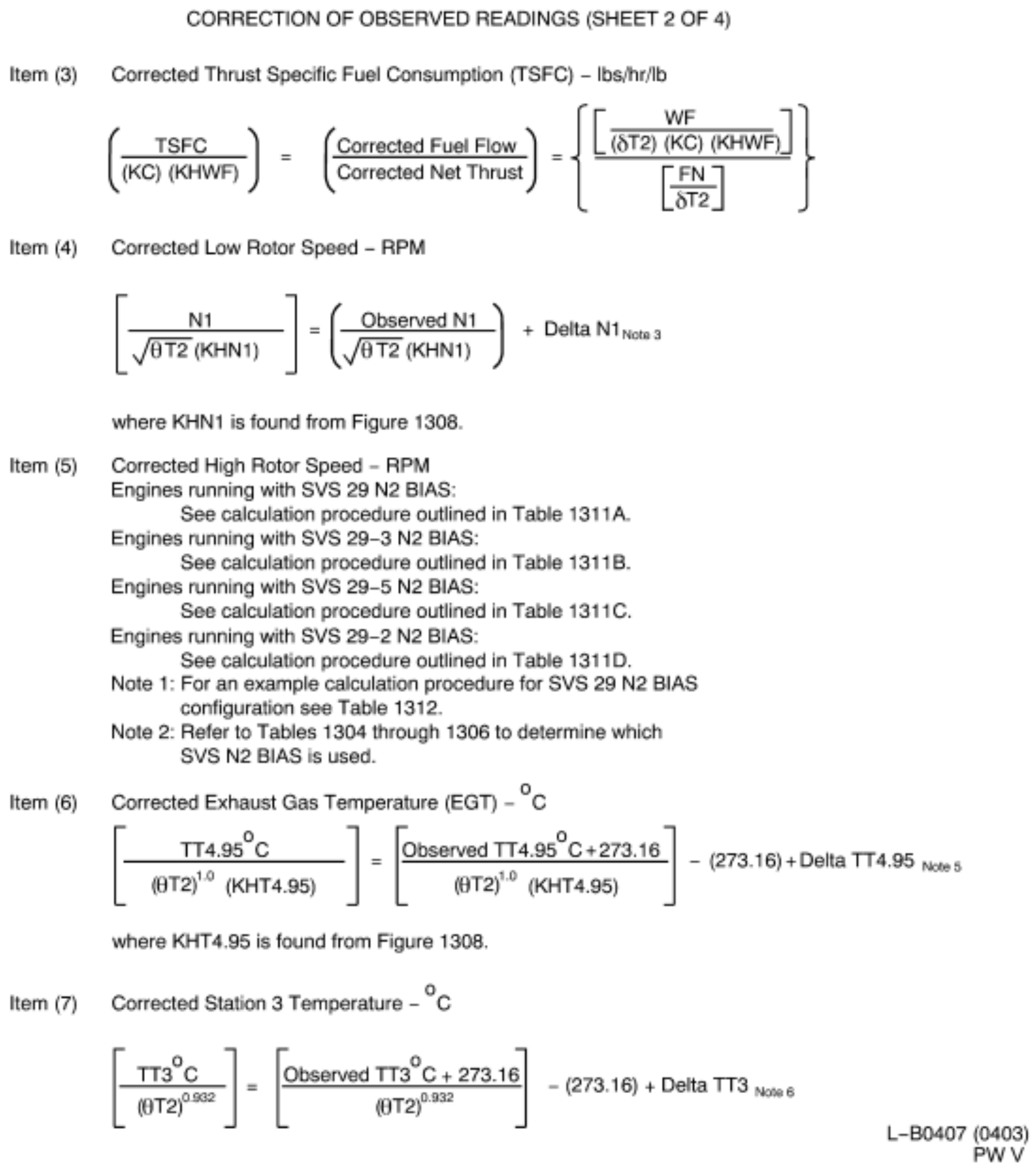
$KH' = C1(SH + C2) + C3$, where SH = specific humidity (lbs moisture/lb dry air)

(c) Set KHWF equal to the greater of the values of KH' calculated above in Item (2) (a) and (b).

(d) LHV = Lower Heating Value of fuel in BTU/LBM.

L−A9025 (0597)
PW V

Correction Of Observed Data
Figure 1302 (Sheet 1)
(Task 71−00−00−760−061)



CORRECTION OF OBSERVED READINGS (SHEET 2 OF 4)

Item (3) Corrected Thrust Specific Fuel Consumption (TSFC) – lbs/hr/lb

$$\left(\frac{TSFC}{(KC)\,(KHWF)}\right) = \left(\frac{\text{Corrected Fuel Flow}}{\text{Corrected Net Thrust}}\right) = \left\{\frac{\left[\frac{WF}{(\delta T2)\,(KC)\,(KHWF)}\right]}{\left[\frac{FN}{\delta T2}\right]}\right\}$$

Item (4) Corrected Low Rotor Speed – RPM

$$\left[\frac{N1}{\sqrt{\theta T2}\,(KHN1)}\right] = \left(\frac{\text{Observed N1}}{\sqrt{\theta T2}\,(KHN1)}\right) + \text{Delta N1}_{\text{Note 3}}$$

where KHN1 is found from Figure 1308.

Item (5) Corrected High Rotor Speed – RPM
Engines running with SVS 29 N2 BIAS:
See calculation procedure outlined in Table 1311A.
Engines running with SVS 29-3 N2 BIAS:
See calculation procedure outlined in Table 1311B.
Engines running with SVS 29-5 N2 BIAS:
See calculation procedure outlined in Table 1311C.
Engines running with SVS 29-2 N2 BIAS:
See calculation procedure outlined in Table 1311D.
Note 1: For an example calculation procedure for SVS 29 N2 BIAS configuration see Table 1312.
Note 2: Refer to Tables 1304 through 1306 to determine which SVS N2 BIAS is used.

Item (6) Corrected Exhaust Gas Temperature (EGT) – ^{o}C

$$\left[\frac{TT4.95\,^{o}C}{(\theta T2)^{1.0}\,(KHT4.95)}\right] = \left[\frac{\text{Observed }TT4.95\,^{o}C + 273.16}{(\theta T2)^{1.0}\,(KHT4.95)}\right] - (273.16) + \text{Delta }TT4.95_{\text{ Note 5}}$$

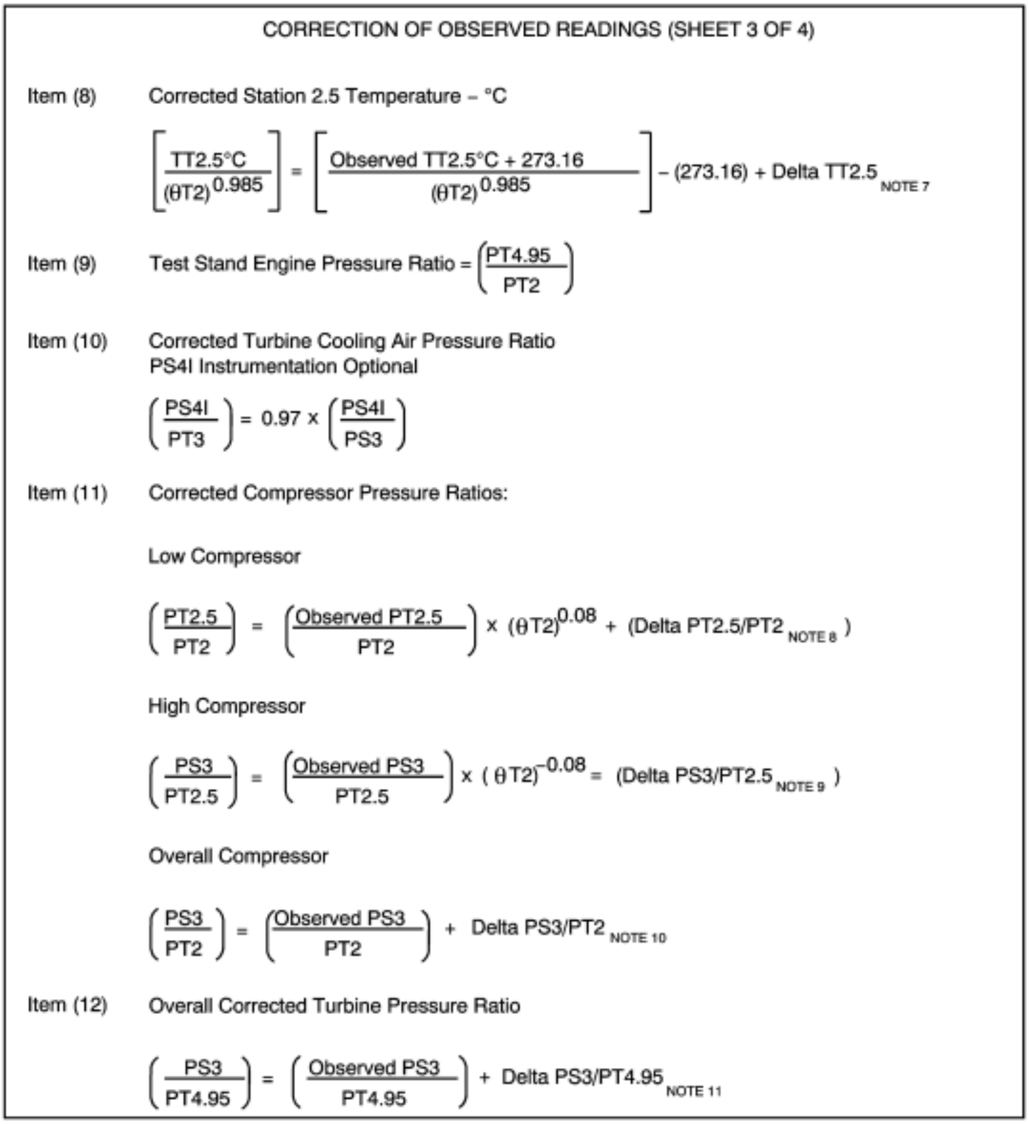
where KHT4.95 is found from Figure 1308.

Item (7) Corrected Station 3 Temperature – ^{o}C

$$\left[\frac{TT3\,^{o}C}{(\theta T2)^{0.932}}\right] = \left[\frac{\text{Observed }TT3\,^{o}C + 273.16}{(\theta T2)^{0.932}}\right] - (273.16) + \text{Delta }TT3_{\text{ Note 6}}$$

L-B0407 (0403)
PW V

Correction Of Observed Data
Figure 1302 (Sheet 2)
(Task 71-00-00-760-061)



CORRECTION OF OBSERVED READINGS (SHEET 3 OF 4)

Item (8) Corrected Station 2.5 Temperature – °C

$$\left[\frac{TT2.5°C}{(\theta T2)^{0.985}}\right] = \left[\frac{\text{Observed } TT2.5°C + 273.16}{(\theta T2)^{0.985}}\right] - (273.16) + \text{Delta } TT2.5_{\text{NOTE 7}}$$

Item (9) Test Stand Engine Pressure Ratio $= \left(\frac{PT4.95}{PT2}\right)$

Item (10) Corrected Turbine Cooling Air Pressure Ratio
PS4I Instrumentation Optional

$$\left(\frac{PS4I}{PT3}\right) = 0.97 \times \left(\frac{PS4I}{PS3}\right)$$

Item (11) Corrected Compressor Pressure Ratios:

Low Compressor

$$\left(\frac{PT2.5}{PT2}\right) = \left(\frac{\text{Observed } PT2.5}{PT2}\right) \times (\theta T2)^{0.08} + (\text{Delta } PT2.5/PT2_{\text{NOTE 8}})$$

High Compressor

$$\left(\frac{PS3}{PT2.5}\right) = \left(\frac{\text{Observed } PS3}{PT2.5}\right) \times (\theta T2)^{-0.08} = (\text{Delta } PS3/PT2.5_{\text{NOTE 9}})$$

Overall Compressor

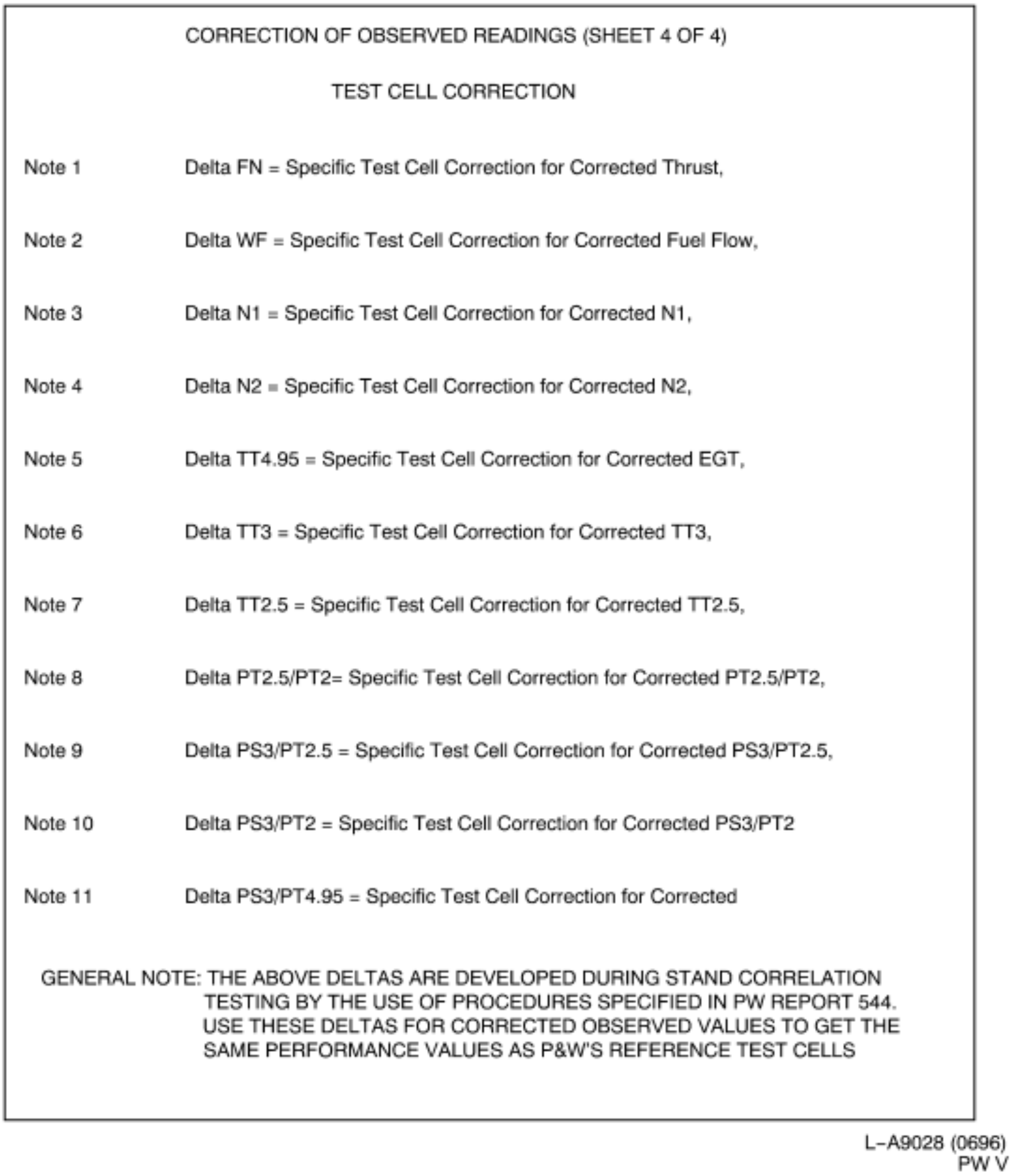
$$\left(\frac{PS3}{PT2}\right) = \left(\frac{\text{Observed } PS3}{PT2}\right) + \text{Delta } PS3/PT2_{\text{NOTE 10}}$$

Item (12) Overall Corrected Turbine Pressure Ratio

$$\left(\frac{PS3}{PT4.95}\right) = \left(\frac{\text{Observed } PS3}{PT4.95}\right) + \text{Delta } PS3/PT4.95_{\text{NOTE 11}}$$

L−B0882 (0705)
PW V

Correction Of Observed Data
Figure 1302 (Sheet 3)
(Task 71−00−00−760−061)



CORRECTION OF OBSERVED READINGS (SHEET 4 OF 4)

TEST CELL CORRECTION

Note 1	Delta FN = Specific Test Cell Correction for Corrected Thrust,
Note 2	Delta WF = Specific Test Cell Correction for Corrected Fuel Flow,
Note 3	Delta N1 = Specific Test Cell Correction for Corrected N1,
Note 4	Delta N2 = Specific Test Cell Correction for Corrected N2,
Note 5	Delta TT4.95 = Specific Test Cell Correction for Corrected EGT,
Note 6	Delta TT3 = Specific Test Cell Correction for Corrected TT3,
Note 7	Delta TT2.5 = Specific Test Cell Correction for Corrected TT2.5,
Note 8	Delta PT2.5/PT2= Specific Test Cell Correction for Corrected PT2.5/PT2,
Note 9	Delta PS3/PT2.5 = Specific Test Cell Correction for Corrected PS3/PT2.5,
Note 10	Delta PS3/PT2 = Specific Test Cell Correction for Corrected PS3/PT2
Note 11	Delta PS3/PT4.95 = Specific Test Cell Correction for Corrected

GENERAL NOTE: THE ABOVE DELTAS ARE DEVELOPED DURING STAND CORRELATION TESTING BY THE USE OF PROCEDURES SPECIFIED IN PW REPORT 544. USE THESE DELTAS FOR CORRECTED OBSERVED VALUES TO GET THE SAME PERFORMANCE VALUES AS P&W'S REFERENCE TEST CELLS

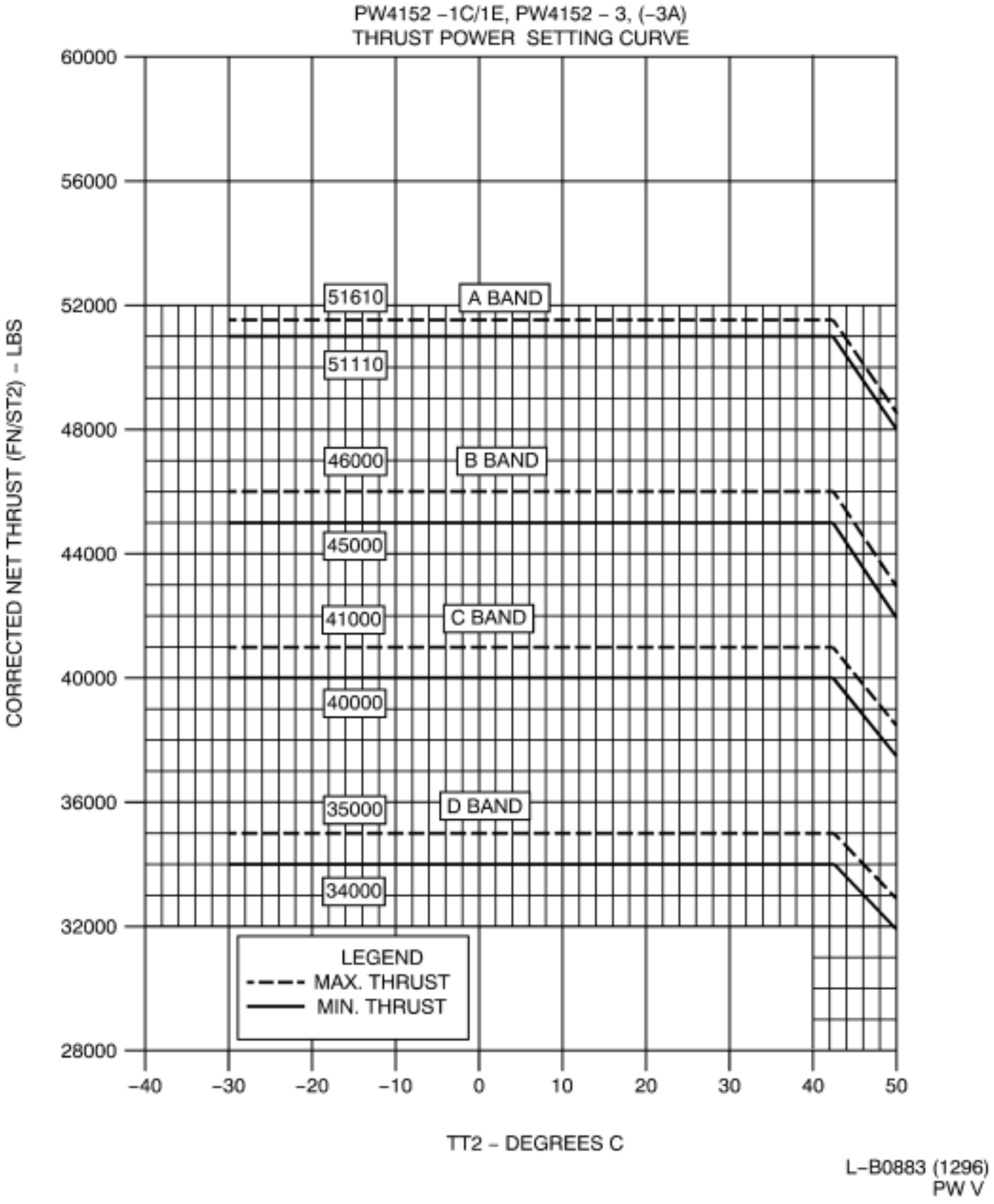
L−A9028 (0696)
PW V

Correction Of Observed Data
Figure 1302 (Sheet 4)
(Task 71−00−00−760−061)

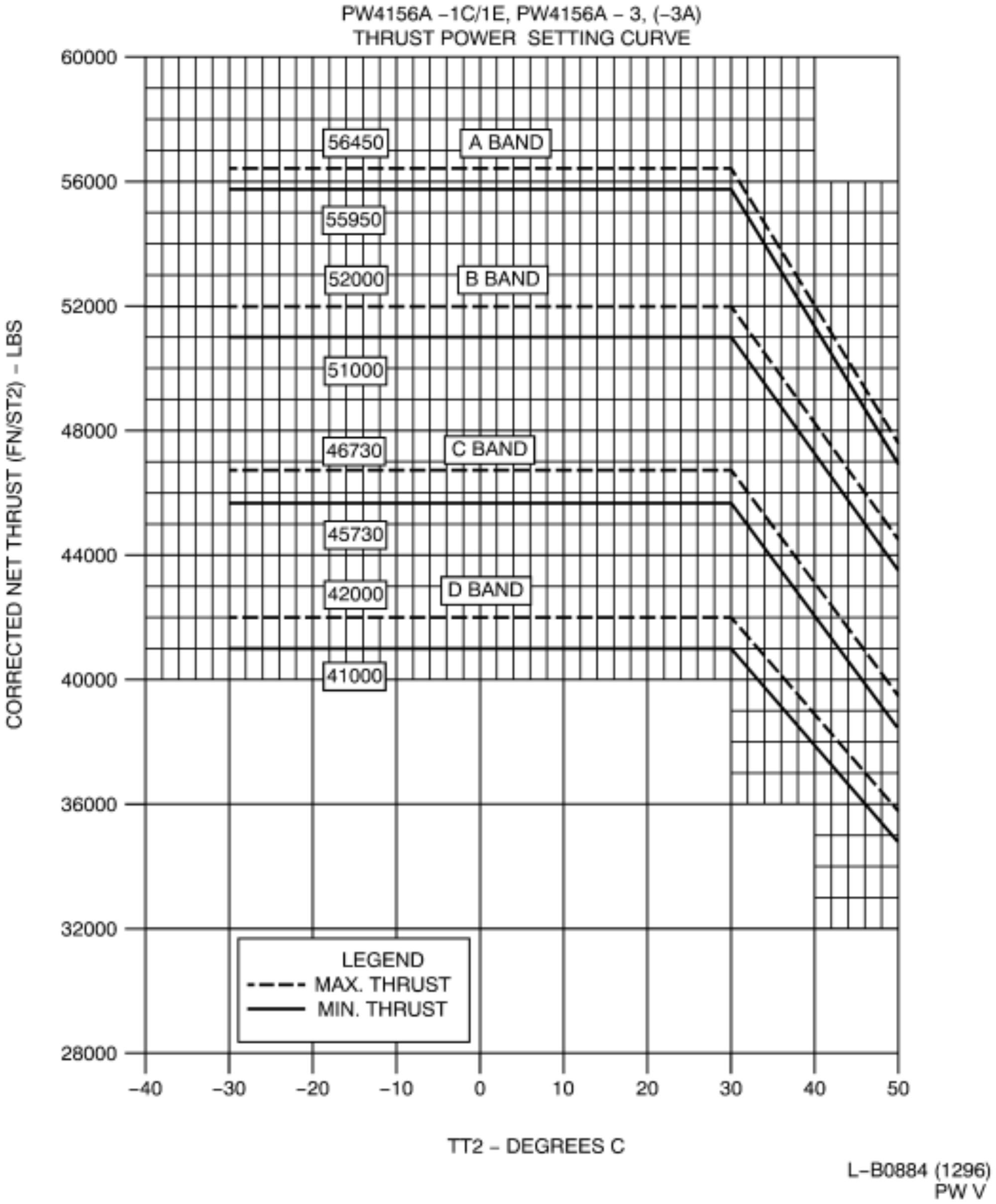
FIGURE NOT USED

L−00000 (0000)
PW V

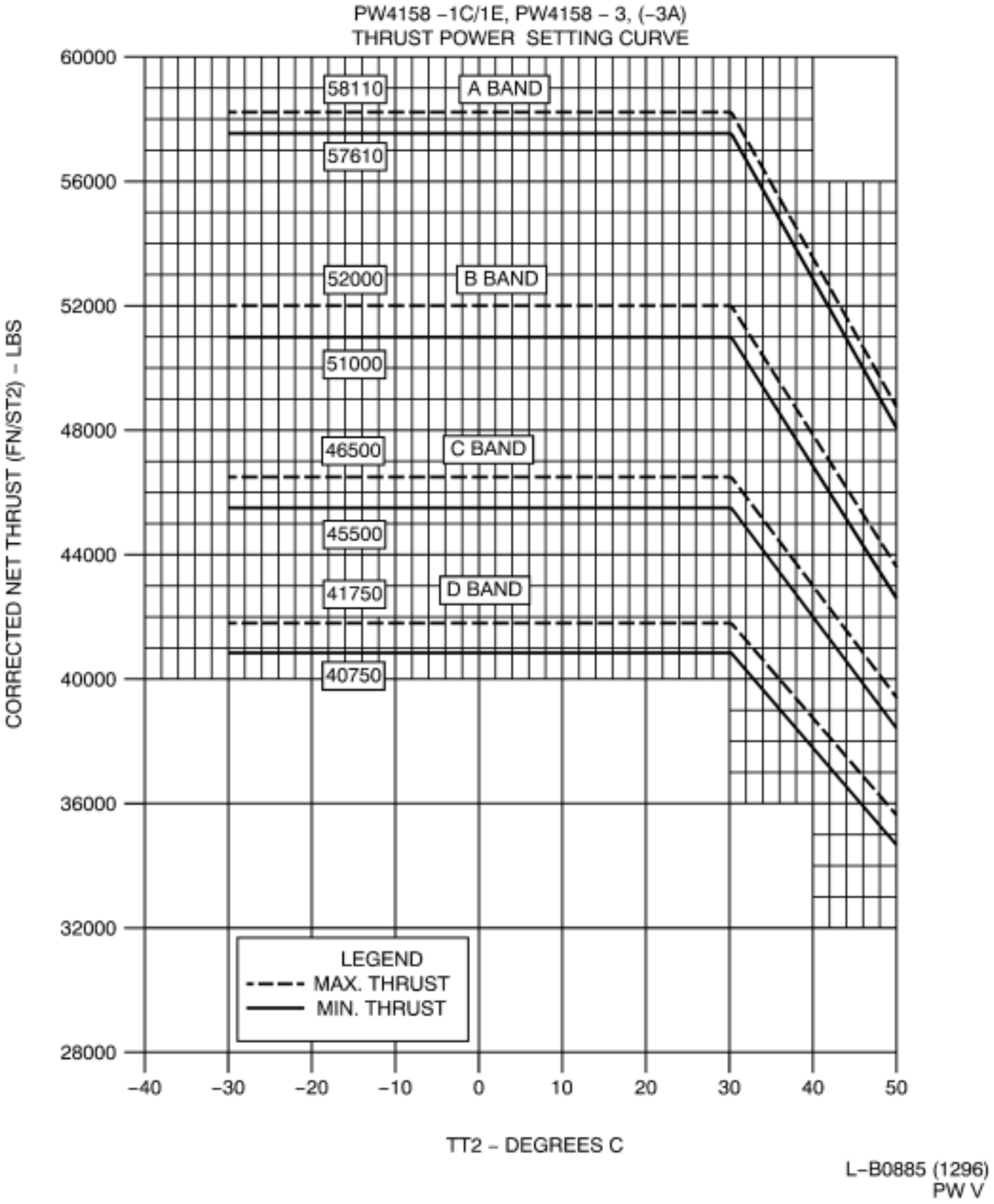
Corrected Turbine Cooling Air Pressure
Figure 1303
(Task 71−00−00−760−061)



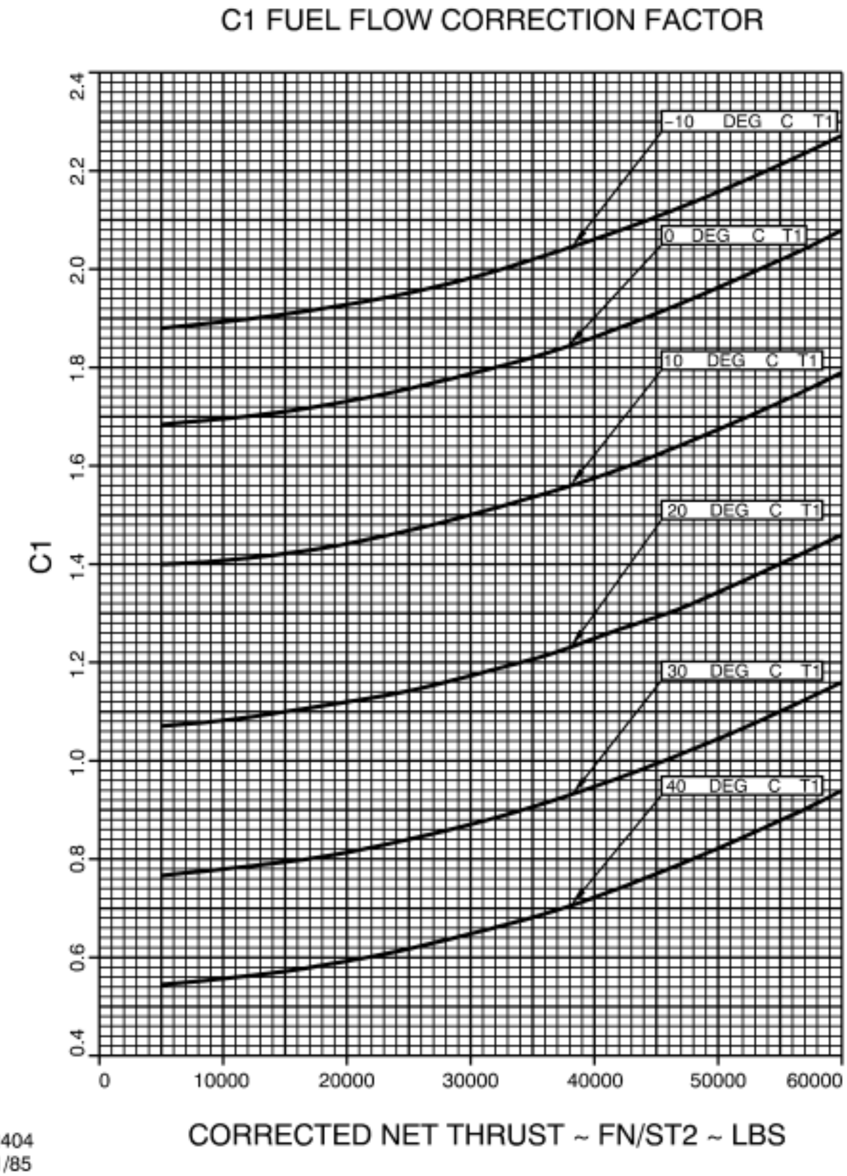
Thrust Power Setting Curve (PW4152 (−3) Engines)
Figure 1304 (Sheet 1)
(Task 71−00−00−760−061)



Thrust Power Setting Curve (PW4156A (−3) Engines)
Figure 1304 (Sheet 2)
(Task 71−00−00−760−061)



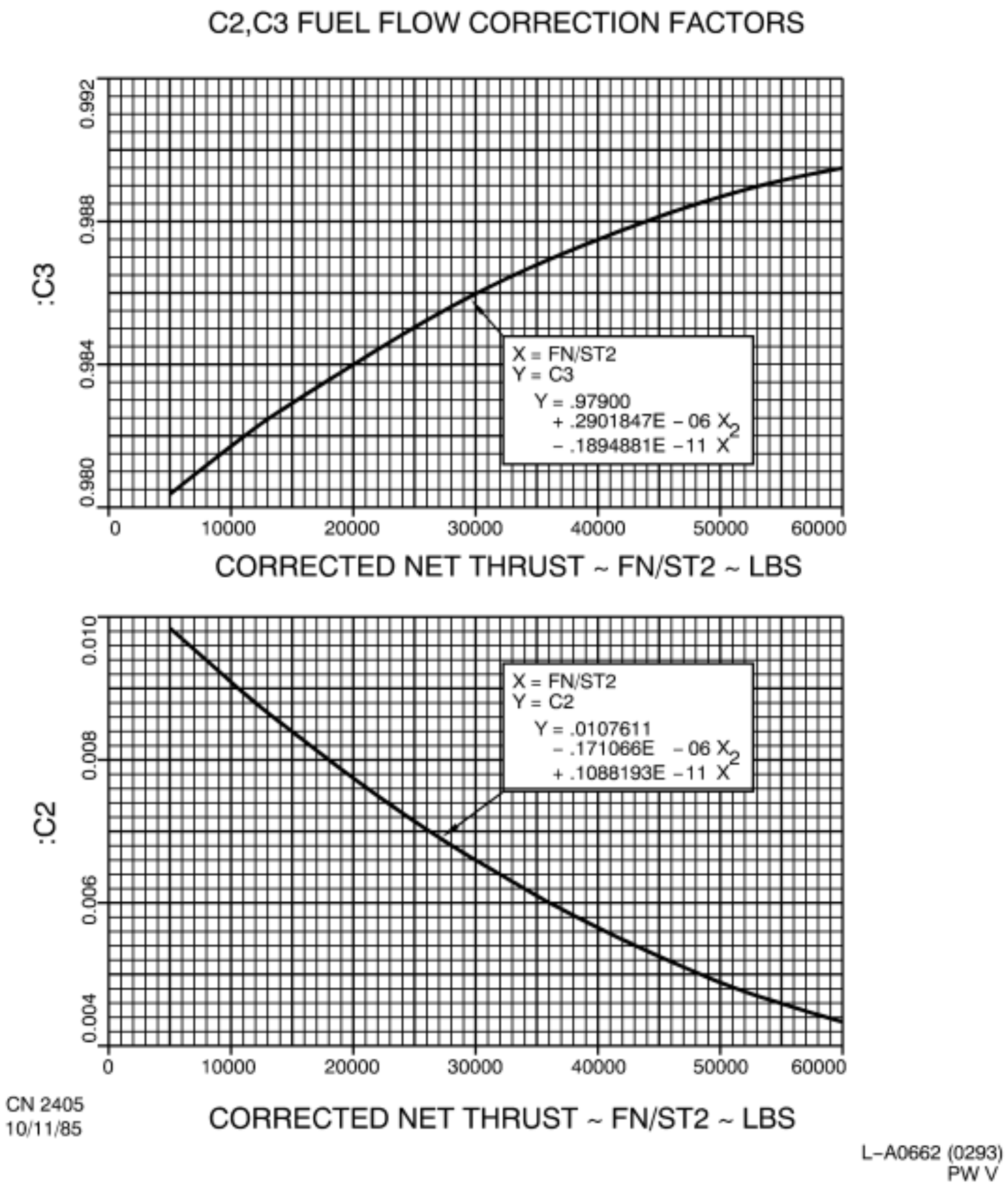
Thrust Power Setting Curve (PW4158 (−3) Engines)
Figure 1304 (Sheet 3)
(Task 71−00−00−760−061)



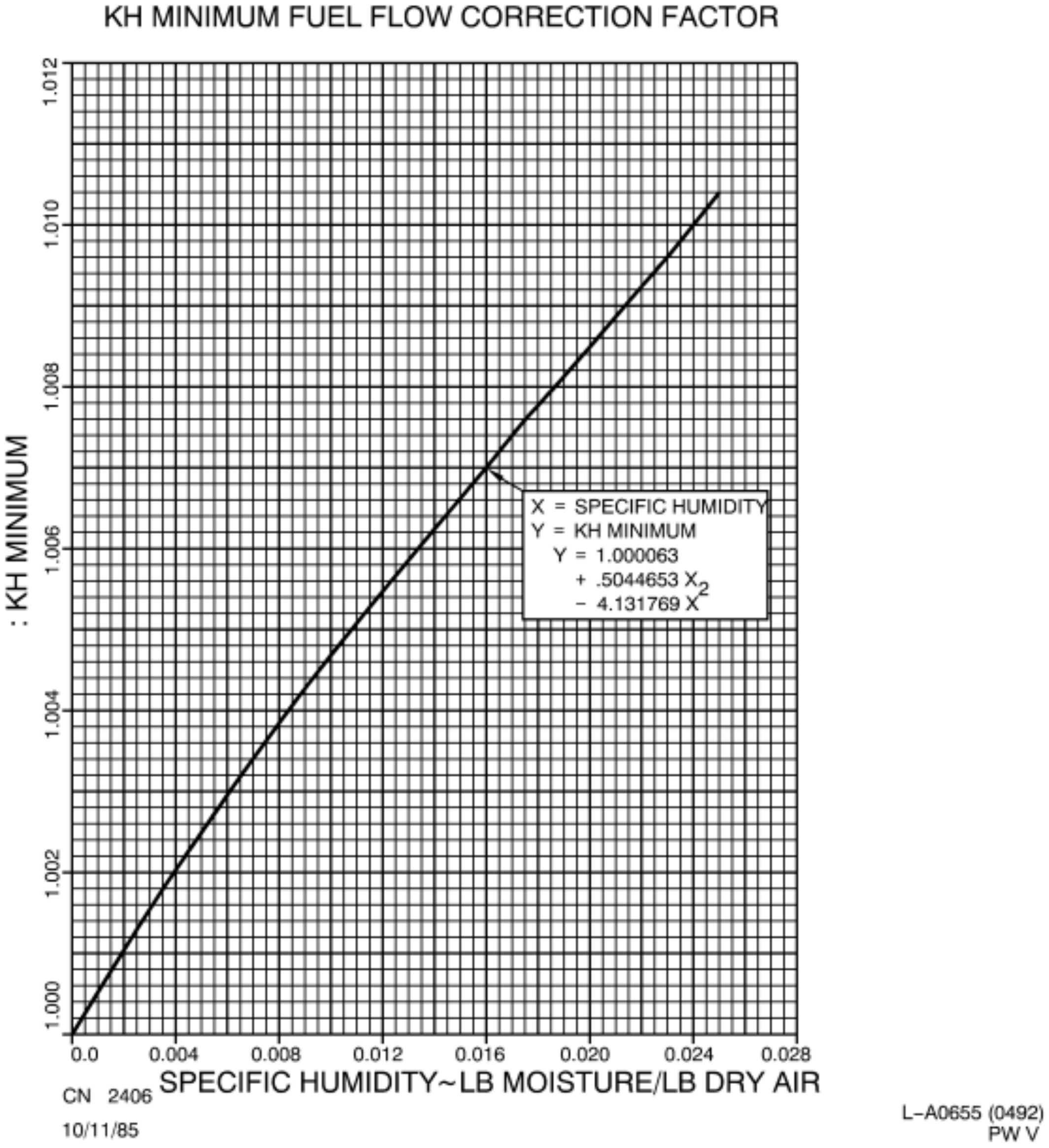
CN 2404
10/11/85

L-A0661 (0690)
PW V

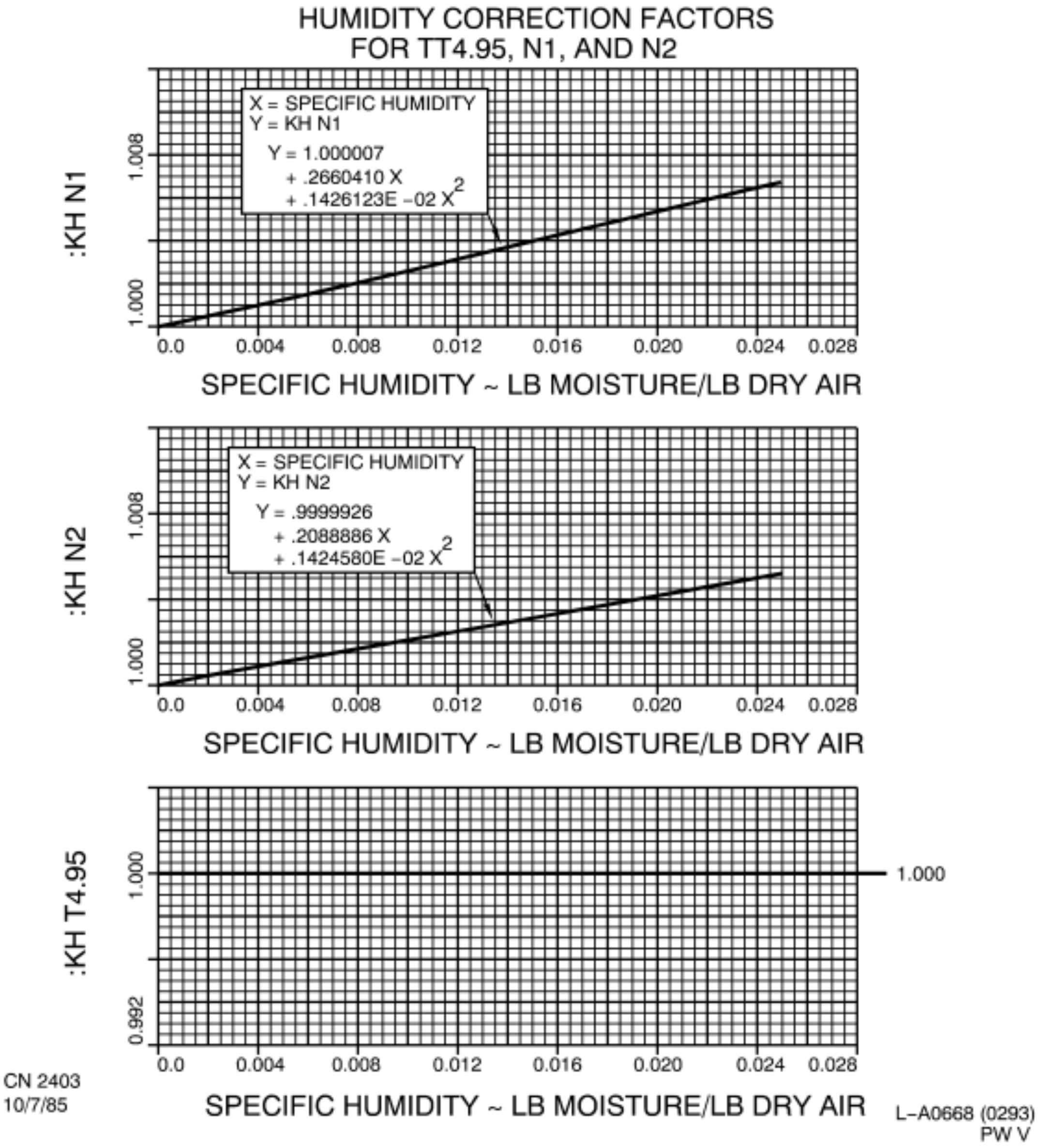
Fuel Flow Correction Factors (KH)
Figure 1305
(Task 71-00-00-760-061)



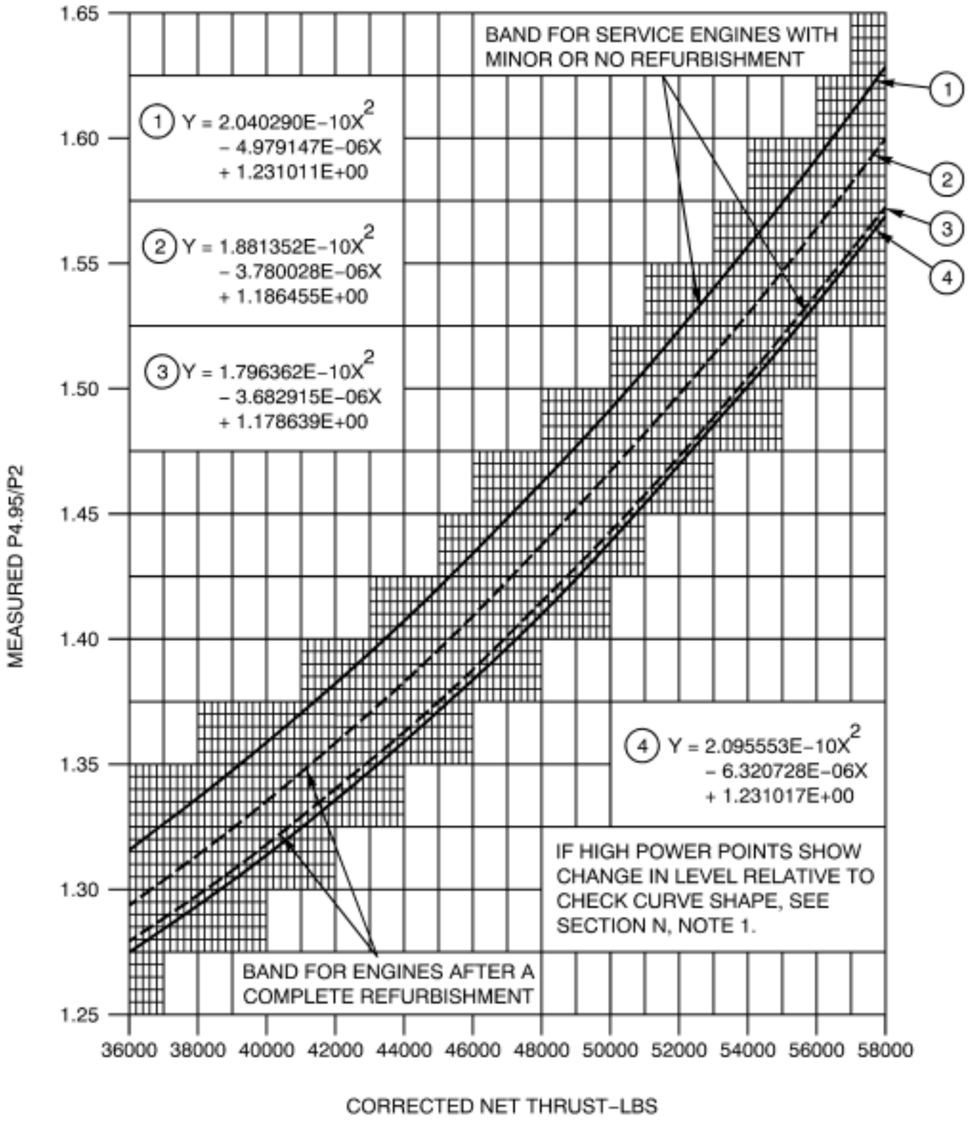
Fuel Flow Correction Factors (KH)
Figure 1306
(Task 71-00-00-760-061)



Fuel Flow Correction Factors (KH)
Figure 1307
(Task 71−00−00−760−061)



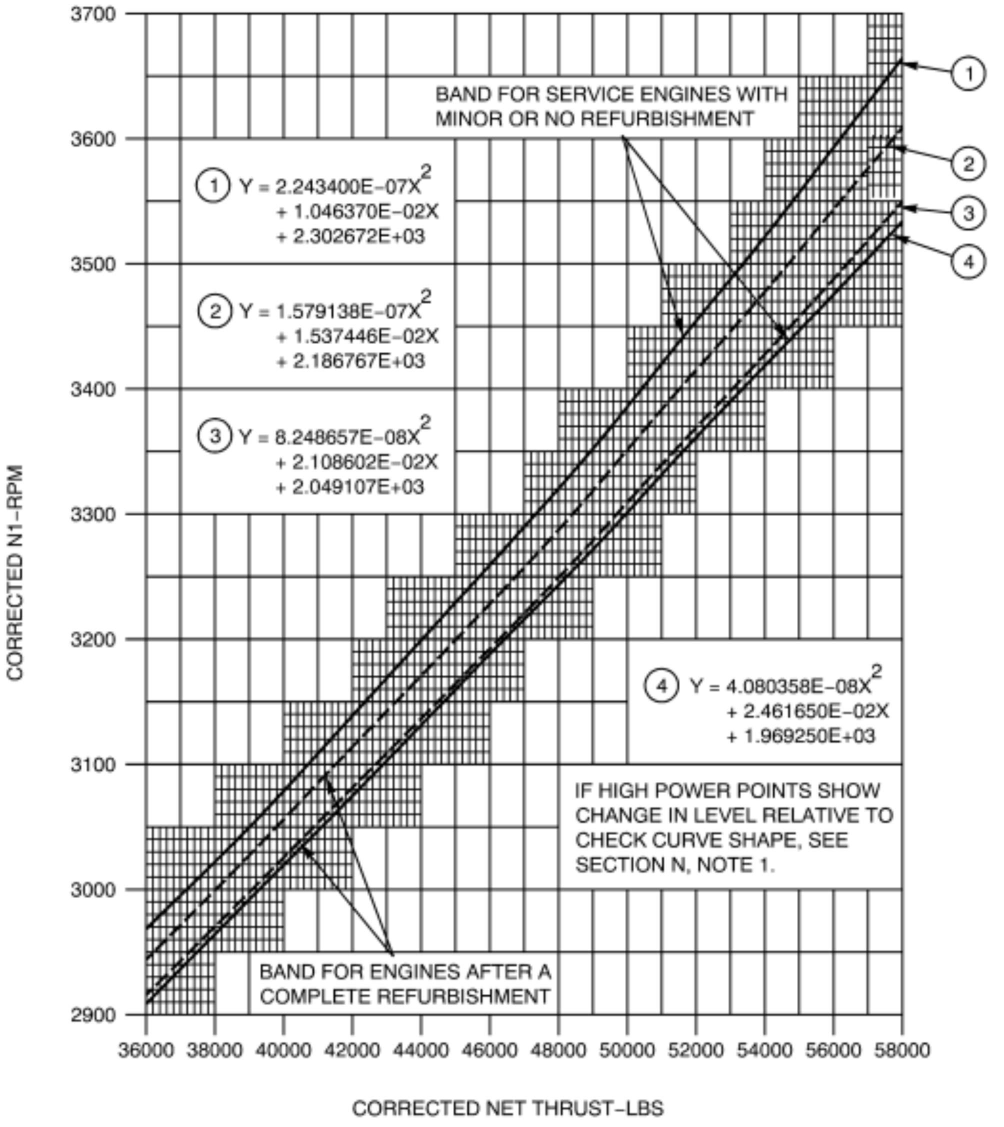
Humidity Correction Factors
Figure 1308
(Task 71−00−00−760−061)



NOTE: FOR ALL EQUATIONS
X = CORRECTED NET THRUST

L-B0217 (0202)
PW V

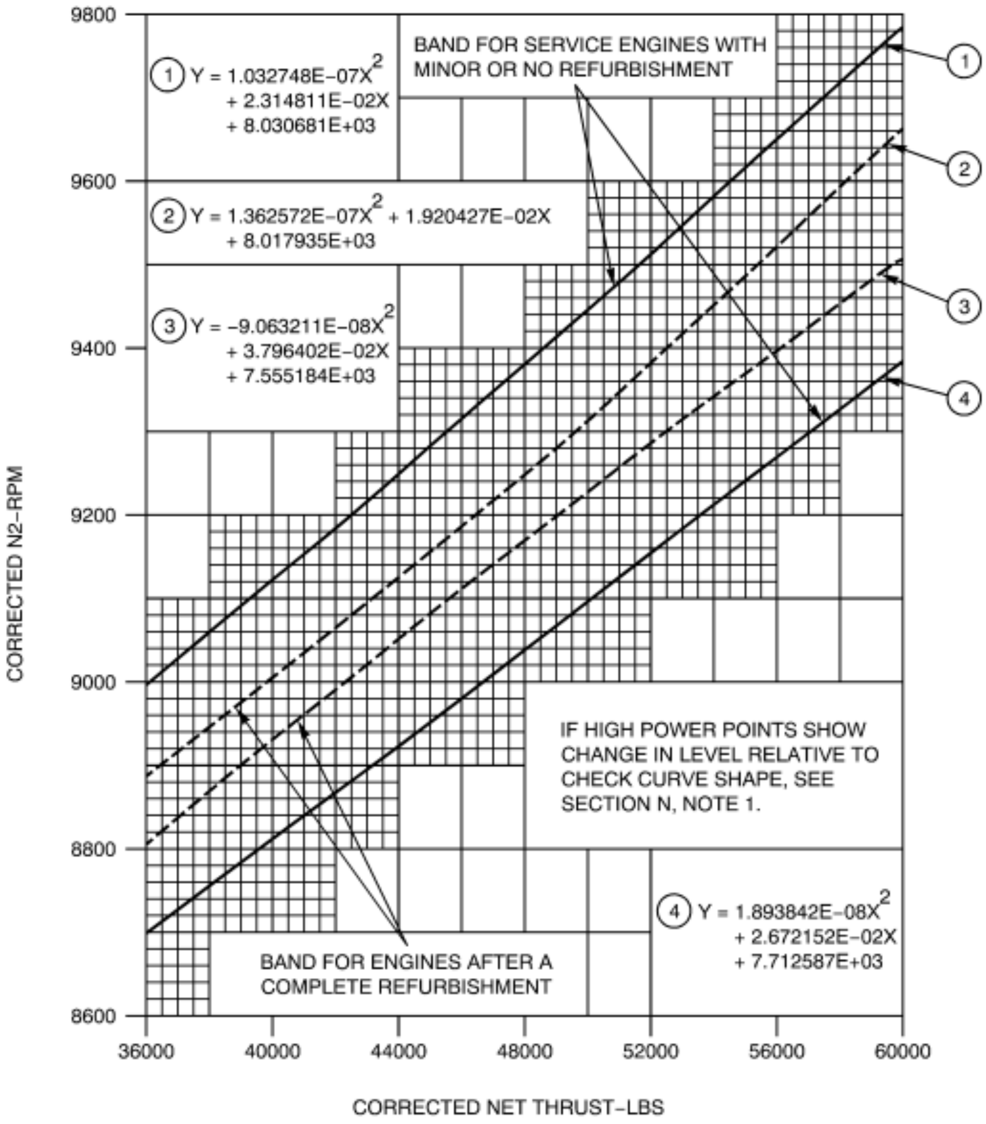
Gas Generator Check Curves
Figure 1309 (Sheet 1)
(Task 71-00-00-760-061)



NOTE: FOR ALL EQUATIONS
X = CORRECTED NET THRUST

L-B0218 (0202)
PW V

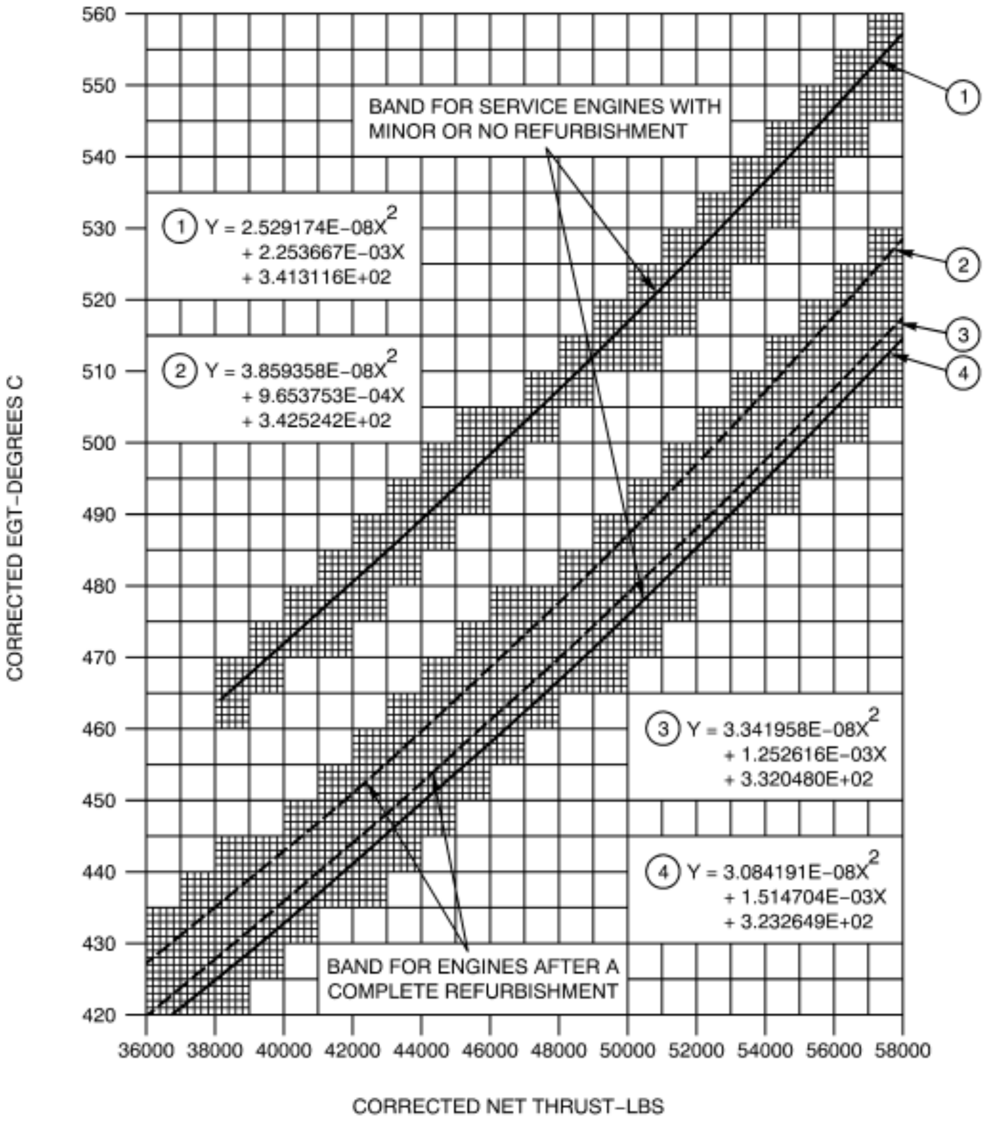
Gas Generator Check Curves
Figure 1309 (Sheet 2)
(Task 71-00-00-760-061)



NOTE: FOR ALL EQUATIONS
X = CORRECTED NET THRUST

L-B0219 (0202)
PW V

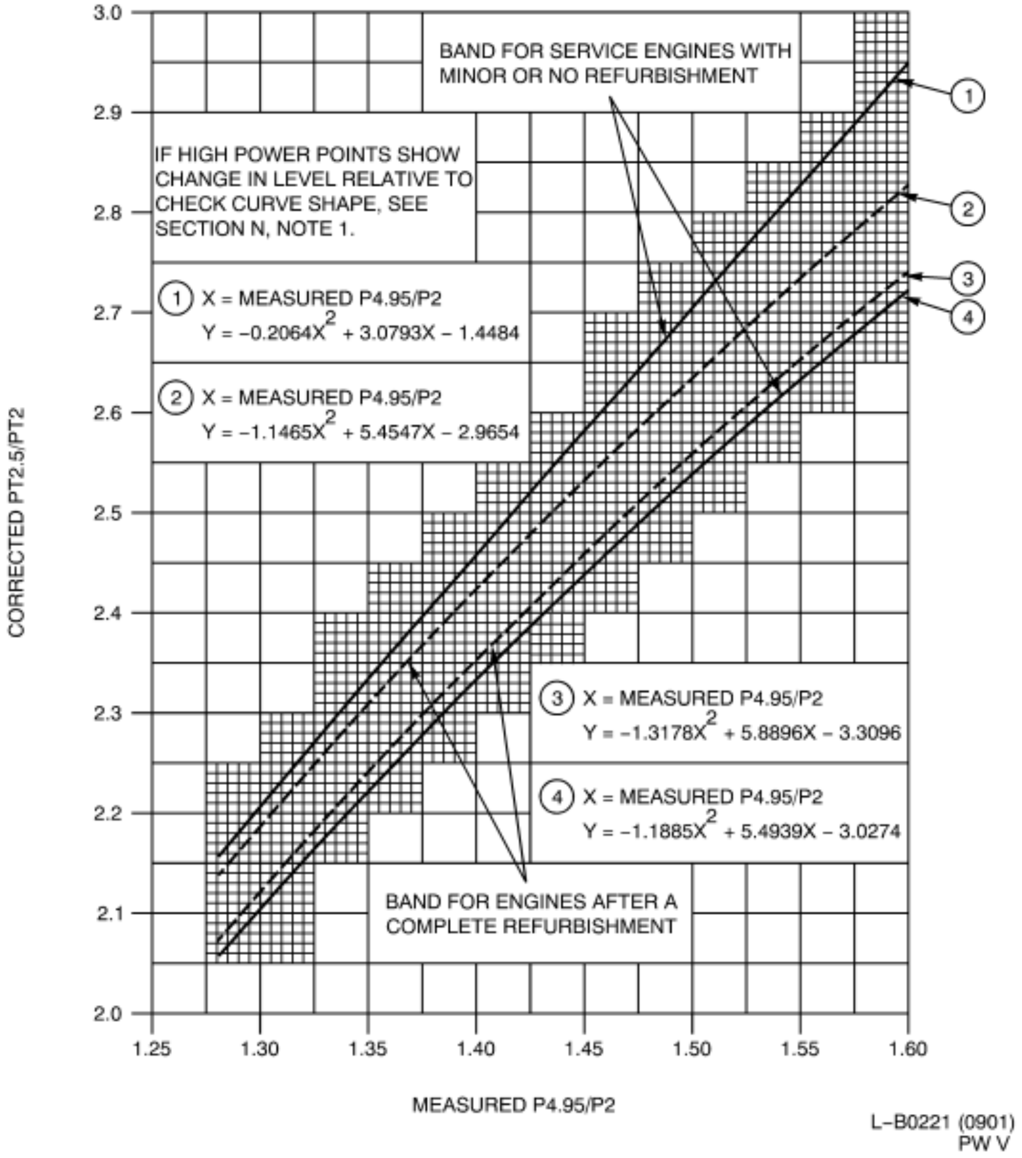
Gas Generator Check Curves
Figure 1309 (Sheet 3)
(Task 71-00-00-760-061)



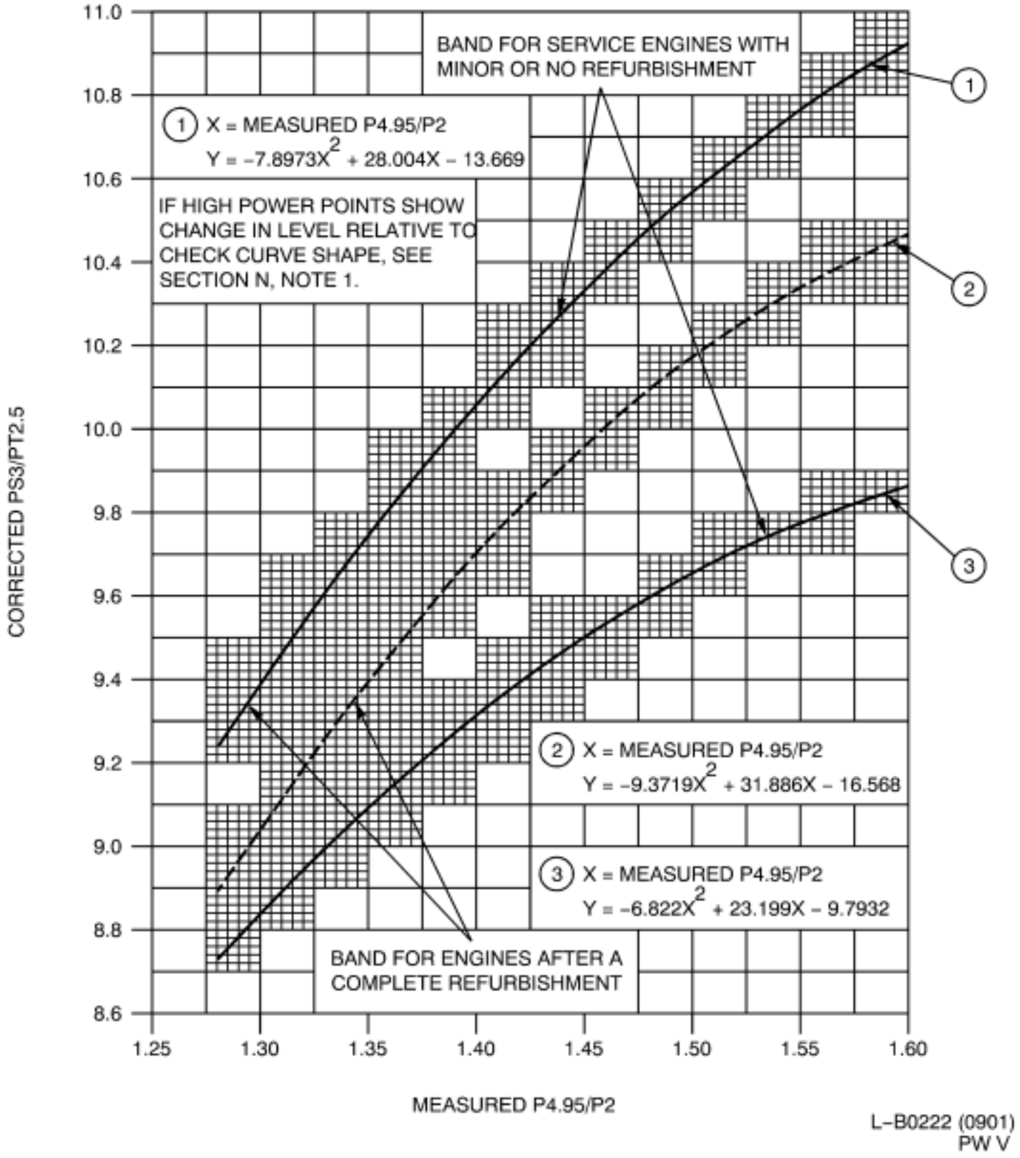
NOTE: FOR ALL EQUATIONS
X = CORRECTED NET THRUST

L−B0220 (0202)
PW V

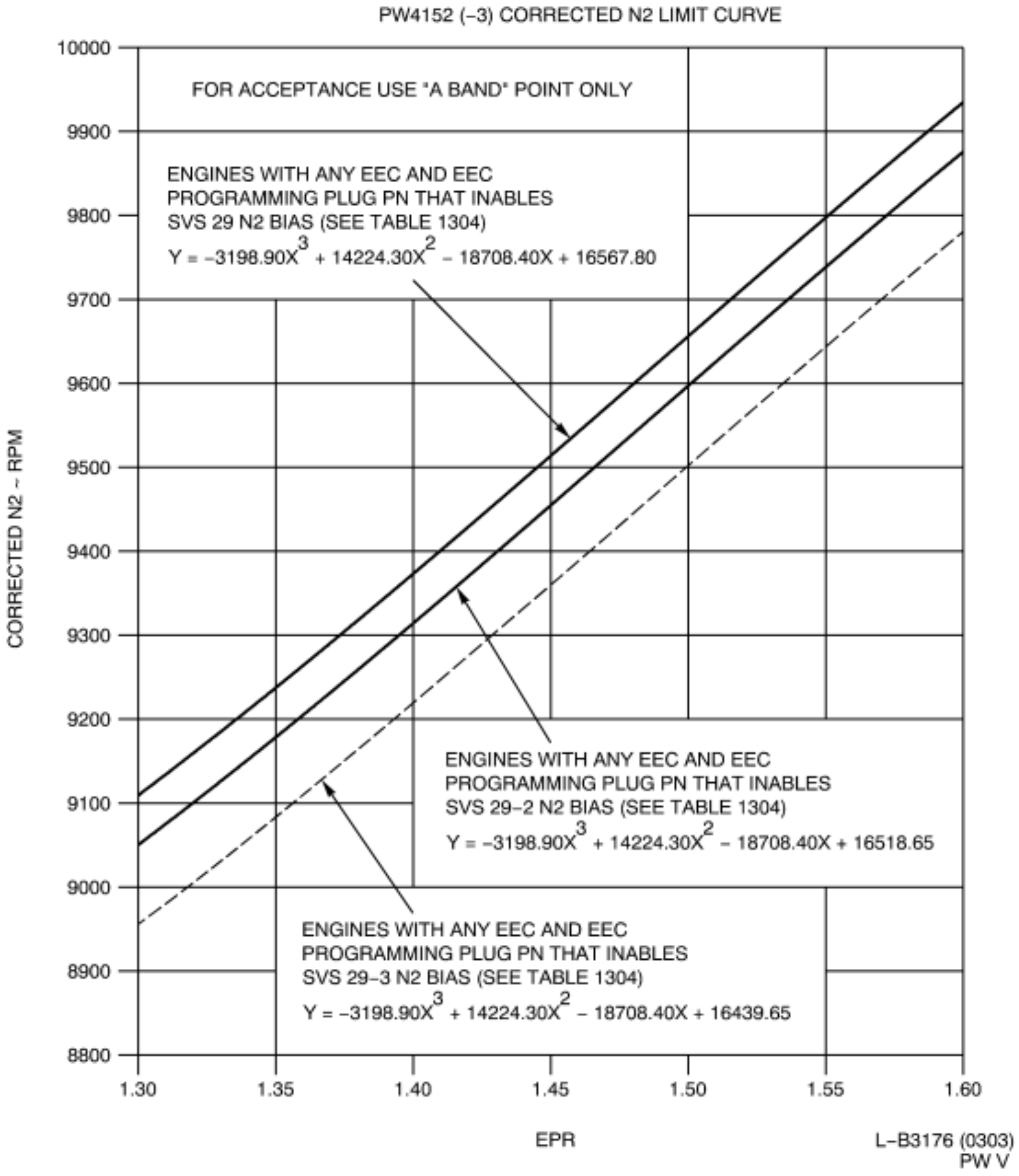
Gas Generator Check Curves
Figure 1309 (Sheet 4)
(Task 71−00−00−760−061)



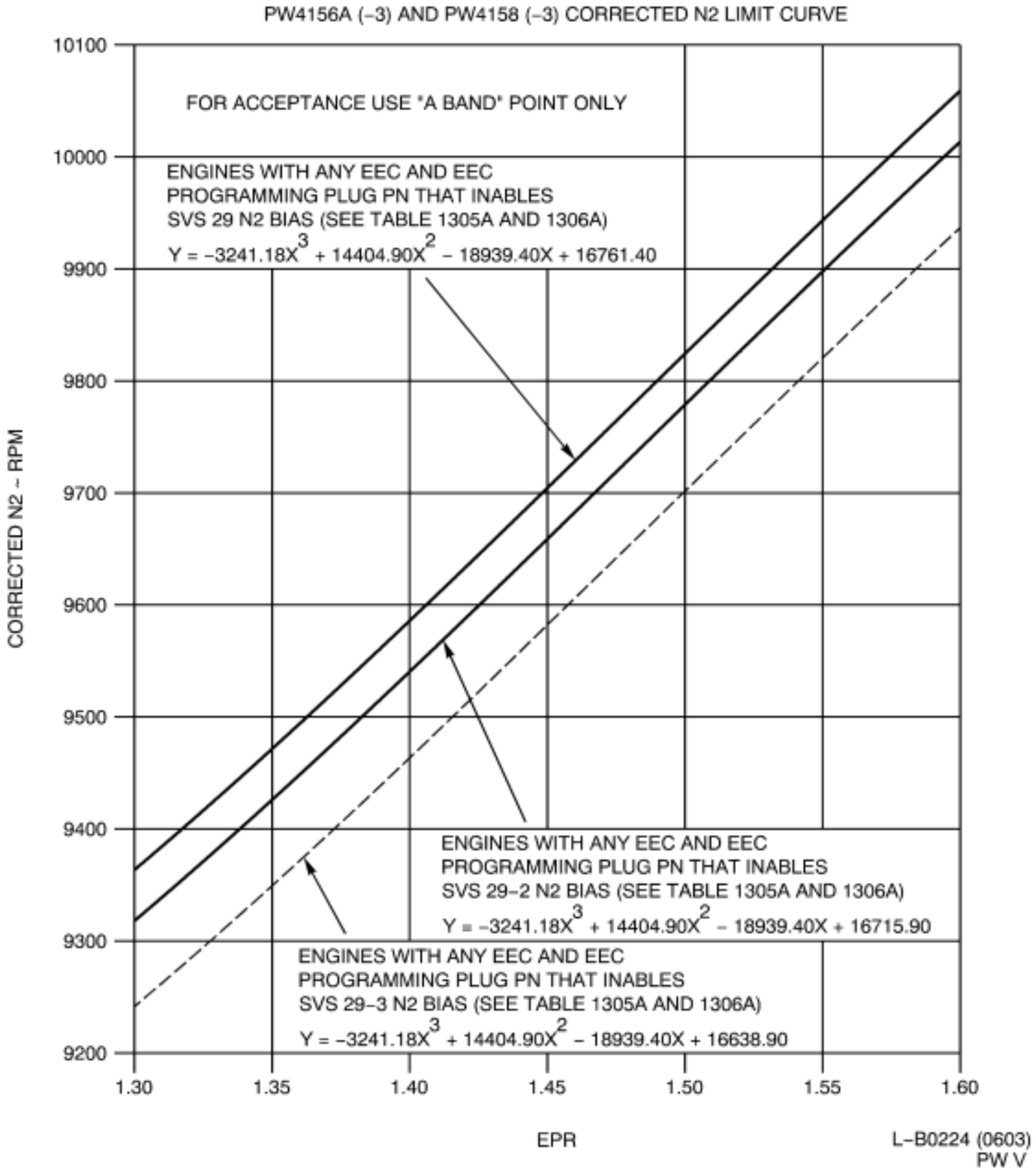
Gas Generator Check Curves
Figure 1309 (Sheet 5)
(Task 71−00−00−760−061)



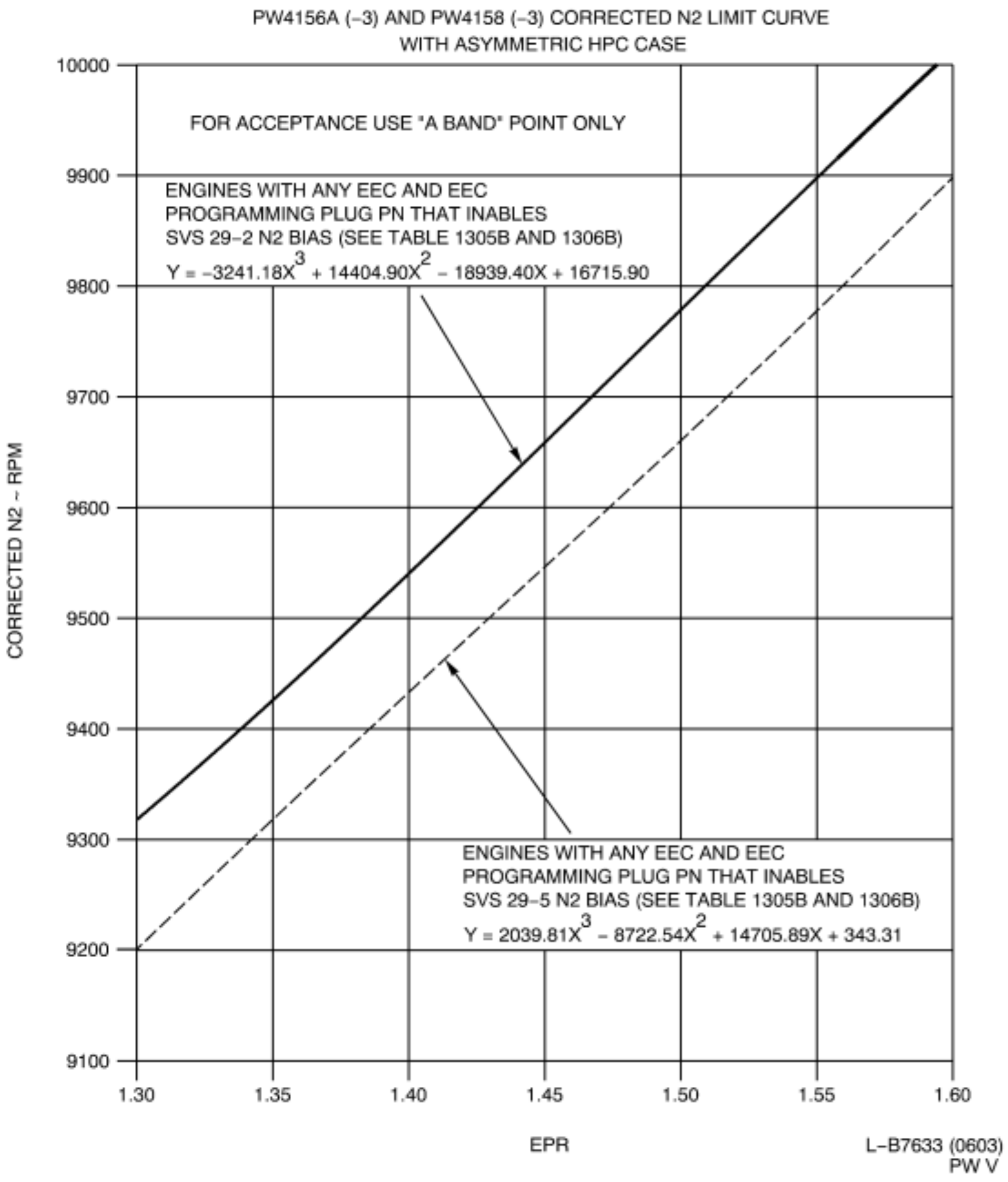
Gas Generator Check Curves
Figure 1309 (Sheet 6)
(Task 71−00−00−760−061)



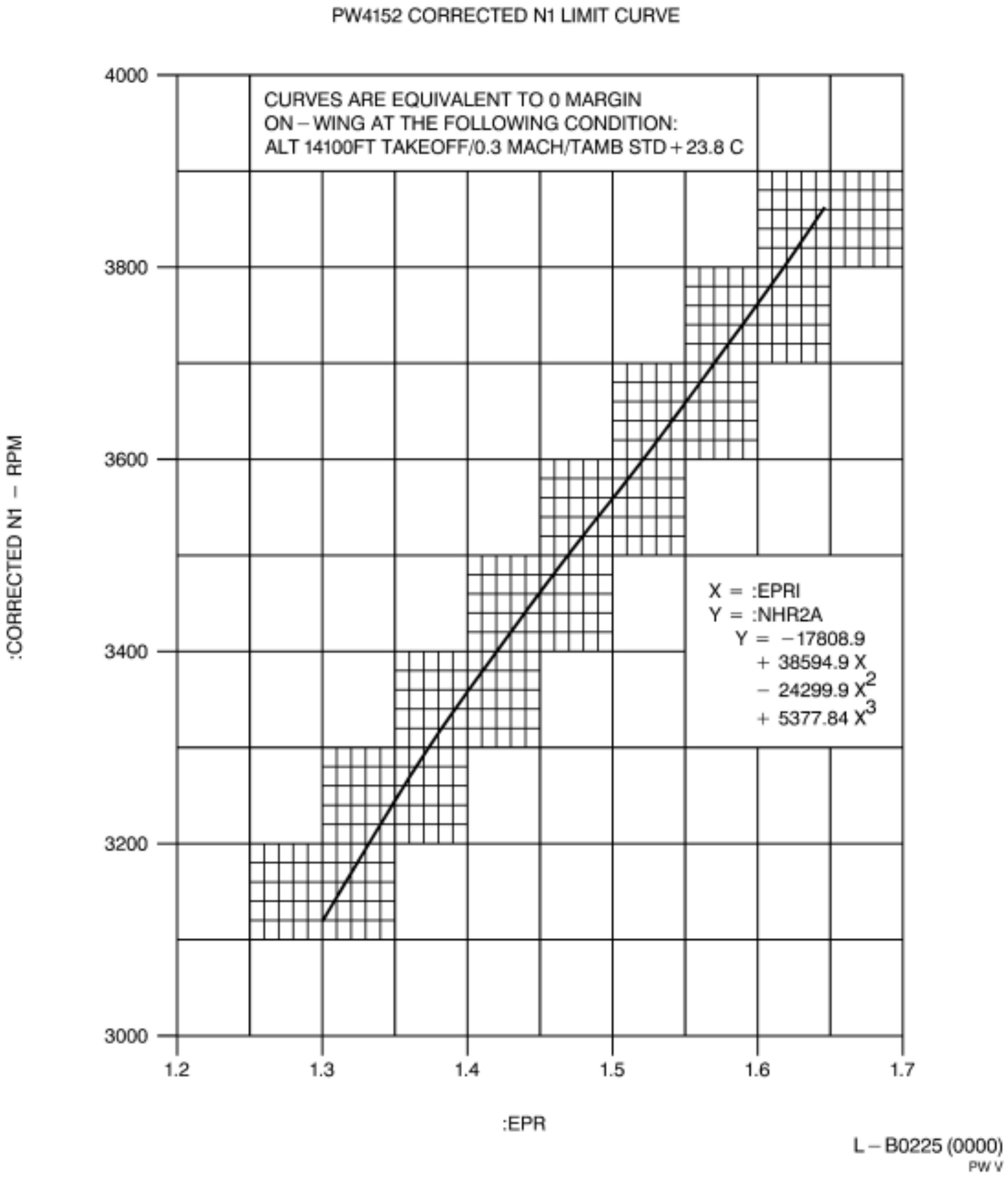
N2 Rotor Speed Limit Curve (PW4152 (−3) Engines)
Figure 1310 (Sheet 1)
(Task 71−00−00−760−061)



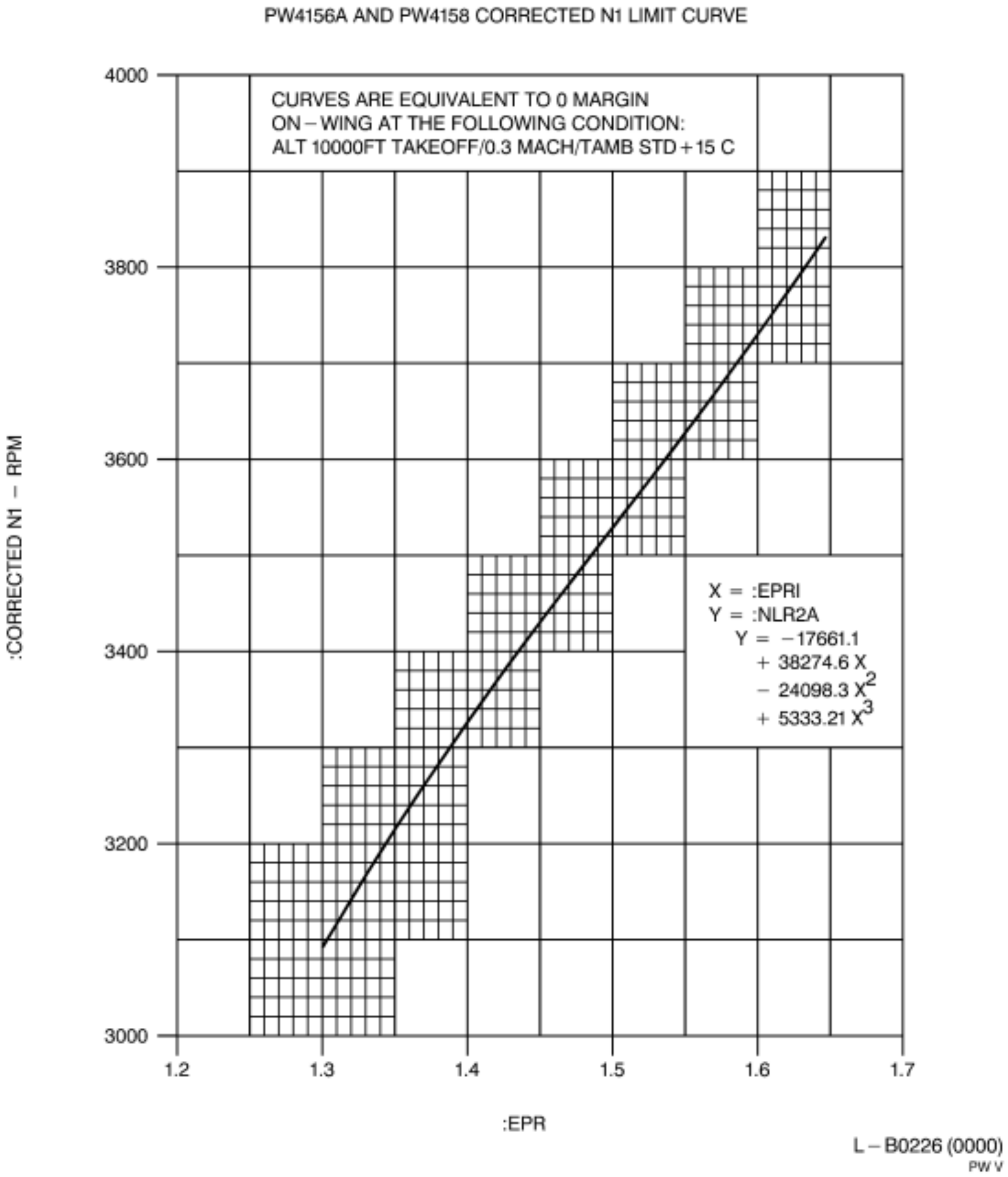
N2 Rotor Speed Limit Curve (PW4156A (−3) And PW4158 (−3) Engines)
Figure 1310 (Sheet 2)
(Task 71−00−00−760−061)



N2 Rotor Speed Limit Curve (PW4156A (−3) (PW4158 (−3) Engines)
Figure 1310 (Sheet 3)
(Task 71−00−00−760−061)

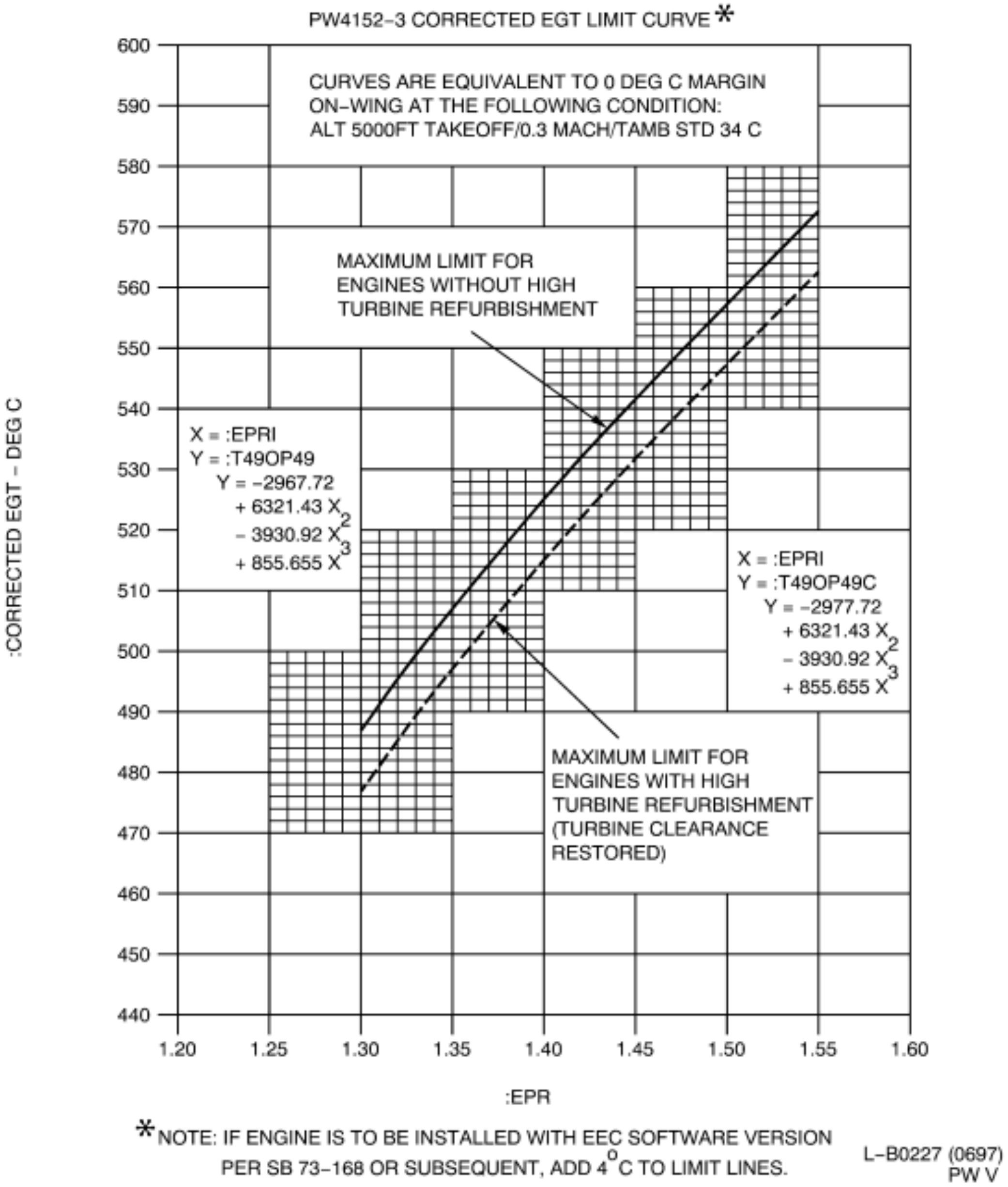


N1 Rotor Speed Limit Curve (PW4152 (-3) Engines)
Figure 1311 (Sheet 1)
(Task 71-00-00-760-061)



$$Y = -17661.1 + 38274.6X - 24098.3X^2 + 5333.21X^3$$

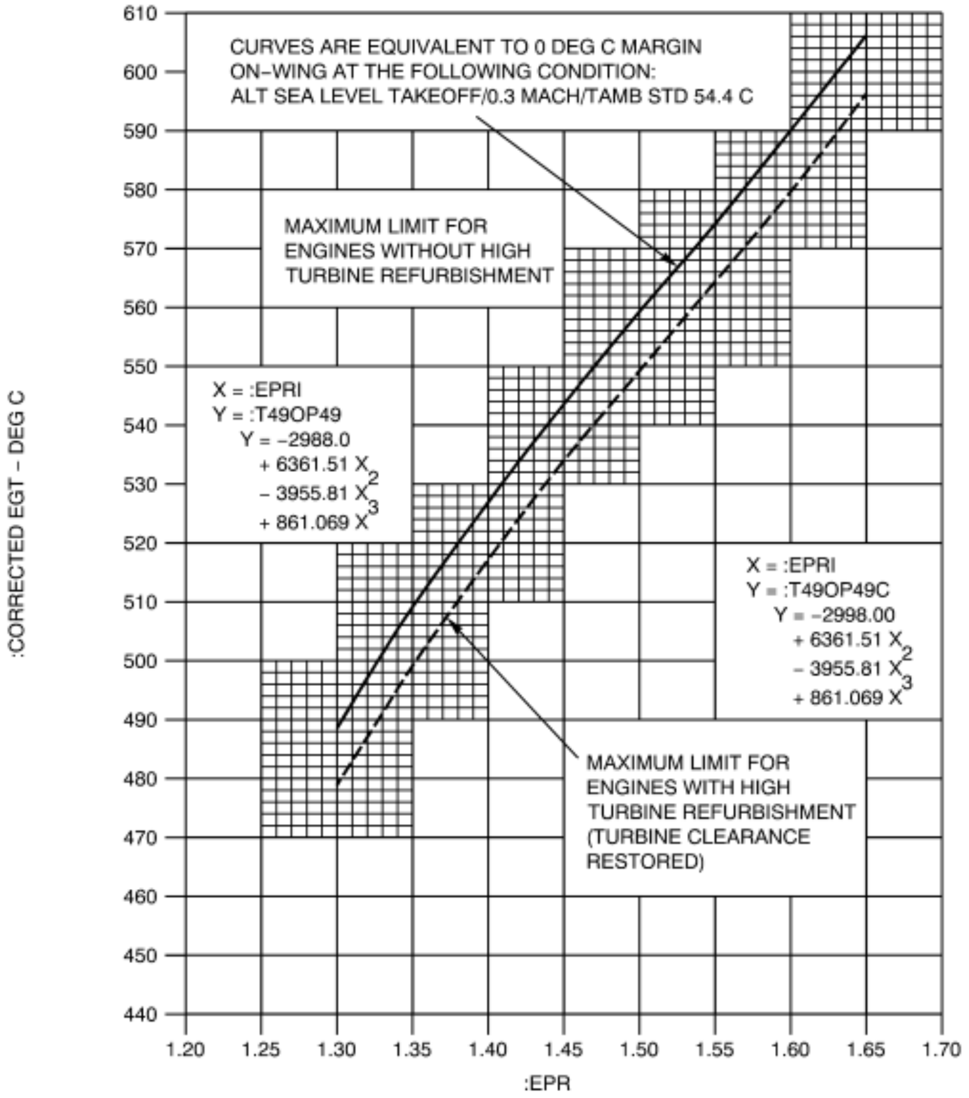
N1 Rotor Speed Limit Curve (PW4156A (−3) And PW4158 (−3) Engines)
Figure 1311 (Sheet 2)
(Task 71−00−00−760−061)



*NOTE: IF ENGINE IS TO BE INSTALLED WITH EEC SOFTWARE VERSION PER SB 73-168 OR SUBSEQUENT, ADD 4 °C TO LIMIT LINES.

Corrected EGT Limit Curve (PW4152 (-3) Engines)
Figure 1312 (Sheet 1)
(Task 71-00-00-760-061)

PW4156A−3 AND PW4158−3 CORRECTED EGT LIMIT CURVE *



*NOTE: IF ENGINE IS TO BE INSTALLED WITH EEC SOFTWARE VERSION PER SB 73−168 OR SUBSEQUENT, ADD 4°C TO LIMIT LINES.

L−B0228 (0697)
PW V

Corrected EGT Limit Curve (PW4156A (−3) And PW4158 (−3) Engines)
Figure 1312 (Sheet 2)
(Task 71−00−00−760−061)

Task 71−00−00−760−060:

1. Test No. 9 − Engine Acceptance Test

A. Prerequisite Procedure

CAUTION: ENGINE CONFIGURATION IDENTIFIER MUST BE CAREFULLY DETERMINED. FAILURE TO CORRECTLY IDENTIFY CONFIGURATION COULD RESULT IN RED LINE EXCEEDANCE AND/OR THRUST SHORTFALL

(1) Use Table 1301 to get the necessary Testing−09 configuration. Get the engine configuration from the engine identification data plate. Look for a configuration identification suffix marked after the engine model in the model field.

(a) EXAMPLE 1:

1 If "PW4158 (−3)" is marked on the engine identification plate, the configuration identifier suffix is "(−3)". This corresponds to a Phase 3 configuration as specified in Table 1301. Use TESTING−09, CONFIG−2 to do the acceptance test.

(b) EXAMPLE 2:

1 If "PW4158" is marked on the engine identification plate with no configuration identifier suffix, the configuration is Pre Phase 3 as specified in Table 1301. Use TESTING−09, CONFIG−1 to do the acceptance test.

(c) EXAMPLE 3:

1 If "PW4158 (−1C/−1E)" is marked on the engine identification plate, the configuration identifier suffix is "(−1C/−1E)". This corresponds to a Pre Phase−3 engine with a FB2C (Phase−3) fan installed by SB PW4ENG 72−516.

TESTING−09 CONFIGURATION	ENGINE CONFIGURATION	CONFIGURATION IDENTIFICATION SUFFIX
Config−1	Pre Phase 3	None

TESTING−09 CONFIG/ENGINE CONFIGURATION
Table 1301

TESTING-09 CONFIGURATION	ENGINE CONFIGURATION	CONFIGURATION IDENTIFICATION SUFFIX
Config-2	Phase 3 (Reference SB PW4ENG 72-572)	(-3)
Config-3	Intermix (-1C or -1E) (Reference SB PW4ENG 72-516)	(-1C/-1E)
Config-4	NOT AVAILABLE for Airbus installations	
Config-5	Intermix (-3A) (Reference SB PW4ENG 73-150)	(-3A)

TESTING-09 CONFIG/ENGINE CONFIGURATION
Table 1301 (Continued)

(2) Use this procedure to test the engine for satisfactory performance after one or more components or modules have been replaced or repaired. This test is also used after the engine was fully disassembled, repaired and assembled.

NOTE: It is recommended that you not install large quantities of blended blades, vanes and airseals in one engine. If these parts are blended to the maximum limits in many areas, the result will be low engine performance.

(3) It is possible that other tests are necessary before you do this test, see 71-00-00 Power Plant General - Testing-00, Test Requirements After Engine/Module/Component Repair or Replacement, Task 71-00-00-990-003. This procedure will also give the sequence for the necessary tests.

(4) Special instrumentation must be installed on the engine before the engine is operated for this test.

(5) The engine testing must be done in a test configuration and test cell that has been calibrated. Calibrate to the specifications shown in P&W Publication Report No. 544. All test data must be corrected to the special test cell correction factors before you use the limits and curves in this procedure.

(6) For general safety information, see 71-00-00, Power Plant General - Testing-00, Engine Safety Precautions, Task 71-00-00-990-004.

(7) For safe engine operation, see 71-00-00, Power Plant General - Testing-00, Precautions And Procedures For Safe And Correct Engine Operation, Task 71-00-00-760-002.

(8) For engine operation limits, see 71-00-00, Power Plant General - Testing-00, Engine Operation Limits, Task 71-00-00-990-007.

B. Equipment And Materials Necessary

Standard Tools (See 71-00-00, Power Plant General - Testing-00, Prepare The Engine For Test In A Cell, Task 71-00-00-480-001

(1) Fuel pump drain hose and collection bottle.

(2) Stator vane drain hose and collection bottle.

(3) Station 2.5 compressor bleed actuator drain hose and collection bottle.

(4) Air/oil cooler modulating valve drain hose and collection bottle.

(5) IDG air/oil cooler modulating valve drain hose and collection bottle.

(6) TCC actuator modulating valve drain hose and collection bottle.

(7) Accessory drive fluid power pump drain hose and collection bottle.

(8) Starter drive drain hose and collection bottle.

(9) IDG drain hose and collection bottle.

(10) Accessory drive EEC generator seal drain hose and collection bottle.

(11) Fuel/oil heat exchanger IDGS core drain hose and collection bottle.

(12) Fuel/oil heat exchanger engine oil core drain hose and collection bottle.

(13) Fuel/oil heat exchanger IDG center tube drain hose and collection bottle.

(14) Bypass valve drain hose and collection bottle.

(15) Hydraulic pump drain hose and collection bottle.

C. Test Instrumentation And Test Cell Connections.
Install the special instrumentation and equipment that follows:

(1) PT2 and PS2 (8 locations) − (optional)

(2) PT2/TT2 Rosemount probe − (PWA 85523)

(3) TT2 − Compressor inlet total temperature (8 locations)

(4) Fuel flow (observed)

(5) T Fuel

(6) N1 RPM − (NL)

(7) N2 RPM − (NH)

(8) PT2.5*

(9) PS3

(10) PS4I (Optional)

(11) PT4.95

(12) Main Oil Pressure

(13) Main Oil Temperature

(14) Oil Filter Differential Pressure

(15) Fuel Pump Inlet Pressure

(16) Fuel Pump Pressure

(17) PAMB

(18) TT2.5*

(19) TT3*

(20) Vibration, fan case flange A (vertical)

(21) TT4.95 Harness Average (stand reading) If EEC T49 value is used, adjustment to T4.95 (real without shunt) must be made.

(22) Thrust - (observed)

(23) Thrust Lever and Fuel Select Switch

(24) Ignition Switch

(25) Test Cell Fuel Supply Pressure

(26) ARINC 429 transceiver.

(27) No. 3 Bearing Compartment Breather Pressure

* - A necessary parameter for the module analysis program MAPNET System. Optional unless a MAPNET System analysis is necessary.

D. Thrust Rating and Operation Limits

(1) Ratings at static sea level standard conditions are shown in Table 1302.

ENGINE MODEL	THRUST SETTING	JET THRUST LBS. (N)	TSFC *
PW4152 (-1C/-1E)	TAKEOFF	51110 (227348)	0.3390
PW4152 (-1C/-1E)	MAX CONTINUOUS	47160 (209778)	0.3320
PW4152 (-1C/-1E)	90% Max. Continuous	42450 (188827)	0.3254
PW4152 (-1C/-1E)	70% Max. Continuous	34200 (152129)	0.3188
PW4156A (-1C/-1E)	TAKEOFF	55950 (248878)	0.3495
PW4156A (-1C/-1E)	91% TAKEOFF	51000 (226859)	0.3388
PW4156A (-1C/-1E)	MAX CONTINUOUS	45730 (203417)	0.3298
PW4156A (-1C/-1E)	90% MAX CONTINUOUS	40940 (182110)	0.3237

THRUST AND TSFC RATINGS AT SEAL LEVEL STANDARD CONDITIONS
Table 1302

ENGINE MODEL	THRUST SETTING	JET THRUST LBS. (N)	TSFC *
PW4158 (-1C/-1E)	TAKEOFF	57610 (256262)	0.3536
PW4158 (-1C/-1E)	88% TAKEOFF	51000 (226859)	0.3388
PW4158 (-1C/-1E)	MAX CONTINUOUS	45490 (202349)	0.3295
PW4158 (-1C/-1E)	90% MAX CONTINUOUS	40770 (181354)	0.3236

*NOTE: TSFC (Thrust Specific Fuel Consumption) is for reference only for a new engine and is not necessary for the engine Acceptance Test.

THRUST AND TSFC RATINGS AT SEAL LEVEL STANDARD CONDITIONS
Table 1302 (Continued)

(2) The engine speed limits are shown in 71-00-00, Power Plant General - Testing-00, Engine Operation Limits, Task 71-00-00-990-007.

(3) The engine exhaust gas temperature (EGT) limits for Station 4.9 are shown in 71-00-00, Power Plant General - Testing-00, Engine Operation Limits, Task 71-00-00-990-007.

E. Seal Drain Leakage Limits

(1) During the Acceptance Test, the seal leakage must be measured. See 71-00-00, Power Plant General - Testing-00, Engine Operation Limits, Task 71-00-00-990-007.

(2) Attach a hose to each seal drain connection and put the other end of the hose in a collection bottle. Each bottle must be identified.

F. Multi-Point Instrumentation

(1) Multi-point instrumentation is necessary and is measured during the acceptance test for some parameters. To get satisfactory data, there is a limit for sampling points that do not operate. The necessary multi-point instrumentation and points that do not operate are listed as follows:

(a) TT2 − Eight sampling points are necessary with a maximum limit of two points that do not operate.

(b) Bellmouth pitot static probes (PT2 and PS2) − This parameter is optional. If it is used, eight sampling points are necessary with a maximum limit of two points that do not operate.

(c) Pitot static probes must be installed for test cell correlation testing. See the specifications shown in P&W publication Report No. 544.

(d) PT2 can be calculated for post test cell correlation testing without pitot static probes. Do a correlation of PT2 (pitot static) to: PT2 Rosemount probe, P cell or (PT2/Pamb vs N1 corrected).

G. Acceptance Test General Specifications

(1) Use the definitions that follow during the acceptance test.

(a) EPR−0 = Engine Pressure Ratio from the EEC (Electronic Engine Control) instrumentation system with a zero delta EPR modified (Class 09) Engine Program Plug (EPP) installed in the Electronic Engine Control (EEC).

OR

EPR−0 can be calculated by adding the necessary EPR Modification (delta EPR) used during the test run to the EPR output from the Engine Control (Engine Electronic Control EPR therefore EECEPR).

In the Airbus Engine Control logic EPR modification (delta EPR) is a function of TRA (throttle lever resolver angle). To correctly calculate EPR−0 from EECEPR, EPR class and TRA are necessary.

The Control logic removes the EPR modification (delta EPR) at low power to align the right and left wing engines. This logic is unique to Airbus installations and controls because it occurs in sea level test range, (below "C" band point when the TRA is less than 72 degrees).

Calculation of EPR-0. Because the recommended test configuration is with a class 16/ -0.028 delta EPR modifier, the calculation is shown as follows:

EECEPR = EPR-028

If TRA is equal or greater than 72 degrees,
EPR-0 = EPR-028 + .028

If TRA is between 40.5 and 72 degrees,
EPR-0 = EPR-028 + (1-(72-TRA)/31.5) x .028

If TRA is equal or less than 40.5 degrees,
EPR-0 = EPR-028

For other EPR class modifiers (other than class 16), see Table 1303 for values.

(b) EPR-028 = Engine Pressure Ratio form the EEC (Electronic Engine Control) instrumentation system with a class 16 (-0.028 delta) EPR modifier Engine Programming Plug (EPP) installed in the EEC.

(c) EPR = Engine Pressure Ratio From the EEC (Electronic Engine Control) instrumentation system with a class EEC programming plug to be calculated. To calculate EPR, (EPR-0 + delta EPR modifier). EPR is the value used in Paragraph Q. Check For Engine Acceptance to check for engine acceptance and to calculate engine margin to the limits.

(d) TRA = Throttle Resolver Angle, position of the EEC thrust control lever as specified by the electrical signal from the EEC.

EPR CLASS	EPR MODIFICATION (DELTA EPR)
01	+ .032
02	+ .028
03	+ .024
04	+ .020
05	+ .016
06	+ .012
07	+ .008

EEC PROGRAMMING PLUG (EPP) CLASSIFICATION
Table 1303

EPR CLASS	EPR MODIFICATION (DELTA EPR)
(CONTINUED)	
08	+ .004
09	0.0
10	- .004
11	- .008
12	- .012
13	- .016
14	- .020
15	- .024
16	- .028

EEC PROGRAMMING PLUG (EPP) CLASSIFICATION
Table 1303 (Continued)

(2) All Acceptance Test specifications are from the test cell instrumentation except the EPR (Engine Pressure Ratio) which is the EPR value from the EEC. The EEC values for Tt2, N1, N2 can be used if it is shown they are consistent and equal to the stand readings. This must be done during the test cell correlation testing. The EEC values must be within the limits and tolerances of 71-00-00 Testing-00 Table 1305 of Test Instrumentation Calibration (Task 71-00-00-990-002). Any exceptions to this rule will be specified in the test procedure or correction to the observed section.

CAUTION: IF YOU USE AN INCORRECT EPP PLUG DURING ENGINE TEST, YOU WILL CAUSE ERRORS IN SETTING THE EPR RATING CLASSIFICATION AND IN DETERMINING ENGINE ACCEPTANCE TO LIMITS OF PARAGRAPHS Q. AND R. RESPECTIVELY.

(3) For standardization for all PW4000 engine models and to make sure that the engine will make Takeoff thrust, it is recommended that the Acceptance Testing be done with a class 16 EEC Programming Plug (EPP) installed in the EEC. Refer to SB PW4ENG 73-203 for EEC Programming Plug (EPP) part number for testing.

(4) After the Acceptance Test, the necessary class and part number of EEC programming plug must be selected. You must calculate the necessary class and get the part number from SB PW4ENG 73-203. After you select the necessary EEC programming plug, install it in the EEC. See the Component Maintenance Manual (CMM), - EEC Data Entry Plug, PN 50A450. This manual has the procedure for setting the plug classification.

(5) The EEC has logic for operation in two modes:

(a) EPR = This is the primary mode.

(b) N1 = This is the alternate mode which is the backup mode (default) for the EPR mode.

(c) The Acceptance Test must be done in the EPR mode.

ENGINE HARDWARE CONFIGURATION - PW4152 (-1C/-1E) MODEL

EEC PROGRAMMING PLUG PART NUMBER NOTE 5	EEC PN 51D860 52D349 52D444 52D714 53D652 54D247 OR LATER	EEC PN 54D094	STATOR VANE SCHEDULE 29 N2 BIAS NOTE 1	STATOR VANE SCHEDULE 29-2 N2 BIAS NOTE 4
51D456	X	X	X	
51D457	X	X	X	
54D331	X			X

NOTE 1 It is necessary to correct N2 to the procedures shown in Table 1310A.

NOTE 2 It is necessary to correct N2 to the procedures shown in Table 1310B (NOT Applicable to this model).

NOTE 3 It is necessary to correct N2 to the procedures shown in Table 1310C (NOT Applicable to this model).

NOTE 4 It is necessary to correct N2 to the procedures shown in Table 1310D.

NOTE 5 See SB PW4ENG 73-203 for programming plug part number requirements "EEC Programming Plug Selection Chart".

PW4152 (-1C/-1E) ENGINES EEC PROGRAMMING PLUG PART NUMBER VERSUS SVS CORRECTION REQUIREMENTS
Table 1304

ENGINE HARDWARE CONFIGURATION - PW4156A (-1C/-1E) MODEL

EEC PROGRAMMING PLUG PART NUMBER NOTE 5	EEC PN 51D860 52D349 52D444 52D714 53D652 54D247 OR LATER	EEC PN 54D094	STATOR VANE SCHEDULE 29 N2 BIAS NOTE 1	STATOR VANE SCHEDULE 29-2 N2 BIAS NOTE 4
51D450	X	X	X	
51D451	X	X	X	
54D336	X			X

NOTE 1	It is necessary to correct N2 to the procedures shown in Table 1310A.
NOTE 2	It is necessary to correct N2 to the procedures shown in Table 1310B (NOT Applicable to this model).
NOTE 3	It is necessary to correct N2 to the procedures shown in Table 1310C (NOT Applicable to this model).
NOTE 4	It is necessary to correct N2 to the procedures shown in Table 1310D.
NOTE 5	See SB PW4ENG 73-203 for programming plug part number requirements "EEC Programming Plug Selection Chart".

PW4156A (-1C/-1E) ENGINES EEC PROGRAMMING PLUG
PART NUMBER VERSUS SVS CORRECTION REQUIREMENTS
Table 1305

ENGINE HARDWARE CONFIGURATION - PW4158 (-1C/-1E) MODEL

EEC PROGRAMMING PLUG PART NUMBER NOTE 5	EEC PN 51D860 52D349 52D444 52D714 53D652 54D247 OR LATER	EEC PN 54D094	STATOR VANE SCHEDULE 29 N2 BIAS NOTE 1	STATOR VANE SCHEDULE 29-2 N2 BIAS NOTE 4
51D442	X	X	X	
51D443	X	X	X	
54D339	X			X

NOTE 1 It is necessary to correct N2 to the procedures shown in Table 1310A.

NOTE 2 It is necessary to correct N2 to the procedures shown in Table 1310B (NOT Applicable to this model).

NOTE 3 It is necessary to correct N2 to the procedures shown in Table 1310C (NOT Applicable to this model).

NOTE 4 It is necessary to correct N2 to the procedures shown in Table 1310D.

NOTE 5 See SB PW4ENG 73-203 for programming plug part number requirements "EEC Programming Plug Selection Chart".

PW4158 (-1C/-1E) ENGINES EEC PROGRAMMING PLUG
PART NUMBER VERSUS SVS CORRECTION REQUIREMENTS
Table 1306

POWER PLANT GENERAL - TESTING-09

H. Procedures To Prepare For Test

(1) Check that all the test instrumentation is calibrated and that there are no leaks.

(2) Service the engine oil system as shown in the procedures of 72-00-00 Servicing-02 (Task 72-00-00-610-002) or 72-00-00 Servicing-03 (Task 72-00-00-610-003).

(3) Prime the engine. See 71-00-00 Power Plant General-00, Oil and Fuel Systems Priming Procedure, (Task 71-00-00-760-003).

(4) Do the EEC static test. See 71-00-00 Test No. 7 - EEC Static Test, (Task 71-00-00-760-038).

I. Testing Prior to Acceptance Test

(1) Do the EEC idle test. See 71-00-00 Test No. 6 - EEC Idle Test, (Task 71-00-00-760-037).

NOTE: Start the engine with one Igniter A only.

(2) Do the idle leak test. See 71-00-00 Test No. 3 - Idle Power Test, (Task 71-00-00-760-030). Check for leaks, if necessary do an engine shutdown and repair any leaks.

NOTE: You can do Test No. 6 and 3 at the same time.

(3) Let the engine become stable for five minutes at MINIMUM IDLE.

(4) Make sure all the engine parameters are in the permitted limits. See Power Plant General - Testing-00, Engine Operation Limits, (Task 71-00-00-990-007).

  (a) Make sure that the main oil pressure is in limits. The oil pressure must also be in the acceptance band shown in 71-00-00, Test No. 13, (Task 71-00-00-760-047).

  (b) Make sure that the No. 1 - 2 bearing compartment breather pressure is in limits.

  (c) Make sure that the No. 3 bearing compartment breather pressure is in limits.

(d) Make sure that the No. 3 bearing compartment scavenge temperature (T3 SCAV) is in limits.

(e) If the optional PS4I instrumentation is installed, make sure that the turbine cooling air pressure ratio (TCAR) is in the operator's historical range.

NOTE: The turbine cooling air ratio (TCAR) check is removed from all PW4000 engine manuals. Field experience shows that the assembly instructions and TOBI flow checks are sufficient to make sure that the engine will operate correctly. You must obey the assembly and check procedures specified in the engine manual and service bulletins.

(5) Make a record of N1 RPM, N2 RPM, T4.95 (EGT), oil pressure and temperature. Check the EEC for fault messages.

NOTE: It is recommended that a complete set of data be taken at this time to check the data system. The data system must be checked before the Engine Acceptance Test.

(6) Do an engine shutdown by the Normal Shutdown Procedure, (Task 71-00-00-760-005).

(7) Check the EEC status for fault messages. Do any maintenance that is necessary.

(8) Between 5 and 35 minutes after shutdown, fill the oil tank manually as shown in the procedures of 72-00-00 Servicing-02 (Task 72-00-00-610-002) or 72-00-00 Servicing-03 (Task 72-00-00-610-003). This oil fill step will be used to calculate the engine oil consumption. The oil consumption will be calculated in gallons per hour after the Acceptance Test.

NOTE: Do not use a remote engine oil fill system during the Acceptance Test. You must not add engine oil during the Acceptance Test.

J. Acceptance Test Data Records

(1) Make a record on the engine log sheet of the general information and data as follows:

(a) Date of the Acceptance Test.

(b) Engine serial number.

(c) Serial number of modules and major components.

(d) Fuel grade and specific gravity.

(e) Engine oil specification and brand.

(f) Ambient atmospheric conditions (true barometer, wet and dry bulb temperatures).

(g) Total time of the Acceptance Test.

(h) Reasons for any engine shutdowns that are not on the schedule.

(i) Any repairs that were necessary during the Acceptance Test.

(j) If it is applicable, the reason the engine was rejected after the Acceptance Test.

(k) The test operator must sign the engine log.

(l) The test inspector must sign the log.

(2) Make a record of the engine parameters shown in Paragraph C. "Test Instrumentation And Test Cell Connections", during the Acceptance Test. Make a record at each thrust lever position during the test, (except oil consumption).

K. Initial Running

NOTE: The INITIAL RUNNING is for the LPC/HPC break−in cycle and is only necessary if the LPC or HPC or both were replaced, repaired or are new. If the LPC/HPC break−in cycle is not necessary, go to the next testing step, Engine Acceptance Test.

(1) Start the engine by the Engine Start Procedure (Normal), (Task 71−00−00−760−004). Start engine using Igniter B. Determine and record overall time from pressurization until MINIMUM IDLE speed is reached. Record data after five minutes at MINIMUM IDLE.

(a) Record data for all stabilized test points prior to moving thrust lever to the next requirement.

(b) Verify that the main oil pressure and the No. 3 bearing compartment breather pressure are within the limits shown under Testing-00, Operating Limits, (Task 71-00-00-990-007).

(c) If the optional PS4I instrumentation is installed, make sure that the turbine cooling air pressure ratio (TCAR) is in the operator's historical range.

(d) Check EEC status and maintenance words for faults. See 71-00-00, Fault Isolation-00 (Task 71-00-00-810-001).

(2) The acceleration in this section is to be done with reverse TRA. Verify in simulated deployed position that the 2.5 bleed is 100 percent open (88 percent of actuator stroke) throughout reverse operation.

CAUTION: IF AN ENGINE STALL OCCURS DURING THIS TEST, YOU MUST MOVE THE THRUST LEVER TO MINIMUM IDLE WITHIN ONE SECOND OF THE STALL. DO THE PROCEDURES SHOWN IN TESTING-00 "PROCEDURE AFTER ENGINE SURGE OR STALL" (TASK 71-00-00-760-009) AND DO THE "START PROCEDURE AFTER AN EMERGENCY SHUTDOWN" (TASK 71-00-00-760-006). IF YOU DO NOT DO THESE PROCEDURES, YOU CAN DAMAGE THE TURBINE TIP SEALS.

(a) Make a slow acceleration (30 - 60 seconds) to 8000 N2. Stabilize for two minutes at 8000 N2. Record data at the end of the stabilization period.

(b) Continue slow acceleration to 8500 N2. Stabilize for two minutes at 8500 N2. Record data at the end of the stabilization period.

(c) Continue slow acceleration to 8800 N2. Stabilize for two minutes at 8800 N2. Record data at the end of the stabilization period.

(d) Continue slow acceleration to 9000 N2. Stabilize for two minutes at 9000 N2. Record data at the end of the stabilization period.

NOTE: At cold inlet temperature maximum reverse scheduling (fN1C), may restrict the engine from achieving 9000 rpm target.

(e) Continue slow acceleration to max reverse TRA. Stabilize for five minutes at fixed TRA. Record data at the end of the stabilization period.

NOTE: At low inlet temperatures, high N2 speeds may result in high thrusts. DO NOT EXCEED 50000 LBS FN/ST2.

(f) Make a slow deceleration (30 - 60 seconds) to MINIMUM IDLE. Stabilize at MINIMUM IDLE for 0 - 30 seconds. Take the engine out of the simulated reverse position.

(g) Continue normal acceptance running.

L. Engine Acceptance Test (to be run following initial break in running for refurbished engines and all other engines).

(1) The Acceptance Testing-09 cycle is shown in the Engine Run Schedule, Figure 1301.

(2) Start the engine by the Engine Start Procedure (Normal), (Task 71-00-00-760-004).

NOTE: Start the engine with one Igniter B only.

NOTE: Monitor the main oil pressure, (MOP), during the start procedure. If you do not see any oil pressure, you must immediately and quickly stop the start procedure.

(3) Make a record of the time from fuel pressurization to MINIMUM IDLE speed.

(4) Let the engine become stable at MINIMUM IDLE.

(5) Make sure all the engine parameters are in the permitted limits. See Power Plant General - Testing-00, Engine Operation Limits, (Task 71-00-00-990-007).

(6) Operate the engine at MINIMUM IDLE for five minutes.

(7) If the optional PS4I instrumentation is installed, make sure that the turbine cooling air pressure ratio (TCAR) is in the operator's historical range.

(8) Check EEC status and maintenance words for faults. See 71-00-00, Fault Isolation-00 (Task 71-00-00-810-001).

(9) Continue slow acceleration (90 - 120 seconds) from MINIMUM IDLE to the thrust of Band A shown in Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3). Stabilize for three minutes. Record data and install TRA stop.

(10) Do the decel vibration survey as follows.

CAUTION: IF AN ENGINE STALL OCCURS DURING THIS TEST, YOU MUST MOVE THE THRUST LEVER TO MINIMUM IDLE WITHIN ONE SECOND OF THE STALL. DO THE PROCEDURES SHOWN IN TESTING-00 "PROCEDURE AFTER ENGINE SURGE OR STALL" (TASK 71-00-00-760-009) AND DO THE "START PROCEDURE AFTER AN EMERGENCY SHUTDOWN" (TASK 71-00-00-760-006). IF YOU DO NOT DO THESE PROCEDURES, YOU CAN DAMAGE THE TURBINE TIP SEALS.

(a) Make a slow deceleration (60 - 120 seconds) to MINIMUM IDLE, surveying engine vibration.

(b) At each speed where peaks have shown during the deceleration, record the mean vibration level of each pickup after 30 second stabilization.

(c) Check that the engine vibration values are in the permitted limits. See Testing-00, Engine Operation Limits, (Task 71-00-00-990-007).

(d) For engines that are more than the permitted vibration limits, do Testing-19, Trim Balance Procedure And Test, (Task 71-00-00-760-043), (Task 71-00-00-760-052) or (Task 71-00-00-760-057).

(11) Select APPROACH IDLE. Stabilize for 15 minutes. At the end of the stabilization period, record data.

(12) Do the snap acceleration/deceleration test cycle shown in 71-00-00, Testing-04 (Task 71-00-00-760-031) and perform step B.(9)(b) through B.(9)(i) for acceleration/deceleration test). Also see Engine Run Schedule shown in Figure 1301.

NOTE: The snap acceleration/deceleration must be done after the compressor break in cycle shown in above.

(13) Vibration Survey (Acceleration).

(a) An engine vibration survey shall be conducted on an engine that has been thermally stabilized. Completion of step M.(12) above without shutdown will result in a stabilized engine. If shutdown occurs, the engine must be run at thrust Band C, Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) or higher for three minutes and then run for six minutes at MINIMUM IDLE prior to conducting the vibration survey.

(b) Make a slow acceleration (90 - 120 seconds) from MINIMUM IDLE to thrust Band A Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3).

(c) At each speed where peaks have shown during the acceleration, record the mean vibration level of each pickup after 30 second stabilization.

(d) Check the engine vibration levels during this test to make sure that the allowable limits are not exceeded. See 71-00-00, Testing-00, Vibration Limits, (Task 71-00-00-990-007).

(e) For engines that exceed the vibration limits, see 71-00-00, Testing-19, (Task 71-00-00-760-043), (Task 71-00-00-760-052) or (Task 71-00-00-760-057).

(14) Performance Calibration.

(a) Stabilize at thrust Band A Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) for five minutes. At the end of the stabilization period, record data.

(b) Stabilize at thrust Band B Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) for three minutes. At the end of the stabilization period, record data.

(c) Stabilize at thrust Band C Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) for three minutes. At the end of the stabilization period, record data.

(d) Stabilize at thrust Band D Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) for three minutes. At the end of the stabilization period, record data.

(e) Decelerate slowly (60 - 120 seconds) to APPROACH IDLE. Stabilize for 20 minutes.

(15) Engine shutdown procedure.

(a) Do an engine shutdown by the Normal Shutdown Procedure, (Task 71-00-00-760-005).

(b) Check the EEC status for fault messages. Do any maintenance that is necessary.

M. Procedures After Engine Shutdown - Corrections Of Observed Readings.

(1) Correct the observed data collected in thrust Bands A, B, C, and D of the performance calibration. Use the procedure defined in Figure 1302 (Sheet 1), Figure 1302 (Sheet 2), Figure 1302 (Sheet 3) and Figure 1302 (Sheet 4).

N. Engine Configuration Determination

(1) Based on the engine configuration identifier suffix in Table 1301, make sure that you are in the appropriate Testing-09 CONFIG section to use to class and check the engine for acceptance.

O. Check Corrected Data

(1) If the optional PS4I instrumentation is installed, make sure that the turbine cooling air pressure ratio (TCAR) is in the operator's historical range.

(2) Values of Corrected Net Thrust versus PT4.95/PT2 corrected N1, corrected N2, and corrected EGT, should fall within the requirements of Figure 1309 (Sheet 1), Figure 1309 (Sheet 2), Figure 1309 (Sheet 3), and Figure 1309 (Sheet 4). The lines on these figures are guidelines only and are not acceptance limits. Points outside these values can suggest that there is a instrumentation and/or other problem that must be identified.

(a) Definitions of terms used in Figure 1309 are as follows:

(b) Complete Refurbishment: Bands are for engines that had all modules repaired or replaced to new engine clearances and airfoil condition.

(c) Minor or No Refurbishment: Bands are for high time service engines that are fully deteriorated without any or only a small quantity of gaspath repair.

(3) Values of corrected PT2.5/PT2 and PS3/PT2.5 versus PT4.95/PT2 should fall within the guidelines of Figure 1309 (Sheet 5) and Figure 1309 (Sheet 6). The lines of these figures are guidelines only and not acceptance limits. Points outside these values can suggest that there is a instrumentation and/or other problem that must be identified.

(4) If a review of the test high power (points generally above 52000 lbf (231307.5 N) thrust, or 1.45 PT4.95/PT2) indicate a change in level relative to the check line shape as shown in Table 1307 below, this can be an indication of abnormal fan operation. This abnormal operation is also accompanied by a noticeable tone change in the engine. This change is triggered at high power by dirty and/or severely eroded fan blade leading edges. Corrective action must be taken. Refer to 72-00-31, Repair-01 (Task 72-00-31-300-001).

(5) Corrected Thrust Specific Fuel Consumption (TSFC) must be compared with the values listed in Table 1302. These values are included for reference to new engine levels only and are not intended as an acceptance requirement.

ABNORMAL FAN OPERATION		
Delta P4.95/PT2	approximately +0.015 to 0.020	at Fn = K
Delta N1C	approximately +80 to +100 RPM	at Fn = K
Delta N2C	approximately −40 RPM	at Fn = K
Delta EGT	approximately −4°C	at Fn = K
Delta PT2.5/PT2	approximately +0.14 ratios	at P4.95/PT2 = K
Delta PS3/PT2.5	approximately −0.5 ratios	at P4.95/PT2 = K

PARAMETER SHIFT WITH ABNORMAL FAN OPERATION
Table 1307

P. Engine Pressure Ratio (EPR) Rating Classification

(1) The necessary EEC programming plug is specified by a part number and EPR class system. The programming plug part number is specified by the engine model and thrust rating. For the necessary EEC programming plug part number, see Table 1304, Table 1305, Table 1306. The necessary EPR Class must be selected by Engine Pressure Ratio (EPR), see SB PW4ENG 73−203.

(2) The plug part number and class is shown on the engine data plate. If a new part number or class plug is used, you must write (scribe) the new part number and class on the engine data plate.

(3) Make a EEC programming plug selection as follows:

(a) See SB PW4ENG 73−203 for the necessary Engine Programming Plug (EPP) for the engine model and hardware configuration that was tested. Confirm that the appropriate EPP part number was installed during acceptance testing.

NOTE: If the incorrect program plug (EPP) was installed during acceptance testing, contact Pratt & Whitney for assistance in correcting data/or rerun with the correct program plug.

(b) EPR class modifiers are used to make sure that the engine pressure ratio sent to the aircraft is less than the given limits. This will make sure that the engine will always give rated thrust at all possible take−off settings. The EPR limit is called "MAX EPR" and is shown in Table 1308.

NOTE: A PW4152 (−1C/−1E) engine must only use the Bands A, B, and C points for the EPR Modifier classification. The PW4156A (−1C/−1E) and PW4158 (−1C/−1E) engines can use the Bands A, B, C and D points in the calculations.

(c) Use EPR-0 and Corrected Net Thrust from the four performance calibration points to find the EPR modifier class. Find the EPR modifier class which gives the highest EPR value and does not go more than the MAX EPR LIMIT specified by Table 1308. Make a straight line curve to fit between the points shown on Table 1308.

NOTE: To calculate EPR-0, go to Paragraph G.(1), Acceptance Test General Specifications.

NOTE: Make sure that the Stage 2.5 bleed valve is in the closed location. Do not use any data points (D band point) where the Stage 2.5 bleed valve starts to open to calculate the modifier class.

(d) To calculate EPR, use the EPR class defined above where EPR = EPR-0 + EPR Modifier. EPR is the value used in Paragraph Q. Check For Engine Acceptance, to check for engine acceptance and to calculate engine margin to the limits.

(e) If multiple ratings are desired, testing need only be performed to the highest rating desired and with a 3rd order curve fit of the four point acceptance data, other "A" band rating EPR-0 values can be found for EPR classification purposes as follows:

1 Use the four point acceptance data to find the 3rd order fit of thrust EPR-0.

2 Find the value of EPR-0 at the rating desired (use the minimum band thrust from Figure 1304).

3 Use the value of the EPR-0 and thrust value calculated in step 2 above as the "A band point. Find the EPR class requirement following the procedure outlined the above step (c). (Use the calculated A band point, with B, C, and D band from the data.)

(f) An example of the EPR class calculation (for a PW4158 (-1C/-1E) configuration) is shown in Table 1309.

FOR THESE CONFIGURATIONS: PW4152 (−1C/−1E), PW4156A (−1C/−1E), PW4158 (−1C/−1E)

CORRECTED NET THRUST LBS (N)	MAXIMUM EPR
34000 lbf (151239.5 N)	1.2632
35000 lbf (155687.8 N)	1.2743
36000 lbf (160136.0 N)	1.2854
37000 lbf (164584.2 N)	1.2965
38000 lbf (169032.4 N)	1.3076
39000 lbf (173480.7 N)	1.3189
40000 lbf (177928.9 N)	1.3302
41000 lbf (182377.1 N)	1.3417
42000 lbf (186825.3 N)	1.3534
43000 lbf (191273.5 N)	1.3652
44000 lbf (195721.8 N)	1.3773
45000 lbf (200170.0 N)	1.3896
46000 lbf (204618.2 N)	1.4022
47000 lbf (209066.4 N)	1.4152
48000 lbf (213514.7 N)	1.4285
49000 lbf (217962.9 N)	1.4421
50000 lbf (222411.1 N)	1.4561
51000 lbf (226859.3 N)	1.4706
52000 lbf (231307.5 N)	1.4856
53000 lbf (235755.8 N)	1.5013
54000 lbf (240204.0 N)	1.5175
55000 lbf (244652.2 N)	1.5346
56000 lbf (249100.4 N)	1.5524
57000 lbf (253548.7 N)	1.5710
58000 lbf (257996.9 N)	1.5906
59000 lbf (262445.1 N)	1.6112
60000 lbf (266893.3 N)	1.6328

MAXIMUM EPR
Table 1308

EXAMPLE OF CALCULATING EPR MODIFIER CLASS FOR PW4158 (-1C/-1E) ENGINE CONFIGURATIONS

Step 1.
Start with the four performance calibration points from engine test.

CORRECTED NET THRUST

LBS (N)	(EEC EPR) EPR-028	TLRA	DELTA EPR MOD [SEE PARA. G. (1)]	= EPR-0
58125 lbf (258552.9 N)	1.555	79.8	.028	1.583
51500 lbf (229083.4 N)	1.444	74.2	.028	1.472
46209 lbf (205547.9 N)	1.376	70.1	.026	1.402
41066 lbf (182670.7 N)	1.317	65.7	.022	1.339

Step 2.
At the Corrected Net Thrust level of the four performance calibration points, find the Maximum EPR as shown in Table 1308. Make a straight line curve to fit between the points shown on Table 1308.

CORRECTED NET THRUST

LBS (N)	EPR-MAX
58125 lbf (258552.9 N)	1.5932
51500 lbf (229083.4 N)	1.4781
46209 lbf (205547.9 N)	1.4049
41066 lbf (182670.7 N)	1.3425

Step 3.
Find the delta EPR value for each point of Maximum EPR:

CORRECTED NET THRUST

LBS (N)	EPR-MAX	EPR-0	DELTA EPR

EXAMPLE OF CALCULATING EPR MODIFIER FOR PW4158 (-1C/-1E) ENGINES
Table 1309

EXAMPLE OF CALCULATING EPR MODIFIER CLASS
FOR PW4158 (-1C/-1E) ENGINE CONFIGURATIONS

58125 lbf (258552.9 N)	1.5932	1.583	.0102
51500 lbf (229083.4 N)	1.4781	1.472	.0061
46209 lbf (205547.9 N)	1.4049	1.402	.0029
41066 lbf (182670.7 N)	1.3425	1.339	.0035

Step 4.
To find the EPR Class Number, use the delta EPR value from Step 3. above, and go to Table 1303.

DELTA EPR	CLASS NUMBER	EPR MODIFIER
0.0102	7	+0.008
0.0061	8	+0.004
0.0029	9	+0.000
0.0035	9	+0.000

Step 5.
The EPR Modifier Class 9 will give the highest possible EPR and will not be more than the EPR-Max limit, (highest class number from above). Make a Class 9 modifier selection and then calculate EPR.

EPR-0	EPR MODIFIER	EPR
1.583	0	1.583
1.472	0	1.472
1.402	0	1.402
1.339	0	1.339

EXAMPLE OF CALCULATING EPR MODIFIER FOR PW4158 (-1C/-1E) ENGINES
Table 1309 (Continued)

Q. Check For Engine Acceptance

CAUTION: MAKE SURE THAT THE STAGE 2.5 BLEED VALVE IS IN THE CLOSED LOCATION. DO NOT USE ANY DATA POINTS TO CALCULATE ACCEPTANCE TO THE LIMITS WHERE THE STAGE 2.5 BLEED VALVE STARTS TO OPEN (D BAND POINT).

(1) The steady state values of corrected N2, N1 and TT4.95 (EGT) versus modified engine pressure ratio (EPR = EPR-0 + EPR Modifier) must be below the limits of Figure 1310 (Sheets 1 through 3), Figure 1311 (Sheest 1 and 2) and Figure 1312 (Sheets 1 and 2). All the calibration points (A Band through D Band) must be examined relative to the limit lines. A large difference between the calibration points and the limit line can indicate instrumentation or engine problems. Use A Band thrust levels for NH and NL acceptance. Use A Band and B Band thrust levels for EGT acceptance. Calculate the EGT margin to the limit line, the engine is acceptable if the average of the A Band and B Band margins is positive (greater than zero).

(a) Figure 1312 (Sheet 1) and Figure 1312 (Sheet 2) shows two maximum EGT limit curves. The upper EGT limit curve applies in all cases except when an engine is tested immediately following high turbine refurbishment. The lower EGT limit curve is to be used only after a high turbine refurbishment (turbine clearances restored) and before engine has flown with turbine cooling air system on.

(b) The N1 rotor speed limits are shown in Figure 1311 (Sheet 1), Figure 1311 (Sheet 2).

(c) Do an N2 Speed Limit Analysis. Figure 1310 (Sheet 1), Figure 1310 (Sheet 2) and Figure 1310 (Sheet 3) presents the corrected rotor speed limits for engines with either SVS 29 N2 BIAS or SVS 29-2 N2 BIAS. Refer to Table 1304 through Table 1306 to determine which SVS N2 limit line to use. Refer to the calculation procedures shown in Figure 1302 (Sheet 2), Item 5. Choose the correct calculation procedure based on the control version that is installed at the time of the test.

NOTE: The EEC incorporates a N2 biased stator vane schedule (SVS). This schedule closes the HPC variable stator vanes 5 degrees for observed N2 rotor speeds less than 9550 N2 RPM, and 9830 N2 RPM for RCC. The SVS transitions linearly to either the original OPEN schedule (SVS 29) or a closed (SVS 29-2) 2 degree schedule (HPC RCC post SB 72-756) at N2 rpm's above 10250. Since the N2 Limit Curve Figure 1310 (Sheet 1), Figure 1310 (Sheet 2) is based on the original OPEN schedule, an adjustment must be made to the N2 data points before they are compared to this N2 Speed Limit Curve, Figure 1310 (Sheet 1), Figure 1310 (Sheet 2) and Figure 1310 (Sheet 3).

(d) Figure 1310 (Sheet 1), Figure 1310 (Sheet 2) and Figure 1310 (Sheet 3) includes the more restrictive speed limits that are necessary for post SB PW4ENG 72-557 engines, (with redesigned 5th stage compressor blade). For simplicity, the more restrictive limits (if they are different) are to be used for both pre and post SB PW4ENG 72-557 engine configurations.

(e) For an example of a N2 Speed Limit Analysis, see Table 1310A for engines running SVS 29 N2 BIAS or see Table 1310B for engines running SVS 29-3 N2 BIAS. An example of a calculation for an engine running SVS 29 N2 BIAS is shown in Table 1311.

EXAMPLE - PROCEDURE TO DO AN N2 SPEED LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29 N2 BIAS

Step 1. Calculate the Corrected Observed N2:

Corrected Observed N2 = Observed N2/SQRT (THETA T2)

Step 2. Calculate FACTOR (Percent difference in N2, SVS 29-5 deg relative to SVS 29):

FACTOR = 1.11244 - 3.93387 x P4.95Q2 + 2.82184 x $P4.95Q2^2$

Where P4.95Q2 = PT4.95/PT2

Step 3. Calculate N2Rcl (Corrected N2 adjusted to SVS 29-5 deg):

If Observed N2 <= 9550 rpm, N2Rcl = Corrected Observed N2

If 9550 < Observed N2 < 10250

N2Rcl = Corrected Observed N2 x [1 + (FACTOR x [Observed N2-9550])/70000]

If Observed N2 >= 10250 rpm, go to step 4b

Step 4. Calculate N2Rop (Corrected N2 adjusted to SVS 29):

(a) If Observed N2 < 10250 rpm, N2Rop = N2Rcl/(1+ FACTOR/100)

(b) If Observed N2 >= 10250 rpm, N2Rop = Corrected Observed N2

Step 5. Calculate Corrected High Rotor Speed - RPM:

Corrected High Rotor Speed = N2Rop/KHN2 + delta N2 (See Figure 1302, (Sheet 4) NOTE 4.

Where KHN2 is found from Figure 1308.

PROCEDURE FOR CALCULATING CORRECTED HIGH ROTOR SPEED (N2) FOR LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29 N2 BIAS
Table 1310A

EXAMPLE − PROCEDURE TO DO AN N2 SPEED LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29−3 N2 BIAS

ENGINES RUNNING WITH SVS 29−3 N2 BIAS NOT APPLICABLE TO THIS CONFIGURATION

PROCEDURE FOR CALCULATING CORRECTED HIGH ROTOR SPEED (N2) FOR LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29−3 N2 BIAS
Table 1310B

EXAMPLE − PROCEDURE TO DO AN N2 SPEED LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29−5 N2 BIAS

ENGINES RUNNING WITH SVS 29−5 N2 BIAS NOT APPLICABLE TO THIS CONFIGURATION

PROCEDURE FOR CALCULATING CORRECTED HIGH ROTOR SPEED (N2) FOR LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29−5 N2 BIAS
Table 1310C

EXAMPLE − PROCEDURE TO DO AN N2 SPEED LIMIT ANALYSIS
FOR ENGINES RUNNING WITH SVS 29−2 N2 BIAS

Step 1. Calculate the Corrected Observed N2:

Corrected Observed N2 = Observed N2/SQRT (THETA T2)

Step 2. Calculate FACTOR (Percent difference in N2, SVS 29−5 deg relative to SVS 29):

FACTOR = 1.11244 − 3.93387 x P4.95Q2 + 2.82184 x
P4.95Q2^2 −
Where P4.95Q2 = P4.95/P2

Step 3. Calculate N2Rcl (Corrected N2 adjusted to SVS 29−5 deg):

If Observed N2 <= 9830 rpm, N2Rcl = Corrected Observed N2

If 9830 < Observed N2 < 10250

N2Rcl = Corrected Observed N2 x [1 + (FACTOR x 0.6 x [Observed N2−9830])/42000]

If Observed N2 >= 10250 rpm, go to step 4(b)

Step 4. Calculate N2Rop (Corrected N2 adjusted to SVS 29):

(a) If Observed N2 < 10250 rpm, N2Rop = N2Rcl/(1+ FACTOR/100)

(b) If Observed N2 >= 10250 rpm, N2Rop = (Corrected Observed N2) / [1+0.4 X (FACTOR)/100]

Step 5. Calculate Corrected High Rotor Speed − RPM:

Corrected High Rotor Speed = N2Rop/KHN2 + delta N2
(See Figure 1302 (Sheet 4) NOTE 4.

Where KHN2 is found from Figure 1308 .

PROCEDURE FOR CALCULATING CORRECTED HIGH ROTOR SPEED (N2) FOR
LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29−3 N2 BIAS
Table 1310D

EXAMPLE - N2 SPEED LIMIT ANALYSIS - PW4158 (-1C/-1E) ENGINE RUNNING WITH SVS 29 N2 BIAS

Step 1. Calculate the Corrected Observed N2:

Parameter Point	1	2	3	4
Observed N2	9694	9467	9287	9135
T2, deg R	529.4	529.4	529.4	529.4
Sqrt Theta T2	1.010	1.010	1.010	1.010
Corrected Observed N2	9597	9373	9194	9044
P4.95/P2	1.583	1.472	1.402	1.340
FACTOR	1.956	1.4361	1.1438	0.908
N2Rcl	9636	9373	9194	9044
N2Rop	9450	9240	9090	8951
KHN2	1.0019	1.0019	1.0019	1.0019
N2Rop/KHN2	9432	9222	9072	8934
Delta N2 Test Cell/Duct Set Corrections - See Figure 1302, (Sheet 4) NOTE 4.	91	61	46	34
Corrected High Rotor Speed	9523	9283	9118	8968
EPR	1.583	1.472	1.402	1.339
N2 Speed Limit (See Figure 1310 (Sheet 2)	10029	9686	9462	9270
Margin (RPM)	506	403	344	302

EXAMPLE - N2 SPEED LIMIT ANALYSIS - PW4158 (-1C/-1E) ENGINE
Table 1311

R. Procedures Necessary After Testing

(1) Oil consumption.

NOTE: When you do the visual inspection for leaks, it is possible to see a small quantity of remaining oil in the area of the spinner, at the bottom of the fan case, or at the HPC variable vane attach bolts at the bottom of the engine. The source of this oil is either the No. 1 bearing carbon seal assembly or the No. 2 bearing rear carbon seal assembly. After the engine windmills or after a long start procedure (conditions where carbon seal pressure differences are very low or negative), a small quantity of oil can get through the carbon seals and go to the external parts of the engine. This condition is satisfactory and is permitted. All other conditions of the inspection must be satisfactory. A limit for the quantity of oil that is permitted is not given. The limits that should be used when you make an estimate of the quantity of oil is oil consumption level.

(a) Between 10 and 15 minutes after engine shutdown, fill the oil tank manually as shown in the procedures of 72-00-00 Servicing-02 (Task 72-00-00-610-002) or 72-00-00 Servicing-03 (Task 72-00-00-610-003). Use a graduated measuring device and make a record of the quantity of engine oil that is added.

(b) Make a record of the engine oil consumption in gal/hr (l/hr) in the engine logs.

(c) If there is more oil in the oil tank after the Acceptance Test than before (such as oil that comes out the scupper drain), the oil must be checked for fuel by a laboratory.

(2) Seal Leakage Limits.

(a) Measure the quantity of leakage in each seal drain collection bottle. The leakage limits for each seal drain are shown in 71-00-00 Power Plant General - Testing-00, Engine Operation Limits, (Task 71-00-00-990-007).

(3) Check Filters.

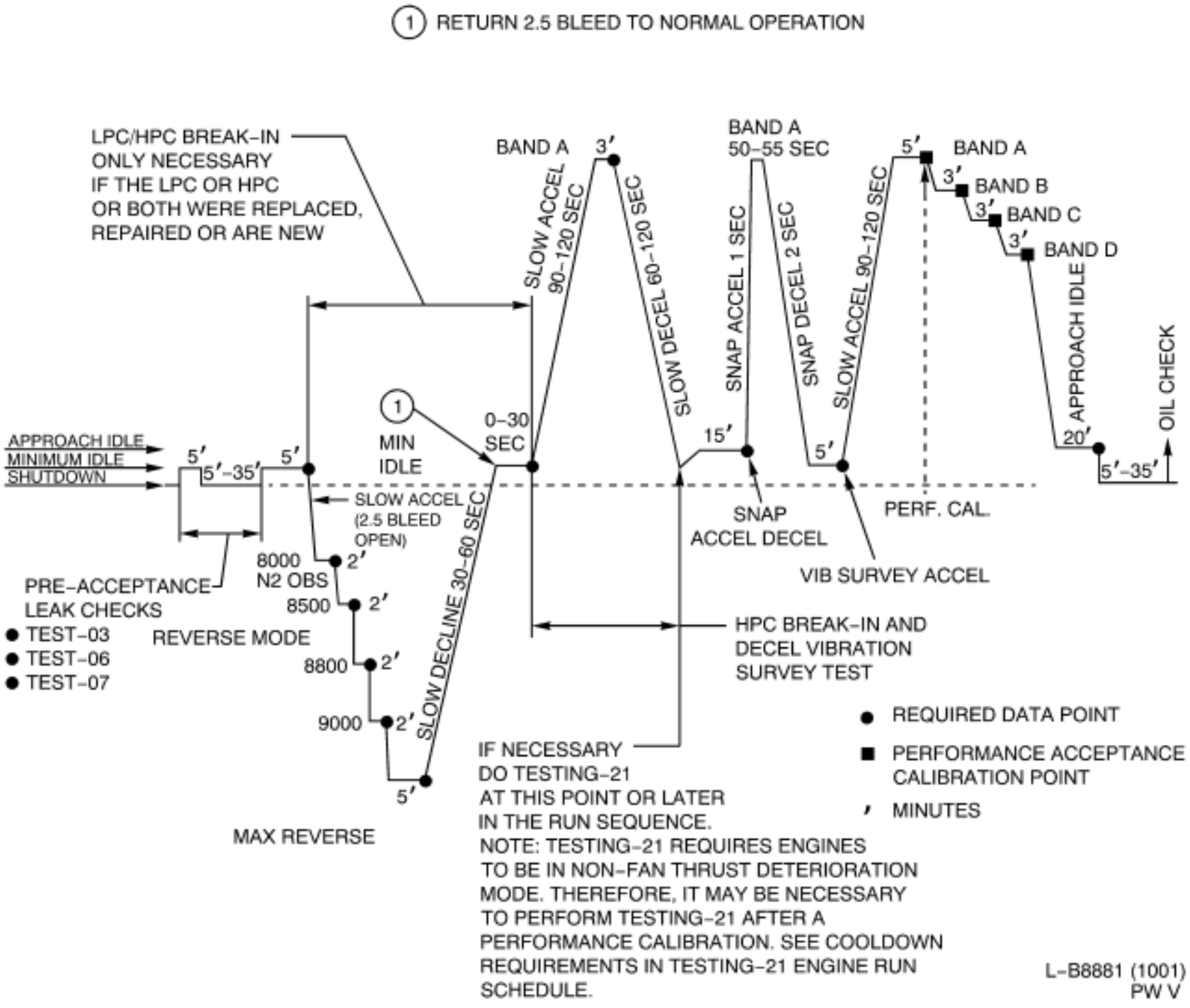
(a) Remove the main oil filter and seals. Examine the filter for pieces of unwanted material (chips) and contamination. Record the results in the engine logs. Install a new main oil filter and seals.

(b) Remove the fuel filters and seals. Examine the filter for pieces of unwanted material (chips) and contamination. Record the results in the engine logs. Install new fuel filters and seals.

R R R 1 Look for bronze colored particles. If you find bronze contamination, you must replace the fuel metering unit and the fuel pump.

(4) Preservation.

(a) For engine preservation refer to 72-00-00, Storage/Transport-03, Accomplish Engine Preservation, (Task 72-00-00-620-001).


① RETURN 2.5 BLEED TO NORMAL OPERATION
LPC/HPC BREAK-IN ONLY NECESSARY IF THE LPC OR HPC OR BOTH WERE REPLACED, REPAIRED OR ARE NEW
BAND A
3′
SLOW ACCEL 90-120 SEC
SLOW DECEL 60-120 SEC
BAND A 50-55 SEC
SNAP ACCEL 1 SEC
SNAP DECEL 2 SEC
SLOW ACCEL 90-120 SEC
5′
BAND A
3′
BAND B
3′
BAND C
3′
BAND D
APPROACH IDLE
20′
5′-35′
OIL CHECK
APPROACH IDLE
MINIMUM IDLE
SHUTDOWN
5′
5′-35′
5′
①
MIN IDLE
0-30 SEC
15′
5′
SLOW ACCEL (2.5 BLEED OPEN)
SNAP ACCEL DECEL
PERF. CAL.
VIB SURVEY ACCEL
PRE-ACCEPTANCE LEAK CHECKS
● TEST-03
● TEST-06
● TEST-07
8000 N2 OBS
2′
8500
2′
REVERSE MODE
8800
2′
9000
2′
SLOW DECLINE 30-60 SEC
5′
MAX REVERSE
HPC BREAK-IN AND DECEL VIBRATION SURVEY TEST
IF NECESSARY DO TESTING-21 AT THIS POINT OR LATER IN THE RUN SEQUENCE.
NOTE: TESTING-21 REQUIRES ENGINES TO BE IN NON-FAN THRUST DETERIORATION MODE. THEREFORE, IT MAY BE NECESSARY TO PERFORM TESTING-21 AFTER A PERFORMANCE CALIBRATION. SEE COOLDOWN REQUIREMENTS IN TESTING-21 ENGINE RUN SCHEDULE.
● REQUIRED DATA POINT
■ PERFORMANCE ACCEPTANCE CALIBRATION POINT
′ MINUTES
L-B8881 (1001)
PW V

Engine Run Schedule
Figure 1301
(Task 71-00-00-760-060)

CORRECTION OF OBSERVED READINGS (SHEET 1 OF 4)

NOTE: For the Following Calculations:

- THETA T2 = $\theta T2 = \left(\frac{TT2^{o}C + 273.16}{288.16}\right)$
- DELTA T2 = $\delta T2 = \frac{PT2\ (IHGA)}{29.92}$
- Note 1 through Note 11 ..... See Sheet 4 Definitions

Item (1) Corrected Net Thrust − lbs

$$\frac{Total\ (FN)}{\delta T2} = \left(\frac{Observed\ Thrust}{\delta T2}\right) + Delta\ FN_{Note\ 1}$$

Item (2) Corrected Fuel Flow − lbs/hr

$$\frac{WF}{(\delta T2)\ (KC)\ (KHWF)} = \left(\frac{Observed\ Fuel\ Flow}{(\delta T2)\ (KC)\ (KHWF)}\right) \times \left(\frac{LHV}{18400}\right) + Delta\ WF_{Note\ 2}$$

KC is defined as $(\theta T2)^{0.59}$

KHWF is determined as follows:

(a) Obtain a value of KH' (min) which is a function of specific humidity (lbs moisture per lb of dry air) from Figure 1307. This value is a minimum correction and will be compared with that obtained in the following step.

(b) Using recorded ambient temperature and Corrected Net Thrust from Item (1) above, obtain values of C1 (Figure 1305), C2, and C3 (Figure 1306). Calculate KH' using the following equation:

$KH' = C1(SH + C2) + C3$, where SH = specific humidity (lbs moisture/lb dry air)

(c) Set KHWF equal to the greater of the values of KH' calculated above in Item (2) (a) and (b).

(d) LHV = Lower Heating Value of fuel in BTU/LBM.

L−A9025 (0597)
PW V

Correction Of Observed Data
Figure 1302 (Sheet 1)
(Task 71−00−00−760−060)

CORRECTION OF OBSERVED READINGS (SHEET 2 OF 4)

Item (3) Corrected Thrust Specific Fuel Consumption (TSFC) – lbs/hr/lb

$$\left(\frac{\text{TSFC}}{(\text{KC})\ (\text{KHWF})}\right) = \left(\frac{\text{Corrected Fuel Flow}}{\text{Corrected Net Thrust}}\right) = \left\{\frac{\left[\frac{\text{WF}}{(\delta\text{T2})(\text{KC})(\text{KHWF})}\right]}{\left[\frac{\text{FN}}{\delta\text{T2}}\right]}\right\}$$

Item (4) Corrected Low Rotor Speed – RPM

$$\left[\frac{\text{N1}}{\sqrt{\theta\text{T2}}\ (\text{KHN1})}\right] = \left(\frac{\text{Observed N1}}{\sqrt{\theta\text{T2}}\ (\text{KHN1})}\right) + \text{Delta N1}_{\text{Note 3}}$$

where KHN1 is found from Figure 1308.

Item (5) Corrected High Rotor Speed – RPM

Engines running with SVS 29 N2 BIAS:
See calculation procedure outlined in Table 1310 A.
Engines running with SVS 29-2 N2 BIAS:
See calculation procedure outlined in Table 1310 D.
Note 1: For an example calculation procedure for SVS 29 N2 BIAS configuration see Table 1311.
Note 2: Refer to Tables 1304 through1306 determine which SVS N2 BIAS is used.

Item (6) Corrected Exhaust Gas Temperature (EGT) – °C

$$\left[\frac{\text{TT4.95}^{\circ}\text{C}}{(\theta\text{T2})^{1.0}\quad(\text{KHT4.95})}\right] = \left[\frac{\text{Observed TT4.95}^{\circ}\text{C} + 273.16}{(\theta\text{T2})^{1.0}\quad(\text{KHT4.95})}\right] - (273.16) + \text{Delta TT4.95}_{\text{Note 5}}$$

where KHT4.95 is found from Figure 1308.

Item (7) Corrected Station 3 Temperature – °C

$$\left[\frac{\text{TT3}^{\circ}\text{C}}{(\theta\text{T2})^{0.932}}\right] = \left[\frac{\text{Observed TT3}^{\circ}\text{C} + 273.16}{(\theta\text{T2})^{0.932}}\right] - (273.16) + \text{Delta TT3}_{\text{Note 6}}$$

L-B4996 (0403)
PW V

Correction Of Observed Data
Figure 1302 (Sheet 2)
(Task 71-00-00-760-060)

CORRECTION OF OBSERVED READINGS (SHEET 3 OF 4)

Item (8) Corrected Station 2.5 Temperature – °C

$$\left[\frac{\text{TT2.5°C}}{(\theta\text{T2})^{0.985}}\right] = \left[\frac{\text{Observed TT2.5°C} + 273.16}{(\theta\text{T2})^{0.985}}\right] - (273.16) + \text{Delta TT2.5}_{\text{NOTE 7}}$$

Item (9) Test Stand Engine Pressure Ratio = $\left(\frac{\text{PT4.95}}{\text{PT2}}\right)$

Item (10) Corrected Turbine Cooling Air Pressure Ratio
PS4I Instrumentation Optional

$$\left(\frac{\text{PS4I}}{\text{PT3}}\right) = 0.97 \times \left(\frac{\text{PS4I}}{\text{PS3}}\right)$$

Item (11) Corrected Compressor Pressure Ratios:

Low Compressor

$$\left(\frac{\text{PT2.5}}{\text{PT2}}\right) = \left(\frac{\text{Observed PT2.5}}{\text{PT2}}\right) \times (\theta\text{T2})^{0.08} + (\text{Delta PT2.5/PT2}_{\text{NOTE 8}})$$

High Compressor

$$\left(\frac{\text{PS3}}{\text{PT2.5}}\right) = \left(\frac{\text{Observed PS3}}{\text{PT2.5}}\right) \times (\theta\text{T2})^{-0.08} = (\text{Delta PS3/PT2.5}_{\text{NOTE 9}})$$

Overall Compressor

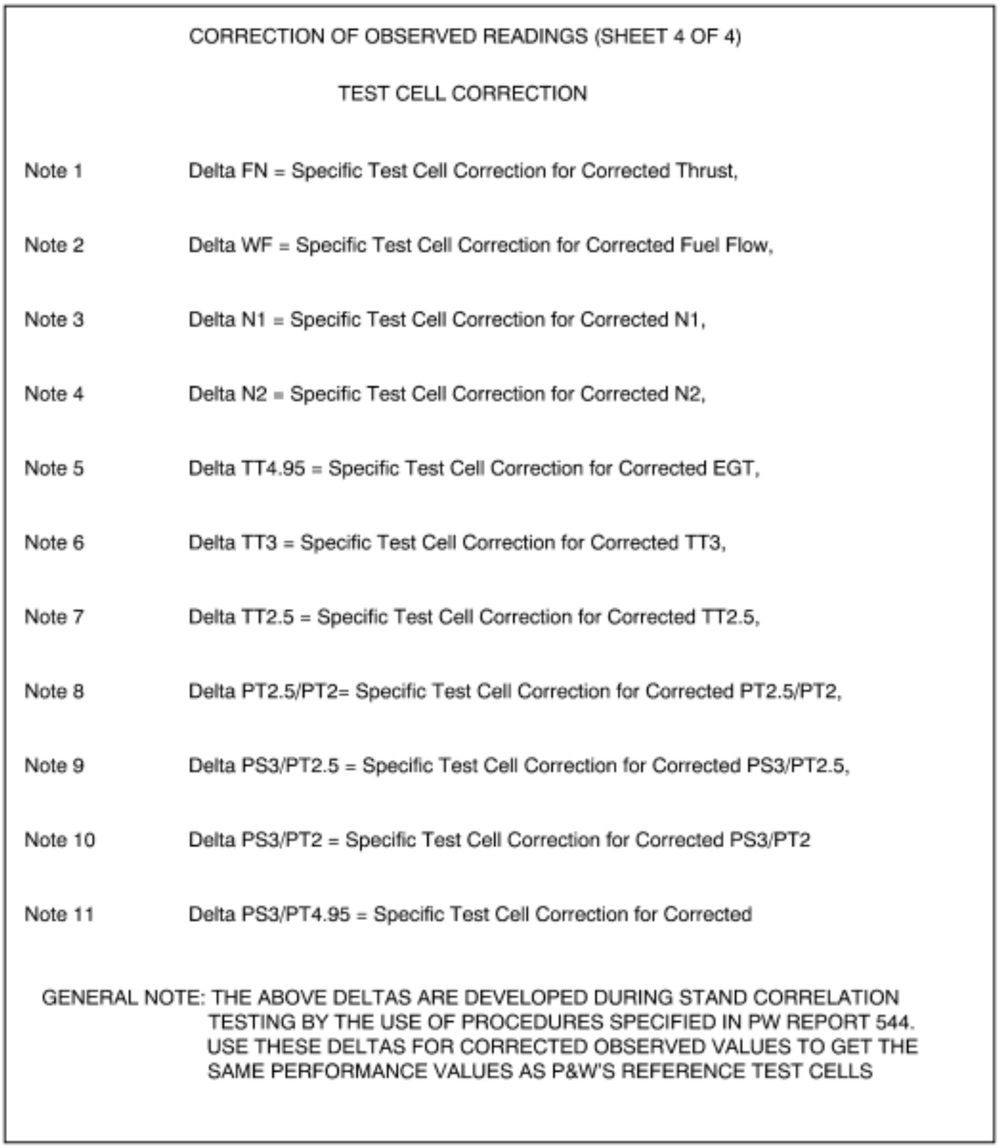
$$\left(\frac{\text{PS3}}{\text{PT2}}\right) = \left(\frac{\text{Observed PS3}}{\text{PT2}}\right) + \text{Delta PS3/PT2}_{\text{NOTE 10}}$$

Item (12) Overall Corrected Turbine Pressure Ratio

$$\left(\frac{\text{PS3}}{\text{PT4.95}}\right) = \left(\frac{\text{Observed PS3}}{\text{PT4.95}}\right) + \text{Delta PS3/PT4.95}_{\text{NOTE 11}}$$

L−B0882 (0705)
PW V

Correction Of Observed Data
Figure 1302 (Sheet 3)
(Task 71−00−00−760−060)



CORRECTION OF OBSERVED READINGS (SHEET 4 OF 4)

TEST CELL CORRECTION

Note 1 Delta FN = Specific Test Cell Correction for Corrected Thrust,

Note 2 Delta WF = Specific Test Cell Correction for Corrected Fuel Flow,

Note 3 Delta N1 = Specific Test Cell Correction for Corrected N1,

Note 4 Delta N2 = Specific Test Cell Correction for Corrected N2,

Note 5 Delta TT4.95 = Specific Test Cell Correction for Corrected EGT,

Note 6 Delta TT3 = Specific Test Cell Correction for Corrected TT3,

Note 7 Delta TT2.5 = Specific Test Cell Correction for Corrected TT2.5,

Note 8 Delta PT2.5/PT2= Specific Test Cell Correction for Corrected PT2.5/PT2,

Note 9 Delta PS3/PT2.5 = Specific Test Cell Correction for Corrected PS3/PT2.5,

Note 10 Delta PS3/PT2 = Specific Test Cell Correction for Corrected PS3/PT2

Note 11 Delta PS3/PT4.95 = Specific Test Cell Correction for Corrected

GENERAL NOTE: THE ABOVE DELTAS ARE DEVELOPED DURING STAND CORRELATION TESTING BY THE USE OF PROCEDURES SPECIFIED IN PW REPORT 544. USE THESE DELTAS FOR CORRECTED OBSERVED VALUES TO GET THE SAME PERFORMANCE VALUES AS P&W'S REFERENCE TEST CELLS

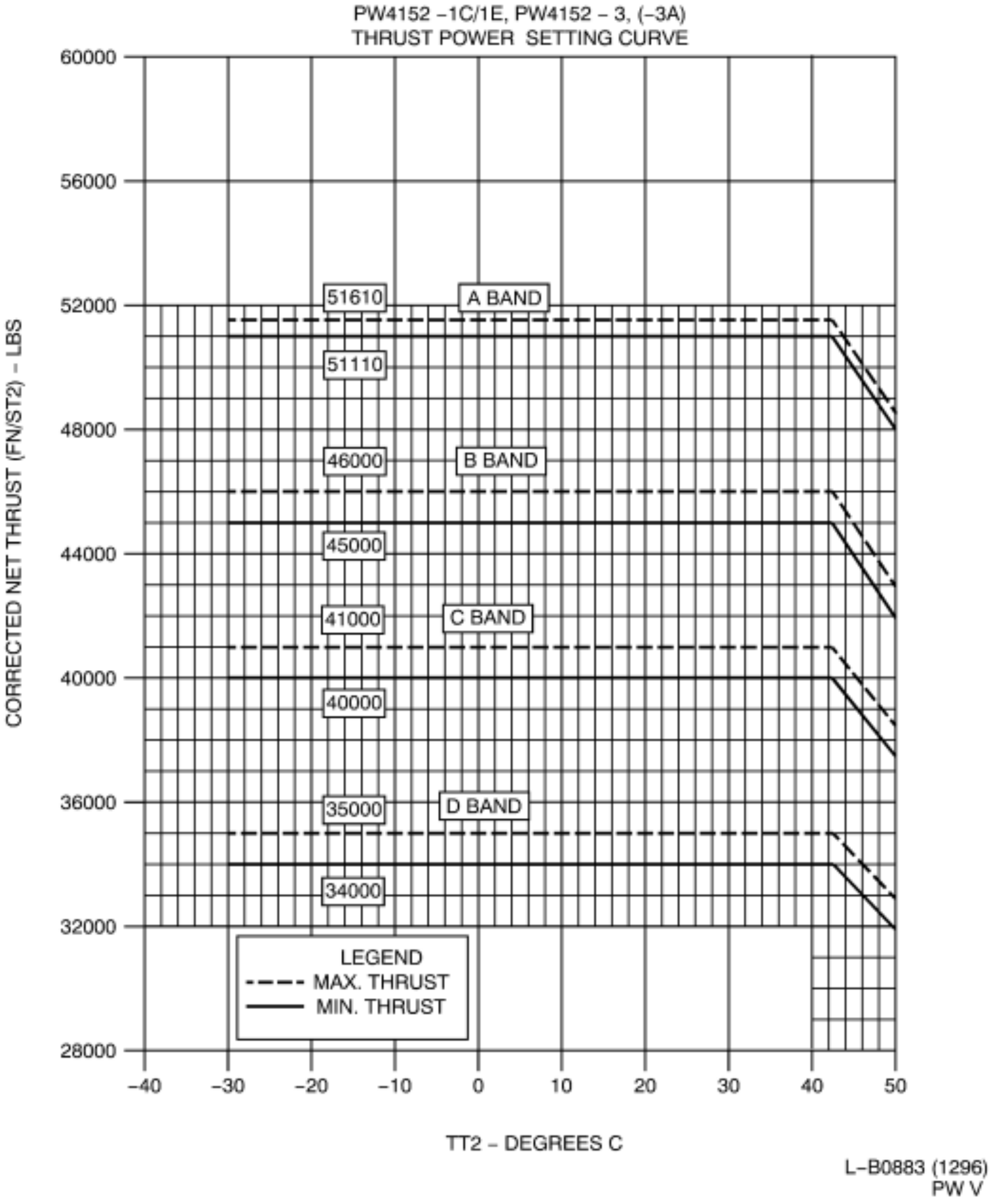
L-A9028 (0696)
PW V

Correction Of Observed Data
Figure 1302 (Sheet 4)
(Task 71-00-00-760-060)

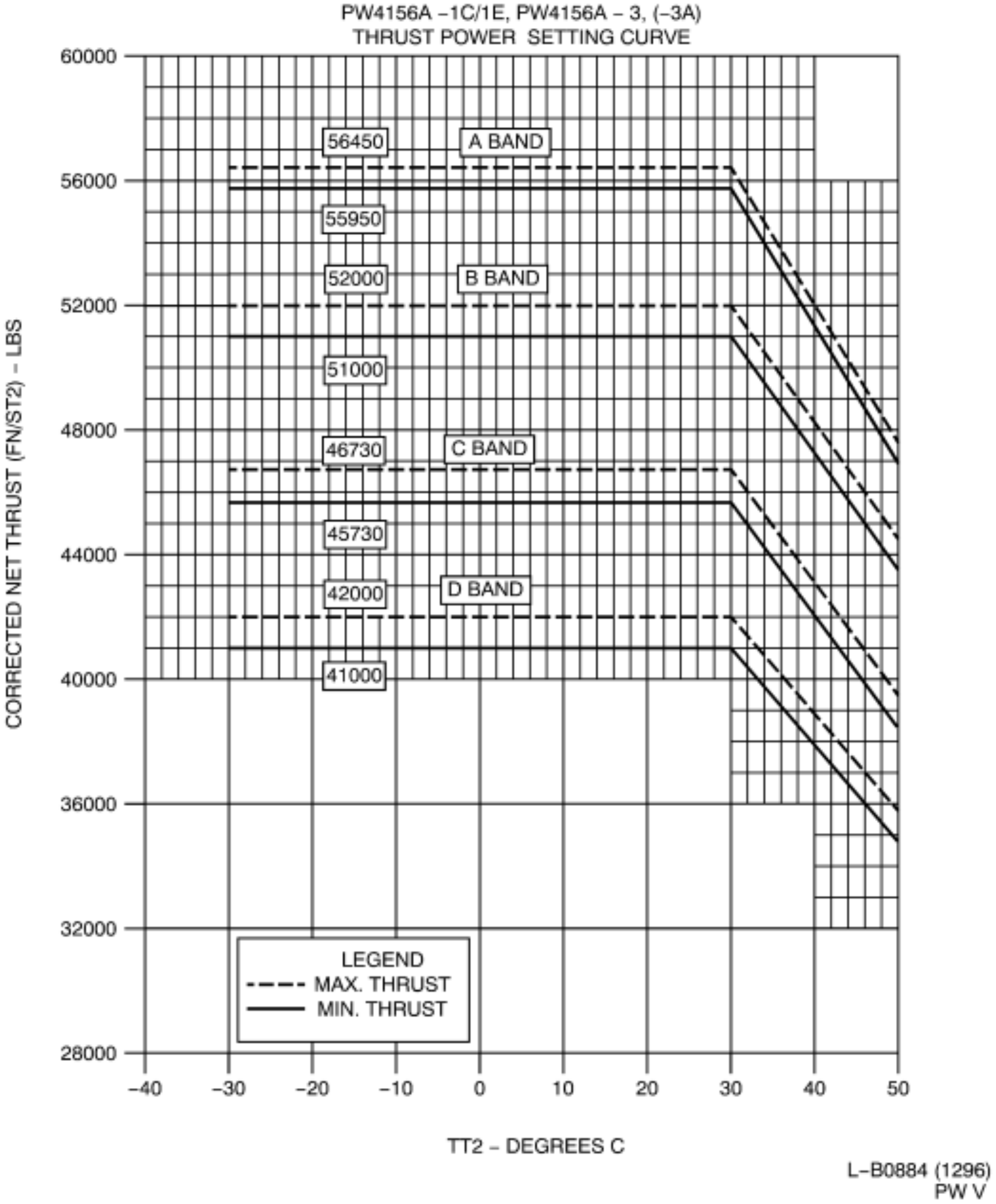
FIGURE NOT USED

L−00000 (0000)
PW V

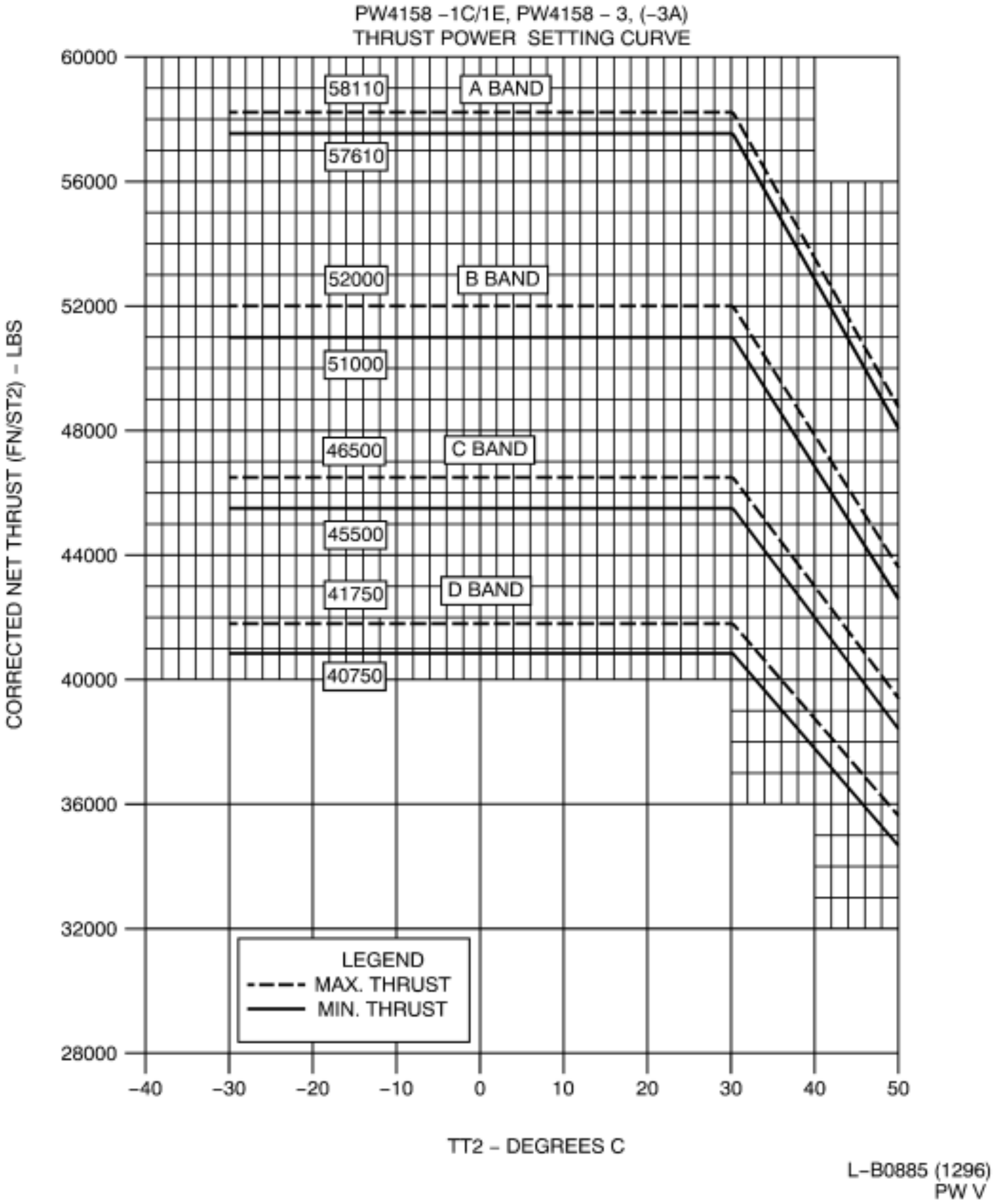
Corrected Turbine Cooling Air Pressure
Figure 1303
(Task 71−00−00−760−060)



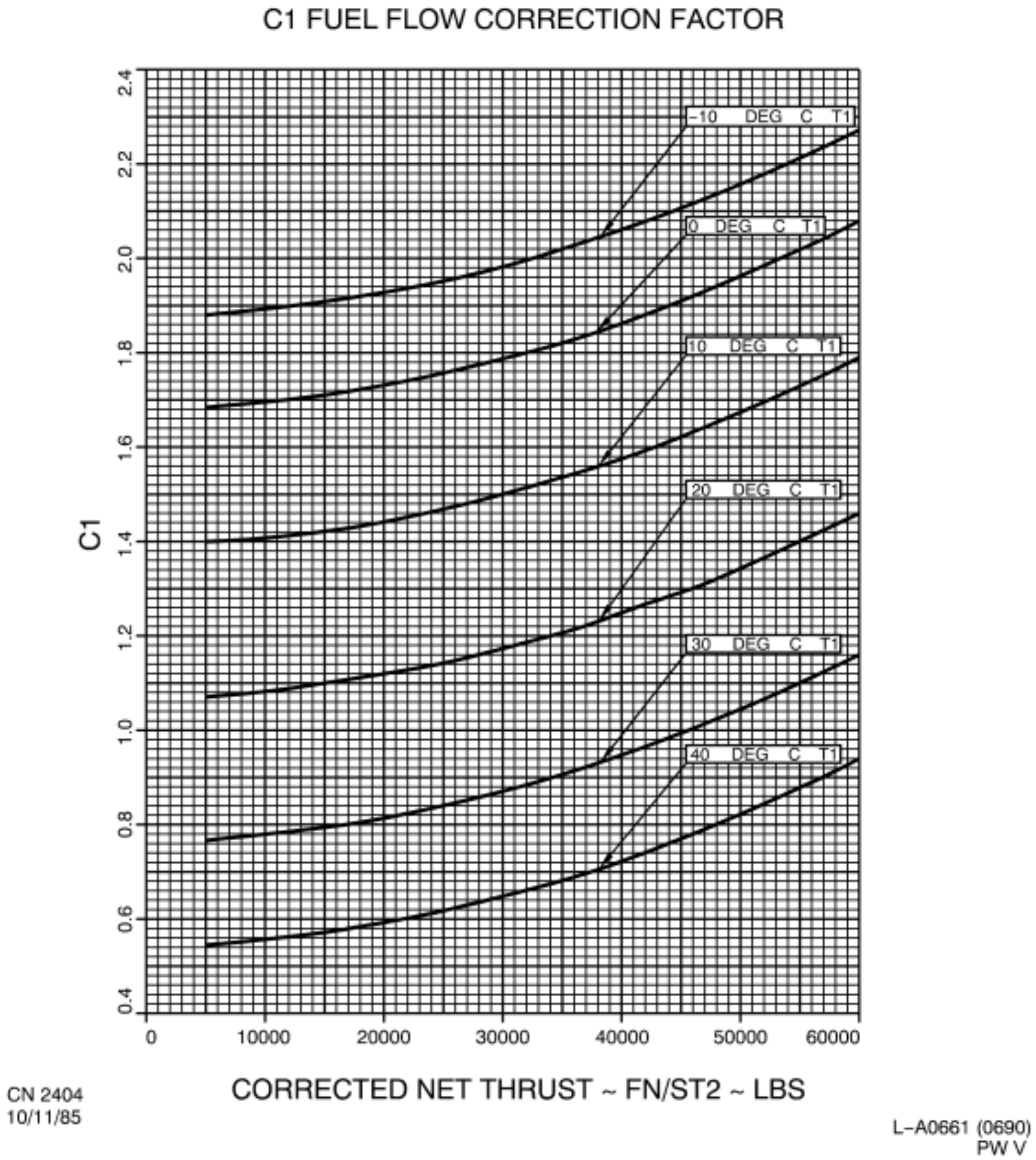
Thrust Power Setting Curve (PW4152 (−1C/−1E) Engines)
Figure 1304 (Sheet 1)
(Task 71−00−00−760−060)



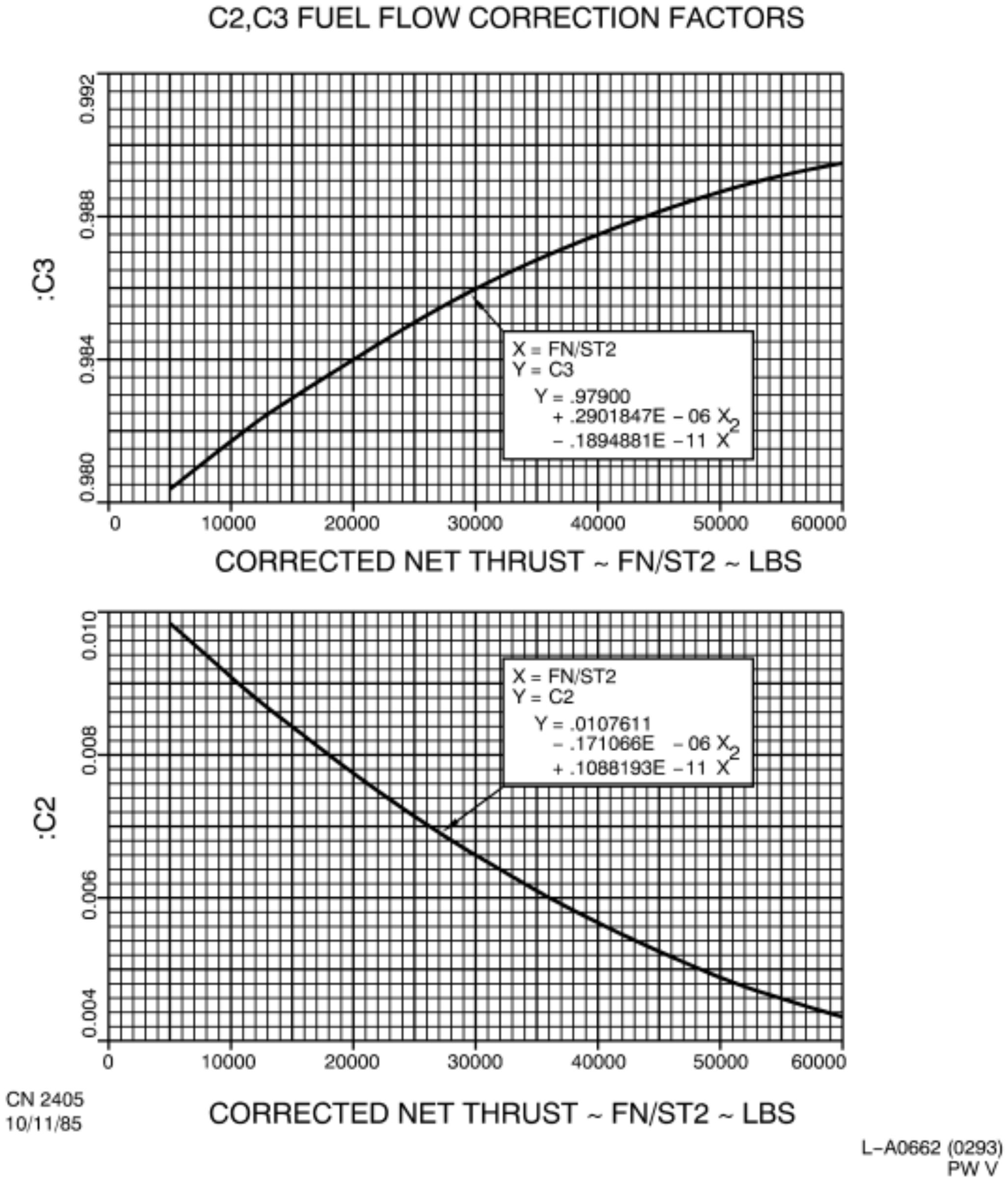
Thrust Power Setting Curve (PW4156A (−1C/−1E) Engines)
Figure 1304 (Sheet 2)
(Task 71−00−00−760−060)



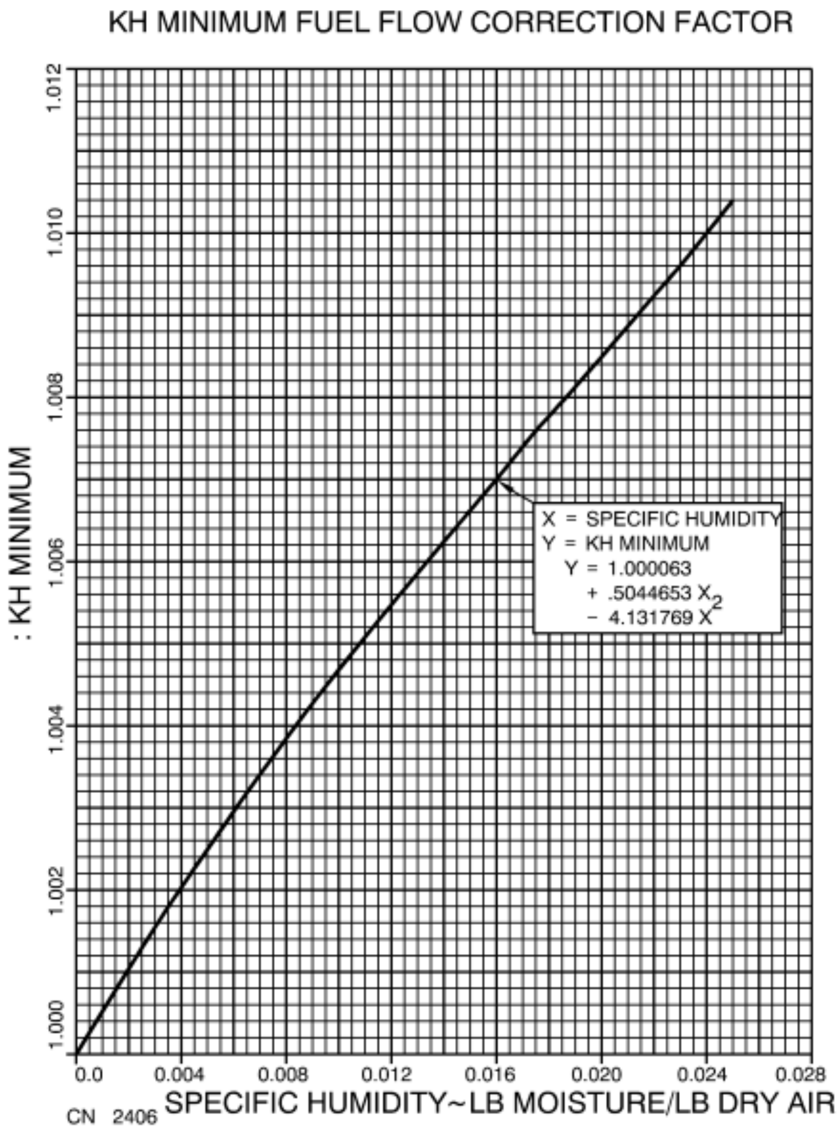
Thrust Power Setting Curve (PW4158 (−1C/−1E) Engines)
Figure 1304 (Sheet 3)
(Task 71−00−00−760−060)



Fuel Flow Correction Factors (KH)
Figure 1305
(Task 71-00-00-760-060)



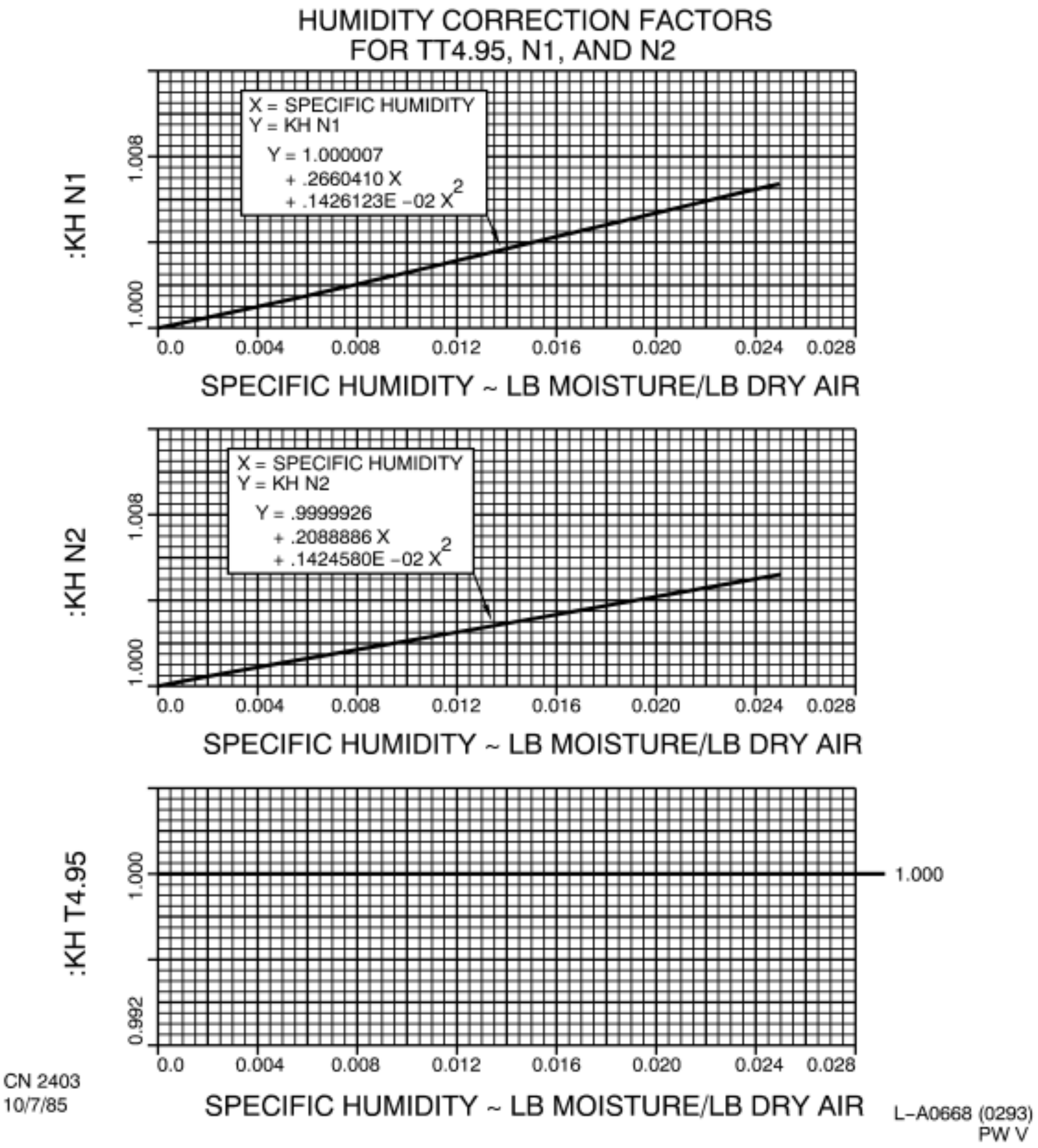
Fuel Flow Correction Factors (KH)
Figure 1306
(Task 71−00−00−760−060)



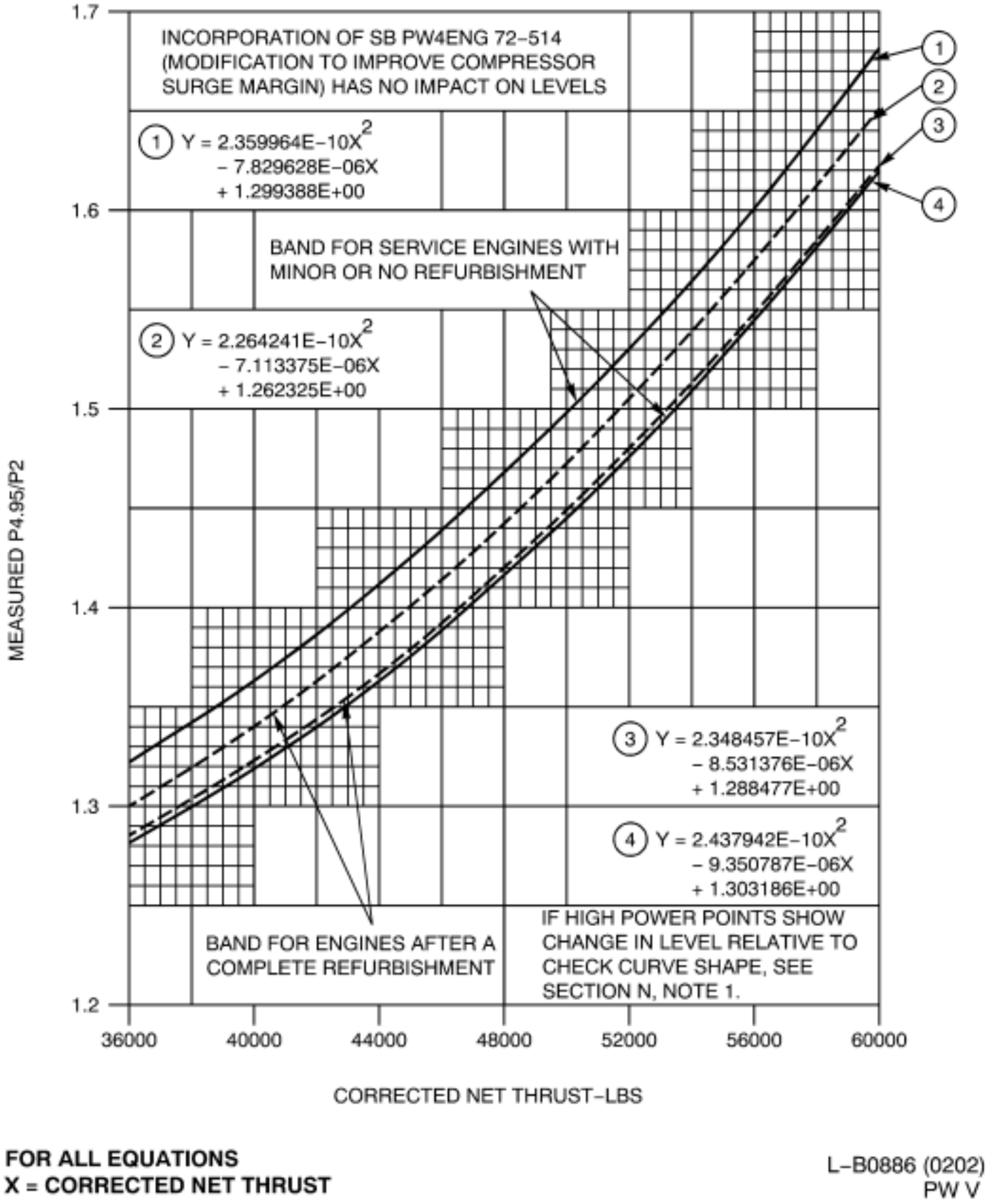
CN 2406
10/11/85

L-A0655 (0492)
PW V

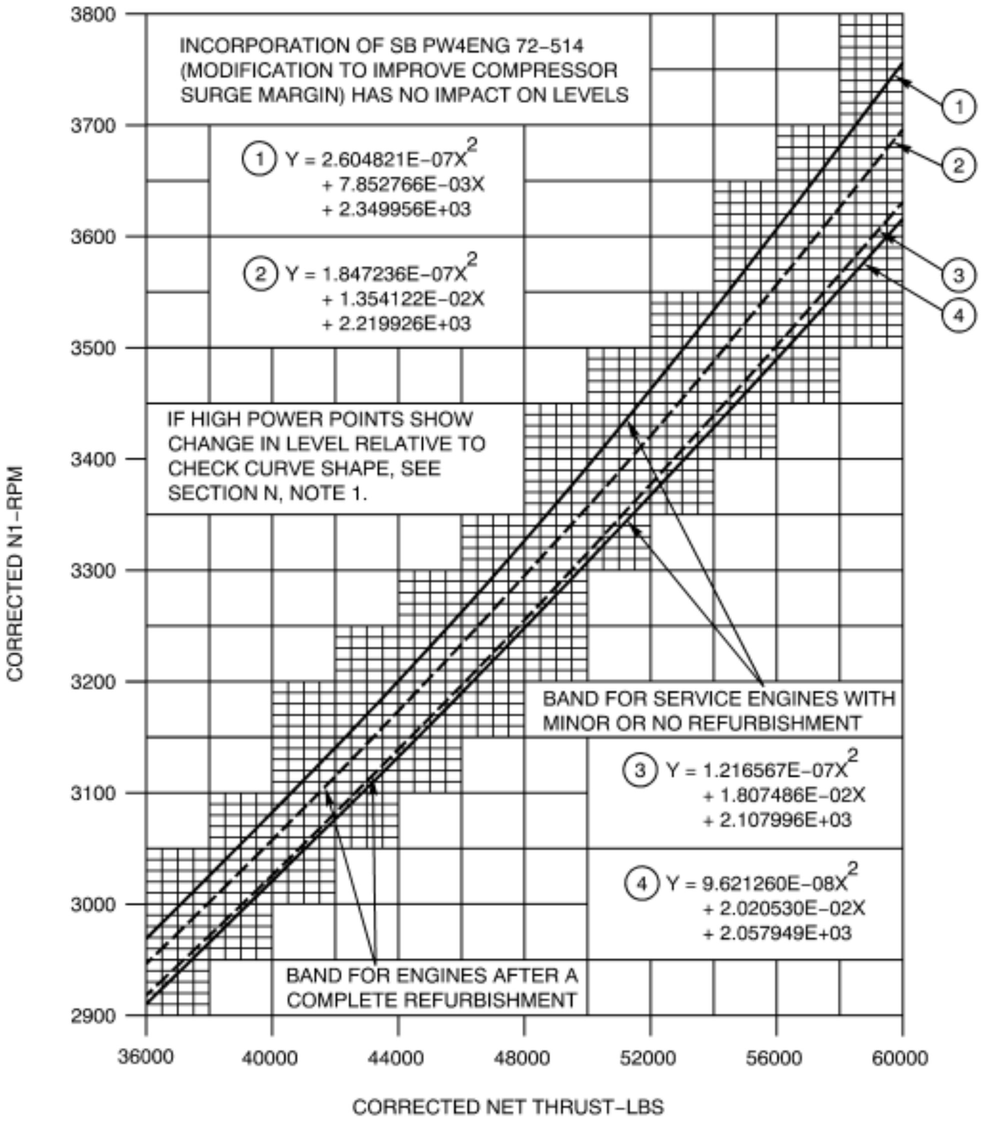
Fuel Flow Correction Factors (KH)
Figure 1307
(Task 71-00-00-760-060)



Humidity Correction Factors
Figure 1308
(Task 71−00−00−760−060)



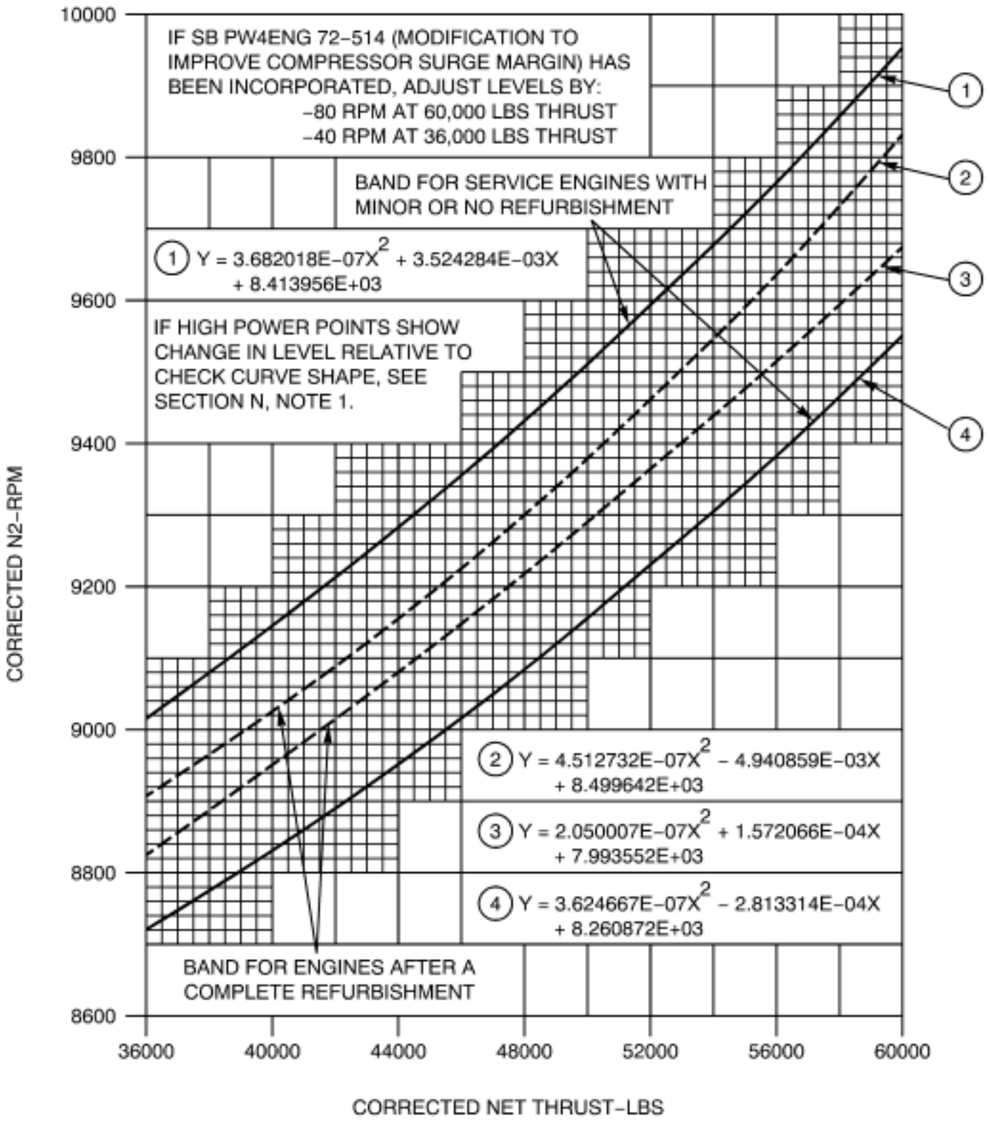
Gas Generator Check Curves
Figure 1309 (Sheet 1)
(Task 71−00−00−760−060)



NOTE: FOR ALL EQUATIONS
X = CORRECTED NET THRUST

L-B0887 (0202)
PW V

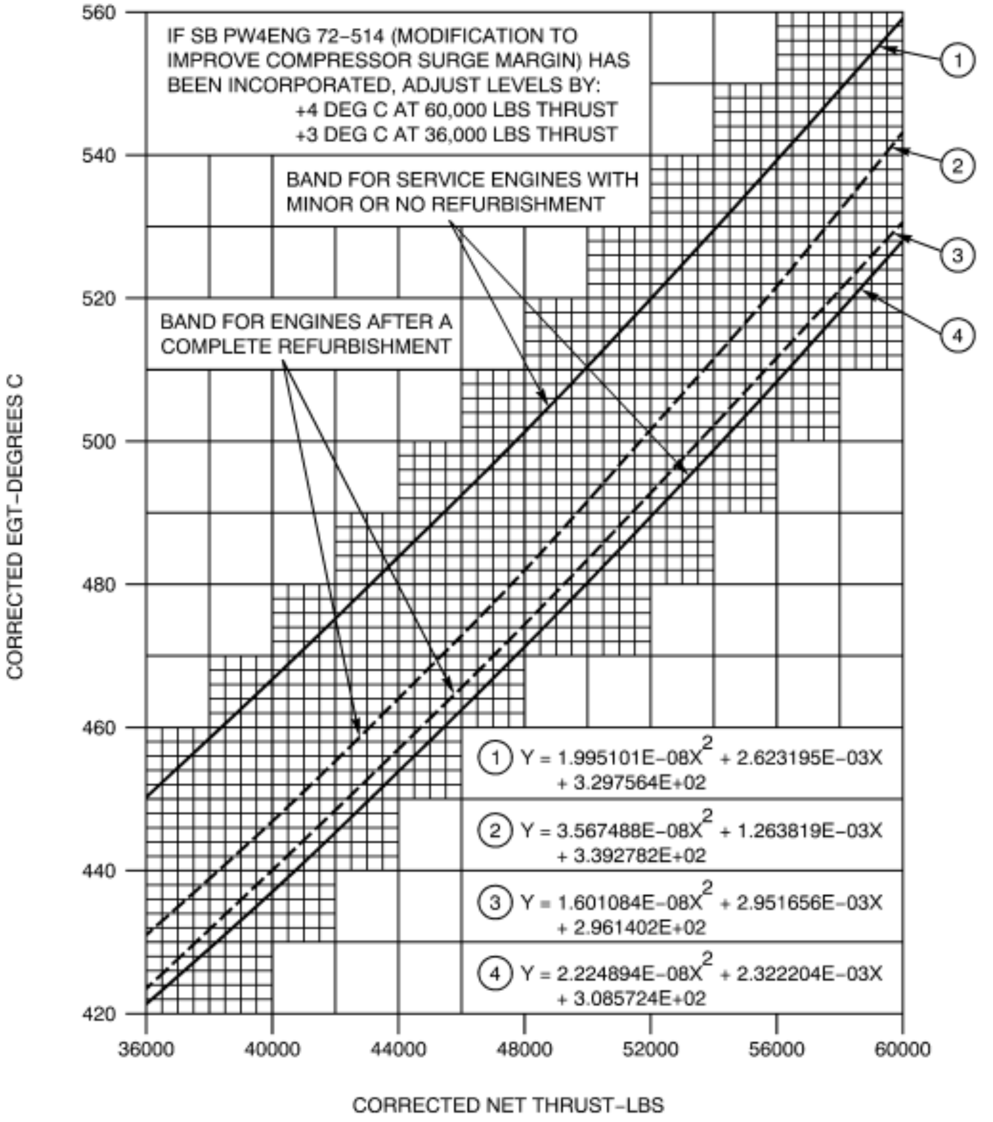
Gas Generator Check Curves
Figure 1309 (Sheet 2)
(Task 71-00-00-760-060)



NOTE: FOR ALL EQUATIONS
X = CORRECTED NET THRUST

L−B0888 (0502)
PW V

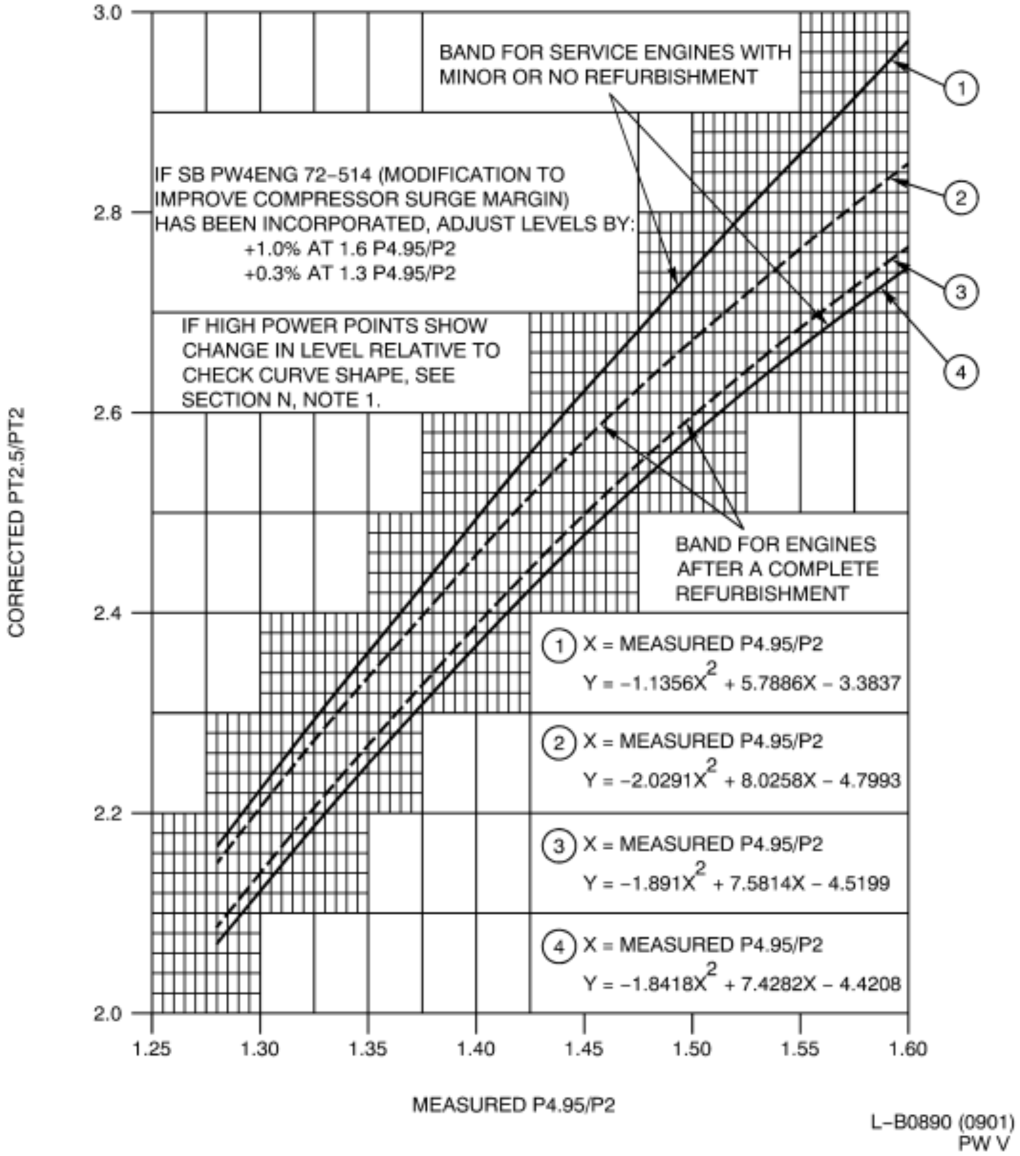
Gas Generator Check Curves
Figure 1309 (Sheet 3)
(Task 71−00−00−760−060)



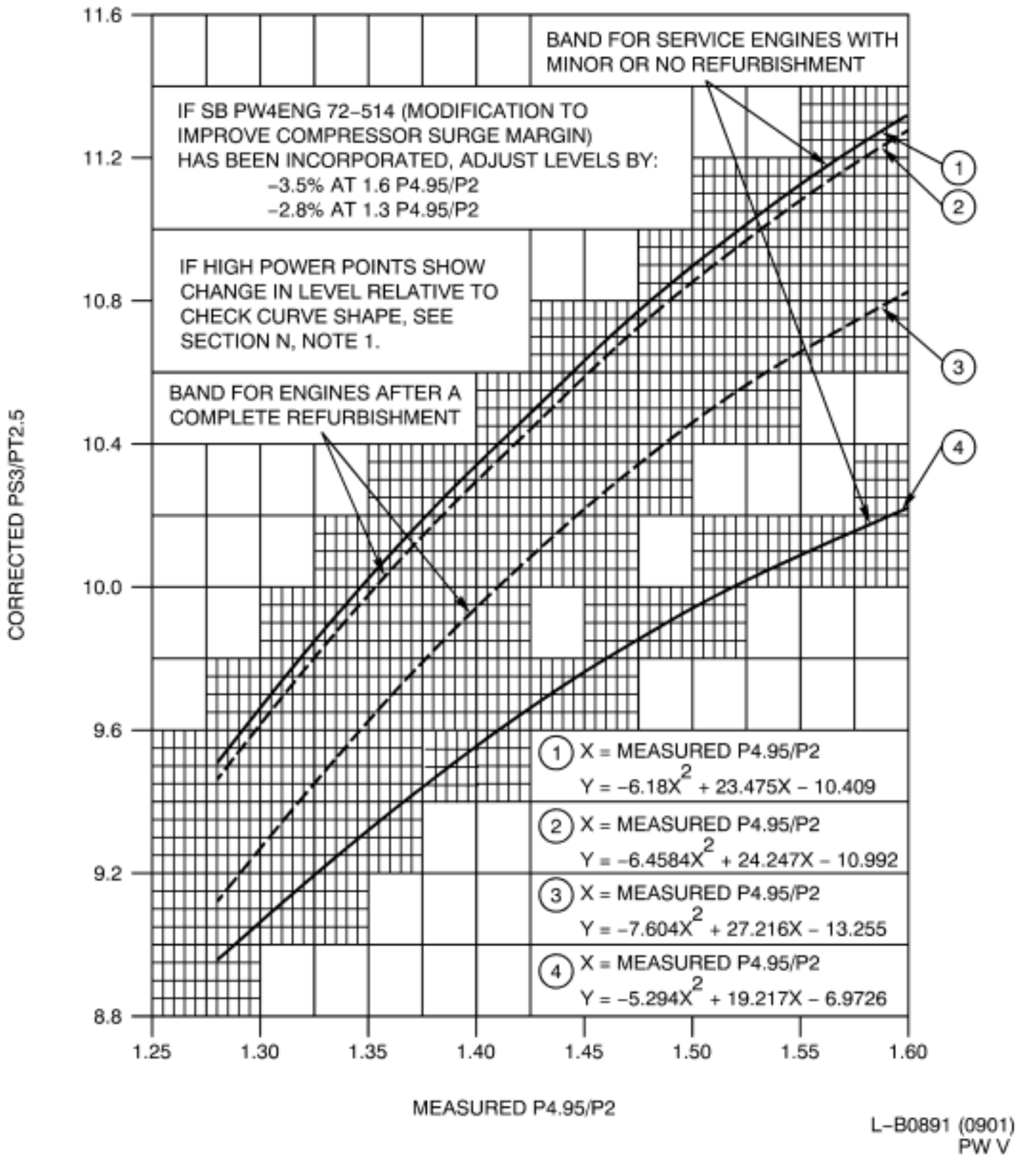
NOTE: FOR ALL EQUATIONS
X = CORRECTED NET THRUST

L-B0889 (0202)
PW V

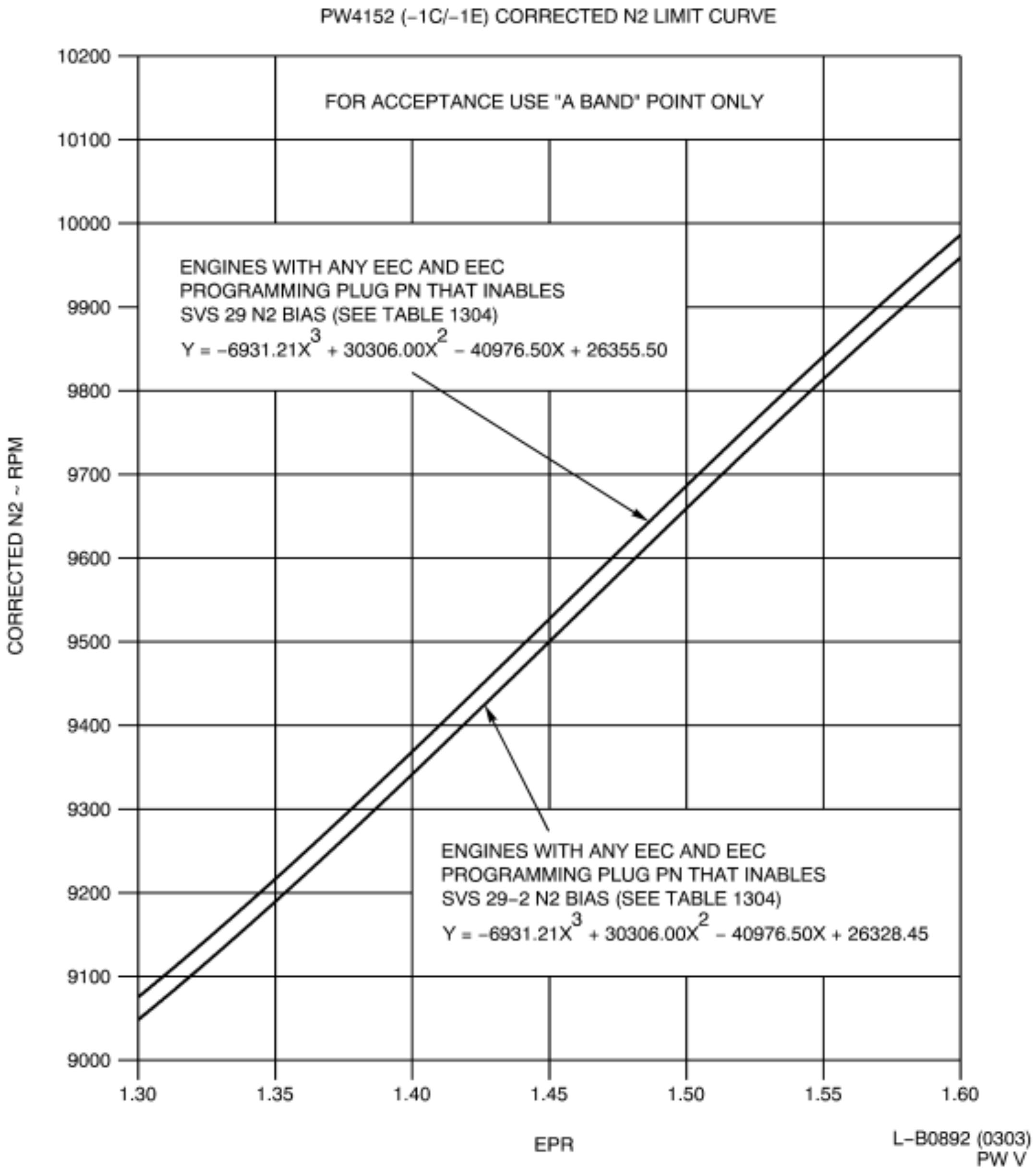
Gas Generator Check Curves
Figure 1309 (Sheet 4)
(Task 71-00-00-760-060)



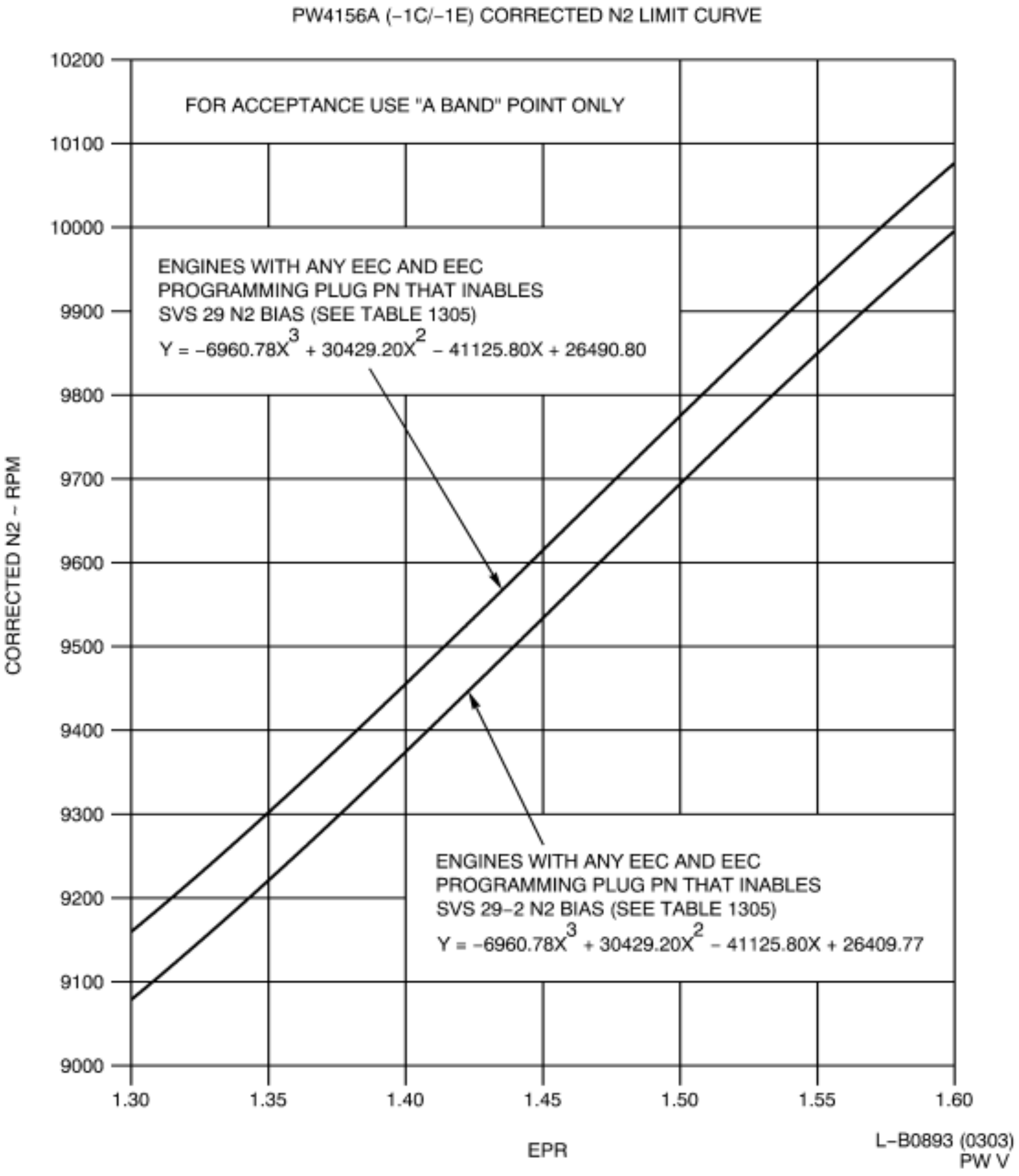
Gas Generator Check Curves
Figure 1309 (Sheet 5)
(Task 71-00-00-760-060)



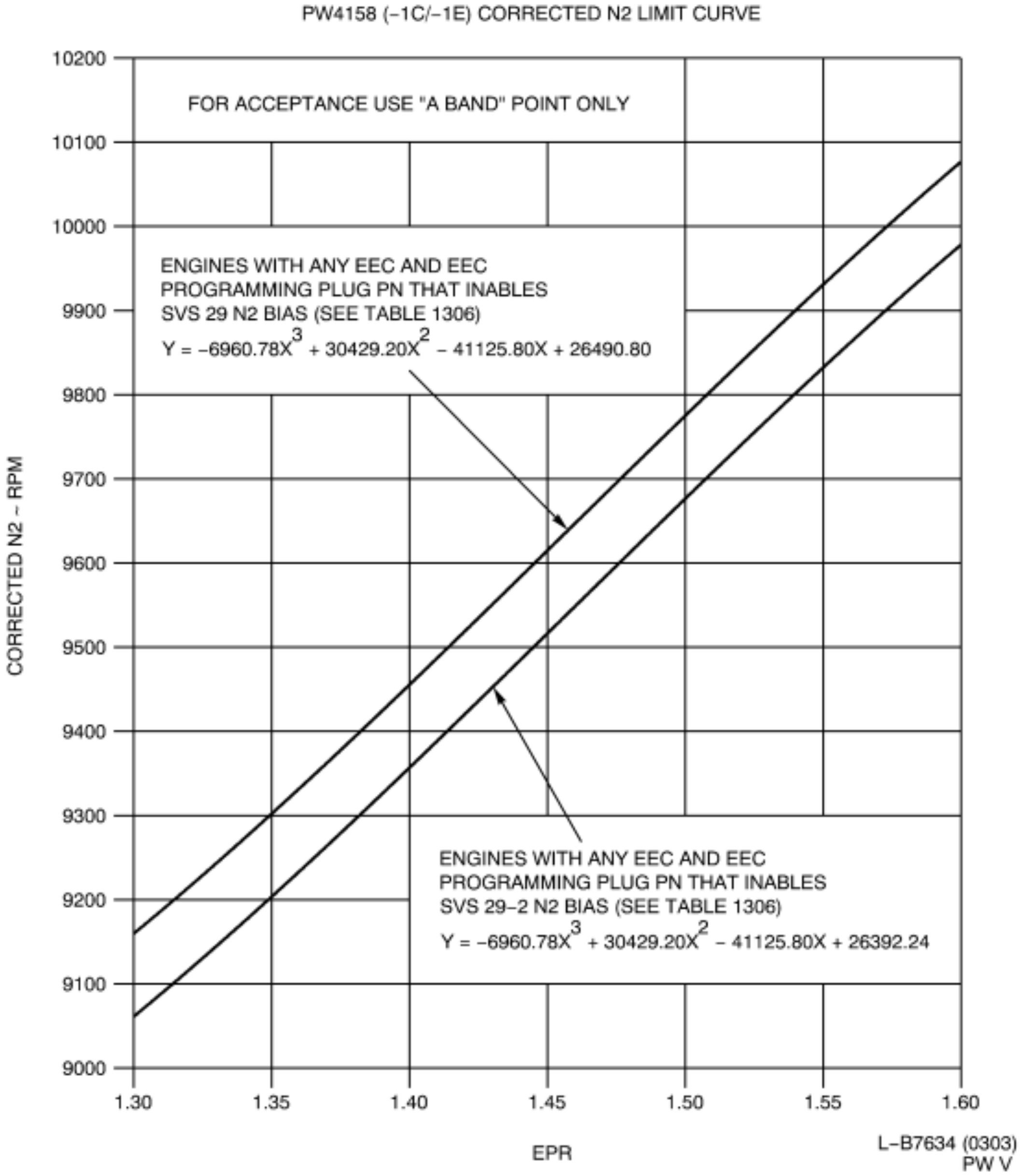
Gas Generator Check Curves
Figure 1309 (Sheet 6)
(Task 71-00-00-760-060)



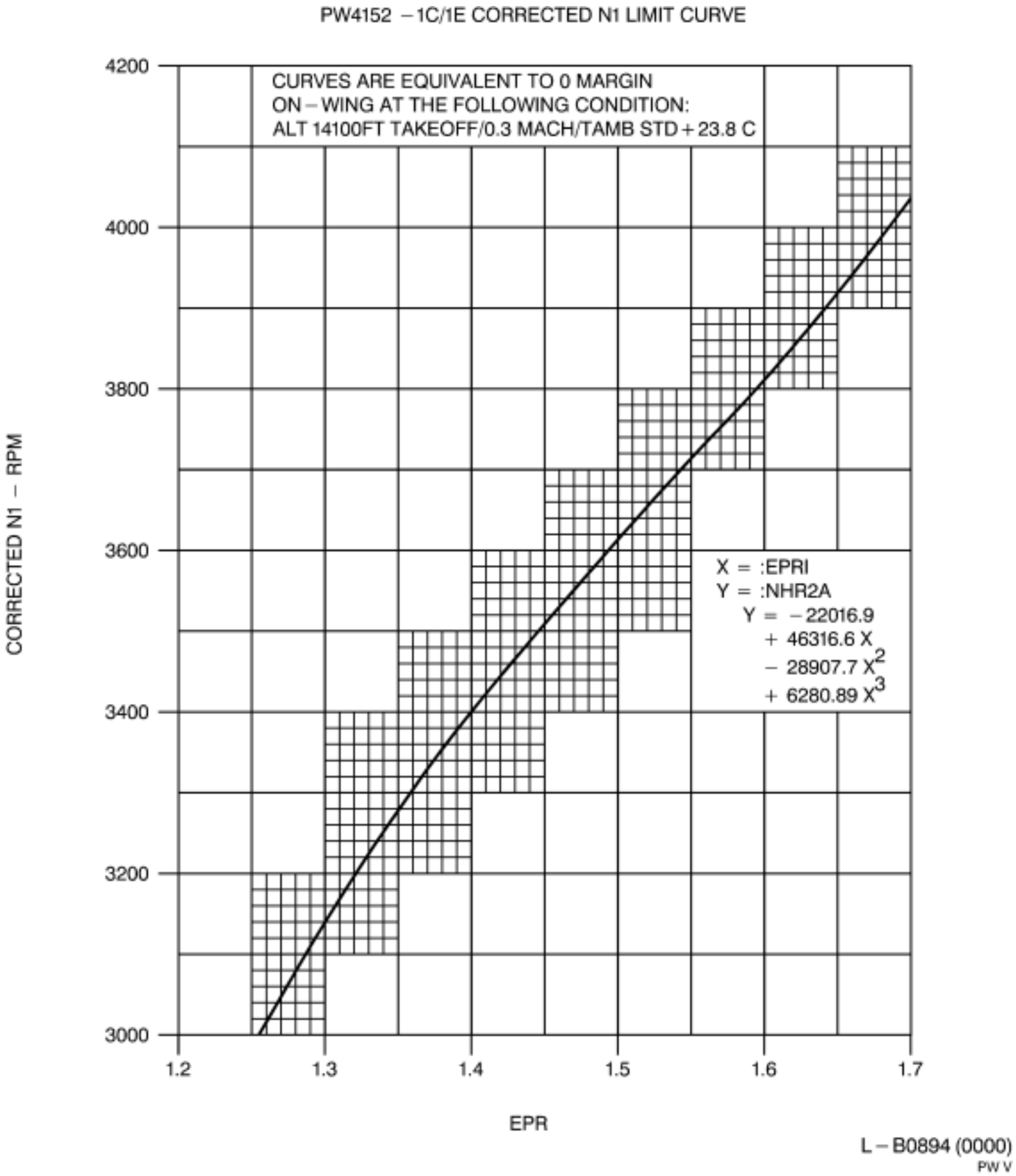
N2 Rotor Speed Limit Curve (PW4152 (−1C/−1E) Engines)
Figure 1310 (Sheet 1)
(Task 71−00−00−760−060)



N2 Rotor Speed Limit Curve (PW4156A (−1C/−1E) Engines)
Figure 1310 (Sheet 2)
(Task 71−00−00−760−060)

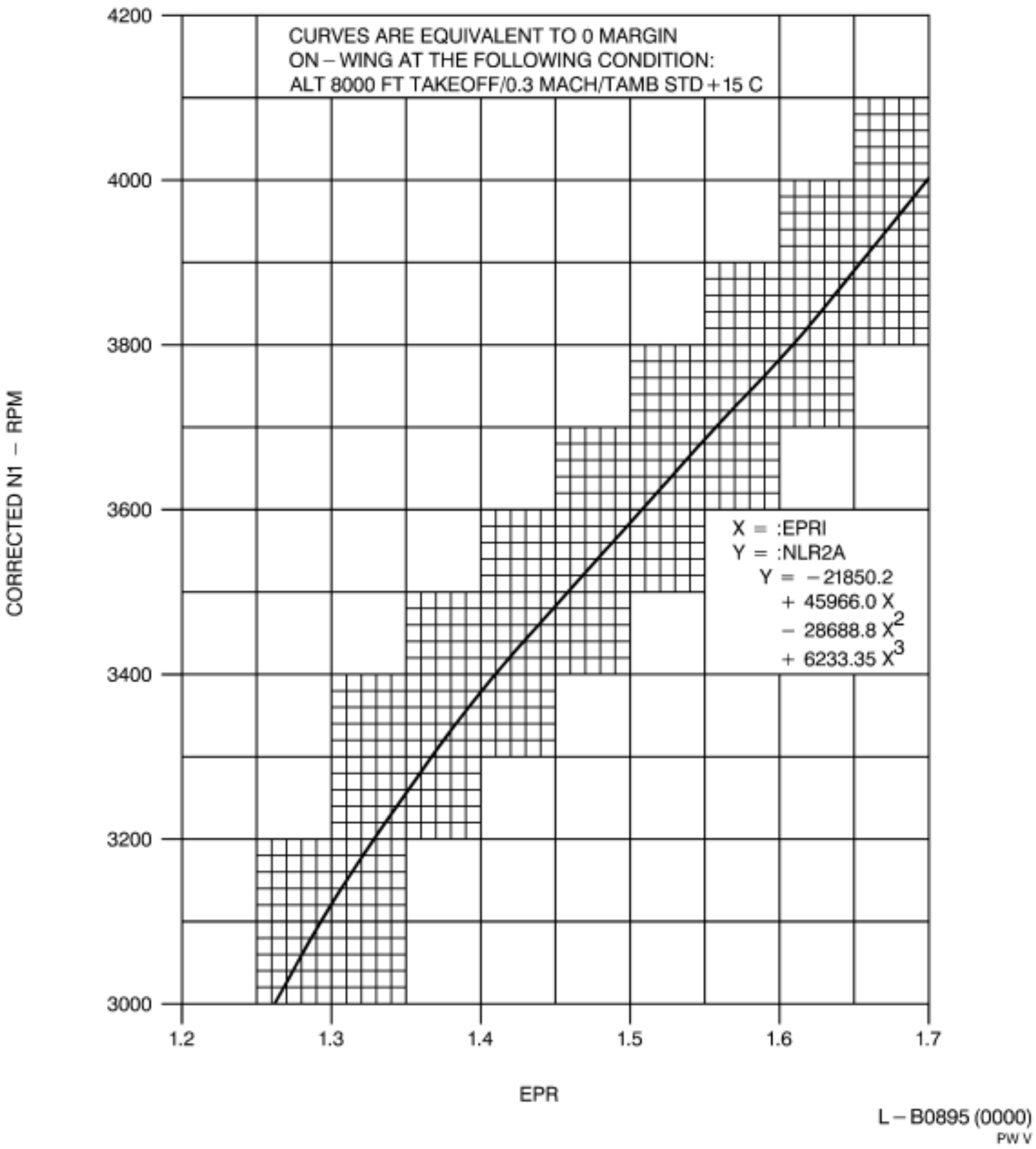


N2 Rotor Speed Limit Curve (PW4158 (−1C/−1E) Engines)
Figure 1310 (Sheet 3)
(Task 71−00−00−760−060)

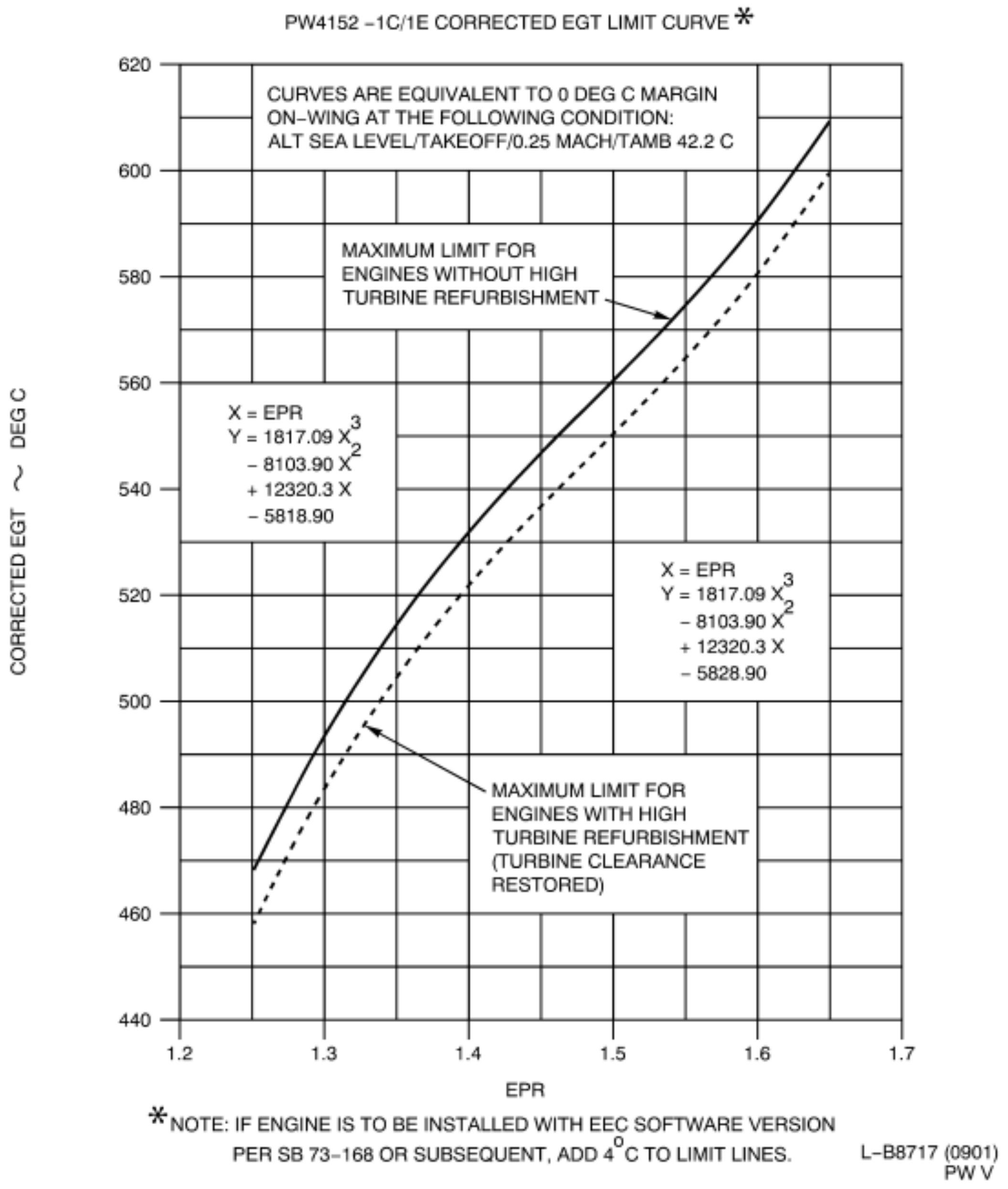


N1 Rotor Speed Limit Curve (PW4152 (−1C/−1E) Engines)
Figure 1311 (Sheet 1)
(Task 71−00−00−760−060)

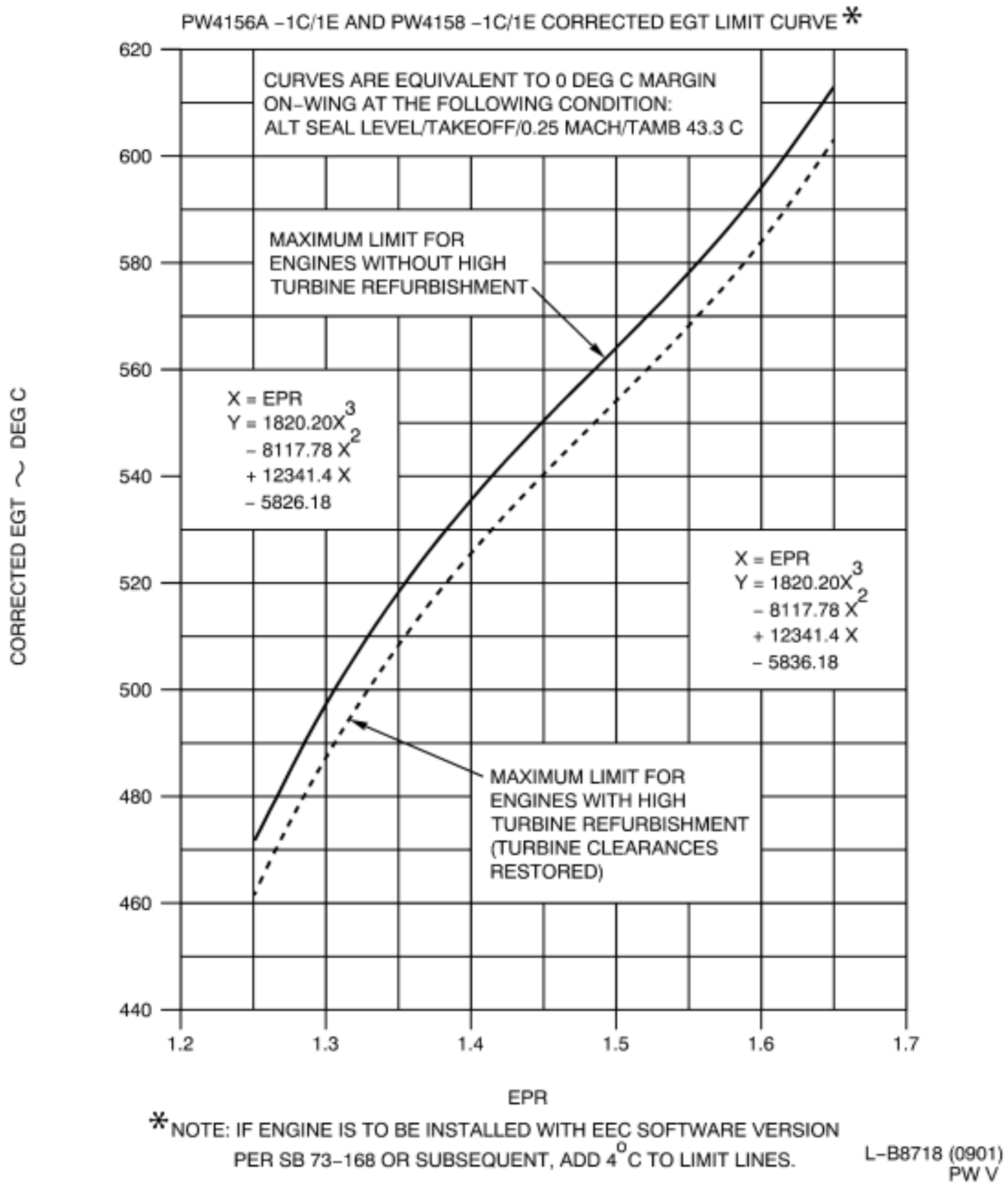
PW4156A -1C/1E AND PW4158 -1C/1E CORRECTED N1 LIMIT CURVE



N1 Rotor Speed Limit Curve (PW4156A
(-1C/-1E) And PW4158 (-1C/-1E) Engines)
Figure 1311 (Sheet 2)
(Task 71-00-00-760-060)



Corrected EGT Limit Curve (PW4152 (−1C/−1E) Engines)
Figure 1312 (Sheet 1)
(Task 71−00−00−760−060)



PW4156A −1C/1E AND PW4158 −1C/1E CORRECTED EGT LIMIT CURVE *

*NOTE: IF ENGINE IS TO BE INSTALLED WITH EEC SOFTWARE VERSION PER SB 73−168 OR SUBSEQUENT, ADD 4 °C TO LIMIT LINES.

Corrected EGT Limit Curve (PW4156A
(−1C/−1E) And PW4158 (−1C/−1E) Engines)
Figure 1312 (Sheet 2)
(Task 71−00−00−760−060)

POWER PLANT GENERAL − TESTING−09

Task 71−00−00−760−062:

1. Test No. 9 − Engine Acceptance Test

A. Test Procedure

(1) Testing−09, CONFIG−4 Is Not Used For Airbus Installations

POWER PLANT GENERAL − TESTING−09

Task 71−00−00−760−063:

1. Test No. 9 − Engine Acceptance Test

A. Prerequisite Procedure

CAUTION: ENGINE CONFIGURATION IDENTIFIER MUST BE CAREFULLY DETERMINED. FAILURE TO CORRECTLY IDENTIFY CONFIGURATION COULD RESULT IN RED LINE EXCEEDANCE AND/OR THRUST SHORTFALL

(1) Use Table 1301 to get the necessary Testing−09 configuration. Get the engine configuration from the engine identification data plate. Look for a configuration identification suffix marked after the engine model in the model field.

(a) EXAMPLE 1:

1 If "PW4158 (−3)" is marked on the engine identification plate, the configuration identifier suffix is "(−3)". This corresponds to a Phase 3 configuration as specified in Table 1301. Use TESTING−09, CONFIG−2 to do the acceptance test.

(b) EXAMPLE 2:

1 If "PW4158" is marked on the engine identification plate with no configuration identifier suffix, the configuration is Pre Phase 3 as specified in Table 1301. Use TESTING−09, CONFIG−1 to do the acceptance test.

(c) EXAMPLE 3:

1 If "PW4158 (−3A)" is marked on the engine identification plate, the configuration identifier suffix is "(−3A)". This corresponds to a Phase−3 configuration engine that is to be installed in a non Phase−3 nacelle. Use TESTING−09, CONFIG−5 to do the acceptance test

TESTING−09 CONFIGURATION	ENGINE CONFIGURATION	CONFIGURATION IDENTIFICATION SUFFIX
Config−1	Pre Phase 3	None

TESTING−09 CONFIG/ENGINE CONFIGURATION
Table 1301

TESTING-09 CONFIGURATION	ENGINE CONFIGURATION	CONFIGURATION IDENTIFICATION SUFFIX
Config-2	Phase 3 (Reference SB PW4ENG 72-572)	(-3)
Config-3	Intermix (-1C or -1E) (Reference SB PW4ENG 72-516)	(-1C/-1E)
Config-4	NOT AVAILABLE for Airbus installations	
Config-5	Intermix (-3A) (Reference SB PW4ENG 73-150)	(-3A)

TESTING-09 CONFIG/ENGINE CONFIGURATION
Table 1301 (Continued)

(2) Use this procedure to test the engine for satisfactory performance after one or more components or modules have been replaced or repaired. This test is also used after the engine was fully disassembled, repaired and assembled.

NOTE: It is recommended that you not install large quantities of blended blades, vanes and airseals in one engine. If these parts are blended to the maximum limits in many areas, the result will be low engine performance.

(3) It is possible that other tests are necessary before you do this test, see 71-00-00 Power Plant General - Testing-00, Test Requirements After Engine/Module/Component Repair or Replacement, Task 71-00-00-990-003. This procedure will also give the sequence for the necessary tests.

(4) Special instrumentation must be installed on the engine before the engine is operated for this test.

(5) The engine testing must be done in a test configuration and test cell that has been calibrated. Calibrate to the specifications shown in P&W Publication Report No. 544. All test data must be corrected to the special test cell correction factors before you use the limits and curves in this procedure.

(6) For general safety information, see 71−00−00, Power Plant General − Testing−00, Engine Safety Precautions, Task 71−00−00−990−004.

(7) For safe engine operation, see 71−00−00, Power Plant General − Testing−00, Precautions And Procedures For Safe And Correct Engine Operation, Task 71−00−00−760−002.

(8) For engine operation limits, see 71−00−00, Power Plant General − Testing−00, Engine Operation Limits, Task 71−00−00−990−007.

B. Equipment And Materials Necessary

Standard Tools (See 71−00−00, Power Plant General − Testing−00, Prepare The Engine For Test In A Cell, Task 71−00−00−480−001

(1) Fuel pump drain hose and collection bottle.

(2) Stator vane drain hose and collection bottle.

(3) Station 2.5 compressor bleed actuator drain hose and collection bottle.

(4) Air/oil cooler modulating valve drain hose and collection bottle.

(5) IDG air/oil cooler modulating valve drain hose and collection bottle.

(6) TCC actuator modulating valve drain hose and collection bottle.

(7) Accessory drive fluid power pump drain hose and collection bottle.

(8) Starter drive drain hose and collection bottle.

(9) IDG drain hose and collection bottle.

(10) Accessory drive EEC generator seal drain hose and collection bottle.

(11) Fuel/oil heat exchanger IDGS core drain hose and collection bottle.

(12) Fuel/oil heat exchanger engine oil core drain hose and collection bottle.

(13) Fuel/oil heat exchanger IDG center tube drain hose and collection bottle.

(14) Bypass valve drain hose and collection bottle.

(15) Hydraulic pump drain hose and collection bottle.

C. Test Instrumentation And Test Cell Connections.
Install the special instrumentation and equipment that follows:

(1) PT2 and PS2 (8 locations) − (optional)

(2) PT2/TT2 Rosemount probe − (PWA 85523)

(3) TT2 − Compressor inlet total temperature (8 locations)

(4) Fuel flow (observed)

(5) T Fuel

(6) N1 RPM − (NL)

(7) N2 RPM − (NH)

(8) PT2.5*

(9) PS3

(10) PS4I (Optional)

(11) PT4.95

(12) Main Oil Pressure

(13) Main Oil Temperature

(14) Oil Filter Differential Pressure

(15) Fuel Pump Inlet Pressure

(16) Fuel Pump Pressure

(17) PAMB

(18) TT2.5*

(19) TT3*

(20) Vibration, fan case flange A (vertical)

(21) TT4.95 Harness Average (stand reading) If EEC T49 value is used, adjustment to T4.95 (real without shunt) must be made.

(22) Thrust - (observed)

(23) Thrust Lever and Fuel Select Switch

(24) Ignition Switch

(25) Test Cell Fuel Supply Pressure

(26) ARINC 429 transceiver.

(27) No. 3 Bearing Compartment Breather Pressure

* - A necessary parameter for the module analysis program MAPNET System. Optional unless a MAPNET System analysis is necessary.

D. Thrust Rating and Operation Limits

(1) Ratings at static sea level standard conditions are shown in Table 1302.

ENGINE MODEL	THRUST SETTING	JET THRUST LBS. (N)	TSFC *
PW4152 (-3A)	TAKEOFF	51110 (227348)	0.3353
PW4152 (-3A)	MAX CONTINUOUS	47160 (209778)	0.3284
PW4152 (-3A)	90% Max. Continuous	42450 (188827)	0.3219
PW4152 (-3A)	70% Max. Continuous	34200 (152129)	0.3154
PW4156A (-3A)	TAKEOFF	55950 (248878)	0.3457
PW4156A (-3A)	91% TAKEOFF	51000 (226859)	0.3351
PW4156A (-3A)	MAX CONTINUOUS	45730 (203417)	0.3262
PW4156A (-3A)	90% MAX CONTINUOUS	40940 (182110)	0.3202

THRUST AND TSFC RATINGS AT SEAL LEVEL STANDARD CONDITIONS
Table 1302

ENGINE MODEL	THRUST SETTING	JET THRUST LBS. (N)	TSFC *
PW4158 (-3A)	TAKEOFF	57610 (256262)	0.3498
PW4158 (-3A)	88% TAKEOFF	51000 (226859)	0.3351
PW4158 (-3A)	MAX CONTINUOUS	45490 (202349)	0.3259
PW4158 (-3A)	90% MAX CONTINUOUS	40770 (181354)	0.3201

*NOTE: TSFC (Thrust Specific Fuel Consumption) is for reference only for a new engine and is not necessary for the engine Acceptance Test.

THRUST AND TSFC RATINGS AT SEAL LEVEL STANDARD CONDITIONS
Table 1302 (Continued)

(2) The engine speed limits are shown in 71-00-00, Power Plant General - Testing-00, Engine Operation Limits, Task 71-00-00-990-007.

(3) The engine exhaust gas temperature (EGT) limits for Station 4.9 are shown in 71-00-00, Power Plant General - Testing-00, Engine Operation Limits, Task 71-00-00-990-007.

E. Seal Drain Leakage Limits

(1) During the Acceptance Test, the seal leakage must be measured. See 71-00-00, Power Plant General - Testing-00, Engine Operation Limits, Task 71-00-00-990-007.

(2) Attach a hose to each seal drain connection and put the other end of the hose in a collection bottle. Each bottle must be identified.

F. Multi-Point Instrumentation

(1) Multi-point instrumentation is necessary and is measured during the acceptance test for some parameters. To get satisfactory data, there is a limit for sampling points that do not operate. The necessary multi-point instrumentation and points that do not operate are listed as follows:

(a) TT2 - Eight sampling points are necessary with a maximum limit of two points that do not operate.

(b) Bellmouth pitot static probes (PT2 and PS2) − This parameter is optional. If it is used, eight sampling points are necessary with a maximum limit of two points that do not operate.

(c) Pitot static probes must be installed for test cell correlation testing. See the specifications shown in P&W publication Report No. 544.

(d) PT2 can be calculated for post test cell correlation testing without pitot static probes. Do a correlation of PT2 (pitot static) to: PT2 Rosemount probe, P cell or (PT2/Pamb vs N1 corrected).

G. Acceptance Test General Specifications

(1) Use the definitions that follow during the acceptance test.

(a) EPR−0 = Engine Pressure Ratio from the EEC (Electronic Engine Control) instrumentation system with a zero delta EPR modified (Class 09) Engine Program Plug (EPP) installed in the Electronic Engine Control (EEC).

OR

EPR−0 can be calculated by adding the necessary EPR Modification (delta EPR) used during the test run to the EPR output from the Engine Control (Engine Electronic Control EPR therefore EECEPR).

In the Airbus Engine Control logic EPR modification (delta EPR) is a function of TRA (throttle lever resolver angle). To correctly calculate EPR−0 from EECEPR, EPR class and TRA are necessary.

The Control logic removes the EPR modification (delta EPR) at low power to align the right and left wing engines. This logic is unique to Airbus installations and controls because it occurs in sea level test range, (below "C" band point when the TRA is less than 72 degrees).

Calculation of EPR-0. Because the recommended test configuration is with a class 16/ -0.028 delta EPR modifier, the calculation is shown as follows:

EECEPR = EPR-028

If TRA is equal or greater than 72 degrees,
EPR-0 = EPR-028 + .028

If TRA is between 40.5 and 72 degrees,
EPR-0 = EPR-028 + (1-(72-TRA)/31.5) x .028

If TRA is equal or less than 40.5 degrees,
EPR-0 = EPR-028

For other EPR class modifiers (other than class 16), see Table 1303 for values.

(b) EPR-028 = Engine Pressure Ratio form the EEC (Electronic Engine Control) instrumentation system with a class 16 (-0.028 delta) EPR modifier Engine Programming Plug (EPP) installed in the EEC.

(c) EPR = Engine Pressure Ratio From the EEC (Electronic Engine Control) instrumentation system with a class EEC programming plug to be calculated. To calculate EPR, (EPR-0 + delta EPR modifier). EPR is the value used in Paragraph Q. Check For Engine Acceptance to check for engine acceptance and to calculate engine margin to the limits.

(d) TRA = Throttle Resolver Angle, position of the EEC thrust control lever as specified by the electrical signal from the EEC.

EPR CLASS	EPR MODIFICATION (DELTA EPR)
01	+ .032
02	+ .028
03	+ .024
04	+ .020
05	+ .016
06	+ .012
07	+ .008

EEC PROGRAMMING PLUG (EPP) CLASSIFICATION
Table 1303

EPR CLASS	EPR MODIFICATION (DELTA EPR)
(CONTINUED)	
08	+ .004
09	0.0
10	- .004
11	- .008
12	- .012
13	- .016
14	- .020
15	- .024
16	- .028

EEC PROGRAMMING PLUG (EPP) CLASSIFICATION
Table 1303 (Continued)

(2) All Acceptance Test specifications are from the test cell instrumentation except the EPR (Engine Pressure Ratio) which is the EPR value from the EEC. The EEC values for Tt2, N1, N2 can be used if it is shown they are consistent and equal to the stand readings. This must be done during the test cell correlation testing. The EEC values must be within the limits and tolerances of 71-00-00 Testing-00 Table 1305 of Test Instrumentation Calibration (Task 71-00-00-990-002). Any exceptions to this rule will be specified in the test procedure or correction to the observed section.

CAUTION: IF YOU USE AN INCORRECT EPP PLUG DURING ENGINE TEST, YOU WILL CAUSE ERRORS IN SETTING THE EPR RATING CLASSIFICATION AND IN DETERMINING ENGINE ACCEPTANCE TO LIMITS OF PARAGRAPHS Q. AND R. RESPECTIVELY.

(3) For standardization for all PW4000 engine models and to make sure that the engine will make Takeoff thrust, it is recommended that the Acceptance Testing be done with a class 16 EEC Programming Plug (EPP) installed in the EEC. Refer to SB PW4ENG 73-203 for EEC Programming Plug (EPP) part number for testing.

(4) After the Acceptance Test, the necessary class and part number of EEC programming plug must be selected. You must calculate the necessary class and get the part number from SB PW4ENG 73-203. After you select the necessary EEC programming plug, install it in the EEC. See the Component Maintenance Manual (CMM), - EEC Data Entry Plug, PN 50A450. This manual has the procedure for setting the plug classification.

(5) The EEC has logic for operation in two modes:

   (a) EPR = This is the primary mode.

   (b) N1 = This is the alternate mode which is the backup mode (default) for the EPR mode.

   (c) The Acceptance Test must be done in the EPR mode.

ENGINE HARDWARE CONFIGURATION - PW4152 (-3A) MODEL

EEC PROGRAM- MING PLUG PART NUMBER NOTE 5	EEC PN 51D860 52D349 52D444 52D714 53D652 54D247 OR LATER	EEC PN 54D094	STATOR VANE SCHEDULE 29 N2 BIAS NOTE 1	STATOR VANE SCHEDULE 29-3 N2 BIAS NOTE 2	STATOR VANE SCHEDULE 29-2 N2 BIAS NOTE 4
51D458	X		X		
51D458		X		X	
51D459	X		X		
51D459		X		X	
54D332	X				X

NOTE 1 It is necessary to correct N2 to the procedures shown in Table 1311A.

NOTE 2 It is necessary to correct N2 to the procedures shown in Table 1311B.

NOTE 3 It is necessary to correct N2 to the procedures shown in Table 1311C (NOT Applicable to this model).

NOTE 4 It is necessary to correct N2 to the procedures shown in Table 1311D.

NOTE 5 See SB PW4ENG 73-203 for programming plug part number requirements "EEC Programming Plug Selection Chart".

PW4152 (-3A) ENGINES EEC PROGRAMMING PLUG PART NUMBER VERSUS SVS CORRECTION REQUIREMENTS
Table 1304

ENGINE HARDWARE CONFIGURATION - PW4156A (-3A) MODEL WITHOUT ASYMMETRIC HPC CASE

EEC PROGRAMMING PLUG PART NUMBER NOTE 5	EEC PN 51D860 52D349 52D444 52D714 53D652 54D247 OR LATER	EEC PN 54D094	STATOR VANE SCHEDULE 29 N2 BIAS NOTE 1	STATOR VANE SCHEDULE 29-3 N2 BIAS NOTE 2	STATOR VANE SCHEDULE 29-2 N2 BIAS NOTE 4
51D452	X		X		
51D452		X		X	
51D453	X		X		
51D453		X		X	
54D337	X				X

NOTE 1 It is necessary to correct N2 to the procedures shown in Table 1311A.

NOTE 2 It is necessary to correct N2 to the procedures shown in Table 1311B.

NOTE 3 It is necessary to correct N2 to the procedures shown in Table 1311C (NOT Applicable to this model).

NOTE 4 It is necessary to correct N2 to the procedures shown in Table 1311D.

NOTE 5 See SB PW4ENG 73-203 for programming plug part number requirements "EEC Programming Plug Selection Chart".

PW4156A (-3A) ENGINES EEC PROGRAMMING PLUG
PART NUMBER VERSUS SVS CORRECTION REQUIREMENTS
Table 1305A

ENGINE HARDWARE CONFIGURATION - PW4156A
(-3A) MODEL WITH ASYMMETRIC HPC CASE

EEC PROGRAMMING PLUG PART NUMBER NOTE 5	EEC PN 54D094 54D247 OR LATER	STATOR VANE SCHEDULE 29-5 N2 BIAS NOTE 3	STATOR VANE SCHEDULE 29-2 N2 BIAS NOTE 4
51D430	X	X	
51D431	X	X	
54D337	X		X

NOTE 1	It is necessary to correct N2 to the procedures shown in Table 1311A (Not applicable to this configuration).
NOTE 2	It is necessary to correct N2 to the procedures shown in Table 1311B (Not applicable to this configuration).
NOTE 3	It is necessary to correct N2 to the procedures shown in Table 1311C.
NOTE 4	It is necessary to correct N2 to the procedures shown in Table 1311D.
NOTE 5	See SB PW4ENG 73-203 for programming plug part number requirements "EEC Programming Plug Selection Chart".

NOTE: Assy - Asymmetric HPC Case: PN 58H006-01 Front HPC Case Set - Segmented HPC Configuration.

NOTE: Assy - Asymmetric HPC Case: PN 58H007-01 Front HPC Case Set - Ring HPC Configuration.

PW4156A (-3A) ENGINES EEC PROGRAMMING PLUG
PART NUMBER VERSUS SVS CORRECTION REQUIREMENTS
Table 1305B

ENGINE HARDWARE CONFIGURATION - PW4158
(-3A) MODEL WITHOUT ASYMMETRIC HPC CASE

EEC PROGRAM- MING PLUG PART NUMBER NOTE 5	EEC PN 51D860 52D349 52D444 52D714 53D652 54D247 OR LATER	EEC PN 54D094	STATOR VANE SCHEDULE 29 N2 BIAS NOTE 1	STATOR VANE SCHEDULE 29-3 N2 BIAS NOTE 2	STATOR VANE SCHEDULE 29-2 N2 BIAS NOTE 4
51D444	X		X		
51D444		X		X	
51D445	X		X		
51D445		X		X	
54D361	X				X

NOTE 1 It is necessary to correct N2 to the procedures shown in Table 1311A.

NOTE 2 It is necessary to correct N2 to the procedures shown in Table 1311B.

NOTE 3 It is necessary to correct N2 to the procedures shown in Table 1311C (NOT Applicable to this model).

NOTE 4 It is necessary to correct N2 to the procedures shown in Table 1311D.

NOTE 5 See SB PW4ENG 73-203 for programming plug part number requirements "EEC Programming Plug Selection Chart".

PW4158 (-3A) ENGINES EEC PROGRAMMING PLUG PART NUMBER VERSUS SVS CORRECTION REQUIREMENTS
Table 1306A

ENGINE HARDWARE CONFIGURATION - PW4158 (-3A) MODEL
WITH ASYMMETRIC HPC CASE

EEC PROGRAMMING PLUG PART NUMBER NOTE 5	EEC PN 54D094 54D247 OR LATER	STATOR VANE SCHEDULE 29-5 N2 BIAS NOTE 3	STATOR VANE SCHEDULE 29-2 N2 BIAS NOTE 4
51D436	X	X	
51D437	X	X	
54D361	X		X

NOTE 1 It is necessary to correct N2 to the procedures shown in Table 1311A (Not applicable to this configuration).

NOTE 2 It is necessary to correct N2 to the procedures shown in Table 1311B (Not applicable to this configuration).

NOTE 3 It is necessary to correct N2 to the procedures shown in Table 1311C.

NOTE 4 It is necessary to correct N2 to the procedures shown in Table 1311D.

NOTE 5 See SB PW4ENG 73-203 for programming plug part number requirements "EEC Programming Plug Selection Chart".

NOTE: Assy - Asymmetric HPC Case: PN 58H006-01 Front HPC Case Set - Segmented HPC Configuration.

NOTE: Assy - Asymmetric HPC Case: PN 58H007-01 Front HPC Case Set - Ring HPC Configuration.

PW4158 (-3A) ENGINES WITH ASYMMETRIC HPC CASE EEC PROGRAMMING PLUG PART NUMBER VERSUS SVS CORRECTION REQUIREMENTS
Table 1306B

H. Procedures To Prepare For Test

(1) Check that all the test instrumentation is calibrated and that there are no leaks.

(2) Service the engine oil system as shown in the procedures of 72-00-00 Servicing-02 (Task 72-00-00-610-002) or 72-00-00 Servicing-03 (Task 72-00-00-610-003).

(3) Prime the engine. See 71-00-00 Power Plant General-00, Oil and Fuel Systems Priming Procedure, (Task 71-00-00-760-003).

(4) Do the EEC static test. See 71-00-00 Test No. 7 - EEC Static Test, (Task 71-00-00-760-038).

I. Testing Prior to Acceptance Test

(1) Do the EEC idle test. See 71-00-00 Test No. 6 - EEC Idle Test, (Task 71-00-00-760-037).

NOTE: Start the engine with one Igniter A only.

(2) Do the idle leak test. See 71-00-00 Test No. 3 - Idle Power Test, (Task 71-00-00-760-030). Check for leaks, if necessary do an engine shutdown and repair any leaks.

NOTE: You can do Test No. 6 and 3 at the same time.

(3) Let the engine become stable for five minutes at MINIMUM IDLE.

(4) Make sure all the engine parameters are in the permitted limits. See Power Plant General - Testing-00, Engine Operation Limits, (Task 71-00-00-990-007).

(a) Make sure that the main oil pressure is in limits. The oil pressure must also be in the acceptance band shown in 71-00-00, Test No. 13, (Task 71-00-00-760-047).

(b) Make sure that the No. 1 - 2 bearing compartment breather pressure is in limits.

(c) Make sure that the No. 3 bearing compartment breather pressure is in limits.

(d) Make sure that the No. 3 bearing compartment scavenge temperature (T3 SCAV) is in limits.

(e) If the optional PS4I instrumentation is installed, make sure that the turbine cooling air pressure ratio (TCAR) is in the operator's historical range.

NOTE: The turbine cooling air ratio (TCAR) check is removed from all PW4000 engine manuals. Field experience shows that the assembly instructions and TOBI flow checks are sufficient to make sure that the engine will operate correctly. You must obey the assembly and check procedures specified in the engine manual and service bulletins.

(5) Make a record of N1 RPM, N2 RPM, T4.95 (EGT), oil pressure and temperature. Check the EEC for fault messages.

NOTE: It is recommended that a complete set of data be taken at this time to check the data system. The data system must be checked before the Engine Acceptance Test.

(6) Do an engine shutdown by the Normal Shutdown Procedure, (Task 71-00-00-760-005).

(7) Check the EEC status for fault messages. Do any maintenance that is necessary.

(8) Between 5 and 35 minutes after shutdown, fill the oil tank manually as shown in the procedures of 72-00-00 Servicing-02 (Task 72-00-00-610-002) or 72-00-00 Servicing-03 (Task 72-00-00-610-003). This oil fill step will be used to calculate the engine oil consumption. The oil consumption will be calculated in gallons per hour after the Acceptance Test.

NOTE: Do not use a remote engine oil fill system during the Acceptance Test. You must not add engine oil during the Acceptance Test.

J. Acceptance Test Data Records

(1) Make a record on the engine log sheet of the general information and data as follows:

(a) Date of the Acceptance Test.

(b) Engine serial number.

(c) Serial number of modules and major components.

(d) Fuel grade and specific gravity.

(e) Engine oil specification and brand.

(f) Ambient atmospheric conditions (true barometer, wet and dry bulb temperatures).

(g) Total time of the Acceptance Test.

(h) Reasons for any engine shutdowns that are not on the schedule.

(i) Any repairs that were necessary during the Acceptance Test.

(j) If it is applicable, the reason the engine was rejected after the Acceptance Test.

(k) The test operator must sign the engine log.

(l) The test inspector must sign the log.

(2) Make a record of the engine parameters shown in Paragraph C. "Test Instrumentation And Test Cell Connections", during the Acceptance Test. Make a record at each thrust lever position during the test, (except oil consumption).

K. Initial Running

NOTE: The INITIAL RUNNING is for the LPC/HPC break−in cycle and is only necessary if the LPC or HPC or both were replaced, repaired or are new. If the LPC/HPC break−in cycle is not necessary, go to the next testing step, Engine Acceptance Test.

(1) Use the run schedule specified in Figure 1301.

(2) Start the engine by the Engine Start Procedure (Normal), (Task 71−00−00−760−004). Start engine using Igniter B. Determine and record overall time from pressurization until MINIMUM IDLE speed is reached. Record data after five minutes at MINIMUM IDLE.

(a) Record data for all stabilized test points prior to moving thrust lever to the next requirement.

(b) Verify that the main oil pressure and the No. 3 bearing compartment breather pressure are within the limits shown under Testing-00, Operating Limits, (Task 71-00-00-990-007).

(c) If the optional PS4I instrumentation is installed, make sure that the turbine cooling air pressure ratio (TCAR) is in the operator's historical range.

(d) Check EEC status and maintenance words for faults. See 71-00-00, Fault Isolation-00 (Task 71-00-00-810-001).

(3) The acceleration in this section is to be done with reverse TRA. Verify in simulated deployed position that the 2.5 bleed is 100 percent open (88 percent of actuator stroke) throughout reverse operation.

CAUTION: IF AN ENGINE STALL OCCURS DURING THIS TEST, YOU MUST MOVE THE THRUST LEVER TO MINIMUM IDLE WITHIN ONE SECOND OF THE STALL. DO THE PROCEDURES SHOWN IN TESTING-00 "PROCEDURE AFTER ENGINE SURGE OR STALL" (TASK 71-00-00-760-009) AND DO THE "START PROCEDURE AFTER AN EMERGENCY SHUTDOWN" (TASK 71-00-00-760-006). IF YOU DO NOT DO THESE PROCEDURES, YOU CAN DAMAGE THE TURBINE TIP SEALS.

(a) Make a slow acceleration (30 - 60 seconds) to 8000 N2. Stabilize for two minutes at 8000 N2. Record data at the end of the stabilization period.

(b) Continue slow acceleration to 8500 N2. Stabilize for two minutes at 8500 N2. Record data at the end of the stabilization period.

(c) Continue slow acceleration to 8800 N2. Stabilize for two minutes at 8800 N2. Record data at the end of the stabilization period.

NOTE: At cold inlet temperature maximum reverse scheduling (fN1C), may restrict the engine from achieving 9000 rpm target.

(d) Continue slow acceleration to 9000 N2. Stabilize for two minutes at 9000 N2. Record data at the end of the stabilization period.

(e) Continue slow acceleration to max reverse TRA. Stabilize for five minutes at fixed TRA. Record data at the end of the stabilization period.

NOTE: At low inlet temperatures, high N2 speeds may result in high thrusts. DO NOT EXCEED 50000 LBS FN/ST2.

(f) Make a slow deceleration (30 - 60 seconds) to MINIMUM IDLE. Stabilize at MINIMUM IDLE for 0 - 30 seconds. Take the engine out of the simulated reverse position.

(g) Continue normal acceptance running.

L. Engine Acceptance Test (to be run following initial break in running for refurbished engines and all other engines).

(1) The Acceptance Testing-09 cycle is shown in the Engine Run Schedule, Figure 1301.

(2) Start the engine by the Engine Start Procedure (Normal), (Task 71-00-00-760-004).

NOTE: Start the engine with one Igniter B only.

NOTE: Monitor the main oil pressure, (MOP), during the start procedure. If you do not see any oil pressure, you must immediately and quickly stop the start procedure.

(3) Make a record of the time from fuel pressurization to MINIMUM IDLE speed.

(4) Let the engine become stable at MINIMUM IDLE.

(5) Make sure all the engine parameters are in the permitted limits. See Power Plant General - Testing-00, Engine Operation Limits, (Task 71-00-00-990-007).

(6) Operate the engine at MINIMUM IDLE for five minutes.

(7) If the optional PS4I instrumentation is installed, make sure that the turbine cooling air pressure ratio (TCAR) is in the operator's historical range.

(8) Check EEC status and maintenance words for faults. See 71-00-00, Fault Isolation-00 (Task 71-00-00-810-001).

(9) Continue slow acceleration (90 - 120 seconds) from MINIMUM IDLE to the thrust of Band A shown in Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3). Stabilize for three minutes. Record data and install TRA stop.

(10) Do the decel vibration survey as follows.

CAUTION: IF AN ENGINE STALL OCCURS DURING THIS TEST, YOU MUST MOVE THE THRUST LEVER TO MINIMUM IDLE WITHIN ONE SECOND OF THE STALL. DO THE PROCEDURES SHOWN IN TESTING-00 "PROCEDURE AFTER ENGINE SURGE OR STALL" (TASK 71-00-00-760-009) AND DO THE "START PROCEDURE AFTER AN EMERGENCY SHUTDOWN" (TASK 71-00-00-760-006). IF YOU DO NOT DO THESE PROCEDURES, YOU CAN DAMAGE THE TURBINE TIP SEALS.

(a) Make a slow deceleration (60 - 120 seconds) to MINIMUM IDLE, surveying engine vibration.

(b) At each speed where peaks have shown during the deceleration, record the mean vibration level of each pickup after 30 second stabilization.

(c) Check that the engine vibration values are in the permitted limits. See Testing-00, Engine Operation Limits, (Task 71-00-00-990-007).

(d) For engines that are more than the permitted vibration limits, do Testing-19, Trim Balance Procedure And Test, (Task 71-00-00-760-043), (Task 71-00-00-760-052) or (Task 71-00-00-760-057).

(11) Select APPROACH IDLE. Stabilize for 15 minutes. At the end of the stabilization period, record data.

(12) Do the snap acceleration/deceleration test cycle shown in 71-00-00, Testing-04 (Task 71-00-00-760-031) and perform step B.(9)(b) through B.(9)(i) for acceleration/deceleration test). Also see Engine Run Schedule shown in Figure 1301.

NOTE: The snap acceleration/deceleration must be done after the compressor break in cycle shown in above.

(13) Vibration Survey (Acceleration).

(a) An engine vibration survey shall be conducted on an engine that has been thermally stabilized. Completion of step L.(12) above without shutdown will result in a stabilized engine. If shutdown occurs, the engine must be run at thrust Band C, Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) or higher for three minutes and then run for six minutes at MINIMUM IDLE prior to conducting the vibration survey.

(b) Make a slow acceleration (90 - 120 seconds) from MINIMUM IDLE to thrust Band A Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3).

(c) At each speed where peaks have shown during the acceleration, record the mean vibration level of each pickup after 30 second stabilization.

(d) Check the engine vibration levels during this test to make sure that the allowable limits are not exceeded. See 71-00-00, Testing-00, Vibration Limits, (Task 71-00-00-990-007).

(e) For engines that exceed the vibration limits, see 71-00-00, Testing-19 (Task 71-00-00-760-043), (Task 71-00-00-760-052) or (Task 71-00-00-760-057).

(14) Performance Calibration.

(a) Stabilize at thrust Band A Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) for five minutes. At the end of the stabilization period, record data.

(b) Stabilize at thrust Band B Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) for three minutes. At the end of the stabilization period, record data.

(c) Stabilize at thrust Band C Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) for three minutes. At the end of the stabilization period, record data.

(d) Stabilize at thrust Band D Figure 1304 (Sheet 1), Figure 1304 (Sheet 2) or Figure 1304 (Sheet 3) for three minutes. At the end of the stabilization period, record data.

(e) Decelerate slowly (60 − 120 seconds) to APPROACH IDLE. Stabilize for 20 minutes.

(15) Engine shutdown procedure.

(a) Do an engine shutdown by the Normal Shutdown Procedure, (Task 71−00−00−760−005).

(b) Check the EEC status for fault messages. Do any maintenance that is necessary.

M. Procedures After Engine Shutdown − Corrections Of Observed Readings.

(1) Correct the observed data collected in thrust Bands A, B, C, and D of the performance calibration. Use the procedure defined in Figure 1302 (Sheet 1), Figure 1302 (Sheet 2), Figure 1302 (Sheet 3) and Figure 1302 (Sheet 4).

N. Engine Configuration Determination

(1) Based on the engine configuration identifier suffix in Table 1301, make sure that you are in the appropriate Testing−09 CONFIG section to use to class and check the engine for acceptance.

O. Check Corrected Data

(1) If the optional PS4I instrumentation is installed, make sure that the turbine cooling air pressure ratio (TCAR) is in the operator's historical range.

(2) Values of Corrected Net Thrust versus PT4.95/PT2 corrected N1, corrected N2, and corrected EGT, should fall within the requirements of Figure 1309 (Sheet 1), Figure 1309 (Sheet 2), Figure 1309 (Sheet 3), and Figure 1309 (Sheet 4). The lines on these figures are guidelines only and are not acceptance limits. Points outside these values can suggest that there is a instrumentation and/or other problem that must be identified.

(a) Definitions of terms used in Figure 1309 are as follows:

(b) Complete Refurbishment: Bands are for engines that had all modules repaired or replaced to new engine clearances and airfoil condition.

(c) Minor or No Refurbishment: Bands are for high time service engines that are fully deteriorated without any or only a small quantity of gaspath repair.

(3) Values of corrected PT2.5/PT2 and PS3/PT2.5 versus PT4.95/PT2 should fall within the guidelines of Figure 1309 (Sheet 5) and Figure 1309 (Sheet 6). The lines of these figures are guidelines only and not acceptance limits. Points outside these values can suggest that there is a instrumentation and/or other problem that must be identified.

(4) If a review of the test high power (points generally above 52000 lbf (231307.5 N) thrust, or 1.45 PT4.95/PT2) indicate a change in level relative to the check line shape as shown in Table 1307 below, this can be an indication of abnormal fan operation. This abnormal operation is also accompanied by a noticeable tone change in the engine. This change is triggered at high power by dirty and/or severely eroded fan blade leading edges. Corrective action must be taken. Refer to 72-00-31, Repair-01 (Task 72-00-31-300-001).

(5) Corrected Thrust Specific Fuel Consumption (TSFC) must be compared with the values listed in Table 1302. These values are included for reference to new engine levels only and are not intended as an acceptance requirement.

ABNORMAL FAN OPERATION

Delta P4.95/PT2	approximately +0.015 to 0.020	at Fn = K
Delta N1C	approximately +80 to +100 RPM	at Fn = K
Delta N2C	approximately −40 RPM	at Fn = K
Delta EGT	approximately −4°C	at Fn = K
Delta PT2.5/PT2	approximately +0.14 ratios	at P4.95/PT2 = K
Delta PS3/PT2.5	approximately −0.5 ratios	at P4.95/PT2 = K

PARAMETER SHIFT WITH ABNORMAL FAN OPERATION
Table 1307

P. Engine Pressure Ratio (EPR) Rating Classification

(1) The necessary EEC programming plug is specified by a part number and EPR class system. The programming plug part number is specified by the engine model and thrust rating. For the necessary EEC programming plug part number, see Table 1304, Table 1305, Table 1306. The necessary EPR Class must be selected by Engine Pressure Ratio (EPR), see SB PW4ENG 73-203.

(2) The plug part number and class is shown on the engine data plate. If a new part number or class plug is used, you must write (scribe) the new part number and class on the engine data plate.

(3) Make a EEC programming plug selection as follows:

(a) See SB PW4ENG 73-203 for the necessary Engine Programming Plug (EPP) for the engine model and hardware configuration that was tested. Confirm that the appropriate EPP part number was installed during acceptance testing.

NOTE: If the incorrect program plug (EPP) was installed during acceptance testing, contact Pratt & Whitney for assistance in correcting data/or rerun with the correct program plug.

(b) EPR class modifiers are used to make sure that the engine pressure ratio sent to the aircraft is less than the given limits. This will make sure that the engine will always give rated thrust at all possible take-off settings. The EPR limit is called "MAX EPR" and is shown in Table 1308 or Table 1309.

NOTE: A PW4152 (-3A) engine must only use the Bands A, B, and C points for the EPR Modifier classification. The PW4156A (-3A) and PW4158 (-3A) engines can use the Bands A, B, C and D points in the calculations.

(c) Use EPR-0 and Corrected Net Thrust from the four performance calibration points to find the EPR modifier class. Find the EPR modifier class which gives the highest EPR value and does not go more than the MAX EPR LIMIT specified by Table 1308 or Table 1309. Make a straight line curve to fit between the points shown on Table 1308 or Table 1309.

NOTE: To calculate EPR-0, go to Paragraph G.(1), Acceptance Test General Specifications.

NOTE: Make sure that the Stage 2.5 bleed valve is in the closed location. Do not use any data points (D band point) where the Stage 2.5 bleed valve starts to open to calculate the modifier class.

(d) To calculate EPR, use the EPR class defined above where EPR = EPR-0 + EPR Modifier. EPR is the value used in Paragraph Q. Check For Engine Acceptance, to check for engine acceptance and to calculate engine margin to the limits.

(e) If multiple ratings are desired, testing need only be performed to the highest rating desired and with a 3rd order curve fit of the four point acceptance data, other "A" band rating EPR-0 values can be found for EPR classification purposes as follows:

1 Use the four point acceptance data to find the 3rd order fit of thrust EPR-0.

2 Find the value of EPR-0 at the rating desired (use the minimum band thrust from Figure 1304).

3 Use the value of the EPR-0 and thrust value calculated in step 2 above as the "A band point. Find the EPR class requirement following the procedure outlined the above step (c). (Use the calculated A band point, with B, C, and D band from the data.)

(f) An example of the EPR class calculation (for a PW4158 (-3A) configuration) is shown in Table 1310.

FOR THESE CONFIGURATIONS: PW4152 (-3A), PW4156A (-3A), PW4158 (-3A) WITH SB PW4ENG 72-256 (AERO 2.5 LPT) AND SB PW4ENG 72-262 (RECAMBERED FEGV)

CORRECTED NET THRUST LBS (N)	MAXIMUM EPR
34000 lbf (151239.5 N)	1.2620
35000 lbf (155687.8 N)	1.2729
36000 lbf (160136.0 N)	1.2840
37000 lbf (164584.2 N)	1.2953
38000 lbf (169032.4 N)	1.3068
39000 lbf (173480.7 N)	1.3193
40000 lbf (177928.9 N)	1.3317
41000 lbf (182377.1 N)	1.3441
42000 lbf (186825.3 N)	1.3566
43000 lbf (191273.5 N)	1.3693
44000 lbf (195721.8 N)	1.3821
45000 lbf (200170.0 N)	1.3950
46000 lbf (204618.2 N)	1.4080
47000 lbf (209066.4 N)	1.4204
48000 lbf (213514.7 N)	1.4330
49000 lbf (217962.9 N)	1.4461
50000 lbf (222411.1 N)	1.4597
51000 lbf (226859.3 N)	1.4738
52000 lbf (231307.5 N)	1.4884
53000 lbf (235755.8 N)	1.5035
54000 lbf (240204.0 N)	1.5191
55000 lbf (244652.2 N)	1.5352
56000 lbf (249100.4 N)	1.5518
57000 lbf (253548.7 N)	1.5690
58000 lbf (257996.9 N)	1.5866
59000 lbf (262445.1 N)	1.6055
60000 lbf (266893.3 N)	1.6255

MAXIMUM EPR
Table 1308

FOR THESE CONFIGURATIONS: PW4152 (-3A), PW4156A (-3A), PW4158 (-3A) WITHOUT SB PW4ENG 72-256 (AERO 2.5 LPT) OR SB PW4ENG 72-262 (RECAMBERED FEGV) OR WITHOUT BOTH OF THESE SERVICE BULLETINS

CORRECTED NET THRUST LBS (N)	MAXIMUM EPR
34000 lbf (151239.5 N)	1.2583
35000 lbf (155687.8 N)	1.2692
36000 lbf (160136.0 N)	1.2801
37000 lbf (164584.2 N)	1.2912
38000 lbf (169032.4 N)	1.3025
39000 lbf (173480.7 N)	1.3145
40000 lbf (177928.9 N)	1.3268
41000 lbf (182377.1 N)	1.3391
42000 lbf (186825.3 N)	1.3514
43000 lbf (191273.5 N)	1.3639
44000 lbf (195721.8 N)	1.3765
45000 lbf (200170.0 N)	1.3893
46000 lbf (204618.2 N)	1.4021
47000 lbf (209066.4 N)	1.4147
48000 lbf (213514.7 N)	1.4271
49000 lbf (217962.9 N)	1.4398
50000 lbf (222411.1 N)	1.4530
51000 lbf (226859.3 N)	1.4667
52000 lbf (231307.5 N)	1.4809
53000 lbf (235755.8 N)	1.4956
54000 lbf (240204.0 N)	1.5108
55000 lbf (244652.2 N)	1.5265
56000 lbf (249100.4 N)	1.5426
57000 lbf (253548.7 N)	1.5593
58000 lbf (257996.9 N)	1.5765
59000 lbf (262445.1 N)	1.5945
60000 lbf (266893.3 N)	1.6136

MAXIMUM EPR
Table 1309

EXAMPLE OF CALCULATING EPR MODIFIER CLASS FOR PW4158 (-3A) ENGINE CONFIGURATIONS

Step 1.
Start with the four performance calibration points from engine test.

CORRECTED NET THRUST

LBS (N)	(EEC EPR) EPR-028	TLRA	DELTA EPR MOD [SEE PARA. G. (1)]	= EPR-0
58125 lbf (258552.9 N)	1.555	79.8	.028	1.583
51500 lbf (229083.4 N)	1.444	74.2	.028	1.472
46209 lbf (205547.9 N)	1.376	70.1	.026	1.402
41066 lbf (182670.7 N)	1.317	65.7	.022	1.339

Step 2.
At the Corrected Net Thrust level of the four performance calibration points, find the Maximum EPR as shown in Table 1308 or Table 1309. Make a straight line curve to fit between the points shown on Table 1308 or Table 1309.

CORRECTED NET THRUST

LBS (N)	EPR-MAX
58125 lbf (258552.9 N)	1.5890
51500 lbf (229083.4 N)	1.4811
46209 lbf (205547.9 N)	1.4106
41066 lbf (182670.7 N)	1.3449

Step 3.
Find the delta EPR value for each point of Maximum EPR:

CORRECTED NET THRUST

LBS (N)	EPR-MAX	EPR-0	DELTA EPR

EXAMPLE OF CALCULATING EPR MODIFIER FOR PW4158 (-3A) ENGINES CONFIGURATION WHERE SERVICE BULLETINS SB PW4ENG 72-256 AND SB PW4ENG 72-262 ARE BOTH INCORPORATED
Table 1310

EXAMPLE OF CALCULATING EPR MODIFIER CLASS
FOR PW4158 (-3A) ENGINE CONFIGURATIONS

58125 lbf (258552.9 N)	1.5890	1.583	.0006
51500 lbf (229083.4 N)	1.4811	1.472	.0091
46209 lbf (205547.9 N)	1.4106	1.402	.0086
41066 lbf (182670.7 N)	1.3449	1.339	.0059

Step 4.
To find the EPR Class Number, use the delta EPR value from Step 3. above, and go to Table 1303.

DELTA EPR	CLASS NUMBER	EPR MODIFIER
0.006	8	+0.004
0.0091	7	+0.008
0.0086	7	+0.008
0.0059	8	+0.004

Step 5.
The EPR Modifier Class 9 will give the highest possible EPR and will not be more than the EPR-Max limit, (highest class number from above). Make a Class 9 modifier selection and then calculate EPR.

EPR-0	EPR MODIFIER	EPR
1.583	.004	1.587
1.472	.004	1.476
1.402	.004	1.406
1.339	.004	1.343

EXAMPLE OF CALCULATING EPR MODIFIER FOR PW4158 (-3A)
ENGINES CONFIGURATION WHERE SERVICE BULLETINS SB PW4ENG
72-256 AND SB PW4ENG 72-262 ARE BOTH INCORPORATED
Table 1310 (Continued)

Q. Check For Engine Acceptance

CAUTION: MAKE SURE THAT THE STAGE 2.5 BLEED VALVE IS IN THE CLOSED LOCATION. DO NOT USE ANY DATA POINTS TO CALCULATE ACCEPTANCE TO THE LIMITS WHERE THE STAGE 2.5 BLEED VALVE STARTS TO OPEN (D BAND POINT).

(1) The steady state values of corrected N2, N1 and TT4.95 (EGT) versus modified engine pressure ratio (EPR = EPR-0 + EPR Modifier) must be below the limits of Figure 1310 (Sheets 1 and 2), Figure 1311 (Sheets 1 and 2) and Figure 1312 (Sheets 1 and 2). All the calibration points (A Band through D Band) must be examined relative to the limit lines. A large difference between the calibration points and the limit line can indicate instrumentation or engine problems. Use A Band thrust levels for NH and NL acceptance. Use A Band and B Band thrust levels for EGT acceptance. Calculate the EGT margin to the limit line, the engine is acceptable if the average of the A Band and B Band margins is positive (greater than zero).

(a) Figure 1312 (Sheet 1) and Figure 1312 (Sheet 2) shows two maximum EGT limit curves. The upper EGT limit curve applies in all cases except when an engine is tested immediately following high turbine refurbishment. The lower EGT limit curve is to be used only after a high turbine refurbishment (turbine clearances restored) and before engine has flown with turbine cooling air system on.

(b) The N1 rotor speed limits are shown in Figure 1311 (Sheet 1), Figure 1311 (Sheet 2).

(c) Do an N2 Speed Limit Analysis. Figure 1310 (Sheet 1), Figure 1310 (Sheet 2) presents the corrected rotor speed limits for engines with SVS 29 N2 BIAS, SVS 29-3 N2 BIAS, SVS 29-5 N2 BIAS, or SVS 29-2 N2 BIAS. Refer to Table 1304 through Table 1306 to determine which SVS N2 limit line to use. Refer to the calculation procedures shown in Figure 1302 (Sheet 2), Item 5. Choose the correct calculation procedure based on the control version that is installed at the time of the test.

NOTE: The EEC incorporates for this engine configuration a fixed SVS 29-5 or a N2 biased stator vane schedules (SVS). For the N2 biased configurations, the schedule closes the HPC variable stator vanes 5 degrees for observed N2 rotor speeds less than 9550 N2 RPM and 9830 N2 RPM for RCC. The SVS transitions linearly to either the original OPEN schedule (SVS 29) or a closed (SVS 29-2) 2 degree schedule (HPC RCC Post SB 72-756 or 72-759) at N2 rpm's above 10250, the SVS 29-5 configuration engines, hold SVS schedule at SVS 29-5 for all N2's. Since the N2 Limit Curve Figure 1310 (Sheet 1), Figure 1310 (Sheet 2) and Figure 1310 (Sheet 3) is based on the original OPEN schedule, an adjustment must be made to the N2 data points before they are compared to this N2 Speed Limit Curve, Figure 1310 (Sheet 1), Figure 1310 (Sheet 2) and Figure 1310 (Sheet 3).

(d) Figure 1310 (Sheet 1) and Figure 1310 (Sheet 2) includes the more restrictive speed limits that are necessary for post SB PW4ENG 72-557 engines, (with redesigned 5th stage compressor blade). For simplicity, the more restrictive limits (if they are different) are to be used for both pre and post SB PW4ENG 72-557 engine configurations.

(e) For an example of a N2 Speed Limit Analysis, see Table 1311A for engines running SVS 29 N2 BIAS or see Table 1311B for engines running SVS 29-3 N2 BIAS. An example of a calculation for an engine running SVS 29 N2 BIAS is shown in Table 1312.

EXAMPLE - PROCEDURE TO DO AN N2 SPEED LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29 N2 BIAS

Step 1. Calculate the Corrected Observed N2:

Corrected Observed N2 = Observed N2/SQRT (THETA T2)

Step 2. Calculate FACTOR (Percent difference in N2, SVS 29-5 deg relative to SVS 29):

FACTOR = 1.11244 - 3.93387 x P4.95Q2 + 2.82184 x $P4.95Q2^2$

Where P4.95Q2 = PT4.95/PT2

Step 3. Calculate N2Rcl (Corrected N2 adjusted to SVS 29-5 deg):

If Observed N2 <= 9550 rpm, N2Rcl = Corrected Observed N2

If 9550 < Observed N2 < 10250

N2Rcl = Corrected Observed N2 x [1 + (FACTOR x [Observed N2-9550])/70000]

If Observed N2 >= 10250 rpm, go to step 4b

Step 4. Calculate N2Rop (Corrected N2 adjusted to SVS 29):

(a) If Observed N2 < 10250 rpm, N2Rop = N2Rcl/(1+ FACTOR/100)

(b) If Observed N2 >= 10250 rpm, N2Rop = Corrected Observed N2

Step 5. Calculate Corrected High Rotor Speed - RPM:

Corrected High Rotor Speed = N2Rop/KHN2 + delta N2 (See Figure 1302, (Sheet 4) NOTE 4.

Where KHN2 is found from Figure 1308.

PROCEDURE FOR CALCULATING CORRECTED HIGH ROTOR SPEED (N2) FOR LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29 N2 BIAS
Table 1311A

EXAMPLE - PROCEDURE TO DO AN N2 SPEED LIMIT ANALYSIS
FOR ENGINES RUNNING WITH SVS 29-3 N2 BIAS

Step 1. Calculate the Corrected Observed N2:

Corrected Observed N2 = Observed N2/SQRT (THETA T2)

Step 2. Calculate FACTOR (Percent difference in N2, SVS 29-5 deg relative to SVS 29):

FACTOR = 1.11244 - 3.93387 x P4.95Q2 + 2.82184 x P4.95Q2^2
Where P4.95Q2 = P4.95/P2

Step 3. Calculate N2Rcl (Corrected N2 adjusted to SVS 29-5 deg):

If Observed N2 <= 9550 rpm, N2Rcl = Corrected Observed N2

If 9550 < Observed N2 < 10250

N2Rcl = Corrected Observed N2 x [1 + (FACTOR x 0.4 x [Observed N2-9550])/70000]

If Observed N2 >= 10250 rpm, go to step 4(b)

Step 4. Calculate N2Rop (Corrected N2 adjusted to SVS 29):

(a) If Observed N2 < 10250 rpm, N2Rop = N2Rcl/(1+ FACTOR/100)

(b) If Observed N2 >= 10250 rpm, N2Rop = (Corrected Observed N2) / [1+0.6(Factor)/100]

Step 5. Calculate Corrected High Rotor Speed - RPM:

Corrected High Rotor Speed = N2Rop/KHN2 + delta N2
(See Figure 1302 (Sheet 4) NOTE 4)

Where KHN2 is found from Figure 1308.

PROCEDURE FOR CALCULATING CORRECTED HIGH ROTOR SPEED (N2) FOR LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29-3 N2 BIAS
Table 1311B

EXAMPLE − PROCEDURE TO DO AN N2 SPEED LIMIT ANALYSIS
FOR ENGINES RUNNING WITH SVS 29−5 N2 BIAS

Step 1. Calculate the Corrected Observed N2:

Corrected Observed N2 = Observed N2/SQRT (THETA T2)

Step 2. Calculate FACTOR (Percent difference in N2, SVS 29−5 deg relative to SVS 29):

FACTOR = 1.11244 − 3.93387 x P4.95Q2 + 2.82184 x P4.95Q2^2
Where P4.95Q2 = P4.95/P2

Step 3. Calculate N2Rop (Corrected N2 adjusted to SVS 29):

N2Rop = (Corrected Observed N2)/(1+ FACTOR/100)

Step 4. Calculate Corrected High Rotor Speed − RPM:

Corrected High Rotor Speed = N2Rop/KHN2 + delta N2 (See Figure 1302 (Sheet 4) NOTE 4)

Where KHN2 is found from Figure 1308.

PROCEDURE FOR CALCULATING CORRECTED HIGH ROTOR SPEED (N2) FOR
LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29−5 N2 BIAS
Table 1311C

EXAMPLE - PROCEDURE TO DO AN N2 SPEED LIMIT ANALYSIS
FOR ENGINES RUNNING WITH SVS 29-2 N2 BIAS

Step 1. Calculate the Corrected Observed N2:

Corrected Observed N2 = Observed N2/SQRT (THETA T2)

Step 2. Calculate FACTOR (Percent difference in N2, SVS 29-5 deg relative to SVS 29):

FACTOR = 1.11244 - 3.93387 x P4.95Q2 + 2.82184 x $P4.95Q2^2$
Where P4.95Q2 = P4.95/P2

Step 3. Calculate N2Rcl (Corrected N2 adjusted to SVS 29-5 deg):

If Observed N2 <= 9830 rpm, N2Rcl = Corrected Observed N2

If 9830 < Observed N2 < 10250

N2Rcl = Corrected Observed N2 x [1 + (FACTOR x 0.6 x [Observed N2-9830])/42000]

If Observed N2 >= 10250 rpm, go to step 4(b)

Step 4. Calculate N2Rop (Corrected N2 adjusted to SVS 29):

(a) If Observed N2 < 10250 rpm, N2Rop = N2Rcl/(1+ FACTOR/100)

(b) If Observed N2 >= 10250 rpm, N2Rop = (Corrected Observed N2) / [1+0.4 X (FACTOR)/100]

Step 5. Calculate Corrected High Rotor Speed - RPM:

Corrected High Rotor Speed = N2Rop/KHN2 + delta N2
(See Figure 1302 (Sheet 4) NOTE 4)

Where KHN2 is found from Figure 1308.

PROCEDURE FOR CALCULATING CORRECTED HIGH ROTOR SPEED (N2) FOR
LIMIT ANALYSIS FOR ENGINES RUNNING WITH SVS 29-2 N2 BIAS
Table 1311D

EXAMPLE - N2 SPEED LIMIT ANALYSIS - PW4158
(-3A) ENGINE RUNNING WITH SVS 29 N2 BIAS

Step 1. Calculate the Corrected Observed N2:

Parameter Point	1	2	3	4
Observed N2	9694	9467	9287	9135
T2, deg R	529.4	529.4	529.4	529.4
Sqrt Theta T2	1.010	1.010	1.010	1.010
Corrected Observed N2	9597	9373	9194	9044
P4.95/P2	1.583	1.472	1.402	1.340
FACTOR	1.956	1.4361	1.1438	0.908
N2Rcl	9636	9373	9194	9044
N2Rop	9450	9240	9090	8951
KHN2	1.0019	1.0019	1.0019	1.0019
N2Rop/KHN2	9432	9222	9072	8934
Delta N2 Test Cell/Duct Set Corrections - See Figure 1302, (Sheet 4) NOTE 4.	91	61	46	34
Corrected High Rotor Speed	9523	9283	9118	8968
EPR	1.583	1.472	1.402	1.339
N2 Speed Limit (See Figure 1310 (Sheet 2)	10041	9767	9595	9451
Margin (RPM)	518	484	477	483

EXAMPLE - N2 SPEED LIMIT ANALYSIS - PW4158 (-3A) ENGINE
Table 1312

R. Procedures Necessary After Testing

(1) Oil consumption.

NOTE: When you do the visual inspection for leaks, it is possible to see a small quantity of remaining oil in the area of the spinner, at the bottom of the fan case, or at the HPC variable vane attach bolts at the bottom of the engine. The source of this oil is either the No. 1 bearing carbon seal assembly or the No. 2 bearing rear carbon seal assembly. After the engine windmills or after a long start procedure (conditions where carbon seal pressure differences are very low or negative), a small quantity of oil can get through the carbon seals and go to the external parts of the engine. This condition is satisfactory and is permitted. All other conditions of the inspection must be satisfactory. A limit for the quantity of oil that is permitted is not given. The limits that should be used when you make an estimate of the quantity of oil is oil consumption level.

(a) Between 10 and 15 minutes after engine shutdown, fill the oil tank manually as shown in the procedures of 72-00-00 Servicing-02 (Task 72-00-00-610-002) or 72-00-00 Servicing-03, (Task 72-00-00-610-003). Use a graduated measuring device and make a record of the quantity of engine oil that is added.

(b) Make a record of the engine oil consumption in gal/hr (l/hr) in the engine logs.

(c) If there is more oil in the oil tank after the Acceptance Test than before (such as oil that comes out the scupper drain), the oil must be checked for fuel by a laboratory.

(2) Seal Leakage Limits.

(a) Measure the quantity of leakage in each seal drain collection bottle. The leakage limits for each seal drain are shown in 71-00-00 Power Plant General - Testing-00, Engine Operation Limits, (Task 71-00-00-990-007).

(3) Check Filters.

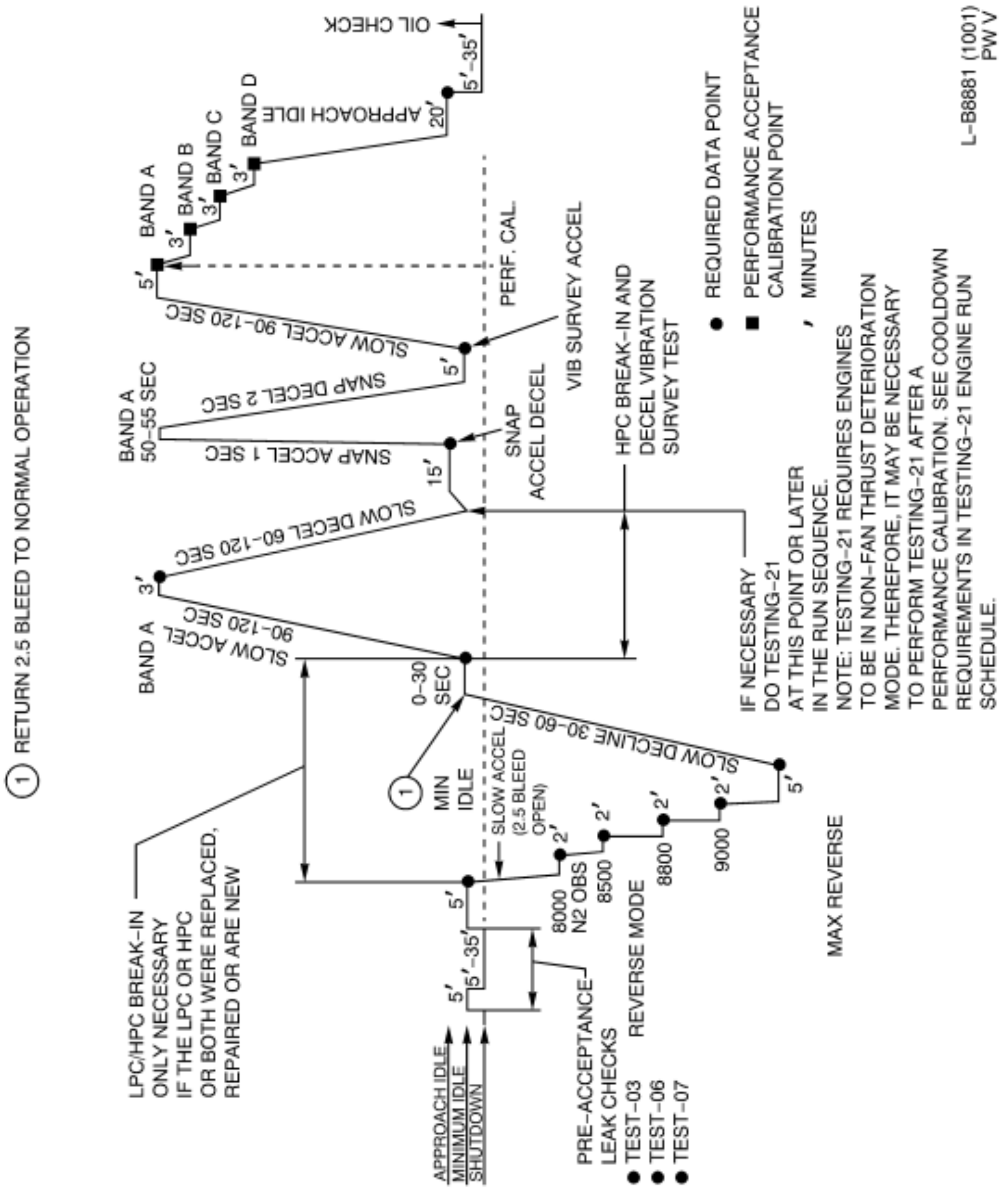
(a) Remove the main oil filter and seals. Examine the filter for pieces of unwanted material (chips) and contamination. Record the results in the engine logs. Install a new main oil filter and seals.

(b) Remove the fuel filters and seals. Examine the filter for pieces of unwanted material (chips) and contamination. Record the results in the engine logs. Install new fuel filters and seals.

R 1 Look for bronze colored particles. If you find
R bronze contamination, you must replace the fuel
R metering unit and the fuel pump.

(4) Preservation.

(a) For engine preservation refer to 72-00-00, Storage/Transport-03, Accomplish Engine Preservation, (Task 72-00-00-620-001).


① RETURN 2.5 BLEED TO NORMAL OPERATION
LPC/HPC BREAK-IN ONLY NECESSARY IF THE LPC OR HPC OR BOTH WERE REPLACED, REPAIRED OR ARE NEW
APPROACH IDLE
MINIMUM IDLE
SHUTDOWN
5'
5'-35'
5'
PRE-ACCEPTANCE LEAK CHECKS
● TEST-03
● TEST-06
● TEST-07
REVERSE MODE
SLOW ACCEL (2.5 BLEED OPEN)
8000 N2 OBS
2'
8500
2'
8800
2'
9000
2'
5'
MAX REVERSE
SLOW DECLINE 30-60 SEC
① MIN IDLE
0-30 SEC
BAND A
SLOW ACCEL 90-120 SEC
3'
SLOW DECEL 60-120 SEC
HPC BREAK-IN AND DECEL VIBRATION SURVEY TEST
15'
SNAP ACCEL DECEL
SNAP ACCEL 1 SEC
BAND A 50-55 SEC
SNAP DECEL 2 SEC
5'
SLOW ACCEL 90-120 SEC
VIB SURVEY ACCEL
5'
BAND A
3'
BAND B
3'
BAND C
3'
BAND D
20'
APPROACH IDLE
5'-35'
OIL CHECK
PERF. CAL.
IF NECESSARY DO TESTING-21 AT THIS POINT OR LATER IN THE RUN SEQUENCE.
● REQUIRED DATA POINT
■ PERFORMANCE ACCEPTANCE CALIBRATION POINT
' MINUTES
NOTE: TESTING-21 REQUIRES ENGINES TO BE IN NON-FAN THRUST DETERIORATION MODE. THEREFORE, IT MAY BE NECESSARY TO PERFORM TESTING-21 AFTER A PERFORMANCE CALIBRATION. SEE COOLDOWN REQUIREMENTS IN TESTING-21 ENGINE RUN SCHEDULE.
L-B8881 (1001)
PW V

Engine Run Schedule
Figure 1301
(Task 71-00-00-760-063)

CORRECTION OF OBSERVED READINGS (SHEET 1 OF 4)

NOTE: For the Following Calculations:

- THETA T2 = $\theta T2 = \left(\frac{TT2\,^{\circ}C + 273.16}{288.16}\right)$
- DELTA T2 = $\delta T2 = \frac{PT2\ (IHGA)}{29.92}$
- Note 1 through Note 11 ..... See Sheet 4 Definitions

Item (1) Corrected Net Thrust - lbs

$$\frac{\text{Total (FN)}}{\delta T2} = \left(\frac{\text{Observed Thrust}}{\delta T2}\right) + \text{Delta FN}_{\text{Note 1}}$$

Item (2) Corrected Fuel Flow - lbs/hr

$$\frac{WF}{(\delta T2)\ (KC)\ (KHWF)} = \left(\frac{\text{Observed Fuel Flow}}{(\delta T2)\ (KC)\ (KHWF)}\right) \times \left(\frac{LHV}{18400}\right) + \text{Delta WF}_{\text{Note 2}}$$

KC is defined as $(\theta T2)^{0.59}$

KHWF is determined as follows:

(a) Obtain a value of KH' (min) which is a function of specific humidity (lbs moisture per lb of dry air) from Figure 1307. This value is a minimum correction and will be compared with that obtained in the following step.

(b) Using recorded ambient temperature and Corrected Net Thrust from Item (1) above, obtain values of C1 (Figure 1305), C2, and C3 (Figure 1306). Calculate KH' using the following equation:

$KH' = C1(SH + C2) + C3$, where SH = specific humidity (lbs moisture/lb dry air)

(c) Set KHWF equal to the greater of the values of KH' calculated above in Item (2) (a) and (b).

(d) LHV = Lower Heating Value of fuel in BTU/LBM.

L-A9025 (0597)
PW V

Correction Of Observed Data
Figure 1302 (Sheet 1)
(Task 71-00-00-760-063)

CORRECTION OF OBSERVED READINGS (SHEET 2 OF 4)

Item (3) Corrected Thrust Specific Fuel Consumption (TSFC) – lbs/hr/lb

$$\left(\frac{\text{TSFC}}{(\text{KC})\ (\text{KHWF})}\right) = \left(\frac{\text{Corrected Fuel Flow}}{\text{Corrected Net Thrust}}\right) = \left\{\frac{\left[\frac{\text{WF}}{(\delta \text{T2})(\text{KC})(\text{KHWF})}\right]}{\left[\frac{\text{FN}}{\delta \text{T2}}\right]}\right\}$$

Item (4) Corrected Low Rotor Speed – RPM

$$\left[\frac{\text{N1}}{\sqrt{\theta \text{T2}}\ (\text{KHN1})}\right] = \left(\frac{\text{Observed N1}}{\sqrt{\theta \text{T2}}\ (\text{KHN1})}\right) + \text{Delta N1}_{\text{Note 3}}$$

where KHN1 is found from Figure 1308.

Item (5) Corrected High Rotor Speed – RPM
Engines running with SVS 29 N2 BIAS:
See calculation procedure outlined in Table 1311 A.
Engines running with SVS 29-3 N2 BIAS:
See calculation procedure outlined in Table 1311 B.
Engines running with SVS 29-5 N2 BIAS:
See calculation procedure outlined in Table 1311C.
Engines running with SVS 29-2 N2 BIAS:
See calculation procedure outlined in Table 1311 D.
Note 1: For an example calculation procedure for SVS 29 N2 BIAS configuration see Table 1312.
Note 2: Refer to Tables 1304 through 1306 to determine which SVS N2 BIAS is used.

Item (6) Corrected Exhaust Gas Temperature (EGT) – °C

$$\left[\frac{\text{TT4.95}^{o}\text{C}}{(\theta \text{T2})^{1.0}\quad (\text{KHT4.95})}\right] = \left[\frac{\text{Observed TT4.95}^{o}\text{C} + 273.16}{(\theta \text{T2})^{1.0}\quad (\text{KHT4.95})}\right] - (273.16) + \text{Delta TT4.95}_{\text{Note 5}}$$

where KHT4.95 is found from Figure 1308.

Item (7) Corrected Station 3 Temperature – °C

$$\left[\frac{\text{TT3}^{o}\text{C}}{(\theta \text{T2})^{0.932}}\right] = \left[\frac{\text{Observed TT3}^{o}\text{C} + 273.16}{(\theta \text{T2})^{0.932}}\right] - (273.16) + \text{Delta TT3}_{\text{Note 6}}$$

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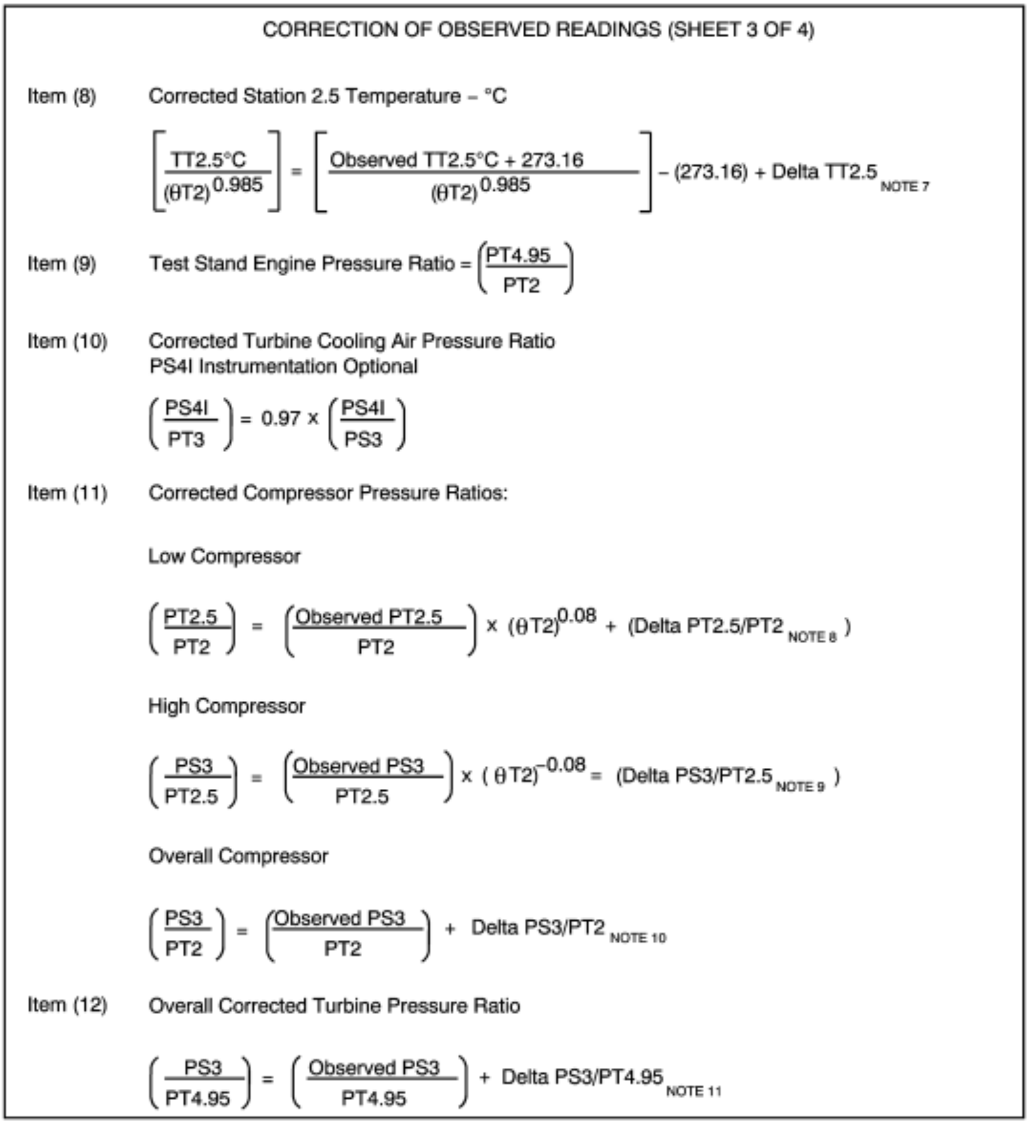
PW V

Correction Of Observed Data
Figure 1302 (Sheet 2)
(Task 71-00-00-760-063)



CORRECTION OF OBSERVED READINGS (SHEET 3 OF 4)

Item (8) Corrected Station 2.5 Temperature – °C

$$\left[\frac{TT2.5°C}{(\theta T2)^{0.985}}\right] = \left[\frac{\text{Observed } TT2.5°C + 273.16}{(\theta T2)^{0.985}}\right] - (273.16) + \text{Delta } TT2.5_{\text{NOTE 7}}$$

Item (9) Test Stand Engine Pressure Ratio $= \left(\frac{PT4.95}{PT2}\right)$

Item (10) Corrected Turbine Cooling Air Pressure Ratio
PS4I Instrumentation Optional

$$\left(\frac{PS4I}{PT3}\right) = 0.97 \times \left(\frac{PS4I}{PS3}\right)$$

Item (11) Corrected Compressor Pressure Ratios:

Low Compressor

$$\left(\frac{PT2.5}{PT2}\right) = \left(\frac{\text{Observed } PT2.5}{PT2}\right) \times (\theta T2)^{0.08} + (\text{Delta } PT2.5/PT2_{\text{NOTE 8}})$$

High Compressor

$$\left(\frac{PS3}{PT2.5}\right) = \left(\frac{\text{Observed } PS3}{PT2.5}\right) \times (\theta T2)^{-0.08} = (\text{Delta } PS3/PT2.5_{\text{NOTE 9}})$$

Overall Compressor

$$\left(\frac{PS3}{PT2}\right) = \left(\frac{\text{Observed } PS3}{PT2}\right) + \text{Delta } PS3/PT2_{\text{NOTE 10}}$$

Item (12) Overall Corrected Turbine Pressure Ratio

$$\left(\frac{PS3}{PT4.95}\right) = \left(\frac{\text{Observed } PS3}{PT4.95}\right) + \text{Delta } PS3/PT4.95_{\text{NOTE 11}}$$

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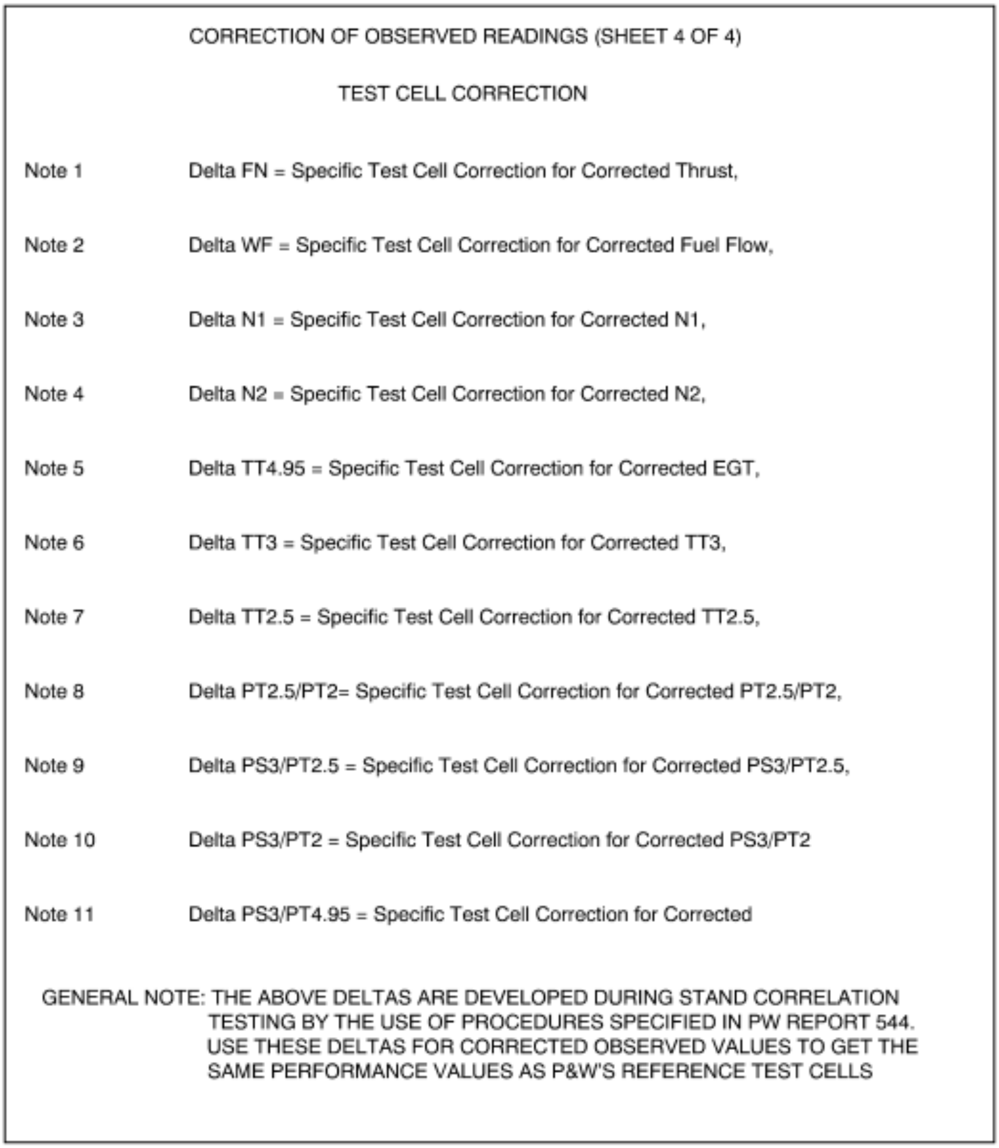
PW V

Correction Of Observed Data
Figure 1302 (Sheet 3)
(Task 71−00−00−760−063)



CORRECTION OF OBSERVED READINGS (SHEET 4 OF 4)

TEST CELL CORRECTION

Note 1 Delta FN = Specific Test Cell Correction for Corrected Thrust,

Note 2 Delta WF = Specific Test Cell Correction for Corrected Fuel Flow,

Note 3 Delta N1 = Specific Test Cell Correction for Corrected N1,

Note 4 Delta N2 = Specific Test Cell Correction for Corrected N2,

Note 5 Delta TT4.95 = Specific Test Cell Correction for Corrected EGT,

Note 6 Delta TT3 = Specific Test Cell Correction for Corrected TT3,

Note 7 Delta TT2.5 = Specific Test Cell Correction for Corrected TT2.5,

Note 8 Delta PT2.5/PT2= Specific Test Cell Correction for Corrected PT2.5/PT2,

Note 9 Delta PS3/PT2.5 = Specific Test Cell Correction for Corrected PS3/PT2.5,

Note 10 Delta PS3/PT2 = Specific Test Cell Correction for Corrected PS3/PT2

Note 11 Delta PS3/PT4.95 = Specific Test Cell Correction for Corrected

GENERAL NOTE: THE ABOVE DELTAS ARE DEVELOPED DURING STAND CORRELATION TESTING BY THE USE OF PROCEDURES SPECIFIED IN PW REPORT 544. USE THESE DELTAS FOR CORRECTED OBSERVED VALUES TO GET THE SAME PERFORMANCE VALUES AS P&W'S REFERENCE TEST CELLS

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PW V

Correction Of Observed Data
Figure 1302 (Sheet 4)
(Task 71-00-00-760-063)

FIGURE NOT USED

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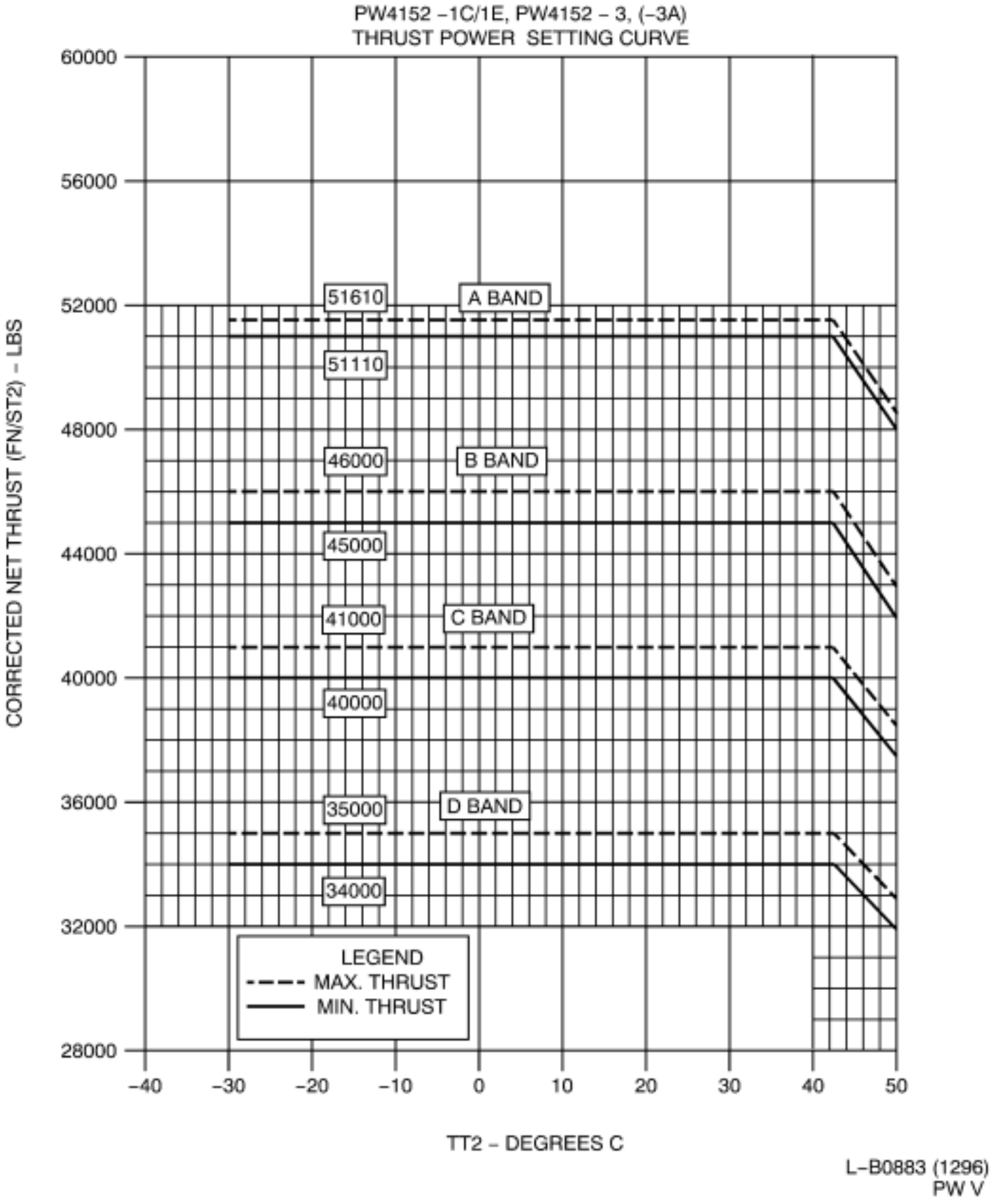
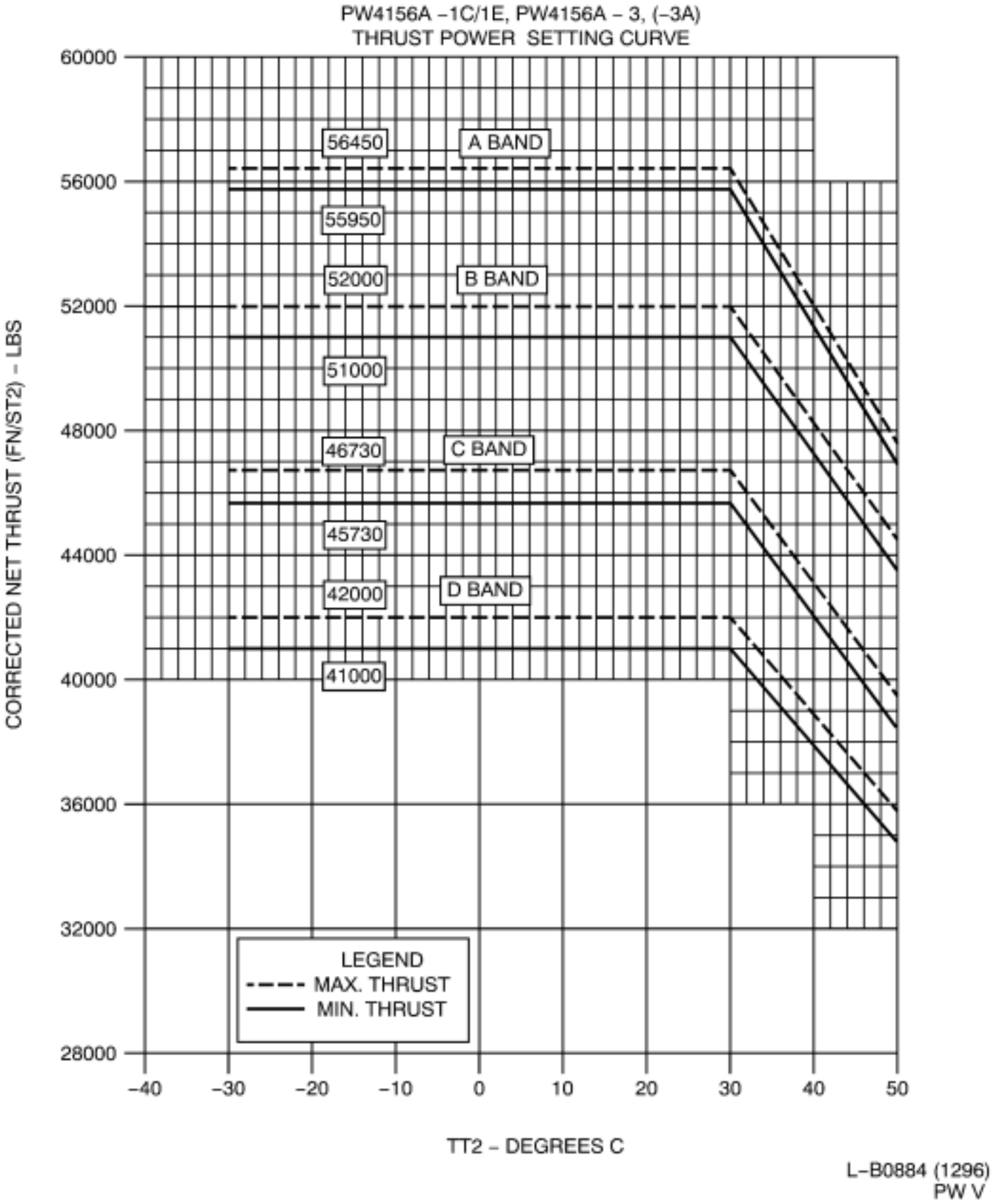
PW V

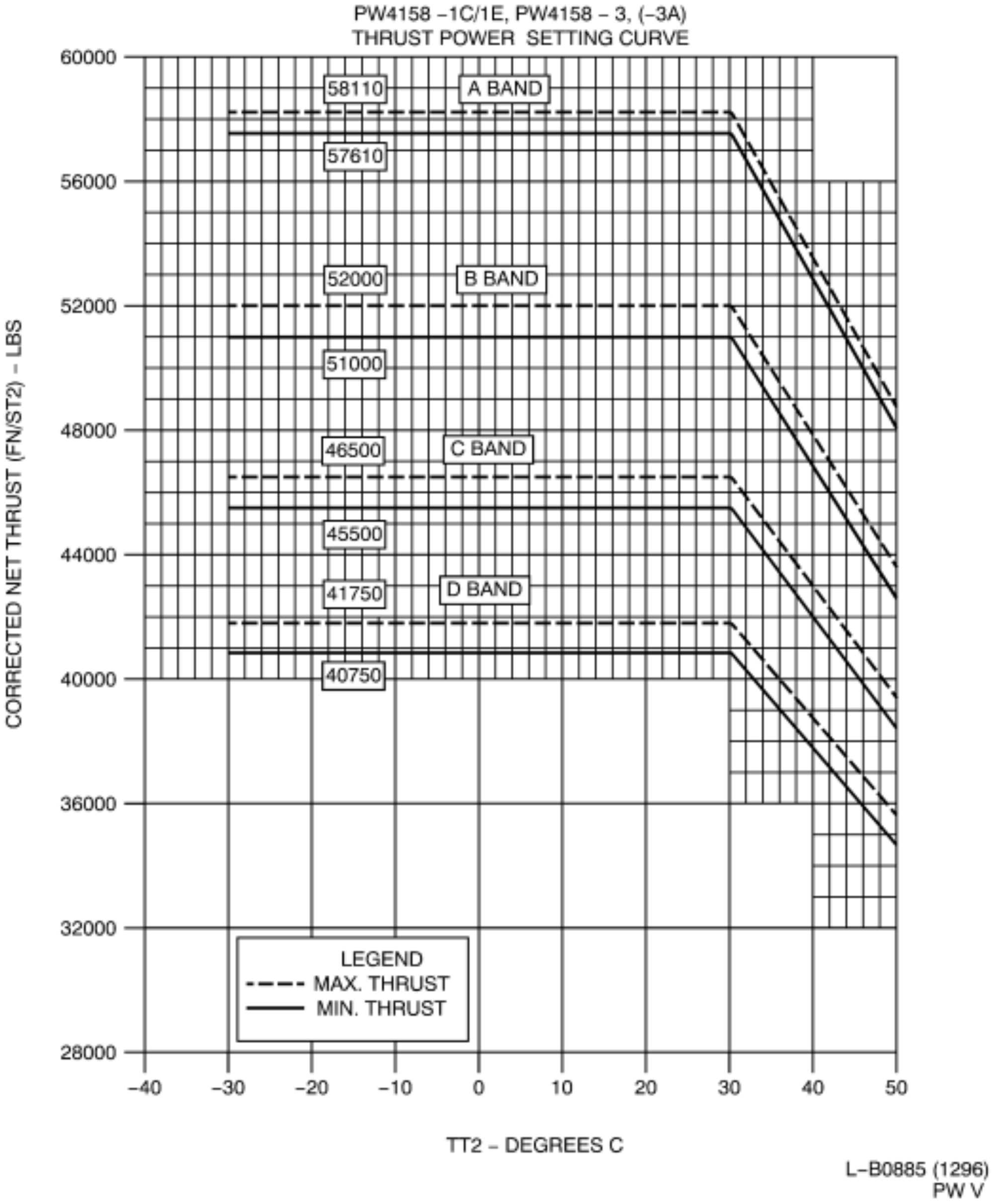
Corrected Turbine Cooling Air Pressure
Figure 1303
(Task 71−00−00−760−063)



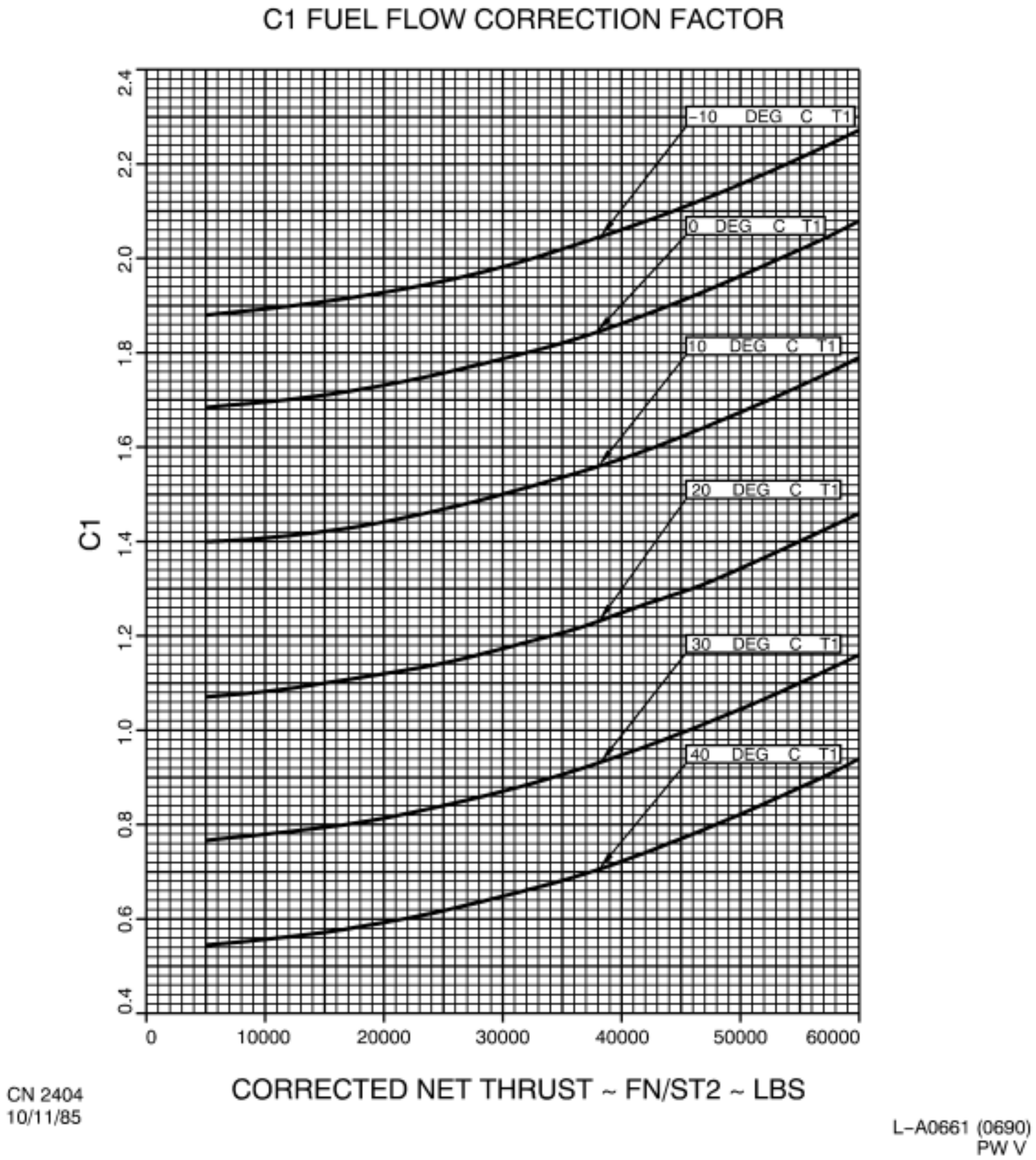
Thrust Power Setting Curve (PW4152 (-3A) Engines)
Figure 1304 (Sheet 1)
(Task 71-00-00-760-063)



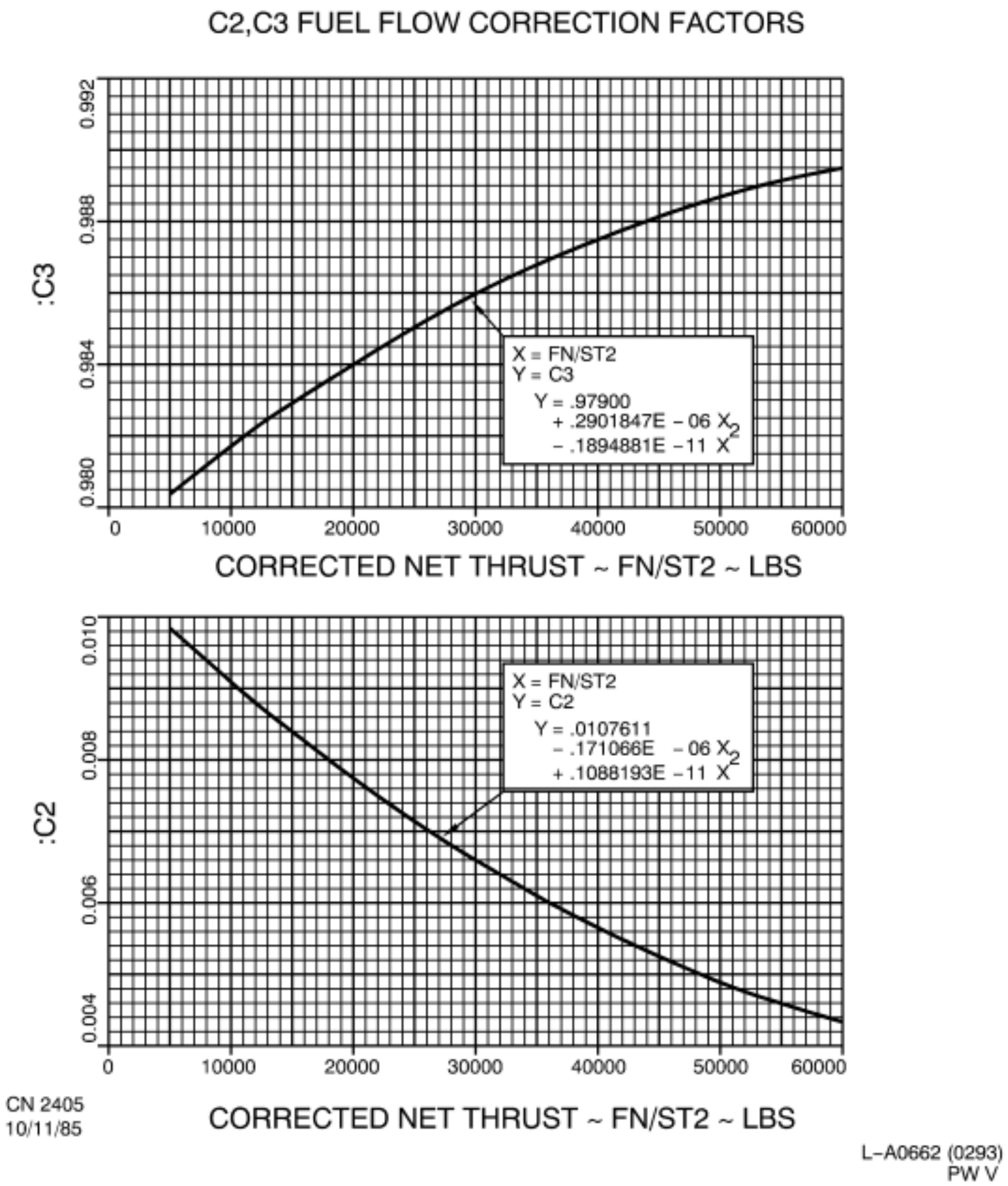
Thrust Power Setting Curve (PW4156A (-3A) Engines)
Figure 1304 (Sheet 2)
(Task 71-00-00-760-063)



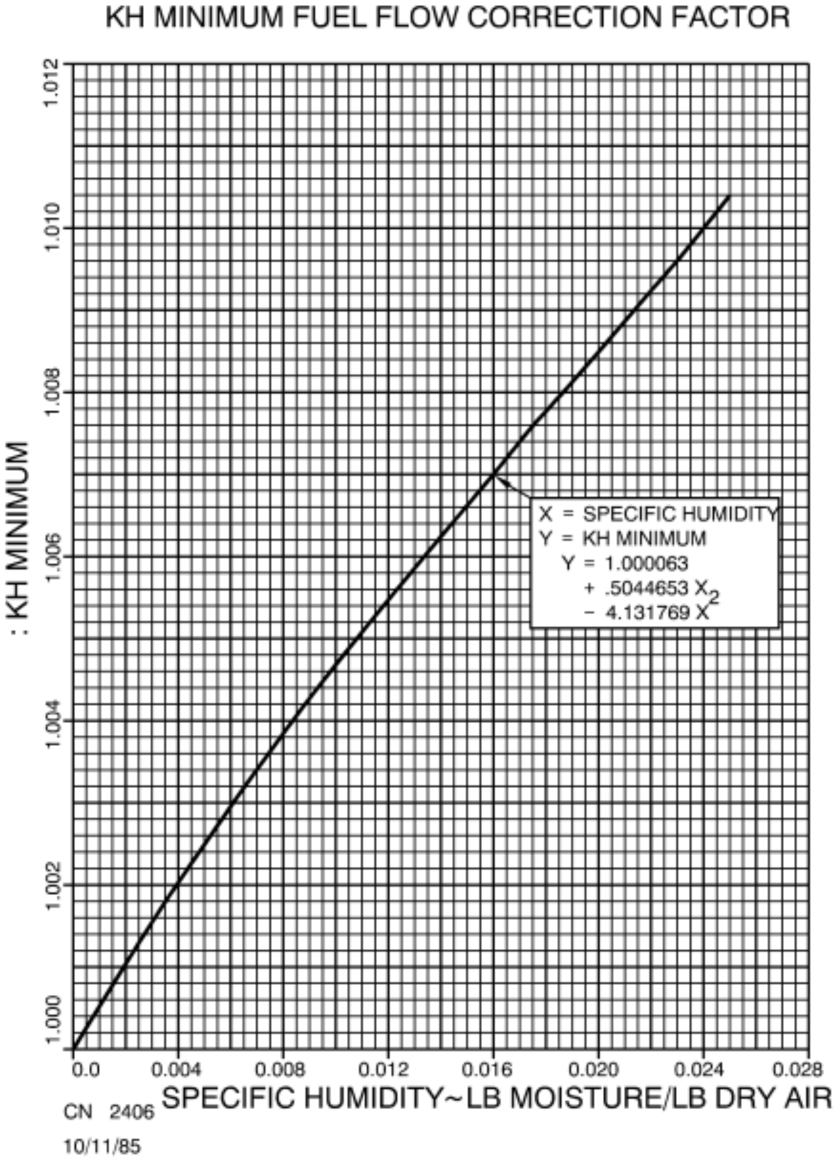
Thrust Power Setting Curve (PW4158 (−3A) Engines)
Figure 1304 (Sheet 3)
(Task 71−00−00−760−063)



Fuel Flow Correction Factors (KH)
Figure 1305
(Task 71-00-00-760-063)



Fuel Flow Correction Factors (KH)
Figure 1306
(Task 71-00-00-760-063)



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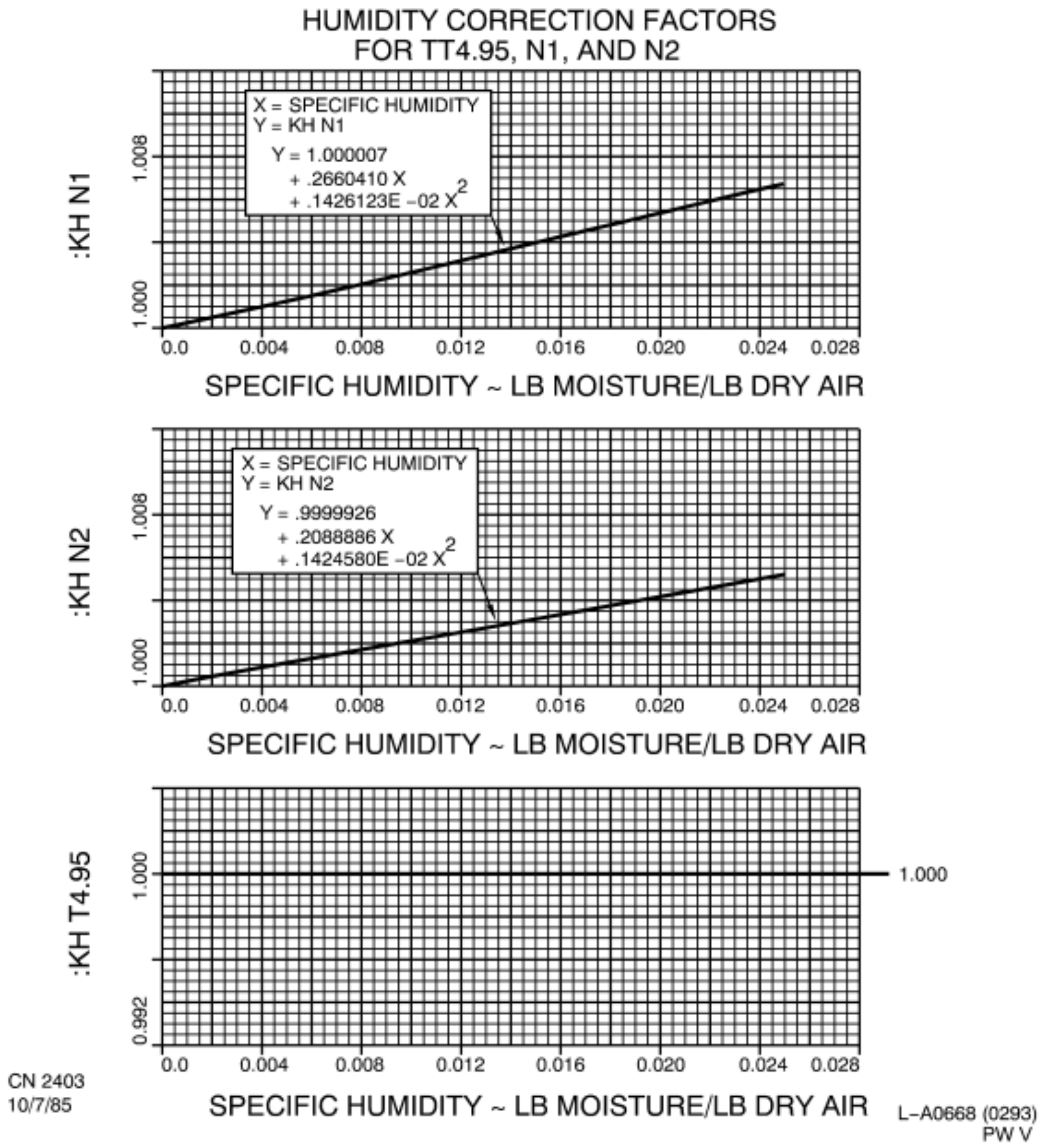
PW V

Fuel Flow Correction Factors (KH)
Figure 1307
(Task 71−00−00−760−063)



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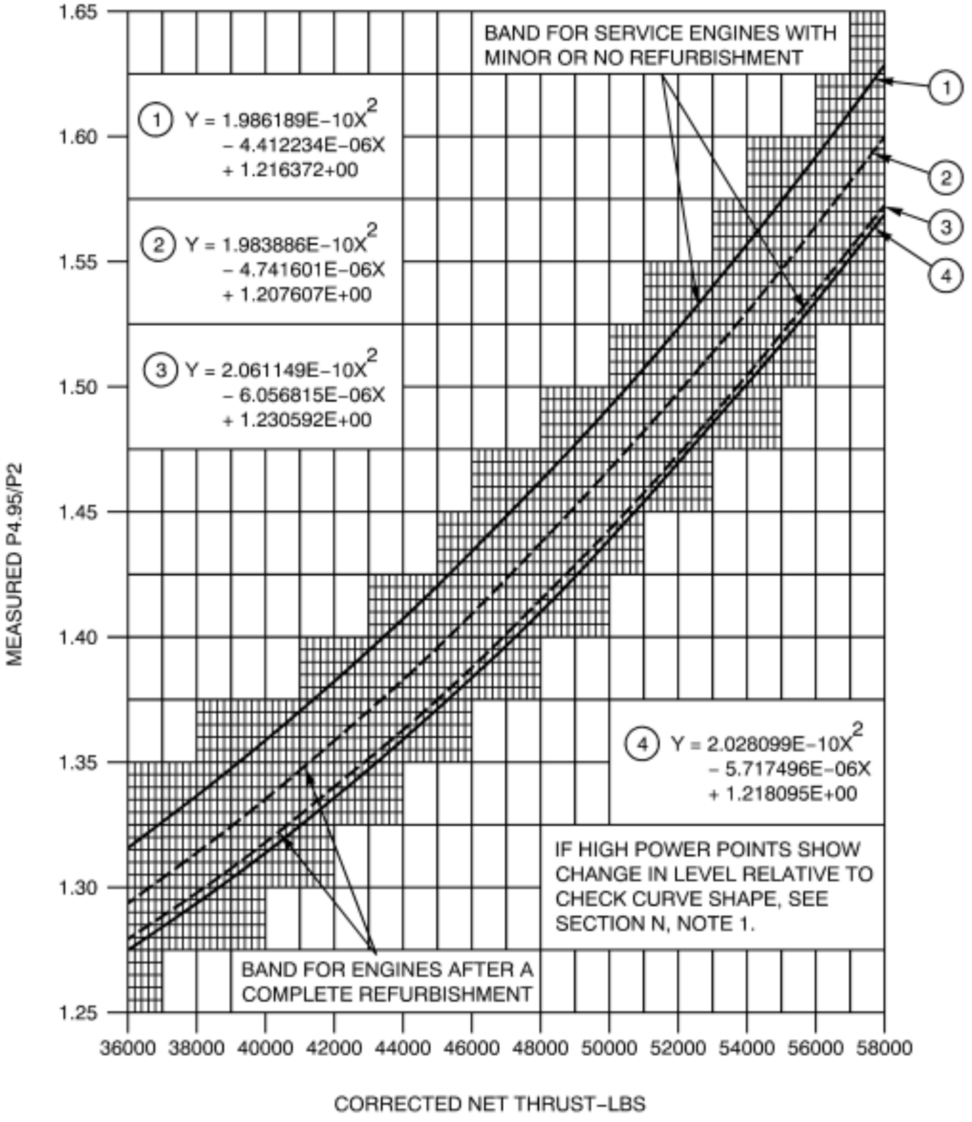
PW V

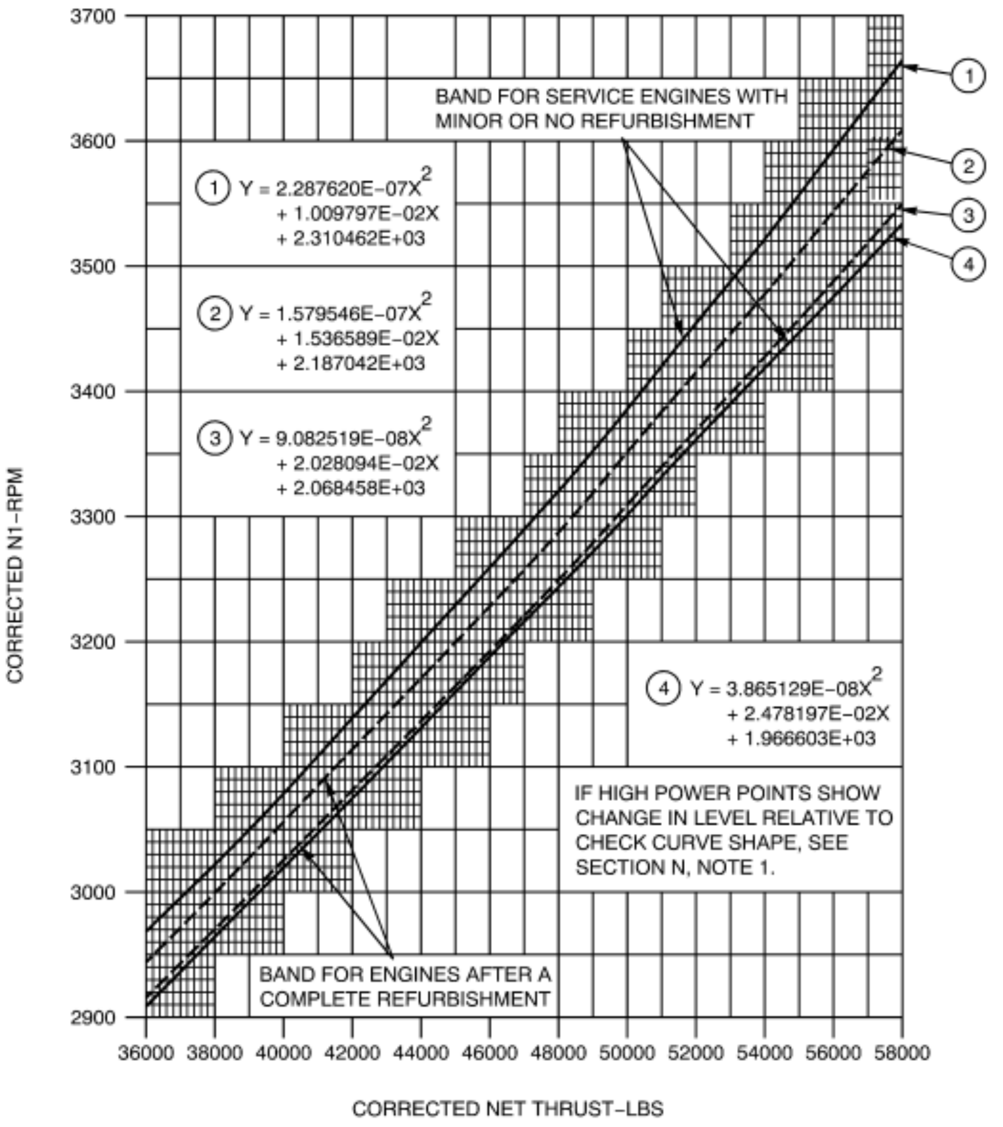
Humidity Correction Factors
Figure 1308
(Task 71−00−00−760−063)



NOTE: FOR ALL EQUATIONS
X = CORRECTED NET THRUST

L−B8712 (0202)
PW V

Gas Generator Check Curves
Figure 1309 (Sheet 1)
(Task 71−00−00−760−063)



① $Y = 2.287620E{-}07X^2 + 1.009797E{-}02X + 2.310462E{+}03$

② $Y = 1.579546E{-}07X^2 + 1.536589E{-}02X + 2.187042E{+}03$

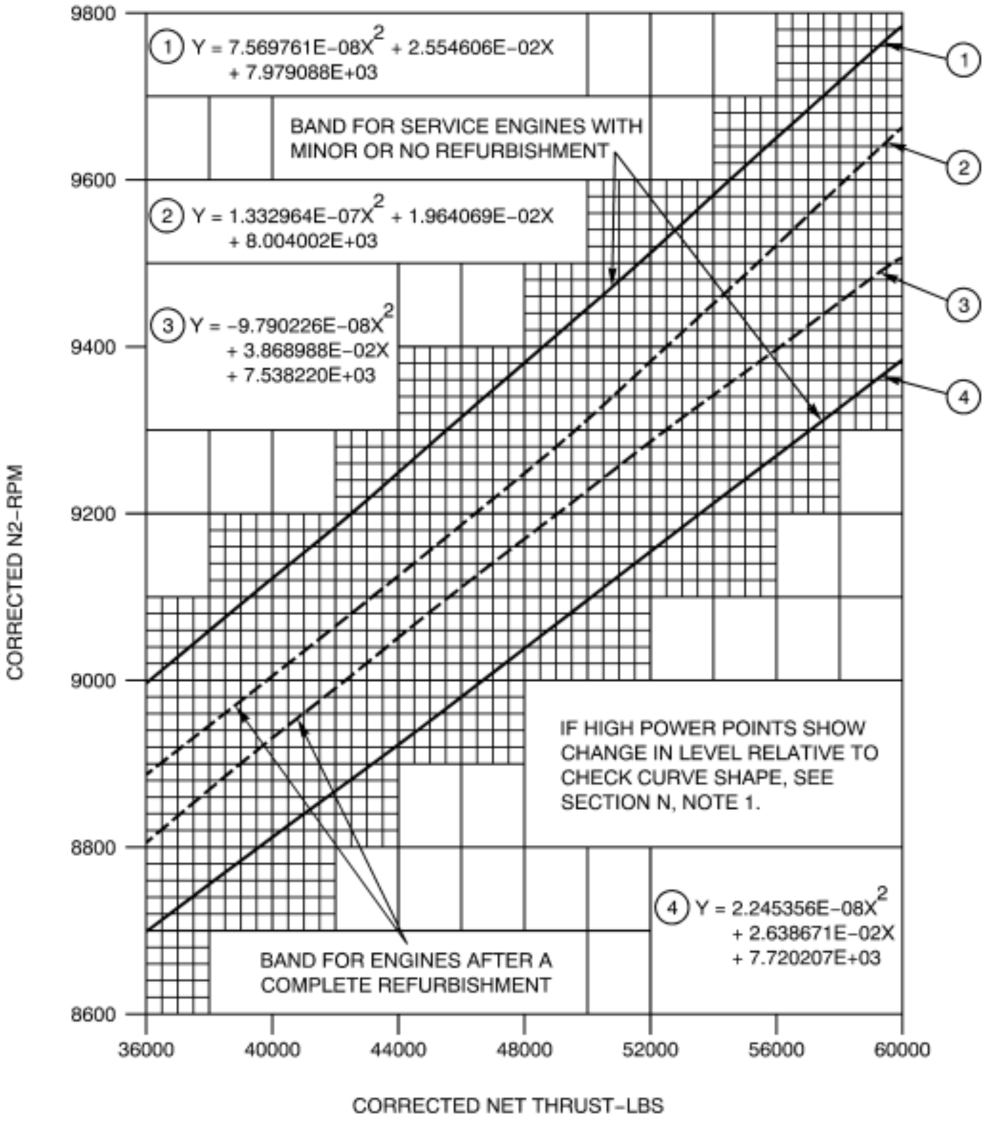
③ $Y = 9.082519E{-}08X^2 + 2.028094E{-}02X + 2.068458E{+}03$

④ $Y = 3.865129E{-}08X^2 + 2.478197E{-}02X + 1.966603E{+}03$

NOTE: FOR ALL EQUATIONS
X = CORRECTED NET THRUST

L-B8711 (0202)
PW V

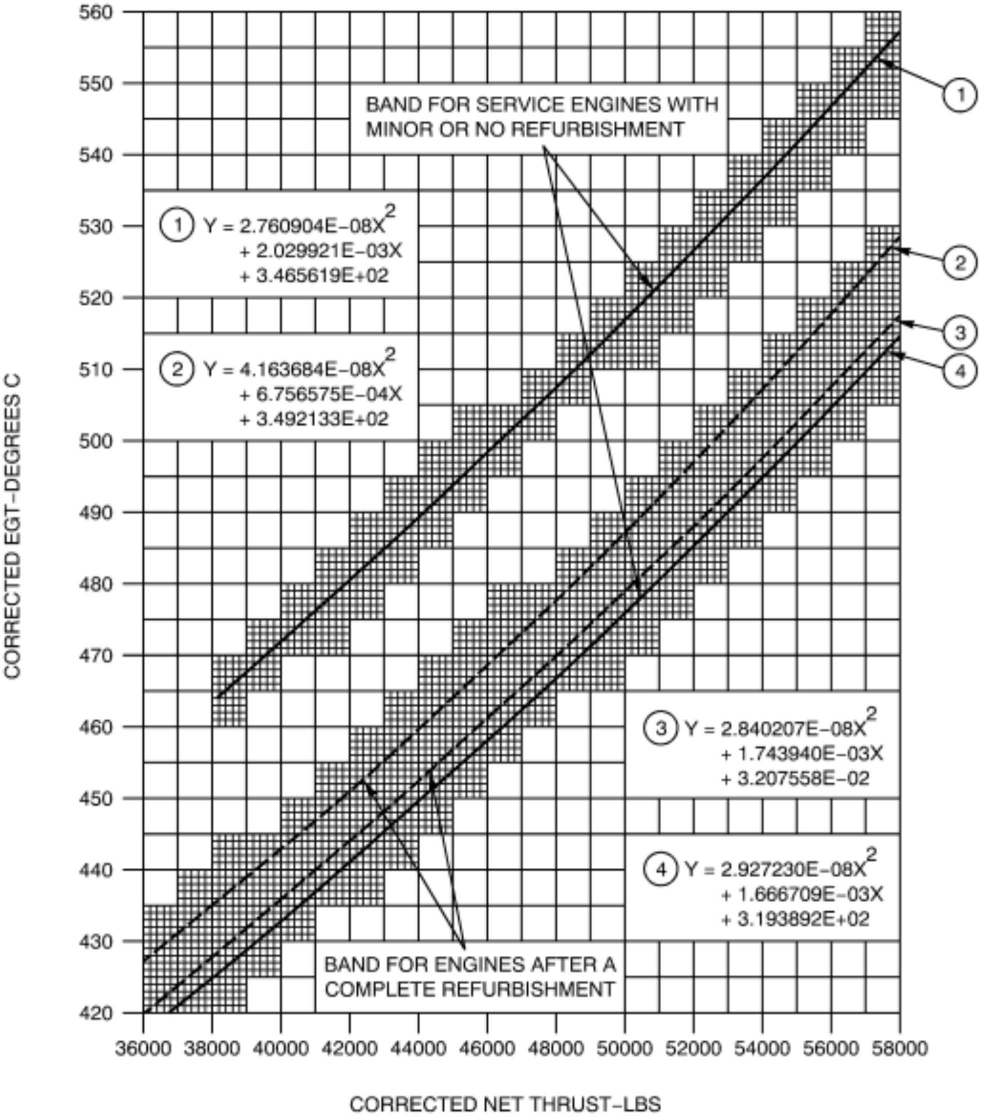
Gas Generator Check Curves
Figure 1309 (Sheet 2)
(Task 71-00-00-760-063)



NOTE: FOR ALL EQUATIONS
X = CORRECTED NET THRUST

L-B8713 (0202)
PW V

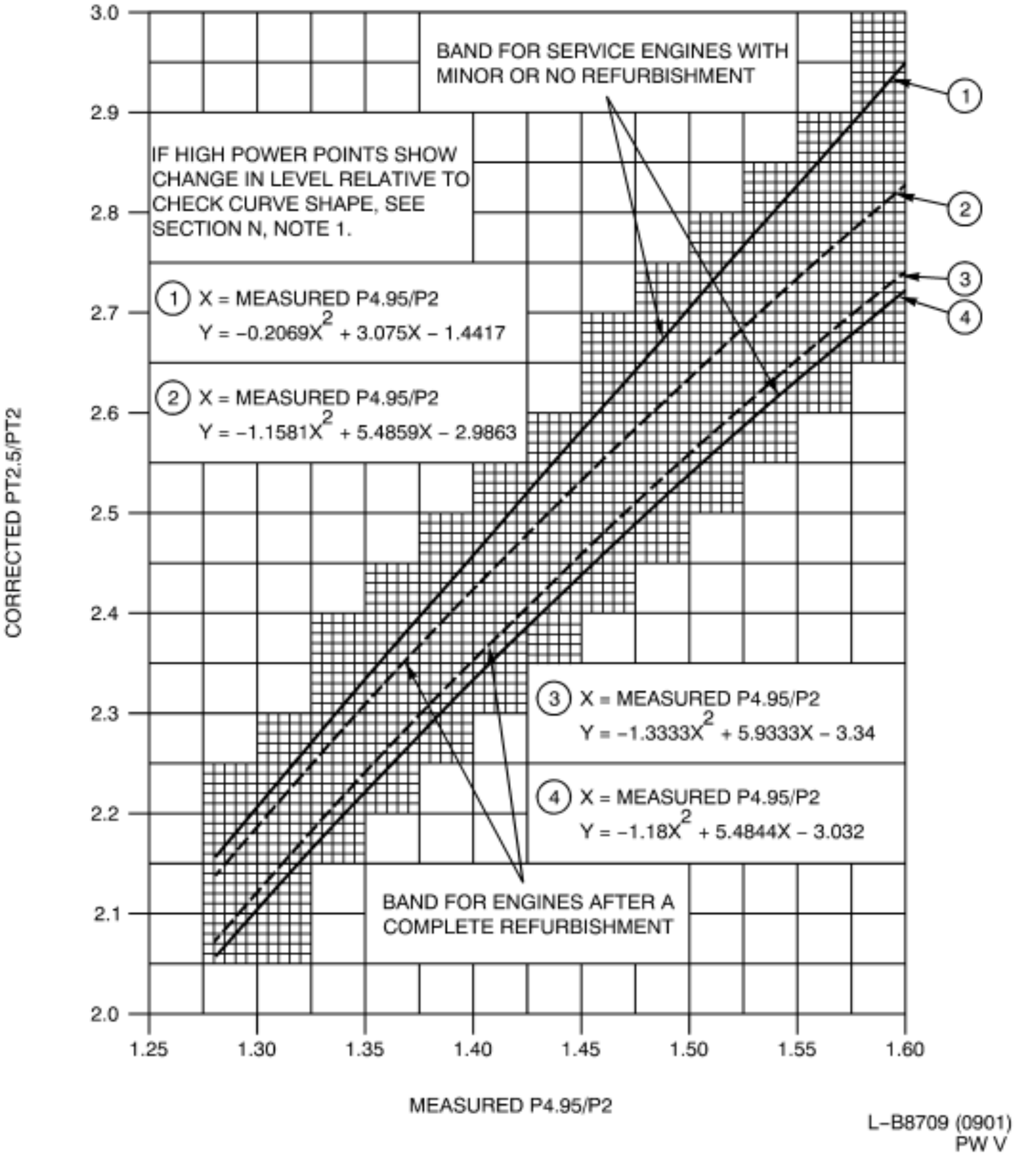
Gas Generator Check Curves
Figure 1309 (Sheet 3)
(Task 71-00-00-760-063)



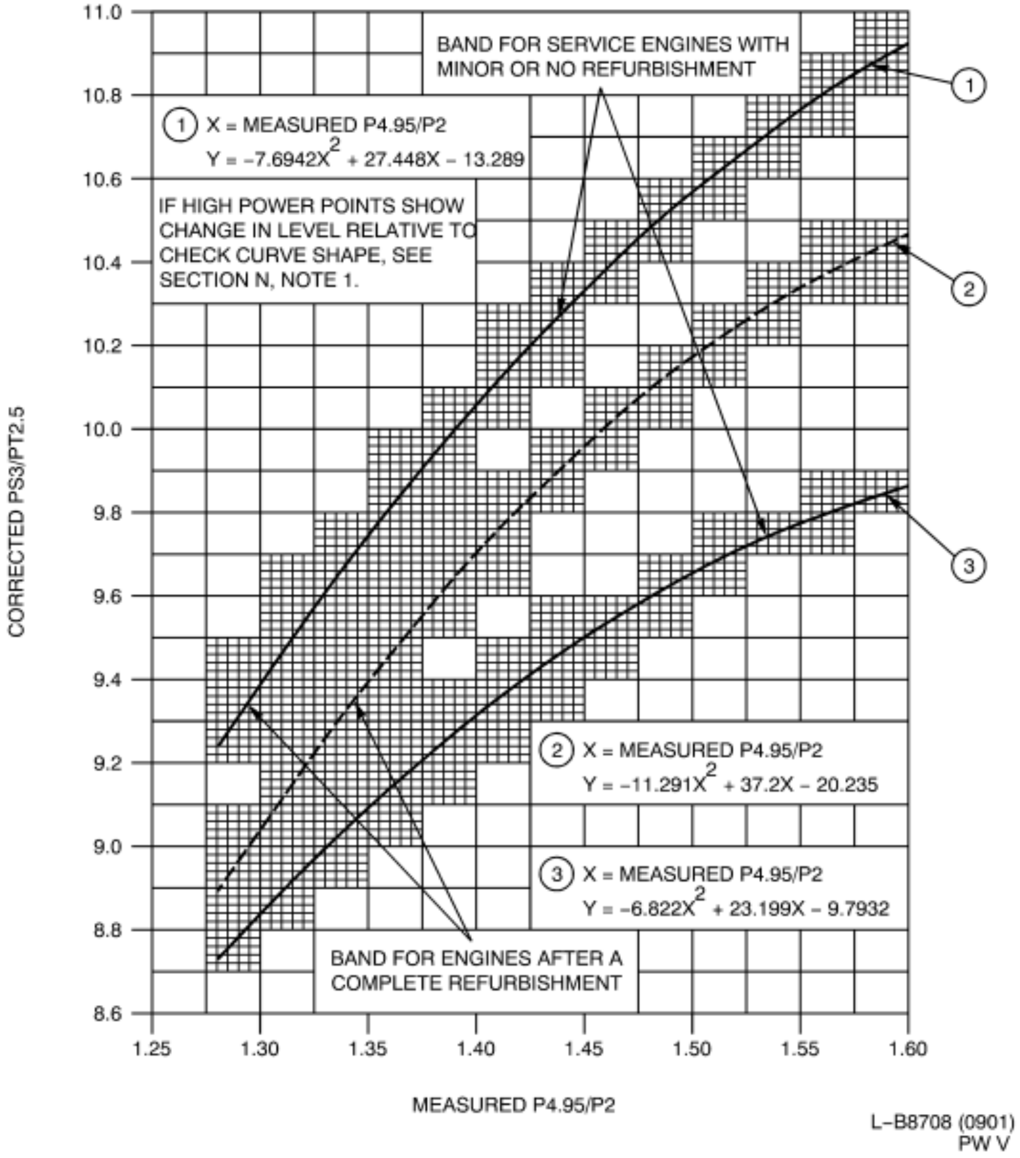
NOTE: FOR ALL EQUATIONS
X = CORRECTED NET THRUST

L-B8710 (0202)
PW V

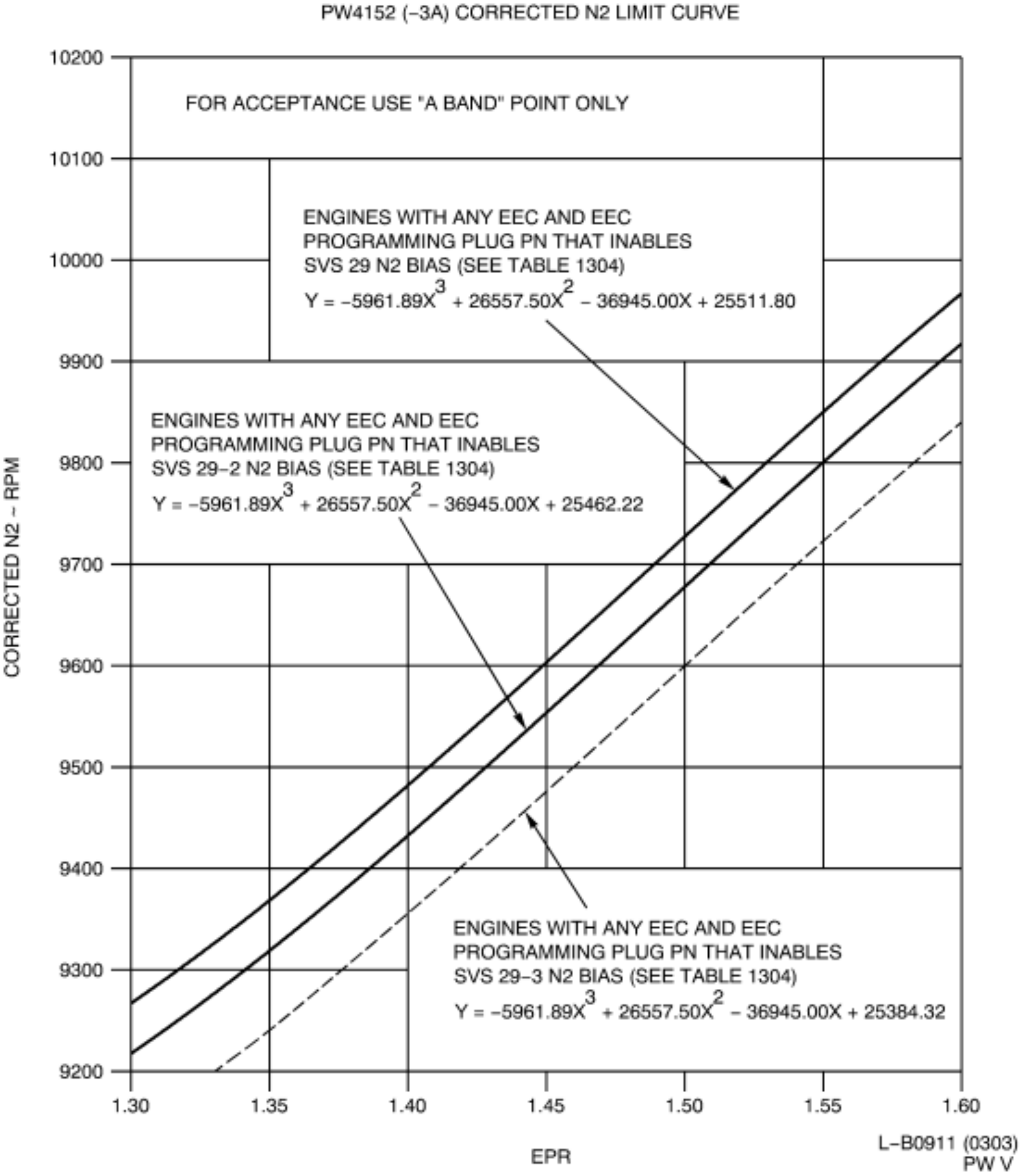
Gas Generator Check Curves
Figure 1309 (Sheet 4)
(Task 71-00-00-760-063)



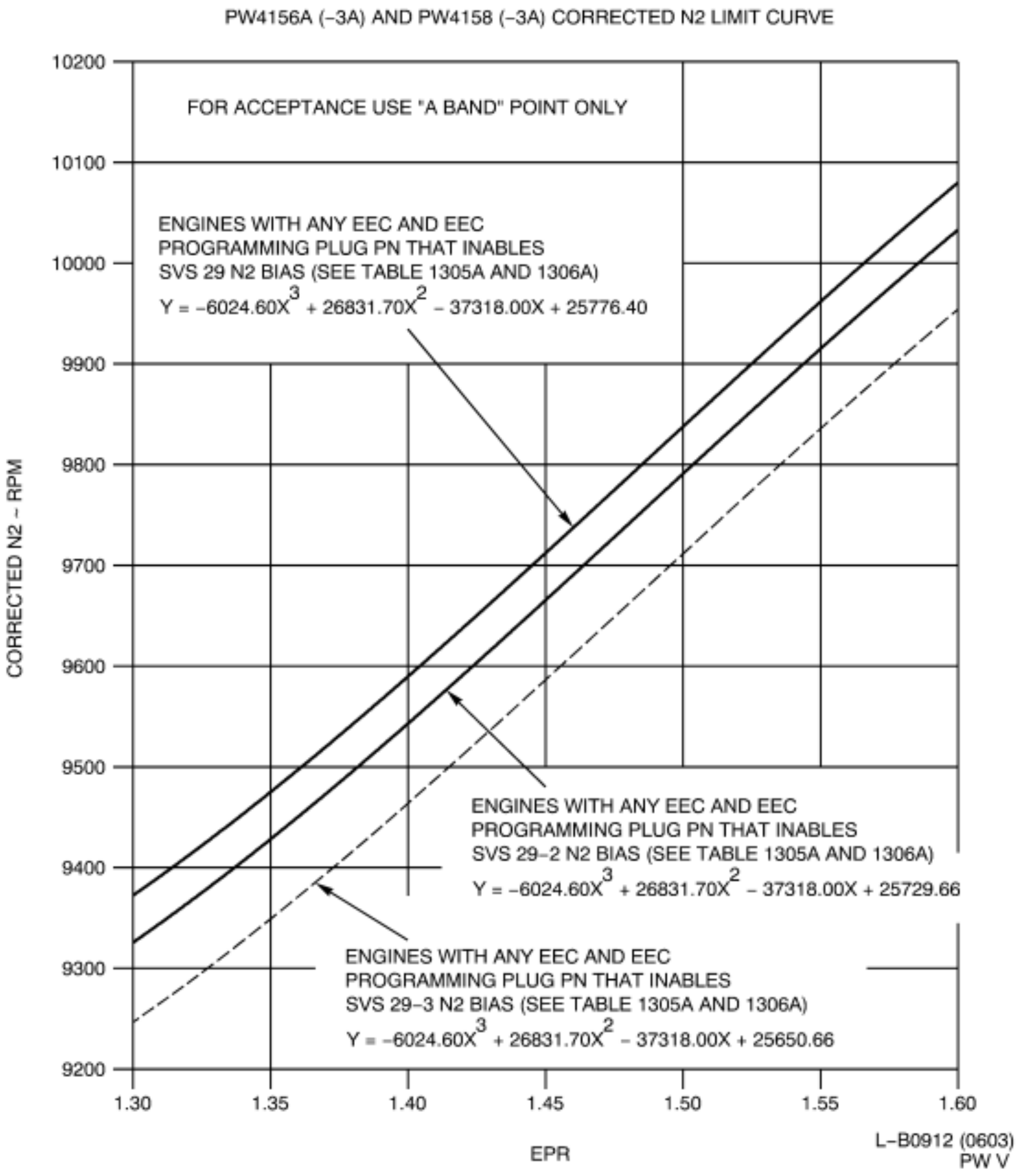
Gas Generator Check Curves
Figure 1309 (Sheet 5)
(Task 71−00−00−760−063)



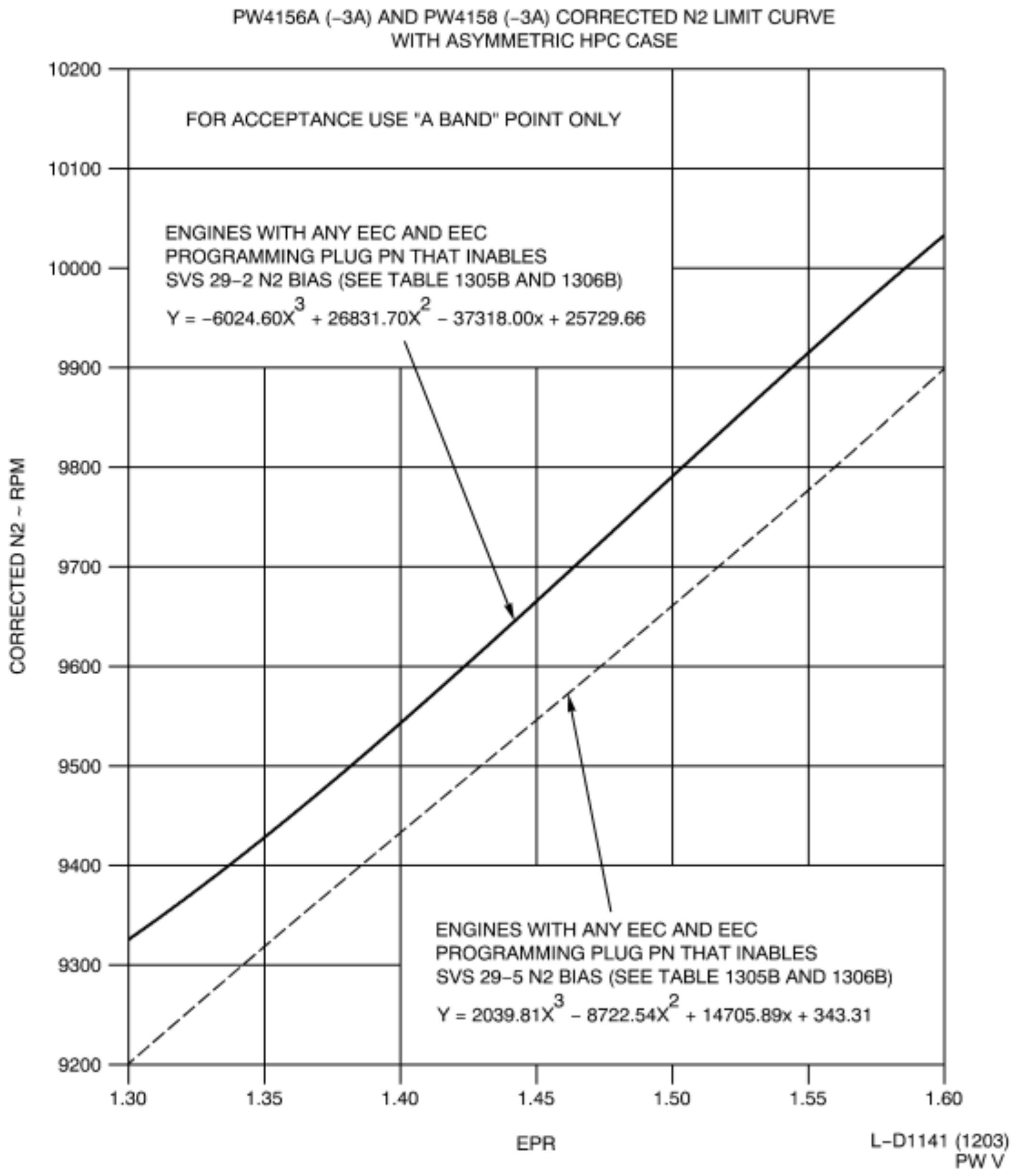
Gas Generator Check Curves
Figure 1309 (Sheet 6)
(Task 71−00−00−760−063)



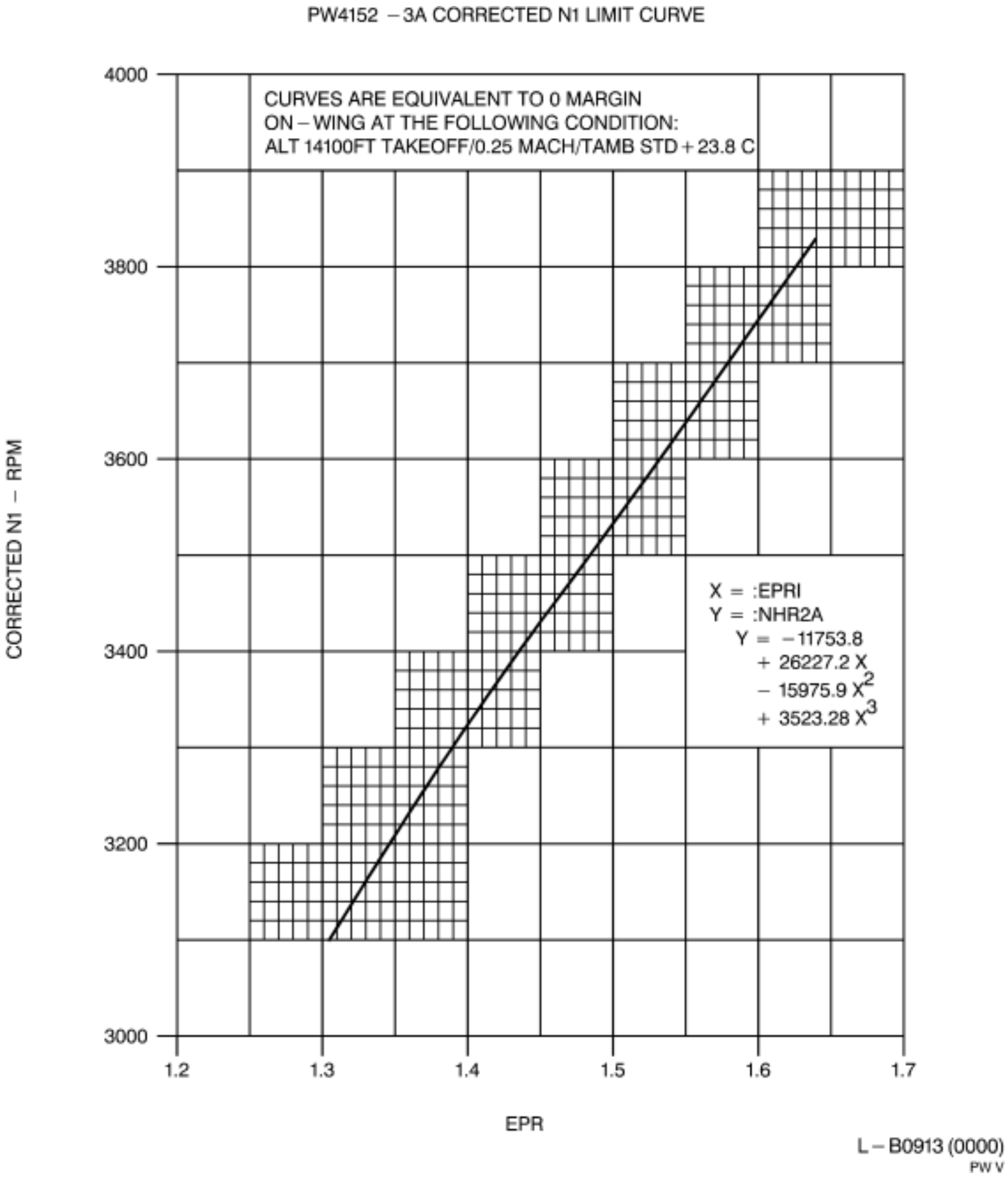
N2 Rotor Speed Limit Curve (PW4152 (−3A) Engines)
Figure 1310 (Sheet 1)
(Task 71−00−00−760−063)



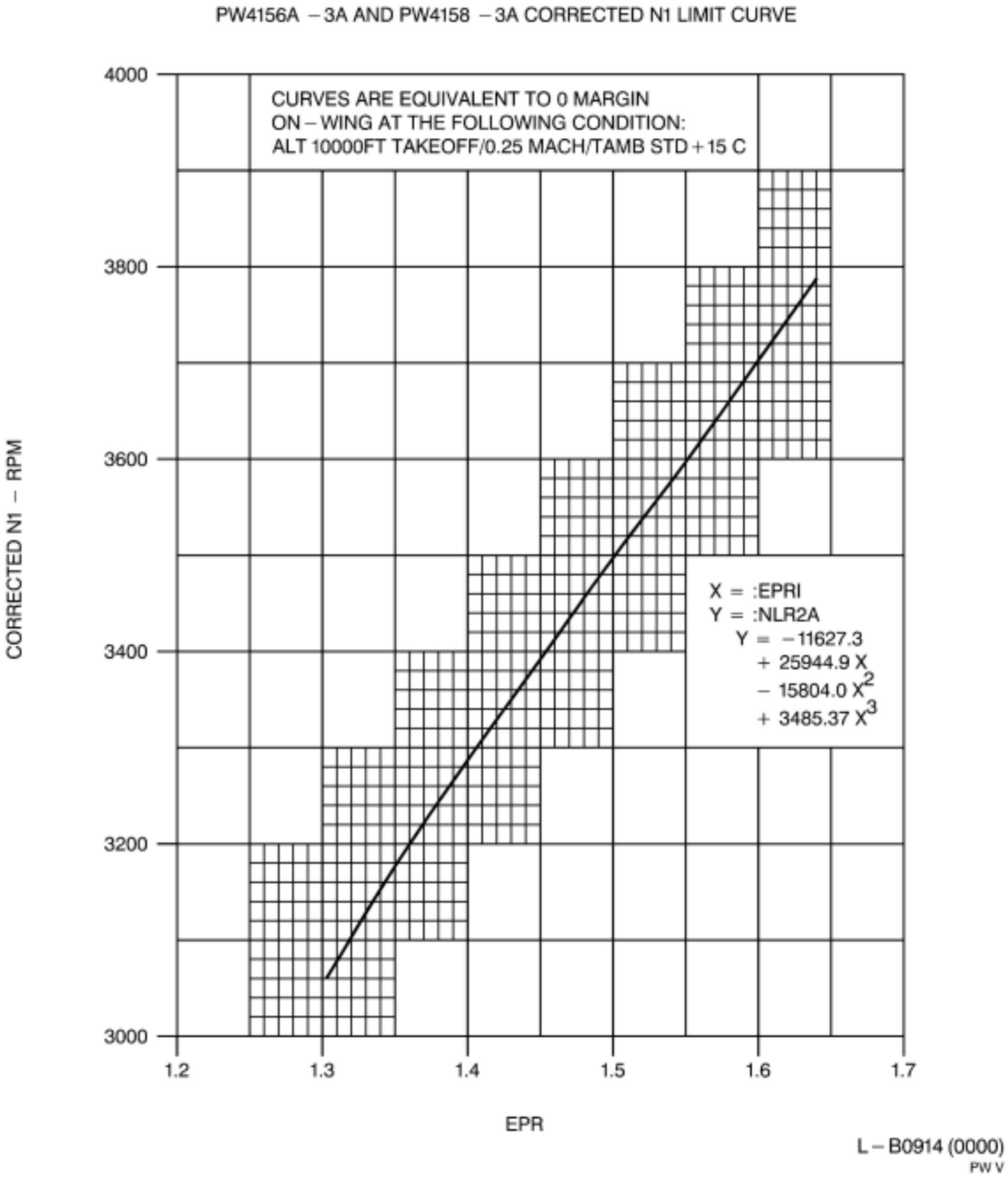
N2 Rotor Speed Limit Curve (PW4156A (−3A) And PW4158 (−3A) Engines)
Figure 1310 (Sheet 2)
(Task 71−00−00−760−063)



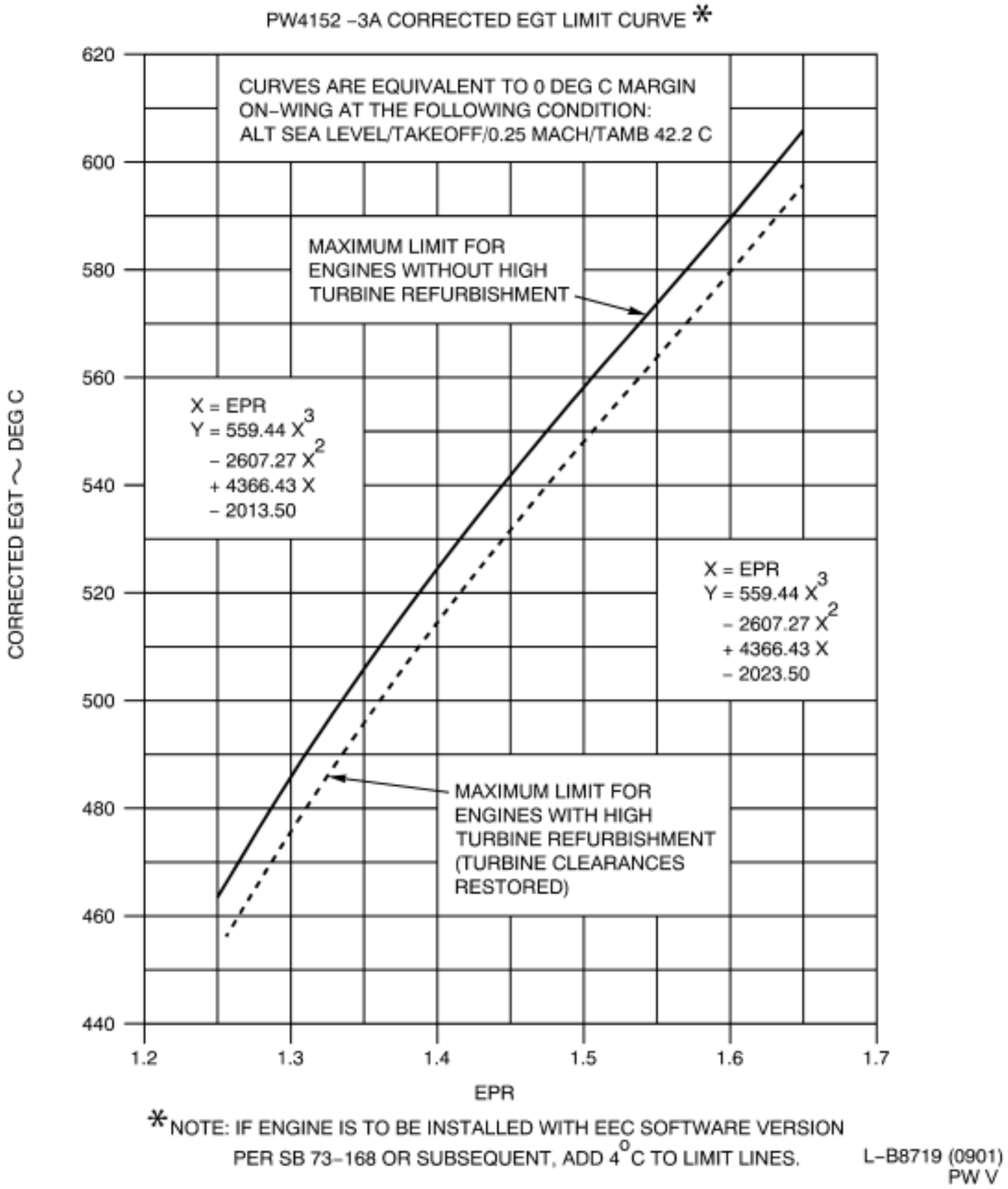
N2 Rotor Speed Limit Curve (PW4156A (−3A) And PW4158 (−3A) Engines)
Figure 1310 (Sheet 3)
(Task 71−00−00−760−063)



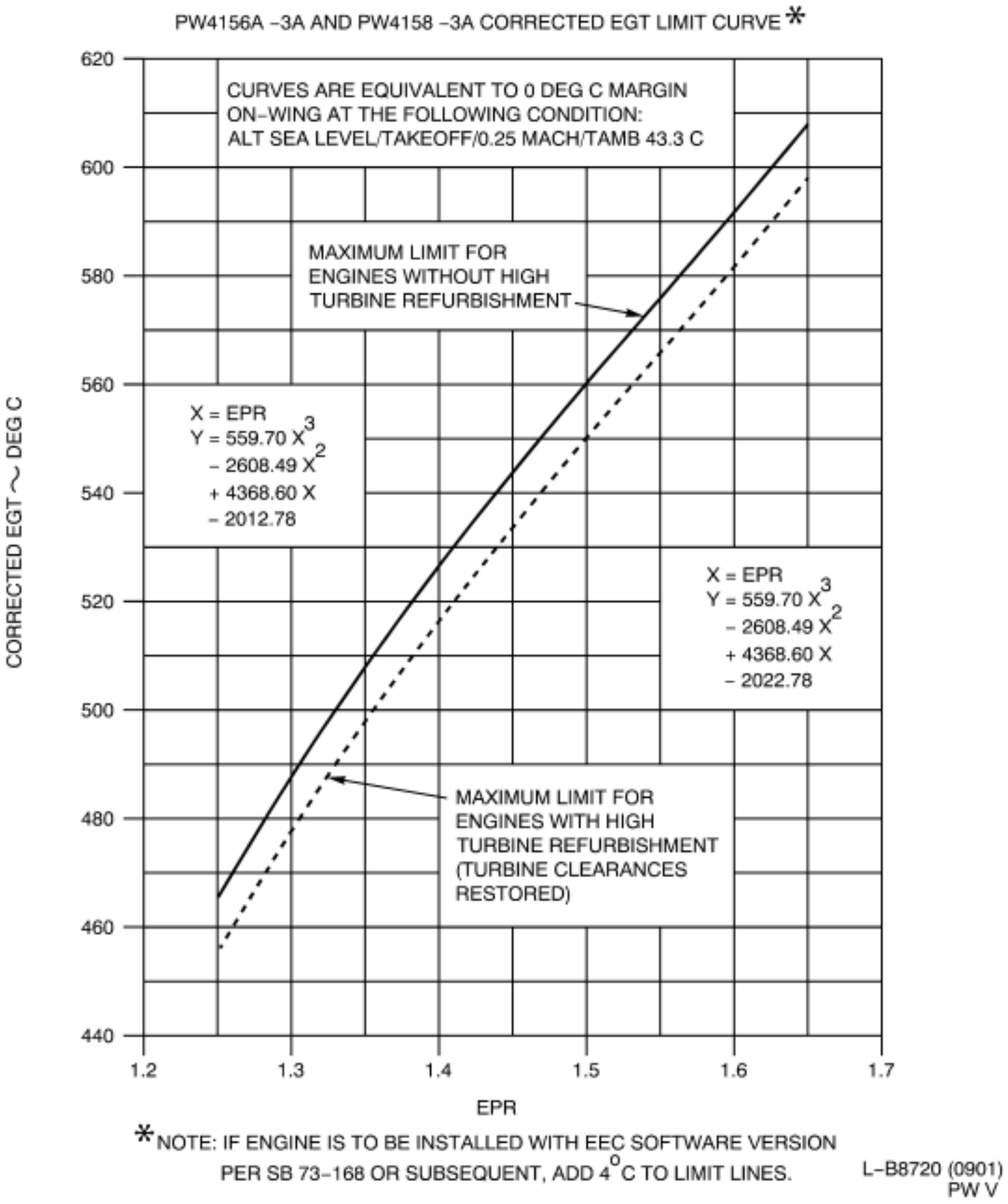
N1 Rotor Speed Limit Curve (PW4152 (−3A) Engines)
Figure 1311 (Sheet 1)
(Task 71−00−00−760−063)



N1 Rotor Speed Limit Curve (PW4156A (−3A) And PW4158 (−3A) Engines)
Figure 1311 (Sheet 2)
(Task 71−00−00−760−063)



Corrected EGT Limit Curve (PW4152 (-3A) Engines)
Figure 1312 (Sheet 1)
(Task 71-00-00-760-063)



Corrected EGT Limit Curve (PW4156A (-3A) And PW4158 (-3A) Engines)
Figure 1312 (Sheet 2)
(Task 71-00-00-760-063)

Task 71-00-00-720-003:

1. Test No. 12 - Engine Oil System Vacuum Test

A. General

(1) Use this procedure to measure the airflow leakage into the bearing compartments.

B. Equipment And Materials Necessary
Standard Tools:

(1) Fluid drain collector/container capacity 5 US gal (18.93 liter)

(2) CTE 6075 Vacuum Cart

(3) Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

(4) Protection covers

Special Tools:
PWA 85498 Adapter
PWA 85843 Adapter
PWA 85845 Adapter
PWA 85978 Plug

Consumable Materials:

	Item No.	Designation
	P03-001	Engune Oil (PWA 521B)
	P05-289	Lockwire, (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
R	P06-054	Paste, Antiseize (PWA 36246)

C. Procedure

(1) Find the airflow leakage limits into the bearing compartments. See Table 1301.

BEARING COMPARTMENT	MAXIMUM AIRFLOW PERMITTED
No. 1, 1.5, 2, 3 (Front And Rear) And Angle Gearbox	44 Lb/hour (19.96 kg/hour)
No. 4	10 Lb/hour (4.54 kg/hour)

Bearing Compartment Airflow Limits
Table 1301

CAUTION: INSTALL PROTECTION COVERS OVER ALL OPENINGS AS SOON AS POSSIBLE TO PREVENT ENGINE DAMAGE.

(2) Disconnect and loosen the No. 4 bearing oil scavenge tube assembly (LR06) as follows:

(a) Remove the bolt, nut and clamp which holds the spray shield to Flange M bracket at approximately the 7 o'clock position. Remove the hose clamp from the forward end of the spray shield and remove the shield from the engine. Remove the lockwire and disconnect the tube nut from the tube coupling. See Figure 1301 (Sheet 1), Figure 1301 (Sheet 2), Figure 1301 (Sheet 3) and Figure 1301 (Sheet 4).

(b) Remove the lockwire and disconnect the tube elbow from the exhaust case internal tube nut at approximately the 10 o'clock position.

(c) Remove the bolts, nuts and clamps which hold the tube to the Flange N and P brackets. Install tube protective covers.

(d) Remove the bolt, spacer, nut and clamp which holds the tube to the adjacent scavenge tube.

(3) Install the PWA 85843 Adapter into the tube coupling nut.

(4) Remove the No. 4 bearing strainer housing.

(a) Remove the hose clamp which holds the spray shield to the rear tube connection on the exhaust case at approximately the 10:30 o'clock position. Remove the shield from the engine. Remove the lockwire and disconnect the tube nut from the strainer housing.

(b) Remove the lockwire and disconnect the strainer housing from the exhaust case internal tube nut at approximately the 10:30 o'clock position.

(c) Close the tube openings for protection.

(5) Install PWA 85978 Plug into the tube coupling nut.

(6) Attach the vacuum hose and the pressure line to the CTE 6075 Vacuum Cart.

(7) For this test, set the vacuum cart pressure at Pamb minus 10 psi (−68.9 kPa) or Pamb minus 20 inches (−508 mm) Hg. At sea level this is 5.0 psia (34.5 kPa absolute). Make a record of the airflow leak rate into the No. 4 bearing compartment.

NOTE: For this vacuum test, (unless specified in this procedure) all the oil supply tubes, breather tubes, and scavenge tubes must be installed. Also, the gearbox pad covers for the integrated drive generator and hydraulic pumps must be installed.

(8) Remove PWA 85843 Adapter from the coupling nut. Close the tube openings with standard shop fittings.

(9) Remove the cover installed on the gearbox port. Install PWA 85498 Adapter on the boss using the detail bolts. Install the adapter so that the larger threaded opening is pointed away from the engine. If the deoiler outlet tube is still attached, use PWA 85845 Adapter. Attach CTE 6075 Vacuum Cart.

(10) For this test set the vacuum cart pressure at PAMB minus 10 psi (69 kPa), or PAMB minus 20 inches (508 mm) HG. At sea level this is 5.0 psia (34.5 kPa absolute). Find the airflow leak rate into the 1, 1.5, 2 and 3 bearing compartment and the angle gearbox.

(11) Disconnect vacuum cart hoses and remove PWA 85845 Adapter or PWA 85498 Adapter and remove vacuum check PWA 85978 Plug.

(12) Install the No. 4 bearing strainer housing.

(a) Install the strainer housing, threads lubricated with Engine Oil P03−001, to the exhaust case internal tube nut at approximately the 10:30 o'clock position, tighten by hand

(b) Install the (LP16) No. 4 bearing oil pressure tube assembly to the strainer housing. Install the tube, threads lubricated with Engine Oil P03−001, to the strainer housing on the exhaust case, tighten by hand.

(13) Connect and clamp the (LR06) No. 4 bearing oil scavenge tube assembly as follows:

(a) Remove protection and install tube elbow with
R nut threads lubricated with Antiseize Paste
R P06−054, to the exhaust case internal tube nut at
approximately the 10 o'clock position, and to the
tube coupling forward of Flange M at approximately
R the 7 o'clock position, tighten by hand. Remove
R unwanted paste.

(b) Install the clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts securing the tube to Flanges N and P brackets. Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Install the clamp, bolt, threads lubricated with Engine Oil P03−001, spacer, and nuts to hold the (LR06) tube to the adjacent (LP16) No. 4 bearing oil pressure tube assembly.

(d) Torque the tube nut at the exhaust case connection to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(e) Torque the tube nut at Flange N connection to 475 − 525 lb−in. (53.668 − 59.317 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(f) (Reference 2151) Install the spray shield to the inboard side of Flange N connection and attach the forward end of the shield with a hose clamp. Torque the hose clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

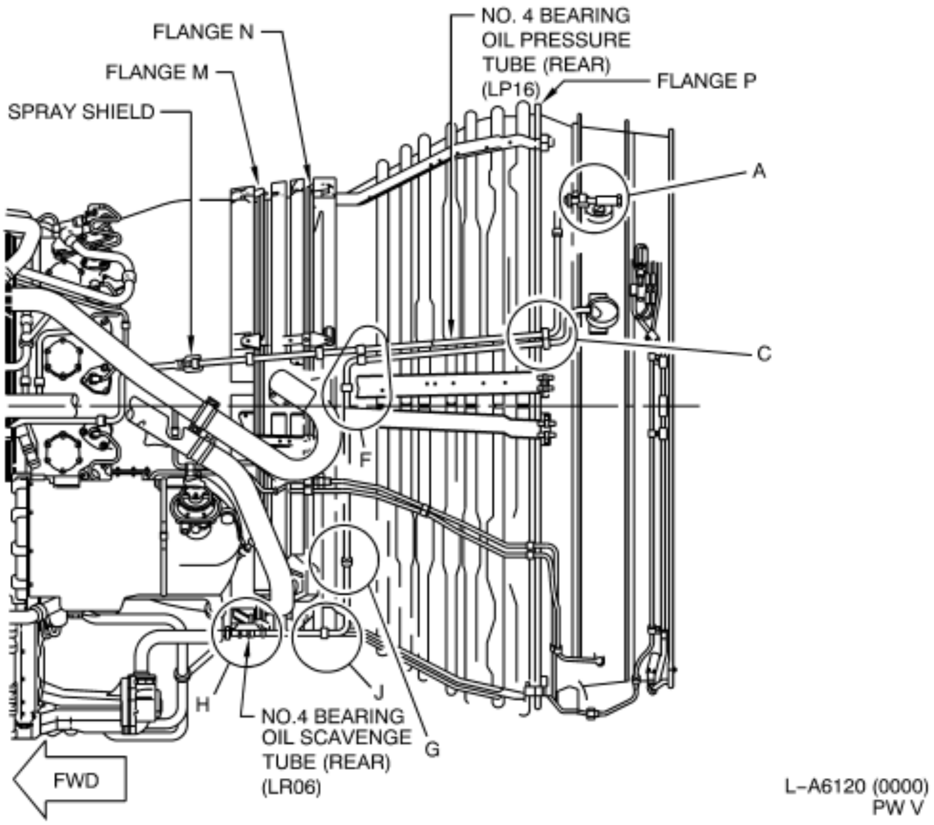
(g) Install the clamp to the rear end of the shield and Flange M bracket with bolt, threads lubricated with Engine Oil P03−001, and nut. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(14) Torque the (LP16)(LP16) No. 4 bearing oil pressure tube nut to the strainer housing. Torque the tube nut to 450 − 500 lb−in. (50.843 − 56.492 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

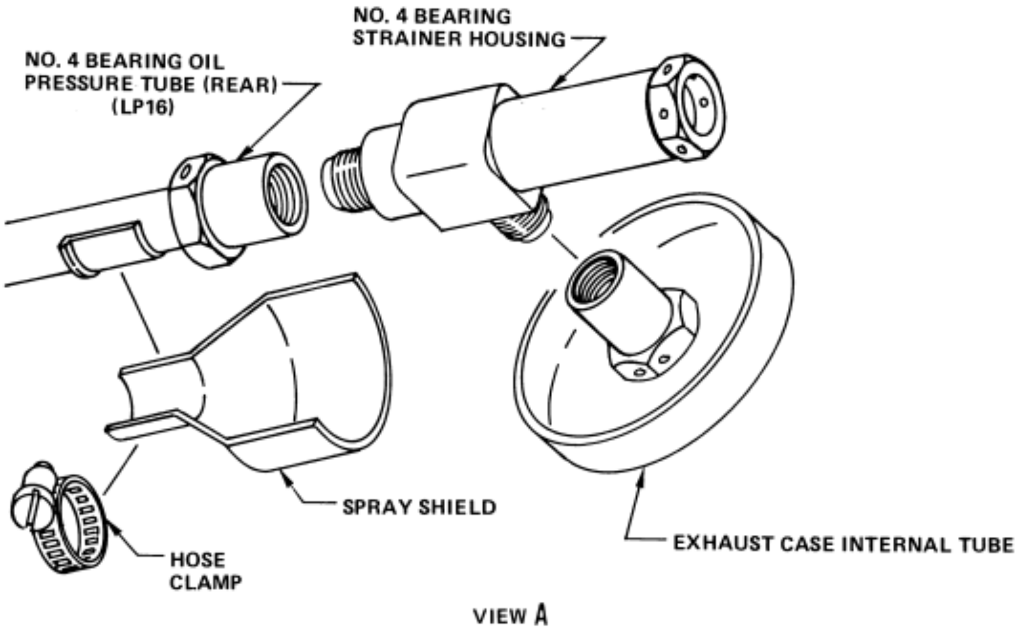
(15) Torque the exhaust case internal tube nut to the last chance strainer housing to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

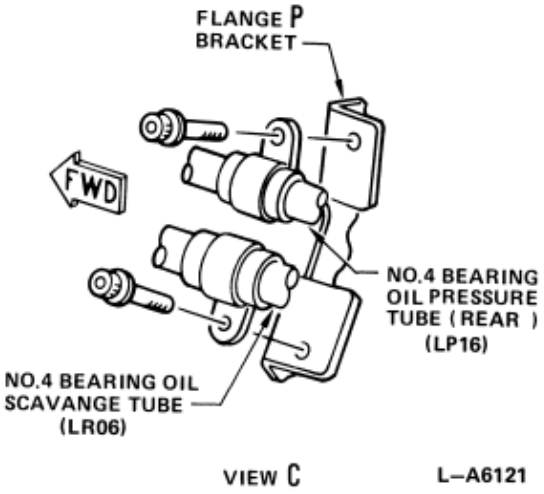
(16) (Reference 2151) Install the spray shields to the inboard side of the front and rear connections and attach with hose clamps. Torque the hose clamps to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(17) Refer to the Test Reference Table, Testing−00, Task 71−00−00−990−003.

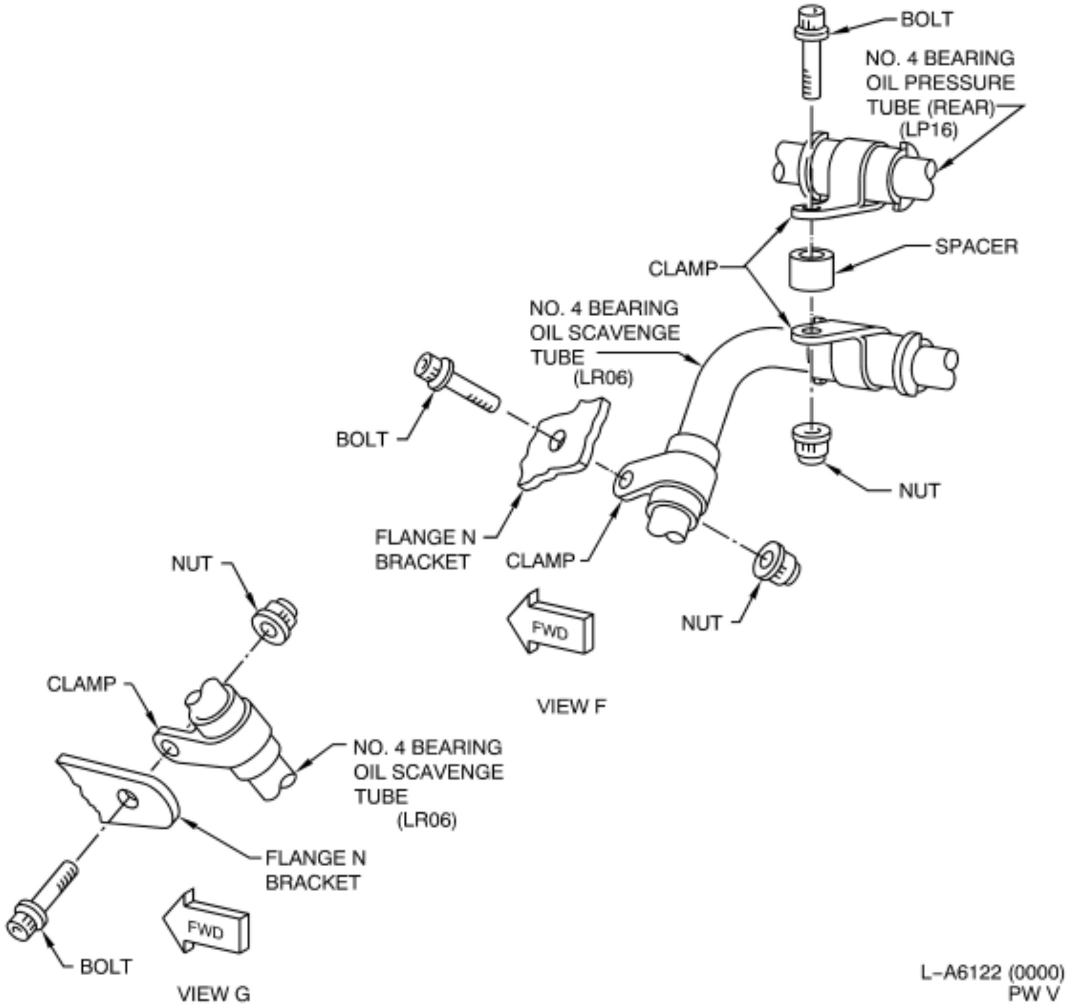

FLANGE N
FLANGE M
SPRAY SHIELD
NO. 4 BEARING OIL PRESSURE TUBE (REAR) (LP16)
FLANGE P
A
C
F
H
J
G
NO.4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
FWD
L−A6120 (0000)
PW V

Test No. 12 − Engine Vacuum Test
Figure 1301 (Sheet 1)
(Task 71−00−00−720−003)

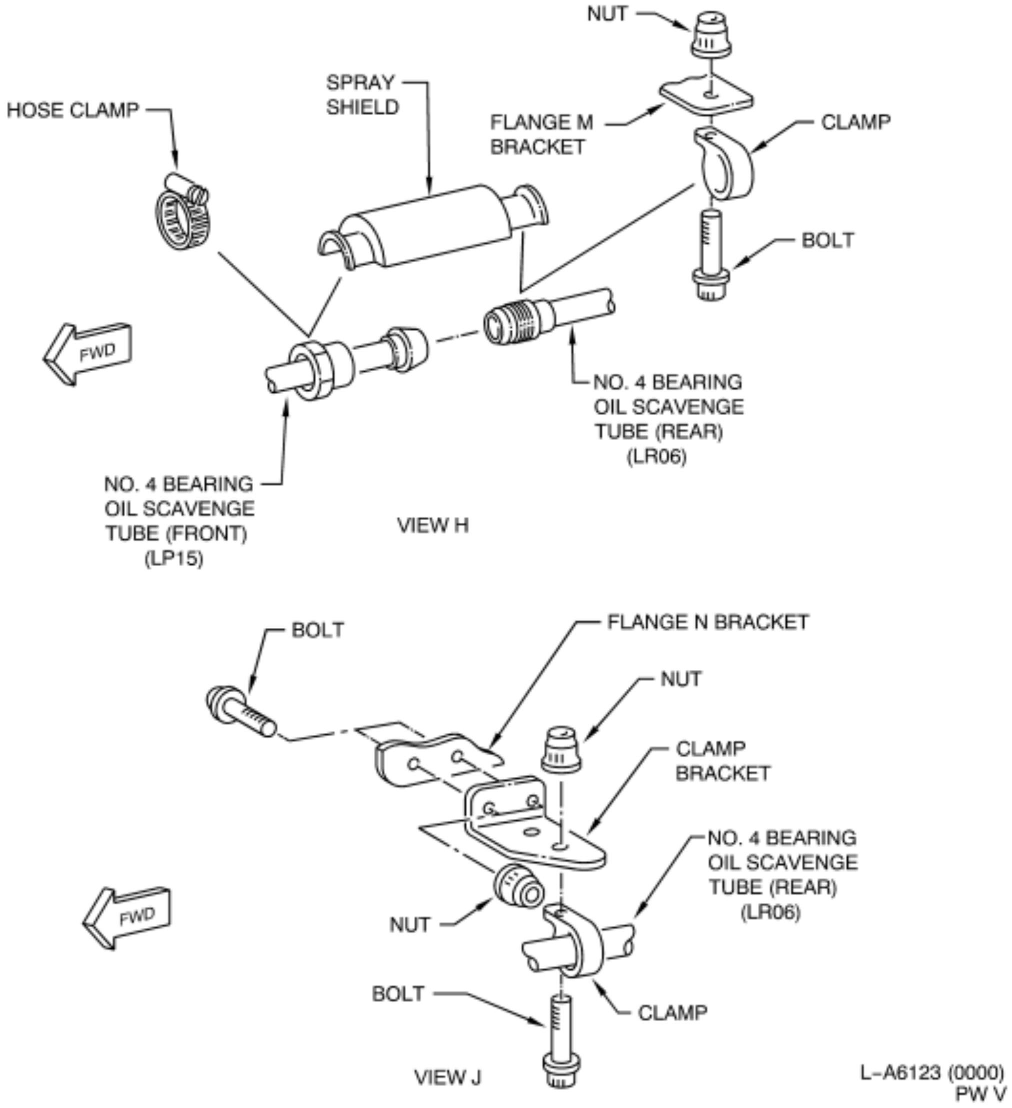

NO. 4 BEARING
STRAINER HOUSING
NO. 4 BEARING OIL
PRESSURE TUBE (REAR)
(LP16)
SPRAY SHIELD
HOSE
CLAMP
EXHAUST CASE INTERNAL TUBE
VIEW A


FLANGE P
BRACKET
FWD
NO.4 BEARING
OIL PRESSURE
TUBE (REAR)
(LP16)
NO.4 BEARING OIL
SCAVANGE TUBE
(LR06)
VIEW C
L−A6121

Test No. 12 − Engine Vacuum Test
Figure 1301 (Sheet 2)
(Task 71−00−00−720−003)


BOLT
NO. 4 BEARING OIL PRESSURE TUBE (REAR) (LP16)
SPACER
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
BOLT
NUT
FLANGE N BRACKET
CLAMP
NUT
NUT
FWD
VIEW F
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
FLANGE N BRACKET
FWD
BOLT
VIEW G
L−A6122 (0000)
PW V

Test No. 12 − Engine Vacuum Test
Figure 1301 (Sheet 3)
(Task 71−00−00−720−003)


NUT
SPRAY SHIELD
HOSE CLAMP
FLANGE M BRACKET
CLAMP
BOLT
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
NO. 4 BEARING OIL SCAVENGE TUBE (FRONT) (LP15)
VIEW H
BOLT
FLANGE N BRACKET
NUT
CLAMP BRACKET
NO. 4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
FWD
NUT
BOLT
CLAMP
VIEW J
L−A6123 (0000)
PW V

Test No. 12 − Engine Vacuum Test
Figure 1301 (Sheet 4)
(Task 71−00−00−720−003)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 71-00-00-760-047:

1. Test No. 13 - Main Oil Pressure Test And Adjustment

A. General

(1) Use this procedure to check the engine main oil pressure and if necessary, to adjust the oil pressure to the necessary limits.

(2) Acceptable main oil pressure readings at high rotor speeds (N2) are provided in this procedure. Main oil pressure is oil supply pressure (LP-1) minus No. 1 and 2 breather pressure (LB-6).

(3) Main oil pressure readings not within specified limits must be adjusted by replacing the external oil tube metering nipple with one of a different class.

B. Equipment And Tools Necessary

Standard Tools:

Bergen Mechanical Crimper (Optional)Model M303, M305 or M307

Consumable Materials

Item No.	Designation
P05-289	Lockwire, (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-021	Compound, Antigalling (PWA 550)
P06-036	Compound, Antigalling (PWA 36065)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Nipple, Metering Tube - See Note 1	1	79-21-00/8/230

Note 1: Specific class must be calculateded by the Testing-13 procedure.

C. Test Procedure

POWER PLANT GENERAL − TESTING−13

CAUTION: IF YOU SEE UNUSUALLY HIGH MAIN OIL PRESSURE OVER THE TRIM BAND, DO AN ENGINE SHUTDOWN. UNUSUALLY HIGH OIL PRESSURE CAN BE CAUSED BY PARTIAL BLOCKAGE OF THE OIL PASSAGEWAYS. EXAMINE THE OIL SYSTEM FOR BLOCKAGE. IF YOU DO NOT SHUTDOWN QUICKLY, DAMAGE TO THE ENGINE WILL OCCUR.

NOTE: Unusually high main oil pressure can be caused by partial blockage of the oil system passageways. Several instances have occurred where a bolt was dropped in the fuel/oil cooler and traveled into the oil pressure manifold. The bolt blocked the oil flow to the Number 3 bearing compartment. This will cause oil starvation to the Number 3 bearing and much engine damage.

(1) Make sure there are no leaks per Testing−03 Task 71−00−00−760−030 prior to testing for main oil pressure.

(2) Start the engine by the Engine Start Procedure (Normal) Task 71−00−00−760−004.

(3) Let the engine become stable for five minutes at MINIMUM Idle.

(4) Make sure all the engine parameters are in the permitted limits. Make a record of the N2 speed, oil pressure and breather pressure readings.

(5) Slowly move the thrust lever forward to 1.3 EPR. Let the engine become stable. Make a record of the N2 speed, oil pressure and breather pressure readings.

(6) Slowly move the thrust lever forward to 1.4 EPR. Let the engine become stable. Make a record of the N2 speed, oil pressure and breather pressure readings.

(7) Slowly move the thrust lever to MINIMUM IDLE and operate the engine for five minutes.

(8) Do an engine shutdown by the Normal Shutdown Procedure, Task 71−00−00−760−005.

(9) Examine the record of the oil pressure and N2 speed data. The limits are shown in Figure 1301 (Sheet 1) and Figure 1301 (Sheet 2). If the oil pressure data for the engine is in the permitted limits, this test is complete.

NOTE: Subtract No. 1 and 2 breather pressure (LB−6) reading from oil supply pressure (LP−1) reading.

D. Adjustment Procedure

(1) If the oil pressure data is not in the permitted limits, the the oil pressure must be adjusted as follows:

(a) For engines prior to SB PW4ENG 72−114 select new class oil tube metering nipple. See Figure 1302 and Table 1301.

(b) For engines incorporating SB PW4ENG 72−114 select new class oil tube metering nipple. See Figure 1303 and Table 1301.

WARNING: TAKE NECESSARY PRECAUTIONS TO AVOID POSSIBLE BURNS DUE TO CONTACT WITH HOT OIL.

(2) Replace the tube metering nipple as follows:

CAUTION: YOU MUST USE THE WRENCHING FLATS ON THE TUBE METERING NIPPLE WHEN YOU LOOSEN OR TIGHTEN THE TUBE NUTS. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

(a) Remove the lockwire from the tube nuts. While you hold the tube metering nipple with a wrench, loosen and disconnect the tube nuts from the nipple. Remove the nipple. See Figure 1304.

(b) Lubricate the back of the ferrules of the two tube nuts that attach to the nipple with Antigallant Compound P06−036. See Figure 1305. Install the new class nipple, threads lubricated with Antigalling Compound P06−021, to the tube nuts and tighten by hand.

CAUTION: YOU MUST USE THE WRENCHING FLATS ON THE TUBE METERING NIPPLE WHEN YOU LOOSEN OR TIGHTEN THE TUBE NUTS. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

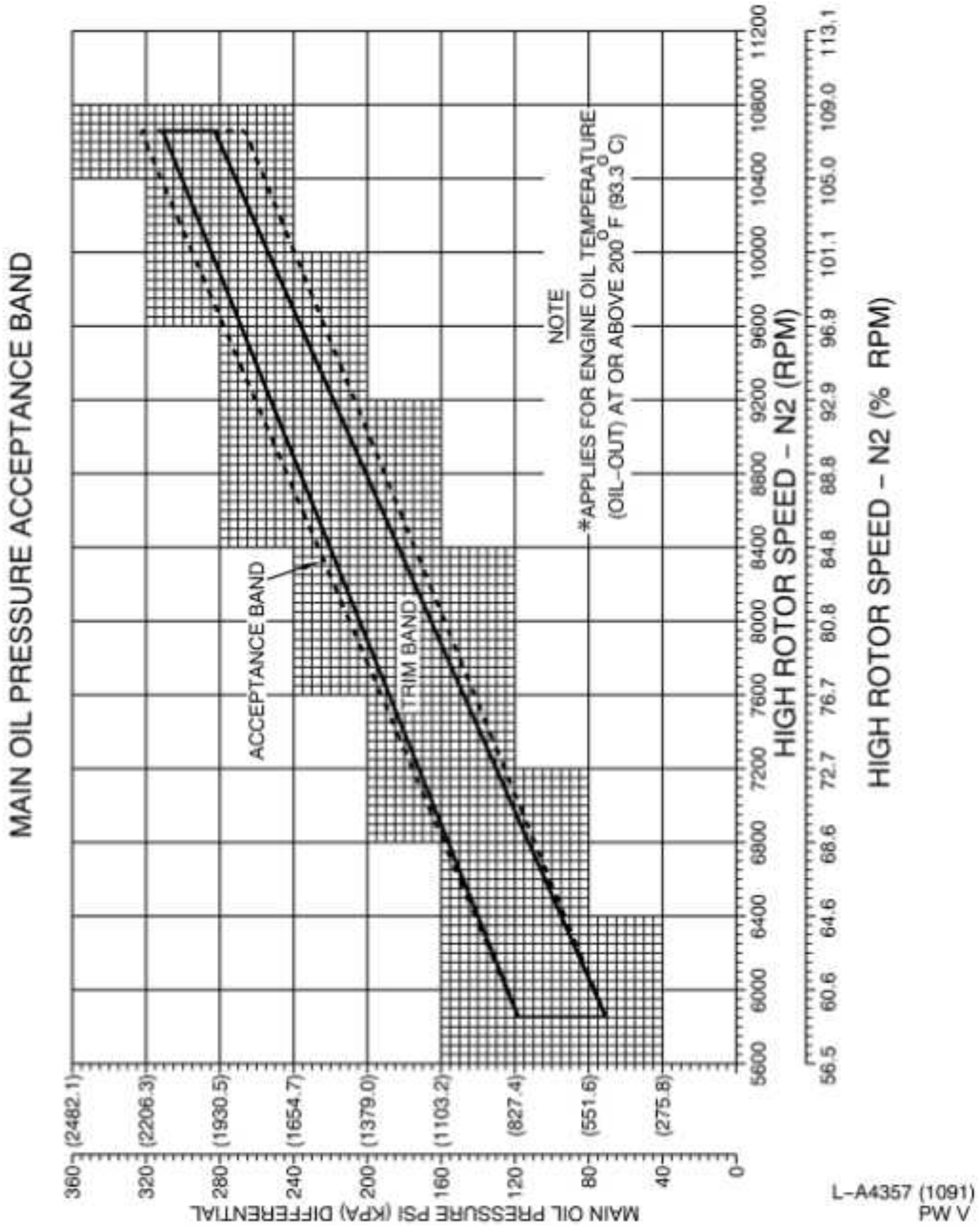
(c) While you hold the nipple with a wrench, torque the tube nuts to 675 − 750 lb−in. (76.265 − 84.739 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(3) If the tube metering nipple was replaced, it will be necessary to do the engine test procedure again to make sure the oil pressure is in the specified limits. Also check that the new metering nipple does not have an oil leak.

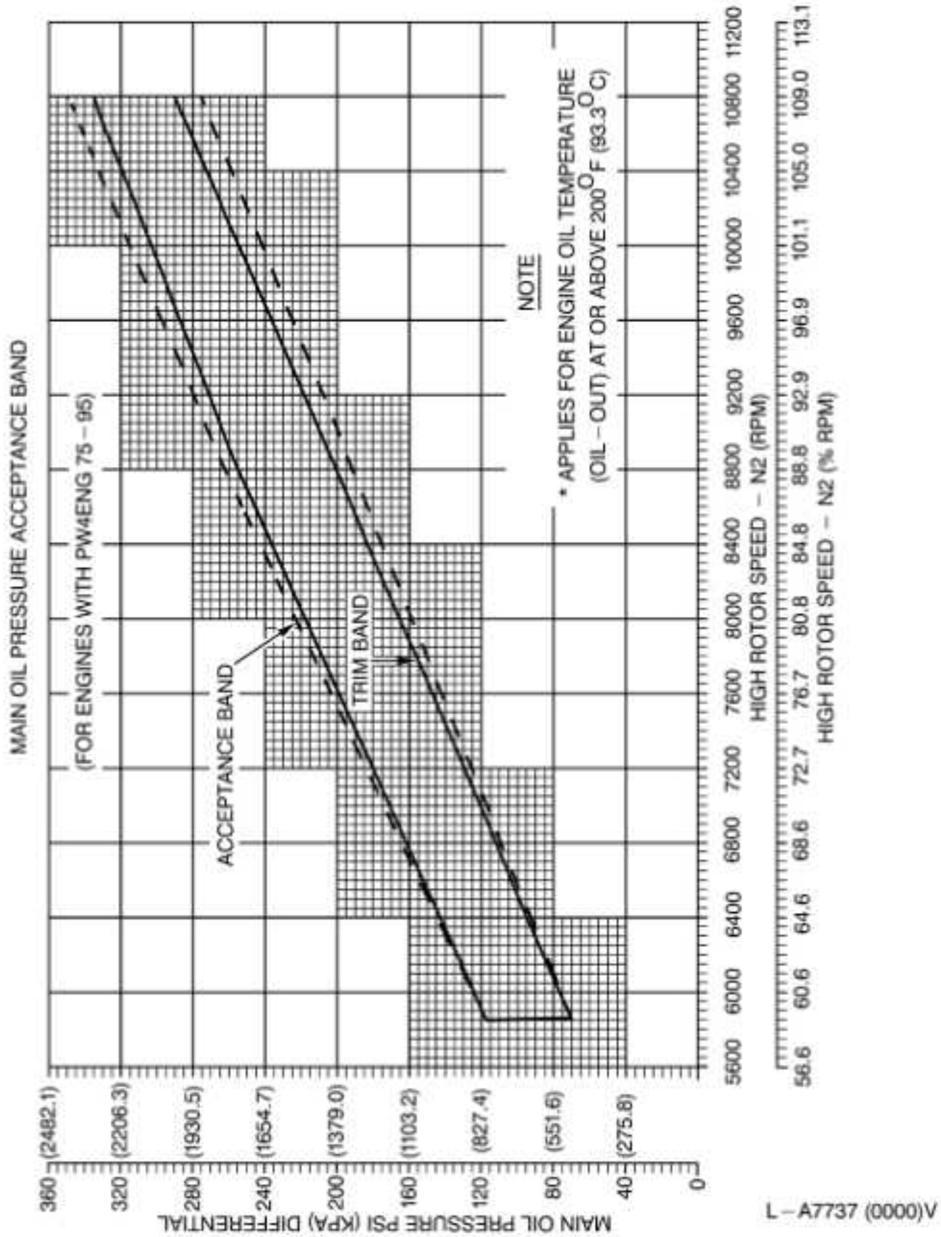
NOTE: Variation in main oil pressure readings from engine to engine is acceptable provided readings are within specified limits.

PART NUMBER	ORIFICE DIAMETER
52T955 CL 1	Over 0.099 - 0.101 Inch (Over 2.515 - 2.565 mm)
52T955 CL 2	Over 0.104 - 0.106 Inch (Over 2.642 - 2.692 mm)
52T955 CL 3	Over 0.109 - 0.111 Inch (Over 2.769 - 2.819 mm)
52T955 CL 4	Over 0.114 - 0.116 Inch (0ver 2.896 - 2.946 mm)
52T955 CL 5	Over 0.119 - 0.121 Inch (Over 3.023 - 3.073 mm)
52T955 CL 7	Over 0.123 - 0.125 Inch (Over 3.124 - 3.175 mm)
52T955 CL 8	Over 0.125 - 0.127 Inch (Over 3.175 - 3.226 mm)
52T955 CL 9	Over 0.127 - 0.129 Inch (Over 3.226 - 3.277 mm)
52T955 CL 10	Over 0.129 - 0.131 Inch (Over 3.276 - 3.327 mm)
52T955 CL 11	Over 0.131 - 0.133 Inch (Over 3.328 - 3.378 mm)
52T955 CL 13	Over 0.135 - 0.137 Inch (Over 3.429 - 3.480 mm)
52T955 CL 17	Over 0.143 - 0.145 Inch (Over 3.632 - 3.683 mm)
52T955 CL 20	Over 0.149 - 0.151 Inch (Over 3.785 - 3.835 mm)
52T955 CL 24	Over 0.157 - 0.159 Inch (Over 3.988 - 4.039 mm)
52T955 CL 27	Over 0.163 - 0.165 Inch (Over 4.140 - 4.191 mm)
52T955 CL 30	Over 0.169 - 0.171 Inch (Over 4.293 - 4.343 mm)
52T955 CL 33	Over 0.175 - 0.177 Inch (Over 4.445 - 4.496 mm)
52T955 CL 36	Over 0.181 - 0.183 Inch (Over 4.597 - 4.648 mm)
52T955 CL 39	Over 0.187 - 0.189 Inch (Over 4.750 - 4.801 mm)
52T955 CL 42	Over 0.193 - 0.195 Inch (Over 4.902 - 4.953 mm)
52T955 CL 45	Over 0.199 - 0.201 Inch (Over 5.055 - 5.105 mm)
52T955 CL 48	Over 0.205 - 0.207 Inch (Over 5.207 - 5.258 mm)

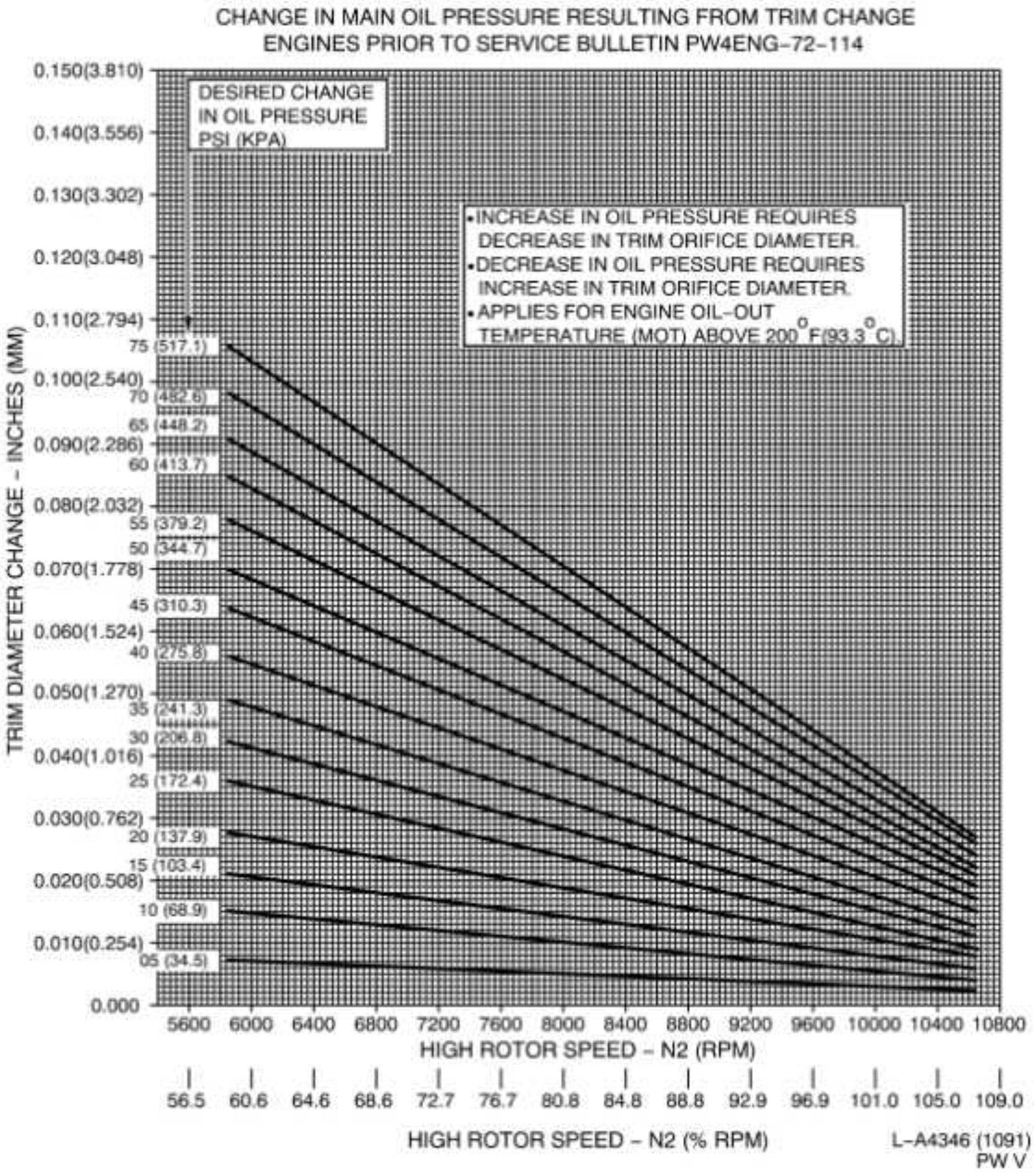
Metering Nipple Class Selection
Table 1301



Main Oil Pressure Limits (Oil Supply Pressure (LP−1) MINUS No. 1 And 2 Breather Pressure (LB−6) (For Engine Prior To SB PW4ENG 75−95)
Figure 1301 (Sheet 1)
(Task 71−00−00−760−047)



Main Oil Pressure Limits (Oil Supply Pressure (LP−1) MINUS No. 1 And 2 Breather Pressure (LB−6) (For Engines With SB PW4ENG 75−95)
Figure 1301 (Sheet 2)
(Task 71−00−00−760−047)

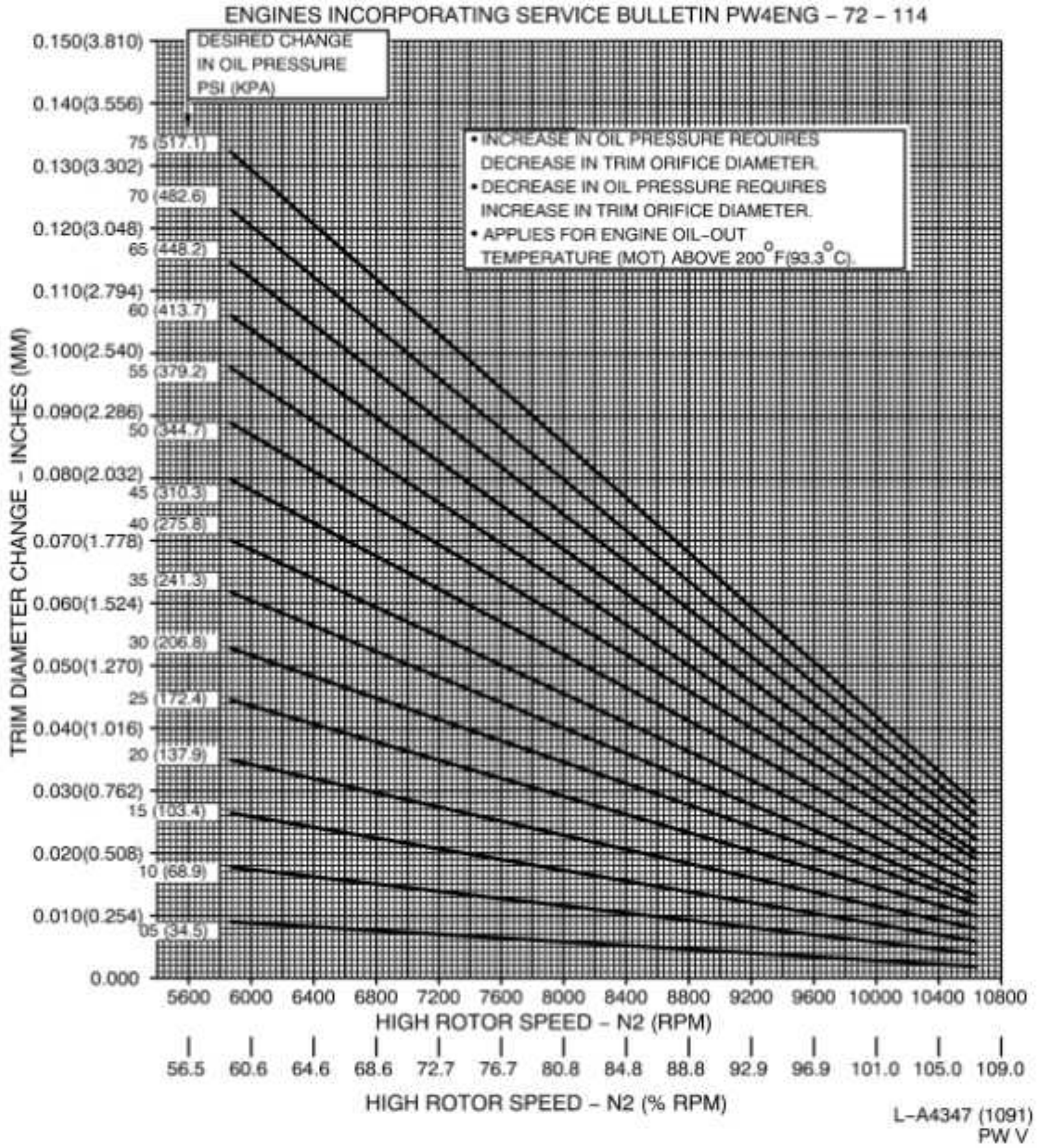


CHANGE IN MAIN OIL PRESSURE RESULTING FROM TRIM CHANGE
ENGINES PRIOR TO SERVICE BULLETIN PW4ENG-72-114

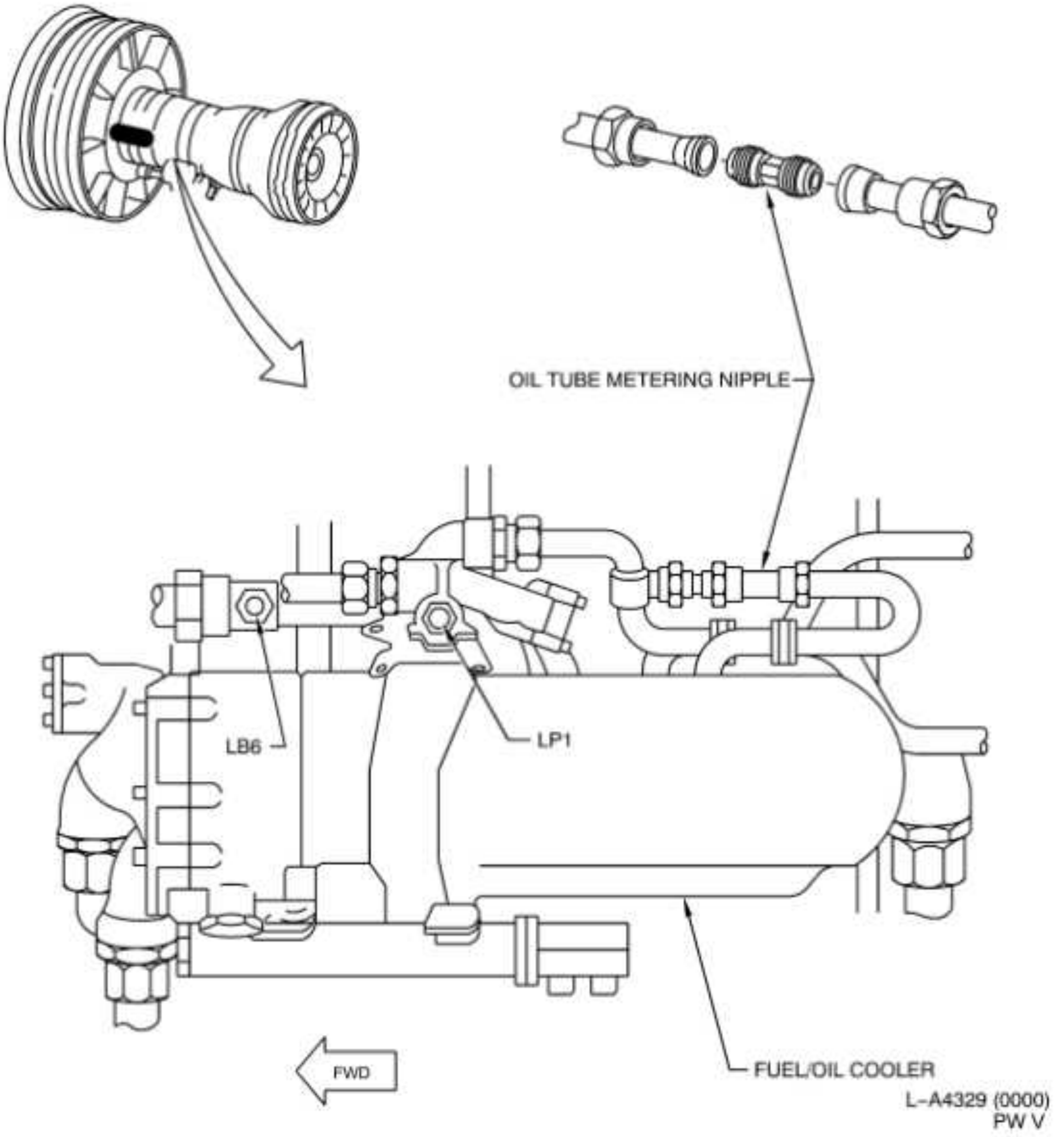
- INCREASE IN OIL PRESSURE REQUIRES DECREASE IN TRIM ORIFICE DIAMETER.
- DECREASE IN OIL PRESSURE REQUIRES INCREASE IN TRIM ORIFICE DIAMETER.
- APPLIES FOR ENGINE OIL-OUT TEMPERATURE (MOT) ABOVE 200°F(93.3°C).

L-A4346 (1091)
PW V

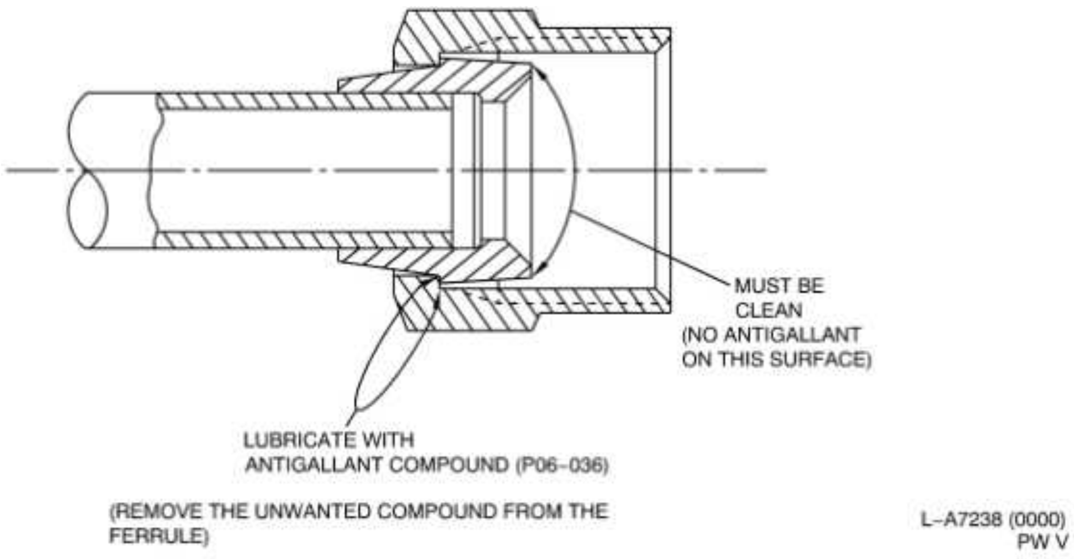
Oil Tube Metering Nipple Orifice Diameter
Selection (Engines Prior To PW4ENG 72-114)
Figure 1302
(Task 71-00-00-760-047)



Oil Tube Metering Nipple Orifice Diameter
Selection (Engines Incorporating PW4ENG 72–114)
Figure 1303
(Task 71–00–00–760–047)


OIL TUBE METERING NIPPLE
LB6
LP1
FWD
FUEL/OIL COOLER
L-A4329 (0000)
PW V

Oil Tube Metering Nipple Location
Figure 1304
(Task 71-00-00-760-047)


MUST BE
CLEAN
(NO ANTIGALLANT
ON THIS SURFACE)
LUBRICATE WITH
ANTIGALLANT COMPOUND (P06−036)
(REMOVE THE UNWANTED COMPOUND FROM THE
FERRULE)
L−A7238 (0000)
PW V

Application Of Antigallant Compound To Back Of Tube Ferrules
Figure 1305
(Task 71−00−00−760−047)

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Task 71-00-00-760-050:

1. Test No. 14 - P2/T2 Probe And P2 Supply Tube Leak Check

A. General

(1) Use this procedure to check the engine P2/T2 probe and P2 supply tubes for leaks. The PT2 system is pressurized from the EEC PT2/TT2 probe, located in the inlet cowl or bellmouth, to (and including) the EEC.

(2) No leaks in the system are acceptable. Any leaks found must be corrected.

(3) This PT2 system leak check must be performed following inlet cowl installation. See Testing-00, Test Reference Table, Task 71-00-00-990-003, for additional information.

B. Equipment And Tools Necessary

Standard Tools:

(1) A regulated air supply source that can supply air pressure between atmospheric and 10 psig (68.9 kPa). The gage must be accurate to ± 10 percent. The system must have an isolation shutoff valve. The air must be clean and dry.

(2) Tygon flexible tubing, 0.250 inch (6.350 mm) inside diameter.

Consumable Materials:

Item No.	Designation
P05-007	Leak Check Fluid (PMC 9569 or PMC 2277)

C. Procedure

(1) Find the P2/T2 probe and the EEC. The P2/T2 probe is found in the engine intake. The EEC is found on the outside of the fan case at approximately the 7 o'clock position. Figure 1301 (Sheet 1).

NOTE: This procedure supplies low pressure air to the P2 system to test for leaks. Leaks are not permitted for the P2 system. If the P2 system has leaks, they must be repaired.

(2) Get the regulated air pressure supply.

  (a) The air pressure must be accurately set between atmospheric and 10 psig (68.9 kPa) maximum.

  (b) The pressure must be checked with a gage with an accuracy of ± 10 percent.

  (c) The air must be clean and dry.

  (d) The supply system must have an isolation shutoff valve.

CAUTION: DO NOT LET THE AIR PRESSURE SUPPLY GO MORE THAN 15 PSIG (103.4 kPa) TO THE P2 SYSTEM. HIGHER PRESSURE CAN CAUSE DAMAGE TO THE EEC.

(3) Pressurize the PT2 system to 10 psig (68.9 kPa) maximum, holding flexible tubing (Tygon tubing 0.250 inch (6.350 mm) ID or equivalent) to PT2 inlet port of probe. Figure 1301 (Sheet 2).

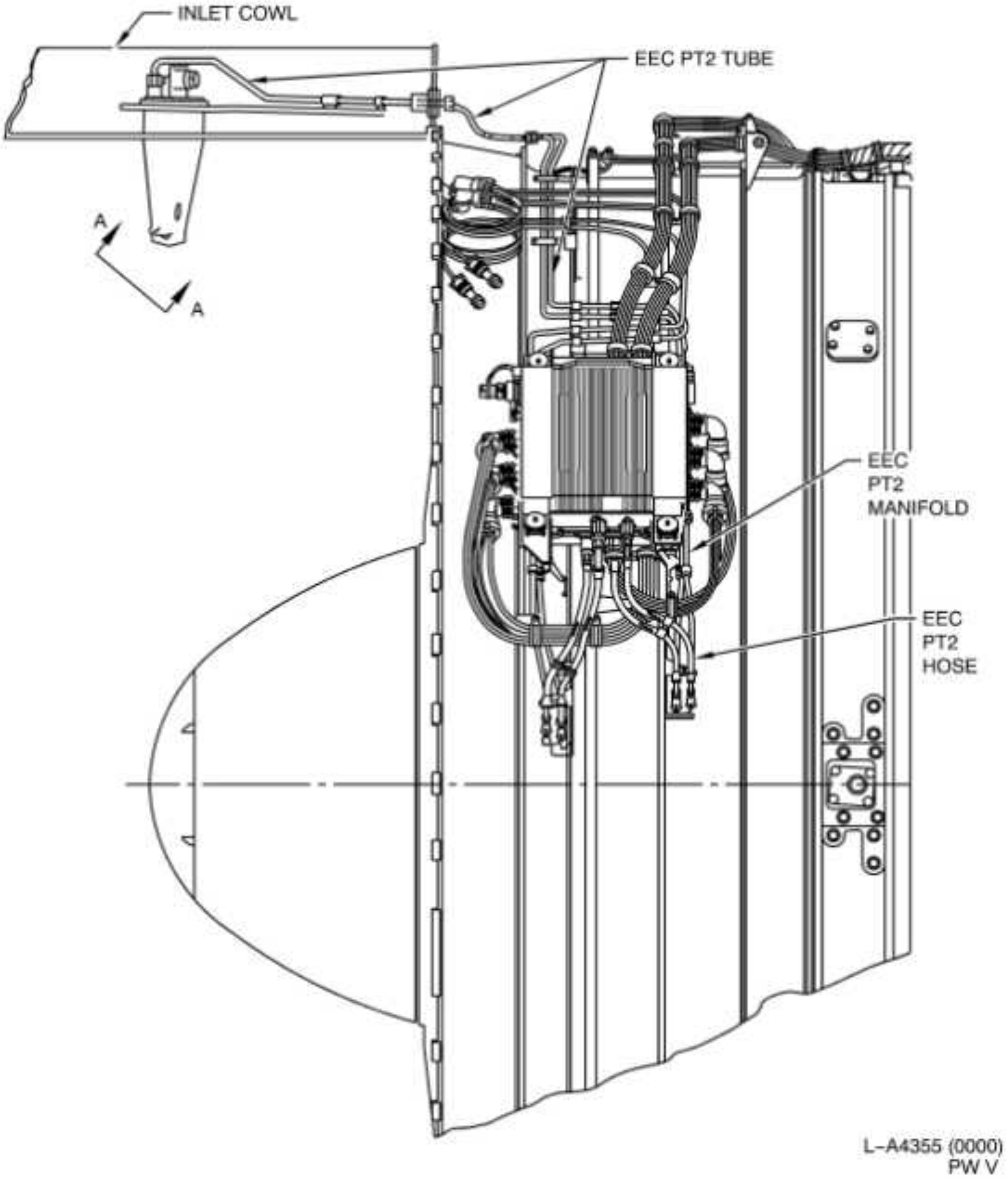
(4) Turn the shutoff valve to the off position to isolate the P2 system. If the pressure decreases there is a leak in the P2 system.

(5) Use Leak Check Fluid P05−007 to find the leak.

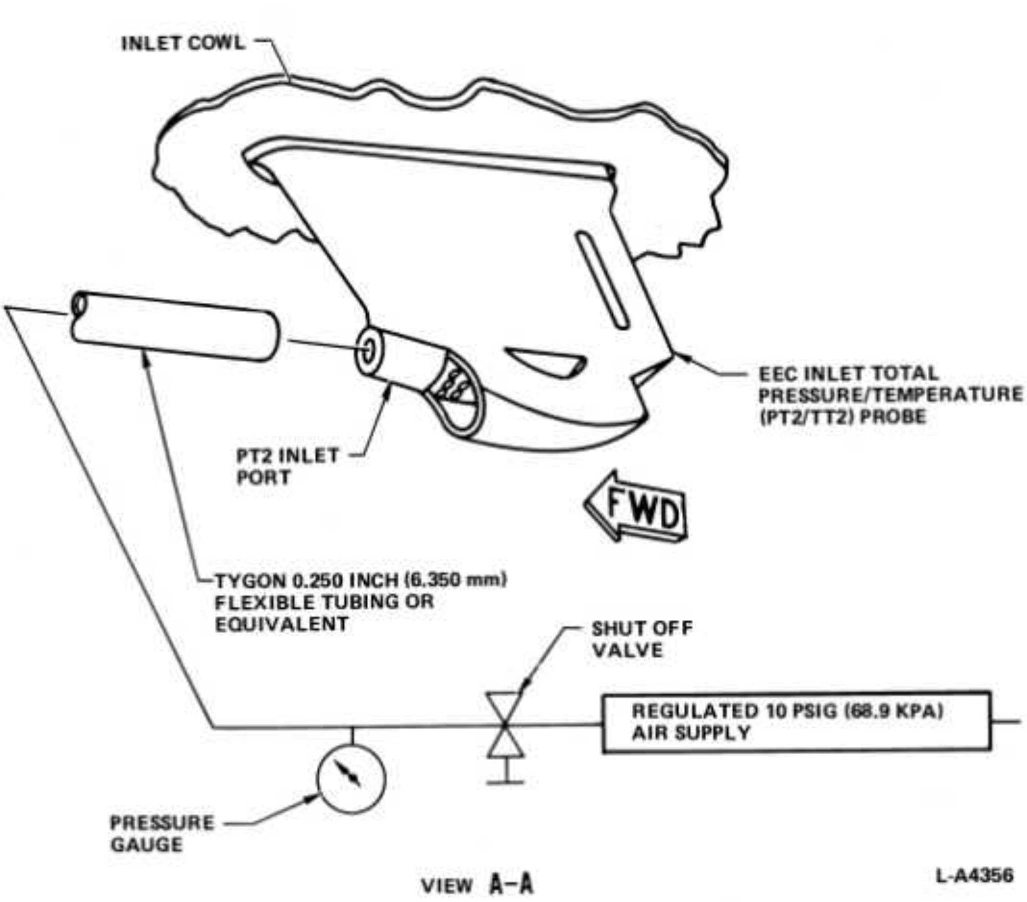
(6) Repair the leaks as necessary.

(7) After the leaks are repaired, do the P2 pressure check again to make sure all the leaks are repaired.

(8) Remove the air supply from the engine.


INLET COWL
EEC PT2 TUBE
A
A
EEC
PT2
MANIFOLD
EEC
PT2
HOSE
L−A4355 (0000)
PW V

View Of P2 Probe And Supply Tubes − PT2 System Leak Check
Figure 1301 (Sheet 1)
(Task 71−00−00−760−050)


INLET COWL
EEC INLET TOTAL PRESSURE/TEMPERATURE (PT2/TT2) PROBE
PT2 INLET PORT
FWD
TYGON 0.250 INCH (6.350 mm) FLEXIBLE TUBING OR EQUIVALENT
SHUT OFF VALVE
REGULATED 10 PSIG (68.9 KPA) AIR SUPPLY
PRESSURE GAUGE
VIEW A−A
L-A4356

View Of P2 Probe And Supply Tubes − PT2 System Leak Check
Figure 1301 (Sheet 2)
(Task 71−00−00−760−050)

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Task 71-00-00-790-001:

1. Test No. 18 - Oil System Leak Test (Dye Method)

A. General

(1) Use the Oil System Leak Test to find the leaks in the oil system with a blue dye that is applied to the engine oil before the test. Use of blue dye is optional for detection of leaks. After this test, the oil with the dye must be drained from the engine. This will permit a distinction between a nuisance leak (from engine assembly oil weeping from seams) and a true leak from the engine lube system.

B. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03-001	Lubricant, Engine Oil (PWA 521)
P05-459	Dye, Blue (PMC 4513)

C. Prepare The Oil System For The Leak Test

WARNING: BEFORE YOU REMOVE THE OIL TANK CAP, YOU MUST WAIT A MINIMUM OF FIVE MINUTES AFTER SHUTDOWN TO LET THE OIL PRESSURE BLEED OFF. THE HOT OIL CAN BURN YOUR EYES AND SKIN.

(1) Drain the oil system fully with the existing procedures.

(2) Mix the Blue Dye P05-459 with the Engine Oil Lubricant P03-001 by Solutions-01 (Task 70-22-00-980-001-197). Refer to Section 70-22-00 in the Standard Practices Manual, PN 585005.

(3) Add the SP 197 Blue dye solution in the oil system at the engine oil tank to refill the system by the applicable procedures. Refer to Section 72-61-00, Disassembly-01 and Assembly-05 for the removal and installation of the oil tank cap.

(4) Clean all the remaining oil from the engine external surfaces, tubes, components and accessories by SPOP 1 (Task 70-21-00-110-047) or SPOP 208 (Task 70-21-00-110-040). Refer to Section 70-21-00 in the Standard Practices Manual, PN 585005.

D. Test Procedure (Idle Only)

(1) Start the engine by the Normal Engine Start Procedure (Task 71−00−00−760−004).

(2) Let the engine become stable for five minutes at minimum idle.

(3) Make sure all the engine parameters are in the permitted limits. The oil temperature must be at the operating limits. See Engine Operation Limits (Task 71−00−00−990−007).

(4) Do an engine shutdown by the Normal Shutdown Procedure (Task 71−00−00−760−005).

E. Procedure After Idle Testing

(1) Do a visual inspection of the engine for oil leaks. The leak location will be identified by the blue fluid at the tube joints or component.

NOTE: Amber color leaks are the result of assembly fluids. Blue leaks are the result of engine oil.

(2) Check the seal drains for signs of the blue fluid.

(3) If necessary, repair the joints or components with leaks. After all the leaks are repaired, clean the dye by SPOP 1 (Task 70−21−00−110−047) or SPOP 208 (Task 70−21−00−110−040) and then check the oil system again for leaks. Refer to Section 70−21−00 in the Standard Practices Manual, PN 585005.

NOTE: It is possible that more running time is necessary at high power to get wetting of the leak area. Running time should be kept to a minimum to prevent too much leakage.

NOTE: If a satisfactory leak check is done, go to Step H (1) after all the leaks are repaired.

F. Optional Test Procedure (TAKE−OFF power)

NOTE: This testing is not necessary if you find all the leaks by the first testing (idle only) procedure.

(1) Start the engine by the Normal Engine Start Procedure (Task 71−00−00−760−004).

(2) Let the engine become stable for five minutes at minimum idle.

(3) Make sure all the engine parameters are in the permitted limits. The oil temperature must be at the operating limits. See Engine Operation Limits (Task 71−00−00−990−007).

(4) Operate the engine at TAKE−OFF Power for one minute.

(5) Reduce the engine power to 1.3 EPR. Stay at this power for two to three minutes.

(6) Do an engine shutdown by the Normal Shutdown Procedure (Task 71−00−00−760−005).

G. Procedure After Optional Testing

R NOTE: For engines in test cell, Item (3) thru Item (6) are
R not applicable.

(1) Do a visual inspection of the engine for oil leaks. The leak location will be identified by the blue fluid at the tube joints or component.

NOTE: Amber color leaks are the result of assembly fluids. Blue leaks are the result of engine oil.

(2) Check the seal drains for signs of the blue fluid.

(3) If necessary repair the joints or components with leaks. After all the leaks are repaired, clean the dye by SPOP 1 (Task 70−21−00−110−047) or SPOP 208 (Task 70−21−00−110−040) and then check the oil system again for leaks. Refer to Section 70−21−00 in the Standard Practices Manual, PN 585005.

H. Procedure After All Leaks Are Repaired

(1) After all the leaks are repaired, drain the dyed oil from the oil system. Drain the oil from the oil tank, main gearbox, angle gearbox, magnetic chip detectors and remove the main oil filter element. Refer to Section 72−00−00, Servicing−03 (Task 72−00−00−610−003).

(2) Remove the main oil filter element and replace with a new one.

NOTE: Make sure you service the oil system before you return the engine to service.

(3) Fill the oil system with new oil and install a new main oil filter element. Refer to Section 72-00-00, Servicing-03 (Task 72-00-00-610-003).

(4) Start the engine by the Normal Engine Start Procedure (Task 71-00-00-760-004).

(5) Operate the engine for three minutes minimum time at minimum idle.

(6) Do an engine shutdown by the Normal Shutdown Procedure (Task 71-00-00-760-005).

(7) Drain the oil from the oil system. Drain the oil from the oil tank, main gearbox, angle gearbox, magnetic chip detectors and remove the main oil filter element. Refer to Section 72-00-00, Servicing-03 (Task 72-00-00-610-003).

(8) Fill the oil system with new oil and install a new main oil filter element. Refer to Section 72-00-00, Servicing-03 (Task 72-00-00-610-003).

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Task 71−00−00−760−043:

1. Test No. 19 − Trim Balance Procedure and Test

A. General

(1) See Test No. 19 − Sommervaille Three Weight Method Task 71−00−00−760−052 for optional procedure.

(2) See Test No. 19 − Optional "P" Flange Location For Low Rotor (N1) Trim Balance Procedure, Task 71−00−00−760−057 for optional procedure.

(3) If the N1 rotor vibration amplitude and/or phase angle values are not stable from one test run to the next test run, lubrication of the Stage 1 LPC (fan) blades can be necessary. The fan blade root lubrication procedure, (Task 71−00−00−380−002), follows this trim balance task.

B. Equipment And Materials

Standard Tools:

Vibro Tool Marker	Used for marking counterweights
Analyzer, Vibration	Spectral Dynamics Model SD119 or Endevco 68101A or Mechanical Technology Inc. Model 4000, PBS 4100 or equivalent.
Generator, Optical	Endevco 35389 or equivalent phase reference tachometer.
Amplifier, Isolation	100K ohms − Endevco or equivalent (may not be required − dependent on analyzer model/type used)
Amplifier, Charge	Endevco or Mechanical

Standard Tools:

(CONTINUED)

Technology Inc., or
equivalent

Standard Tools are available from:

Endevco Corp.
30700 Rancho Viejo Road
San Juan Capistrano
CA 92675
USA

Mechanical Technology Inc.
968 Albany−Shaker Road
Latham
NY 12110
USA

Spectral Dynamics
P.O. Box 671
San Diego, CA 92112

Special Tools:

PWA 76855	Pump, Hydraulic (Use With PWA 86302)
PWA 85234	Riveter, Hand (For LPC counterweights)
PWA 85306	Puller, Knocker (For turbine shaft plug)
PWA 85703	Accelerometer And Lead Assembly (2 Required)
PWA 85774	Bracket, Accelerometer (P Flange)
PWA 86137	Bracket, Accelerometer (A Flange)
PWA 86140	Harness Assembly
PWA 86302	Bender, Hydraulic, For 6th Stage Turbine Blade (Use With PWA 76855 Pump) (Optional to PWA 102335)
PWA 101024	Drift, (For Removal of 6th Stage LPT Blade Counterweights)
PWA 102335	Bender, Mecha nical, For 6th Stage Turbine Blade − (Optional To PWA 86302)

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−018	Pencil, Silver
P05−026	Ink
P05−135	Tape, Reflective
P06−002	Petrolatum, White

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Counterweight, LPC Fan Hub	As Necessary	72-31-00/4/40
Counterweight, LPC Fan Hub	As Necessary	72-31-00/4/50
Rivet, Fan Counterweight	As Necessary	72-31-00/4/60
Counterweight, LPT Clip-On	0 - 10	72-53-00/6/100
Packing	1	72-32-00/2/30

C. General Trim Balance Specifications

NOTE: If vibration occurred after fan blade replacement, the replaced blades should be inspected to verify that the moment weight pairs do not exceed 1.0 oz-in. (720. g.mm) difference. The moment weight is marked on the concave airfoil surface inboard of the mid-span shroud. If necessary, replace with a different set of moment weight fan blade pair.

CAUTION: TRIM BALANCE SHOULD NOT BE USED TO CORRECT VIBRATION CAUSED BY MECHANICAL PROBLEMS. EXAMPLES OF THIS TYPE OF PROBLEM ARE:

CAUTION: INCORRECT ASSEMBLY - INCORRECT ASSEMBLY DURING ENGINE OVERHAUL OR REPAIR CAN BE SHOWN BY VIBRATION LEVELS LARGER THAN TWICE THE VIBRATION LIMIT. SEE 71-00-00, TESTING-00, Task 71-00-00-990-007.

CAUTION: DAMAGE TO ROTOR PARTS - PART DAMAGE MUST BE REPAIRED BEFORE ENGINE TRIM BALANCE.

(1) Trim balance can decrease engine vibration. The trim balance procedure adds a small amount of weight to correct unbalance. The weight(s) are installed on the compressor front balance plane and the turbine rear balance plane. The trim balance procedure is done on the engine while it is in the test stand.

(2) Trim balance is only used to correct stable low rotor related (1EL) vibration.

(3) It is recommended that you do a fan plane balance first for two reasons:

  (a) Because a fan plane balance will cause the vibration values to decrease at both the "A" and "P" flange (LPT) pickups.

  (b) Because it is easier to install fan plane trim balance counterweights than the LPT counterweights.

(4) The total vector sum of the trim balance weights and the weights installed for component (LPC) balance must not be more than the limits that follow:

  (a) Fan plane: 50 oz−in. (36,000 g.mm)

  (b) LPT: 48 oz−in. (34,560 g.mm)

  (c) Engines that require more correction weight than allowed should be inspected for incorrect assembly and/or part damage.

(5) Identify all the trim balance weights permanently with the letters "TB".

  NOTE: The balance weights installed on the fan hub during LPC balance are not identified with the letters "TB".

(6) If the sum of the low rotor and the high rotor vibration does not equal the total vibration, then some N1 or N2 related vibration harmonics can be present. The total vibration limit applies to the square root of the sum of the N1 vibration squared plus the N2 vibration squared.

(7) Trial balance weights are identified as CW1, CW2, CW3, etc.

(8) Definitions:

  (a) 1EL: The low rotor related vibration.

(b) Vibration Units: Measure vibration displacement in mils (mm) or vibration velocity in inches per second (mm per second).

1 mil = 0.001 inch (0.025 mm)

(c) Phase Angle Lag: The angle the low rotor turns during the time the "heavy point" goes by the vibration transducer and the effect of this is shown.

NOTE: This procedure uses phase measurement equipment that measures from the N1 speed pulse to the vibration pulse (maximum). Measure positive angles, in this coordinate system, in the opposite direction from the direction in which the engine turns. Some phase measurement equipment, such as MTI equipment, measure positive angles in the direction in which the engine turns (lead angle).

(d) Phase Angle: The angle between the signal from the vibration transducer and the signal from the once per revolution N1 speed reference.

(e) Sensitivity: The moment weight that causes 1.0 mil (0.025 mm) of vibration.

(f) Once Per Revolution N1 Speed Reference: The short tooth of the tachometer gear on the turbine shaft coupling makes a signal to the N1 speed transducer once each revolution. As an alternative method, use an optical tachometer for the once per revolution N1 speed reference.

(g) N1 Reference Blade: Fan blade ink marked for reference to short tooth location.

(h) Stable Vibration: Stable vibration is a vibration of which the maximum does not change by more than one quarter of the average (vibration) during 30 seconds of engine operation.

(i) Vibration Survey: The process of acquiring and recording engine vibration data versus rotational speed during an engine acceleration/deceleration. This is used to document that an engine is within vibration limits or to identify peak vibration levels at certain engine speeds which are not within vibration limits.

(j) Trim Balance Survey: The process of acquiring and recording at each peak vibration level the steady state (1EL) low rotor engine vibration amplitude and phase angle data used to make the correction weight calculations.

D. Procedure

(1) Install the accelerometers (vibration transducers). See Figure 1301 (Sheet 1) and (Sheet 2).

NOTE: Install accelerometer leads along tubes and harnesses, and attach every 12 − 16 inches (305. − 406. mm). Do not install on tubes which contain hot bleed air. Install accelerometer leads so that they will not touch the closed nacelle doors.

(a) Install a PWA 86137 Bracket and a PWA 85703 Accelerometer And Lead Assembly to the bracket on Flange A, in bolt hole No. 3 location from 12:00 o'clock position. See Figure 1301 (Sheet 1).

(b) Install a PWA 85774 Bracket and a PWA 85703 Accelerometer And Lead Assembly on Flange P in bolt holes No. 18 and 19 locations from 12:00 o'clock position. See Figure 1301 (Sheet 2).

(2) Find the mark (recess) that refers to the once per revolution N1 speed signal.

(a) Remove the compressor inlet cone. See 72−00−31, Removal−02 Task 72−00−31−020−001.

(b) Remove the key washer retaining ring and the retaining nut key washer which holds the turbine shaft plug, at the front of the coupling. Use a PWA 85306 Puller to remove the plug. Discard the packing. See Figure 1302.

(c) Find the small recess on the end of the turbine shaft coupling assembly. This recess shows the location of the short tooth which makes the signal for the N1 speed transducer. Mark the fan blade which is aligned with this recess, using Ink P05−026, in an easily seen location. If an optical tachometer is used, install a 4 inch (101.600 mm) by 5 inch (127.000 mm) piece of Tape P05−135 on a fan blade.

NOTE: When the optical method is used the ink marked fan blade and rub strip must still be aligned before you install any trim balance weights.

(d) Install a new packing lubricated with Petrolatum White P06−002, to the turbine shaft plug. Install the plug to the coupling ID and install the key washer and the retaining ring.

NOTE: Make sure retaining ring is fully inserted in the retaining nut groove, all around, and ring end gap is 0.010 inch (0.254 mm).

(e) Examine the hub flange for installed counterweights. Check each counterweight for the letters "TB" marked on the inner diameter face. Remove all the counterweights marked "TB"

NOTE: Remove only those counterweights marked "TB".

(f) Install the compressor inlet cone. See 72−00−31, Install−02 Task 72−00−31−420−001.

(g) Make a mark on the fan blade rubstrip, with Silver Pencil P05−018, at the N1 transducer location which is at the seven o'clock position (when seen from the front).

(3) Install the trim balance equipment. See Figure 1303 or Figure 1304.

NOTE: If the N1 speed transducer is used: N1 signal comes from the N1 speed transducer on either the Channel A connector J19 pins "1" and "2" or the Channel B connector J19 pins "4" and "5".

(a) Install a PWA 86140 Harness Assembly to the N1 probe connector and plug it into the isolation amplifier/vibration analyzer equipment.

NOTE: An isolation amplifier may not be required dependent upon the model/type of the vibration analyzer used.

(b) Attach Flanges A and P vibration PWA 85703 Accelerometer Wire Leads, at two places, into the charge amplifier/vibration analyzer equipment

NOTE: The N1 signal characteristics are: The minimum, no load, equals one volt. The maximum, no load, equals 30 volts. The frequency (Hz) equals N1 rpm (from the short tooth signal).

(4) Operate the engine in it's "as is" (before trim balance) condition. See 71-00-00 Testing-08, Task 71-00-00-760-032.

(a) Make sure the trim balance equipment operates correctly during engine operation. Make sure that the N1 speed shown on the trim balance analyzer and test stand agree. Make sure that the phase angle becomes stable as the engine becomes stable.

(b) Make a graph of the vibration and the N1 speed. Find the N1 speed that causes the maximum 1EL. Return the engine to idle.

(c) Wait five minutes at idle and find four to six steady state speeds; above, below and at the problem N1 speed, 100 rpm apart, and at the maximum allowable operating speed. See Power Plant General - Testing-00, Engine Operation Limits Task 71-00-00-990-007.

(d) Start of the lowest N1 speed found in the step above. Accelerate to each steady state speed, and record Flanges A and P 1EL and phase angle.

(e) Shut down engine as described for normal engine shutdown.

(5) Find which low rotor plane (the fan or the LPT) will be trim balanced. A vibration maximum at an approximate N1 speed of 2000 rpm for Flange A and 2800 rpm for Flange P is caused by LPT plane unbalance. A vibration maximum at an approximate N1 speed of 2500 rpm for Flange A and/or a high vibration at TAKEOFF (1.4 EPR) on Flanges A and P is caused by unbalance in the fan plane.

NOTE: These speeds are estimates and they come from test stand data. As your data base increases, you can adjust these estimates to make them more accurate.

(6) Find the angular location and the amount of 1EL, at each of the N1 speeds, at which a maximum vibration occurs. Make a polar graph of the results. Install CW1 by one of the methods that follows.

(a) If the polar graph shows a group of different points at which correction is necessary; then install CW1 at the center of the area which contains most of these points. This area must be within a 60 degrees angle and the moment weight quantity of the points within this area will vary by a maximum ratio of two to one.

(b) If no group of correction points exists, then install CW1 to reduce the maximum 1EL.

(7) Calculate the moment weight and the location of the first trial balance weight (CW1).

(a) Find the moment weight of CW1 by multiplying the value of the "as is" unbalance, Vector A (1EL), by the sensitivity (fan or LPT).

CW1 = sensitivity x 1EL

The sensitivity used for estimating the moment weight of CW1 is:

Fan 15 oz−in/mil (10800 g.mm/0.025 mm) Flange A
LPT 20 oz−in/mil (14400 g.mm/0.025 mm) Flange P

Example: If maximum Flange P vibration is 2 mils (0.051 mm) at 2800 rpm then an unbalance in the LPT plane is shown. Calculate the moment weight of CW1 as follows:

CW1 = 20 oz−in/mil (14400 g.mm/0.025 mm) x 2.0 mils (0.051 mm)

CW1 = 40 oz−in. (28800 g.mm)

(b) Align the ink marked fan blade (which shows the location of the short tooth) with the ink mark on the fan blade rubstrip (which shows the location of the N1 speed transducer).

(c) The correct location of CW1 is unknown if the phase angle lag is unknown. If a data base for the phase angle lag is available it can be used to find the location of CW1 (see optional procedure). If a data base for the phase angle lag is not available, then install CW1 at any angular location.

(8) Turn the low rotor and align the ink marked fan blade (reference for the short tooth) with the N1 speed transducer. Install the trail balance weight and record the location.

(9) Install the trial balance weight on the fan plane.

(a) Use an engine weight for the trial balance weight.

1 Use a Silver Pencil P05−018 and mark the inlet cone front segment and the inlet cone (rear) segment for alignment during installation.

2 Remove the six bolts and washers which hold the compressor inlet cone front segment to the compressor inlet cone (rear) segment.

3 Install an engine weight and use a cotter pin, or a rivet with a piece of tape, to hold the weight in position. See Table 1301.

RIVETED LPC FAN HUB COUNTERWEIGHTS

PART NUMBER/ CLASS	MOMENT WEIGHT WITH RIVET PN 534494	MOMENT WEIGHT WITH COTTER PIN PN MS9245−45
534493 CLS 1	2.0 oz−in. (1440 g.mm)	2.2 oz−in. (1584 g.mm)
534493 CLS 2	2.4 oz−in. (1728 g.mm)	2.5 oz−in. (1800 g.mm)
534493 CLS 3	2.8 oz−in. (2016 g.mm)	2.9 oz−in. (2088 g.mm)

Table 1301

RIVETED LPC FAN HUB COUNTERWEIGHTS

PART NUMBER/ CLASS	MOMENT WEIGHT WITH RIVET PN 534494	MOMENT WEIGHT WITH COTTER PIN PN MS9245-45
534495 CLS 1	4.9 oz-in. (3528 g.mm)	5.0 oz-in. (3600 g.mm
534495 CLS 2	5.3 oz-in. (3816 g.mm)	5.4 oz-in. (3888 g.mm)
534495 CLS 3	5.7 oz-in. (4104 g.mm)	5.8 oz-in. (4176 g.mm)
534495 CLS 4	6.1 oz-in. (4392 g.mm)	6.2 oz-in. (4464 g.mm)
534495 CLS 5	6.5 oz-in. (4680 g.mm)	6.6 oz-in. (4752 g.mm)
1B4294	12.8 oz-in. (9216 g.mm)	12.9 oz-in. (9288 g.mm)

Table 1301 (Continued)

4 Align the pencil mark on the inlet cone front segment with the pencil mark on the inlet cone (rear) segment. Install the cone front segment with six washers and bolts, lubricated with Engine Oil P03-001. Tighten and torque bolts to 45 - 50 lb-in. (5.084 - 5.649 N.m).

(10) Install the trial balance weight on the LPT plane.

(11) Do the vibration survey, see 71-00-00 Testing-08, Task 71-00-00-760-032 with the trial balance weight installed. Make a graph of the vibration and the N1 speed.

(12) If the vibration is less than the recommended guidelines, then go to the step that follows, and install the permanent counterweight(s).

(13) If the vibration is not within the recommended guidelines, then perform another trim balance survey. Calculate and install a second trial balance weight (CW2). If necessary, a third trial balance weight (CW3) can be installed.

NOTE: This calculation is done for each N1 speed and for each of the accelerometer locations.

(a) Make a polar graph of the "as is" 1EL and the phase angle. This is Vector A.

(b) Make a line for Vector R, which is equal and opposite (180 degrees) from Vector A. Vector R shows the effect that CW2 should cause.

(c) Make a line for Vector C, which shows the effect caused by CW1.

(d) Make a line for Vector D, which shows the vector difference between Vectors A and C. Subtract Vector C from Vector A and make Vector D with the arrow pointed to Vector C. Move Vector D to the origin of the polar graph.

(e) Calculate the moment weight and the location of the second trial balance weight (CW2).

1 CW2 = CW1 x A/D

2 Find the angle from Vector D to Vector R. Turn from CW1 by this same angle and direction for the location of CW2.

(f) An example of vector balance method follows.

1 A high level of 1EL at TAKEOFF (1.4 EPR) on Flanges A and P shows unbalance in the fan plane.

2 Make a polar graph of the "as is" 1EL and the phase angle. 1EL equals 2.6 mils (0.066 mm) at 60 degrees. This is Vector A. See Figure 1305.

3 Make a line for Vector R, which is equal and opposite (180 degrees) from Vector A. Vector R equals 2.6 mils (0.066 mm) at 240 degrees.

4 Calculate the moment weight of trial balance weight.

CW1 = Sensitivity x 1 EL

39 oz−in. (28080 g.mm) = 15 oz−in./mil
(10800 g.mm)/(0.025 mm) x 2.6 mils (0.066 mm)

5 Install CW1 at 10 degrees. Make a mark on the polar graph equal to 2.6 mils (0.066 mm) at 10 degrees.

NOTE: The correct location of CW1 is unknown if the phase angle lag is unknown. In this example, 10 degrees is used arbitrarily.

6 Operate the engine with the trial balance weight installed. Make a vibration survey. Make a graph of the vibration and the N1 speed. 1EL equals 2.0 mils (0.051 mm) at 340 degrees. This is Vector C.

7 Subtract Vector C from Vector A and make Vector D with the arrow pointed to Vector C. Move Vector D to the origin of the polar graph. Vector D equals 3.0 mils (0.076 mm) at 281 degrees.

8 Calculate the correct moment weight of CW2.

CW2 = CW1 x A/D

33.8 oz−in. (24336 g.mm) = 39 oz−in. (28080 g.mm) x 2.6 mils (0.066 mm)/3.0 mils (0.076 mm)

NOTE: Sensitivity can be calculated, at any speed point, by dividing the moment weight by the measured response. In this example 39 oz−in. (28080 g.mm)/3.0 mils (0.076 mm) = 13.0 oz−in. (9360. g.mm) per mil (0.025 mm).

9 Find the correct location for CW2. The angle between Vector D (281 degrees) and Vector R (240 degrees) is 41 degrees. Install CW2 at 41 degrees from the location of CW1, in the direction of Vector R. Remove CW1. Install CW2 at 329 degrees. This will cause Vector D to align with Vector R.

10 Find the phase angle lag, which is the angle between CW1 and effect of Vector D, measured in the opposite direction from which the engine turns. Phase angle lag in this example is 89 degrees

(g) This data can be used for increased accuracy on future trim balance attempts, see optional procedure.

(14) Remove the trial balance weights and install the permanent counterweight(s).

(a) Install the counterweights on the fan plane.

1 Use a Silver Pencil P05−018 and mark the inlet cone front segment and the inlet cone (rear) segment for alignment during installation.

2 Install the counterweight(s) with a rivet. Use a PWA 85234 Riveter to make a 0.125 inch (3.175 mm) diameter head on the rivet. See Figure 1306.

NOTE: Vibro peen the letters "TB" on the inner diameter face of all the trim balance counterweights.

3 Align the pencil mark on the inlet cone front segment with the pencil mark on the inlet cone (rear) segment. Install the cone front segment with six washers and bolts, lubricated with Engine Oil P03−001. Tighten and torque bolts to 45 − 50 lb−in. (5.084 − 5.649 N.m).

(b) Install the counterweights on the LPT plane. See Figure 1307.

1 Determine the quantity of LPT blade clip−on counterweights. See Table Table 1302.

LPT BLADE COUNTERWEIGHT

PART NUMBER	ATTACHMENT METHOD	MOMENT WEIGHT oz−in (g−mm)
50N401	CLIP−ON TYPE	4.30 oz−in. (3096 g.mm)

NOTE: The clip−on weight (50N401) attaches to the LPT 6th stage blade shroud. The quantity is as required with a maximum number of 10 clip−on weights per engine.

Table 1302

CAUTION: MAKE SURE THAT ALL LOOSE COUNTERWIEGHTS THAT ARE REMOVED FROM THE 6TH STAGE LPT BLADES ARE REMOVED FROM THE ENGINE. IF THEY ARE NOT REMOVED FORM THE ENGINE, DAMAGE TO THE ENGINE CAN OCCUR WHEN THE ENGINE IS STARTED.

(c) If it is necessary by the computer balance solution, first remove the old LPT clip on counterweights from the 6th stage blades with a PWA 101024 Drift as follows:

1 Put the chisel tip end of the PWA 101024 Drift under the hook tab of the counterweight at the leading edge of the 6th stage blade.

2 Push on the handle end of the Drift to unbend the counterweight from the leading edge of the blade.

3 Remove the loose counterweight from the 6th stage blade with mechanical fingers.

4 Take all the removed counterweights and tools out of the engine. Discard the used counterweights.

(d) Install the clip−on counterweight(s) to the 6th stage turbine shroud. See Figure 1307 (Sheet 1) and Table 1302. Two methods are provided for the installation of the clip−on counterweight:

1 Attach the counterweights with a PWA 86302 Hydraulic Bender and a PWA 76855 Hydraulic Pump. See Figure 1307 (Sheet 2).

2 Attach the counterweights with a PWA 102335 Mechanical Bender as follows. See Figure 1307 (Sheet 3) and Figure 1307 (Sheet 4).

a Put the counterweight on the counterweight holder of the PWA 102335 Mechanical Bender.

CAUTION: DO NOT BEND THE COUNTERWEIGHT TABS WHEN YOU HOLD THE COUNTERWEIGHT IN THE MECHANICAL BENDER. IF YOU BEND THE TABS, YOU WILL NOT BE ABLE TO INSTALL THE COUNTERWEIGHT ON THE 6TH STAGE TURBINE BLADE.

b Operate the quick grip handle to lightly hold the counterweight. Do not squeeze the quick grip handle too much so that you bend the counterweight tabs.

c Put the PWA 102335 Mechanical Bender with the counterweight on the airfoil section of the designated 6th stage turbine blade(s).

d With the counterweight still installed in the bender, slide the counterweight along the airfoil onto the blade outer shroud. Make sure the counterweight hook goes around the leading edge of the blade.

e To attach the counterweight to the blade, operate the quick grip handle to bend the tab. Operate the quick grip handle until it hits the bar stop.

f Release the quick grip handle and remove the PWA 102335 Mechanical Bender from the engine.

(15) Remove the test equipment from the engine.

(16) Install two bolts and nuts, lubricated with Engine Oil P03−001 to Flange P at the accelerometer bracket location. Torque the nuts to 180 − 200 lb−in 22.597 N.m).

NOTE: Install the bolts with the heads toward the front of the engine.

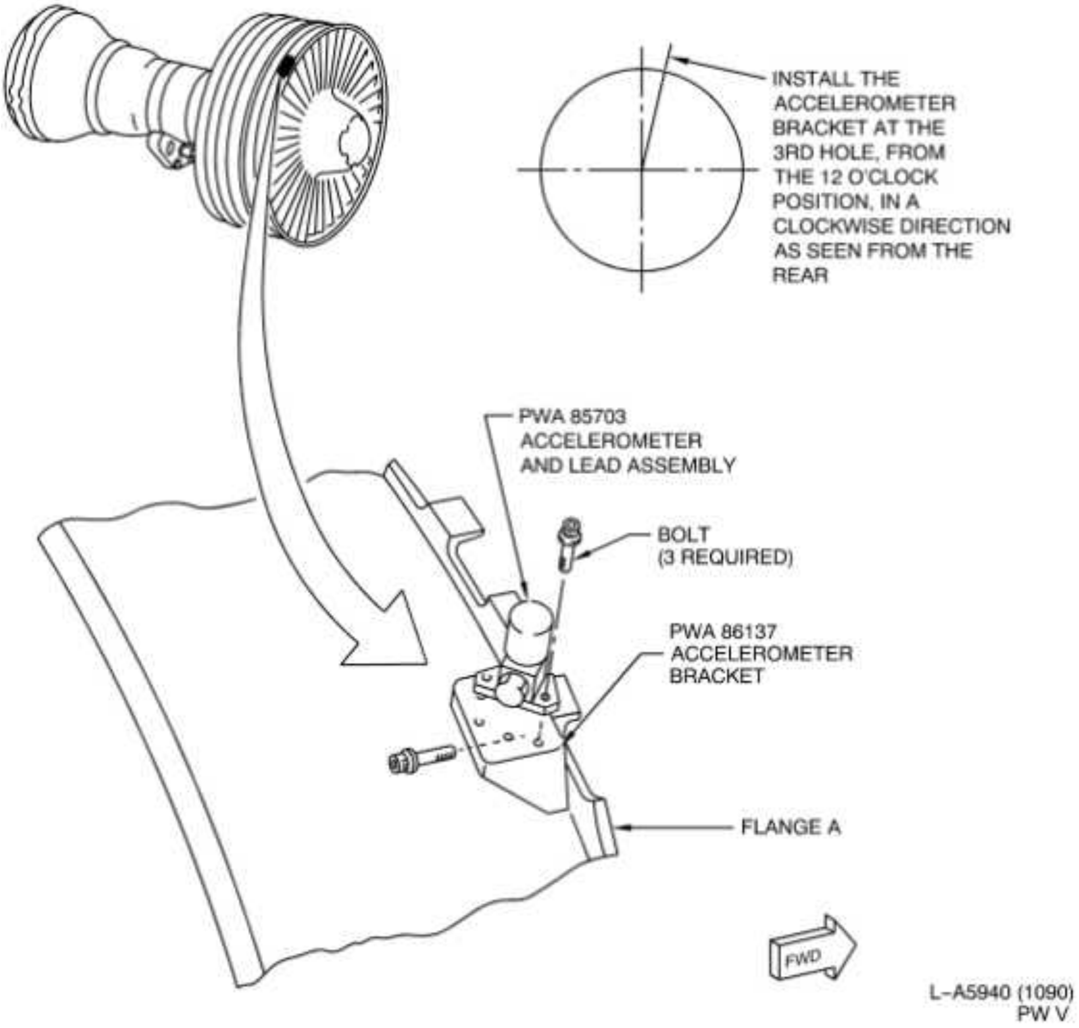
(17) Optional procedure.

(a) Record the phase angle lag and the sensitivity data and refer to it during subsequent trim balance. Instead of an arbitrary location for the installation of the first counterweight (CW1), phase angle lag data can be used.

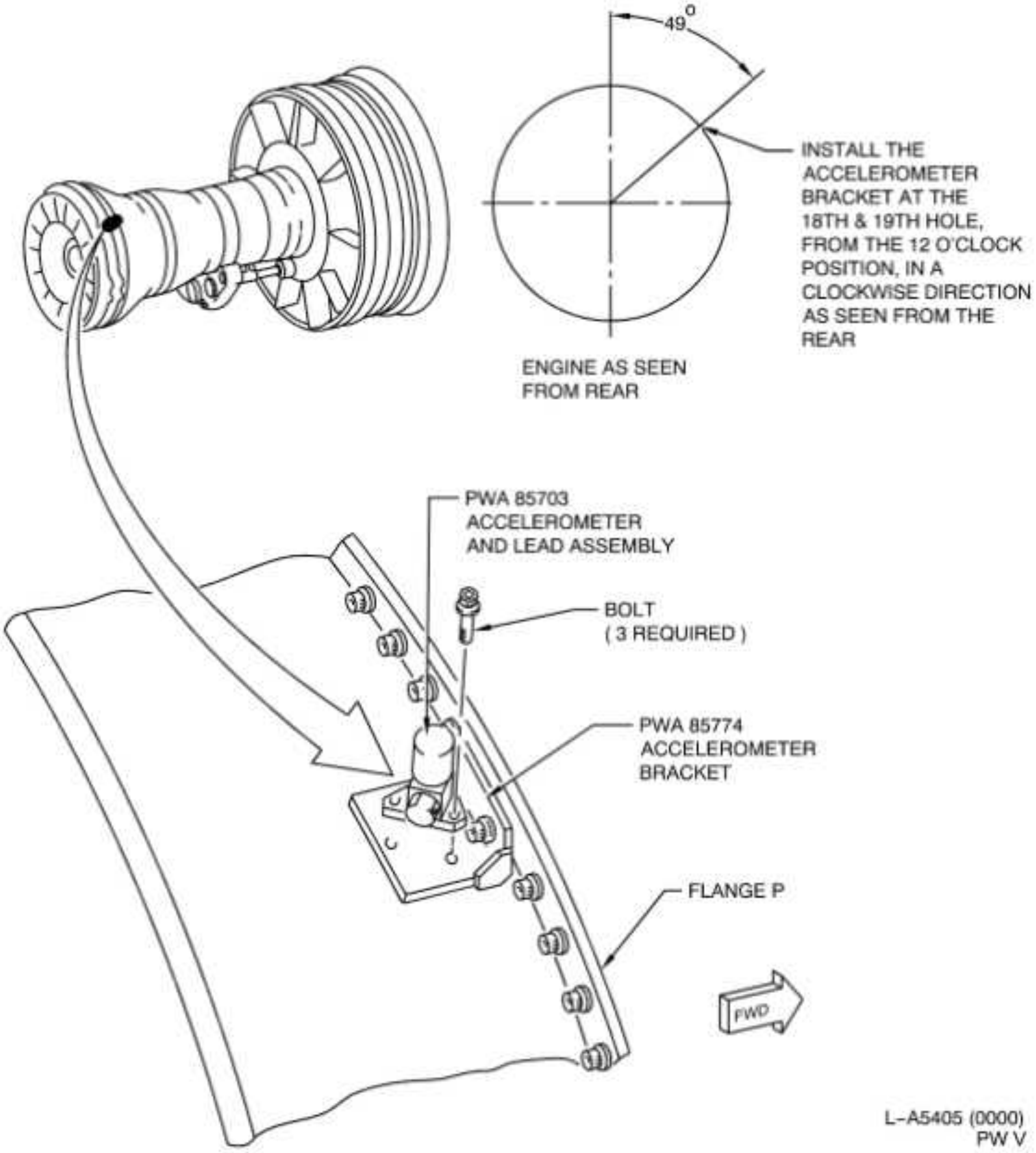
(b) For example, if the data base shows phase angle lag of 90 degrees, then locate CW1 90 degrees from Vector R (240 degrees), in the direction of rotation. This results in a CW1 location which is as good as CW2 location, in the previous example.

CW1 = Data trend sensitivity X 1EL

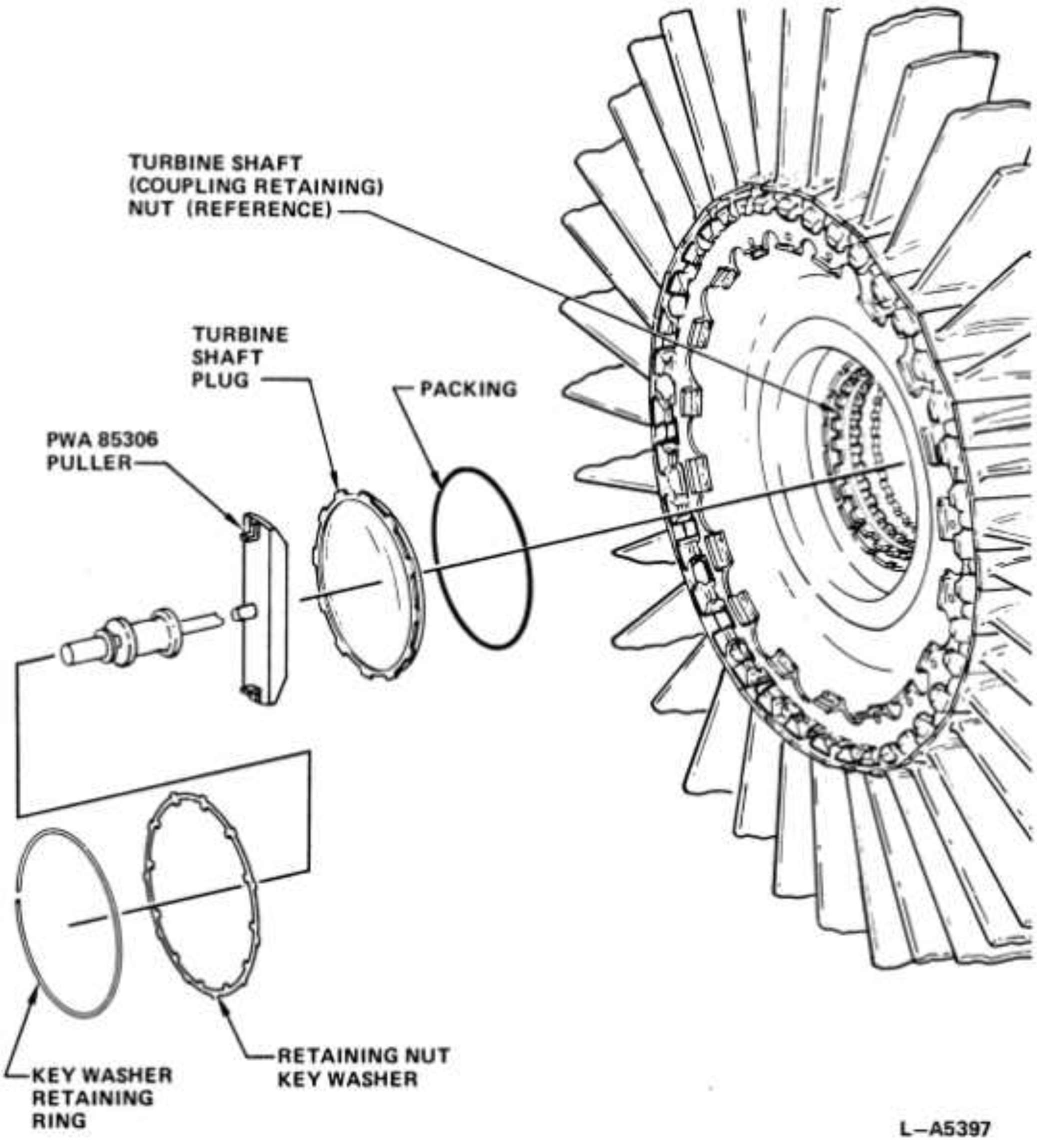
NOTE: Sensitivity can be calculated, at any speed point, by dividing the moment weight by the measured response. In this example 39 oz−in. (28080 g.mm)/3.0 mils (0.076 mm) = 13.0 oz−in. (9360 g.mm) per mil (0.025 mm).


INSTALL THE ACCELEROMETER BRACKET AT THE 3RD HOLE, FROM THE 12 O'CLOCK POSITION, IN A CLOCKWISE DIRECTION AS SEEN FROM THE REAR
PWA 85703 ACCELEROMETER AND LEAD ASSEMBLY
BOLT (3 REQUIRED)
PWA 86137 ACCELEROMETER BRACKET
FLANGE A
FWD
L-A5940 (1090)
PW V

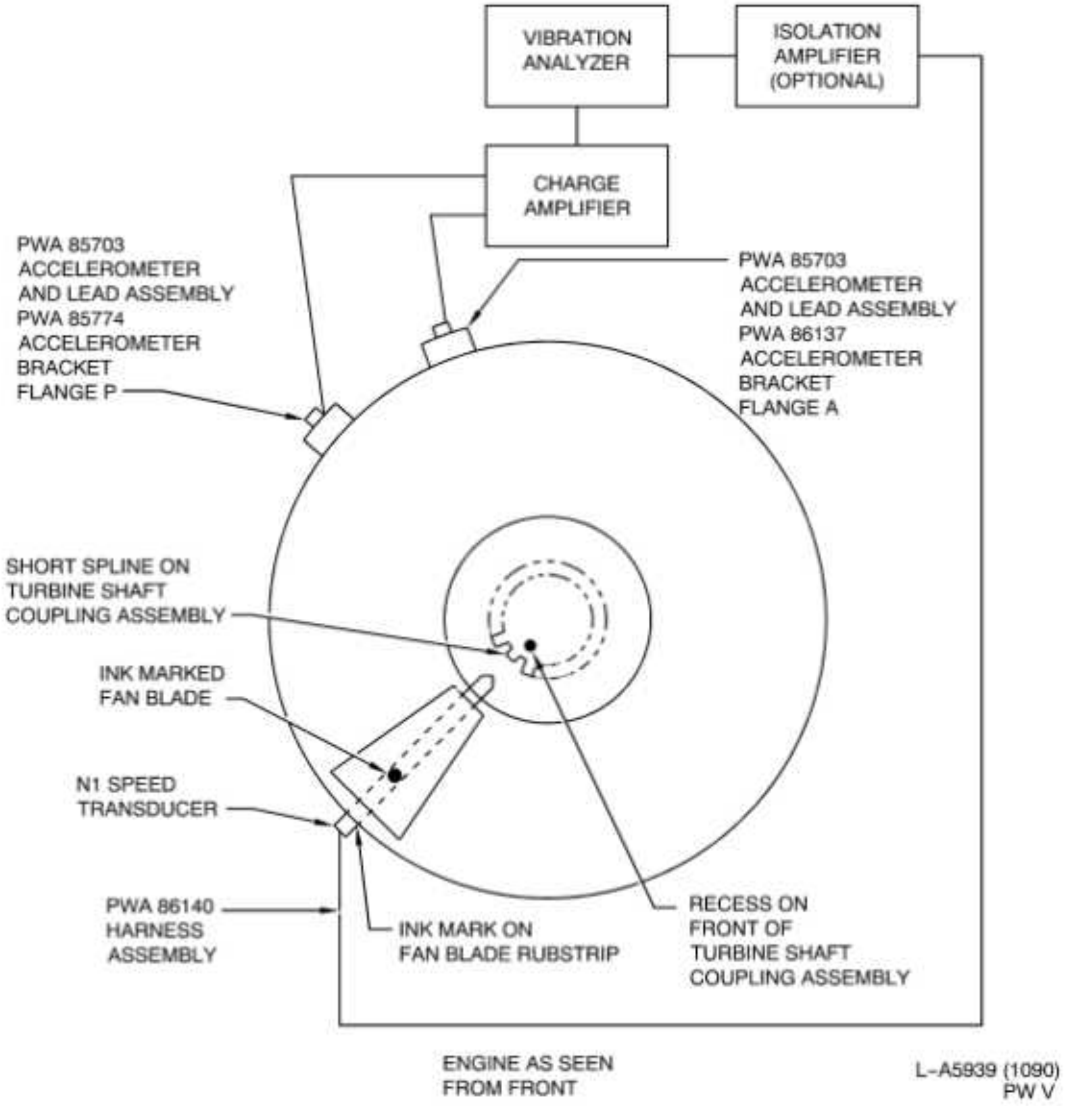
Accelerometer Installation On Flange A
Figure 1301 (Sheet 1)
(Task 71-00-00-760-043)


49°
INSTALL THE ACCELEROMETER BRACKET AT THE 18TH & 19TH HOLE, FROM THE 12 O'CLOCK POSITION, IN A CLOCKWISE DIRECTION AS SEEN FROM THE REAR
ENGINE AS SEEN FROM REAR
PWA 85703 ACCELEROMETER AND LEAD ASSEMBLY
BOLT (3 REQUIRED)
PWA 85774 ACCELEROMETER BRACKET
FLANGE P
FWD
L−A5405 (0000)
PW V

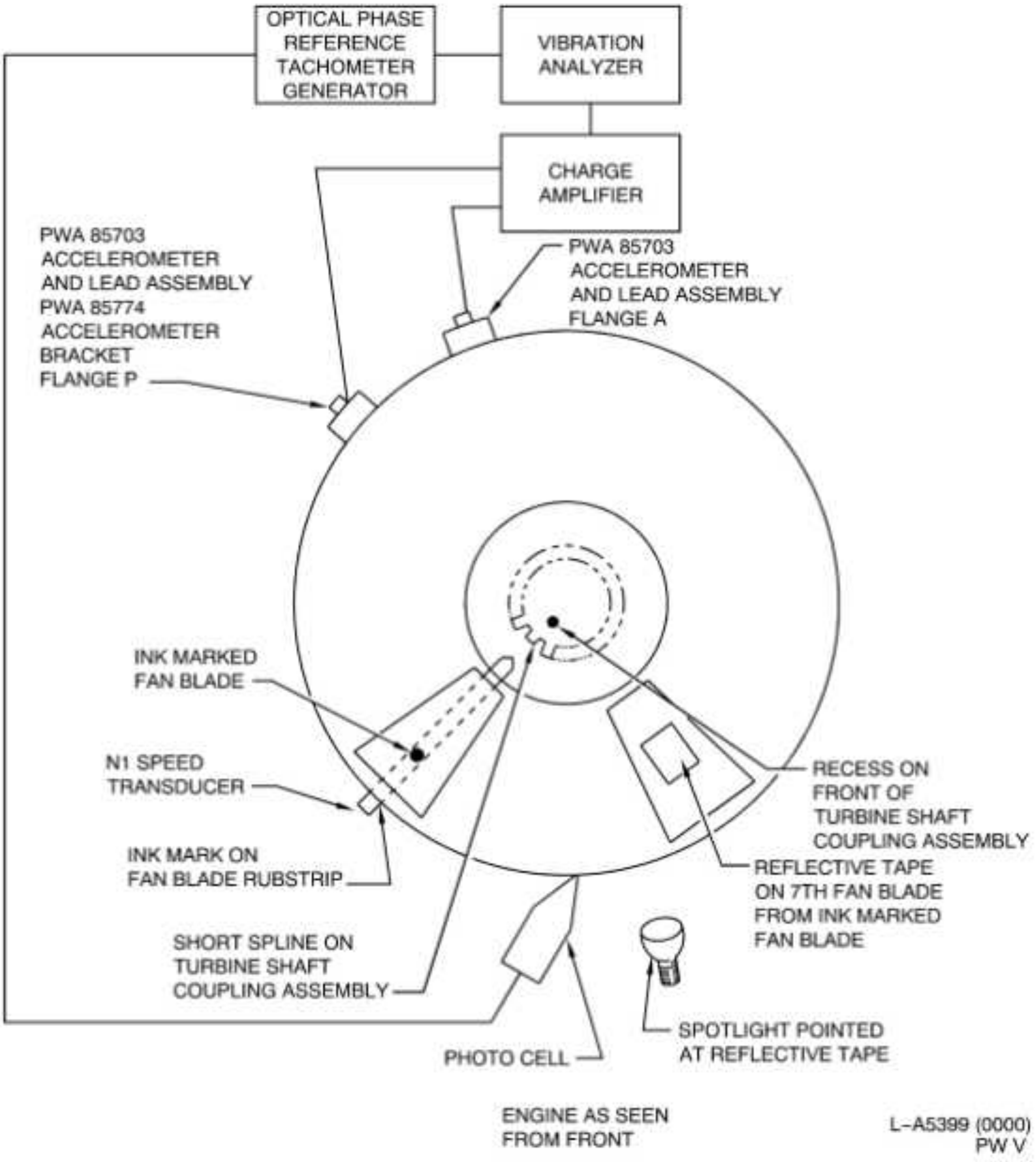
Accelerometer Installation On Flange P
Figure 1301 (Sheet 2)
(Task 71−00−00−760−043)


TURBINE SHAFT (COUPLING RETAINING) NUT (REFERENCE)
TURBINE SHAFT PLUG
PACKING
PWA 85306 PULLER
KEY WASHER RETAINING RING
RETAINING NUT KEY WASHER
L-A5397

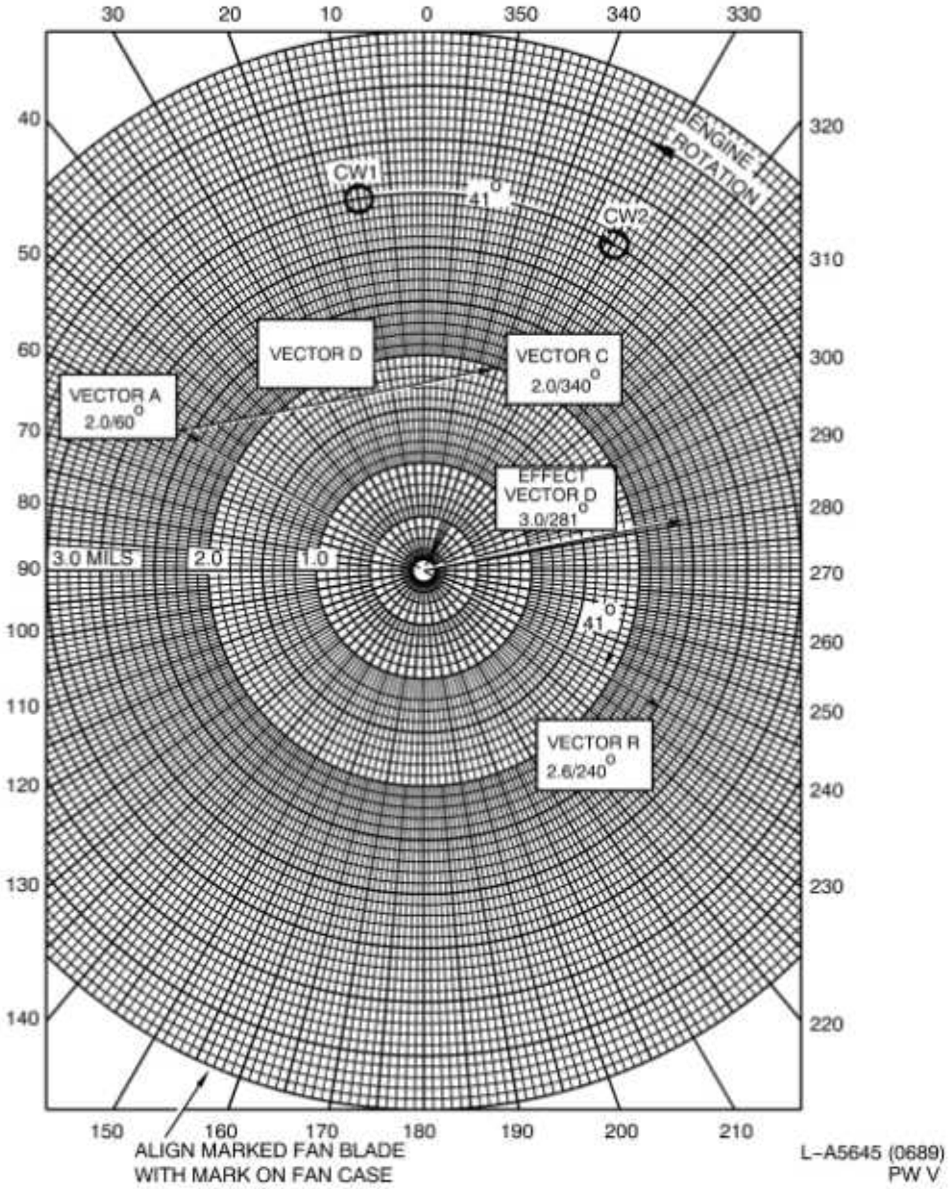
Turbine Shaft Plug
Figure 1302
(Task 71-00-00-760-043)


VIBRATION ANALYZER
ISOLATION AMPLIFIER (OPTIONAL)
CHARGE AMPLIFIER
PWA 85703 ACCELEROMETER AND LEAD ASSEMBLY PWA 85774 ACCELEROMETER BRACKET FLANGE P
PWA 85703 ACCELEROMETER AND LEAD ASSEMBLY PWA 86137 ACCELEROMETER BRACKET FLANGE A
SHORT SPLINE ON TURBINE SHAFT COUPLING ASSEMBLY
INK MARKED FAN BLADE
N1 SPEED TRANSDUCER
PWA 86140 HARNESS ASSEMBLY
INK MARK ON FAN BLADE RUBSTRIP
RECESS ON FRONT OF TURBINE SHAFT COUPLING ASSEMBLY
ENGINE AS SEEN FROM FRONT
L-A5939 (1090)
PW V

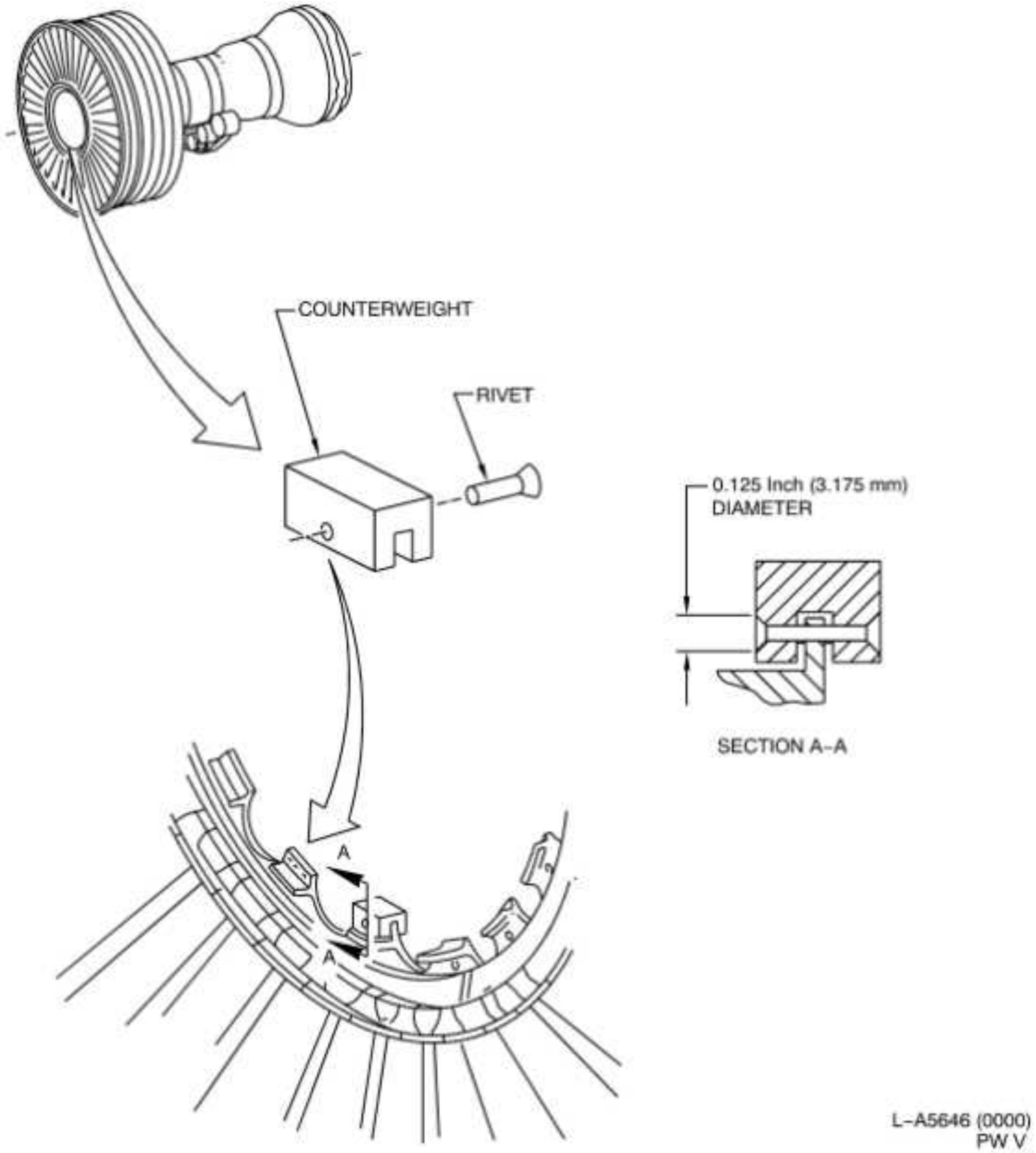
Trim Balance Equipment
Figure 1303
(Task 71-00-00-760-043)


OPTICAL PHASE REFERENCE TACHOMETER GENERATOR
VIBRATION ANALYZER
CHARGE AMPLIFIER
PWA 85703 ACCELEROMETER AND LEAD ASSEMBLY PWA 85774 ACCELEROMETER BRACKET FLANGE P
PWA 85703 ACCELEROMETER AND LEAD ASSEMBLY FLANGE A
INK MARKED FAN BLADE
N1 SPEED TRANSDUCER
INK MARK ON FAN BLADE RUBSTRIP
SHORT SPLINE ON TURBINE SHAFT COUPLING ASSEMBLY
RECESS ON FRONT OF TURBINE SHAFT COUPLING ASSEMBLY
REFLECTIVE TAPE ON 7TH FAN BLADE FROM INK MARKED FAN BLADE
SPOTLIGHT POINTED AT REFLECTIVE TAPE
PHOTO CELL
ENGINE AS SEEN FROM FRONT
L−A5399 (0000)
PW V

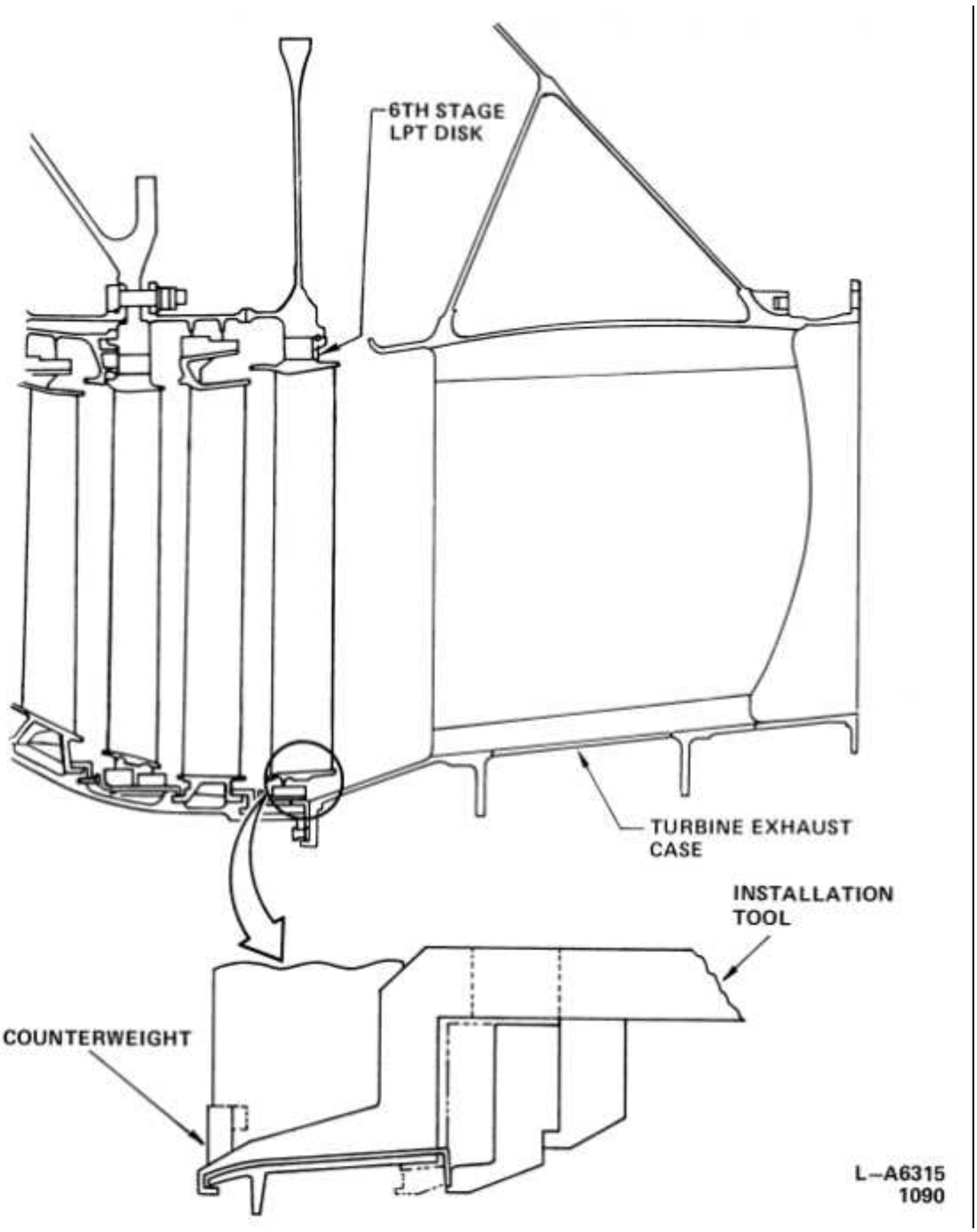
Trim Balance Equipment With Optical Tachometer
Figure 1304
(Task 71−00−00−760−043)



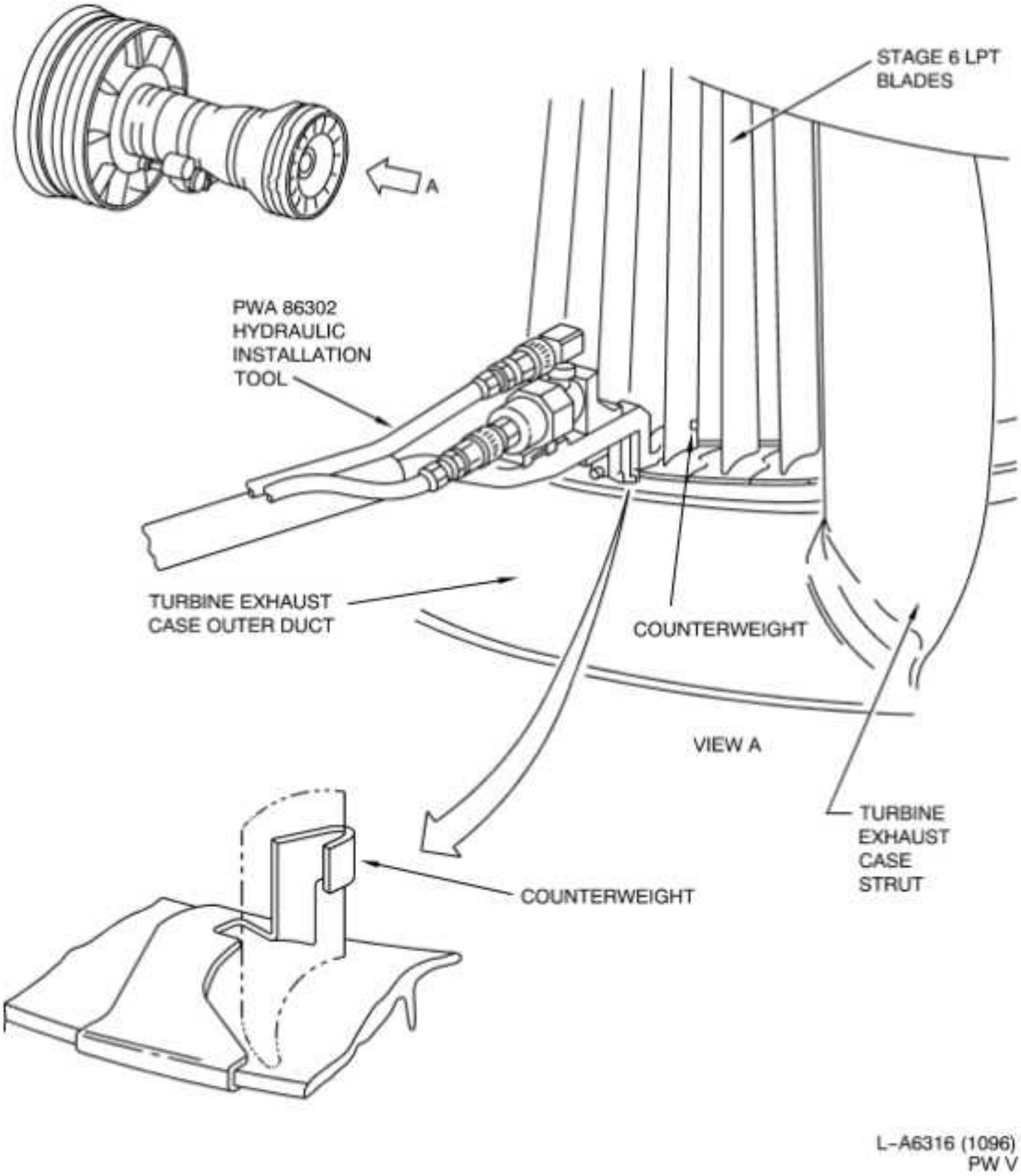
Polar Graph
Figure 1305
(Task 71-00-00-760-043)


COUNTERWEIGHT
RIVET
0.125 Inch (3.175 mm) DIAMETER
SECTION A-A
A
A
L-A5646 (0000)
PW V

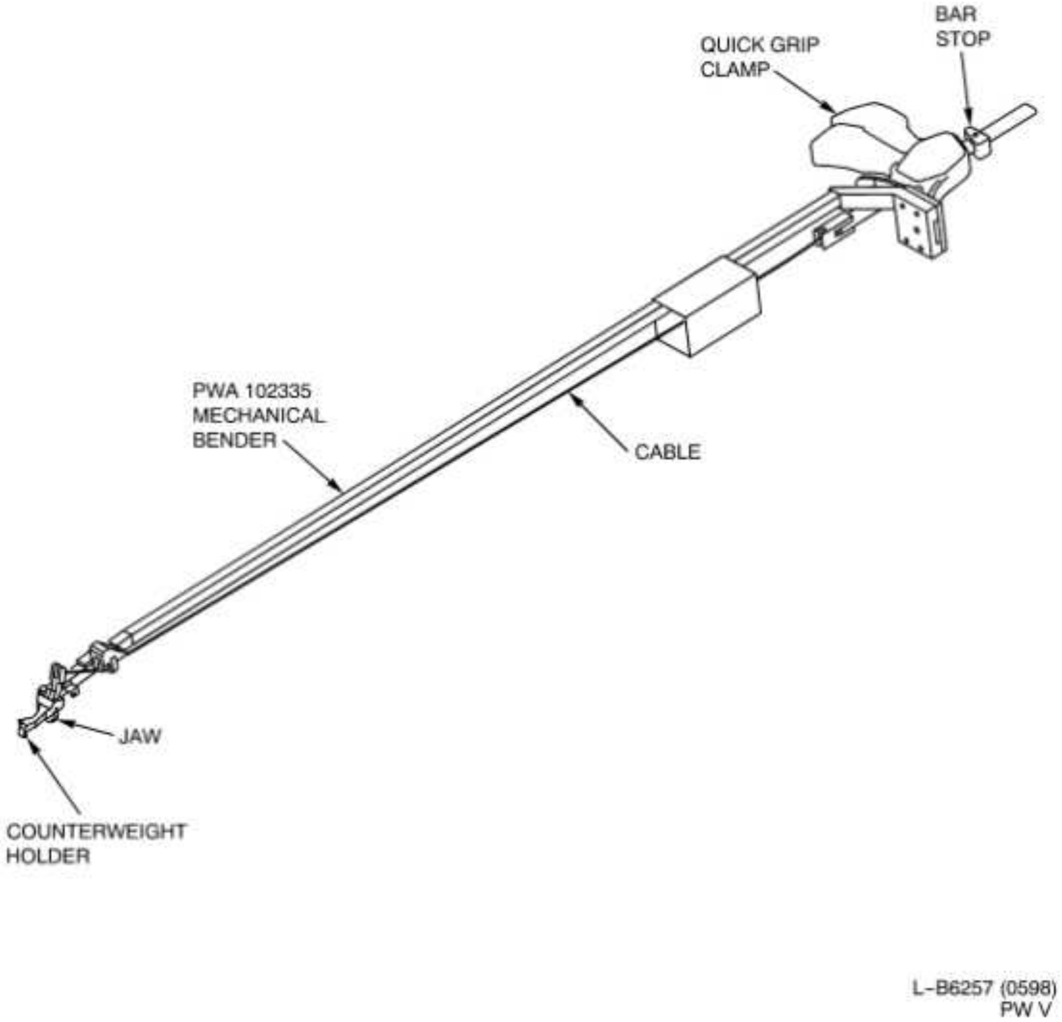
Counterweight Installation On The Fan Plane
Figure 1306
(Task 71−00−00−760−043)


6TH STAGE
LPT DISK
TURBINE EXHAUST
CASE
INSTALLATION
TOOL
COUNTERWEIGHT
L−A6315
1090

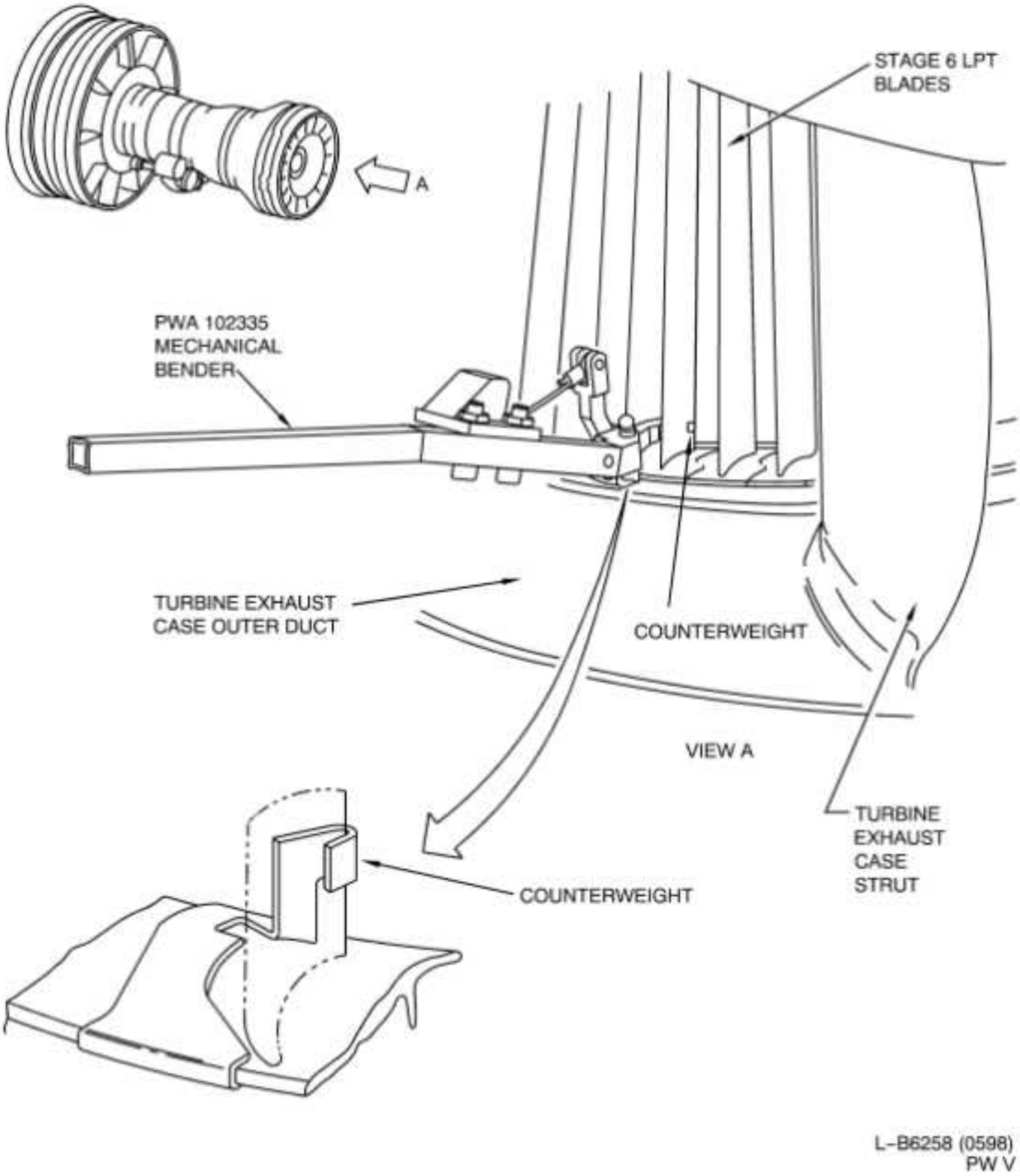
Counterweight Installation On The 6th Stage LPT Blades
Figure 1307 (Sheet 1)
(Task 71−00−00−760−043)


A
STAGE 6 LPT BLADES
PWA 86302 HYDRAULIC INSTALLATION TOOL
TURBINE EXHAUST CASE OUTER DUCT
COUNTERWEIGHT
VIEW A
TURBINE EXHAUST CASE STRUT
COUNTERWEIGHT
L-A6316 (1096)
PW V

Counterweight Installation On The 6th Stage
LPT Blades With Hydraulic Bender PWA 86302
Figure 1307 (Sheet 2)
(Task 71−00−00−760−043)


BAR STOP
QUICK GRIP CLAMP
PWA 102335 MECHANICAL BENDER
CABLE
JAW
COUNTERWEIGHT HOLDER
L-B6257 (0598)
PW V

Counterweight Installation On The 6th Stage
LPT Blades With Mechanical Bender PWA 102335
Figure 1307 (Sheet 3)
(Task 71−00−00−760−043)


A
STAGE 6 LPT BLADES
PWA 102335 MECHANICAL BENDER
TURBINE EXHAUST CASE OUTER DUCT
COUNTERWEIGHT
VIEW A
TURBINE EXHAUST CASE STRUT
COUNTERWEIGHT
L-B6258 (0598)
PW V

Counterweight Installation On The 6th Stage
LPT Blades With Mechanical Bender PWA 102335
Figure 1307 (Sheet 4)
(Task 71−00−00−760−043)

POWER PLANT GENERAL - TESTING-19

Task 71-00-00-760-052:

2. Test No. 19 - Sommervaille Three Weight Method

A. General

(1) See Test No. 19 - Trim Balance, Task 71-00-00-760-043 for optional procedure.

(2) See Test No. 19 - Optional "P" Flange Location For Low Rotor (N1) Trim Balance Procedure, Task 71-00-00-760-057 for optional procedure.

B. Equipment And Materials

Standard Tools:

Standard N1 Tachometer

Standard Vibration Monitoring Equipment	CEC 4-123 Pickup and PWA 156-4 Meter or equivalent. GR 1564-A Wave Analyzer to determine 1EL vibration amplitudes. or equivalent.

Special Tools:
PWA 85234 Riveter, Hand (For LPC counterweights)
PWA 85703 Accelerometer And Lead Assembly (2 Required)
PWA 85774 Bracket, Accelerometer (P Flange)

C. General Trim Balance Specifications

(1) Engines whose rotating parts are balanced as required by subassembly section of this manual will normally have some residual unbalance which will result in detectable vibration at engine operating conditions. This vibration may be minimized by trim balancing, which entails addition of weight positioned to offset residual unbalance in compressor front balance plane. Trim balancing can be accomplished on engine as mounted in test cell.

(2) Engines that experience stable overall vibration levels which are within limits of this section may be trim balanced in order to further reduce low rotor oriented (1EL) outputs. Stable vibration is defined as any vibration whose peak amplitude after thirty (30) seconds of stabilized running does not vary more than 0.5 mils (0.0127 mm).

(3) Trim balance should not be used to mask fundamental engine problems.

(4) The total vector sum of the trim balance weights and the weights installed for component (LPC) balance must not be more than the limits that follow:

  (a) Fan plane: 50 oz−in. (36,000 g.mm)

  (b) LPT: 48 oz−in. (34,560 g.mm)

  (c) Engines that require more correction weight than allowed should be inspected for incorrect assembly and/or part damage.

(5) For ease of identification in the field, all trim weights should be permanently identified with the letters "TB".

D. Procedure

(1) The Sommervaille three weight method requires four trial runs of the engine. An "As−Is" run and three "Calibration" runs (using a trial weight). The responses measured in all cases are 1EL vibration amplitudes (in mils (mm)), at selected N1 speed points. Balance weights available for this procedure are listed by part number and class in Table 1303. This procedure may be used to determine the amount and location of the unbalance, and the amount and location of the corrective weight. In this procedure, the word amplitude means balance displacement in mils (mm).

Trim Balance Weights
Fan Balance Flange Radius is 13.342 Inches (338.887 mm)

PART NUMBER	MOMENT WEIGHT
584944 Class 1	5.163 oz−in. (3717 g.mm)
584944 Class 2	5.617 oz−in. (4044 g.mm)
584944 Class 3	6.071 oz−in. (4371 g.mm)

Table 1303

Trim Balance Weights
Fan Balance Flange Radius is 13.342 Inches (338.887 mm)

PART NUMBER	MOMENT WEIGHT
(CONTINUED)	
584944 Class 4	6.498 oz−in. (4679 g.mm)
584944 Class 5	6.951 oz−in. (5005 g.mm)
584944 Class 6	5.550 oz−in. (3996 g.mm)
534493 Class 1	1.9 oz−in. (1368 g.mm)
534493 Class 2	2.3 oz−in. (1656 g.mm)
534493 Class 3	2.6 oz−in. (1872 g.mm)
534495 Class 1	4.7 oz−in. (3384 g.mm)
534495 Class 2	5.1 oz−in. (3672 g.mm)
534495 Class 3	5.6 oz−in. (4032 g.mm)
534495 Class 4	6.0 oz−in. (4320 g.mm)
534495 Class 5	6.4 oz−in. (4608 g.mm)

NOTE: The above weights can be installed on the fan hub balance flange to trim balance engine. These are permanent weights, but can be temporarily attached to the balance flange by using a cotter key (HG 34−1).

Table 1303 (Continued)

(a) Choose at least three N1 speeds with a fair amount of unbalance for the "As−Is" run. Record 1EL vibration amplitudes and N1 speeds. Using the "As−Is" 1EL amplitude as the radius, plot a entered circle on a polar coordinate chart. Use separate polar charts for each pickup (Flange A and Flange P) and speed combination.

(b) Arbitrarily ink−mark the rotor. The rotor is now indexed, and all references will be made from TDC. Choose three trial weight locations on the rotor approximately 120 degrees apart, and identify them serially as No. 1, 2, and 3. Locate and mark these three locations on the polar chart "As−Is" circumference.

(c) Place the trial weight (22 oz−in. (15840 g.mm) at the No. 1 location. Run the engine and record 1EL vibration amplitudes at the same speeds as in the "As−Is". From location No. 1 on the polar chart, swing an arc equal in radius to the vibration amplitude.

(d) Relocate the trial weight to location No. 2, and repeat (c) using No. 2 position and amplitude.

(e) Relocate the trial weight to location No. 3, and repeat (c) using No. 3 position and amplitude.

(f) Draw a vector from the polar chart origin to the center of the triangle formed by the three arcs. (Or the common intersection of the three arcs.) This vector indicates the angular location of the correcting weight. Its magnitude is inversely proportional to the magnitude of the correcting weight. To determine the magnitude of the correcting weight, use the formula:

$$M = \frac{MoV}{T}$$

Where: M = Balancing Weight or moment required.
Mo = Moment or Test weight.
V = Initial (As−Is) vibration amplitude
T = Resultant vector

M and Mo may be in grams, ounces, oz−in.
V and T are in mils (mm)

(g) The correct trim balance weight(s), see Table 1304, should be permanently installed on the fan balance flange at the correct angular location as determined in step (f). Record the quantity and part number of weights installed. Secure weights using PN 534494 rivet. Rivet counterweights using PWA 85234 Riveter. See 70−43, Standard Practices Manual, PN 585005.

NOTE: Trial weights may be placed on balance flanges using cotter key (HG 34−1).

(2) The following example describes a detailed procedure to illustrate the Sommervaille method. See Figure 1308.

(a) Three N1 speeds, with the most significant amounts of unbalance, are selected for "As−Is" run. The "As−Is" 1EL amplitude is used as the radius of a circle (1308/A) centered on a polar−coordinate chart. In this example, the 1EL vibration amplitude is 3.3 mils (0.084 mm), and the speed for this run is designated Speed 1.

(b) Arbitrarily ink mark the rotor at three equally spaced locations (120 degrees apart), and identify as 1, 2, and 3.

(c) Trial weight 22 oz−in. (15840 g.mm) is placed at Location 1. Run engine at same speeds as chosen in "As−Is" run. From Location 1 on polar chart, swing an arc equal in radius to vibration amplitude (1308/B). In this example, vibration amplitude equals 7.3 mils (0.185 mm), with weight at Location 1. Remove trial weight.

NOTE: Trial weight may be several engine weights whose total equal approximately 22 oz−in. (15840 g.mm).

(d) Repeat step (c), but apply procedure to Location 2. In this example, vibration amplitude equals 5.5 mils (0.140 mm), with weight at Location 2 (1308/C).

(e) Repeat step (c), but apply procedure to Location 3. In this example, vibration amplitude equals 2.8 mils (0.071 mm), with weight at Location 3 (1308/D).

(f) Three arcs drawn on polar coordinate chart form a triangle or share a common intersection. Draw a vector from origin to either center of triangle or point of common intersection. In this example, resultant vector equals 4.4 mils (0.112 mm). This vector indicates the necessary correction. Vector magnitude is inversely proportional to moment magnitude, use formula:

$$M = \frac{MoV}{T}$$

Where: M = Moment Required
Mo = Moment or Test weight.
V = Initial (As−Is) vibration amplitude
T = Resultant vector

In this example:

Mo = 22 oz−in. (15840 g.mm)
V = 3.3 mils (0.084 mm)
T = 4.4 mils (0.112 mm)

POWER PLANT GENERAL − TESTING−19

$$M = \frac{(22)(3.3)}{(4.4)} \quad \frac{(15840)(0.084)}{(0.112)}$$

M = 16.5 oz−in. (11,880 g.mm)

The correction weight must produce a moment equal to 16.5 oz−in. (11,880 g.mm), when installed.

(g) Referring to polar chart, position the correction weight at 35 degrees from Location 3 toward Location 2. Correct weight should be permanently installed on fan hub balance flange, located behind compressor inlet cone, using PWA 85234 Riveter .

NOTE: If a module balance weight is installed at the same location as that determined for trim balance weight, then install trim balance weight as close as possible to this location.

(3) During trim balance, a correction weight for vibration at one speed may adversely affect the vibration at another speed. If these vibration modes require corrective balance at different angular locations and magnitudes, a compromise trim balance may be attempted. This procedure consists of determining the required weight (magnitude and location) and sensitivity for each point under consideration, using normal trim balance procedure. This data is then plotted to determine a compromise vector representing the optimum correction. See Figure 1309. The following example describes a detailed procedure to illustrate compromise balance procedure. See Figure 1309.

(a) After engine trim balance, the data is found as follows in Table 1304:

EXAMPLE − TRIM BALANCE DATA

N1 SPEED	REQUIRED BALANCE WEIGHT	ANGLE	MODE SENSITIVITY
1300	2.0 oz−in. (1440 g.mm)	150	1.11 oz−in./mil (799 g.mm/ 0.025 mm)
2000	3.2 oz−in. (2304 g.mm)	130	1.45 oz−in./mil (1044 g.mm/0.025 mm)

Table 1304

EXAMPLE - TRIM BALANCE DATA

N1 SPEED	REQUIRED BALANCE WEIGHT	ANGLE	MODE SENSITIVITY
2400	2.6 oz-in. (1872 g.mm)	70	1.30 oz-in./mil (936 g.mm/0.025 mm)
3400	4.0 oz-in. (2880 g.mm)	160	2.50 oz-in./mil (1800 g.mm/0.025 mm)

Table 1304 (Continued)

(b) On a polar chart, plot vectors representing the required weight (magnitude and angle) for each speed point. These are the correction vectors for each speed point.

(c) Multiply the sensitivity of each point (oz-in./mil or g.mm/mm) by vibration limit (mils or mm). This figure represents the moment weight required to cause a vibration equal to vibration limit. Each correction vector (tip) on polar chart is the point at which that mode is perfectly balanced. Draw a circle from vector tip, whose radius is equal to mode sensitivity times vibration limit. A compromise vector falling anywhere within this circle area will cause a response within the vibration limit. A compromise vector closer to the circle's center will result in a vibration response closer to zero, for that speed. In this example, the vibration limit will be 1.5 mils (0.038 mm) 1EL and the data is found as follows in Table 1305:

EXAMPLE - COMPROMISE TRIM BALANCE DATA

N1 SPEED	SENSITIVITY	VIBRATION LIMIT	MOMENT WEIGHT
1300	1.11 oz-in./mil (799 g.mm/ 0.025 mm)	X 1.5 mils (0.038 mm)	= 1.7 oz-in. (1224 g.mm)
2000	1.45 oz-in./mil (1044 g.mm/0.025 mm)	X 1.5 mils (0.038 mm)	= 2.2 oz-in. (1584 g.mm)
2400	1.30 oz-in./mil (936 g.mm/0.025 mm)	X 1.5 mils (0.038 mm)	= 2.0 oz-in. (1440 g.mm)
3400	2.50 oz-in./mil (1800 g.mm/0.025 mm)	X 1.5 mils (0.038 mm)	=3.8 oz-in. (2736 g.mm)

Table 1305

(d) Draw a compromise vector that begins at polar chart origin and ends at center of area of common intersection for all circles. This compromise vector represents location and magnitude of compromise balance weight. In this example, 2.00 oz−in. (1440 g.mm) at 110 degrees.

NOTE: If no common area of intersection exists for all circles, then no weight can be added to lower all modes below vibration limit.

Task 71−00−00−760−057:

3. Test No. 19 − Optional "P" Flange Location For Low Rotor (N1) Trim Balance Procedure

A. General

(1) This Trim Balance installs vibration accelerometers on "P" flange at optional locations of 3:30 or 9:00 o'clock in addition to the accelerometer on A flange. See Task 71−00−00−760−043 for all other information.

(2) See Test No. 19 − Trim Balance − Task 71−00−00−760−043 for optional procedure.

(3) See Test No. 19 − Sommervaille Three Weight Method, Task 71−00−00−760−052 for optional procedure.

B. Equipment And Materials

Special Tools:
PWA 85703 Accelerometer And Lead Assembly (2 Required)
PWA 85774 Bracket, Accelerometer (P Flange)
PWA 86140 Harness Assembly

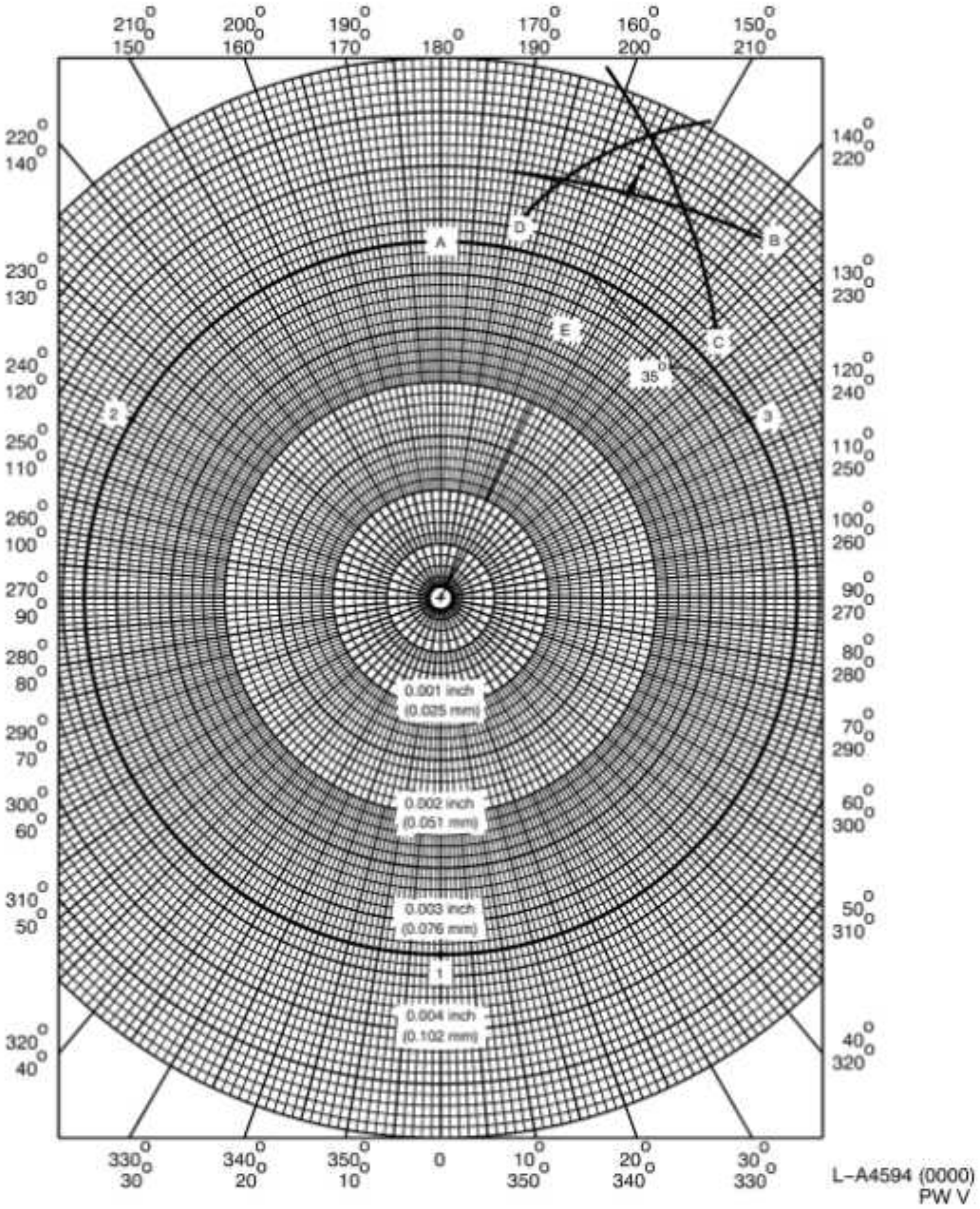
Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)

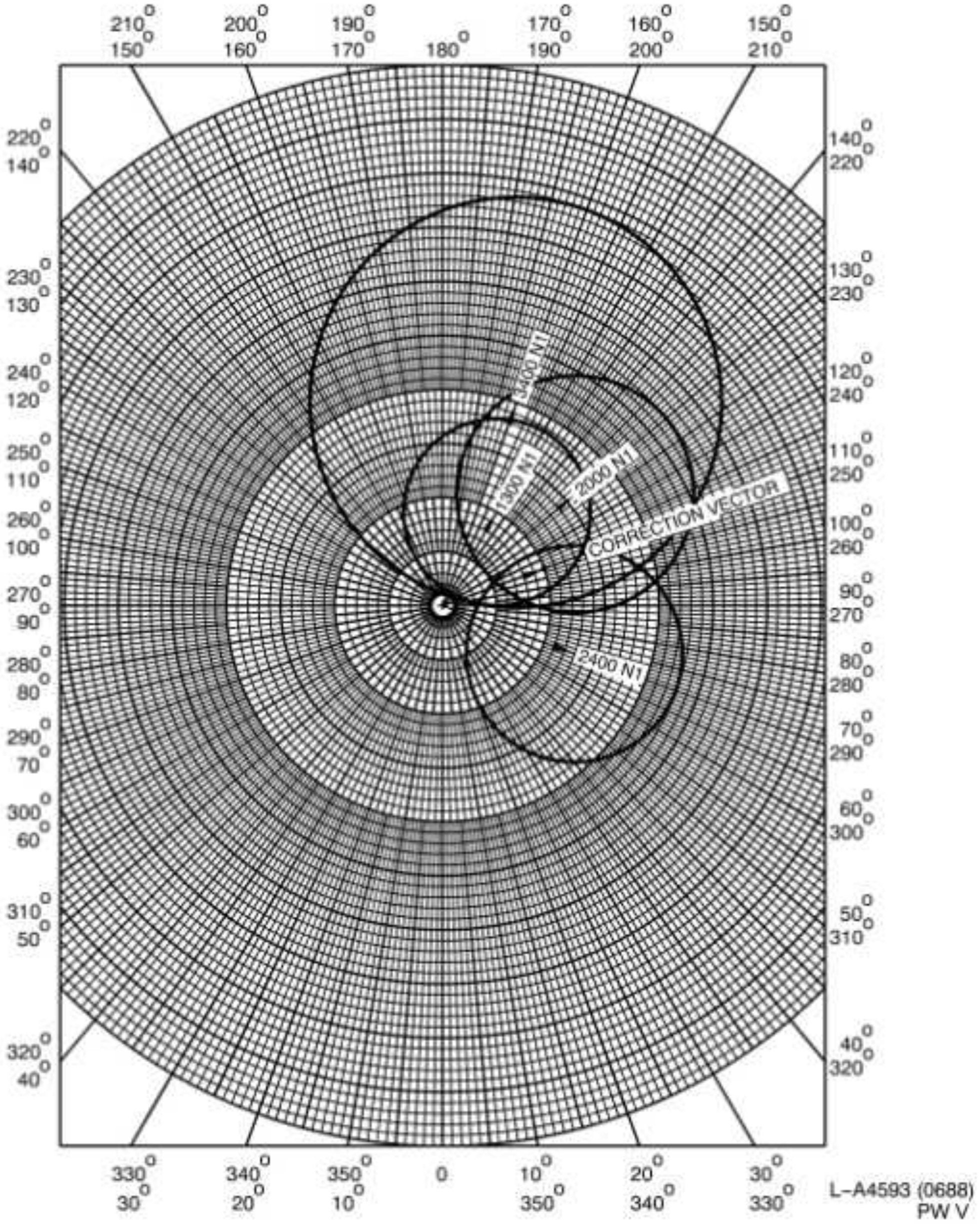
C. Procedure

(1) Install the accelerometers (vibration transducers) on Flange "P" as follows:

(a) Flange A bracket: See Task 71−00−00−760−043.



Sommervaille Three Weight Method
Figure 1308
(Task 71-00-00-760-052)



Compromise Trim Balance
Figure 1309
(Task 71-00-00-760-052)

(b) Flange "P" bracket for Post SB PW4ENG 79−76 (rerouting of the No. 4 bearing pressure and oil tubes) engines: Install a PWA 85774 Bracket on Flange "P" at the 3:30 o'clock position as viewed from the rear of the engine. Install on the rear side of flange in bolt holes No. 38 and 39 located clockwise from the 12:00 o'clock position. Bolt hole No. 38 is the first bolt hole location below the existing 8 bolt nut plate bracket at the 3:00 o'clock position as viewed from the rear. See Figure 1310 (Sheet 1).

(c) Flange "P" bracket for Pre SB PW4ENG 79−76 engines: Install a PWA 85774 Bracket on Flange "P" at the 9:00 o'clock position as viewed from the rear of the engine. Install on the rear side of flange in bolt holes No. 33 and 34 located counterclockwise from the 12:00 o'clock position. See Figure 1310 (Sheet 2).

NOTE: As an option you can install the vibration bracket at the 3:30 o'clock location for pre SB PW4ENG 79−76 engines. See the paragraph (c) above for bracket installation

(d) Install a PWA 85703 Accelerometer And Lead Assembly to the PWA 85774 Bracket on Flange P.

(e) Install accelerometer leads along tubes and harnesses, and attach every 12 − 16 inches (305. − 406. mm). Do not install on tubes which contain hot bleed air. Install accelerometer leads so that they will not touch the closed nacelle doors.

(2) Install the trim balance equipment. See Figure 1311.

NOTE: The P Flange transducer is located at the 3:30 or 9:00 o'clock position and the Flange A transducer is located at the 12:30 o'clock position as viewed from the rear of the engine. If the N1 speed transducer is used: N1 signal comes from the N1 speed transducer on either the Channel A connector J19 pins "1" and "2" or the Channel B connector J19 pins "4" and "5".

(a) Install a PWA 86140 Harness Assembly to the N1 probe connector and plug it into the isolation amplifier/vibration analyzer equipment.

NOTE: An isolation amplifier may not be required dependent upon the model/type of the vibration analyzer used.

(b) Attach Flanges A and P vibration PWA 85703 Accelerometer Wire Leads, at two places, into the charge amplifier/vibration analyzer equipment

NOTE: The N1 signal characteristics are: The minimum, no load, equals one volt. The maximum, no load, equals 30 volts. The frequency (Hz) equals N1 rpm (from the short tooth signal).

(3) Do the trim balance procedure as shown in Task 71−00−00−760−043.

(4) After the trim balance procedure, remove the test equipment from the engine.

(5) Install two bolts and nuts, lubricated with Engine Oil P03−001 to Flange P at the accelerometer bracket location. Torque the nuts to 180 − 200 lb−in. (20.337 − 22.597 N.m).

(a) Install the bolts, with the heads toward the front of the engine.

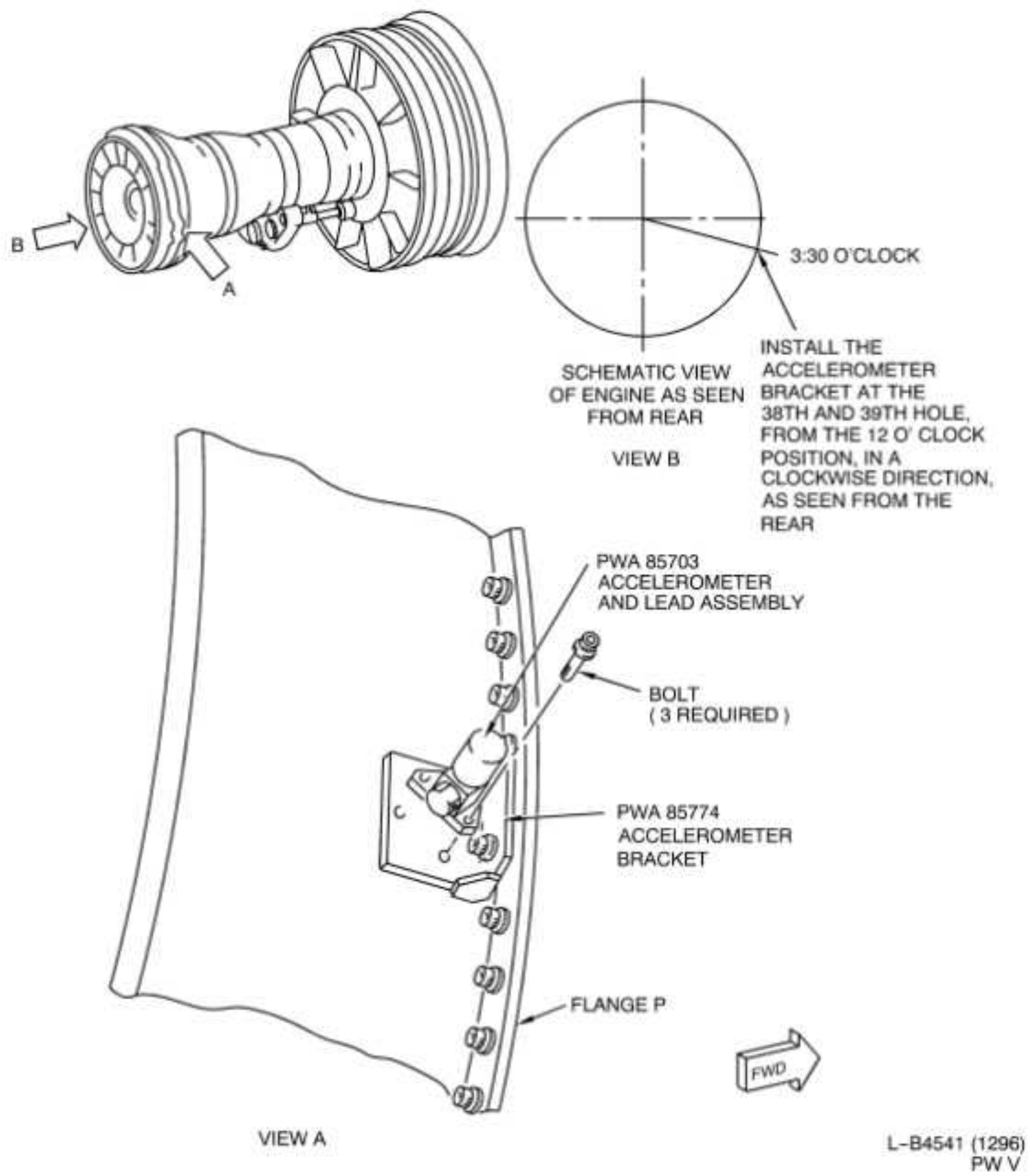
(b) Torque the nuts to 180 − 200 lb−in. (20.337 − 22.597 N.m).

Task 71−00−00−380−002:

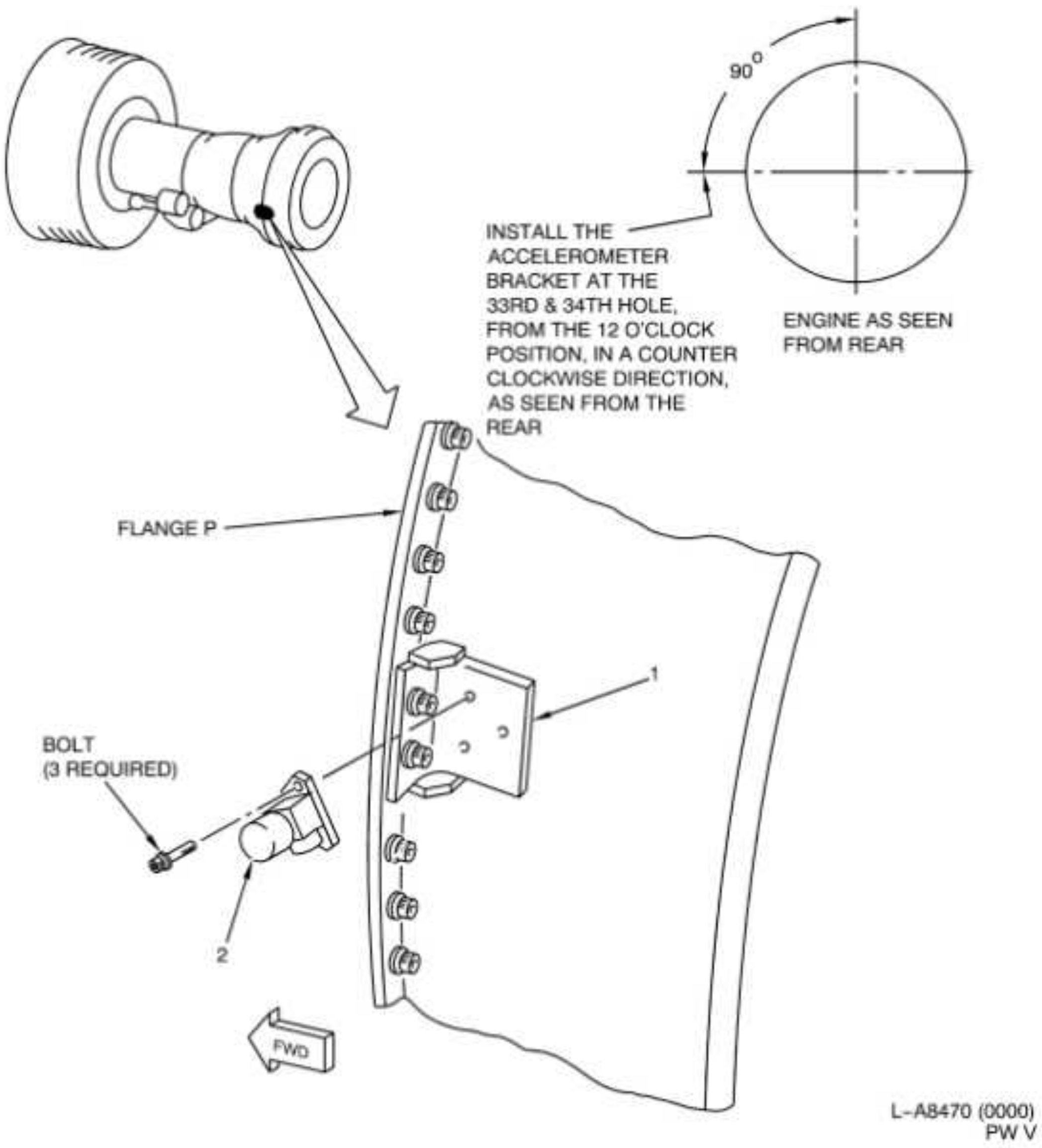
4. Test No. 19 − Lubrication Of The Stage 1 LPC (Fan) Blade Roots To Reduce N1 Vibration

A. General

(1) Use this procedure to decrease a small quantity of N1 rotor unbalance that is not stable in the test cell. This type of vibration changes from engine run to engine run at the same N1 speeds when no change in balance weight or rotor parts has been made.

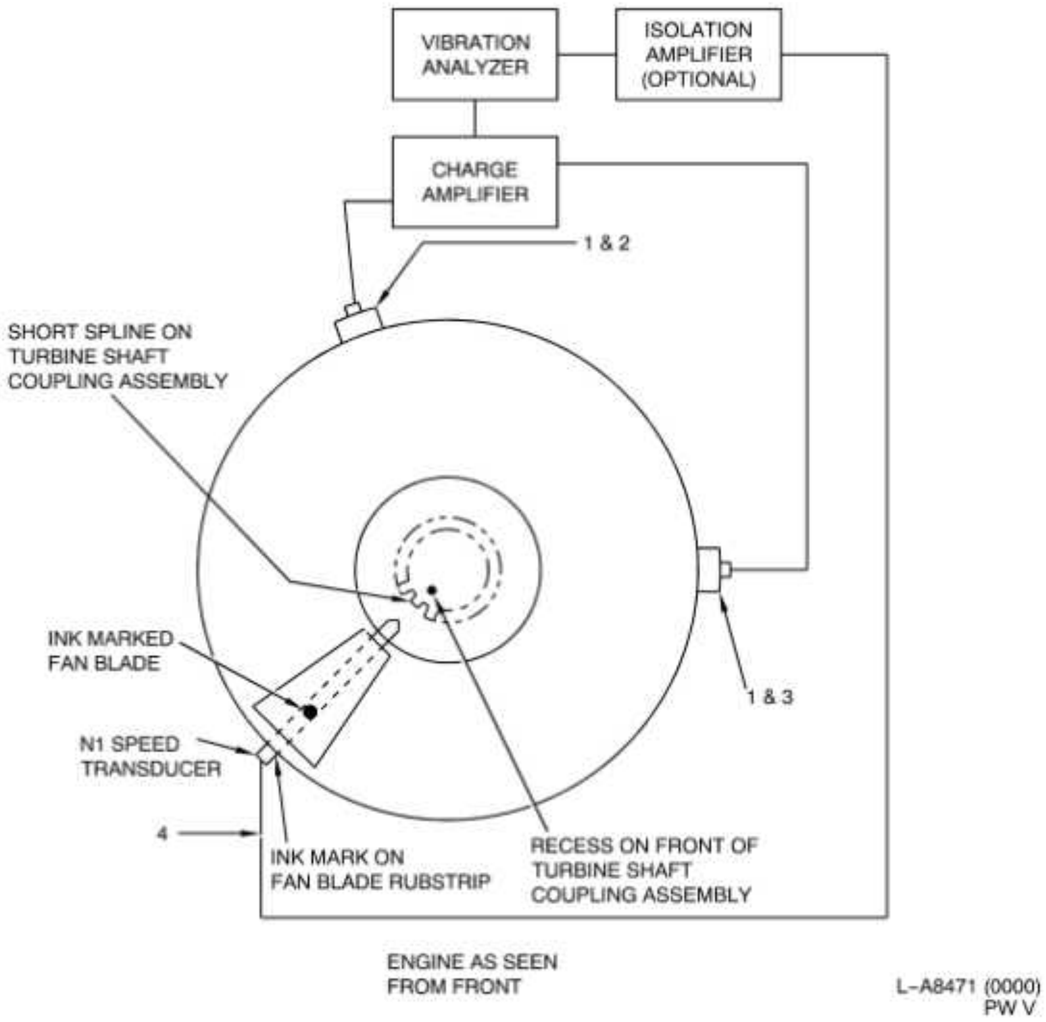

B
A
3:30 O'CLOCK
SCHEMATIC VIEW OF ENGINE AS SEEN FROM REAR
VIEW B
INSTALL THE ACCELEROMETER BRACKET AT THE 38TH AND 39TH HOLE, FROM THE 12 O' CLOCK POSITION, IN A CLOCKWISE DIRECTION, AS SEEN FROM THE REAR
PWA 85703 ACCELEROMETER AND LEAD ASSEMBLY
BOLT (3 REQUIRED)
PWA 85774 ACCELEROMETER BRACKET
FLANGE P
FWD
VIEW A
L-B4541 (1296)
PW V

Accelerometer Installation On Flange P At 3:30 O'Clock Location
Figure 1310 (Sheet 1)
(Task 71−00−00−760−057)


90°
INSTALL THE ACCELEROMETER BRACKET AT THE 33RD & 34TH HOLE, FROM THE 12 O'CLOCK POSITION, IN A COUNTER CLOCKWISE DIRECTION, AS SEEN FROM THE REAR
ENGINE AS SEEN FROM REAR
FLANGE P
1
BOLT (3 REQUIRED)
2
FWD
L-A8470 (0000)
PW V

1. PWA 85774, Accelerometer Bracket
2. PWA 85703, Accelerometer And Lead Assembly

Accelerometer Installation On Flange P At 9:00 O'Clock Location
Figure 1310 (Sheet 2)
(Task 71−00−00−760−057)


VIBRATION ANALYZER
ISOLATION AMPLIFIER (OPTIONAL)
CHARGE AMPLIFIER
1 & 2
SHORT SPLINE ON TURBINE SHAFT COUPLING ASSEMBLY
INK MARKED FAN BLADE
1 & 3
N1 SPEED TRANSDUCER
4
INK MARK ON FAN BLADE RUBSTRIP
RECESS ON FRONT OF TURBINE SHAFT COUPLING ASSEMBLY
ENGINE AS SEEN FROM FRONT
L-A8471 (0000)
PW V

1. PWA 85703, Accelerometer And Lead Assembly
2. PWA 86137, Accelerometer Bracket - Flange A
3. PWA 85774, Accelerometer Bracket
4. PWA 86140, Harness Assembly

Trim Balance Equipment
Figure 1311
(Task 71-00-00-760-057)

(2) If the N1 rotor vibration amplitude and/or phase angle is not stable, lubrication of the Stage 1 LPC (fan) blades (called fan blades) roots (dovetail areas) can be necessary.

(3) Lubrication of the fan blades roots can also be necessary if the fan blades operational time or cycles is more than the recommended lubrication interval.

B. Equipment And Materials Necessary

Standard Tools:
Brush Used For The Application Of Lubricant P06−005

Consumable Materials:

Item No.	Designation
P06−005	Lubricant (Optional To P06−044)
P06−044	Compound, Antigallant (Optional To P06−005)

C. Procedure To Lubricate The Fan Blade Roots To Reduce N1 Vibration

(1) Remove the compressor inlet cone by 72−00−31 Removal−02 (Task 72−00−31−020−001).

(2) Choose one of the two antigallant compounds that are available for this procedure.

(a) A cure time is not necessary for Lubricant P06−005. The fan blades can be removed one at a time for the application of the lubricant or the complete set of fan blades can be removed for the application.

(b) A 4 hour cure time is necessary for Antigallant Compound P06−044. You must remove the complete set of fan blades for the application so that the compound can cure before reinstallation.

CAUTION: YOU MUST REMOVE THE FAN BLADES TO APPLY THE LUBRICANT CORRECTLY. IF YOU DO NOT, YOU CAN MAKE THE VIBRATION WORSE.

(3) Apply Lubricant P06-005 (Optional to P06-044) to each fan blade root, one blade at a time, as follows:

NOTE: A cure time is not necessary for Lubricant P06-005.

(a) Remove the No. 1 fan blade from the hub. See 72-00-31 Removal-03 (Task 72-00-31-020-002-001).

(b) Use a cloth and remove any dirt or grit from the fan blade root area and the hub blade slot. As an option, clean the blade root area and the hub blade slot by SPOP 208 (Task 70-21-00-110-040), see the Standard Practices Manual, PN 585005 and see Figure 1312.

1 Do not try to remove the existing coating.

2 Do not try to polish the metal.

(c) Use a clean brush and apply Lubricant P06-005 to the dovetail area only on the fan blade root. See Figure 1312.

1 Do not apply lubricant to the fan hub slots.

2 Do not apply lubricant to the fan blade fairing seal areas (flowpath lines). Lubricant is not permitted on the fairing seal areas.

3 Do not apply lubricant to the bottom face of the fan blade root. Lubricant is not permitted on the bottom face of the fan blade root.

4 Some lubricant is permitted on the area between the dovetail area and the flowpath line.

5 Remove the excess lubricant.

(d) Install the No. 1 fan blade to the hub. See 72-00-31 Install-03 (Task 72-00-31-420-002-001).

(e) Continue to remove, lubricate and reinstall one at a time, all of the remaining fan blades.

(4) Apply Lubricant P06-005 (Optional to P06-044) to the fan blade roots, with all the fan blades removed first, as follows:

NOTE: A cure time is not necessary for Lubricant P06-005.

(a) Make a mark and record the location of each fan blade and fairing in the hub as shown in the procedure 72-00-31 Removal-03 (Task 72-00-31-020-002-001). See Standard Practices Manual, PN 585005 Section 70-11-00 for approved temporary markers.

(b) Remove all the fan blades and fairings from the hub as shown in the procedure 72-00-31 Removal-03 (Task 72-00-31-020-002-002).

(c) Use a cloth and remove any dirt or grit from the fan blade root area and the hub blade slot. See Figure 1312.

1 Do not try to remove the existing coating.

2 Do not try to polish the metal.

(d) Use a clean brush and apply Lubricant P06-005 to the dovetail area only on the fan blade root. See Figure 1312.

1 Do not apply lubricant to the fan hub slots.

2 Do not apply lubricant to the fan blade fairing seal areas (flowpath lines). Lubricant is not permitted on the fairing seal areas.

3 Do not apply lubricant to the bottom face of the fan blade root. Lubricant is not permitted on the bottom face of the fan blade root.

4 Some lubricant is permitted on the area between the dovetail area and the flowpath line.

5 Remove the excess lubricant.

(e) Install all the fan blades and fairings to their correct slot locations in the hub. See 72-00-31 Install-03 (Task 72-00-31-420-002-002).

(5) Apply Antigallant Compound P06-044 (Optional to P06-005) to each fan blade root as follows:

NOTE: A 4 hour cure time is necessary for Antigallant Compound P06-044.

(a) Make a mark and record the location of each fan blade and fairing in the hub as shown in the procedure 72-00-31 Removal-03 (Task 72-00-31-020-002-002). See Standard Practices Manual, PN 585005 Section 70-11-00 for approved temporary markers.

(b) Remove all the fan blades and fairings from the hub as shown in the procedure 72-00-31 Removal-03 (Task 72-00-31-020-002-002).

(c) Use a cloth and remove any dirt or grit from the fan blade root area and the hub blade slot. See Figure 1312.

1 Do not try to remove the existing coating.

2 Do not try to polish the metal.

(d) Apply the spray-on Antigallant Compound P06-044 to the dovetail area only on the fan blade root. See Figure 1312.

1 Do not apply antigallant compound to the fan hub slots.

2 Do not apply antigallant compound to the fan blade fairing seal areas (flowpath lines). Antigallant compound is not permitted on the fairing seal areas.

3 Do not apply antigallant compound to the bottom face of the fan blade root. Antigallant compound is not permitted on the bottom face of the fan blade root.

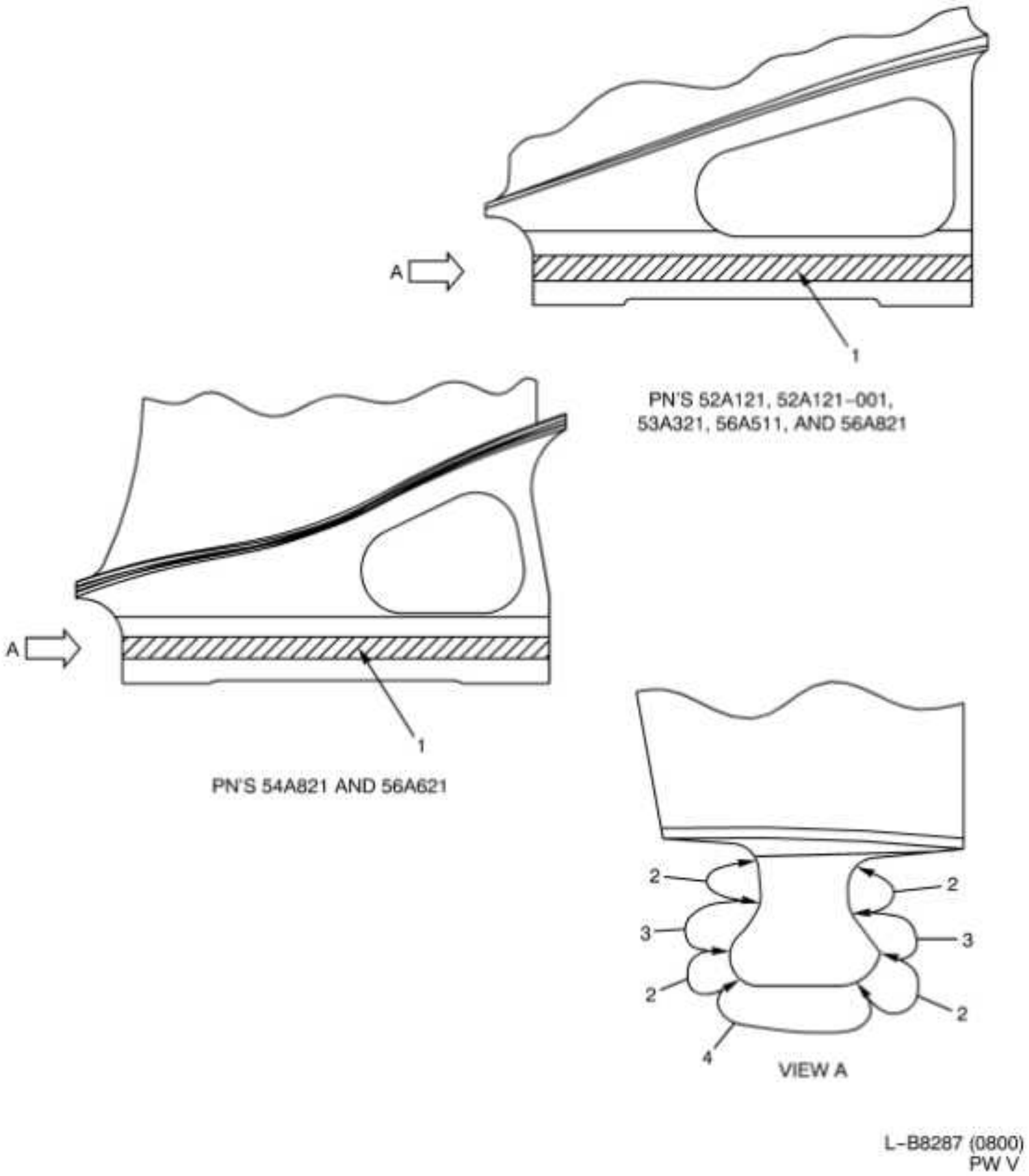
4 Some antigallant compound is permitted on the area between the dovetail area and the flowpath line.

(e) Let the antigallant compound cure for 4 hours minimum at 70°F (21.1°C) minimum before installation of the fan blades in the hub.

(f) Install all the fan blades and fairings to their correct slot locations in the hub. See 72-00-31 Install-03 (Task 72-00-31-420-002-002).

(6) Install the compressor inlet cone by 72-00-31 Install-02 (Task 72-00-31-420-001).

(7) Continue the 71-00-00 Test No. 19 - Trim Balance Procedure and Test (Task 71-00-00-760-043).


A
1
PN'S 52A121, 52A121-001,
53A321, 56A511, AND 56A821
A
1
PN'S 54A821 AND 56A621
2
3
2
4
2
3
2
VIEW A
L-B8287 (0800)
PW V

Application Of Antigallant To The Fan Blade Root
Figure 1312
(Task 71-00-00-380-002)

1. Blade Root Application Area
2. A Small Quantity Of Lubrication Is Permitted In This Area
3. Lubrication Is Applied To This Area
4. No Lubrication Is Permitted In This Area

Key to Figure 1312

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - TESTING-20

Task 71-00-00-760-034:

1. Test No. 20 - Cold Engine Fuel Spike Stability Test

A. General

NOTE: This procedure has been deleted, refer to Testing-21, (Task 71-00-00-760-065) for the Cool Engine Fuel Spike Stability Test.

Previous Pageblock Return to Previous Menu Next Pageblock

Task 71-00-00-760-065:

1. Test No. 21 - Cool Engine Fuel Spike Stability Test

A. General Specifications and Requirements

NOTE: PW4000-94 Engines incorporating HPC Cutback Stator configuration per SB PW4ENG 72-704, that have not been converted to HPC non-Cutback Stator configuration, are not required to do Testing-21.

(1) Use this procedure to verify that the engine has satisfactory high pressure compressor surge margin for return to service. Refer to 71-00-00, Testing-00, the Test Requirements After Engine/Module/Component Repair or Replacement (Task 71-00-00-990-003) and look at the Test Reference Table 1302, to determine if the engine workscope during this shop visit requires Testing-21. This test can also be used for an engine just removed from the wing for a high pressure compressor surge margin verification. This test must not be used to return an engine to service that was confirmed to have experienced a Group 3 surge event.

(2) Before the special PWA Tool Surge Margin Analysis Control (SMAC-2) can be used, the test cell data system must be modified and validated by Pratt & Whitney.

(a) For most test cell configurations, these changes will be limited to software changes to the test cell computer.

(b) The necessary changes must be done by a person familiar with the specific test cell computer that will be modified and familiar with the ARINC 429 specification.

(c) The test cell modification includes three basic Tasks as follows, Refer to Figure 1301 for Block Diagram and Figure 1302 for Input/Output Spike EEC Control.

1 Task 1: Test cell computer update to ARINC data bus TCC(AI)/TMC or FMC(TBC)/FCC(MD).

2 Task 2: "Spiker Control Panel/User Interface" selects content of additional ARINC labels that control SMAC-2 functions that are necessary for the cool engine fuel spike stability test. Based on the computer test cell configuration, the implementation of this function can vary greatly.

3 Task 3: Monitoring of SMAC-2 feedback status word OL 277 to make sure control is functioning correctly. Refer to Figure 1305.

(3) The operation of the Cool Engine Fuel Spike Stability Test system must be periodically checked to verify correct operation. P&W will support the initial checkout of the test cell and computer software changes to make sure that the system is working correctly and that the engine test results are satisfactory in order to validate a test cell for Testing-21.

(4) Once the test cell has been modified and qualified as "Testing-21" capable, the requirements for this test must be accomplished on all engines that are required to do this test by the Test Reference Table 1302 of 71-00-00 Testing-00.

(5) Fan Thrust Deterioration Mode Testing-21 Requirement

NOTE: For engines with Phase 0/FB2T or Phase 1/FB2B fan blade configurations, the engine must be tested in the non-Fan Thrust Deterioration Mode (non-FTDM). To demonstrate that the fan does not have FTDM, do the steps that follow before you do Testing-21.

(a) Do the steps necessary in the PW4152 Series Engine Manual, PN 50A443 Engine Acceptance Test, 71-00-00, Testing-09 (Task 71-00-00-760-020), Paragraph M, in order to determine if the engine fan operation is normal or abnormal in accordance with the procedures shown in step 1. O. "Check Corrected Data". Parameter shifts shown in 71-00-00, Testing-09 step 1. O. (3) are used to determine if engine fan operation is normal or abnormal. If parameters are abnormal, FTDM exists and action must be taken with one of the procedures in step (5) (c), to correct fan condition before you do Testing-21. Repeat this step to demonstrate that Fan corrective action resulted in non-FTDM condition.

(b) Alternate 2-Point Calibration Procedure to Test for Fan Thrust Deterioration Mode (Alternate to Step (5), (a))

NOTE: The purpose of this procedure is to establish an alternate method to determine if an engine has or has not developed fan Thrust Deterioration Mode (FTDM). Current Engine Manual procedures for identifying FTDM require that a 4-point acceptance calibration be performed. Refer to Engine Acceptance Test, 71-00-00, Testing-09 (Task 71-00-00-760-020), requirements (with station 2.5 instrumentation) followed by analysis. This alternate procedure allows a shorter/simplified 2-point data method.

1 Data requirements

NOTE: Use the procedures in the Engine Manual, 71-00-00, Testing-09 (Task 71-00-00-760-020), Paragraph M., "Engine Acceptance Test" to get two steady state performance points at power levels of 1.55+/-0.01 and 1.45 +/-0.01 PT4.95/PT2.

a Accelerate engine to 1.55, stabilize for 5 minutes, take data point.

b Decelerate engine to 1.45, stabilize for 3 minutes, take data point.

c The parameters as follows are required as a minimum:

PT4.95/PT2
N1
N2
TT2

2 Analysis requirements

NOTE: Use the procedures defined in the Engine Acceptance Test, 71−00−00, Testing−09 (Task 71−00−00−760−020) "Correction Of Observed Data". Refer to Figure 1302 to calculate the data that follows:

a Corrected Low Rotor Speed (N1C), then calculate %N1C=N1C/36.

b Corrected High Rotor Speed (N2C), then calculate %N2C=N2C/99.

c Calculate %N1C/%N2C for both points.

d Calculate %N1C/%N2C baseline levels for each point with the equation that follows:

$$\%N1C/\%N2C\ \text{baseline}=(-0.49762) \times (PT4.95/PT2)^2 + (1.83988) \times (PT4.95/PT2) - (0.64163).$$

e Calculate % Delta relative to baseline (for 1.45 and 1.55 points).

$$\%\text{Delta}=(100) \times (\%N1C/\%N2C - \%N1C/\%N2C\ \text{baseline})/(\%N1C/\%N2C\ \text{baseline}).$$

f Assess data for FTDM condition using % Delta parameter.

Compare 1.45 and 1.55 PT4.95/PT2 power points.
If 1.55 power point is 1.5 percent or greater than the 1.45 power point, engine has FTDM. Refer to Figure 1308 for example of the upward shift expected when FTDM is present at high power.
If the engine demonstrates it has FTDM, corrective action must be taken with one of the procedures in step A. (5)(c) to correct problem before you do the fuel spike test sequence shown in Testing−21.
Following corrective action for FTDM, Steps 5. (b)1 and 2 must be repeated to verify that the corrective action taken was effective in eliminating the FTDM condition.

(c) Repair fan leading edge contour of Fan Blades with one of the methods: Engine Manual 72-00-31, Repair-01 (Task 72-00-31-300-001); or Engine Cleaning, Inspection, and Repair Manual 72-31-82, Repair-13 PW4000 Series CIR, PN 51A357; or Service Bulletin No. PW4ENG 72-732, as applicable based on fan blade part number; or Service Bulletin No. PW4ENG 72-655, as applicable based on fan blade part number.

(6) The engine need not have any special thermal history (i.e. specific shutdown period or engine operation that establishes a cold engine or warm engine thermal condition) prior to start of Testing-21.

(7) The Bill Of Material EEC (Electronic Engine Control) and EEC programming plug are removed from the engine for this test. A special PWA Tool Surge Margin Analysis Control (SMAC-2) with a special tool EEC programming plug is installed.

(8) It is possible that other tests are necessary before you do this test. Refer to 71-00-00 Power Plant General - Testing-00, Test Requirements After Engine/Module/Component Repair or Replacement, (Task 71-00-00-990-003). This procedure will also give the sequence for the necessary tests.

(9) If the Engine Acceptance Test - Testing-09 is necessary, you must do Testing-09 before you do Testing-21 or do Testing-21 in the correct sequence within Testing-09. Refer to the "Engine Run Schedule" in Testing-09, Figure 1301 for the necessary sequence.

(a) Testing-21 can only be run after the engine has passed the initial engine operational limits (oil system, vibration and secondary limits) shown in Testing-09. It must also be done after the necessary LPC/HPC break in testing shown in Figure 1301, Testing-09.

(b) To minimize control changes, it is possible to run the initial testing shown in Testing-09 with the SMAC-2 in the unarmed configuration and with the applicable PWA 103469 EEC Programming Plug as shown in step B., Equipment and Materials Necessary.

(c) After the successful completion of Testing−21 requirements, it is recommended that the engine be shutdown, the SMAC−2 be removed and the Bill of Material EEC and EEC Programming Plug be installed. Repeat Testing−07, −03, and −06 again to make sure the operation of the Bill of Material EEC is satisfactory. Continue with the remaining requirements of Testing−09. This procedure would result in the Acceptance Test being run with the same control that the engine will be returned to service with. Although running with the Bill of Material EEC is the recommended procedure, as an option the remainder of Testing−09 can be run with the SMAC−2 if set in the unarmed configuration. The SMAC−2 has the same logic (if set in the unarmed configuration) as the Bill of Material EEC.

(10) During Testing−21, Pratt & Whitney recommends that the test be documented. The purpose for documentation is to allow review of any Testing−21 test to confirm it was properly conducted.

(a) Make a record and keep these records of the data that follows:

1 Engine Serial Number, Model/Suffix

2 Engine Configuration, (NBS HPC (A1Ox or ZrOx), HPT 1st Vane Cutback, Phase I or Phase III Fan, etc.)

3 HPC Serial Number and Hours/Cycles Since New or Since Last Overhaul

4 FMU Part Number and Serial Number

5 Fuel Pump Part Number and Serial Number and Hours Since Last Overhaul

6 Testing−21 Test Date

7 Test Cell (for facilities with more than one test cell)

8 Test Cell Fan Duct Set Number/CONF (MAPNET setup parameter)

9 P Nozzle (MAPNET setup parameter)

10 TT2 and P (barometer) at start of test

11 EEC Programming Plug PN and suffix

(b) For each of the three Testing−21 fuel spikes (if all three conducted), provide the data that follows:

1 Time at Idle (xx Min:xx Sec)

2 Time to Fuel Spike (xx.x Sec)

3 EPR at Fuel Spike Initiate (1.xxx)

4 Goodness Bit Status (Octal Label 277, Bit 19) − Good/Bad

(c) Make a record of ARINC transient time history data (for those cells having this capability) for the ARINC parameters (Octal Label in parentheses) from the Channel−in−Control as follows:

1 EPRI (340), EPRCOM (341), N2A (344), N2DOT (300), P5I (132), P2E (131), WFRLRQ (334), T2E (130), PB (264), SVA (325), B25 (335), N2C25 (336), T5 (345), TRASL (133), N1A (346)

B. Equipment And Materials Necessary

Special Tools:

To do the cool engine spike test you will need one PWA 105321 SMAC−2 Control and one PWA 103469 EEC Programming Plug that is matched for the specific engine model/suffix that will be tested.

PWA 105321	Control, Surge Margin Analysis (SMAC−2)

The EEC Programming Plug utilized for Testing−21 for all PW4152 engine model/suffix configurations will allow the SMAC−2 control to command thrust operation above their respective rated thrust. This condition is acceptable during Testing−21 as these engines are capable of operating at a higher thrust level with no detrimental effect. No post−Testing−21 actions are required for these engine configurations after completing Testing−21.

PWA 103469−18	Plug, EEC Programming (For PW4152, PW4156A, PW4158)

Special Tools:

(CONTINUED)

PWA 103469-19	Plug, EEC Programming (For PW4152-3A, PW4156A-3A, PW4158-3A)
PWA 103469-20	Plug, EEC Programming (For PW4152-1E/1C, PW4156A-1E/1C, PW4158-1E/1C)
PWA 103469-21	Plug, EEC Programming (For PW4152-3, PW4156A-3 , PW4158-3)

The engine fuel system must be capable of delivering the required Fuel Spike. Certain FMU's can limit the fuel spike capability. Only use FMU PN's 55T423 or 50U150, or subsequent, during testing. Do not use low flow FMU PN's 51T217, or 53T419, or 53T510, or 55T678, or 53T335, or 50U149.

C. Procedures To Prepare For Test

(1) Disconnect the engine EEC programming plug and remove the engine EEC (Electronic Engine Control). Refer to 72-00-33, Removal-04, (Task 72-00-33-050-001).

(a) The EEC programming plug will stay attached to the engine by its lanyard and will not be used for this test. Install a protective cover on the EEC programming plug. Attach the EEC programming plug tightly to the engine with safety wire or wire ties so it will not be damaged during the test.

(2) Install the PWA 105321 Surge Margin Analysis Control-2 in place of the engine EEC on the fan case. See 72-00-33, Installation-04, (Task 72-00-33-450-001). Do not install the engine EEC programming plug.

(3) Make a selection for a PWA 103469 EEC Programming Plug. To make the selection go to the engine identification plate and get the engine model and suffix (if any). Go to the Special Tool list and find the necessary PWA 103469 EEC Programming Plug for the engine model/suffix that you are testing.

(a) EXAMPLE 1:

1 If "PW4152 (-3)" is marked on the engine identification plate, the configuration identifier suffix is "(-3)". Make a selection of a PWA 103469-21 EEC Programming Plug.

(b) EXAMPLE 2:

1 If "PW4158" is marked on the engine identification plate with no configuration identifier suffix, the configuration is Pre Phase 3. Make a selection of a PWA 103469-18 EEC Programming Plug.

D. Testing Prior to Stability Test

(1) Do the EEC static test. See 71-00-00, Test No. 7, EEC Static Test, (Task 71-00-00-760-038).

(2) You cannot do Testing-21 above the ambient temperature levels shown in Table 1301 due to the Testing-21 1.50 EPR target requirement exceeding the sea-level takeoff rating defined by the specified EEC programming Plug. If temperatures are above the levels shown in Table 1301, you cannot do the test until the temperatures are cooler.

EEC Programming Plug	Tamb Upper Limit
PWA 103469-18 Plug	106.7° F (41.5° C)
PWA 103469-19 Plug	106.7° F (41.5° C)
PWA 103469-20 Plug	106.7° F (41.5° C)
PWA 103469-21 Plug	106.7° F (41.5° C)

NOTE: Hot day ambient temperature limits to make allowance to get 1.50 target EPR.

Tamb Upper Limit For Testing-21
Table 1301

(3) Before the test with the engine not running, set the throttle to the target 1.50 EPR setting as follows:

NOTE: It is recommended that setting the 1.50 EPR TLA mark should be done as close in time as possible to the actual running of Testing-21 in order to minimize the chance of a change in the EPR versus TLA relationship due to the ambient temperature and pressure effects.

NOTE: In certain conditions where ambient temperature or ambient pressure are changing rapidly, it may be necessary to reset the target for a 1.50 EPR setting for each separate fuel spike event.

(a) Turn the ground test power on to the SMAC-2.

(b) If T2 < 30 degrees C, continue to (3)(d).

(c) If Tamb <= 30 degrees C and T2EEC indicates > 30 degrees C; Dry motor the engine until T2EEC < 30 degrees C and then continue to (3)(d). If however, Tamb > 30 degrees C do not dry motor and go to step (3)(f).

(d) Move the throttle forward until 1.50 EPR Reference is shown. Mark the angular location or set the throttle stop.

(e) This indexing procedure will work in setting the 1.50 EPR power requirements of the stability test if the PWA 105321 Surge Margin Analysis Control SMAC-2 is run in the "EPR" mode.

(f) If the PWA 105321 Surge Margin Analysis Control SMAC-2 is run in the "N1" mode, you will have to adjust the throttle down slightly when the engine operates.

(g) If the fuel system has not been checked for leaks before, do the Engine Motor Leak Test (Wet Method). See 71-00-00, Test No. 2A, (Task 71-00-00-760-010). Check for leaks with the starter, if necessary repair any leaks. Ignore step (3)(h) if you have completed step (3)(d), if not continue to step (3)(h).

(h) If Tamb > 30 degrees C, run the engine to 1.50 EPR and set the throttle stop. Then, return to idle and continue with Testing-21.

E. Cool Engine Fuel Spike Stability Test Procedure

CAUTION: NO SPECIAL PRE-TEST THERMAL HISTORY IS NECESSARY FOR TESTING-21. THE TEST CAN BE RUN AT ANYTIME DURING ENGINE RUNNING IF THE REQUIREMENTS OF TESTING-09 FIGURE 1301 HAVE BEEN MET IF REQUIRED (I.E. ENGINE BREAK-IN FOLLOWING LPC/HPC REPAIR, REPLACE OR NEW).

CAUTION: MAKE SURE THE TEST CELL COMPUTER SOFTWARE FOR TESTING-21 IS VALIDATED FOR SATISFACTORY OPERATION BY P&W BEFORE THE COOL ENGINE SPIKE TEST IS RUN. THE P&W REPRESENTATIVE WILL MAKE SURE THE SYSTEM WILL RUN THE ENGINE STABILITY TEST SATISFACTORILY. THIS MUST BE DONE PRIOR TO FIRST RUN OF TESTING-21 FOR EACH TEST CELL. ANY TIME THERE IS A SUBSEQUENT CHANGE TO THE TEST CELL STRUCTURE, OR COMPUTER HARDWARE OR SOFTWARE, P & W MUST BE CONTACTED TO DETERMINE IF RE-VALIDATION IS REQUIRED.

(1) The Cool Engine Fuel Spike Stability Test is a stand alone test supported by test cell computer software. The Engine Run Schedule is shown in Testing-21, Figure 1306. If the "Necessary Test" shown in the Test Reference Table - Engine, Modules and Primary Parts, Table 1302, (Task 71-00-00-990-003) require Testing-09, (Task 71-00-00-760-020) to be performed, Testing-21 must be performed in the sequence shown in Figure 1301, Testing-09. Testing-21 Figure 1306 shows the test sequence starting from an engine shutdown condition. Testing-21 can also be initiated with the engine running at idle condition.

NOTE: The requirement to operate the engine for a minimum of 20 minutes at SMAC-2 Idle must be satisfied if testing is interrupted between any of the individual fuel spikes.

(2) Start Testing-21 procedure with engine shutdown, Arm SMAC-2 Control.

(a) If the engine is already running, decelerate the engine to idle TLA setting and arm the SMAC-2 control. Then proceed to step E. (4).

(3) Start the engine by the Engine Start Procedure (Normal), (Task 71-00-00-760-003).

CAUTION: IF AN ENGINE SURGE OR STALL OCCURS DURING THIS TEST, YOU MUST MOVE THE THRUST LEVER TO MINIMUM IDLE WITHIN ONE SECOND OF THE SURGE OR STALL. DO THE PROCEDURES SHOWN IN TESTING-00 "PROCEDURE AFTER ENGINE SURGE OR STALL" (TASK 71-00-00-760-008). IF YOU DO

NOT DO THESE PROCEDURES, YOU CAN DAMAGE THE TURBINE TIP SEALS.

(4) Operate the engine at SMAC−2 IDLE for minimum of 20 minutes (−0/+ indefinite seconds) and then quickly advance the throttle in one second or less to the 1.50 EPR target. Use the throttle stop or reference mark that you set before the test.

(a) Closely monitor to make sure that the 1.5 EPR +/−0.01 EPR target is achieved before initiation any fuel spike. If during Testing−21, the target EPR is not achieved, Disarm fuel spike before initiation of spike, re−adjust the throttle stop to achieve 1.50 EPR +/−0.01 EPR. Return throttle to idle, re−arm the spike and repeat this part of the test (which includes 20 minute cool down at idle).

(b) For the time at idle requirement, start the timing at the gates shown on Run Schedule Figure 1306.

NOTE: If the engine is already running at stabilized idle, start the timing at the point when the SMAC−2 control is armed.

(c) SMAC−2 IDLE = Special idle speed (6000 RPM N2 corrected) which is activated when SMAC−2 is armed.

(d) 6000 RPM N2 corrected = 6000 RPM N2/SQRT ((T2EEC °C + 273.15)/288.15).

(5) Operate the engine at 1.50 EPR (± 0.01) for 40 seconds (± 3 seconds) and then do the cool engine fuel spike.

(a) For the time at 1.50 EPR requirements, start the timing at the gates shown on Run Schedule, Figure 1306.

(b) When the engine fuel spike initiated, the engine will automatically accelerate in speed due to the fuel spike introduced by the SMAC−2 and then return to 1.50 EPR power level.

NOTE: The change in N2 speed observed during the fuel spike should be a consistent RPM value for different engines tested.

(c) If the engine does a surge or a stall (a very loud booming noise with flames out the tailpipe) during the cool engine fuel spike immediately bring the throttle back to IDLE. Follow the procedures shown in Procedure After Engine Surge Or Stall, (Task 71-00-00-760-008). If the engine does a surge or a stall on any of the Testing-21 fuel spikes, the test is terminated, as the engine has not passed the test.

(6) If the engine does not surge or stall, continue to operate the engine at 1.50 EPR for a minimum of ten seconds following the fuel spike and then move the throttle to SMAC-2 idle power setting, engine will return to SMAC-2 idle N2 speed.

CAUTION: BIT 19 OF OCTAL LABEL (OL) 277 WILL ONLY BE SET FOR 60 SECONDS FOLLOWING INITIATION OF FUEL SPIKE. AFTER 60 SECONDS BIT 19 OF OL 277 WILL BE RETURNED TO "0" WHICH IS DEFINED AS "BAD". IT IS NECESSARY TO VISUALLY CONFIRM THAT THIS BIT IS SET TO "1" WHICH IS DEFINED AS "GOOD" IN EITHER CHANNEL A OR B FOLLOWING THE FUEL SPIKE IN ORDER TO VERIFY THAT THE FUEL SPIKE MAGNITUDE IS ACCEPTABLE.

(7) Visually make a check that the bit 19 of Octal Label (OL) 277 was set as a "1" which is defined as "good" in either channel A OR B following the fuel spike. This indicates that the fuel spike magnitude was correct and that testing may continue.

(a) If bit was set to "0" which is defined as "bad" in both Channel A AND B following the fuel spike, discontinue testing and take corrective action to resolve fuel spike magnitude out of allowable tolerance problem, then repeat test.

(8) Do steps E. (4) through E. (7) above activating fuel spike at 60 and 20 seconds, as shown in Engine Run Schedule Figure 1306.

(9) At idle engine power, disarm the SMAC-2 control. The engine will return to normal MINIMUM IDLE speed.

NOTE: Other engine test requirements may be done at this time or do an engine shutdown procedure, Refer to "Normal Shutdown Procedure", (Task 71-00-00-760-004).

F. Pass or Fail Criteria Of The Stability Test

(1) To pass the Cool Engine Fuel Spike Stability Test, the engine must not surge or stall during any of the fuel spike points at 40, 60, or 20 seconds, including verification that the bit 19 of Octal Label (OL) 277 was set as a "1" which is defined as "good" in either channel A OR B following each spike.

(2) The engine fails the Cool Engine Fuel Spike Test if it has a surge or stall during either the 40, 60, or 20 second fuel spike points independent of the value set by bit 19 of Octal Label 277 in channel A or B. The engine does not have satisfactory HPC surge margin and must not be returned to service.

G. Procedures Necessary After Testing

(1) Remove the PWA 105321 Surge Margin Analysis Control (SMAC−2) and PWA 103469 EEC Programming Plug from the fan case. See 72−00−33 Removal−04, (Task 72−00−33−050−001).

(a) As an option, the SMAC−2 can remain on the engine for any additional testing if set in the unarmed configuration.

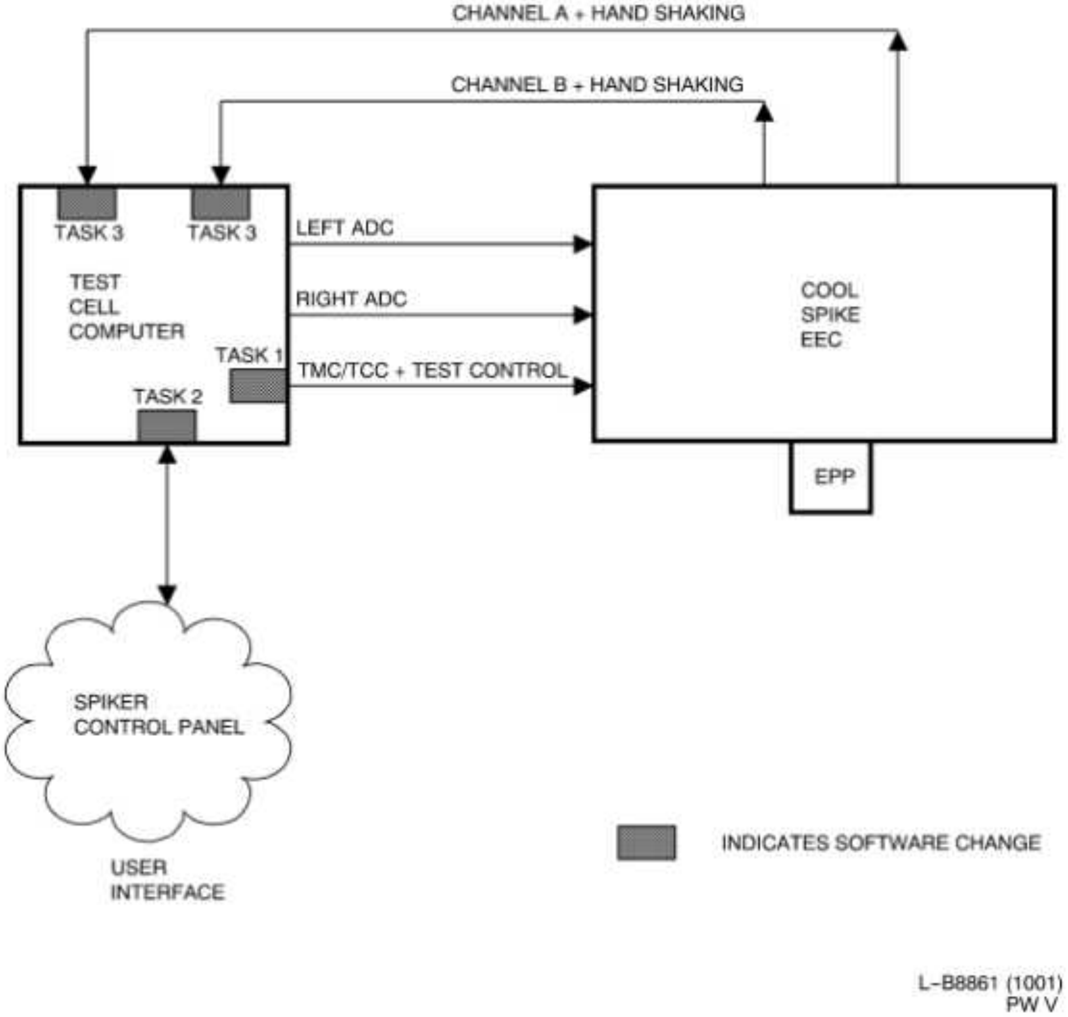
NOTE: When running additional engine testing with the SMAC−2 unit in the un−armed mode, the EPR modifier (CDX) will be set to class 16.

(2) Install the engine Bill of Material EEC (Electronic Engine Control) on the fan case. See 72−00−33, Installation−04, (Task 72−00−33−450−001).

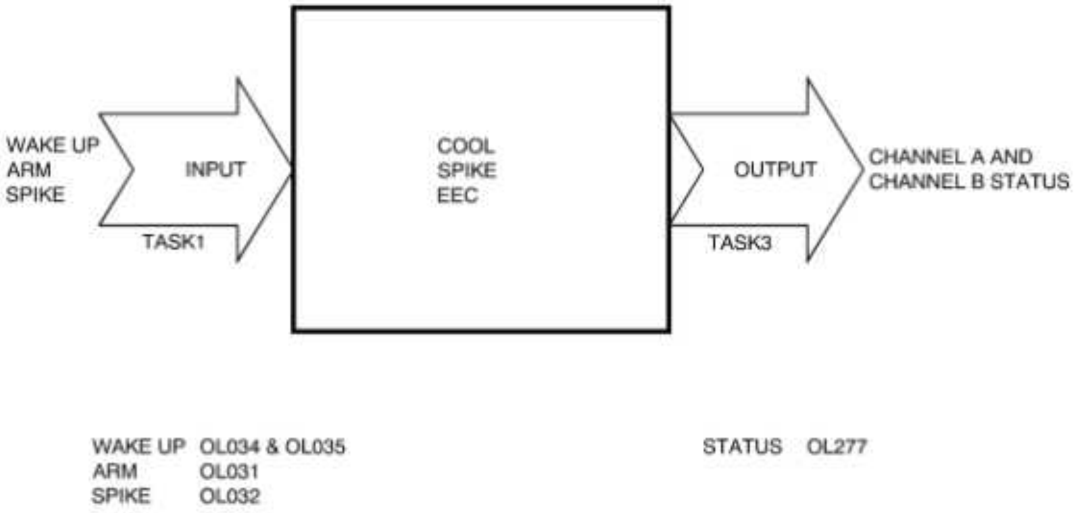
CAUTION: DO NOT INSTALL THE PWA 103469 EEC PROGRAMMING PLUG IN THE BILL OF MATERIAL ENGINE EEC (ELECTRONIC ENGINE CONTROL). YOU MUST INSTALL THE CORRECT ENGINE EEC PROGRAMMING PLUG IN THE BILL OF MATERIAL EEC. IF THE PWA 103469 EEC PROGRAMMING PLUG IS INSTALLED THE ENGINE WILL NOT OPERATE.

(a) Install the original engine EEC programming plug that is attached to the engine by its lanyard, Refer to 72−00−33, Installation−04, (Task 72−00−33−450−001).

(b) If the engine will continue with the Engine Acceptance Test − Testing−09, (Task 71−00−00−760−020) install the special programming plug used during Testing−09.

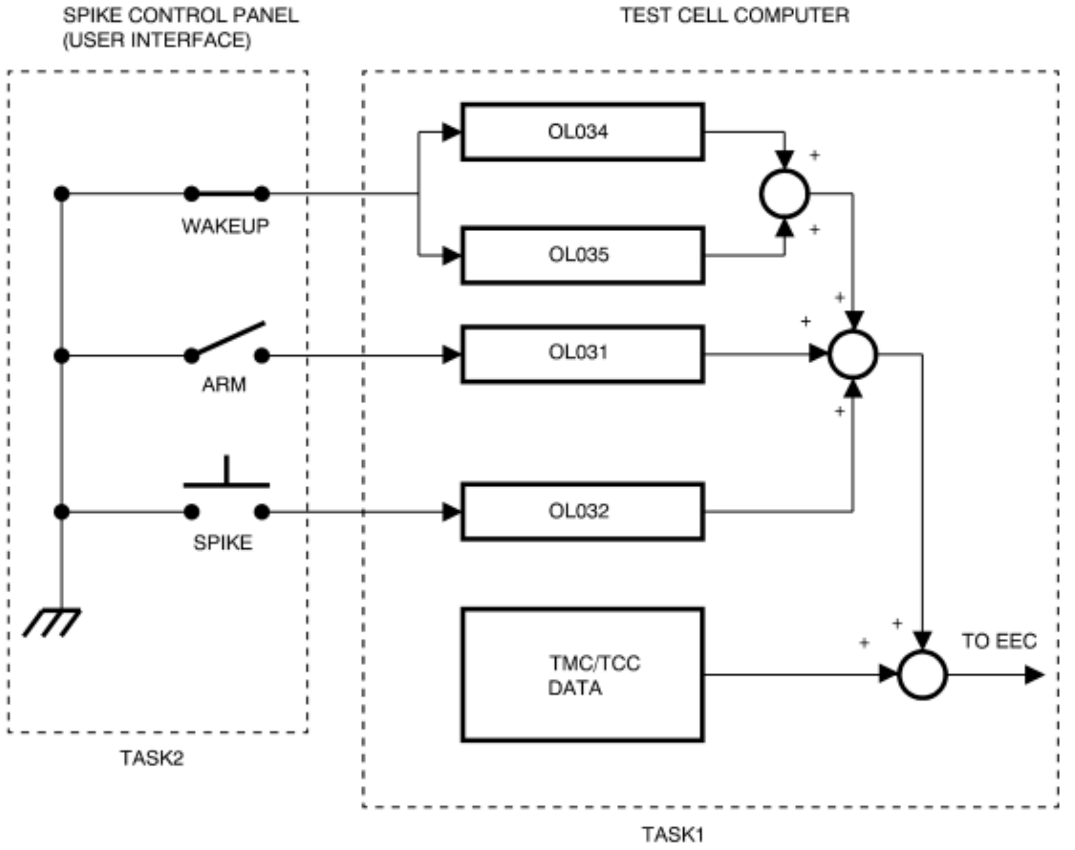

CHANNEL A + HAND SHAKING
CHANNEL B + HAND SHAKING
TASK 3
TASK 3
TEST CELL COMPUTER
TASK 1
TASK 2
LEFT ADC
RIGHT ADC
TMC/TCC + TEST CONTROL
COOL SPIKE EEC
EPP
SPIKER CONTROL PANEL
USER INTERFACE
INDICATES SOFTWARE CHANGE
L-B8861 (1001)
PW V

Special Requirements - Block Diagram
Figure 1301
(Task 71-00-00-760-065)


WAKE UP
ARM
SPIKE
INPUT
TASK1
COOL
SPIKE
EEC
OUTPUT
TASK3
CHANNEL A AND
CHANNEL B STATUS
WAKE UP OL034 & OL035
ARM OL031
SPIKE OL032
STATUS OL277

L-B8862 (1001)
PW V

Special Requirements - Input/Output Spike EEC Control
Figure 1302
(Task 71-00-00-760-065)


SPIKE CONTROL PANEL
(USER INTERFACE)
TEST CELL COMPUTER
WAKEUP
ARM
SPIKE
OL034
OL035
OL031
OL032
TMC/TCC
DATA
+
TO EEC
TASK2
TASK1

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PW V

Special Requirements - Conceptual Block Diagram
Figure 1303
(Task 71-00-00-760-065)

Spiker EEC Inputs (Test Cell to SMAC−2)
TASK 1

		Parity	SSM		DATA																			SDI		LABEL								DATA (HEX)
		32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
(LABEL 034)	Wake−Up Word #1	Odd	1	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1	0	0	0	0	X	X	0	0	0	1	1	1	0	0	E38E
(LABEL 035)	Wake−Up Word #2	Odd	1	0	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1	0	0	0	X	X	0	0	0	1	1	1	0	1	71C7
(LABEL 031)	SPIKER ARMED	Odd	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	0	0	0	S	S	0	0	0	1	1	0	0	1	AAAA
(LABEL 032)	SPIKE INITIATE	Odd	1	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	0	0	0	S	S	0	0	0	1	1	0	1	0	CCCC

Maximum Transmit Interval 200 msec
Maximum Transport Delay 200 msec

X= Doesn't distinguish SDI
S= Distinguishes SDI

BIT 10	BIT 9	
0	0	ENGINE #4
0	1	ENGINE #1
1	0	ENGINE #2
1	1	ENGINE #3

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PW V

Special Requirements − Inputs To SMAC−2
Figure 1304
(Task 71−00−00−760−065)

POWER PLANT GENERAL − TESTING−21

1. General Comments: All ARINC Labels, OL 031, OL 032, OL 034 And OL 035 Will Be Continuously Sent To The Cool Spike EEC (SMAC−2). A Bill Of Material EEC Does Not Recognize These Labels, They Can Be Permanently Added To The FMC/TMC/FCC/TCC data Stream. The Contents Of These Labels Change Dependent On What Function Is Being Selected/Enabled. Unless Specified Below, It Is Recommended That The Labels Be Sent With A Content Of Hex 0000 For Bits 29 Through 14 When A Given Function Is Not Being Selected/Enabled.
2. LABEL 034/035: "Wake Up" words, OL 034 AND OL 035 Indicate To The SMAC−2 control That It Is Installed On An Engine That Is Mounted In A Test Cell Rather Than On Wing. These Labels Do Not Exist On Either The TCC/TMC/FCC ARINC Data Buss In Any Aircraft. Therefore, These Labels Can Be Continuously Transmitted With Their Content Indicating The Selected/ Enabled State. If The Cool Spike SMAC−2 Does Not Receive The "Wake Up" Words With The Correct Content, The SMAC−2 Will Not Control Any Of It's Outputs And Therefore The Engine Will Not Start.
3. LABEL 031: "The Spiker Arm", When Enabled, Selects A Correct Consistent N2 Idle Speed From Which The Engine Is Accelerated To The 1.5 EPR Power Level For The Spike Test and changes EPR modifier from Class 16 to Class 9 (null). This idle level Is 6000 RPM N2 Corrected To Engine T2. The Requirement For The Test Is That This Idle Level Be Selected/Enabled Prior To The Engine Reaching Idle During The Start. It Is Permitted And Recommended That The "Spiker Arm" Word Be Transmitted With It's Content Indicating Selected/Enabled Prior To Engine Start But It Must Be Sent In This State Before The Engine Reaches Idle. The "Spiker Armed" Label Must Be Set For The "Spiker Initiate" Label To Activate The Fuel Spike Logic. The "Spiker Arm" Label Must Be Deactivated When Tests Other Than Testing−21 Are Being Performed In Order To Return To The Normal Engine Idle Schedule.
4. LABEL 032: "The Spiker Initiate" Word Is Used To Indicate To The SMAC−2 That It Should Activate The Fuel Spike Logic (Results In Fuel Pulse To Engine).
5. Post Test Comments: After The Test Is Completed, It Is Recommended That The SMAC−2 Be Deactivated In The Sequence That Follows:
   (a) Return The "Spiker Armed" Word To The De−selected/ Disarmed State.
   (b) Return The "Spiker Initiate" To The Deselected/Disarmed State.

Key to Figure 1304

Spiker Status Word 8 Octal Label 277

Bit	Value 1	0
11	Spiker is armed	Spiker is un−armed
12	Spike initiated	Spike not initiated
13	Spike is running	Spike not running
14	EEC is awake	EEC is asleep
15	NOT USED	NOT USED
16	NOT USED	NOT USED
17	Spiker Arm word is bad	Spiker Arm word is good
18	Spike initiate word is bad	Spike initiate word is good
19	Spike Magnitude OK * NOTE 1	Spike Magnitude no good or Spike Test not run
20	Wake−Up word #1 is bad	Wake−Up word #1 is good
21	Wake−Up word #2 is bad	Wake−Up word #2 is good
22	Wake−Up word #1 was good but currently is bad	Wake−Up word #1 was and currently is good
23	Wake−Up word #2 was good but currently is bad	Wake−Up word #2 was and currently is good
24	Spiker arm words disagree	Spiker arm words agree
25	Spiker initiate words disagree	Spiker initiate words agree
26	Aircraft Designator (see table below)	
27	Aircraft Designator (see table below)	
28	Local channel spiker is armed	Local channel spiker is disarmed
29	Local channel spike initiated	Local channel spike not initiated

(The SSM for Status Word 8 is always functional Test)

* NOTE 1: BIT WILL BE SET AFTER COMPLETION OF THE SPIKE AND HELD ON FOR 60 SECONDS. BIT MAY NOT BE SET IF ENGINE EXPERIENCES A SURGE.

Aircraft Designator Table

Bit 27	Bit 26	Aircraft
0	0	Airbus
0	1	Boeing
1	0	Douglas
1	1	Invalid

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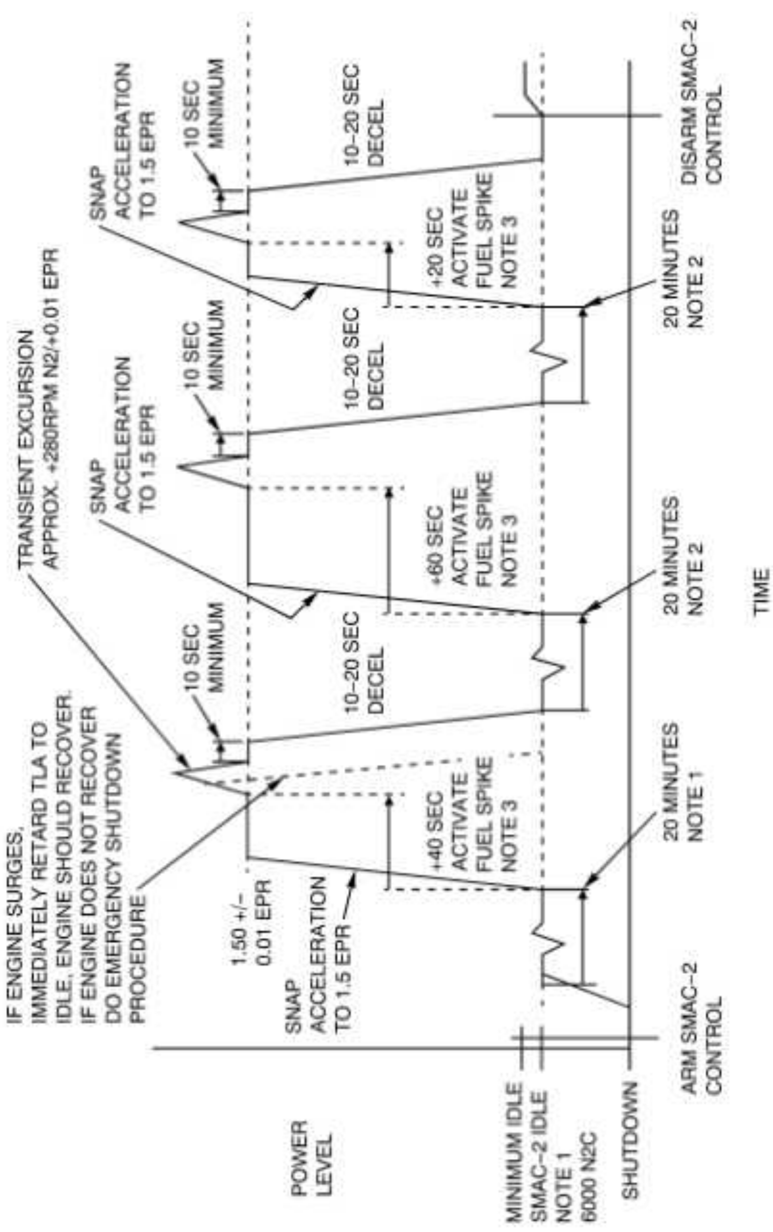
PW V

Special Requirements − Status Word
Figure 1305
(Task 71−00−00−760−065)



NOTE: IF TESTING−09 IS ALSO NECESSARY SEE THE ENGINE RUN SCHEDULE SHOWN IN TESTING−09, FIGURE 1301 FOR THE NECESSARY SEQUENCE FOR RUNNING TESTING−09 AND TESTING−21

NOTES: 1 START 20 MINUTE TIMER WHEN N2C2>5900 AND N2DOT<0
2 START 20 MINUTE TIMER WHEN N2C2<6100 AND LOOPNO IS NOT EQUAL TO 9 (INDICATES DECEL SCHEDULE GOVERNING)
3 START TIMER FOR FUEL SPIKE WHEN TLA IS 2 DEGREES > IDLE TLA

L−B8867 (1001)
PW V

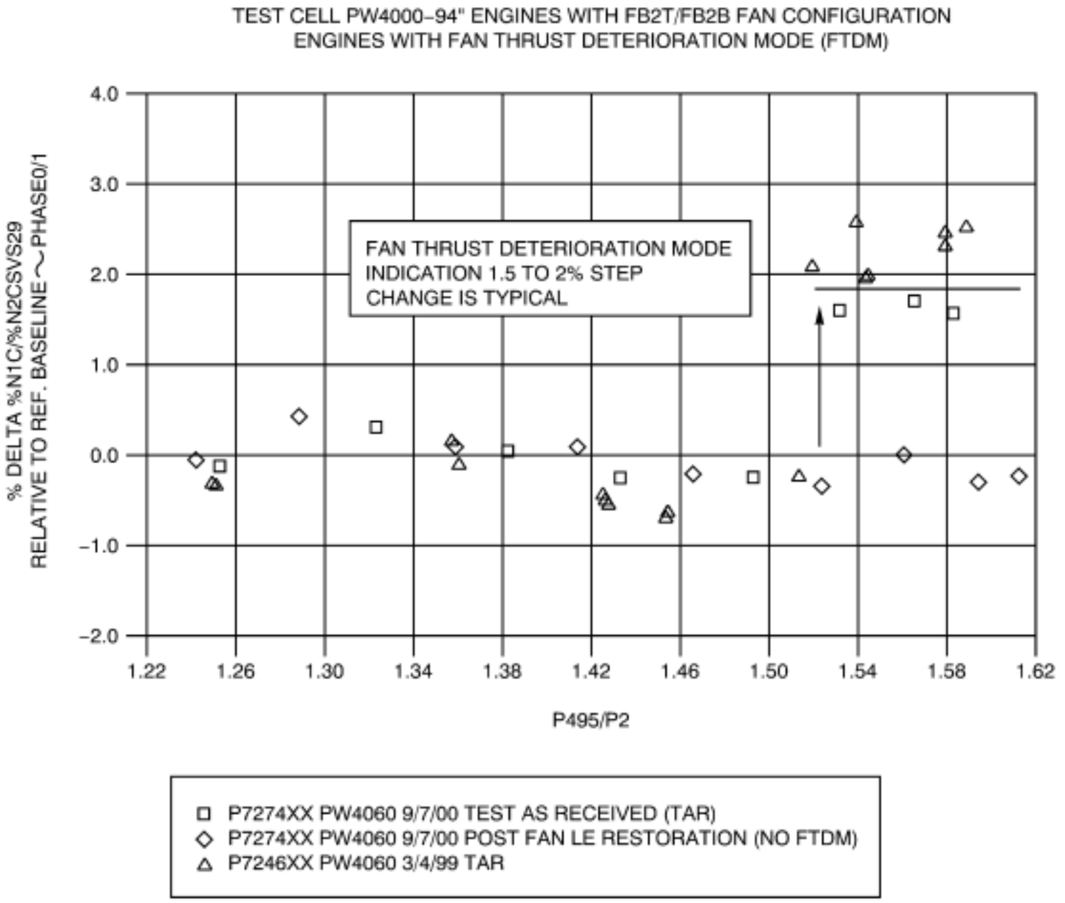
Engine Run Schedule − Cool Engine Fuel Spike Test
Figure 1306
(Task 71−00−00−760−065)

EECS ARINC STATUS WORD 2 OCTAL LABEL 271			
BIT FUNCTION		BIT STATUS	
		1	0
14	TCA VALVE	ON/CLOSE	OFF/OPEN
15	THERMATIC ROTOR	ON/CLOSED	OFF/OPEN
16	FOC BYPASS VALVE	ON/OPEN	OFF/CLOSE
17	OCL SOLENOID	ON/ON	OFF/OFF
18	RESERVED		
19	START BLEED SOL.	ON/OPEN	OFF/CLOSED
20	TANDEM BLEED SOL.	ON/CLOSED	OFF/OPEN
21	RATING	SET	CLEAR
22	RATING	SET	CLEAR
23	RATING	SET	CLEAR
24	RATING	SET	CLEAR
25	LOOPNO (LSB)	SEE TABLE	SEE TABLE
26	LOOPNO (BIT 2)	SEE TABLE	SEE TABLE
27	LOOPNO (BIT 3)	SEE TABLE	SEE TABLE
28	LOOPNO (BIT 4)	SEE TABLE	SEE TABLE
29	LOOPNO (MSB)	SEE TABLE	SEE TABLE

OL 271					LOOP NUMBER	LOOP NAME
BIT 29	BIT 28	BIT 27	BIT 26	BIT 25		
0	0	0	0	0	0	NO LOOP SELECTED
0	0	0	0	1	1	N1 BOTTOMING
0	0	0	1	0	2	N1 TOPPING
0	0	0	1	1	3	N2 IDLE
0	0	1	0	0	4	N2 TOPPING
0	0	1	0	1	5	PB TOPPING
0	0	1	1	0	6	PB BOTTOMING
0	0	1	1	1	7	EPR
0	1	0	0	0	8	N2DOT ACCEL SCHEDULE
0	1	0	0	1	9	N2DOT DECEL SCHEDULE
1	0	0	0	0	10	MIN RATIO UNIT
1	0	0	0	1	11	N1
1	0	0	1	0	12	NOT DEFINED
1	0	0	1	1	13	MINIMUM FUEL FLOW
1	0	1	0	0	14	START SCHEDULE
1	0	1	0	1	15	WF RATE

L-B8869 (1001)
PW V

Special Requirements - Status Word For Governing LOOPNO
Figure 1307
(Task 71-00-00-760-065)



L-B8893 (1001)
PW V

Alternate 2-Point Data Procedure To Check For Fan Thrust Deterioration Mode. Example That Indicates FTDM Exist
Figure 1308
(Task 71-00-00-760-065)

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Pratt & Whitney

PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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See end of list.

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		1323		DEC 15/05
		1324		DEC 15/05
		1325		DEC 15/05
		1326		DEC 15/05
		1327		DEC 15/05
		1328		DEC 15/05
		1329		DEC 15/05
		1330		DEC 15/05
		1331		DEC 15/05
		1332		DEC 15/05
		1333		DEC 15/05
		1334		DEC 15/05
	R	1335		JAN 1/08
	R	1336		JAN 1/08
		1337		DEC 15/05
		1338		DEC 15/05
		1339		DEC 15/05
		1340		DEC 15/05
		1341		DEC 15/06
		1342		DEC 15/06
		1343		DEC 15/06
		1344		DEC 15/06
		1345		DEC 15/05
		1346		DEC 15/05
		1347		DEC 15/05
		1348		DEC 15/05
		1349		DEC 15/05
		1350		DEC 15/05
		1351		DEC 15/05
		1352		DEC 15/05
		1353		DEC 15/05
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REVISION NO. 85 DATED JANUARY 1, 2008

HIGHLIGHTS - POWER PLANT GENERAL - TESTING

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
71-00-00 TESTING-09	1335	Revised the procedure to Check Filters to add a step to look for bronze contamination in the fuel filters. (IEN07KC819)	CONFIG-1 ALL
71-00-00 TESTING-09	1339	Revised the procedure to Check Filters to add a step to look for bronze contamination in the fuel filters. (IEN07KC819)	CONFIG-2 ALL
71-00-00 TESTING-09	1336	Revised the procedure to Check Filters to add a step to look for bronze contamination in the fuel filters. (IEN07KC819)	CONFIG-3 ALL
71-00-00 TESTING-09	1340	Revised the procedure to Check Filters to add a step to look for bronze contamination in the fuel filters. (IEN07KC819)	CONFIG-5 ALL

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71−00−33	POWER PLANT GENERAL − FAN CASE − INSTALLATION−21 - 71−00−33−450−034: Install Inlet Cowl Alignment Pins
71−00−33	POWER PLANT GENERAL − FAN CASE − INSTALLATION−22

	- 71−00−33−450−035: Install EEC And RVDT Electrical Junction Box − Right Hand Side
71−00−33	POWER PLANT GENERAL − FAN CASE − INSTALLATION−23 - 71−00−33−450−036: Install EEC And RVDT Junction Box − Left Hand Side
71−00−33	POWER PLANT GENERAL − FAN CASE − INSTALLATION−24 - 71−00−33−450−037: Install PS And P2 System Tubing
71−00−33	POWER PLANT GENERAL − FAN CASE − INSTALLATION−25 - 71−00−33−450−041: Install Barometric Switch

POWER PLANT GENERAL - FAN CASE - REMOVAL-01

Task 71-00-33-050-001:

1. Remove Inlet Cowl
   A. Equipment And Materials Required

      Special Tools:
      RSE 1003 Sling, Inlet Cowl
      RSE 1105 Dolly/Work Stand, Inlet Cowl

   B. Procedure
      (1) Tag and remove three electrical connectors from 1 o'clock position on inlet cowl aft bulkhead. Install protective covers over plugs and sockets.
      (2) Remove two hydraulic tubes from 1 o'clock position on inlet cowl aft bulkhead. Install protective cover over ends of both hydraulic tubes and both port fittings.
      (3) Remove electrical connector from 4 o'clock position on inlet cowl aft bulkhead.
      (4) Remove coupling and seal attaching anti-ice duct to anti-ice tube at 4 o'clock position on inlet cowl aft bulkhead. Install protective cover over aft bulkhead anti-ice port.
      (5) Remove four (4) hoist point filler plugs from hoist point (four places) on outside surface of inlet cowl. See Figure 301. Retain plugs for reinstallation.
      (6) Position hoist and RSE 1003 Sling inlet cowl sling over inlet cowl. Using four (4) bolt and four (4) washer details of sling, attach sling pad to inlet cowl hoist point (four places). See Figure 302 for arrangement of sling pads and cables.

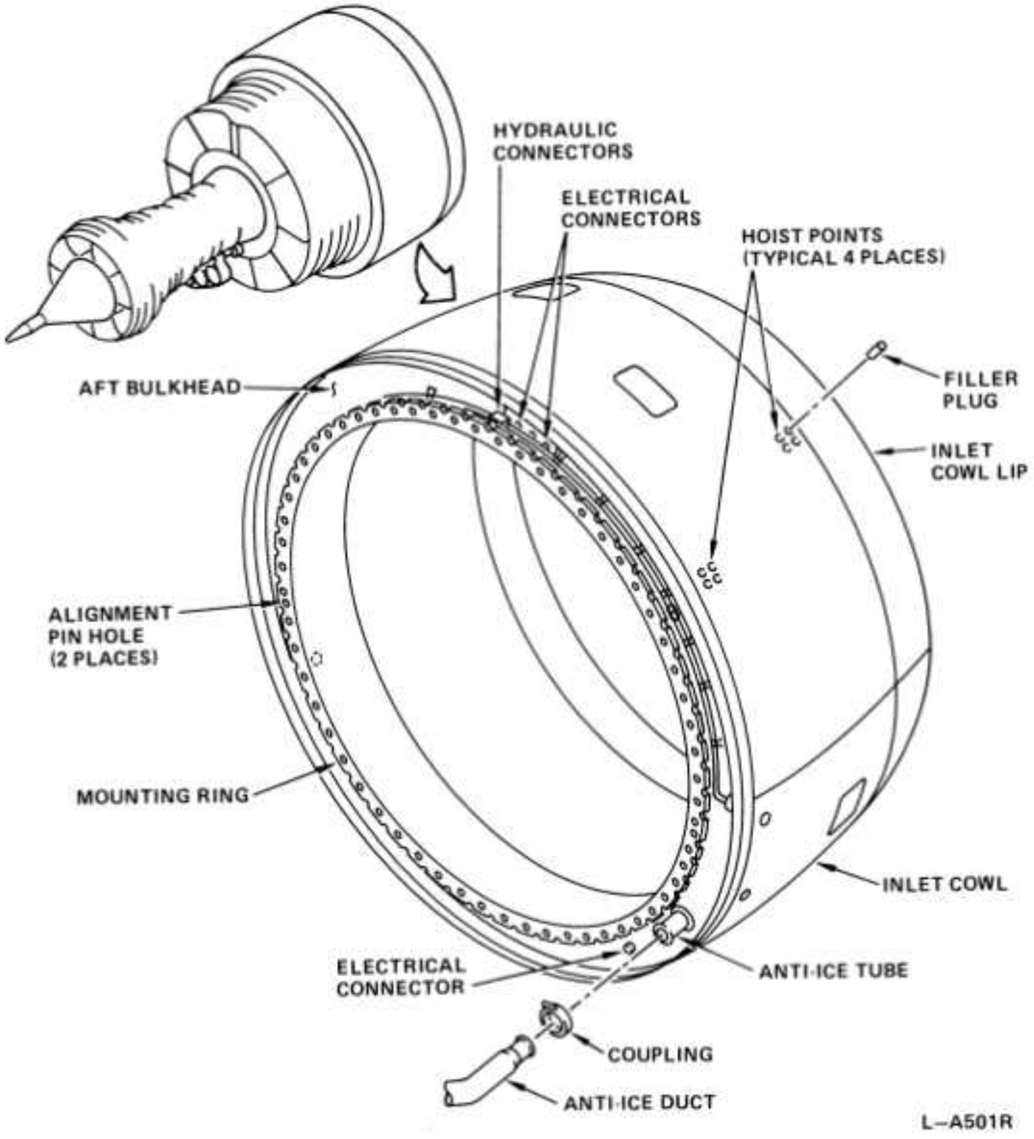
      NOTE: Nut details on sling attachment bolts are for tool storage only. Retain nuts for reinstallation to bolt details after removal of sling.

      (7) Raise hoist to remove slack from sling cables. Do not apply hoist load to inlet cowl. Adjust cable turnbuckles to equalize hoist loading on all cables.

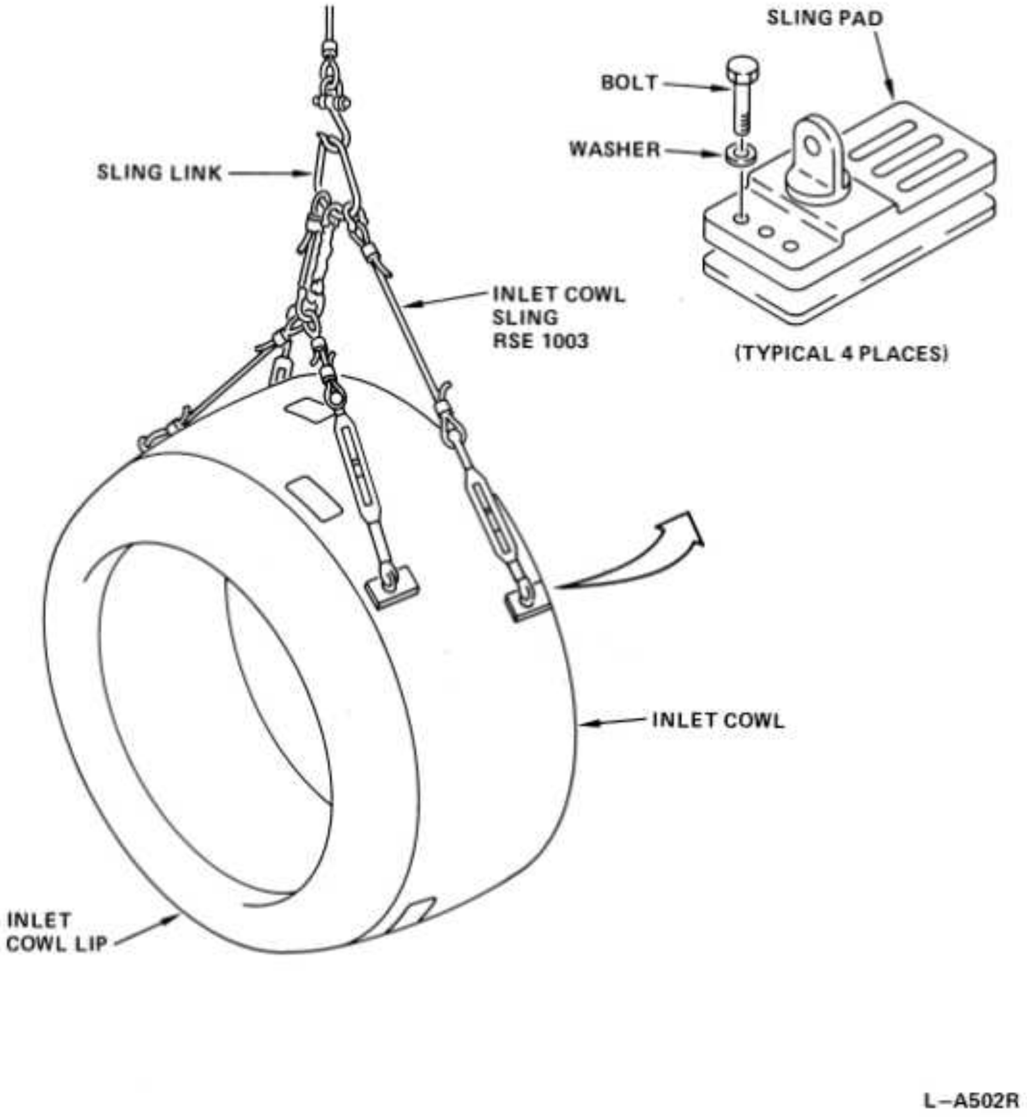
      CAUTION: WHEN LAST BOLTS ARE REMOVED FROM MOUNTING RING, SLING LINK MUST BE DIRECTLY OVER INLET COWL CENTER OF GRAVITY. IF NOT, COWL WILL SWING AND STRIKE FAN CASE.

      (8) Remove bolts, washers, and spacers (60 places) attaching inlet cowl mounting ring to fan case flange. Remove bolts in positions 6 and 7 (next to alignment pins) last. See Figure 303.
      (9) With hoist and sling supporting weight of inlet cowl, move cowl away from engine.

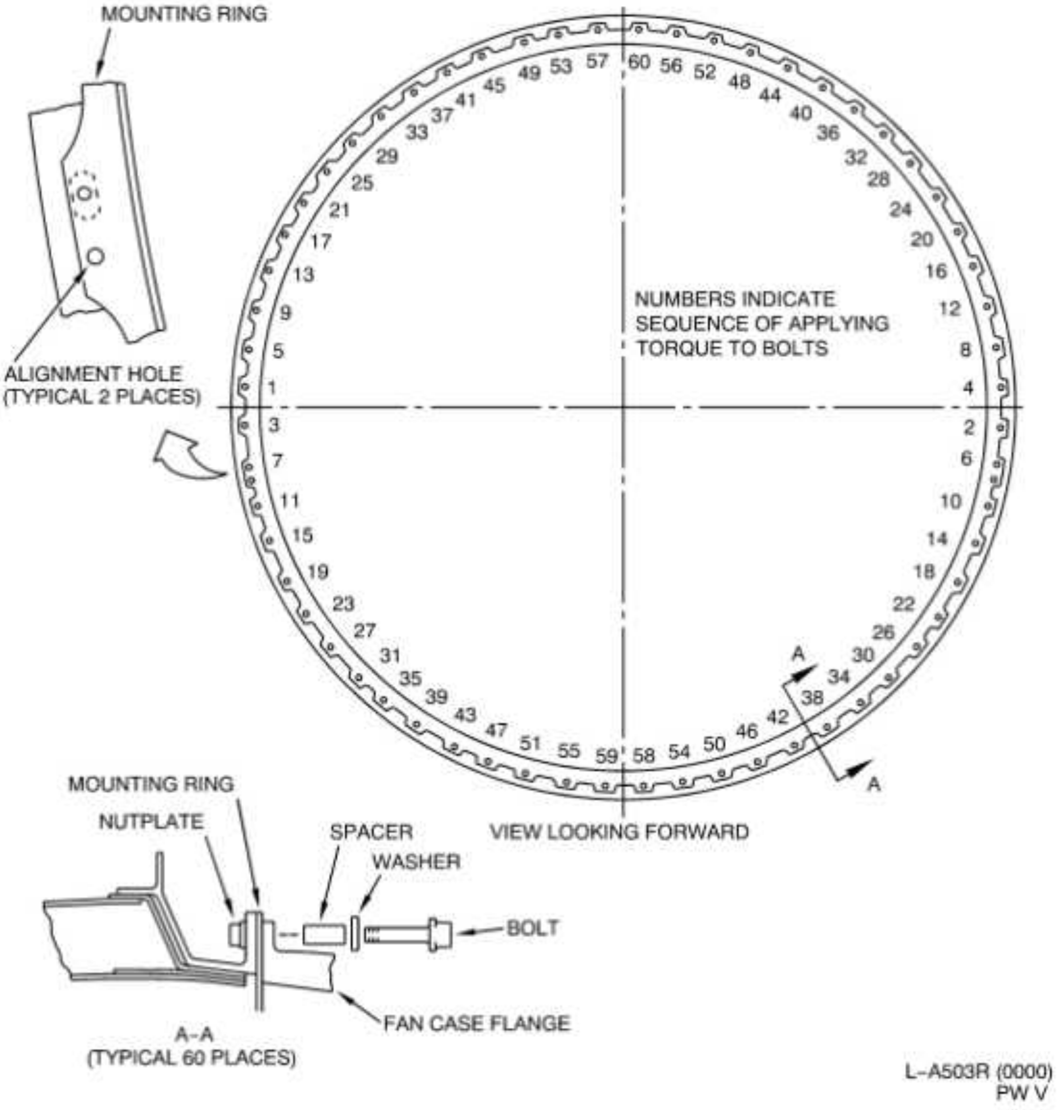
POWER PLANT GENERAL - FAN CASE - REMOVAL-01


HYDRAULIC CONNECTORS
ELECTRICAL CONNECTORS
HOIST POINTS (TYPICAL 4 PLACES)
FILLER PLUG
INLET COWL LIP
AFT BULKHEAD
ALIGNMENT PIN HOLE (2 PLACES)
MOUNTING RING
INLET COWL
ELECTRICAL CONNECTOR
ANTI-ICE TUBE
COUPLING
ANTI-ICE DUCT
L-A501R

Inlet Cowl Assembly
Figure 301
(Task 71-00-33-050-001)


SLING PAD
BOLT
WASHER
SLING LINK
INLET COWL SLING RSE 1003
(TYPICAL 4 PLACES)
INLET COWL
INLET COWL LIP
L−A502R

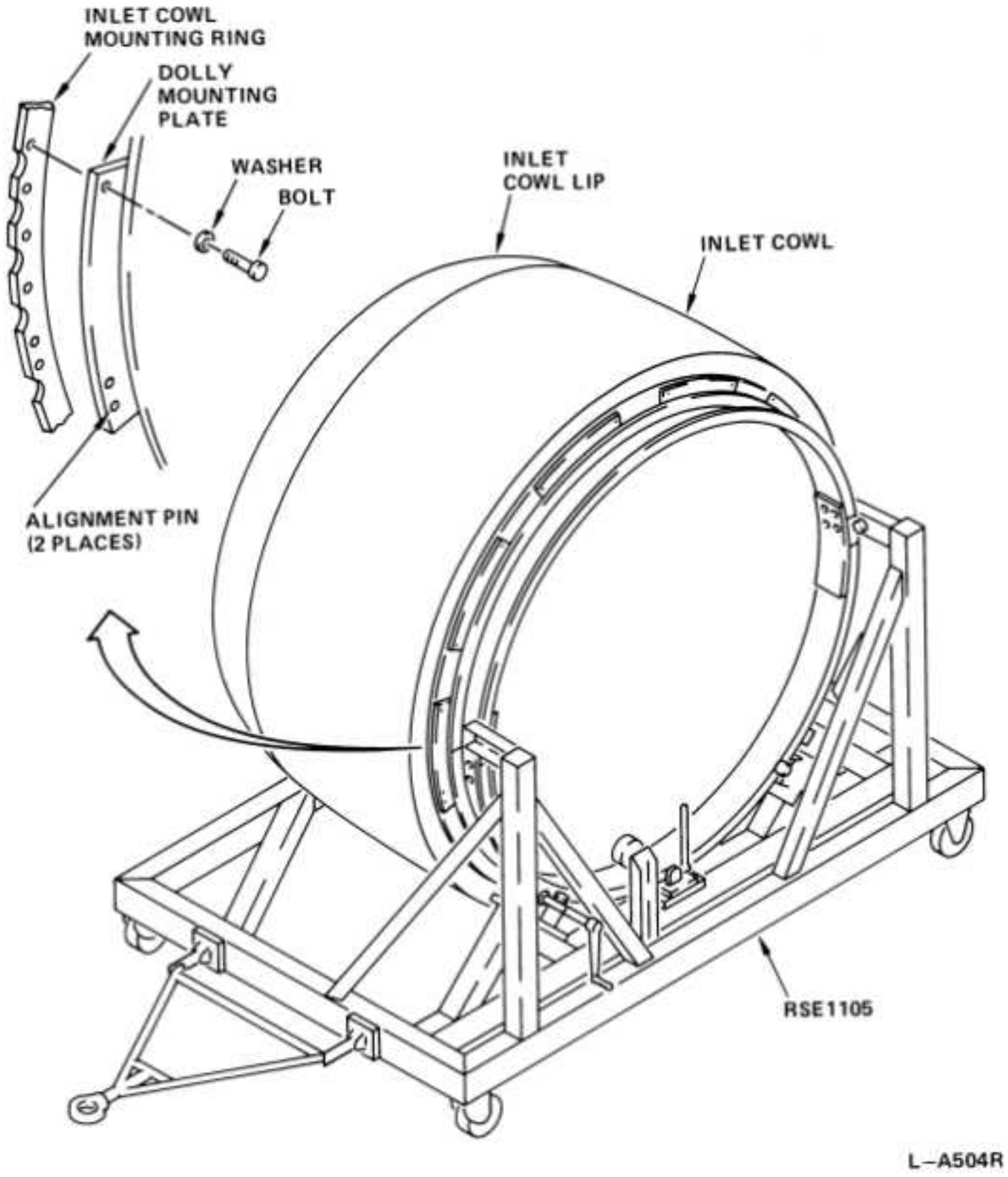
Inlet Cowl with Sling
Figure 302
(Task 71−00−33−050−001)


MOUNTING RING
ALIGNMENT HOLE
(TYPICAL 2 PLACES)
57
60
53
56
49
52
45
48
41
44
37
40
33
36
29
32
25
28
21
24
17
20
13
16
9
12
5
8
1
4
3
2
7
6
11
10
15
14
19
18
23
22
27
26
31
30
35
34
39
38
43
42
47
46
51
50
55
54
59
58
NUMBERS INDICATE
SEQUENCE OF APPLYING
TORQUE TO BOLTS
A
A
VIEW LOOKING FORWARD
MOUNTING RING
NUTPLATE
SPACER
WASHER
BOLT
FAN CASE FLANGE
A-A
(TYPICAL 60 PLACES)
L-A503R (0000)
PW V

Inlet Cowling Mounting Ring
Figure 303
(Task 71−00−33−050−001)

POWER PLANT GENERAL − FAN CASE − REMOVAL−01

(10) Install inlet cowl in RSE 1105 Inlet Cowl Dolly. See Figure 304.
  (a) Ease inlet cowl over dolly. Position inlet cowl so two alignment pins on dolly side mounting plates fit through alignment holes on inlet cowl mounting ring.
  (b) Attach inlet cowl to dolly mounting ring with two bolts, washers and nuts through each dolly mounting plate, 10 places.
(11) Remove four (4) bolts and washers attaching sling pads to hoist points (four places).
(12) Install bolts, washers and nuts in sling pad (four places) for storage.
(13) Install four (4) filler plugs to inlet cowl hoist point (four places).


INLET COWL MOUNTING RING
DOLLY MOUNTING PLATE
WASHER
BOLT
INLET COWL LIP
INLET COWL
ALIGNMENT PIN (2 PLACES)
RSE1105
L−A504R

Inlet Cowl Mounting Ring
Figure 304
(Task 71−00−33−050−001)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 71-00-33-050-011:

R 1. Remove Fan Cowl Door Hold-Open Rod Without SCU

A. Equipment And Materials Required - None

B. Procedure

(1) Remove fan cowl door hold-open rod, right side. See Figure 301.

(a) Remove two bolts, washers, and nuts attaching hold-open rod mounting bracket to Flange B1. Retain bolts, washers, and nuts with mounting bracket.

(b) Remove two bolts, washers, and nuts attaching hold-open rod retaining bracket to Flange B1. Retain bolts, washers, and nuts with retaining bracket. Retain bracket with hold-open rod.

(2) Remove two hold-open rod braces, right side. See Figure 302.

(a) Remove two bolts, washers, and nuts attaching fan cowl door hold-open rod brace to Flange A1. Retain bolts, washers, and nuts with brace.

(b) Remove two bolts, washers, and nuts attaching thrust reverser sleeve hold-open rod brace to Flange C. Reinstall bolts, washers, and nuts in same holes (Flange C 32,33). Torque nuts 85 - 95 lb-in. (9.604 - 10.734 N.m).

(3) Remove fan cowl door hold-open rod, left side. See Figure 303.

(a) Remove two bolts, washers, and nuts attaching hold-open rod mounting bracket to Flange B2. Retain bolts, washers, and nuts with mounting bracket.

(b) Remove two bolts, washers, and nuts attaching hold-open rod retaining bracket to Flange B1. Retain bolts, washers, and nuts with retaining bracket. Retain bracket with hold-open rod.

(4) Remove two hold-open rod braces, left side. See Figure 304.

(a) Remove two bolts, washers and nuts attaching fan cowl door hold−open rod brace to Flange A1. Retain bolts, washers, and nuts with brace.

(b) Remove two bolts, washers, and nuts attaching thrust reverser sleeve hold−open rod brace to Flange C. Reinstall bolts, washers, and nuts in same holes (Flange C 76,77). Torque nuts 85 − 95 lb−in. (9.604 − 10.734 N.m).

R Task 71−00−33−050−011−A:

R 2. Remove Fan Cowl Door Hold−Open Rod With SCU

R A. Equipment And Materials Required − None

R B. Procedure

R (1) Remove fan cowl door hold−open rod, right side. See Figure 305.

R (a) Remove two bolts, washers, and nuts attaching hold−open rod mounting bracket to Flange B1. Retain bolts, washers, and nuts with mounting bracket.

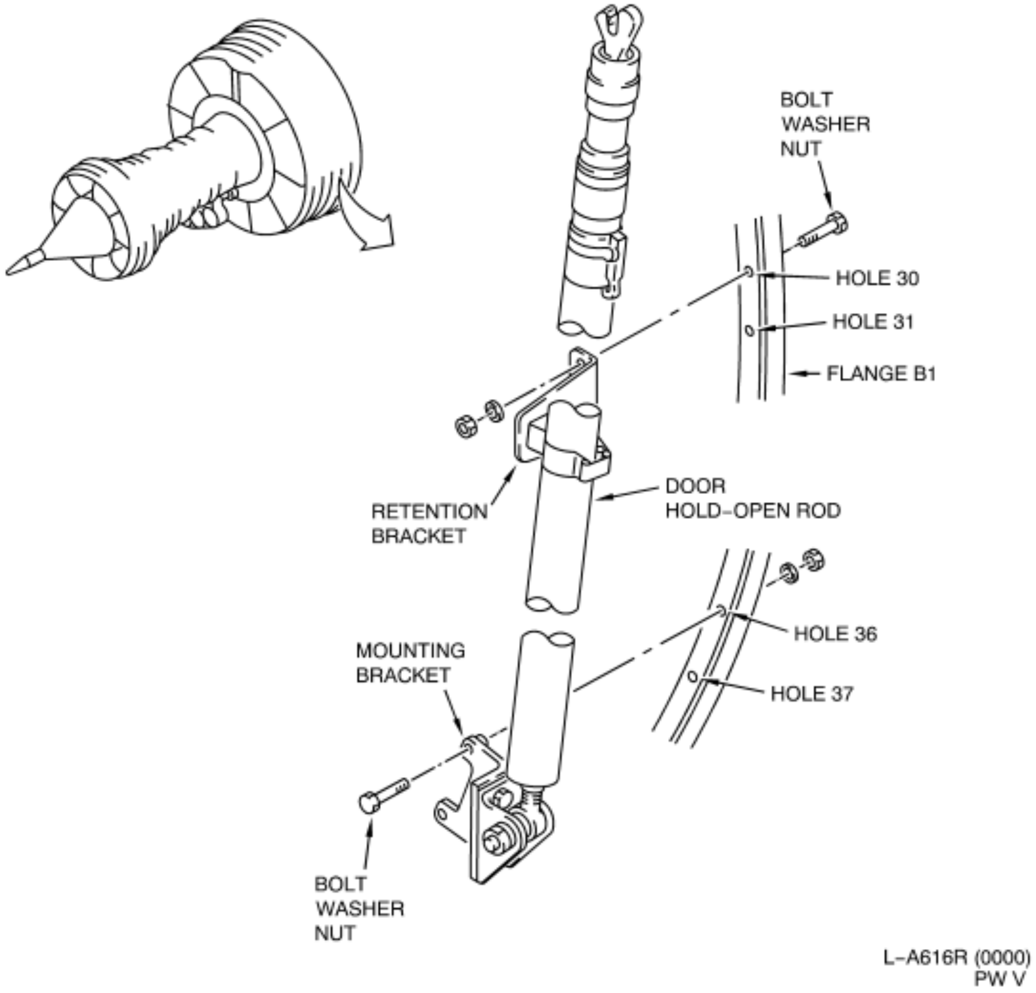
R (b) Remove two bolts, washers, and nuts attaching hold−open rod retaining bracket to Flange B1. Retain bolts, washers, and nuts with retaining bracket. Retain bracket with hold−open rod.

R (2) Remove two hold−open rod braces, right side. See Figure 306.

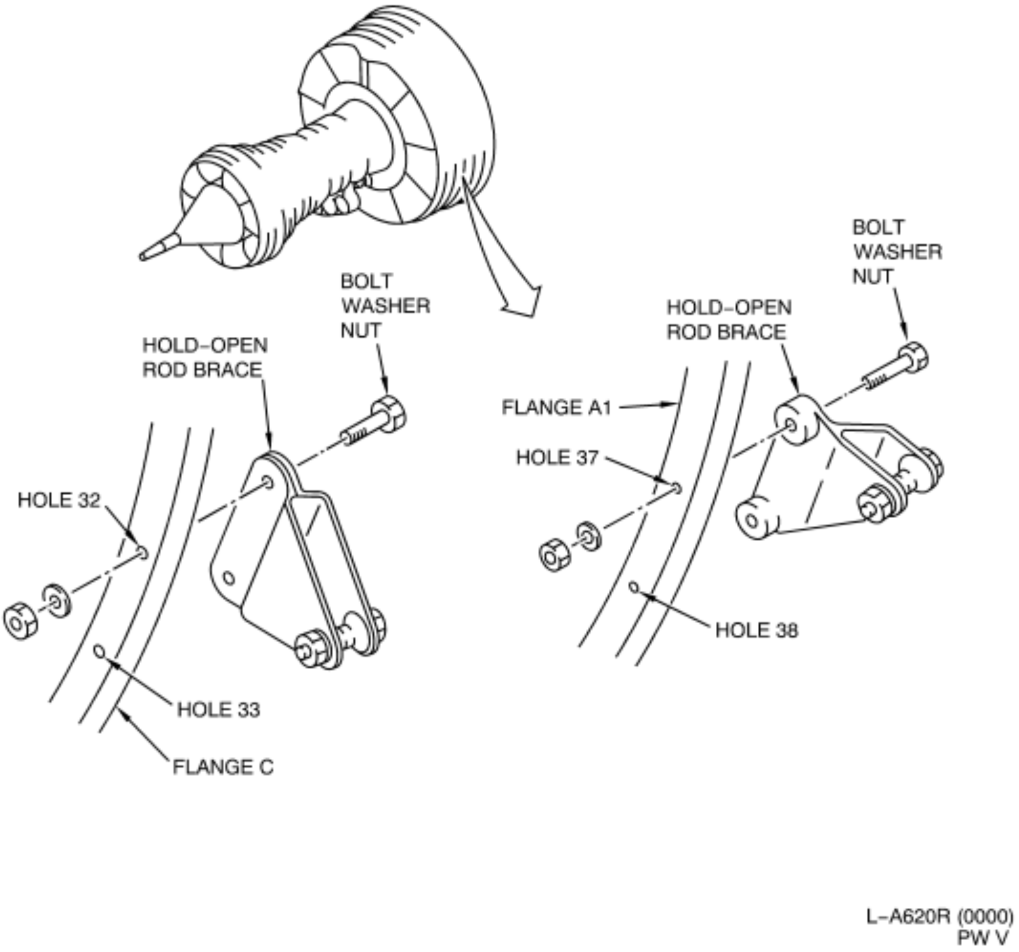
R (a) Remove two bolts, washers, and nuts attaching fan cowl door hold−open rod brace to Flange A1. Retain bolts, washers, and nuts with brace.

R (b) Remove two bolts, washers, and nuts attaching thrust reverser sleeve hold−open rod brace to Flange C. Reinstall bolts, washers, and nuts in same holes (Flange C 30,31). Torque nuts 85 − 95 lb−in. (9.604 − 10.734 N.m).

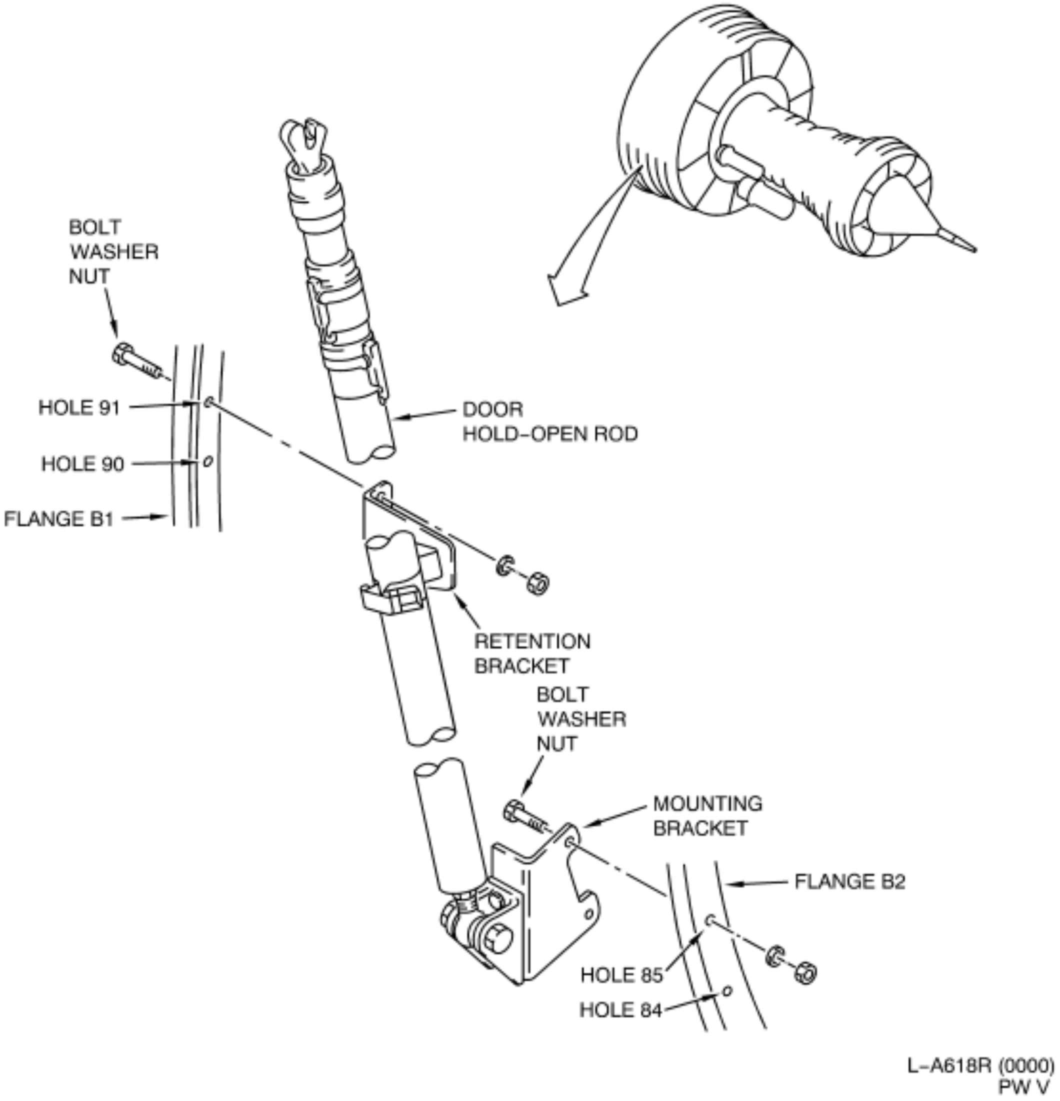
R (3) Remove fan cowl door hold−open rod, left side. See Figure 307.


BOLT
WASHER
NUT
HOLE 30
HOLE 31
FLANGE B1
DOOR
HOLD-OPEN ROD
RETENTION
BRACKET
HOLE 36
HOLE 37
MOUNTING
BRACKET
BOLT
WASHER
NUT
L-A616R (0000)
PW V

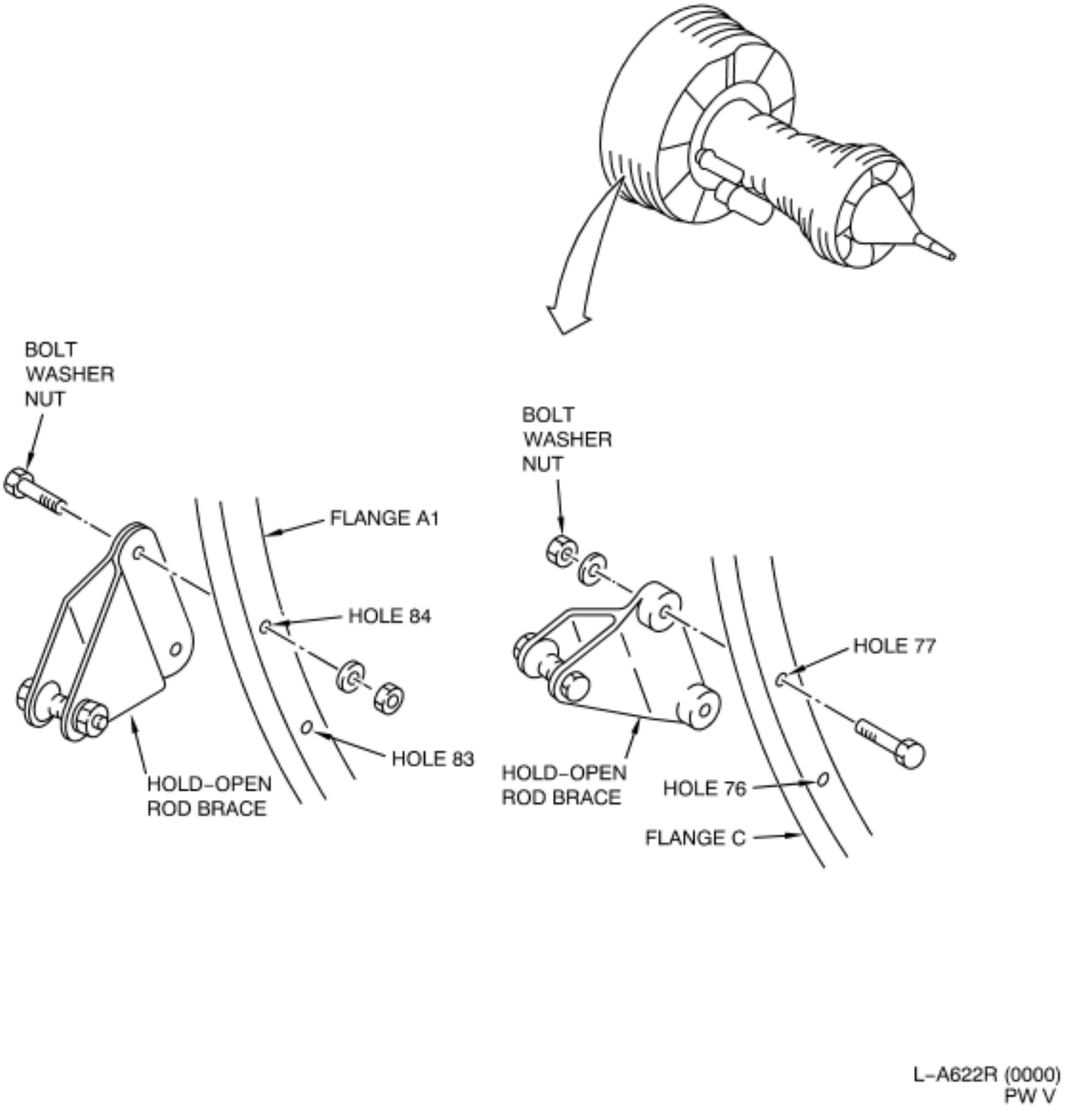
Fan Cowl Door Hold-Open Rod, Right Side
Figure 301
(Task 71-00-33-050-011)


BOLT
WASHER
NUT
HOLD−OPEN
ROD BRACE
HOLE 32
HOLE 33
FLANGE C
BOLT
WASHER
NUT
HOLD−OPEN
ROD BRACE
FLANGE A1
HOLE 37
HOLE 38
L−A620R (0000)
PW V

Door Hold−Open Rod Braces, Right Side
Figure 302
(Task 71−00−33−050−011)


BOLT
WASHER
NUT
HOLE 91
HOLE 90
FLANGE B1
DOOR
HOLD−OPEN ROD
RETENTION
BRACKET
BOLT
WASHER
NUT
MOUNTING
BRACKET
FLANGE B2
HOLE 85
HOLE 84
L−A618R (0000)
PW V

Fan Cowl Door Hold−Open Rod, Left Side
Figure 303
(Task 71−00−33−050−011)


BOLT
WASHER
NUT
FLANGE A1
HOLE 84
HOLE 83
HOLD−OPEN
ROD BRACE
BOLT
WASHER
NUT
HOLE 77
HOLD−OPEN
ROD BRACE
HOLE 76
FLANGE C
L−A622R (0000)
PW V

Door Hold−Open Rod Braces, Left Side
Figure 304
(Task 71−00−33−050−011)

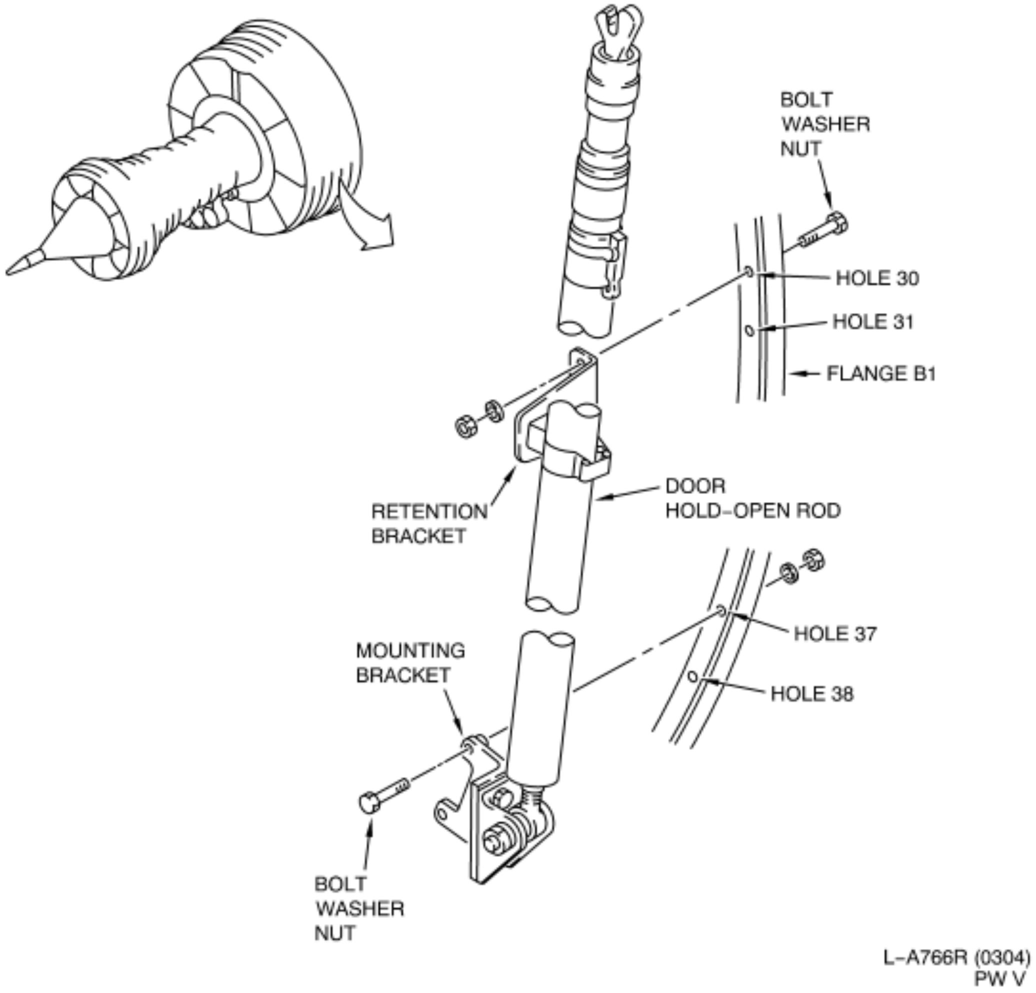
R (a) Remove two bolts, washers, and nuts attaching
R hold−open rod mounting bracket to Flange B2.
R Retain bolts, washers, and nuts with mounting
R bracket.

R (b) Remove two bolts, washers, and nuts attaching
R hold−open rod retaining bracket to Flange B1.
R Retain bolts, washers, and nuts with retaining
R bracket. Retain bracket with hold−open rod.

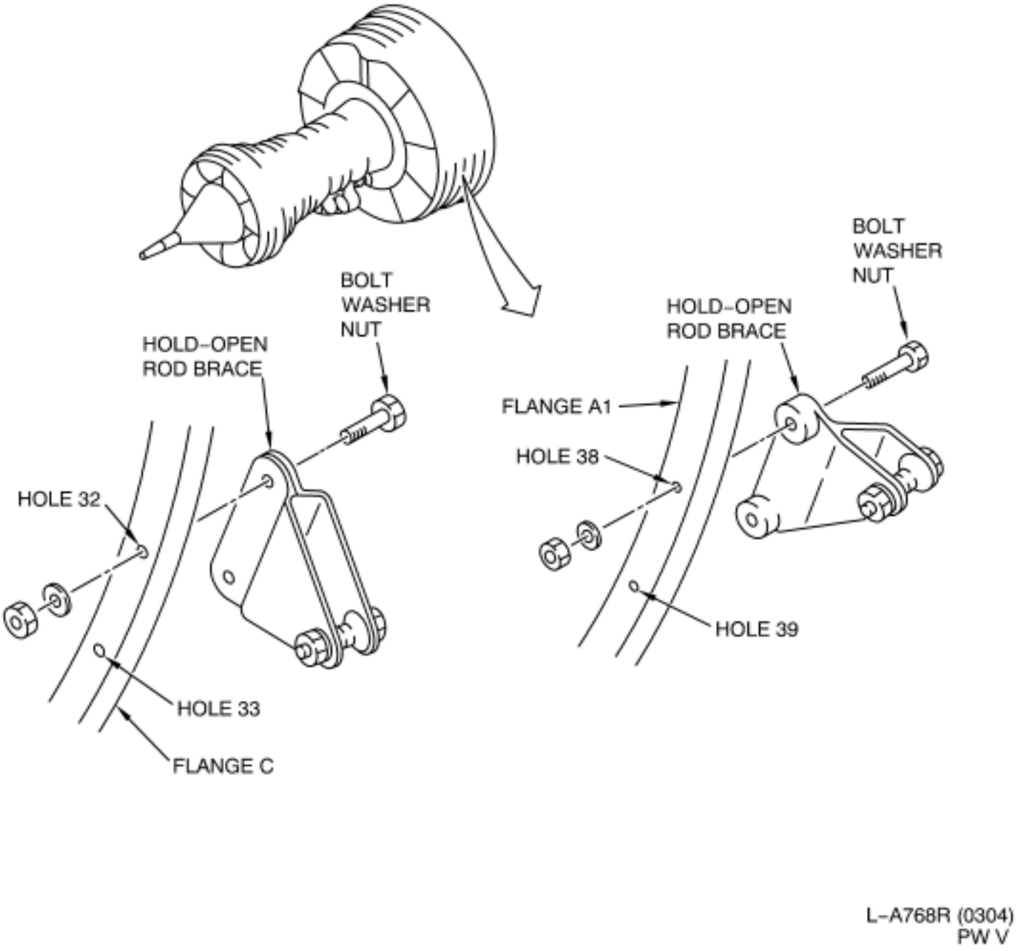
R (4) Remove two hold−open rod braces, left side. See Figure
R 308.

R (a) Remove two bolts, washers and nuts attaching fan
R cowl door hold−open rod brace to Flange A1.
R Retain bolts, washers, and nuts with brace.

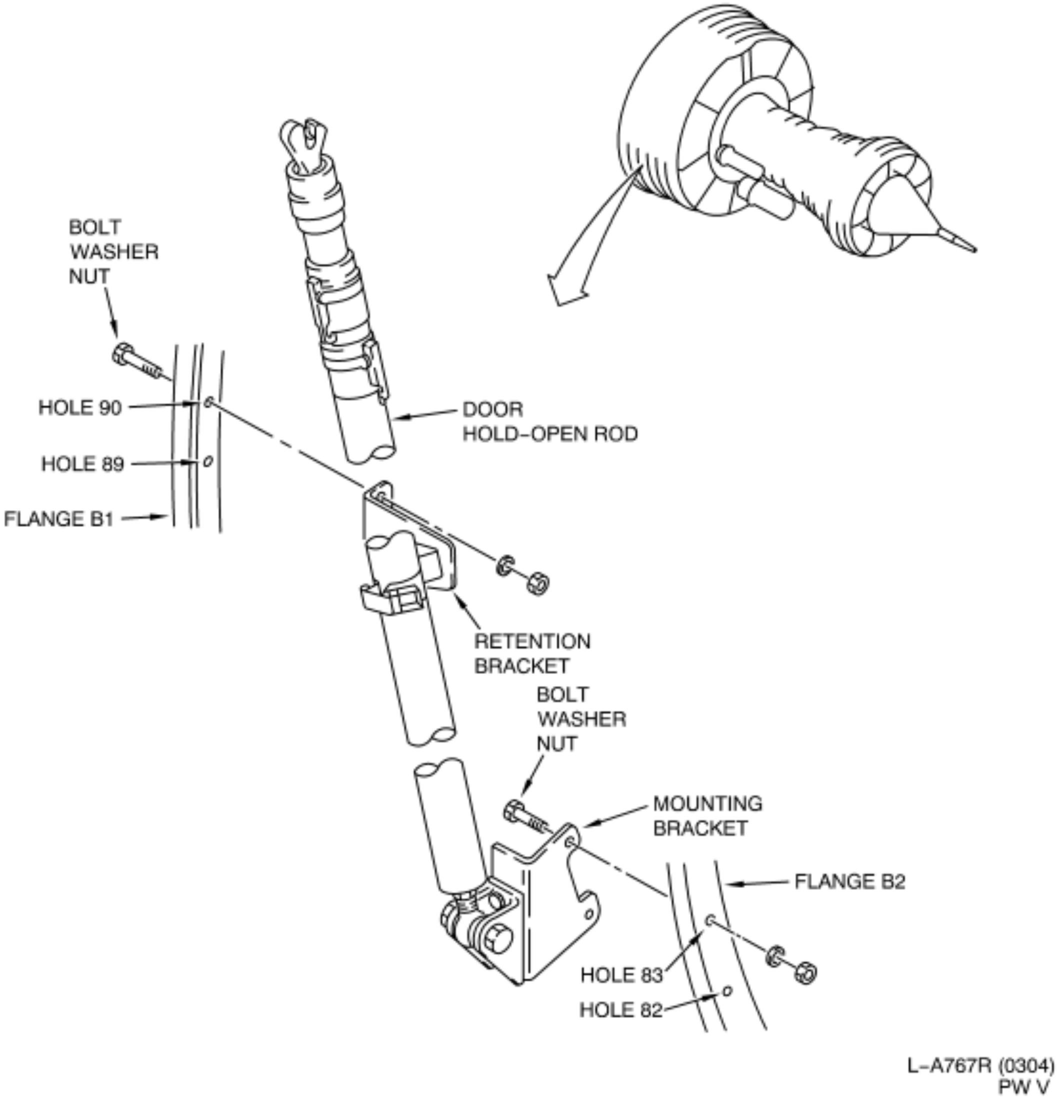
R (b) Remove two bolts, washers, and nuts attaching
R thrust reverser sleeve hold−open rod brace to
R Flange C. Reinstall bolts, washers, and nuts in
R same holes (Flange C 76,77). Torque nuts 85 − 95
R lb−in. (9.604 − 10.734 N.m).


BOLT
WASHER
NUT
HOLE 30
HOLE 31
FLANGE B1
RETENTION
BRACKET
DOOR
HOLD−OPEN ROD
HOLE 37
HOLE 38
MOUNTING
BRACKET
BOLT
WASHER
NUT
L−A766R (0304)
PW V

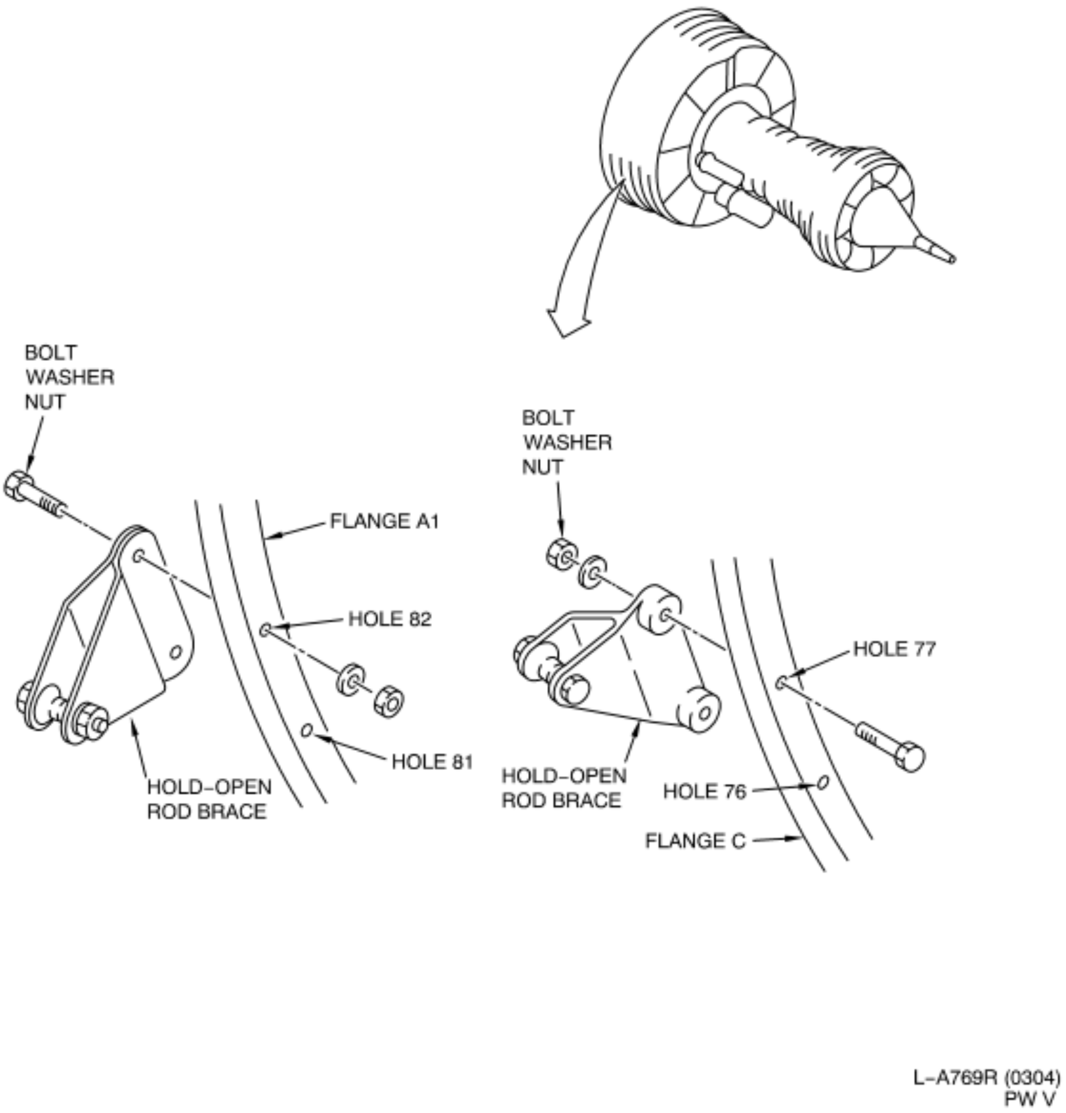
R Fan Cowl Door Hold−Open Rod, Right Side, With SCU
R Figure 305
R (Task 71−00−33−050−011−A)


BOLT
WASHER
NUT
HOLD-OPEN
ROD BRACE
HOLE 32
HOLE 33
FLANGE C
BOLT
WASHER
NUT
HOLD-OPEN
ROD BRACE
FLANGE A1
HOLE 38
HOLE 39
L-A768R (0304)
PW V

R Door Hold-Open Rod Braces, Right Side, With SCU
R Figure 306
R (Task 71-00-33-050-011-A)


BOLT
WASHER
NUT
HOLE 90
HOLE 89
FLANGE B1
DOOR
HOLD−OPEN ROD
RETENTION
BRACKET
BOLT
WASHER
NUT
MOUNTING
BRACKET
FLANGE B2
HOLE 83
HOLE 82
L−A767R (0304)
PW V

R Fan Cowl Door Hold−Open Rod, Left Side, With SCU
R Figure 307
R (Task 71−00−33−050−011−A)

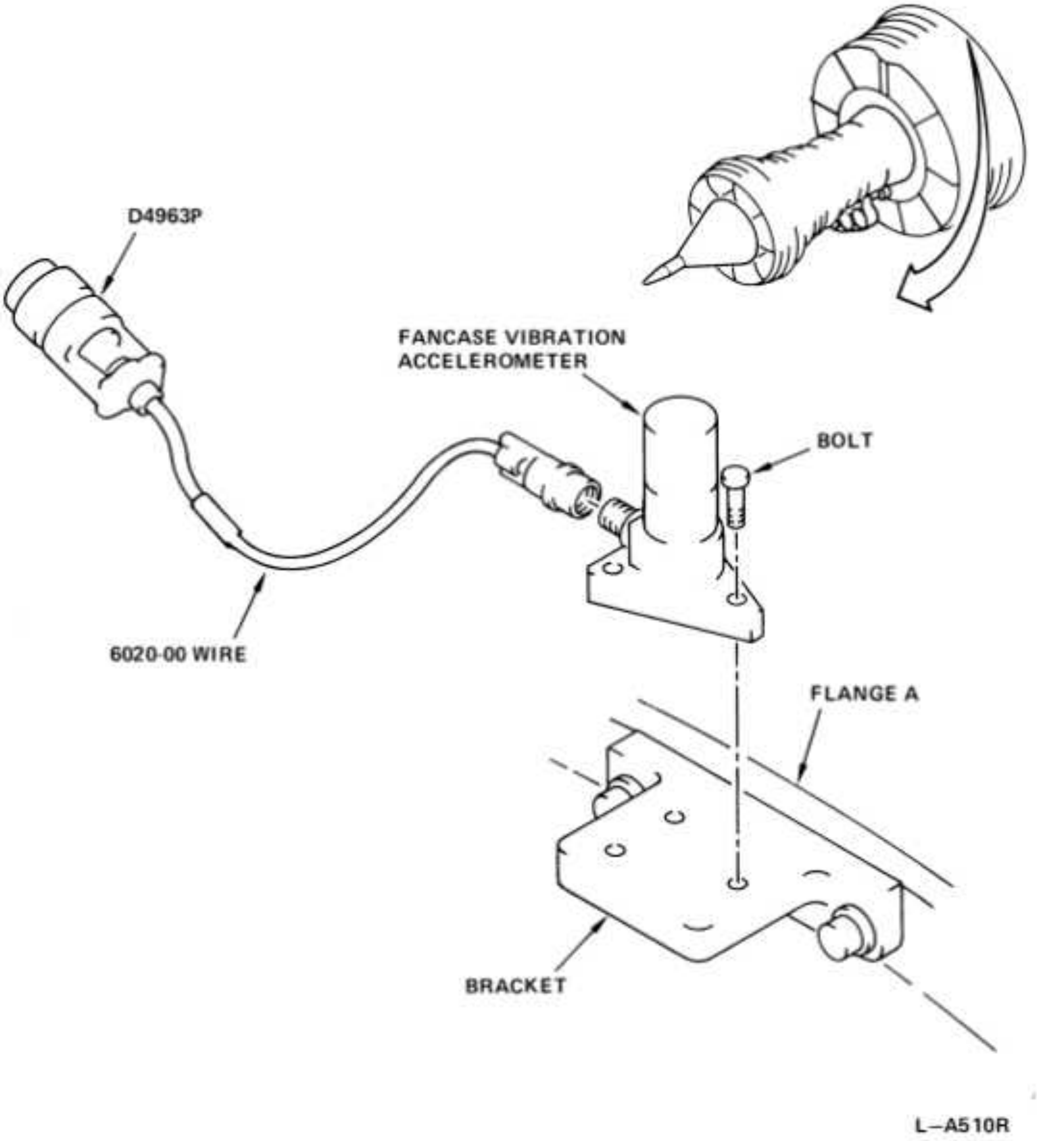

BOLT
WASHER
NUT
FLANGE A1
HOLE 82
HOLE 81
HOLD−OPEN
ROD BRACE
BOLT
WASHER
NUT
HOLE 77
HOLD−OPEN
ROD BRACE
HOLE 76
FLANGE C
L−A769R (0304)
PW V

R Door Hold−Open Rod Braces, Left Side, With SCU
R Figure 308
R (Task 71−00−33−050−011−A)

POWER PLANT GENERAL − FAN CASE − REMOVAL−03

Task 71−00−33−050−002:

1. Removal Fan Case Vibration Accelerometer
   A. Equipment And Materials Required − None
   B. Procedure
      See Figure 301.
      (1) Remove three (3) bolts attaching vibration accelerometer to mounting bracket on fan case, Flange A, at 1 o'clock position. Remove accelerometer and wire harness.


D4963P
FANCASE VIBRATION ACCELEROMETER
BOLT
6020-00 WIRE
FLANGE A
BRACKET
L−A510R

Fan Case Vibration Accelerometer
Figure 301
(Task 71−00−33−050−002)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL − FAN CASE − REMOVAL−04

Task 71−00−33−050−004:

1. Remove Inlet Cowl Anti−Ice Visual Overpressure Indicator

NOTE: This procedure has been deleted.

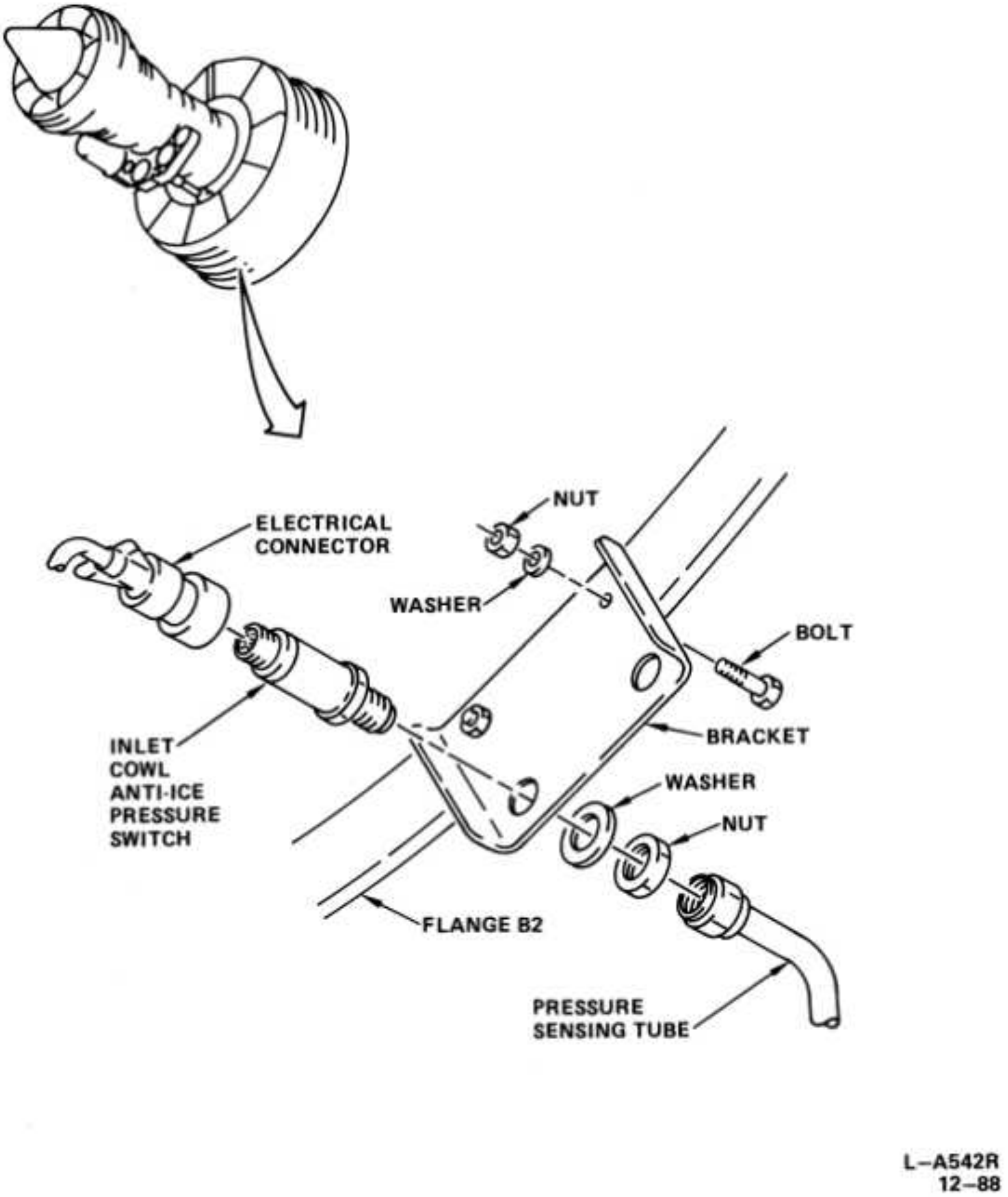
Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL − FAN CASE − REMOVAL−05

Task 71−00−33−050−008:

1. Remove Inlet Cowl Anti−Ice Pressure Switch
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figure 301.
     - (1) Disconnect pressure sensing tube from anti−ice pressure switch. Install protective cover over tube.
     - (2) Remove electrical connector from inlet cowl anti−ice pressure switch and install protective covers on connector and switch.
     - (3) Remove two bolts, nuts, and washers attaching pressure switch to mounting bracket. Install protective cover on pressure switch port.
     - (4) Remove two (2) bolts, washers and nuts attaching bracket case flange.


NUT
ELECTRICAL CONNECTOR
WASHER
BOLT
BRACKET
INLET COWL ANTI-ICE PRESSURE SWITCH
WASHER
NUT
FLANGE B2
PRESSURE SENSING TUBE
L−A542R
12−88

Inlet Cowl Anti−Ice Pressure Switch
Figure 301
(Task 71−00−33−050−008)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - FAN CASE - REMOVAL-06

Task 71-00-33-050-010:

1. Remove Inlet Cowl Anti-Ice Shutoff And Regulating Valve - Deleted

   NOTE: This Procedure Has Been Deleted

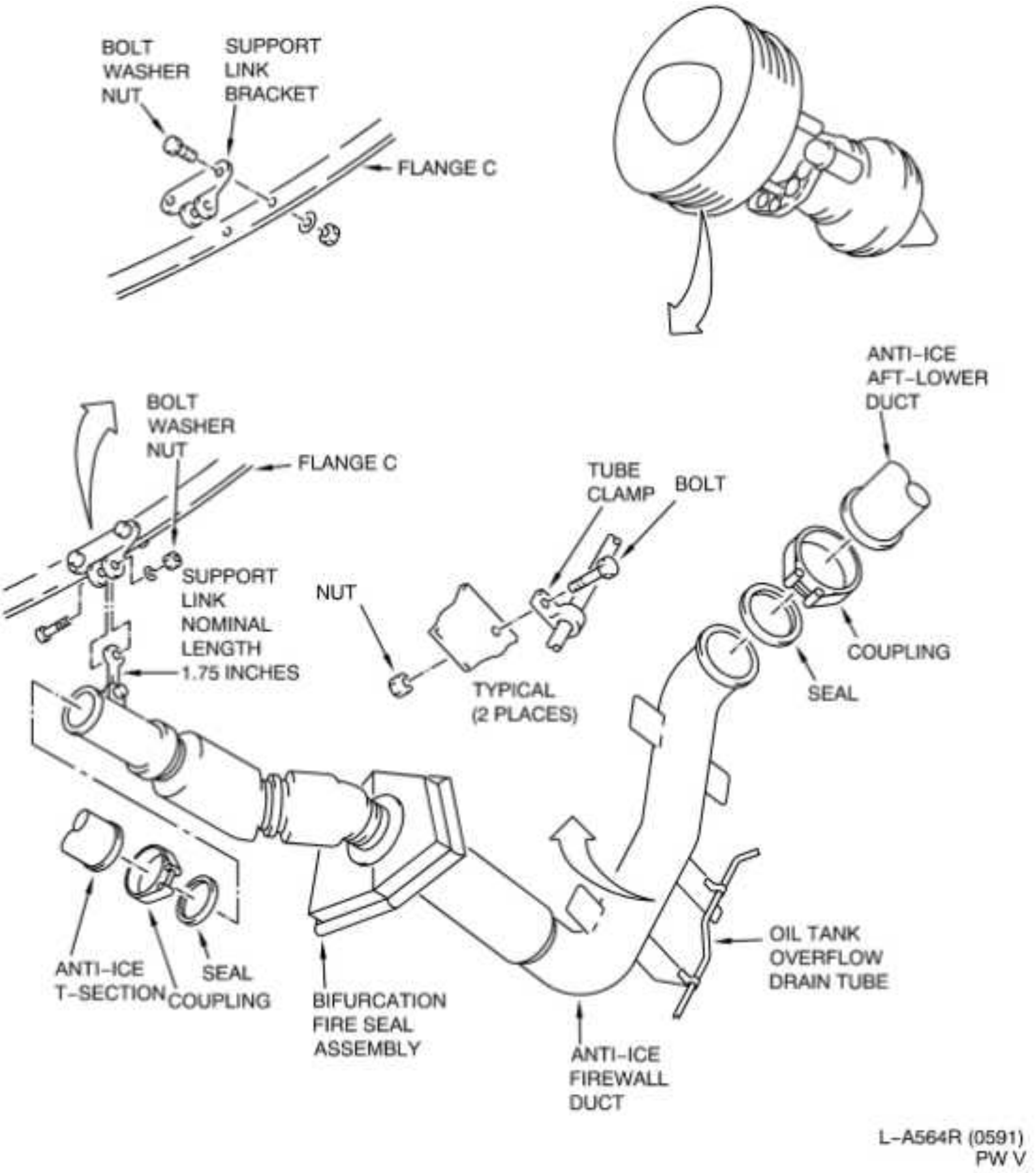
Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL − FAN CASE − REMOVAL−07

Task 71−00−33−050−012:

1. Remove Bifurcation Fire Seal
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figure 301.
     - (1) Remove bolts, washers, clamps, and nuts attaching oil tank overflow drain tube to anti−ice firewall duct. Retain clamps, bolts, washers, and nuts on duct flange.
     - (2) Remove bolt, washer and nut attaching duct support link to bracket on fan case Flange C at bottom of fan case.
     - (3) Remove two (2) couplings and seals attaching anti−ice firewall duct to anti−ice T−section and to anti−ice aft−lower duct.
     - (4) Remove two (2) bolts, washers and nuts attaching duct support link bracket to fan case Flange C. Reinstall bolts, washers and nuts in same holes to maintain tightness of Flange C union. Torque nuts 85 − 95 lb−in. (9.604 − 10.734 N.m). Retain bracket, support link bolt and nut with support link.
     - (5) Install protective cover over both ends of firewall duct, anti−ice aft−lower duct and anti−ice T−section port.


BOLT
WASHER
NUT
SUPPORT
LINK
BRACKET
FLANGE C
ANTI−ICE
AFT−LOWER
DUCT
BOLT
WASHER
NUT
FLANGE C
TUBE
CLAMP
BOLT
SUPPORT
LINK
NOMINAL
LENGTH
1.75 INCHES
NUT
TYPICAL
(2 PLACES)
COUPLING
SEAL
OIL TANK
OVERFLOW
DRAIN TUBE
ANTI−ICE
T−SECTION
COUPLING
SEAL
BIFURCATION
FIRE SEAL
ASSEMBLY
ANTI−ICE
FIREWALL
DUCT
L−A564R (0591)
PW V

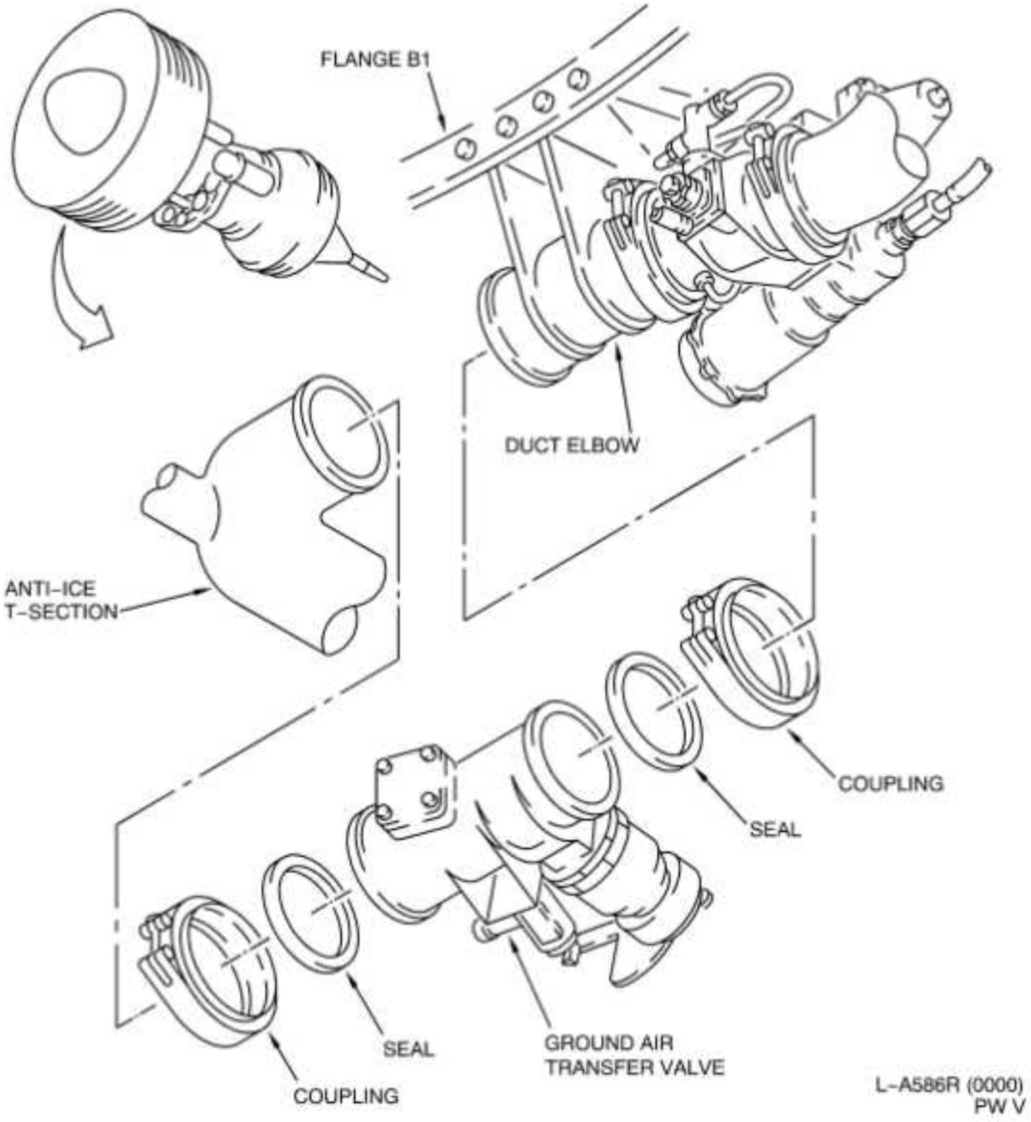
Anti−Ice Firewall Duct
Figure 301
(Task 71−00−33−050−012)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - FAN CASE - REMOVAL-08

Task 71-00-33-050-013:

1. Remove Ground Operation Air Transfer Pneumatic Valve
    - A. Equipment And Materials Required - None
    - B. Procedure
      See Figure 301.
        - (1) Remove anti-ice T-section.
            - (a) Remove coupling and seal attaching anti-ice T-section to ground operation air transfer pneumatic valve. Retain coupling with T-section.
            - (b) Install protective cover over anti-ice T-section port.
        - (2) Remove ground operation air transfer pneumatic valve.
            - (a) Remove coupling and seal attaching valve to duct elbow. Retain coupling with valve.
            - (b) Install protective cover over valve ports and over duct elbow end.


FLANGE B1
DUCT ELBOW
ANTI−ICE T−SECTION
COUPLING
SEAL
SEAL
GROUND AIR TRANSFER VALVE
COUPLING
L−A586R (0000)
PW V

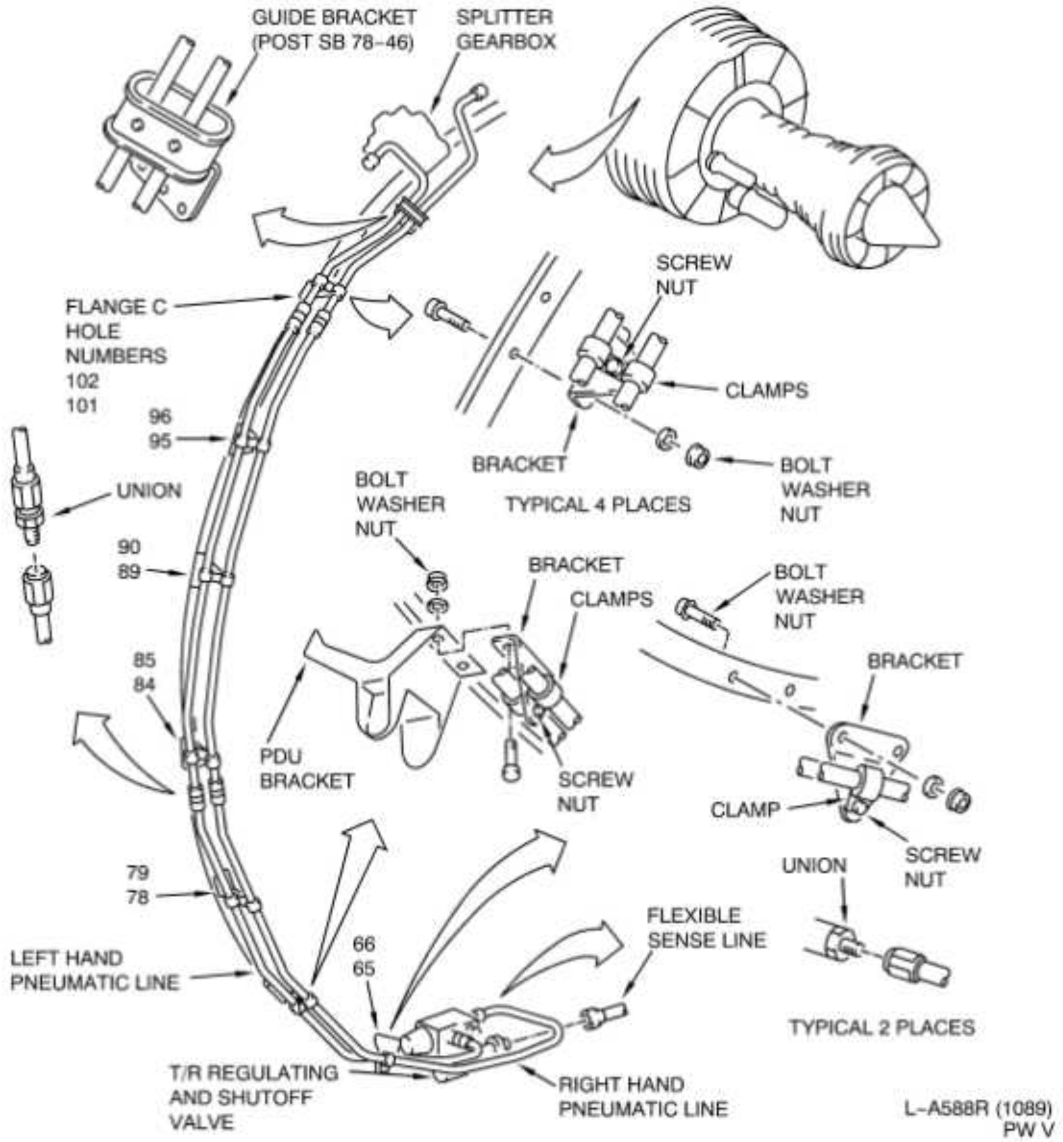
Ground Operation Air Transfer Pneumatic Valve
Figure 301
(Task 71−00−33−050−013)

Previous Pageblock Return to Previous Menu Next Pageblock

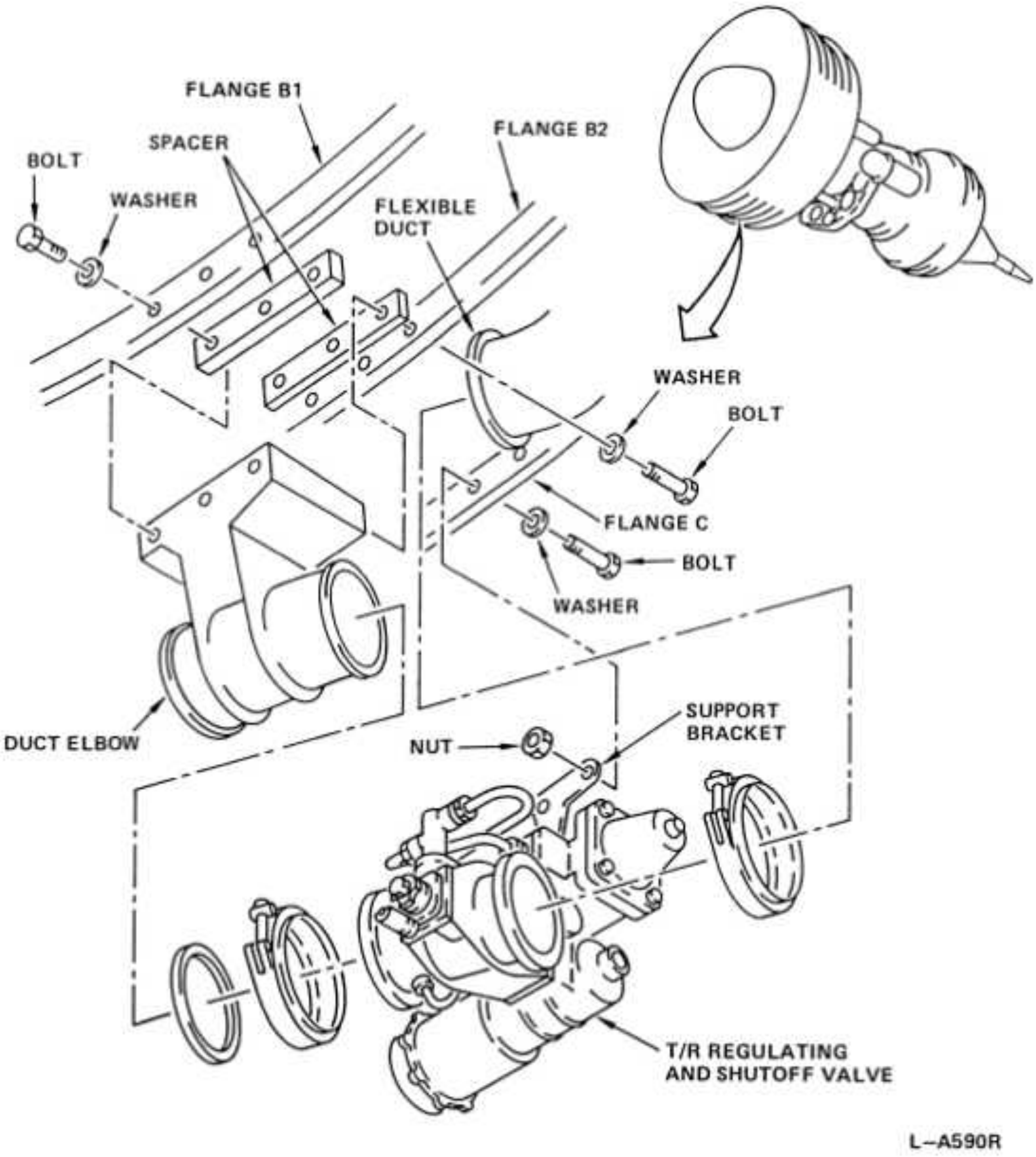
POWER PLANT GENERAL − FAN CASE − REMOVAL−09

Task 71−00−33−050−009−001:

1. Remove Thrust Reverser Pressure Regulating And Shutoff Valve − Pre SB PW4NAC 78−46
   A. Equipment And Materials Required − None
   B. Procedure
      See Figures 301 and 302.
      (1) Remove pneumatic lines.
         (a) Disconnect two (2) pneumatic lines from T/R pressure regulating valve. Do not remove nipples and O−rings from valve.
         (b) Disconnect coupling of two pneumatic lines at point near Flange C hole 83. Do not remove unions.
         (c) Remove two (2) bolts, washers and nuts attaching pneumatic line support bracket to Flange C, holes 65,66. Reinstall bolts, washers and nuts in same holes of Flange C to maintain tightness of Flange C union. Torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
         (d) Remove screw and nut attaching two (2) pneumatic line clamps to bracket mounted on PDU support. Retain clamps, screw and nut on pneumatic lines.
         (e) Remove two (2) bolts, washers and nuts attaching support bracket to Flange C, holes 78,79. Reinstall bolts, washer and nuts in same holes of Flange C and torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
         (f) Remove lower section of pneumatic lines.
         (g) Install protective cover over both ends of both pneumatic lines and over two (2) valve ports.
         (h) Remove bolts, washers and nuts attaching four (4) pneumatic line support brackets to Flange C, holes 84,85; 89,90; 95,96; and 101,102. Reinstall bolts, washers and nuts in same holes of Flange C and torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
         (i) Remove upper section of pneumatic lines.
         (j) Install protective cover over ends of both pneumatic lines.
      (2) Remove duct elbow.
         (a) Remove coupling and seal attaching duct elbow to valve. Retain coupling with duct elbow.
         (b) Remove bolts, washers and spacer attaching duct elbow to Flange Bl. Retain bolts, washers and spacer with duct elbow.
         (c) Install protective covers over ends of duct elbow.
      (3) Remove thrust reverser pressure regulating and shutoff valve.
         (a) Disconnect flexible sense line from valve. Do not remove nipple and O−ring from valve.
         (b) Install protective covers over sense line and over valve port.


GUIDE BRACKET
(POST SB 78-46)
SPLITTER
GEARBOX
SCREW
NUT
FLANGE C
HOLE
NUMBERS
102
101
96
95
CLAMPS
UNION
BRACKET
BOLT
WASHER
NUT
BOLT
WASHER
NUT
TYPICAL 4 PLACES
90
89
BRACKET
CLAMPS
BOLT
WASHER
NUT
85
84
BRACKET
PDU
BRACKET
SCREW
NUT
CLAMP
SCREW
NUT
UNION
79
78
FLEXIBLE
SENSE LINE
LEFT HAND
PNEUMATIC LINE
66
65
TYPICAL 2 PLACES
T/R REGULATING
AND SHUTOFF
VALVE
RIGHT HAND
PNEUMATIC LINE
L-A588R (1089)
PW V

Thrust Reverser Regulating Valve Pneumatic Lines
Figure 301
(Task 71-00-33-050-009-001)


FLANGE B1
SPACER
BOLT
WASHER
FLANGE B2
FLEXIBLE DUCT
WASHER
BOLT
FLANGE C
BOLT
WASHER
DUCT ELBOW
NUT
SUPPORT BRACKET
T/R REGULATING AND SHUTOFF VALVE
L−A590R

Thrust Reverser Pressure Regulating And Shutoff Valve
Figure 302
(Task 71−00−33−050−009−001)

- (c) Remove coupling attaching valve to flexible duct. Retain coupling with valve.
- (d) Remove two (2) bolts, washers and nuts attaching valve support bracket to Flange C holes 61,62. Reinstall bolts, washers and nuts in same holes of Flange C and torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
- (e) Install protective covers over ends of valve and over end of flexible duct.

Task 71−00−33−050−009−002:

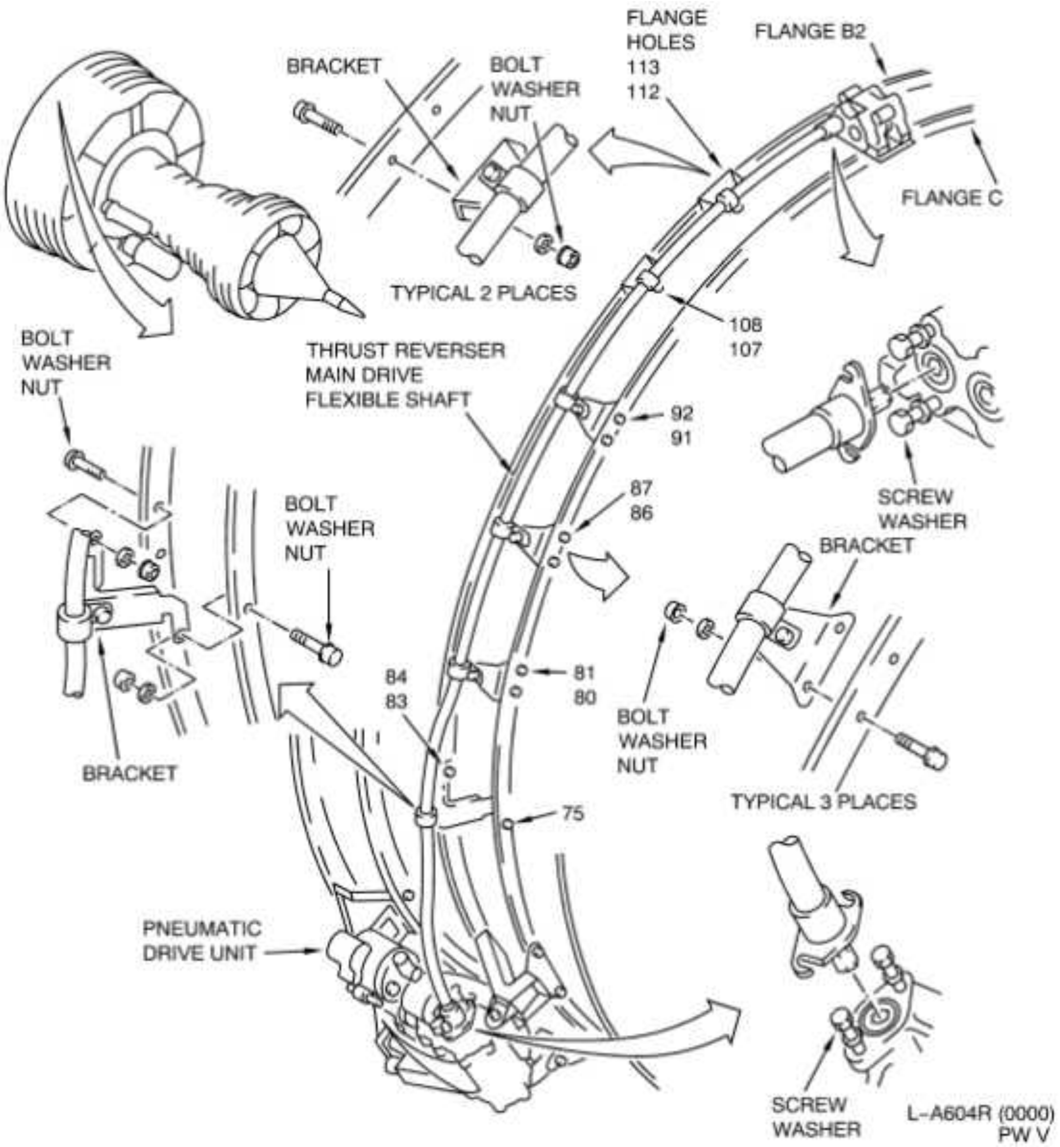
2. Remove Thrust Reverser Pressure Regulating And Shutoff Valve − Post SB PW4NAC 78−46
   - A. Equipment And Materials Required − None
   - B. Procedure
     See Figures 301 and 302.
     - (1) Remove pneumatic lines.
       - (a) Disconnect two (2) pneumatic lines from T/R pressure regulating valve. Do not remove nipples and O−rings from valve.
       - (b) Disconnect coupling of two pneumatic lines at point near Flange C hole 83. Do not remove unions.
       - (c) Remove two (2) bolts, washers and nuts attaching pneumatic line support bracket to Flange C, holes 65,66. Reinstall bolts, washers and nuts in same holes of Flange C to maintain tightness of Flange C union. Torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
       - (d) Remove screw and nut attaching two (2) pneumatic line clamps to bracket mounted on PDU support. Retain clamps, screw and nut on pneumatic lines.
       - (e) Remove two (2) bolts, washers and nuts attaching support bracket to Flange C, holes 78,79. Reinstall bolts, washer and nuts in same holes of Flange C and torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
       - (f) Remove lower section of pneumatic lines.
       - (g) Install protective cover over both ends of both pneumatic lines and over two (2) valve ports.
       - (h) Remove bolts, washers and nuts attaching four (4) pneumatic line support brackets to Flange C, holes 84,85; 89,90; 95,96; and 101,102. Reinstall bolts, washers and nuts in same holes of Flange C and torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
       - (i) Remove two (2) screws attaching tube guide to bracket. Remove pneumatic lines and reinstall screws in guide. Torque to 20 − 25 lb−in. (2.258 − 2.823 N.m).
       - (j) Install protective cover over ends of both pneumatic lines.

POWER PLANT GENERAL − FAN CASE − REMOVAL−10

Task 71−00−33−050−005:

1. Remove Thrust Reverser Main Drive Flexible Shaft
   - A. Equipment And Materials Required − None
   - B. Procedure

     See figure 301.
     - (1) Loosen two (2) screws and washers attaching flexible shaft to PDU. Rotate flexible shaft mounting plate until it is free of screws. Tighten screws and washers fingertight and retain with PDU.
     - (2) Remove two (2) bolts, washers and nuts attaching shaft support bracket to Flange B2. Retain bolts, washers and nuts with bracket. Do not remove shaft clamp from bracket.
     - (3) Remove bolt, washer and nut attaching shaft support bracket to Flange C. Reinstall bolt, washer and nut in same hole to maintain tightness of Flange C. Torque nut 85 − 95 lb−in. (9.604 − 10.734 N.m).
     - (4) Remove bolts, washers and nuts attaching three (3) shaft support brackets to Flange C. Reinstall bolts, washers and nuts in same holes of Flange C. Torque nuts 85 − 95 lb−in. (9.604 − 10.734 N.m).
     - (5) Remove bolts, washers and nuts attaching two (2) shaft support brackets to Flange B2. Retain bolts, washers and nuts with bracket.
     - (6) Loosen two (2) screws and washers attaching flexible shaft to splitter gearbox. Rotate flexible shaft mounting plate until it is free of screws. Tighten screws and washers fingertight and retain with splitter gearbox.
     - (7) Remove main drive flexible shaft.
     - (8) Install protective cover over both ends of flexible shaft, over splitter gearbox port and PDU port.

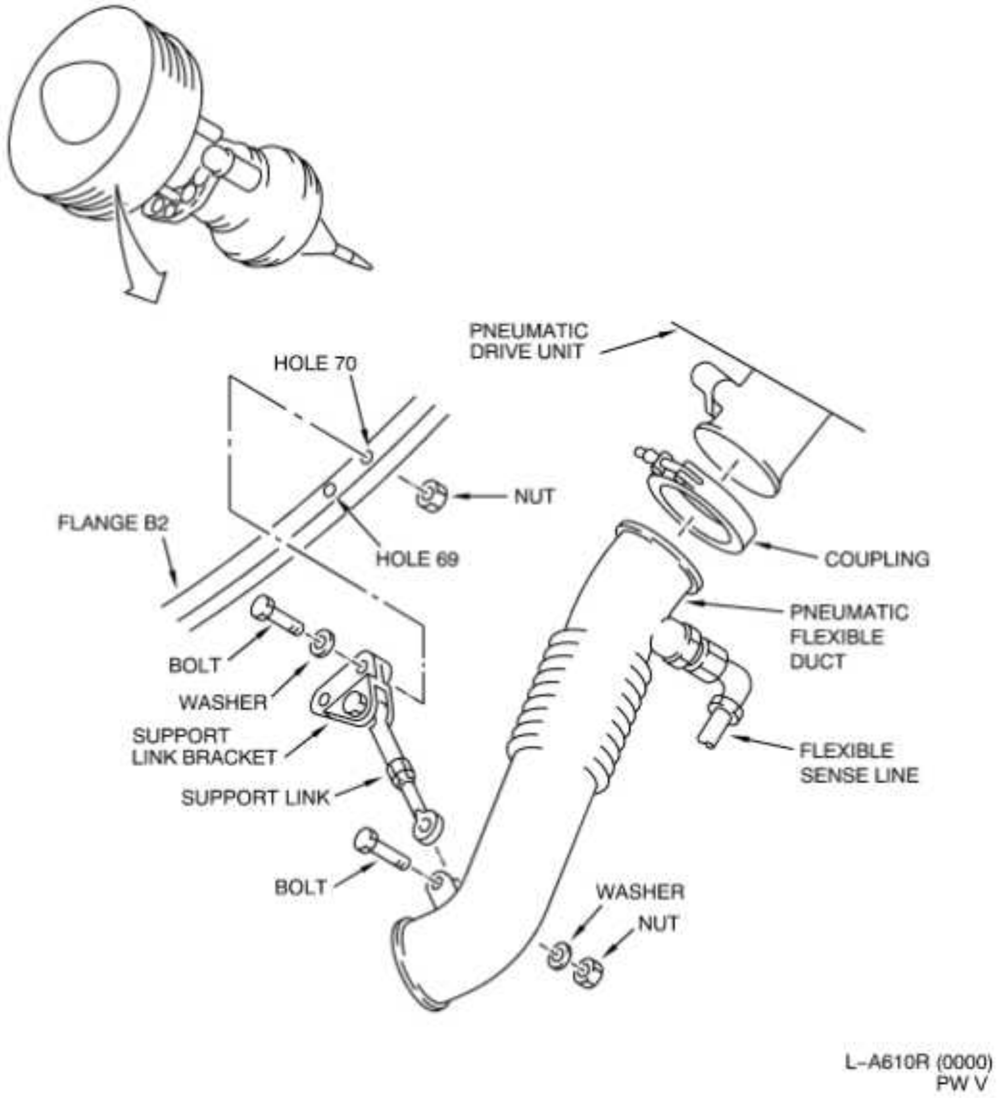

FLANGE
HOLES
113
112
FLANGE B2
BRACKET
BOLT
WASHER
NUT
FLANGE C
TYPICAL 2 PLACES
108
107
BOLT
WASHER
NUT
THRUST REVERSER
MAIN DRIVE
FLEXIBLE SHAFT
92
91
87
86
SCREW
WASHER
BOLT
WASHER
NUT
BRACKET
84
83
81
80
BOLT
WASHER
NUT
BRACKET
TYPICAL 3 PLACES
75
PNEUMATIC
DRIVE UNIT
SCREW
WASHER
L-A604R (0000)
PW V

Thrust Reverser Main Flexible Shaft
Figure 301
(Task 71−00−33−050−005)

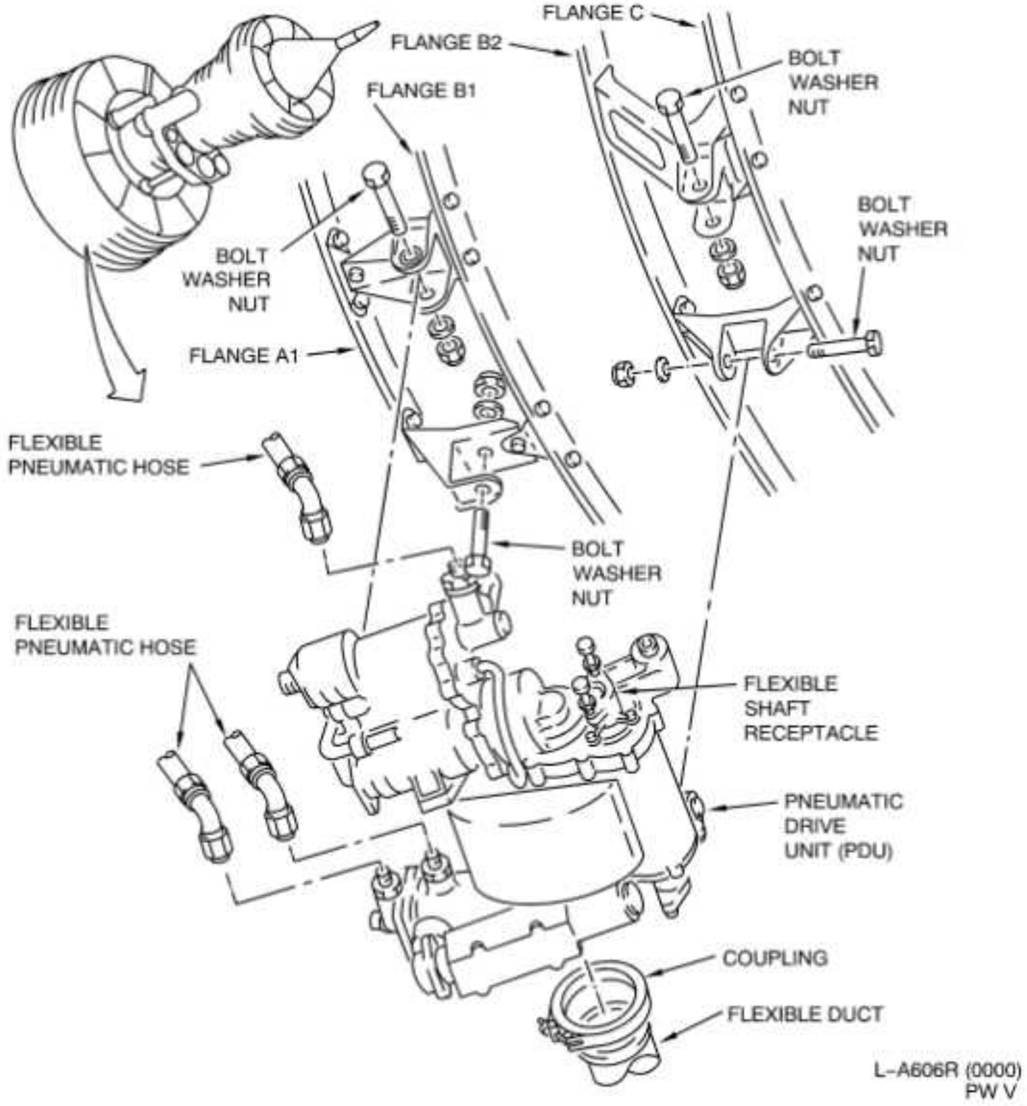
POWER PLANT GENERAL - FAN CASE - REMOVAL-11

Task 71-00-33-050-003:

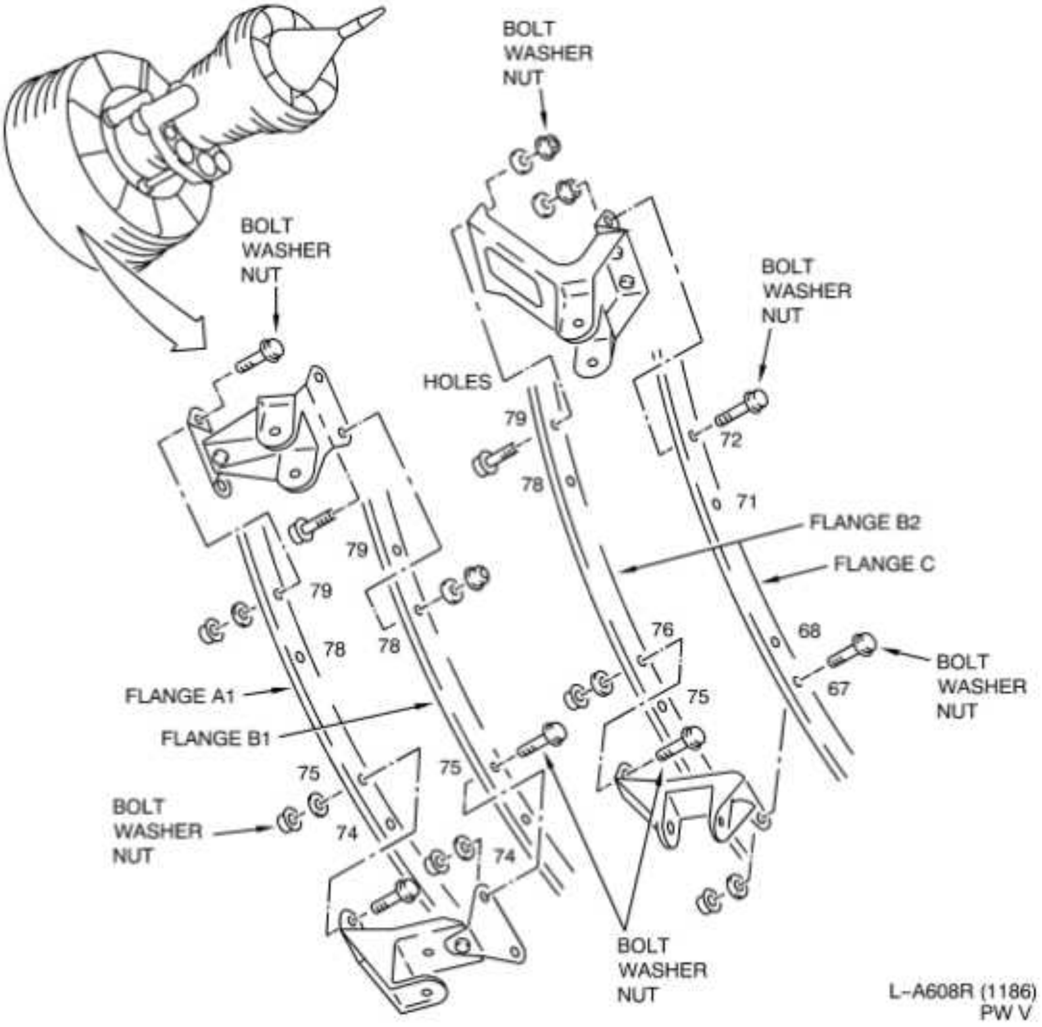
1. Remove Thrust Reverser Pneumatic Drive Unit (PDU)
    A. Prerequisites
        (1) Remove thrust reverser main drive flexible shaft. See Removal-10, (Task 71-00-33-050-005).
    B. Equipment and Materials Required - None
    C. Procedure
        See Figure 301.
        (1) Remove flexible duct. See Figure 301.
            (a) Remove bolt, washer and nut attaching support link to flexible duct.
            (b) Remove bolts washers and nuts attaching support link bracket to Flange B2. Retain bolts, washers, nuts, bracket and link with flexible duct.
            (c) Remove coupling attaching flexible duct to PDU.
            (d) Remove flexible duct.
            (e) Install protective cover over end of flexible duct and over PDU port.
        (2) Remove pneumatic drive unit (PDU). See Figure 302.
            (a) Disconnect three (3) flexible pneumatic hoses from PDU. Do not remove nipples and O-rings from PDU. Install protective cover over ends of hoses and over PDU ports.
            (b) Remove bolts, washers and nuts attaching PDU to four (4) support brackets. Retain bolts, washers and nuts with PDU.
            (c) Remove PDU.
        (3) Remove PDU support brackets. See Figure 303.
            (a) Remove bolts, washers and nuts attaching two (2) PDU support brackets to fan case Flanges A1 and B1. Retain bolts, washers and nuts with support brackets.
            (b) Remove bolts, washers and nuts attaching two (2) PDU support brackets to fan case Flange B2. Retain bolts, washers and nuts with support brackets.
            (c) Remove bolts, washers and nuts attaching two (2) PDU support brackets to fan case Flange C. Reinstall bolts, washers and nuts in same holes of Flange C (67,68 and 71,72) to maintain tightness of Flange C union. Torque nuts 85 - 95 lb-in. (9.604 - 10.734 N.m).
            (d) Remove support brackets.


PNEUMATIC DRIVE UNIT
HOLE 70
NUT
FLANGE B2
HOLE 69
COUPLING
PNEUMATIC FLEXIBLE DUCT
BOLT
WASHER
SUPPORT LINK BRACKET
FLEXIBLE SENSE LINE
SUPPORT LINK
BOLT
WASHER
NUT
L-A610R (0000)
PW V

Thrust Reverser PDU Flexible Duct
Figure 301
(Task 71-00-33-050-003)


FLANGE C
FLANGE B2
BOLT
WASHER
NUT
FLANGE B1
BOLT
WASHER
NUT
BOLT
WASHER
NUT
FLANGE A1
FLEXIBLE
PNEUMATIC HOSE
BOLT
WASHER
NUT
FLEXIBLE
PNEUMATIC HOSE
FLEXIBLE
SHAFT
RECEPTACLE
PNEUMATIC
DRIVE
UNIT (PDU)
COUPLING
FLEXIBLE DUCT
L−A606R (0000)
PW V

Thrust Reverser Pneumatic Drive Unit (PDU)
Figure 302
(Task 71−00−33−050−003)

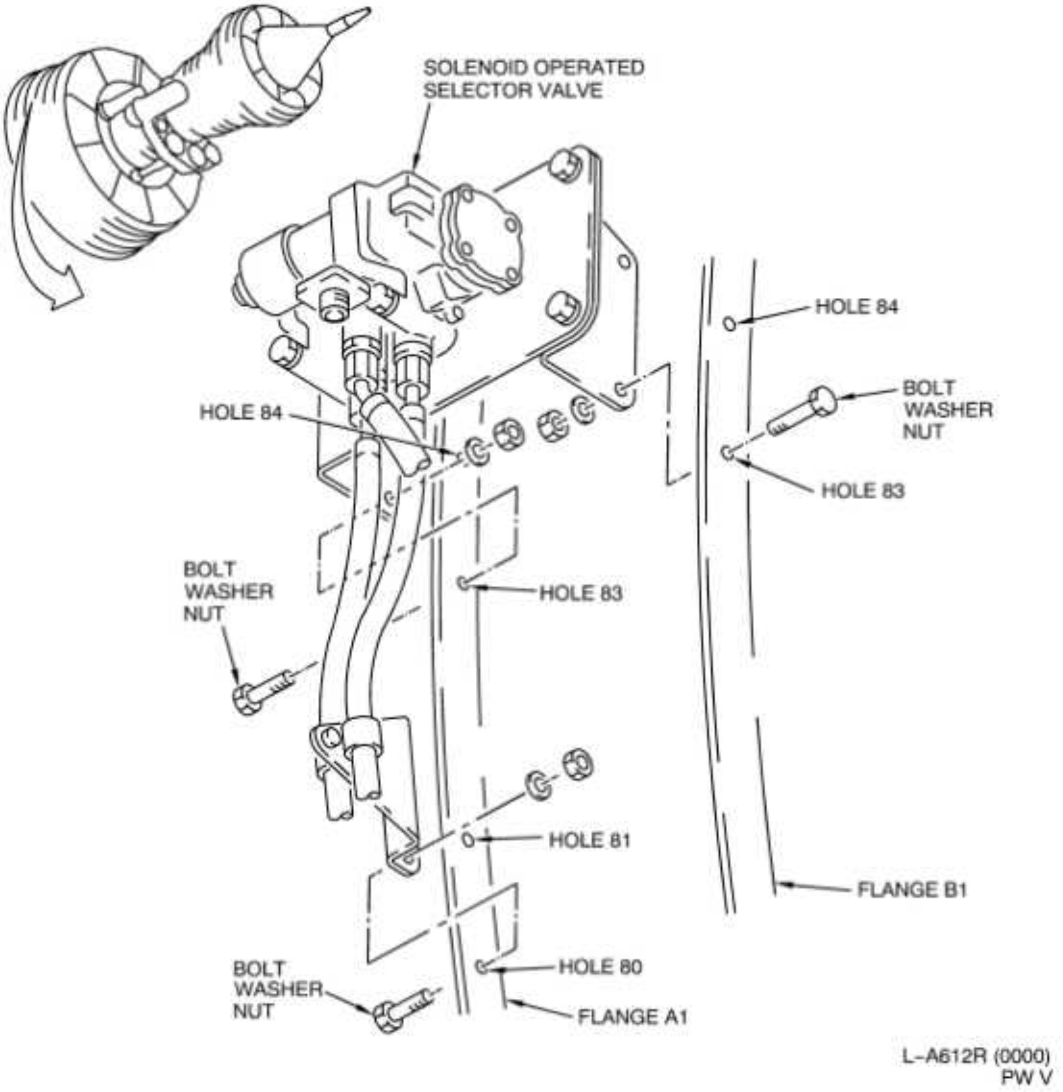

BOLT
WASHER
NUT
BOLT
WASHER
NUT
BOLT
WASHER
NUT
HOLES
79
72
78
71
FLANGE B2
FLANGE C
79
79
78
78
76
68
67
BOLT
WASHER
NUT
FLANGE A1
FLANGE B1
75
75
75
BOLT
WASHER
NUT
74
74
BOLT
WASHER
NUT
L-A608R (1186)
PW V

Thrust Reverser PDU Mounting Brackets
Figure 303
(Task 71-00-33-050-003)

POWER PLANT GENERAL - FAN CASE - REMOVAL-12

Task 71-00-33-050-007:

1. Remove Thrust Reverser Solenoid Operated Selector Valve
   A. Equipment And Materials Required - None
   B. Procedure
      See Figure 301.
      (1) Remove two (2) bolts, washers and nuts attaching flexible hose support bracket to Flange A1. Retain bolts, washers and nuts with bracket.
      (2) Remove four (4) bolts, washers and nuts attaching selector valve mounting bracket to Flanges A1 and B1. Retain bolts, washers and nuts with selector valve.


SOLENOID OPERATED
SELECTOR VALVE
HOLE 84
BOLT
WASHER
NUT
HOLE 84
HOLE 83
BOLT
WASHER
NUT
HOLE 83
HOLE 81
FLANGE B1
BOLT
WASHER
NUT
HOLE 80
FLANGE A1
L−A612R (0000)
PW V

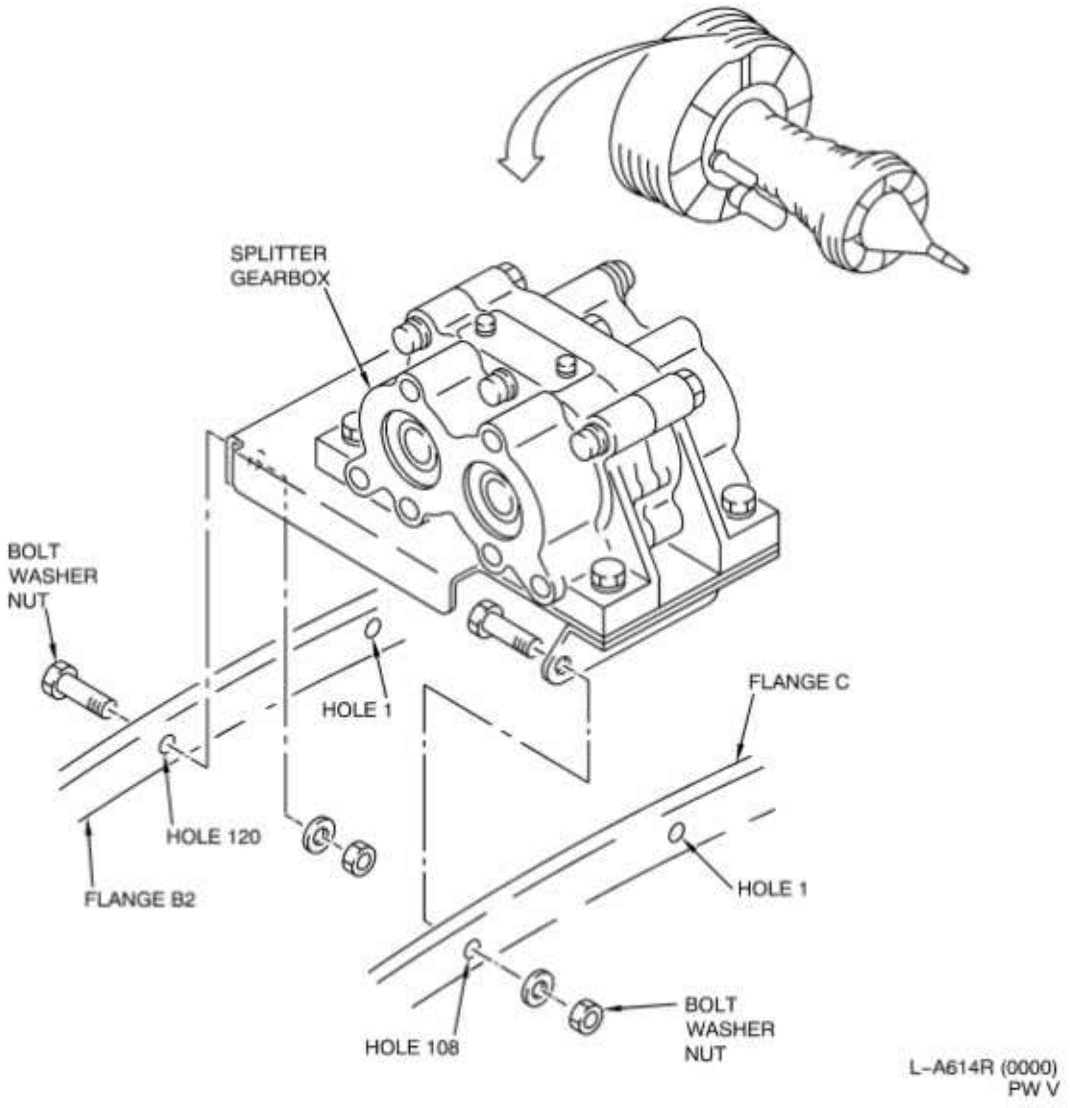
Thrust Reverser Solenoid Operated Selector Valve
Figure 301
(Task 71−00−33−050−007)

POWER PLANT GENERAL − FAN CASE − REMOVAL−13

Task 71−00−33−050−006:

1. Remove Thrust Reverser Splitter Gearbox
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figure 301.
     - (1) Remove two (2) bolts, washers and nuts attaching splitter gearbox mounting bracket to Flange B2. Retain bolts, washers and nuts with splitter gearbox.
     - (2) Remove two (2) bolts, washers and nuts attaching splitter gearbox mounting bracket to Flange C.
     - (3) Reinstall bolts, washers and nuts in same hole (Flange C holes 108,1). Torque nuts 85 − 95 lb−in. (9.604 − 10.734 N.m).


SPLITTER GEARBOX
BOLT
WASHER
NUT
HOLE 1
HOLE 120
FLANGE B2
FLANGE C
HOLE 1
HOLE 108
BOLT
WASHER
NUT
L−A614R (0000)
PW V

Thrust Reverser Splitter Gearbox
Figure 301
(Task 71−00−33−050−006)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - FAN CASE - REMOVAL-14

Task 71-00-33-050-014:

1. Remove Fan Case Wire Harness - Pre SB PW4NAC 71-100
   - A. Prerequisites
     - (1) Remove inlet cowl. See Removal-01, (Task 71-00-33-050-001).
   - B. Equipment and Materials Required - None
   - C. Procedure
     - (1) Remove wire harness 21W4118 and 21W4120. See Figure 301 (Sheet 1).
       - (a) Remove screws and nuts attaching harness clamps (1 and 2) to left T/R J-box. Leave harness clamps attached to harness. Retain screws and nuts with clamps.
       - (b) Remove two bolts, washers and nuts attaching harness support bracket (3) to fan case Flange A1. Leave harness clamps attached to harness and to bracket. Retain bolts, washers and nuts with bracket.
       - (c) Remove screw and nut attaching harness clamp (2) to support bracket on Flange B1 above EEC. Reinstall screw and nut in bracket to maintain attachment of other harness clamps.
       - (d) Remove two bolts, washers and nuts attaching harness support bracket (4) to fan case Flange B2. Leave harness clamp attached to bracket. Reinstall bolts, washers and nuts in same holes (104, 105) on fan case Flange B2 to maintain attachment of EEC support and hydraulic tubing support.
       - (e) Remove screw and nut attaching harness clamp (2), on each side of EEC. Retain screw and nut with clamp.
       - (f) Disconnect two electrical connectors D5000P and D5001P from EEC. Install protective covers over connector plugs and receptacles.
       - (g) Disconnect electrical connectors D5020P, D5021P and D5022P from left T/R J-box. Install protective covers over connector plugs and receptacles.
       - (h) Remove harnesses 21W4118 and 21W4120.
     - (2) Remove part of wire harnesses 21W4076, 21W4132 and 21W4150. See Figure 301 (Sheet 2).
       - (a) Disconnect electrical connector D5002P from left T/R J-box. Install protective covers over connector plug and receptacle.
       - (b) Remove two bolts, washers and nuts attaching support bracket (5), with electrical connectors D4986J and D5018J, to fan case Flange B1. Retain bolts, washers and nuts with bracket.

(c) Remove bolts, washers and nuts attaching two support brackets (7) to fan case Flange B1. Retain bolts, washers and nuts with brackets.

(d) Remove screw and nut attaching harness clamps to bracket (7). From clamp (6), remove wire harness (8) that joins wire harness (9). Reattach clamps, including empty clamp (6), screw and nut to bracket (7).

(e) Arrange removed harnesses and brackets near fan case center line to be pulled across fan case from right side.

(3) Remove wire harnesses 21W4076, 21W4132 and 21W4150. See Figure 302 (Sheet 1).

(a) Disconnect electrical connectors D5006P, D5010P and D5007P from right T/R J−box. Install protective cover over connector plugs and receptacles.

(b) Remove screw and nut attaching clamp (11) to support bracket. Retain screw and nut with clamp.

(c) Remove screw and nut attaching harness clamps to support bracket (12). Remove wire harness (8) from clamp (10). Reattach clamps, including empty clamp (10), screws and nuts to bracket (12).

(d) Remove two bolts, washers and nuts attaching bracket (12) to fan case Flange B2. Reinstall bolts, washers and nuts in same holes (11, 12) in fan case Flange B2 to maintain attachment of PMUX support.

(e) Remove two bolts, washers and nuts attaching bracket (13) to fan case Flange B2. Reinstall bolts, washers and nuts in same holes (9,10) in fan case Flange B2 to maintain attachment of PMUX support.

(f) Remove bolts, washers and nuts attaching two support brackets (7) to fan case Flange B1. Retain bolts, washers and nuts with bracket.

(g) Remove screw and nut attaching harness clamps to two brackets (7). Remove wire harness (8) from clamp (6). Reattach clamps, including empty clamp (6), screw and nut to bracket (7).

(h) Remove two bolts, washers and nuts attaching bracket (14), with electrical connectors D5019J, D4987J and D5008J, to fan case Flange B2. Retain bolts, washers and nuts with bracket.

(i) Remove wire harnesses 21W4076, 21W4132 and 21W4150, pulling loosened harnesses, brackets and electrical connectors from left side across top of fan case.

(4) Remove wire harnesses 21W4068, 21W4116 and 21W4140. See Figure 302 (Sheet 2).

    - (a) Remove screw and nut attaching clamp (15) to support bracket (16). Remove vibration accelerometer wire harness from clamp (15). Reattach clamps, including empty clamp (15), screw and nut to support bracket (16). See Figure 302 (Sheet 2), View A.
    - (b) Remove two bolts, washers and nuts attaching bracket (16) to fan case Flange A1. Retain bolts, washers and nuts with bracket.
    - (c) Remove bolts, washers and nuts attaching four brackets (17) to fan case Flange A1. Retain bolts, washers and nuts with bracket.
    - (d) Remove two bolts, washers and nuts attaching bracket (18) to fan case Flange B1. Retain bolts, washers and nuts with bracket.
    - (e) Disconnect electrical connector D5011P from right T/R J−box. Install protective cover over connector plug and receptacle.
    - (f) Remove bolts, washers and nuts attaching three brackets (19) to fan case Flange A1. Retain bolts, washers and nuts with bracket.
    - (g) Remove wire harnesses 21W4068, 21W4116 and 21W4140 from fan case upper−right quarter.
- (5) Harness removal continues on fan case lower−right quarter. See Figure 303.
    - (a) Remove bolts, washers and nuts attaching two brackets (19) to fan case Flange A1. Retain bolts, washers and nuts with bracket.
    - (b) Remove two bolts, washers and nuts attaching bracket (19) to fan case Flange A1. Reinstall bolts, washers and nuts in same holes (37,38) on fan case Flange A1 to maintain attachment of fan cowl door hold−open rod bracket.
    - (c) Remove two bolts, washers and nuts attaching bracket (20) to fan case Flange A1. Retain bolts, washers and nuts with bracket.
    - (d) Remove two bolts, washers and nuts attaching bracket (26) to fan case Flange A1. Retain bolts, washers and nuts with bracket.
    - (e) Remove two bolts, washers and nuts attaching bracket (28) to fan case Flange A1. Reinstall bolts, washers and nuts in same holes (45,46) on fan case Flange A1 to maintain attachment of inlet cowl anti−ice duct support link bracket.
    - (f) Remove two bolts, washers and nuts attaching bracket (18) to fan case Flange B1. Retain bolts, washers and nuts with bracket.

(g) Remove two bolts, washers and nuts attaching bracket (21) to fan case Flange B2. Retain bolts, washers and nuts with bracket.

(h) Remove bolts, washers and nuts attaching two brackets (22) to fan case Flange C. Reinstall bolts, washers and nuts in same holes (40, 41 and 42, 43) to maintain tightness of Flange C union. Torque nuts 85 − 95 lb−in. (9.604 −10.734 N.m).

(i) Remove screw and nut attaching harness clamp (24) to bracket. Retain screw and nut with clamp. See Figure 303, View B.

(j) Remove two bolts, washers and nuts attaching bracket (23) to fan case Flange B2. Retain bolts, washers and nuts with bracket.

(k) Disconnect electrical connector DV220 from anti−ice shutoff and regulating valve. Install protective cover over connector plug and receptacle.

(l) Disconnect electrical connector DS300 from anti−ice pressure switch. Install protective cover over connector plug and receptacle.

(m) Remove bolts, washers and nuts attaching two brackets (25) to fan case Flange C. Reinstall bolts, washers and nuts in same holes (45, 46 and 48, 49) to maintain tightness of Flange C union. Torque nuts 85 − 95 lb−in. (9.604 − 10.734 N.m).

(n) Remove two bolts, washers and nuts attaching bracket (26) to fan case Flange B2. Retain bolts, washers and nuts with bracket.

(o) Remove two bolts, washers and nuts attaching bracket (27) to fan case Flange B1. Retain bolts, washers and nuts with bracket.

(p) Remove two bolts, washers and nuts attaching bracket (28) to fan case Flange A1. Retain bolts, washers and nuts with bracket.

(q) Remove two bolts, washers and nuts attaching bracket (28) to fan case Flange A1. Reinstall one bolt, washer and nut in hole 61 on fan case Flange A1 to maintain attachment of inlet cowl anti−ice support link bracket. Retain other bolt, washer and nut with harness support bracket.

(r) Remove wire harnesses 21W4068, 21W4116 and 21W4140 from fan case lower−right quarter.

(6) Harness removal continues on fan case lower−left quarter. See Figure 304.

(a) Disconnect electrical connector DH9 from T/R regulating and shutoff valve. Install protective cover over connector plug and receptacle.

(b) Remove two bolts, washers and nuts attaching bracket (29) to fan case Flange B1. Retain bolts, washers and nuts with bracket.

(c) Remove two bolts, washers and nuts attaching bracket (28) to fan case Flange A1. Reinstall one bolt, washer and nut in hole 63 on fan case Flange A1 to maintain attachment of inlet cowl anti−ice support link bracket. Retain other bolt, washer and nut with harness support bracket.

(d) Remove bolts, washers and nuts attaching three brackets (28) to fan case Flange A1. Retain bolts, washers and nuts with bracket.

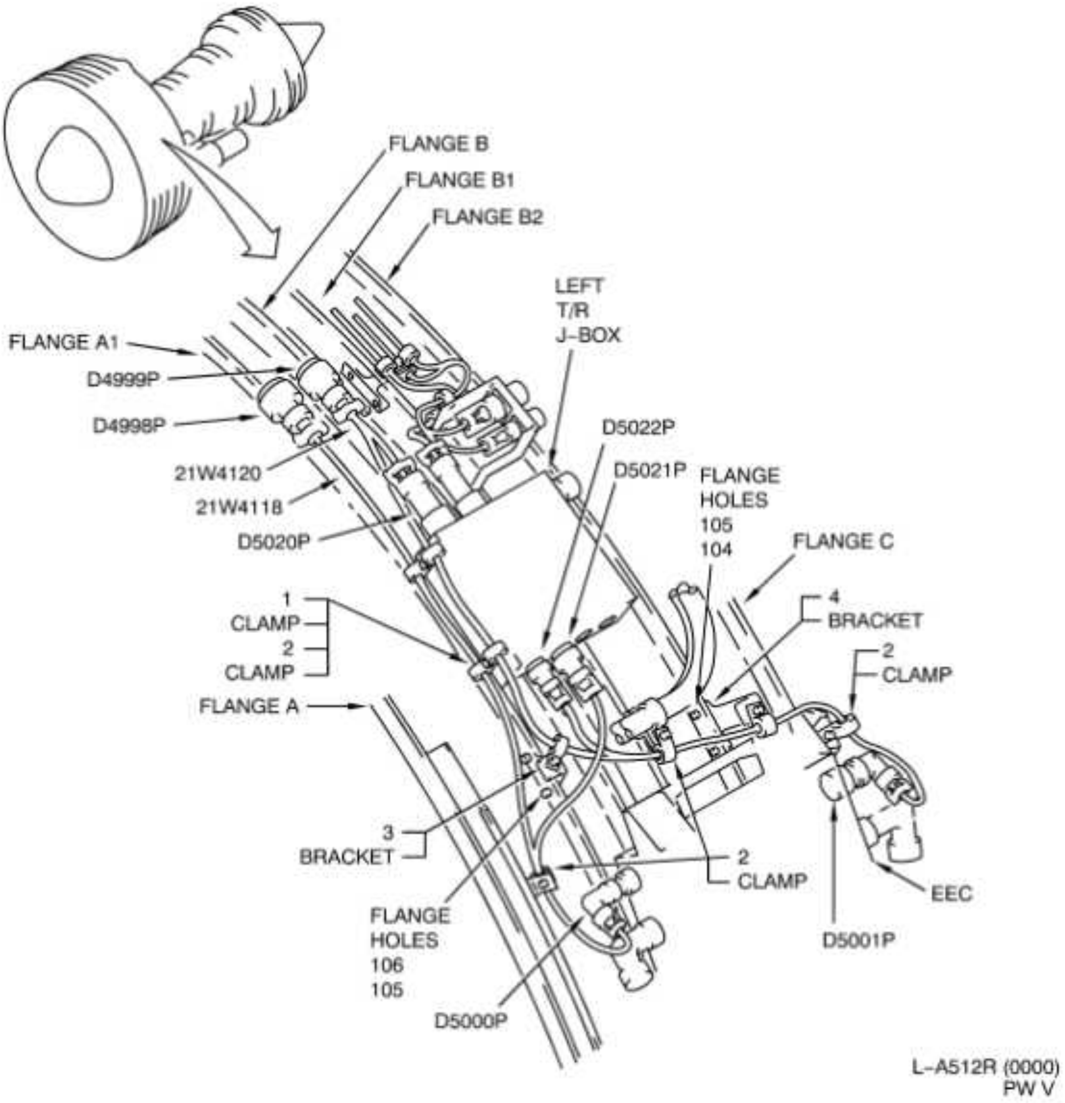
(e) Remove bolts, washers and nuts attaching two brackets (28) to fan case Flange A1. Reinstall three bolts, washers and nuts in holes 78, 79 and 75 on fan case Flange A1 to maintain attachment of PDU support. Retain other bolt, washer and nut with harness support bracket.

(f) Disconnect electrical connector DS304 from PDU. Install protective cover over connector plug and receptacle.

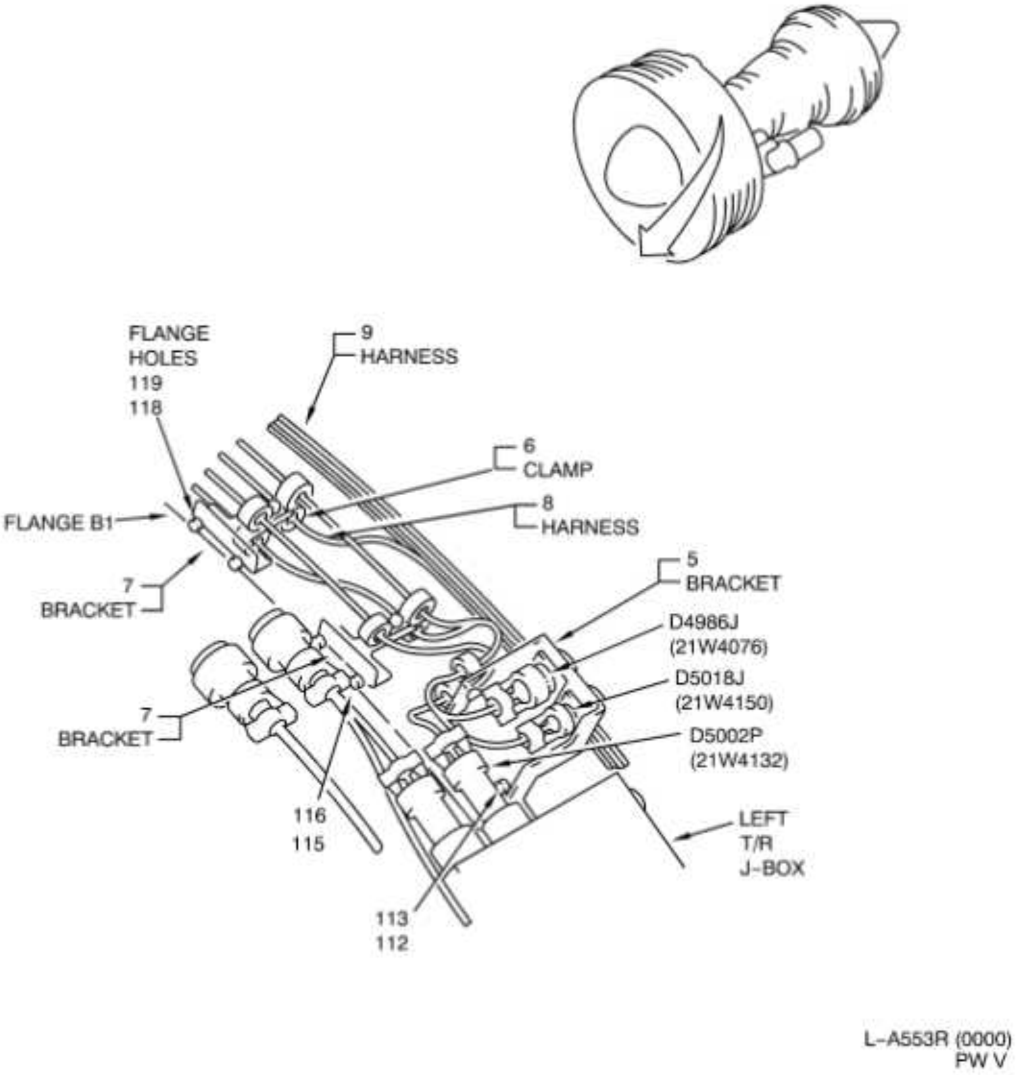
(g) Disconnect electrical connector DH15 from T/R selector valve. Install protective cover over connector plug and receptacle.

(h) Remove two bolts, washers and nuts attaching bracket (30) to fan case Flange A1. Retain bolts, washers and nuts with bracket.

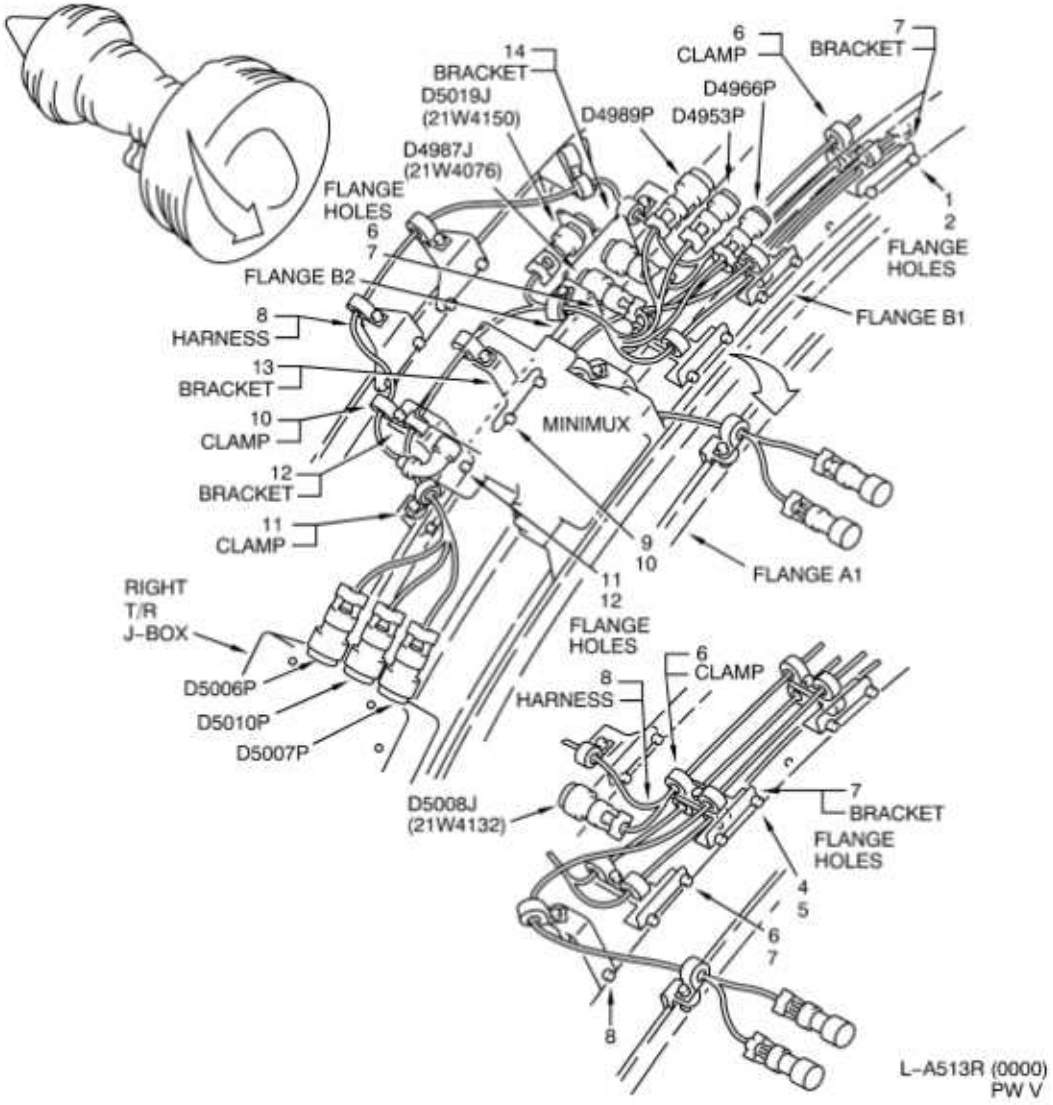
(i) Remove wire harnesses 21W4068, 21W4116 and 21W4140 from fan case lower−right quarter.


FLANGE B
FLANGE B1
FLANGE B2
LEFT T/R J-BOX
FLANGE A1
D4999P
D4998P
21W4120
21W4118
D5020P
D5022P
D5021P
FLANGE HOLES 105 104
FLANGE C
1 CLAMP
2 CLAMP
4 BRACKET
2 CLAMP
FLANGE A
3 BRACKET
2 CLAMP
EEC
FLANGE HOLES 106 105
D5001P
D5000P
L-A512R (0000)
PW V

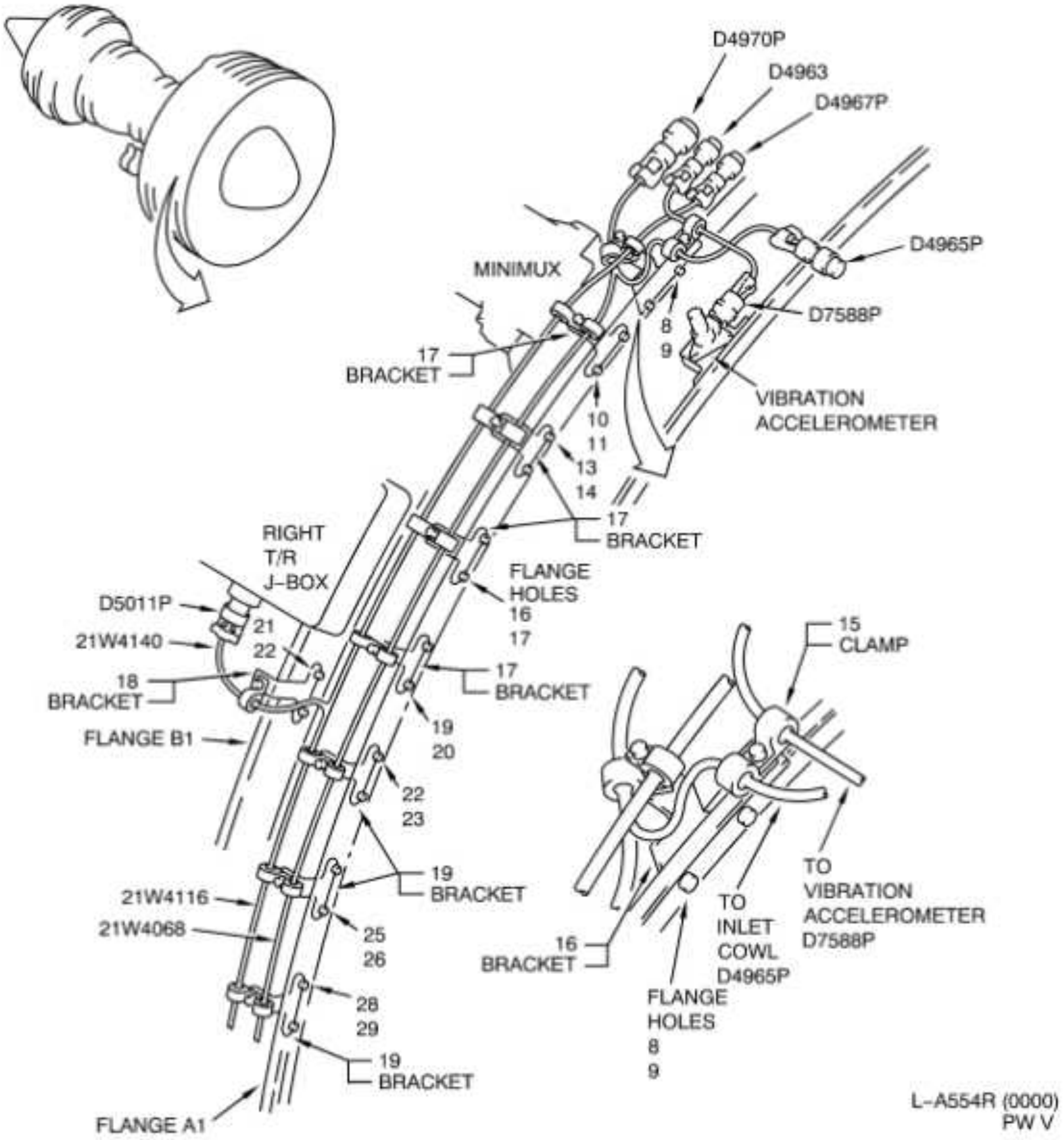
Fan Case Wire Harness, Upper−Left Quarter
Figure 301 (Sheet 1)
(Task 71−00−33−050−014)


FLANGE
HOLES
119
118
9
HARNESS
6
CLAMP
FLANGE B1
8
HARNESS
7
BRACKET
5
BRACKET
D4986J
(21W4076)
D5018J
(21W4150)
7
BRACKET
D5002P
(21W4132)
116
115
LEFT
T/R
J-BOX
113
112
L-A553R (0000)
PW V

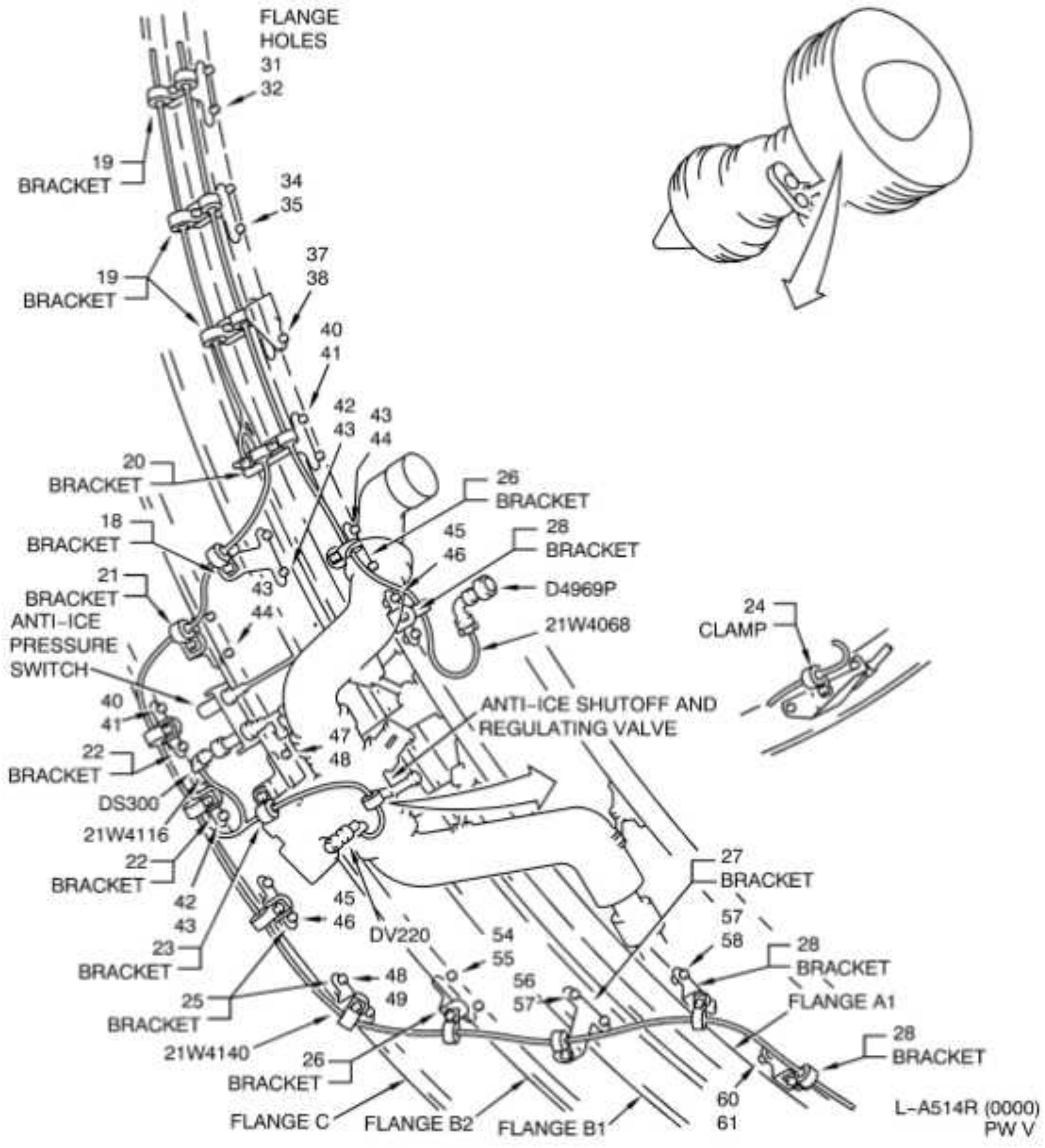
Fan Case Wire Harness, Upper−Left Quarter
Figure 301 (Sheet 2)
(Task 71−00−33−050−014)


14
BRACKET
D5019J
(21W4150)
D4987J
(21W4076)
FLANGE HOLES
6
7
FLANGE B2
8
HARNESS
13
BRACKET
10
CLAMP
12
BRACKET
11
CLAMP
RIGHT T/R J-BOX
D5006P
D5010P
D5007P
D4989P
D4953P
6
CLAMP
D4966P
7
BRACKET
1
2
FLANGE HOLES
FLANGE B1
MINIMUX
9
10
11
12
FLANGE HOLES
FLANGE A1
6
CLAMP
8
HARNESS
7
BRACKET
FLANGE HOLES
4
5
6
7
8
D5008J
(21W4132)
L-A513R (0000)
PW V

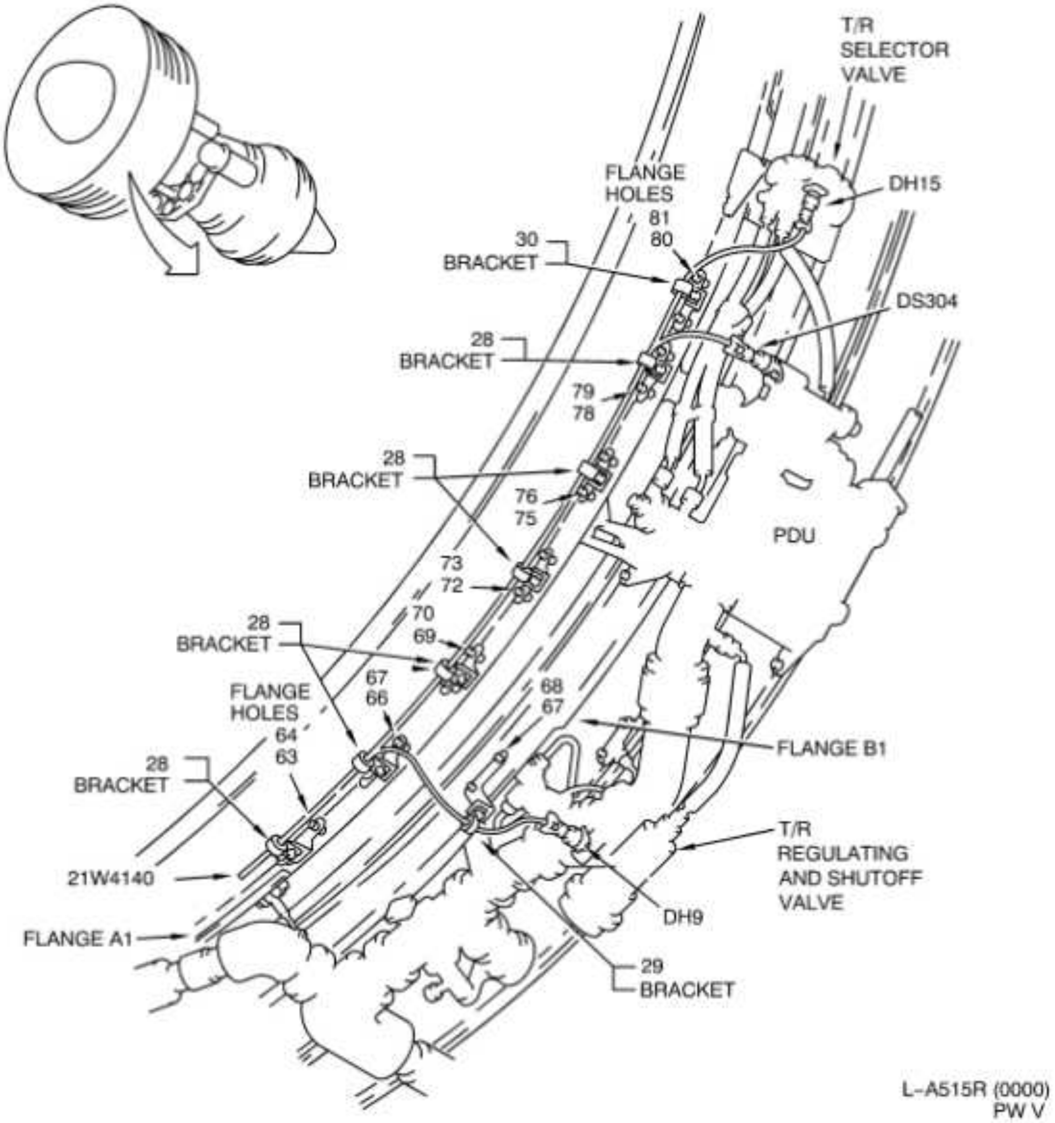
Fan Case Wire Harness, Upper−Right Quarter
Figure 302 (Sheet 1)
(Task 71−00−33−050−014)


D4970P
D4963
D4967P
D4965P
MINIMUX
D7588P
8
9
17
BRACKET
VIBRATION
ACCELEROMETER
10
11
13
14
17
BRACKET
RIGHT
T/R
J-BOX
FLANGE
HOLES
16
17
D5011P
21W4140
21
22
18
BRACKET
17
BRACKET
15
CLAMP
FLANGE B1
19
20
22
23
19
BRACKET
21W4116
21W4068
25
26
28
29
19
BRACKET
16
BRACKET
TO
INLET
COWL
D4965P
TO
VIBRATION
ACCELEROMETER
D7588P
FLANGE
HOLES
8
9
FLANGE A1
L-A554R (0000)
PW V

Fan Case Wire Harness, Upper−Right Quarter
Figure 302 (Sheet 2)
(Task 71−00−33−050−014)


FLANGE
HOLES
31
32
19
BRACKET
34
35
37
38
19
BRACKET
40
41
42
43
43
44
20
BRACKET
26
BRACKET
18
BRACKET
45
46
28
BRACKET
21
BRACKET
43
44
D4969P
21W4068
24
CLAMP
ANTI-ICE
PRESSURE
SWITCH
40
41
ANTI-ICE SHUTOFF AND
REGULATING VALVE
22
BRACKET
47
48
DS300
21W4116
22
BRACKET
27
BRACKET
42
43
45
46
57
58
23
BRACKET
DV220
54
55
28
BRACKET
48
49
56
57
FLANGE A1
25
BRACKET
21W4140
26
BRACKET
28
BRACKET
60
61
FLANGE C
FLANGE B2
FLANGE B1
L-A514R (0000)
PW V

Fan Case Wire Harness, Lower−Right Quarter
Figure 303
(Task 71−00−33−050−014)


T/R SELECTOR VALVE
FLANGE HOLES
81
80
DH15
30 BRACKET
DS304
28 BRACKET
79
78
28 BRACKET
76
75
PDU
73
72
70
69
28 BRACKET
FLANGE HOLES
67
66
64
63
68
67
FLANGE B1
28 BRACKET
21W4140
T/R REGULATING AND SHUTOFF VALVE
FLANGE A1
DH9
29 BRACKET
L−A515R (0000)
PW V

Fan Case Wire Harness, Lower−Left Quarter
Figure 304
(Task 71−00−33−050−014)

POWER PLANT GENERAL − FAN CASE − REMOVAL−14

Task 71−00−33−050−014−A:

2. Remove Fan Case Wire Harness − Post SB PW4NAC 71−100
    - A. Prerequisites
        - (1) Remove inlet cowl. See Removal−01, (Task 71−00−33−050−001).
    - B. Equipment and Materials Required − None
    - C. Procedure
        - (1) Remove wire harness 21W4118 and 21W4120.
            - (a) Disconnect electrical connectors D4998P and D4999P from pylon interface; D5020P, D5021P, and D5022P from left thrust reverser J−box; and D5000P and D5001P from electronic engine control (EEC). Install protective covers. See Figure 305 (Sheets 1 and 2).
            - (b) Remove attaching hardware and clamps (1, 2) attaching harness to brackets, left thrust reverser J−box, and EEC. Retain hardware with clamp.
            - (c) Remove attaching hardware and clamps attaching harnesses to support brackets (3, 4) on Flanges A1 and B2. Retain hardware with clamp.
            - (d) Remove wire harnesses 21W4118 and 21W4120 from fan case.
        - (2) Remove harnesses 21W4075, 21W4076, 21W4132, and 21W4150.
            - (a) Disconnect electrical connector D5002P from left thrust reverser J−box; and D4986J and D5018J from bracket (5). Install protective covers.
            - (b) Remove harnesses, attaching hardware, and clamps from three brackets (6, 7, 8). Retain hardware with clamp.
            - (c) Arrange previously removed harnesses and brackets near fan case centerline to be pulled across fan case from right side.
            - (d) Disconnect electrical connectors D5006P, D5010P, D5051P and D5007P from right thrust reverser J−box; D5019J, D4987J, and D5008J, from bracket (9); and D4989P, D4953P, and D4966P from pylon interface. Install protective covers. See Figure 306.
            - (e) Remove attaching hardware and clamps attaching harnesses to fan case.
            - (f) Remove wire harnesses 21W4076, 21W4132, and 21W4150 from fan case.
        - (3) Remove wire harnesses 21W4068, 21W4116, and 21W4140.
            - (a) Disconnect electrical connectors D4970P, D4963P, and D4967P from pylon interface; D4965P from inlet cowl, DT588 from vibration accelerometer, and D5011P and D5053P from right thrust reverser J−box. Install protective covers. See Figure 306.

(b) Remove harnesses, attaching hardware, and clamps from brackets (10 through 20). Retain hardware with clamps.

(c) Remove wire harness 21W4068, 21W4116, and 21W4140 from fan case upper−right quarter.

(d) Disconnect electrical connector DV220 from anti−ice shutoff and regulating valve, DS300 from anti−ice pressure switch, and D4969P from inlet cowl. Install protective covers. See Figure 307.

(e) Disconnect grounding wire from stud. Retain attaching hardware for reinstallation.

(f) Remove harnesses attaching hardware and clamps from brackets (21 through 31).

(4) Remove wire harnesses 21W4068, 21W4116 and 21W4140 from fan case lower−right quarter.

(a) Disconnect electrical connector DH15 from thrust reverser selector valve, DS304 from pneumatic drive unit (PDU), and DH9 from thrust reverser regulating and shutoff valve. Install protective covers. See Figure 308.

(b) Remove hardware and clamps attaching harnesses to brackets (31, 32, 33). Retain hardware with clamps.

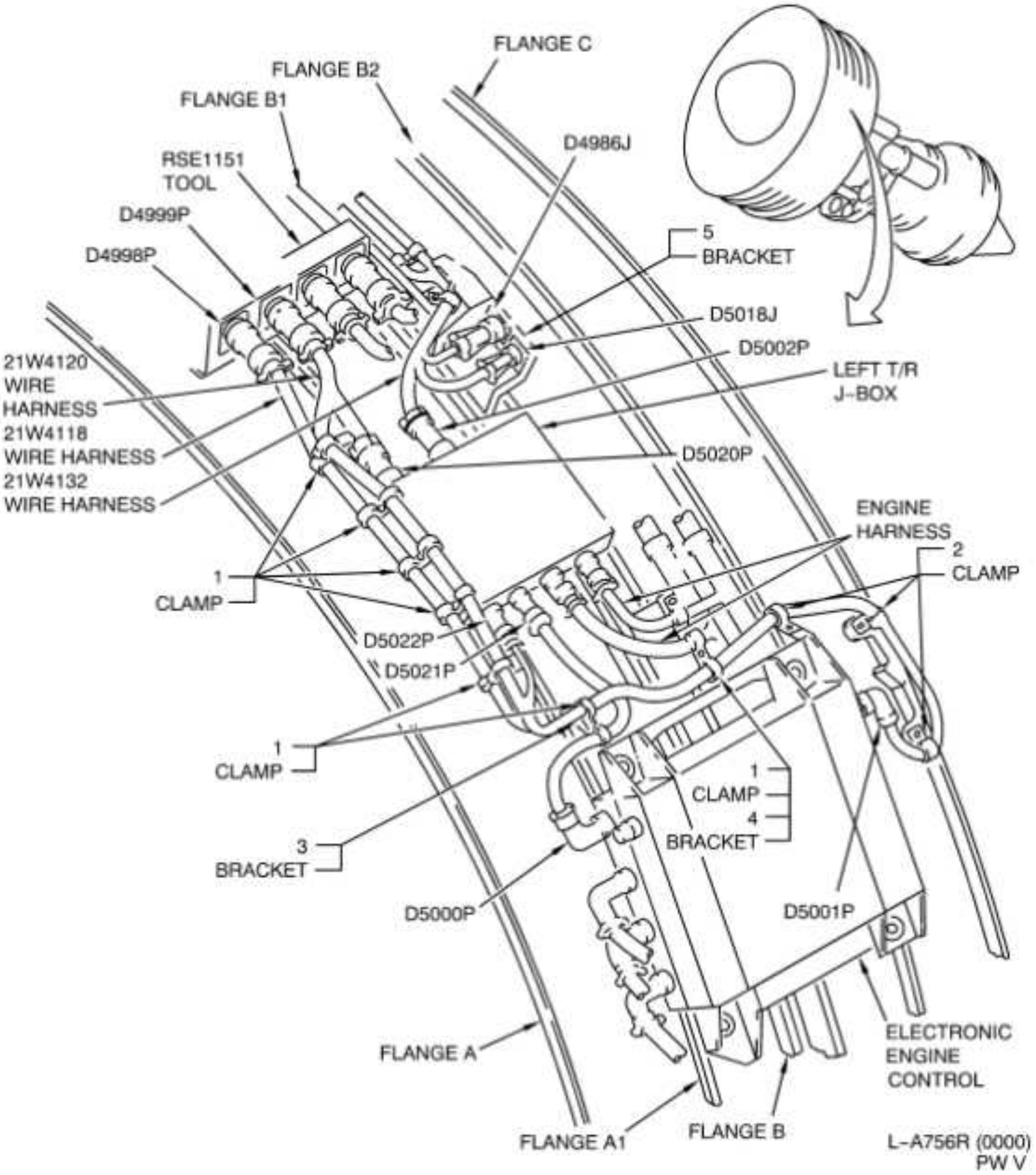
(c) Remove wire harnesses 21W4068, 21W4116, and 21W4140 from fan case.

(5) Remove wire harness 21W4083.

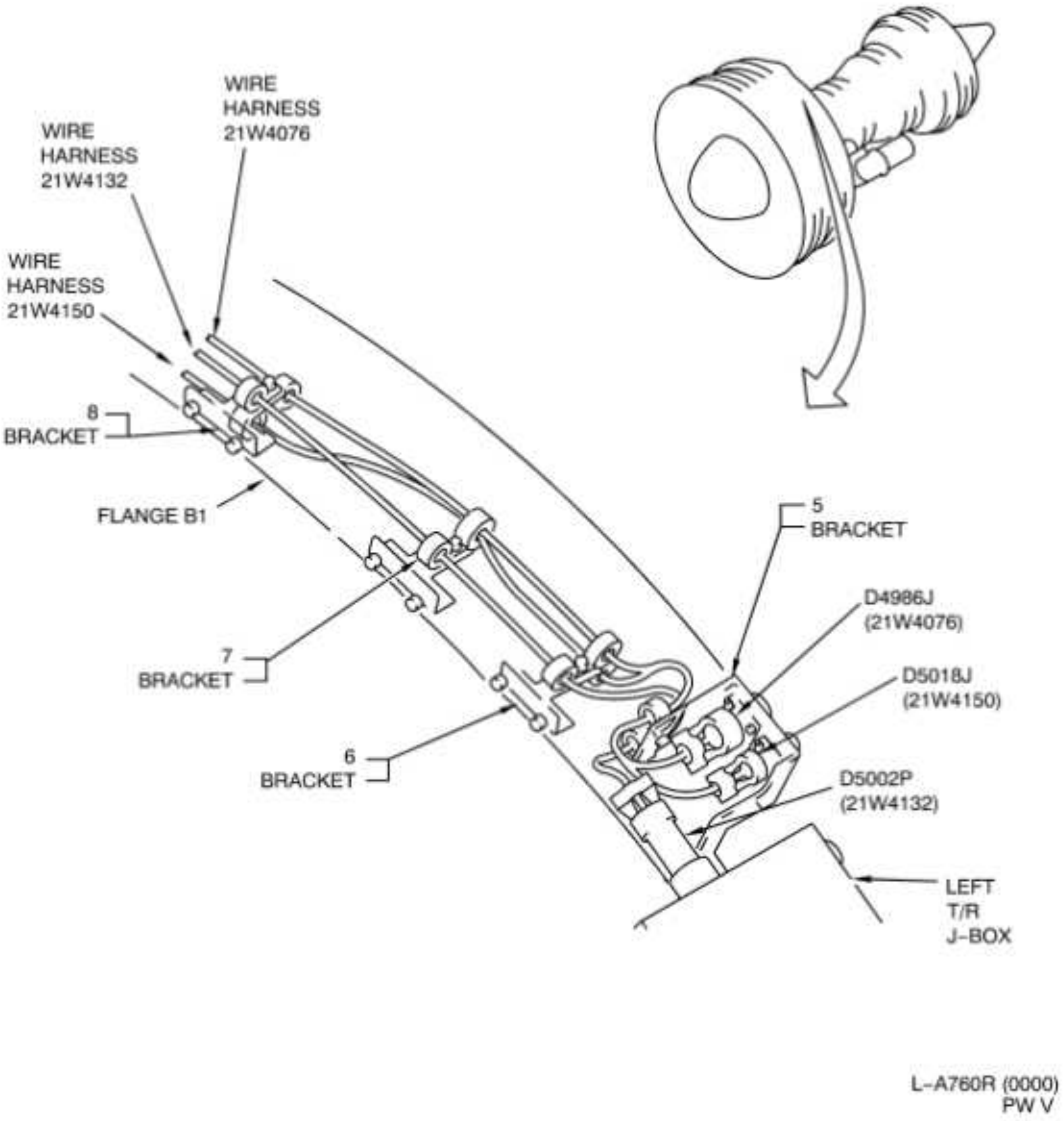
(a) Disconnect electrical connector D5052P from right thrust reverser J−box. Install protective cover. See Figure 306.

(b) Disconnect electrical connector DS308 from bracket−mounted barometric switch. Install protective cover.

(c) Remove wire harness 21W4083 from fan case.

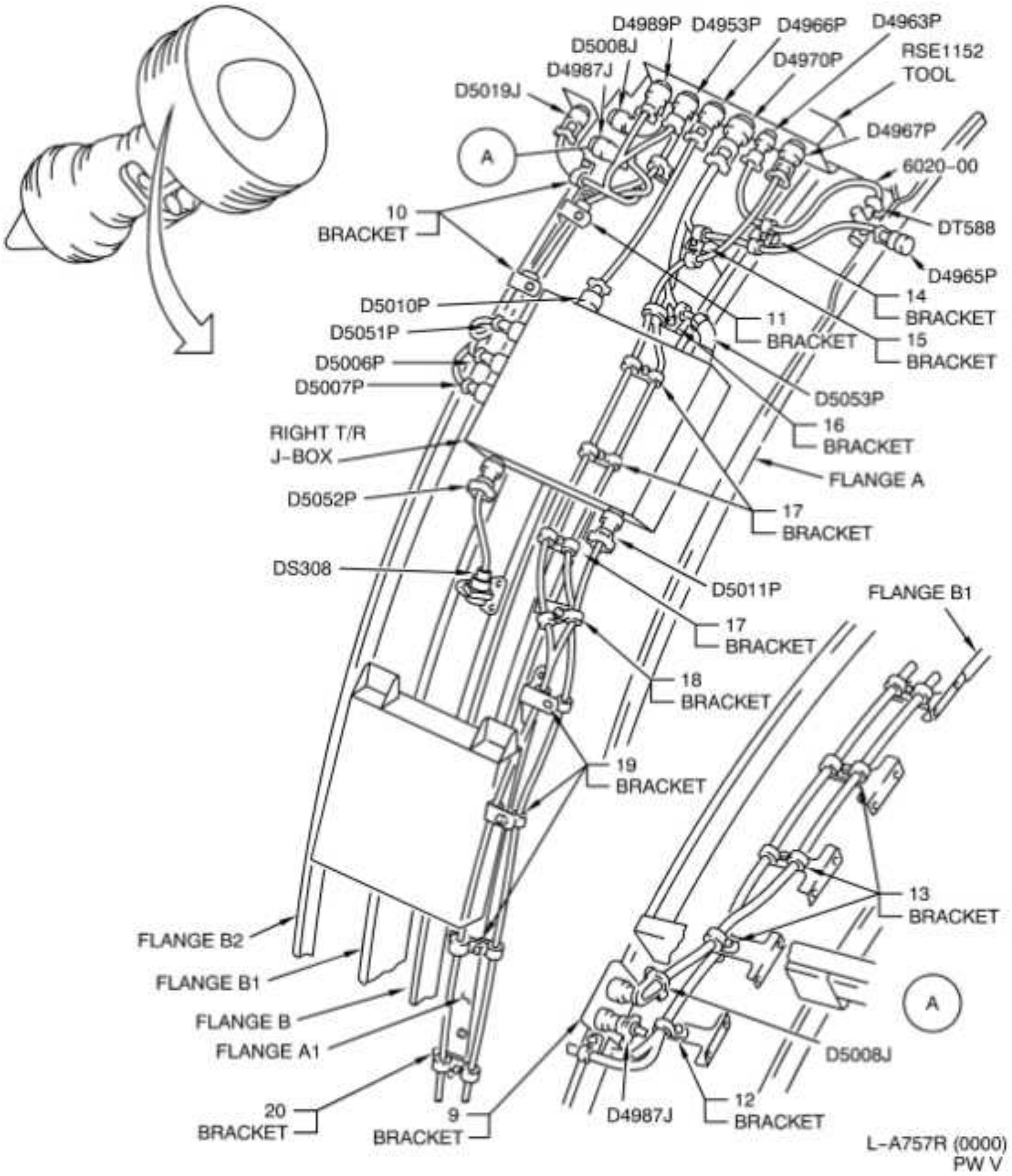

FLANGE C
FLANGE B2
FLANGE B1
RSE1151 TOOL
D4986J
D4999P
D4998P
5 BRACKET
D5018J
D5002P
LEFT T/R J-BOX
21W4120 WIRE HARNESS
21W4118 WIRE HARNESS
21W4132 WIRE HARNESS
D5020P
ENGINE HARNESS
2 CLAMP
1 CLAMP
D5022P
D5021P
1 CLAMP
1 CLAMP
4 BRACKET
3 BRACKET
D5000P
D5001P
FLANGE A
ELECTRONIC ENGINE CONTROL
FLANGE A1
FLANGE B
L-A756R (0000)
PW V

Fan Case Wire Harness − Upper Left Side
Figure 305 (Sheet 1)
(Task 71−00−33−050−014−A)

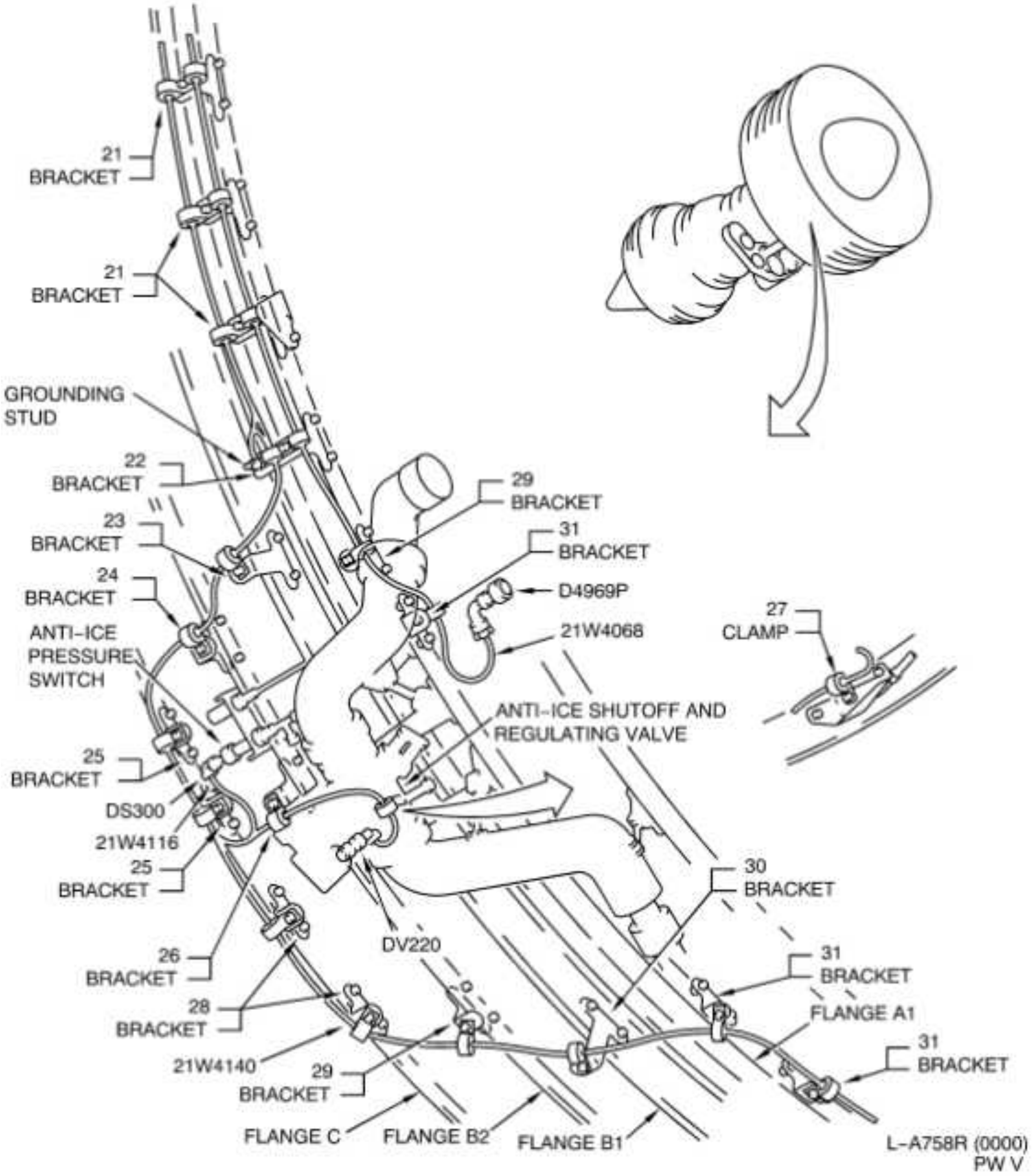

WIRE HARNESS 21W4076
WIRE HARNESS 21W4132
WIRE HARNESS 21W4150
8 BRACKET
FLANGE B1
7 BRACKET
6 BRACKET
5 BRACKET
D4986J (21W4076)
D5018J (21W4150)
D5002P (21W4132)
LEFT T/R J-BOX
L-A760R (0000)
PW V

Fan Case Wire Harness − Upper Left Side
Figure 305 (Sheet 2)
(Task 71−00−33−050−014−A)

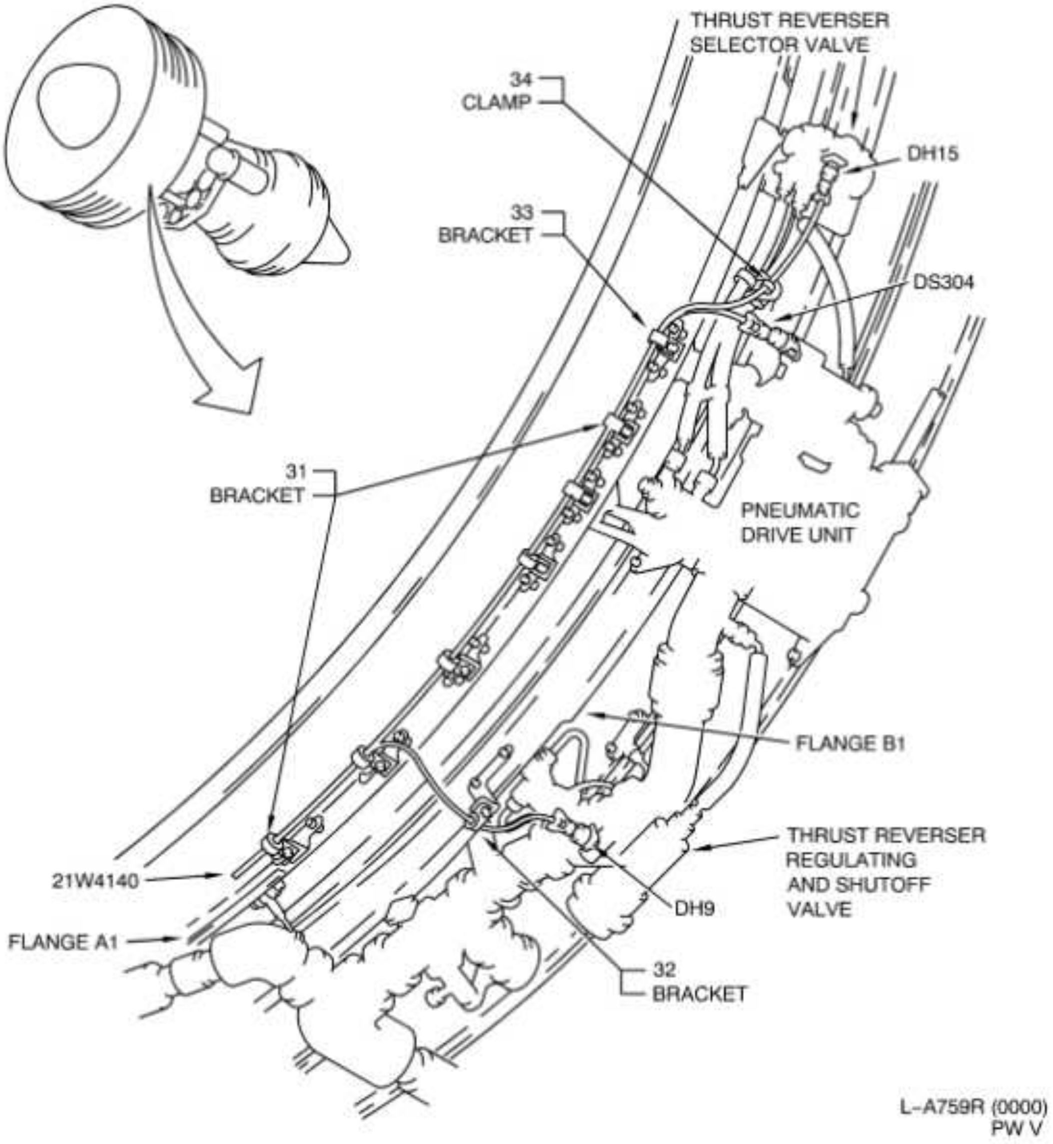
POWER PLANT GENERAL - FAN CASE - REMOVAL-14


D4989P
D4953P
D4966P
D4963P
D5008J
D4987J
D4970P
RSE1152
TOOL
D5019J
A
D4967P
6020-00
10
BRACKET
DT588
D4965P
14
BRACKET
D5010P
11
BRACKET
D5051P
15
BRACKET
D5006P
D5007P
D5053P
RIGHT T/R
J-BOX
16
BRACKET
FLANGE A
D5052P
17
BRACKET
DS308
D5011P
FLANGE B1
17
BRACKET
18
BRACKET
19
BRACKET
13
BRACKET
FLANGE B2
FLANGE B1
A
FLANGE B
D5008J
FLANGE A1
20
BRACKET
9
BRACKET
D4987J
12
BRACKET
L-A757R (0000)
PW V

Fan Case Wire Harness - Right Side
Figure 306
(Task 71-00-33-050-014-A)


21
BRACKET
21
BRACKET
GROUNDING STUD
22
BRACKET
23
BRACKET
24
BRACKET
ANTI–ICE PRESSURE SWITCH
25
BRACKET
DS300
21W4116
25
BRACKET
26
BRACKET
28
BRACKET
21W4140
29
BRACKET
FLANGE C
FLANGE B2
FLANGE B1
DV220
29
BRACKET
31
BRACKET
D4969P
21W4068
27
CLAMP
ANTI–ICE SHUTOFF AND REGULATING VALVE
30
BRACKET
31
BRACKET
FLANGE A1
31
BRACKET
L–A758R (0000)
PW V

Fan Case Wire Harness – Lower Right Side
Figure 307
(Task 71–00–33–050–014–A)


THRUST REVERSER SELECTOR VALVE
34 CLAMP
DH15
33 BRACKET
DS304
31 BRACKET
PNEUMATIC DRIVE UNIT
FLANGE B1
THRUST REVERSER REGULATING AND SHUTOFF VALVE
21W4140
FLANGE A1
DH9
32 BRACKET
L-A759R (0000)
PW V

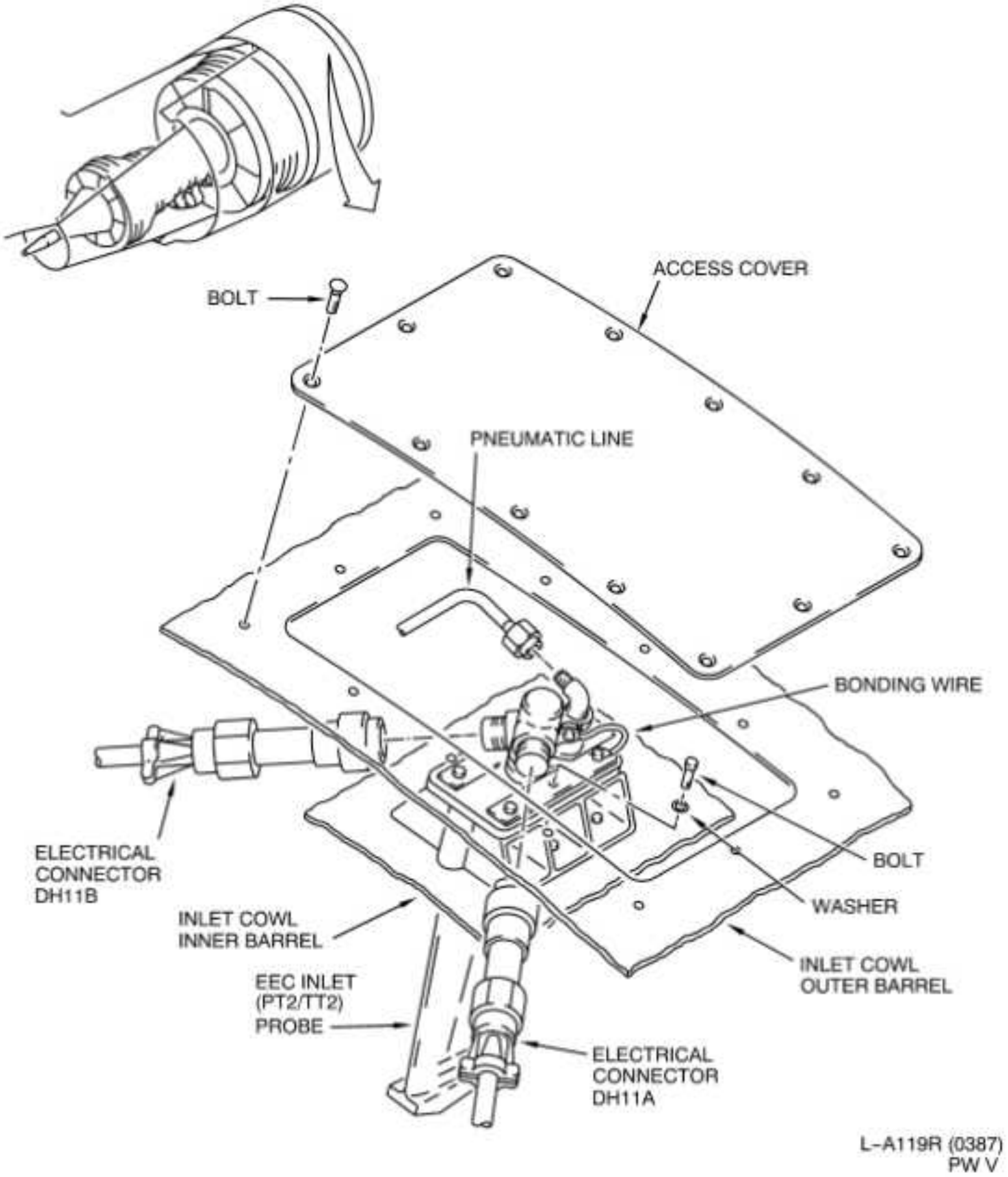
Fan Case Wire Harness − Lower Left Side
Figure 308
(Task 71−00−33−050−014−A)

POWER PLANT GENERAL - FAN CASE - REMOVAL-15

Task 71-00-33-050-019:

1. Remove EEC Inlet Pressure/Temperature (PT2/TT2) Probe
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 301.
     - (1) Gain access to probe by removing 12 bolts and access cover on upper right side of inlet cowl.
     - (2) Disconnect electrical connectors DH11A and DH11B. Install protective covers on connectors and receptacles.
     - (3) Remove pneumatic pressure line from probe and install protective covers on line and probe fitting.
     - (4) Remove six bolts and washers attaching probe to inner cowl barrel mounting bracket and remove probe.


BOLT
ACCESS COVER
PNEUMATIC LINE
BONDING WIRE
BOLT
WASHER
ELECTRICAL CONNECTOR DH11B
INLET COWL INNER BARREL
INLET COWL OUTER BARREL
EEC INLET (PT2/TT2) PROBE
ELECTRICAL CONNECTOR DH11A
L−A119R (0387)
PW V

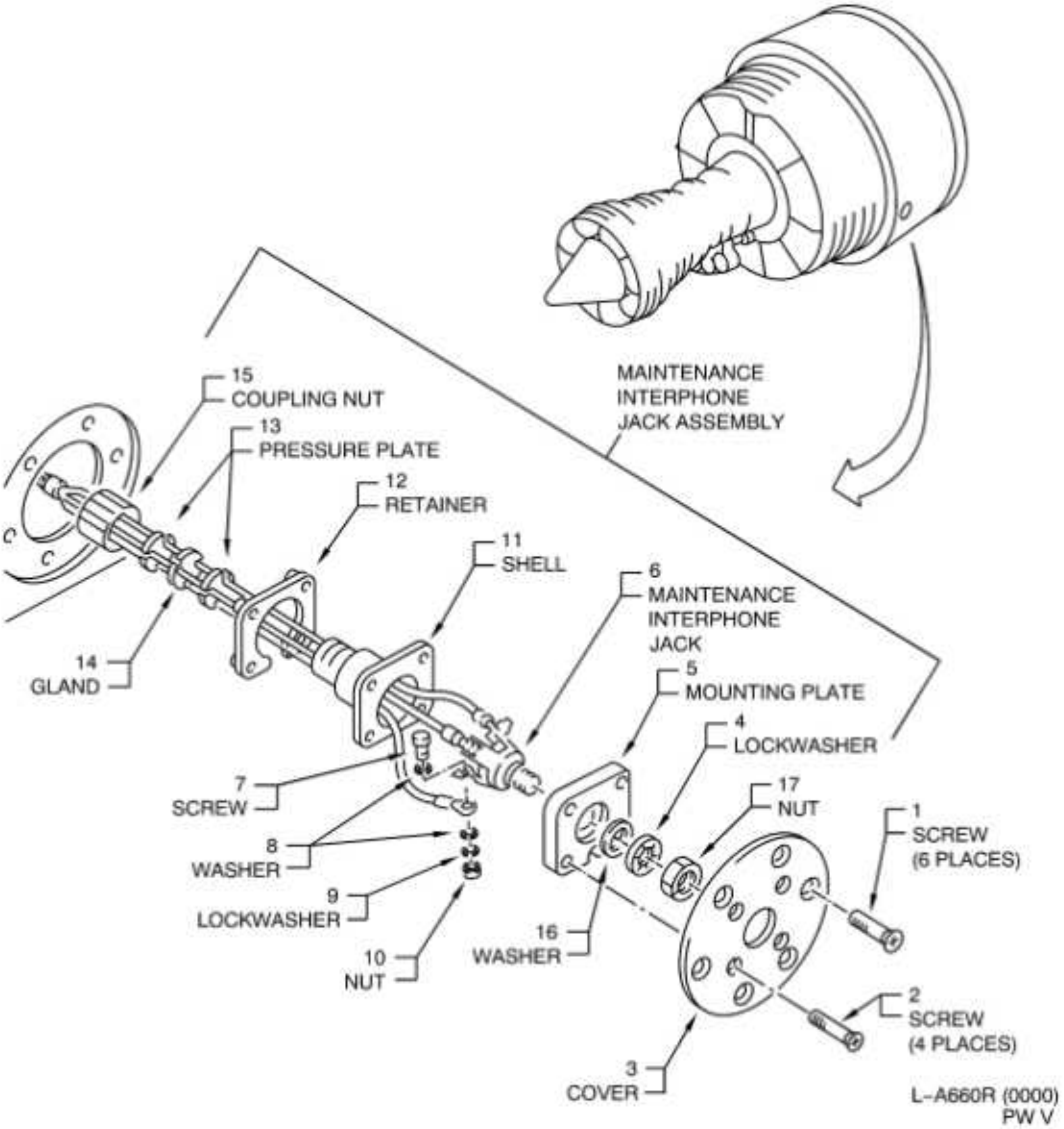
EEC Inlet Pressure/Temperature
PT2/TT2 Probe
Figure 301
(Task 71−00−33−050−019)

POWER PLANT GENERAL – FAN CASE – REMOVAL–16

Task 71–00–33–050–020:

1. Remove Maintenance Interphone Jack
   - A. Equipment and Materials Required – None
   - B. Procedure

     See Figure 301.
     - (1) Loosen four inner screws (301/2) attaching maintenance interphone assembly to cover (301/3).
     - (2) Remove six screws (301/1) attaching cover to inlet cowl.
     - (3) Draw jack assembly, cover and wires out of inlet cowl.
     - (4) Remove screws (301/2), retainer (301/12) and cover from jack assembly.
     - (5) Remove nut (301/17), lockwasher (301/4), washer (301/16) and mounting plate (301/5) from jack. Discard lockwasher.
     - (6) Unscrew coupling nut (301/15) holding gland (301/14) and pressure plates (301/13) in place and pull maintenance interphone jack (301/6) out of shell, exposing electrical connections.
     - (7) Remove screws (301/7), washers (301/8), lockwashers (301/9) and nuts (301/10) attaching wire to maintenance interphone jack. Remove jack.


15 COUPLING NUT
13 PRESSURE PLATE
12 RETAINER
11 SHELL
MAINTENANCE INTERPHONE JACK ASSEMBLY
6 MAINTENANCE INTERPHONE JACK
5 MOUNTING PLATE
4 LOCKWASHER
17 NUT
1 SCREW (6 PLACES)
14 GLAND
7 SCREW
8 WASHER
9 LOCKWASHER
10 NUT
16 WASHER
2 SCREW (4 PLACES)
3 COVER
L−A660R (0000)
PW V

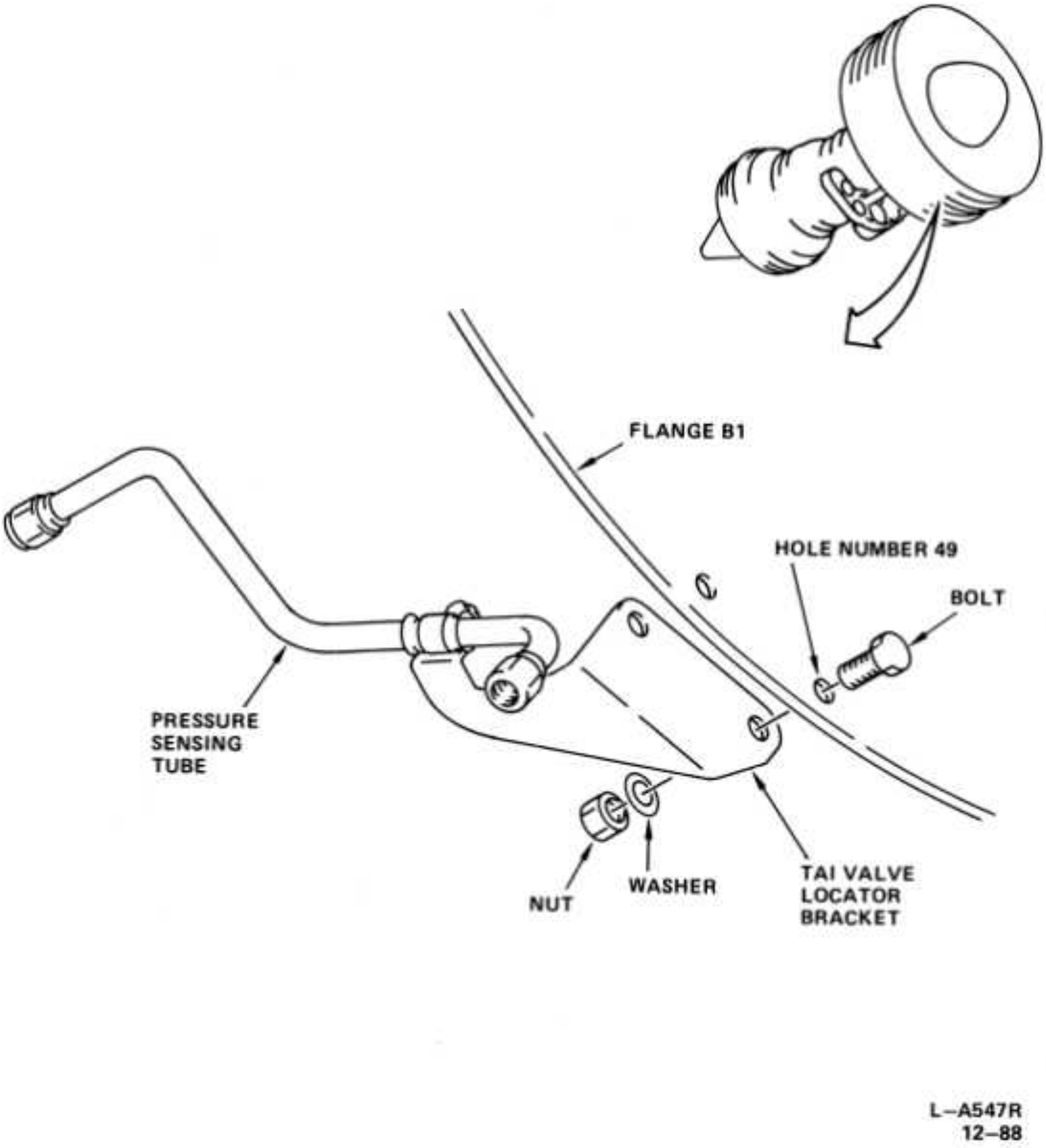
Inlet Cowl Maintenance
Interphone Jack
Figure 301
(Task 71−00−33−050−020)

Previous Pageblock Return to Previous Menu Next Pageblock

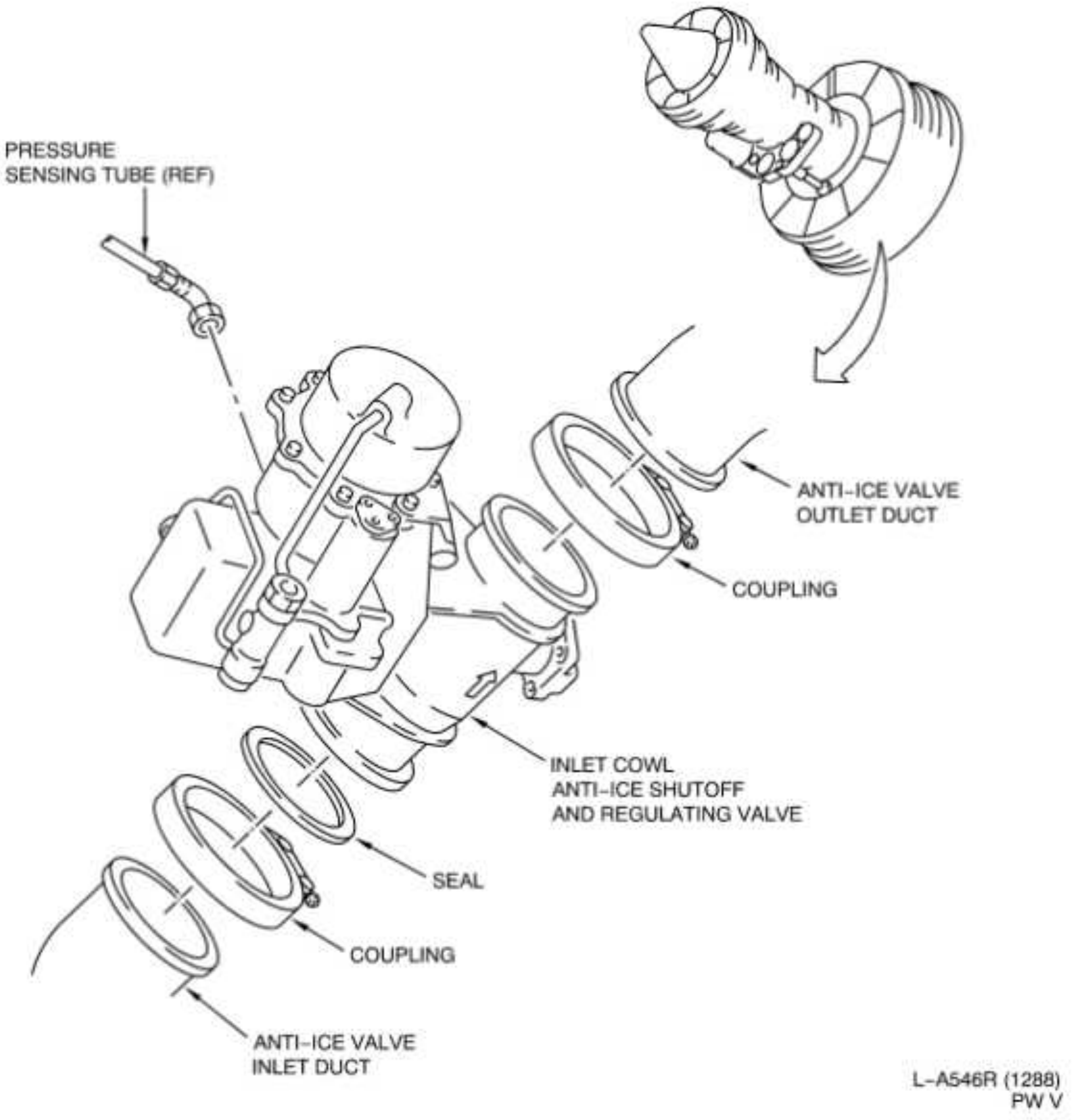
POWER PLANT GENERAL - FAN CASE - REMOVAL-17

Task 71-00-33-050-021:

1. Inlet Cowl Anti-Ice Shutoff And Regulating Valve Removal
   - A. Equipment and Materials Required - None
   - B. Procedure
     - (1) Remove anti-ice valve sensing tube. See Figure 301.
       - (a) Remove two (2) bolts, washers and nuts attaching TAI valve locator bracket to fan case Flange B1 at holes 48 and 49.
       - (b) Disconnect pressure sensing tube from anti-ice shutoff and regulating valve. Do not remove tube union from valve.
       - (c) Install protective covers over sensing tube and valve port.
     - (2) Remove anti-ice shutoff and regulating valve. See Figure 302.
       - (a) Remove coupling and seal securing valve to anti-ice valve inlet duct.
       - (b) Remove coupling securing valve to anti-ice outlet duct.
       - (c) Install protective covers over both valve ports.
       - (d) Install protective covers over valve inlet and outlet duct open ends.


FLANGE B1
HOLE NUMBER 49
BOLT
PRESSURE SENSING TUBE
NUT
WASHER
TAI VALVE LOCATOR BRACKET
L−A547R
12−88

Anti−Ice Valve Pressure
Sensing Tube
Figure 301
(Task 71−00−33−050−021)


PRESSURE SENSING TUBE (REF)
ANTI−ICE VALVE OUTLET DUCT
COUPLING
INLET COWL ANTI−ICE SHUTOFF AND REGULATING VALVE
SEAL
COUPLING
ANTI−ICE VALVE INLET DUCT
L−A546R (1288)
PW V

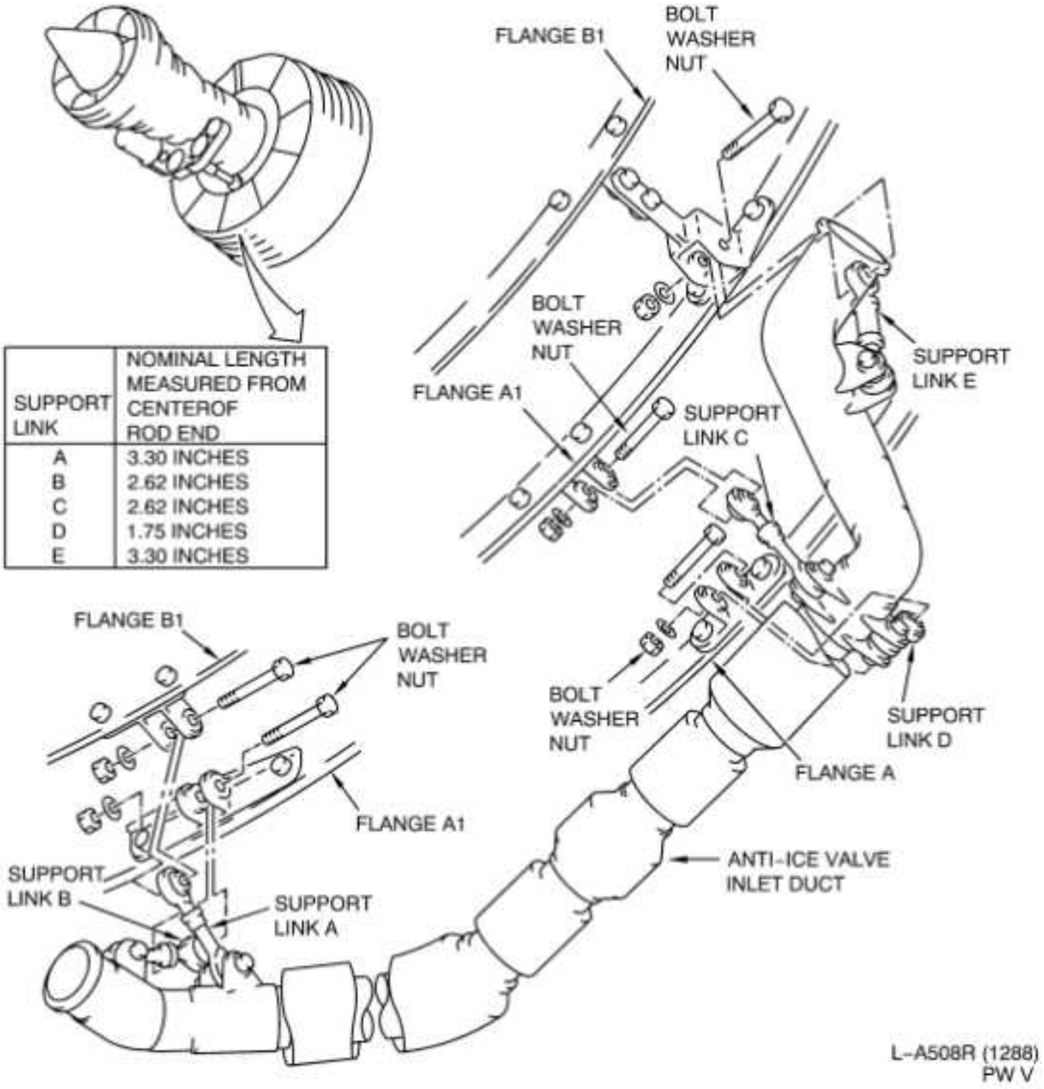
Inlet Cowl Anti−Ice Shutoff And
Regulating Valve
Figure 302
(Task 71−00−33−050−021)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - FAN CASE - REMOVAL-18

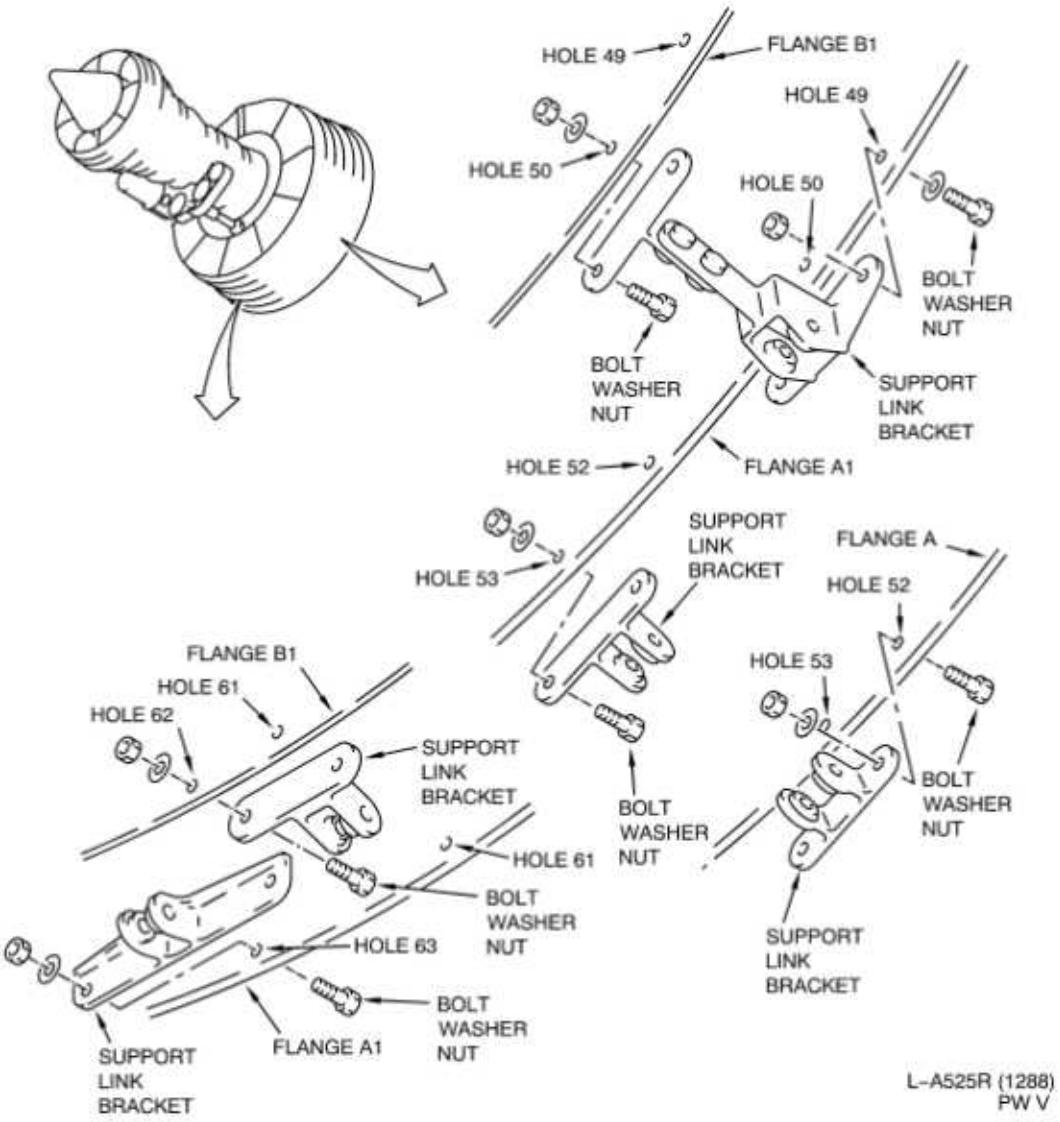
Task 71-00-33-050-022:

1. Remove Inlet Cowl Anti-Ice System Ducts
    - A. Prerequisites
        - (1) Remove inlet cowl anti-ice shutoff and regulating valve. See Removal-17 (Task 71-00-33-050-021).
    - B. Equipment and Materials Required - None
    - C. Procedure
        - (1) Remove anti-ice valve inlet duct. See Figures 301 and 302.
            - (a) Remove coupling and seal attaching duct to anti-ice duct T-section.
            - (b) Remove bolts, washers and nuts attaching five (5) duct support links to support link brackets on fan case flanges. Temporarily replace bolts, washers and nuts in support links.
            - (c) Remove bolts, washers and nuts attaching five (5) support link brackets to fan case flanges. Temporarily replace bolts, washers and nuts in support link brackets.
            - (d) Install protective covers over both ends of duct and over anti-ice duct T-section port.
        - (2) Remove anti-ice valve outlet duct. See Figures 303 and 304.
            - (a) Remove bolts, washers and nuts attaching two (2) support links to support link brackets on fan case flanges. Temporarily replace bolts, washers and nuts in support link brackets.
            - (b) Remove bolts, washers and nuts attaching two (2) support link brackets to fan case flanges. Temporarily replace bolts, washers and nuts in support link brackets.
            - (c) Install protective covers over both ends of duct.

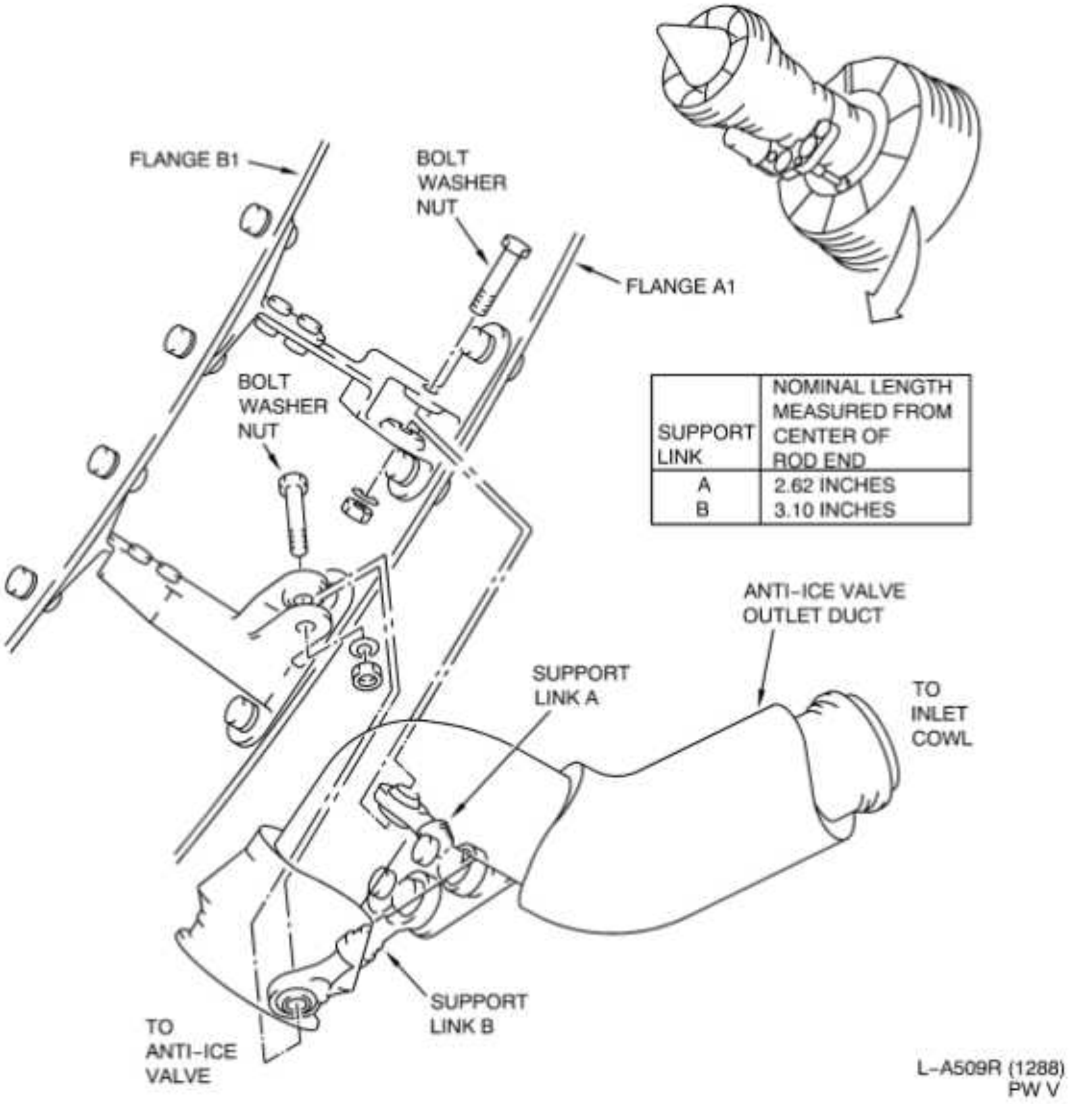

FLANGE B1
BOLT
WASHER
NUT
BOLT
WASHER
NUT
FLANGE A1
SUPPORT
LINK C
SUPPORT
LINK E
FLANGE B1
BOLT
WASHER
NUT
FLANGE A1
BOLT
WASHER
NUT
SUPPORT
LINK D
FLANGE A
ANTI-ICE VALVE
INLET DUCT
SUPPORT
LINK B
SUPPORT
LINK A
L-A508R (1288)
PW V

SUPPORT LINK	NOMINAL LENGTH MEASURED FROM CENTEROF ROD END
A	3.30 INCHES
B	2.62 INCHES
C	2.62 INCHES
D	1.75 INCHES
E	3.30 INCHES

Anti−Ice Valve Inlet Duct
Figure 301
(Task 71−00−33−050−022)

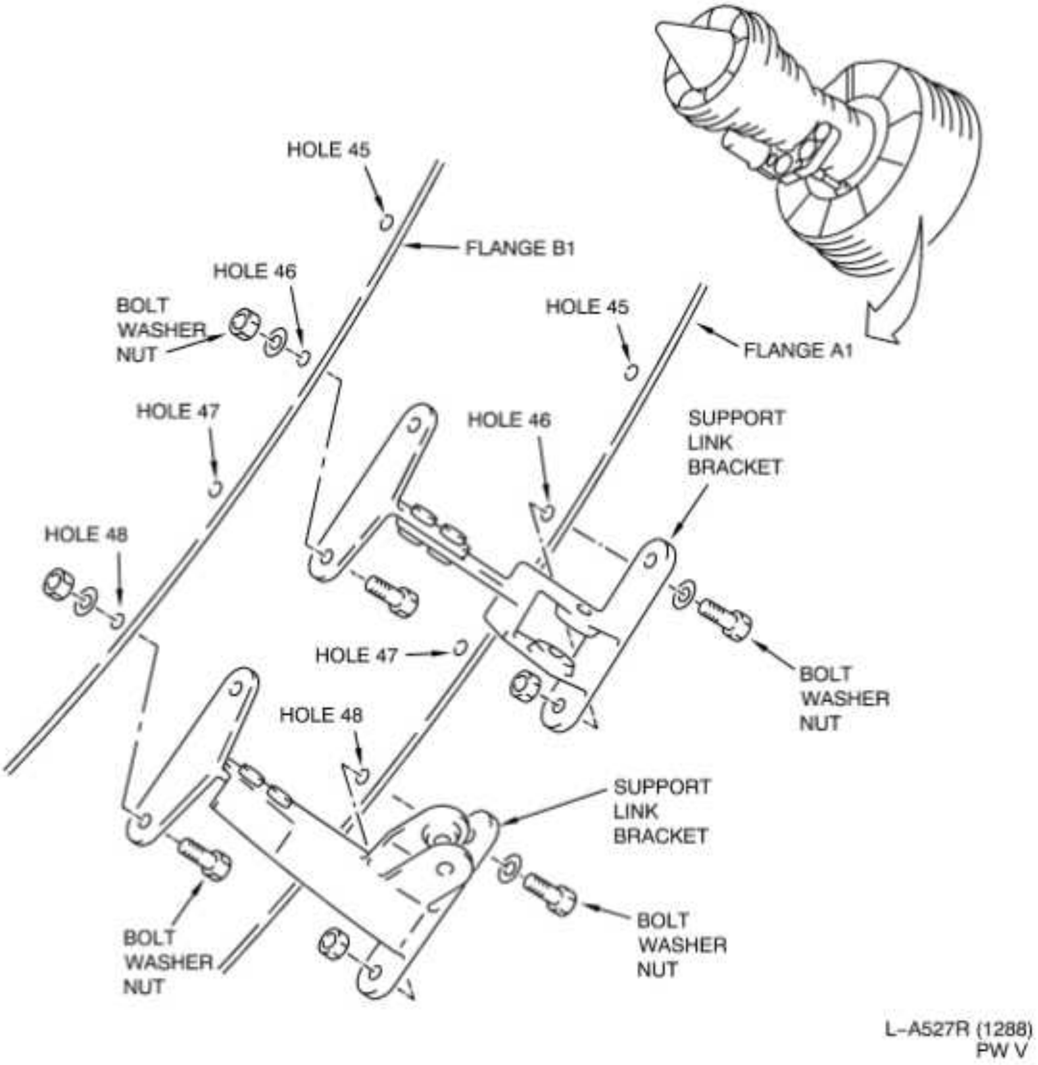

HOLE 49
FLANGE B1
HOLE 49
HOLE 50
HOLE 50
BOLT
WASHER
NUT
BOLT
WASHER
NUT
SUPPORT
LINK
BRACKET
HOLE 52
FLANGE A1
SUPPORT
LINK
BRACKET
FLANGE A
HOLE 53
HOLE 52
FLANGE B1
HOLE 53
HOLE 61
HOLE 62
SUPPORT
LINK
BRACKET
BOLT
WASHER
NUT
BOLT
WASHER
NUT
HOLE 61
BOLT
WASHER
NUT
HOLE 63
SUPPORT
LINK
BRACKET
BOLT
WASHER
NUT
SUPPORT
LINK
BRACKET
FLANGE A1
L-A525R (1288)
PW V

Anti−Ice Valve Inlet Duct
Figure 302
(Task 71−00−33−050−022)


FLANGE B1
BOLT
WASHER
NUT
FLANGE A1
BOLT
WASHER
NUT
ANTI−ICE VALVE
OUTLET DUCT
SUPPORT
LINK A
TO
INLET
COWL
TO
ANTI−ICE
VALVE
SUPPORT
LINK B
L−A509R (1288)
PW V

SUPPORT LINK	NOMINAL LENGTH MEASURED FROM CENTER OF ROD END
A	2.62 INCHES
B	3.10 INCHES

Anti−Ice Valve Outlet Duct
Figure 303
(Task 71−00−33−050−022)


HOLE 45
FLANGE B1
HOLE 46
BOLT
WASHER
NUT
HOLE 45
FLANGE A1
HOLE 47
HOLE 46
SUPPORT
LINK
BRACKET
HOLE 48
HOLE 47
BOLT
WASHER
NUT
HOLE 48
SUPPORT
LINK
BRACKET
BOLT
WASHER
NUT
BOLT
WASHER
NUT
L−A527R (1288)
PW V

Anti−Ice Outlet Duct
Figure 304
(Task 71−00−33−050−022)

Task 71−00−33−050−029:

1. Remove Nacelle Cooling Tube Assemblies

   A. Equipment and Materials Required − None

   B. Procedure

      (1) Remove nacelle cooling tube assemblies (Post SB PW4NAC 78−40. See Figure 301.

         (a) Disconnect nut, washer, and union from top end of upper nacelle cooling tube assembly (1) at bracket.

         (b) Disconnect lower coupling of upper tube assembly from tee at Flange C bracket.

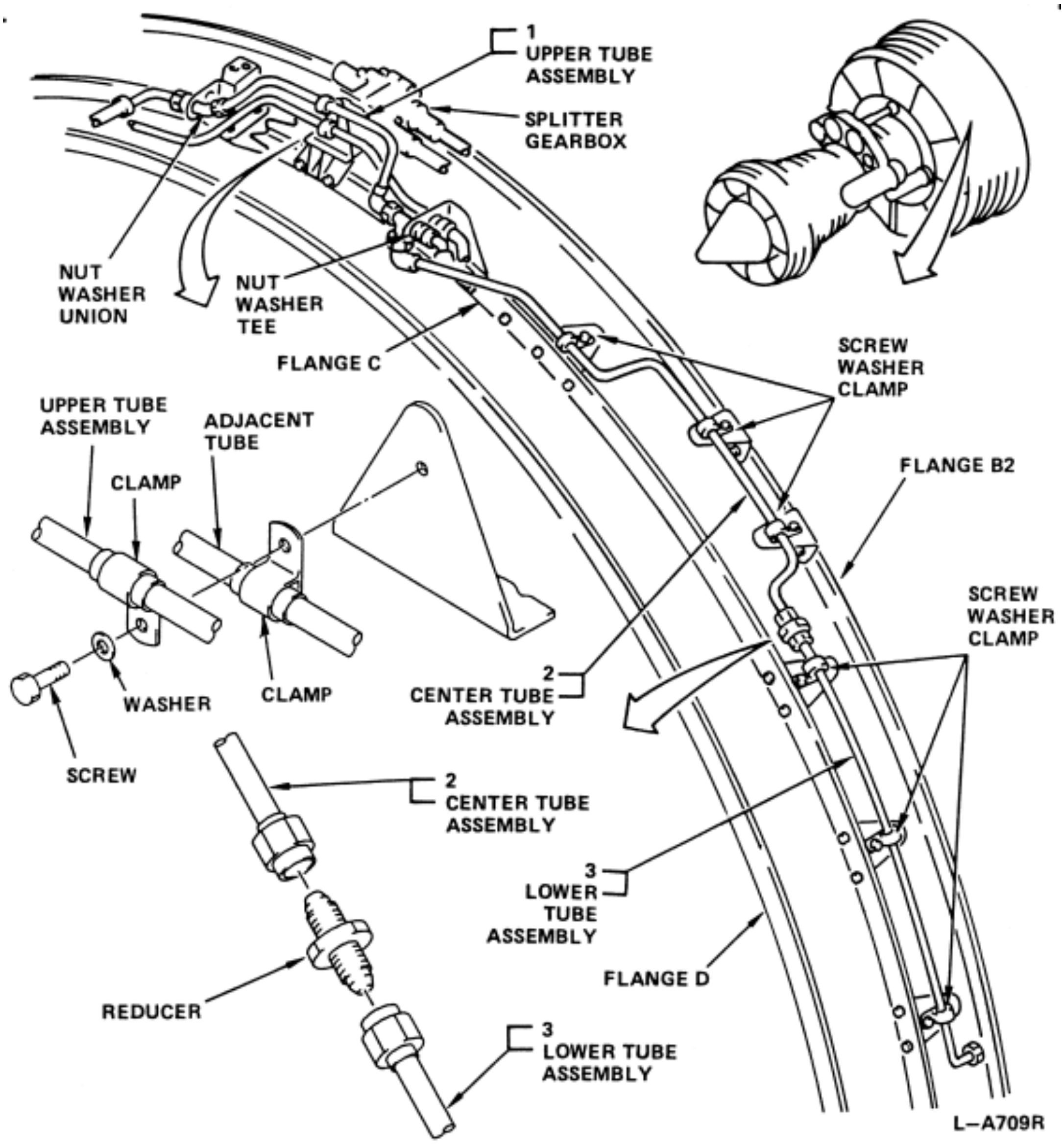
         (c) Remove screw, washer, and clamp attaching upper tube assembly to adjacent pneumatic tube at splitter gearbox bracket.

         (d) Disconnect top of center tube assembly (2) from tee fitting and lower end of tube from union at top of lower tube assembly (3).

         (e) Remove screws, washers, and clamps attaching center tube assembly to two brackets on Flange B2 and one bracket on Flange C.

         (f) Disconnect lower tube assembly from reducer and remove screws, washers, and clamps attaching tube assembly to three brackets on Flange C of the fan case.

R
R


1
UPPER TUBE
ASSEMBLY
SPLITTER
GEARBOX
NUT
WASHER
UNION
NUT
WASHER
TEE
FLANGE C
SCREW
WASHER
CLAMP
UPPER TUBE
ASSEMBLY
ADJACENT
TUBE
CLAMP
FLANGE B2
SCREW
WASHER
CLAMP
WASHER
CLAMP
2
CENTER TUBE
ASSEMBLY
SCREW
2
CENTER TUBE
ASSEMBLY
3
LOWER
TUBE
ASSEMBLY
FLANGE D
REDUCER
3
LOWER TUBE
ASSEMBLY
L-A709R

Nacelle Cooling Tube Assembly (Post SB PW4NAC 78-40)
Figure 301
(Task 71-00-33-050-029)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - FAN CASE - REMOVAL-20

Task 71-00-33-050-033:

1. Remove Heat Diffuser Assembly - Post SB PW4NAC 78-21 And Pre SB PW4NAC 78-40

   A. Equipment and Materials Required - None

   B. Procedure

   See Figures 301 and 302.

   (1) On left side of fan case, disconnect tube assembly from tee fitting and tee duct assembly.

   (2) Remove bolts, washers, and nuts attaching diffuser assembly to Flange B2.

   (3) Disconnect diffuser assembly from union in upper tube assembly.

   (4) Remove union from upper tube assembly.

   (5) Disconnect lower end of tube assembly from tee fitting at mounting bracket.

   (6) Remove clamps, bolts, nuts, and washers attaching tube assemblies and to Flange B2.

   (7) Remove union from tube assemblies.

   (8) Remove tube assemblies from beneath pneumatic drive unit (PDU).

   (9) On right side of fan case, disconnect lower tube assembly from tee fitting.

   (10) Remove bolts, washers, and nuts attaching diffuser assembly from Flange B2.

   (11) Disconnect diffuser assembly from union.

   (12) Remove union from upper tube assembly.

   (13) Remove clamps, screws, washers, and nuts attaching tube assemblies to Flange B2.

   (14) Disconnect upper tube assembly from union.

   (15) Remove union from lower tube assembly.

(16) Remove tube assemblies.

Task 71−00−33−050−033−A:

2. Remove Heat Diffuser Assembly − Post SB PW4NAC 78−21 And PW4NAC 78−40

A. Equipment and Materials Required − None

B. Procedure

See Figures 301 and 303.

(1) On left side of fan case, disconnect tube assembly from tee fitting and tee duct assembly.

(2) Remove bolts, washers, and nuts attaching diffuser assembly to Flange B2.

(3) Disconnect diffuser assembly from union in upper tube assembly.

(4) Remove union from upper tube assembly.

(5) Disconnect lower end of tube assembly from tee fitting at mounting bracket.

(6) Remove clamps, bolts, nuts, and washers attaching tube assemblies and to Flange B2.

(7) Remove union from tube assemblies.

(8) Remove tube assemblies from beneath pneumatic drive unit (PDU).

(9) On right side of fan case, disconnect coupling of pneumatic supply tube assembly at tee fitting.

(10) Disconnect lower tube assembly from tee fitting.

(11) Remove bolts, washers, and nuts attaching diffuser assembly from Flange B2.

(12) Disconnect diffuser assembly from union.

(13) Remove union from upper tube assembly.

(14) Loosen upper tube assembly coupling at tee.

(15) Remove clamp, screw, washer, and nut attaching upper tube assembly to Flange B2.

(16) Remove upper tube assembly.

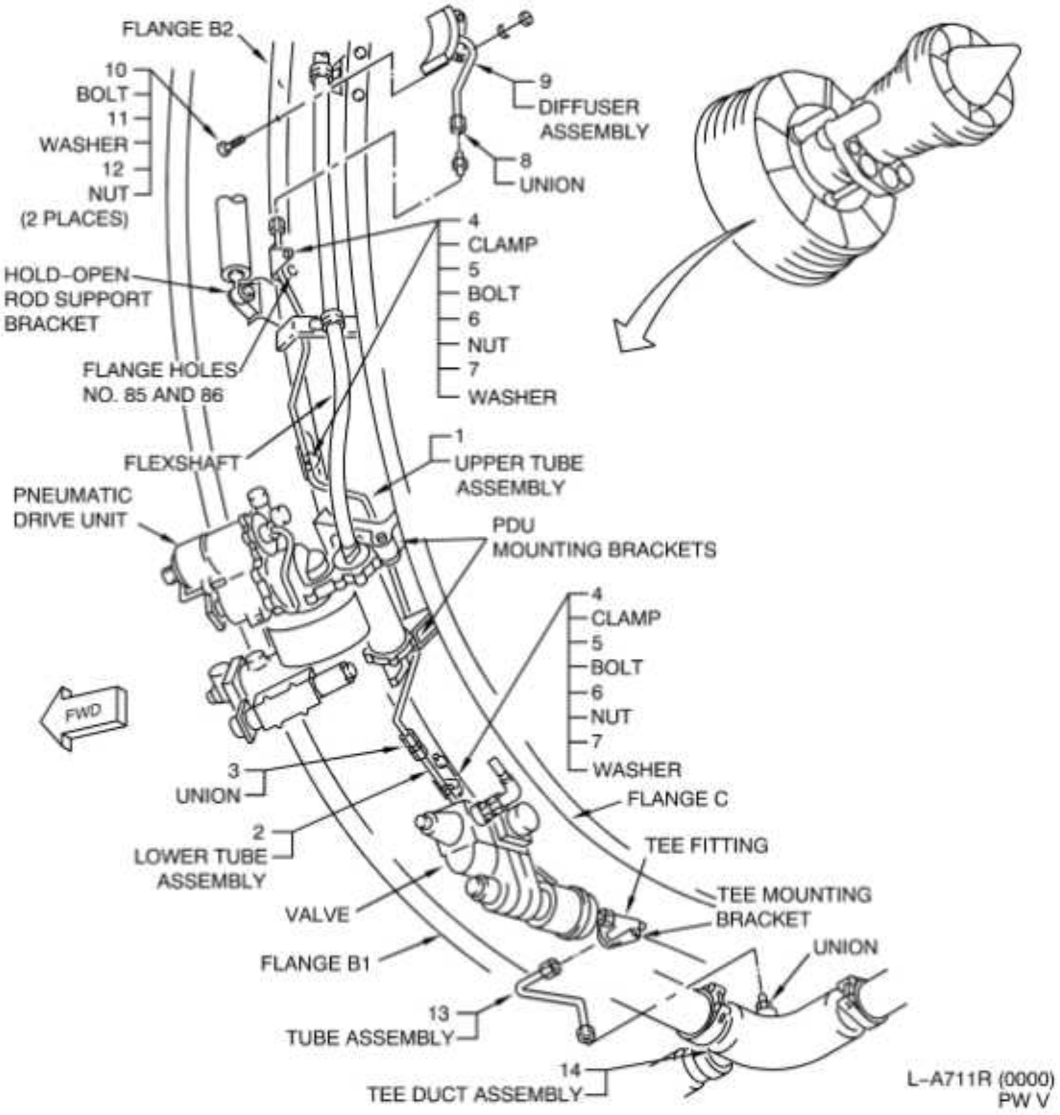
(17) Loosen top coupling of center tube assembly at tee fitting.

(18) Remove clamps, screws, washers and nuts attaching tube assemblies and to Flange B2.

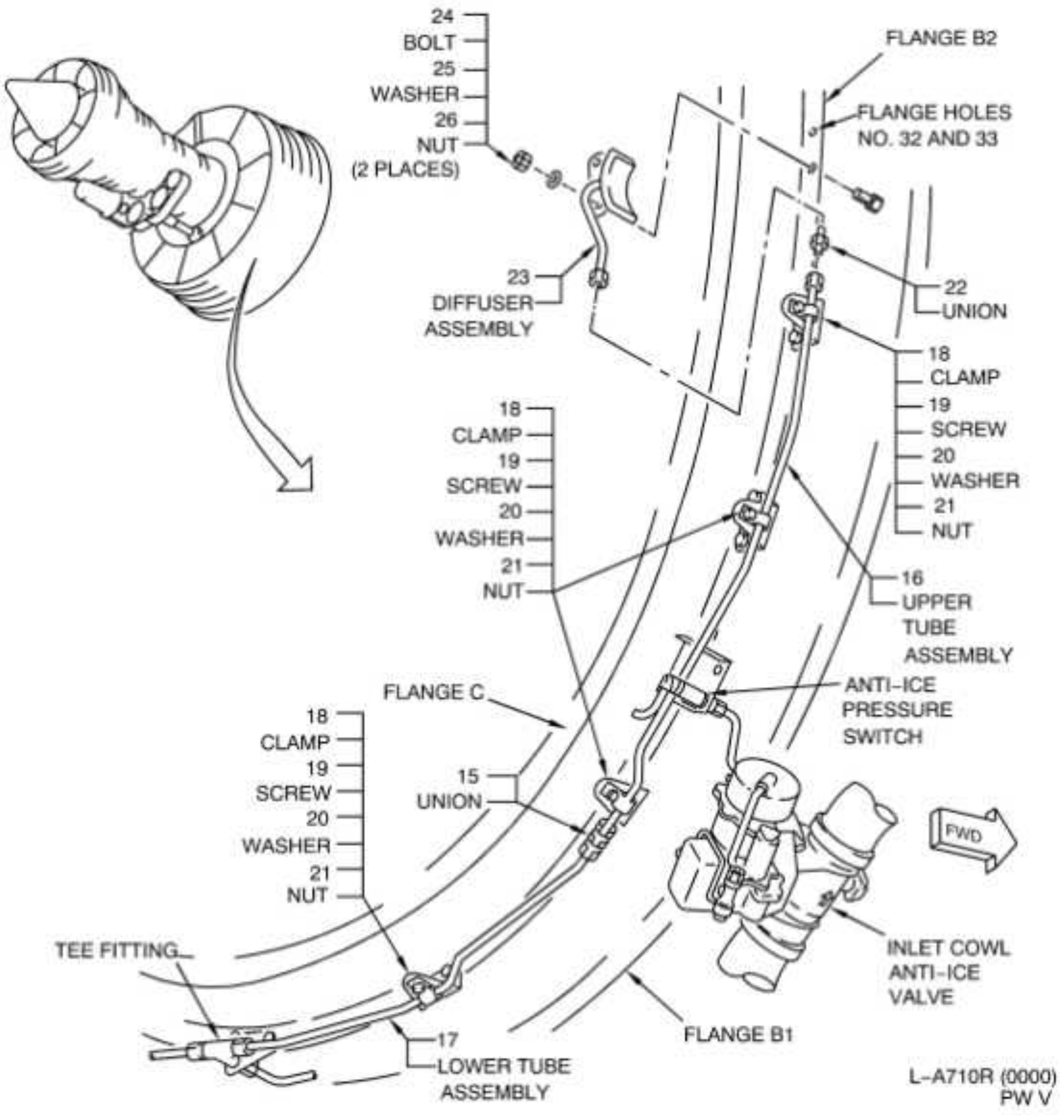
(19) Disconnect center tube assembly from union.

(20) Remove union from lower tube assembly.

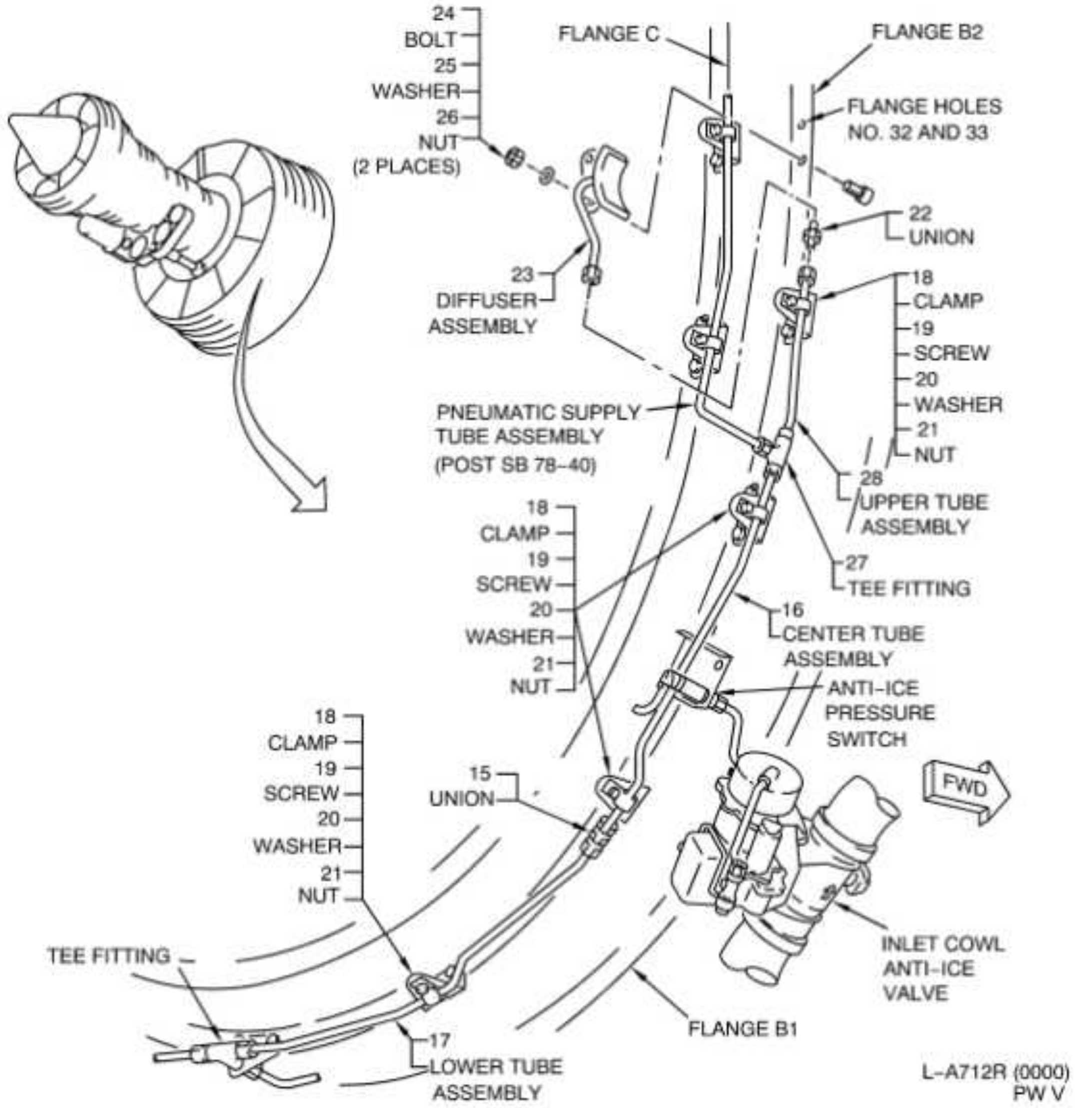
(21) Remove tube assemblies.


FLANGE B2
10
BOLT
11
WASHER
12
NUT
(2 PLACES)
9
DIFFUSER ASSEMBLY
8
UNION
4
CLAMP
5
BOLT
6
NUT
7
WASHER
HOLD-OPEN ROD SUPPORT BRACKET
FLANGE HOLES NO. 85 AND 86
FLEXSHAFT
1
UPPER TUBE ASSEMBLY
PNEUMATIC DRIVE UNIT
PDU MOUNTING BRACKETS
4
CLAMP
5
BOLT
6
NUT
7
WASHER
FWD
3
UNION
FLANGE C
2
LOWER TUBE ASSEMBLY
TEE FITTING
TEE MOUNTING BRACKET
VALVE
UNION
FLANGE B1
13
TUBE ASSEMBLY
14
TEE DUCT ASSEMBLY
L-A711R (0000)
PW V

Heat Diffuser Assembly - Left Side
(Post SB PW4NAC 78-21)
Figure 301
(Task 71-00-33-050-033)


24
BOLT
25
WASHER
26
NUT
(2 PLACES)
FLANGE B2
FLANGE HOLES
NO. 32 AND 33
23
DIFFUSER
ASSEMBLY
22
UNION
18
CLAMP
19
SCREW
20
WASHER
21
NUT
18
CLAMP
19
SCREW
20
WASHER
21
NUT
16
UPPER
TUBE
ASSEMBLY
ANTI−ICE
PRESSURE
SWITCH
FLANGE C
18
CLAMP
19
SCREW
20
WASHER
21
NUT
15
UNION
FWD
TEE FITTING
INLET COWL
ANTI−ICE
VALVE
FLANGE B1
17
LOWER TUBE
ASSEMBLY
L−A710R (0000)
PW V

Heat Diffuser Assembly − Right Side
(Post SB PW4NAC 78−21)
Figure 302
(Task 71−00−33−050−033)


24
BOLT
25
WASHER
26
NUT
(2 PLACES)
FLANGE C
FLANGE B2
FLANGE HOLES NO. 32 AND 33
22
UNION
23
DIFFUSER ASSEMBLY
18
CLAMP
19
SCREW
20
WASHER
21
NUT
PNEUMATIC SUPPLY TUBE ASSEMBLY (POST SB 78-40)
28
UPPER TUBE ASSEMBLY
27
TEE FITTING
18
CLAMP
19
SCREW
20
WASHER
21
NUT
16
CENTER TUBE ASSEMBLY
ANTI-ICE PRESSURE SWITCH
18
CLAMP
19
SCREW
20
WASHER
21
NUT
15
UNION
FWD
TEE FITTING
INLET COWL ANTI-ICE VALVE
FLANGE B1
17
LOWER TUBE ASSEMBLY
L-A712R (0000)
PW V

Heat Diffuser Assembly - Right Side
(Post SB PW4NAC 78-21 And 78-40)
Figure 303
(Task 71-00-33-050-033)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - FAN CASE - REMOVAL-21

Task 71-00-33-050-034:

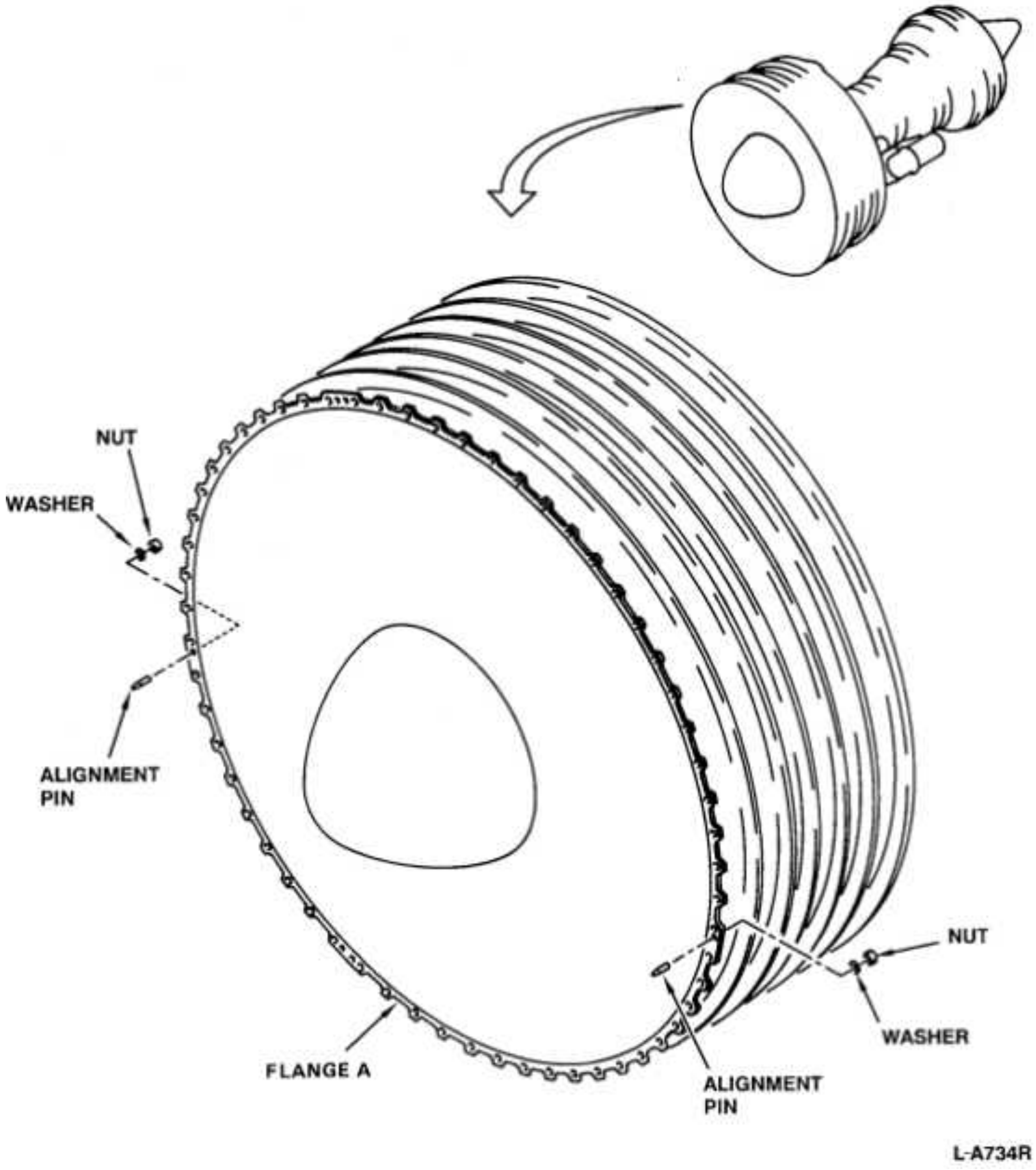
1. Remove Inlet Cowl Alignment Pins

   A. Equipment and Materials Required - None

   B. Procedure

      See Figure 301.

      (1) Remove nut and washer securing two inlet cowl alignment pins to Flange A of engine case.


NUT
WASHER
ALIGNMENT PIN
FLANGE A
ALIGNMENT PIN
NUT
WASHER
L-A734R

Inlet Cowl Alignment Pins
Figure 301
(Task 71−00−33−050−034)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 71-00-33-050-035:

1. Remove EEC And RVDT Electrical Junction Box - Right Hand Side

A. Equipment and Materials Required

Standard Tools:

Name	Manufacturer
Wrench, Strap (Glenair TG-70)	Glenair International Corp 312 5th Ave. New Rochelle, NY 10802
Pliers, Soft-Jawed (optional) (Glenair TG-69)	Glenair International Corp 312 5th Ave. New Rochelle, NY 10802

B. Procedure

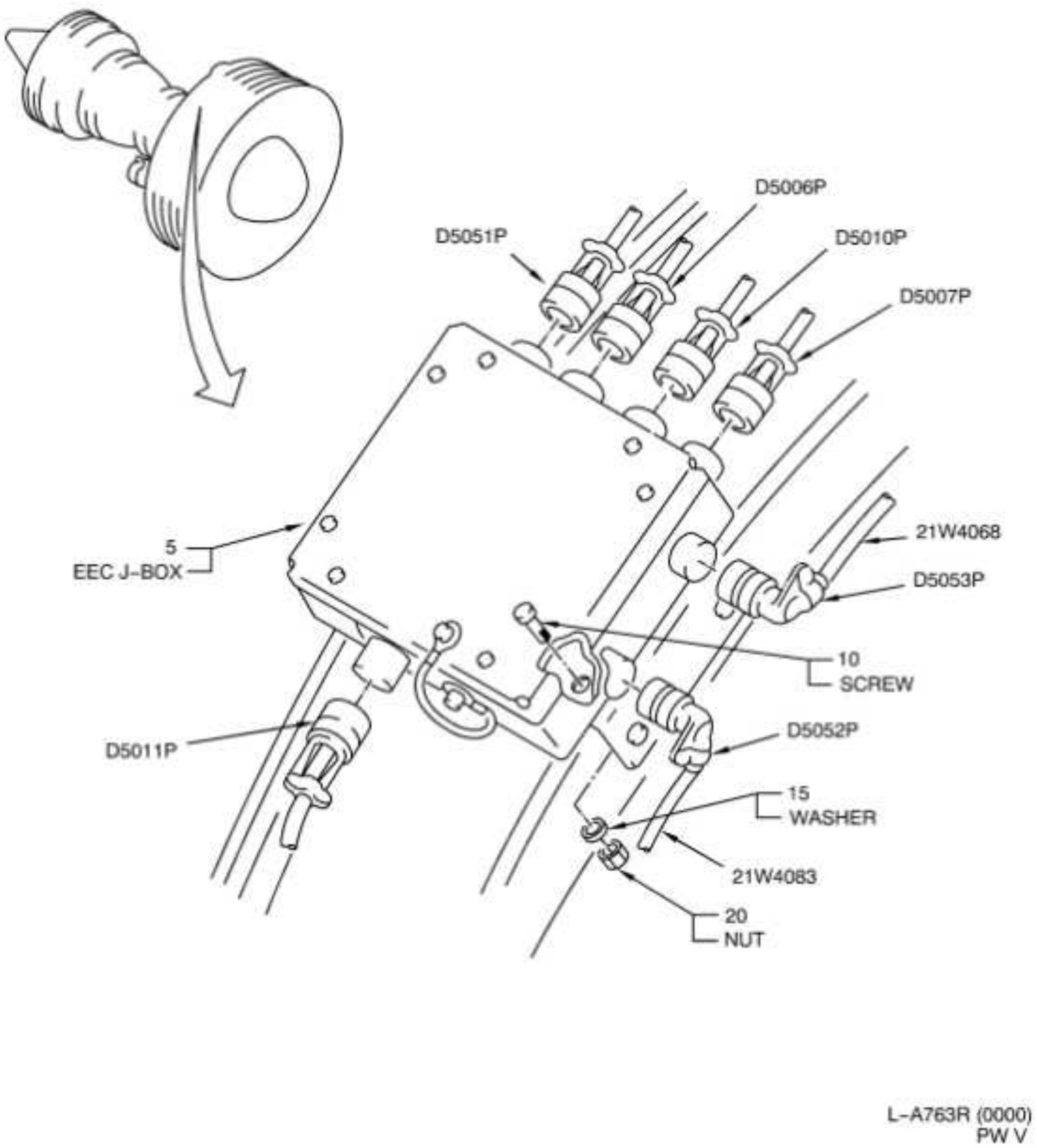
See Figure 301.

(1) Remove lockwire and disconnect electrical connectors D5011P, D5052P, D5053P, D5007P, D5010P, D5006P and D5051P from the EEC J-Box (5) on the brackets on the fan case. Install protective covers on the connectors.

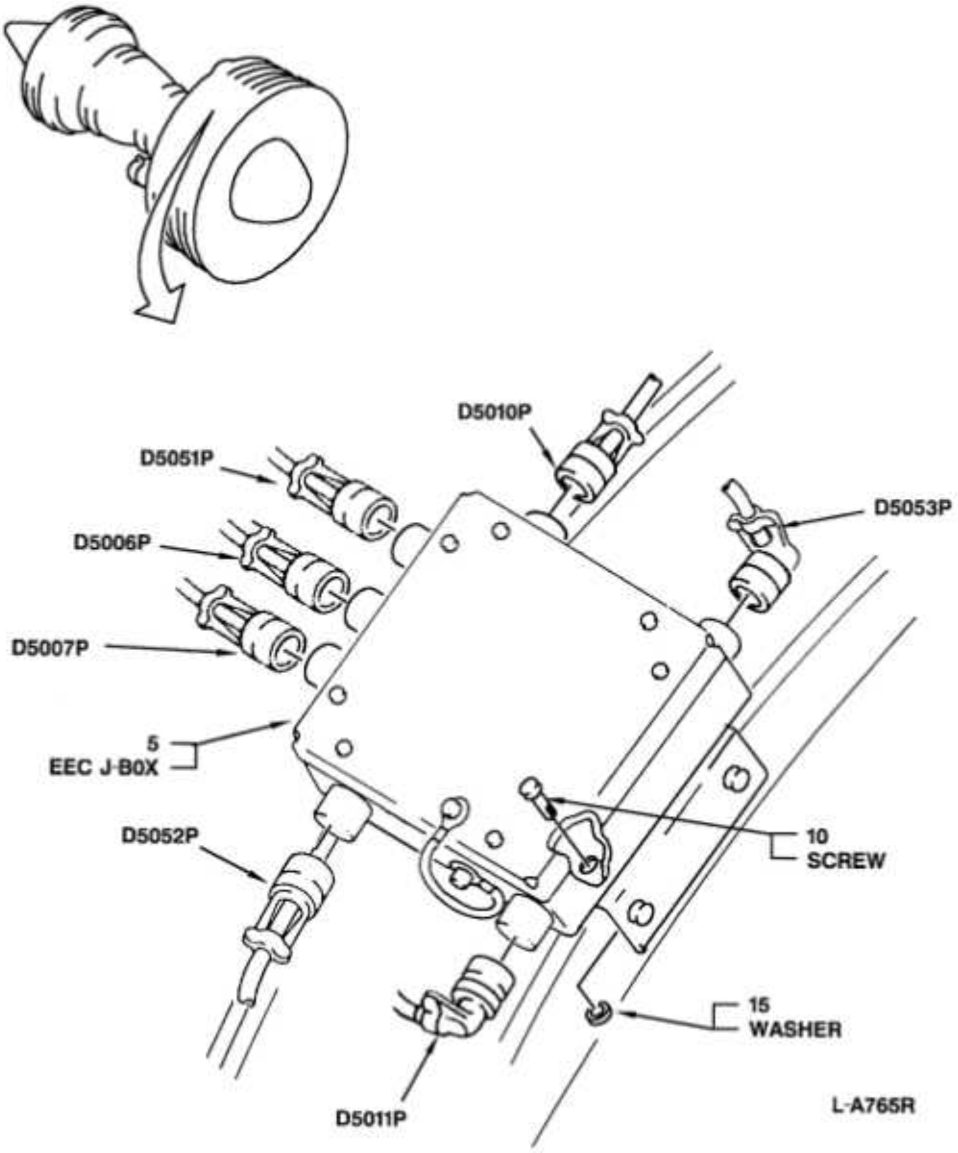
(2) (Pre SB PW4NAC 71-100) Remove the screws (10), washers (15) and nuts (20) that attach the EEC J-Box (5) to the brackets on the fan case.

(3) (Post SB PW4NAC 71-100) Remove the screws (10) and washers (15) that attach the EEC J-Box to the brackets on the fan case.

(4) Remove the J-Box (5).


D5006P
D5051P
D5010P
D5007P
5
EEC J-BOX
21W4068
D5053P
10
SCREW
D5011P
D5052P
15
WASHER
21W4083
20
NUT
L-A763R (0000)
PW V

Thrust Reverser J−Box − Right Hand Side
(Pre SB PW4NAC 71−100)
Figure 301 (Sheet 1)
(Task 71−00−33−050−035)


D5010P
D5051P
D5053P
D5006P
D5007P
5
EEC J-BOX
D5052P
10
SCREW
15
WASHER
D5011P
L-A765R

Thrust Reverser J−Box − Right Hand Side
(Post SB PW4NAC 71−100)
Figure 301 (Sheet 2)
(Task 71−00−33−050−035)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - FAN CASE - REMOVAL-23

Task 71-00-33-050-036:

1. Removal of EEC J-Box - Left Hand Side

A. Equipment and Materials Required

Standard Tools:

Name	Manufacturer
Wrench, Strap (Glenair TG-70)	Glenair International Corp 312 5th Ave. New Rochelle, NY 10802
Pliers, Soft-Jawed (optional) (Glenair TG-69)	Glenair International Corp 312 5th Ave. New Rochelle, NY 10802

B. Procedure

See Figure 301.

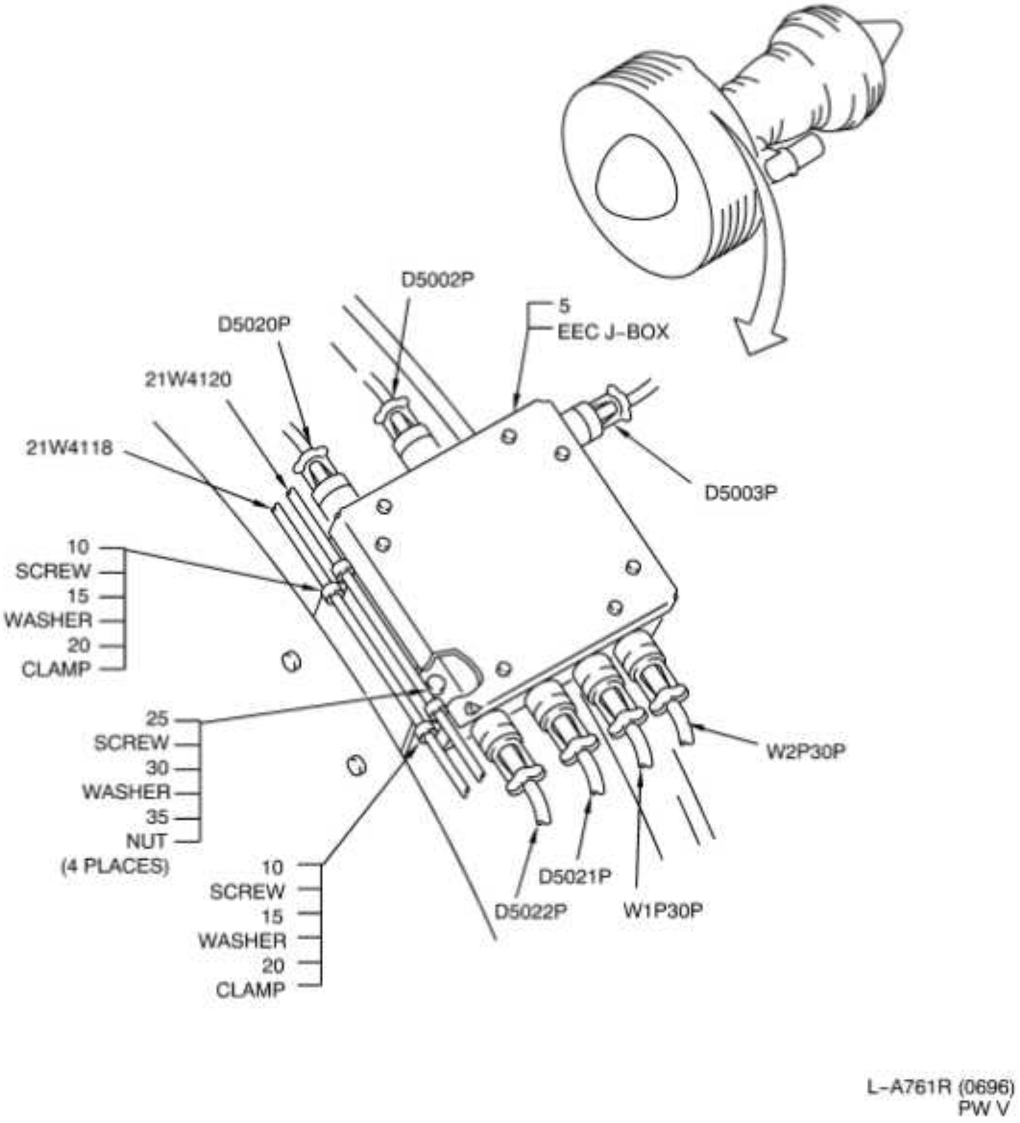
(1) Remove lockwire and disconnect electrical connectors D5003P, D5021P, D5020P, D5002P, D5022P, W1P30P and W2P30P connectors from the EEC J-Box (5) located on the left side of the fan case. Install protective covers on the connectors.

(2) Remove the screws (10), washers (15) and clamps (20) that attach the wire harnesses to the aft side of the EEC J-Box (5).

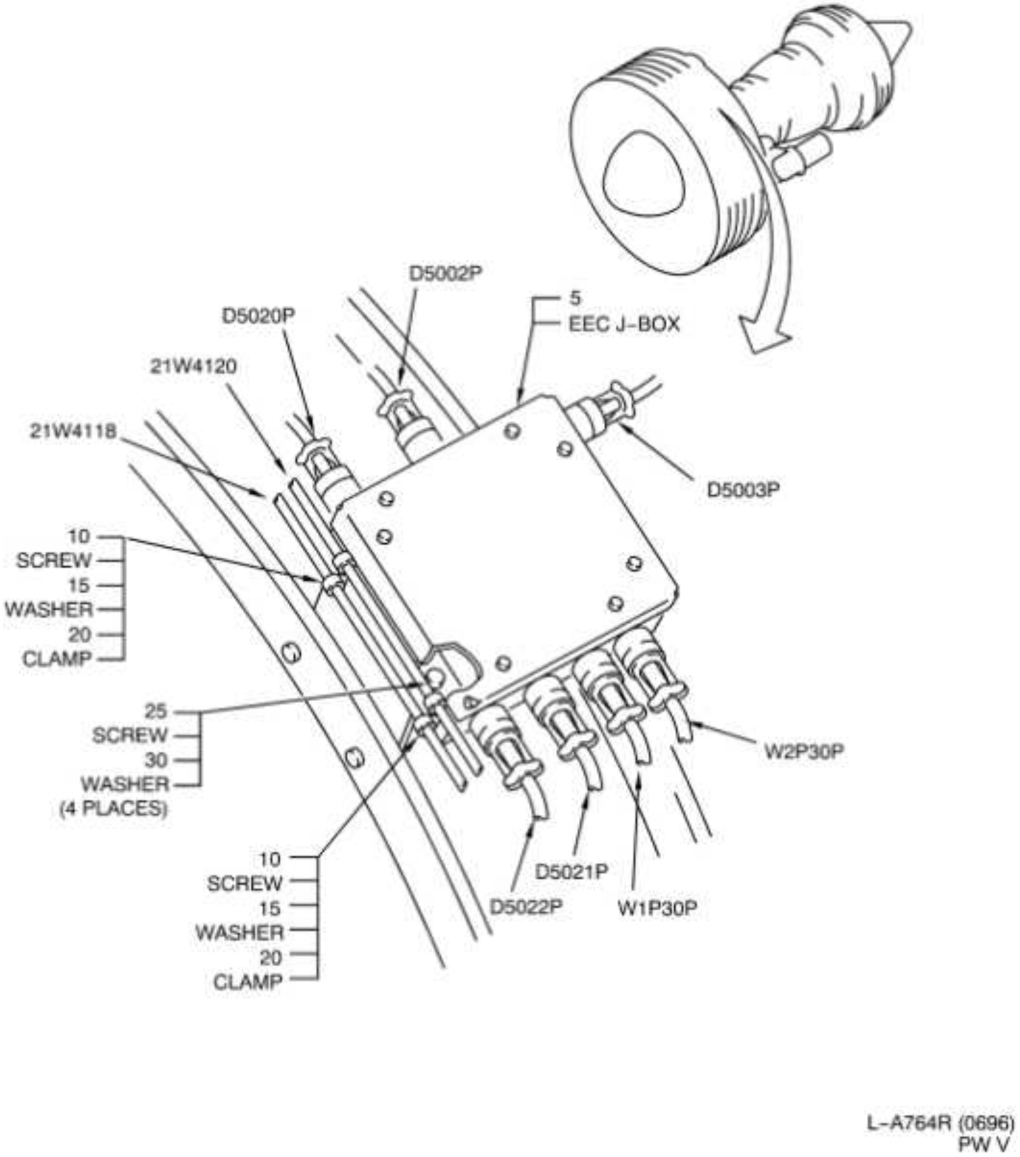
(3) (Pre SB PW4NAC 71-100) Remove the screws (25), washers (30) and nuts (35) that attach the EEC J-Box (5) to the brackets on the fan case.

(4) (Post SB PW4NAC 71-100) Remove the screws (25) and washers (30) that attach the EEC J-Box (5) to the brackets on the fan case.

(5) Remove the EEC J-Box (5).


D5002P
5
EEC J-BOX
D5020P
21W4120
21W4118
D5003P
10
SCREW
15
WASHER
20
CLAMP
25
SCREW
30
WASHER
35
NUT
(4 PLACES)
W2P30P
10
SCREW
15
WASHER
20
CLAMP
D5021P
D5022P
W1P30P
L-A761R (0696)
PW V

Thrust Reverser J−Box − Left Hand Side
(Pre SB PW4NAC 71−100)
Figure 301 (Sheet 1)
(Task 71−00−33−050−036)


D5002P
5
EEC J-BOX
D5020P
21W4120
21W4118
D5003P
10
SCREW
15
WASHER
20
CLAMP
25
SCREW
30
WASHER
(4 PLACES)
W2P30P
10
SCREW
15
WASHER
20
CLAMP
D5021P
D5022P
W1P30P
L-A764R (0696)
PW V

Thrust Reverser J−Box − Left Hand Side
(Post SB PW4NAC 71−100)
Figure 301 (Sheet 2)
(Task 71−00−33−050−036)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - FAN CASE - REMOVAL-24

Task 71-00-33-050-037:

1. Remove PS And P2 System Tubing

A. Equipment and Materials Required - None

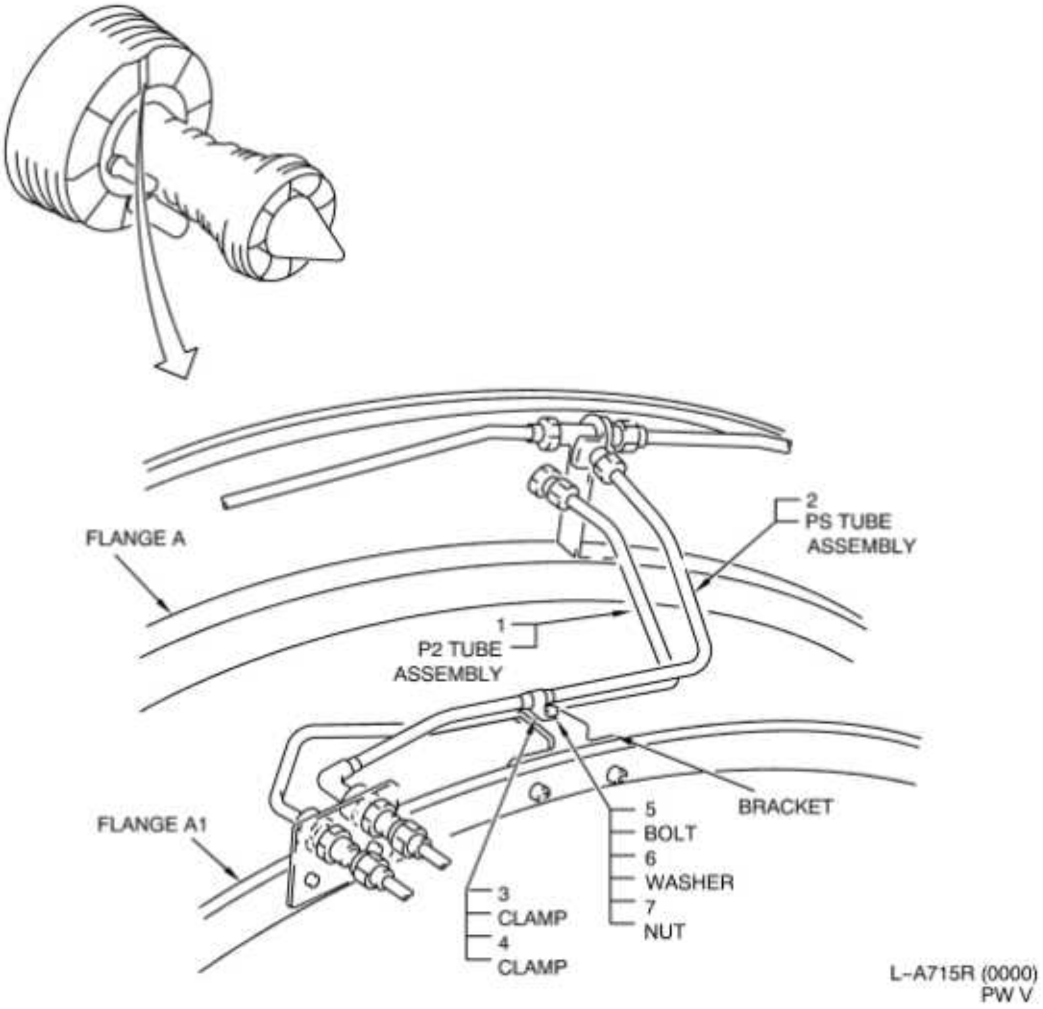
B. Procedure

See Figure 301.

(1) Disconnect coupling nuts on PS tube (301/2) and P2 tube (301/1) assemblies at fittings.

(2) Remove clamps, washer, screw, and nut securing tube assemblies to bracket on forward face of Flange A1.

(3) Remove tube assemblies from engine case.


2
PS TUBE
ASSEMBLY
FLANGE A
1
P2 TUBE
ASSEMBLY
FLANGE A1
BRACKET
5
BOLT
6
WASHER
7
NUT
3
CLAMP
4
CLAMP
L-A715R (0000)
PW V

PS And P2 System Tubing
Figure 301
(Task 71−00−33−050−037)

POWER PLANT GENERAL - FAN CASE - REMOVAL-25

Task 71-00-33-050-041:

1. Remove Barometric Switch

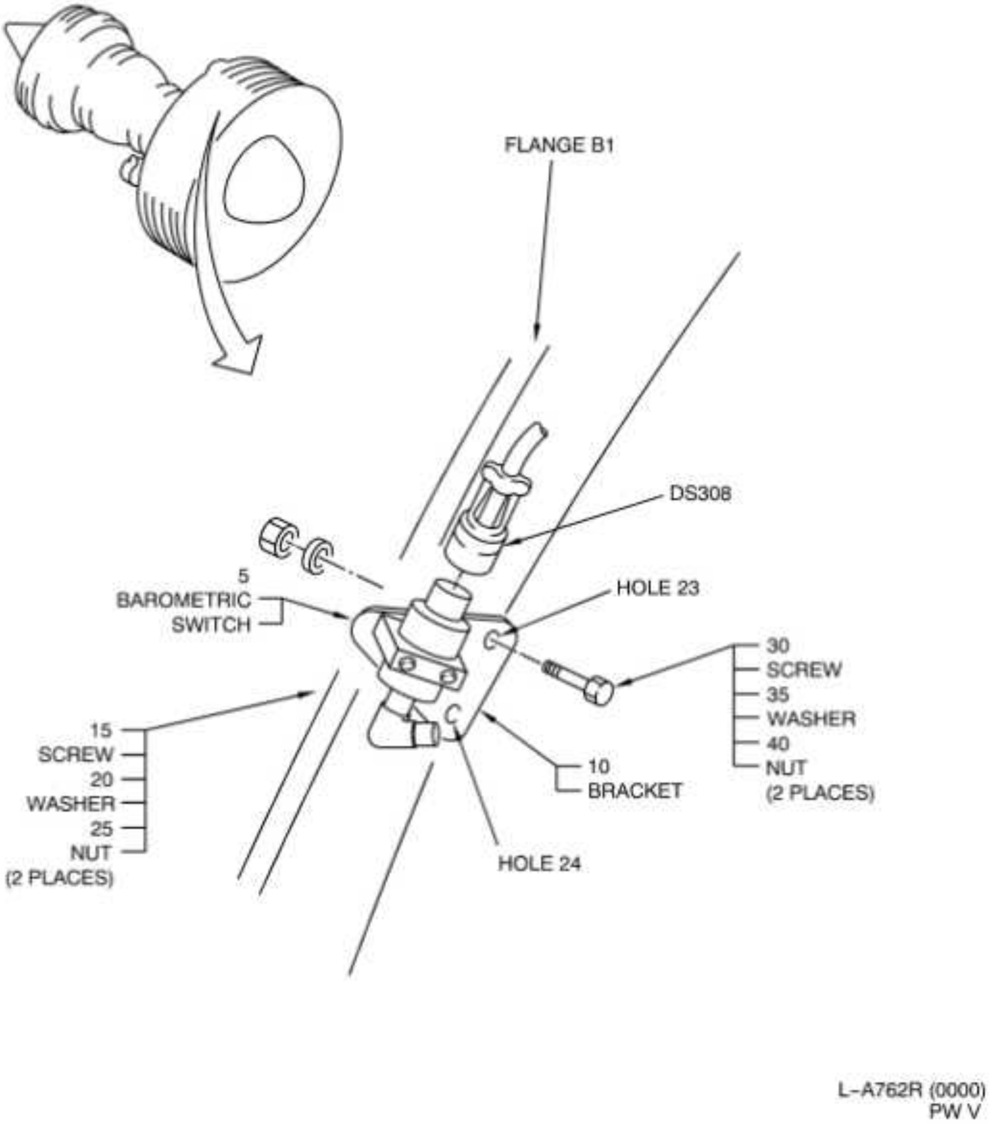
A. Equipment and Materials Required - None

B. Procedure

See Figure 301.

(1) Disconnect electrical connector DS308. Install a protective cover.

(2) Remove the barometric switch (5) from the bracket (10). Remove the screws (15), washers (20) and nuts (25).


FLANGE B1
DS308
5
BAROMETRIC
SWITCH
HOLE 23
30
SCREW
35
WASHER
40
NUT
(2 PLACES)
15
SCREW
20
WASHER
25
NUT
(2 PLACES)
10
BRACKET
HOLE 24
L-A762R (0000)
PW V

Nacelle Cooling Barometric Switch
Figure 301
(Task 71−00−33−050−041)

POWER PLANT GENERAL - FAN CASE - INSTALLATION-01

Task 71-00-33-450-001:

1. Install Inlet Cowl

A. Equipment And Materials Required

Special Tools:
RSE1003 PW Sling, Inlet Cowl
RSE1105 PW Dolly/Work Stand, Inlet Cowl

Consumable Materials:

Item No.	Designation
P06-013	Solid Film Lubricant

B. Procedure

(1) Remove four (4) hoist point filler plugs from hoist points on outside surface of inlet cowl. Retain plugs for re-installation. See Figure 401.

(2) Position hoist and RSE 1003 Inlet Cowl Sling over inlet cowl and, using four (4) bolt and four (4) washer details, attach sling pad to inlet cowl hoist points. See Figure 402 for arrangement of sling pads and cables.

NOTE: Nut on sling pad bolt retains bolt and washer in sling pad while sling is not in use. When sling is in use, save nut for re-installation in sling pad.

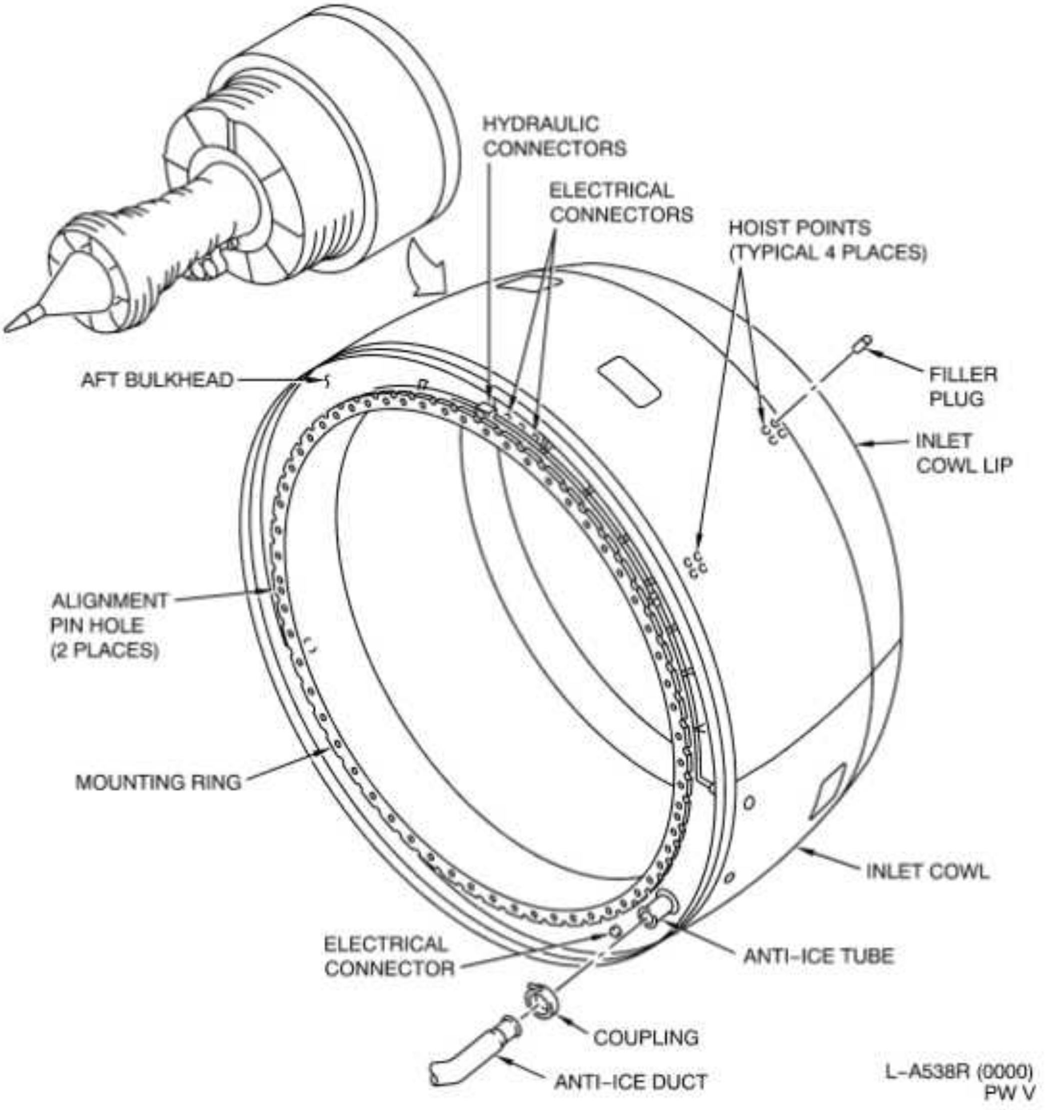
(3) Raise and position hoist just enough to remove slack from sling cables but not enough to cause strain to inlet cowl. Place even tension on all cables of sling so cowl will not swing when removed from dolly.

CAUTION: WHEN LAST BOLTS ARE REMOVED FROM DOLLY MOUNTING RING, SLING LINK MUST BE DIRECTLY OVER INLET COWL CENTER OF GRAVITY. IF NOT, COWL WILL SWING AND STRIKE DOLLY.

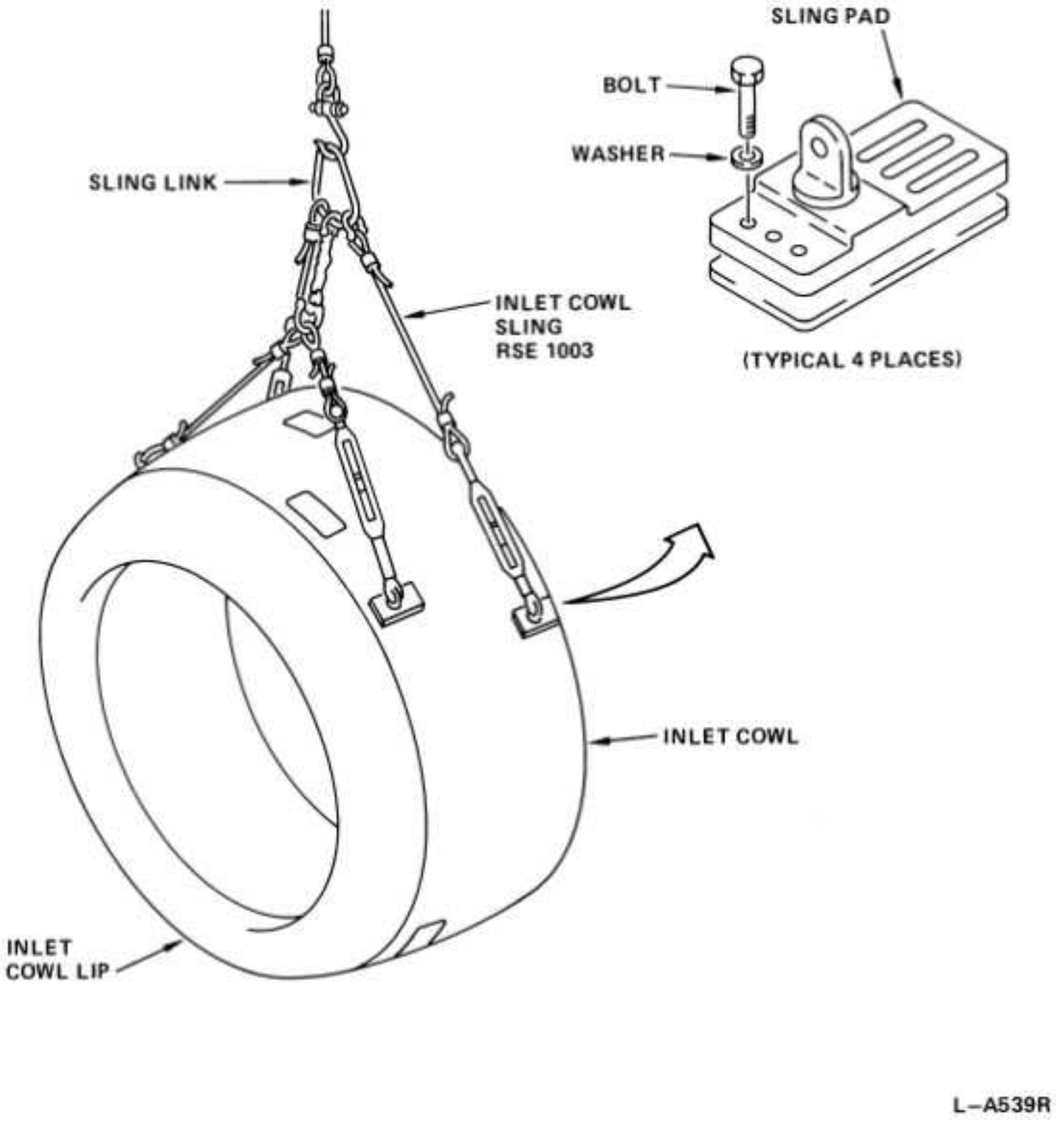
(4) Remove bolts, washers and nuts attaching inlet cowl mounting ring to dolly mounting plates. Remove two bolts next to two (2) alignment pins on side dolly mounting plates last. See Figure 403.

(5) With hoist and sling supporting weight of inlet cowl, move cowl away from dolly.

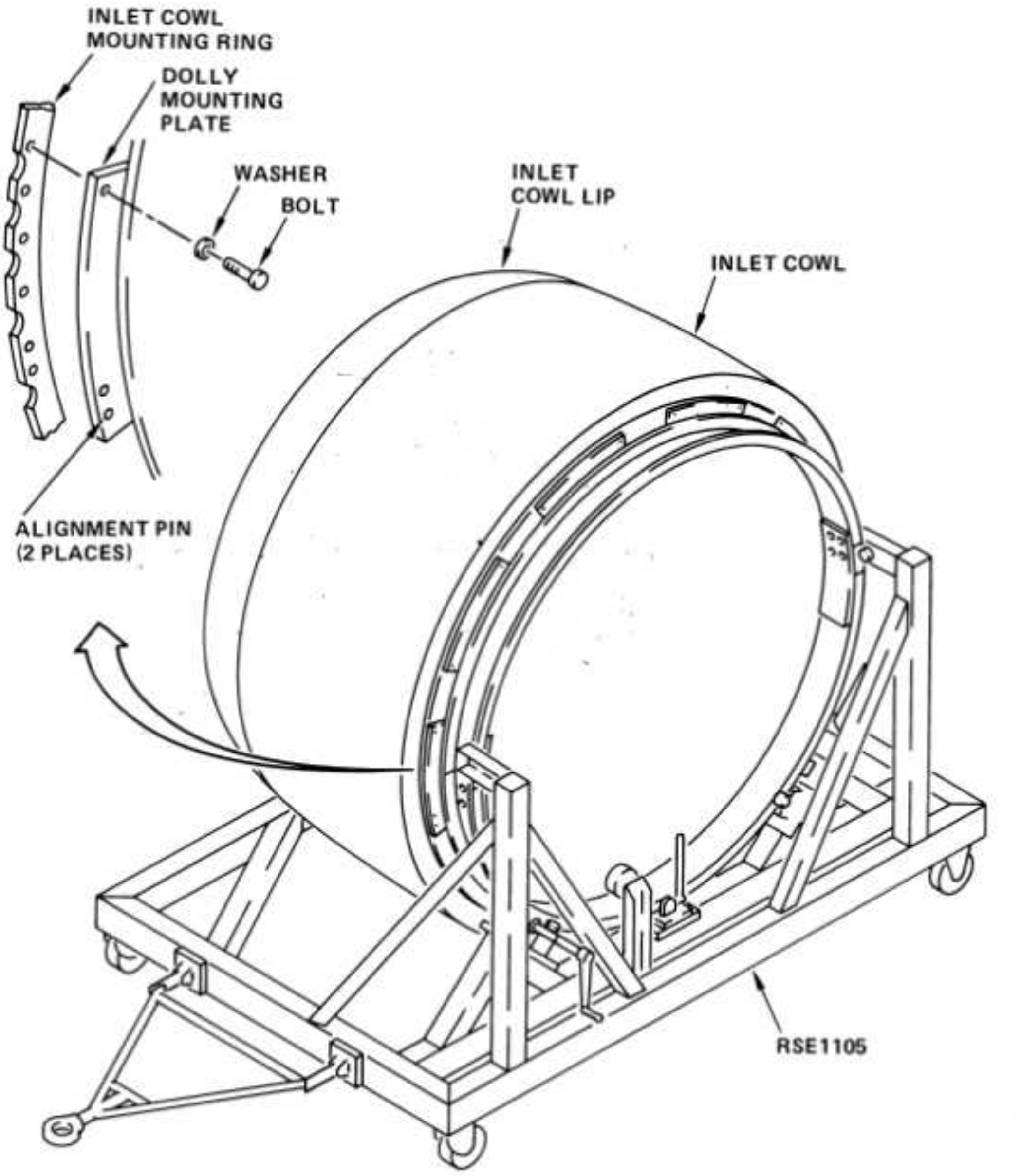
(6) Position inlet cowl so two alignment pins on fan case flange fit through alignment holes on inlet cowl mounting ring. See Figure 404.


HYDRAULIC CONNECTORS
ELECTRICAL CONNECTORS
HOIST POINTS (TYPICAL 4 PLACES)
FILLER PLUG
AFT BULKHEAD
INLET COWL LIP
ALIGNMENT PIN HOLE (2 PLACES)
MOUNTING RING
INLET COWL
ELECTRICAL CONNECTOR
ANTI−ICE TUBE
COUPLING
ANTI−ICE DUCT
L−A538R (0000)
PW V

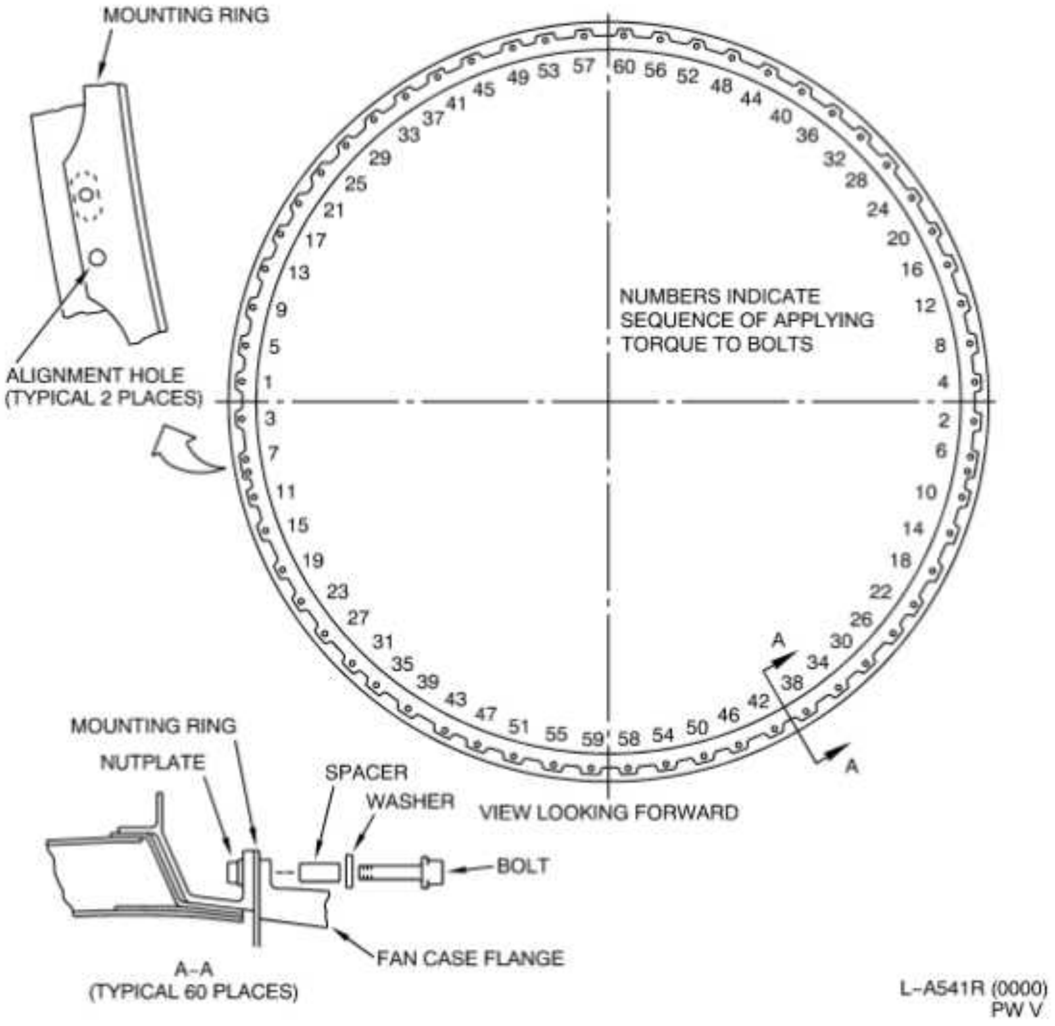
Inlet Cowl Assembly
Figure 401
(Task 71−00−33−450−001)


SLING PAD
BOLT
WASHER
SLING LINK
INLET COWL SLING RSE 1003
(TYPICAL 4 PLACES)
INLET COWL
INLET COWL LIP
L-A539R

Inlet Cowl With Sling
Figure 402
(Task 71-00-33-450-001)


INLET COWL MOUNTING RING
DOLLY MOUNTING PLATE
WASHER
BOLT
INLET COWL LIP
INLET COWL
ALIGNMENT PIN (2 PLACES)
RSE1105
L–A540R

Inlet Cowl Dolly And Work Stand
Figure 403
(Task 71–00–33–450–001)


MOUNTING RING
ALIGNMENT HOLE
(TYPICAL 2 PLACES)
NUMBERS INDICATE
SEQUENCE OF APPLYING
TORQUE TO BOLTS
57 53 49 45 41 37 33 29 25 21 17 13 9 5 1
60 56 52 48 44 40 36 32 28 24 20 16 12 8 4
3 7 11 15 19 23 27 31 35 39 43 47 51 55 59
2 6 10 14 18 22 26 30 34 38 42 46 50 54 58
A
A
VIEW LOOKING FORWARD
MOUNTING RING
NUTPLATE
SPACER
WASHER
BOLT
FAN CASE FLANGE
A–A
(TYPICAL 60 PLACES)
L–A541R (0000)
PW V

Inlet Cowling Mounting Ring
Figure 404
(Task 71–00–33–450–001)

POWER PLANT GENERAL − FAN CASE − INSTALLATION−01

CAUTION: DO NOT LUBRICATE MOUNTING BOLTS.

(7) Attach inlet cowl to fan case mounting flange with sixty (60) bolts, washers and spacers. Snug bolts but do not torque at this time. See Figure 404.

(8) When all 60 bolts are installed, follow sequence of numbered bolts in Figure 404 and torque all attaching bolts 310 − 330 lb−in. (35.025 − 37.285 N.m). After all bolts have been torqued in sequence, retorque all 60 bolts in sequence a second time.

(9) Remove four (4) bolts and washers attaching sling pads to hoist points. See Figure 402.

(10) Retain four (4) bolts, washers and nuts in sling pads of RSE 1003 Sling kit.

(11) Install four (4) filler plugs to inlet cowl hoist points. See Figure 401.

(12) Lubricate inside surface of duct coupling with Material P06−013.

(13) Using Coupling, attach anti−ice duct to anti−ice tube at 4 o'clock position on inlet cowl aft bulkhead. Torque coupling to the value marked on coupling. See Figure 401.

(14) Connect electrical connector to receptacle at 4 o'clock position on inlet cowl aft bulkhead. Tighten connector fingertight plus one−eighth turn.

(15) Connect two (2) hydraulic tubes to inlet cowl aft bulkhead, at 1 o'clock position. Torque tube connections 180 − 200 lb−in. (20.337 − 22.597 N.m).

(16) Connect three electrical connectors to inlet cowl aft bulkhead at 1 o'clock position. Tighten connectors fingertight plus one−eighth turn.

Task 71−00−33−450−011:

R 1. Install Fan Cowl Door Hold−Open Rod Without SCU

A. Equipment and Materials Required − None

B. Procedure

(1) Install fan cowl door hold−open rod, right side. See Figure 401.

(a) Position hold−open rod mounting bracket over Flange B1 holes 36,37.

(b) Install two bolts, washers, and nuts, attaching hold−open rod mounting bracket to Flange B1. Torque nuts 93 − 107 lb−in. (10.508 − 12.089 N.m).

(c) Position hold−open rod retaining bracket over Flange B1 holes 30,31.

(d) Install two bolts, washers, and nuts attaching hold−open rod retaining bracket to Flange B1. Torque nuts 93 − 107 lb−in. (10.508 − 12.089 N.m).

(2) Install two hold−open rod braces, right side. See Figure 402.

(a) Position fan cowl door hold−open rod brace over Flange A1 holes 37,38.

(b) Install two bolts, washers, and nuts attaching fan cowl door hold−open rod brace to Flange A1. Torque nuts 93 − 107 lb−in. (10.508 − 12.089 N.m).

(c) Remove existing bolts, washers, and nuts from Flange C holes 32,33.

(d) Position thrust reverser sleeve hold−open rod brace over Flange C holes 32,33.

(e) Install two bolts, washers, and nuts attaching thrust reverser sleeve hold−open rod brace to Flange C. Torque nuts 93 − 107 lb−in. (10.508 − 12.089 N.m).

(3) Install fan cowl door hold−open rod, left side. See Figure 403.

  (a) Position hold−open rod mounting bracket over Flange B2 holes 84,85.

  (b) Install two bolts, washers, and nuts attaching hold−open rod mounting bracket to Flange B2. Torque nuts 93 − 107 lb−in. (10.508 − 12.089 N.m).

  (c) Position hold−open rod retaining bracket over Flange B1 holes 90,91.

  (d) Install two bolts, washers, and nuts attaching hold−open rod retaining bracket to Flange B1. Torque nuts 93 − 107 lb−in. (10.508 − 12.089 N.m).

(4) Install two hold−open rod braces, left side. See Figure 404.

  (a) Position fan cowl door hold−open rod brace over Flange A1 holes 83,84.

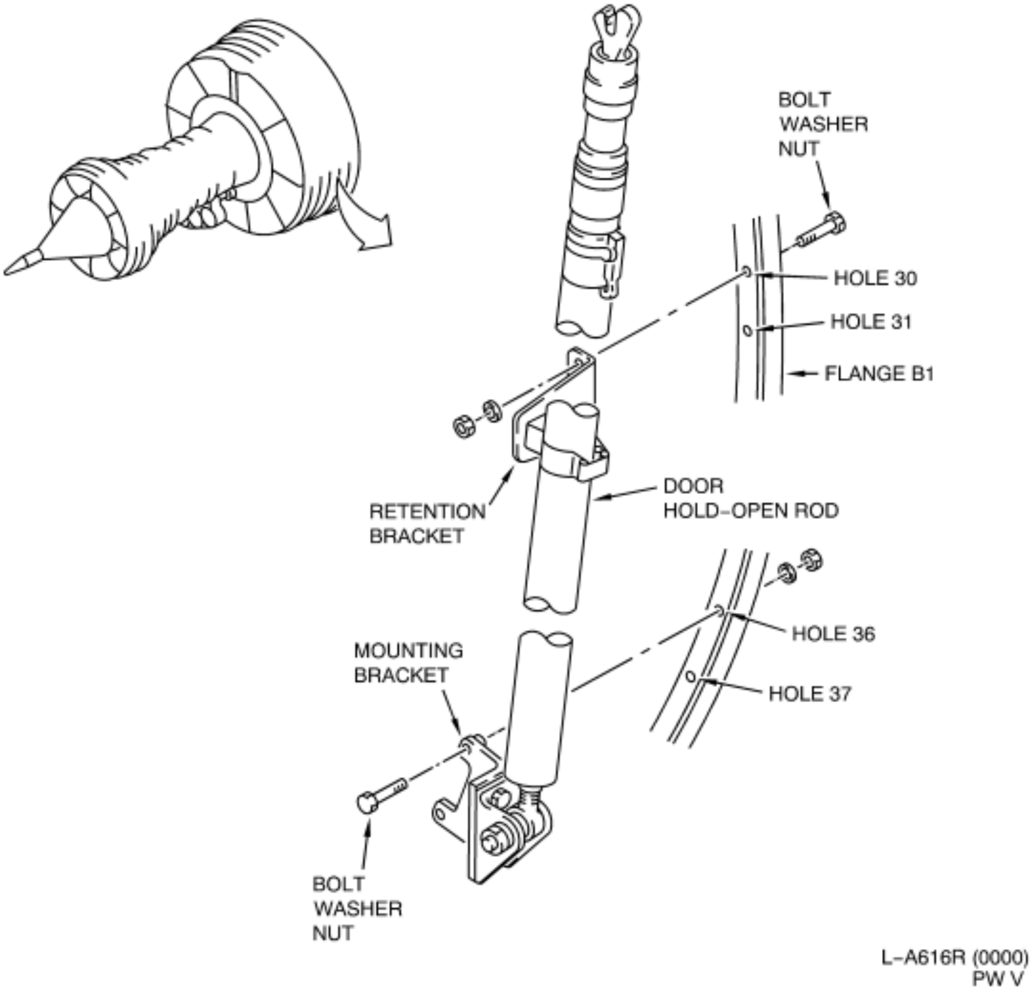
  (b) Install two bolts, washers, and nuts attaching fan cowl door hold−open rod brace to Flange A1. Torque nuts 93 − 107 lb−in. (10.508 − 12.089 N.m).

  (c) Remove existing bolts, washers and nuts from Flange C holes 76,77.

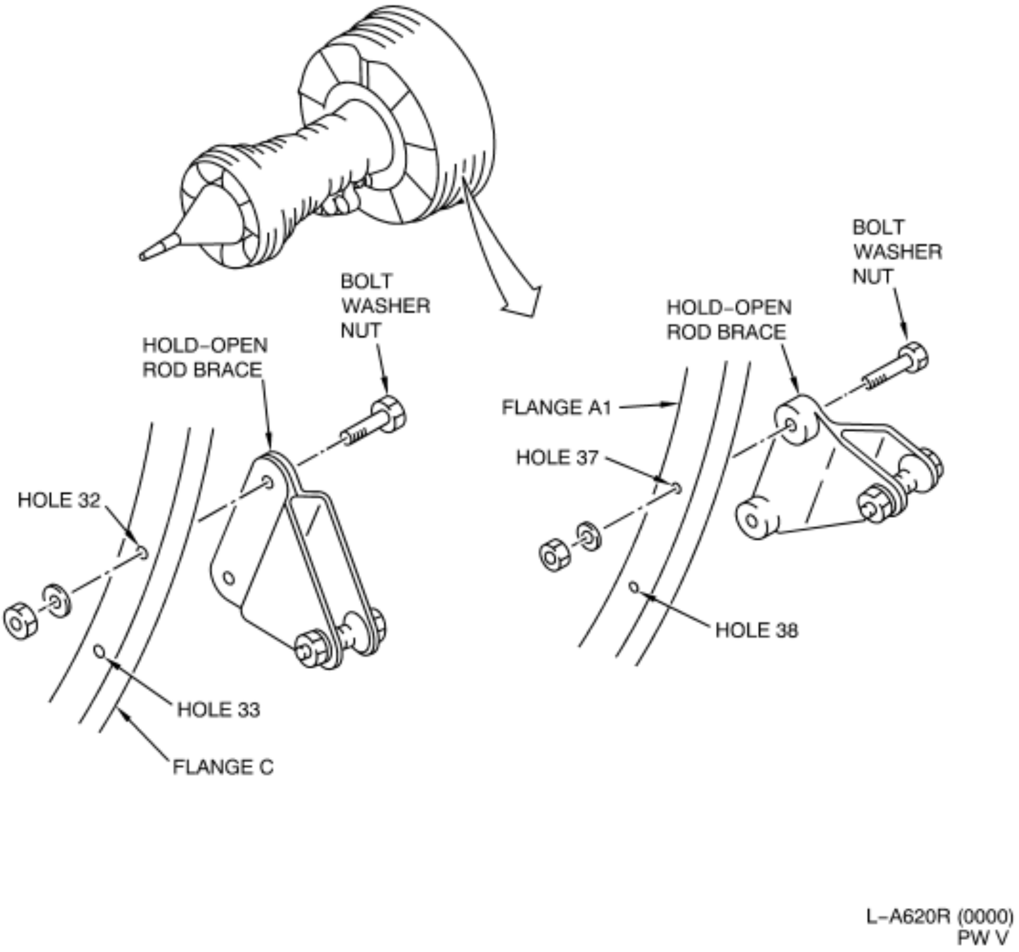
  (d) Position thrust reverser sleeve hold−open rod brace over Flange C holes 76,77.

  (e) Install two bolts, washers, and nuts attaching thrust reverser sleeve hold−open rod brace to Flange C. Torque nuts 93 − 107 lb−in. (10.508 − 12.089 N.m).

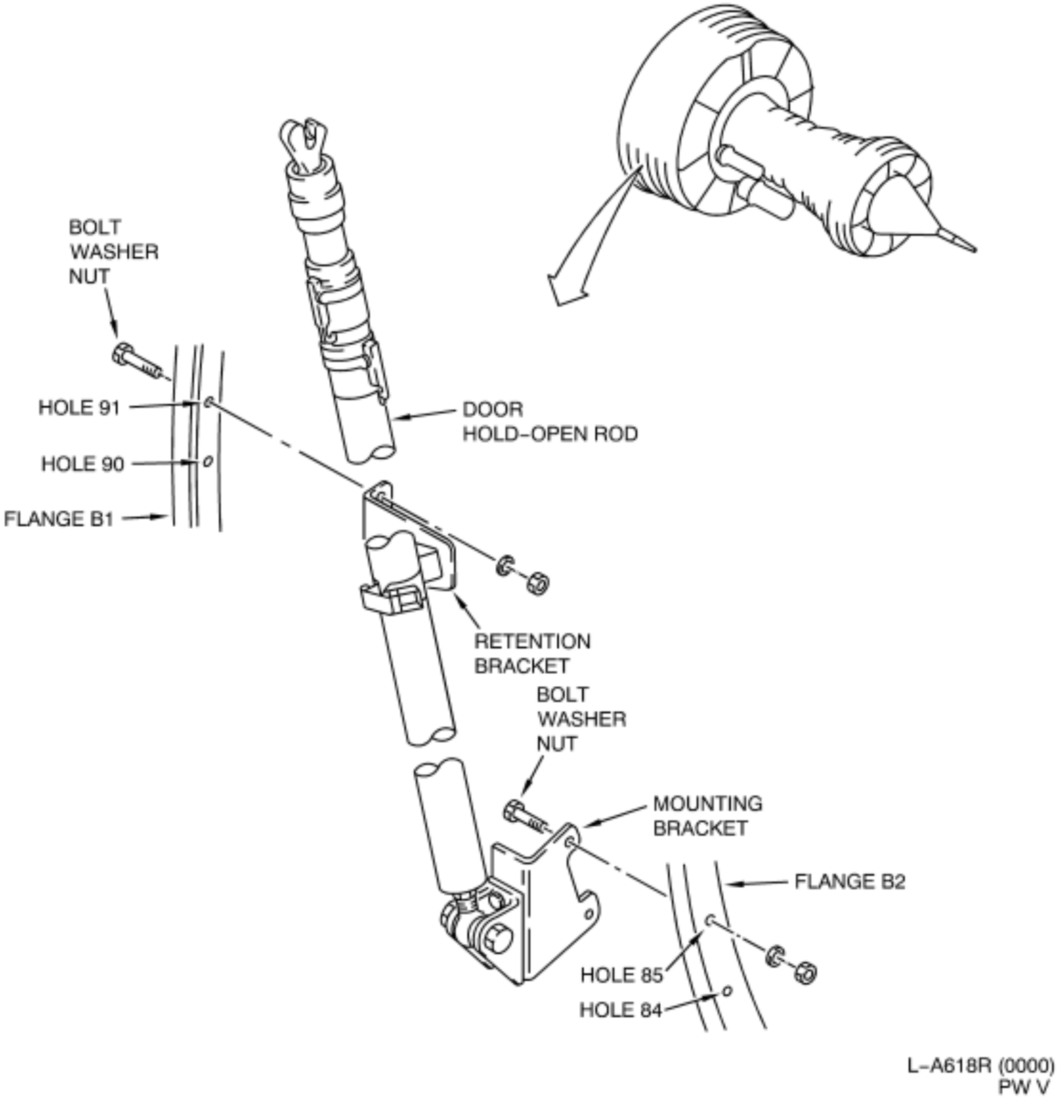
R
R


BOLT
WASHER
NUT
HOLE 30
HOLE 31
FLANGE B1
RETENTION
BRACKET
DOOR
HOLD−OPEN ROD
HOLE 36
HOLE 37
MOUNTING
BRACKET
BOLT
WASHER
NUT
L−A616R (0000)
PW V

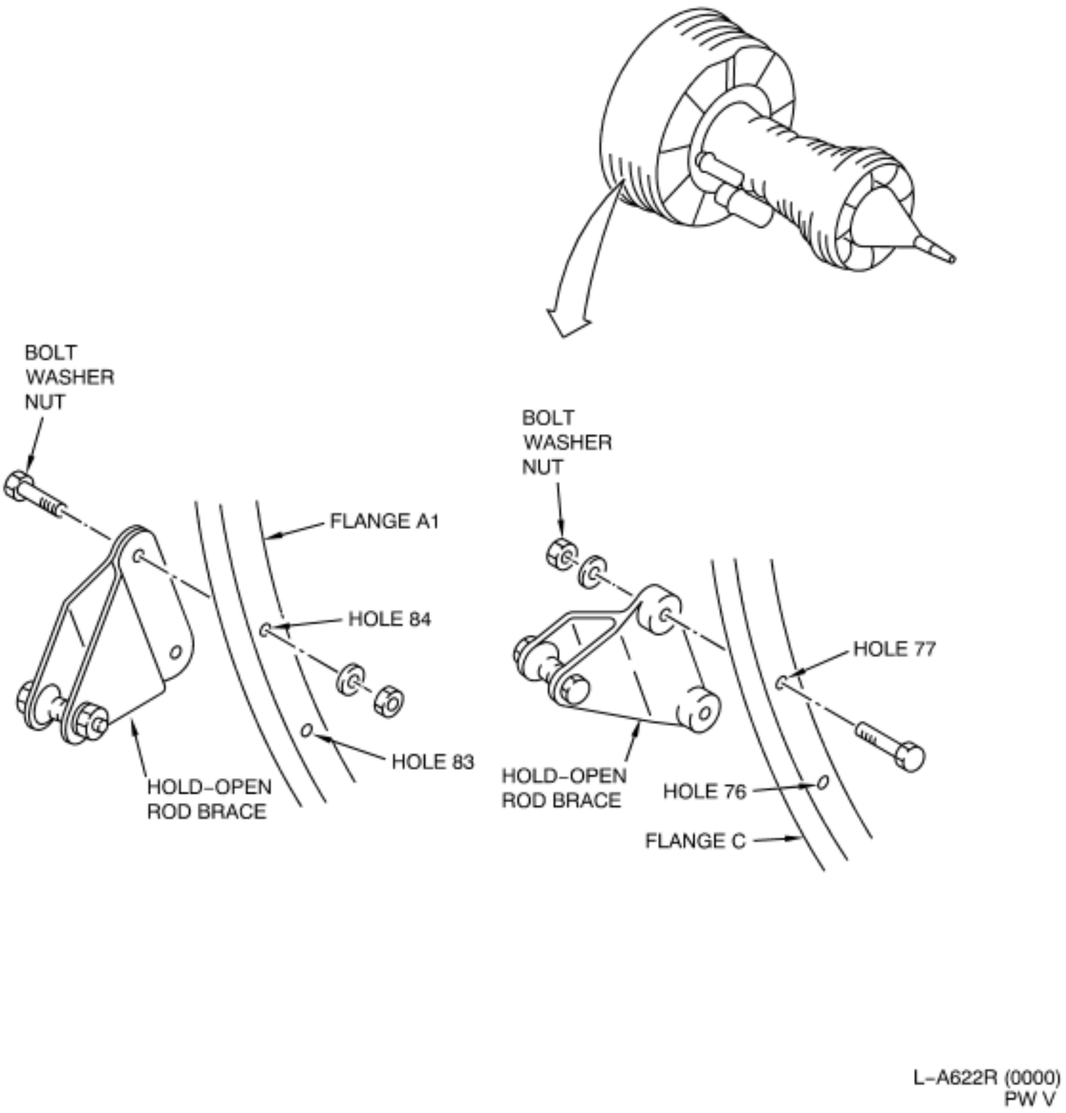
R Fan Cowl Door Hold−Open Rod, Right Side, Without SCU
Figure 401
(Task 71−00−33−450−011)


BOLT
WASHER
NUT
HOLD−OPEN
ROD BRACE
HOLE 32
HOLE 33
FLANGE C
BOLT
WASHER
NUT
HOLD−OPEN
ROD BRACE
FLANGE A1
HOLE 37
HOLE 38
L−A620R (0000)
PW V

R Door Hold−Open Rod Braces, Right Side, Without SCU
Figure 402
(Task 71−00−33−450−011)


BOLT
WASHER
NUT
HOLE 91
HOLE 90
FLANGE B1
DOOR
HOLD−OPEN ROD
RETENTION
BRACKET
BOLT
WASHER
NUT
MOUNTING
BRACKET
FLANGE B2
HOLE 85
HOLE 84
L−A618R (0000)
PW V

R Fan Cowl Door Hold−Open Rod, Left Side, Without SCU
Figure 403
(Task 71−00−33−450−011)


BOLT
WASHER
NUT
FLANGE A1
HOLE 84
HOLE 83
HOLD−OPEN
ROD BRACE
BOLT
WASHER
NUT
HOLE 77
HOLD−OPEN
ROD BRACE
HOLE 76
FLANGE C
L−A622R (0000)
PW V

R Door Hold−Open Rod Braces, Left Side, Without SCU
Figure 404
(Task 71−00−33−450−011)

R Task 71−00−33−450−011−A:

R 2. Install Fan Cowl Door Hold−Open Rod With SCU

R A. Equipment and Materials Required − None

R B. Procedure

R (1) Install fan cowl door hold−open rod, right side. See Figure 405.

R (a) Position hold−open rod mounting bracket over Flange B1 holes 37,38.

R (b) Install two bolts, washers, and nuts, attaching hold−open rod mounting bracket to Flange B1. Torque nuts 93 − 107 lb−in. (10.508 − 12.089 N.m).

R (c) Position hold−open rod retaining bracket over Flange B1 holes 30,31.

R (d) Install two bolts, washers, and nuts attaching hold−open rod retaining bracket to Flange B1. Torque nuts 93 − 107 lb−in. (10.508 − 12.089 N.m).

R (2) Install two hold−open rod braces, right side. See Figure 406.

R (a) Position fan cowl door hold−open rod brace over Flange A1 holes 38,39.

R (b) Install two bolts, washers, and nuts attaching fan cowl door hold−open rod brace to Flange A1. Torque nuts 93 − 107 lb−in. (10.508 − 12.089 N.m).

R (c) Remove existing bolts, washers, and nuts from Flange C holes 32,33.

R (d) Position thrust reverser sleeve hold−open rod brace over Flange C holes 32,33.

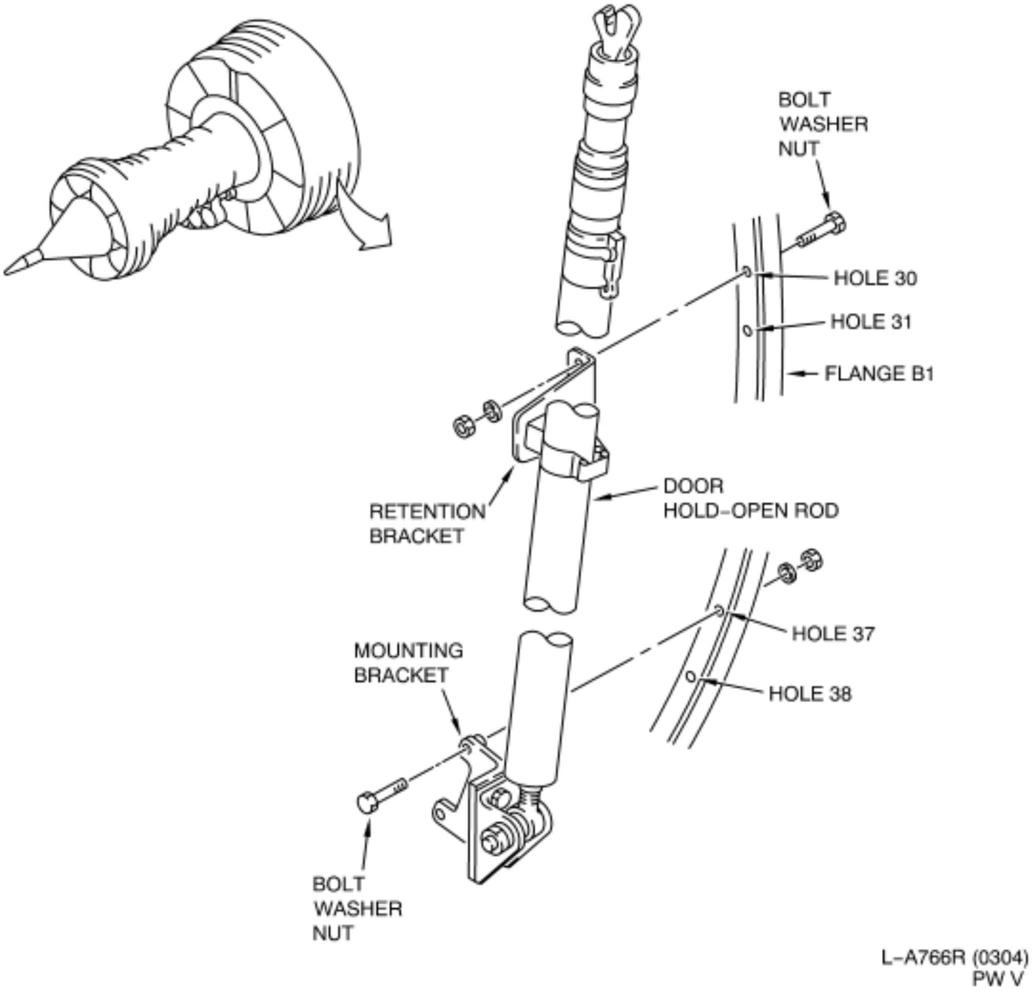
R (e) Install two bolts, washers, and nuts attaching thrust reverser sleeve hold−open rod brace to Flange C. Torque nuts 93 − 107 lb−in. (10.508 − 12.089 N.m).

(3) Install fan cowl door hold−open rod, left side. See Figure 407.

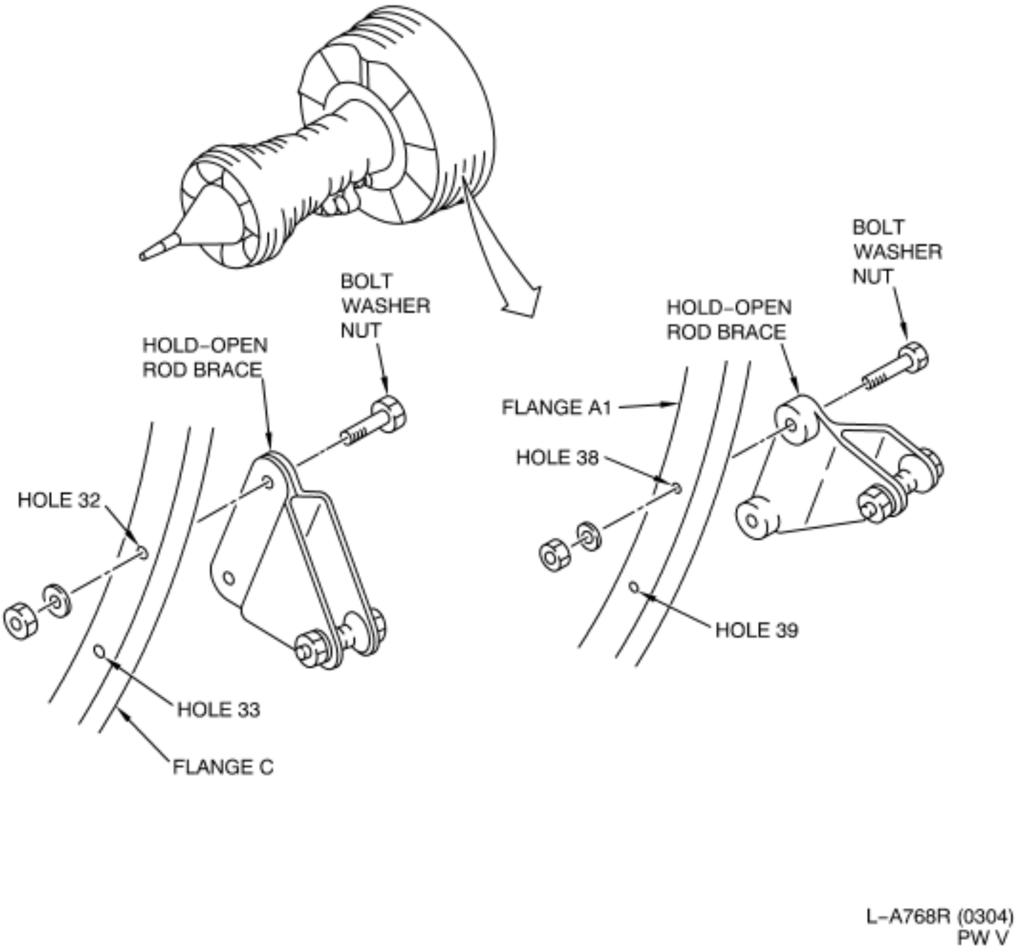
- (a) Position hold−open rod mounting bracket over Flange B2 holes 82,83.
- (b) Install two bolts, washers, and nuts attaching hold−open rod mounting bracket to Flange B2. Torque nuts 93 − 107 lb−in. (10.508 − 12.089 N.m).
- (c) Position hold−open rod retaining bracket over Flange B1 holes 89,90.
- (d) Install two bolts, washers, and nuts attaching hold−open rod retaining bracket to Flange B1. Torque nuts 93 − 107 lb−in. (10.508 − 12.089 N.m).

(4) Install two hold−open rod braces, left side. See Figure 408.

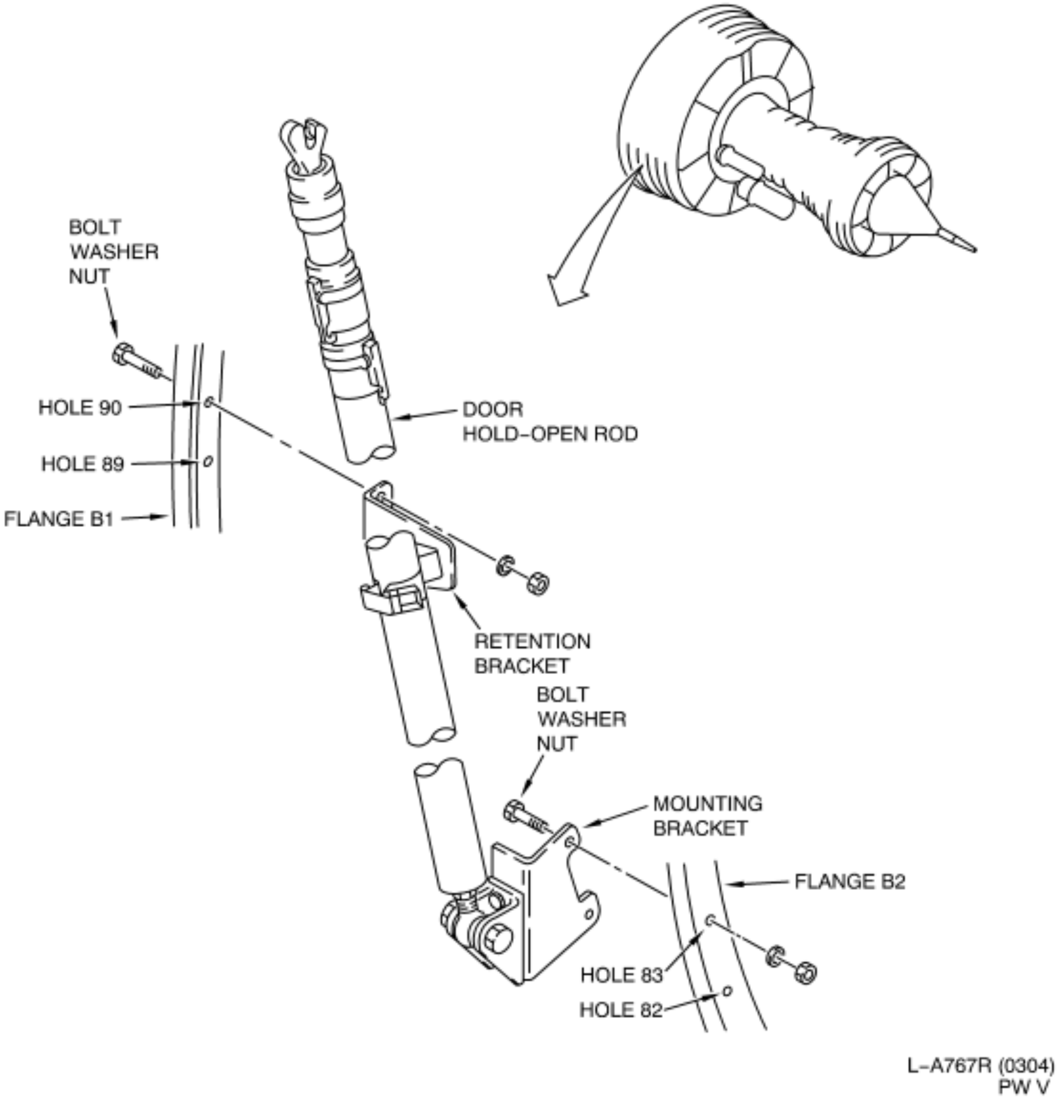
- (a) Position fan cowl door hold−open rod brace over Flange A1 holes 81,82.
- (b) Install two bolts, washers, and nuts attaching fan cowl door hold−open rod brace to Flange A1. Torque nuts 93 − 107 lb−in. (10.508 − 12.089 N.m).
- (c) Remove existing bolts, washers and nuts from Flange C holes 76,77.
- (d) Position thrust reverser sleeve hold−open rod brace over Flange C holes 76,77.
- (e) Install two bolts, washers, and nuts attaching thrust reverser sleeve hold−open rod brace to Flange C. Torque nuts 93 − 107 lb−in. (10.508 − 12.089 N.m).


BOLT
WASHER
NUT
HOLE 30
HOLE 31
FLANGE B1
RETENTION
BRACKET
DOOR
HOLD-OPEN ROD
HOLE 37
MOUNTING
BRACKET
HOLE 38
BOLT
WASHER
NUT
L-A766R (0304)
PW V

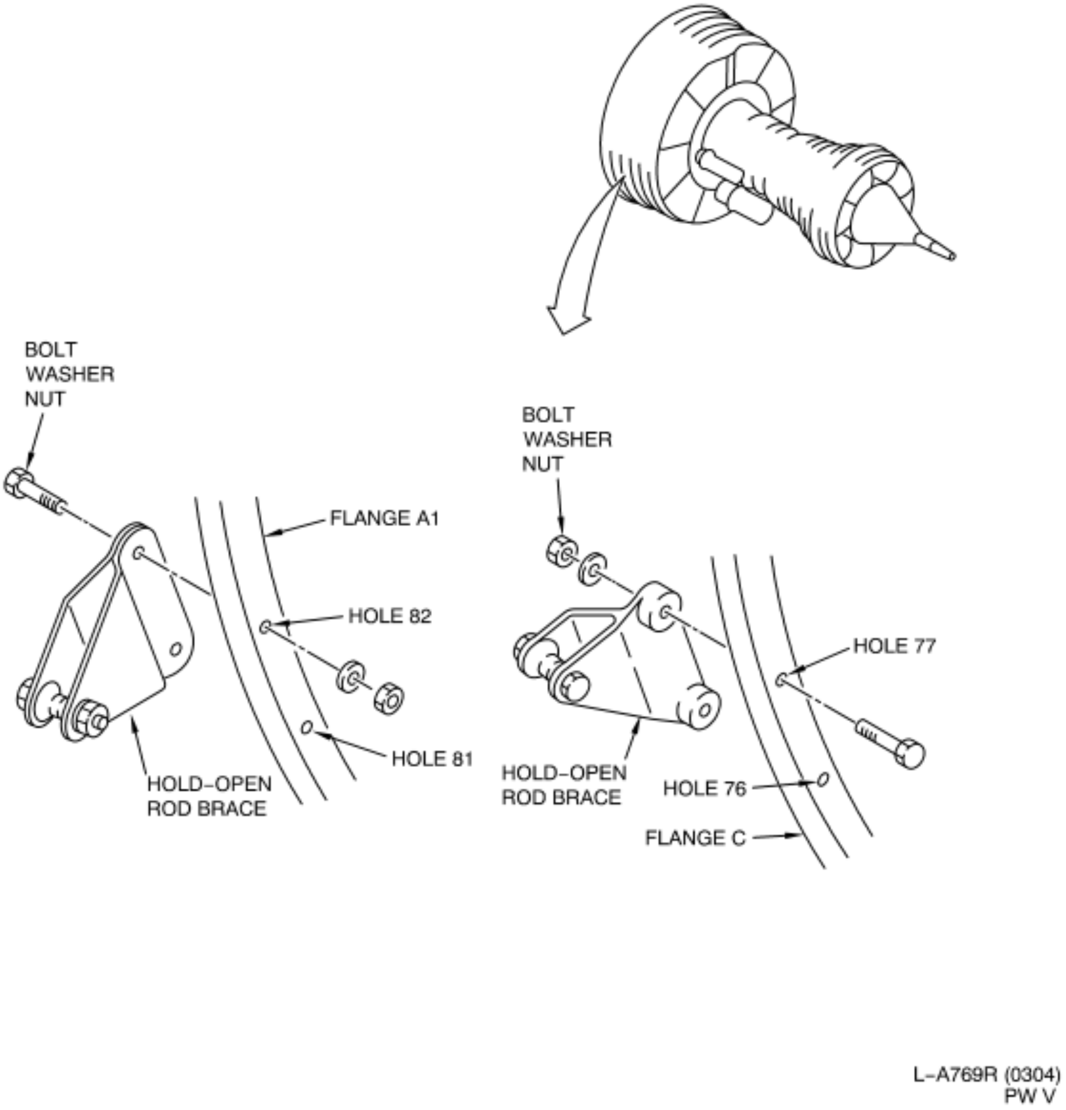
R Fan Cowl Door Hold-Open Rod, Right Side, With SCU
R Figure 405
R (Task 71-00-33-450-011-A)


BOLT
WASHER
NUT
HOLD−OPEN
ROD BRACE
HOLE 32
HOLE 33
FLANGE C
BOLT
WASHER
NUT
HOLD−OPEN
ROD BRACE
FLANGE A1
HOLE 38
HOLE 39
L−A768R (0304)
PW V

R Door Hold−Open Rod Braces, Right Side, With SCU
R Figure 406
R (Task 71−00−33−450−011−A)


BOLT
WASHER
NUT
HOLE 90
HOLE 89
FLANGE B1
DOOR
HOLD−OPEN ROD
RETENTION
BRACKET
BOLT
WASHER
NUT
MOUNTING
BRACKET
FLANGE B2
HOLE 83
HOLE 82
L−A767R (0304)
PW V

R Fan Cowl Door Hold−Open Rod, Left Side, With SCU
R Figure 407
R (Task 71−00−33−450−011−A)


BOLT
WASHER
NUT
FLANGE A1
HOLE 82
HOLE 81
HOLD−OPEN
ROD BRACE
BOLT
WASHER
NUT
HOLE 77
HOLD−OPEN
ROD BRACE
HOLE 76
FLANGE C
L−A769R (0304)
PW V

R Door Hold−Open Rod Braces, Left Side, With SCU
R Figure 408
R (Task 71−00−33−450−011−A)

POWER PLANT GENERAL - FAN CASE - INSTALLATION-03

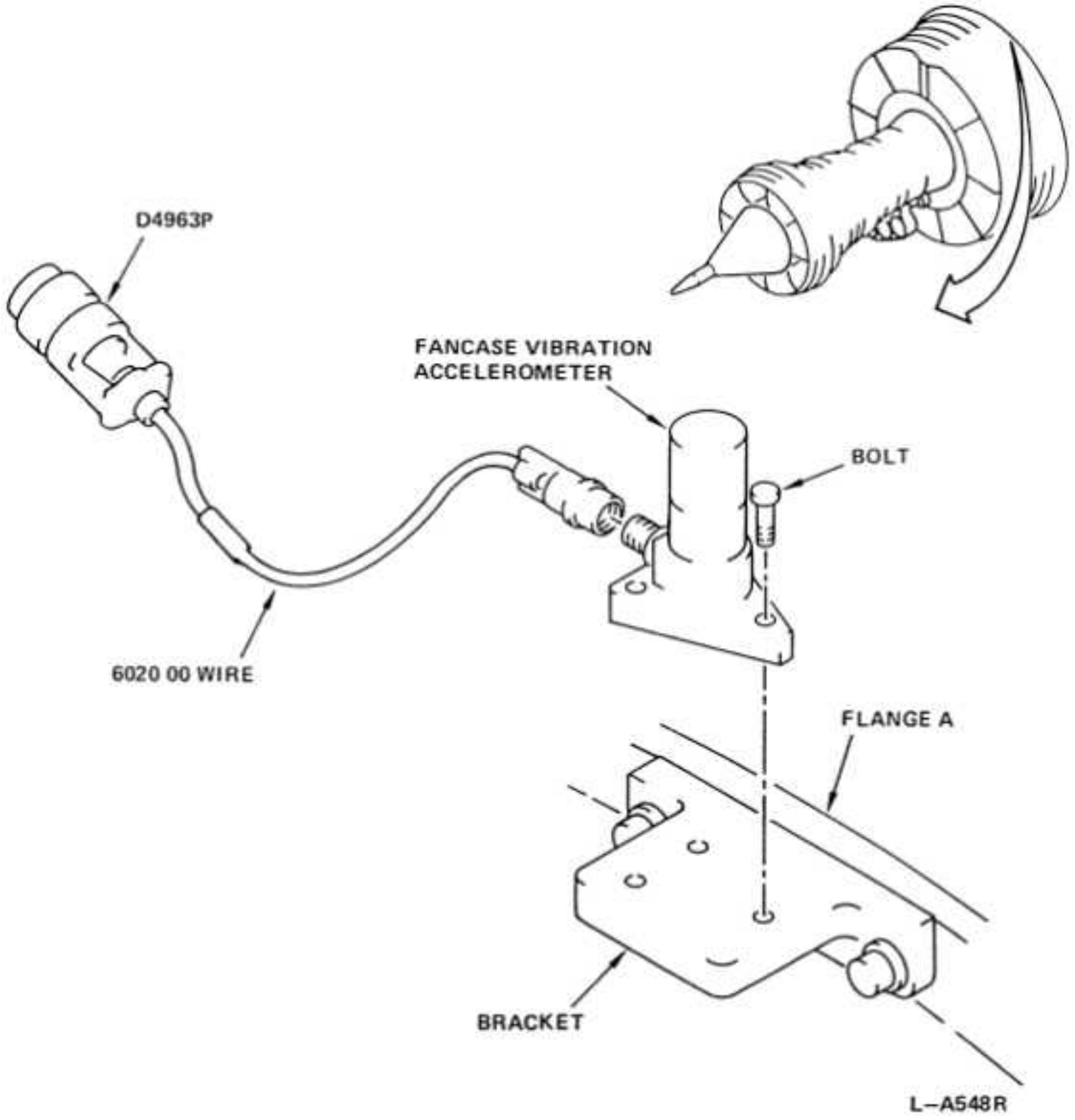
Task 71-00-33-450-002:

1. Install Fan Case Vibration Accelerometer
   A. Equipment And Materials Required

      Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
MS20995N20				
Lockwire, As Required				

   B. Procedure
      See Figure 401.
      (1) Position vibration accelerometer on bracket mounted on fan case Flange A at 1 o'clock position. Attach accelerometer with three (3) bolts. Torque bolts 12 - 15 lb-in. (1.356 - 1.695 N.m). Lockwire bolts.


D4963P
FANCASE VIBRATION ACCELEROMETER
BOLT
6020 00 WIRE
FLANGE A
BRACKET
L−A548R

Fan Case Vibration Accelerometer
Figure 401
(Task 71−00−33−450−002)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL − FAN CASE − INSTALLATION−04

Task 71−00−33−450−004:

1. Install Inlet Cowl Anti−Ice Visual Overpressure Indicator

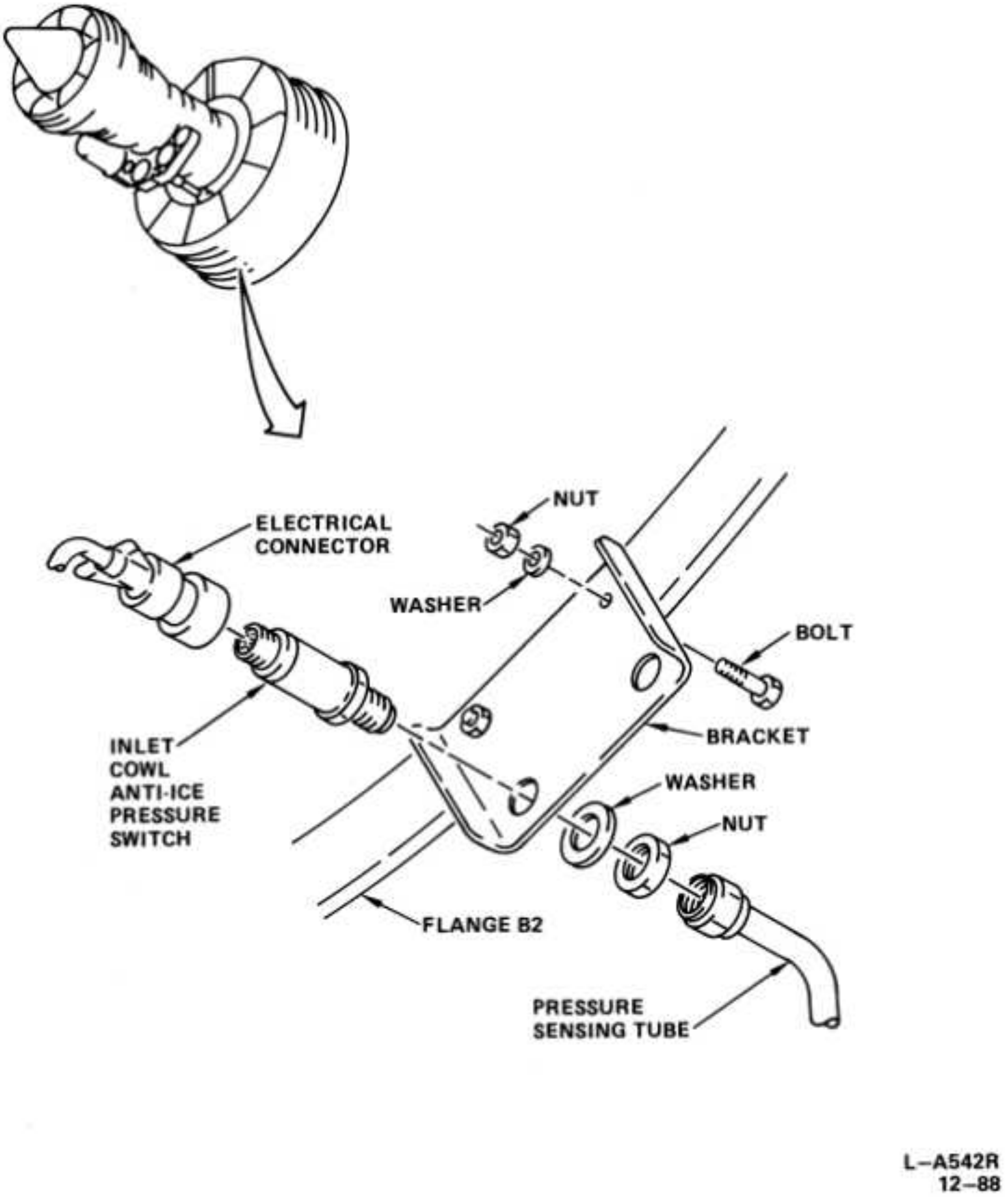
NOTE: This procedure has been deleted.

POWER PLANT GENERAL - FAN CASE - INSTALLATION-05

Task 71-00-33-450-008:

1. Install Inlet Cowl Anti-Ice Pressure Switch
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 401.
     - (1) Position inlet cowl mounting bracket on fan case Flange B2 over holes 45 and 46. Attach bracket with two bolts, washers and nuts. Torque nuts 93 - 107 lb-in. (10.508 - 12.089 N.m).
     - (2) Install inlet cowl anti-ice pressure switch in the mounting bracket with washer and nut. Torque nut to 120 - 130 lb-in. (13.6 - 13.7 N.m).
     - (3) Remove protective covers from electrical connector and pressure switch and connect connector. Tighten fingertight, plus one-eighth turn.
     - (4) Connect pressure sensing tube to pressure switch. Torque tube connection 180 - 200 lb-in. (20.337 - 24.857 N.m).


NUT
ELECTRICAL CONNECTOR
WASHER
BOLT
INLET COWL ANTI-ICE PRESSURE SWITCH
BRACKET
WASHER
NUT
FLANGE B2
PRESSURE SENSING TUBE
L–A542R
12–88

Inlet Cowl Anti–Ice Pressure Switch
Figure 401
(Task 71–00–33–450–008)

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POWER PLANT GENERAL - FAN CASE - INSTALLATION-06

Task 71-00-33-450-010:

1. Install Inlet Cowl Anti-Ice Shutoff And Regulating Valve - Deleted

NOTE: This Procedure Has Been Deleted

POWER PLANT GENERAL - FAN CASE - INSTALLATION-07

Task 71-00-33-450-012:

1. Install Bifurcation Fire Seal

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P06-013	Solid Film Lubricant

B. Procedure

See Figure 401.

(1) Remove protective covers from both ends of firewall duct, end of anti-ice aft-lower duct and anti-ice T-section port.

(2) Remove existing bolts and nuts from fan case Flange C holes 54 and 55.

(3) Position duct support link bracket over forward side of fan case Flange C, holes 54 and 55, with link attachment toward hole 55. Install bolts, washers and nuts attaching support bracket to Flange C. Torque nuts 85 - 95 lb-in. (9.604 - 10.734 N.m).

(4) Check and, if necessary, set support link to nominal length (1.75 inch (44.45 mm), center of rod ends). Torque locking nuts 100 - 140 lb-in. (11.298 - 15.818 N.m).

(5) Lubricate inside surface of duct coupling with Material (P06-013).

(6) Position duct against anti-ice aft-lower duct. Place coupling seal between mating flanges.

(7) Verify that outside diameters of mating flanges are aligned radially within 0.06 inch (1.524 mm), and angular gap between mating faces of flanges is not greater than 0.04 inch (1.016 mm).

(8) Install coupling to attach duct to anti-ice aft-lower duct. Tighten coupling fingertight.

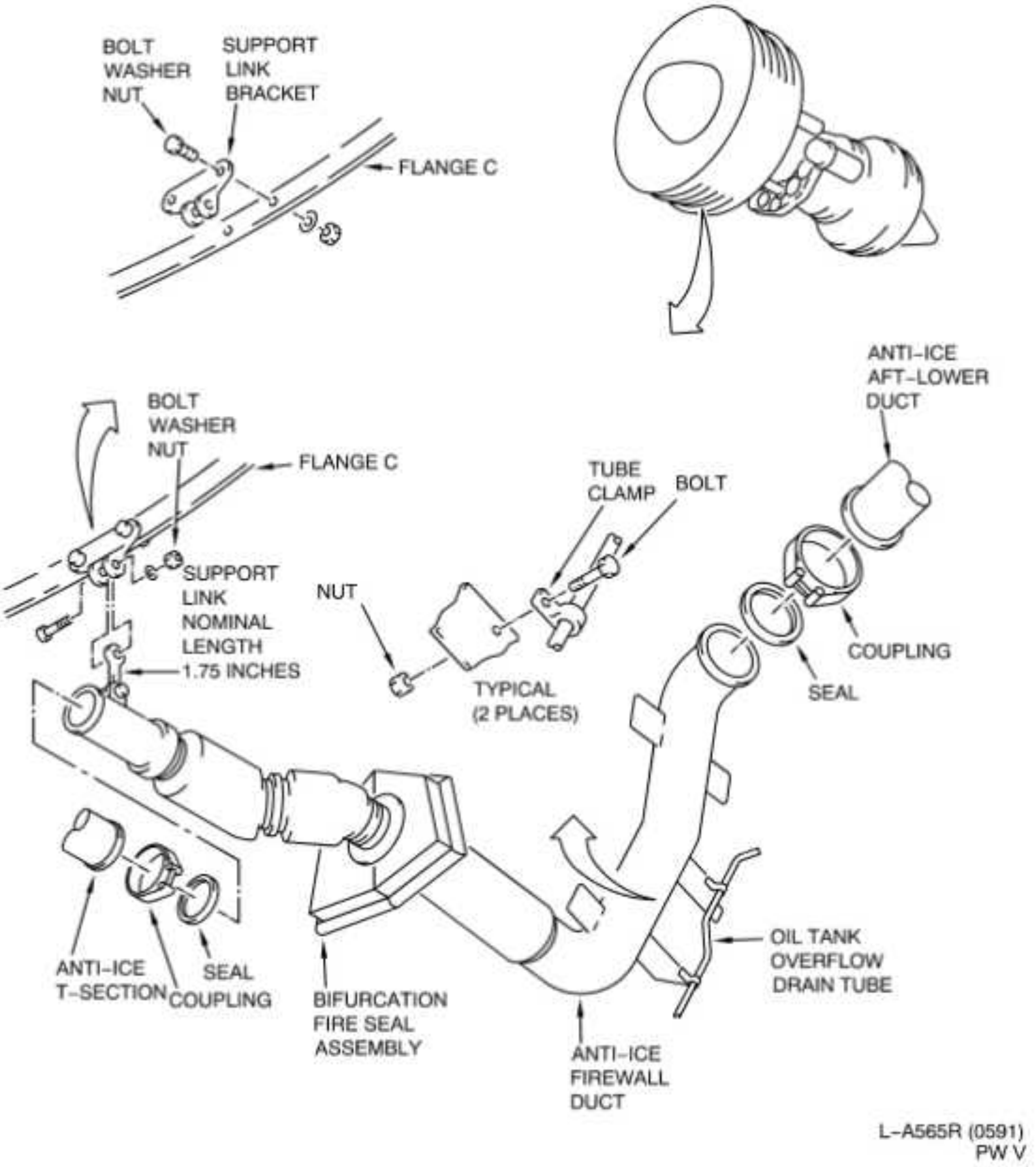
(9) Lubricate inside surface of duct coupling with Material (P06-013).

(10) Position duct against anti-ice T-section. Place coupling seal between mating flanges.

(11) Verify that outside diameters of mating flanges are aligned radially within 0.06 inch (1.524 mm) and angular gap between mating faces of flanges is not greater than 0.04 inch (1.016 mm).

(12) Install coupling to attach duct to anti-ice T-section. Tighten coupling fingertight.

(13) Install bolt, washer and nut attaching duct support link to support link bracket on fan case Flange C. Torque nut 50 - 70 lb-in. (5.649 - 7.909 N.m).


BOLT
WASHER
NUT
SUPPORT
LINK
BRACKET
FLANGE C
ANTI−ICE
AFT−LOWER
DUCT
BOLT
WASHER
NUT
FLANGE C
TUBE
CLAMP
BOLT
SUPPORT
LINK
NOMINAL
LENGTH
1.75 INCHES
NUT
TYPICAL
(2 PLACES)
COUPLING
SEAL
OIL TANK
OVERFLOW
DRAIN TUBE
ANTI−ICE
T−SECTION
COUPLING
SEAL
BIFURCATION
FIRE SEAL
ASSEMBLY
ANTI−ICE
FIREWALL
DUCT
L−A565R (0591)
PW V

Anti−Ice Firewall Duct
Figure 401
(Task 71−00−33−450−012)

POWER PLANT GENERAL − FAN CASE − INSTALLATION−07

(14) Torque two duct couplings to value indicated on each coupling. Tap around coupling with plastic mallet. Retorque coupling.

(15) Install bolts, washers, clamps, and nuts to attach oil tank overflow drain tube to flanges on anti−ice firewall duct. Torque nuts to 20 − 25 lb−in. (2.260 − 2.825 N.m)

Previous Pageblock Return to Previous Menu Next Pageblock

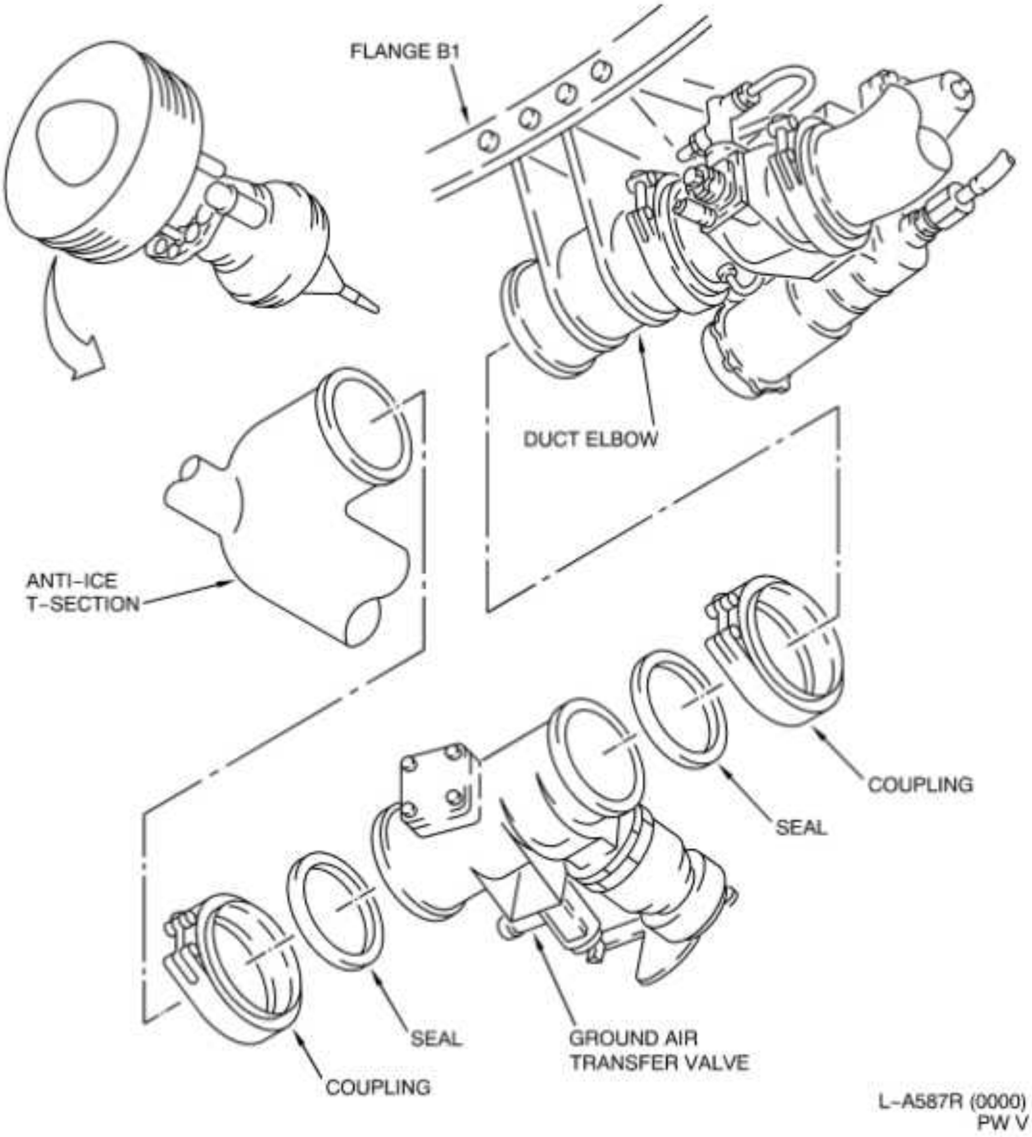
Task 71−00−33−450−013:

1. Install Ground Operation Air Transfer Pneumatic Valve
   A. Equipment And Materials Required

      Consumable Materials:

Item No.	Designation
P06−013	Lubricant

   B. Procedure
      See Figure 401.
      (1) Install Ground Operation Air Transfer Pneumatic Valve. See Figure 401.
         (a) Remove protective covers from both valve ports and from duct elbow.
         (b) Lubricate inside surface of duct coupling with Material P06−013.
         (c) Position valve against duct elbow. Rotate valve until key on valve flange fits key slot on duct elbow. Place seal between mating flanges.
         (d) Verify that outside diameters of mating flanges are aligned radially within 0.06 inch (1.524 mm), and angular gap between mating faces of flanges is not greater than 0.04 inch (1.016 mm).
         (e) Install coupling to attach valve to duct elbow. Tighten coupling fingertight.
      (2) Install Anti−Ice Duct T−section.
         (a) Remove protective cover from anti−ice duct T−section.
         (b) Lubricate inside surface of duct coupling with Material P06−013.
         (c) Position T−section against valve. Place seal between mating flanges.
         (d) Verify that outside diameters of mating flanges are aligned radially within 0.06 inch (1.524 mm), and angular gap between mating faces of flanges is not greater than 0.04 inch (1.016 mm).
         (e) Install coupling to attach T−section to valve. Tighten coupling fingertight.
         (f) Torque two couplings to value indicated on each coupling. Tap around couplings with plastic mallet. Retorque couplings.

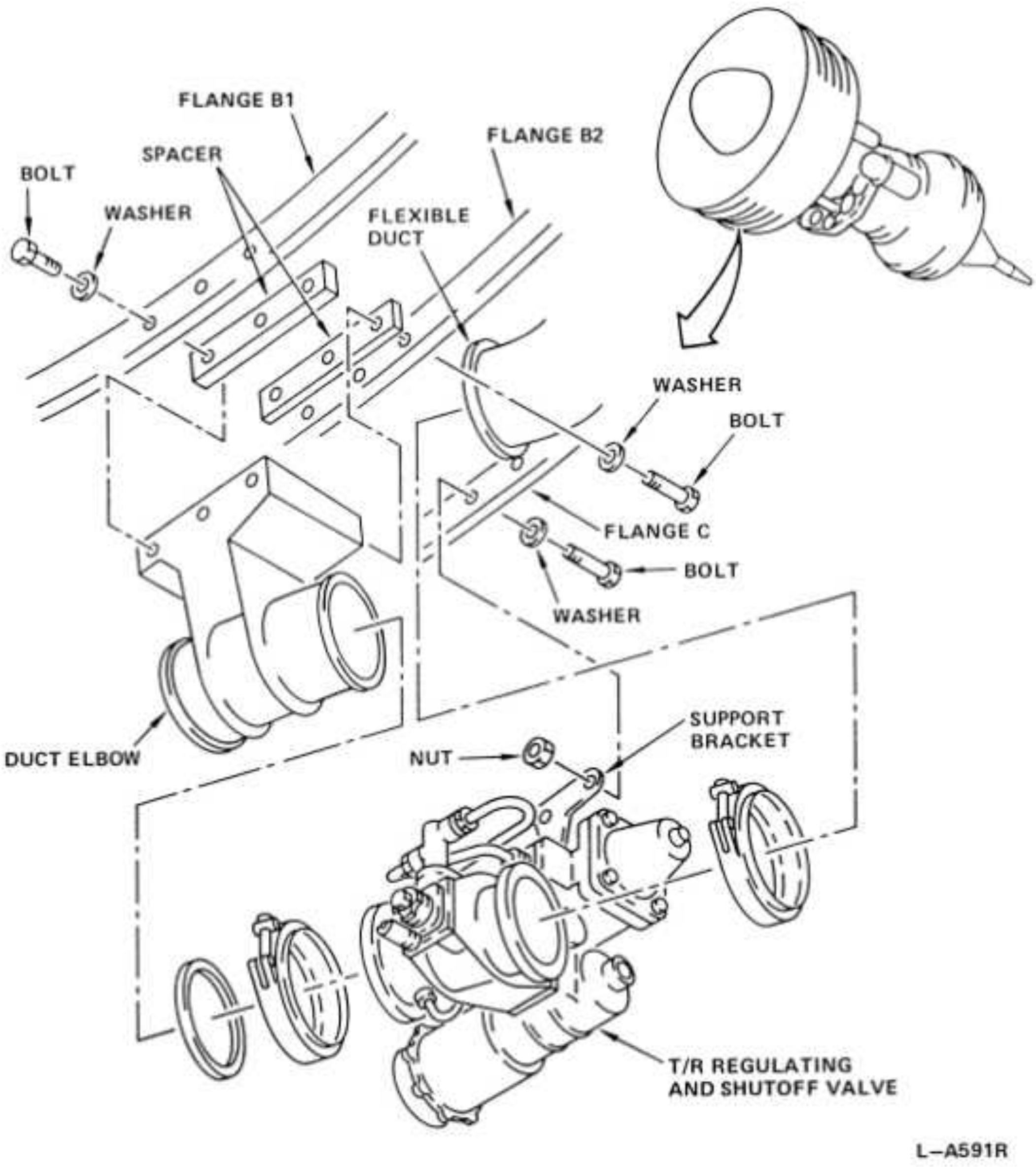

FLANGE B1
DUCT ELBOW
ANTI−ICE
T−SECTION
COUPLING
SEAL
SEAL
GROUND AIR
TRANSFER VALVE
COUPLING
L−A587R (0000)
PW V

Ground Operation Air Transfer Pneumatic Valve
Figure 401
(Task 71−00−33−450−013)

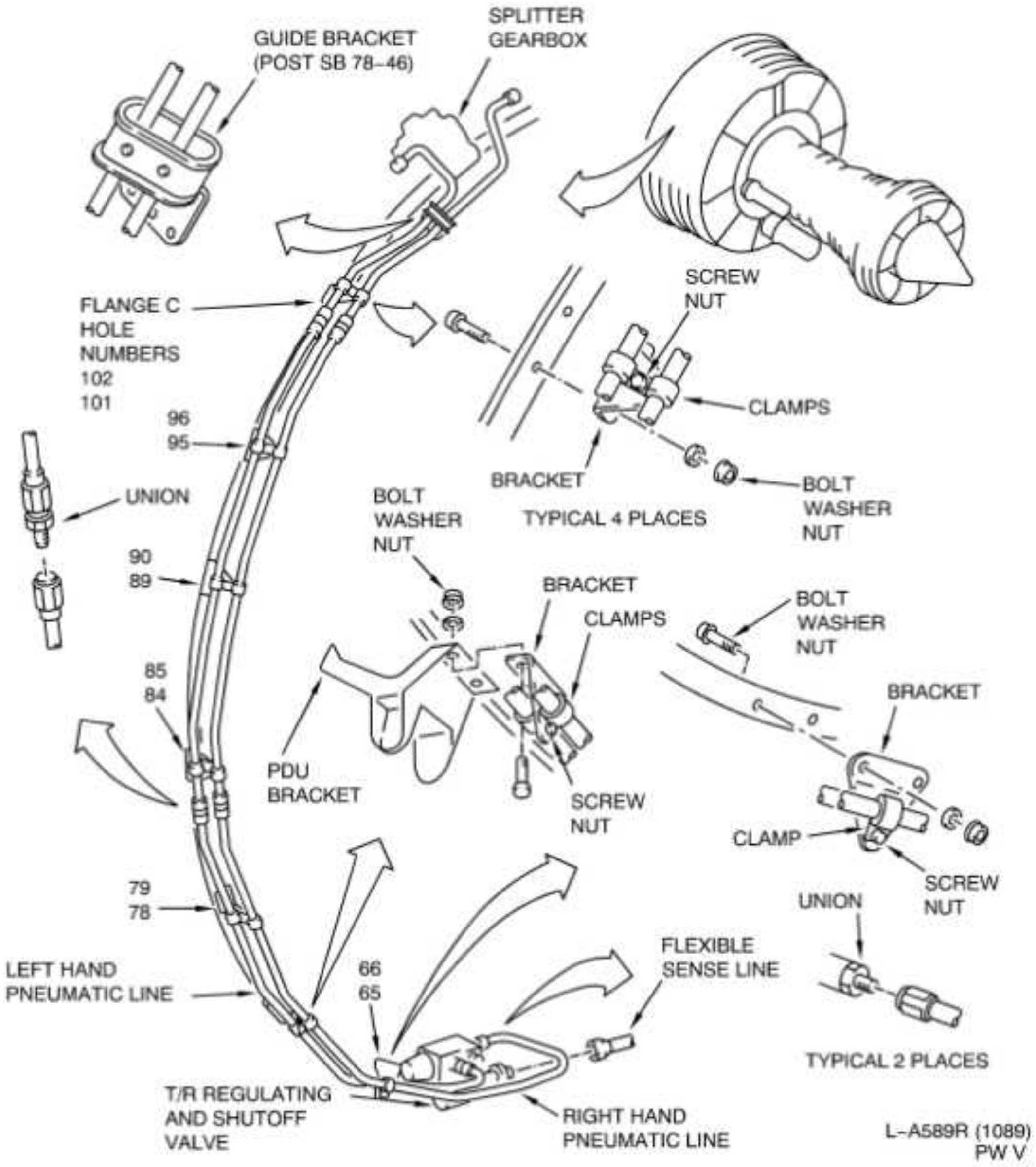
POWER PLANT GENERAL - FAN CASE - INSTALLATION-09

Task 71-00-33-450-009-001:

1. Install Thrust Reverser Pressure Regulating And Shutoff Valve - Pre SB PW4NAC 78-46
   A. Equipment And Materials Required - None
   B. Procedure
      See Figures 401 and 402.
      (1) Install duct elbow.
         (a) Position duct elbow between Flanges B1 and B2 with straight end pointing down and with mounting frame over holes 65,66,67.
         (b) Place spacer between mounting frame and Flange B1 and install three (3) bolts and washers attaching mounting frame to flange. Tighten bolts fingertight.
         (c) Place spacer between mounting frame and Flange B2 and install three (3) bolts and washers attaching mounting frame to flange. Tighten bolts fingertight.
      (2) Install thrust reverser pressure regulating and shutoff valve.
         (a) Remove protective covers from both ends of valve, end of flexible duct, upper end of duct elbow, end of flexible sense line (from flexible duct) and valve port for sense line.
         (b) Remove existing bolts, washers and nuts from Flange C holes 61,62.
         (c) Observe direction of arrow on valve. Point arrow toward flexible duct.
         (d) Position valve against duct elbow. Place seal between mating flanges.
         (e) Verify that outside diameters of mating flanges are aligned radially within 0.06 inch (1.524 mm), and angular gap between mating faces of flanges is not greater than 0.04 inch (1.016 mm).
         (f) Install coupling to attach valve to duct elbow. Tighten coupling fingertight.
         (g) Adjust valve position so support (clocking) bracket fits against Flange C over holes 61,62.
         (h) Install bolts, washers and nuts attaching valve bracket to Flange C. Tighten nuts fingertight.
         (i) Position valve against flexible duct.
         (j) Verify that outside diameters of mating flanges are aligned radially within 0.06 inch (1.524 mm), and angular gap between mating faces of flanges is not greater than 0.04 inch (1.016 mm).
         (k) Install coupling to attach valve to flexible duct. tighten coupling fingertight.
         (l) Connect flexible sense line to receptacle on valve and torque 270 - 300 lb-in. (30.506 - 33.895 N.m).


FLANGE B1
SPACER
BOLT
WASHER
FLANGE B2
FLEXIBLE DUCT
WASHER
BOLT
FLANGE C
BOLT
WASHER
DUCT ELBOW
NUT
SUPPORT BRACKET
T/R REGULATING AND SHUTOFF VALVE
L−A591R

Thrust Reverser Pressure Regulating And Shutoff Valve
Figure 401
(Task 71−00−33−450−009−001)


GUIDE BRACKET
(POST SB 78-46)
SPLITTER
GEARBOX
SCREW
NUT
FLANGE C
HOLE
NUMBERS
102
101
CLAMPS
96
95
BRACKET
BOLT
WASHER
NUT
UNION
BOLT
WASHER
NUT
TYPICAL 4 PLACES
90
89
BRACKET
CLAMPS
BOLT
WASHER
NUT
85
84
BRACKET
PDU
BRACKET
SCREW
NUT
CLAMP
SCREW
NUT
79
78
UNION
FLEXIBLE
SENSE LINE
LEFT HAND
PNEUMATIC LINE
66
65
TYPICAL 2 PLACES
T/R REGULATING
AND SHUTOFF
VALVE
RIGHT HAND
PNEUMATIC LINE
L-A589R (1089)
PW V

Thrust Reverser Regulating Valve Pneumatic Lines
Figure 402
(Task 71−00−33−450−009−001)

(m) Torque two nuts attaching valve support bracket to Flange C 85 − 95 lb−in. (9.604 − 10.734 N.m).
(n) Torque two couplings to value indicated on each coupling. Tap around coupling with plastic mallet. Retorque coupling.
(o) Torque three (3) bolts attaching duct elbow to Flange B1, and three (3) bolts attaching duct elbow to Flange B2 each 85 − 95 lb−in. (9.604 − 10.734 N.m).

(3) Install pneumatic lines.
(a) Remove protective covers from lower ends of upper section of pneumatic lines.
(b) Remove existing bolts, washers and nuts from Flange C holes 101,102.
(c) Lay upper pneumatic line section along Flange C with the upper support bracket over holes 101,102.
(d) Install bolts, washers and nuts attaching pneumatic line support bracket to Flange C holes 101,102. Torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
(e) Remove existing bolts, washers and nuts from Flange C holes 95,96. Install bolts, washers and nuts attaching pneumatic line support bracket to Flange C holes 95,96. Torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
(f) Remove existing bolts, washers and nuts from Flange C holes 89,90. Install bolts, washers and nuts attaching pneumatic line support bracket to Flange C holes 89,90. Torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
(g) Remove existing bolts, washers and nuts from Flange C holes 84,85. Install bolts, washers and nuts attaching pneumatic line support bracket to Flange C holes 84,85. Torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
(h) Remove protective covers from both ends of lower pneumatic line section and from pneumatic line receptacles on valve.
(i) Connect both lines of the lower section to upper section. Torque couplings 270 − 300 lb−in. (30.506 − 33.895 N.m).
(j) Remove existing bolts, washers and nuts from Flange C holes 78,79. Install bolts, washers and nuts attaching pneumatic line support bracket to Flange C holes 78,79. Torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
(k) Install screw and nut attaching two (2) pneumatic line clamps, with pneumatic lines, to support bracket mounted on PDU support.

(l) Remove existing bolts, washers and nuts from Flange C holes 65,66. Install bolts, washers and nuts attaching pneumatic line support bracket to Flange C holes 65,66. Torque 85 − 95 lb−in. (9.604 − 10.734 N.m).

(m) Connect both pneumatic lines to respective receptacle on regulating and shutoff valve. Torque couplings 270 − 300 lb−in. (30.506 − 33.895 N.m).

Task 71−00−33−450−009−002:

2. Install Thrust Reverser Pressure Regulating And Shutoff Valve − Post SB PW4NAC 78−46
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figures 401 and 402.
     - (1) Install duct elbow.
       - (a) Position duct elbow between Flanges B1 and B2 with straight end pointing down and with mounting frame over holes 65,66,67.
       - (b) Place spacer between mounting frame and Flange B1 and install three (3) bolts and washers attaching mounting frame to flange. Tighten bolts fingertight.
       - (c) Place spacer between mounting frame and Flange B2 and install three (3) bolts and washers attaching mounting frame to flange. Tighten bolts fingertight.
     - (2) Install thrust reverser pressure regulating and shutoff valve.
       - (a) Remove protective covers from both ends of valve, end of flexible duct, upper end of duct elbow, end of flexible sense line (from flexible duct) and valve port for sense line.
       - (b) Remove existing bolts, washers and nuts from Flange C holes 61,62.
       - (c) Observe direction of arrow on valve. Point arrow toward flexible duct.
       - (d) Position valve against duct elbow. Place seal between mating flanges.
       - (e) Verify that outside diameters of mating flanges are aligned radially within 0.06 inch (1.524 mm), and angular gap between mating faces of flanges is not greater than 0.04 inch (1.016 mm).
       - (f) Install coupling to attach valve to duct elbow. Tighten coupling fingertight.
       - (g) Adjust valve position so support (clocking) bracket fits against Flange C over holes 61,62.

(h) Install bolts, washers and nuts attaching valve bracket to Flange C. Tighten nuts fingertight.
(i) Position valve against flexible duct.
(j) Verify that outside diameters of mating flanges are aligned radially within 0.06 inch (1.524 mm), and angular gap between mating faces of flanges is not greater than 0.04 inch (1.016 mm).
(k) Install coupling to attach valve to flexible duct. tighten coupling fingertight.
(l) Connect flexible sense line to receptacle on valve and torque 270 − 300 lb−in. (30.506 − 33.895 N.m).
(m) Torque two nuts attaching valve support bracket to Flange C 85 − 95 lb−in. (9.604 − 10.734 N.m).
(n) Torque two couplings to value indicated on each coupling. Tap around coupling with plastic mallet. Retorque coupling.
(o) Torque three (3) bolts attaching duct elbow to Flange B1, and three (3) bolts attaching duct elbow to Flange B2 each 85 − 95 lb−in. (9.604 − 10.734 N.m).

(3) Install pneumatic lines.
(a) Remove protective covers from lower ends of upper section of pneumatic lines.
(b) Remove existing bolts, washers and nuts from Flange C holes 101,102.
(c) Remove two (2) screws attaching tube guide to bracket, position upper pneumatic line sections along Flange C and through guide bracket. Reinstall screws in guide and torque to 20 − 25 lb−in. (2.258 − 2.823 N.m).
(d) With upper support bracket over holes 101,102, install bolts, washers and nuts attaching pneumatic line support bracket to Flange C. Torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
(e) Remove existing bolts, washers and nuts from Flange C holes 95,96. Install bolts, washers and nuts attaching pneumatic line support bracket to Flange C holes 95,96. Torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
(f) Remove existing bolts, washers and nuts from Flange C holes 89,90. Install bolts, washers and nuts attaching pneumatic line support bracket to Flange C holes 89,90. Torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
(g) Remove existing bolts, washers and nuts from Flange C holes 84,85. Install bolts, washers and nuts attaching pneumatic line support bracket to Flange C holes 84,85. Torque 85 − 95 lb−in. (9.604 − 10.734 N.m).

POWER PLANT GENERAL − FAN CASE − INSTALLATION−09

(h) Remove protective covers from both ends of lower pneumatic line section and from pneumatic line receptacles on valve.
(i) Connect both lines of the lower section to upper section. Torque couplings 270 − 300 lb−in. (30.506 − 33.895 N.m).
(j) Remove existing bolts, washers and nuts from Flange C holes 78,79. Install bolts, washers and nuts attaching pneumatic line support bracket to Flange C holes 78,79. Torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
(k) Install screw and nut attaching two (2) pneumatic line clamps, with pneumatic lines, to support bracket mounted on PDU support.
(l) Remove existing bolts, washers and nuts from Flange C holes 65,66. Install bolts, washers and nuts attaching pneumatic line support bracket to Flange C holes 65,66. Torque 85 − 95 lb−in. (9.604 − 10.734 N.m).
(m) Connect both pneumatic lines to respective receptacle on regulating and shutoff valve. Torque couplings 270 − 300 lb−in. (30.506 − 33.895 N.m).

POWER PLANT GENERAL - FAN CASE - INSTALLATION-10

Task 71-00-33-450-005:

1. Install Thrust Reverser Main Drive Flexible Shaft

A. Equipment And Materials Required

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
AS20995C32				
Lockwire, As Required				

B. Procedure

See Figure 401.

(1) Remove protective cover from both ends of flexible shaft and from shaft receptacles on PDU and on splitter gearbox.

(2) Arrange flexible shaft vertically on upper-left fan case with wide support bracket at bottom.

(3) Loosen two (2) screws and washers on splitter gearbox flexible shaft receptacle.

(4) Insert hexagonal end of shaft into hexagonal receptacle on splitter gearbox. Rotate shaft mounting plate to capture mounting screws. Rotate flexible shaft so shaft support brackets fit against fan case Flange B2. Tighten and lockwire mounting screws.

(5) Loosen two (2) screws and washers on PDU flexible shaft receptacle.

(6) Insert hexagonal end of shaft into hexagonal receptacle on PDU. Rotate shaft mounting plate to capture mounting screws. Tighten and lockwire mounting screws.

(7) Install bolts, washers and nuts attaching two (2) shaft support brackets to Flange B2 holes 112,113; 107,108. Torque nuts 62 - 72 lb-in. (7.005 - 8.135 N.m).

(8) Remove existing bolts, washers and nuts from Flange C holes 91,92; 86,87; 80,81.

(9) Position shaft support brackets over holes 91,92; 86,87; 80,81 on Flange C.

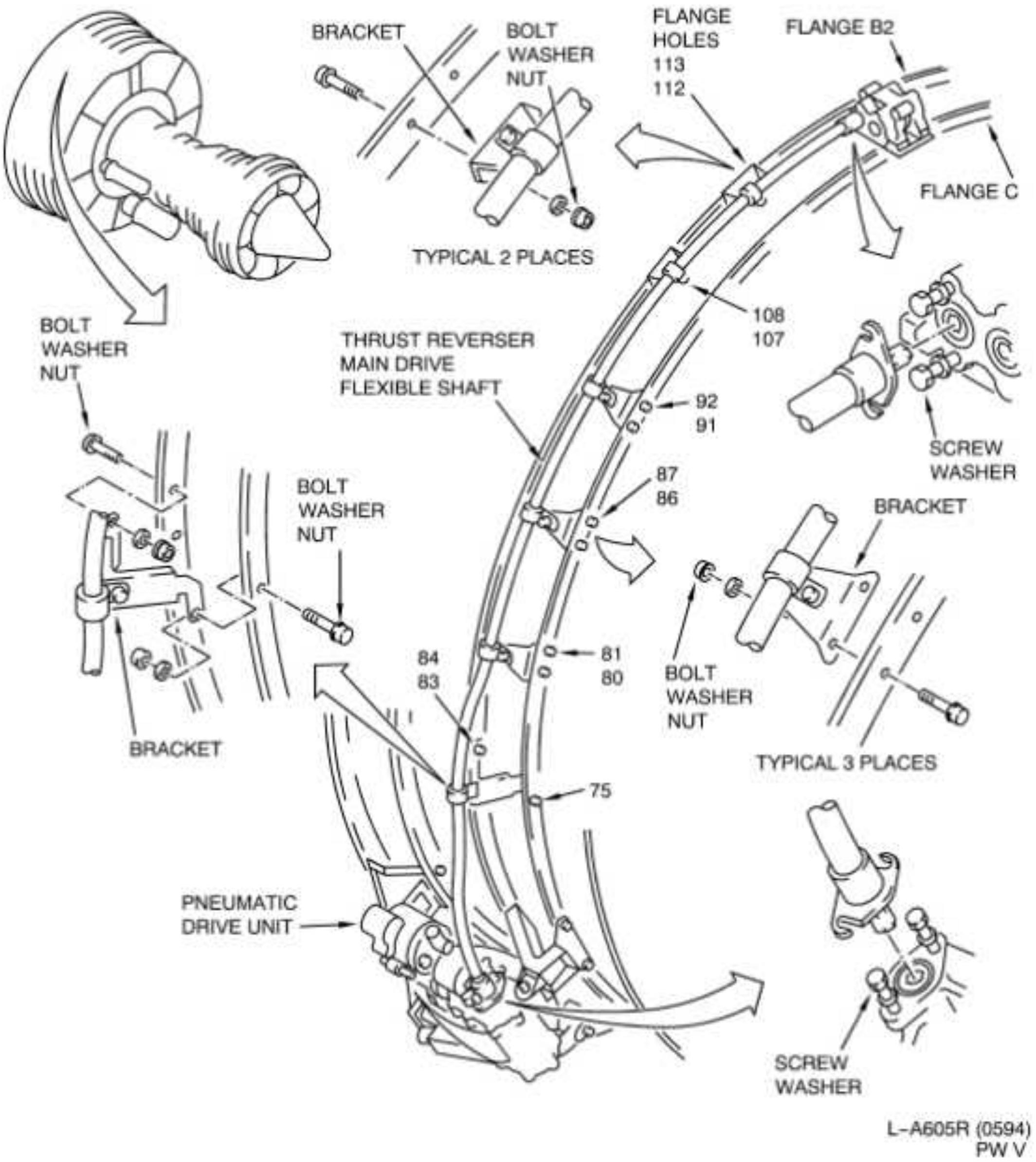
(10) Install bolts, washers and nuts attaching three (3) shaft support brackets to Flange C. Torque nuts 85 - 95 lb-in. (9.604 - 10.734 N.m).

(11) Remove existing bolt, washer and nut from Flange C hole 75.

(12) Position shaft support bracket over Flange C hole 75.

(13) Install bolt, washer and nut attaching one (1) end of bracket to Flange C. Torque nut 85 - 95 lb-in. (9.604 - 10.734 N.m).

(14) Position other end of bracket over Flange B2 holes 83,84.


BRACKET
BOLT
WASHER
NUT
FLANGE
HOLES
113
112
FLANGE B2
FLANGE C
TYPICAL 2 PLACES
108
107
BOLT
WASHER
NUT
THRUST REVERSER
MAIN DRIVE
FLEXIBLE SHAFT
92
91
SCREW
WASHER
87
86
BRACKET
BOLT
WASHER
NUT
84
83
81
80
BOLT
WASHER
NUT
BRACKET
TYPICAL 3 PLACES
75
PNEUMATIC
DRIVE UNIT
SCREW
WASHER
L-A605R (0594)
PW V

Thrust Reverser Main Drive Flexible Shaft
Figure 401
(Task 71−00−33−450−005)

POWER PLANT GENERAL - FAN CASE - INSTALLATION-10

(15) Install bolts, washers and nuts attaching shaft support bracket to Flange B2. Torque nuts 62 - 72 lb-in. (7.005 - 8.135 N.m).

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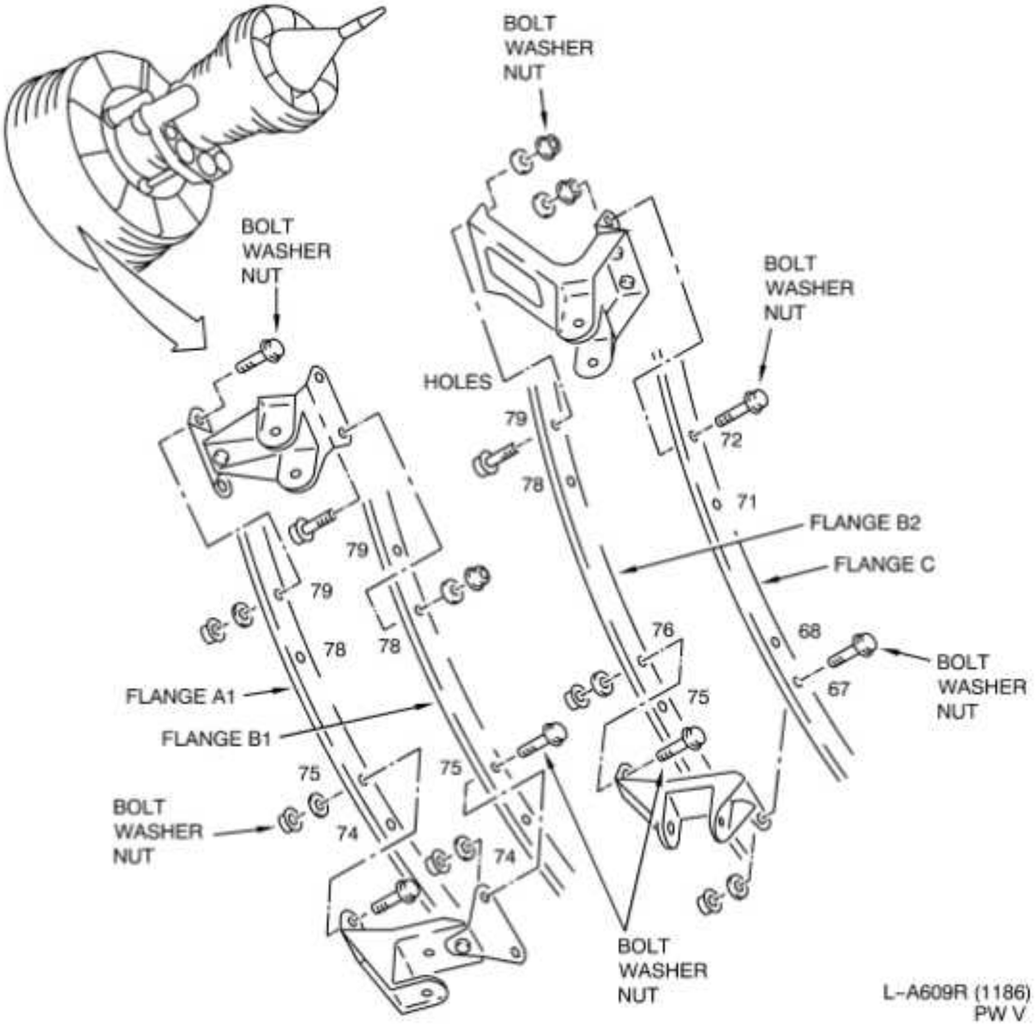
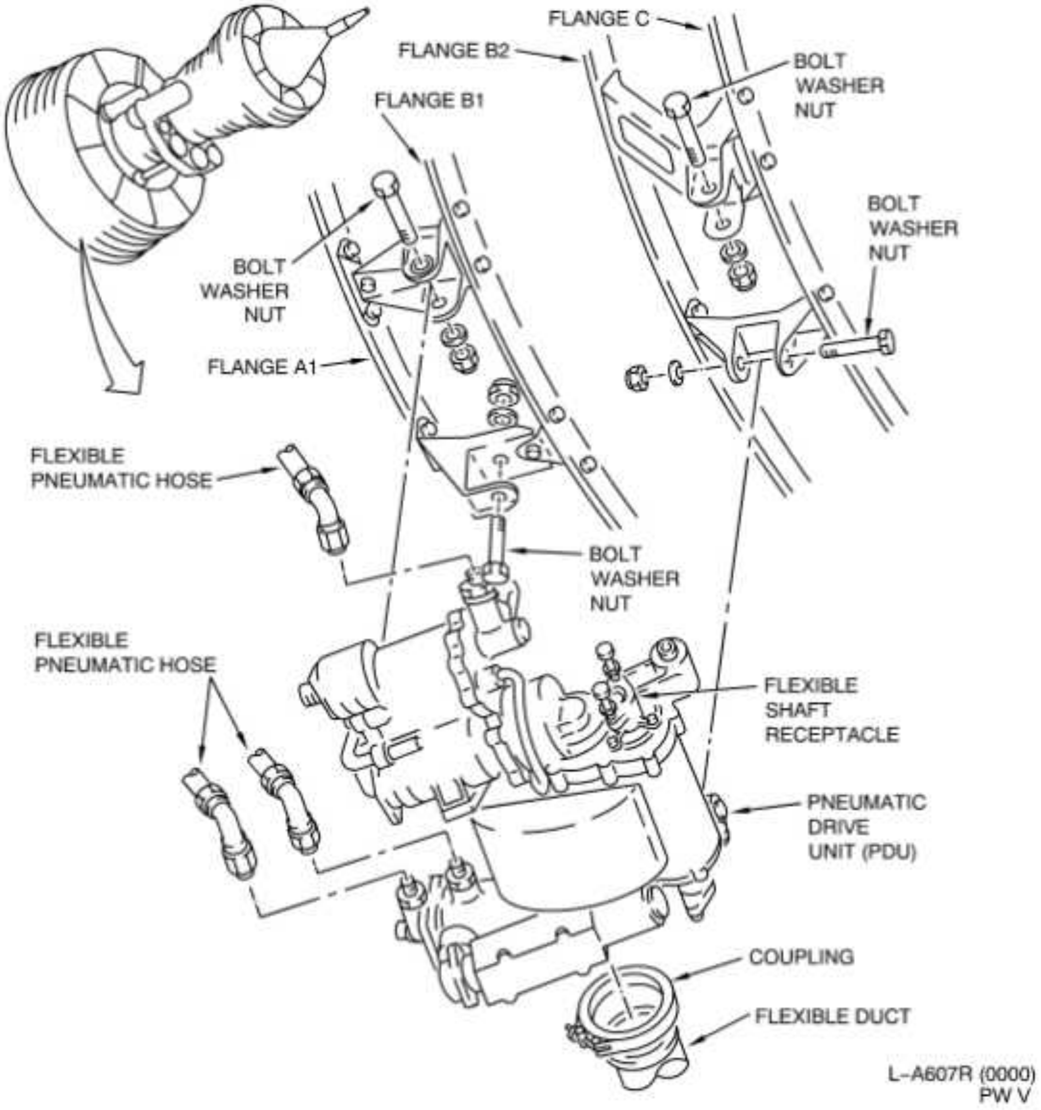
Task 71−00−33−450−003:

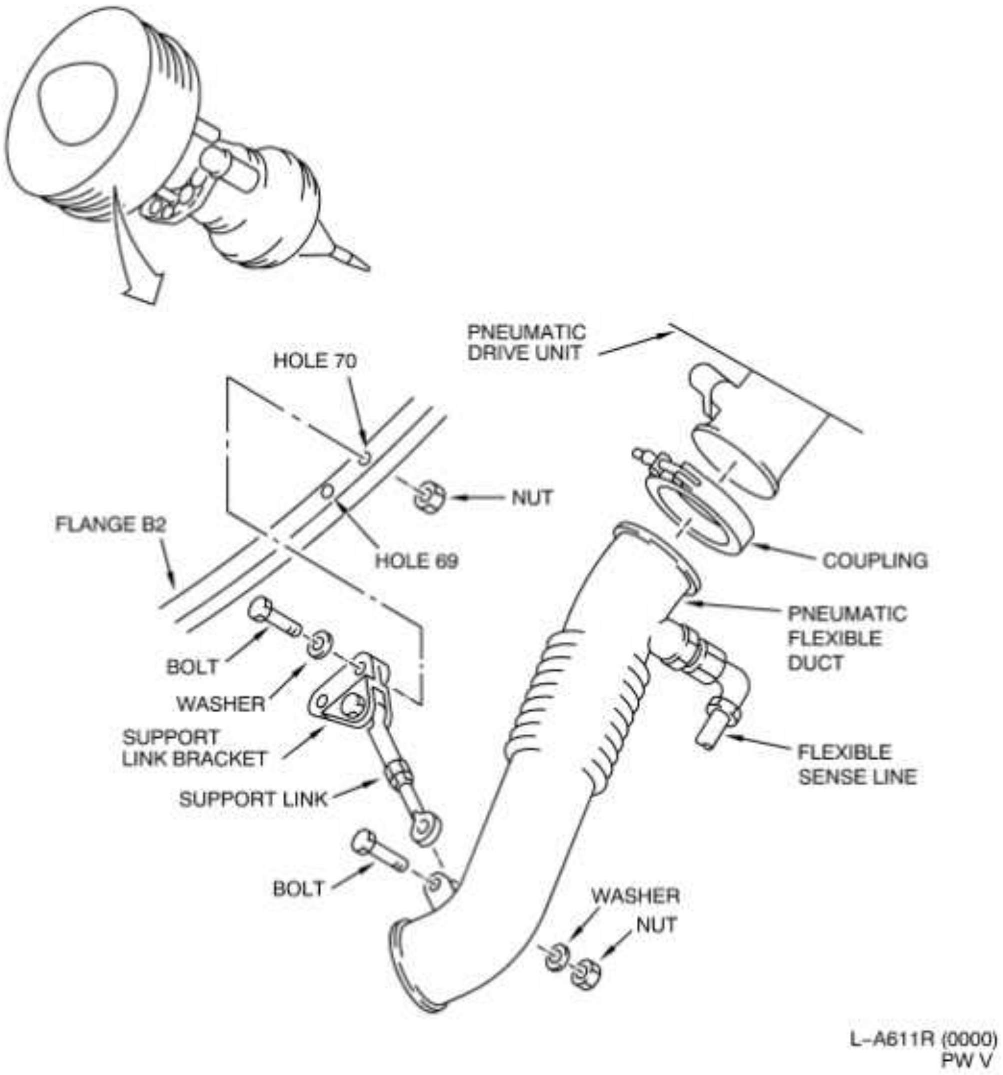
1. Install Thrust reverser Pneumatic Drive Unit (PDU)
    - A. Equipment And Materials Required − None
    - B. Procedure
        - (1) Install PDU support brackets. See Figure 401.
            - (a) Remove existing bolts, washers and nuts from Flange C holes 67,68.
            - (b) Position PDU support bracket over Flange C holes 67,68.
            - (c) Install bolts, washers and nuts attaching support bracket to Flange C. Torque nuts 85 − 95 lb−in. (9.604 − 10.734 N.m).
            - (d) Position other end of bracket over Flange B2 holes 75,76.
            - (e) Install bolts, washers and nuts attaching support bracket to Flange B2. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).
            - (f) Remove existing bolts, washers and nuts from Flange C holes 71,72.
            - (g) Position PDU support bracket over Flange C holes 71,72.
            - (h) Install bolts, washers and nuts attaching support bracket to Flange C. Torque nuts 85 − 95 lb−in. (9.604 − 10.734 N.m).
            - (i) Position other end of bracket over Flange B2 hole 78,79.
            - (j) Install bolts, washers and nuts, attaching support bracket to Flange B2. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).
            - (k) Position PDU support bracket over Flange B1 holes 74,75 and Flange A1 holes 74,75.
            - (l) Install bolts, washers and nuts attaching support bracket to Flanges B1 and A1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).
            - (m) Position PDU support bracket over Flange B1 holes 78,79 and Flange A1 holes 78,79.
            - (n) Install bolts, washers and nuts attaching support bracket to Flanges B1 and A1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).
        - (2) Install PDU. See Figure 402.
            - (a) Position PDU on four (4) PDU support brackets.
            - (b) Install bolts, washers and nuts attaching PDU to four (4) support brackets.
        - (3) Install flexible duct. See Figure 403.
            - (a) Remove protective cover from PDU end of flexible duct and from PDU port.
            - (b) Position flexible duct against PDU port.


BOLT
WASHER
NUT
BOLT
WASHER
NUT
BOLT
WASHER
NUT
HOLES
79
72
78
71
FLANGE B2
FLANGE C
79
79
78
78
76
68
BOLT
WASHER
NUT
67
FLANGE A1
75
FLANGE B1
75
75
BOLT
WASHER
NUT
74
74
BOLT
WASHER
NUT
L-A609R (1186)
PW V

Thrust Reverser PDU Mounting Brackets
Figure 401
(Task 71-00-33-450-003)


FLANGE C
FLANGE B2
BOLT
WASHER
NUT
FLANGE B1
BOLT
WASHER
NUT
BOLT
WASHER
NUT
FLANGE A1
FLEXIBLE
PNEUMATIC HOSE
BOLT
WASHER
NUT
FLEXIBLE
PNEUMATIC HOSE
FLEXIBLE
SHAFT
RECEPTACLE
PNEUMATIC
DRIVE
UNIT (PDU)
COUPLING
FLEXIBLE DUCT
L−A607R (0000)
PW V

Thrust Reverser Pneumatic Drive Unit
Figure 402
(Task 71−00−33−450−003)


PNEUMATIC DRIVE UNIT
HOLE 70
NUT
FLANGE B2
HOLE 69
COUPLING
PNEUMATIC FLEXIBLE DUCT
BOLT
WASHER
SUPPORT LINK BRACKET
FLEXIBLE SENSE LINE
SUPPORT LINK
BOLT
WASHER
NUT
L−A611R (0000)
PW V

Thrust Reverser PDU Flexible Duct
Figure 403
(Task 71−00−33−450−003)

(c) Verify that outside diameters of mating flanges are aligned radially within 0.06 inch (1.524 mm), and angular gap between mating faces of flanges is not greater than 0.04 inch (1.016 mm).
(d) Install coupling attaching flexible duct to PDU. Tighten coupling fingertight.
(e) Install bolts, washers and nuts attaching support link bracket to Flange B2 holes 69,70. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).
(f) Install bolt, washer and nut attaching support link to flexible duct. Torque nut 50 − 70 lb−in. (5.649 − 7.909 N.m).
(g) Torque coupling attaching flexible duct to PDU to value indicated on coupling. Tap around coupling with plastic mallet. Retorque coupling.

C. Postrequisites
(1) Install Thrust Reverser Main Drive Flexible Shaft. See Installation−10 (Task 71−00−33−450−005).

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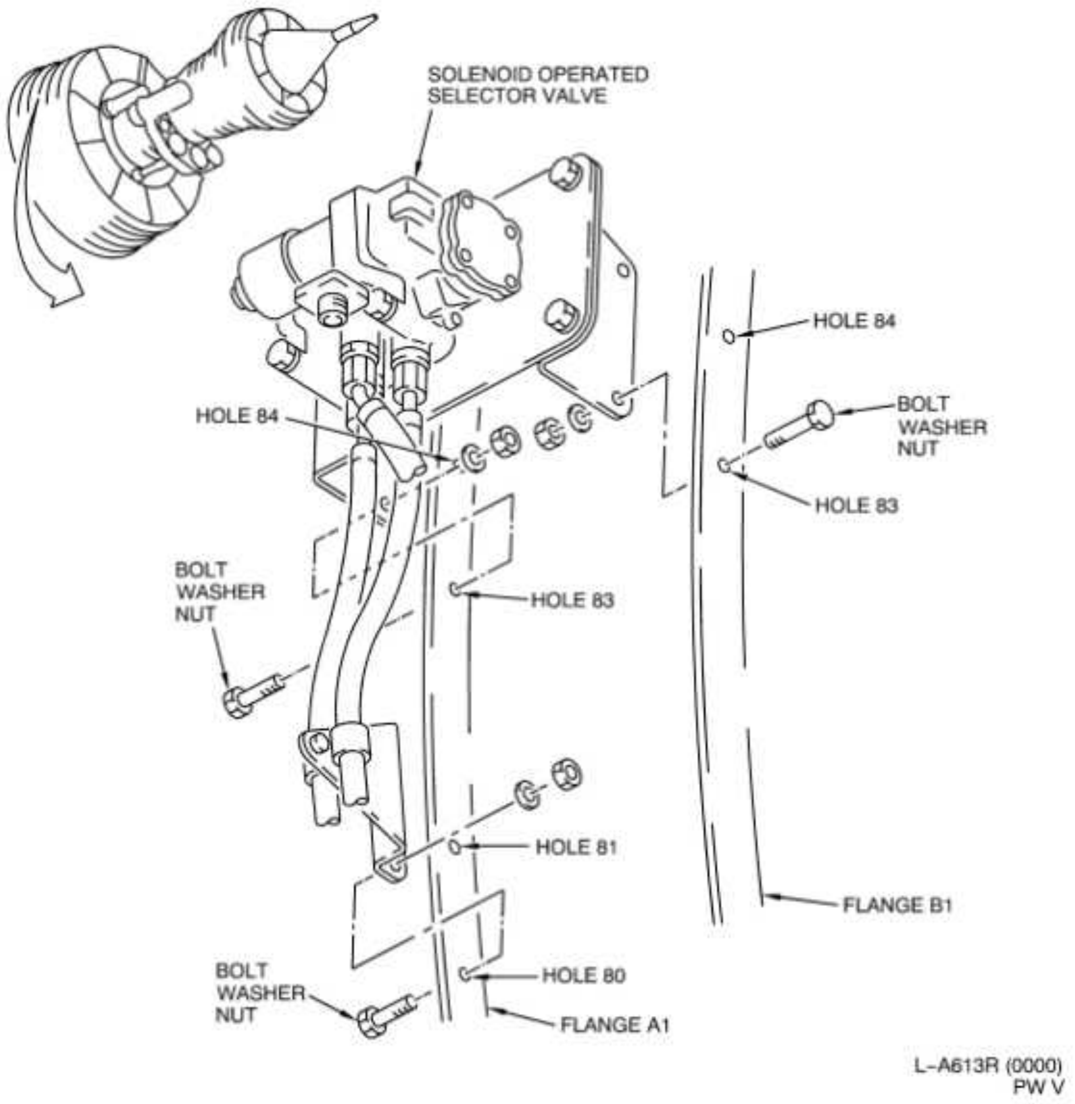
POWER PLANT GENERAL − FAN CASE − INSTALLATION−12

Task 71−00−33−450−007:

1. Install Thrust Reverser Solenoid Operated Selector Valve
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figure 401.
     - (1) Position selector valve mounting bracket, with selector valve, over Flange A1 holes 83,84 and Flange B1 holes 83,84.
     - (2) Install four (4) bolts, washers and nuts attaching selector valve mounting bracket to Flange A1 and B1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).
     - (3) Position flexible hose support bracket, with flexible hoses, over Flange A1 holes 80,81.
     - (4) Install two (2) bolts, washers and nuts attaching flexible hose support bracket to Flange A1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

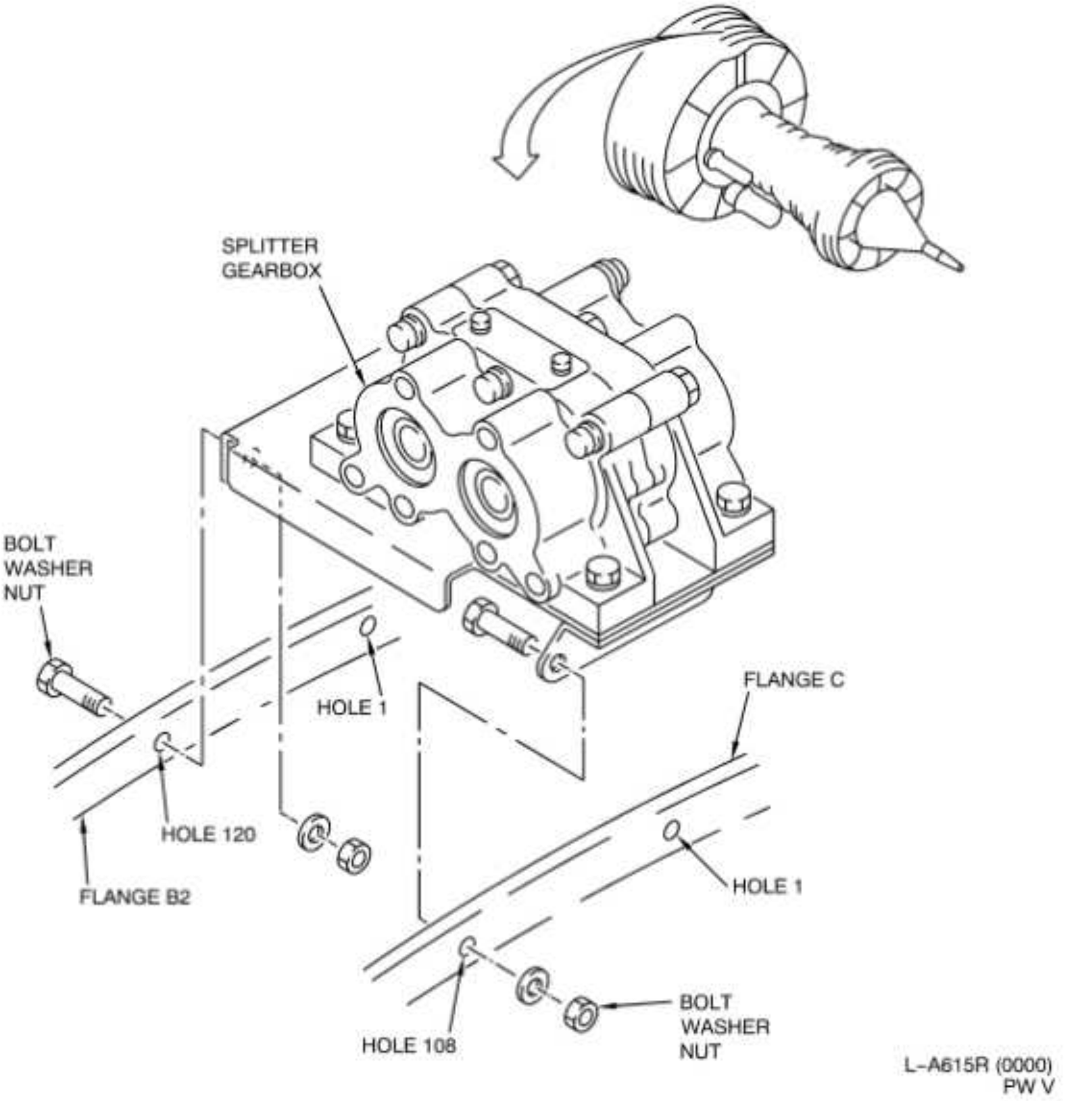

SOLENOID OPERATED SELECTOR VALVE
HOLE 84
BOLT WASHER NUT
HOLE 84
HOLE 83
BOLT WASHER NUT
HOLE 83
HOLE 81
FLANGE B1
BOLT WASHER NUT
HOLE 80
FLANGE A1
L−A613R (0000)
PW V

Thrust Reverser Solenoid Operated Selector Valve
Figure 401
(Task 71−00−33−450−007)

POWER PLANT GENERAL − FAN CASE − INSTALLATION−13

Task 71−00−33−450−006:

1. Install Thrust Reverser Splitter Gearbox
    A. Equipment And Materials Required − None
    B. Procedure
        See Figure 401.
        (1) Remove existing bolts, washers and nuts from Flange C holes 108,1.
        (2) Position splitter gearbox mounting bracket, with splitter gearbox, over Flange C holes 108,1 and Flange B1 holes 120,1.
        (3) Install two (2) bolts, washers and nuts attaching splitter gearbox mounting bracket to Flange C. Torque nuts 85 − 95 lb−in. (9.604 − 10.734 N.m).
        (4) Install two bolts, washers and nuts attaching splitter gearbox mounting bracket to Flange B2. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).


SPLITTER
GEARBOX
BOLT
WASHER
NUT
HOLE 1
FLANGE C
HOLE 120
FLANGE B2
HOLE 1
BOLT
WASHER
NUT
HOLE 108
L−A615R (0000)
PW V

Thrust Reverser Splitter Gearbox
Figure 401
(Task 71−00−33−450−006)

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POWER PLANT GENERAL - FAN CASE - INSTALLATION-14

Task 71-00-33-450-014:

1. Install Fan Case Wire Harness - Pre SB PW4NAC 71-100

A. Equipment and Materials Required

Standard Tools:
Glenair TG-69 Soft Jawed Pliers
Glenair TG-70 Strap Wrench or

Special Tools:
RSE1151 PW Interface Locator
RSE1152 PW Interface Locator

Consumable Materials:

Item No.	Designation
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Lockwire, MS20995C32				

B. Procedure

(1) Install RSE1152 Interface Locator Tool. See Figure 401.
   (a) Position tool on upper right fan case between Flanges A and A1, aligning hole in aft support angle of tool with hole 5 of Flange A.
   (b) Place larger alignment hole in forward locating plate of tool onto fastener on Flange A.
   (c) Secure tool by inserting lockpin through tool.

(2) Install RSE1151 Interface Locator Tool. See Figure 402.
   (a) Position tool on upper left fan case between Flanges A and A1, aligning hole in aft support angle of tool with hole 116 on Flange A1.
   (b) Place large alignment hole in forward locating plate of tool onto fastener on Flange A.
   (c) Secure tool by inserting lockpin through Flange A1 hole 116 and through tool.

(3) Install wire harnesses 21W4068, 21W4116 and 21W4140. See Figures 403, 404 and 405.
   (a) Position wire harness support bracket (1) over holes 80, 81 on fan case Flange A1. Install two bolts, washers and nuts attaching support bracket (1) to Flange A1. Torque nuts 62 - 72 lb-in. (7.005 - 8.135 N.m).

(b) Remove protective cover from connector plug and receptacle and connect electrical connector DH15 to receptacle on T/R selector valve. Tighten connector fingertight plus one–eighth turn. Lockwire connector.

(c) Remove protective cover from connector plug and receptacle and connect electrical connector DS304 to receptacle on PDU. Tighten connector fingertight plus one–eighth turn. Lockwire connector.

(d) Install two harness support brackets (2).
   - 1 Remove existing bolts, washers and nuts from holes 78, 79 and 75 on Flange A1.
   - 2 Position two support brackets (2) over holes 78, 79 and 75, 76 on Flange A1.
   - 3 Install bolts, washers and nuts attaching support brackets (2) and PDU support to Flange A1.
   - 4 Torque nuts 62 – 72 lb–in. (7.005 – 8.135 N.m).

(e) Position three harness support brackets (2) over holes 72, 73; 69, 70 and 66, 67 on fan case Flange A1. Install bolts, washers and nuts attaching three support brackets (2) to Flange A1. Torque nuts 62 – 72 lb–in. (7.005 – 8.135 N.m).

(f) Position harness support bracket (3) over holes 67, 68 on fan case Flange B1. Install two bolts, washers and nuts attaching support brackets (3) to Flange B1. Torque nuts 62 – 72 lb–in. (7.005 – 8.135 N.m).

(g) Remove protective cover from connector plug and receptacle and connect electrical connector DH9 to receptacle on T/R regulating and shutoff valve. Tighten connector fingertight plus one–eighth turn. Lockwire connector.

(h) Install harness support bracket (2).
   - 1 Remove existing bolt, washer and nut from hole 63 on Flange A1.
   - 2 Position support bracket (2) over holes 63, 64 on Flange A1.
   - 3 Install bolts, washers and nuts attaching support bracket (2) and anti–ice duct support link bracket to Flange A1.
   - 4 Torque nuts 62 – 72 lb–in. (7.005 – 8.135 N.m).

     NOTE: Harness installation continues on fan case lower right quarter. See Figure 404.

(i) Install harness support bracket (2).

1 Remove existing bolt, washer and nut from hole 61 on Flange A1.
2 Position support bracket (2) over holes 60, 61 on Flange A1.
3 Install bolts, washers and nuts attaching support bracket (2) and anti−ice duct support link bracket to Flange A1.
4 Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(j) Position wire harness support bracket (2) over holes 57, 58 on fan case Flange A1. Install two bolts, washers and nuts attaching support bracket (2) to Flange A1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(k) Position wire harness support bracket (4) over holes 56, 57 on fan case Flange B1. Install two bolts, washers and nuts attaching support bracket (4) to Flange B1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(l) Position wire harness support bracket (5) over holes 54, 55 on fan case Flange B2. Install two bolts, washers and nuts attaching support bracket (5) to Flange B2. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(m) Remove existing bolts, washers and nuts from Flange C holes 45, 46 and 48, 49. Position two wire harness support brackets (6) over holes 48, 49 and 45, 46 on fan case Flange C. Install bolts, washers and nuts attaching two support brackets (6) to Flange C. Torque nuts 85 − 95 lb−in. (9.604 − 10.734 N.m).

(n) Remove existing bolts, washers and nuts from Flange C holes 40, 41 and 42, 43. Position two wire harness support brackets (7) over holes 42, 43 and 40, 41 on fan case Flange C. Install bolts, washers and nuts attaching two support brackets (7) to Flange C. Torque nuts 85 − 95 lb−in. (9.604 − 10.734 N.m).

(o) Position wire harness support bracket (8) over holes 47, 48 on fan case Flange B2. Install two bolts, washers and nuts attaching support bracket (8) to Flange B2. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(p) Attach screw, nut and cable clamp (9), with wire harness, to existing support bracket on Flange B1. See Figure 404, View B.

(q) Remove protective cover from connector plug and receptacle and connect electrical connector DV220 to receptacle on anti−ice shutoff and regulating valve. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(r) Remove protective cover from connector plug and receptacle and connect electrical connector DS300 to receptacle on anti−ice pressure switch. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(s) Position wire harness support bracket (10) over holes 43, 44 on fan case Flange B2. Install two bolts, washers and nuts attaching support bracket (10) to Flange B2. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(t) Position wire harness support bracket (11) over holes 42, 43 on fan case Flange B1. Install two bolts, washers and nuts attaching support bracket (11) to Flange B1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(u) Position wire harness support bracket (12) over holes 40, 41 on fan case Flange A1. Install two bolts, washers and nuts attaching support bracket (12) to Flange A1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(v) Position wire harness support bracket (5) over holes 43, 44 on fan case Flange A1. Install two bolts, washers and nuts attaching support bracket (5) to Flange A1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(w) Install harness support bracket (2).
  1 Remove existing bolts, washers and nuts from holes 45, 46 on Flange A1.
  2 Position support bracket (2) over holes 45, 46 on Flange A1.
  3 Install bolts, washers and nuts attaching support bracket (2) and anti−ice duct support link bracket to Flange A1.
  4 Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(x) Install harness support bracket (13).
  1 Remove existing bolts, washers and nuts from holes 37, 38 on Flange A1.
  2 Position support bracket (13) over holes 37, 38 on Flange A1.
  3 Install bolts, washers and nuts attaching support bracket (13) and fan cowl door hold−open rod bracket to Flange A1.
  4 Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(y) Position two wire harness support brackets (13) holes 34, 35 and 31, 32 on fan case Flange A1. Install bolts, washers and nuts attaching two support brackets (13) to Flange A1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

NOTE: Harness installation continues on fan case upper right quarter. See Figure 405.

(z) Connect D4970P, D4963, and D4967P to interface locator tool.

(aa) Position three wire harness support bracket (13) over holes 28, 29; 25, 26 and 22, 23 on fan case Flange A1. Install bolts, washers and nuts attaching three support brackets (13) to Flange A1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(ab) Position harness support bracket (11) over holes 21, 22 on fan case Flange B1. Install two bolts, washers and nuts attaching support bracket (11) to Flange B1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(ac) Remove protective cover from connector plug and receptacle and connect electrical connector D5011P to receptacle on right T/R J−box. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(ad) Position four wire harness support brackets (14) over holes 19, 20; 16, 17; 13, 14 and 10, 11 on fan case Flange A1. Install bolts, washers and nuts attaching four support brackets (14) to Flange A1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(ae) Position harness support bracket (15) over holes 8, 9 on fan case Flange A1. Install two bolts, washers and nuts attaching support bracket (15) to Flange A1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(af) Remove screw and nut attaching clamp (16) to bracket (15). Insert existing wire harness from vibration accelerometer into clamp (16). Reattach clamp (16), screw and nut to bracket (15). See Figure 405, View A.

(4) Install wire harnesses 21W4076, 21W4132 and 21W4150. See Figure 406.

(a) Connect D4989P, D4953P, and D4966P to interface locator tool.

(b) Position harness support bracket (17) over holes 6, 7 on fan case Flange B2. Install two bolts, washers and nuts attaching support bracket (17) to Flange B2. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(c) Straighten and lay out wire harnesses, brackets and electrical connectors that are to go across the top of the fan case to the upper left side.

(d) Position two harness support brackets (18) over holes 4, 5 and 1, 2 on fan case Flange B1. Install bolts, washers and nuts attaching two support brackets (18) to Flange B1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(e) Remove screw and nut attaching harness clamps to two brackets (18). Insert existing wire harness (19) into clamp (20). Reattach clamps, screw and nut to bracket (18).

(f) Install harness support bracket (21).
   1 Remove existing bolts, washers and nuts from holes 9, 10 on Flange B2.
   2 Position support bracket (21) over holes 9, 10 on Flange B2.
   3 Install bolts, washers and nut attaching support bracket (21) and PMUX support to Flange B2.
   4 Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(g) Install harness support bracket (22).
   1 Remove existing bolts, washers and nuts from holes 11, 12 on Flange B2.
   2 Position support bracket (22) over holes 11, 12 on Flange B2.
   3 Install bolts, washers and nuts attaching support bracket (22) and multiplexer support to Flange B2.
   4 Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(h) Remove screw and nut attaching harness clamps to support bracket (22). Insert existing wire harness (19) into clamp (23). Reattach clamps, screw and nut to bracket (22).

(i) Attach screw, nut and harness clamp (24), with wire harness, to existing support bracket on Flange B2.

(j) Remove protective cover from connector plugs and receptacles and connect electrical connectors D5006, D5010P and D5007P to their respective receptacles on right T/R J−box. Tighten connectors fingertight plus one−eighth turn. Lockwire connector.

(5) Install wire harnesses 21W4076, 21W4132 and 21W4150. See Figure 407.

(a) Straighten and lay out wire harnesses, brackets and electrical connectors that were passed across the top of the fan case from upper right side.

(b) Connect D4998P and D4999P to interface locator tool.

(c) Position harness support bracket (18) over holes 118, 119 on fan case Flange B1. Install two bolts, washers and nuts attaching support bracket (18) to Flange B1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(d) Remove screw and nut attaching harness clamps to bracket (18). Insert existing wire harness (19), that joins wire harness (25), into clamp (20). Reattach clamps, screw and nut to bracket (18).

(e) Position harness support bracket (18) over holes 115, 116 on fan case Flange B1. Install two bolts, washers and nuts attaching support bracket (18) to Flange B1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(f) Position harness support bracket (26) over holes 112, 113 on fan case Flange B1. Install two bolts, washers and nuts attaching support bracket (26) to Flange B1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(g) Connect electrical connector D5002P to respective receptacle on left T/R J−box as follows.

  1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol (P11−009). Let dry.

  2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

  NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

  CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS

VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the (Glenair TG−70) strap wrench or the (Glenair TG−69) soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

See the instructions given with the strap wrench for correct use.

(6) Install wire harnesses 21W4118, and 21W4120. See Figure 408.
  (a) Attach clamps (27, 28), with harnesses, screw and nut to forward edge of left T/R J−box.
  (b) Position harness support bracket (29) over holes 105, 106 on fan case Flange A1. Install two bolts, washers and nuts attaching support bracket (29) to Flange A1. Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).
  (c) Remove screw and nut attaching existing harness clamps to support bracket on Flange B1 above center of EEC. Position harness clamp (28), with harness 21W4120, over support bracket. Attach harness clamp (28), screw and nut to support bracket, including existing clamps.
  (d) Install harness support bracket (30).
    1 Remove bolts, washers and nuts from holes 104, 105 of Flange B2.
    2 Position wire harness support bracket (30) over holes 104, 105 on fan case Flange B2.
    3 Install two bolts, washers and nuts attaching support bracket (30), EEC support and hydraulic tubing support to Flange B2.
    4 Torque nuts 62 − 72 lb−in. (7.005 − 8.135 N.m).
  (e) Attach screw, nut and harness clamp (28), with wire harnesses, to existing support bracket on each side of EEC.

(f) Connect two electrical connectors D50001P and D5000P to respective receptacles on EEC as follows.

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol (P11−009). Let dry.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the (Glenair TG−70) strap wrench or the (Glenair TG−69) soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

See the instructions given with the strap wrench for correct use.

(g) Connect electrical connectors D5020P, D5021P and D5022P to respective receptacles on left T/R J−box as follows.

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol (P11−009). Let dry.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the (Glenair TG−70) strap wrench or the (Glenair TG−69) soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).

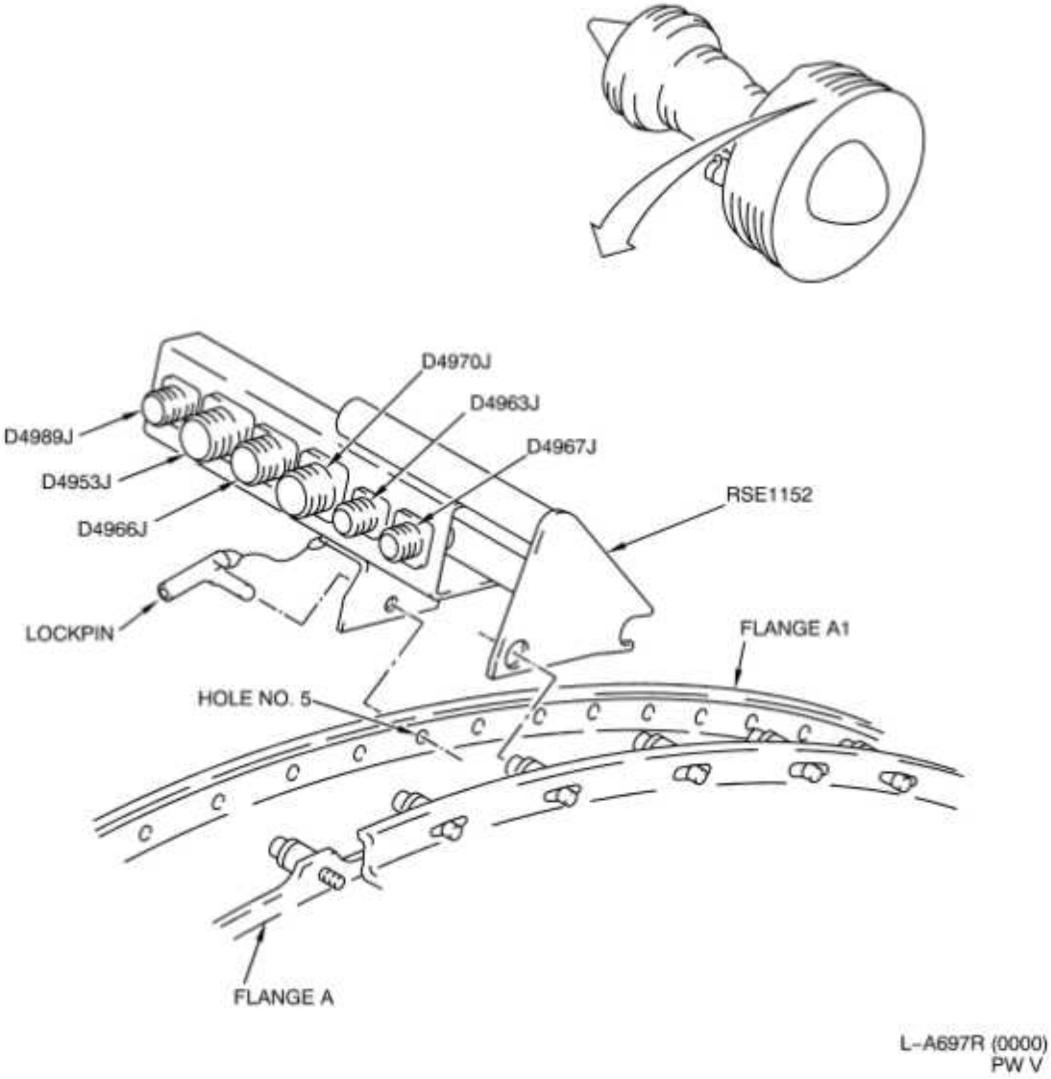
This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

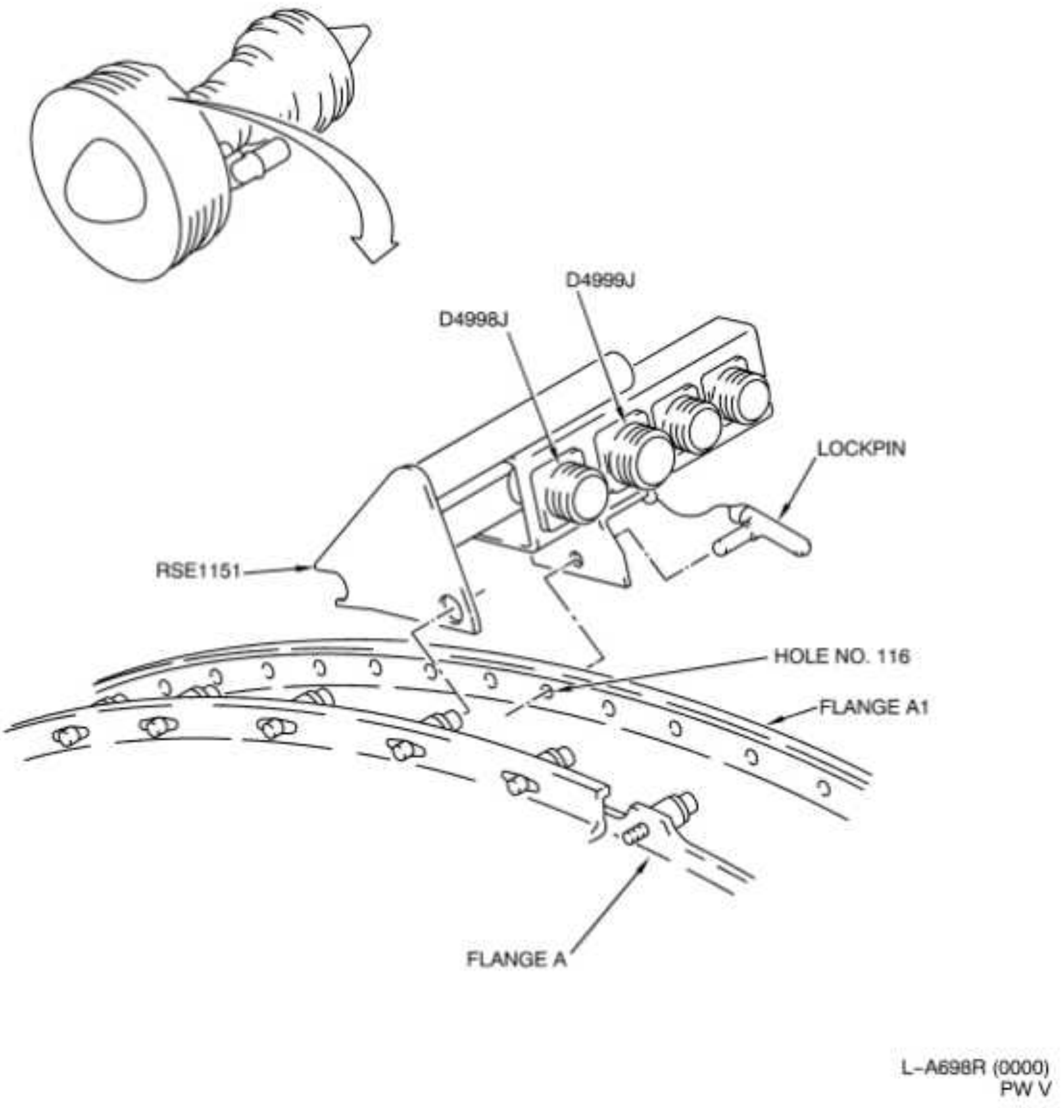
See the instructions given with the strap wrench for correct use.

C. Postrequisites

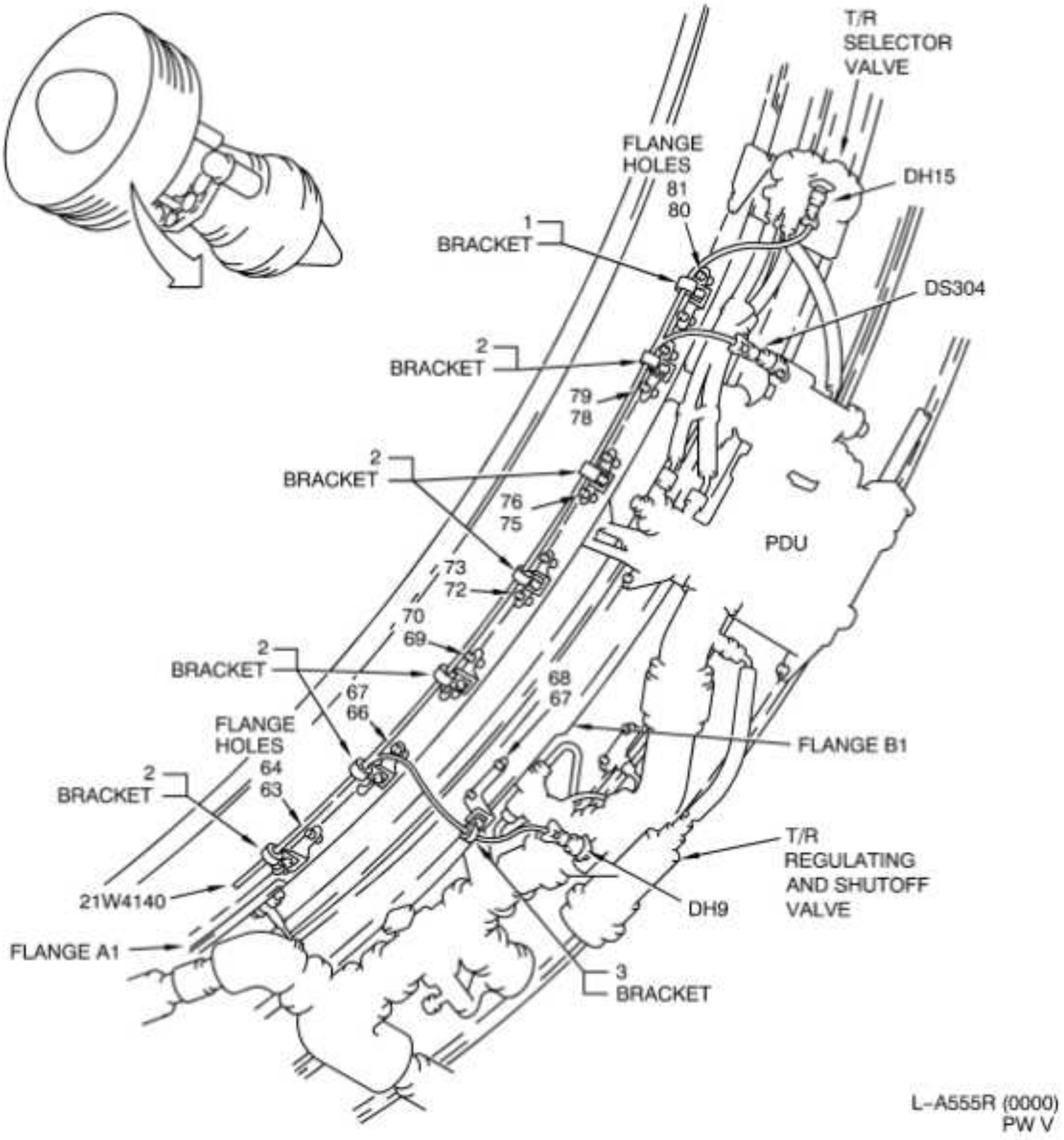
(1) Install inlet cowl. See Installation−01, (Task 71−00−33−450−001).


D4970J
D4963J
D4967J
D4989J
D4953J
D4966J
RSE1152
LOCKPIN
FLANGE A1
HOLE NO. 5
FLANGE A
L−A697R (0000)
PW V

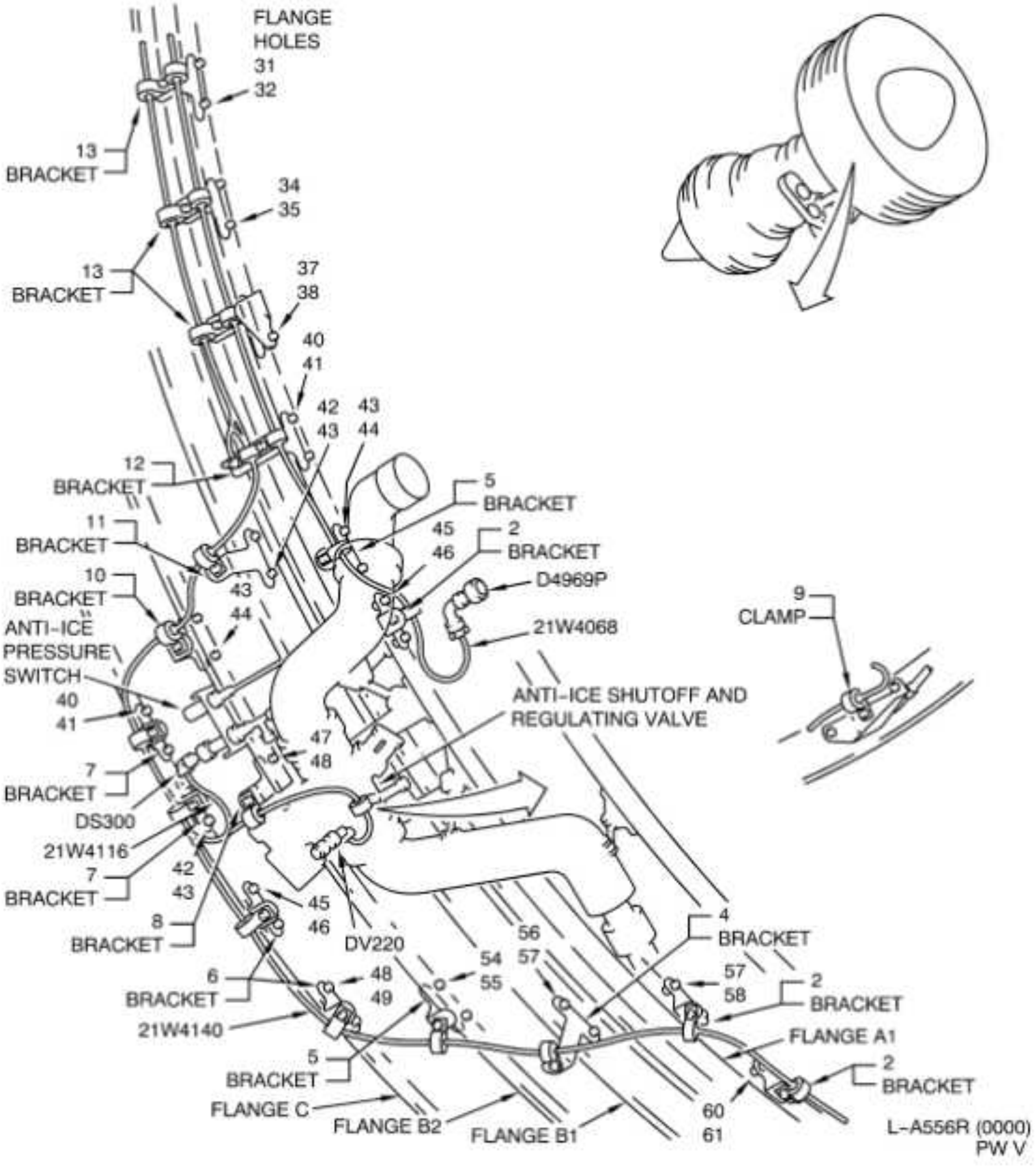
RSE1152 Interface Locator Tool, Upper Right Fan Case
Figure 401
(Task 71−00−33−450−014)


D4999J
D4998J
LOCKPIN
RSE1151
HOLE NO. 116
FLANGE A1
FLANGE A
L−A698R (0000)
PW V

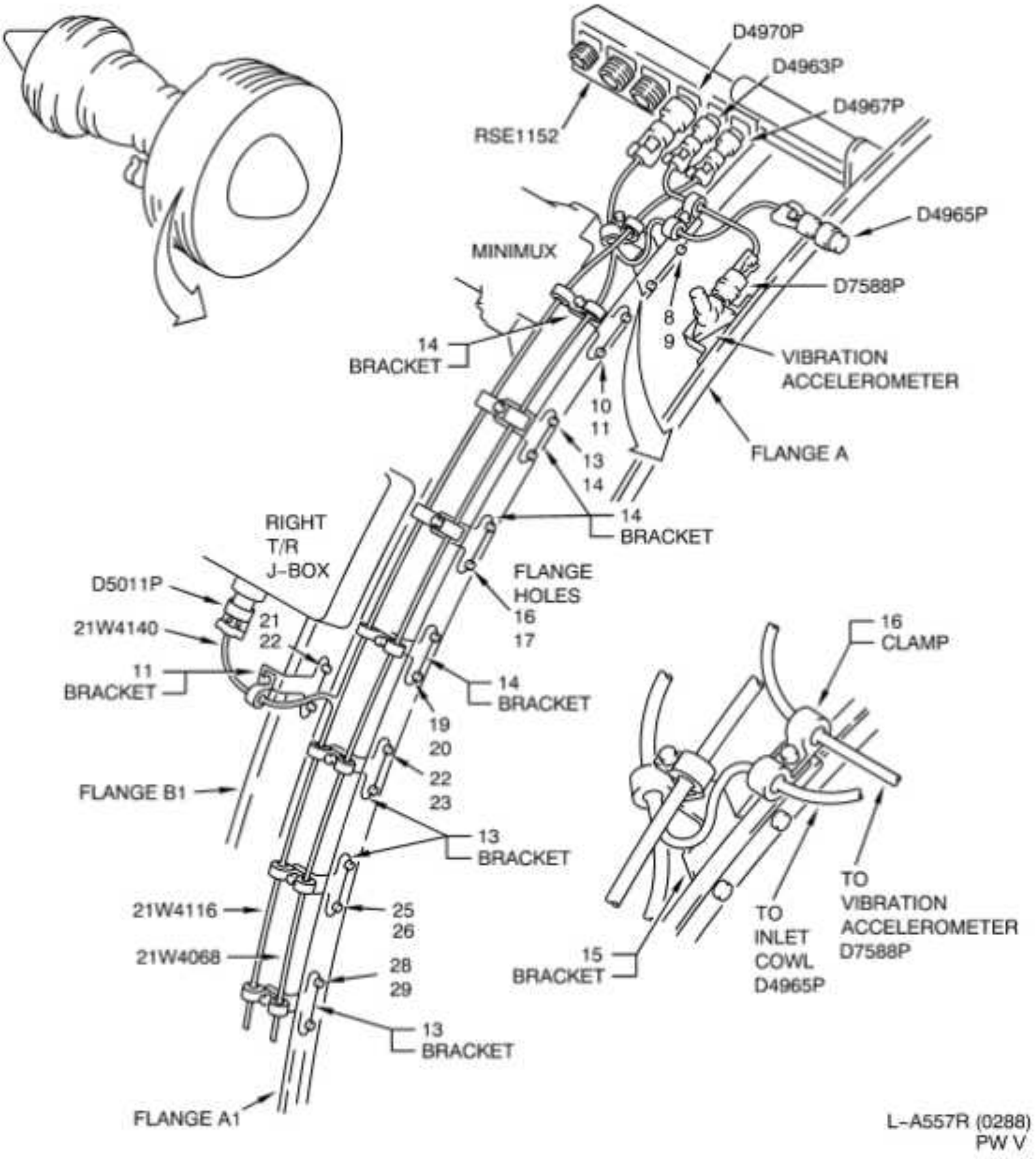
RSE1151 Interface Locator Tool, Upper Left Fan Case
Figure 402
(Task 71−00−33−450−014)


T/R SELECTOR VALVE
FLANGE HOLES
81
80
DH15
1 BRACKET
DS304
2 BRACKET
79
78
2 BRACKET
76
75
PDU
73
72
70
69
2 BRACKET
68
67
67
66
FLANGE HOLES
64
63
FLANGE B1
2 BRACKET
T/R REGULATING AND SHUTOFF VALVE
21W4140
DH9
FLANGE A1
3 BRACKET
L−A555R (0000)
PW V

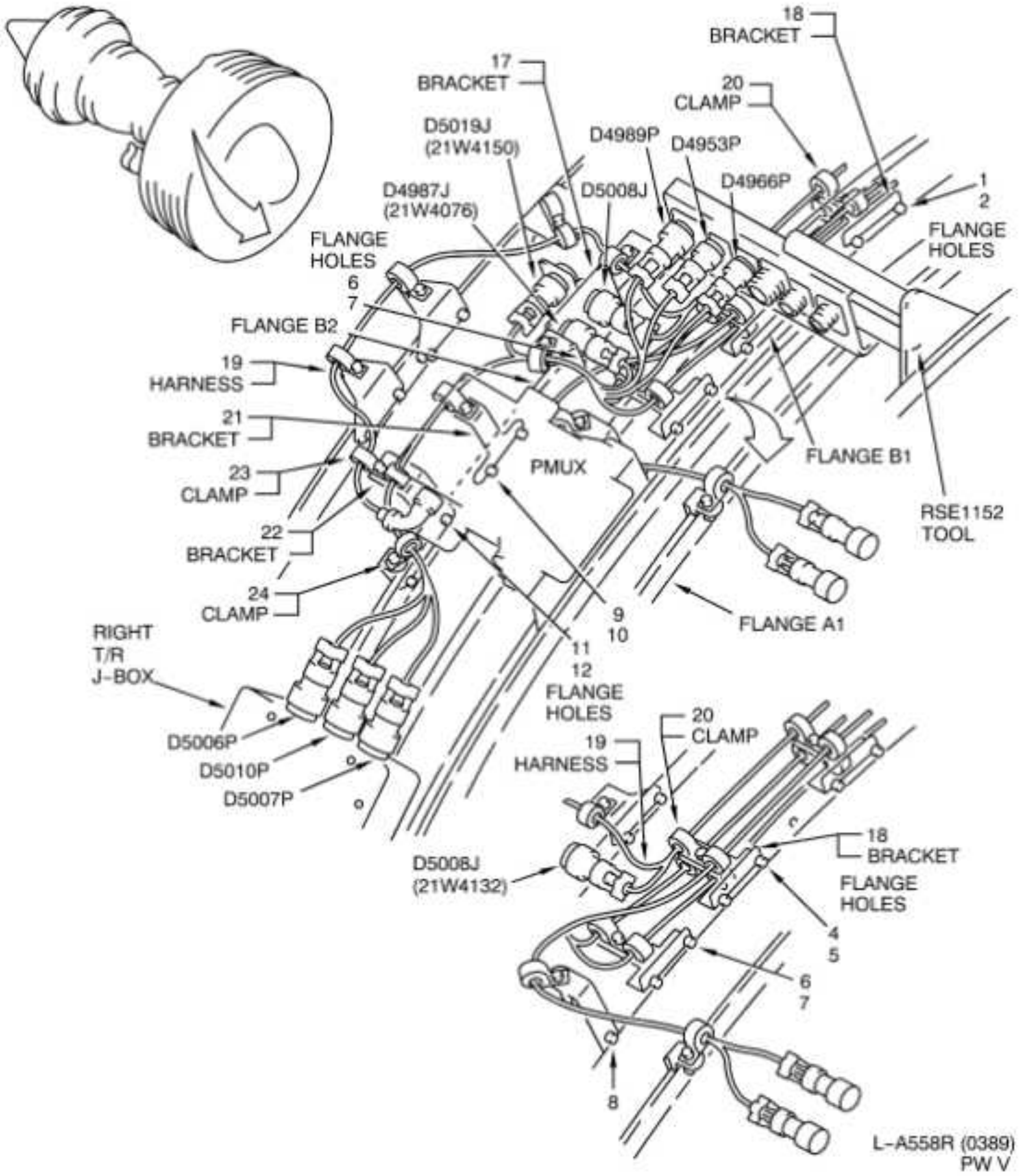
Fan Case Wire Harness, Lower−Left Quarter
Figure 403
(Task 71−00−33−450−014)


FLANGE HOLES
31
32
13
BRACKET
34
35
13
BRACKET
37
38
40
41
42
43
43
44
12
BRACKET
5
BRACKET
11
BRACKET
45
46
2
BRACKET
D4969P
10
BRACKET
43
44
21W4068
9
CLAMP
ANTI-ICE PRESSURE SWITCH
40
41
ANTI-ICE SHUTOFF AND REGULATING VALVE
47
48
7
BRACKET
DS300
21W4116
7
BRACKET
42
43
45
46
8
BRACKET
DV220
56
57
4
BRACKET
6
BRACKET
48
49
54
55
57
58
2
BRACKET
21W4140
FLANGE A1
5
BRACKET
2
BRACKET
FLANGE C
FLANGE B2
FLANGE B1
60
61
L-A556R (0000)
PW V

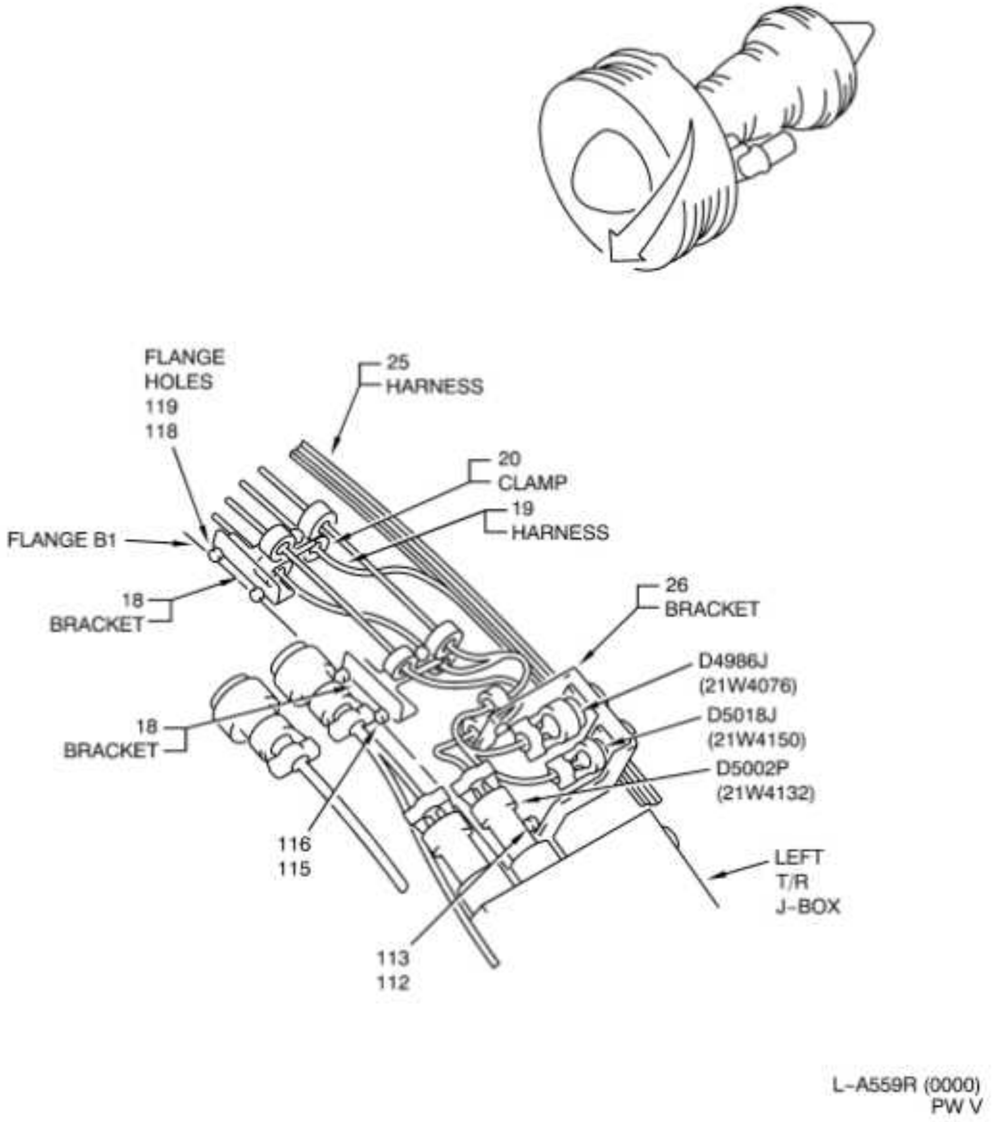
Fan Case Wire Harness, Lower−Right Quarter
Figure 404
(Task 71−00−33−450−014)


D4970P
D4963P
D4967P
RSE1152
D4965P
MINIMUX
D7588P
8
9
14
BRACKET
VIBRATION
ACCELEROMETER
10
11
FLANGE A
13
14
14
BRACKET
RIGHT
T/R
J-BOX
FLANGE
HOLES
16
17
D5011P
21W4140
21
22
16
CLAMP
11
BRACKET
14
BRACKET
19
20
22
23
FLANGE B1
13
BRACKET
TO
VIBRATION
ACCELEROMETER
D7588P
21W4116
25
26
TO
INLET
COWL
D4965P
15
BRACKET
21W4068
28
29
13
BRACKET
FLANGE A1
L-A557R (0288)
PW V

Fan Case Wire Harness, Upper−Right Quarter
Figure 405
(Task 71−00−33−450−014)

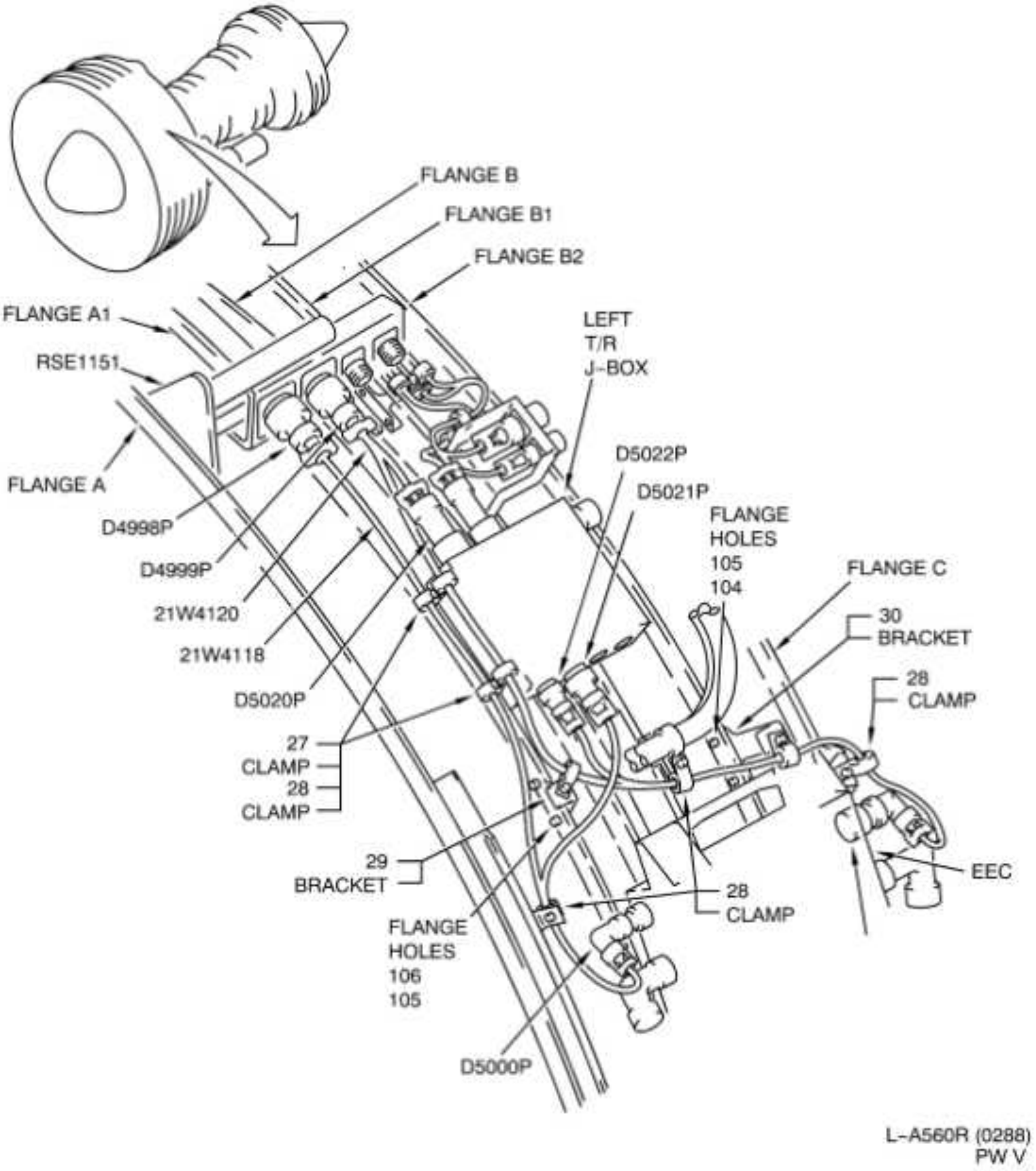

18
BRACKET
17
BRACKET
20
CLAMP
D5019J
(21W4150)
D4989P
D4953P
D4987J
(21W4076)
D5008J
D4966P
1
2
FLANGE
HOLES
FLANGE
HOLES
6
7
FLANGE B2
19
HARNESS
21
BRACKET
PMUX
FLANGE B1
23
CLAMP
RSE1152
TOOL
22
BRACKET
24
CLAMP
9
10
FLANGE A1
RIGHT
T/R
J-BOX
11
12
FLANGE
HOLES
D5006P
D5010P
D5007P
20
CLAMP
19
HARNESS
18
BRACKET
D5008J
(21W4132)
FLANGE
HOLES
4
5
6
7
8
L-A558R (0389)
PW V

Fan Case Wire Harness, Upper−Right Quarter
Figure 406
(Task 71−00−33−450−014)


FLANGE
HOLES
119
118
25
HARNESS
20
CLAMP
19
HARNESS
FLANGE B1
18
BRACKET
26
BRACKET
D4986J
(21W4076)
D5018J
(21W4150)
D5002P
(21W4132)
18
BRACKET
116
115
LEFT
T/R
J-BOX
113
112
L-A559R (0000)
PW V

Fan Case Wire Harness, Upper−Left Quarter
Figure 407
(Task 71−00−33−450−014)

POWER PLANT GENERAL − FAN CASE − INSTALLATION−14


FLANGE B
FLANGE B1
FLANGE B2
FLANGE A1
RSE1151
FLANGE A
LEFT
T/R
J-BOX
D5022P
D5021P
FLANGE
HOLES
105
104
FLANGE C
30
BRACKET
28
CLAMP
D4998P
D4999P
21W4120
21W4118
D5020P
27
CLAMP
28
CLAMP
29
BRACKET
FLANGE
HOLES
106
105
28
CLAMP
EEC
D5000P
L-A560R (0288)
PW V

Fan Case Wire Harness, Upper−Left Quarter
Figure 408
(Task 71−00−33−450−014)

Task 71−00−33−450−014−A:

2. Install Fan Case Wire Harness − Post SB PW4NAC 71−100

A. Equipment and Materials Required

Standard Tools:
Glenair TG−69 Soft Jawed Pliers
Glenair TG−70 Strap Wrench or

Special Tools:
RSE1151 PW Interface Locator
RSE1152 PW Interface Locator

Consumable Materials:

Item No.	Designation
P11−009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Lockwire, MS20995C32				

B. Procedure
- (1) Install RSE1152 Interface Locator Tool. See Figure 409.
  - (a) Position tool on upper right fan case between Flanges A and A1, aligning hole in aft support angle of tool with hole 5 of Flange A.
  - (b) Place larger alignment hole in forward locating plate of tool onto fastener on Flange A.
  - (c) Secure tool by inserting lockpin through Flange A1 hole 5 and through tool.
- (2) Install RSE1151 Interface Locator Tool. See Figure 410.
  - (a) Position tool on upper left fan case between Flanges A and A1, aligning hole in aft support angle of tool with hole 116 on Flange A1.
  - (b) Place large alignment hole in forward locating plate of tool onto fastener on Flange A.
  - (c) Secure tool by inserting lockpin through Flange A1 hole 116 and through tool.
- (3) Install wire harnesses 21W4068, 21W4116 and 21W4140.
  - (a) Remove protective covers and connect electrical connectors DH15 to thrust reverer selector valve, DS304 to PDU, and DH9 to thrust reverser regulating and shutoff valve. Tighten connectors fingertight plus one−eighth turn. Lockwire connectors. See Figure 411.

   (b) Install harenesses, clamps, and attaching hardware on brackets (31, 32, 33). Torque nuts 32 − 36 lb−in. (3.616 − 4.067 N.m).
   (c) Remove protective covers and connect electrical connectors DV220 to anti−ice shutoff and regulating valve, and DS300 to anti−ice pressure switch. Tighten connector fingertight plus one−eighth turn. Lockwire connectors. See Figure 412.
   (d) Install grounding wire to stud using attaching hardware. Torque nut to 20 − 25 lb−in. (2.26 − 2.82 N.m).
   (e) Install harnesses, clamps, and attaching hardware to brackets (21 through 31). Torque nuts 32 − 36 lb−in. (3.616 − 4.067 N.m).
   (f) Remove protective covers and connect electrical connectors D4970P, D4963P, and D4967P to RSE1152 tool, DT588 to vibration accelerometer, and D5011P and D5053P to right thrust reverser J−box. Tighten connectors fingertight plus one−eighth turn. Lockwire connectors. See Figure 413.
   (g) Install harnesses, clamps, and attaching hardware to brackets (14 through 20). Torque nuts 32 − 36 lb−in. (3.616 − 4.067 N.m).

(4) Install wire harnesses 21W4075, 21W4076, 21W4132, and 21W4150. See Figure 413.
   (a) Position harnesses on top of fan case and drape over to upper left side.
   (b) Remove protective covers and connect electrical connectors D4989P, D4953P, and D4966P to RSE1152 tool; D5019J, D5008P, and D4987J to bracket (9); and D5006P, D5007P, D5051P, and D5010P to right thrust reverser J−box. Tighten connectors fingertight plus one−eighth turn. Lockwire connectors.
   (c) Install harnesses, clamps, and attaching hardware to brackets (10 through 13) to fan case. Torque nuts 32 − 36 lb−in. (3.616 − 4.067 N.m).

(5) Install wire harness 21W4083.
   (a) Remove protective covers and connect electrical connector D5052P to right side J−box and electrical connect DS308 to barometric switch. See Figure 413.

(6) Install wire harnesses 21W4076, 21W4132, and 21W4150.
   (a) Straighten and lay out wire harnesses that were passed across the top of the fan case from upper right side. See Figure 414.
   (b) Connect electrical connector D5002P to left thrust reverser J−box as follows:

1 Remove the protective covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, clean the connector and receptacle with Denatured Alcohol (P11−009). Allow hardware to dry.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nuts.

CAUTION: USE THE CORRECT ASSEMBLY PROCEDURE AND TOOLS FOR THE HARNESS CONNECTOR INSTALLATION. IF YOU USE THE INCORRECT ASSEMBLY PROCEDURE OR TOOLS, A DAMAGED OR LOOSE CONNECTION CAN OCCUR. A LOOSE CONNECTOR PERMITS VIBRATION, WHICH CAN CAUSE THE CONTACTS TO WEAR AND THEREBY PROVIDE UNSATISFACTORY LIGHTNING PROTECTION.

3 Use the (Glenair TG−70) strap wrench or the (Glenair TG−69) soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
−the connector coupling nut is fully tight
−the connector fits tightly against the receptacle (metal−to−metal).

This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent over torquing.

See the instructions provided with the strap wrench for correct use.

(c) Remove protective covers and connect electrical connectors D4986J and D5018J to bracket (5). Tighten connectors fingertight plus one−eighth turn.

(d) Install harnesses clamps, and attaching hardware to brackets (6, 7, 8). Torque nuts 32 − 36 lb−in. (3.616 − 4.067 N.m). See Figure 414 (Sheet 1).

(7) Install wire harnesses 21W4118 and 21W4120.

(a) Remove protective covers and connect electrical connectors D4998P and D4999P to RSE1151 tool. Tighten connectors fingertight plus one−eighth turn. Lockwire connectors. See Figure 414 (Sheet 2).

(b) Connect electrical connectors D5020P, D5021P, and D5022P to left thrust reverser J−box; and D5001P and D5000P to EEC as follows:

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol (P11−009). Allow hardware to dry.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent over torquing.

CAUTION: USE THE CORRECT ASSEMBLY PROCEDURE AND TOOLS FOR THE HARNESS CONNECTOR INSTALLATION. IF YOU USE THE INCORRECT ASSEMBLY PROCEDURE OR TOOLS, A DAMAGED OR LOOSE CONNECTOR CAN OCCUR. A LOOSE CONNECTOR PERMITS VIBRATION, WHICH CAN CAUSE THE CONTACTS TO WEAR AND THEREBY PROVIDE UNSATISFACTORY LIGHTNING PROTECTION.

3 Use the (Glenair TG−70) strap wrench or the (Glenair TG−69) soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
− the connector coupling nut is fully tight

- the connector fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

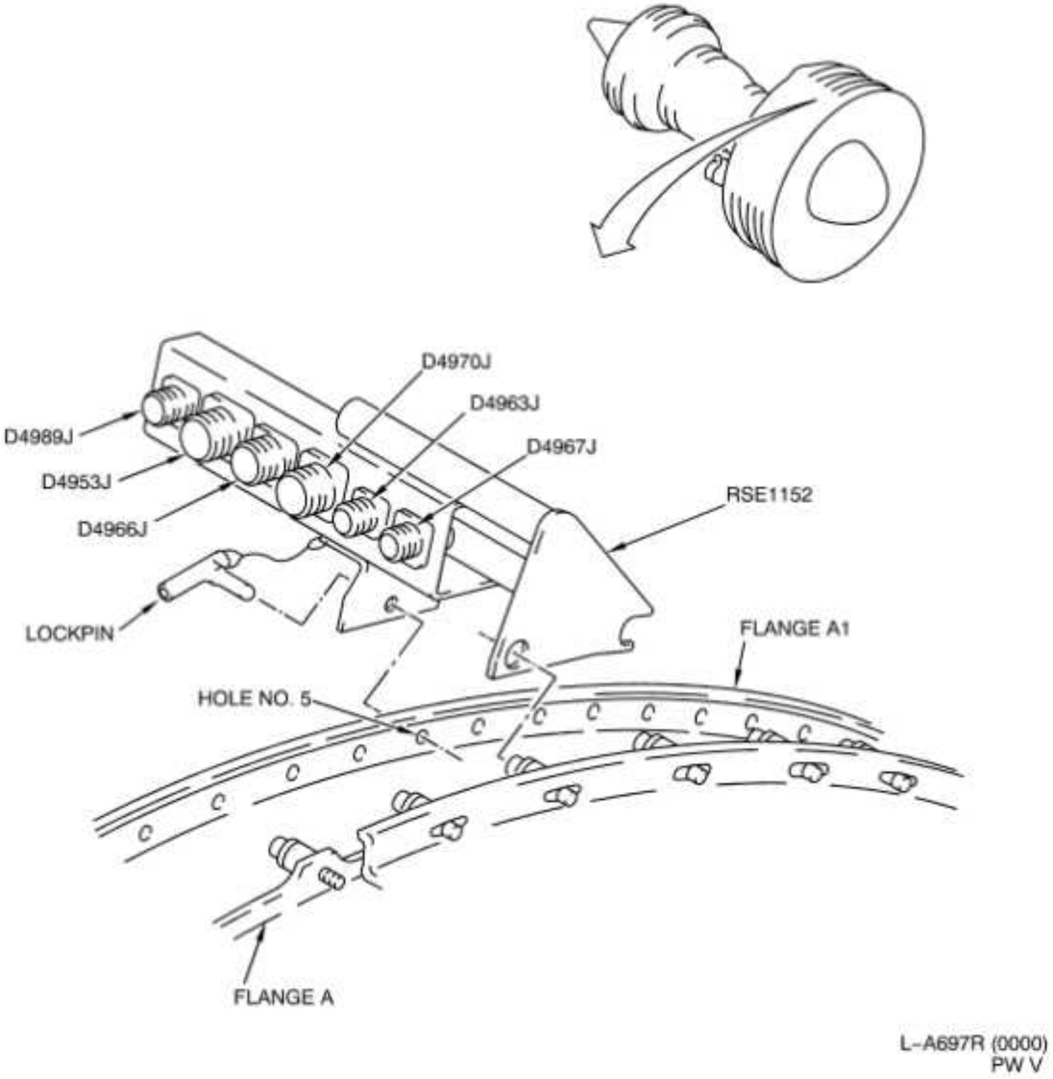
NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent over torquing.

See the instructions given with the strap wrench for correct use.

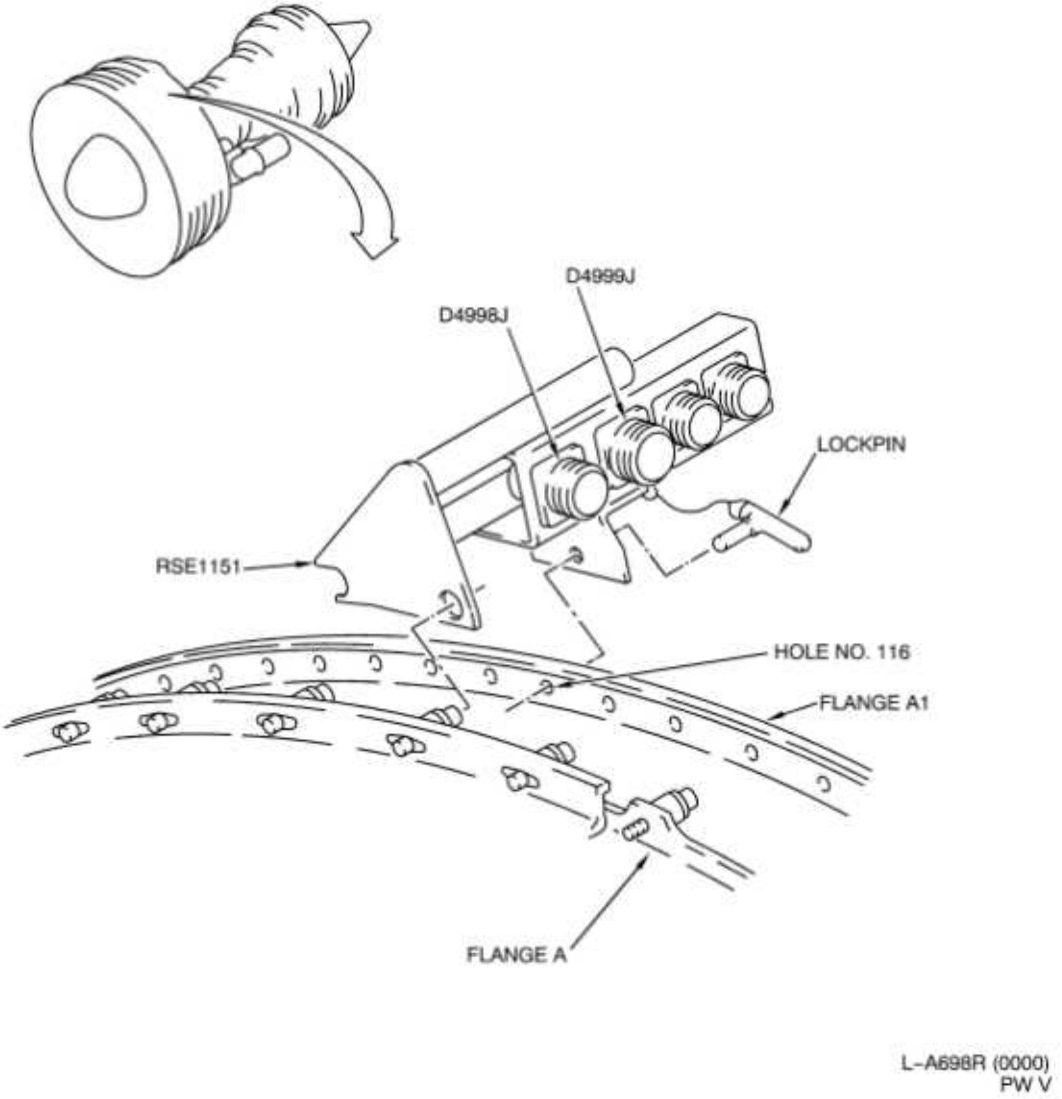
(c) Install harnesses, clamps (1, 2), and attaching hardware to brackets (3, 4), Flanges (A, B, C), harness support, and left thrust reverser J-box. Torque nuts 32 - 36 lb-in. (3.616 - 4.067 N.m).

C. Postrequisites

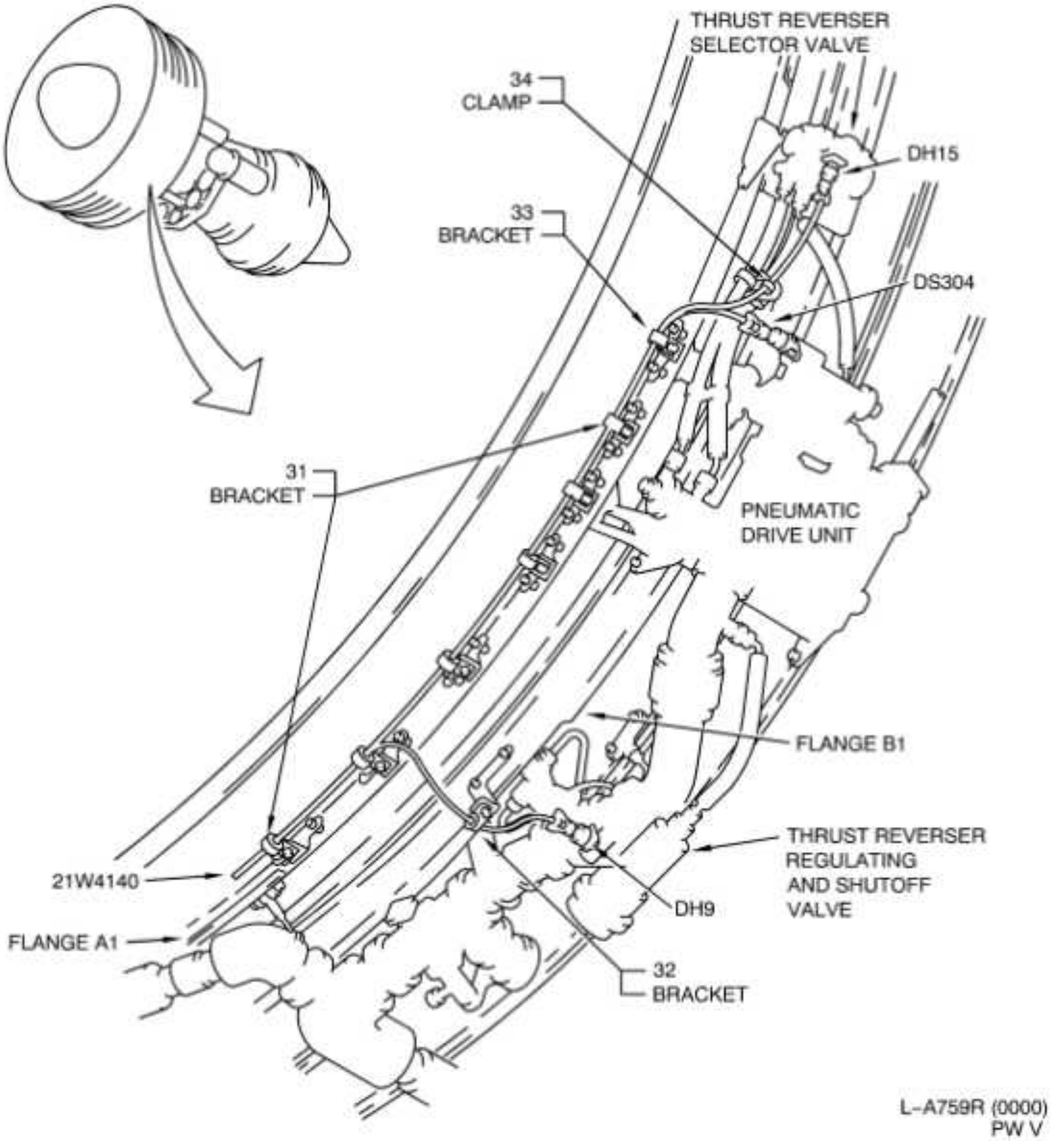
(1) Install inlet cowl. See Installation-01 (Task 71-00-33-450-001).


D4970J
D4963J
D4989J
D4967J
D4953J
RSE1152
D4966J
LOCKPIN
FLANGE A1
HOLE NO. 5
FLANGE A
L−A697R (0000)
PW V

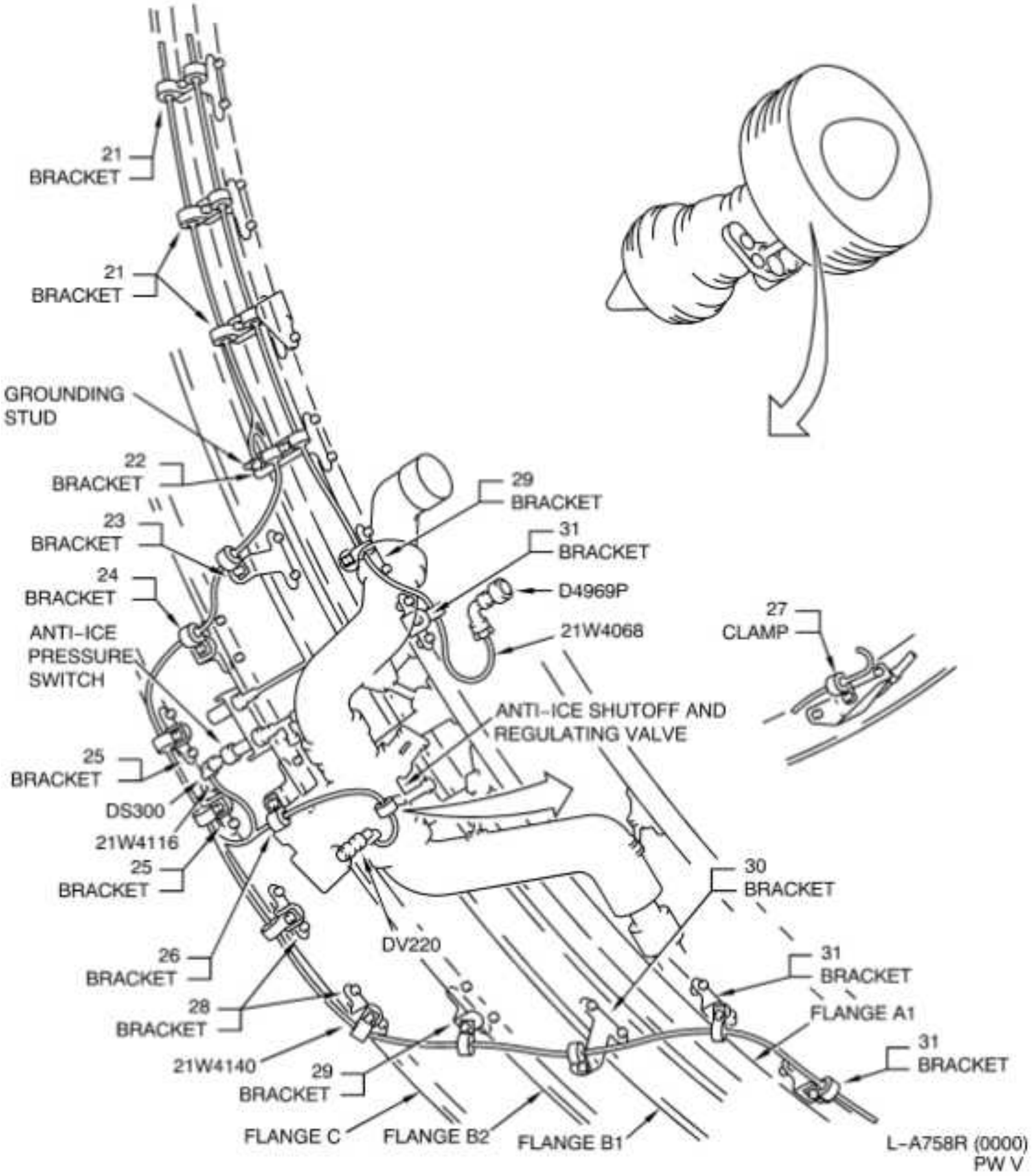
RSE1152 Interface Locator Tool, Upper Right Fan Case
Figure 409
(Task 71−00−33−450−014−A)


D4999J
D4998J
LOCKPIN
RSE1151
HOLE NO. 116
FLANGE A1
FLANGE A
L−A698R (0000)
PW V

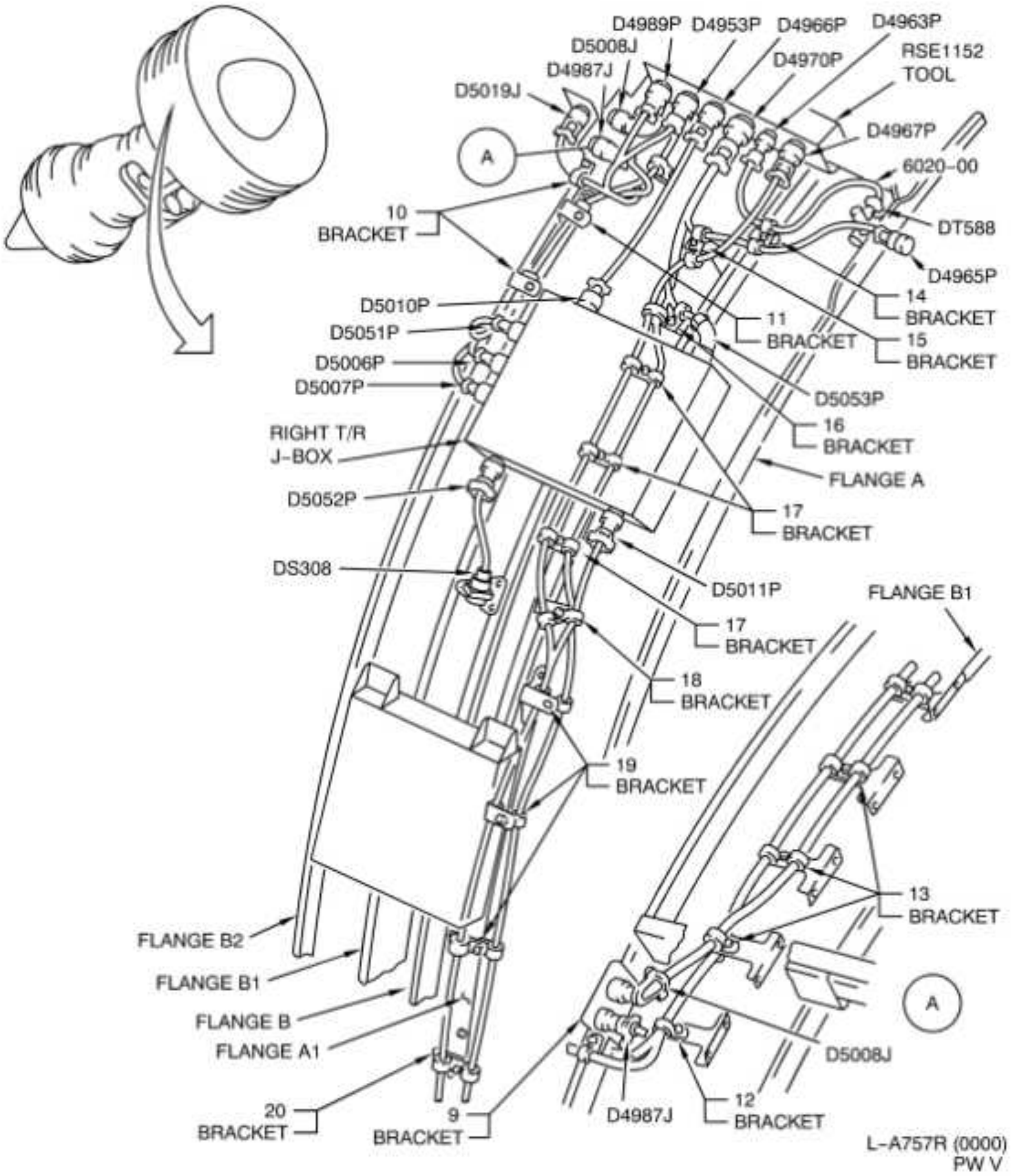
RSE1151 Interface Locator Tool, Upper Left Fan Case
Figure 410
(Task 71−00−33−450−014−A)


THRUST REVERSER SELECTOR VALVE
34 CLAMP
DH15
33 BRACKET
DS304
31 BRACKET
PNEUMATIC DRIVE UNIT
FLANGE B1
THRUST REVERSER REGULATING AND SHUTOFF VALVE
21W4140
FLANGE A1
DH9
32 BRACKET
L-A759R (0000)
PW V

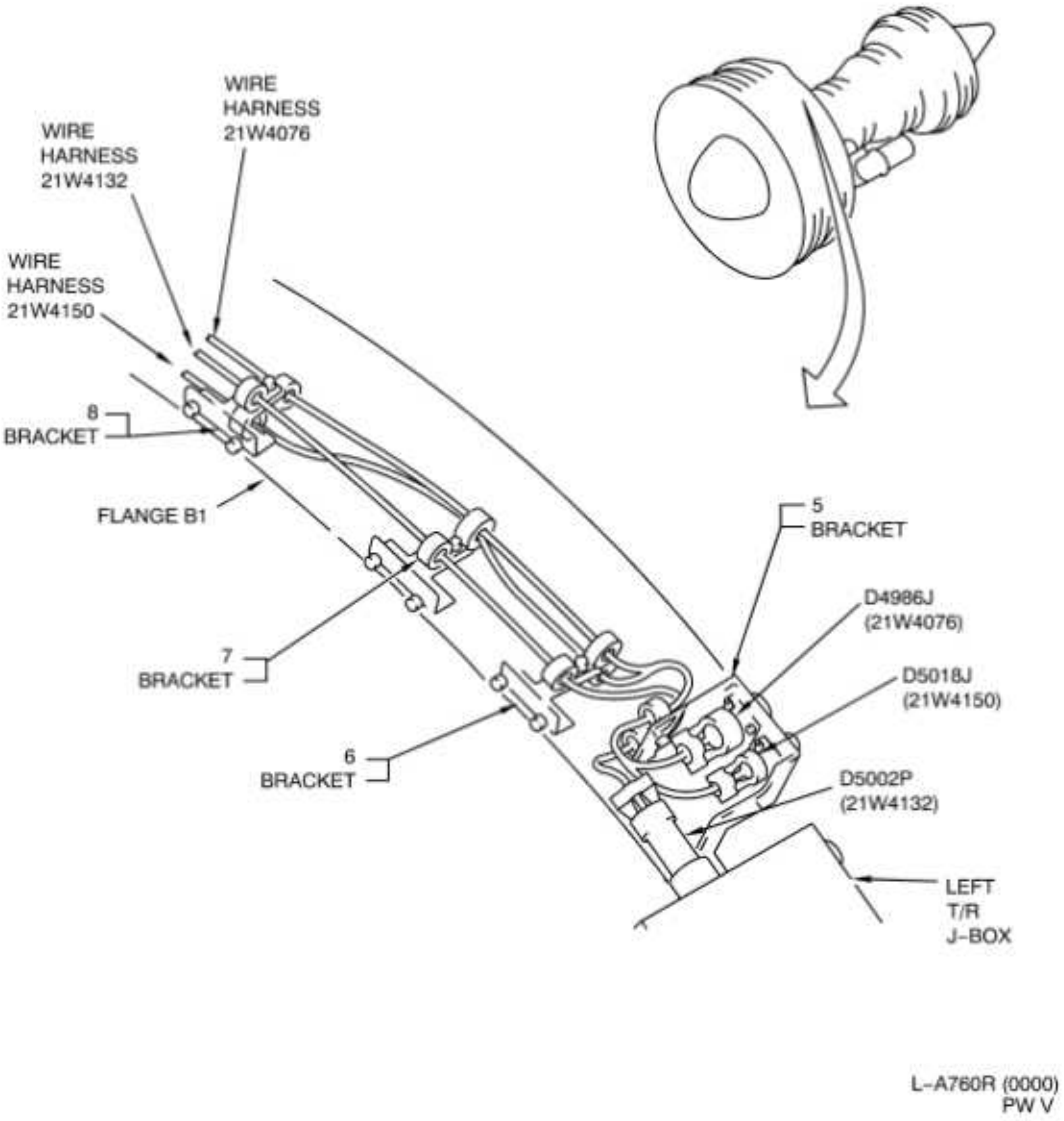
Fan Case Wire Harness, Lower Left Quarter
Figure 411
(Task 71−00−33−450−014−A)


21 BRACKET
21 BRACKET
GROUNDING STUD
22 BRACKET
23 BRACKET
24 BRACKET
ANTI-ICE PRESSURE SWITCH
25 BRACKET
DS300
21W4116
25 BRACKET
26 BRACKET
28 BRACKET
21W4140
29 BRACKET
FLANGE C
FLANGE B2
FLANGE B1
DV220
29 BRACKET
31 BRACKET
D4969P
21W4068
27 CLAMP
ANTI-ICE SHUTOFF AND REGULATING VALVE
30 BRACKET
31 BRACKET
FLANGE A1
31 BRACKET
L-A758R (0000)
PW V

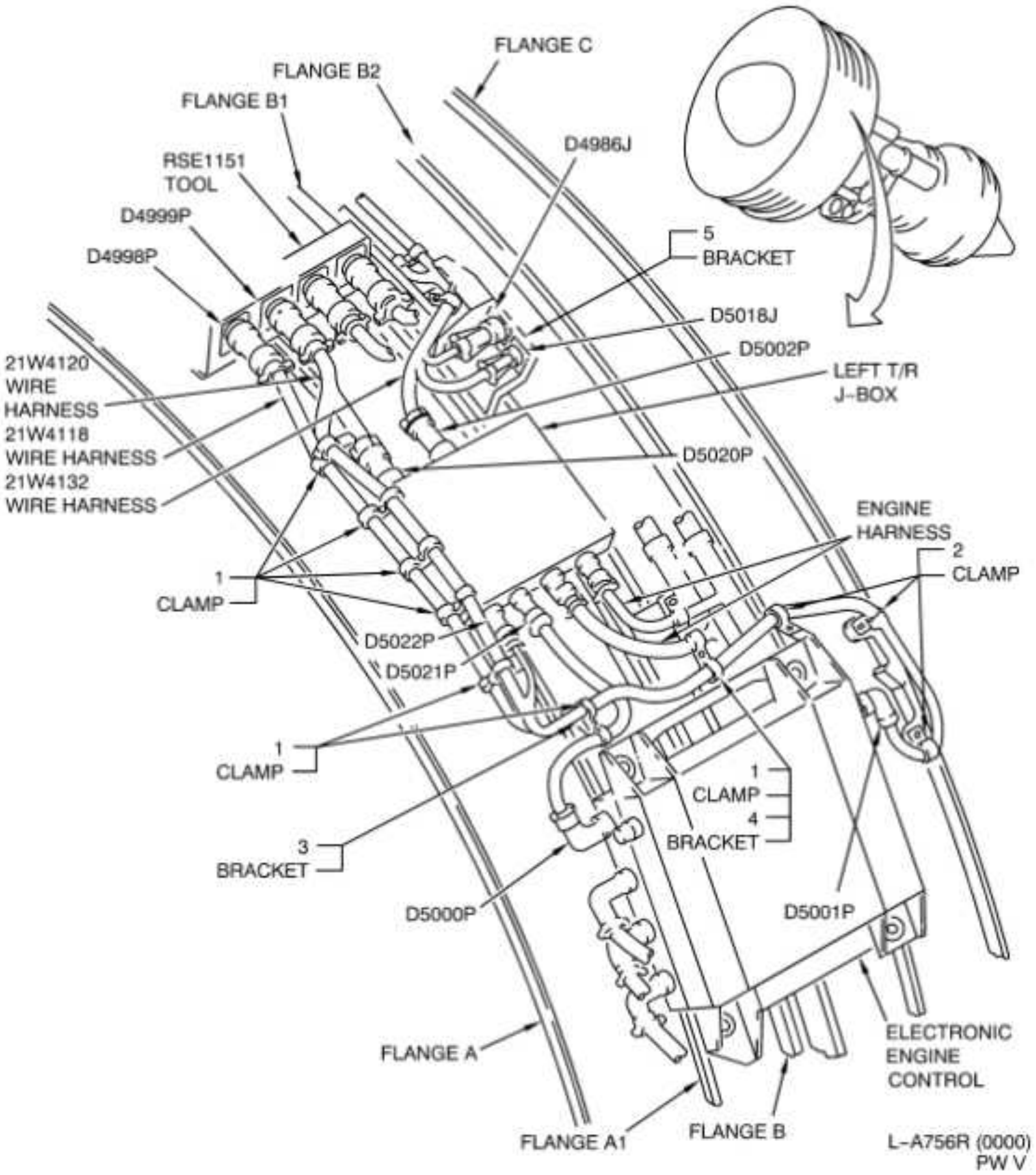
Fan Case Wire Harness, Lower Right Quarter
Figure 412
(Task 71–00–33–450–014–A)


D4989P
D4953P
D4966P
D4963P
D5008J
D4970P
RSE1152
TOOL
D4987J
D5019J
D4967P
A
6020-00
10
BRACKET
DT588
D4965P
14
BRACKET
D5010P
11
BRACKET
15
BRACKET
D5051P
D5006P
D5007P
D5053P
RIGHT T/R
J-BOX
16
BRACKET
FLANGE A
D5052P
17
BRACKET
DS308
D5011P
FLANGE B1
17
BRACKET
18
BRACKET
19
BRACKET
13
BRACKET
FLANGE B2
FLANGE B1
A
FLANGE B
FLANGE A1
D5008J
20
BRACKET
9
BRACKET
D4987J
12
BRACKET
L-A757R (0000)
PW V

Fan Case Wire Harness, Right Side
Figure 413
(Task 71−00−33−450−014−A)


WIRE HARNESS 21W4076
WIRE HARNESS 21W4132
WIRE HARNESS 21W4150
8 BRACKET
FLANGE B1
5 BRACKET
D4986J (21W4076)
D5018J (21W4150)
7 BRACKET
6 BRACKET
D5002P (21W4132)
LEFT T/R J-BOX
L-A760R (0000)
PW V

Fan Case Wire Harness, Upper Left Side
Figure 414 (Sheet 1)
(Task 71−00−33−450−014−A)


FLANGE C
FLANGE B2
FLANGE B1
D4986J
RSE1151 TOOL
D4999P
D4998P
5 BRACKET
D5018J
D5002P
LEFT T/R J-BOX
21W4120 WIRE HARNESS
21W4118 WIRE HARNESS
21W4132 WIRE HARNESS
D5020P
ENGINE HARNESS
2 CLAMP
1 CLAMP
D5022P
D5021P
1 CLAMP
1 CLAMP
4 BRACKET
3 BRACKET
D5000P
D5001P
FLANGE A
ELECTRONIC ENGINE CONTROL
FLANGE A1
FLANGE B
L-A756R (0000)
PW V

Fan Case Wire Harness, Upper Left Side
Figure 414 (Sheet 2)
(Task 71−00−33−450−014−A)

POWER PLANT GENERAL - FAN CASE - INSTALLATION-15

Task 71-00-33-450-019:

1. Install EEC Inlet Pressure/Temperature (PT2/TT2) Probe
   A. Equipment And Materials Required

      Standard Tools:
      Glenair TG-70 Strap Wrench or
      Glenair TG-69 Soft Jawed Pliers

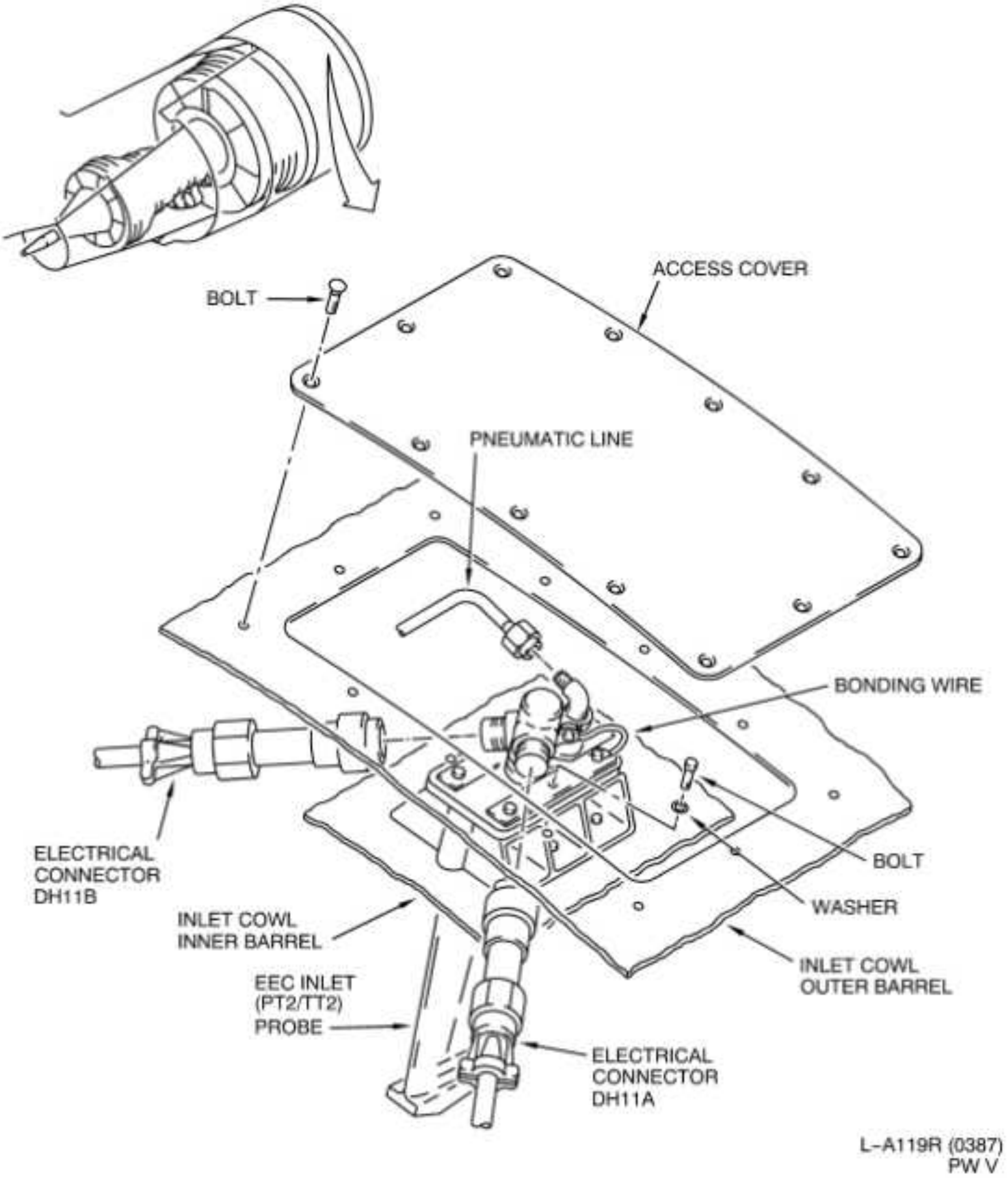
      Consumable Materials:

Item No.	Designation
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

   B. Procedure
      See Figure 401.
      (1) Position probe on inlet cowl inner barrel mounting bracket and align boltholes.
      (2) Using longer bolt with washer, attach bonding wire terminal to inlet probe flange at a forward mounting bolthole position.
      (3) Install five remaining mounting bolts and washers. Torque all six bolts to 32 - 36 lb-in. (3.616 - 4.067 N.m).

      CAUTION: USE OF LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS COULD RESULT IN CONTAMINATION OF EEC.

      (4) Remove protective covers from pneumatic pressure line and inlet probe fitting and connect pressure line coupling nut to probe fitting. Torque coupling nut 90 - 100 lb-in. (10.169 - 11.298 N.m).
      (5) Connect the DH11A and the DH11B harness connectors to the probe harness receptacles as follows. For each connector:
         (a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol (P11-009). Let dry.


ACCESS COVER
BOLT
PNEUMATIC LINE
BONDING WIRE
ELECTRICAL CONNECTOR DH11B
BOLT
WASHER
INLET COWL INNER BARREL
INLET COWL OUTER BARREL
EEC INLET (PT2/TT2) PROBE
ELECTRICAL CONNECTOR DH11A
L−A119R (0387)
PW V

EEC Inlet Pressure/Temperature
PT2/TT2 Probe
Figure 401
(Task 71−00−33−450−019)

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the (Glenair TG−70) strap wrench or the (Glenair TG−69) soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

See the instructions given with the strap wrench for correct use.

(6) Reinstall access cover on inlet cowl with 12 bolts. Sequentially torque bolts 32 − 36 lb−in. (3.616 − 4.067 N.m).

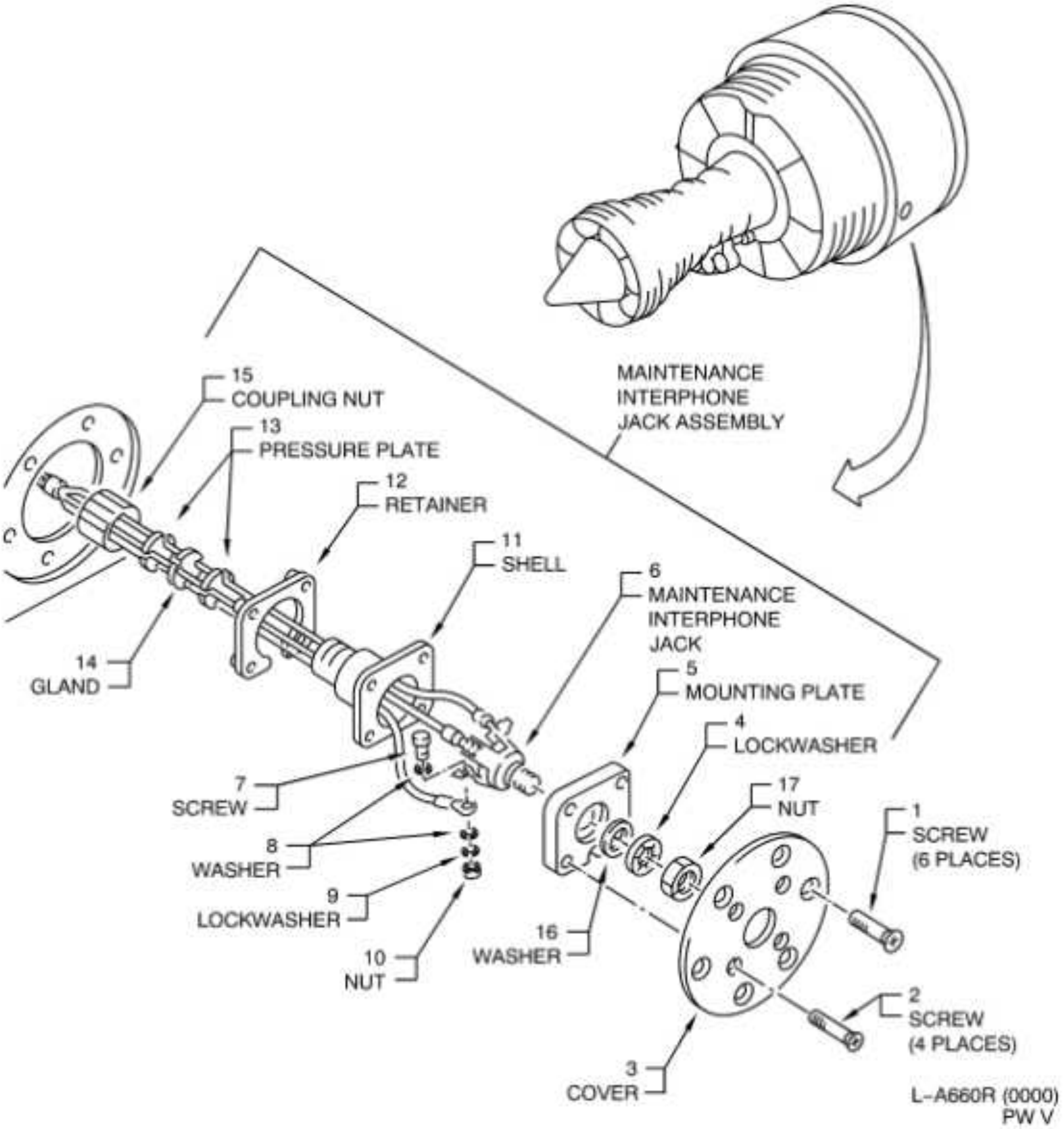
Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - FAN CASE - INSTALLATION-16

Task 71-00-33-450-020:

1. Install Maintenance Interphone Jack
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 401.
     - (1) Install screws (401/7), washers (401/8), lockwashers (401/9) and nuts (401/10) attaching wires to maintenance interphone jack (401/6). Torque nuts to 20 - 25 lb-in. (2.260 - 2.825 N.m).
     - (2) Slide shell (401/11) over jack and wire connections.
     - (3) Screw coupling nut (401/15), on shell holding gland (401/14), pressure plates (401/13) and retainer (401/12) in place.
     - (4) Attach mounting plate (401/5) to jack with nut (401/17), washer (401/16), and lockwasher (401/4). Torque nut to 110 - 120 lb-in. (12.428 - 13.558 N.m).
     - (5) Attach cover (401/3) to mounting plate (401/5) and retainer (401/12) with four screws (401/2). Tighten screws to 8 - 10 lb-in. (0.904 - 1.130 N.m).
     - (6) Insert jack assembly and cover into inlet cowl and attach with six screws (401/1). Torque screws to 20 - 25 lb-in. (2.260 - 2.825 N.m).


MAINTENANCE INTERPHONE JACK ASSEMBLY
15 COUPLING NUT
13 PRESSURE PLATE
12 RETAINER
11 SHELL
6 MAINTENANCE INTERPHONE JACK
5 MOUNTING PLATE
4 LOCKWASHER
17 NUT
1 SCREW (6 PLACES)
14 GLAND
7 SCREW
8 WASHER
9 LOCKWASHER
10 NUT
16 WASHER
2 SCREW (4 PLACES)
3 COVER
L−A660R (0000)
PW V

Inlet Cowl Maintenance
Interphone Jack
Figure 401
(Task 71−00−33−450−020)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 71-00-33-450-021:

1. Install Inlet Cowl Anti-Ice Shutoff And Regulating Valve

A. Prerequisites

(1) Install anti-ice valve inlet and outlet ducts. See
R Installation-18 (Task 71-00-33-450-022).

B. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P06-013	Solid Film Lubricant

C. Procedure

(1) Install anti-ice shutoff and regulating valve. See Figure 401.

(a) Remove protective covers from end of valve inlet and outlet ducts.

(b) Remove protective covers from both ends of valve.

(c) Lubricate inside surfaces of duct coupling with Lubricant P06-013.

CAUTION: OBSERVE DIRECTION OF ARROW ON VALVE. POINT ARROW TOWARD ANTI-ICE VALVE OUTLET DUCT.

(d) Install coupling and seal to valve aft flange and attach valve to anti-ice valve inlet duct. Tighten coupling fingertight.

(e) Lubricate inside surfaces of duct coupling with Lubricant P06-013.

(f) Install coupling to valve forward flange and attach valve to anti-ice outlet duct. Tighten coupling fingertight.

(2) Install anti-ice valve pressure sensing tube. See Figure 402.

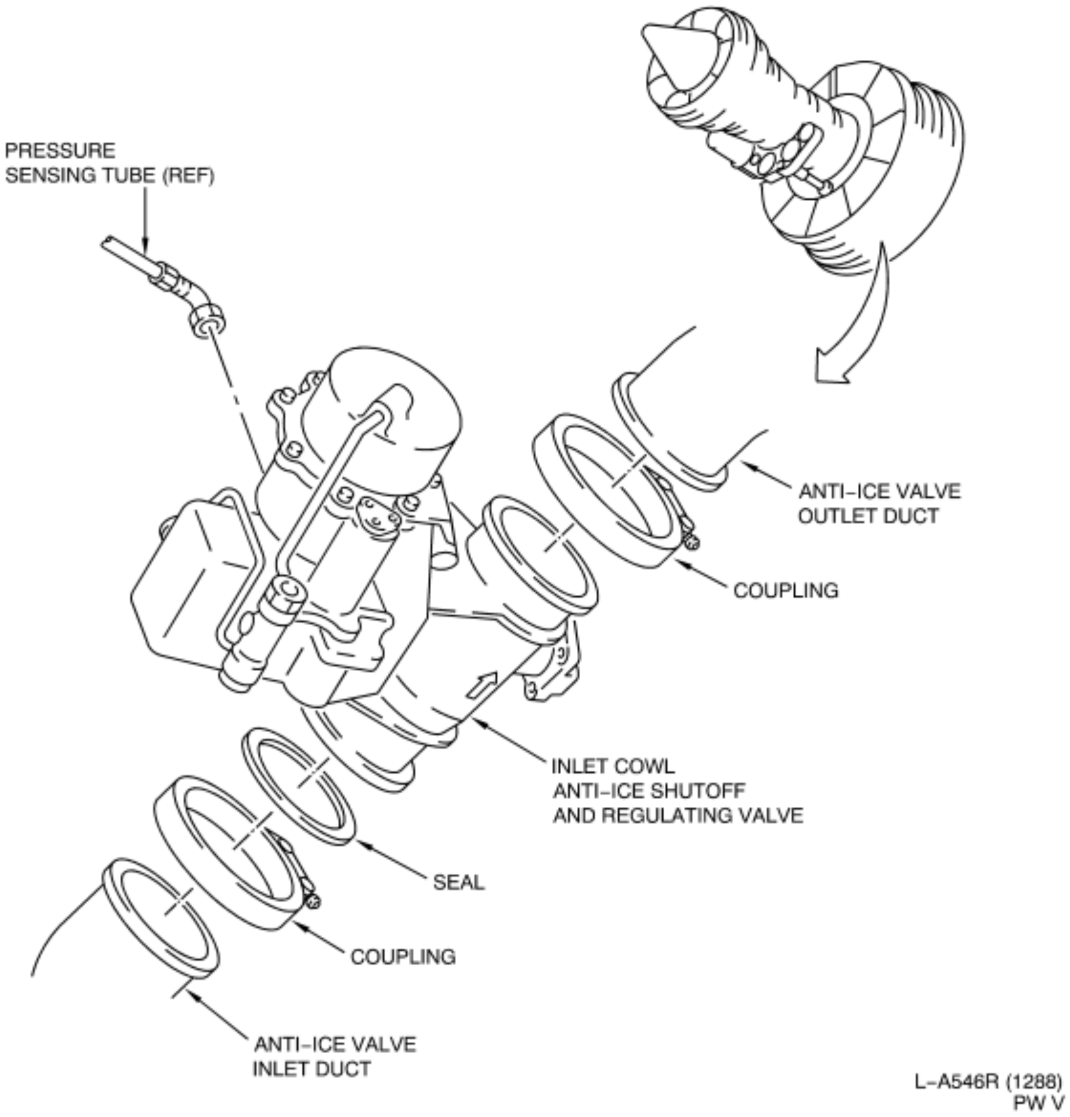
(a) Remove protective cover from sensing tube and valve port.

POWER PLANT GENERAL − FAN CASE − INSTALLATION−17

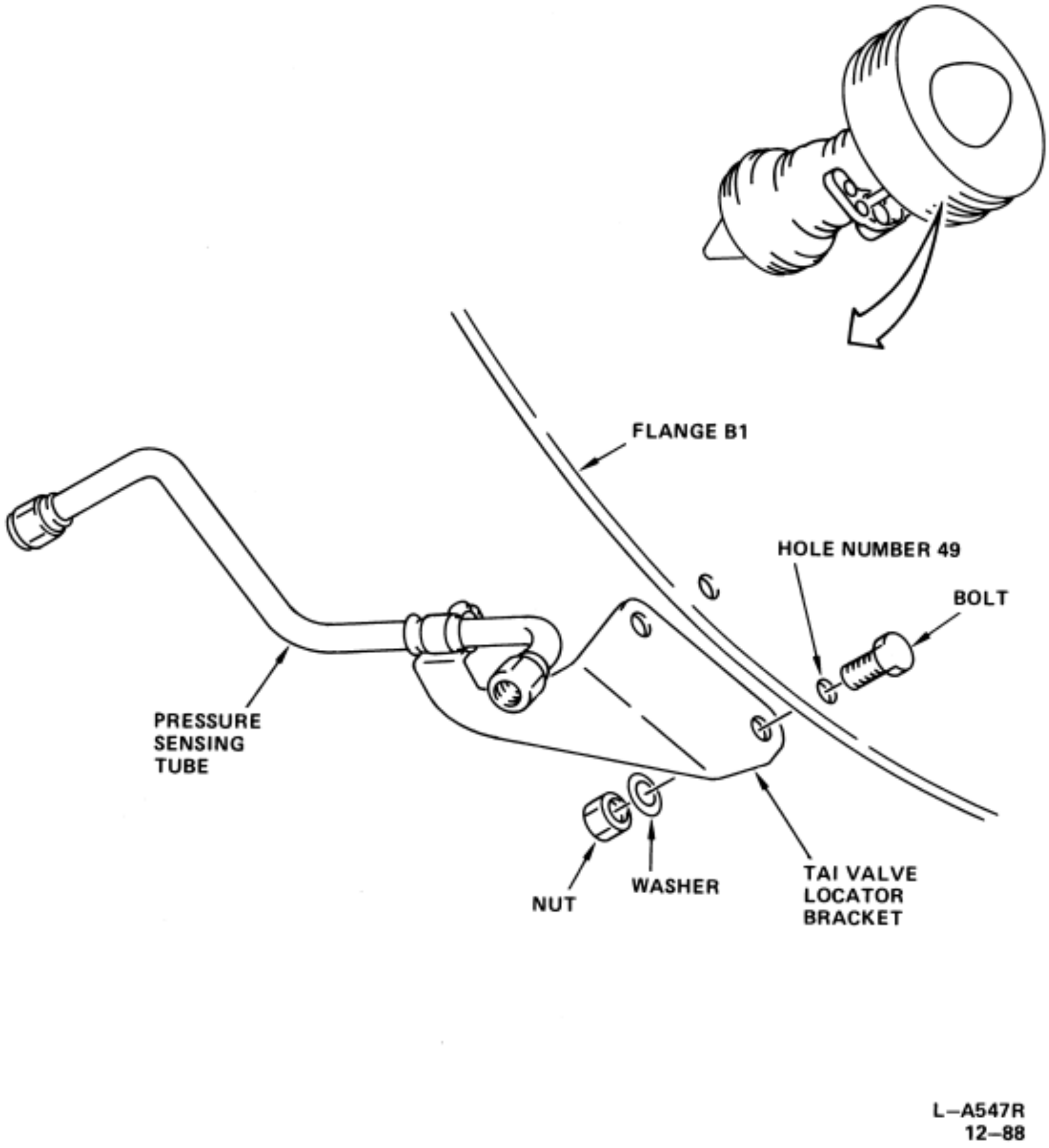
(b) Position TAI valve locator bracket on fan case Flange B1 over holes 48 and 49. Install two (2) bolts, washers, and nuts attaching bracket to Flange B1. Torque nuts 75 − 85 lb−in. (8.474 − 9.604 N.m).

(c) Adjust valve position and connect pressure sensing tube to union on valve. Torque tube connecting nut to 180 − 200 lb−in. (20.337 − 22.597 N.m).

(3) Torque two (2) duct couplings to value indicated on each coupling. Tap around coupling with plastic mallet. Retorque coupling.


PRESSURE SENSING TUBE (REF)
ANTI−ICE VALVE OUTLET DUCT
COUPLING
INLET COWL ANTI−ICE SHUTOFF AND REGULATING VALVE
SEAL
COUPLING
ANTI−ICE VALVE INLET DUCT
L−A546R (1288)
PW V

Inlet Cowl Anti−Ice Shutoff And Regulating Valve
Figure 401
(Task 71−00−33−450−021)


FLANGE B1
HOLE NUMBER 49
BOLT
PRESSURE SENSING TUBE
NUT
WASHER
TAI VALVE LOCATOR BRACKET
L−A547R
12−88

Anti−Ice Pressure Sensing Tube
Figure 402
(Task 71−00−33−450−021)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 71-00-33-450-022:

1. Install Inlet Cowl Anti-Ice System Ducts

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P06-013	Solid Film Lubricant

B. Procedure

(1) Install anti-ice inlet duct. See Figures 401 and 402.

(a) Install bolts, washers and nuts attaching five (5) support link brackets to fan case flanges using flange holes shown in Table 401. Torque nut 75 - 85 lb-in. (8.474 - 9.604 N.m).

Support Link	Flange	Holes
A	B1	61,62
B	A1	61,63
C	A1	52,53
D	A	52,53
E	B1	49,50
E	A1	49,50

Support Link Bracket Mounting Holes
Table 401

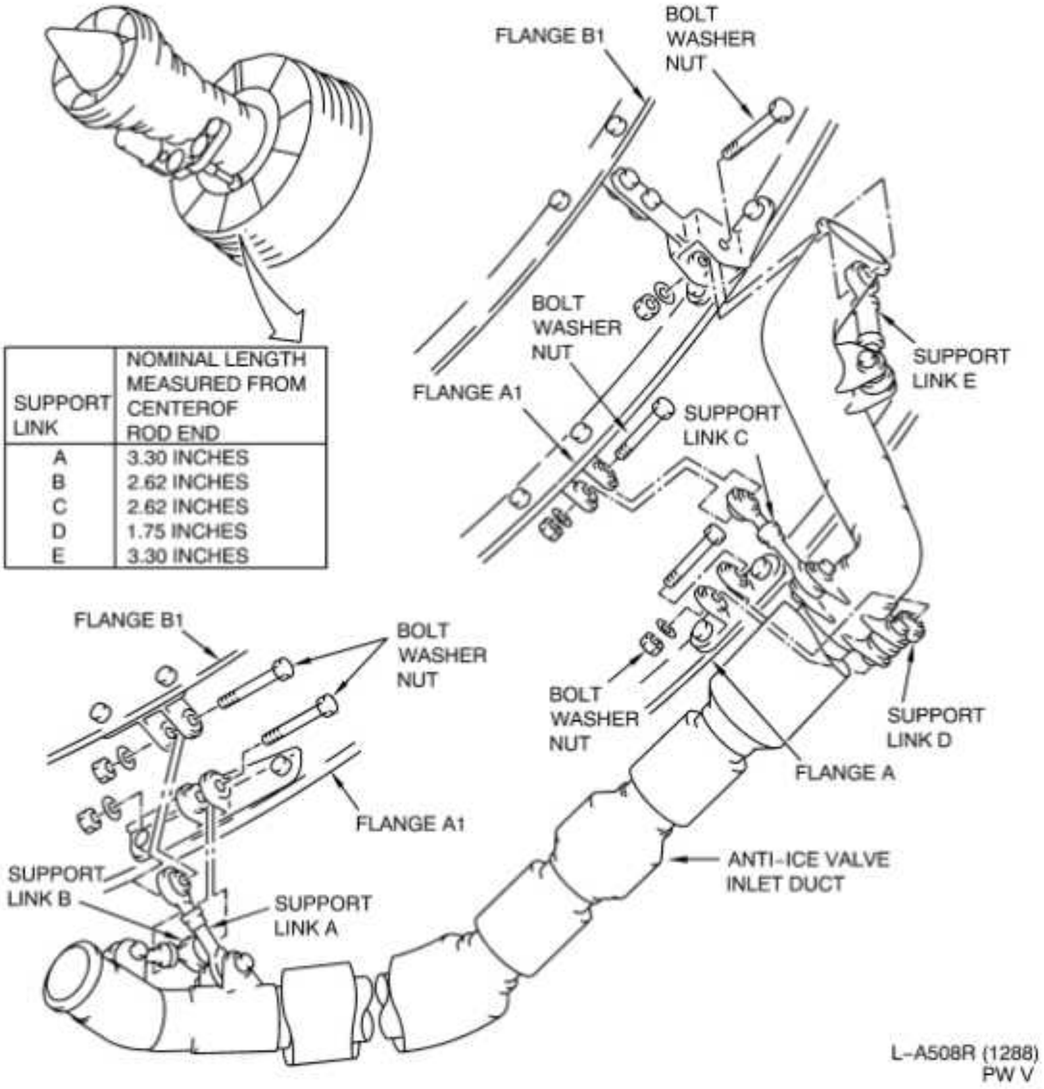
(b) Check and, if necessary, set five (5) support links to nominal length. See Figure 401 for lengths. Torque locking nuts 100 - 140 lb-in. (11.298 - 15.818 N.m).

(c) Install five (5) support links to their respective inlet duct bracket with bolts, washers and nuts. Torque bolts 50 - 70 lb-in. (5.649 - 7.909 N.m).

(d) Remove protective covers from anti-ice duct T-section port and duct opening that connects to T-section port.

(e) Install bolts, washers and nuts attaching five (5) duct support links to support link brackets on fan case. Torque nuts 50 - 70 lb-in. (5.649 - 7.909 N.m).

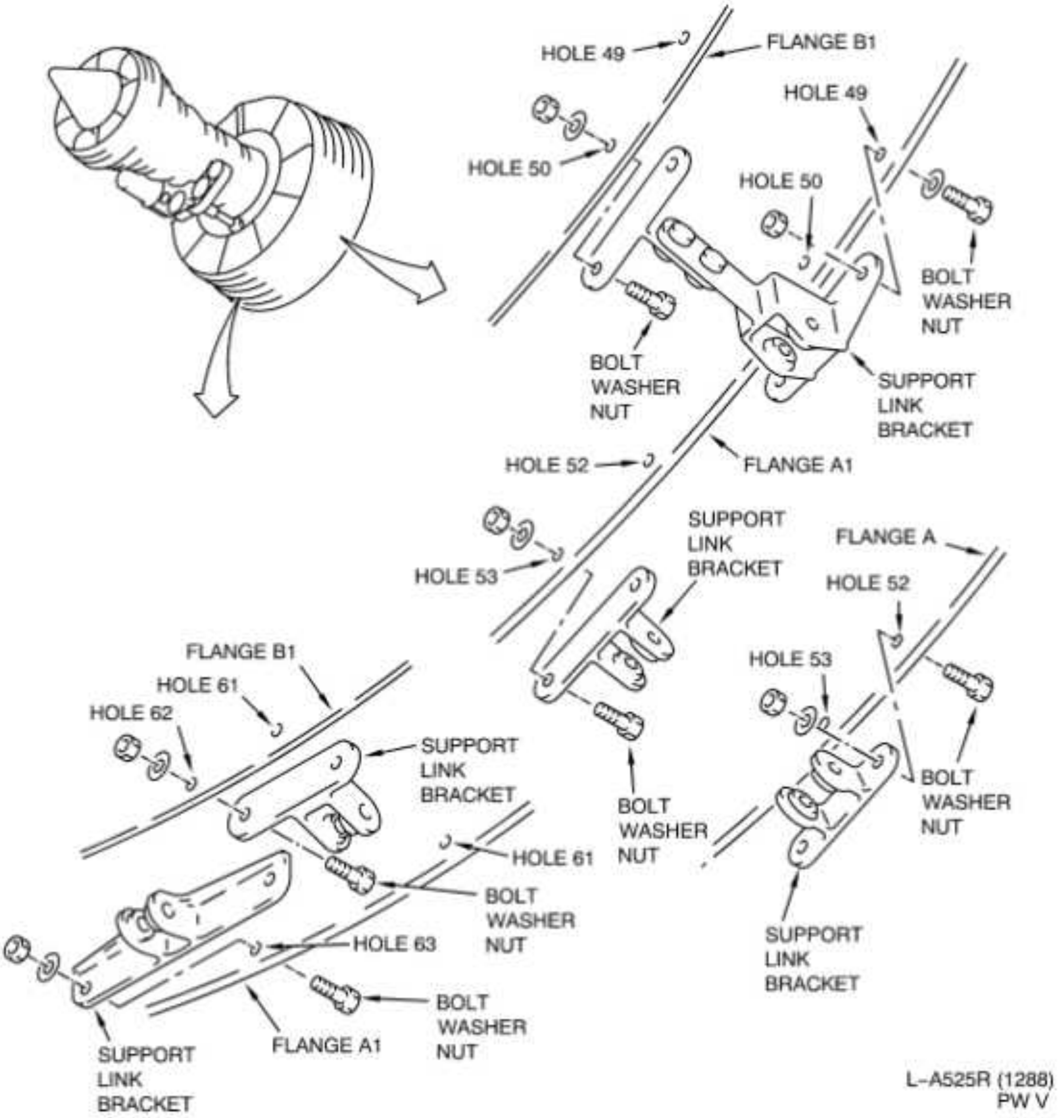
(f) Lubricate inside surfaces of duct coupling with Lubricant (P06-013).



SUPPORT LINK	NOMINAL LENGTH MEASURED FROM CENTEROF ROD END
A	3.30 INCHES
B	2.62 INCHES
C	2.62 INCHES
D	1.75 INCHES
E	3.30 INCHES

FLANGE B1
BOLT
WASHER
NUT
BOLT
WASHER
NUT
FLANGE A1
SUPPORT LINK E
SUPPORT LINK C
FLANGE B1
BOLT
WASHER
NUT
BOLT
WASHER
NUT
FLANGE A1
SUPPORT LINK D
FLANGE A
ANTI-ICE VALVE INLET DUCT
SUPPORT LINK B
SUPPORT LINK A
L-A508R (1288)
PW V

Anti−Ice Valve Inlet Duct
Figure 401
(Task 71−00−33−450−022)


HOLE 49
FLANGE B1
HOLE 49
HOLE 50
HOLE 50
BOLT
WASHER
NUT
BOLT
WASHER
NUT
SUPPORT
LINK
BRACKET
HOLE 52
FLANGE A1
SUPPORT
LINK
BRACKET
FLANGE A
HOLE 53
HOLE 52
HOLE 53
FLANGE B1
HOLE 61
HOLE 62
SUPPORT
LINK
BRACKET
BOLT
WASHER
NUT
BOLT
WASHER
NUT
HOLE 61
BOLT
WASHER
NUT
HOLE 63
SUPPORT
LINK
BRACKET
BOLT
WASHER
NUT
SUPPORT
LINK
BRACKET
FLANGE A1
L-A525R (1288)
PW V

Anti−Ice Valve Inlet Duct
Figure 402
(Task 71−00−33−450−022)

(g) Attach duct to anti−ice T−section with coupling and seal. Torque coupling to value indicated on coupling. Tap around coupling with plastic mallet. Retorque coupling.

(2) Install anti−ice valve outlut duct. See Figures 403 and 404.

(a) Install bolts, washers and nuts attaching two (2) support link brackets to fan case Flanges A1 and B1. Use flange holes 45, 46 for Support Link A and holes 47, 48 for Support Link B. Torque nuts 75 − 85 lb−in. (8.474 − 9.604 N.m).

(b) Check and, if necssary, set two (2) support links to nominal length. See Figure 403 for lengths. Torque nuts 100 − 140 lb−in. (11.298 − 15.818 N.m).

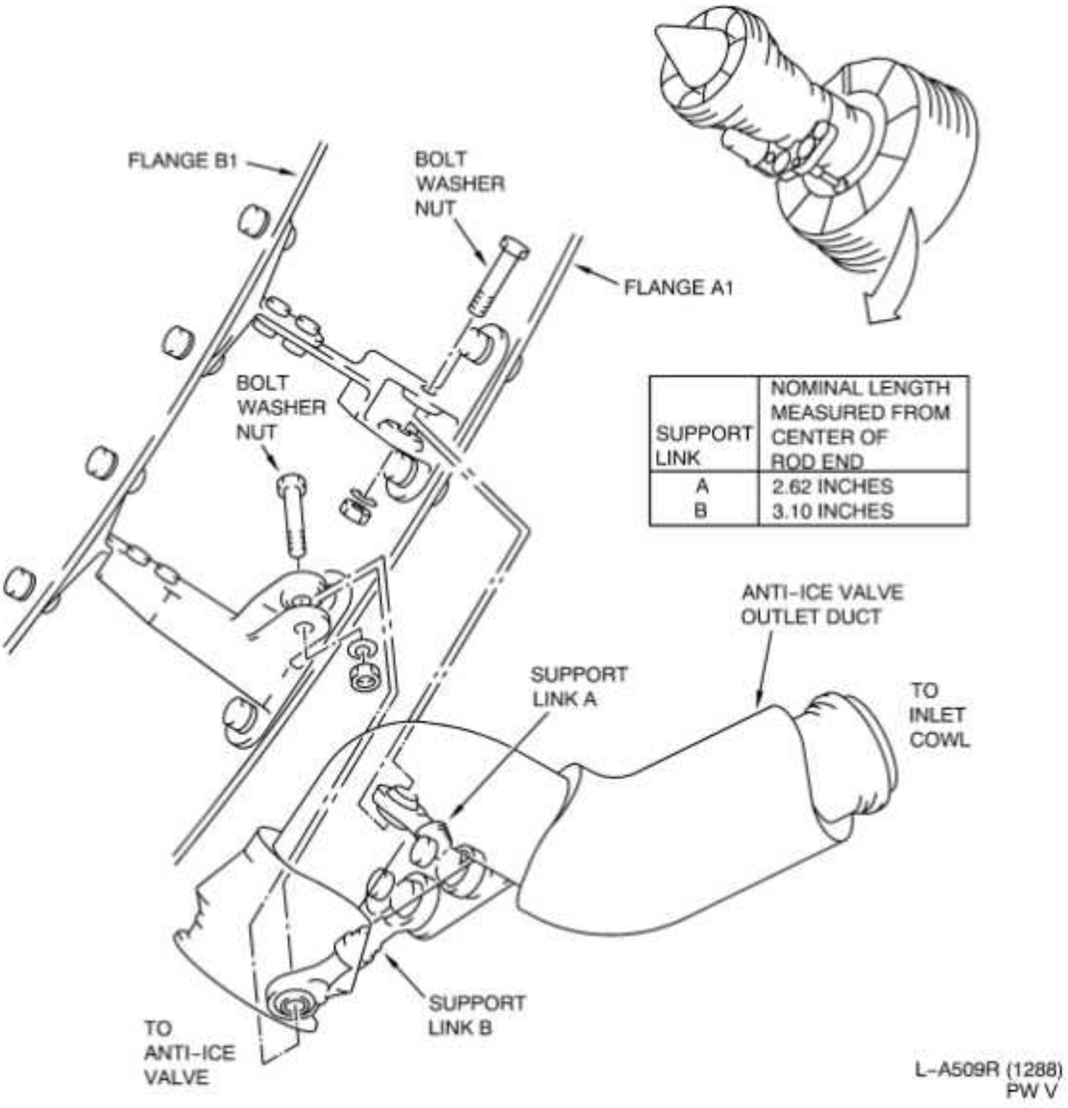
(c) Install bolts, washers and nuts attaching two (2) duct support links to their respective brackets on the outlet duct (see Figure 404). Torque nuts 75 − 85 lb−in. (8.474 − 9.604 N.m).

(d) Remove protective cover from inlet cowl port and duct end that connects to inlet cowl.

(e) Install bolts, washers and nuts attaching two (2) duct support links to support link brackets on fan case (see Figure 404). Torque nuts 50 − 70 lb−in. (5.649 − 7.909 N.m).

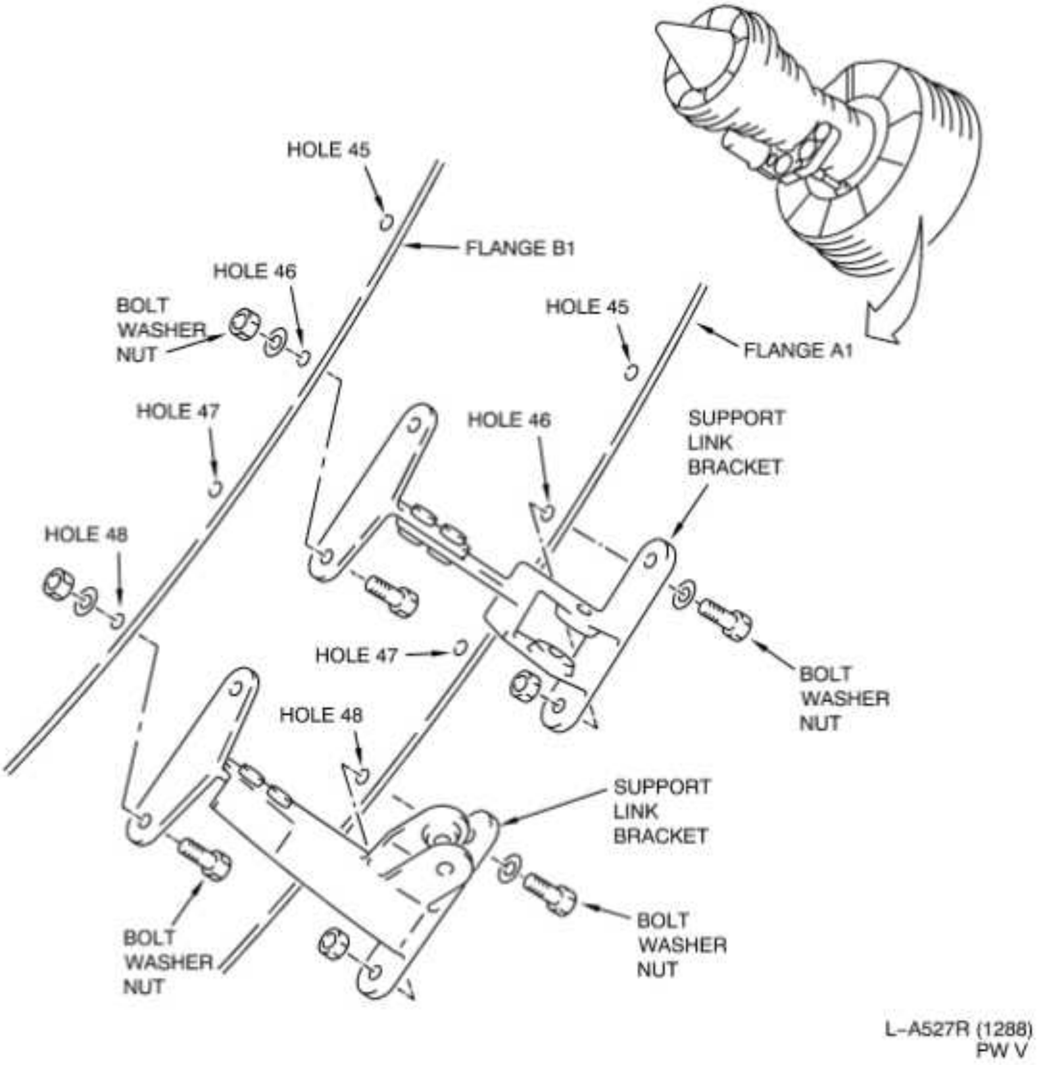
(f) Lubricate inside surfaces of coupling with Lubricant (P06−013).

(g) Attach outlet duct to inlet cowl port with coupling. Torque coupling to value indicated on coupling. Tap around the coupling with plastic mallet. Retorque coupling.


FLANGE B1
BOLT
WASHER
NUT
FLANGE A1
BOLT
WASHER
NUT
ANTI−ICE VALVE
OUTLET DUCT
SUPPORT
LINK A
TO
INLET
COWL
SUPPORT
LINK B
TO
ANTI−ICE
VALVE
L−A509R (1288)
PW V

SUPPORT LINK	NOMINAL LENGTH MEASURED FROM CENTER OF ROD END
A	2.62 INCHES
B	3.10 INCHES

Anti−Ice Valve Outlet Duct
Figure 403
(Task 71−00−33−450−022)


HOLE 45
FLANGE B1
HOLE 46
BOLT
WASHER
NUT
HOLE 45
FLANGE A1
HOLE 47
HOLE 46
SUPPORT
LINK
BRACKET
HOLE 48
BOLT
WASHER
NUT
HOLE 47
HOLE 48
SUPPORT
LINK
BRACKET
BOLT
WASHER
NUT
BOLT
WASHER
NUT
L−A527R (1288)
PW V

Anti−Ice Valve Outlet Duct
Figure 404
(Task 71−00−33−450−022)

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Task 71−00−33−450−029:

1. Install Nacelle Cooling Tube Assemblies

A. Equipment And Materials Required − None

B. Procedure

(1) Install nacelle cooling tube assemblies (Post SB PW4NAC 78−40). See Figure 401.

(a) Install reducer in upper end of lower tube assembly (3). Torque tube coupling nut to 170 − 200 lb−in. (19.7 − 22.6 N.m).

(b) Attach lower tube assembly to three Flange C brackets with clamps, screws, and washers. Torque screws to 20 − 25 lb−in. (2.3 − 2.8 N.m).

(c) Install tee fitting on Flange C bracket just below splitter gearbox with washer and nut. Torque nut to 120 − 130 lb−in. (13.6 − 14.7 N.m).

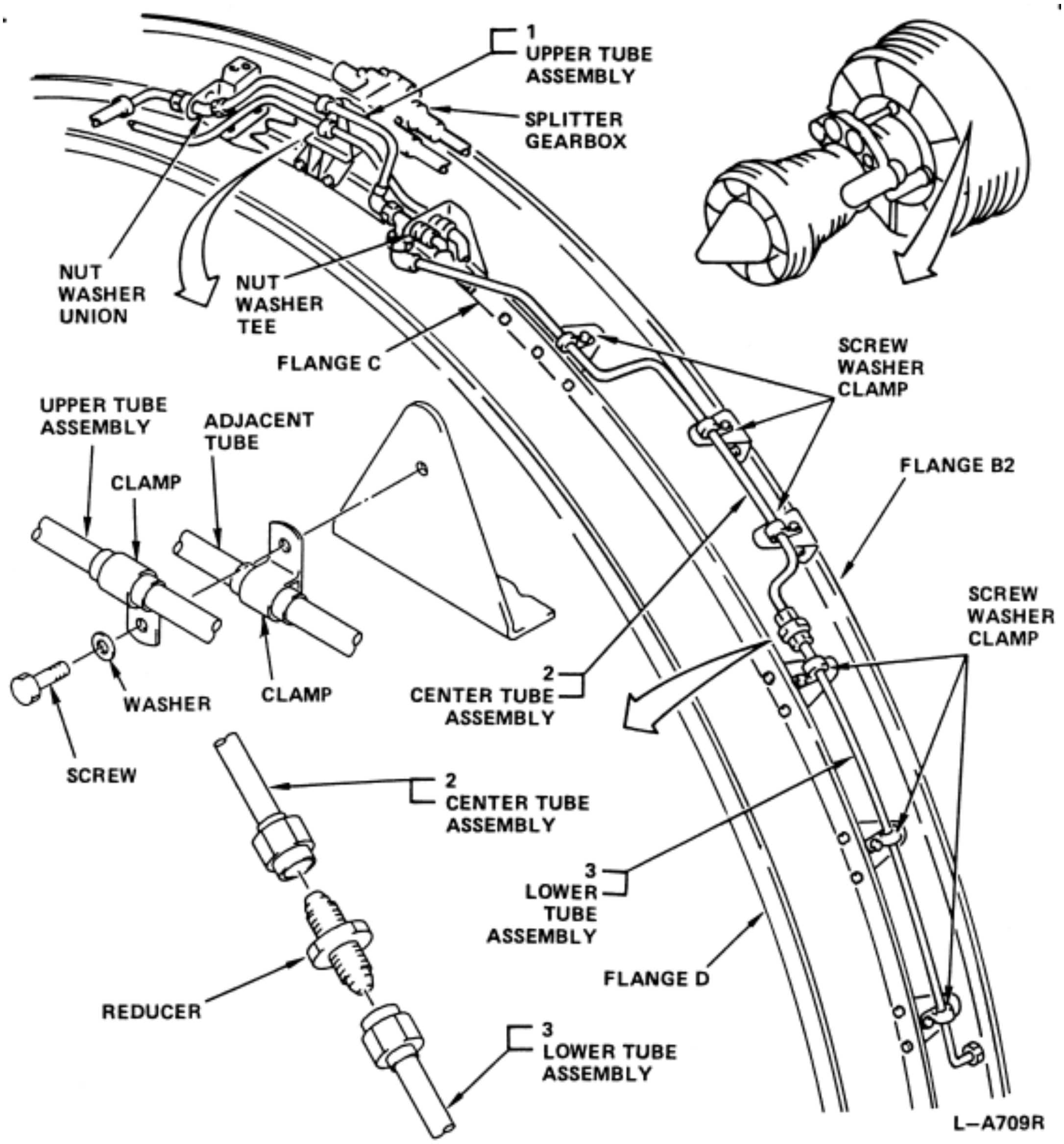
(d) Install lower end of center tube assembly (2) to reducer and upper end to tee fitting. Torque lower coupling nut to 170 − 200 lb−in. (19.7 − 22.6 N.m). Torque upper coupling nut at tee fitting to 120 − 130 lb−in. (13.6 − 14.7 N.m).

(e) Attach center tube assembly to two brackets on Flange B2 and one bracket on Flance C with clamps, washers, and screws. Torque screws to 20 − 25 lb−in. (2.3 − 2.8 N.m).

(f) Install union on uppermost Flange C bracket with washer and nut. Torque nut to 120 − 130 lb−in. (13.6 − 14.7 N.m).

(g) Install lower end of upper tube assembly to tee fitting and upper end to union. Torque coupling nuts to 120 − 130 lb−in. (13.6 − 14.7 N.m).

(h) Install clamp on upper tube assembly and attach to adjacent pneumatic tube clamp on splitter gearbox bracket with washer and screw. Torque screw to 20 − 25 lb−in. (2.3 − 2.8 N.m).


1
UPPER TUBE
ASSEMBLY
SPLITTER
GEARBOX
NUT
WASHER
UNION
NUT
WASHER
TEE
FLANGE C
SCREW
WASHER
CLAMP
UPPER TUBE
ASSEMBLY
ADJACENT
TUBE
CLAMP
FLANGE B2
SCREW
WASHER
CLAMP
WASHER
CLAMP
2
CENTER TUBE
ASSEMBLY
SCREW
2
CENTER TUBE
ASSEMBLY
3
LOWER
TUBE
ASSEMBLY
FLANGE D
REDUCER
3
LOWER TUBE
ASSEMBLY
L–A709R

Nacelle Cooling Tube Assemblies (Post SB PW4NAC 78–40)
Figure 401
(Task 71–00–33–450–029)

POWER PLANT GENERAL - FAN CASE - INSTALLATION-20

Task 71-00-33-450-033:

1. Install Heat Diffuser Assembly - Post SB PW4NAC 78-21 And Pre SB PW4NAC 78-40

   A. Equipment And Materials Required - None

   B. Procedure

   See Figures 401 and 402.

   (1) On left side of fan case, insert upper tube assembly (401/1) beneath PDU mounting brackets between Flanges B2 and C.

   (2) Install union (401/3) between upper and lower tube assemblies (401/1) and (401/2). Torque union to 125 - 140 lb-in. (14.12 - 15.82 N.m). Torque remaining tube coupling at union to 140 - 150 lb-in. (15.82 - 16.95 N.m).

   (3) Position joined tube assemblies along Flange B2 and attach three places with clamps (401/4), bolts (401/5), nuts (401/6), and washers (401/7). Torque nuts to 20 - 25 lb-in. (2.26 - 2.83 N.m).

   (4) Attach lower end of tube assembly (401/2) to tee fitting at mounting bracket. Torque tube coupling to 140 - 150 lb-in. (15.82 - 16.95 N.m).

   (5) Install union (401/8) in diffuser assembly (401/9). Orient smaller orifice of union toward diffuser assembly. Torque union to 270 - 300 lb-in. (30.51 - 33.90 N.m).

   (6) Attach diffuser assembly (401/9) to union (401/8). Torque tube coupling to 140 - 150 lb-in. (15.82 - 16.95 N.m).

   (7) Attach diffuser assembly to Flange B2 using bolts (401/10), washers (401/11), and nuts (401/12). Torque nuts to 50 - 70 lb-in. (5.65 - 7.91 N.m).

   (8) Install tube assembly (401/13) between tee duct assembly (401/14) and tee fitting. Torque tube coupling to 140 - 150 lb-in. (15.82 - 16.95 N.m).

   (9) On right side of fan case, install union (401/15) in upper tube assembly (401/16). Torque union to 125 - 140 lb-in. (14.12 - 15.82 N.m).

(10) Install lower tube assembly (401/17) to union. Torque tube coupling to 140 − 150 lb−in. (15.82 − 16.95 N.m).

(11) Position tube assemblies between Flanges C and B2 and attach four places along Flange B2 using clamps (401/18), screws (401/19), washers (401/20), and nuts (401/21). Torque nuts to 20 − 25 lb−in. (2.26 − 2.83 N.m).

(12) Install union (401/22) in end of upper tube assembly (401/16). Install larger orifice of union in tube assembly. Torque union to 270 − 300 lb−in. (30.51 − 33.90 N.m).

(13) Attach diffuser assembly (401/23) to union (401/22). Torque diffuser assembly coupling nut to 270 − 300 lb−in. (30.51 − 33.90 N.m).

(14) Attach diffuser assembly to Flange B2 using bolts (401/24), washers (401/25), and nuts (401/26). Torque nuts to 50 − 70 lb−in. (5.65 − 7.91 N.m).

(15) Attach lower end of tube assembly (401/17) to tee fitting. Torque tube coupling to 140 − 150 lb−in. (15.82 − 16.95 N.m).

Task 71−00−33−450−033−A:

2. Install Heat Diffuser Assembly − Post SB PW4NAC 78−21 And PW4NAC 78−40

A. Equipment And Materials Required − None

B. Procedure

See Figures 401 and 403.

(1) On left side of fan case, insert upper tube assembly (401/1) beneath PDU mounting brackets between Flanges B2 and C.

(2) Install union (401/3) between upper and lower tube assemblies (401/1) and (401/2). Torque union to 125 − 140 lb−in. (14.12 − 15.82 N.m). Torque remaining tube coupling at union to 140 − 150 lb−in. (15.82 − 16.95 N.m).

POWER PLANT GENERAL − FAN CASE − INSTALLATION−20

(3) Position joined tube assemblies along Flange B2 and attach three places with clamps (401/4), bolts (401/5), nuts (401/6), and washers (401/7). Torque nuts to 20 − 25 lb−in. (2.26 − 2.83 N.m).

(4) Attach lower end of tube assembly (401/2) to tee fitting at mounting bracket. Torque tube coupling to 140 − 150 lb−in. (15.82 − 16.95 N.m).

(5) Install union (401/8) in diffuser assembly (401/9). Orient smaller orifice of union toward diffuser assembly. Torque union to 270 − 300 lb−in. (30.51 − 33.90 N.m).

(6) Attach diffuser assembly (401/9) to union (401/8). Torque tube coupling to 140 − 150 lb−in. (15.82 − 16.95 N.m).

(7) Attach diffuser assembly to Flange B2 using bolts (401/10), washers (401/11), and nuts (401/12). Torque nuts to 50 − 70 lb−in. (5.65 − 7.91 N.m).

(8) Install tube assembly (401/13) between tee duct assembly (401/14) and tee fitting. Torque tube coupling to 140 − 150 lb−in. (15.82 − 16.95 N.m).

(9) On right side of fan case, install union (401/15) in lower end of center tube assembly (401/16). Torque union to 125 −140 lb−in. (14.12 − 15.82 N.m).

(10) Install lower tube assembly (401/17) to union. Torque tube coupling to 140 − 150 lb−in. (15.82 − 16.95 N.m).

(11) Install upper tee fitting (401/27) into upper end of center tube assembly (401/16). Torque tube coupling to 270 − 300 lb−in. (30.51 − 33.90 N.m).

(12) Install upper tube assembly (401/28) onto tee fitting (401/27). Torque tube coupling to 270 − 300 lb−in. (30.51 − 33.90 N.m).

(13) Position connected tube assemblies between Flanges C and B2 and attach four places along Flange B2 using clamps (401/18), screws (401/19), washers (401/20), and nuts (401/21). Torque nuts to 20 − 25 lb−in. (2.26 − 2.83 N.m).

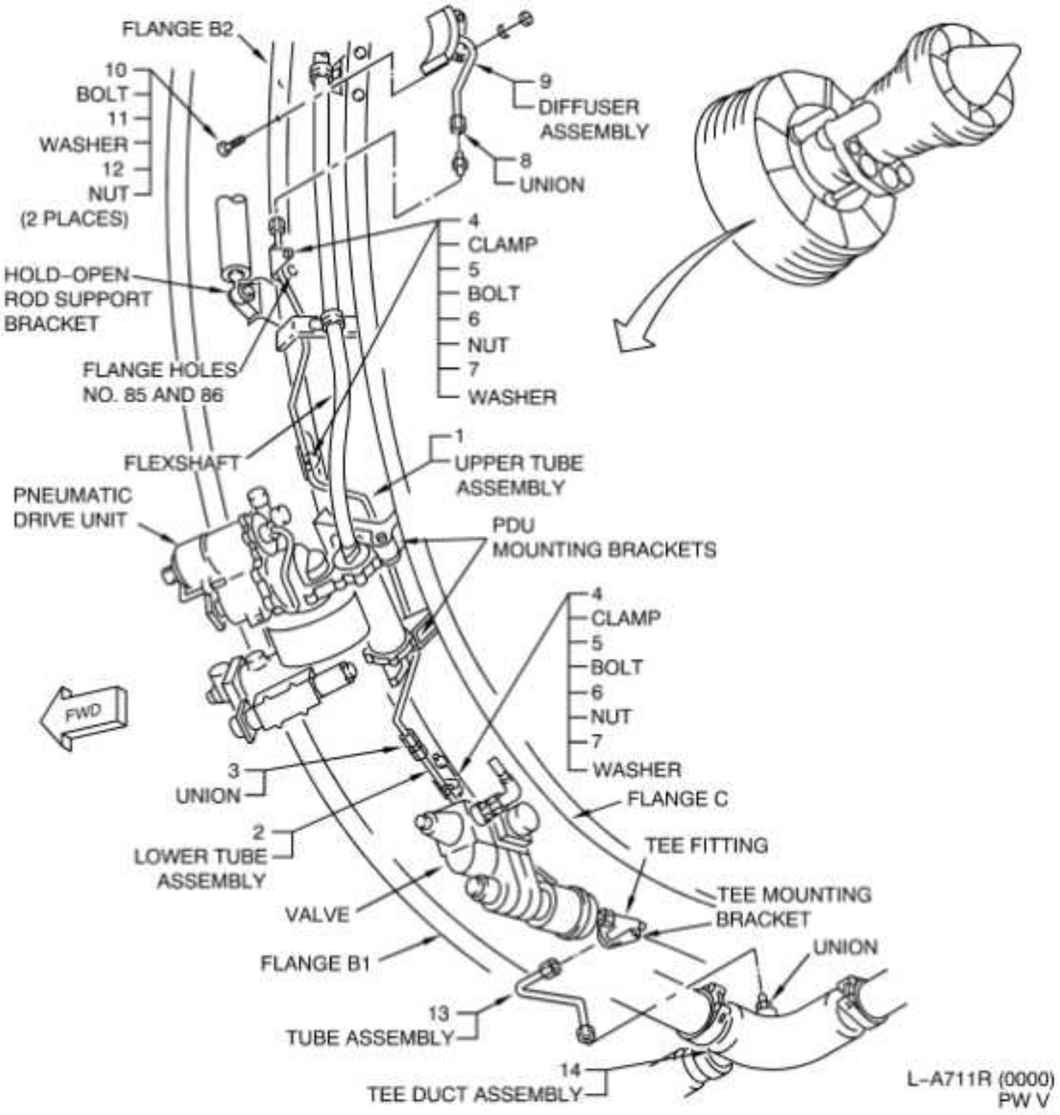
(14) Install union (401/22) in upper end of upper tube assembly (401/28). Install larger orifice of union in tube assembly. Torque union to 270 − 300 lb−in. (30.51 − 33.90 N.m).

(15) Attach diffuser assembly (401/23) to union (401/22). Torque diffuser assembly coupling nut to 270 − 300 lb−in. (30.51 − 33.90 N.m).

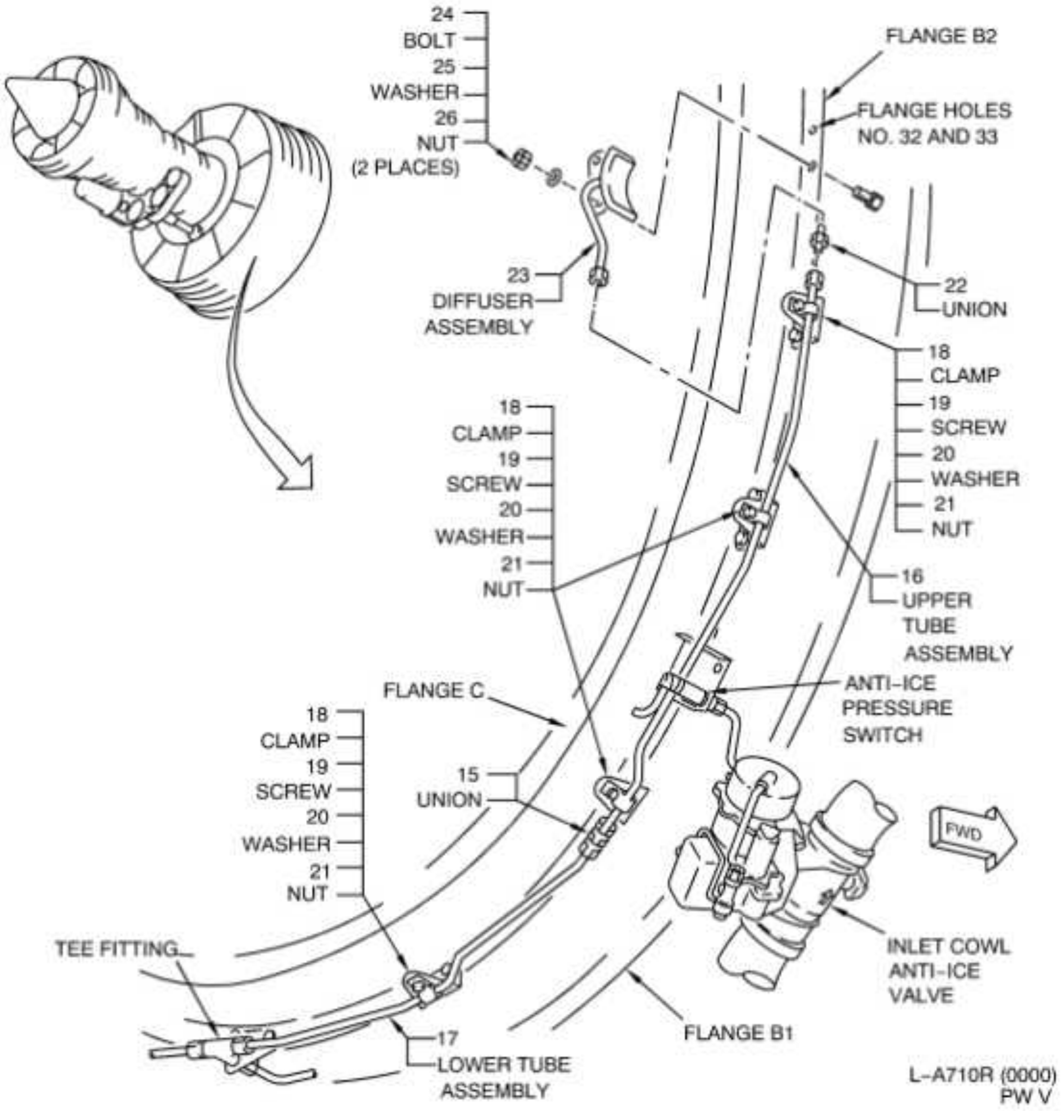
(16) Attach diffuser assembly to Flange B2 using bolts (401/24), washers (401/25), and nuts (401/26). Torque nuts to 50 − 70 lb−in. (5.65 − 7.91 N.m).

(17) Attach lower end of tube assembly (401/17) to tee fitting. Torque tube coupling to 140 − 150 lb−in. (15.82 − 16.95 N.m).

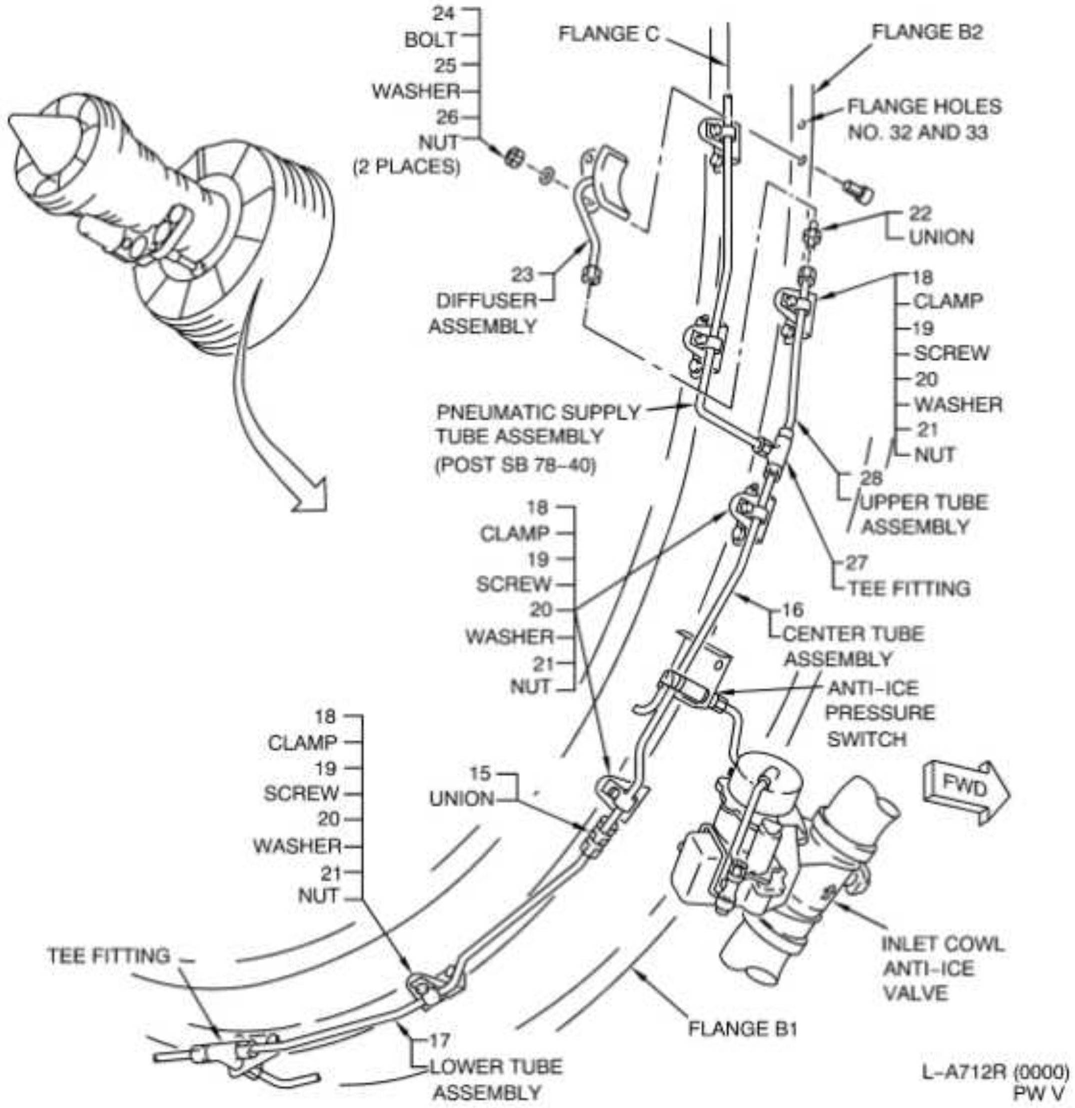
(18) Connect pneumatic supply tube assembly to upper tee fitting (401/27). Torque tube coupling to 270 − 300 lb−in. (30.51 − 33.90 N.m).


FLANGE B2
10
BOLT
11
WASHER
12
NUT
(2 PLACES)
9
DIFFUSER ASSEMBLY
8
UNION
4
CLAMP
5
BOLT
6
NUT
7
WASHER
HOLD-OPEN ROD SUPPORT BRACKET
FLANGE HOLES NO. 85 AND 86
FLEXSHAFT
1
UPPER TUBE ASSEMBLY
PNEUMATIC DRIVE UNIT
PDU MOUNTING BRACKETS
4
CLAMP
5
BOLT
6
NUT
7
WASHER
FWD
3
UNION
FLANGE C
2
LOWER TUBE ASSEMBLY
TEE FITTING
VALVE
TEE MOUNTING BRACKET
FLANGE B1
UNION
13
TUBE ASSEMBLY
14
TEE DUCT ASSEMBLY
L-A711R (0000)
PW V

Heat Diffuser Assembly − Left Side
(Post SB PW4NAC 78−21)
Figure 401
(Task 71−00−33−450−033)


24
BOLT
25
WASHER
26
NUT
(2 PLACES)
FLANGE B2
FLANGE HOLES NO. 32 AND 33
23
DIFFUSER ASSEMBLY
22
UNION
18
CLAMP
19
SCREW
20
WASHER
21
NUT
18
CLAMP
19
SCREW
20
WASHER
21
NUT
16
UPPER TUBE ASSEMBLY
FLANGE C
ANTI−ICE PRESSURE SWITCH
18
CLAMP
19
SCREW
20
WASHER
21
NUT
15
UNION
FWD
TEE FITTING
INLET COWL ANTI−ICE VALVE
17
LOWER TUBE ASSEMBLY
FLANGE B1
L−A710R (0000)
PW V

Heat Diffuser Assembly − Right Side
(Post SB PW4NAC 78−21)
Figure 402
(Task 71−00−33−450−033)


24
BOLT
25
WASHER
26
NUT
(2 PLACES)
FLANGE C
FLANGE B2
FLANGE HOLES
NO. 32 AND 33
22
UNION
23
DIFFUSER
ASSEMBLY
18
CLAMP
19
SCREW
20
WASHER
21
NUT
PNEUMATIC SUPPLY
TUBE ASSEMBLY
(POST SB 78−40)
28
UPPER TUBE
ASSEMBLY
18
CLAMP
19
SCREW
20
WASHER
21
NUT
27
TEE FITTING
16
CENTER TUBE
ASSEMBLY
ANTI-ICE
PRESSURE
SWITCH
18
CLAMP
19
SCREW
20
WASHER
21
NUT
15
UNION
FWD
TEE FITTING
INLET COWL
ANTI-ICE
VALVE
FLANGE B1
17
LOWER TUBE
ASSEMBLY
L-A712R (0000)
PW V

Heat Diffuser Assembly − Right Side
(Post SB PW4NAC 78−21 And 78−40)
Figure 403
(Task 71−00−33−450−033)

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POWER PLANT GENERAL − FAN CASE − INSTALLATION−21

Task 71−00−33−450−034:

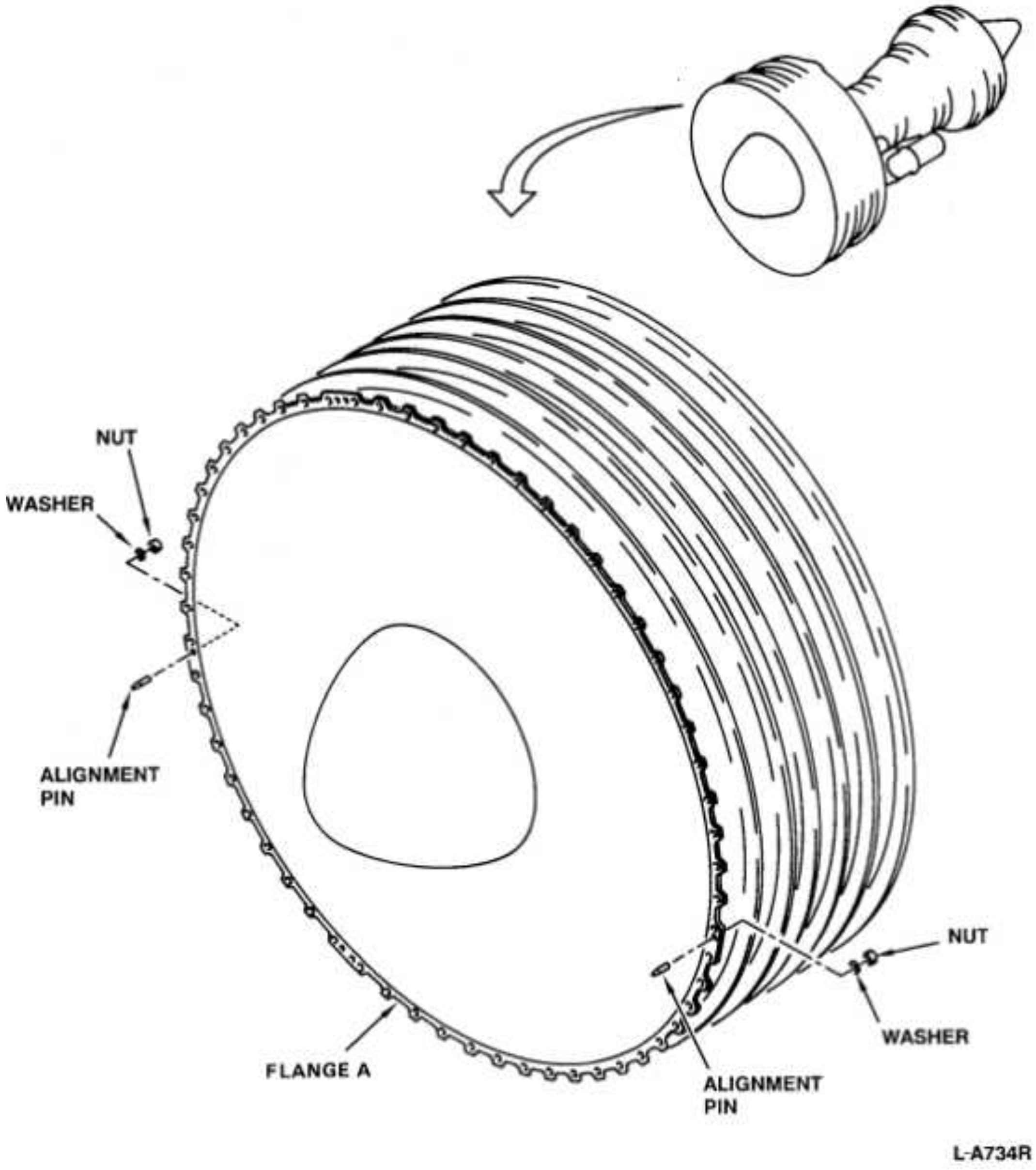
1. Install Inlet Cowl Alignment Pins

A. Equipment And Materials Required − None

B. Procedure

See Figure 401.

(1) At opposite sides on Flange A of engine case, install two inlet cowl alignment pins using washer and nut. Torque nuts 50 − 70 lb−in. (5.65 − 7.91 N.m).


NUT
WASHER
ALIGNMENT PIN
FLANGE A
NUT
WASHER
ALIGNMENT PIN
L-A734R

Inlet Cowl Alignment Pins
Figure 401
(Task 71−00−33−450−034)

POWER PLANT GENERAL - FAN CASE - INSTALLATION-22

Task 71-00-33-450-035:

1. Install EEC And RVDT Electrical Junction Box - Right Hand Side

A. Equipment And Materials Required

Standard Tools:

Name	Manufacturer
Wrench, Strap (Glenair TG-70)	Glenair International Corp 312 5th Ave. New Rochelle, NY 10802
Pliers, Soft-Jawed (optional) (Glenair TG-69)	Glenair International Corp 312 5th Ave. New Rochelle, NY 10802

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Lockwire, MS20995N20				

B. Procedure

See Figure 401.

(1) (Pre SB PW4NAC 71-100) Install the EEC J-Box (5) on the brackets on the right side of the fan case with screws (10), washers (15) and nuts (20). Torque the nuts to 20 - 25 lb-in. (2.3 - 2.8 N.m).

(2) (Post SB PW4NAC 71-100) Install the EEC J-Box (5) on the brackets on the right side of the fan case with screws (10) and washers (15). Torque the screws to 20 - 25 lb-in. (2.3 - 2.8 N.m).

(3) (Pre/Post SB PW4NAC 71-100) Align electrical connectors D5011P, D5052P, D5053P, D5007P, D5010P, D5006P and D5051P of wire harness keyways with mating receptacles.

NOTE: Witness (color) band is the first band receptacle.

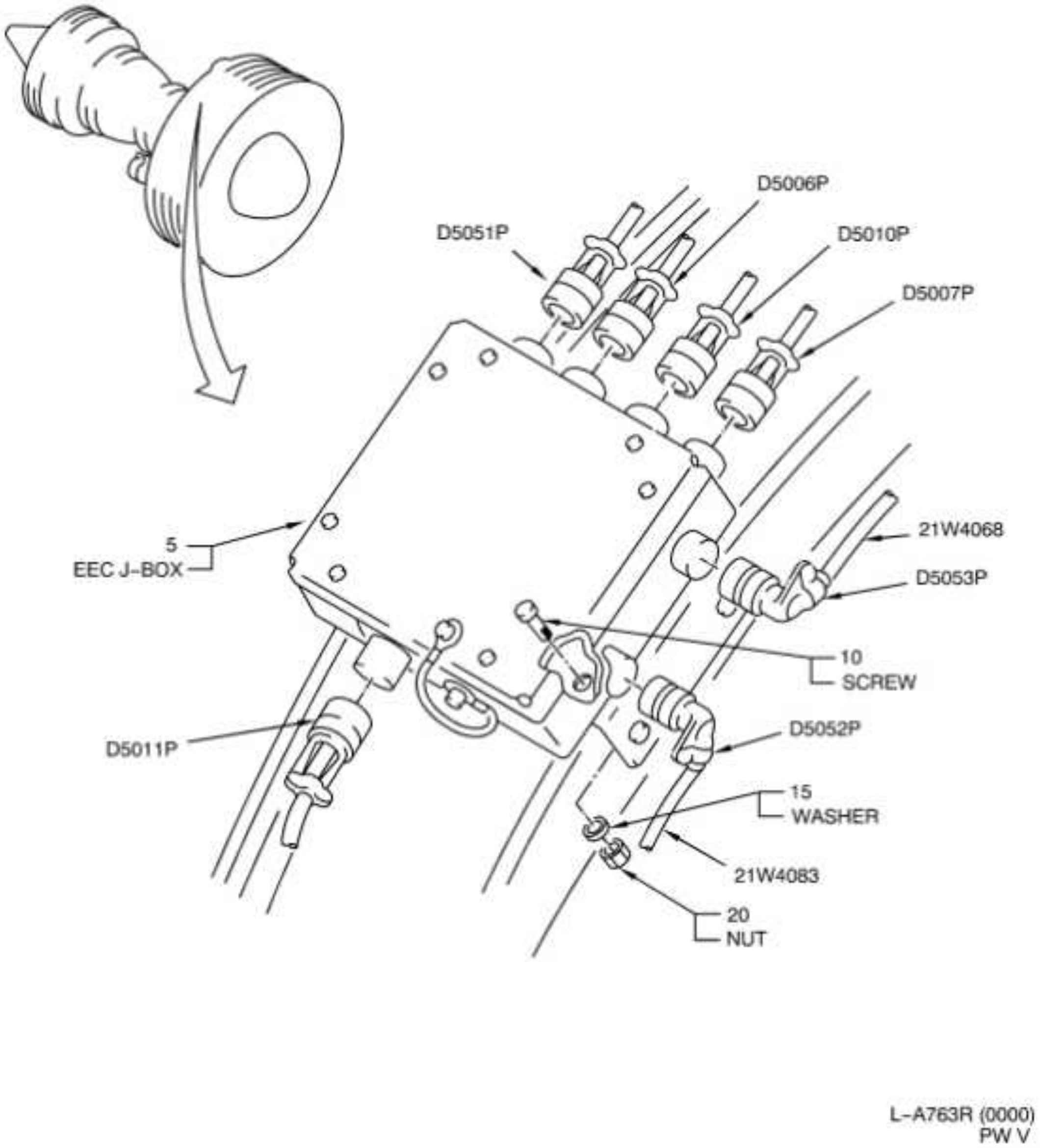
(4) Tighten connectors D5011P, D5052P, D5053P, D5007P, D5010P, D5006P and D5051P coupling nuts until the witness (color) band on the receptacle is out of view and the coupling nuts are fingertight.

CAUTION: THE USE OF INCORRECT TOOLS CAN CAUSE DAMAGE TO THE CONNECTORS. LOOSE CONNECTORS CAN ALLOW ENGINE VIBRATION TO CAUSE CONTACTS TO WEAR AND CREATE UNSATISFACTORY LIGHTNING PROTECTION.

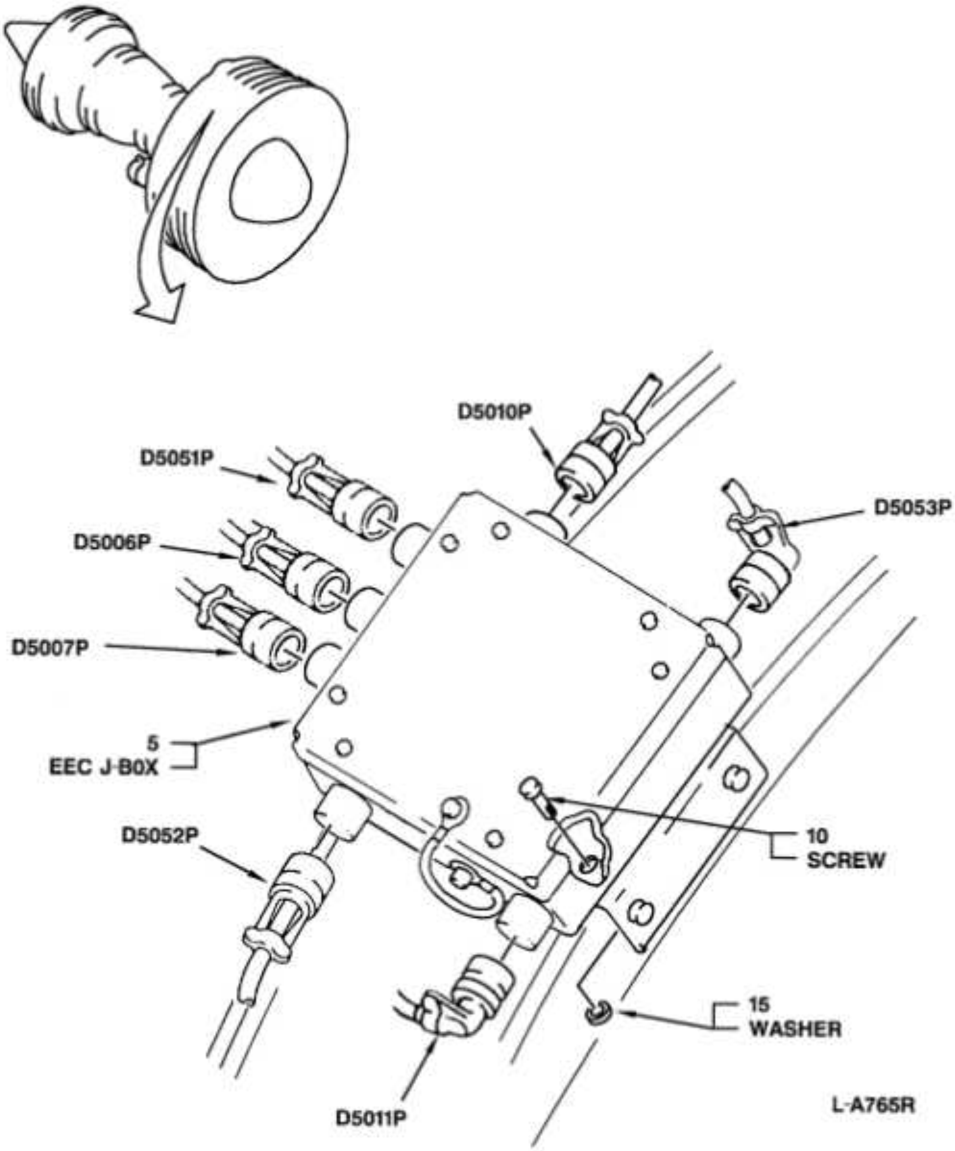
(5) Tighten the connector coupling nuts with a strap wrench (Glenair TG−70) or soft−jawed pliers (Glenair TG−69). Use sufficient force to ensure that the coupling nuts are fully tightened against the receptacles (metal to metal contact).

NOTE: When tools are used correctly, contacts will be sufficiently engaged and the connector coupling nuts will be tight. If excessive force is used, the tools will turn on the coupling nuts without tightening the nuts, preventing the nuts from being overtorqued.

(6) Lockwire the connectors.


D5006P
D5051P
D5010P
D5007P
5
EEC J-BOX
21W4068
D5053P
10
SCREW
D5011P
D5052P
15
WASHER
21W4083
20
NUT
L-A763R (0000)
PW V

Thrust Reverser J−Box − Right Hand Side
(Pre SB PW4NAC 71−100)
Figure 401 (Sheet 1)
(Task 71−00−33−450−035)


D5010P
D5051P
D5053P
D5006P
D5007P
5
EEC J-BOX
D5052P
10
SCREW
15
WASHER
D5011P
L-A765R

Thrust Reverser J−Box − Right Hand Side
(Post SB PW4NAC 71−100)
Figure 401 (Sheet 2)
(Task 71−00−33−450−035)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - FAN CASE - INSTALLATION-23

Task 71-00-33-450-036:

1. Install EEC And RVDT Junction Box - Left Hand Side

A. Equipment And Materials Required

Standard Tools:

Name	Manufacturer
Wrench, Strap (Glenair TG-70)	Glenair International Corp 312 5th Ave. New Rochelle, NY 10802
Pliers, Soft-Jawed (optional) (Glenair TG-69)	Glenair International Corp 312 5th Ave. New Rochelle, NY 10802

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Lockwire, MS20995N20				

B. Procedure

See Figure 401.

(1) (Pre SB PW4NAC 71-100) Install the EEC J-Box (5) on the brackets on the left side of the fan case with screws (25), washers (30) and nuts (35). Torque the nuts to 50 - 70 lb-in. (5.7 - 7.9 N.m).

(2) (Post SB PW4NAC 71-100) Install the EEC J-Box (5) on the brackets on the left side of the fan case with screws (25) and washers (30). Torque the screws to 50 - 70 lb-in. (5.7 - 7.9 N.m).

(3) Attach wire harness (21W4120 and 21W4118) to the aft side of the J-Box (5) with clamps (20), screws (10) and washers (15). Torque the screws to 20 - 25 lb-in. (2.3 - 2.8 N.m).

(4) Align electrical connectors D5003P, D5021P, D5020P, D5022P and D5002P of wire harness keyways with mating receptacles.

NOTE: Witness (color) band is the first band receptacle.

(5) Tighten connectors D5021P, D5022P, D5002P, D5020P and D5003P coupling nuts until the witness (color) band on the receptacle is out of view and the coupling nuts are fingertight.

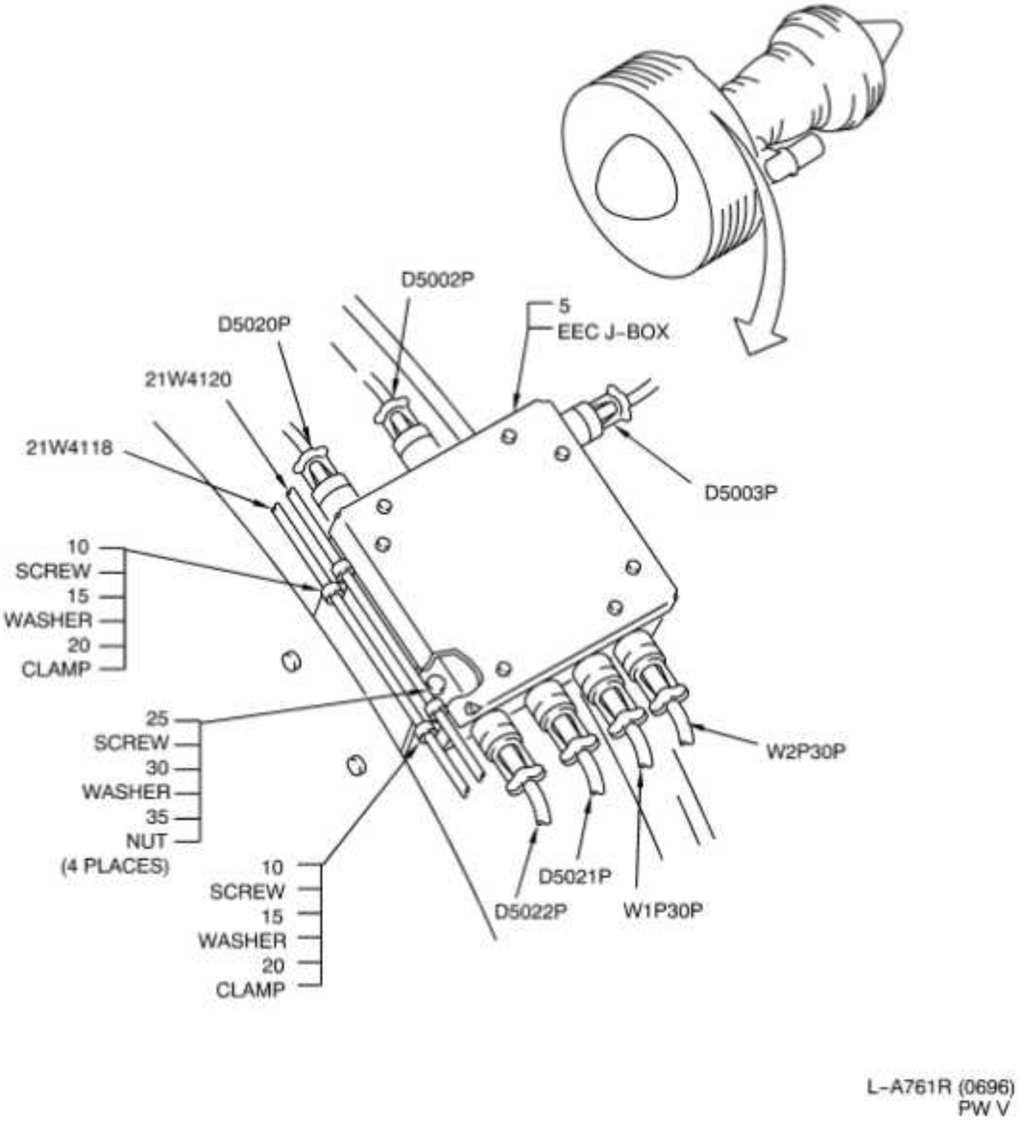
CAUTION: THE USE OF INCORRECT TOOLS CAN CAUSE DAMAGE TO THE CONNECTORS. LOOSE CONNECTORS CAN ALLOW ENGINE VIBRATION TO CAUSE CONTACTS TO WEAR AND CREATE UNSATISFACTORY LIGHTNING PROTECTION.

(6) Tighten the connector coupling nuts with a strap wrench (Glenair TG−70) or soft−jawed pliers (Glenair TG−69). Use sufficient force to ensure that the coupling nuts are fully tightened against the receptacles (metal to metal contact).

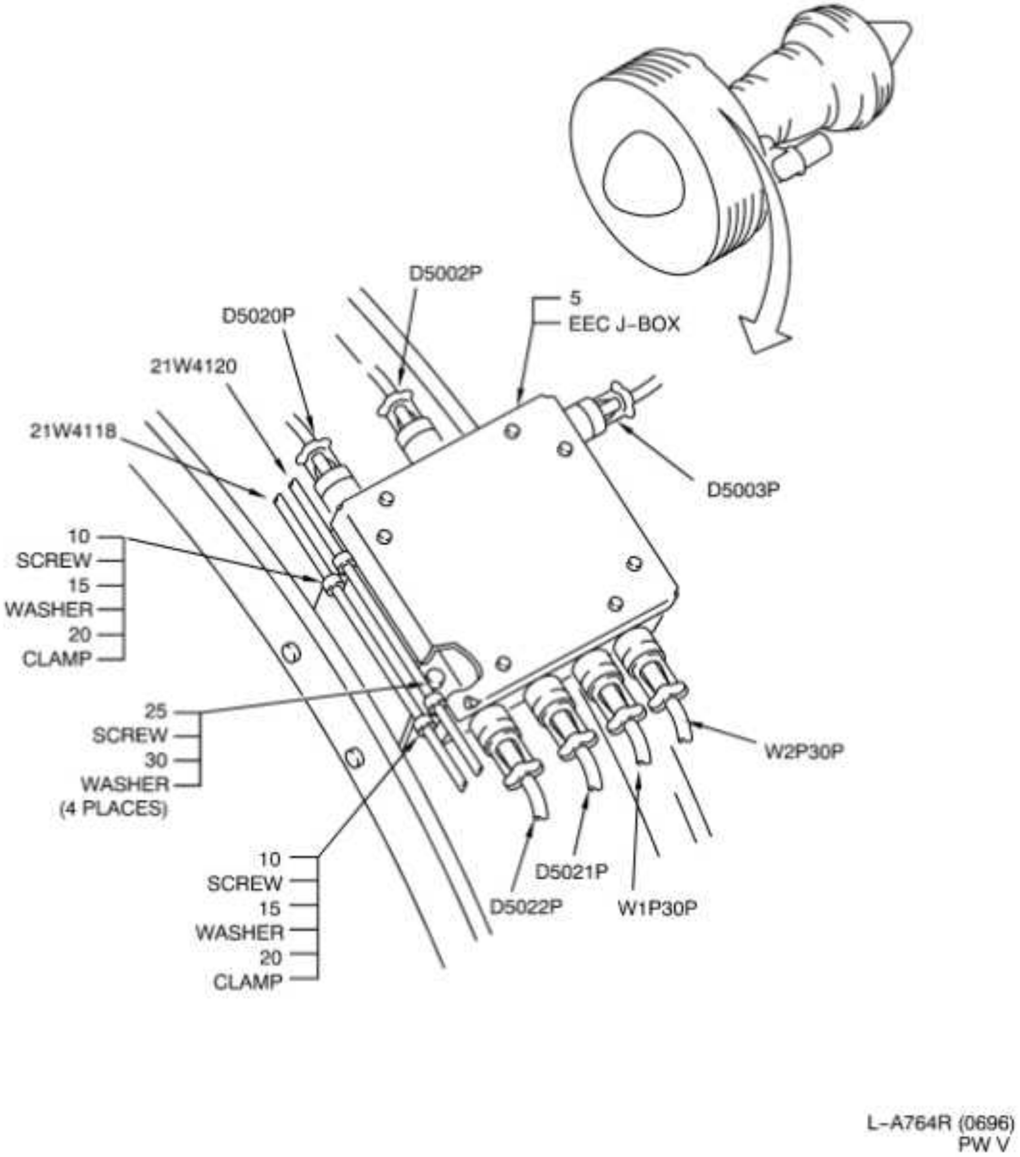
NOTE: When tools are used correctly, contacts will be sufficiently engaged and the connector coupling nuts will be tight. If excessive force is used, the tools will turn on the coupling nuts without tightening the nuts, preventing the nuts from being overtorqued.

(7) Connect W1P30P and W2P30P connectors.

(8) Lockwire the connectors.


D5002P
5
EEC J-BOX
D5020P
21W4120
21W4118
D5003P
10
SCREW
15
WASHER
20
CLAMP
25
SCREW
30
WASHER
35
NUT
(4 PLACES)
W2P30P
10
SCREW
15
WASHER
20
CLAMP
D5021P
D5022P
W1P30P
L-A761R (0696)
PW V

Thrust Reverser J−Box − Left Hand Side
(Pre SB PW4NAC 71−100)
Figure 401 (Sheet 1)
(Task 71−00−33−450−036)


D5002P
5
EEC J-BOX
D5020P
21W4120
21W4118
D5003P
10
SCREW
15
WASHER
20
CLAMP
25
SCREW
30
WASHER
(4 PLACES)
W2P30P
10
SCREW
15
WASHER
20
CLAMP
D5021P
D5022P
W1P30P
L-A764R (0696)
PW V

Thrust Reverser J−Box − Left Hand Side
(Post SB PW4NAC 71−100)
Figure 401 (Sheet 2)
(Task 71−00−33−450−036)

Task 71-00-33-450-037:

1. Install PS And P2 System Tubing

R A. Equipment And Materials Necessary

R Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine

B. Procedure
See Figure 401.

R (1) Lubricate the coupling nuts and clamp bolt (401/5) with Engine Oil P03-001.

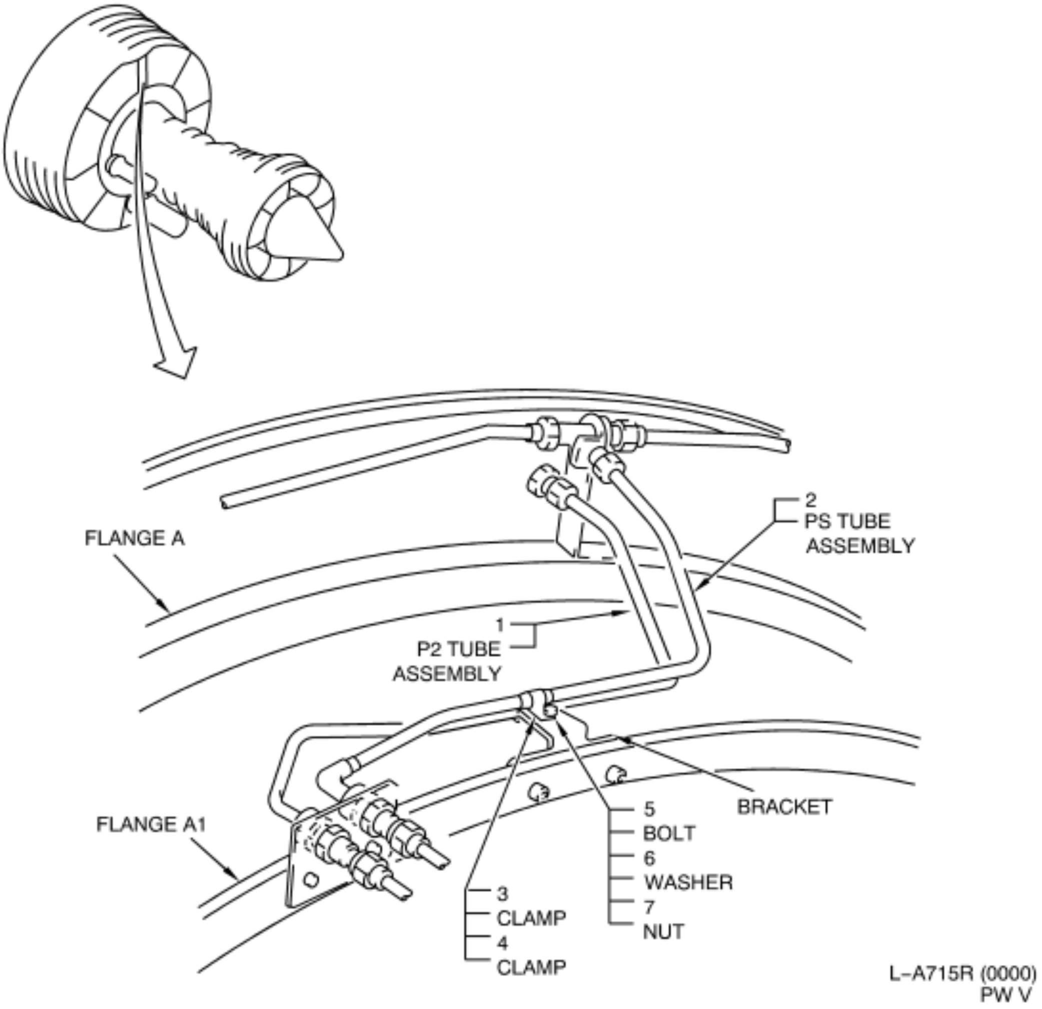
R (2) Position P2 tube assembly (401/1), PS tube assembly (401/2), and two clamps (401/3, 401/4) on top of engine between Flanges A and A1. Using bolt (401/5), washer (401/6), and nut (401/7), loosely install clamps and tube assemblies to bracket located on forward face of Flange A1 at holes 3 and 4. Tighten nut fingertight.

R (3) Loosely connect PS and P2 tube assemblies to fittings at brackets on Flanges A1 and A. Tighten coupling nuts fingertight.

R (4) Tighten nut on two clamps securing PS and P2 tube assemblies to bracket. Torque nut to 20 - 25 lb-in. (2.26 - 2.82 N.m).

R (5) Torque the coupling nuts on PS (AS17) tube assembly to 270 - 300 lb-in. (30.51 - 33.90 N.m).

R (6) Torque the coupling nuts on P2 (AS16) tube assembly to 135 - 150 lb-in. (15.253 - 16.948 N.m).


FLANGE A
2
PS TUBE
ASSEMBLY
1
P2 TUBE
ASSEMBLY
BRACKET
FLANGE A1
5
BOLT
6
WASHER
7
NUT
3
CLAMP
4
CLAMP
L-A715R (0000)
PW V

PS And P2 System Tubing
Figure 401
(Task 71-00-33-450-037)

R
R

POWER PLANT GENERAL − FAN CASE − INSTALLATION−25

Task 71−00−33−450−041:

1. Install Barometric Switch

   A. Equipment And Materials Required − None

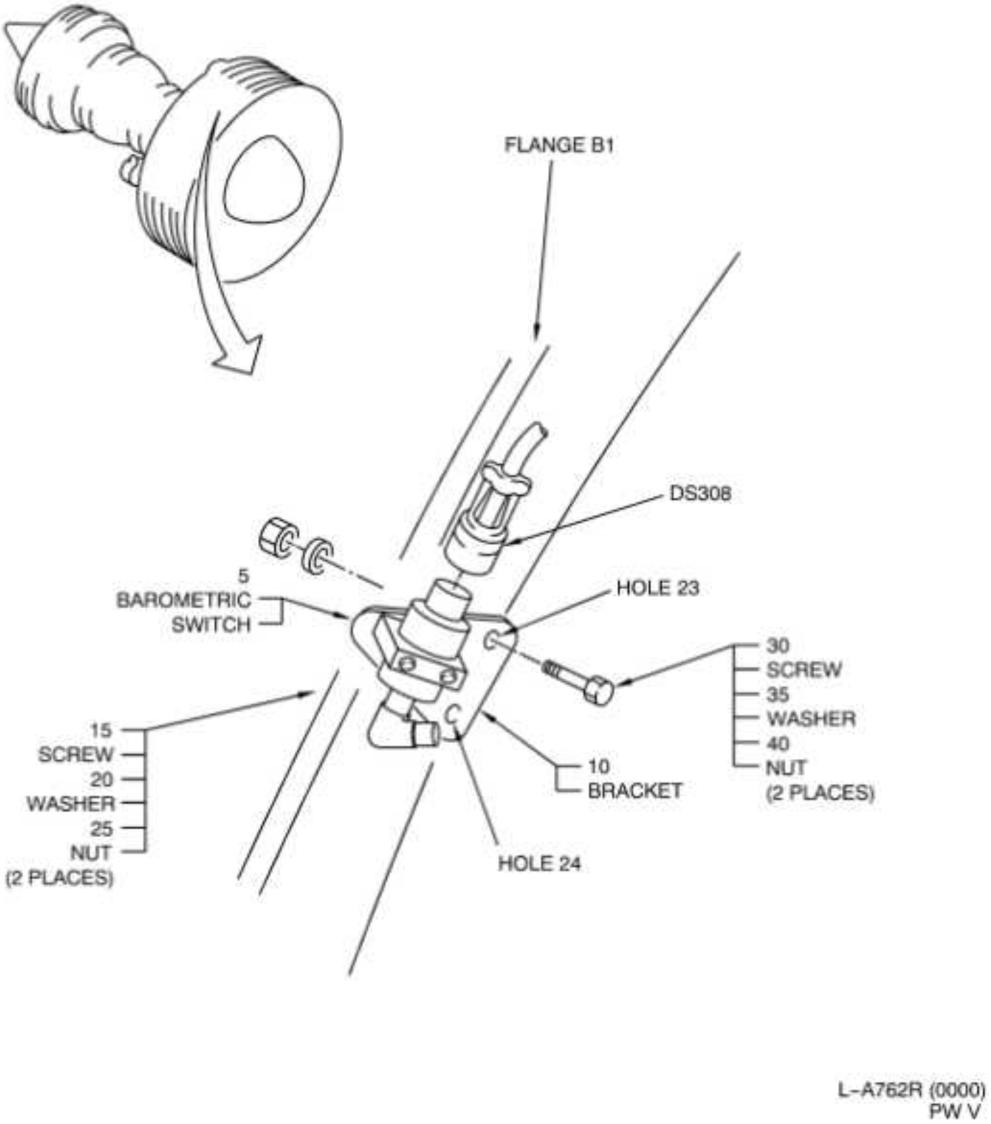
   B. Procedure

   See Figure 401.

   (1) Mount the barometric switch (5) onto the bracket (10) the screws (15), washers (20) and nuts (25). Torque the nuts to 20 − 25 lb−in. (2.3 − 2.8 N.m).

   (2) Install the bracket with the barometric switch attached to the forward side of engine flange B1 at holes 23 and 24 with the screws (30), washers (35) and nuts (40). Torque the nuts to 50 − 70 lb−in. (5.7 − 7.9 N.m).

   (3) Install electrical connector DS308 to the barometric switch receptacle. Tighten the connector fingertight plus one−eighth turn.


FLANGE B1
DS308
5
BAROMETRIC
SWITCH
HOLE 23
30
SCREW
35
WASHER
40
NUT
(2 PLACES)
15
SCREW
20
WASHER
25
NUT
(2 PLACES)
10
BRACKET
HOLE 24
L−A762R (0000)
PW V

Nacelle Cooling Barometric Switch
Figure 401
(Task 71−00−33−450−041)

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71−00−34	POWER PLANT GENERAL − INTERMEDIATE CASE − REMOVAL−02 • 71−00−34−050−007: Remove Circumferential Latch Supports
71−00−34	POWER PLANT GENERAL − INTERMEDIATE CASE − INSTALLATION−01 • 71−00−34−450−001: Install Engine Forward Mount
71−00−34	POWER PLANT GENERAL − INTERMEDIATE CASE − INSTALLATION−02 • 71−00−34−450−007: Install Circumferential Latch Supports

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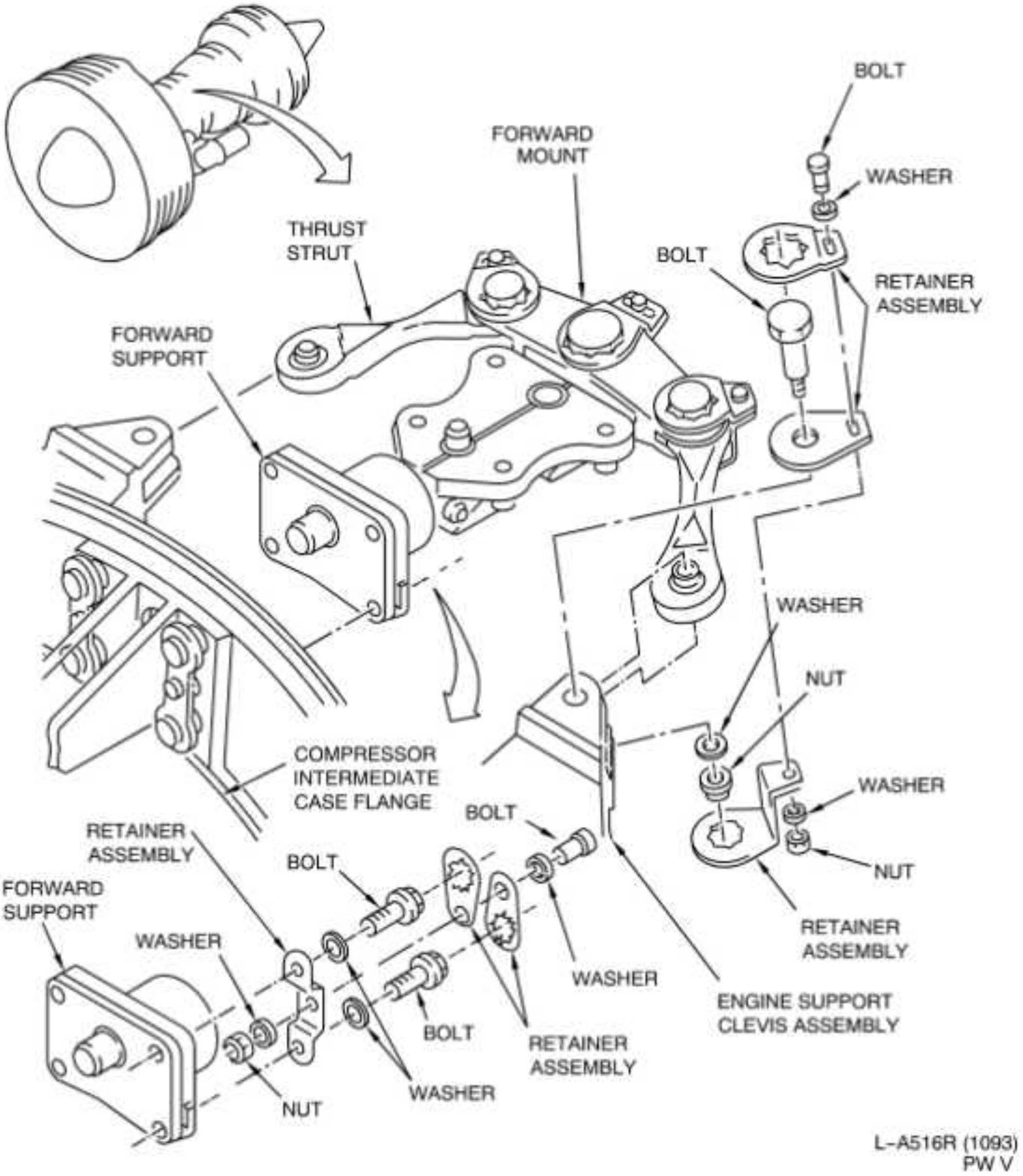
POWER PLANT GENERAL − INTERMEDIATE CASE − REMOVAL−01

Task 71−00−34−050−001:

1. Remove Engine Forward Mount
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figure 301.
     - (1) Remove bolt, washers and nut securing two retainer assemblies to secondary retainer.
     - (2) Remove bolts and washers securing secondary retainer assembly to forward support.
     - (3) Remove nuts, washers, bolts and retainers from two (2) sets of fasteners attaching forward mount to engine support clevis assembly.
     - (4) Remove two (2) bolts, washers and nuts attaching thrust struts to engine support clevis assemblies.
     - (5) Remove mount from engine.

       NOTE: For additional information concerning detailed maintenance of the component, see Forward Engine Mount Component Maintenance Manual, 71−20−04 (P&W PN 221−4049).


BOLT
WASHER
FORWARD MOUNT
THRUST STRUT
BOLT
RETAINER ASSEMBLY
FORWARD SUPPORT
WASHER
NUT
COMPRESSOR INTERMEDIATE CASE FLANGE
WASHER
BOLT
NUT
RETAINER ASSEMBLY
FORWARD SUPPORT
BOLT
WASHER
RETAINER ASSEMBLY
WASHER
ENGINE SUPPORT CLEVIS ASSEMBLY
BOLT
RETAINER ASSEMBLY
NUT
WASHER
L-A516R (1093)
PW V

Engine Forward Mount Removal
Figure 301
(Task 71-00-34-050-001)

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POWER PLANT GENERAL − INTERMEDIATE CASE − REMOVAL−02

Task 71−00−34−050−007:

1. Remove Circumferential Latch Supports

A. Equipment And Materials Required − None

B. Procedure

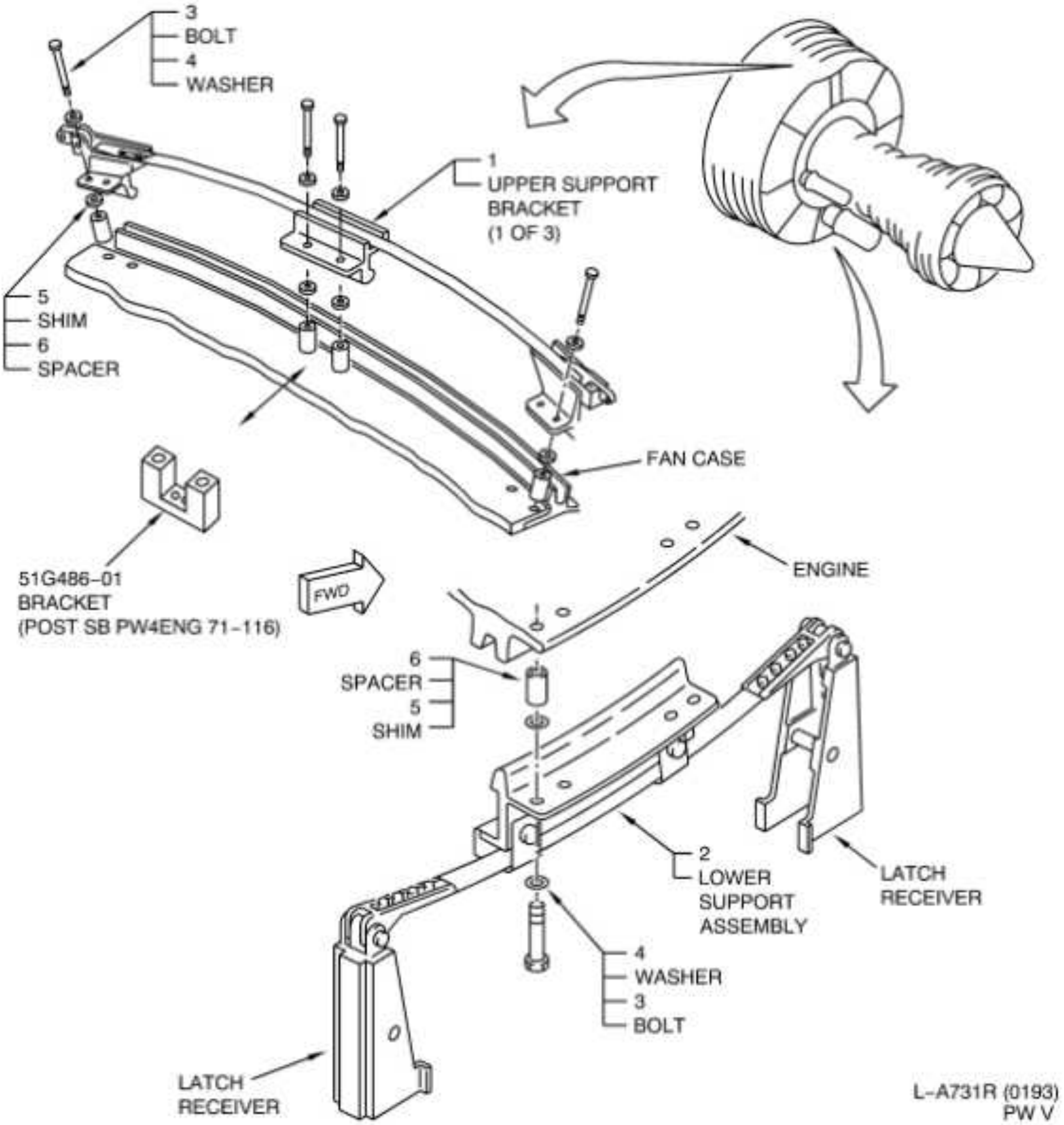
See Figure 301.

(1) At top of fan case, remove bolts, washers, spacers, and shims attaching upper support assembly to fan case.

(2) At bottom of fan case, remove bolts, washers, spacers, and shims attaching lower support assembly to engine case.

NOTE: Identify shim location on shim and retain for re−installation.

(3) Remove upper and lower support assemblies from engine.


3
BOLT
4
WASHER
1
UPPER SUPPORT
BRACKET
(1 OF 3)
5
SHIM
6
SPACER
FAN CASE
51G486-01
BRACKET
(POST SB PW4ENG 71-116)
FWD
ENGINE
6
SPACER
5
SHIM
2
LOWER
SUPPORT
ASSEMBLY
LATCH
RECEIVER
4
WASHER
3
BOLT
LATCH
RECEIVER
L-A731R (0193)
PW V

Circumferential Latch Supports
Figure 301
(Task 71-00-34-050-007)

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POWER PLANT GENERAL - INTERMEDIATE CASE - INSTALLATION-01

Task 71-00-34-450-001:

1. Install Engine Forward Mount

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P06-020	Lubricant, Bolt
P09-001	Sealant, Silicone (DC 90-006)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Lockwire, MS20995C32				

B. Procedure

See Figure 401.

(1) Position mount (401/1) on engine.

(2) Apply Lubricant (P06-020) to shank and threads of bolt (401/2).

NOTE: Prior to re-installation of (Post SB PW4NAC 71-111) forward mounts, ensure residual sealant is removed from engine support clevis assembly, bottom retainer assembly (401/3), nut (401/5) and washer (401/4). For additional information concerning detailed removal of sealant from these parts, see Forward Engine Mount Component Maintenance Manual, 71-20-04, Page Block 700 (P&W PN 221-4049).

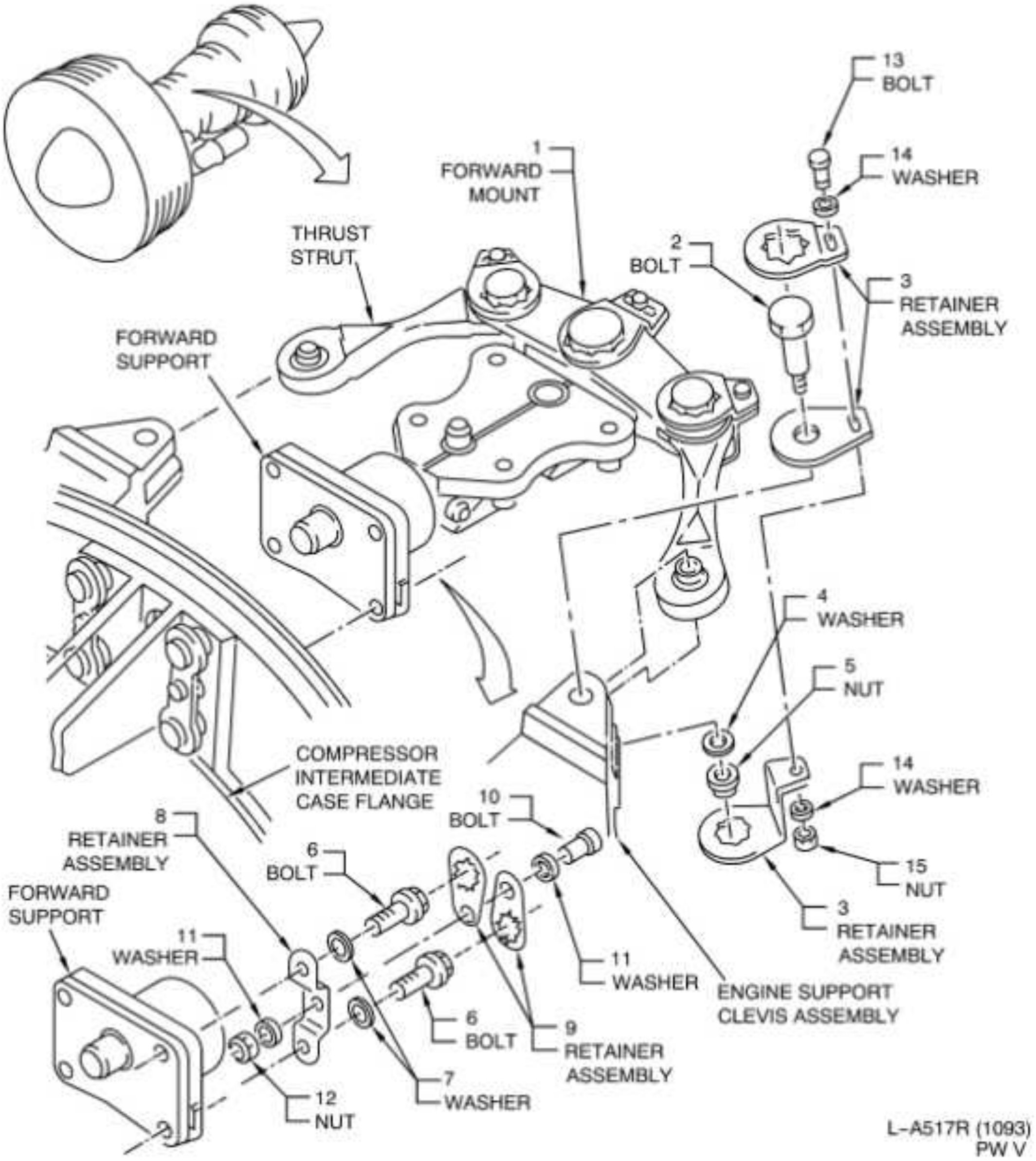
(3) Install center retainers (401/3), two bolts (401/2), washers (401/4) both sides of washers wet with Sealant (P09-001) (Post SB PW4NAC 71-111), and nuts (401/5) attaching thrust struts to engine support clevis assemblies.

(a) During installation, observe run on torque required to turn nuts (401/5) on bolts (401/2) until a minimum of two bolt threads extend beyond nuts. Check that run-on torque is between 18 - 100 lb-in. (2.034 - 11.298 N.m) with no axial loads applied.

(b) Replace any nuts not meeting specified run-on torque value and repeat check.

(4) Position forward mount assembly (401/1) on engine compressor intermediate case aft flange.

POWER PLANT GENERAL − INTERMEDIATE CASE − INSTALLATION−01


13 BOLT
14 WASHER
1 FORWARD MOUNT
2 BOLT
3 RETAINER ASSEMBLY
THRUST STRUT
FORWARD SUPPORT
4 WASHER
5 NUT
14 WASHER
15 NUT
3 RETAINER ASSEMBLY
COMPRESSOR INTERMEDIATE CASE FLANGE
10 BOLT
8 RETAINER ASSEMBLY
6 BOLT
FORWARD SUPPORT
11 WASHER
11 WASHER
ENGINE SUPPORT CLEVIS ASSEMBLY
6 BOLT
9 RETAINER ASSEMBLY
7 WASHER
12 NUT
L-A517R (1093)
PW V

Engine Forward Mount Installation
Figure 401
(Task 71−00−34−450−001)

POWER PLANT GENERAL − INTERMEDIATE CASE − INSTALLATION−01

- (a) Install mount assembly with four bolts (401/6), four washers (401/7), and retainer assemblies (401/8). Position retainers under boltheads. Torque bolts (401/6) to 180 − 220 lb−ft. (244.0 − 298.3 N.m).
- (b) Install two retainers (401/9) onto each pair of bolts (401/6) with bolt (401/10), two washers (401/11), and nut (401/12). Torque nut to 20 − 25 lb−in. (2.259 − 2.825 N.m).

(5) Torque bolts (401/2) to 250 − 300 lb−in. (28.246 − 33.895 N.m).

(6) Position top retainer (401/3) over bolt (401/2) and wet install bottom retainer (401/3) over nut (401/5) with Sealant (P09−001) on clevis mating surface of bottom retainer (Post SB PW4NAC 71−111), and install bolt (401/13), washer (401/14), and nut (401/15).

- (a) During installation, observe run−on torque required to turn nuts (401/15) on bolts (401/13) until a minimum of two bolt threads extend beyond nuts. Check that run−on torque is between 2 − 10 lb−in. (0.226 − 1.130 N.m).
- (b) Replace any nuts not meeting specified run−on torque value and repeat check.

(7) Torque nuts (401/15) to 20 − 25 lb−in. (2.260 − 2.825 N.m).

POWER PLANT GENERAL - INTERMEDIATE CASE - INSTALLATION-02

Task 71-00-34-450-007:

1. Install Circumferential Latch Supports

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P18-001	Primer, Epoxy Polyamide (MIL-P-23377)

B. Procedure

See Figure 401.

(1) On top of fan case, position upper support assembly and peel shims to obtain net fit between upper support assembly and spacer prior to installing bolts.

(2) Lubricate bolts with Oil (P03-001), and coat spacers with Primer (P18-001).

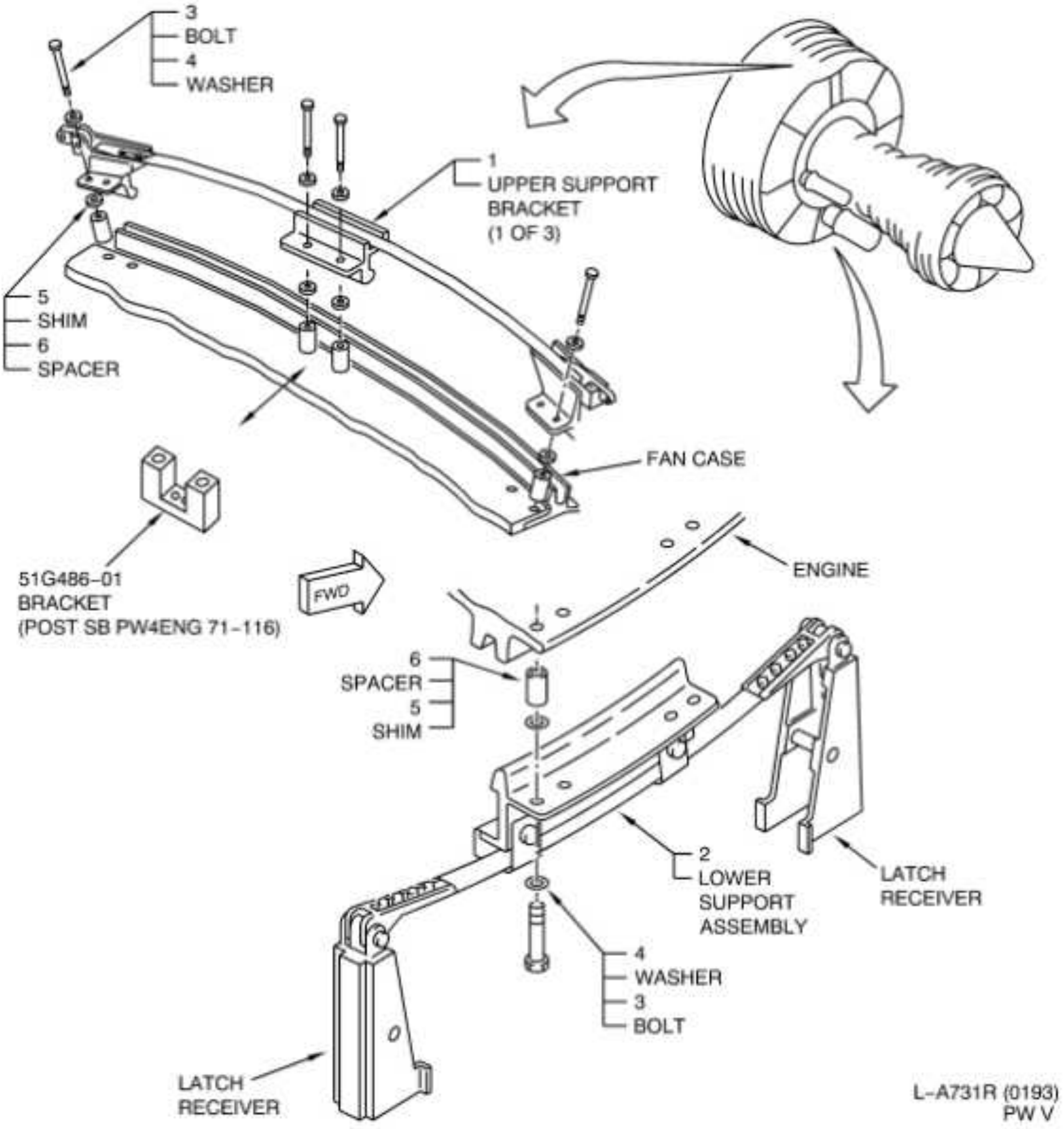
(3) Install upper support assembly and lower support assembly with bolts, washers, shims, and spacers. Torque bolts 35 - 40 lb-in. (3.954 - 4.519 N.m).

(4) At bottom of fan case, position lower support assembly and peel shims to obtain net fit between lower support assembly and spacer prior to installing bolts.

(5) Lubricate bolts with Oil (P03-001), and coat spacers with Primer (P18-001).

(6) Install lower support assembly with bolts, washers, shims, and spacers. Torque bolts 35 - 40 lb-in. (3.954 - 4.519 N.m).

POWER PLANT GENERAL − INTERMEDIATE CASE − INSTALLATION−02


3
BOLT
4
WASHER
1
UPPER SUPPORT
BRACKET
(1 OF 3)
5
SHIM
6
SPACER
FAN CASE
51G486−01
BRACKET
(POST SB PW4ENG 71−116)
FWD
ENGINE
6
SPACER
5
SHIM
2
LOWER
SUPPORT
ASSEMBLY
LATCH
RECEIVER
4
WASHER
3
BOLT
LATCH
RECEIVER
L−A731R (0193)
PW V

Circumferential Latch Supports
Figure 401
(Task 71−00−34−450−007)

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71−00−35	POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−04 • 71−00−35−050−009: Remove 2.95 Bleed Valve Bellows
71−00−35	POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−05 • 71−00−35−050−010: Remove Fire Extinguisher Tubes
71−00−35	POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−06 • 71−00−35−050−011: Remove IDG Cooling Tubes
71−00−35	POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−07 • 71−00−35−050−012: Remove Bleed Air Pneumatic Tubes And Hoses
71−00−35	POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−08 • 71−00−35−050−013: Remove TRC Valve Cooling Tube
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71−00−35	POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−02 • 71−00−35−450−002: Install High Pressure Bleed Control Valve
71−00−35	POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−03 • 71−00−35−450−003: Install Pressure Regulator Valve
71−00−35	POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−04 • 71−00−35−450−009: Install 2.95 Bleed Valve Bellows
71−00−35	POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−05 • 71−00−35−450−010: Install Fire Extinguisher Tubes
71−00−35	POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−06 • 71−00−35−450−011: Install IDG Cooling Tubes
71−00−35	POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−07 • 71−00−35−450−012: Install Bleed Air Pneumatic Tubes And Hoses
71−00−35	POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−08 • 71−00−35−450−013: Install TRC Valve Cooling Tube
71−00−35	POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−09 • 71−00−35−450−014: Install Oil System Tubes

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−01

Task 71−00−35−050−001:

1. Remove Engine Core Wiring Harness − Pre SB PW4NAC 71−70, 71−80, 71−107
   - A. Equipment And Material Required − None
   - B. Procedure

     See Figure 301.

     NOTE: Procedural steps (1) through (30) remove wire harnesses 21W4070, 21W4072 and 21W4114 from left side of engine core, Figure 301.

     (1) Remove terminal cover with attaching hardware from terminal block on IDG.
     (2) Remove four nuts and washers from terminal studs. Remove power cables 070002−00N, 070003−00A, 070004−00B and 070005−00C from IDG terminal block.
     (3) Install terminal cover on IDG with screws and washers.
     (4) Disconnect connectors DG13A and DG13B from IDG. Install protective covers.
     (5) Remove harness support with four clamps and attaching hardware.
     (6) Remove support bracket with clamp guide and two clamps and attaching hardware.
     (7) Remove support bracket with clamp guide and two clamps and attaching hardware.
     (8) Remove support bracket with ground studs 070001−00N and 070002−00N and attaching hardware.
     (9) Disconnect electrical connector DV213 from disconnect valve. Install protective covers.
     (10) Disconnect connector DT582 from oil temperature sensor. Install protective covers.
     (11) Disconnect connector DS299 from oil filter differential pressure switch. Install protective covers.
     (12) Disconnect electrical connector DS297 from low oil pressure switch. Install protective covers.
     (13) Remove two clamps (301/1) with attaching hardware.
     (14) Remove four clamps (301/2) with attaching hardware.
     (15) Disconnect electrical connector DT583 from oil pressure transmitter. Install protective covers.
     (16) Remove clamps (301/3) through (301/8) with attaching hardware.
     (17) Disconnect electrical connector DT584 from oil quantity transmitter. Install protective covers.
     (18) Disconnect electrical connectors DV225A thru DV225C from high pressure bleed control valve. Install protective covers.
     (19) Remove clamp (301/9) and clampshell (301/10) with attaching hardware.
     (20) Remove clamp (301/11) with attaching hardware.

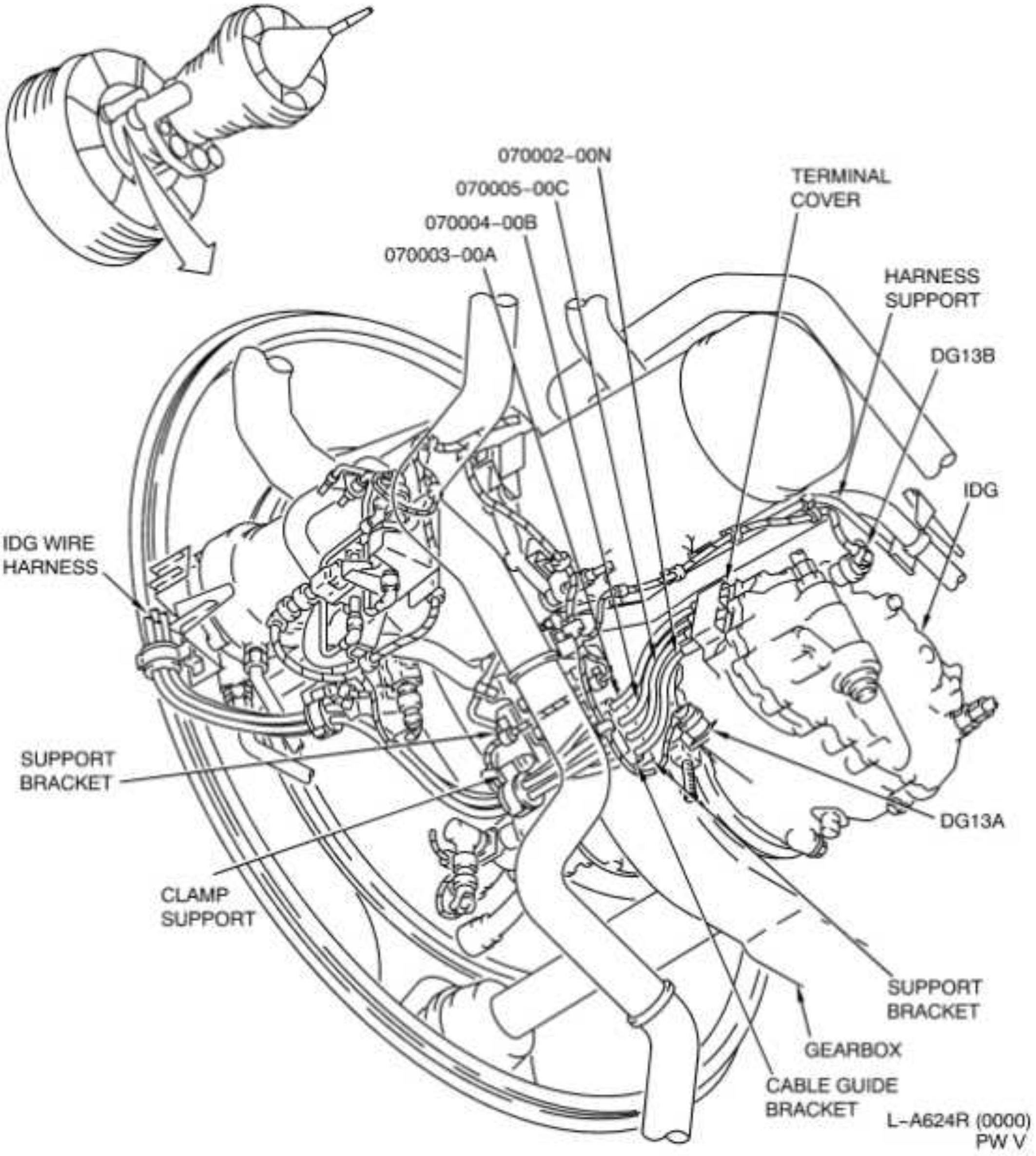
(21) Remove clamp (301/12) and spacer with attaching hardware.
(22) Remove four clamp supports (301/13) and attaching hardware from existing brackets.
(23) Disconnect IDG wire harness 21W4114 electrical connector D4955P from pylon generator wire harness receptacle. Install protective covers.
(24) Disconnect electrical connectors DV224A and DV224B from pneumatic regulator. Install protective covers.
(25) Remove clamps (301/14) and clampshells (301/15) and attaching hardware from tubing bracket.
(26) Remove two nuts, washers and contacts 1387−3 and 1387−4 from high−stage temperature sensor terminals. Reinstall nuts and washers on terminals.
(27) Remove two clamps (301/16) and attaching hardware.
(28) Remove three clamps (301/17) and clampshells (301/18) with attaching hardware from tubing bracket.
(29) Remove five clamps (301/19) and attaching hardware.
(30) Disconnect electrical plugs D4954P and D4958P from pylon interface panel receptacles. Install protective covers.

NOTE: Procedural steps (31) through (71) remove wire harness 21W4072 from right side of engine core, Figure 302.

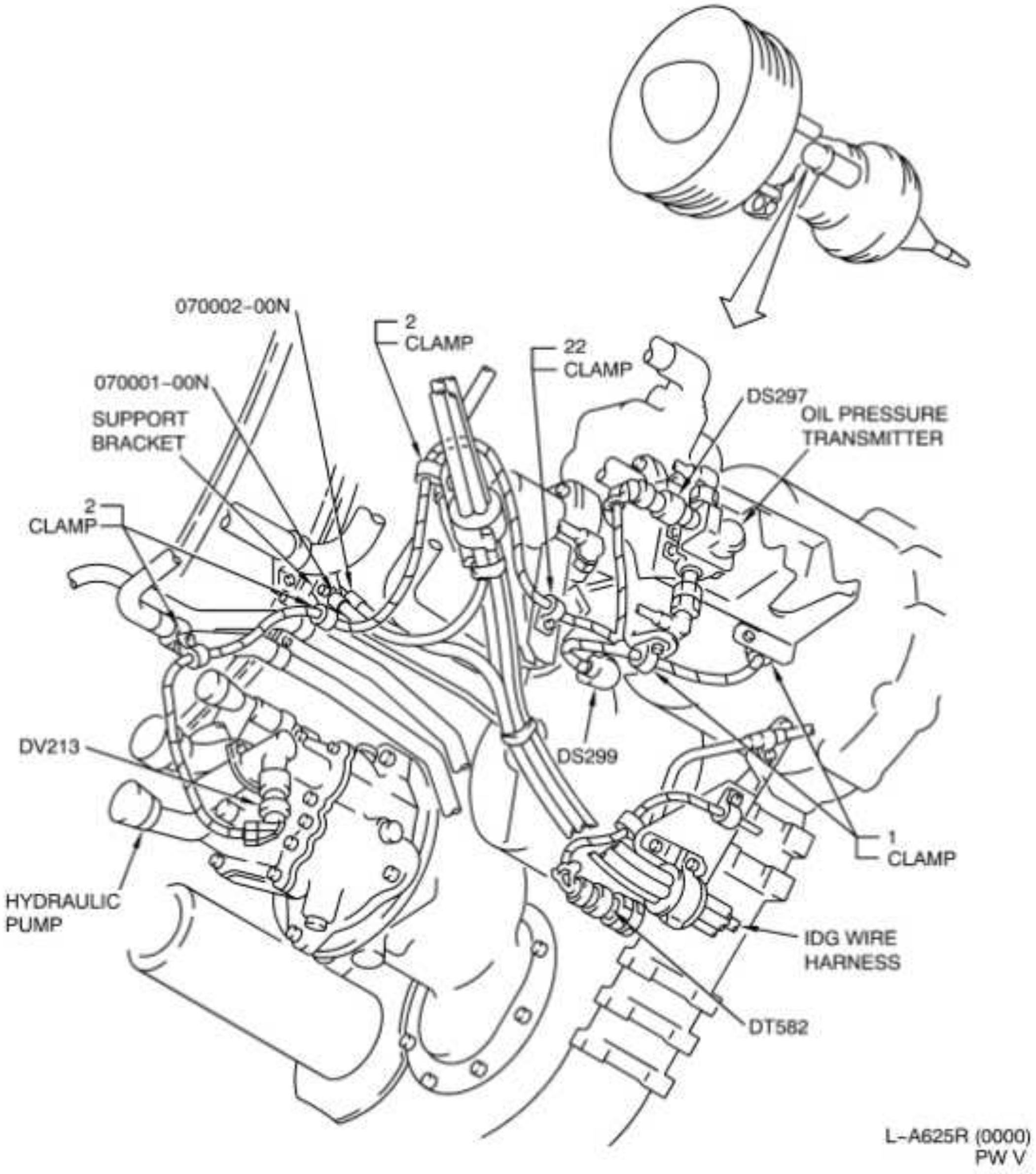
(31) Disconnect connector DT579 from No. 3 bearing oil temperature sensor. Install protective covers.
(32) Disconnect electrical connector DV215 from starter shutoff valve. Install protective covers.
(33) Remove clamp (302/1) with attaching hardware from starter shutoff valve cover.
(34) Remove three clamps (302/1) and attaching hardware from starter shutoff valve cover.
(35) Remove clamp (302/1) and attaching hardware from end of drain filter support bracket.
(36) Remove three clamps (302/1) and spacers (302/2) and attaching hardware from drain filter support bracket.
(37) Disconnect connector DV214 from hydraulic pump. Install protective covers.
(38) Remove clamp (302/3) with attaching hardware from existing support bracket on hydraulic pump.
(39) Remove clamp (302/4) with attaching hardware from existing support bracket.
(40) Remove clamp (302/5) with attaching hardware from stator vane actuator support bracket.
(41) Remove clamp (302/6) with attaching hardware from tube support bracket.
(42) Remove clamp (302/7) and clampshell with attaching hardware from tube support bracket.

(43) Remove two clamps (302/8) with attaching hardware from stator vane actuator support bracket.
(44) Disconnect electrical connector DV216 from IDG AOC valve. Install protective covers.
(45) Disconnect connector DT581 from fuel pressure transmitter. Install protective covers.
(46) Disconnect electrical connector DT595 from core compartment temperature sensor. Install protective covers.
(47) Remove clamp (302/9) with attaching hardware from fuel pressure transmitter support bracket.
(48) Remove two clamps (302/10) with attaching hardware from tube support bracket.
(49) Disconnect connector DH10 from fuel condition actuator. Install protective covers.
(50) Remove clamp (302/11) with attaching hardware from tube support bracket.
(51) Remove clamp (302/12) with attaching hardware from fuel condition actuator support bracket.
(52) Remove clamp (302/13) and clampshell (302/14) with attaching hardware from tube support bracket.
(53) Remove clamp (302/15) with attaching hardware from tube support bracket.
(54) Disconnect connector D4991P from fuel pump. Install protective covers.
(55) Disconnect connector DT580 from fuel flow transmitter. Install protective covers.
(56) Remove clamps (302/16) and (302/17) with attaching hardware from fuel flow transmitter support bracket.
(57) Remove two clamps (302/18) with attaching hardware from drain filters support bracket.
(58) Remove hardware attaching clamp (302/19) and support bracket (302/20) to drain filters support bracket.
(59) Remove clamp (302/21) and attaching hardware from support bracket.
(60) Remove hardware attaching support bracket (302/22) with clamp (302/23) to drain filter support.
(61) Disconnect electrical connector DH8 from ignitor exciter. Install protective covers.
(62) Disconnect electrical connector DH7 from engine exciter. Install protective covers.
(63) Remove three clamps (302/24) with attaching hardware from existing brackets.
(64) Remove clamp (302/25) with attaching hardware from existing bracket.
(65) Remove clamp (302/26) and attaching hardware from TCC bellows flange bracket.
(66) Remove clamp (302/27) and attaching hardware from support bracket on Flange J.

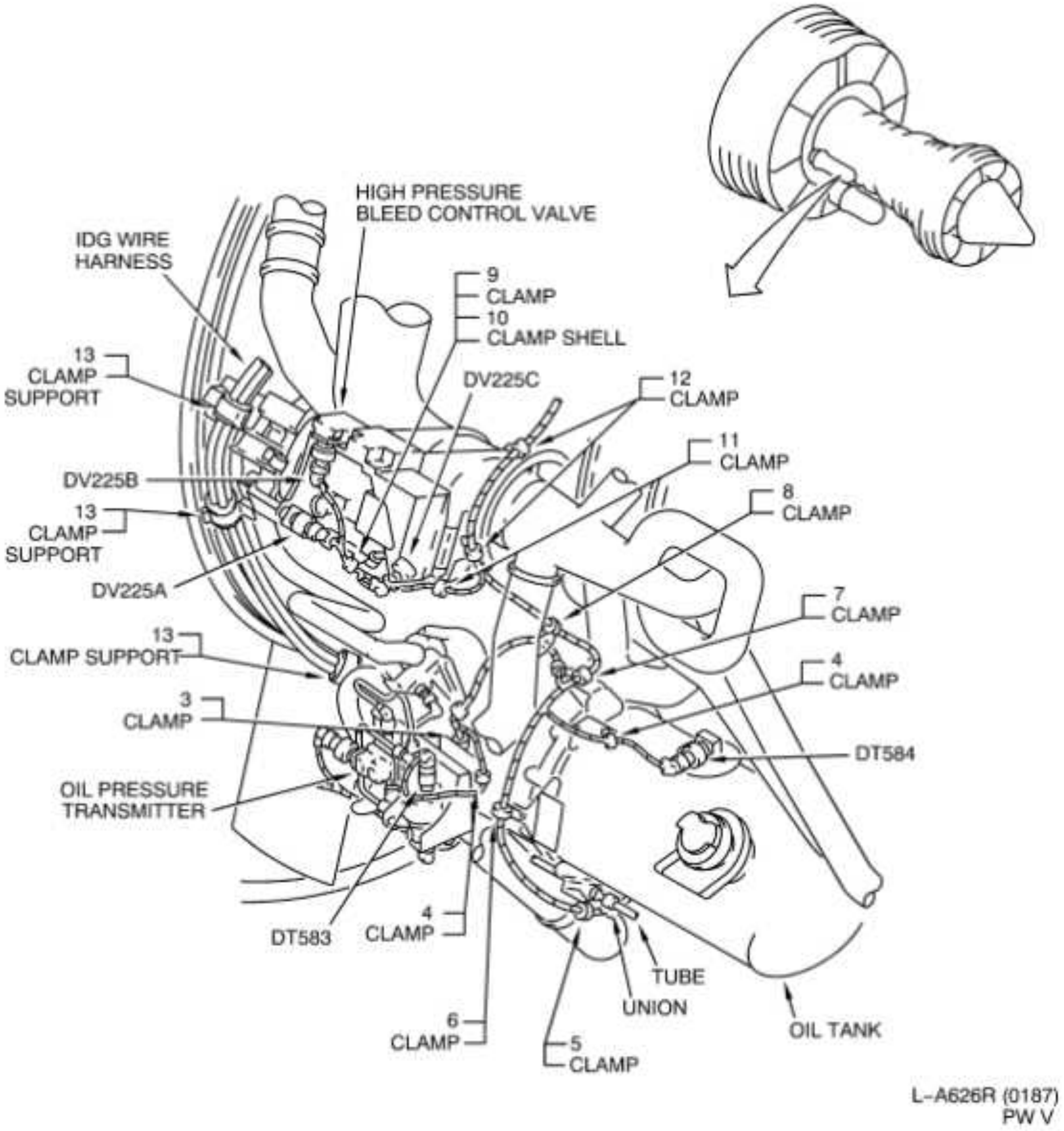
(67) Disconnect ground connections (302/28) from ground connection support bracket.
(68) Remove three clamps (302/29) and attaching hardware from existing brackets.
(69) Remove clamp (302/30) and clampshell (302/31) and attaching hardware from existing bracket.
(70) Disconnect electrical connector DS298 from IDG AOC pressure switch. Install protective covers.
(71) Disconnect electrical plugs D4952P, D4956P and D4961P from pylon interface panel receptacles. Install protective covers.


070002-00N
070005-00C
070004-00B
070003-00A
TERMINAL COVER
HARNESS SUPPORT
DG13B
IDG
IDG WIRE HARNESS
SUPPORT BRACKET
CLAMP SUPPORT
DG13A
SUPPORT BRACKET
GEARBOX
CABLE GUIDE BRACKET
L-A624R (0000)
PW V

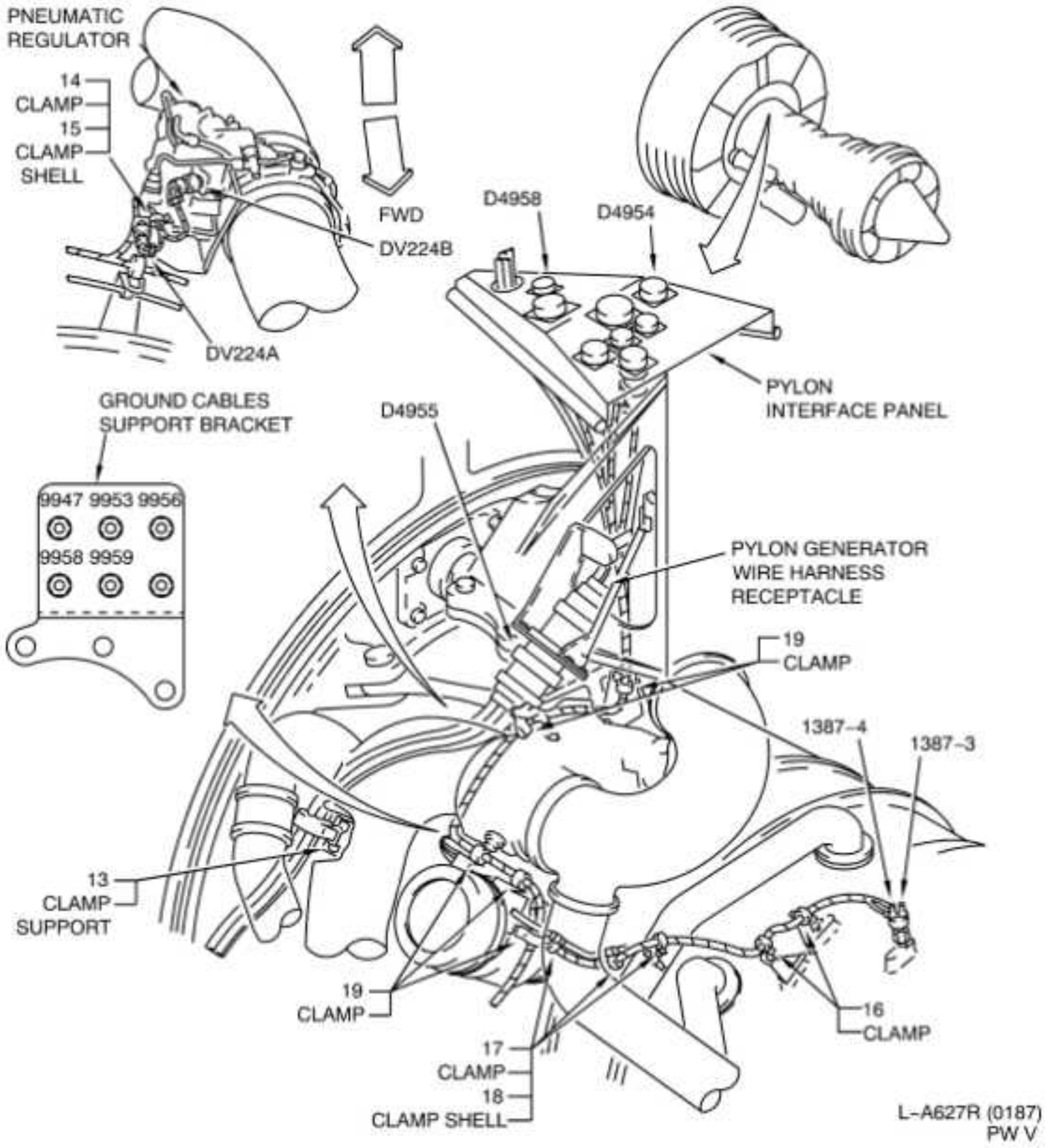
Engine Core Harness
(Bottom Left)
Figure 301 (Sheet 1)
(Task 71−00−35−050−001)


070002-00N
2 CLAMP
22 CLAMP
070001-00N
SUPPORT BRACKET
DS297
OIL PRESSURE TRANSMITTER
2 CLAMP
DV213
DS299
1 CLAMP
HYDRAULIC PUMP
IDG WIRE HARNESS
DT582
L-A625R (0000)
PW V

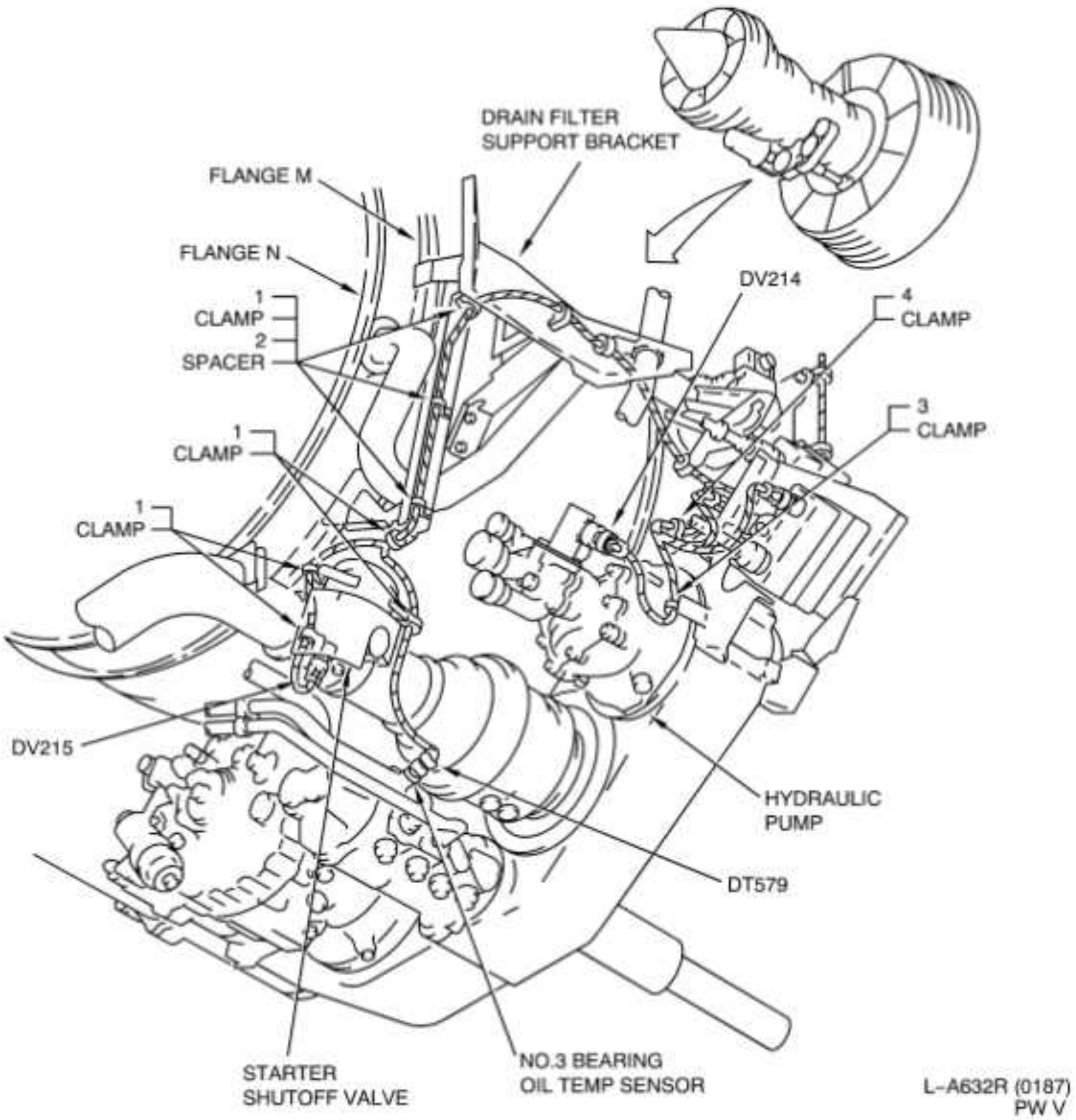
Engine Core Harness
(Lower Left)
Figure 301 (Sheet 2)
(Task 71−00−35−050−001)


HIGH PRESSURE BLEED CONTROL VALVE
IDG WIRE HARNESS
9 CLAMP
10 CLAMP SHELL
13 CLAMP SUPPORT
DV225C
12 CLAMP
11 CLAMP
DV225B
8 CLAMP
13 CLAMP SUPPORT
DV225A
7 CLAMP
13 CLAMP SUPPORT
4 CLAMP
3 CLAMP
DT584
OIL PRESSURE TRANSMITTER
DT583
4 CLAMP
TUBE
UNION
OIL TANK
6 CLAMP
5 CLAMP
L-A626R (0187)
PW V

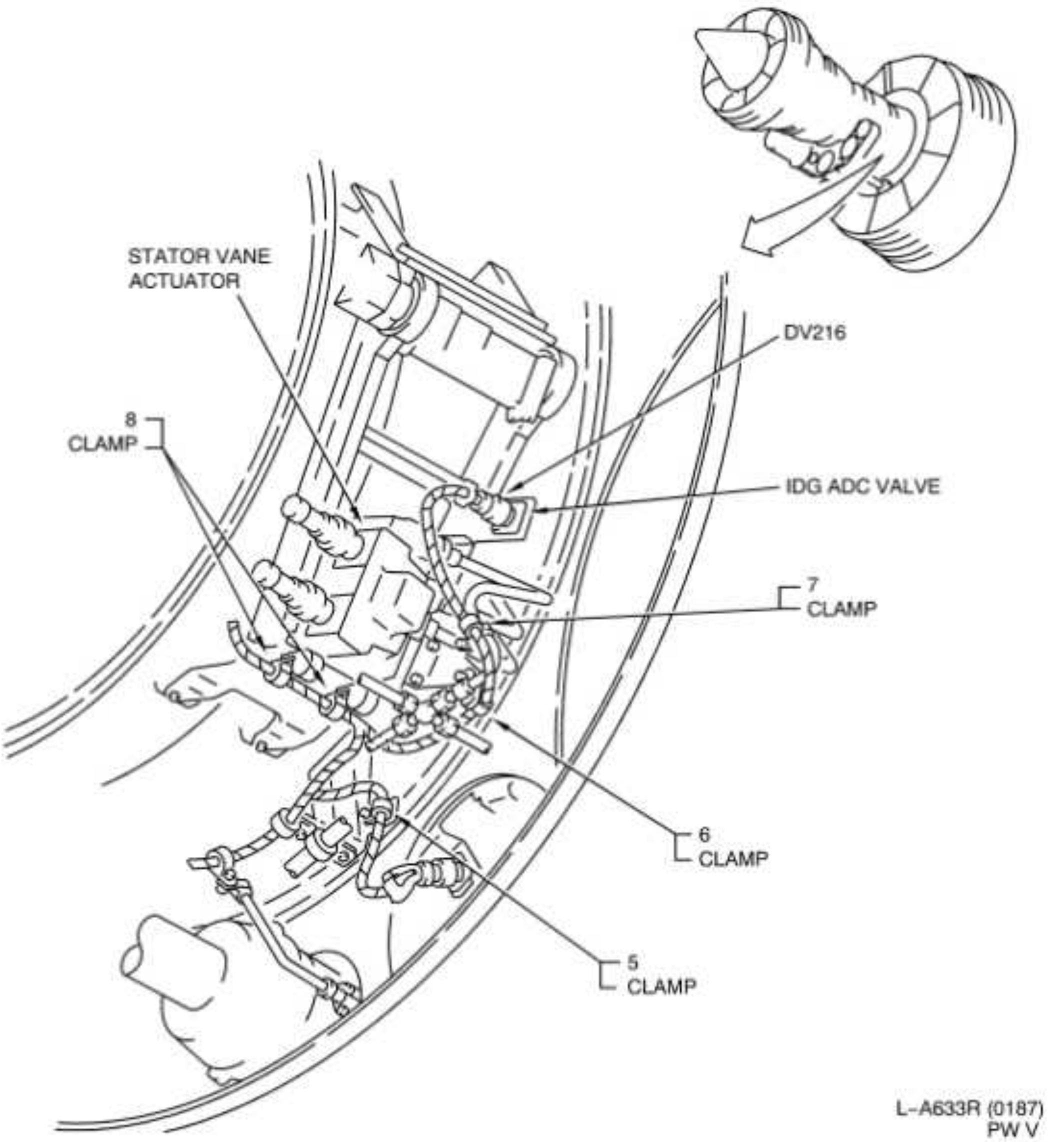
Engine Core Harness (Left)
Figure 301 (Sheet 3)
(Task 71−00−35−050−001)


PNEUMATIC REGULATOR
14
CLAMP
15
CLAMP SHELL
FWD
DV224B
DV224A
D4958
D4954
PYLON INTERFACE PANEL
GROUND CABLES SUPPORT BRACKET
9947 9953 9956
9958 9959
D4955
PYLON GENERATOR WIRE HARNESS RECEPTACLE
19
CLAMP
1387-4
1387-3
13
CLAMP SUPPORT
19
CLAMP
16
CLAMP
17
CLAMP
18
CLAMP SHELL
L-A627R (0187)
PW V

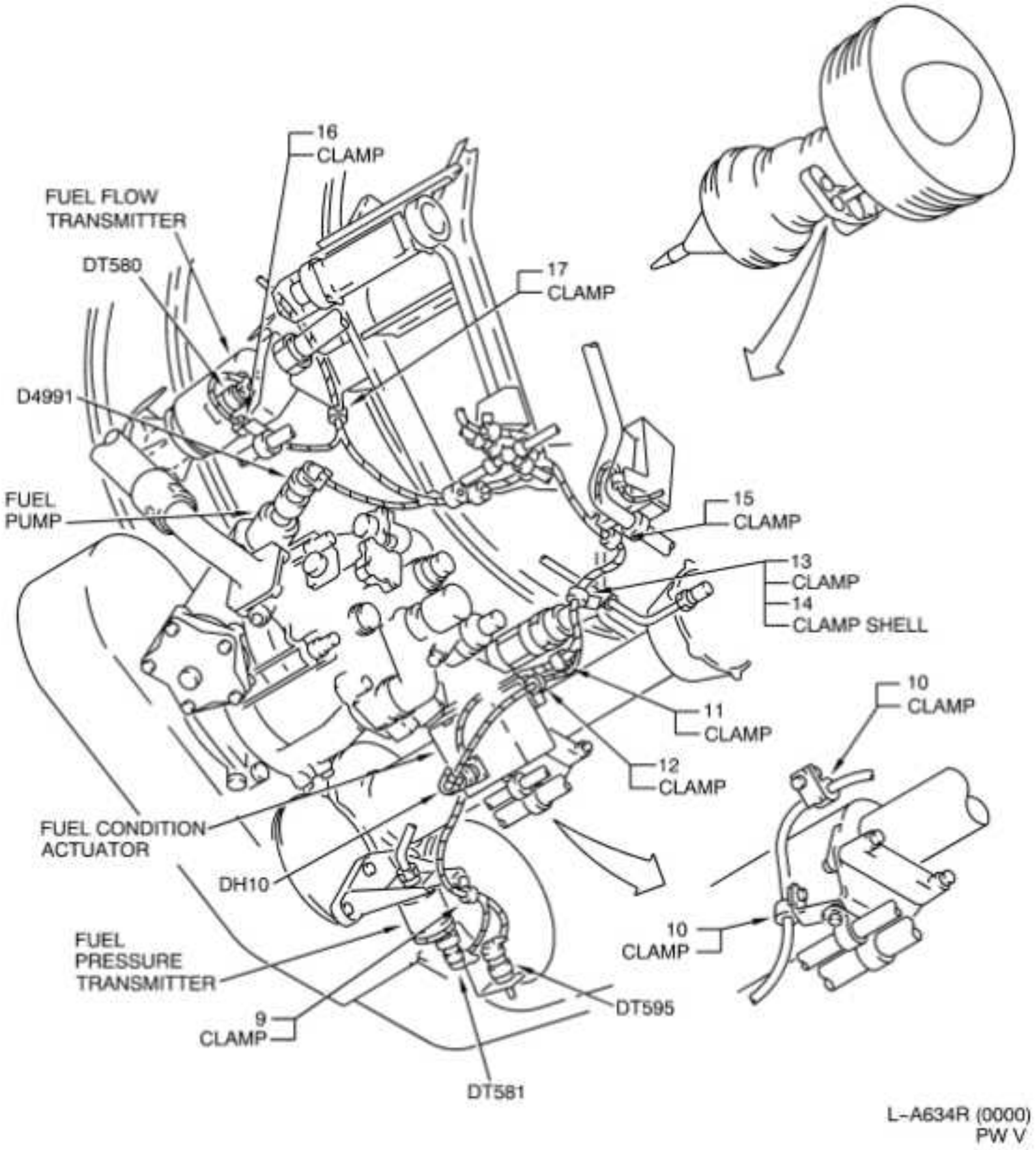
Engine Core Harness
(Upper Left)
Figure 301 (Sheet 4)
(Task 71−00−35−050−001)


DRAIN FILTER SUPPORT BRACKET
FLANGE M
FLANGE N
1
CLAMP
2
SPACER
1
CLAMP
1
CLAMP
DV214
4
CLAMP
3
CLAMP
DV215
HYDRAULIC PUMP
DT579
STARTER SHUTOFF VALVE
NO.3 BEARING OIL TEMP SENSOR
L−A632R (0187)
PW V

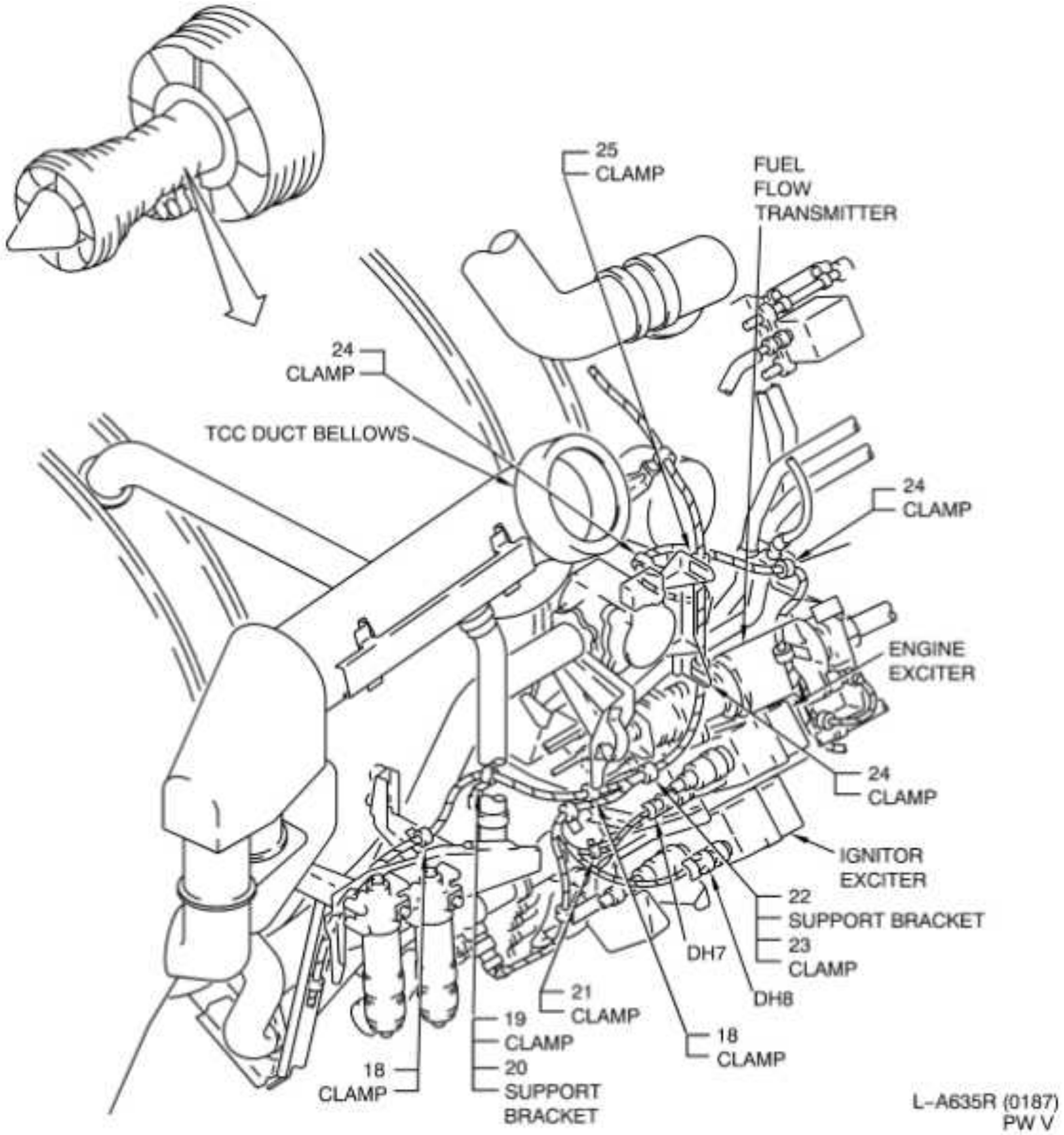
Engine Core Harness
(Bottom Right)
Figure 302 (Sheet 1)
(Task 71−00−35−050−001)


STATOR VANE ACTUATOR
DV216
8 CLAMP
IDG ADC VALVE
7 CLAMP
6 CLAMP
5 CLAMP
L-A633R (0187)
PW V

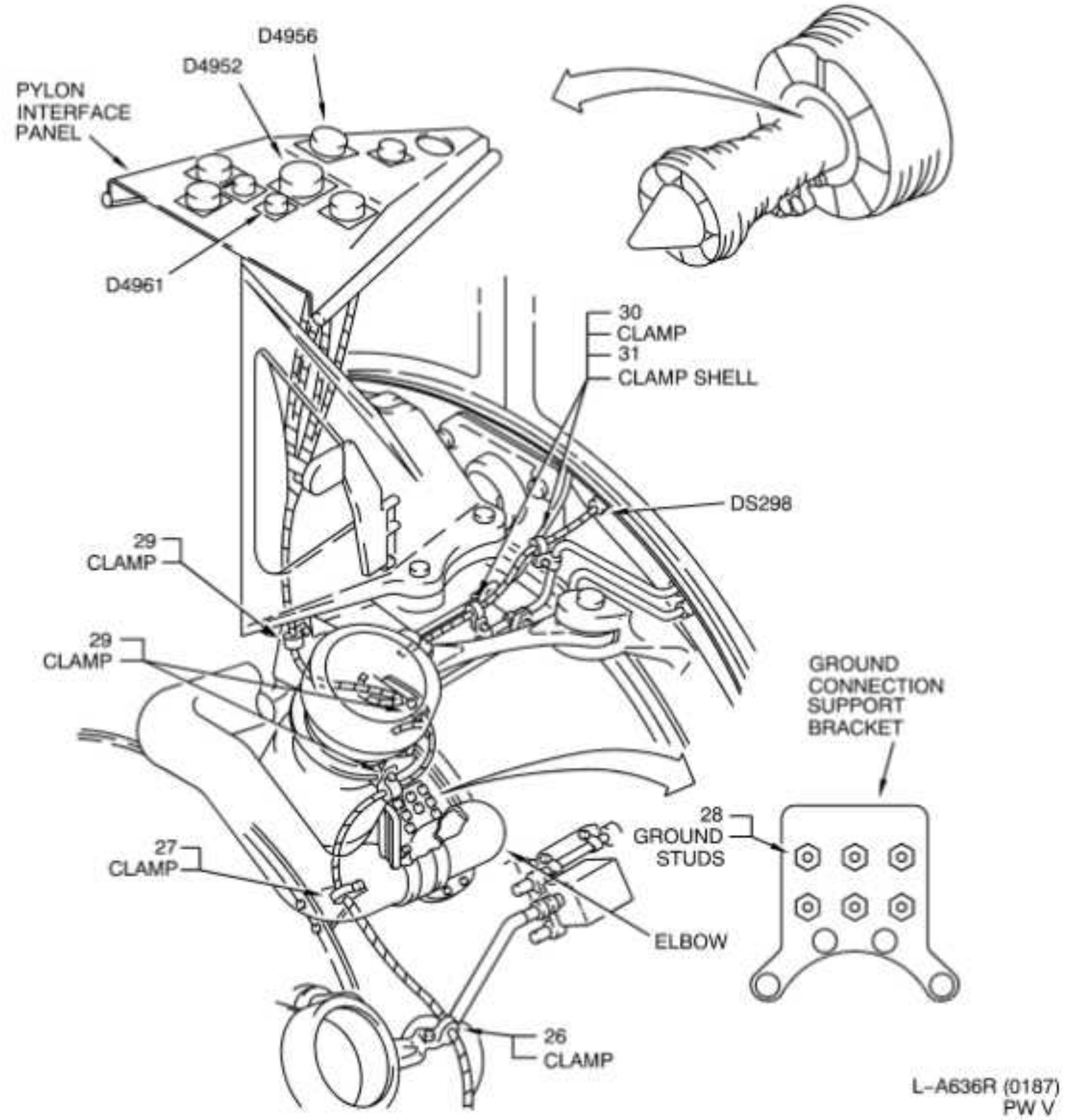
Engine Core Harness
(Forward Lower Right)
Figure 302 (Sheet 2)
(Task 71-00-35-050-001)


16
CLAMP
FUEL FLOW TRANSMITTER
DT580
17
CLAMP
D4991
FUEL PUMP
15
CLAMP
13
CLAMP
14
CLAMP SHELL
10
CLAMP
11
CLAMP
12
CLAMP
FUEL CONDITION ACTUATOR
DH10
10
CLAMP
FUEL PRESSURE TRANSMITTER
DT595
9
CLAMP
DT581
L−A634R (0000)
PW V

Engine Core Harness
(Rear Lower Right)
Figure 302 (Sheet 3)
(Task 71−00−35−050−001)


25
CLAMP
FUEL
FLOW
TRANSMITTER
24
CLAMP
TCC DUCT BELLOWS
24
CLAMP
ENGINE
EXCITER
24
CLAMP
IGNITOR
EXCITER
22
SUPPORT BRACKET
23
CLAMP
DH7
DH8
21
CLAMP
19
CLAMP
20
SUPPORT
BRACKET
18
CLAMP
18
CLAMP
L−A635R (0187)
PW V

Engine Core Harness
(Right)
Figure 302 (Sheet 4)
(Task 71−00−35−050−001)


D4956
D4952
PYLON INTERFACE PANEL
D4961
30
CLAMP
31
CLAMP SHELL
DS298
29
CLAMP
29
CLAMP
GROUND CONNECTION SUPPORT BRACKET
28
GROUND STUDS
27
CLAMP
ELBOW
26
CLAMP
L−A636R (0187)
PW V

Engine Core Harness
(Upper Right)
Figure 302 (Sheet 5)
(Task 71−00−35−050−001)

Task 71−00−35−050−001−A:

2. Remove Engine Core Wiring Harness − Post SB PW4NAC 71−70, 71−80, 71−107

A. Equipment And Material Required − None

B. Procedure

See Figure 303.

NOTE: Procedural steps (1) through (30) remove wire harnesses 21W4070, 21W4072 and 21W4114 from left side of engine core, Figure 303.

(1) Remove terminal cover with attaching hardware from terminal block on IDG.

(2) Remove four nuts and washers from terminal studs. Remove power cables 070002−00N, 070003−00A, 070004−00B and 070005−00C from IDG terminal block.

(3) Install terminal cover on IDG with screws and washers.

(4) Disconnect connectors DG13A and DG13B from IDG. Install protective covers.

(5) Remove two clamps and attaching hardware securing harness to tube and terminal cover (Post SB PW4NAC 71−107).

(6) Remove support bracket with clamp guide and two clamps and attaching hardware.

(7) Remove support bracket with clamp guide and two clamps and attaching hardware.

(8) Remove support bracket with ground studs 070001−00N and 070002−00N and attaching hardware.

(9) Disconnect electrical connector DV214 from disconnect valve. Install protective covers (Post SB PW4NAC 71−70).

(10) Disconnect connector DT582 from oil temperature sensor. Install protective covers.

(11) Disconnect connector DS299 from oil filter differential pressure switch. Install protective covers.

(12) Disconnect electrical connector DS297 from low oil pressure switch. Install protective covers.

(13) Remove two clamps (303/1) with attaching hardware.

(14) Remove six clamps (303/2) with attaching hardware (Post SB PW4NAC 71−80 rerouting of harnesses).

(15) Disconnect electrical connector DT583 from oil pressure transmitter. Install protective covers.

(16) Remove clamps (303/3) through (303/8) with attaching hardware.

(17) Disconnect electrical connector DT584 from oil quantity transmitter. Install protective covers.

(18) Disconnect electrical connectors DV225A through DV225C from high pressure bleed control valve. Install protective covers.

(19) Remove clamp (303/9) and clampshell (303/10) with attaching hardware.
(20) Remove clamp (303/11) with attaching hardware.
(21) Remove three clamps (303/12) and spacers (303/13) with attaching hardware.
(22) Remove four clamp supports (303/14) and attaching hardware from existing brackets.
(23) Disconnect IDG wire harness 21W4114 electrical connector D4955P from pylon generator wire harness receptacle. Install protective covers.
(24) Disconnect electrical connectors DV224A and DV224B from pneumatic regulator. Install protective covers.
(25) Remove clamps (303/15) and clampshells (303/16) and attaching hardware from tubing bracket.
(26) Remove two nuts, washers and contacts 1387−3 and 1387−4 from high−stage temperature sensor terminals. Reinstall nuts and washers on terminals.
(27) Remove three clamps (303/17) and attaching hardware.
(28) Remove three clamps (303/18) and clampshells (303/19) with attaching hardware from tubing bracket.
(29) Remove five clamps (303/20) and attaching hardware.
(30) Disconnect electrical plugs D4954P and D4958P from pylon interface panel receptacles. Install protective covers.

NOTE: Procedural steps (31) through (69) remove wire harness 21W4072 from right side of engine core, Figure 304.

(31) Disconnect connector DT579 from No. 3 bearing oil temperature sensor. Install protective covers.
(32) Disconnect electrical connector DV215 from starter shutoff valve. Install protective covers.
(33) Remove three clamps (304/1) with attaching hardware securing harness to No. 4 bearing scavenge tube.
(34) Remove four clamps (304/2) and attaching hardware securing harness to gearbox scavenge tube.
(35) Remove clamp (304/3) and attaching hardware securing harness to standoff bracket on gearbox.
(36) Disconnect electrical connector DV213 from hydraulic pump. Install protective covers (Post SB PW4NAC 71−70).
(37) Remove clamp (304/4) with attaching hardware from existing support bracket on hydraulic pump.
(38) Remove clamp (304/5) with attaching hardware from existing support bracket.
(39) Remove clamp (304/6) with attaching hardware from stator vane actuator support bracket.
(40) Remove clamp (304/7) with attaching hardware from tube support bracket.

(41) Remove two clamps (304/8) with attaching hardware from tube support bracket.

(42) Remove two clamps (304/9) with attaching hardware from stator vane actuator support bracket.

(43) Disconnect electrical connector DT216 from IDG AOC valve. Install protective covers.

(44) Disconnect connector DT581 from fuel pressure transmitter. Install protective covers.

(45) Disconnect electrical connector DT595 from core compartment temperature sensor. Install protective covers.

(46) Remove two clamps (304/10) with attaching hardware from fuel pressure transmitter support bracket and support tube.

(47) Remove two clamps (304/11) with attaching hardware from tube support bracket.

(48) Disconnect connector DH10 from fuel condition actuator. Install protective covers.

(49) Remove clamp (304/12) with attaching hardware from tube support bracket.

(50) Remove clamp (304/13) with attaching hardware from fuel condition actuator support bracket.

(51) Remove clamp (304/14) and clampshell (304/15) with attaching hardware from tube support bracket.

(52) Remove clamp (304/16) with attaching hardware from tube support bracket.

(53) Disconnect electrical connector D4991P from fuel pump. Install protective covers.

(54) Disconnect electrical connector DT580 from fuel flow transmitter.

(55) Remove clamps (304/17) and (304/18) with attaching hardware from fuel flow transmitter support bracket.

(56) Remove clamp (304/19) with attaching hardware from support bracket.

(57) Remove clamp (304/20) and attaching hardware from support bracket.

(58) Remove hardware attaching support bracket (304/21) with clamp (304/22).

(59) Disconnect electrical connector DH8 from ignitor exciter. Install protective covers.

(60) Disconnect electrical connector DH7 from engine exciter. Install protective covers.

(61) Remove two clamps (304/23) with attaching hardware from existing brackets.

(62) Remove clamp (304/24) with attaching hardware from existing bracket.

(63) Remove clamp (304/25) and attaching hardware from TCC bellows flange bracket.

(64) Remove clamp (304/26) and attaching hardware from support bracket on Flange J.

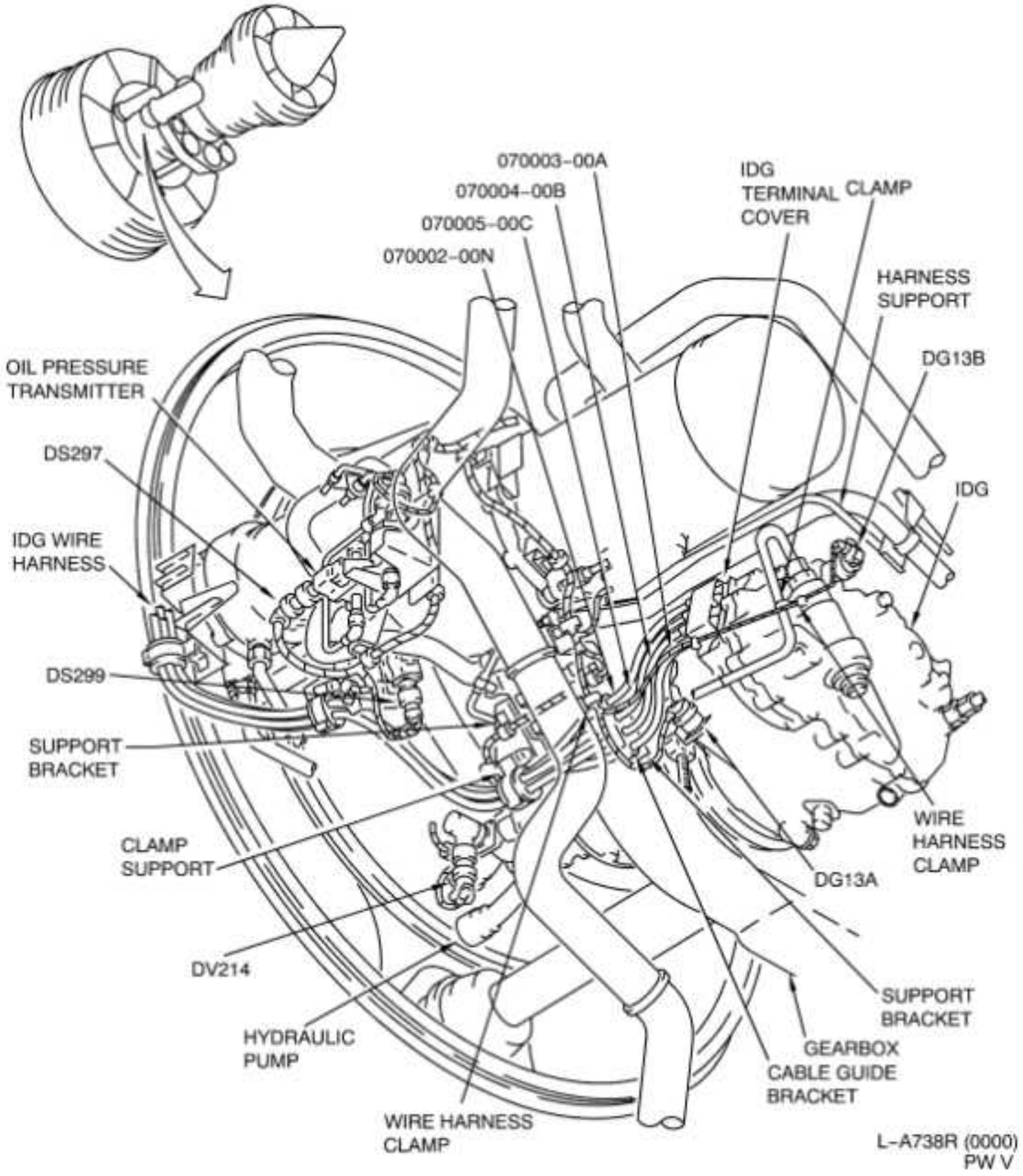
(65) Disconnect five ground connectors (304/27) from ground connection support bracket.

(66) Remove four clamps (304/28) and attaching hardware from existing brackets.

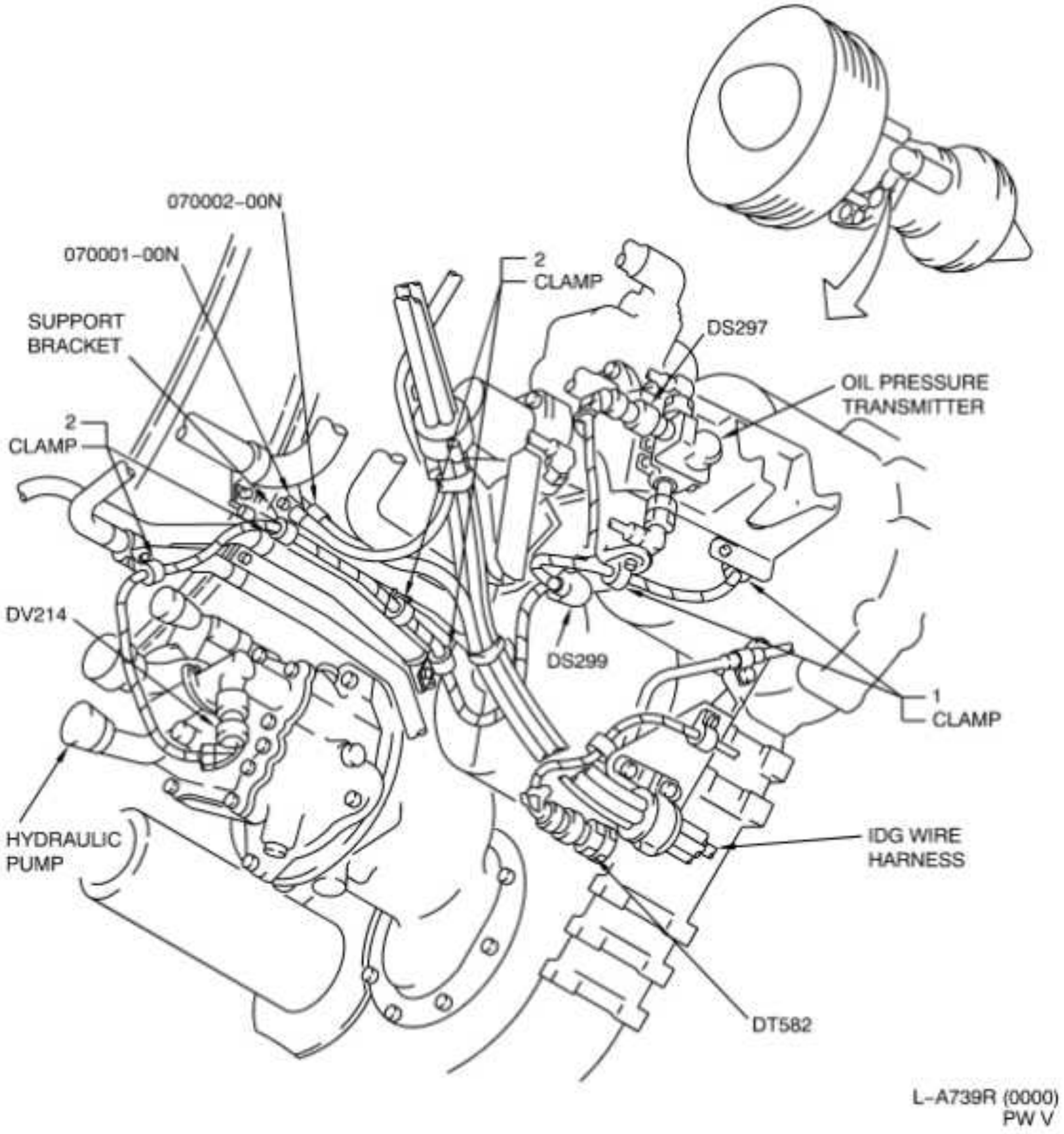
(67) Remove three clamps (304/29) and clampshells (304/30) and attaching hardware from existing brackets.

(68) Disconnect electrical connector DS298 from IDG AOC pressure switch. Install protective covers.

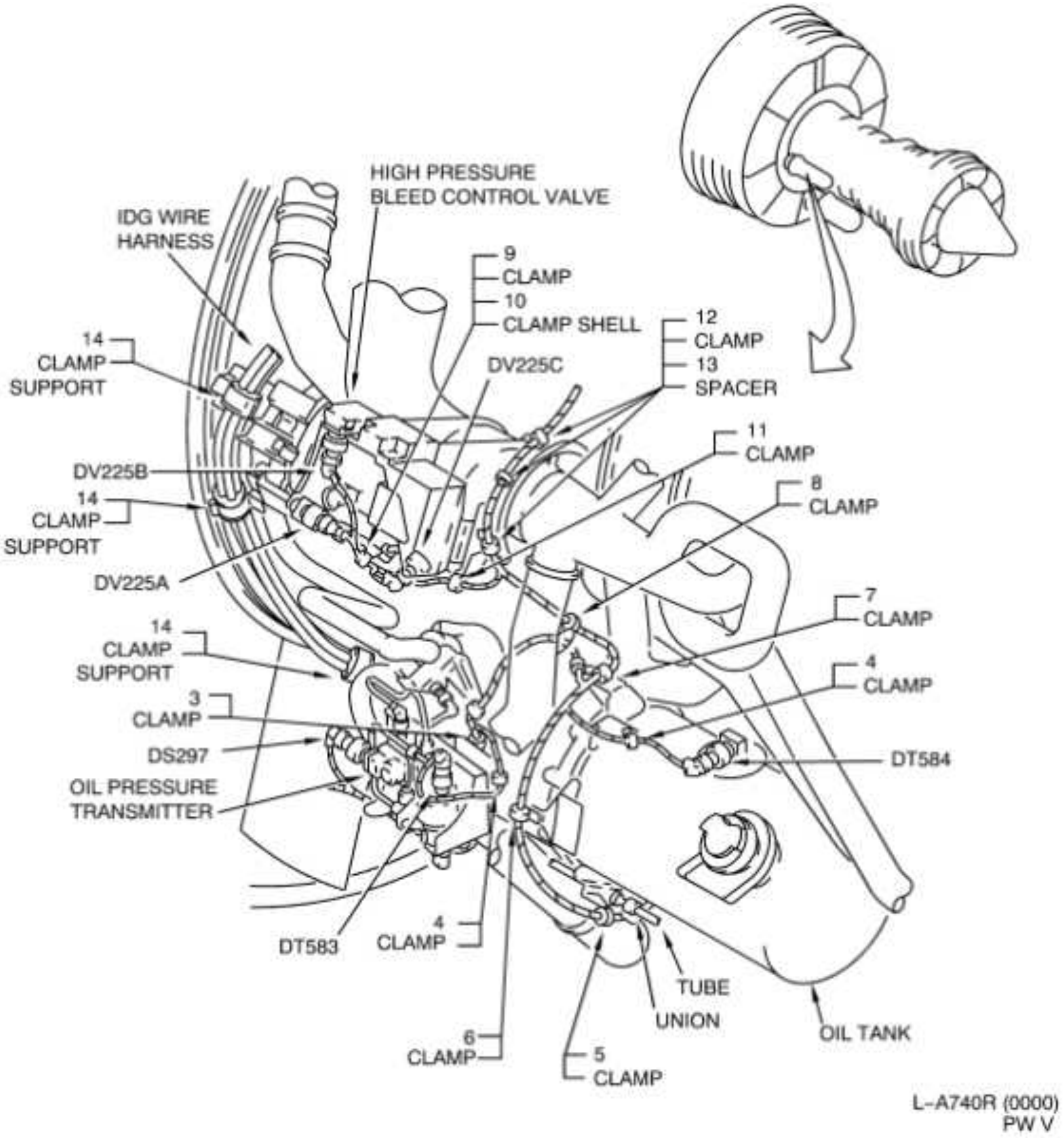
(69) Disconnect electrical plugs D4952P, D4956P and D4961P from pylon interface panel receptacles. Install protective covers.


070003-00A
070004-00B
070005-00C
070002-00N
IDG TERMINAL COVER
CLAMP
HARNESS SUPPORT
DG13B
IDG
OIL PRESSURE TRANSMITTER
DS297
IDG WIRE HARNESS
DS299
SUPPORT BRACKET
CLAMP SUPPORT
DV214
HYDRAULIC PUMP
WIRE HARNESS CLAMP
WIRE HARNESS CLAMP
DG13A
SUPPORT BRACKET
GEARBOX
CABLE GUIDE BRACKET
L-A738R (0000)
PW V

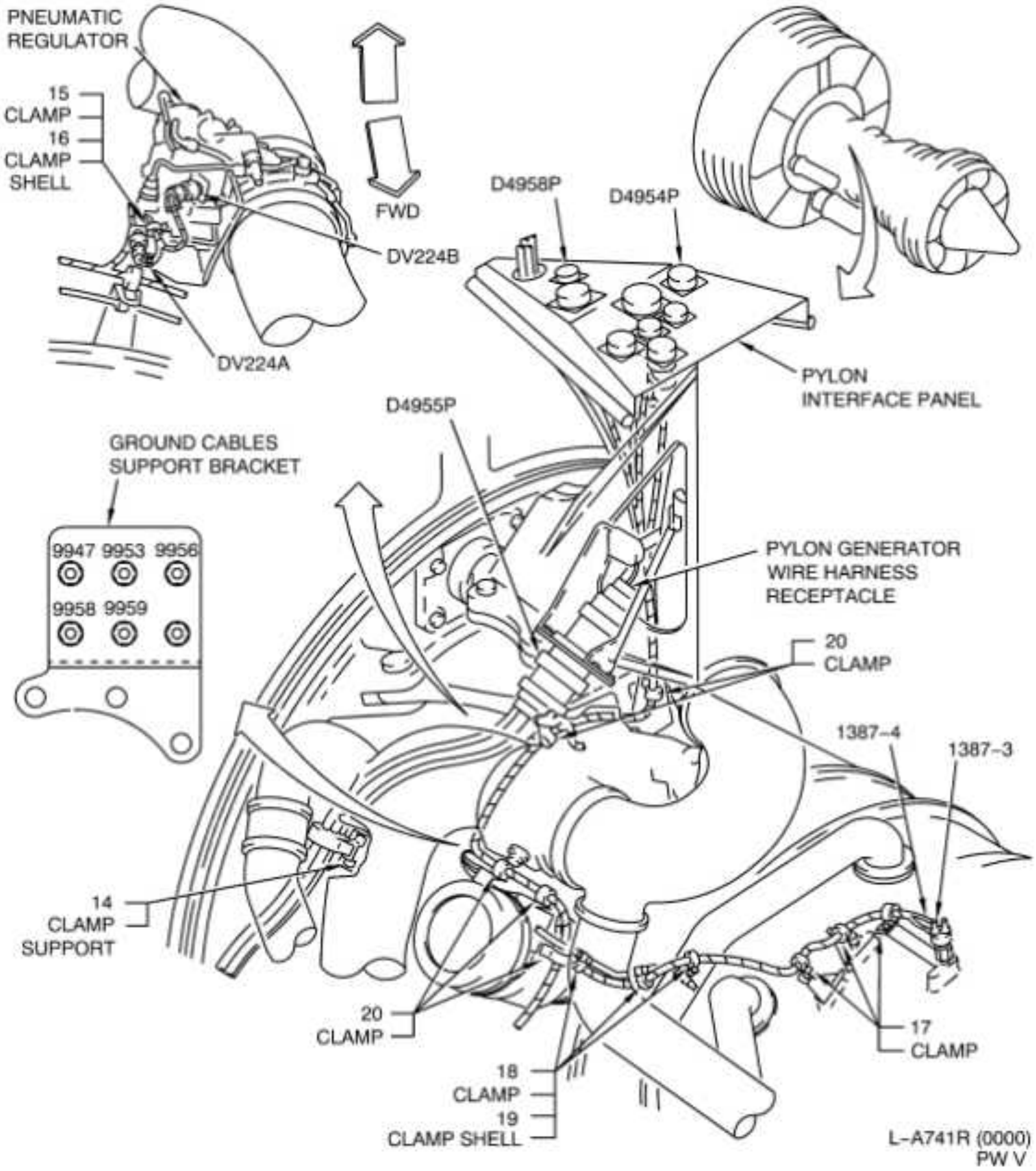
Engine Core Harness
(Bottom Left)
Figure 303 (Sheet 1)
(Task 71−00−35−050−001−A)


070002-00N
070001-00N
2
CLAMP
SUPPORT BRACKET
DS297
OIL PRESSURE TRANSMITTER
2
CLAMP
DV214
DS299
1
CLAMP
HYDRAULIC PUMP
IDG WIRE HARNESS
DT582
L-A739R (0000)
PW V

Engine Core Harness
(Lower Left)
Figure 303 (Sheet 2)
(Task 71−00−35−050−001−A)

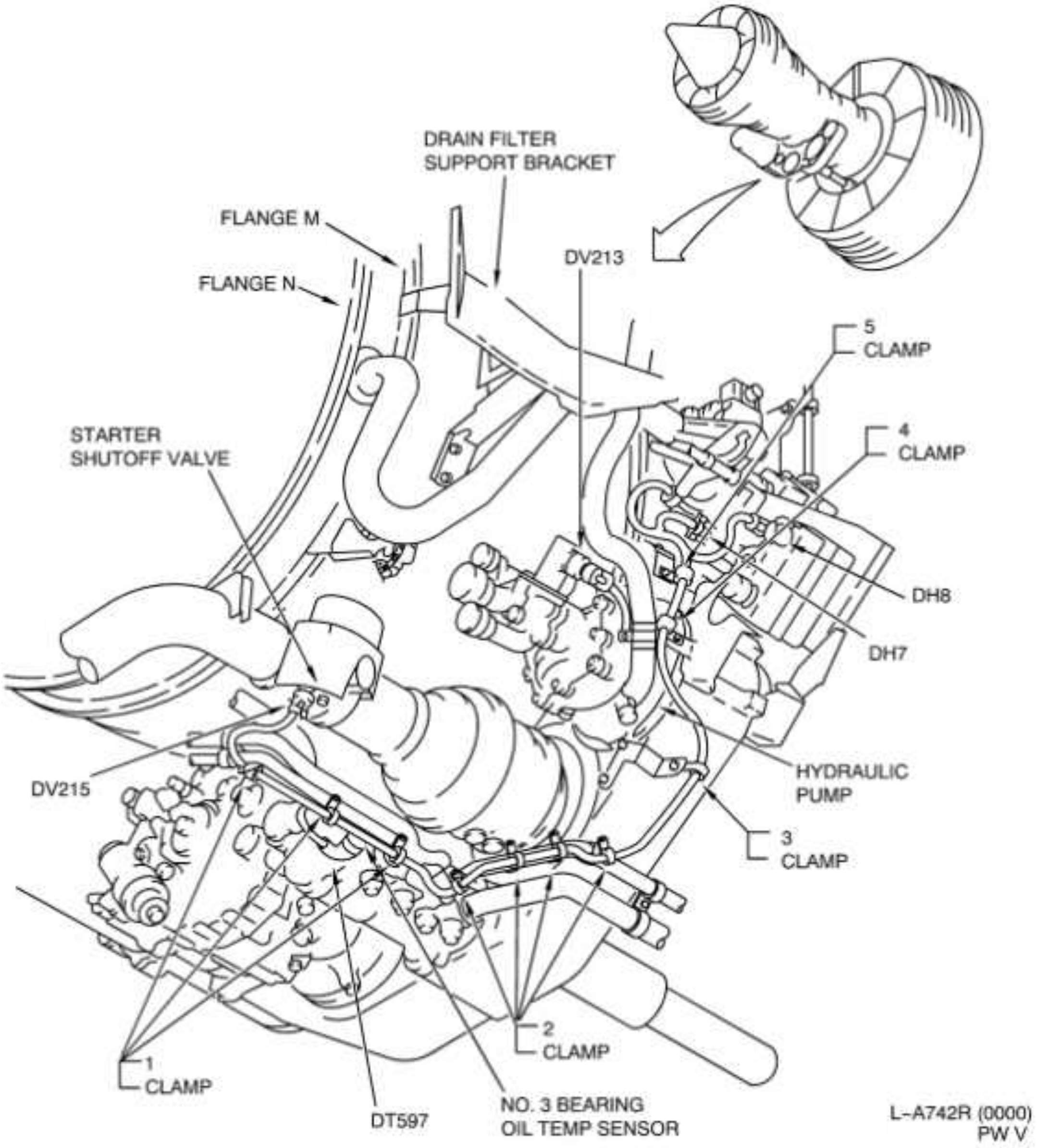

HIGH PRESSURE BLEED CONTROL VALVE
IDG WIRE HARNESS
9 CLAMP
10 CLAMP SHELL
12 CLAMP
13 SPACER
DV225C
14 CLAMP SUPPORT
DV225B
11 CLAMP
14 CLAMP SUPPORT
8 CLAMP
DV225A
7 CLAMP
14 CLAMP SUPPORT
4 CLAMP
3 CLAMP
DS297
DT584
OIL PRESSURE TRANSMITTER
DT583
4 CLAMP
TUBE
UNION
OIL TANK
6 CLAMP
5 CLAMP
L-A740R (0000)
PW V

Engine Core Harness (Left)
Figure 303 (Sheet 3)
(Task 71−00−35−050−001−A)

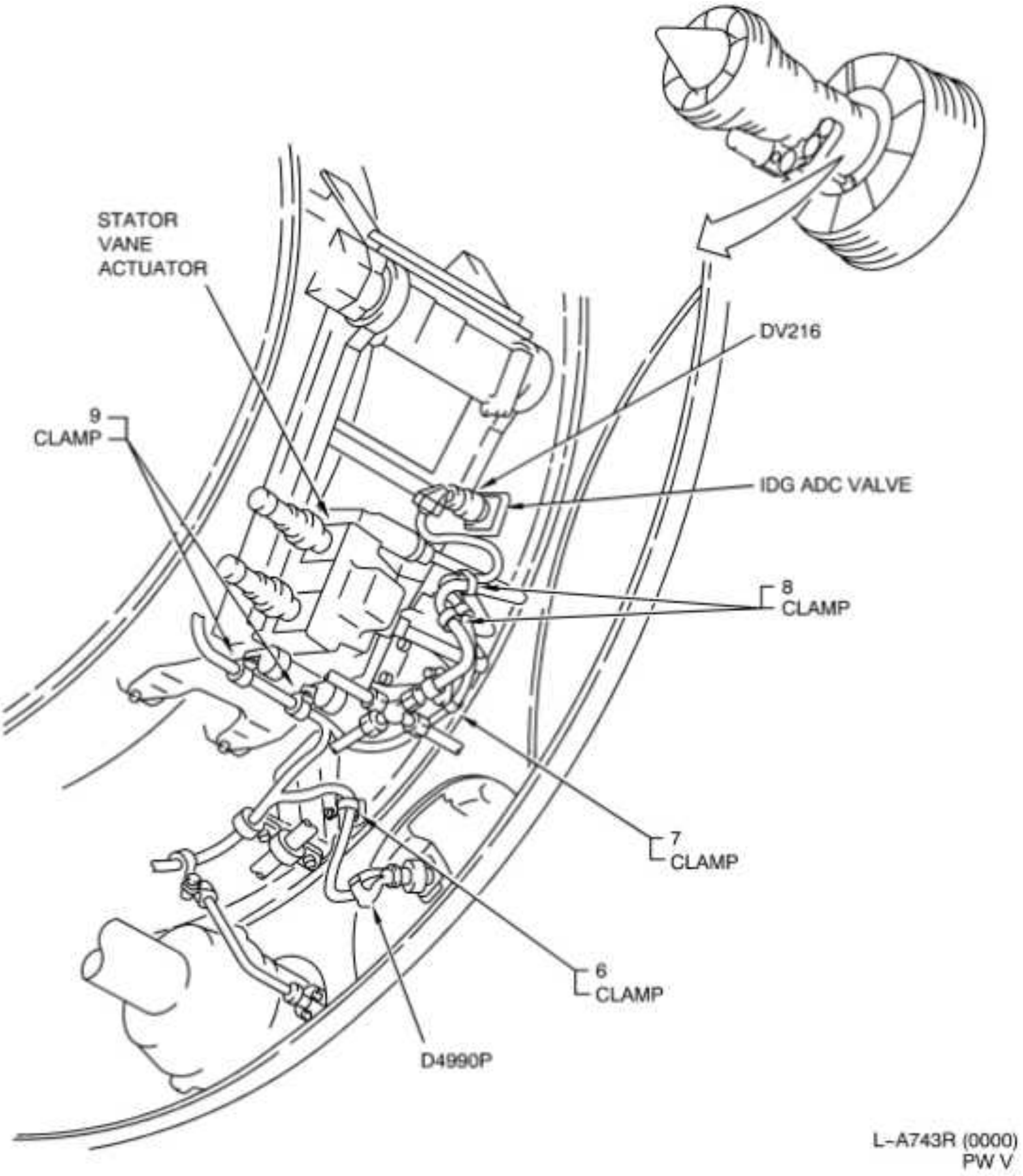

PNEUMATIC REGULATOR
15
CLAMP
16
CLAMP SHELL
FWD
D4958P
D4954P
DV224B
DV224A
PYLON INTERFACE PANEL
D4955P
GROUND CABLES SUPPORT BRACKET
9947 9953 9956
9958 9959
PYLON GENERATOR WIRE HARNESS RECEPTACLE
20
CLAMP
1387−4
1387−3
14
CLAMP SUPPORT
20
CLAMP
17
CLAMP
18
CLAMP
19
CLAMP SHELL
L-A741R (0000)
PW V

Engine Core Harness
(Upper Left)
Figure 303 (Sheet 4)
(Task 71−00−35−050−001−A)

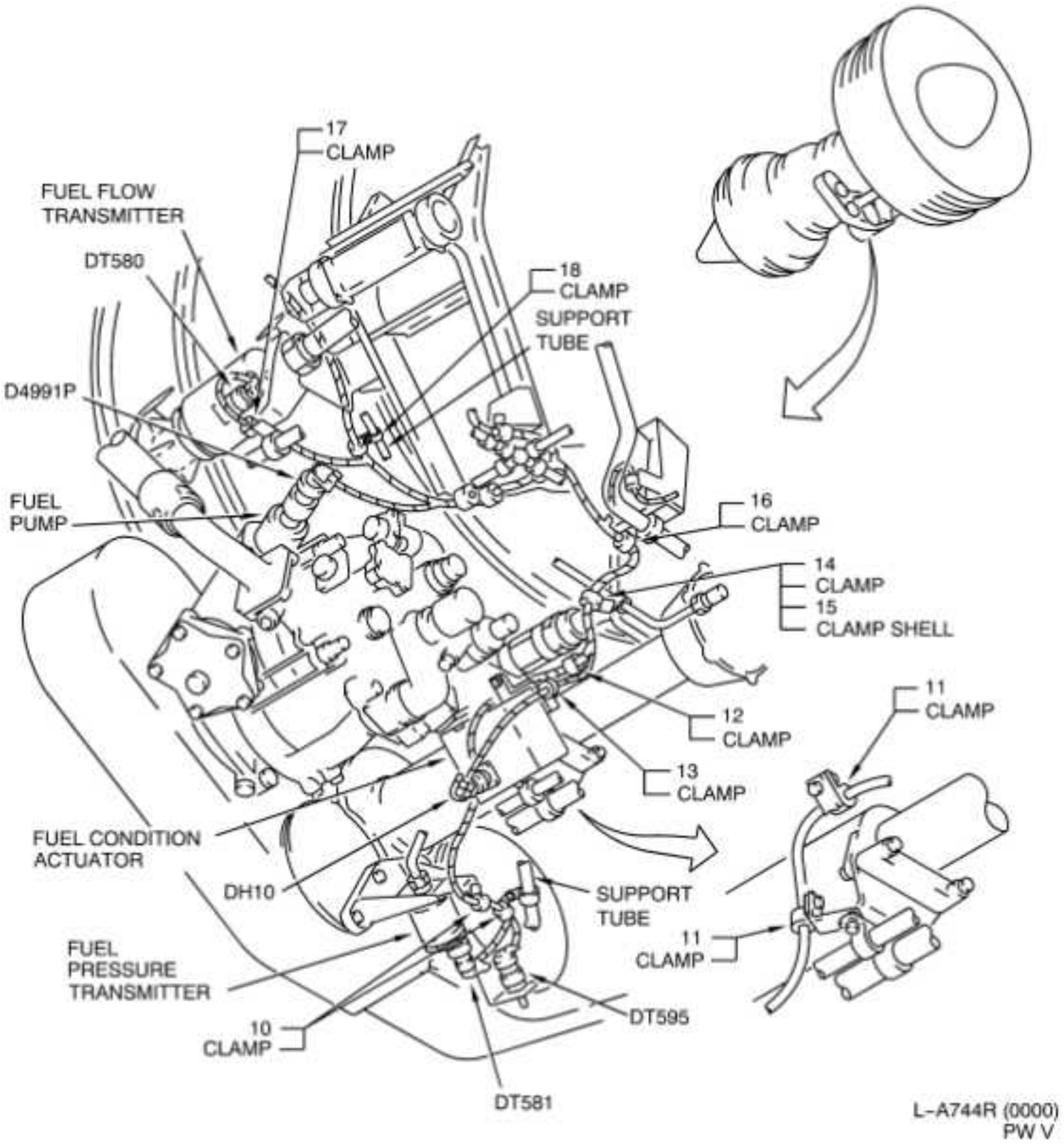
POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−01


DRAIN FILTER SUPPORT BRACKET
FLANGE M
FLANGE N
DV213
5 CLAMP
4 CLAMP
STARTER SHUTOFF VALVE
DH8
DH7
HYDRAULIC PUMP
DV215
3 CLAMP
2 CLAMP
1 CLAMP
DT597
NO. 3 BEARING OIL TEMP SENSOR
L-A742R (0000)
PW V

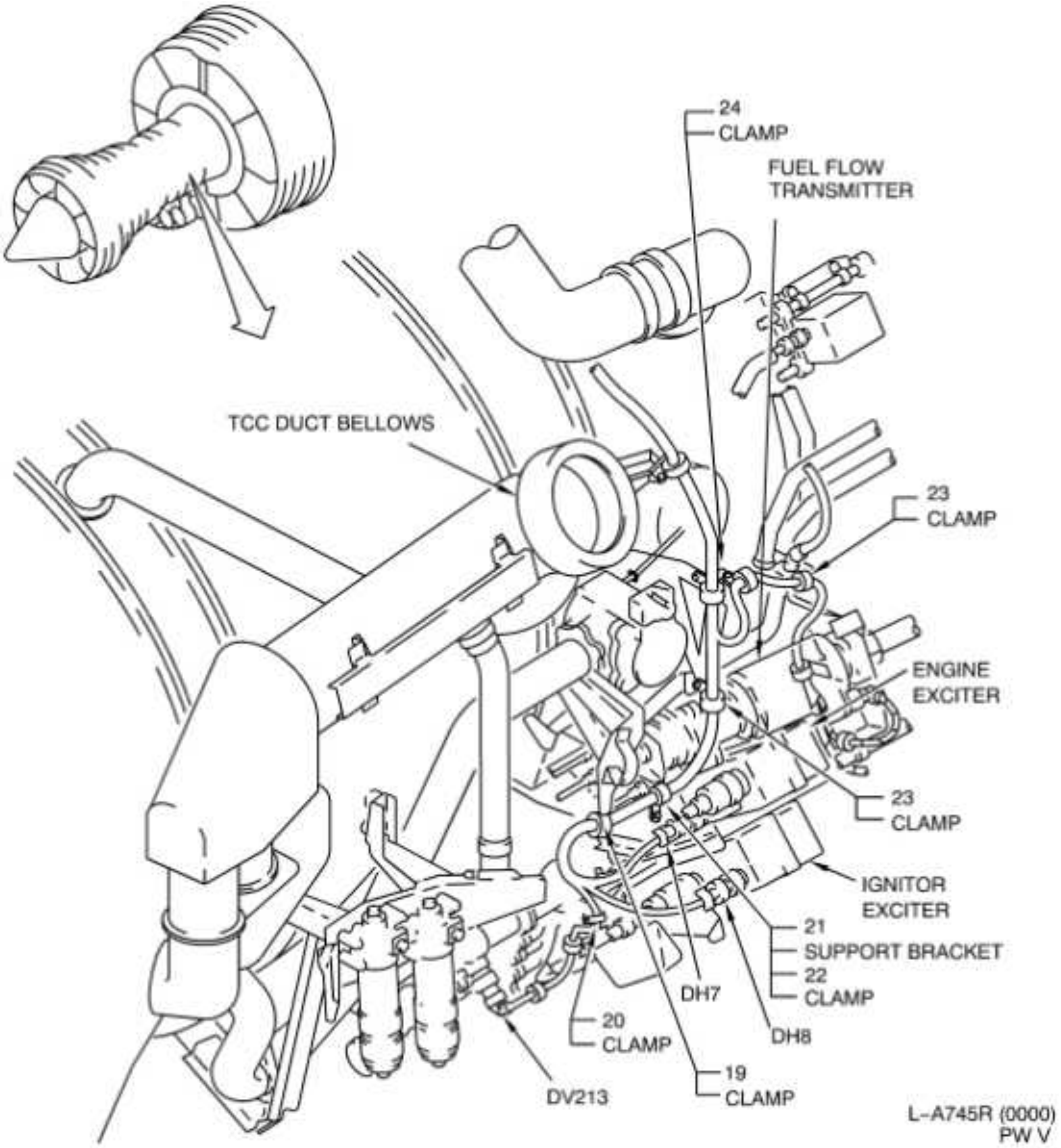
Engine Core Harness
(Bottom Right)
Figure 304 (Sheet 1)
(Task 71−00−35−050−001−A)


STATOR VANE ACTUATOR
DV216
9 CLAMP
IDG ADC VALVE
8 CLAMP
7 CLAMP
6 CLAMP
D4990P
L-A743R (0000)
PW V

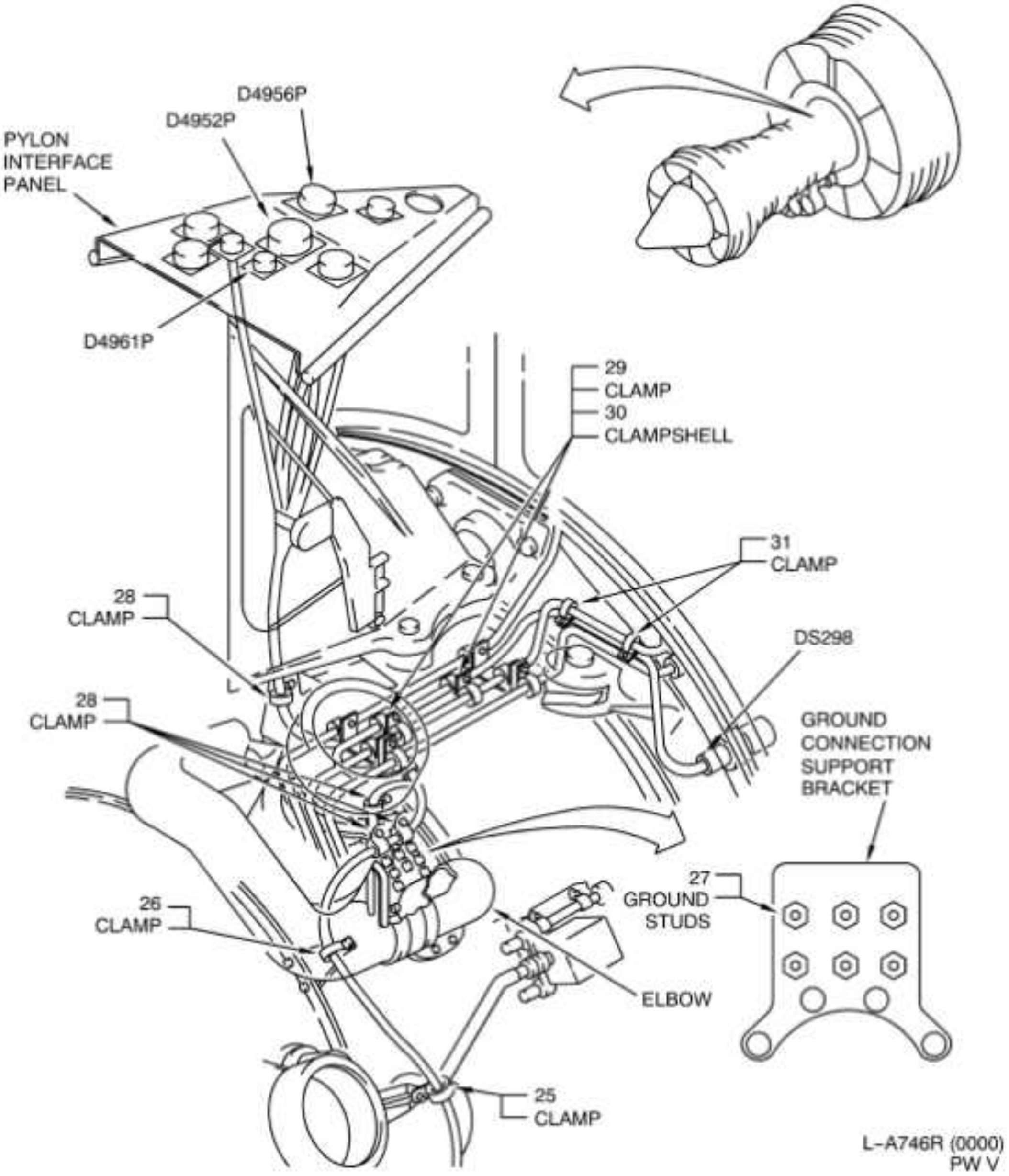
Engine Core Harness
(Forward Lower Right)
Figure 304 (Sheet 2)
(Task 71−00−35−050−001−A)


17
CLAMP
FUEL FLOW TRANSMITTER
DT580
18
CLAMP
SUPPORT TUBE
D4991P
FUEL PUMP
16
CLAMP
14
CLAMP
15
CLAMP SHELL
11
CLAMP
12
CLAMP
13
CLAMP
FUEL CONDITION ACTUATOR
DH10
SUPPORT TUBE
11
CLAMP
FUEL PRESSURE TRANSMITTER
DT595
10
CLAMP
DT581
L-A744R (0000)
PW V

Engine Core Harness
(Rear Lower Right)
Figure 304 (Sheet 3)
(Task 71−00−35−050−001−A)


24
CLAMP
FUEL FLOW TRANSMITTER
TCC DUCT BELLOWS
23
CLAMP
ENGINE EXCITER
23
CLAMP
IGNITOR EXCITER
21
SUPPORT BRACKET
22
CLAMP
DH7
DH8
20
CLAMP
19
CLAMP
DV213
L-A745R (0000)
PW V

Engine Core Harness
(Right)
Figure 304 (Sheet 4)
(Task 71−00−35−050−001−A)


D4956P
D4952P
PYLON INTERFACE PANEL
D4961P
29 CLAMP
30 CLAMPSHELL
31 CLAMP
DS298
28 CLAMP
28 CLAMP
GROUND CONNECTION SUPPORT BRACKET
27 GROUND STUDS
26 CLAMP
ELBOW
25 CLAMP
L-A746R (0000)
PW V

Engine Core Harness
(Upper Right)
Figure 304 (Sheet 5)
(Task 71−00−35−050−001−A)

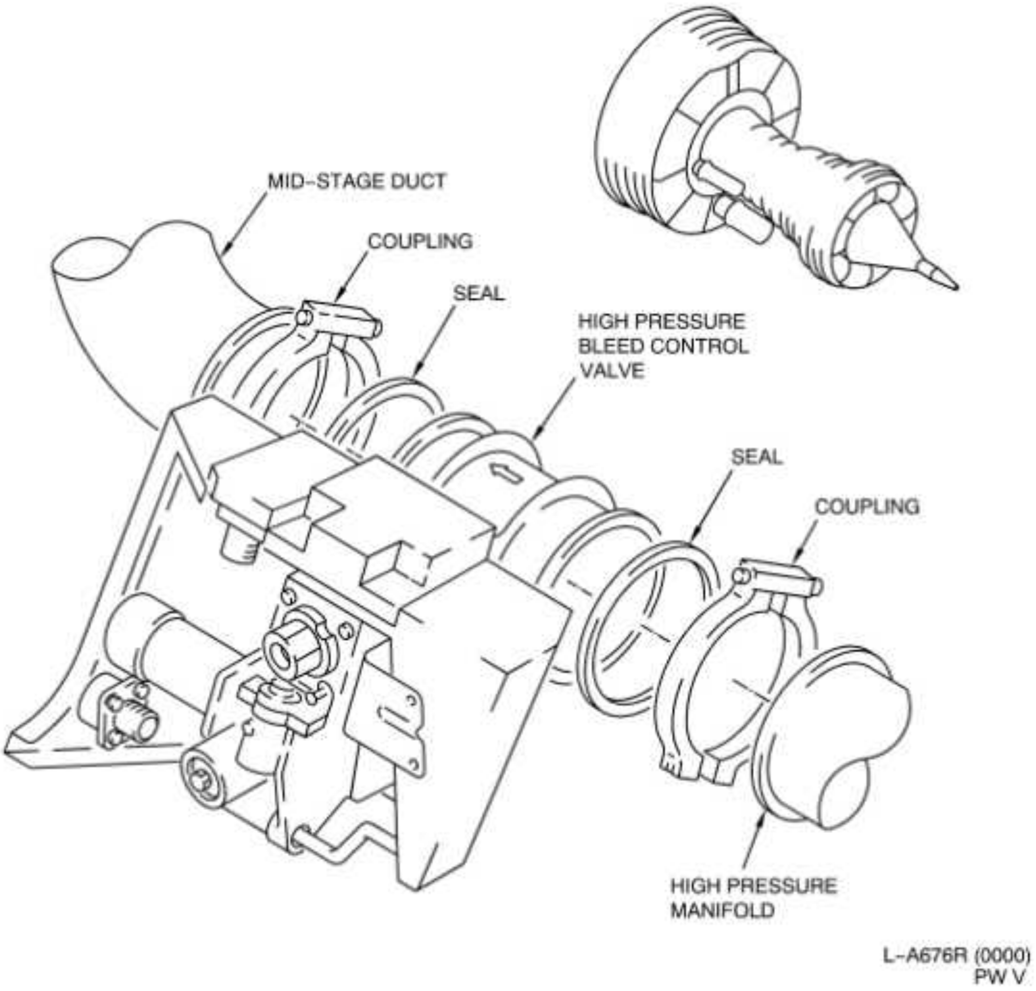
Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−02

Task 71−00−35−050−002:

1. Remove High Pressure Bleed Control Valve
    - A. Equipment And Materials Required − None
    - B. Procedure

      See Figure 301.
        - (1) Remove couplings and metal seals attaching valve to midstage duct and high pressure manifold.
        - (2) Install protective covers over open valve and duct ports.
        - (3) Remove valve from engine core.


MID-STAGE DUCT
COUPLING
SEAL
HIGH PRESSURE BLEED CONTROL VALVE
SEAL
COUPLING
HIGH PRESSURE MANIFOLD
L-A676R (0000)
PW V

High Pressure Bleed Control Valve
Figure 301
(Task 71-00-35-050-002)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 71-00-35-050-003:

1. Remove Pressure Regulator Valve

A. Equipment And Materials Necessary - None

B. Procedure
See Figure 301.

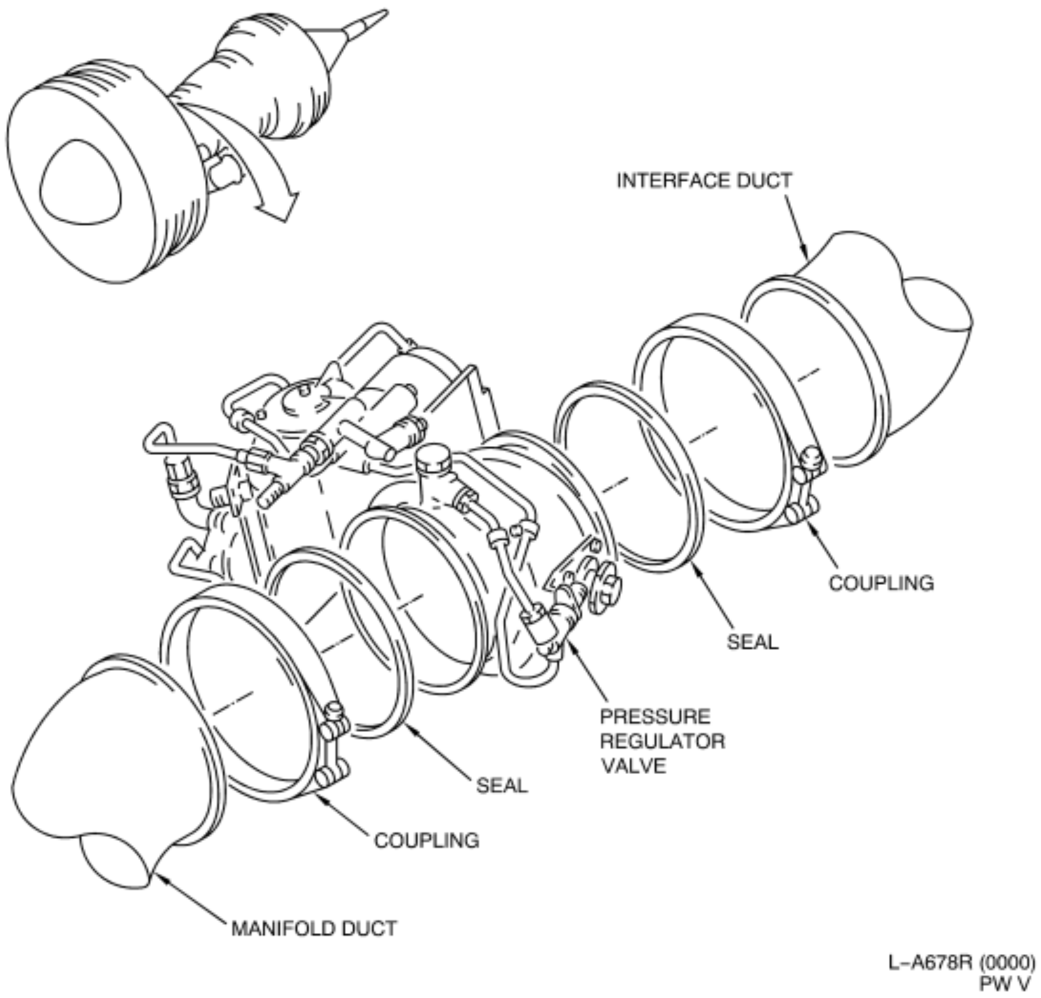
R CAUTION: BE CAREFUL WHEN YOU HANDLE, REMOVE OR INSTALL
R ALL TUBES WHICH CONTAIN A FLEX DESIGN
R SEGMENT. REMOVE AND INSTALL A TUBE WITH A
R FLEX SEGMENT WITH THE SAME PRECAUTIONS
R USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO
R NOT BEND THE FLEXHOSE OF A TUBE TO HELP
R WITH THE INSTALLATION OR REMOVAL OF AN
R ATTACHED COMPONENT. IF A FLEX SEGMENT IS
R BENT TOO MUCH, THIS CAN CAUSE A KINK IN
R THE EXTERNAL WIRE BRAID AND IN THE INNER
R POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS
R OR TUBE RUPTURE CAN BE THE RESULT.

(1) Remove couplings and seals attaching valve to manifold duct and interface duct.

(2) Install protective covers over open valve and duct ports.

(3) Remove valve from engine core.

POWER PLANT GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - REMOVAL-03


INTERFACE DUCT
COUPLING
SEAL
PRESSURE
REGULATOR
VALVE
SEAL
COUPLING
MANIFOLD DUCT
L-A678R (0000)
PW V

Pressure Regulator Valve
Figure 301
(Task 71-00-35-050-003)

POWER PLANT GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - REMOVAL-04

Task 71-00-35-050-009:

1. Remove 2.95 Bleed Valve Bellows

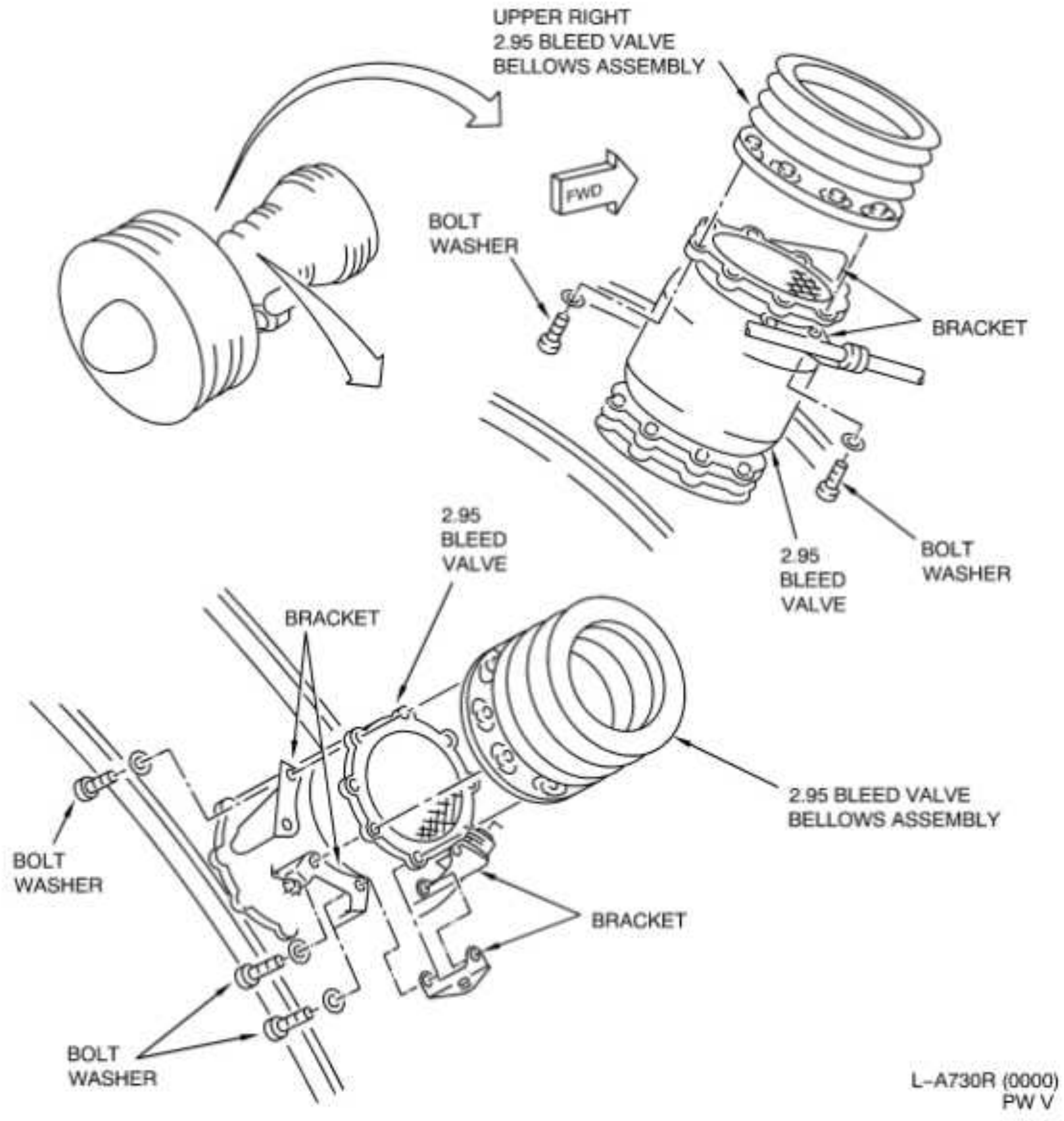
   A. Equipment And Materials Required - None

   B. Procedure

      See Figure 301.

      (1) Remove screws and washers securing bellows and brackets to valve.

      (2) Install protective cover on bleed valve port.


UPPER RIGHT
2.95 BLEED VALVE
BELLOWS ASSEMBLY
FWD
BOLT
WASHER
BRACKET
2.95
BLEED
VALVE
BOLT
WASHER
2.95
BLEED
VALVE
BRACKET
2.95 BLEED VALVE
BELLOWS ASSEMBLY
BOLT
WASHER
BRACKET
BOLT
WASHER
L-A730R (0000)
PW V

2.95 Bleed Valve Bellows
Figure 301
(Task 71−00−35−050−009)

Task 71-00-35-050-010:

1. Remove Fire Extinguisher Tubes

A. Equipment And Materials Required - None

B. Procedure

See Figure 301.

(1) Disconnect pylon hose from elbow at upper bracket on Flange K.

(2) Loosen fire extinguisher tube coupling nuts on both ends of tube assembly.

(3) Remove clamps, bolts, washers, and nuts attaching upper fire extinguisher tube to two support brackets.

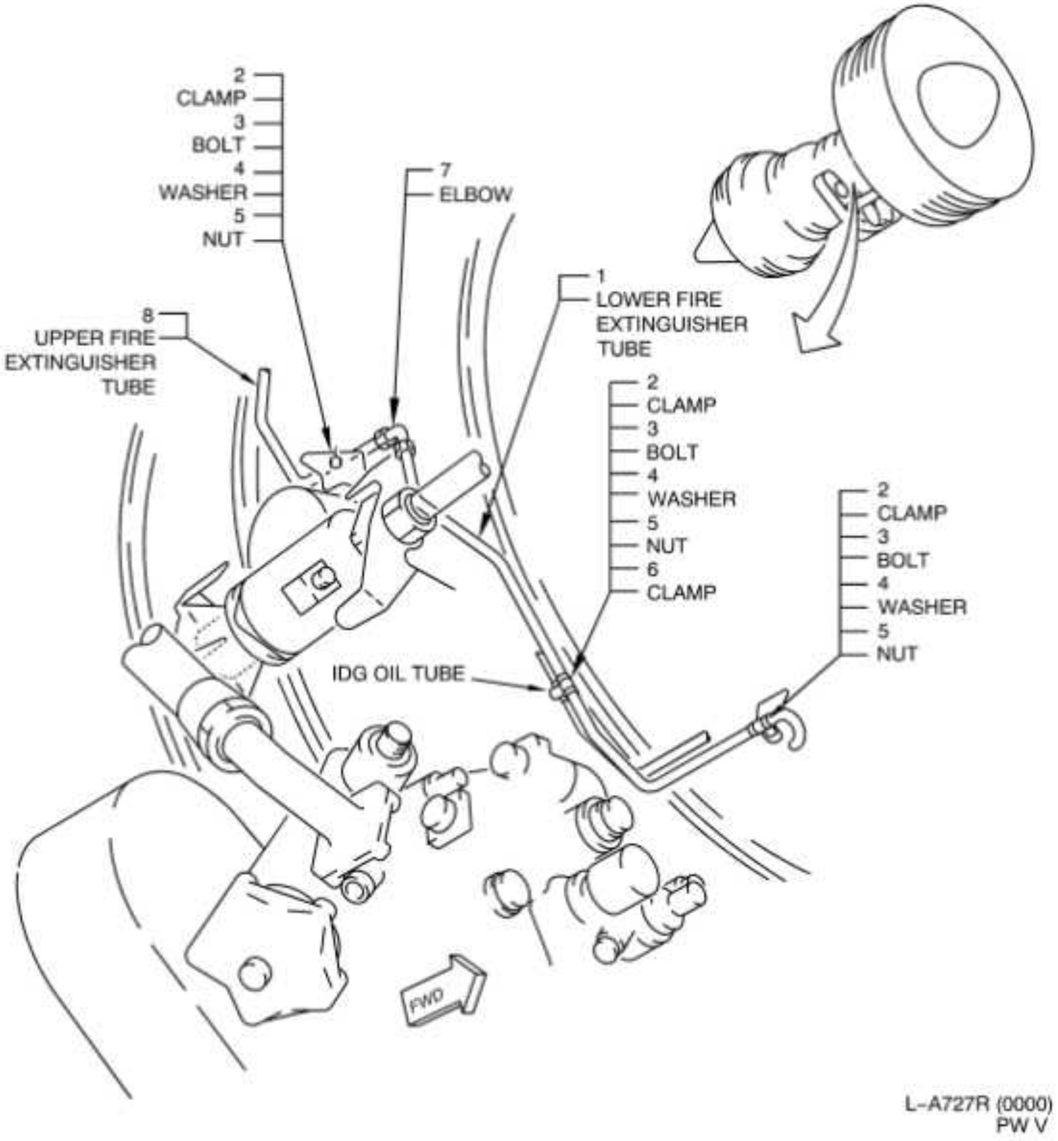
(4) Disconnect upper fire extinguisher tube from two elbows.

(5) Remove elbow, washer, and nut from bracket mounted on Flange J.

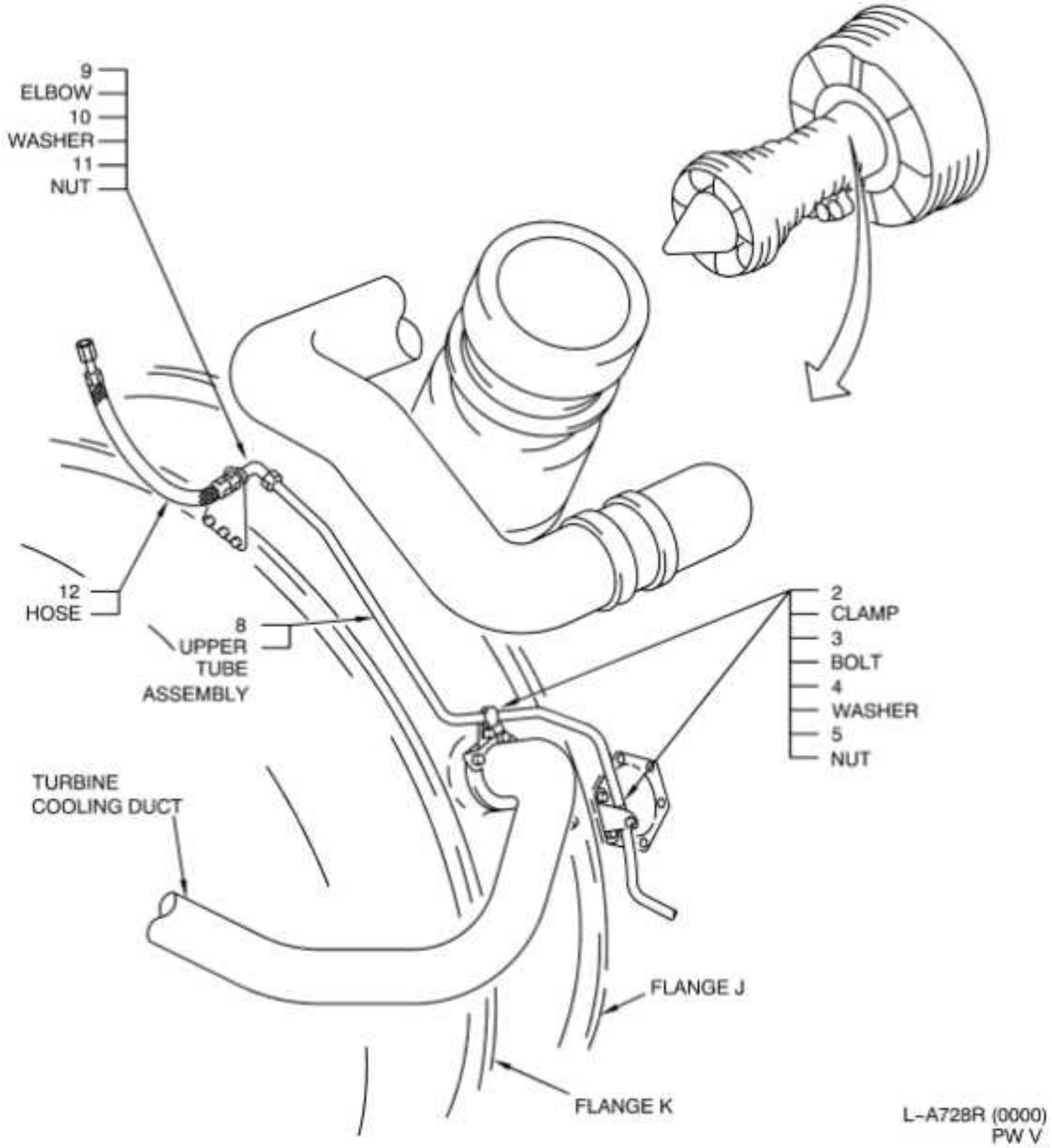
(6) Remove elbow from upper end of fire extinguisher tube.

(7) Remove two clamps, bolt, washer, and nut securing lower fire extinguisher tube to bracket shared with IDG oil tube.

(8) Remove clamp, bolt, washer, and nut securing lower fire extinguisher tube to support bracket.


2
CLAMP
3
BOLT
4
WASHER
5
NUT
7
ELBOW
8
UPPER FIRE EXTINGUISHER TUBE
1
LOWER FIRE EXTINGUISHER TUBE
2
CLAMP
3
BOLT
4
WASHER
5
NUT
6
CLAMP
2
CLAMP
3
BOLT
4
WASHER
5
NUT
IDG OIL TUBE
FWD
L−A727R (0000)
PW V

Fire Extinguisher Tubes
Figure 301 (Sheet 1)
(Task 71−00−35−050−010)


9
ELBOW
10
WASHER
11
NUT
12
HOSE
8
UPPER
TUBE
ASSEMBLY
2
CLAMP
3
BOLT
4
WASHER
5
NUT
TURBINE
COOLING DUCT
FLANGE J
FLANGE K
L−A728R (0000)
PW V

Fire Extinguisher Tubes
Figure 301 (Sheet 2)
(Task 71−00−35−050−010)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 71-00-35-050-011:

1. Remove IDG Cooling Tubes

A. Equipment And Materials Required - None

B. Procedure

See Figure 301.

(1) Disconnect coupling nuts of tube (6) from IDG oil in union and from tube (5). Remove union and discard packing.

(2) Remove clamp, bolt, washer, and nut attaching tube (6) to tube (5). Remove tube (6) from engine.

(3) Disconnect coupling nut of tube (5) from IDG fuel/oil cooler oil out union. Remove union and discard packing.

(4) Remove clamp, bolt, washer, and nut attaching tube (5) to bracket. Remove tube (5) from engine.

(5) Disconnect coupling nuts of tube (4) from IDG scavenge filter oil out reducer and from tube (3). Remove reducer and discard packing.

(6) Remove tube (4) from engine.

(7) Disconnect coupling nut of tube (3) from tube (2).

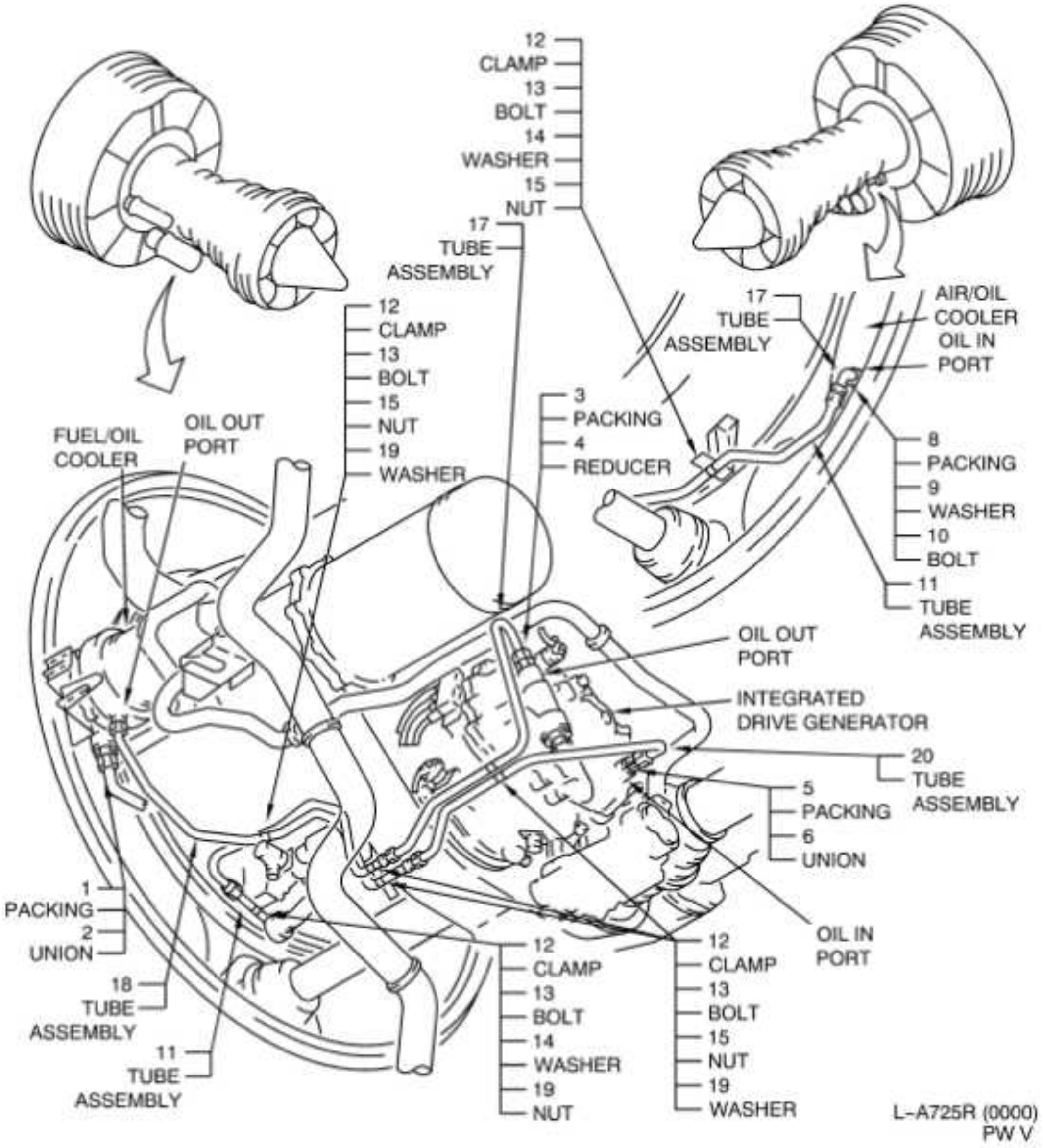
(8) Remove clamp, bolt, washer, and nut attaching tube (3) to bracket. Remove tube (3) from engine.

(9) Disconnect coupling nut of tube (2) from tube (1).

(10) Remove clamp, bolt, washer, and nut attaching tube (2) to bracket. Remove tube (2) from engine.

(11) Disconnect coupling nut of tube (1) from union on IDG oil in port. Remove union and discard packing.

(12) Remove tube (1) from engine.


12
CLAMP
13
BOLT
14
WASHER
15
NUT
17
TUBE
ASSEMBLY
12
CLAMP
13
BOLT
15
NUT
19
WASHER
17
TUBE
ASSEMBLY
AIR/OIL
COOLER
OIL IN
PORT
3
PACKING
4
REDUCER
FUEL/OIL
COOLER
OIL OUT
PORT
8
PACKING
9
WASHER
10
BOLT
11
TUBE
ASSEMBLY
OIL OUT
PORT
INTEGRATED
DRIVE GENERATOR
20
TUBE
ASSEMBLY
5
PACKING
6
UNION
OIL IN
PORT
1
PACKING
2
UNION
18
TUBE
ASSEMBLY
11
TUBE
ASSEMBLY
12
CLAMP
13
BOLT
14
WASHER
19
NUT
12
CLAMP
13
BOLT
15
NUT
19
WASHER
L-A725R (0000)
PW V

IDG Cooling Tubes
Figure 301
(Task 71-00-35-050-011)

POWER PLANT GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - REMOVAL-07

Task 71-00-35-050-012:

1. Remove Bleed Air Pneumatic Tubes And Hoses

A. Equipment And Materials Required - None

B. Procedure

See Figure 301.

(1) Disconnect three hoses (301/21, 301/22, 301/23) from pylon interface.

(2) Disconnect hose (301/23) from upper left elbow on bracket, at Flange M.

(3) Disconnect hose (301/22) from upper right elbow on bracket, at Flange M.

(4) Disconnect hose (301/21) from lower elbow of bracket, at Flange M.

(5) Disconnect clamp, bolt, washer, and nut attaching tube (301/11) to support bracket on left side of 2.9 bleed bellows.

(6) Disconnect clamp, bolt, washer, and nut attaching tube (301/12) to upper support bracket on left side of 2.9 bleed bellows.

(7) Disconnect clamps, bolts, washers, and nuts attaching tube (301/15) to two support bracket on left side of 2.9 bleed bellows.

(8) Disconnect clamp, bolt, washer, and nut attaching tube (301/9) to forward support bracket on starter upper duct.

(9) Disconnect clamps, washers, and bolts securing tubes (301/12, 301/13) to forward support bracket on starter upper duct.

(10) Disconnect clamp, washer, and bolt securing tube (301/9) to aft bracket on starter upper duct.

(11) Disconnect clamps, washers, and bolts securing tubes (301/12, 301/13) to aft bracket on starter upper duct.

(12) Disconnect tube (301/15) from union and pneumatic regulating valve.

(13) Disconnect tube (301/13) from upper left elbow on bracket, at Flange M. Remove union from tube.

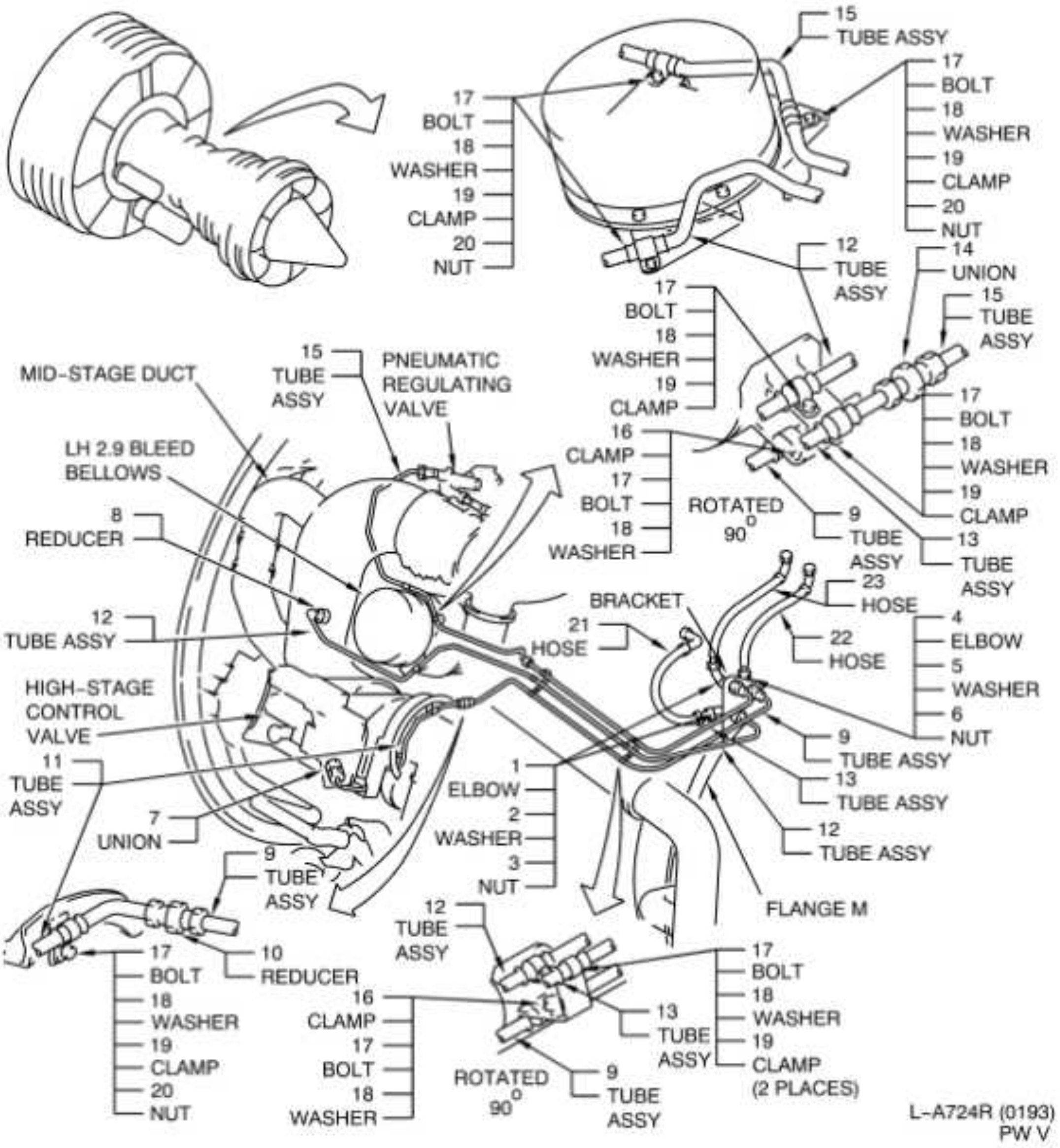
(14) Disconnect tube (301/12) from lower elbow on bracket at Flange M and from reducer on mid−stage duct.

(15) Disconnect tube (301/11) from reducer and from union.

(16) Disconnect tube (301/9) from upper right elbow on bracket at Flange M. Remove reducer from tube.

(17) Remove reducer from mid−stage duct.

(18) Remove washers and nuts securing three elbows to bracket at Flange M.


15 TUBE ASSY
17 BOLT
18 WASHER
19 CLAMP
20 NUT
17 BOLT
18 WASHER
19 CLAMP
20 NUT
12 TUBE ASSY
14 UNION
15 TUBE ASSY
17 BOLT
18 WASHER
19 CLAMP
MID-STAGE DUCT
15 TUBE ASSY
PNEUMATIC REGULATING VALVE
17 BOLT
18 WASHER
19 CLAMP
16 CLAMP
17 BOLT
18 WASHER
ROTATED 90°
9 TUBE ASSY
13 TUBE ASSY
LH 2.9 BLEED BELLOWS
8 REDUCER
12 TUBE ASSY
BRACKET
23 HOSE
21 HOSE
22 HOSE
4 ELBOW
5 WASHER
6 NUT
HIGH-STAGE CONTROL VALVE
11 TUBE ASSY
7 UNION
9 TUBE ASSY
13 TUBE ASSY
1 ELBOW
2 WASHER
3 NUT
12 TUBE ASSY
9 TUBE ASSY
FLANGE M
12 TUBE ASSY
17 BOLT
18 WASHER
19 CLAMP
20 NUT
10 REDUCER
16 CLAMP
17 BOLT
18 WASHER
ROTATED 90°
9 TUBE ASSY
13 TUBE ASSY
17 BOLT
18 WASHER
19 CLAMP (2 PLACES)
L-A724R (0193)
PW V

Bleed Air Pneumatic Tubes And Hoses
Figure 301
(Task 71-00-35-050-012)

Task 71-00-35-050-013:

1. Remove TRC Valve Cooling Tube

   A. Equipment And Materials Required - None

   B. Procedure

   See Figure 301.

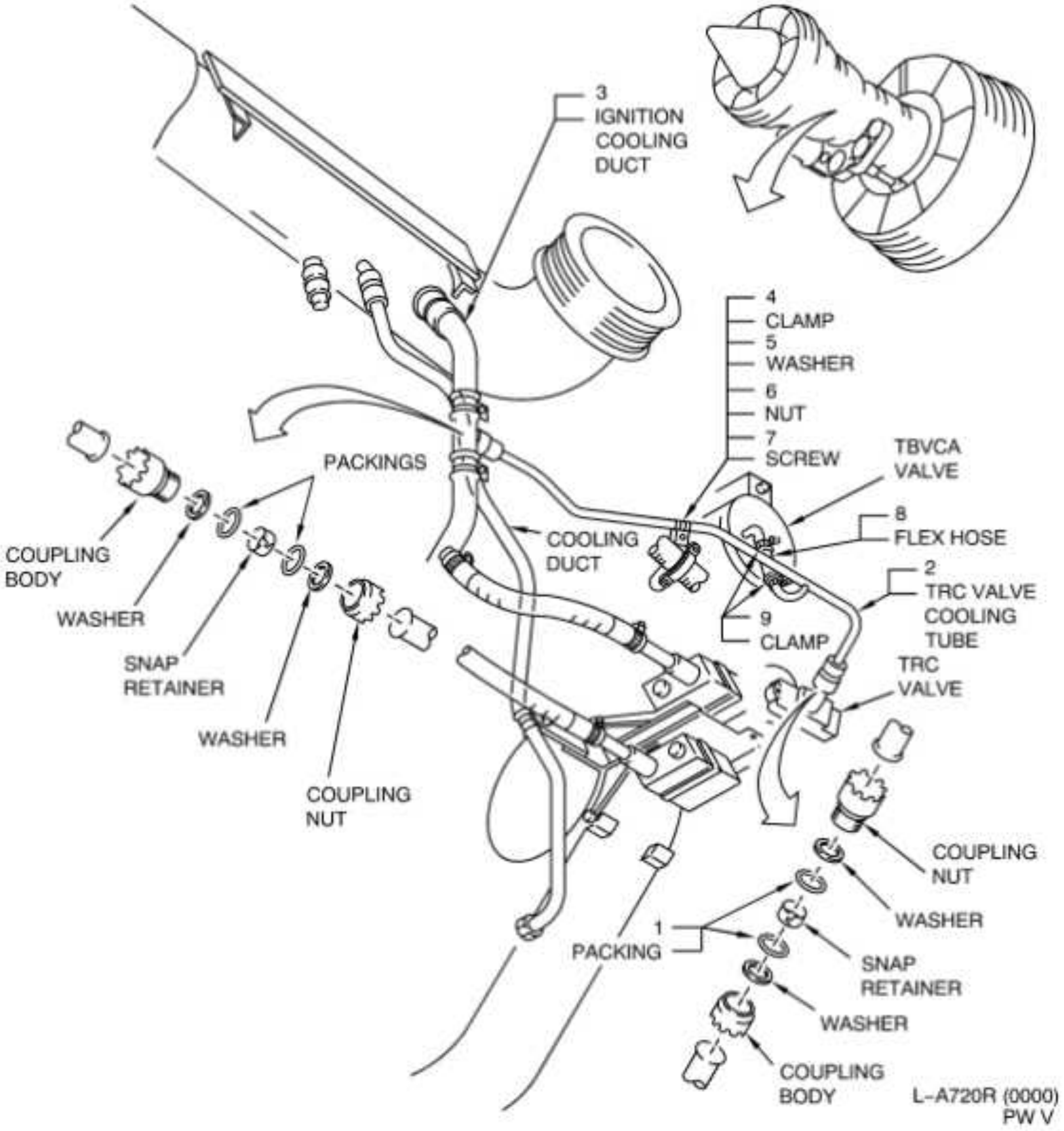
   (1) Disconnect clamps securing flex hose (301/8) to cooling tube (301/2) and TBVCA valve. Remove flex hose.

   (2) Loosen coupling nuts at both ends of cooling tube (301/2).

   (3) Release snap retainer of connector body securing TRC valve cooling tube to TRC valve. Retain loose hardware of connector body.

   (4) Disconnect clamp, screw, washer, and nut securing cooling tube (301/2) to bracket.

   (5) Remove cooling tube (301/2) from engine.


3
IGNITION
COOLING
DUCT
4
CLAMP
5
WASHER
6
NUT
7
SCREW
TBVCA
VALVE
8
FLEX HOSE
2
TRC VALVE
COOLING
TUBE
9
CLAMP
TRC
VALVE
PACKINGS
COOLING
DUCT
COUPLING
BODY
WASHER
SNAP
RETAINER
WASHER
COUPLING
NUT
COUPLING
NUT
WASHER
1
PACKING
SNAP
RETAINER
WASHER
COUPLING
BODY
L-A720R (0000)
PW V

TRC Valve Cooling Tube
Figure 301
(Task 71−00−35−050−013)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - REMOVAL-09

Task 71-00-35-050-014:

1. Remove Oil System Tubes

   A. Equipment And Materials Required - None

   B. Procedure

      See Figure 301.

      (1) Disconnect clamp, screw, washer, and nut securing oil tube (301/18) to engine bracket.

      (2) Disconnect clamps, screw, washer, and nut securing oil tubes (301/18) and (301/19) to bracket.

      (3) Loosen and disconnect coupling nuts of oil tube (301/19) from restrictor in LP4 port and union of oil filter differential pressure switch.

      (4) Loosen and disconnect coupling nuts of oil tube (301/18) from restrictor in LP5 port and union of oil filter differential pressure switch.

      (5) Remove two bolts securing bracket on oil cooler bypass valve.

      (6) Disconnect two clamps, bolt, washer, and nut securing hose assembly to oil tube.

      (7) Disconnect clamps, spacer, bolt, washer, and nut securing oil tubes (301/14) and (301/13) together.

      (8) Loosen and disconnect coupling nuts of oil tube (301/14) from tee in top of oil pressure transmitter and union in bottom of low oil pressure warning switch. Remove oil tube from engine.

      (9) Loosen and disconnect coupling nuts of oil hose/tube (301/12) from tee in oil tube support bracket and union of low oil pressure warning switch. Remove oil tube from engine.

      (10) Disconnect coupling nuts of hose assembly from tee in oil tube support bracket and union in bottom of oil pressure transmitter.

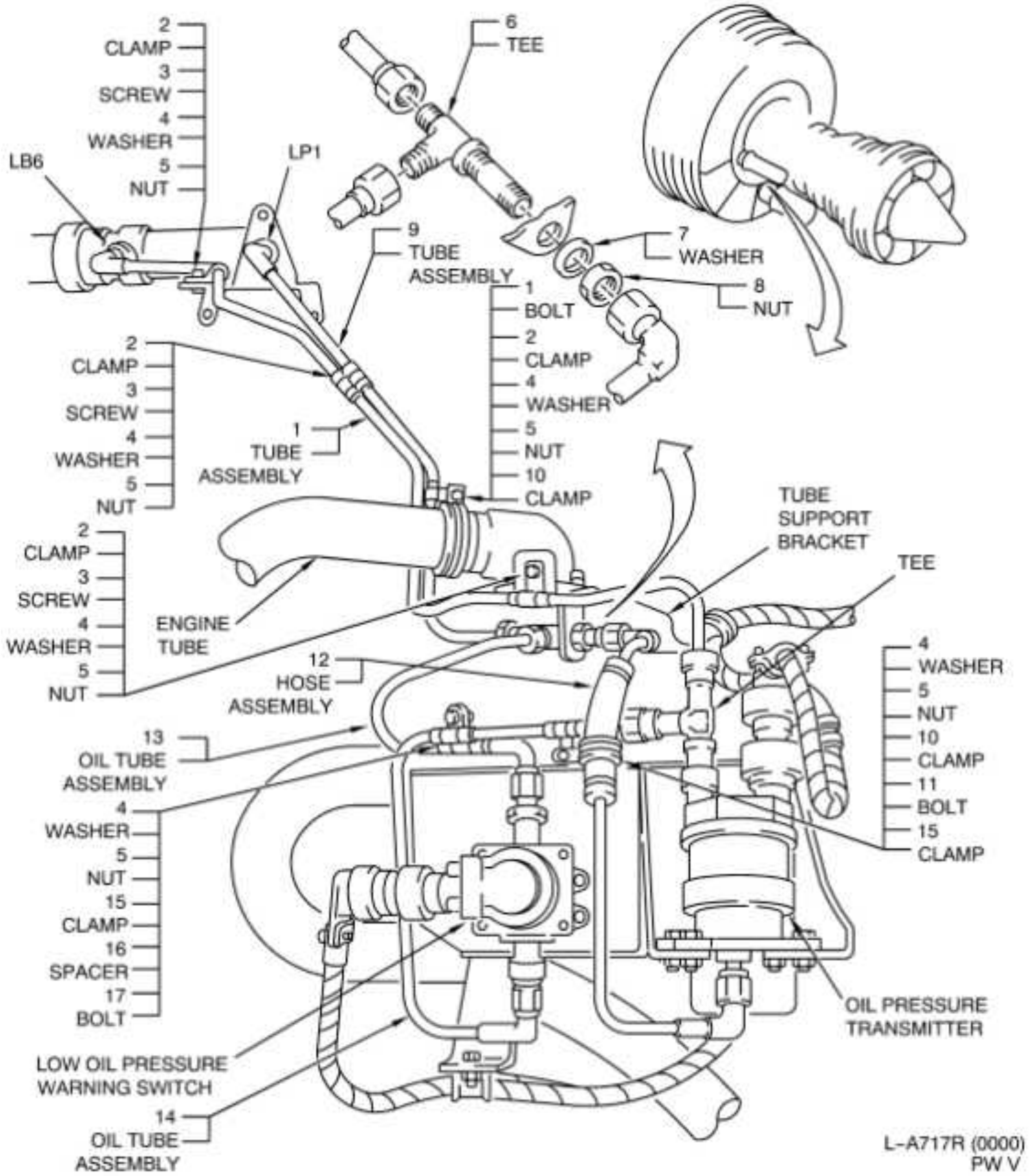
      (11) Disconnect clamp, screw, washer, and nut securing oil tube (301/9) to engine drain tube.

(12) Loosen and disconnect coupling nuts of oil tube (301/9) from reducer in LP1 port and tee in oil tube support bracket. Remove oil tube from engine.

(13) Remove washer and nut securing tee in oil tube support bracket.

(14) Disconnect clamps, screws, washers, and nuts securing oil tube (301/1) to bracket.

(15) Loosen and disconnect coupling nuts of oil tube (301/1) from union in LB6 port and tee in oil pressure transmitter. Remove oil tube from engine.


2
CLAMP
3
SCREW
4
WASHER
5
NUT
LB6
LP1
6
TEE
9
TUBE ASSEMBLY
7
WASHER
8
NUT
1
BOLT
2
CLAMP
4
WASHER
5
NUT
10
CLAMP
2
CLAMP
3
SCREW
4
WASHER
5
NUT
1
TUBE ASSEMBLY
2
CLAMP
3
SCREW
4
WASHER
5
NUT
ENGINE TUBE
TUBE SUPPORT BRACKET
TEE
12
HOSE ASSEMBLY
4
WASHER
5
NUT
10
CLAMP
11
BOLT
15
CLAMP
13
OIL TUBE ASSEMBLY
4
WASHER
5
NUT
15
CLAMP
16
SPACER
17
BOLT
LOW OIL PRESSURE WARNING SWITCH
OIL PRESSURE TRANSMITTER
14
OIL TUBE ASSEMBLY
L-A717R (0000)
PW V

Oil System Tubes
Figure 301
(Task 71-00-35-050-014)

POWER PLANT GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - INSTALLATION-01

Task 71-00-35-450-001:

1. Install Engine Core Wiring Harness - Pre SB PW4NAC 71-70, 71-80, 71-107

A. Equipment And Materials Necessary

Standard Tools:
Glenair TG-69 Soft Jawed Pliers Or
Glenair TG-70 Strap Wrench

Consumable Materials:

Item No.	Designation
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lockwire, MS20995C32		

B. Procedure
See Figure 401.

NOTE: Procedural steps (1) through (40) install wire harness 21W4072 on right side of engine core, Figure 401.

(1) Position wire harness 21W4072 under pylon interface panel with electrical connectors D4952P, D4956P and D4961P closest to panel.

(2) At pylon interface panel, remove protective covers from electrical plugs and receptacles for D4952P, D4956P and D4961P.

(3) Connect electrical plugs D4952P, D4956P and D4961P to receptacles. Tighten connector fingertight plus one-eighth turn. Lockwire connector.

(4) Install three clamps (401/1) and attaching hardware on support brackets. Torque nuts to 32 - 36 lb-in. (3.616 - 4.067 N.m).

(5) Connect electrical connector DS298 to IDG AOC pressure switch as follows.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(6) Install two clamps (401/2) and clamp shells (401/3) and attaching hardware on existing bracket. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(7) At ground connection support bracket (401/4), remove five nuts and washers from five ground studs (401/5). Install five ground connections, washers, and nuts on ground studs. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(8) Install clamp (401/6) and attaching hardware on support bracket in Flange J. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(9) Install clamp (401/7) and attaching hardware on TCC bellows flange. Torque nuts to 32 − 36 lb−in (3.616 − 4.067 N.m).

(10) Install three clamps (401/8) and attaching hardware on support brackets. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(11) Install clamp (401/9) and attaching parts on existing bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(12) Install support bracket (401/10) with clamp (401/11) and attaching hardware on drain filter support. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(13) Connect electrical connector DH7 to engine exciter. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(14) Connect electrical connector DH8 to igniter exciter. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(15) Install two clamps (401/12) and attaching hardware on drain filters support bracket. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(16) Install clamp (401/13) and attaching parts on existing bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(17) Install support bracket (401/14) with clamp (401/15) and attaching hardware on drain filter support. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−01

(18) Install clamp (401/16) with attaching hardware on fuel flow transmitter support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(19) Install clamp (401/17) with attaching hardware on fuel flow transmitter support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(20) Connect electrical connector DT580 to fuel flow transmitter. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(21) Connect electrical connector D4991P to fuel pump. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(22) Install clamp (401/18) with attaching hardware on tube support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(23) Install clamp (401/19) and clamp shell (401/20) with attaching hardware on tube support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(24) Install clamp (401/21) with attaching hardware on tube support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(25) Install clamp (401/22) with attaching hardware on fuel condition actuator support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(26) Connect electrical connector DH10 to fuel condition actuator. Tighten connector as follows.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

R
R

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(27) Install two clamps (401/23) with attaching hardware on tube support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(28) Install clamp (401/24) with attaching hardware on fuel pressure transmitter support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(29) Connect electrical connector DT595 to core compartment temperature sensor. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(30) Connect electrical connector DT581 to fuel pressure transmitter. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(31) Connect electrical connector DV216 to IDG AOC valve. Tighten connector as follows.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:

- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(32) Install clamp (401/25) and clamp shell (401/26) with attaching hardware on tube support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(33) Install clamp (401/27) with attaching hardware on stator vane actuator support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(34) Install clamp (401/28) with attaching hardware on tube support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(35) Install two clamps (401/29) with attaching hardware on stator vane actuator support brackets. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(36) Install three clamps (401/30) with spacers (401/31) and attaching hardware on drain filters support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(37) Install three clamps (401/30) with attaching hardware on three support brackets on starter shutoff valve cover. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(38) Install clamps (401/32) and (401/33) with attaching hardware on support brackets. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(39) Connect electrical connector DV215 to starter shutoff valve. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(40) Connect electrical connector DT579 to No. 3 bearing oil temperature sensor. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

NOTE: Procedural steps (41) through (72) install wire harnesses 21W4070, 21W4072 and 21W4114 on left side of engine core, Figure 402.

(41) Position wire harness 21W4114 under pylon interface panel with electrical connectors D4954P and D4958P closest to panel.

(42) At pylon interface panel, remove protective covers from electrical plugs and receptacles for D4954P and D4958P.

(43) Connect electrical plugs D4954P and D4958P to receptacles. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(44) At base of pylon interface panel, remove protective covers from electrical plug D4955P and receptacle (402/1) for pylon generator wire harness. Connect plug to receptacle and tighten plug fingertight plus one−eighth turn. Lockwire plug.

(45) Install five clamps (402/2) on existing brackets with attaching hardware. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(46) At ground cables support bracket (402/3), remove five nuts and washers from five ground studs (402/4). Install ground connections, washers, and nuts on ground studs. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(47) Install three clamps (402/5) and clamp shells (402/6) on tubing bracket with attaching hardware. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(48) Install two clamps (402/7) and attaching hardware on support brackets. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(49) Remove two nuts and washers from high−stage temperature sensor terminals. Install terminal lugs, 1387−3 (yellow) on Post C and 1387−4 (red) on Post A, with removed nuts and washers. Torque nut for 1387−3 to 20 − 22 lb−in. (2.260 − 2.486 N.m), nut for 1387−4 to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(50) Install clamps (402/8) and clamp shells (402/9) on tubing bracket with attaching hardware. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(51) Connect electrical connectors DV224A and DV224B to pneumatic regulator. Tighten connectors fingertight plus one−eighth turn. Lockwire connectors.

(52) Connect IDG wire harness 21W4114 electrical connector D4955P to pylon generator wire harness. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(53) Install four clamp supports (402/10) to existing brackets with attaching hardware. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(54) Install clamp (402/11) and spacer (402/12) with attaching hardware. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(55) Install clamp (402/13) with attaching hardware on support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(56) Install clamp (402/14) and clamp shell (402/15) with attaching hardware. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(57) Connect electrical connectors DV255A thru DV255C to high pressure bleed control valve. Tighten connectors fingertight plus one−eighth turn. Lockwire connectors.

(58) Install clamps (402/16) thru (402/21) and attaching hardware on support brackets. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(59) Connect electrical connector DT584 to oil quantity transmitter. Tighten connector as follows.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(60) Connect electrical connector DT583 to oil pressure transmitter. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(61) Install four clamps (402/22) with attaching hardware. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(62) Install two clamps (402/23) with attaching hardware. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(63) Connect electrical connector DS297 to low oil pressure switch. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(64) Connect electrical connector DS299 to oil filter differential pressure switch. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(65) Connect electrical connector DT582 to oil temperature sensor. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(66) Connect electrical connector DV213 to disconnect valve. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(67) Install support bracket (402/24) with ground studs 070001−00N and 070002−00N and attaching hardware on Flange H. Torque nuts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(68) Install support bracket (402/25) with clamp guide and two clamps and attaching hardware. Torque bolts to 75 − 85 lb−in. (8.474 − 9.604 N.m).

(69) Install support bracket (402/26) with cable guide bracket and three clamps and attaching hardware. Torque bolts to 75 − 85 lb−in. (8.474 − 9.604 N.m).

(70) Install harness support (402/27) with four clamps and attaching hardware. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(71) Connect electrical connectors DS13A and DS13B to IDG. Tighten connectors fingertight plus one−eighth turn. Lockwire connectors.

(72) Remove terminal cover (402/28) with attaching hardware from terminal block on IDG.

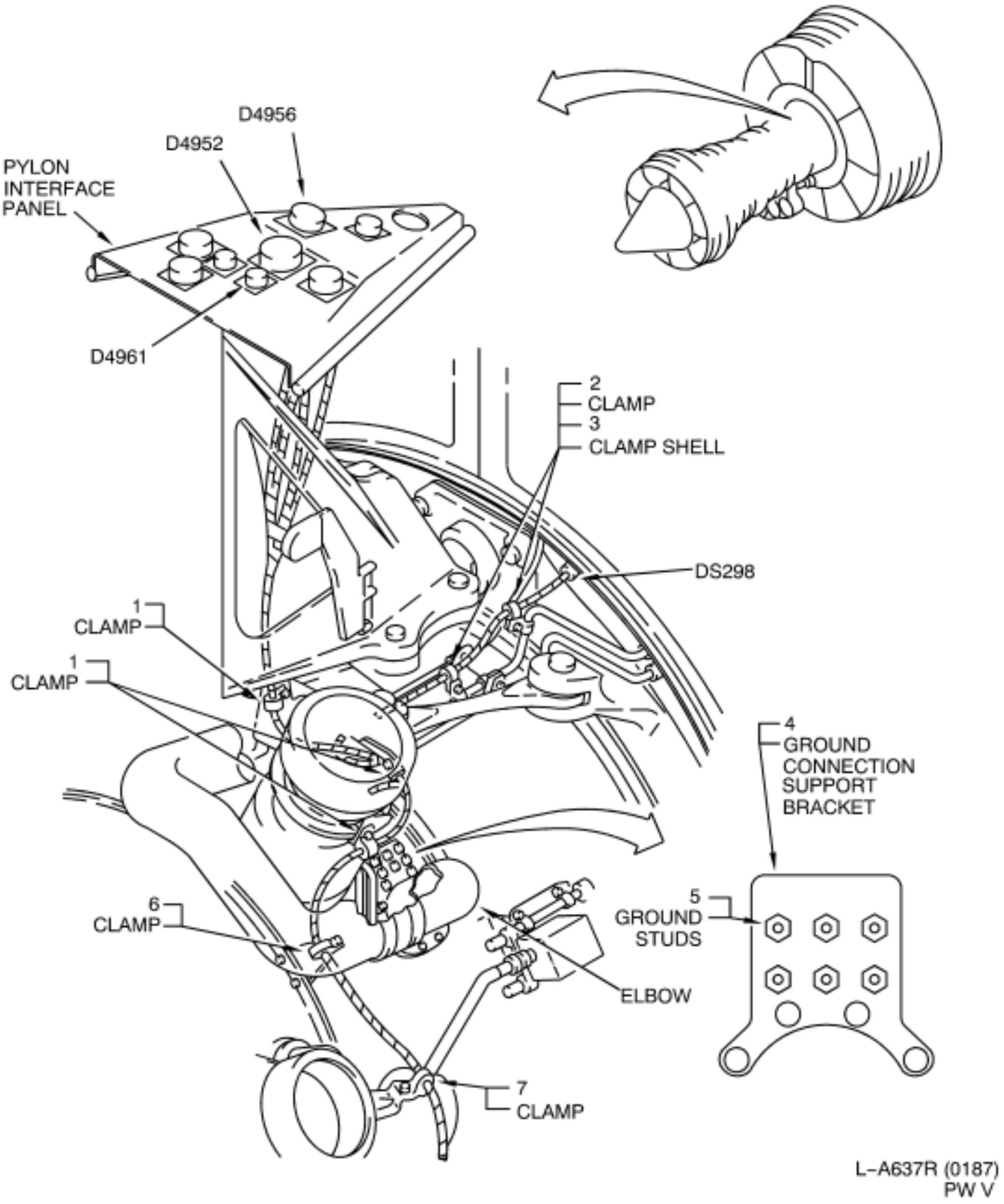
R (73) Connect power cables 070002−00N, 070003−00A, 070004−00B
R and 070005−00C to terminal block studs with nuts and
R washers or nuts with captive washers. Torque nuts to
R 144 − 186 lb−in. (16.270 − 21.015 N.m).

(74) Install terminal cover (402/28) on IDG with screws and washers. Torque screws to 20 − 22 lb−in. (2.260 − 2.486 N.m).

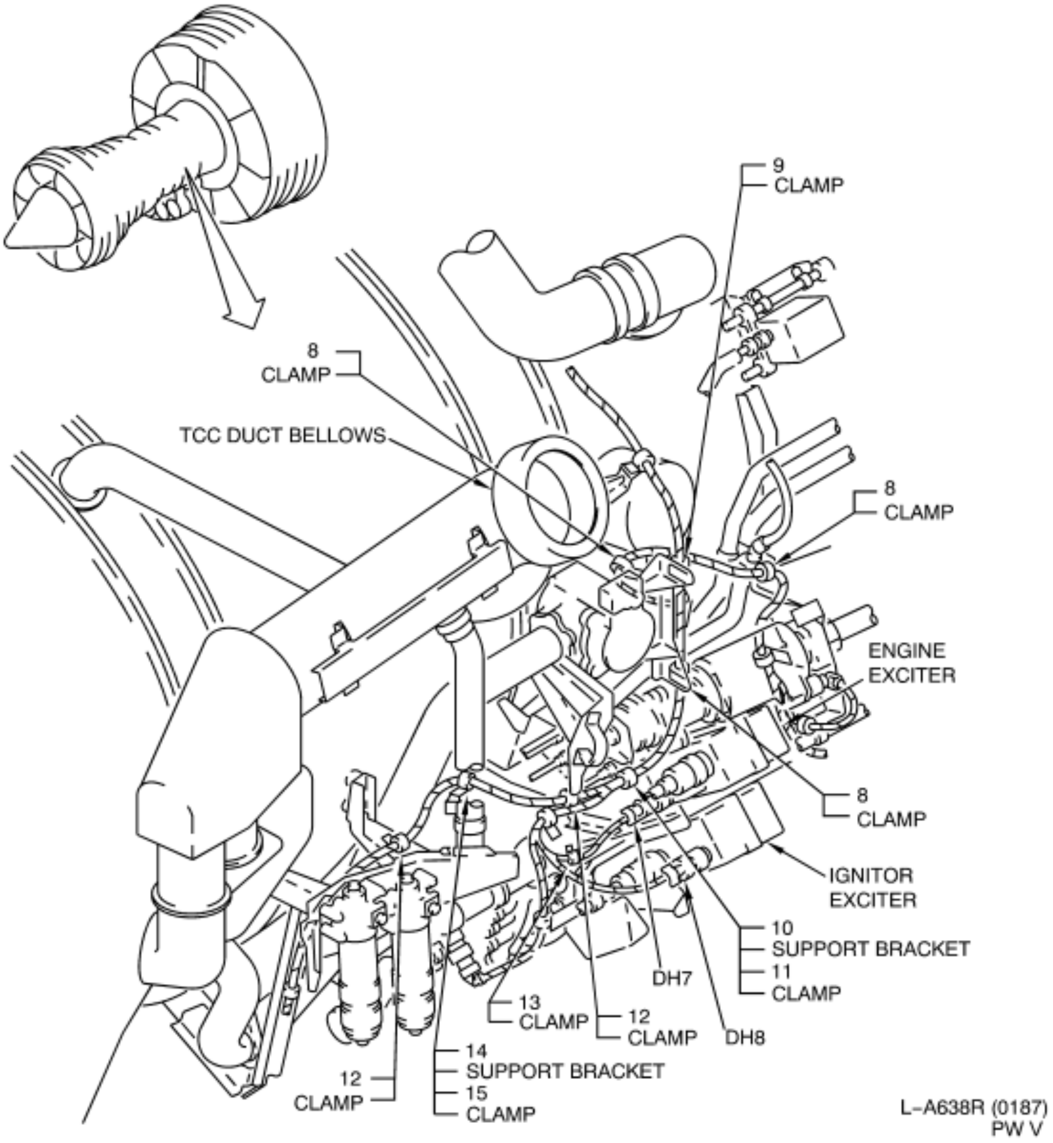
Task 71−00−35−450−001−A:

2. Install Engine Core Wiring Harness − Post SB PW4NAC 71−70, 71−80, 71−107

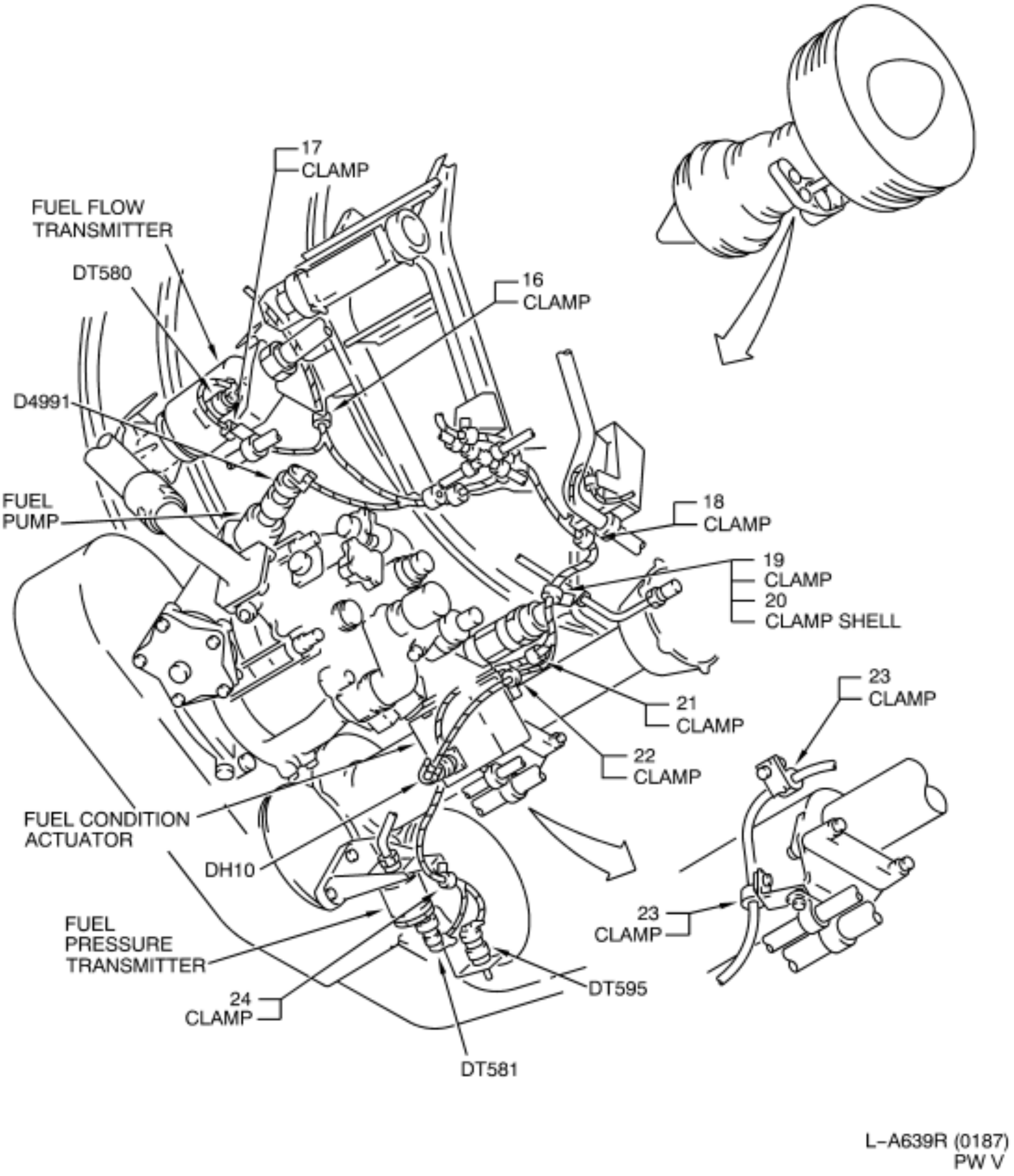
A. Equipment And Materials Necessary


D4956
D4952
PYLON INTERFACE PANEL
D4961
2 CLAMP
3 CLAMP SHELL
DS298
1 CLAMP
1 CLAMP
4 GROUND CONNECTION SUPPORT BRACKET
5 GROUND STUDS
6 CLAMP
ELBOW
7 CLAMP
L-A637R (0187)
PW V

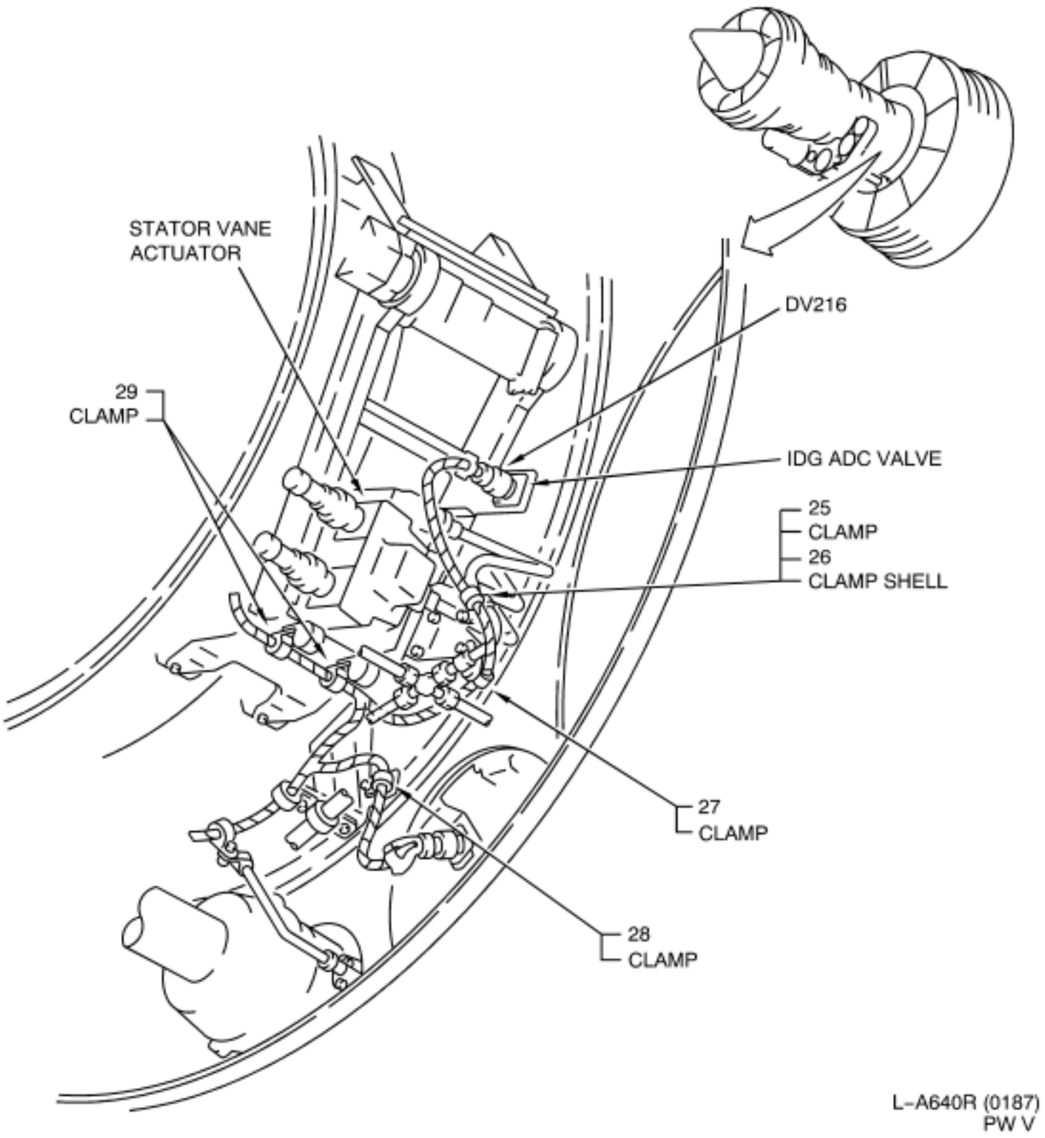
Engine Core Harness (Upper Right)
Figure 401 (Sheet 1)
(Task 71-00-35-450-001)


9
CLAMP
8
CLAMP
TCC DUCT BELLOWS
8
CLAMP
ENGINE
EXCITER
8
CLAMP
IGNITOR
EXCITER
10
SUPPORT BRACKET
11
CLAMP
DH7
13
CLAMP
12
CLAMP
DH8
14
SUPPORT BRACKET
15
CLAMP
12
CLAMP
L-A638R (0187)
PW V

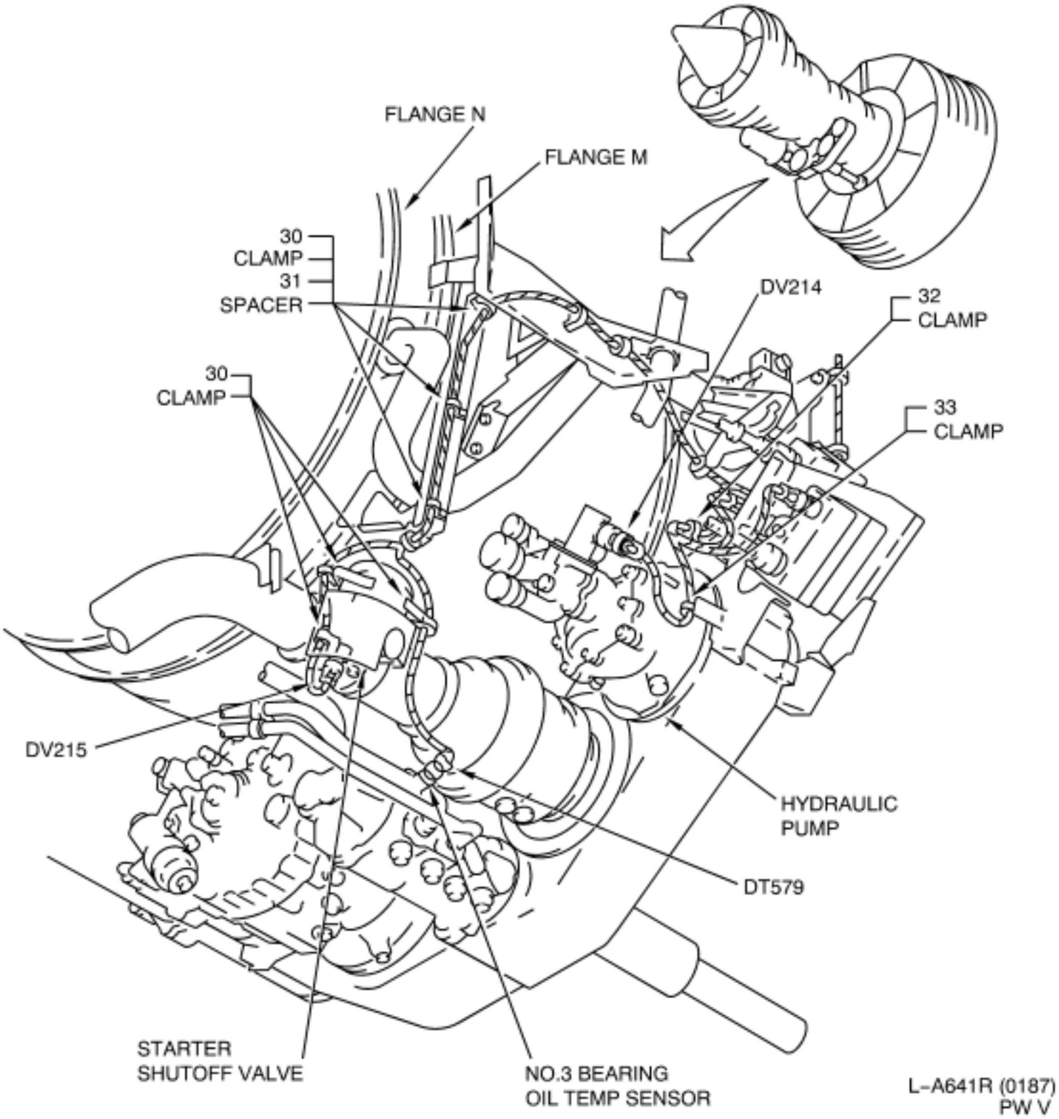
Engine Core Harness (Right)
Figure 401 (Sheet 2)
(Task 71-00-35-450-001)


17
CLAMP
FUEL FLOW
TRANSMITTER
DT580
16
CLAMP
D4991
FUEL
PUMP
18
CLAMP
19
CLAMP
20
CLAMP SHELL
23
CLAMP
21
CLAMP
22
CLAMP
FUEL CONDITION
ACTUATOR
DH10
23
CLAMP
FUEL
PRESSURE
TRANSMITTER
DT595
24
CLAMP
DT581
L−A639R (0187)
PW V

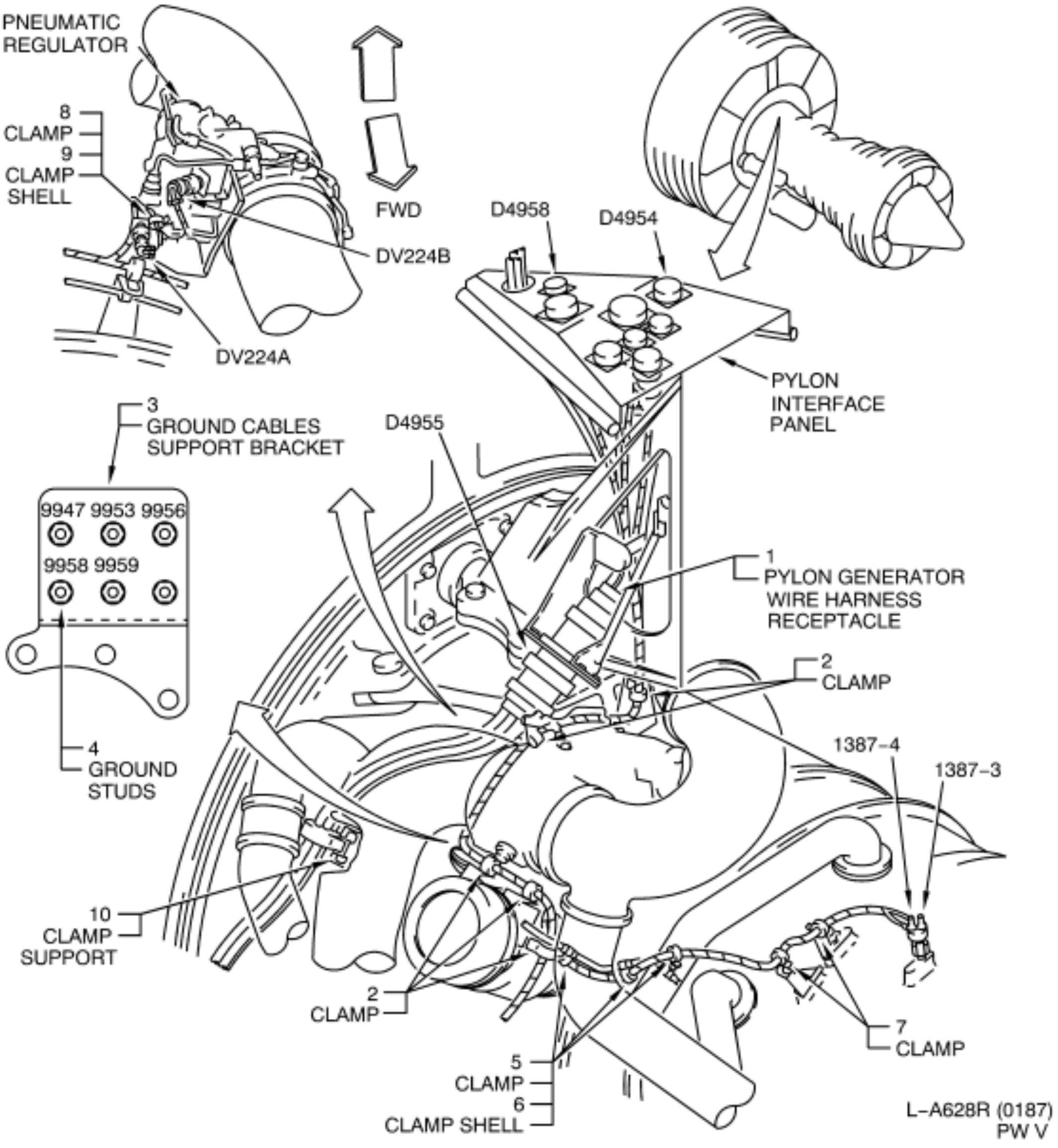
Engine Core Harness (Rear Lower Right)
Figure 401 (Sheet 3)
(Task 71−00−35−450−001)


STATOR VANE ACTUATOR
29 CLAMP
DV216
IDG ADC VALVE
25 CLAMP
26 CLAMP SHELL
27 CLAMP
28 CLAMP
L−A640R (0187)
PW V

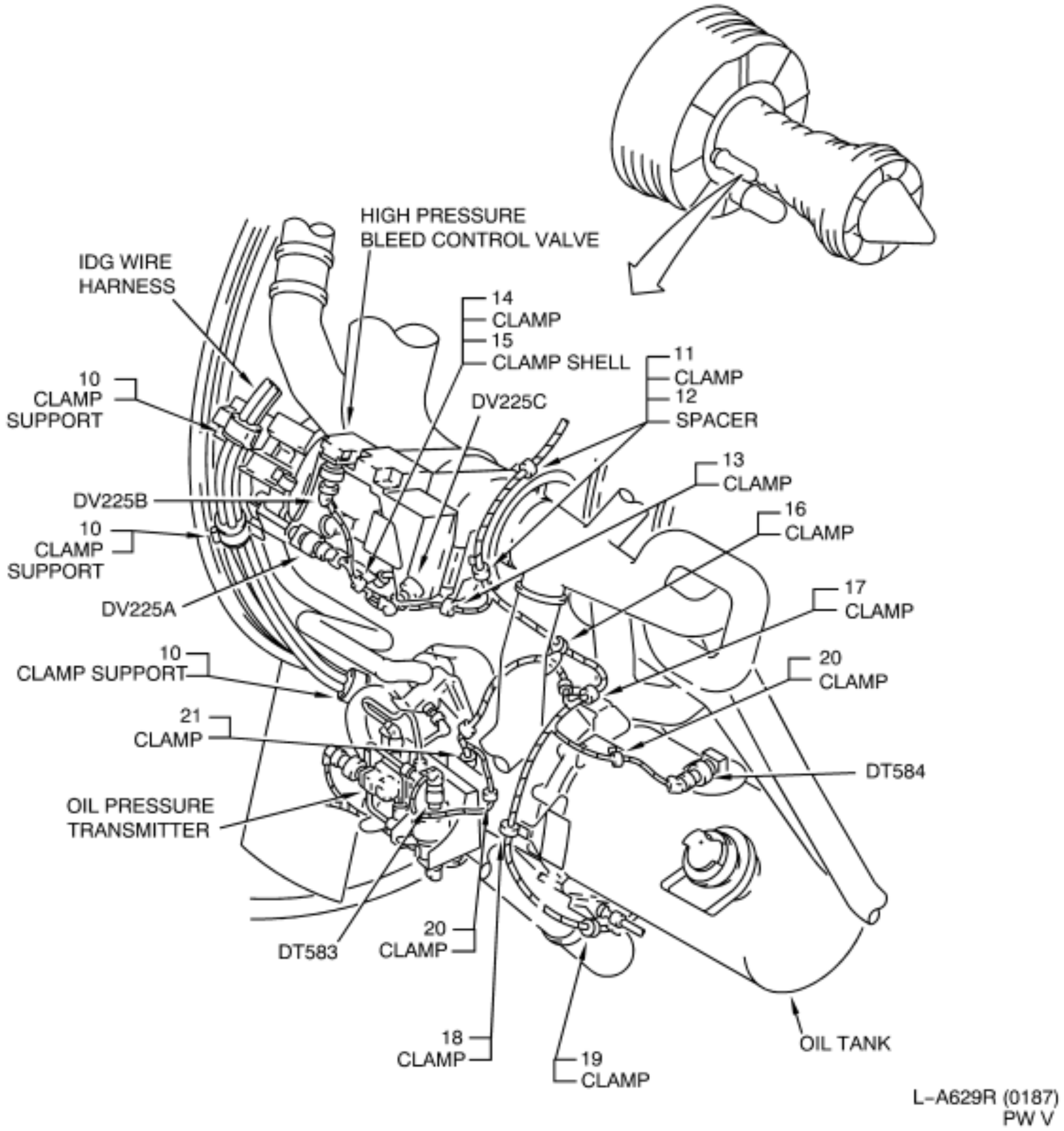
Engine Core Harness (Forward Lower Right)
Figure 401 (Sheet 4)
(Task 71−00−35−450−001)


FLANGE N
FLANGE M
30
CLAMP
31
SPACER
30
CLAMP
DV214
32
CLAMP
33
CLAMP
DV215
HYDRAULIC
PUMP
DT579
STARTER
SHUTOFF VALVE
NO.3 BEARING
OIL TEMP SENSOR
L−A641R (0187)
PW V

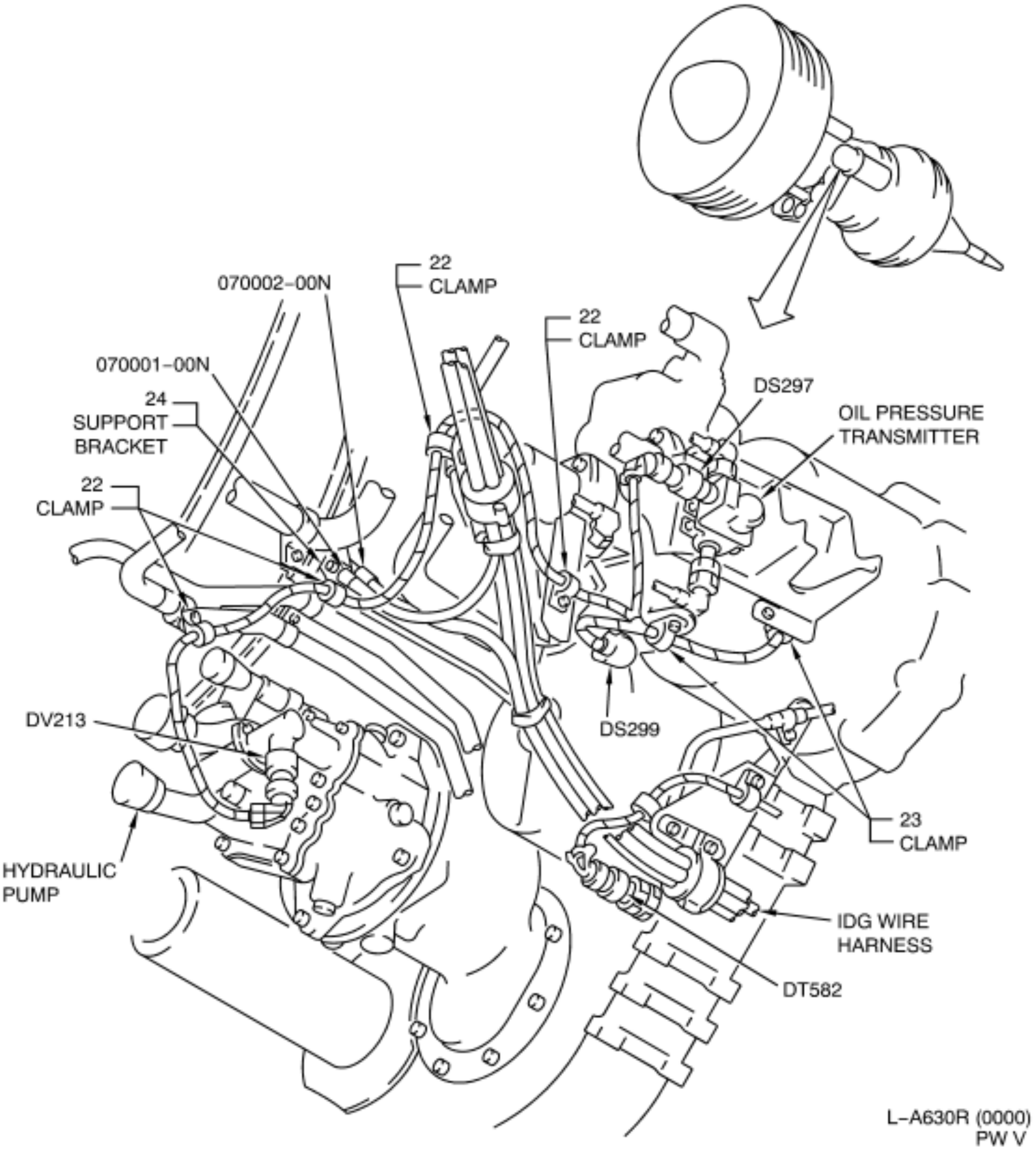
Engine Core Harness (Bottom Right)
Figure 401 (Sheet 5)
(Task 71−00−35−450−001)


PNEUMATIC REGULATOR
8
CLAMP
9
CLAMP SHELL
FWD
D4958
D4954
DV224B
DV224A
PYLON INTERFACE PANEL
3
GROUND CABLES SUPPORT BRACKET
D4955
9947 9953 9956
9958 9959
1
PYLON GENERATOR WIRE HARNESS RECEPTACLE
2
CLAMP
4
GROUND STUDS
1387-4
1387-3
10
CLAMP SUPPORT
2
CLAMP
7
CLAMP
5
CLAMP
6
CLAMP SHELL
L-A628R (0187)
PW V

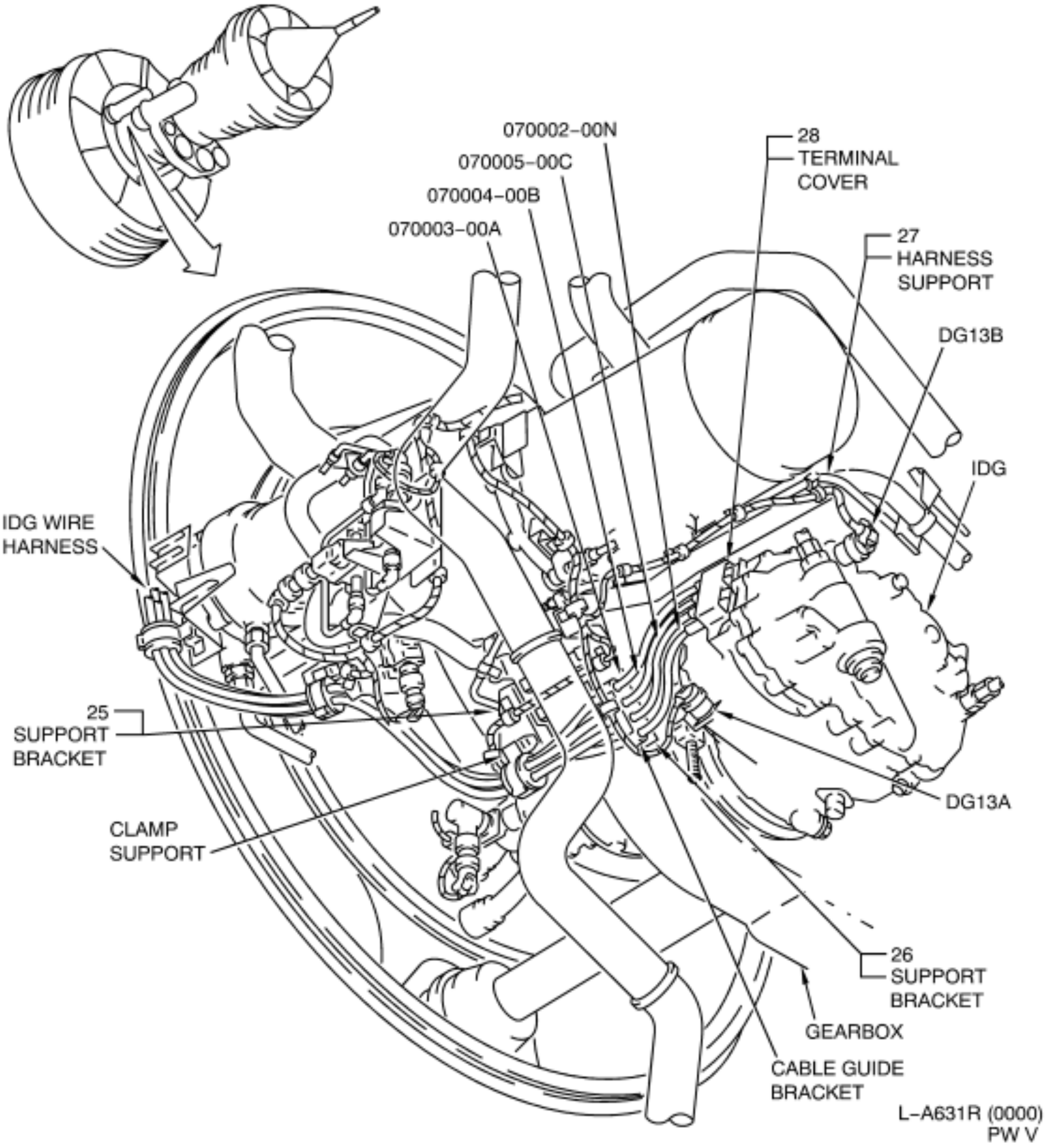
Engine Core Harness (Upper Left)
Figure 402 (Sheet 1)
(Task 71-00-35-450-001)


HIGH PRESSURE
BLEED CONTROL VALVE
IDG WIRE
HARNESS
14
CLAMP
15
CLAMP SHELL
11
CLAMP
12
SPACER
10
CLAMP
SUPPORT
DV225C
13
CLAMP
DV225B
16
CLAMP
10
CLAMP
SUPPORT
DV225A
17
CLAMP
10
CLAMP SUPPORT
20
CLAMP
21
CLAMP
DT584
OIL PRESSURE
TRANSMITTER
20
CLAMP
DT583
18
CLAMP
19
CLAMP
OIL TANK
L-A629R (0187)
PW V

Engine Core Harness (Left)
Figure 402 (Sheet 2)
(Task 71−00−35−450−001)


22
CLAMP
070002-00N
22
CLAMP
070001-00N
24
SUPPORT
BRACKET
DS297
OIL PRESSURE
TRANSMITTER
22
CLAMP
DV213
DS299
23
CLAMP
HYDRAULIC
PUMP
IDG WIRE
HARNESS
DT582
L-A630R (0000)
PW V

Engine Core Harness (Lower Left)
Figure 402 (Sheet 3)
(Task 71-00-35-450-001)


070002-00N
070005-00C
070004-00B
070003-00A
28
TERMINAL
COVER
27
HARNESS
SUPPORT
DG13B
IDG
IDG WIRE
HARNESS
25
SUPPORT
BRACKET
CLAMP
SUPPORT
DG13A
26
SUPPORT
BRACKET
GEARBOX
CABLE GUIDE
BRACKET
L-A631R (0000)
PW V

Engine Core Harness (Bottom Left)
Figure 402 (Sheet 4)
(Task 71-00-35-450-001)

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−01

Standard Tools:
Glenair TG−69 Soft Jawed Pliers Or
Glenair TG−70 Strap Wrench

Consumable Materials:

Item No.	Designation
P11−009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lockwire, MS20995C32		

B. Procedure
See Figure 403.

NOTE: Procedural steps (1) through (41) install wire harness 21W4072 on right side of engine core, Figure 403.

(1) Position wire harness 21W4072 under pylon interface panel with electrical connectors D4952P, D4956P and D4961P closest to panel.

(2) At pylon interface panel, remove protective covers from electrical plugs and receptacles for D4952P, D4956P and D4961P.

(3) Connect electrical plugs D4952P, D4956P and D4961P to receptacles. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(4) Install four clamps (403/1) and attaching hardware on support brackets. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(5) Connect electrical connector DS298 to IDG AOC pressure switch as follows.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(6) Install three clamps (403/2) and clamp shells (403/3) and attaching hardware on existing bracket. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(7) Install clamp (403/4) using existing hardware on support tube.

(8) At ground connection support bracket (403/5), remove five nuts and washers from five ground studs (403/6). Install five ground connections, washers, and nuts on ground studs. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(9) Install clamp (403/7) and attaching hardware on support bracket in Flange J. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(10) Install clamp (403/8) and attaching hardware on TCC bellows flange. Torque nuts to 32 − 36 lb−in (3.616 − 4.067 N.m).

(11) Install two clamps (403/9) and attaching hardware on support brackets. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(12) Install two clamps (403/10) and attaching parts on existing bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(13) Install support bracket (403/11) with clamp (403/12) and attaching hardware on drain filter support. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(14) Connect electrical connector DH7 to engine exciter. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(15) Connect electrical connector DH8 to igniter exciter. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(16) Install clamp (403/13) and attaching hardware on drain filters support bracket. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(17) Install clamp (403/14) and attaching parts on existing bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(18) Install clamp (403/15) with attaching hardware on fuel flow transmitter support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(19) Install clamp (403/16) with attaching hardware on fuel flow transmitter support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(20) Connect electrical connector DT580 to fuel flow transmitter. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(21) Connect electrical connector D4991P to fuel pump. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(22) Install clamp (403/17) with attaching hardware on tube support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(23) Install clamp (403/18) and clamp shell (403/19) with attaching hardware on tube support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(24) Install clamp (403/20) with attaching hardware on tube support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(25) Install clamp (403/21) with attaching hardware on fuel condition actuator support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(26) Connect electrical connector DH10 to fuel condition actuator. Tighten connector as follows.

  (a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

  (b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

  NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(27) Install two clamps (403/22) with attaching hardware on tube support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(28) Install clamp (403/23) with attaching hardware on fuel pressure transmitter support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(29) Connect electrical connector DT595 to core compartment temperature sensor. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(30) Connect electrical connector DT581 to fuel pressure transmitter. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(31) Connect electrical connector DV216 to IDG AOC valve. Tighten connector as follows.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(32) Install two clamps (403/24) and clampshells (403/25) with attaching hardware on tube support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(33) Install clamp (403/26) with attaching hardware on stator vane actuator support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(34) Install clamp (403/27) with attaching hardware on tube support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(35) Install two clamps (403/28) with attaching hardware on stator vane actuator support brackets. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(36) Install four clamps (403/30) and attaching hardware to secure harness to gearbox scavenge tube. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(37) Install three clamps (403/29) with attaching hardware to secure harness to No. 4 bearing scavenge tube. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(38) Remove clamp (403/31) securing harness to standoff bracket on gearbox.

(39) Install clamps (403/32) and (403/33) with attaching hardware on support brackets. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(40) Connect electrical connector DV215 to starter shutoff valve. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(41) Connect electrical connector DT579 to No. 3 bearing oil temperature sensor. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

NOTE: Procedural steps (42) through (75) install wire harnesses 21W4070, 21W4072 and 21W4114 on left side of engine core, Figure 404.

(42) Position wire harness 21W4114 under pylon interface panel with electrical connectors D4954P and D4958P closest to panel.

(43) At pylon interface panel, remove protective covers from electrical plugs and receptacles for D4954P and D4958P.

(44) Connect electrical plugs D4954P and D4958P to receptacles. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(45) At base of pylon interface panel, remove protective covers from electrical plug D4955P and receptacle (404/1) for pylon generator wire harness. Connect plug to receptacle and tighten plug fingertight plus one−eighth turn. Lockwire plug.

(46) Install five clamps (404/2) on existing brackets with attaching hardware. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(47) At ground cables support bracket (404/3), remove five nuts and washers from five ground studs (404/4). Install ground connections, washers, and nuts on ground studs. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(48) Install three clamps (404/5) and clamp shells (404/6) on tubing bracket with attaching hardware. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(49) Install three clamps (404/7) and attaching hardware on support brackets. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(50) Remove two nuts and washers from high−stage temperature sensor terminals. Install terminal lugs, 1387−3 (yellow) on Post C and 1387−4 (red) on Post A, with removed nuts and washers. Torque nut for 1387−3 to 20 − 22 lb−in. (2.260 − 2.486 N.m), nut for 1387−4 to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(51) Install clamps (404/8) and clamp shells (404/9) on tubing bracket with attaching hardware. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(52) Connect electrical connectors DV224A and DV224B to pneumatic regulator. Tighten connectors fingertight plus one−eighth turn. Lockwire connectors.

(53) Connect IDG wire harness 21W4114 electrical connector D4955P to pylon generator wire harness. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(54) Install four clamp supports (404/10) to existing brackets with attaching hardware. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(55) Install three clamps (404/11) and spacers (404/12) with attaching hardware. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(56) Install clamp (404/13) with attaching hardware on support bracket. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(57) Install clamp (404/14) and clamp shell (404/15) with attaching hardware. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(58) Connect electrical connectors DV255A thru DV255C to high pressure bleed control valve. Tighten connectors fingertight plus one−eighth turn. Lockwire connectors.

(59) Install clamps (404/16) thru (404/21) and attaching hardware on support brackets. Torque nut to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(60) Connect electrical connector DT584 to oil quantity transmitter. Tighten connector as follows.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND

CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(61) Connect electrical connector DT583 to oil pressure transmitter. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(62) Install four clamps (404/22) with attaching hardware. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(63) Install two clamps (404/23) with attaching hardware. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(64) Connect electrical connector DS297 to low oil pressure switch. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(65) Connect electrical connector DS299 to oil filter differential pressure switch. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(66) Connect electrical connector DT582 to oil temperature sensor. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

(67) Connect electrical connector DV213 to disconnect valve. Tighten connector fingertight plus one−eighth turn. Lockwire connector.

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−01

(68) Install support bracket (404/24) with ground studs 070001−00N and 070002−00N and attaching hardware on Flange H. Torque nuts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(69) Install support bracket (404/25) with clamp guide and two clamps and attaching hardware. Torque bolts to 75 − 85 lb−in. (8.474 − 9.604 N.m).

(70) Install support bracket (404/26) with cable guide bracket and three clamps and attaching hardware. Torque bolts to 75 − 85 lb−in. (8.474 − 9.604 N.m).

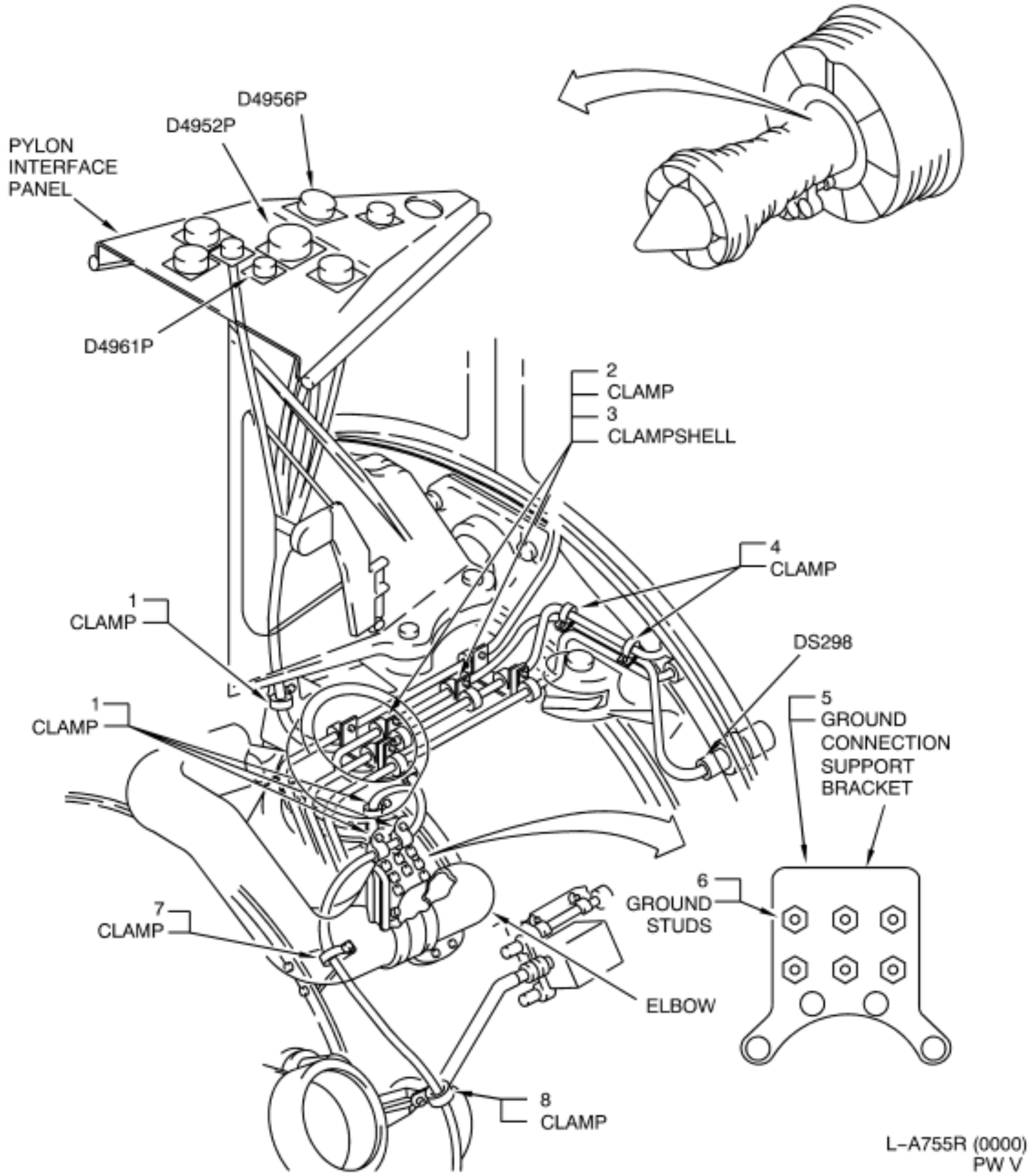
(71) Install two clamps (404/29) and attaching hardware to secure harness to support tube and terminal cover.

(72) Connect electrical connectors DS13A and DS13B to IDG. Tighten connectors fingertight plus one−eighth turn. Lockwire connectors.

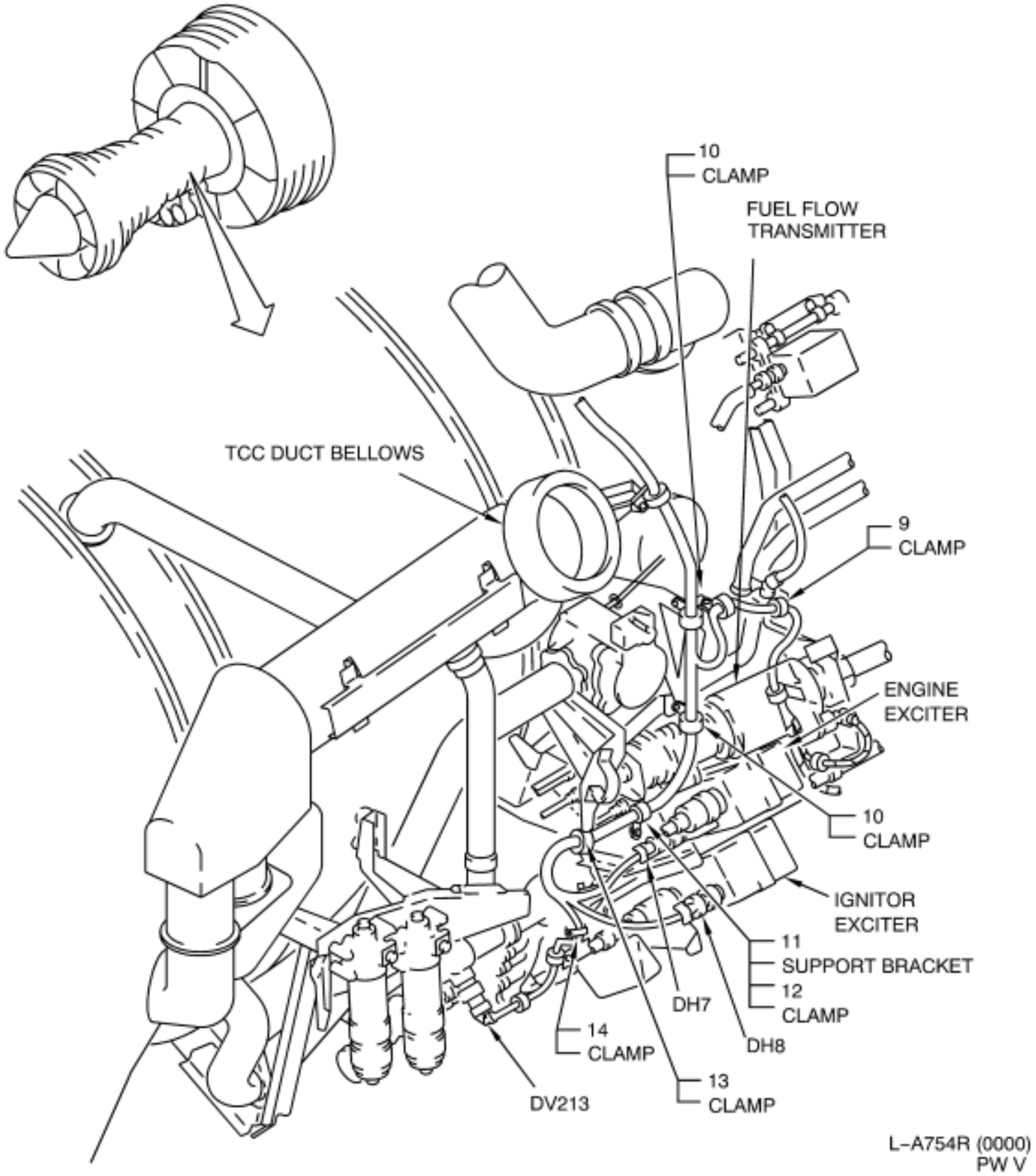
(73) Remove terminal cover (404/28) with attaching hardware from terminal block on IDG.

(74) Connect power cables 070002−00N, 070003−00A, 070004−00B and 070005−00C to terminal block studs with nuts and washers. Torque nuts to 145 − 155 lb−in. (16.383 − 17.513 N.m).

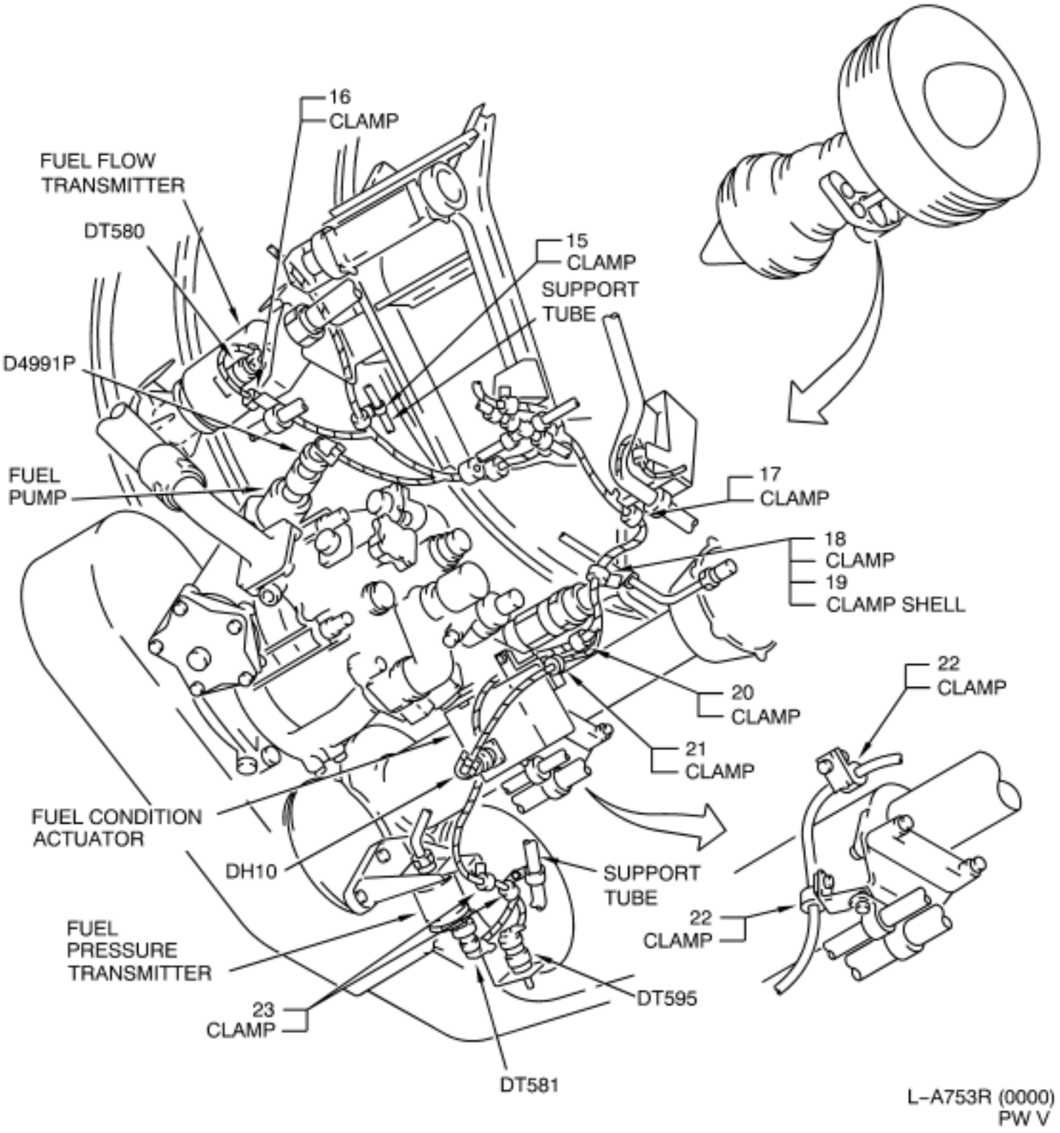
(75) Install terminal cover (404/28) on IDG with screws and washers. Torque screws to 20 − 22 lb−in. (2.260 − 2.486 N.m).


D4956P
D4952P
PYLON INTERFACE PANEL
D4961P
2 CLAMP
3 CLAMPSHELL
4 CLAMP
1 CLAMP
DS298
1 CLAMP
5 GROUND CONNECTION SUPPORT BRACKET
6 GROUND STUDS
7 CLAMP
ELBOW
8 CLAMP
L–A755R (0000)
PW V

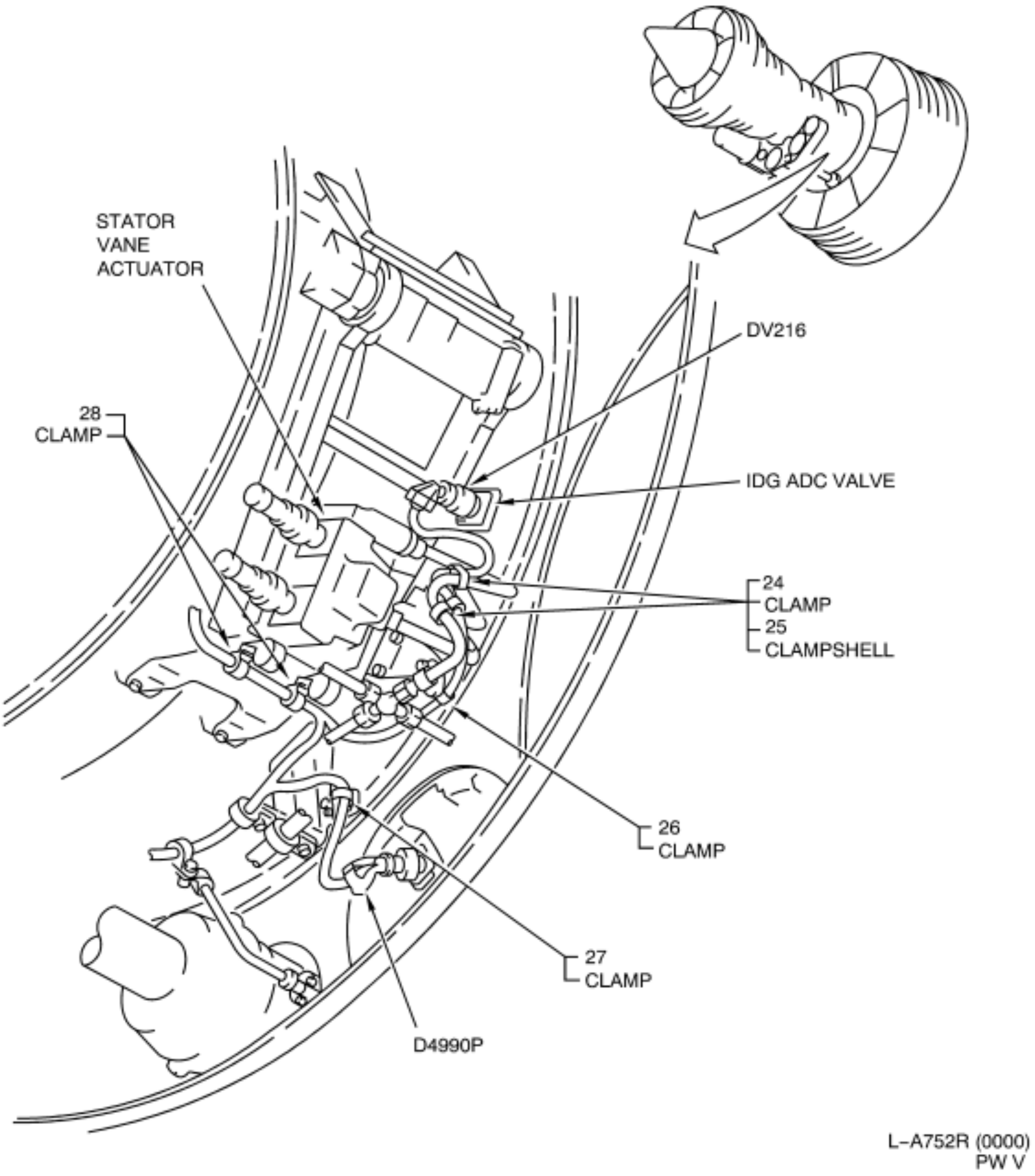
Engine Core Harness (Upper Right)
Figure 403 (Sheet 1)
(Task 71–00–35–450–001–A)


10
CLAMP
FUEL FLOW
TRANSMITTER
TCC DUCT BELLOWS
9
CLAMP
ENGINE
EXCITER
10
CLAMP
IGNITOR
EXCITER
11
SUPPORT BRACKET
12
CLAMP
DH7
DH8
14
CLAMP
13
CLAMP
DV213
L-A754R (0000)
PW V

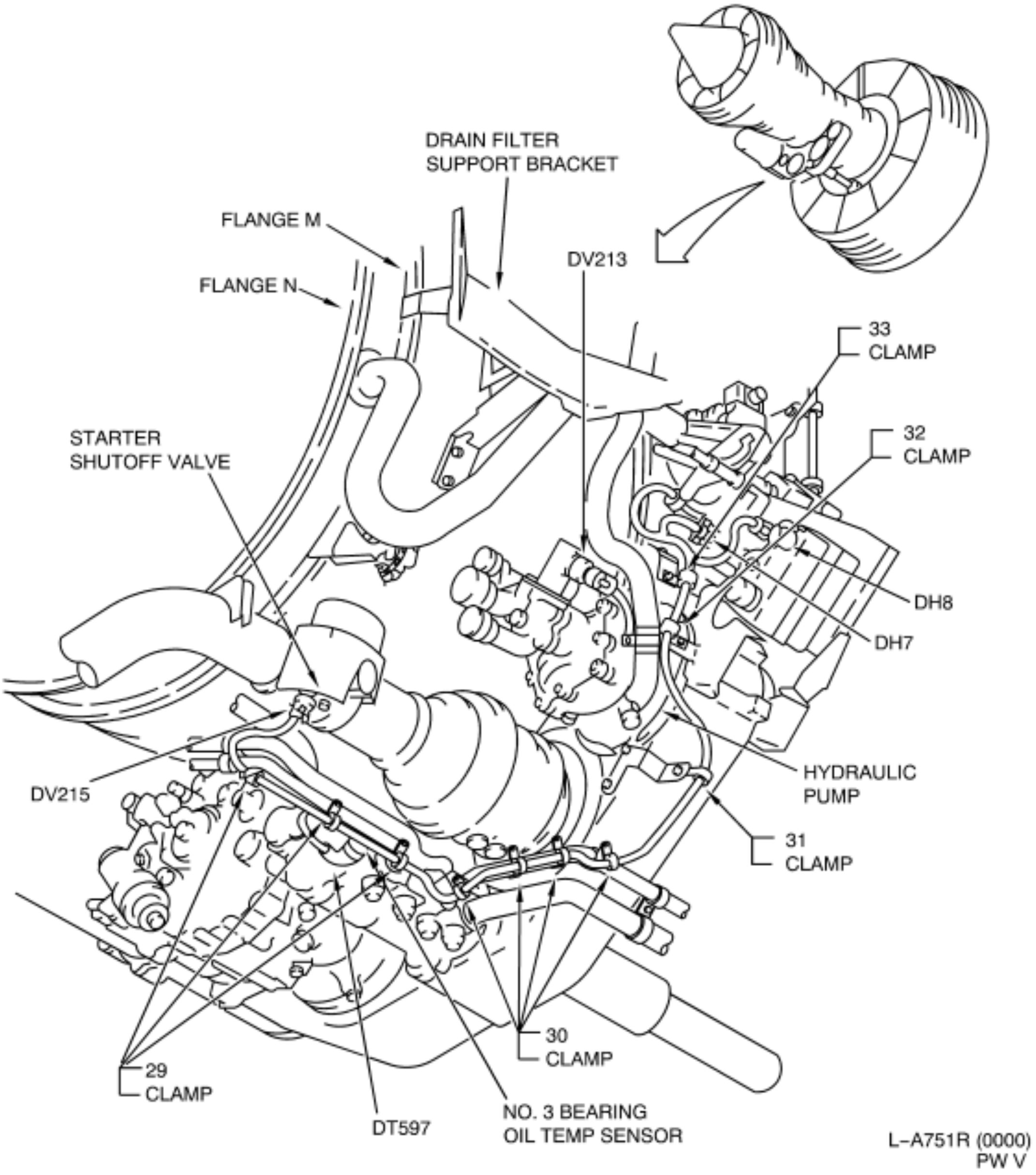
Engine Core Harness (Right)
Figure 403 (Sheet 2)
(Task 71-00-35-450-001-A)


16
CLAMP
FUEL FLOW
TRANSMITTER
DT580
15
CLAMP
SUPPORT
TUBE
D4991P
FUEL
PUMP
17
CLAMP
18
CLAMP
19
CLAMP SHELL
22
CLAMP
20
CLAMP
21
CLAMP
FUEL CONDITION
ACTUATOR
DH10
SUPPORT
TUBE
22
CLAMP
FUEL
PRESSURE
TRANSMITTER
DT595
23
CLAMP
DT581
L-A753R (0000)
PW V

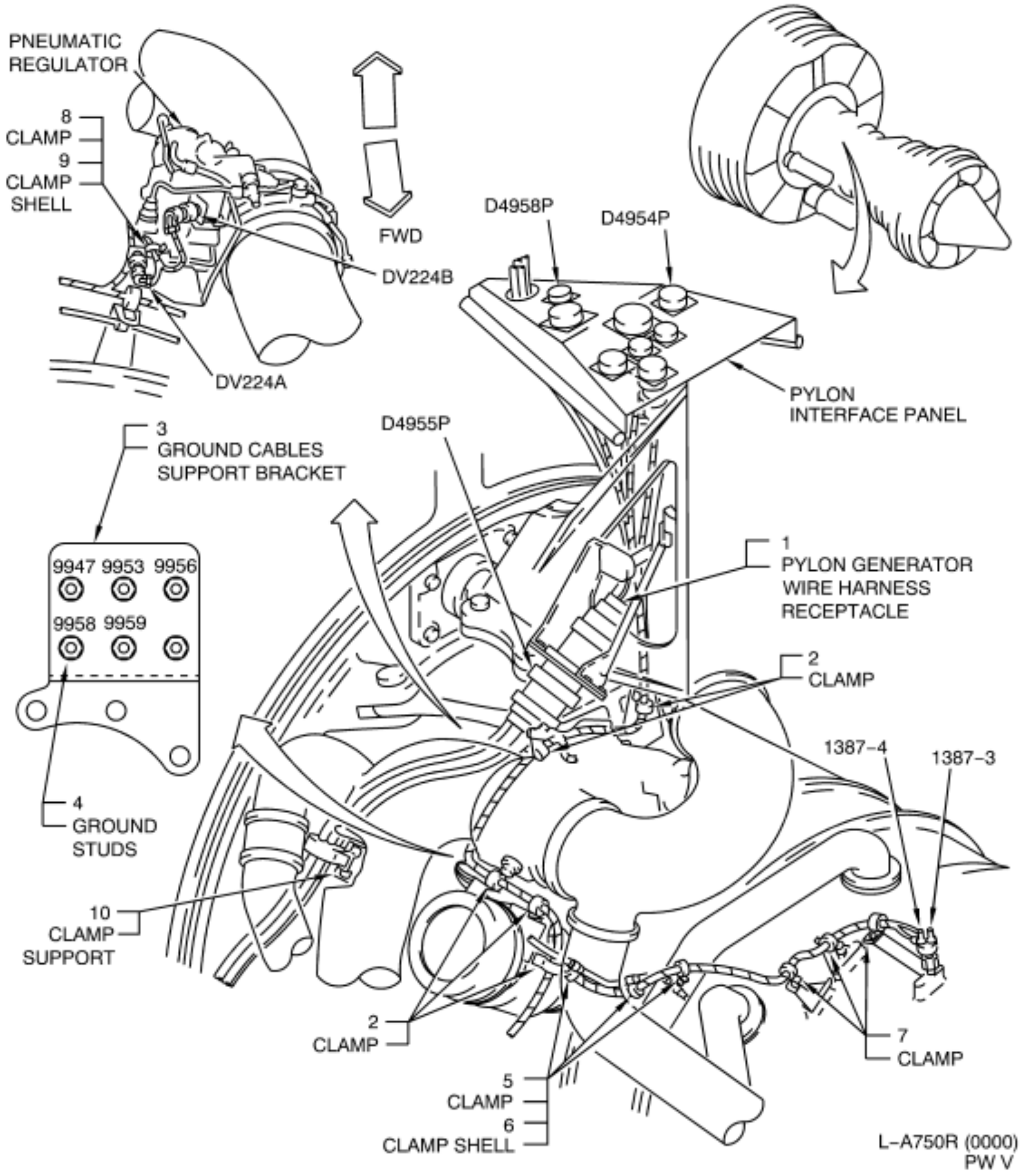
Engine Core Harness (Rear Lower Right)
Figure 403 (Sheet 3)
(Task 71-00-35-450-001-A)


STATOR VANE ACTUATOR
DV216
28 CLAMP
IDG ADC VALVE
24 CLAMP
25 CLAMPSHELL
26 CLAMP
27 CLAMP
D4990P
L-A752R (0000)
PW V

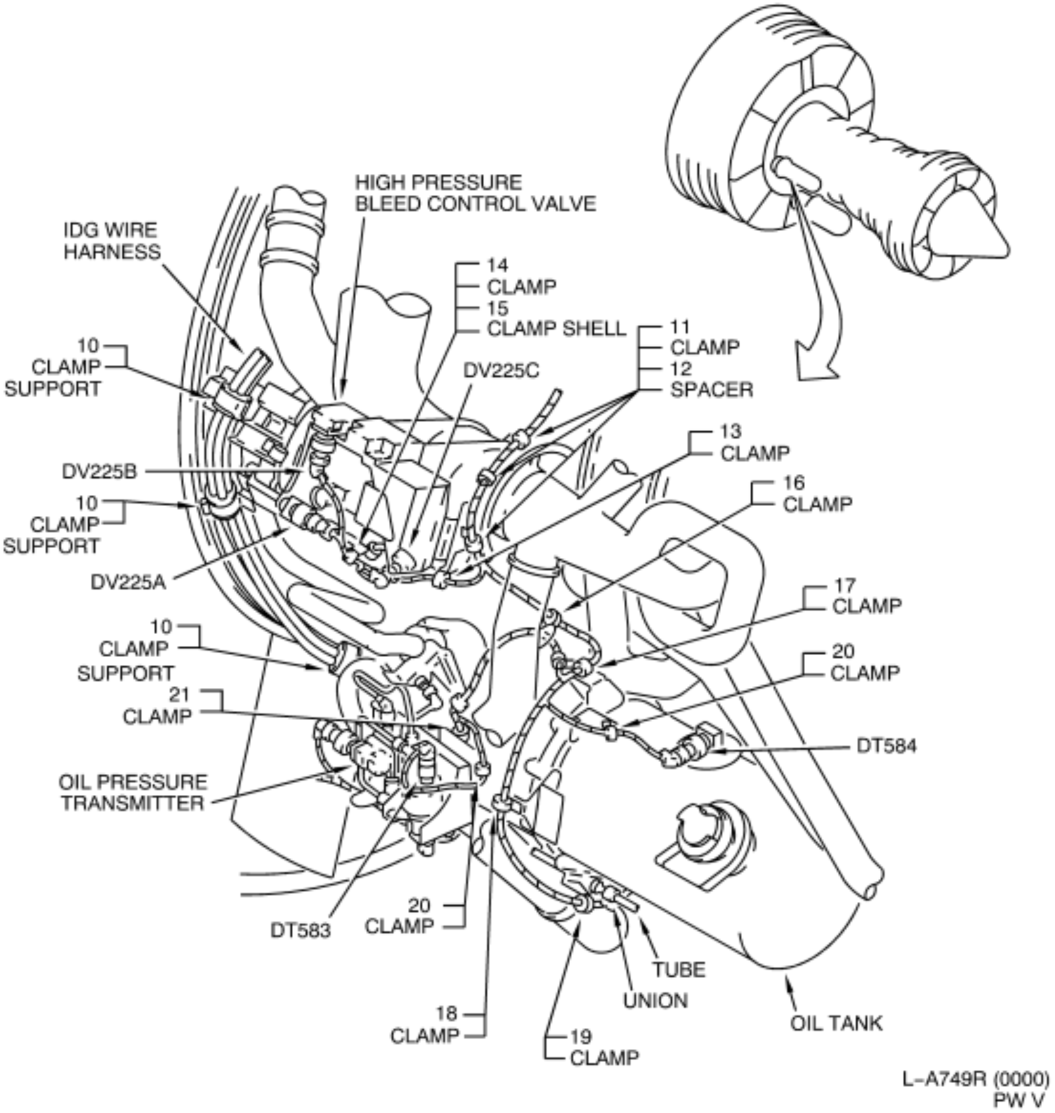
Engine Core Harness (Forward Lower Right)
Figure 403 (Sheet 4)
(Task 71-00-35-450-001-A)


DRAIN FILTER
SUPPORT BRACKET
FLANGE M
FLANGE N
DV213
33
CLAMP
32
CLAMP
STARTER
SHUTOFF VALVE
DH8
DH7
HYDRAULIC
PUMP
DV215
31
CLAMP
30
CLAMP
29
CLAMP
DT597
NO. 3 BEARING
OIL TEMP SENSOR
L-A751R (0000)
PW V

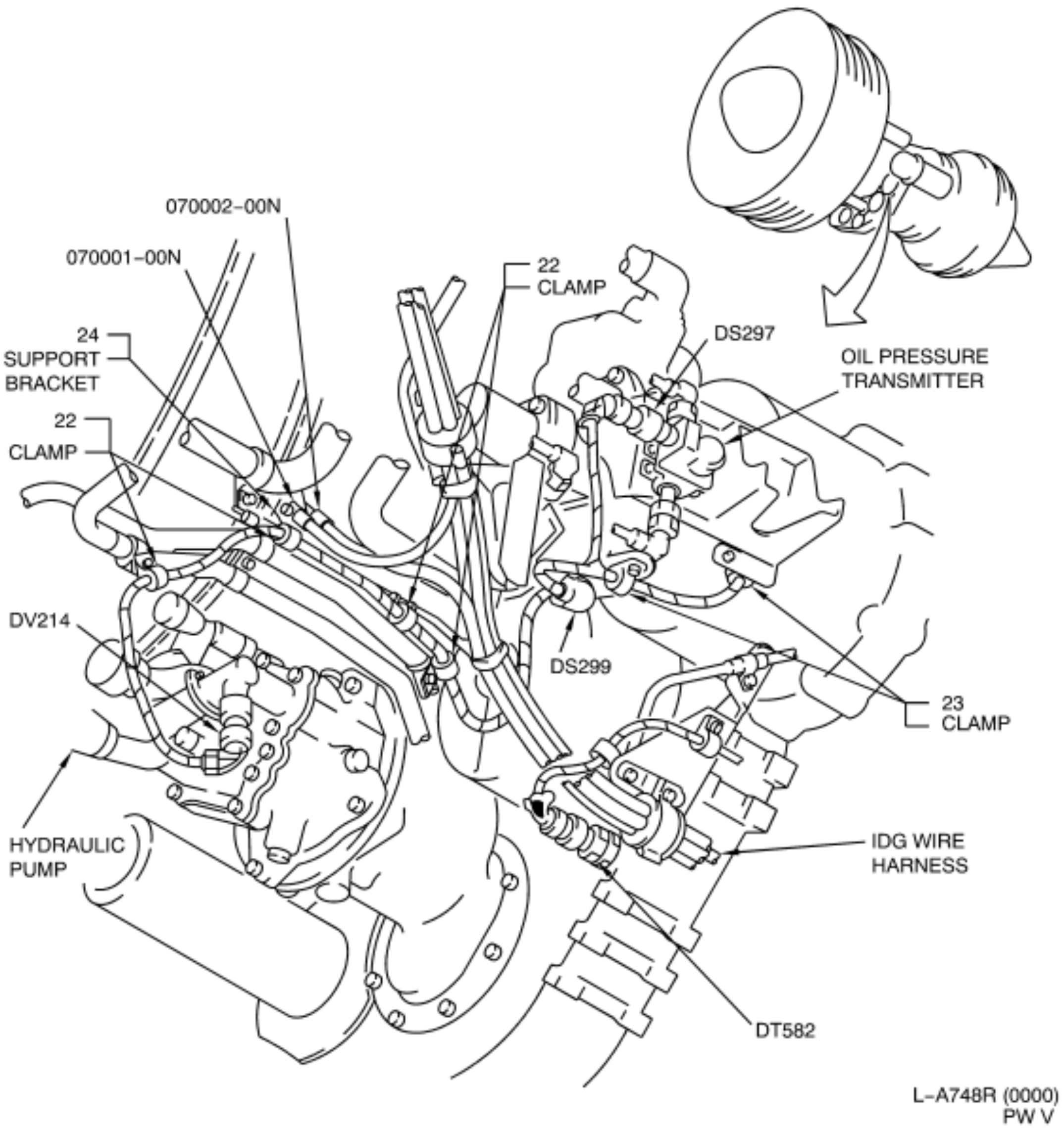
Engine Core Harness (Bottom Right)
Figure 403 (Sheet 5)
(Task 71-00-35-450-001-A)


PNEUMATIC REGULATOR
8
CLAMP
9
CLAMP SHELL
FWD
DV224B
DV224A
D4958P
D4954P
PYLON INTERFACE PANEL
D4955P
3
GROUND CABLES SUPPORT BRACKET
9947
9953
9956
9958
9959
1
PYLON GENERATOR WIRE HARNESS RECEPTACLE
2
CLAMP
1387-4
1387-3
4
GROUND STUDS
10
CLAMP SUPPORT
2
CLAMP
5
CLAMP
6
CLAMP SHELL
7
CLAMP
L-A750R (0000)
PW V

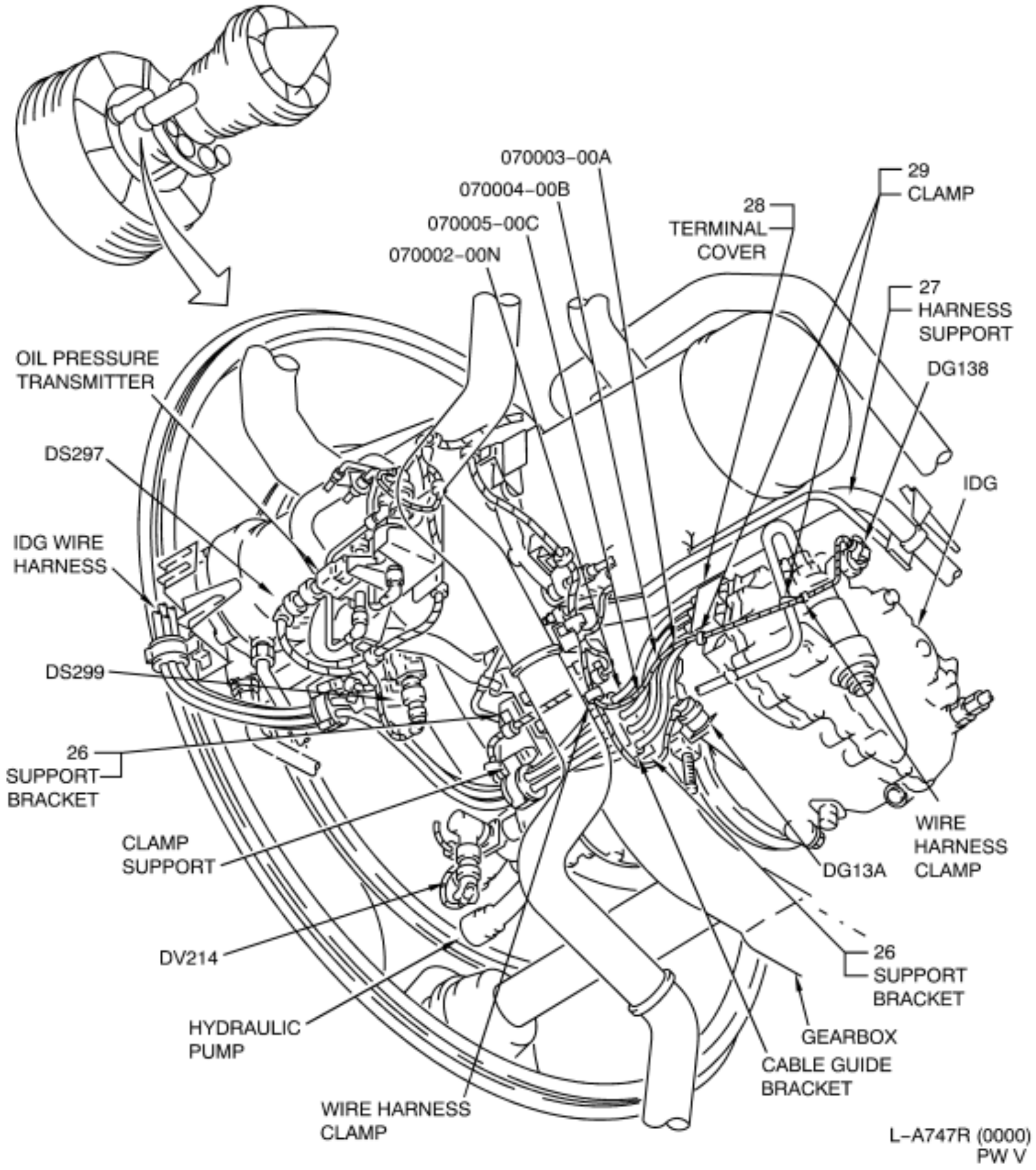
Engine Core Harness (Upper Left)
Figure 404 (Sheet 1)
(Task 71-00-35-450-001-A)


HIGH PRESSURE
BLEED CONTROL VALVE
IDG WIRE
HARNESS
14
CLAMP
15
CLAMP SHELL
11
CLAMP
12
SPACER
10
CLAMP
SUPPORT
DV225C
13
CLAMP
DV225B
16
CLAMP
10
CLAMP
SUPPORT
DV225A
17
CLAMP
10
CLAMP
SUPPORT
20
CLAMP
21
CLAMP
DT584
OIL PRESSURE
TRANSMITTER
DT583
20
CLAMP
TUBE
UNION
OIL TANK
18
CLAMP
19
CLAMP
L-A749R (0000)
PW V

Engine Core Harness (Left)
Figure 404 (Sheet 2)
(Task 71-00-35-450-001-A)


070002−00N
070001−00N
24
SUPPORT
BRACKET
22
CLAMP
22
CLAMP
DS297
OIL PRESSURE
TRANSMITTER
DV214
DS299
23
CLAMP
HYDRAULIC
PUMP
IDG WIRE
HARNESS
DT582
L−A748R (0000)
PW V

Engine Core Harness (Lower Left)
Figure 404 (Sheet 3)
(Task 71−00−35−450−001−A)


070003−00A
070004−00B
070005−00C
070002−00N
28
TERMINAL
COVER
29
CLAMP
27
HARNESS
SUPPORT
DG138
IDG
OIL PRESSURE
TRANSMITTER
DS297
IDG WIRE
HARNESS
DS299
26
SUPPORT
BRACKET
CLAMP
SUPPORT
DV214
HYDRAULIC
PUMP
WIRE HARNESS
CLAMP
WIRE
HARNESS
CLAMP
DG13A
26
SUPPORT
BRACKET
GEARBOX
CABLE GUIDE
BRACKET
L−A747R (0000)
PW V

Engine Core Harness (Bottom Left)
Figure 404 (Sheet 4)
(Task 71−00−35−450−001−A)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−02

Task 71−00−35−450−002:

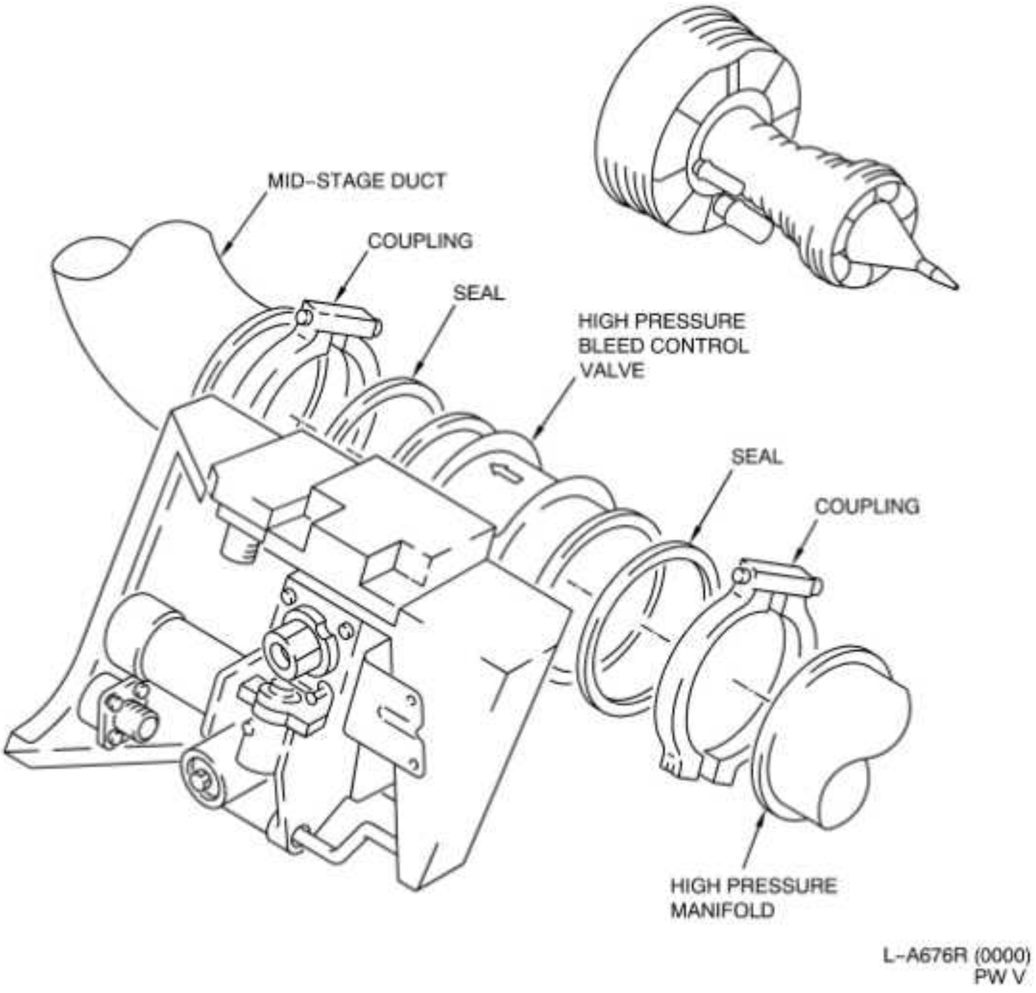
1. Install High Pressure Bleed Control Valve
   A. Equipment And Materials Required

      Consumable Materials:

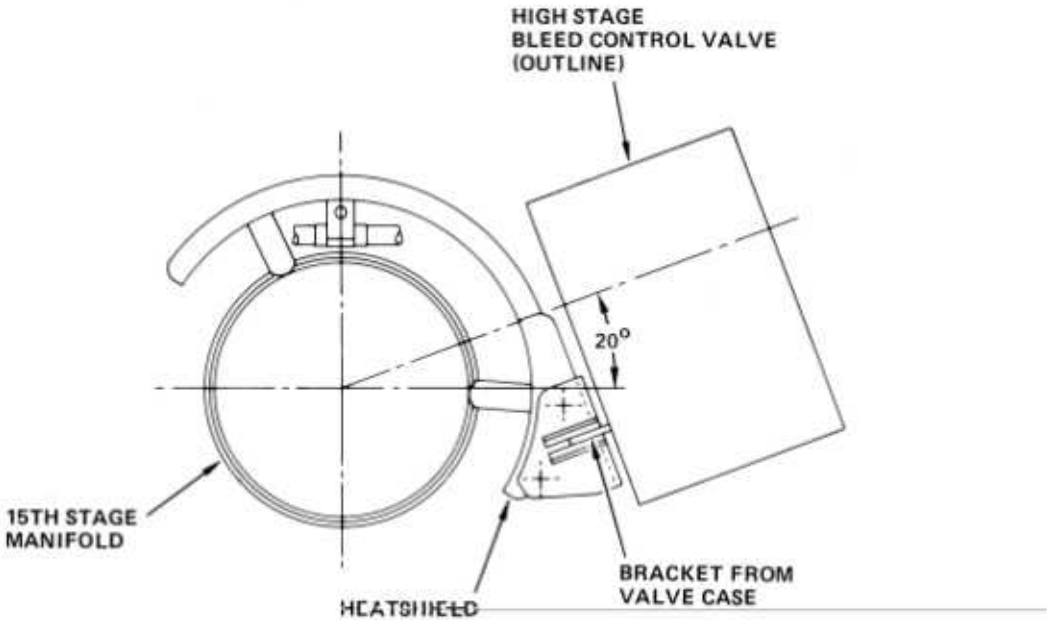
Item No.	Designation
P06−013	Lubricant, Solid Film

   B. Procedure
      See Figure 401.
      (1) Remove protective covers from high pressure valve, midstage duct and high pressure manifold.
      (2) Apply Material P06−013, to inner surfaces of couplings. Install couplings and metal seals on valve flanges.
      (3) Install valve between midstage duct and high pressure manifold with arrow pointing forward, 15 degrees inboard of centerline.
      (4) Orient valve so bracket on bottom of valve fits in slot formed by brackets of heat shield on end of 15th stage manifold. See Figure 402.
      (5) Torque couplings to value indicated on coupling bands.

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) −
INSTALLATION−02


MID-STAGE DUCT
COUPLING
SEAL
HIGH PRESSURE
BLEED CONTROL
VALVE
SEAL
COUPLING
HIGH PRESSURE
MANIFOLD
L-A676R (0000)
PW V

High Pressure Bleed Control Valve
Figure 401
(Task 71−00−35−450−002)


HIGH STAGE
BLEED CONTROL VALVE
(OUTLINE)
20°
15TH STAGE
MANIFOLD
HEATSHIELD
BRACKET FROM
VALVE CASE

L-A693R

High Pressure Bleed Control Valve Orientation
Figure 402
(Task 71-00-35-450-002)

POWER PLANT GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - INSTALLATION-03

Task 71-00-35-450-003:

1. Install Pressure Regulator Valve

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P06-013	Lubricant, Solid Film

B. Procedure
See Figure 401.

R CAUTION: BE CAREFUL WHEN YOU HANDLE, REMOVE OR INSTALL ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTIONS USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(1) Remove protective covers from bleed valve, manifold duct and interface duct.

(2) Apply Lubricant P06-013, to inner surfaces of couplings. Install couplings and metal seals on valve flanges.

(3) Install valve between manifold duct and interface duct.

(4) Orient valve by setting the valve heat shield 11.20 inch (284.48 mm) from engine Flange J. See Figure 402.

(5) Torque couplings to value indicated on coupling bands.

C. Alternate Procedure
See Figure 403.

(1) Make a cardboard valve orientation template.

(2) Remove protective covers from bleed valve, manifold duct and interface duct. See Figure 401.

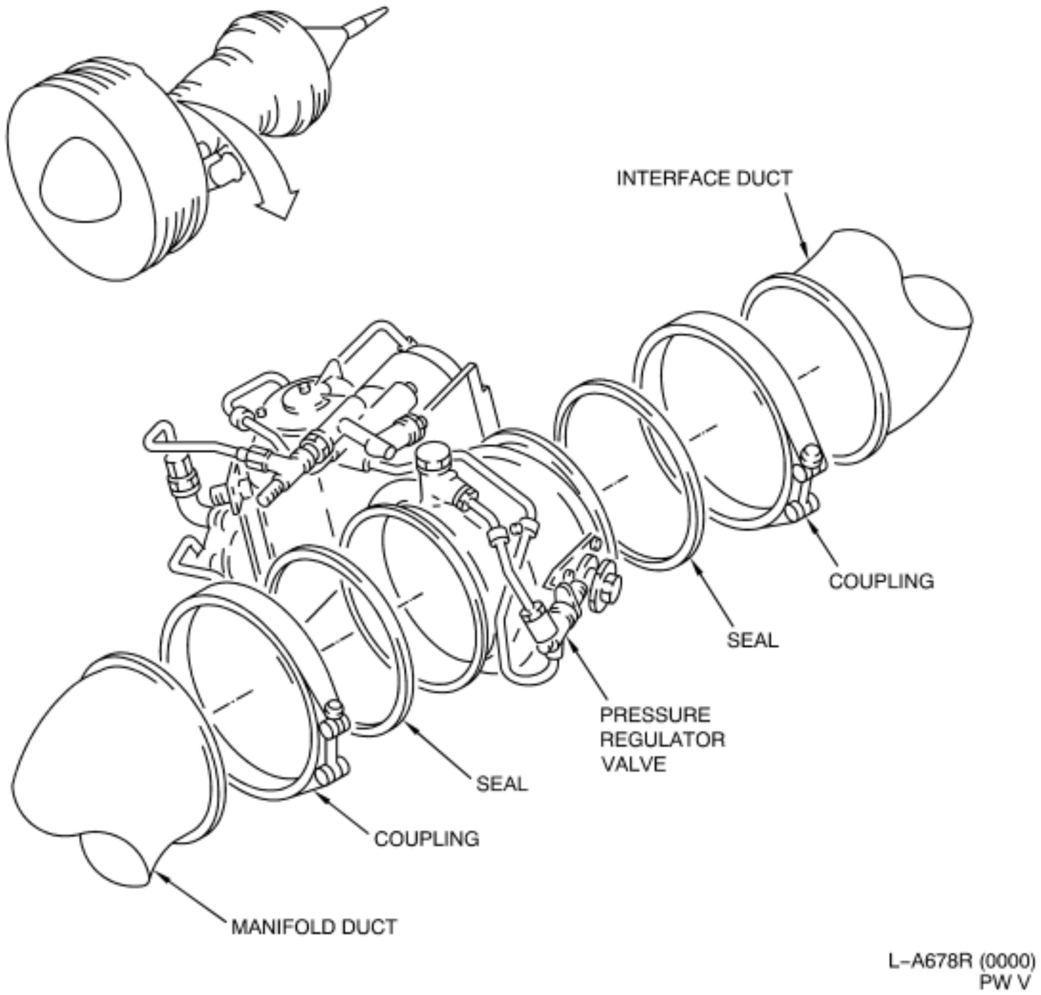
(3) Apply Lubricant P06−013, to inner surfaces of couplings. Install couplings and metal seals on valve flanges.

(4) Install valve between manifold duct and interface duct.

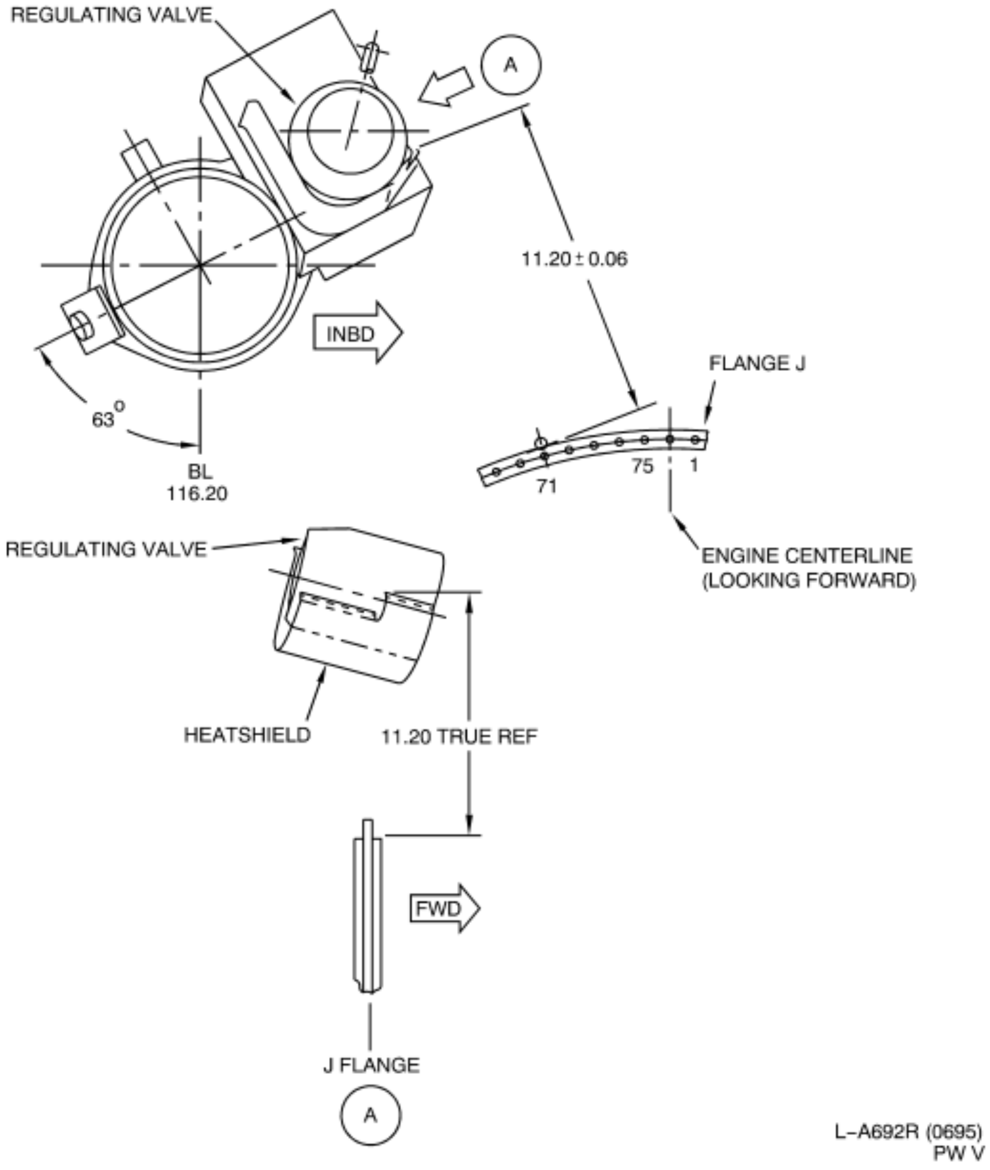
(5) Orient valve using template positioned on engine Flange J. See Figure 404.

(6) Torque couplings to value indicated on coupling bands.

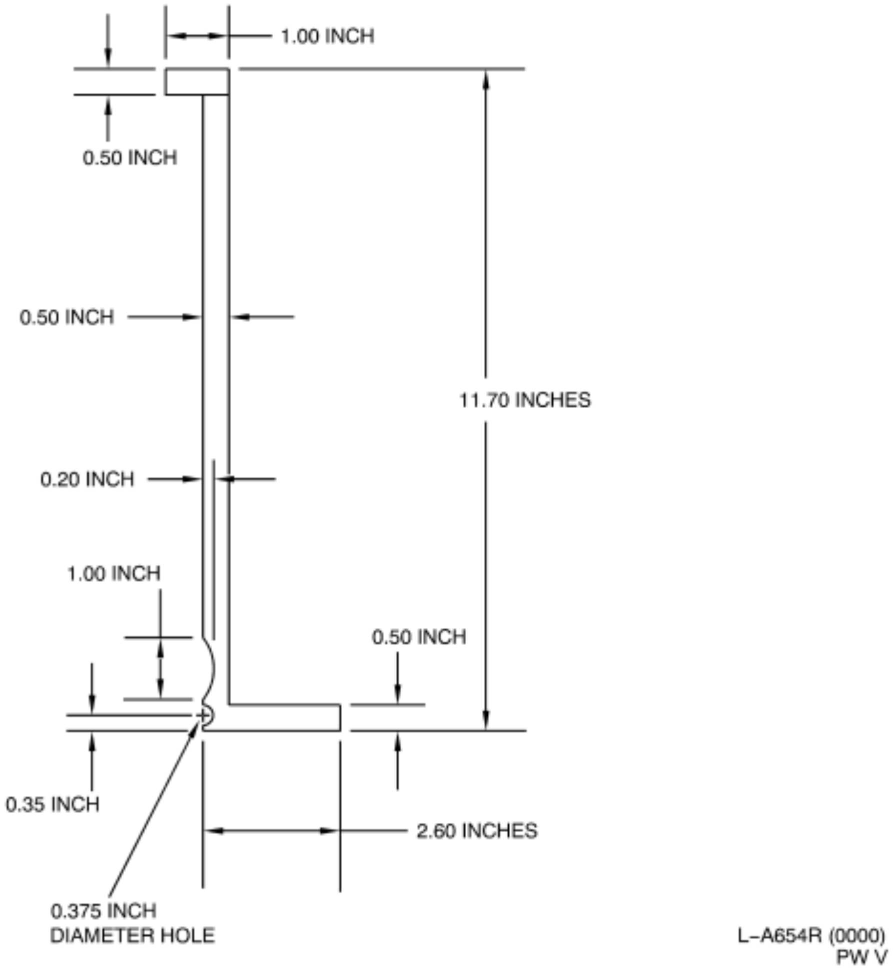
POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−03


INTERFACE DUCT
COUPLING
SEAL
PRESSURE
REGULATOR
VALVE
SEAL
COUPLING
MANIFOLD DUCT
L−A678R (0000)
PW V

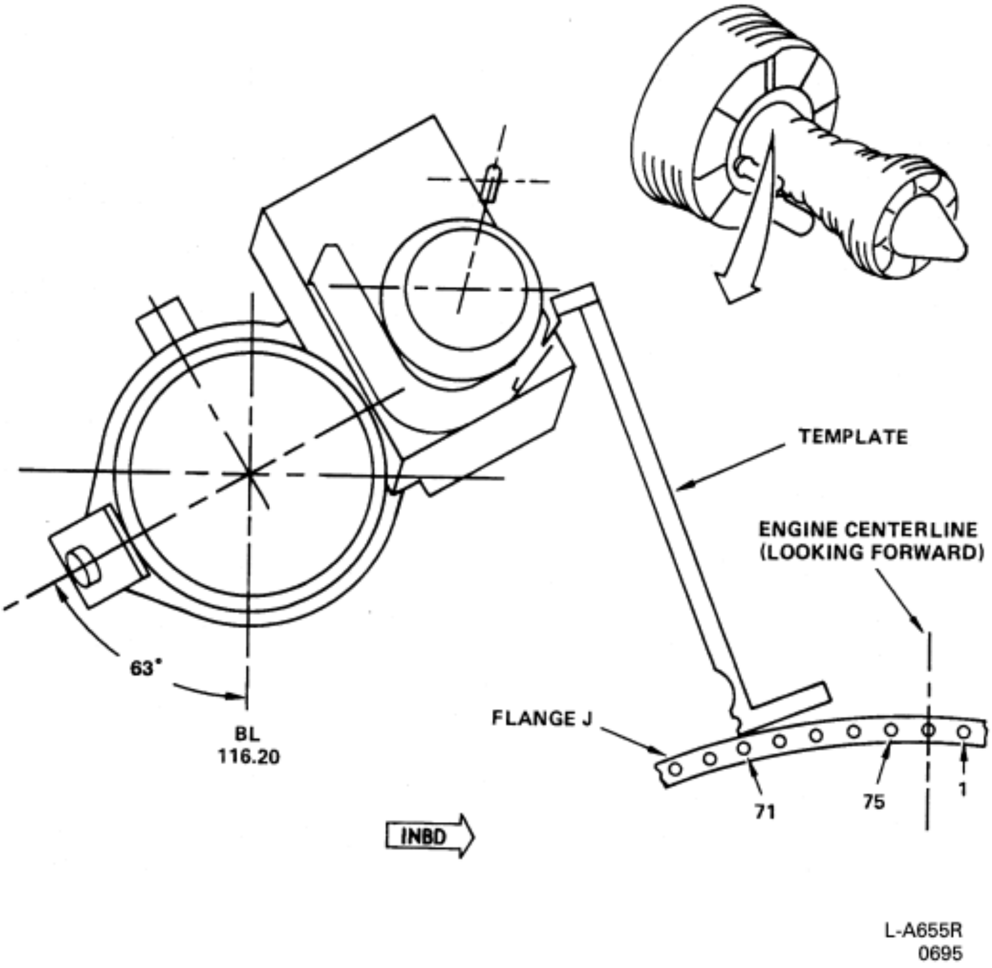
Pressure Regulator Valve
Figure 401
(Task 71−00−35−450−003)


REGULATING VALVE
A
11.20 ± 0.06
INBD
FLANGE J
63°
BL
116.20
75
1
71
ENGINE CENTERLINE
(LOOKING FORWARD)
REGULATING VALVE
HEATSHIELD
11.20 TRUE REF
FWD
J FLANGE
A
L-A692R (0695)
PW V

Pressure Regulator Valve Orientation
Figure 402
(Task 71-00-35-450-003)


1.00 INCH
0.50 INCH
0.50 INCH
11.70 INCHES
0.20 INCH
1.00 INCH
0.50 INCH
0.35 INCH
2.60 INCHES
0.375 INCH
DIAMETER HOLE
L-A654R (0000)
PW V

Pressure Regulator Valve Orientation Template
Figure 403
(Task 71-00-35-450-003)


TEMPLATE
ENGINE CENTERLINE
(LOOKING FORWARD)
63°
BL
116.20
FLANGE J
71
75
1
INBD
L-A655R
0695

Template Orientation Of Pressure Regulator Valve
Figure 404
(Task 71−00−35−450−003)

POWER PLANT GENERAL – HIGH PRESSURE COMPRESSOR (HPC) – INSTALLATION-04

Task 71-00-35-450-009:

1. Install 2.95 Bleed Valve Bellows

A. Equipment And Materials Required – None

B. Procedure

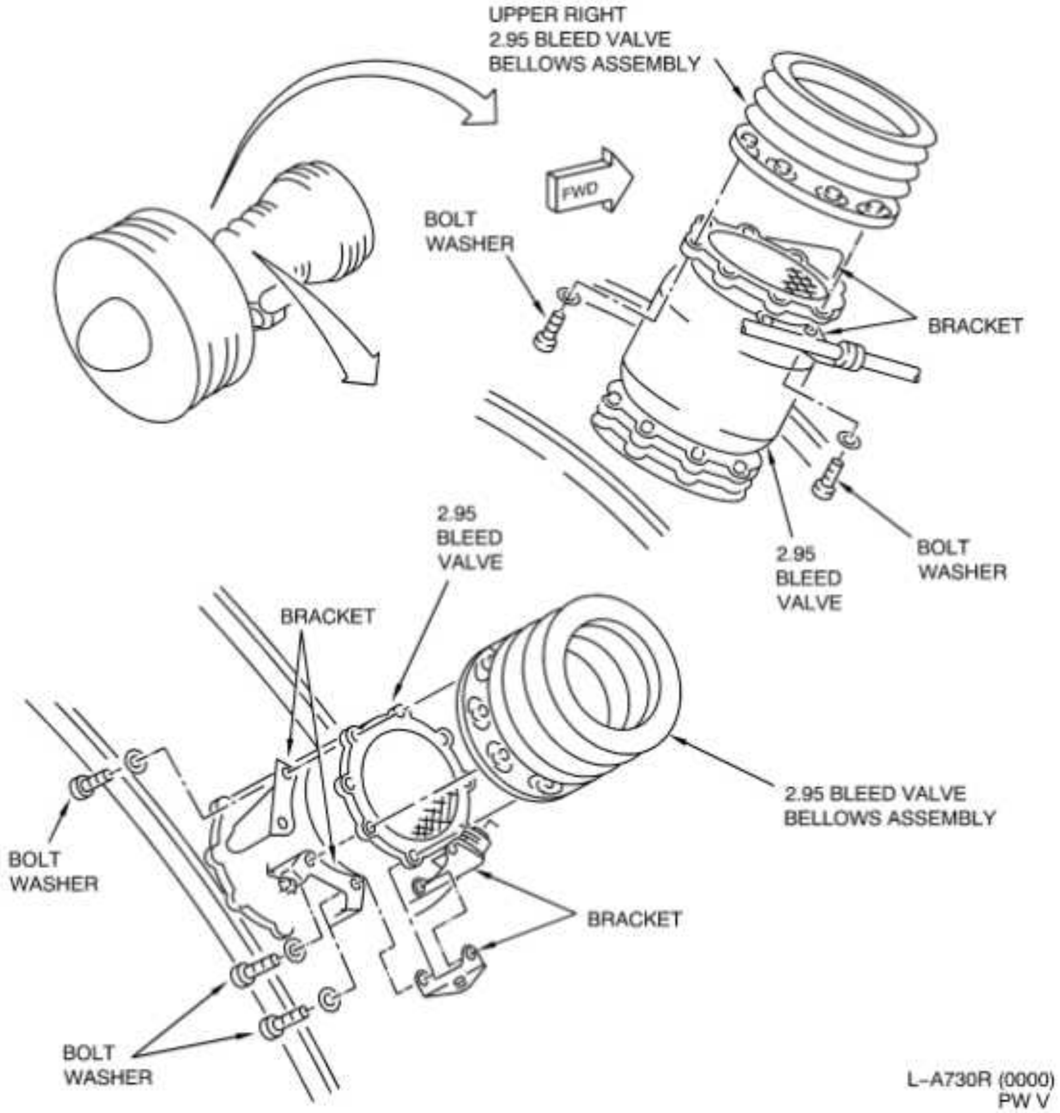
See Figure 401.

(1) Remove protective cover from bleed valve port.

(2) Install bellows seal and brackets on bleed valve. Secure with bolts and washers. Torque bolts 50 – 70 lb-in. (5.65 – 7.91 N.m).

NOTE: Washers are required under boltheads to maintain minimum clearance of 0.030 inch (0.762 mm) between bolthead and bellows.

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−04


UPPER RIGHT
2.95 BLEED VALVE
BELLOWS ASSEMBLY
FWD
BOLT
WASHER
BRACKET
2.95
BLEED
VALVE
BOLT
WASHER
2.95
BLEED
VALVE
BRACKET
2.95 BLEED VALVE
BELLOWS ASSEMBLY
BOLT
WASHER
BRACKET
BOLT
WASHER
L−A730R (0000)
PW V

2.95 Bleed Valve Bellows
Figure 401
(Task 71−00−35−450−009)

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−05

Task 71−00−35−450−010:

1. Install Fire Extinguisher Tubes

A. Equipment And Materials Required − None

B. Procedure

See Figure 401.

(1) Attach lower fire extinguisher tube (401/1) to lower support bracket with clamp (401/2), bolt (401/3), washer (401/4), and nut (401/5).

(2) Install clamp (401/6) on integrated drive generator (IDG) oil tube and position at upper support bracket.

(3) Attach lower fire extinguisher tube to upper bracket with clamp (401/2), IDG oil tube clamp (401/6) on opposite side of bracket, bolt (401/3), washer (401/4), and nut (401/5). Torque nuts to 20 − 25 lb−in. (2.3 − 2.8 N.m).

(4) Install elbow (401/7) on upper end of lower fire extinguisher tube and tighten coupling fingertight.

(5) Install elbow (401/9), washer (401/10), and nut (401/11) on bracket mounted at Flange K. Tighten nut fingertight.

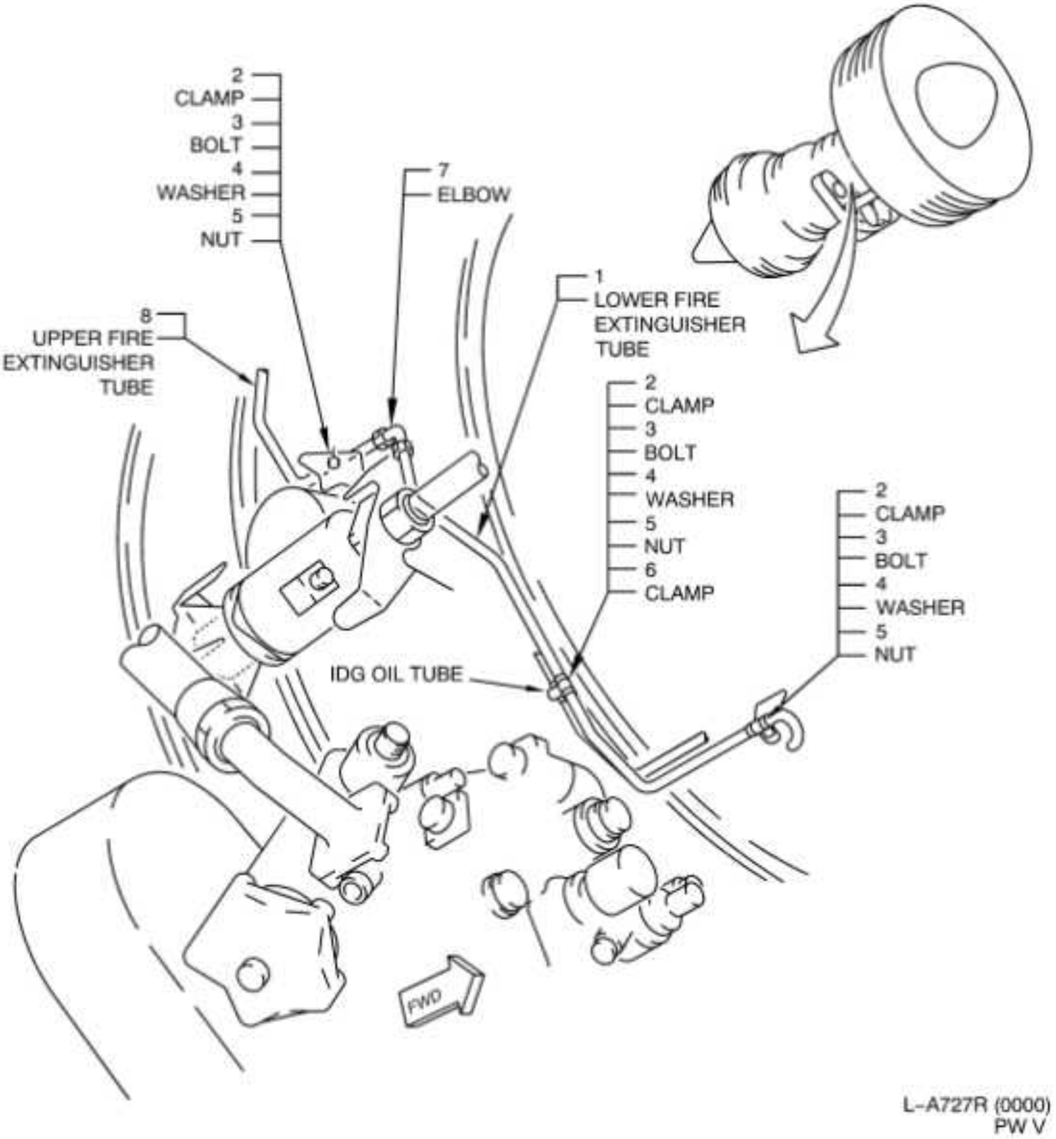
(6) Connect upper fire extinguisher tube (401/8) to two elbows (401/7, 401/9) and tighten couplings fingertight.

(7) Attach upper fire extinguisher tube (401/8) to two support brackets with clamps (401/2), bolts (401/3), washers (401/4), and nuts (401/5). Torque nuts to 20 − 25 lb−in. (2.3 − 2.8 N.m).

(8) Torque nut (401/11) and both fire extinguisher tube coupling nuts (at both elbows) to 215 − 240 lb−in. (24.3 − 27.1 N.m).

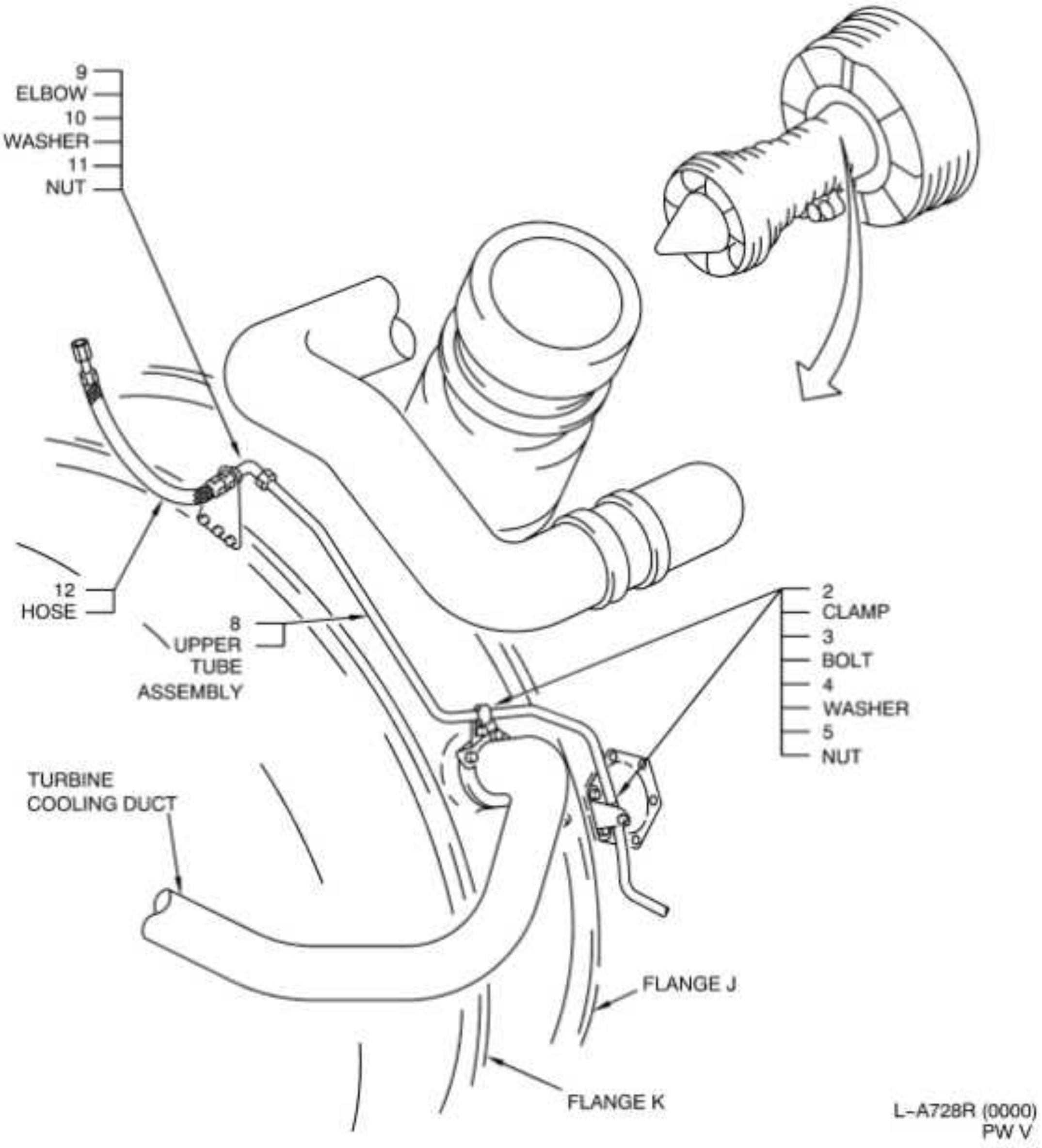
(9) Connect pylon hose (401/12) to elbow (401/9) at support bracket on Flange K. Torque hose coupling nut to 215 − 240 lb−in. (24.3 − 27.1 N.m).

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) −
INSTALLATION−05


2
CLAMP
3
BOLT
4
WASHER
5
NUT
7
ELBOW
8
UPPER FIRE EXTINGUISHER TUBE
1
LOWER FIRE EXTINGUISHER TUBE
2
CLAMP
3
BOLT
4
WASHER
5
NUT
6
CLAMP
2
CLAMP
3
BOLT
4
WASHER
5
NUT
IDG OIL TUBE
FWD
L−A727R (0000)
PW V

Fire Extinguisher Tubes
Figure 401 (Sheet 1)
(Task 71−00−35−450−010)

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−05


9
ELBOW
10
WASHER
11
NUT
12
HOSE
8
UPPER
TUBE
ASSEMBLY
TURBINE
COOLING DUCT
2
CLAMP
3
BOLT
4
WASHER
5
NUT
FLANGE J
FLANGE K
L-A728R (0000)
PW V

Fire Extinguisher Tubes
Figure 401 (Sheet 2)
(Task 71−00−35−450−010)

POWER PLANT GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - INSTALLATION-06

Task 71-00-35-450-011:

1. Install IDG Cooling Tubes

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIG.	ITEM
Packing	1	79-20-05	1	150A
Packing	1	79-20-05	1	160
Packing	1	79-20-05	1	170
Packing	1	79-20-05	1	180

B. Procedure

See Figure 401.

(1) At lower left side of engine case, install packing (401/1), lubricated with Engine Oil (P03-001), on union (401/2). Install union in IDG fuel/oil cooler oil out port. Torque union to 390 - 430 lb-in. (44.1 - 48.6 N.m).

(2) Install packing (401/3), lubricated with Engine Oil (P03-001), on reducer (401/4). Install reducer in IDG scavenge filter oil out port. Torque reducer to 360 - 400 lb-in. (40.7 - 45.2 N.m).

(3) Install packing (401/5), lubricated with Engine Oil (P03-001), on union (401/6). Install union in IDG oil in port. Torque union to 390 - 430 lb-in. (44.1 - 48.6 N.m).

(4) Install packing (401/8), lubricated with Engine Oil (P03-001), on sleeve of tube (401/7). Connect tube to air/oil cooler in port with washers and bolts. Tighten bolts fingertight.

(5) At lower right side of engine case, connect tube (401/7) to tube (401/11) and tighten coupling nut to 900 - 1000 lb-in. (101.7 - 113.0 N.m).

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−06

(6) Attach tube (401/11) to two brackets using clamps (401/12), bolts (401/13), washers (401/14), and nuts (401/15). Tighten nuts fingertight.

(7) Torque bolts attaching tube (401/7) to air/oil cooler to 50 − 70 lb−in. (5.65 − 7.91 N.m).

(8) Connect tube (401/16) to tube (401/11) and tighten coupling nut fingertight.

(9) Attach tube (401/16) to two brackets using clamps (401/12), bolts (401/13), washers (401/14), and nuts (401/15). Tighten nuts fingertight.

(10) Torque coupling nut connecting tubes (401/11) and (401/16) to 900 − 1000 lb−in. (101.7 − 113.0 N.m).

(11) Connect tube (401/17) to tube (401/16) and IDG scavenge filter oil out reducer. Tighten coupling fingertight.

(12) Torque coupling nuts connecting tube (401/17) to IDG scavenge filter oil out reducer and to tube (401/16) to 900 − 1000 lb−in. (101.7 − 113.0 N.m).

(13) Connect tube (401/18) coupling nut to IDG fuel/oil cooler oil out union. Tighten coupling nut fingertight.

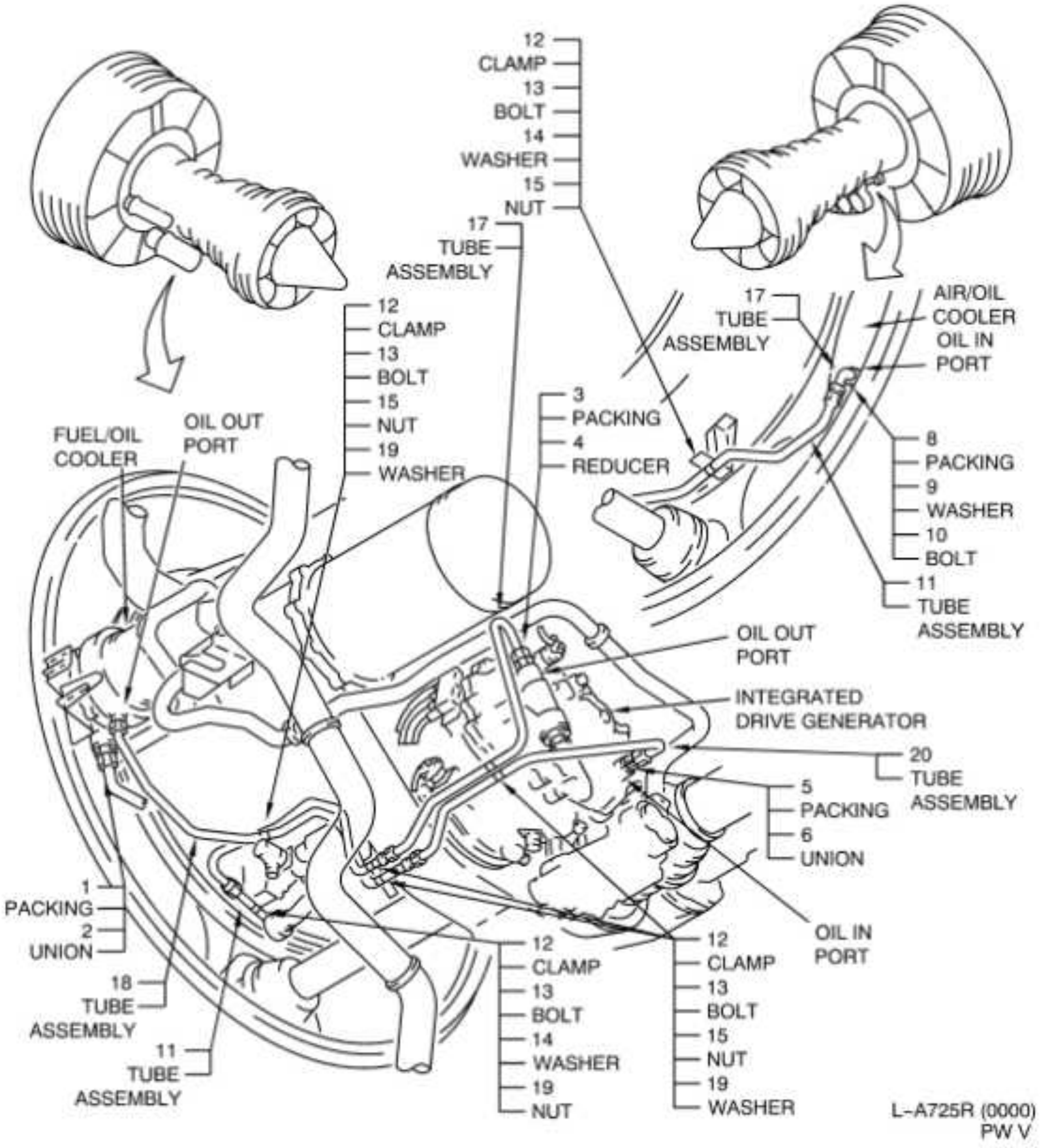
(14) Attach tube (401/18) to bracket with clamp (401/12), bolt (401/13), washer (401/19), and nut (401/15). Tighten nut fingertight.

(15) Torque tube (18) coupling nut to union to 900 − 1000 lb−in. (101.7 − 113.0 N.m).

(16) Connect tube (20) to tube (18) and IDG oil in union. Tighten coupling nuts fingertight.

(17) Attach tube (20) to tube (17) with clamp (401/12), bolt (401/13), washer (401/19), and nut (401/15). Torque nut to 20 − 25 lb−in. (2.26 − 2.82 N.m).

(18) Torque coupling nuts connecting tube (20) to IDG oil in union and to tube (18) to 900 − 1000 lb−in. (101.7 − 113.0 N.m).


12
CLAMP
13
BOLT
14
WASHER
15
NUT
17
TUBE
ASSEMBLY
12
CLAMP
13
BOLT
15
NUT
19
WASHER
17
TUBE
ASSEMBLY
AIR/OIL
COOLER
OIL IN
PORT
3
PACKING
4
REDUCER
FUEL/OIL
COOLER
OIL OUT
PORT
8
PACKING
9
WASHER
10
BOLT
11
TUBE
ASSEMBLY
OIL OUT
PORT
INTEGRATED
DRIVE GENERATOR
20
TUBE
ASSEMBLY
5
PACKING
6
UNION
1
PACKING
2
UNION
18
TUBE
ASSEMBLY
11
TUBE
ASSEMBLY
12
CLAMP
13
BOLT
14
WASHER
19
NUT
12
CLAMP
13
BOLT
15
NUT
19
WASHER
OIL IN
PORT
L-A725R (0000)
PW V

IDG Cooling Tubes
Figure 401
(Task 71−00−35−450−011)

POWER PLANT GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - INSTALLATION-07

Task 71-00-35-450-012:

1. Install Bleed Air Pneumatic Tubes And Hoses

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine

B. Procedure

See Figure 401.

(1) At Flange M, install two elbows (401/1) to bracket using washers (401/2) and nuts (401/3). Torque nuts to 120 - 130 lb-in. (13.6 - 14.7 N.m).

(2) At Flange M, install elbow (401/4) to bracket using washer (401/5) and nut (401/6). Torque nut to 125 - 140 lb-in. (14.1 - 15.8 N.m).

(3) Install union (401/7) in high-stage control valve and torque union to 120 - 130 lb-in. (13.6 - 14.7 N.m).

(4) Install reducer (401/8) in mid-stage duct and torque to 125 - 140 lb-in. (14.1 - 15.8 N.m).

(5) Connect tube (401/9) to upper right elbow (401/4) on bracket at Flange M. Torque coupling nut to 270 - 300 lb-in. (30.5 - 33.9 N.m).

(6) Install reducer (401/10) in tube (401/9) and torque coupling nut to 270 - 300 lb-in. (30.5 - 33.9 N.m).

(7) Connect tube (401/11) to reducer (401/10) and union (401/7). Torque coupling nuts of tube to 180 - 200 lb-in. (20.3 - 22.6 N.m).

(8) Connect tube (401/12) to lower elbow (401/1) on bracket at Flange M and to reducer (401/8) on mid-stage duct. Torque both coupling nuts to 180 - 200 lb-in. (20.3 - 22.6 N.m).

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−07

(9) Connect tube (401/13) to upper left elbow (401/1) on bracket at Flange M and torque coupling nut to 180 − 200 lb−in. (20.3 − 22.6 N.m). Flange M and torque coupling nut to 180 − 200 lb−in. (20.3 − 22.6 N.m).

(10) Install union (401/14) in tube (401/13) and torque coupling nut to 180 − 200 lb−in. (20.3 − 22.6 N.m).

(11) Connect tube (401/15) to union (401/14) and to pneumatic regulating valve. Torque both coupling nuts to 180 − 200 lb−in. (20.3 − 22.6 N.m).

(12) Attach tubes (401/12 and 401/13) to aft bracket on starter upper duct using clamps (401/19), washers (401/18), and bolts (401/17). Torque bolts to 20 − 25 lb−in. (2.26 − 2.82 N.m).

(13) Attach tube (401/9) to aft bracket on starter upper duct using clamp (401/16), washer (401/18), and bolt (401/17). Torque bolt to 20 − 25 lb−in. (2.26 − 2.82 N.m).

(14) Attach tubes (401/12 and 401/13) to forward support bracket on starter upper duct using clamps (401/19), washers (401/18), and bolts (401/17). Torque bolts to 20 − 25 lb−in. (2.26 − 2.82 N.m).

(15) Attach tube (401/9) to forward support bracket on starter upper duct using clamp (401/16), washer (401/18), and bolt (401/17). Torque bolt to 20 − 25 lb−in. (2.26 − 2.82 N.m).

(16) Attach tube (401/15) to two support brackets on left side 2.9 bellows using clamps (401/19), bolts (401/17), washers (401/18), and nuts (401/20). Torque nuts to 20 − 25 lb−in. (2.26 − 2.82 N.m).

(17) Attach tube (401/12) to upper support bracket on left side 2.9 bellows using clamp (401/19), bolt (401/17), washer (401/18), and nut (401/20). Torque nut to 20 − 25 lb−in. (2.26 −2.82 N.m).

(18) Attach tube (401/11) to support bracket on left side 2.9 bleed bellows using clamp (401/19), bolt (401/17), washer (401/18), and nut (401/20). Torque nut to 20 − 25 lb−in. (2.26 − 2.82 N.m).

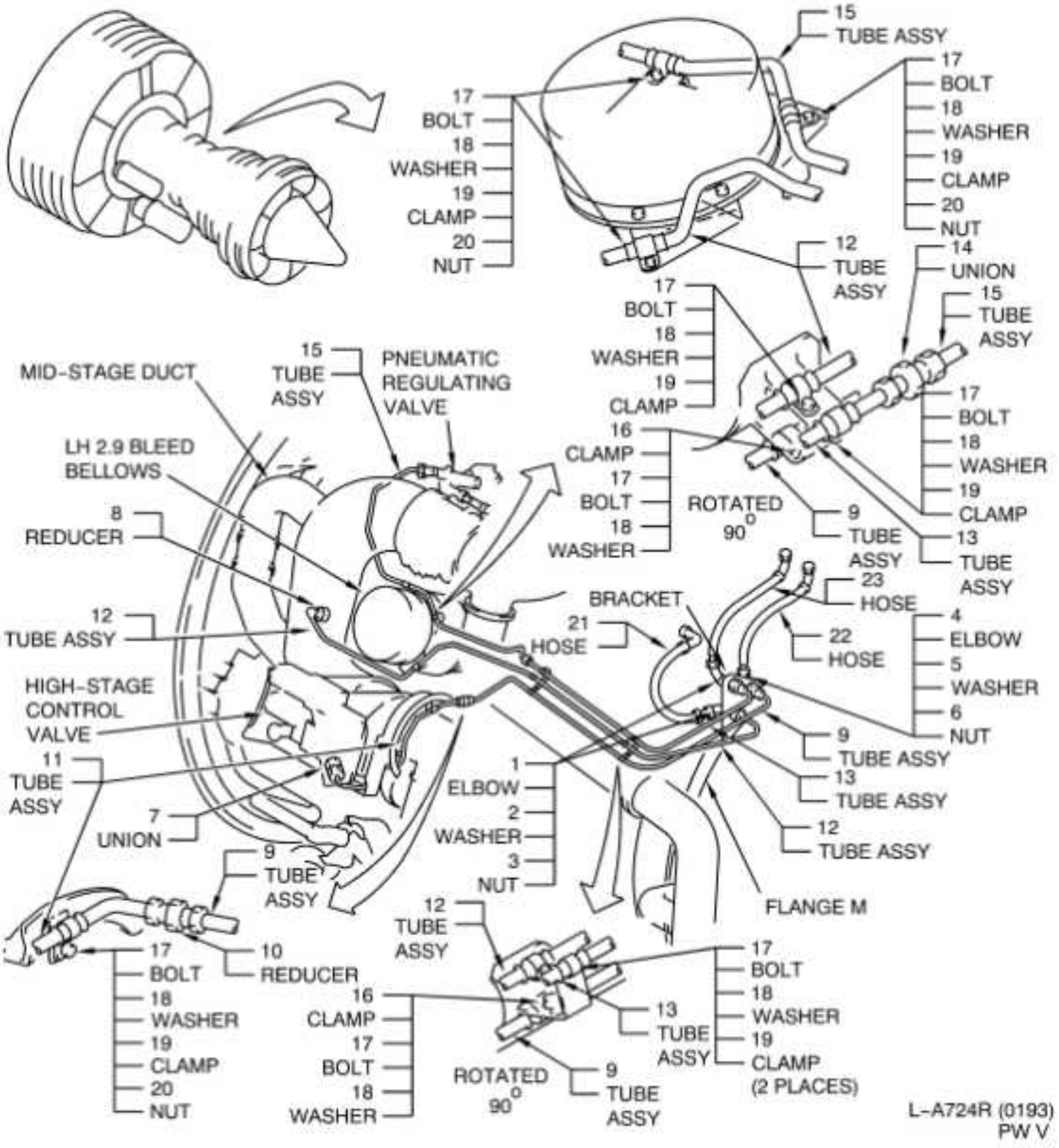
POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−07

(19) Connect hose (401/21) to lower elbow (401/1) on bracket, at Flange M, and torque hose coupling to 180 − 200 lb−in. (20.3 − 22.6 N.m).

(20) Connect hose (401/22) to upper right elbow (401/4) on bracket, at Flange M, and torque hose coupling to 270 − 300 lb−in. (30.5 − 33.9 N.m).

(21) Connect hose (401/23) to upper left elbow (401/1) on bracket, at Flange M, and torque hose coupling to 180 − 200 lb−in. (20.3 − 22.6 N.m).

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) −
INSTALLATION−07


15
TUBE ASSY
17
BOLT
18
WASHER
19
CLAMP
20
NUT
17
BOLT
18
WASHER
19
CLAMP
20
NUT
12
TUBE ASSY
14
UNION
15
TUBE ASSY
17
BOLT
18
WASHER
19
CLAMP
17
BOLT
18
WASHER
19
CLAMP
MID-STAGE DUCT
15
TUBE ASSY
PNEUMATIC REGULATING VALVE
LH 2.9 BLEED BELLOWS
16
CLAMP
17
BOLT
18
WASHER
ROTATED 90°
9
TUBE ASSY
13
TUBE ASSY
8
REDUCER
BRACKET
23
HOSE
12
TUBE ASSY
21
HOSE
22
HOSE
4
ELBOW
5
WASHER
6
NUT
HIGH-STAGE CONTROL VALVE
9
TUBE ASSY
13
TUBE ASSY
11
TUBE ASSY
1
ELBOW
2
WASHER
3
NUT
12
TUBE ASSY
7
UNION
9
TUBE ASSY
FLANGE M
12
TUBE ASSY
17
BOLT
18
WASHER
19
CLAMP
(2 PLACES)
17
BOLT
18
WASHER
19
CLAMP
20
NUT
10
REDUCER
16
CLAMP
17
BOLT
18
WASHER
13
TUBE ASSY
ROTATED 90°
9
TUBE ASSY
L-A724R (0193)
PW V

Bleed Air Pneumatic Tubes And Hoses
Figure 401
(Task 71−00−35−450−012)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - INSTALLATION-08

Task 71-00-35-450-013:

1. Install TRC Valve Cooling Tube

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P06-002	Petrolatum, White

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIG.	ITEM
Lockwire, MS20995C32				

B. Procedure

See Figure 401.

(1) Lubricate packings (401/1) with Petrolatum (P06-002).

(2) Install connector coupling body on TRC valve cooling tube (401/2) and coupling nut on ignition cooling duct (401/3).

(3) Install washer and packing in coupling nut, install washer and packing on coupling body using lubricated packings to retain washers.

(4) Secure ignition coupling duct (401/3) and TRC valve cooling tube (401/2) together with snap retainer.

(5) Engage connector body and coupling nut threads and tighten coupling nut fingertight.

NOTE: Connector consists of coupling body, coupling nut, two washers, and snap retainer.

(6) Install TRC valve cooling tube (401/2) to bracket using clamp (401/4), screw (401/7), washer (401/5), and nut (401/6). Torque nut 20 - 25 lb-in. (2.3 - 2.8 N.m).

(7) Lubricate packings (401/1) with Petrolatum (P06-002).

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−08

(8) Install connector coupling body on right TRC valve cooling tube (401/2) and coupling nut on TRC valve.

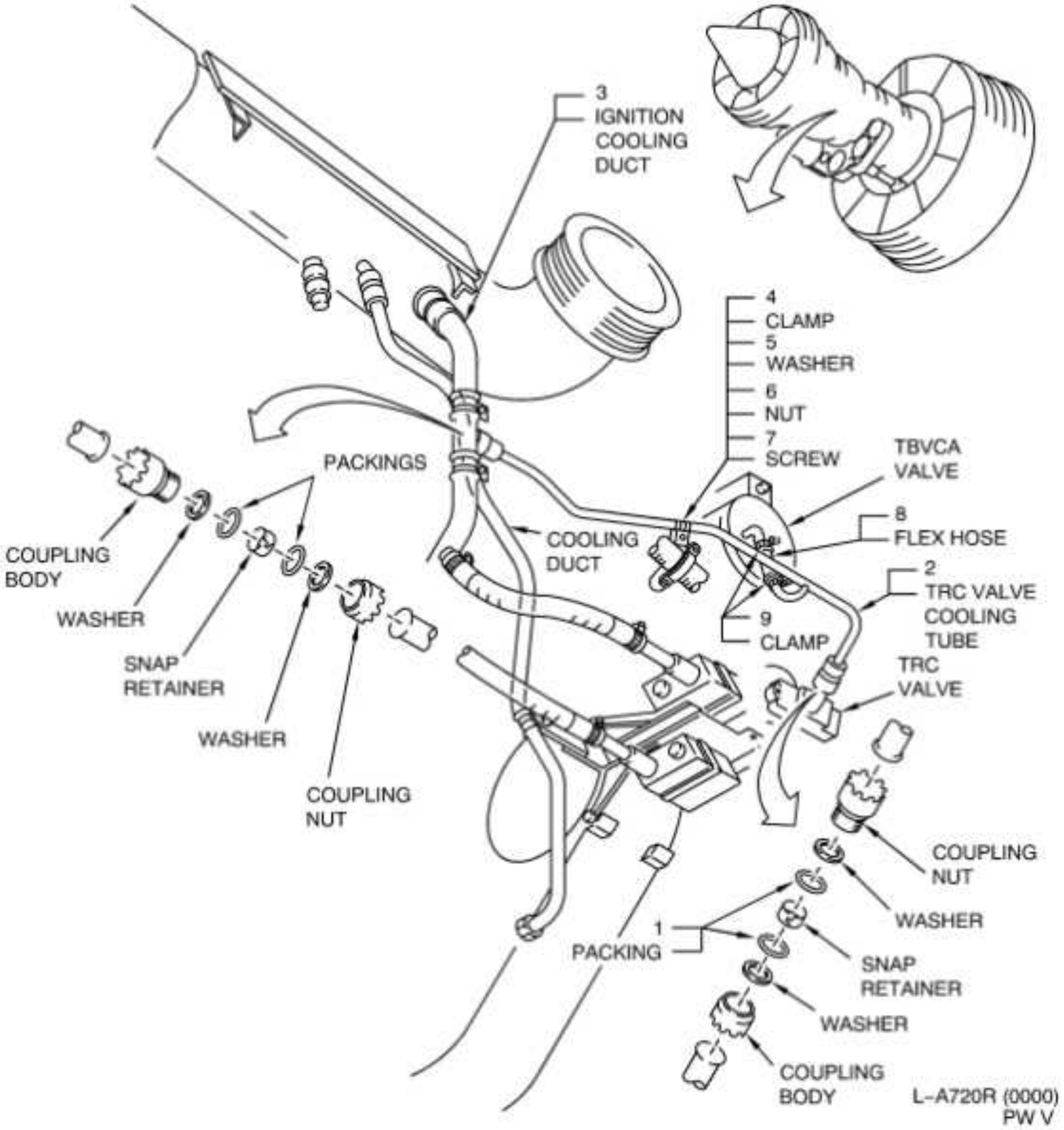
(9) Install washer and packing in coupling nut, install washer and packing on coupling body using lubricated packings to retain washers.

(10) Secure TRC valve cooling tube (401/2) and TRC valve together with snap retainer. Engage connector body and coupling nut threads and tighten fingertight.

(11) Torque connectors at both ends of cooling tube (401/2) to 65 − 80 lb−in. (7.34 − 9.04 N.m).

(12) Connect flex hose (401/8) to cooling tube and TBVCA valve using clamps (401/9). Torque clamps to 25 − 30 lb−in. (2.8 − 3.4 N.m).

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−08


3
IGNITION COOLING DUCT
4
CLAMP
5
WASHER
6
NUT
7
SCREW
TBVCA VALVE
8
FLEX HOSE
2
TRC VALVE COOLING TUBE
9
CLAMP
TRC VALVE
PACKINGS
COUPLING BODY
WASHER
SNAP RETAINER
WASHER
COUPLING NUT
COOLING DUCT
COUPLING NUT
WASHER
SNAP RETAINER
1
PACKING
WASHER
COUPLING BODY
L-A720R (0000)
PW V

TRC Valve Cooling Tube
Figure 401
(Task 71−00−35−450−013)

POWER PLANT GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - INSTALLATION-09

Task 71-00-35-450-014:

1. Install Oil System Tubes

   A. Equipment And Materials Required - None

   B. Procedure

   See Figure 401.

   (1) Install oil tube (401/1) to union in LB6 port and to tee in oil pressure transmitter. Torque coupling nuts to 135 - 150 lb-in. (15.25 - 16.95 N.m).

   (2) Attach oil tube (401/1) to brackets with clamps (401/2), screws (401/3), washers (401/4), and nuts (401/5). Torque nuts to 20 - 25 lb-in. (2.26 - 2.82 N.m). Two places.

   (3) Install tee (401/6) in oil tube support bracket with washer (401/7) and nut (401/8). Torque nut to 90 - 100 lb-in. (10.17 - 11.29 N.m).

   (4) Connect tube (401/9) to reducer in LP1 port and to tee (401/6) in oil tube support bracket. Torque tube coupling to 135 - 150 lb-in. (15.25 - 16.95 N.m).

   (5) Attach oil tube (401/9) to oil tube (401/1) with clamps (401/2), screws (401/3), washer (401/4), and nut (401/5). Torque nut to 20 - 25 lb-in. (2.26 - 2.82 N.m).

   (6) Attach oil tube (401/9) to existing engine tube with two clamps (401/2, 401/10), bolt (401/11), washer (401/4), and nut (401/5). Torque nut to 20 - 25 lb-in. (2.26 - 2.82 N.m).

   (7) Connect hose assembly (401/12) to tee (401/6) in oil tube support bracket and to union in bottom of oil pressure transmitter. Torque coupling nuts to 135 - 150 lb-in. (15.25 - 16.95 N.m).

   (8) Connect oil tube (401/13) to tee (401/6) in oil tube support bracket and to union in top of low oil pressure warning switch. Torque coupling nuts to 135 - 150 lb-in. (15.25 - 16.95 N.m).

(9) Connect oil tube (401/14) to tee in top of oil pressure transmitter and to union in bottom of low oil pressure warning switch. Torque coupling nuts to 135 − 150 lb−in. (15.25 − 16.95 N.m).

(10) Attach oil tubes (401/13) and (401/14) together with clamps (401/15), spacer (401/16), bolt (401/17), washer (401/4), and nut (401/5). Torque nut to 20 − 25 lb−in. (2.26 − 2.82 N.m).

(11) Attach hose assembly (401/12) to oil tube (401/14) with two clamps (401/10, 401/15), bolt (401/11), washer (401/4), and nut (401/5). Torque nut to 20 − 25 lb−in. (2.26 − 2.82 N.m).

(12) Remove top two bolts (401/16) from oil cooler bypass valve and install bracket (401/17) on bypass valve.

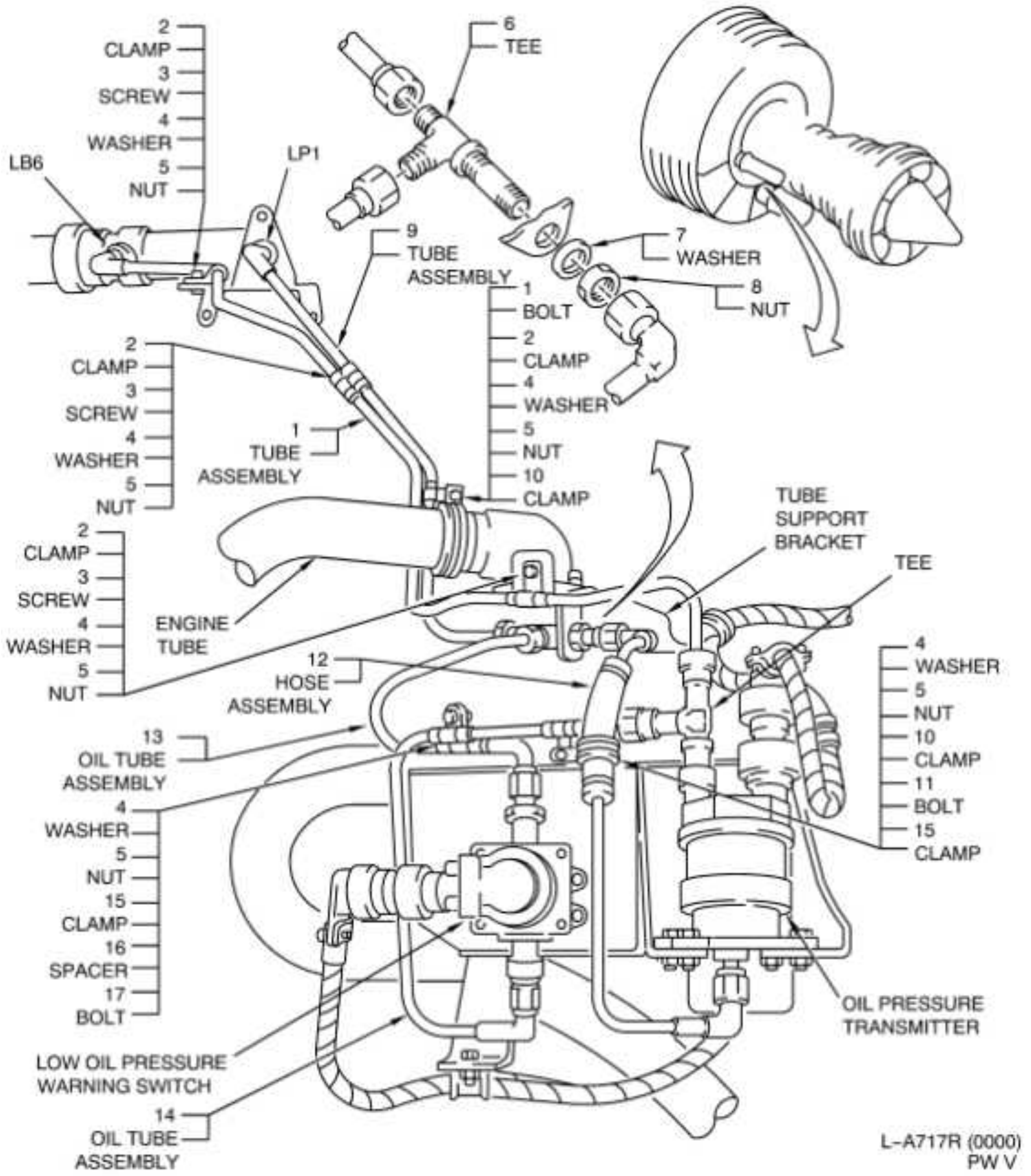
(13) Connect oil tube (401/18) to restrictor in LP5 port and to union in oil filter differential pressure switch. Torque coupling nuts to 135 − 150 lb−in. (15.25 − 16.95 N.m).

(14) Connect oil tube (401/19) to restrictor in LP4 port and to union oil filter differential pressure switch. Torque coupling nuts to 135 − 150 lb−in. (15.25 − 16.95 N.m).

(15) Attach oil tubes (401/18) and (401/19) to bracket with clamps (401/2), screw (401/3), washer (401/4), and nut (401/5). Torque nut to 20 − 25 lb−in. (2.26 − 2.82 N.m).

(16) Attach oil tube (401/18) to engine bracket with clamp (401/2), screw (401/3), washer (401/4), and nut (401/5). Torque nut to 20 − 25 lb−in. (2.26 − 2.82 N.m).

POWER PLANT GENERAL − HIGH PRESSURE COMPRESSOR (HPC) −
INSTALLATION−09


2
CLAMP
3
SCREW
4
WASHER
5
NUT
LB6
LP1
6
TEE
9
TUBE
ASSEMBLY
7
WASHER
8
NUT
1
BOLT
2
CLAMP
4
WASHER
5
NUT
10
CLAMP
2
CLAMP
3
SCREW
4
WASHER
5
NUT
1
TUBE
ASSEMBLY
TUBE
SUPPORT
BRACKET
TEE
2
CLAMP
3
SCREW
4
WASHER
5
NUT
ENGINE
TUBE
12
HOSE
ASSEMBLY
4
WASHER
5
NUT
10
CLAMP
11
BOLT
15
CLAMP
13
OIL TUBE
ASSEMBLY
4
WASHER
5
NUT
15
CLAMP
16
SPACER
17
BOLT
OIL PRESSURE
TRANSMITTER
LOW OIL PRESSURE
WARNING SWITCH
14
OIL TUBE
ASSEMBLY
L-A717R (0000)
PW V

Oil System Tubes
Figure 401
(Task 71−00−35−450−014)

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71−00−41

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71−00−41	POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−06 • 71−00−41−050−006: Remove Fuel Flow Transmitter
71−00−41	POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−07 • 71−00−41−050−007: Remove Engine Pump Case Drain Filter Modules
71−00−41	POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−08 • 71−00−41−050−008: Remove Hydraulic Case Drain Filter
71−00−41	POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−09 • 71−00−41−050−009: Remove Engine Pump Case Drain Filter Module Check Valve
71−00−41	POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−10 • 71−00−41−050−010: Remove Pylon Drain Tubing
71−00−41	POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−04 • 71−00−41−450−004: Install High Stage Temperature Sensor
71−00−41	POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−05 • 71−00−41−450−005: Install Engine Bleed Air Ducting
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71−00−41	POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−08

	- 71−00−41−450−008: Install Engine Pump Case Drain Filters
71−00−41	POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−09 - 71−00−41−450−009: Install Engine Pump Case Drain Filter Module Check Valve
71−00−41	POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−10 - 71−00−41−450−010: Install Pylon Drain Tubing

POWER PLANT GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-04

Task 71-00-41-050-004:

1. Remove High Stage Temperature Sensor

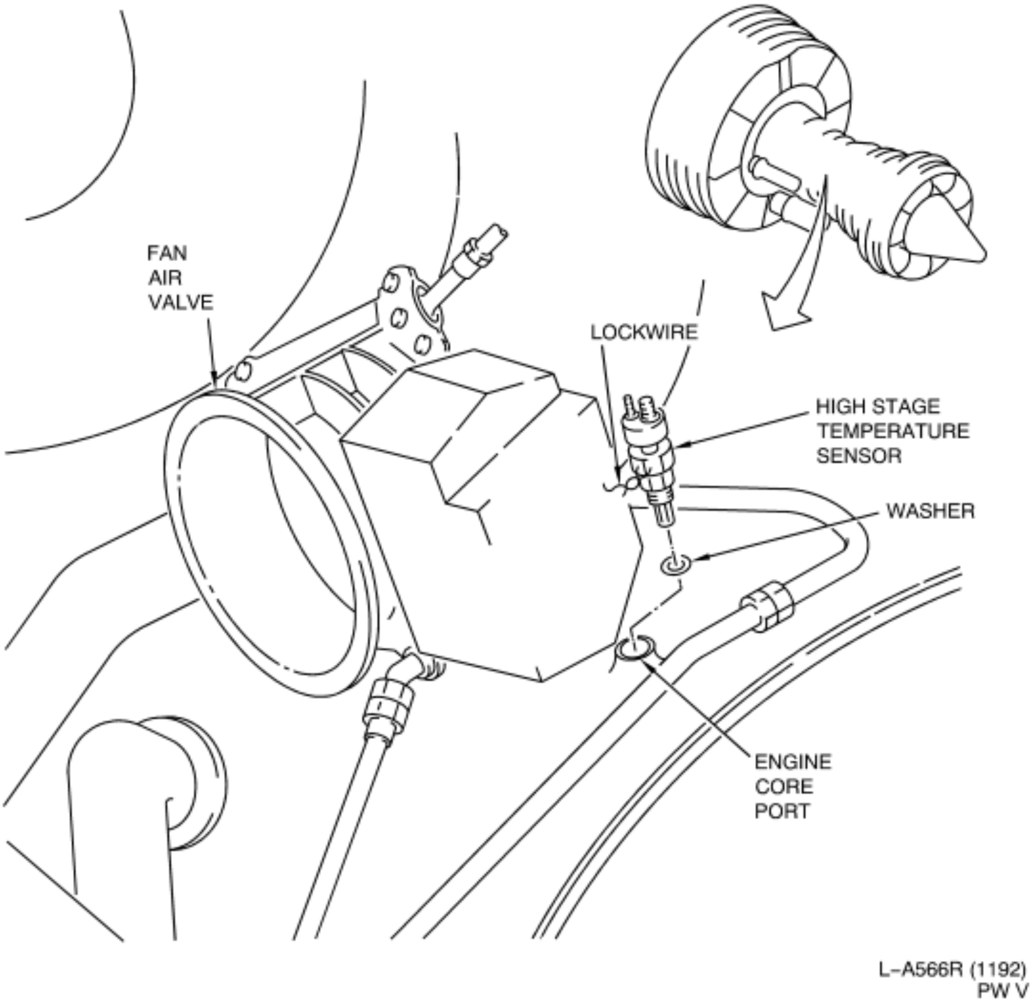
   A. Equipment And Materials Necessary - None

   B. Procedure
   See Figure 301.

R CAUTION: BE CAREFUL WHEN YOU HANDLE, REMOVE OR INSTALL
R ALL TUBES WHICH CONTAIN A FLEX DESIGN
R SEGMENT. REMOVE AND INSTALL A TUBE WITH A
R FLEX SEGMENT WITH THE SAME PRECAUTIONS
R USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO
R NOT BEND THE FLEXHOSE OF A TUBE TO HELP
R WITH THE INSTALLATION OR REMOVAL OF AN
R ATTACHED COMPONENT. IF A FLEX SEGMENT IS
R BENT TOO MUCH, THIS CAN CAUSE A KINK IN
R THE EXTERNAL WIRE BRAID AND IN THE INNER
R POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS
R OR TUBE RUPTURE CAN BE THE RESULT.

   (1) Remove lockwire from between sensor nuts and engine core ports.

   (2) Remove sensor from engine core port. Install protective cover over open port.


FAN
AIR
VALVE
LOCKWIRE
HIGH STAGE
TEMPERATURE
SENSOR
WASHER
ENGINE
CORE
PORT
L-A566R (1192)
PW V

High Stage Temperature Sensor Removal
Figure 301
(Task 71-00-41-050-004)

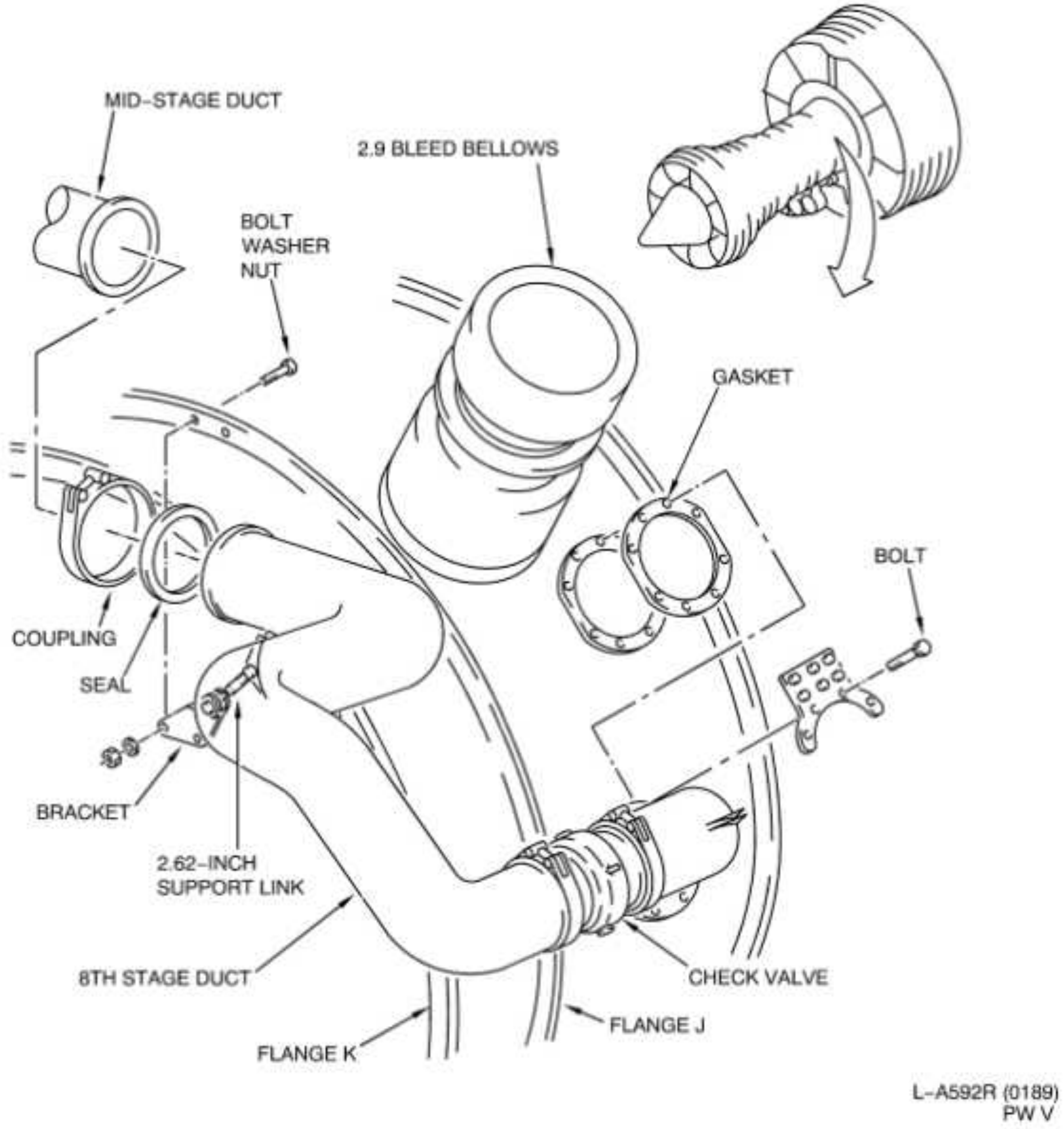
Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-05

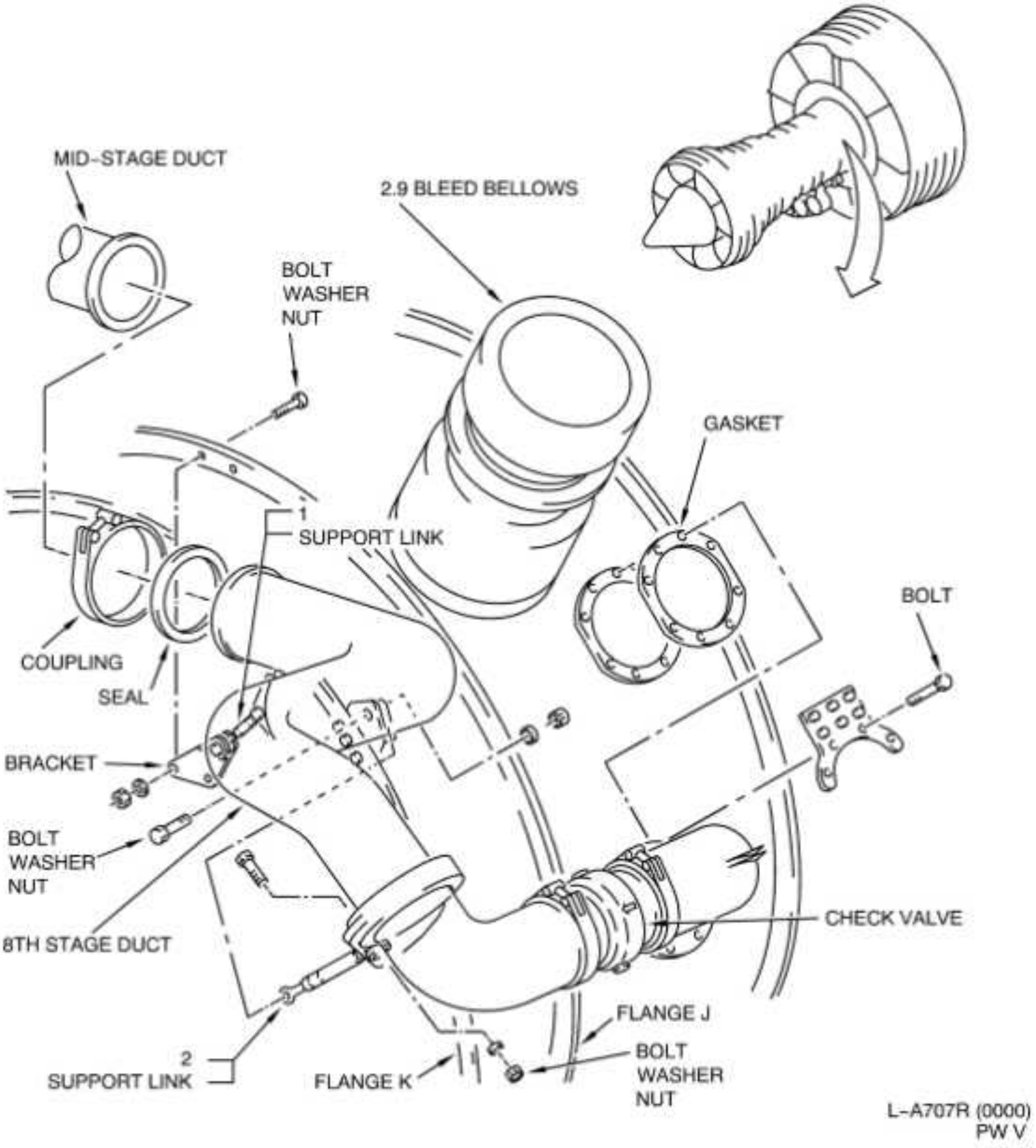
Task 71-00-41-050-005:

1. Remove Engine Bleed Air Ducting
   - A. Equipment And Materials Required - None
   - B. Procedure
     - (1) Remove right 8th stage duct. See Figures 301, 302 and 303.
       - (a) Remove bolt, washer, bushing and nut attaching support link to bracket.
       - (b) For engines incorporating additional pneumatic duct support link (Post SB PWNAC 36-6 and SB PWNAC 36-9), remove bolt, washer and nut attaching clamp/bracket support link to engine case bracket. See Figures 302 and 303.
       - (c) For engines incorporating additional pneumatic duct support link (Post SB PWNAC 36-6 and SB PWNAC 36-9), remove bolt, washer and nut attaching support link to duct clamp/bracket. See Figures 302 and 303.
       - (d) For engines incorporating additional pneumatic duct support link (Post SB PWNAC 36-6, Pre SB PWNAC 36-9), remove two bolts, washers, and nuts attaching clamp to duct. See Figure 302.
       - (e) Remove coupling and seal attaching right 8th stage duct to mid-stage duct.
       - (f) Remove lockwire and eight bolts that attach bracket, elbow and gasket to engine core. Discard lockwire and gasket.
       - (g) Remove right 8th stage duct with check valve and elbow attached from engine core.
       - (h) Install protective cover over core port.
     - (2) Remove pressure regulating duct. See Figure 304.
       - (a) Remove coupling and seal attaching starter upper duct to starter lower duct.
       - (b) Remove three bolts, washers, bushings and nuts attaching three support links to three brackets.
       - (c) Remove coupling and seal attaching pressure regulating duct to pressure regulating valve.
       - (d) Remove pressure regulating duct with starter upper duct attached from engine core.
       - (e) Install protective cover over valve port.
     - (3) Remove left 8th stage duct and mid-stage duct. See Figure 305.
       - (a) Remove lockwire and eight bolts that attach bracket, left 8th stage duct and gasket to engine core. Discard lockwire and gasket.
       - (b) Remove coupling and seal attaching mid-stage duct to high stage bleed control valve.
       - (c) Remove coupling and seal attaching mid-stage duct to pressure regulating valve.

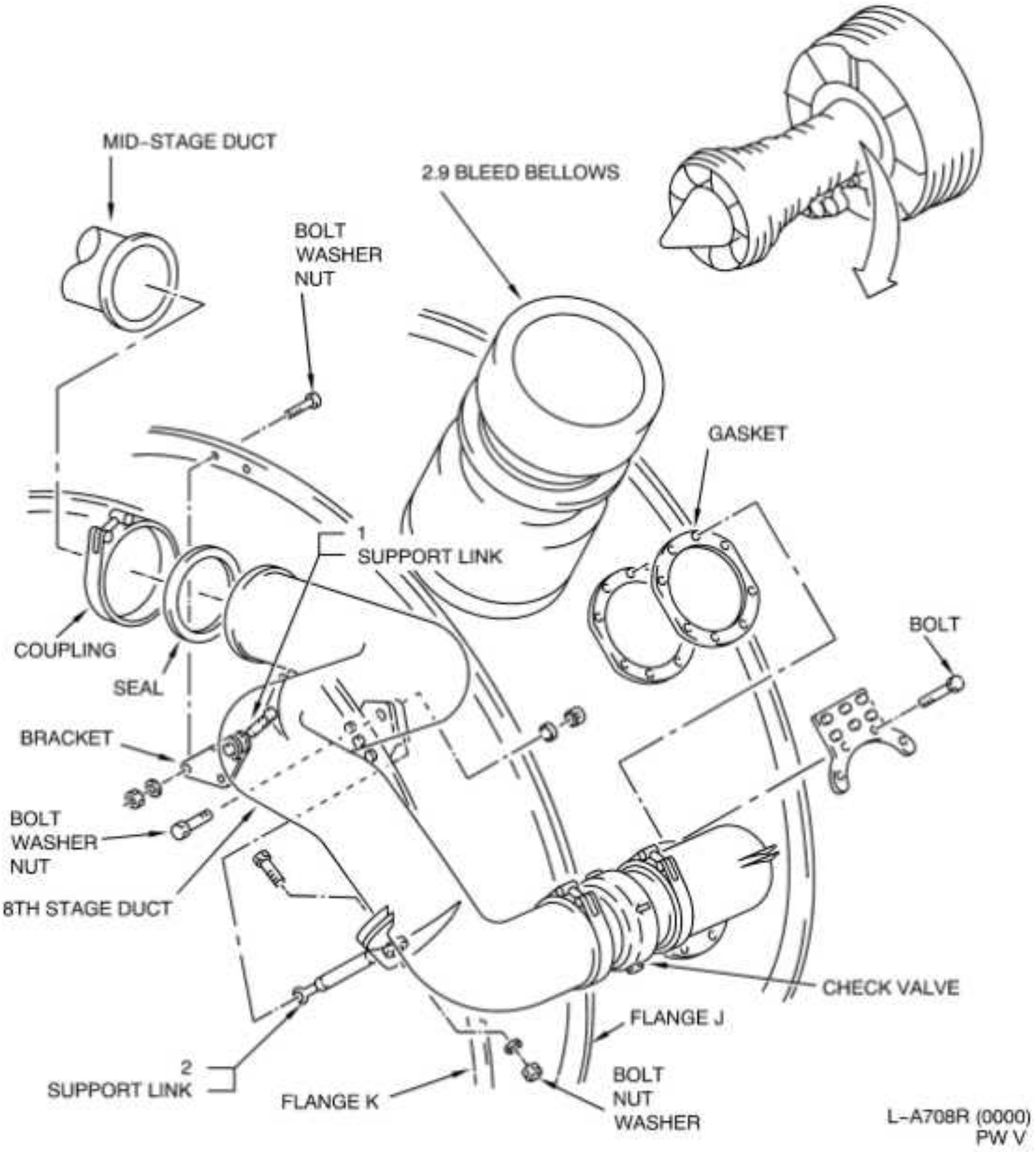
POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−05


MID-STAGE DUCT
2.9 BLEED BELLOWS
BOLT
WASHER
NUT
GASKET
BOLT
COUPLING
SEAL
BRACKET
2.62-INCH
SUPPORT LINK
8TH STAGE DUCT
CHECK VALVE
FLANGE J
FLANGE K
L-A592R (0189)
PW V

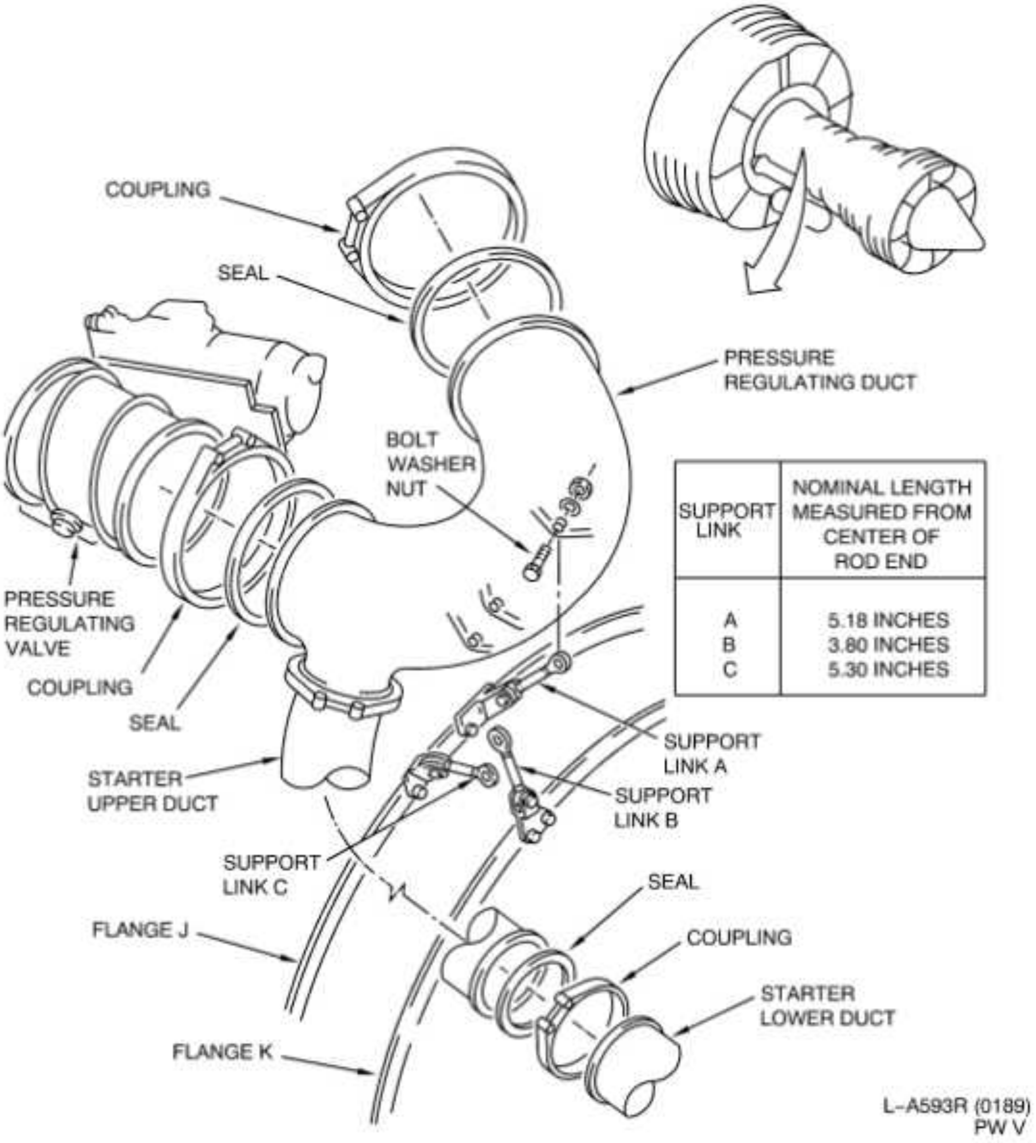
Right 8th Stage Duct Removal
(Pre SB PWNAC 36−6)
Figure 301
(Task 71−00−41−050−005)


MID-STAGE DUCT
2.9 BLEED BELLOWS
BOLT
WASHER
NUT
GASKET
1
SUPPORT LINK
BOLT
COUPLING
SEAL
BRACKET
BOLT
WASHER
NUT
8TH STAGE DUCT
CHECK VALVE
FLANGE J
BOLT
WASHER
NUT
2
SUPPORT LINK
FLANGE K
L-A707R (0000)
PW V

Right 8th Stage Duct Removal
(Post SB PWNAC 36−6, Pre SB PWNAC 36−9)
Figure 302
(Task 71−00−41−050−005)

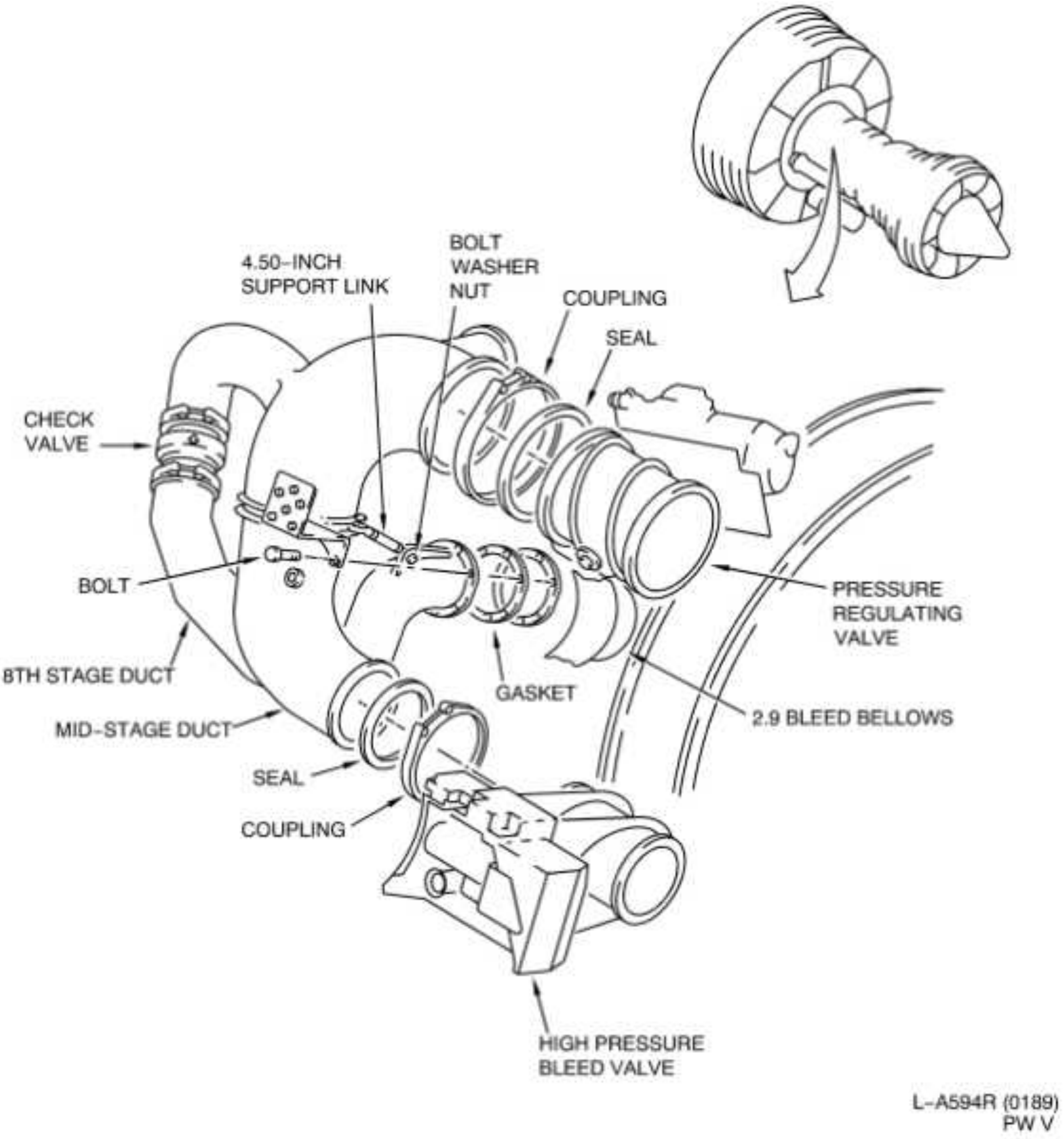

MID-STAGE DUCT
2.9 BLEED BELLOWS
BOLT
WASHER
NUT
GASKET
1
SUPPORT LINK
BOLT
COUPLING
SEAL
BRACKET
BOLT
WASHER
NUT
8TH STAGE DUCT
CHECK VALVE
FLANGE J
2
SUPPORT LINK
FLANGE K
BOLT
NUT
WASHER
L-A708R (0000)
PW V

Right 8th Stage Duct Removal
(Post SB PWNAC 36−9)
Figure 303
(Task 71−00−41−050−005)


COUPLING
SEAL
PRESSURE REGULATING DUCT
BOLT
WASHER
NUT
PRESSURE REGULATING VALVE
COUPLING
SEAL
STARTER UPPER DUCT
SUPPORT LINK A
SUPPORT LINK B
SUPPORT LINK C
FLANGE J
FLANGE K
SEAL
COUPLING
STARTER LOWER DUCT
L−A593R (0189)
PW V

SUPPORT LINK	NOMINAL LENGTH MEASURED FROM CENTER OF ROD END
A	5.18 INCHES
B	3.80 INCHES
C	5.30 INCHES

Pressure Regulating Duct Removal
Figure 304
(Task 71−00−41−050−005)


4.50-INCH SUPPORT LINK
BOLT WASHER NUT
COUPLING
SEAL
CHECK VALVE
BOLT
8TH STAGE DUCT
MID-STAGE DUCT
SEAL
COUPLING
GASKET
PRESSURE REGULATING VALVE
2.9 BLEED BELLOWS
HIGH PRESSURE BLEED VALVE
L-A594R (0189)
PW V

Left 8th Stage And Mid-Stage Ducts Removal
Figure 305
(Task 71-00-41-050-005)

(d) Remove mid−stage duct with left 8th stage duct and check valve attached from engine core.

(e) Install protective covers over core port and two valve ports.

(4) Remove 15th stage manifold. See Figures 306, 307 and 308.

(a) For engines incorporating additional pneumatic duct support link (Post SB PWNAC 36−4 and SB PWNAC 36−8), remove bolt, washer and nut attaching support link to engine bracket. See Figures 307 and 308.

(b) For engines incorporating additional pneumatic duct support link (Post SB PWNAC 36−4 and SB PWNAC 36−8), remove bolt, washer and nut attaching support link to manifold clamp/bracket. See Figures 307 and 308.

(c) For engines incorporating additional pneumatic duct support link (Post SB PWNAC 36−4, Pre SB PWNAC 36−8), remove four bolts, washers, and nuts attaching clamp to manifold. See Figure 307.

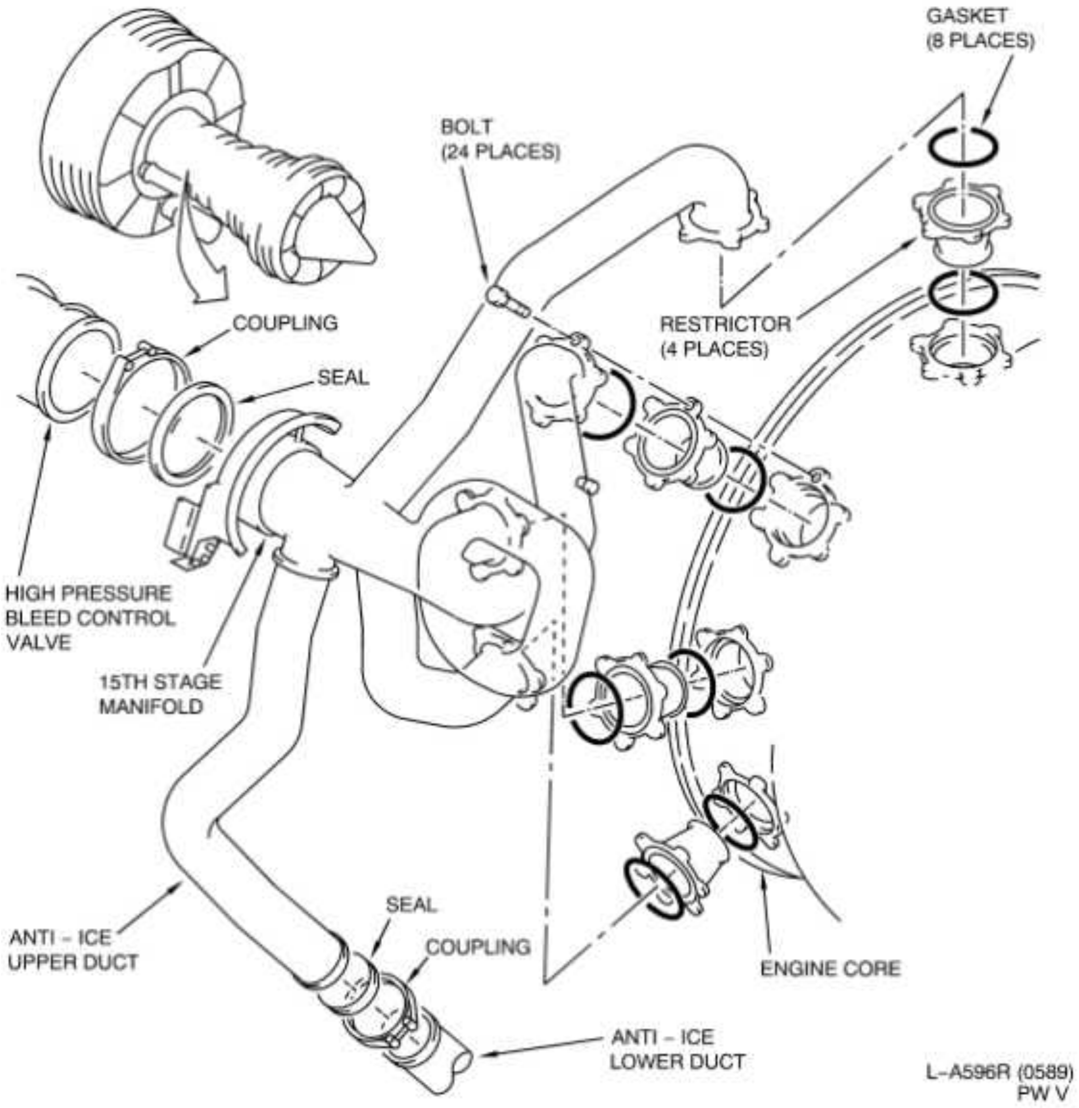
(d) Remove coupling and seal attaching upper anti−ice duct to lower anti−ice duct.

(e) Remove coupling and seal attaching 15th stage manifold to high pressure bleed control valve.

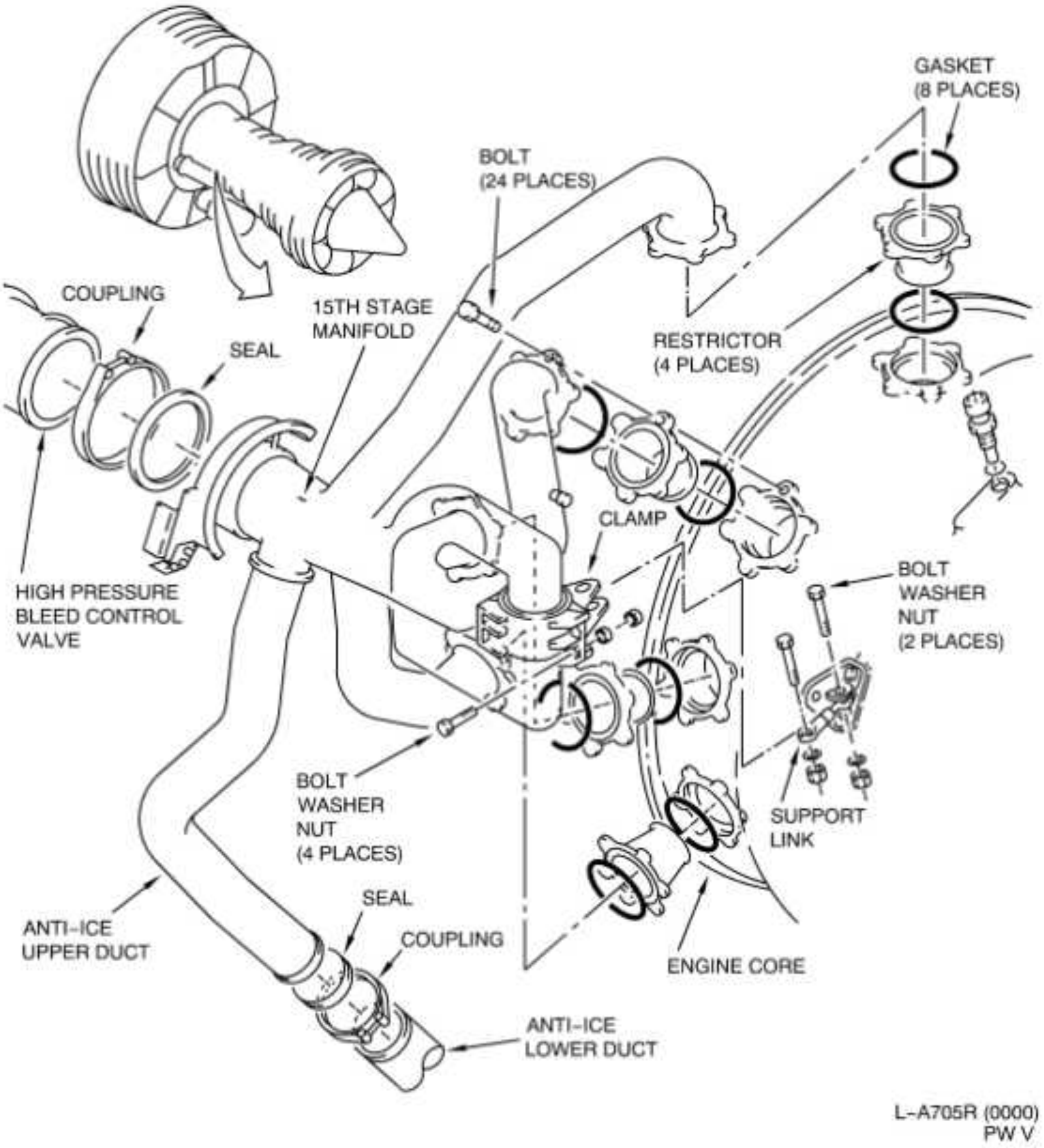
(f) Remove lockwire and six bolts that attach 15th stage manifold to engine core in four places. Discard lockwire.

(g) Remove 15th stage manifold with upper anti−ice duct attached from engine core.

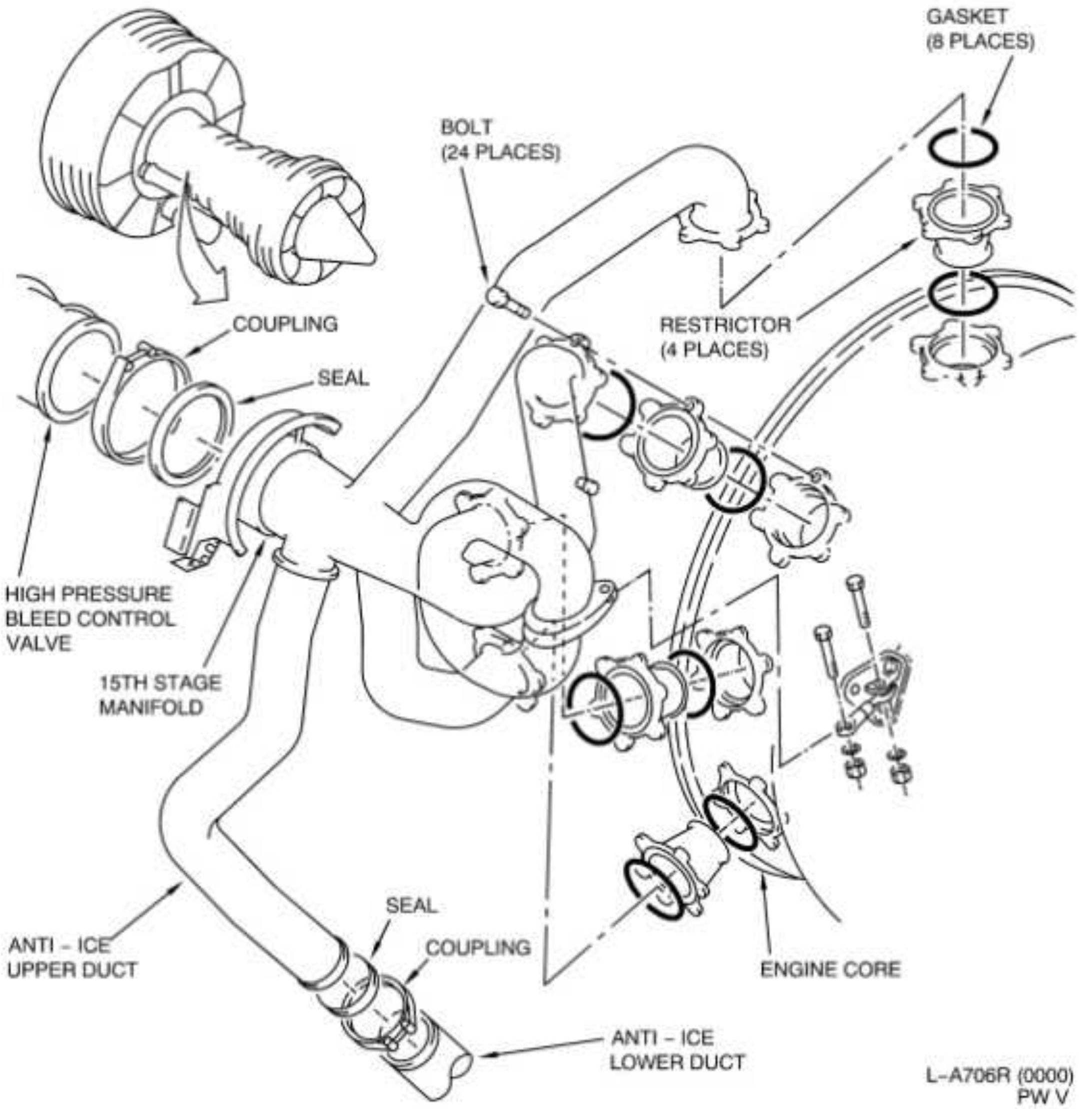
(h) Install protective covers over four core ports and valve port.


GASKET
(8 PLACES)
BOLT
(24 PLACES)
COUPLING
SEAL
RESTRICTOR
(4 PLACES)
HIGH PRESSURE
BLEED CONTROL
VALVE
15TH STAGE
MANIFOLD
ANTI - ICE
UPPER DUCT
SEAL
COUPLING
ENGINE CORE
ANTI - ICE
LOWER DUCT
L-A596R (0589)
PW V

Fifteenth Stage Manifold Removal
(Pre SB PWNAC 36−4)
Figure 306
(Task 71−00−41−050−005)


GASKET
(8 PLACES)
BOLT
(24 PLACES)
COUPLING
15TH STAGE
MANIFOLD
SEAL
RESTRICTOR
(4 PLACES)
CLAMP
BOLT
WASHER
NUT
(2 PLACES)
HIGH PRESSURE
BLEED CONTROL
VALVE
BOLT
WASHER
NUT
(4 PLACES)
SUPPORT
LINK
SEAL
ANTI-ICE
UPPER DUCT
COUPLING
ENGINE CORE
ANTI-ICE
LOWER DUCT
L-A705R (0000)
PW V

Fifteenth Stage Manifold Removal
(Post SB PWNAC 36−4, Pre SB PWNAC 36−8)
Figure 307
(Task 71−00−41−050−005)

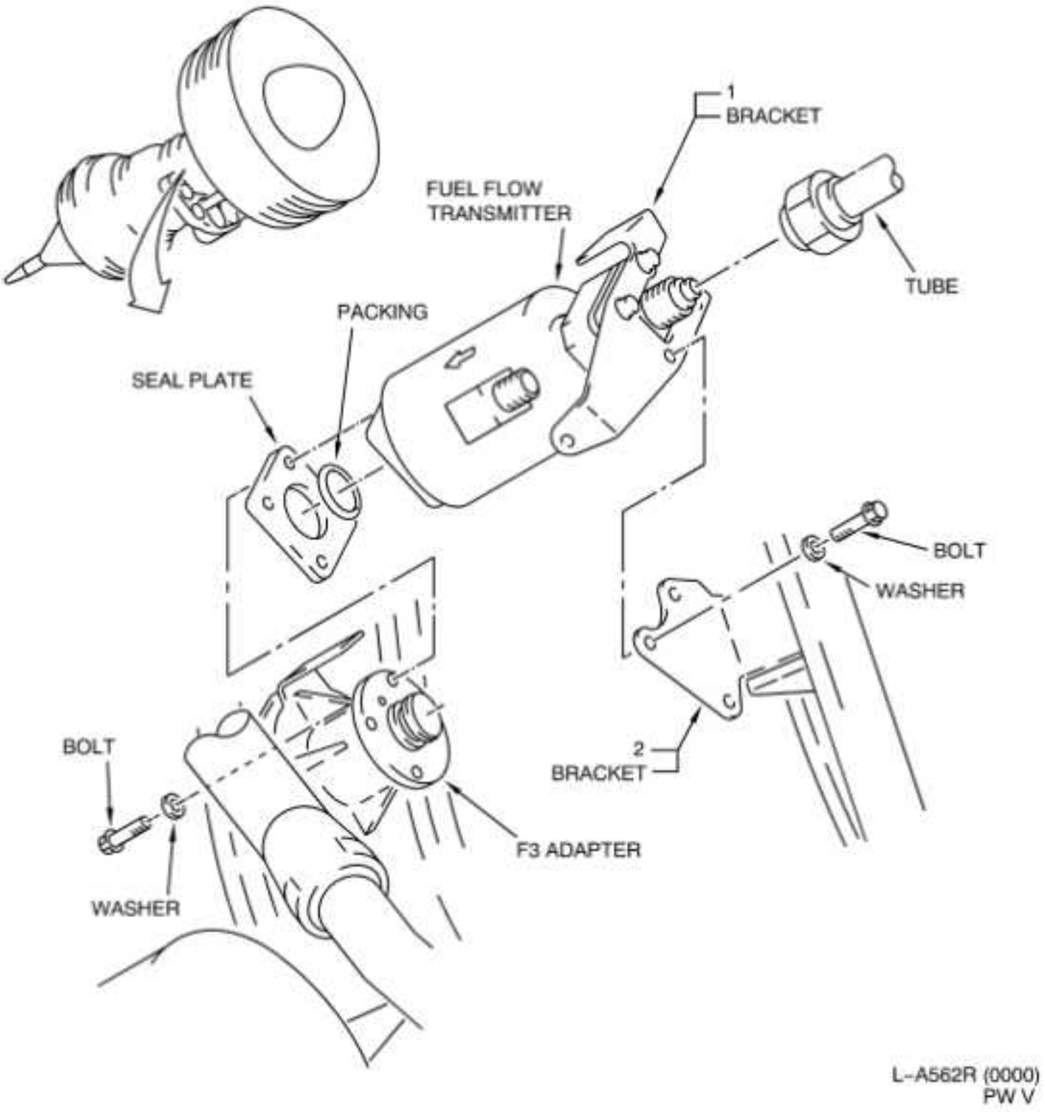

GASKET
(8 PLACES)
BOLT
(24 PLACES)
COUPLING
SEAL
RESTRICTOR
(4 PLACES)
HIGH PRESSURE
BLEED CONTROL
VALVE
15TH STAGE
MANIFOLD
ANTI - ICE
UPPER DUCT
SEAL
COUPLING
ENGINE CORE
ANTI - ICE
LOWER DUCT
L-A706R (0000)
PW V

Fifteenth Stage Manifold Removal
(Post SB PWNAC 36−8)
Figure 308
(Task 71−00−41−050−005)

POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−06

Task 71−00−41−050−006:

1. Remove Fuel Flow Transmitter
   A. Equipment And Materials Required − None
   B. Procedure
   See Figure 301.
      (1) Disconnect tube from transmitter and install protective covers to tube and transmitter.
      (2) Remove bolts and washers attaching bracket (301/2) to bracket (301/1).
      (3) Remove four bolts attaching F3 adapter and seal plate to fuel flow transmitter.


1
BRACKET
FUEL FLOW
TRANSMITTER
TUBE
PACKING
SEAL PLATE
BOLT
WASHER
2
BRACKET
BOLT
WASHER
F3 ADAPTER
L−A562R (0000)
PW V

Fuel Flow Transmitter Removal
Figure 301
(Task 71−00−41−050−006)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-07

Task 71-00-41-050-007:

1. Remove Engine Pump Case Drain Filter Modules

A. Equipment And Materials Required

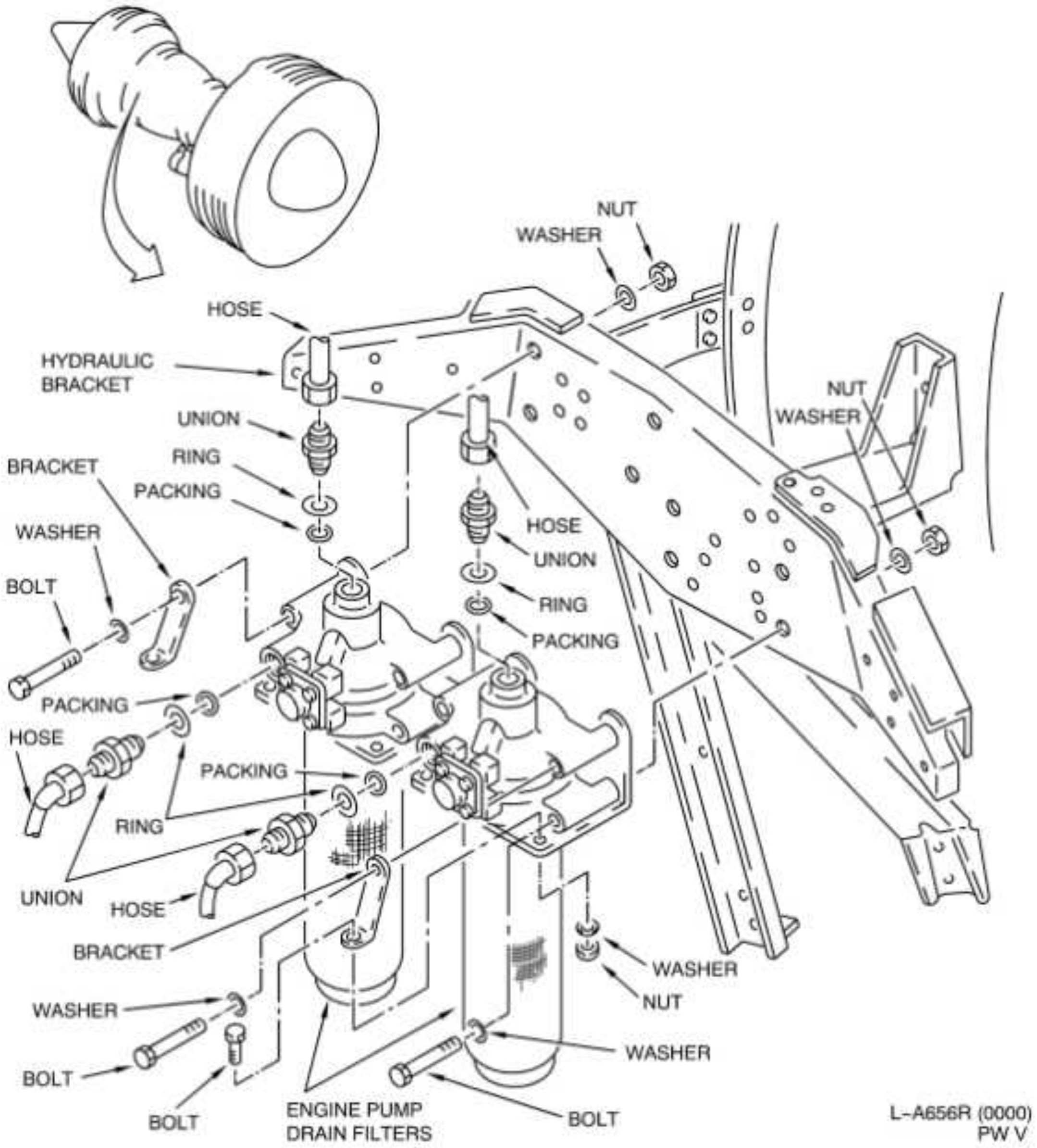
Standard Tools:

Name	Manufacturer
Container, approximately 2 U.S. gallons (7.57 l)	Local Purchase

B. Procedure
See Figure 301.

WARNING: HYDRAULIC FLUID MAY CAUSE EYE, NOSE, AND SKIN IRRITATION. AVOID PROLONGED BREATHING OF MIST OR VAPOR AND PROLONGED OR REPEATED CONTACT WITH SKIN. IF THERE IS A POSSIBILITY OF SPLASH, WEAR GOGGLES. PROTECTIVE GLOVES SHOULD BE WORN DURING USE TO PREVENT DRYING THE SKIN DUE TO CONTACT WITH HYDRAULIC FLUID.

(1) Position container under engine pump case drain filters to catch residual hydraulic fluid.
(2) Remove hoses from unions and install protective covers on hoses.
(3) Remove unions and install protective covers on ports of filter.
(4) Remove screws, bolts, nuts, and washers attaching angled brackets to filter module and remove brackets.
(5) Remove screws and washers attaching filter module assembly to engine bracket and remove module.


NUT
WASHER
HOSE
HYDRAULIC BRACKET
UNION
RING
PACKING
BRACKET
WASHER
BOLT
NUT
WASHER
HOSE
UNION
RING
PACKING
PACKING
HOSE
PACKING
RING
UNION
HOSE
BRACKET
WASHER
NUT
WASHER
BOLT
BOLT
ENGINE PUMP DRAIN FILTERS
WASHER
BOLT
L-A656R (0000)
PW V

Engine Pump Case Drain Filter Modules
Figure 301
(Task 71−00−41−050−007)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-08

Task 71-00-41-050-008:

1. Remove Hydraulic Case Drain Filter

A. Equipment And Materials Required

Standard Tools:

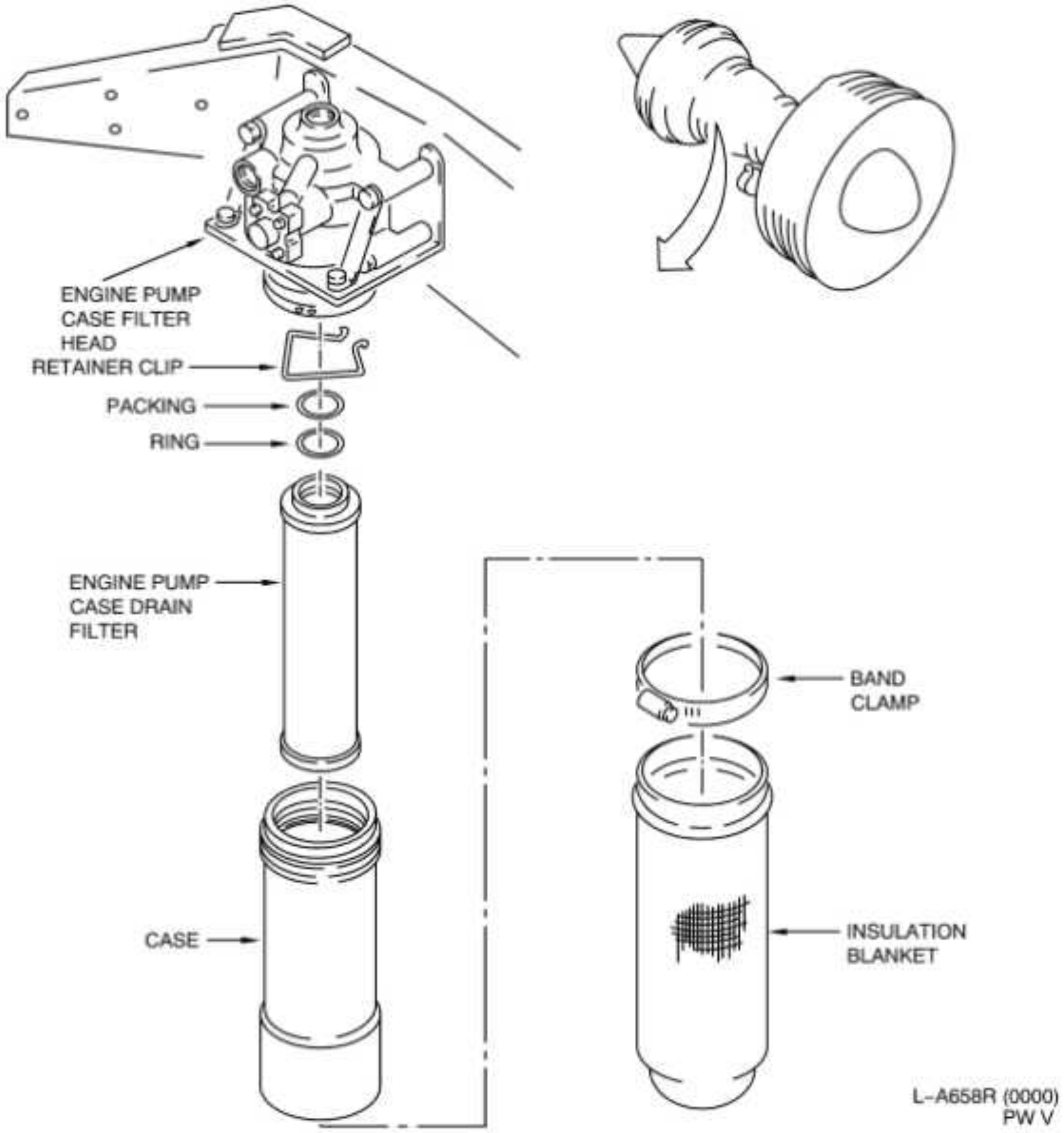
Name	Manufacturer
Container, approximately 2 U.S. gallons (7.57 l)	Local Purchase

B. Procedure
See Figure 301.

WARNING: HYDRAULIC FLUID MAY CAUSE EYE, NOSE, AND SKIN IRRITATION. AVOID PROLONGED BREATHING OF MIST OR VAPOR AND PROLONGED OR REPEATED CONTACT WITH SKIN. IF THERE IS A POSSIBILITY OF SPLASH, WEAR GOGGLES. PROTECTIVE GLOVES SHOULD BE WORN DURING USE TO PREVENT DRYING THE SKIN DUE TO CONTACT WITH HYDRAULIC FLUID.

(1) Loosen band clamp attaching filter blanket and remove blanket.
(2) Position container under filter case to allow catch residual hydraulic fluid.
(3) Remove lockwire and case from head of drain filter.
(4) Remove retainer clip, ring, packing and filter. Discard ring, packing and filter.

NOTE: For additional information concerning detailed maintenance of this component, see Filter Assembly Component Maintenance Manual, 29-12-02 (Purolator, Inc. PN 7578944).


ENGINE PUMP CASE FILTER HEAD
RETAINER CLIP
PACKING
RING
ENGINE PUMP CASE DRAIN FILTER
CASE
BAND CLAMP
INSULATION BLANKET
L−A658R (0000)
PW V

Hydraulic Case Drain Filter
Figure 301
(Task 71−00−41−050−008)

POWER PLANT GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-09

Task 71-00-41-050-009:

1. Remove Engine Pump Case Drain Filter Module Check Valve

A. Equipment And Materials Required

Standard Tools:

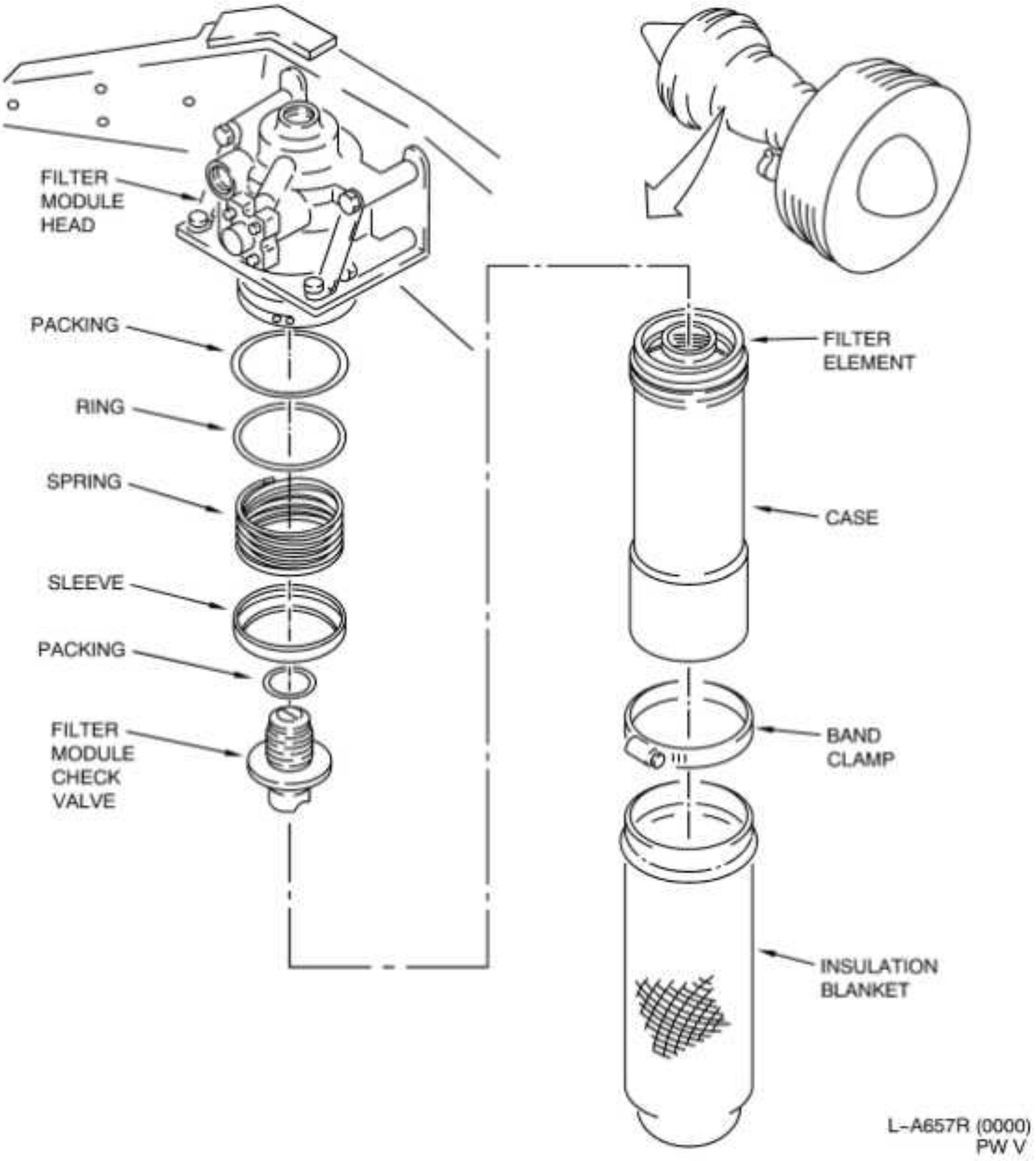
Name	Manufacturer
NSK1521, Fitting Tool	Purolator Inc. Aerospace Division 950 Rancho Conejo Blvd. Newbury Park, CA 91320
Container, approximately 2 U.S. gallons (7.57 l)	Local Purchase

B. Procedure
See Figure 301.

WARNING: HYDRAULIC FLUID MAY CAUSE EYE, NOSE, AND SKIN IRRITATION. AVOID PROLONGED BREATHING OF MIST OR VAPOR AND PROLONGED OR REPEATED CONTACT WITH SKIN. IF THERE IS A POSSIBILITY OF SPLASH, WEAR GOGGLES. PROTECTIVE GLOVES SHOULD BE WORN DURING USE TO PREVENT DRYING THE SKIN DUE TO CONTACT WITH HYDRAULIC FLUID.

(1) Position container under filter module to allow residual hydraulic fluid to drain during procedure.
(2) Loosen band clamp attaching filter insulation blanket and remove blanket and clamp.
(3) Remove lockwire and unscrew filter case from filter module.
(4) Using Fitting Tool NSK1521, remove filter module check valve, sleeve and spring from head of filter module.
(5) Remove packing from valve. Discard packing.
(6) Remove ring and packing from head of filter module. Discard packing.

NOTE: For additional information concerning detailed maintenance of this component, see Filter Assembly Component Maintenance Manual, 29-12-02 (Purolator, Inc. PN 7578944).


FILTER MODULE HEAD
PACKING
RING
SPRING
SLEEVE
PACKING
FILTER MODULE CHECK VALVE
FILTER ELEMENT
CASE
BAND CLAMP
INSULATION BLANKET
L−A657R (0000)
PW V

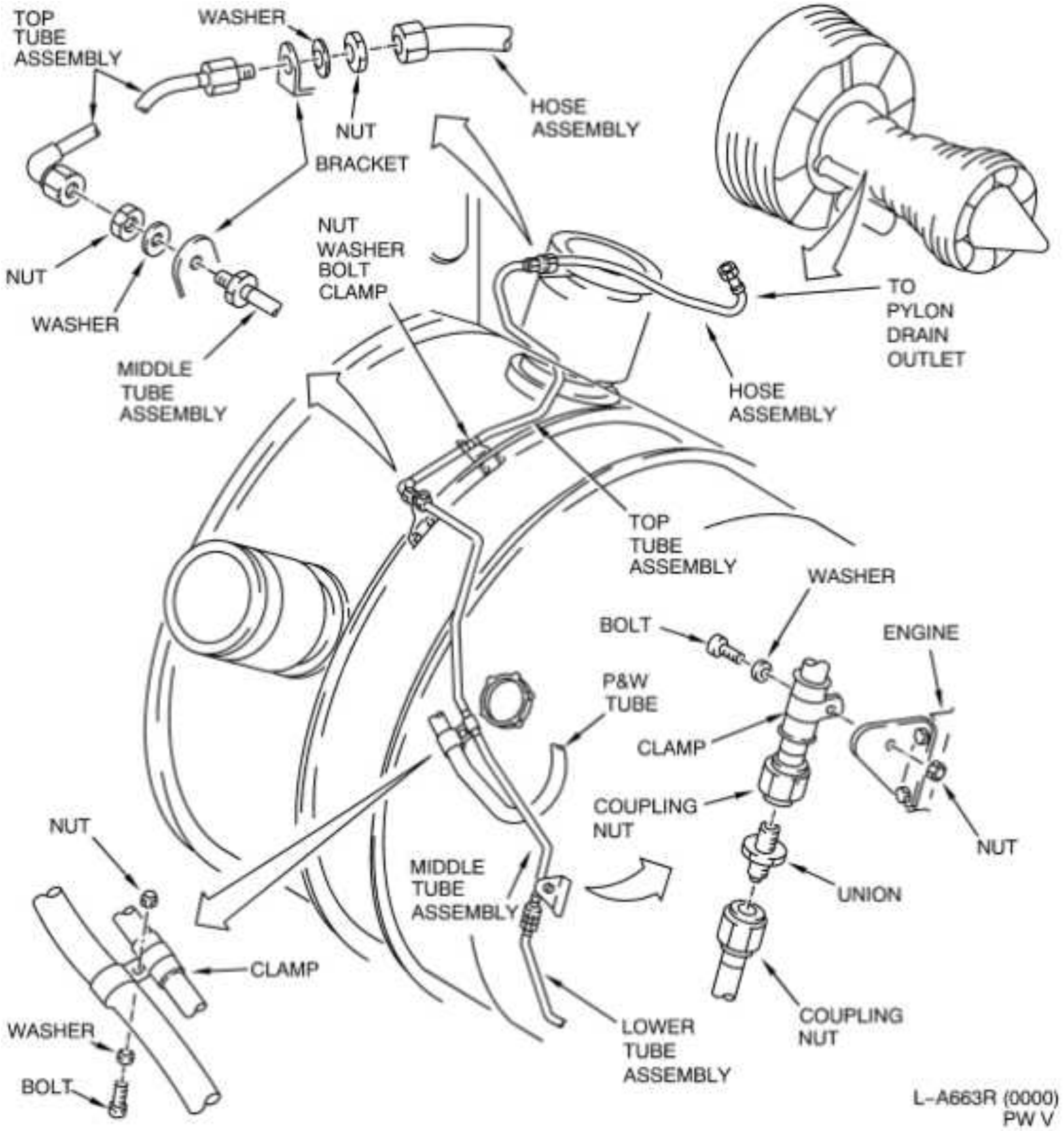
Engine Pump Case Drain Filter
Module Check Valve
Figure 301
(Task 71−00−41−050−009)

POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−10

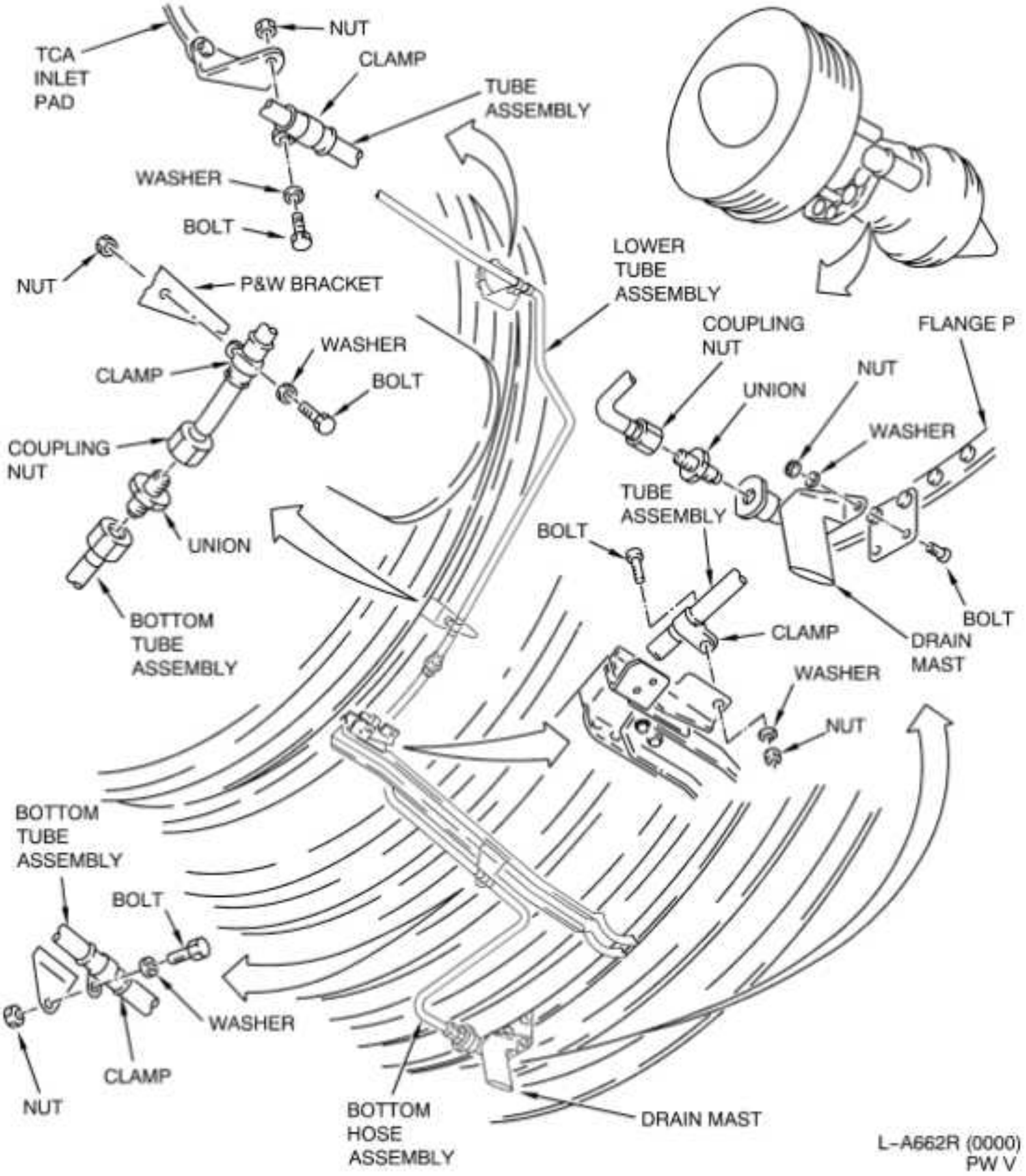
Task 71−00−41−050−010:

1. Remove Pylon Drain Tubing
   A. Equipment And Materials Required − None
   B. Procedure
      See Figures 301 and 302.
      (1) Remove hose assembly attached to top tube assembly.
      (2) Remove nut and washer attaching top tube assembly to bracket.
      (3) Disconnect top tube assembly coupling nut from middle tube assembly.
      (4) Remove nut, washer, and bolt from clamp attached to engine bracket and remove top tube assembly.
      (5) Remove nut and washer attaching middle tube assembly to engine bracket.
      (6) Remove nut, bolt and washer attaching middle tube assembly clamp to P&W tube assembly.
      (7) Remove nut, washer and bolt attaching middle tube assembly clamp to engine bracket.
      (8) Disconnect middle tube assembly coupling nut from union in lower tube assembly and remove middle tube assembly.
      (9) Remove union from lower tube assembly.
      (10) Remove nut washer and bolt attaching lower tube assembly to bracket installed on TCA inlet pad.
      (11) Remove nut, washer, and bolt attaching lower tube assembly clamp to P&W bracket.
      (12) Disconnect lower tube assembly coupling nut from bottom tube assembly and remove lower tube assembly.
      (13) Remove union from bottom tube assembly.
      (14) Disconnect bottom tube assembly coupling nut from drain mast.
      (15) Remove nuts, washers, and bolts attaching two bottom tube assembly clamps to engine brackets and remove bottom tube assembly.

POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−10


TOP TUBE ASSEMBLY
WASHER
NUT
HOSE ASSEMBLY
BRACKET
NUT
WASHER
MIDDLE TUBE ASSEMBLY
NUT
WASHER
BOLT
CLAMP
TO PYLON DRAIN OUTLET
HOSE ASSEMBLY
TOP TUBE ASSEMBLY
WASHER
BOLT
ENGINE
P&W TUBE
CLAMP
COUPLING NUT
NUT
UNION
NUT
CLAMP
MIDDLE TUBE ASSEMBLY
WASHER
BOLT
LOWER TUBE ASSEMBLY
COUPLING NUT
L-A663R (0000)
PW V

Pylon Drain Tubing
Figure 301
(Task 71−00−41−050−010)


TCA INLET PAD
NUT
CLAMP
TUBE ASSEMBLY
WASHER
BOLT
NUT
P&W BRACKET
LOWER TUBE ASSEMBLY
WASHER
CLAMP
BOLT
COUPLING NUT
UNION
BOTTOM TUBE ASSEMBLY
COUPLING NUT
FLANGE P
NUT
UNION
WASHER
TUBE ASSEMBLY
BOLT
BOLT
CLAMP
DRAIN MAST
WASHER
NUT
BOTTOM TUBE ASSEMBLY
BOLT
WASHER
CLAMP
NUT
BOTTOM HOSE ASSEMBLY
DRAIN MAST
L-A662R (0000)
PW V

Pylon Drain Tubing
Figure 302
(Task 71−00−41−050−010)

Task 71-00−41−450−004:

1. Install High Stage Temperature Sensor

A. Equipment And Materials Necessary

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lockwire (MS20995c32)		

B. Procedure
See Figure 401.

R CAUTION: BE CAREFUL WHEN YOU HANDLE, REMOVE OR INSTALL
R ALL TUBES WHICH CONTAIN A FLEX DESIGN
R SEGMENT. REMOVE AND INSTALL A TUBE WITH A
R FLEX SEGMENT WITH THE SAME PRECAUTIONS
R USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO
R NOT BEND THE FLEXHOSE OF A TUBE TO HELP
R WITH THE INSTALLATION OR REMOVAL OF AN
R ATTACHED COMPONENT. IF A FLEX SEGMENT IS
R BENT TOO MUCH, THIS CAN CAUSE A KINK IN
R THE EXTERNAL WIRE BRAID AND IN THE INNER
R POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS
R OR TUBE RUPTURE CAN BE THE RESULT.

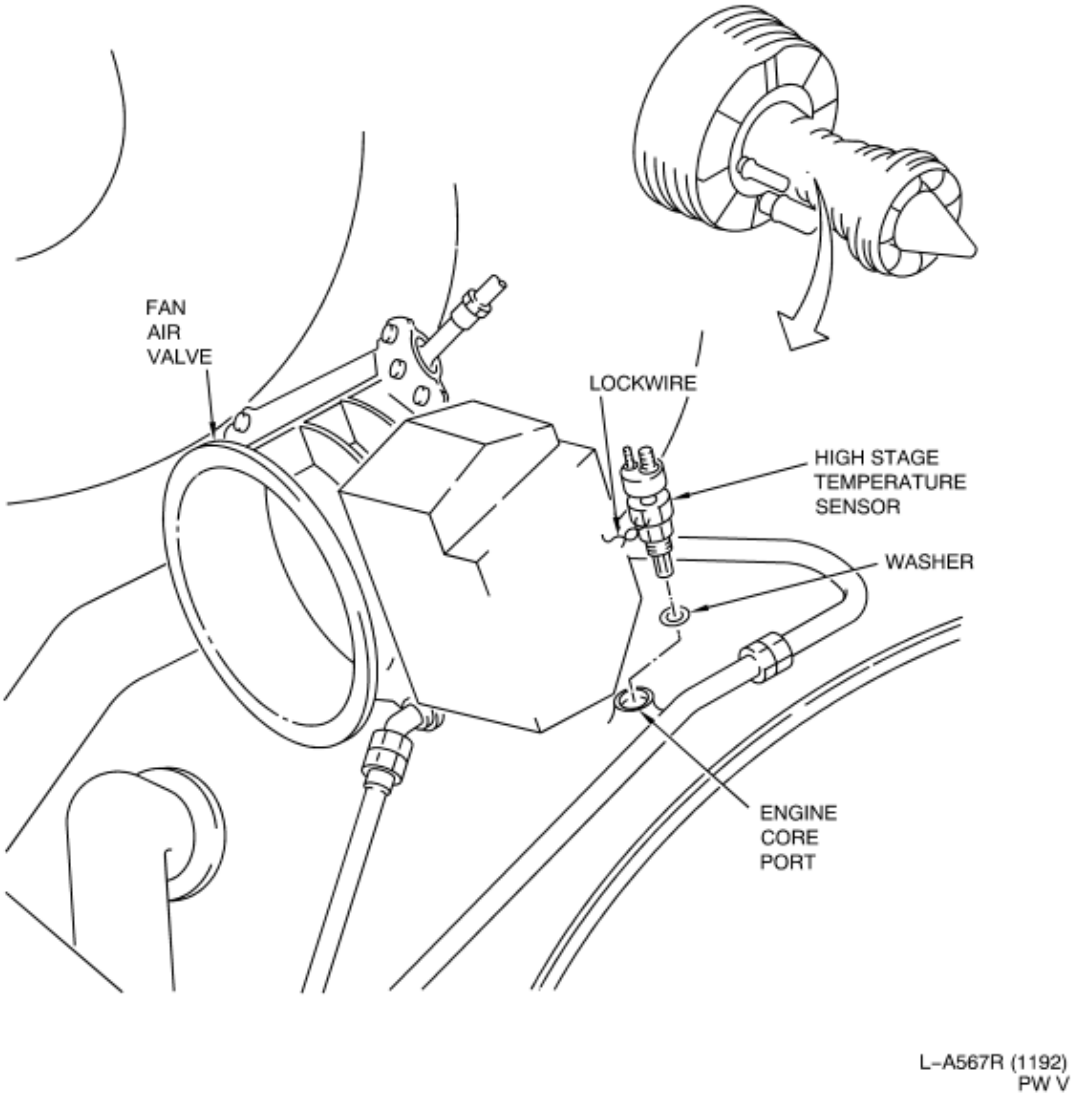
(1) Remove protective cover over engine core port.

(2) Install sensor and washer in port.

(3) Torque the lower sensor nut to 95 − 110 lb-in. (10.734 − 12.428 N.m).

(4) Torque the upper sensor nut to 70 − 80 lb−in. (7.909 − 9.039 N.m).

(5) Install lockwire between both sensor nuts and port.


FAN
AIR
VALVE
LOCKWIRE
HIGH STAGE
TEMPERATURE
SENSOR
WASHER
ENGINE
CORE
PORT
L–A567R (1192)
PW V

High Stage Temperature Sensor Installation
Figure 401
(Task 71–00–41–450–004)

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POWER PLANT GENERAL - DIFFUSER AND COMBUSTOR - INSTALLATION-05

Task 71-00-41-450-005:

1. Install Engine Bleed Air Ducting
   A. Equipment And Materials Required

Special Tools:
RSE1101 PW Alignment Tool

Consumable Materials:

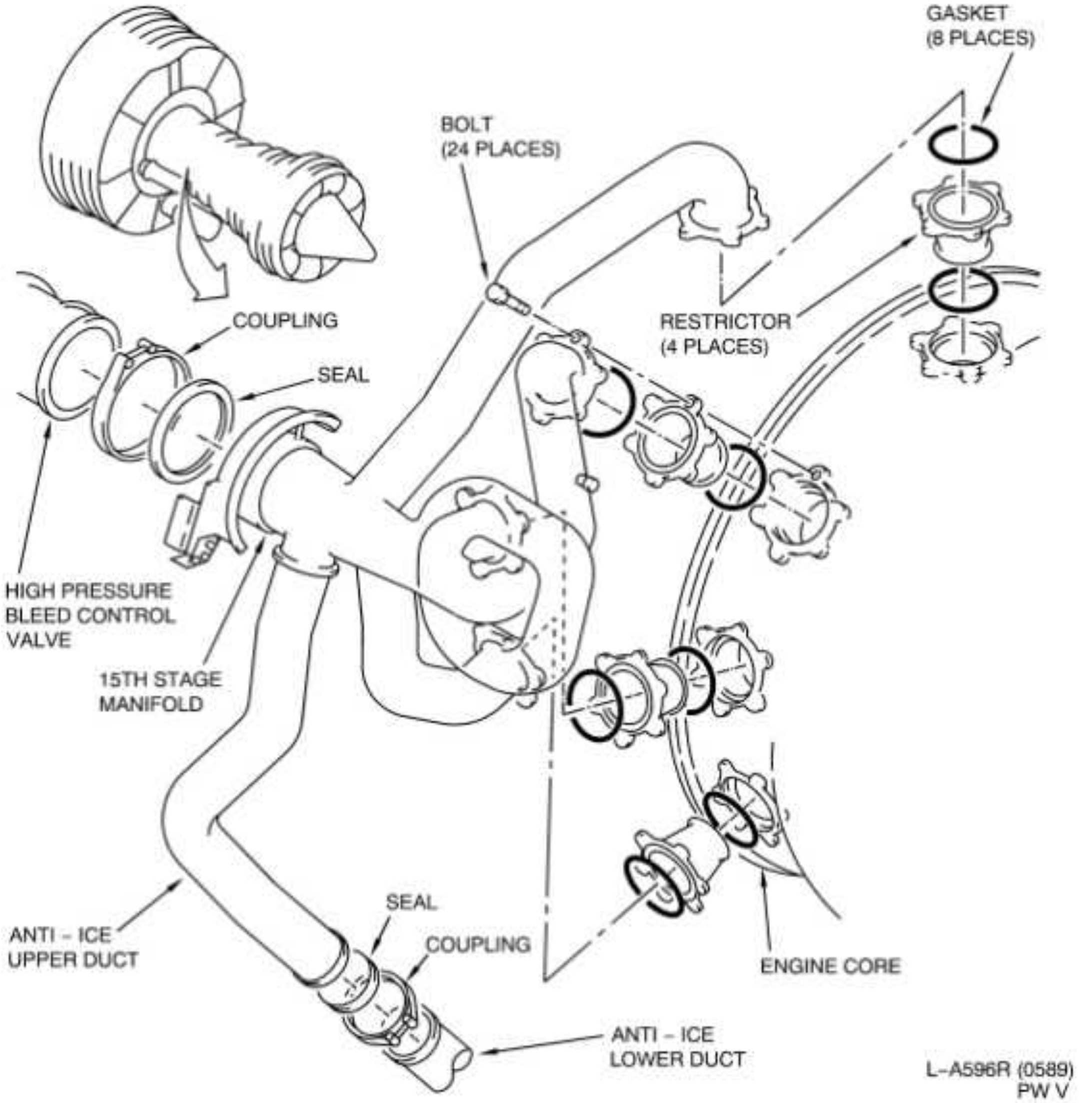
Item No.	Designation
P03-005	Lubricating Oil
P06-013	Solid Film Lubricant

Expendable Parts:

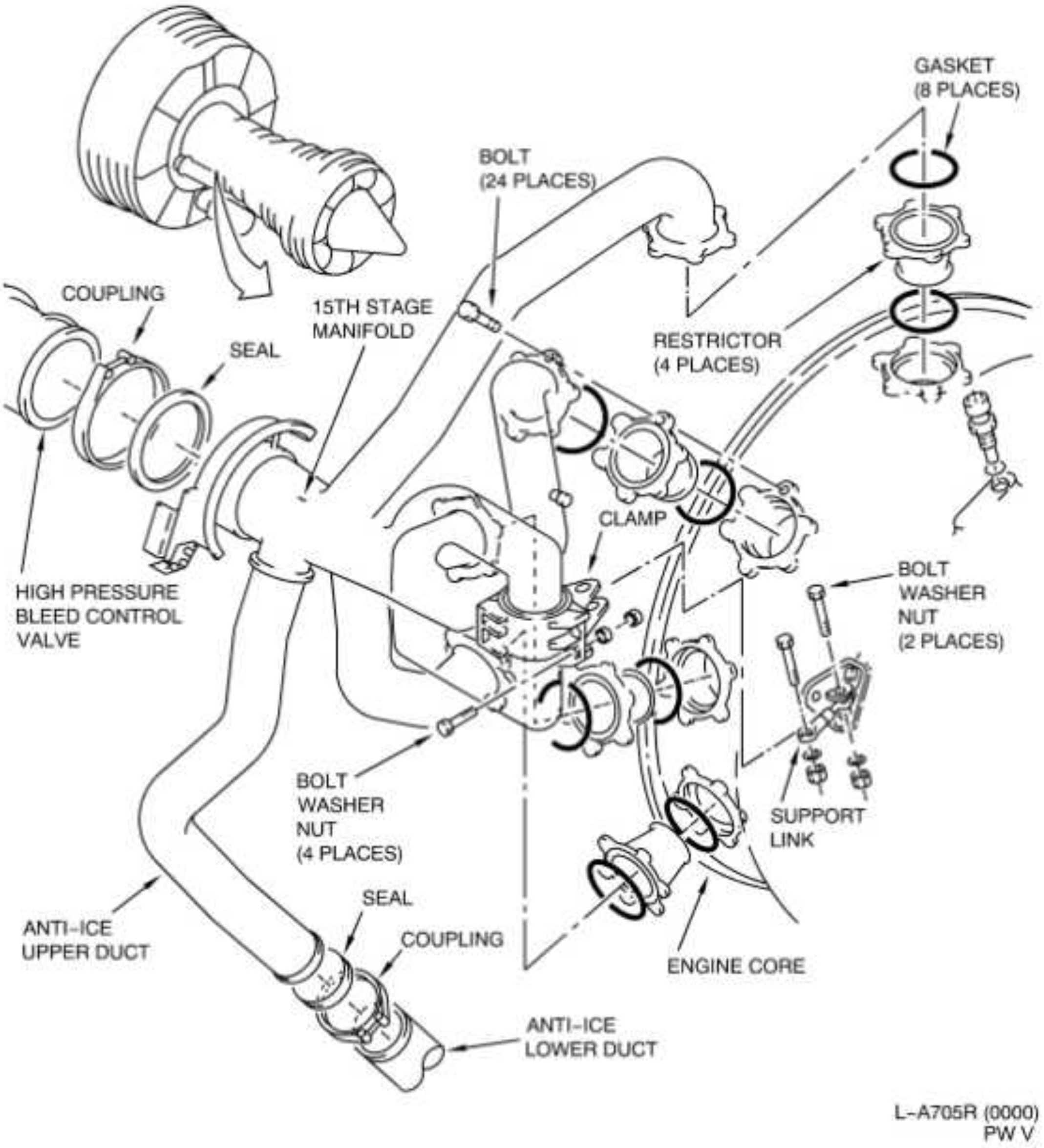
PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Lockwire, MS20995N20		As Required		

B. Procedure
(1) Install 15th stage manifold. See Figures 401, 402 and 403.

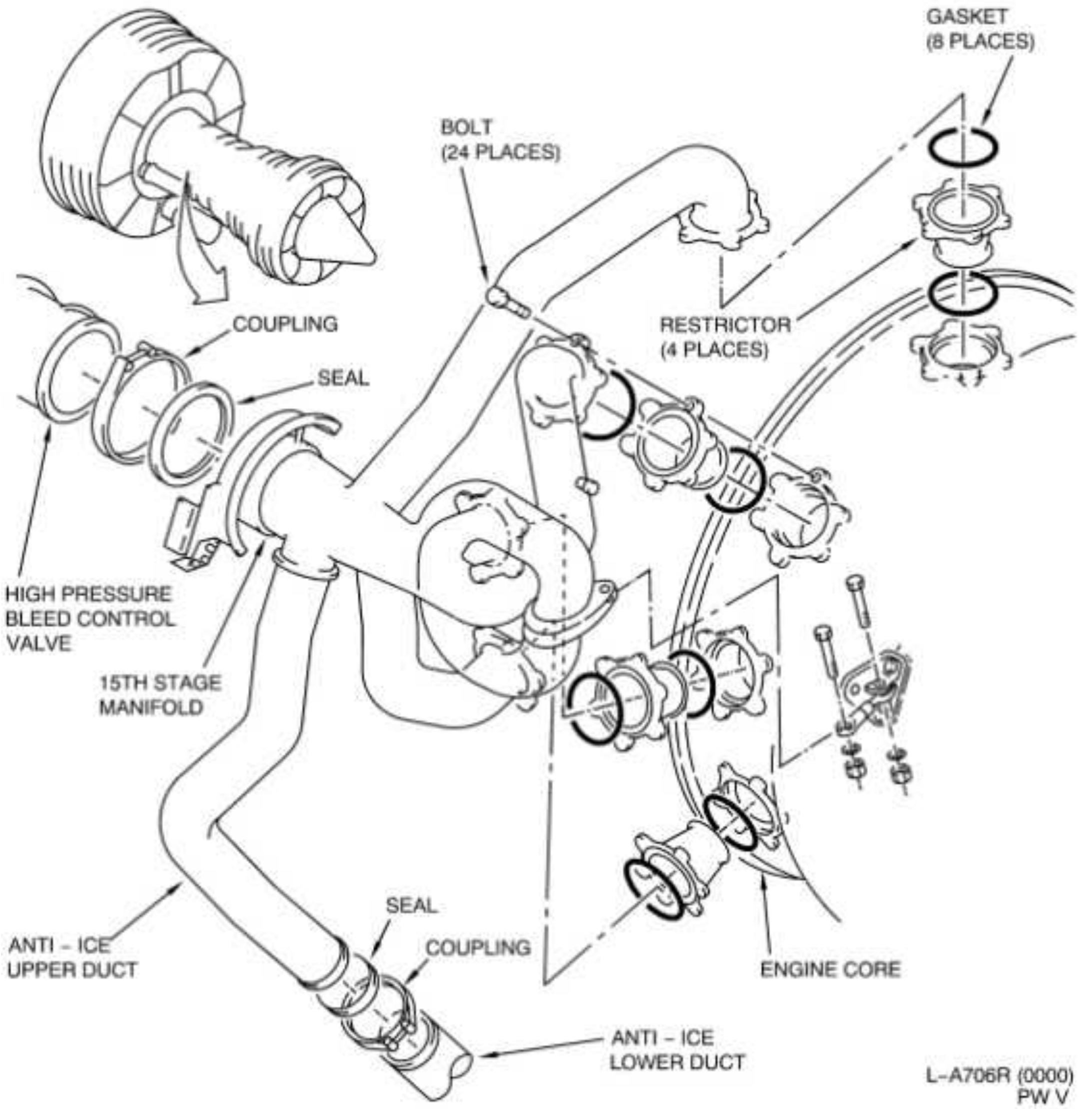
(a) Install gaskets, flow restrictors, and 15th stage manifold with anti-ice upper duct attached on engine core with bolts lubricated with Lubricating Oil (P03-005).
(b) Torque bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m) and lockwire bolts.
(c) Lubricate inside surface of coupling with Solid Film Lubricant (P06-013) and install seal and coupling attaching 15th stage manifold to high pressure bleed control valve. Tighten coupling fingertight.
(d) Lubricate inside surface of coupling with Solid Film Lubricant (P06-013) and install seal and coupling attaching upper anti-ice duct to lower anti-ice duct. Tighten coupling fingertight.
(e) For engines incorporating additional pneumatic duct support link (Post SB PWNAC 36-4, Pre SB PWNAC 36-8), position the upper and lower clamp halves on the manifold and attach with four bolts, washers and nuts. Tighten nuts fingertight. Ensure clamp bearing surfaces do not bear on the manifold weld bead. See Figure 402.


GASKET
(8 PLACES)
BOLT
(24 PLACES)
COUPLING
SEAL
RESTRICTOR
(4 PLACES)
HIGH PRESSURE
BLEED CONTROL
VALVE
15TH STAGE
MANIFOLD
ANTI - ICE
UPPER DUCT
SEAL
COUPLING
ENGINE CORE
ANTI - ICE
LOWER DUCT
L-A596R (0589)
PW V

Fifteenth Stage Manifold Installation
(Pre SB PWNAC 36−6)
Figure 401
(Task 71−00−41−450−005)


GASKET
(8 PLACES)
BOLT
(24 PLACES)
COUPLING
15TH STAGE
MANIFOLD
SEAL
RESTRICTOR
(4 PLACES)
CLAMP
HIGH PRESSURE
BLEED CONTROL
VALVE
BOLT
WASHER
NUT
(2 PLACES)
BOLT
WASHER
NUT
(4 PLACES)
SUPPORT
LINK
ANTI−ICE
UPPER DUCT
SEAL
COUPLING
ENGINE CORE
ANTI−ICE
LOWER DUCT
L−A705R (0000)
PW V

Fifteenth Stage Manifold Installation
(Post SB PWNAC 36−4, Pre SB PWNAC 36−8)
Figure 402
(Task 71−00−41−450−005)


GASKET
(8 PLACES)
BOLT
(24 PLACES)
COUPLING
SEAL
RESTRICTOR
(4 PLACES)
HIGH PRESSURE
BLEED CONTROL
VALVE
15TH STAGE
MANIFOLD
ANTI - ICE
UPPER DUCT
SEAL
COUPLING
ENGINE CORE
ANTI - ICE
LOWER DUCT
L-A706R (0000)
PW V

Fifteenth Stage Manifold Installation
(Post SB PWNAC 36−8)
Figure 403
(Task 71−00−41−450−005)

(f) For engines incorporating addition pneumatic duct support link (Post SB PWNAC 36−4 and SB PWNAC 36−8), adjust support link to nominal length of 3.10 inches (78.74 mm) and attach to manifold clamp/bracket with bolt, washer and nut. Torque bolt 50 − 70 lb−in. (7.3 − 9.6 N.m). See Figures 402 and 403.

(g) For engines incorporating additional pneumatic duct support link (Post SB PWNAC 36−4 and SB PWNAC 36−8), attach support link with bolt, washer and nut to engine core bracket. Torque bolt 50 − 70 lb−in. (5.7 − 7.9 N.m). Adjust manifold clamp as required to achieve in−line position for link to engine core bracket. See Figures 402 and 403.

(h) For engines incorporating additional pneumatic duct support link (Post SB PWNAC 36−4, Pre SB PWNAC 36−8), torque four manifold clamp bolts 45 − 55 lb−in. (5.1 − 6.2 N.m). See Figure 402.

(2) Install left 8th stage and mid−stage ducts. See Figure 404.

(a) Install ground cable support bracket, gasket and left 8th stage duct with mid−stage duct and check valve attached to engine core with bolts lubricated with Lubricating Oil (P03−005). Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m) and lockwire bolts.

(b) Lubricate inside surface of coupling with Solid Film Lubricant (P06−013) and attach mid−stage duct and seal to high pressure bleed valve. Tighten coupling fingertight.

(c) Lubricate inside surface of coupling and attach mid−stage duct and seal to pressure regulating valve. Tighten coupling fingertight.

(d) Adjust support link to nominal length of 4.50 inches (114.300 mm) and attach to mid−stage and 8th stage duct with bolt, washers, and nuts. Torque bolts to 50 − 70 lb−in. (5.649 − 7.909 N.m).

(e) Apply one−half turn of tension adjustment to support link and torque locking nut to 100 − 140 lb−in. (11.298 − 15.818 N.m).

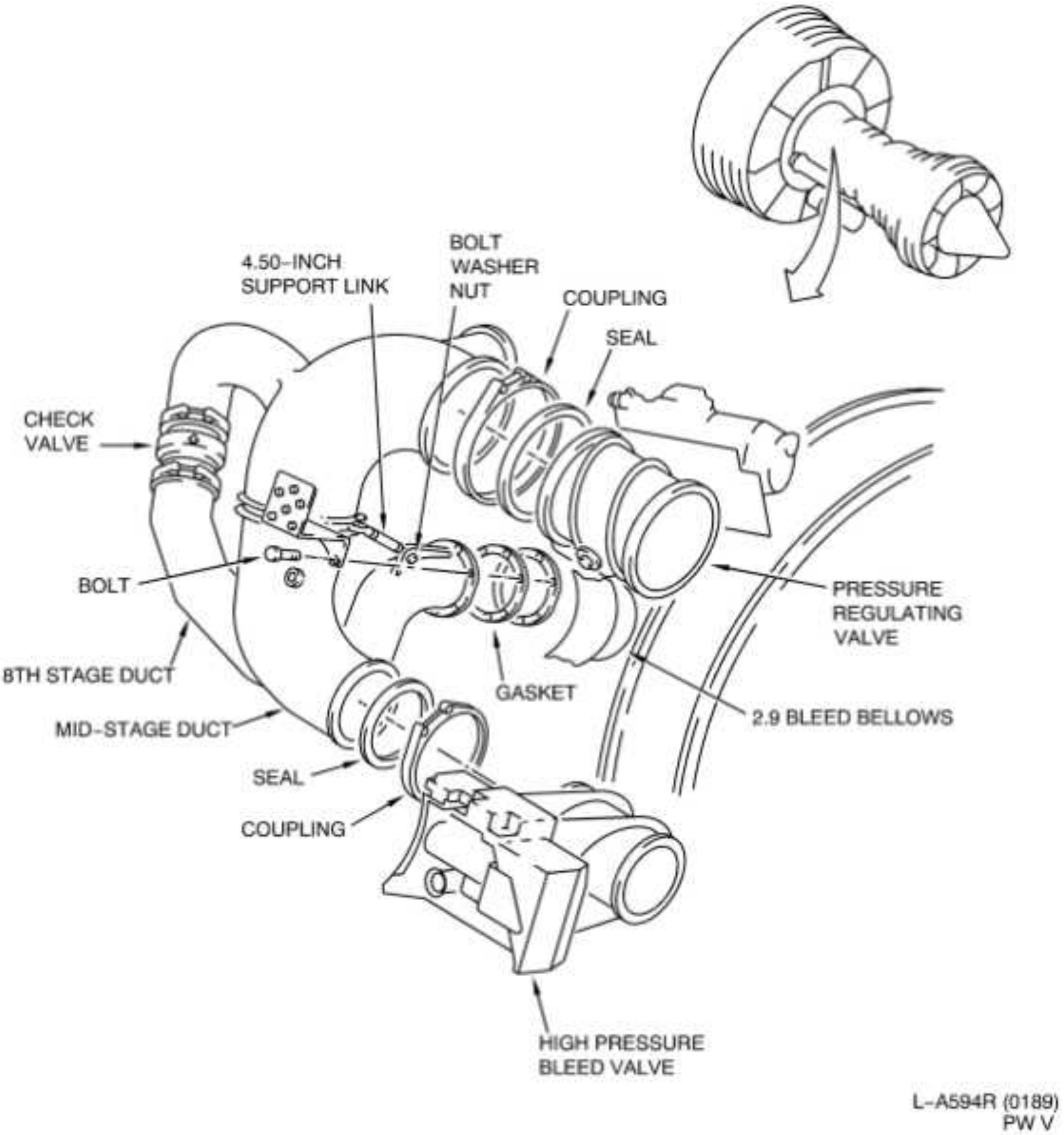
(3) Install RSE1101 Alignment Tool. See Figure 405.

(a) Install RSE1101 Alignment Tool on engine forward mount pad.

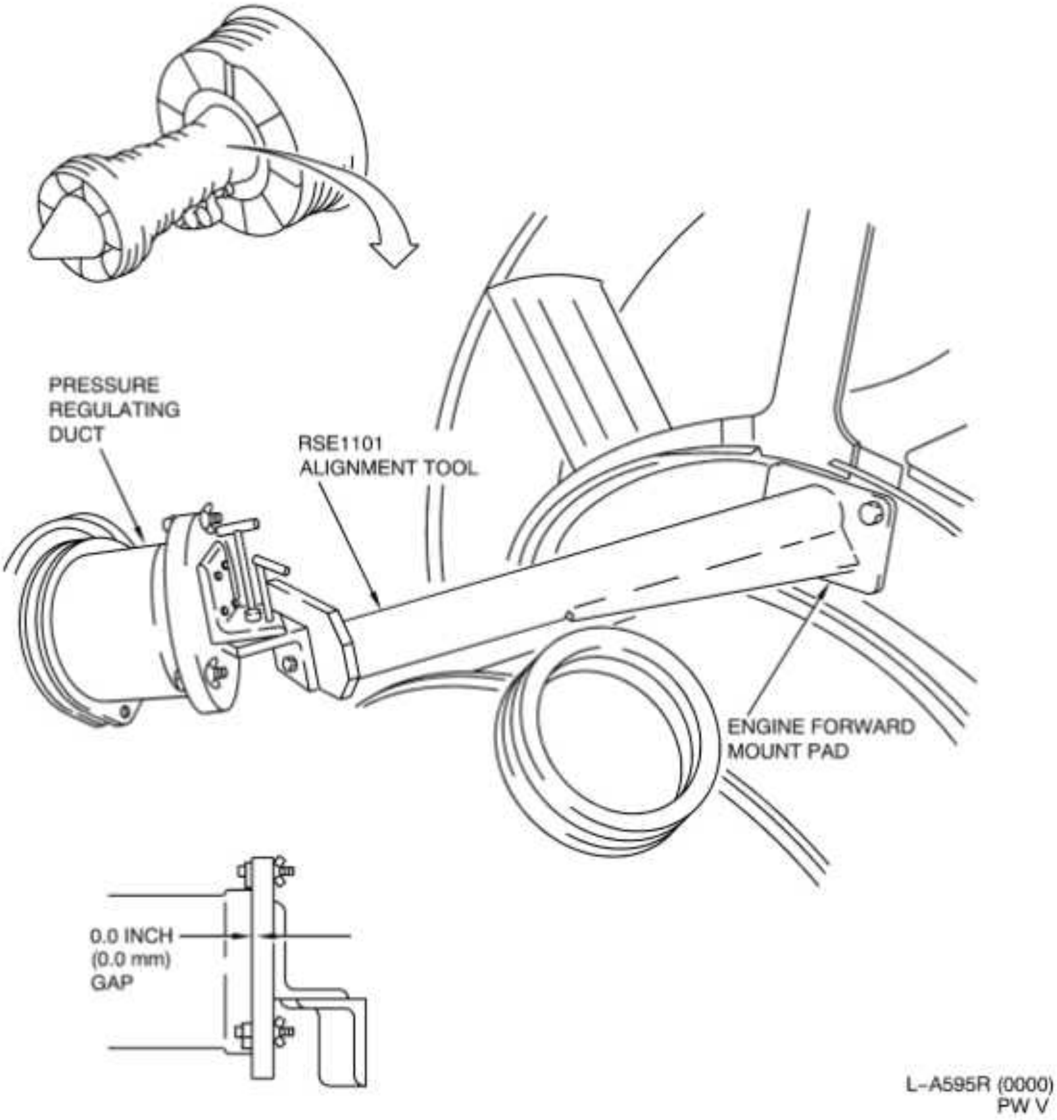
(b) Install pressure regulating duct on alignment tool with 0.0 inch (0.0 mm) gap between alignment tool plate and duct.

(4) Install pressure regulating duct. See Figure 406.

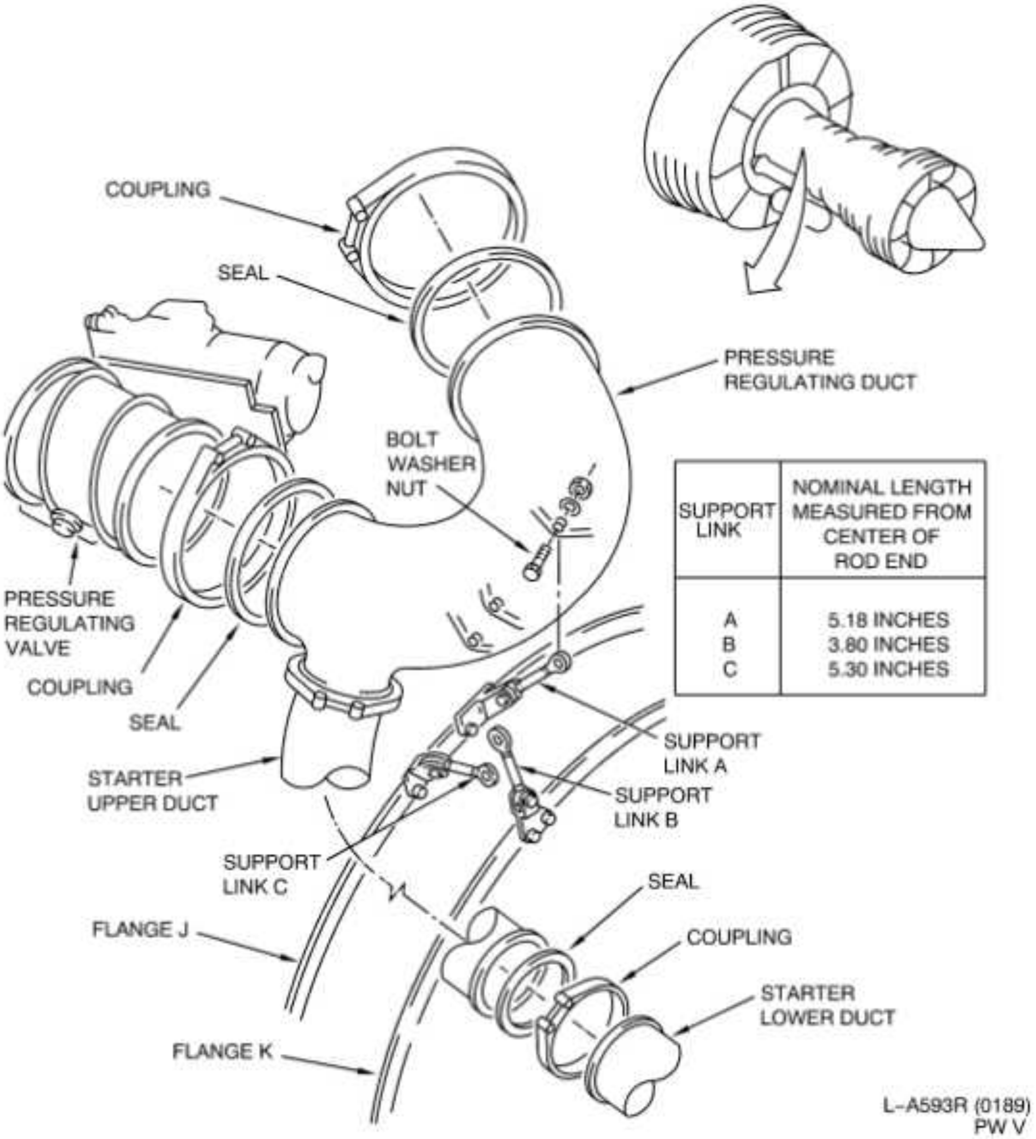
(a) Adjust support Links A, B, and C to nominal lengths shown on Figure 402.


4.50-INCH SUPPORT LINK
BOLT
WASHER
NUT
COUPLING
SEAL
CHECK VALVE
BOLT
8TH STAGE DUCT
MID-STAGE DUCT
SEAL
COUPLING
PRESSURE REGULATING VALVE
GASKET
2.9 BLEED BELLOWS
HIGH PRESSURE BLEED VALVE
L-A594R (0189)
PW V

Left 8th Stage And Mid−Stage Ducts Installation
Figure 404
(Task 71−00−41−450−005)


PRESSURE
REGULATING
DUCT
RSE1101
ALIGNMENT TOOL
ENGINE FORWARD
MOUNT PAD
0.0 INCH
(0.0 mm)
GAP
L−A595R (0000)
PW V

Alignment Tool And Regulated Pressure Elbow
Figure 405
(Task 71−00−41−450−005)


COUPLING
SEAL
PRESSURE REGULATING DUCT
BOLT
WASHER
NUT
PRESSURE REGULATING VALVE
COUPLING
SEAL
STARTER UPPER DUCT
SUPPORT LINK A
SUPPORT LINK B
SUPPORT LINK C
FLANGE J
FLANGE K
SEAL
COUPLING
STARTER LOWER DUCT
L−A593R (0189)
PW V

SUPPORT LINK	NOMINAL LENGTH MEASURED FROM CENTER OF ROD END
A	5.18 INCHES
B	3.80 INCHES
C	5.30 INCHES

Pressure Regulating Duct Installation
Figure 406
(Task 71−00−41−450−005)

(b) Attach support links to flange brackets with bushing, bolt, washer and nut. Torque nuts 50 − 70 lb−in. (5.649 − 7.909 N.m).

(c) Lubricate inside surfaces of coupling with Solid Film Lubricant (P06−013) and attach seal and pressure regulating duct, with starter upper duct attached, to pressure regulating valve. Tighten coupling fingertight.

(d) Lubricate inside surfaces of coupling with Solid Film Lubricant (P06−013) and attach seal and starter upper duct to starter lower duct. Tighten coupling fingertight.

NOTE: Additional coupling and seal are to be used to attach pressure regulating duct to pylon interface duct when the engine is mounted on the aircraft pylon.

(5) Install right 8th stage duct. See Figures 407, 408 and 409.

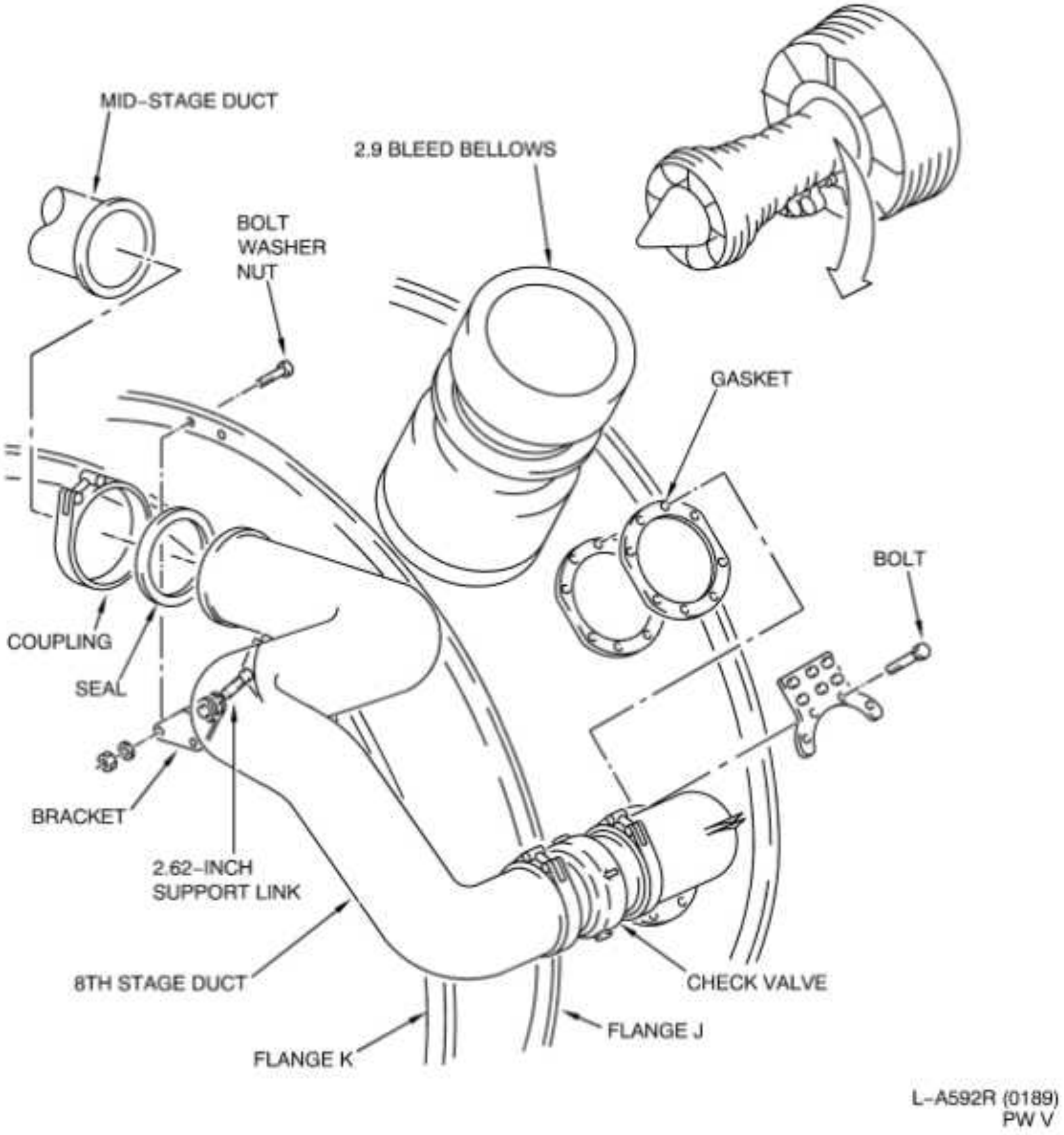
(a) Install ground cable support bracket, 8th stage duct with check valve and elbow attached, and gasket with bolts lubricated with Lubricating Oil (P03−005) to engine core. Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(b) Lubricate inside surfaces of coupling with Solid Film Lubricant (P06−013) and attach 8th stage duct and seal to mid−stage duct. Tighten coupling fingertight.

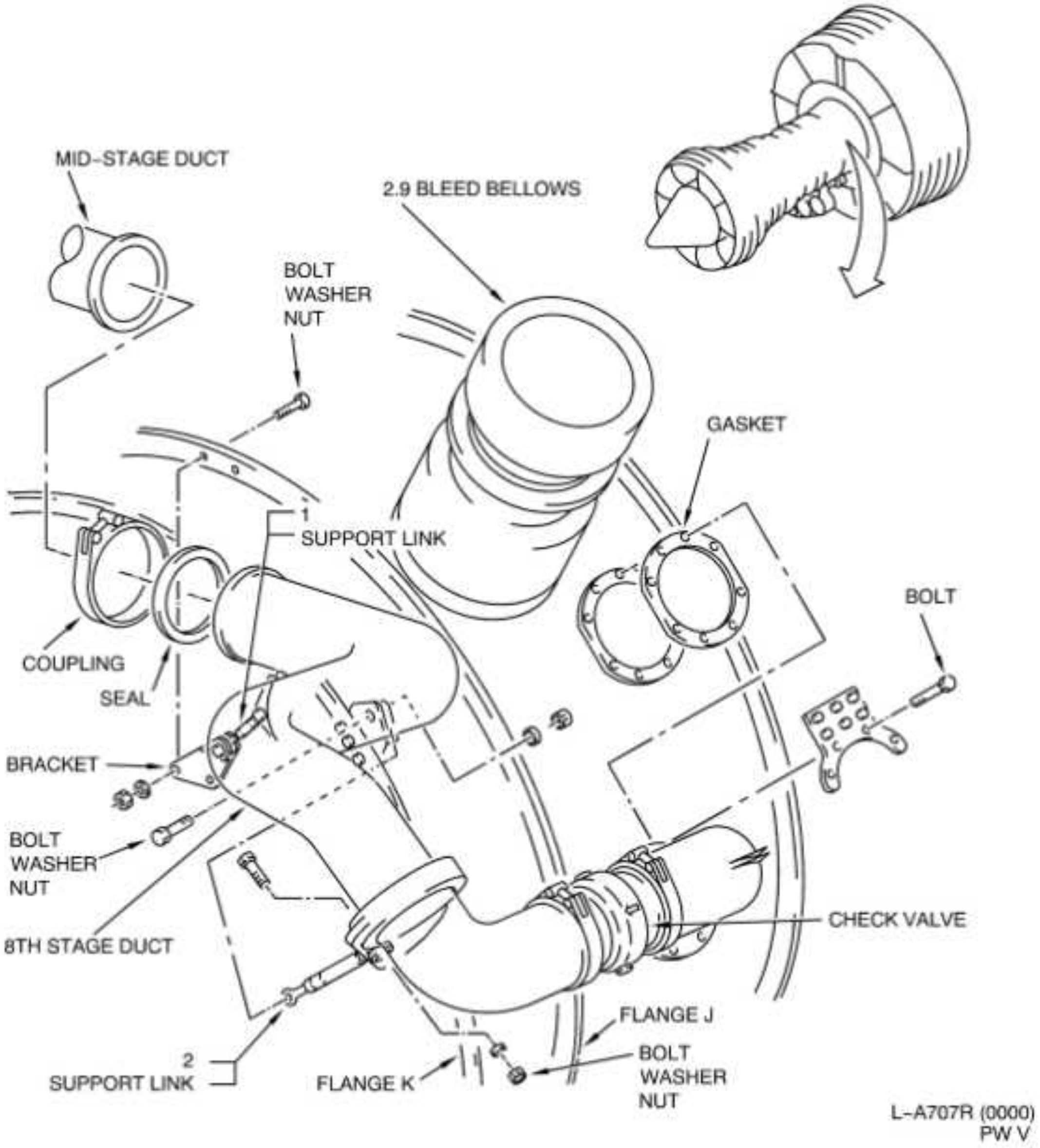
(c) Adjust support link to 2.62 inches (66.55 mm) and attach bracket to Flange J with bolt, washer and nut. Torque nut to 50 − 70 lb−in. (5.649 − 7.909 N.m).

(d) For engines incorporating additional pneumatic duct support link (Post SB PWNAC 36−6, Pre SB PWNAC 36−9), position the upper and lower halves of clamp on 8th stage manifold and attach with two bolts, washers and nuts. Tighten nuts fingertight. See Figure 408.

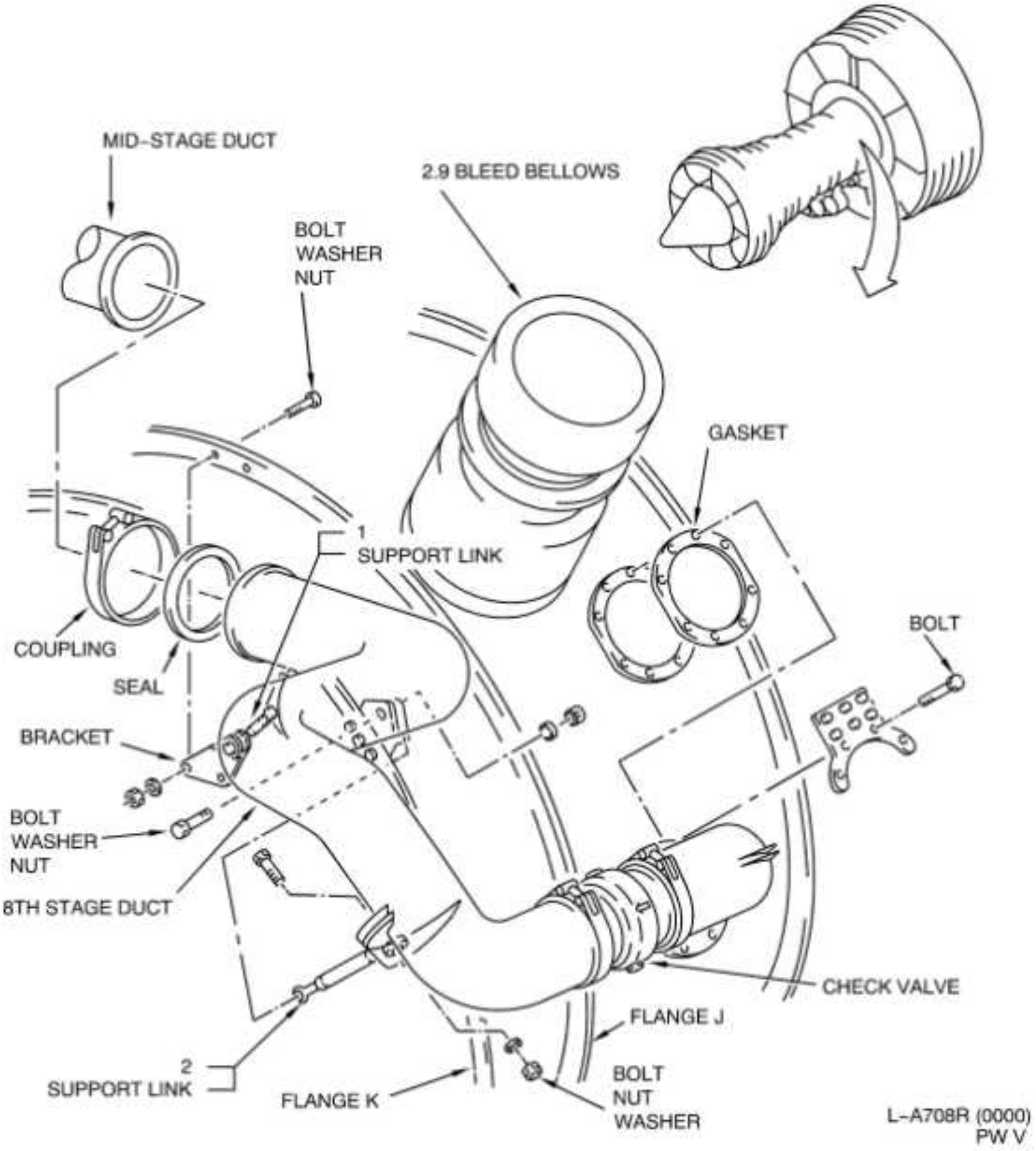
(e) For engines incorporating additional pneumatic duct support link (Post SB PWNAC 36−6 and SB PWNAC 36−9), attach support link (2) to manifold clamp/bracket with bolt, washer and nut. See Figures 408 and 409.


MID-STAGE DUCT
2.9 BLEED BELLOWS
BOLT
WASHER
NUT
GASKET
BOLT
COUPLING
SEAL
BRACKET
2.62-INCH
SUPPORT LINK
8TH STAGE DUCT
CHECK VALVE
FLANGE J
FLANGE K
L-A592R (0189)
PW V

Right 8th Stage Duct Installation
(Pre SB PWNAC 36−6)
Figure 407
(Task 71−00−41−450−005)


MID-STAGE DUCT
2.9 BLEED BELLOWS
BOLT
WASHER
NUT
GASKET
1
SUPPORT LINK
BOLT
COUPLING
SEAL
BRACKET
BOLT
WASHER
NUT
8TH STAGE DUCT
CHECK VALVE
FLANGE J
BOLT
WASHER
NUT
2
SUPPORT LINK
FLANGE K
L-A707R (0000)
PW V

Right 8th Stage Duct Installation
(Post SB PWNAC 36−6, Pre SB PWNAC 36−9)
Figure 408
(Task 71−00−41−450−005)


MID−STAGE DUCT
2.9 BLEED BELLOWS
BOLT
WASHER
NUT
GASKET
1
SUPPORT LINK
BOLT
COUPLING
SEAL
BRACKET
BOLT
WASHER
NUT
8TH STAGE DUCT
CHECK VALVE
FLANGE J
2
SUPPORT LINK
FLANGE K
BOLT
NUT
WASHER
L−A708R (0000)
PW V

Right 8th Stage Duct Installation
(Post SB PWNAC 36−6, And SB PWNAC 36−9)
Figure 409
(Task 71−00−41−450−005)

(f) For engines incorporating additional pneumatic duct support link (Post SB PWNAC 36−6 and SB PWNAC 36−9), adjust support link for no−preload length, plus one−half turn in the tension direction, and attach to support bracket on engine Flange K with bolt, washer and nut. Adjust manifold clamp as required to achieve in−line position for link to engine flange bracket. See Figures 408 and 409.

(g) For engines incorporating additional pneumatic duct support link (Post SB PWNAC 36−6 and SB PWNAC 36−9), torque bolts installed in steps (e) and (f) to 50 − 70 lb−in. (7.3 − 9.6 N.m). See Figures 408 and 409.

(h) For engines incorporating additional pneumatic duct support link (Post SB PWNAC 36−6, Pre SB PWNAC 36−9), tighten two bolts on manifold clamp to 45 − 55 lb−in. (5.1 − 6.2 N.m). Maintain 0.050 − 0.110 inch (1.27 − 2.79 mm) gap between clamp halves. See Figure 408.

(6) Torque all couplings installed fingertight to value indicated on couplings. Tap outer perimeter of couplings with plastic mallet while tightening.

(7) Adjust all support links to a no−preload condition, then add one−half turn of tension adjustment to support links and torque locking nuts to 100 − 140 lb−in. (11.298 − 15.818 N.m).

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - DIFFUSER AND COMBUSTOR - INSTALLATION-06

Task 71-00-41-450-006:

1. Install Fuel Flow Transmitter

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Engine Oil
P06-053	Lubricant, Seal Ring (PWA 36500)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	XX/XX/XX
Lockwire (MS20995C32)		

B. Procedure
See Figure 401.

(1) Lubricate new packing with Seal Ring Lubricant P06-053.

(2) Install packing on F3 adapter.

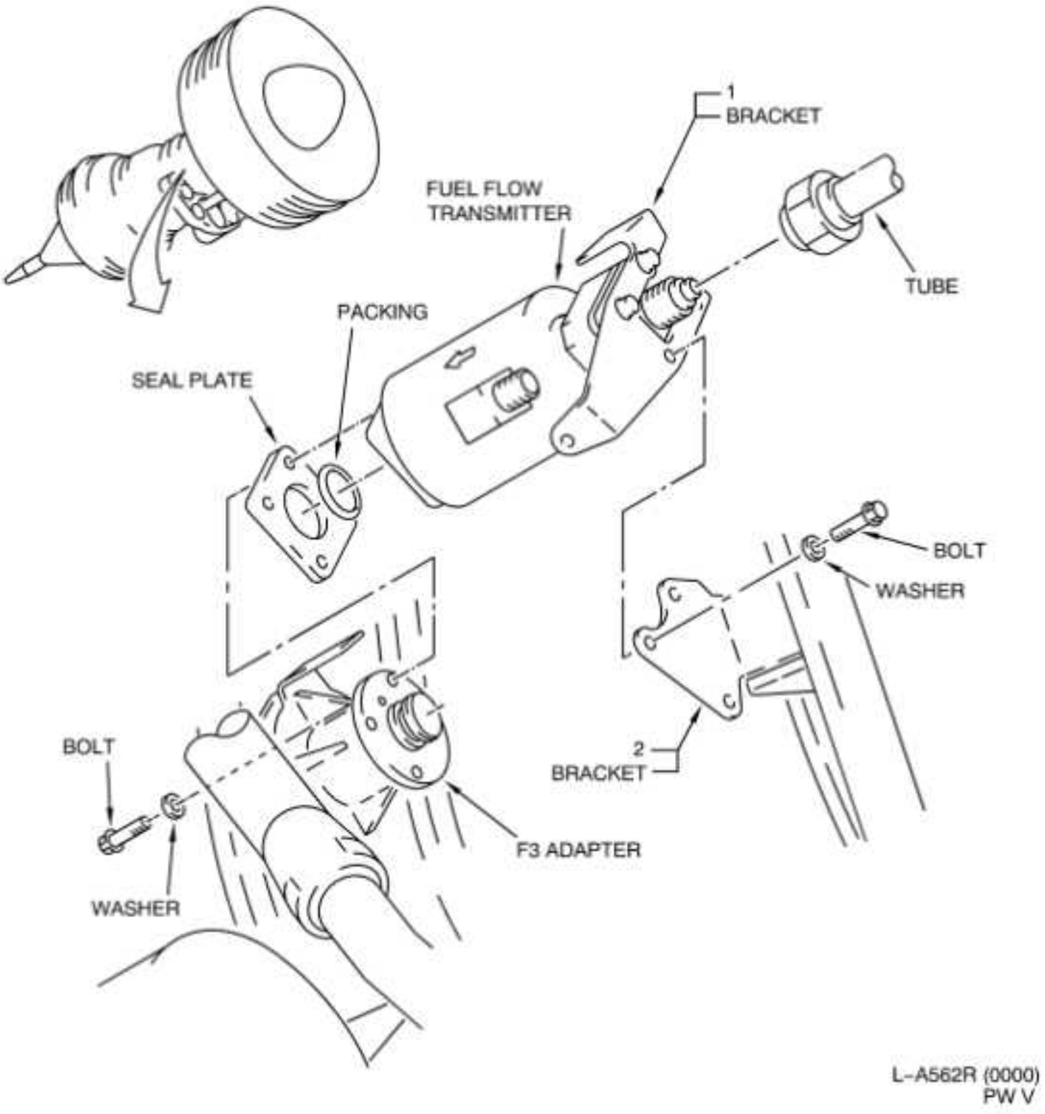
(3) Install transmitter with bracket and adapter attached on F3 adapter using four bolts and washers.

(4) Torque bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Lockwire bolts.

(5) Attach bracket (401/1) to bracket (401/2) with two bolts and washers. Torque bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Lockwire bolts.

(6) Connect tube to adapter threads lubricated with Engine Oil P03-001 on fuel flow transmitter.

(7) Torque the tube nut to 100 - 110 lb-in. (11.298 - 12.428 N.m), loosen the tube nut. Torque the tube nut again to the specified limit. Lockwire tube nut.


1
BRACKET
FUEL FLOW TRANSMITTER
TUBE
PACKING
SEAL PLATE
BOLT
WASHER
2
BRACKET
BOLT
F3 ADAPTER
WASHER
L-A562R (0000)
PW V

Fuel Flow Transmitter Installation
Figure 401
(Task 71-00-41-450-006)

POWER PLANT GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−07

Task 71−00−41−450−007:

1. Install Engine Pump Case Drain Filter Modules

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P02−001	Hydraulic Fluid

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing NAS1612−6	4	
Lockwire, MS20995C32	AR	

B. Procedure
See Figure 401.

WARNING: HYDRAULIC FLUID MAY CAUSE EYE, NOSE, AND SKIN IRRITATION. AVOID PROLONGED BREATHING OF MIST OR VAPOR AND PROLONGED OR REPEATED CONTACT WITH SKIN. IF THERE IS A POSSIBILITY OF SPLASH, WEAR GOGGLES. PROTECTIVE GLOVES SHOULD BE WORN DURING USE TO PREVENT DRYING THE SKIN DUE TO CONTACT WITH HYDRAULIC FLUID.

(1) Install engine pump case drain filter module with screw and washers. Tighten screws fingertight only.

(2) Install angle brackets with bolts, screws, washers and nuts. Tighten screws and bolts fingertight only.

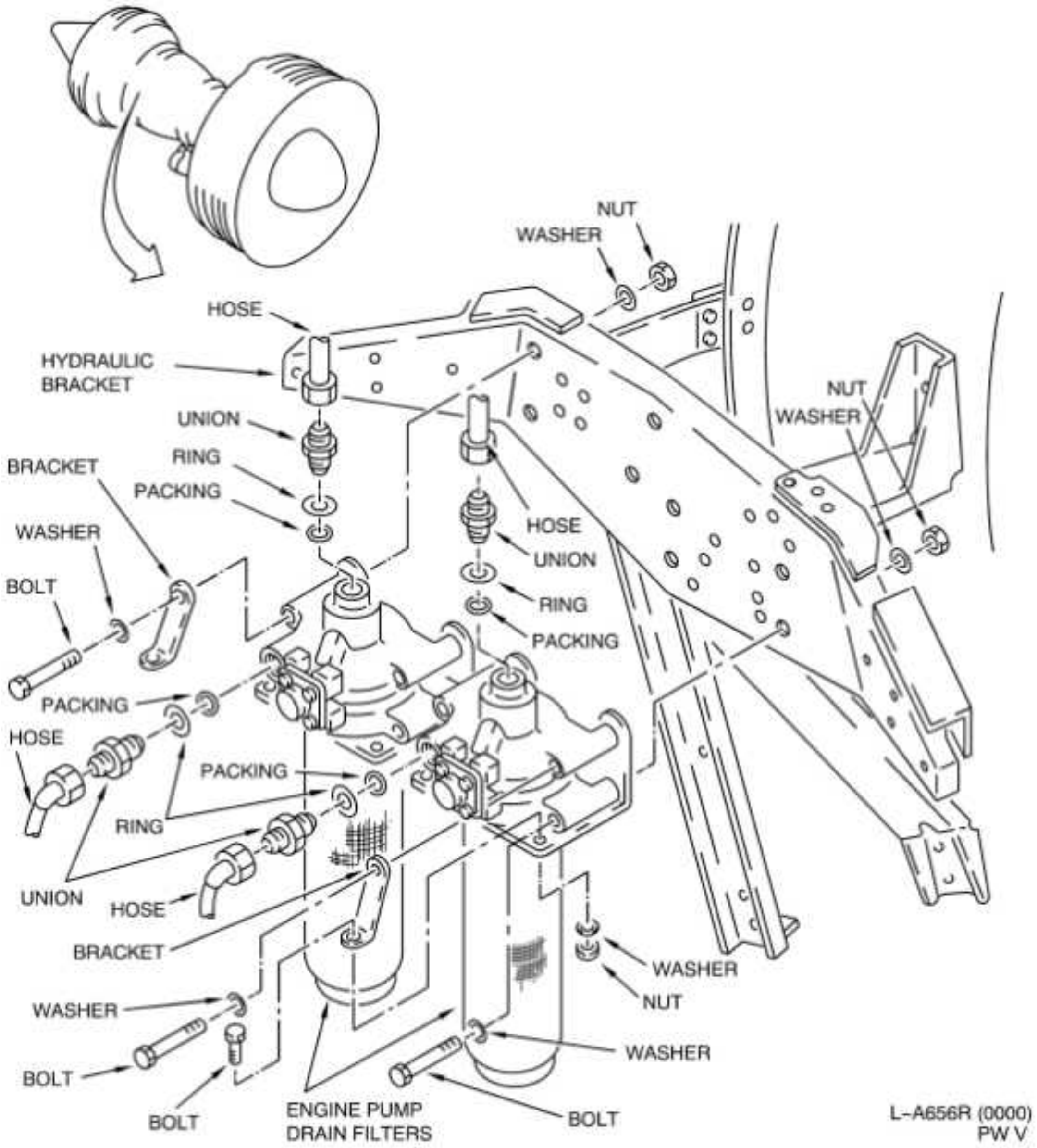
(3) Torque screws to 50 − 70 lb−in. (5.649 − 7.909 N.m) and bolts to 20 − 25 lb−in. (2.260 − 2.825 N.m).

(4) Remove protective covers from filter ports.

(5) Lubricate union threads with Hydraulic Fluid P02−001.

(6) Install unions, rings, and packings in filter ports. Torque unions 250 − 300 lb−in. (28.246 − 33.895 N.m).

(7) Remove protective covers from hoses and install hoses on unions. Torque hose coupling 270 − 290 lb−in. (30.506 − 33.895 N.m).


NUT
WASHER
HOSE
HYDRAULIC BRACKET
UNION
RING
PACKING
BRACKET
WASHER
BOLT
HOSE
UNION
RING
PACKING
NUT
WASHER
PACKING
HOSE
PACKING
RING
UNION
HOSE
BRACKET
WASHER
NUT
WASHER
BOLT
BOLT
ENGINE PUMP DRAIN FILTERS
BOLT
WASHER
L-A656R (0000)
PW V

Engine Pump Case Drain Filter Modules
Figure 401
(Task 71−00−41−450−007)

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POWER PLANT GENERAL - DIFFUSER AND COMBUSTOR - INSTALLATION-08

Task 71-00-41-450-008:

1. Install Engine Pump Case Drain Filters

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P02-001	Hydraulic Fluid

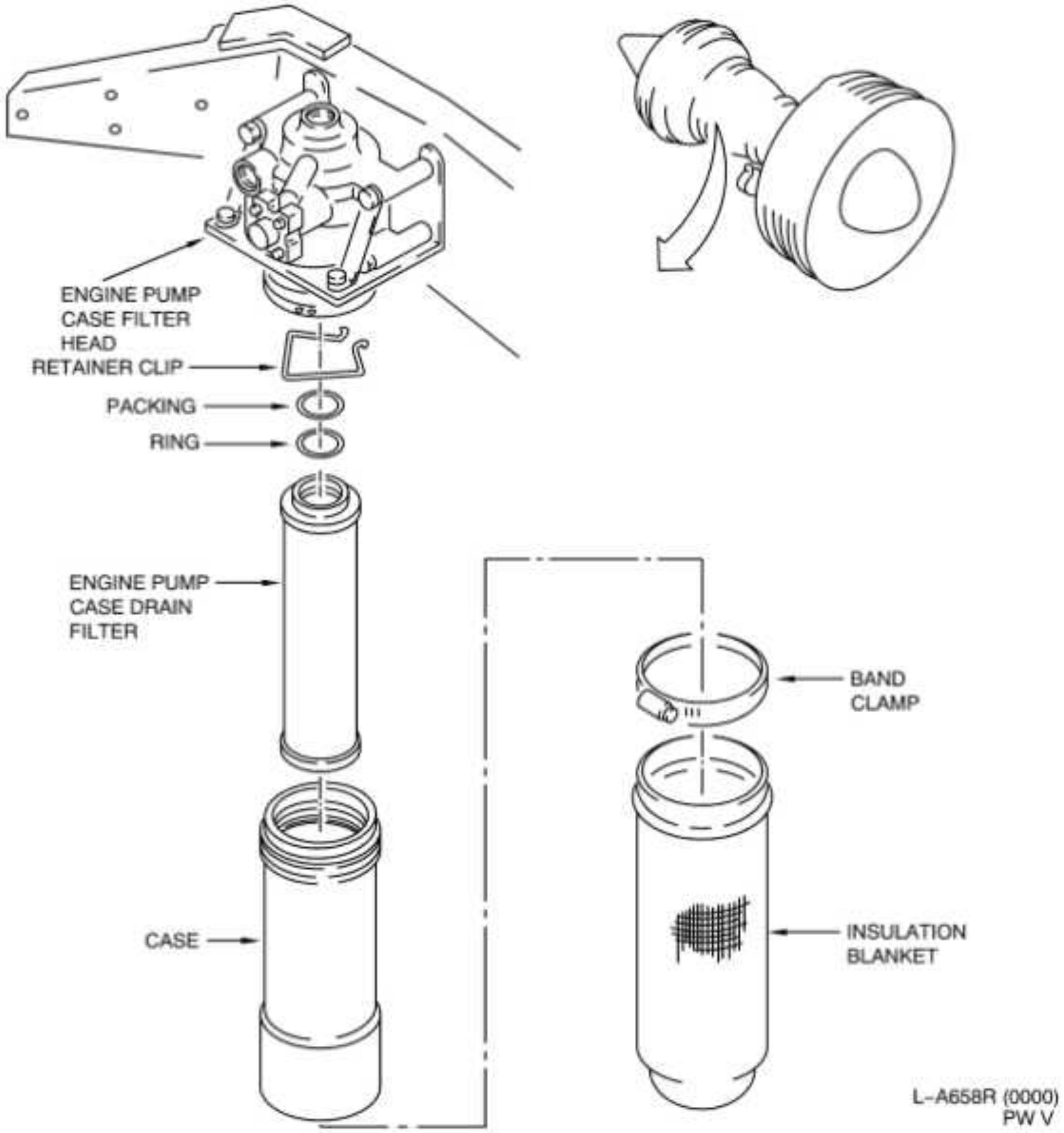
Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Filter (includes Packing and Ring)	1	29-11-01	1	800
Lockwire, MS20995C32				

B. Procedure
See Figure 401.

WARNING: HYDRAULIC FLUID MAY CAUSE EYE, NOSE, AND SKIN IRRITATION. AVOID PROLONGED BREATHING OF MIST OR VAPOR AND PROLONGED OR REPEATED CONTACT WITH SKIN. IF THERE IS A POSSIBILITY OF SPLASH, WEAR GOGGLES. PROTECTIVE GLOVES SHOULD BE WORN DURING USE TO PREVENT DRYING THE SKIN DUE TO CONTACT WITH HYDRAULIC FLUID.

(1) Lubricate packing, ring and threads of case with Hydraulic Fluid (P02-001).
(2) Install ring and packing on engine pump case drain filter.
(3) Insert filter into case, secure with retainer clip and install case in filter module head.
(4) Torque case 180 - 240 lb-in. (20.337 - 27.116 N.m) and lockwire.
(5) Slide band clamp and insulation blanket over filter case and tighten clamp.


ENGINE PUMP CASE FILTER HEAD
RETAINER CLIP
PACKING
RING
ENGINE PUMP CASE DRAIN FILTER
CASE
BAND CLAMP
INSULATION BLANKET
L−A658R (0000)
PW V

Engine Case Drain Filters
Figure 401
(Task 71−00−41−450−008)

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POWER PLANT GENERAL - DIFFUSER AND COMBUSTOR - INSTALLATION-09

Task 71-00-41-450-009:

1. Install Engine Pump Case Drain Filter Module Check Valve

A. Equipment And Materials Required

Standard Tools:

Name	Manufacturer
NSK1521, Fitting Tool	Purolator Inc. Aerospace Division 950 Rancho Conejo Blvd Newbury Park, CA 91320

Consumable Materials:

Item No.	Designation
P02-001	Hydraulic Fluid

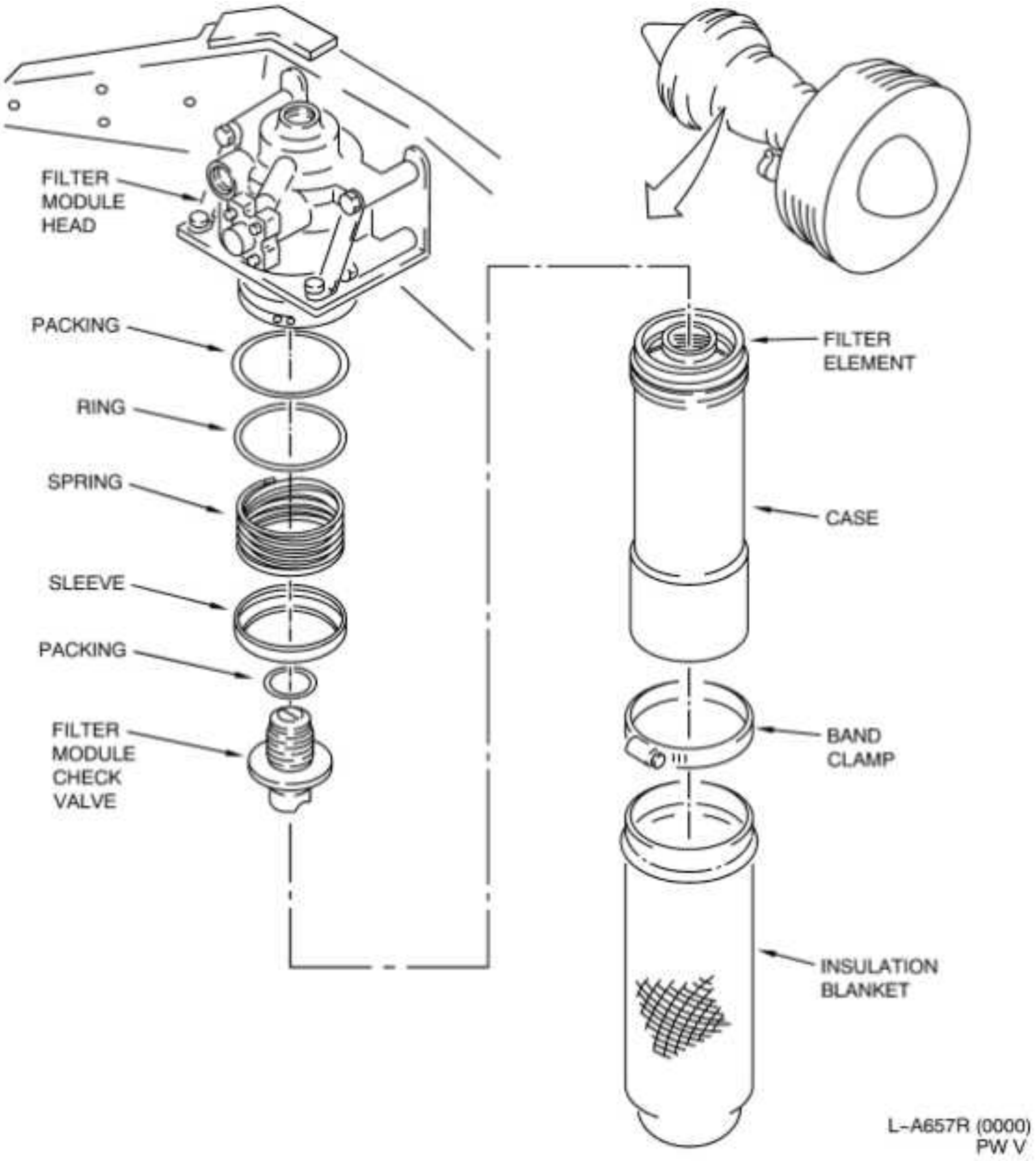
Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Packing NAS1611-024	1			
Packing NAS1611-228	1			
Lockwire, MS20995C32	AR			

B. Procedure
See Figure 401.

WARNING: HYDRAULIC FLUID MAY CAUSE EYE, NOSE, AND SKIN IRRITATION. AVOID PROLONGED BREATHING OF MIST OR VAPOR AND PROLONGED OR REPEATED CONTACT WITH SKIN. IF THERE IS A POSSIBILITY OF SPLASH, WEAR GOGGLES. PROTECTIVE GLOVES SHOULD BE WORN DURING USE TO PREVENT DRYING THE SKIN DUE TO CONTACT WITH HYDRAULIC FLUID.

(1) Lubricate packings, ring and threads of case with Hydraulic Fluid (P02-001).
(2) Install packing and ring in head of filter module.
(3) Install packing on check valve.
(4) Install spring, sleeve and check valve in head of filter module and torque valve, with Fitting Tool NSK1521, 200 - 225 lb-in. (22.597 - 25.422 N.m).
(5) Verify that ring and packing are in the groove in the end of filter element.


FILTER MODULE HEAD
PACKING
RING
SPRING
SLEEVE
PACKING
FILTER MODULE CHECK VALVE
FILTER ELEMENT
CASE
BAND CLAMP
INSULATION BLANKET
L−A657R (0000)
PW V

Engine Pump Case Drain Filter
Module Check Valve
Figure 401
(Task 71−00−41−450−009)

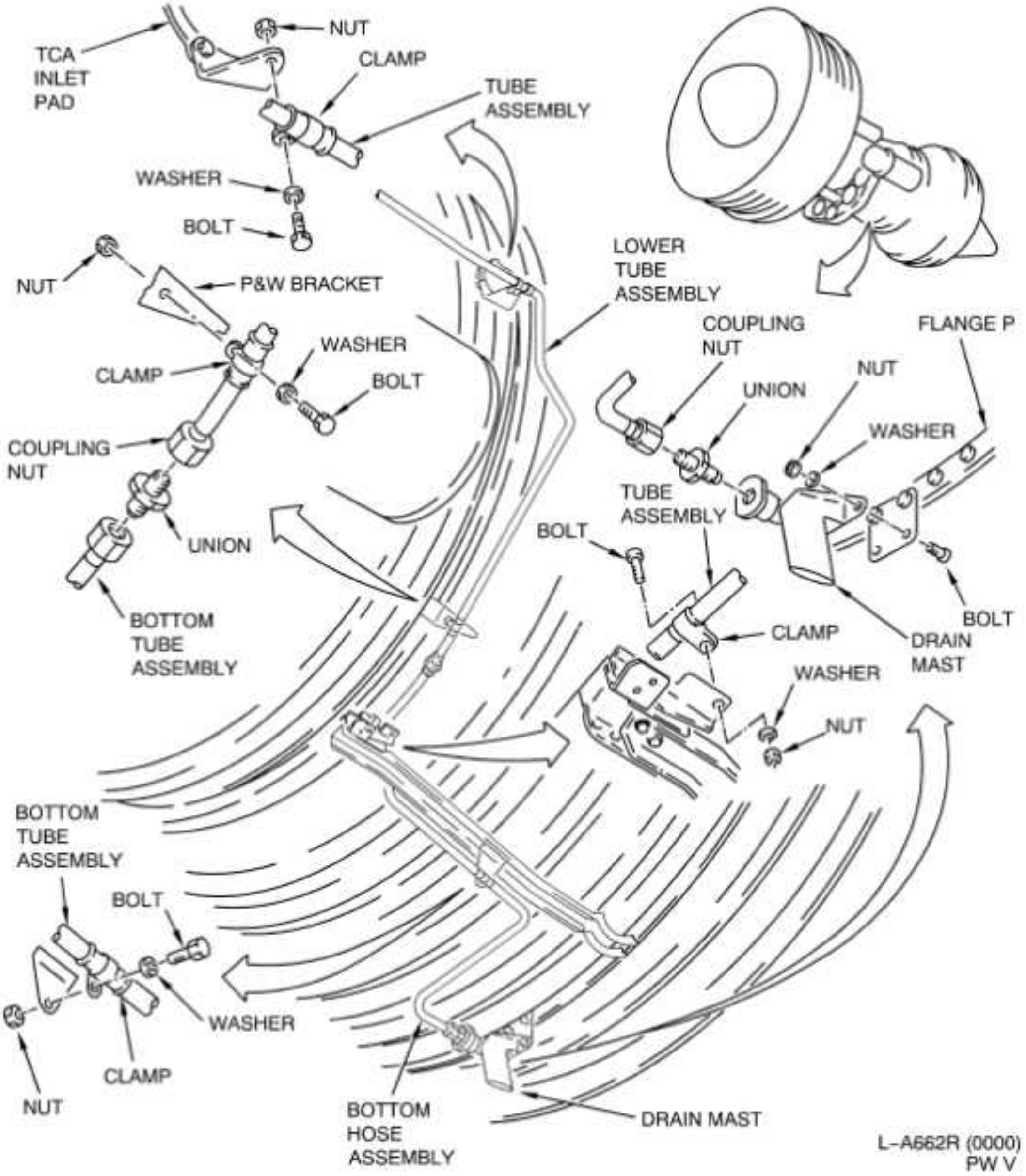
(6) Install filter case in head of filter module, torque 180 − 240 lb−in. (20.337 − 27.116 N.m) and lockwire filter case to module head.
(7) Slide band clamp and insulation blanket over filter case and tighten clamp.

POWER PLANT GENERAL - DIFFUSER AND COMBUSTOR - INSTALLATION-10

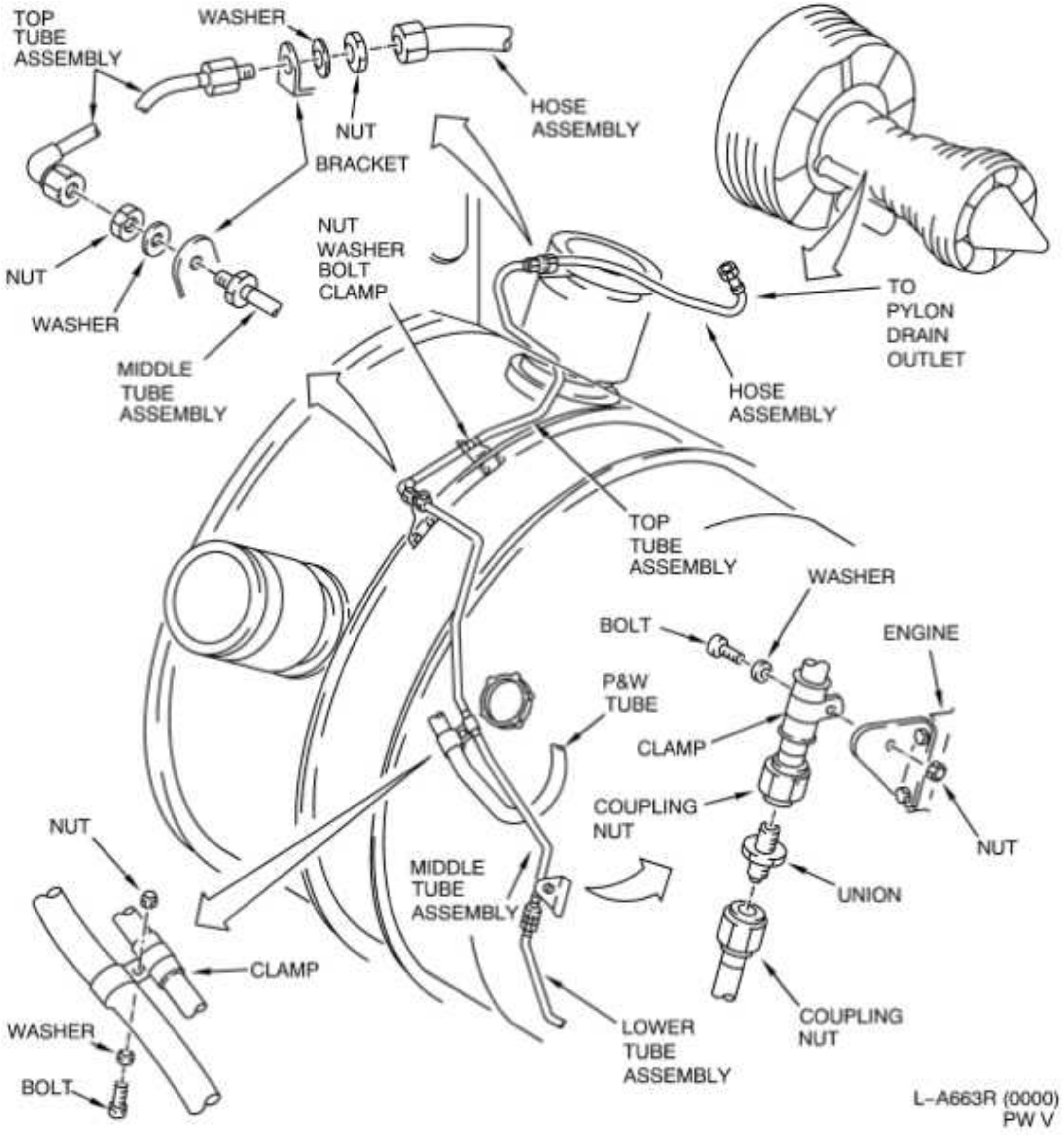
Task 71-00-41-450-010:

1. Install Pylon Drain Tubing
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figures 401 and 402.
     - (1) Position bottom tube assembly and attach to drain mast union. Torque coupling nut 450 - 500 lb-in. (50.843 - 56.492 N.m).
     - (2) Position two clamps on bottom tube assembly and attach to engine brackets with bolts, washers, and nut. Torque nuts 20 - 25 lb-in. (2.260 - 2.825 N.m).
     - (3) Install union in bottom tube assembly. Torque union 215 - 240 lb-in. (24.292 - 27.116 N.m).
     - (4) Position lower tube assembly and attach to bottom tube assembly union. Torque coupling nut 450 - 500 lb-in. (50.843 - 56.492 N.m).
     - (5) Position two clamps on lower tube assembly and attach to engine TCA inlet pad bracket and P&W engine bracket with bolts, washers, and nuts. Torque nuts 20 - 25 lb-in. (2.260 - 2.825 N.m).
     - (6) Install union in lower tube assembly. Torque union 215 - 240 lb-in. (24.292 - 27.116 N.m).
     - (7) Position middle tube assembly and attach to lower tube assembly union. Torque coupling nut 450 - 500 lb-in. (50.843 - 56.492 N.m).
     - (8) Insert middle tube assembly fitting in engine flange bracket and attach with washer and nut. Torque nut 215 - 240 lb-in. (24.292 - 27.116 N.m).
     - (9) Position clamp on middle tube assembly and attach to P&W tube assembly clamp with bolt, washer and nut. Torque nut 20 - 25 lb-in. (2.260 - 2.825 N.m).
     - (10) Position top tube assembly and attach to middle tube assembly. Torque coupling nut 450 - 500 lb-in. (50.843 - 56.492 N.m).
     - (11) Insert top tube assembly fitting into bellows brackets and attach with washer and nut. Torque nut 215 - 240 lb-in. (24.292 - 27.116 N.m).
     - (12) Attach hose assembly to top tube assembly. Torque coupling nut 450 - 500 lb-in. (50.843 - 56.492 N.m).


TCA INLET PAD
NUT
CLAMP
TUBE ASSEMBLY
WASHER
BOLT
NUT
P&W BRACKET
LOWER TUBE ASSEMBLY
CLAMP
WASHER
BOLT
COUPLING NUT
UNION
BOTTOM TUBE ASSEMBLY
COUPLING NUT
UNION
FLANGE P
NUT
WASHER
TUBE ASSEMBLY
BOLT
BOLT
CLAMP
DRAIN MAST
WASHER
NUT
BOTTOM TUBE ASSEMBLY
BOLT
WASHER
NUT
CLAMP
BOTTOM HOSE ASSEMBLY
DRAIN MAST
L−A662R (0000)
PW V

Pylon Drain Tubing
Figure 401
(Task 71−00−41−450−010)


TOP TUBE ASSEMBLY
WASHER
HOSE ASSEMBLY
NUT
BRACKET
NUT
WASHER
MIDDLE TUBE ASSEMBLY
NUT
WASHER
BOLT
CLAMP
TO PYLON DRAIN OUTLET
HOSE ASSEMBLY
TOP TUBE ASSEMBLY
WASHER
BOLT
ENGINE
P&W TUBE
CLAMP
COUPLING NUT
NUT
UNION
NUT
CLAMP
MIDDLE TUBE ASSEMBLY
WASHER
BOLT
LOWER TUBE ASSEMBLY
COUPLING NUT
L-A663R (0000)
PW V

Pylon Drain Tubing
Figure 402
(Task 71−00−41−450−010)

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71−00−52

	LIST OF EFFECTIVE PAGES
	HIGHLIGHTS
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71−00−52	POWER PLANT GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−02 • 71−00−52−050−007: Remove Hydraulic Pump Filter Support Bracket
71−00−52	POWER PLANT GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−01 • 71−00−52−450−006: Install Ignition Cooling Duct And Hoses
71−00−52	POWER PLANT GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−02 • 71−00−52−450−007: Install Hydraulic Pump Filter Support Bracket

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POWER PLANT GENERAL - HIGH PRESSURE TURBINE (HPT) - REMOVAL-01

Task 71-00-52-050-006:

1. Remove Ignition Cooling Duct And Hoses

A. Equipment And Materials Required - None

B. Procedure

See Figure 301.

(1) Disconnect clamps securing hose (301/8) to ignition cooling duct and from lower ignition exciter.

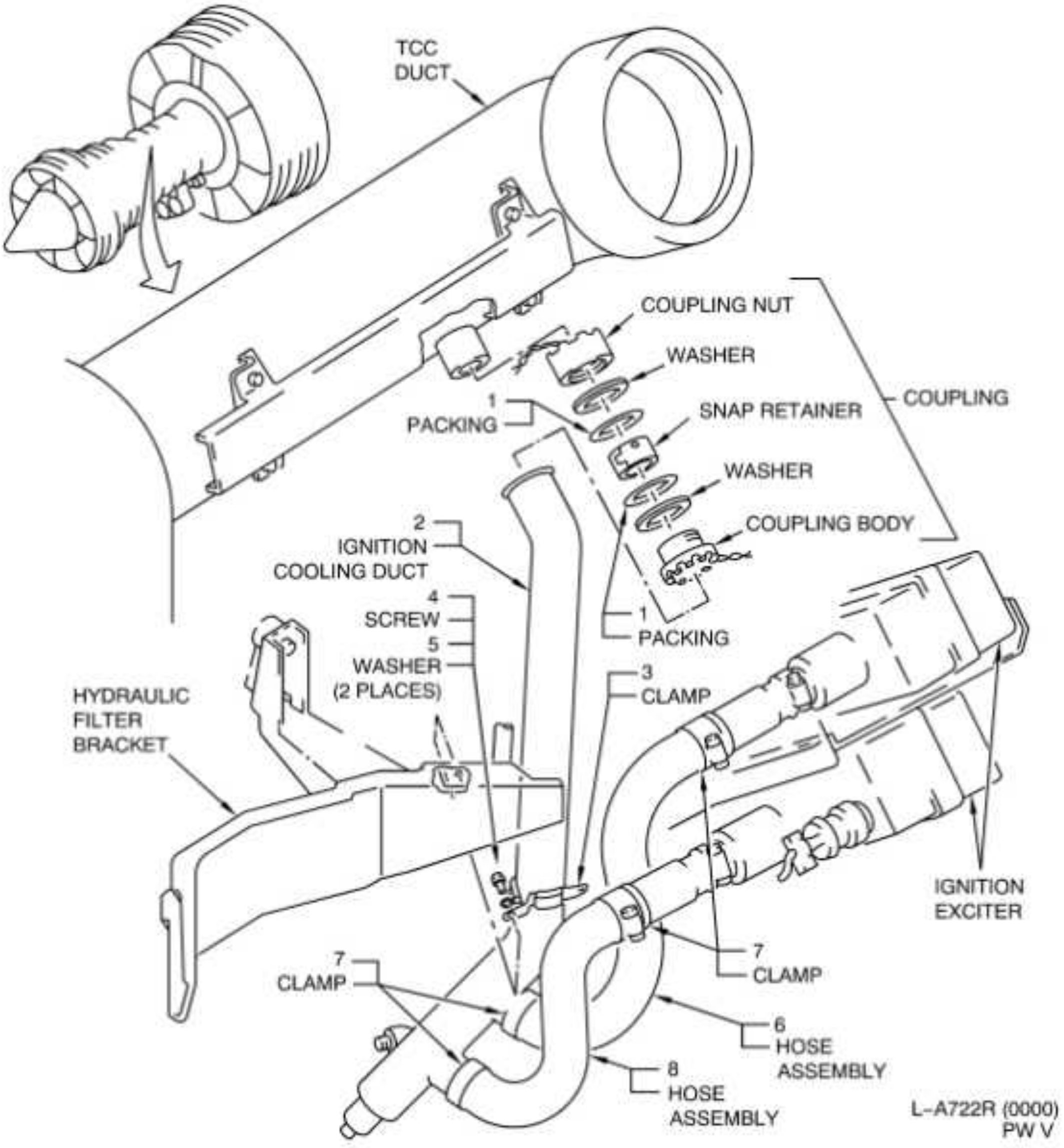
(2) Disconnect clamps securing hose (301/6) to ignition cooling duct and from upper ignition exciter.

(3) Disconnect clamp, screw, and washer securing ignition cooling duct to hydraulic filter bracket.

(4) Cut lockwire and disconnect connector body from coupling nut.

(5) Disconnect TCC duct and ignition cooling duct by releasing snap retainer. Remove and discard packings.

(6) Remove connector coupling body from ignition cooling duct and coupling nut on TCC duct.


TCC DUCT
COUPLING NUT
WASHER
1 PACKING
SNAP RETAINER
COUPLING
WASHER
COUPLING BODY
2 IGNITION COOLING DUCT
4 SCREW
5 WASHER (2 PLACES)
1 PACKING
3 CLAMP
HYDRAULIC FILTER BRACKET
IGNITION EXCITER
7 CLAMP
7 CLAMP
6 HOSE ASSEMBLY
8 HOSE ASSEMBLY
L−A722R (0000)
PW V

Ignition Cooling Duct And Hoses
Figure 301
(Task 71−00−52−050−006)

POWER PLANT GENERAL - HIGH PRESSURE TURBINE (HPT) - REMOVAL-02

Task 71-00-52-050-007:

1. Remove Hydraulic Pump Filter Support Bracket

A. Equipment And Materials Required - None

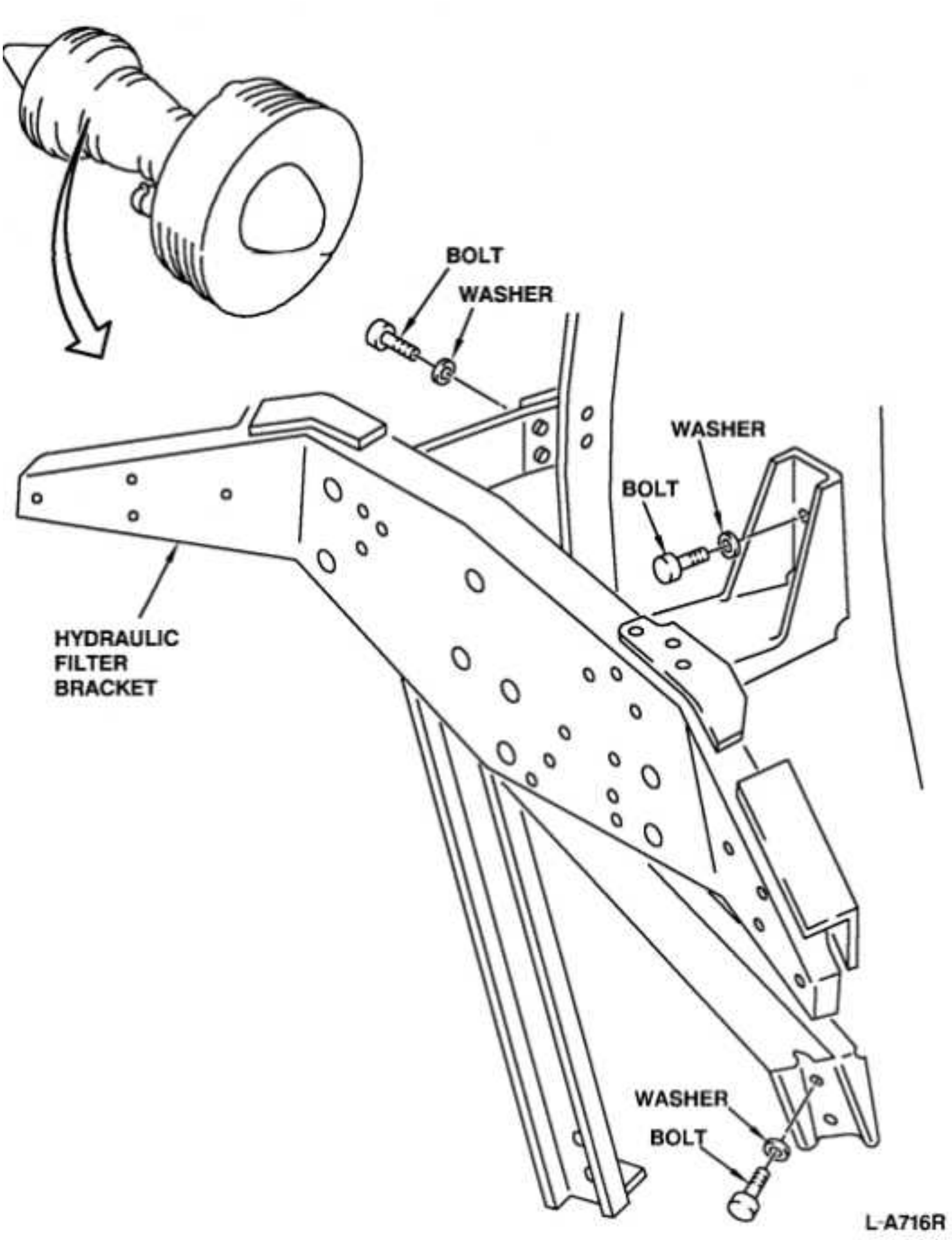
B. Procedure

See Figure 301.

(1) Remove lockwire and disconnect bolts securing hydraulic filter support bracket to two mounting brackets on engine case.

(2) Remove bolts securing hydraulic filter support bracket to mounting bracket on Flange M.

(3) Remove hydraulic filter support bracket from engine.


BOLT
WASHER
WASHER
BOLT
HYDRAULIC FILTER BRACKET
WASHER
BOLT
L-A716R

Hydraulic Pump Filter Support Bracket
Figure 301
(Task 71−00−52−050−007)

Task 71−00−52−450−006:

1. Install Ignition Cooling Duct And Hoses

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P02−002	Petrolatum, White

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Lockwire, MS20995C32				

B. Procedure

See Figure 401.

(1) Lubricate packings (401/1) with White Petrolatum (P06−002).

(2) Install connector coupling body on ignition cooling duct (401/2) and coupling nut on TCC duct.

(3) Install washer and packing in coupling nut, install washer and packing on coupling body using lubricated packings to retain washers.

(4) Secure TCC duct and ignition cooling duct (401/2) together with snap retainer.

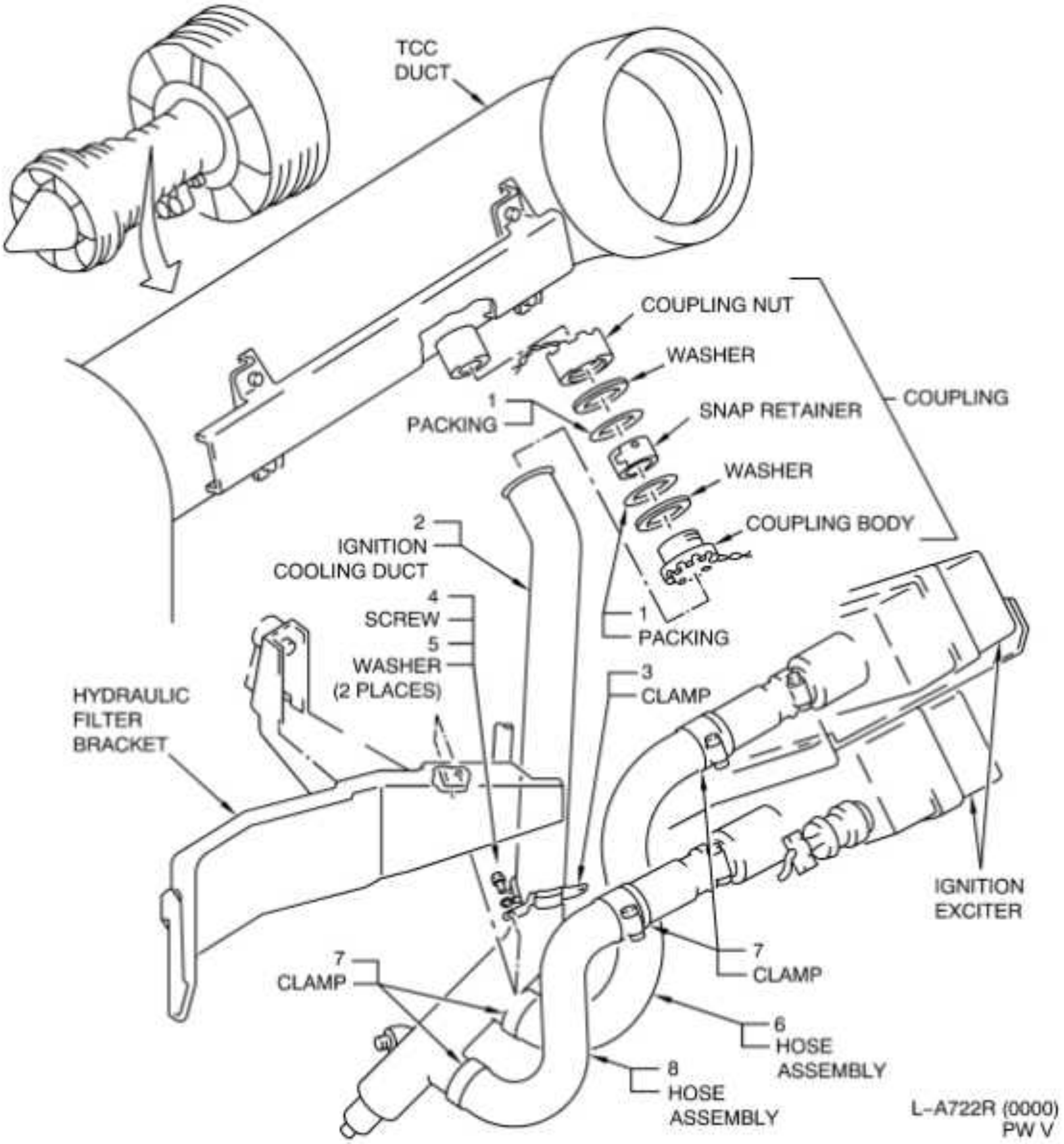
(5) Engage connector body and coupling nut threads, then torque to 15.3 − 18.7 lb−ft. (20.7 − 25.4 N.m) and lockwire.

NOTE: Connector consists of coupling body, coupling nut, two washers, and snap retainer.

(6) Attach ignition cooling duct (401/2) to hydraulic filter bracket with clamp (401/3), screws (401/4), and washers (401/5). Torque nuts to 50 − 70 lb−in. (5.7 − 7.9 N.m).

(7) Connect hose (401/6) to ignition cooling duct and upper ignition exciter with clamps (401/7). Torque clamps 25 − 30 lb−in. (2.8 − 3.4 N.m).

(8) Connect hose (401/8) to ignition cooling duct and lower ignition exciter with clamps. Torque clamps 25 − 30 lb−in. (2.8 − 3.4 N.m).


TCC DUCT
COUPLING NUT
WASHER
1 PACKING
SNAP RETAINER
COUPLING
WASHER
COUPLING BODY
2 IGNITION COOLING DUCT
4 SCREW
5 WASHER (2 PLACES)
1 PACKING
HYDRAULIC FILTER BRACKET
3 CLAMP
IGNITION EXCITER
7 CLAMP
7 CLAMP
6 HOSE ASSEMBLY
8 HOSE ASSEMBLY
L-A722R (0000)
PW V

Ignition Cooling Duct And Hoses
Figure 401
Task 71−00−52−450−006)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 71-00-52-450-007:

1. Install Hydraulic Pump Filter Support Bracket

A. Equipment And Materials Required - None

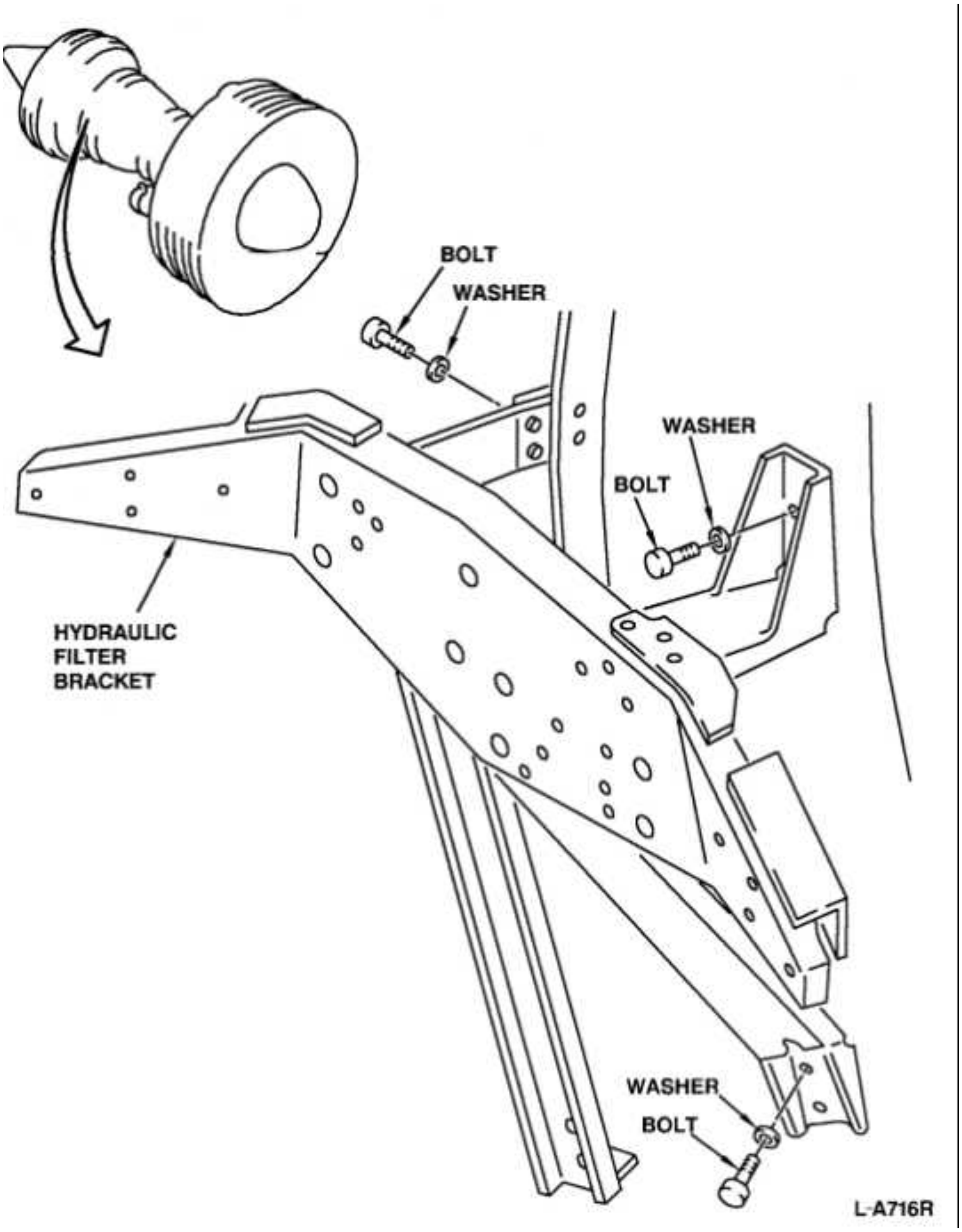
B. Procedure

See Figure 401.

(1) Install hydraulic filter support bracket on mounting bracket at Flange M using bolts and washers. Torque bolts to 100 - 140 lb-in. (11.29 - 15.82 N.m).

(2) At two brackets forward of Flange M on engine case attach hydraulic filter support bracket using bolts and washers. Torque bolts to 50 - 70 lb-in. (5.65 - 7.91 N.m).

(3) Lockwire nuts securing hydraulic filter support bracket to mounting brackets on engine case.


BOLT
WASHER
WASHER
BOLT
HYDRAULIC FILTER BRACKET
WASHER
BOLT
L-A716R

Hydraulic Pump Filter Support Bracket
Figure 401
Task 71−00−52−450−007)

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71−00−53

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71−00−53	POWER PLANT GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−02 • 71−00−53−050−002: Remove Starter Air Supply Duct
71−00−53	POWER PLANT GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−01 • 71−00−53−450−001: Install Turbine Case Cooling (TCC) Duct And Bellows
71−00−53	POWER PLANT GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−02 • 71−00−53−450−002: Install Starter Air Supply Duct

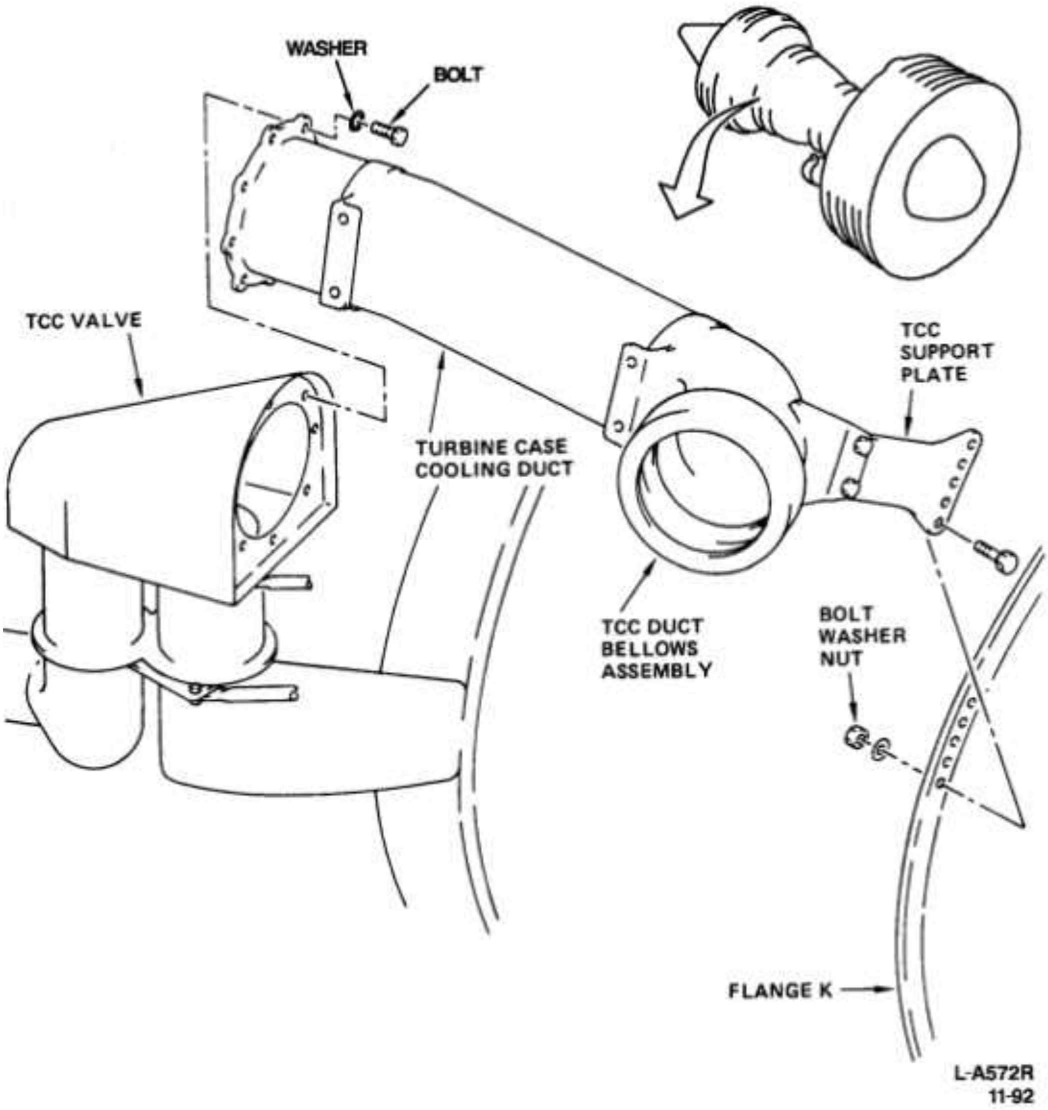
POWER PLANT GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−01

Task 71−00−53−050−001:

1. Remove Turbine Case Cooling (TCC) Duct And Bellows
   - A. Prerequisites
     - (1) Remove ignition cooling ducts. See 71−00−41, Removal−06 (Task 71−00−41−050−006).
   - B. Equipment And Materials Required − None
   - C. Procedure

     See Figure 301.

     - (1) Remove eight bolts and nuts attaching TCC duct to TCC valve.
     - (2) Remove five bolts, washers and nuts attaching TCC support plate to engine.
     - (3) Remove TCC duct with bellows and support plate from engine.


WASHER
BOLT
TCC VALVE
TURBINE CASE COOLING DUCT
TCC SUPPORT PLATE
TCC DUCT BELLOWS ASSEMBLY
BOLT WASHER NUT
FLANGE K
L-A572R
11-92

Turbine Case Cooling Duct Bellows
Figure 301
(Task 71−00−53−050−001)

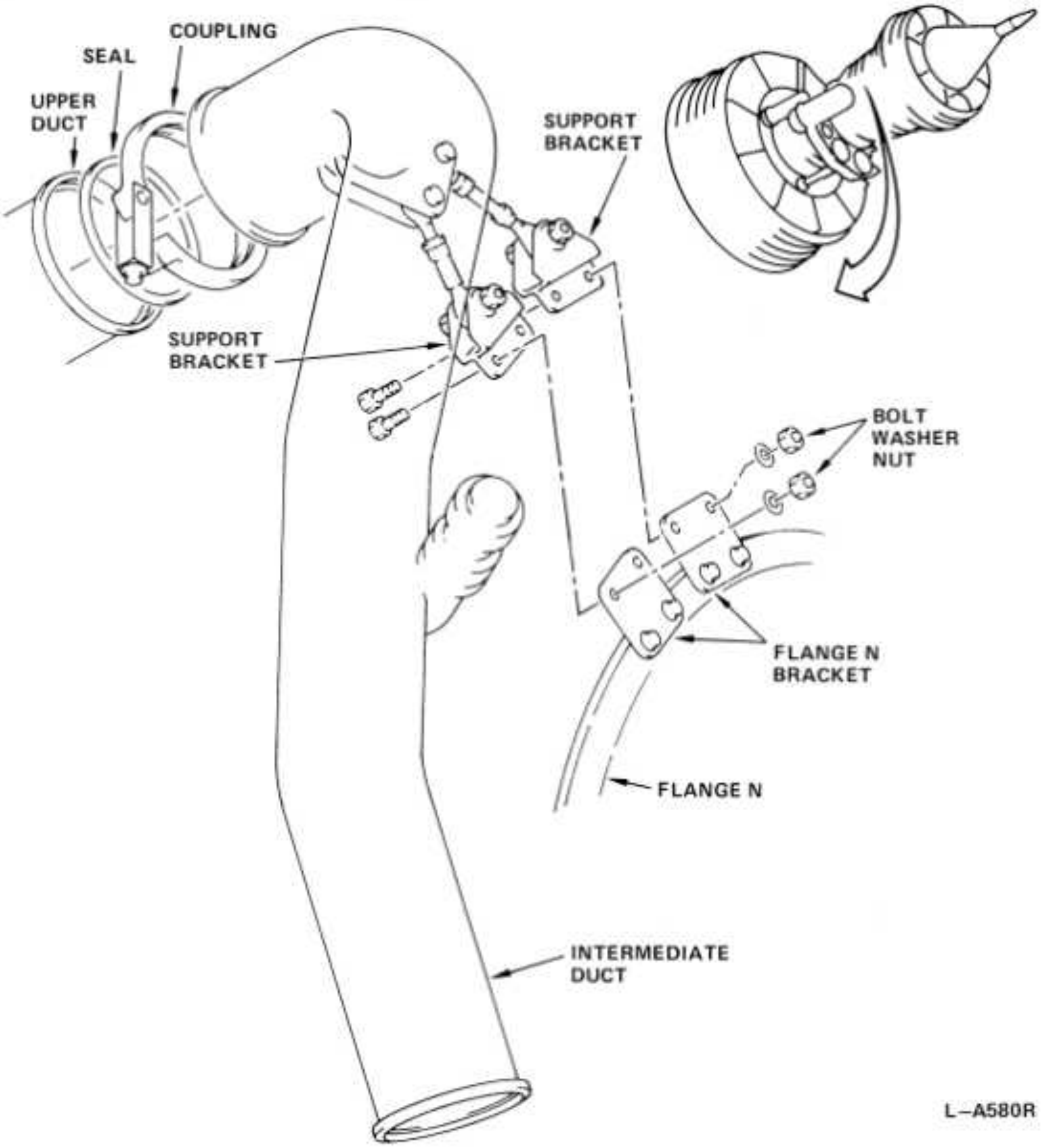
Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - LOW PRESSURE TURBINE (LPT) - REMOVAL-02

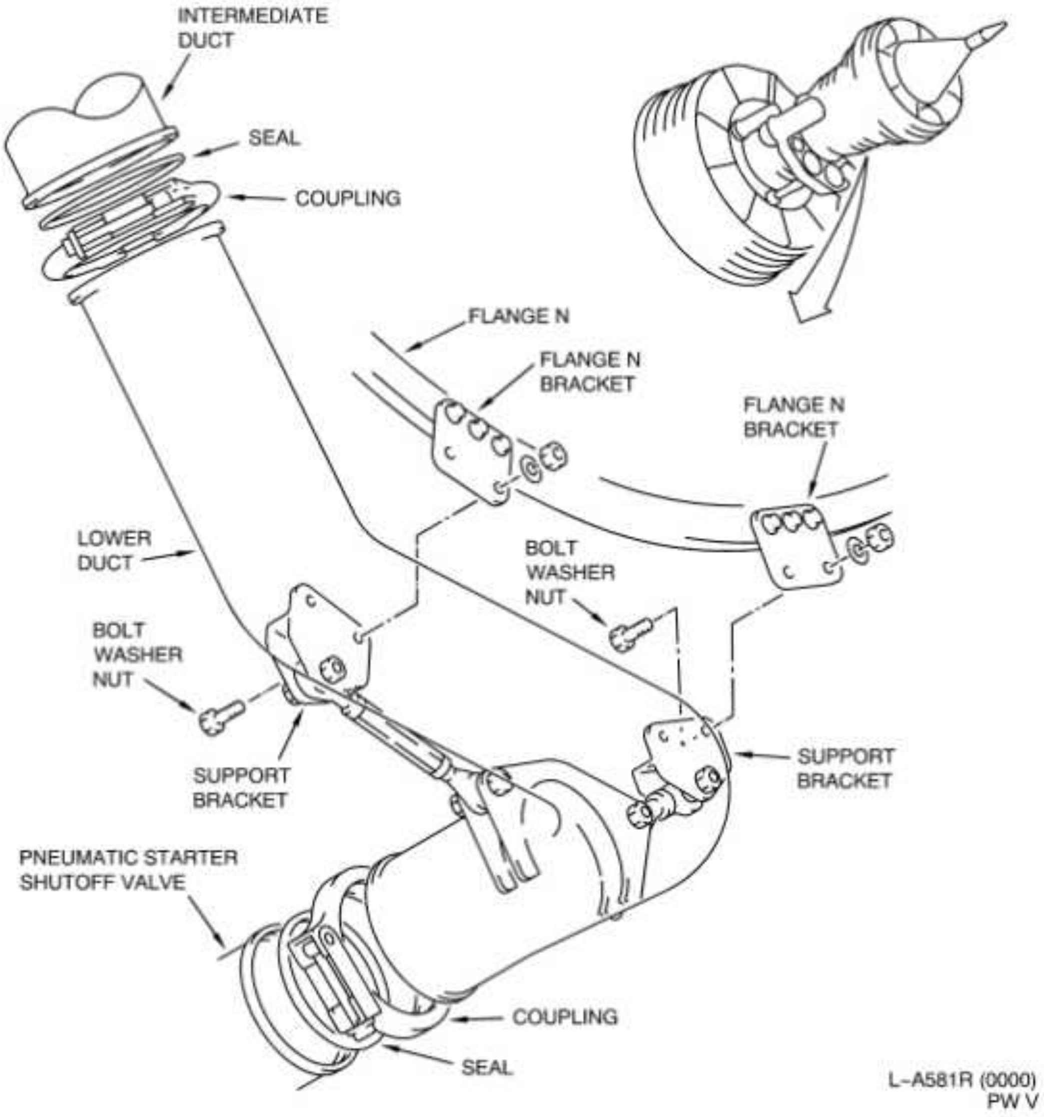
Task 71-00-53-050-002:

1. Remove Starter Air Supply Duct
   - A. Prerequisites - None
   - B. Equipment And Materials Required - None
   - C. Procedure

     See Figures 301 and 302.
     - (1) Remove starter air supply intermediate duct.
       - (a) Loosen nuts to remove couplings that secure intermediate duct to upper and lower ducts.
       - (b) Remove nuts, washers and bolts that attach two support brackets and intermediate duct to engine Flange N brackets.
       - (c) Remove intermediate duct.
       - (d) Remove and discard seals.
       - (e) Install protective covers on ducts.
     - (2) Remove starter air supply lower duct.
       - (a) Loosen nut to remove coupling that secures lower duct to pneumatic starter shutoff valve.
       - (b) Remove nuts, washers and bolts that attach two support brackets and lower duct to engine Flange N brackets.
       - (c) Remove lower duct.
       - (d) Remove and discard seal.
       - (e) Install protective covers on duct and pneumatic starter shutoff valve.
     - (3) Remove eight bolts and washers that connect turbine case cooling (TCC) duct to TCC valve. Retain bolts and washers with TCC valve.

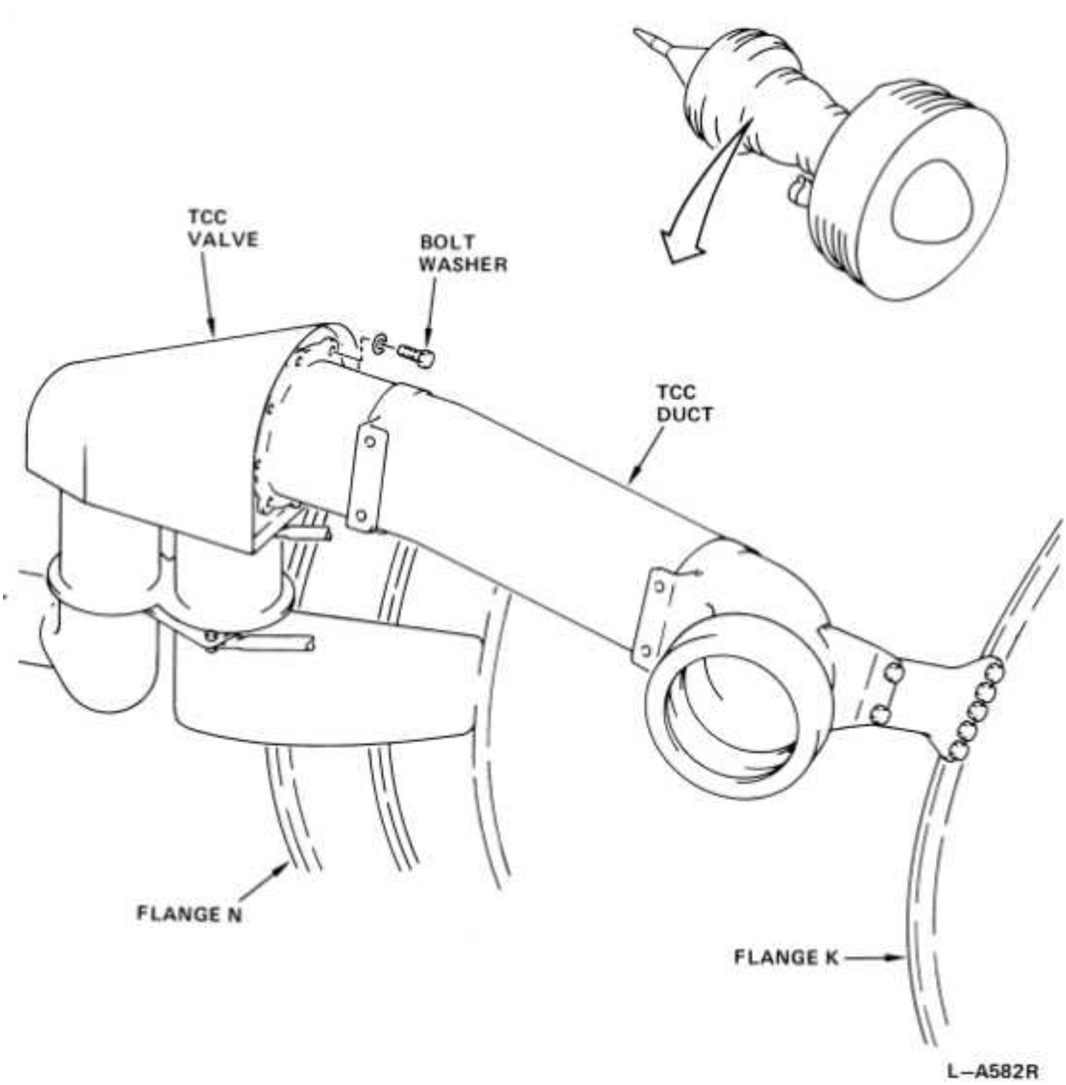

COUPLING
SEAL
UPPER DUCT
SUPPORT BRACKET
SUPPORT BRACKET
BOLT
WASHER
NUT
FLANGE N BRACKET
FLANGE N
INTERMEDIATE DUCT
L-A580R

Starter Air Supply Duct Removal
Figure 301 (Sheet 1)
(Task 71-00-53-050-002)


INTERMEDIATE DUCT
SEAL
COUPLING
FLANGE N
FLANGE N BRACKET
FLANGE N BRACKET
LOWER DUCT
BOLT WASHER NUT
BOLT WASHER NUT
SUPPORT BRACKET
SUPPORT BRACKET
PNEUMATIC STARTER SHUTOFF VALVE
COUPLING
SEAL
L-A581R (0000)
PW V

Starter Air Supply Duct Removal
Figure 301 (Sheet 2)
(Task 71-00-53-050-002)

POWER PLANT GENERAL - LOW PRESSURE TURBINE (LPT) - REMOVAL-02


TCC
VALVE
BOLT
WASHER
TCC
DUCT
FLANGE N
FLANGE K
L-A582R

Turbine Case Cooling Duct Removal
Figure 302
(Task 71-00-53-050-002)

POWER PLANT GENERAL - LOW PRESSURE TURBINE (LPT) - INSTALLATION-01

Task 71-00-53-450-001:

1. Install Turbine Case Cooling (TCC) Duct And Bellows
   A. Equipment And Materials Required

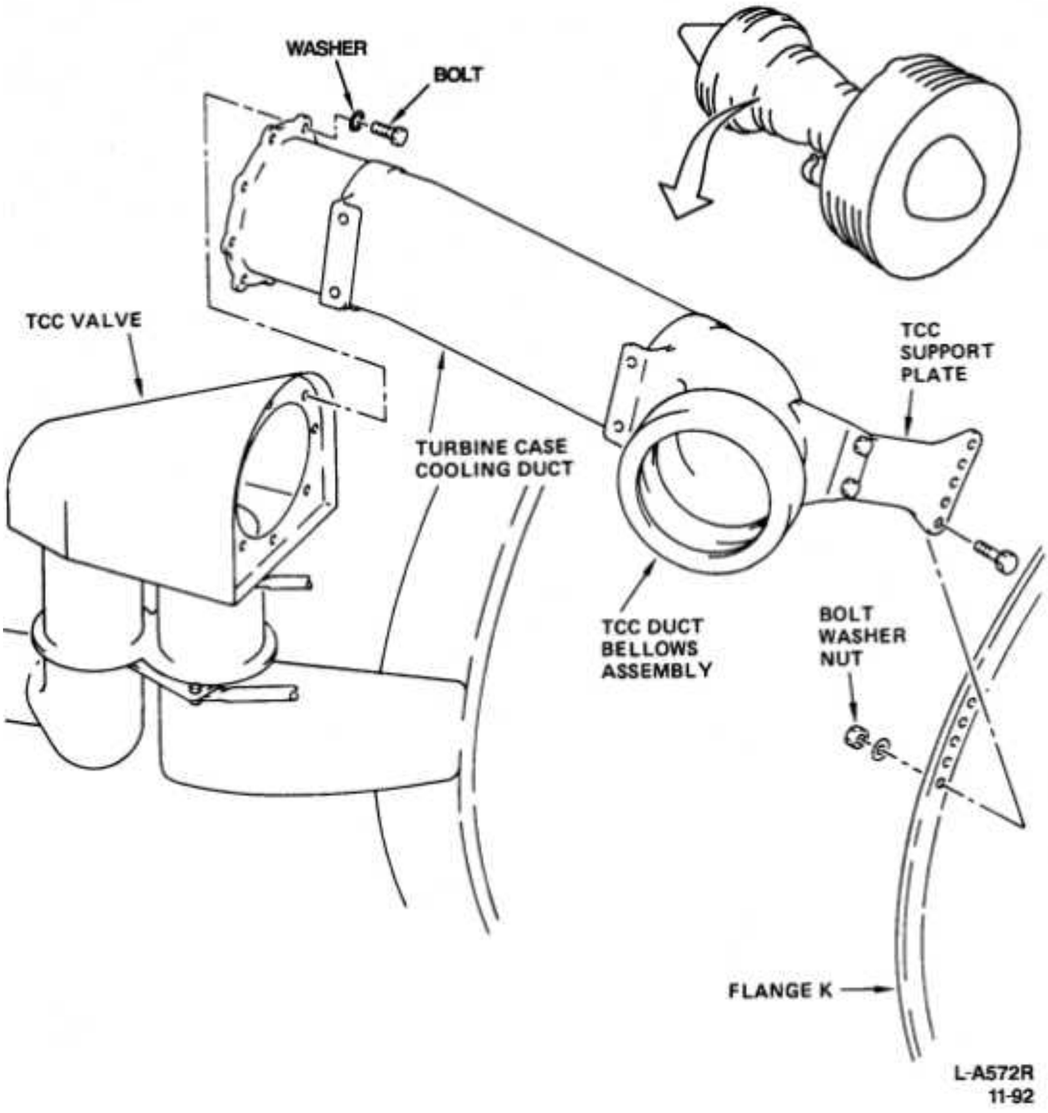
      Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Packing	2	(TBD)		
Nuts	6			

Lockwire, MS20995C32

   B. Procedure
      (1) Install TCC duct and bellows: See Figure 401.
         (a) Install TCC duct with TCC bellows on TCC support plate using five bolts, washers and nuts. Torque nuts to 125 - 140 lb-in. (14.123 - 15.818 N.m).
         (b) Remove protective covers from end of TCC valve, duct and bellows.
         (c) Install TCC duct with TCC bellows on TCC valve using eight bolts and washers. Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

   C. Postrequisites
      (1) Install ignition, starter valve and PMA cooling ducts. See 71-00-41, Installation-03 (Task 71-00-41-450-002).


WASHER
BOLT
TCC VALVE
TURBINE CASE COOLING DUCT
TCC SUPPORT PLATE
TCC DUCT BELLOWS ASSEMBLY
BOLT
WASHER
NUT
FLANGE K
L-A572R
11-92

Turbine Case Cooling Duct And Bellows
Figure 401
(Task 71−00−53−450−001)

POWER PLANT GENERAL - LOW PRESSURE TURBINE (LPT) - INSTALLATION-02

Task 71-00-53-450-002:

1. Install Starter Air Supply Duct

A. Prerequisites

(1) Install P flange brackets. See Installation-01 (Task 71-00-53-450-001).

B. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P06-013	Lubricant, Solid Film
P06-020	Lubricant, Bolt - Molybdenum Disulfide

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Seal	1	TO BE DETERMINED		
Seal	2	TO BE DETERMINED		

C. Procedure

See Figure 401 and 402.

(1) Adjust starter air supply lower duct support link (401/1) to length of 6.34 inch (161.036 mm).

(2) Adjust lower duct support link (401/2) to length of 3.10 inch (78.740 mm).

(3) Adjust intermediate duct support link (401/3) to length of 4.25 inch (107.950 mm).

(4) Adjust intermediate duct support link (401/2) to length of 3.10 inch (78.740 mm).

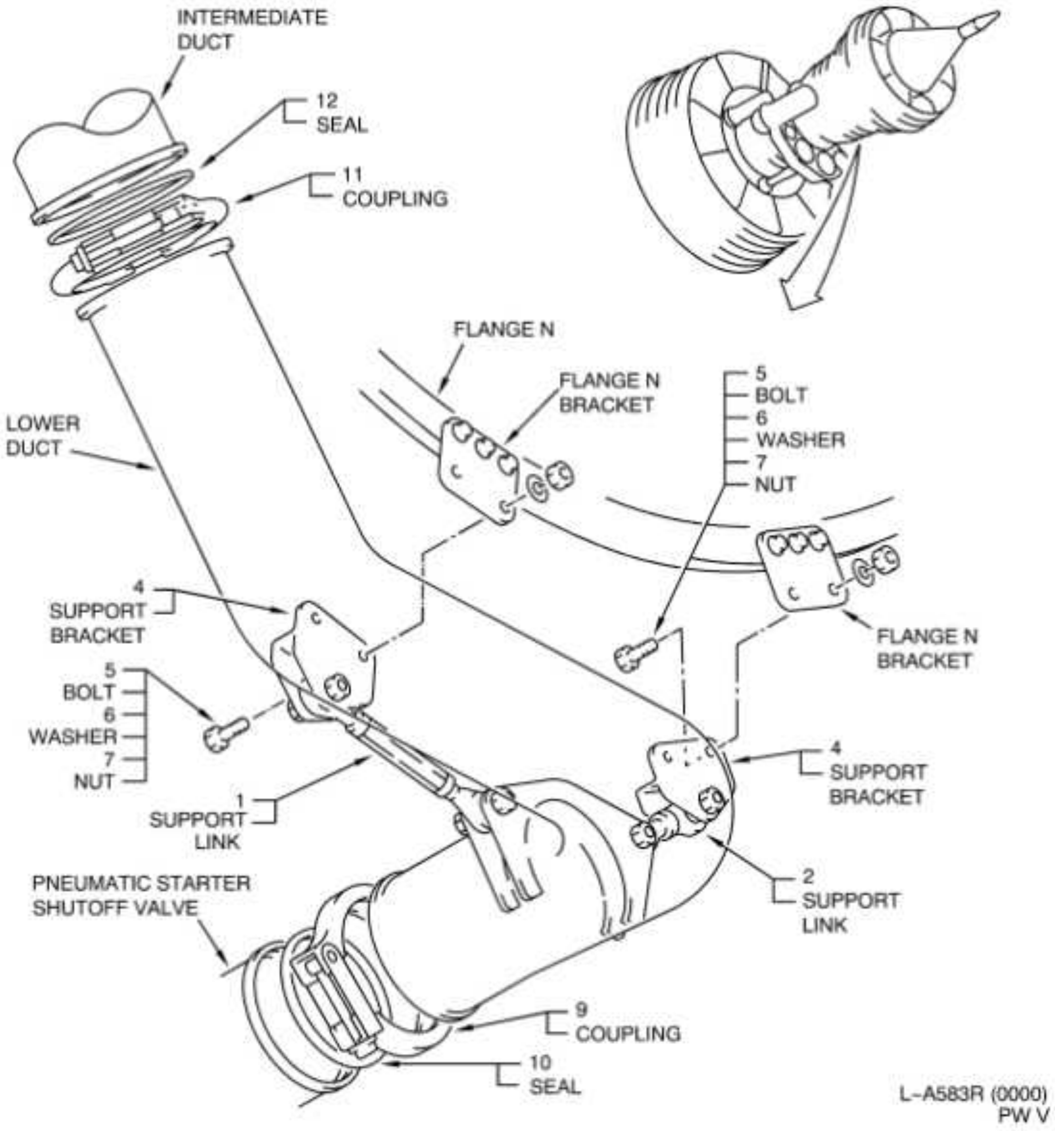
(5) Remove protective covers from ducts and pneumatic starter shutoff valve.

(6) Attach two support brackets (401/4), connected to lower duct, to forward side of engine Flange N brackets with bolts (401/5), washers (401/6) and nuts (401/7). Torque nuts to 50 - 70 lb-in. (5.649 - 7.909 N.m).

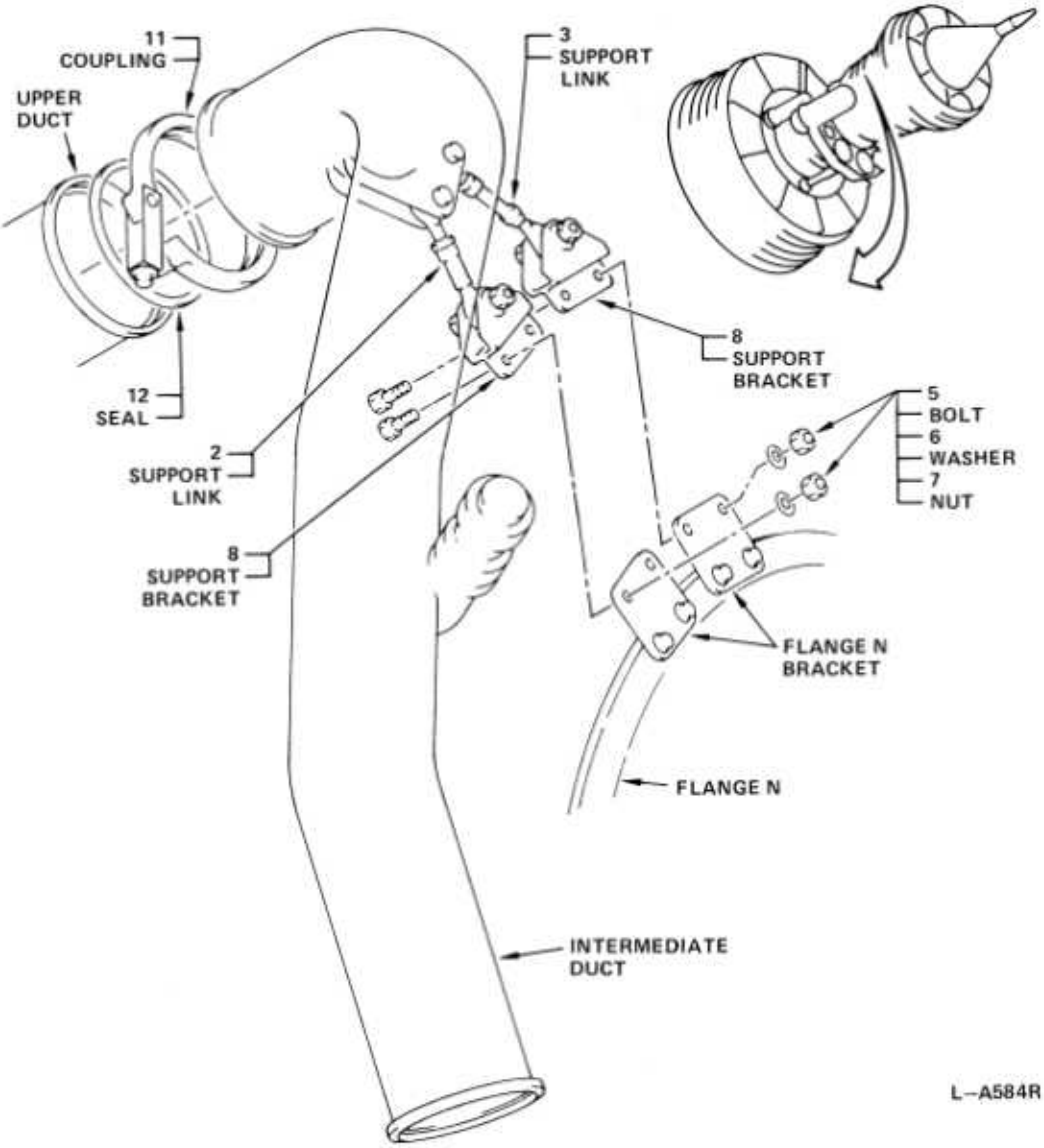
(7) Attach two support brackets (401/8), connected to intermediate duct, to forward side of engine Flange N brackets with bolts (401/5), washers (401/6) and nuts (401/7). Torque nuts to 50 - 70 lb-in. (5.649 - 7.909 N.m).

(8) Lubricate inside surface of coupling (401/9) with Solid Film Lubricant (P06-013).

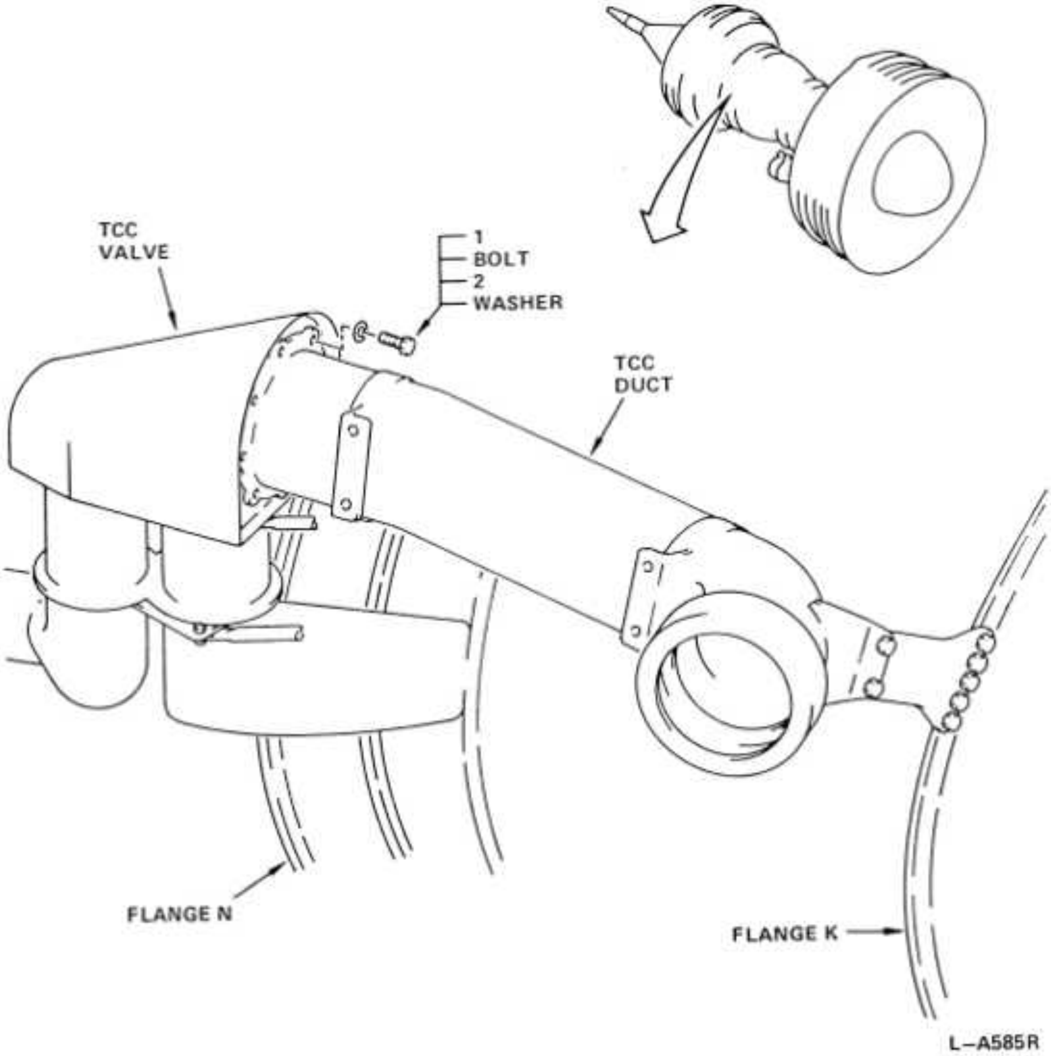
(9) Place seal (401/10) on lower end of lower duct and connect duct to pneumatic starter shutoff valve with coupling (401/9), after positioning seal over joint flanges. Do not torque coupling this step.


INTERMEDIATE DUCT
12 SEAL
11 COUPLING
FLANGE N
FLANGE N BRACKET
5 BOLT
6 WASHER
7 NUT
LOWER DUCT
4 SUPPORT BRACKET
5 BOLT
6 WASHER
7 NUT
FLANGE N BRACKET
4 SUPPORT BRACKET
1 SUPPORT LINK
2 SUPPORT LINK
PNEUMATIC STARTER SHUTOFF VALVE
9 COUPLING
10 SEAL
L-A583R (0000)
PW V

Starter Air Supply Duct Installation
Figure 401 (Sheet 1)
(Task 71-00-53-450-002)


11
COUPLING
UPPER DUCT
3
SUPPORT LINK
8
SUPPORT BRACKET
5
BOLT
6
WASHER
7
NUT
12
SEAL
2
SUPPORT LINK
8
SUPPORT BRACKET
FLANGE N BRACKET
FLANGE N
INTERMEDIATE DUCT
L-A584R

Starter Air Supply Duct Installation
Figure 401 (Sheet 2)
(Task 71-00-53-450-002)


TCC VALVE
1 BOLT
2 WASHER
TCC DUCT
FLANGE N
FLANGE K
L−A585R

Turbine Case Cooling Duct Installation
Figure 402
(Task 71−00−53−450−002)

(10) Lubricate inside surfaces of two couplings (401/11) with Solid Film Lubricant (P06−013).

(11) Place seals (401/12) on each end of intermediate duct and connect to lower duct and upper duct with couplings (401/11), after positioning seals over joint flanges. Do not torque couplings this step.

(12) Adjust intermediate duct support links (401/2) and (401/3) to eliminate any preload. Torque locking nuts on both support links to 100 − 140 lb−in. (11.298 − 15.818 N.m).

(13) Adjust lower duct support links (401/1) and (401/2) to eliminate any preload. Torque locking nuts on both support links to 100 − 140 lb−in. (11.298 − 15.818 N.m).

(14) Torque coupling (401/9) to value indicated on coupling band. Tap outer perimeter of coupling with plastic mallet while tightening.

(15) Torque couplings (401/11) to values indicated on coupling bands. Tap outer perimeters of couplings with plastic mallet while tightening.

(16) Apply Molybdenum Disulfide Lubricant (P06−020) to threads of bolts (402/1).

(17) Connect turbine case cooling (TCC) duct to TCC valve with eight bolts (402/1) and washers (402/2). Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

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71−00−54	POWER PLANT GENERAL − TURBINE EXHAUST CASE − REMOVAL−03 • 71−00−54−050−003: Remove Engine Exhaust Nozzle
71−00−54	POWER PLANT GENERAL − TURBINE EXHAUST CASE − REMOVAL−04 • 71−00−54−050−004: Remove Flange P Brackets
71−00−54	POWER PLANT GENERAL − TURBINE EXHAUST CASE − REMOVAL−05 • 71−00−54−050−005: Remove Pylon Drain Mast
71−00−54	POWER PLANT GENERAL − TURBINE EXHAUST CASE − REMOVAL−06 • 71−00−54−050−011: Remove Exhaust Nozzle And Plug Alignment Pins
71−00−54	POWER PLANT GENERAL − TURBINE EXHAUST CASE − INSTALLATION−01 • 71−00−54−450−001: Install Engine Aft Mount
71−00−54	POWER PLANT GENERAL − TURBINE EXHAUST CASE − INSTALLATION−02 • 71−00−54−450−003: Install Engine Exhaust Plug
71−00−54	POWER PLANT GENERAL − TURBINE EXHAUST CASE − INSTALLATION−03 • 71−00−54−450−002: Install Engine Exhaust Nozzle
71−00−54	POWER PLANT GENERAL − TURBINE EXHAUST CASE − INSTALLATION−04 • 71−00−54−450−004: Install Flange P Brackets
71−00−54	POWER PLANT GENERAL − TURBINE EXHAUST CASE − INSTALLATION−05 • 71−00−54−450−005: Install Pylon Drain Mast
71−00−54	POWER PLANT GENERAL − TURBINE EXHAUST CASE − INSTALLATION−06 • 71−00−54−450−011: Install Exhaust Nozzle And Plug Alignment Pins

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POWER PLANT GENERAL − TURBINE EXHAUST CASE − REMOVAL−01

Task 71−00−54−050−001:

1. Remove Engine Aft Mount

A. Equipment And Materials Required − None

B. Procedure

See Figure 301.

(1) Remove eight bolts, washers, nuts, washers, plates and retainers.

CAUTION: DO NOT ROTATE THE BOLT WHEN YOU REMOVE THE BOLT. ROTATION CAN CAUSE SCORING DAMAGE TO THE BOLT.

(2) Remove two outboard bolts, washers and nuts.

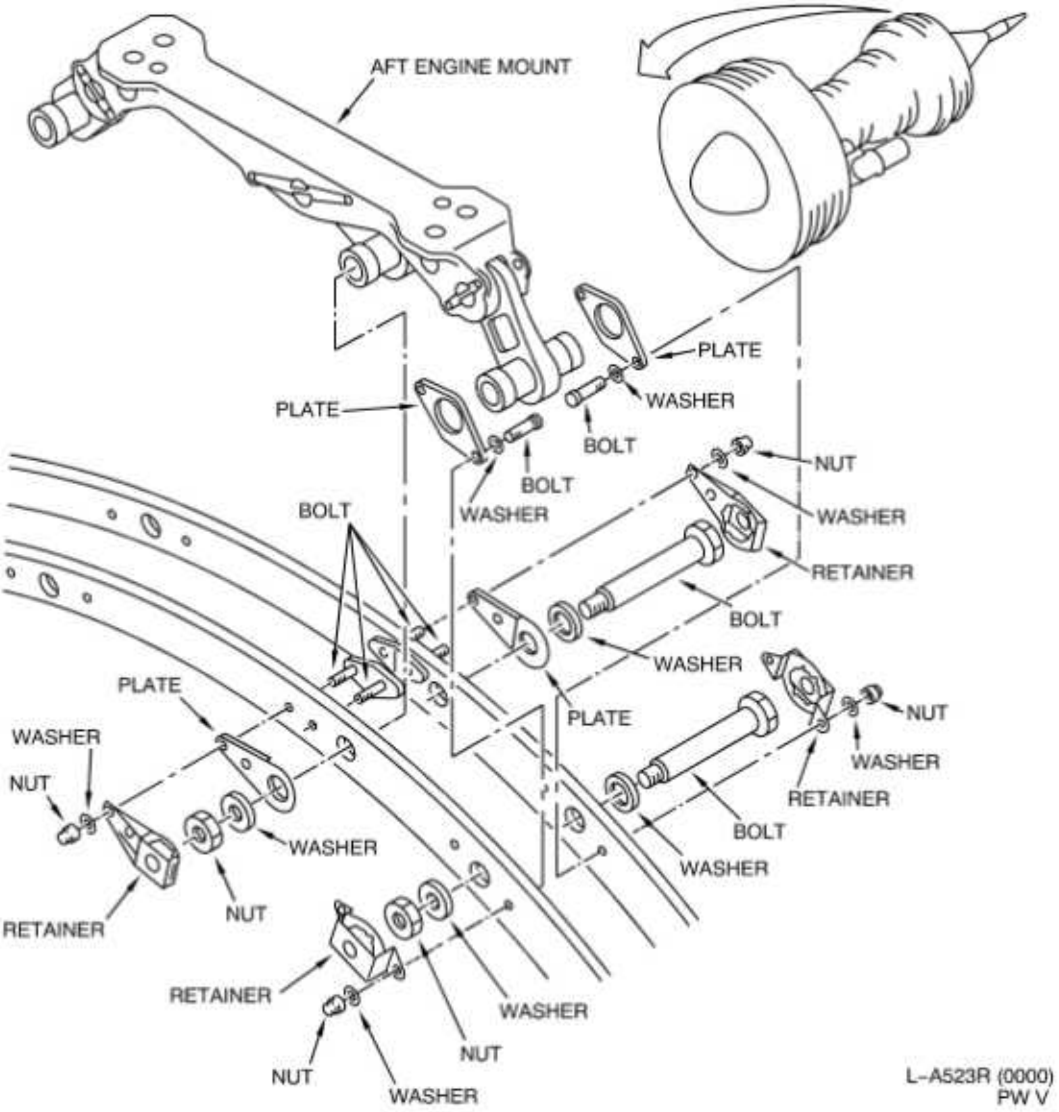
(3) Remove four bolts, washers, nuts, plates and retainers.

CAUTION: DO NOT ROTATE THE BOLT WHEN YOU REMOVE THE BOLT. ROTATION CAN CAUSE SCORING DAMAGE TO THE BOLT.

(4) Remove center bolt, washers, plates and nuts.

(5) Remove mount from engine.

NOTE: For additional information concerning detailed maintenance of the component, see Aft Engine Mount Component Maintenance Manual, 71−20−05 (P&W PN 221−0260).


AFT ENGINE MOUNT
PLATE
WASHER
BOLT
PLATE
BOLT
WASHER
NUT
WASHER
BOLT
RETAINER
BOLT
WASHER
PLATE
PLATE
NUT
WASHER
NUT
RETAINER
BOLT
WASHER
WASHER
WASHER
RETAINER
NUT
RETAINER
WASHER
NUT
NUT
WASHER
L-A523R (0000)
PW V

Engine Aft Mount Removal
Figure 301
(Task 71−00−54−050−001)

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POWER PLANT GENERAL – TURBINE EXHAUST CASE – REMOVAL–02

Task 71–00–54–050–002:

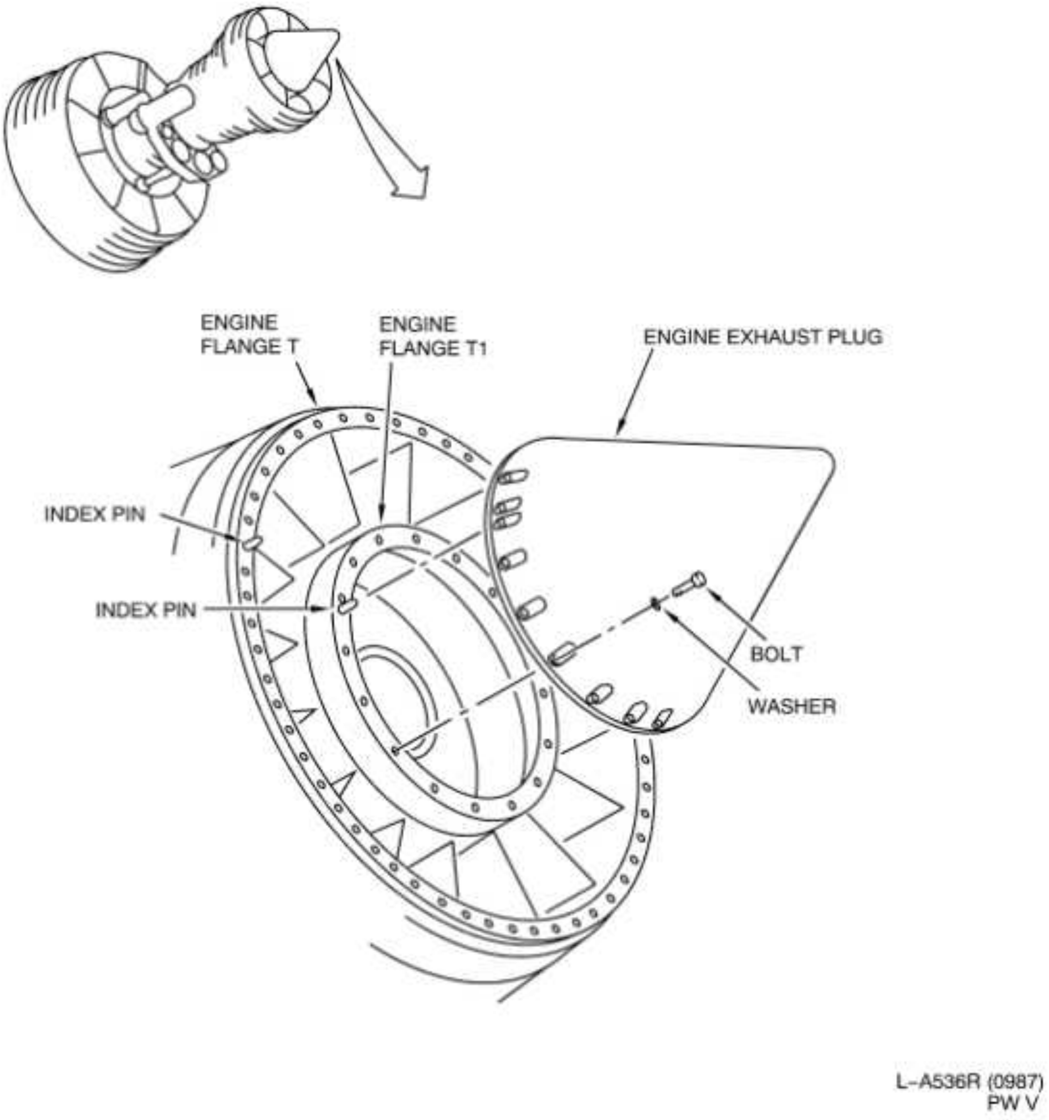
1. Remove Engine Exhaust Plug
   A. Equipment And Materials Required

      Special Tools:
      RSE1012 Support, Exhaust Plug

   B. Procedure
      See Figure 301.
      (1) Position RSE1012 Support under engine exhaust plug.
      (2) Remove bolts and washers attaching plug to engine Flange T1.
      (3) Remove plug and support from engine.

         NOTE: For additional information concerning detailed maintenance of the component, see Plug Assembly Component Maintenance Manual, 78–10–03.

POWER PLANT GENERAL − TURBINE EXHAUST CASE − REMOVAL−02


ENGINE FLANGE T
ENGINE FLANGE T1
ENGINE EXHAUST PLUG
INDEX PIN
INDEX PIN
BOLT
WASHER
L−A536R (0987)
PW V

Engine Exhaust Plug Removal
Figure 301
(Task 71−00−54−050−002)

POWER PLANT GENERAL − TURBINE EXHAUST CASE − REMOVAL−03

Task 71−00−54−050−003:

1. Remove Engine Exhaust Nozzle
   A. Equipment And Materials Required

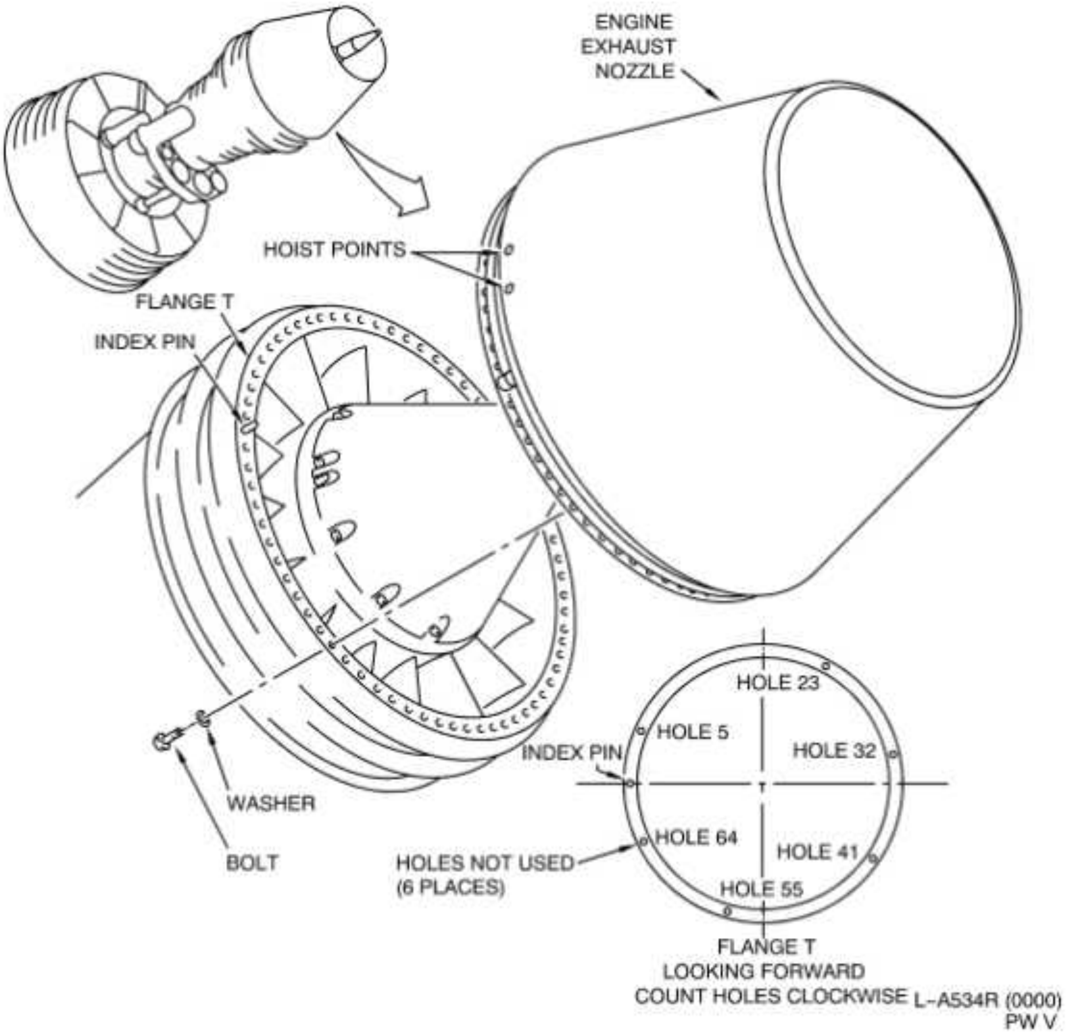
      Special Tools:
      RSE1006 Sling, Primary Nozzle
      RSE1022 Fixture, Primary Nozzle
      RSE1011 Dolly, Primary Nozzle

   B. Procedure
      See Figure 301.
      (1) Remove four plugs from engine exhaust nozzle hoist points.
      (2) Attach RSE1006 Sling to nozzle hoist points and torque bolts to 63 − 70 lb−in. (7.118 − 7.909 N.m).
      (3) Support weight of nozzle with sling.
      (4) Remove bolts and washers attaching nozzle to engine Flange T.

      NOTE: See Figure 301 for locations of bolts. Six holes are not used.

      (5) Remove nozzle and place on RSE1022 Fixture.
      (6) Remove sling and reinstall plugs in nozzle hoist points. Torque plugs to 50 − 70 lb−in. (5.649 − 7.909 N.m).
      (7) Place nozzle and fixture on RSE1011 Dolly.

      NOTE: For additional information concerning detailed maintenance of the component, see Nozzle Assembly Component Maintenance Manual, 78−10−04.


ENGINE EXHAUST NOZZLE
HOIST POINTS
FLANGE T
INDEX PIN
WASHER
BOLT
HOLES NOT USED (6 PLACES)
HOLE 23
HOLE 5
HOLE 32
INDEX PIN
HOLE 64
HOLE 41
HOLE 55
FLANGE T
LOOKING FORWARD
COUNT HOLES CLOCKWISE
L-A534R (0000)
PW V

Engine Exhaust Nozzle Removal
Figure 301
(Task 71-00-54-050-003)

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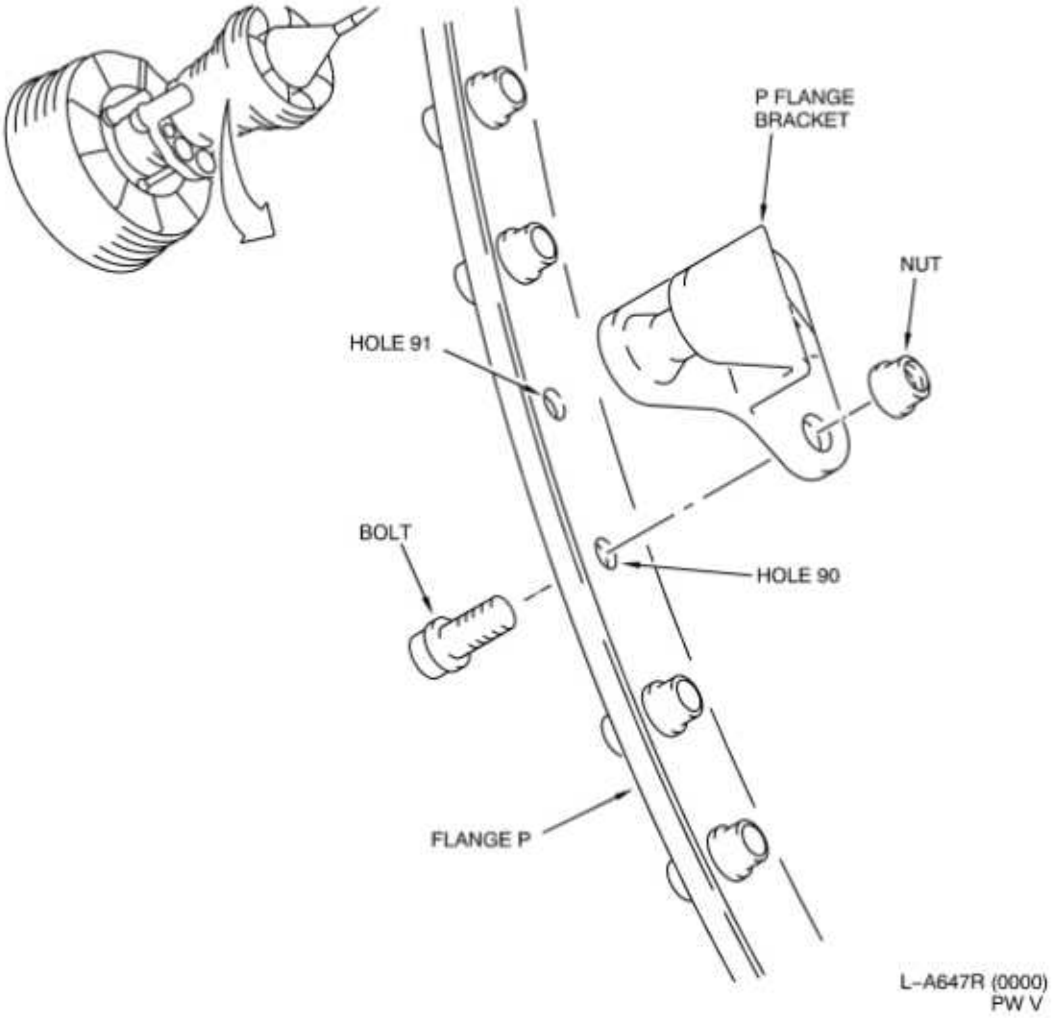
POWER PLANT GENERAL − TURBINE EXHAUST CASE − REMOVAL−04

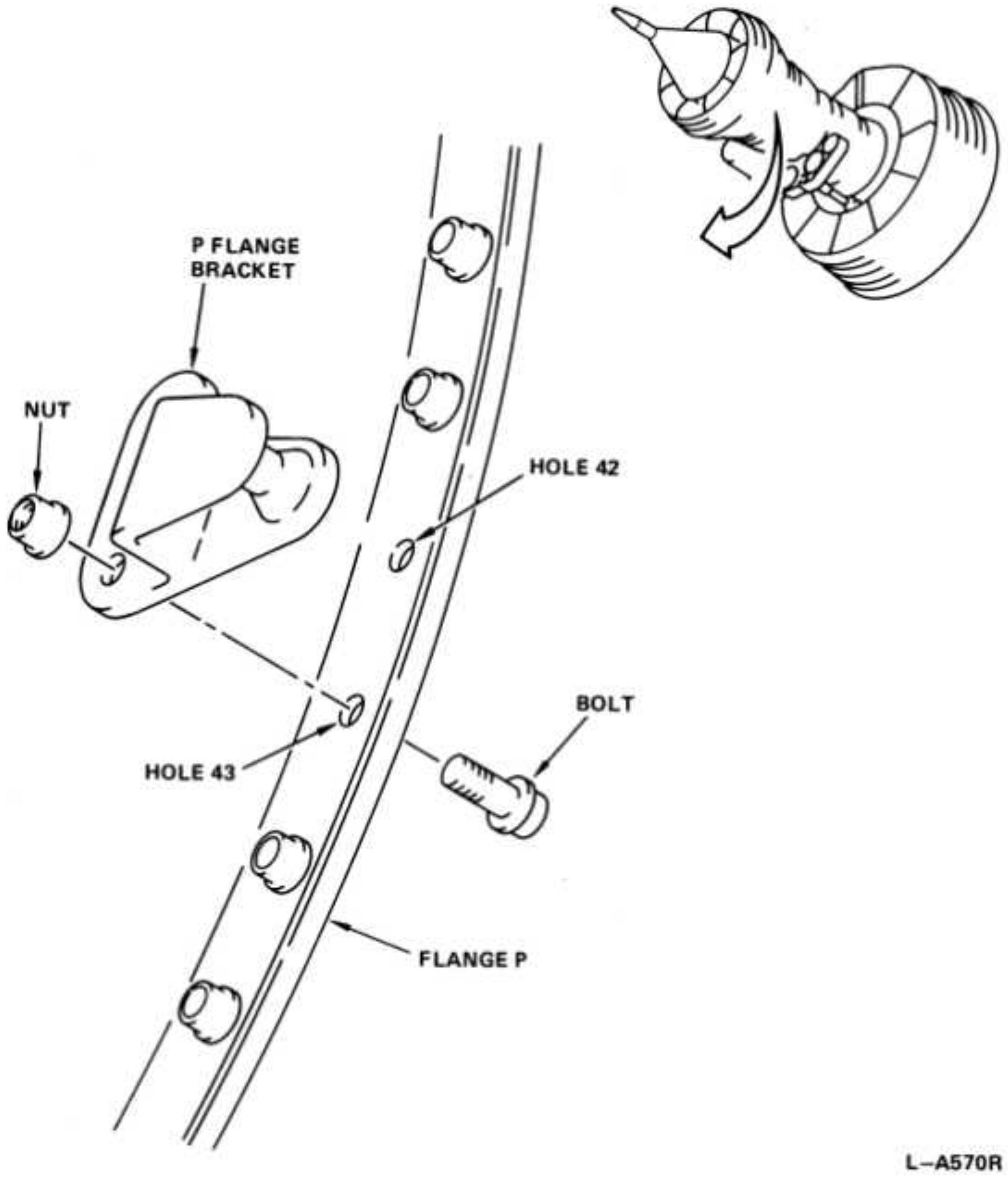
Task 71−00−54−050−004:

1. Remove Flange P Brackets
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figure 301.
     - (1) Remove two nuts and bolts attaching left thrust reverser door aft hold−open rod Flange P bracket to engine Flange P. Retain nuts and bolts with engine.
     - (2) Remove two nuts and bolts attaching right thrust reverser door aft hold−open rod Flange P bracket to engine Flange P. Retain nuts and bolts with engine.


P FLANGE BRACKET
NUT
HOLE 91
BOLT
HOLE 90
FLANGE P
L−A647R (0000)
PW V

Flange P Brackets Removal
Figure 301 (Sheet 1)
(Task 71−00−54−050−004)


P FLANGE BRACKET
NUT
HOLE 42
BOLT
HOLE 43
FLANGE P
L−A570R

Flange P Brackets Removal
Figure 301 (Sheet 2)
(Task 71−00−54−050−004)

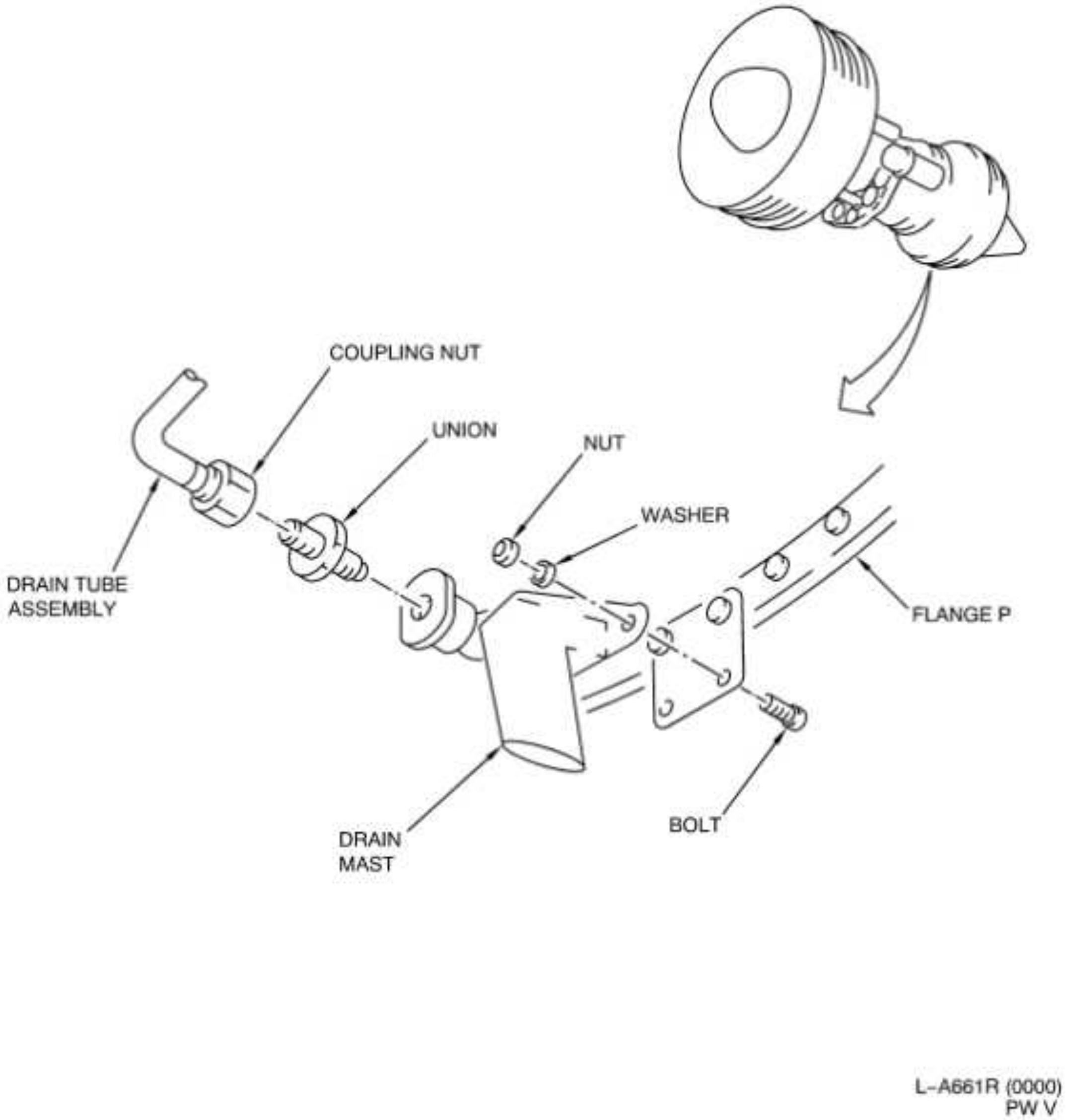
Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL − TURBINE EXHAUST CASE − REMOVAL−05

Task 71−00−54−050−005:

1. Remove Pylon Drain Mast
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figure 301.
     - (1) Disconnect coupling nut attaching drain tube assembly to drain mast.
     - (2) Remove union installed in drain outlet mast.
     - (3) Remove two nuts, washers and bolts attaching drain mast from bracket on engine Flange P. Retain nuts, washers and bolts with engine.


COUPLING NUT
UNION
NUT
WASHER
DRAIN TUBE ASSEMBLY
FLANGE P
DRAIN MAST
BOLT
L−A661R (0000)
PW V

Pylon Drain Mast Removal
Figure 301
(Task 71−00−54−050−005)

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POWER PLANT GENERAL - TURBINE EXHAUST CASE - REMOVAL-06

Task 71-00-54-050-011:

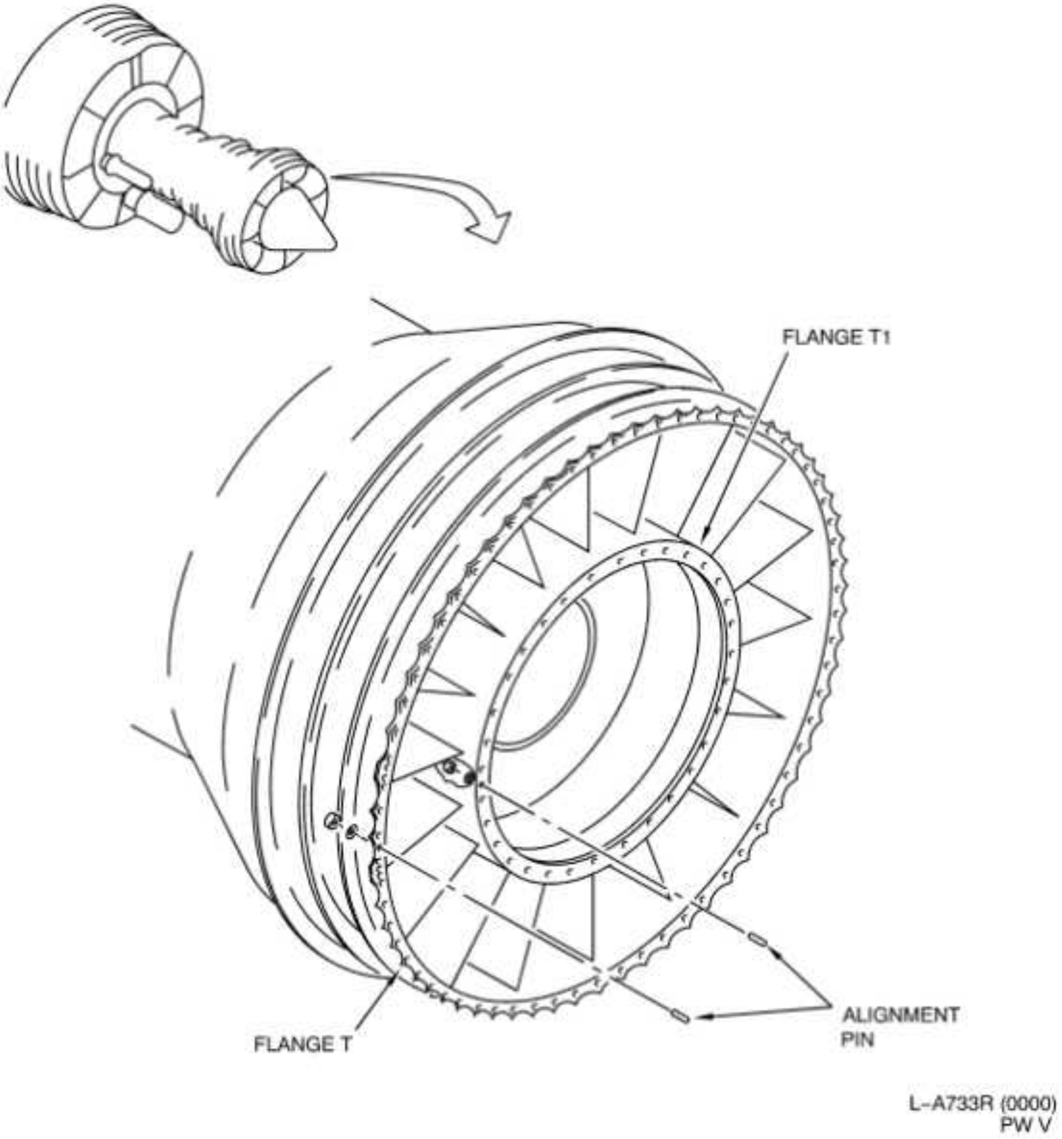
1. Remove Exhaust Nozzle And Plug Alignment Pins

A. Equipment And Materials Required - None

B. Procedure

See Figure 301.

(1) Remove nut and washer securing exhaust nozzle and plug alignment pins to Flanges T and T1 of left side of turbine exhaust case.


FLANGE T1
ALIGNMENT PIN
FLANGE T
L-A733R (0000)
PW V

Exhaust Nozzle And Plug Alignment Pins
Figure 301
(Task 71−00−54−050−011)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL − TURBINE EXHAUST CASE − INSTALLATION−01

Task 71−00−54−450−001:

1. Install Engine Aft Mount

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine

B. Procedure

See Figure 401.

(1) Slide four plates (401/1) over ends of outboard mount bearings.

CAUTION: DO NOT ROTATE THE BOLT WHEN YOU INSTALL THE BOLT. ROTATION CAN CAUSE SCORING DAMAGE TO THE BOLT.

(2) Lubricate threads of center bolt (401/2) with Engine Oil (P03−001). Position engine aft mount (401/3) on engine and install center bolt, washer (401/4), plates (401/5) and (401/6), washer (401/7) and nut (401/8).

(3) Lubricate threads of four bolts (401/9) with Engine Oil (P03−001). Install four bolts through engine flanges and plates (401/5) and (401/6) with washers (401/10) and nuts (401/11).

(4) Torque nuts (401/8) to 250 − 300 lb−in. (28.246 − 33.895 N.m).

(5) Remove nuts (401/11) and washers (401/10) from bolts (401/9) and install retainers (401/12) and (401/13) on bolts by reinstalling washers and nuts. Torque nuts to 400 − 500 lb−in. (45.194 − 56.492 N.m).

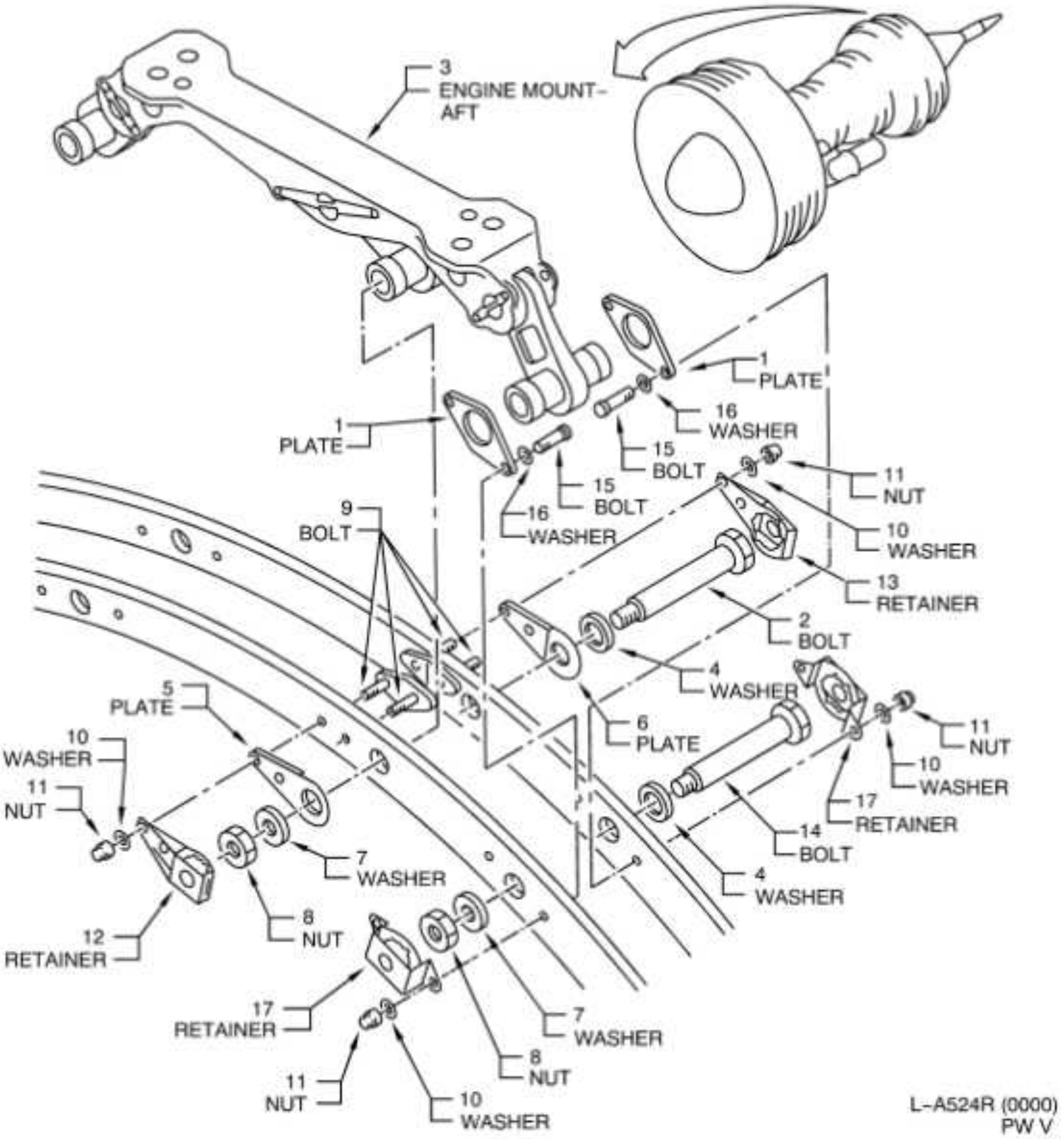
CAUTION: DO NOT ROTATE THE BOLT WHEN YOU INSTALL THE BOLT. ROTATION CAN CAUSE SCORING DAMAGE TO THE BOLT.

(6) Lubricate threads of two outboard bolts (401/14) with Engine Oil (P03−001). Install two outboard bolts, washers (401/4) and (401/7) and nuts (401/8) in outboard bearings and torque nuts to 250 − 300 lb−in. (28.246 − 33.895 N.m).

POWER PLANT GENERAL − TURBINE EXHAUST CASE − INSTALLATION−01

(7) Lubricate threads of eight bolts (401/15) with Engine Oil (P03−001). Install eight bolts and washers (401/16) through plates (401/1).

(8) Install four retainers (401/17) on bolts (401/15) and secure with washers (401/10) and nuts (401/11). Torque nuts to 400 − 500 lb−in. (45.194 − 56.492 N.m).


3 ENGINE MOUNT-AFT
1 PLATE
16 WASHER
15 BOLT
1 PLATE
15 BOLT
16 WASHER
11 NUT
10 WASHER
9 BOLT
13 RETAINER
2 BOLT
4 WASHER
5 PLATE
6 PLATE
11 NUT
10 WASHER
10 WASHER
11 NUT
17 RETAINER
14 BOLT
7 WASHER
4 WASHER
8 NUT
12 RETAINER
17 RETAINER
7 WASHER
8 NUT
11 NUT
10 WASHER
L-A524R (0000)
PW V

Engine Aft Mount Installation
Figure 401
(Task 71–00–54–450–001)

POWER PLANT GENERAL − TURBINE EXHAUST CASE − INSTALLATION−02

Task 71−00−54−450−003:

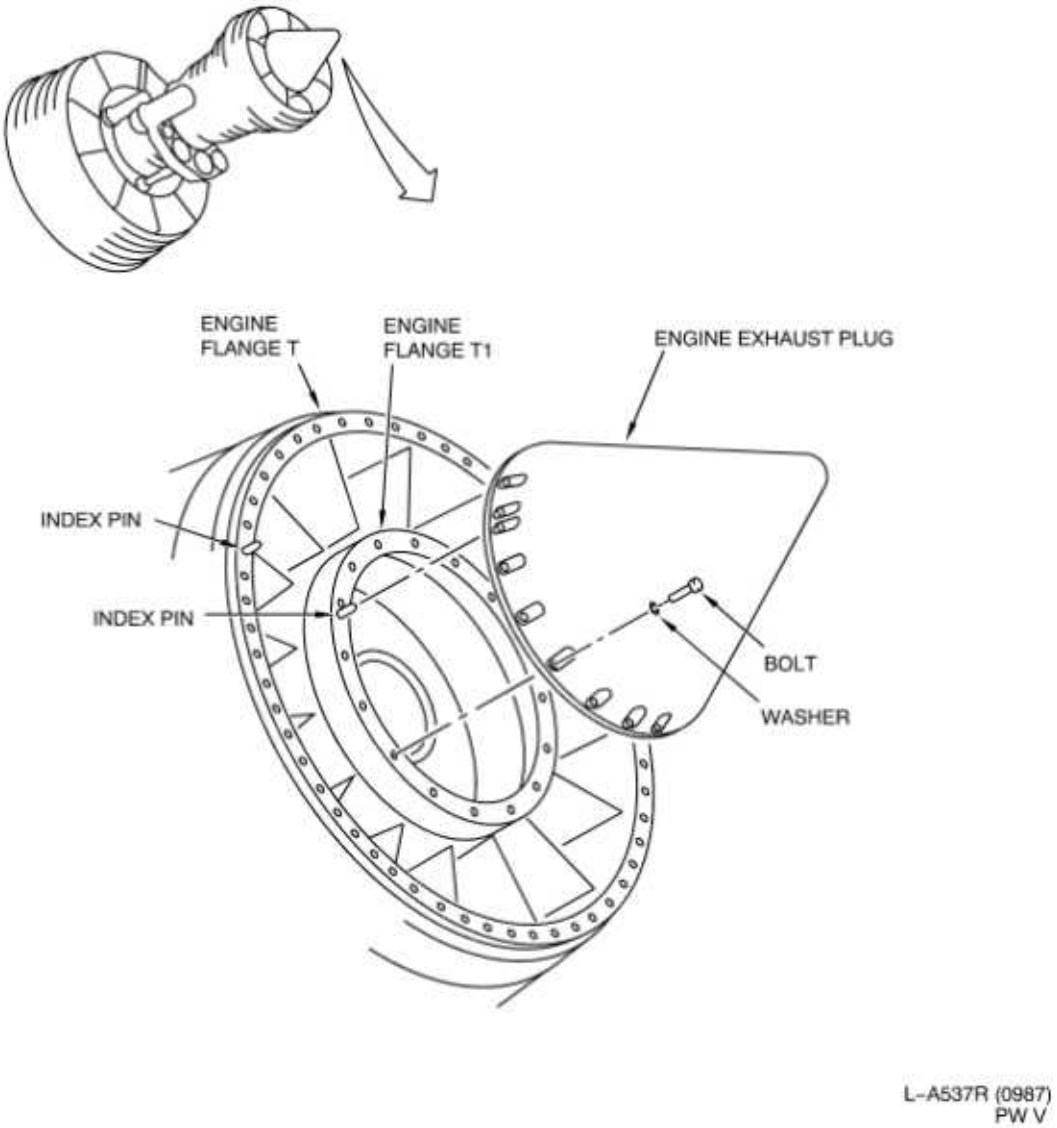
1. Install Engine Exhaust Plug
   A. Equipment And Materials Required

   Special Tools:
   RSE1012 Support, Exhaust Plug

   Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine

   B. Procedure
   See Figure 401.
   (1) Position RSE1012 Support and engine exhaust plug at engine Flange T1.
   (2) Align index hole in plug with engine Flange T1 index pin and mate plug with flange.
   (3) Install five upper bolts and washers attaching plug to engine Flange T1.
   (4) Remove the plug support fixture and install the remaining bolts, threads lubricated with Engine Oil (P03−001), and washers. Use an opposite bolt tightening pattern sequence and apply an initial torque of 100 lb−in. (11.298 N.m) to the bolts.
   (5) Use an opposite bolt tightening pattern sequence and apply the final torque of 100 − 115 lb−in. (11.298 − 12.993 N.m) to the bolts.


ENGINE FLANGE T
ENGINE FLANGE T1
ENGINE EXHAUST PLUG
INDEX PIN
INDEX PIN
BOLT
WASHER
L−A537R (0987)
PW V

Engine Exhaust Plug Installation
Figure 401
(Task 71−00−54−450−003)

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POWER PLANT GENERAL - TURBINE EXHAUST CASE - INSTALLATION-03

Task 71-00-54-450-002:

1. Install Engine Exhaust Nozzle

A. Equipment And Materials Required

Special Tools:
RSE1006 Sling, Primary Nozzle
RSE1022 Fixture, Primary Nozzle

R NOTE: As a result of the incorporation of SB PW4ENG
R 72-756 or PW4ENG 72-759, modification of the HPC to
R incorporate a Ring Case Configuration (RCC), it is
R not acceptable, due to weight restrictions, to
R install Thrust Reverser Improvement Program (TRIP)
R configuration thrust reversers (SN 0714001 and on)
R with Inconel exhaust nozzles (SN 1 through 0744001)
R if any of the following options are included on
R the nacelles: SCU, acoustically treated inlet or
R acoustic plug. Incorporation of an Inconel nozzle
R (PN 221-0051 SN 1 through 0744001) on a post SB
R 72-256 or SB 72-259 engine could disallow the use
R of the powerplant depending on the nacelle options.
R Refer to inspection SB PW4NAC 78-111 that defines
R the disallowed combinations which will result in an
R unacceptable propulsion system weight.

B. Procedure
See Figure 401.

(1) Remove four plugs from engine exhaust nozzle hoist points.

(2) Attach RSE1006 Sling to nozzle hoist points and torque bolts to 63 - 70 lb-in. (7.118 - 7.909 N.m).

(3) Remove nozzle from RSE1022 Fixture and position nozzle with index hole at 9 o'clock looking forward.

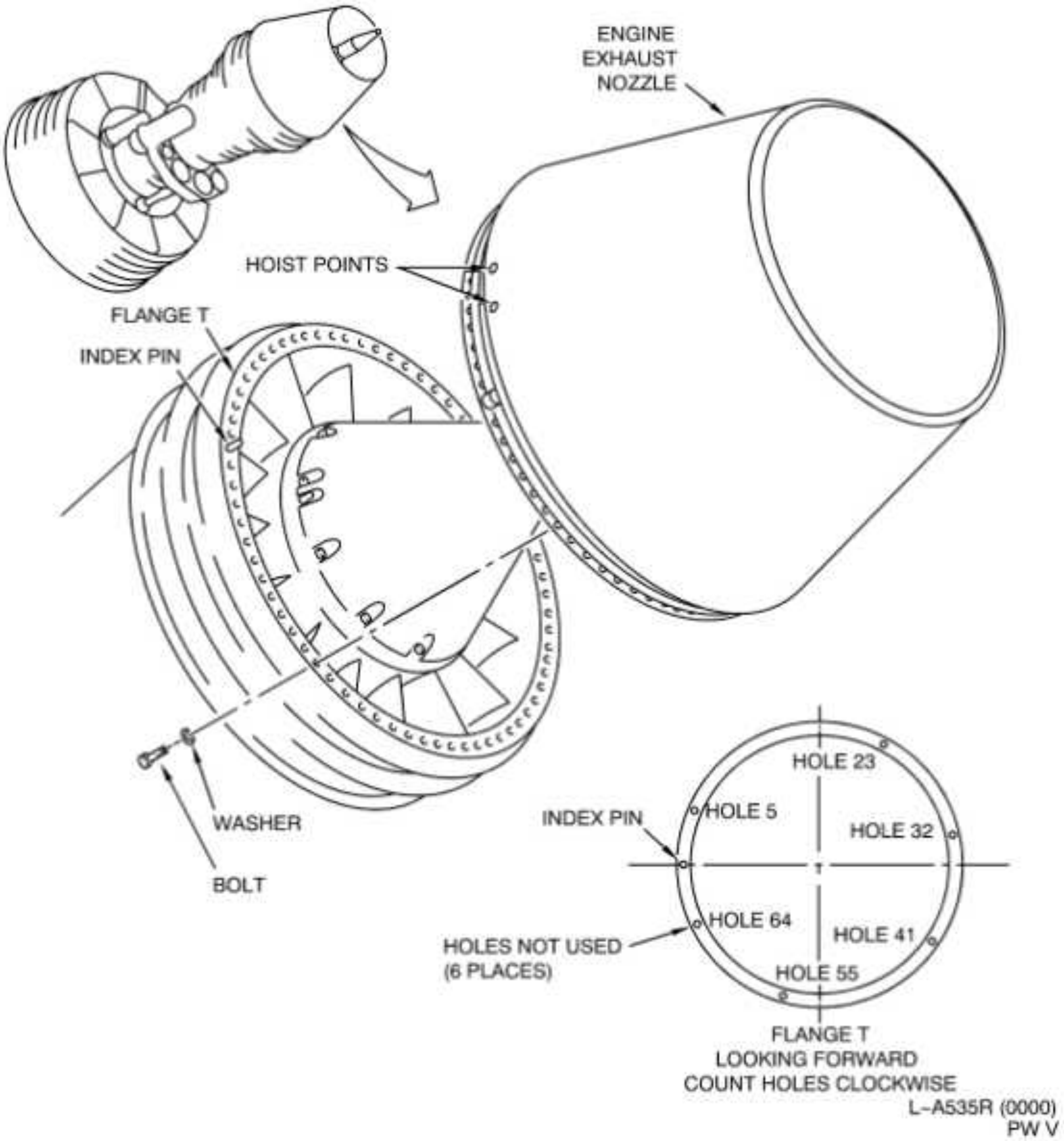
(4) Align index hole in nozzle with engine Flange T index pin and mate nozzle with flange.

(5) Attach nozzle to engine flange with bolts and washers. Torque bolts to initial torque of 63 lb-in. (7.118 N.m) using opposite bolt tightening sequence.

NOTE: See Figure 401 for installation of bolts. Six holes will not be used.

(6) Apply final torque of 63 − 70 lb−in. (7.118 − 7.909 N.m) to bolts using opposite bolt tightening sequence.

(7) Remove sling and reinstall plugs in nozzle hoist points. Torque plugs to 50 − 70 lb−in. (5.649 − 7.909 N.m).


ENGINE
EXHAUST
NOZZLE
HOIST POINTS
FLANGE T
INDEX PIN
WASHER
BOLT
HOLE 23
INDEX PIN
HOLE 5
HOLE 32
HOLE 64
HOLE 41
HOLES NOT USED
(6 PLACES)
HOLE 55
FLANGE T
LOOKING FORWARD
COUNT HOLES CLOCKWISE
L−A535R (0000)
PW V

Engine Exhaust Nozzle Installation
Figure 401
(Task 71−00−54−450−002)

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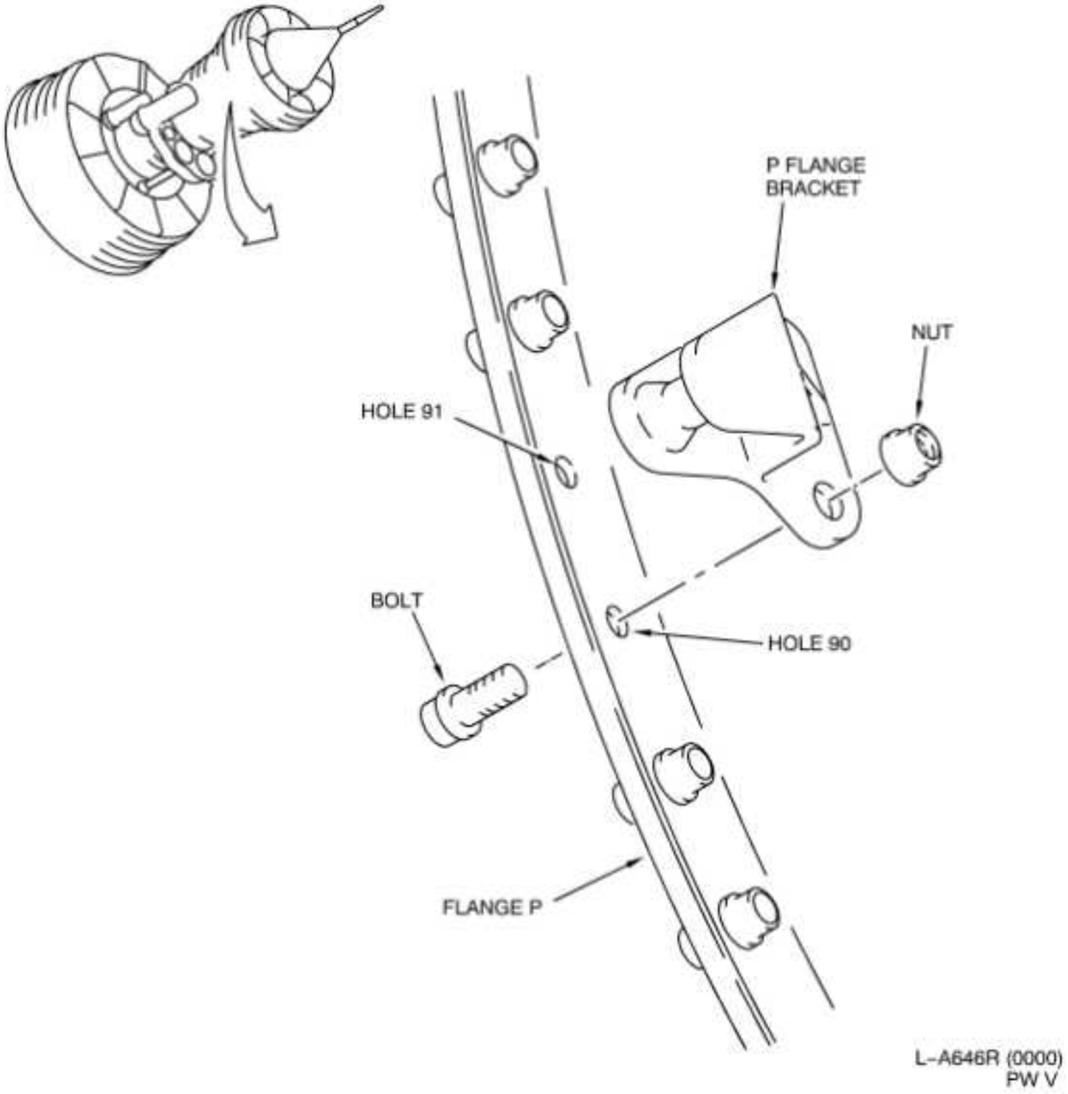
POWER PLANT GENERAL − TURBINE EXHAUST CASE − INSTALLATION−04

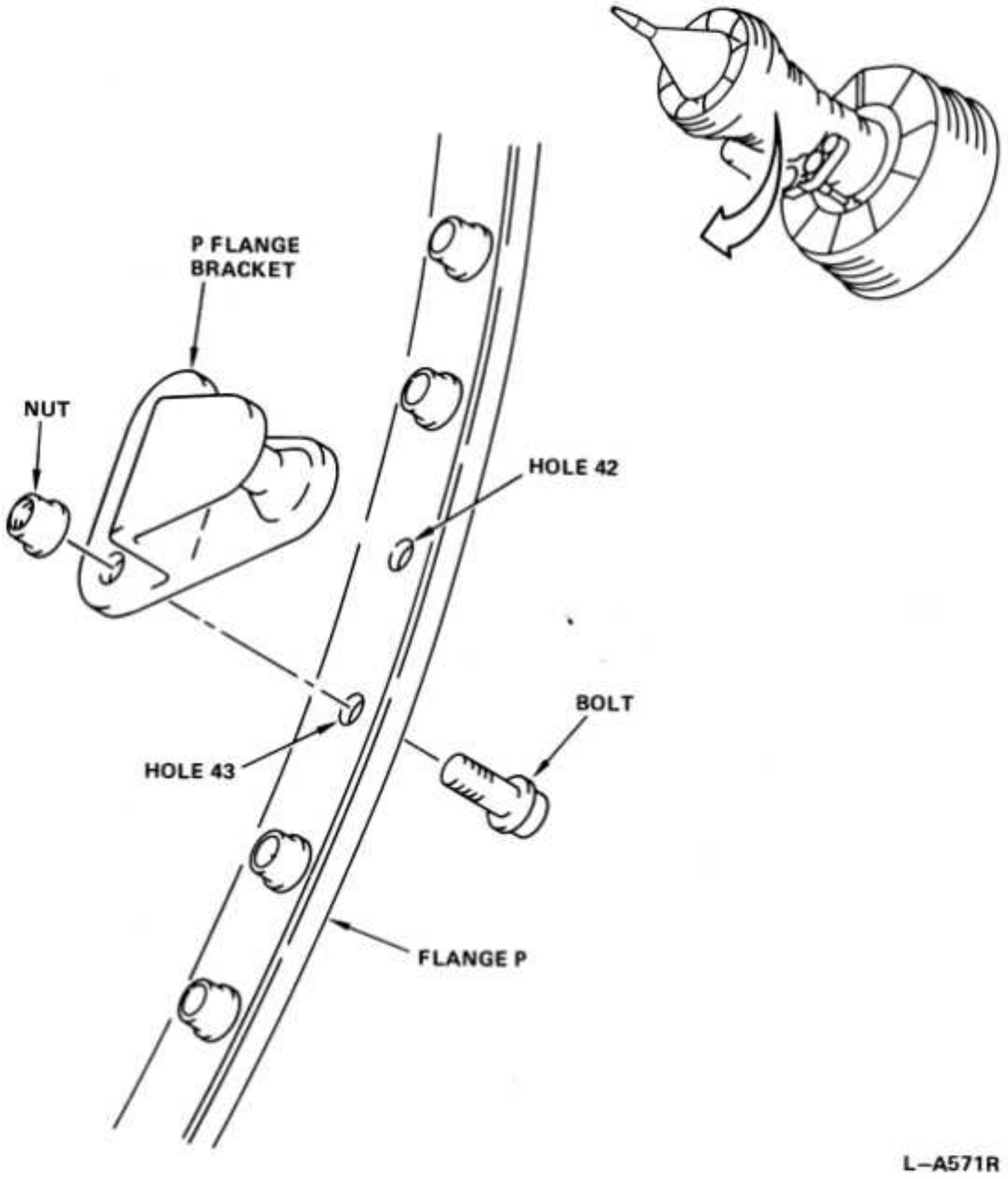
Task 71−00−54−450−004:

1. Install Flange P Brackets
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figure 401.
     - (1) Attach left thrust reverser door aft hold−open rod Flange P bracket to aft face of engine Flange P with bolts and nuts in hole numbers 90 and 91. Torque nuts to 180 − 200 lb−in. (20.337 − 22.597 N.m).
     - (2) Attach right thrust reverser door aft hold−open rod Flange P bracket to aft face of engine Flange P with bolts and nuts in hole numbers 42 and 43. Torque nuts to 180 − 200 lb−in. (20.337 − 22.597 N.m).


P FLANGE BRACKET
NUT
HOLE 91
BOLT
HOLE 90
FLANGE P
L-A646R (0000)
PW V

Flange P Brackets Installation
Figure 401 (Sheet 1)
(Task 71-00-54-450-004)


P FLANGE BRACKET
NUT
HOLE 42
HOLE 43
BOLT
FLANGE P
L−A571R

Flange P Brackets Installation
Figure 401 (Sheet 2)
(Task 71−00−54−450−004)

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POWER PLANT GENERAL - TURBINE EXHAUST CASE - INSTALLATION-05

Task 71-00-54-450-005:

1. Install Pylon Drain Mast

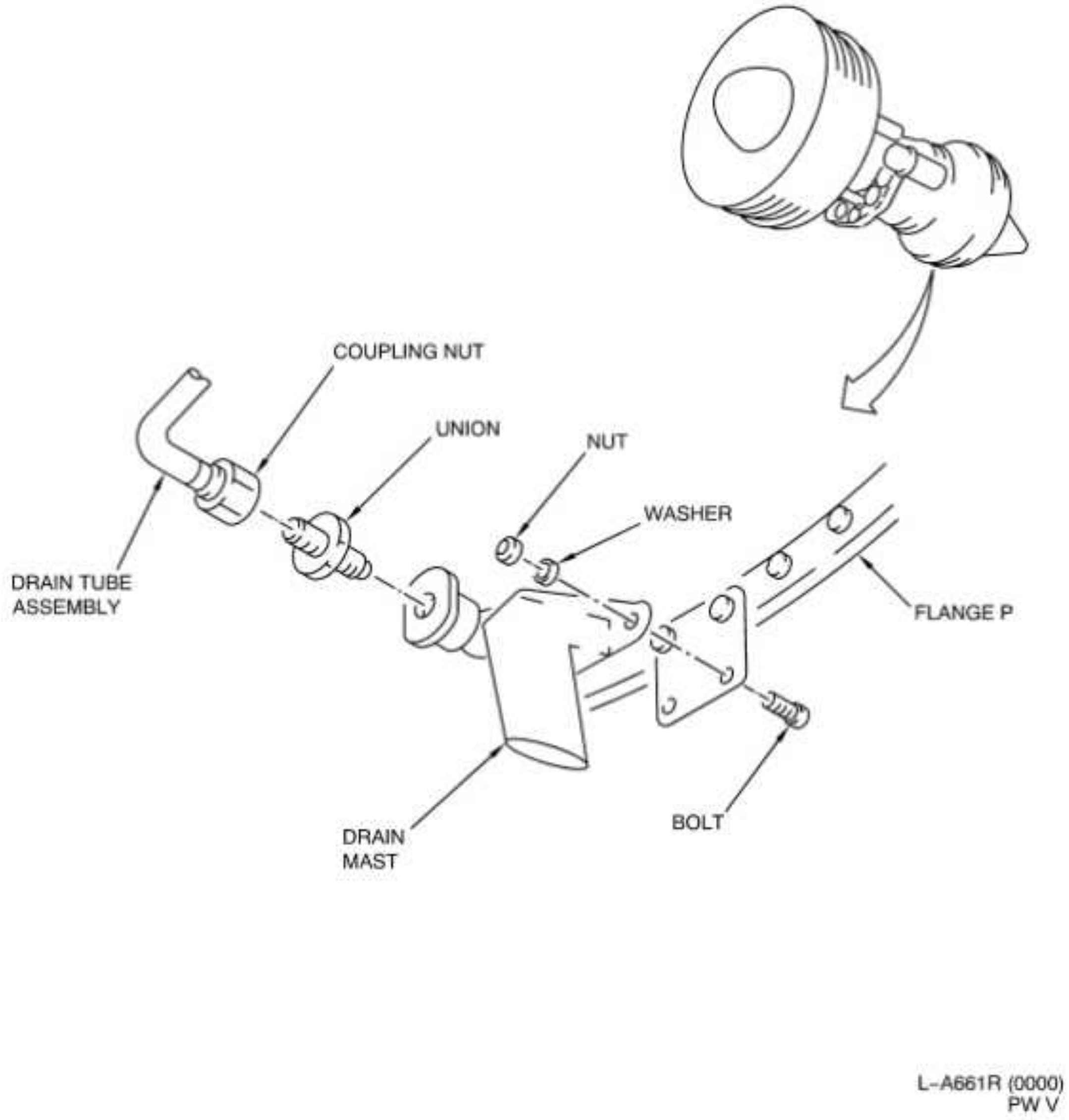
   A. Equipment And Materials Required - None

   B. Procedure
   See Figure 401.

      (1) Position drain mast on engine Flange P bracket and attach using two bolts, washers and nuts. Torque nuts 50 - 70 lb-in. (5.649 - 7.909 N.m).

      (2) Install union in drain mast. Torque union 215 - 240 lb-in. (24.292 - 27.116 N.m).

      (3) Attach drain tube assembly to drain mast union. Torque coupling nut to 450 - 500 lb-in. (50.843 - 56.492 N.m).


COUPLING NUT
UNION
NUT
WASHER
DRAIN TUBE ASSEMBLY
FLANGE P
DRAIN MAST
BOLT
L−A661R (0000)
PW V

Pylon Drain Mast Installation
Figure 401
(Task 71−00−54−450−005)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - TURBINE EXHAUST CASE - INSTALLATION-06

Task 71-00-54-450-011:

1. Install Exhaust Nozzle And Plug Alignment Pins

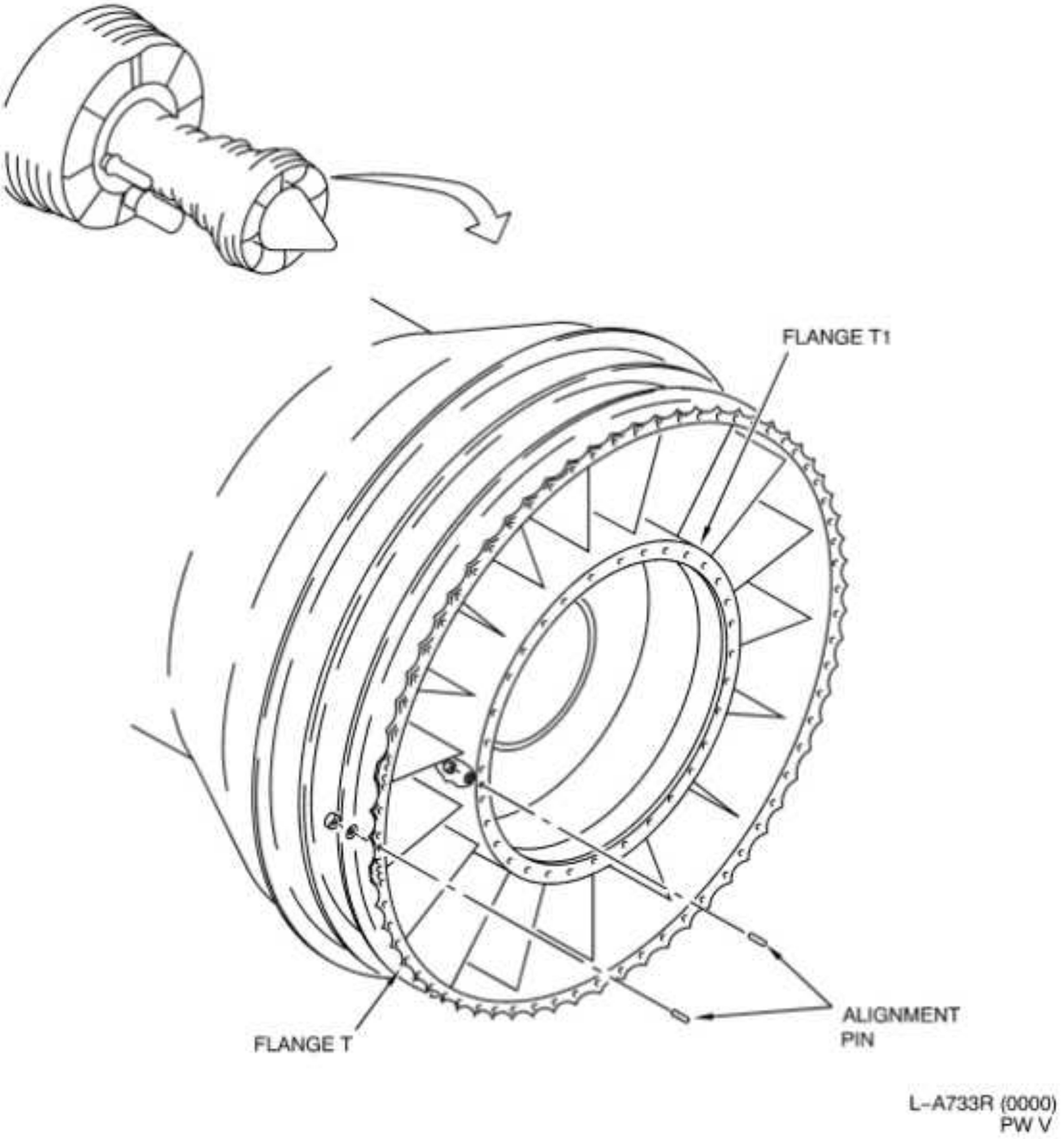
A. Equipment And Materials Required - None

B. Procedure

See Figure 401.

(1) On left side of turbine exhaust case at Flanges T and T1, install one alignment pin on each flange using washer and nut. Torque nuts 50 - 70 lb-in. (5.65 - 7.91 N.m).

NOTE: Install washers between nuts and flanges.


FLANGE T1
ALIGNMENT PIN
FLANGE T
L−A733R (0000)
PW V

Exhaust Nozzle And Plug Alignment Pins
Figure 401
(Task 71−00−54−450−011)

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	HIGHLIGHTS
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71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−03 • 71−00−61−050−003: Remove Starter Shutoff Valve
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−04 • 71−00−61−050−004: Remove Integrated Drive Generator (IDG)
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−05 • 71−00−61−050−005: Remove IDG Quick−Attach−Detach (QAD) Adapter
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−06 • 71−00−61−050−006: Remove Main Fuel Supply Line
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71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−08 • 71−00−61−050−008: Remove Oil Filter Differential Pressure Switch
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71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−10 • 71−00−61−050−010: Remove Engine Oil Tank Pressure Fill System
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−11 • 71−00−61−050−011: Remove Oil Quantity Transmitter

71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−12 • 71−00−61−050−012: Remove Front Hydraulic Pump
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−13 • 71−00−61−050−013: Remove Rear Hydraulic Pump
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−14 • 71−00−61−050−014: Remove Starter Assembly
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−15 • 71−00−61−050−015: Remove Chip Detectors
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−16 • 71−00−61−050−016: Remove Deoiler Vent Duct
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−17 • 71−00−61−050−017−001: Remove HP Fuel Shutoff Valve Actuator (PN 221D4003−507) • 71−00−61−050−017−002: Remove HP Fuel Shutoff Valve Actuator (PN 221D4003−509)
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71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−28 • 71−00−61−050−034: Remove IDG Starter, And Hydraulic Pump Heat Shields
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71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−30 • 71−00−61−050−036: Remove EEC Alternator (PMA) Cooling Hose And Tubes
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−31 • 71−00−61−050−037: Remove Starter Cooling Tubes
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−32 • 71−00−61−050−038: Remove Oil Quantity Transmitter Cooling Tube
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71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−04 • 71−00−61−450−004: Install Integrated Drive Generator (IDG)
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71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−08 • 71−00−61−450−008: Install Oil Filter Differential Pressure Switch
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71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−16 • 71−00−61−450−016: Install Deoiler Vent Duct
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−17 • 71−00−61−450−017−001: Install HP Fuel Shutoff Valve Actuator (PN 221D4003−507) • 71−00−61−450−017−002: Install HP Fuel Shutoff Valve Actuator (PN 221D4003−509)
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−18 • 71−00−61−450−018: Install Drain Collector Manifold Assembly
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−19 • 71−00−61−450−019: Install Accessory Drain Tubing
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−25 • 71−00−61−450−031: Install Fuel Pump Interstage Pressure Transmitter
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−26 • 71−00−61−450−032: Install Oil Temperature Sensor
71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−27 • 71−00−61−450−033: Install No. 3 Bearing Oil Temperature Sensor (Immersion Thermocouple)
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71−00−61	POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−29 • 71−00−61−450−035: Install Starter Control Valve Cooling Tube And Hose
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POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-01

Task 71-00-61-050-001:

1. Remove Hydraulic Hoses (Abex Pump)
   A. Prerequisites
      (1) Remove engine main fuel supply hose. See 71-00-61, Removal-XX (Task 71-00-61-050-XXX).
   B. Equipment And Materials Required - None
   C. Procedure
      See Figures 301 and 302.

      NOTE: Removal of insulation blankets is unnecessary during hose removal.

      (1) Remove front hydraulic pump upper case drain hose.
         (a) Remove upper case drain hose from clamp block (301/1).
            1 Remove bolt and washer securing clamp block (301/1).
            2 Open right hand clamp band and remove case drain hose from clamp block (301/).
         (b) Disconnect hose from fluid disconnect panel.
         (c) Disconnect hose from union on top of front hydraulic filter and remove hose from the engine.
      (2) Remove front hydraulic pump lower case drain hose.
         (a) Remove two clamps (302/5 and 302/7) attaching upper case drain hose to front hydraulic pump pressure hose.
         (b) Remove clamp (302/10) attaching three front hydraulic pump hoses together.
         (c) Remove clamp (302/9) attaching three front hydraulic pump hoses to bracket on main gearbox.
         (d) Remove clamp (302/11) attaching three front hydraulic pump hoses together.
         (e) Remove clamp (302/5) attaching lower case drain hose to lower hose support bracket.
         (f) Disconnect lower case drain hose from union on side of front hydraulic filter.
         (g) Disconnect lower case drain hose from reducer in front hydraulic pump and remove hose from engine.
      (3) Remove front hydraulic pump pressure hose.
         (a) Remove clamps (302/7 and 302/9) attaching pressure hose to front hydraulic pump suction hose.
         (b) Remove clamp (302/6) attaching pressure hose to lower hose support bracket.
         (c) Remove clamp (301/2) attaching pressure hose to hydraulic filter bracket.
         (d) Remove clamp (301/3) attaching pressure hose to upper hose support bracket.
         (e) Disconnect hose from fluid disconnect panel.

- (f) Disconnect hose from pulsation dampener on front hydraulic pump and remove hose from engine.

(4) Remove front hydraulic pump suction hose.
- (a) Remove clamp (302/8) attaching suction hose to lower hose support bracket.
- (b) Remove clamp (301/3) attaching suction hose to hydraulic filter bracket.
- (c) Remove clamp (301/3) attaching suction hose to upper hose support bracket.
- (d) Disconnect suction hose from fluid disconnect panel.
- (e) Disconnect suction hose from adapter on front hydraulic pump and remove hose from engine.

(5) Remove rear hydraulic pump upper case drain hose.
- (a) Remove upper case drain hose from clamp block (301/1)
  - 1 Remove bolt and washer from clamp block (301/1).
  - 2 Open left hand clamp band and remove hose from clamp block (301/1).
- (b) Disconnect upper case drain hose from the fluid disconnect panel.
- (c) Disconnect upper case drain hose from union on top of rear hydraulic filter and remove hose from engine.

(6) Remove rear hydraulic pump case drain hose.
- (a) Remove clamp (301/4) attaching three rear hydraulic hoses together.
- (b) Disconnect lower case drain hose from fluid disconnect panel.
- (c) Disconnect lower case drain hose from union on side of rear hydraulic filter and remove hose from engine.

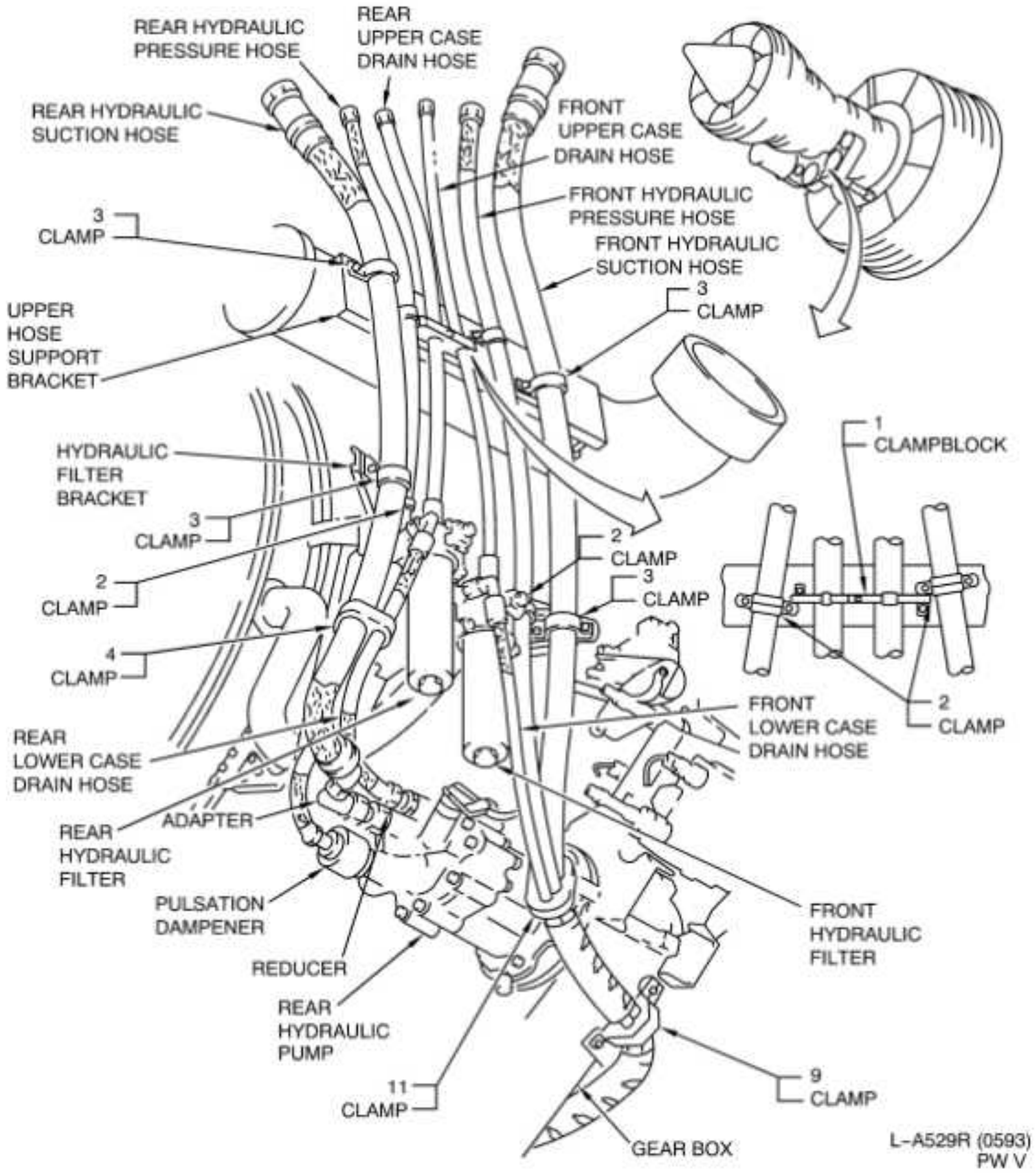
(7) Remove rear hydraulic pump pressure hose.
- (a) Remove clamp (301/2) attaching pressure hose to hydraulic filter bracket.
- (b) Remove clamp (301/2) attaching pressure hose to upper hose support bracket.
- (c) Disconnect pressure hose from fluid disconnect panel.
- (d) Disconnect pressure hose from pulsation dampener on rear hydraulic pump and remove hose from engine.

(8) Remove rear hydraulic pump suction hose.
- (a) Remove clamp (301/3) attaching suction hose to hydraulic filter bracket.
- (b) Remove clamp (301/3) attaching suction hose to upper hose support bracket.
- (c) Disconnect suction hose from fluid disconnect panel.

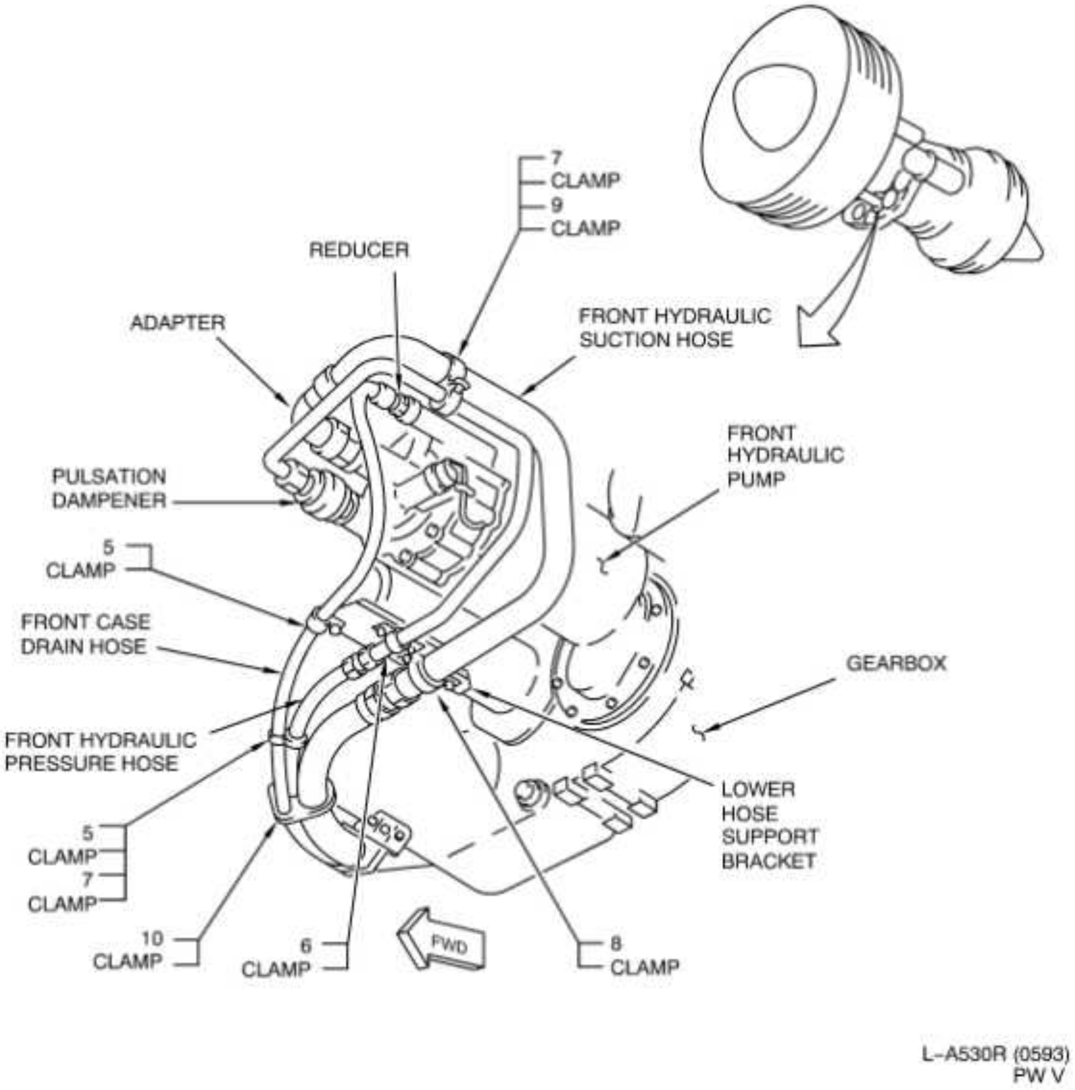
  - (d) Disconnect suction hose from adapter on rear hydraulic pump and remove hose from engine.

D. Postrequisites

- (1) Remove hydraulic pump case drain filters. See 71−00−61, Removal−07 (Task 71−00−61−050−007).


REAR HYDRAULIC PRESSURE HOSE
REAR UPPER CASE DRAIN HOSE
REAR HYDRAULIC SUCTION HOSE
FRONT UPPER CASE DRAIN HOSE
FRONT HYDRAULIC PRESSURE HOSE
FRONT HYDRAULIC SUCTION HOSE
3 CLAMP
UPPER HOSE SUPPORT BRACKET
3 CLAMP
1 CLAMPBLOCK
HYDRAULIC FILTER BRACKET
3 CLAMP
2 CLAMP
2 CLAMP
3 CLAMP
4 CLAMP
FRONT LOWER CASE DRAIN HOSE
2 CLAMP
REAR LOWER CASE DRAIN HOSE
ADAPTER
REAR HYDRAULIC FILTER
PULSATION DAMPENER
FRONT HYDRAULIC FILTER
REDUCER
REAR HYDRAULIC PUMP
9 CLAMP
11 CLAMP
GEAR BOX
L-A529R (0593)
PW V

Right Side Hydraulic Hoses (Abex Pump)
Figure 301
(Task 71−00−61−050−001)


7
CLAMP
9
CLAMP
REDUCER
ADAPTER
FRONT HYDRAULIC
SUCTION HOSE
FRONT
HYDRAULIC
PUMP
PULSATION
DAMPENER
5
CLAMP
FRONT CASE
DRAIN HOSE
GEARBOX
FRONT HYDRAULIC
PRESSURE HOSE
LOWER
HOSE
SUPPORT
BRACKET
5
CLAMP
7
CLAMP
10
CLAMP
6
CLAMP
FWD
8
CLAMP
L−A530R (0593)
PW V

Left Side Hydraulic Hoses (Abex Pump)
Figure 302
(Task 71−00−61−050−001)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-02

Task 71-00-61-050-002:

1. Remove Hydraulic Hoses (Sperry-Vickers Pump)
   A. Prerequisites
      (1) Remove engine main fuel supply hose. See 71-00-61, Removal-XX (Task 71-00-61-050-XXX).
   B. Equipment And Materials Required - None
   C. Procedure
      See Figures 301 and 302.

      NOTE: Removal of insulation blankets is unnecessary during hose removal.

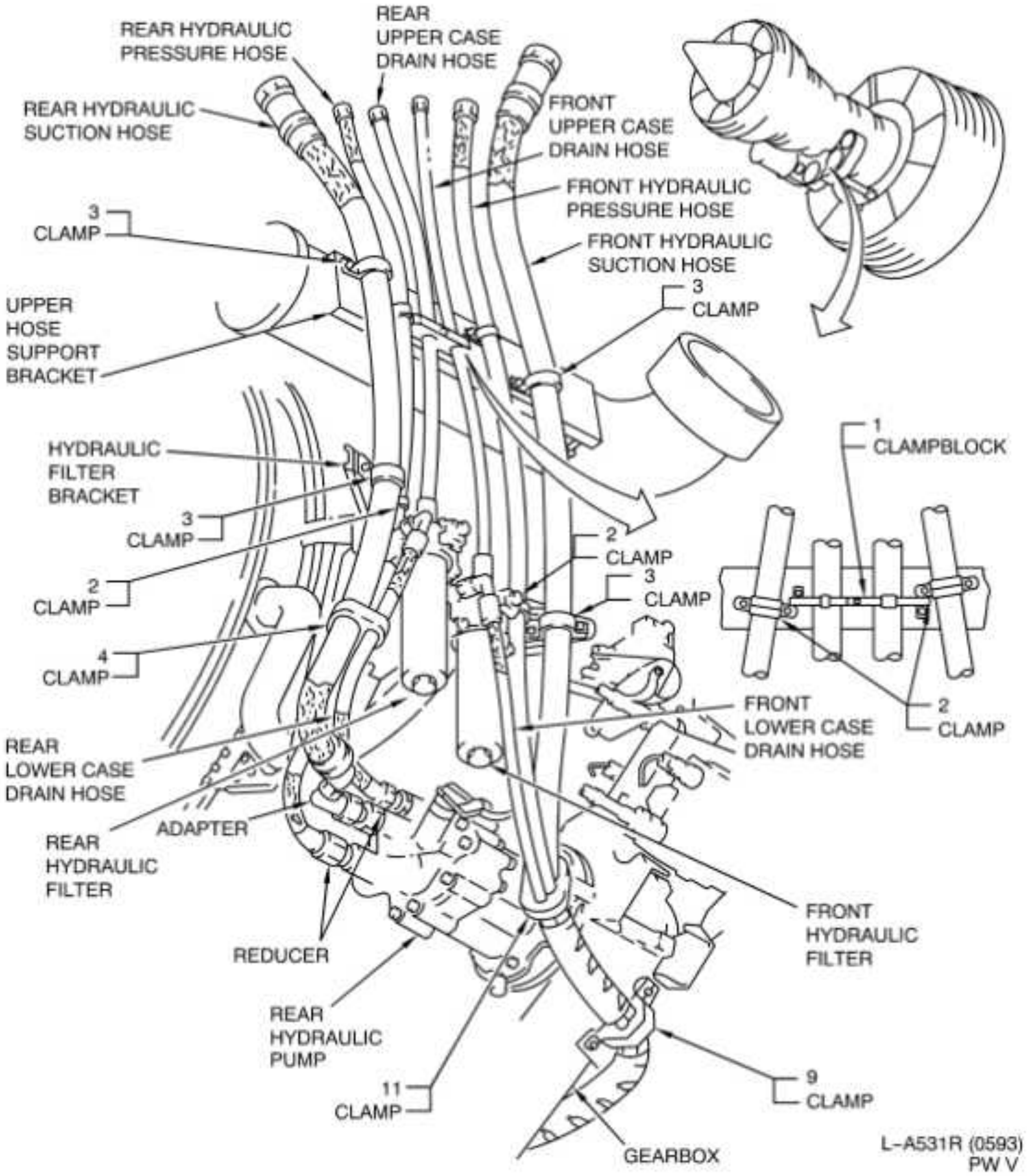
      (1) Remove front hydraulic pump upper case drain hose.
         (a) Remove upper case drain hose from clamp block (301/1).
            1 Remove bolt and washer securing clamp block (301/1).
            2 Open right hand clamp band and remove case drain hose from clamp block (301/).
         (b) Disconnect hose from fluid disconnect panel.
         (c) Disconnect hose from union on top of front hydraulic filter and remove hose from the engine.
      (2) Remove front hydraulic pump lower case drain hose.
         (a) Remove two clamps (302/5 and 302/7) attaching upper case drain hose to front hydraulic pump pressure hose.
         (b) Remove clamp (302/10) attaching three front hydraulic pump hoses together.
         (c) Remove clamp (302/9) attaching three front hydraulic pump hoses to bracket on main gearbox.
         (d) Remove clamp (302/11) attaching three front hydraulic pump hoses together.
         (e) Remove clamp (302/5) attaching lower case drain hose to lower hose support bracket.
         (f) Disconnect lower case drain hose from union on side of front hydraulic filter.
         (g) Disconnect lower case drain hose from reducer in front hydraulic pump and remove hose from engine.
      (3) Remove front hydraulic pump pressure hose.
         (a) Remove clamps (302/7 and 302/9) attaching pressure hose to front hydraulic pump suction hose.
         (b) Remove clamp (302/6) attaching pressure hose to lower hose support bracket.
         (c) Remove clamp (301/2) attaching pressure hose to hydraulic filter bracket.
         (d) Remove clamp (301/3) attaching pressure hose to upper hose support bracket.
         (e) Disconnect hose from fluid disconnect panel.

  - (f) Disconnect hose from reducer in front hydraulic pump and remove hose from engine.
- (4) Remove front hydraulic pump suction hose.
  - (a) Remove clamp (302/8) attaching suction hose to lower hose support bracket.
  - (b) Remove clamp (301/3) attaching suction hose to hydraulic filter bracket.
  - (c) Remove clamp (301/3) attaching suction hose to upper hose support bracket.
  - (d) Disconnect suction hose from fluid disconnect panel.
  - (e) Disconnect suction hose from adapter on front hydraulic pump and remove hose from engine.
- (5) Remove rear hydraulic pump upper case drain hose.
  - (a) Remove upper case drain hose from clamp block (301/1)
    - _1_ Remove bolt and washer from clamp block (301/1).
    - _2_ Open left hand clamp band and remove hose from clamp block (301/1).
  - (b) Disconnect upper case drain hose from the fluid disconnect panel.
  - (c) Disconnect upper case drain hose from union on top of rear hydraulic filter and remove hose from engine.
- (6) Remove rear hydraulic pump case drain hose.
  - (a) Remove clamp (301/4) attaching three rear hydraulic hoses together.
  - (b) Disconnect lower case drain hose from fluid disconnect panel.
  - (c) Disconnect lower case drain hose from union on side of rear hydraulic filter and remove hose from engine.
- (7) Remove rear hydraulic pump pressure hose.
  - (a) Remove clamp (301/2) attaching pressure hose to hydraulic filter bracket.
  - (b) Remove clamp (301/2) attaching pressure hose to upper hose support bracket.
  - (c) Disconnect pressure hose from fluid disconnect panel.
  - (d) Disconnect pressure hose from reducer in rear hydraulic pump and remove hose from engine.
- (8) Remove rear hydraulic pump suction hose.
  - (a) Remove clamp (301/3) attaching suction hose to hydraulic filter bracket.
  - (b) Remove clamp (301/3) attaching suction hose to upper hose support bracket.
  - (c) Disconnect suction hose from fluid disconnect panel.

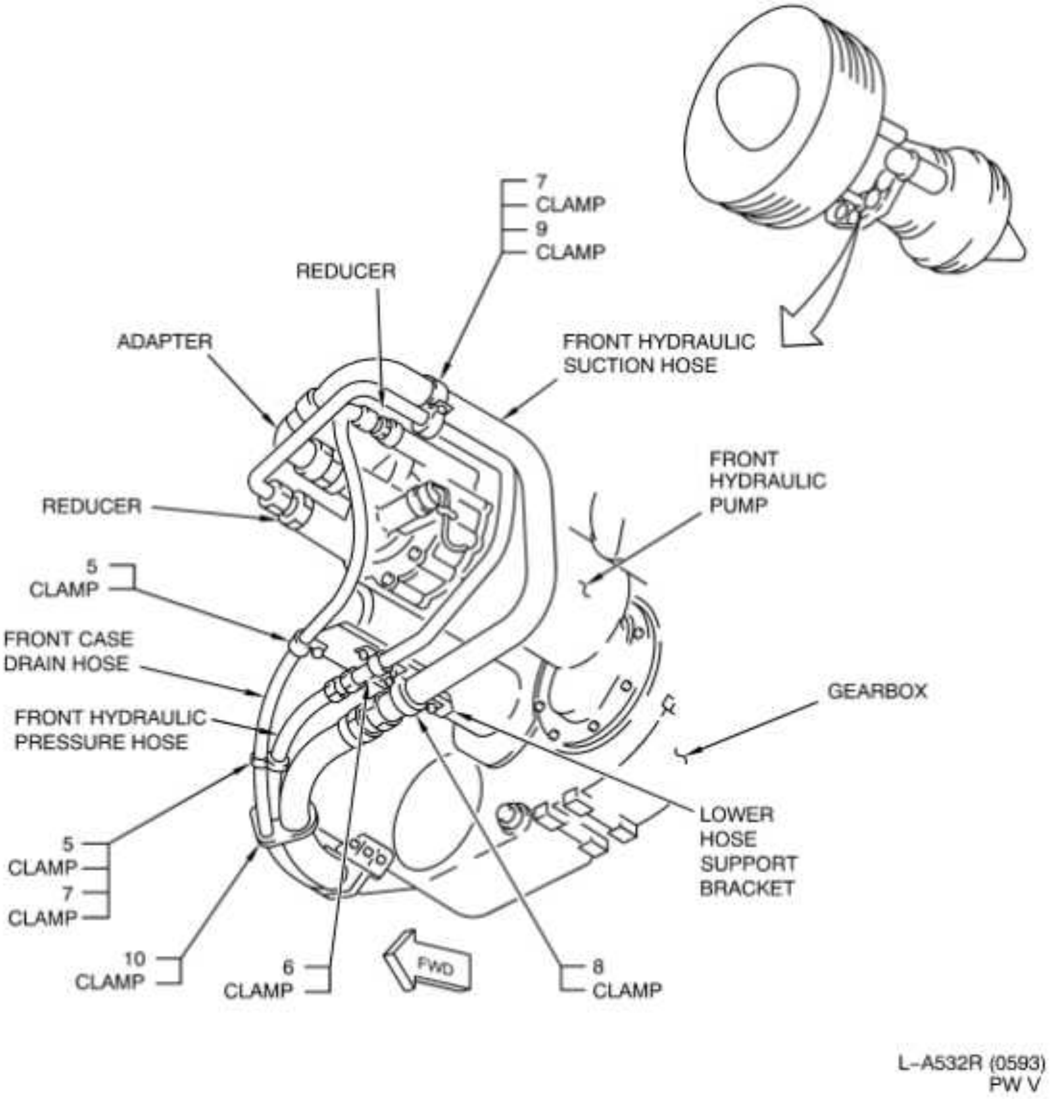
(d) Disconnect suction hose from adapter on rear hydraulic pump and remove hose from engine.

D. Postrequisites

(1) Remove hydraulic pump case drain filters. See 71-00-61, Removal-07 (Task 71-00-61-050-007).


REAR HYDRAULIC PRESSURE HOSE
REAR UPPER CASE DRAIN HOSE
REAR HYDRAULIC SUCTION HOSE
FRONT UPPER CASE DRAIN HOSE
FRONT HYDRAULIC PRESSURE HOSE
3 CLAMP
FRONT HYDRAULIC SUCTION HOSE
UPPER HOSE SUPPORT BRACKET
3 CLAMP
1 CLAMPBLOCK
HYDRAULIC FILTER BRACKET
3 CLAMP
2 CLAMP
2 CLAMP
3 CLAMP
4 CLAMP
FRONT LOWER CASE DRAIN HOSE
2 CLAMP
REAR LOWER CASE DRAIN HOSE
ADAPTER
REAR HYDRAULIC FILTER
FRONT HYDRAULIC FILTER
REDUCER
REAR HYDRAULIC PUMP
9 CLAMP
11 CLAMP
GEARBOX
L-A531R (0593)
PW V

Right Side Hydraulic Hoses (Sperry−Vickers Pump)
Figure 301
(Task 71−00−61−050−002)


7
CLAMP
9
CLAMP
REDUCER
ADAPTER
FRONT HYDRAULIC SUCTION HOSE
FRONT HYDRAULIC PUMP
REDUCER
5
CLAMP
FRONT CASE DRAIN HOSE
FRONT HYDRAULIC PRESSURE HOSE
GEARBOX
LOWER HOSE SUPPORT BRACKET
5
CLAMP
7
CLAMP
10
CLAMP
6
CLAMP
FWD
8
CLAMP
L-A532R (0593)
PW V

Left Side Hydraulic Hoses (Sperry−Vickers Pump)
Figure 302
(Task 71−00−61−050−002)

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POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-03

Task 71-00-61-050-003:

1. Remove Starter Shutoff Valve
   A. Equipment And Materials Required - None
   B. Procedure

      See Figure 301.

      (1) Disconnect electrical connector from shutoff valve. Install protective cover over plug and receptacle.

      (2) Remove coupling and seal attaching valve to starter lower-forward duct.

      (3) Remove coupling and seal attaching valve to starter lower duct.

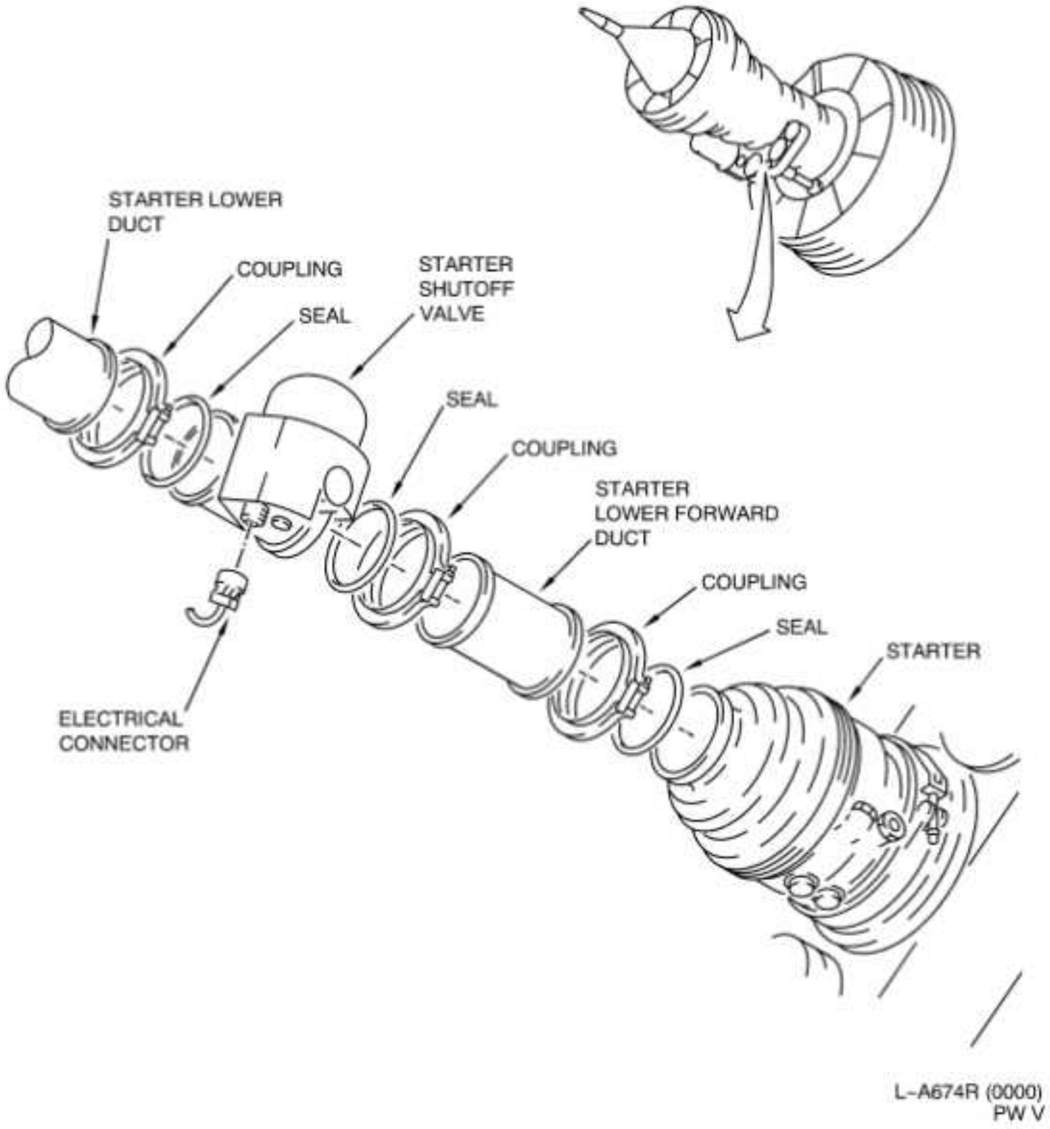
      (4) Remove starter shutoff valve.

      (5) Remove coupling and seal attaching starter lower-forward duct to starter.

      (6) Remove lower-forward duct. Retain starter lower-forward duct and three couplings and seals with starter shutoff valve.

      (7) Install protective cover over starter port and starter lower duct port.

      (8) Install protective cover over both starter shutoff valve ports.


STARTER LOWER DUCT
COUPLING
SEAL
STARTER SHUTOFF VALVE
SEAL
COUPLING
STARTER LOWER FORWARD DUCT
COUPLING
SEAL
STARTER
ELECTRICAL CONNECTOR
L−A674R (0000)
PW V

Starter Shutoff Valve
Figure 301
(Task 71−00−61−050−003)

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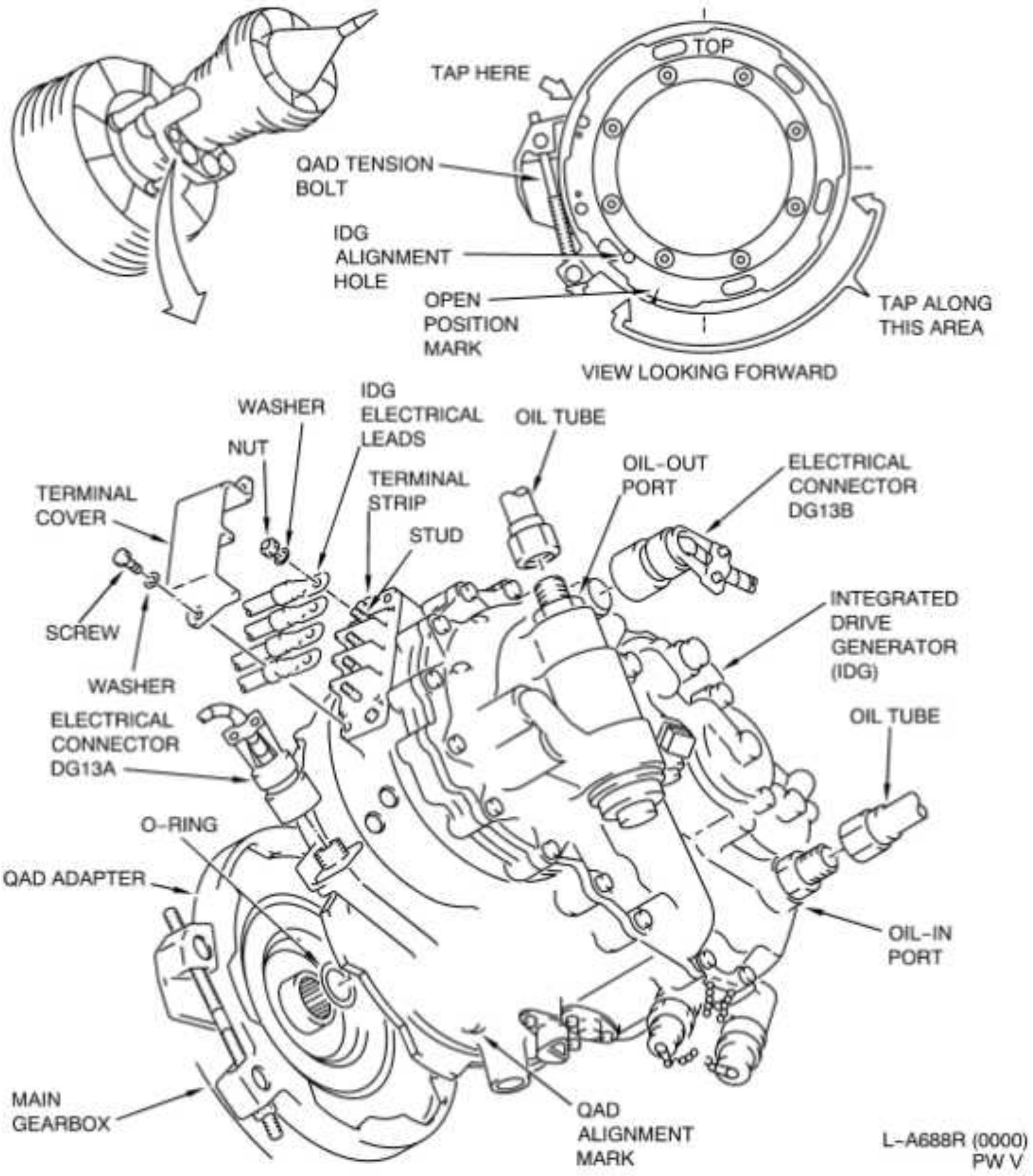
POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-04

Task 71-00-61-050-004:

1. Remove Integrated Drive Generator (IDG)
   A. Equipment And Materials Required

      Special Tools:
      RSE1001-1 Accessory Hoist (Optional to RSE1110)
      RSE1110 IDG Hoist Support

   B. Procedure
      See Figure 301.
      (1) Disconnect two electrical connectors, DG13A and DG13B, from IDG. Install protective covers over two electrical plugs and two receptacles.
      (2) Remove two bolts and washers attaching generator output wires to IDG. Disconnect four generator output wires. Retain nuts and washers on terminal strip studs.
      (3) Remove four nuts and washers attaching generator output wires to IDG. Disconnect four generator output wires. Retain nuts and washers on terminal strip studs.
      (4) Reinstall two bolts and washers attaching cover to IDG output wire terminal strip.
      (5) Disconnect two oil supply tubes from IDG oil-in port and IDG oil-out port. Leave unions attached to IDG. Install protective covers over two tube ends and over two IDG ports.
      (6) Position RSE1110 or RSE1001-1 Hoist under IDG and tighten holding strap securing IDG to hoist.
      (7) Loosen tension bolt of coupling attaching IDG to IDG quick-attach-detach (QAD) adapter. Continue loosening, moving lower part of coupling counterclockwise to line up "open position" mark (white) on coupling with mark (narrow groove) on bottom of IDG.
      (8) Remove IDG from QAD adapter.
      (9) Remove and discard packing from IDG drive shaft.
      (10) Install protective cover over exposed end of IDG.
      (11) Install protective cover over main gearbox port.


TOP
TAP HERE
QAD TENSION BOLT
IDG ALIGNMENT HOLE
OPEN POSITION MARK
TAP ALONG THIS AREA
VIEW LOOKING FORWARD
WASHER
IDG ELECTRICAL LEADS
OIL TUBE
NUT
TERMINAL STRIP
OIL-OUT PORT
ELECTRICAL CONNECTOR DG13B
TERMINAL COVER
STUD
SCREW
INTEGRATED DRIVE GENERATOR (IDG)
WASHER
ELECTRICAL CONNECTOR DG13A
OIL TUBE
O-RING
QAD ADAPTER
OIL-IN PORT
MAIN GEARBOX
QAD ALIGNMENT MARK
L-A688R (0000)
PW V

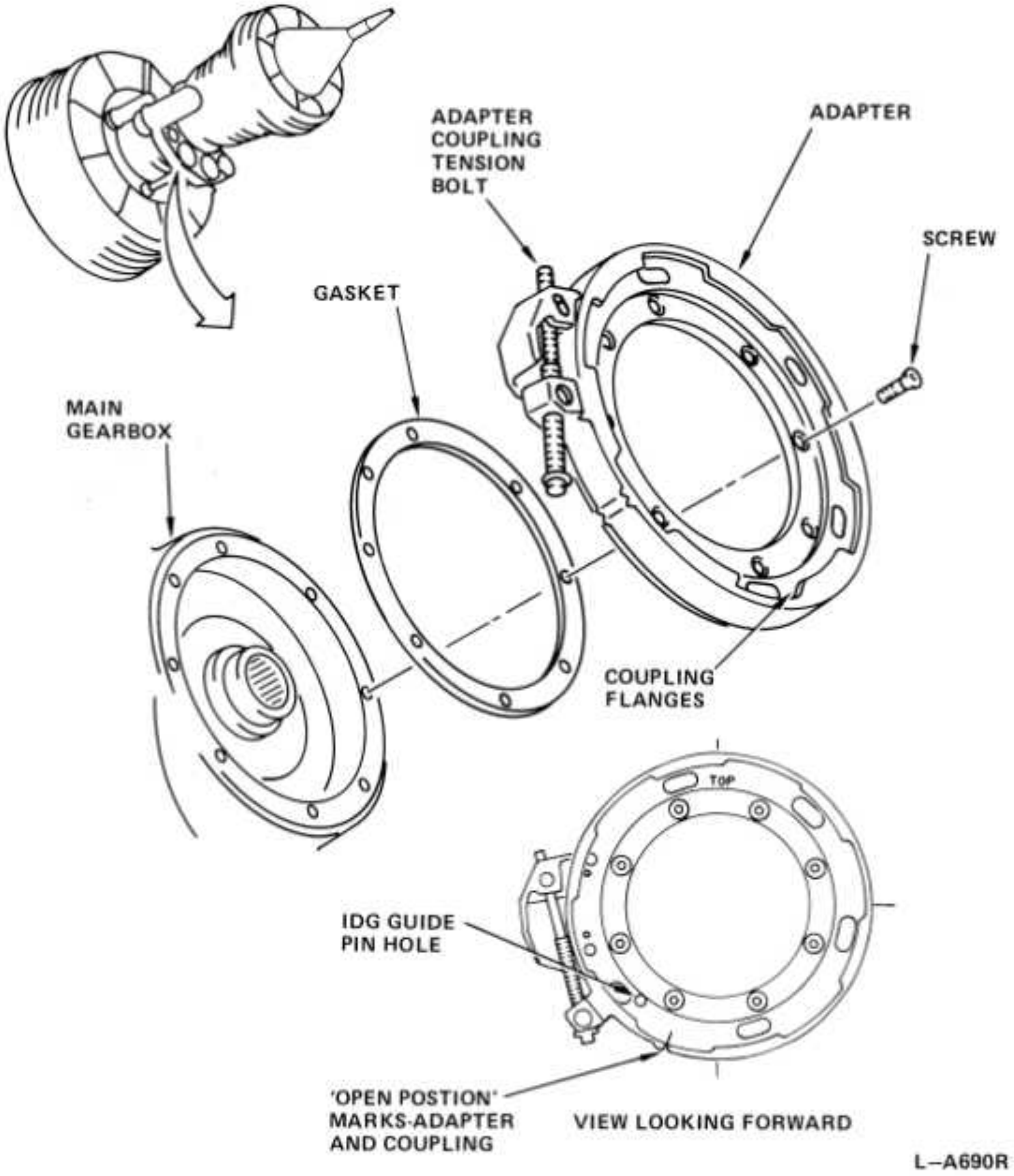
Integrated Drive Generator (IDG)
Figure 301
(Task 71−00−61−050−004)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-05

Task 71-00-61-050-005:

1. Remove IDG Quick-Attach-Detach (QAD) Adapter
   A. Prerequisites
      (1) Remove Integrated Drive Generator (IDG). See Removal-04. (Task 71-00-61-050-004).
   B. Equipment And Material Required - None
   C. Procedure
      See Figure 301.
      (1) Remove eight mounting bolts attaching QAD adapter and gasket to main gearbox. Retain gasket and bolts with adapter.
      (2) Install protective cover over main gearbox port.


ADAPTER COUPLING TENSION BOLT
ADAPTER
SCREW
GASKET
MAIN GEARBOX
COUPLING FLANGES
TOP
IDG GUIDE PIN HOLE
'OPEN POSTION' MARKS-ADAPTER AND COUPLING
VIEW LOOKING FORWARD
L–A690R

QAD Adapter
Figure 301
(Task 71–00–61–050–005)

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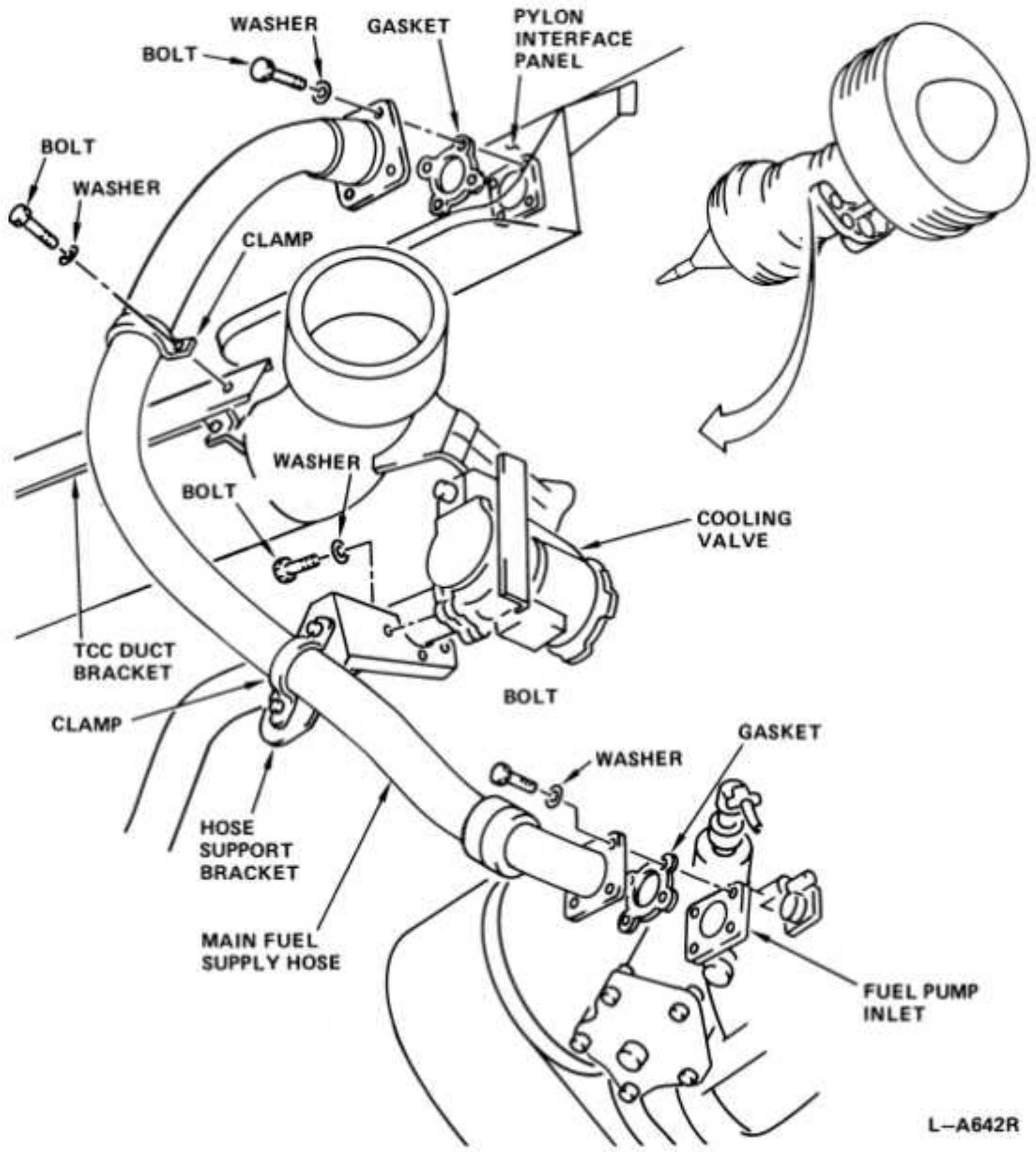
POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-06

Task 71-00-61-050-006:

1. Remove Main Fuel Supply Line
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 301.
     - (1) Remove four bolts and washers attaching fuel supply hose and gasket to fuel pump inlet. Discard gasket. Retain bolts and washers with hose.
     - (2) Install protective cover over end of hose and over fuel pump inlet port.
     - (3) Remove three bolts and washers attaching lower hose support bracket to turbine cooling valve flange. Replace bolts and washers in same holes to maintain valve/duct tightness. Torque bolts 85 - 95 lb-in. (9.604 - 10.734 N.m).
     - (4) Remove two bolts and washers attaching upper hose support clamp to TCC duct bracket. Retain bolts, washers, and clamp with hose.
     - (5) Remove four bolts and washer attaching fuel supply hose and gasket to pylon interface panel. Discard gasket. Retain bolts and washers with hose.
     - (6) Install protective cover over end of hose and over pylon interface panel port.


WASHER
GASKET
PYLON INTERFACE PANEL
BOLT
BOLT
WASHER
CLAMP
WASHER
BOLT
COOLING VALVE
TCC DUCT BRACKET
CLAMP
BOLT
GASKET
WASHER
HOSE SUPPORT BRACKET
MAIN FUEL SUPPLY HOSE
FUEL PUMP INLET
L−A642R

Main Fuel Supply Line
Figure 301
(Task 71−00−61−050−006)

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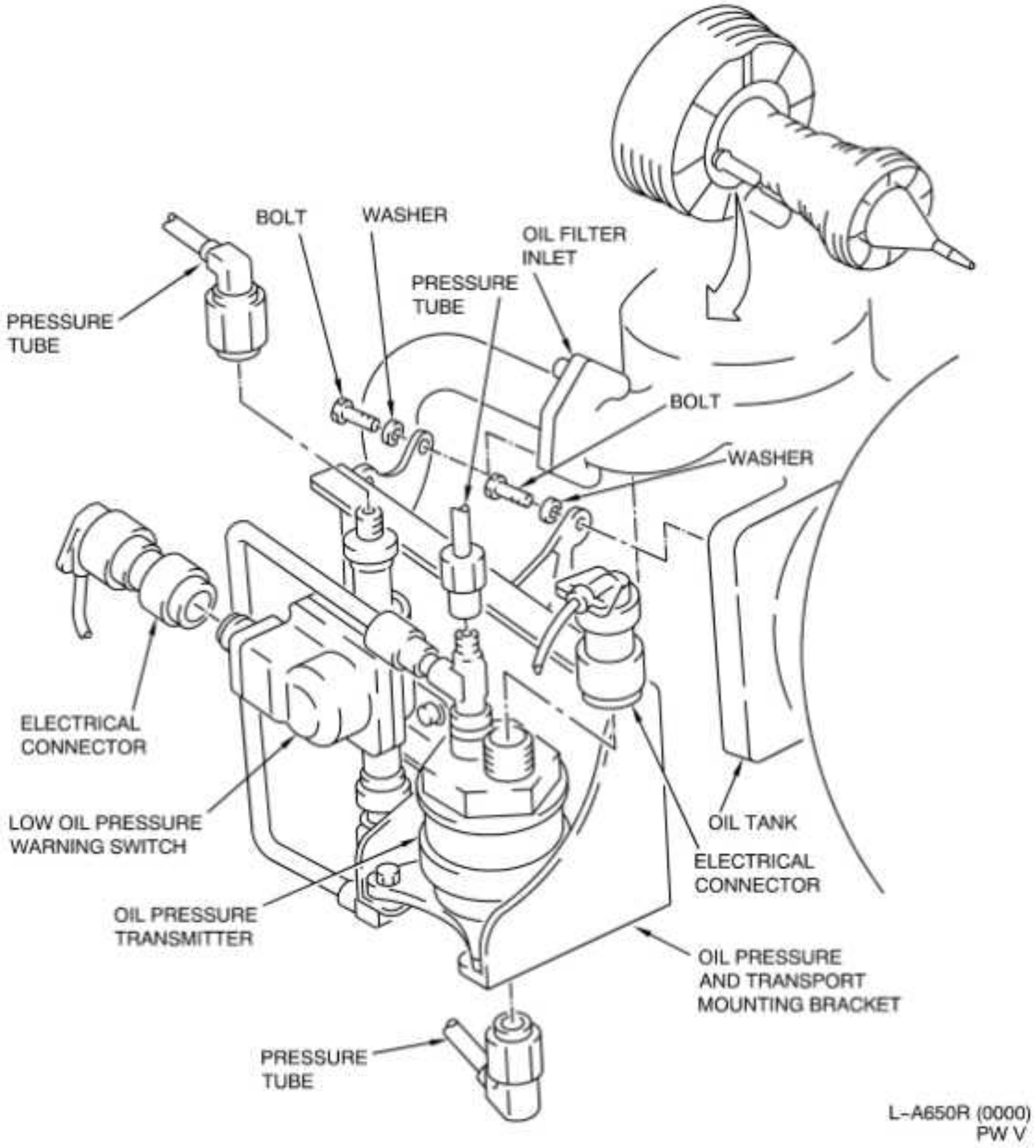
POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-07

Task 71-00-61-050-007:

1. Remove Low Oil Pressure Switch And Oil Pressure Transmitter
   A. Equipment And Materials Required - None
   B. Procedure
      See Figure 301.
      (1) Disconnect electrical connectors.
         (a) Disconnect electrical connector from oil pressure transmitter.
         (b) Disconnect electrical connector from low oil pressure warning switch.
         (c) Install protective cover over two electrical plugs and over two receptacles.
      (2) Disconnect pressure tubes.
         (a) Disconnect pressure tube from top end of tee on top of oil pressure transmitter.
         (b) Disconnect pressure tube from bottom of oil pressure transmitter.
         (c) Disconnect pressure tube from top of low oil pressure warning switch.
         (d) Install protective covers over the ends of three pressure tubes and over three pressure ports on the two instruments.
      (3) Remove instrument mounting bracket.
         (a) Remove two bolts attaching oil low pressure switch and oil pressure transmitter mounting bracket to oil filter inlet flange. Retain bolts for reinstallation.
         (b) Remove two bolts attaching oil low pressure switch and oil pressure transmitter mounting bracket to oil filter. Retain bolts for reinstallation.
         (c) Reinstall two bolts in same holes of oil filter inlet flange. Torque bolts 75 - 85 lb-in. (8.474 - 9.604 N.m).
         (d) Reinstall two bolts in same holes of oil filter. Torque bolts 200 - 250 lb-in. (22.597 - 28.246 N.m).


BOLT
WASHER
OIL FILTER INLET
PRESSURE TUBE
PRESSURE TUBE
BOLT
WASHER
ELECTRICAL CONNECTOR
LOW OIL PRESSURE WARNING SWITCH
OIL PRESSURE TRANSMITTER
OIL TANK
ELECTRICAL CONNECTOR
OIL PRESSURE AND TRANSPORT MOUNTING BRACKET
PRESSURE TUBE
L-A650R (0000)
PW V

Oil Low Pressure Switch And
Oil Pressure Transmitter
Figure 301
(Task 71−00−61−050−007)

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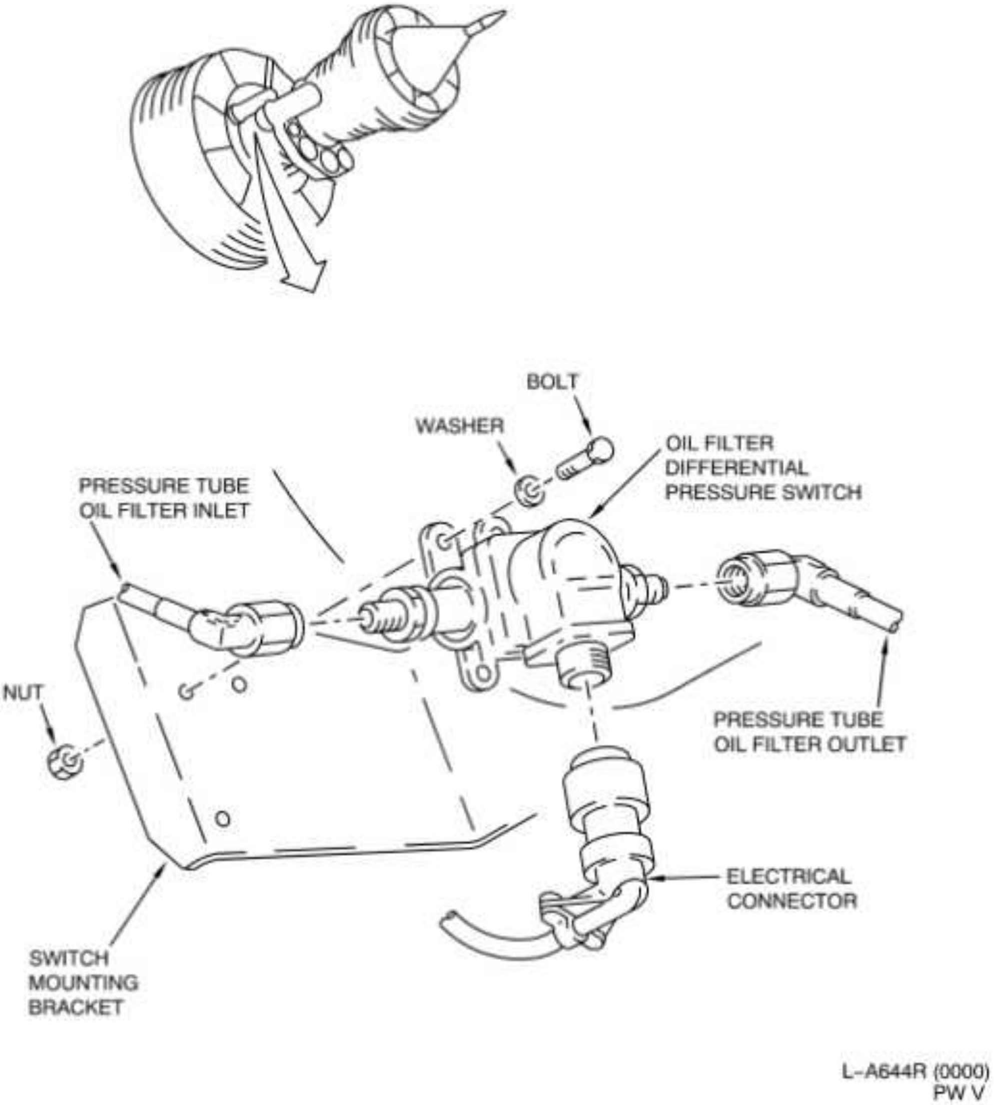
POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-08

Task 71-00-61-050-008:

1. Remove Oil Filter Differential Pressure Switch
    - A. Equipment And Material Required - None
    - B. Procedure

      See Figure 301.
        - (1) Disconnect electrical connector.
        - (2) Install protective cover over electrical plug and over electrical receptacle on switch.
        - (3) Disconnect two pressure tubes. Do not remove unions and packings from switch.
        - (4) Install protective cover over tube ends and over switch ports.
        - (5) Remove three bolts, washers and nuts attaching oil filter differential pressure switch to mounting bracket. Retain bolts with switch.


BOLT
WASHER
OIL FILTER DIFFERENTIAL PRESSURE SWITCH
PRESSURE TUBE OIL FILTER INLET
NUT
PRESSURE TUBE OIL FILTER OUTLET
ELECTRICAL CONNECTOR
SWITCH MOUNTING BRACKET
L−A644R (0000)
PW V

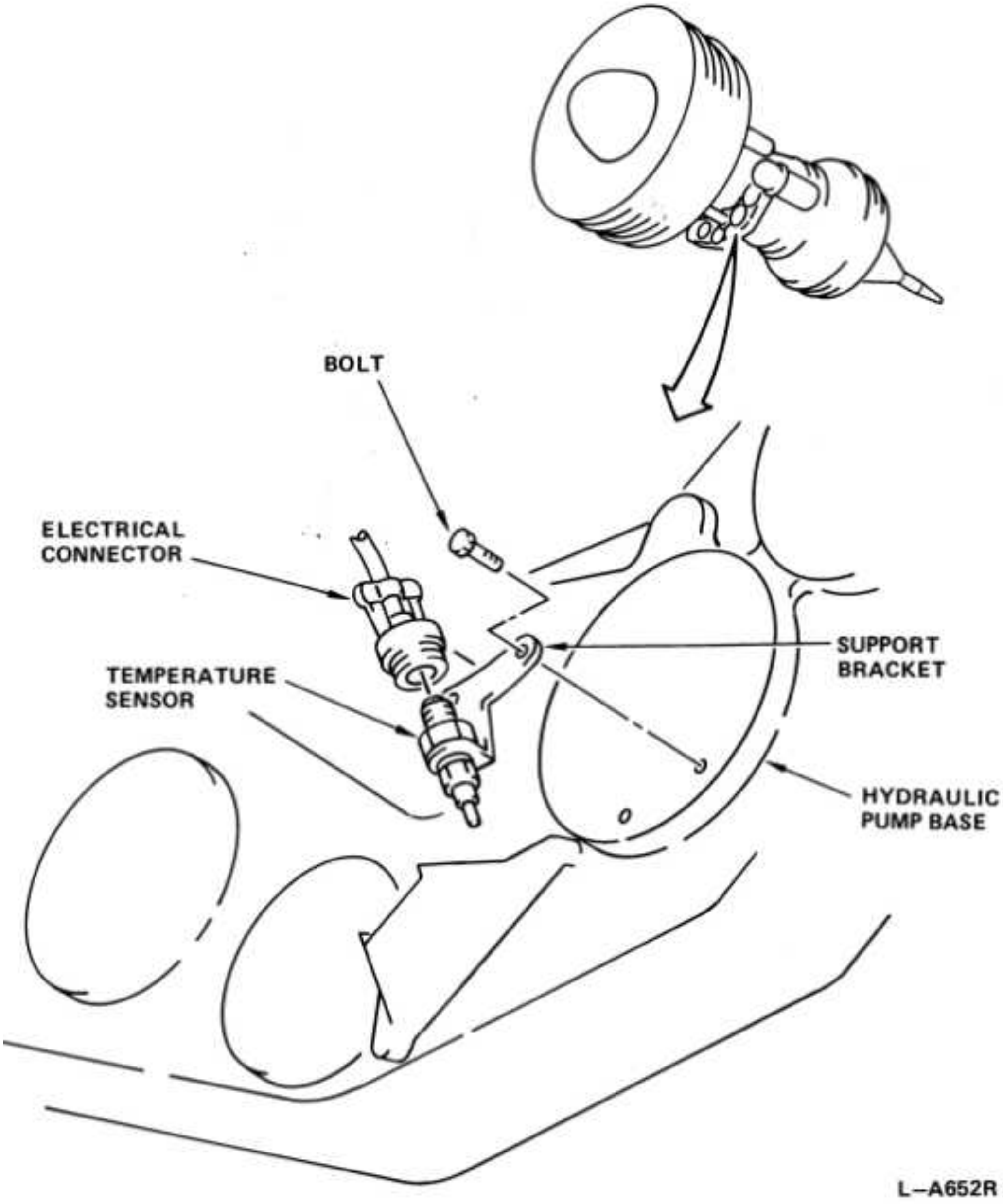
Oil Filter Differential
Pressure Switch
Figure 301
(Task 71−00−61−050−008)

POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−09

Task 71−00−61−050−009:

1. Remove Engine Core Compartment Temperature Sensor
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figure 301.
     - (1) Disconnect electrical connector.
     - (2) Install protective cover over electrical plug and over receptacle.
     - (3) Remove two bolts attaching core compartment temperature sensor support bracket to gearbox at base of front hydraulic pump.
     - (4) Reinstall bolts in same holes. Torque bolts 275 − 300 lb−in. (31.071 − 33.895 N.m).


BOLT
ELECTRICAL CONNECTOR
TEMPERATURE SENSOR
SUPPORT BRACKET
HYDRAULIC PUMP BASE
L−A652R

Engine Core Compartment
Temperature Sensor
Figure 301
(Task 71−00−61−050−009)

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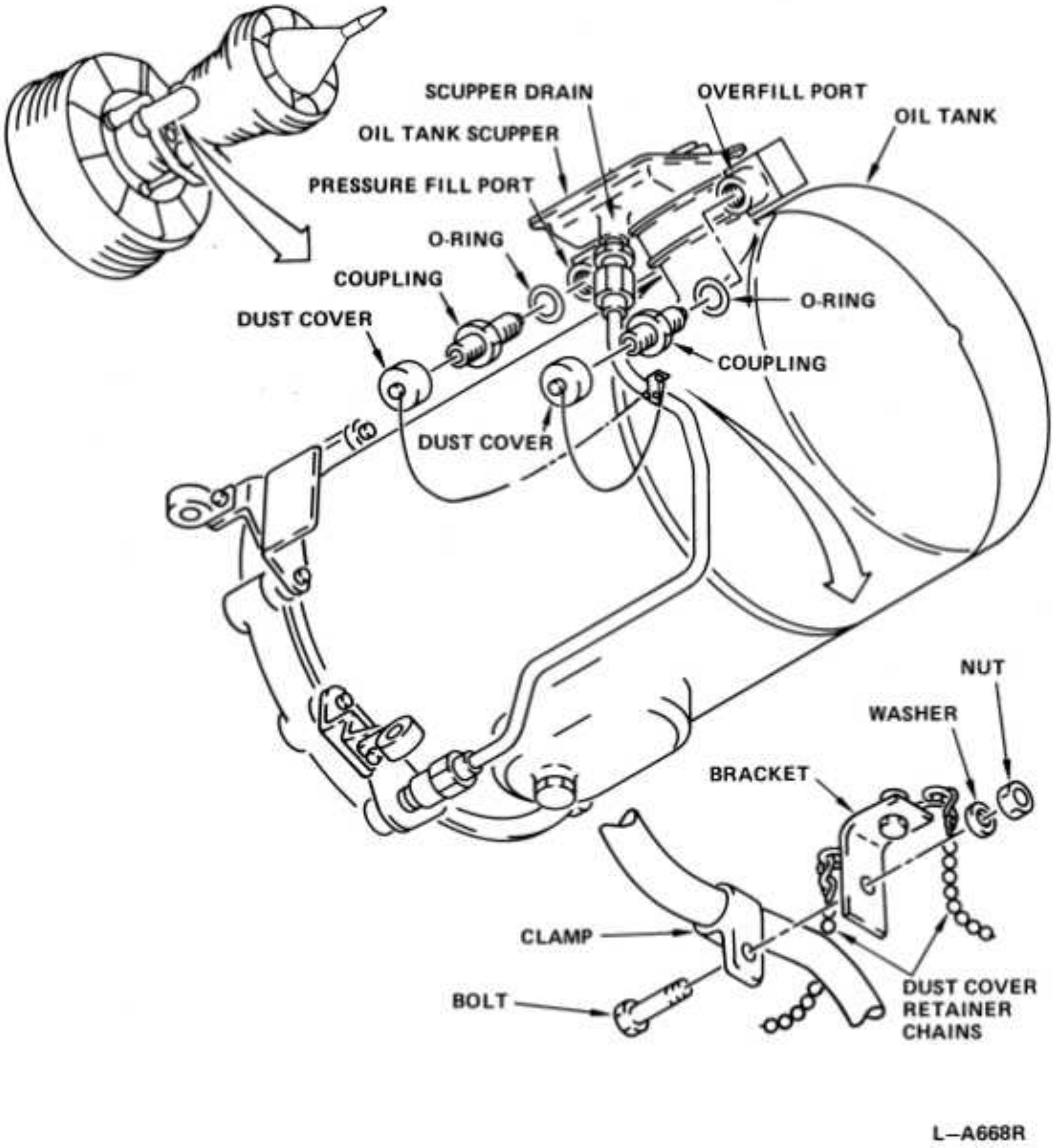
POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-10

Task 71-00-61-050-010:

1. Remove Engine Oil Tank Pressure Fill System
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 301.
     - (1) Remove bolt, washer and nut attaching oil pressure fill/overfill dust cover retaining cords clamp to oil tank scupper drain tube. Retain bolt, washer and nut with clamp.
     - (2) Remove coupling and packing from pressure fill port. Discard packing. Retain coupling with dust cap.
     - (3) Remove coupling and packing from pressure overfill port. Discard packing. Retain coupling with dust cap.
     - (4) Install protective cover over two pressure fill/ overfill ports.


SCUPPER DRAIN
OVERFILL PORT
OIL TANK
OIL TANK SCUPPER
PRESSURE FILL PORT
O-RING
COUPLING
DUST COVER
O-RING
COUPLING
DUST COVER
NUT
WASHER
BRACKET
CLAMP
BOLT
DUST COVER RETAINER CHAINS
L-A668R

Engine Oil Tank Pressure
Fill System
Figure 301
(Task 71-00-61-050-010)

POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-11

Task 71-00-61-050-011:

1. Remove Oil Quantity Transmitter

   A. Equipment And Materials Required - None

   B. Procedure

   See Figure 301.

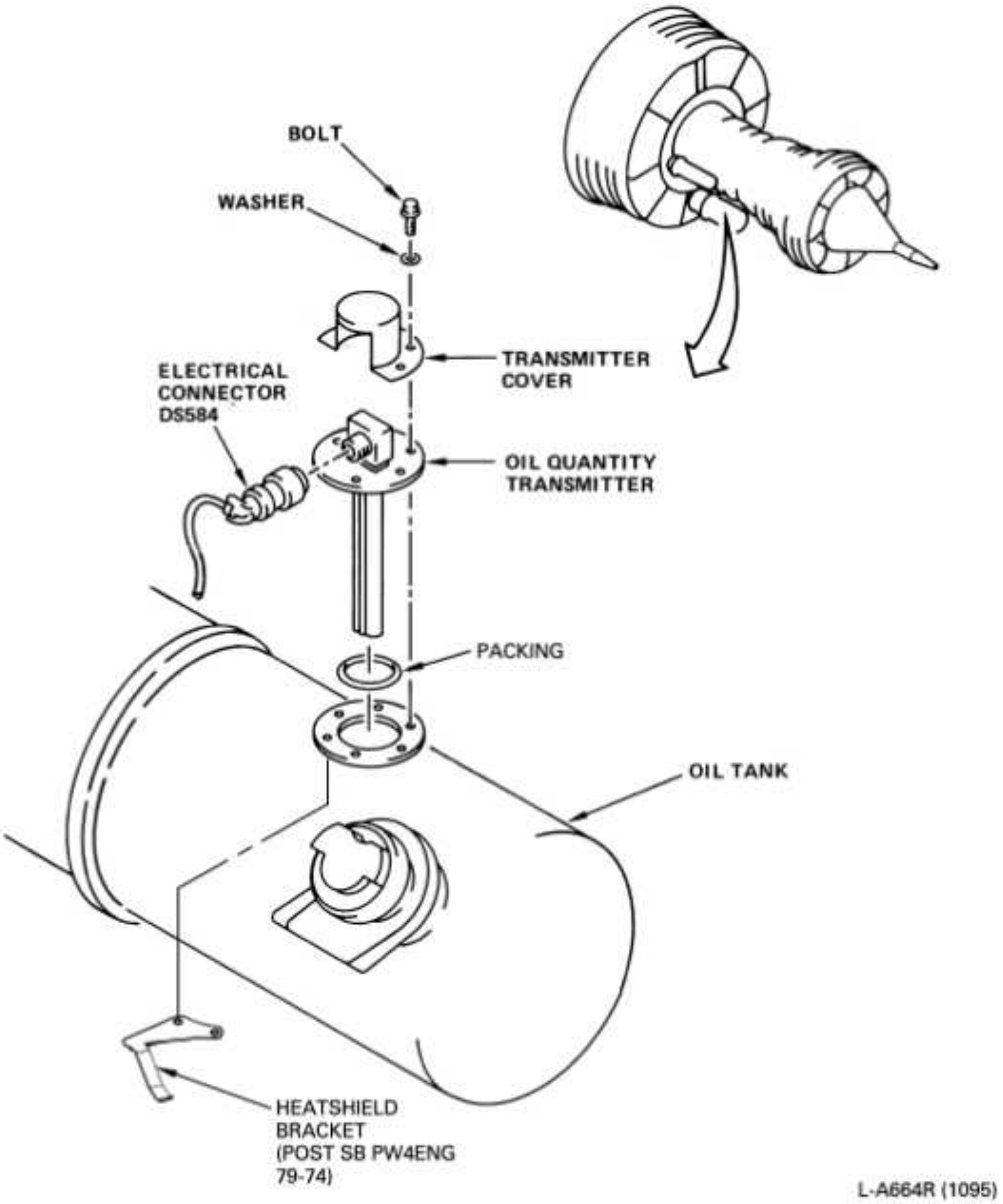
   (1) Disconnect electrical connector.

   (2) Install protective cover over electrical plug and over receptacle.

   (3) Remove six bolts, washers and nuts attaching oil quantity transmitter, cover and heat shield bracket (Post SB PW4ENG 79-74) to oil tank.

   (4) Remove transmitter from tank. Discard packing. Retain cover, bolts, washers and nuts with transmitter.

   (5) Install protective cover over oil tank port and over exposed portion of transmitter.


BOLT
WASHER
TRANSMITTER COVER
ELECTRICAL CONNECTOR DS584
OIL QUANTITY TRANSMITTER
PACKING
OIL TANK
HEATSHIELD BRACKET (POST SB PW4ENG 79-74)
L-A664R (1095)

Oil Quantity Transmitter
Figure 301
(Task 71−00−61−050−011)

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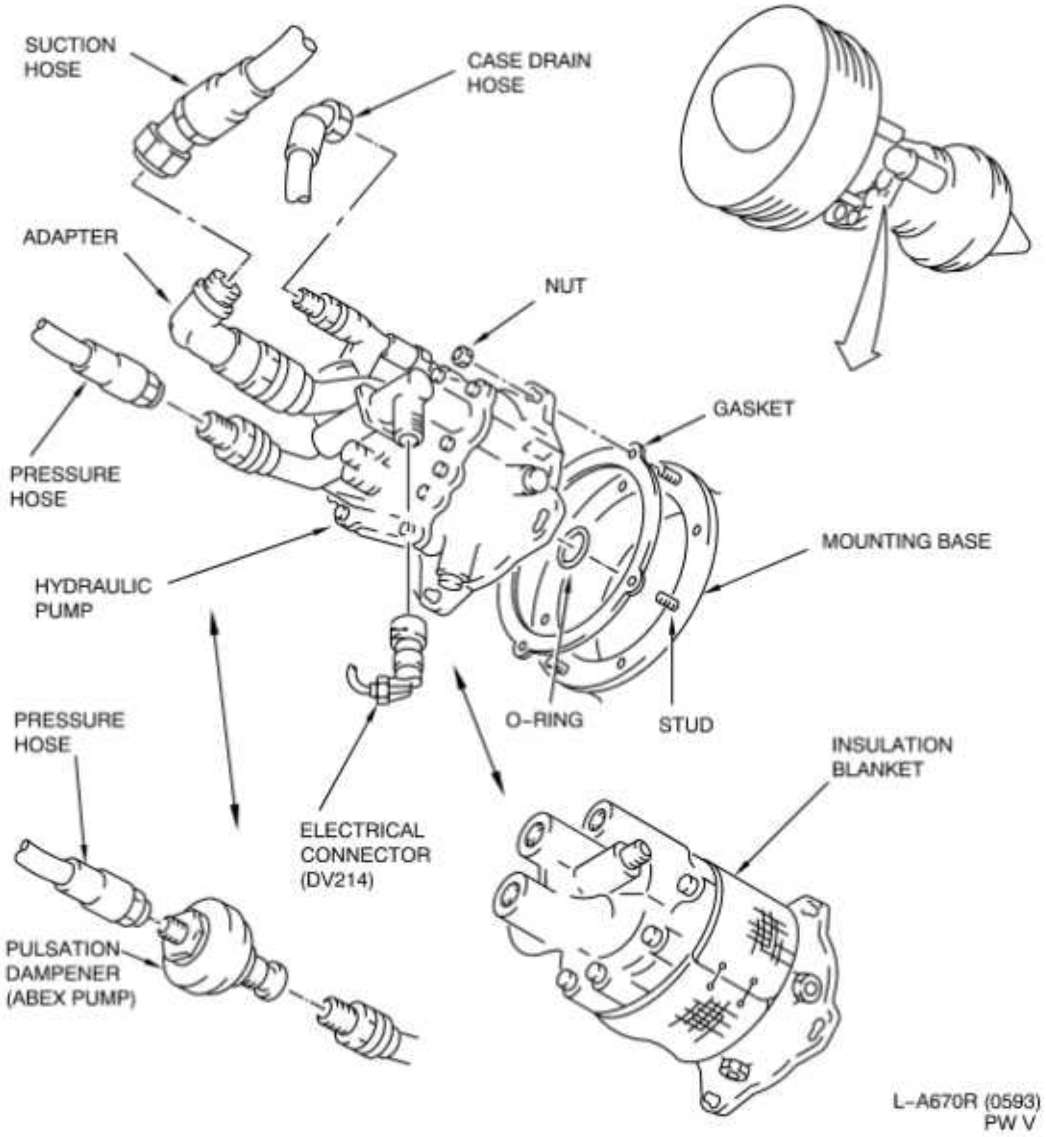
POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−12

Task 71−00−61−050−012:

1. Remove Front Hydraulic Pump
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figure 301.
     - (1) Disconnect electrical and hydraulic connections.
       - (a) Disconnect electrical connector. Install protective cover over plug and receptacle.
       - (b) Disconnect pressure hose.
         - 1 (Sperry−Vickers) Leave union attached to pump.
         - 2 (Abex) Leave dampener attached to pump.
       - (c) Disconnect suction hose. Leave adapter and union attached to pump.
       - (d) Disconnect case drain hose. Leave reducer attached to pump.
       - (e) Install protective covers over three hoses and three pump ports.
     - (2) Remove pump.
       - (a) Loosen four nuts attaching hydraulic pump to mounting studs on mounting base of gearbox.
       - (b) Rotate pump clockwise until nuts pass through enlarged ends of pump mounting slots. Remove pump from mounting base.
       - (c) Remove mounting nuts and gasket from studs on mounting base. Discard gasket. Retain nuts with pump.
       - (d) Remove and discard packing from pump shaft.
       - (e) Install protective covers over pump end and over pump mounting base on gearbox.

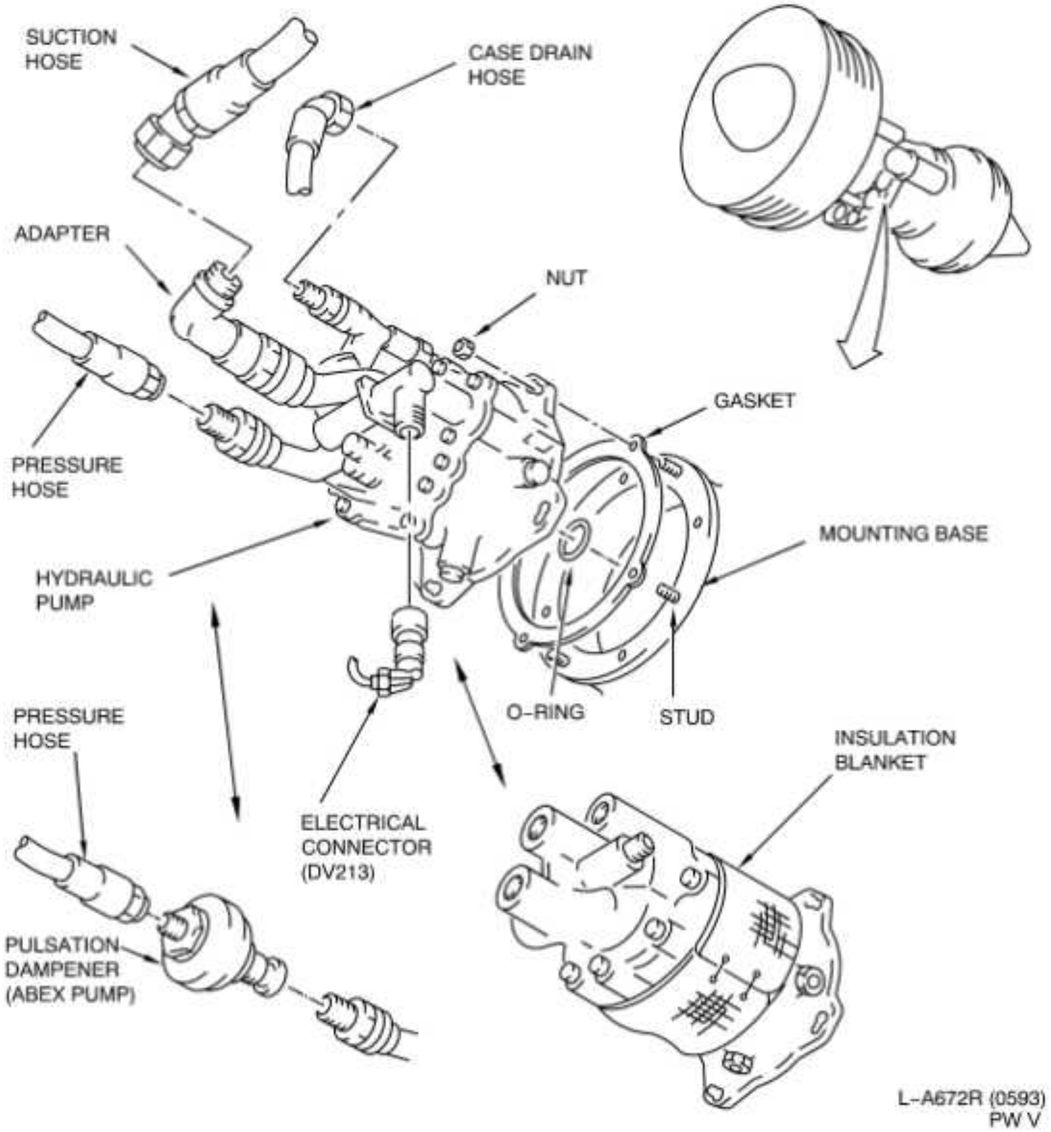

SUCTION HOSE
CASE DRAIN HOSE
ADAPTER
NUT
GASKET
PRESSURE HOSE
MOUNTING BASE
HYDRAULIC PUMP
PRESSURE HOSE
O-RING
STUD
INSULATION BLANKET
ELECTRICAL CONNECTOR (DV214)
PULSATION DAMPENER (ABEX PUMP)
L-A670R (0593)
PW V

Front Hydraulic Pump
Figure 301
(Task 71-00-61-050-012)

POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-13

Task 71-00-61-050-013:

1. Remove Rear Hydraulic Pump
   - A. Equipment And Materials Required - None
   - B. Procedure
     See Figure 301.
     - (1) Disconnect electrical and hydraulic connections.
       - (a) Disconnect electrical connector. Install protective covers over plug and receptacle.
       - (b) Disconnect pressure hose.
         - 1 (Sperry-Vickers) Leave union attached to pump.
         - 2 (Abex) Leave dampener attached to pump.
       - (c) Disconnect suction hose. Leave adapter and union attached to pump.
       - (d) Disconnect case drain hose. Leave reducer attached to pump.
       - (e) Install protective covers over three hoses and three pump ports.
     - (2) Remove pump.
       - (a) Loosen four nuts attaching hydraulic pump to mounting studs on mounting base of gearbox.
       - (b) Rotate pump clockwise until nuts pass through enlarged ends of pump mounting slots. Remove pump from mounting base.
       - (c) Remove mounting nuts and gasket from studs on mounting base. Discard gasket. Retain nuts with pump.
       - (d) Remove and discard packing from pump shaft.
       - (e) Install protective covers over pump end and over pump mounting base on gearbox.


SUCTION HOSE
CASE DRAIN HOSE
ADAPTER
NUT
PRESSURE HOSE
GASKET
MOUNTING BASE
HYDRAULIC PUMP
O−RING
STUD
PRESSURE HOSE
INSULATION BLANKET
ELECTRICAL CONNECTOR (DV213)
PULSATION DAMPENER (ABEX PUMP)
L−A672R (0593)
PW V

Rear Hydraulic Pump
Figure 301
(Task 71−00−61−050−013)

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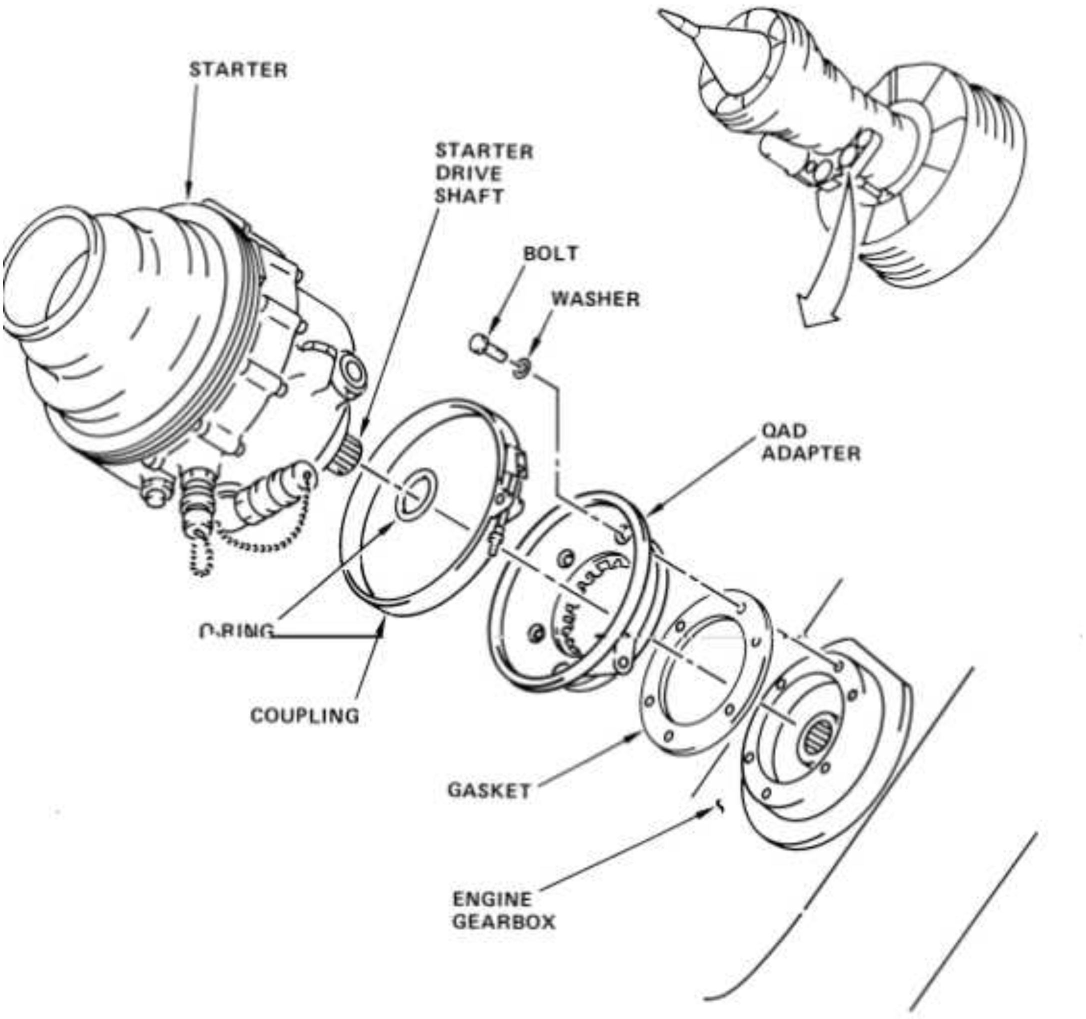
POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-14

Task 71-00-61-050-014:

1. Remove Starter Assembly
   - A. Prerequisites
     - (1) Remove shutoff valve. See Removal-03 (Task 71-00-61-050-003).
   - B. Equipment And Materials Required - None
   - C. Procedure

     See Figure 301.
     - (1) Remove starter.
       - (a) Remove coupling attaching starter to quick-attach-detach (QAD) adapter. Remove starter.
       - (b) Remove and discard packing from starter drive shaft.
     - (2) Remove quick-attach-detach (QAD) adapter.
       - (a) Remove six bolts and washers attaching QAD adapter to main gearbox.
       - (b) Remove QAD adapter and gasket. Discard gasket.


STARTER
STARTER DRIVE SHAFT
BOLT
WASHER
QAD ADAPTER
O-RING
COUPLING
GASKET
ENGINE GEARBOX

L−A684R

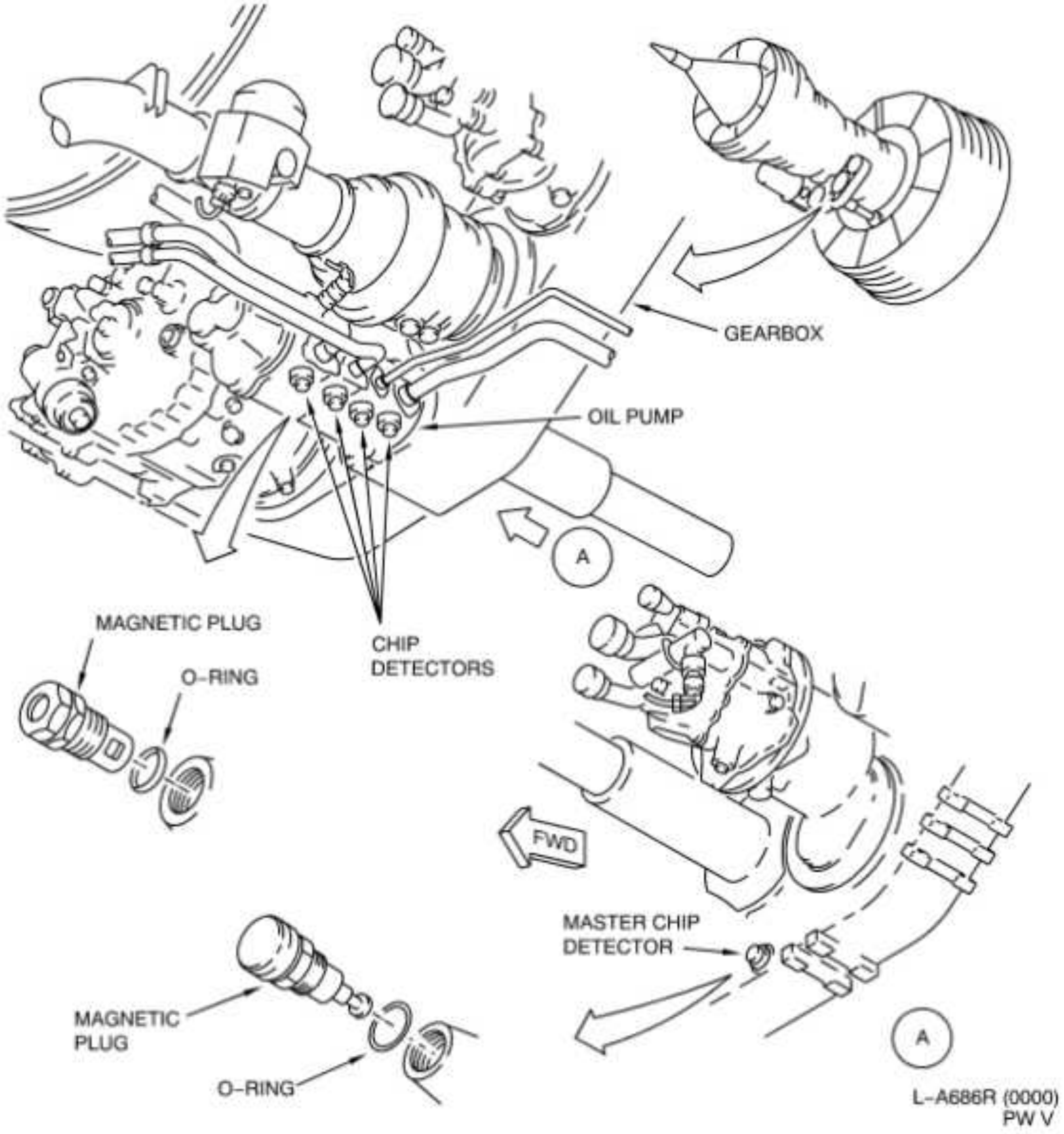
Starter And Adapter Assembly
Figure 301
(Task 71−00−61−050−014)

POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-15

Task 71-00-61-050-015:

1. Remove Chip Detectors
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 301.
     - (1) Remove and discard lockwire.
     - (2) Remove chip detectors.
     - (3) Remove and discard packing from each of five chip detectors.


GEARBOX
OIL PUMP
A
MAGNETIC PLUG
O−RING
CHIP DETECTORS
FWD
MASTER CHIP DETECTOR
MAGNETIC PLUG
O−RING
A
L−A686R (0000)
PW V

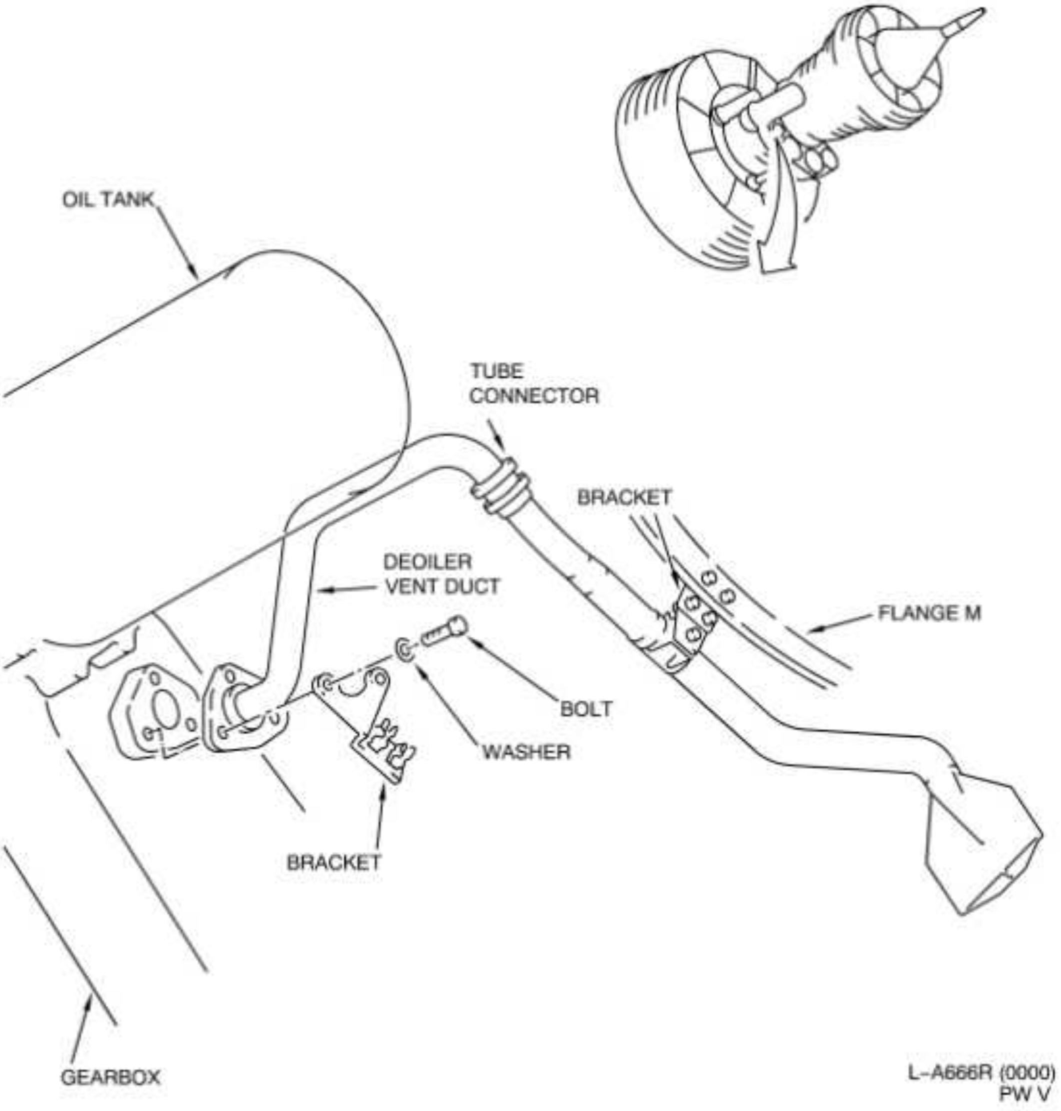
Chip Detectors
Figure 301
(Task 71−00−61−050−015)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-16

Task 71-00-61-050-016:

1. Remove Deoiler Vent Duct
   A. Equipment And Materials Required - None
   B. Procedure
      See Figure 301.
      (1) Remove three bolts and washers attaching deoiler vent duct and bracket to gearbox.
      (2) Retain bracket, bolts, and washers with vent duct.
      (3) Install protective cover over gearbox port and over end of duct.


OIL TANK
TUBE CONNECTOR
BRACKET
DEOILER VENT DUCT
FLANGE M
BOLT
WASHER
BRACKET
GEARBOX
L-A666R (0000)
PW V

Deoiler Vent Duct
Figure 301
(Task 71−00−61−050−016)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-17

Task 71-00-61-050-017-001:

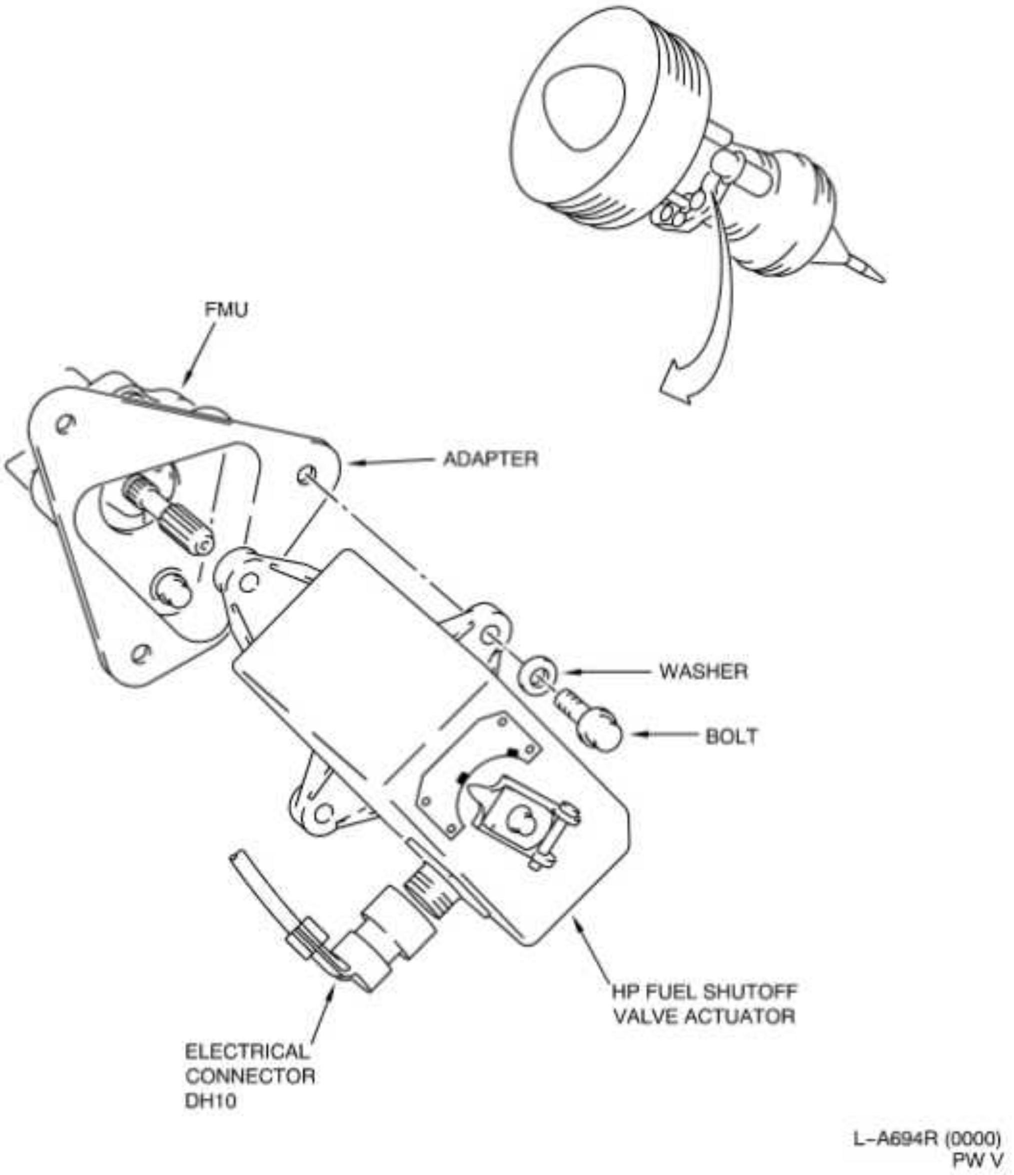
1. Remove HP Fuel Shutoff Valve Actuator (PN 221D4003-507)
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 301.
     - (1) Remove electrical connector from fuel shutoff valve actuator and install protective cover on connector and receptacle.
     - (2) Remove three bolts and washers attaching fuel shutoff valve actuator to adapter assembly and remove actuator.
     - (3) Remove three bolts and washers attaching adapter assembly to fuel metering unit (FMU).

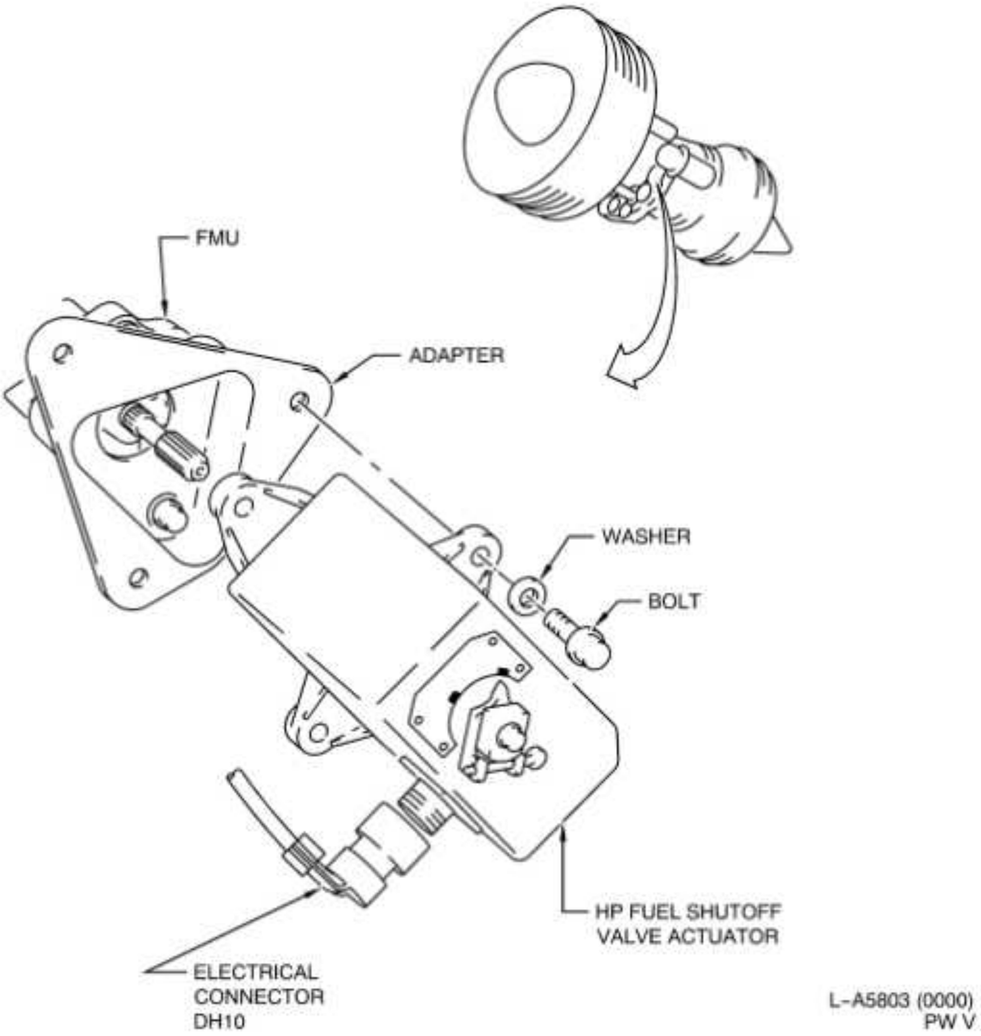
Task 71-00-61-050-017-002:

2. Remove HP Fuel Shutoff Valve Actuator (PN 221D4003-509)
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 302.
     - (1) Remove electrical connector from fuel shutoff valve actuator and install protective cover on connector and receptacle.
     - (2) Remove three bolts and washers attaching fuel shutoff valve actuator to adapter assembly and remove actuator.
     - (3) Remove three bolts and washers attaching adapter assembly to fuel metering unit (FMU).


FMU
ADAPTER
WASHER
BOLT
HP FUEL SHUTOFF VALVE ACTUATOR
ELECTRICAL CONNECTOR DH10
L−A694R (0000)
PW V

HP Fuel Shutoff Valve Actuator Removal
(PN 221D4003−507)
Figure 301
(Task 71−00−61−050−017−001)


FMU
ADAPTER
WASHER
BOLT
HP FUEL SHUTOFF VALVE ACTUATOR
ELECTRICAL CONNECTOR DH10
L-A5803 (0000)
PW V

HP Fuel Shutoff Valve Actuator Removal
(PN 221D4003-509)
Figure 302
(Task 71-00-61-050-017-002)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-18

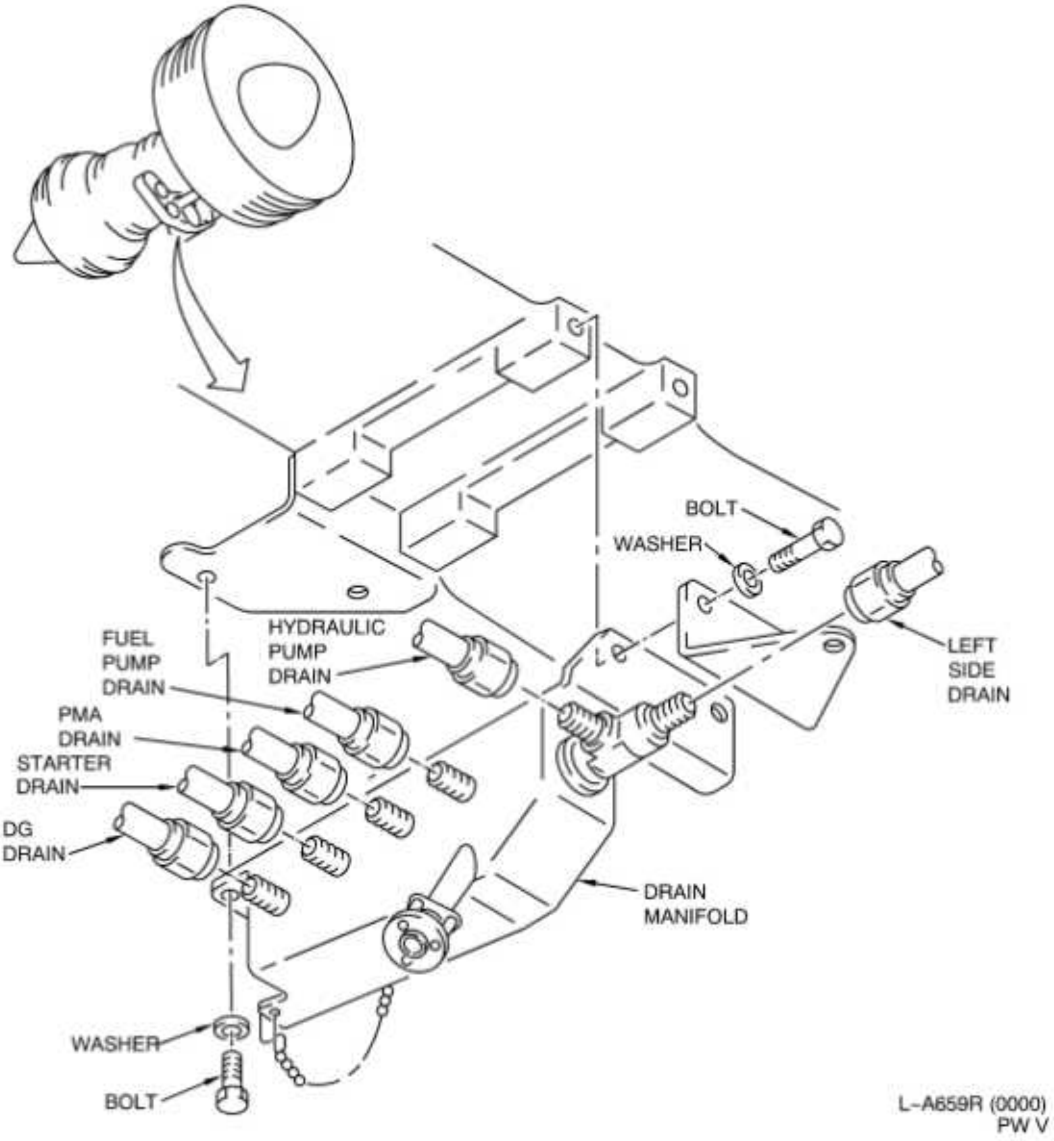
Task 71-00-61-050-018:

1. Remove Drain Collector Manifold Assembly
   A. Equipment And Materials Required

      Standard Tools:

Name	Manufacturer
Container, approximately 2 U.S. gallons (7.57 l)	Local Purchase

   B. Procedure
      See Figure 301.
      (1) Position container to catch residual fluids from drain tubes or manifold. Place protective covers on open ports and drain tubes when opened or removed.
      (2) Disconnect four drain lines from the right-hand side of the drain manifold.
      (3) Disconnect two drain lines from the tee at the forward end of the drain manifold.
      (4) Remove four bolts and washers attaching the drain manifold from the engine and remove the manifold.


BOLT
WASHER
LEFT SIDE DRAIN
HYDRAULIC PUMP DRAIN
FUEL PUMP DRAIN
PMA DRAIN
STARTER DRAIN
DG DRAIN
DRAIN MANIFOLD
WASHER
BOLT
L−A659R (0000)
PW V

Drain Collector Manifold Assembly
Figure 301
(Task 71−00−61−050−018)

Previous Pageblock　Return to Previous Menu　Next Pageblock

POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−19

Task 71−00−61−050−019:

1. Remove Accessory Drain Tubing
   A. Prerequisites
      (1) Remove drain collector manifold assembly. See 71−00−61, Removal−18.
   B. Equipment And Materials Required

Standard Tools:

Name	Manufacturer
Container, approximately 2 U.S. gallons (7.57 l)	Local Purchase

C. Procedure

WARNING: BE CAREFUL WHEN DISCONNECTING OIL LINES OR DRAINING OIL FROM AN ENGINE THAT HAS RECENTLY BEEN SHUT DOWN. HOT OIL CAN CAUSE SERIOUS INJURY TO EYES AND SEVERELY BURN SKIN.

(1) Remove left side engine drain tubing. See Figure 301.

NOTE: Place protective covers on open ports and drain tubes during removal procedures.

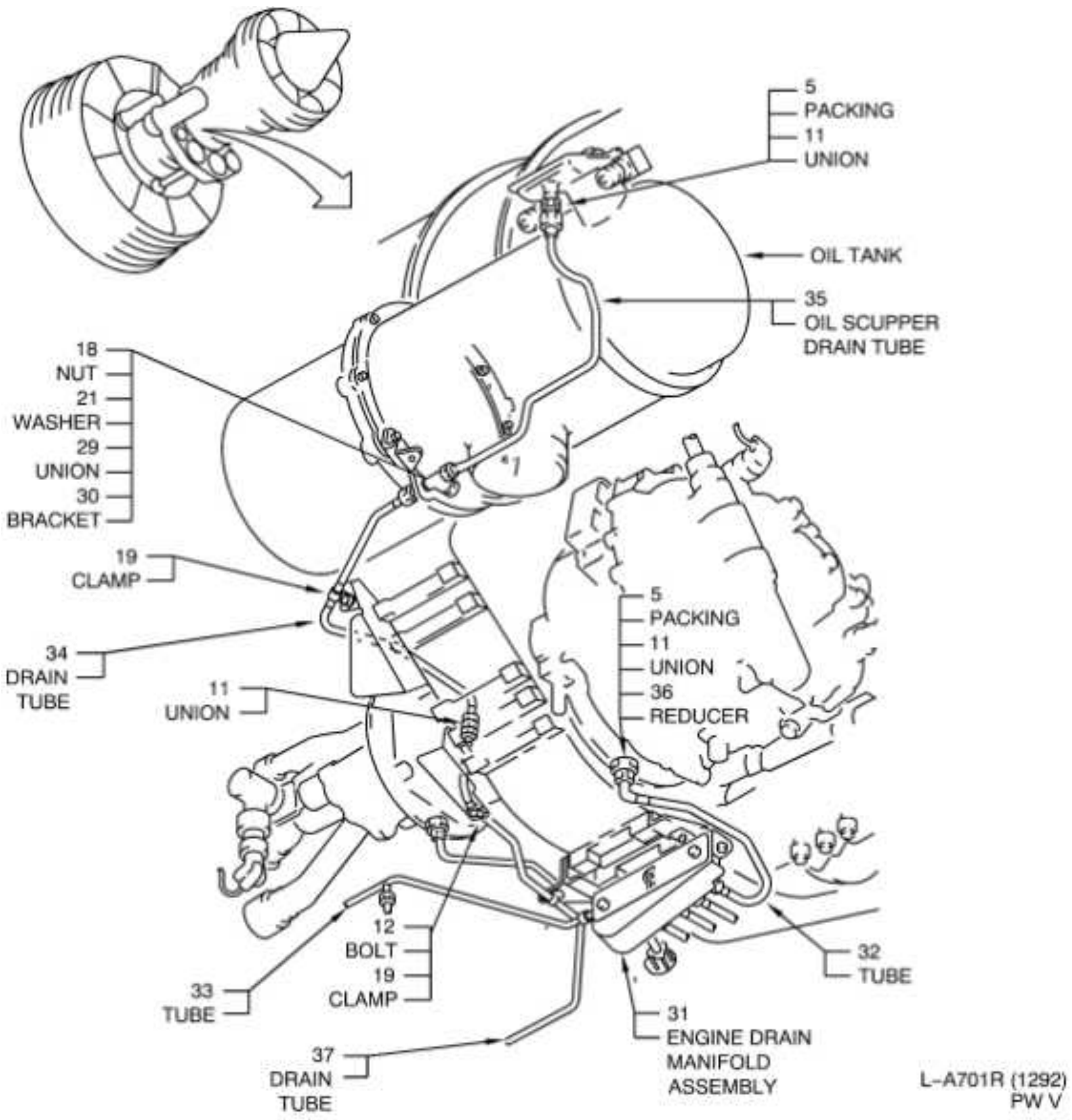
Maintenance time can be reduced by temporarily installing clamps fingertight on the mounting brackets from which they were removed.

- (a) Disconnect clamp (301/19) from drain tube (301/34).
- (b) Disconnect and remove drain tube (301/34) from union (301/29) and union (301/11).
- (c) Remove union (301/11) and discard packing (301/5).
- (d) Disconnect clamp (301/19) and attaching parts from drain tube (301/33) and remove drain tube.

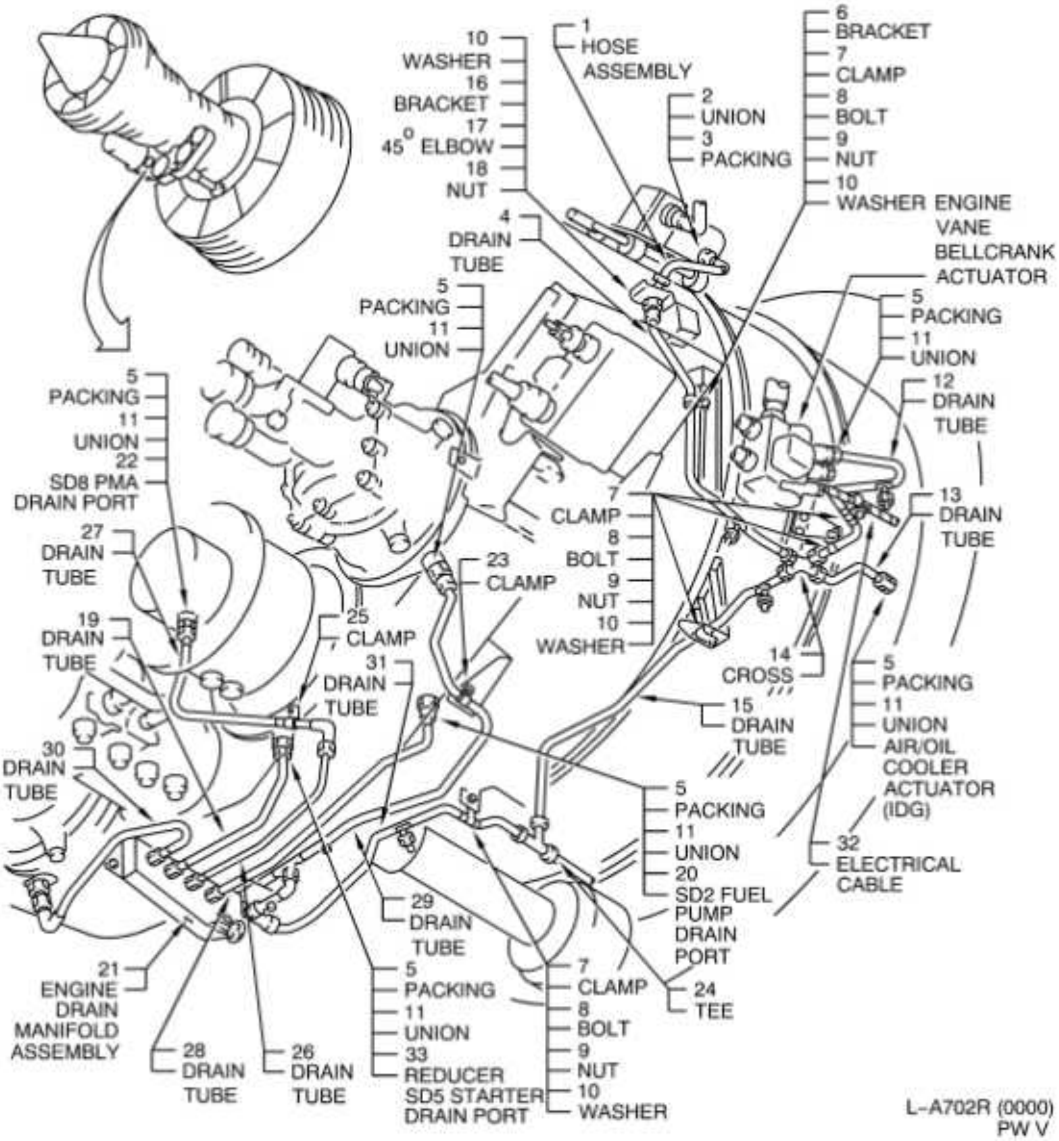
(2) Remove oil tank scupper drain tube. See Figure 301.
- (a) Disconnect and remove oil tank scupper drain tube (301/35) from union (301/11) and union (301/29).
- (b) Remove union (301/29) from bracket (301/30).
- (c) Remove union (301/11) from oil tank and discard packing (301/5).

(3) Remove integrated drive generator (IDG) drain tube. See Figure 301.
- (a) On IDG Port SD6, disconnect and remove IDG drain tube (301/32).
- (b) Remove union (301/11) from reducer (301/36) and discard packing (301/5).

(4) Remove starter drain tube. See Figure 302.

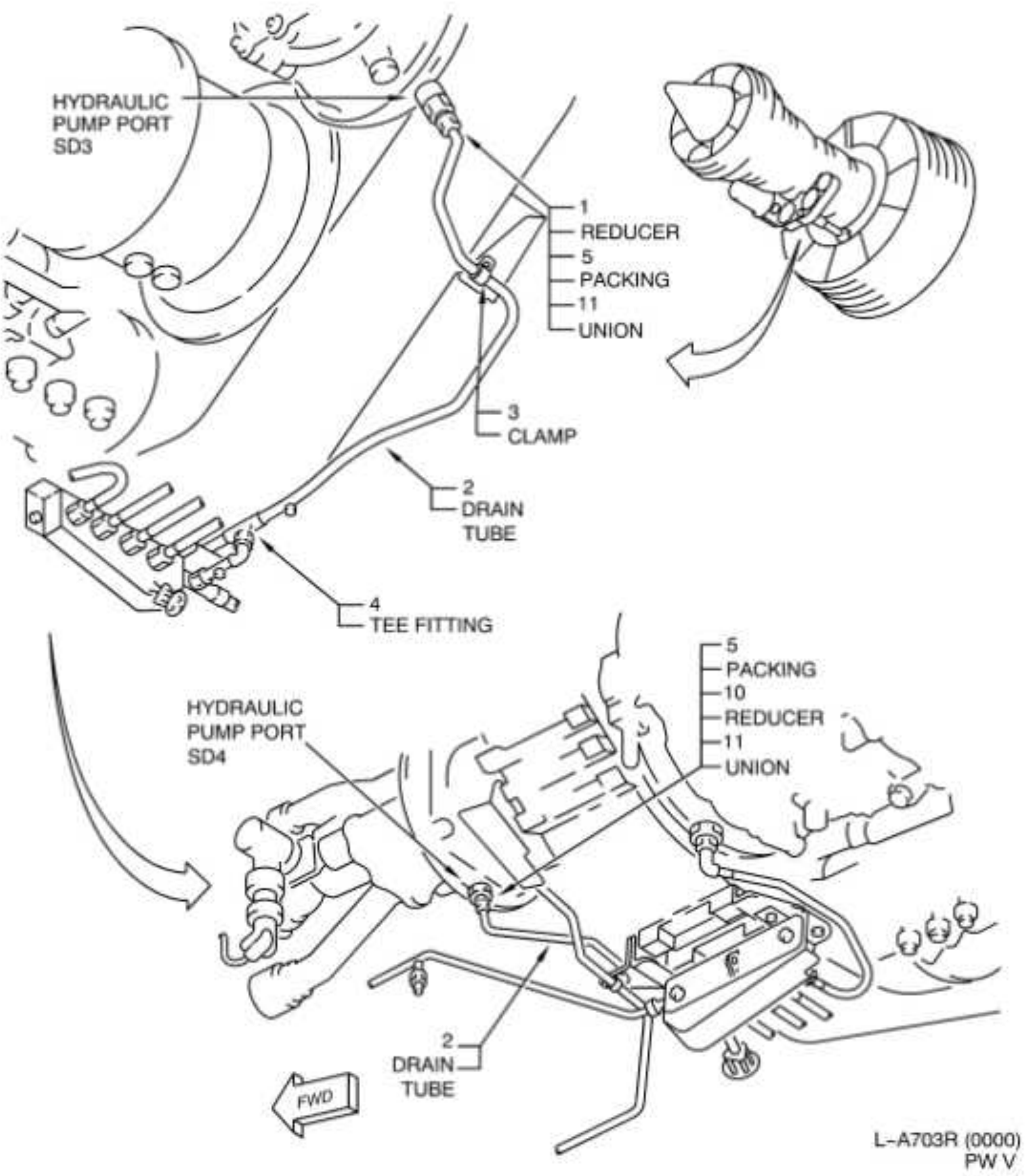

5
PACKING
11
UNION
OIL TANK
35
OIL SCUPPER DRAIN TUBE
18
NUT
21
WASHER
29
UNION
30
BRACKET
19
CLAMP
34
DRAIN TUBE
11
UNION
5
PACKING
11
UNION
36
REDUCER
12
BOLT
19
CLAMP
33
TUBE
32
TUBE
31
ENGINE DRAIN MANIFOLD ASSEMBLY
37
DRAIN TUBE
L-A701R (1292)
PW V

Left Side Engine Drain System
Figure 301
(Task 71-00-61-050-019)


10 WASHER
16 BRACKET
17 45° ELBOW
18 NUT
1 HOSE ASSEMBLY
2 UNION
3 PACKING
6 BRACKET
7 CLAMP
8 BOLT
9 NUT
10 WASHER ENGINE VANE BELLCRANK ACTUATOR
4 DRAIN TUBE
5 PACKING
11 UNION
5 PACKING
11 UNION
12 DRAIN TUBE
5 PACKING
11 UNION
22 SD8 PMA DRAIN PORT
7 CLAMP
8 BOLT
9 NUT
10 WASHER
13 DRAIN TUBE
27 DRAIN TUBE
23 CLAMP
19 DRAIN TUBE
25 CLAMP
31 DRAIN TUBE
14 CROSS
5 PACKING
11 UNION
AIR/OIL COOLER ACTUATOR (IDG)
15 DRAIN TUBE
30 DRAIN TUBE
5 PACKING
11 UNION
20 SD2 FUEL PUMP DRAIN PORT
32 ELECTRICAL CABLE
29 DRAIN TUBE
21 ENGINE DRAIN MANIFOLD ASSEMBLY
5 PACKING
11 UNION
33 REDUCER
SD5 STARTER DRAIN PORT
7 CLAMP
8 BOLT
9 NUT
10 WASHER
24 TEE
28 DRAIN TUBE
26 DRAIN TUBE
L-A702R (0000)
PW V

Engine Drain System
Figure 302
(Task 71−00−61−050−019)

   - (a) On pneumatic engine starter, Port SD5, Flange K, disconnect and remove starter drain tube (302/19) from union (302/11).
   - (b) Remove union (302/11) from reducer (302/31) at Port SD5 and discard packing (302/5).
- (5) Remove fuel pump drain tube. See Figure 302.
   - (a) On fuel pump, Port SD2, Flange J, disconnect and remove fuel pump drain tube (302/28) from union (302/11).
   - (b) Remove union (302/11) from Port SD2 and discard packing (302/5).
- (6) Remove PMA drain tubing. See Figure 302.
   - (a) Disconnect and remove PMA drain tube (302/26) from PMA drain tube (302/27).
   - (b) Disconnect and remove clamp (302/25) and attaching hardware.
   - (c) Disconnect and remove PMA drain tube (302/27) from union (302/11) at drain Port SD8 (302/22).
   - (d) Remove union (302/11) and discard packing (302/5).
- (7) Remove hydraulic pumps drain tube. See Figure 303.
   - (a) Remove clamp (303/3) and attaching parts from hydraulic pumps drain tube (303/2).
   - (b) Disconnect and remove hydraulic pump drain tube (303/2) from union (303/11) at Port SD3 and union (303/11) at Port SD4.
   - (c) Remove union (303/11) from reducer (303/1) and discard packing (303/5).
   - (d) Remove union (303/11) from reducer (303/10) and discard packing (303/5).
- (8) Remove TCC cooling actuator drain tubing. See Figure 302.
   - (a) Disconnect and remove hose (302/1) from union (302/2) and 45 degrees elbow (302/17).
   - (b) Remove union (302/2) and discard packing (302/3).
   - (c) Remove clamp (302/7) and attaching parts from drain tube (302/4).
   - (d) Disconnect and remove drain tube (302/4) from 45 degrees elbow (302/17) and cross fitting (302/14).
   - (e) Remove clamp (302/7) and attaching parts from drain tube (302/15).
   - (f) Disconnect and remove drain tube (302/15) from cross fitting (302/14) and tee (302/24).
- (9) Remove engine vane bellcrank drain tube. See Figure 302.
   - (a) Disconnect and remove clamp (302/7) and attaching parts that secure electrical cable (302/32) to drain tube (302/12).


HYDRAULIC PUMP PORT SD3
1 REDUCER
5 PACKING
11 UNION
3 CLAMP
2 DRAIN TUBE
4 TEE FITTING
5 PACKING
10 REDUCER
11 UNION
HYDRAULIC PUMP PORT SD4
2 DRAIN TUBE
FWD
L-A703R (0000)
PW V

Engine Drain System
Figure 303
(Task 71−00−61−050−019)

- (b) Remove clamp (302/7) and attaching parts that secure drain tube (302/12) to mounting bracket.
- (c) Disconnect and remove bellcrank drain tube (302/12) from union (302/11) and cross fitting (302/14).
- (d) Remove union (302/11) and discard packing (302/5).

(10) Remove air/oil cooler, integrated drive generator (IDG) actuator drain tube. See Figure 302.
- (a) Disconnect and remove air/oil cooler, IDG, drain tube (302/13) from union (302/11).
- (b) Remove cross fitting (302/14) from drain tube (302/13).
- (c) Remove union (302/11) and discard packing (302/5).

(11) Remove fuel/oil cooler, front fuel drain tube at Port AP24. See Figure 304.
- (a) Disconnect and remove drain tube (304/4) from union (304/11) and tee (304/25).
- (b) Remove union (304/11) and discard packing (304/5).

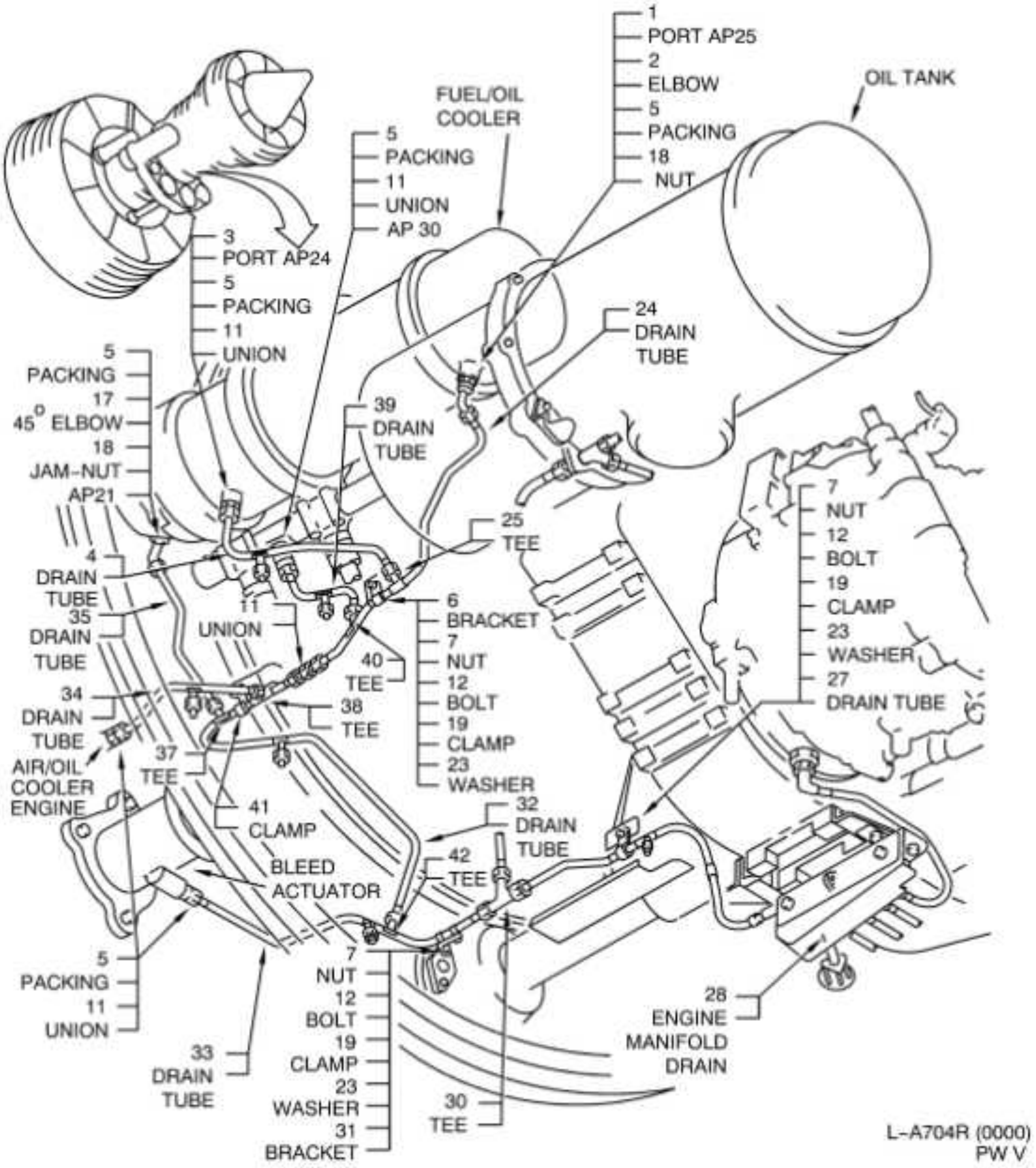
(12) Remove fuel/oil cooler bypass valve oil drain tube at Port AP30. See Figure 304.
- (a) Disconnect and remove drain tube (304/39) from union (304/11) and tee (304/40).
- (b) Remove union (304/11) and discard packing (304/5).

(13) Remove fuel/oil cooler IDG core fuel drain tube at Port AP21. See Figure 304.
- (a) Disconnect and remove tube (304/35) from elbow (304/17) and tee (304/37).
- (b) Remove elbow (304/17) and discard packing (304/5).

(14) Remove air/oil cooler, engine, drain tube. See Figure 304.
- (a) Disconnect and remove drain tube (304/34) from union (304/11) and tee (304/38).
- (b) Remove union (304/11) and discard packing (304/5).

(15) Remove fuel/oil cooler, rear fuel drain tubing at Port AP25. See Figure 304.
- (a) Remove clamp (304/19) and attaching parts on drain tube (304/24).
- (b) Disconnect and remove drain tube (304/24) from elbow (304/2) and union (304/11).
- (c) Remove elbow (304/2) and discard packing (304/5).
- (d) Remove union (304/11) from drain tube (304/32).
- (e) Remove clamp (304/41) and attaching parts from drain tube (304/32).
- (f) Disconnect and remove drain tube (304/32) from tee (304/42).

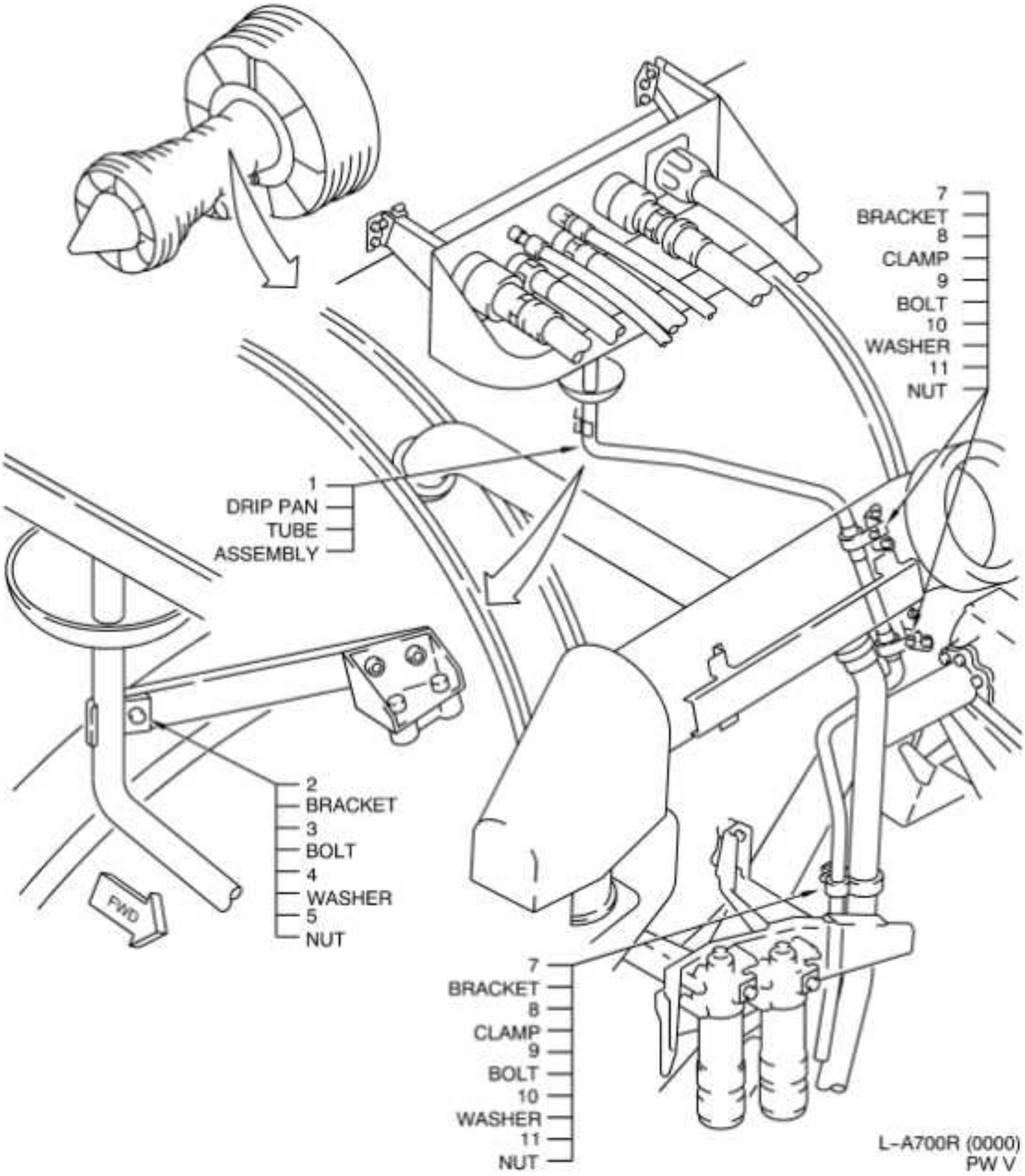
(16) Remove bleed actuator fuel drain. See Figure 304.
- (a) Remove clamp (304/19) and attaching parts from drain tube (304/33).


1
PORT AP25
2
ELBOW
5
PACKING
18
NUT
OIL TANK
FUEL/OIL
COOLER
5
PACKING
11
UNION
AP 30
3
PORT AP24
5
PACKING
11
UNION
24
DRAIN
TUBE
5
PACKING
17
45° ELBOW
18
JAM-NUT
AP21
39
DRAIN
TUBE
7
NUT
12
BOLT
19
CLAMP
23
WASHER
27
DRAIN TUBE
25
TEE
4
DRAIN
TUBE
35
DRAIN
TUBE
11
UNION
6
BRACKET
7
NUT
12
BOLT
19
CLAMP
23
WASHER
40
TEE
34
DRAIN
TUBE
38
TEE
AIR/OIL
COOLER
ENGINE
37
TEE
41
CLAMP
BLEED
ACTUATOR
32
DRAIN
TUBE
42
TEE
5
PACKING
11
UNION
33
DRAIN
TUBE
7
NUT
12
BOLT
19
CLAMP
23
WASHER
31
BRACKET
30
TEE
28
ENGINE
MANIFOLD
DRAIN
L-A704R (0000)
PW V

Engine Drain System
Figure 304
(Task 71–00–61–050–019)

(b) Disconnect and remove drain tube (304/33) from union (302/11) and tee (304/30).
(c) Remove union (304/11) at bleed actuator port and discard packing (304/5).
(d) Remove tee (304/30) from drain tube (304/27).
(e) Remove clamp (304/19) and attaching parts from drain tube (304/27) and remove drain tube.

(17) Remove drip pan tube assembly. See Figure 305.
(a) Remove lower clamp (305/8) and attaching parts from drip pan tube assembly (305/1).
(b) Remove attaching parts from bracket (305/2).
(c) Remove the two middle clamps (305/8) and attaching parts from drip pan tube assembly (305/1) and remove assembly.


7
BRACKET
8
CLAMP
9
BOLT
10
WASHER
11
NUT
1
DRIP PAN
TUBE
ASSEMBLY
2
BRACKET
3
BOLT
4
WASHER
5
NUT
FWD
7
BRACKET
8
CLAMP
9
BOLT
10
WASHER
11
NUT
L-A700R (0000)
PW V

Drip Pan Drain Assembly
Figure 305
(Task 71-00-61-050-019)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-25

Task 71-00-61-050-031:

1. Remove Fuel Pump Interstage Pressure Transmitter

   A. Equipment And Materials Required

   Standard Toos:
   Container, Approximately One U.S. Gallon (3.79 liter)
   Capacity, Suitable for Fuel

   B. Procedure

   See Figure 301.

   (1) Remove electrical connector DT581 from fuel pump interstage pressure transmitter (301/1).

   (2) Install protective covers on connector and receptacle.

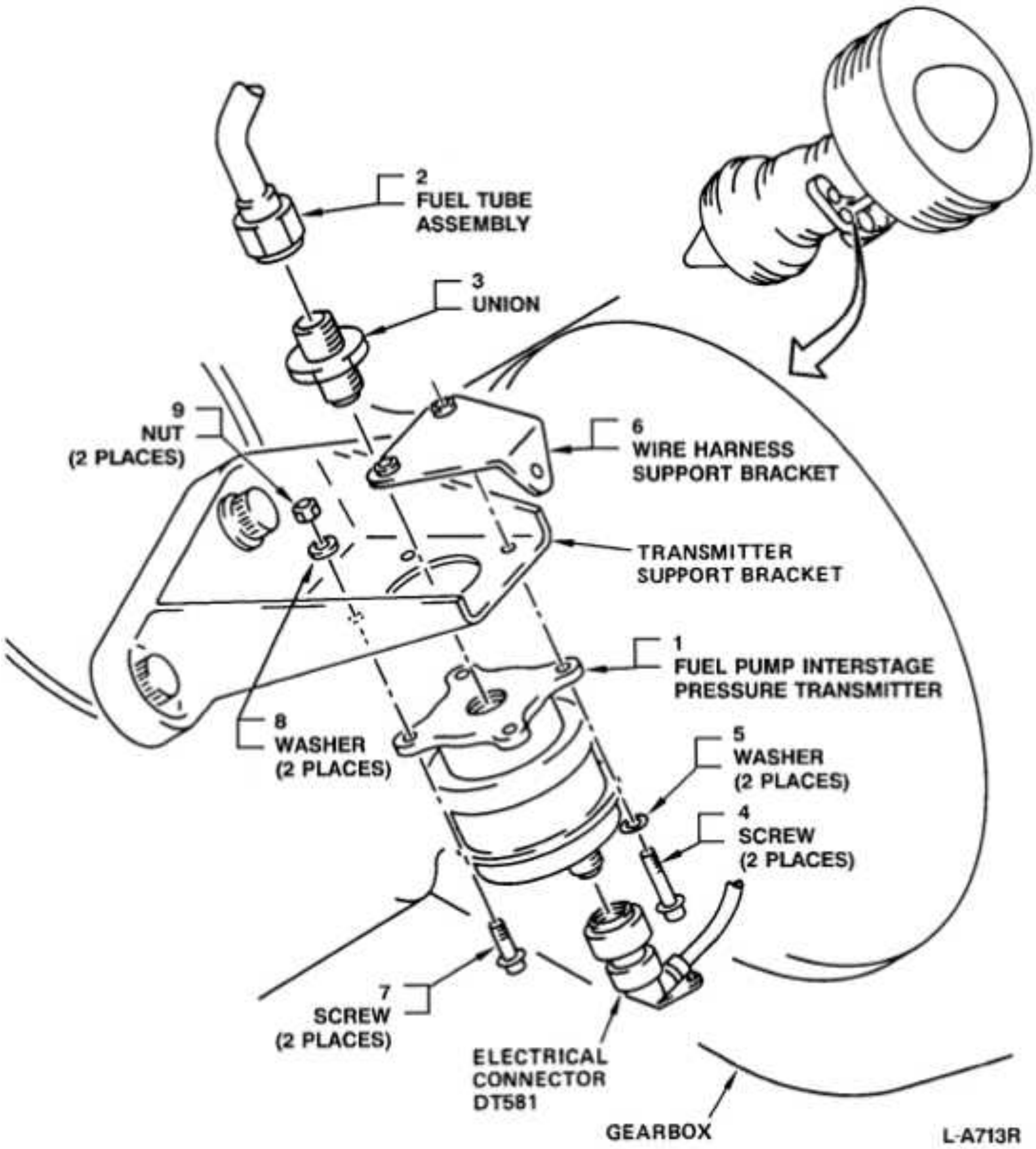
   WARNING: ENGINE FUEL IS A FIRE HAZARD. AVOID SPILLAGE AND MAKE SURE THAT FIRE EXTINGUISHING EQUIPMENT IS READILY AVAILABLE AND IN PROXIMITY TO THE WORK AREA. REMOVE ANY SPILLED FUEL IMMEDIATELY.

   (3) Remove fuel tube assembly (301/2) from transmitter union (301/3) and drain residual fuel into suitable container.

   (4) Install protective covers on fuel tube coupling nut and transmitter union.

   (5) Remove two screws (301/4) and washers (301/5) securing wire harness support bracket (301/6) and forward mounting flange of transmitter to transmitter support bracket.

   (6) Remove transmitter (301/1) from transmitter support bracket by removing remaining two screws (301/7), washers (301/8) and nuts (301/9) from aft mounting flange.


2
FUEL TUBE ASSEMBLY
3
UNION
9
NUT
(2 PLACES)
6
WIRE HARNESS SUPPORT BRACKET
TRANSMITTER SUPPORT BRACKET
1
FUEL PUMP INTERSTAGE PRESSURE TRANSMITTER
8
WASHER
(2 PLACES)
5
WASHER
(2 PLACES)
4
SCREW
(2 PLACES)
7
SCREW
(2 PLACES)
ELECTRICAL CONNECTOR DT581
GEARBOX
L-A713R

Fuel Pump Interstage Pressure Transmitter
Figure 301
(Task 71−00−61−050−031)

POWER PLANT GENERAL − MAIN GEARBOX − REMOVAL−26

Task 71−00−61−050−032:

1. Remove Oil Temperature Sensor

    A. Equipment And Materials Required − None

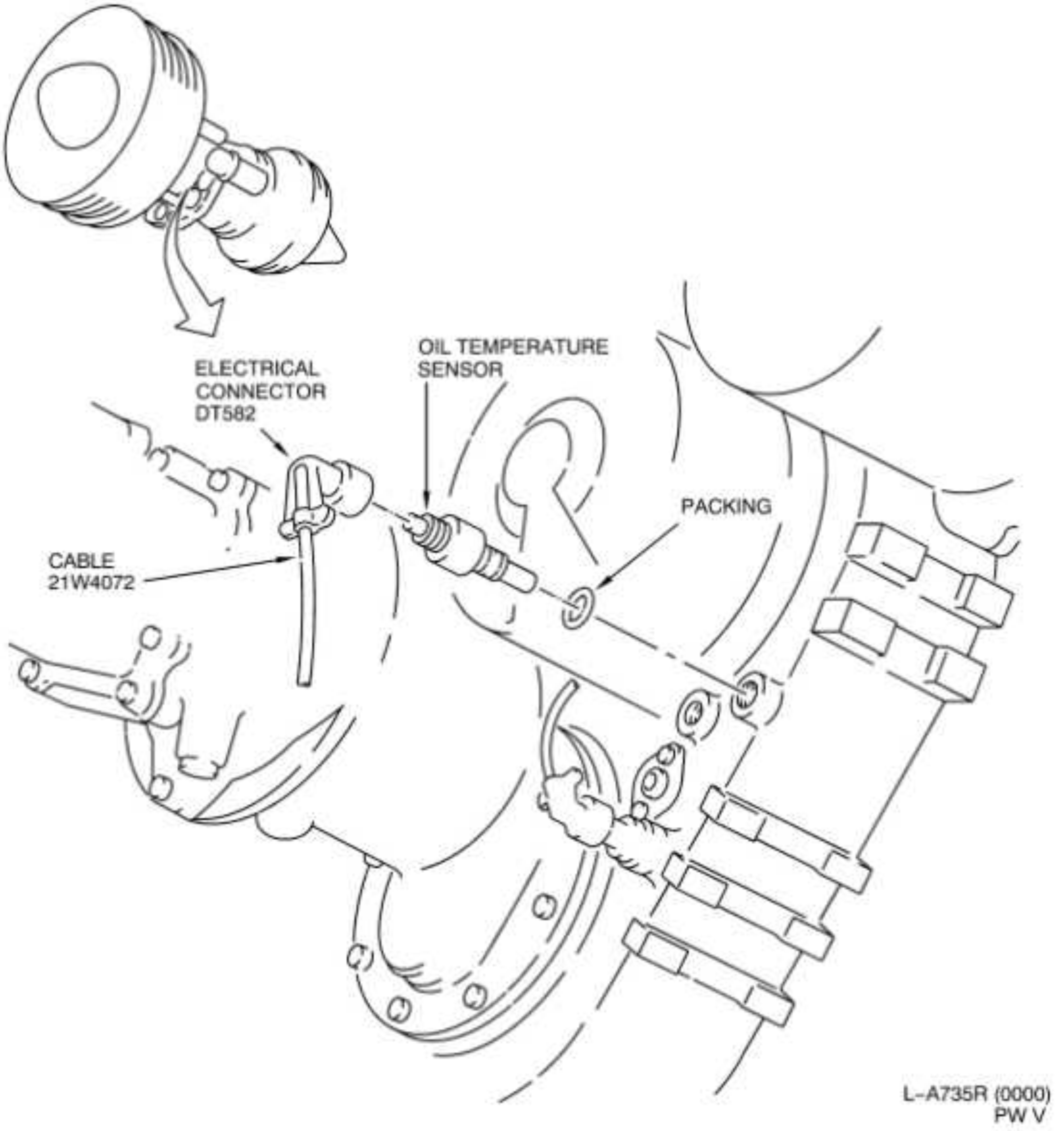
    B. Procedure

    See Figure 301.

    (1) Disconnect electrical connector DT592 from sensor.

    (2) Remove oil temperature sensor and packing from bottom of main gearbox. Discard packing.

    (3) Install protective covers on electrical connector and open port.


ELECTRICAL CONNECTOR DT582
OIL TEMPERATURE SENSOR
PACKING
CABLE 21W4072
L-A735R (0000)
PW V

Oil Temperature Sensor
Figure 301
(Task 71-00-61-050-032)

POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-27

Task 71-00-61-050-033:

1. Remove No. 3 Bearing Oil Temperature Sensor (Immersion Thermocouple)

   A. Equipment And Materials Required - None

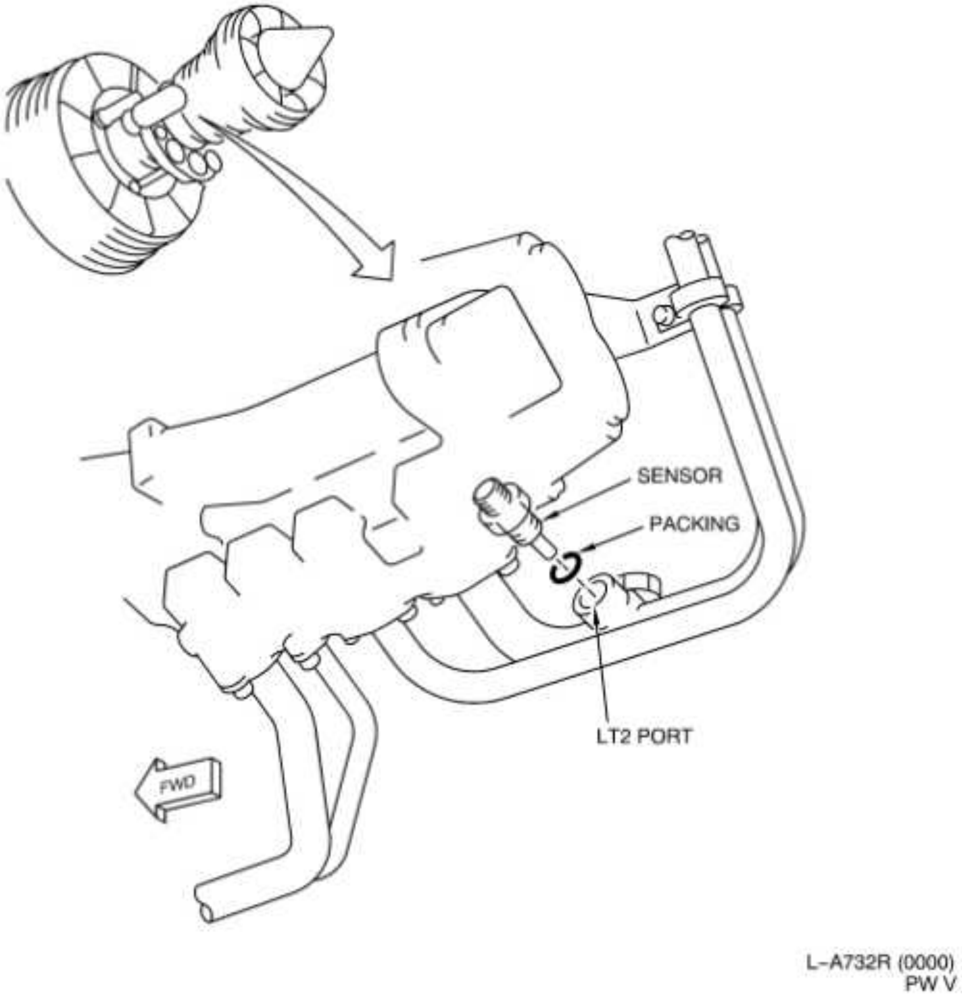
   B. Procedure

   See Figure 301.

   (1) Disconnect electrical connector DT597 from sensor.

   (2) Remove oil temperature sensor from LT2 port in No. 3 bearing scavenge line. Discard packing.

   (3) Install protective covers on electrical connector and open LT2 port.


SENSOR
PACKING
LT2 PORT
FWD
L-A732R (0000)
PW V

No. 3 Bearing Oil Temperature Sensor
Figure 301
(Task 71-00-61-050-033)

POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-28

Task 71-00-61-050-034:

1. Remove IDG Starter, And Hydraulic Pump Heat Shields

A. Equipment And Materials Required - None

B. Procedure

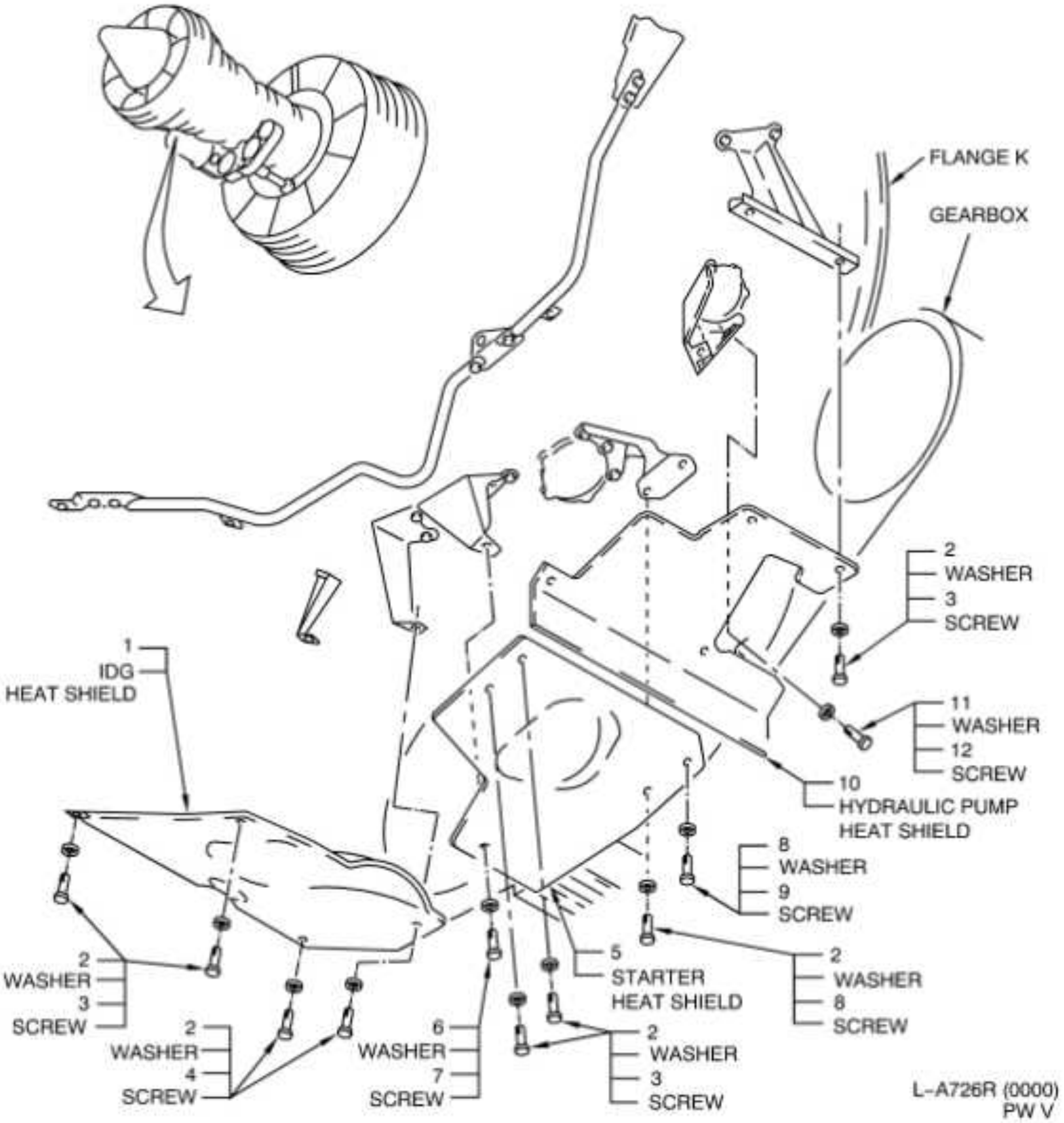
See Figure 301.

(1) Remove two sets of screws and four washers securing IDG heat shield to support brackets.

(2) Remove screws and washers securing starter heat shield to support brackets.

(3) Remove screws and washers securing hydraulic pump heat shield to support brackets.

(4) Remove IDG, starter, and hydraulic pump heat shields from engine.


FLANGE K
GEARBOX
2 WASHER
3 SCREW
11 WASHER
12 SCREW
10 HYDRAULIC PUMP HEAT SHIELD
1 IDG HEAT SHIELD
8 WASHER
9 SCREW
2 WASHER
8 SCREW
5 STARTER HEAT SHIELD
2 WASHER
3 SCREW
2 WASHER
4 SCREW
6 WASHER
7 SCREW
2 WASHER
3 SCREW
L−A726R (0000)
PW V

IDG, Starter, And Hydraulic Pump Heat Shields
Figure 301
(Task 71−00−61−050−034)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 71-00-61-050-035:

1. Remove Starter Control Valve Cooling Tube And Hose

A. Equipment And Materials Required - None

B. Procedure

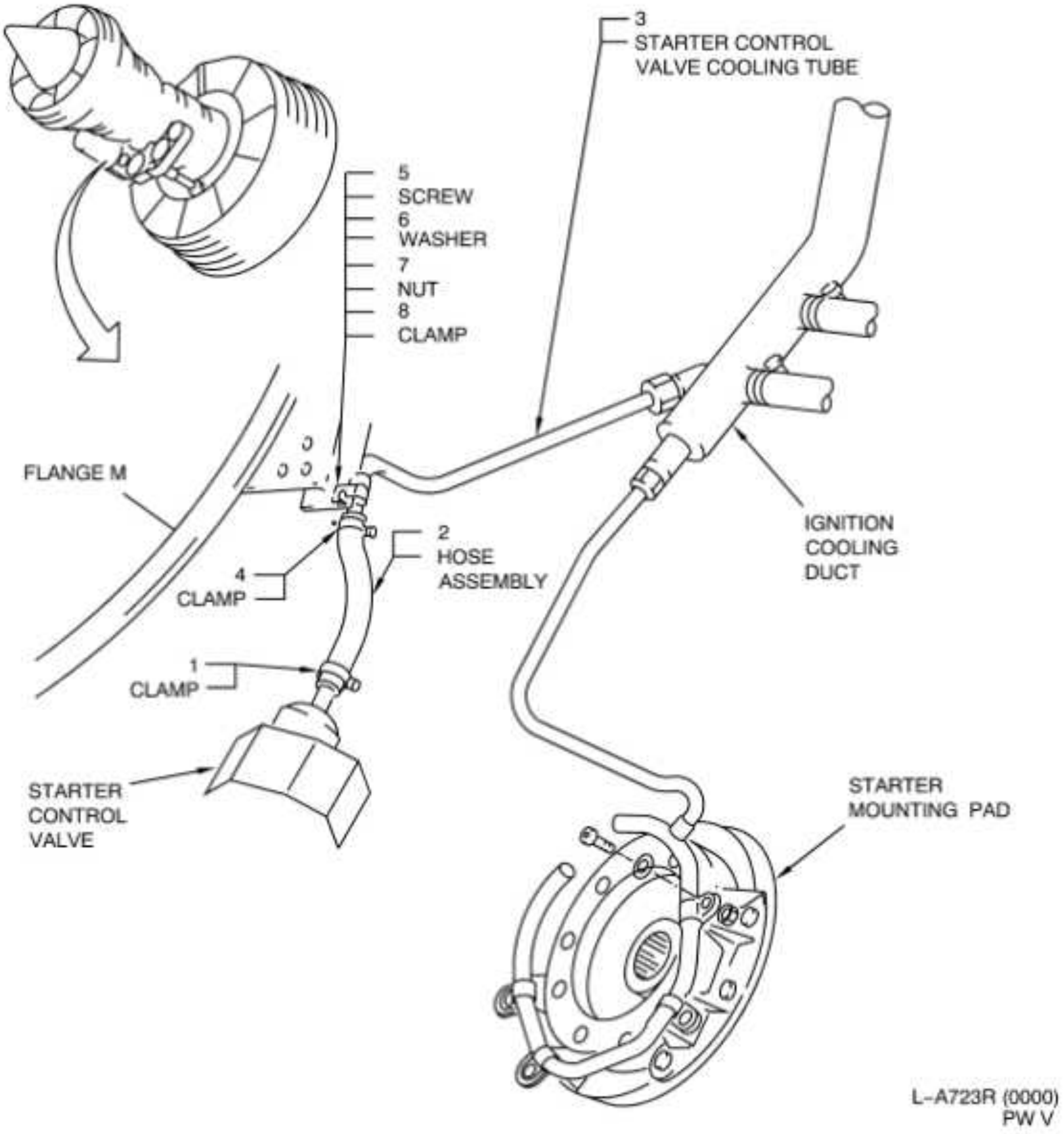
See Figure 301.

(1) At lower end of ignition cooling duct, disconnect coupling nut of starter control valve cooling tube from ignition cooling duct.

(2) Remove clamp, screw, washer, and nut securing lower end of starter control valve cooling tube to bracket on Flange M.

(3) Disconnect clamp securing cooling hose to starter control valve cooling tube. Remove cooling tube from engine.

(4) Disconnect clamp securing lower end of cooling hose to starter control valve.


3
STARTER CONTROL
VALVE COOLING TUBE
5
SCREW
6
WASHER
7
NUT
8
CLAMP
FLANGE M
2
HOSE
ASSEMBLY
4
CLAMP
IGNITION
COOLING
DUCT
1
CLAMP
STARTER
CONTROL
VALVE
STARTER
MOUNTING PAD
L-A723R (0000)
PW V

Starter Control Valve Cooling Tube And Hose
Figure 301
(Task 71-00-61-050-035)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-30

Task 71-00-61-050-036:

1. Remove EEC Alternator (PMA) Cooling Hose And Tubes

   A. Equipment And Materials Required - None

   B. Procedure

      See Figure 301.

      (1) Disconnect clamp securing hose (301/10) to PMA cooling shroud.

      (2) Disconnect clamp securing hose to tube (301/7).

      (3) Loosen and disengage coupling nut securing tube (301/7) to duct (301/2).

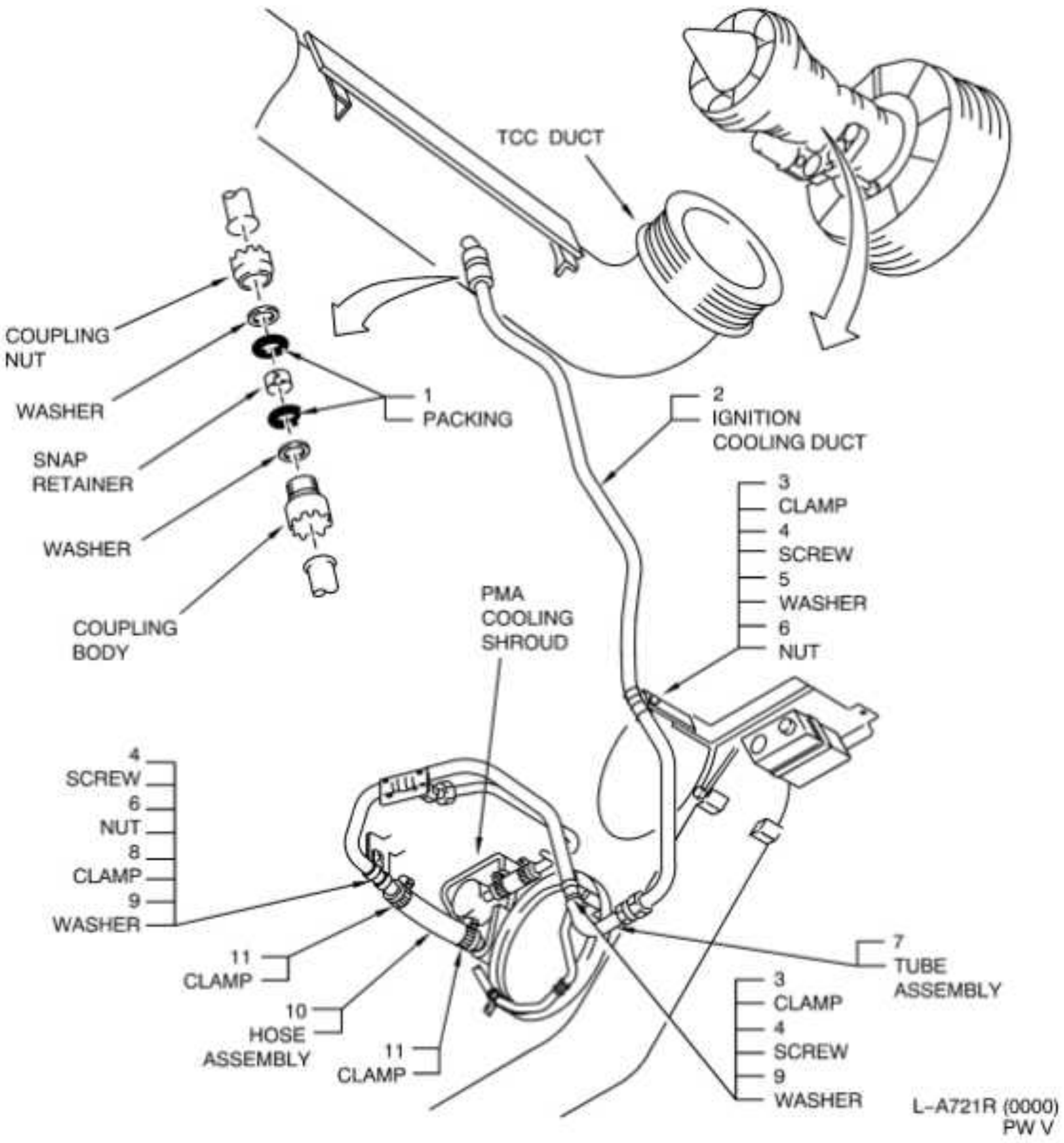
      (4) Disconnect clamp securing tube (301/7) near bracket on starter pad.

      (5) Disconnect clamp securing opposite end of duct (301/2).

      (6) Disconnect clamp securing cooling duct to bracket.

      (7) Disengage snap retainer. loosen connector body and coupling nut securing TCC duct to ignition cooling duct.

      (8) Remove connector coupling body, coupling nut, two washers, packings and snap retainer from ignition cooling duct and TCC duct. Discard packings.


TCC DUCT
COUPLING NUT
WASHER
SNAP RETAINER
WASHER
COUPLING BODY
1 PACKING
2 IGNITION COOLING DUCT
3 CLAMP
4 SCREW
5 WASHER
6 NUT
PMA COOLING SHROUD
4 SCREW
6 NUT
8 CLAMP
9 WASHER
11 CLAMP
10 HOSE ASSEMBLY
11 CLAMP
7 TUBE ASSEMBLY
3 CLAMP
4 SCREW
9 WASHER
L-A721R (0000)
PW V

EEC Alternator (PMA) Cooling Hose And Tubes
Figure 301
(Task 71–00–61–050–036)

POWER PLANT GENERAL - MAIN GEARBOX - REMOVAL-31

Task 71-00-61-050-037:

1. Remove Starter Cooling Tubes

   A. Equipment And Materials Required - None

   B. Procedure

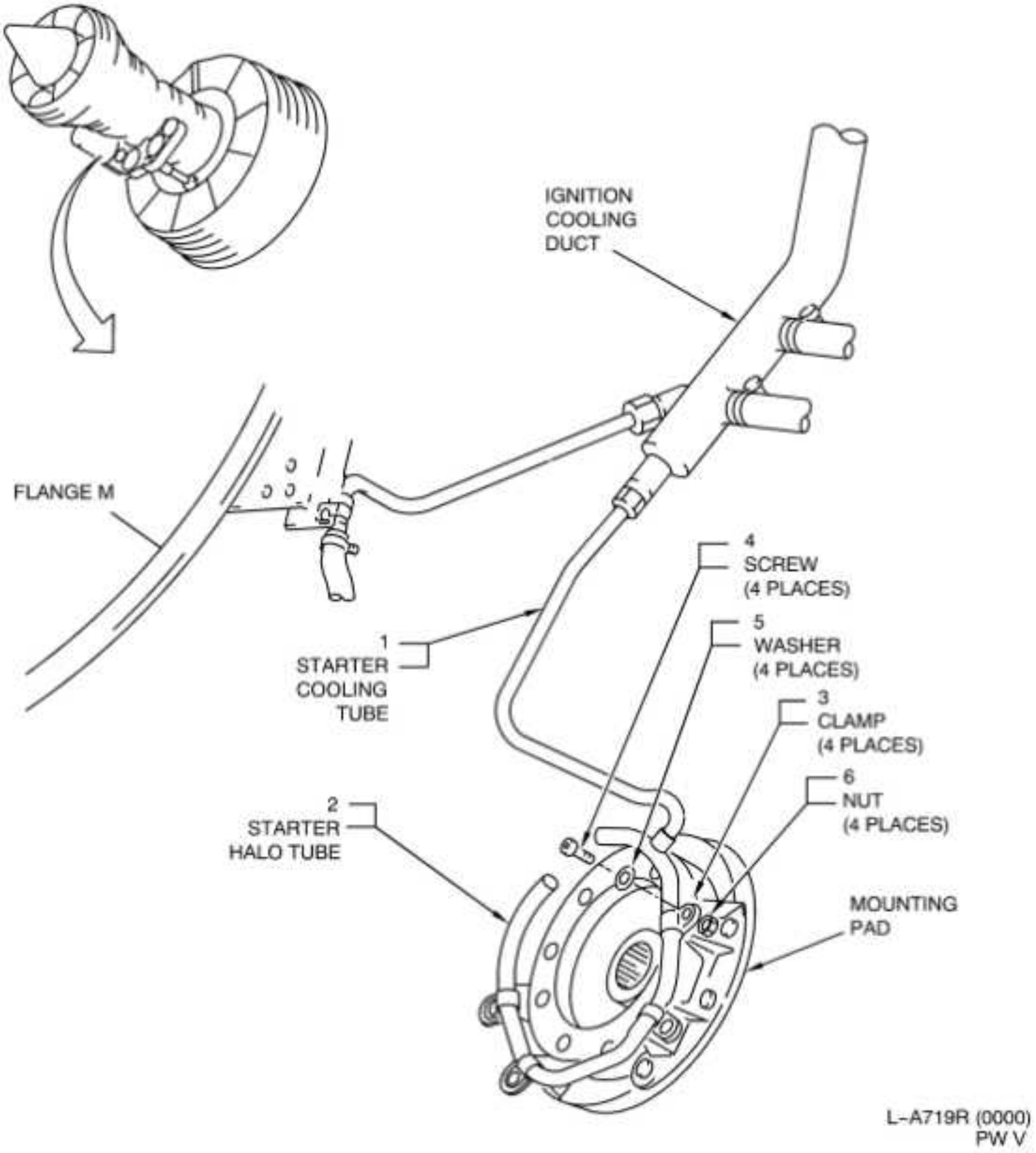
   See Figure 301.

   (1) Disconnect starter cooling tube (301/1) coupling nut from ignition cooling duct.

   (2) Disconnect starter cooling tube coupling nut from starter halo cooling tube (301/2).

   (3) Remove clamps, screws, washers, and nuts securing starter halo cooling tube (301/2) to mounting brackets.

   (4) Remove starter cooling tube and halo tube from engine.


IGNITION COOLING DUCT
FLANGE M
4 SCREW (4 PLACES)
5 WASHER (4 PLACES)
1 STARTER COOLING TUBE
3 CLAMP (4 PLACES)
6 NUT (4 PLACES)
2 STARTER HALO TUBE
MOUNTING PAD
L−A719R (0000)
PW V

Starter Cooling Tubes
Figure 301
(Task 71−00−61−050−037)

Task 71−00−61−050−038:

1. Remove Oil Quantity Transmitter Cooling Tube

A. Equipment And Materials Required − None

B. Procedure

See Figure 301.

(1) Disconnect two clamps (301/12) securing hose (301/13) to tube (301/10) and to oil quantity transmitter cooling shroud.

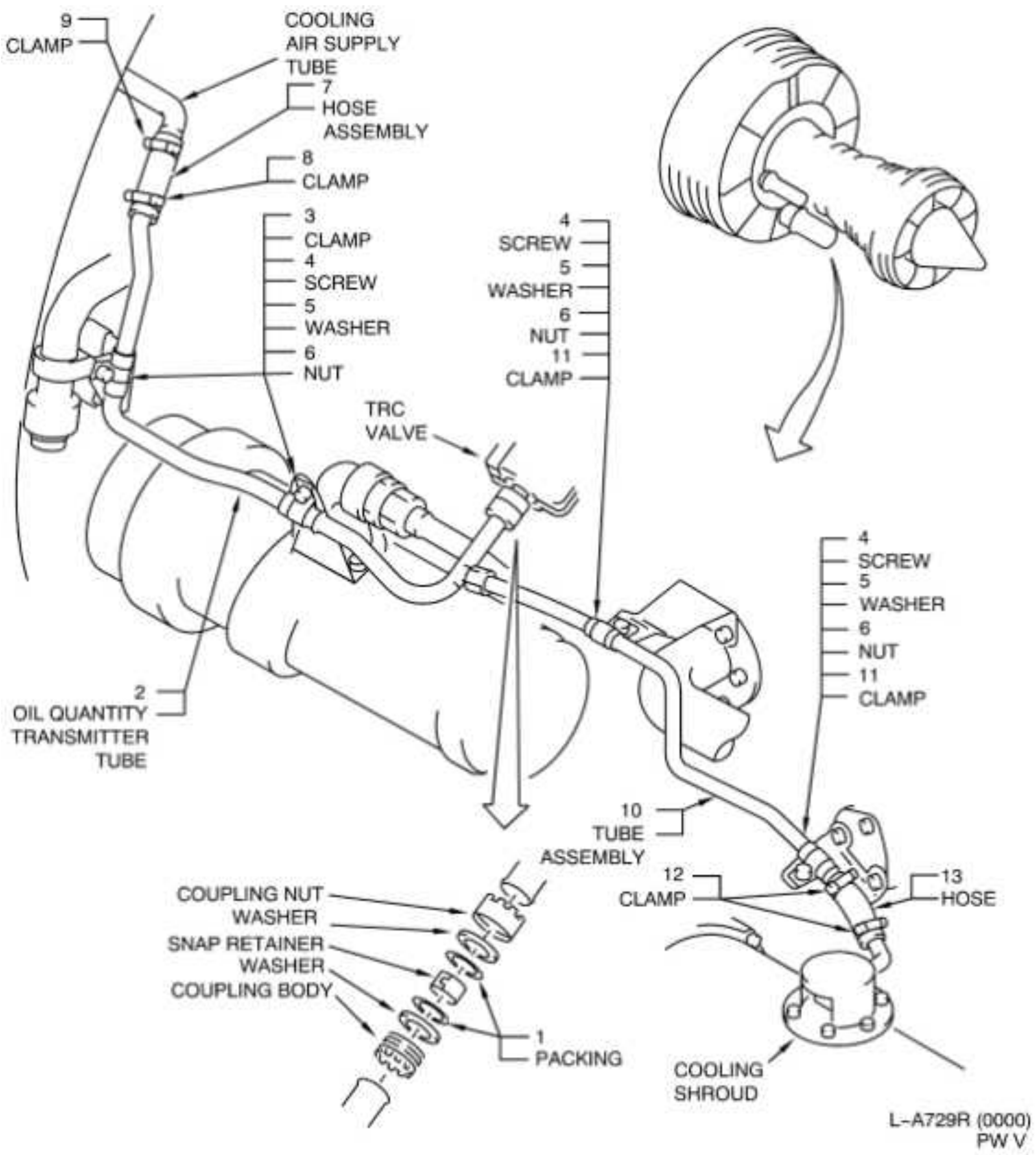
(2) Disconnect clamps, screws, washers, and nuts securing tube (301/10) to two brackets.

(3) Disconnect coupling nut securing tube (301/10) to nipple on oil quantity transmitter tube (301/2).

(4) Disconnect clamps, screws, washers, and nuts securing oil quantity transmitter tube to two brackets.

(5) Disconnect clamps securing hose (301/7) to cooling air supply tube and forward end of oil quantity transmitter tube (301/2).

(6) Disconnect tube (301/2) connector coupling body from TRC valve. Discard connector packings.


9
CLAMP
COOLING AIR SUPPLY TUBE
7
HOSE ASSEMBLY
8
CLAMP
3
CLAMP
4
SCREW
5
WASHER
6
NUT
4
SCREW
5
WASHER
6
NUT
11
CLAMP
TRC VALVE
4
SCREW
5
WASHER
6
NUT
11
CLAMP
2
OIL QUANTITY TRANSMITTER TUBE
10
TUBE ASSEMBLY
COUPLING NUT
WASHER
SNAP RETAINER
WASHER
COUPLING BODY
1
PACKING
12
CLAMP
13
HOSE
COOLING SHROUD
L-A729R (0000)
PW V

Oil Quantity Transmitter Cooling Tube
Figure 301
(Task 71-00-61-050-038)

Task 71-00-61-450-001:

1. Install Hydraulic Hoses (Abex Pump)

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
R P06-054	Paste, Anti-Seize (PWA 36246)

B. Procedure
See Figure 401, Figure 402 and Figure 403.

(1) Install upper hose support bracket with four bolts, washers and nuts. Torque nuts 85 - 95 lb-in. (9.604 - 10.734 N.m).

R (2) Apply Anti-Seize Paste P06-054 to the screws and install the lower hose support bracket with three screws and washers. Remove the unwanted paste. Torque screws 62 - 72 lb-in. (7.005 - 8.135 N.m).

(3) Install rear hydraulic pump lower case drain hose.

(a) Connect hose to reducer in rear hydraulic pump case drain port. Torque hose coupling nut to 215 - 245 lb-in. (24.292 - 27.681 N.m).

(b) Connect hose to union on side of rear case hydraulic filter. Torque hose coupling nut to 215 - 245 lb-in. (24.292 - 27.681 N.m).

(4) Install rear hydraulic pump upper case drain hose with male connectors to the pylon and the rear hydraulic pump.

(a) Connect hose to union on top of rear case hydraulic filter. Torque hose coupling nut to 215 - 245 lb-in. (24.292 - 27.681 N.m).

(b) Connect hose to fluid disconnect panel. Torque hose coupling nut to 215 - 245 lb-in. (24.292 - 27.681 N.m).

(c) Attach hose to upper hose support bracket with clamp block (401/1).

1 Open left hand clamp band and insert hose into clamp block.

2 Close clamp band. Do not tighten clamp block at this time.

(5) Install rear hydraulic pump pressure hose.

(a) Connect hose to pulsation dampener on rear hydraulic pump pressure port. Torque hose coupling nut to 900 − 1150 lb−in. (101.686 − 129.932 N.m).

(b) Connect hose to fluid disconnect panel. Torque hose coupling nut to 900 − 1150 lb−in. (101.686 − 129.932 N.m).

(c) Attach hose to hydraulic filter bracket with clamp (401/2) and attaching hardware. Do not tighten clamp at this time.

(d) Attach hose to upper hose support bracket with clamp (401/2) and attaching hardware. Do not tighten clamp at this time.

(6) Install rear hydraulic pump suction hose.

(a) Connect hose to adapter in rear hydraulic pump suction port. Torque hose coupling nut to 1900 − 2100 lb−in. (214.671 − 237.268 N.m).

(b) Connect hose to fluid disconnect panel. Torque hose coupling nut to 1900 − 2100 lb−in. (214.671 − 237.268 N.m).

(c) Attach hose to hydraulic filter bracket with clamp (401/3) and attaching hardware. Do not tighten clamp at this time.

(d) Attach hose to upper hose support bracket with clamp (401/3) and attaching hardware. Do not tighten clamp at this time.

(7) Collect three hoses: rear hydraulic pump lower case drain hose, rear hydraulic pump pressure hose, and rear hydraulic pump suction hose. Secure the hoses with clamp (401/4) and attaching hardware. Torque nut to 50 − 70 lb−in. (5.649 − 7.909 N.m).

(8) Install front hydraulic pump lower case drain hose.

  (a) Connect hose to reducer in front hydraulic pump case drain port. Torque hose coupling nut to 215 − 245 lb−in. (24.292 − 27.681 N.m).

  (b) Connect hose to union on side of front hydraulic filter. Torque hose coupling nut to 215 − 245 lb−in. (24.292 − 27.681 N.m).

  (c) Attach hose to lower hose support bracket with clamp (402/5) and attaching hardware. Do not tighten clamp at this time.

(9) Install front hydraulic pump upper case drain hose.

  (a) Connect hose to union on top of front hydraulic filter. Torque hose coupling nut to 215 − 245 lb−in. (24.292 − 27.681 N.m).

  (b) Connect hose to fluid disconnect panel. Torque to 215 − 245 lb−in. (24.292 − 27.681 N.m).

  (c) Attach hose to upper hose support bracket with clamp block (401/1).

    1 Open right hand clamp band and insert hose into clamp block.

    2 Close clamp band. Torque screw 50 − 70 lb−in. (5.649 − 7.909 N.m).

    3 Secure clamp block (401/1) with bolt and washer and torque to 50 − 70 lb−in. (5.649 − 7.909 N.m).

(10) Install front hydraulic pump pressure hose.

  (a) Connect hose to pulsation dampener on front hydraulic pump pressure port. Torque hose coupling nut to 900 − 1150 lb−in. (101.686 − 129.932 N.m).

  (b) Connect hose to fluid disconnect panel. Torque hose coupling nut to 900 − 1150 lb−in. (101.686 − 129.932 N.m).

(c) Attach hose to lower hose support bracket with clamp (402/6) and attaching hardware. Do not tighten clamp at this time.

(d) On lower case drain hose, measure 8.7 inch (221.0 mm) from fitting at end of flexible part of hose. At this point, attach pressure hose to lower case drain hose with two clamps (402/5 and 402/7) and attaching hardware. Torque nut to 50 − 70 lb−in. (5.649 − 7.909 N.m).

(e) Attach hose to hydraulic filter bracket with clamp (401/2) and attaching hardware. Do not tighten clamp at this time.

(f) Attach hose to upper hose support bracket with clamp (401/3) and attaching hardware. Do not tighten clamp at this time.

(11) Install front hydraulic pump suction hose.

(a) Connect hose to adapter on front hydraulic pump suction port. Torque hose coupling nut to 1900 − 2100 lb−in. (214.671 − 237.268 N.m).

(b) Connect hose to fluid disconnect panel. Torque hose coupling nut to 1900 − 2100 lb−in. (214.671 − 237.268 N.m).

(c) Attach hose to lower hose support bracket with clamp (402/8) and attaching hardware. Do not tighten clamp at this time.

(d) At outside horizontal section of hydraulic suction hose, measure 7.0 inch (177.8 mm) from aft right angle bend. At this point, attach pressure hose to suction hose with two clamps (402/7 and 402/9) and attaching hardware. Torque nut to 50 − 70 lb−in. (5.649 − 7.909 N.m).

(e) Attach hydraulic suction hose to hydraulic filter bracket with clamp (401/3) and attaching hardware. Do not tighten clamp at this time.

(f) Attach hose to upper hose support bracket with clamp (401/3) and attaching hardware. Do not tighten clamp at this time.

(12) Adjust hoses and tighten nuts holding three clamps on lower hose support bracket. Torque nuts to 50 − 70 lb−in. (5.649 − 7.909 N.m).

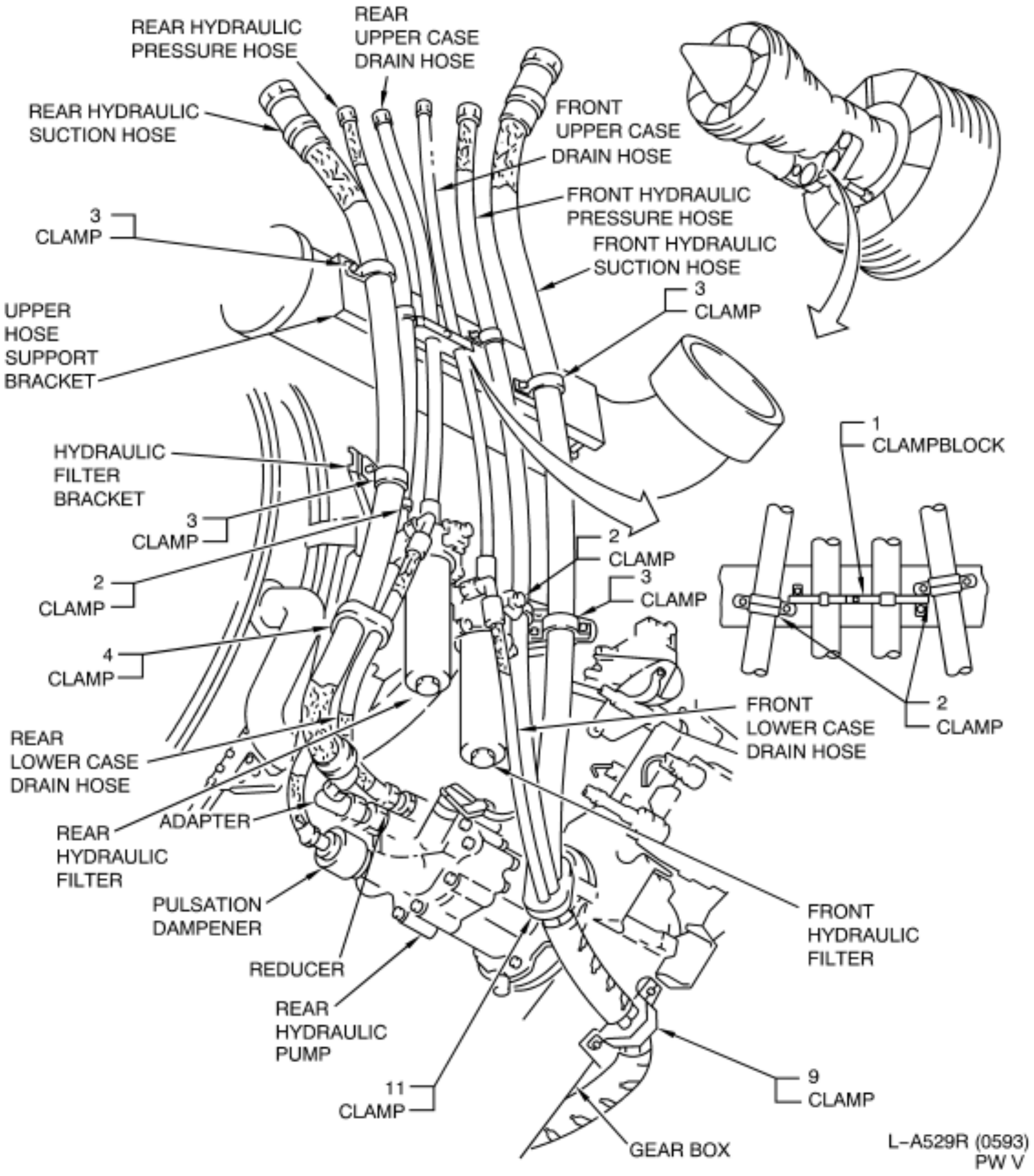
(13) Collect three hoses: front hydraulic pump lower case drain hose, hydraulic pressure hose and hydraulic suction hose with clamp (401/9) and attach clamp to support bracket on main gearbox with attaching hardware. Torque nuts to 50 − 70 lb−in. (5.649 − 7.909 N.m).

(14) On front hydraulic pump suction hose, measure 13.0 inch (330.2 mm) below clamp (403/9) on gearbox support bracket. Collect three hoses: hydraulic suction hose, pressure hose and lower case drain hose with clamp (403/10) and secure with attaching hardware. Torque nut to 50 − 70 lb−in. (5.649 − 7.909 N.m).

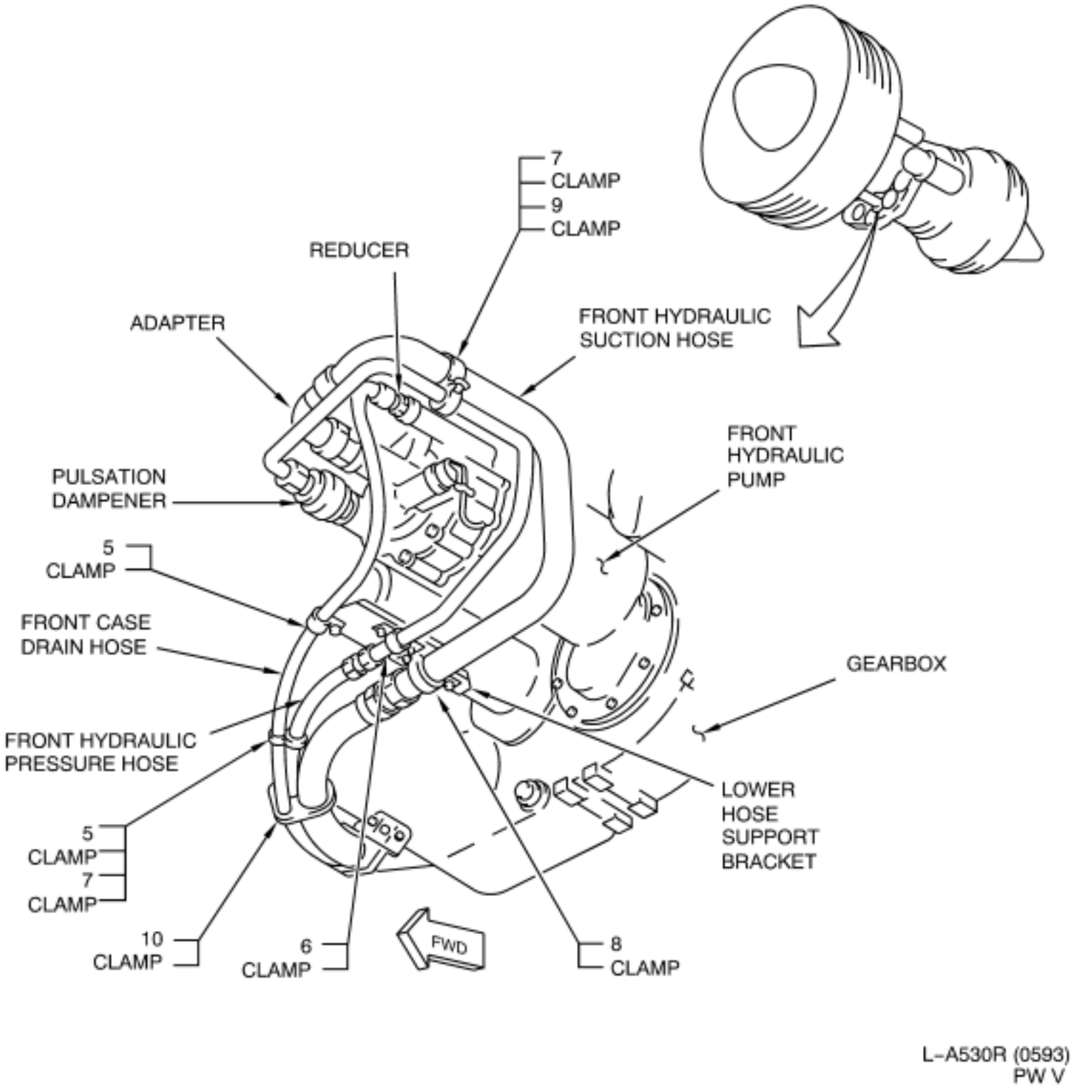
(15) On front hydraulic suction hose, measure 17.8 inch (452.1 mm) above support clamp (403/9) on gearbox. Collect three hoses; hydraulic suction hose, pressure hose and lower case drain hose with clamp (403/11) and secure with attaching hardware. Torque nut to 50 − 70 lb−in. (5.649 − 7.909 N.m).

(16) Adjust hoses and tighten nuts holding two clamps on hydraulic filter bracket. Torque nuts to 50 − 70 lb−in. (5.649 − 7.909 N.m).

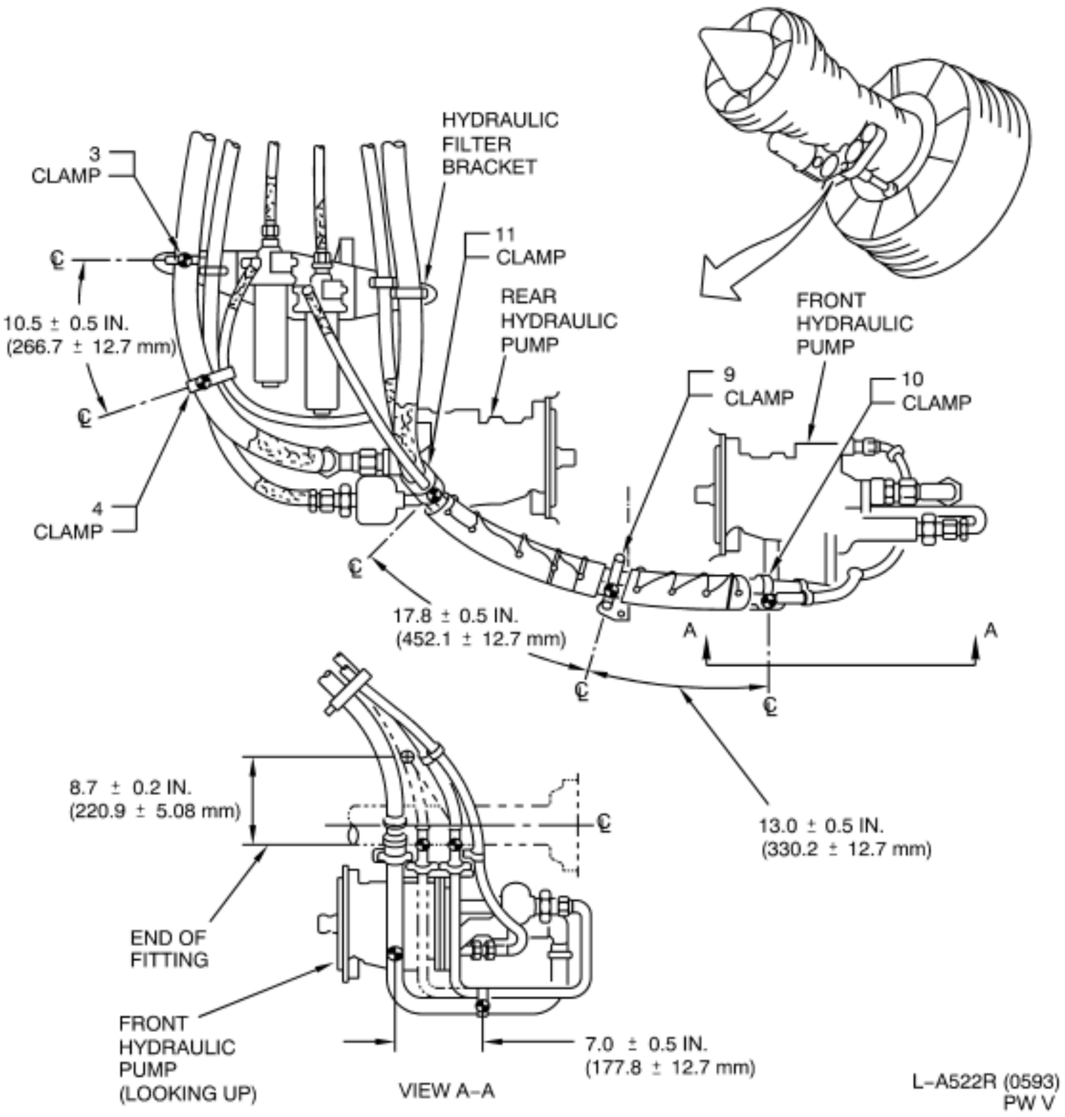
(17) Adjust hoses and tighten nuts holding two clamps on upper hydraulic hose support bracket. Torque nuts to 50 − 70 lb−in. (5.649 − 7.909 N.m).


REAR HYDRAULIC PRESSURE HOSE
REAR UPPER CASE DRAIN HOSE
REAR HYDRAULIC SUCTION HOSE
FRONT UPPER CASE DRAIN HOSE
FRONT HYDRAULIC PRESSURE HOSE
FRONT HYDRAULIC SUCTION HOSE
3 CLAMP
UPPER HOSE SUPPORT BRACKET
3 CLAMP
1 CLAMPBLOCK
HYDRAULIC FILTER BRACKET
3 CLAMP
2 CLAMP
2 CLAMP
3 CLAMP
4 CLAMP
FRONT LOWER CASE DRAIN HOSE
2 CLAMP
REAR LOWER CASE DRAIN HOSE
ADAPTER
REAR HYDRAULIC FILTER
PULSATION DAMPENER
FRONT HYDRAULIC FILTER
REDUCER
REAR HYDRAULIC PUMP
9 CLAMP
11 CLAMP
GEAR BOX
L-A529R (0593)
PW V

Right Side Hydraulic Hoses
Figure 401
(Task 71−00−61−450−001)


7
CLAMP
9
CLAMP
REDUCER
ADAPTER
FRONT HYDRAULIC
SUCTION HOSE
FRONT
HYDRAULIC
PUMP
PULSATION
DAMPENER
5
CLAMP
FRONT CASE
DRAIN HOSE
GEARBOX
FRONT HYDRAULIC
PRESSURE HOSE
LOWER
HOSE
SUPPORT
BRACKET
5
CLAMP
7
CLAMP
10
CLAMP
6
CLAMP
FWD
8
CLAMP
L-A530R (0593)
PW V

Left Side Hydraulic Hoses
Figure 402
(Task 71-00-61-450-001)


HYDRAULIC FILTER BRACKET
3 CLAMP
℄
11 CLAMP
REAR HYDRAULIC PUMP
FRONT HYDRAULIC PUMP
10.5 ± 0.5 IN. (266.7 ± 12.7 mm)
℄
9 CLAMP
10 CLAMP
4 CLAMP
℄
17.8 ± 0.5 IN. (452.1 ± 12.7 mm)
A
A
℄
℄
8.7 ± 0.2 IN. (220.9 ± 5.08 mm)
℄
13.0 ± 0.5 IN. (330.2 ± 12.7 mm)
END OF FITTING
FRONT HYDRAULIC PUMP (LOOKING UP)
VIEW A−A
7.0 ± 0.5 IN. (177.8 ± 12.7 mm)
L−A522R (0593)
PW V

Hose Clamp Mounting Locations
Figure 403
(Task 71−00−61−450−001)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 71-00-61-450-002:

1. Install Hydraulic Hoses (Sperry-Vickers Pump)

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
R P06-054	Paste, Anti-Seize (PWA 36246)

B. Procedure
See Figure 401, Figure 402 and Figure 403.

(1) Install upper hose support bracket with four bolts, washers and nuts. Torque nuts 85 - 95 lb-in. (9.604 - 10.734 N.m).

R R R (2) Apply Anti-Seize Paste P06-054 to the screws and install the lower hose support bracket with three screws and washers. Remove the unwated paste. Torque screws 62 - 72 lb-in. (7.005 - 8.135 N.m).

(3) Install rear hydraulic pump lower case drain hose.

(a) Connect hose to reducer in rear hydraulic pump case drain port. Torque hose coupling nut to 215 - 245 lb-in. (24.292 - 27.681 N.m).

(b) Connect hose to union on side of rear case hydraulic filter. Torque hose coupling nut to 215 - 245 lb-in. (24.292 - 27.681 N.m).

(4) Install rear hydraulic pump upper case drain hose.

(a) Connect hose to union on top of rear case hydraulic filter. Torque hose coupling nut to 215 - 245 lb-in. (24.292 - 27.681 N.m).

(b) Connect hose to fluid disconnect panel. Torque hose coupling nut to 215 - 245 lb-in. (24.292 - 27.681 N.m).

(c) Attach hose to upper hose support bracket with clamp block (401/1).

1 Open left hand clamp band and insert hose into clamp block.

2 Close clamp band. Do not tighten clamp block at this time.

(5) Install rear hydraulic pump pressure hose.

(a) Connect hose to reducer in rear hydraulic pump pressure port. Torque hose coupling nut to 900 − 1150 lb−in. (101.686 − 129.932 N.m).

(b) Connect hose to fluid disconnect panel. Torque hose coupling nut to 900 − 1150 lb−in. (101.686 − 129.932 N.m).

(c) Attach hose to hydraulic filter bracket with clamp (401/2) and attaching hardware. Do not tighten clamp at this time.

(d) Attach hose to upper hose support bracket with clamp (401/2) and attaching hardware. Do not tighten clamp at this time.

(6) Install rear hydraulic pump suction hose.

(a) Connect hose to adapter in rear hydraulic pump suction port. Torque hose coupling nut to 1900 − 2100 lb−in. (214.671 − 237.268 N.m).

(b) Connect hose to fluid disconnect panel. Torque hose coupling nut to 1900 − 2100 lb−in. (214.671 − 237.268 N.m).

(c) Attach hose to hydraulic filter bracket with clamp (401/3) and attaching hardware. Do not tighten clamp at this time.

(d) Attach hose to upper hose support bracket with clamp (401/3) and attaching hardware. Do not tighten clamp at this time.

(7) Collect three hoses: rear hydraulic pump lower case drain hose, rear hydraulic pump pressure hose, and rear hydraulic pump suction hose. Secure the hoses with clamp (401/4) and attaching hardware. Torque nut to 50 − 70 lb−in. (5.649 − 7.909 N.m).

(8) Install front hydraulic pump lower case drain hose.

(a) Connect hose to reducer in front hydraulic pump case drain port. Torque hose coupling nut to 215 − 245 lb−in. (24.292 − 27.681 N.m).

(b) Connect hose to union on side of front hydraulic filter. Torque hose coupling nut to 215 − 245 lb−in. (24.292 − 27.681 N.m).

(c) Attach hose to lower hose support bracket with clamp (402/5) and attaching hardware. Do not tighten clamp at this time.

(9) Install front hydraulic pump upper case drain hose.

(a) Connect hose to union on top of front hydraulic filter. Torque hose coupling nut to 215 − 245 lb−in. (24.292 − 27.681 N.m).

(b) Connect hose to fluid disconnect panel. Torque to 215 − 245 lb−in. (24.292 − 27.681 N.m).

(c) Attach hose to upper hose support bracket with clamp block (401/1).

1 Open right hand clamp band and insert hose into clamp block.

2 Close clamp band. Torque screw 50 − 70 lb−in. (5.649 − 7.909 N.m).

3 Secure clamp block (401/1) with bolt and washer and torque to 50 − 70 lb−in. (5.649 − 7.909 N.m).

(10) Install front hydraulic pump pressure hose.

(a) Connect hose to reducer in front hydraulic pump pressure port. Torque hose coupling nut to 900 − 1150 lb−in. (101.686 − 129.932 N.m).

(b) Connect hose to fluid disconnect panel. Torque hose coupling nut to 900 − 1150 lb−in. (101.686 − 129.932 N.m).

(c) Attach hose to lower hose support bracket with clamp (402/6) and attaching hardware. Do not tighten clamp at this time.

(d) On lower case drain hose, measure 8.7 inch (221.0 mm) from fitting at end of flexible part of hose. At this point, attach pressure hose to lower case drain hose with two clamps (402/5 and 402/7) and attaching hardware. Torque nut to 50 − 70 lb−in. (5.649 − 7.909 N.m).

(e) Attach hose to hydraulic filter bracket with clamp (401/2) and attaching hardware. Do not tighten clamp at this time.

(f) Attach hose to upper hose support bracket with clamp (401/3) and attaching hardware. Do not tighten clamp at this time.

(11) Install front hydraulic pump suction hose.

(a) Connect hose to adapter on front hydraulic pump suction port. Torque hose coupling nut to 1900 − 2100 lb−in. (214.671 − 237.268 N.m).

(b) Connect hose to fluid disconnect panel. Torque hose coupling nut to 1900 − 2100 lb−in. (214.671 − 237.268 N.m).

(c) Attach hose to lower hose support bracket with clamp (402/8) and attaching hardware. Do not tighten clamp at this time.

(d) At outside horizontal section of hydraulic suction hose, measure 7.0 inch (177.8 mm) from aft right angle bend. At this point, attach pressure hose to suction hose with two clamps (402/7 and 402/9) and attaching hardware. Torque nut to 50 − 70 lb−in. (5.649 − 7.909 N.m).

(e) Attach hydraulic suction hose to hydraulic filter bracket with clamp (401/3) and attaching hardware. Do not tighten clamp at this time.

(f) Attach hose to upper hose support bracket with clamp (401/3) and attaching hardware. Do not tighten clamp at this time.

(12) Adjust hoses and tighten nuts holding three clamps on lower hose support bracket. Torque nuts to 50 − 70 lb−in. (5.649 − 7.909 N.m).

POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−02

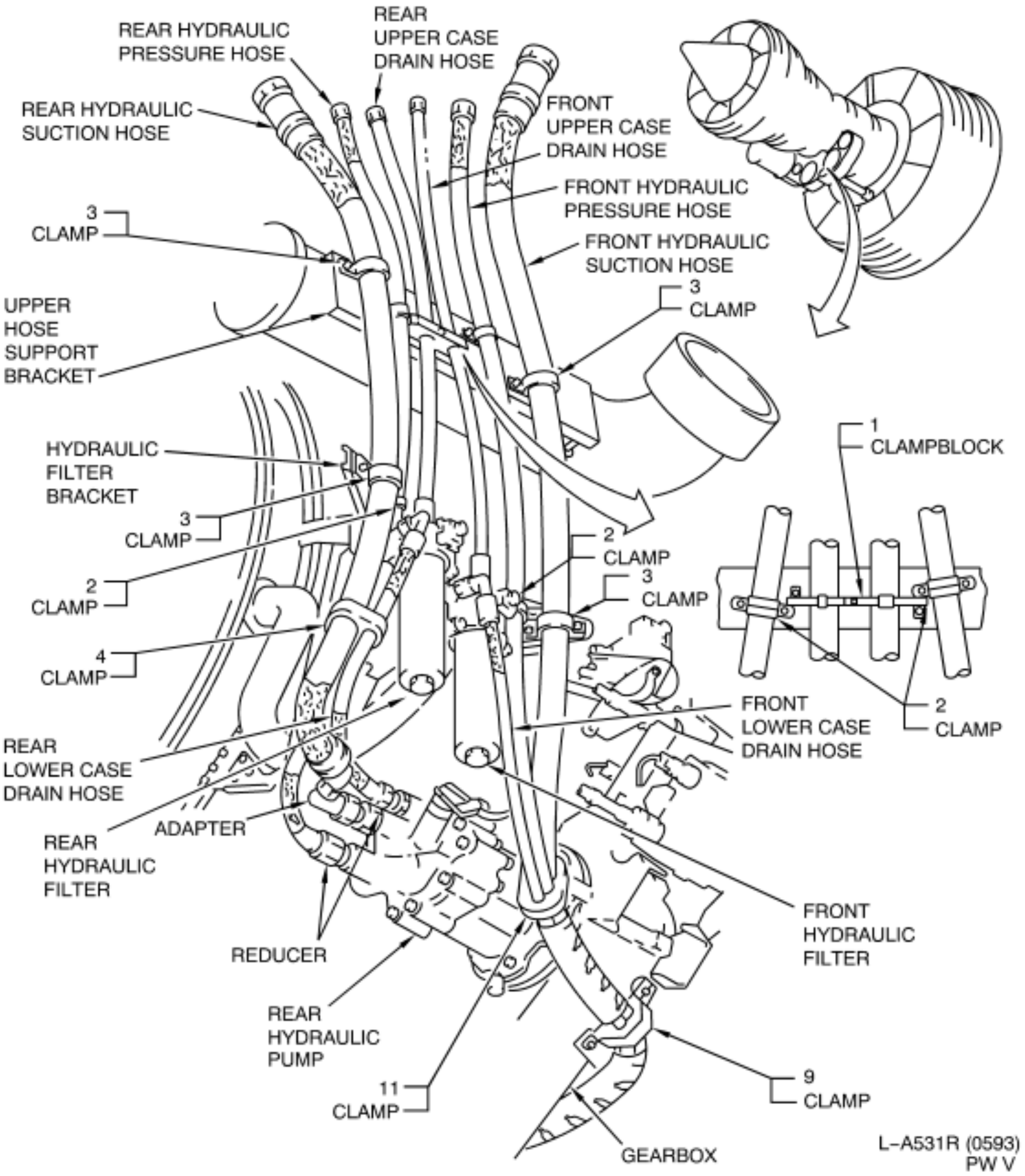
(13) Collect three hoses: front hydraulic pump lower case drain hose, hydraulic pressure hose and hydraulic suction hose with clamp (401/9) and attach clamp to support bracket on main gearbox with attaching hardware. Torque nuts to 50 − 70 lb−in. (5.649 − 7.909 N.m).

(14) On front hydraulic pump suction hose, measure 13.0 inch (330.2 mm) below clamp (403/9) on gearbox support bracket. Collect three hoses: hydraulic suction hose, pressure hose and lower case drain hose with clamp (403/10) and secure with attaching hardware. Torque nut to 50 − 70 lb−in. (5.649 − 7.909 N.m).

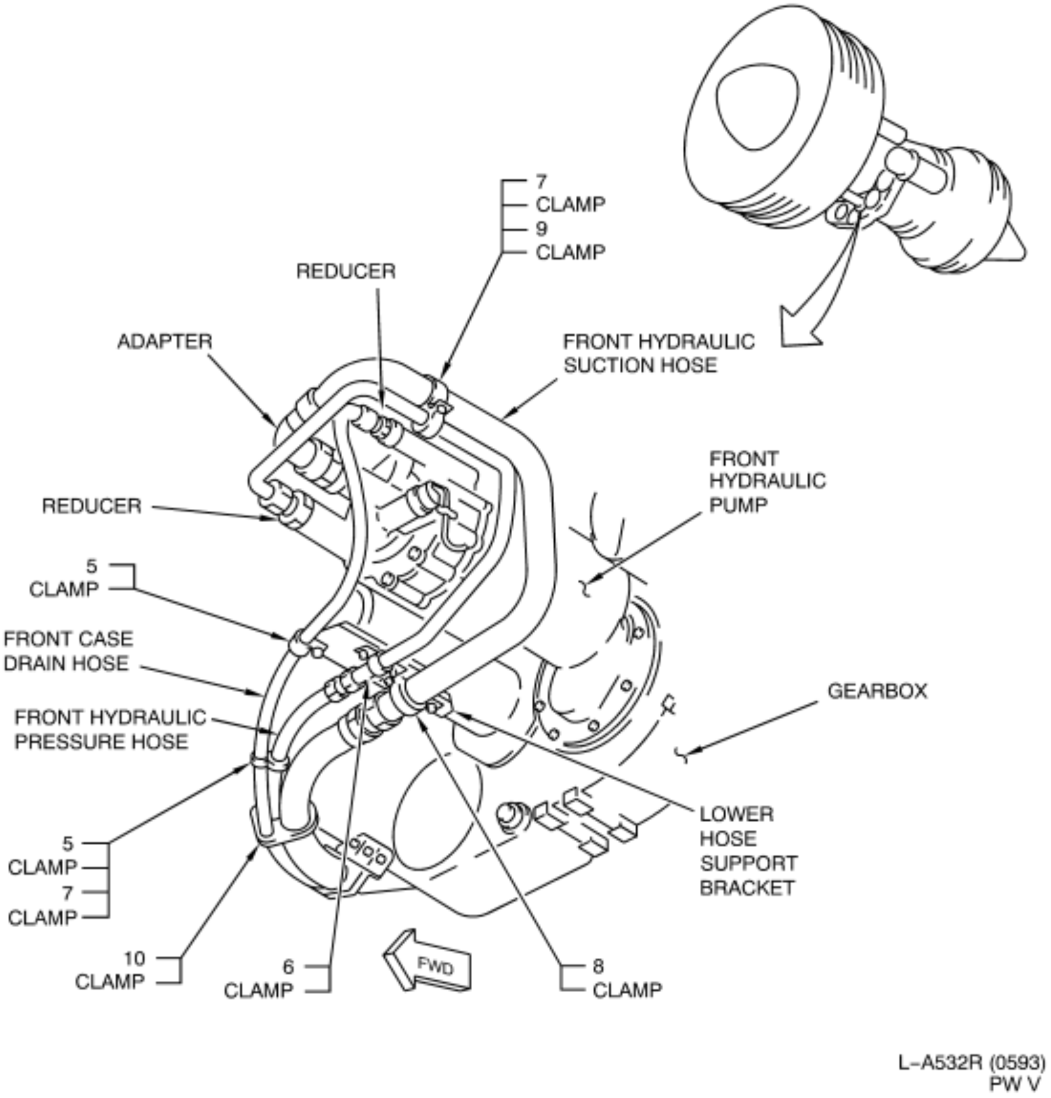
(15) On front hydraulic suction hose, measure 17.8 inch (452.1 mm) above support clamp (403/9) on gearbox. Collect three hoses; hydraulic suction hose, pressure hose and lower case drain hose with clamp (403/11) and secure with attaching hardware. Torque nut to 50 − 70 lb−in. (5.649 − 7.909 N.m).

(16) Adjust hoses and tighten nuts holding two clamps on hydraulic filter bracket. Torque nuts to 50 − 70 lb−in. (5.649 − 7.909 N.m).

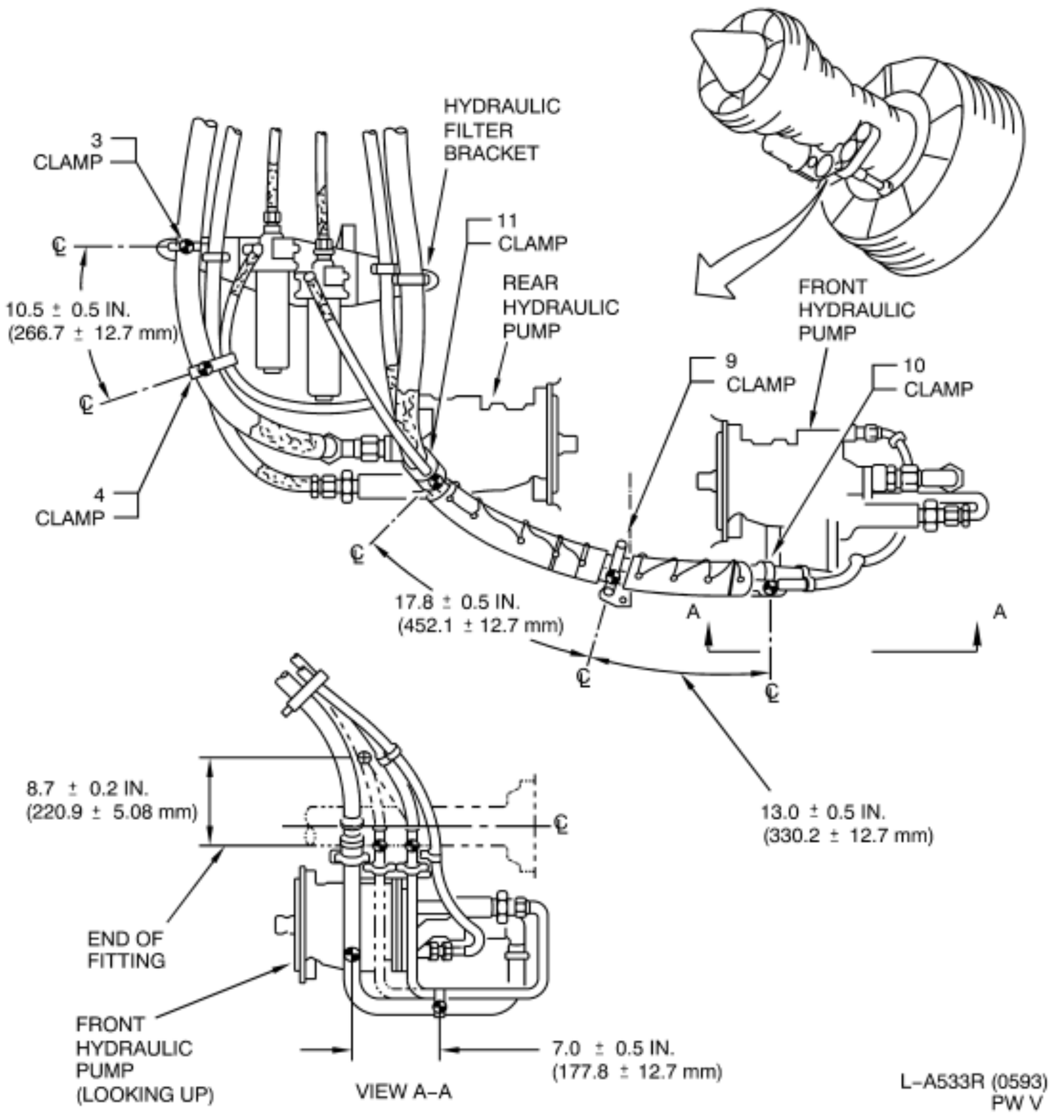
(17) Adjust hoses and tighten nuts holding two clamps on upper hydraulic hose support bracket. Torque nuts to 50 − 70 lb−in. (5.649 − 7.909 N.m).


REAR HYDRAULIC PRESSURE HOSE
REAR UPPER CASE DRAIN HOSE
REAR HYDRAULIC SUCTION HOSE
FRONT UPPER CASE DRAIN HOSE
FRONT HYDRAULIC PRESSURE HOSE
3 CLAMP
FRONT HYDRAULIC SUCTION HOSE
UPPER HOSE SUPPORT BRACKET
3 CLAMP
1 CLAMPBLOCK
HYDRAULIC FILTER BRACKET
3 CLAMP
2 CLAMP
3 CLAMP
2 CLAMP
4 CLAMP
FRONT LOWER CASE DRAIN HOSE
2 CLAMP
REAR LOWER CASE DRAIN HOSE
ADAPTER
REAR HYDRAULIC FILTER
FRONT HYDRAULIC FILTER
REDUCER
REAR HYDRAULIC PUMP
9 CLAMP
11 CLAMP
GEARBOX
L-A531R (0593)
PW V

Right Side Hydraulic Hoses
Figure 401
(Task 71-00-61-450-002)


7
CLAMP
9
CLAMP
REDUCER
ADAPTER
FRONT HYDRAULIC SUCTION HOSE
FRONT HYDRAULIC PUMP
REDUCER
5
CLAMP
FRONT CASE DRAIN HOSE
FRONT HYDRAULIC PRESSURE HOSE
GEARBOX
5
CLAMP
7
CLAMP
LOWER HOSE SUPPORT BRACKET
10
CLAMP
6
CLAMP
FWD
8
CLAMP
L-A532R (0593)
PW V

Left Side Hydraulic Hoses
Figure 402
(Task 71-00-61-450-002)


HYDRAULIC
FILTER
BRACKET
3
CLAMP
11
CLAMP
REAR
HYDRAULIC
PUMP
FRONT
HYDRAULIC
PUMP
℄
10.5 ± 0.5 IN.
(266.7 ± 12.7 mm)
℄
9
CLAMP
10
CLAMP
4
CLAMP
℄
17.8 ± 0.5 IN.
(452.1 ± 12.7 mm)
A
A
℄
℄
8.7 ± 0.2 IN.
(220.9 ± 5.08 mm)
℄
13.0 ± 0.5 IN.
(330.2 ± 12.7 mm)
END OF
FITTING
FRONT
HYDRAULIC
PUMP
(LOOKING UP)
VIEW A−A
7.0 ± 0.5 IN.
(177.8 ± 12.7 mm)
L−A533R (0593)
PW V

Hose Clamp Mounting Locations
Figure 403
(Task 71−00−61−450−002)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - MAIN GEARBOX - INSTALLATION-03

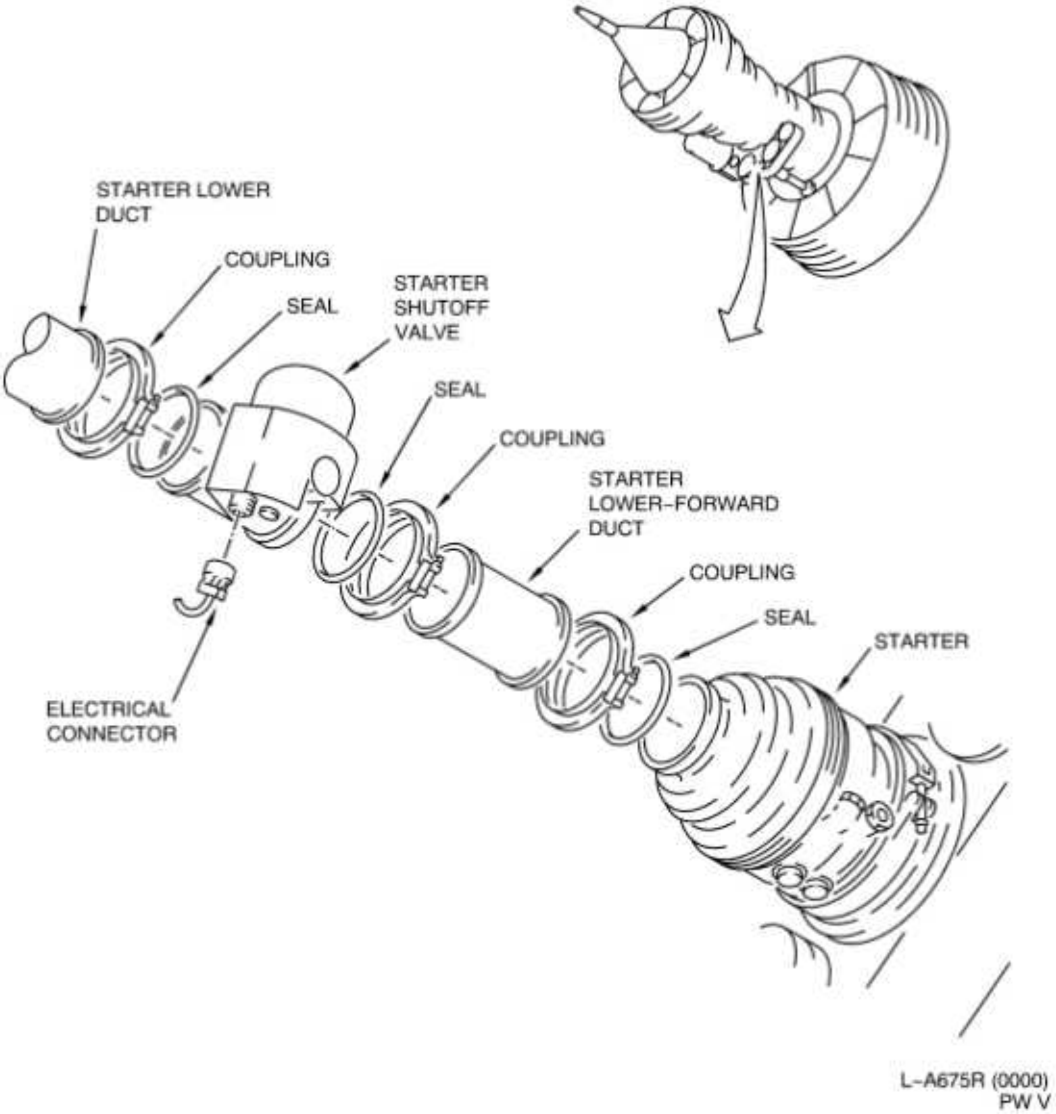
Task 71-00-61-450-003:

1. Install Starter Shutoff Valve
   A. Prerequisites
      (1) Install starter assembly. See Installation-14. (Task 71-00-61-450-014)
   B. Equipment And Materials Required

      Consumable Materials:

Item No.	Designation
P06-013	Lubricant, Solid Film

   C. Procedure
      See Figure 401.
      (1) Install starter lower-forward duct.
         (a) Lubricate inside surface of duct coupling with Material P06-013.
         (b) Position duct against starter, fitting key on duct to keyslot on starter. Place coupling seal between mating flanges.
         (c) Verify that outside diameters of mating flanges are aligned radially within 0.06 inch (1.524 mm), and angular gap between mating faces of flanges is not greater than 0.04 inch (1.016 mm).
         (d) Attach duct to starter with coupling. Tighten coupling fingertight.
      (2) Install starter shutoff valve.
         (a) Lubricate inside surface of duct coupling wiht Material P06-013.
         (b) Position valve against lower-forward duct, fitting key on valve to keyslot on duct. Place coupling seal between mating flanges.
         (c) Verify that outside diameters of mating flanges are aligned radially within 0.06 inch (1.524 mm), and angular gap between mating faces of flanges is not greater than 0.04 inch (1.016 mm).
         (d) Attach valve to duct with coupling. Tighten coupling fingertight.
         (e) Lubricate inside surface of duct coupling with Material P06-013.
         (f) Position valve against starter lower duct. Place seal between mating flanges.
         (g) Verify that outside diameters of mating flanges are aligned radially within 0.06 inch (1.524 mm), and angular gap between mating faces of flanges is not greater than 0.04 inch (1.016 mm).
         (h) Attach valve to duct with coupling. Tighten coupling fngertight.


STARTER LOWER DUCT
COUPLING
SEAL
STARTER SHUTOFF VALVE
SEAL
COUPLING
STARTER LOWER−FORWARD DUCT
COUPLING
SEAL
STARTER
ELECTRICAL CONNECTOR
L−A675R (0000)
PW V

Starter Shutoff Valve
Figure 401
(Task 71−00−61−450−003)

(i) Torque three couplings to values marked on each coupling. Tap around coupling with plastic mallet. Retorque coupling.
(j) Connect electrical connector to shutoff valve. Tighten connector fingertight plus one−eighth turn.

POWER PLANT GENERAL - MAIN GEARBOX - INSTALLATION-04

Task 71-00-61-450-004:

1. Install Integrated Drive Generator (IDG)

A. Equipment And Materials Required

Special Tools:
RSE1001-1 Accessory Hoist (Optional to RSE1110)
RSE1110 IDG Hoist Support

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Packing	1		TBD	

B. Procedure

See Figure 401.

(1) Remove protective covers from end of IDG, from two oil supply tube ports, and from two electrical receptacles.

(2) Position IDG on Hoist RSE1110 or RSE1001-1 with "open position" mark (narrow groove near alignment pin) on bottom and tighten holding strap securing IDG to hoist.

(3) Lubricate new packing with Engine Oil (P03-001), and install packing on IDG driveshaft.

(4) Adjust IDG adapter coupling to line up the "open position" marks at bottom of QAD adapter plate and coupling.

(5) Align guide pin on IDG (lower outboard) with alignment hole on QAD adapter plate.

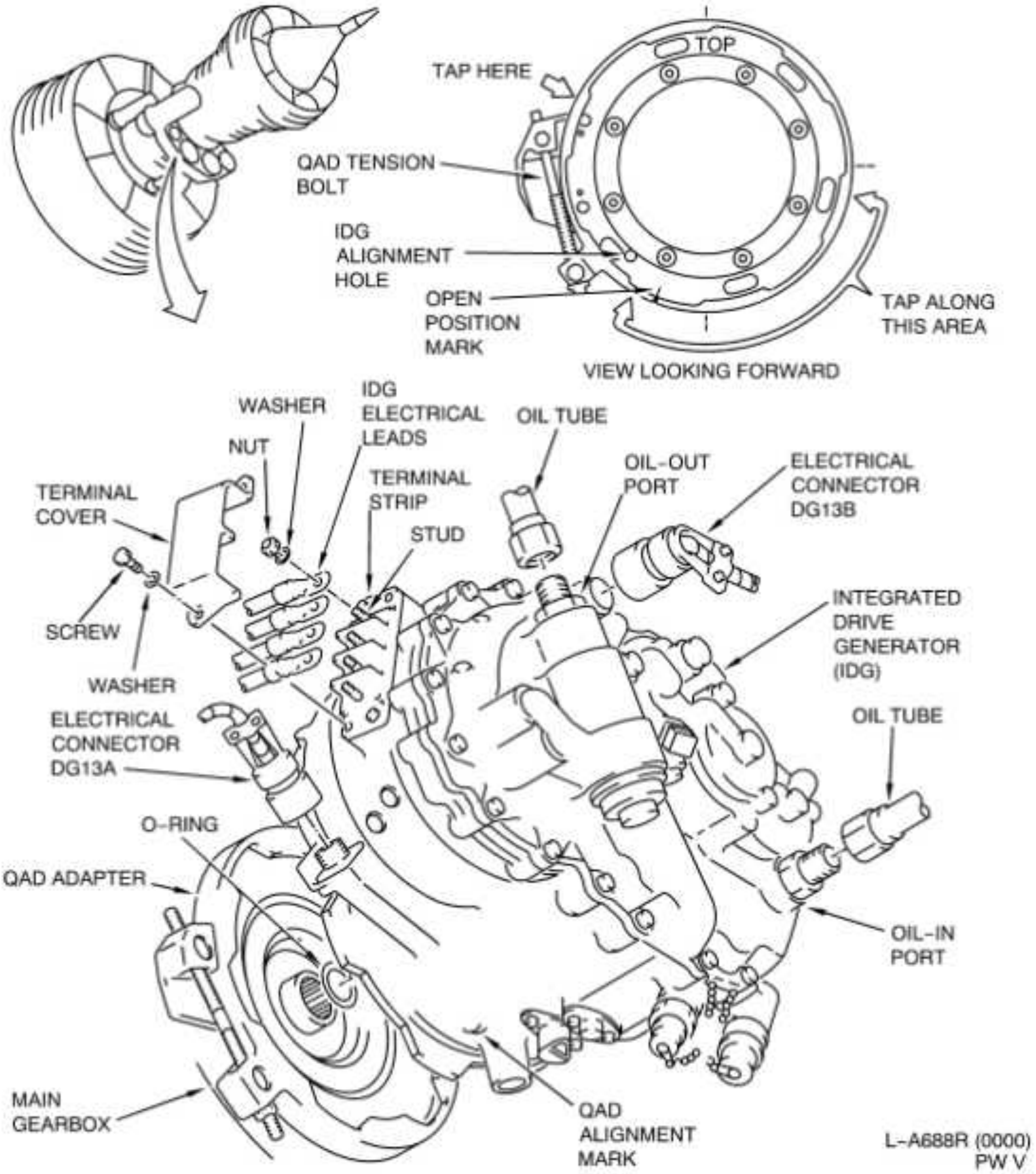
(6) Move IDG against QAD adapter plate. Engage splines on IDG driveshaft with splines in gearbox shaft. Fit IDG guide pin in adapter alignment hole. Pass IDG flange tabs between adapter coupling flange tabs.

(7) Tighten adapter coupling tension bolt to lock IDG and adapter flange tabs together.

(8) Torque adapter coupling tension bolt to 240 - 268 lb-in. (27.116 - 30.280 N.m). Tap around adapter coupling with plastic mallet. Retorque coupling tension bolt. Repeat tapping and retorque.

(9) Remove accessory hoist.

(10) Lubricate unions in IDG oil-in port and oil-out port with Engine Oil (P03-001).


TOP
TAP HERE
QAD TENSION BOLT
IDG ALIGNMENT HOLE
OPEN POSITION MARK
TAP ALONG THIS AREA
VIEW LOOKING FORWARD
WASHER
IDG ELECTRICAL LEADS
OIL TUBE
NUT
OIL-OUT PORT
ELECTRICAL CONNECTOR DG13B
TERMINAL COVER
TERMINAL STRIP
STUD
SCREW
INTEGRATED DRIVE GENERATOR (IDG)
WASHER
ELECTRICAL CONNECTOR DG13A
OIL TUBE
O-RING
QAD ADAPTER
OIL-IN PORT
MAIN GEARBOX
QAD ALIGNMENT MARK
L-A688R (0000)
PW V

Integrated Drive Generator (IDG)
Figure 401
(Task 71−00−61−450−004)

POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−04

(11) Connect oil supply tubes to IDG oil−in and oil−out ports. Torque tube fittings 900 − 1000 lb−in. (101.686 − 112.985 N.m).
(12) Remove screws and washers attaching cover over generator output wire terminal strip.
(13) Remove nuts and washers on four studs of generator output terminal strip.
(14) Connect four generator output wires to four studs of IDG generator output terminal strip.
(15) Install nuts and washers attaching four generator output wires to four studs of generator output terminal strip. Torque nuts to 144 − 168 lb−in. (16.270 − 18.981 N.m).
(16) Install two bolts and washers attaching cover over generator output terminal strip. Torque screws to 20 − 22 lb−in. (2.260 − 2.486 N.m).
(17) Connect two electrical connectors, DG13A and DG13B, to IDG receptacles. Tighten connectors fingertight plus one−eighth turn.

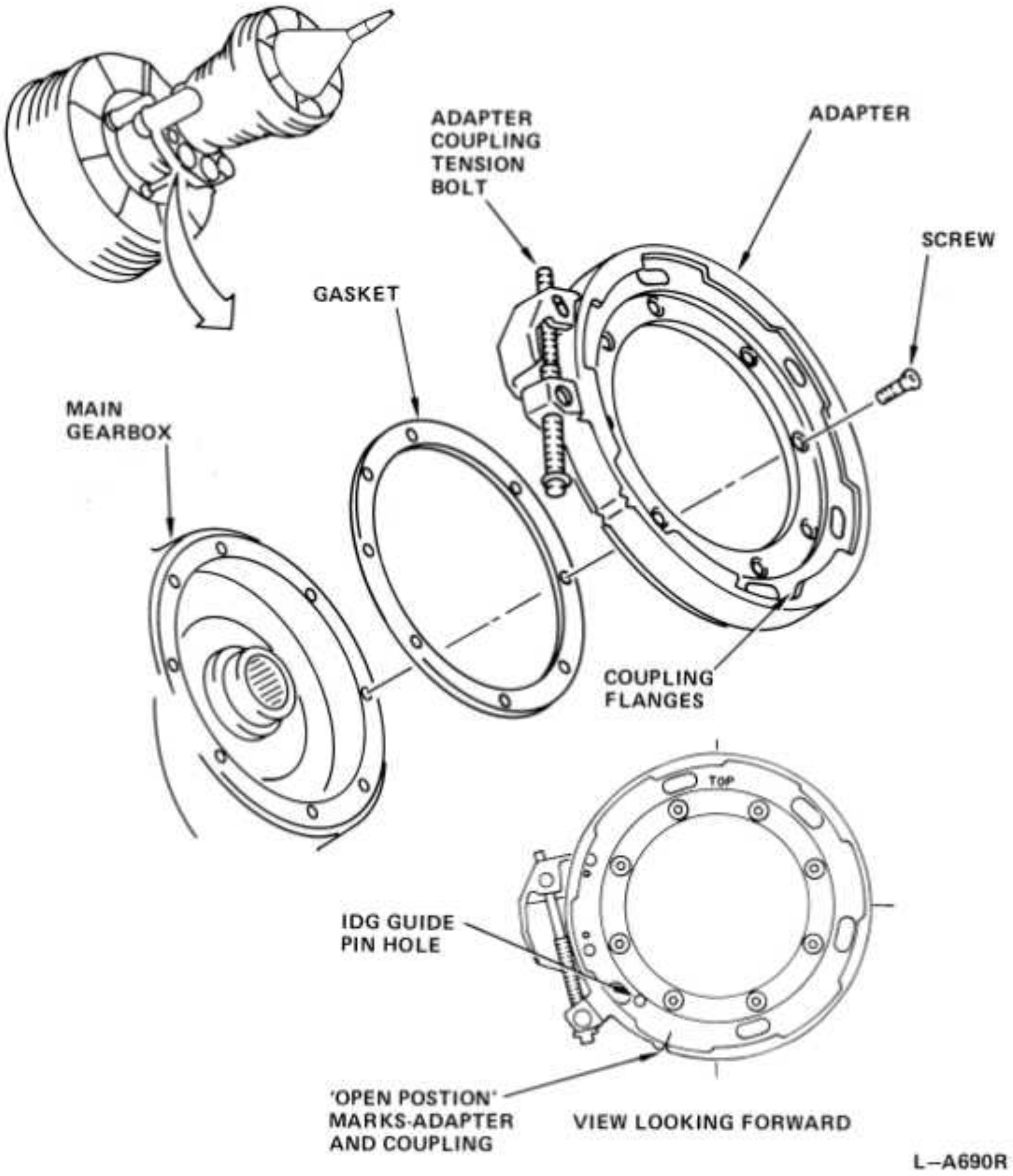
NOTE: Attach placard to IDG indicating that IDG must be serviced in accordance with instructions in Airbus Industrie Maintenance Manual, Chapter 12−13−24, before engine is run.

POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−05

Task 71−00−61−450−005:

1. Install IDG Quick−Attach−Detach (QAD) Adapter
   - A. Equipment And Materials Required − None
   - B. Procedure
     See Figure 401.
     - (1) Position QAD adapter and gasket against main gearbox with word TOP uppermost.
     - (2) Install eight mounting bolts attaching QAD adapter and gasket to main gearbox.
     - (3) Torque bolts to 276 − 300 lb−in. (31.184 − 33.895 N.m).
   - C. Postrequisites
     - (1) Install Integrated Drive Generator (IDG). See Installation−04 (Task 71−00−61−450−004).

POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−05


ADAPTER COUPLING TENSION BOLT
ADAPTER
SCREW
GASKET
MAIN GEARBOX
COUPLING FLANGES
TOP
IDG GUIDE PIN HOLE
'OPEN POSTION' MARKS-ADAPTER AND COUPLING
VIEW LOOKING FORWARD
L−A690R

QAD Adapter
Figure 401
(Task 71−00−61−450−005)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 71-00-61-450-006:

1. Install Main Fuel Supply Line

A. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P05-262	Lockwire (MS20995C32)
P05-289	Lockwire (AS3214-02) (Optional)
P05-291	Safety Cable (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	2	TBD

B. Procedure

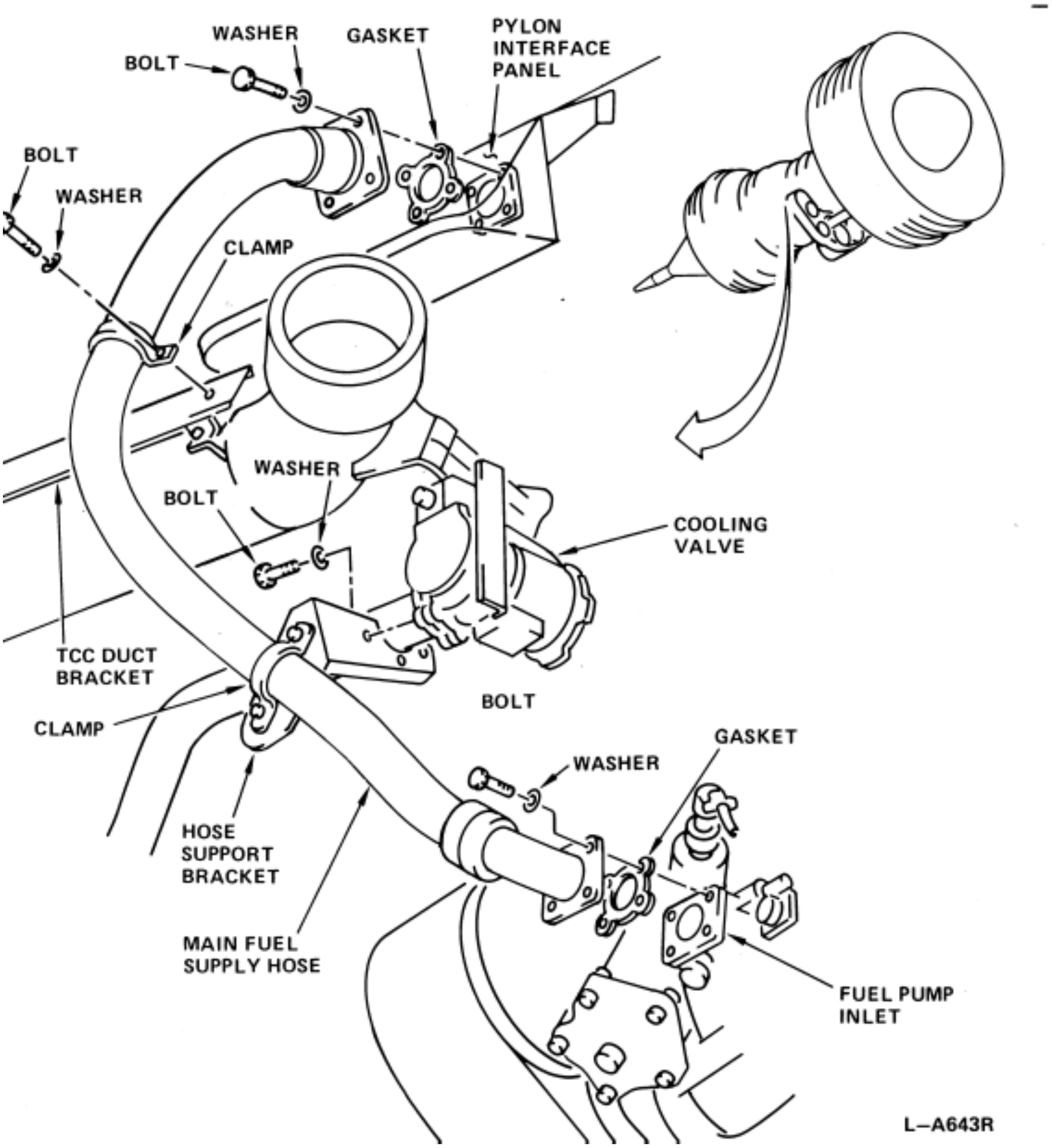
See Figure 401.

(1) Install four bolts and washers attaching fuel supply hose and new gasket to pylon interface panel. Torque bolts 75 - 85 lb-in. (8.474 - 9.604 N.m). Lockwire four bolts.

(2) Install two bolts and washers attaching hose clamp and hose to TCC duct bracket.

(3) Remove three existing bolts and washers from turbine cooling valve flange. Using same bolts and washers, attach hose lower support bracket, with hose, to turbine cooling valve flange. Torque bolts 85 - 95 lb-in. (9.604 - 10.734 N.m).

R R R (4) Install four bolts and washers attaching fuel supply hose and new gasket to fuel pump inlet. Torque the bolts to 180 - 200 lb-in. (20.337 - 22.597 N.m). Safety the four bolts with Lockwire P05-262, Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.


WASHER
GASKET
PYLON INTERFACE PANEL
BOLT
BOLT
WASHER
CLAMP
WASHER
BOLT
COOLING VALVE
TCC DUCT BRACKET
CLAMP
BOLT
GASKET
WASHER
HOSE SUPPORT BRACKET
MAIN FUEL SUPPLY HOSE
FUEL PUMP INLET
L-A643R

Main Fuel Supply
Figure 401
(Task 71-00-61-450-006)

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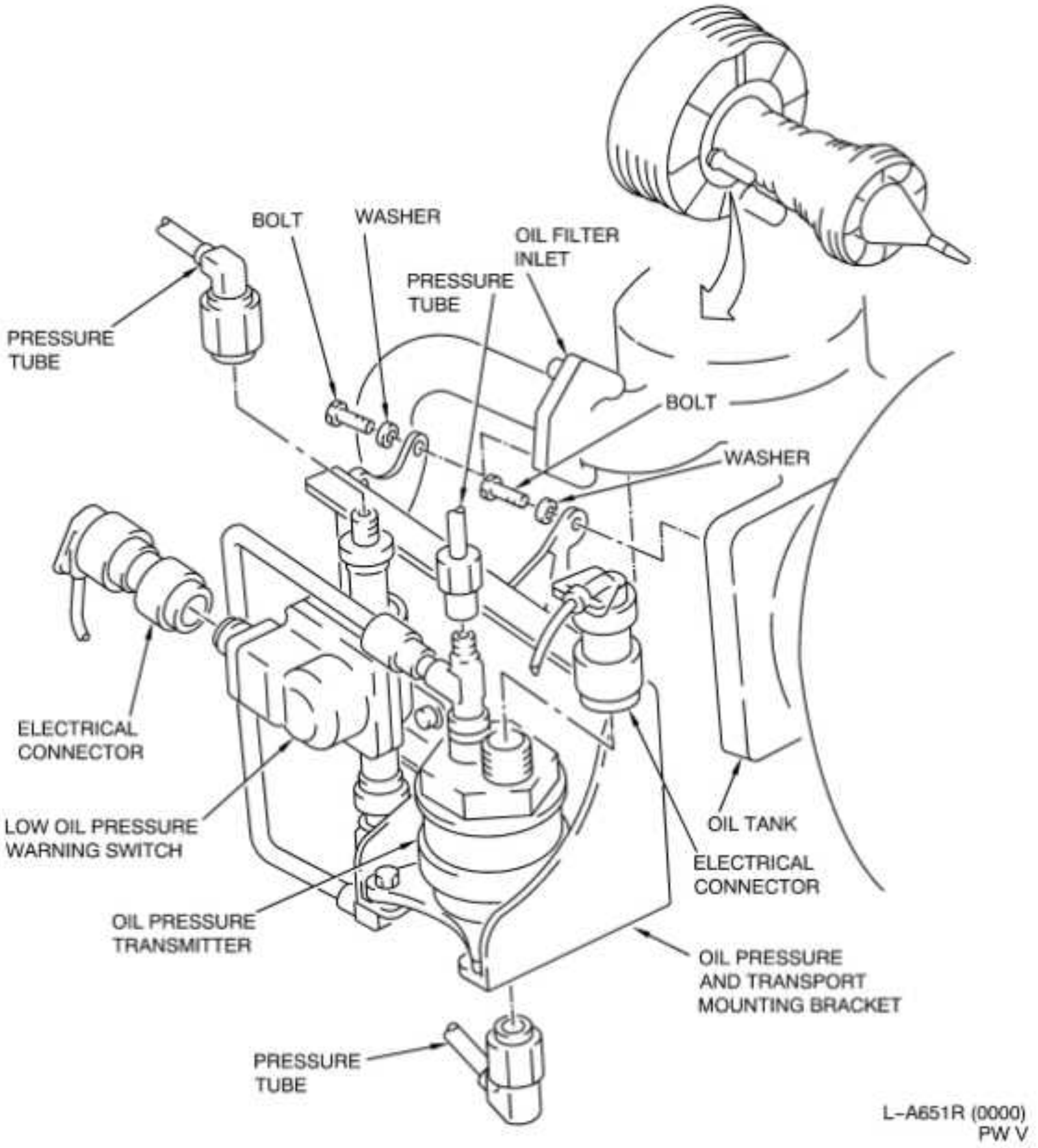
POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−07

Task 71−00−61−450−007:

1. Install Low Oil Pressure Switch And Oil Pressure Transmitter
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figure 401.
     - (1) Install instrument mounting bracket.
       - (a) Remove two bolts and washers from oil filter.
       - (b) Remove two bolts and washers from oil filter inlet flange.
       - (c) Install two bolts and washers attaching oil low pressure switch and oil pressure transmitter mounting bracket to oil filter. Torque bolts 75 − 85 lb−in. (8.474 − 9.604 N.m).
       - (d) Install two bolts and washers attaching oil low pressure switch and oil pressure transmitter mounting bracket to oil filter inlet flange. Torque bolts 75 − 85 lb−in. (8.474 − 9.604 N.m).
     - (2) Connect pressure tubes.
       - (a) Connect pressure tube to top of low oil pressure warning switch.
       - (b) Connect pressure tube to bottom of oil pressure transmitter.
       - (c) Connect pressure tube to top of tee on top of oil pressure transmitter.
       - (d) Torque three tube connections 107 − 117 lb−in. (12.089 − 13.219 N.m).
     - (3) Connect electrical connectors.
       - (a) Connect electrical connector to top of oil pressure transmitter.
       - (b) Connect electrical connector to low oil pressure warning switch.
       - (c) Tighten two electrical connectors fingertight plus one−eighth turn.


BOLT
WASHER
OIL FILTER INLET
PRESSURE TUBE
PRESSURE TUBE
BOLT
WASHER
ELECTRICAL CONNECTOR
LOW OIL PRESSURE WARNING SWITCH
OIL TANK
ELECTRICAL CONNECTOR
OIL PRESSURE TRANSMITTER
OIL PRESSURE AND TRANSPORT MOUNTING BRACKET
PRESSURE TUBE
L−A651R (0000)
PW V

Low Oil Pressure Switch And
Oil Pressure Transmitter
Figure 401
(Task 71−00−61−450−007)

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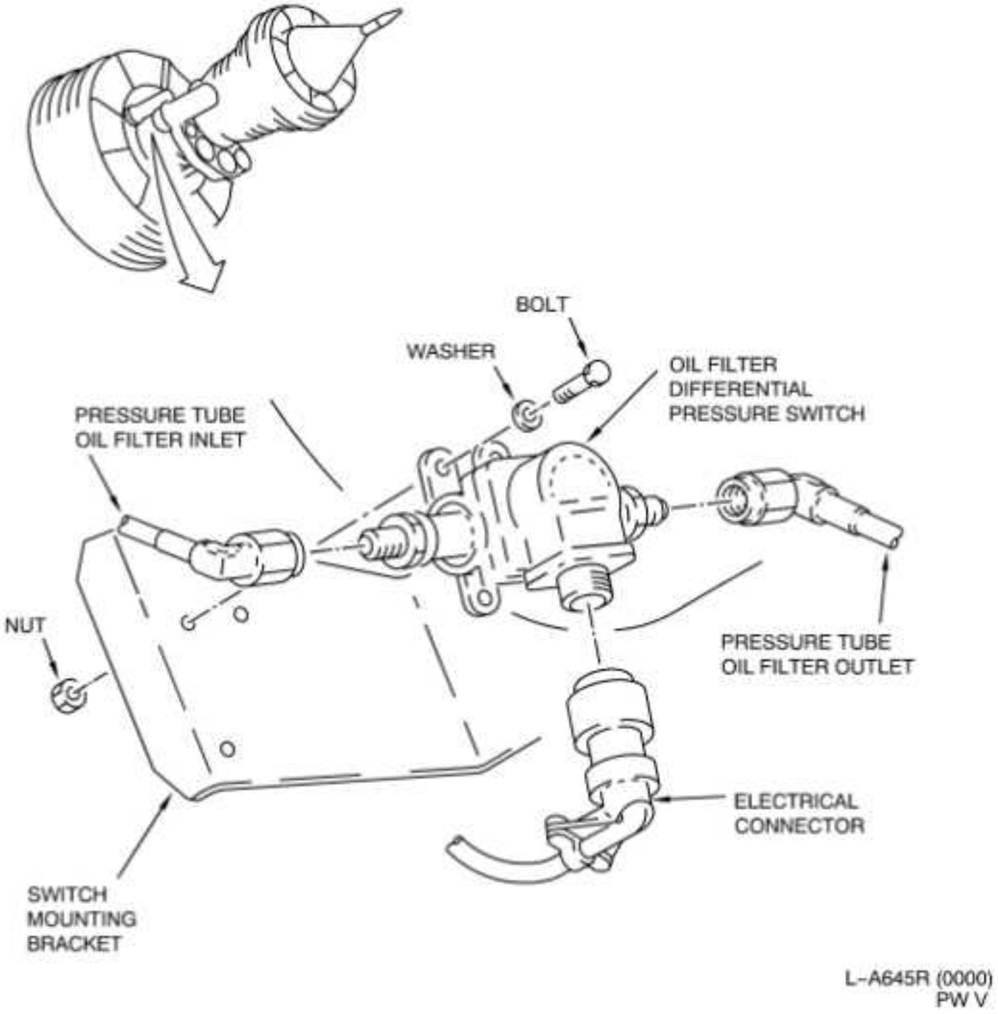
POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−08

Task 71−00−61−450−008:

1. Install Oil Filter Differential Pressure Switch
   - A. Equipment And Materials Required − None
   - B. Procedure
     See Figure 401.
     - (1) Install three bolts, washers, and nuts attaching oil filter differential pressure switch to mounting bracket.
     - (2) Install two pressure tubes to switch. Torque tube connections 107 − 117 lb−in. (12.089 − 13.219 N.m).
     - (3) Connect electrical connector to switch. Tighten connector fingertight.


BOLT
WASHER
OIL FILTER DIFFERENTIAL PRESSURE SWITCH
PRESSURE TUBE OIL FILTER INLET
NUT
PRESSURE TUBE OIL FILTER OUTLET
ELECTRICAL CONNECTOR
SWITCH MOUNTING BRACKET
L-A645R (0000)
PW V

Oil Filter Differential
Pressure Switch
Figure 401
(Task 71−00−61−450−008)

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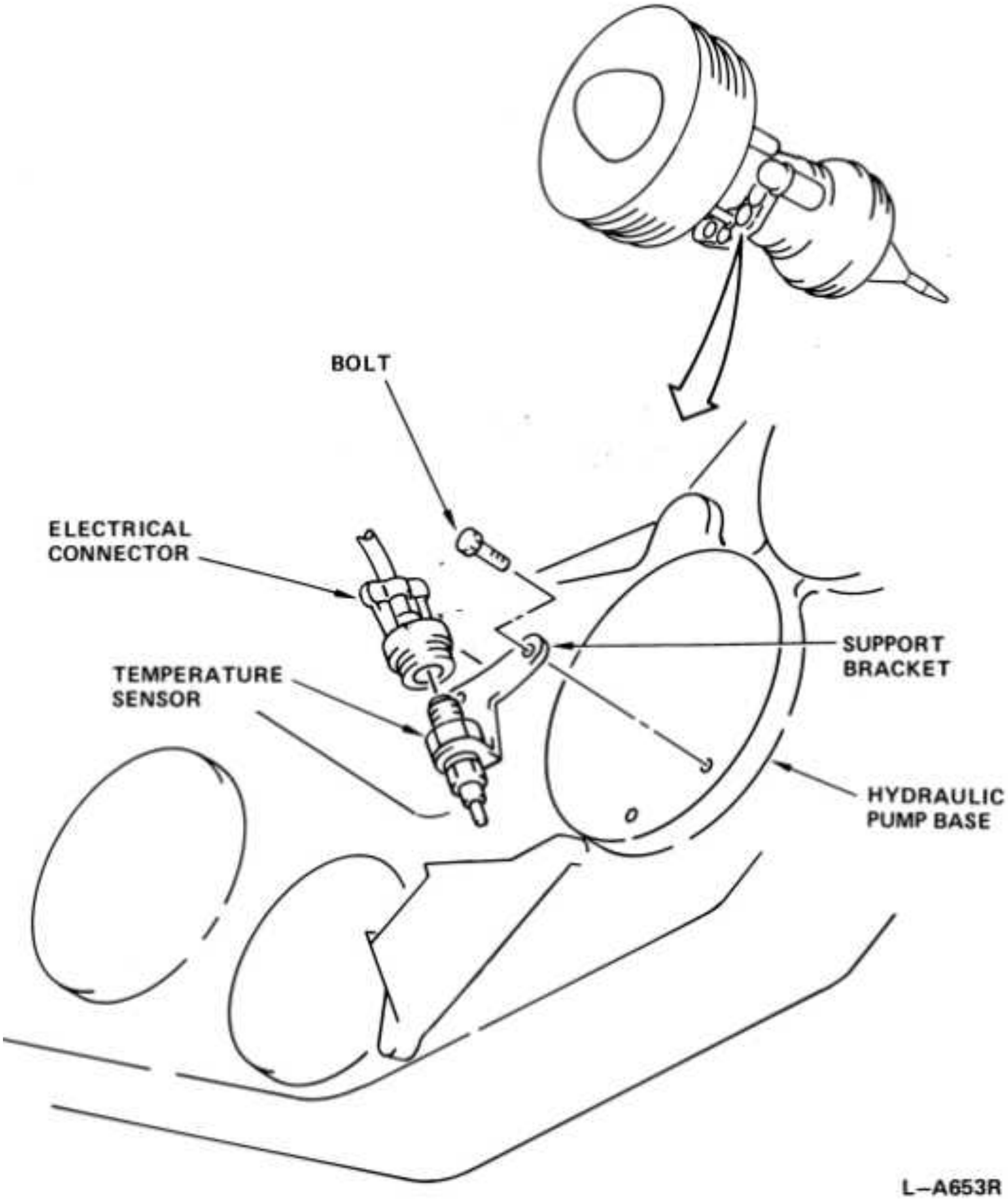
POWER PLANT GENERAL - MAIN GEARBOX - INSTALLATION-09

Task 71-00-61-450-009:

1. Install Engine Core Compartment Temperature Sensor
    - A. Equipment And Materials Required - None
    - B. Procedure

      See Figure 401.
        - (1) Remove two bolts from front hydraulic pump base on gearbox.
        - (2) Using same bolts, attach core compartment temperature sensor support bracket to gearbox. Torque bolts 275 - 300 lb-in. (31.071 - 33.895 N.m).
        - (3) Connect electrical connector DT595.
        - (4) Tighten electrical connector fingertight plus one-eighth turn.


BOLT
ELECTRICAL CONNECTOR
TEMPERATURE SENSOR
SUPPORT BRACKET
HYDRAULIC PUMP BASE
L−A653R

Engine Core Compartment
Temperature Sensor
Figure 401
(Task 71−00−61−450−009)

POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−10

Task 71−00−61−450−010:

1. Install Engine Oil Tank Pressure Fill System

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Packing	1		TBD	
Packing	1		TBD	

B. Procedure

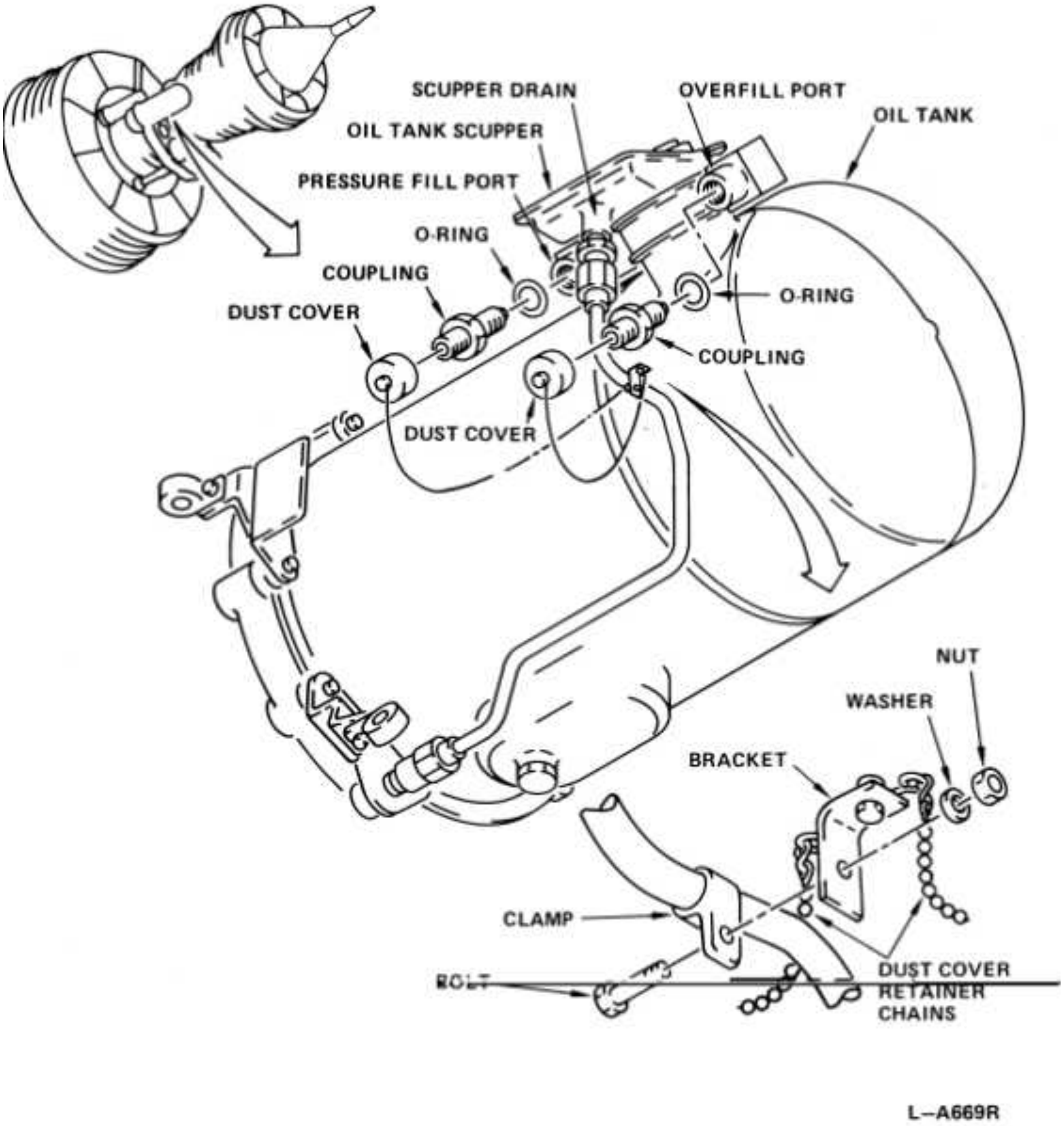
See Figure 401.

(1) Lubricate new packing with Material P03−001 and install packing and coupling in oil tank pressure overfill port. Torque coupling 215 − 240 lb−in. (24.292 − 27.116 N.m).

(2) Lubricate new packing with Material P03−001 and install packing and coupling in oil tank pressure fill port. Torque coupling 125 − 140 lb−in. (14.123 − 15.818 N.m).

(3) Install dust covers on pressure overfill coupling and on pressure fill coupling.

(4) Install bolt, washer and nut attaching oil pressure fill/overfill dust cover retaining cords clamp to oil tank scupper drain tube.


SCUPPER DRAIN
OVERFILL PORT
OIL TANK
OIL TANK SCUPPER
PRESSURE FILL PORT
O-RING
COUPLING
DUST COVER
O-RING
COUPLING
DUST COVER
NUT
WASHER
BRACKET
CLAMP
BOLT
DUST COVER RETAINER CHAINS
L−A669R

Engine Oil Tank Pressure
Fill System
Figure 401
(Task 71−00−61−450−010)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL – MAIN GEARBOX – INSTALLATION–11

Task 71–00–61–450–011:

1. Install Oil Quantity Transmitter

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03–001	Oil, Engine

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Packing	1		TBD	

B. Procedure

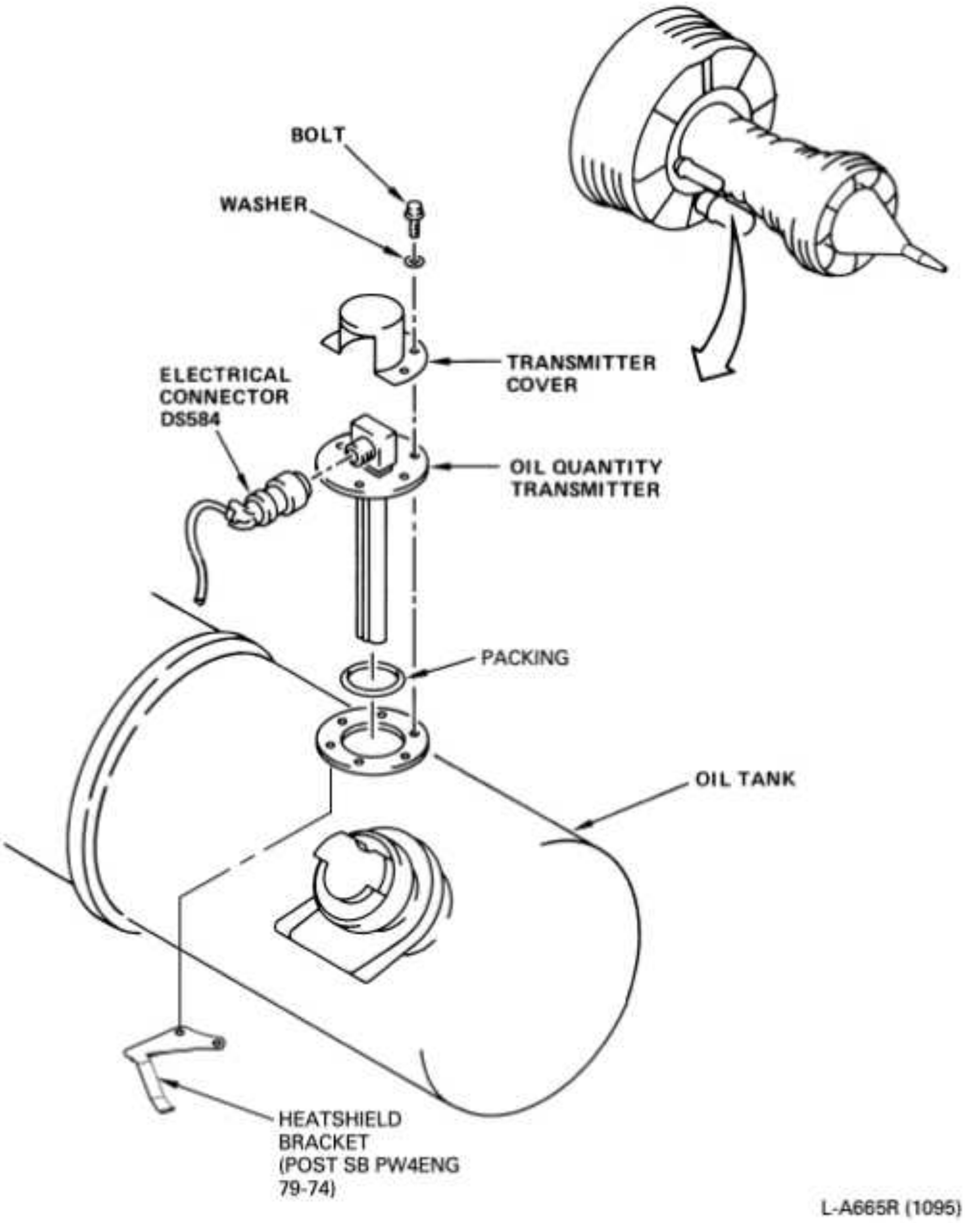
See Figure 401.

(1) Lubricate new packing with Engine Oil (P03–001) and install packing on oil quantity transmitter.

(2) Install transmitter, with cover, and heat shield bracket (Post SB PW4ENG 79–74) in oil tank and attach with six bolts, washers and nuts. Torque nuts to 75 – 85 lb–in. (8.474 – 9.604 N.m).

(3) Connect electrical connector.

(4) Tighten electrical connector fingertight plus one–eighth turn.


BOLT
WASHER
TRANSMITTER COVER
ELECTRICAL CONNECTOR DS584
OIL QUANTITY TRANSMITTER
PACKING
OIL TANK
HEATSHIELD BRACKET (POST SB PW4ENG 79-74)
L-A665R (1095)

Oil Quantity Transmitter
Figure 401
(Task 71−00−61−450−011)

Task 71-00-61-450-012:

1. Install Front Hydraulic Pump

A. Equipment And Materials Required

Consumable Materials:

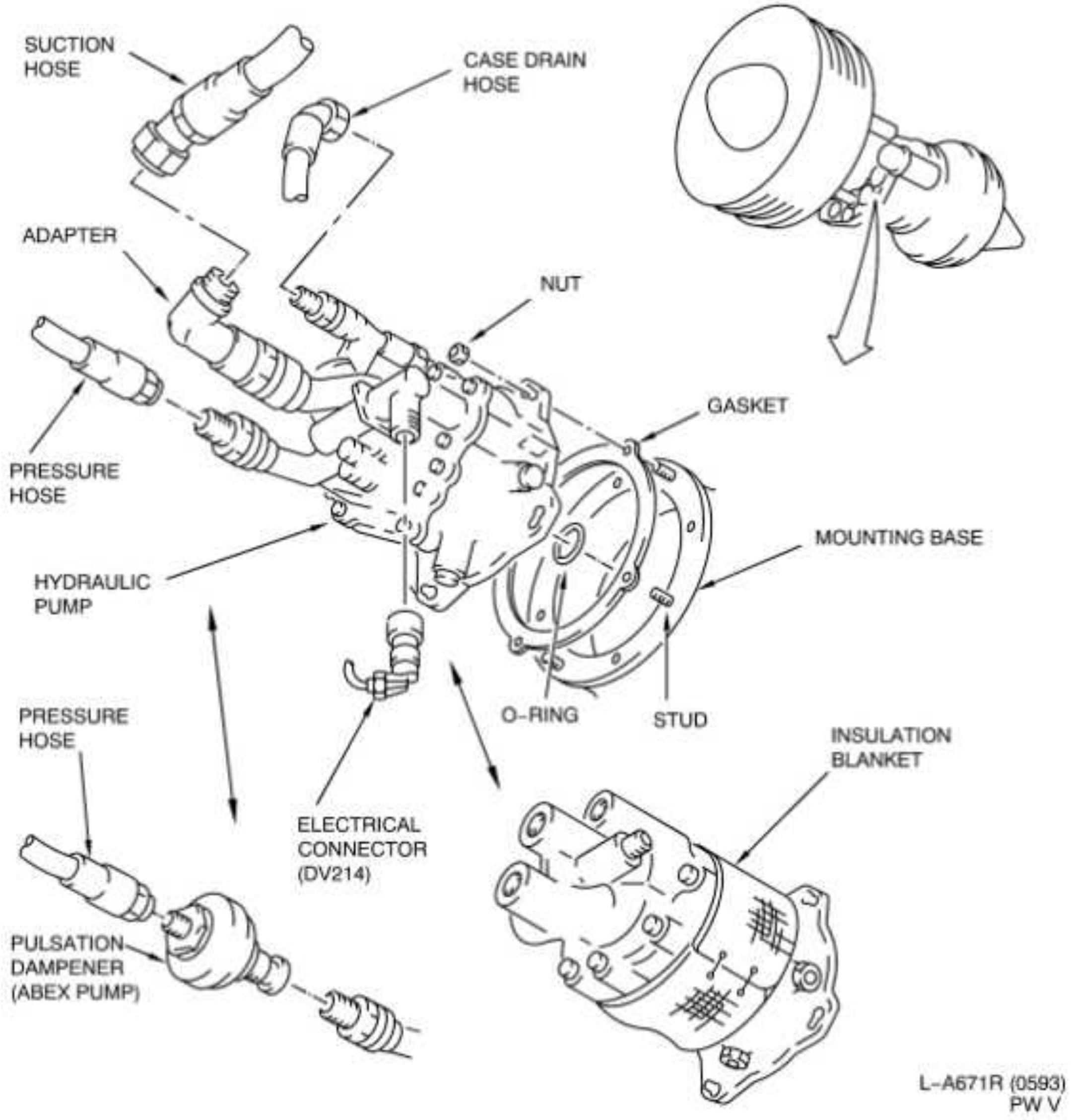
Item No.	Designation
P02-001	Fluid, Hydraulic
P03-001	Oil, Engine

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Gasket	1	29-11-01	1	580
Packing	1	29-11-01	1	520

B. Procedure
See Figure 401.

- (1) Install pump.
  - (a) Lubricate packing with Engine Oil (P03-001) and install packing on pump shaft.
  - (b) Install new gasket over studs on pump mounting base on gearbox.
  - (c) Lubricate four mounting studs on pump base with Engine Oil (P03-001) and install nuts loosely on tips of studs.
  - (d) Support pump on mounting base with pump electrical connector pointing to lower-outboard.
  - (e) Position pump on mounting studs so mounting nuts pass through enlarged ends of pump mounting slots.
  - (f) Rotate pump counterclockwise to engage nuts. Torque nuts 260 - 320 lb-in. (29.376 - 36.155 N.m).
- (2) Connect electrical and hydraulic connectors.
  - (a) Lubricate case drain reducer (attached to pump) with Hydraulic Fluid (P02-001). Connect case drain hose to reducer. Torque hose coupling 215 - 245 lb-in. (24.292 - 27.681 N.m).
  - (b) Lubricate suction hose adapter (attached to pump) with Material P02-001. Connect suction hose to adapter. Torque hose coupling 1900 - 2100 lb-in. (214.671 - 237.268 N.m).
  - (c) Lubricate pressure hose union (Sperry-Vickers) or dampener fitting (Abex), attached to pump, with Hydraulic Fluid (P02-001). Connect pressure hose to union or dampener. Torque hose coupling 900 - 1150 lb-in. (101.686 - 129.932 N.m).


SUCTION HOSE
CASE DRAIN HOSE
ADAPTER
NUT
PRESSURE HOSE
GASKET
MOUNTING BASE
HYDRAULIC PUMP
PRESSURE HOSE
O-RING
STUD
INSULATION BLANKET
ELECTRICAL CONNECTOR (DV214)
PULSATION DAMPENER (ABEX PUMP)
L-A671R (0593)
PW V

Front Hydraulic Pump
Figure 401
(Task 71−00−61−450−012)

(d) Connect electrical connector DV214. Tighten connector fingertight plus one−eighth turn.

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Task 71-00-61-450-013:

1. Install Rear Hydraulic Pump

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P02-001	Fluid, Hydraulic
P03-001	Oil, Engine

Expendable Parts:

PART NAME	QUANTITY	POWER PLANT PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	29-11-01/1/580
Packing	1	29-11-01/1/520

B. Procedure
See Figure 401.

(1) Install pump.

(a) Lubricate new packing with Engine Oil P03-001 and install packing on pump shaft.

(b) Install new gasket over studs on pump mounting base on gearbox.

(c) Lubricate four mounting studs on pump base with Engine Oil P03-001 and install nuts loosely on tips of studs.

(d) Support pump on mounting base with pump electrical connector pointing outboard.

(e) Position pump on mounting studs so mounting nuts pass through enlarged ends of pump mounting slots.

(f) Rotate pump counterclockwise to engage nuts. Torque nuts 260 - 320 lb-in. (29.376 - 36.155 N.m).

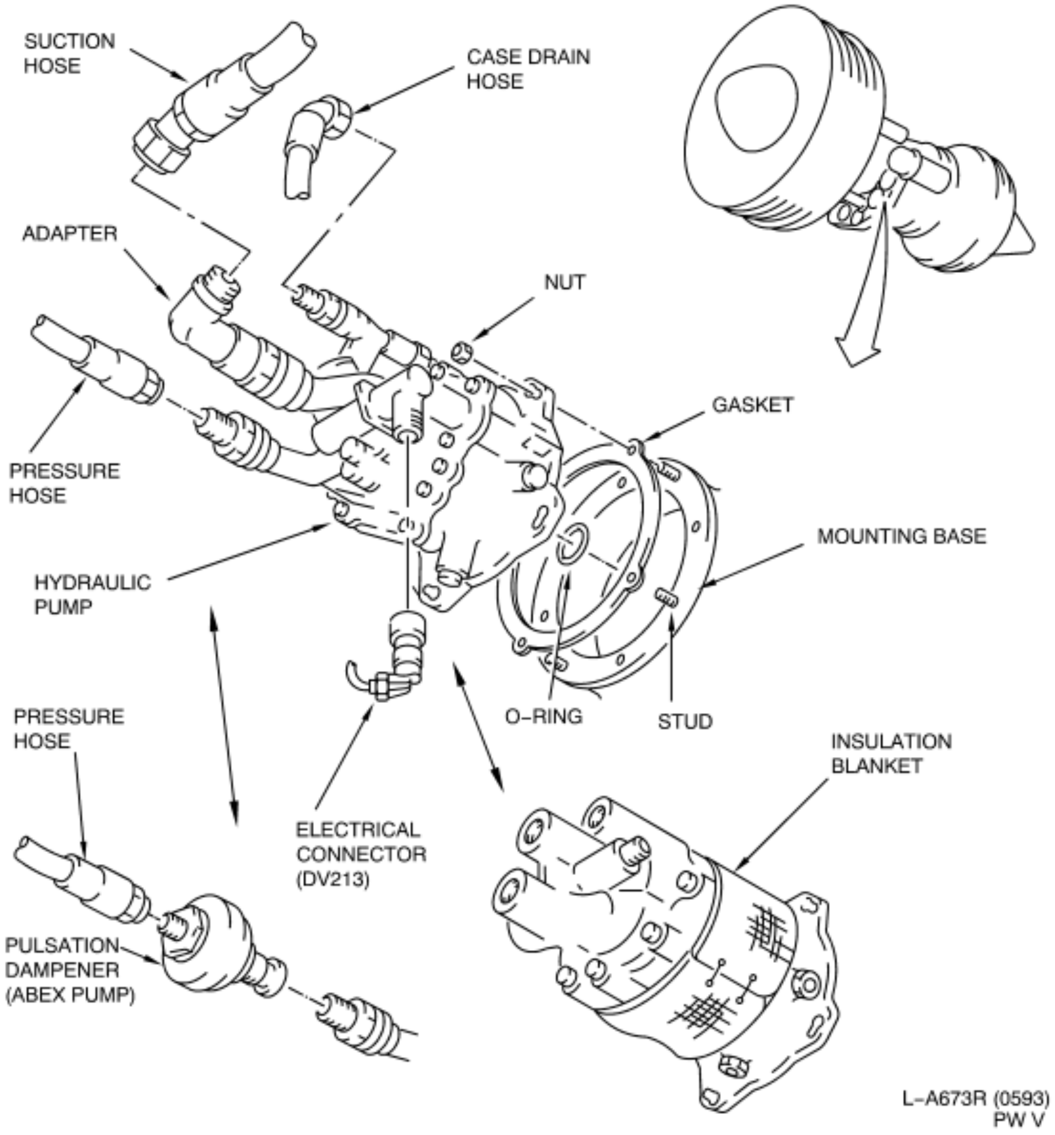
(2) Connect electrical and hydraulic connectors.

(a) Lubricate case drain reducer (attached to pump) with Hydraulic Fluid P02-001. Connect case drain hose to reducer. Torque hose coupling 215 - 245 lb-in. (24.292 - 27.681 N.m).

(b) Lubricate suction hose adapter (attached to pump) with Material P02−001. Connect suction hose to adapter. Torque hose coupling 1900 − 2100 lb−in. (214.671 − 237.268 N.m).

(c) Lubricate pressure hose union (Sperry−Vickers) or dampener fitting (Abex), attached to pump, with Hydraulic Fluid P02−001. Connect pressure hose to union or dampener. Torque hose coupling 900 − 1150 lb−in. (101.686 − 129.932 N.m).

R (d) Connect electrical connector DV213. Tighten
R connector fingertight plus one−eighth turn.


SUCTION HOSE
CASE DRAIN HOSE
ADAPTER
NUT
PRESSURE HOSE
GASKET
MOUNTING BASE
HYDRAULIC PUMP
PRESSURE HOSE
O-RING
STUD
INSULATION BLANKET
ELECTRICAL CONNECTOR (DV213)
PULSATION DAMPENER (ABEX PUMP)
L-A673R (0593)
PW V

Rear Hydraulic Pump
Figure 401
(Task 71-00-61-450-013)

R
R

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POWER PLANT GENERAL - MAIN GEARBOX - INSTALLATION-14

Task 71-00-61-450-014:

1. Install Starter Assembly

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine
P06-020	Lubricant, Bolt
P06-059	Lubricant, Fluorinated Grease (PWA 36230)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	TBD
Packing	1	TBD

B. Procedure
See Figure 401.

(1) Install starter quick-attach-detach (QAD) adapter.

(a) Coat six bolts with Lubricant P06-020.

(b) Position gasket and adapter, with double tooth of adapter inner mounting flange up, against starter adapter mounting base on main gearbox.

(c) Install six bolts and washers attaching adapter and gasket to main gearbox. Torque bolts 138 - 150 lb-in. (15.592 - 16.948 N.m).

(2) Install starter

(a) Lubricate packing with Engine Oil P03-001.

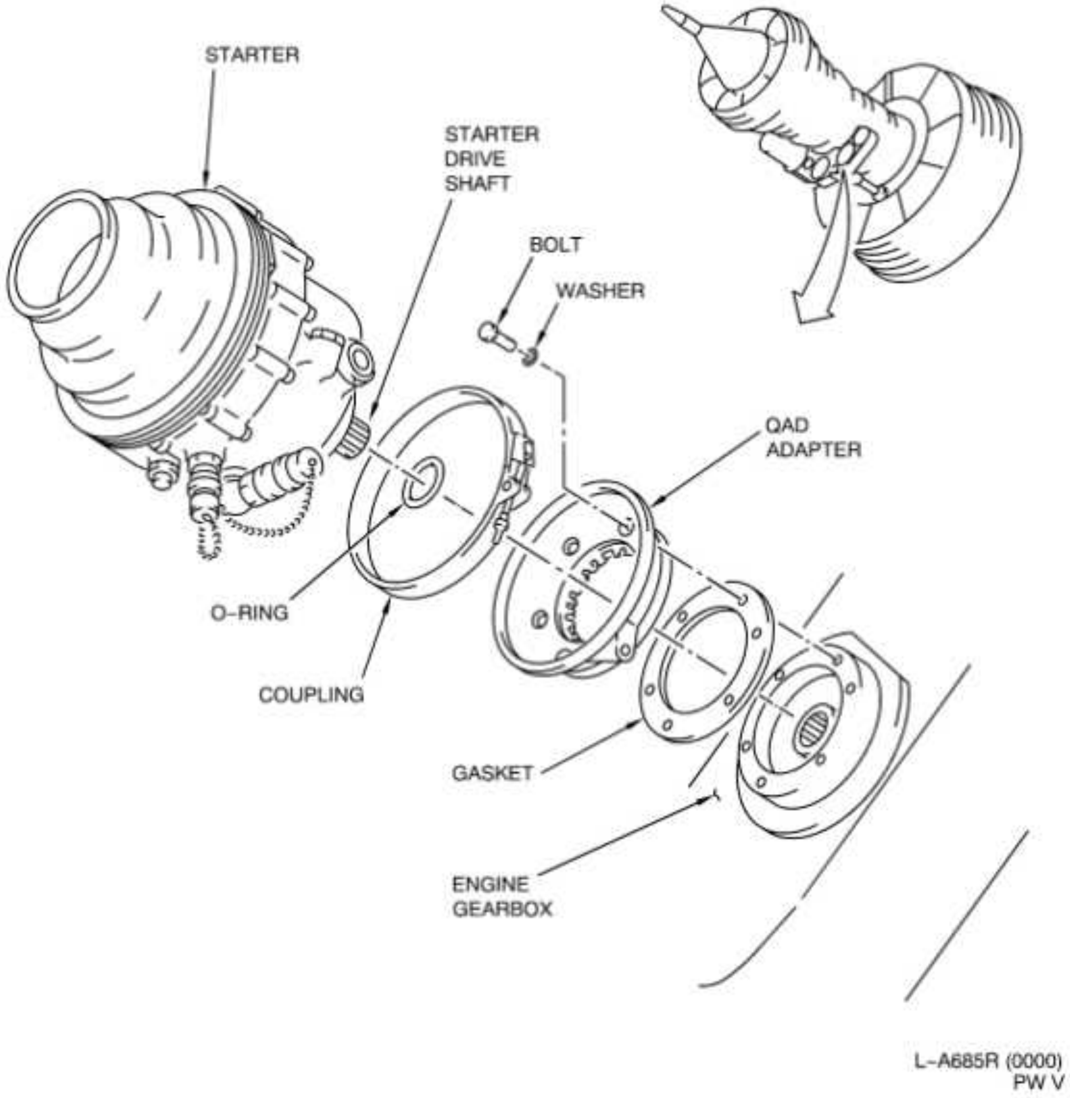
(b) Install packing on starter driveshaft.

CAUTION: Before you apply Fluorinated Grease Lubricant to the starter driveshaft splines, make sure the starter splines and gearbox splines are clean and not damaged. Apply Fluorinated Grease Lubricant to the starter driveshaft splines to reduce wear and increase service life of the parts.

(c) Apply Fluorinated Grease Lubricant P06−059 to the starter driveshaft splines.

(d) Position starter to adapter with double tooth of forward mounting flange up. Align starter driveshaft splines with splines in main gearbox. Press starter against adapter.

(e) Install coupling attaching starter to QAD adapter. Torque coupling bolt 60 − 65 lb−in. (6.779 − 7.344 N.m).


STARTER
STARTER DRIVE SHAFT
BOLT
WASHER
QAD ADAPTER
O-RING
COUPLING
GASKET
ENGINE GEARBOX
L-A685R (0000)
PW V

Starter And Adapter Assembly
Figure 401
(Task 71−00−61−450−014)

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POWER PLANT GENERAL - MAIN GEARBOX - INSTALLATION-15

Task 71-00-61-450-015:

1. Install Chip Detectors

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	4	TBD
Packing	1	TBD
Lockwire, MS20995C32		

B. Procedure
See Figure 401.

(1) Install four chip detectors.

(a) Lubricate packing with Material P03-001. Install packing on chip detector.

(b) Install chip detector in bottom of oil pump. Torque chip detector to 32 - 40 lb-in. (3.616 - 4.519 N.m).

(c) Install lockwire to chip detector.

(2) Install master chip detector.

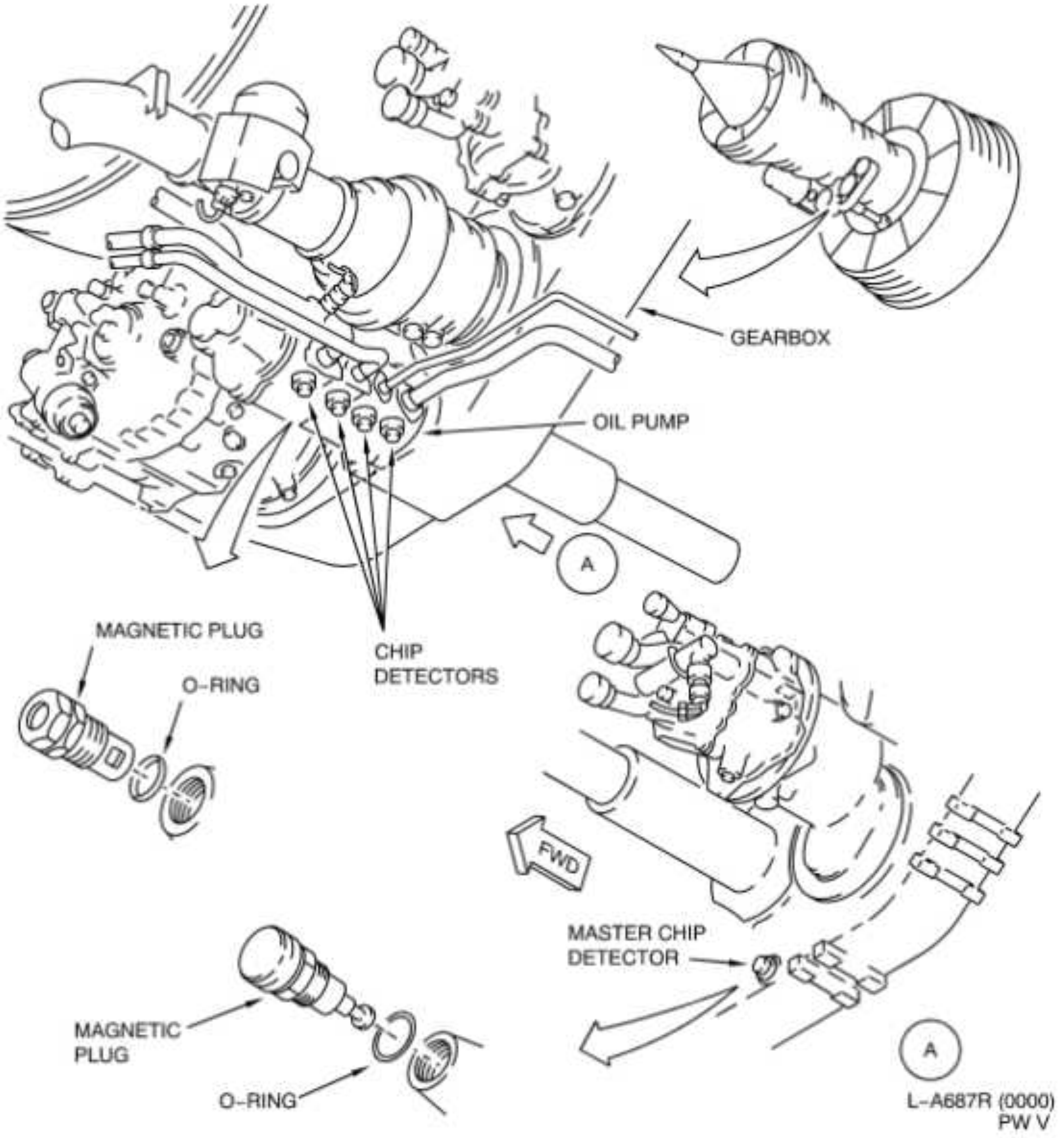
(a) Lubricate packing with Material P03-001. Install packing on master chip detector.

(b) Install master chip detector in forward edge of main gearbox. Torque master chip detector to 87 - 108 lb-in. (9.830 - 12.202 N.m).

(c) Install lockwire to master chip detector.

C. Postrequisites

(1) Test engine by the Test Reference Table. See 71-00-00, Testing-00 Task 71-00-00-990-003.


GEARBOX
OIL PUMP
A
MAGNETIC PLUG
O-RING
CHIP DETECTORS
FWD
MASTER CHIP DETECTOR
MAGNETIC PLUG
O-RING
A
L-A687R (0000)
PW V

Chip Detectors
Figure 401
(Task 71−00−61−450−015)

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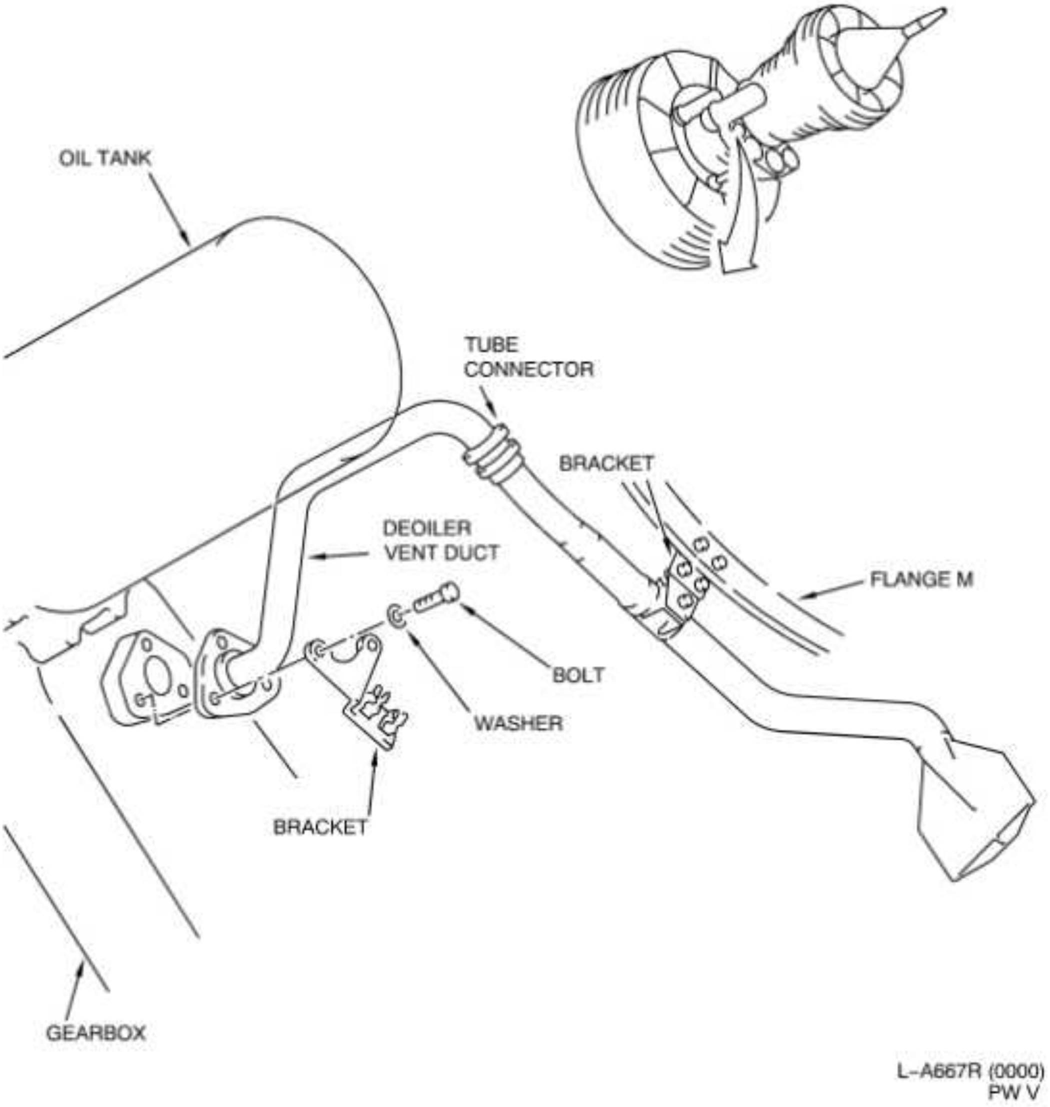
POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−16

Task 71−00−61−450−016:

1. Install Deoiler Vent Duct
   - A Equipment And Materials Required − None
   - A. Procedure

     See Figure 401.
     - (1) Install three bolts and washers attaching deoiler vent duct, with bracket, to gearbox.
     - (2) Torque bolts to 75 − 85 lb−in. (8.474 − 9.604 N.m).


OIL TANK
TUBE CONNECTOR
BRACKET
DEOILER VENT DUCT
FLANGE M
BOLT
WASHER
BRACKET
GEARBOX
L−A667R (0000)
PW V

Deoiler Vent Duct
Figure 401
(Task 71−00−61−450−016)

Task 71-00-61-450-017-001:

1. Install HP Fuel Shutoff Valve Actuator (PN 221D4003-507)

A. Equipment And Materials Required

Special Tools:
RSE1041-1 Rig Pin

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Lockwire, MS20995C32				

B. Procedure
See Figure 401.

NOTE: The HP fuel shutoff actuator is installed and rigged in the "RUN" position.

(1) Rotor fuel metering unit (FMU) condition shaft from "OFF" position to "RUN" position.
(2) Install RSE1041-1 Rig Pin through rig pin hole on FMU into rigging slot of condition shaft cam.
(3) Remove protective covers and connect electrical connector DH10 to actuator. Tighten connector fingertight only at this time. See Figure 402.

CAUTION: DO NOT ATTEMPT TO MANUALLY ROTATE THE HP FUEL SHUTOFF VALVE ACTUATOR MOTOR TO THE "RUN" POSITION.

(4) Energize HP fuel shutoff valve actuator motor to run from "OFF" position to "RUN" position.

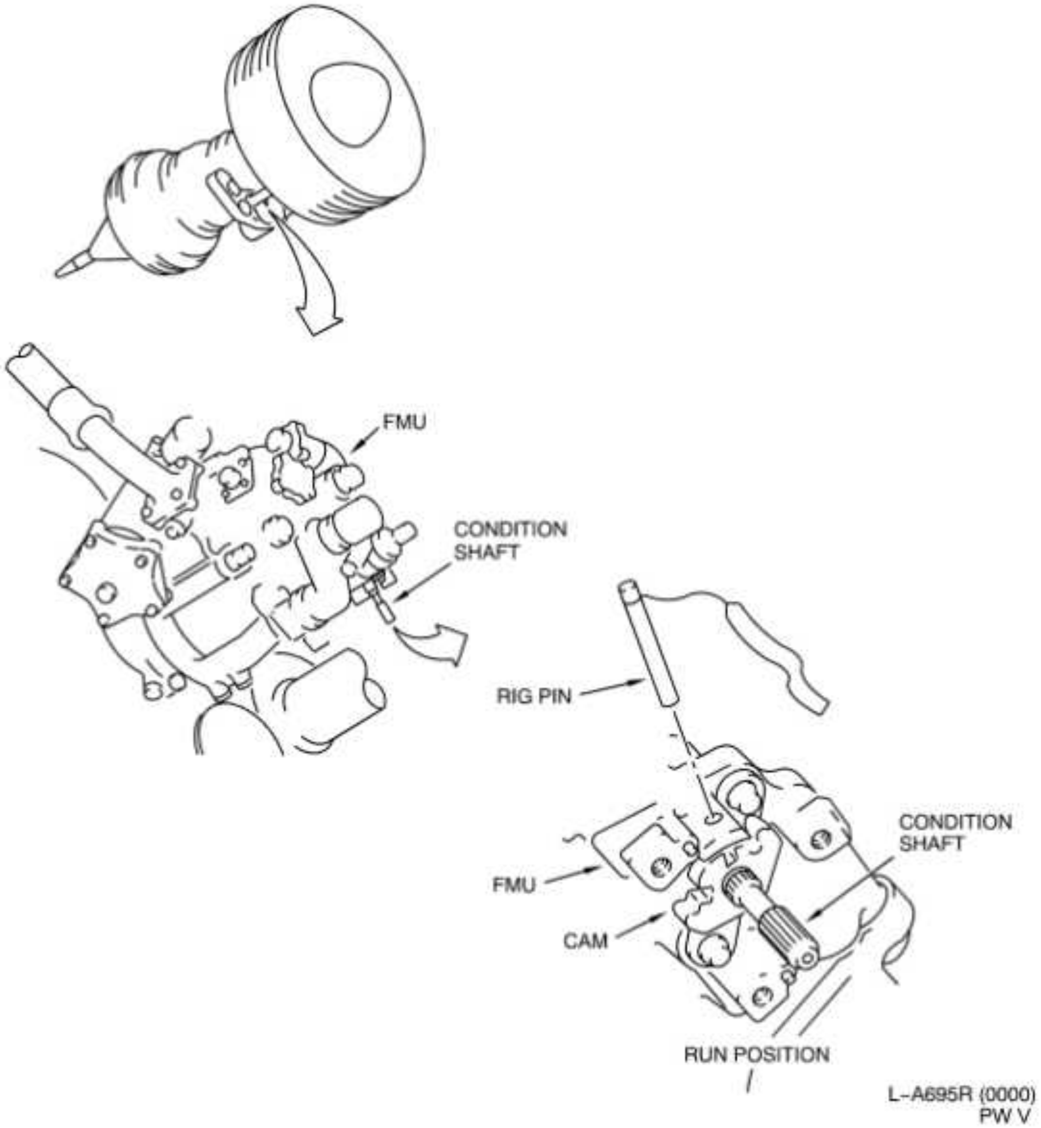
NOTE: If aircraft electrical power is not available at connector DH10, use an external power source of 28 volts DC and connect the terminals to the following pins:

Pin No. 5	Negative terminal

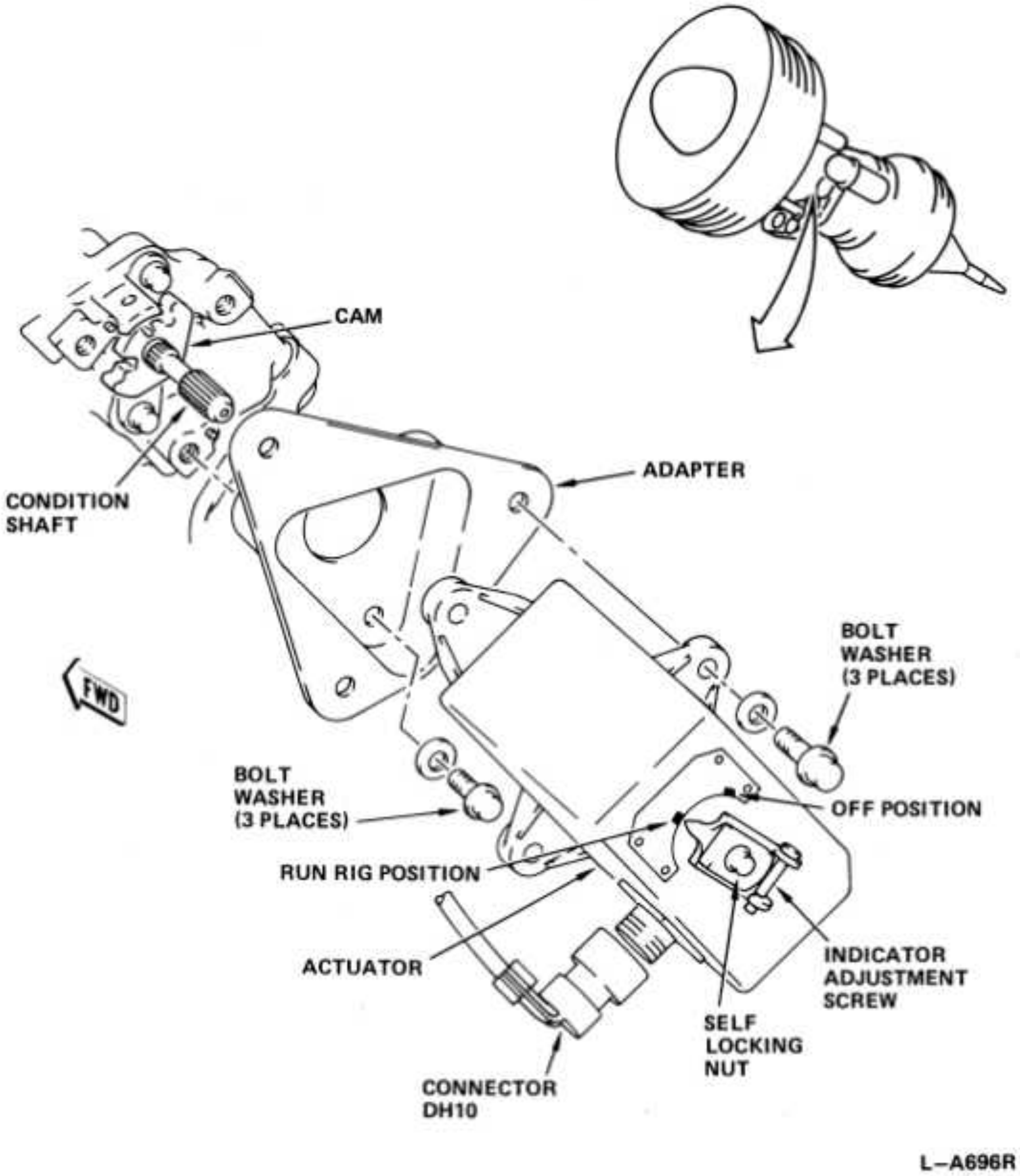
Connect positive terminal, in sequence, to the following pins:

Pin No. 1	Selects to "OFF" position
Pin No. 3	Selects to "RUN" position

(5) Verify that actuator is in "RUN" position.


FMU
CONDITION SHAFT
RIG PIN
CONDITION SHAFT
FMU
CAM
RUN POSITION
L-A695R (0000)
PW V

Fuel Metering Unit Condition
Shaft Rigging
(PN 221D4003-507)
Figure 401
(Task 71-00-61-450-017-001)


CAM
CONDITION SHAFT
ADAPTER
FWD
BOLT
WASHER
(3 PLACES)
BOLT
WASHER
(3 PLACES)
OFF POSITION
RUN RIG POSITION
ACTUATOR
INDICATOR ADJUSTMENT SCREW
SELF LOCKING NUT
CONNECTOR DH10
L–A696R

HP Fuel Shutoff Valve Actuator Installation
(PN 221D4003–507)
Figure 402
(Task 71–00–61–450–017–001)

CAUTION: VERIFY THAT SHIM (SB PW4 73−2), WHICH PREVENTS INTERFERENCE BETWEEN FUEL METERING UNIT SHAFT AND FUEL SHUTOFF VALVE ACTUATOR SHAFT, IS INSTALLED ON ADAPTER ASSEMBLY.

(6) Install adapter assembly on FMU with three bolts and washers. Torque bolts to 20 − 25 lb−in. (2.260 − 2.825 N.m).

(7) Install HP fuel shutoff valve actuator on FMU adapter.
  (a) Align splines of shutoff valve condition shaft with socket splines of actuator and position actuator on adapter.
  (b) Check attaching bolt hole alignment between actuator and adapter. If the three bolt holes are not aligned, loosen self−locking nut on actuator position indicator and remove lockwire from indicator adjustment screw. Turn adjustment screw until holes align. Lockwire adjustment screw and tighten self−locking nut on actuator position indicator.
  (c) Install three bolts and washers. Torque bolts to 50 − 70 lb−in. (5.6 − 6.9 N.m) and lockwire.

(8) Remove rig pin from FMU.

(9) Energize fuel shutoff valve actuator motor to rotate from "RUN" position to "OFF" position and back to "RUN" position.
  (a) Check that rig pin can be inserted at "RUN" position. Verify that actuator rotates to "OFF" position.
  (b) If rig pin cannot be inserted at "RUN" position when selected, recheck installation for proper assembly and repeat previous steps.

(10) If aircraft electrical power is not available to connector DH10, use an external power source of 28 volts DC and perform the following steps.
  (a) Connect negative terminal to Pin No. 5 of actuator receptacle.
  (b) Connect positive terminal to Pin No. 1 to select actuator to "OFF" position. Verify that actuator goes to "OFF" position.
  (c) Connect positive terminal to Pin No. 3 to select actuator to "RUN" position. Check that rig pin can be inserted when actuator is in "RUN" position. Disconnect positive terminal from Pin No. 3 and remove rig pin.
  (d) If rig pin cannot be inserted at "RUN" position when selected, recheck installation for proper assembly and repeat previous steps.

POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−17

Task 71−00−61−450−017−002:

2. Install HP Fuel Shutoff Valve Actuator (PN 221D4003−509)

A. Equipment And Materials Required

Special Tools:
RSE1041−1 Rig Pin

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Lockwire, MS20995C32				

CAUTION: THESE RIGGING INSTRUCTIONS ARE TO BE USED ONLY WITH ACTUATORS, PN 221D4003−509.

B. Procedure
See Figure 403.

NOTE: The HP fuel shutoff actuator is installed and rigged in the "OFF" position.

(1) Rotate Fuel Metering Unit (FMU) condition shaft clockwise from "RUN" to "OFF" position.
(2) Install RSE1041−1 rig pin through hole on FMU into rigging slot of condition shaft cam.
(3) Remove protective covers and connect electrical connector DH10 to actuator. Tighten connector fingertight only at this time.

CAUTION: DO NOT ATTEMPT TO MANUALLY ROTATE THE HP FUEL SHUTOFF VALVE ACTUATOR MOTOR TO THE "OFF" POSITION.

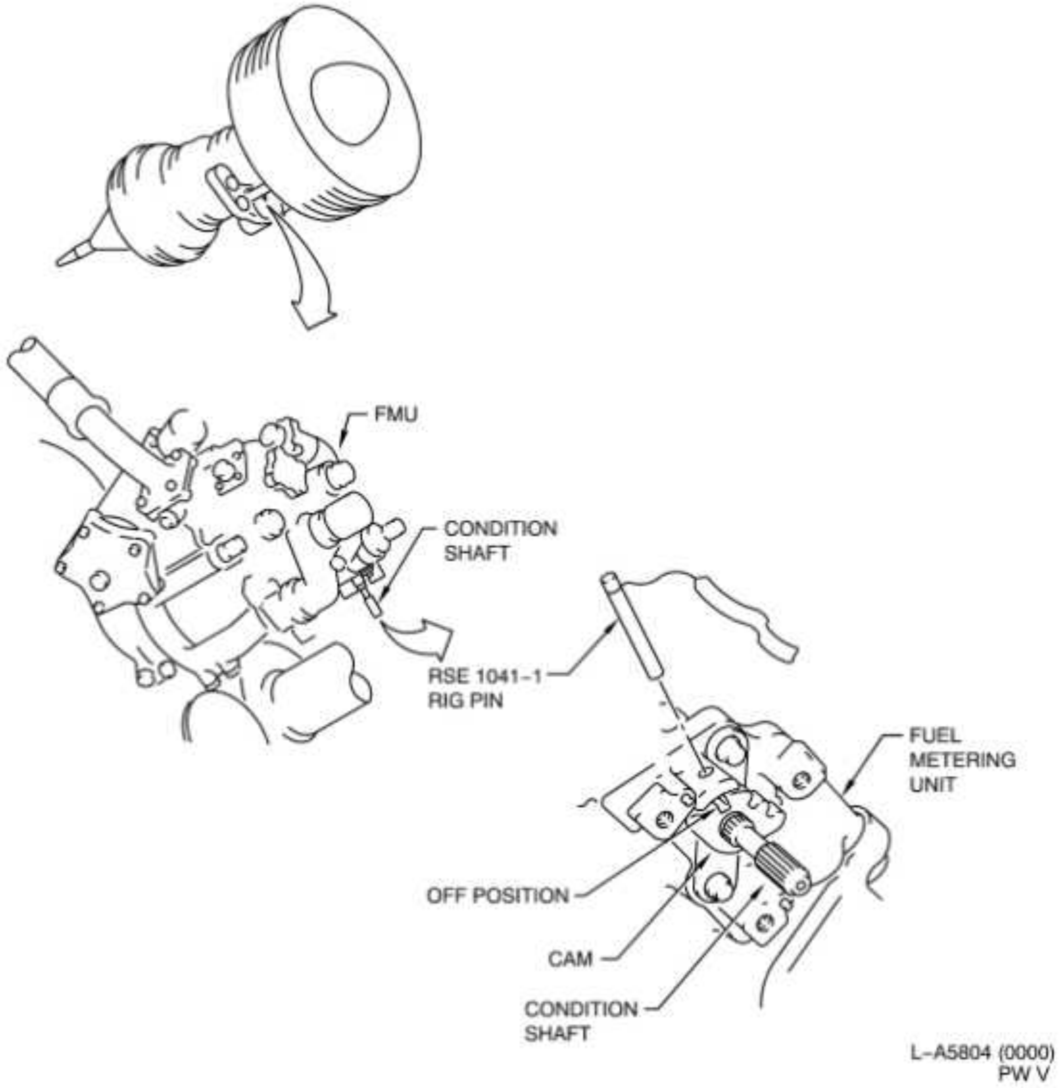
(4) Energize HP fuel shutoff valve actuator motor to run from "RUN" position to "OFF" position. See Figure 402.

NOTE: Use an external power source of 28 volts DC and connect the terminals to the following pins:

Pin No. 5 Negative terminal

Connect positive terminal, in sequence, to the following pins:

Pin No. 3 Selects to "RUN" position
Pin No. 1 Selects to "OFF" position


FMU
CONDITION SHAFT
RSE 1041−1 RIG PIN
FUEL METERING UNIT
OFF POSITION
CAM
CONDITION SHAFT
L−A5804 (0000)
PW V

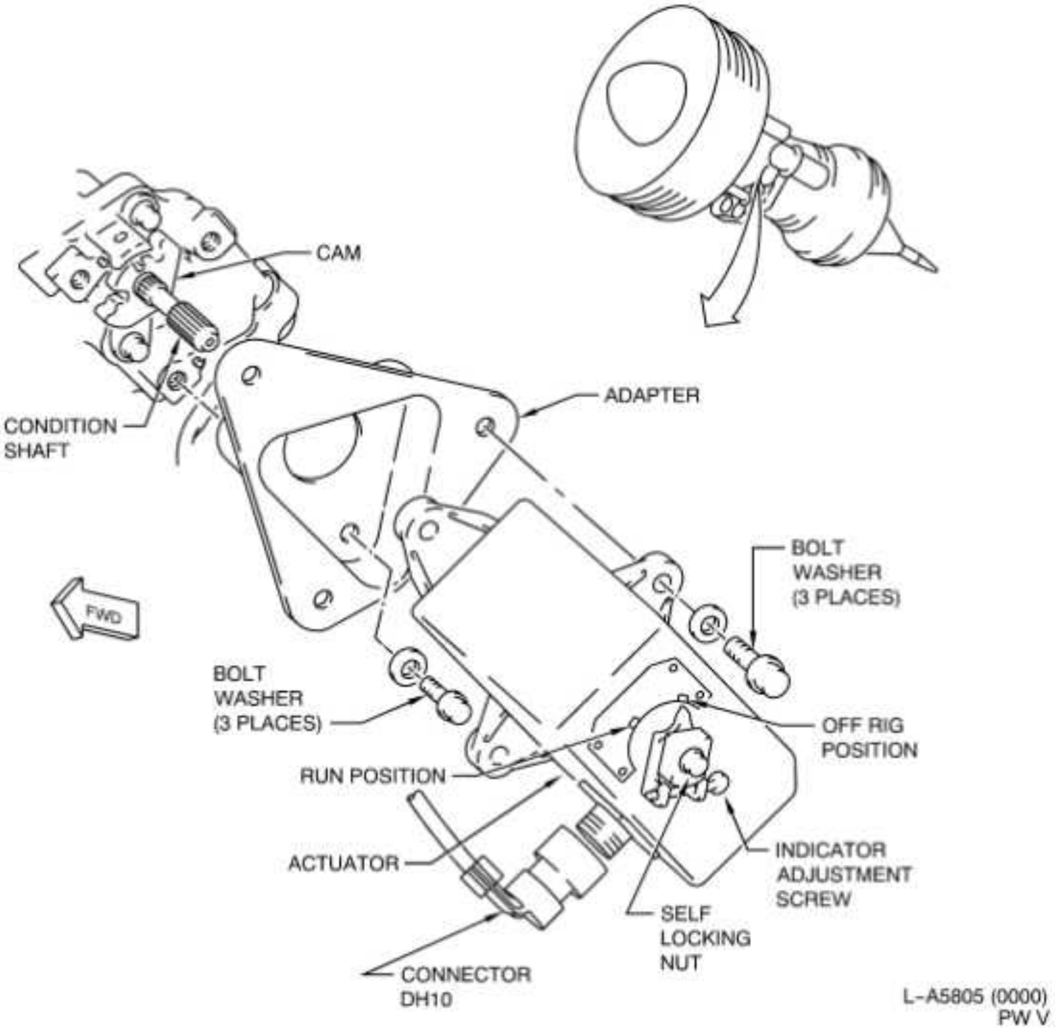
Fuel Metering Unit Condition
Shaft Rigging
(PN 221D4003−509)
Figure 403
(Task 71−00−61−450−017−002)

POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−17

(5) Verify actuator position indicator is in "OFF" position. See Figure 404.

CAUTION: VERIFY THAT SHIM (POST SB PW4NAC73−2), WHICH PREVENTS INTERFERENCE BETWEEN FUEL METERING UNIT SHAFT AND FUEL SHUTOFF VALVE ACTUATOR SHAFT, IS RIVETED TO ADAPTER ASSEMBLY.

(6) Install adapter on FMU with three bolts and washers. Torque bolts 20 − 25 lb−in. (2.260 − 2.825 N.m).
(7) Install HP fuel shutoff valve actuator on FMU adapter.
    (a) Align splines of shutoff valve condition shaft with socket splines of actuator and position actuator on adapter.
    (b) Check attaching bolt hole alignment between actuator and adapter. If the three bolt holes are not aligned, loosen self−locking nut on actuator position indicator and remove lockwire from indicator adjustment screw. Turn adjustment screw until holes align. Lockwire adjustment screw. Tighten and torque self−locking nut on actuator position indicator to 57 − 63 lb−in. (6.440 − 7.118 N.m).
    (c) Install three bolts and washers. Torque bolts 50 − 70 lb−in. (5.6 − 6.9 N.m) and lockwire.
(8) Remove rig pin from FMU.
(9) Energize HP fuel shutoff valve actuator motor to rotate from "OFF" position to "RUN" position and back to "OFF" position.
    (a) Check that rig pin can be inserted at "OFF" position. Verify that actuator rotates to "RUN" position.
    (b) If rig pin cannot be inserted in "OFF" position when selected, recheck installation for proper assembly and repeat steps 2.B.(1) through 2.B.(9).
(10) Use an external power source of 28 volts DC and perform the following steps.
    (a) Connect negative terminal to Pin 5 of actuator receptacle.
    (b) Connect positive terminal to Pin No. 3 to select actuator to "RUN" position. Verify that actuator goes to "RUN" position.
    (c) Connect positive terminal to Pin No. 1 to select actuator to "OFF" position. Check that rig pin can be inserted when actuator is in "OFF" position.
    (d) Disconnect positive terminal from Pin No. 1 and remove rig pin.


CAM
ADAPTER
CONDITION SHAFT
BOLT
WASHER
(3 PLACES)
FWD
BOLT
WASHER
(3 PLACES)
OFF RIG POSITION
RUN POSITION
ACTUATOR
INDICATOR ADJUSTMENT SCREW
SELF LOCKING NUT
CONNECTOR DH10
L-A5805 (0000)
PW V

HP Fuel Shutoff Valve Actuator Installation
(PN 221D4003-509)
Figure 404
(Task 71-00-61-450-017-002)

(e) If rig pin cannot be inserted at "OFF" position when selected, recheck installation for proper assembly and repeat steps 2.B.(1) through 2.B.(10).

CAUTION: CHECK HARNESS CONNECTOR AND/OR MATING COMPONENT CONNECTOR FOR BENT PINS AND CONTAMINATION. CAREFULLY STRAIGHTEN BENT PINS AND CLEAN CONNECTOR AS REQUIRED.

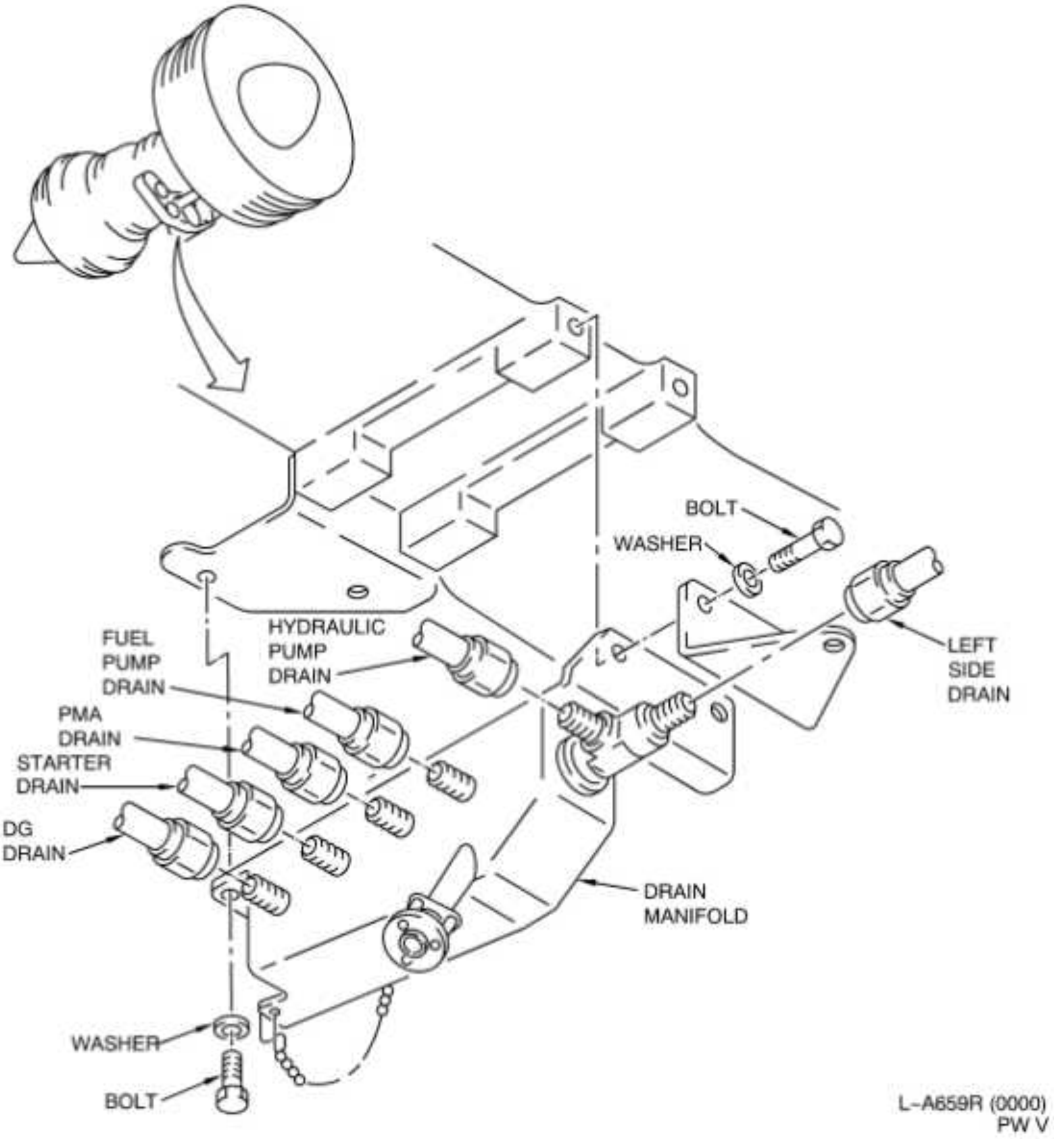
(11) Align connector keyway and push harness connector into mating receptacle. While pushing inward on connector, tighten coupling ring handtight. Connector is properly secured when color band closest to threads is fully covered by coupling ring.

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−18

Task 71−00−61−450−018:

1. Install Drain Collector Manifold Assembly
   A. Equipment And Materials Required − None
   B. Procedure
      See Figure 401.
      (1) Position engine accessory drain manifold on the engine case and attach using four bolts and washers. Tighten bolts fingertight.
      (2) Check the drain manifold alignment with the drain tubes to be connected and torque bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).
      (3) Remove protective covers from the drain manifold tee ports and the lines that connect to the tee. Connect the two drain lines and torque drain line nuts to 300 lb−in. (33.895 N.m).
      (4) Remove protective covers from drain manifold ports and the lines that connect to the right−hand manifold side. Connect the drain lines and torque drain line nut to 300 lb−in. (33.895 N.m).


BOLT
WASHER
HYDRAULIC PUMP DRAIN
FUEL PUMP DRAIN
LEFT SIDE DRAIN
PMA DRAIN
STARTER DRAIN
DG DRAIN
DRAIN MANIFOLD
WASHER
BOLT
L-A659R (0000)
PW V

Drain Collector Manifold Assembly
Figure 401
(Task 71-00-61-450-018)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - MAIN GEARBOX - INSTALLATION-19

Task 71-00-61-450-019:

1. Install Accessory Drain Tubing
   A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine

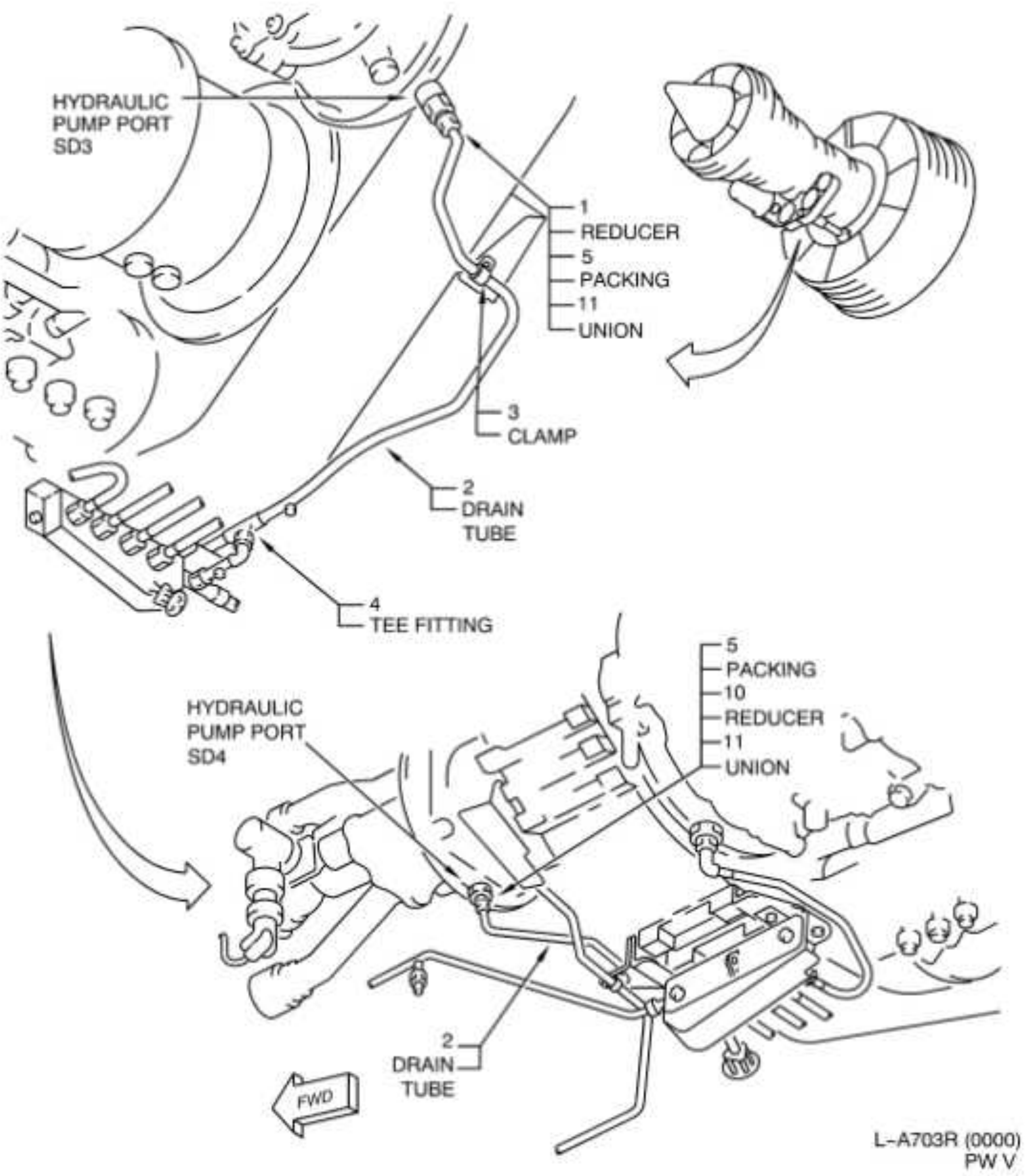
Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Packing	9	71-70-01	1	230
Packing	4	71-70-02	1	178
Packing	1	71-70-02	1	180
Packing	1	71-70-02	1	185

B. Procedure

CAUTION: INSTALL DRAIN TUBES, FITTINGS, AND CLAMPS FINGERTIGHT UNTIL DRAIN TUBE ALIGNMENT HAS BEEN VERIFIED OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Install engine drain collector manifold assembly. See 71-00-61, Installation-18.
(2) Remove all protective covers.
(3) Install hydraulic pumps drain tube (401/2). See Figure 401.
   (a) Lubricate packings (401/5) with Engine Oil (P03-001) and position on unions (401/11).
   (b) Install two unions (401/11) in reducers (401/1 and 401/10) and torque to 250 - 300 lb-in. (28.246 - 33.895 N.m).
   (c) Install hydraulic drain tube (401/2) finger-tight on unions (401/11) and tee fitting (401/4).
   (d) Install clamp (401/3) with attaching parts fingertight on hydraulic pumps drain tube (401/2).
   (e) Ensure alignment of drain tube (401/2) and torque connectors at two unions (401/11) to 300 lb-in. (33.895 N.m).
   (f) Torque connector on top end of hydraulic pumps discharge tube (401/2) at tee fitting (401/4) to 300 lb-in. (33.895 N.m).
   (g) Torque clamp (401/3) to 20 - 25 lb-in. (2.260 -


HYDRAULIC PUMP PORT SD3
1 REDUCER
5 PACKING
11 UNION
3 CLAMP
2 DRAIN TUBE
4 TEE FITTING
HYDRAULIC PUMP PORT SD4
5 PACKING
10 REDUCER
11 UNION
2 DRAIN TUBE
FWD
L−A703R (0000)
PW V

Engine Drain System
Figure 401
(Task 71−00−61−450−019)

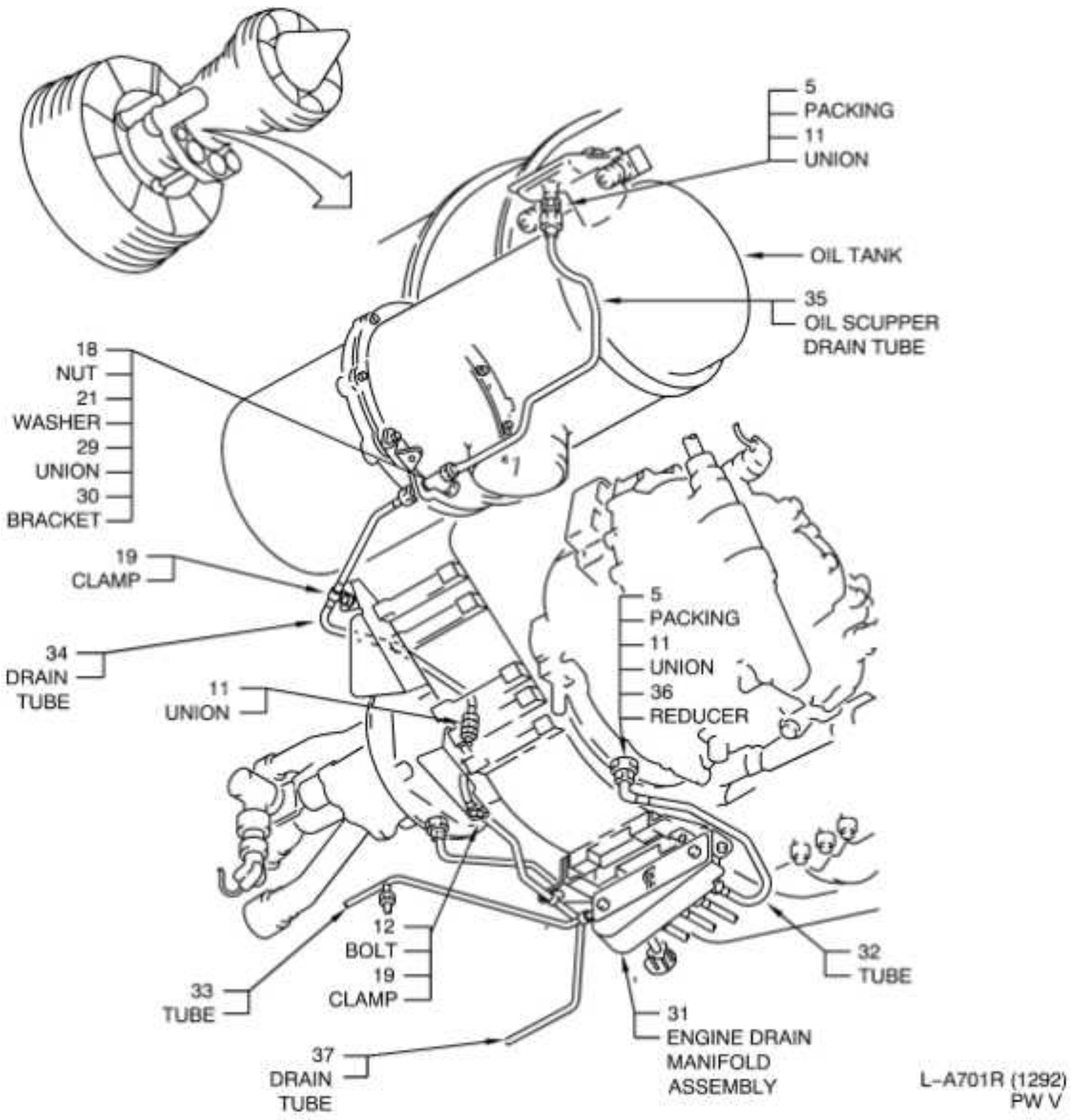
2.825 N.m).

(4) Install left side engine drain tubing. See Figure 402.
  - (a) Install union (402/29) on bracket (402/30).

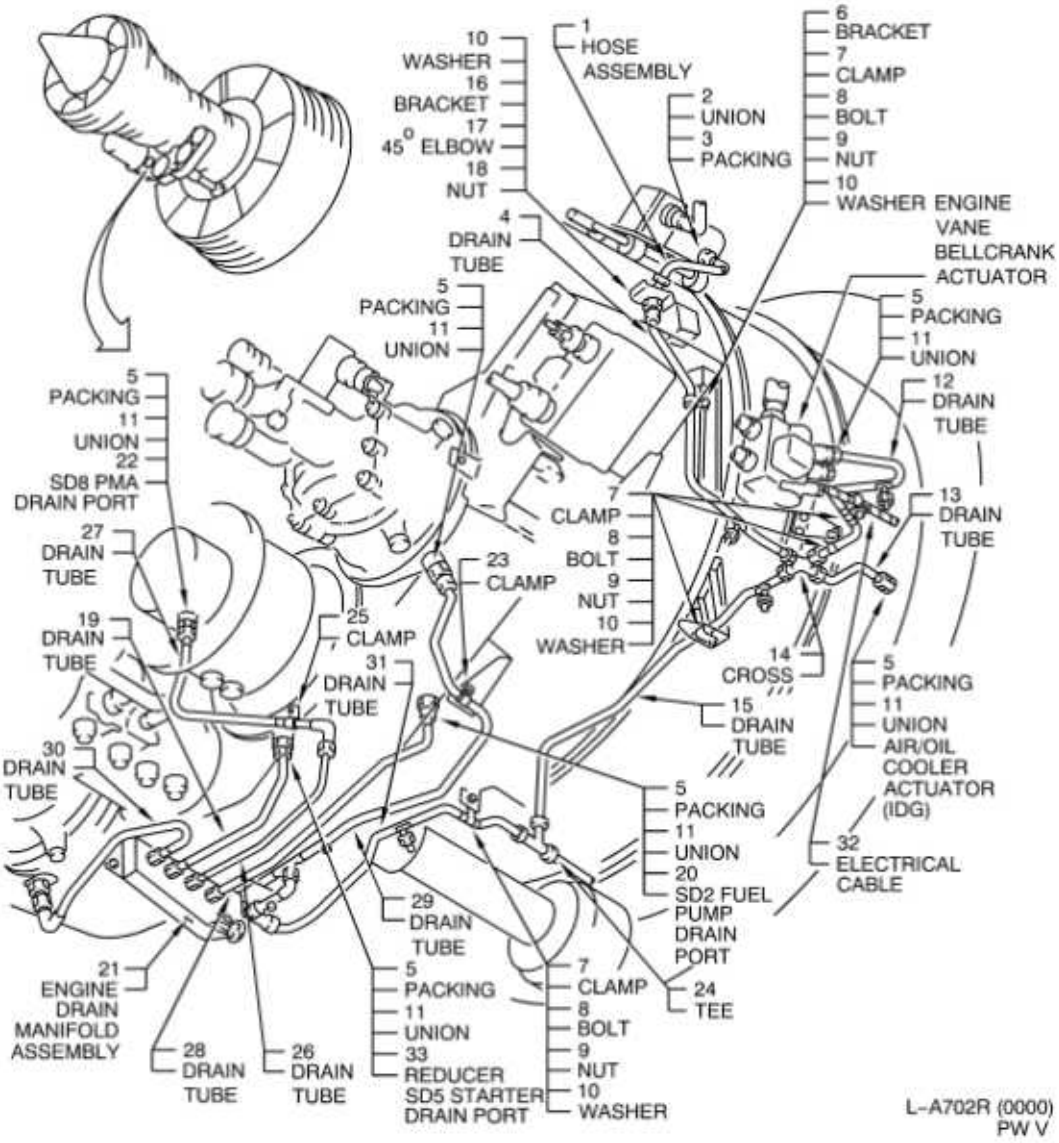
  - (b) Install union (402/11) on lower end of drain tube (402/34).
  - (c) Install drain tube (402/34) to tee (402/29).
  - (d) Install drain tube (402/33) to union (402/11) on lower end of drain tube (402/34) and to engine drain manifold discharge tube (402/37).
  - (e) Install clamp (402/19) with attaching parts to drain tube (402/33).
  - (f) Ensure that all sections of pylon drain system are correctly aligned.
  - (g) On bracket (402/30) torque nut (402/18) on tee (402/29) to 300 lb−in. (33.895 N.m).
  - (h) Torque connectors on drain tube (402/33) to 300 lb−in. (33.895 N.m).
  - (i) On drain tube (402/33), torque nut on clamp (402/19) to 20 − 25 lb−in. (2.260 − 2.825 N.m).
  - (j) Torque connectors on drain tube (402/34) to 300 lb−in. (33.895 N.m).
  - (k) On drain tube (402/34), torque nut on clamp (402/19) to 20 − 25 lb−in. (2.260 − 2.825 N.m).

(5) Install oil tank scupper drain tube. See Figure 402.
  - (a) Lubricate packing (402/5) with Engine Oil (P03−001) and position on union (402/11).
  - (b) Install union (402/11) on oil scupper drain port and torque to 250 − 300 lb−in. (28.246 − 33.895 N.m).
  - (c) Install oil scupper drain tube (402/35) fingertight on union (402/11) and union (402/29).
  - (d) Ensure alignment and torque drain tube (402/35) connectors to 300 lb−in. (33.895 N.m).

(6) Install fuel pump drain line. See Figure 403.
  - (a) Lubricate packing (403/5) with Engine Oil (P03−001) and position on union (403/11).
  - (b) Install union (403/11) on fuel pump drain tube (403/20), Port SD2, Flange J, and torque to 250 − 300 lb−in. (28.246 − 33.895 N.m).
  - (c) Install fuel pump drain tube (403/28) finger−tight on union (403/11) and engine drain manifold at fuel pump input connector.
  - (d) Ensure alignment and torque drain tube (403/28) connectors to 300 lb−in. (33.895 N.m).


5
PACKING
11
UNION
OIL TANK
35
OIL SCUPPER
DRAIN TUBE
18
NUT
21
WASHER
29
UNION
30
BRACKET
19
CLAMP
34
DRAIN
TUBE
11
UNION
5
PACKING
11
UNION
36
REDUCER
32
TUBE
12
BOLT
19
CLAMP
33
TUBE
31
ENGINE DRAIN
MANIFOLD
ASSEMBLY
37
DRAIN
TUBE
L-A701R (1292)
PW V

Left Side Engine Drain System
Figure 402
(Task 71−00−61−450−019)


10 WASHER
16 BRACKET
17 45° ELBOW
18 NUT
1 HOSE ASSEMBLY
2 UNION
3 PACKING
6 BRACKET
7 CLAMP
8 BOLT
9 NUT
10 WASHER ENGINE VANE BELLCRANK ACTUATOR
4 DRAIN TUBE
5 PACKING
11 UNION
5 PACKING
11 UNION
12 DRAIN TUBE
5 PACKING
11 UNION
22 SD8 PMA DRAIN PORT
27 DRAIN TUBE
7 CLAMP
8 BOLT
9 NUT
10 WASHER
13 DRAIN TUBE
23 CLAMP
19 DRAIN TUBE
25 CLAMP
14 CROSS
31 DRAIN TUBE
15 DRAIN TUBE
5 PACKING
11 UNION
AIR/OIL COOLER ACTUATOR (IDG)
30 DRAIN TUBE
5 PACKING
11 UNION
20 SD2 FUEL PUMP DRAIN PORT
32 ELECTRICAL CABLE
29 DRAIN TUBE
21 ENGINE DRAIN MANIFOLD ASSEMBLY
5 PACKING
11 UNION
33 REDUCER SD5 STARTER DRAIN PORT
7 CLAMP
8 BOLT
9 NUT
10 WASHER
24 TEE
28 DRAIN TUBE
26 DRAIN TUBE
L-A702R (0000) PW V

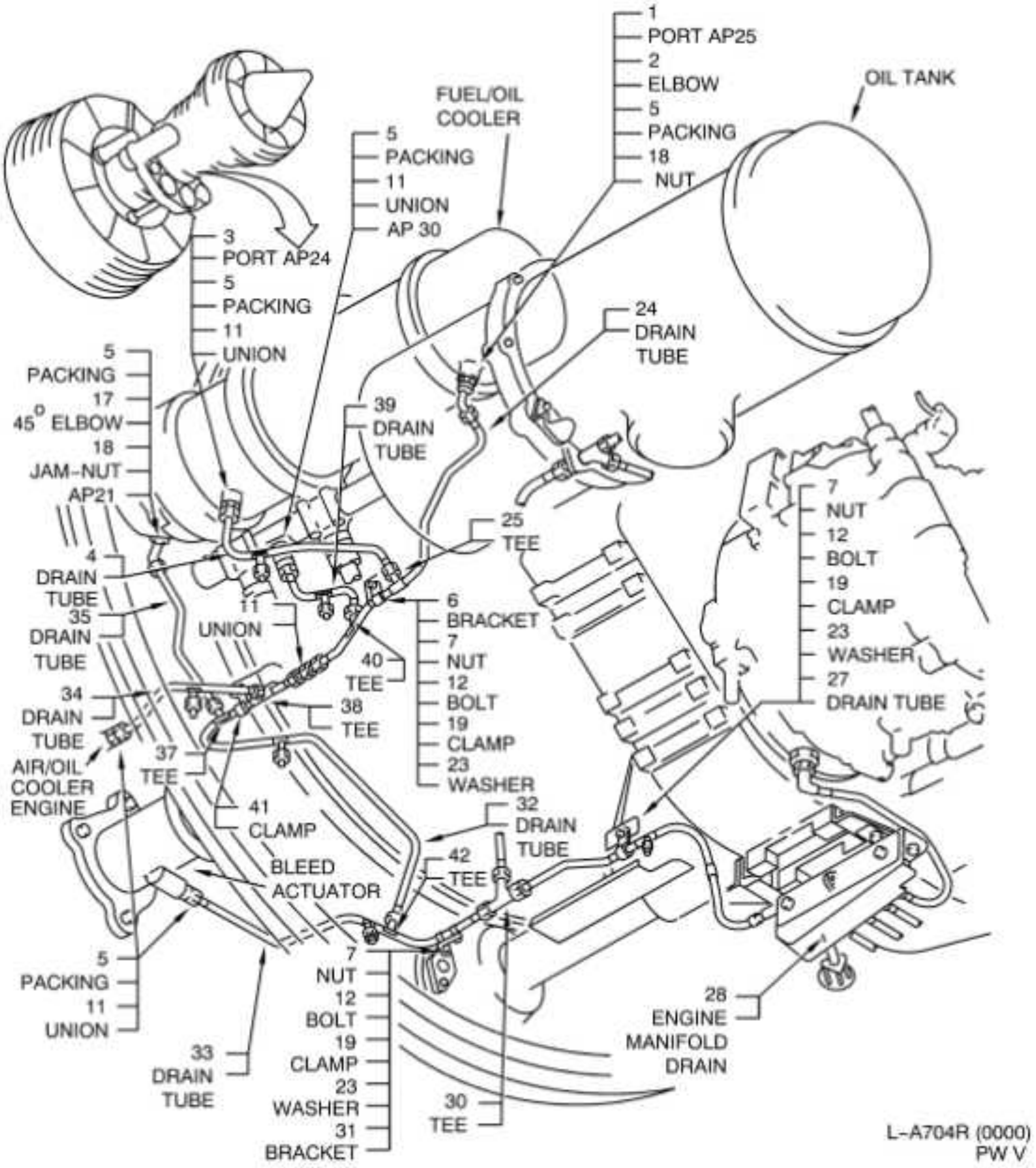
Engine Drain System
Figure 403
(Task 71−00−61−450−019)

(7) Install EEC drain tubing. See Figure 403.
  (a) Lubricate packing (403/5) with Engine Oil (P03−001) and position on union (403/11).
  (b) Install union (403/11) in PMA drain port (403/22), Port SD8, and torque to 250 − 300 lb−in. (28.246 − 33.895 N.m).
  (c) Install EEC drain tube (403/27) fingertight on union (403/11).
  (d) Install clamp (403/25) with attaching parts fingertight on drain tube (403/27).
  (e) Install EEC drain tube (403/26) fingertight on lower end off EEC drain tube (403/27) and engine drain manifold at EEC input connector.
  (f) Ensure alignment of drain tubes (403/27 and 403/26) and torque connectors to 300 lb−in. (33.895 N.m).
  (g) On drain tube (403/27) torque nut on clamp (403/25) to 20 − 25 lb−in. (2.260 − 2.825 N.m).

(8) Install starter drain tube. See Figure 403.
  (a) Lubricate packing (403/5) with Engine Oil (P03−001) and position on union (403/11).
  (b) Install union (403/11) in reducer (403/33), at pneumatic engine starter drain Port SD5, Flange K, and torque to 250 − 300 lb−in. (28.246 − 33.895 N.m).
  (c) Install starter drain tube (403/19) fingertight on union (403/11) and engine drain manifold at starter input connector.
  (d) Ensure alignment of drain tube (403/19) and torque connectors to 300 lb−in. (33.895 N.m).

(9) Install integrated drive generator (IDG) drain tube (402/32). See Figure 402.
  (a) Lubricate packing (402/5) with Engine Oil (P03−001) and position on union (402/11).
  (b) Install union (402/11) in reducer (402/36) at IDG Port SD6 and torque to 250 − 300 lb−in. (28.246 − 33.895 N.m).
  (c) Connect IDG drain tube (402/32) fingertight to union (402/11) and engine drain manifold at IDG input connector.
  (d) Ensure alignment of drain tube (402/32) and torque tube connectors to 300 lb−in. (33.895 N.m).

(10) Install bleed actuator drain tubing. See Figure 404.


1
PORT AP25
2
ELBOW
5
PACKING
18
NUT
OIL TANK
FUEL/OIL
COOLER
5
PACKING
11
UNION
AP 30
3
PORT AP24
5
PACKING
11
UNION
24
DRAIN
TUBE
5
PACKING
17
45° ELBOW
18
JAM-NUT
AP21
39
DRAIN
TUBE
7
NUT
12
BOLT
19
CLAMP
23
WASHER
27
DRAIN TUBE
25
TEE
4
DRAIN
TUBE
35
DRAIN
TUBE
11
UNION
6
BRACKET
7
NUT
12
BOLT
19
CLAMP
23
WASHER
40
TEE
38
TEE
34
DRAIN
TUBE
AIR/OIL
COOLER
ENGINE
37
TEE
41
CLAMP
BLEED
ACTUATOR
32
DRAIN
TUBE
42
TEE
5
PACKING
11
UNION
33
DRAIN
TUBE
7
NUT
12
BOLT
19
CLAMP
23
WASHER
31
BRACKET
30
TEE
28
ENGINE
MANIFOLD
DRAIN
L-A704R (0000)
PW V

Engine Drain System
Figure 404
(Task 71−00−61−450−019)

(a) Lubricate packing (404/5) with Engine Oil (P03−001) and position on union (404/11).
(b) Install union (404/11) in bleed actuator drain port and torque to 250 − 300 lb−in. (28.246 − 33.895 N.m).
(c) Install tee (404/30) fingertight on aft end of bleed actuator drain tube (404/33).
(d) Connect drain tube (404/33) to union (404/11) on bleed actuator drain port.
(e) Install clamp (404/19) with attaching parts on drain tube (404/33).
(f) Connect drain tube (404/27) to tee (404/30) and drain manifold direct discharge tube.
(g) Connect clamp (404/19) with attaching parts to drain tube (404/27).
(h) Connect drain tube (402/15), fingertight to tee (404/30).
(i) Install clamp (404/31) with attaching parts fingertight on drain tube (402/15).

NOTE: Drain tube (402/15) is installed fingertight at this step to allow tee (404/30) to be aligned and torqued.

(j) Torque forward end of drain tube (404/33) on union (404/11) and aft end on tee (404/30) to 300 lb−in. (33.895 N.m).
(k) Torque clamp (404/19) on drain tube (404/33) to 20 − 25 lb−in. (2.260 − 2.825 N.m).
(l) Torque connectors on drain tube (404/27) to 300 lb−in. (33.895 N.m).
(m) Torque clamp (404/19) on drain tube (404/27) to 20 − 25 lb−in. (2.260 − 2.825 N.m).

(11) Install fuel/oil cooler, rear fuel drain tubing, Port AP25. See Figure 404.
(a) Install jamnut (404/18) fingertight on elbow (404/2).
(b) Lubricate packing (404/5) with Engine Oil (P03−001) and position on elbow (404/5).
(c) Install elbow (404/2) fingertight in Port AP25.
(d) Install union (404/11) on lower end of drain tube (404/24).
(e) Install upper end of drain tube (404/24) to elbow (404/2).
(f) On drain tube (404/24) install clamp (404/19) with attaching parts fingertight to bracket (404/6).
(g) Install drain tube (404/32) to union (404/11) on lower end of drain tube (404/24) and to tee

fitting (404/42) on drain tube (404/33).

(h) Install clamp (404/41) with attaching parts on drain tube (404/32).

(i) Ensure alignment of drain tubes (404/24 and 404/32) and torque jamnut (404/18) on elbow (404/2) to 300 lb−in. (33.895 N.m).

(j) Torque connectors on drain tubes (404/24 and 404/32) to 300 lb−in. (33.895 N.m).

(k) Torque clamp (404/19) on drain tube (404/24) to 20 − 25 lb−in. (2.260 − 2.825 N.m).

(l) Torque clamp (404/41) on drain tube (404/32) to 20 − 25 lb−in. (2.260 − 2.825 N.m).

(12) Install air/oil cooler, engine drain tube (404/34). See Figure 404.

(a) Lubricate packing (404/5) with Engine Oil (P03−001) and position on union (404/11). Install union (404/11) in air/oil cooler, engine drain port and torque to 250 − 300 lb−in. (28.246 − 33.895 N.m).

(c) Install drain tube (404/34) fingertight on union (404/11) and tee fitting (404/38).

(d) Ensure alignment of drain tube (404/34) and torque connectors to 300 lb−in. (33.895 N.m).

(13) Install fuel/oil cooler IDG core fuel drain tube Port AP21. See Figure 404.

(a) Install jamnut (404/18) fingertight on 45 degrees elbow (404/17).

(b) Lubricate packing (404/5) with Engine Oil (P03−001) and position on 45 degrees elbow (404/17).

(c) Install 45 degrees elbow (404/17) fingertight in drain Port AP21.

(d) Install drain tube (404/35) fingertight on 45 degrees elbow (404/17) and tee fitting (404/37).

(e) Ensure alignment of drain tube (404/35) and elbow (404/17) and torque jamnut (404/18) to 300 lb−in. (33.895 N.m) and drain tube (404/35) connectors to 300 lb−in. (33.895 N.m).

(14) Install fuel/oil cooler bypass valve oil drain tube (404/39), Port AP30. See Figure 404.

(a) Lubricate packing (404/5) with Engine Oil (P03−001) and position on union (404/11).

(b) Install union (404/11) in Port AP30 and torque to 250 − 300 lb−in. (28.246 − 33.895 N.m).

(c) Install drain tube (404/39) fingertight on union (404/11) and tee fitting (404/40).

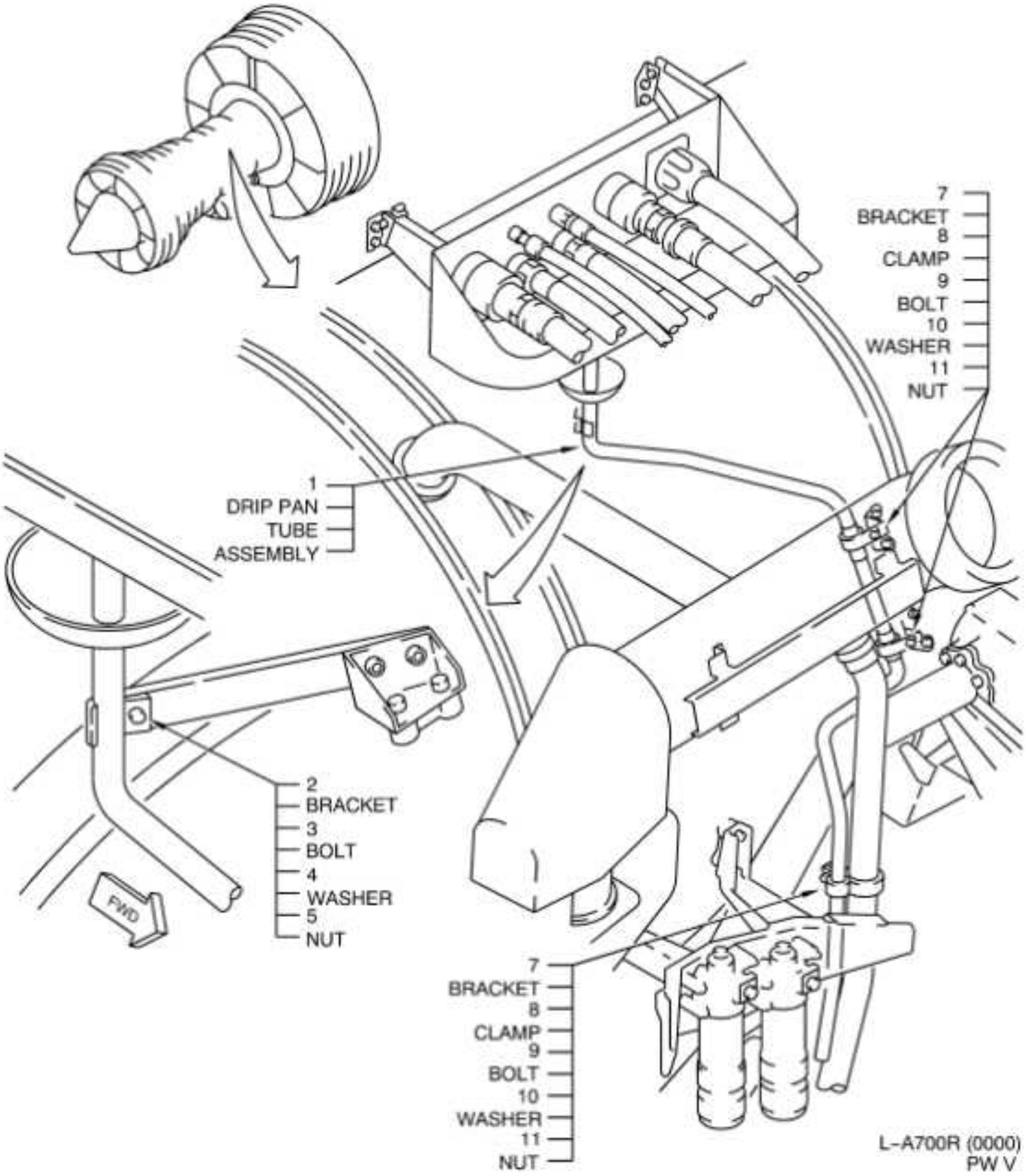
(d) Ensure alignment of drain tube (404/39) and torque connectors to 300 lb−in. (33.895 N.m).

(15) Install fuel/oil cooler, front fuel drain tubing (404/4), drain Port AP24. See Figure 404.
  (a) Lubricate packing (404/5) with Engine Oil (P03−001) and position on union (404/11).
  (b) Install union (404/11) in drain Port AP24 and torque to 250 − 300 lb−in. (28.246 − 33.895 N.m).
  (c) Install drain tube (404/4) fingertight on union (404/11) and tee fitting (404/25).
  (d) Ensure alignment of drain tube (404/4) and torque connectors to 300 lb−in. (33.895 N.m).

(16) Install turbine case cooling (TCC) actuator drain tubing. See Figure 403.
  (a) Lubricate packing (404/3) with Engine Oil (P03−001) and position on union (403/2).
  (b) Install union (403/2) in TCC cooling actuator drain and torque to 150 lb−in. (16.948 N.m).
  (c) Install 45 degrees elbow (403/17) fingertight on bracket (403/16).
  (d) Install TCC actuator drain hose (403/1) fingertight on union (403/2) and elbow (403/17).
  (e) Ensure alignment of elbow (403/17) and torque to 300 lb−in. (33.895 N.m).
  (f) Ensure alignment of drain hose (403/1) and torque connectors to 300 lb−in. (33.895 N.m).
  (g) Install drain tube (403/4) fingertight on elbow (403/17) and cross fitting (403/14).
  (h) Install clamp (403/7) fingertight on drain tube (403/4) at bracket (403/6).
  (i) Ensure alignment of drain tube (403/4) on elbow (403/17) and cross fitting (403/14), and ensure alignment of drain tube (403/15) on tee (403/24) and cross fitting (403/14).
  (j) Torque drain tube (403/4 and 403/15) connectors to 300 lb−in. (33.895 N.m).
  (k) Torque clamp (403/7) on drain tube (403/15) to 20 − 25 lb−in. (2.260 − 2.825 N.m).
  (l) Torque clamp (403/7) on drain tube (403/4) to 20 − 25 lb−in. (2.260 − 2.825 N.m).

(17) Install engine vane bellcrank drain tubing (403/12). See Figure 403.
  (a) Lubricate packing (403/5) with Engine Oil (P03−001) and position on union (403/11).
  (b) Install union (403/11) in engine bellcrank actuator port and torque to 250 − 300 lb−in. (28.246 − 33.895 N.m).
  (c) Install drain tube (403/12) fingertight to union (403/11) and cross fitting (403/14).

    - (d) Install clamp (403/7) with attaching parts fingertight that clamps electrical cable (403/32) to drain tube (403/12).
    - (e) Install clamp (403/7) with attaching parts fingertight that clamps drain tube (403/12) to mounting bracket.
    - (f) Ensure that drain tube (403/12) and clamps (403/7) are aligned.
    - (g) Torque drain tube (403/12) connectors to 300 lb−in. (33.895 N.m).
    - (h) Torque two clamps (403/7) to 20 − 25 lb−in. (2.260 − 2.825 N.m).
- (18) Install air/oil cooler, IDG actuator drain tube (403/13). See Figure 403.
    - (a) Lubricate packing (403/5) with Engine Oil (P03−001) and position on union (403/11).
    - (b) Install union (403/11) in IDG actuator drain port and torque to 250 − 300 lb−in. (28.246 − 33.895 N.m).
    - (c) Install drain tube (403/13) fingertight to union (403/11) and cross fitting (403/14).
    - (d) Ensure alignment of drain tube (403/13) and torque to 300 lb−in. (33.895 N.m).
- (19) Install drip pan tube assembly. See Figure 405.
    - (a) Install drip pan assembly tube assembly (405/1) with attaching parts fingertight to bracket (403/2).
    - (b) Install the two middle clamps (405/8) with attaching parts fingertight to drip pan tube assembly (405/1).
    - (c) Install the lower clamps (405/8) with attaching parts to drip pan tube assembly (405/1).
    - (d) Ensure that drip pan assembly (405/1) is correctly positioned and torque nut (405/5) on bracket (405/2) to 50 − 70 lb−in. (5.649 − 7.909 N.m).
    - (e) Torque nuts (405/11) on clamps (405/8) to 20 − 25 lb−in. (2.260 − 2.825 N.m).


7
BRACKET
8
CLAMP
9
BOLT
10
WASHER
11
NUT
1
DRIP PAN
TUBE
ASSEMBLY
2
BRACKET
3
BOLT
4
WASHER
5
NUT
FWD
7
BRACKET
8
CLAMP
9
BOLT
10
WASHER
11
NUT
L-A700R (0000)
PW V

Drip Pan Drain Assembly
Figure 405
(Task 71−00−61−450−019)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - MAIN GEARBOX - INSTALLATION-25

Task 71-00-61-450-031:

1. Install Fuel Pump Interstage Pressure Transmitter

A. Equipment And Materials Required

Standard Tools:
Torque Wrench, 0 - 200 lb-in. (0.000 - 22.597 N.m) Range

B. Procedure

See Figure 401.

(1) Position fuel pump interstage pressure transmitter (401/1) on transmitter support bracket and install two screws (401/7), washers (401/8), and nuts (401/9) in transmitter aft mounting flange holes.

(2) Position wire harness support bracket (401/6) on transmitter support bracket and install two screws (401/4) and washers (401/5) through transmitter forward mounting flange holes and into nutplates on wire harness support bracket.

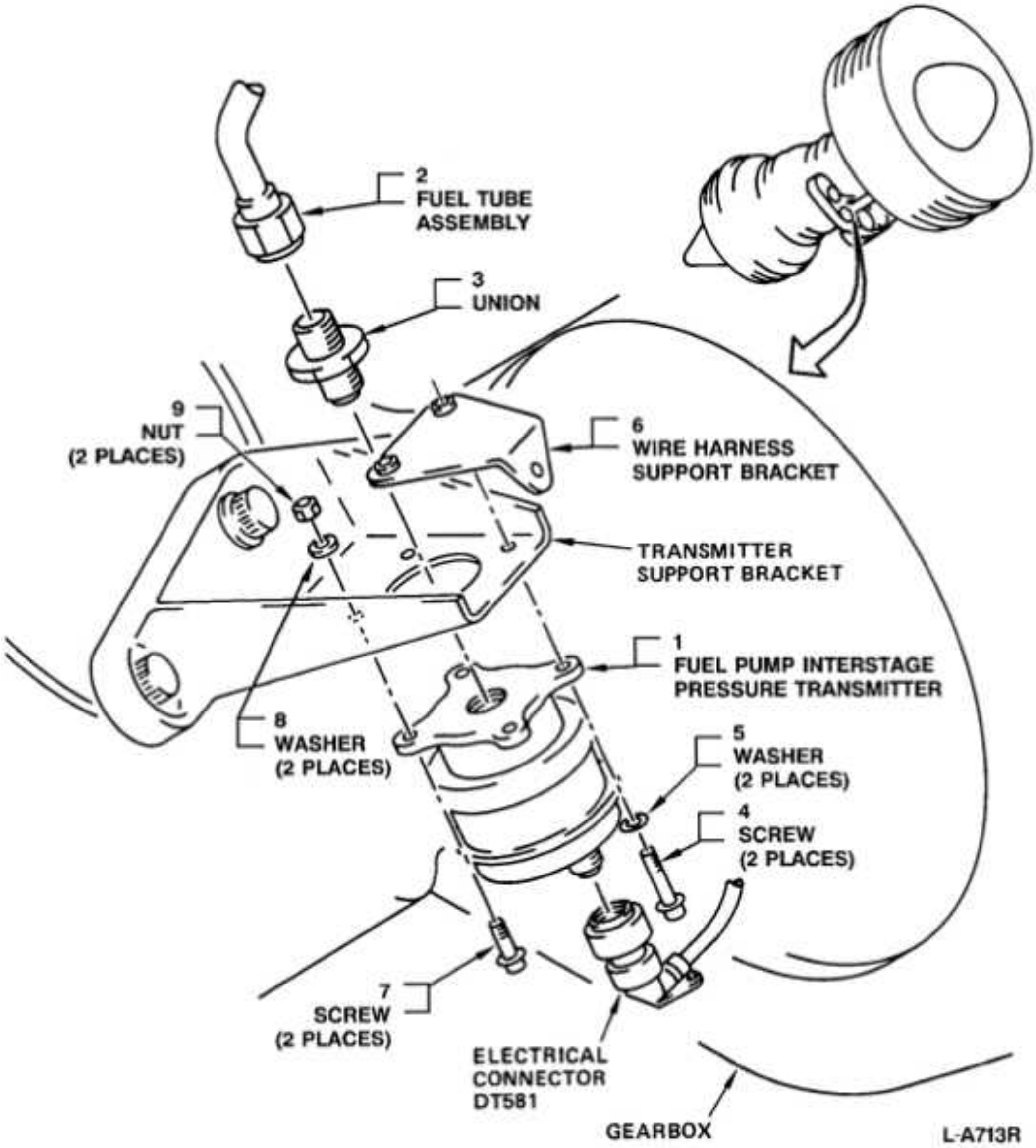
(3) Torque screws (401/4) to 63 - 70 lb-in. (7.118 - 7.909 N.m).

(4) Torque transmitter aft mounting flange nuts (401/9) to 50 - 70 lb-in. (5.649 - 7.909 N.m).

(5) Remove protective covers and connect fuel tube assembly (401/2) coupling nut to transmitter union (401/3).

(6) Torque coupling nut to 135 - 150 lb-in. (15.253 - 16.948 N.m).

(7) Remove protective covers and connect electrical connector DT581 to transmitter. Tighten connector fingertight plus one-eighth turn.


2
FUEL TUBE ASSEMBLY
3
UNION
9
NUT
(2 PLACES)
6
WIRE HARNESS SUPPORT BRACKET
TRANSMITTER SUPPORT BRACKET
1
FUEL PUMP INTERSTAGE PRESSURE TRANSMITTER
8
WASHER
(2 PLACES)
5
WASHER
(2 PLACES)
4
SCREW
(2 PLACES)
7
SCREW
(2 PLACES)
ELECTRICAL CONNECTOR DT581
GEARBOX
L-A713R

Fuel Pump Interstage Pressure Transmitter
Figure 401
(Task 71−00−61−450−031)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 71-00-61-450-032:

1. Install Oil Temperature Sensor

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIG.	ITEM
Packing	1	79-33-01	1	90

B. Procedure

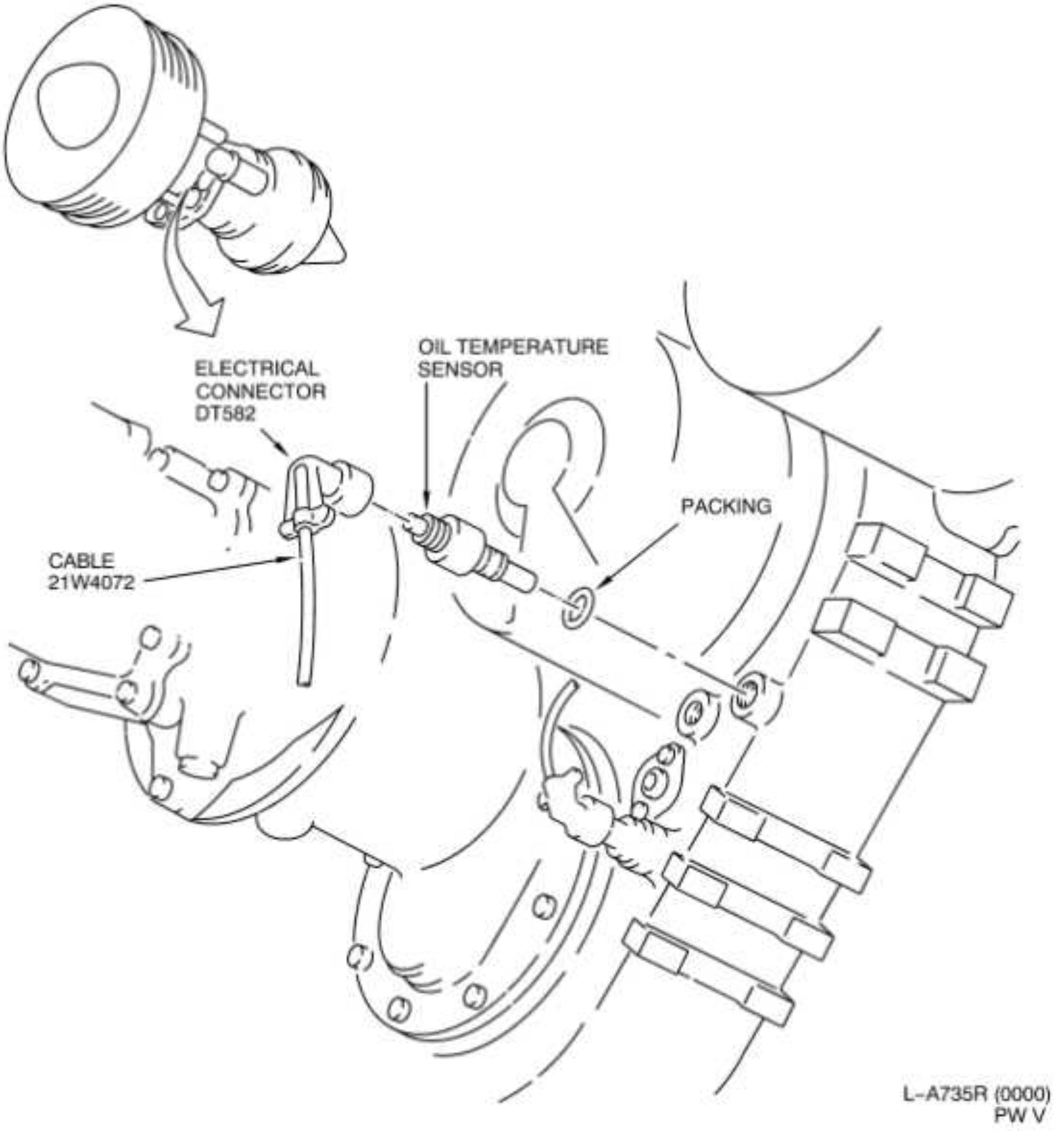
See Figure 401.

(1) Remove protective covers from electrical connector DT582 and sensor port.

(2) Lubricate new packing with Oil (P03-001) and position packing on oil temperature sensor.

(3) On bottom of main gearbox, install oil temperature sensor with new packing. Torque oil temperature sensor 150 - 170 lb-in. (16.948 - 19.207 N.m).

(4) Install electrical connector DT582 to oil temperature sensor. Tighten electrical connector fingertight plus one-eighth turn.


ELECTRICAL CONNECTOR DT582
OIL TEMPERATURE SENSOR
PACKING
CABLE 21W4072
L−A735R (0000)
PW V

Oil Temperature Sensor
Figure 401
(Task 71−00−61−450−032)

Task 71-00-61-450-033:

1. Install No. 3 Bearing Oil Temperature Sensor (Immersion Thermocouple)

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIG.	ITEM
Packing	1	79-33-01	1	70

B. Procedure

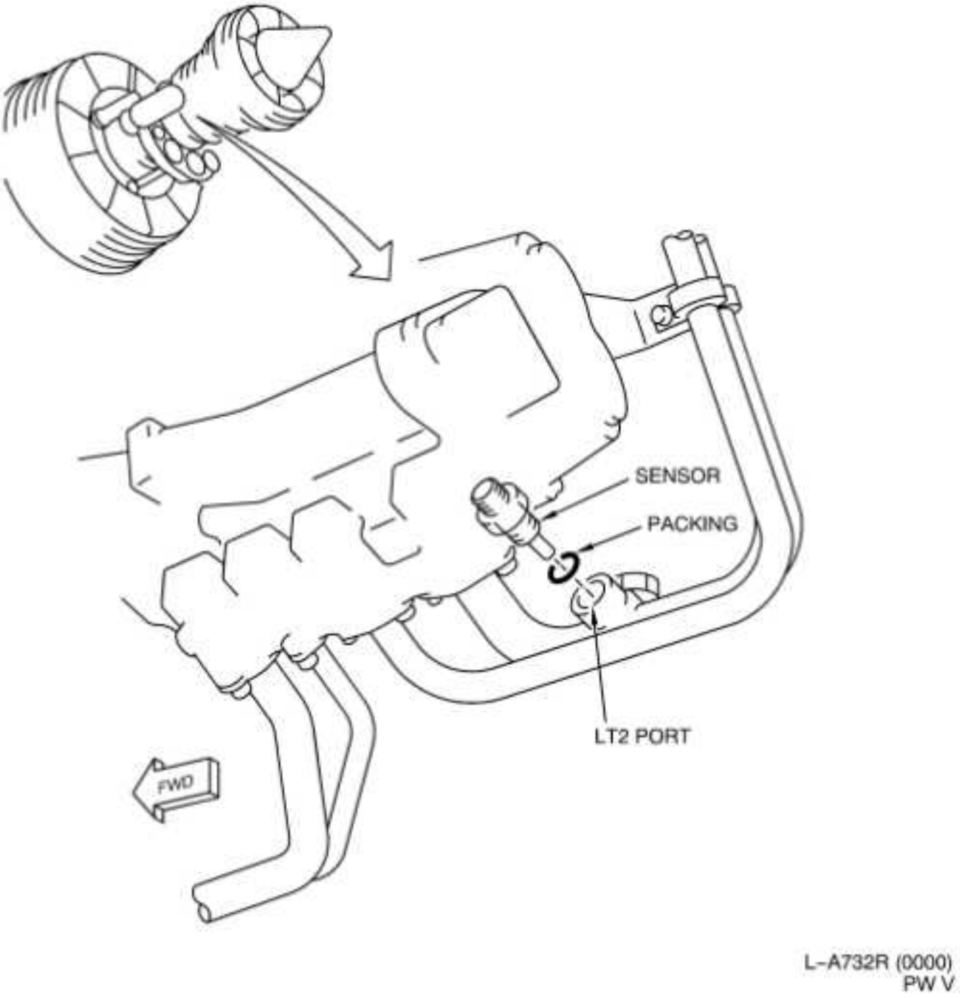
See Figure 401.

(1) Remove protective covers from electrical connector and LT2 port.

(2) Lubricate new packing with Oil (P03-001) and position packing on sensor.

(3) At LT2 port on No. 3 bearing scavenge line, install oil temperature sensor with new packing. Torque temperature sensor 90 - 100 lb-in. (10.2 - 11.3 N.m).

(4) Connect electrical connector DT597 to sensor. Tighten connector fingertight plus one-eighth turn.


SENSOR
PACKING
LT2 PORT
FWD
L−A732R (0000)
PW V

No. 3 Bearing Oil Temperature Sensor
Figure 401
(Task 71−00−61−450−033)

POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−28

Task 71−00−61−450−034:

1. Install IDG, Starter, And Hydraulic Pump Heat Shields

A. Equipment And Materials Required − None

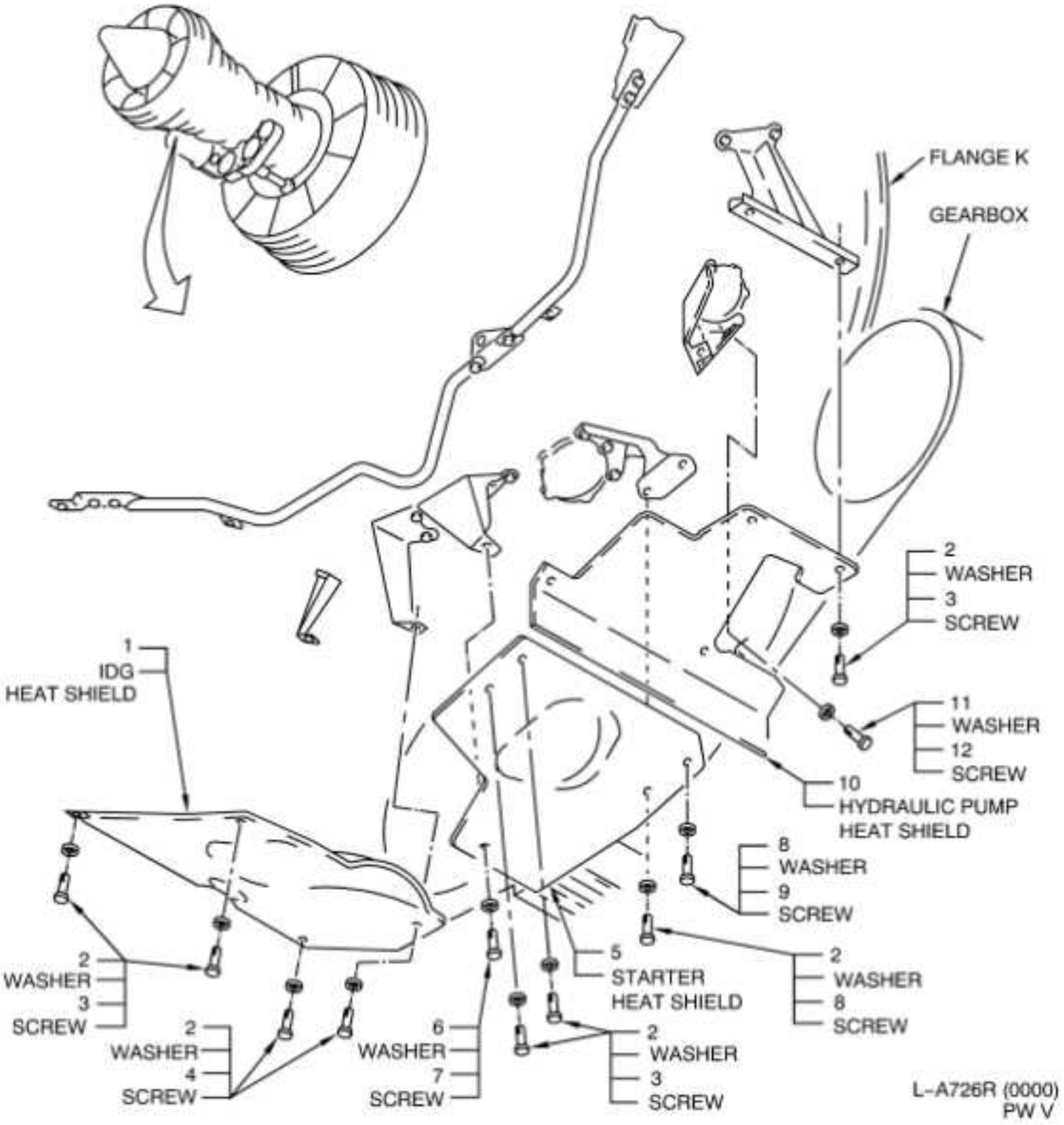
B. Procedure

See Figure 401.

(1) Attach IDG heat shield (401/1) to support brackets using two sets of screws (401/3, 401/4) and four washers (401/2). Torque screws to 50 − 70 lb−in. (5.65 − 7.91 N.m).

(2) Attach starter heat shield (401/5) to support brackets using screws (401/3, 401/7, 401/8) and washers (401/2, 401/6). Torque screws to 50 − 70 lb−in. (5.65 − 7.91 N.m).

(3) Attach hydraulic pump heat shield (401/10) to support brackets using screws (401/3, 401/12) and washers (401/2, 401/11). Torque screws to 50 − 70 lb−in. (5.65 − 7.91 N.m).


FLANGE K
GEARBOX
2 WASHER
3 SCREW
1 IDG HEAT SHIELD
11 WASHER
12 SCREW
10 HYDRAULIC PUMP HEAT SHIELD
8 WASHER
9 SCREW
2 WASHER
3 SCREW
5 STARTER HEAT SHIELD
2 WASHER
8 SCREW
2 WASHER
4 SCREW
6 WASHER
7 SCREW
2 WASHER
3 SCREW
L−A726R (0000)
PW V

IDG, Starter, And Hydraulic Pump Heat Shield
Figure 401
(Task 71−00−61−450−034)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL - MAIN GEARBOX - INSTALLATION-29

Task 71-00-61-450-035:

1. Install Starter Control Valve Cooling Tube And Hose

   A. Equipment And Materials Required - None

   B. Procedure

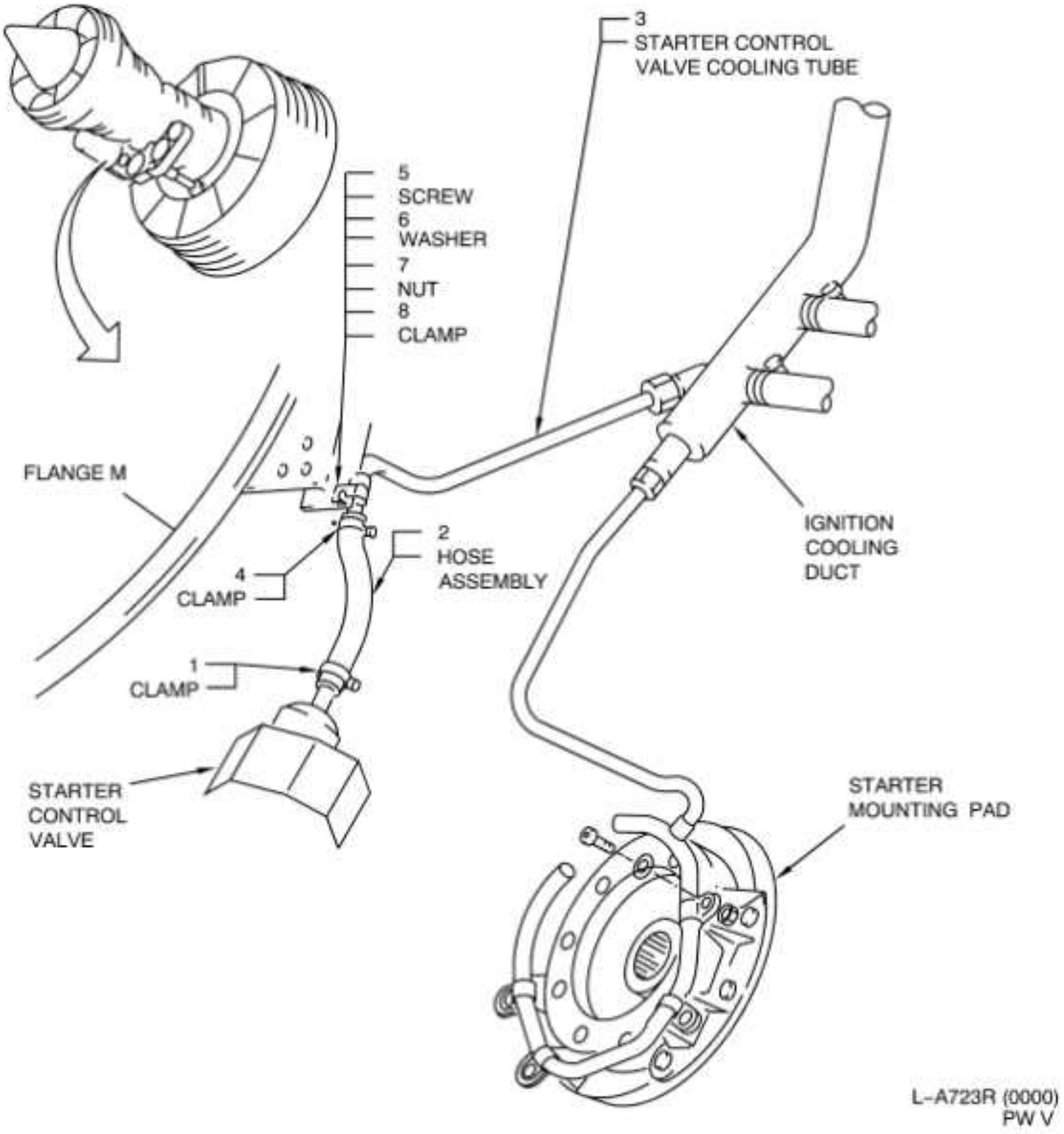
   See Figure 401.

   (1) Connect clamp (401/1) securing lower end of cooling hose (401/2) to starter control valve. Torque clamp to 25 - 30 lb-in. (2.83 - 3.39 N.m).

   (2) Connect cooling hose (401/2) to starter control valve cooling tube (401/3) with clamp (401/4). Torque clamp to 25 - 30 lb-in. (2.83 - 3.39 N.m).

   (3) Attach upper end of starter control valve cooling tube (401/3) to ignition cooling duct. Torque coupling nut 400 - 500 lb-in. (50.9 - 56.5 N.m).

   (4) Attach cooling hose (401/2) and starter control valve cooling tube (401/3) to bracket on Flange M using clamp (401/5), washer (401/6), screw (401/7), and nut (401/8). Torque nut 20 - 25 lb-in. (2.3 - 2.8 N.m).


3
STARTER CONTROL
VALVE COOLING TUBE
5
SCREW
6
WASHER
7
NUT
8
CLAMP
FLANGE M
2
HOSE
ASSEMBLY
4
CLAMP
IGNITION
COOLING
DUCT
1
CLAMP
STARTER
CONTROL
VALVE
STARTER
MOUNTING PAD
L−A723R (0000)
PW V

Starter Control Valve Cooling Tube And Hose
Figure 401
(Task 71−00−61−450−035)

POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−30

Task 71−00−61−450−036:

1. Install EEC Alternator (PMA) Cooling Hose And Tubes

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P06−002	Petrolatum, White

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIG.	ITEM
Lockwire, MS20995C32				

B. Procedure

See Figure 401.

(1) Lubricate packings (401/1) with Petrolatum (P06−002).

(2) Install connector coupling body on ignition cooling duct (401/2) and coupling nut on TCC duct.

(3) Install washer and packing in coupling nut, install washer and packing on coupling body using lubricated packings to retain washers.

(4) Secure TCC duct and ignition cooling duct (401/2) together with snap retainer.

(5) Engage connector body and coupling nut threads, then torque to 8.1 − 9.9 lb−ft. (11.0 − 13.4 N.m) and lockwire.

NOTE: Connector consists of coupling body, coupling nut, two washers, and snap retainer.

(6) Attach ignition cooling duct (401/2) to bracket with clamp (401/3), screw (401/4), washer (401/5), and nut (401/6). Torque nut to 20 − 25 lb−in. (2.3 − 2.8 N.m).

(7) Connect ignition cooling duct (2) to tube (401/7) and tighten nut fingertight.

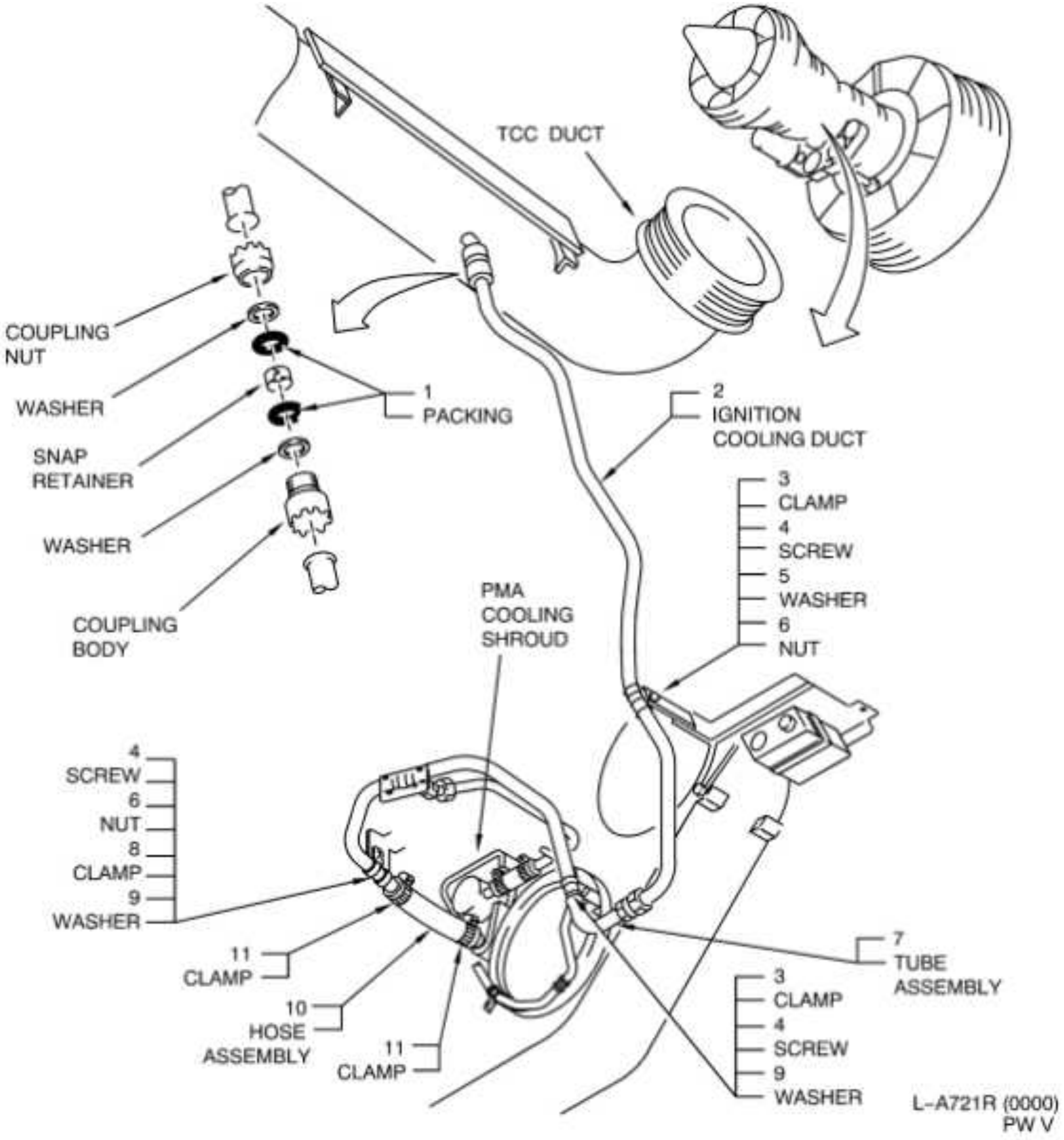
(8) Position clamp (401/8) near end of tube (401/7) and attach clamp to bracket with screw (401/4), washer (401/9), and nut (401/6). Torque nut to 20 − 25 lb−in. (2.5 − 2.8 N.m).

(9) Position clamp (401/3) on duct (401/2) near bracket on starter pad, and attach clamp to bracket with screw (401/4) and washer (401/9). Torque screw 22 − 25 lb−in. (2.5 − 2.8 N.m).

(10) Torque tube coupling nut joining duct (401/2) and tube (401/7) to 480 − 720 lb−in. (54.2 − 81.3 N.m).

(11) Connect hose (401/10) to tube (401/7) with clamp (401/11) to 25 − 30 lb−in. (2.8 − 3.4 N.m).

(12) Connect hose (401/10) to PMA cooling shroud with clamp (401/11). Torque clamp to 25 − 30 lb−in. (2.8 − 3.4 N.m).


TCC DUCT
COUPLING NUT
WASHER
SNAP RETAINER
WASHER
COUPLING BODY
1 PACKING
2 IGNITION COOLING DUCT
3 CLAMP
4 SCREW
5 WASHER
6 NUT
PMA COOLING SHROUD
4 SCREW
6 NUT
8 CLAMP
9 WASHER
11 CLAMP
10 HOSE ASSEMBLY
11 CLAMP
7 TUBE ASSEMBLY
3 CLAMP
4 SCREW
9 WASHER
L-A721R (0000)
PW V

EEC Alternator (PMA) Cooling Hose And Tubes
Figure 401
(Task 71−00−61−450−036)

Previous Pageblock Return to Previous Menu Next Pageblock

POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−31

Task 71−00−61−450−037:

1. Install Starter Cooling Tubes

A. Equipment And Materials Required − None

B. Procedure

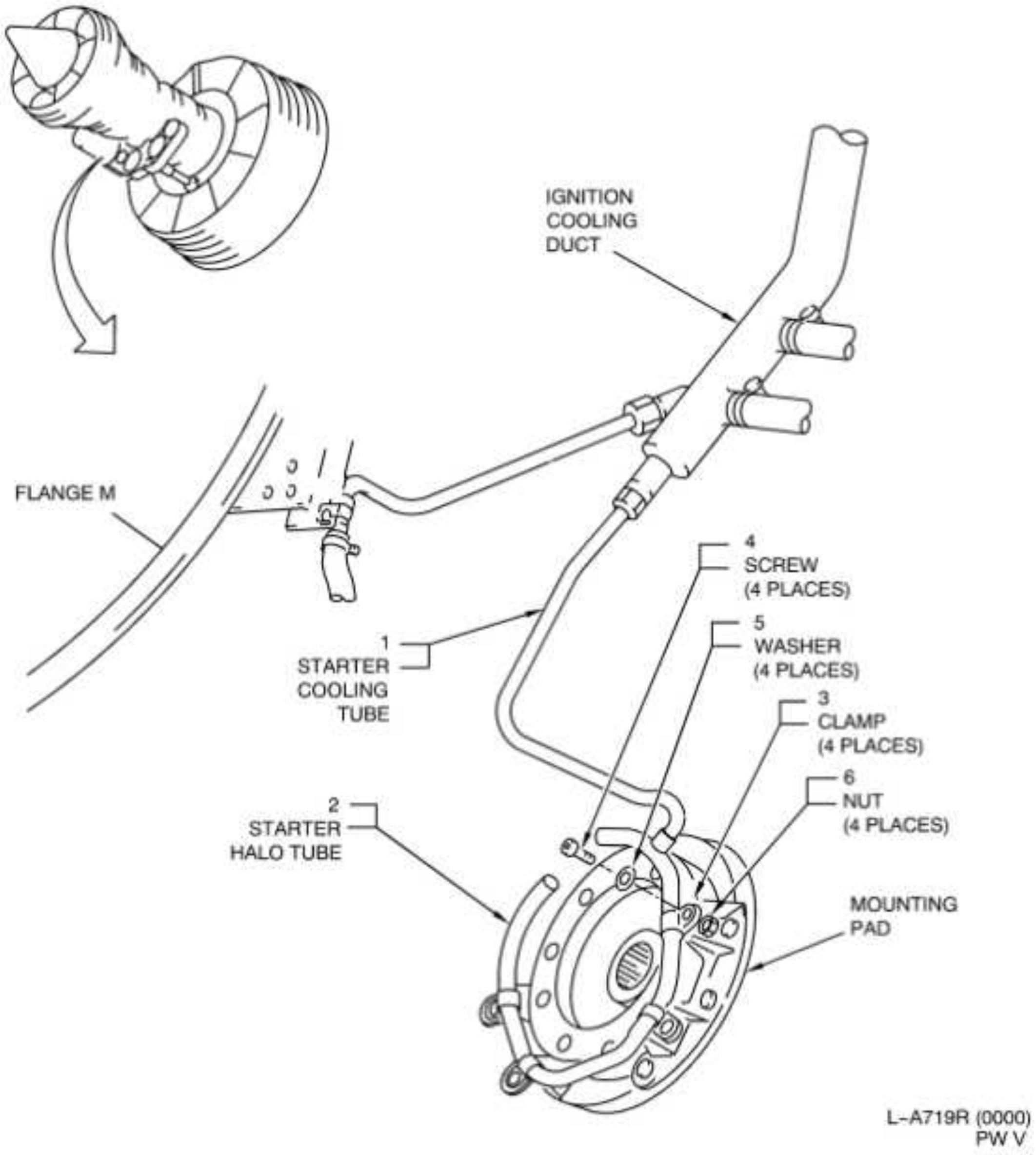
See Figure 401.

(1) Install coupling nut on upper end of starter cooling tube (401/1) to ignition cooling duct. Tighten coupling fingertight.

(2) Install starter halo cooling tube (401/2) to mounting brackets using clamps (401/3), screws (401/4), washers (401/5), and nuts (401/6). Torque nuts to 20 − 25 lb−in. (2.32 − 2.82 N.m).

(3) Connect starter cooling tube (401/1) coupling to nipple on starter halo cooling tube. Torque coupling 450 − 500 lb−in. (50.9 − 56.5 N.m).

(4) Torque starter cooling tube (401/1) coupling nut at ignition cooling duct to 450 − 500 lb−in. (50.9 − 56.5 N.m).


IGNITION
COOLING
DUCT
FLANGE M
4
SCREW
(4 PLACES)
5
WASHER
(4 PLACES)
1
STARTER
COOLING
TUBE
3
CLAMP
(4 PLACES)
6
NUT
(4 PLACES)
2
STARTER
HALO TUBE
MOUNTING
PAD
L-A719R (0000)
PW V

Starter Cooling Tubes
Figure 401
(Task 71−00−61−450−037)

POWER PLANT GENERAL - MAIN GEARBOX - INSTALLATION-32

Task 71-00-61-450-038:

1. Install Oil Quantity Transmitter Cooling Tube

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P06-002	Petrolatum, White

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Lockwire, MS20995C32				

B. Procedure

See Figure 401.

(1) Lubricate packings (401/1) with White Petrolatum (P06-002).

(2) Install connector coupling body on oil quantity transmitter tube (401/2) and coupling nut on LH TRC valve.

(3) Install washer and packing in coupling nut, install washer and packing on coupling body using lubricated packings to retain washers.

(4) Secure oil quantity transmitter tube and LH TRC valve together with snap retainer.

(5) Engage connector body and coupling nut threads, then tighten fingertight.

NOTE: Connector consists of coupling body, coupling nut, two washers, and snap retainer.

(6) Attach oil quantity transmitter tube (401/2) to two brackets using clamps (401/3), screws (401/4), washers (401/5), and nuts (401/6). Torque nut to 20 - 25 lb-in. (2.26 - 2.82 N.m).

POWER PLANT GENERAL − MAIN GEARBOX − INSTALLATION−32

(7) Connect hose (401/7) to forward end of oil quantity transmitter tube (401/2) and to cooling air supply tube using two clamps (401/8, 401/9).

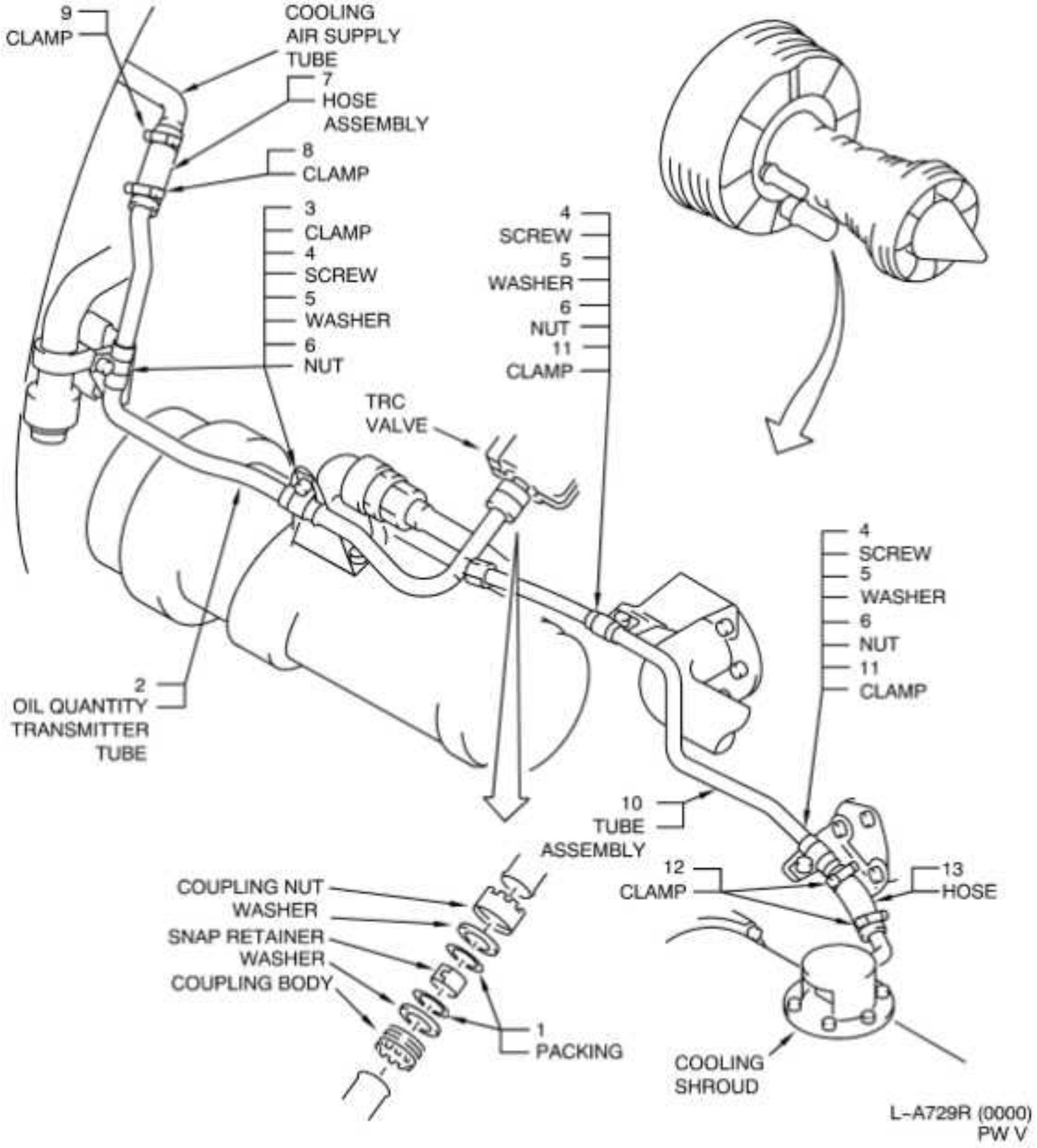
(8) Torque connector body (in step (5)) to 5.4 − 6.6 lb−ft. (7.3 − 8.9 N.m) and lockwire.

(9) Loosely connect tube (401/10) coupling nut to nipple on oil quantity transmitter tube.

(10) Attach tube (401/10) to brackets using clamps (401/11), screws (401/4), washers (401/5), and nuts (401/6). Torque nuts to 20 − 25 lb−in. (2.26 − 2.82 N.m).

(11) Torque tube (401/10) coupling nut to 450 − 500 lb−in. (50.84 − 56.49 N.m).

(12) Connect hose (401/13) to tube (401/10) and to oil quantity transmitter cooling shroud using two clamps (401/12). Torque clamps to 25 − 30 lb−in. (2.82 − 3.39 N.m).


9
CLAMP
COOLING
AIR SUPPLY
TUBE
7
HOSE
ASSEMBLY
8
CLAMP
3
CLAMP
4
SCREW
5
WASHER
6
NUT
4
SCREW
5
WASHER
6
NUT
11
CLAMP
TRC
VALVE
4
SCREW
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WASHER
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NUT
11
CLAMP
2
OIL QUANTITY
TRANSMITTER
TUBE
10
TUBE
ASSEMBLY
COUPLING NUT
WASHER
SNAP RETAINER
WASHER
COUPLING BODY
1
PACKING
12
CLAMP
13
HOSE
COOLING
SHROUD
L-A729R (0000)
PW V

Oil Quantity Transmitter Cooling Tube
Figure 401
(Task 71-00-61-450-038)

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Pratt & Whitney

PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

Tab Separator - Power Plant General - Fan Case

List of Effective Pages - Power Plant General - Fan Case

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	05/ 06		JUN 15/04
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REMOVAL-07	302		OCT 15/91

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REVISION NO. 82 DATED DECEMBER 15, 2006

HIGHLIGHTS − POWER PLANT GENERAL − FAN CASE

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The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 79 DATED MARCH 15, 2006

HIGHLIGHTS - POWER PLANT GENERAL - HIGH PRESSURE COMPRESSOR (HPC)

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
71-00-35 REMOVAL-03	301	Revised to add a new caution for hoses. (IEN05GC003)	ALL
71-00-35 INSTALL-03	401	Revised to add a new caution for hoses. (IEN05GC003)	ALL

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Task 71-00-35-450-011: Install IDG Cooling Tubes		401	
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Tab Separator - Power Plant General - Diffuser And Combustor

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REVISION NO. 79 DATED MARCH 15, 2006

HIGHLIGHTS - POWER PLANT GENERAL - DIFFUSER AND COMBUSTOR

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
71-00-41 REMOVAL-04	301	Revised to add a new caution for hoses. (IEN05GC003)	ALL
71-00-41 INSTALL-04	401	Revised to add a new caution for hoses. (IEN05GC003)	ALL

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Tab Separator - Power Plant General - High Pressure Turbine (HPT)

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REVISION NO. 70 DATED DECEMBER 15, 2003

HIGHLIGHTS − POWER PLANT GENERAL − HIGH PRESSURE TURBINE (HPT)

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Tab Separator - Power Plant General - Low Pressure Turbine (LPT)

List of Effective Pages - Power Plant General - Low Pressure Turbine (LPT)

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Tab Separator - Power Plant General - Turbine Exhaust Case

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REVISION NO. 70 DATED DECEMBER 15, 2003

HIGHLIGHTS − POWER PLANT GENERAL − TURBINE EXHAUST CASE

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
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Tab Separator - Power Plant General - Main Gearbox

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PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 82 DATED DECEMBER 15, 2006

HIGHLIGHTS - POWER PLANT GENERAL - MAIN GEARBOX

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
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71-00-61 INSTALL-02	401	Revised PWA 586 to PWA 36246. (IEN05KC109A)	ALL

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ENGINE GENERAL - DESCRIPTION/OPERATION-00

Task 72-00-00-990-005:

1. General.

See Figure 1.

NOTE: If not already familiar with fundamentals and theory of the turbofan engine, readers should refer to: The Aircraft Gas Turbine Engine and Its Operation. P&W Operating Instruction (O.I.) 200. Copies of this document have been provided to commercial operators of P&W engines.

A. Engine Specifications

(1) General

Type	Axial-Flow, gas turbine turbofan
Number of Combustion Chambers/type	One/Annular
Type of Compressor	Two spool, 16 stage compressor, consisting of a 5 stage low pressure compressor group (includes high pressure compressor group.
Type of Turbine	6 stage, split, having a 2 stage high pressure turbine group and a 4 stage low pressure turbine assembly.
(Engine Weight Accessories Incl.)	9200 pounds (4173 kg) (approx.)
Engine Length	133 inches (3378 mm) (approx.)
Engine Inlet Diameter	96.00 inches (2438 mm) (approx.)

(2) Ignition System

Ignition Exciter	Bendix
Igniter Plugs	Champion, Auburn
Exciter-to-Igniter Plug Cables	Bendix

(3) Lubrication System

Oil Specification	PWA-521 Type II (SB 238).
Oil System Capacity Fully Serviced (including Oil Tank)	Approximately 40 U.S. Quarts (37.85 liters)
Oil Tank Capacity Manual Fill	Approximately 34.8 U.S. Quarts (17.79 liters)
Pressure Fill	Approximately XX U.S. Quarts (XX liters)
Lubrication And Scavenge Oil Pump	Sundstrand
Air/Oil Heat Exchanger And Valve	Hughes - Treitler, Hamilton Standard

(4) Fuel System

Fuel/Oil Cooler	Serck
Fuel/Oil Cooler Bypass Valve	Parker - Hannifin
Fuel Specification	PWA 522 (SB 2016)
Electronic Engine Control (EEC)	Hamilton Standard
Fuel Distribution Valve	Hamilton Standard
Fuel Pump TRW Fuel Pump Filter Differential Pressure Switch	Custom Component Switches
Fuel Injector And Support	Pratt And Whitney
Fuel Metering Unit	Hamilton Standard

(5) Air System

Stator Vane Actuator Intercompressor (2.5)	Hamilton Standard
Bleed Actuator Turbine Case Cooling	Hamilton Standard
Air Valve Actuator Turbine Case Cooling Air (Shutoff) Valve	Parker Hannifin
(HPT)	Parker Hannifin
Turbine Case Cooling Air (Shutoff) Valve (LPT)	Parker Hannifin
Compressor Heating Air/Start Bleed Valve Solenoid	Midland Ross
Compressor Heating Air/Turbine Vane Cooling Air Valve Solenoid	Midland Ross
Compressor Rotor Heating Air Valves	Midland Ross
2.9 Start Bleed Valves	Midland Ross
Turbine Vane Cooling Air Valves	Midland Ross

B. Directional References

(1) Unless otherwise specified, right and left, clockwise and counterclockwise, upper and lower, and similar directional references apply to engine as viewed from the rear (exhaust end) with engine in a horizontal position and with main accessory section at bottom of engine. The rotation of rotor assemblies is clockwise.

C. Engine Flange Identification.
See Figure 2.

(1) Engine flanges are identified in alphabetical and alphabetical/numerical sequence from front to rear.

D. Borescope Ports.
See Figure 3, Sheets 1 and 2.

(1) Inspection of internal areas of the engine is facilitated by 16 borescope access ports (AP−11 port optional) at specific locations around the engine. These ports permit visual analysis of part condition in areas not otherwise accessible without engine disassembly.

E. Designation Of Engine Stations.
See Figure 4.

(1) Certain specific points along the engine axial profile are identified by station number to provide ease of reference for items such as component locations, test tapes, and sensor locations.

F. Engine Dimensions

(1) The engine without airframe installations is approximately 133 inches (3378 mm) long and 97 inches (2464 mm) across the largest diameter. The engine weight is approximately 9200 pounds (4173 kg).

G. Engine Description

(1) The engine is a two−spool axial flow turbofan engine of high compression and bypass ratio, having 16 compressor stages, an annular combustion chamber, and 6 turbine stages. the low pressure system consists of a five−stage Low Pressure Compressor (LPC) and a four−stage Low Pressure Turbine (LPT) and is mechanically independent of the high pressure system consisting of the 11 stage High Pressure Compressor (HPC) and twostage High Pressure Turbine (HPT). The engine cases, when bolted together, form a structurally rigid support for the engine, with internal parts supported through struts and bearings. The engine mounts are located at the 12 o'clock positions on the intermediate case and turbine exhaust case.

(2) The 1st stage of the Low Pressure Compressor (LPC) rotor, referred to as the "fan", is larger in diameter then the other Compressor stages, and produces two separate airstreams. The primary (inner) airstream passes through the engine gaspath, where is is compressed and employed in the generation of heated gases which provide propulsive force. The secondary (outer) airstream is compressed by the fan and ducted outside the engine, adding to the propulsive force.

H. Main And Angle Gearbox

(1) Main gearbox power to drive the engine and aircraft supplied accessories is obtained from the High Pressure Compressor rotor (HPC). A towershaft in the intermediate case is geared to the front of the rotor.

(2) The towershaft drives the angle gearbox bevel gear set which transmits power to the main gearbox group through the gear−box driveshaft assembly. The angle gearbox is located in the intermediate case group completely enclosed between the fan exit case rear and the intermediate case OD wall.

(3) The main gearbox group incorporates drive pads for the engine fuel pump and fuel metering unit (tandem mounted), engine hydraulic pump(s), the starter, the integrated drive generator system. Provisions are also incorporated to per−mit hand cranking of the high compressor rotor to allow more complete inspection through the borescope ports.

(4) The gearbox engine accessories include an electronic engine control alternator, a lubrication and scavenge oil pump module and an oil filter housing.

I. Main Bearing Numbering And Description

(1) Main bearing locations are commonly referred to by number. Table 1 provides information on bearing location and type. Figure 5 illustrates bearing location.

Bearing No.	Location	Type
1	Low Pressure Compressor Turbine Shaft Coupling	Ball
1.5	Intermediate Case; Turbine Shaft Coupling	Roller
2	Intermediate Case; Rear Compressor Front Hub	Ball
3	Diffuser Case; Rear Compressor Rear Hub	Roller
4	Turbine Exhaust Case; Front Compressor Drive Turbine Shaft	Roller

Main Bearing Identification
Table 1

(2) The No. 1 bearing is a thrust bearing for the Low Pressure Compressor (LPC) and consists of a split inner race, angular contact ball bearing mounted aft of the fan rotor in a relatively cool area. Lubrication and cooling oil is supplied under the inner race and introduced to the bearing through the inner race split.

(3) The No. 1.5 bearing is a standard non-preloaded cylindrical roller bearing which radially supports the low pressure compressor drive turbine shaft coupling. It is mounted at the forward end of the intermediate case. Lubrication for the front seal and the bearing is provided by a single jet directed at the front of the seal plate. Lubrication for the rear seal plate is provided by use of an axial scoop.

(4) The No. 2 bearing is a thrust bearing for the High Pressure Compressor (HPC) and consists of a split inner race, angular contact ball bearing mounted forward of the rear compressor rotor. The lubrication features are similar to the No. 1 bearing.

(5) The No. 3 bearing is a preloaded cylindrical roller bearing mounted forward of the high pressure turbine. The preload to prevent skidding is mechanically applied by grinding the outer surface of the outer race elliptical and the inner surface of outer race round. Mounting this race in a round housing forces the inner

surface to assume an elliptical shape, thereby creating a two−point preload of the bearing. The retainer is a one piece inner land riding cage, silver plated. Cooling oil is fed under the race and lubrication is provided by splash oil from the seal plates and scoop.

(6) The No. 4 bearing is a standard non−preloaded cylindrical roller bearing mounted aft of the front compressor drive turbine. Lubrication features are similar to the No. 3 bearing.

J. Bearing Supports

(1) General

(a) The engine incorporates three main bearing support structures; both the low pressure and high pressure compressor rotors are supported at the front by the intermediate case structure. The high pressure compressor and high pressure turbine are supported by the diffuser case structure and the low pressure turbine is supported by the turbine exhaust case structure.

(b) All bearing support structures consists of a system of inner and outer cones or rings connected through the flow path by airfoil shaped struts.

(2) Intermediate Case Support

(a) The loads from the Nos. 1, 1.5 and 2 bearings are carried by the compressor intermediate case struts across the engine flowpath to the outer case.

(3) Diffuser And Combustion Case Support

(a) The inner section of the diffuser case provides structural support for the No. 3 bearing compartment and is connected radially to the outer section by 24 struts. Bearing loads are carried from the inner case through the struts to the outer case.

(4) Turbine Exhaust Case Support

(a) The inner cone section of the turbine exhaust case provides structural support for the No. 4 bearing compartment. Bearing loads are transferred to the outer case section through 15 radial struts.

K. Bearing Compartment Seal Pressurization.
See Figure 6.

(1) The main bearing carbon seals are pressurized by compressor air to ensure that oil is not permitted to enter the airstream as follows:

(a) No. 1, 1.5 and 2 bearing compartment. See Figure 6 (Sheets 1, 2 and 5).

1 The carbon seals in this area are dry face spring loaded seals.

2 The No. 1 and 2 bearing carbon seals are pressurized by station 2.5 low pressure compressor bleed air.

3 The No. 1.5 bearing carbon seals are pressurized by 9th stage HPC bleed air.

(b) No. 3 Bearing Compartment. See Figure 6 (Sheets 1 and 4).

1 The No. 3 bearing carbon seals are spring−loaded wet face carbon seals.

2 The carbon seals are pressurized by 12th stage HPC bleed air that has passed through an air/air heat exchanger located in the fan exit/intermediate case.

(c) No. 4 Bearing Compartment. See Figure 6 (Sheets 1 and 5).

1 The No. 4 bearing carbon seal is a dry face ring seal.

2 This carbon seal is pressurized by LPC station 2.5 air that enters the LPT shaft forward of the No. 1 bearing.

L. Lubrication System.
See Figure 7.

(1) General

(a) The oil system provides and distributes lubricating oil within specified temperature and pressure limits to the engine main shaft bearings, to the main and angle gearboxes and the accessory drives. It also provides for the return of the lubrication oil to the oil tank through a scavenge system.

(b) The oil system includes a main filter and four last chance screens, pressure relief and bypass valves to ensure flow is maintained, an air/oil heat exchanger and a fuel/oil cooler to maintain desired temperatures and a deoiler and deaerator to remove oil droplets from breather air and entrained air from scavenge oil respectively.

(c) The oil system includes an oil quantity transmitter, oil temperature sensing bulb , oil pressure transmitter, low oil pressure switch, oil filter differential pressure switch, and deaerator vent duct.

(d) The oil indicating system supplies the flight compartment with information regarding the engine oil system. The main gearbox deaerator vent duct provides means for routing breather air overboard.

(2) Pressure System

(a) Oil is supplied to the pressure pump from the tank and is delivered to the main oil filter. In the event of filter clogging, a bypass valve is provided to ensure uninterrupted flow. Instrumentation taps are installed at filter inlet and outlet to provide direct measurement to detect an increase in filter pressure drop. The filtered, pressure oil is then routed through an air/oil heat exchanger and a fuel/oil cooler to maintain desired oil temperature prior to distribution to the main shaft bearings and gearboxes. Each heat exchanger is equipped with a bypass valve which will ensure uninterrupted flow should either exchanger or cooler pressure drop become too high. In the event of an extremely low oil temperature (i.e., a cold start), a temperature bypass valve will bypass the engine fuel/oil cooler.

(b) Once the oil temperature has been regulated, the oil is distributed to the five (5) bearings and the main and angle gearbox. Prior to reaching the desired location, the oil is filtered again by last chance screens which are line replaceable units (lru). The oil is metered to each compartment by flow restrictors. These restrictors are required to maintain proper flow levels which tend to be elevated due to higher supply pressures inherent with a non−regulated system.

(3) Components

(a) Oil Quantity Transmitter

1 The oil quantity transmitter measures the oil quantity in the engine oil tank and is installed in the top of the tank, located on the left side of engine. Operating on 115 VAC the transmitter consists of a reed switch potentiometer and a float with an integral permanant magnet. The transmitter is not adjustable at field maintenance level.

(b) Oil Temperature Sensing Bulb

1 The oil temperature bulb senses the oil temperature down line from the engine fuel/oil cooler, and is located on the top aft portion of the engine fuel/oil cooler, on the right side of engine. Operating on 28VDC, the temperature sensor is a resistance−type bulb that consists of an element hermetically sealed in an insulating material within a housing.

(c) Oil Pressure Transmitter

1 The oil pressure transmitter is located above the forward end of the fuel flow meter on the right side of the engine. The oil pressure is measured before entering the main bearings. Operating on 28VDC the transmitter is a diaphragm type and is not adjustable at field level maintenance.

(d) Low Oil Pressure Switch

1 The low oil pressure transmitter is located above the aft end of the fuel flow transmitter on the right side of the engine and measures oil pressure before entering the main bearings. Operating on 29VDC the transmitter is a diaphragm type with dual contacts. It trips at 38 − 42 psi (262.0 − 289.6 kPa) when the engine is building up oil pressure and 34 − 38 psi (234.4 − 262.0 kPa) when losing oil pressure.

(e) Oil Filter Differential Pressure Switch

1 The oil filter differential pressure switch is located below the forward end of the engine/oil tank, on the left side of the engine. The switch measures the difference between the high pressure port and the low pressure port of the main oil filter. When the differential pressure across the main oil filter reaches 48 − 52 psi (330.9 − 358.5 kPa), the pressure switch diaphragm and mechanical linkage actuate the switch to the closed position. The circuit is completed and a caution light comes on, signaling filter element clogging. When pressure decreases to 38 − 42 psi (262.0 − 289.6 kPa) the caution light goes out.

(4) Scavenge System

(a) Oil collecting in the main bearing compartments and the gearboxes is returned to the oil tank by use of individual scavenge pumps which are located in the same module as the main oil pump. At the inlet to each pump is a chip detector. All scavenge oil returning to the tank via the scavenge system passes through a deaerator to remove the entrained air.

(5) Breather System

(a) Breather air, resulting from air leakage past the knife−edge and carbon seals, is routed from the Nos. 1, 1.5, 2 and 3 bearing compartments to the external deoiler on the gearbox front face.

(b) The No. 4 compartment has its breather air/scavenge oil returned to the tank via the scavenge pump for the No. 4 bearing. The entrained air is removed via the deaerator in the oil tank.

M. Engine Fuel And Control Systems.
See Figure 8.

(1) The function of the PW4000 engine control system is to provide automatic regulation of engine power settings when initiated by the pilot. The system also provides diagnostic information which enhances aircraft line maintenance and dispatch readiness by identifying faulty engine components.

(2) The engine control system consists of a dual channel, full authority digital electronic engine control (EEC) which interfaces with aircraft and engine control components as illustrated in Figure 8. Power to each control channel is provided by a dedicated, engine gearbox−driven alternator. All essential control system input sensors and output actuators are also dual redundant providing high operational reliability.

(3) The system is comprised of individually part−numbered components mounted on the engine. The components are classified into the following functional groups.

(a) Engine fuel and control components.

(b) Compressor bleed, compressor stator vane control, compressor and turbine active clearance control, and turbine vane cooling components.

(c) Oil system components (includes engine and aircraft IDG air/oil heat exchangers).

(d) An instrumentation package, available as optional equipment, for engine condition monitoring and diagnostic purposes.

(4) All the components either provide inputs to the EEC or implement the EEC electrical output command signals. All output devices use either hydraulic or pneumatic (muscle) pressure. Hydraulic pressure is supplied by the engine fuel metering unit. Pneumatic pressure is supplied by the engine compressor.

(5) Referring to Figure 8, the aircraft fuel system supplies fuel to the engine fuel pump at the required inlet conditions. The engine Pump supplies fuel to the fuel metering unit for control of engine fuel flow, and also to the Engine/IDGS fuel/oil cooler for the purposes of fuel de−icing and engine oil cooling. The fuel metering unit (FMU) contains a torque motor which responds to commands from the EEC to position the metering valve. Metered fuel from the fuel metering unit is delivered to the fuel distribution valve, which divides the fuel equally among eight manifolds, each of which feed three single−orifice fuel injectors. Fuel shut−off and pressurization are accomplished with an electrical signal from the aircraft pilot stand to the fuel shutoff motor on FMU.

(6) The EEC provides the full range of control required to modulate engine fuel flow, high compressor stator vanes, low and high turbine case cooling, engine air/oil cooling, and 2.5 compressor bleed flow. These functions are all provided by torque motor controlled hydraulic actuators.

(7) To ensure reliability of the system, redundant torque motors and feedback elements are used. Fuel pump discharge pressure, filtered through a fine wash−flow filter in the fuel metering unit, provides hydraulic pressure for the actuators.

(8) The electronic control schedules discrete signals for solenoid on−off operation to control the IDGS air/oil cooler override and the fuel/oil cooler bypass valve. The compressor starting bleeds, high compressor active clearances, and high turbine blade and vane cooling are pneumatically controlled by solenoids.

(9) Information supplied to the EEC by the aircraft includes throttle position, service bleed status, altitude, and total air pressure and temperature at engine inlet. Engine−mounted sensors provide the EEC with measurements of engine temperatures, pressures, and speeds.

(10) The electronic engine control provides digital data by dual data busses for use by the aircraft.

(11) The system provides simplified engine operation procedures either with or without the aircraft autothrottle. The control of pilot−selected thrust settings, coupled with aircraft thrust setting procedures and cockpit displays provides an integrated system which greatly simplifies the task of aircraft thrust management. This electronic engine control system requires no trimming.

N. Ignition System

(1) The ignition system consists of two independent exciters, two high−tension leads and two igniters. The exciters are designed for 4 joule continuous duty operation. Each exciter is AC powered and fires one recessed−gap spark igniter through an air−cooled steel conduit high−tension lead. Each exciter is contained in a separate housing and mounted on vibration isolators that attach to bracket on main gearbox.

(2) Ignition exciter spark repetition rate is a minimum of one spark per second at 115 VAC, 400 HZ. The open circuit output voltage of each exciter is nominally 24KV.

(3) The complete ignition system is capable of open−circuit operation (igniters quenched) when operated to a continuous duty cycle.

O. Compressor Stator Vane Control System.
See Figure 9.

(1) The variable vane system provides optimum engine performance throughout the engine operating envelope by varifing compressor airflow.

(2) Variable geometry stator vanes are incorporated on the inlet guide vanes and the 5th, 6th and 7th stages of the high pressure compressor. Stator vane actuator position is scheduled as a function of low rotor speed (N1), high rotor speed (N2) and engine inlet total temperature (T2). The Electronic Engine control interfaces with the stator vane actuator through a pilot valve positioned by a dual coil torque motor. Stator vane actuator position is sensed by dual, temperature compensated, linear variable differential transformers (LVDT) and fed back to the Electronic Engine Control.

(3) The pilot valve, torque motor and LVDT's are integral with the stator vane actuator. The actuator is powered by hydraulic pressure supplied by the fuel pump. The relative scheduling of the four stator vane stages is controlled by a fixed geometry linkage driven by the stator vane actuator. The actuator piston linear motion is transmitted to the variable vanes through a mechanical linkage which includes one bellcrank, four adjustable links (one per stage), four unison rings (one per stage), and 230 connector links (one per vane).

(4) At low engine RPM the variable vanes are positioned in the closed direction allowing minimal airflow through the compressor. At high engine RPM the variable vanes are open allowing maximum airflow through the compressor. The vanes begin to close if an impending surge is detected by the EEC. In the event of loss of the electrical signal to the actuator the system is designed to open the vanes.

P. 2.5 Bleed System.
See Figure 10.

(1) The 2.5 bleed system provides increased compressor stability during starting, transient and reverse thrust operation.

(2) The Electronic Engine Control (EEC) modulates the 2.5 bleed valve actuator to a schedule determined by thrust lever angle, low rotor speed (N1), high rotor speed (N2), mach number, engine inlet total temperature (T2) and altitude. The actuator piston linear motion is transmitted by mechanical linkage and a series of cams and rollers to position the 360 degree translating ring type 2.5 bleed valve.

(3) During engine start the bleed valve is translated to the full open position venting low pressure compressor discharge (4th stage compressor) air into the fan stream. The valve is fully open at idle. As engine power is increased the valve is modulating to its fully closed position. It is commanded to its full open position during rapid engine decelerations, reverse thrust operation or if an impending surge is detected.

(4) The EEC interfaces with the intercompressor (2.5) bleed actuator through a pilot valve positioned by a redundant coil torque motor. Intercompressor (2.5) bleed actuator position is sensed by dual rotational variable transformers (RVT) and fed back to the EEC. The pilot valve, torque motor and RVT's are integral with the intercompressor (2.5) bleed actuator assembly. The actuator is powered by hydraulic pressure supplied by the fuel pump. In the event of loss of electrical signal to the actuator the system is designed to open the 2.5 bleed valve.

Q. 2.9 Bleed System.
See Figure 11.

(1) The two 9th stage compressor bleeds, (compressor bleed control system) provide increased compressor stability during starting and transient operation. The bleeds are controlled as a function of high rotor speed (N2) and engine inlet total temperature (T2). The Electronic Engine Control (EEC) interfaces with the compressor bleed valves through two redundant coil solenoid valve assemblies. The two solenoid valves are remotely mounted as part of a single assembly.

(2) During most of the engine start cycle, both 9th stage compressor bleeds are commanded open, venting 9th stage compressor air into the fan stream. Both bleeds close at approximately two percent N2 below idle. The start 2.9 bleed (right bleed) remains closed during all engine operation. The stability 2.9 bleed (left bleed) is opened for a maximum of two seconds if the engine is decelerated to below eighty−one percent N2 and is also opened if an impending engine surge is detected.

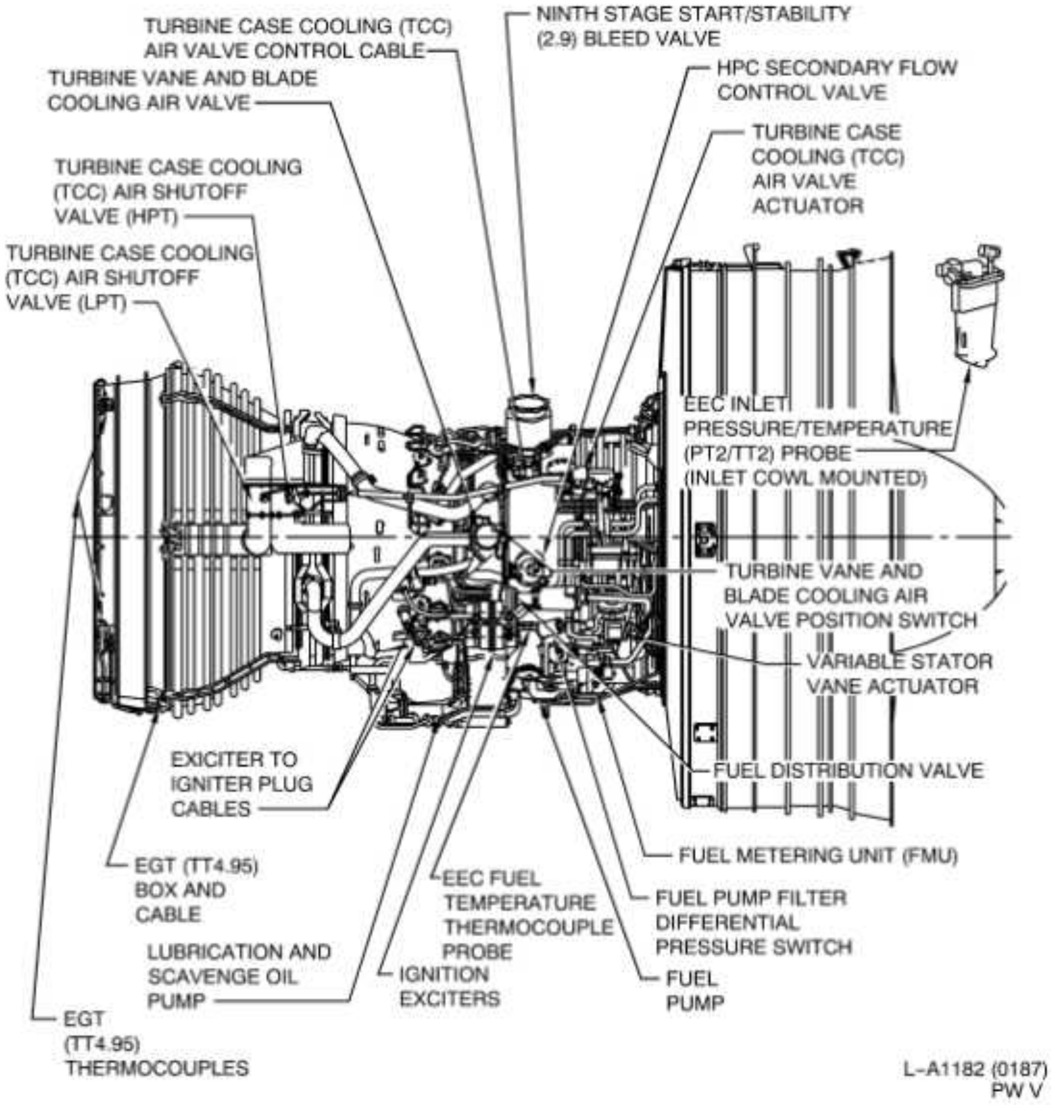
(3) The 9th stage bleed valves are two position (open/closed) poppet design valves which are spring loaded open. The poppets are closed by compressor discharge pressure routed through the EEC controlled solenoid valves.

R. Turbine Case Cooling.
See Figure 12.

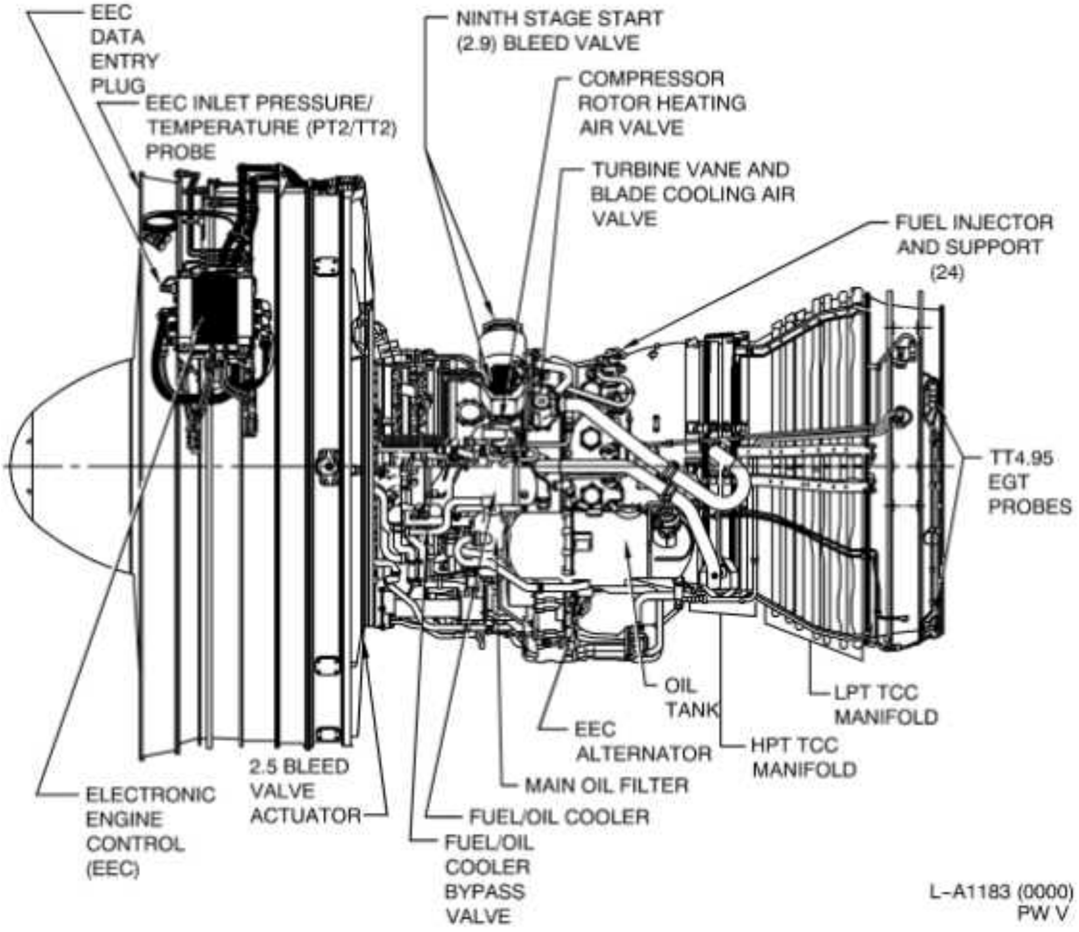
(1) The exterior surfaces of the high and low pressure turbine cases are cooled with engine fan discharge air to control turbine blade tip clearance for performance improvement. The turbine case cooling actuator position is scheduled as a function of altitude and

high rotor speed (N2). The electronic engine control (EEC) interfaces with the turbine case cooling actuator through a pilot valve positioned by a redundant coil torque motor. Turbine case cooling actuator position is sensed by dual linear variable differential transformers (LVDT) and fed back to the EEC.

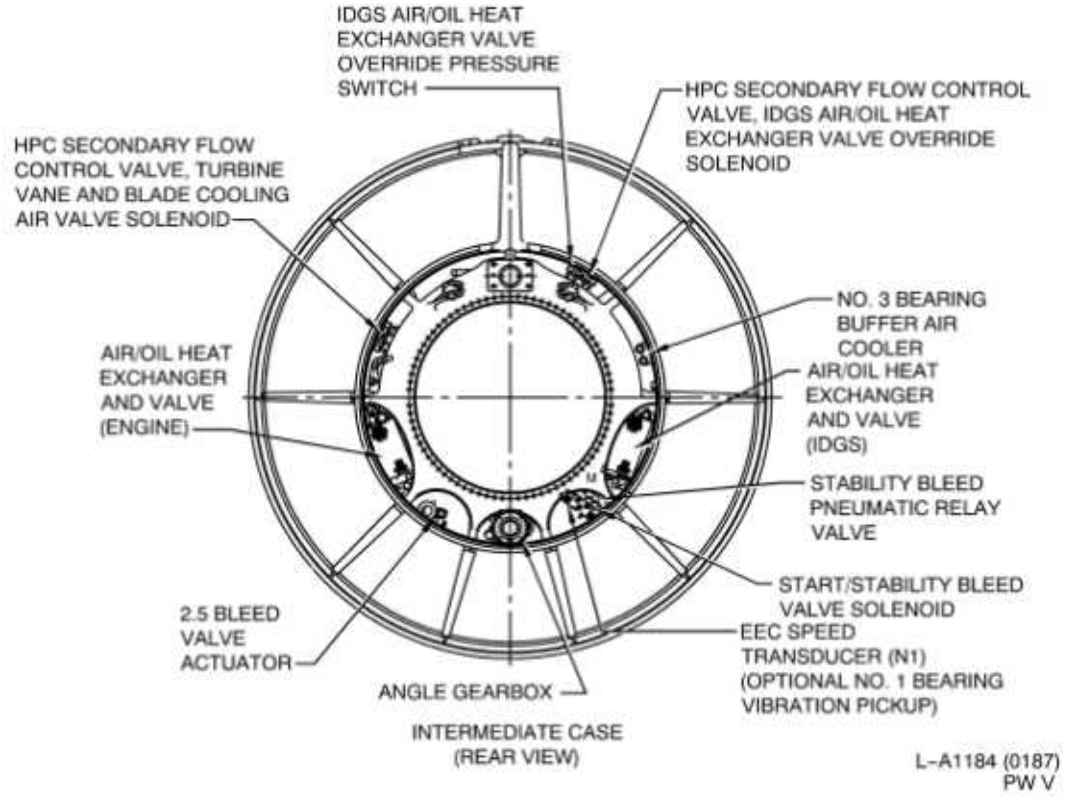
(2) The pilot valve, torque motors and LVDT's are integral with the turbine case cooling actuator. The actuator is powered by hydraulic pressure supplied by the fuel pump. The linear motion of the actuator piston is transmitted to the high and low pressure turbine case cooling air valves by a push−pull cable. The high and low pressure turbine case cooling air valves (one each) are mechanically actuated, fully modulated spring loaded closed butterfly valves mounted in tandem with a common inlet. The relative schedule of each valve is controlled by a single fixed geometry mechanical linkage which starts to open the low pressure turbine case cooling air shut−off valve before the high pressure turbine case cooling air shut−off valve starts to open. In the event of loss of electrical power, hydraulic pressure or mechanical connection, the system is designed to close the cooling air valves.


TURBINE CASE COOLING (TCC) AIR VALVE CONTROL CABLE
NINTH STAGE START/STABILITY (2.9) BLEED VALVE
TURBINE VANE AND BLADE COOLING AIR VALVE
HPC SECONDARY FLOW CONTROL VALVE
TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
TURBINE CASE COOLING (TCC) AIR SHUTOFF VALVE (HPT)
TURBINE CASE COOLING (TCC) AIR SHUTOFF VALVE (LPT)
EEC INLET PRESSURE/TEMPERATURE (PT2/TT2) PROBE (INLET COWL MOUNTED)
TURBINE VANE AND BLADE COOLING AIR VALVE POSITION SWITCH
VARIABLE STATOR VANE ACTUATOR
FUEL DISTRIBUTION VALVE
EXCITER TO IGNITER PLUG CABLES
FUEL METERING UNIT (FMU)
EGT (TT4.95) BOX AND CABLE
EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
FUEL PUMP FILTER DIFFERENTIAL PRESSURE SWITCH
LUBRICATION AND SCAVENGE OIL PUMP
IGNITION EXCITERS
FUEL PUMP
EGT (TT4.95) THERMOCOUPLES
L-A1182 (0187)
PW V

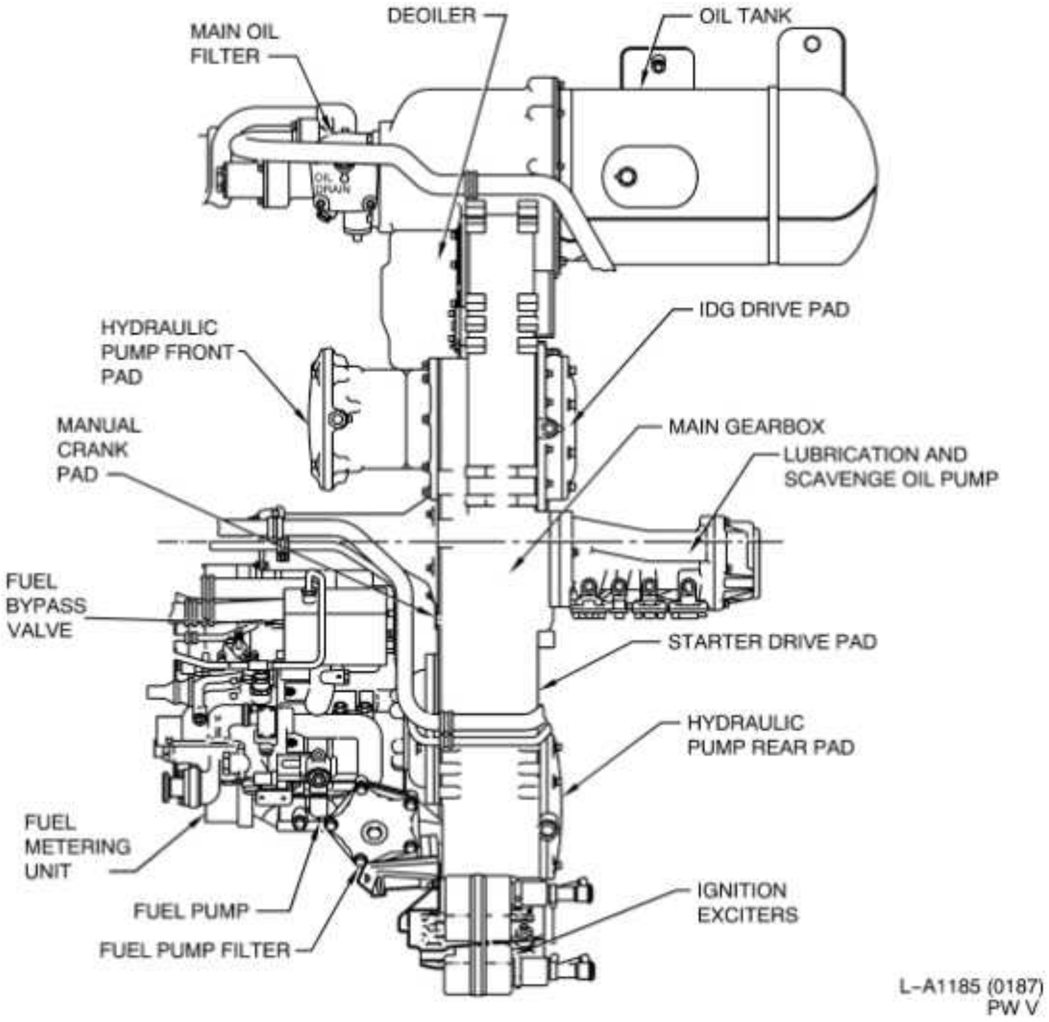
Engine External Components (Right Side)
Figure 1 (Sheet 1)
(Task 72-00-00-990-005)


EEC DATA ENTRY PLUG
EEC INLET PRESSURE/ TEMPERATURE (PT2/TT2) PROBE
NINTH STAGE START (2.9) BLEED VALVE
COMPRESSOR ROTOR HEATING AIR VALVE
TURBINE VANE AND BLADE COOLING AIR VALVE
FUEL INJECTOR AND SUPPORT (24)
TT4.95 EGT PROBES
OIL TANK
LPT TCC MANIFOLD
EEC ALTERNATOR
HPT TCC MANIFOLD
MAIN OIL FILTER
FUEL/OIL COOLER
FUEL/OIL COOLER BYPASS VALVE
2.5 BLEED VALVE ACTUATOR
ELECTRONIC ENGINE CONTROL (EEC)
L−A1183 (0000)
PW V

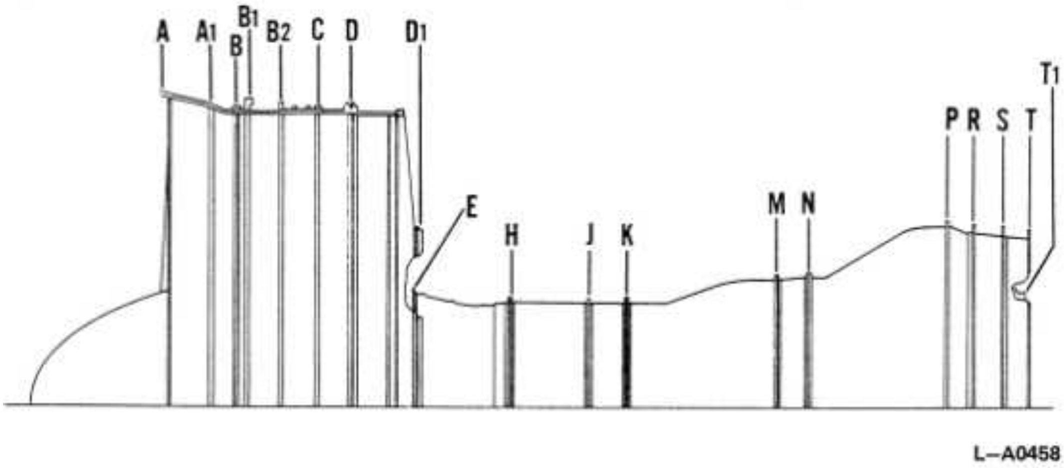
Engine External Components (Left Side)
Figure 1 (Sheet 2)
(Task 72−00−00−990−005)


IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE PRESSURE SWITCH
HPC SECONDARY FLOW CONTROL VALVE, IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE SOLENOID
HPC SECONDARY FLOW CONTROL VALVE, TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
NO. 3 BEARING BUFFER AIR COOLER
AIR/OIL HEAT EXCHANGER AND VALVE (ENGINE)
AIR/OIL HEAT EXCHANGER AND VALVE (IDGS)
STABILITY BLEED PNEUMATIC RELAY VALVE
START/STABILITY BLEED VALVE SOLENOID
2.5 BLEED VALVE ACTUATOR
EEC SPEED TRANSDUCER (N1) (OPTIONAL NO. 1 BEARING VIBRATION PICKUP)
ANGLE GEARBOX
INTERMEDIATE CASE (REAR VIEW)
L-A1184 (0187)
PW V

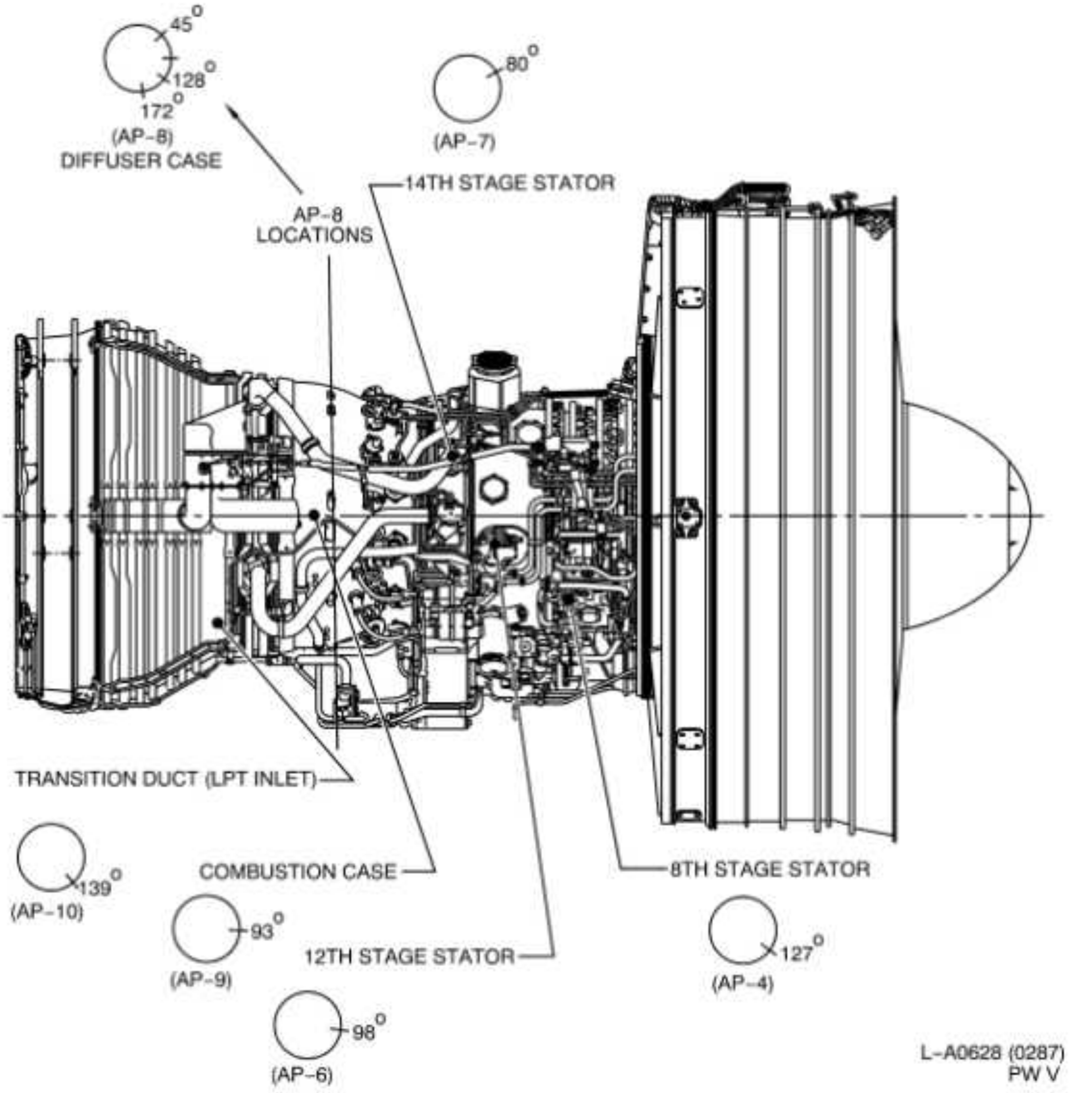
Engine External Components Intermediate Case View
Figure 1 (Sheet 3)
(Task 72−00−00−990−005)


MAIN OIL FILTER
DEOILER
OIL TANK
OIL DRAIN
HYDRAULIC PUMP FRONT PAD
IDG DRIVE PAD
MANUAL CRANK PAD
MAIN GEARBOX
LUBRICATION AND SCAVENGE OIL PUMP
FUEL BYPASS VALVE
STARTER DRIVE PAD
HYDRAULIC PUMP REAR PAD
FUEL METERING UNIT
FUEL PUMP
FUEL PUMP FILTER
IGNITION EXCITERS
L−A1185 (0187)
PW V

Engine External Components (Bottom View)
Figure 1 (Sheet 4)
(Task 72−00−00−990−005)


A
A1
B
B1
B2
C
D
D1
E
H
J
K
M
N
P
R
S
T
T1
L-A0458

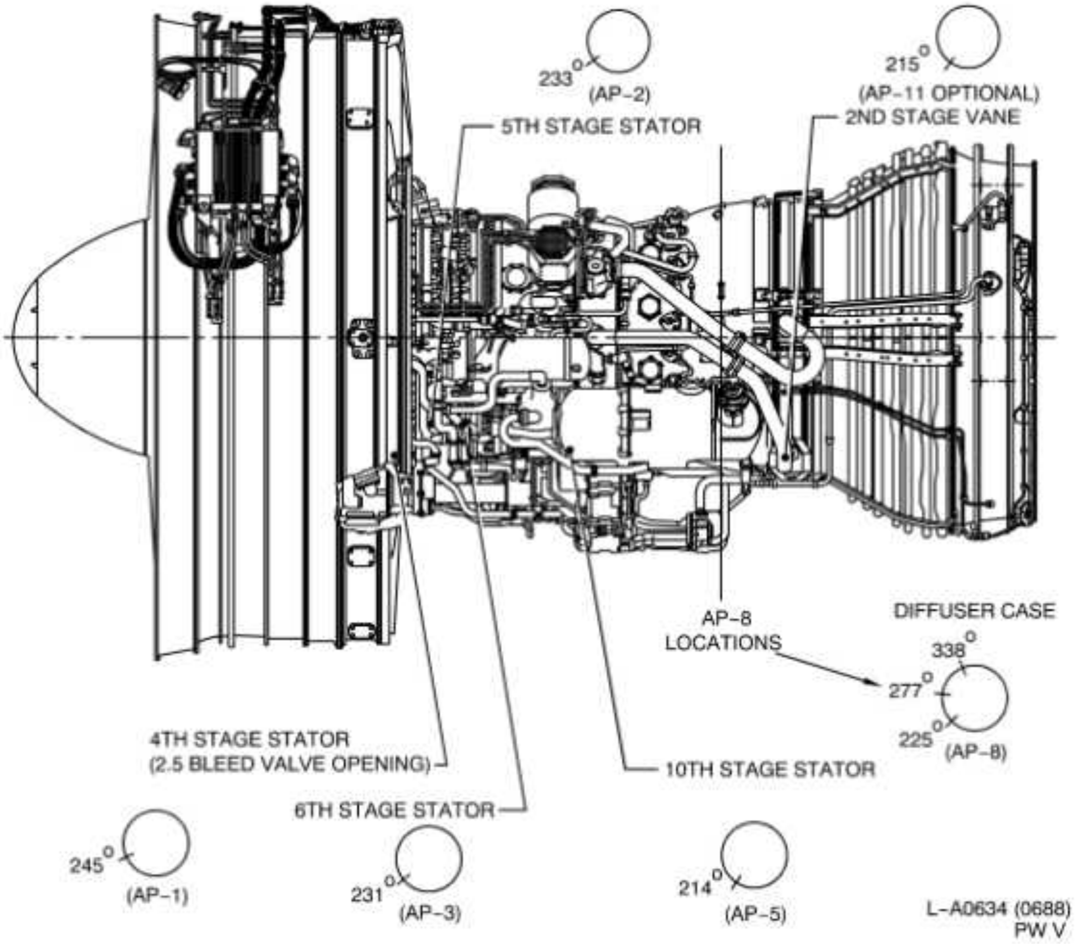
Engine Flange Identification
Figure 2
(Task 72-00-00-990-005)


45°
128°
172°
(AP-8)
DIFFUSER CASE
80°
(AP-7)
14TH STAGE STATOR
AP-8
LOCATIONS
TRANSITION DUCT (LPT INLET)
139°
(AP-10)
COMBUSTION CASE
93°
(AP-9)
12TH STAGE STATOR
98°
(AP-6)
8TH STAGE STATOR
127°
(AP-4)
L-A0628 (0287)
PW V

Borescope Port Locations (Right Side)
Figure 3 (Sheet 1)
(Task 72-00-00-990-005)

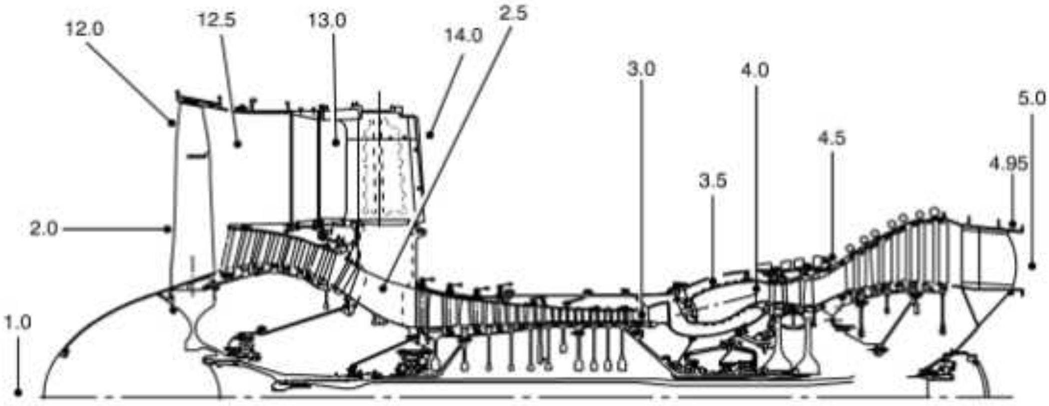
Borescope Access Port Location (rear view)	Viewing Capability
AP−4	8th And 9th Stage Blades
AP−6	12th And 13th Stage Blades
AP−7	14th And 15th Stage Blades
AP−8	Combustion Liner And Fuel Nozzles
AP−9	1st Stage HPT Blades
AP−10	2nd HPT Blades And 3rd LPT Vanes

Key to Figure 3 (Sheet 1)


233°
(AP−2)
215°
(AP−11 OPTIONAL)
5TH STAGE STATOR
2ND STAGE VANE
AP−8
LOCATIONS
DIFFUSER CASE
338°
277°
225°
(AP−8)
4TH STAGE STATOR
(2.5 BLEED VALVE OPENING)
10TH STAGE STATOR
6TH STAGE STATOR
245°
(AP−1)
231°
(AP−3)
214°
(AP−5)
L−A0634 (0688)
PW V

Borescope Access Port Location (rear view)	Viewing Capability
AP−1	4th Stage Blades
AP−2	5th And 6th Stage Blades
AP−3	6th And 7th Stage Blades
AP−5	10th And 11th Stage Blades
AP−8	Combustion Liner And Fuel Nozzles
AP−11	Rear Of 1st, Front Of 2nd Stage Blades

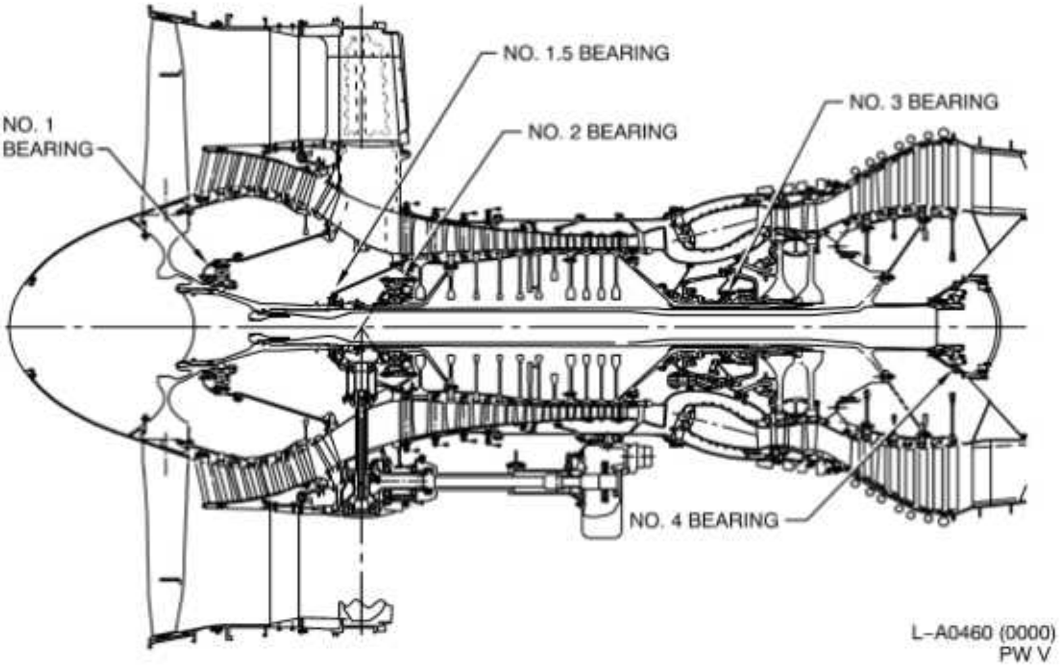
Borescope Port Locations (Left Side)
Figure 3 (Sheet 2)
(Task 72−00−00−990−005)



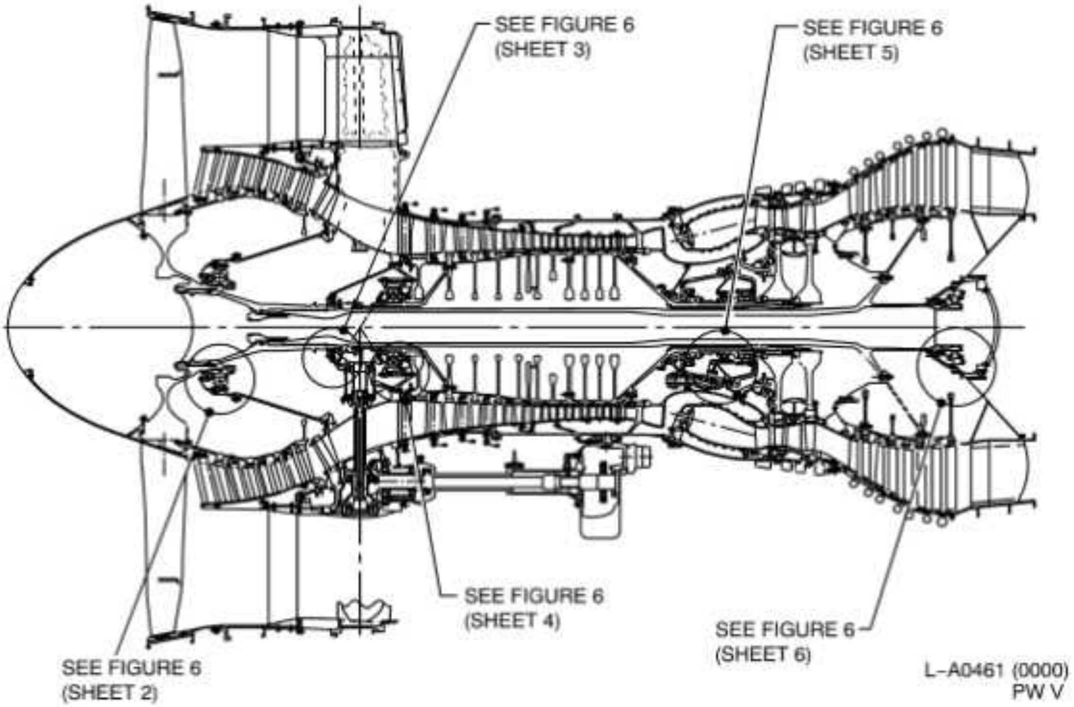
L-A0459 (0000)
PW V

Station	Description
1.0	Ambient
2.0	Fan Inlet ID
2.5	Low Compressor Exit
3.0	Diffuser Inlet − Upstream Of The Diffuser Bleed Ports And Divergent Nozzle
3.5	Combustor
4.0	Combustor Exit
4.5	HPT Exit, LPT Inlet Transition Duct
4.95	Turbine Exhaust Case, Temperature And Pressure Measuring Probe Location.
5.0	Turbine Exit Guide Vane Exit
12.0	Fan Inlet OD
12.5	Fan Exit − Rotor Trailing Edge
13.0	Fan Exit − Upstream Of Fan Exit Guide Vane
14.0	Fan Exit Guide Vane, Exit

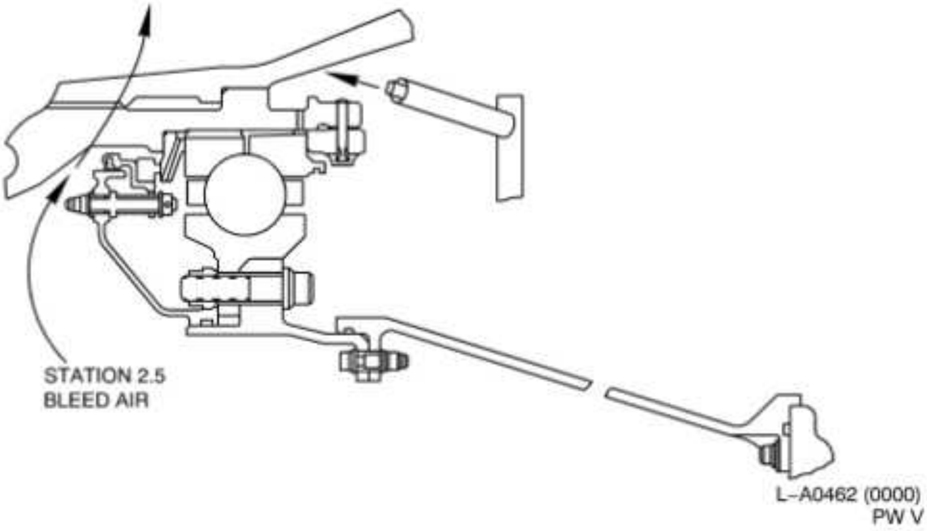
Designation Of Engine Stations
Figure 4
(Task 72−00−00−990−005)


NO. 1 BEARING
NO. 1.5 BEARING
NO. 2 BEARING
NO. 3 BEARING
NO. 4 BEARING
L−A0460 (0000)
PW V

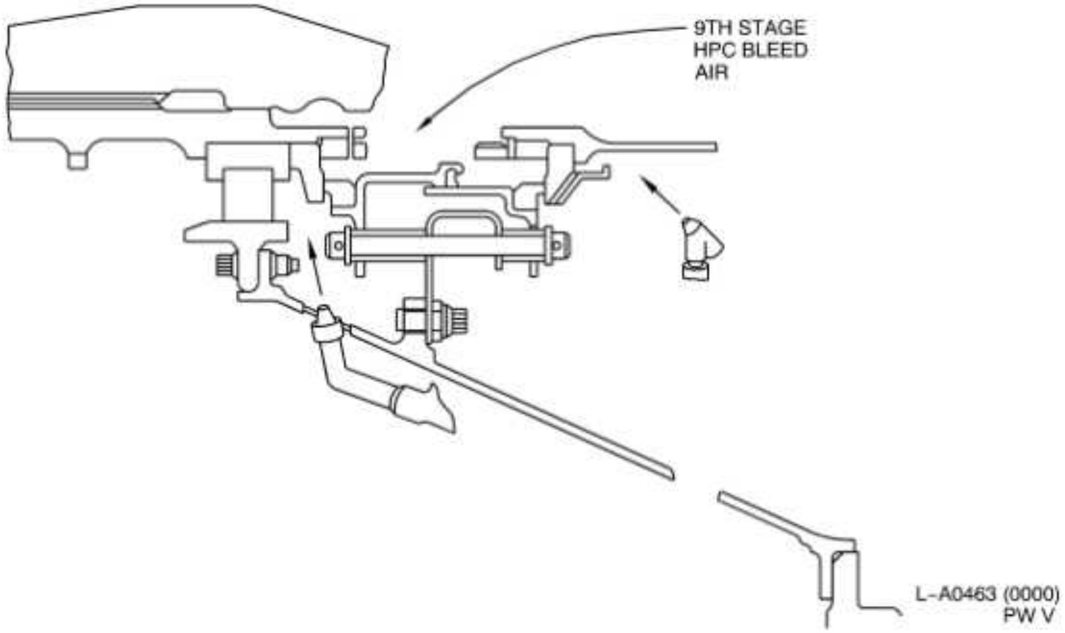
Main Bearing Numbering/Location
Figure 5
(Task 72−00−00−990−005)


SEE FIGURE 6
(SHEET 3)
SEE FIGURE 6
(SHEET 5)
SEE FIGURE 6
(SHEET 4)
SEE FIGURE 6
(SHEET 6)
SEE FIGURE 6
(SHEET 2)
L−A0461 (0000)
PW V

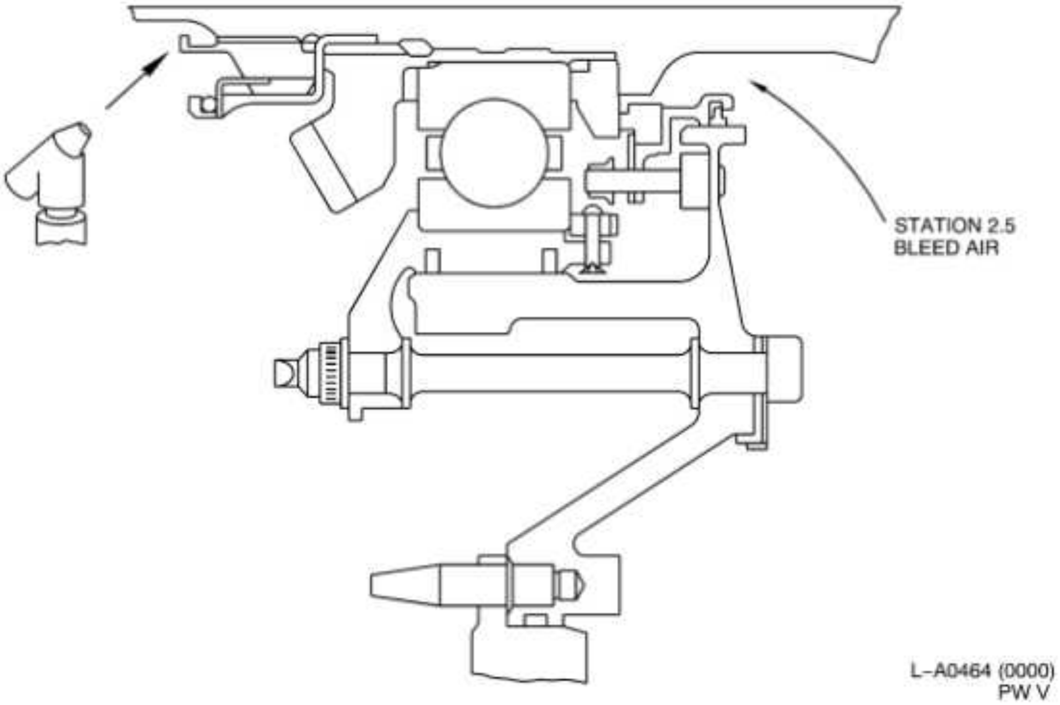
Bearing Compartment Locations
Figure 6 (Sheet 1)
(Task 72−00−00−990−005)


STATION 2.5
BLEED AIR
L−A0462 (0000)
PW V

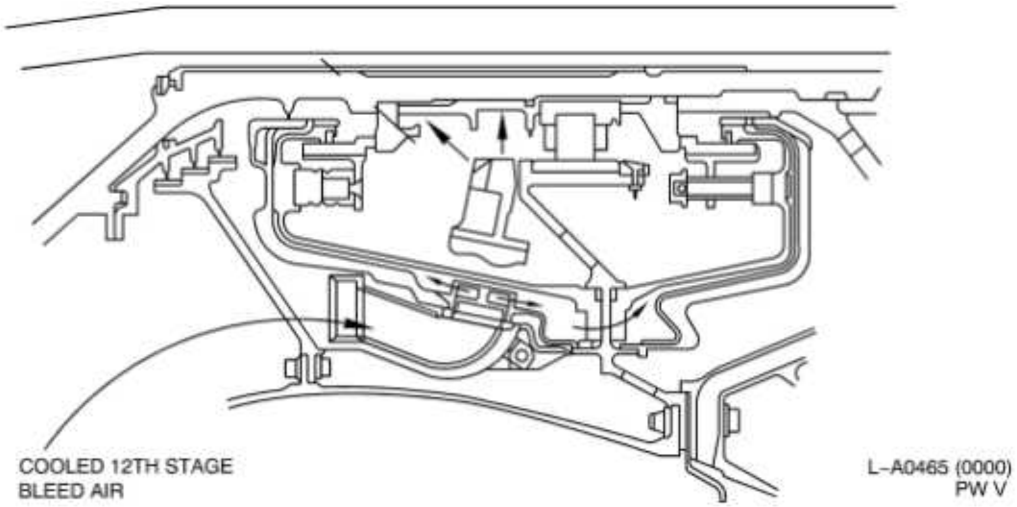
No. 1 Bearing Area
Figure 6 (Sheet 2)
(Task 72−00−00−990−005)


9TH STAGE
HPC BLEED
AIR
L-A0463 (0000)
PW V

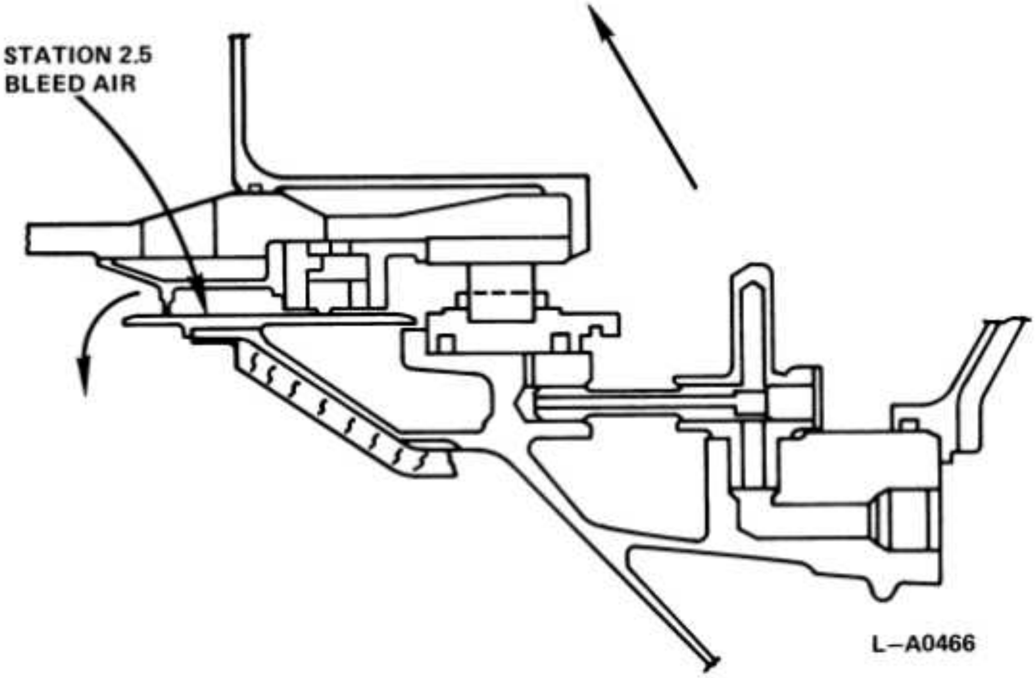
No. 1.5 Bearing Area
Figure 6 (Sheet 3)
(Task 72−00−00−990−005)


STATION 2.5
BLEED AIR
L-A0464 (0000)
PW V

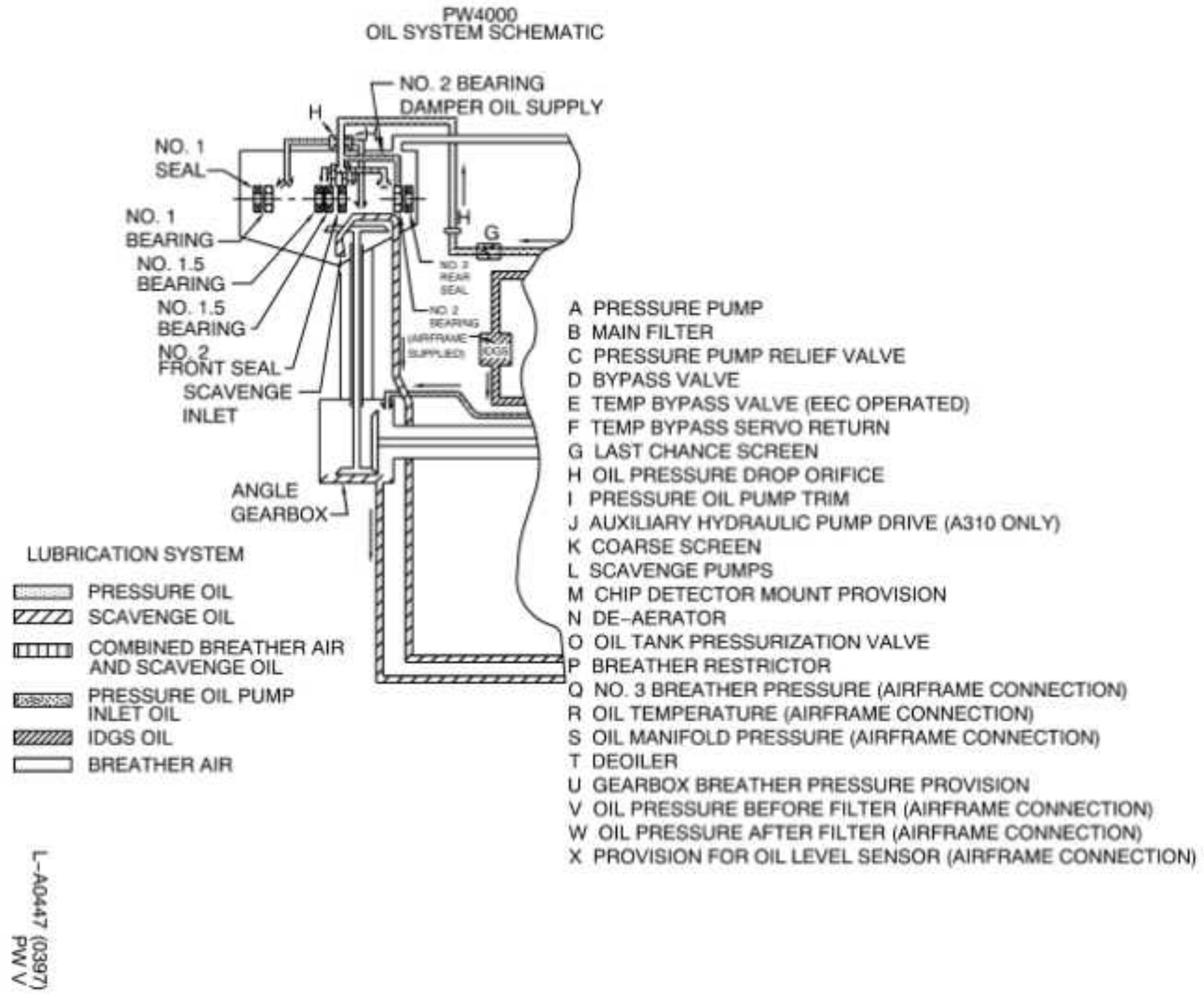
No. 2 Bearing Area
Figure 6 (Sheet 4)
(Task 72-00-00-990-005)


COOLED 12TH STAGE BLEED AIR
L-A0465 (0000)
PW V

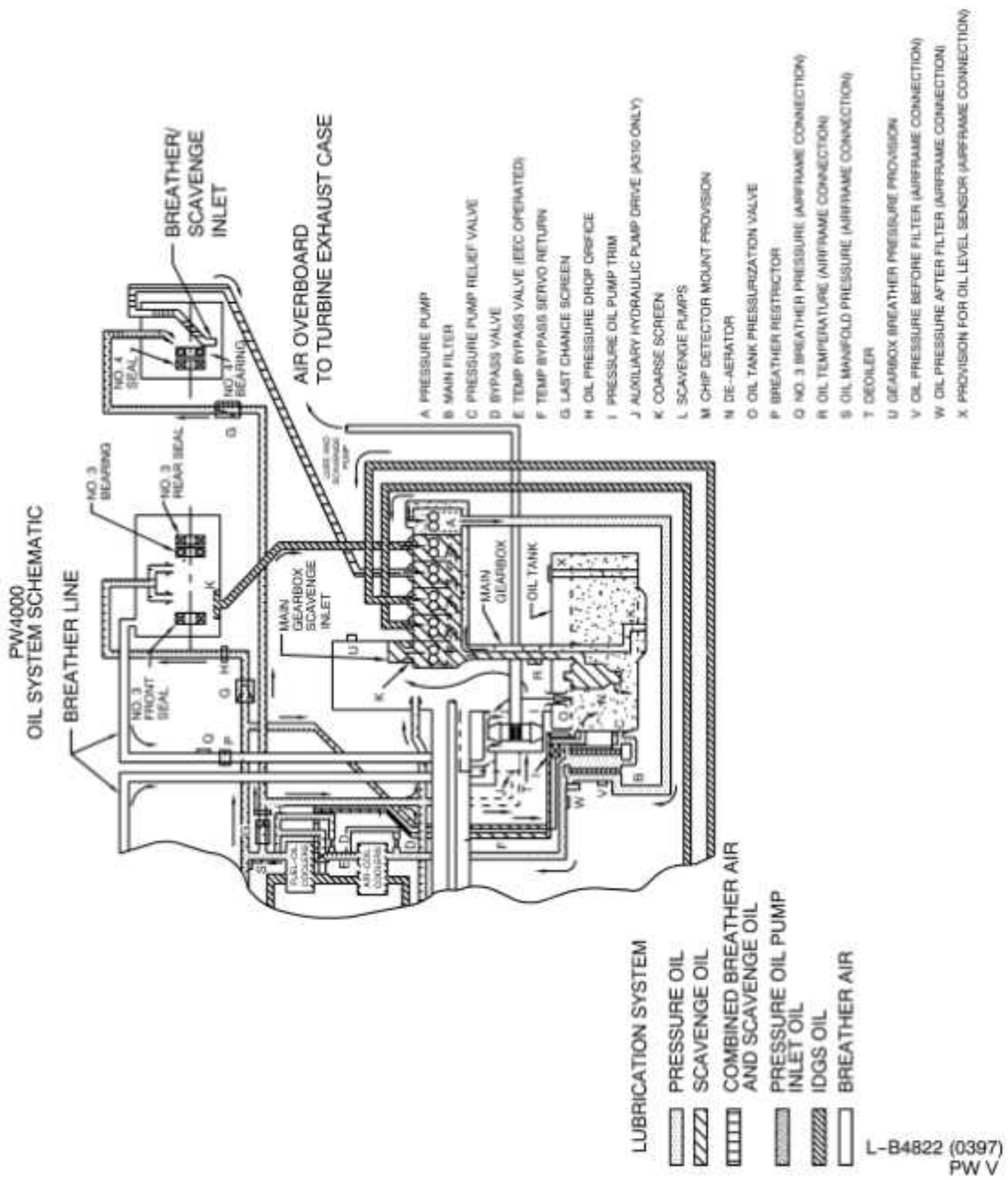
No. 3 Bearing Area
Figure 6 (Sheet 5)
(Task 72-00-00-990-005)


STATION 2.5
BLEED AIR
L−A0466

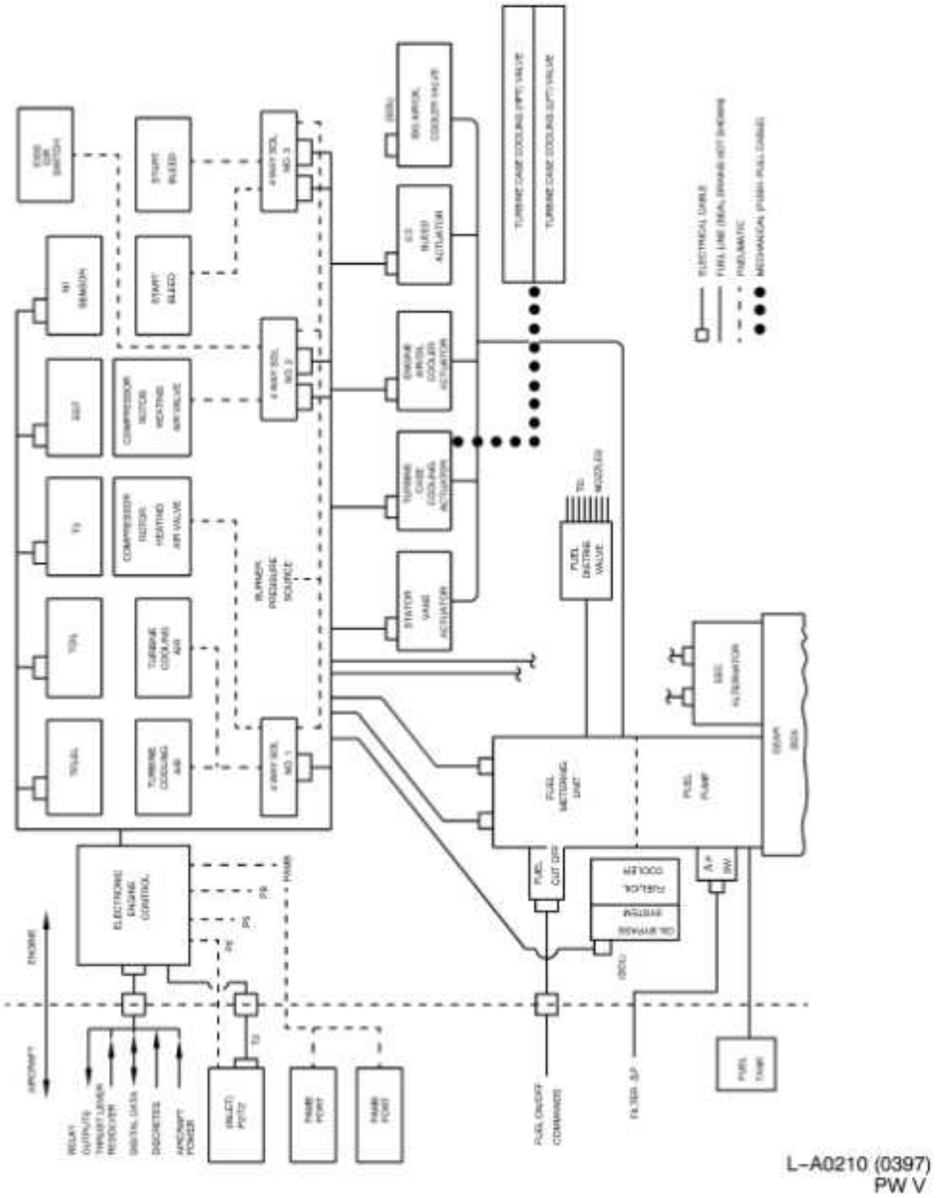
No. 4 Bearing Area
Figure 6 (Sheet 6)
(Task 72−00−00−990−005)


PW4000
OIL SYSTEM SCHEMATIC
NO. 2 BEARING
DAMPER OIL SUPPLY
H
NO. 1
SEAL
NO. 1
BEARING
NO. 1.5
BEARING
NO. 1.5
BEARING
NO. 2
FRONT SEAL
SCAVENGE
INLET
ANGLE
GEARBOX
NO. 3
REAR
SEAL
NO. 2
BEARING
(AIRFRAME
SUPPLIED)
IDGS
G
H
A PRESSURE PUMP
B MAIN FILTER
C PRESSURE PUMP RELIEF VALVE
D BYPASS VALVE
E TEMP BYPASS VALVE (EEC OPERATED)
F TEMP BYPASS SERVO RETURN
G LAST CHANCE SCREEN
H OIL PRESSURE DROP ORIFICE
I PRESSURE OIL PUMP TRIM
J AUXILIARY HYDRAULIC PUMP DRIVE (A310 ONLY)
K COARSE SCREEN
L SCAVENGE PUMPS
M CHIP DETECTOR MOUNT PROVISION
N DE-AERATOR
O OIL TANK PRESSURIZATION VALVE
P BREATHER RESTRICTOR
Q NO. 3 BREATHER PRESSURE (AIRFRAME CONNECTION)
R OIL TEMPERATURE (AIRFRAME CONNECTION)
S OIL MANIFOLD PRESSURE (AIRFRAME CONNECTION)
T DEOILER
U GEARBOX BREATHER PRESSURE PROVISION
V OIL PRESSURE BEFORE FILTER (AIRFRAME CONNECTION)
W OIL PRESSURE AFTER FILTER (AIRFRAME CONNECTION)
X PROVISION FOR OIL LEVEL SENSOR (AIRFRAME CONNECTION)
LUBRICATION SYSTEM
PRESSURE OIL
SCAVENGE OIL
COMBINED BREATHER AIR AND SCAVENGE OIL
PRESSURE OIL PUMP INLET OIL
IDGS OIL
BREATHER AIR
L-A0447 (0397)
PW V

Oil System Schematic (Part 1)
Figure 7 (Sheet 1)
(Task 72-00-00-990-005)

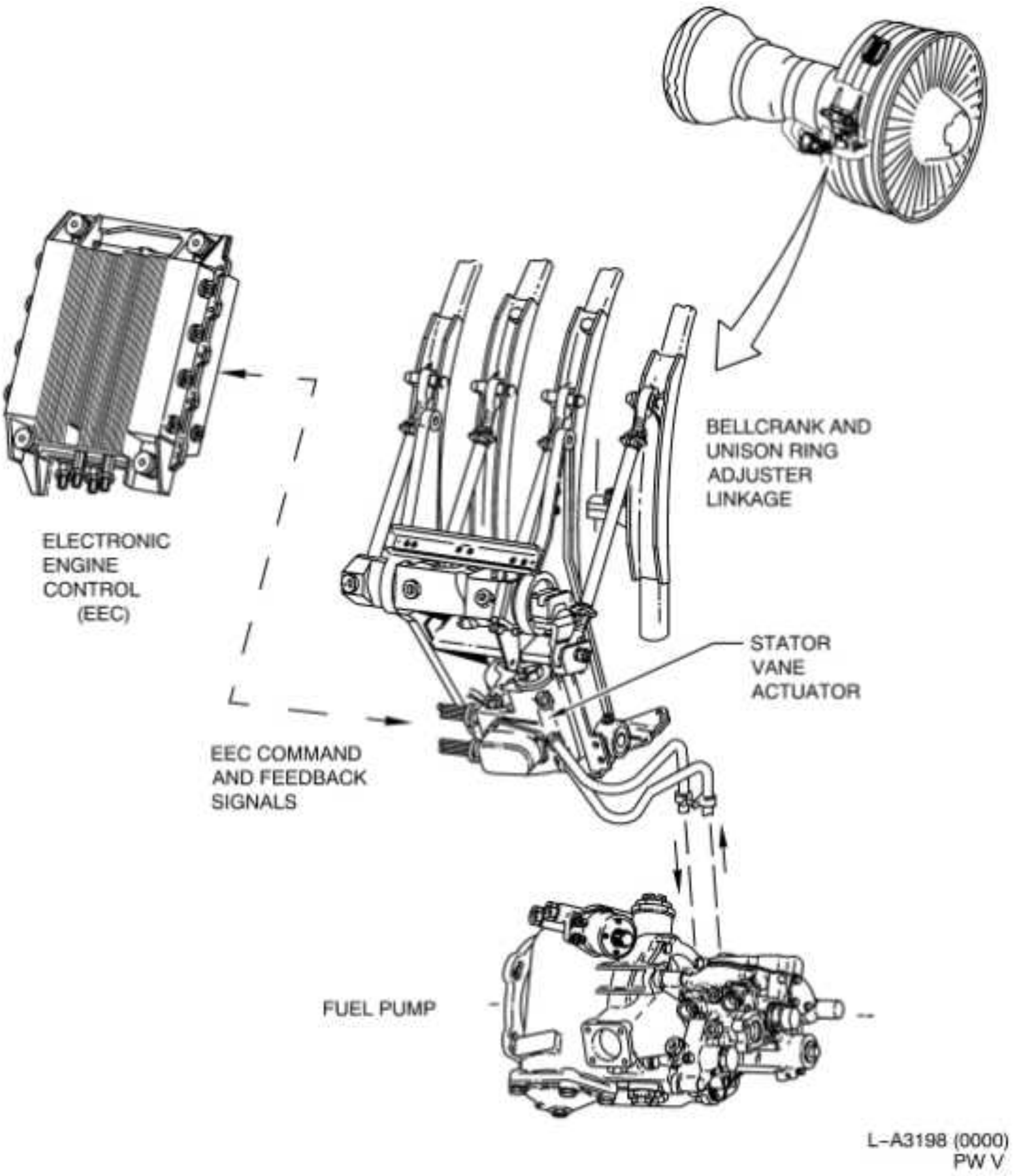

PW4000
OIL SYSTEM SCHEMATIC
BREATHER LINE
NO. 3 BEARING
NO. 3 FRONT SEAL
NO. 3 REAR SEAL
NO. 4 SEAL
NO. 4 BEARING
BREATHER/ SCAVENGE INLET
MAIN GEARBOX SCAVENGE INLET
AIR OVERBOARD TO TURBINE EXHAUST CASE
LUBE AND SCAVENGE PUMP
MAIN GEARBOX
OIL TANK
FUEL-OIL COOLERS
AIR-OIL COOLERS
A PRESSURE PUMP
B MAIN FILTER
C PRESSURE PUMP RELIEF VALVE
D BYPASS VALVE
E TEMP BYPASS VALVE (EEC OPERATED)
F TEMP BYPASS SERVO RETURN
G LAST CHANCE SCREEN
H OIL PRESSURE DROP ORIFICE
I PRESSURE OIL PUMP TRIM
J AUXILIARY HYDRAULIC PUMP DRIVE (A310 ONLY)
K COARSE SCREEN
L SCAVENGE PUMPS
M CHIP DETECTOR MOUNT PROVISION
N DE-AERATOR
O OIL TANK PRESSURIZATION VALVE
P BREATHER RESTRICTOR
Q NO. 3 BREATHER PRESSURE (AIRFRAME CONNECTION)
R OIL TEMPERATURE (AIRFRAME CONNECTION)
S OIL MANIFOLD PRESSURE (AIRFRAME CONNECTION)
T DEOILER
U GEARBOX BREATHER PRESSURE PROVISION
V OIL PRESSURE BEFORE FILTER (AIRFRAME CONNECTION)
W OIL PRESSURE AFTER FILTER (AIRFRAME CONNECTION)
X PROVISION FOR OIL LEVEL SENSOR (AIRFRAME CONNECTION)
LUBRICATION SYSTEM
PRESSURE OIL
SCAVENGE OIL
COMBINED BREATHER AIR AND SCAVENGE OIL
PRESSURE OIL PUMP INLET OIL
IDGS OIL
BREATHER AIR
L-B4822 (0397)
PW V

Oil System Schematic (Part 2)
Figure 7 (Sheet 2)
(Task 72−00−00−990−005)

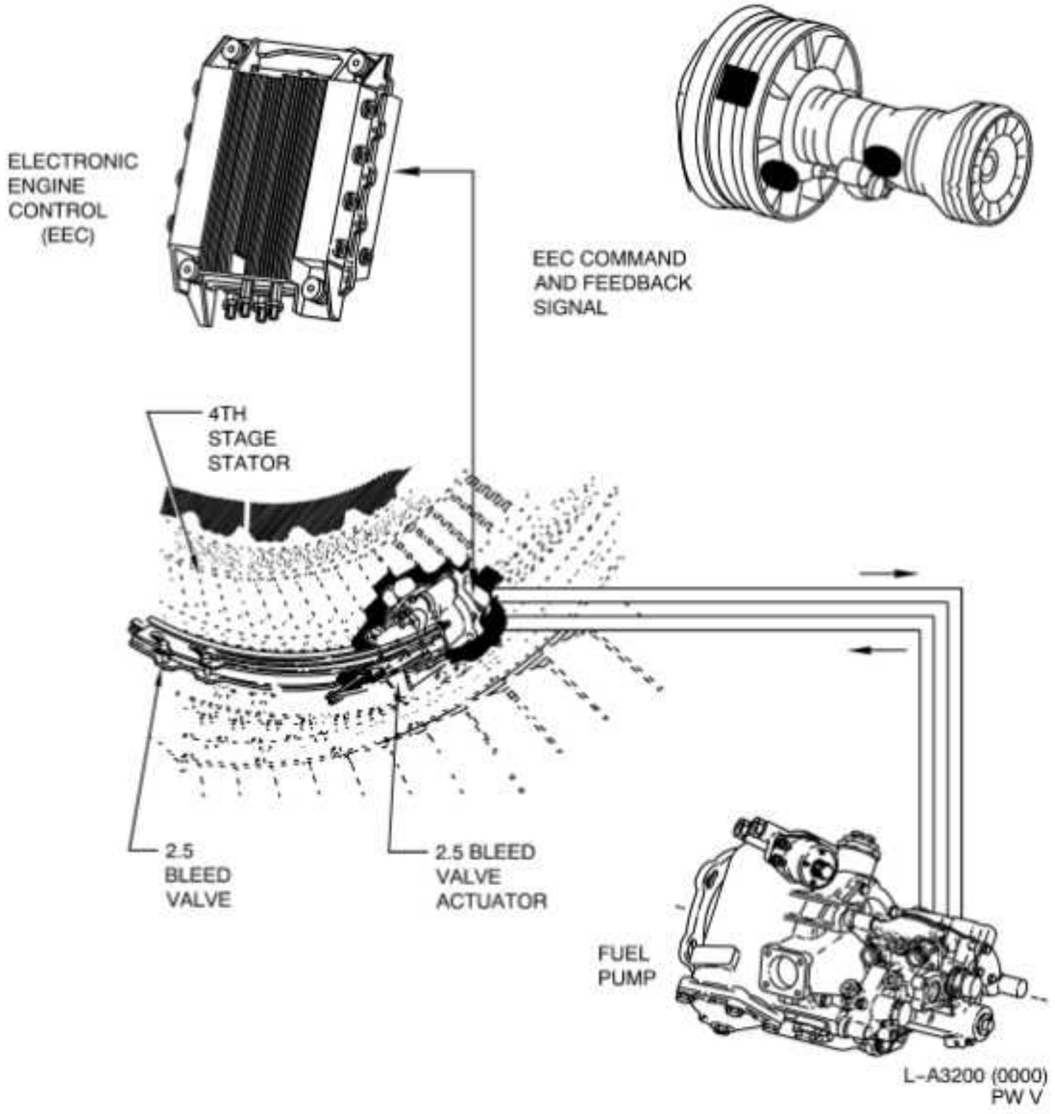


L−A0210 (0397)
PW V

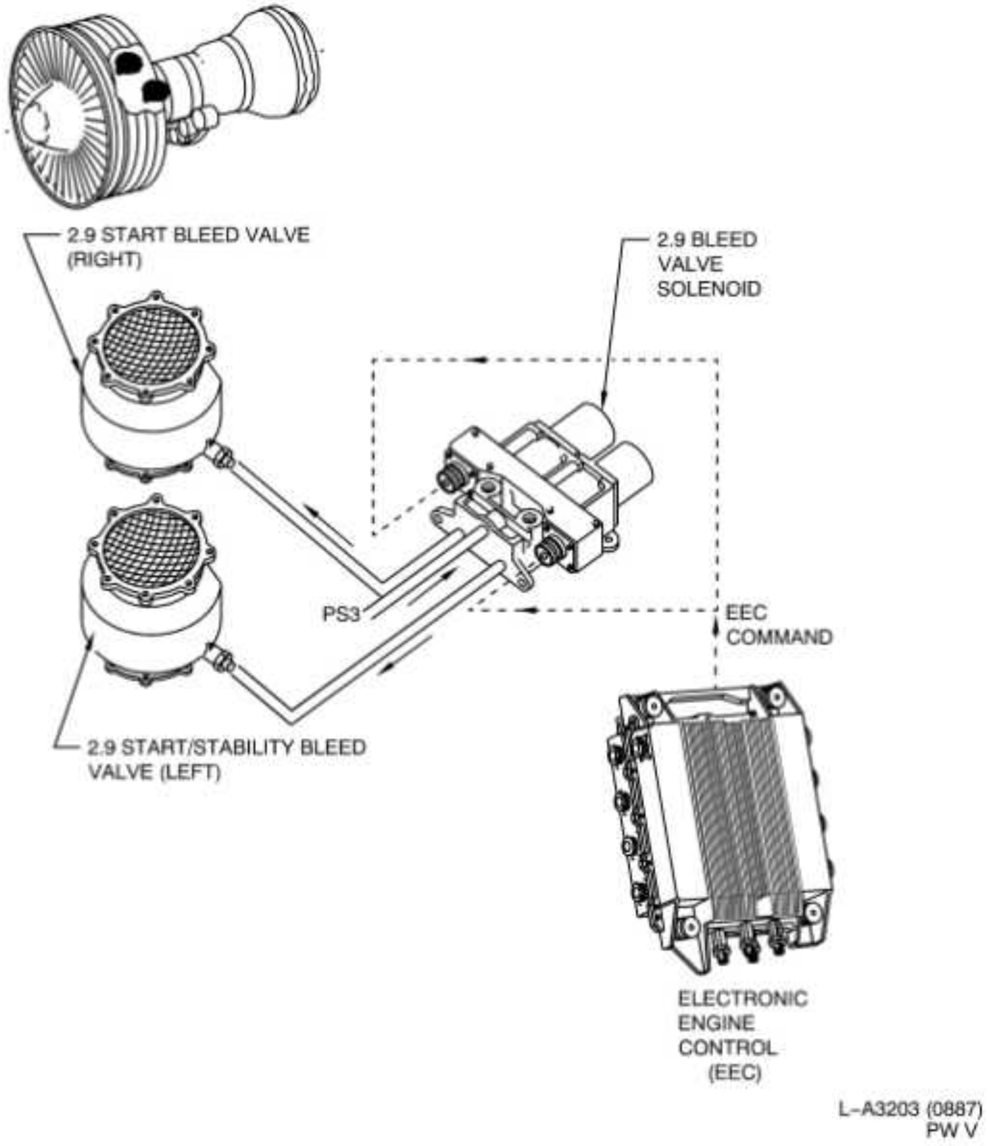
Engine Fuel And Control Systems
Figure 8
(Task 72−00−00−990−005)


BELLCRANK AND UNISON RING ADJUSTER LINKAGE
ELECTRONIC ENGINE CONTROL (EEC)
STATOR VANE ACTUATOR
EEC COMMAND AND FEEDBACK SIGNALS
FUEL PUMP
L−A3198 (0000)
PW V

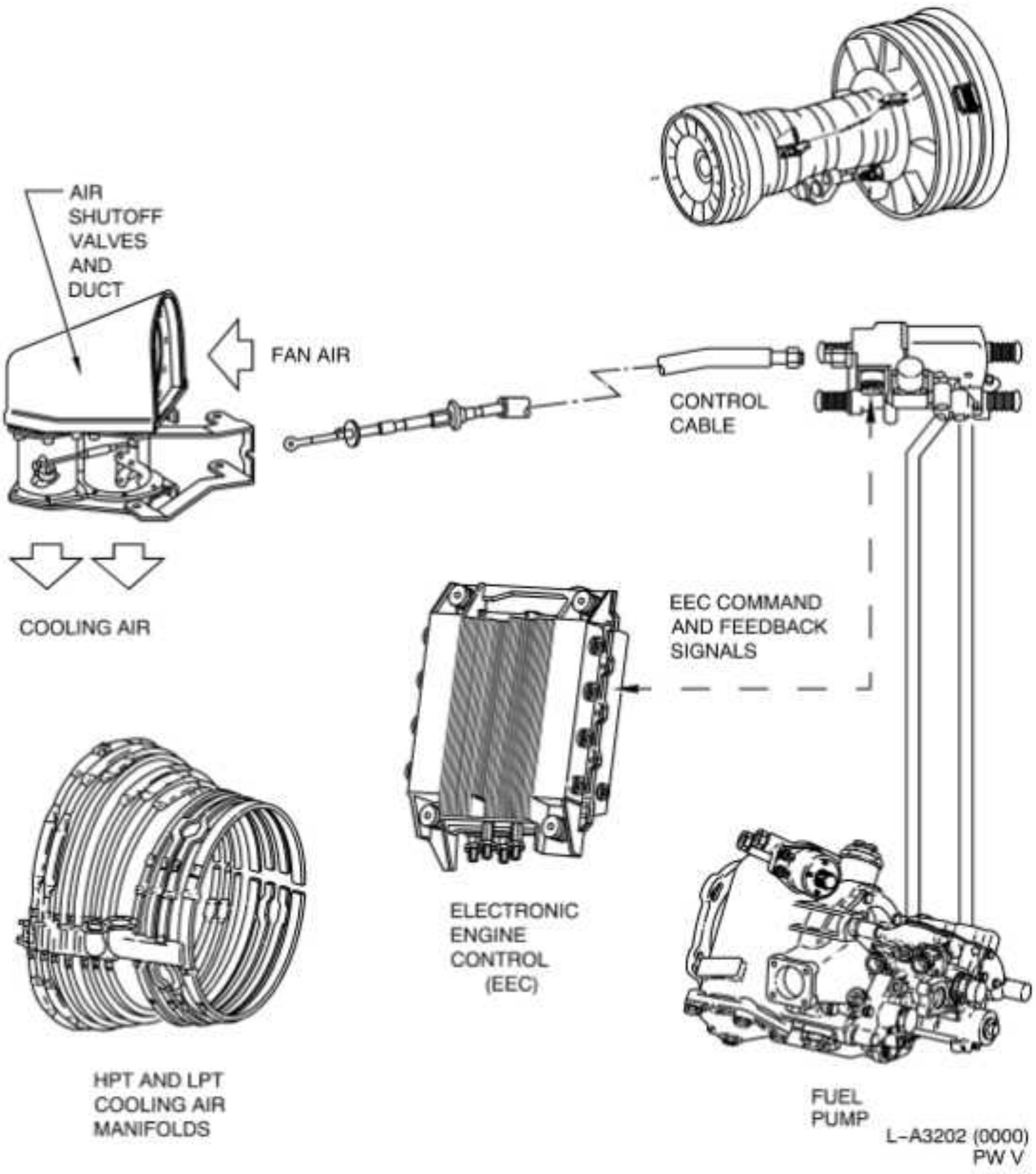
Compressor Stator Vane Control System
Figure 9
(Task 72−00−00−990−005)


ELECTRONIC ENGINE CONTROL (EEC)
EEC COMMAND AND FEEDBACK SIGNAL
4TH STAGE STATOR
2.5 BLEED VALVE
2.5 BLEED VALVE ACTUATOR
FUEL PUMP
L-A3200 (0000)
PW V

2.5 Bleed System
Figure 10
(Task 72−00−00−990−005)


2.9 START BLEED VALVE (RIGHT)
2.9 BLEED VALVE SOLENOID
PS3
EEC COMMAND
2.9 START/STABILITY BLEED VALVE (LEFT)
ELECTRONIC ENGINE CONTROL (EEC)
L-A3203 (0887)
PW V

2.9 Bleed System
Figure 11
(Task 72-00-00-990-005)


AIR SHUTOFF VALVES AND DUCT
FAN AIR
CONTROL CABLE
COOLING AIR
EEC COMMAND AND FEEDBACK SIGNALS
ELECTRONIC ENGINE CONTROL (EEC)
HPT AND LPT COOLING AIR MANIFOLDS
FUEL PUMP
L−A3202 (0000)
PW V

Turbine Case Cooling Description And Operation
Figure 12
(Task 72−00−00−990−005)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-00-010-001:

1. Transfer Engine From Transport Stand To Pedestals

A. Equipment And Materials Required

Special Tools:

PWA 25040	Bracket, Support (Optional To PWA 85195 Bracket For Engines With Exhaust Nozzle Removed)
PWA 25041	Bracket, Support (Optional To PWA 85195 Bracket For Engines With Exhaust Nozzle Removed)
PWA 25757	Pedestal (Non-Adjustable, Three Required)
PWA 25758	Pedestal (Adjustable)
PWA 25926	Adapter (Three Required)
PWA 28414	Bracket, Support (Two Required) (Optional To PWA 85195 Brackets For Engine Horizontal Support)
PWA 29243	Support Bracket (Two Required - Optional To PWA 85195 Brackets For Engine Horizontal Support)
PWA 85195	Support Bracket (Two Required)
PWA 85452	Rear Lifting Eye
PWA 85623	Front Lifting Eye
PWA 85662	Support Bracket (Two Required - Optional To PWA 85667)
PWA 85667	Support Bracket (Two Required)

NOTE: (PWA 28414) and (PWA 29243) may be used in place of (PWA 85195) Brackets for engine horizontal support only.

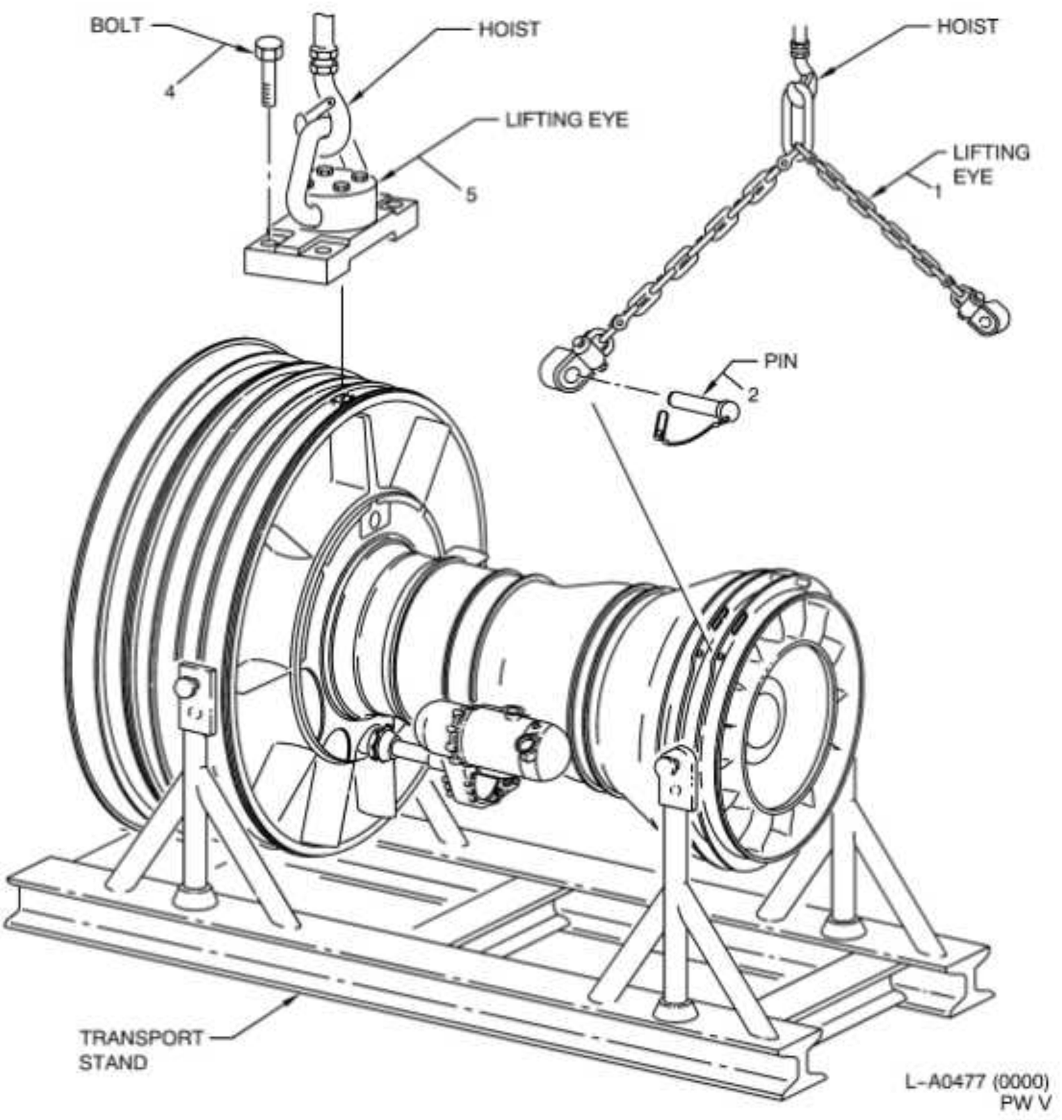
(PWA 25040) and (PWA 25041) Brackets may be used in place of (PWA 85195) Brackets on engines with exhaust nozzle removed.

B. Procedure

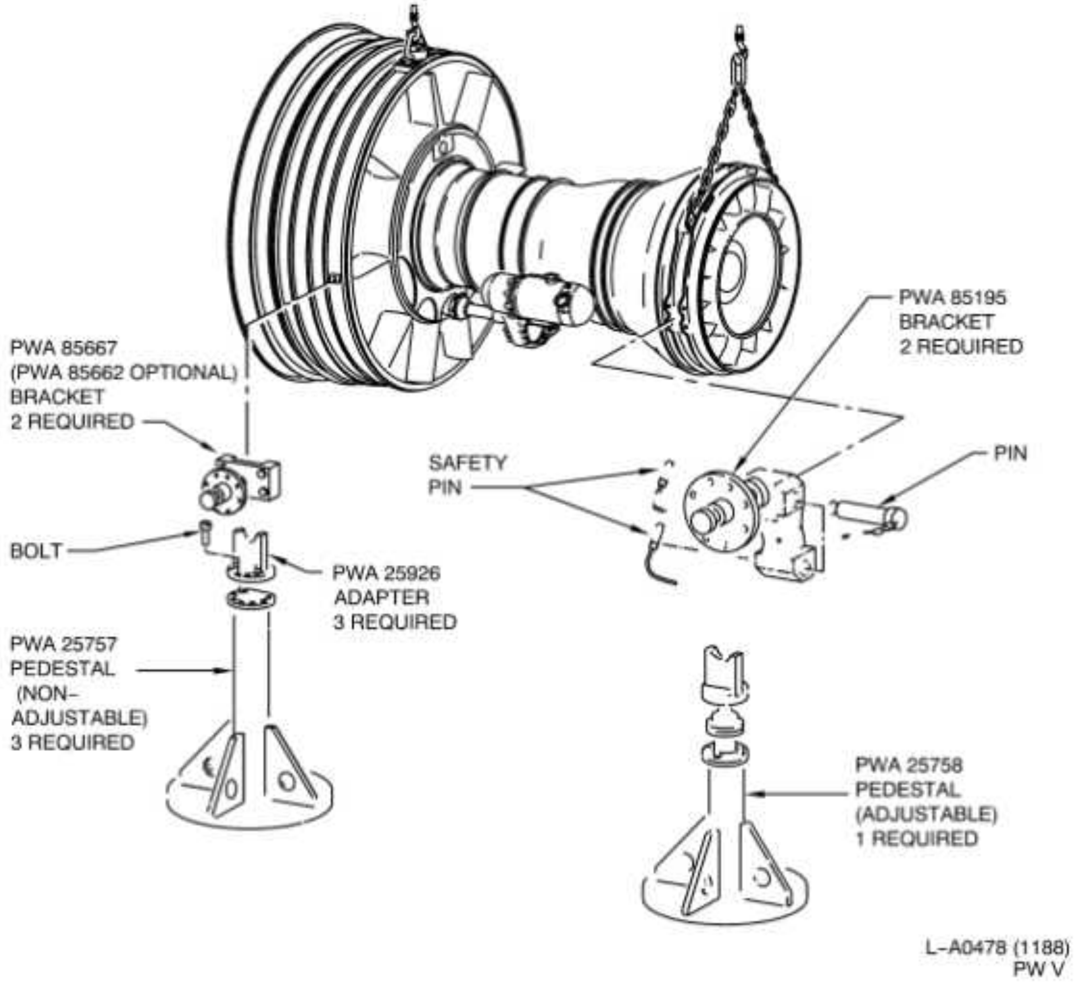
See Figures 201 and 202.

NOTE: If there is a bolt in one of the holes of the 12 o'clock ground handling pad that you cannot remove, you must repair the intermediate case. Refer to 72-00-34, Repair-01 (Task 72-00-34-300-001).

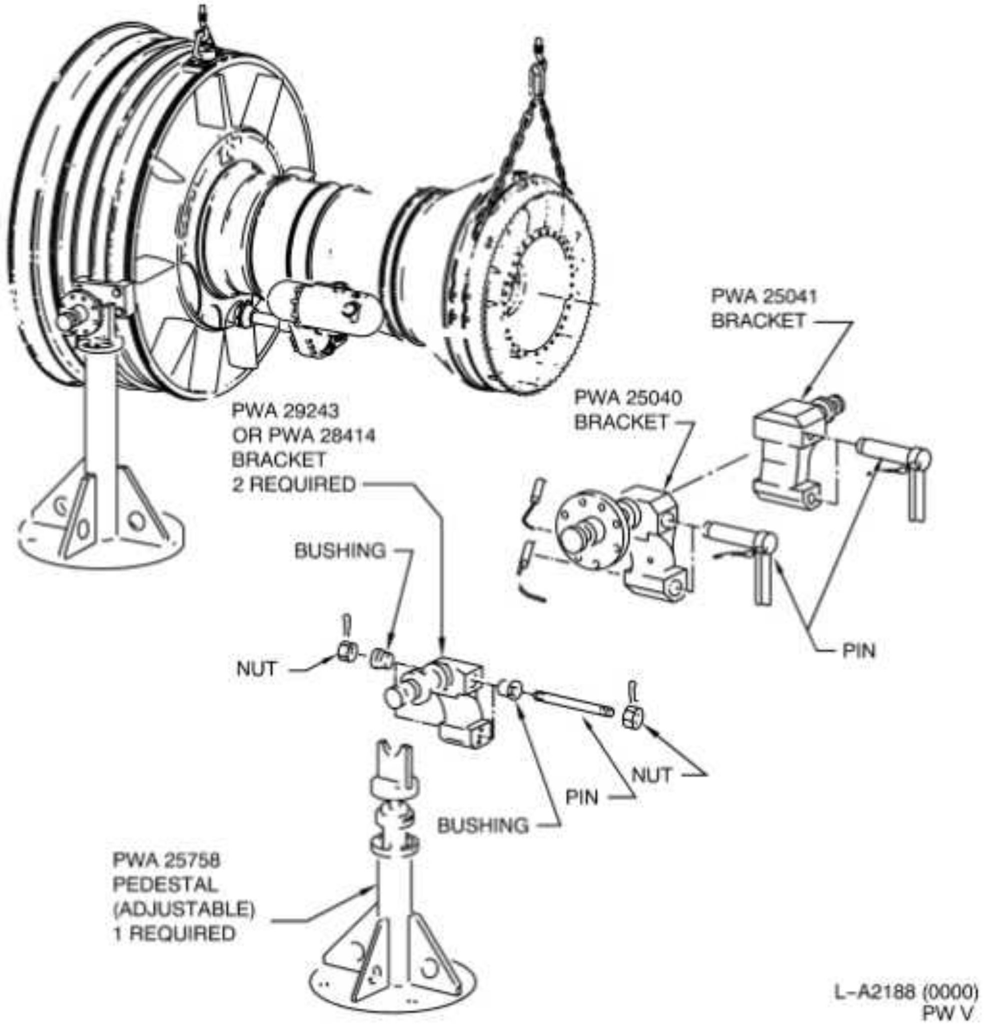
(1) Position PWA 85623 Front Lifting Eye (201/5) to ground handling boss at 12 o'clock location on outer intermediate case. Secure lifting eye to case boss with bolts (201/4). Torque bolts to 675 - 750 lb-in. (76.265 - 84.739 N.m).


BOLT
4
HOIST
LIFTING EYE
5
HOIST
LIFTING EYE
1
PIN
2
TRANSPORT STAND
L-A0477 (0000)
PW V

Remove Engine From Transport Stand
Figure 201
(Task 72−00−00−010−001)


PWA 85667
(PWA 85662 OPTIONAL)
BRACKET
2 REQUIRED
BOLT
PWA 25926
ADAPTER
3 REQUIRED
PWA 25757
PEDESTAL
(NON–
ADJUSTABLE)
3 REQUIRED
SAFETY
PIN
PWA 85195
BRACKET
2 REQUIRED
PIN
PWA 25758
PEDESTAL
(ADJUSTABLE)
1 REQUIRED
L–A0478 (1188)
PW V

Position Engine On Pedestals
Figure 202 (Sheet 1)
(Task 72−00−00−010−001)


PWA 25041
BRACKET
PWA 25040
BRACKET
PWA 29243
OR PWA 28414
BRACKET
2 REQUIRED
BUSHING
NUT
PIN
NUT
PIN
BUSHING
PWA 25758
PEDESTAL
(ADJUSTABLE)
1 REQUIRED
L−A2188 (0000)
PW V

Position Engine On Pedestals
Figure 202 (Sheet 2)
(Task 72−00−00−010−001)

(2) Position PWA 85452 Rear Lifting Eye (201/1) to engine turbine exhaust case. Align attachment block details to bushing holes in case rails at 2 and 10 o'clock. Install pins (201/2) through bushings and blocks. Secure pins with safety clips.
(3) Attach hoist to each lifting eye.
(4) Disconnect/remove transport stand to engine attachment devices as applicable.
(5) Lift and remove engine from transport stand.
(6) Move transport stand or engine as applicable to clear area.
(7) Install PWA 85195, PWA 29243, PWA 25040 and PWA 25041, or PWA 28414 Support Brackets to turbine exhaust case at 3 and 9 o'clock locations. See Figure 202.

NOTE: Brackets (PWA 29243) or (PWA 28414) may be used in place of Brackets (PWA 85195) for horizontal support only.

Brackets (PWA 25040) and (PWA 25041) may be used in place of PWA 85195 on engines with exhaust nozzle removed.

(a) Position brackets between case rails and align holes.

NOTE: If applicable, install Bracket PWA 25040 at 3 o'clock and PWA 25041 at 9 o'clock positions.

(b) For Brackets (PWA 85195) or (PWA 25040) and (PWA 25041), install pin from rear through flange and bracket. Secure pin with safety pin as required.
(c) For other brackets, insert pin through flanges and bracket and install bushings through flanges and into bracket. Secure pins with nuts.

(8) Position PWA 85662 or PWA 85667 Support Brackets to ground handling bosses at 3 and 9 o'clock locations on engine outer intermediate case. Secure brackets to engine case with four bolts through each bracket. Torque bolts to 675 - 750 lb-in. (76.265 - 84.739 N.m).

(9) Position three PWA 25757 Pedestals and one PWA 25758 Pedestal under brackets at exhaust and intermediate cases.

NOTE: Two non-adjustable pedestals are to be positioned at intermediate case location.

One non-adjustable pedestal and one adjustable pedestal are to be positioned at exhaust case location.

(10) Install PWA 25926 Adapters to three non-adjustable (PWA 25757) Pedestals. Secure adapters to pedestals with bolts.
(11) Turn jackscrew detail of adjustable pedestal to position lower than non-adjustable pedestals.
(12) Align pedestals with brackets on engine cases.
(13) Lower engine to engage bracket inboard spools with adapters on non-adjustable pedestals.

CAUTION: YOKE OF ADJUSTABLE PEDESTAL MUST BE IN COMPLETE CONTACT WITH SPOOL OF BRACKET TO PROVIDE ACCEPTABLE POWER PLANT SUPPORT.

(14) Turn jackscrew detail of adjustable pedestal to raise yoke and engage inboard spool of bracket.
(15) Ensure pedestals are in vertical position with no side loading and lower engine to position full weight on four pedestals. Remove hoists.
(16) Remove bolts securing lifting eye at 12 o'clock position on engine intermediate case. Remove lifting eye.
(17) Remove safety clips and pins securing lifting eye to engine exhaust case. Remove lifting eye.

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ENGINE GENERAL - SPECIAL PROCEDURES-02

Task 72-00-00-410-001:

1. Transfer Engine From Pedestals To Transport Stand

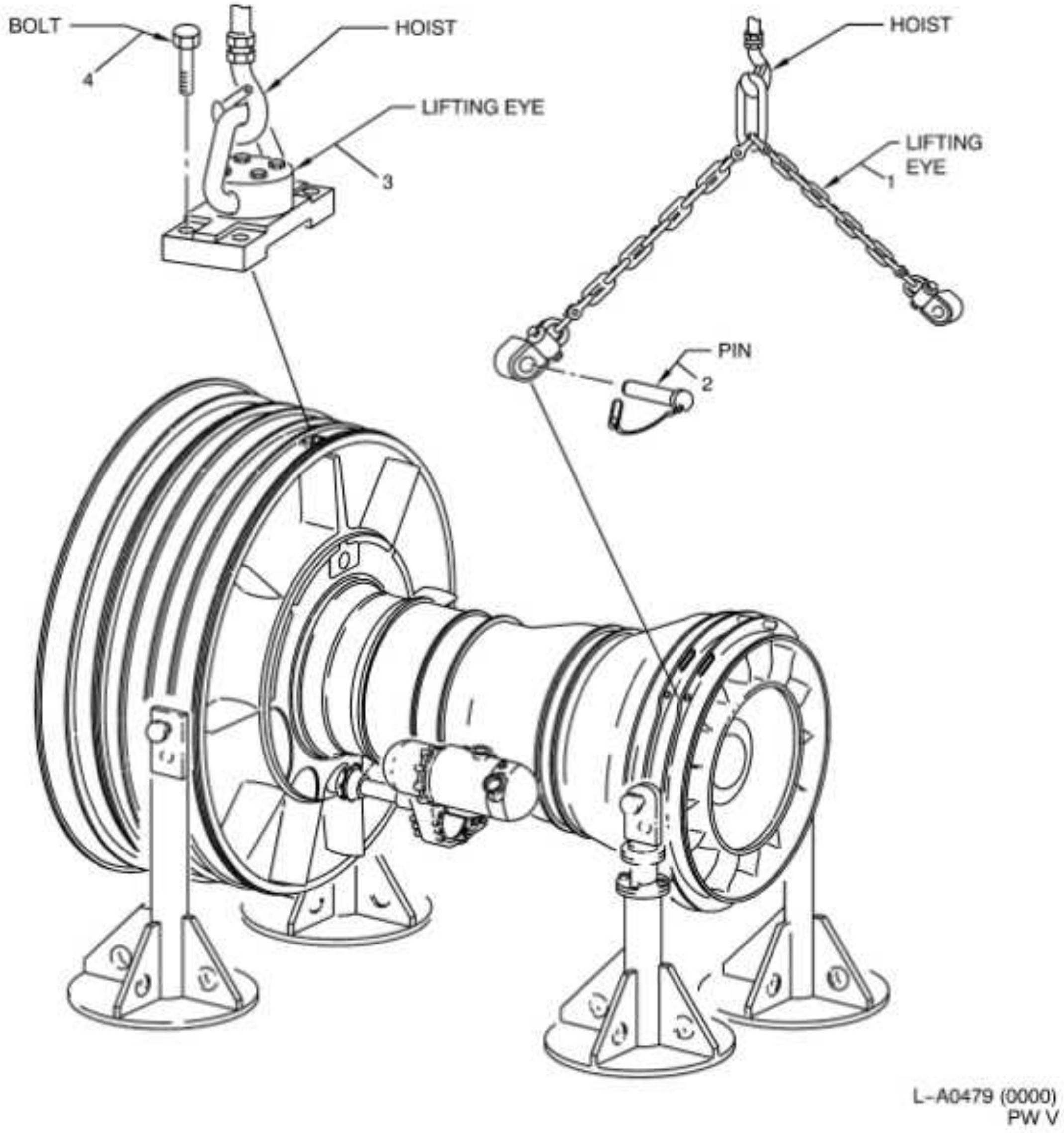
A. Equipment And Materials Required

Special Tools:
PWA 85452 Rear Lifting Eye
PWA 85623 Front Lifting Eye

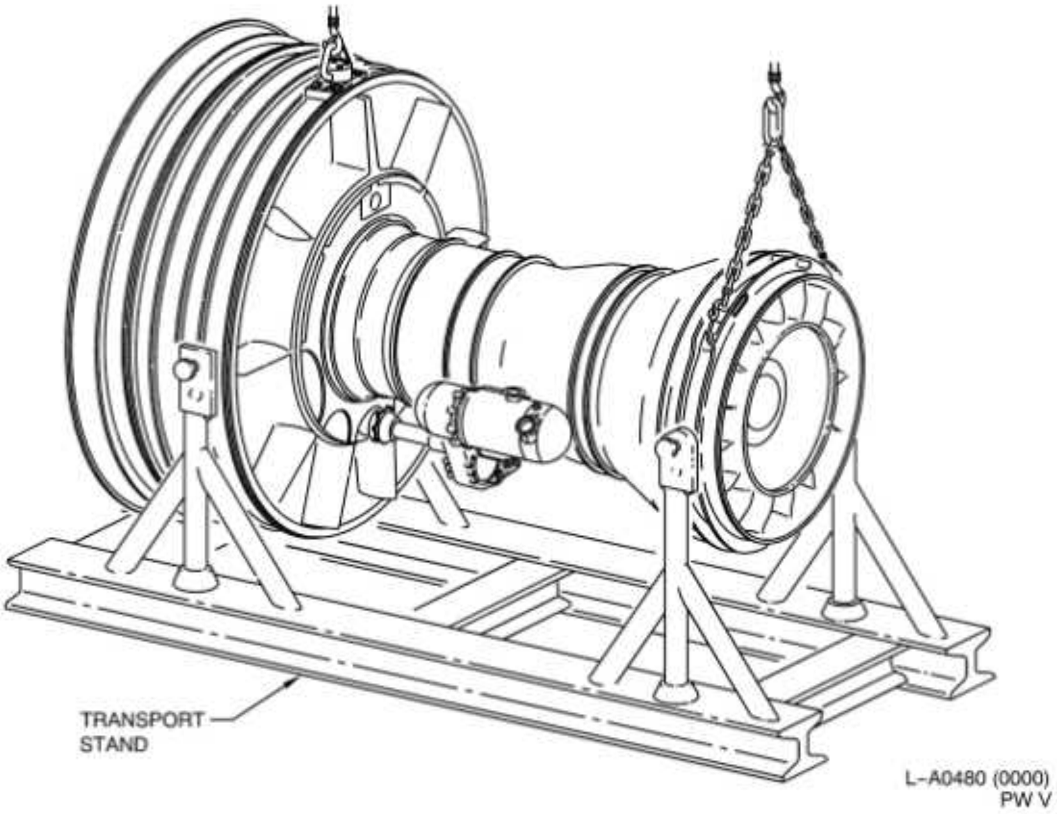
B. Procedure
See Figures 201 and 202.

NOTE: If there is a bolt in one of the holes of the 12 o'clock ground handling pad that you cannot remove, you must repair the intermediate case. Refer to 72-00-34, Repair-01 (Task 72-00-34-300-001).

(1) Position PWA 85623 Front Lifting Eye (201/3) to ground handling boss at 12 o'clock location on outer intermediate case. Secure lifting eye to boss with bolts (201/4). Torque bolts to 675 - 750 lb-in. (76.265 - 84.739 N.m).
(2) Position PWA 85452 Rear Lifting Eye (201/1) to engine exhaust case. Align attachment block details to bushing holes in case rails at 2 and 10 o'clock. Install pins (201/2) through bushings and blocks. Secure pins with safety clips.
(3) Attach hoist to each lifting eye. Lift engine from pedestals.
(4) Remove bolts securing support brackets to engine intermediate case at 3 and 9 o'clock. Remove brackets.
(5) Remove safety clips and pins securing support brackets to engine exhaust case at 3 and 9 o'clock. Remove brackets.
(6) Position engine to transport stand and secure with applicable attachment devices. Remove hoists. See Figure 202.
(7) Remove bolts securing front lifting eye at 12 o'clock position on engine intermediate case. Remove lifting eye.
(8) Remove safety clips and pins securing rear lifting eye to engine exhaust case. Remove lifting eye.


BOLT
4
HOIST
LIFTING EYE
3
HOIST
LIFTING EYE
1
PIN
2
L-A0479 (0000)
PW V

Remove Engine From Pedestals
Figure 201
(Task 72-00-00-410-001)


TRANSPORT STAND
L−A0480 (0000)
PW V

Position Engine To Transport Stand
Figure 202
(Task 72−00−00−410−001)

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Task 72-00-00-830-001:

1. Rig 2.5 Bleed Valve Actuator (Manual)

A. General

(1) This procedure permits the 2.5 bleed valve actuator to be rigged manually. To hydraulically rig the 2.5 bleed valve actuator, see 72-00-00, Special Procedure-24 Task 72-00-00-830-006.

B. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
R P06-054	Paste, Anti-Seize (PWA 36246)
P09-014	Sealant, Silicon Rubber (PWA 36003)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	1	75-32-00/1/50

C. Procedure

See Figure 201.

CAUTION: TO AVOID SHOULDER BOLT (201/5) DAMAGE, BE AWARE THAT SHOULDER BOLT IS LEFT HAND THREAD. HOLD ACTUATOR PISTON SHAFT HEX (201/3) WHILE LOOSENING SHOULDER BOLT.

CAUTION: MAKE SURE THE CRIMPED LOCKING CUP AND RETAINING NUT DO NOT LOOSEN FROM THE PISTON SHAFT WHEN THE SHOULDER BOLT IS REMOVED.

(1) If not previously accomplished, remove cotter pin (201/6) from shoulder bolt (201/5) on actuator piston shaft (201/3) and while holding piston shaft, remove shoulder bolt.

CAUTION: MAKE SURE THE CRIMPED LOCKING CUP AND RETAINING NUT DO NOT LOOSEN FROM THE PISTON SHAFT WHEN THE PISTON SHAFT HEX IS ROTATED. IF THE RETAINING NUT CHANGES OR LOOSENS, THE INTERNAL ADJUSTMENT OF THE ACTUATOR CAN BE AFFECTED AND ACTUATOR OR ENGINE DAMAGE CAN OCCUR.

CAUTION: DO NOT USE EXCESSIVE FORCE WHEN ROTATING THE PISTON SHAFT BECAUSE INTERNAL DAMAGE TO THE ACTUATION COULD RESULT.

(2) Install a speed handle and socket on the hex end of the piston shaft (201/3). Rotate the piston shaft clockwise (as viewed from the rear) until the shaft rotation stops.

(3) Rotate the piston shaft counterclockwise (as viewed from the rear) four turns.

CAUTION: TO AVOID SHOULDER BOLT (201/5) DAMAGE, BE AWARE THAT SHOULDER BOLT IS LEFT HAND THREAD. HOLD ACTUATOR PISTON SHAFT HEX WHILE TORQUING SHOULDER BOLT.

(4) Holding piston shaft hex (201/3) to prevent rotation, install shoulder bolt (201/5), threads lubricated with Engine Oil P03−001 to piston shaft. Torque shoulder bolt to 50 − 70 lb−in. (5.649 − 7.909 N.m).

NOTE: Shoulder bolt may be rotated 30 degrees maximum in either direction to install cotter pin and can cause acceptable torques not in the torque range given in the previous step.

(5) Install cotter pin (201/6) to secure shoulder bolt. See 70−00−00, Standard Practices Manual, PN 585005.

(6) If necessary, install bleed valve actuator pressure and return tubes.

(a) Remove protective closures.

(b) Lubricate return tube (CR02) nut threads with Engine Oil P03−001 and connect to manifold tee and to actuator adapter (201/2).

R (c) Lubricate the pressure tube (CP06) nut threads with Anti-Seize Paste P06-054 and connect tube to the manifold tee and to the actuator adapter (201/1). Remove the unwanted paste.

(d) For post SB PW4ENG 75-45 engines, install clamps, bolt, lubricated with Engine Oil P03-001, and nut that attach the tube together. Torque the clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque return tube (CR02) nuts to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(f) Torque pressure tube (CP06) nut at manifold tee to 340 - 375 lb-in. (38.415 - 42.369 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

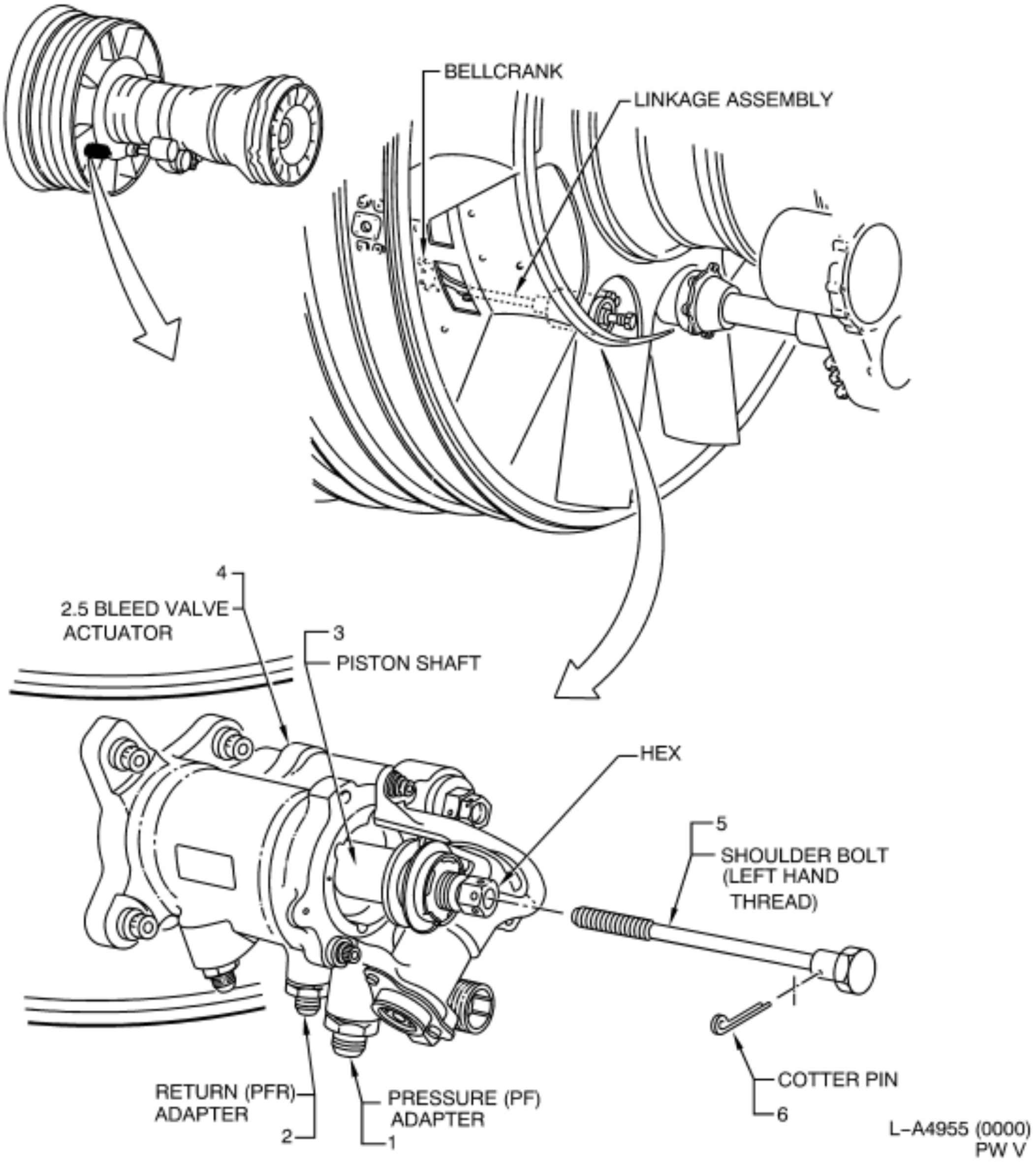
(g) Torque pressure tube (CP06) nut at actuator to 225 - 250 lb-in. (25.422 - 28.246 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(7) Clean shoulder bolt cotter pin area at both ends by SPOP 208 Wipe Method (Task 70-21-00-110-040). Surfaces shall be thoroughly dried in ambient temperatures. Drying time shall be sufficient to remove traces of solvent detrimental to sealant. Apply Sealant P09-014 to both ends of cotter pin.

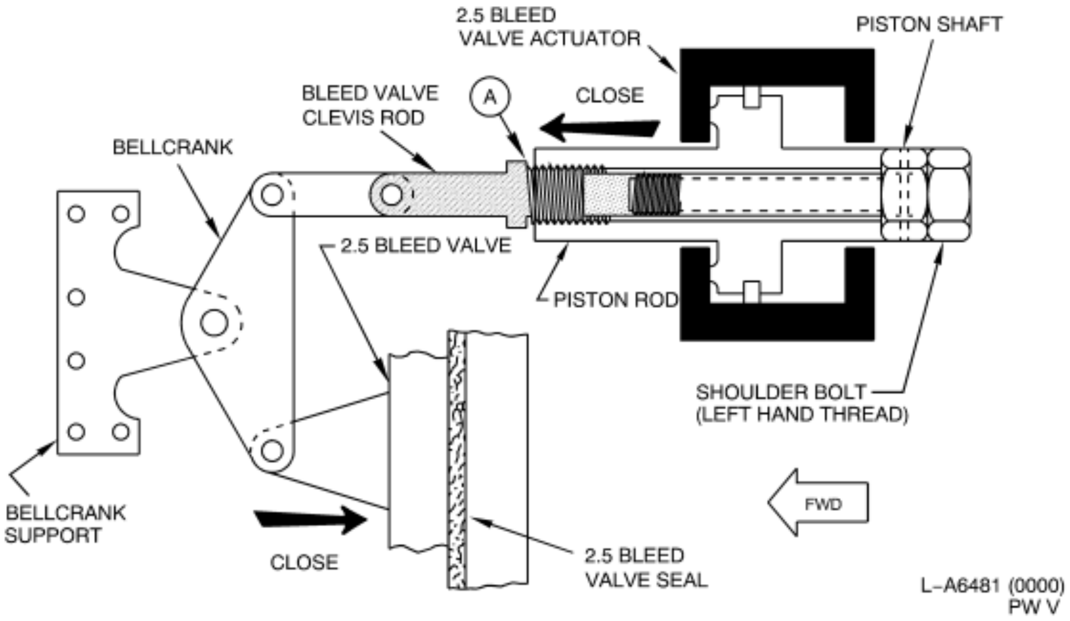
D. Postrequisites

(1) Install the fan exit liner segment (inner rear) that you removed. Refer to 72-00-33, Installation-16 Task 72-00-33-440-001.

(2) Test engine per Test Reference Table. See 71-00-00, Testing-00 Task 71-00-00-990-003.


BELLCRANK
LINKAGE ASSEMBLY
4
2.5 BLEED VALVE ACTUATOR
3
PISTON SHAFT
HEX
5
SHOULDER BOLT (LEFT HAND THREAD)
RETURN (PFR) ADAPTER
2
PRESSURE (PF) ADAPTER
1
COTTER PIN
6
L-A4955 (0000)
PW V

2.5 Bleed Valve Actuator
Figure 201 (Sheet 1)
(Task 72-00-00-830-001)


2.5 BLEED VALVE ACTUATOR
PISTON SHAFT
BLEED VALVE CLEVIS ROD
A
CLOSE
BELLCRANK
2.5 BLEED VALVE
PISTON ROD
SHOULDER BOLT (LEFT HAND THREAD)
FWD
BELLCRANK SUPPORT
CLOSE
2.5 BLEED VALVE SEAL
L-A6481 (0000)
PW V

2.5 Bleed Valve Actuator (System Cross Section)
Figure 201 (Sheet 2)
(Task 72-00-00-830-001)

Task 72−00−00−830−002−A:

1. Rig Variable Stator Vane Actuator − (Hydraulic Procedure)

A. General

WARNING: DO NOT PUT YOUR FINGERS IN THE WAY OF THE LINKAGES, UNISON RINGS, OR LEVERS WHEN YOU OPERATE THE STATOR VANE SYSTEM.

CAUTION: IT IS VERY IMPORTANT TO DO THIS HYDRAULIC RIGGING PROCEDURE WITH PRECISION. BAD RIGGING CAN CAUSE INCREASED HPC BLADE FATIGUE, INTERNAL ENGINE DAMAGE, OR COMPLETE ENGINE FAILURE.

CAUTION: ALWAYS REMOVE ALL RIG PINS BEFORE YOU MOVE THE STATOR VANE SYSTEM OR DAMAGE CAN RESULT.

NOTE: This hydraulic rigging procedure is the preferred method over the mechanical procedure given in Paragraph 2. Task 72−00−00−830−002−B00. This hydraulic rigging procedure puts a load on the system. This hydraulic load is more equivalent to the load caused during engine operation than the mechanical procedure load.

NOTE: Refer to ENGINE GENERAL − SPECIAL PROCEDURES−23, Task 72−00−00−910−001 for Hydraulic Pump Service And Operation of the PWA 49030 Hydraulic Pump or the CTE 5100 Hydraulic Pump.

B. Equipment And Materials Necessary

Standard Tools:

Glenair TG−70	Strap Wrench Or
Glenair TG−69	Soft Jawed Pliers
Bergen Mechanical Crimper	(Optional) Model M303, M305 or M307

Special Tools:

PWA 29451	Adapter
PWA 49030	Hydraulic Cart (Pneumatic) (Optional To CTE 5100)
PWA 85395	Rig Pin (Pre SB PW4ENG 72−246)
PWA 86097	Rig Pin (Post SB PW4ENG 72−246)
PWA 86317	Electrical Switch Box (Preferred)
PWA 101618	Adapter Elbow 90° (Optional)

Special Tools:

(CONTINUED)

CTE 5100	Hydraulic Cart (Pneumatic) Optional To PWA 49030)

NOTE: The PWA 85675 Rigging Pin Kit contains the above rig pins.

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P03-003	Fluid, Calibrating
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
R P06-054	Paste, Anti-Seize (PWA 36246)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	1	75-31-00/1/170
Seal	1	75-31-00/1/240

C. Procedure
See Figure 201 and 202.

WARNING: DO NOT LET ENGINE FUEL STAY ON YOUR SKIN FOR A LONG TIME. THE FUEL IS POISONOUS AND CAN GO THROUGH YOUR SKIN. PUT A CONTAINER, MINIMUM CAPACITY OF 5 U.S. GALLONS (19 liters), IN POSITION AND COLLECT THE DRAINED FUEL.

(1) If not done, remove the lockwire and disconnect the compressor stator hydraulic pressure tube (CP12) at both ends. Remove the lockwire and disconnect the compressor stator hydraulic return tube (CR03) at both ends. Loosen both clamp bolts and position the tubes away from the actuator adapters. Install the protection covers.

(2) Install the PWA 49030 Hydraulic Cart or CTE 5100 Hydraulic Cart as follows.

NOTE: If you do not know which pump to use, refer to Engine General - Special Procedures-23, Task 72-00-00-910-001 for Hydraulic Pump Service And Operation of the PWA 49030 Hydraulic Pump or the CTE 5100 Hydraulic Pump.

(a) Install the PWA 29451 Adapter to the actuators pressure adapter (Port PF). See Figure 201 (Sheet 1).

(b) Tighten and torque the PWA 29451 Adapter to 225 - 250 lb-in. (25.422 - 28.246 N.m).

NOTE: Hold the actuator adapter while you torque the tool adapter.

(c) Install the hydraulic pressure hose to the PWA 29451 Adapter.

NOTE: If necessary, use a standard 45 degree elbow or 90 degree PWA 101618 Adapter on the end of hydraulic pressure hose.

(d) Install the hydraulic return hose to the actuators return adapter (Port PFR).

(e) Hold the adapters with a wrench and torque the nuts on pressure hose and return hose to 200 - 225 lb-in. (22.597 - 25.422 N.m).

(3) With the power OFF, install the PWA 86317 Electrical Switch Box as follows.

NOTE: Although the PWA 86317 Electrical Switch Box is preferred, if the electrical switch box is not available, you can do a check of the stator vane actuater rigging without the box. Go to step (4).

(a) If not done, Disconnect the W4P3 and the W5P7 harness connectors from the stator vane actuator electrical receptacles "J7" and "J3". Install protection covers to the connectors. See Figure 201 (Sheet 2).

(b) Install the electrical lead from the electrical switch box to the upper receptacle on the stator vane actuator marked "J7".

(4) If not done, make the initial rod end bearing (202/3) adjustment as follows.

(a) Turn the actuator piston rod (202/6) until the flat surface below the hex of the rod end bearing is approximately 9/16 inch (14.288 mm) from the flat surface below the actuator rod threads. See Figure 202 (Sheet 1). This is the approximate initial adjustment only.

NOTE: You can turn the actuator piston rod for this adjustment only with no hydraulic pressure to the (Port PF).

(5) Service the hydraulic pump with Calibrating Fluid P03-003.

NOTE: If you do not know how to service the hydraulic pump, refer to Engine General - Special Procedures-23, Task 72-00-00-910-001 for Hydraulic Pump Service of the PWA 49030 Hydraulic Pump or the CTE 5100 Hydraulic Pump.

WARNING: MAKE SURE ALL PERSONS AND TOOLS ARE AWAY FROM THE MECHANICAL PARTS OF THE STATOR VANE ACTUATOR. WHEN YOU START THE PUMP, THE ACTUATOR CAN MOVE. IF YOU DO NOT DO THIS, YOU CAN CAUSE INJURY OR DAMAGE THE ENGINE.

(6) Operate the PWA 49030 Hydraulic Pump or the CTE 5100 Hydraulic Pump to fully extend the actuator rod (vanes open).

NOTE: If you do not know how to operate the hydraulic pump, refer to Engine General - Special Procedures-23, Task 72-00-00-910-001 for operation instructions of the PWA 49030 Hydraulic Pump or the CTE 5100 Hydraulic Pump.

(a) If a pneumatic driven hydraulic pump is used, supply 25 - 30 psig (172.4 - 206.8 kPa) air pressure to the pumps air gage.

(b) Supply 250 - 300 psig (1723.7 - 2068.4 kPa) hydraulic pressure to the stator vane actuator (Port PF).

(7) Push the power switch or the electrical box to the on position. Push the actuator switch to the extend position. See Figure 201 (Sheet 2).

NOTE: The actuator piston rod is fully extended at this time (vanes open).

(8) Adjust the actuator rod end bearing (202/3) as follows.

CAUTION: BE SURE THE ACTUATOR ROD STAYS FULLY EXTENDED WHEN YOU INSTALL THE BELLCRANK RIG PIN. IF THE ACTUATOR ROD IS ALLOWED TO RETRACT, THE VARIABLE STATOR VANES WILL OVERTRAVEL WHICH MAY RESULT IN HARMFUL STABILITY AND/OR DURABILITY EFFECTS.

CAUTION: BE SURE AND USE THE CORRECT BELLCRANK RIG PIN. USE THE LARGER PWA 85395 RIG PIN FOR (PRE SB PW4ENG 72-246 ENGINES). USE THE SMALLER PWA 86097 RIG PIN FOR (POST SB PW4ENG 72-246 ENGINES).

CAUTION: MAKE SURE THAT THE END OF THE RIG PINS ARE PROPERLY AND FULLY INSTALLED.

(a) Adjust the rod end bearing (202/3) so you can put the bellcrank PWA 85395 Rig Pin or PWA 86097 Rig Pin into the rig pin slot of the bellcrank arm (202/12) and into both holes of the support (202/11) with the hydraulic pressure on.

NOTE: During actuator rod end adjustments only, you can temporarily reduce the hydraulic pressure to 0 psig. You can turn the actuator piston rod for the last small adjustment.

(b) Lock the rod end bearing to the actuator rod with the jamnut (202/5). Torque the jamnut (202/5) to 460 - 510 lb-in. (51.973 - 57.622 N.m).

CAUTION: REMOVE ALL THE RIG PINS FROM THE UNISON RINGS AND THE BELLCRANK BEFORE YOU CONTINUE OR DAMAGE CAN RESULT.

(c) Remove the bellcrank rig pin. Push the actuation switch (201/6) on the electrical switch box to retract and extend the actuator several times through full travel. Stop with the rod fully extended. Go to step (e).

NOTE: If an electrical switch box is not available continue with step (d).

(d) If the PWA 86317 Electrical Switch Box is not available, operate the stator vane system as follows.

1 If an air supply is used, turn the air supply valve knob to the closed position (perpendicular to flow).

2 Use a crowsfoot and wrench on the flats of the bellcrank (202/1). Push the wrench up and move the system to the closed position. Remove the wrench.

3 Operate the hydraulic cart and supply 250 − 300 psig hydraulic pressure to the actuator PF port. Fully extend the actuator rod (202/6) to the full open position. The stator vane actuator piston is now extended against the internal stop. Do step (d) again one more time.

(e) With the actuator rod (202/6) extended fully (vanes open), install the bellcrank rig pin in the rig pin slot (202/12) of the bellcrank arm and both holes of the support (202/11). If you can not install the rig pin, do the rod end adjustment again in step (6). If you can install the rig pin, lock the jamnut (202/5) and rod end (202/3) with the key washer (202/4). Bend one set of tabs onto the rod end bearing (202/3) and the other set onto the jamnut (202/5). Install the Lockwire P05−289 and seal (202/7). See 70−53−00, Standard Practices Manual, PN 585005.

(f) Torque the rod end bearing retaining bolt nut (202/10) to a minimum of 15 lb-in. (1.695 N.m) plus the torque necessary to turn the nut on the bolt (202/2). Continue and torque the nut until the slot in the nut aligns with the hole in the bolt. This torque must not be more than 22 lb-in. (2.486 N.m) plus the torque necessary to turn the nut on the bolt. Install the cotter pin (202/9) to the nut. Bend the cotter pin. See the 70-53-00, Standard Practices Manual, PN 585005.

CAUTION: REMOVE ALL THE RIG PINS FROM THE UNISON RINGS AND THE BELLCRANK BEFORE YOU CONTINUE OR DAMAGE CAN RESULT.

(9) Remove the rig pin.

(10) After the adjustment, disconnect the pumps hydraulic pressure hose and return hose from the actuator. Refer to Engine General - Special Procedures-23, Task 72-00-00-910-001 for operation instructions of the PWA 49030 Hydraulic Pump or the CTE 5100 Hydraulic Pump.

(11) Remove the PWA 29451 Adapter from the (Port PF).

NOTE: Hold the adapters while you disconnect the hoses and tool adapter.

(12) Push the power switch (201/3) on the electrical switch box to off. Disconnect the electrical connector from the actuator.

(13) Connect the W4P3 and the W5P7 harness connectors to the actuator harness receptacles as follows. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11-009. Let the connector and receptacle dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal). This procedure will make sure the contacts are sufficiently engaged and the connector is tight.
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(14) Install the compressor stator cylinder hydraulic pressure tube assembly (CP12).

R R R (a) Remove the protective covers. Lubricate the tube adapter threads at each end with Anti−Seize Paste P06−054. Remove the unwanted paste.

(b) Install the tube nuts to the larger adapter on the actuator and to the hydraulic manifold tee handtight only.

(c) Torque the clamp bolt, lubricated with Engine Oil P03−001, to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Torque the tube nuts to 225 - 250 lb-in. (25.422 - 28.246 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(15) Install the compressor stator cylinder hydraulic return tube assembly (CR03).

R (a) Remove the protective covers. Lubricate the tube
R adapter threads at each end with Anti-Seize Paste
R P06-054. Remove the unwanted paste.

(b) Install the tube nuts to the smaller adapter on the actuator and to the inlet return manifold tee handtight only.

(c) Torque the clamp bolt, lubricated with Engine Oil P03-001, to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Torque the tube nuts to 225 - 250 lb-in. (25.422 - 28.246 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

D. Postrequisites

CAUTION: BE SURE YOU REMOVE ALL RIG PINS AND TOOLS FROM THE ENGINE OR ENGINE DAMAGE CAN RESULT.

(1) Test engine per Test Reference Table. See 71-00-00, Testing-00 Task 71-00-00-990-003.

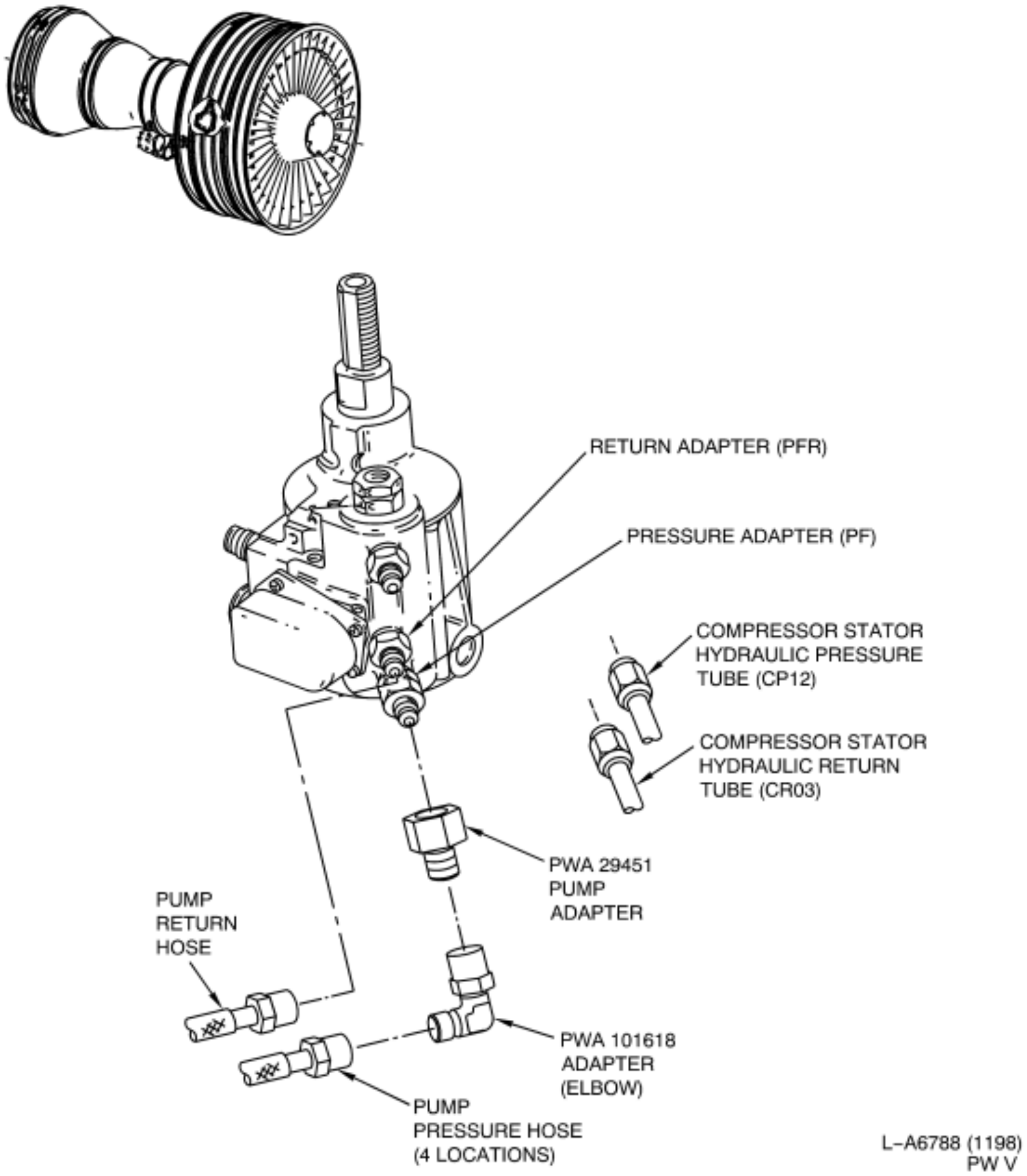
Task 72-00-00-830-002-B:

2. Rig Variable Stator Vane Actuator - (Mechanical Procedure)

A. General

WARNING: DO NOT PUT YOUR FINGERS IN THE WAY OF THE LINKAGES, UNISON RINGS, OR LEVERS WHEN YOU OPERATE THE STATOR VANE SYSTEM.

CAUTION: IT IS VERY IMPORTANT TO DO THIS MECHANICAL RIGGING PROCEDURE WITH PRECISION. BAD RIGGING CAN CAUSE


RETURN ADAPTER (PFR)
PRESSURE ADAPTER (PF)
COMPRESSOR STATOR HYDRAULIC PRESSURE TUBE (CP12)
COMPRESSOR STATOR HYDRAULIC RETURN TUBE (CR03)
PWA 29451 PUMP ADAPTER
PUMP RETURN HOSE
PWA 101618 ADAPTER (ELBOW)
PUMP PRESSURE HOSE (4 LOCATIONS)
L-A6788 (1198)
PW V

Variable Stator Vane Actuator Rigging - (Hydraulic Procedure)
CTE 5100 Or PWA 49030 Hydraulic Cart Installation)
Figure 201 (Sheet 1)
(Task 72-00-00-830-002-A)

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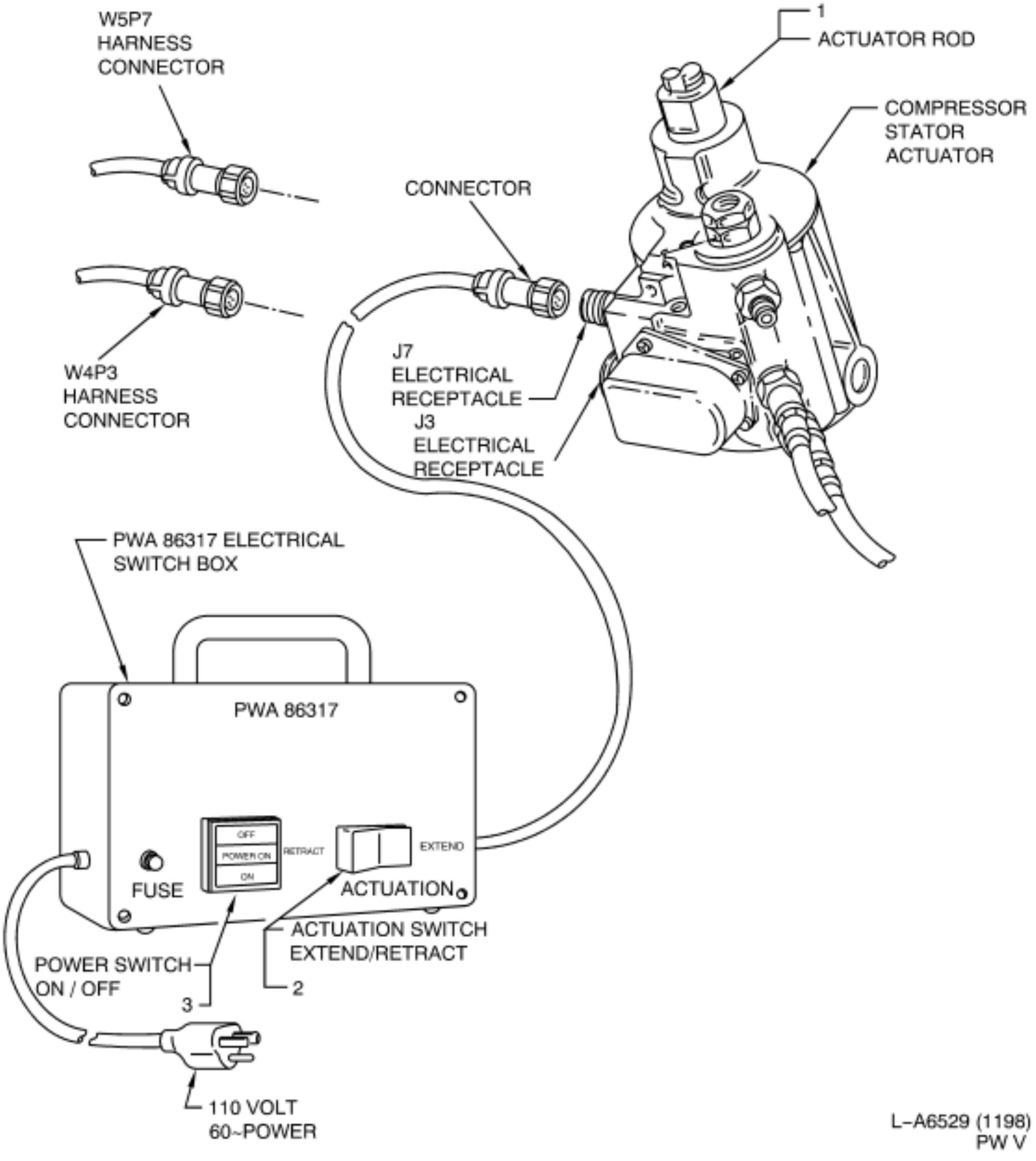
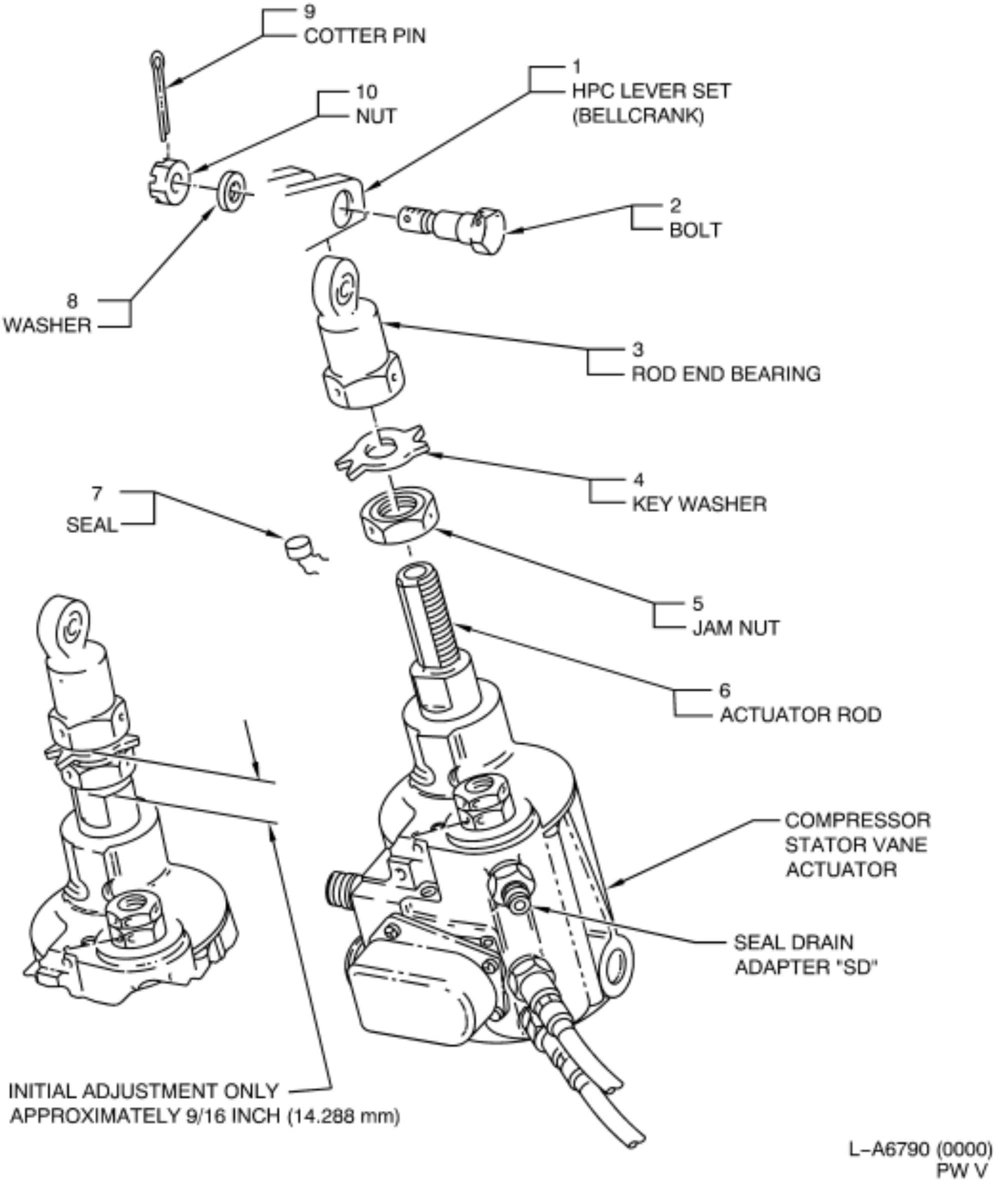
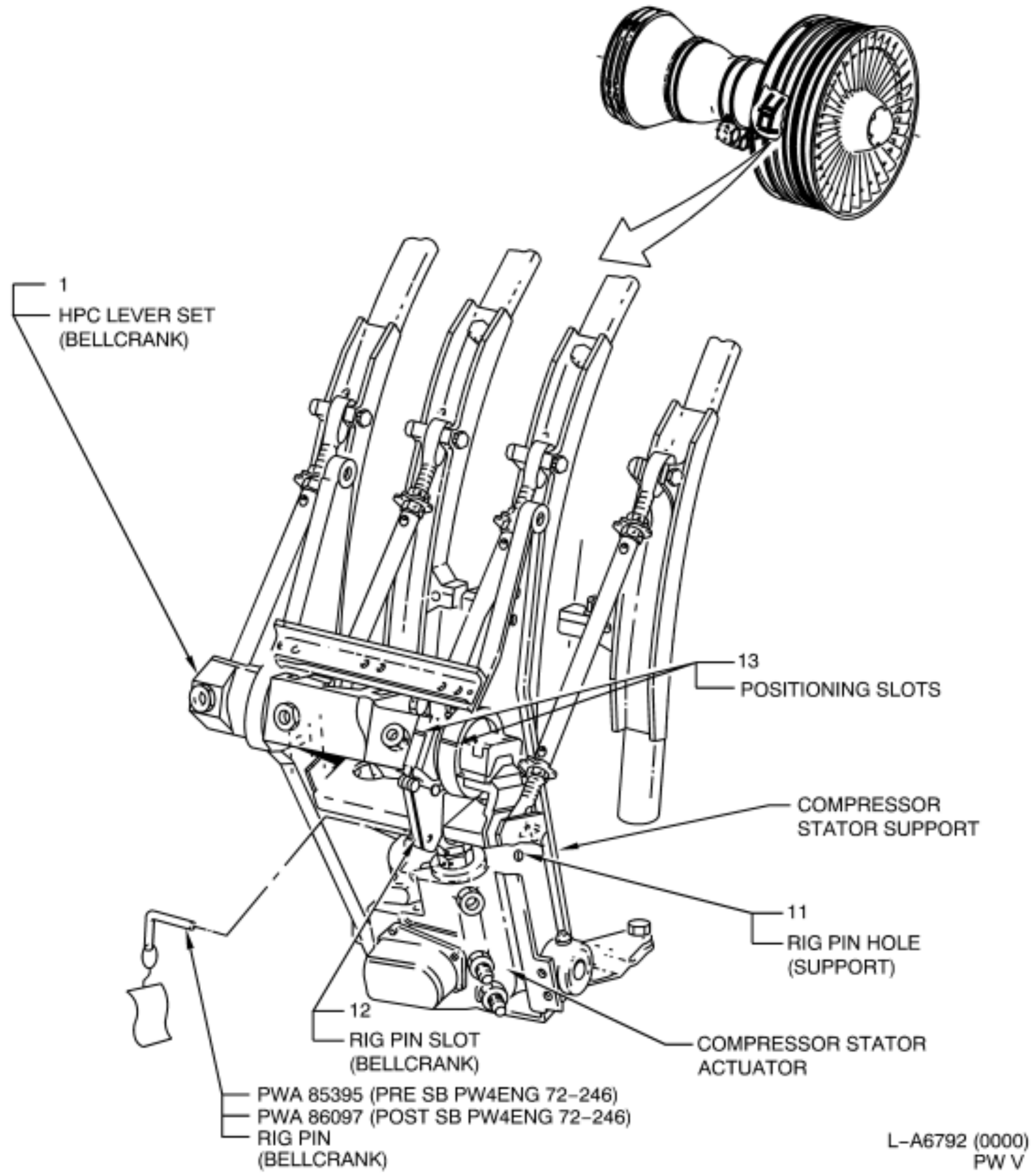

W5P7
HARNESS
CONNECTOR
1
ACTUATOR ROD
COMPRESSOR
STATOR
ACTUATOR
CONNECTOR
W4P3
HARNESS
CONNECTOR
J7
ELECTRICAL
RECEPTACLE
J3
ELECTRICAL
RECEPTACLE
PWA 86317 ELECTRICAL
SWITCH BOX
PWA 86317
OFF
POWER ON
ON
RETRACT
EXTEND
FUSE
ACTUATION
ACTUATION SWITCH
EXTEND/RETRACT
2
POWER SWITCH
ON / OFF
3
110 VOLT
60~POWER
L−A6529 (1198)
PW V

Variable Stator Vane Actuator Rigging − (Hydraulic Procedure) PWA 86317 Electrical Switch Box Installation)
Figure 201 (Sheet 2)
(Task 72−00−00−830−002−A)


9
COTTER PIN
1
HPC LEVER SET
(BELLCRANK)
10
NUT
2
BOLT
8
WASHER
3
ROD END BEARING
4
KEY WASHER
7
SEAL
5
JAM NUT
6
ACTUATOR ROD
COMPRESSOR
STATOR VANE
ACTUATOR
SEAL DRAIN
ADAPTER "SD"
INITIAL ADJUSTMENT ONLY
APPROXIMATELY 9/16 INCH (14.288 mm)
L−A6790 (0000)
PW V

Variable Stator Vane Actuator Rigging
− (Hydraulic Procedure) (Actuator Adjustment)
Figure 202 (Sheet 1)
(Task 72−00−00−830−002−A)


1
HPC LEVER SET
(BELLCRANK)
13
POSITIONING SLOTS
COMPRESSOR
STATOR SUPPORT
11
RIG PIN HOLE
(SUPPORT)
12
RIG PIN SLOT
(BELLCRANK)
COMPRESSOR STATOR
ACTUATOR
PWA 85395 (PRE SB PW4ENG 72−246)
PWA 86097 (POST SB PW4ENG 72−246)
RIG PIN
(BELLCRANK)
L−A6792 (0000)
PW V

Variable Stator Vane Actuator Rigging
− (Hydraulic Procedure) (Rigging Location)
Figure 202 (Sheet 2)
(Task 72−00−00−830−002−A)

INCREASED HPC BLADE FATIGUE, INTERNAL ENGINE DAMAGE, OR COMPLETE ENGINE FAILURE.

CAUTION: ALWAYS REMOVE ALL RIG PINS BEFORE YOU MOVE THE STATOR VANE SYSTEM.

NOTE: Also see the preferred hydraulic procedure in Paragraph 1, Task 72-00-00-830-002-A00.

B. Equipment And Materials Necessary

Special Tools:

PWA 85395	Rig Pin (Pre SB PW4ENG 72-246)
PWA 86097	Rig Pin (Post SB PW4ENG 72-246)
PWA 86344	Holder, Rigging

NOTE: The PWA 85675 Rigging Pin Kit contains the above rig pins.

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	1	75-31-00/1/170
Seal	1	75-31-00/1/240

C. Procedure
See Figure 203.

CAUTION: BE SURE AND USE THE CORRECT BELLCRANK RIG PIN. USE THE LARGER PWA 85395 RIG PIN FOR (PRE SB PW4ENG 72-246 ENGINES). USE THE SMALLER PWA 86097 RIG PIN FOR (POST SB PW4ENG 72-246 ENGINES).

CAUTION: BE SURE THAT THE END OF THE RIG PINS ARE PROPERLY AND FULLY INSTALLED.

CAUTION: BE SURE YOU KEEP THE ACTUATOR ROD FULLY EXTENDED WHEN YOU INSTALL THE BELLCRANK RIG PIN. IF YOU LET THE ACTUATOR ROD RETRACT, THE VARIABLE STATOR

VANES WILL OVERTRAVEL WHICH MAY RESULT IN HARMFUL STABILITY AND/OR DURABILITY EFFECTS.

CAUTION: TOO MUCH TORQUE WITH THE WRENCH ON THE BELLCRANK DURING THIS RIGGING CAN BEND THE BELLCRANK BRACKET. THIS CAN RESULT IN BAD RIGGING.

(1) If not done, make the initial rod end bearing (203/3) adjustment as follows.

(a) Turn the actuator piston rod (203/6) until the flat surface below the rod end bearing (203/3) hex is approximately 9/16 inch (14.288 mm) from the flat surface below the actuator rod threads. See Figure 203 (Sheet 1). This is the approximate initial adjustment only.

(2) Adjust the actuator rod end bearing (203/3) as follows.

(a) Use a standard crowsfoot and wrench on the flats of the bellcrank (203/1) adjacent to the 5th stage adjuster. Pull down on the wrench until you feel the actuator internal stop. Push up on the wrench until you are off of the actuator internal stop. Pull down on the wrench again. Hold the bellcrank (203/1) so that the actuator rod (203/6) is fully extended against the internal stop (vanes open). Hold the actuator fully extended against the internal stop with 300 - 400 lb-in. (33.895 - 45.194 N.m) on the crowsfoot. While you hold the actuator fully extended against the internal stop, install the PWA 86344 Holder between the jamnut and the top of the actuator housing. Tighten and torque the detail bolt to 8 - 10 lb-in. (0.904 - 1.130 N.m). Do not tighten the bolt too much. Tighten the detail jamnut by hand.

(b) Adjust the rod end bearing (203/3) so that you can install the PWA 85395 Rig Pin or the PWA 86097 Rig Pin into the bellcrank arm slot (203/12) and into both holes of the support (203/11).

NOTE: You must remove the PWA 86344 Holder when you adjust the rod end bearing and then install the holder again for the rig pin installation.

(c) Remove the rig pin and PWA 86344 Holder. Lock the rod end bearing to the actuator rod with the jamnut (203/5). Torque the jamnut (203/5) to 460 − 510 lb−in. (51.973 − 57.622 N.m).

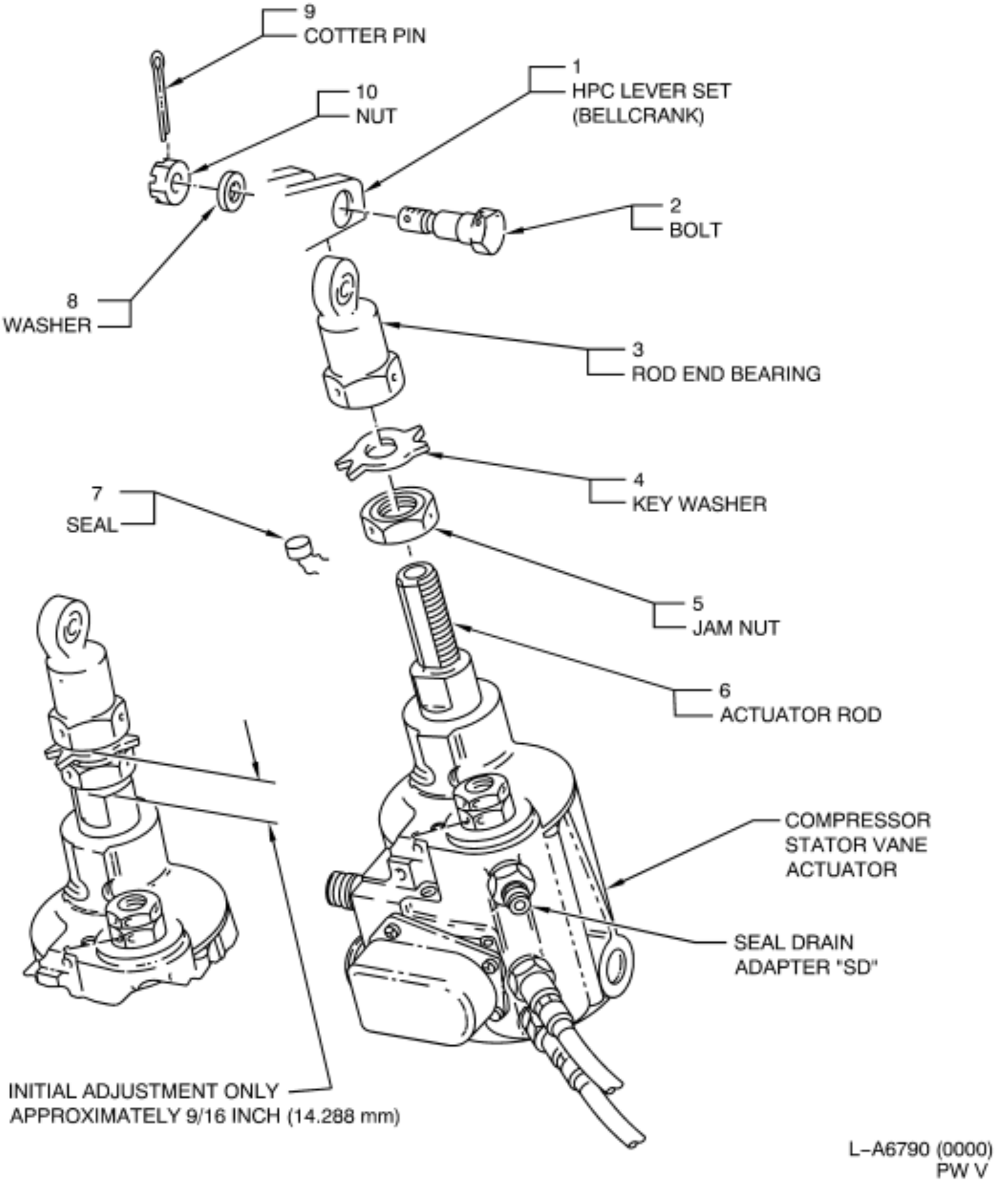
(d) Push up on the wrench and retract the actuator rod. Pull down again to fully extend the actuator rod again. Hold the actuator fully extended against the internal stop with 300 − 400 lb−in. (33.895 − 45.194 N.m) on the crowsfoot. While you hold the actuator fully extended against the internal stop, install the PWA 86344 Holder between the jamnut and the top of the actuator housing. Tighten and torque the detail bolt to 8 − 10 lb−in. (0.904 − 1.130 N.m). Do not tighten the bolt too much. Tighten the detail jamnut by hand. Install the rig pin again with the actuator rod fully extended. If you can not install the bellcrank rig pin do the rod end adjustment again in step (2). If you can install the bellcrank rig pin, remove the rig pin and the PWA 86344 Holder. Lock the jamnut (203/5) and the rod end bearing (203/3) with the key washer (203/4). Bend one set of tabs onto the rod end bearing (203/3) and the other set onto the jamnut (203/5). Install the Lockwire P05−289 and seal (203/7). See section 72−53−00,Standard Practices Manual, PN 585005.

(3) Torque the rod end bearing retaining bolt nut (203/10) to a minimum of 15 lb−in. (1.695 N.m) plus the torque necessary to turn the nut on the bolt (203/2). Continue and torque the nut until the slot in the nut aligns with the hole in the bolt. This torque must not be more than 22 lb−in. (2.486 N.m) plus the torque necessary to turn the nut on the bolt. Install the cotter pin (203/9) to the nut. Bend the cotter pin. See section 70−53−00, Standard Practices Manual, PN 585005.

D. Postrequisites

CAUTION: BE SURE YOU REMOVE ALL RIG PINS AND TOOLS FROM THE ENGINE OR ENGINE DAMAGE CAN RESULT.

(1) Test engine per Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


9
COTTER PIN
10
NUT
1
HPC LEVER SET
(BELLCRANK)
2
BOLT
8
WASHER
3
ROD END BEARING
4
KEY WASHER
7
SEAL
5
JAM NUT
6
ACTUATOR ROD
COMPRESSOR
STATOR VANE
ACTUATOR
SEAL DRAIN
ADAPTER "SD"
INITIAL ADJUSTMENT ONLY
APPROXIMATELY 9/16 INCH (14.288 mm)
L-A6790 (0000)
PW V

Variable Stator Vane Actuator Rigging -
(Mechanical Procedure) (Actuator Adjustment)
Figure 203 (Sheet 1)
(Task 72-00-00-830-002-B)

R
R
R
R
R
R
R
R
R
R
R
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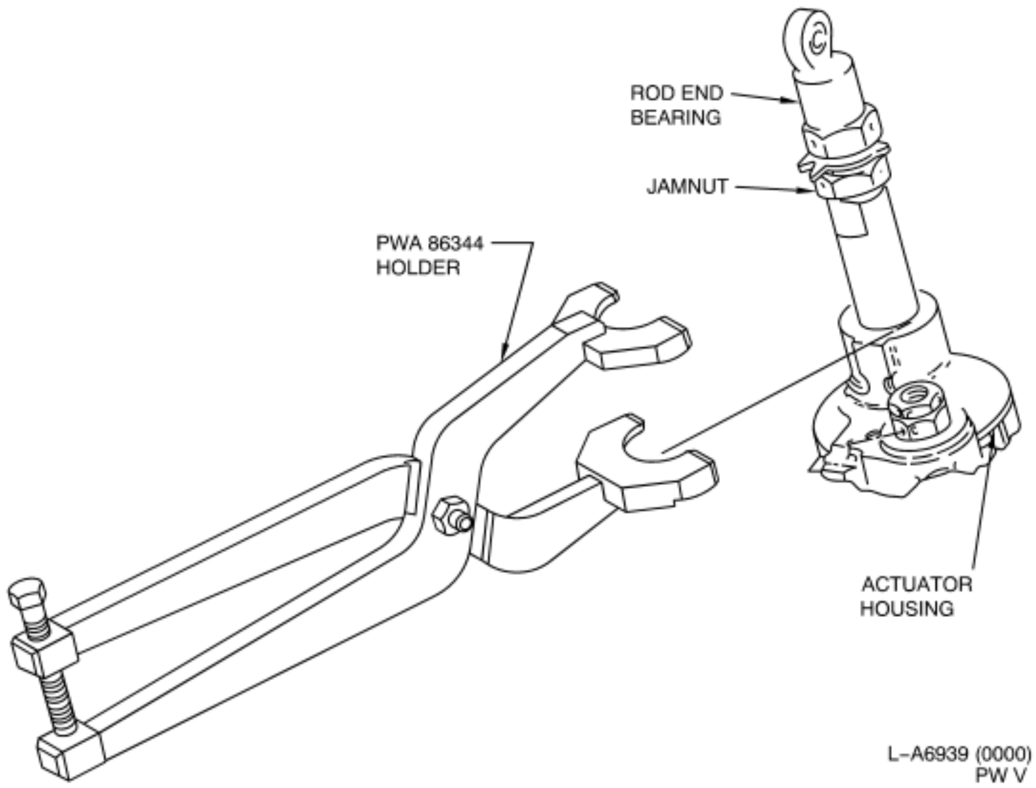
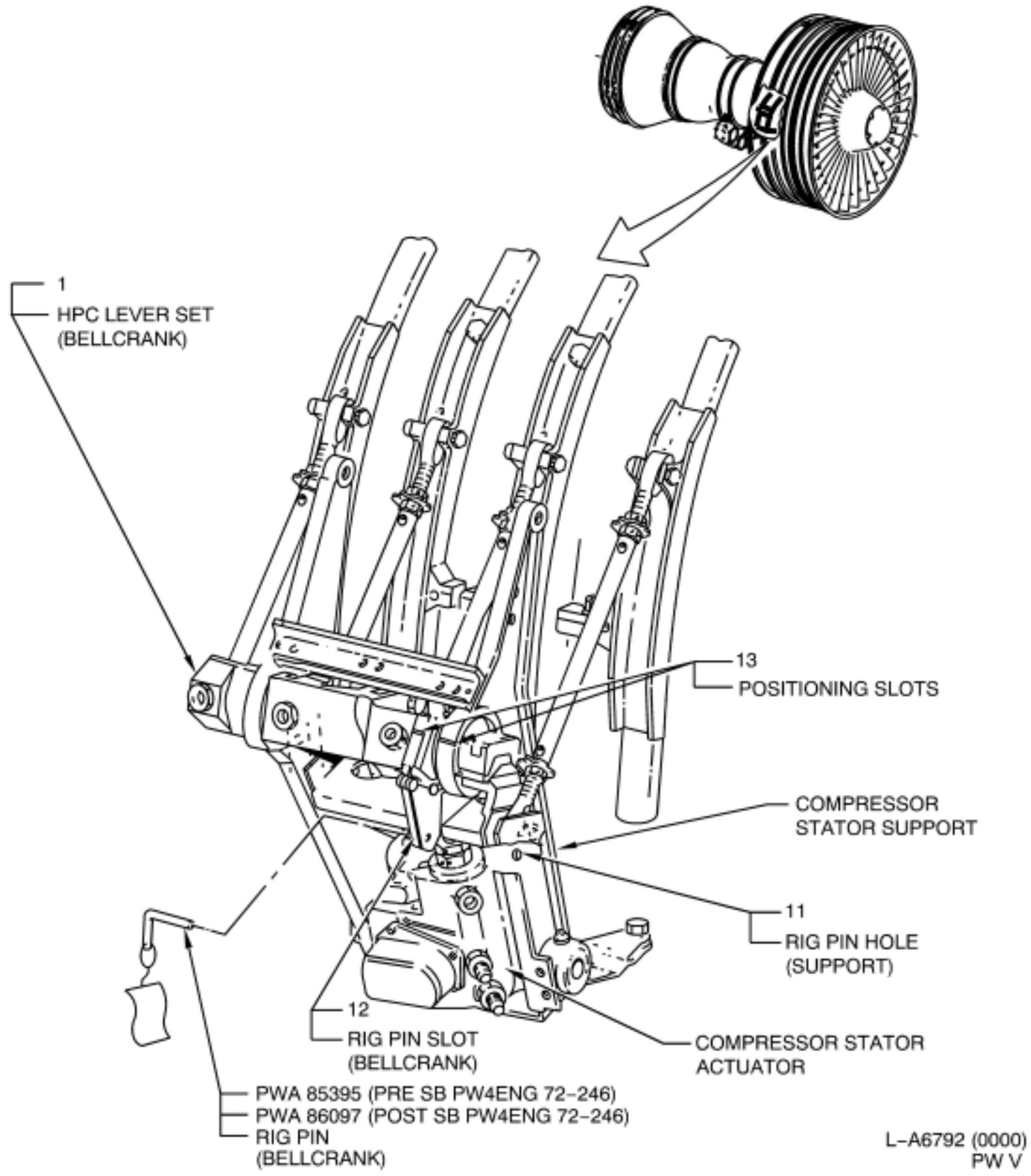

ROD END
BEARING
JAMNUT
PWA 86344
HOLDER
ACTUATOR
HOUSING
L-A6939 (0000)
PW V

R Variable Stator Vane Actuator Rigging - (Mechanical
R Procedure) PWA 86344 Holder Installation)
R Figure 203 (Sheet 2)
R (Task 72-00-00-830-002-B)


1
HPC LEVER SET
(BELLCRANK)
13
POSITIONING SLOTS
COMPRESSOR
STATOR SUPPORT
11
RIG PIN HOLE
(SUPPORT)
COMPRESSOR STATOR
ACTUATOR
12
RIG PIN SLOT
(BELLCRANK)
PWA 85395 (PRE SB PW4ENG 72-246)
PWA 86097 (POST SB PW4ENG 72-246)
RIG PIN
(BELLCRANK)
L-A6792 (0000)
PW V

Variable Stator Vane Actuator Rigging -
(Mechanical Procedure) (Rigging Locations)
Figure 203 (Sheet 3)
(Task 72-00-00-830-002-B)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-00-830-003-A:

1. Rig Variable Stator Vane Control System - (Hydraulic Procedure)

A. General

WARNING: DO NOT PUT YOUR FINGERS IN THE WAY OF THE LINKAGES, UNISON RINGS, OR LEVERS WHEN YOU OPERATE THE STATOR VANE SYSTEM.

CAUTION: IT IS VERY IMPORTANT TO DO THIS HYDRAULIC RIGGING PROCEDURE WITH PRECISION. BAD RIGGING CAN CAUSE INCREASED HPC BLADE FATIGUE, INTERNAL ENGINE DAMAGE, OR COMPLETE ENGINE FAILURE.

CAUTION: ALWAYS REMOVE ALL RIG PINS BEFORE YOU MOVE THE STATOR VANE SYSTEM OR DAMAGE CAN RESULT.

NOTE: This hydraulic rigging procedure is the preferred method over the mechanical procedure given in Paragraph 2, Task 72-00-00-830-003-B00. This hydraulic rigging procedure puts a load on the system. This hydraulic load is more equivalent to the load caused during engine operation than the mechanical procedure load.

B. Equipment And Materials Necessary

Standard Tools:

Glenair TG-70	Strap Wrench (Optional to Glenair TG-69)
Glenair TG-69	Soft Jawed Pliers (Optional to Glenair TG-70)
Bergen Mechanical Crimper	(Optional) Model M303, M305 or M307

Special Tools:

PWA 29451 Adapter	
PWA 49030	Hydraulic Cart (Pneumatic) (Optional To CTE 5100)
PWA 85393	Rig Pin (3 Required)
PWA 85394	Rig Pin (Optional to PWA 86197)
PWA 85395	Rig Pin (Pre SB PW4ENG 72-246)
PWA 86097	Rig Pin (Post SB PW4ENG 72-246)
PWA 86197	Rig Pin
PWA 86317	Electrical Switch Box (Preferred)
PWA 101618	Adapter Elbow 90° (Optional)

Special Tools:

(CONTINUED)

CTE 5100	Hydraulic Cart (Pneumatic) Optional To PWA 49030)

NOTE: NOTE: The PWA 85675 Rigging Pin Kit contains the above rig pins.

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P03-003	Fluid, Calibrating
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
R	P06-054	Paste, Anti-Seize (PWA 36246)
	P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	2	72-35-00/25/160
Cotter Pin	2	72-35-00/26/160
Cotter Pin	1	72-35-00/27/140
Cotter Pin	1	72-35-00/27/180
Cotter Pin	2	72-35-00/28/160
Key Washer	2	72-35-00/25/90
Key Washer	2	72-35-00/26/90
Key Washer	2	72-35-00/27/90
Key Washer	2	72-35-00/28/90
Seal	2	72-35-00/25/170
Seal	2	72-35-00/26/170
Seal	2	72-35-00/27/190
Seal	2	72-35-00/28/170

C. Procedure
See Figure 201 and Figure 202.

WARNING: DO NOT LET ENGINE FUEL STAY ON YOUR SKIN FOR A LONG TIME. THE FUEL IS POISONOUS AND CAN GO THROUGH YOUR SKIN. PUT A CONTAINER, MINIMUM CAPACITY OF 5 U.S. GALLONS (19 liters), IN POSITION AND COLLECT THE DRAINED FUEL.

(1) Remove the lockwire and disconnect the compressor stator hydraulic pressure tube (CP12) at both ends. Remove the lockwire and disconnect the compressor stator hydraulic return tube (CR03) at both ends. Loosen both clamp bolts and position the tubes away from the actuator adapters. Install the protection covers.

(2) Install the PWA 49030 Hydraulic Cart or CTE 5100 Hydraulic Cart as follows.

NOTE: If you do not know which pump to use, refer to Engine General − Special Procedures−23, Task 72−00−00−910−001 for Hydraulic Pump Service And Operation of the PWA 49030 Hydraulic Pump or the CTE 5100 Hydraulic Pump.

(a) Install the PWA 29451 Adapter to the actuators pressure adapter (Port PF). See Figure 201 (Sheet 1).

(b) Tighten and torque the PWA 29451 Adapter to 225 − 250 lb−in. (25.422 − 28.246 N.m).

NOTE: Hold the actuator adapter while you torque the tool adapter.

(c) Install the hydraulic pressure hose to the PWA 29451 Adapter.

NOTE: If necessary, use a standard 45 degree or 90 degree PWA 101618 Adapter on the end of hydraulic pressure hose.

(d) Install the hydraulic return hose to the actuators return adapter (Port PFR).

(e) Hold the adapters with a wrench and torque the nuts on pressure hose and return hose to 200 − 225 lb−in. (22.597 − 25.422 N.m).

(3) With the power OFF, install the PWA 86317 Electrical Switch Box as follows.

NOTE: Although the PWA 86317 Electrical Switch Box is preferred, if the electrical switch box is not available, you can do a check of the stator vane rigging system without the box. Go to step (4).

(a) Disconnect the W4P3 and the W5P7 harness connectors from the stator vane actuator electrical Receptacles J7 and J3. Install protection covers to the connectors.

(b) Install the electrical lead from the electrical switch box to the upper receptacle on the stator vane actuator Marked J7.

(4) Service the hydraulic pump with Calibrating Fluid P03-003.

NOTE: If you do not know how to service the hydraulic pump, refer to Engine General - Special Procedures-23, Task 72-00-00-910-001 for Hydraulic Pump Service of the PWA 49030 Hydraulic Pump or the CTE 5100 Hydraulic Pump.

WARNING: MAKE SURE ALL PERSONS AND TOOLS ARE AWAY FROM THE MECHANICAL PARTS OF THE STATOR VANE ACTUATOR. WHEN YOU START THE PUMP, THE ACTUATOR CAN MOVE. IF YOU DO NOT DO THIS, YOU CAN CAUSE INJURY OR DAMAGE THE ENGINE.

(5) Operate the PWA 49030 Hydraulic Pump or the CTE 5100 Hydraulic Pump to fully extend the actuator rod (vanes open).

NOTE: If you do not know how to operate the hydraulic pump, refer to Engine General - Special Procedures-23, Task 72-00-00-910-001 for operation instructions of the PWA 49030 Hydraulic Pump or the CTE 5100 Hydraulic Pump.

(a) If a pneumatic driven hydraulic pump is used, supply 25 - 30 psig (172.4 - 206.8 kPa) air pressure to the pumps air gage.

(b) Supply 250 - 300 psig (1723.7 - 2068.4 kPa) hydraulic pressure to the stator vane actuator (Port PF).

(6) Examine the stator vane control system rigging as follows.

NOTE: If an electrical switch box is not available, go to step (7).

(a) Push the power switch (201/3) on the electrical switch box to on position.

(b) Push the actuation switch (201/2) on the electrical switch box to the extend and retract positions several times to operate the actuator. Stop the rod (201/1) in the extended position. Go to step (8).

(7) If the PWA 86317 Electrical Switch Box is not available, operate the stator vane system as follows.

(a) If an air supply is used, turn the air supply valve knob to the closed position (perpendicular to flow). Hydraulic pressure will bleed off.

(b) Use a standard crowsfoot and wrench on the flats of the bellcrank (202/4) adjacent to the 5th stage adjuster. See Figure 202. Push up on the wrench and move the bellcrank (202/4) to the closed position. Remove the crowsfoot and wrench.

(c) Operate the hydraulic cart and supply 250 - 300 psig (1723.7 - 2068.4 kPa) hydraulic pressure to the Actuator PF port. The stator vane actuator will move to the full open position. The stator vane actuator piston is now extended against the internal stop. Do step (7) again (one more time).

CAUTION: BE SURE AND USE THE CORRECT BELLCRANK RIG PIN. USE THE LARGER PWA 85395 RIG PIN FOR (PRE SB PW4ENG 72-246 ENGINES). USE THE SMALLER PWA 86097 RIG PIN FOR (POST SB PW4ENG 72-246 ENGINES).

CAUTION: BE SURE THAT THE END OF THE RIG PINS ARE PROPERLY AND FULLY INSTALLED.

(8) With the actuator rod fully extended, (vanes open) put the bellcrank PWA 85395 Rig Pin or bellcrank PWA 86097 Rig Pin into the rig pin slot of the bellcrank arm (202/3) and into both holes of the support (202/2).

(9) If you can put the bellcrank rig pin in, go to step (12) and do a check of the unison rings rigging.

(10) If you can not put the bellcrank rig pin in, go to step (11) and adjust the actuator rod end.

CAUTION: RIG PINS MUST ALWAYS BE REMOVED PRIOR TO RELEASING ACTUATOR PRESSURE OR DAMAGE TO SYSTEM CAN RESULT.

(11) If necessary, adjust the actuator rod end bearing (202/6) as follows.

(a) If an air supply is used, turn the air supply valve knob of the hydraulic cart to the closed position (perpendicular to flow).

(b) Remove and discard the cotter pin (202/12) from the stator vane actuator rod end bearing retaining bolt (202/5). Loosen and remove the nut (202/13), washer (202/11) and bolt (202/5) from the stator vane actuator rod end bearing.

(c) Remove the lockwire and seal (202/10) from the actuator rod and make the tabs of key washer (202/7) straight. Loosen the jamnut (202/8) and remove the rod end bearing (202/6) Remove the key washer (202/7). Install the new key washer and install the rod end bearing (202/6), threads lubricated with Engine Oil P03-001. Tighten until the flat surface below the hex is approximately 9/16 inch (14.288 mm) from the flat surface below the actuator rod threads. See Figure 202 (Sheet 2). This is the approximate initial adjustment only.

(d) Align and temporarily connect the rod end bearing (202/6) to the bellcrank (202/4) with the bolt (202/5).

NOTE: Make sure the bolt head stays against the surface of the bellcrank. Do not let the bolt move out of the bolthole at all.

(e) Operate the hydraulic cart and supply 250 - 300 psig (1723.7 - 2068.4 kPa) hydraulic pressure to the Actuator (Port PF). Fully extend the actuator rod (202/9) to the full open position.

CAUTION: BE SURE THE ACTUATOR ROD STAYS FULLY EXTENDED WHEN YOU INSTALL THE BELLCRANK RIG PIN. IF THE ACTUATOR ROD IS ALLOWED TO RETRACT, THE VARIABLE STATOR VANES WILL OVERTRAVEL WHICH MAY RESULT IN

HARMFUL STABILITY AND/OR DURABILITY EFFECTS.

(f) Adjust the rod end bearing (202/6) so you can put the bellcrank PWA 85395 Rig Pin or PWA 86097 Rig Pin into the rig pin slot of the bellcrank arm (202/3) and into both holes of the support (202/2) with the hydraulic pressure on. Install the washer (202/11) and nut (202/13), threads lubricated with Engine Oil P03-001, to the bolt (202/5). Torque the nut to a minimum of 15 lb-in. (1.695 N.m) plus the torque necessary to turn the nut on the bolt. Continue to torque the nut until the slot in the nut aligns with the hole in the bolt. This torque must not be more than 22 lb-in. (2.486 N.m) plus the torque necessary to turn the nut on the bolt. Install the cotter pin (202/12) to the nut. Bend the cotter pin. See section 70-53-00 in the Standard Practices Manual, PN 585005.

NOTE: If an air supply is used, turn the air supply valve knob of the hydraulic cart to the closed position and temporarily reduce the hydraulic pressure to 0 psig (0.0 kPa). You can turn the actuator piston rod for the last small adjustment.

(g) Lock the rod end bearing to the actuator rod with the jamnut (202/8). Torque the jamnut (202/8) to 460 - 510 lb-in. (51.973 - 57.622 N.m).

CAUTION: REMOVE ALL THE RIG PINS FROM THE UNISON RINGS AND THE BELLCRANK BEFORE YOU CONTINUE OR DAMAGE CAN RESULT.

(h) Remove the bellcrank rig pin. Push the actuation switch (201/2) on the electrical switch box to retract and extend the actuator several times through full travel. Stop with the rod fully extended. Go to step (j).

NOTE: If an electrical switch box is not available continue with step (i).

(i) If the PWA 86317 Electrical Switch Box is not available, operate the stator vane system as follows.

1 If an air supply is used, turn the air supply valve knob of the hydraulic cart to the closed position (perpendicular to flow).

2 Use a crowsfoot and wrench on the flats of the bellcrank (202/4). Push the wrench up and move the system to the closed position. Remove the wrench.

3 Operate the hydraulic cart and supply 250 − 300 psig (1723.7 − 2068.4 kPa) hydraulic pressure to the Actuator (Port PF). Fully extend the actuator rod (202/9) to the full open position. The stator vane actuator piston is now extended against the internal stop. Do step (i) again one more time.

(j) With the actuator rod (202/9) extended fully (vanes open), install the bellcrank rig pin in the rig pin slot (202/3) of the bellcrank arm and both holes of the support (202/2). If you can not install the rig pin, do the rod end adjustment again in step (10). If you can install the rig pin, lock the jamnut (202/8) and rod end (202/6) with the key washer (202/7). Bend one set of tabs onto the rod end bearing (202/6) and the other set onto the jamnut (202/8). Install the Lockwire P05−289 and seal (202/10). See section 70−53−00 of the Standard Practices Manual, PN 585005.

CAUTION: REMOVE ALL THE RIG PINS FROM THE UNISON RINGS AND THE BELLCRANK BEFORE YOU CONTINUE OR DAMAGE CAN RESULT.

(12) Remove the bellcrank rig pin. Operate the hydraulic cart and supply 250 − 300 psig (1723.7 − 2068.4 kPa) hydraulic pressure to the Actuator PF port. Fully extend the actuator rod (202/9) to the full open position. Install the bellcrank PWA 85395 Rig Pin or PWA 86097 Rig Pin. Install three PWA 85393 Rig Pins into the IGV, 5th, and 6th stage unison ring rig pin holes. Install the PWA 85394 Rig Pin or the PWA 86197 Rig Pin into the 7th stage unison ring rig pin hole.

(13) If you can put all the rig pins in, then remove all the rig pins from the unison rings and the bellcrank. Go to step (15).

(14) If you can not put any one of the unison ring rig pins in, remove the unison ring rig pins and bellcrank rig pins. Move the hydraulic cart flow control valve handle to the neutral position. If an air supply is used, turn the air supply valve knob to the neutral position. Turn the air supply valve handle to the closed position (perpendicular to flow). Disconnect the unison ring linkage. Disassemble and reassemble with new key washers (202/21), then adjust as follows.

(a) Install the bellcrank PWA 85395 Rig Pin or PWA 86097 Rig Pin. Turn the adjusters (202/19) so that you can install all the unison ring rig pins.

(b) Torque the nuts (202/16) at each changed rod end to 15 − 22 lb−in. (1.695 − 2.486 N.m) plus the torque necessary to turn the nut on the bolt (202/14). Install the cotter pins (202/15). See section 70−53−00, Standard Practices Manual, PN 585005.

(c) Examine the adjusters (202/19) and rod ends for proper installation. Install a piece of wire into the inspection holes (202/20) at both ends of each adjuster. If you can not put the wire through, the installation is satisfactory. If you can put the wire through at either end, you must disassemble the linkage and adjust it as necessary so that the wire will not pass through.

(d) With the rod ends properly installed, torque the jamnuts (202/17) at each rod end to 115 − 150 lb−in. (12.993 − 16.948 N.m).

CAUTION: REMOVE ALL THE RIG PINS FROM THE UNISON RINGS AND THE BELLCRANK BEFORE YOU CONTINUE OR DAMAGE CAN RESULT.

(e) With all the rig pins removed, operate the hydraulic cart and supply 250 − 300 psig (1723.7 − 2068.4 kPa) hydraulic pressure to the Actuator (Port PF). Push the actuation switch (201/2) to retract and extend the actuator several times through full travel. Stop with the rod fully extended. Go to step (g).

(f) If an electrical switch box is not used, use a standard crowsfoot and wrench on the flats of the bellcrank adjacent to the 5th stage adjuster. Push up on the wrench and move the bellcrank (202/4) to the closed position. Remove the crowsfoot and wrench. Operate the hydraulic cart and supply 250 - 300 psig (1723.7 - 2068.4 kPa) hydraulic pressure to the Actuator (Port PF). Extend the actuator to the full open position. Do this again (one more time).

(g) Install the bellcrank PWA 85395 Rig Pin or PWA 86097 Rig Pin. Install the four unison ring rig pins. If you can not install any one of the rig pins, do step (14) again. Remove all the rig pins.

(h) Bend one set of key washer (202/21) tabs onto the adjuster (202/19) flats and the other set onto the jamnuts (202/17). Install the Lockwire P05-289 and seals (202/18) to the rod ends. See section 70-53-00 in the Standard Practices Manual, PN 585005.

(15) After the adjustment, disconnect the pumps hydraulic pressure hose and return hose from the actuator. Refer to Engine General - Special Procedures-23, Task 72-00-00-910-001 for operation instructions of the PWA 49030 Hydraulic Pump or the CTE 5100 Hydraulic Pump.

(16) Remove the PWA 29451 Adapter from the (Port PF).

NOTE: Hold the adapters while you disconnect the hoses and tool adapter.

(17) Push the power switch (201/3) on the electrical switch box to off. Disconnect the electrical connector from the actuator.

(18) Connect the W4P3 and the W5P7 harness connectors to the actuator harness receptacles as follows. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11-009. Let the connector and receptacle dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG-70 Strap Wrench or the Glenair TG-69 Soft-jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(19) Install the compressor stator cylinder hydraulic pressure tube assembly (CP12).

R (a) Remove the protective covers. Lubricate the tube
R adapter threads at each end with Anti-Seize Paste
R P06-054. Remove the unwanted paste.

(b) Install the tube nuts to the larger adapter on the actuator and to the hydraulic manifold tee handtight only.

(c) Torque the clamp bolt, lubricated with Engine Oil P03-001, to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Torque the tube nuts to 225 - 250 lb-in. (25.422 - 28.246 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(20) Install the compressor stator cylinder hydraulic return tube assembly (CR03).

R (a) Remove the protective covers. Lubricate the tube
R adapter threads at each end with Anti-Seize Paste
R P06-054. Remove the unwanted paste.

(b) Install the tube nuts to the smaller adapter on the actuator and to the inlet return manifold tee handtight only.

(c) Torque the clamp bolt, lubricated with Engine Oil P03-001, to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Torque the tube nuts to 225 - 250 lb-in. (25.422 - 28.246 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

D. Postrequisites

CAUTION: BE SURE YOU REMOVE ALL RIG PINS AND TOOLS FROM THE ENGINE OR ENGINE DAMAGE CAN RESULT.

(1) Test engine per Test Reference Table. See 71-00-00, Testing-00 Task 71-00-00-990-003.

Task 72-00-00-830-003-B:

2. Rig Variable Stator Vane Control System - (Mechanical Procedure)

A. General

WARNING: DO NOT PUT YOUR FINGERS IN THE WAY OF THE LINKAGES, UNISON RINGS, OR LEVERS WHEN YOU OPERATE THE STATOR VANE SYSTEM.

CAUTION: IT IS VERY IMPORTANT TO DO THIS MECHANICAL RIGGING PROCEDURE WITH PRECISION. BAD RIGGING CAN CAUSE INCREASED HPC BLADE FATIGUE, INTERNAL ENGINE DAMAGE, OR COMPLETE ENGINE FAILURE.

CAUTION: ALWAYS REMOVE ALL RIG PINS BEFORE YOU MOVE THE STATOR VANE SYSTEM.

NOTE: Also see the preferred hydraulic procedure in Paragraph 1, Task 72-00-00-830-003-A00.

B. Equipment And Materials Necessary

Special Tools:

PWA 85393	Rig Pin (3 Required)
PWA 85394	Rig Pin (Optional to PWA 86197)
PWA 85395	Rig Pin (Pre SB PW4ENG 72-246)
PWA 86097	Rig Pin (Post SB PW4ENG 72-246)
PWA 86197	Rig Pin
PWA 86344	Holder, Rigging

NOTE: The PWA 85675 Rigging Pin Kit contains the above rig pins.

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	2	72-35-00/25/160
Cotter Pin	2	72-35-00/26/160
Cotter Pin	1	72-35-00/27/140
Cotter Pin	1	72-35-00/27/180
Cotter Pin	2	72-35-00/28/160

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
(CONTINUED)		
Cotter Pin	1	72-31-00/1/170
Key Washer	2	72-35-00/25/90
Key Washer	2	72-35-00/26/90
Key Washer	2	72-35-00/27/90
Key Washer	2	72-35-00/28/90
Key Washer	1	72-00-00/1/120
Seal	2	72-35-00/25/170
Seal	2	72-35-00/26/170
Seal	2	72-35-00/27/190
Seal	2	72-35-00/28/170
Seal	1	72-00-00/1/240

C. Procedure
See Figure 203 and Figure 204.

CAUTION: BE SURE AND USE THE CORRECT BELLCRANK RIG PIN. USE THE LARGER PWA 85395 RIG PIN FOR (PRE SB PW4ENG 72-246 ENGINES). USE THE SMALLER PWA 86097 RIG PIN FOR (POST SB PW4ENG 72-246 ENGINES).

CAUTION: BE SURE THAT THE END OF THE RIG PINS ARE PROPERLY AND FULLY INSTALLED.

CAUTION: BE SURE YOU KEEP THE ACTUATOR ROD FULLY EXTENDED WHEN YOU INSTALL THE BELLCRANK RIG PIN. IF YOU LET THE ACTUATOR ROD RETRACT, THE VARIABLE STATOR VANES WILL OVERTRAVEL WHICH MAY RESULT IN HARMFUL STABILITY AND/OR DURABILITY EFFECTS.

CAUTION: TOO MUCH TORQUE WITH THE WRENCH ON THE BELLCRANK DURING THIS RIGGING CAN BEND THE BELLCRANK BRACKET. THIS CAN RESULT IN BAD RIGGING.

(1) Use a standard crowsfoot and wrench on the flats of the bellcrank (203/3) adjacent to the 5th stage adjuster. Pull down on the wrench until you feel the actuator internal stop. Push up on the wrench until you are off of the actuator internal stop. Pull down on the wrench again. Hold the bellcrank (203/3) so that the actuator rod (204/8) is fully extended against the internal stop (vanes open). Hold the actuator fully extended against

the internal stop with 300 − 400 lb−in. (33.895 − 45.194 N.m) on the crowsfoot. While you hold the actuator fully extended against the internal stop, install the PWA 86344 Holder between the jamnut and the top of the actuator housing. Tighten and torque the detail bolt to 8 − 10 lb−in. (0.904 − 1.130 N.m). Do not tighten the bolt too much. Tighten the detail jamnut by hand. Install the bellcrank PWA 85395 Rig Pin or the bellcrank PWA 86097 Rig Pin into the bellcrank arm slot (203/2) and into both holes of the support (203/1).

(2) If you can install the bellcrank rig pin, remove the rig pin. Remove the PWA 86344 Holder. Push up on the wrench and retract the actuator rod. Pull down again to fully extend the actuator rod again. Hold the actuator fully extended against the internal stop with 300 − 400 lb−in. (33.895 − 45.194 N.m) on the crowsfoot. While you hold the actuator fully extended against the internal stop, install the PWA 86344 Holder between the jamnut and the top of the actuator housing. Tighten and torque the detail bolt to 8 − 10 lb−in. (0.904 − 1.130 N.m). Do not tighten the bolt too much. Tighten the detail jamnut by hand. Install the bellcrank rig pin again with the actuator rod fully extended. Go to step (5).

(3) If you can not install the bellcrank rig pin, go to step (4) and adjust the actuator rod end bearing (204/5).

(4) If necessary, adjust the actuator rod end bearing (204/5) as follows.

  (a) Remove the PWA 86344 Holder. Remove and discard the cotter pin (204/12) from the stator vane actuator rod end bearing retaining bolt (204/4). Loosen and remove the nut (204/11), washer (204/10) and bolt (204/4) from the stator vane actuator rod end bearing.

  (b) Remove the lockwire and seal (204/9) from the actuator rod and make the tabs of key washer (204/6) straight. Loosen the jamnut (204/7) and remove the rod end bearing (204/5). Remove the key washer (204/6). Install the new key washer and install the rod end bearing (204/5), threads lubricated with Engine Oil P03−001. Tighten until the flat surface below the hex is approximately

9/16 inch (14.288 mm) from the flat surface below the actuator rod threads. See Figure 204 (Sheet 1). This is the approximate initial adjustment only.

(c) Align and temporarily connect the rod end bearing (204/5) to the bellcrank (204/3) with the bolt (204/4).

NOTE: Make sure the bolt head stays against the surface of the bellcrank. Do not let the bolt move out of the bolthole at all.

CAUTION: BE SURE AND USE THE CORRECT BELLCRANK RIG PIN. USE THE LARGER PWA 85395 RIG PIN FOR (PRE SB PW4ENG 72-246 ENGINES). USE THE SMALLER PWA 86097 RIG PIN FOR (POST SB PW4ENG 72-246 ENGINES).

CAUTION: BE SURE THAT THE END OF THE RIG PINS ARE PROPERLY AND FULLY INSTALLED.

CAUTION: BE SURE YOU KEEP THE ACTUATOR ROD FULLY EXTENDED WHEN YOU INSTALL THE BELLCRANK RIG PIN. IF YOU LET THE ACTUATOR ROD RETRACT, THE VARIABLE STATOR VANES WILL OVERTRAVEL WHICH MAY RESULT IN HARMFUL STABILITY AND/OR DURABILITY EFFECTS.

CAUTION: TOO MUCH TORQUE WITH THE WRENCH ON THE BELLCRANK DURING THIS RIGGING CAN BEND THE BELLCRANK BRACKET. THIS CAN RESULT IN BAD RIGGING.

(d) Pull down on the wrench and hold the bellcrank (204/3) so that the actuator rod (204/8) is fully extended against the internal stop (vanes open). Hold the actuator fully extended against the internal stop with 300 - 400 lb-in. (33.895 - 45.194 N.m) on the crowsfoot. While you hold the actuator fully against the internal stop, install the PWA 86344 Holder between the jamnut and the top of the actuator housing. Tighten and torque the detail bolt to 8 - 10 lb-in. (0.904 - 1.130 N.m). Do not tighten the bolt too much. Tighten the detail jamnut by hand. Install the bellcrank rig pin into the bellcrank arm slots (204/2) and into both holes of the support (204/1).

(e) If you can install the bellcrank rig pin, remove the rig pin. Remove the PWA 85344 Holder. Push up on the wrench and retract the actuator rod. Pull down again to fully extend the actuator rod again. Hold the actuator fully extended against the internal stop with 300 − 400 lb−in. (33.895 − 45.194 N.m) on the crowsfoot. While you hold the actuator fully extended against the internal stop, install the PWA 86344 Holder between the jamnut and the top of the actuator housing. Tighten and torque the detail bolt to 8 − 10 lb−in. (0.904 − 1.130 N.m). Do not tighten the bolt too much. Tighten the detail jamnut by hand. Install the rig pin again with the actuator rod fully extended. Go to step (g).

(f) If you can not install the bellcrank rig pin, remove the PWA 86344 Holder. Adjust the rod end bearing (204/5) so that you can install the bellcrank rig pin with the actuator rod (204/8) fully extended and the PWA 86344 Holder installed. Install the bellcrank rig pin.

NOTE: Remove the bolt (204/4) and turn the rod end bearing (204/5) for larger adjustment if necessary. Use the flats and turn the actuator rod (204/8) for smaller adjustment. You must remove and install again the PWA 86344 Holder when you adjust the rod end bearing.

(g) Install the washer (204/10) and nut (204/11), threads lubricated with Engine Oil P03−001, to the bolt (204/4). Torque the nut to a minimum of 15 lb−in. (1.695 N.m) plus the torque necessary to turn the nut on the bolt. Continue and torque the nut until the slot in the nut aligns with the hole in the bolt. This torque must not be more than 22 lb−in. (2.486 N.m) plus the torque necessary to turn the nut on the bolt. Install the cotter pin (204/12) to the nut. Bend the cotter pin. See the 70−00−00, Standard Practices Section. Lock the rod end bearing to the actuator rod with the jamnut (204/7). Torque the jamnut (204/7) to 460 − 510 lb−in. (51.973 − 57.622 N.m). With the rig pin removed, push down on the wrench. Hold the actuator fully extended against the internal stop with 300 − 400 lb−in. (33.895 − 45.194 N.m) on the crowsfoot. While you hold the actuator fully extended against the internal stop, install the PWA 86344 Holder between the jamnut and the top of the actuator housing. Tighten and torque the detail bolt to 8 - 10 lb-in. (0.904 - 1.130 N.m). Do not tighten the bolt too much. Tighten the detail jamnut by hand. Install the bellcrank rig pin again with the actuator rod fully extended. Lock the jamnut (204/7) and rod end (204/5) with the key washer (204/6). Bend one set of tabs onto the rod end bearing (204/5) and the other set onto the jamnut (204/7). Install the Lockwire P05-289 and seal (204/9). See section 70-53-00 in the Standard Practices Manual, PN 585005.

(5) With the actuator rod (204/8) fully extended and the bellcrank rig pin fully installed, install three PWA 85393 Rig Pins into the IGV, 5th, and 6th stage unison ring rig pin holes. Install the PWA 85394 Rig Pin or PWA 86197 Rig Pin into the 7th stage unison ring rig pin hole.

(6) If you can put all the rig pins in, then remove all the rig pins from the unison rings and the bellcrank. Remove the PWA 86344 Holder. The system is properly adjusted.

(7) If you can not put any one of the unison ring rig pins in, remove all the rig pins and the PWA 86344 Holder. Disconnect the unison ring linkage. Disassemble and reassemble with new key washers (204/20), then adjust as follows.

(a) While you hold the actuator fully extended against the internal stop, install the PWA 86344 Holder between the jamnut and the top of the actuator housing. Tighten and torque the detail bolt to 8 - 10 lb-in. (0.904 - 1.130 N.m). Do not tighten the bolt too much. Tighten the detail jamnut by hand. Install the bellcrank PWA 85395 Rig Pin or PWA 86097. Turn the adjusters (204/18) so that you can install all the unison ring rig pins.

(b) Torque the nuts (204/15) at each changed rod end to 15 - 22 lb-in. (1.695 - 2.486 N.m) plus the torque necessary to turn the nut on the bolt (204/13). Install the cotter pins (204/14). See section 70-53-00 in the Standard Practices Manual, PN 585005.

(c) Examine the adjusters (204/18) and rod ends for proper installation. Install a piece of wire into the inspection holes (204/19) at both ends of each adjuster. If you can not put the wire through, the installation is satisfactory. If you can put the wire through at either end, you must disassemble the linkage and adjust it as necessary so that the wire will not pass through.

(d) With the rod ends properly installed, torque the jamnuts (204/16) at each rod end to 115 - 150 lb-in. (12.993 - 16.948 N.m).

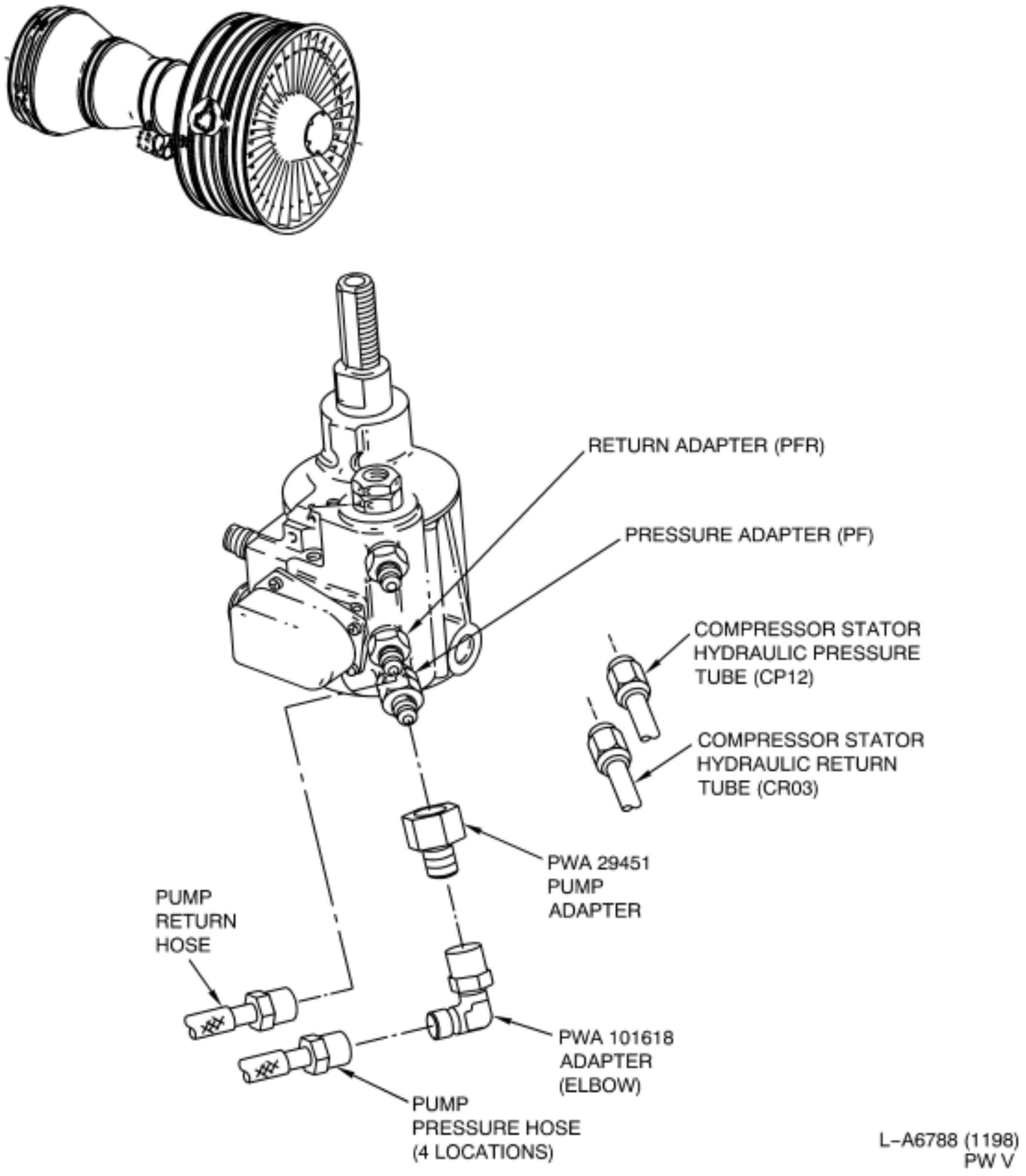
(e) With the bellcrank rig pin installed, install all the unison ring rig pins. If you can not install any one of the unison ring rig pins do step (7) again. If you can install all the unison ring rig pins, then remove all the rig pins from the unison rings and the bellcrank. Remove the PWA 86344 Holder. The system is properly adjusted.

(f) Bend one set of key washer (204/20) tabs onto the adjuster (204/18) flats and the other set onto the jamnuts (204/16). Install the Lockwire P05-289 and seals (204/17) to the rod ends. See section 70-53-00 in the Standard Practices Manual, PN 585005.

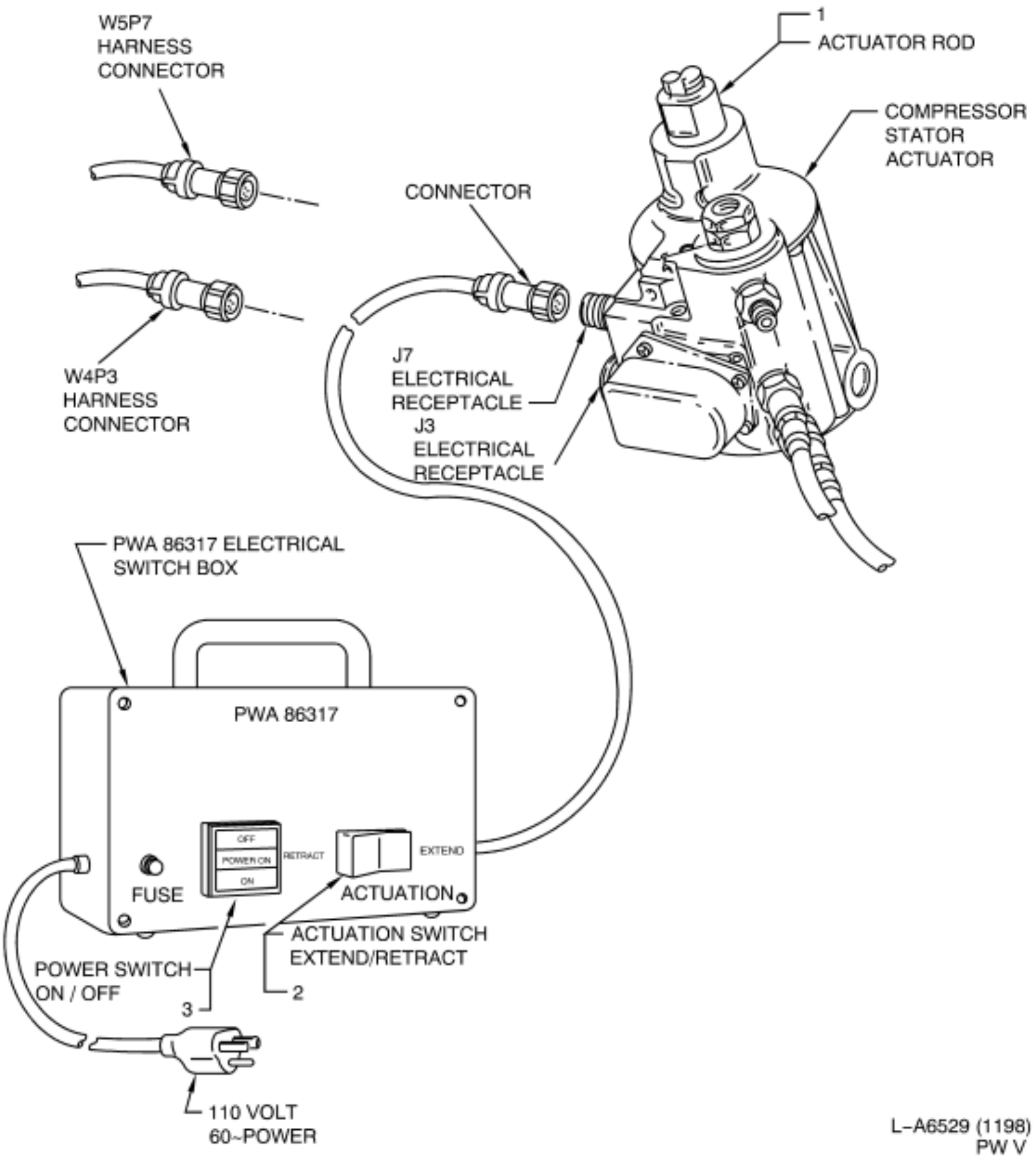
D. Postrequisites

CAUTION: BE SURE YOU REMOVE ALL RIG PINS AND TOOLS FROM THE ENGINE OR ENGINE DAMAGE CAN RESULT.

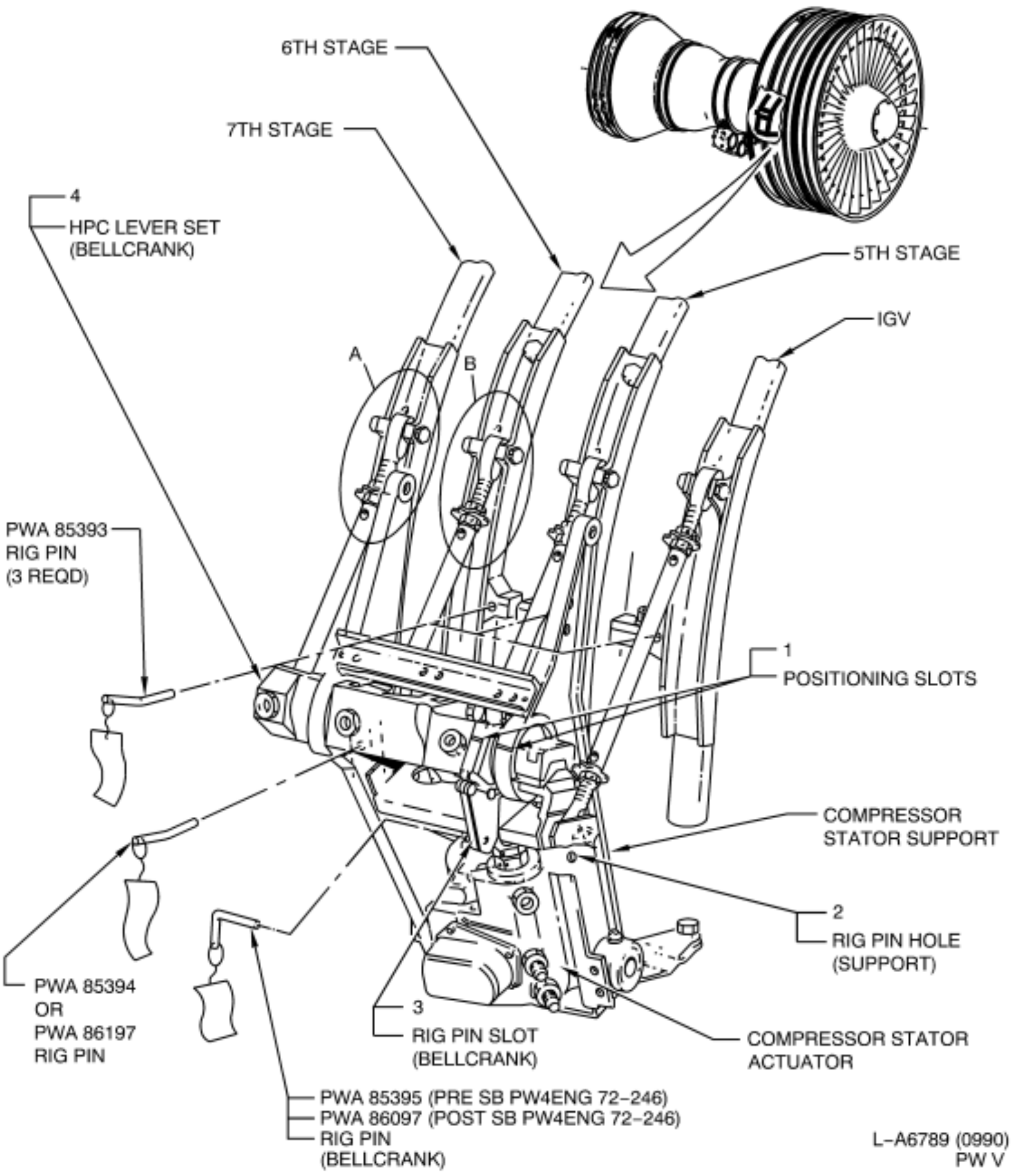
(1) Test engine per Test Reference Table. See 71-00-00, Testing-00 Task 71-00-00-990-003.


RETURN ADAPTER (PFR)
PRESSURE ADAPTER (PF)
COMPRESSOR STATOR HYDRAULIC PRESSURE TUBE (CP12)
COMPRESSOR STATOR HYDRAULIC RETURN TUBE (CR03)
PWA 29451 PUMP ADAPTER
PUMP RETURN HOSE
PWA 101618 ADAPTER (ELBOW)
PUMP PRESSURE HOSE (4 LOCATIONS)
L−A6788 (1198)
PW V

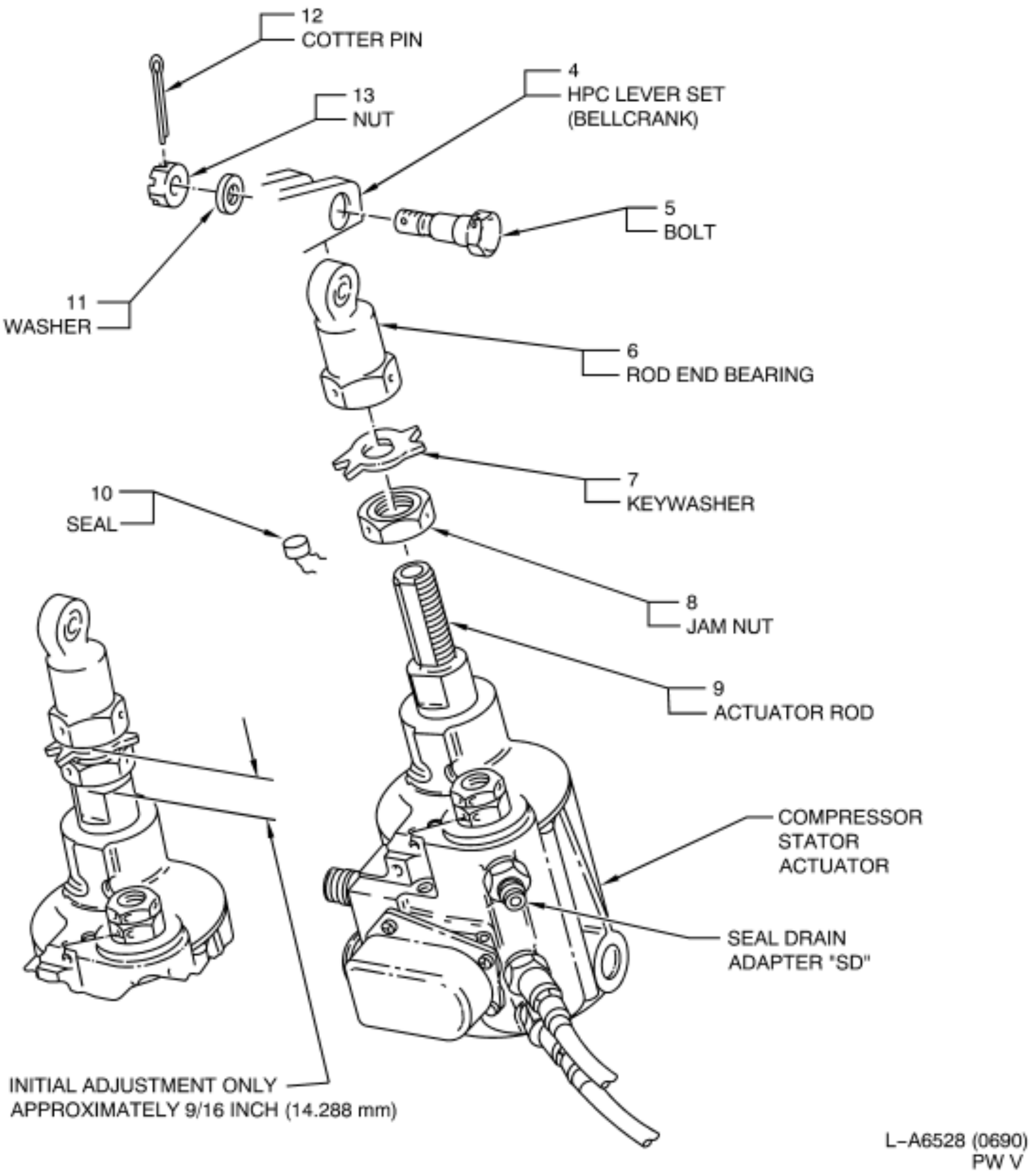
Stator Vane Control System Rigging − (Hydraulic Procedure)
CTE 5100 Or PWA 49030 Hydraulic Cart Installation)
Figure 201 (Sheet 1)
(Task 72−00−00−830−003−B)


W5P7
HARNESS
CONNECTOR
1
ACTUATOR ROD
COMPRESSOR
STATOR
ACTUATOR
CONNECTOR
W4P3
HARNESS
CONNECTOR
J7
ELECTRICAL
RECEPTACLE
J3
ELECTRICAL
RECEPTACLE
PWA 86317 ELECTRICAL
SWITCH BOX
PWA 86317
OFF
POWER ON
ON
RETRACT
EXTEND
FUSE
ACTUATION
ACTUATION SWITCH
EXTEND/RETRACT
2
POWER SWITCH
ON / OFF
3
110 VOLT
60~POWER
L−A6529 (1198)
PW V

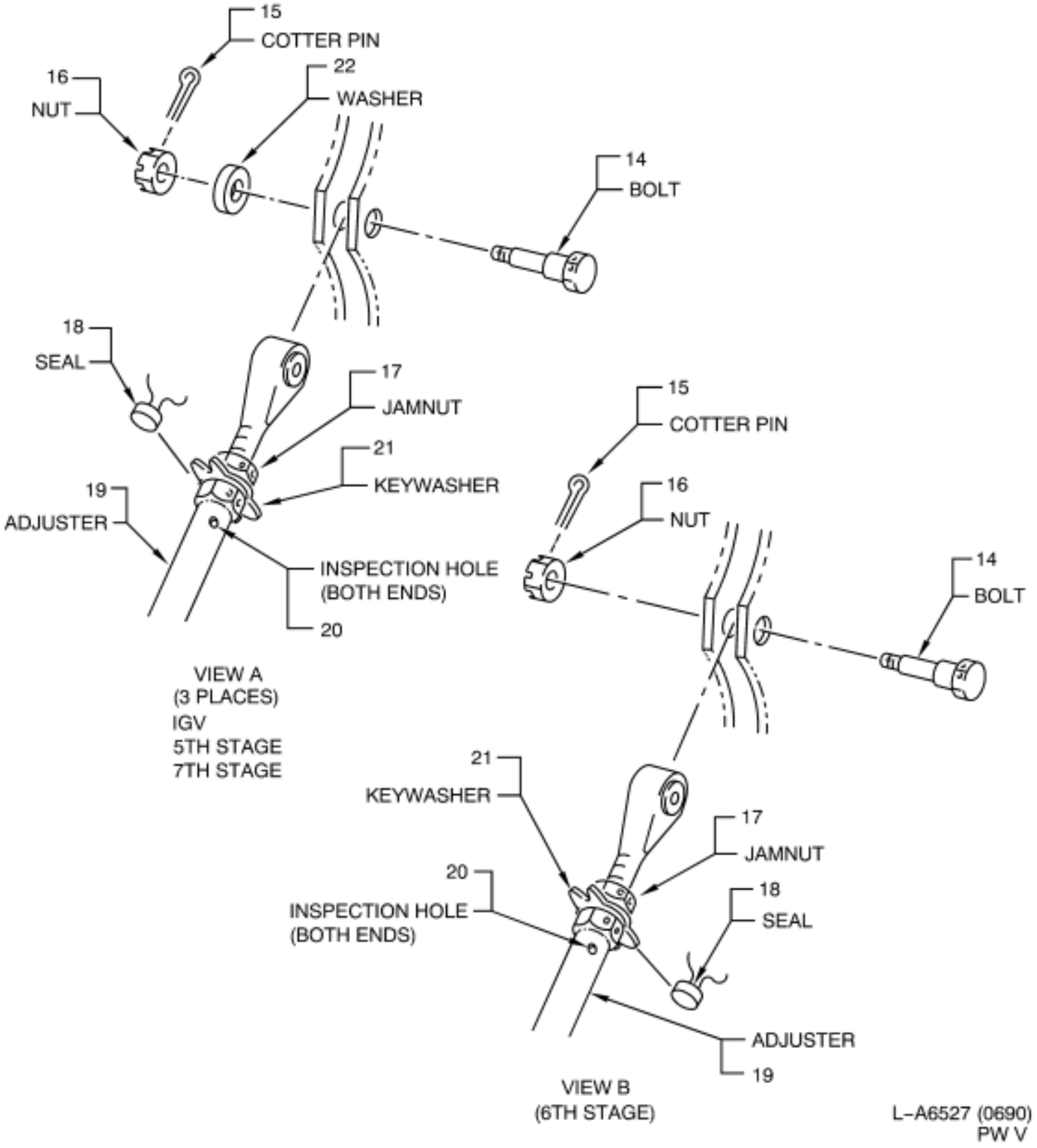
Stator Vane Control System Rigging − (Hydraulic
Procedure) PWA 86317 Electrical Switch Box Installation)
Figure 201 (Sheet 2)
(Task 72−00−00−830−003−B)


6TH STAGE
7TH STAGE
4
HPC LEVER SET
(BELLCRANK)
5TH STAGE
IGV
A
B
PWA 85393
RIG PIN
(3 REQD)
1
POSITIONING SLOTS
COMPRESSOR
STATOR SUPPORT
2
RIG PIN HOLE
(SUPPORT)
PWA 85394
OR
PWA 86197
RIG PIN
3
RIG PIN SLOT
(BELLCRANK)
COMPRESSOR STATOR
ACTUATOR
PWA 85395 (PRE SB PW4ENG 72-246)
PWA 86097 (POST SB PW4ENG 72-246)
RIG PIN
(BELLCRANK)
L-A6789 (0990)
PW V

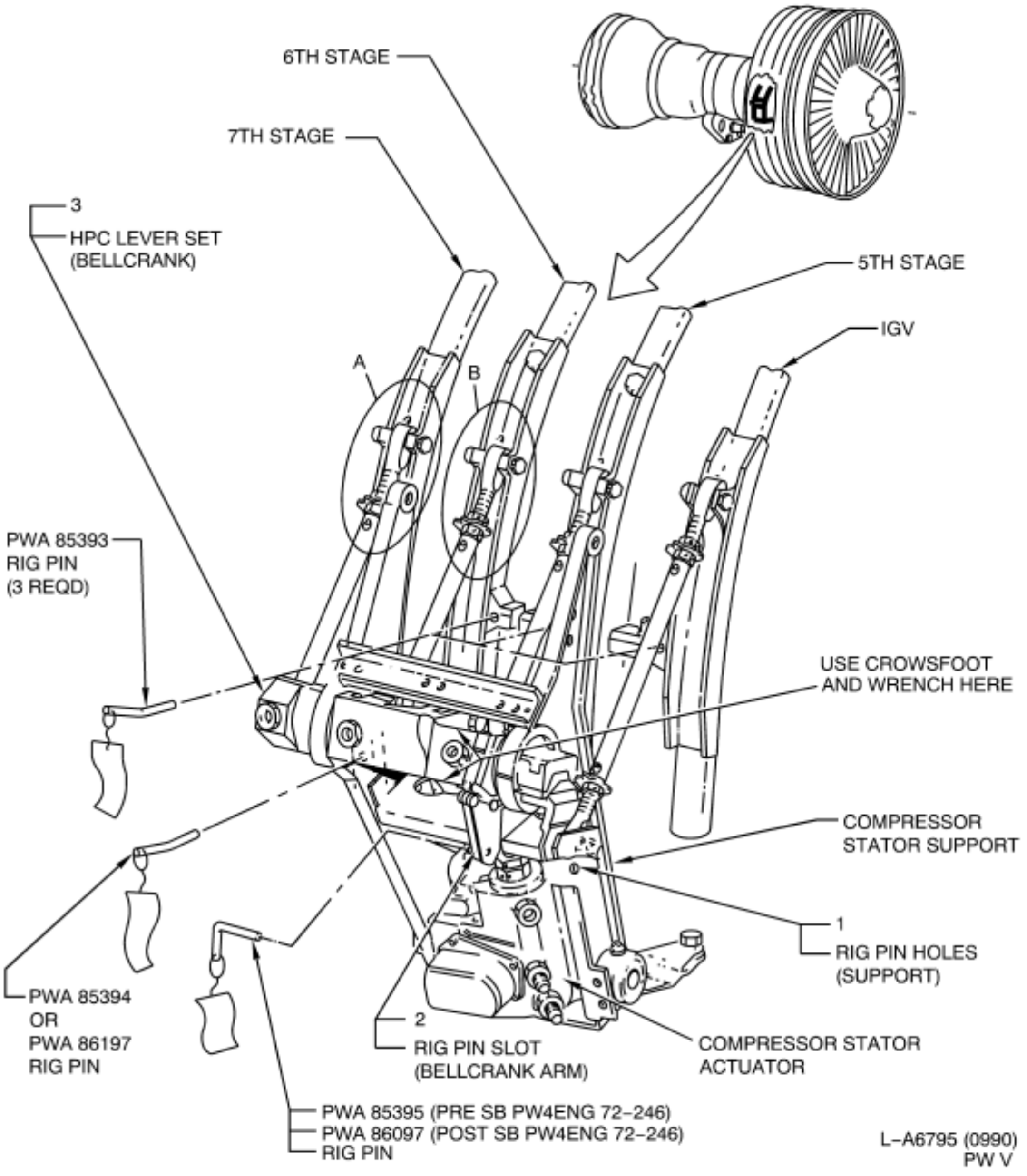
Stator Vane Control System Rigging -
(Hydraulic Procedure) (Rigging Locations)
Figure 202 (Sheet 1)
(Task 72-00-00-830-003-B)


12
COTTER PIN
4
HPC LEVER SET
(BELLCRANK)
13
NUT
5
BOLT
11
WASHER
6
ROD END BEARING
7
KEYWASHER
10
SEAL
8
JAM NUT
9
ACTUATOR ROD
COMPRESSOR
STATOR
ACTUATOR
SEAL DRAIN
ADAPTER "SD"
INITIAL ADJUSTMENT ONLY
APPROXIMATELY 9/16 INCH (14.288 mm)
L−A6528 (0690)
PW V

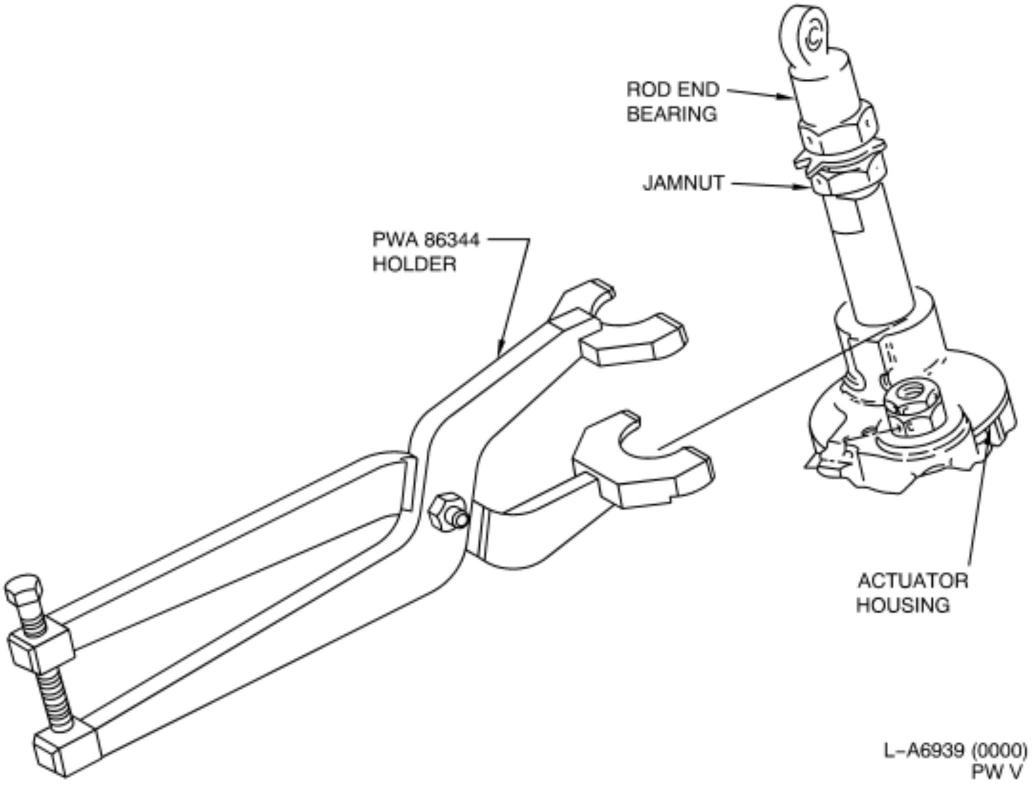
Stator Vane Control System Rigging −
(Hydraulic Procedure) (Actuator Adjustment)
Figure 202 (Sheet 2)
(Task 72−00−00−830−003−B)


15
COTTER PIN
22
WASHER
16
NUT
14
BOLT
18
SEAL
17
JAMNUT
21
KEYWASHER
19
ADJUSTER
INSPECTION HOLE
(BOTH ENDS)
20
VIEW A
(3 PLACES)
IGV
5TH STAGE
7TH STAGE
15
COTTER PIN
16
NUT
14
BOLT
21
KEYWASHER
17
JAMNUT
20
INSPECTION HOLE
(BOTH ENDS)
18
SEAL
ADJUSTER
19
VIEW B
(6TH STAGE)
L−A6527 (0690)
PW V

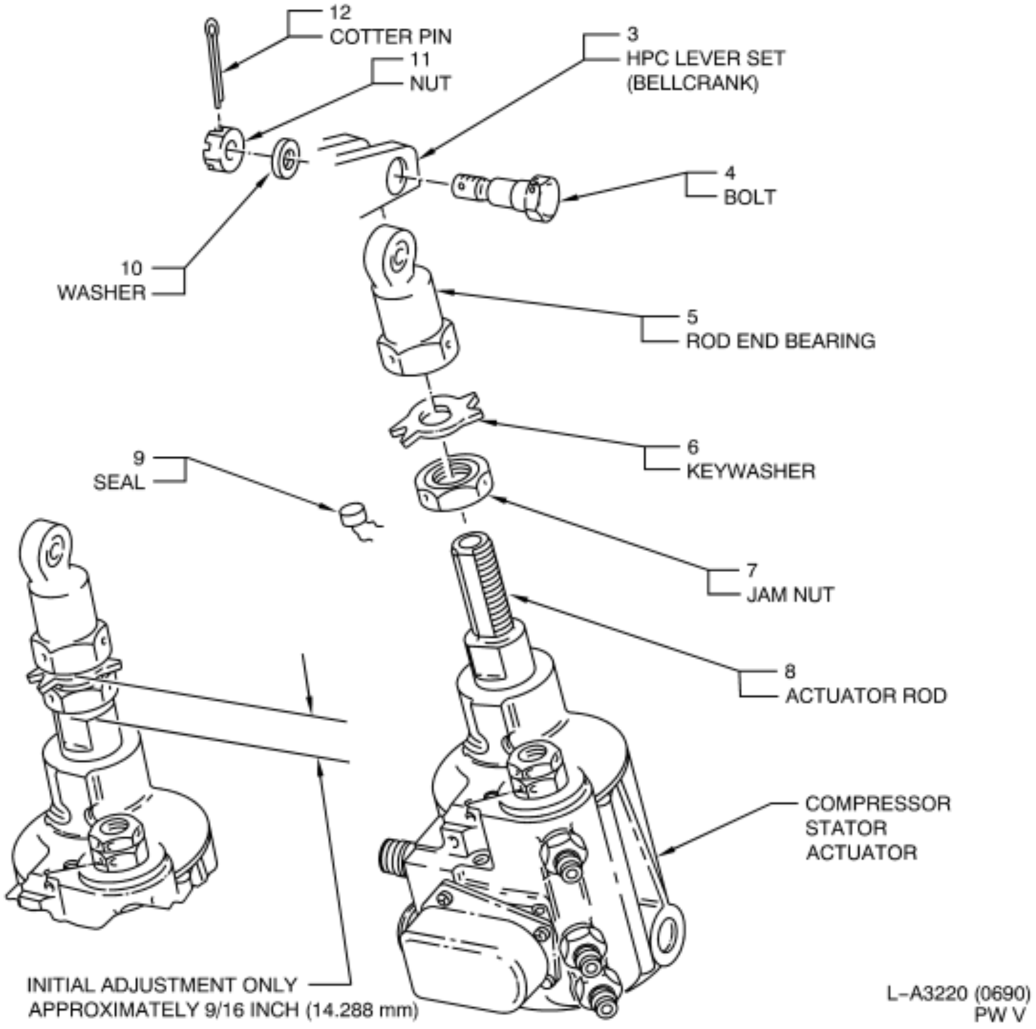
Stator Vane Control System Rigging − (Hydraulic Procedure) (Unison Ring Linkage Adjustment)
Figure 202 (Sheet 3)
(Task 72−00−00−830−003−B)


6TH STAGE
7TH STAGE
3
HPC LEVER SET
(BELLCRANK)
5TH STAGE
IGV
A
B
PWA 85393
RIG PIN
(3 REQD)
USE CROWSFOOT
AND WRENCH HERE
COMPRESSOR
STATOR SUPPORT
1
RIG PIN HOLES
(SUPPORT)
PWA 85394
OR
PWA 86197
RIG PIN
2
RIG PIN SLOT
(BELLCRANK ARM)
COMPRESSOR STATOR
ACTUATOR
PWA 85395 (PRE SB PW4ENG 72-246)
PWA 86097 (POST SB PW4ENG 72-246)
RIG PIN
L-A6795 (0990)
PW V

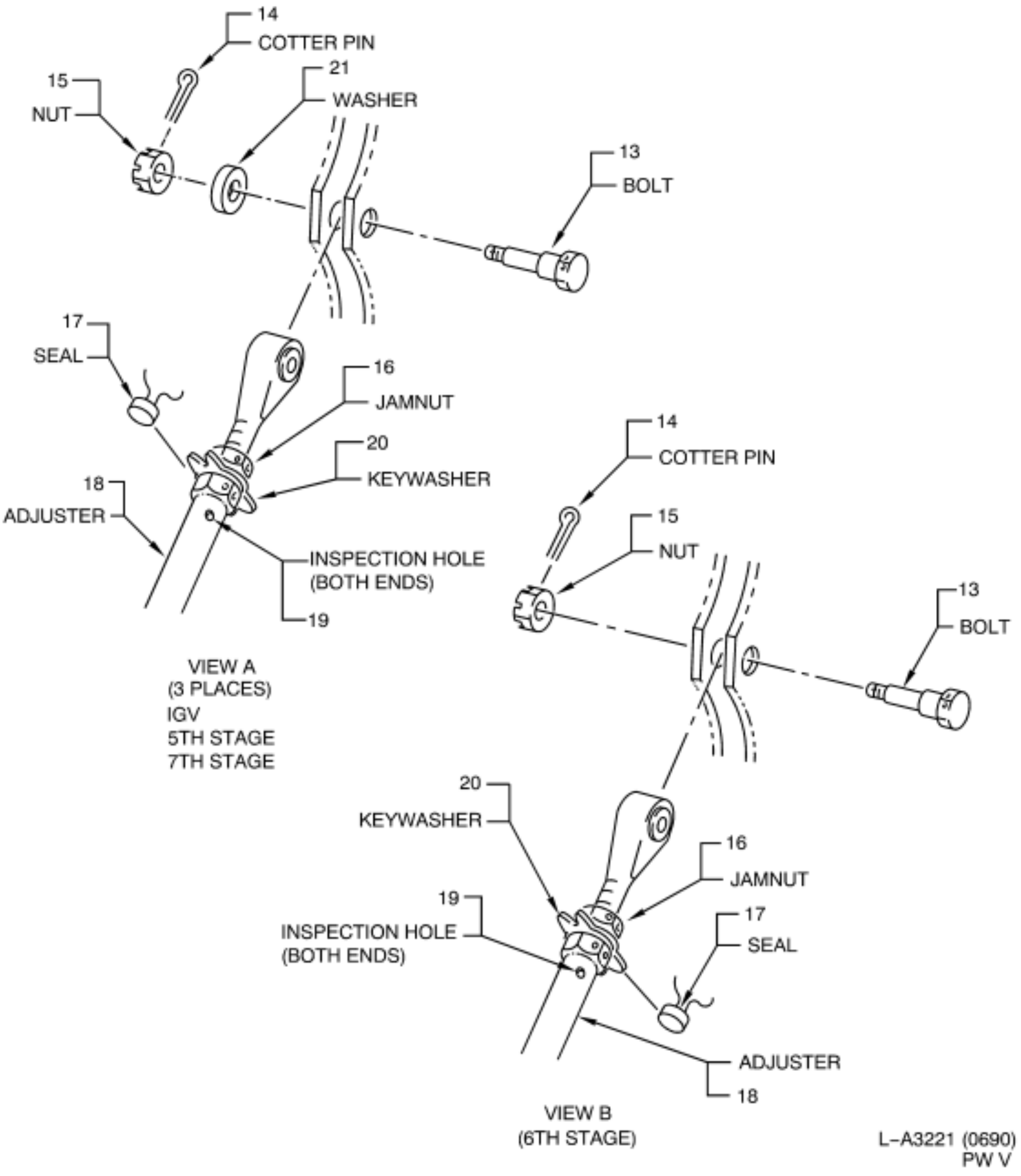
Stator Vane Control System Rigging -
(Mechanical Procedure) (Rigging Locations)
Figure 203 (Sheet 1)
(Task 72-00-00-830-003-B)


ROD END BEARING
JAMNUT
PWA 86344 HOLDER
ACTUATOR HOUSING
L−A6939 (0000)
PW V

Stator Vane Control System Rigging − (Mechanical Procedure) PWA 86344 Holder Installation)
Figure 203 (Sheet 2)
(Task 72−00−00−830−003−B)


12
COTTER PIN
11
NUT
3
HPC LEVER SET
(BELLCRANK)
4
BOLT
10
WASHER
5
ROD END BEARING
6
KEYWASHER
9
SEAL
7
JAM NUT
8
ACTUATOR ROD
COMPRESSOR
STATOR
ACTUATOR
INITIAL ADJUSTMENT ONLY
APPROXIMATELY 9/16 INCH (14.288 mm)
L-A3220 (0690)
PW V

Stator Vane Control System Rigging -
(Mechanical Procedure) (Actuator Adjustment)
Figure 204 (Sheet 1)
(Task 72-00-00-830-003-B)


14
COTTER PIN
21
WASHER
15
NUT
13
BOLT
17
SEAL
16
JAMNUT
20
KEYWASHER
18
ADJUSTER
INSPECTION HOLE
(BOTH ENDS)
19
VIEW A
(3 PLACES)
IGV
5TH STAGE
7TH STAGE
14
COTTER PIN
15
NUT
13
BOLT
20
KEYWASHER
16
JAMNUT
19
INSPECTION HOLE
(BOTH ENDS)
17
SEAL
ADJUSTER
18
VIEW B
(6TH STAGE)
L-A3221 (0690)
PW V

Stator Vane Control System Rigging - (Mechanical Procedure) (Unison Ring Linkage Adjustment)
Figure 204 (Sheet 2)
(Task 72-00-00-830-003-B)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - SPECIAL PROCEDURES-06

Task 72-00-00-830-004:

1. Rig The Turbine Case Cooling (TCC) Control System-Check And Partial Rig With Undersize Rigging Pins

NOTE: Use this rigging procedure:
- After the replacement of the (TCC) HPT air shutoff valve and/or
- After the replacement of the (TCC) LPT air shutoff valve and/or
- After the replacement of the (TCC) air valve actuator
- For a check of the entire turbine case cooling control system.

NOTE: Use the complete rigging procedure in Special/ Procedures-11 only:
- If the turbine case cooling control system can not be rigged per this procedure
- After the assembly of the entire turbine case cooling control system during the engine build-up
- After the replacement of the (TCC) air valve control cable.

A. Equipment And Materials Required

Special Tools:

PWA 85465	Rigging Pin
PWA 86069	Rigging Pin - Undersize (2 Required)

NOTE: Above rigging pin can be contained within the Rigging Pin Kit (PWA 85675).

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)

B. Procedure
See Figure 201.

CAUTION: IF YOU USE A LONGER POSITIONING BOLT OTHER THAN THE SPECIFIED BOLT LENGTH AND YOU TURN THE BOLT UNTIL IT TOUCHES BOTTOM (SEATED), YOU CAN DAMAGE THE ACTUATOR.

(1) Install a positioning bolt into the threaded positioning hole on the rear of the actuator (201/1). Turn the bolt in and align the piston shaft rig hole with the rigging hole in the actuator housing. Install

a PWA 85465 Rigging Pin in the rigging hole. Feel the rigging pin installation to be sure that the pin is fully engaged into the piston shaft rigging hole.

NOTE: The positioning bolt is a quality standard hexhead bolt with a 8−32 by 1.5 inch (38.1 mm) thread length. With a 1.5 inch (38.1 mm) length bolt and when the rig pin touches bottom (fully seated), approximately 0.125 inch (3.175 mm) of the bolt threads are showing.

(2) Hold the HPT valve lever arm (201/3) against the idler arm (201/2) during the entire rigging check. Allow no gap between the arms. Install a PWA 86069 Undersize Rigging Pin through the HPT valve lever arm (201/3) and into the housing rigging hole. If you can not install the pin into the valve housing rigging hole, rig the complete system per Special Procedures−11. If you can install the pin into the valve housing rigging hole, keep the pin installed and continue as follows.

(3) Install one more PWA 86069 Undersize Rigging Pin through the LPT valve lever arm (201/8) and into the valve housing rigging hole. If you can install the pin into the valve rigging hole, the rigging of the system is satisfactory. If the system is satisfactory, remove the tools per step (7). If you cannot install the pin into the valve housing rigging hole, continue as follows.

(4) Remove the bolt (201/9) and nut (201/7) that attach the adjuster rod end (201/4) to the LPT valve lever arm (201/8). Align the LPT valve lever arm (201/8) with the rigging pin hole in the valve housing. Install the PWA 86069 Rigging Pin .

(5) Remove the lockwire and loosen the two adjuster jamnuts (201/5). Turn the adjuster (201/6) and align the rod end (201/4) with the bolthole in the LPT valve lever arm (201/8). Be sure rod end threads are seen through both sight holes in the adjuster. Install the bolt (201/9), lubricated with Engine Oil P03−001, and nut (201/7) that attach the rod end (201/4) to the arm (201/8). Torque the nut to 36 − 40 lb−in. (4.067 − 4.519 N.m).

NOTE: The bolt (201/9) must be installed from the inside of the LPT lever arm (201/8).

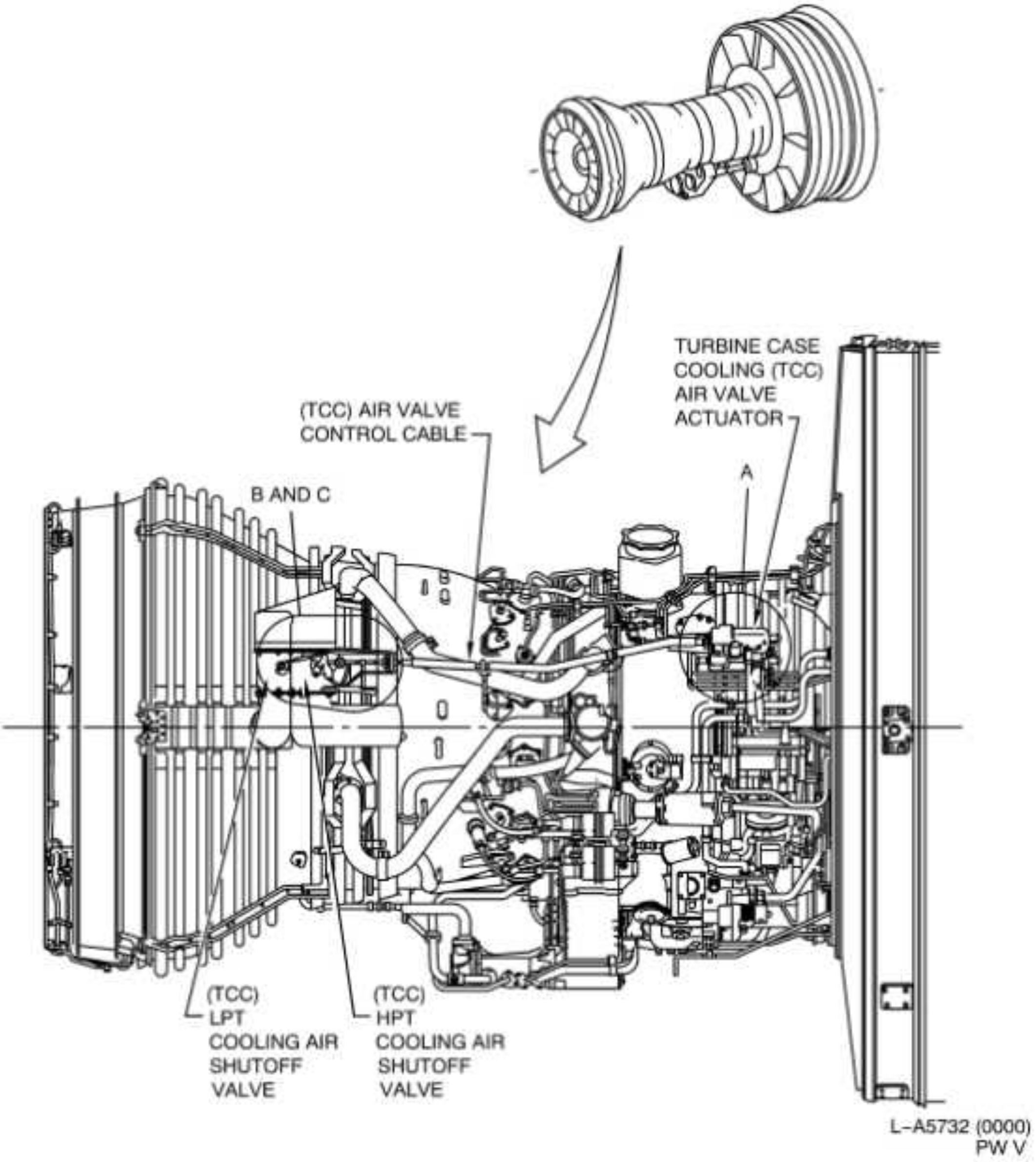
(6) Tighten and torque the jamnuts (201/5) to 14 − 16 lb−in. (1.582 − 1.808 N.m). Install the Lockwire P05−289.

(7) Remove all three rigging pins. After the removal of the rigging pins, remove the positioning bolt from the rear of the actuator (201/1).

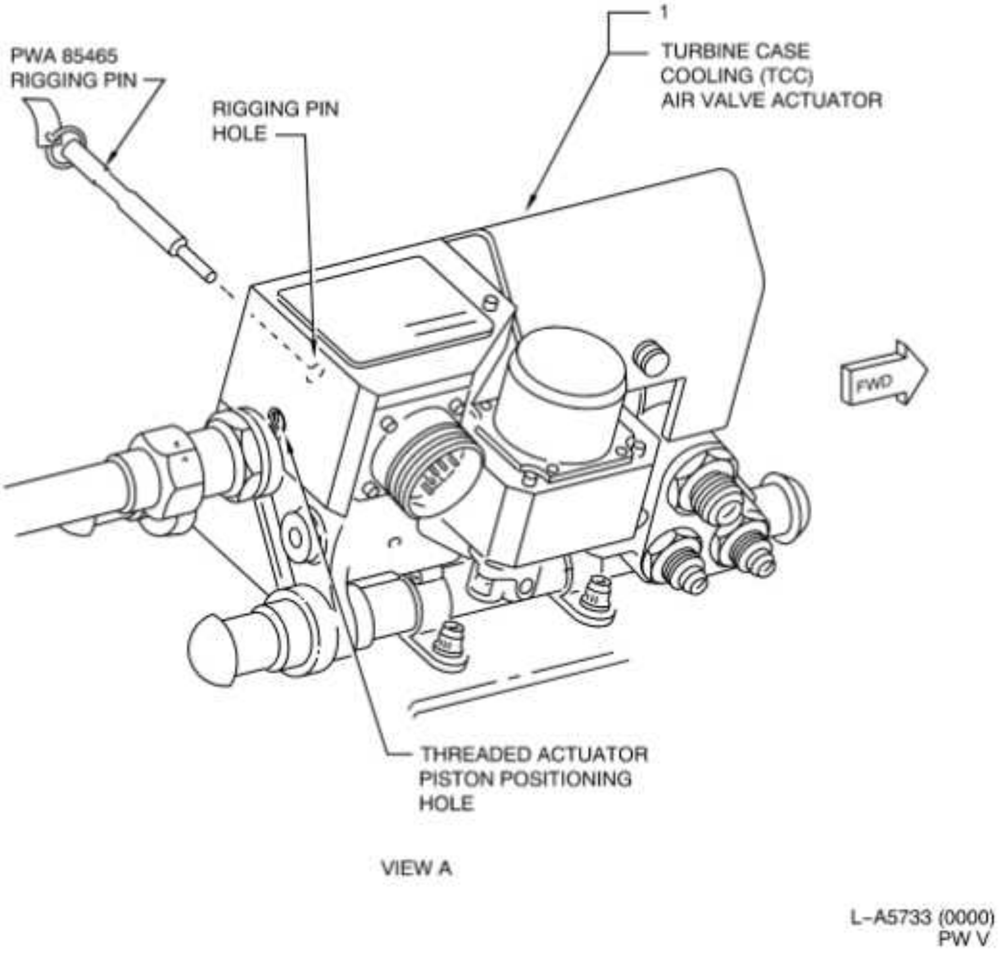
C. Postrequisites

CAUTION: BE SURE THE THREE RIGGING PINS AND THE POSITIONING BOLT ARE REMOVED FROM THE ENGINE OR DAMAGE CAN RESULT.

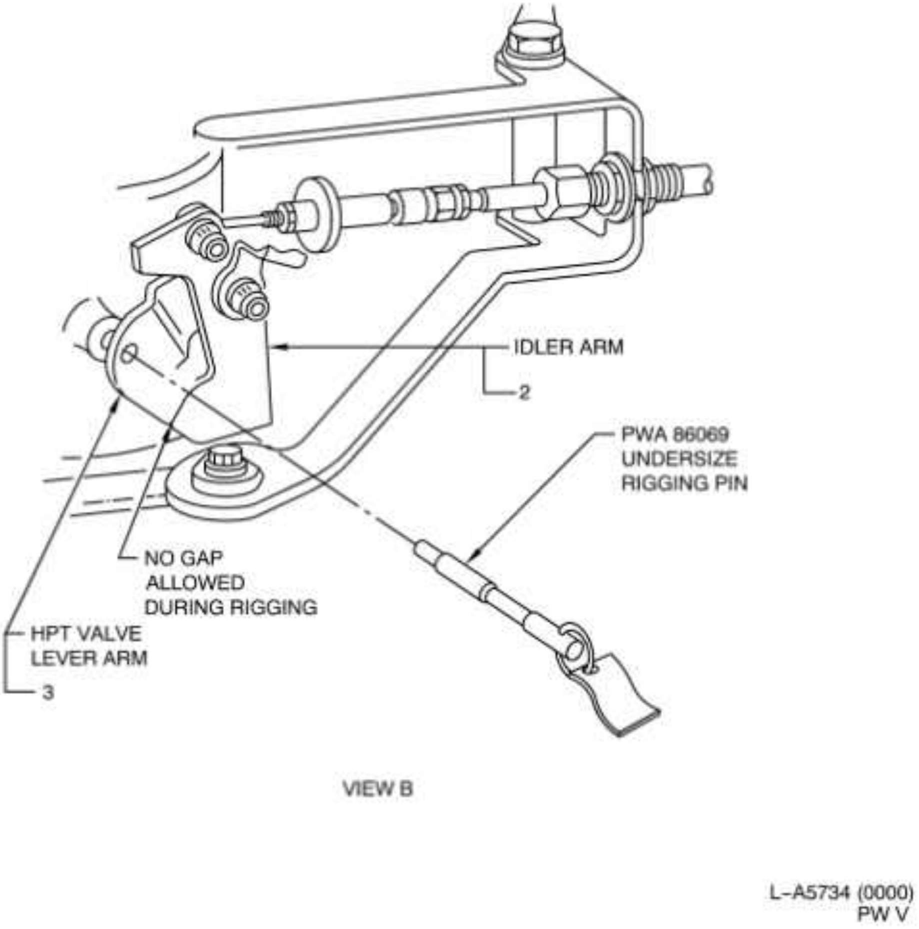
(1) Test the engine per the Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


TURBINE CASE
COOLING (TCC)
AIR VALVE
ACTUATOR
(TCC) AIR VALVE
CONTROL CABLE
A
B AND C
(TCC)
LPT
COOLING AIR
SHUTOFF
VALVE
(TCC)
HPT
COOLING AIR
SHUTOFF
VALVE
L−A5732 (0000)
PW V

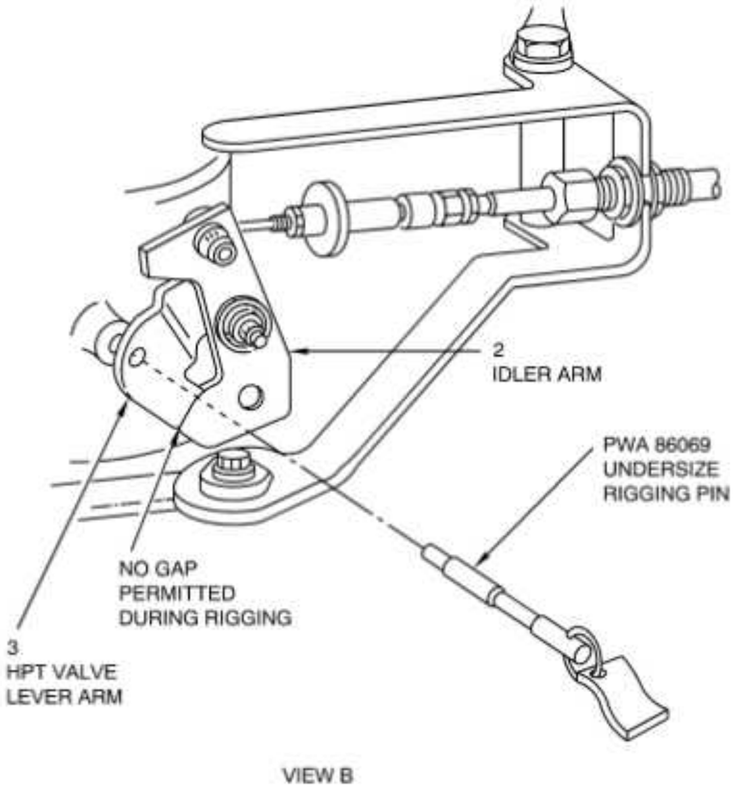
Turbine Case Cooling Control System
Figure 201 (Sheet 1)
(Task 72−00−00−830−004)


1
TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
PWA 85465 RIGGING PIN
RIGGING PIN HOLE
FWD
THREADED ACTUATOR PISTON POSITIONING HOLE
VIEW A
L-A5733 (0000)
PW V

Turbine Case Cooling Control System
Figure 201 (Sheet 2)
(Task 72-00-00-830-004)

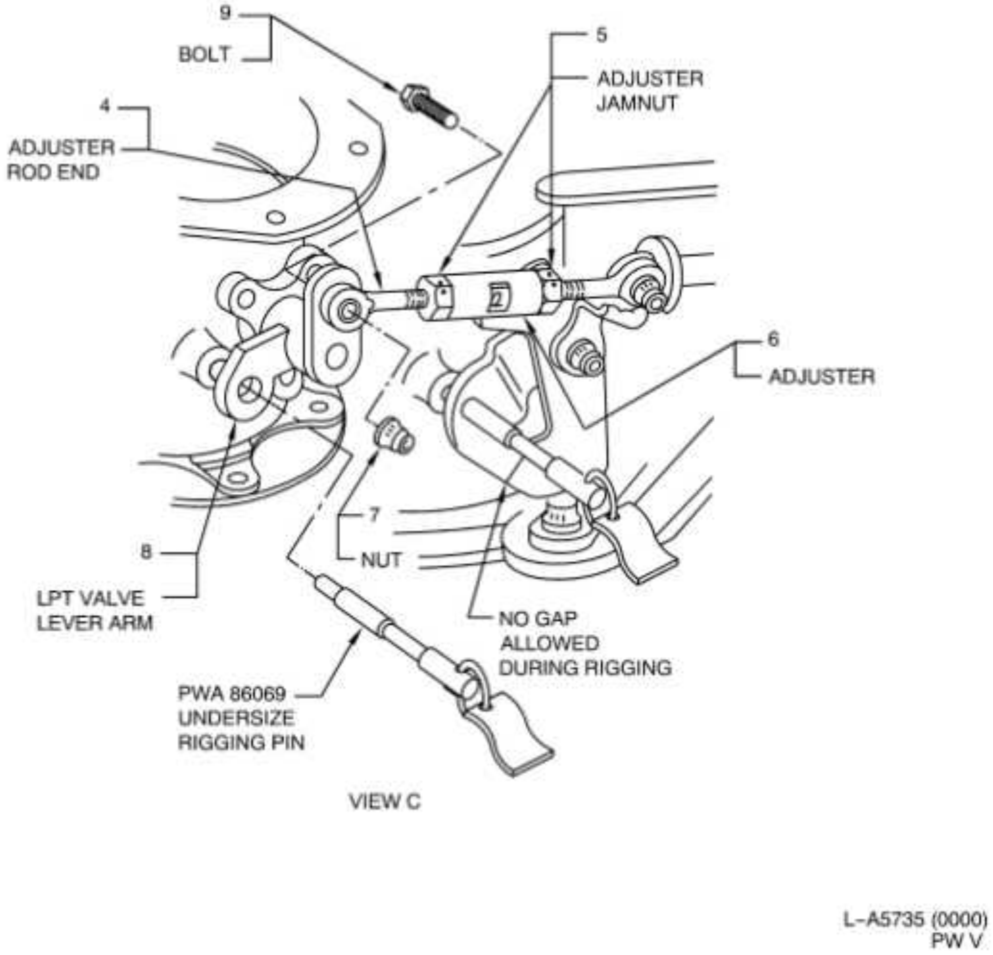

IDLER ARM
2
PWA 86069
UNDERSIZE
RIGGING PIN
NO GAP
ALLOWED
DURING RIGGING
HPT VALVE
LEVER ARM
3
VIEW B
L-A5734 (0000)
PW V

Turbine Case Cooling Control System (Pre And Post SB PW4ENG 72-572 And Post SB PW4ENG 72-592 Engines)
Figure 201 (Sheet 3)
(Task 72-00-00-830-004)

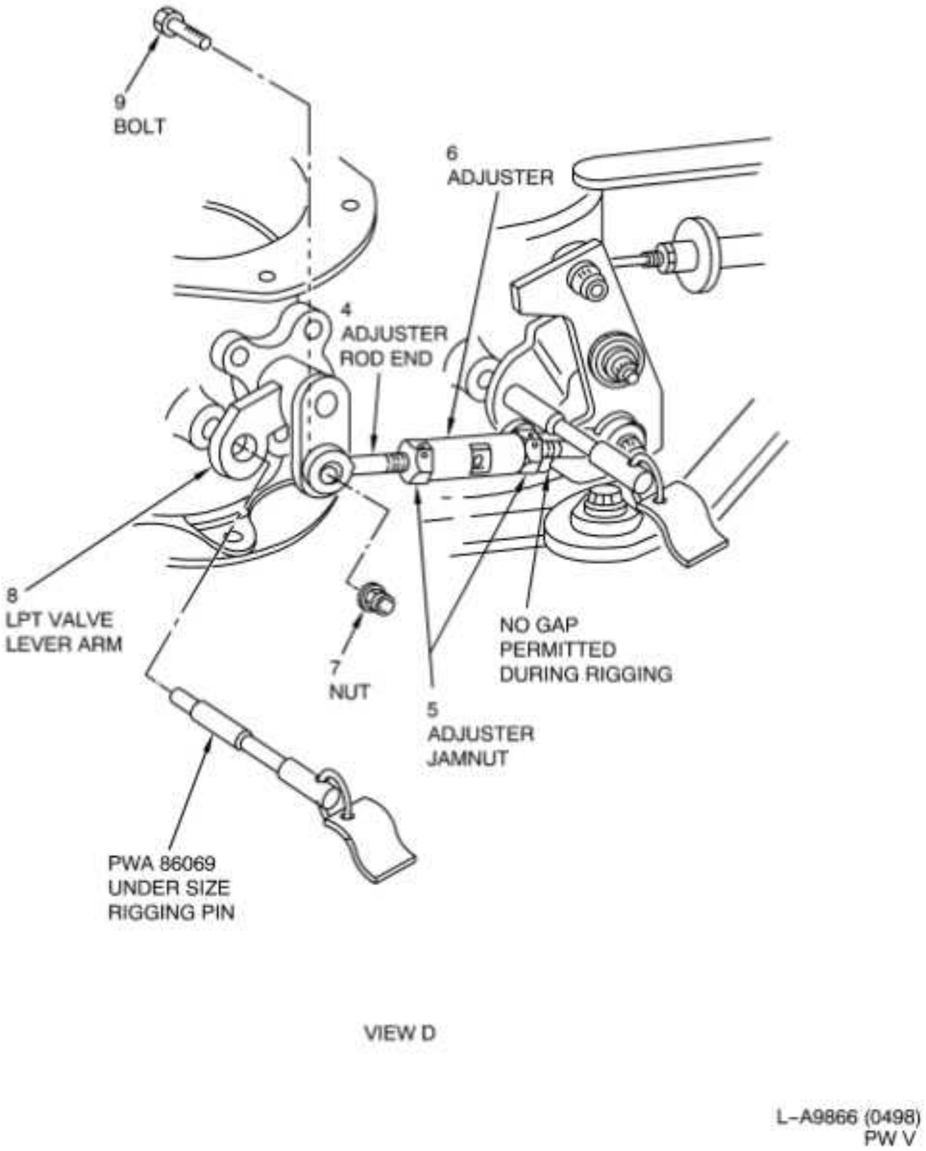

2
IDLER ARM
PWA 86069
UNDERSIZE
RIGGING PIN
NO GAP
PERMITTED
DURING RIGGING
3
HPT VALVE
LEVER ARM
VIEW B

L−A9865 (0000)
PW V

Turbine Case Cooling Control System
(Phase 3 Engines As Built By P&W)
Figure 201 (Sheet 4)
(Task 72−00−00−830−004)


9
BOLT
5
ADJUSTER
JAMNUT
4
ADJUSTER
ROD END
6
ADJUSTER
7
NUT
8
LPT VALVE
LEVER ARM
NO GAP
ALLOWED
DURING RIGGING
PWA 86069
UNDERSIZE
RIGGING PIN
VIEW C
L−A5735 (0000)
PW V

Turbine Case Cooling Control System (Pre And Post SB PW4ENG 72−572 And Post SB PW4ENG 72−592 Engines)
Figure 201 (Sheet 5)
(Task 72−00−00−830−004)


9
BOLT
6
ADJUSTER
4
ADJUSTER
ROD END
8
LPT VALVE
LEVER ARM
7
NUT
5
ADJUSTER
JAMNUT
NO GAP
PERMITTED
DURING RIGGING
PWA 86069
UNDER SIZE
RIGGING PIN
VIEW D
L−A9866 (0498)
PW V

Turbine Case Cooling Control System
(Phase 3 Engines As Built By P&W)
Figure 201 (Sheet 6)
(Task 72−00−00−830−004)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-00-020-001:

1. Trunnion Intermediate Case Through HPT From Horizontal To Front End Down Position

A. Equipment And Materials Required

Special Tools:
PWA 28657 Sling
PWA 76156 Adapter (2 Necessary)
PWA 85064 Fixture, Handling
PWA 85243 Plug, Support
PWA 85344 Ring, Adapter
PWA 85623 Eye, Lifting
PWA 85678 Stand, Support (3 Necessary) (Optional to PWA 87166/PWA 101960)
PWA 86617 Retainer, Rotor
PWA 87166 Stand, Support (3 Necessary)
PWA 101960 Adapter, Support (3 Necessary)

B. Procedure

See Figure 201.

NOTE: If there is a bolt in one of the holes of the 12 o'clock ground handling pad that you cannot remove, you must repair the intermediate case. Refer to 72-00-34, Repair-01 (Task 72-00-34-300-001).

(1) Install the PWA 85623 Eye to the ground handling boss at the 12 o'clock location on outer intermediate case. Attach the eye to the case with bolts. Torque the bolts to 675 - 750 lb-in. (76.265 - 84.739 N.m).

(2) Install the PWA 85344 Ring onto the rear flange of the HPT case and attach in place.

(3) Using PWA 28657 Sling with two PWA 76156 Adapters attached to trunnion spools of PWA 85064 Fixture, position fixture onto Ring (PWA 85344). Aligning dowel pin hole with dowel pin in ring, secure fixture to case with bolts.

(4) Loosen knobs in center hub and install PWA 85243 Plug into center hub against 2nd stage hub. Secure plug in position using fixture knobs.

(5) Install the PWA 86617 Retainer into the hub of the fixture and into the inner diameter of the HPC rear hub. Attach the retainer to the center hub of the fixture.

(6) With hoist and sling attached to fixture attach second hoist to eye on intermediate case and raise engine from pedestals and saddle. Trunnion engine to front end down.

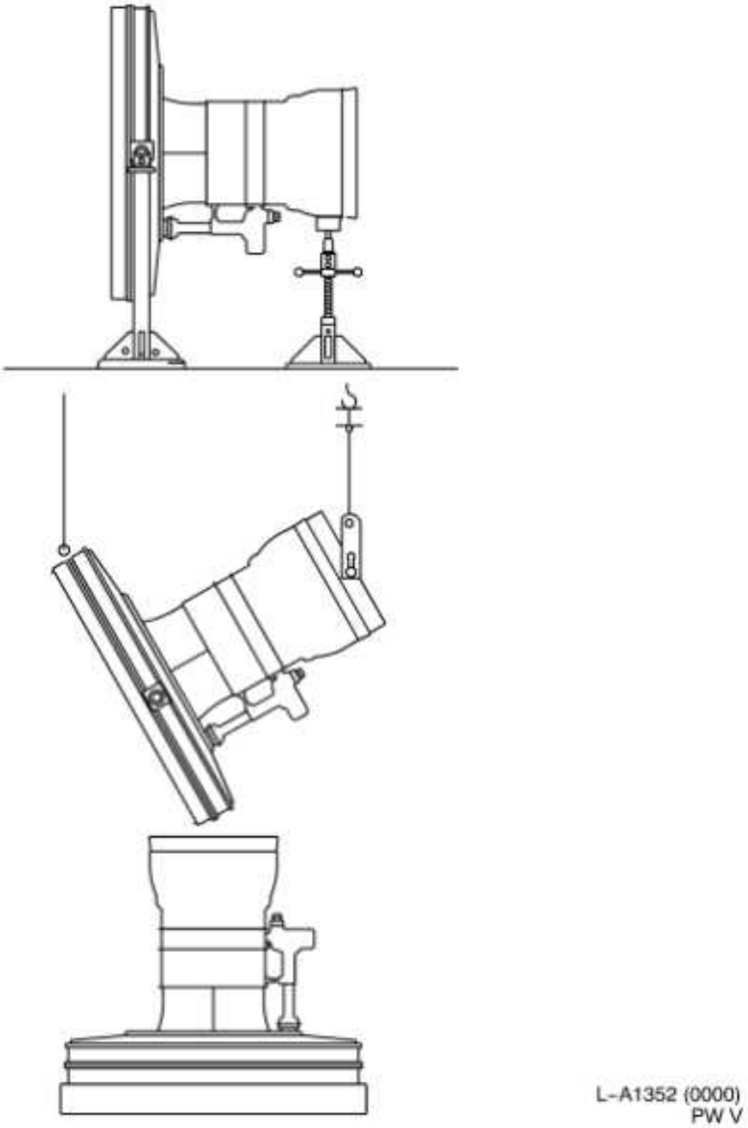
CAUTION: BE SURE PINS ARE PROPERLY SECURED IN PLACE.

(7) Position three PWA 87166 Stands or three PWA 87166 Stands with PWA 101960 Adapters approximately 120 degrees apart. Lower engine to rest on stands. Secure case to stands with detail bolts and nuts.

NOTE: Stands are adjustable for height. Be sure all stands are locked for equal height.

(8) Remove hoist, eye and brackets from intermediate case.

(9) Remove retainer and plug from fixture. Using hoist, with sling and adapters attached, remove fixture from case and ring. Remove ring from case.



Trunnion Intermediate Case Through
HPT To Front End Down
Figure 201
(Task 72−00−00−020−001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - SPECIAL PROCEDURES-08

Task 72-00-00-420-001:

1. Trunnion Intermediate Case Through HPT From Front End Down To Horizontal Position

A. Equipment And Materials Required

Special Tools:
PWA 25757 Pedestal (2 Necessary)
PWA 25926 Adapters (2 Necessary)
PWA 26157 Pedestal (Optional to PWA 87359)
PWA 28657 Sling
PWA 76156 Adapter (2 Necessary)
PWA 85062 Saddle
PWA 85064 Fixture, Handling
PWA 85243 Plug, Support
PWA 85344 Ring, Adapter
PWA 85623 Eye, Lifting
PWA 85662 Bracket (2 Necessary)
PWA 86617 Retainer, Rotor
PWA 87359 Pedestal

B. Procedure

See Figure 201.

NOTE: If there is a bolt in one of the holes of the 12 o'clock ground handling pad that you cannot remove, you must repair the intermediate case. Refer to 72-00-34, Repair-01 (Task 72-00-34-300-001).

(1) Install two PWA 85662 Bracket to ground handling bosses at 3 and 9 o'clock locations on intermediate case. Secure brackets with four bolts and torque bolts to 675 - 750 lb-in. (76.265 - 84.739 N.m).

(2) Install the PWA 85623 Eye to the ground handling boss at the 12 o'clock location on the outer intermediate case. Attach the eye to the case with bolts. Torque the bolts to 675 - 750 lb-in. (76.265 - 84.739 N.m).

(3) Install PWA 85344 Ring onto rear flange of HPT case and secure in place.

(4) Using PWA 28657 Sling with two PWA 76156 Adapters attached to trunnion spools of PWA 85064 Fixture, position fixture on Ring (PWA 85344). Aligning dowel pin hole with dowel pin in ring, secure fixture to case with bolts.

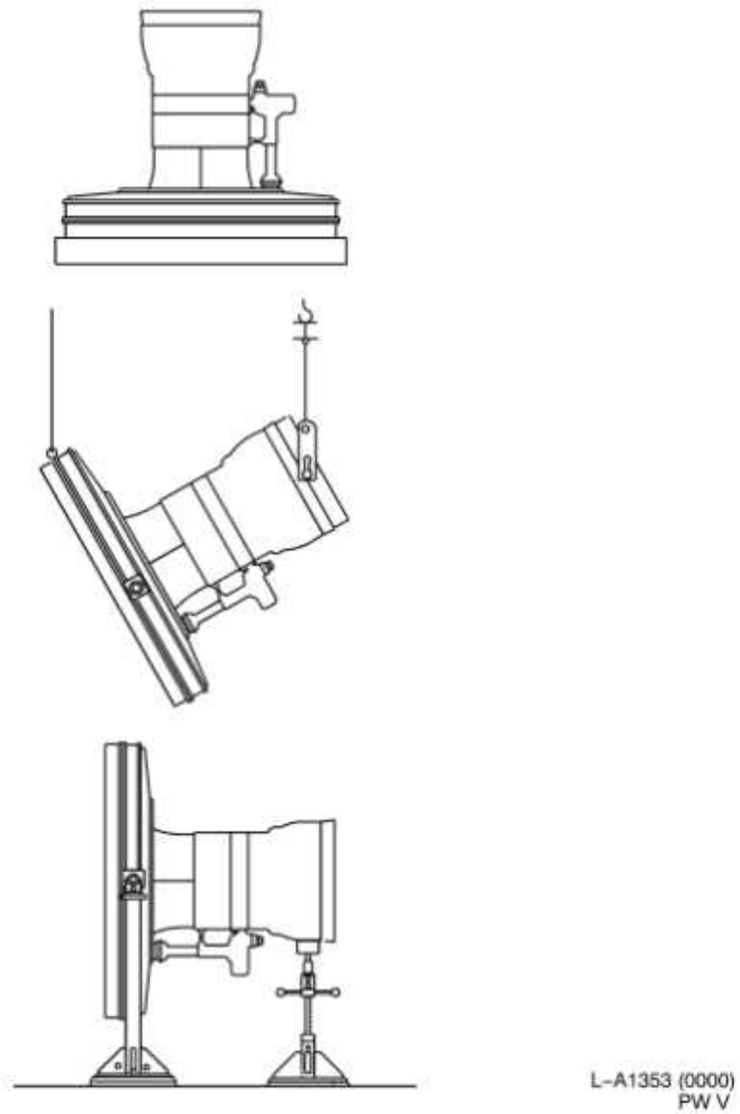
(5) Loosen knobs in center hub and install PWA 85243 Plug into center hub against 2nd stage hub. Secure plug in position using fixture knobs.

(6) Install the PWA 86617 Retainer into the hub of the fixture and into the inner diameter of the HPC rear hub. Attach the retainer to the center hub of the fixture.

(7) With hoist and sling attached to fixture attach second hoist to eye on intermediate case. Remove bolts and nuts securing case to stands and raise engine from stands. Trunnion engine to horizontal position.

(8) Position two PWA 25757 Pedestals with two PWA 25926 Adapters under brackets on intermediate case. Install PWA 85062 Saddle on either PWA 87359 or PWA 26157 Pedestal and secure with ball lock pin. Position saddle under diffuser case at 6 o'clock location just forward of Flange M.

(9) Lower engine on pedestals and saddle. Remove hoist and eye from intermediate case. Remove retainer and plug from rear fixture. Using hoist and sling attached, remove fixture. Remove ring from diffuser case.



Trunnion Intermediate Case Through
HPT To Horizontal
Figure 201
(Task 72-00-00-420-001)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-00-020-002-A:

1. Trunnion Intermediate Case Through Diffuser And Combustor From Horizontal To Front End Down Position

NOTE: See Paragraph 2. for optional method for trunnioning intermediate case through diffuser and combustor from horizontal to front end down position.

A. Equipment And Materials Required

Special Tools:
PWA 28657 Sling
PWA 76156 Adapter (2 Necessary)
PWA 85064 Fixture, Handling
PWA 85246 Plug, Support
PWA 85623 Eye, Lifting
PWA 85678 Stand, Support (3 Necessary) (Optional to PWA 87166/PWA 101960)
PWA 87166 Stand, Support (3 Necessary)
PWA 101960 Adapter, Support (3 Necessary)
PWA 88709 Plug, Holding

B. Procedure

See Figure 201.

NOTE: If there is a bolt in one of the holes of the 12 o'clock ground handling pad that you cannot remove, you must repair the intermediate case. Refer to 72-00-34, Repair-01 (Task 72-00-34-300-001).

(1) Position PWA 85623 Eye to ground handling boss at 12 o'clock location on outer intermediate case. Secure eye to case with bolts. Torque bolts to 675 - 750 lb-in. (76.265 - 84.739 N.m).

(2) Thread PWA 85246 Plug onto HPC rear hub at center of diffuser case,

(3) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3 (Pre SB PW4ENG 72-562) Thread the PWA 85246 Plug onto the HPC rear hub at the center of the diffuser case.

(4) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3 (Post SB PW4ENG 72-562) Thread the PWA 88709 Plug onto the HPC rear shaft at the center of the diffuser case.

(5) Using PWA 28657 Sling with two PWA 76156 Adapters attached to trunnion spools of PWA 85064 Fixture, position fixture over plug and onto diffuser case. Align dowel pin hole in case with fixture. Secure fixture to case with bolts.

(6) With hoist and sling attached to fixture attach second hoist to eye on intermediate case and raise engine from pedestals and saddle. Trunnion engine to front end down.

CAUTION: BE SURE PINS ARE PROPERLY SECURED IN PLACE.

(7) Lower engine to rest intermediate case on three PWA 85678 Support Stands or three PWA 87166 Stands with PWA 101960 Adapters positioned 120 degrees apart. Secure stands to case with detail bolts and nuts.

NOTE: Stands are adjustable for height. Be sure all three stands are locked for equal height.

(8) Remove hoist, eye and brackets from intermediate case.

(9) Remove fixture from case, using hoist with sling and adapters. Remove plug from HPC rear hub.

Task 72-00-00-020-002-B:

2. Trunnion Intermediate Case Through Diffuser And Combustor From Horizontal To Front End Down Position - Optional Method

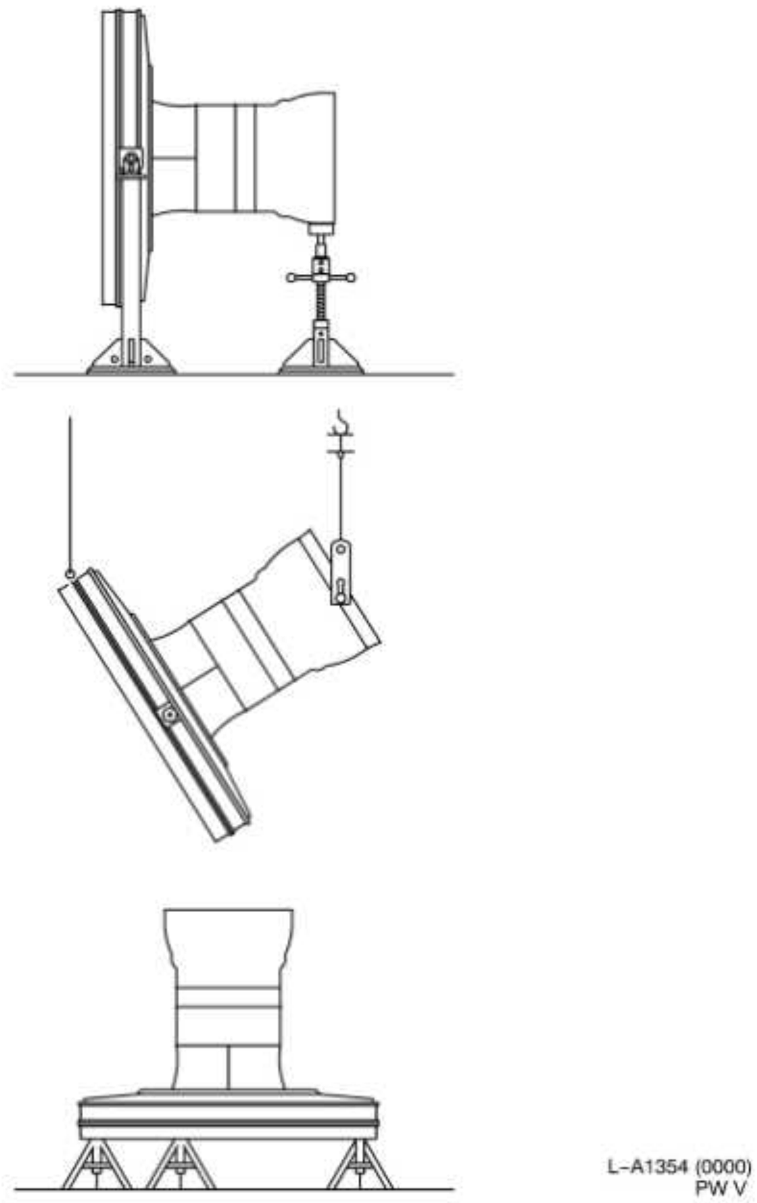
A. Equipment And Materials Necessary

Special Tools:
PWA 85678 Stand, Support (3 Necessary) (Optional to PWA 87166/ PWA 101960)
PWA 86020 Eye, Lifting
PWA 86090 Spacer, Trunnioning
PWA 87166 Stand, Support (3 Necessary)
PWA 101960 Adapter, Support (3 Necessary)

B. Procedure

See Figure 202.

NOTE: If there is a bolt in one of the holes of the 12 o'clock ground handling pad that you cannot remove, you must repair the intermediate case. Refer to 72-00-34, Repair-01 (Task 72-00-34-300-001).



Trunnion Intermediate Case Through
Diffuser Case To Front End Down
Figure 201
(Task 72-00-00-020-002-A)

(1) Position PWA 85623 Eye to ground handling boss at 12 o'clock location on outer intermediate case. Secure eye to case with bolts. Torque bolts to 675 − 750 lb−in. (76.265 − 84.739 N.m).

(2) Install PWA 86090 Spacer over HPC rear hub until it touches the No. 3 bearing rear seat.

(3) Thread the PWA 86020 Lifting Eye onto the rear of the HPC rear hub until the lifting eye touches the Spacer (PWA 86090).

(4) Attach a hoist to Lifting Eye (PWA 86020) and a second hoist to Eye (PWA 85623) on the intermediate case. Lift and trunnion engine to front end down.

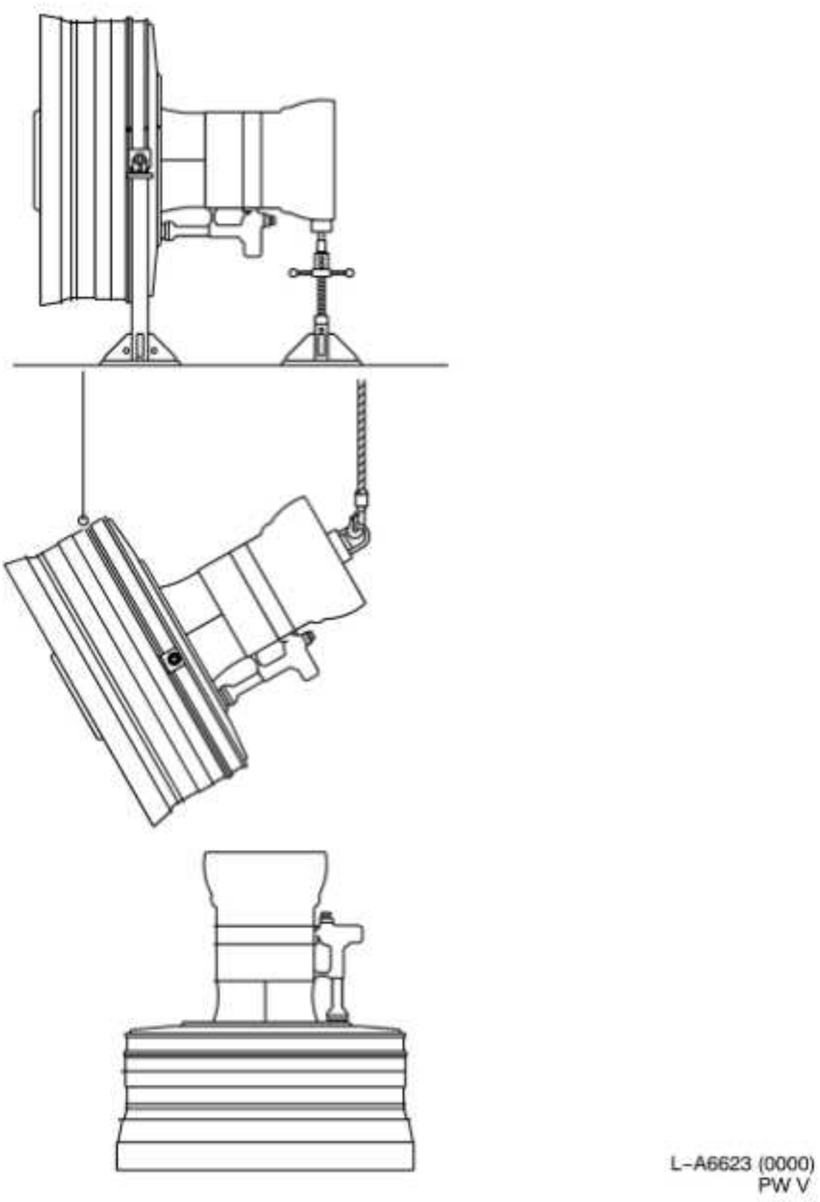
CAUTION: BE SURE PINS ARE PROPERLY SECURED IN PLACE.

(5) Lower engine to rest intermediate case on three PWA 85678 Support Stands or PWA 87166 Stands with PWA 101960 Adapters positioned 120 degrees apart. Secure stands to case with detail bolts and nuts.

NOTE: Stands are adjustable for height. Be sure all three stands are locked for equal height.

(6) Remove hoist, eye and brackets from intermediate case.

(7) Remove lifting eye and spacer from HPC rear hub.



Trunnion Intermediate Case Through
Diffuser Case To Front End Down
Figure 202
(Task 72−00−00−020−002−B)

Task 72-00-00-420-002-A:

1. Trunnion Intermediate Case Through Diffuser And Combustor From Front End Down To Horizontal Position

NOTE: See Paragraph 2. for optional method for trunnioning intermediate case through diffuser and combustor from front end down to horizontal position.

A. Equipment And Materials Required

Special Tools:
PWA 25757 Pedestal (2 Required)
PWA 25926 Adapters (2 Required)
PWA 26157 Pedestal (Optional to PWA 87359)
PWA 28657 Sling
PWA 76156 Adapter (2 Required)
PWA 85062 Saddle
PWA 85064 Fixture, Handling
PWA 85246 Plug, Support
PWA 85623 Eye, Lifting
PWA 85662 Bracket (2 Required)
PWA 87359 Pedestal
PWA 88709 Plug, Holding

B. Procedure

See Figure 201.

NOTE: If there is a bolt in one of the holes of the 12 o'clock ground handling pad that you cannot remove, you must repair the intermediate case. Refer to 72-00-34, Repair-01 (Task 72-00-34-300-001).

(1) Install two PWA 85334 Bracket to ground handling bosses at 3 and 9 o'clock locations on intermediate case. Secure brackets with four bolts and torque bolts to 675 - 750 lb-in. (76.265 - 84.739 N.m).

(2) Install PWA 85623 Eye to ground handling boss at 12 o'clock location on outer intermediate case. Secure eye to case with bolts. Torque bolts to 675 - 750 lb-in. (76.265 - 84.739 N.m).

(3) Thread PWA 85246 Plug onto HPC rear hub at center of diffuser case.

(4) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3 (Pre SB PW4ENG 72-562) Thread the PWA 85246 Plug onto the HPC rear hub at the center of the diffuser case.

(5) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
(Post SB PW4ENG 72−562) Thread the PWA 88709 Plug onto the HPC rear shaft at the center of the diffuser case.

(6) Using PWA 28657 Sling with two PWA 76156 Adapters attached to trunnion spools of PWA 85064 Fixture, position fixture over plug and onto diffuser case. Align dowel pin hole in case with fixture. Secure fixture to case with bolts. Tighten center hub clamping knobs.

(7) With hoist and sling attached to fixture raise engine from stands to allow for bolt removal. Attach second hoist to eye on intermediate case and trunnion engine to horizontal position.

(8) Position two PWA 25757 Pedestals with two PWA 25926 Adapters under brackets on intermediate case. Install PWA 85062 Saddle on either PWA 87359 or PWA 26157 Pedestal and secure with ball lock pin. Position saddle under diffuser case at 6 o'clock location just forward of Flange M.

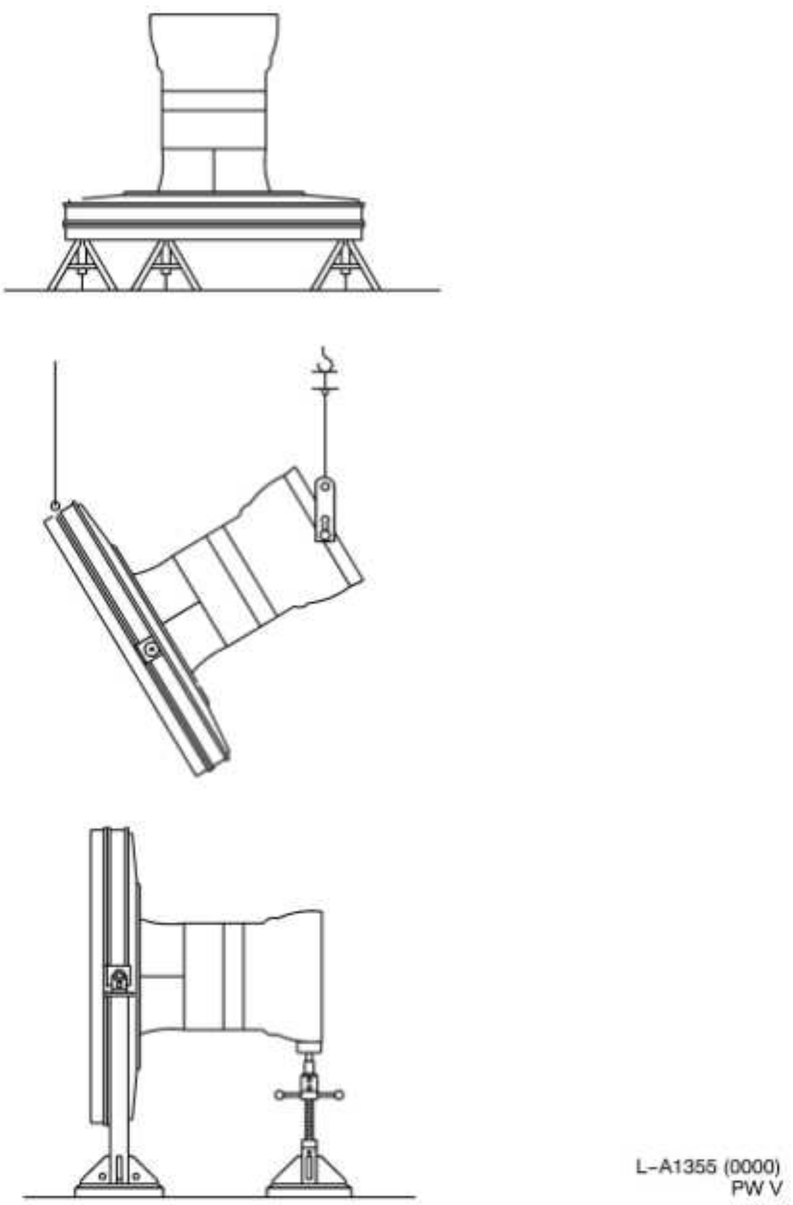
(9) Lower engine on pedestals and saddle. Remove hoist and eye from intermediate case. Remove fixture and plug from diffuser case.

Task 72−00−00−420−002−B:

2. Trunnion Intermediate Case Through Diffuser And Combustor From Front End Down To Horizontal Position − Optional Method

A. Equipment And Materials Required

Special Tools:
PWA 25757 Pedestal (2 Required)
PWA 25926 Adapters (2 Required)
PWA 26157 Pedestal
PWA 85062 Saddle
PWA 85623 Eye, Lifting
PWA 85662 Bracket (2 Required)
PWA 86020 Eye, Lifting
PWA 86090 Spacer, Trunnion



Trunnion Intermediate Case Through
Diffuser Case To Horizontal
Figure 201
(Task 72−00−00−420−002−A)

B. Procedure

See Figure 202.

NOTE: If there is a bolt in one of the holes of the 12 o'clock ground handling pad that you cannot remove, you must repair the intermediate case. Refer to 72−00−34, Repair−01 (Task 72−00−34−300−001).

(1) Install two PWA 85662 Bracket to ground handling bosses at 3 and 9 o'clock locations on intermediate case. Secure brackets with four bolts and torque bolts to 675 − 750 lb−in. (76.265 − 84.739 N.m).

(2) Install PWA 85623 Eye to ground handling boss at 12 o'clock location on outer intermediate case. Secure eye to case with bolts. Torque bolts to 675 − 750 lb−in. (76.265 − 84.739 N.m).

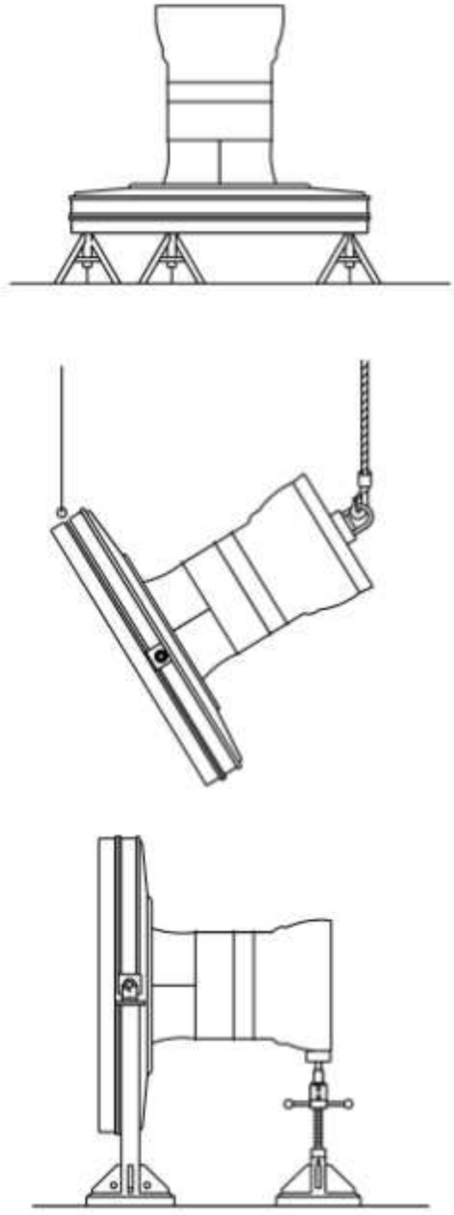
(3) Install PWA 86090 Spacer over HPC rear hub until it touches the No. 3 bearing rear seat.

(4) Thread the PWA 86020 Lifting Eye onto the rear of the HPC rear hub until the lifting eye touches the Spacer (PWA 86090).

(5) Attach a hoist to Lifting Eye (PWA 86020) and a second hoist to Eye (PWA 85623) on the intermediate case. Lift and trunnion engine to horizontal position.

(6) Position two PWA 25757 Pedestals with two PWA 25926 Adapters under brackets on intermediate case. Install PWA 85062 Saddle on PWA 26157 Pedestal and secure with ball lock pin. Position saddle under diffuser case at 6 o'clock location just forward of Flange M.

(7) Lower engine on pedestals and saddle. Remove hoist and eye from intermediate case. Remove lifting eye and spacer from HPC rear hub.



Trunnion Intermediate Case Through
Diffuser Case To Horizontal
Figure 202
(Task 72−00−00−420−002−B)

ENGINE GENERAL - SPECIAL PROCEDURES-11

Task 72-00-00-830-005:

1. Rig The Turbine Case Cooling (TCC) Control System-Complete Rig With Standard Rigging Pins

NOTE: Use this procedure only:

- After the replacement of the (TCC) air valve control cable and/or
- After the assembly of the entire turbine case cooling control system during the engine build-up
- If the turbine case cooling control system can not be rigged per Special Procedures-06.

NOTE: Use the partial rigging procedure in Special Procedures-06

- After the replacement of the (TCC) HPT air shutoff valve and/or
- After the replacement of the (TCC) LPT air shutoff valve and/or
- After the replacement of the (TCC) air valve actuator
- For a check of the entire turbine case cooling control system.

A. Equipment And Materials Required

Special Tools:

PWA 85465	Rigging Pin (3 Necessary)

NOTE: Above rigging pin can be contained within the Rigging Pin Kit (PWA 85675).

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)

B. Procedure
See Figure 201.

(1) If the TCC air valve control cable was not replaced or disassembled, do steps (a) and (b). See View A.

(a) Remove the bolt (201/1) and nut (201/3) that attach the cable rod end (201/9).

(b) Remove the two bolts (201/2), nuts (201/6) and one bushing (201/4) that attach the adjuster rod ends (201/5).

CAUTION: IF YOU USE A LONGER POSITIONING BOLT OTHER THAN THE SPECIFIED BOLT LENGTH AND YOU TURN THE BOLT UNTIL IT TOUCHES BOTTOM (SEATED), YOU CAN DAMAGE THE ACTUATOR.

(2) (Reference 2010) Install a positioning bolt into the threaded positioning hole on the rear of the actuator (201/10). See View B. Turn the bolt in and align the piston shaft rig hole with the rigging hole in the actuator housing. Install a PWA 85465 Rigging Pin in the rigging hole. Feel the rigging pin installation to be sure that the pin is fully engaged into the piston shaft rigging hole.

NOTE: The positioning bolt is a quality standard hexhead bolt with a 8−32 by 1.500 inch (38.1 mm) thread length. With a 1.5 inch (38.1 mm) length bolt and when the rig pin touches bottom (fully seated), approximately 0.125 inch (3.175 mm) of the bolt threads are showing.

(3) Align the rigging pin hole in the HPT valve lever arm (201/12) with the hole in the valve housing. Install a PWA 85465 Rigging Pin. See View C.

(4) Pull the cable rod end (201/9) rearward and see if the rod end and the bolthole on the idler arm (201/11) align. Hold the idler arm (201/11) against the HPT valve lever arm (201/12) during this procedure.

NOTE: Allow no gap between the idler arm (201/11) and the HPT valve lever arm (201/12) during the entire rigging procedure.

(5) If the bolthole aligns, install the bolt (201/1) (from the inside) that attaches the cable rod end (201/9) to the idler arm (201/11). If the bolthole does not align, remove the lockwire from the rod end jamnut (201/13). Loosen the jamnut and adjust the cable rod end (201/9) to align the bolthole. Install the bolt (201/1) (from the inside). Tighten and torque the rod end jamnut (201/13) to 32 − 36 lb−in. (3.616 − 4.067 N.m). Install the Lockwire P05−289.

(6) Lubricate the threads of bolt (201/1) with Engine Oil P03−001 and install the nut (201/3). Torque the nut to 36 − 40 lb−in. (4.067 − 4.519 N.m).

NOTE: Be sure and install the cable rod end (201/9) and the head of bolt (201/1) to the inside of the idler arm (201/11).

(7) Align the rigging pin hole in the LPT valve lever arm (201/14) with the hole in the valve housing. Install one more PWA 85465 Rigging Pin. See View D.

(8) Install the forward adjuster rod end (201/5) with the bolt (201/2), lubricated with Engine Oil P03−001, bushing (201/4), and nut (201/6). Torque the nut to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View A.

NOTE: Be sure and install the bolt (201/2) from the inside and the bushing (201/4) between the idler arm (201/11) and the adjuster rod end (201/5).

(9) Pull the cable rod end (201/9) rearward. See View D. See if the rear adjuster rod end (201/5) and the LPT valve lever arm (201/14) bolthole align.

(10) If the bolthole aligns, install the bolt (201/2), (from the inside) and attach the rod end (201/5). Lubricate the bolt threads with Engine Oil P03−001 and install the nut (201/6). Torque the nut to 36 − 40 lb−in. (4.067 − 4.519 N.m).

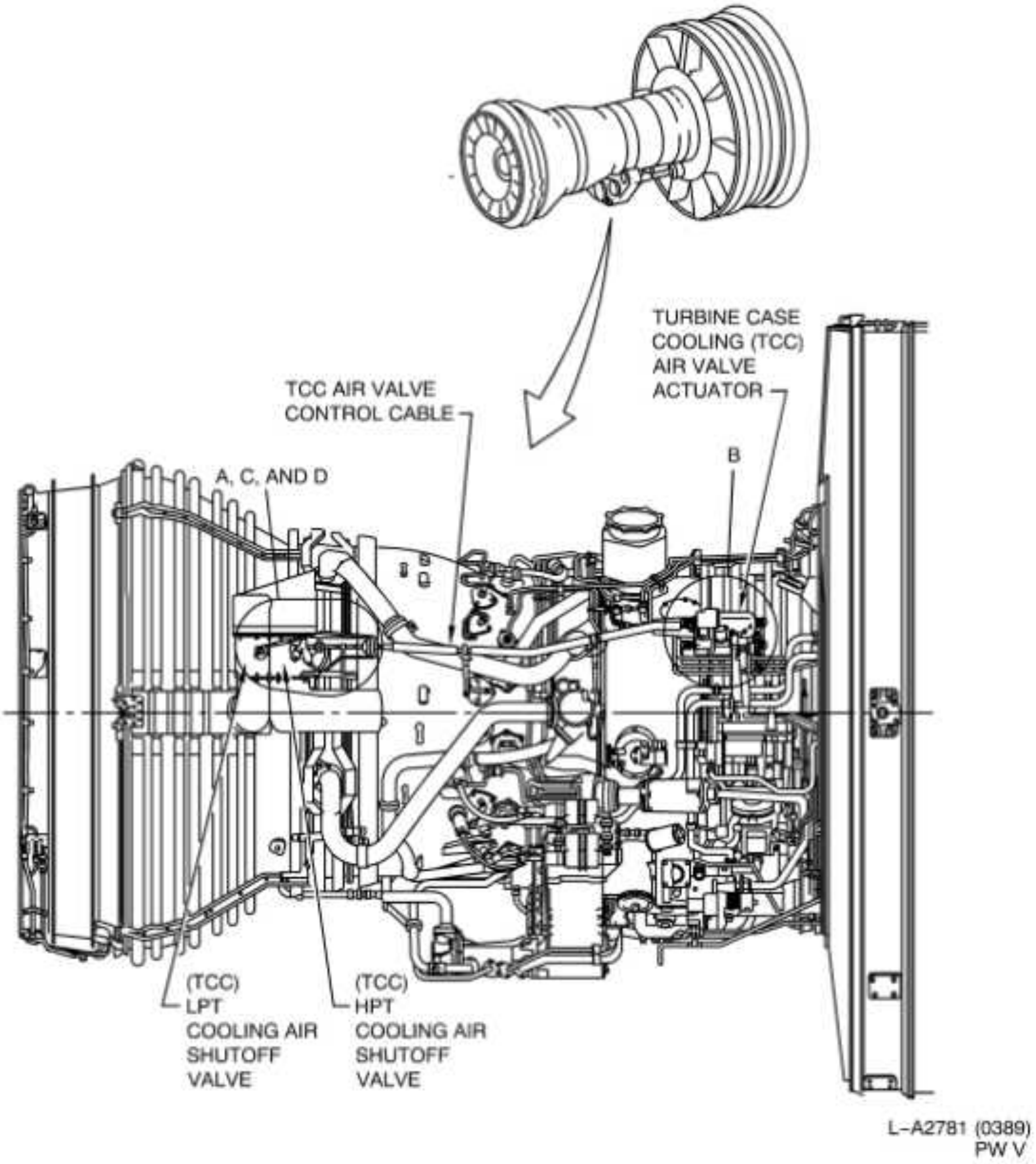
(11) If the bolthole does not align, remove the lockwire and loosen the two adjuster jamnuts (201/8). See View D. Turn the adjuster (201/7) and align the rod end (501/5) with the LPT valve lever arm (201/14) bolthole. Be sure rod end threads are seen through both sight holes in the adjuster. Install the bolt (201/2), lubricated with Engine Oil P03−001, and nut (201/6) and attach the rod end (201/5). Torque the nut to 36 − 40 lb−in. (4.067 − 4.519 N.m). Tighten and torque the jamnuts (201/8) to 14 − 16 lb−in. (1.582 − 1.808 N.m). Install the Lockwire P05−289.

CAUTION: BE SURE THE THREE RIGGING PINS AND THE POSITIONING BOLT ARE REMOVED FROM THE ENGINE OR DAMAGE CAN RESULT.

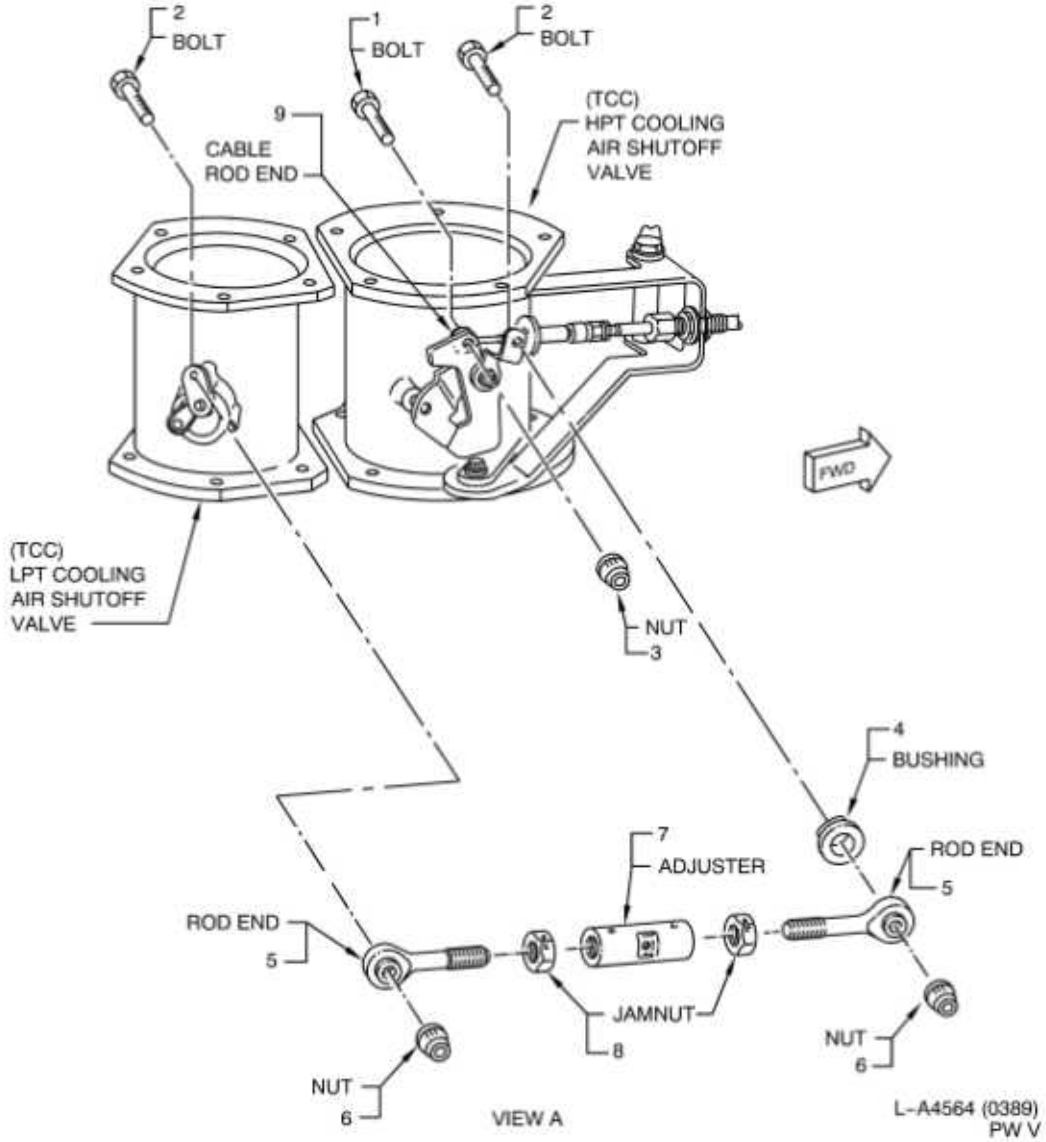
(12) Remove all three rigging pins. After the removal of the rigging pins, remove the positioning bolt from the rear of the actuator (201/12).

C. Postrequisite

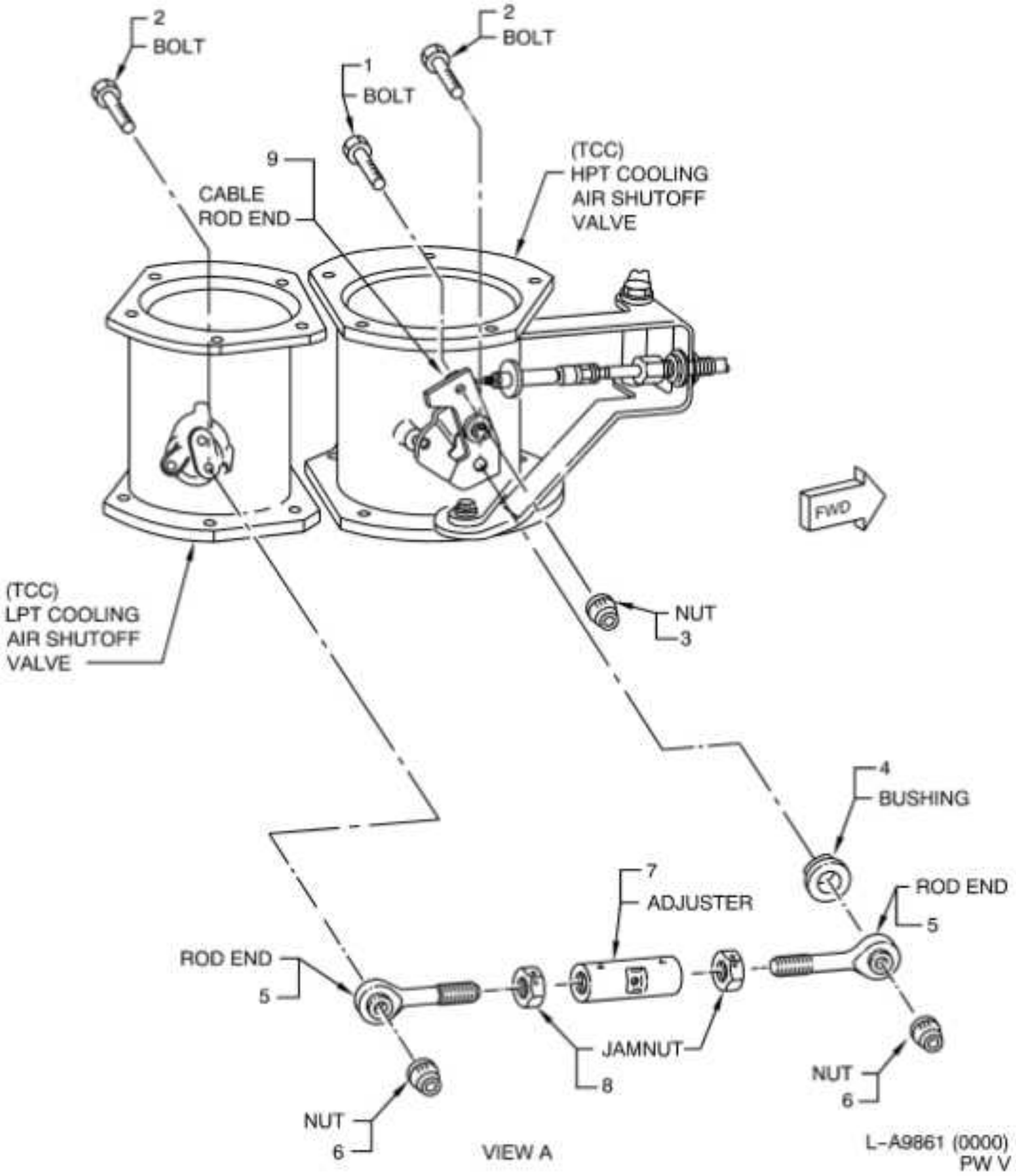
(1) Test the engine per the Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
TCC AIR VALVE CONTROL CABLE
B
A, C, AND D
(TCC) LPT COOLING AIR SHUTOFF VALVE
(TCC) HPT COOLING AIR SHUTOFF VALVE
L−A2781 (0389)
PW V

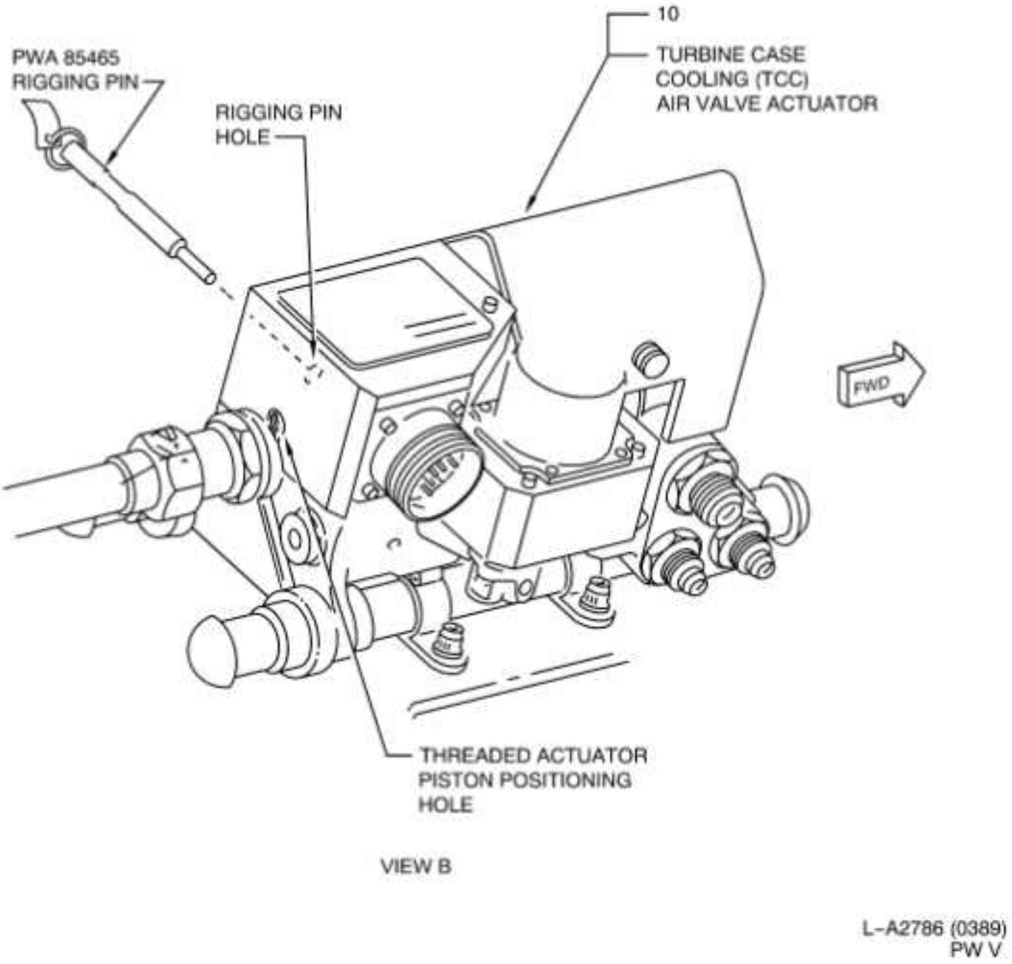
Turbine Case Cooling Control System
Figure 201 (Sheet 1)
(Task 72−00−00−830−005)


2
BOLT
1
BOLT
2
BOLT
9
CABLE
ROD END
(TCC)
HPT COOLING
AIR SHUTOFF
VALVE
FWD
(TCC)
LPT COOLING
AIR SHUTOFF
VALVE
NUT
3
4
BUSHING
7
ADJUSTER
ROD END
5
ROD END
5
JAMNUT
8
NUT
6
NUT
6
VIEW A
L-A4564 (0389)
PW V

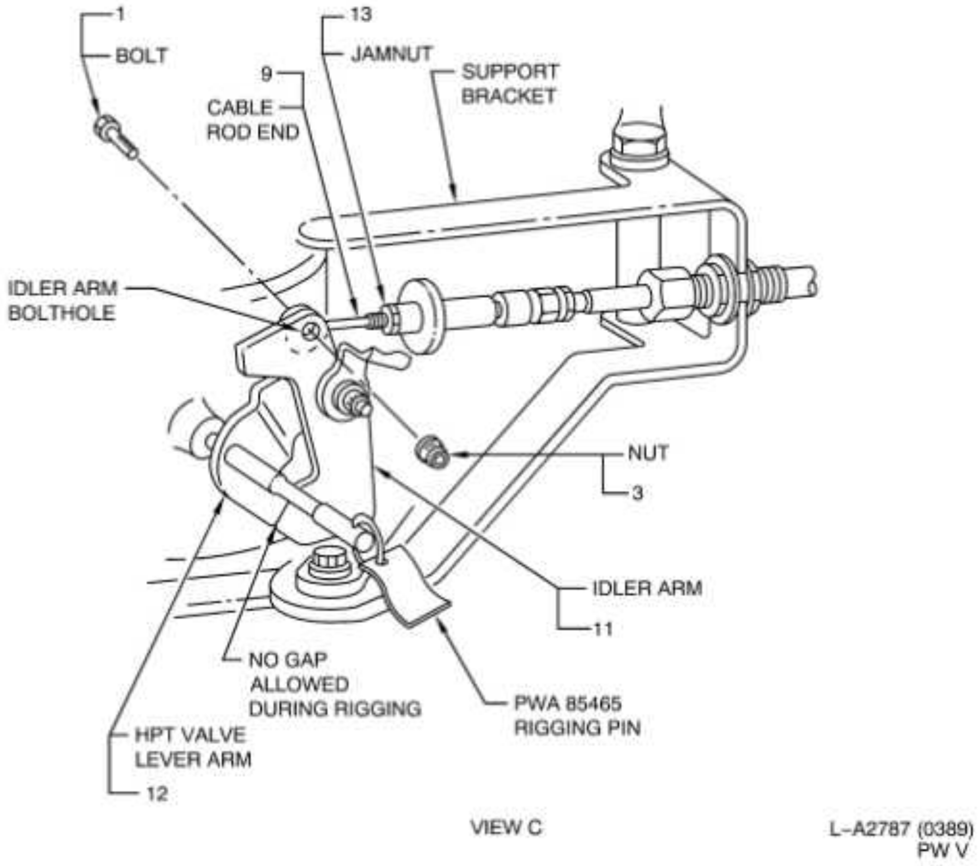
Turbine Case Cooling Control System (Pre And Post SB PW4ENG 72−572 And Post SB PW4ENG 72−592 Engines)
Figure 201 (Sheet 2)
(Task 72−00−00−830−005)


2
BOLT
2
BOLT
1
BOLT
9
CABLE ROD END
(TCC) HPT COOLING AIR SHUTOFF VALVE
FWD
(TCC) LPT COOLING AIR SHUTOFF VALVE
NUT
3
4
BUSHING
7
ADJUSTER
ROD END
5
ROD END
5
JAMNUT
8
NUT
6
NUT
6
VIEW A
L-A9861 (0000)
PW V

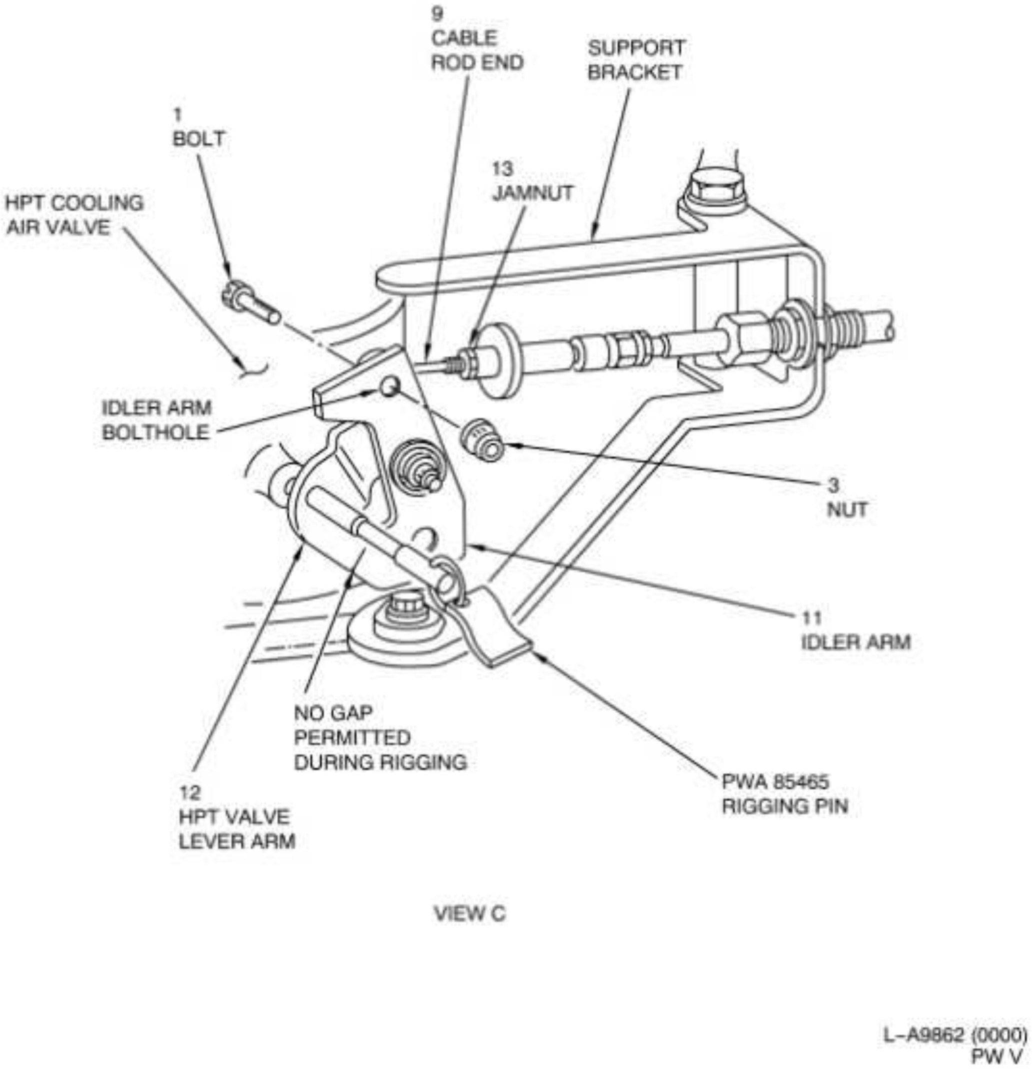
Turbine Case Cooling Control System
(Phase 3 Engines As Built By P&W)
Figure 201 (Sheet 3)
(Task 72−00−00−830−005)


10
TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
PWA 85465 RIGGING PIN
RIGGING PIN HOLE
FWD
THREADED ACTUATOR PISTON POSITIONING HOLE
VIEW B
L−A2786 (0389)
PW V

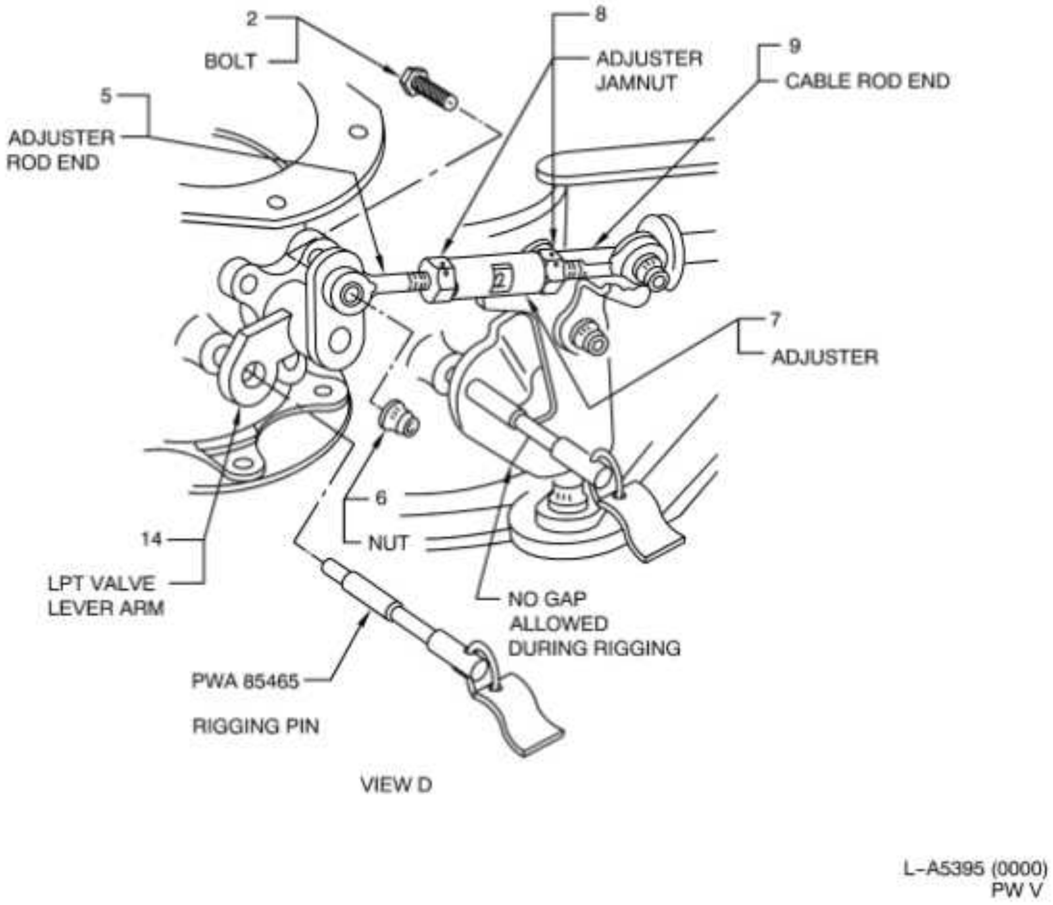
Turbine Case Cooling Control System
Figure 201 (Sheet 4)
(Task 72−00−00−830−005)


1
BOLT
13
JAMNUT
9
CABLE
ROD END
SUPPORT
BRACKET
IDLER ARM
BOLTHOLE
NUT
3
IDLER ARM
11
NO GAP
ALLOWED
DURING RIGGING
PWA 85465
RIGGING PIN
HPT VALVE
LEVER ARM
12
VIEW C
L−A2787 (0389)
PW V

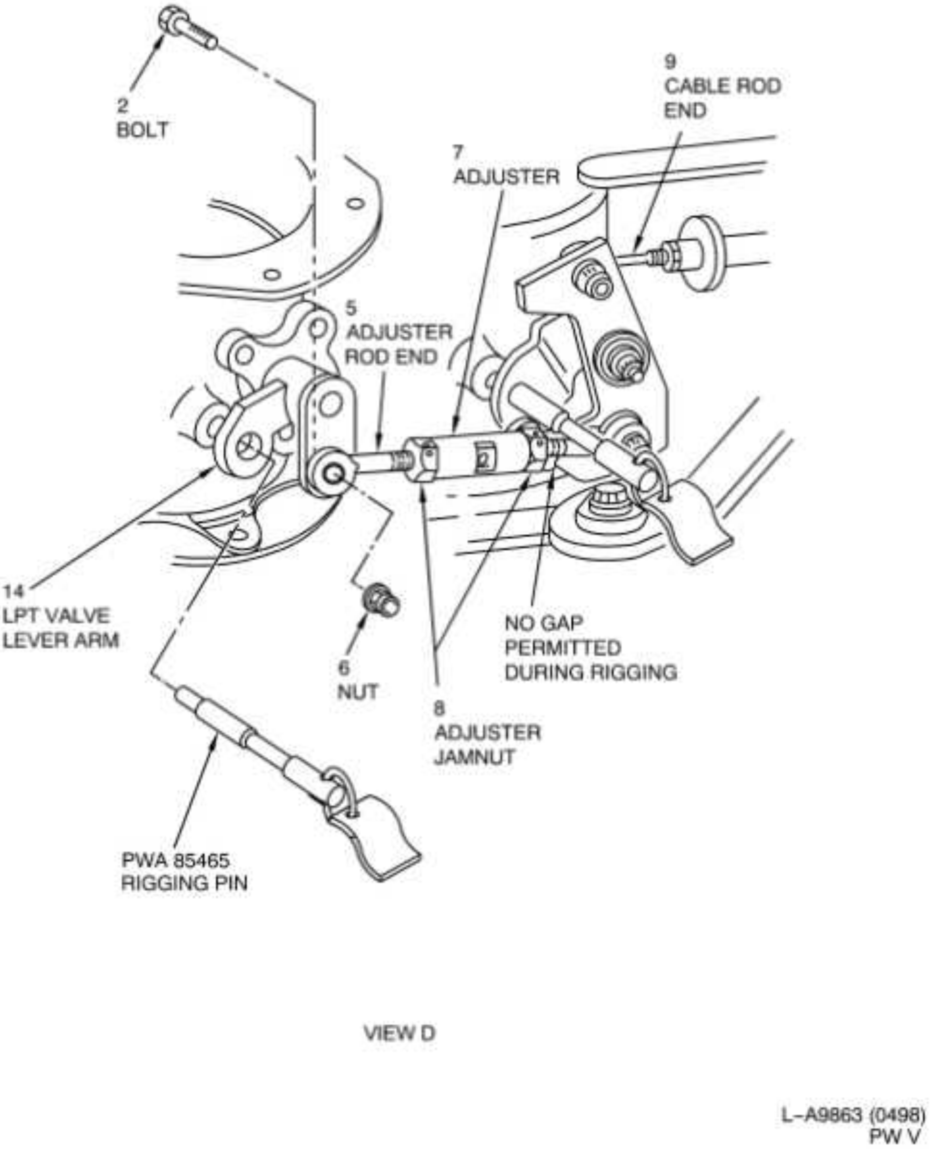
Turbine Case Cooling Control System (Pre And Post SB PW4ENG 72−572 And Post SB PW4ENG 72−592 Engines)
Figure 201 (Sheet 5)
(Task 72−00−00−830−005)


9
CABLE
ROD END
SUPPORT
BRACKET
1
BOLT
13
JAMNUT
HPT COOLING
AIR VALVE
IDLER ARM
BOLTHOLE
3
NUT
11
IDLER ARM
NO GAP
PERMITTED
DURING RIGGING
PWA 85465
RIGGING PIN
12
HPT VALVE
LEVER ARM
VIEW C
L−A9862 (0000)
PW V

Turbine Case Cooling Control System
(Phase 3 Engines As Built By P&W)
Figure 201 (Sheet 6)
(Task 72−00−00−830−005)


2
BOLT
8
ADJUSTER JAMNUT
9
CABLE ROD END
5
ADJUSTER ROD END
7
ADJUSTER
6
NUT
14
LPT VALVE LEVER ARM
NO GAP ALLOWED DURING RIGGING
PWA 85465
RIGGING PIN
VIEW D
L-A5395 (0000)
PW V

Turbine Case Cooling Control System (Pre And Post SB PW4ENG 72−572 And Post SB PW4ENG 72−592 Engines)
Figure 201 (Sheet 7)
(Task 72−00−00−830−005)


2
BOLT
9
CABLE ROD
END
7
ADJUSTER
5
ADJUSTER
ROD END
14
LPT VALVE
LEVER ARM
NO GAP
PERMITTED
DURING RIGGING
6
NUT
8
ADJUSTER
JAMNUT
PWA 85465
RIGGING PIN
VIEW D
L−A9863 (0498)
PW V

Turbine Case Cooling Control System
(Phase 3 Engines As Built By P&W)
Figure 201 (Sheet 8)
(Task 72−00−00−830−005)

ENGINE GENERAL - SPECIAL PROCEDURES-12

Task 72-00-00-020-003:

1. Trunnion Fan Cases Through HPT (Without LPC) From Horizontal To Front End Down Position

A. Equipment And Materials Required

Special Tools:

PWA 28657	Sling
PWA 76156	Adapter (2 Necessary)
PWA 85064	Fixture, Handling
PWA 85243	Plug, Support
PWA 85344	Ring, Adapter
PWA 85623	Eye, Lifting
PWA 85678	Stand, Support (3 Necessary) (Optional to PWA 87166/PWA 101960)
PWA 86617	Retainer, Rotor
PWA 87166	Stand, Support (3 Necessary)
PWA 101960	Adapter, Support (3 Necessary)

B. Procedure
See Figure 201.

NOTE: If there is a bolt in one of the holes of the 12 o'clock ground handling pad that you cannot remove, you must repair the intermediate case. Refer to 72-00-34, Repair-01 Task 72-00-34-300-001.

(1) Position PWA 85623 Eye to ground handling boss at 12 o'clock location on outer intermediate case. Attach eye to case with bolts. Torque bolts to 675 - 750 lb-in. (76.265 - 84.739 N.m).

(2) Position PWA 85344 Ring onto rear flange of HPT case and attach in place.

(3) With PWA 28657 Sling with two PWA 76156 Adapters attached to trunnion spools of PWA 85064 Fixture, position fixture onto PWA 85344 Ring. Aligning dowel pin hole with dowel pin in ring, attach fixture to case with bolts.

(4) Loosen knobs in center hub and install PWA 85243 Plug into center hub against 2nd stage hub. Hold plug in position with fixture knobs.

(5) Install the PWA 86617 Retainer into the hub of the fixture and into the inner diameter of the HPC rear hub. Attach the retainer to the center hub of the fixture.

(6) With hoist and sling attached to fixture attach second hoist to eye on intermediate case and raise engine from pedestals and saddle. Trunnion engine to front end down.

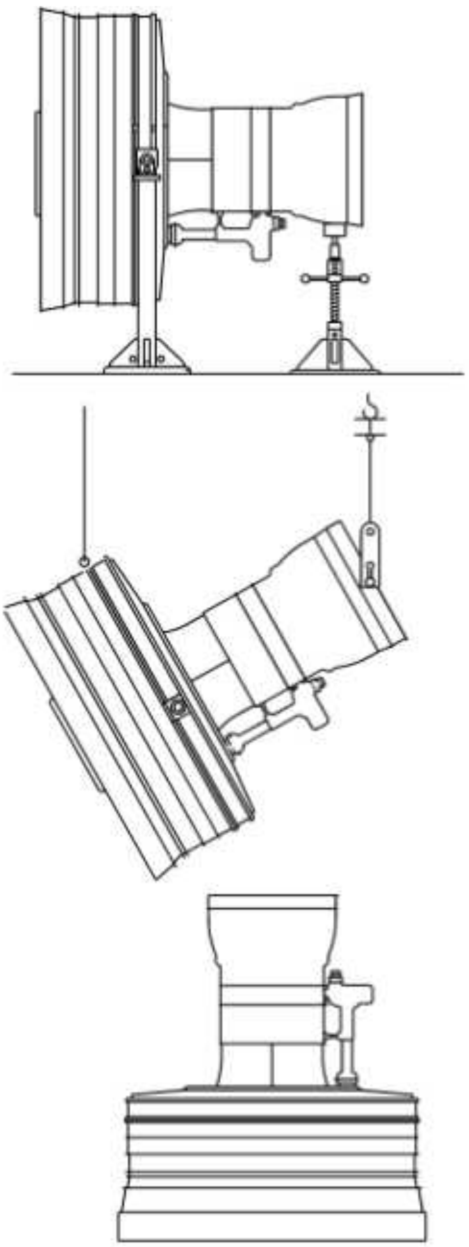
CAUTION: BE SURE PINS ARE PROPERLY SECURED IN PLACE.

(7) Position three PWA 85671 Stands or three PWA 87166 Stands with PWA 101960 Adapters approximately 120 degrees apart. Lower engine to rest on stands. Attach case to stands with detail bolts and nuts.

NOTE: Stands are adjustable for height. Be sure all stands are locked for equal height.

(8) Remove hoist, eye and brackets from intermediate case.

(9) Remove retainer and plug from fixture. With hoist, with sling and adapters attached, remove fixture from case and ring. Remove ring from case.



Trunnion Fan Cases Through HPT (Without LPC) To Front End Down
Figure 201
(Task 72−00−00−020−003)

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Task 72-00-00-420-003:

1. Trunnion Fan Cases Through HPT From Front End Down To Horizontal Position

A. Equipment And Materials Necessary

Special Tools:

PWA 25757	Pedestal (2 Necessary)
PWA 25926	Adapters (2 Necessary)
PWA 26157	Pedestal (Optional to PWA 87359)
PWA 28657	Sling
PWA 76156	Adapter (2 Necessary)
PWA 85062	Saddle
PWA 85064	Fixture, Handling
PWA 85243	Plug, Support
PWA 85344	Ring, Adapter
PWA 85623	Eye, Lifting
PWA 85662	Bracket (2 Necessary)
PWA 86617	Retainer, Rotor
PWA 87359	Pedestal
PWA 102727	Support
PWA 103636	Base, Support

B. Procedure

See Figure 201.

NOTE: If there is a bolt in one of the holes of the 12 o'clock ground handling pad that you cannot remove, you must repair the intermediate case. Refer to PW4000 Series CIR, PN 51A357.

(1) Install two PWA 85662 Bracket to ground handling bosses at 3 and 9 o'clock locations on intermediate case. Secure brackets with four bolts and torque bolts to 675 - 750 lb-in. (76.265 - 84.739 N.m).

(2) Install PWA 85623 Eye to ground handling boss at 12 o'clock location on outer intermediate case. Attach eye to case with bolts. Torque bolts to 675 - 750 lb-in. (76.265 - 84.739 N.m).

(3) Install PWA 85344 Ring onto rear flange of HPT case.

(4) Use PWA 28657 Sling with two PWA 76156 Adapters attached to trunnion spools of PWA 85064 Fixture, position fixture on PWA 85344 Ring. Aligning dowel pin hole with dowel pin in ring, attach fixture to case with bolts.

(5) Loosen knobs in center hub and install PWA 85243 Plug into center hub against 2nd stage hub. Hold plug in position with fixture knobs.

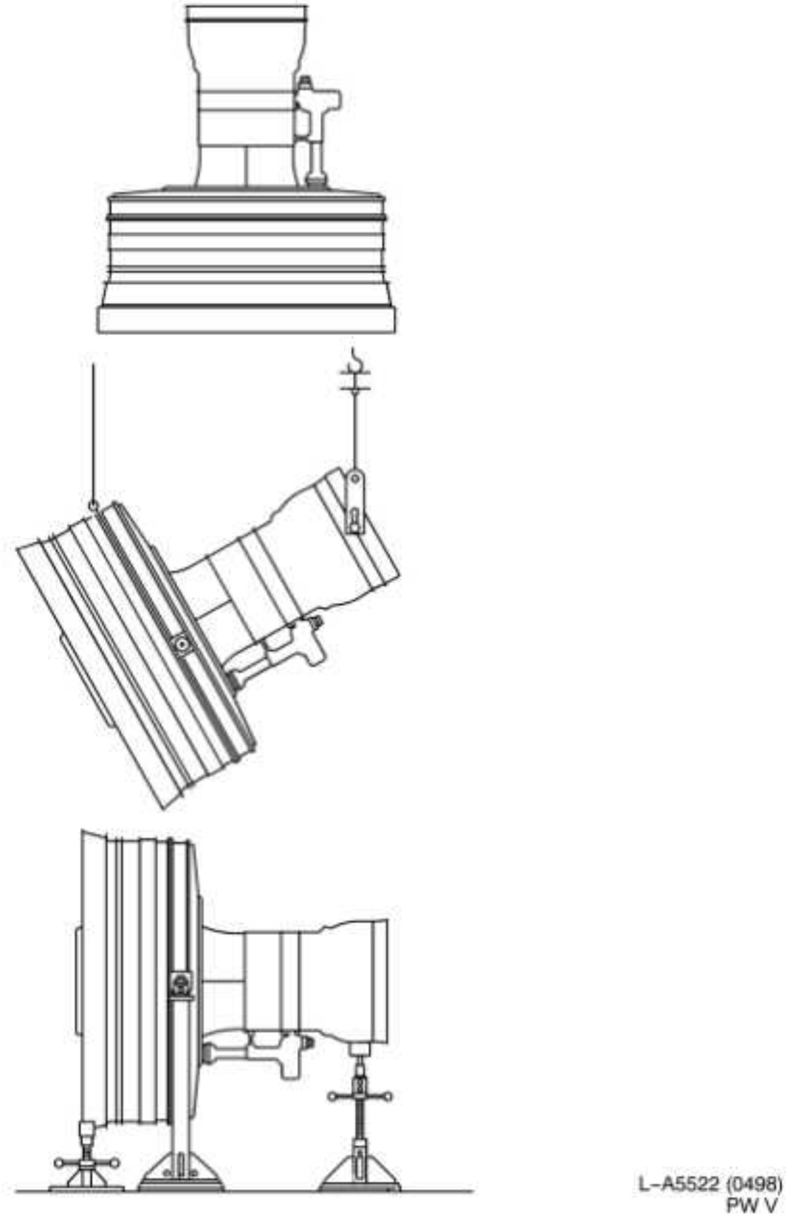
(6) Install the PWA 86617 Retainer into the hub of the fixture and into the inner diameter of the HPC rear hub. Attach the retainer to the center hub of the fixture.

(7) With hoist and sling attached to fixture attach second hoist to eye on intermediate case. Remove bolts and nuts securing case to stands and raise engine from stands. Trunnion engine to horizontal position.

(8) Position two PWA 25757 Pedestals with two PWA 25926 Adapters under brackets on intermediate case. Install PWA 85062 Saddle on either PWA 87359 Pedestal or PWA 26157 Pedestal and attach with ball lock pin. Position saddle under diffuser case at 6 o'clock location just forward of Flange M. Position PWA 102727 Support to align with Flange "A" of the fan inlet case at the 6 o'clock location.

(9) Lower engine on pedestals and saddle. Adjust the PWA 102727 Support to engage and hold the fan inlet case at Flange "A" at the 6 o'clock location. If it is necessary because of the height of the engine in the pedestals, first install the Fan Case Support (PWA 102727) in a PWA 103636 Base Support. Attach the Fan Case Support (PWA 102727) to the Base Support (PWA 103636) with the three detail bolts and nuts. Remove hoist and eye from intermediate case. Remove retainer and plug from rear fixture. With hoist and sling attached, remove fixture. Remove ring from diffuser case.

NOTE: If necessary several Base Supports (PWA 103636) can be stacked together. They must be attached to each other with the three detail bolts and nuts.



Trunnion Fan Cases Through HPT To Horizontal
Figure 201
(Task 72−00−00−420−003)

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Task 72-00-00-840-004:

1. Change The Engine Thrust Level (Only)

A. General

The purpose of this procedure is to provide directions and requirements for various thrust level conversions up to the PW4158 thrust level. This procedure does not apply to airframe model to airframe model conversions. The PW4000 engine serial numbers and related models referenced in this procedure are for those engines, as manufactured, at Pratt & Whitney. This procedure contains four separate sections that address specific subjects and requirements.

B. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Rivet (MS9319-002)	1	72-34-00/4A/XX

C. Procedure

(1) Basic engine gaspath hardware requirements for engines prior to the thrust conversion.

(a) Use the following figures and determine if the engine that you want to convert (to a higher thrust) requires Service Bulletin incorporation prior to the conversion. If you are converting your engine to a higher thrust level, incorporate the applicable Service Bulletins before you convert. If you are converting your engine to a lower thrust level, no gaspath Service Bulletin incorporation is required.

NOTE: The Service Bulletins listed on the figures with an "X" must be incorporated into the applicable engine serial numbers before you convert.

NOTE: The Service Bulletins (or their intent) listed on the figures without an "X" were previously incorporated into the applicable engine serial numbers at production manufacture.

1 For a PW4152 to a PW4156 conversion, see Figure 201 for required gaspath Service Bulletin incorporation.

2 For a PW4152 to a PW4156A/PW4158 conversion, see Figure 202 for required gaspath Service Bulletin incorporation.

3 For a PW4156 to a PW4156A/PW4158 conversion, see Figure 203 for required gaspath Service Bulletin incorporation.

(2) Replace the EEC programming plug as follows.

(a) Remove the EEC programming plug. See 72-00-33, Removal-12 (Task 72-00-33-050-007).

R (b) Get the correct part number and class EEC
R programming plug (called plug) as follows:

R 1 For engines that are changed to a higher thrust
R level and acceptance test, Testing-09 IS
R necessary. Do as follows:

R a See step (4) for the engines where 71-00-00,
R Testing-09 (Task 71-00-00-760-020) is
R necessary.

R b Get the correct plug part number from
R SB PW4ENG 73-203, "EEC EPP part number
R look-up".

R c Get the correct plug class from the
R necessary Testing-09.

R 2 For engines that are changed to a higher thrust
R level and where an acceptance test, Testing-09
R IS NOT necessary, do as follows:

R NOTE: See step (4) for the engines
R where 71-00-00, Testing-09 (Task
R 71-00-00-760-020) is necessary.

R a Get the correct plug part number from SB PW4ENG 73-203, "EEC EPP part number look-up".

R b Get the correct plug class from the "Log Of Engine Tests" supplied with the engine.

R 3 For engines that are changed to a lower thrust level, no Testing-09 is necessary. If the engines ARE acceptance tested to operate across all thrust ranges, do as follows:

R a Get the correct plug part number from SB PW4ENG 73-203, "EEC EPP part number look-up".

R b Get the correct plug class from the "Log Of Engine Tests" supplied with the engine.

R 4 For engines that are changed to a lower thrust level, no Testing-09 is necessary. If the engines ARE NOT acceptance tested at production manufacture to operate across all thrust ranges do as follows:

R a Get the correct part number plug from SB PW4ENG 73-203, "EEC EPP part number look-up".

R b Get the EPR class from the procedure given in 71-00-00, Testing-09, Paragraph P. Step (3) titled "Make a EEC programming plug selection as follows".

R (c) Install the new replacement EEC programming plug to the EEC. See 72-00-33, Installation-12 Task 72-00-33-450-007-A00 or Task 72-00-33-050-007-B00.

(3) Replace the engine (serial number) identification plate as follows:

(a) Remove the four screws and the engine (serial number) identification plate from the Flange C bracket at approximately 5 o'clock position.

(b) (Pre SB PW4ENG 72-687) For the new replacement engine identification plate, send the necessary information, as specified by Spare Parts Bulletin P0351, to:

Pratt & Whitney
Spares Management And Logistics
400 Main Street
East Hartford, CT 06108 USA

1 Install the new replacement engine identification plate to the Flange C bracket. Attach the plate with the four screws, lubricated with Engine Oil P03-001. Torque the screws to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) (Post SB PW4ENG 72-687) For the new replacement engine identification plate, send the necessary information, as specified by Spare Parts Bulletin P0351, to:

Pratt & Whitney
Spares Management And Logistics
400 Main Street
East Hartford, CT 06108 USA

1 Install the new replacement engine identification plate to the Flange C bracket. Attach the plate with the four screws, lubricated with Engine Oil P03-001. Torque the screws to 36 - 40 lb-in. (4.067 - 4.519 N.m).

2 If a subsequent thrust rating change occurs, install the rivet in the applicable hole in the engine identification plate that corresponds to the engines new thrust rating.

(d) Examine the data plate as follows:

1 (Pre SB PW4ENG 72-687) Verify that the correct side of the data plate is installed outward (visible).

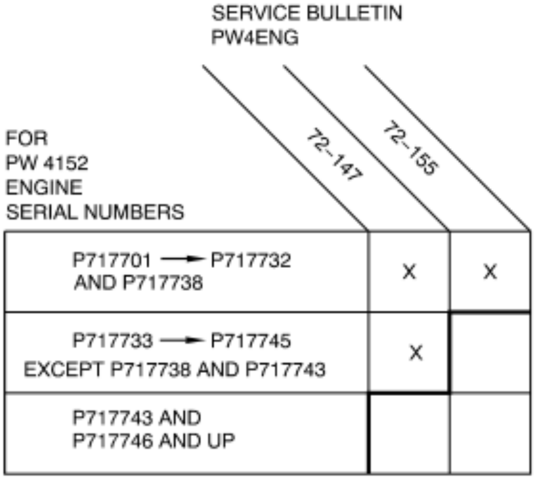
2 Verify that the correct engine model, rating, and EEC programing plug part number and class are visible.

(4) Determine the test requirements and test the converted engine as follows.

(a) Not all converted engines require acceptance testing. Engines that are converted to a lower thrust level do not require acceptance test (71-00-00, Testing-09).

R
R

(b) Test all engines that are converted to a higher thrust level. See 71-00-00, Testing-09 Task 71-00-00-760-020.

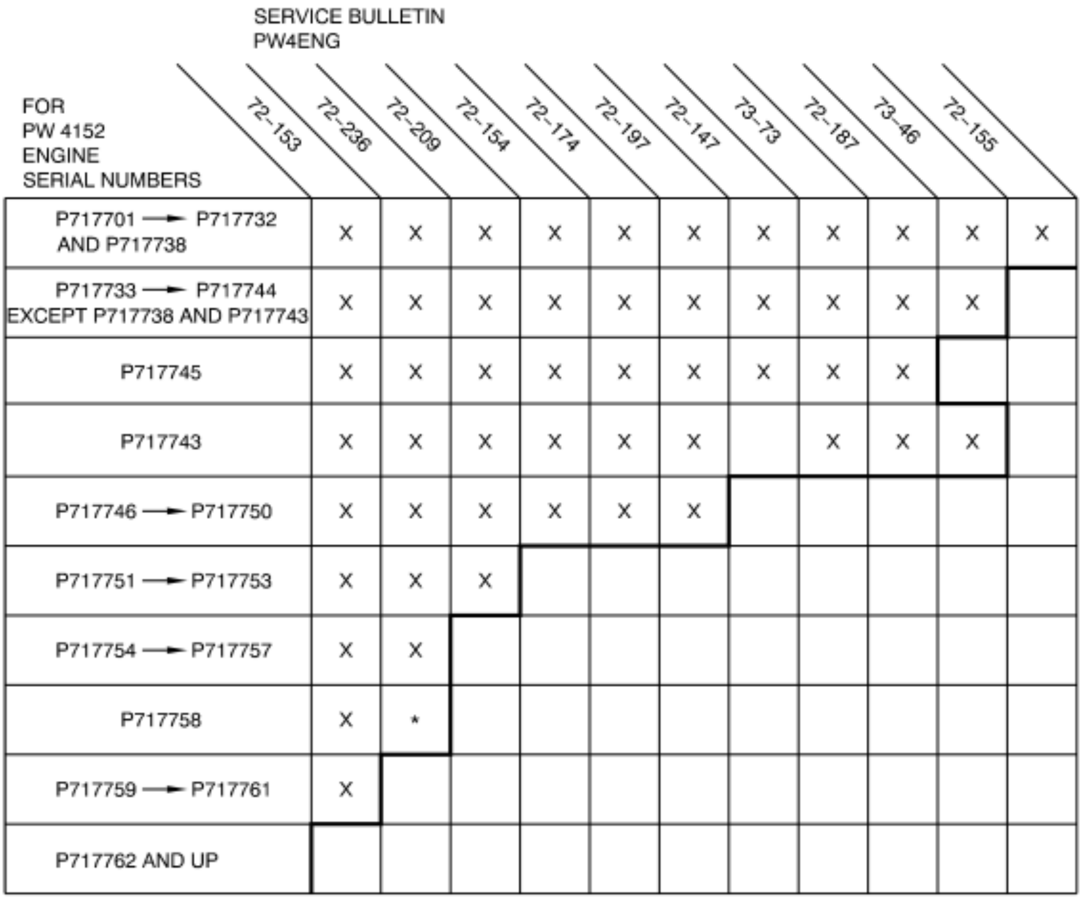


SERVICE BULLETIN PW4ENG

FOR PW 4152 ENGINE SERIAL NUMBERS	72-147	72-155
P717701 → P717732 AND P717738	X	X
P717733 → P717745 EXCEPT P717738 AND P717743	X	
P717743 AND P717746 AND UP		

L−A7242 (0000)
PW V

Service Bulletin Incorporation Requirements For
A PW4152 To PW4156 Conversion (Thrust Only)
Figure 201
(Task 72−00−00−840−004)

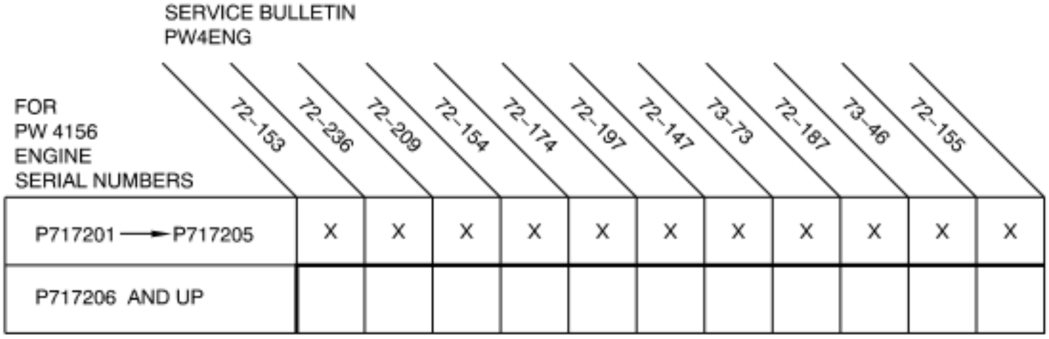


FOR PW 4152 ENGINE SERIAL NUMBERS / SERVICE BULLETIN PW4ENG	72-153	72-236	72-209	72-154	72-174	72-197	72-147	73-73	72-187	73-46	72-155
P717701 → P717732 AND P717738	X	X	X	X	X	X	X	X	X	X	X
P717733 → P717744 EXCEPT P717738 AND P717743	X	X	X	X	X	X	X	X	X	X	
P717745	X	X	X	X	X	X	X	X	X		
P717743	X	X	X	X	X	X		X	X	X	
P717746 → P717750	X	X	X	X	X	X					
P717751 → P717753	X	X	X								
P717754 → P717757	X	X									
P717758	X	*									
P717759 → P717761	X										
P717762 AND UP											

L-A7243 (0000)
PW V

* Incorporate the new 5th stage spacer only. The new 4th stage spacer was incorporated at production manufacture.

Service Bulletin Incorporation Requirements For
A PW4152 To PW4156A/PW4158 Conversion (Thrust Only)
Figure 202
(Task 72−00−00−840−004)



SERVICE BULLETIN PW4ENG

FOR PW 4156 ENGINE SERIAL NUMBERS	72-153	72-236	72-209	72-154	72-174	72-197	72-147	73-73	72-187	73-46	72-155
P717201 → P717205	X	X	X	X	X	X	X	X	X	X	X
P717206 AND UP											

L−A7244 (0000)
PW V

Service Bulletin Incorporation Requirements For
A PW4156 To PW4156A/PW4158 Conversion (Thrust Only)
Figure 203
(Task 72−00−00−840−004)

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ENGINE GENERAL - SPECIAL PROCEDURES-17

Task 72-00-00-840-007:

1. Convert An Airbus Model Engine (As Manufactured By Pratt Whitney) To A Boeing Model Engine

A. General
The purpose of this section is to provide directions and requirements for the conversion of an Airbus configured engine/power plant to a Boeing configured engine/power plant. The PW4000 engine serial numbers and related models referenced in this procedure are for those engines, as manufactured, at Pratt & Whitney. This procedure contains four separate sections that address specific subjects and requirements.

B. Equipment And Materials Required - None

C. Procedure

(1) Basic engine gaspath hardware requirements for engines prior to the airframe/thrust conversion.

NOTE: Other Service Bulletins that require external hardware changes may be required prior to the conversion. These Service Bulletins are listed in the referenced Conversion Service Bulletin PW4ENG 72-390.

(a) Use the following figures and determine if the engine that you want to convert (to a higher thrust) requires Service Bulletin incorporation prior to the conversion. If you are converting your engine to a higher thrust level, incorporate the applicable Service Bulletins before you convert. If you are converting your engine to a lower thrust level, no gaspath Service Bulletin incorporation is required.

NOTE: The Service Bulletins listed on the figures with an "X" must be incorporated into the applicable engine serial numbers before you convert.

NOTE: The Service Bulletins (or their intent) listed on the figures without an "X" were previously incorporated into the applicable engine serial numbers at production manufacture.

1 For an (Airbus) PW4152 to a (Boeing) PW4052 conversion, no gaspath Service Bulletin incorporation is required.

2 For an (Airbus) PW4152 to a (Boeing) PW4056 conversion, see Figure 201 for required gaspath Service Bulletin incorporation.

3 For an (Airbus) PW4152 to a (Boeing) PW4060/PW4060A/PW4060C conversion, see Figure 202 for required gaspath Service Bulletin incorporation.

4 For an (Airbus) PW4156 to a (Boeing) PW4056 conversion, no gaspath Service Bulletin incorporation is required.

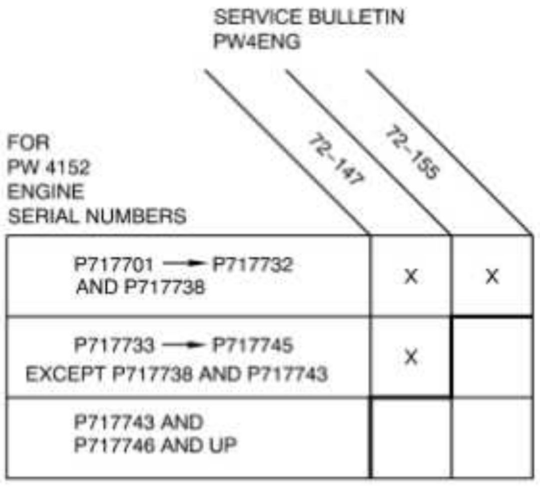
5 For an (Airbus) PW4156 to a (Boeing) PW4060/PW4060A/PW4060C conversion, see Figure 203 for required gaspath Service Bulletin incorporation.

6 For an (Airbus) PW4156A/PW4158 to a (Boeing) PW4060/PW4060A/PW4060C conversion, see Figure 204 for required gaspath Service Bulletin incorporation.

(2) If installed, remove all the Airbus nacelle (EBU/QEC) parts from the mountable power plant so that the engine is in the basic (bare) configuration. See the removal procedures in the 71-00-00 Chapter Sections.

(3) Replace the necessary (Airbus unique) external engine parts with the necessary (Boeing unique) external engine parts. See Conversion Service Bulletin PW4ENG 72-390.

(4) After the accomplishment of the conversion Service Bulletin PW4ENG 72-390, continue the conversion procedure in the (Boeing model) Engine Manual (Part Number 50A605), 72-00-00, Special Procedures-18 Task 72-00-00-840-009.



SERVICE BULLETIN PW4ENG

FOR PW 4152 ENGINE SERIAL NUMBERS	72-147	72-155
P717701 → P717732 AND P717738	X	X
P717733 → P717745 EXCEPT P717738 AND P717743	X	
P717743 AND P717746 AND UP		

L−A7615 (0000)
PW V

Service Bulletin Incorporation Requirements For
A (Airbus) PW4152 To (Boeing) PW4056 Conversion
Figure 201
(Task 72−00−00−840−007)

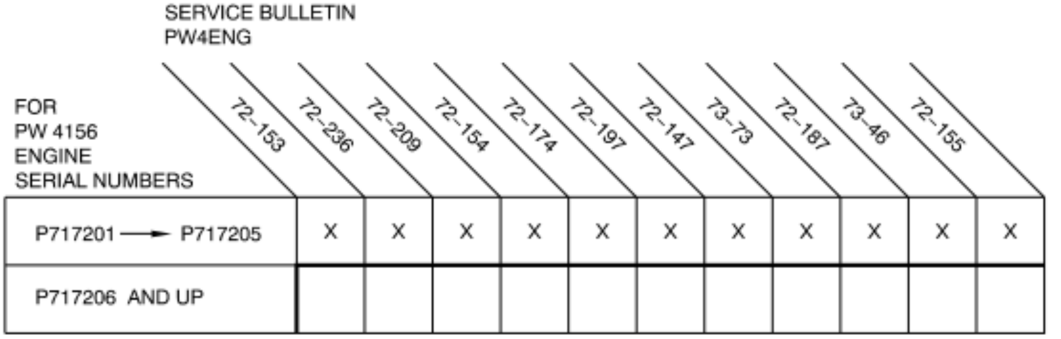
SERVICE BULLETIN
PW4ENG

FOR PW 4152 ENGINE SERIAL NUMBERS	72-153	72-236	72-209	72-154	72-174	72-197	72-147	73-73	72-187	73-46	72-155
P717701 → P717732 AND P717738	X	X	X	X	X	X	X	X	X	X	X
P717733 → P717744 EXCEPT P717738 AND P717743	X	X	X	X	X	X	X	X	X	X	
P717745	X	X	X	X	X	X	X	X	X		
P717743	X	X	X	X	X	X		X	X	X	
P717746 → P717750	X	X	X	X	X	X					
P717751 → P717753	X	X	X								
P717754 → P717757	X	X									
P717758	X	*									
P717759 → P717761	X										
P717762 AND UP											

L-A7616 (0000)
PW V

* Incorporate the new 5th stage spacer only. The new 4th stage spacer was incorporated at production manufacture.

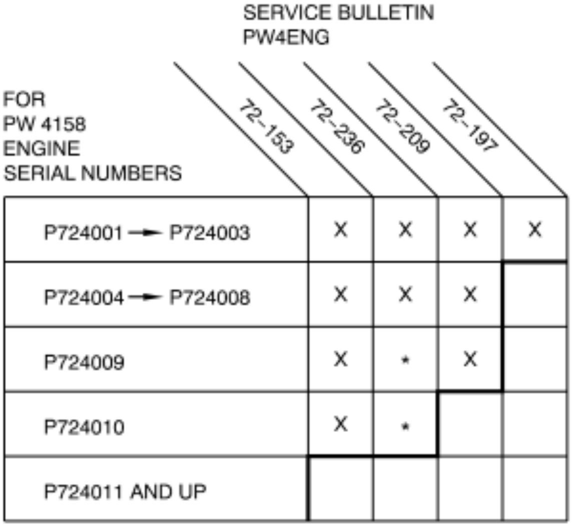
Service Bulletin Incorporation Requirements For A (Airbus) PW4152 To (Boeing) PW4060/PW4060A/PW4060C Conversion
Figure 202
(Task 72−00−00−840−007)



FOR PW 4156 ENGINE SERIAL NUMBERS / SERVICE BULLETIN PW4ENG	72-153	72-236	72-209	72-154	72-174	72-197	72-147	73-73	72-187	73-46	72-155
P717201 → P717205	X	X	X	X	X	X	X	X	X	X	X
P717206 AND UP											

L-A7617 (0000)
PW V

Service Bulletin Incorporation Requirements For A (Airbus)
PW4156 To (Boeing) PW4060/PW4060A/PW4060C Conversion
Figure 203
(Task 72−00−00−840−007)



SERVICE BULLETIN PW4ENG

FOR PW 4158 ENGINE SERIAL NUMBERS	72-153	72-236	72-209	72-197
P724001 → P724003	X	X	X	X
P724004 → P724008	X	X	X	
P724009	X	*	X	
P724010	X	*		
P724011 AND UP				

L-A7618 (0000)
PW V

* Incorporate the new 5th stage spacer only. The new 4th stage spacer was incorporated at production manufacture.

Service Bulletin Incorporation Requirements For A (Airbus)
PW4156A/PW4158 To (Boeing) PW4060/PW4060A/PW4060C Conversion
Figure 204
(Task 72-00-00-840-007)

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ENGINE GENERAL - SPECIAL PROCEDURES-18

Task 72-00-00-840-010:

1. Complete The Conversion Of A Boeing Model Engine (As Manufactured By Pratt & Whitney) To An Airbus Model Engine

A. Prerequisites

(1) Start the conversion procedure for a Boeing model engine (as manufactured by Pratt & Whitney) to an Airbus model engine. See the (Boeing model) Engine Manual (Part Number 50A605), 72-00-00, Special Procedures-17 Task 72-00-00-840-006.

(2) Complete the Conversion Service Bulletin PW4ENG 72-389.

B. General

The purpose of this procedure is to provide directions and requirements to complete the conversion of a Boeing model engine (as manufactured by Pratt & Whitney) to an Airbus model engine. You must complete Conversion Service Bulletin PW4ENG 72-389 before you do this procedure. This procedure contains directions for the procurement of an engine (serial number) identification plate and the test requirements for the converted engine.

C. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

D. Procedure

(1) Replace the engine (serial number) identification plate, as follows.

(a) Send the necessary information, as specified by Spare Parts Bulletin P0351, to:

Pratt & Whitney
Customer Engine Performance Group
400 Main Street
East Hartford, CT 06108 USA

(b) Install the new replacement engine identification plate to the Flange C bracket. Attach the plate with the four screws, lubricated with Engine Oil P03-001. Torque the screws to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Examine the data plate as follows:

1 Verify that the correct side of the data plate is installed outward (visible).

2 Verify that the correct engine model, rating, and EEC programing plug part number and class are visible.

(2) Do an acceptance test on all airframe model converted engines. See 71−00−00, Testing−09 Task 71−00−00−760−020.

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ENGINE GENERAL - SPECIAL PROCEDURES-19

Task 72-00-00-840-013:

1. Convert An Airbus Model Engine (As Manufactured By Pratt Whitney) To A McDonnell Douglas Model Engine

A. General
The purpose of this section is to provide directions and requirements for the conversion of an Airbus configured engine/power plant to a McDonnell Douglas configured engine/power plant. The PW4000 engine serial numbers and related models referenced in this procedure are for those engines, as manufactured, at Pratt & Whitney. This procedure contains four separate sections that address specific subjects and requirements.

B. Equipment And Materials Required - None

C. Procedure

(1) Basic engine gaspath hardware requirements for engines prior to the airframe/thrust conversion.

NOTE: Other Service Bulletins that require external hardware changes may be required prior to the conversion. These Service Bulletins are listed in the referenced Conversion Service Bulletin PW4ENG 72-401.

(a) Use the following figures and determine if the engine that you want to convert (to a higher thrust) requires Service Bulletin incorporation prior to the conversion. If you are converting your engine to a higher thrust level, incorporate the applicable Service Bulletins before you convert. If you are converting your engine to a lower thrust level, no gaspath Service Bulletin incorporation is required.

NOTE: The Service Bulletins listed on the figures with an "X" must be incorporated into the applicable engine serial numbers before you convert.

NOTE: The Service Bulletins (or their intent) listed on the figures without an "X" were previously incorporated into the applicable engine serial numbers at production manufacture.

ENGINE GENERAL − SPECIAL PROCEDURES−19

1 For an (Airbus) PW4152 to a (McDonnell Douglas) PW4460 conversion, see Figure 201 for required gaspath Service Bulletin incorporation.

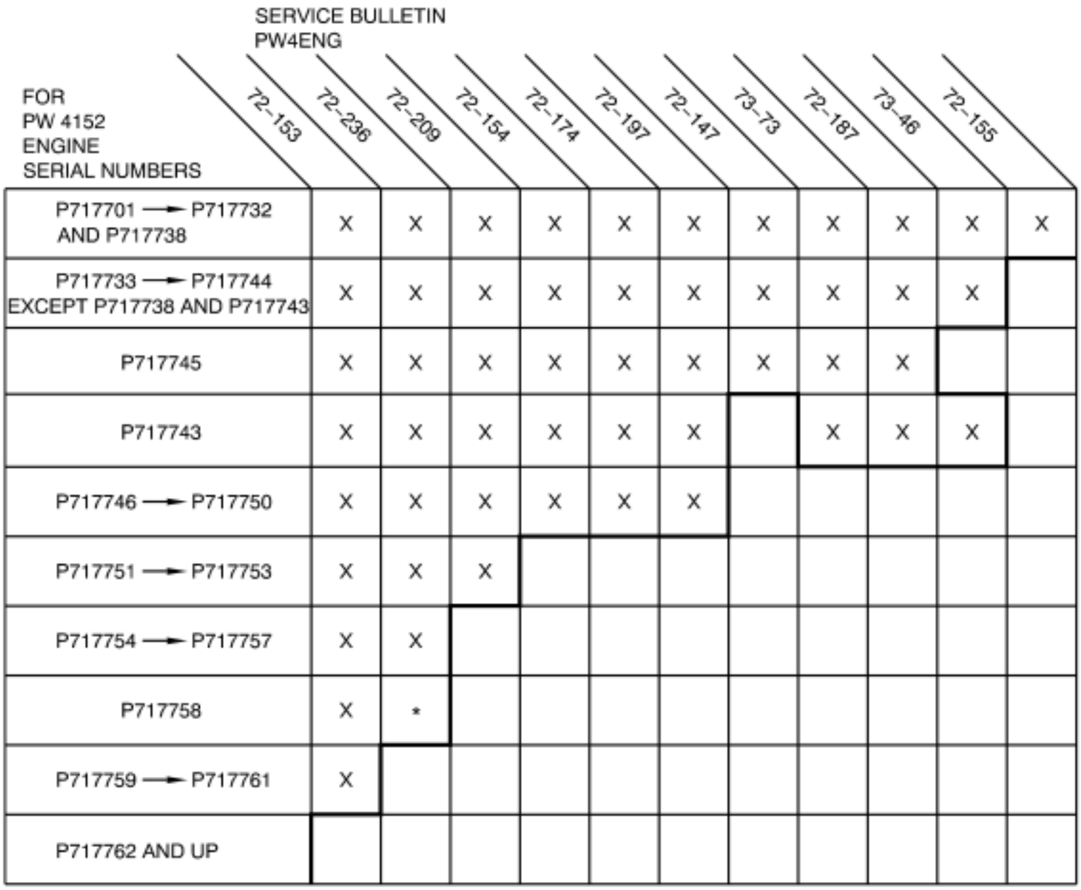
2 For an (Airbus) PW4156 to a (McDonnell Douglas) PW4460 conversion, see Figure 202 for required gaspath Service Bulletin incorporation.

3 For an (Airbus) PW4156A/PW4158 to a (McDonnell Douglas) PW4460 conversion, see Figure 203 for required gaspath Service Bulletin incorporation.

(2) If installed, remove all the Airbus nacelle (EBU/QEC) parts from the mountable power plant so that the engine is in the basic (bare) configuration. See the removal procedures in the 71−00−00 Chapter Sections.

(3) Replace the necessary (Airbus unique) external engine parts with the necessary (McDonnell Douglas unique) external engine parts. See Conversion Service Bulletin PW4ENG 72−401.

(4) After the accomplishment of the conversion Service Bulletin PW4ENG 72−401, continue the conversion procedure in the (McDonnell Douglas model) Engine Manual (Part Number 50A822), 72−00−00, Special Procedures−18 Task 72−00−00−840−011.



SERVICE BULLETIN PW4ENG

FOR PW 4152 ENGINE SERIAL NUMBERS	72-153	72-236	72-209	72-154	72-174	72-197	72-147	73-73	72-187	73-46	72-155
P717701 → P717732 AND P717738	X	X	X	X	X	X	X	X	X	X	X
P717733 → P717744 EXCEPT P717738 AND P717743	X	X	X	X	X	X	X	X	X	X	
P717745	X	X	X	X	X	X	X	X	X		
P717743	X	X	X	X	X	X		X	X	X	
P717746 → P717750	X	X	X	X	X	X					
P717751 → P717753	X	X	X								
P717754 → P717757	X	X									
P717758	X	*									
P717759 → P717761	X										
P717762 AND UP											

L-A7628 (0000)
PW V

* Incorporate the new 5th stage spacer only. The new 4th stage spacer was incorporated at production manufacture.

Service Bulletin Incorporation Requirements For An
(Airbus) PW4152 To (McDonnell Douglas) PW4460 Conversion
Figure 201
(Task 72−00−00−840−013)

FOR PW 4156 ENGINE SERIAL NUMBERS	SERVICE BULLETIN PW4ENG 72-153	72-236	72-209	72-154	72-174	72-197	72-147	73-73	72-187	73-46	72-155
P717201 ──► P717205	X	X	X	X	X	X	X	X	X	X	X
P717206 AND UP											

L−A7629 (0000)
PW V

Service Bulletin Incorporation Requirements For An
(Airbus) PW4156 To (McDonnell Douglas) PW4460 Conversion
Figure 202
(Task 72−00−00−840−013)

SERVICE BULLETIN
PW4ENG

FOR PW 4158 ENGINE SERIAL NUMBERS	72-153	72-236	72-209	72-197
P724001 → P724003	X	X	X	X
P724004 → P724008	X	X	X	
P724009	X	*	X	
P724010	X	*		
P724011 AND UP				

L-A7630 (0000)
PW V

* Incorporate the new 5th stage spacer only. The new 4th stage spacer was incorporated at production manufacture.

Service Bulletin Incorporation Requirements For An (Airbus) PW4156A/PW4158 To (McDonnell Douglas) PW4460 Conversion
Figure 203
(Task 72-00-00-840-013)

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ENGINE GENERAL - SPECIAL PROCEDURES-20

Task 72-00-00-840-016:

1. Complete The Conversion Of A McDonnell Douglas Model Engine (As Manufactured By Pratt & Whitney) To An Airbus Model Engine

A. Prerequisites

(1) Start the conversion procedure for a McDonnell Douglas model engine (as manufactured by Pratt & Whitney) to an Airbus model engine. See the (McDonnell Douglas model) Engine Manual (Part Number 50A822), 72-00-00, Special Procedures-17 Task 72-00-00-840-008.

(2) Complete the Conversion Service Bulletin PW4ENG 72-400.

B. General

The purpose of this procedure is to provide directions and requirements to complete the conversion of a McDonnell Douglas model engine (as manufactured by Pratt & Whitney) to an Airbus model engine. You must complete Conversion Service Bulletin PW4ENG 72-400 before you do this procedure. This procedure contains directions for the procurement of an engine (serial number) identification plate and the test requirements for the converted engine.

C. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

D. Procedure

(1) Replace the engine (serial number) identification plate, as follows.

(a) Send the necessary information, as specified by Spare Parts Bulletin No. P0351, to:

Pratt & Whitney
Customer Engine Performance Group
400 Main Street
East Hartford, CT 06108 USA

(b) Install the new replacement engine identification plate to the Flange C bracket. Attach the plate with the four screws, lubricated with Engine Oil P03-001. Torque the screws to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Examine the data plate as follows:

1 Verify that the correct side of the data plate is installed outward (visible).

2 Verify that the correct engine model, rating, and EEC programing plug part number and class are visible.

(2) Do an acceptance test on all airframe model converted engines. See 71-00-00, Testing-09 Task 71-00-00-760-020.

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Task 72-00-00-020-004:

1. Trunnion The Fan Unit (Stage 1 Blades Not Installed) From Horizontal Position To Rear End Down

A. Prerequisites

(1) Remove the fan-unit from the core engine. Refer to
R 72-00-34, Removal-21 (Task 72-00-34-020-004).

(2) Remove the Stage 1 LPC blade assemblies. Refer to 72-00-31, Removal-04 (Task 72-00-31-020-002-002).

B. Equipment And Materials

Special Tools:

PWA 76154	Adapters (2 Necessary)
PWA 76155	Sling
PWA 85623	Eye
PWA 86567	Adapters (2 Necessary)

CAUTION: DO NOT DO THIS PROCEDURE IF THE LPC/LPT COUPLING OR THE STAGE 1 LPC BLADE ASSEMBLIES ARE INSTALLED. FAILURE OF THE TOOL CAN OCCUR.

C. Procedure

See Figure 201.

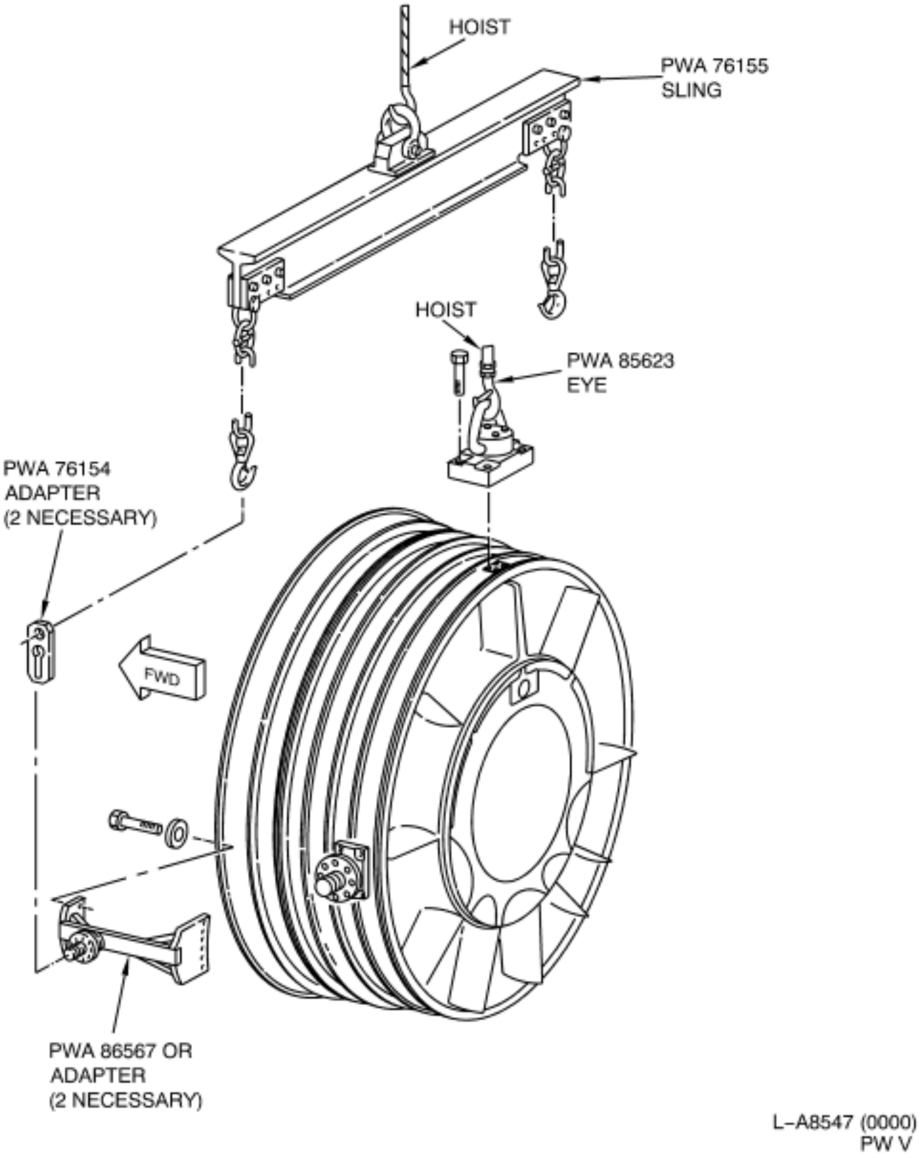
(1) If not installed, attach PWA 86567 Adapter to Flanges A and B of the fan case at 3 and 9 o'clock positions. Use the detail washers and screws.

(2) If not installed, attach PWA 85623 Eye to the pad on the intermediate case at 12 o'clock position. Use the detail screws.

(3) Hang two PWA 76154 Adapters in the hooks of PWA 76155 Sling.

(4) Put the trunnion spools of PWA 86567 Adapters in the holes of PWA 76154 Adapters. With one hoist at the sling and another hoist at the eye, trunnion the fan unit to rear end down.

(5) Remove the tools.


HOIST
PWA 76155
SLING
HOIST
PWA 85623
EYE
PWA 76154
ADAPTER
(2 NECESSARY)
FWD
PWA 86567 OR
ADAPTER
(2 NECESSARY)
L−A8547 (0000)
PW V

Trunnion The Fan Unit
Figure 201
(Task 72−00−00−020−004)

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ENGINE GENERAL - SPECIAL PROCEDURES-22

Task 72-00-00-420-004:

1. Trunnion The Fan Unit (Stage 1 Blades Not Installed) From Rear End Down To Horizontal Position

A. Equipment And Materials

Special Tools:
PWA 25757 Pedestal (4 Necessary)
PWA 25926 Adapters (4 Necessary)
PWA 76154 Adapters (2 Necessary)
PWA 76155 Sling
PWA 85623 Eye
PWA 85662 Bracket (2 Necessary)(Optional to PWA 85667)
PWA 85667 Bracket (2 Necessary)
PWA 86567 Adapters (2 Necessary)

B. Procedure

See Figure 201.

(1) Attach PWA 86567 Adapter to Flanges A and B of the fan case at 3 and 9 o'clock positions. Use the detail washers and screws.

(2) Attach PWA 85623 Eye to the pad on the intermediate case at 12 o'clock position. Use the detail screws.

(3) Hang two PWA 76154 Adapters in the hooks of PWA 76155 Sling.

(4) Put the trunnion (small) spools of PWA 86567 Adapter in the holes of PWA 76154 Adapters. With one hoist at the sling and another hoist at the eye, trunnion the fan unit to horizontal position.

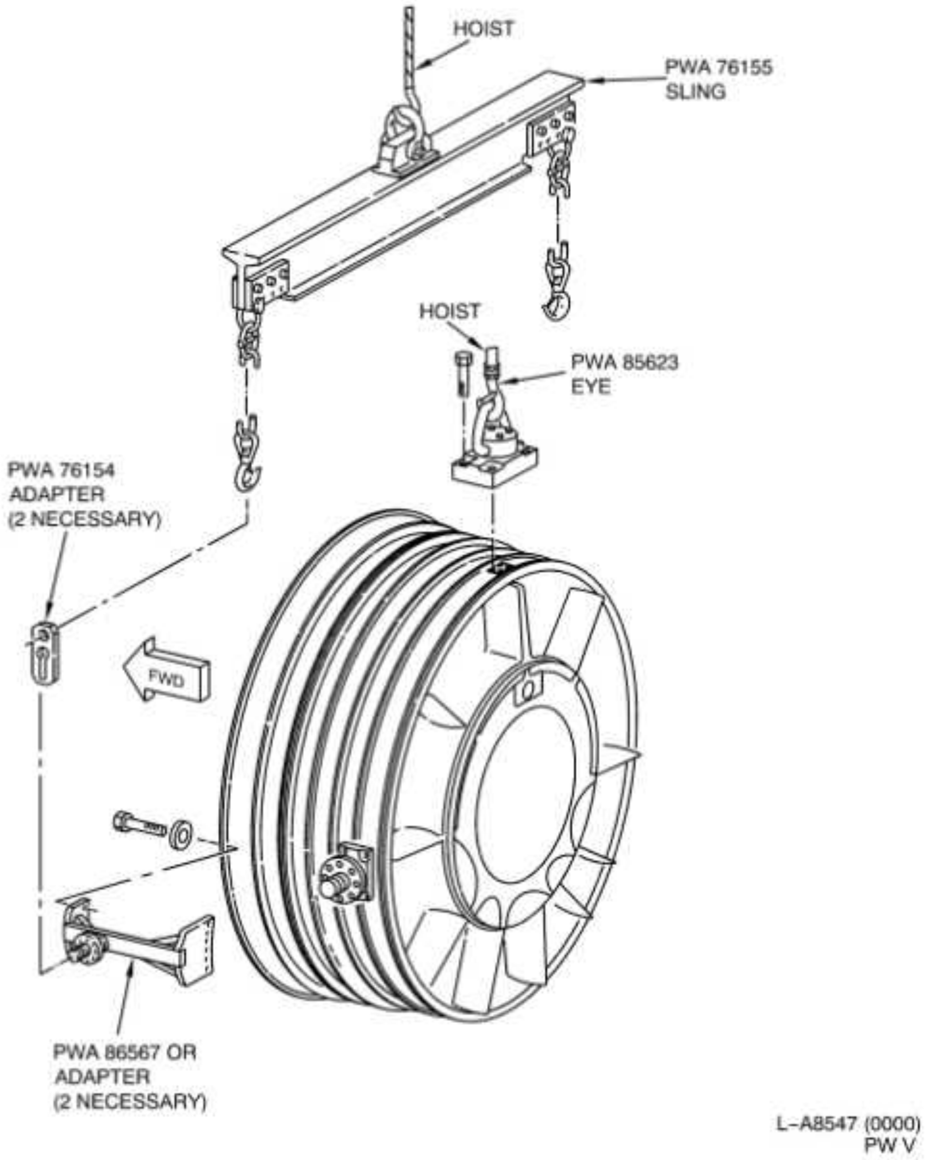
(5) If you want to support the fan unit on pedestals, do as follows:

    (a) Install two PWA 85662 or PWA 85667 Adapters to the intermediate case at 3 and 9 o'clock.

    (b) Install four PWA 25926 Adapters on four PWA 25757 Pedestals.

    (c) Install the trunnion spools attached to the fan unit in the adapters that are on the pedestals.

    NOTE: Use the large inner spools of the adapters and brackets for support on the pedestals.


HOIST
PWA 76155
SLING
HOIST
PWA 85623
EYE
PWA 76154
ADAPTER
(2 NECESSARY)
FWD
PWA 86567 OR
ADAPTER
(2 NECESSARY)
L−A8547 (0000)
PW V

Trunnion The Fan Unit
Figure 201
(Task 72−00−00−420−004)

ENGINE GENERAL − SPECIAL PROCEDURES−22

C. Postrequisites

(1) Install the Stage 1 LPC blade assemblies. Refer to 72−00−31, Installation−04 (Task 72−00−31−420−002−002).

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Task 72-00-00-910-001:

1. Hydraulic Pump Service And Operation

A. General

(1) Use this procedure for the service or operation of the PWA 49030 Hydraulic Pump or the CTE 5100 Hydraulic Pump. The CTE 5100 Hydraulic Pump replaces the PWA 49030 Hydraulic Pump.

(2) Either hydraulic pump is available with an air driven pneumatic motor or an electric motor. All pumps must be serviced with clean filtered Calibrating Fluid P03-003.

(3) These pumps are used for many applications and for other engine models. Make sure that you have the necessary adapters, elbows, and fittings for your application. The adjustment procedure specifies the correct adapters to connect the hoses to the actuator.

(4) This procedure has the tasks necessary to operate the pneumatic motor or electric motor driven pumps.

B. Equipment And Materials Necessary

Special Tools:

CTE 5100	Hydraulic Pump (Optional to PWA 49030)
PWA 49030	Hydraulic Pump (Optional to CTE 5100)

Consumable Materials:

Item No.	Designation
P03-003	Fluid, Calibrating

C. Pump Operation - Pneumatic Motor Driven
See Figure 201.

(1) Check the hoses as follows:

(a) Make sure the pressure Hose A is connected to the pressure adapter of the actuator.

(b) Make sure the return Hose B is connected to the return adapter of the actuator.

(2) Service the pump reservoir as follows:

(a) Remove the Oil Fill plug at the top of the pump reservoir.

(b) Examine the level of fluid in the reservoir.

(c) If you cannot see the fluid level, add clean filtered Calibrating Fluid P03−003 until full.

(d) Install the Oil Fill plug.

(3) Before you connect an air supply to the pump, do a check of the controls and valves as follows:

(a) Put the Control Handle to the neutral position (center).

(b) Turn the Hydraulic Valve Handle to the closed position (perpendicular to flow).

(c) Turn the Air Supply Valve Handle to the closed position (perpendicular to the flow).

(d) Turn the Small Adjustment Knob (clockwise) to stop. Do not over tighten the knob.

(4) Connect an air supply hose to the pump air supply connector.

WARNING: MAKE SURE ALL PERSONS AND TOOLS ARE AWAY FROM THE MECHANICAL PARTS OF THE SYSTEM THAT YOU ARE ADJUSTING. WHEN YOU START THE PUMP, THE ACTUATOR MAY MOVE. IF YOU DO NOT DO THIS, YOU CAN CAUSE INJURY OR DAMAGE TO THE ENGINE.

(5) Operate the pump to supply hydraulic pressure to the applicable actuator as follows:

(a) Turn the Air Supply Valve Handle to the open position (parallel to the flow).

(b) Lift and turn the Large Adjustment Knob clockwise to raise the pressure on the small hydraulic pressure gauge.

NOTE: The pump ratio is 1 to 10 (30 psig air equals 300 psig hydraulic)

1 See the applicable adjustment procedure for the correct pressure.

(c) Turn the Hydraulic Valve Handle to the open position (parallel with flow).

(d) Slowly turn the Smaller Adjustment Knob counterclockwise until the air motor turns.

NOTE: The smaller adjustment knob controls the speed of the actuator and the pressure recovery after actuation. Adjust as necessary.

NOTE: With the Control Handle in the neutral position (central), the hydraulic pressure will be 0 psig on the large gage.

1 See the applicable adjustment procedure for the correct pressure.

(e) Put the Control Handle of the hydraulic cart to the advanced position (toward hoses).

(6) Use the applicable Electrical Control Box to extend and retract the actuator.

NOTE: You do not use the pump valves to extend or retract the actuator.

(7) After the adjustment, disconnect and remove the equipment as follows:

(a) Turn the Air Supply Valve Handle to the closed position (perpendicular to the flow).

(b) Disconnect the air supply hose from the pump air supply connector.

(c) Put the Control Handle to the neutral position (center).

(d) Disconnect the hoses from the actuator and install protection covers to the ends.

D. Pump Operation − Pneumatic Motor Driven
See Figure 202.

(1) Check the hoses as follows:

(a) Make sure the return hose is connected to the return adapter of the actuator.

(b) Make sure the pressure hose A or B is connected to the pressure adapter of the actuator.

(c) Install a No. 6 plug to the end of the hose that is being used.

(d) Tighten the plug with a wrench.

NOTE: Do not use aluminum or plastic dust covers. Make sure you use fittings that will seal the hose when you put pressure to the hose.

(2) Service the pump reservoir as follows:

(a) Examine the sightglass on the side of the pump reservoir.

(b) If you cannot see the fluid level, service the pump as follows:

1 Remove the fill cap.

2 Add clean filtered Calibrating Fluid P03−003 until full.

3 Install the fill cap.

(3) Before you connect an air supply to the pump, do a check of the controls and valve as follows:

(a) Turn the Air Supply Valve to CLOSED (perpendicular to the flow).

(b) Lift and turn the Hydraulic Pressure Adjustment Knob towards OFF (MINUS) (to the counterclockwise stop).

(c) Move the Hydraulic Flow Control Valve to NEUTRAL (middle position).

(4) Connect an air supply hose to the pump air supply connector.

WARNING: MAKE SURE ALL PERSONS AND TOOLS ARE AWAY FROM THE MECHANICAL PARTS OF THE SYSTEM THAT YOU ARE ADJUSTING. WHEN YOU START THE PUMP, THE ACTUATOR MAY MOVE. IF YOU DO NOT DO THIS, YOU CAN CAUSE INJURY OR DAMAGE TO THE ENGINE.

(5) Operate the pump to supply hydraulic pressure to the applicable actuator as follows:

(a) Turn the Air Supply Valve to OPEN (parallel to the flow).

NOTE: The air flow out of the air vent will stop when the valve is full open. Do not install a plug to the vent hole.

(b) Lift and turn the Hydraulic Pressure Adjustment Knob towards ON (PLUS) only until the correct pressure is on the larger hydraulic pressure gauge.

(c) See the adjustment procedure for the correct pressure.

(d) Move the Hydraulic Flow Control valve to pressurize the hose that is connected to the actuator.

(e) Lift and turn the Hydraulic Pressure Adjustment Knob as necessary to keep the correct pressure during the adjustment.

(6) Use the applicable Electrical Control Box to extend and retract the actuator.

NOTE: You do not use the pump valves to extend or retract the actuator.

(7) After the adjustment, disconnect and remove the equipment after the adjustment as follows:

(a) Move the Hydraulic Flow Control Valve to NEUTRAL (middle position).

(b) Lift and turn the Hydraulic Pressure Adjustment Knob towards OFF (MINUS) (to counterclockwise stop).

(c) Turn the Air Supply Valve to CLOSED (perpendicular to flow).

(d) Disconnect the air supply.

(e) Move the Hydraulic Flow Control Valve from A to B a few times to bleed any pressure in the hoses.

(f) Disconnect the hoses from the actuator and install protection covers to the ends.

E. Pump Operation − Electric Motor Driven
See Figure 203.

(1) Check the hoses as follows:

(a) Make sure the return hose is connected to the return adapter of the actuator.

(b) Make sure the pressure hose A is connected to the pressure adapter of the actuator.

(c) Install a No. 6 cap to the B1 and B2 pressure port adapters (not used) on the pump.

(d) Tighten the caps with a wrench.

NOTE: Do not use aluminum or plastic dust covers. Make sure you use fittings that will seal the adapters if pressurized.

(2) Service the pump reservoir as follows:

(a) Remove the reservoir fill plug.

(b) If you cannot see the fluid level, service the pump as follows:

1 Add clean filtered Calibrating Fluid P03−003 until full.

2 Install the fill cap.

(3) Before you connect the pump to the power supply, set the controls and valves as follows:

(a) Turn the Power Supply Switch to OFF.

(b) Turn the Supply Valve B and Bypass Valve B to CLOSED (to clockwise stop).

(c) Turn the Supply Valve A and Bypass Valve A to OPEN (counterclockwise approximately 10 turns).

(d) Turn the Gauge Valve to the A position.

(e) Move the Hydraulic Flow Control Valve to the Neutral (middle) position.

(4) Connect the power cord to the power supply.

WARNING: MAKE SURE ALL PERSONS AND TOOLS ARE AWAY FROM THE MECHANICAL PARTS OF THE SYSTEM THAT YOU ARE ADJUSTING. WHEN YOU START THE PUMP, THE ACTUATOR MAY MOVE. IF YOU DO NOT DO THIS, YOU CAN CAUSE INJURY OR DAMAGE TO THE ENGINE.

(5) Operate the pump to supply hydraulic pressure to the applicable actuator as follows:

(a) Turn the Power Switch to ON.

(b) Move the Hydraulic Flow Control Handle to the A position.

(c) Slowly close the Bypass Valve A (clockwise) only until the correct pressure is on the hydraulic pressure gauge.

1 See the adjustment procedure for the correct pressure.

(6) Use the applicable Electrical Control Box to extend and retract the actuator. Refer to the adjustment task.

NOTE: You do not use the pump valves to extend and retract the actuator.

(7) After the adjustment, disconnect and remove the equipment as follows:

(a) Open the Bypass Valve A (counterclockwise) until the pressure on the hydraulic pressure gauge is 0.

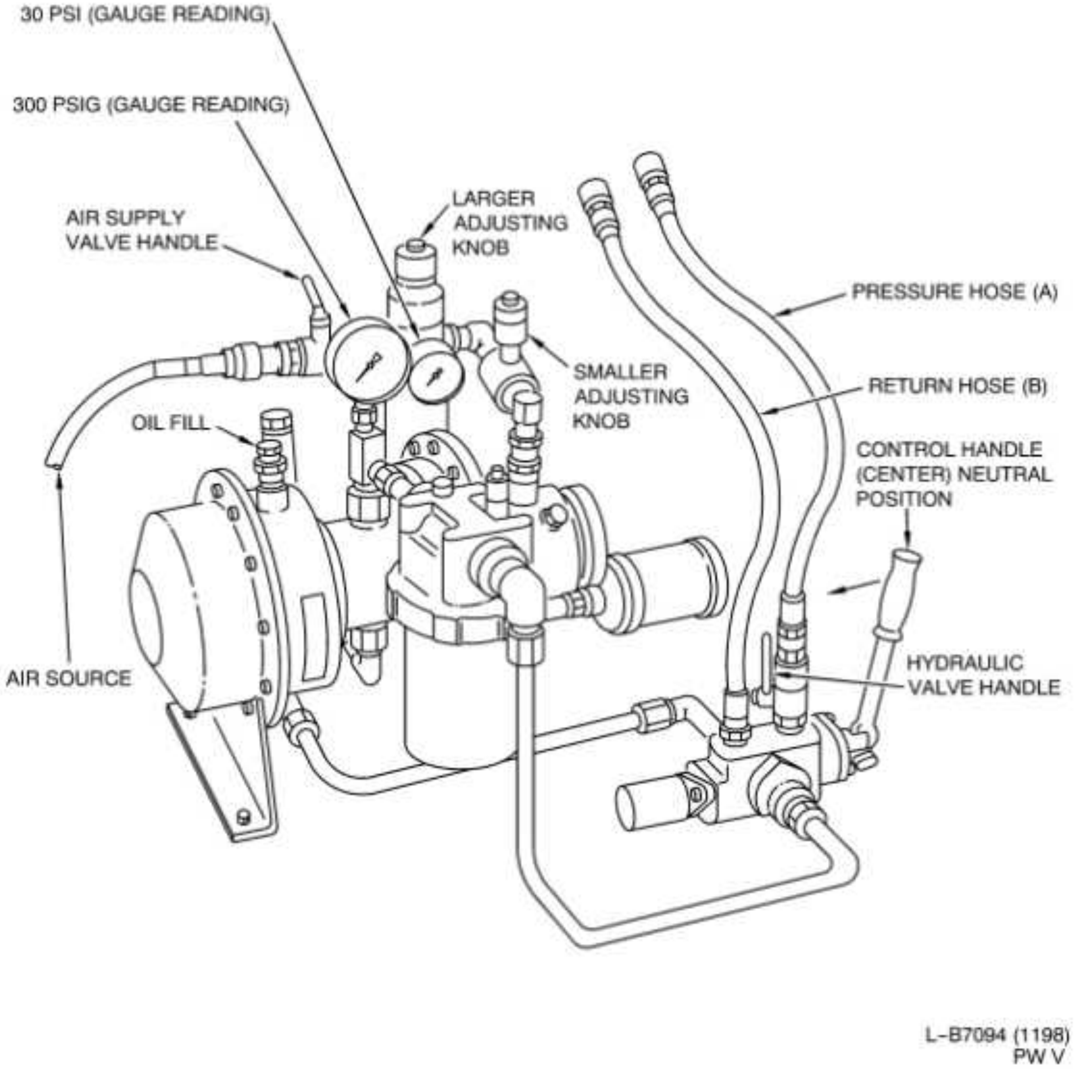
(b) Move the Hydraulic Flow Control Valve to NEUTRAL (middle position).

(c) Close the Supply Valve A (to clockwise stop).

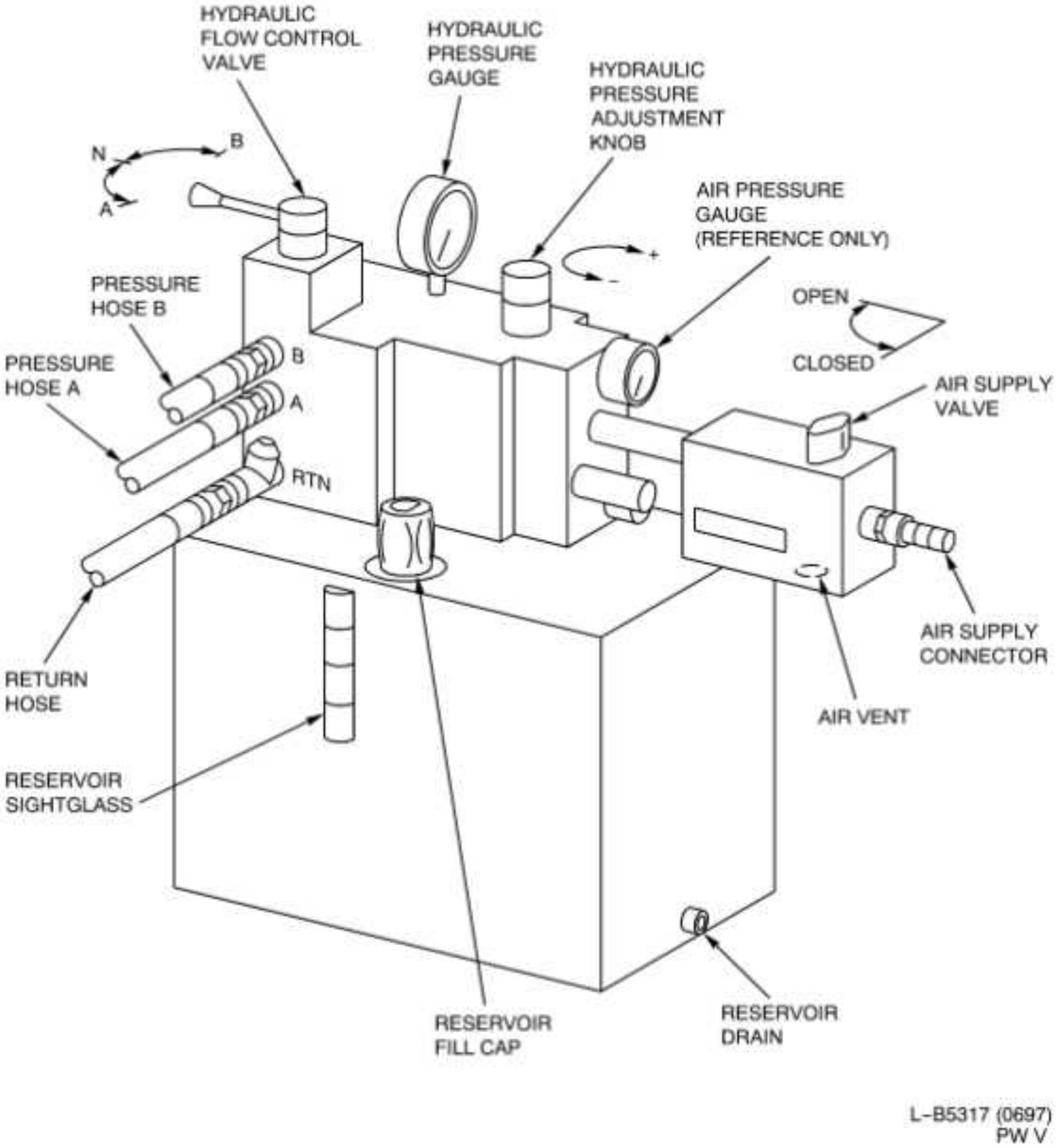
(d) Turn the Power Supply Switch to OFF.

(e) Disconnect the power cord from the power supply.

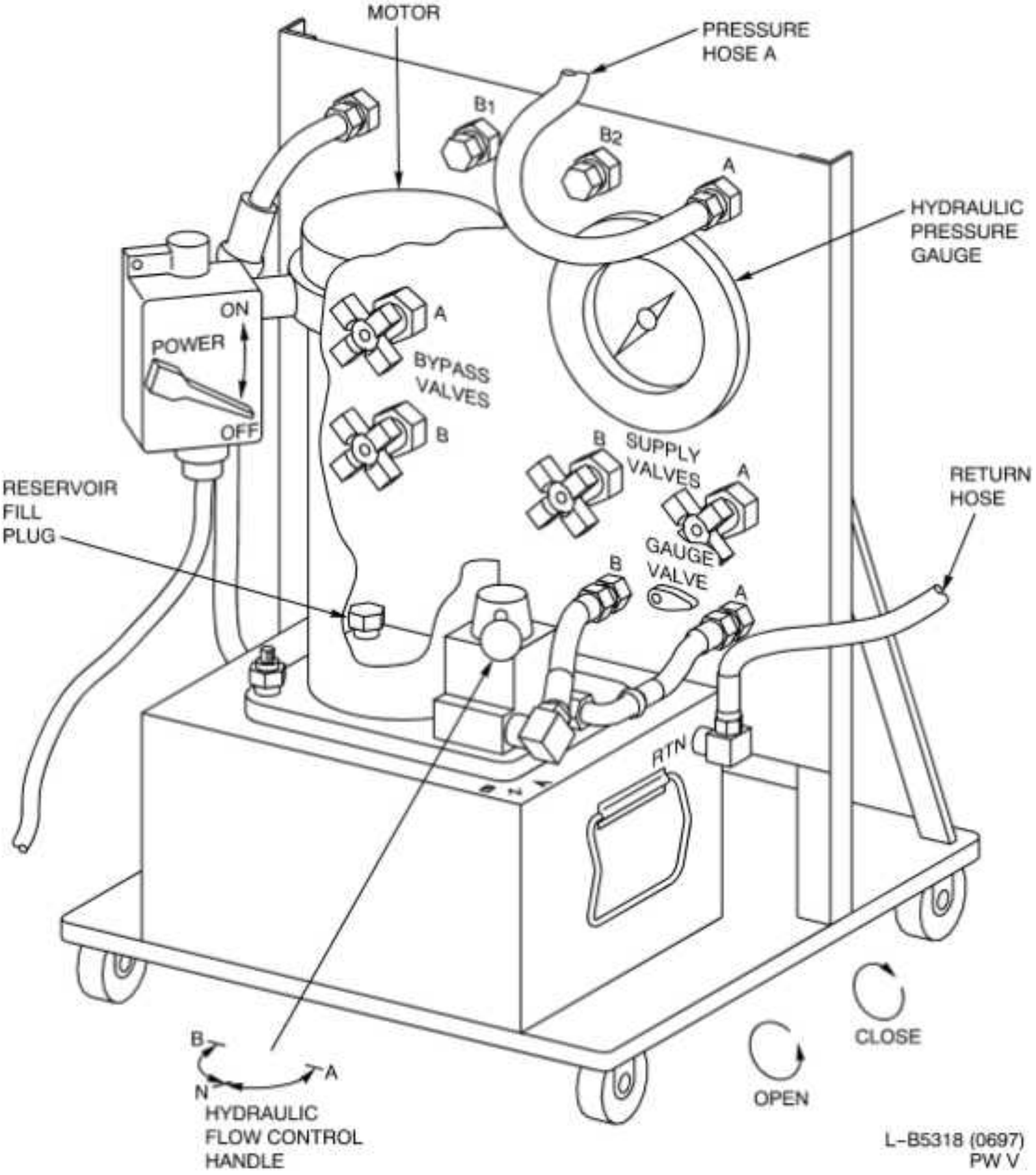
(f) Disconnect the hoses from the actuator and install protection covers to the ends.


30 PSI (GAUGE READING)
300 PSIG (GAUGE READING)
AIR SUPPLY VALVE HANDLE
LARGER ADJUSTING KNOB
PRESSURE HOSE (A)
SMALLER ADJUSTING KNOB
RETURN HOSE (B)
OIL FILL
CONTROL HANDLE (CENTER) NEUTRAL POSITION
AIR SOURCE
HYDRAULIC VALVE HANDLE
L-B7094 (1198)
PW V

Hydraulic Pump (Pneumatic Motor Driven)
Figure 201
(Task 72−00−00−910−001)


HYDRAULIC FLOW CONTROL VALVE
HYDRAULIC PRESSURE GAUGE
HYDRAULIC PRESSURE ADJUSTMENT KNOB
N
B
A
+
-
AIR PRESSURE GAUGE (REFERENCE ONLY)
OPEN
CLOSED
PRESSURE HOSE B
PRESSURE HOSE A
B
A
RTN
AIR SUPPLY VALVE
AIR SUPPLY CONNECTOR
AIR VENT
RETURN HOSE
RESERVOIR SIGHTGLASS
RESERVOIR FILL CAP
RESERVOIR DRAIN
L-B5317 (0697)
PW V

Hydraulic Pump (Pneumatic Motor Driven)
Figure 202
(Task 72−00−00−910−001)


MOTOR
PRESSURE HOSE A
B1
B2
A
HYDRAULIC PRESSURE GAUGE
ON
POWER
OFF
A
BYPASS VALVES
B
B
SUPPLY VALVES
A
RETURN HOSE
RESERVOIR FILL PLUG
GAUGE VALVE
B
A
RTN
CLOSE
OPEN
B
A
N
HYDRAULIC FLOW CONTROL HANDLE
L−B5318 (0697)
PW V

Hydraulic Pump (Electric Motor Driven)
Figure 203
(Task 72−00−00−910−001)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-00-830-006:

1. Adjustment Of The 2.5 Bleed Valve Actuator (Hydraulic)

A. General

(1) Use the procedure to adjust the 2.5 bleed valve actuator to the necessary limits. This procedure uses hydraulic pressure for the operation of the actuator during the adjustment. To manually rig the 2.5 bleed valve actuator, see 72-00-00, Special Procedure-03 Task 72-00-00-830-001.

NOTE: Refer to ENGINE GENERAL - SPECIAL PROCEDURES-23, Task 72-00-00-910-001 for Hydraulic Pump Service And Operation of the PWA 49030 Hydraulic Pump or the CTE 5100 Hydraulic Pump.

B. Equipment And Materials Necessary

Standard Tools:

Glenair (Electrical Connector) Soft Jawed Pliers - TG-69
Glenair (Electrical Connector) Strap Wrench - TG-70
Torque Wrench
Depth Micometer, 0 - 6 INCHES (0 - 152.4 MM)
Bergen Mechanical Crimper (Optional), Model M303, M305 or M307

Special Tools

PWA 29451	Pump Adapter
PWA 49030	Hydraulic Pump (Optional to CTE 5100)
PWA 85842	Electrical Control Box
PWA 101618	Pump Adapter (Elbow) (2 Necessary)
CTE 5100	Hydraulic Pump (Optional to PWA 49030)

NOTE: Make sure the correct adapters are with the Hydraulic Pump. You can use the PWA 101618 Adapter Elbows or the equivalent No. 6 standard elbows. The elbows are necessary to connect the hoses to the adapters on the actuator.

Consumable Materials

P03−001	Oil, Engine (PWA 521B, Type II)
P03−003	Calibrating Fluid
P05−038	Cheesecloth, Unsized
P05−289	Lockwire (AS3214−02
P05−291	Cable, Safety (Optional)
P05−292	Ferrule, Safety Cable (Optional)
P06−021	Antigalling Compound (PWA 550−3)
P09−014	Silicone Rubber Sealant (PWA 36003, RTV 159)
P11−014a	Alcohol, Isopropyl

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	1	75−32−00/1/50

C. Prepare For The Adjustment

NOTE: Do the following steps only if not previously done during the removal of the old 2.5 bleed actuator.

(1) Remove the fan exit liner segment (inner) which covers the actuator.

(2) Use the TG−69 Glenair Soft Jawed Pliers or the TG−70 Glenair Strap Wrench to disconnect the electrical connector (W3P15) from the actuator. See Figure 201.

(3) Put a fluid drain collector/container under the actuator.

(4) Remove pressure from the hydraulic tubes as follows:

  (a) Remove the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 from the tube nuts at both ends of each of the tubes (CP06) and (CR02).

  (b) While you hold the tee with a wrench, disconnect the hydraulic pressure tube (CP06) at the (CP02) tee to remove any pressure.

  (c) While you hold the tee with a wrench, disconnect the hydraulic return tube (CR02) at the (CR04) tee to remove any pressure.

(5) Remove the bleed valve actuator hydraulic pressure tube (CP06) and return tube (CR02) as follows:

(a) Hold the adapters with a wrench and disconnect the tube nuts from the actuator.

NOTE: It is not necessary to disconnect the drain manifold (DR11) from the actuator.

(6) Connect the hoses from the PWA 49030 Hydraulic Pump or the CTE 5100 Hydraulic Pump as follows:

NOTE: If you do not know which pump to use, refer to ENGINE GENERAL − SPECIAL PROCEDURES−23, Task 72−00−00−910−001 for Hydraulic Pump Service And Operation of the PWA 49030 Hydraulic Pump or the CTE 5100 Hydraulic Pump.

(a) Install the PWA 29451 Pump Adapter to the actuator rear adapter.

(b) While you hold the rear adapter with a wrench, tighten the PWA 29451 Pump Adapter.

(c) Connect the two PWA 101618 Adapters (or equivalent elbows) to the two pump hoses (pressure and return).

(d) Tighten the hoses to the elbows.

(e) Connect the return hose elbow to the forward adapter.

(f) While you hold the forward adapter with a wrench, tighten the elbow.

(g) Connect the pressure hose elbow to the pump adapter.

(h) While you hold the pump adapter with a wrench, tighten the elbow.

(7) With the power OFF, connect the PWA 85842 Electrical Control Box Connector to the actuator receptacle. See Figure 201 (Sheet 2).

(8) Remove the shoulder bolt (201/1) from the actuator piston shaft as follows:

(a) Remove and discard the cotter pin (201/2) installed to the piston shaft and bolt (201/1).

CAUTION: BE CAREFUL WHEN YOU LOOSEN THE SHOULDER BOLT BECAUSE THE SHOULDER BOLT HAS A LEFT−HAND THREAD. IF YOU DO NOT DO THIS, YOU CAN DAMAGE THE SHOULDER BOLT AND PISTON SHAFT.

CAUTION: MAKE SURE THAT YOU HOLD THE HEX PORTION OF THE ACTUATOR PISTON SHAFT WITH A WRENCH WHEN YOU LOOSEN THE SHOULDER BOLT. IF YOU DO NOT DO THIS, YOU CAN DAMAGE THE SHOULDER BOLT AND PISTON SHAFT.

CAUTION: MAKE SURE THAT THE CRIMPED LOCKING CUP AND RETAINING NUT DO NOT LOOSEN FROM THE PISTON SHAFT WHEN THE SHOULDER BOLT IS REMOVED. IF THE RETAINING NUT CHANGES OR LOOSENS, THE INTERNAL ADJUSTMENT OF THE ACTUATOR CAN BE AFFECTED AND ACTUATOR OR ENGINE DAMAGE CAN OCCUR.

(b) Hold the piston shaft hex with a wrench and remove the shoulder bolt (201/1) (LEFT−HAND THREAD).

(9) Turn the piston shaft hex clockwise (from the rear) only until the shaft stops.

(a) Do not use too much force. This will tighten the piston shaft against the bleed valve clevis rod until bottomed.

D. Procedure

(1) Equipment Check

WARNING: MAKE SURE ALL PERSONS AND TOOLS ARE AWAY FROM THE MECHANICAL PARTS OF THE BLEED SYSTEM. WHEN YOU START THE PUMP, THE ACTUATOR CAN MOVE. IF YOU DO NOT DO

THIS, YOU CAN CAUSE INJURY OR DAMAGE THE ENGINE.

(a) Service the pump with Calibrating Fluid P03-003 and connect to a power source.

NOTE: If you do not know how to service and operate the hydraulic pump, refer to ENGINE GENERAL - SPECIAL PROCEDURES-23, Task 72-00-00-910-001 for Hydraulic Pump Service And Operation of the PWA 49030 Hydraulic Pump or the CTE 5100 Hydraulic Pump.

(b) Supply 100 psig (689.5 kPa) to the actuator aft pressure adapter.

(c) Set the POWER switch on the PWA 85842 Electrical Control Box to the ON position.

(d) Use the Electrical Box to cycle the bleed valve back and forth between open and closed positions to make sure the 2.5 bleed valve assembly moves freely.

(e) After cycling the bleed valve, leave the bleed valve in the closed position (actuator piston shaft forward).

(f) All actuation of the bleed system to the valve open or valve closed positions should now be done using the PWA 85842 Electrical Control Box OPEN/CLOSE switch.

(g) Keep 100 psig (689.5 kPa) pressure applied to the actuator during all measurements.

(2) Piston Travel Check

NOTE: All measurements must be made with 100 psig (689.5 kPa) at the actuator with a depth micrometer and from the piston shaft to the same location on the housing.

(a) Measure the length of the piston travel as follows: See Figure 202 (Sheet 1).

1 Establish a stationary reference point on the actuator housing to be used for all piston travel measurements that follow.

2 Make sure the bleed valve is in the closed (actuator piston shaft forward) position.

3 Measure the distance from the piston shaft end to the reference point on the actuator housing.

4 Record this measurement as Dimension No. 1.

5 Actuate the bleed system to the valve open (actuator piston shaft rearward) position.

6 Measure the distance from the piston shaft end to the reference point on the actuator housing.

7 Record this measurement as Dimension No. 2.

8 Determine piston travel by subtracting Dimension No. 1 from Dimension No. 2.

9 Record the result as Dimension No. 3.

10 Piston travel should be 2.280 − 2.320 inches (57.91 − 58.93 mm).

(b) If the piston travel is not within limits, repeat the measurement.

(c) If the piston travel is still not within limits, check to make sure the piston shaft is fully against the bleed valve clevis rod as follows:

1 Remove pressure to the actuator.

2 Turn the piston shaft hex clockwise (from rear) only until the shaft stops.

3 Do not use too much force.

4 This will tighten the piston shaft against the bleed valve clevis rod until bottomed.

(d) Supply 100 psig (689.5 kPa) to the actuator and do the piston travel check again.

1 If the piston travel is still not within the limits, replace the actuator and do the piston travel check for the new actuator.

(3) Set The Bleed Valve Compression

(a) Make the initial bleed valve compression adjustment as follows: See Figure 202 (Sheet 2).

1 Remove the pressure from the actuator (0 psig) (0.0 kPa)

2 Turn the piston shaft one (1) turn counterclockwise.

3 Supply 100 psig (689.5 kPa) pressure to the actuator again.

4 Actuate the bleed system to the valve closed (actuator piston shaft forward) position.

5 Measure the adjusted dimension between the piston shaft end and the established reference point on the actuator housing.

6 Record this measurement as Dimension No. 4.

7 Dimension No. 4 should be 0.015 inch (0.381 mm) minimum greater than Dimension No. 1.

(b) If Dimension No. 4 is not within the limits, do as follows;

1 Actuate the bleed system to the valve open (actuator piston shaft rearward) position.

2 Remove pressure from the actuator.

3 Turn the piston one (1) more full turn counterclockwise.

4 Supply 100 psig (689.5 kPa) pressure to the actuator again.

5 Actuate the bleed system again to the valve closed (actuator piston shaft forward) position.

6 Measure the adjusted dimension again between the piston shaft end and the established housing reference point.

7 The adjusted Dimension No. 4 should be 0.015 inch (0.381 mm) minimum greater than Dimension No. 1.

8 If Dimension No. 4 is still not within the limits, do this step again only enough times until Dimension No. 4 is within limits.

(c) Make the final compression adjustment as follows: See Figure 202 (Sheet 3).

1 Actuate the bleed system to the valve open (actuator piston shaft rearward) position.

2 Remove pressure to the actuator.

3 Turn the piston shaft 1/4 turn (90 degrees) clockwise.

4 Supply 100 psig (689.5 kPa) pressure to the actuator again.

5 Actuate the bleed system again to the valve closed (actuator piston shaft forward) position.

6 Measure the dimension between the end of the piston shaft to the established reference point on the actuator housing.

7 Record this measurement as Dimension No. 5.

8 Compare Dimension No. 5 with Dimension No. 1.

9 Dimension No. 5 should be within 0.005 inch (0.127 mm) of Dimension No. 1.

(d) If Dimension No. 5 is not within 0.005 inch (0.127 mm) of Dimension No. 1, do as follows:

1 Actuate the bleed system to the valve open (actuator piston shaft rearward) position.

2 Remove pressure to the actuator.

3 Turn the piston shaft 1/4 turn (90 degrees) clockwise.

4 Supply 100 psig (689.5 kPa) pressure to the actuator again.

5 Actuate the bleed system again to the valve closed (actuator piston shaft forward) position.

6 Measure Dimension No. 5 again.

7 Dimension No. 5 should be within 0.005 inch (0.127 mm) of Dimension No. 1.

8 If Dimension No. 5 is still not within the limits, do this step again only enough times until Dimension No. 5 is within limits.

(e) Cycle the bleed valve between the open and closed positions to verify that the 2.5 bleed valve assembly can be moved freely.

(f) Remove pressure to the actuator.

(g) Remove power to the pump.

(h) Set the POWER switch on PWA 85842 Electrical Control Box to the OFF position.

(4) Shoulder Bolt Installation

(a) Install the shoulder bolt (201/1) (LEFT−HAND THREAD) to the piston shaft as follows:

1 Apply Engine Oil P03−001 to the threads on the shoulder Bolt (201/1).

CAUTION: TO PREVENT LOSS OF ADJUSTMENT OR DAMAGE TO THE SHOULDER BOLT, MAKE SURE YOU HOLD THE ACTUATOR PISTON SHAFT HEX NUT WHEN YOU TORQUE THE SHOULDER BOLT.

2 Hold the piston shaft hex nut with a wrench and tighten the shoulder bolt (201/1) (LEFT−HAND THREAD).

3 Torque the shoulder bolt (201/1) (LEFT−HAND THREAD) to 50 − 70 lb−in. (5.649 − 7.909 N.m).

4 Remove any contamination (oil, fuel, grease, dirt, etc.) from the end of the piston shaft where you must install the cotter pin (201/2) and sealant.

5 Install the new cotter pin (201/2) to the piston shaft and shoulder bolt (201/1).

NOTE: You can turn the shoulder bolt 30 degrees maximum in either direction to install the cotter pin. This adjustment for the cotter pin will keep satisfactory torque on the shoulder bolt.

6 Apply Silicone Rubber Sealant P09−014 to both ends of the cotter pin (201/1).

(5) Remove The Adjustment Equipment

(a) Disconnect the electrical control box connector from the actuator receptacle.

CAUTION: CONNECT THE ENGINE ELECTRICAL CONNECTOR AS SOON AS POSSIBLE. IF YOU DO NOT, CONTAMINATION OF THE CONNECTION CAN OCCUR.

CAUTION: USE THE CORRECT ASSEMBLY PROCEDURE AND TOOLS FOR THE HARNESS CONNECTOR INSTALLATION. IF YOU DO NOT, A DAMAGED OR LOOSE CONNECTOR CAN OCCUR. A LOOSE CONNECTOR CAN AFFECT ENGINE OPERATION, LIGHTNING PROTECTION, AND CAUSE AN IN−FLIGHT SHUTDOWN.

(b) Connect the self−locking electrical connector (W3P15) to the actuator receptacle as follows:

1 Examine, align, and install the connector.

2 Use the Glenair TG−69 Soft Jawed Pliers or the Glenair TG−70 Strap Wrench and tighten the connector against the receptacle.

3 While you tighten, push the connector in and move side to side.

4 Make sure you can feel the ratchet feature.

5 Tighten the connector until the pliers or strap wrench slip on the connector ring.

(c) While you hold the adapters with a wrench, disconnect the hydraulic pump hoses from the two PWA 101618 Pump Adapter Elbows and the elbows from the PWA 29451 Pump Adapter and the actuators return adapter.

  1 Follow the procedure shown in Step 7 (After Adjustment), Engine General − Special Procedures−23, Task 72−00−00−910−001.

(d) While you hold the adapter with a wrench, remove the PWA 29451 Pump Adapter from the aft actuator adapter.

(e) Install the hydraulic pressure tube (CP06) and the hydraulic return tube (CR02) as follows:

  1 Apply Antigalling Compound P06−021 to the nut threads and the backs of the ferrules on both tubes.

  2 Connect the hydraulic return tube (CR02) to the forward adapter on the actuator and the (CR04) tee.

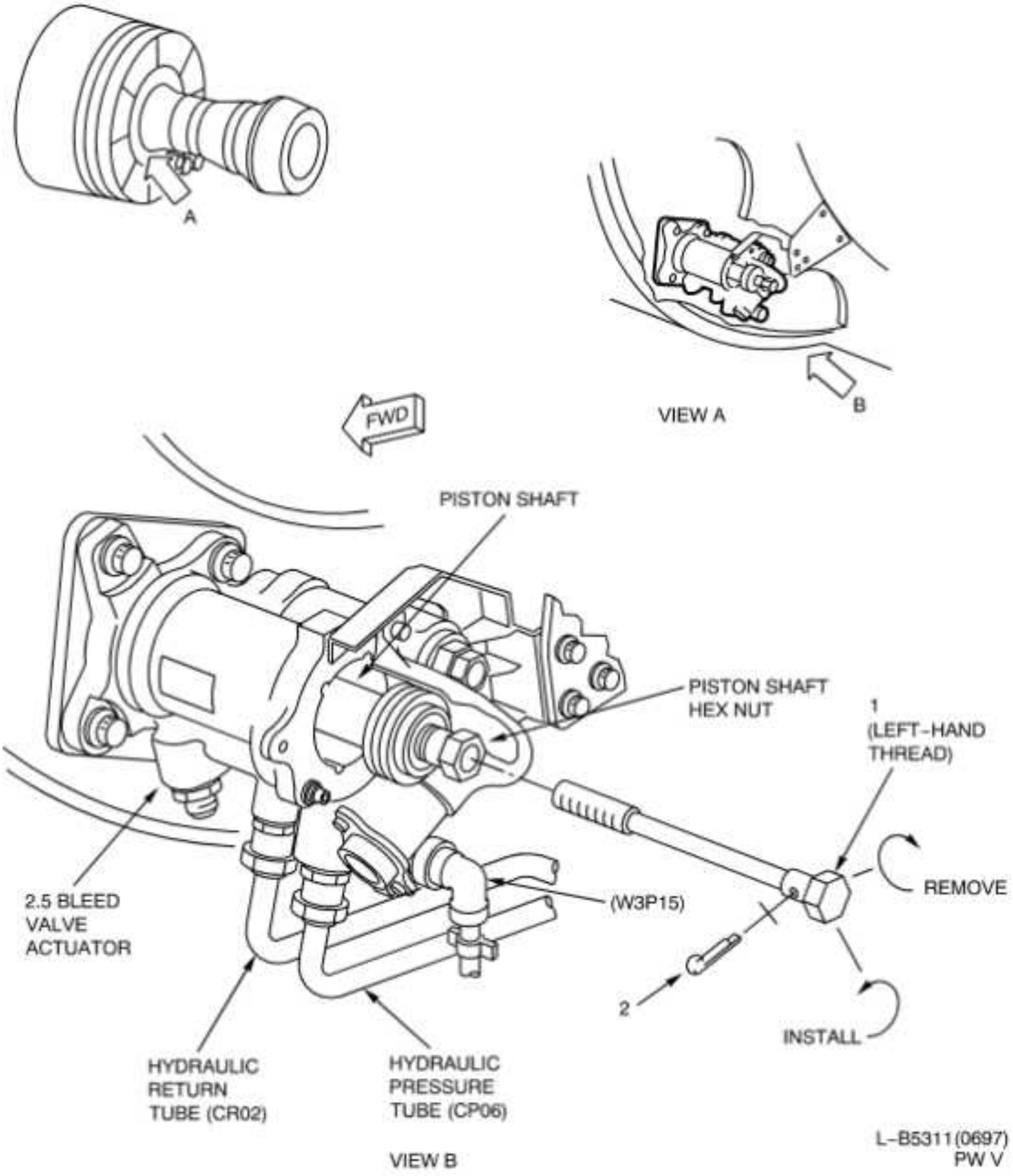
  3 While you hold the adapter and tee with a wrench, torque the (CR02) tube nuts at each end to 200 − 225 lb−in. (22.597 − 25.422 N.m)

  4 Connect the hydraulic pressure tube (CP06) to the aft adapter on the actuator and to the (CP02) tee.

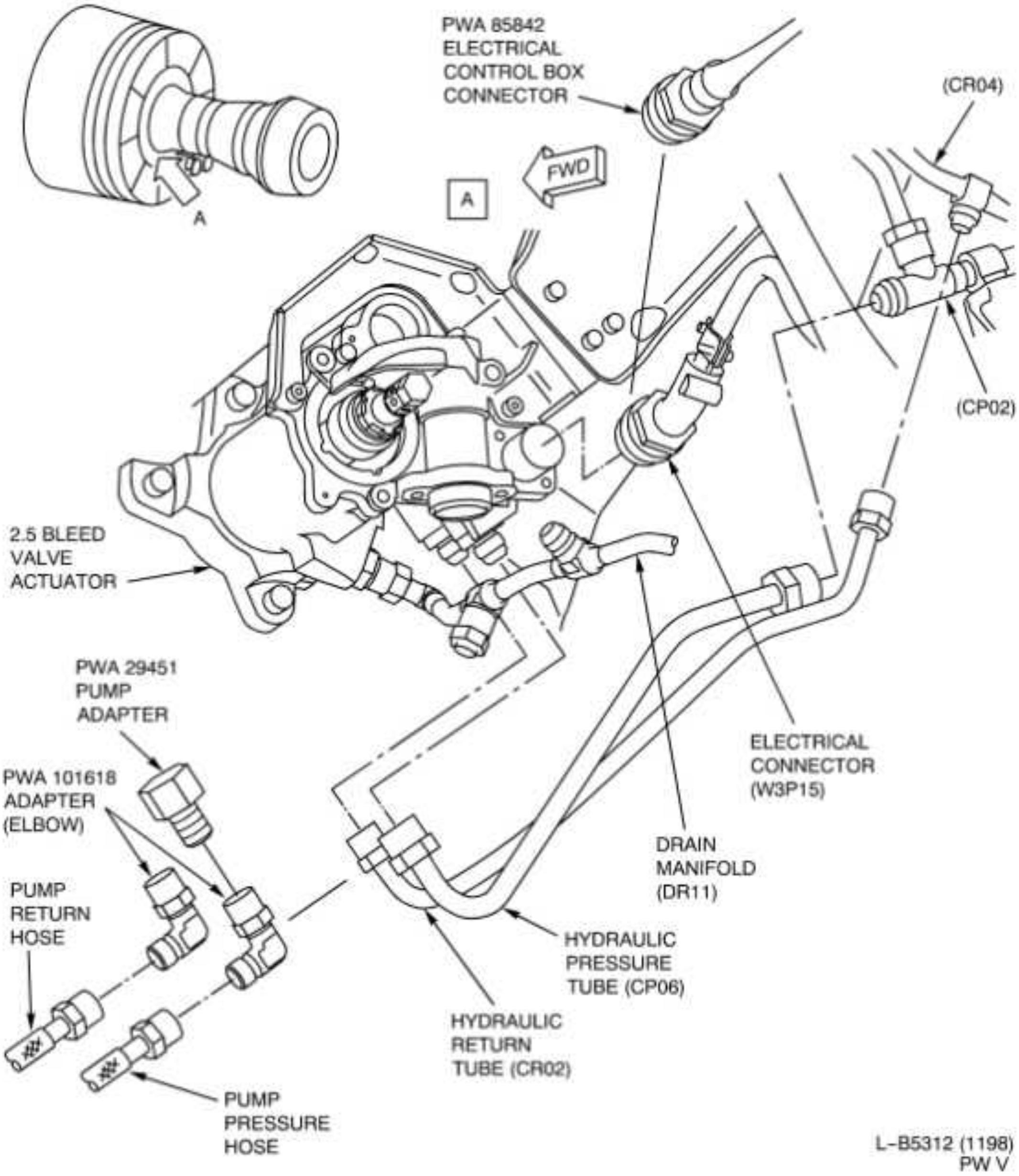
  5 While you hold the adapter and tee with a wrench, torque the (CP06) tube nuts at each end to 225 − 250 lb−in. (25.422 − 28.246 N.m)

  6 Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nuts on both tubes at both ends.

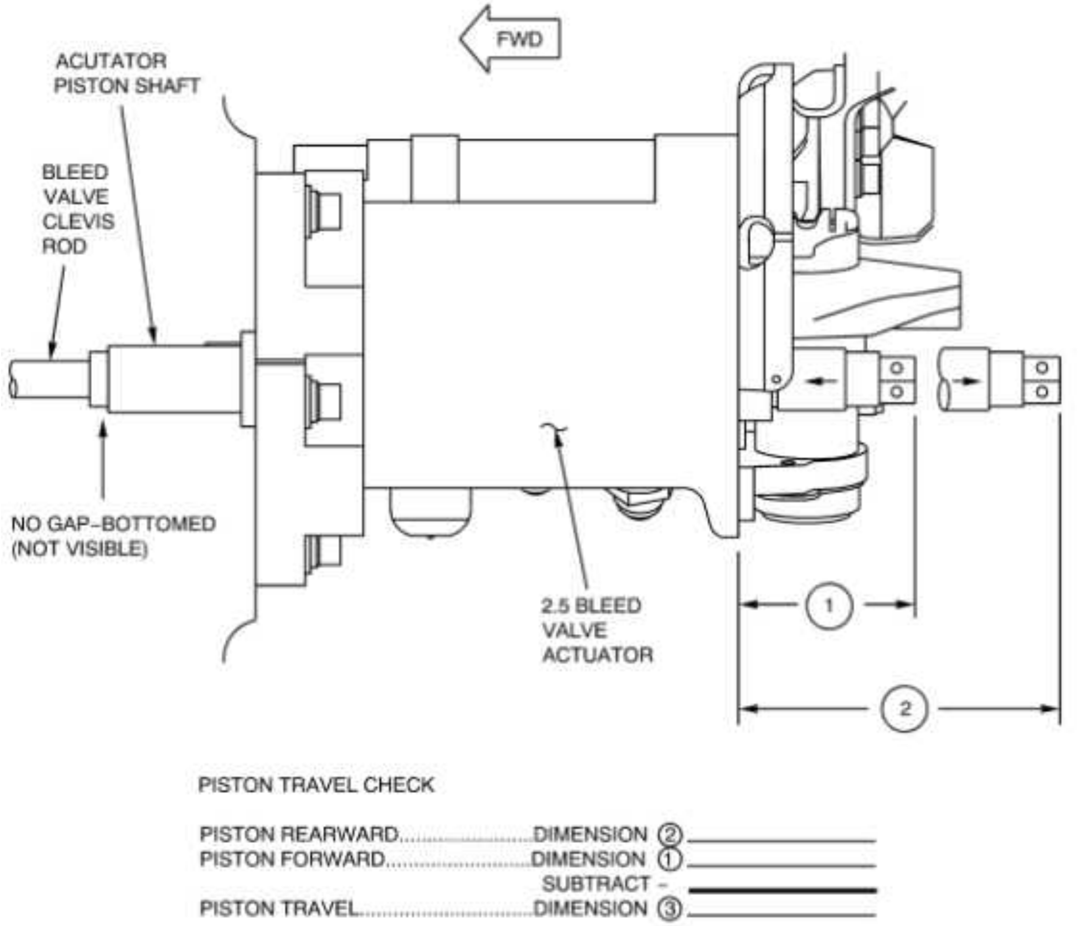
(f) Install the fan exit liner segment (inner).


A
VIEW A
B
FWD
PISTON SHAFT
PISTON SHAFT HEX NUT
1 (LEFT−HAND THREAD)
REMOVE
INSTALL
2
(W3P15)
2.5 BLEED VALVE ACTUATOR
HYDRAULIC RETURN TUBE (CR02)
HYDRAULIC PRESSURE TUBE (CP06)
VIEW B
L−B5311(0697)
PW V

Adjustment Of The 2.5 Bleed Valve Actuator
Figure 201 (Sheet 1)
(Task 72−00−00−830−006)

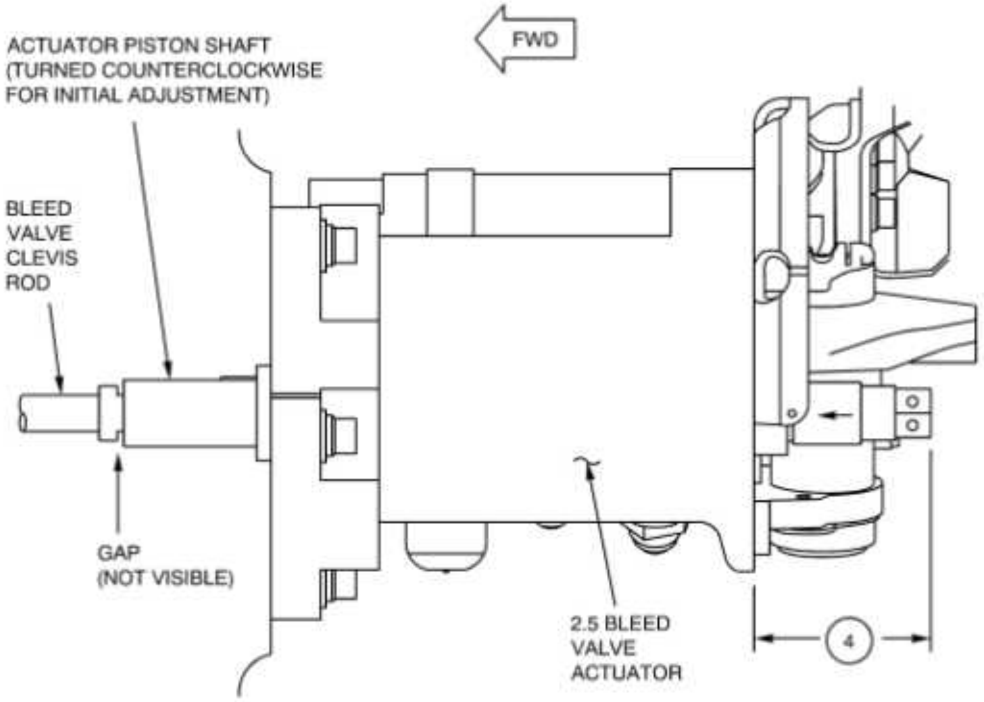

PWA 85842
ELECTRICAL
CONTROL BOX
CONNECTOR
(CR04)
A
FWD
A
(CP02)
2.5 BLEED
VALVE
ACTUATOR
PWA 29451
PUMP
ADAPTER
PWA 101618
ADAPTER
(ELBOW)
PUMP
RETURN
HOSE
ELECTRICAL
CONNECTOR
(W3P15)
DRAIN
MANIFOLD
(DR11)
HYDRAULIC
PRESSURE
TUBE (CP06)
HYDRAULIC
RETURN
TUBE (CR02)
PUMP
PRESSURE
HOSE
L-B5312 (1198)
PW V

Adjustment Of The 2.5 Bleed Valve Actuator
Figure 201 (Sheet 2)
(Task 72−00−00−830−006)


FWD
ACUTATOR PISTON SHAFT
BLEED VALVE CLEVIS ROD
NO GAP-BOTTOMED (NOT VISIBLE)
2.5 BLEED VALVE ACTUATOR
1
2
PISTON TRAVEL CHECK
PISTON REARWARD.......................DIMENSION ②
PISTON FORWARD.........................DIMENSION ①
SUBTRACT -
PISTON TRAVEL..............................DIMENSION ③

L-B5314 (0697)
PW V

Adjustment Of The 2.5 Bleed Valve
Actuator (Initial Compression Adjustment)
Figure 202 (Sheet 1)
(Task 72−00−00−830−006)

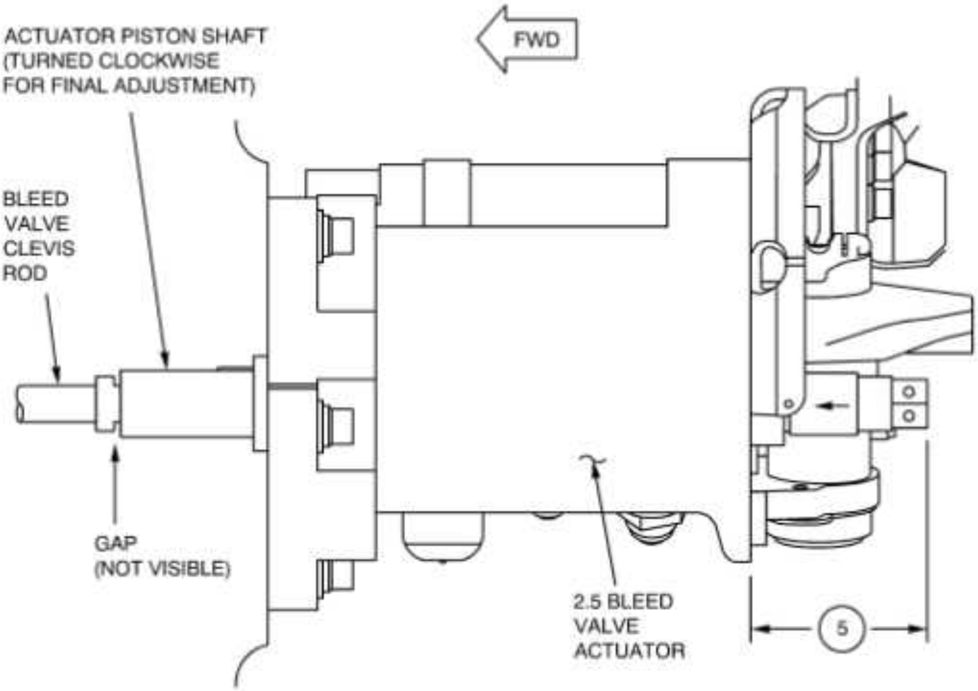

FWD
ACTUATOR PISTON SHAFT (TURNED COUNTERCLOCKWISE FOR INITIAL ADJUSTMENT)
BLEED VALVE CLEVIS ROD
GAP (NOT VISIBLE)
2.5 BLEED VALVE ACTUATOR
4

INITIAL COMPRESSION ADJUSTMENT

NUMBER OF TURNS COUNTERCLOCKWISE FROM BOTTOMED ________
PISTON FORWARD
(AFTER INITIAL ADJUSTMENT).....DIMENSION ④ ________
DIMENSION ① ________
SUBTRACT - ________
INITIAL DIFFERENCE ________

L-B5315 (0697)
PW V

Adjustment Of The 2.5 Bleed Valve
Actuator (Final Compression Adjustment)
Figure 202 (Sheet 2)
(Task 72−00−00−830−006)


FWD
ACTUATOR PISTON SHAFT
(TURNED CLOCKWISE
FOR FINAL ADJUSTMENT)
BLEED
VALVE
CLEVIS
ROD
GAP
(NOT VISIBLE)
2.5 BLEED
VALVE
ACTUATOR
5

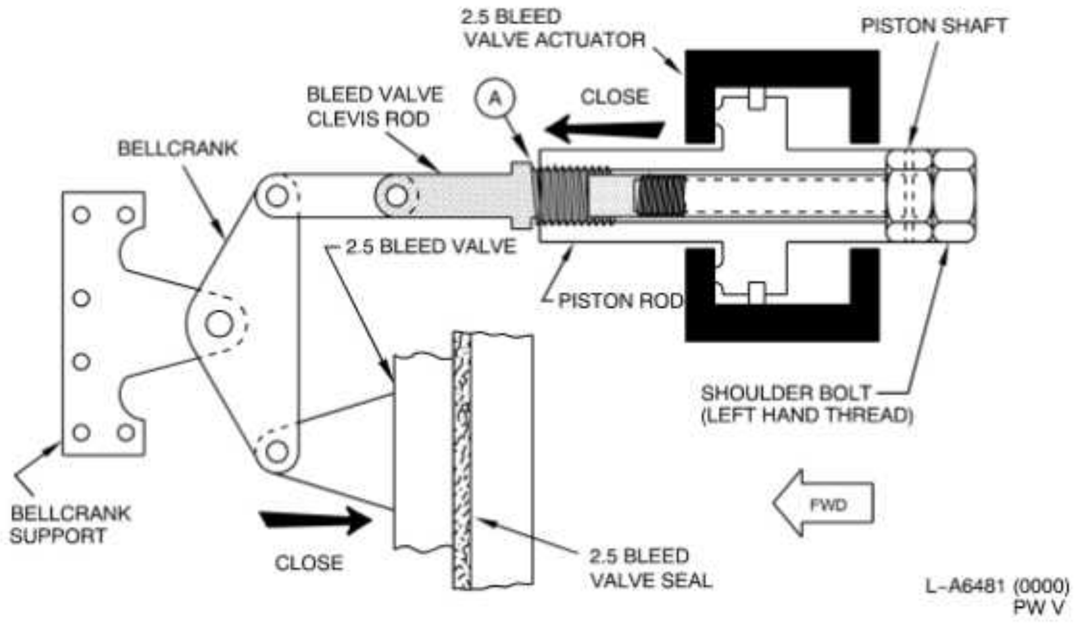
FINAL COMPRESSION ADJUSTMENT

NUMBER OF TURNS CLOCKWISE FROM INITIAL ADJUSTMENT ________
PISTON FORWARD
(AFTER FINAL ADJUSTMENT)........DIMENSION ⑤ ____________
DIMENSION ① ____________
SUBTRACT − ____________
FINAL DIFFERENCE ____________

(NOTE: IF DEMENSION ① IS MORE THAN DIMENSION ⑤, SUBTRACT DIMENSION ⑤ FROM DIMENSION ① TO DETERMINE THE DIFFERENCE.)

L−B5316 (0697)
PW V

Adjustment Of The 2.5 Bleed Valve Actuator (Cross Section Schematic)
Figure 202 (Sheet 3)
(Task 72−00−00−830−006)


2.5 BLEED VALVE ACTUATOR
PISTON SHAFT
BLEED VALVE CLEVIS ROD
A
CLOSE
BELLCRANK
2.5 BLEED VALVE
PISTON ROD
SHOULDER BOLT (LEFT HAND THREAD)
BELLCRANK SUPPORT
FWD
CLOSE
2.5 BLEED VALVE SEAL
L-A6481 (0000)
PW V

Adjustment Of The 2.5 Bleed Valve Actuator (Cross Section Schematic)
Figure 202 (Sheet 4)
(Task 72-00-00-830-006)

R ## ENGINE GENERAL - SPECIAL PROCEDURES-25

R Task 72-00-00-020-005-001:

R ## 1. Remove The HPC/Diffuser Assembly From Engine (Horizontal)

R ### A. Prerequisites

R NOTE: See Figure 301 for part/assembly removal procedure
R sequence.

R (1) Remove electronic engine control (EEC) speed transducer
R (N1) by Removal-03 (Task 72-00-34-050-001, Section
R 72-00-34).

R (2) Remove compressor inlet cone by Removal-02 (Task
R 72-00-31-020-001, Section 72-00-31).

R (3) Remove LPC/LPT coupling with a mechanical wrench or
R hydraulic wrench by Removal-01 (Task 72-00-32-020-001,
R Section 72-00-32).

R NOTE: Do not remove the Stage 1 LPC blade assemblies.

R (a) Optional: Remove low pressure compressor by
R Removal-01 (Task 72-00-31-020-003, Section
R 72-00-31).

R (4) Remove main gearbox by Removal-01 (Task
R 72-00-61-020-001, Section 72-00-61).

R (5) Remove turbine exhaust case by Removal-01 (Task
R 72-00-54-020-001, Section 72-00-54).

R (a) Optional: Remove low pressure turbine and
R turbine exhaust case with shaft (mechanical
R wrench or hydraulic wrench) by Removal-08 (Task
R 72-00-53-020-002, Section 72-00-53).

R (6) Remove low pressure turbine with shaft by Removal-01
R (Task 72-00-53-020-001, Section 72-00-53).

R (7) Remove high pressure turbine by Removal-01 (Task
R 72-00-52-020-001, Section 72-00-52).

R ### B. Equipment And Materials Necessary

ENGINE GENERAL - SPECIAL PROCEDURES-25

Special Tools:

PWA 25757	Pedestal (8 Necessary)
PWA 25926	Adapters (8 Necessary)
PWA 28657	Sling (Optional to PWA 76155)
PWA 29855-7	Pin, Aligning (2 Necessary)
PWA 76154	Adapter (2 Necessary)
PWA 76155	Sling
PWA 85064	Fixture
PWA 85246	Plug
PWA 85260	Pin, Guide (2 Necessary)
PWA 85390	Adapter, Lifting
PWA 85471	Wrench, Torque
PWA 85537	Fixture, Handling
PWA 85585	Ring, Guide
PWA 85631	Guide, Piloting
PWA 85662	Bracket (Optional to PWA 85667)
PWA 85667	Bracket (2 Necessary)
PWA 85749	Adapter, Torque-Electrical Connector
PWA 86209	Retainer, Positioning (Optional to PWA 85537)
PWA 86567	Adapter, Lift and Trunnion (2 Necessary)
PWA 86598	Retainer, Positioning (Optional to PWA 86209)
PWA 88709	Plug
PWA 101848	Puller, Jackscrew (6 Necessary)

NOTE: Use PWA 86598 or PWA 86209 Retainer as an alternate to PWA 85537 Fixture if you will remove the HPC top front case with the procedure in Removal-18 (Task 72-00-35-030-001, Section 72-00-35).

C. Disconnect the EEC Wiring Harnesses (See Figure 302 and Figure 303.)

(1) Disconnect the W1 EEC wiring harness as follows:

(a) Use the PWA 85749 Torque Adapter and disconnect the W1P11 and the W1P10 harness connectors from the 1 o'clock position solenoid.

(b) Remove the clamp bolts and nuts that attach the harness to the Flange E bracket and to the solenoid muscle tube.

(c) Disconnect the W1P25 harness connector at the HPC case bracket at 1 o'clock position.

R ENGINE GENERAL − SPECIAL PROCEDURES−25

R (d) Use the PWA 85749 Torque Adapter and disconnect the W1P12 connector from the 10 o'clock position solenoid.

R (e) Disconnect the W1P24 harness connector at the HPC case bracket at 10 o'clock position.

R (f) Disconnect the W1P9 harness connector at the HPC case bracket at 11 o'clock position.

R (g) Remove the clamp bolts and nuts that attach the W1 harness to the HPC case brackets.

R (h) Temporarily attach the W1 harness to the 12 o'clock strut with lockwire. Keep the harness clear of Flange E.

R (i) Install protection covers.

R (2) Disconnect the W2 EEC wiring harness.

R (a) Disconnect the W2P26 harness connector at the HPC case bracket at the 1 o'clock position.

R (b) Remove the bolt that attaches the retaining bracket and the W2J9 receptacle to the HPC case bracket at 11 o'clock position.

R (c) Remove the clamp bolts that attach the W2 harness to the Flange E bracket and the No. 1., 1.5, and 2 bearing tubes.

R (d) Temporarily attach the W2 harness to the 12 o'clock strut with lockwire. Keep the harness clear of Flange E.

R (e) Install protection covers.

R (3) Remove the two bolts that attach the IDG heat exchanger valve harness and retaining bracket to the HPC case bracket. Remove the retaining bracket and disconnect the harness receptacle. Install a protection cover. Remove the two clamp bolts that attach the IDG harness to the hydraulic tube.

R (4) Use the PWA 85749 Torque Adapter and disconnect the W4P4 and the W5P11 harness connectors from the 5 o'clock position solenoid. Install protection covers.

(5) Remove the clamp bolt that attaches the W4 harness (to the EEC speed transducer) to the bleed valve supply tube at the 5 o'clock position.

(6) Disconnect the W3P15 harness connector from the 2.5 bleed valve actuator at 7 o'clock position. Install protection covers.

(7) Disconnect the W3P17 connector from the (engine) air/oil heat exchanger harness receptacle at 7:30 o'clock position. Remove the two bolts that attach the retaining bracket and receptacle from the HPC case bracket. Install a protection cover on the receptacle.

D. Disconnect The Tubes
(See Figure 304.)

(1) Remove the lockwire and disconnect the EEC PB sensing tubes (AS09, AS20) at 12:30 o'clock position. See Figure 304 (Sheet 1).

(2) For engines with PMUX or SCU, remove lockwire and disconnect the PT2.5 sensing tubes (AS29, AS30) at 12:30 o'clock position. See Figure 304 (Sheet 1).

(3) Remove lockwire and disconnect the HPC air valve supply and signal tubes (AA01, AA25) from the solenoid adapters at 1 o'clock position. See Figure 304 (Sheet 1).

(4) Remove lockwire and disconnect the two No. 3 bearing air cooler tubes (AP33, AP34) from the cooler at 2:30 o'clock position.

(5) Disconnect and remove the tubes from the IDG heat exchanger at 4 o'clock position as follows: (see Figure 304, Sheet 2)

(a) Remove the lockwire and disconnect the airframe (IDG) cooler outlet oil tube nut. Remove the three bolts that attach the tube to the heat exchanger. Remove the tube and discard the packing. Install the protection covers to the tube ends and port.

  - (b) Remove the lockwire and remove the (IDG) air/oil cooler valve hydraulic pressure and return tubes from the heat exchanger and the manifolds. Install the protective covers to the tubes, manifold tees, and the adapters.

- (6) Remove the lockwire and disconnect the compressor stator cylinder hydraulic pressure (CP12) and return tube (CR03) from the manifolds and cylinder as follows: (see Figure 304, Sheet 3)
  - (a) Remove the clamp bolts that attach the tubes to the Flange E bracket.
  - (b) Remove the tubes and install the protective covers to the tubes, manifold tees, and adapters.

- (7) Remove the hydraulic pressure (CP05) and oil cooler inlet return (CR01) manifolds as follows: (see Figure 304, Sheet 3)
  - (a) Remove the lockwire and disconnect the two hose nuts from the manifolds at 3 o'clock position.
  - (b) Remove the lockwire and disconnect the two manifolds at the lower tee connections at 5 o'clock position.
  - (c) Remove the clamp bolts and nut that attach the manifolds to the engine brackets. Remove the manifolds and install the protective covers to the hoses and to the manifold ends.

- (8) Remove the fuel distribution valve supply tube (FM09) as follows: (see Figure 304, Sheet 4)
  - (a) Remove the lockwire and disconnect each end.
  - (b) Remove the clamp bolts and nuts that attach the tube to the engine.
  - (c) Remove the tube and discard the packings.
  - (d) Install the protective cover.

- (9) Remove the three bleed valve supply tubes (AA26, AA27 and AA29) as follows: (see Figure 304, Sheet 5)

R (a) Remove the lockwire and disconnect the three tube connections at 2:30 o'clock position.

R (b) Remove the lockwire and disconnect the two tube connections to the 5 o'clock position solenoid. Remove the lockwire and disconnect the tube connection at the maintenance break adjacent to the solenoid. Remove the lockwire and disconnect the tube nut from the tee adjacent to the solenoid.

R (c) Remove the clamp bolts that attach the tubes to the engine brackets, to each other, and to the harness clamps.

R (d) Remove the tubes from the engine. Install the protective covers to all the tube ends and the solenoid adapters.

R (10) Remove the upper PT2.5 sensing tube assembly (AS30) as follows: (see Figure 304, Sheets 6, 7, and 8)

R (a) For engines not equipped with the supplemental control unit (SCU) with multiplexing, remove the lockwire from the cap assembly. Remove the cap assembly from the tube.

R (b) For engines equipped with the supplemental control unit (SCU) with multiplexing, remove the lockwire and disconnect the lower tube nut from the tube coupling tube (AS30) at approximately the 4 o'clock position rearward of Flange E.

R (c) Remove the bolts, clamps and a nut that attach the (AS30) tube to brackets on Flange E at the 1, 1:30, 2:30, and 3:30 o'clock positions.

R (d) Remove the tube from the engine and install protection covers.

R (11) For engines equipped with the supplemental control unit (SCU) with multiplexing, remove the lower PT2.5 sensing tube assembly (AS35)as follows:

R (a) Remove the bolts and clamps that attach the tube (AS35) to brackets on Flange E at the 4:30 and 5:00 o'clock positions.

(b) Remove the tube from the engine and install protection covers.

NOTE: The lower manifold (AS31) was removed before with the EEC speed transducer (N1) multiplexer input probe.

(12) Remove lockwire and disconnect the 2.5 bleed valve cylinder hydraulic pressure (CP02) and return (CR02) tubes from the cylinder and manifolds. See Figure 304(Sheet 9). Remove the tubes. Install protective covers to the tubes, adapters, and manifold tees.

(13) Remove the two bolts and disconnect the cooling air manifold (AC34) from the fan case boss at the 7 o'clock position. Remove the clamp bolt and tube.

(14) Remove the lockwire and disconnect the No. 1, 1.5, and 2 bearing oil scavenge tube (LR02) at 7:30 o'clock position. See Figure 304 (Sheet 10).

(15) Remove lockwire and disconnect each end of the left air/oil cooler hydraulic pressure (CP08) and return (CR08) tubes from the air/oil heat exchanger adapters at 8 o'clock position and manifolds. Remove the clamp bolt that attaches the pressure tube to the Flange E bracket. Remove the two tubes and install the protective closures.

(16) Remove the five bolts that attach the air/oil cooler inlet (LP02) oil tube to the main oil filter housing and the air/oil heat exchanger. See Figure 304 (Sheet 11). Remove the clamp bolt that attaches the tube to the HPC case bracket. Move the tube rearward and temporarily attach with lockwire. Discard the packings. Install the protection covers.

(17) Remove the two bolts that attach the air/oil cooler outlet hose and tube assembly (LP03) to the air/oil heat exchanger. Remove the lockwire and disconnect the tube nut from the fuel oil cooler bypass valve adapter. Remove the clamp bolts that attach the tube to the engine. Remove the tube and discard the packings. Install the protection covers.

R ENGINE GENERAL - SPECIAL PROCEDURES-25

R (18) Remove lockwire and disconnect the main bearing oil pressure tube (LP05) from the strainer housing at 9 o'clock position and the strainer housing at top of the fuel/oil cooler. See Figure 304 (Sheet 12). Remove the clamp bolts and remove the tube. Discard the packing and retainer. Remove the bolt and clamp that attaches the strainer housing to the Flange E bracket. Install protective covers.

R (19) Remove lockwire and disconnect the two signal tubes (AA06 and AA18) and the supply tube (AA22) from the solenoid adapters at 10 o'clock position.

R (20) Remove lockwire and disconnect the main bearing breather tube (LB06) at 11:30 o'clock position. See Figure 304 (Sheet 13).

R (21) Remove lockwire and disconnect the EEC PT4.95 tube (AS04) at 11:30 o'clock position.

R (22) If removal of the HPC top front case is necessary by Removal-18 (Task 72-00-35-430-001, Section 72-00-35), after the engine is split, remove the TCC air valve actuator at 2 o'clock position as follows: (see Figure 305)

R (a) Remove the nut and bolt that attach the cable rod end to the HPC TCC air shutoff valve idler arm.

R (b) Remove the lockwire and disconnect the cable coupling nut from the actuator.

R (c) Remove the bolt and ground strap from the actuator.

R (d) Remove the four bolts (and nuts, if equipped) that attach the actuator clamps to the bracket.

R NOTE: Do not remove the hoses from the actuator.

R (23) If removal of the HPC top front case is necessary by Removal-18 (Task 72-00-35-430-001, Section 72-00-35), after the engine is split, remove the stator vane actuator and support assembly as follows: (see Figure 306)

R (a) Remove the bolts that attach the fuel flowmeter support bracket to the support assembly. Remove the bracket.

(b) Remove the cotter pins, nuts, washers, and bolts that attach the four rod ends to the synchronizing rings. Disengage the rod ends. Install lockwire to the rod end bearings to attach them to the rod ends.

(c) Remove the cotter pins, nuts, bolts, studs, spacers, and shims that attach the support assembly to the HPC cases and brackets. Remove the stator vane actuator and support assembly.

E. Separate The Fan Unit From The Core Engine

(1) Install PWA 85585 Guide Ring on the No. 1.5 bearing support assembly as follows: (see Figure 307)

(a) Install PWA 85585 Guide Ring to the No. 1.5 bearing support assembly.

(b) Attach the ring with the detail screws.

CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE UNIT BY THE GUIDE THAT YOU INSTALL ON THE FRONT OF THE CORE UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE GUIDE. TOO MUCH STRESS ON THE GUIDE CAN CAUSE DAMAGE TO THE PLAIN ROUND NUT.

(2) Install PWA 85631 Guide as follows:

(a) Install the PWA 85631 Guide in the plain round nut. Be sure the threads engage correctly.

(b) Use PWA 85471 Wrench and tighten the PWA 85631 Guide until seated.

NOTE: If equipped, the four grooves on the PWA 85631 Guide (Change B) must be fully rearward of the PWA 85585 Guide Ring front surface. If the grooves are not fully rearward of the ring, the threads of the guide are not fully engaged.

(3) Install two PWA 86567 Adapters on the fan case at 3 and 9 o'clock positions. See Figure 308.

R ENGINE GENERAL - SPECIAL PROCEDURES-25

R (4) Attach PWA 25926 Adapters to two PWA 25757 Pedestals. Put the PWA 86567 Adapters that are on the fan case and the brackets that are on the intermediate case in the adapters on the pedestals. Install two PWA 25757 Pedestals and PWA 25926 Adapters to support the forward end of the fan case. See Figure 308.

R (5) Install PWA 85390 Lifting Adapter on the 8th stage bleed pads as follows:

R (a) Remove the two adapters. To remove the adapters, remove the pins.

R (b) Attach the adapters to the 8th stage bleed pads with the detail screws.

R (c) With a hoist, lift the arms of the tool.

R (d) Attach the arms to the adapters with the pins.

R (6) For these models: 4052-3, 4056-3, 4060-3, 4060A-3, 4060C-3, 4062-3 (Pre SB PW4ENG 72-562) Thread the PWA 85246 Plug onto the HPC rear hub at the center of the diffuser case. See Figure 308.

R (7) For these models: 4052-3, 4056-3, 4060-3, 4060A-3, 4060C-3, 4062-3 (Post SB PW4ENG 72-562) Thread the PWA 88709 Plug onto the HPC rear shaft at the center of the diffuser case. See Figure 308.

R (8) Use PWA 28657 Sling with two PWA 76156 Adapters attached to trunnion spools of PWA 85064 Fixture to position fixture over plug and onto diffuser case. Align dowel pin hole in case with fixture. Secure fixture to case with bolts.

R (9) Support the engine with:

R (a) Four PWA 25757 Pedestals, PWA 25926 Adapter and PWA 86567 Adapter and PWA 85667 Brackets at the fan unit.

R (b) The middle of the core engine: Use a hoist and PWA 85390 Adapter.

R (c) The rear of the core engine: Use a hoist, PWA 28657 Sling, PWA 76156 Adapters, and PWA 85064 Fixture.

(10) Remove the 33 bolts in the rear flange of the No. 1.5 bearing support assembly. See Figure 309.

NOTE: If removal of the HPC top front case is necessary by Removal-18 (Task 72-00-35-430-001, Section 72-00-35), use the PWA 86598 Retainer or PWA 86209 Retainer as an alternative to PWA 85537 Fixture. The retainer will permit removal of the top case.

CAUTION: FOR RETAINING BOLTS USE WORKBOLTS WITH DRILLED HEADS WITH A 0.500 INCH (12.700 MM) MAXIMUM SHANK AND THREAD LENGTH. (PART NUMBER MS9218-05 OR MS9218-06 IS RECOMMENDED.)

(11) Install four retaining bolts in the holes indicated in Figure 309. Tighten by hand. Tag the bolts "To Be Removed".

(12) Install four jacking bolts in the rear flange of the No. 1.5 bearing support assembly. Tighten by hand. See Figure 309. Tag the bolts "Jacking Bolts".

(13) Remove the 74 bolts that attach the HPC to the intermediate case at Flange E. Install two PWA 85260 Guide Pins at approximately 3 and 9 o'clock positions on Flange E. Install two PWA 29855-7 Aligning Pins at approximately 6 and 12 o'clock positions on Flange E. See Figure 310, Figure 311, and Figure 312.

(a) For engines with the 2.5 bleed actuator support bracket (post SB PW4ENG 75-84), remove the three bolts and nuts that attach the support bracket to a bracket on Flange E.

(14) Install six PWA 101848 Jackscrew Pullers as follows: (see Figure 312)

(a) Remove the two detail screws from one of the plates.

(b) Put the plate in the space between the intermediate case and the bosses of the HPC inlet synchronizing ring assemblies. Align the screw holes in the plate with the inserts in the intermediate case.

(c) Attach the plate to the intermediate case with the two screws.

R (d) Install the five other jackscrew plates in the same way. Make sure that the distances between the plates are equal.

R CAUTION: BE SURE THAT THE HOISTS HAVE THE CORRECT EQUAL TENSION TO PERMIT THE SEPARATION OF THE FAN UNIT FROM THE CORE ENGINE. TOO MUCH OR TOO LESS TENSION ON ANY OF THE HOISTS CAN CAUSE DAMAGE TO THE ENGINE.

R CAUTION: USE A FLASHLIGHT AND BE SURE THAT ALL 33 SUPPORT BOLTS AND ALL 74 FLANGE E BOLTS ARE REMOVED. COUNT THE BOLTS. BE SURE ALL EXTERNAL PARTS ARE DISCONNECTED AND ARE CLEAR FOR SEPARATION.

R (15) Move core engine away from fan unit.

R (a) Use the jackscrews in the No. 1.5 bearing support assembly and the jackscrew plates.

R (16) For engines that have incorporated SB PW4ENG 72−48, discard the packing on the intermediate case at Flange E. Remove the transfer tube (and packings, if equipped).

R (17) Remove the four bolts that are in the No. 1.5 bearing support assembly with the tag "Jacking Bolts".

R (18) Remove the two PWA 85260 Guide Pins and the two PWA 29855−7 Aligning Pins from Flange E.

R CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE UNIT BY PWA 85631 GUIDE THAT IS INSTALLED ON THE FRONT OF THE CORE UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE GUIDE. TOO MUCH STRESS ON THE GUIDE CAN CAUSE DAMAGE TO THE PLAIN ROUND NUT.

R (19) To install core unit in horizontal position perform the steps that follow:

R (a) Install PWA 85537 Fixture (optional to the installation of PWA 86598 Retainer or PWA 86209 Retainer) on the HPC. See Figure 313.

1 The No. 2 bearing support assembly has a locating pin at 6:00 o'clock. Put the locating pin in one of the holes of the inner bolt circle on the tool.

2 Attach the tool to the HPC with the detail screws, washers and nuts.

3 Attach the tool to the No. 2 bearing support assembly with the detail screws.

(b) Install PWA 86598 Retainer or PWA 86209 Retainer (optional to PWA 85537 Fixture) on the HPC. Use the detail bolts and nuts. See Figure 313.

(c) Attach PWA 25926 Adapters to four PWA 25757 Pedestals. Put the PWA 85537 Fixture that is on the HPC and the PWA 85064 Fixture that is on the diffuser in the adapters on the pedestals.

(d) Remove PWA 101848 Jackscrew Plates.

NOTE: Do not remove PWA 85390 Adapter from the core unit.

1 Attach PWA 25926 Adapters to four PWA 25757 Pedestals. Put the PWA 86567 Adapters that are on the fan case and the brackets that are on the intermediate case in the adapters on the pedestals.

2 Remove the PWA 76154 Adapters, sling, eye, and hoists from the fan unit.

(20) To install core unit in vertical position front end down position perform the steps that follow:

(a) Place PWA 85537 Fixture onto PWA 87022 Stand or PWA 85108 Stand.

(b) Trunnion the core unit front end down (use PWA 85390 Adapter and PWA 28657 Sling). Lower the core unit front end down onto PWA 85537 Fixture.

(c) Attach PWA 85537 Fixture to the HPC front flange and the No. 2 bearing support assembly with detail screws, washers and nuts.

R ENGINE GENERAL - SPECIAL PROCEDURES-25

R (d) Remove PWA 85390 Fixture and PWA 101848 Jackscrew
R Plates.

R NOTE: If there is a need to install the core unit
R rear end down, install hoist at PWA 85337
R Fixture and PWA 85064 Fixture. Lift the
R core unit and trunnion the core unit rear
R end down. Lower the core unit onto PWA
R 87022 Stand or PWA 85108 Stand.

R F. Postrequisites

R (1) If necessary, remove the HPC top front case. Refer to
R Removal-18 (Task 72-00-35-030-001, Section 72-00-35).

R (2) If necessary, remove the No. 3 bearing assembly.
R Refer to Removal-17 (Task 72-00-41-040-001, Section
R 72-00-41), core unit front end down.

R (3) If necessary, remove the No. 2 bearing assembly.
R Refer to Removal-01 (Task 72-00-35-020-001, Section
R 72-00-35), core unit rear end down.

R Task 72-00-00-020-005-002:

R 2. Install HPC/Diffuser Assembly To The Engine (Horizontal)

R A. Prerequisites

R (1) If disassembled, install the HPC top front case. Refer
R to Installation-18 (Task 72-00-35-430-001, Section
R 72-00-35).

R (2) If applicable, trunnion the fan unit from rear end down
R to horizontal position. Refer to Special Procedures-22
R (Task 72-00-00-420-004).

R B. Equipment And Materials Necessary

R NOTE: Refer to Task 72-00-00-020-005-001 in this document
R for all necessary tools.

R C. Installation Procedure

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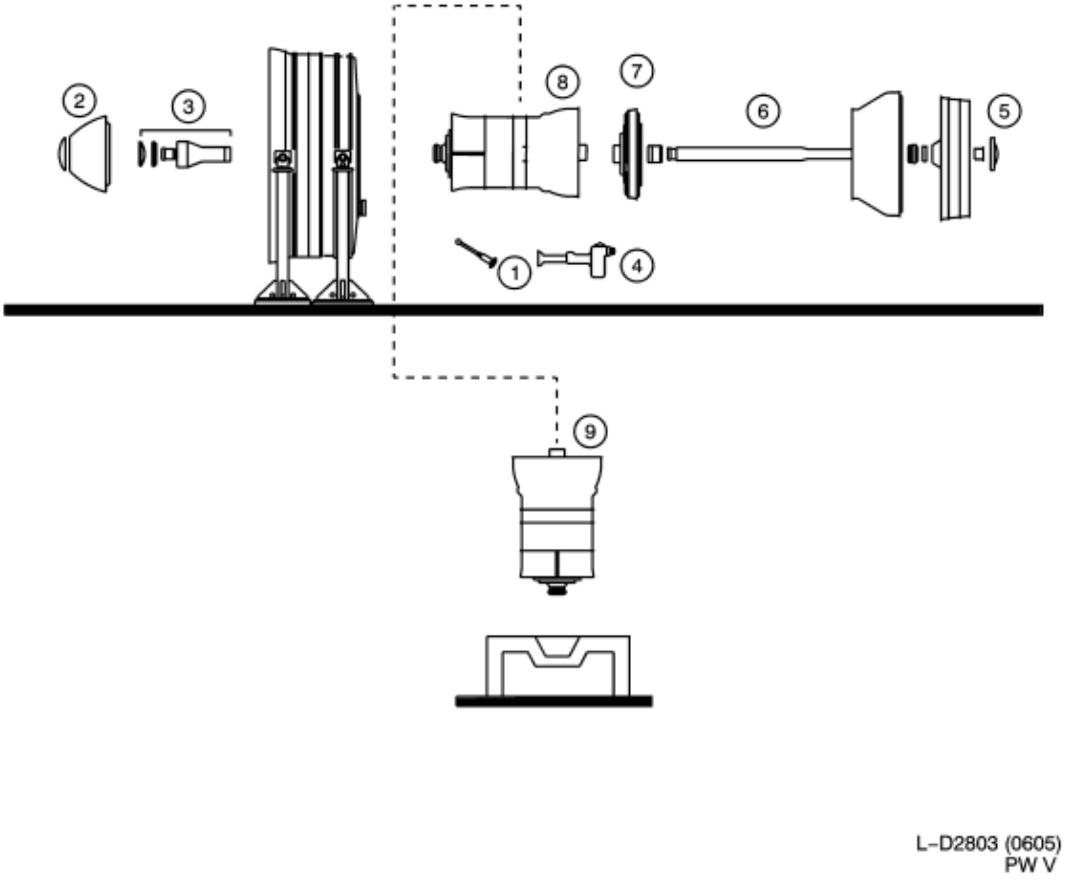


R Removal Procedure Sequence
R Figure 301
R (Task 72-00-00-020-005-001)

ENGINE GENERAL - SPECIAL PROCEDURES-25

1. Remove Electronic Engine Control (EEC) Speed Transducer (N1)
2. Remove Compressor Inlet Cone
3. Remove LPC/LPT Coupling
4. Remove Main Gearbox
5. Remove Turbine Exhaust Case
6. Remove Low Pressure Turbine (LPT)
7. Remove High Pressure Turbine (HPT)
8. Remove Diffuser And High Pressure Compressor From Intermediate Case
9. Trunnion High Pressure Compressor Through Diffuser Case To Front End Down

Key to Figure 301

(1) The installation procedures are to be done in the reverse order of the removal procedure defined in Task 72-00-00-020-005-001 in this document. Be sure to use appropriate torques, measurements, support equipment, consumables and expendable materials specified in similar procedures in the engine manual Section 72-00-34.

D. Postrequisites

(1) Install the high pressure turbine by Installation-01 (Task 72-00-52-420-001, Section 72-00-52).

(2) Install the low pressure turbine with shaft by Installation-01 (Task 72-00-53-420-001, Section 72-00-53).

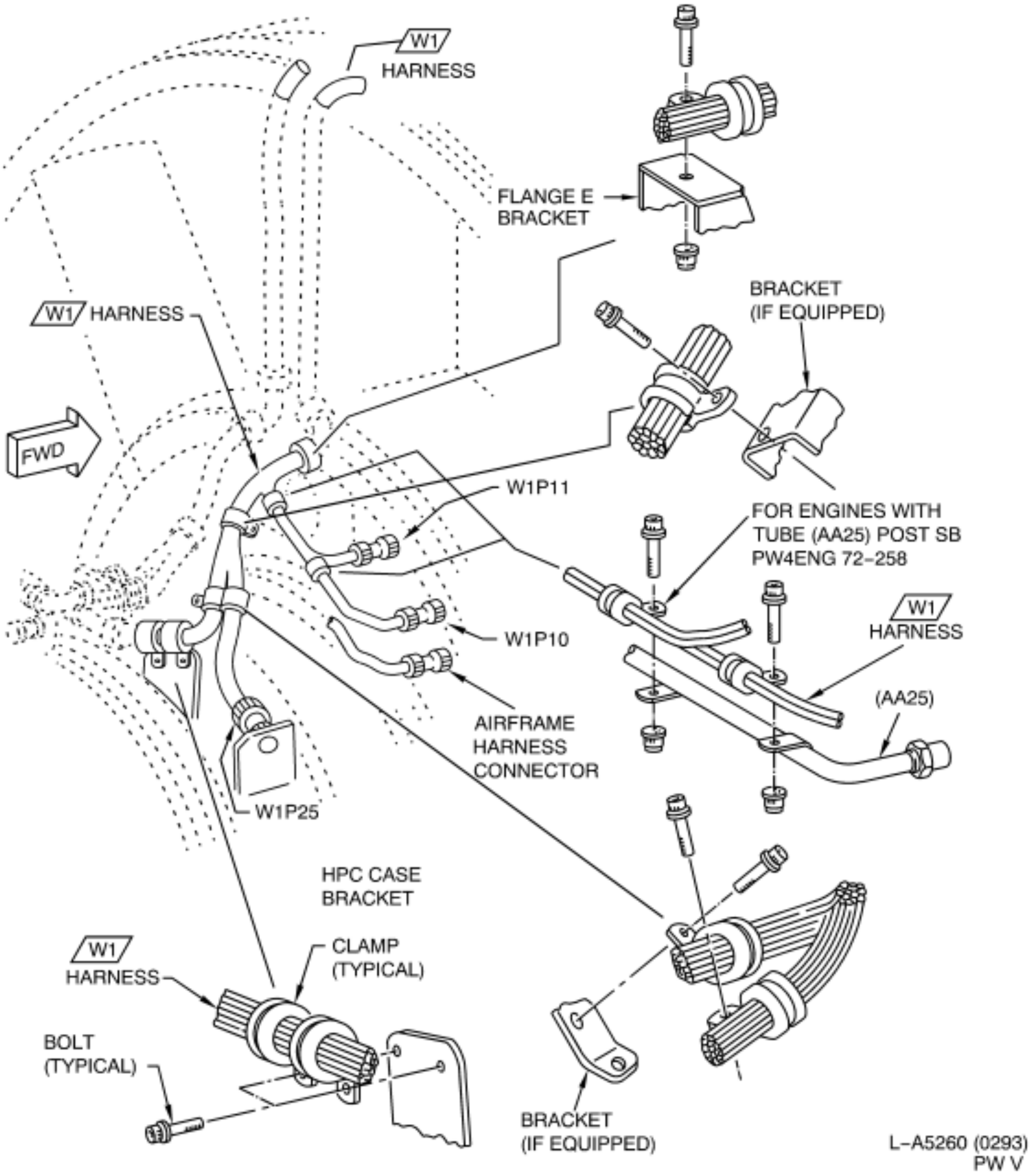
  (a) Optional: Install the low pressure turbine and turbine exhaust case with shaft (mechanical wrench or hydraulic wrench) by Installation-08 (Task 72-00-53-420-002, Section 72-00-53).

(3) Install turbine exhaust case by Installation-01 (Task 72-00-54-420-001, Section 72-00-54).

(4) Install main gearbox by Installation-01 (Task 72-00-61-420-001, Section 72-00-61).

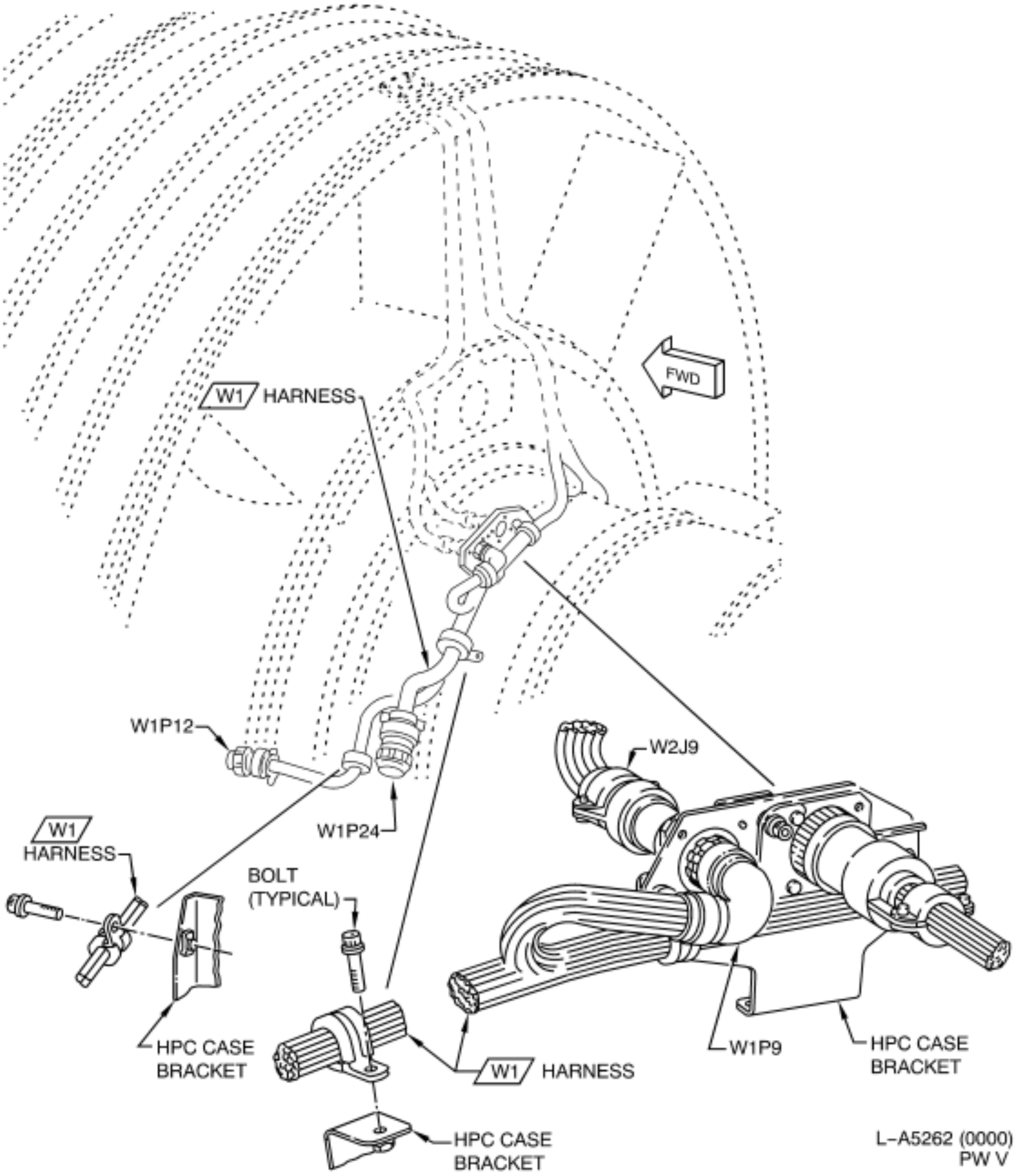
(5) If necessary, install low pressure compressor by Installation-01 (Task 72-00-31-420-003, Section 72-00-31).

(6) Install LPC/LPT coupling with a mechanical wrench or hydraulic wrench by Installation-01 (Task 72-00-32-420-001, Section 72-00-32).


W1
HARNESS
FLANGE E
BRACKET
BRACKET
(IF EQUIPPED)
W1
HARNESS
FWD
W1P11
FOR ENGINES WITH
TUBE (AA25) POST SB
PW4ENG 72-258
W1
HARNESS
(AA25)
W1P10
AIRFRAME
HARNESS
CONNECTOR
W1P25
HPC CASE
BRACKET
W1
HARNESS
CLAMP
(TYPICAL)
BOLT
(TYPICAL)
BRACKET
(IF EQUIPPED)
L-A5260 (0293)
PW V

R EEC Wiring Harness Removal (Pre SB PW4ENG 73-140)
R Figure 302 (Sheet 1)
R (Task 72-00-00-020-005-001)

R ENGINE GENERAL - SPECIAL PROCEDURES-25


W1 HARNESS
FWD
W1P12
W2J9
W1P24
W1 HARNESS
BOLT (TYPICAL)
HPC CASE BRACKET
W1P9
HPC CASE BRACKET
W1 HARNESS
HPC CASE BRACKET
L-A5262 (0000)
PW V

R EEC Wiring Harness Removal (Pre SB PW4ENG 73-140)
R Figure 302 (Sheet 2)
R (Task 72-00-00-020-005-001)

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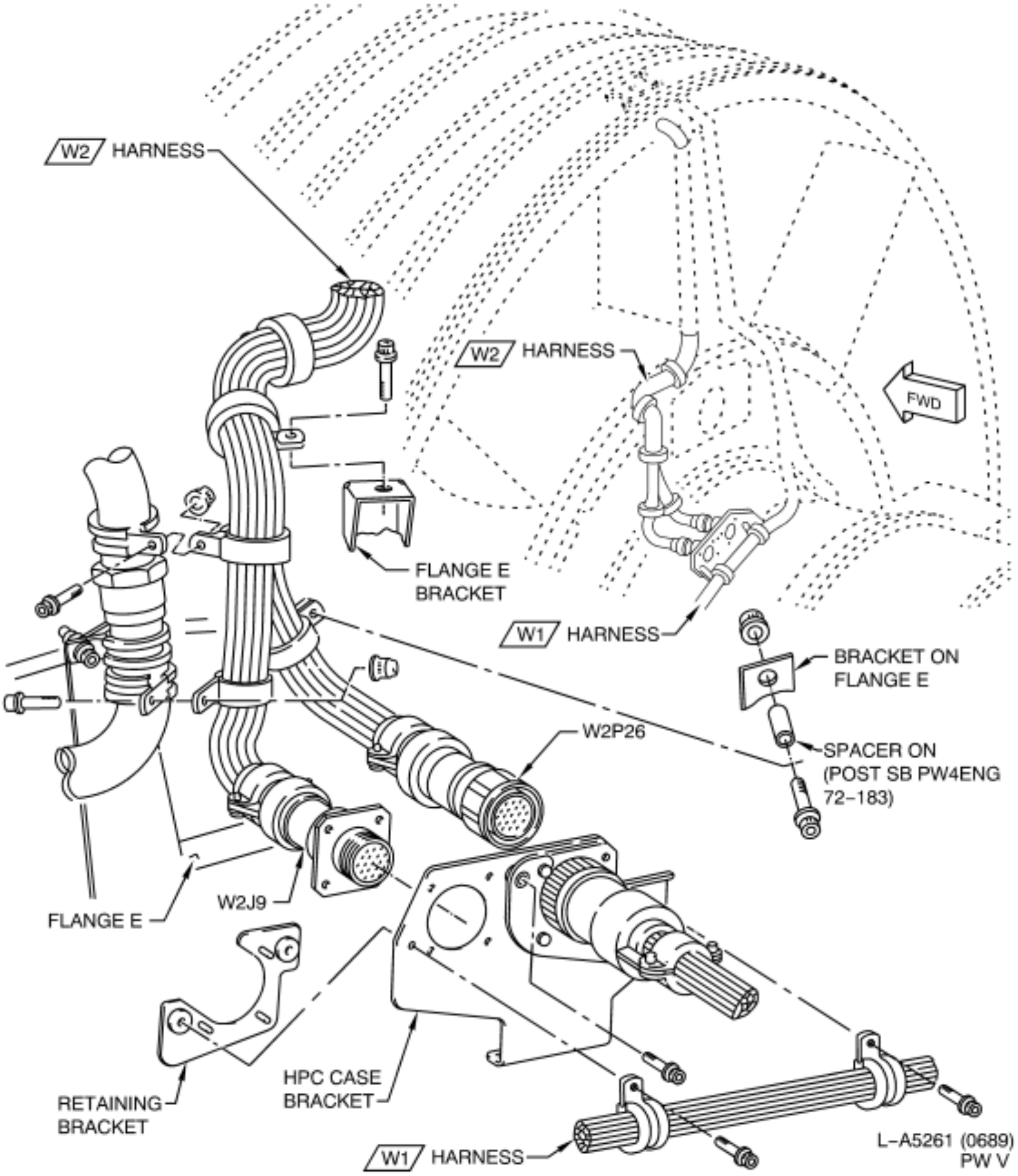
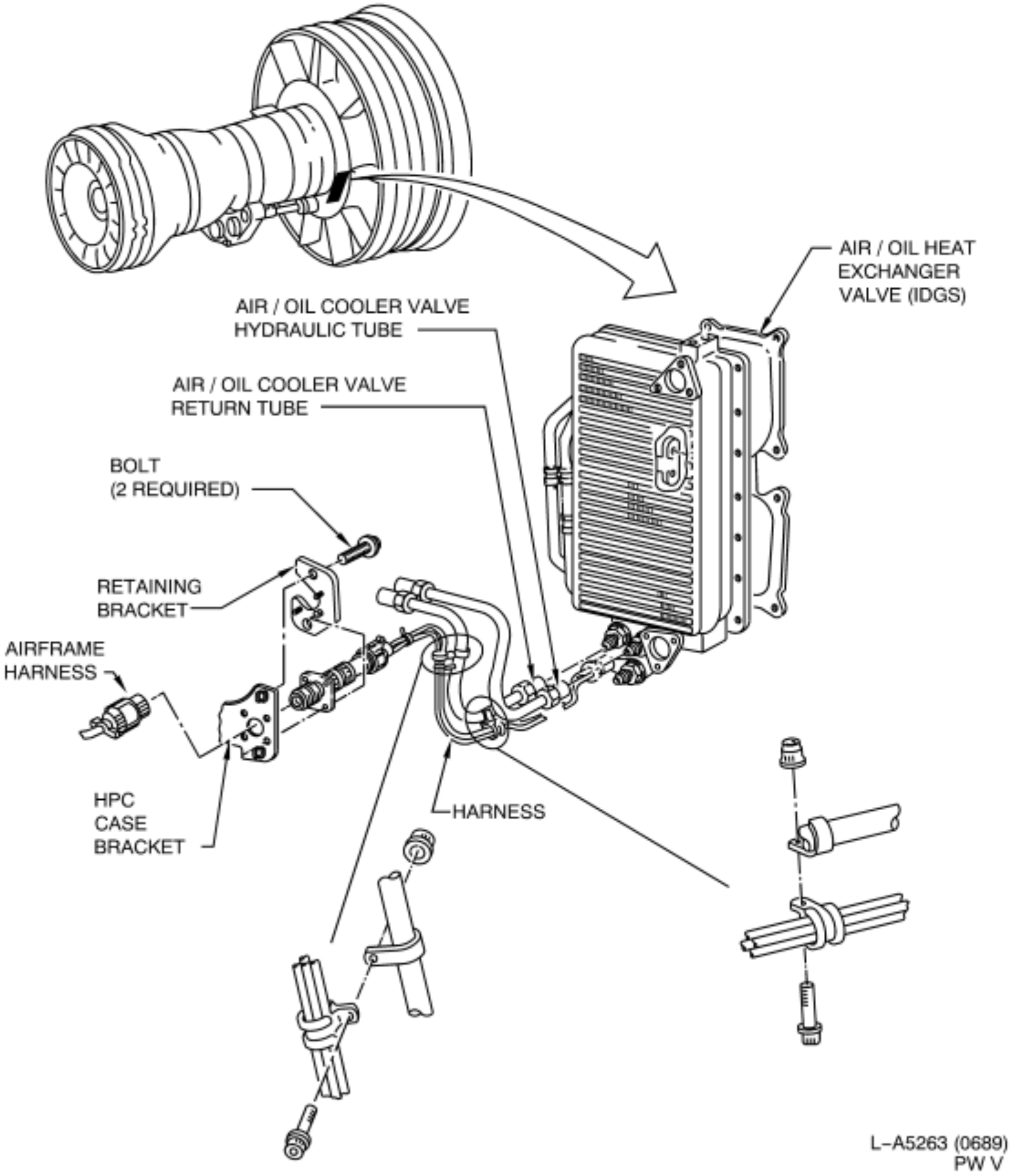
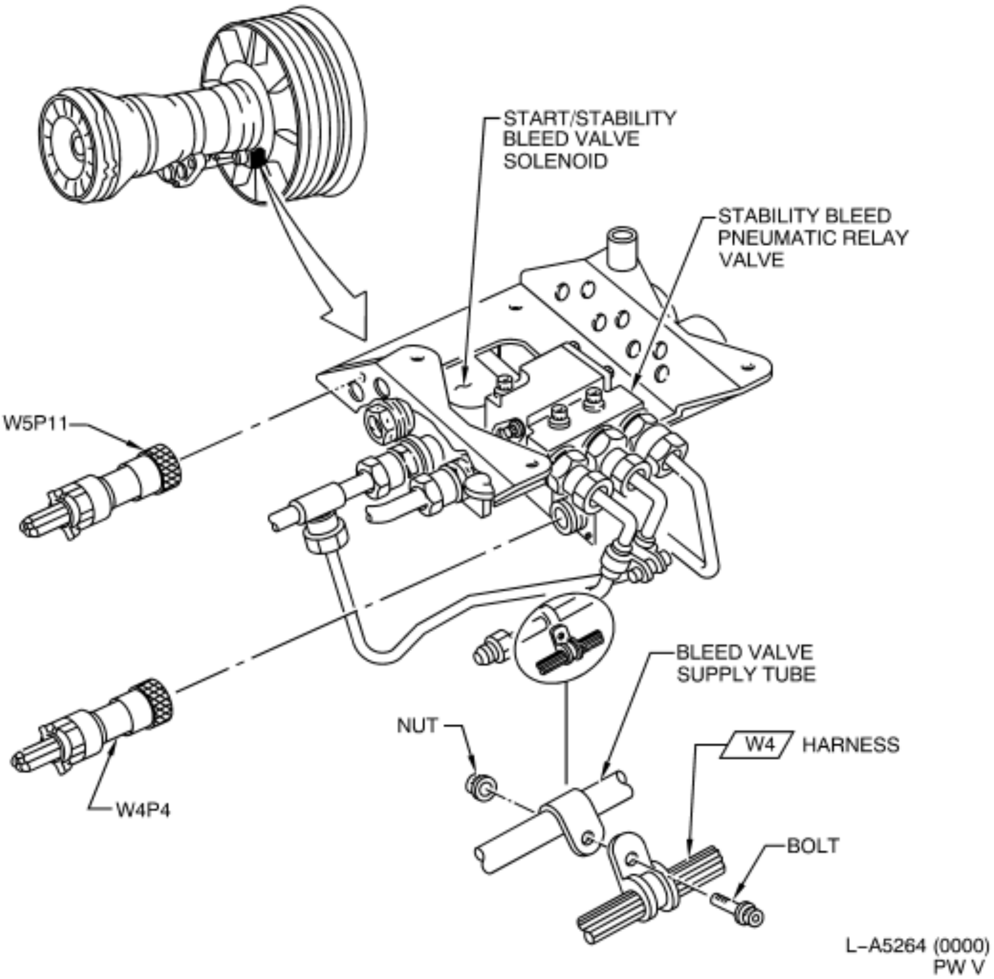

W2 HARNESS
W2 HARNESS
FWD
FLANGE E BRACKET
W1 HARNESS
BRACKET ON FLANGE E
W2P26
SPACER ON (POST SB PW4ENG 72-183)
FLANGE E
W2J9
RETAINING BRACKET
HPC CASE BRACKET
W1 HARNESS
L-A5261 (0689)
PW V

R EEC Wiring Harness Removal (Pre SB PW4ENG 73-140)
R Figure 302 (Sheet 3)
R (Task 72-00-00-020-005-001)


AIR / OIL HEAT EXCHANGER VALVE (IDGS)
AIR / OIL COOLER VALVE HYDRAULIC TUBE
AIR / OIL COOLER VALVE RETURN TUBE
BOLT (2 REQUIRED)
RETAINING BRACKET
AIRFRAME HARNESS
HPC CASE BRACKET
HARNESS
L-A5263 (0689)
PW V

R Heat Exchanger Wiring Harness Removal
R Figure 302 (Sheet 4)
R (Task 72-00-00-020-005-001)


START/STABILITY BLEED VALVE SOLENOID
STABILITY BLEED PNEUMATIC RELAY VALVE
W5P11
BLEED VALVE SUPPLY TUBE
NUT
W4
HARNESS
BOLT
W4P4
L-A5264 (0000)
PW V

R EEC Wiring Harness Removal
R Figure 302 (Sheet 5)
R (Task 72-00-00-020-005-001)

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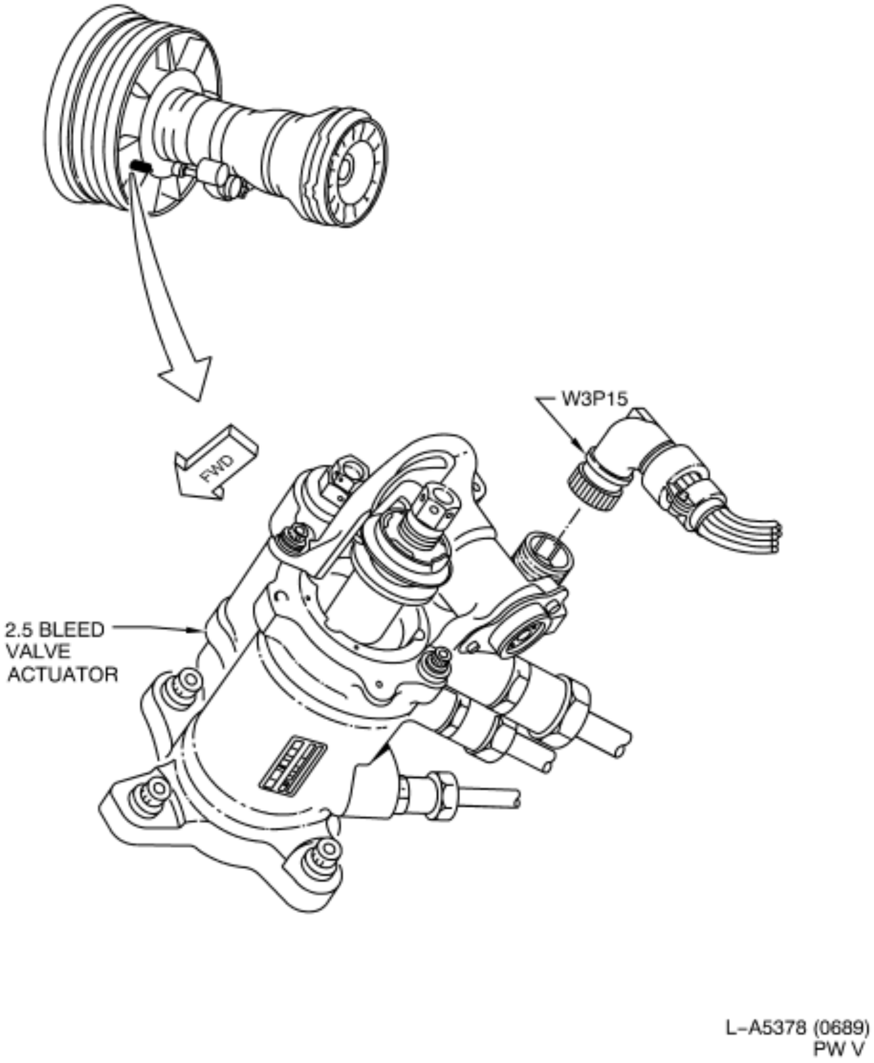
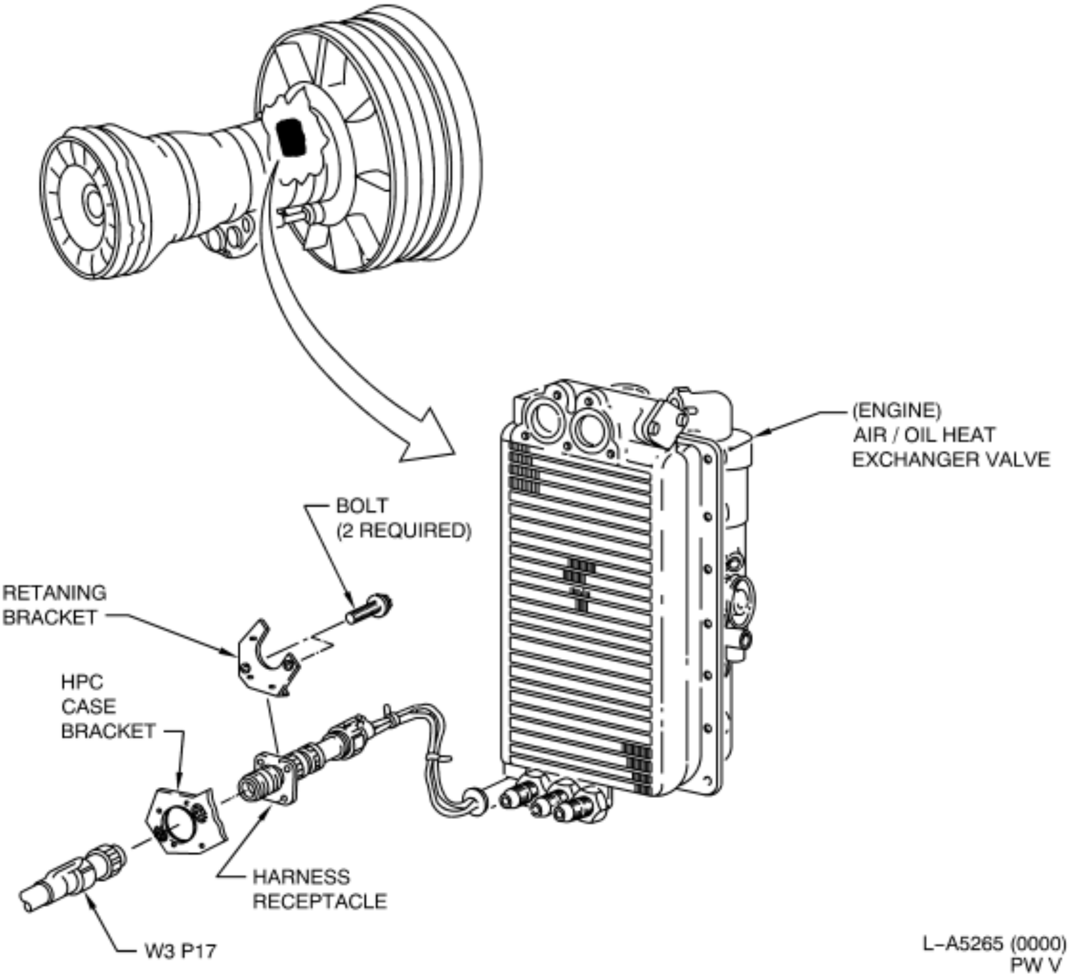
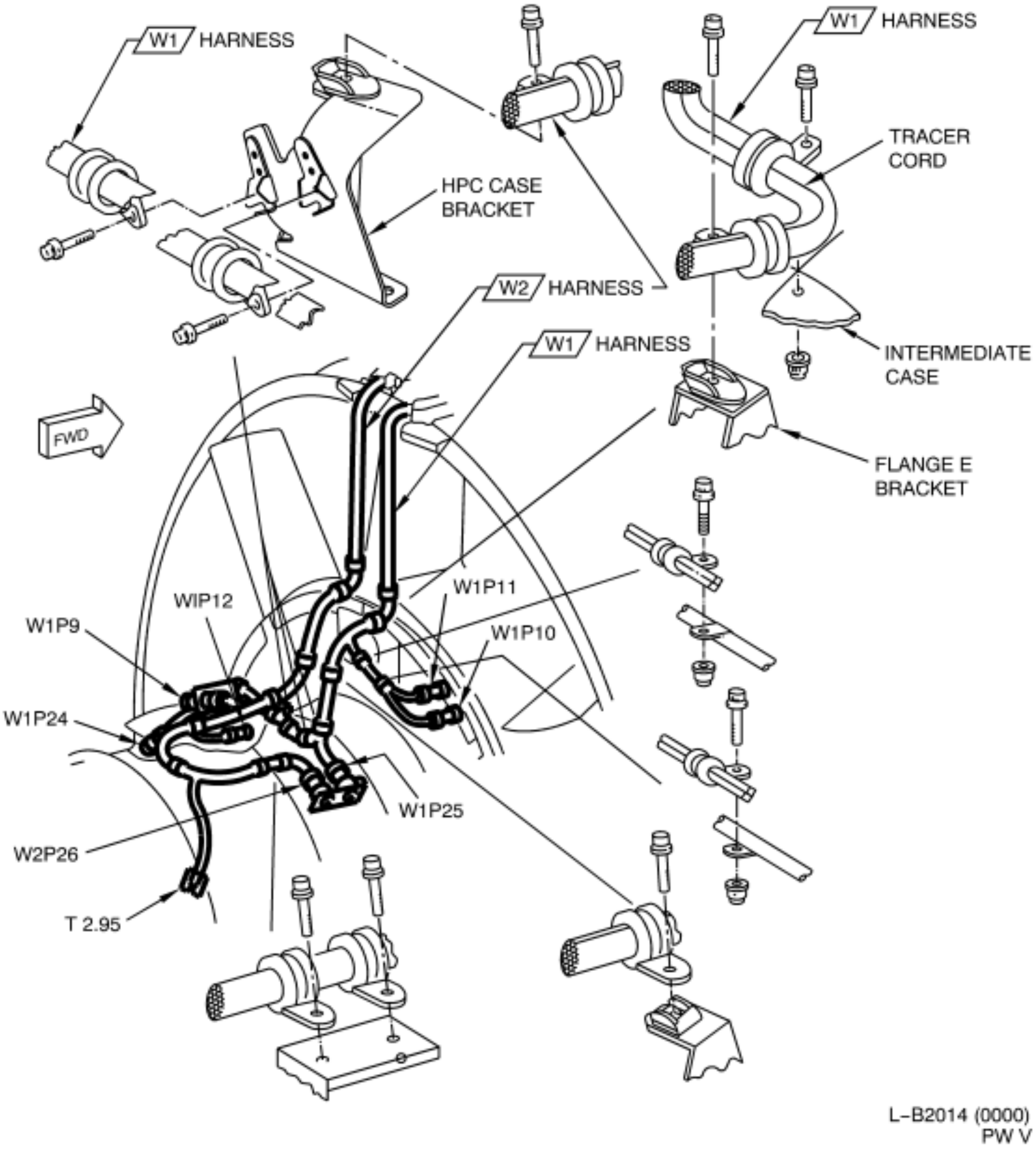

W3P15
FWD
2.5 BLEED VALVE ACTUATOR
L-A5378 (0689)
PW V

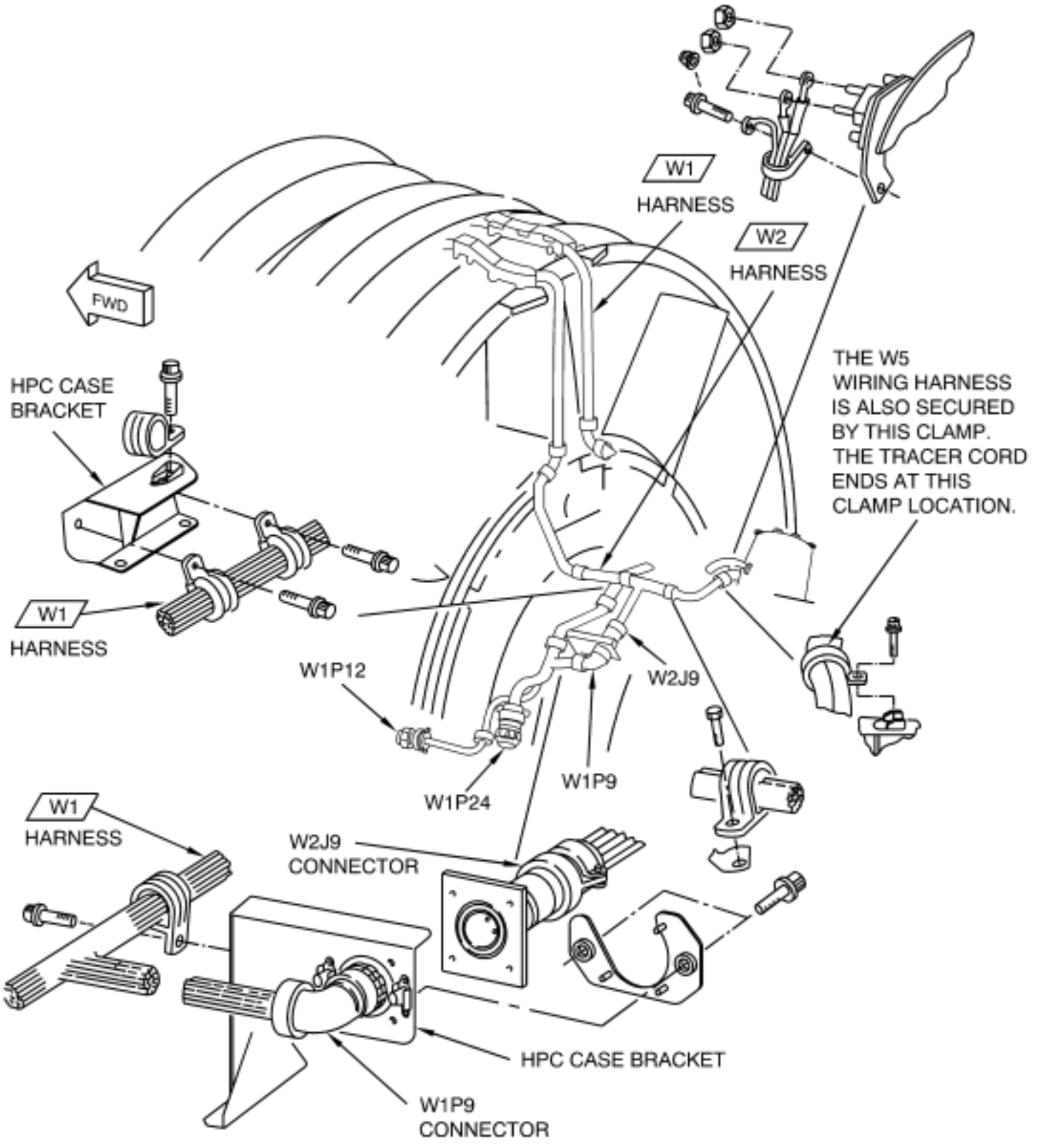
R EEC Wiring Harness Removal
R Figure 302 (Sheet 6)
R (Task 72-00-00-020-005-001)


(ENGINE)
AIR / OIL HEAT
EXCHANGER VALVE
BOLT
(2 REQUIRED)
RETANING
BRACKET
HPC
CASE
BRACKET
HARNESS
RECEPTACLE
W3 P17
L-A5265 (0000)
PW V

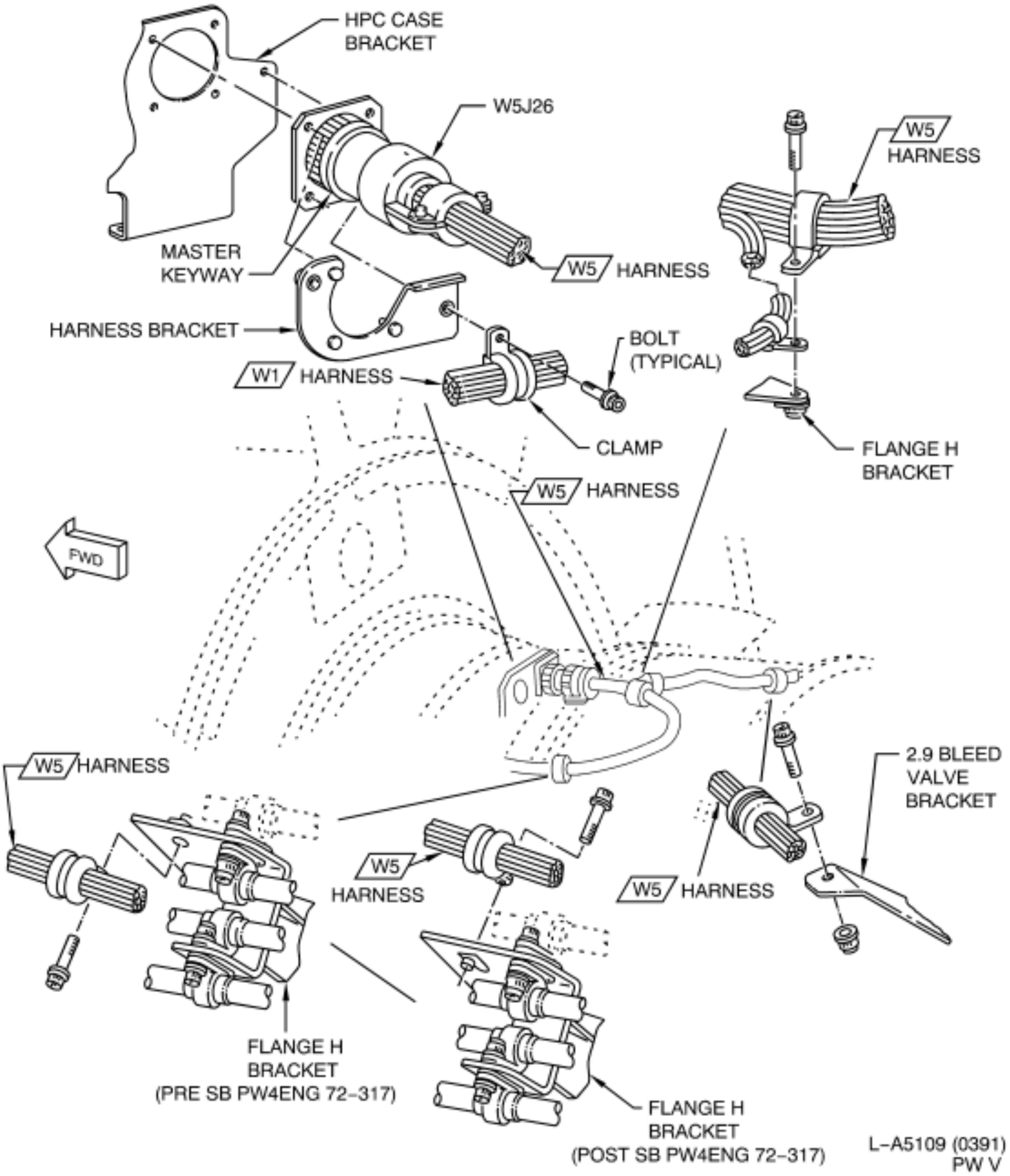
R Heat Exchanger Wiring Harness Removal
R Figure 302 (Sheet 7)
R (Task 72-00-00-020-005-001)


W1 HARNESS
HPC CASE BRACKET
W1 HARNESS
TRACER CORD
W2 HARNESS
W1 HARNESS
INTERMEDIATE CASE
FLANGE E BRACKET
FWD
WIP12
W1P11
W1P9
W1P10
W1P24
W1P25
W2P26
T 2.95
L-B2014 (0000)
PW V

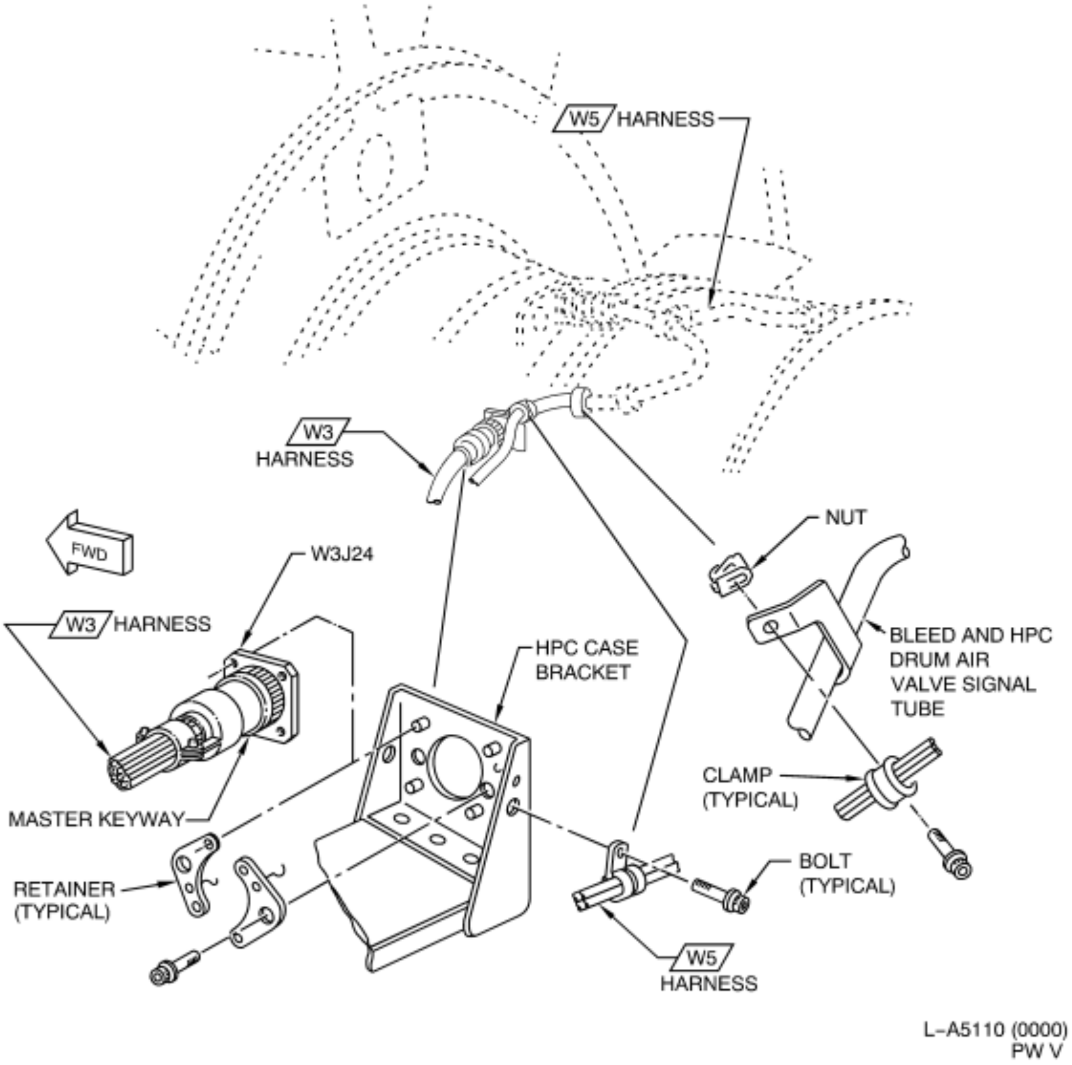
R EEC Wiring Harness - Installation (Post
R SB PW4ENG 73-140 Or SB PW4ENG 72-504)
R Figure 302 (Sheet 8)
R (Task 72-00-00-020-005-001)


W1
HARNESS
W2
HARNESS
FWD
HPC CASE
BRACKET
THE W5
WIRING HARNESS
IS ALSO SECURED
BY THIS CLAMP.
THE TRACER CORD
ENDS AT THIS
CLAMP LOCATION.
W1
HARNESS
W1P12
W2J9
W1P24
W1P9
W1
HARNESS
W2J9
CONNECTOR
HPC CASE BRACKET
W1P9
CONNECTOR
L-B1958 (0000)
PW V

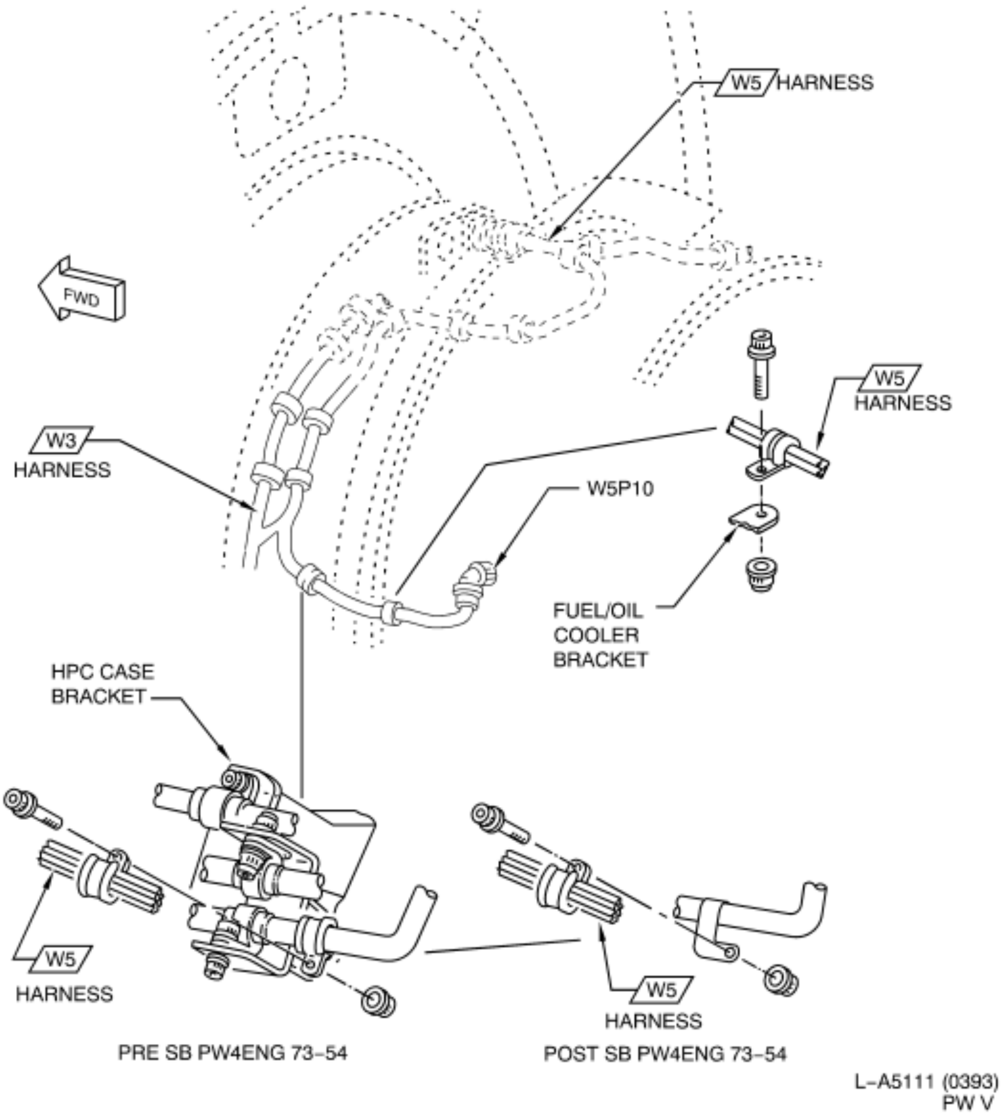
R EEC Wiring Harness - Installation (Post
R SB PW4ENG 73-140 Or SB PW4ENG 72-504)
R Figure 302 (Sheet 9)
R (Task 72-00-00-020-005-001)


HPC CASE BRACKET
W5J26
W5 HARNESS
MASTER KEYWAY
W5 HARNESS
HARNESS BRACKET
BOLT (TYPICAL)
W1 HARNESS
CLAMP
FLANGE H BRACKET
W5 HARNESS
FWD
W5 HARNESS
2.9 BLEED VALVE BRACKET
W5 HARNESS
W5 HARNESS
FLANGE H BRACKET (PRE SB PW4ENG 72-317)
FLANGE H BRACKET (POST SB PW4ENG 72-317)
L-A5109 (0391)
PW V

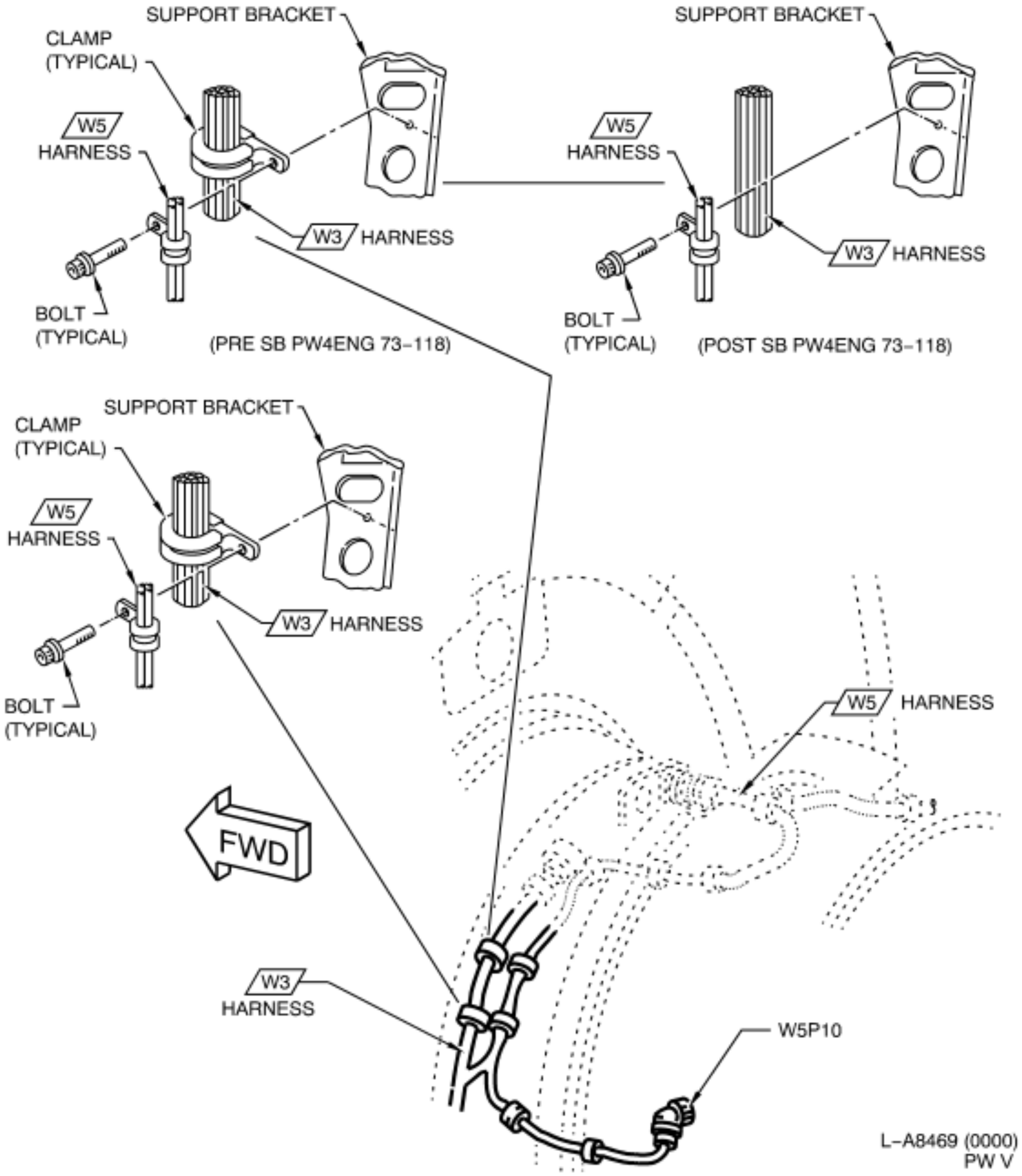
R EEC Wiring Harness Removal (Pre SB PW4ENG 73-140)
R (Necessary Only For Removal Of HPC Top Front Case)
R Figure 303 (Sheet 1)
R (Task 72-00-00-020-005-001)


W5 HARNESS
W3 HARNESS
NUT
FWD
W3J24
W3 HARNESS
BLEED AND HPC DRUM AIR VALVE SIGNAL TUBE
HPC CASE BRACKET
CLAMP (TYPICAL)
MASTER KEYWAY
BOLT (TYPICAL)
RETAINER (TYPICAL)
W5 HARNESS
L-A5110 (0000)
PW V

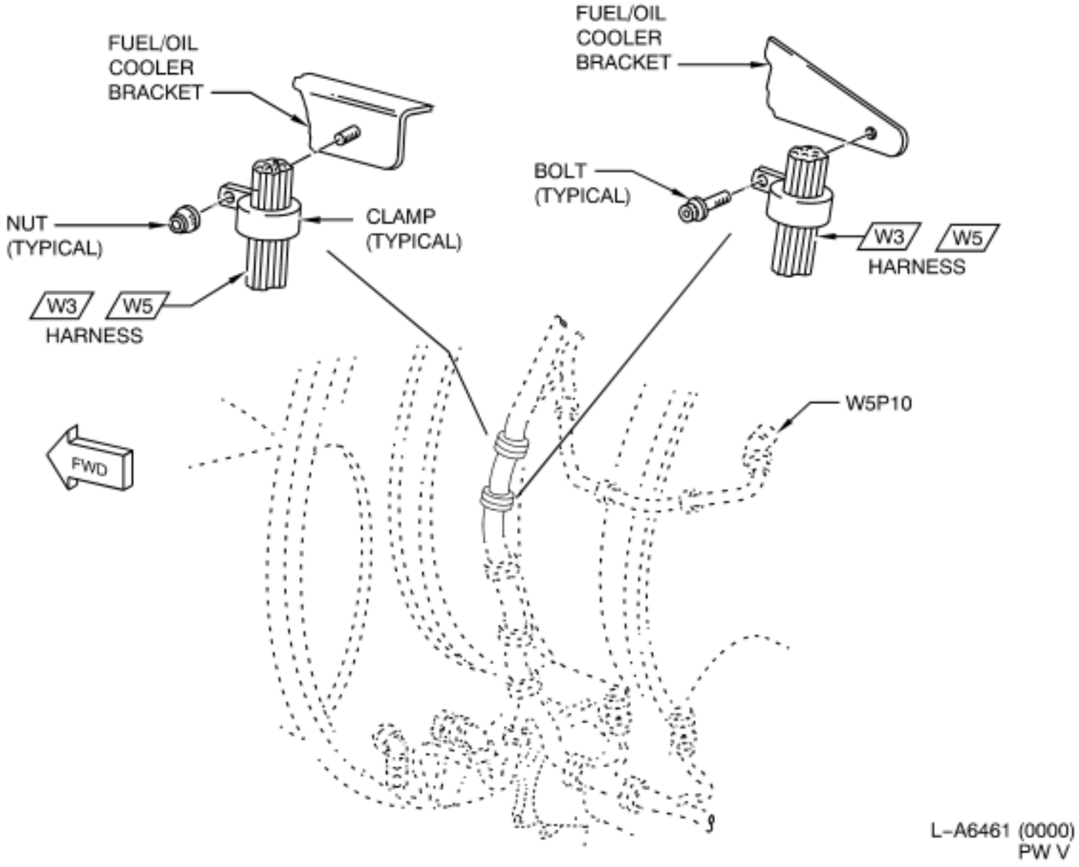
R EEC Wiring Harness Removal (Pre SB PW4ENG 73-140)
R (Necessary Only For Removal Of HPC Top Front Case)
R Figure 303 (Sheet 2)
R (Task 72-00-00-020-005-001)


W5 HARNESS
FWD
W5 HARNESS
W3 HARNESS
W5P10
FUEL/OIL COOLER BRACKET
HPC CASE BRACKET
W5 HARNESS
W5 HARNESS
PRE SB PW4ENG 73-54
POST SB PW4ENG 73-54
L-A5111 (0393)
PW V

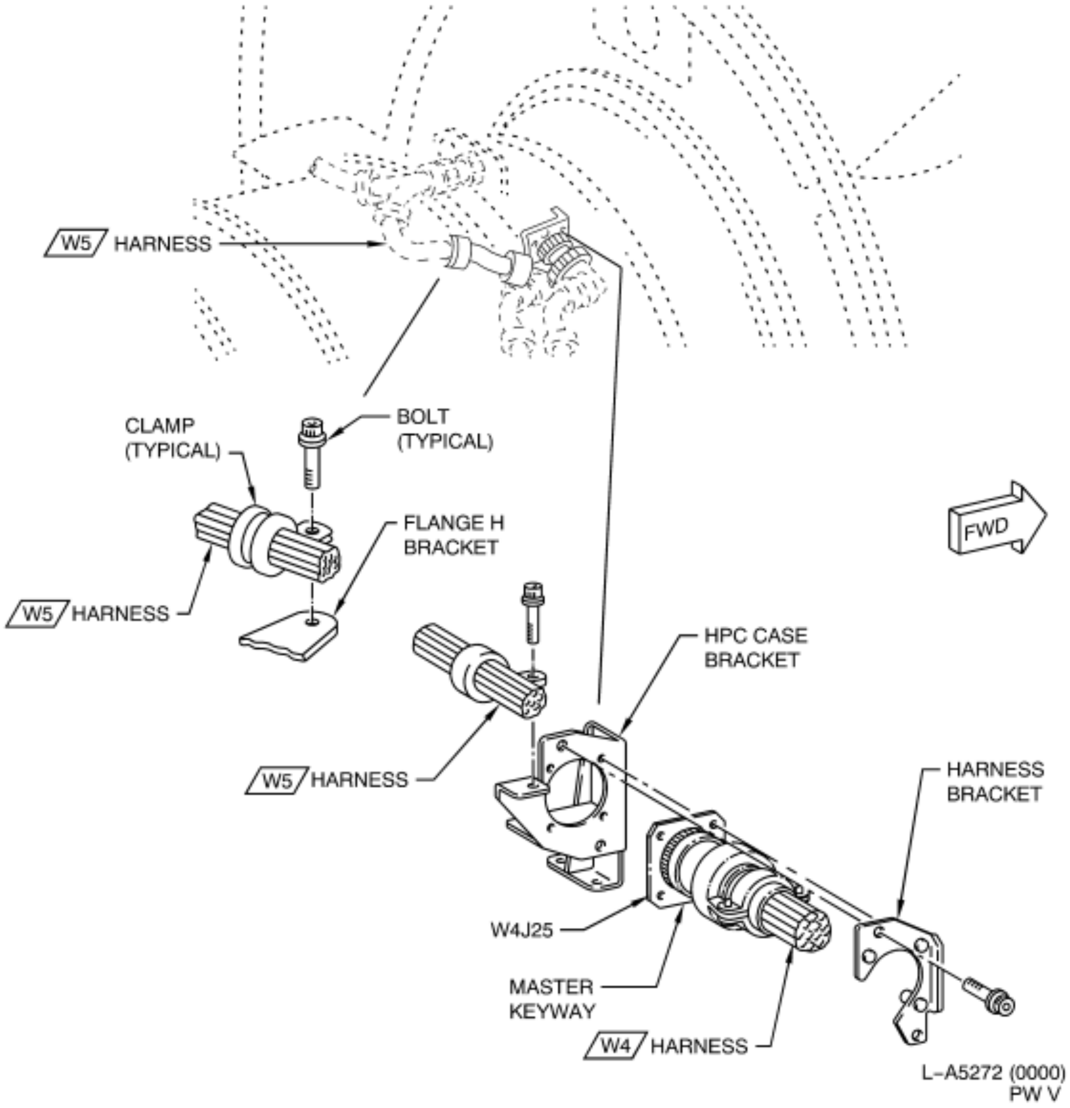
R EEC Wiring Harness Removal (Pre SB PW4ENG 73-140)
R (Necessary Only For Removal Of HPC Top Front Case)
R Figure 303 (Sheet 3)
R (Task 72-00-00-020-005-001)


SUPPORT BRACKET
CLAMP (TYPICAL)
W5 HARNESS
W3 HARNESS
BOLT (TYPICAL)
(PRE SB PW4ENG 73-118)
SUPPORT BRACKET
W5 HARNESS
W3 HARNESS
BOLT (TYPICAL)
(POST SB PW4ENG 73-118)
SUPPORT BRACKET
CLAMP (TYPICAL)
W5 HARNESS
W3 HARNESS
BOLT (TYPICAL)
FWD
W5 HARNESS
W3 HARNESS
W5P10
L-A8469 (0000)
PW V

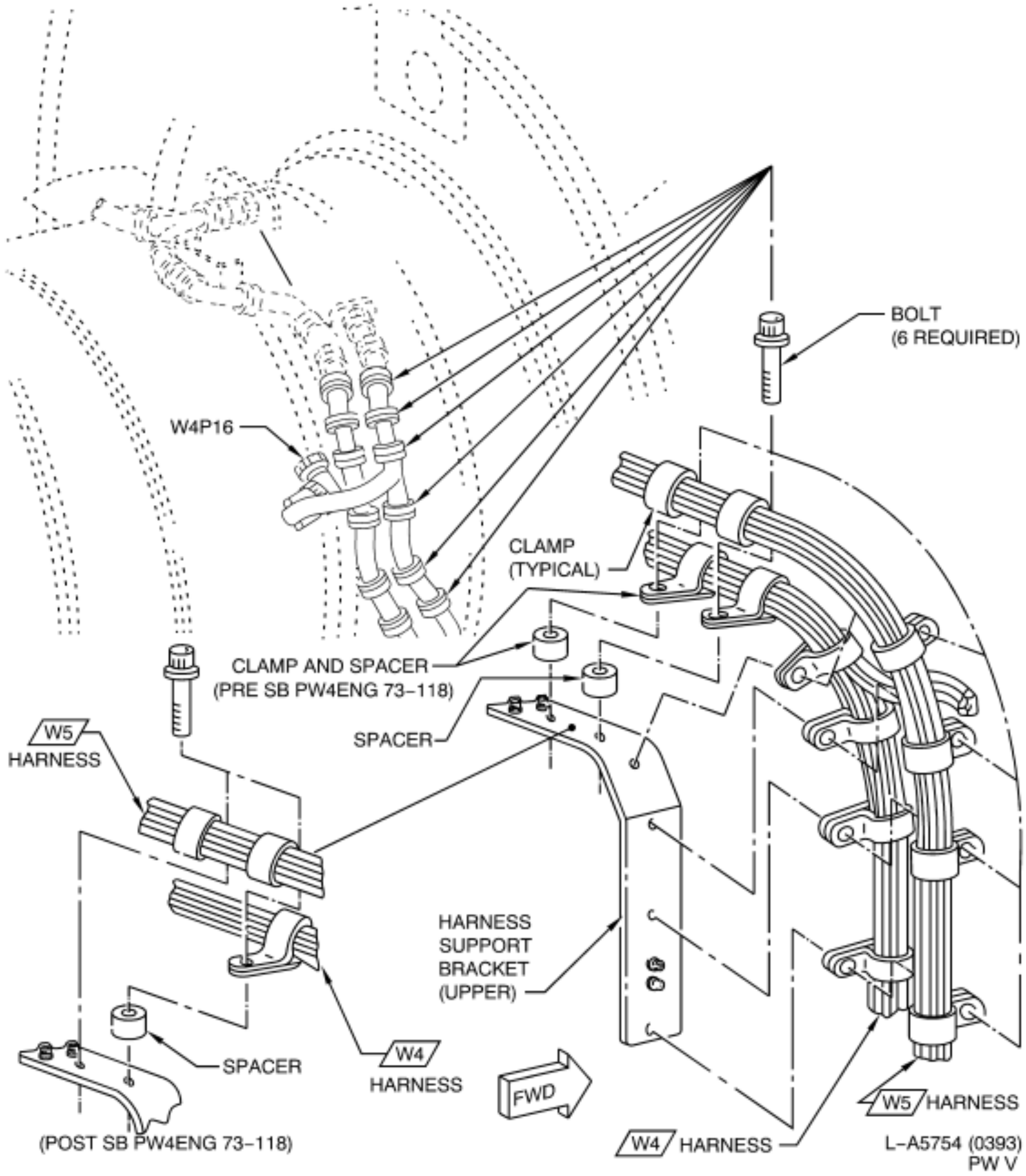
R EEC Wiring Harness Removal (Pre SB PW4ENG 73-140)
R Figure 303 (Sheet 4)
R (Task 72-00-00-020-005-001)


FUEL/OIL
COOLER
BRACKET
FUEL/OIL
COOLER
BRACKET
BOLT
(TYPICAL)
NUT
(TYPICAL)
CLAMP
(TYPICAL)
W3
W5
HARNESS
W3
W5
HARNESS
FWD
W5P10
L-A6461 (0000)
PW V

R EEC Wiring Harness Removal (Pre SB PW4ENG 73-140)
R (Necessary Only For Removal Of HPC Top Front Case)
R Figure 303 (Sheet 5)
R (Task 72-00-00-020-005-001)


W5 HARNESS
CLAMP (TYPICAL)
BOLT (TYPICAL)
FLANGE H BRACKET
W5 HARNESS
FWD
HPC CASE BRACKET
W5 HARNESS
HARNESS BRACKET
W4J25
MASTER KEYWAY
W4 HARNESS
L-A5272 (0000)
PW V

R EEC Wiring Harness Removal (Pre SB PW4ENG 73-140)
R (Necessary Only For Removal Of HPC Top Front Case)
R Figure 303 (Sheet 6)
R (Task 72-00-00-020-005-001)


BOLT
(6 REQUIRED)
W4P16
CLAMP
(TYPICAL)
CLAMP AND SPACER
(PRE SB PW4ENG 73-118)
SPACER
W5
HARNESS
HARNESS
SUPPORT
BRACKET
(UPPER)
SPACER
W4
HARNESS
FWD
(POST SB PW4ENG 73-118)
W4
HARNESS
W5
HARNESS
L-A5754 (0393)
PW V

R EEC Wiring Harness Removal (Pre SB PW4ENG 73-140)
R (Necessary Only For Removal Of HPC Top Front Case)
R Figure 303 (Sheet 7)
R (Task 72-00-00-020-005-001)

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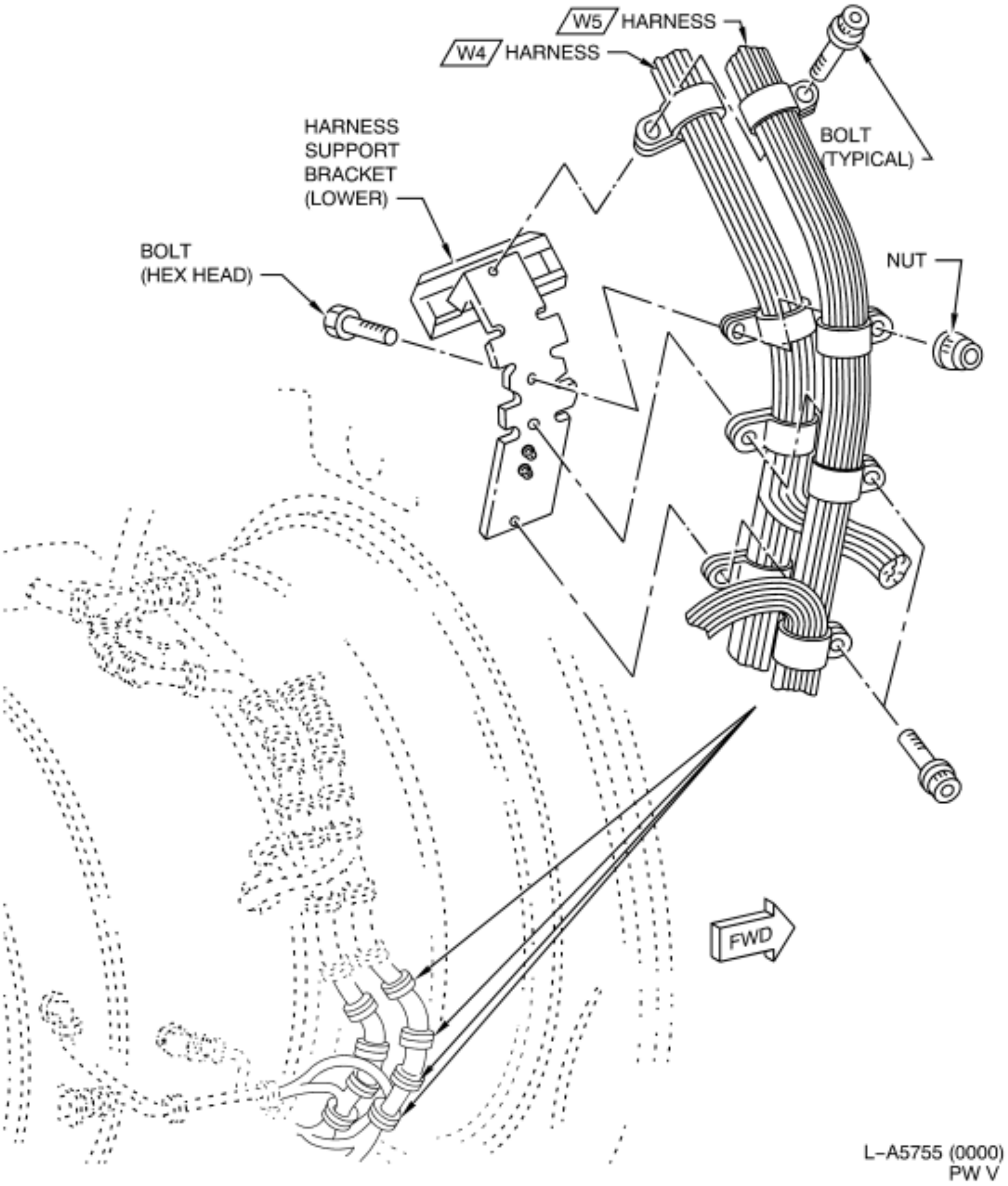
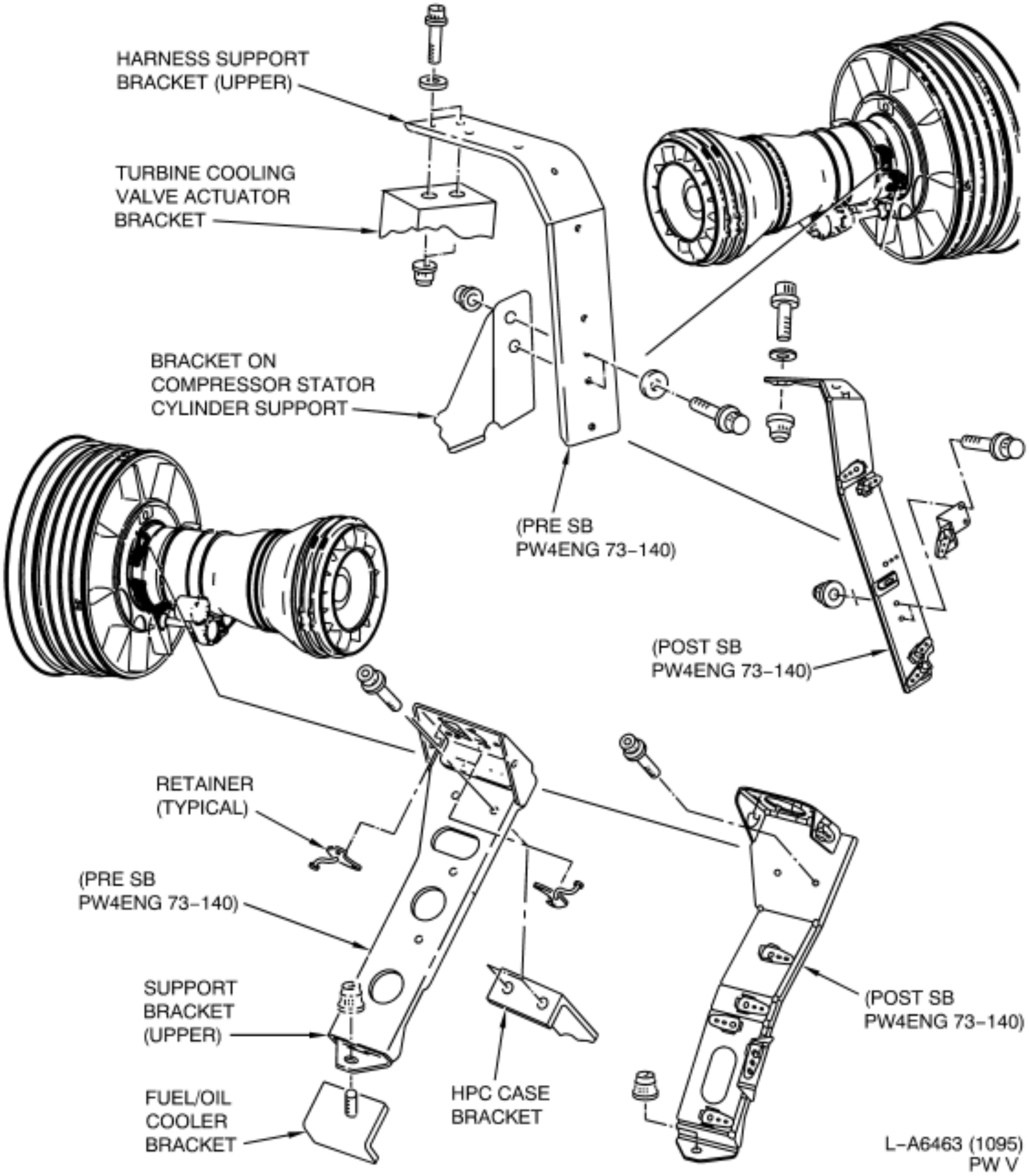
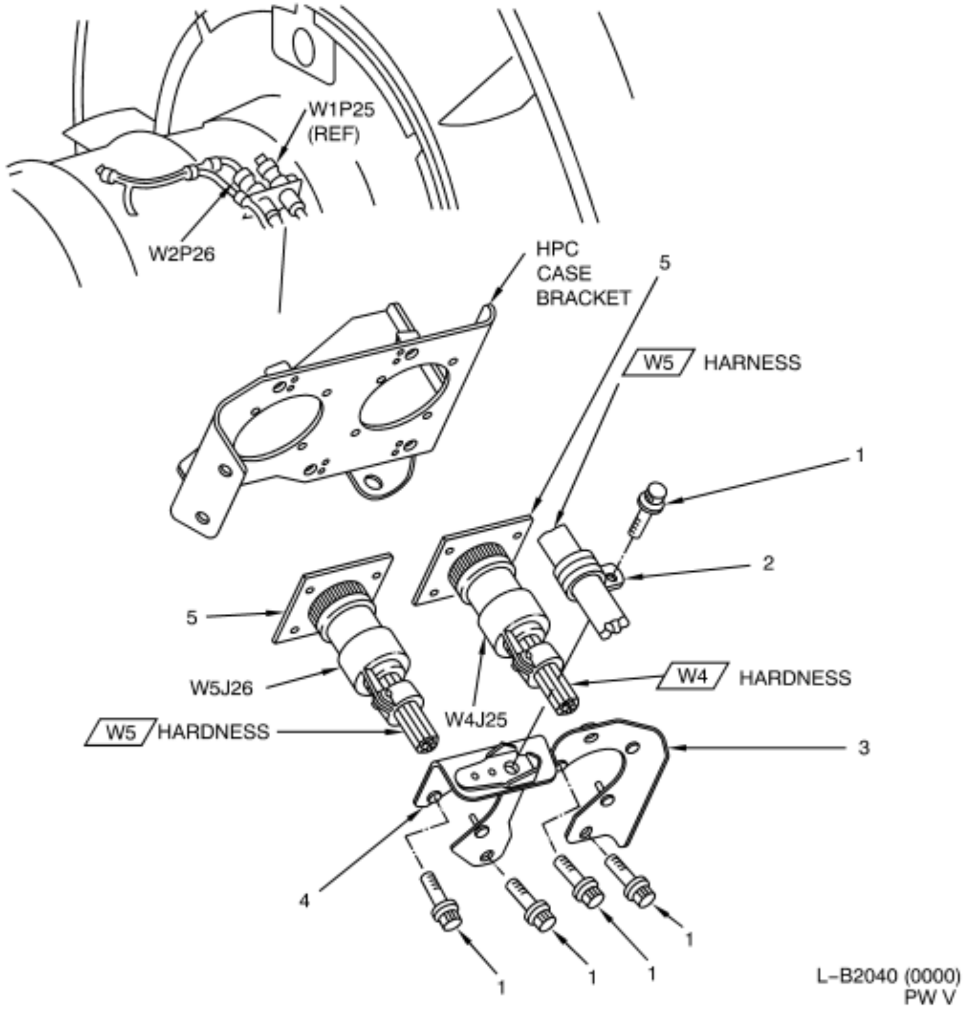

W5 HARNESS
W4 HARNESS
HARNESS SUPPORT BRACKET (LOWER)
BOLT (TYPICAL)
BOLT (HEX HEAD)
NUT
FWD
L-A5755 (0000)
PW V

R EEC Wiring Harness Removal (Pre SB PW4ENG 73-140)
R (Necessary Only For Removal Of HPC Top Front Case)
R Figure 303 (Sheet 8)
R (Task 72-00-00-020-005-001)

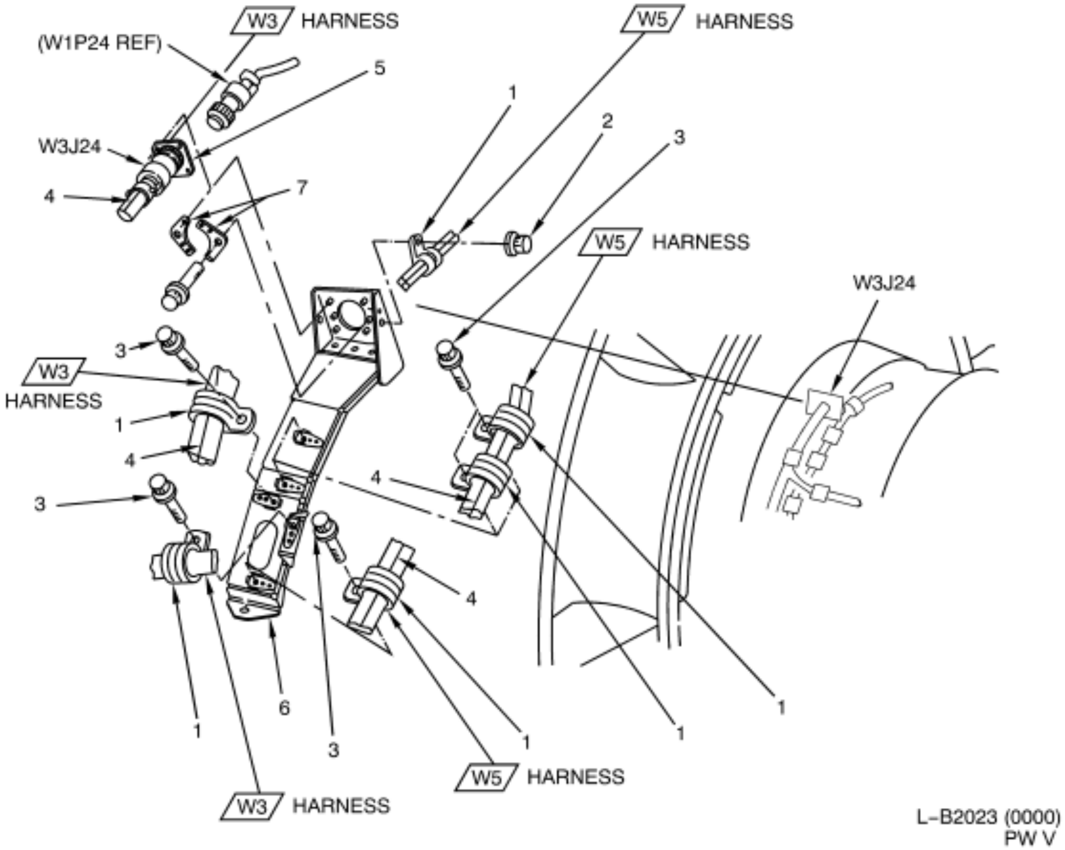

HARNESS SUPPORT BRACKET (UPPER)
TURBINE COOLING VALVE ACTUATOR BRACKET
BRACKET ON COMPRESSOR STATOR CYLINDER SUPPORT
(PRE SB PW4ENG 73-140)
(POST SB PW4ENG 73-140)
RETAINER (TYPICAL)
(PRE SB PW4ENG 73-140)
SUPPORT BRACKET (UPPER)
FUEL/OIL COOLER BRACKET
HPC CASE BRACKET
(POST SB PW4ENG 73-140)
L-A6463 (1095)
PW V

R EEC Wiring Harness Removal (Necessary
R Only For Removal Of HPC Top Front Case)
R Figure 303 (Sheet 9)
R (Task 72-00-00-020-005-001)


W1P25
(REF)
W2P26
HPC
CASE
BRACKET
5
W5 HARNESS
1
2
5
W5J26
W5 HARDNESS
W4J25
W4 HARDNESS
3
4
1
1
1
1
L-B2040 (0000)
PW V

R 1. Bolt
R 2. Clamp
R 3. Bracket
R 4. Bracket
R 5. Installed With Master Keyway Inboard

R EEC Wiring Harness Installation (Post
R SB PW4ENG 73-140 Or SB PW4ENG 72-504)
R Figure 303 (Sheet 10)
R (Task 72-00-00-020-005-001)


W3 HARNESS
(W1P24 REF)
5
W3J24
4
7
W5 HARNESS
1
2
3
W5 HARNESS
W3J24
3
W3 HARNESS
1
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3
4
4
6
1
3
1
1
1
W5 HARNESS
W3 HARNESS
L-B2023 (0000)
PW V

R 1. Clamp
R 2. Nut
R 3. Bolt
R 4. Tracer Cord Outboard. Tracer Cord Ends At First Breakout
R 5. Installed With Master Keyway Inboard
R 6. Upper Support Bracket
R 7. Retainers

R EEC Wiring Harness Installation (Post SB PW4ENG 73-140 Or SB PW4ENG 72-504)
R Figure 303 (Sheet 11)
R (Task 72-00-00-020-005-001)

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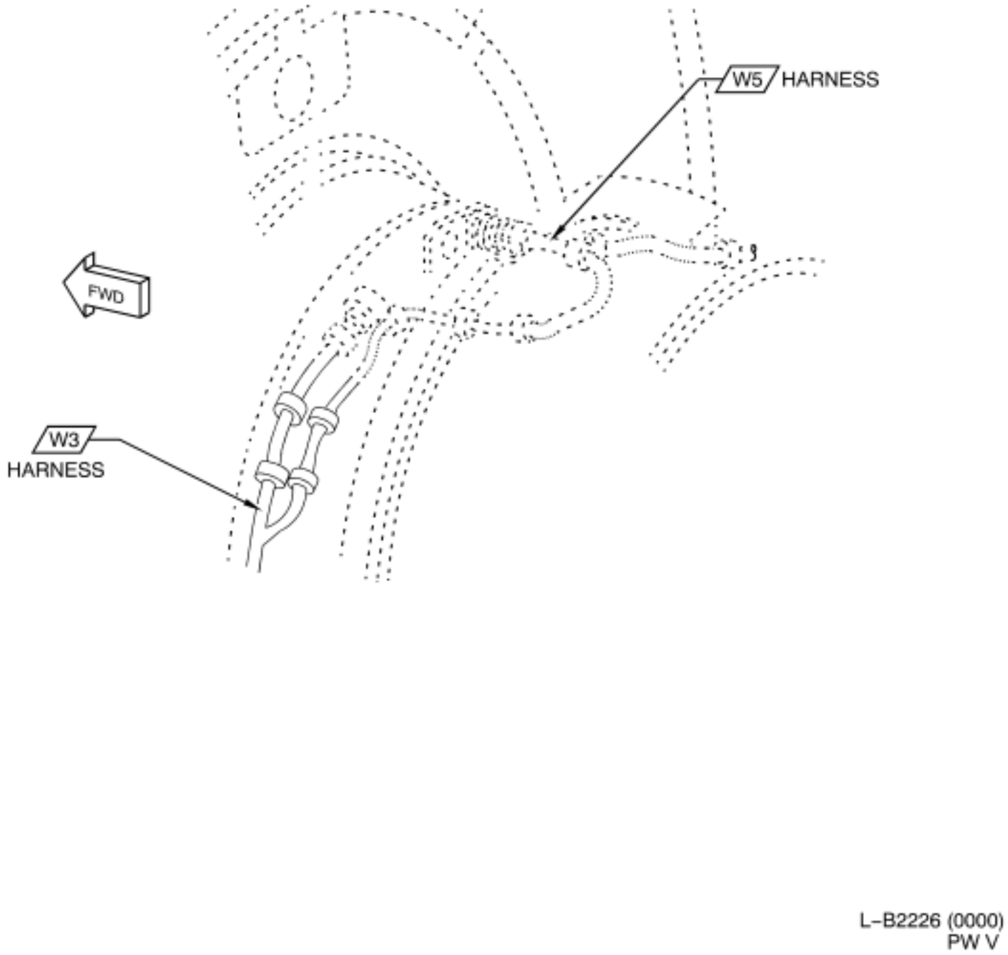
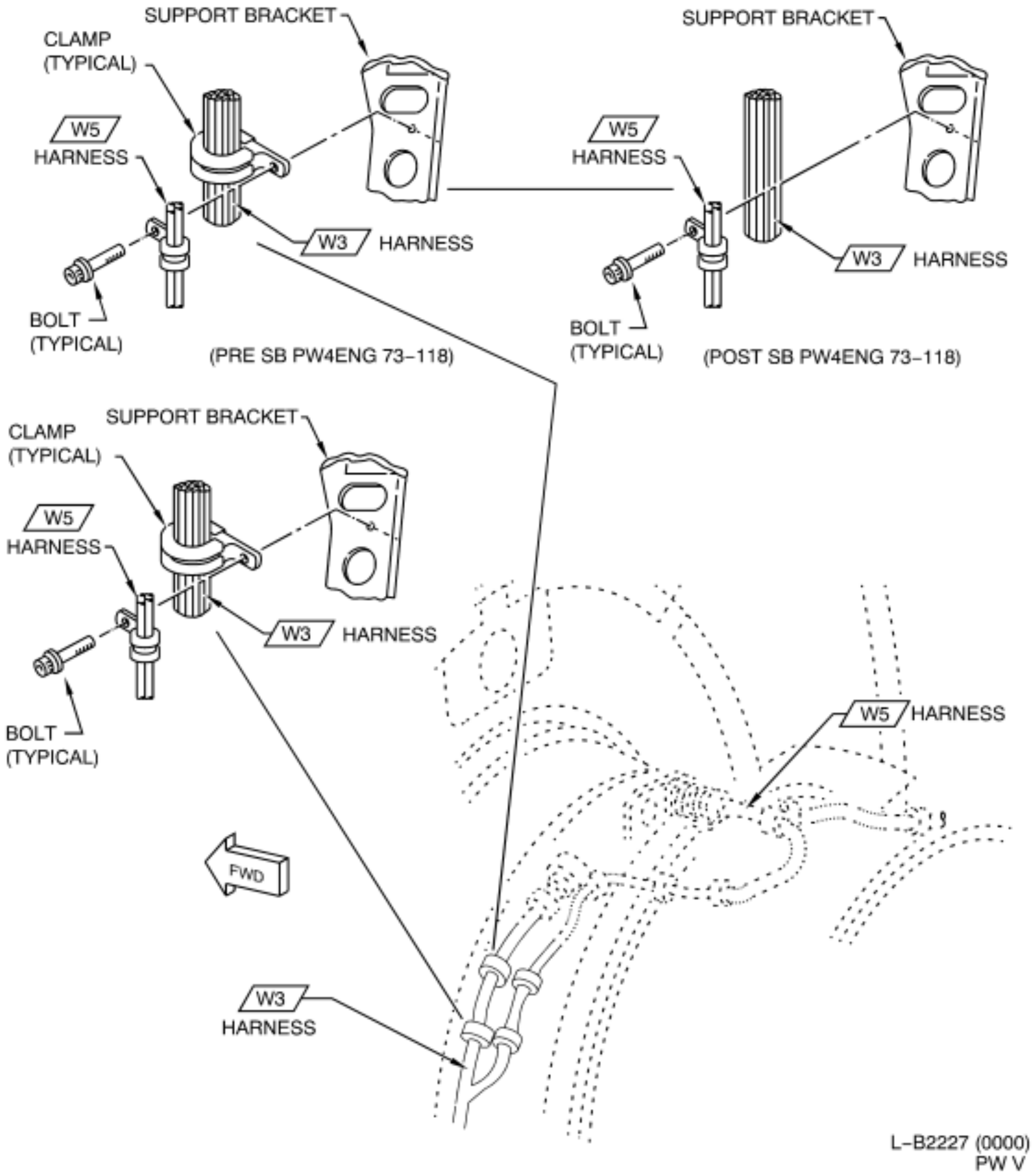
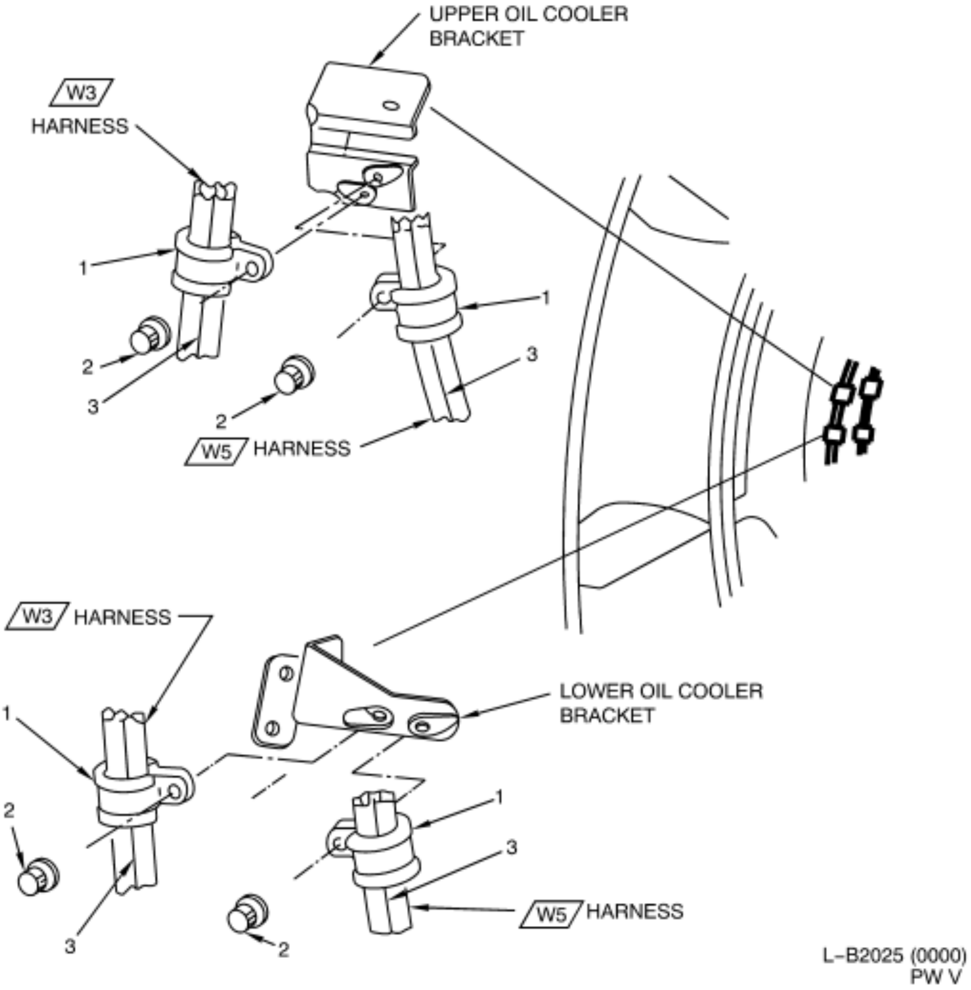

W5 HARNESS
FWD
W3 HARNESS
L-B2226 (0000)
PW V

R EEC Wiring Harness Installation (Post
R SB PW4ENG 73-140 Or SB PW4ENG 72-504)
R Figure 303 (Sheet 12)
R (Task 72-00-00-020-005-001)

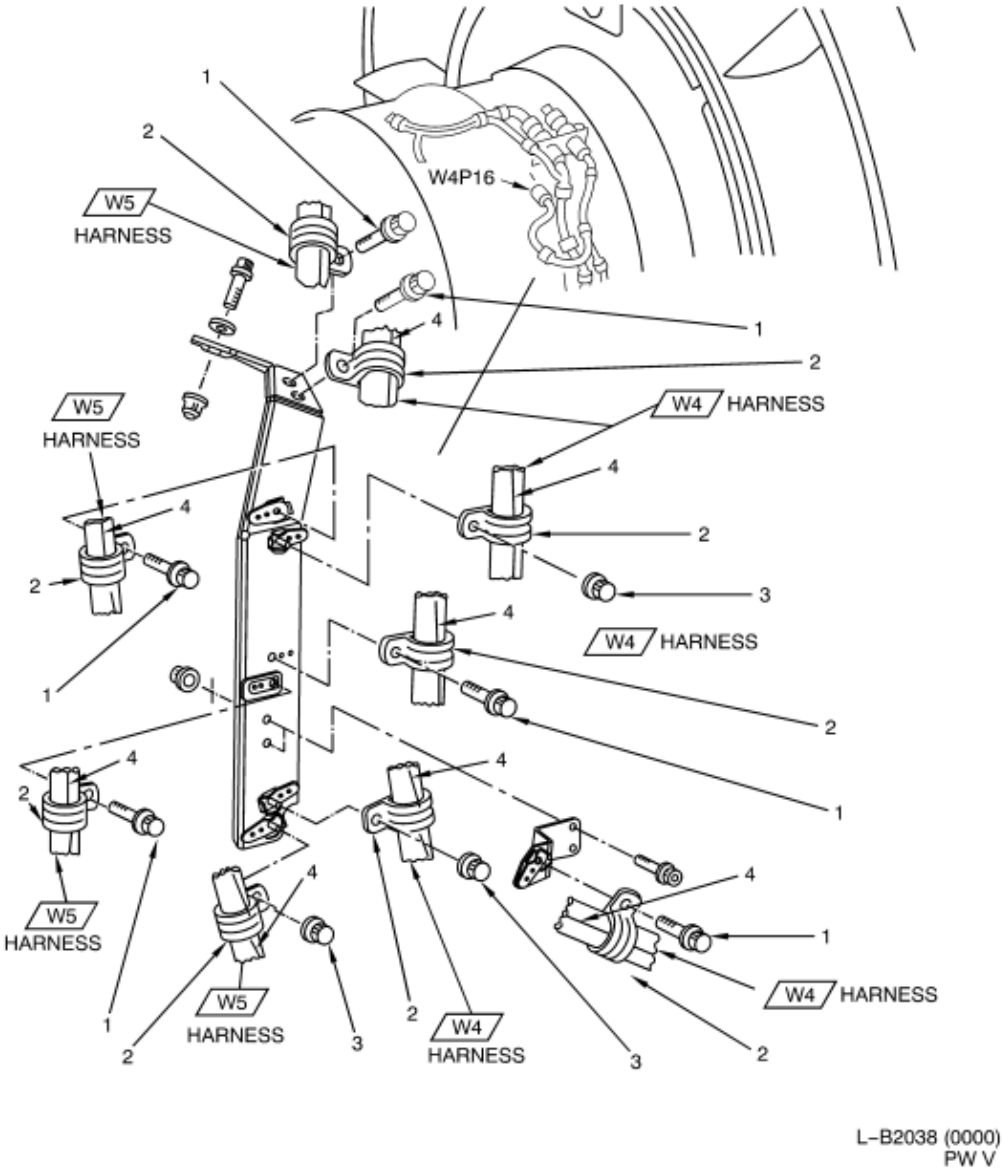

SUPPORT BRACKET
CLAMP (TYPICAL)
W5 HARNESS
W3 HARNESS
BOLT (TYPICAL)
(PRE SB PW4ENG 73-118)
SUPPORT BRACKET
W5 HARNESS
W3 HARNESS
BOLT (TYPICAL)
(POST SB PW4ENG 73-118)
SUPPORT BRACKET
CLAMP (TYPICAL)
W5 HARNESS
W3 HARNESS
BOLT (TYPICAL)
FWD
W5 HARNESS
W3 HARNESS
L-B2227 (0000)
PW V

R EEC Wiring Harness Installation (Post
R SB PW4ENG 73-140 Or SB PW4ENG 72-504)
R Figure 303 (Sheet 13)
R (Task 72-00-00-020-005-001)


UPPER OIL COOLER BRACKET
W3 HARNESS
1
2
3
W5 HARNESS
W3 HARNESS
LOWER OIL COOLER BRACKET
L-B2025 (0000)
PW V

R 1. Clamp
R 2. Nut
R 3. Tracer Cord Outbound (Where Applicable)

R EEC Wiring Harness Installation (Post
R SB PW4ENG 73-140 Or SB PW4ENG 72-504)
R Figure 303 (Sheet 14)
R (Task 72-00-00-020-005-001)


1
2
W5 HARNESS
W4P16
4
1
2
W5 HARNESS
W4 HARNESS
4
2
4
2
1
3
4
W4 HARNESS
2
1
4
4
2
1
4
W5 HARNESS
4
1
W4 HARNESS
1
2
W5 HARNESS
3
2
W4 HARNESS
3
2
L-B2038 (0000)
PW V

R EEC Wiring Harness Installation (Post
R SB PW4ENG 73-140 Or SB PW4ENG 72-504)
R Figure 303 (Sheet 15)
R (Task 72-00-00-020-005-001)

R ENGINE GENERAL - SPECIAL PROCEDURES-25

R 1. Bolt
R 2. Clamp
R 3. Nut
R 4. Tracer Cord Is Outboard

R Key to Figure 303 (Sheet 15)

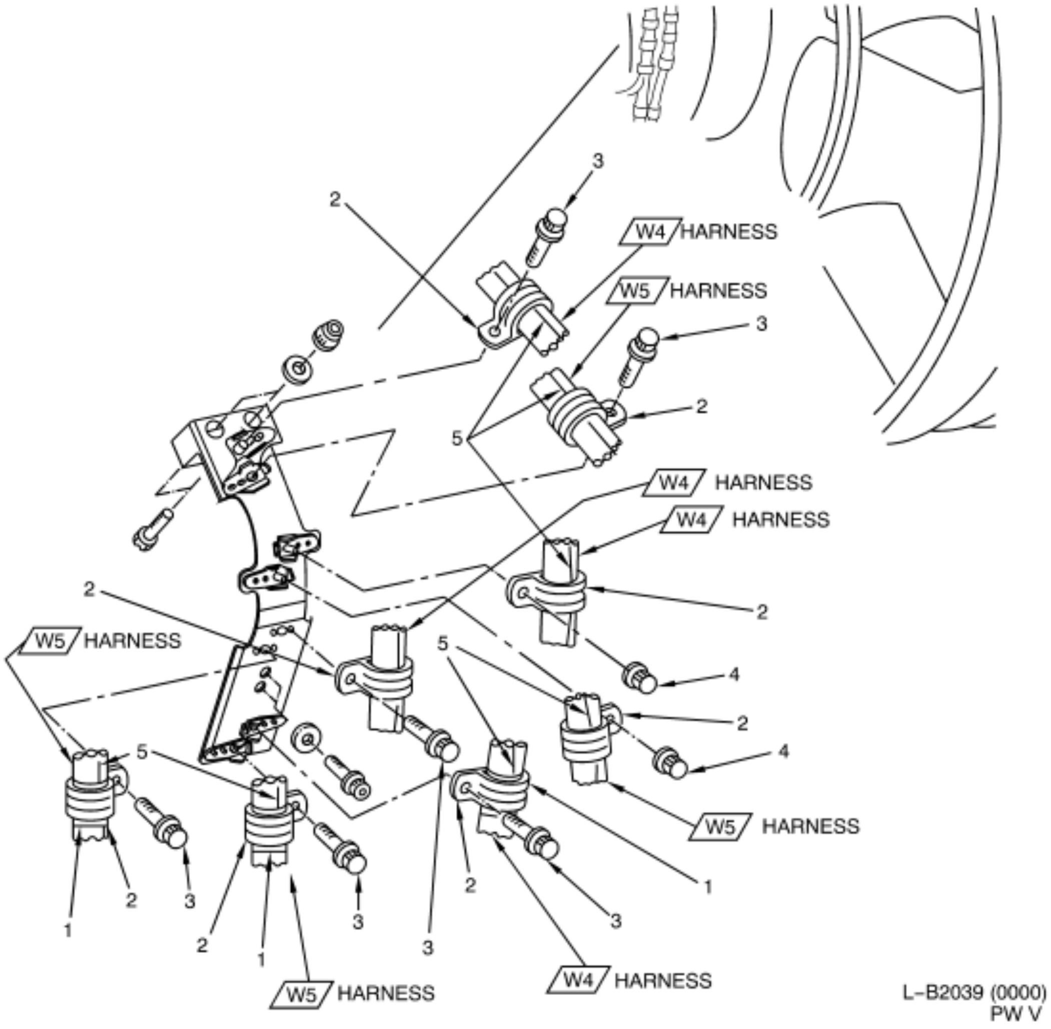
R (7) Install compressor inlet cone by Installation-02 (Task 72-00-31-420-001, Section 72-00-31).

R (8) Install the electronic engine control (EEC) speed transducer (N1) by Installation-03 (Task 72-00-34-420-002, Section 72-00-34).

R (9) If the quick HPC blade change procedure was used to replace the 5th, 6th, 7th, and/or 8th stage blades, test the engine by the Test reference table. Refer to Testing-00 (Task 71-00-00-990-003, Section 71-00-00).

R (10) If the variable stator vane control system was removed or disturbed, rig the system. Refer to Special Procedures-05 (Task 72-00-00-830-003-A00 or Task 72-00-00-830-003-B00).

R (11) If the turbine case cooling (TCC) air valve actuator was removed or disturbed, rig the actuator. Refer to Special Procedures-06 (Task 72-00-00-830-004).


3
2
W4 HARNESS
W5 HARNESS
3
5
2
W4 HARNESS
W4 HARNESS
2
2
W5 HARNESS
5
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W5 HARNESS
1
1
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3
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1
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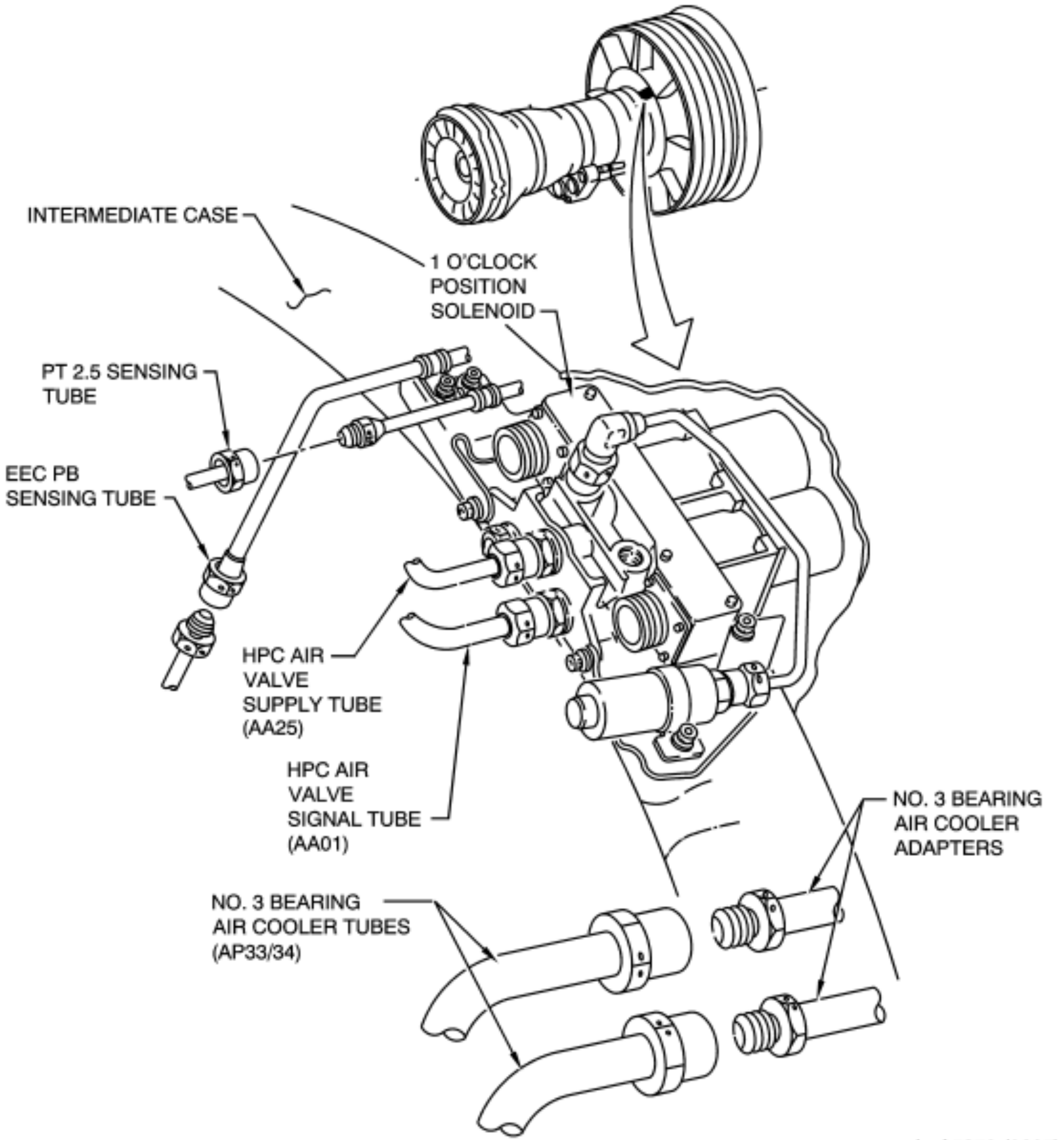
3
2
3
W4 HARNESS
W5 HARNESS
L-B2039 (0000)
PW V

R EEC Wiring Harness Installation (Post
R SB PW4ENG 73-140 Or SB PW4ENG 72-504)
R Figure 303 (Sheet 16)
R (Task 72-00-00-020-005-001)

R ENGINE GENERAL - SPECIAL PROCEDURES-25

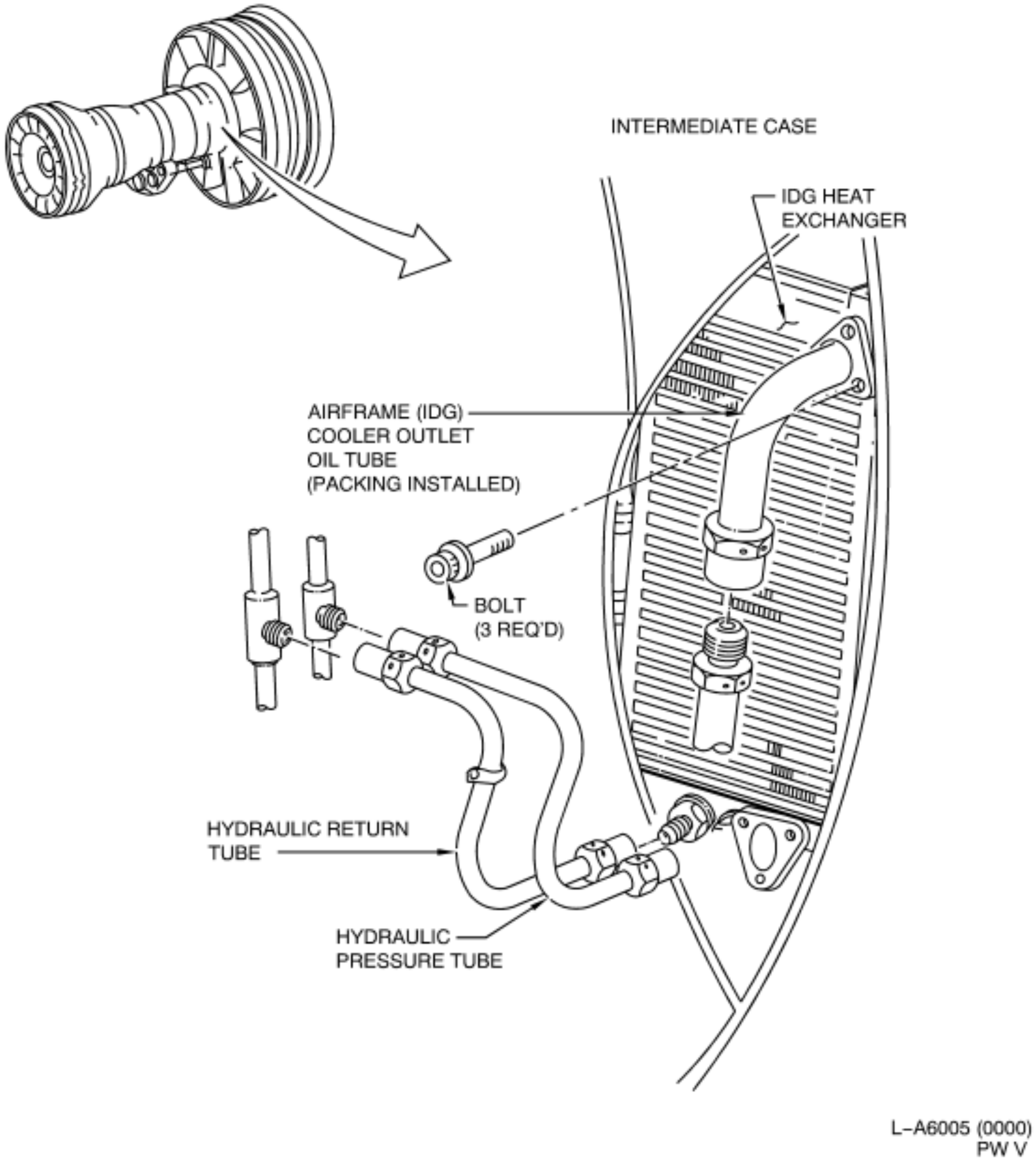
R 1. These Clamps Were Installed First. You Should Be Able To See The Marker On Both Sides.
R 2. Clamp
R 3. Bolt
R 4. Nut
R 5. Tracer Cord Is Outboard

R Key to Figure 303 (Sheet 16)

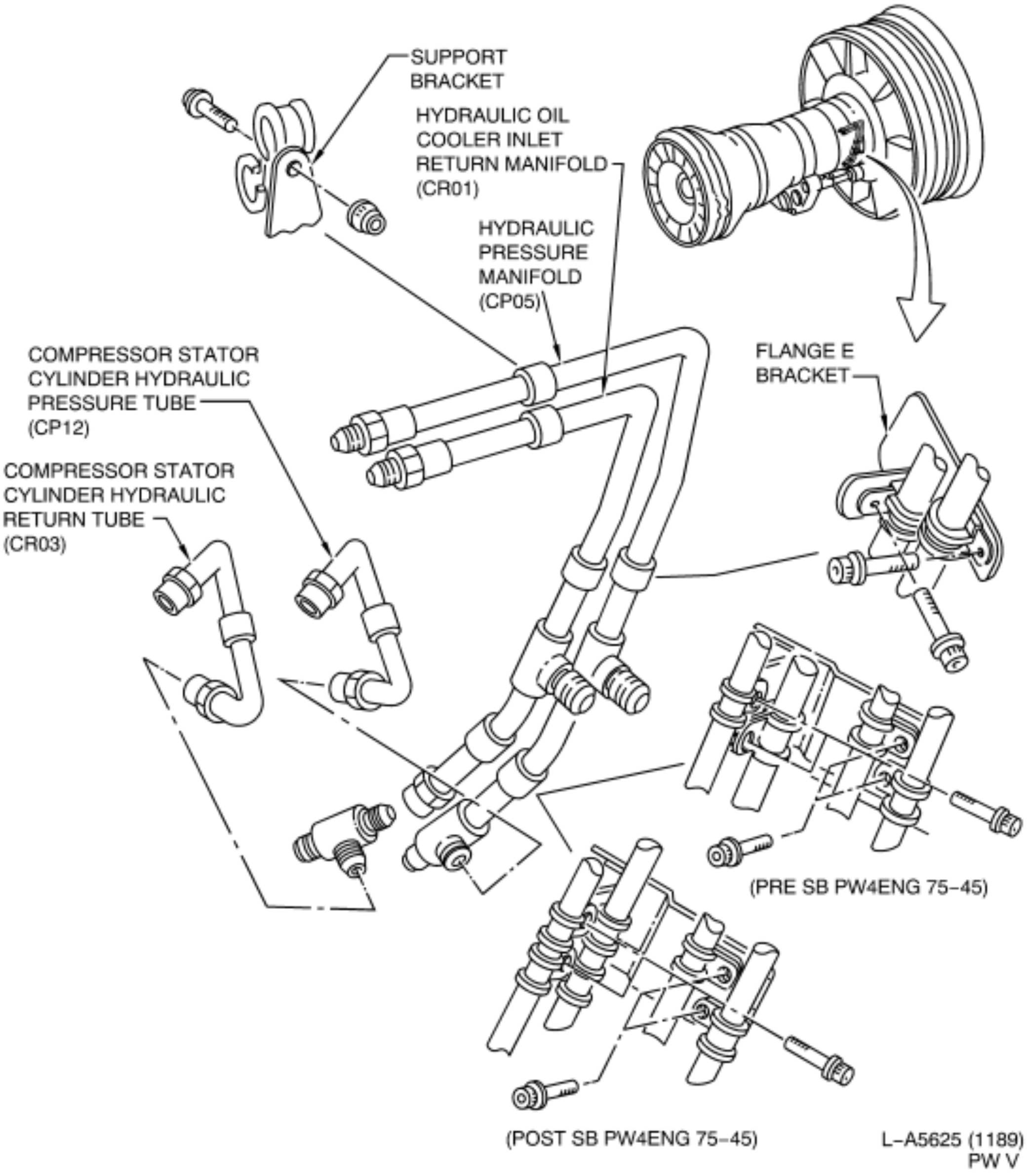

INTERMEDIATE CASE
1 O'CLOCK POSITION SOLENOID
PT 2.5 SENSING TUBE
EEC PB SENSING TUBE
HPC AIR VALVE SUPPLY TUBE (AA25)
HPC AIR VALVE SIGNAL TUBE (AA01)
NO. 3 BEARING AIR COOLER ADAPTERS
NO. 3 BEARING AIR COOLER TUBES (AP33/34)
L-A5379 (0605)
PW V

R Engine Tube Disconnects And Removals
R Figure 304 (Sheet 1)
R (Task 72-00-00-020-005-001)

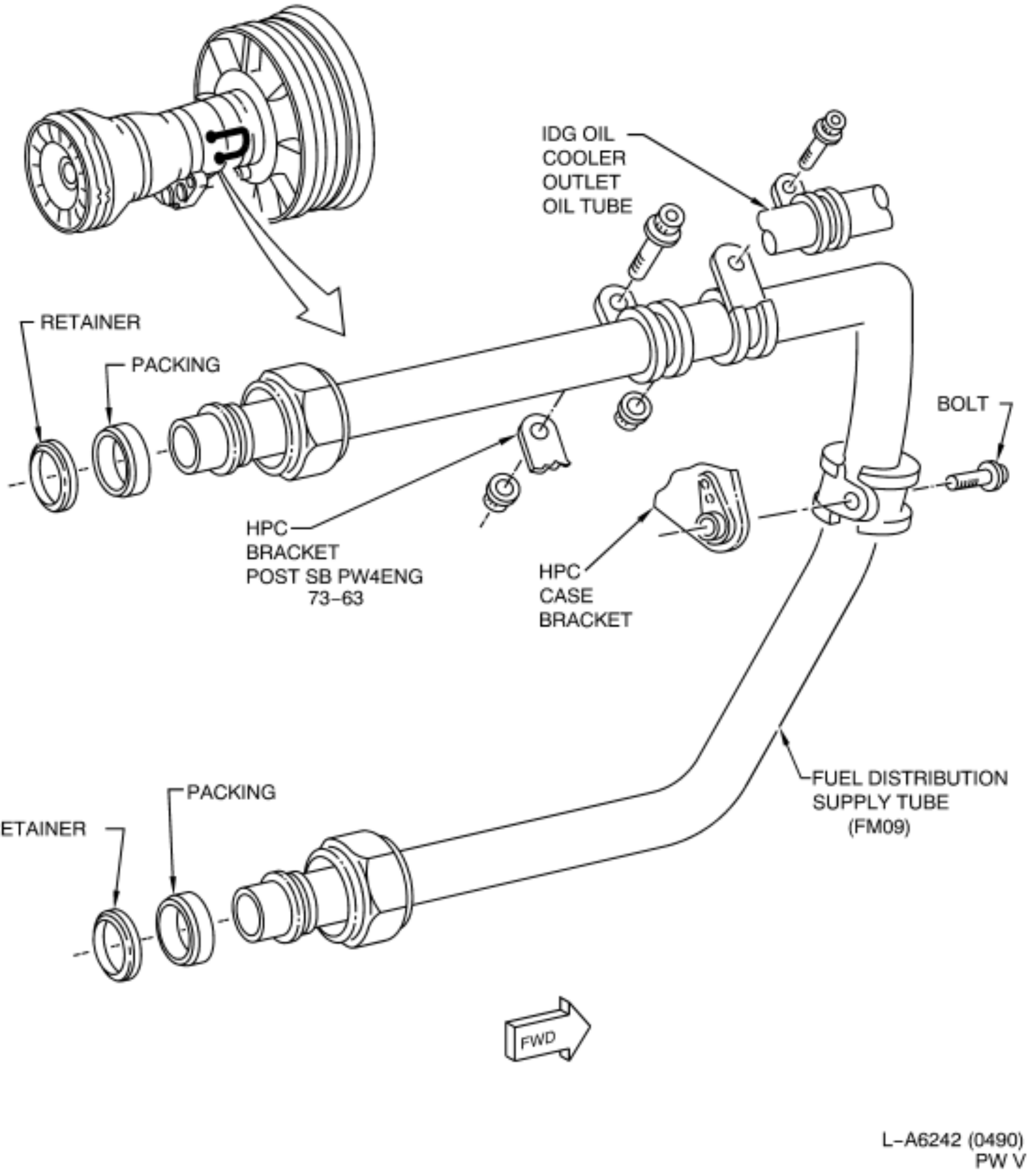
R ENGINE GENERAL - SPECIAL PROCEDURES-25


INTERMEDIATE CASE
IDG HEAT EXCHANGER
AIRFRAME (IDG) COOLER OUTLET OIL TUBE (PACKING INSTALLED)
BOLT (3 REQ'D)
HYDRAULIC RETURN TUBE
HYDRAULIC PRESSURE TUBE
L-A6005 (0000)
PW V

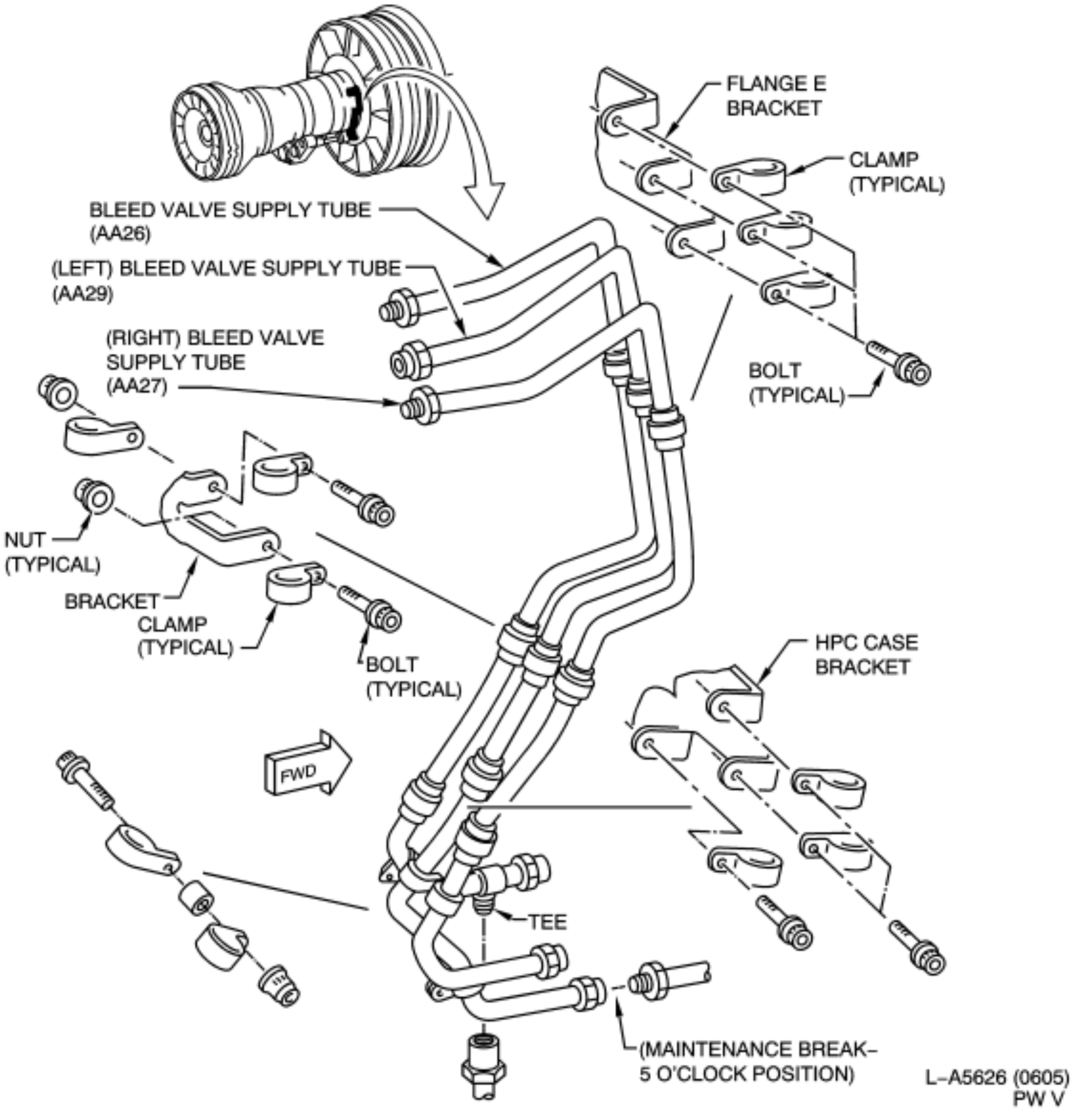
R Engine Tube Disconnects And Removals
R Figure 304 (Sheet 2)
R (Task 72-00-00-020-005-001)


SUPPORT BRACKET
HYDRAULIC OIL COOLER INLET RETURN MANIFOLD (CR01)
HYDRAULIC PRESSURE MANIFOLD (CP05)
COMPRESSOR STATOR CYLINDER HYDRAULIC PRESSURE TUBE (CP12)
COMPRESSOR STATOR CYLINDER HYDRAULIC RETURN TUBE (CR03)
FLANGE E BRACKET
(PRE SB PW4ENG 75-45)
(POST SB PW4ENG 75-45)
L-A5625 (1189)
PW V

R Engine Tube Disconnects And Removals
R Figure 304 (Sheet 3)
R (Task 72-00-00-020-005-001)


IDG OIL COOLER OUTLET OIL TUBE
RETAINER
PACKING
BOLT
HPC BRACKET POST SB PW4ENG 73−63
HPC CASE BRACKET
PACKING
RETAINER
FUEL DISTRIBUTION SUPPLY TUBE (FM09)
FWD
L−A6242 (0490)
PW V

R Engine Tube Disconnects And Removals
R Figure 304 (Sheet 4)
R (Task 72−00−00−020−005−001)


FLANGE E BRACKET
CLAMP (TYPICAL)
BLEED VALVE SUPPLY TUBE (AA26)
(LEFT) BLEED VALVE SUPPLY TUBE (AA29)
(RIGHT) BLEED VALVE SUPPLY TUBE (AA27)
BOLT (TYPICAL)
NUT (TYPICAL)
BRACKET
CLAMP (TYPICAL)
BOLT (TYPICAL)
HPC CASE BRACKET
FWD
TEE
(MAINTENANCE BREAK-5 O'CLOCK POSITION)
L-A5626 (0605)
PW V

R Engine Tube Disconnects And Removals
R Figure 304 (Sheet 5)
R (Task 72-00-00-020-005-001)

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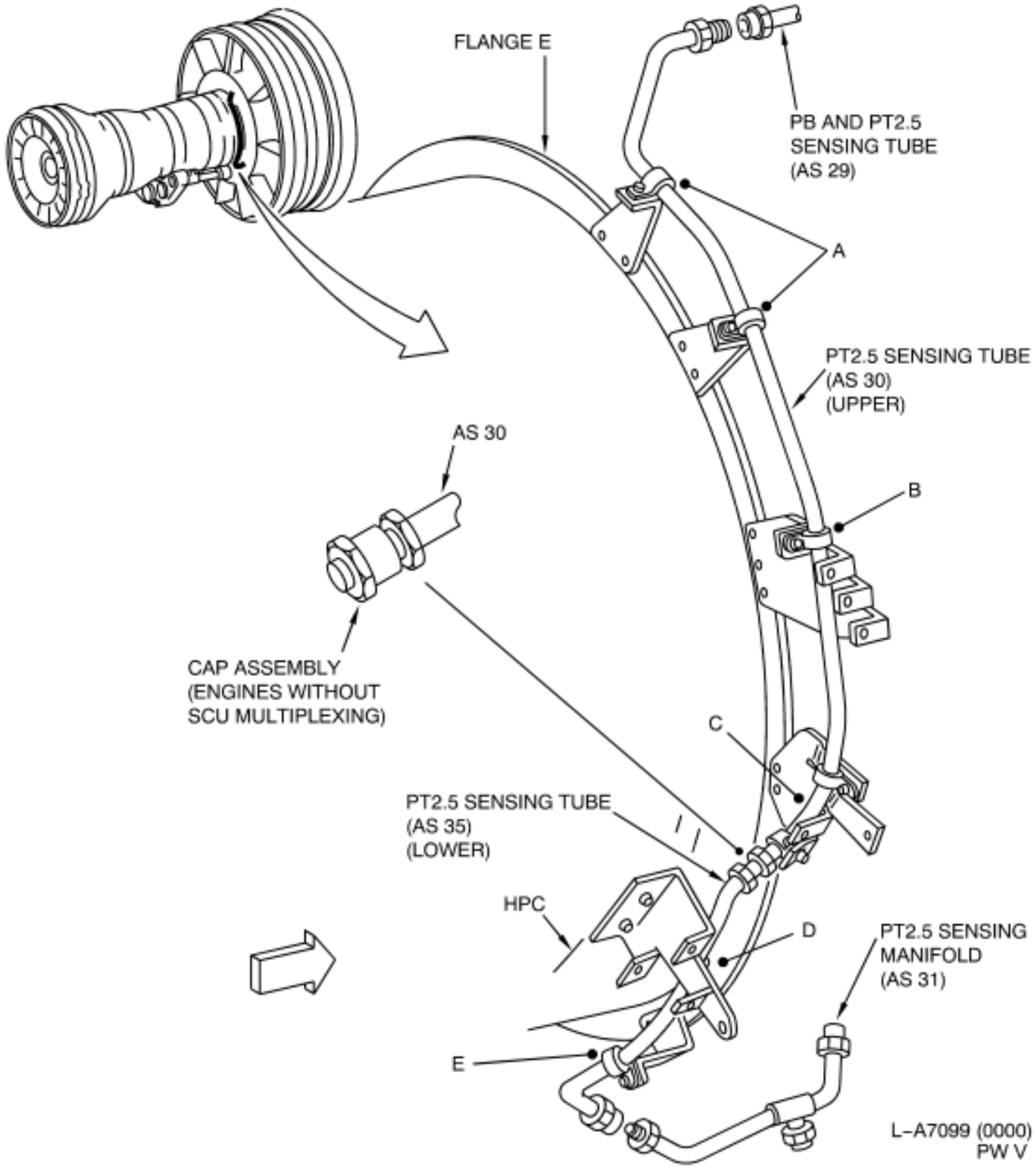
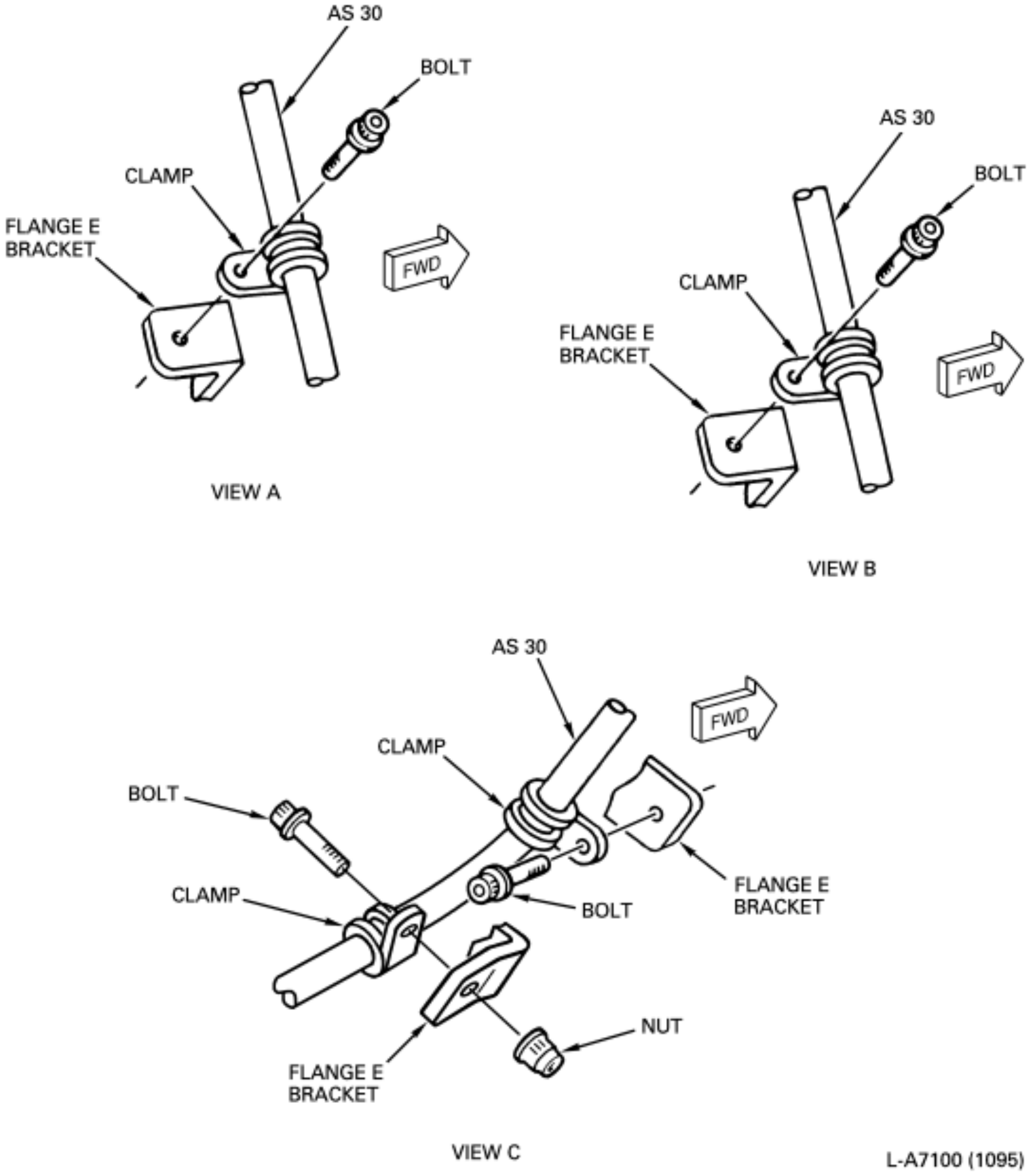

FLANGE E
PB AND PT2.5 SENSING TUBE (AS 29)
A
PT2.5 SENSING TUBE (AS 30) (UPPER)
AS 30
B
CAP ASSEMBLY (ENGINES WITHOUT SCU MULTIPLEXING)
C
PT2.5 SENSING TUBE (AS 35) (LOWER)
HPC
D
PT2.5 SENSING MANIFOLD (AS 31)
E
L−A7099 (0000)
PW V

R Engine Tube Disconnects And Removals
R Figure 304 (Sheet 6)
R (Task 72−00−00−020−005−001)


AS 30
BOLT
CLAMP
FLANGE E BRACKET
FWD
VIEW A
AS 30
BOLT
CLAMP
FLANGE E BRACKET
FWD
VIEW B
AS 30
FWD
CLAMP
BOLT
CLAMP
FLANGE E BRACKET
BOLT
FLANGE E BRACKET
NUT
VIEW C
L-A7100 (1095)

R Engine Tube Disconnects And Removals
R Figure 304 (Sheet 7)
R (Task 72-00-00-020-005-001)

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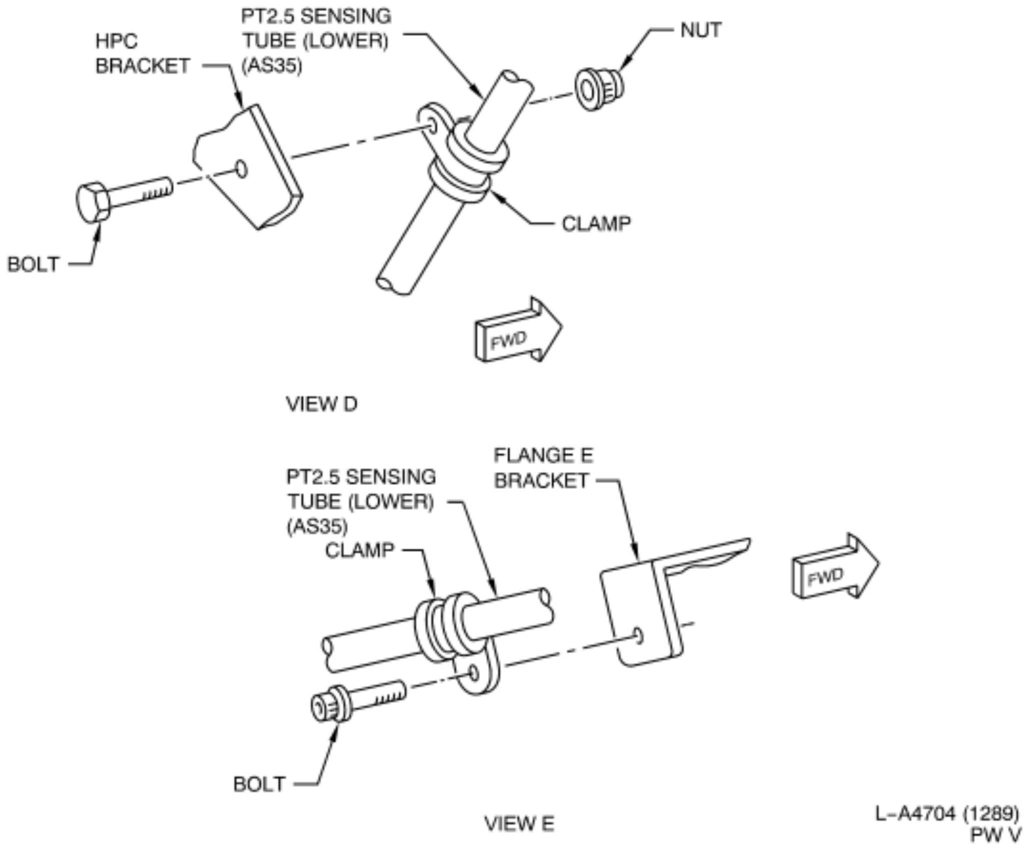
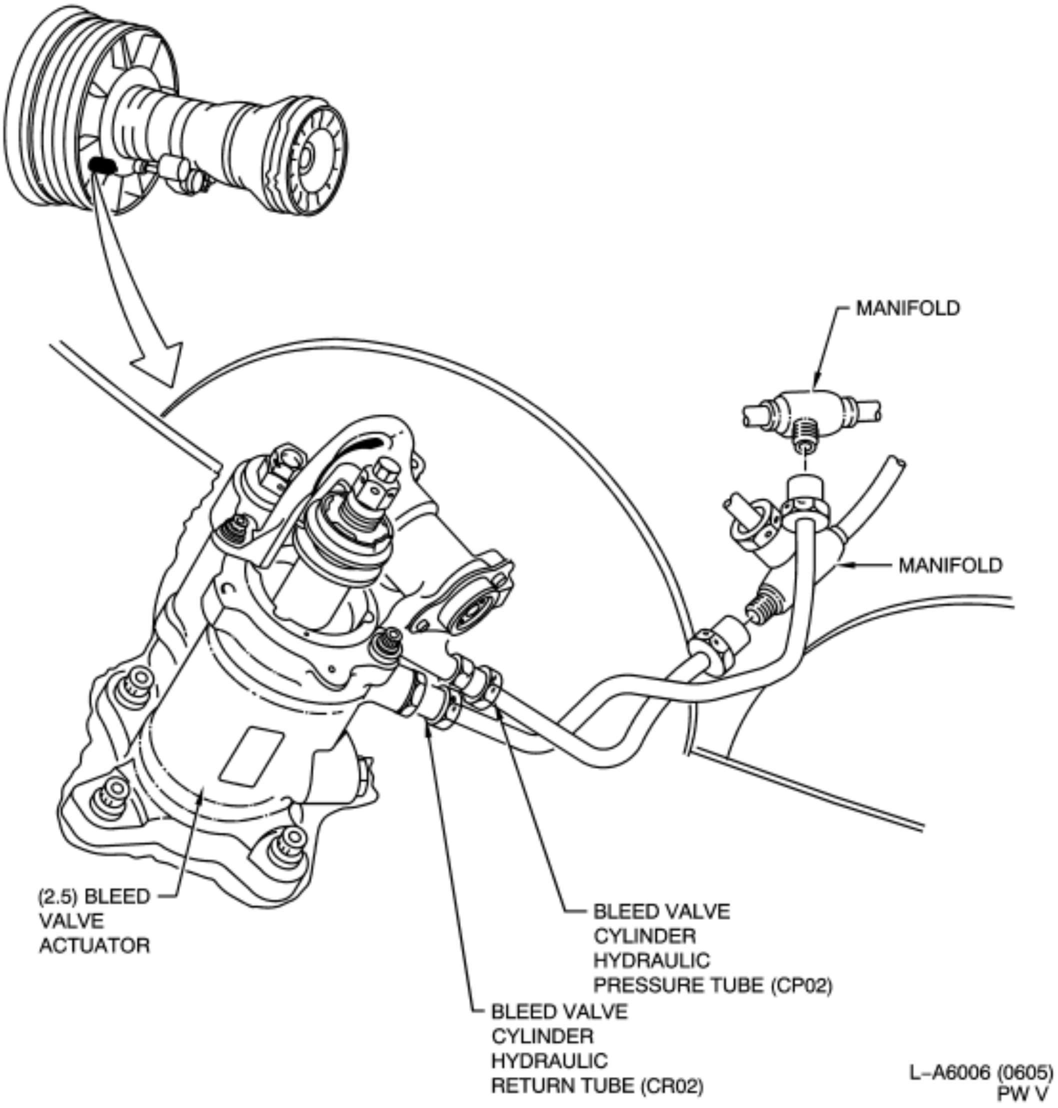

HPC
BRACKET
PT2.5 SENSING
TUBE (LOWER)
(AS35)
NUT
CLAMP
BOLT
FWD
VIEW D
FLANGE E
BRACKET
PT2.5 SENSING
TUBE (LOWER)
(AS35)
CLAMP
FWD
BOLT
VIEW E
L-A4704 (1289)
PW V

R Engine Tube Disconnects And Removals
R Figure 304 (Sheet 8)
R (Task 72-00-00-020-005-001)

R ENGINE GENERAL - SPECIAL PROCEDURES-25


MANIFOLD
MANIFOLD
(2.5) BLEED VALVE ACTUATOR
BLEED VALVE CYLINDER HYDRAULIC PRESSURE TUBE (CP02)
BLEED VALVE CYLINDER HYDRAULIC RETURN TUBE (CR02)
L-A6006 (0605)
PW V

R Engine Tube Disconnects And Removals
R Figure 304 (Sheet 9)
R (Task 72-00-00-020-005-001)

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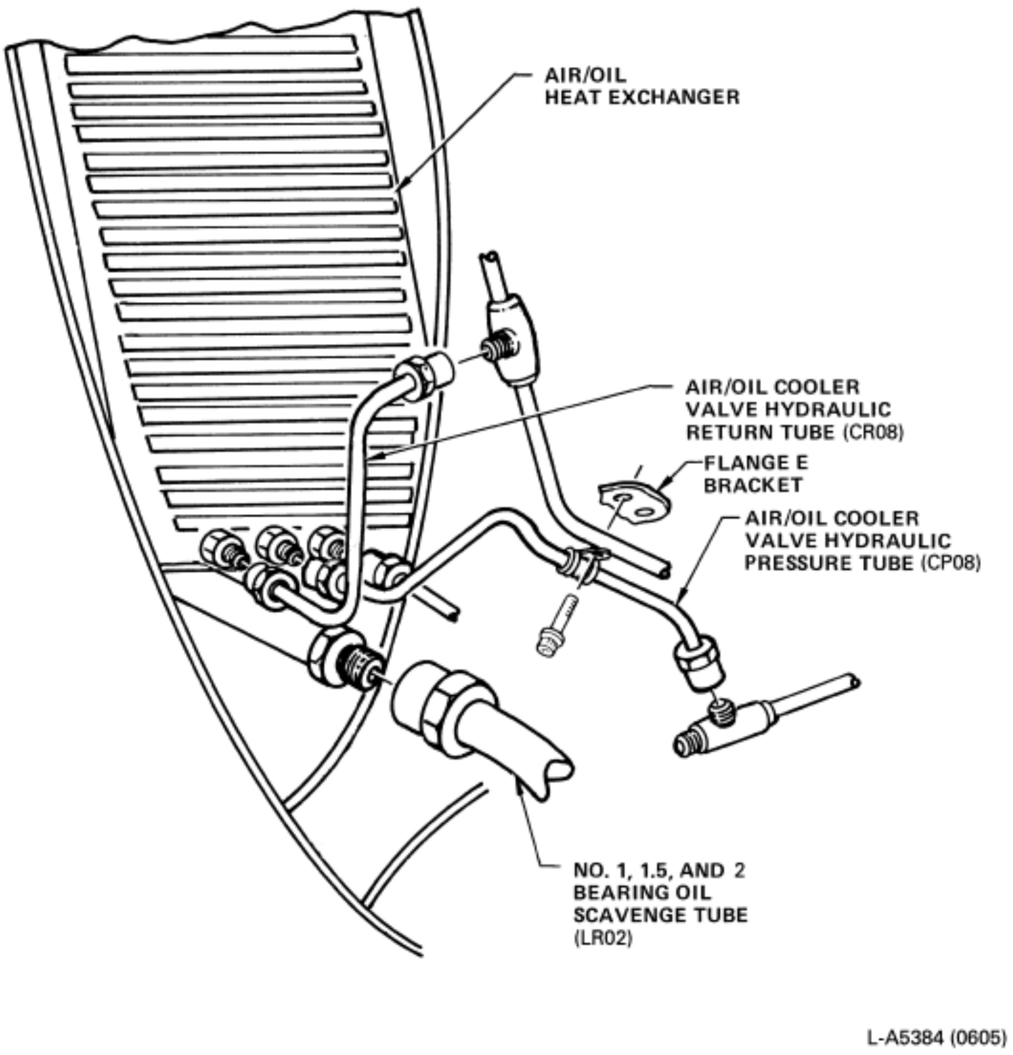
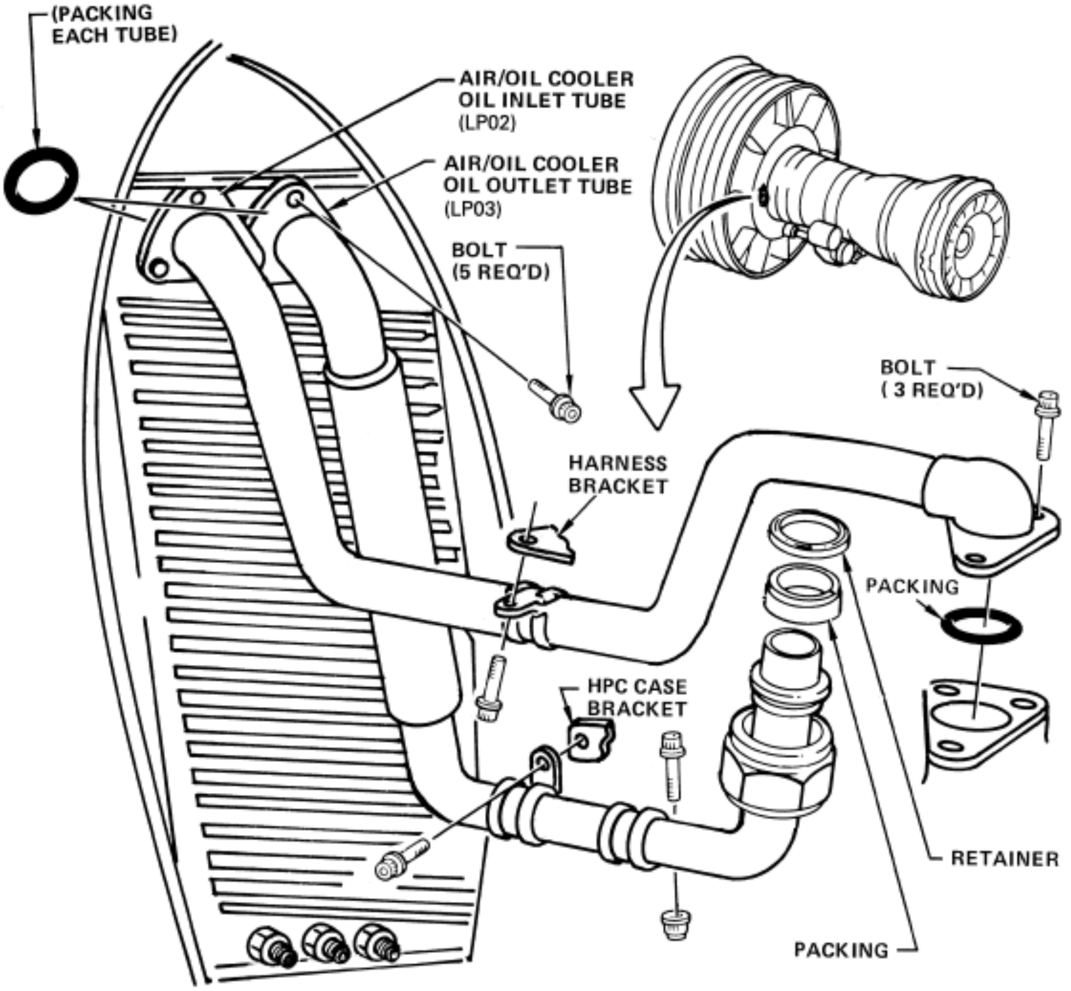

AIR/OIL HEAT EXCHANGER
AIR/OIL COOLER VALVE HYDRAULIC RETURN TUBE (CR08)
FLANGE E BRACKET
AIR/OIL COOLER VALVE HYDRAULIC PRESSURE TUBE (CP08)
NO. 1, 1.5, AND 2 BEARING OIL SCAVENGE TUBE (LR02)
L-A5384 (0605)

R Engine Tube Disconnects And Removals
R Figure 304 (Sheet 10)
R (Task 72-00-00-020-005-001)


(PACKING EACH TUBE)
AIR/OIL COOLER OIL INLET TUBE (LP02)
AIR/OIL COOLER OIL OUTLET TUBE (LP03)
BOLT (5 REQ'D)
BOLT (3 REQ'D)
HARNESS BRACKET
PACKING
HPC CASE BRACKET
RETAINER
PACKING

L-A5629 (0605)

R Engine Tube Disconnects And Removals
R Figure 304 (Sheet 11)
R (Task 72-00-00-020-005-001)

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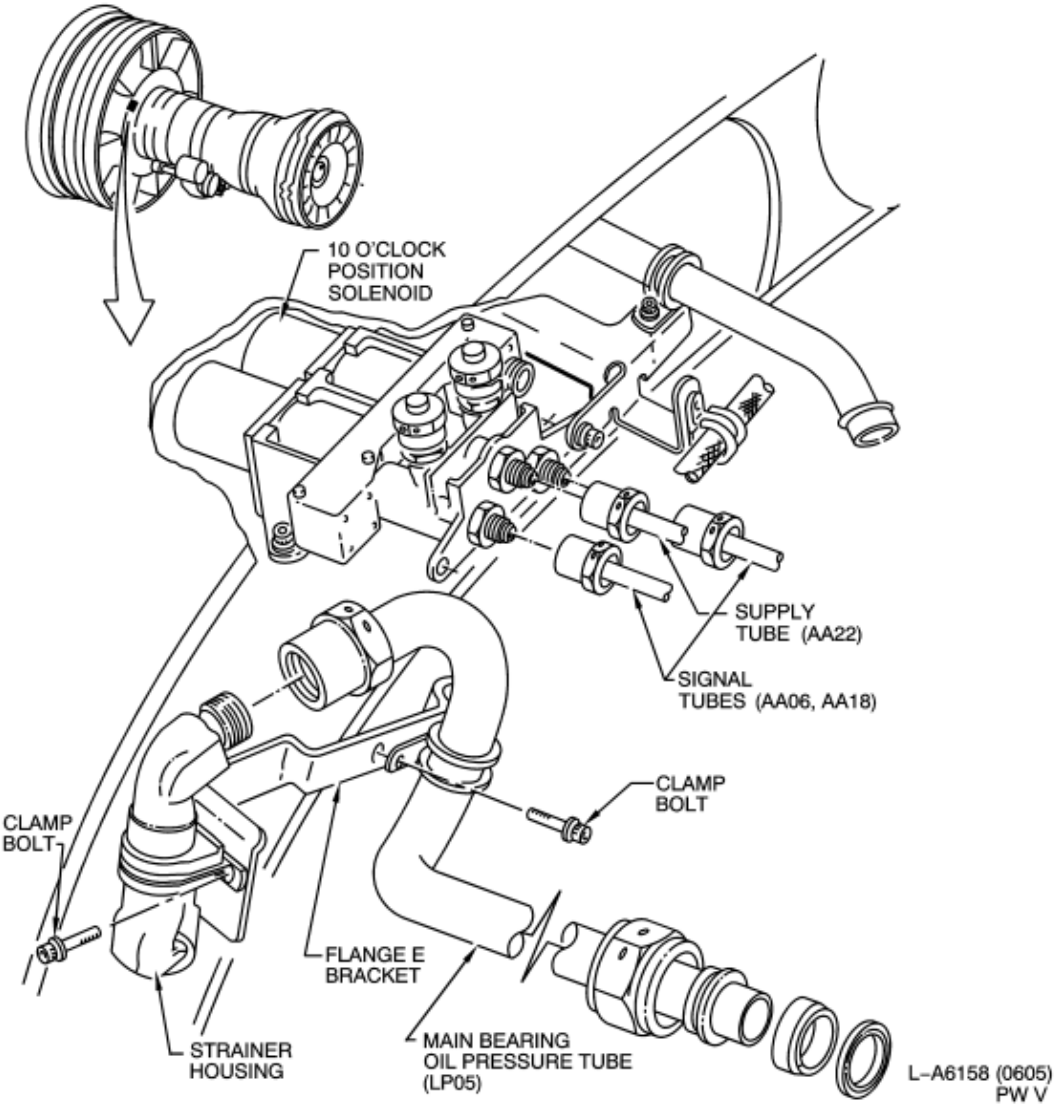
10 O'CLOCK
POSITION
SOLENOID
SUPPLY
TUBE (AA22)
SIGNAL
TUBES (AA06, AA18)
CLAMP
BOLT
CLAMP
BOLT
FLANGE E
BRACKET
STRAINER
HOUSING
MAIN BEARING
OIL PRESSURE TUBE
(LP05)
L-A6158 (0605)
PW V

R Engine Tube Disconnects And Removals
R Figure 304 (Sheet 12)
R (Task 72-00-00-020-005-001)

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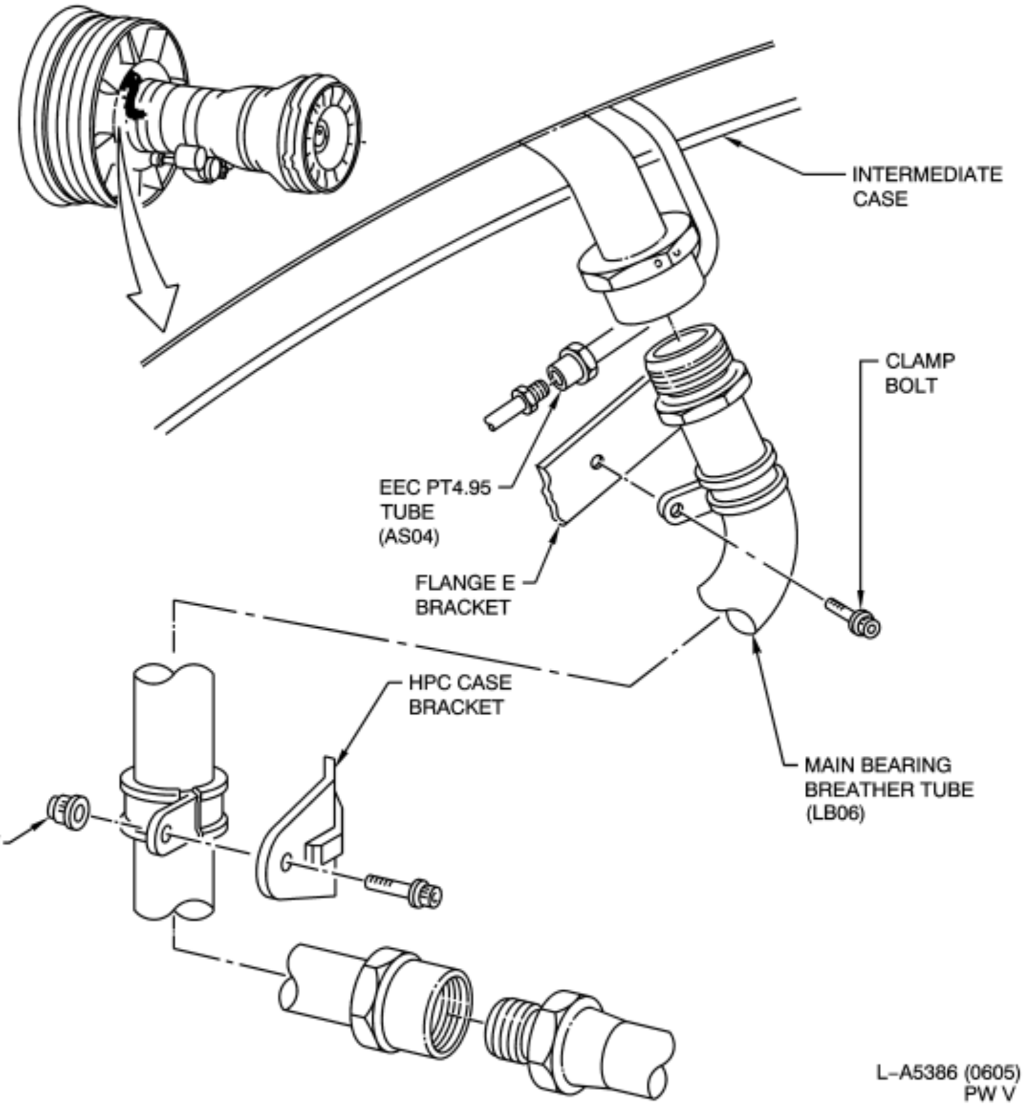
INTERMEDIATE CASE
CLAMP BOLT
EEC PT4.95 TUBE (AS04)
FLANGE E BRACKET
HPC CASE BRACKET
MAIN BEARING BREATHER TUBE (LB06)
NUT
L-A5386 (0605)
PW V

R Engine Tube Disconnects And Removals
R Figure 304 (Sheet 13)
R (Task 72-00-00-020-005-001)

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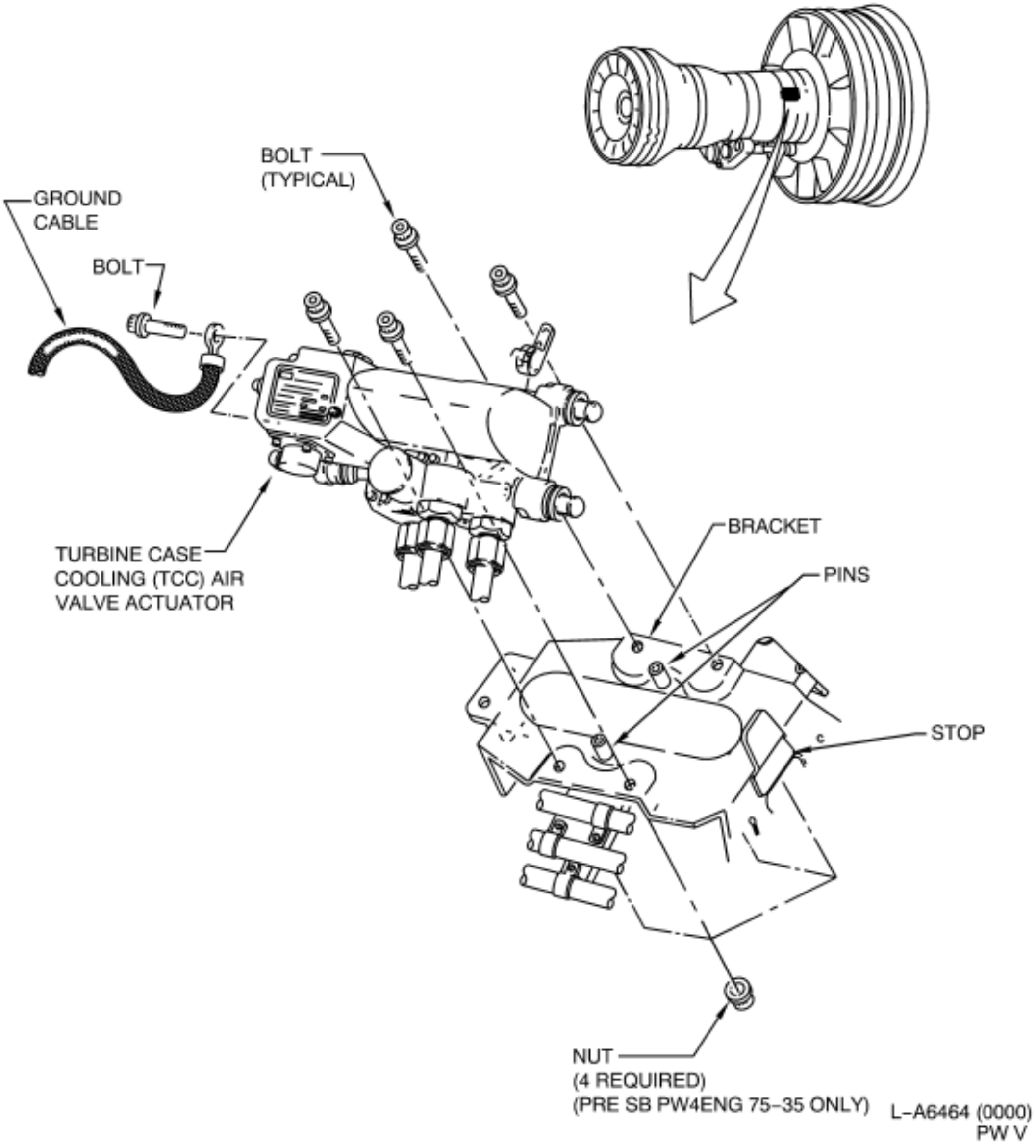
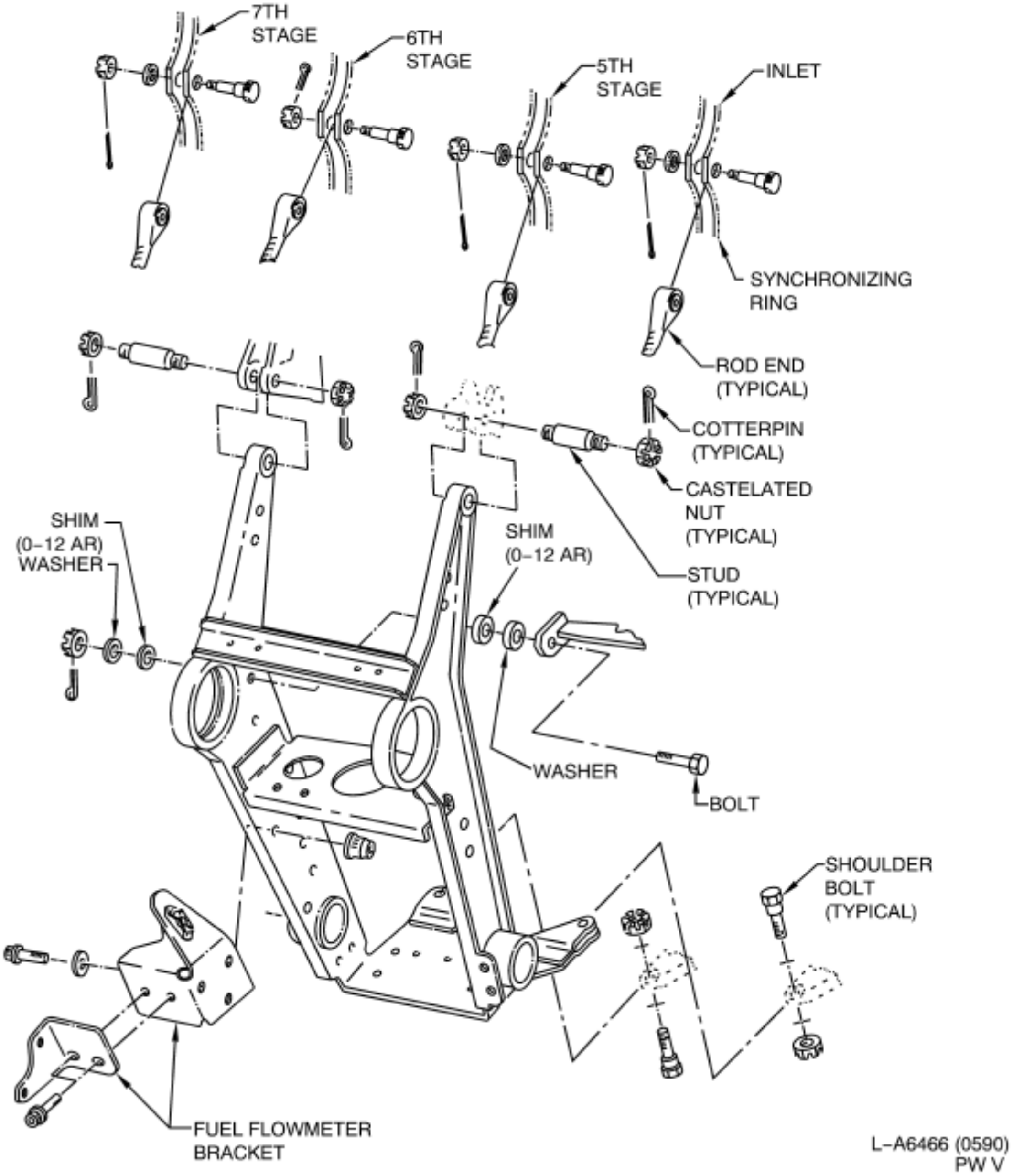
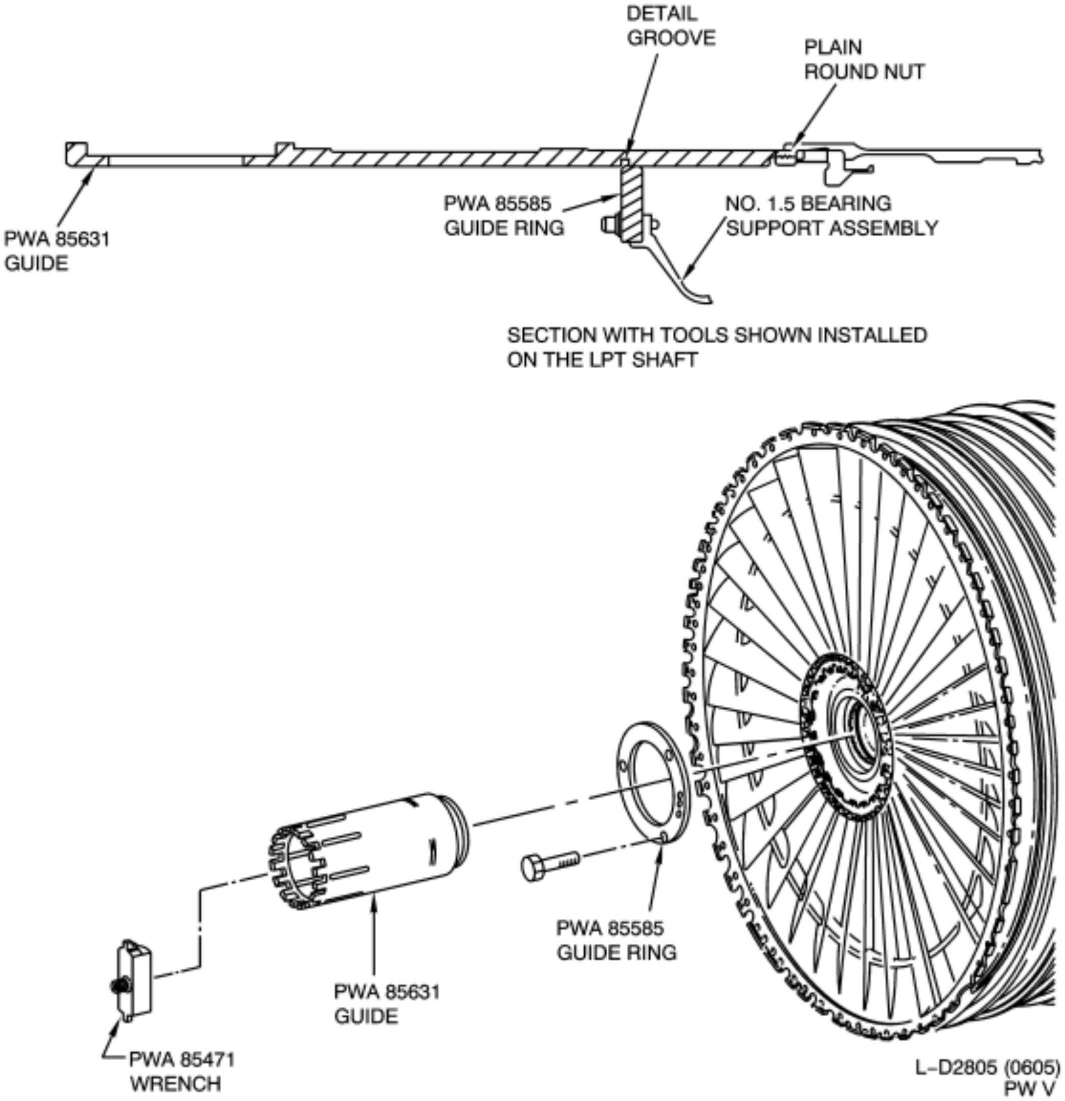

BOLT
(TYPICAL)
GROUND
CABLE
BOLT
TURBINE CASE
COOLING (TCC) AIR
VALVE ACTUATOR
BRACKET
PINS
STOP
NUT
(4 REQUIRED)
(PRE SB PW4ENG 75-35 ONLY)
L-A6464 (0000)
PW V

R Turbine Case Cooling (TCC) Air Valve Actuator Removal
R (Necessary Only For Removal Of HPC Top Front Case)
R Figure 305
R (Task 72-00-00-020-005-001)

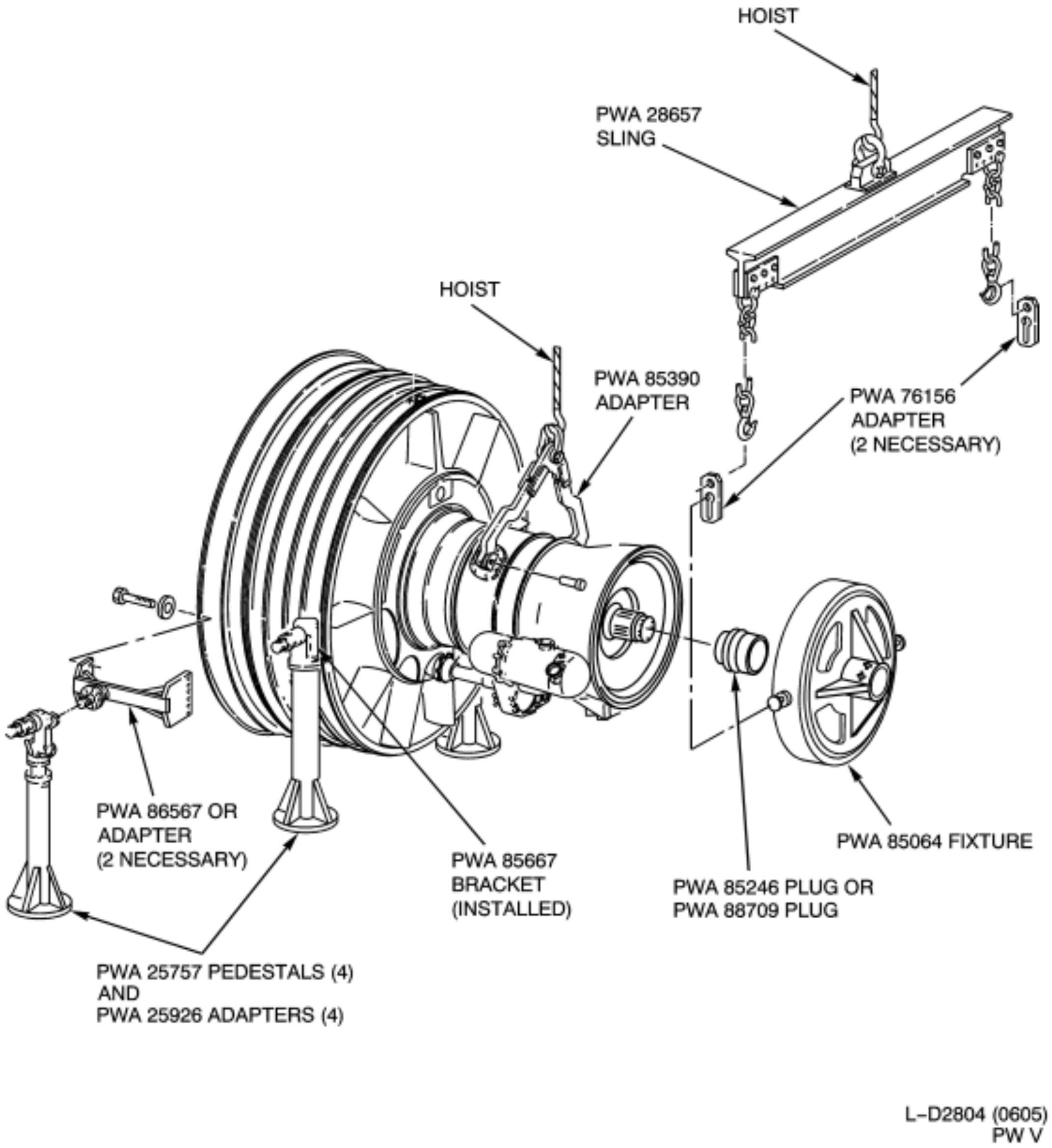
R ENGINE GENERAL - SPECIAL PROCEDURES-25


7TH STAGE
6TH STAGE
5TH STAGE
INLET
SYNCHRONIZING RING
ROD END (TYPICAL)
COTTERPIN (TYPICAL)
CASTELATED NUT (TYPICAL)
STUD (TYPICAL)
SHIM (0-12 AR)
WASHER
SHIM (0-12 AR)
WASHER
BOLT
SHOULDER BOLT (TYPICAL)
FUEL FLOWMETER BRACKET
L-A6466 (0590)
PW V

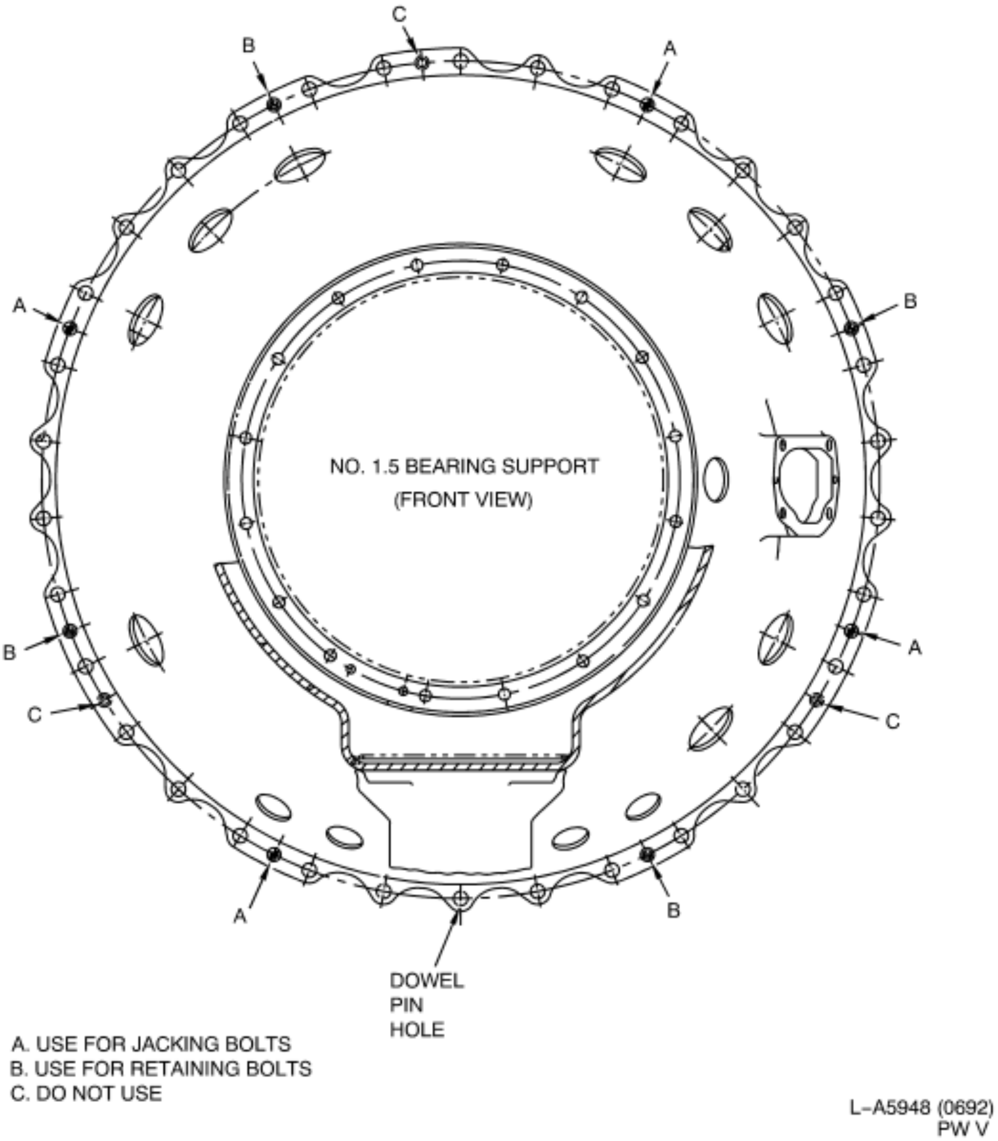
R Stator Vane Actuator And Support Assembly
R (Necessary Only For Removal Of HPC Top Front Case)
R Figure 306
R (Task 72-00-00-020-005-001)


DETAIL
GROOVE
PLAIN
ROUND NUT
PWA 85585
GUIDE RING
NO. 1.5 BEARING
SUPPORT ASSEMBLY
PWA 85631
GUIDE
SECTION WITH TOOLS SHOWN INSTALLED
ON THE LPT SHAFT
PWA 85585
GUIDE RING
PWA 85631
GUIDE
PWA 85471
WRENCH
L-D2805 (0605)
PW V

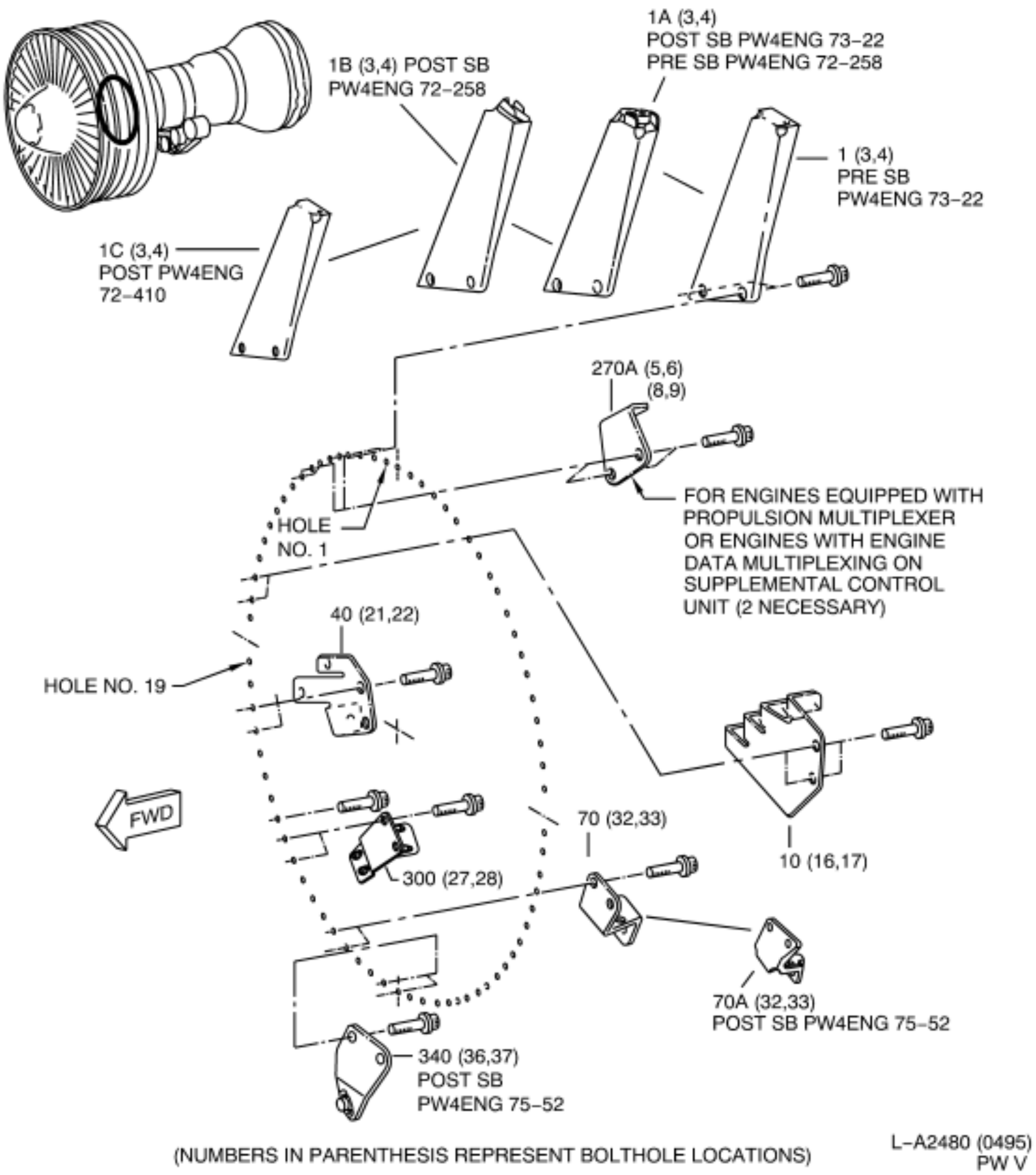
R Installation Of Tools On The LPT Shaft
R Figure 307
R (Task 72-00-00-020-005-001)


HOIST
PWA 28657 SLING
HOIST
PWA 85390 ADAPTER
PWA 76156 ADAPTER (2 NECESSARY)
PWA 86567 OR ADAPTER (2 NECESSARY)
PWA 85667 BRACKET (INSTALLED)
PWA 85246 PLUG OR PWA 88709 PLUG
PWA 85064 FIXTURE
PWA 25757 PEDESTALS (4) AND PWA 25926 ADAPTERS (4)
L−D2804 (0605)
PW V

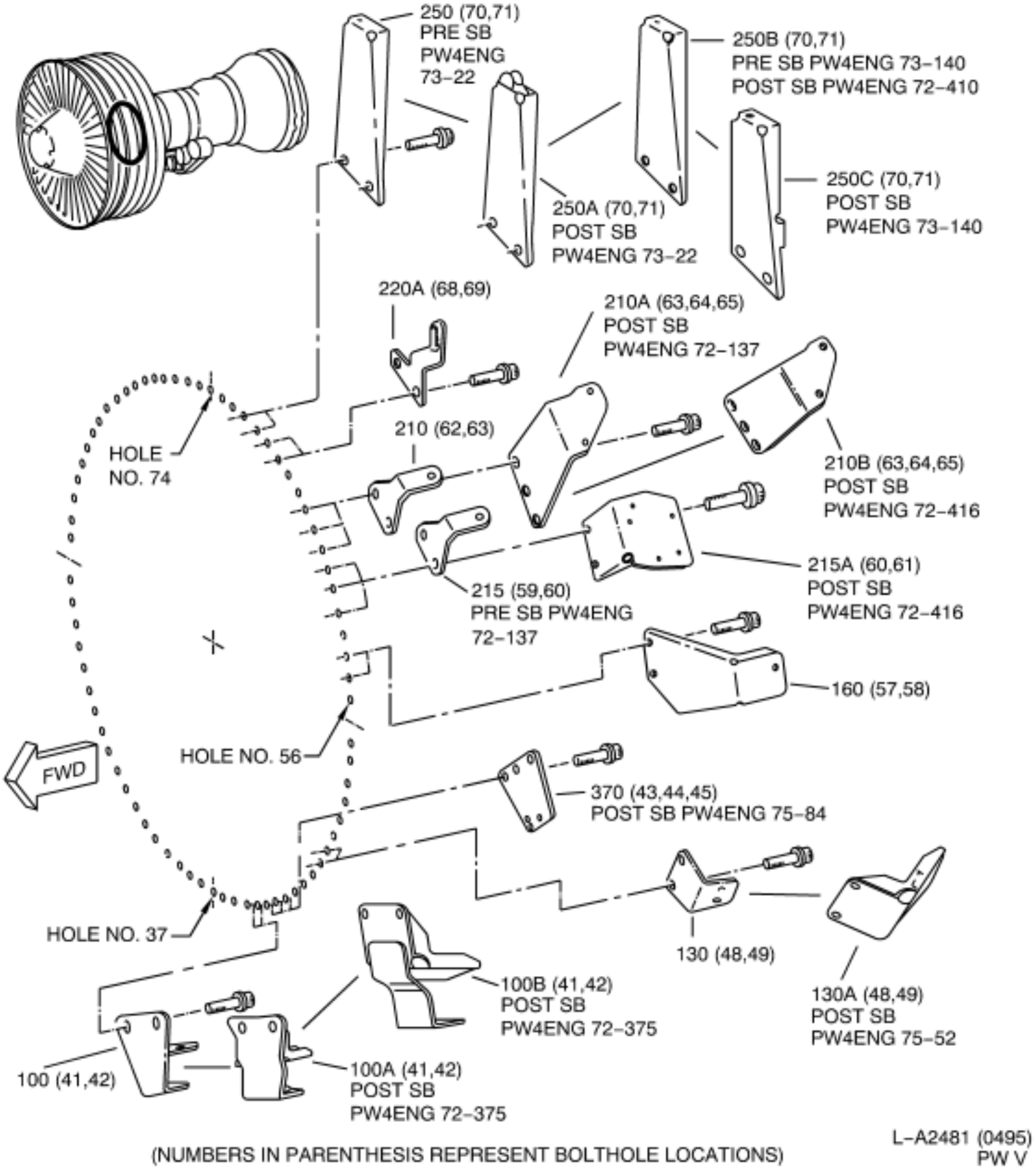
R Installation Of The Lifting Tools
R Figure 308
R (Task 72−00−00−020−005−001)


C
B
A
A
B
NO. 1.5 BEARING SUPPORT
(FRONT VIEW)
B
A
C
C
A
B
DOWEL
PIN
HOLE
A. USE FOR JACKING BOLTS
B. USE FOR RETAINING BOLTS
C. DO NOT USE
L-A5948 (0692)
PW V

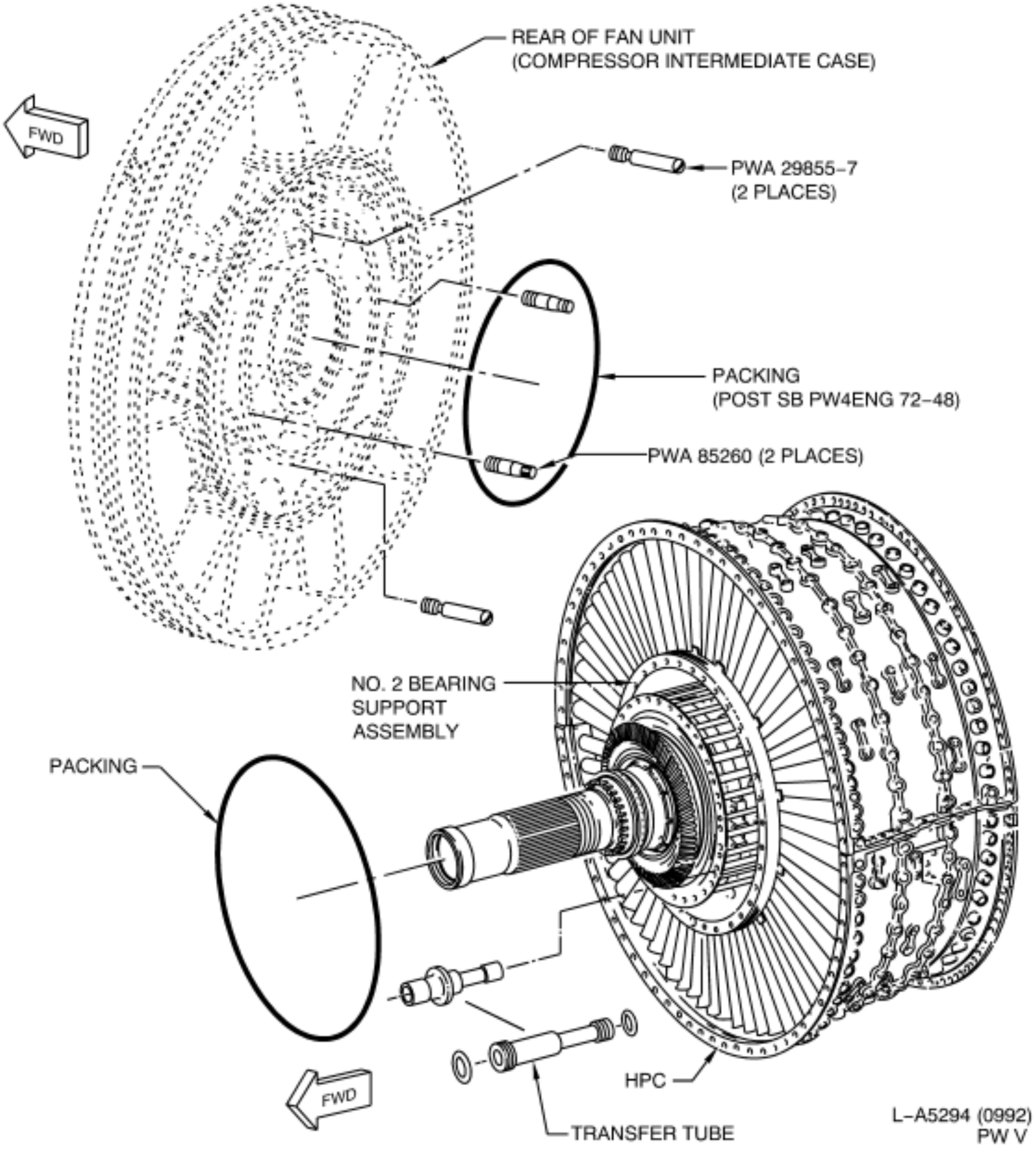
R No. 1.5 Bearing Support Bolt Locations
R Figure 309
R (Task 72-00-00-020-005-001)


1A (3,4)
POST SB PW4ENG 73-22
PRE SB PW4ENG 72-258
1B (3,4) POST SB
PW4ENG 72-258
1 (3,4)
PRE SB
PW4ENG 73-22
1C (3,4)
POST PW4ENG
72-410
270A (5,6)
(8,9)
FOR ENGINES EQUIPPED WITH
PROPULSION MULTIPLEXER
OR ENGINES WITH ENGINE
DATA MULTIPLEXING ON
SUPPLEMENTAL CONTROL
UNIT (2 NECESSARY)
HOLE
NO. 1
40 (21,22)
HOLE NO. 19
FWD
70 (32,33)
10 (16,17)
300 (27,28)
70A (32,33)
POST SB PW4ENG 75-52
340 (36,37)
POST SB
PW4ENG 75-52
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L-A2480 (0495)
PW V

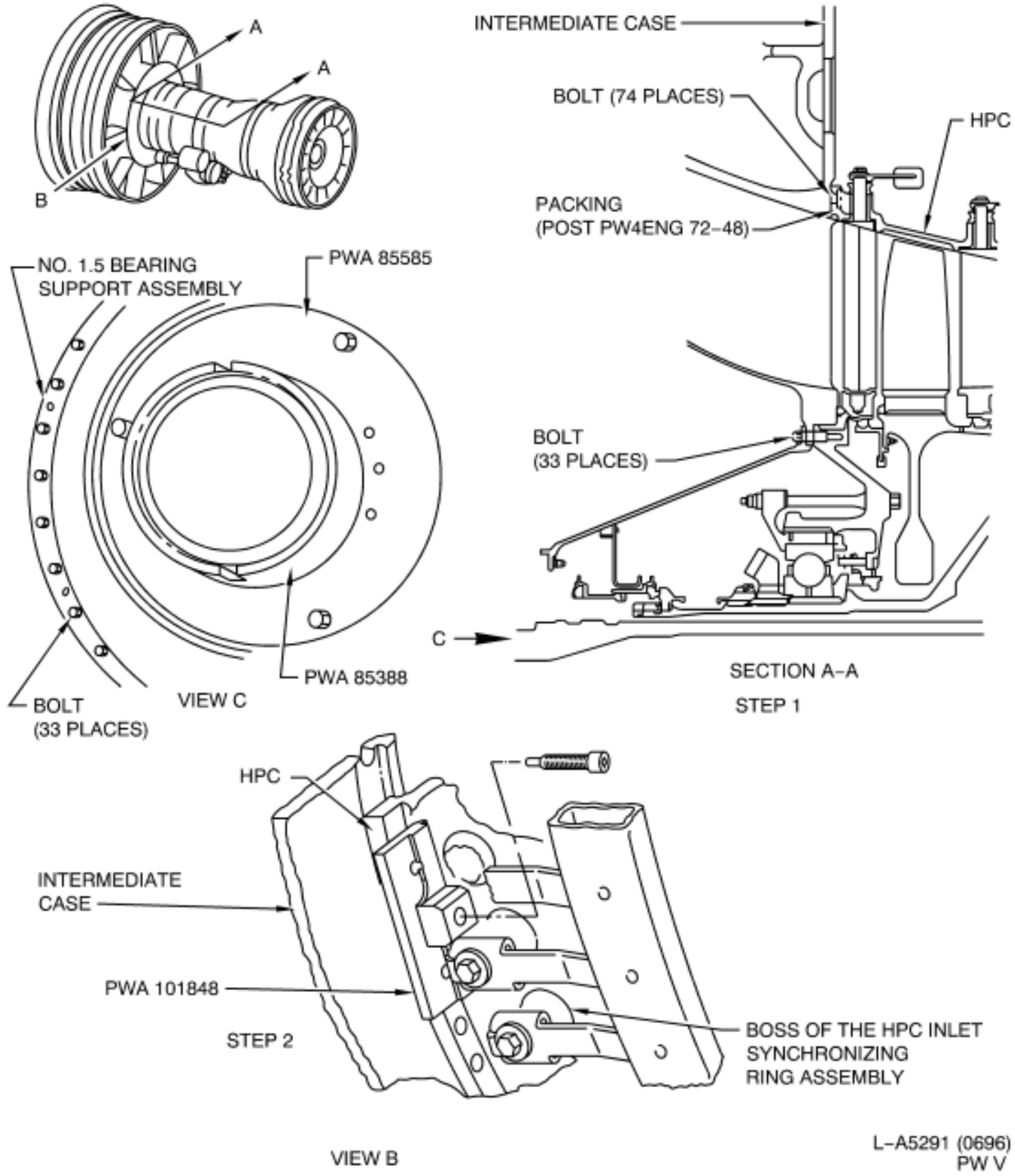
R Flange E Bracket Locations
R Figure 310 (Sheet 1)
R (Task 72-00-00-020-005-001)


250 (70,71) PRE SB PW4ENG 73-22
250B (70,71) PRE SB PW4ENG 73-140 POST SB PW4ENG 72-410
250A (70,71) POST SB PW4ENG 73-22
250C (70,71) POST SB PW4ENG 73-140
220A (68,69)
210A (63,64,65) POST SB PW4ENG 72-137
HOLE NO. 74
210 (62,63)
210B (63,64,65) POST SB PW4ENG 72-416
215A (60,61) POST SB PW4ENG 72-416
215 (59,60) PRE SB PW4ENG 72-137
160 (57,58)
FWD
HOLE NO. 56
370 (43,44,45) POST SB PW4ENG 75-84
130 (48,49)
HOLE NO. 37
100B (41,42) POST SB PW4ENG 72-375
130A (48,49) POST SB PW4ENG 75-52
100 (41,42)
100A (41,42) POST SB PW4ENG 72-375
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L-A2481 (0495) PW V

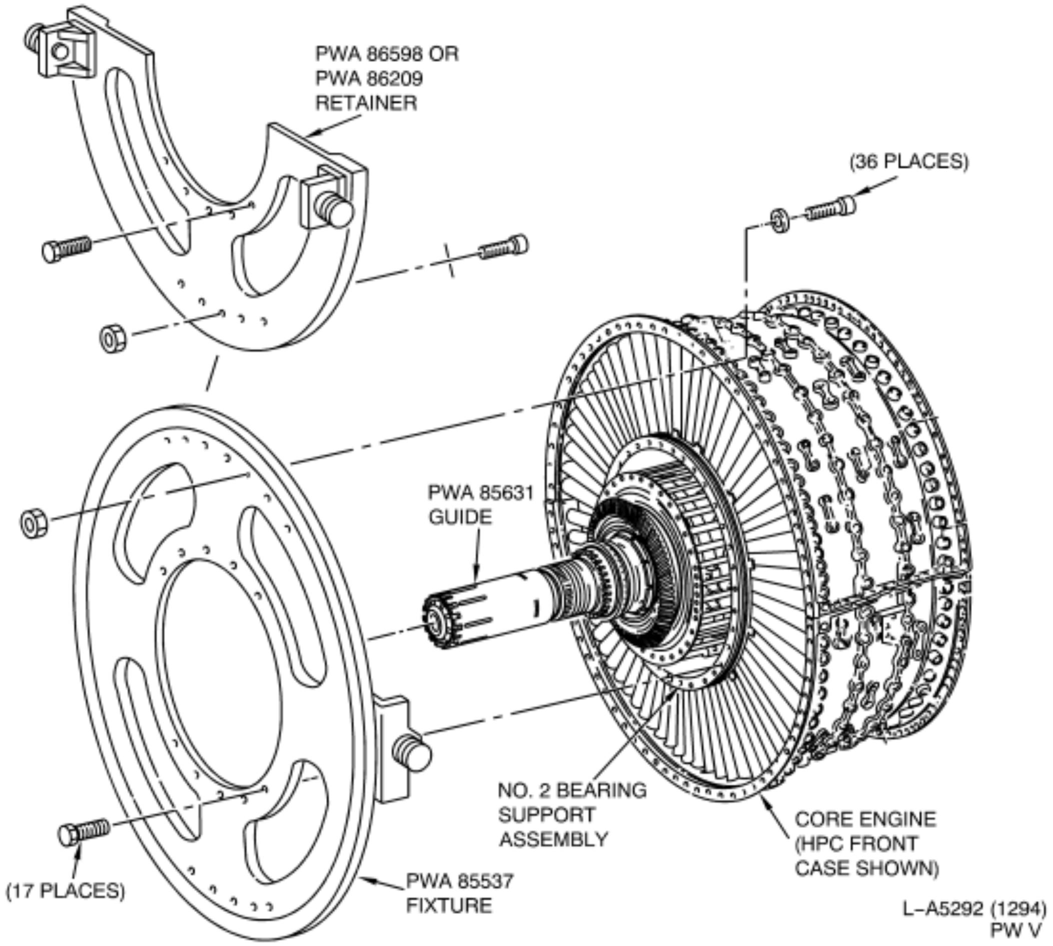
R Flange E Bracket Locations
R Figure 310 (Sheet 2)
R (Task 72-00-00-020-005-001)


FWD
REAR OF FAN UNIT
(COMPRESSOR INTERMEDIATE CASE)
PWA 29855-7
(2 PLACES)
PACKING
(POST SB PW4ENG 72-48)
PWA 85260 (2 PLACES)
NO. 2 BEARING
SUPPORT
ASSEMBLY
PACKING
HPC
FWD
TRANSFER TUBE
L-A5294 (0992)
PW V

R Installation Of Separation Tools
R Figure 311
R (Task 72-00-00-020-005-001)


A
A
B
INTERMEDIATE CASE
BOLT (74 PLACES)
HPC
PACKING
(POST PW4ENG 72-48)
NO. 1.5 BEARING
SUPPORT ASSEMBLY
PWA 85585
BOLT
(33 PLACES)
C
PWA 85388
BOLT
(33 PLACES)
VIEW C
SECTION A-A
STEP 1
HPC
INTERMEDIATE
CASE
PWA 101848
STEP 2
BOSS OF THE HPC INLET
SYNCHRONIZING
RING ASSEMBLY
VIEW B
L-A5291 (0696)
PW V

R Installation Of Separation Tools
R Figure 312
R (Task 72-00-00-020-005-001)


PWA 86598 OR
PWA 86209
RETAINER
(36 PLACES)
PWA 85631
GUIDE
NO. 2 BEARING
SUPPORT
ASSEMBLY
CORE ENGINE
(HPC FRONT
CASE SHOWN)
(17 PLACES)
PWA 85537
FIXTURE
L−A5292 (1294)
PW V

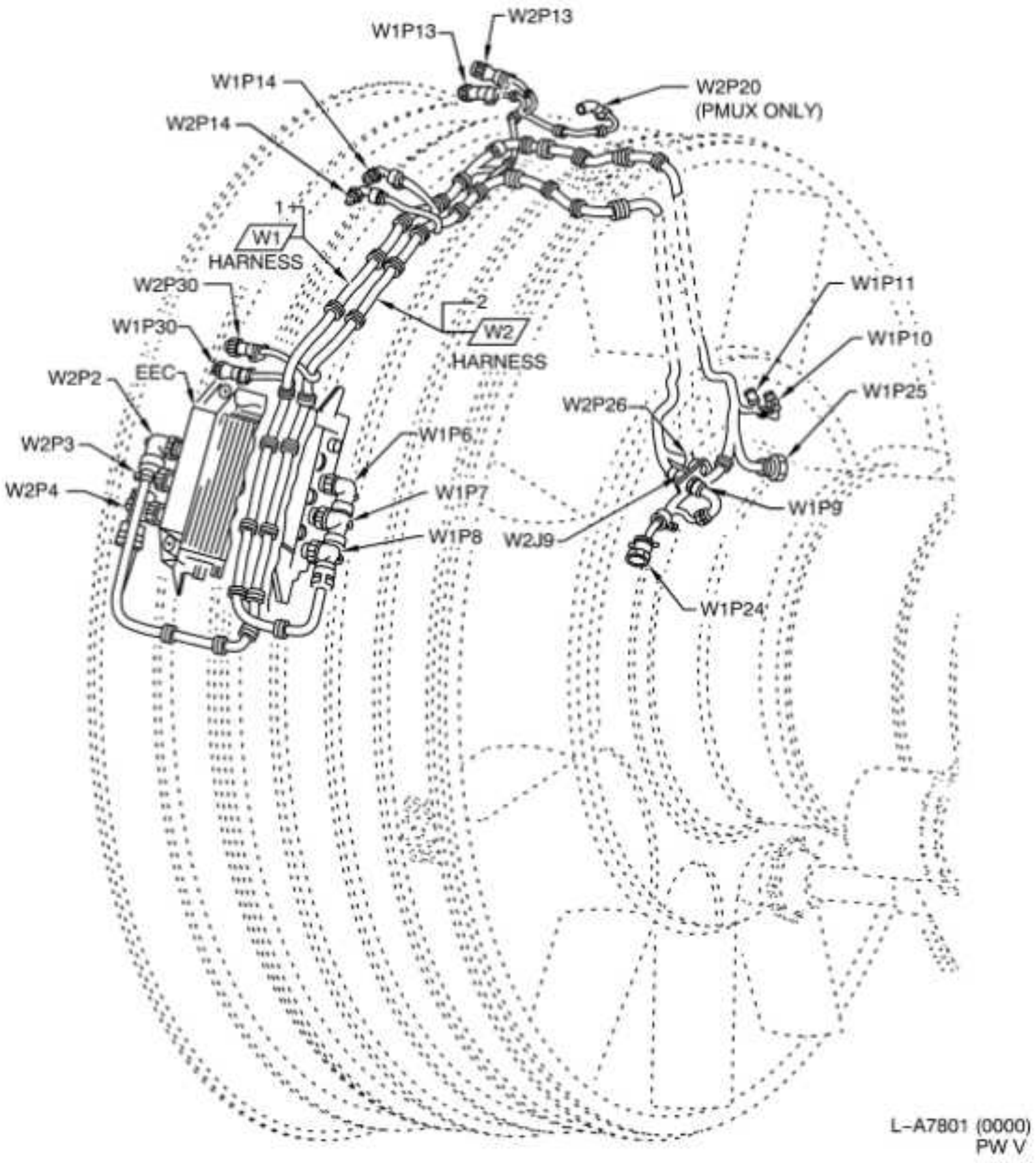
R Installation Of HPC Support Tools
R Figure 313
R (Task 72−00−00−020−005−001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - REMOVAL-00

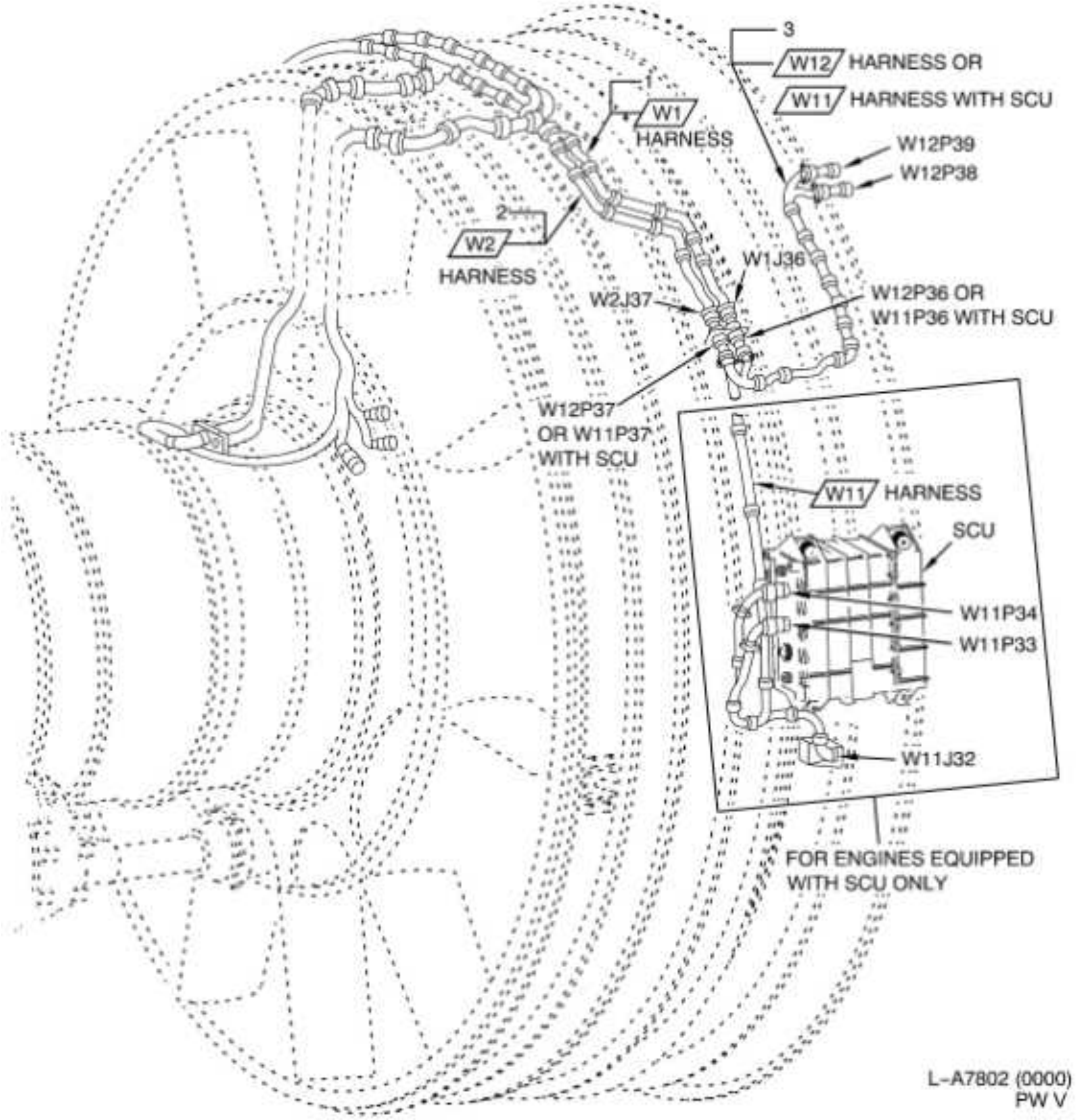
Task 72-00-00-990-007:

1. Remove Engine Wire Harnesses
   See Figure 301 (Sheets 1 through 7).
   A. General
      (1) Procedures for removal of engine wire harnesses are located within appropriate engine sectionalization sections of the manual. Referenced figures provide specific location data for procedures related to each segment of wire harness.


W1P13
W2P13
W1P14
W2P20
(PMUX ONLY)
W2P14
1
W1
HARNESS
W2P30
2
W1P30
W2
HARNESS
W2P2
EEC
W1P11
W1P10
W1P25
W2P26
W2P3
W1P6
W2P4
W1P7
W1P9
W1P8
W2J9
W1P24
L-A7801 (0000)
PW V

1. EEC Fan Case Wiring Harness (W1), See 72−00−33, Removal−06.
2. EEC Fan Case Wiring Harness (W2), See and 72−00−33, Removal−06.

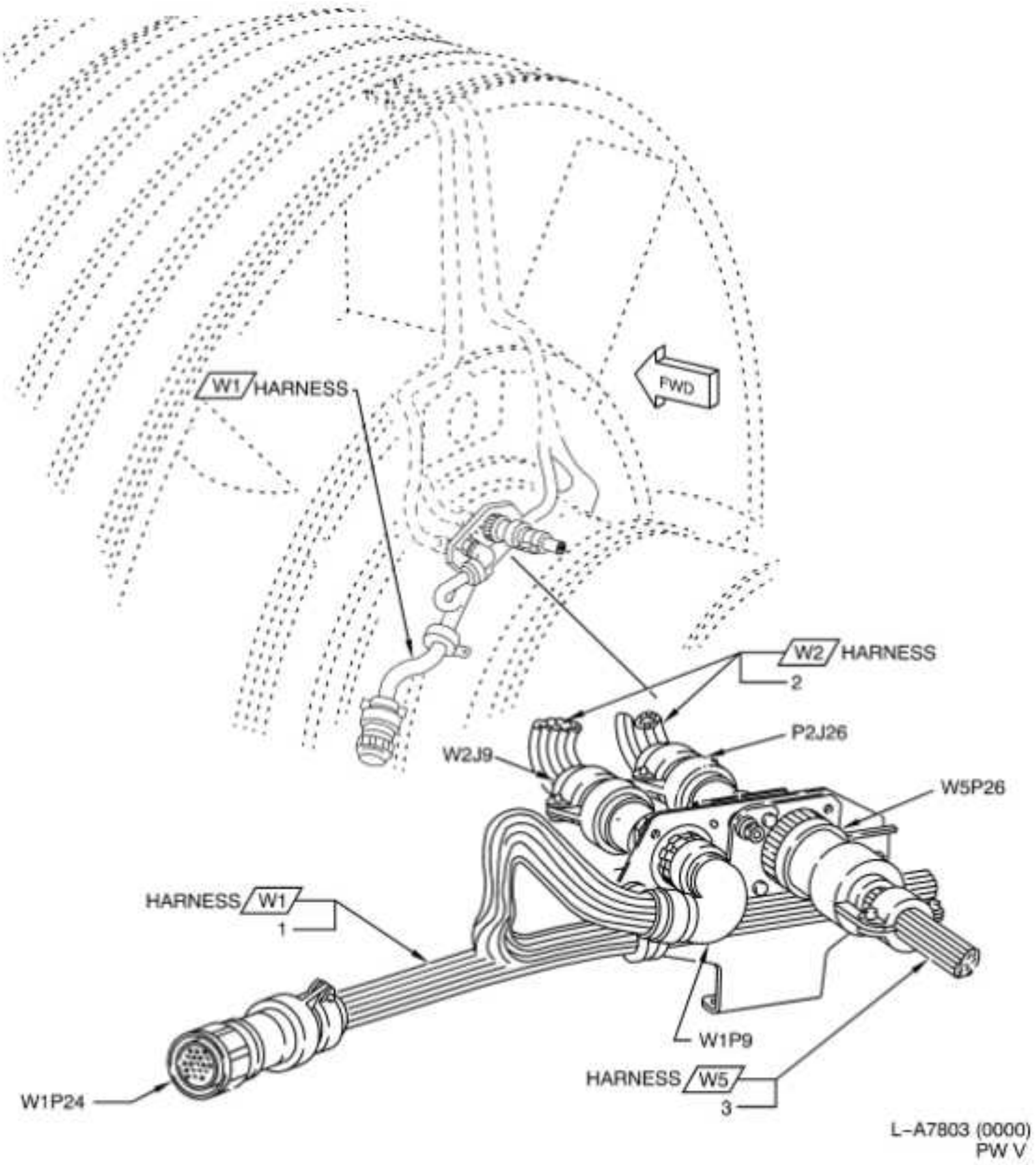
EEC Fan Case Wiring Harnesses (W1) And (W2)
Figure 301 (Sheet 1)
(Task 72−00−00−990−007)


3
W12 HARNESS OR
W11 HARNESS WITH SCU
1
W1 HARNESS
W12P39
W12P38
2
W2 HARNESS
W1J36
W2J37
W12P36 OR
W11P36 WITH SCU
W12P37
OR W11P37
WITH SCU
W11 HARNESS
SCU
W11P34
W11P33
W11J32
FOR ENGINES EQUIPPED
WITH SCU ONLY
L-A7802 (0000)
PW V

EEC Fan Case Wiring Harnesses
(W1), (W2), (W11) And (W12)
Figure 301 (Sheet 2)
(Task 72-00-00-990-007)

1. EEC Fan Case Wiring Harness (W1), See 72−00−33, Removal−06.
2. EEC Fan Case Wiring Harness (W2), See 72−00−33, Removal−06.
3. EEC Fan Case Wiring Harness (W11) Or (W12) , See 72−00−33, Removal−06.

Key To Figure 301 (Sheet 2)

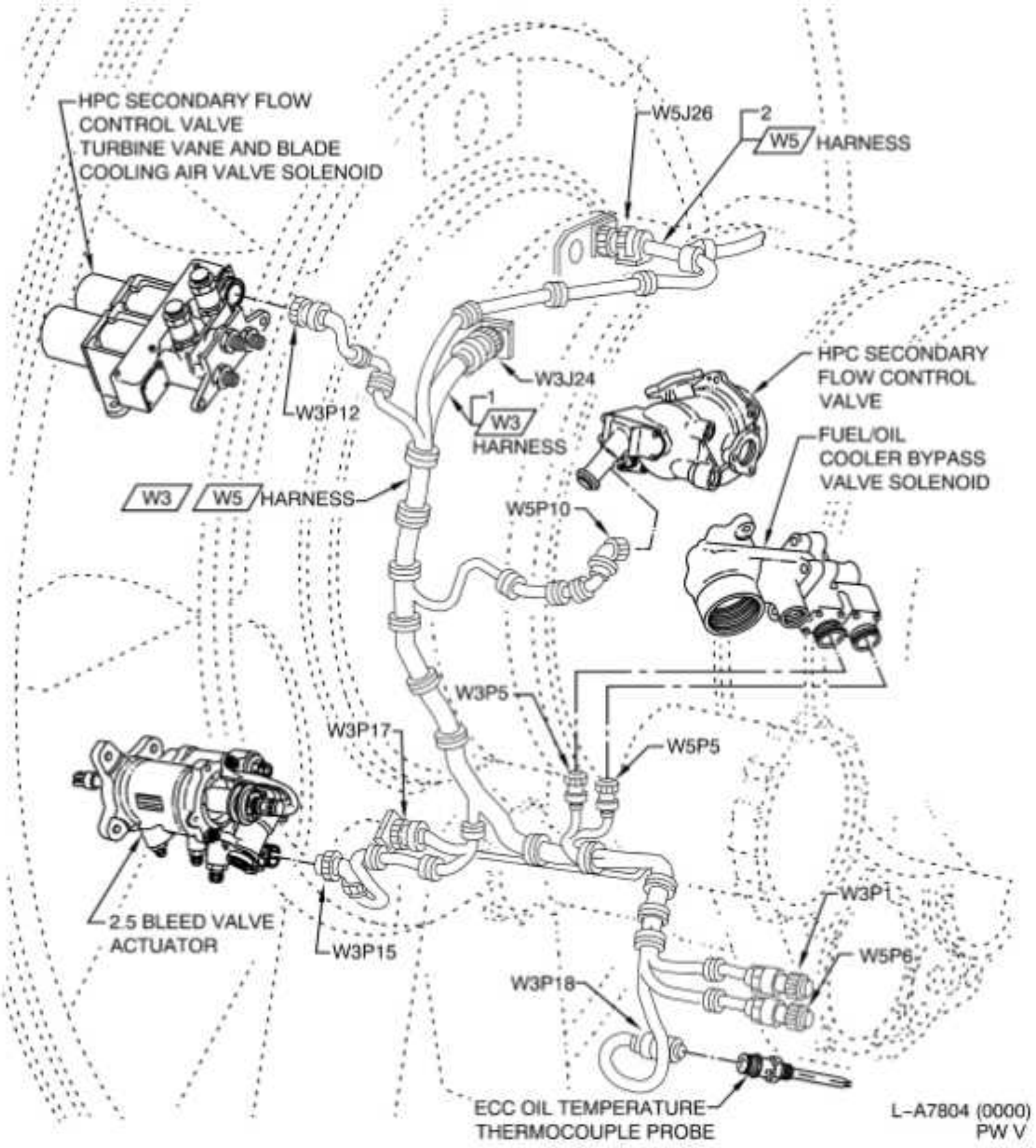

W1 HARNESS
FWD
W2 HARNESS
2
P2J26
W2J9
W5P26
HARNESS W1
1
W1P9
W1P24
HARNESS W5
3
L-A7803 (0000)
PW V

EEC Core Engine Wiring Harnesses (W1) And (W2)
And EEC Core Engine Wiring Harness (W5)
Figure 301 (Sheet 3)
(Task 72-00-00-990-007)

ENGINE GENERAL − REMOVAL−00

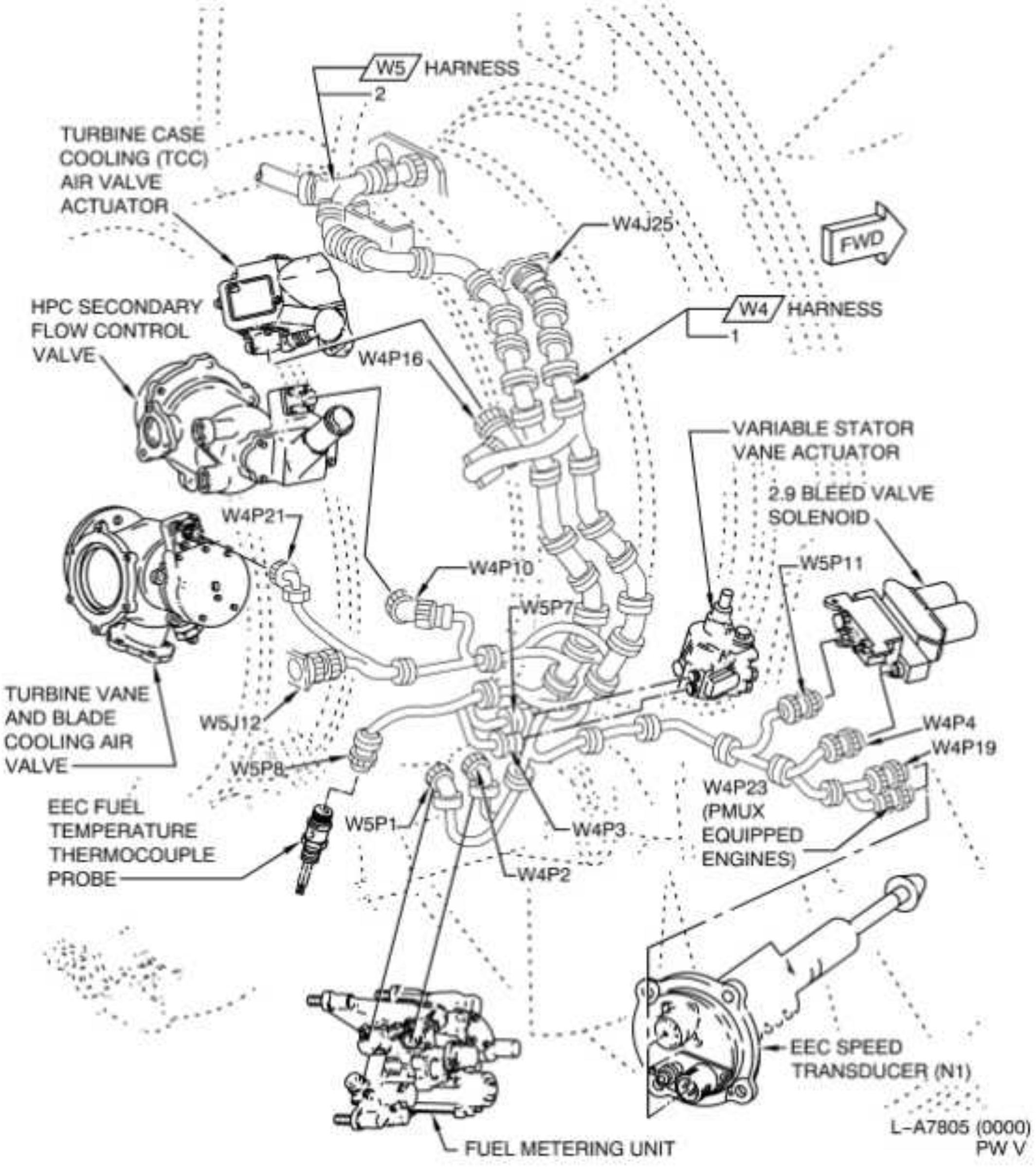
1. EEC Fan Case Wiring Harness (W1), See 72−00−33, Removal−06.
2. EEC Fan Case Wiring Harness (W2), See 72−00−33, Removal−06.
3. EEC Core Engine Wiring Harness (W5), See 72−00−34, Removal−20.

Key To Figure 301 (Sheet 3)


HPC SECONDARY FLOW CONTROL VALVE TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
W5J26
2
W5 HARNESS
W3P12
W3J24
1
W3 HARNESS
HPC SECONDARY FLOW CONTROL VALVE
FUEL/OIL COOLER BYPASS VALVE SOLENOID
W3 W5 HARNESS
W5P10
W3P5
W3P17
W5P5
2.5 BLEED VALVE ACTUATOR
W3P15
W3P1
W5P6
W3P18
ECC OIL TEMPERATURE THERMOCOUPLE PROBE
L-A7804 (0000)
PW V

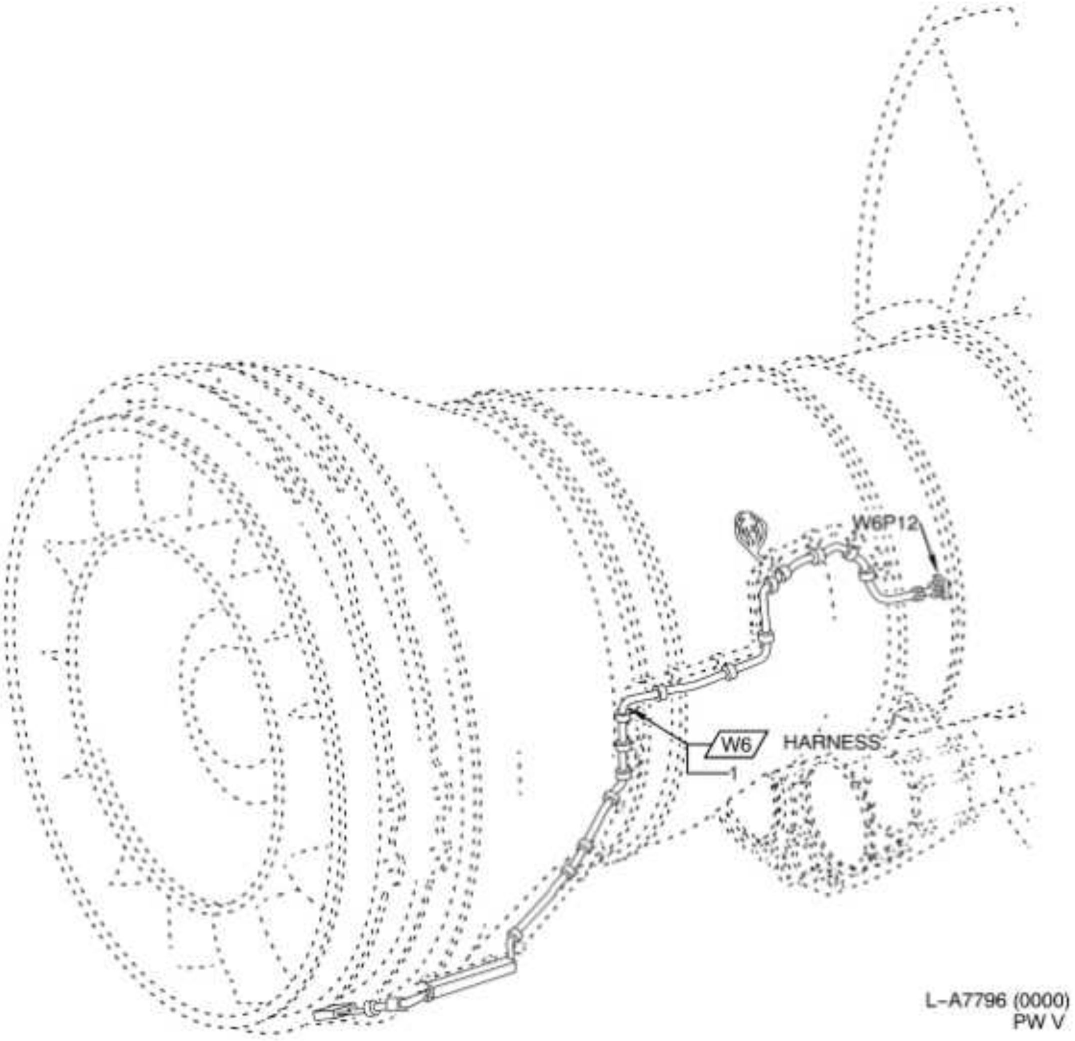
1. EEC Core Engine Wiring Harness (W3), See 72-00-34, Removal-18.
2. EEC Core Engine Wiring Harness (W5), See 72-00-34, Removal-20.

EEC Core Engine Wiring Harnesses (W3) And (W5)
Figure 301 (Sheet 4)
(Task 72-00-00-990-007)


W5 HARNESS
2
TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
W4J25
FWD
HPC SECONDARY FLOW CONTROL VALVE
W4 HARNESS
1
W4P16
VARIABLE STATOR VANE ACTUATOR
2.9 BLEED VALVE SOLENOID
W4P21
W4P10
W5P11
W5P7
TURBINE VANE AND BLADE COOLING AIR VALVE
W5J12
W4P4
W4P19
W5P8
W4P23 (PMUX EQUIPPED ENGINES)
EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
W5P1
W4P3
W4P2
EEC SPEED TRANSDUCER (N1)
L-A7805 (0000)
PW V
FUEL METERING UNIT

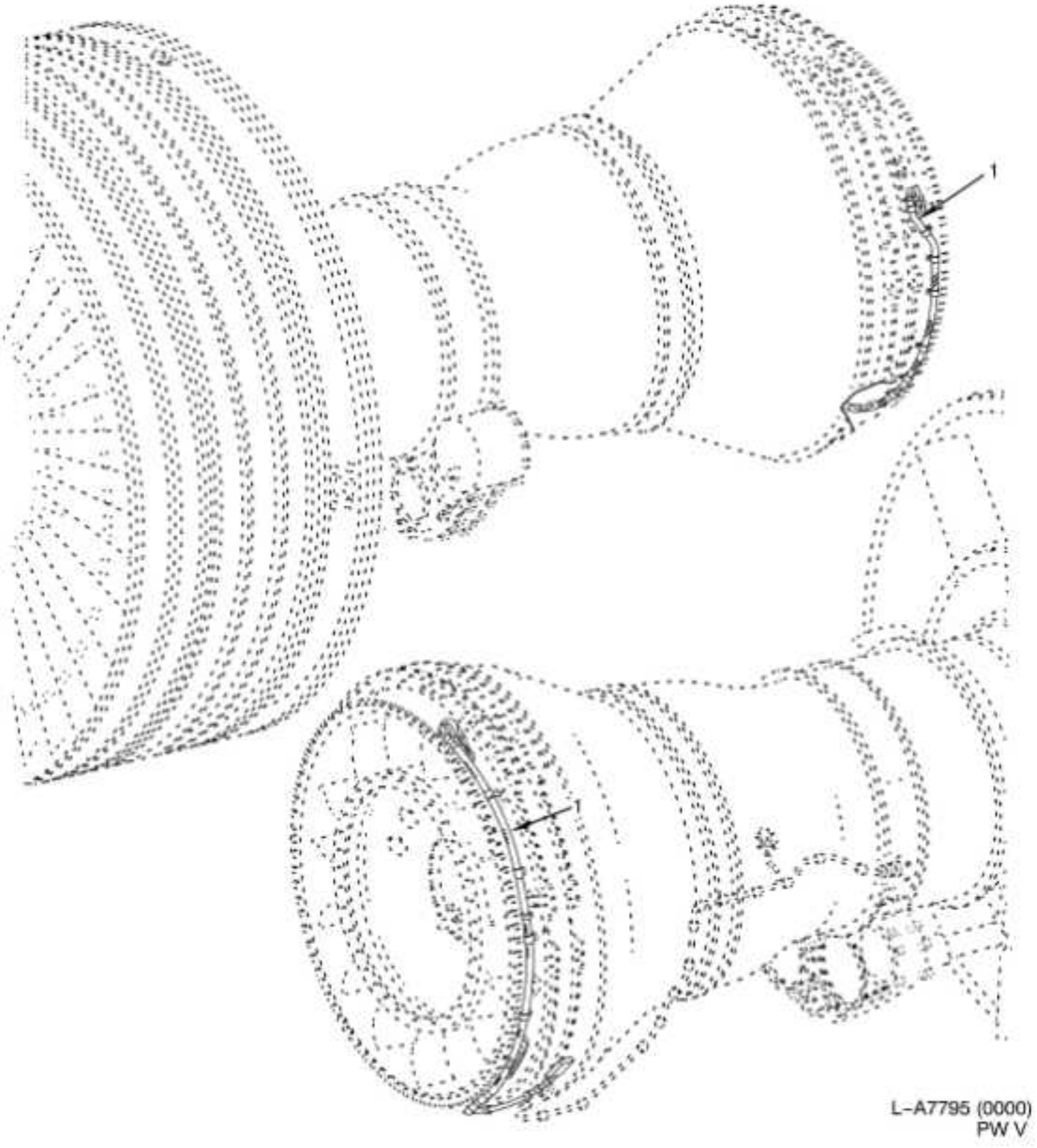
1. EEC Core Engine Wiring Harness (W4), See 72-00-34, Removal-19.
2. EEC Core Engine Wiring Harness (W5), See 72-00-34, Removal-20.

EEC Core Engine Wiring Harnesses (W4) And (W5)
Figure 301 (Sheet 5)
(Task 72-00-00-990-007)


W6P12
W6
HARNESS
1
L−A7796 (0000)
PW V

1. EEC Thermocouple And Airframe Cable (W6), See 72−00−54, Removal−09.

EEC Thermocouple And Airframe Cable (W6)
Figure 301 (Sheet 6)
(Task 72−00−00−990−007)



1. Thermocouple Box And Cable Assembly, See 72−00−54, Removal−09.

Thermocouple Box And Cable Assembly
Figure 301 (Sheet 7)
(Task 72−00−00−990−007)

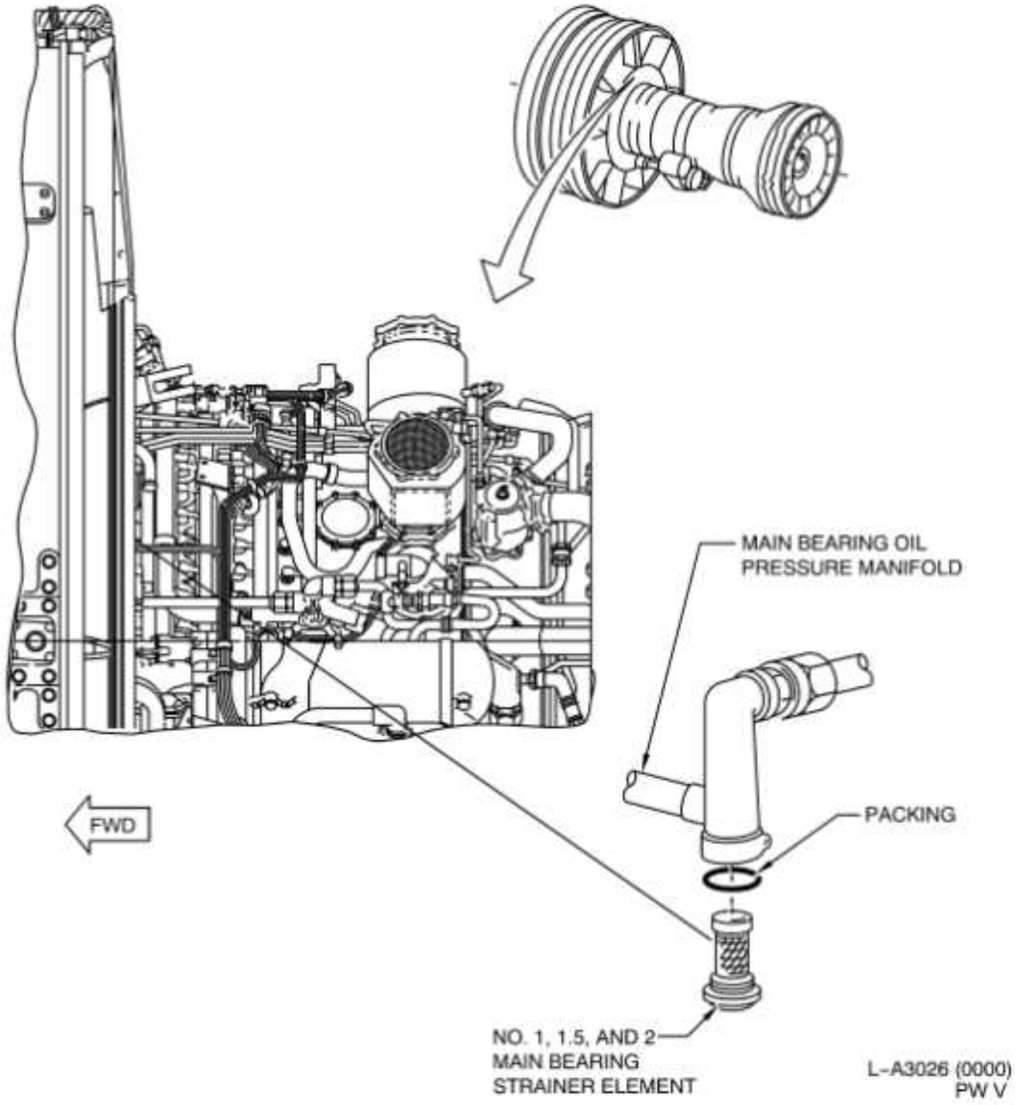
Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - REMOVAL-01

Task 72-00-00-050-001:

1. Remove No. 1, 1 1/2 And 2 Bearing Oil Pressure Strainer
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 301.
     - (1) Locate in line strainer on main bearing pressure manifold assembly on left side of engine protruding from intermediate case at appoximately 9 o'clock position.
     - (2) Remove lockwire securing strainer and remove strainer from manifold. Collect residual oil.
     - (3) Remove and discard packing.
     - (4) Install protective closures.
   - C. Postrequisites
     - (1) Clean and inspect strainer per Cleaning-01 (Task 72-00-00-110-001).


MAIN BEARING OIL PRESSURE MANIFOLD
PACKING
FWD
NO. 1, 1.5, AND 2 MAIN BEARING STRAINER ELEMENT
L-A3026 (0000)
PW V

No. 1, 1 1/2 And 2 Bearing Oil Pressure Strainer
Figure 301
(Task 72−00−00−050−001)

Previous Pageblock Return to Previous Menu Next Pageblock

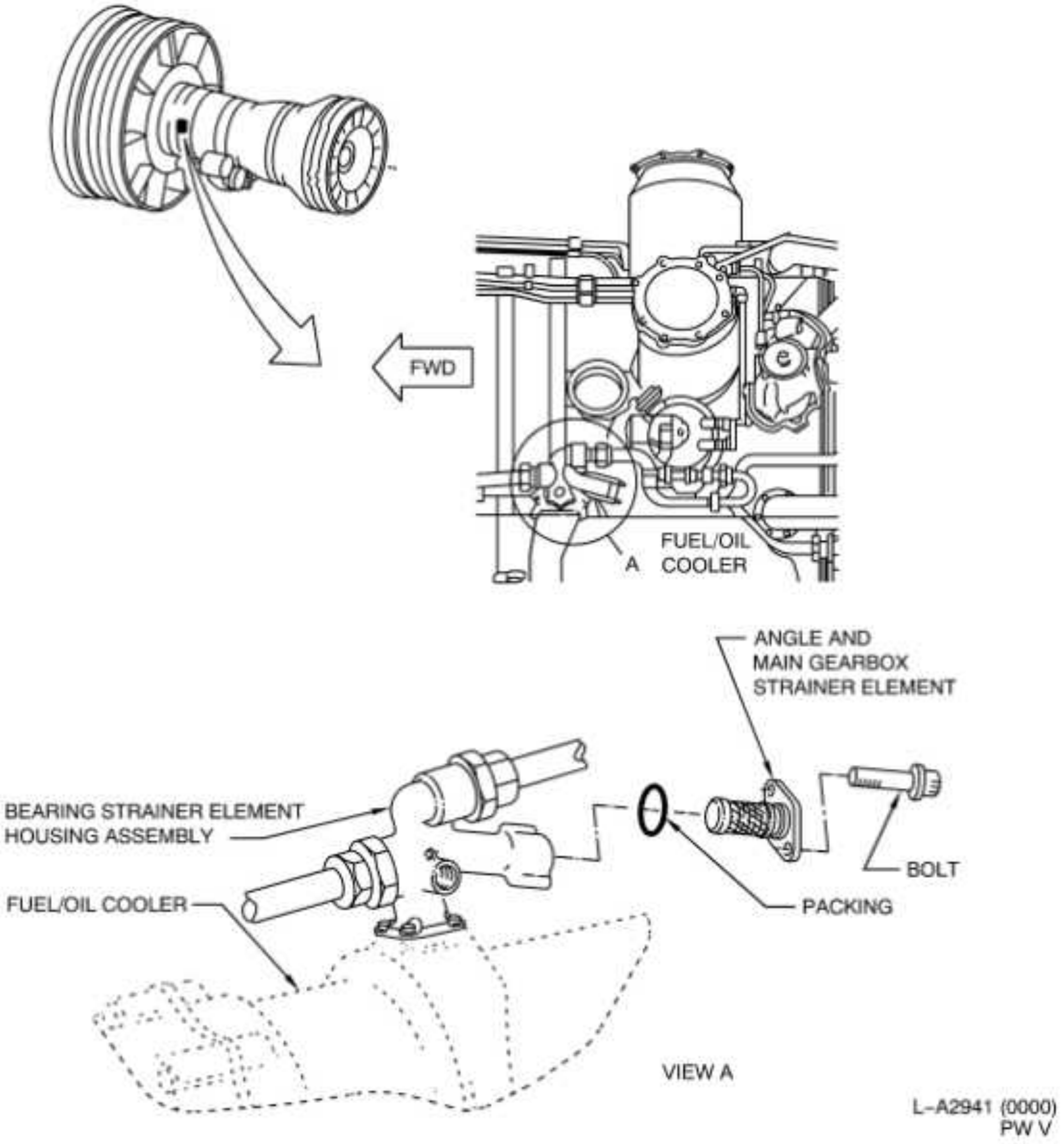
ENGINE GENERAL - REMOVAL-02

Task 72-00-00-050-002:

1. Remove Angle And Main Gearbox Strainer
   - A. Equipment And Materials Required

     Special Tools:
     PWA 85518 Puller

   - B. Procedure
     See Figure 301.
     - (1) Locate angle and main gearbox strainer on left side of engine in housing mounted on top of fuel oil cooler.
     - (2) Remove bolts securing strainer and remove strainer from housing using PWA 85518 Puller. Collect residual oil.
     - (3) Remove and discard packing.
     - (4) Install protective closures.
   - C. Postrequisites
     - (1) Clean and inspect strainer per Cleaning-01 (Task 72-00-00-110-001).


FWD
A
FUEL/OIL COOLER
ANGLE AND MAIN GEARBOX STRAINER ELEMENT
BEARING STRAINER ELEMENT HOUSING ASSEMBLY
BOLT
FUEL/OIL COOLER
PACKING
VIEW A
L-A2941 (0000)
PW V

Angle And Main Gearbox Strainer
Figure 301
(Task 72-00-00-050-002)

Previous Pageblock   Return to Previous Menu   Next Pageblock

ENGINE GENERAL - REMOVAL-03

Task 72-00-00-050-003:

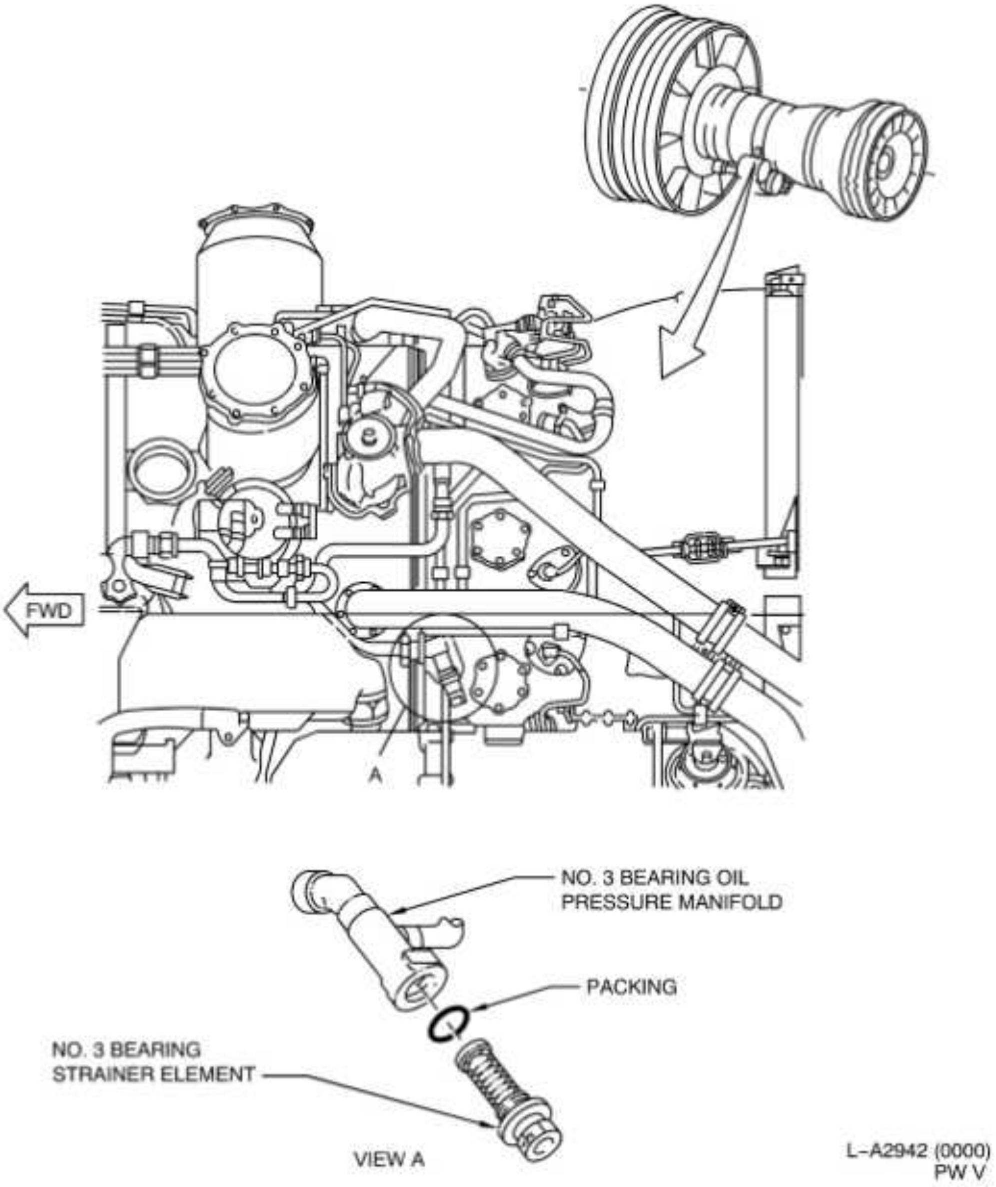
1. Remove No. 3 Bearing Oil Pressure Strainer (Pre SB PW4ENG 79-52)
   A. Equipment And Materials Required - None
   B. Procedure
      See Figure 301.
      (1) Locate in line strainer on No. 3 bearing oil pressure manifold on left side of engine, rearward of fuel oil cooler.

      CAUTION: YOU MUST USE THE WRENCHING FLATS ON THE STRAINER HOUSING WHEN YOU LOOSEN OR TIGHTEN THE STRAINER. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

      (2) Remove the lockwire from the strainer and the strainer housing. While you hold the strainer housing with a wrench, remove the strainer from the housing. Collect the oil.
      (3) Remove and discard packing.
      (4) Install protective closures.
   C. Postrequisites
      (1) Clean and inspect strainer per Cleaning-01 (Task 72-00-00-110-001).

Task 72-00-00-050-003-A:

2. Remove No. 3 Bearing Oil Pressure Strainer (Post SB PW4ENG 79-52)
   A. Equipment And Materials Required - None
   B. Procedure
      See Figure 302.
      (1) Remove the bolt from the clamp that attaches the No. 3 bearing oil pressure manifold (LP18) and spray shield to a bracket on the high compressor at approximately the 9 o'clock position. Remove the bolt, clamp and spray shield.
      (2) Remove the lockwire and disconnect the manifold nut (LP18) from the adapter in the No. 3 bearing oil pressure tube (LP19). Collect the oil.
      (3) Remove the bolts that attach the ferrule end of the tube (LP19) to a bracket on Flange K.
      (4) Remove the lockwire from the bolts that attach the adapter and a strainer into the ferrule end of tube (LP19). Remove the bolts and nuts from the adapter.
      (5) Remove a nut and bolt that attach clamps together on the oil trim pressure tube (LP32) and the No. 3 bearing oil pressure manifold (LP18). The clamps are located just above the fuel/oil cooler. The clamps can stay with the tube and manifold.


FWD
A
NO. 3 BEARING OIL PRESSURE MANIFOLD
PACKING
NO. 3 BEARING STRAINER ELEMENT
VIEW A
L-A2942 (0000)
PW V

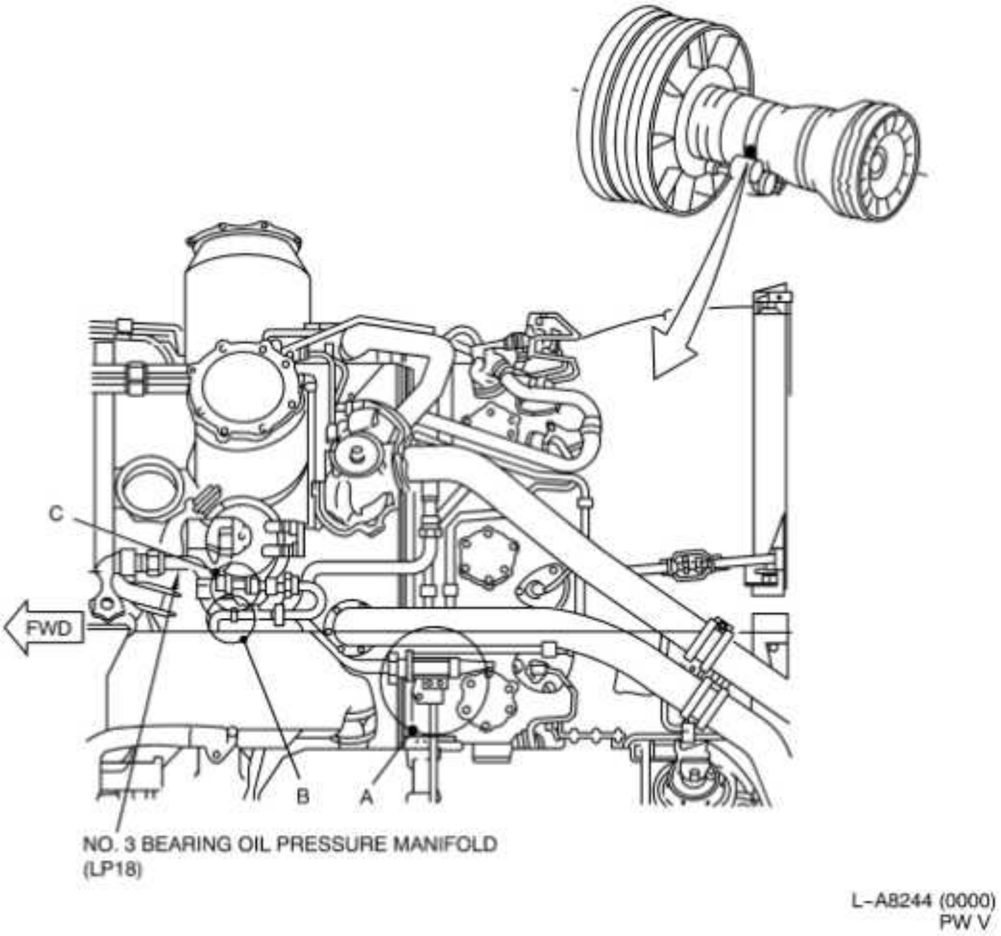
No. 3 Bearing Oil Pressure Strainer
Figure 301
(Task 72-00-00-050-003)

CAUTION: YOU MUST USE THE FLATS ON THE MATING PARTS WHEN YOU LOOSEN MANIFOLDS AND TUBES. THIS WILL PREVENT ANY TWISTS DAMAGE TO THE TUBES.

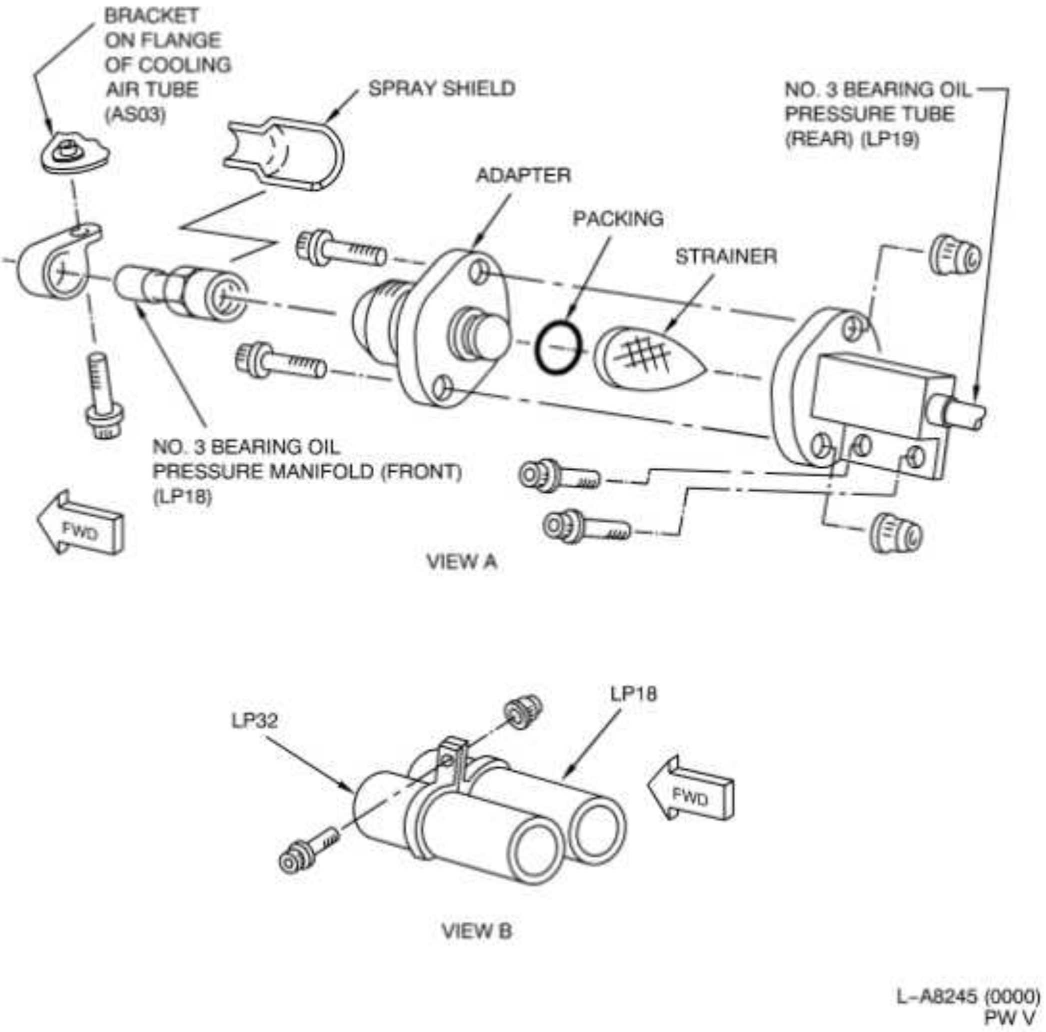
(6) Remove the lockwire from the tube nuts on the oil trim pressure tube (LP31) and disconnect the tube nuts.
(7) Remove the lockwire from the tube nut on the No. 3 bearing oil pressure manifold (LP18) that is attached to the bearing strainer element housing on top of the fuel/oil cooler. Remove the retainer and packing and discard. Remove the oil trim pressure tube (LP31).
(8) With the No. 3 bearing oil pressure manifold loosened sufficiently, remove the adapter from the ferrule end of No. 3 bearing oil pressure tube (LP19). Remove the packing from the adapter.
(9) Remove the strainer from the ferrule end of tube (LP19).
(10) Install protective closures.

C. Postrequisites

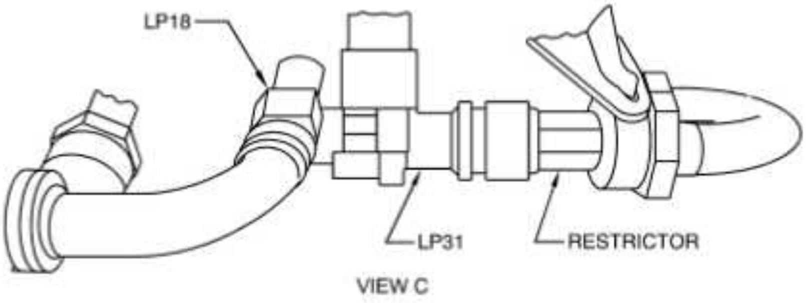
(1) Inspect and clean strainer. See Cleaning−01 (Task 72−00−00−110−001).


C
FWD
B
A
NO. 3 BEARING OIL PRESSURE MANIFOLD
(LP18)
L−A8244 (0000)
PW V

No. 3 Bearing Oil Pressure Strainer
Figure 302 (Sheet 1)
(Task 72−00−00−050−003−A)


BRACKET ON FLANGE OF COOLING AIR TUBE (AS03)
SPRAY SHIELD
NO. 3 BEARING OIL PRESSURE TUBE (REAR) (LP19)
ADAPTER
PACKING
STRAINER
NO. 3 BEARING OIL PRESSURE MANIFOLD (FRONT) (LP18)
FWD
VIEW A
LP32
LP18
FWD
VIEW B
L-A8245 (0000)
PW V

No. 3 Bearing Oil Pressure Strainer
Figure 302 (Sheet 2)
(Task 72-00-00-050-003-A)


LP18
LP31
RESTRICTOR
VIEW C

L-A8246 (0000)
PW V

No. 3 Bearing Oil Pressure Strainer
Figure 302 (Sheet 3)
(Task 72-00-00-050-003-A)

ENGINE GENERAL - REMOVAL-04

Task 72-00-00-050-004:

1. Remove No. 4 Bearing Oil Pressure Strainer

A. Equipment And Materials Required - None

B. Procedure

See Figure 301.

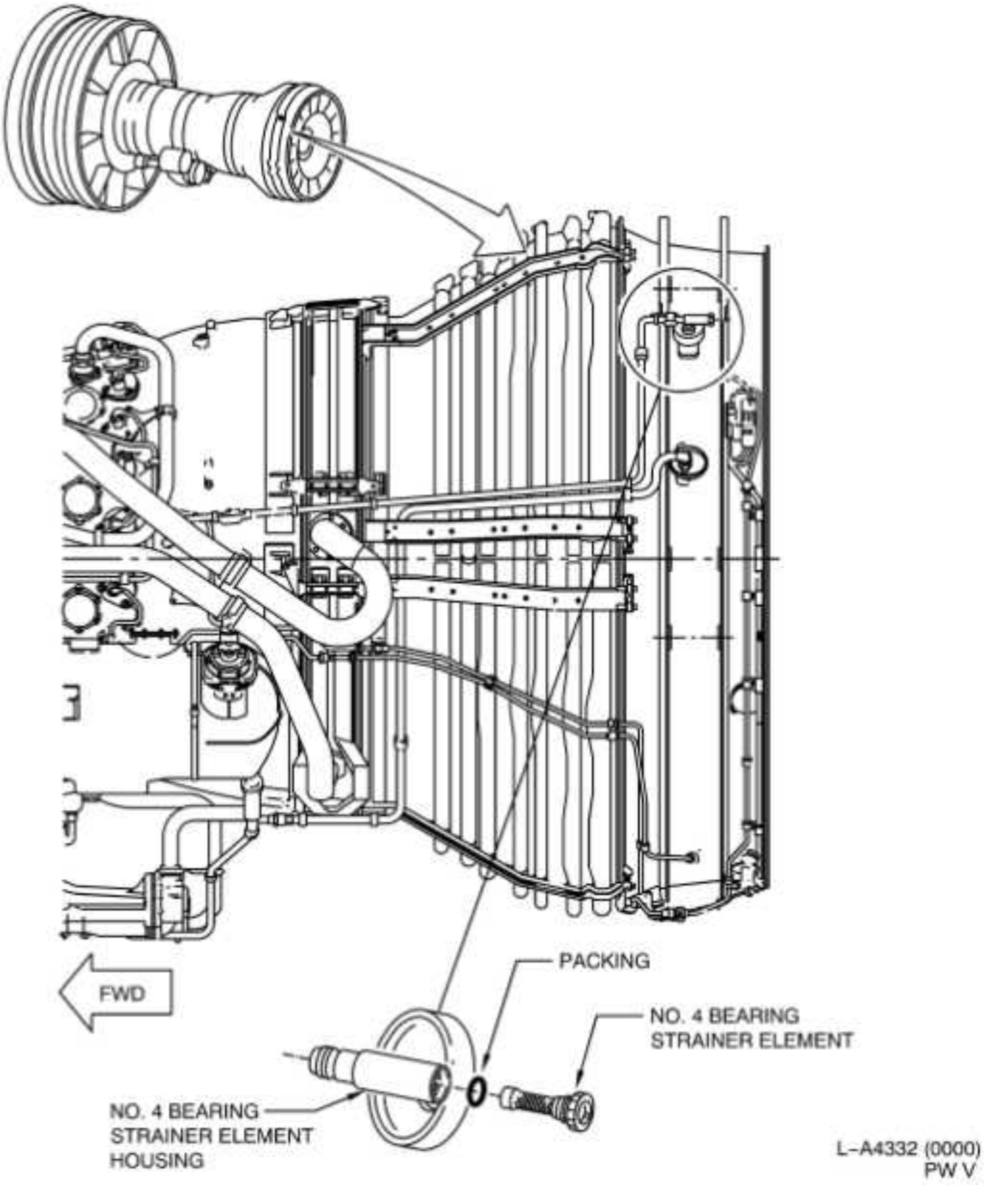
(1) Remove lockwire securing strainer element to strainer housing at approximately 10:30 o'clock position on exhaust case.

(2) Remove strainer from housing. Collect residual oil.

(3) Remove and discard packing. Install protective closures.

C. Postrequisites

(1) Clean and inspect strainer per Cleaning-01 (Task 72-00-00-110-001).


FWD
PACKING
NO. 4 BEARING STRAINER ELEMENT
NO. 4 BEARING STRAINER ELEMENT HOUSING
L−A4332 (0000)
PW V

No. 4 Bearing Oil Pressure Strainer
Figure 301
(Task 72−00−00−050−004)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - REMOVAL-05

Task 72-00-00-050-005:

1. Remove HPC Secondary Flow Control Filter Element

NOTE: Procedure for removal of filter elements from left and right side of engine is the same.

A. Equipment And Materials Required - None

B. Procedure

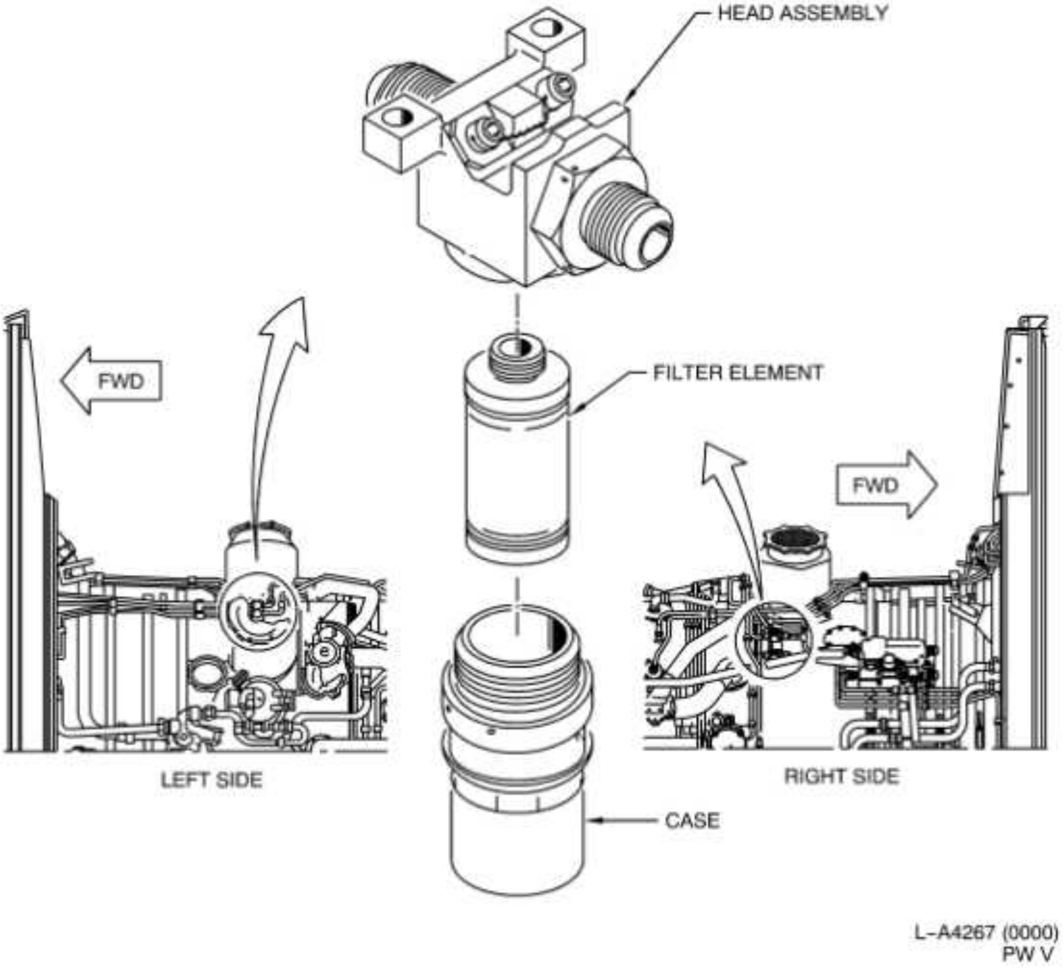
See Figure 301.

(1) Remove lockwire and unscrew case from head assembly.

(2) Unscrew filter element from head assembly.

(3) Install protective closure on head assembly.

(4) Inspect and clean filter element per 72-00-00, Cleaning-02 (Task 72-00-00-110-003).


HEAD ASSEMBLY
FWD
FILTER ELEMENT
FWD
LEFT SIDE
RIGHT SIDE
CASE
L-A4267 (0000)
PW V

HPC Secondary Flow Control Filter
Figure 301
(Task 72-00-00-050-005)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-00-990-008:

1. Install Engine Wire Harnesses

See Figure 401 (Sheets 1 through 8).

A. General

(1) Procedures for installation of engine wire harnesses are located within appropriate engine sectionalization sections of the manual. Referenced figures provide specific location data for procedures related to each segment of wire harness.

Task 72-00-00-990-009:

2. General Installation Requirements For Electrical Harnesses, Leads And Cables

See Figures 402, 403 and 404.

NOTE: This procedure consists of general guidelines for the installation of electrical harnesses, leads and cables. For specific installation of a particular unit, see appropriate engine manual section.

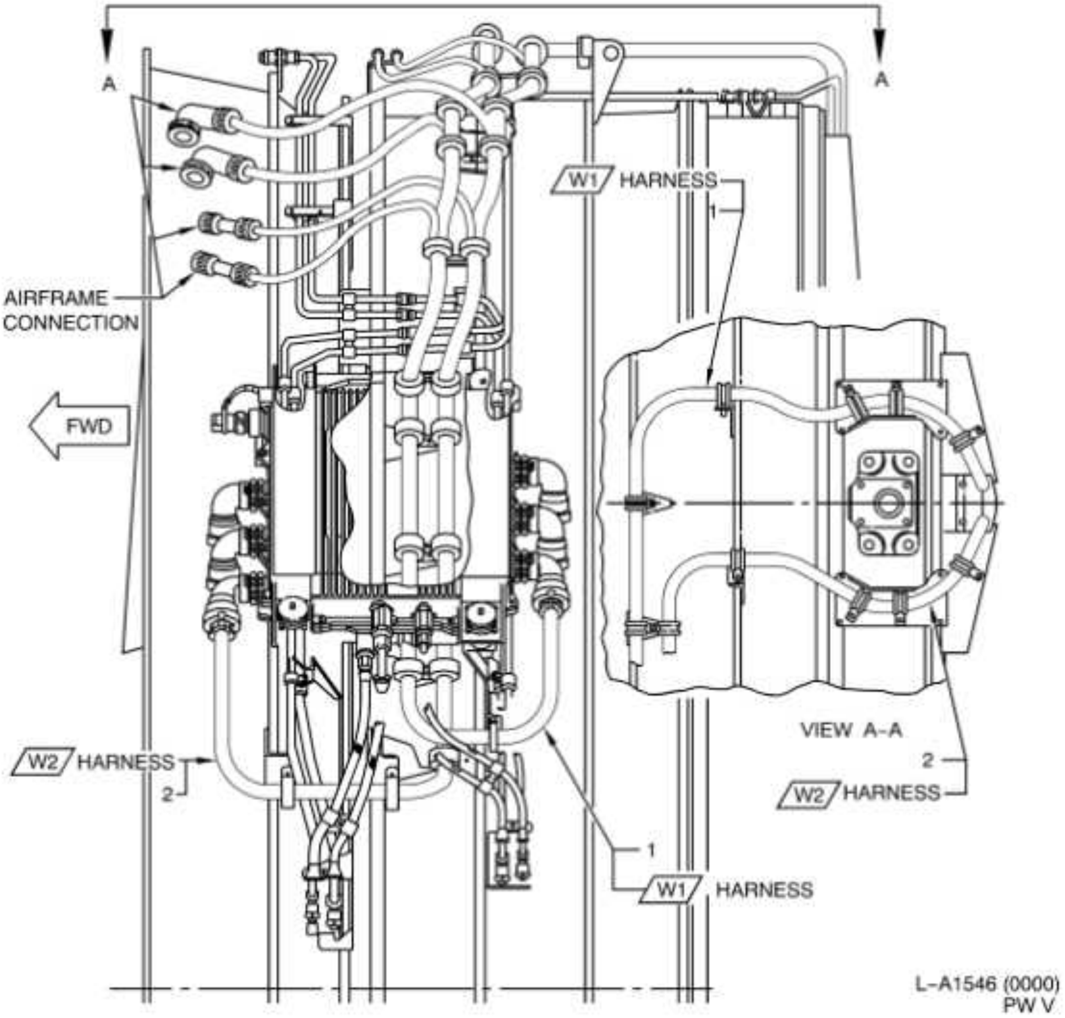
A. Install harness, lead or cable assembly loosely on engine, making all end connections. See Figure 402 for typical installation.

NOTE: When modules or assembly groups are being removed or installed on the engine, certain requirements, such as initially connecting both ends of harness or cable, or locating mid-point of harness, may not be applicable. In such instances, adhere to the remaining general installation requirements.

To allow for variances in harness diameter, it is permissible to select alternate clamp sizes, larger or smaller, to secure electrical harnesses and to prevent harness slipping and/or rotation. See Illustrated Parts Catalog for applicable clamp sizes.

(1) Connect the harness connectors to the harness receptacles as follows. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol (P11-009). Let dry.


A
A
AIRFRAME CONNECTION
FWD
W1 HARNESS
1
W2 HARNESS
2
VIEW A-A
2
W2 HARNESS
1
W1 HARNESS
L-A1546 (0000)
PW V

EEC Fan Case Wiring Harnesses (W1) And (W2)
Figure 401 (Sheet 1)
(Task 72−00−00−990−008)

1. EEC Fan Case Wiring Harness (W1), See 72−00−33, Installation−06.
2. EEC Fan Case Wiring Harness (W2), See 72−00−33, Installation−06.

Key To Figure 401 (Sheet 1)

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the (Glenair TG−70) strap wrench or the (Glenair TG−69) soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).

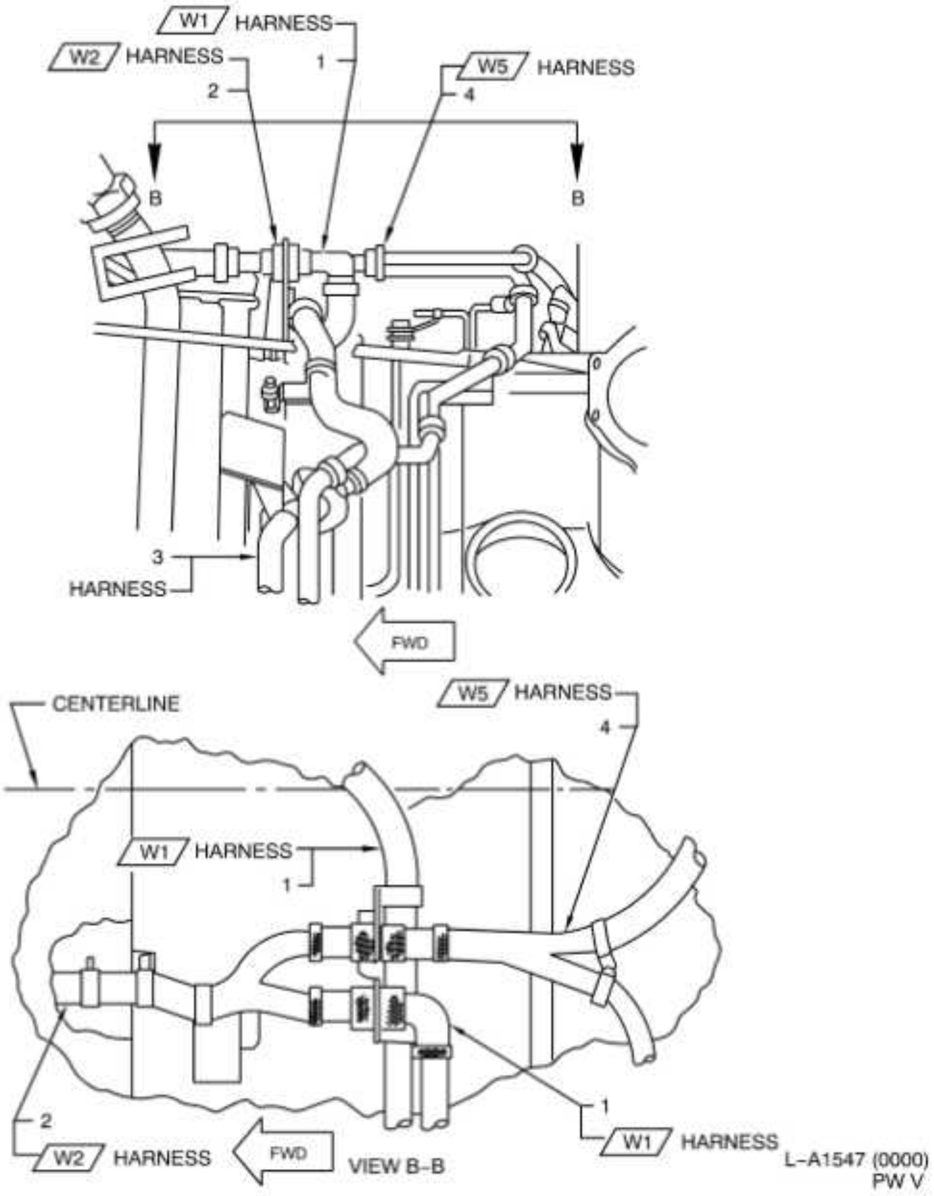
This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

See the instructions given with the strap wrench for correct use.

(2) Locate mid−point or control point of harness at a position where harness is clamped to a fixed bracket. Attach a clamp with proper hardware and torque.

(3) From established control point, attach clamps loosely in both directions, ensuring that slack is equal between all clamps and no mechanical strain is imposed on wires, junctions, supports or connections. Care must be taken to avoid sharp bends at clamps, supports and connector backshells.


W1 HARNESS
1
W2 HARNESS
2
W5 HARNESS
4
B
B
3
HARNESS
FWD
CENTERLINE
W5 HARNESS
4
W1 HARNESS
1
1
W1 HARNESS
2
W2 HARNESS
FWD
VIEW B−B
L−A1547 (0000)
PW V

EEC Fan Case Wiring Harnesses (W1) And (W2)
And EEC Core Engine Wiring Harnesses (W3) And (W5)
Figure 401 (Sheet 2)
(Task 72−00−00−990−008)

1. EEC Fan Case Wiring Harness (W1), See 72−00−33, Installation−06.
2. EEC Fan Case Wiring Harness (W2), See 72−00−33, Installation−06.
3. EEC Core Engine Wiring Harness (W3), See 72−00−34, Installation−18.
4. EEC Core Engine Wiring Harness (W5), See 72−00−34, Installation−20.

Key To Figure 401 (Sheet 2)

(4) Where wiring is dressed downward to a connector, terminal block, panel or junction box a trap or drip loop shall be provided to prevent fluids or condensate from running into these devices. See Figure 403. Waterproof connections and backshells are exempt from this requirement. Allow sufficient slack for removal and installation of connectors and to permit free movement of shock and vibration isolater mounted equipment.

B. After all harness, lead or cable attachments are in place, tighten clamp hardware with proper torque.

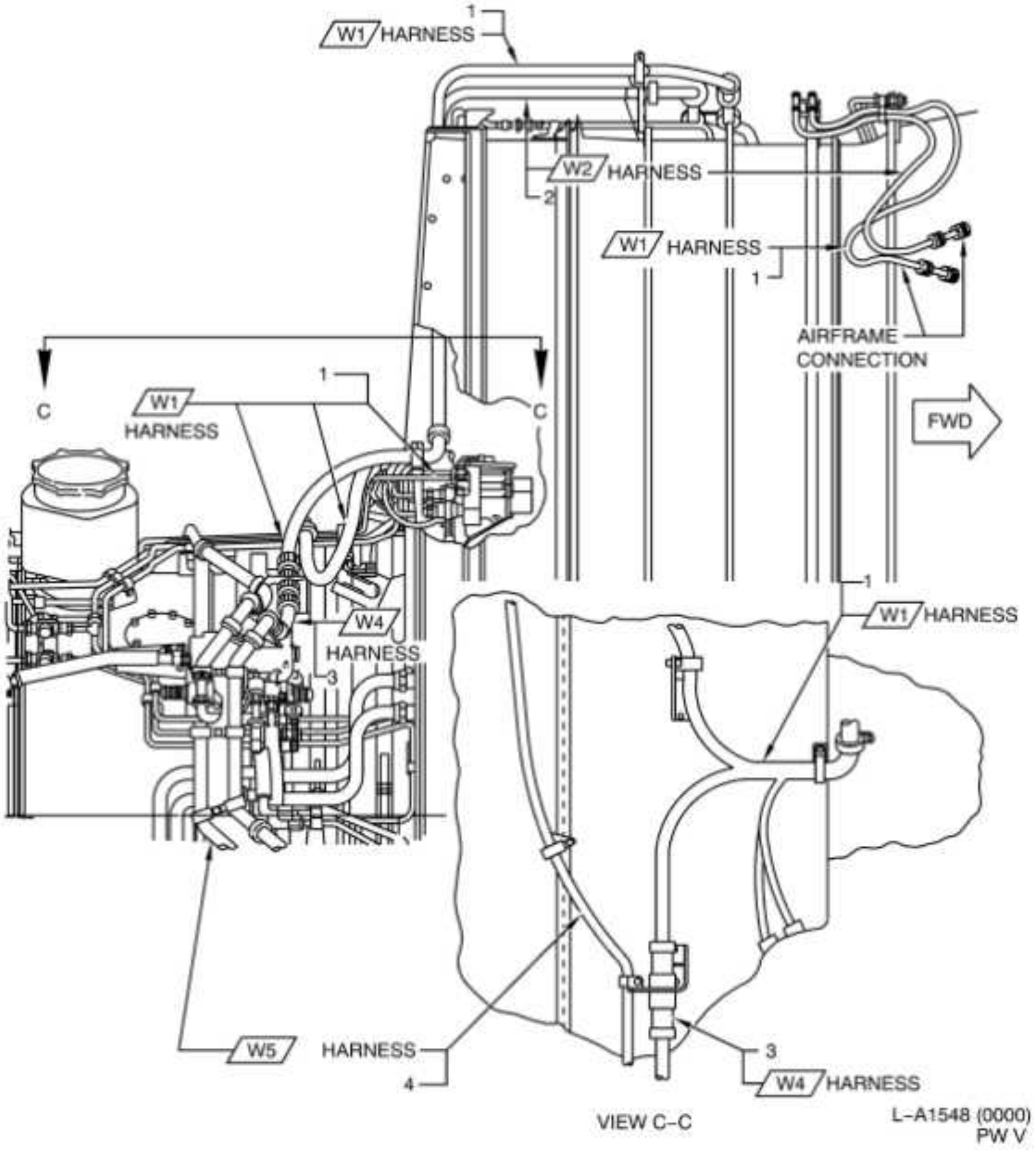
(1) Clamps must be at 90 degree to the harness, lead or cable (see Figure 402) and must not slip, rotate, or have cushion material between the clamp ends.

(2) Make certain that all wires within the open bundle harness are within the cushion portion of the clamp and none are caught or trapped in the metal parts of the clamp. See Figure 404.

(3) Tie wire groups and bundles together at intervals not greater than two inches (50.80 mm). Bundles shall have a neat and orderly appearance with no foldbacks or loops outside the bundle. Individual wires should be essentially parallel within the bundle with a minimum of tangling except where twisted groups may be required.

(4) All clamp bolts and nuts must be tightened to recommended standard torque values without distorting the clamp cushion material.

(5) Chafing must be prevented by proper routing and clamping to prevent contact with edges of equipment or structure. Maintain 0.125 inch (3.175 mm) minimum clearance with adjacent part when harness, lead or cable is deflected or pushed.

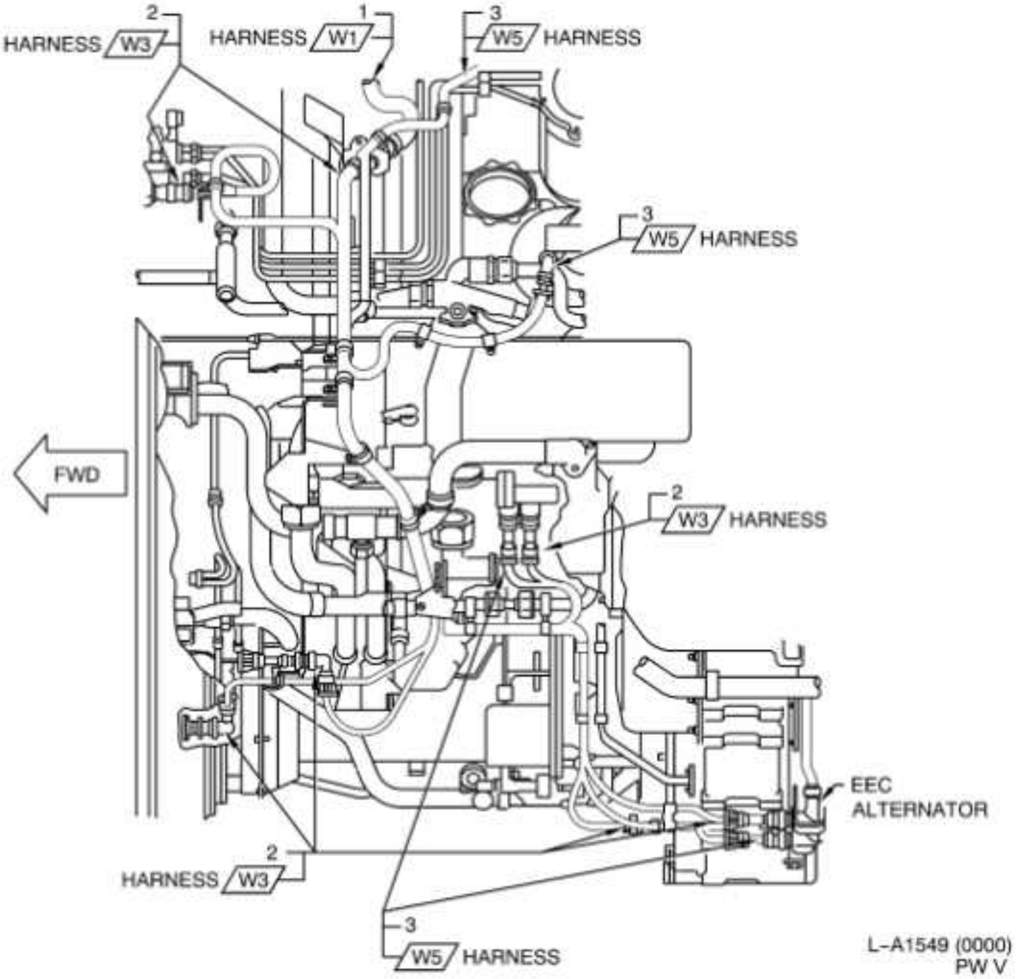

W1 HARNESS
1
W2 HARNESS
2
W1 HARNESS
1
AIRFRAME CONNECTION
FWD
C
C
1
W1 HARNESS
W4 HARNESS
3
1
W1 HARNESS
W5
HARNESS
4
3
W4 HARNESS
VIEW C-C
L-A1548 (0000)
PW V

EEC Fan Case Wiring Harnesses (W1) And (W2)
And EEC Core Engine Wiring Harnesses (W4) And (W5)
Figure 401 (Sheet 3)
(Task 72-00-00-990-008)

ENGINE GENERAL − INSTALLATION−00

1. EEC Fan Case Wiring Harness (W1), See 72−00−33, Installation−06.
2. EEC Fan Case Wiring Harness (W2), See 72−00−33, Installation−06.
3. EEC Core Engine Wiring Harness (W4), See 72−00−34, Installation−19.
4. EEC Core Engine Wiring Harness (W5), See 72−00−34, Installation−20.

Key To Figure 401 (Sheet 3)

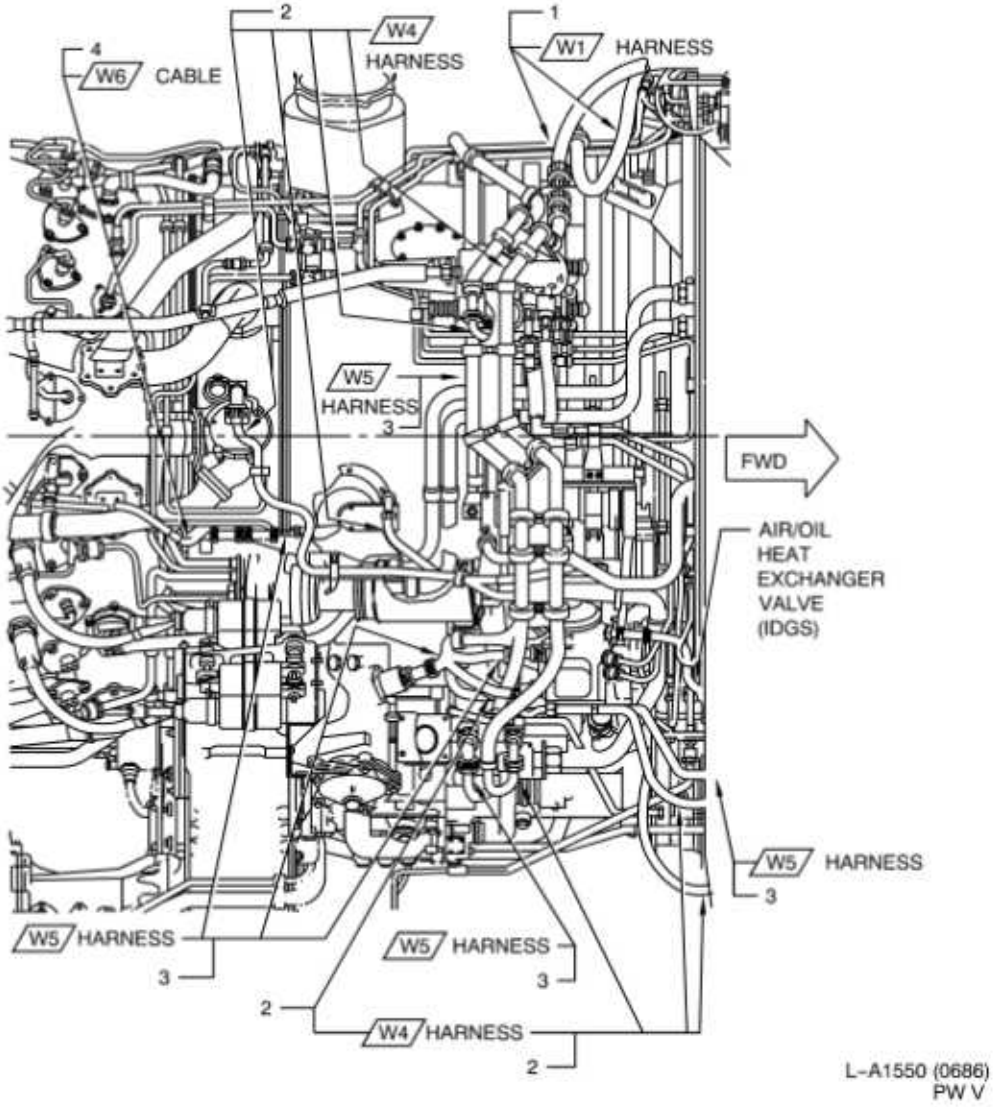

2
HARNESS W3
1
HARNESS W1
3
W5 HARNESS
3
W5 HARNESS
FWD
2
W3 HARNESS
EEC
ALTERNATOR
2
HARNESS W3
3
W5 HARNESS
L-A1549 (0000)
PW V

EEC Fan Case Wiring Harness (W1) And EEC Core
Engine Wiring Harnesses (W3) And (W5)
Figure 401 (Sheet 4)
(Task 72-00-00-990-008)

ENGINE GENERAL − INSTALLATION−00

1. EEC Fan Case Wiring Harness (W1), See 72−00−33, Installation−06.
2. EEC Core Engine Wiring Harness (W3), 72−00−34, Installation−18.
3. EEC Core Engine Wiring Harness (W5), See 72−00−34, Installation−20.

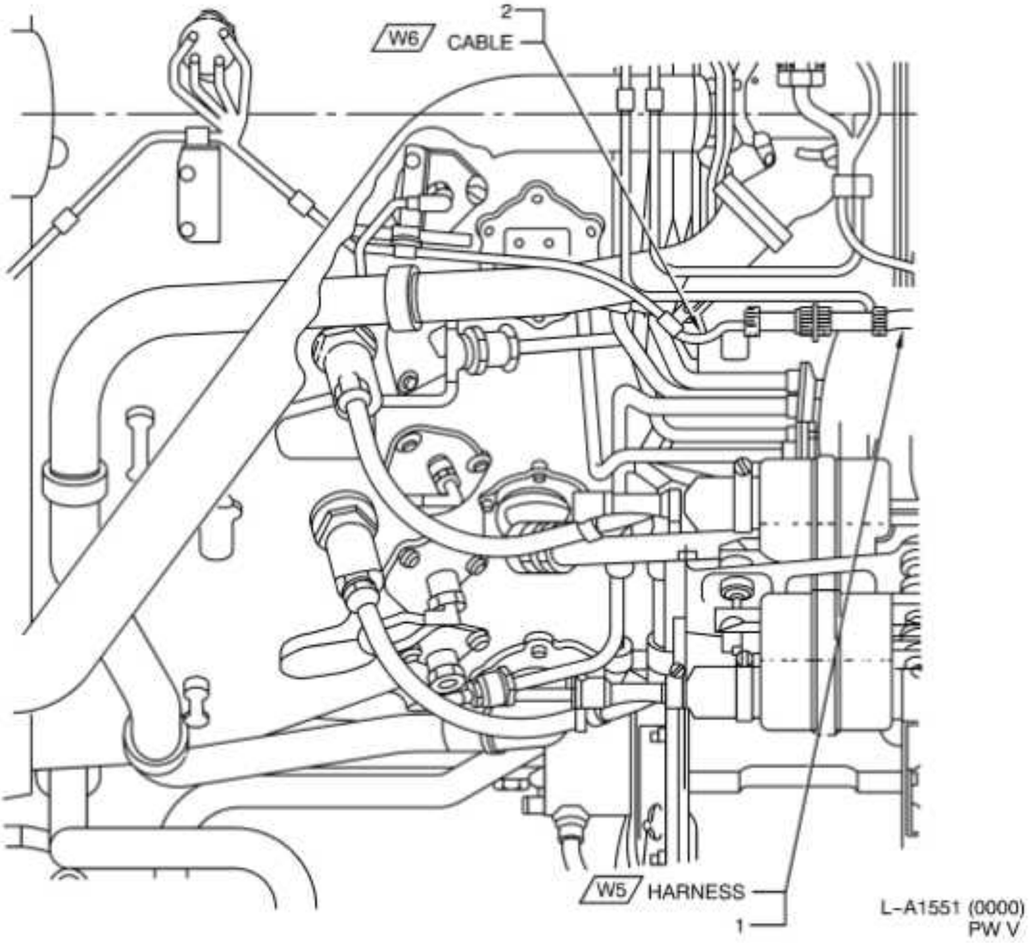
Key To Figure 401 (Sheet 4)


2
W4
HARNESS
1
W1
HARNESS
4
W6
CABLE
W5
HARNESS
3
FWD
AIR/OIL
HEAT
EXCHANGER
VALVE
(IDGS)
W5
HARNESS
3
W5
HARNESS
3
W5
HARNESS
3
2
W4
HARNESS
2
L-A1550 (0686)
PW V

EEC Fan Case Wiring Harness (W1), EEC Core Engine Wiring Harnesses (W4) And (W5) And EEC Thermocouple And Airframe Cable (W6)
Figure 401 (Sheet 5)
(Task 72−00−00−990−008)

1. EEC Fan Case Wiring Harness (W1), See 72−00−33, Installation−06.
2. EEC Core Engine Wiring Harness (W4), See 72−00−34, Installation−19.
3. EEC Core Engine Wiring Harness (W5), See 72−00−34, Installation−20.
4. EEC Thermocouple And Airframe Cable (W6), See 72−00−54, Installation−09.

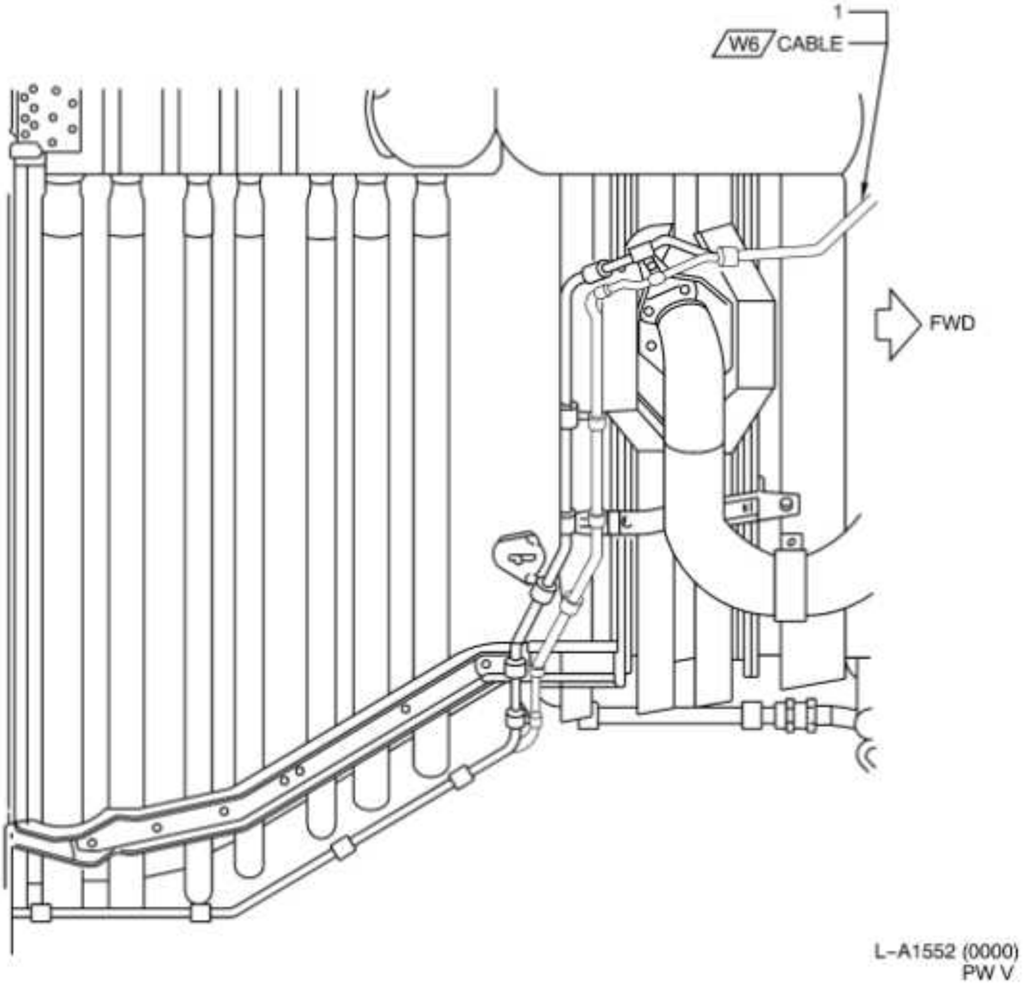
Key To Figure 401 (Sheet 5)


2
W6
CABLE
W5
HARNESS
1
L-A1551 (0000)
PW V

EEC Core Engine Wiring Harness (W5) And
EEC Thermocouple And Airframe Cable (W6)
Figure 401 (Sheet 6)
(Task 72-00-00-990-008)

1. EEC Core Engine Wiring Harness (W5), See 72−00−34, Installation−20.
2. EEC Thermocouple And Airframe Cable (W6), See 72−00−54, Installation−09.

Key To Figure 401 (Sheet 6)

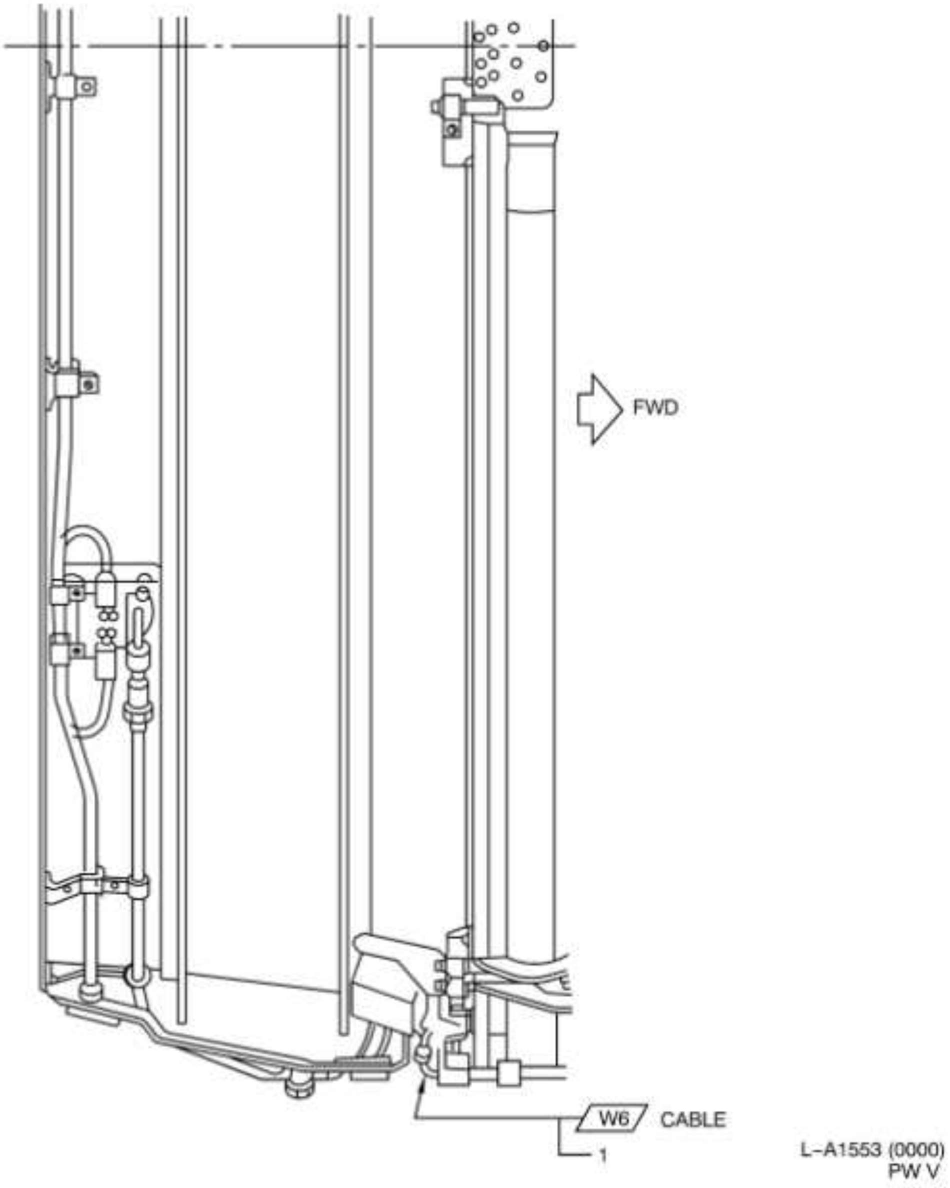

1
W6 CABLE
FWD
L-A1552 (0000)
PW V

EEC Thermocouple And Airframe Cable (W6)
Figure 401 (Sheet 7)
(Task 72-00-00-990-008)

ENGINE GENERAL − INSTALLATION−00

1. EEC Thermocouple And Airframe Cable (W6), See 72−00−54, Installation−09.

Key To Figure 401 (Sheet 7)

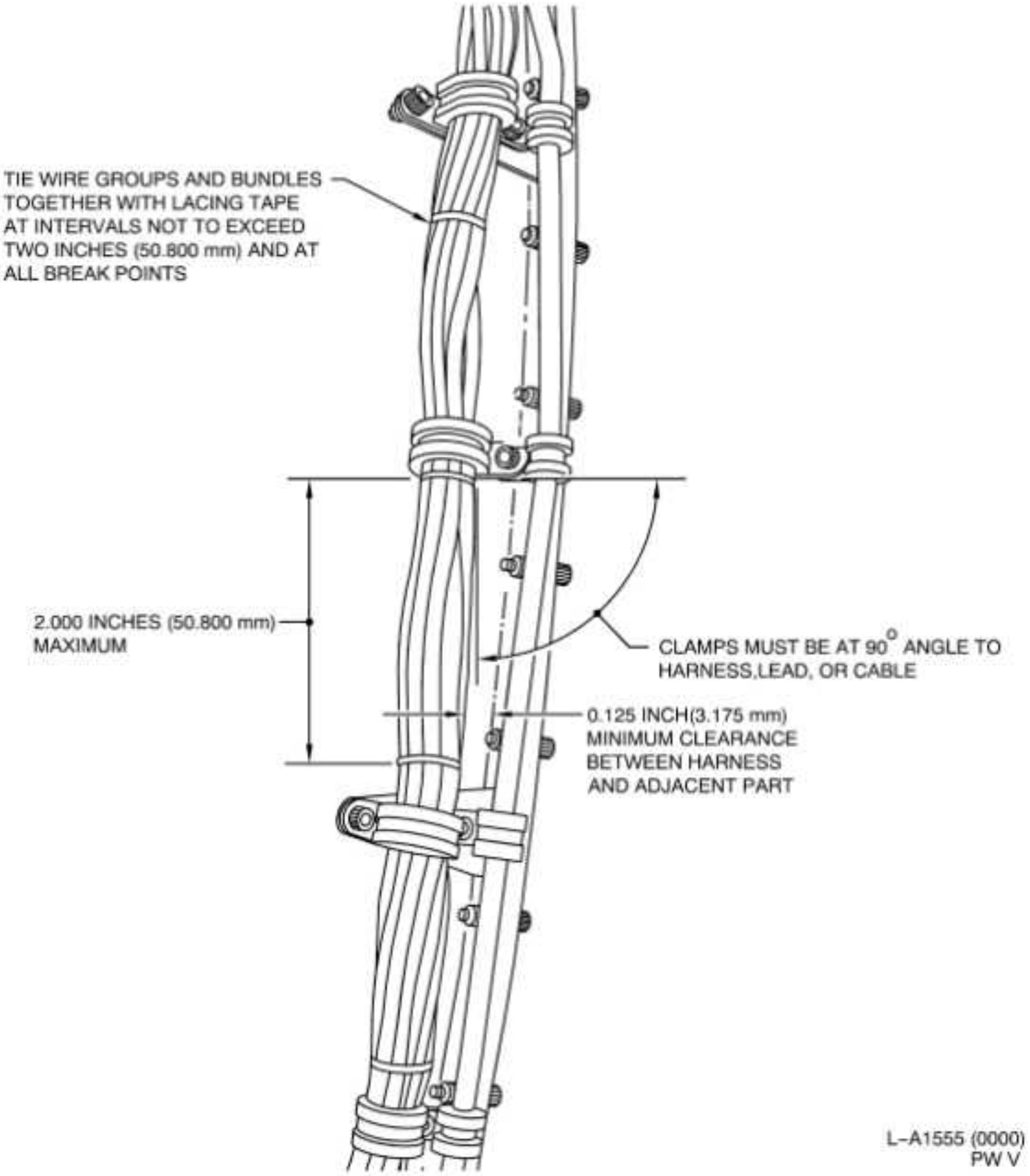

FWD
W6
CABLE
1
L-A1553 (0000)
PW V

EEC Thermocouple And Airframe Cable (W6)
Figure 401 (Sheet 8)
(Task 72-00-00-990-008)

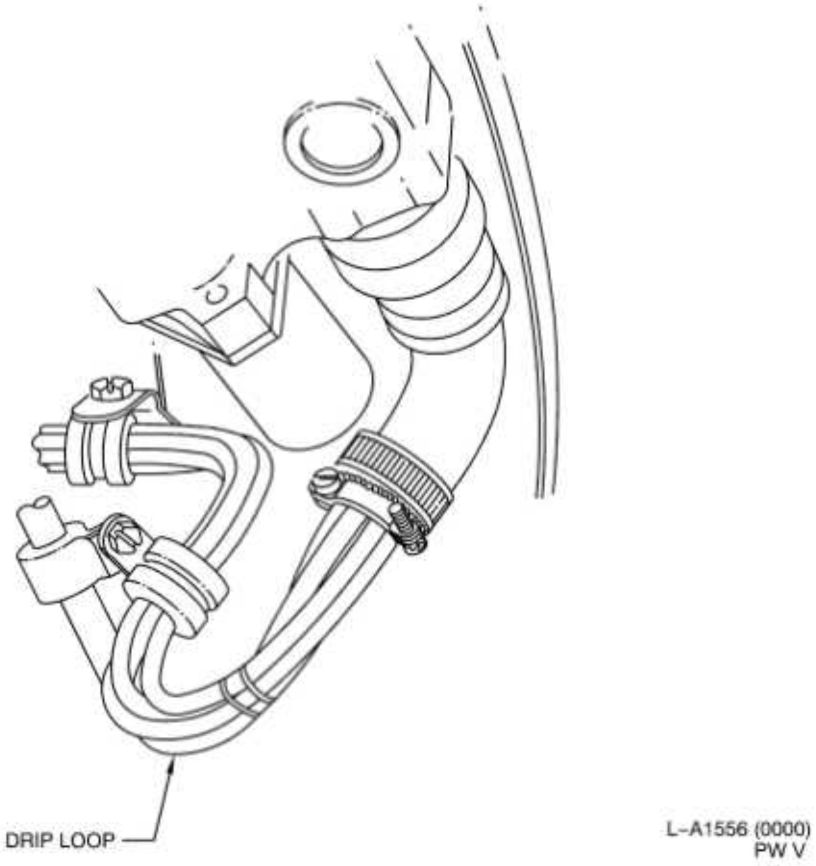
ENGINE GENERAL − INSTALLATION−00

1. EEC Thermocouple And Airframe Cable (W6), See 72−00−54, Installation−09.

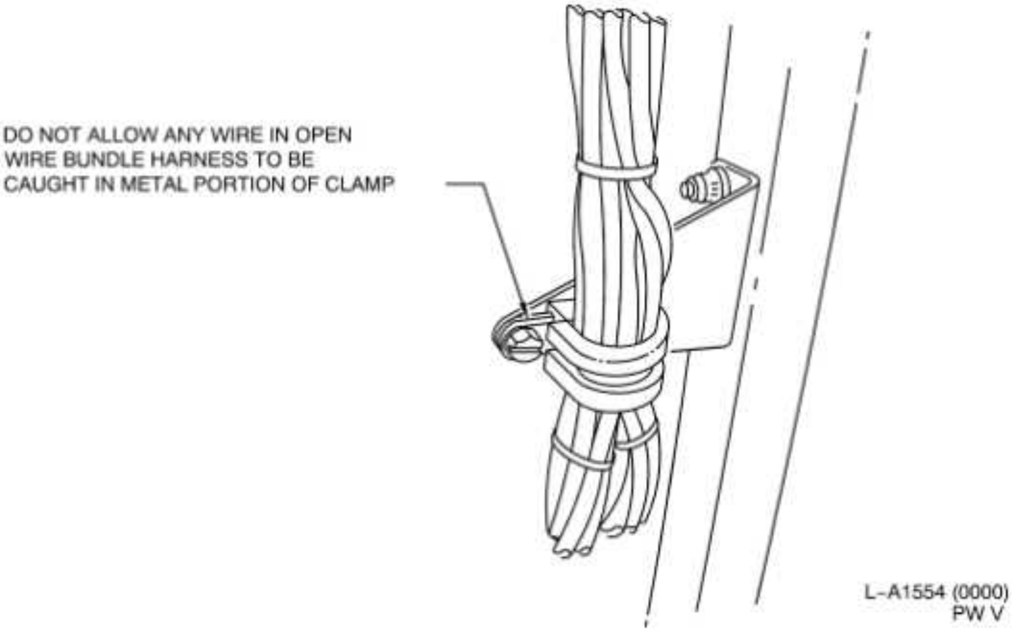
Key To Figure 401 (Sheet 8)


TIE WIRE GROUPS AND BUNDLES TOGETHER WITH LACING TAPE AT INTERVALS NOT TO EXCEED TWO INCHES (50.800 mm) AND AT ALL BREAK POINTS
2.000 INCHES (50.800 mm) MAXIMUM
CLAMPS MUST BE AT 90° ANGLE TO HARNESS,LEAD, OR CABLE
0.125 INCH(3.175 mm) MINIMUM CLEARANCE BETWEEN HARNESS AND ADJACENT PART
L−A1555 (0000)
PW V

Typical Harness Installation
Figure 402
(Task 72−00−00−990−009)


DRIP LOOP
L-A1556 (0000)
PW V

Typical Drip Loop
Figure 403
(Task 72-00-00-990-009)


DO NOT ALLOW ANY WIRE IN OPEN WIRE BUNDLE HARNESS TO BE CAUGHT IN METAL PORTION OF CLAMP
L-A1554 (0000)
PW V

Typical Clamp Installation
Figure 404
(Task 72-00-00-990-009)

ENGINE GENERAL - INSTALLATION-01

Task 72-00-00-450-001:

1. Install No. 1, 1 1/2 And 2 Bearing Oil Pressure Strainer

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Material:

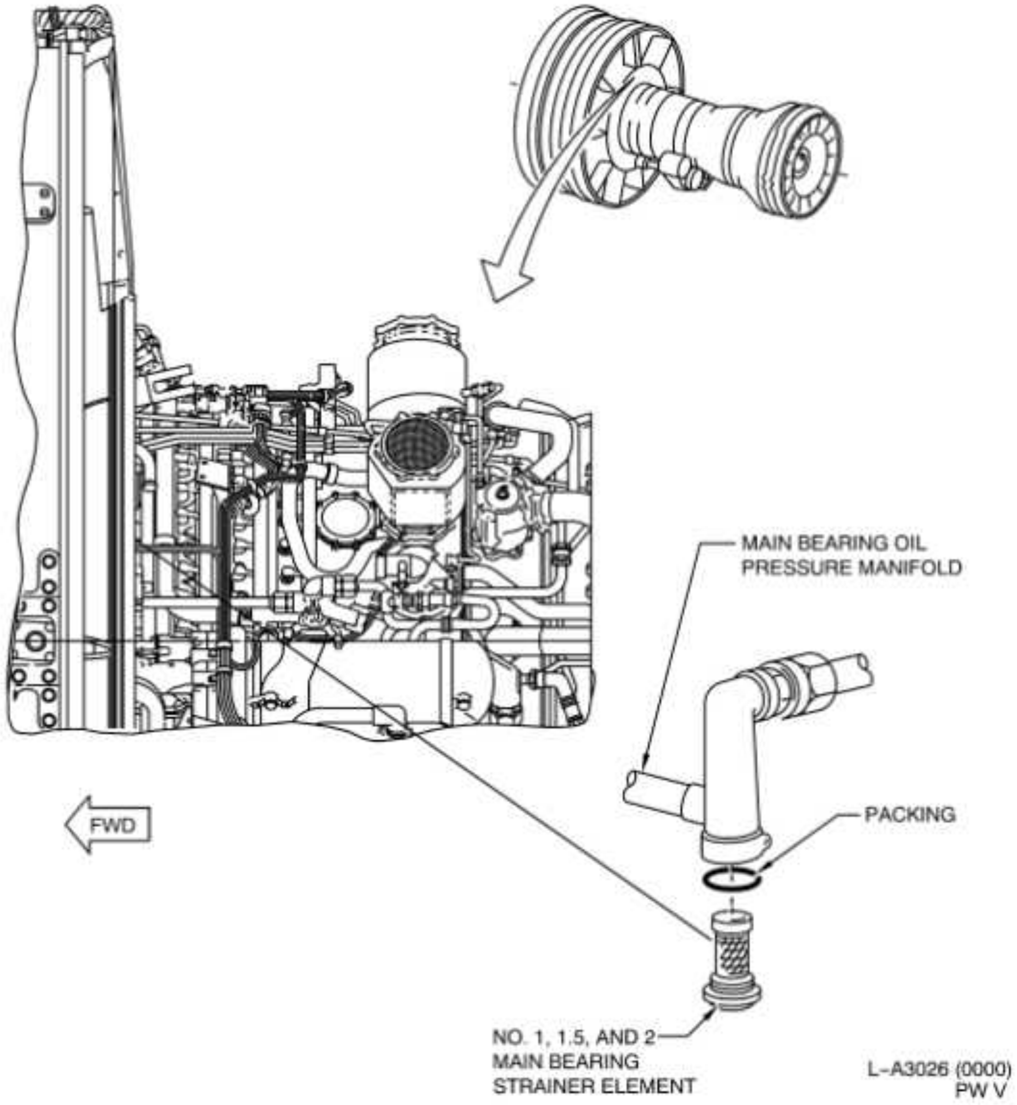
Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Packing	1	79-21-00	11	150

B. Procedure
See Figure 401.
(1) Remove protective closures.
(2) Lubricate packing with Engine Oil (P03-001) and install packing onto strainer.
(3) Lubricate threads of strainer with Engine Oil (P03-001) and install strainer to housing on main bearing pressure manifold assembly. Torque strainer to 275 - 300 lb-in. (31.071 - 33.895 N.m). Install the Lockwire (P05-289) or Safety Cable (P05-291) and Safety Cable Ferrule (P05-292).

C. Postrequisites
(1) Test engine per Repair Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).


MAIN BEARING OIL PRESSURE MANIFOLD
PACKING
FWD
NO. 1, 1.5, AND 2 MAIN BEARING STRAINER ELEMENT
L-A3026 (0000)
PW V

No. 1, 1 1/2 And 2 Bearing Oil Pressure Strainer
Figure 401
(Task 72−00−00−450−001)

ENGINE GENERAL - INSTALLATION-02

Task 72-00-00-450-002:

1. Install Angle And Main Gearbox Strainer

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Packing	1	79-21-00	6	90

B. Procedure

See Figure 401.

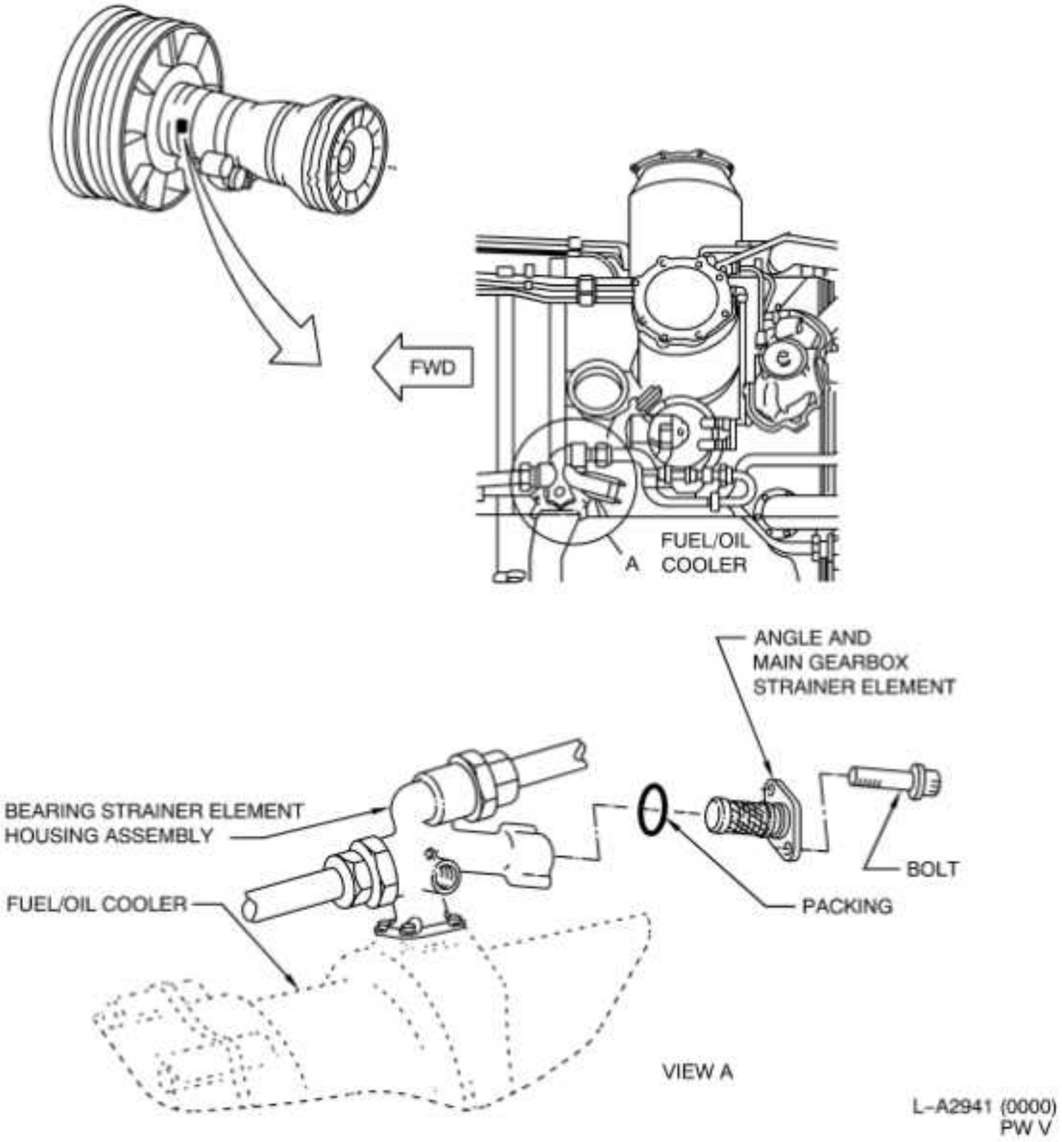
(1) Remove protective closures.

(2) Lubricate packing with Engine Oil (P03-001) and install packing to groove at base of strainer.

(3) Install strainer to main bearing strainer element housing assembly located on top of fuel oil cooler at approximately 9 o'clock position. Secure in place with bolts, lubricated with Engine Oil (P03-001). Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

C. Postrequisites

(1) Test engine per Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).


FWD
FUEL/OIL
COOLER
A
ANGLE AND
MAIN GEARBOX
STRAINER ELEMENT
BEARING STRAINER ELEMENT
HOUSING ASSEMBLY
BOLT
FUEL/OIL COOLER
PACKING
VIEW A
L−A2941 (0000)
PW V

Angle And Main Gearbox Strainer
Figure 401
(Task 72−00−00−450−002)

Task 72-00-00-450-003:

1. Install No. 3 Bearing Oil Pressure Strainer (Pre SB PW4ENG 79-52)

A. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	79-21-00/10/130

B. Procedure
See Figure 401.

(1) Remove protective closures.

(2) Lubricate packing with Engine Oil P03-001, and install packing onto strainer.

CAUTION: YOU MUST USE THE WRENCHING FLATS ON THE STRAINER HOUSING WHEN YOU LOOSEN OR TIGHTEN THE STRAINER. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

(3) Lubricate the threads of the strainer with Engine Oil P03-001. Install the strainer to the No. 3 bearing oil strainer housing and tighten by hand. While you hold the stainer housing with a wrench, torque the strainer to 275 - 300 lb-in. (31.071 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

C. Postrequisites

(1) Test engine per Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003). R

Task 72-00-00-450-003-A:

2. Install No. 3 Bearing Oil Pressure Strainer (Post SB PW4ENG 79-52)

A. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-021	Antigallant Compound (PWA 550-3)

Expendable Parts:

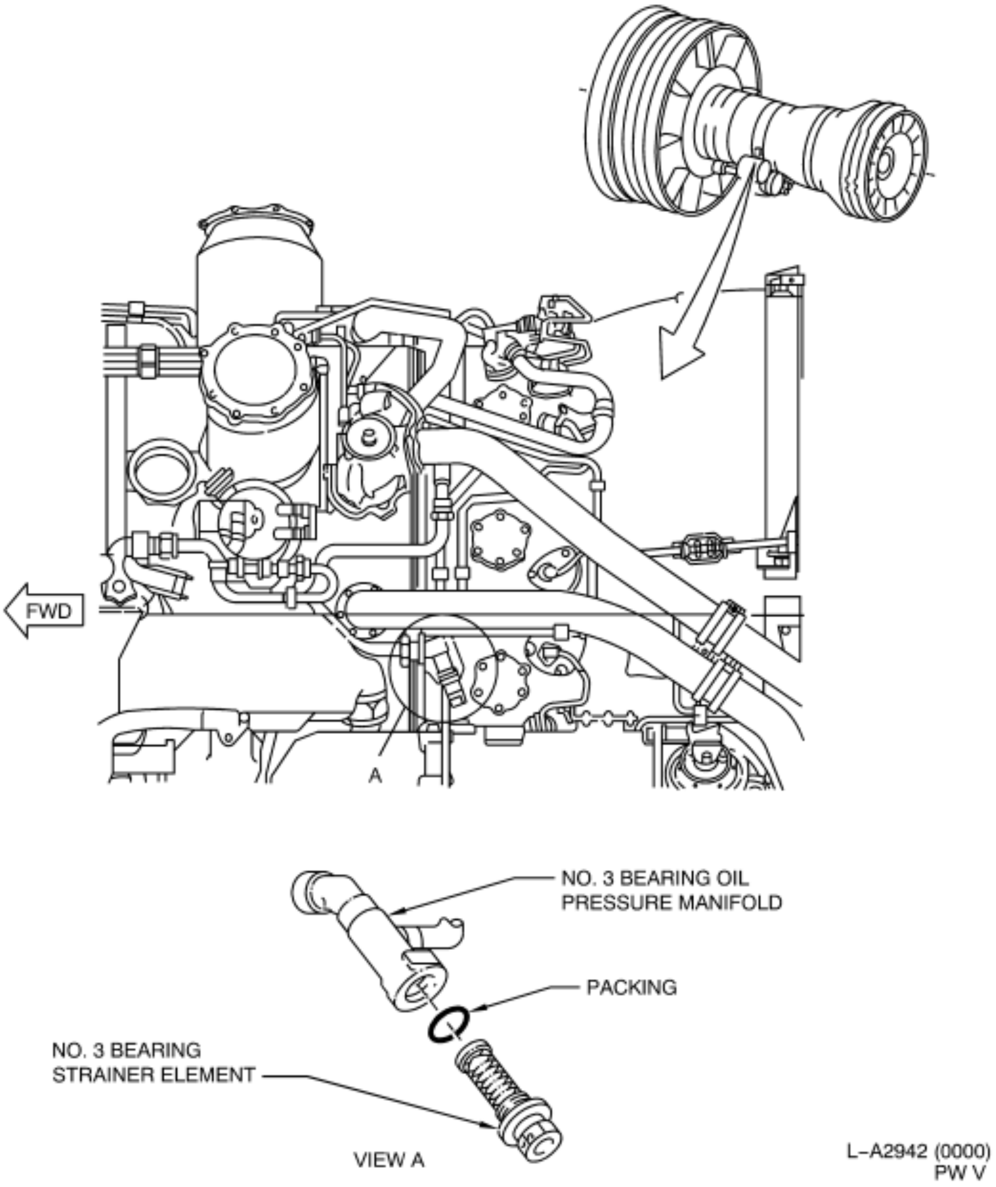
PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	79-21-00/9/110
Retainer	1	79-21-00/9/120
Packing, AS3209-014		

B. Procedure
See Figure 402 and Figure 403.

(1) Remove protective closures.

(2) Install the strainer to the ferrule end of the No. 3 bearing oil pressure tube (LP19).

(3) Install a packing, lubricated with Engine Oil P03-001, to the adapter. Install the adapter to the ferrule end of the No. 3 bearing oil pressure tube (LP19). Attach the adapter to the tube with bolts, threads lubricated with Engine Oil P03-001, and nuts.


FWD
A
NO. 3 BEARING OIL PRESSURE MANIFOLD
PACKING
NO. 3 BEARING STRAINER ELEMENT
VIEW A
L-A2942 (0000)
PW V

No. 3 Bearing Oil Pressure Strainer
Figure 401
(Task 72-00-00-450-003)

ENGINE GENERAL - INSTALLATION-03

(4) Torque the nuts that attach the adapter to the ferrule end of the tube (LP19) to 36 - 40 lb-in. (4.067 - 4.519 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to the bolts.

(5) Install the oil pressure trim tube assembly (LP31) as follows.

  (a) Lubricate the tube nuts with Antigallant Compound P06-021.

  (b) Install the trim tube to the oil metering nipple (restrictor). Tighten the tube nut by hand.

(6) Connect the manifold nuts on the No. 3 bearing oil pressure manifold (LP18) as follows.

  (a) Lubricate the manifold nut threads and manifold ferrules with Antigallant Compound P06-021. See Figure 403.

  (b) Lubricate a packing with Engine Oil P03-001 and install the packing and retainer to the front of the manifold.

  (c) Connect the front manifold nut to the rear of the strainer housing on the fuel/oil cooler. Tighten the manifold nut by hand.

  (d) Tighten the nut on the oil pressure trim tube (LP31) to the manifold tee (LP18) by hand.

  (e) Connect the rear manifold nut (LP18) to the adapter in the No. 3 bearing oil pressure tube (LP19) located at the 9 o'clock position. Tighten the manifold nut by hand.

(7) Attach the ferrule end of the No. 3 bearing oil pressure tube (LP19) to the bracket on Flange K with two bolts, threads lubricated with Engine Oil P03-001. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(8) (Reference 2016) Adjust the forward tube clamp on the oil trim pressure tube (LP32) and the clamp on the No. 3 bearing oil pressure manifold (LP18) so that center of the forward clamp (on the oil trim pressure tube) is 2.500 - 3.000 inch (63.500 - 76.200 mm) from the center of the rear clamp (Post SB PW4ENG 72-211).

(9) Attach the clamps together with a bolt, threads lubricated with Engine Oil P03-001, and a nut. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

CAUTION: YOU MUST USE THE FLATS ON THE MATING PARTS WHEN YOU TIGHTEN MANIFOLDS AND TUBES. THIS WILL PREVENT ANY TWISTS DAMAGE TO THE TUBES.

(10) Torque the manifold nuts on the No. 3 bearing oil pressure manifold (LP18) as follows.

(a) Torque the front manifold nut that is attached to the strainer housing on the fuel/oil cooler to 140 - 160 lb-in. (15.818 - 18.078 N.m), then loosen and torque again to the same value.

(b) Torque the rear manifold nut to the adapter in the No. 3 bearing oil pressure tube (LP19) to 675 - 750 lb-in. (76.265 - 84.739 N.m).

(c) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to the manifold nuts.

(11) Torque the tube nuts on oil trim pressure tube (LP31) as follows.

(a) Torque the front tube nut that is attached to the manifold tee (LP18) to 675 - 750 lb-in. (76.265 - 84.739 N.m).

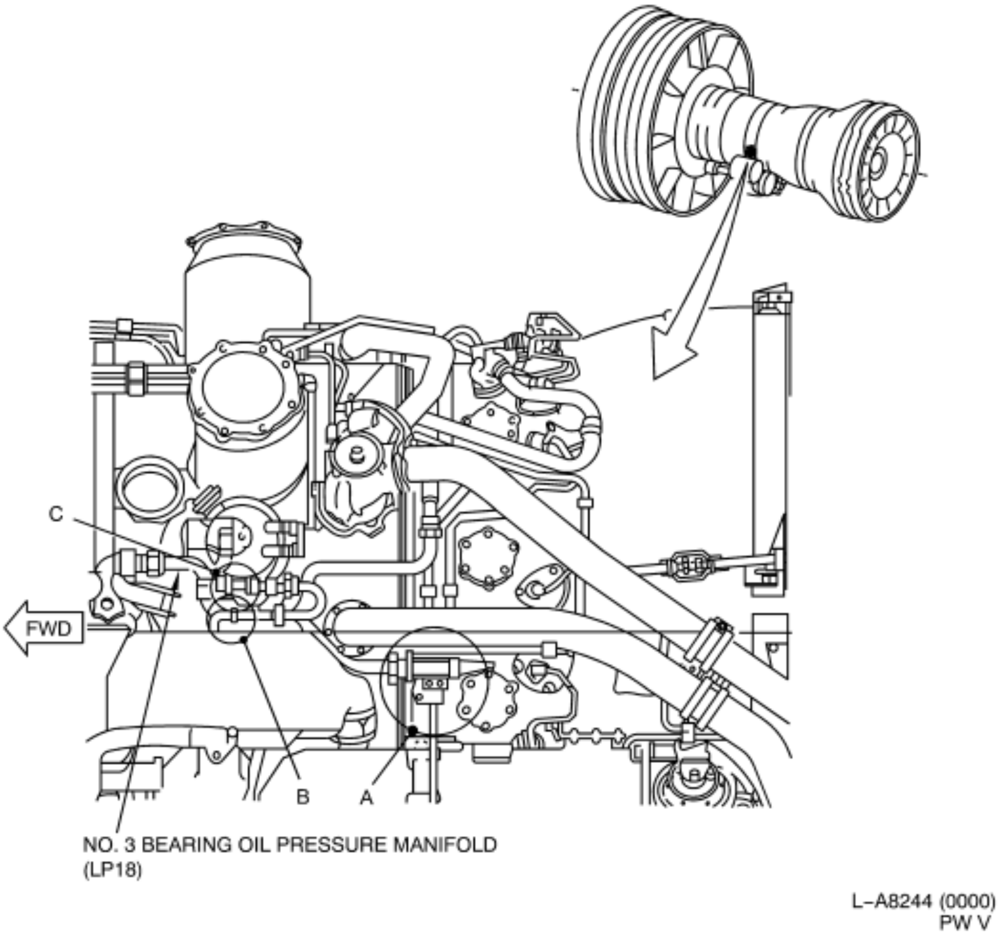
(b) Torque the tube nut that is attached to the oil tube metering nipple (restrictor) to 675 - 750 lb-in. (76.265 - 84739 N.m).

(c) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to the tube nuts.

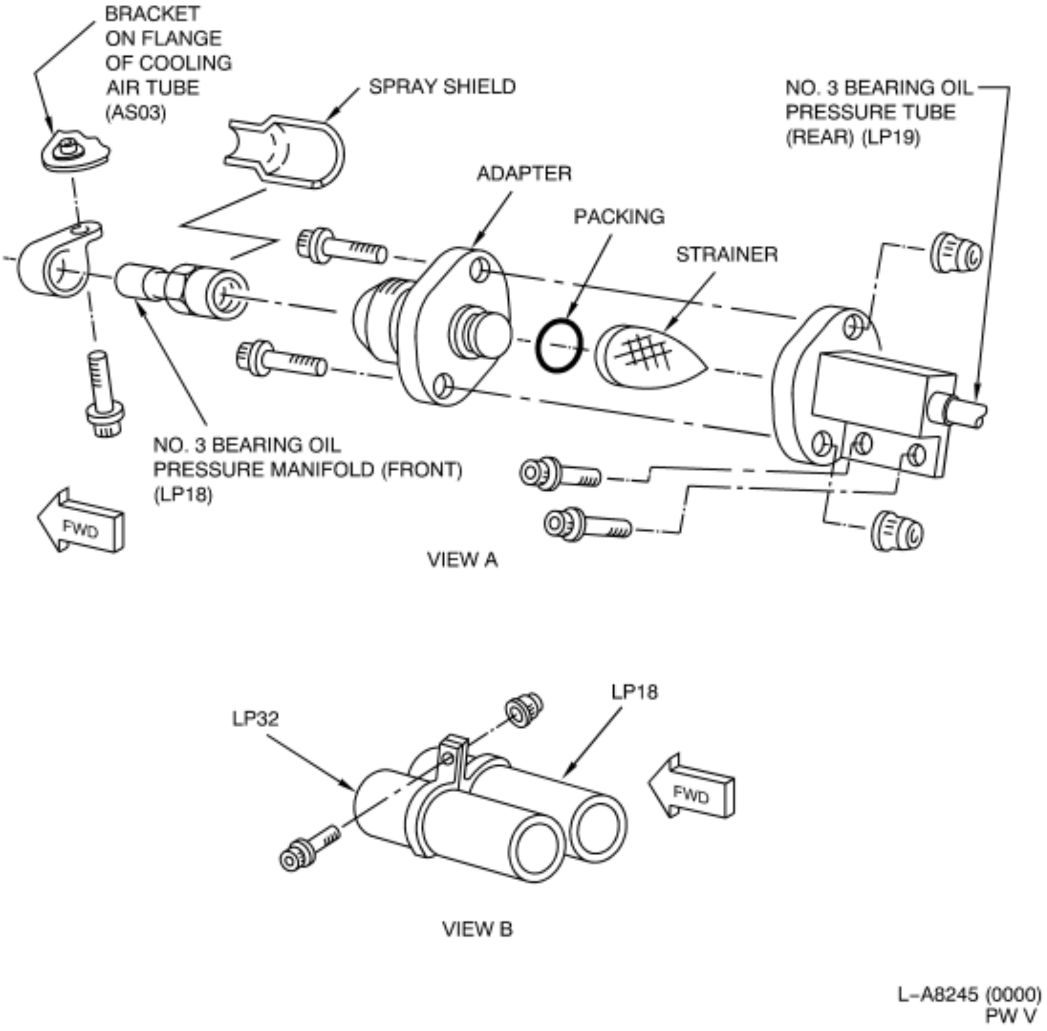
(12) At the rear of the No. 3 bearing oil pressure manifold (LP18), install a spray shield to the inboard side of the manifold. Attach the spray shield with a clamp and a bolt, threads lubricated with Engine Oil P03−001, to a bracket that is attached to the flange of the cooling air tube on the high compressor. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

C. Postrequisites

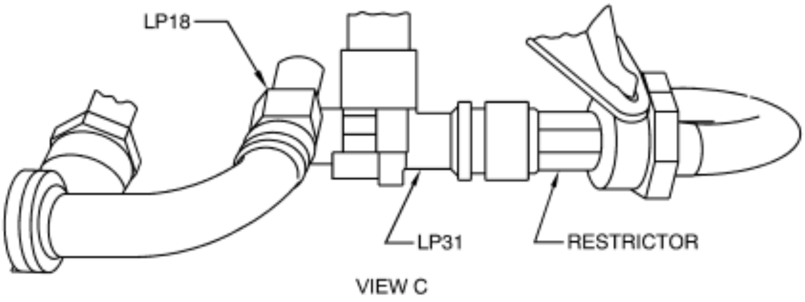
(1) Test engine per Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003). R


C
FWD
B
A
NO. 3 BEARING OIL PRESSURE MANIFOLD
(LP18)
L−A8244 (0000)
PW V

No. 3 Bearing Oil Pressure Strainer
Figure 402 (Sheet 1)
(Task 72−00−00−450−003−A)

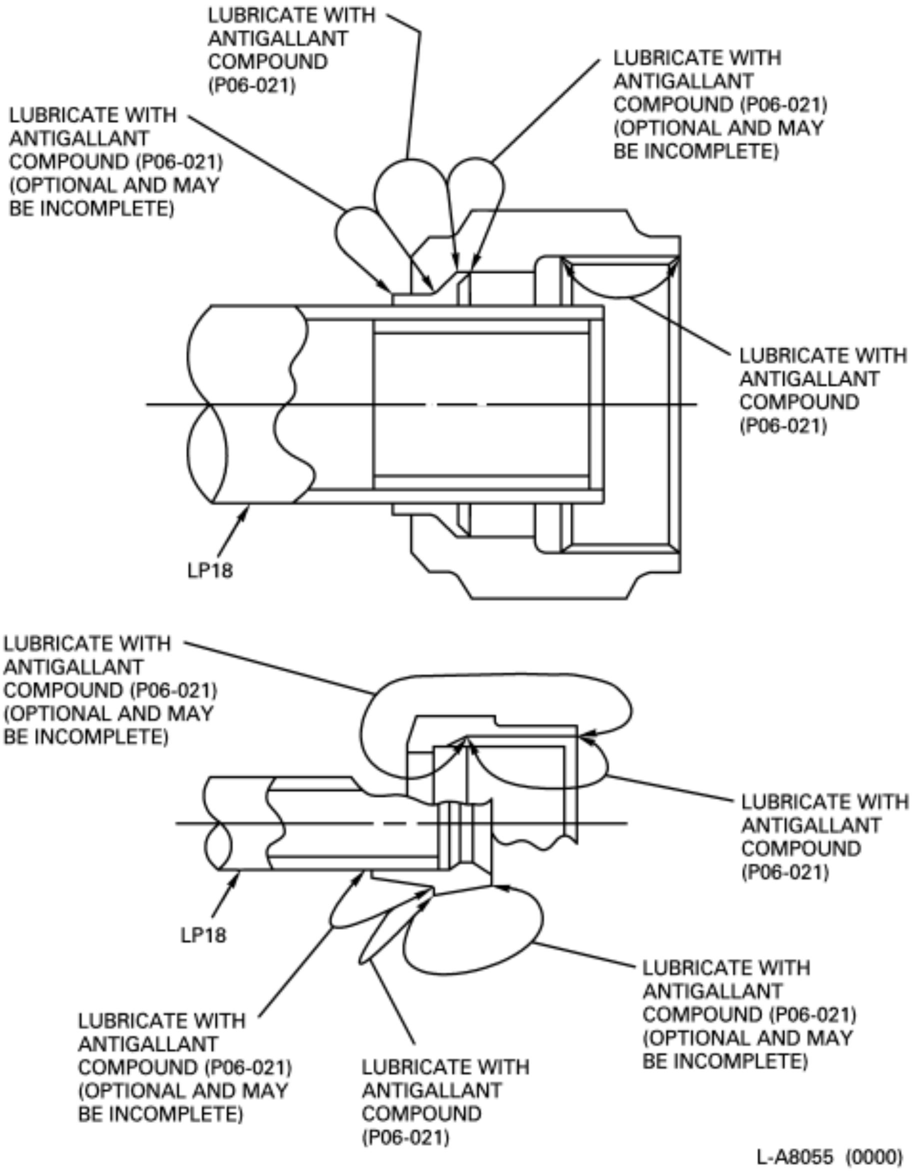

BRACKET ON FLANGE OF COOLING AIR TUBE (AS03)
SPRAY SHIELD
NO. 3 BEARING OIL PRESSURE TUBE (REAR) (LP19)
ADAPTER
PACKING
STRAINER
NO. 3 BEARING OIL PRESSURE MANIFOLD (FRONT) (LP18)
FWD
VIEW A
LP32
LP18
FWD
VIEW B
L-A8245 (0000)
PW V

No. 3 Bearing Oil Pressure Strainer
Figure 402 (Sheet 2)
(Task 72-00-00-450-003-A)


LP18
LP31
RESTRICTOR
VIEW C

L−A8246 (0000)
PW V

No. 3 Bearing Oil Pressure Strainer
Figure 402 (Sheet 3)
(Task 72−00−00−450−003−A)


LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LP18
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LP18
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
L-A8055 (0000)

Application Of Antigallant On Manifold Ferrules And Nuts
Figure 403
(Task 72−00−00−450−003−A)

ENGINE GENERAL - INSTALLATION-04

Task 72-00-00-450-004:

1. Install No. 4 Bearing Oil Pressure Strainer
   A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

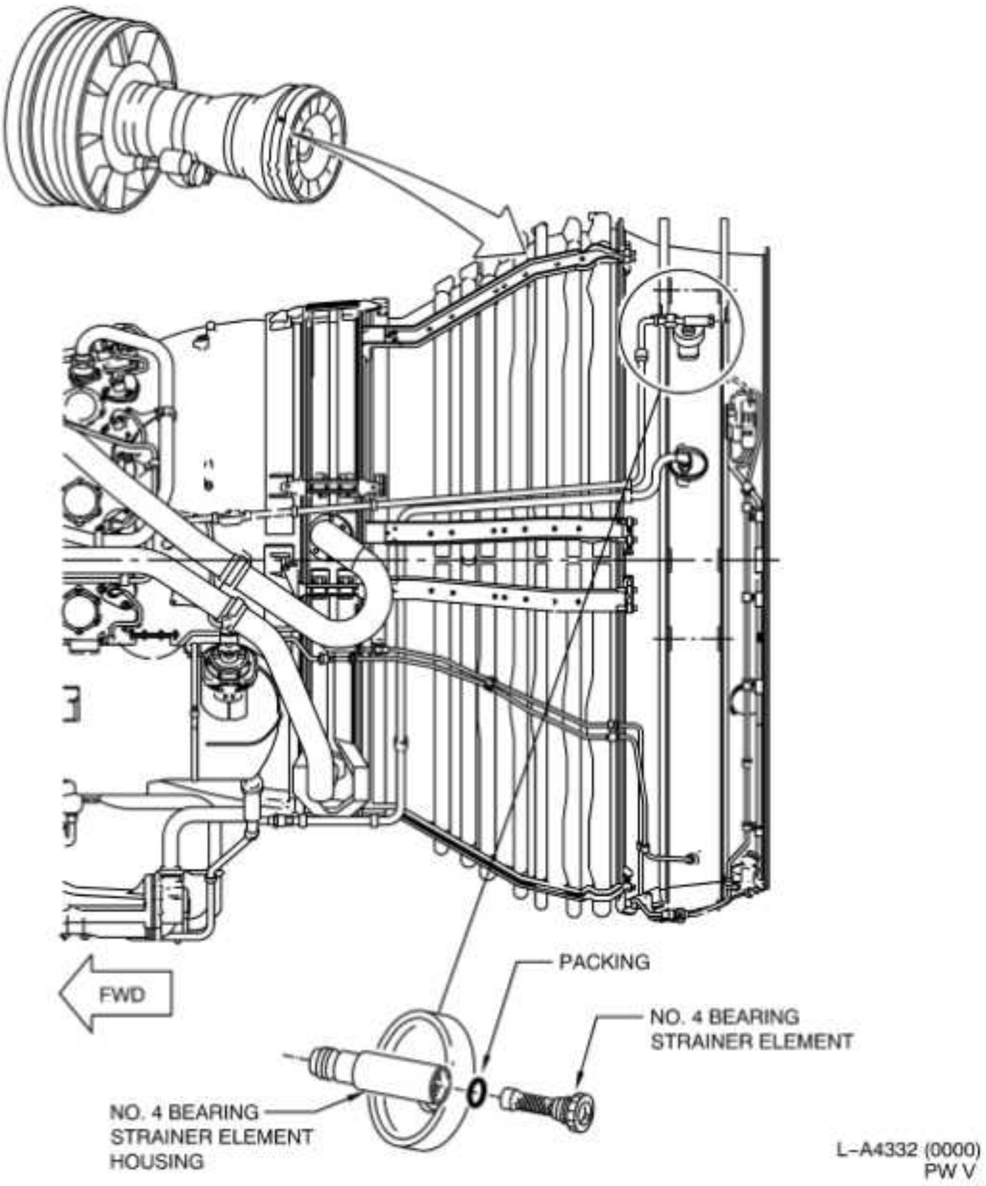
Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Packing	1	79-21-00	12	190

   B. Procedure
      See Figure 401.
      (1) Remove protective closures and install new packing lubricated with Engine Oil (P03-001) to strainer element.
      (2) Install strainer element, threads lubricated with Engine Oil (P03-001), to strainer housing at approximately 10:30 o'clock position on exhaust case.
      (3) Torque strainer element to 150 - 170 lb-in. (16.948 - 19.207 N.m). Install the Lockwire (P05-289) or Safety Cable (P05-291) and Safety Cable Ferrule (P05-292).
   C. Postrequisites
      (1) Test engine per Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).


FWD
PACKING
NO. 4 BEARING STRAINER ELEMENT
NO. 4 BEARING STRAINER ELEMENT HOUSING
L−A4332 (0000)
PW V

No. 4 Bearing Oil Pressure Strainer
Figure 401
(Task 72−00−00−450−004)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INSTALLATION-05

Task 72-00-00-450-005:

1. Install HPC Secondary Flow Control Filter Element

NOTE: Procedure for installation of filter elements on left and right side of engine is the same.

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P05-262	Lockwire, (MS20995C32)
P05-289	Lockwire

B. Procedure
See Figure 401.

(1) Remove protective closure from head assembly.

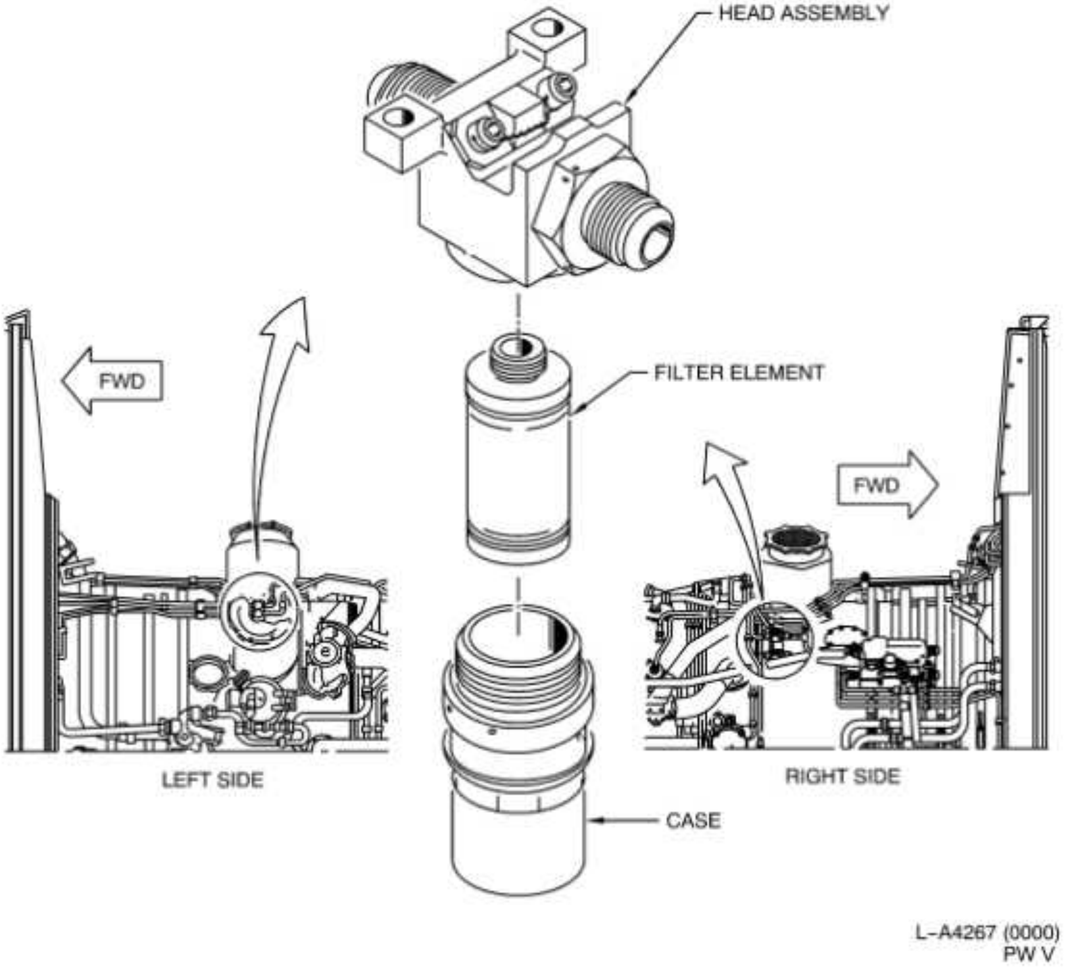
(2) Screw filter element into head assembly. Tighten filter element handtight.

(3) Install the case and tighten to a torque of 240 - 300 lb-in. (27.116 - 33.895 N.m).

(4) Safety the case to the head assembly with Lockwire P05-262 or Lockwire P05-289.

C. Postrequisites

(1) Test engine per Test Reference Table. See 71-00-00, Testing-00 Task 71-00-00-990-003.


HEAD ASSEMBLY
FWD
FILTER ELEMENT
FWD
LEFT SIDE
RIGHT SIDE
CASE
L-A4267 (0000)
PW V

HPC Secondary Flow Control Filter
Figure 401
(Task 72-00-00-450-005)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − CLEANING−00

Task 72−00−00−990−002:

1. Cleaning

A. Clean Engine Exterior

(1) Remove grease, oil and/or dirt from engine exterior as necessary. Refer to SPOP 1 (Task 70−21−00−110−047).

B. General Cleaning

(1) As soon as the engine has been completely disassembled, clean all engine parts thoroughly to prepare them for adequate and thorough inspection.

CAUTION: TITANIUM WELDMENTS AND ASSEMBLIES SHOULD NOT BE PROCESSED THROUGH TRICHLORETHYLENE DEGREASERS OR ANY CLEANER CONTAINING CHLORIDES IN ORDER TO AVOID POSSIBILITY OF STRESS CORROSION ASSOCIATED WITH ENTRAPMENT OF CHLORINE CONTAINING MATERIALS IN TIGHT FITTING AREAS. THIS RESTRICTION ALSO APPLIES TO PARTS SUCH AS TITANIUM DISKS OR HUBS CONTAINING INSERTS, SLEEVES, OR PINS. DISKS MUST BE DEBLADED PRIOR TO CLEANING AND PRIOR TO FLUORESCENT PENETRANT OR MAGNETIC PARTICLE INSPECTION.

(2) See Standard Practices Manual for general cleaning procedures.

(3) Blind Holes

(a) To avoid the possibility of damage due to the hydraulic action of residual oil, grease, preservative compound, or other liquids, make sure that all holes into which studs, bolts, inserts, screw bushings, etc., will be driven are thoroughly clean.

(4) Face−Type Oil Seals

(a) See Standard Practices Manual for handling recommendations.

(5) Process Indexes

CAUTION: REMOVE OR PROTECT PRE−PACKED BEARINGS WHEN CLEANING ASSEMBLY CONTAINING BEARINGS.

CAUTION: IN ORDER TO AVOID THE POSSIBILITY OF STRESS CORROSION ASSOCIATED WITH THE ENTRAPMENT OF MATERIALS CONTAINING CHLORINE IN TIGHT FITTING AREAS, TITANIUM ALLOW WELDMENTS AND ASSEMBLIES MUST NOT BE PROCESSED THROUGH VAPOR DEGREASERS. THIS RESTRICTION ALSO APPLIES TO PARTS SUCH AS TITANIUM DISKS OR HUBS CONTAINING INSERTS, SLEEVES, OR PINS.

CAUTION: WHEN CLEANING PARTS MANUFACTURED, OR PREVIOUSLY REPAIR, WITH A METAL COATING, OR CHROMIUM PLATING, REFER TO SECTION 70−20 IN STANDARD PRACTICES MANUAL. CERTAIN CLEANING SOLUTIONS AND METAL COATINGS ARE INCOMPATIBLE AND THEIR USE TOGETHER WILL RESULT IN CORROSION ATTACK OF THE METAL COATING, OR CHROMIUM PLATING.

(a) The indexed parts in the various cleaning sections require carefully controlled chemical baths and water rinses, or other regulated processes to obtain various degrees of cleanliness. Each part is keyed to one, or more, cleaning processes by Service Process Operation Procedure (SPOP) numbers. Where more than one cleaning process number appears for the part name, any of the processes may be used as desired.

NOTE: A large percentage of parts can be cleaned satisfactorily for inspection by SPOP 209 (Task 70−21−00−110−041) Degreasing Of Parts By Aqueous Cleaning.

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - CLEANING-01

Task 72-00-00-110-001:

1. Clean Last Chance Oil Pressure Strainers
   A. Prerequisites
      (1) Remove No. 1, 1 1/2, and 2 bearing oil pressure strainer. See 72-00-00, Removal-01 (Task 72-00-00-050-001).
      (2) Remove angle and main gearbox oil strainer. See 72-00-00, Removal-02 (Task 72-00-00-050-002).
      (3) Remove No. 3 bearing oil pressure strainer. See 72-00-00, Removal-03 (Task 72-00-00-050-003).
      (4) Remove No. 4 bearing oil pressure strainer. See 72-00-00, Removal-04 (Task 72-00-00-050-004).
   B. Equipment And Materials Required

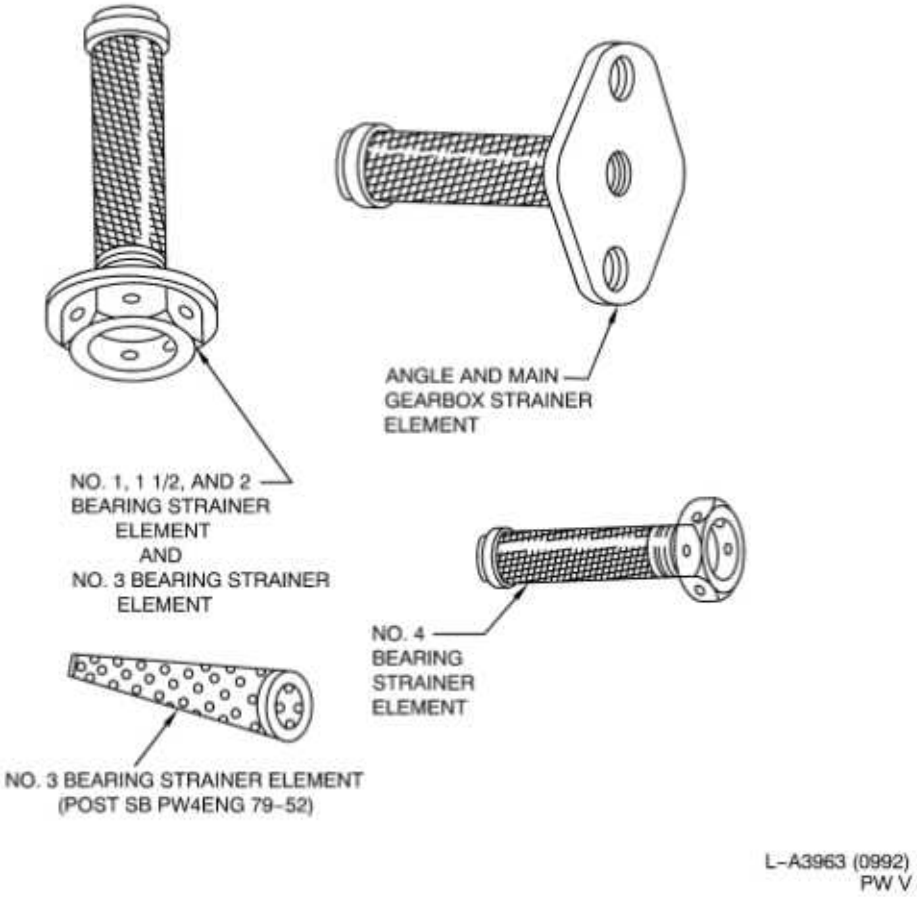
Consumable Materials:

Item No.	Designation
P05-026	Brush, Nylon
P11-004	Solvent, Cleaning (PMC 9010)

   C. Procedure
      See Figure 601.
      (1) Check for metal particle contamination by brushing strainer elements with Nylon Brush (P05-026) or equivalent and Cleaning Solvent (P11-004). Collect cleaning solvent in suitable container and filter through paint strainer or equivalent for metal particle indications.

NOTE: Strainer elements can also be degreased by SPOP 209 (Task 70-21-00-110-041) Degreasing Of Parts By Aqueous Cleaning.

      (2) Ensure strainer elements are clean and free of any foreign material.
      (3) Dry strainer elements with dry, filtered compressed air.
   D. Postrequisites
      (1) Install No. 4 bearing oil pressure strainer. See 72-00-00, Installation-04 (Task 72-00-00-450-004).
      (2) Install No. 3 bearing oil pressure strainer. See 72-00-00, Installation-03 (Task 72-00-00-450-003).
      (3) Install angle and main gearbox oil strainer. See 72-00-00, Installation-02 (Task 72-00-00-450-002).
      (4) Install No. 1, 1 1/2, and 2 bearing oil pressure strainer. See 72-00-00, Installation-01 (Task 72-00-00-450-001).


ANGLE AND MAIN GEARBOX STRAINER ELEMENT
NO. 1, 1 1/2, AND 2 BEARING STRAINER ELEMENT AND NO. 3 BEARING STRAINER ELEMENT
NO. 4 BEARING STRAINER ELEMENT
NO. 3 BEARING STRAINER ELEMENT (POST SB PW4ENG 79-52)
L-A3963 (0992)
PW V

Strainer Elements
(Last Chance)
Figure 601
(Task 72−00−00−110−001)

ENGINE GENERAL - CLEANING-02

Task 72-00-00-110-003:

1. Clean HPC Secondary Flow Control Filter Element

A. Prerequisites

(1) Remove HPC secondary flow control filter element. See 72-00-00, Removal-05 (Task 72-00-00-050-005).

B. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P05-005	Cloth, Lint-Free
P05-058	Brush, Stiff Bristle, Non-Metallic
P11-004	Solvent, Cleaning (PMC 9010)

C. Procedure

See Figure 601.

(1) Inspect filter element for evidence of an accumulation of contamination.

(2) Clean filter element with Cleaning Solvent (P11-004). Use a non-metallic, Stiff Bristle Brush (P05-058) to remove stubborn accumulations of contamination.

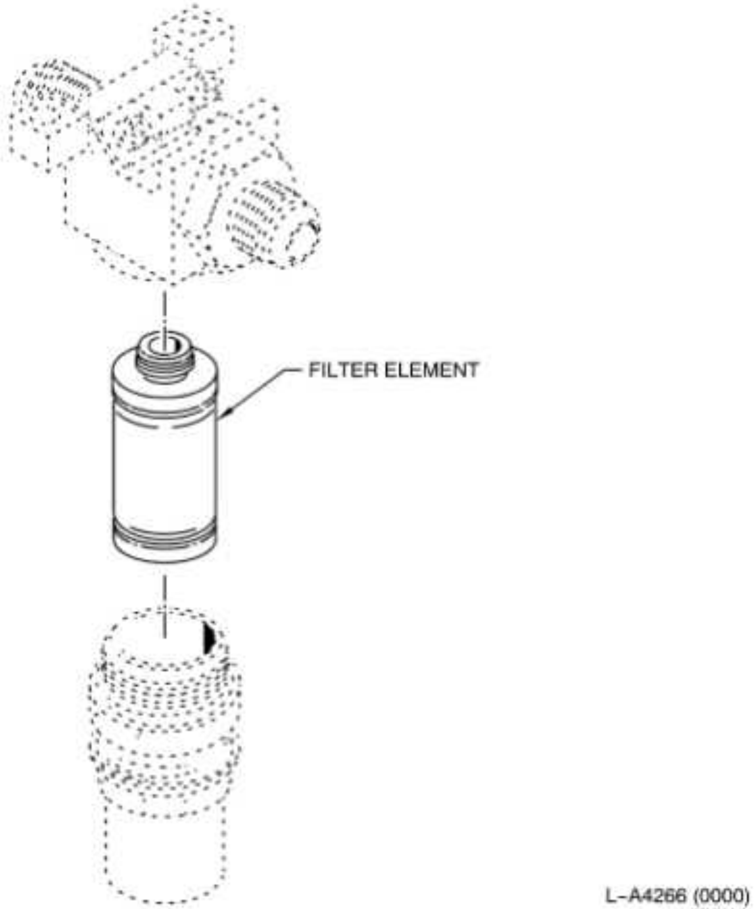
(3) Dry filter element with clean, Lint-Free Cloth (P05-005) or filtered, moisture free compressed air at 20 psig (138 kPa) maximum.

(4) Repeat cleaning procedure if any contaminants remain in filter element.

(5) If filter element remains contaminated after repeated cleaning, replace filter element.

D. Postrequisites

(1) Install HPC secondary flow control filter element. See 72-00-00, Installation-05 (Task 72-00-00-450-005).


FILTER ELEMENT
L-A4266 (0000)
PW V

HPC Secondary Flow Control Filter Element
Figure 601
(Task 72-00-00-110-003)

ENGINE GENERAL - CLEANING-03

Task 72-00-00-110-004:

1. Clean Engine Gaspath (Water Wash With Or Without Cleaning Solution) For Performance Improvement (Hose Method)

R CAUTION: REFER TO SPOP 425 (TASK 70-00-00-160-001) FOR ENGINES THAT HAVE BEEN EXPOSED TO FIRE EXTINGUISHING AGENTS, HYDRAULIC FLUID, OIL OR FUEL.

NOTE: The hose method is the least effective method for cleaning the core engine gaspath as most of the water exits through the fan exhaust air ducts. See Paragraph 2. for alternate cleaning method.

A. Equipment And Materials Required

(1) Hoses and nozzles to provide water flow capacity of approximately 160 U.S. gallons/minute (605.67 liters/minute). Experience has shown that two 7/8 inch (22.225 mm) nozzles with appropriate size hoses and city water supply pressure will provide this flow.

(2) Potable water (Refer to 70-20-00, General-01 (Task 70-20-00-100-001-003) Standard Practices Manual, PN 585005) source at pressure of 50 - 100 psi (144.7 - 689.50 kPa). Use existing potable water from tap or substitute suitable tank and pump.

(3) Shop air or nitrogen gas.

(4) The following Special Tools (PWA carts available in four options) may be used in place of the above equipment.

Special Tools:

PWA 86516	Basic Cart With Gasoline Powered Pump
PWA 86517	Basic Cart With Electric Powered Pump
PWA 86527	Basic Cart With Gasoline Powered Pump And Nitrogen Supply System
PWA 86528	Basic Cart With Electric Powered Pump And Nitrogen Supply System

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-005	Cloth, Lint Free Cotton
P05-022	Pad, Scotch Brite
P05-068	Gas, Nitrogen (PMC 2214)
P05-099	Tape, Moisture Resistant (PMC 4141)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-054	Antiseize, Paste (PWA 36246)
P11-014	Alcohol, Isopropyl (PMC 9094)
P11-049	Cleaner, Wipe (SPMC 148)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	75-37-00/1/20
Gasket	1	75-37-00/1/30

B. Procedure

NOTE: The use of a gaspath cleaning solution is based on each operator's previous experience and condition of each engine to be washed.

CAUTION: TO PREVENT FORMATION OF ICE, WATER WASHING SHOULD NOT BE PERFORMED WHEN AMBIENT TEMPERATURE IS 40°F (4.4°C) OR BELOW UNLESS YOU ADD ISOPROPYL ALCOHOL TO THE WATER.

(1) For an optional water wash with cleaning solution, prepare 30 gallons (113.56 liters) of SPS 87 Gaspath /Compressor Solution. Refer to 70-22-00, Solutions-02 (Task 70-22-00-980-002-087) Standard Practices Manual, PN 585005 for the make-up of this solution.

(a) The solution must be completely mixed and you must start the water wash within one hour after you mix the solution.

(2) Under freezing temperature conditions, it is permissible to add sufficient Isopropyl Alcohol P11-014 to water. At freezing temperature and below, caution should be exercised during water washing to ensure no ice has formed that could cause damage to the engine. Table 601 recommends minimum water-alcohol mixture. However, a maximum mixture of 50 percent alcohol may be used.

Percent Alcohol By Volume	Outside Air Temperature (OAT)
3	40°F (4.4°C)
6	38°F (3.3°C)
9	36°F (2.2°C)
14	33°F (0.6°C)
17	31°F (-0.6°C)
20	28°F (-2.2°C)
22	26°F (-3.3°C)
23	25°F (-3.9°C)
27	20°F (-6.6°C)
32	15°F (-9.4°C)
36	10°F (-12.2°C)
39	5°F (-15°C)
43	0°F (-17.8°C)

Minimum Required Alcohol/Water Mixtures
Table 601

(3) Remove, plug and/or cap the following tubes, manifolds or components. See Figure 601, Figure 602, Figure 603, Figure 604, Figure 605, Figure 606 and Figure 607.

(a) Remove lockwire and disconnect HPC air valve signal tubes (left and right) from adapters on HPC secondary flow control valves located at approximately 3:30 and 9:30 o'clock positions. Plug tubes and supply shop air or Nitrogen Gas P05-068 at 50 psi (344.7 kPa) to valve adapters to maintain valves in closed position. See Figure 601 and Figure 602.

(b) Remove lockwire and disconnect air shutoff valve signal tubes (left and right) from adapters on turbine vane and blade cooling air valves located at approximately 3 and 10 o'clock positions. Plug tubes and supply shop air or Nitrogen Gas P05-068 at 50 psi (344.7 kPa) to valve adapters to maintain valves in closed position. See Figure 601 and Figure 603.

(c) Remove lockwire and disconnect EEC PT4.95 manifold at approximately 6 o'clock position adjacent to Flange P. Install plug and cap to tube and manifold. See Figure 601 and Figure 605.

(d) Remove lockwire and disconnect HPC air valve and air shutoff valve supply tube from diffuser case adapter at approximately 12:30 o'clock position. Remove clamp bolt and nut securing tube to Flange K bracket to disengage tube from adapter. Install plug to tube and cap to adapter. See Figure 601 and Figure 606.

(e) Remove lockwire and disconnect EEC PB tube from diffuser case adapter at approximately 1:30 o'clock position. Remove clamp bolt and nut securing tube to Flange K bracket to disengage tube from adapter. Install plug to tube and cap to adapter. See Figure 601 and Figure 606.

(f) Remove lockwire and disconnect HPC air valve and bleed valve supply tube from diffuser case at approximately 2 o'clock position. Disengage tube from adapter and install plug to tube and cap to adapter. See Figure 601 and Figure 606.

(g) For engines equipped with engine propulsion multiplexer unit (PMUX), remove lockwire and disconnect PT2.5 sensing manifold from probe adapter located in intermediate case at approximately 5 o'clock position. Remove clamp bolt securing tube to Flange E bracket to disengage tube from adapter. Install plug to tube and cap to adapter. See Figure 607.

(h) Cover all openings on PT2/TT2 probe located in inlet cowl with Moisture Resistant Tape P05-099.

(4) Top off engine oil tank. See 72-00-00, Servicing-03 Task 72-00-00-610-003.

(5) Null ignition system.

WARNING: IN FOLLOWING WATER SPRAY PROCEDURE, IF HOSE IS HAND HELD, OPERATOR MUST STAND AT LEAST FIVE FEET FROM ENGINE INLET.

CAUTION: DO NOT INTRODUCE WATER INTO GASPATH IF EGT IS ABOVE 150°F (66°C). IF YOU START THE WATER FLOW WITH THE EGT ABOVE 150°F (66°C) THE WATER WILL EVAPORATE FROM THE HOT SURFACES AND WILL NOT EFFECTIVELY CLEAN THE SURFACES.

(6) Motor the engine with the starter until 18 − 22 percent N2 is reached. Keep the N2 in this range during the washing and the rinsing.

NOTE: The engine RPM will decrease as water is flowed into the gaspath.

(7) If water only is used, spray at fan blade roots at engine top dead center at 50 psig (344.7 kPa) minimum followed by 20 minutes of soaking. Repeat cycle three times.

NOTE: If the flow rate and supply pressure specified in steps (7) and (8) are not available, use the pressure and flow rate you have. If the engine has been satisfactorily cleaned, the water leaving the tail pipe will be clear. If water is not clear, repeat cleaning cycle as necessary.

NOTE: If water flow from the tailpipe is dirty, benefit can be increased if you do the wash procedure again. The operator can do the wash procedure again at their discretion.

(8) If cleaning solution is used, spray 30 gallons (113.56 liters) of solution at fan blade roots at engine top dead center at 50 psig (344.7 kPa) minimum followed by 20 minutes of soaking. Repeat cycle three times. Rinse engine by spraying clean water in same manner followed by 10 minutes of soaking. Repeat rinse again.

(9) Examine the LPC 1st stage (fan) blades, fairing, fan exit guide vanes and 1.6 stage blades for any damage from the cleaning procedure.

(10) Hand wash LPC 1st stage (fan) blades by one of the methods that follow:

(a) Make a clean Lint Free Cotton Cloth (P05−005) or fine or medium Scotch Brite Pad (P05−252) moist with SPS 87 Gaspath Cleaner Solution. Wipe both sides of the fan blades (as possible) until clean. See Section 70−22−00, Solutions−02 in the Standard Practices Manual, PN 585005, for SPS 87 make−up. Rinse the blades thoroughly with clean water.

(b) Wipe the blades with SPMC 148 Wipe Cleaner (P11−049) on a clean cloth. A tampico or nylon brush may be used to scrub the fan blades. Wipe off with a clean cloth. Rinse is not necessary.

(11) Hand wash the Stage 1 LPC stator vanes with SPMC 148 Wipe Cleaner (P11−049) on a clean cloth. A tampico or nylon brush may be used to scrub LPC stator vanes. Wipe off with a clean cloth. Rinse is not necessary.

(12) Upon completion of wash remove all caps and plugs on all previously disconnected tube assemblies, components, and probes. Allow any water to drain.

CAUTION: USE OF LUBRICANTS ON EEC OR PMUX SENSING TUBES, ADAPTERS, OR PACKINGS COULD RESULT IN CONTAMINATION OF EEC OR PMUX.

(13) Reconnect previously disconnected tubes, manifolds and components as follows:

(a) For engines equipped with engine propulsion multiplexer (PMUX), connect PT2.5 sensing manifold to probe adapter in intermediate case at approximately 5 o'clock position. Install clamp and bolt, threads lubricated with Engine Oil P03−001, securing tube to Flange E bracket. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). Torque manifold nut to probe adapter to 135 − 150 lb−in. (15.253 − 16.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292. See Figure 607.

(b) Connect HPC air valve and bleed valve supply tube to diffuser case adapter, threads lubricated with Antiseize Paste P06-054, at approximately 2 o'clock position on diffuser case. Torque tube nut to 200 - 225 lb-in. (22.597 - 25.422 N.m). Wipe off excess paste. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292. See Figure 601 and Figure 606.

(c) Connect EEC PB tube to adapter at approximately 1:30 o'clock position on diffuser case handtight only. Install clamps, bolt, threads lubricated with Engine Oil P03-001, and nut securing two tubes to Flange K bracket. Torque bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m). Torque tube nut to adapter 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292. See See Figure 601 and Figure 606.

(d) Connect HPC air valve and air shutoff valve supply tube to adapter, threads lubricated with Antiseize Paste P06-054, at approximately 12:30 o'clock position on diffuser case handtight only. Wipe off excess paste. Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to Flange K bracket. Torque bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m). Torque tube nut to adapter to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292. See Figure 601 and Figure 606.

(e) Connect EEC PT4.95 tube to manifold tee at approximately 6 o'clock position adjacent to Flange P. Torque tube nut to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292. See Figure 601 and Figure 605.

(f) Disconnect shop air from turbine blade and vane cooling air valves located at approximately 3 and 10 o'clock positions between Flanges J and K. Connect air shutoff valve signal tubes (left and right) to valve adapters, threads lubricated with Antiseize Paste P06-054. Torque tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Wipe off excess paste. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292. See Figure 601 and Figure 603.

(g) Disconnect shop air from HPC secondary flow control valve adapters located forward of Flange J at approximately 3:30 and 9:30 o'clock positions. Connect HPC air valve signal tubes (left and right) to valve adapters, threads lubricated with Antiseize Paste P06-054. Torque tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Wipe off excess paste. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292. See Figure 601 and Figure 602.

(h) Remove tape from PT2/TT2 probe located in inlet cowl.

(14) Reset nulled ignition system.

(15) Test the engine. See 71-00-00, Testing-03 Task 71-00-00-760-030.

NOTE: Be sure to run engine at Minimum Idle until the main oil temperature reaches or exceeds 220°F (104.4°C) for a minimum of two minutes.

C. Postrequisites

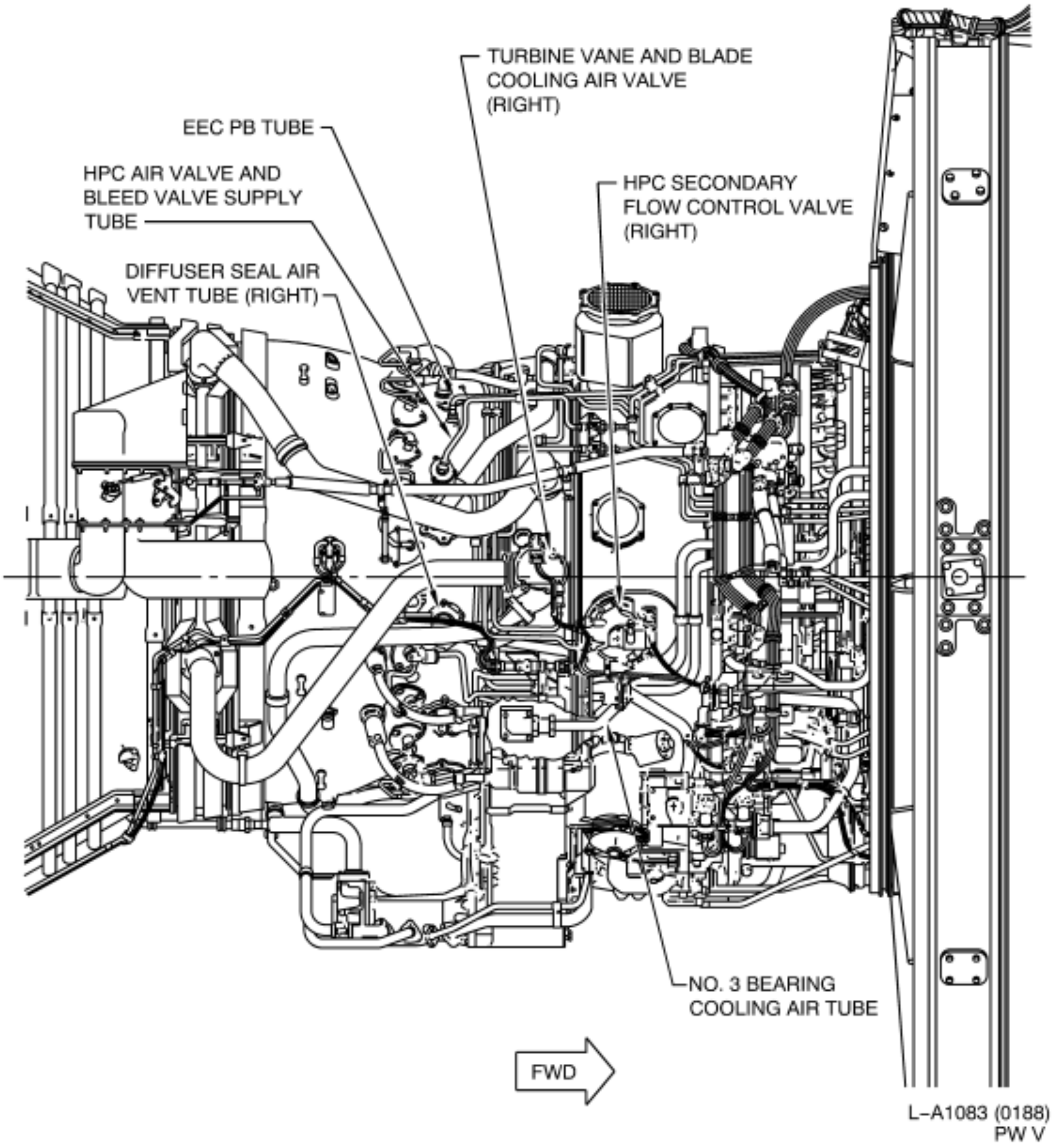
(1) Inspect PB, PT4.95, PAMB, and PT2 water traps. See 72-00-33, Inspection/Check-02 Task 72-00-33-210-001.

Task 72-00-00-110-004-A:

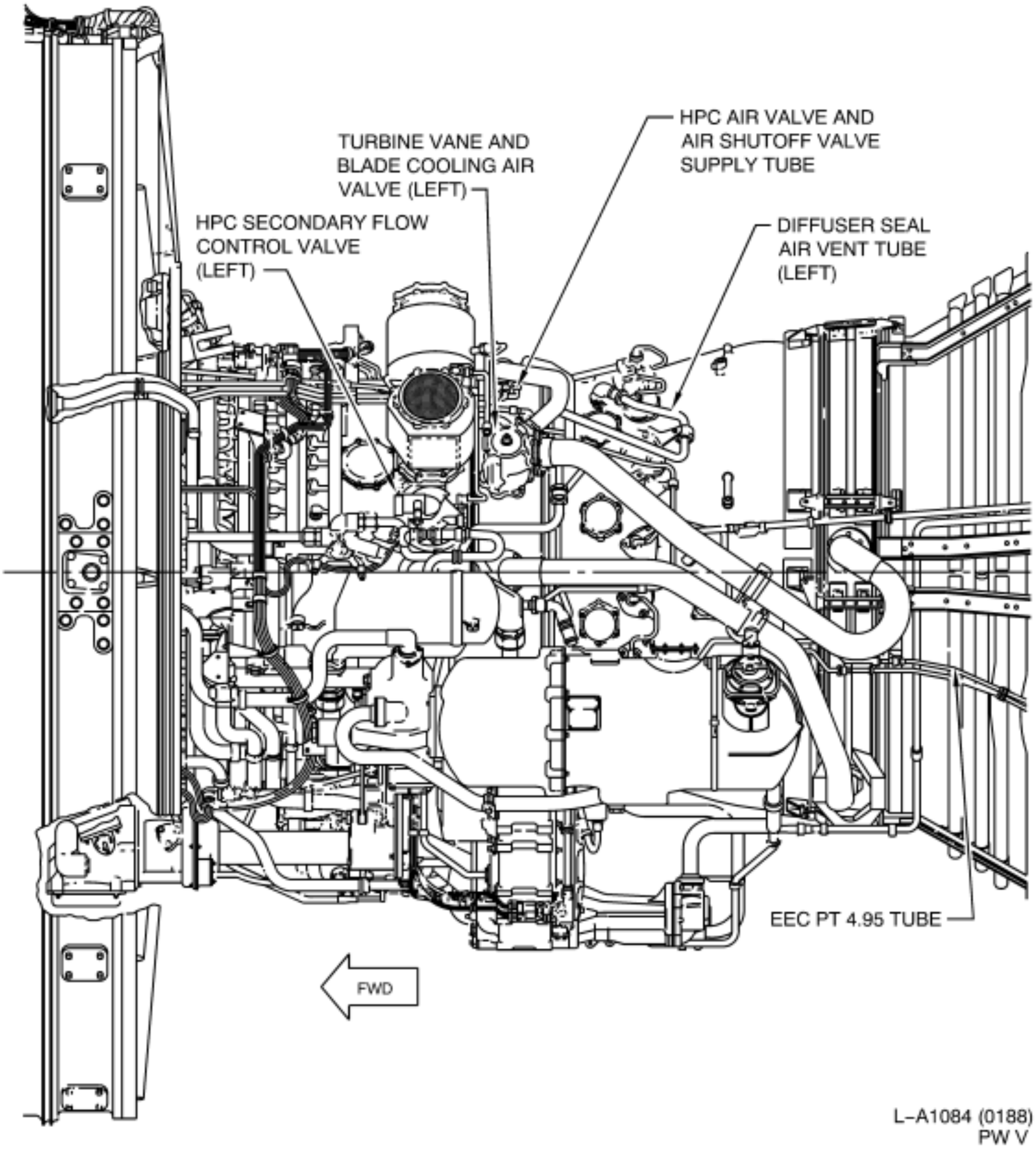
2. Clean Engine Gaspath (Water Wash With Or Without Cleaning Solution) For Performance Improvement (Hook Method)

R CAUTION: REFER TO SPOP 425 (TASK 70-00-00-160-001) IN THE STANDARD PRACTICES MANUAL, PN 585005 FOR ENGINES THAT HAVE BEEN EXPOSED TO FIRE EXTINGUISHING AGENTS, HYDRAULIC FLUID, OIL OR FUEL.

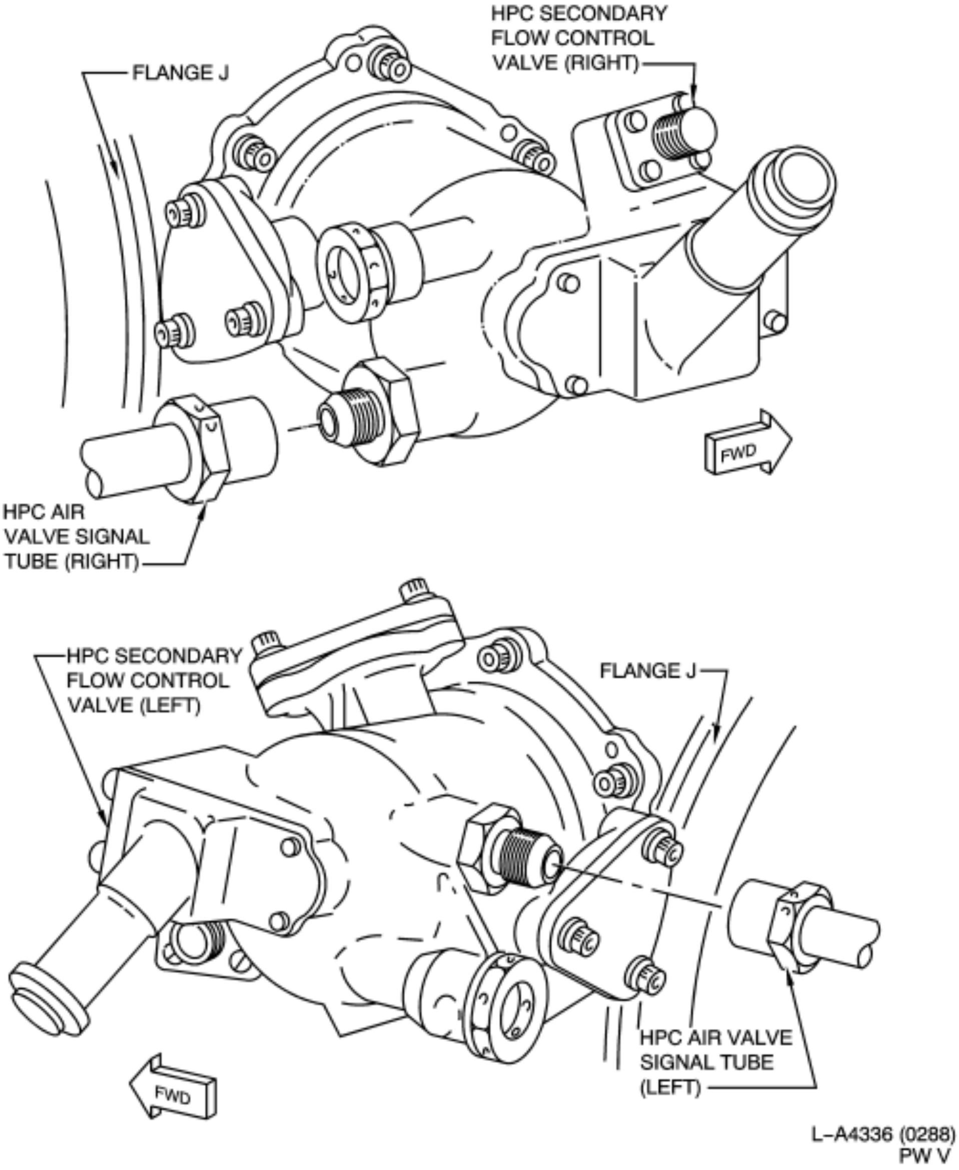
A. Equipment And Materials Required


TURBINE VANE AND BLADE COOLING AIR VALVE (RIGHT)
EEC PB TUBE
HPC AIR VALVE AND BLEED VALVE SUPPLY TUBE
HPC SECONDARY FLOW CONTROL VALVE (RIGHT)
DIFFUSER SEAL AIR VENT TUBE (RIGHT)
NO. 3 BEARING COOLING AIR TUBE
FWD
L−A1083 (0188)
PW V

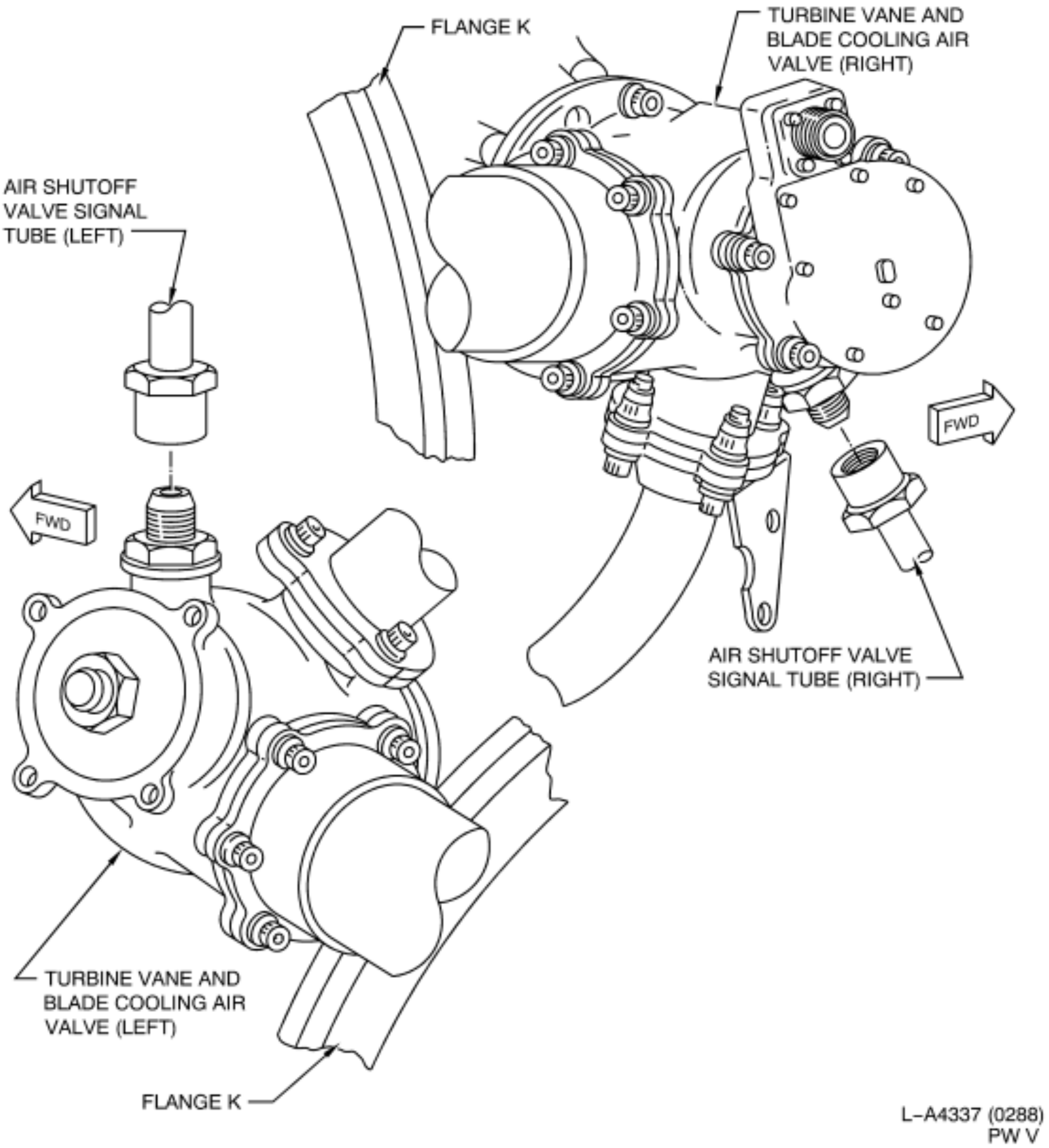
Tubes, Manifolds, And Components (Right Side)
Figure 601 (Sheet 1)
(Task 72−00−00−110−004)


TURBINE VANE AND
BLADE COOLING AIR
VALVE (LEFT)
HPC AIR VALVE AND
AIR SHUTOFF VALVE
SUPPLY TUBE
HPC SECONDARY FLOW
CONTROL VALVE
(LEFT)
DIFFUSER SEAL
AIR VENT TUBE
(LEFT)
EEC PT 4.95 TUBE
FWD
L-A1084 (0188)
PW V

Tubes, Manifolds, And Components (Left Side)
Figure 601 (Sheet 2)
(Task 72-00-00-110-004)


HPC SECONDARY FLOW CONTROL VALVE (RIGHT)
FLANGE J
FWD
HPC AIR VALVE SIGNAL TUBE (RIGHT)
HPC SECONDARY FLOW CONTROL VALVE (LEFT)
FLANGE J
HPC AIR VALVE SIGNAL TUBE (LEFT)
FWD
L-A4336 (0288)
PW V

HPC Secondary Flow Control Valves
Figure 602
(Task 72-00-00-110-004)

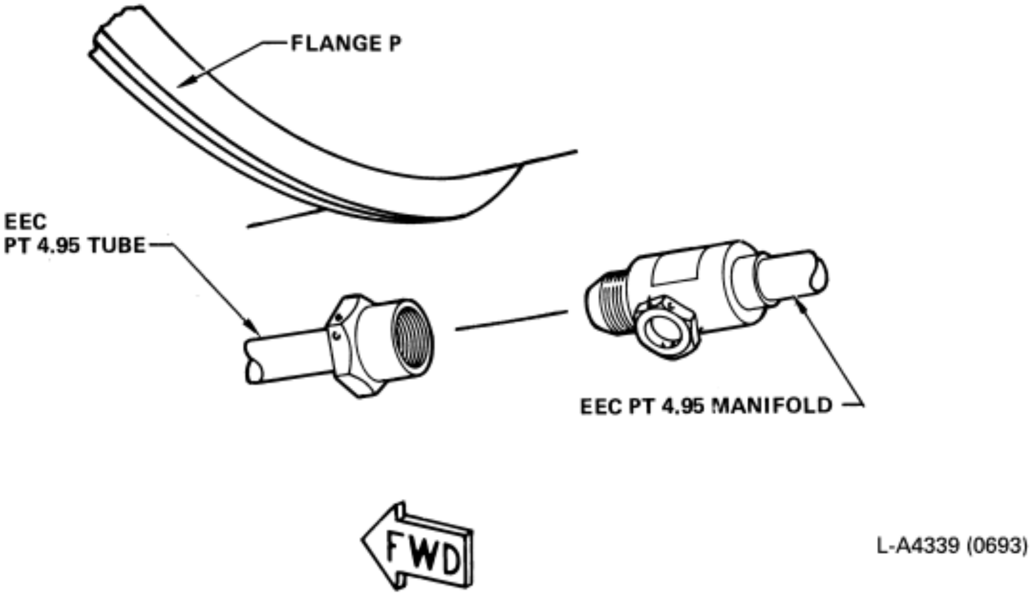

FLANGE K
TURBINE VANE AND BLADE COOLING AIR VALVE (RIGHT)
AIR SHUTOFF VALVE SIGNAL TUBE (LEFT)
FWD
FWD
AIR SHUTOFF VALVE SIGNAL TUBE (RIGHT)
TURBINE VANE AND BLADE COOLING AIR VALVE (LEFT)
FLANGE K
L-A4337 (0288)
PW V

Turbine Vane And Blade Cooling Air Valves
Figure 603
(Task 72-00-00-110-004)

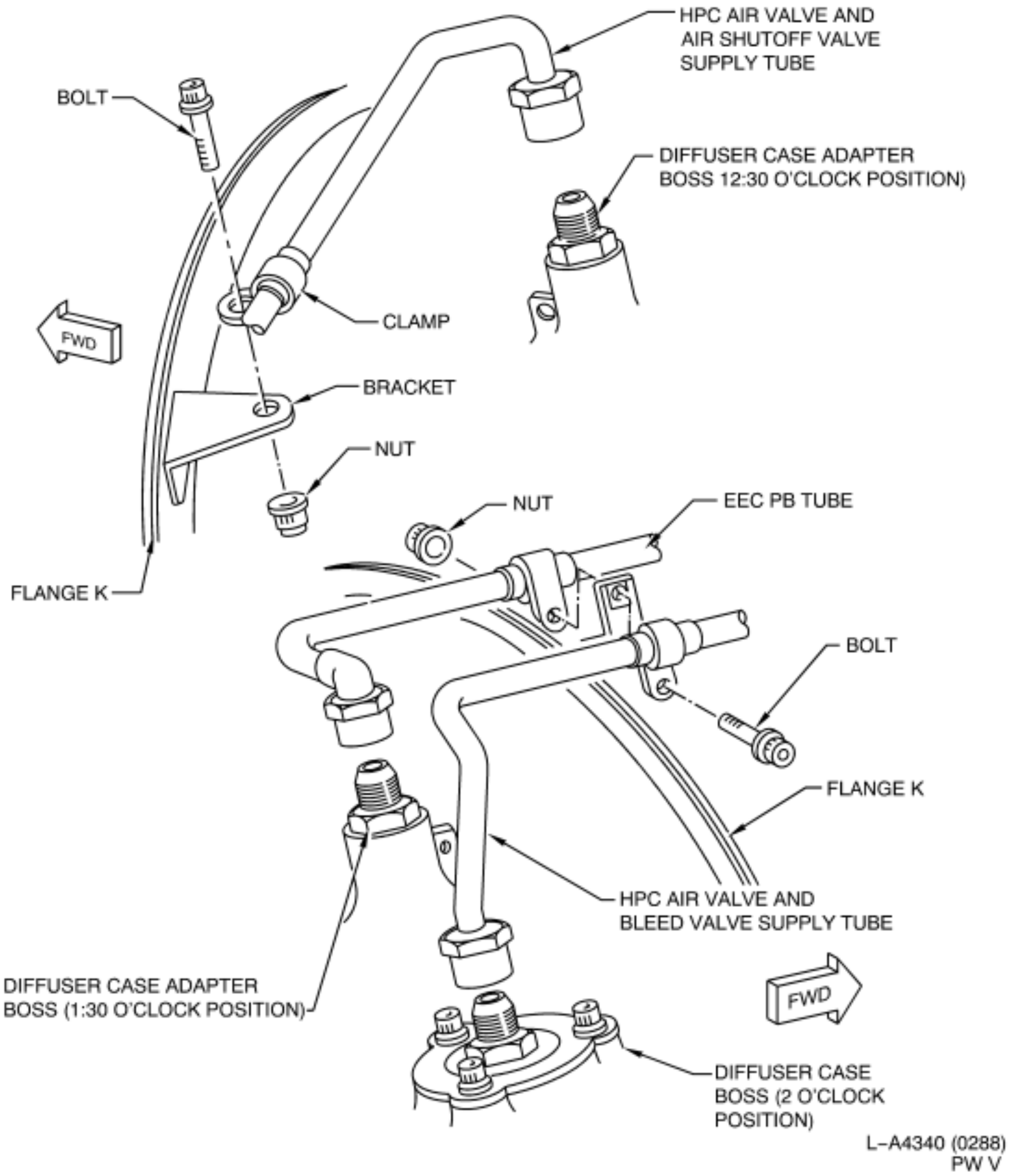
FIGURE NOT USED

L−00000 (0000)
PW V

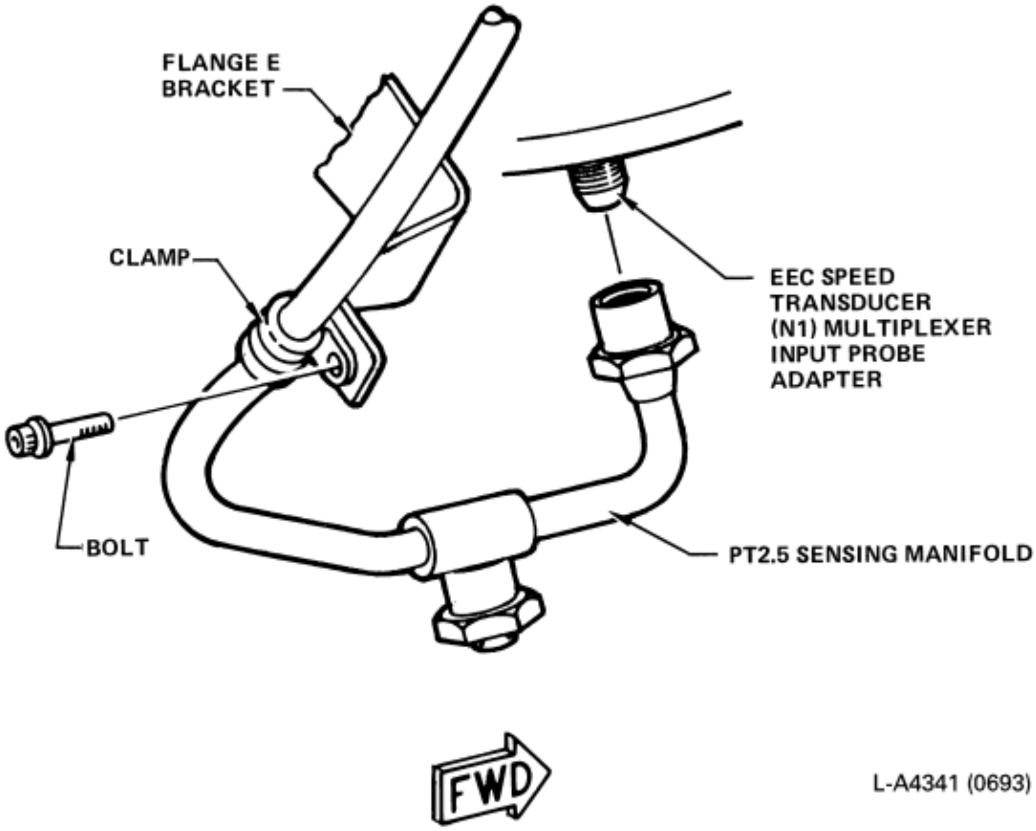
No. 3 Bearing Cooling Air Tube
Figure 604
(Task 72−00−00−110−004)


FLANGE P
EEC PT 4.95 TUBE
EEC PT 4.95 MANIFOLD
FWD
L-A4339 (0693)

EEC PT4.95 Manifold
Figure 605
(Task 72-00-00-110-004)


HPC AIR VALVE AND
AIR SHUTOFF VALVE
SUPPLY TUBE
BOLT
DIFFUSER CASE ADAPTER
BOSS 12:30 O'CLOCK POSITION)
FWD
CLAMP
BRACKET
NUT
NUT
EEC PB TUBE
FLANGE K
BOLT
FLANGE K
HPC AIR VALVE AND
BLEED VALVE SUPPLY TUBE
DIFFUSER CASE ADAPTER
BOSS (1:30 O'CLOCK POSITION)
FWD
DIFFUSER CASE
BOSS (2 O'CLOCK
POSITION)
L−A4340 (0288)
PW V

HPC Air Valve Supply Tubes And EEC PB Tube
Figure 606
(Task 72−00−00−110−004)


FLANGE E
BRACKET
CLAMP
EEC SPEED
TRANSDUCER
(N1) MULTIPLEXER
INPUT PROBE
ADAPTER
BOLT
PT2.5 SENSING MANIFOLD
FWD
L-A4341 (0693)

PT2.5 Sensing Manifold
Figure 607
(Task 72−00−00−110−004)

(1) Hoses and nozzles to provide water flow capacity of approximately 160 U.S. gallons/minute (605.67 liters/minute). Experience has shown that two 7/8 inch (22.225 mm) nozzles with appropriate size hoses and city water supply pressure will provide this flow.

(2) Potable water (Refer to 70-20-00, General-01 (Task 70-20-00-100-001-003) Standard Practices Manual, PN 585005) source at 7.5 Gal/Min (28 liters/Min) with PWA 101041 Wash Nozzles. Use existing potable water from tap or substitute suitable tank and pump.

(3) Shop air or nitrogen gas.

(4) The following Special Tools (PWA carts available in four options) may be used in place of the above equipment.

Special Tools:

PWA 83298	Valve (with necessary hoses to give 15 US gallons (57 liters) per minute flow)
PWA 86516	Basic cart with gasoline powered pump
PWA 86517	Basic cart with electric powered pump
PWA 86527	Basic cart with gasoline powered pump and nitrogen supply system
PWA 86528	Basic cart with electric powered pump and nitrogen supply system
PWA 101041	Water Wash Nozzle (2 Necessary)

NOTE: Experience has shown that local water supply pressure will give enough flow. You must use one of the optional carts if:
- You use a cleaning solution or
- You use alcohol for antifreeze or
- There is no clean tap water source at the wash site.

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P05-005	Cloth, Lint Free Cotton
P05-022	Pad, Scotch Brite
P05-058	Brush, Stiff Bristle, Nonmetallic
P05-068	Gas, Nitrogen (PMC 2214)
P05-252	Pad, Scotch Brite
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P11-014	Alcohol, Isopropyl (PMC 9094)
P11-049	Cleaner, Wipe (SPMC 148)

B. Procedure
See Figures 608, 609 and 610.

NOTE: Use your previous experience to determine if you use cleaning solution to wash the engine gaspath.

CAUTION: TO PREVENT THE FORMATION OF ICE, WATER WASH SHOULD NOT BE DONE WHEN AMBIENT TEMPERATURE IS LESS THAN 40°F (4.4°C) UNLESS YOU ADD ISOPROPYL ALCOHOL TO THE WATER.

CAUTION: DO NOT DO THIS PROCEDURE ON ALL ENGINES DURING THE SAME MAINTENANCE VISIT.

(1) To prevent the formation of ice, do not do this water wash procedure when the ambient temperature is less than 40°F (4.4°C) unless you add isopropyl alcohol antifreeze to the water.

(2) Calibrate and install the wash equipment as follows:

(a) Connect the hoses, adapters, PWA 83298 Valve, and the two PWA 101041 Wash Nozzles to the water source.

(b) Turn on the water source.

(c) Adjust the PWA 83298 Flow Valve for approximately 15 US gallons (57 liters) per minute total flow (7.5 US gallons (28.5 liters) per minute from each nozzle).

NOTE: Use a container of known volume and a stop watch to calculate the flow rate.

(d) Make a mark on the valve and valve handle for the correct position.

(e) Turn off the source.

(3) Install the equipment to the engine as follows:

(a) Use two persons and carefully insert the PWA 101041 Wash Nozzles from the rear of the fan and core cowl fan exit area at approximately the 3 and 9 o'clock positions.

(b) Put the nozzles over the forward lip of the fan exit fairing (splitter) just aft of the fan blades.

(c) Make sure the flow will go into the engine core gaspath at approximately the 3 and 9 o'clock positions.

(d) Put the nozzles in position as not to touch the fan exit guide vanes.

(e) Carefully, attach the nozzle hooks to the fan and core cowl as follows:

1 Pull the hook handle aft

2 Engage the hook over the aft edge of the fan and core cowl to hold the wash nozzle in position.

3 Check that the four detail bolts on the clamp assembly are tight to hold the clamp in the correct position.

4 Attach the hoses and the valve to some adjacent structure so that they don't move during the washing and rinsing procedure.

(4) Examine the equipment installation as follows:

(a) If necessary, change the position of the wash nozzles for better attachment.

(b) Make sure there is enough clearance between the nozzles and the LPC 1st Stage fan blades for safe engine motoring.

(c) Make sure there is enough clearance between the nozzles and the LPC 1.6 stage blades for safe engine motoring.

(d) Make sure you can turn the low pressure compressor (LPC) freely.

(e) Make sure the hose and valve are not in the fan airstream and are correctly attached before you motor the engine with the starter.

(f) Make sure the hoses and valve are correctly attached to an adjacent structure so that they are not able to move during the washing and rinsing procedure.

(5) For optional water wash with cleaning solution, prepare 30 US gallons (113.56 liters) of SPS 87 Gaspath/Compressor Solution. Refer to 70-22-00, Solutions-02 (Task 70-22-00-980-002-087), Standard Practices Manual, PN 585005 for the make-up of this solution.

(a) The solution must be completely mixed and you must start the water wash within one hour after you mix the solution.

(6) For outside ambient temperatures less than 40°F (4.4°C), mix Isopropyl Alcohol P11-014 to the water as follows:

NOTE: At 40°F (4.4°C) and below, be careful when you do the water wash. Make sure no ice forms which could cause damage to the engine. Use Table 602 for the correct mixture.

Outside Air Temperature (OAT):	Percent Alcohol By Volume:
39°F (3.9°C)	5
36°F (2.7°C)	9
33°F (0.6°C)	14
31°F (-0.6°C)	17
28°F (-2.2°C)	20
26°F (-3.3°C)	22
25°F (-3.9°C)	23
20°F (-6.7°C)	27
15°F (-9.4°C)	32
10°F (-12.2°C)	36

Minimum Required Alcohol/Water Mixtures
Table 602

Outside Air Temperature (OAT):	Percent Alcohol By Volume:
(CONTINUED)	
5°F (−15°C)	39
0°F (−17.8°C)	43

Minimum Required Alcohol/Water Mixtures
Table 602 (Continued)

(7) Motor the engine with the starter until 18 − 22 percent N2 is reached. Keep the N2 in this range during the washing and rinsing.

NOTE: The engine RPM will decrease as water is flowed into the gaspath.

CAUTION: DO NOT START THE WATER FLOW INTO THE GASPATH IF EGT IS ABOVE 150°F (66°C). IF YOU START THE WATER FLOW WITH THE EGT ABOVE 150°F (66°C) THE WATER WILL EVAPORATE FROM THE HOT SURFACES AND WILL NOT EFFECTIVELY CLEAN THE SURFACES.

(8) With the EGT less than 150°F (66°C), start the flow of water (or solution) into the gaspath at approximately 15 US gallons (57 liters) total flow.

(9) After approximately 45 seconds, stop the water flow and stop the starter motoring.

(10) Wait approximately five minutes.

(11) Do this wash procedure three times or until the water (or solution) from the tailpipe is clear.

NOTE: If the water flow from the tail pipe is dirty, benefit can be increased if you do the wash procedure again. The operator can do the wash procedure again at their discretion.

(12) If you used detergent cleaning solution, do the wash procedure two more times with water only.

NOTE: This is necessary to rinse all the detergent from the gaspath.

NOTE: The engine RPM will decrease as water is flowed into the gaspath.

CAUTION: REMOVE THE WATER WASH EQUIPMENT AS SOON AS POSSIBLE AND BEFORE YOU OPEN THE THRUST REVERSER. IF YOU TRY TO OPEN THE THRUST REVERSER WITH THE EQUIPMENT INSTALLED, YOU WILL CAUSE DAMAGE TO THE ENGINE AND/OR THRUST REVERSER.

(13) Remove the wash nozzles from the engine as follows:

(a) Remove hoses, adapters, and valve.

(b) Loosen the four bolts on the clamp assembly.

(c) Pull the hook handles aft.

(d) Carefully remove the wash hooks.

(14) Examine the LPC 1st stage (fan) blades, fairing, fan exit guide vanes and 1.6 Stage blades for any damage from the cleaning procedure.

(15) Hand wash LPC 1st stage (fan) blades by one of the methods that follow:

(a) Make a clean Lint Free Cotton Cloth (P05-005) or fine or medium Scotch Brite Pad (P05-252) moist with SPS 87 Gaspath Cleaner Solution. Wipe both sides of the fan blades (as possible) until clean. See Section 70-22-00, Solutions-02, Standard Practices Manual, PN 585005, for SPS 87 make-up. Rinse the blades thoroughly with clean water.

(b) Wipe the blades with SPMC 148 Wipe Cleaner (P11-049) on a clean cloth. A tampico or nylon brush may be used to scrub the fan blades. Wipe off with a clean cloth. Rinse is not necessary.

(16) Hand wash the Stage 1 LPC stator vanes with SPMC 148 Wipe Cleaner (P11-049) on a clean cloth. A tampico or nylon brush may be used to scrub LPC stator vanes. Wipe off with a clean cloth. Rinse is not necessary.

CAUTION: MAKE SURE YOU REMOVE THE WATER WASH EQUIPMENT BEFORE YOU OPEN THE THRUST REVERSER. IF YOU TRY TO OPEN THE THRUST REVERSER WITH THE EQUIPMENT INSTALLED, YOU WILL CAUSE DAMAGE TO THE ENGINE AND/OR THRUST REVERSER.

(17) Open the right and left fan and core cowl.

(18) Do an inspection and drain the EEC P2, P2.5 (with SCU), PAMB, PB, and P4.95 condensation traps. See 72-00-33, Inspection/Check-02 Task 72-00-33-210-001.

(19) Do an inspection and drain the PMUX (if installed) P2.5 condensation trap as follows:

  (a) Remove the lockwire and cap from the manifold tee. Permit the water to drain.

  CAUTION: USE OF LUBRICANTS ON PMUX SENSING TUBES, ADAPTERS, OR PACKINGS CAN RESULT IN CONTAMINATION OF THE PMUX.

  (b) Install the cap to the manifold tee. Torque the cap to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(20) Remove any water from the EEC sensing system by the steps that follow:

  (a) Hold the adapters with a wrench and disconnect the sensing P2, P2.5, PAMB, P4.95, and PB hoses from the EEC, SCU or PMUX (if installed).

  (b) Install the necessary adapters and fittings to attach shop air or Nitrogen P05-068 to each sensing hose.

  CAUTION: DO NOT PUT PRESSURE INTO THE EEC, SCU, OR PMUX (IF INSTALLED). IF YOU DO, YOU CAN CAUSE DAMAGE TO THE EEC, SCU, OR PMUX.

  (c) Use 20 psi (137.9 kPa) shop air or Nitrogen P05-068 and remove any water from each sensing system.

  (d) Remove the adapters and fittings.

CAUTION: DO NOT USE LUBRICANTS ON EEC, SCU OR PMUX SENSING TUBES, ADAPTERS, OR PACKINGS. IF YOU DO, CONTAMINATION CAN OCCUR TO THESE COMPONENTS.

(21) Connect the EEC, SCU or PMUX (if installed) sensing hoses as follows:

(a) Do not apply lubricant to the hoses or adapters.

(b) Attach the rear PB flex hose (AS12) to the adapter in the port marked PB. Hold the adapter with a wrench and torque the flex hose nut to 270 − 300 lb−in. (30.506 − 33.895 N.m). (Post SB PW4ENG 72−645) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(c) Attach the P4.95 flex hose (AS13) to the adapter in the port marked P5. Hold the adapter with a wrench and torque the flex hose nut to 450 − 500 lb−in. (50.843 − 56.492 N.m). (Post SPN No. P3042) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(d) Attach the PAMB flex hose (AS10) to the adapter in the port marked PAMB. Hold the adapter with a wrench and torque the flex hose nut to 135 − 150 lb−in. (15.253 − 16.948 N.m). (Post SPN No. P3042) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(e) Attach the P2 flex hose (AS11) to the adapter marked P2. Hold the adapter with a wrench and torque the flex hose nut to 90 − 100 lb−in. (10.169 − 11.298 N.m). (Post SPN No. P3042) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(f) If the supplemental control unit has the multiplexing option, attach the P2.5 flex hose (AS38) to the adapter at the bottom side of the supplemental control unit. Hold the adapter with a wrench and torque the flex hose nut to 270 − 300 lb−in. (30.506 − 33.895 N.m). (Post SPN No. P3042) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(g) If the engine has a propulsion multiplexer unit (PMUX) installed, attach the P2.5 flex hose (AS32) to the adapter at the bottom side of the PMUX. Hold the adapter with a wrench and torque the flex hose nut to 135 - 150 lb-in. (15.253 - 16.948 N.m). (Post SPN No. P3042) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the hose nut(s) as applicable.

(h) Safety the PB sensing hose nut, on the EEC, with Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(22) Start the engine by the Engine Starting Procedure (Normal). See 71-00-00, Testing-00, Paragraph G. Task 71-00-00-990-003.

(a) Run at MINIMUM IDLE until main oil temperature is 220°F (104.4°C) minimum for a minimum of two minutes.

(b) Do the Engine Shutdown Procedure. See 71-00-00, Testing-00, Paragraph H. Task 71-00-00-990-003.

(23) Examine the P2, P2.5 (with SCU), PAMB, PB, and P4.95 condensation traps again. See 72-00-33, Inspection/ Check-02 Task 72-00-33-210-001.

NOTE: You must remove all water from the sense lines before you continue in service.

(24) Examine the PMUX (if installed) P2.5 condensation trap as follows:

NOTE: You must remove all water from the sense line before you continue in service.

(a) Remove the lockwire and cap from the manifold tee. Permit the water to drain.

CAUTION: USE OF LUBRICANTS ON PMUX SENSING TUBES, ADAPTERS, OR PACKINGS CAN RESULT IN CONTAMINATION OF THE PMUX.

(b) Install the cap to the manifold tee. Torque the cap to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(25) Do an inspection of the turbine vane and blade cooling air valve air filter elements as follows:

NOTE: The procedure for removal of the filter elements from the left and right side of the engine is the same.

(a) Remove the lockwire and remove the case from the head assembly.

(b) Remove the filter element from the head assembly.

(c) Install protective closures on the head assembly.

(d) Examine the filter element for signs of an accumulation of contamination.

(e) If necessary, clean the filter element with Isopropyl Alcohol P11-014. Use a Nonmetallic, Stiff Bristle Brush P05-058 to remove stubborn accumulations of contamination.

(f) Dry the filter element with clean a Lint Free Cloth P05-005 or filtered, moisture free compressed air at 20 psig (138 kPa) maximum.

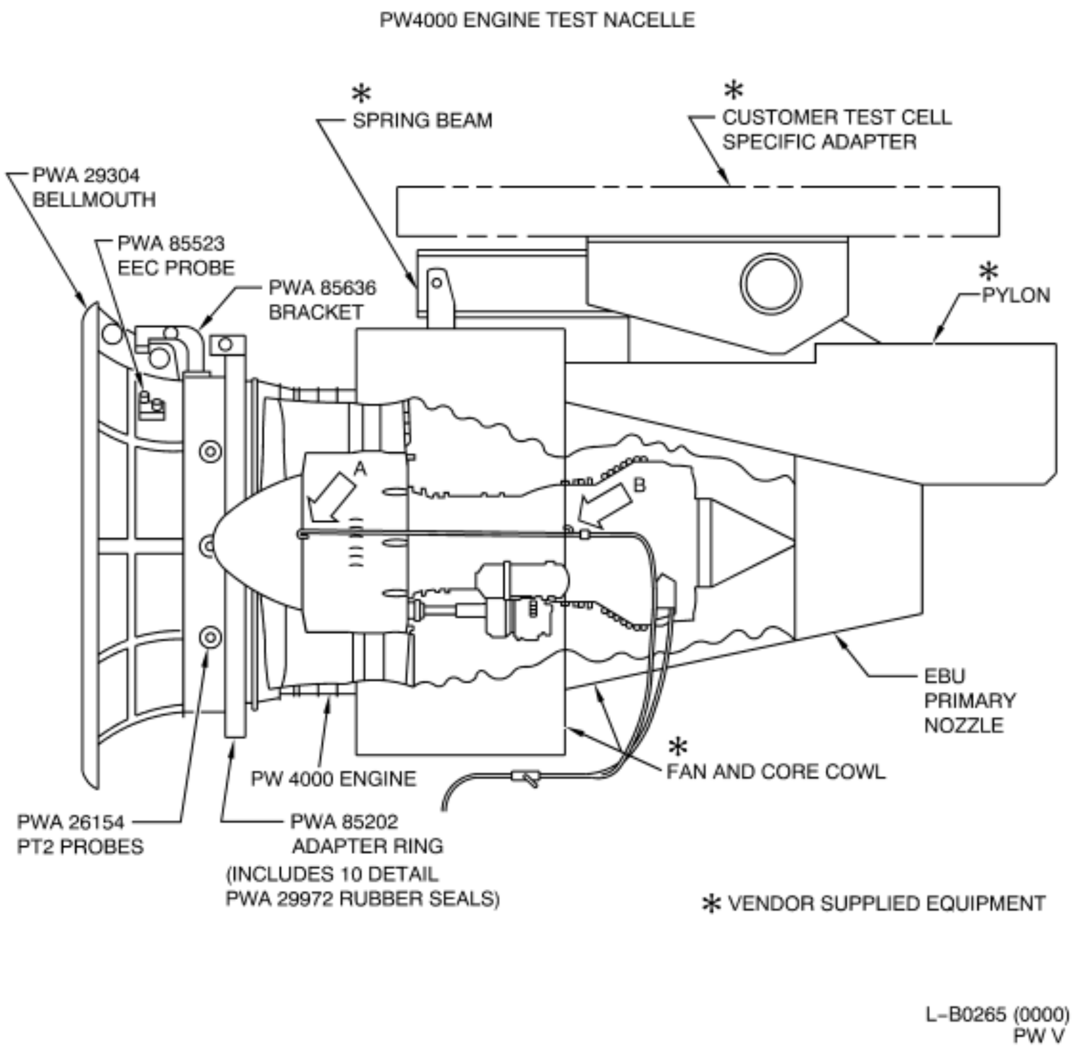
(g) If the filter remains contaminated after repeated cleanings, replace the filter element.

(h) Remove the protective closure from the head assembly and install the filter element to the head assembly. Tighten the filter element, handtight.

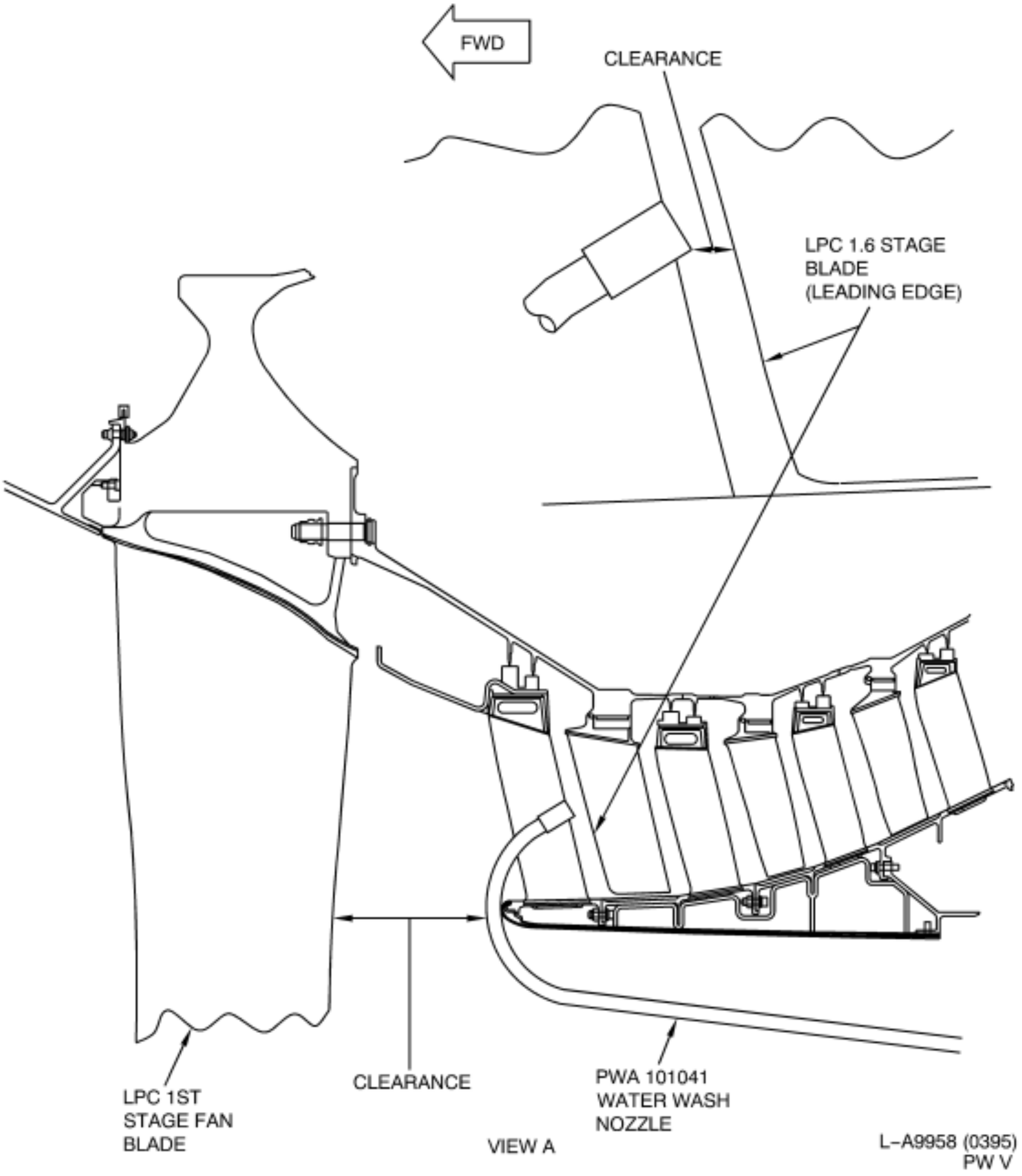
(i) Install the case to the head assembly and apply a torque of 20 - 25 lb-in. (2.260 - 2.825 N.m).

(j) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

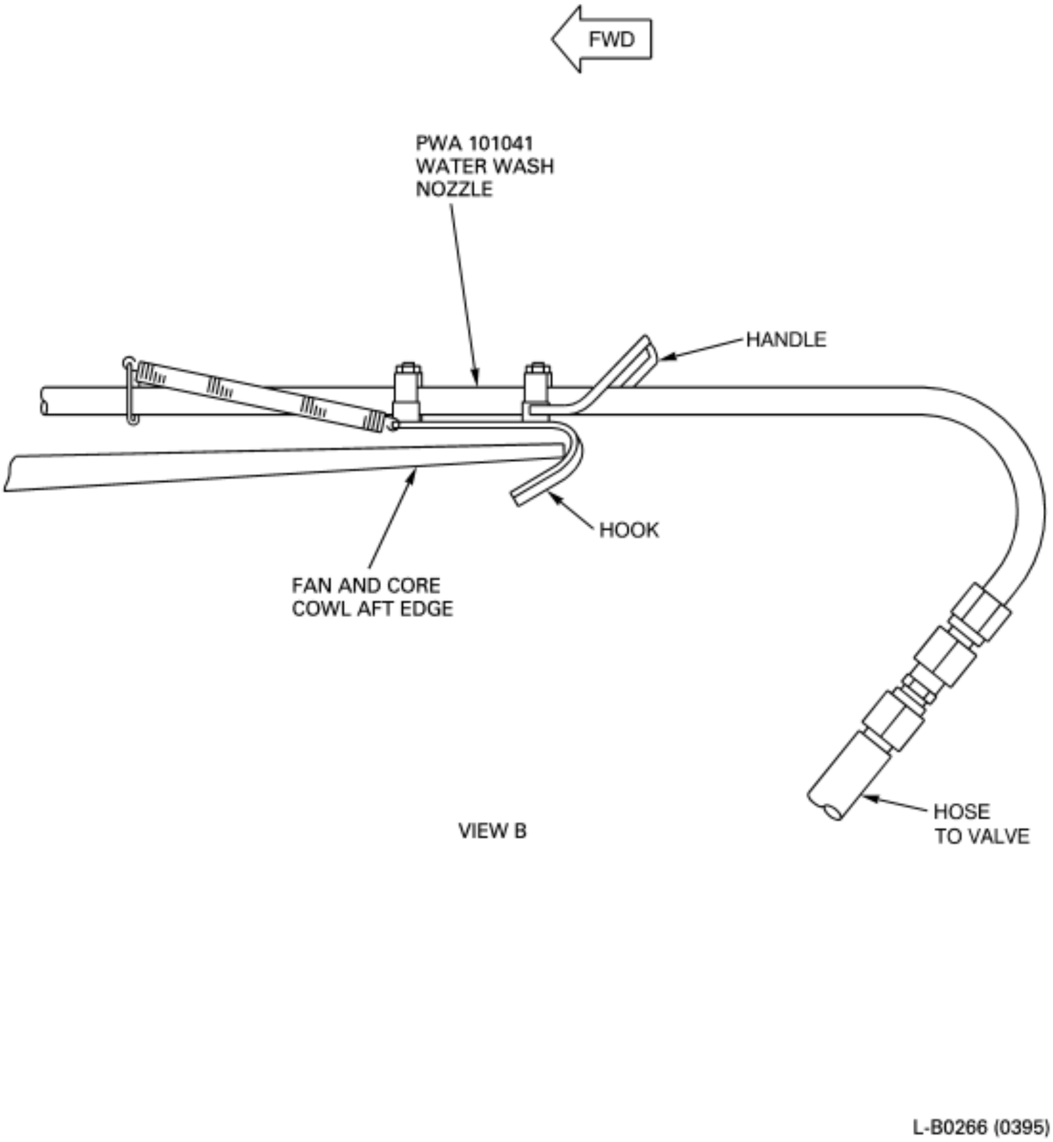
(k) Do steps (a) through (j) for each filter element location.


PW4000 ENGINE TEST NACELLE
* SPRING BEAM
* CUSTOMER TEST CELL SPECIFIC ADAPTER
PWA 29304 BELLMOUTH
PWA 85523 EEC PROBE
PWA 85636 BRACKET
* PYLON
A
B
EBU PRIMARY NOZZLE
* FAN AND CORE COWL
PW 4000 ENGINE
PWA 26154 PT2 PROBES
PWA 85202 ADAPTER RING (INCLUDES 10 DETAIL PWA 29972 RUBBER SEALS)
* VENDOR SUPPLIED EQUIPMENT
L-B0265 (0000)
PW V

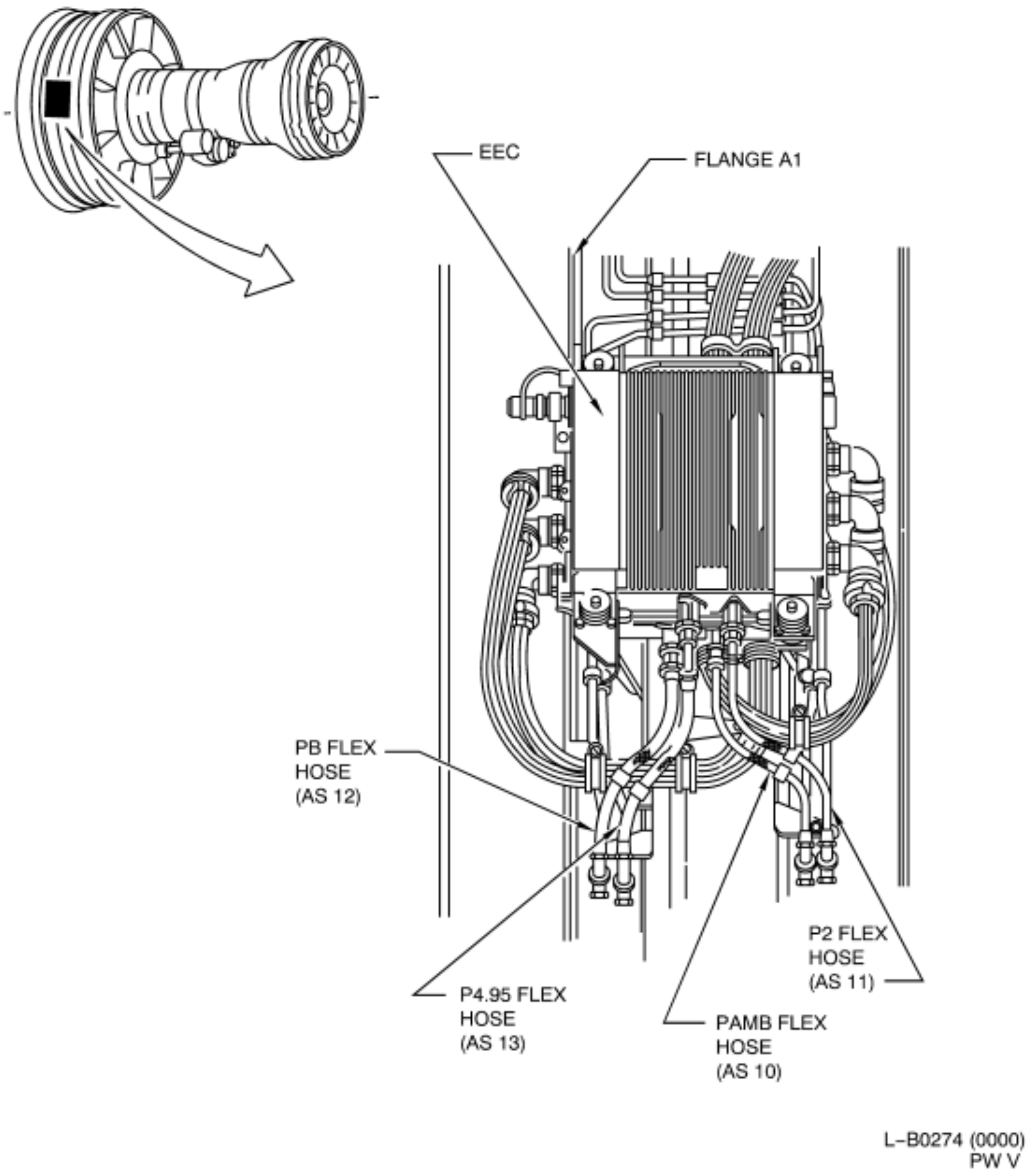
Water Wash Equipment Installation
Figure 608 (Sheet 1)
(Task 72-00-00-110-004-A)


FWD
CLEARANCE
LPC 1.6 STAGE
BLADE
(LEADING EDGE)
LPC 1ST
STAGE FAN
BLADE
CLEARANCE
PWA 101041
WATER WASH
NOZZLE
VIEW A
L-A9958 (0395)
PW V

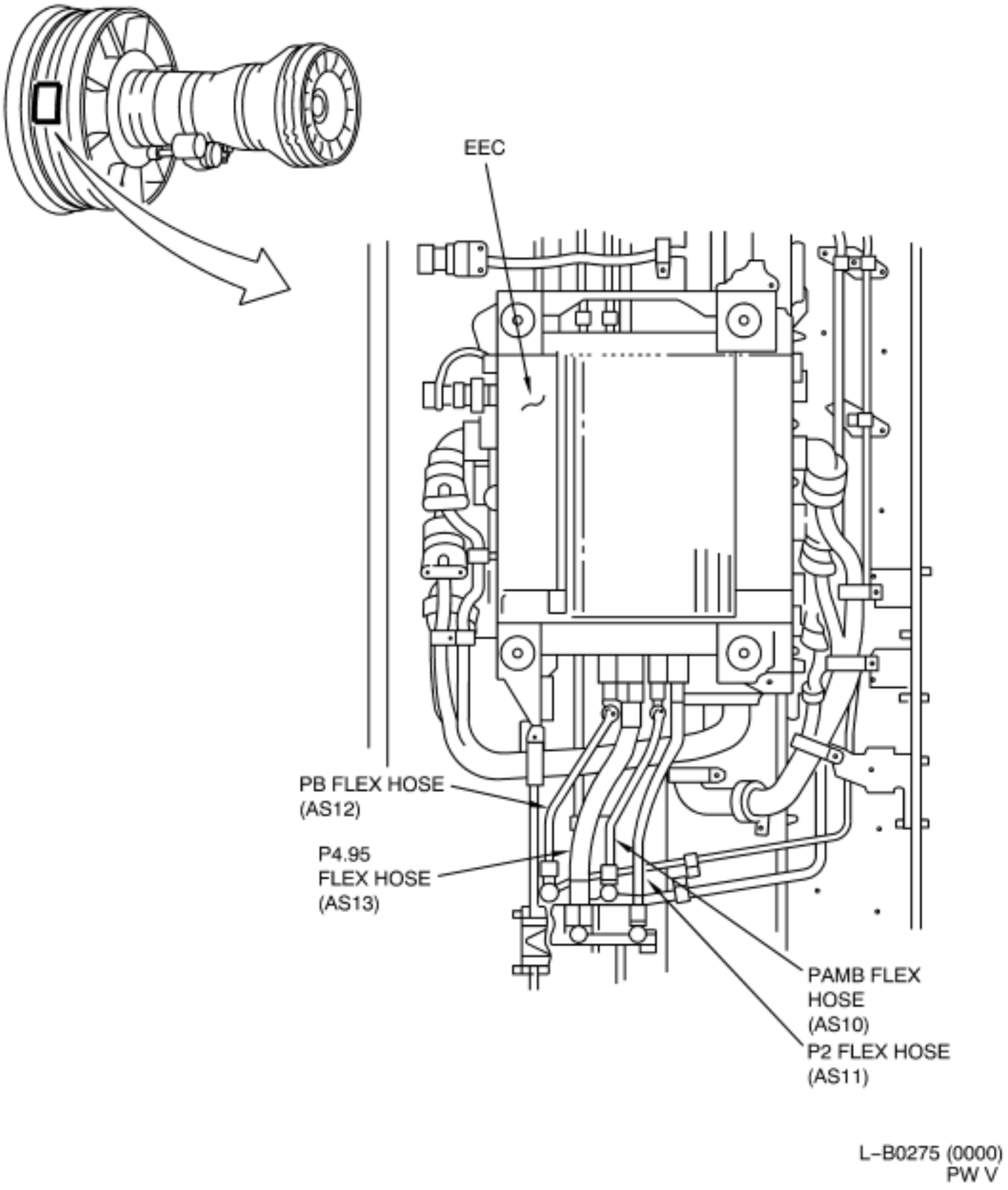
Water Wash Equipment Installation
Figure 608 (Sheet 2)
(Task 72-00-00-110-004-A)


FWD
PWA 101041
WATER WASH
NOZZLE
HANDLE
HOOK
FAN AND CORE
COWL AFT EDGE
VIEW B
HOSE
TO VALVE
L-B0266 (0395)

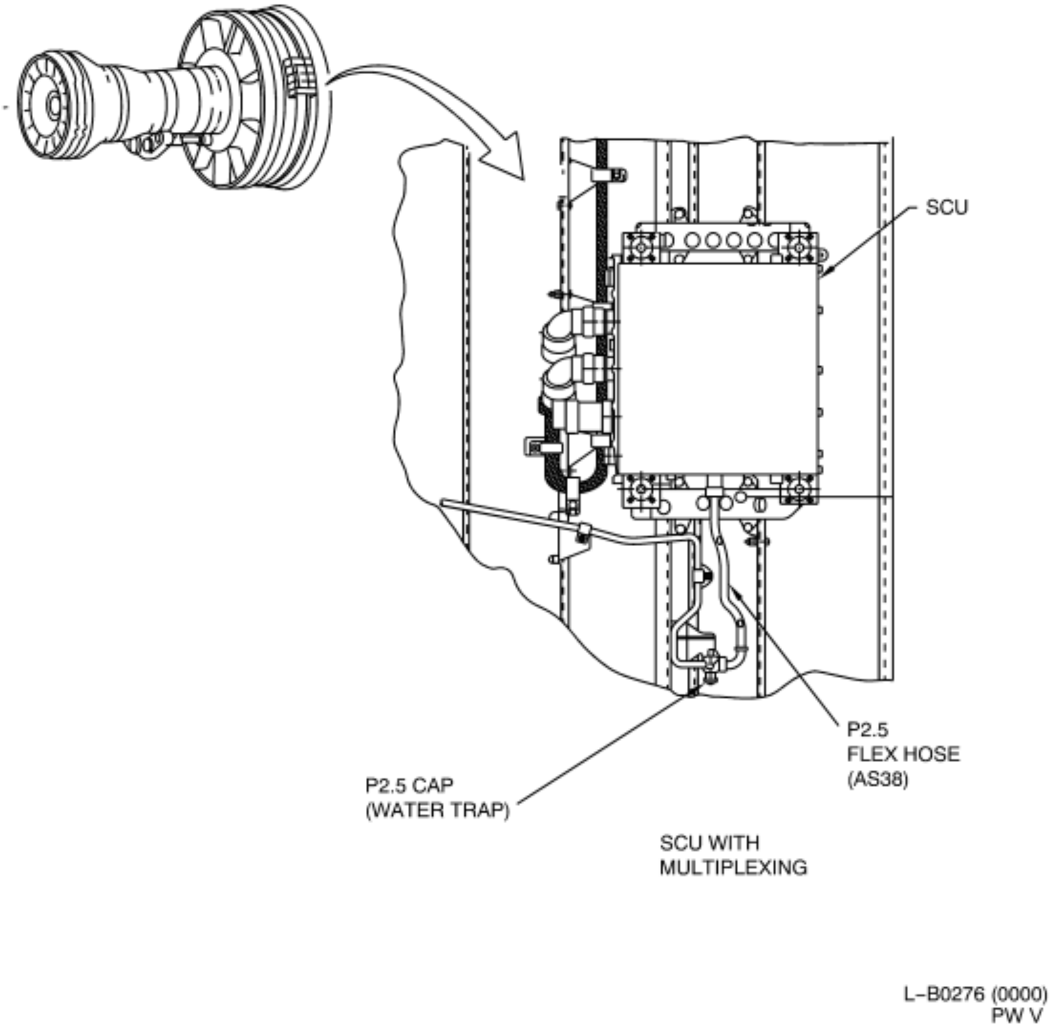
Water Wash Equipment Installation
Figure 608 (Sheet 3)
(Task 72-00-00-110-004-A)


EEC
FLANGE A1
PB FLEX HOSE (AS 12)
P4.95 FLEX HOSE (AS 13)
PAMB FLEX HOSE (AS 10)
P2 FLEX HOSE (AS 11)
L-B0274 (0000)
PW V

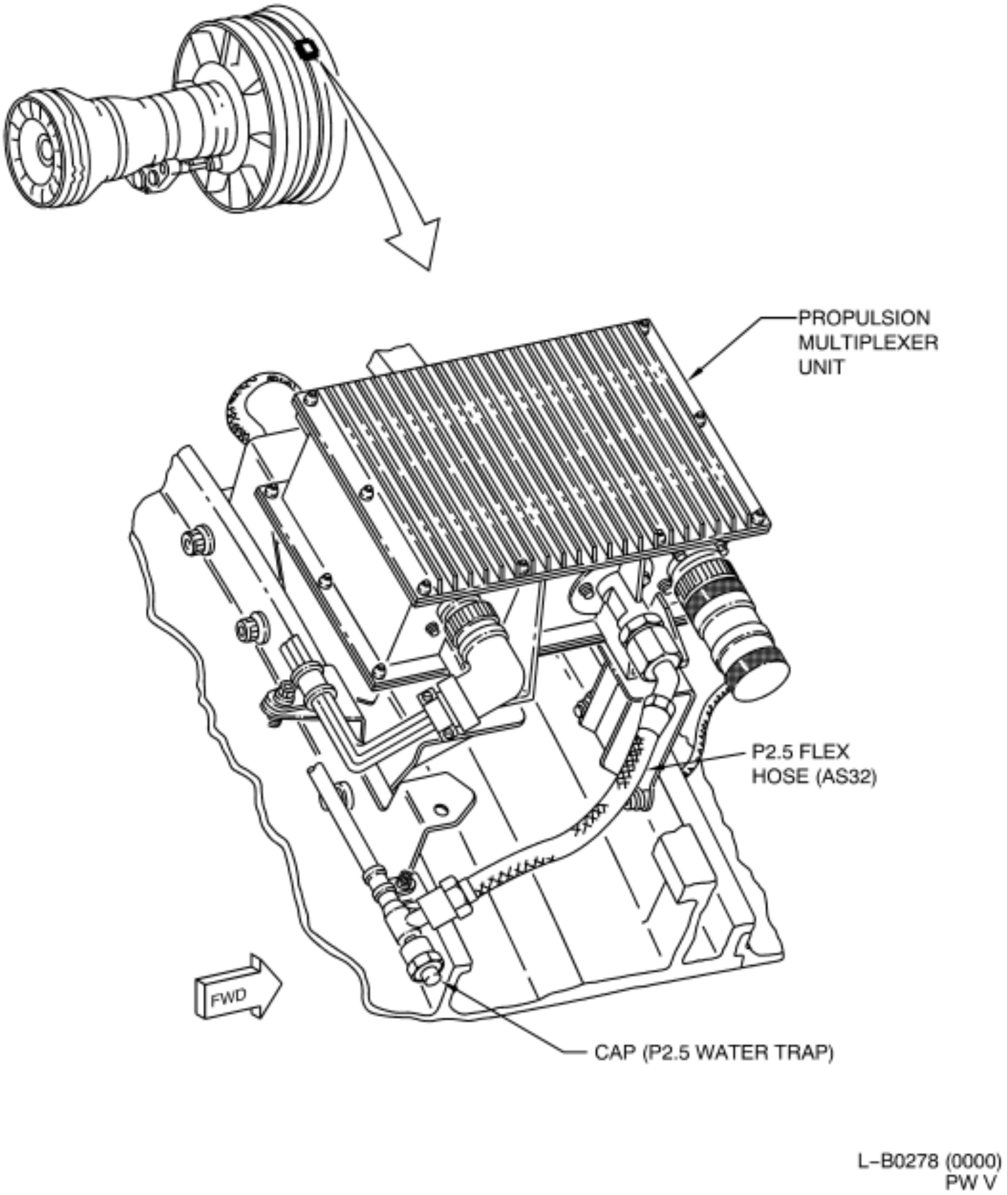
Electronic Engine Control Sensing Lines
Figure 609 (Sheet 1)
(Task 72-00-00-110-004-A)


EEC
PB FLEX HOSE (AS12)
P4.95 FLEX HOSE (AS13)
PAMB FLEX HOSE (AS10)
P2 FLEX HOSE (AS11)
L−B0275 (0000)
PW V

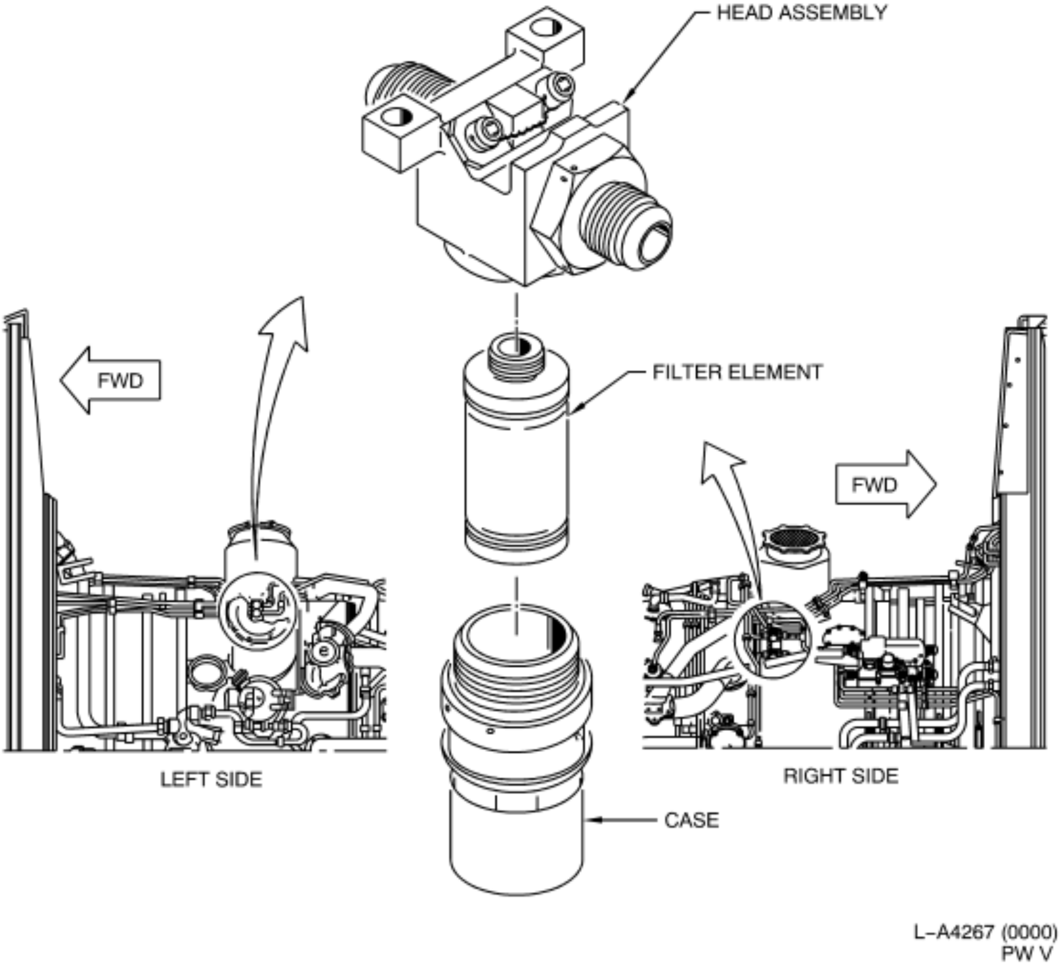
Electronic Engine Control Sensing Lines For Engines With
Commonality Parts Between Airbus And McDonnell Douglas
Figure 609 (Sheet 2)
(Task 72−00−00−110−004−A)


SCU
P2.5
FLEX HOSE
(AS38)
P2.5 CAP
(WATER TRAP)
SCU WITH
MULTIPLEXING
L-B0276 (0000)
PW V

Supplemental Control Unit (With Multiplexing) Sense Line
Figure 609 (Sheet 3)
(Task 72-00-00-110-004-A)


PROPULSION MULTIPLEXER UNIT
P2.5 FLEX HOSE (AS32)
CAP (P2.5 WATER TRAP)
FWD
L-B0278 (0000)
PW V

Propulsion Multiplexer Unit (PMUX) Sense Line
Figure 609 (Sheet 4)
(Task 72-00-00-110-004-A)


HEAD ASSEMBLY
FWD
FILTER ELEMENT
FWD
LEFT SIDE
RIGHT SIDE
CASE
L-A4267 (0000)
PW V

Turbine Vane And Blade Cooling Air Valve Filter
Figure 610
(Task 72-00-00-110-004-A)

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Task 72−00−00−990−004:

1. Introduction − General

A. Preliminary Instructions

(1) Thorough and intelligent inspection of all engine parts is one of the controlling factors in efficient and dependable maintenance, and too much emphasis cannot be placed on the importance of careful inspection and the decisions it involves. Inspection personnel must be thoroughly familiar with instructions in this chapter, in the requirements of the Standard Practices Manual and in Repair Sections.

B. Records and Limits

(1) Refer to the specific fits and clearances requirements in the appropriate Inspection/Check sections of this manual for proper limits. Attach a tag, indicating that replacement is necessary, to any part which is found to be unfit for further service. Attach a tag describing necessary refurbishment to any part which requires repair.

(2) When a new part is to be installed and it is important that it be identified as to engine number or position in engine; mark it by appropriate method described in Marking of Parts in Standard Practices Manual.

(3) When making out inspection records or reports, use only descriptive words which accurately qualify existing conditions. In order to eliminate confusion and to maintain consistent terminology, the various physical conditions and the determination of the usual causes of wear or damage to engine parts which might be encountered during inspection are defined in the Physical Inspection Section of Standard Practices Manual.

(4) Each life limited part must also have a part number and serial number on it. The marking of hours and cycles by engine model on the engine part(s) is optional to maintaining accurate accumulated service life (hours and cycles by engine model) in the form of permanent records, paper documents, or computer data base records. Refer to Standard Practices Manual, Section 70−30, Paragraph 2.C., Evaluation of Service Life (Hours and Cycles).

C. General Inspections

(1) See Standard Practices Manual as follows:

(a) Physical Inspection

(b) Magnetic Particle Inspection

(c) Fluorescent Penetrant Inspection

(d) Surface Treatments

(e) Welding

(f) Gage Inspection

D. Corrosion Prevention After Inspection

(1) After inspection, whenever it is deemed that sufficient time will elapse before reassembly to allow damage to parts from corrosion, cover all unprotected surfaces of magnesium and steel parts, or any parts with which corrosion difficulties are experienced, with Corrosion Preventive Oil P05−035. Unless the parts are otherwise preserved for longer periods of time, they should be recoated with Corrosion Preventive Oil P05−035, every four days.

E. X−Ray Inspection

(1) General

(a) Inspection/Check sections provide standards and acceptance limits applicable for parts requiring X−Ray inspection.

(b) For specific information not covered in Inspection/Check sections concerning X−Ray methods see 70−37−1, Standard Practices Manual.

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ENGINE GENERAL - INSPECTION/CHECK-01A

Task 72-00-00-990-010:

1. General Borescope Inspection Procedures And Borescope Access Port (AP) Data

A. General
See Figure 801, Figure 802 and Figure 803 and Table 801.

Access Port	Angular Location Clockwise From Rear	Part(s) Viewable For Inspection	Recommended Maximum Probe Diamter Inch/(mm)
Thru Fan	-------	1st C-Vane 1st C-Blades	----------
AP-1	245° (1)	Rear of 4th C-Blade Front of 4th C-Vane	----------
AP-2	233°	Rear of 5th C-Blade Front of 6th C-Blade	.270/6.8
AP-3	231°	Rear of 6th C-Blade Front of 7th C-Blade	.270/6.8
AP-4	127°	Rear of 8th C-Blade Front of 9th C-Blade	.270/6.8
AP-5	214°	Rear of 10th C-Blade Front of 11th C-Blade	.270/6.8
AP-6	98°	Rear of 12th C-Blade Front of 13th C-Blade	.270/6.8
AP-7	80°	Rear of 14th C-Blade Front of 15th C-Blade	.270/6.8
AP-8	277°	Fuel Nozzle Combustion Chamber 1st T-Vane	.444/11.3
AP-8	45° 128° 172° (2) 225° 338° (3) (1) (5)	Fuel Nozzle Combustion Chamber 1st T-Vane	.444/11.3 .444/11.3
AP-9	93°	Front of 1st T-Vane Front of 1st T-Blade	.270/6.8
AP-10	139°	Rear of 2nd T-Blade Front of 3rd T-Vane	.270/6.8
AP-11	215° (4)	Rear of 1st Turbine Blade Front of 2nd Turbine Blade	.444/11.3
Thru Exhaust	--------	6th T-Blade	----------

Table 801

Access Port	Angular Location Clockwise From Rear	Part(s) Viewable For Inspection	Recommended Maximum Probe Diamter Inch/(mm)
(CONTINUED) Case Struts			
		6th T-Vane	

NOTE: (1) Flexible probe required at this access port (optional all other ports).

NOTE: (2) Right angle eye piece required at this access port.

NOTE: (3) Right angle eye piece desirable at this access port.

NOTE: (4) Optional borescope port location.

NOTE: (5) For engines equipped, remove high temp sensor unit from (338°) port per Section 71-00-41, Removal-04 Task 72-00-41-050-001. Use flex probe to gain access.

Table 801 (Continued)

WARNING: BORESCOPE INSPECTIONS MUST BE PERFORMED IN A PROTECTED AREA. IF INSPECTIONS ARE PERFORMED IN WET WEATHER, APPROPRIATE PROTECTION MUST BE USED TO PREVENT DAMAGE TO EQUIPMENT OR POSSIBLE ELECTRICAL SHOCK TO THE OPERATOR.

CAUTION: BORESCOPE INSPECTION LIMITS ARE DERIVED FROM TESTING AND STRUCTURAL ANALYSIS. CONTINUED SERVICE OF PARTS AT OR NEAR MAXIMUM LIMITS MAY NOT BE ECONOMICALLY SOUND BECAUSE OF PERFORMANCE LOSS OR REDUCED PART LIFE.

(1) The provisions for borescope inspection of the engine represent a significant aid to effective maintenance. Borescope access is incorporated at 15 locations (16 for engines utilizing AP-11) along the engine gaspath, allowing for detailed examination of critical internal engine areas.

NOTE: Borescope ports used in the following procedures are identified by their "AP" (access port) designation as shown in Figure 801 and Figure 802.

(2) Inspection interval definition, (regular/reduced).

(a) The regular inspection interval referred to in this procedure is obtained from the Maintenance Planning Guide. The reduced interval is set at half that value. These inspection intervals may be adjusted based on operator experience and consultation with the local regulatory agency.

(b) The maximum damage limit assigned to either inspection interval is such that, under normal circumstances, the damage should not progress beyond an operable condition before the end of the applicable inspection interval. Usually, a greater level of damage is allowed when inspection at a reduced interval than at a regular interval becomes the increased inspection frequency greatly reduces the changes of the damage progressing beyond the operable condition before the next inspection. For some features, however, the damage is so critical that an expanded (reduced interval) limit is not prudent. Hence, the limit will be the same for regular and reduced intervals.

(3) No data is given in Table 801 to inspect the LPC airfoils between the Stages 1.6 and 4 blades. However, if damage is seen while viewing through the fan inlet, the allowable damage limit given for the 4th stage vanes in step 1.B.(3) will apply to LPC Stages 1.6, 2, and 3 vanes, and the damage limits given for the 4th stage blades in step 1.B.(4) will apply to the Stage 2 and 3 blades.

B. Special Borescope Equipment

CAUTION: TEMPERATURES IN AREAS TO BE BORESCOPED SHOULD BE PERMITTED TO COOL TO BELOW 150°F (65.6°C) FOLLOWING ENGINE OPERATION. DAMAGE MAY RESULT TO BORESCOPE EQUIPMENT IF EQUIPMENT IS EXPOSED TO GASPATH OR METAL TEMPERATURES IN EXCESS OF 150°F (65.6°C). AS A GUIDE − IF ADJACENT CASES ARE TOO HOT TO TOUCH COMFORTABLY, INSPECTION SHOULD BE DELAYED.

(1) Borescope inspection equipment for the PW4000 Engine should satisfy the requirements of CTE 6181 as published by Support Equipment Engineering, Pratt &

Whitney, Commercial Products Division, 400 Main Street, MS 118−03 East Hartford, CT 06108

(2) Specification CTE 6181 identifies the equipment and associated hardware (such as power source, light cables, adapter etc.) required during borescope inspection and sets the quality and functional standards for this equipment. In summary the following borescope equipment is recommended:

(a) Low magnification rigid borescope,.........AP−2−7, 9 (0.270 inch/(6.8 mm) barrel diameter maximum)

(b) High magnification rigid borescope,.........AP−8, 11 (0.444 inch/(11.3 mm) barrel diameter maximum)

(c) Flexible borescope,......AP−1, (optional for AP2−8) (0.270 inch/(6.8 mm) cable diameter maximum)

(3) Optional borescope equipment and sizes are also provided in CTE 6181 to enhance the borescoping capability and ease the task for the inspector. These items range from clamping equipment to hold the borescope in position to optical video equipment to view and videotape record the borescoping session for later in depth review.

Task 72−00−00−480−001:

2. Installation Of the Rotator Used To Turn The N2 Rotor

A. Equipment And Materials Required

Special Tools:

PWA 49058	Rotator, Hand (Hand Crank) Optional
PWA 76271	Control Kit, Engine Turning
PWA 85572−1	Compressor Rotating Kit (Foot Operated) Optional to PWA 85572
PWA 85572−2	Compressor Rotating Kit (Hand Operated) Optional to PWA 85572−1
PWA 85768	Puller, Knocker
PWA 86441	Drive Unit
PWA 102089	Control Kit, Engine Turning (Alternate to PWA 85572−1 and 2) (Used with PWA 102093 or PWA 102390)

Special Tools:

(CONTINUED)

PWA 102093	Drive Adapter, Engine Turning (Used with PWA 102089) (Optional to PWA 102390)
PWA 102390	Drive Adapter, Engine Turning (Used with PWA 102089) (PWA 102093)

Special Borescope Equipment:
See Task 72-00-00-990-010 for Special Borescope Equipment.

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
R	P06-054	Paste, Anti-Seize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72-61-00/8/160

B. Rotation Of High Pressure Rotor During Borescope Inspection

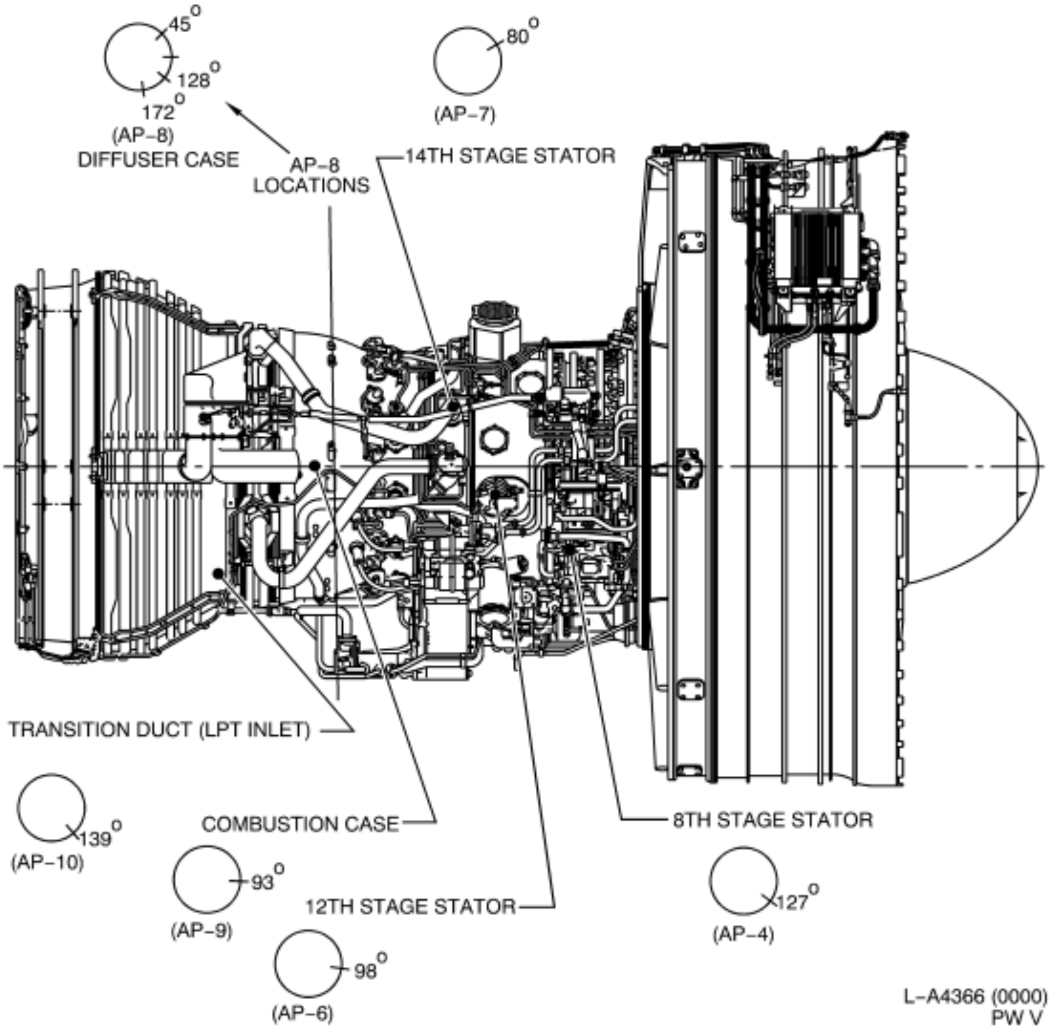
(1) Full 360 degree borescope inspection of the high pressure rotor can be accomplished using the rotorcranking provision on the gearbox.

(2) Remove manual crank pad cover on main gearbox. See Figure 804.

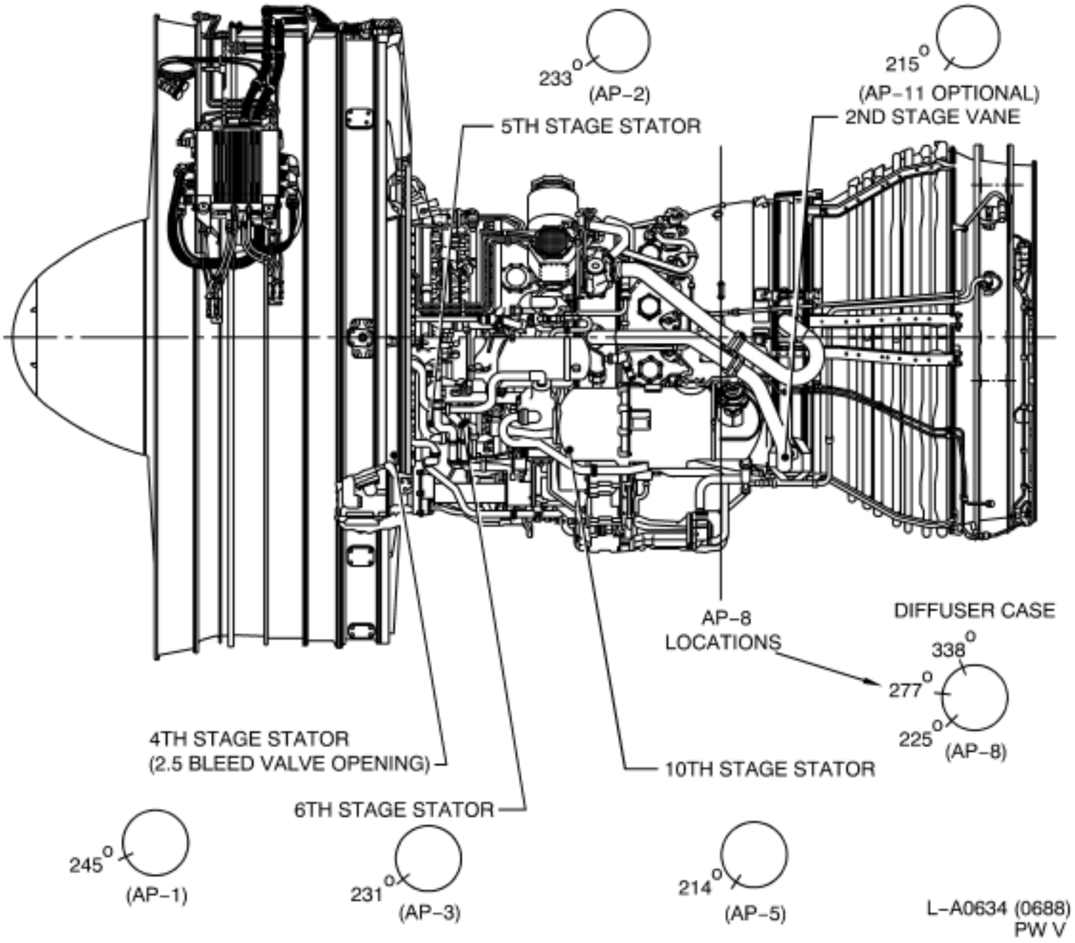
CAUTION: DO NOT REMOVE THE GEARBOX (SCAVENGE PUMP DRIVE) BEARING HOUSING ASSEMBLY. INSTALLATION OF THE BEARING HOUSING ASSEMBLY IS DIFFICULT. INCORRECT INSTALLATION WILL DAMAGE THE BEARING.

(a) Remove two bolts and two washers securing manual crank pad cover. Using PWA 85768 Puller, remove crank pad cover. Discard packing from stem of cover.

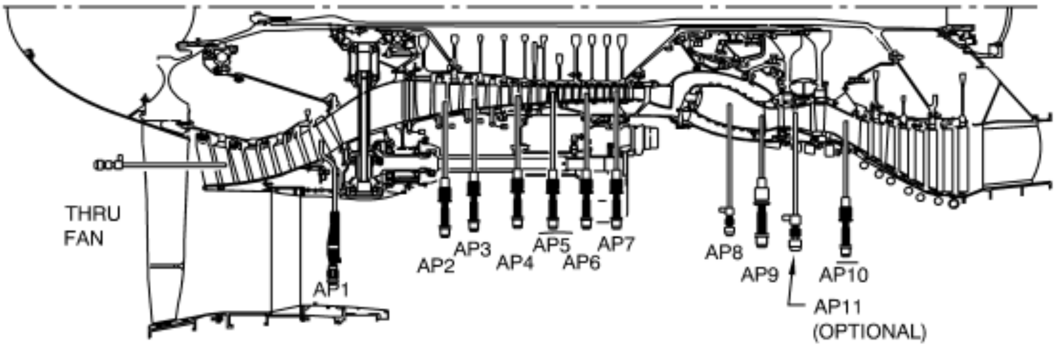
(3) To install the Pneumatic N2 Rotor Turning Tool:


45°
128°
172°
(AP−8)
DIFFUSER CASE
AP−8
LOCATIONS
80°
(AP−7)
14TH STAGE STATOR
TRANSITION DUCT (LPT INLET)
139°
(AP−10)
COMBUSTION CASE
93°
(AP−9)
12TH STAGE STATOR
98°
(AP−6)
8TH STAGE STATOR
127°
(AP−4)
L−A4366 (0000)
PW V

Borescope Access Ports (Right Side)
Figure 801 (Sheet 1)
(Task 72−00−00−990−010)


233°
(AP−2)
215°
(AP−11 OPTIONAL)
5TH STAGE STATOR
2ND STAGE VANE
AP−8
LOCATIONS
DIFFUSER CASE
338°
277°
225°
(AP−8)
4TH STAGE STATOR
(2.5 BLEED VALVE OPENING)
10TH STAGE STATOR
6TH STAGE STATOR
245°
(AP−1)
231°
(AP−3)
214°
(AP−5)
L−A0634 (0688)
PW V

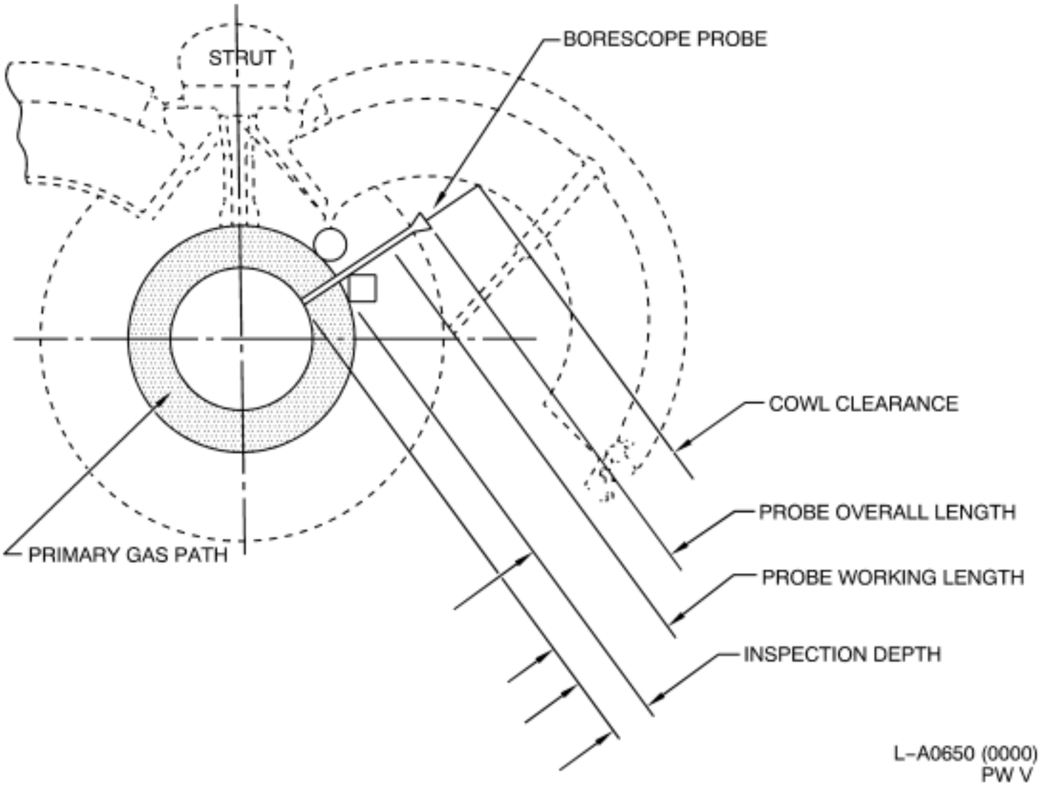
R Borescope Access Ports (Left Side)
R Figure 801 (Sheet 2)
R (Task 72−00−00−990−010)



AP2−7, 9, 10	LOW MAGNIFICATION RIGID BORESCOPE, (0.270 INCH/6.8 mm BARREL DIA. MAX.)
AP8, 11	HIGH MAGNIFICATION RIGID BORESCOPE, (0.444 INCH/11.3 mm BARREL DIA. MAX.)
AP−1, (OPTIONAL FOR AP2−7)	FLEXIBLE BORESCOPE, (0.270 INCH/6.8 mm CABEL DIA. MAX.)
THRU FAN (STG. 1 VANE, STG. 1.6 BLADE)	FLEXIBLE BORESCOPE (0.270 INCH/6.8 mm CABLE DIA. MAX.) −OR− LOW MAGNIFICATION RIGID BORESCOPE (0.270 INCH/6.8 mm BARREL DIA. MAX.)

L−A0640 (0490)
PW V

Borescope Access Port Locations
Figure 802
(Task 72−00−00−990−010)


STRUT
BORESCOPE PROBE
COWL CLEARANCE
PROBE OVERALL LENGTH
PROBE WORKING LENGTH
INSPECTION DEPTH
PRIMARY GAS PATH
L−A0650 (0000)
PW V

Borescope Probe Working Specifications
Figure 803
(Task 72−00−00−990−010)

(a) Attach PWA 85572−1 Foot Operated Rotator or PWA 85572−2 Hand Operated Rotator to N2 rotator pad. Make sure socket drive in the angle drive adapter aligns correctly with hex end of oil pump idler gear in gearbox and secure using two 1/4 − 28 cap screws provided. Attach an air supply to the pneumatic motor. Actuate using foot or hand control.

NOTE: Use of motor−drive unit will free operator to use both hands to position and adjust the borescope. It is recommended that rotation be stopped as each rotor blade is positioned properly for inspection. This will allow thorough, detailed appraisal of each blade's condition.

(4) To install the alternate Jupitor Corporation Electronic N2 Rotor Turning Tool Kit. See Figure 805.

(a) Engage the PWA 86441 Drive Unit to the hex shaped internal drive at the N2 rotator pad and connect with two 1/4 x 20 nuts. Engage this drive unit to the power unit detail of the PWA 76271 Control Kit with the detail cable as shown in figure.

(b) Use the remaining three cables to connect the controller and the power source to the power unit detail and the remote foot switch to the controller. Set the controller so the preprogramed instructions in the controller match the engine being inspected.

(c) Operate the Digital Turning Tool, during borescope inspection, in accordance with the Manufactures Instruction Manual included with the PWA 76271 Kit.

(5) To install the alternate PWA 49058 Hand Rotator:

(a) Install the elbow to the handle and attach with the shoulder screw. Tighten the screw with the attached allen wrench.

(b) If necessary, adjust the angle of the elbow to the rod assembly with the set screw. Use the attached allen wrench.

(c) Install the socket and PW4000 bracket to the hex shaped internal drive at the N2 rotator pad. Attach with the two bracket bolts and check nuts.

(d) Install the ratchet and handle assembly to the socket on the crank pad.

(e) The lever assembly on the handle has a position for clockwise and counterclockwise N2 rotation.

(f) Turn the handle to rotate the N2 rotor during the borescope blade inspection procedure.

(6) Install the alternate PWA 102089 Controller Kit as follows:

NOTE: This is the Rhinestahl Corporation Engine Turning Controller Kit.

(a) Install the PWA 102093 Drive Adapter or PWA 102390 Drive Adapter to the N2 rotator pad. Make sure the drive in the drive adapter aligns correctly with hex end of oil pump idler gear in the gearbox.

(b) Attach the power drive unit of the PWA 102089 Controller Kit to the PWA 102093 Drive Adapter or PWA 102390 Drive Adapter.

(c) Follow the manufacturer's instructions for assembly of the rotator kit.

(d) Connect the electrical power cable to a power source.

(7) Remove the rotator from the gearbox and install manual crank pad cover. See Figure 804.

(a) Remove the power cable from the power unit or remove the air supply to the pneumatic motor.

(b) Remove the cables from the rotator and controller.

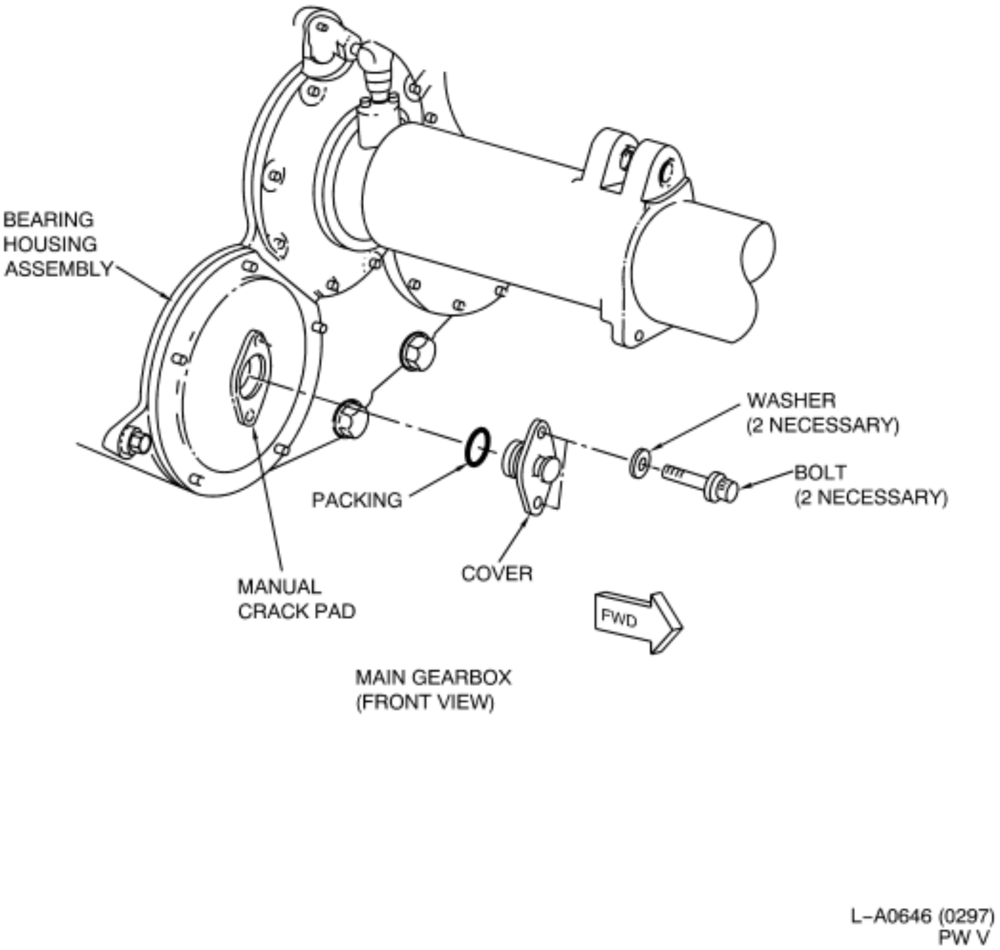
(c) Remove the two rotator attachment bolts.

(d) Remove the rotator from the gearbox.

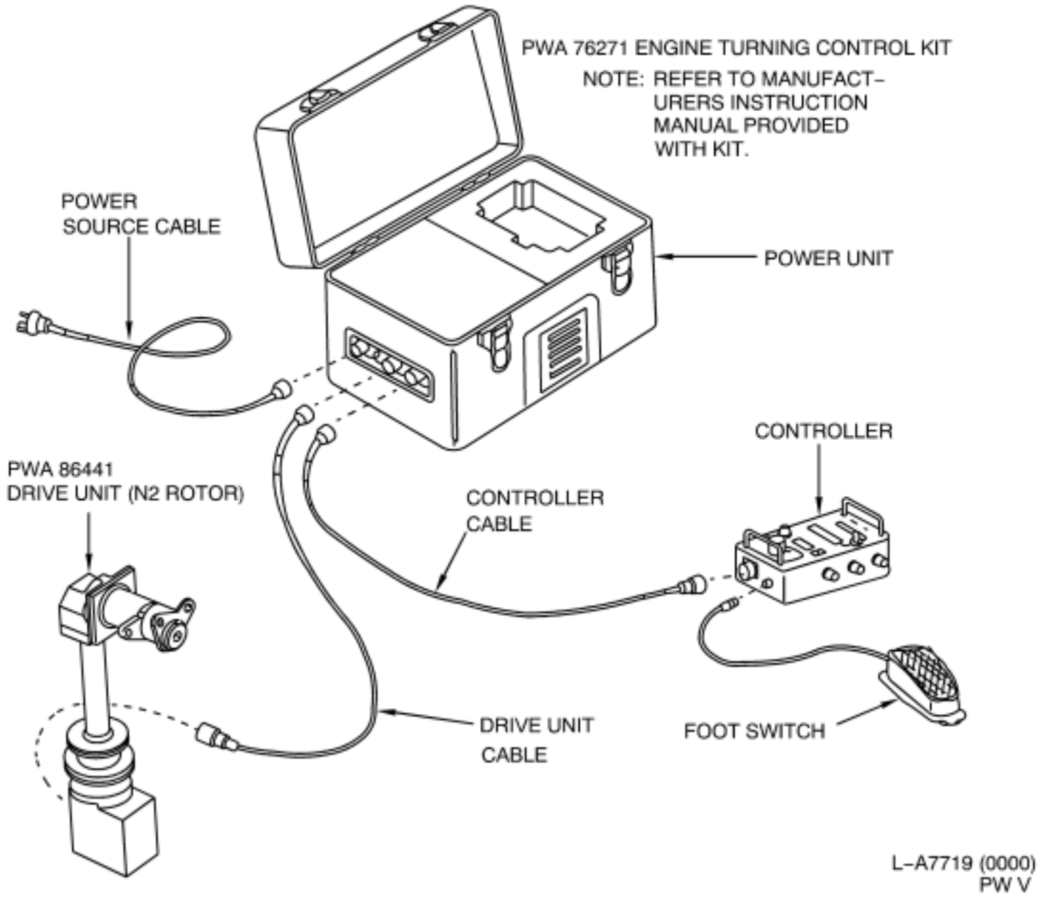
(e) Install packing lubricated with Engine Oil P03−001, in groove on stem of manual crank pad cover. Install cover and secure with two washers
R and two bolts lubricated with Anti−Seize Paste
R P06−054. Remove the unwanted paste. Torque bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

C. Postrequisites

(1) Do an oil leak check of the gearbox crank pad cover. Do 71−00−00 Testing−03 − Idle Power Test, Task 71−00−00−760−030.


BEARING HOUSING ASSEMBLY
WASHER (2 NECESSARY)
BOLT (2 NECESSARY)
PACKING
COVER
MANUAL CRACK PAD
FWD
MAIN GEARBOX (FRONT VIEW)
L−A0646 (0297)
PW V

Manual Crank Pad Locations
Figure 804
(Task 72−00−00−480−001)


PWA 76271 ENGINE TURNING CONTROL KIT
NOTE: REFER TO MANUFACT−URERS INSTRUCTION MANUAL PROVIDED WITH KIT.
POWER SOURCE CABLE
POWER UNIT
CONTROLLER
PWA 86441 DRIVE UNIT (N2 ROTOR)
CONTROLLER CABLE
DRIVE UNIT CABLE
FOOT SWITCH
L−A7719 (0000)
PW V

Engine Turning Control Kit, With Drive Unit
Figure 805
(Task 72−00−00−480−001)

Task 72-00-00-990-011:

1. General Borescope Inspection Procedures And Borescope Access Port (AP) Data

A. General

See Figure 801, Figure 802, Figure 803 and Table 801.

Access Port	Angular Location Clockwise From Rear	Part(s) Viewable For Inspection	Recommended Maximum Probe Diamter Inch/(mm)
Thru Fan	------	1st C-Vane 1st C-Blades	---------
AP-1	245° (1)	Rear of 4th C-Blade Front of 4th C-Vane	---------
AP-2	233°	Rear of 5th C-Blade Front of 6th C-Blade	.270/6.8
AP-3	231°	Rear of 6th C-Blade Front of 7th C-Blade	.270/6.8
AP-4	127°	Rear of 8th C-Blade Front of 9th C-Blade	.270/6.8
AP-5	214°	Rear of 10th C-Blade Front of 11th C-Blade	.270/6.8
AP-6	98°	Rear of 12th C-Blade Front of 13th C-Blade	.270/6.8
AP-7	80°	Rear of 14th C-Blade Front of 15th C-Blade	.270/6.8
AP-8	277° (1)	Fuel Nozzle Combustion Chamber 1st T-Vane	.270/6.8
AP-8	45° (1) 128° (1)	Fuel Nozzle Combustion Chamber	.270/6.8
	172° (1) (2) 225° (1) 338° (1) (3) (5)	1st T-Vane	.270/6.8
AP-8	(1) (1)	Front of 1st T-Vane Front of 1st T-Blade	.270/6.8
AP-10	139°	Rear of 2nd T-Blade Front of 3rd T-Vane	.270/6.8
AP-11	215° (4)	Rear of 1st Turbine Blade Front of 2nd Turbine Blade	.444/11.3
Thru Exhaust Case	-------	6th T-Blade	---------

Table 801

Access Port	Angular Location Clockwise From Rear	Part(s) Viewable For Inspection	Recommended Maximum Probe Diamter Inch/(mm)
(CONTINUED) Struts			
		6th T-Vane	

NOTE: (1) Flexible probe required at this access port (optional all other ports).

NOTE: (2) Right angle eye piece required at this access port.

NOTE: (3) Right angle eye piece desirable at this access port.

NOTE: (4) Optional borescope port location.

NOTE: (5) For engines equipped, remove high temp sensor unit from (338°) port per Section 71-00-41, Removal-04 Task 72-00-41-050-001. Use flex probe to gain access.

Table 801 (Continued)

WARNING: BORESCOPE INSPECTIONS MUST BE PERFORMED IN A PROTECTED AREA. IF INSPECTIONS ARE PERFORMED IN WET WEATHER, APPROPRIATE PROTECTION MUST BE USED TO PREVENT DAMAGE TO EQUIPMENT OR POSSIBLE ELECTRICAL SHOCK TO THE OPERATOR.

CAUTION: BORESCOPE INSPECTION LIMITS ARE DERIVED FROM TESTING AND STRUCTURAL ANALYSIS. CONTINUED SERVICE OF PARTS AT OR NEAR MAXIMUM LIMITS MAY NOT BE ECONOMICALLY SOUND BECAUSE OF PERFORMANCE LOSS OR REDUCED PART LIFE.

(1) The provisions for borescope inspection of the engine represent a significant aid to effective maintenance. Borescope access is incorporated at 14 locations (15 for engines utilizing AP-11) along the engine gaspath, to permit detailed examination of critical internal engine areas.

NOTE: Borescope ports used in the following procedures are identified by their "AP" (access port) designation as shown in Figure 801 and Figure 802.

(2) Inspection interval definition, (regular/reduced).

(a) The regular inspection interval referred to in this procedure is obtained from the Maintenance Planning Guide. The reduced interval is set at half that value. These inspection intervals may be adjusted based on operator experience and consultation with the local regulatory agency.

(b) The maximum damage limit assigned to either inspection interval is such that, under normal circumstances, the damage should not progress beyond an operable condition before the end of the applicable inspection interval. Usually, a greater level of damage is allowed when inspection at a reduced interval than at a regular interval becomes the increased inspection frequency greatly reduces the changes of the damage progressing beyond the operable condition before the next inspection. For some features, however, the damage is so critical that an expanded (reduced interval) limit is not prudent. Hence, the limit will be the same for regular and reduced intervals.

(3) No data is given in Table 801 to inspect the LPC airfoils between the Stages 1.6 and 4 blades. However, if damage is seen while viewing through the fan inlet, the allowable damage limit given for the 4th stage vanes in step 1.B.(3) will apply to LPC Stages 1.6, 2, and 3 vanes, and the damage limits given for the 4th stage blades in step 1.B.(4) will apply to the Stage 2 and 3 blades.

B. Special Borescope Equipment

CAUTION: TEMPERATURES IN AREAS TO BE BORESCOPED SHOULD BE PERMITTED TO COOL TO BELOW 150°F (65.6°C) FOLLOWING ENGINE OPERATION. DAMAGE MAY RESULT TO BORESCOPE EQUIPMENT IF EQUIPMENT IS EXPOSED TO GASPATH OR METAL TEMPERATURES IN EXCESS OF 150°F (65.6°C). AS A GUIDE − IF ADJACENT CASES ARE TOO HOT TO TOUCH COMFORTABLY, INSPECTION SHOULD BE DELAYED.

(1) Borescope inspection equipment for the PW4000 Engine should satisfy the requirements of CTE 6181 as published by Support Equipment Engineering, Pratt & Whitney, Commercial Products Division, 400 Main Street, MS 118−03 East Hartford, CT 06108

(2) Specification CTE 6181 identifies the equipment and associated hardware (such as power source, light cables, adapter etc.) required during borescope inspection and sets the quality and functional standards for this equipment. In summary the following borescope equipment is recommended:

(a) Low magnification rigid borescope,........AP−2−7 (0.270 inch/(6.8 mm) barrel diameter maximum)

(b) High magnification rigid borescope,.......AP−11 (0.444 inch/(11.3 mm) barrel diameter maximum)

(c) Flexible borescope,......................AP−1, AP−8 (optional for AP2−7) (0.270 inch/(6.8 mm) cable diameter maximum)

(3) Optional borescope equipment and sizes are also provided in CTE 6181 to enhance the borescoping capability and ease the task for the inspector. These items range from clamping equipment to hold the borescope in position to optical video equipment to view and videotape record the borescoping session for later in depth review.

Task 72−00−00−480−002:

2. Installation Of the Rotator Used To Turn The N2 Rotor

A. Equipment And Materials Necessary

Special Tools:

PWA 49058	Rotator, Hand (Hand Crank) Optional
PWA 76271	Control Kit, Engine Turning
PWA 85572−1	Compressor Rotating Kit (Foot Operated) Optional to PWA 85572
PWA 85572−2	Compressor Rotating Kit (Hand Operated) Optional to PWA 85572−1
PWA 85768	Puller, Knocker
PWA 86441	Drive Unit
PWA 102089	Control Kit, Engine Turning (Alternate to PWA 85572−1 and 2) (Used with PWA 102093 or PWA 102390)
PWA 102093	Drive Adapter, Engine Turning (Used with PWA 102089) (Optional to PWA 102390)
PWA 102390	Drive Adapter, Engine Turning (Used with PWA 102089) (PWA 102093)

Special Tools:

(CONTINUED)
Special Borescope Equipment:
See Task 72-00-00-990-010 for Special Borescope Equipment.

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
R	P06-054	Paste, Anti-Seize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72-61-00/8/160

B. Rotation Of High Pressure Rotor During Borescope Inspection

(1) Full 360 degree borescope inspection of the high pressure rotor can be accomplished using the rotorcranking provision on the gearbox.

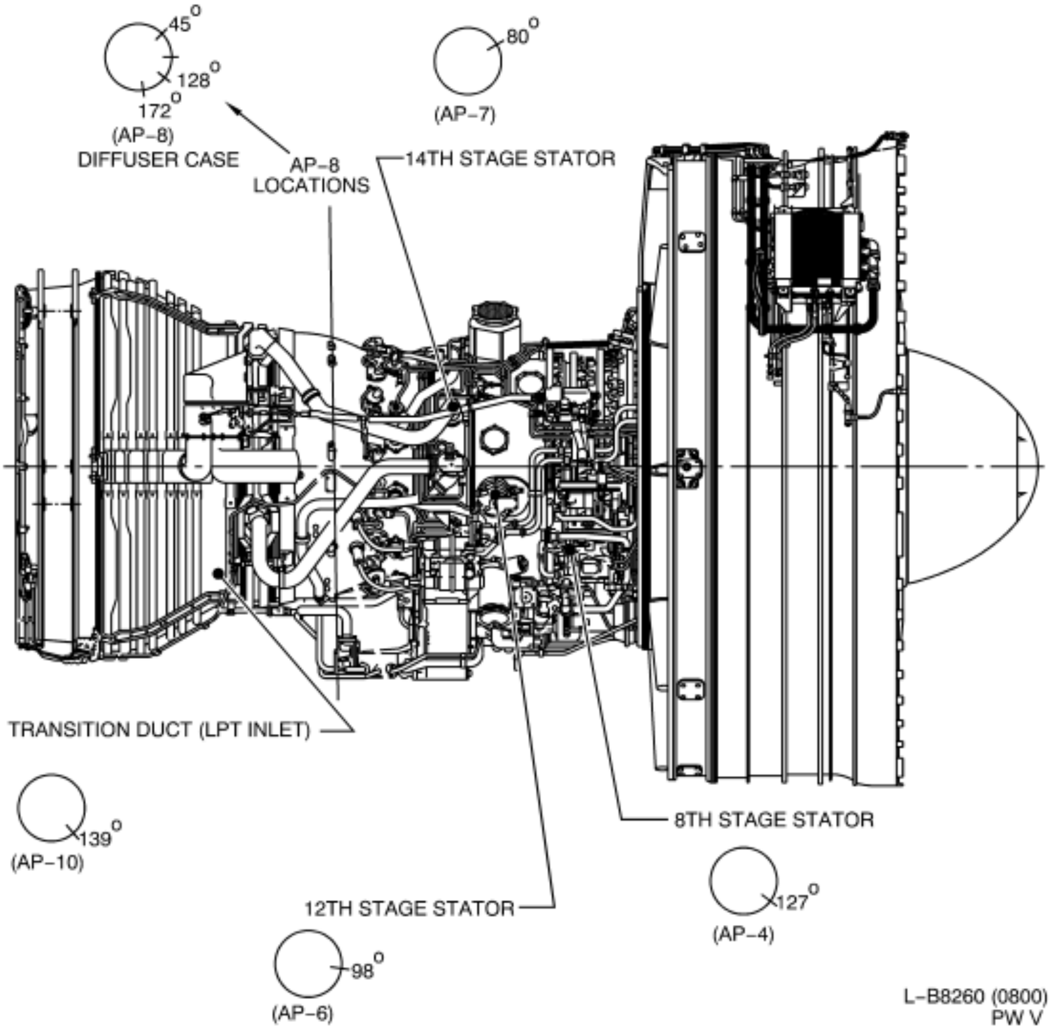
(2) Remove manual crank pad cover on main gearbox. See Figure 804.

CAUTION: DO NOT REMOVE THE GEARBOX (SCAVENGE PUMP DRIVE) BEARING HOUSING ASSEMBLY. INSTALLATION OF THE BEARING HOUSING ASSEMBLY IS DIFFICULT. INCORRECT INSTALLATION WILL DAMAGE THE BEARING.

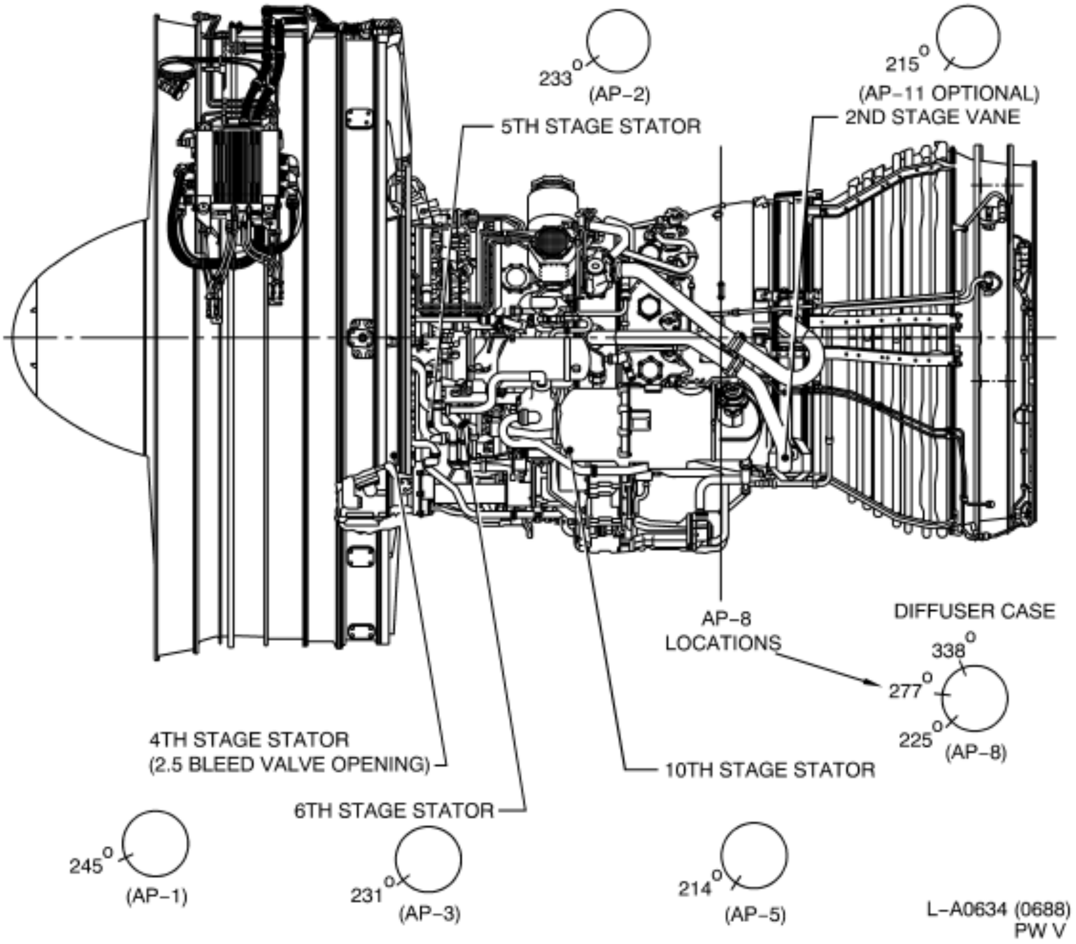
(a) Remove two bolts and two washers that attach the manual crank pad cover. Using PWA 85768 Puller, remove crank pad cover. Discard packing from stem of cover.

(3) To install the Pneumatic N2 Rotor Turning Tool:

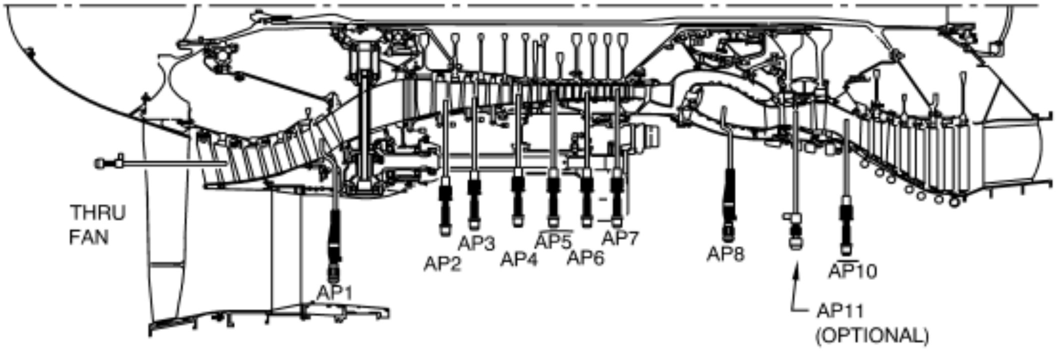
(a) Attach PWA 85572-1 Foot Operated Rotator or PWA 85572-2 Hand Operated Rotator to the N2 rotator pad. Make sure the socket drive in the angle drive adapter aligns correctly with the hex end of the oil pump idler gear in the gearbox and attach with two 1/4 - 28 cap screws provided. Attach an


45°
128°
172°
(AP−8)
DIFFUSER CASE
AP−8
LOCATIONS
80°
(AP−7)
14TH STAGE STATOR
TRANSITION DUCT (LPT INLET)
139°
(AP−10)
8TH STAGE STATOR
12TH STAGE STATOR
127°
(AP−4)
98°
(AP−6)
L−B8260 (0800)
PW V

Borescope Access Ports (Right Side)
Figure 801 (Sheet 1)
(Task 72−00−00−990−011)


233°
(AP−2)
215°
(AP−11 OPTIONAL)
5TH STAGE STATOR
2ND STAGE VANE
AP−8
LOCATIONS
DIFFUSER CASE
338°
277°
225°
(AP−8)
4TH STAGE STATOR
(2.5 BLEED VALVE OPENING)
10TH STAGE STATOR
6TH STAGE STATOR
245°
(AP−1)
231°
(AP−3)
214°
(AP−5)
L−A0634 (0688)
PW V

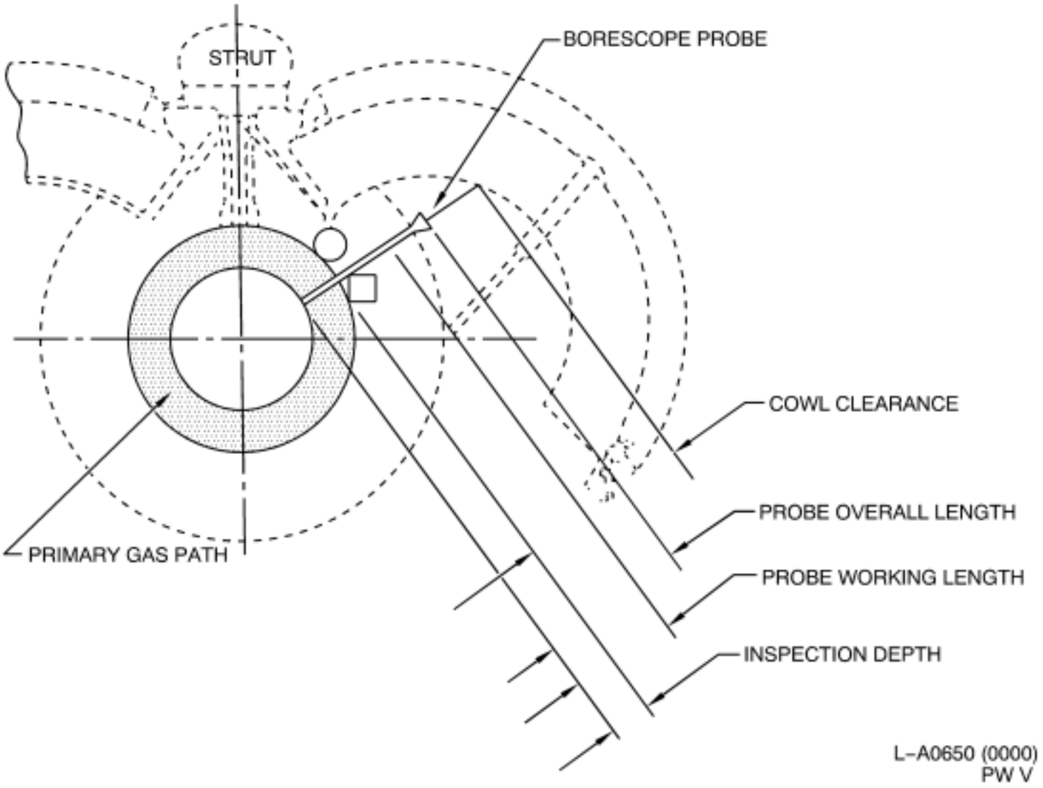
Borescope Access Ports (Left Side)
Figure 801 (Sheet 2)
(Task 72−00−00−990−011)



AP2−7,10	LOW MAGNIFICATION RIGID BORESCOPE, (0.270 INCH/6.8 mm BARREL DIA. MAX.)
AP11	HIGH MAGNIFICATION RIGID BORESCOPE, (0.444 INCH/11.3 mm BARREL DIA. MAX.)
AP8	FLEXIBLE BORESCOPE, (0.270 INCH/6.8 mm CABLE DIA. MAX.)
AP1 (OPTIONAL FOR AP−2−7)	FLEXIBLE BORESCOPE, (0.270 INCH/6.8 mm CABLE DIA. MAX.)
THRU FAN (STG.1 VANE, STG.1.6 BLADE)	FLEXIBLE BORESCOPE (0.270 INCH/6.8 mm CABLE DIA. MAX.) −OR− LOW MAGNIFICATION RIGID BORESCOPE (0.270 INCH/6.8 mm BARREL DIA. MAX.)

L−B8261 (0800)
PW V

Borescope Access Port Locations
Figure 802
(Task 72−00−00−990−011)


STRUT
BORESCOPE PROBE
COWL CLEARANCE
PROBE OVERALL LENGTH
PROBE WORKING LENGTH
INSPECTION DEPTH
PRIMARY GAS PATH
L−A0650 (0000)
PW V

Borescope Probe Working Specifications
Figure 803
(Task 72−00−00−990−011)

air supply to the pneumatic motor. Actuate using foot or hand control.

NOTE: Use of motor-drive unit will free the operator to use both hands to position and adjust the borescope. It is recommended that rotation be stopped as each rotor blade is positioned properly for inspection. This will allow thorough, detailed appraisal of each blade's condition.

(4) To install the alternate Jupitor Corporation Electronic N2 Rotor Turning Tool Kit. See Figure 805.

(a) Engage the PWA 86441 Drive Unit to the hex shaped internal drive at the N2 rotator pad and connect with two 1/4 x 20 nuts. Engage this drive unit to the power unit detail of the PWA 76271 Control Kit with the detail cable as shown in the figure.

(b) Use the remaining three cables to connect the controller and the power source to the power unit detail and the remote foot switch to the controller. Set the controller so the preprogramed instructions in the controller match the engine being inspected.

(c) Operate the Digital Turning Tool, during borescope inspection, in accordance with the Manufactures Instruction Manual included with the PWA 76271 Kit.

(5) To install the alternate PWA 49058 Hand Rotator:

(a) Install the elbow to the handle and attach with the shoulder screw. Tighten the screw with the attached allen wrench.

(b) If necessary, adjust the angle of the elbow to the rod assembly with the set screw. Use the attached allen wrench.

(c) Install the socket and PW4000 bracket to the hex shaped internal drive at the N2 rotator pad. Attach with the two bracket bolts and check nuts.

(d) Install the ratchet and handle assembly to the socket on the crank pad.

(e) The lever assembly on the handle has a position for clockwise and counterclockwise N2 rotation.

(f) Turn the handle to rotate the N2 rotor during the borescope blade inspection procedure.

(6) Install the alternate PWA 102089 Controller Kit as follows:

NOTE: This is the Rhinestahl Corporation Engine Turning Controller Kit.

(a) Install the PWA 102093 Drive Adapter or PWA 102390 Drive Adapter to the N2 rotator pad. Make sure the drive in the drive adapter aligns correctly with hex end of oil pump idler gear in the gearbox.

(b) Attach the power drive unit of the PWA 102089 Controller Kit to the PWA 102093 Drive Adapter or PWA 102390 Drive Adapter.

(c) Follow the manufacturer's instructions for assembly of the rotator kit.

(d) Connect the electrical power cable to a power source.

(7) Remove the rotator from the gearbox and install manual crank pad cover. See Figure 804.

(a) Remove the power cable from the power unit or remove the air supply to the pneumatic motor.

(b) Remove the cables from the rotator and controller.

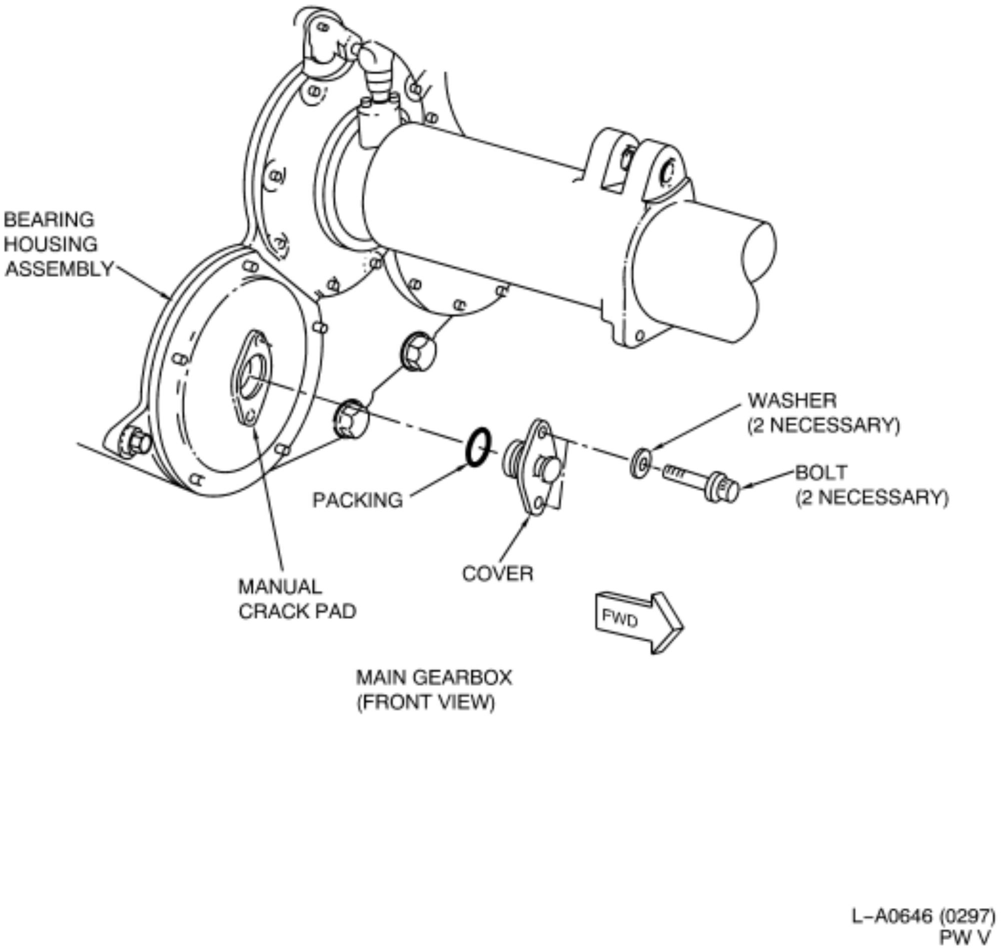
(c) Remove the two rotator attachment bolts.

(d) Remove the rotator from the gearbox.

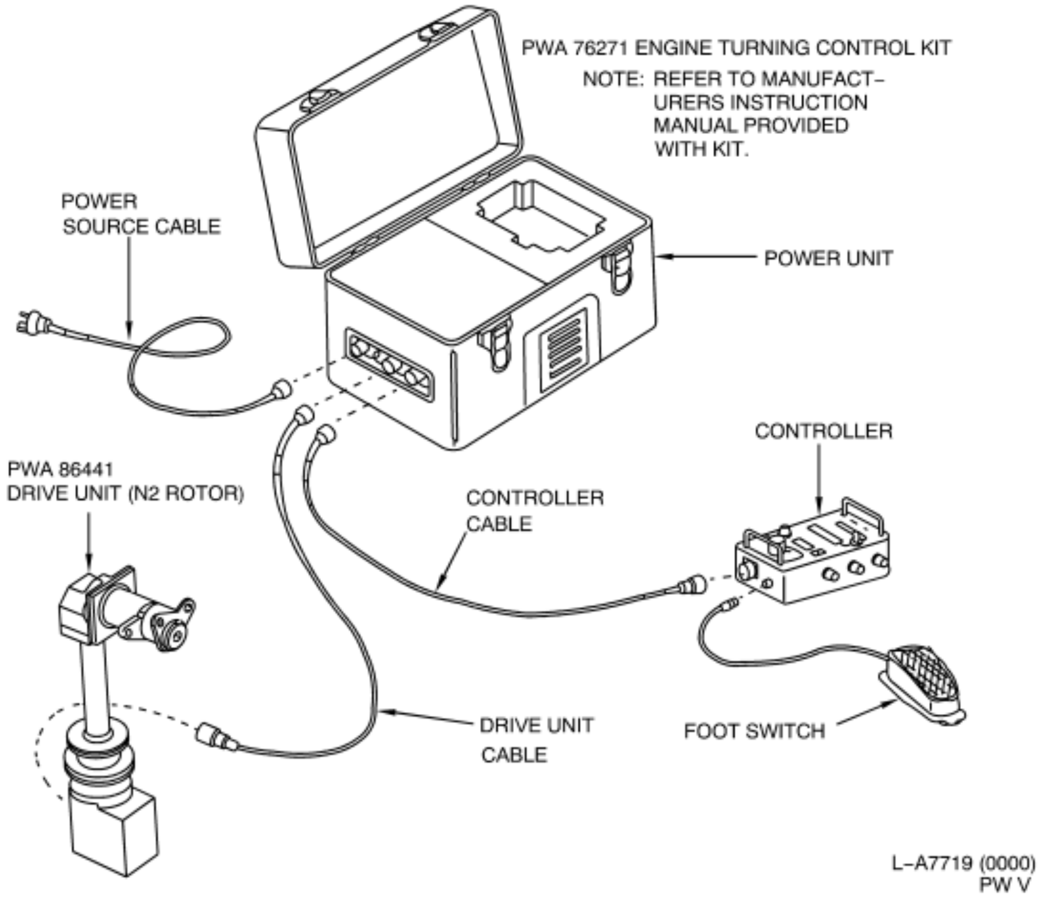
(e) Install packing lubricated with Engine Oil P03-001, in the groove on the stem of manual crank pad cover. Install the cover and attach with two
R washers and two bolts lubricated with Anti-Seize
R Paste P06-054. Remove the unwanted paste. Torque bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

C. Postrequisites

(1) Do an oil leak check of the gearbox crank pad cover. Do 71−00−00 Testing−03 − Idle Power Test, Task 71−00−00−760−030.


BEARING HOUSING ASSEMBLY
WASHER (2 NECESSARY)
BOLT (2 NECESSARY)
PACKING
COVER
MANUAL CRACK PAD
FWD
MAIN GEARBOX (FRONT VIEW)
L−A0646 (0297)
PW V

Manual Crank Pad Locations
Figure 804
(Task 72−00−00−480−002)


PWA 76271 ENGINE TURNING CONTROL KIT
NOTE: REFER TO MANUFACT–URERS INSTRUCTION MANUAL PROVIDED WITH KIT.
POWER SOURCE CABLE
POWER UNIT
CONTROLLER
PWA 86441 DRIVE UNIT (N2 ROTOR)
CONTROLLER CABLE
DRIVE UNIT CABLE
FOOT SWITCH
L–A7719 (0000)
PW V

Engine Turning Control Kit, With Drive Unit
Figure 805
(Task 72−00−00−480−002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INSPECTION/CHECK-01B

Task 72-00-00-210-003:

1. Perform Borescope Inspection Of Low Pressure Compressor (LPC)

A. Equipment And Materials Required

Standard Tools:
See Inspection/Check-01A for borescope equipment.

B. Procedure For Inspecting Stage 4 LPC Blades And Vanes

(1) Access to LPC Stage 4 blades and vanes is provided at AP-1 access port location through any of fourteen (14) openings in the fan exit case inner liner and an open 2.5 bleed valve. See Figure 801. Refer to
R 72-00-00, Inspection/Check-01A (Task 72-00-00-990-010)
R or (Task 72-00-00-990-011) Table 801 for additional AP-1 borescope access port data.

NOTE: Eight (8) of the fourteen (14) openings in the fan exit case inner liner across top of engine contain protective screens which must be removed to gain borescope access. The remaining six (6) openings across bottom of engine do not contain these screens and borescope access is direct. Removal of protective screens requires removal of flow path liner and bleed exit duct (see 72-33-00, Disassembly-01).

CAUTION: TEMPERATURES IN AREAS TO BE BORESCOPED SHOULD BE PERMITTED TO COOL TO BELOW 150°F (65.6°C) FOLLOWING ENGINE OPERATION. DAMAGE MAY RESULT TO BORESCOPE EQUIPMENT IF EQUIPMENT IS EXPOSED TO GASPATH OR METAL TEMPERATURES IN EXCESS OF 150°F (65.6°C). AS A GUIDE - IF ADJACENT CASES ARE TOO HOT TO TOUCH COMFORTABLY, INSPECTION SHOULD BE DELAYED.

(2) Insert a flexible (non-rigid) borescope through the AP-1 opening, and inspect condition of Stage 4 vanes and blades. Damaged parts must be evaluated for serviceability as described in steps (3) and (4).

CAUTION: THE FOLLOWING CONTINUE-IN-SERVICE LIMITS FOR FOREIGN OBJECT DAMAGE OBSERVED THROUGH AP-1 BORESCOPE INSPECTION PORTS ARE INTENDED AS A GUIDE TO DETERMINE WHETHER ENGINE MAY REMAIN IN SERVICE OR A REPAIR IS NECESSARY. IT IS IMPORTANT THAT CAUSE OF FOREIGN OBJECT DAMAGE BE DETERMINED TO ENSURE COMPRESSOR INTEGRITY

SINCE IT MAY BE AN INDICATION OF MORE SERIOUS PROBLEMS. SHOULD COMPRESSOR INTEGRITY BE QUESTIONED, COMPONENT IS TO BE REPLACED.

(3) Borescope inspection (continue-in-service) limits for Stage 4 vanes. See Figure 802 and Figure 803.

NOTE: During borescope inspection, if a potential defect appears to exceed the allowable "damage limits", examine the area closely to determine if the condition being evaluated is a defect or previously blended damage.

NOTE: (Blended areas are recognizable by a 4 to 1 length to depth blend ratio and smooth round corners).

NOTE: This determination is an important one because a blended area could exceed the "damage limits" allowed for a defect.

(a) Damage in form of nicks and dents on leading and trailing edge which are shallower than 0.050 inch (1.270 mm) deep and which are at least 0.5000 inch (12.700 mm) apart.

(b) Damage on both edges must not be directly opposite and must be separated diagonally by minimum distance equal to mean chordal length of vane.

(c) Dents in Area A which are less than 0.010 inch (0.254 mm) deep and which are at least 1.000 inch (25.400 mm) apart. Any material tears in this area must be repaired by replacing vanes.

(4) Borescope inspection (continue-in-service) limits for Stage 4 blades. See Figure 804.

NOTE: During borescope inspection, if a potential defect appears to exceed the allowable "damage limits", examine the area closely to determine if the condition being evaluated is a defect or previously blended damage.

NOTE: (Blended areas are recognizable by a 4 to 1 length to depth blend ratio and smooth round corners).

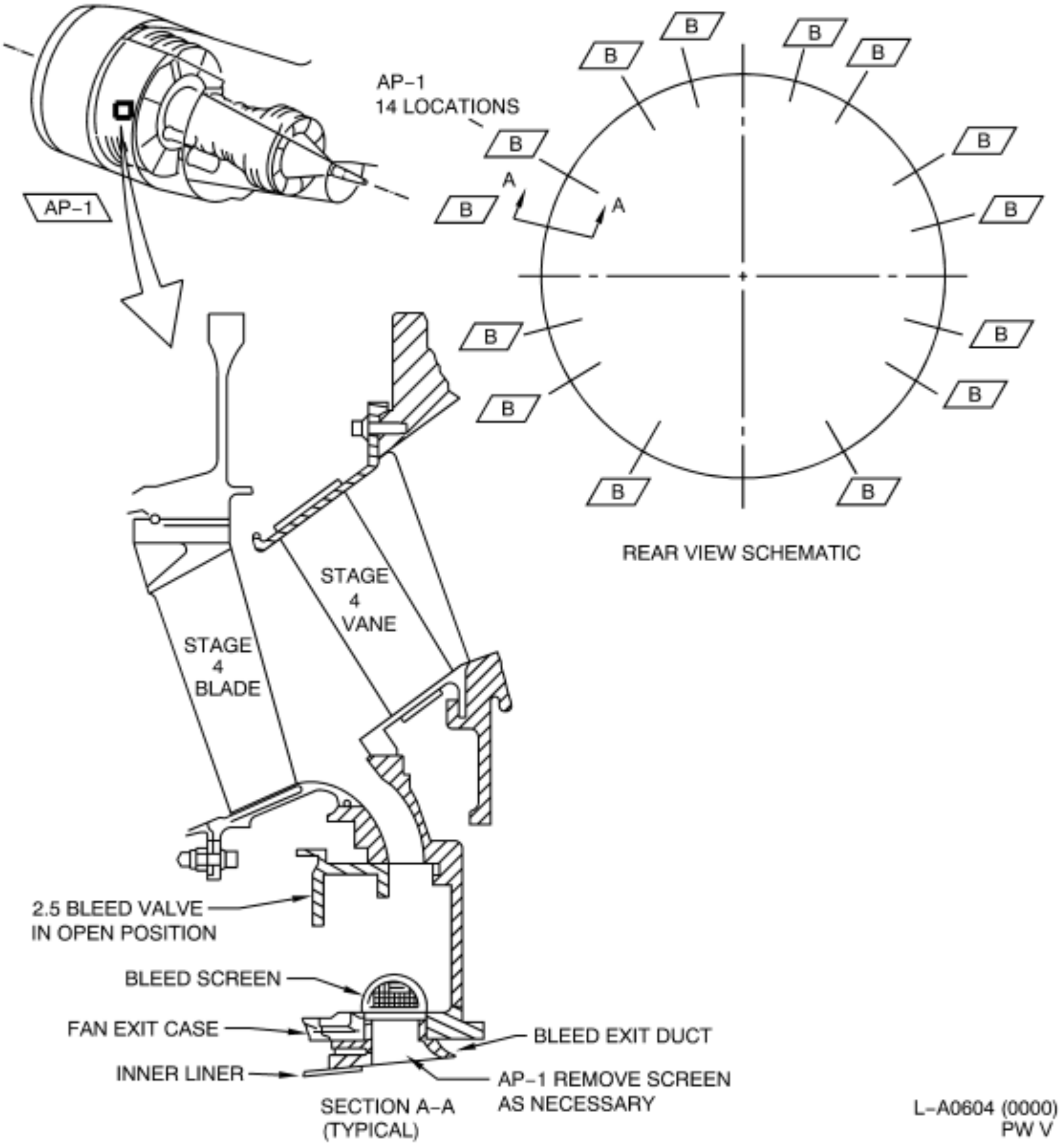
NOTE: This determination is an important one because a blended area could exceed the "damage limits" allowed for a defect.

(a) Damage approximately 0.0312 inch (0.792 mm) deep in Area A and which is at least 1.000 inch (25.400 mm) apart on either leading or trailing edge.

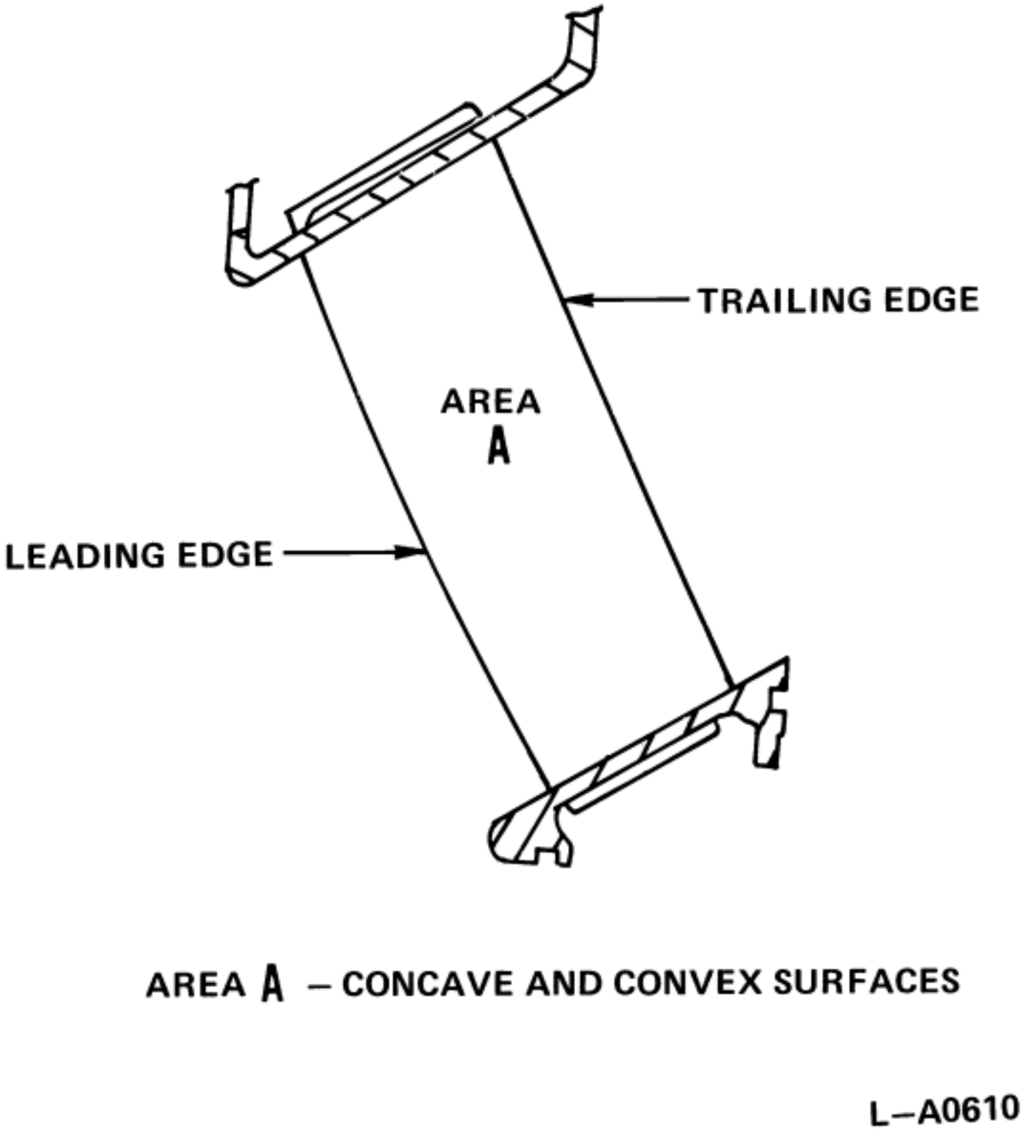
(b) Damage on both edges must not be directly opposite and must be separated diagonally by a minimum distance equal to mean chordal length of blade. (See Figure 803).

(c) Damage in Area B which is smaller than 0.0312 inch (0.792 mm) round bottomed indication and which does not have material tears.

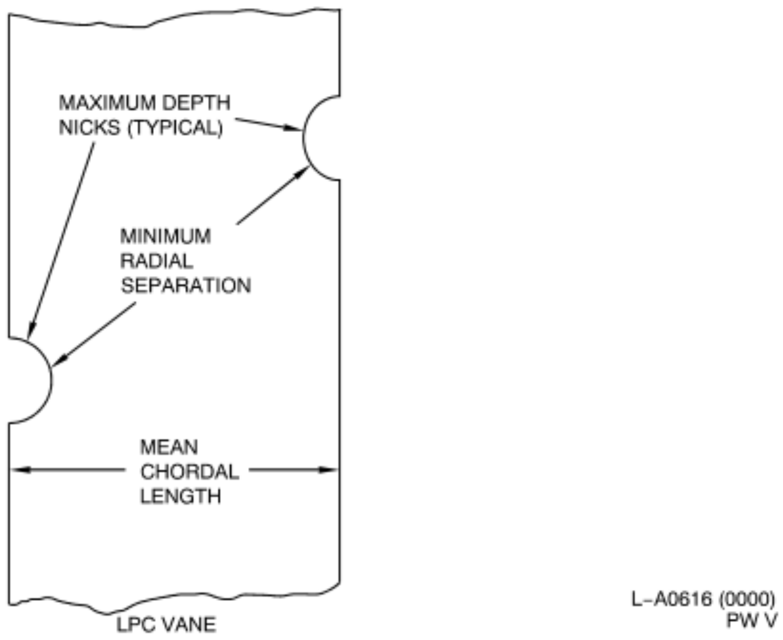
(d) Damage in Area C is not allowed unless blended.


AP-1
14 LOCATIONS
B
A
A
AP-1
REAR VIEW SCHEMATIC
STAGE
4
VANE
STAGE
4
BLADE
2.5 BLEED VALVE
IN OPEN POSITION
BLEED SCREEN
FAN EXIT CASE
INNER LINER
BLEED EXIT DUCT
AP-1 REMOVE SCREEN
AS NECESSARY
SECTION A-A
(TYPICAL)
L-A0604 (0000)
PW V

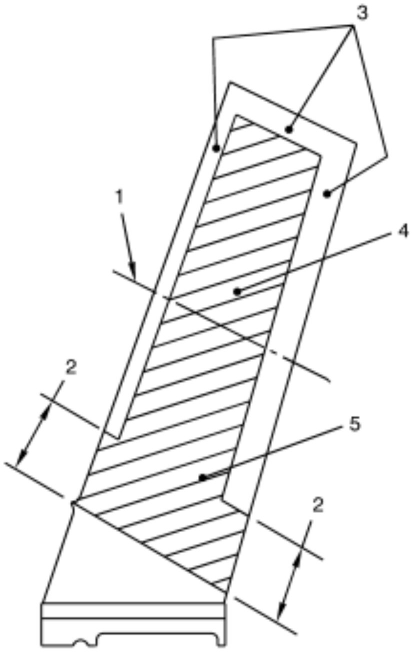
LPC Stage 4 Borescope Access Port (AP-1)
Figure 801
(Task 72-00-00-210-003)


TRAILING EDGE
AREA
A
LEADING EDGE
AREA A – CONCAVE AND CONVEX SURFACES
L–A0610

Stage 4 LPC Vane Service Limits
Figure 802
(Task 72-00-00-210-003)


MAXIMUM DEPTH
NICKS (TYPICAL)
MINIMUM
RADIAL
SEPARATION
MEAN
CHORDAL
LENGTH
LPC VANE
L-A0616 (0000)
PW V

Compressor Vanes Proximity Of Nicks
Between Leading And Trailing Edges
Figure 803
(Task 72-00-00-210-003)



1. APPROXIMATE AIRFOIL CENTERLINE
2. 0.500 INCH (12.700mm)
3. AREA A
4. AREA B-CONCAVE AND CONVEX SURFACES
5. AREA C-CONCAVE AND CONVEX SURFACES

L−A0622 (0000)
PW V

LPC Stage 4 Blade Service Limits
Figure 804
(Task 72−00−00−210−003)

ENGINE GENERAL - INSPECTION/CHECK-01C

Task 72-00-00-210-004:

1. Perform Borescope Inspection Of High Pressure Compressor (HPC)

A. Equipment And Materials Necessary

Standard Tools:
See 72-00-00 Inspection/Check-01A (Task 72-00-00-990-010)
For Borescope Equipment.

Special Tools:

	PWA 75250	Wrench, (AP-5 And AP-7 Inner Plug)
	PWA 86580	Driver, (AP-5 And AP-7 Inner Plug)
R	PWA 101674	Crimper, Mechanical (AP-2, AP-3, AP-5 And AP-7 Plugs)

Consumable Materials:

Item No.	Designation
P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer (AP2)	1	72-35-00/16/5
Key Washer (AP3)	1	72-35-00/16/15
Key Washer (AP5 And AP7)	2	72-35-00/22/10 or 72-35-00/22/10A

B. Procedure For Inspecting HPC Rotor And Stator Assembly
See Figure 801, Figure 802, Figure 803, Figure 804, Figure 805 and Figure 806.

CAUTION: SEE THE FOLLOWING STEP FOR ADDITIONAL REQUIREMENTS FOR REMOVING THE AP-2 AND AP-3 PLUGS OR DAMAGE TO THE SYNCHRONIZING RING CAN OCCUR.

(1) Remove plug(s) from borescope access port(s) (AP's). Access to HPC gaspath is provided at six AP locations along the HPC front and rear compressor cases. Identified as AP-2, AP-3, AP-4, AP-5, AP-6 and AP-7, these six access ports enable borescope viewing of

specific blade and vane areas as illustrated in Figure 801 through Figure 806.

NOTE: Table 801, 72-00-00 Inspection/Check-01A (Task 72-00-00-990-010) provides additional AP-2 through AP-7 data.

NOTE: PWA 75250 Wrench and PWA 86580 Driver can be used on engines without QEC installed. Engines with QEC installed, you must use PWA 86580 Driver to remove the inner plugs AP-5 and AP-7.

CAUTION: IF NECESSARY, TURN THE SYNCHRONIZING RINGS FOR ACCESS TO THE AP-2 AND AP-3 PLUGS. DO NOT PRY AGAINST THE RING LEVERS. USE A STANDARD CROWS FOOT WRENCH AND TURN THE BELLCRANK. IF YOU DO NOT DO THIS, DAMAGE TO THE ENGINE CAN OCCUR.

CAUTION: FOR AP-2 AND AP-3 PLUGS, THE 6TH STAGE SYNCHRONIZING RING MUST BE IN ITS REARMOST POSITION TO PROVIDE SUFFICIENT CLEARANCE TO REMOVE THE PLUG OR DAMAGE TO THE SYNCHRONIZING RING CAN OCCUR. WHEN THE SYNCHRONIZING RING IS IN ITS REARMOST POSITION, THE VANE ARMS WILL BE APPROXIMATELY AXIAL TO THE ENGINE.

(2) Do this step if access to AP-2 and AP-3 borescope port plugs (at 7 o'clock position) is blocked by the synchronizing ring, stator vane actuator(SVA) synchronizing ring arm, or if a better view of the blades and vanes is necessary during borescope inspection.

(a) Install a standard Crows Foot wrench on SVA Bellcrank (flats), adjacent to Stage 5 adjustor. Push on the wrench in the applicable (up or down) direction. This turns the syncronizing ring and moves the ring arms and variable vanes.

CAUTION: TEMPERATURES IN AREAS TO BE BORESCOPED SHOULD BE PERMITTED TO COOL TO BELOW 150°F (65.6°C) FOLLOWING ENGINE OPERATION. DAMAGE MAY RESULT TO BORESCOPE EQUIPMENT IF EQUIPMENT IS EXPOSED TO GASPATH OR METAL TEMPERATURES IN EXCESS OF 150°F (65.6°C). AS A GUIDE -

IF ADJACENT CASES ARE TOO HOT TO TOUCH COMFORTABLY, INSPECTION SHOULD BE DELAYED.

(3) Insert borescope through applicable port (AP-2 through AP-7) and inspect condition of HPC blades and vanes. Damaged parts must be evaluated for serviceability as described in steps (3) through (6).

NOTE: Full 360 degree inspection of the HPC rotor can be accomplished by using manual or power equipment on the cranking provision on the main gearbox. See 72-00-00 Inspection/Check-01A, Installation Of The Rotator Used To Turn The N2 Rotor, (Task 72-00-00-480-001).

NOTE: It can be possible to view outer airseal rubstrip areas during borescope inspection of the HPC but rubstrip inspection is not mandatory. If rubstrips are inspected:

NOTE: For Stages 6 and 7, there is no limit to missing feltmetal, feltmetal disbond, or chunk out provided there is no airfoil damage beyond the acceptable Continue in Service limits and that the engine has no history of operational, or stability abnormalities.

NOTE: For the remaining Stages, if missing feltmetal, disbond or chunk out is seen, then only up to four areas of material can be missing for a maximum area of 3.000 square inches (1935. sq. mm) for any one stage.

(4) Inspect HPC Stages 5 through 7 blades for curled leading edge/blade tip. Blades within limits listed below and in Figure 807 (Sheet 1) are acceptable.

NOTE: Curled leading edge/blade tip is defined as a triangular piece of blade material formed by bending about a line connecting points on leading edge and blade tip, respectively, whose average convex surface contour (curl) is greater than 20 degrees but less than or equal to 90 degrees out of plane angle (toward the convex blade side), with average concave blade contour.

(a) Maximum of six curled blades.

(b) Curled blades must be separated by at least three non-curled blades.

(c) Borescope inspection limits for blade surface damage in all other areas other than Index 5 of Figure 807 (Sheet 1) are applicable.

(5) Inspect all HPC Stages 5 through 7 blades for bending of the leading edge, refer to Figure 807 (Sheet 2).

(a) No bending permitted on adjacent blades.

(b) Bending not permitted on more than (6) blades per stage.

(c) No tears or cracks are permitted. Bends must be smooth and continuous.

(d) No more than one bend per blade is permitted.

(6) Borescope inspect HPC Stages 9 through 15 tangential blade locks.

(a) Inspect for loose/improperly seated blade locks. The engine may be continued-in-service with up to two loose Stage 9 through 15 blade locks (per stage) until the next regularly scheduled HPC disassembly.

(7) Borescope inspect HPC Stage 9 through 15 blade seals.

(a) Inspect for loose/missing blade seals (Reference 72-35-22). The engine may be continued-in-service with loose/missing Stage 9 through 15 blade seals until the next regularly scheduled HPC disassembly.

CAUTION: THE FOLLOWING BLADE NICK LIMITS FOR FOREIGN OBJECT DAMAGE OBSERVED THROUGH THE BORESCOPE INSPECTION PORTS ARE INTENDED AS A GUIDE TO DETERMINE WHETHER THE ENGINE MAY REMAIN IN SERVICE OR A REPAIR IS NECESSARY. IT IS IMPORTANT THAT THE CAUSE OF THE FOREIGN OBJECT DAMAGE BE DETERMINED TO ENSURE COMPRESSOR INTEGRITY SINCE IT MAY BE AN INDICATION OF MORE SERIOUS PROBLEMS. SHOULD

COMPRESSOR INTEGRITY BE QUESTIONED, THE COMPONENT IS TO BE REPLACED.

(8) Borescope inspection (service limits) compressor blade (Stages 5 through 15) - nicks and dents. See Figure 808, Figure 809, and Figure 810.

NOTE: During borescope inspection, if a potential defect appears to exceed the allowable "damage limits", examine the area closely to determine if the condition being evaluated is a defect or previously blended damage.

NOTE: (Blended areas are recognizable by a 4 to 1 length to depth blend ratio and smooth round corners).

NOTE: This determination is an important one because a blended area could exceed the "damage limits" allowed for a defect.

NOTE: Stages 12 and 13 blades cannot be In-situ blended for an engine that has incorporated the HPC ring case since it prevents the ability to insert the blending tool through the AP-6 borescope port.

(a) HPC continue-in-service and reairable limits are provided on the Figure 808, Figure 809 and Figure 810. The borescope ports for each stage are provided as follows:

STAGE (BLADES)	AP PLUG
Stage 5	(AP-2)
Stage 6	(AP-2/AP-3)
Stage 7	(AP-3)
Stage 8	(AP-4)
Stage 9	(AP-4)
Stage 10	(AP-5)
Stage 11	(AP-5)
Stage 12	(AP-6)
Stage 13	(AP-6)
Stage 14	(AP-7)
Stage 15	(AP-7)

(b) In−situ (assembled engine) blend repairs are permitted by 72−00−00, Repair−02 (Task 72−00−00−300−002) if damage is within the limits shown in Figure 809 and as follows:

NOTE: Limits shown in Figure 809 are the maximum size that can be repaired by in−situ repair. The in−situ repair will remove additional material. The final repair depth is controlled by the in−situ repair procedure.

NOTE: Repairs are allowed for the leading and trailing edges except as noted.

1 Blend repairs are only allowed where shown.

2 Multiple blends are permitted to a maximum depth of the limits shown in Figure 808.

3 One blend in each blade is permitted to the maximum depth shown in Figure 809.

4 All blends must be separated by a minimum of 0.125 inch (3.175 mm).

5 Blends on both edges must not be directly opposite and must be separated diagonally by a minimum distance equal to the mean chordal length of the blade. See Figure 810.

(c) There is no limit to the number of blades in a single stage or for all nine stages that can be blended by this method.

(d) Damage in Area C that is near the change into Area A on the leading and trailing edges only, can be repaired by 72−00−00, Repair−02 (Task 72−00−00−300−002) to the limits of Area C in Figure 809. However, tooling clearances with the outer duct can prevent a successful repair. It is not possible to blend damage on the blade tips due to tooling clearance with the outer ducts. If a successful repair cannot be accomplished and the damage exceeds the continue−in−service limits, then the blade must be replaced.

(e) Replace In-situ blend repaired blades at the next overhaul if blend repairs are greater than the repair limits specified for that blade.

CAUTION: THE FOLLOWING VANE NICK LIMITS FOR FOREIGN OBJECT DAMAGE OBSERVED THROUGH BORESCOPE INSPECTION PORTS ARE INTENDED AS A GUIDE TO DETERMINE WHETHER ENGINE MAY REMAIN IN SERVICE OR A REPAIR IS NECESSARY. IT IS IMPORTANT THAT CAUSE OF THE FOREIGN OBJECT DAMAGE BE DETERMINED TO ENSURE COMPRESSOR INTEGRITY SINCE IT MAY BE AN INDICATION OF MORE SERIOUS PROBLEMS. SHOULD COMPRESSOR INTEGRITY BE QUESTIONED, COMPONENT IS TO BE REPLACED.

(9) Borescope inspection (service limits) compressor stator vanes (IGV and Stages 5 through 15). See Figure 811, Figure 812 (Sheets 1 through 5), and Figure 813.

NOTE: During borescope inspection, if a potential defect appears to exceed the allowable "damage limits", examine the area closely to determine if the condition being evaluated is a defect or previously blended damage.

NOTE: (Blended areas are recognizable by a 4 to 1 length to depth blend ratio and smooth round corners).

NOTE: This determination is an important one because a blended area could exceed the "damage limits" allowed for a defect.

(a) Vane service limits - nicks. See Figure 811 and Figure 812.

1 Nicks to maximum depth on leading edge and nicks to maximum depth on trailing edge must not be at same radial station and must be radially separated by not less than vane chordal length. Nicks to leading and trailing edges not to maximum depth limit and within chordal length radial spacing, are acceptable only if combined nicked leading edge depth and nicked trailing edge depth does not exceed above single nick limit.

2 No more than two nicks to maximum depth limit allowed per vane.

3 Total nicked length on any vane edge shall not be in excess of 1/8 of the total edge length.

4 No cracks allowed.

(b) Vane service limits - missing braze.

1 For 14th stage stator only: Missing braze is permitted at the vane to shroud OD fillet radius for the two 14th stage vanes adjacent to the AP-7 borescope port.

(10) After borescope inspection, install applicable AP-2 through AP-7 plug(s) and where removed, a new key washer per requirement of Table 801 and as follows:

CAUTION: IT IS VERY IMPORTANT TO OBEY THE PROCEDURES IN THE STANDARD PRACTICES MANUAL, PN 585005 70-53, LOCKING DEVICES, WHEN YOU INSTALL (BORESCOPE) PLUG KEY WASHERS. INCORRECT INSTALLATION OF THE KEY WASHERS CAN CAUSE THE (BORESCOPE) PLUGS TO COME OUT. IF AN AP-5 OR AP-7 (BORESCOPE) PLUG IS NOT THERE, HOT GASES FROM THE PLUG OPENING CAN CAUSE DAMAGE TO THE THRUST REVERSER.

(a) (Pre SB PW4ENG 72-675) (AP-5 and AP-7) and all AP-2, AP-3, AP-4 and AP-6: Prior to installing borescope plugs, remove excess baked on compound from threads using a nylon brush. Apply Antiseize Paste P06-054 to threads and to plug head washer contact surface area. Wipe off unwanted paste. Do not use Engine Oil P03-001. Run in borescope plug to be sure plug is seated before applying torque by Table 801. R

CAUTION: DO NOT APPLY ANTISEIZE PASTE P06-054 TO THE THREADS AND WASHER FACE OF THE POST SB PW4ENG 72-675 PLUGS. THESE PLUGS HAVE BAKED ON ANTIGALLANT COMPOUND.

CAUTION: IT IS VERY IMPORTANT TO OBEY THE PROCEDURES IN THE STANDARD PRACTICES MANUAL, PN 585005 70-53, LOCKING DEVICES, WHEN YOU INSTALL (BORESCOPE)

PLUG KEY WASHERS. INCORRECT INSTALLATION OF THE KEY WASHERS CAN CAUSE THE (BORESCOPE) PLUGS TO COME OUT. IF AN AP-5 OR AP-7 (BORESCOPE) PLUG IS NOT THERE, HOT GASES FROM THE PLUG OPENING CAN CAUSE DAMAGE TO THE THRUST REVERSER.

(b) (Post SB PW4ENG 72-675) (AP-5 and AP-7): Install the plugs into the compressor case. Do not use Antiseize Paste P06-054 or Engine Oil P03-001. Run in borescope plug to be sure plug is seated before applying torque by Table 801. R

AP No. And Location	Plug Locking Method	Plug Replacement Lubricant	Plug Torque lb-in. (N.m)
AP-2 Stage 5 Compr. Vane	Self- locking Insert For Earlier Plug Key Washer (PN 53H027) For Later Plug (Post SB 72-517)	P06-054 Antiseize Paste	175 - 190 (19.772 - 21.467) Reference Number 1554
AP-3 Stage 6 Compr. Vane	Self-locking Insert For Earlier Plug Key Washer (PN 53H028) For Later Plug (Post SB PW4ENG 72-517)	P06-054 Antiseize Paste	175 - 190 (19.772 - 21.467) Reference Number 1552
AP-4 Stage 8 Compr. Vane	Self-locking Insert	P06-054 Antiseize Compound	175 - 190 (19.772 - 21.467) Reference Number 1556

HPC Borescope/Access Plug Installation Data
Table 801

AP No. And Location	Plug Locking Method	Plug Replacement Lubricant	Plug Torque lb-in. (N.m)
AP-5 Stage 10 Compr. Vane Outer	Key Washer MS9582-19 (Pre SB PW4ENG 72-708) 58H216 (Post SB PW4ENG 72-708)	P06-054 Antiseize Paste	175 - 190 (19.772 - 21.467) Reference Number 1555
Inner	Plug Assembly With Integral Lockwasher (Pre SB PW4ENG 72-675)	P06-054 Antiseize Paste	175 - 190 (19.772 - 21.467) Reference Number 1557
Inner	Plug Assembly With Integral Lockwasher (Post SB PW4ENG 72-675)	DO NOT APPLY ANY ANTISEIZE PASTE (This plug has baked on antigalling compound)	175 - 190 (19.772 - 21.467) Reference Number 1557
AP-6 Stage 12 Compr. Vane	Self-locking Insert	P06-054 Antiseize Paste	175 - 190 (19.772 - 21.467) Reference Number 1556
AP-7 Stage 14 Compr. Vane Outer	Key Washer MS9582-19 (Post SB PW4ENG 72-517) (Pre SB PW4ENG 72-708) 58H216 (Post SB PW4ENG 72-708)	P06-054 Antiseize Paste	175 - 190 (19.772 - 21.467) Reference Number 1555

HPC Borescope/Access Plug Installation Data
Table 801 (Continued)

AP No. And Location	Plug Locking Method	Plug Replacement Lubricant	Plug Torque lb-in. (N.m)
Inner	Self-locking Insert (Pre SB PW4ENG 72-517 and Pre SB PW4ENG 72-675)	P06-054 Antiseize Paste	175 - 190 (19.772 - 21.467) Reference Number 1559
Inner	Bushing. No Insert (Post SB PW4ENG 72-517 and Pre SB PW4ENG 72-675)	P06-054 Antiseize Paste	175 - 190 (19.772 - 21.467) Reference Number 1559
Inner	Bushing. or Insert (Post SB PW4ENG 72-675)	DO NOT APPLY ANY ANTISEIZE PASTE (This plug has baked on antigalling compound)	175 - 190 (19.772 - 21.467) Reference Number 1559

HPC Borescope/Access Plug Installation Data
Table 801 (Continued)

(c) (Post SB PW4ENG 72-708) (AP-5 and AP-7): Install the plugs into the compressor case. Do not use Antiseize Paste P06-054 or Engine Oil P03-001. Run in the borescope plug to be sure the plug is
R seated before you apply torque by Table 801.

R (d) After you torque the borescope plug(s), use the
R PWA 105181 Mechanical Crimper to bend the tabs of
R the key washer as follows: See Figure 814.

R 1 Put the end of the crimper onto the end of the
R plug. Turn the crimper so the jaw is under a
R key washer tab.

R 2 Squeeze the crimper handle to bend the key
R washer tab until the tab makes contact with the
R hex head of the plug.

3 Release the handle and reposition the jaw so that it makes contact again at the base of the tab.

4 Squeeze the crimper handle to final bend the key washer tab until the tab makes contact with the hex head of the plug and maintains less than a 0.020 inch (0.508 mm) gap everywhere between the tab and the hex head of the plug.

5 Crimp all five (5) of the key washer tabs by the same method.

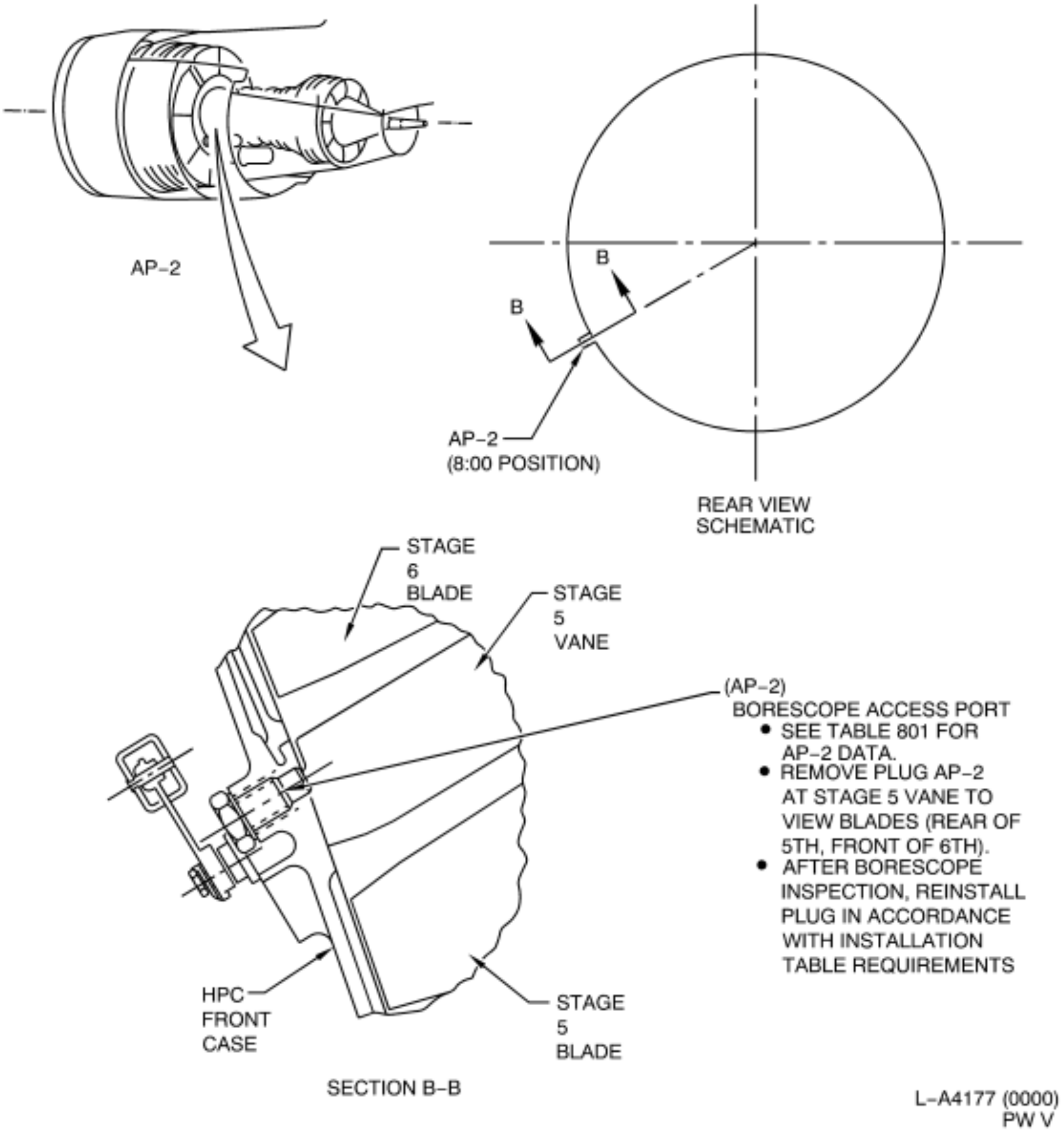
6 All tabs of the key washer must be bent, examine the tabs for the following conditions:

NOTE: Key washer PN 58H216 uses five tabs as an alternative to two. These additional tabs permit some deviation from the Standard Practices Manual, PN 585005 requirements but it is necessary that all five tabs meet these relaxed requirements. The variations to the Standard Practices Manual, PN 585005 procedure for this key washer are as follows:

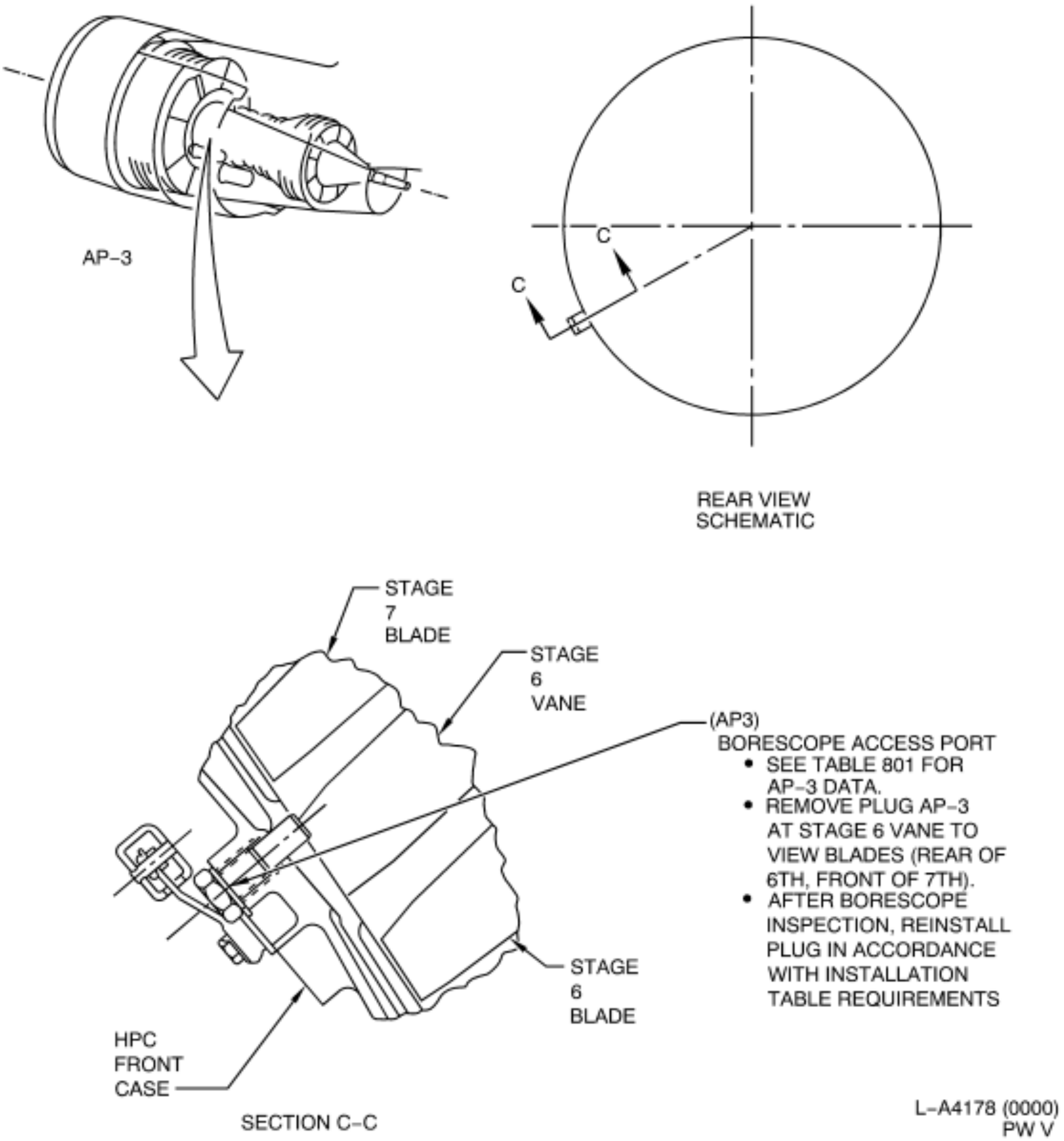
a All five tabs must be within 0.020 inch (0.508 mm) maximum of the hex head of the plug. If a tab overlaps two different faces of the hex head the 0.020 inch (0.508 mm) gap requirement must be kept between the tab and which ever face of the hex head has the larger surface area coverage with the tab. It is a good practice to bend the tab against the remaining face.

b It is not necessary that 75 percent of the base of the tab make contact with the hex head of the plug.

c It is not necessary that the key washer tabs be pulled away from the axis of the plug before you torque the plug. This requirement, as stated in the Standard Practices Manual, PN 585005 is meant for key washers that have fewer tabs.

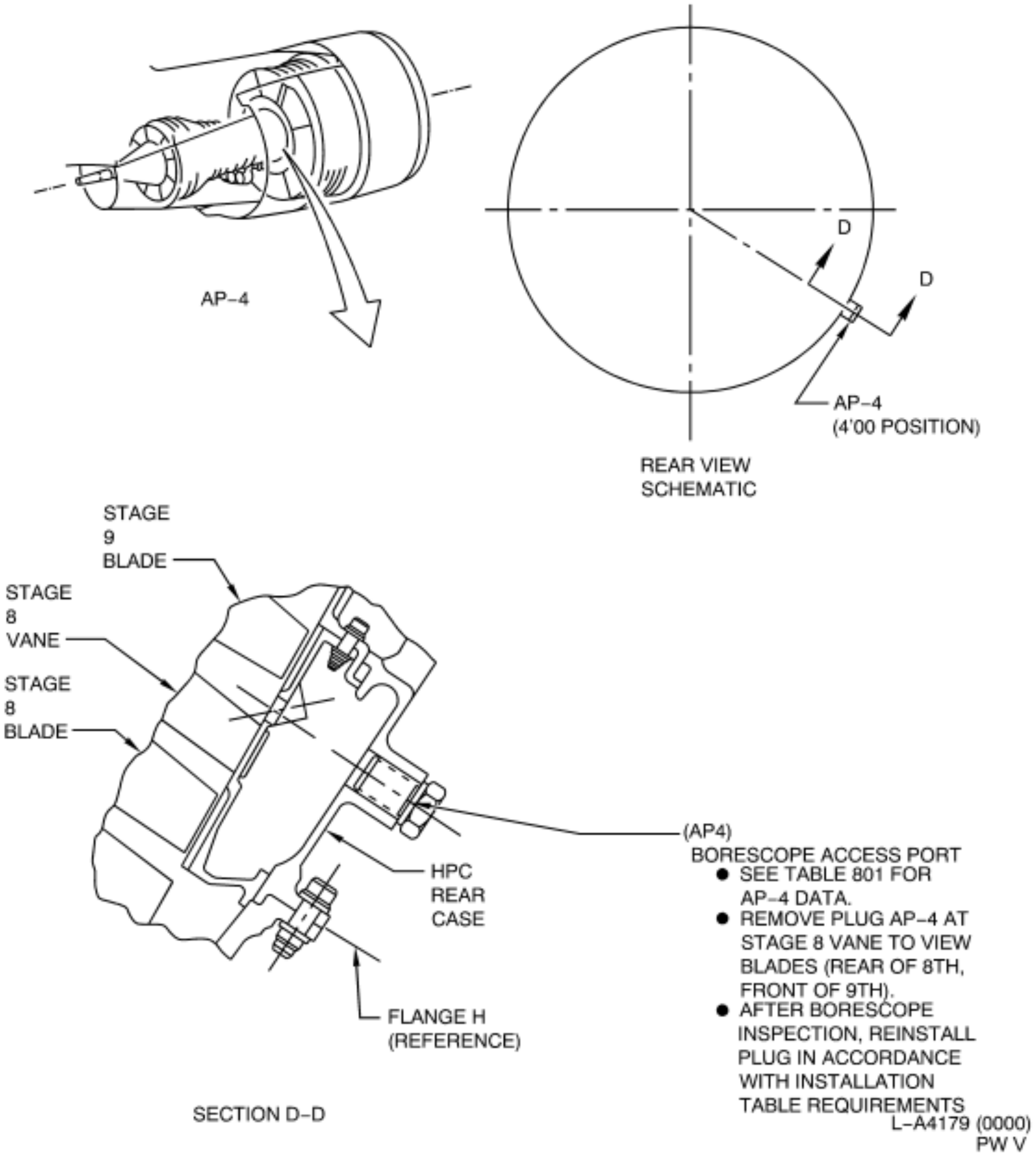

AP−2
B
B
AP−2
(8:00 POSITION)
REAR VIEW
SCHEMATIC
STAGE
6
BLADE
STAGE
5
VANE
(AP−2)
BORESCOPE ACCESS PORT
• SEE TABLE 801 FOR AP−2 DATA.
• REMOVE PLUG AP−2 AT STAGE 5 VANE TO VIEW BLADES (REAR OF 5TH, FRONT OF 6TH).
• AFTER BORESCOPE INSPECTION, REINSTALL PLUG IN ACCORDANCE WITH INSTALLATION TABLE REQUIREMENTS
HPC
FRONT
CASE
STAGE
5
BLADE
SECTION B−B
L−A4177 (0000)
PW V

HPC Borescope Access Port AP−2
Figure 801
(Task 72−00−00−210−004)

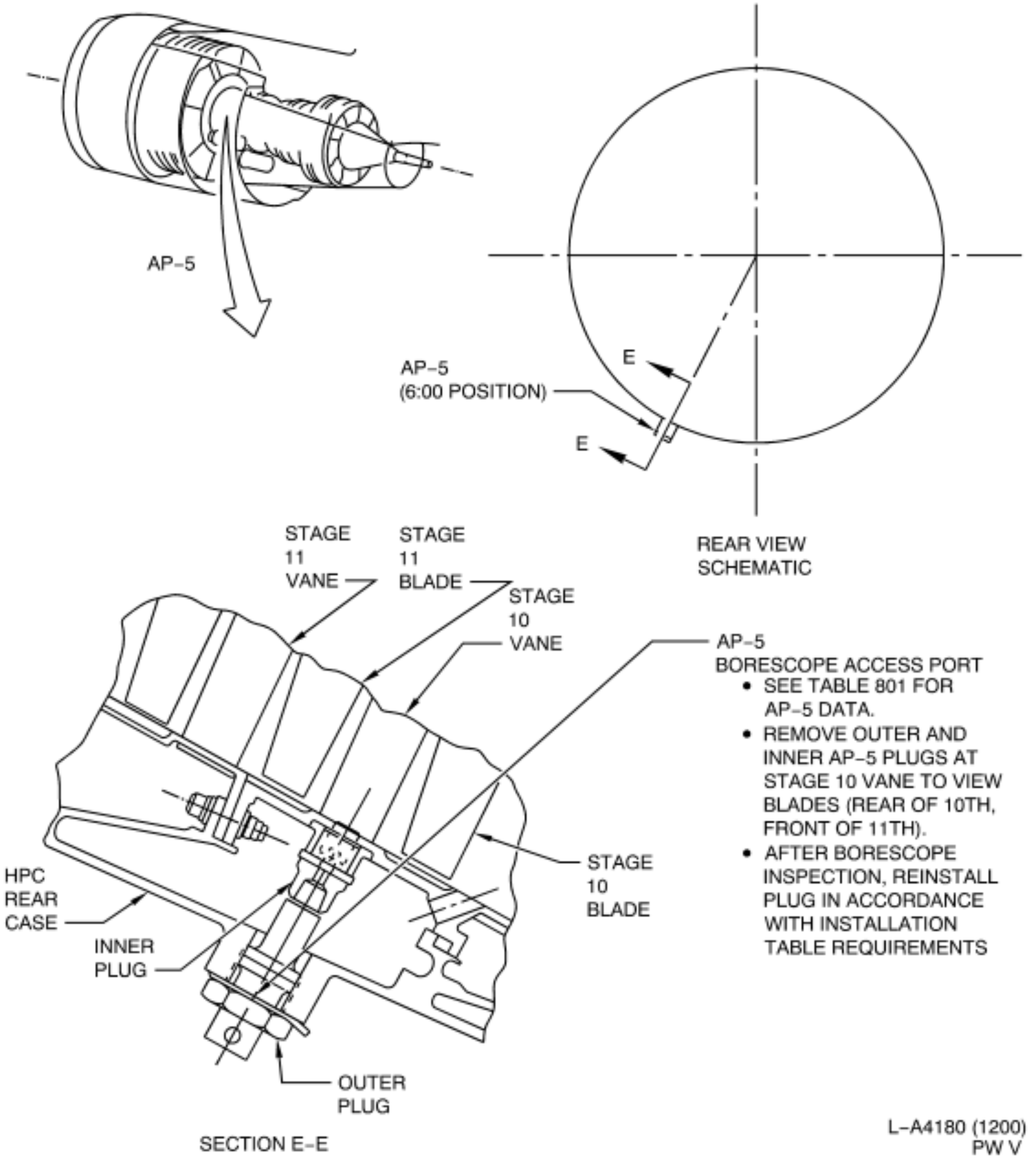

AP−3
C
C
REAR VIEW SCHEMATIC
STAGE 7 BLADE
STAGE 6 VANE
(AP3)
BORESCOPE ACCESS PORT
STAGE 6 BLADE
HPC FRONT CASE
SECTION C−C
L−A4178 (0000)
PW V

- SEE TABLE 801 FOR AP−3 DATA.
- REMOVE PLUG AP−3 AT STAGE 6 VANE TO VIEW BLADES (REAR OF 6TH, FRONT OF 7TH).
- AFTER BORESCOPE INSPECTION, REINSTALL PLUG IN ACCORDANCE WITH INSTALLATION TABLE REQUIREMENTS

HPC Borescope Access Port AP−3
Figure 802
(Task 72−00−00−210−004)

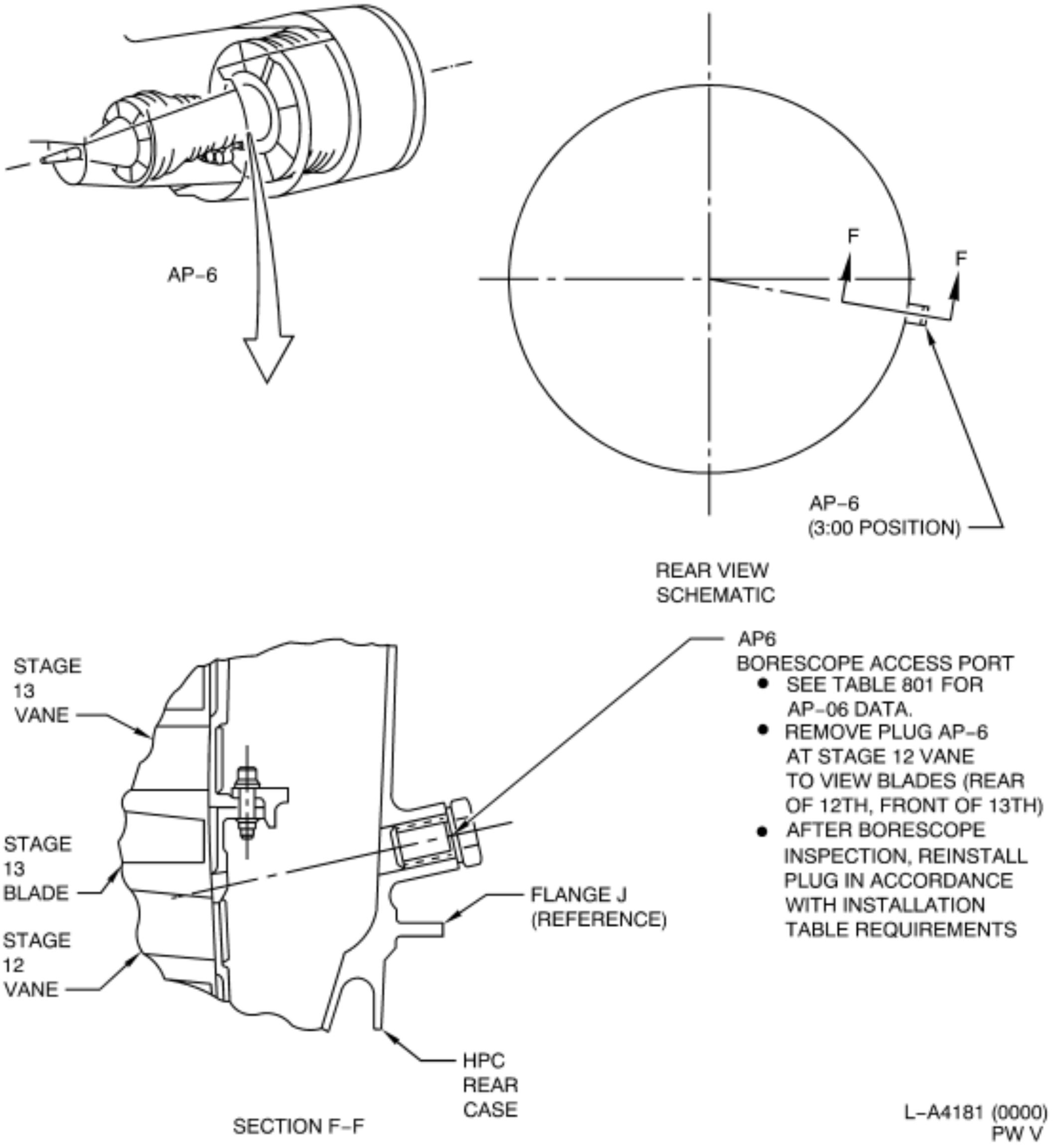

AP−4
D
D
AP−4
(4'00 POSITION)
REAR VIEW
SCHEMATIC
STAGE
9
BLADE
STAGE
8
VANE
STAGE
8
BLADE
(AP4)
BORESCOPE ACCESS PORT
● SEE TABLE 801 FOR AP−4 DATA.
● REMOVE PLUG AP−4 AT STAGE 8 VANE TO VIEW BLADES (REAR OF 8TH, FRONT OF 9TH).
● AFTER BORESCOPE INSPECTION, REINSTALL PLUG IN ACCORDANCE WITH INSTALLATION TABLE REQUIREMENTS
HPC
REAR
CASE
FLANGE H
(REFERENCE)
SECTION D−D
L−A4179 (0000)
PW V

HPC Borescope Access Port AP−4
Figure 803
(Task 72−00−00−210−004)


AP−5
AP−5
(6:00 POSITION)
E
E
REAR VIEW
SCHEMATIC
STAGE
11
VANE
STAGE
11
BLADE
STAGE
10
VANE
STAGE
10
BLADE
HPC
REAR
CASE
INNER
PLUG
OUTER
PLUG
SECTION E−E
L−A4180 (1200)
PW V

AP−5
BORESCOPE ACCESS PORT
- SEE TABLE 801 FOR AP−5 DATA.
- REMOVE OUTER AND INNER AP−5 PLUGS AT STAGE 10 VANE TO VIEW BLADES (REAR OF 10TH, FRONT OF 11TH).
- AFTER BORESCOPE INSPECTION, REINSTALL PLUG IN ACCORDANCE WITH INSTALLATION TABLE REQUIREMENTS

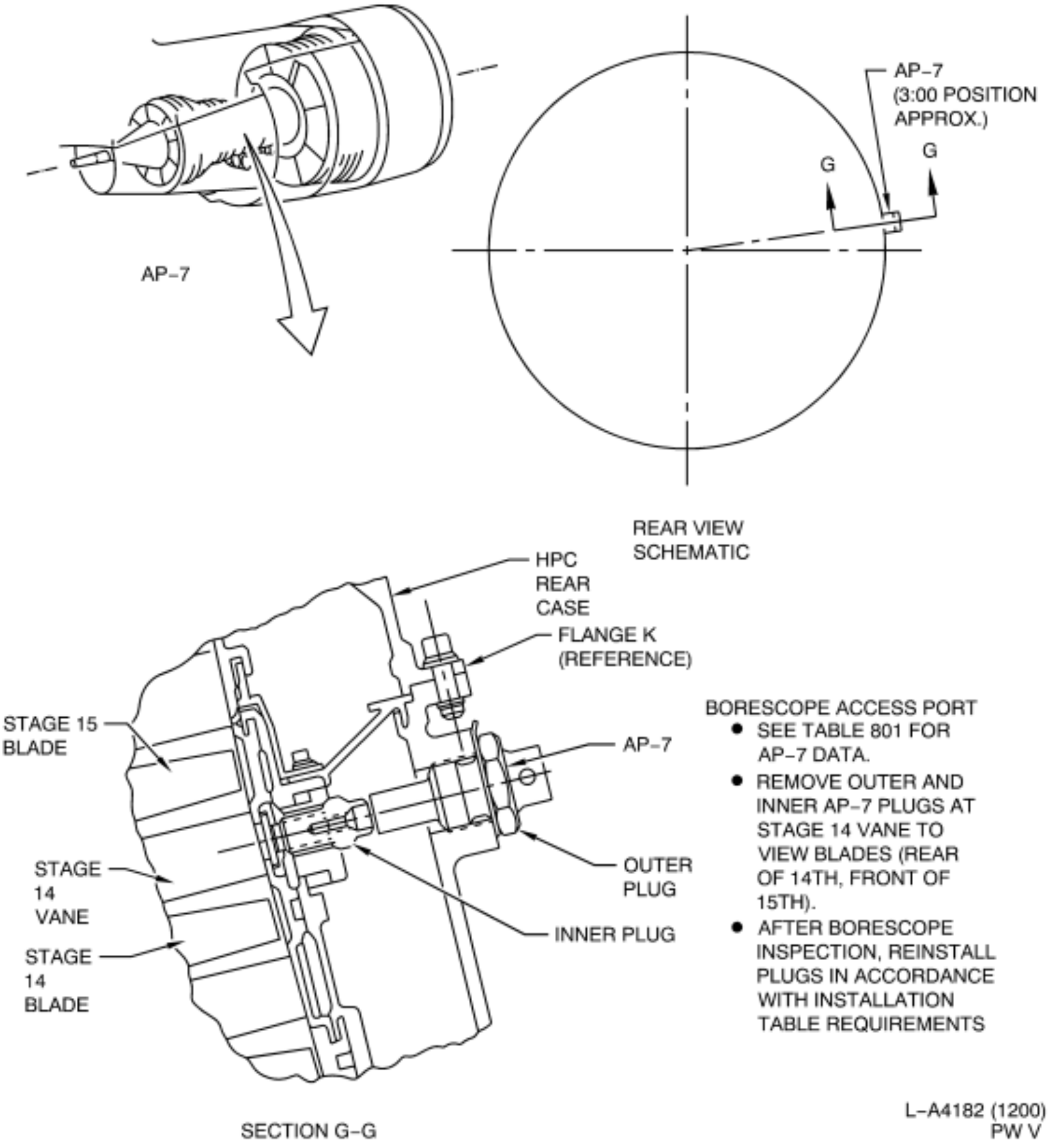
HPC Borescope Access Port AP−5
Figure 804
(Task 72−00−00−210−004)


AP-6
REAR VIEW SCHEMATIC
F
F
AP-6 (3:00 POSITION)
STAGE 13 VANE
STAGE 13 BLADE
STAGE 12 VANE
FLANGE J (REFERENCE)
HPC REAR CASE
SECTION F-F
L-A4181 (0000)
PW V

AP6
BORESCOPE ACCESS PORT

- SEE TABLE 801 FOR AP-06 DATA.
- REMOVE PLUG AP-6 AT STAGE 12 VANE TO VIEW BLADES (REAR OF 12TH, FRONT OF 13TH)
- AFTER BORESCOPE INSPECTION, REINSTALL PLUG IN ACCORDANCE WITH INSTALLATION TABLE REQUIREMENTS

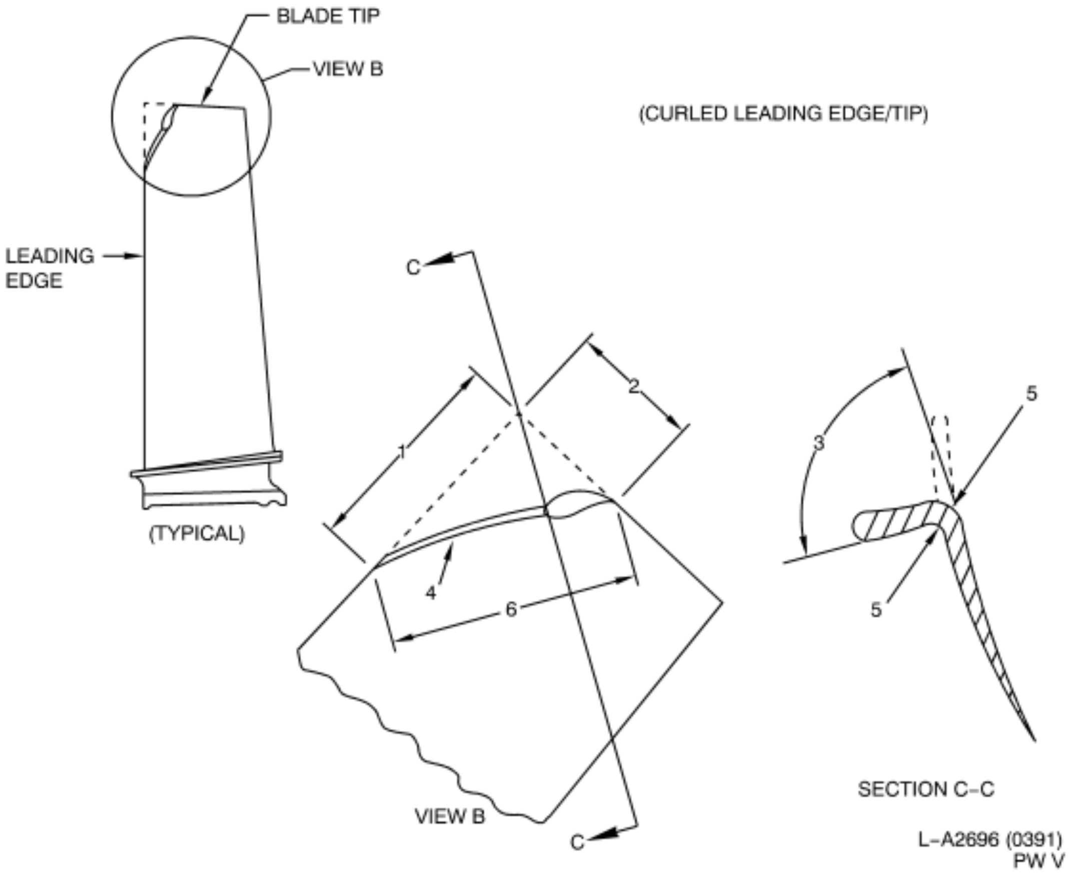
HPC Borescope Access Port AP−6
Figure 805
(Task 72−00−00−210−004)


AP−7
AP−7
(3:00 POSITION
APPROX.)
G
G
REAR VIEW
SCHEMATIC
HPC
REAR
CASE
FLANGE K
(REFERENCE)
STAGE 15
BLADE
AP−7
STAGE
14
VANE
OUTER
PLUG
INNER PLUG
STAGE
14
BLADE
SECTION G−G
L−A4182 (1200)
PW V

BORESCOPE ACCESS PORT

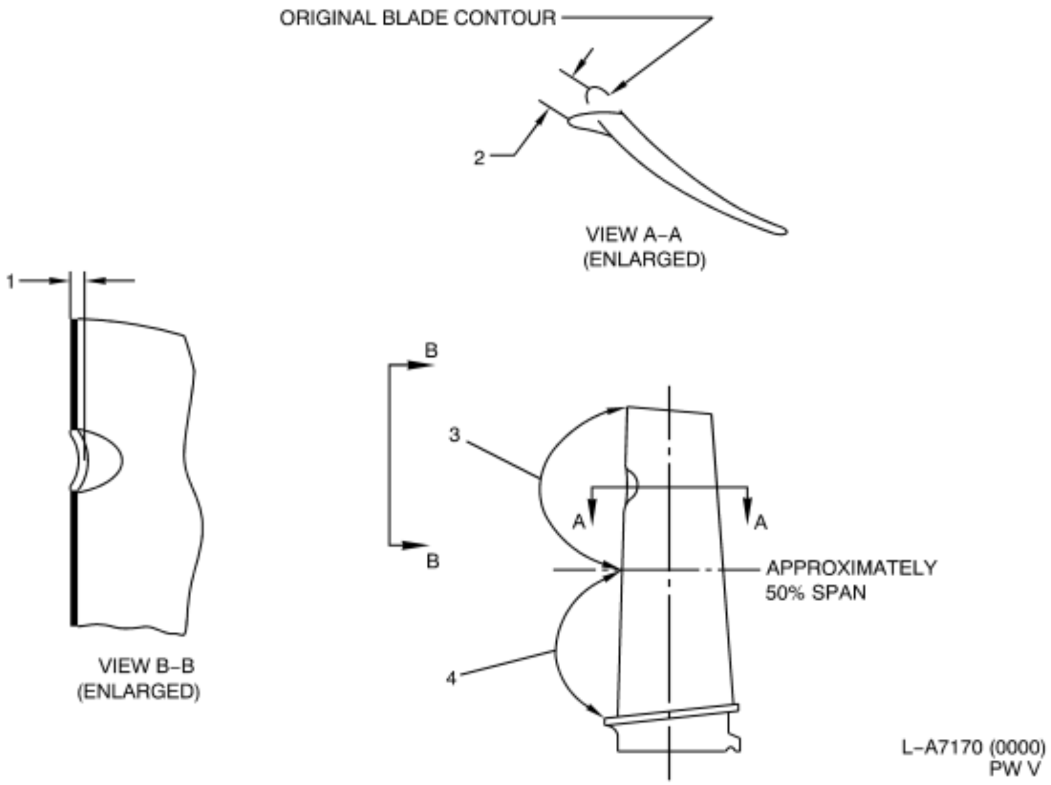
- SEE TABLE 801 FOR AP−7 DATA.
- REMOVE OUTER AND INNER AP−7 PLUGS AT STAGE 14 VANE TO VIEW BLADES (REAR OF 14TH, FRONT OF 15TH).
- AFTER BORESCOPE INSPECTION, REINSTALL PLUGS IN ACCORDANCE WITH INSTALLATION TABLE REQUIREMENTS

HPC Borescope Access Port AP−7
Figure 806
(Task 72−00−00−210−004)


BLADE TIP
VIEW B
(CURLED LEADING EDGE/TIP)
LEADING EDGE
(TYPICAL)
C
1
2
3
4
5
5
6
VIEW B
C
SECTION C−C
L−A2696 (0391)
PW V

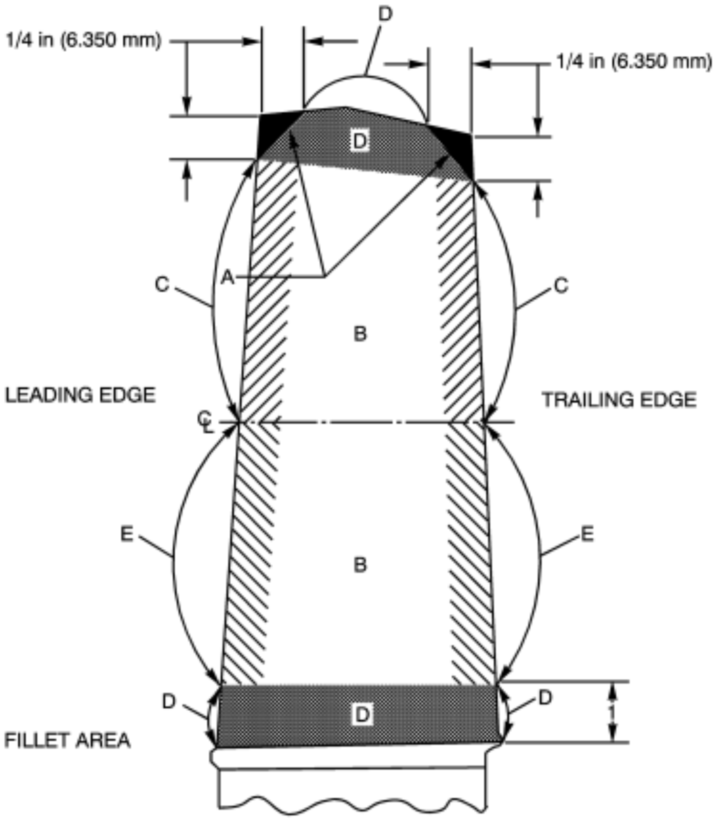
1. 0.500 Inch (12.700 mm) Maximum, Stages 5 Through 7
2. 0.250 Inch (6.350 mm) Maximum, Stages 5 Through 7
3. 90° Maximum
4. Leading Edge Should Be Continuous And Smooth.
5. No Dents, Gouges, Cracks Or Scratches Permitted On Bend Radii For Length Of Bend (Index 6).
6. Length Of Bend

HPC Stages 5 Through 7 Blade Leading Edge/Tip − Curl Limits
Figure 807 (Sheet 1)
(Task 72−00−00−210−004)


ORIGINAL BLADE CONTOUR
2
VIEW A−A
(ENLARGED)
1
B
3
A
A
B
APPROXIMATELY
50% SPAN
4
VIEW B−B
(ENLARGED)
L−A7170 (0000)
PW V

1. Stage 5 Blades 0.045 Inch (1.143 mm) Maximum
   Stages 6 And 7 Blades 0.030 Inch (0.762 mm) Maximum
2. Maximum Deviation In Any Direction From Original Blade Contour
   Stage 5 Blades 0.045 Inch (1.143 mm) Maximum
   Stages 6 And 7 Blades 0.030 Inch (0.762 mm) Maximum
3. Bending Is Permitted As Shown
4. No Bending Is Permitted

HPC Stages 5 Through 7 Blade Leading Edge Bend Limits
Figure 807 (Sheet 2)
(Task 72−00−00−210−004)


1/4 in (6.350 mm)
D
1/4 in (6.350 mm)
D
A
C
C
B
LEADING EDGE
TRAILING EDGE
℄
E
E
B
D
D
D
FILLET AREA

L−D2086 (0105)
PW V

Compressor Blade Damage Limits
(Continue−In−Service Limits) (Stages 5 Through 15)
Figure 808
(Task 72−00−00−210−004)

	Area A	Area B (Airfoil Only)	Area C Depth Inch (mm)	Area E Depth Inch (mm)	Area D	Index 1 Inch (mm)
Stage 5	See The Limits Below.	See The Limits Below.	1/32 (0.794)	1/64 (0.397)	None Allowed	1/2 (12.700)
Stage 6 Thru. 8	See The Limits Below.	See The Limits Below.	1/32 (0.794)	1/64 (0.397)	See The Limits Below.	1/2 (12.700)
Stage 9 Thru. 12	See The Limits Below.	See The Limits Below.	1/32 (0.794)	1/32 (0.794)	See The Limits Below.	1/2 (12.700)
Stage 13 Thru. 15	See The Limits Below.	See The Limits Below.	1/32 (0.794)	1/32 (0.794)	See The Limits Below.	0.38 (9.652)

Blade Area	Service Limits	Notes
A	1/4 Inch (6.350 mm) Corner Broken-off Completely Is Acceptable. Curled, Deformed Or Impact Damaged Material Is Acceptable In This Area.	Nicks And Dents Near Leading Edge And Trailing Edge Corners Are NOT Critical.
B	Indentations Contained In This Area Are Acceptable. Raised Spots On Opposite Side Of Foil Are Acceptable If No Cracks Are Present.	Raised Spots On Opposite Side Of Airfoil Are Result Of Indentations.
C	Damage 1/32 Inch (0.794 mm) Deep. Separated By At Least 1/4 Inch (6.350 mm) Radially Is Acceptable.	Nicks In Leading Edge And Trailing Edge Become Critical Closer To Blade Root. Damage With Small Radii Or Ragged Edges Are Especially Critical.

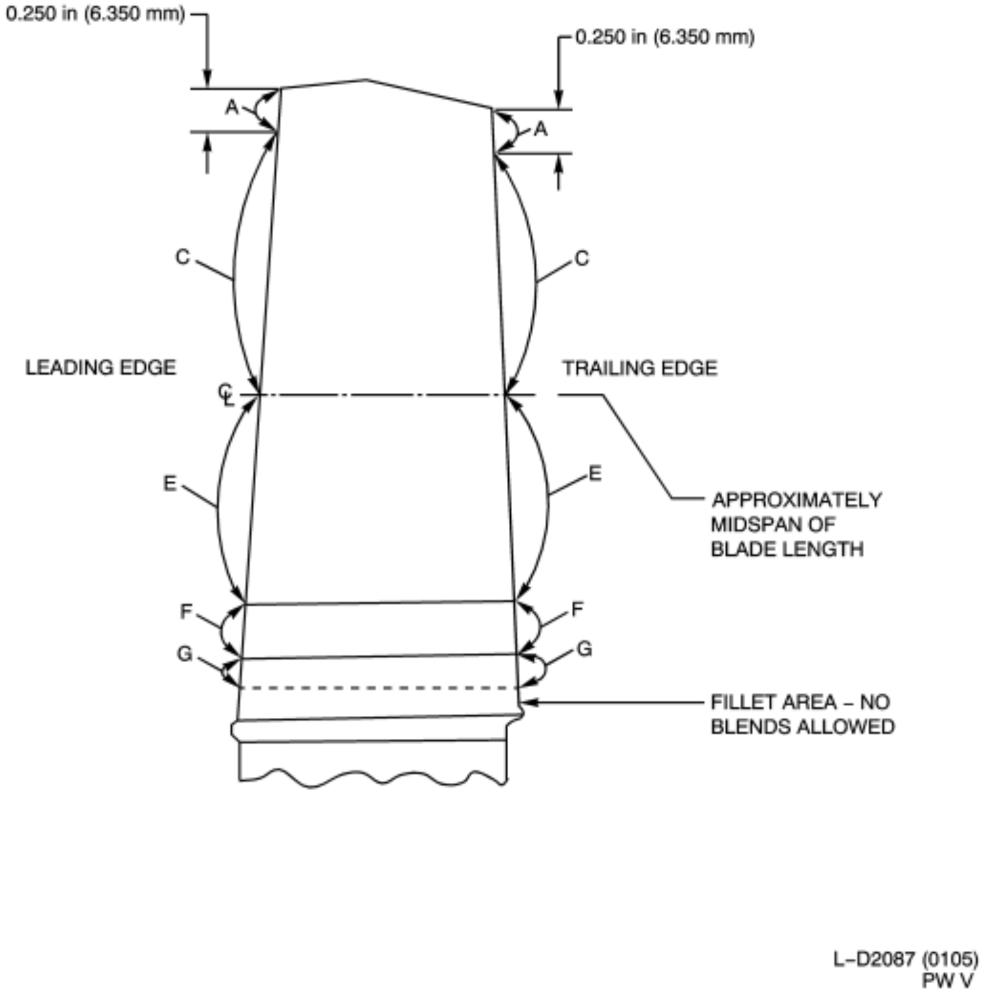
Key To Figure 808

Blade Area	Service Limits	Notes
D	Stage 5 No Damage Permitted Except Small Surface Imperfections Caused By Erosion Are Permitted.	The Erosion Imperfections Will Look Larger Because Of The Borescope Magnification.
D	Stages 6 through 8 No Damage Permitted Except Small Surface Imperfections Caused By Erosion Or Smooth Round Bottomed Indentations. A Maximum Of 0.006 Inch (0.152 mm) Depth Imperfec-ions Is Permitted Outside Fillet And A Maximum of 0.003 Inch (0.076 mm) Depth Imperfections Permitted In Fillet Provided There Is No Raised Material, No Sharp Discontinuities, And No Multiple Overlapping Indentations. No Cracks Permitted.	The Imperfections Will Look Larger Because Of The Borescope Magnification.
D	Stages 9 through 15 No Damage Permitted Except Small Surface Imperfections Caused By Erosion Or Smooth Round Bottomed Indentations. A Maximum Of 0.006 Inch (0.152 mm) Depth Imperfec-ions Is Permitted Outside Fillet And A Maximum of 0.003 Inch (0.076 mm) Depth Imperfections Permitted In Fillet Provided There Is No Raised Material, No Sharp Discontinuities, And No Multiple Overlapping Indentations. No Cracks Permitted.	The Imperfections Will Look Larger Because Of The Borescope Magnification.

Key To Figure 808 (Continued)

Blade Area	Service Limits	Notes
D	Stages 9 through 15 Signs Of Overheating (Blueing) Are Permitted On The Tip Of The Airfoil But Cannot Extend Down Onto The Concave Or Convex Surfaces Of The Airfoil.	
E	Stages 5 through 8 Damage 1/64 Inch (0.397 mm) Deep Separated By At Least 1/4 Inch (6.350 mm) Radially Is Acceptable.	Nicks In Leading Edge And Trailing Edge Become Critical Closer To Blade Root. Damage With Small Radii Or Ragged Edges Are Especially Critical.
E	Stages 9 through 15 Damage 1/32 Inch (0.794 mm) Deep Separated By At Least 1/4 Inch (6.350 mm) Radially Is Acceptable.	Nicks In Leading Edge And Trailing Edge Become Critical Closer To Blade Root. Damage With Small Radii Or Ragged Edges Are Especially Critical.

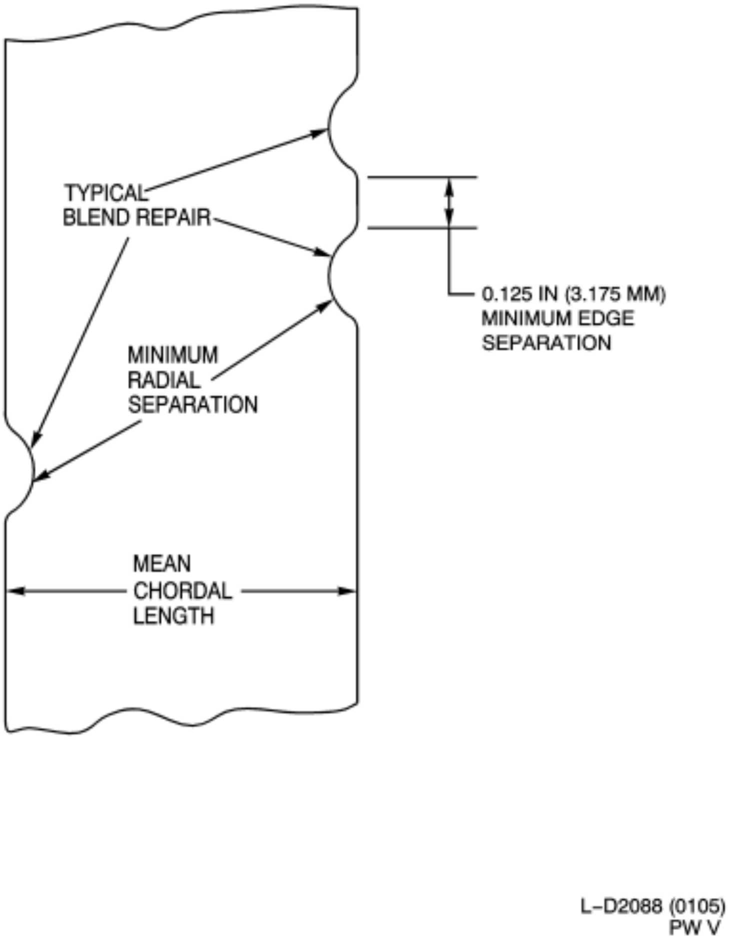
Key To Figure 808 (Continued)


0.250 in (6.350 mm)
0.250 in (6.350 mm)
A
A
C
C
LEADING EDGE
TRAILING EDGE
℄
E
E
APPROXIMATELY MIDSPAN OF BLADE LENGTH
F
F
G
G
FILLET AREA – NO BLENDS ALLOWED
L−D2087 (0105)
PW V

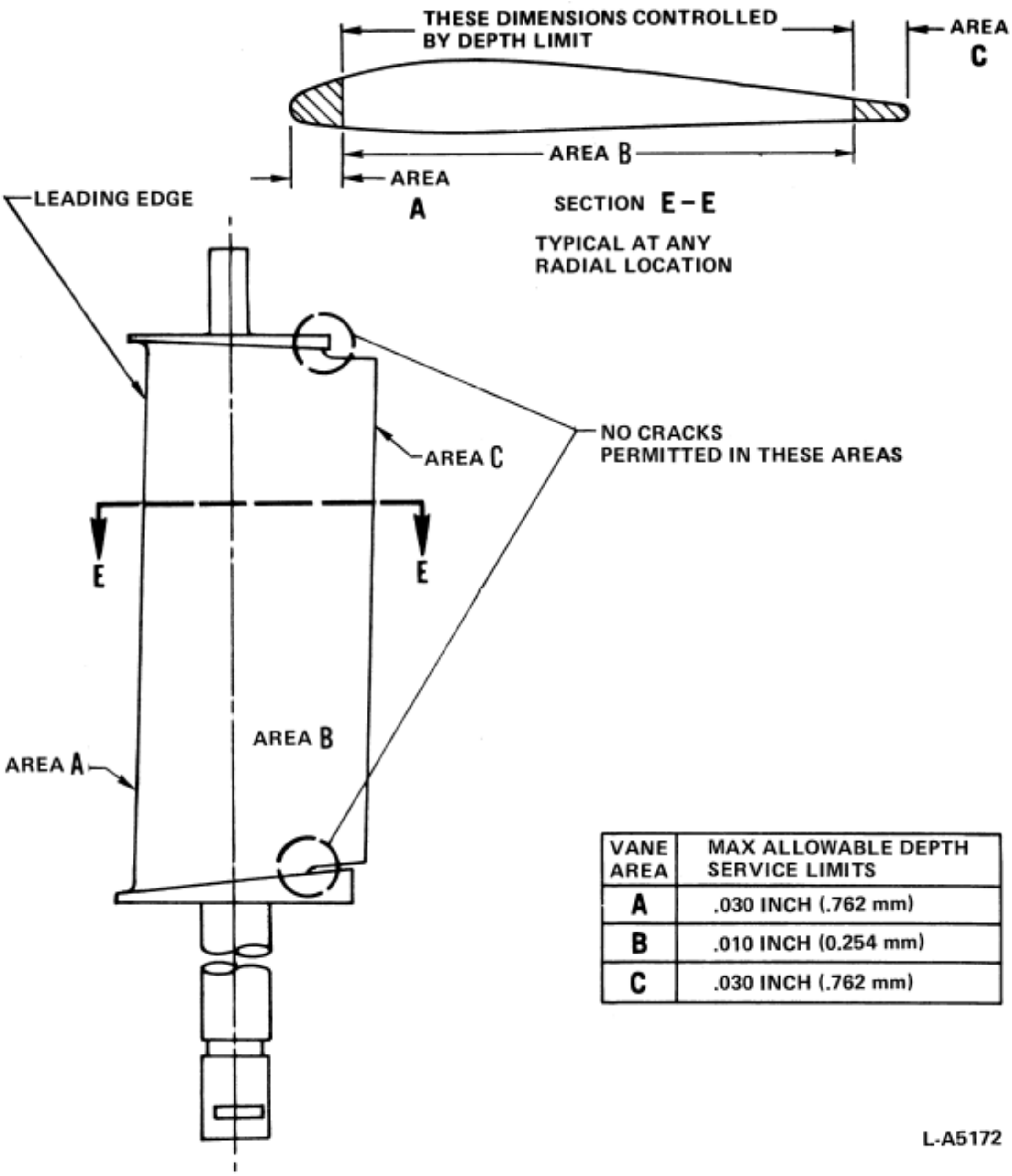
Compressor Blade In−situ Repair Limits
Figure 809
(Task 72−00−00−210−004)

	Area C Midspan to 0.250 In. (6.350 mm) From Tip (Max. Depth)	Area E 0.250 In. (6.350 mm) Above Root Platform To Midspan (Max. Depth)	Area F 0.190 - 0.250 Inch (4.83 - 6.35 mm) Above Root Platform (Max. Depth)	Area G 0.150 - 0.190 Inch (3.81 - 4.83 mm) Above Root Platform (Max Depth)
Stage 5	0.144 Inch (3.66 mm)	None	None	None
Stages 6 and 7	0.144 Inch (3.66 mm)	0.048 Inch (1.22 mm)	0.023 Inch (0.58 mm)	0.007 Inch (0.18 mm)
Stage 8	0.082 Inch (2.08 mm)	0.048 Inch (1.22 mm)	0.023 Inch (0.58 mm)	0.007 Inch (0.18 mm)
Stage 9 Leading Edge Only	0.082 Inch (2.08 mm)	0.048 Inch (1.22 mm)	0.023 Inch (0.58 mm)	0.007 Inch (0.18 mm)
Stage 10 Trailing Edge Only	0.082 Inch (2.08 mm)	0.048 Inch (1.22 mm)	0.023 Inch (0.58 mm)	0.007 Inch (0.18 mm)
Stage 11 Leading Edge Only	0.082 Inch (2.08 mm)	0.048 Inch (1.22 mm)	0.023 Inch (0.58 mm)	0.007 Inch (0.18 mm)
Stage 12 Trailing Edge Only	0.082 Inch (2.08 mm)	0.048 Inch (1.22 mm)	0.023 Inch (0.58 mm)	0.007 Inch (0.18 mm)
Stages 13 And 14	0.082 Inch (2.08 mm)	0.048 Inch (1.22 mm)	0.023 Inch (0.58 mm)	0.007 Inch (0.18 mm)
Stage 15 Leading Edge Only	0.082 Inch (2.08 mm)	0.048 Inch (1.22 mm)	0.023 Inch (0.58 mm)	0.007 Inch (0.18 mm)

Key to Figure 809


TYPICAL
BLEND REPAIR
0.125 IN (3.175 MM)
MINIMUM EDGE
SEPARATION
MINIMUM
RADIAL
SEPARATION
MEAN
CHORDAL
LENGTH
L−D2088 (0105)
PW V

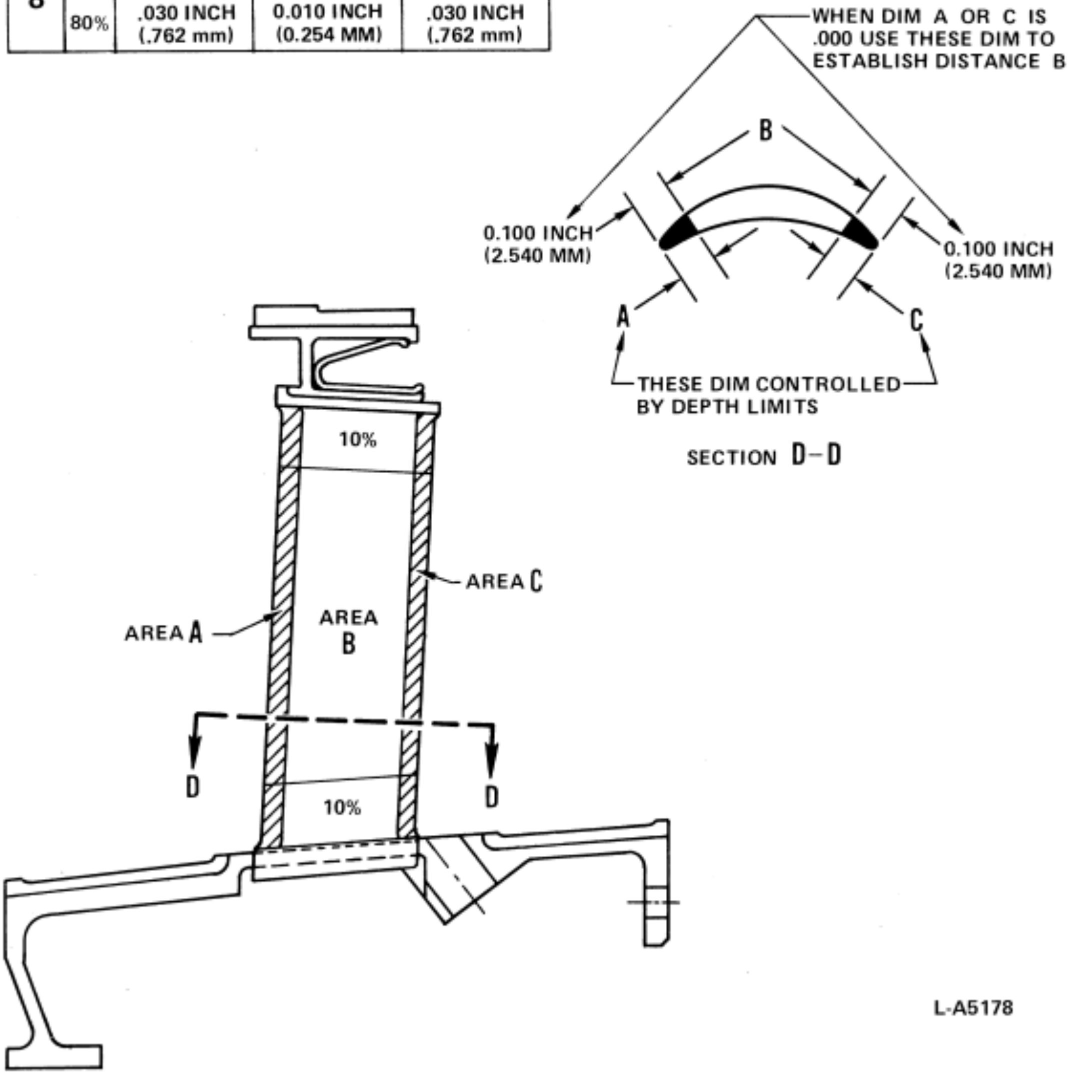
Compressor Blade − Blend Separation Limits (Stages 5 Through 15)
Figure 810
(Task 72−00−00−210−004)


THESE DIMENSIONS CONTROLLED BY DEPTH LIMIT
AREA C
AREA B
AREA A
LEADING EDGE
SECTION E−E
TYPICAL AT ANY RADIAL LOCATION
NO CRACKS PERMITTED IN THESE AREAS
AREA C
E
E
AREA B
AREA A
L-A5172

VANE AREA	MAX ALLOWABLE DEPTH SERVICE LIMITS
A	.030 INCH (.762 mm)
B	.010 INCH (0.254 mm)
C	.030 INCH (.762 mm)

HPC Vane Nick Limits (Stages IGV through −7)
Figure 811
(Task 72−00−00−210−004)

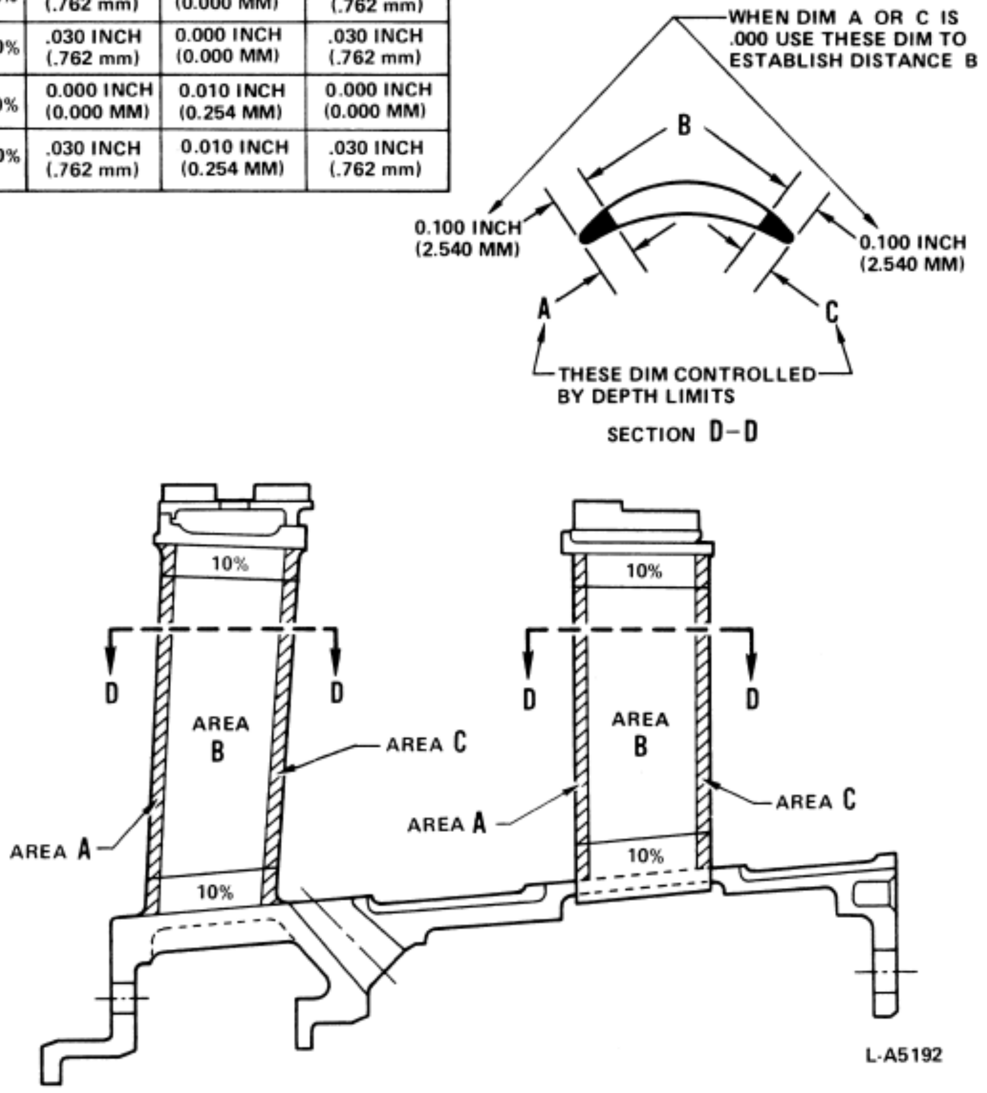
VANE AREA		MAX DEPTH SERVICE LIMIT		
		A	B	C
8	10%	0.000 INCH (0.000 MM)	0.010 INCH (0.254 MM)	0.000 INCH (0.000 MM)
	80%	.030 INCH (.762 mm)	0.010 INCH (0.254 MM)	.030 INCH (.762 mm)


WHEN DIM A OR C IS .000 USE THESE DIM TO ESTABLISH DISTANCE B
B
0.100 INCH (2.540 MM)
0.100 INCH (2.540 MM)
A
C
THESE DIM CONTROLLED BY DEPTH LIMITS
SECTION D-D
10%
AREA C
AREA A
AREA B
D
D
10%

L-A5178

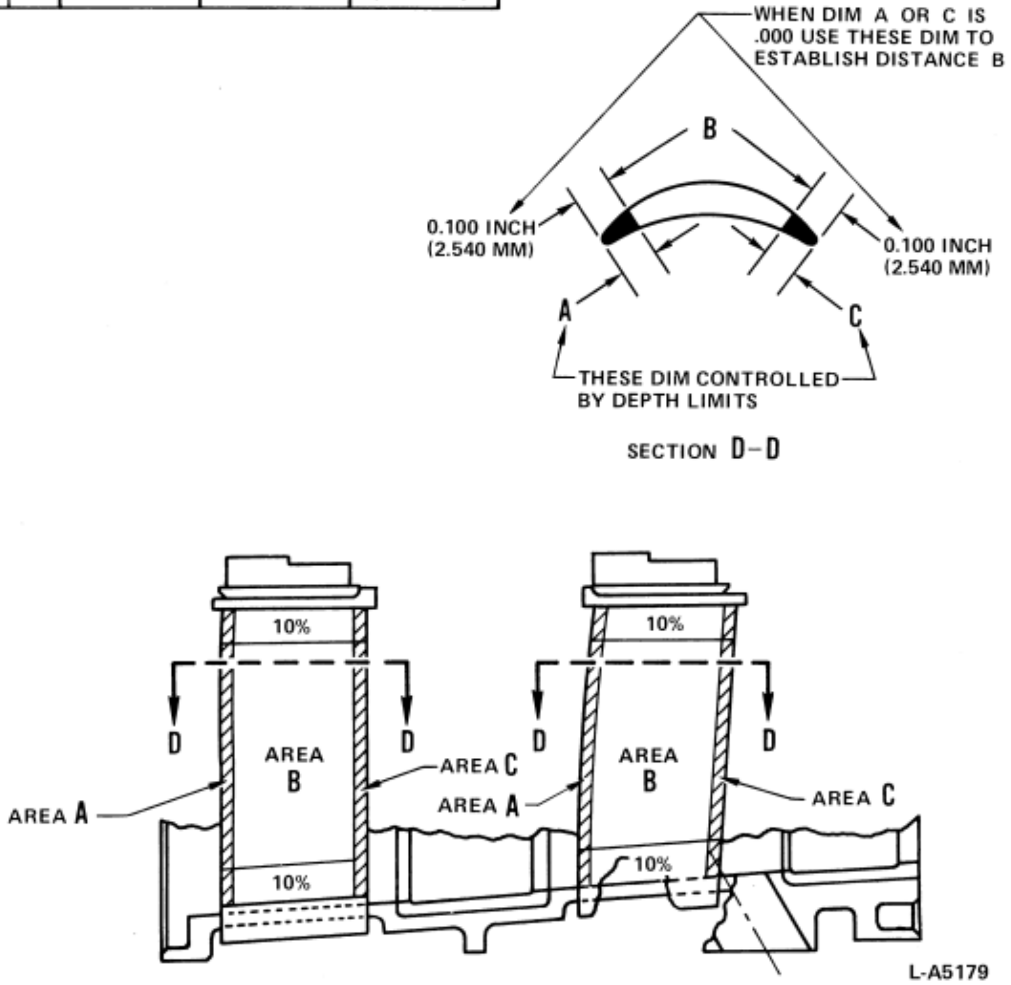
HPC Vane Nick Limits (Stages 8)
Figure 812 (Sheet 1)
(Task 72-00-00-210-004)

VANE AREA		MAX DEPTH SERVICE LIMIT		
		A	B	C
9	10%	.030 INCH (.762 mm)	0.000 INCH (0.000 MM)	.030 INCH (.762 mm)
	80%	.030 INCH (.762 mm)	0.000 INCH (0.000 MM)	.030 INCH (.762 mm)
10	10%	0.000 INCH (0.000 MM)	0.010 INCH (0.254 MM)	0.000 INCH (0.000 MM)
	80%	.030 INCH (.762 mm)	0.010 INCH (0.254 MM)	.030 INCH (.762 mm)


WHEN DIM A OR C IS .000 USE THESE DIM TO ESTABLISH DISTANCE B
B
0.100 INCH (2.540 MM)
0.100 INCH (2.540 MM)
A
C
THESE DIM CONTROLLED BY DEPTH LIMITS
SECTION D−D
10%
D
D
AREA B
AREA C
AREA A
10%
10%
D
D
AREA B
AREA C
AREA A
10%
L-A5192

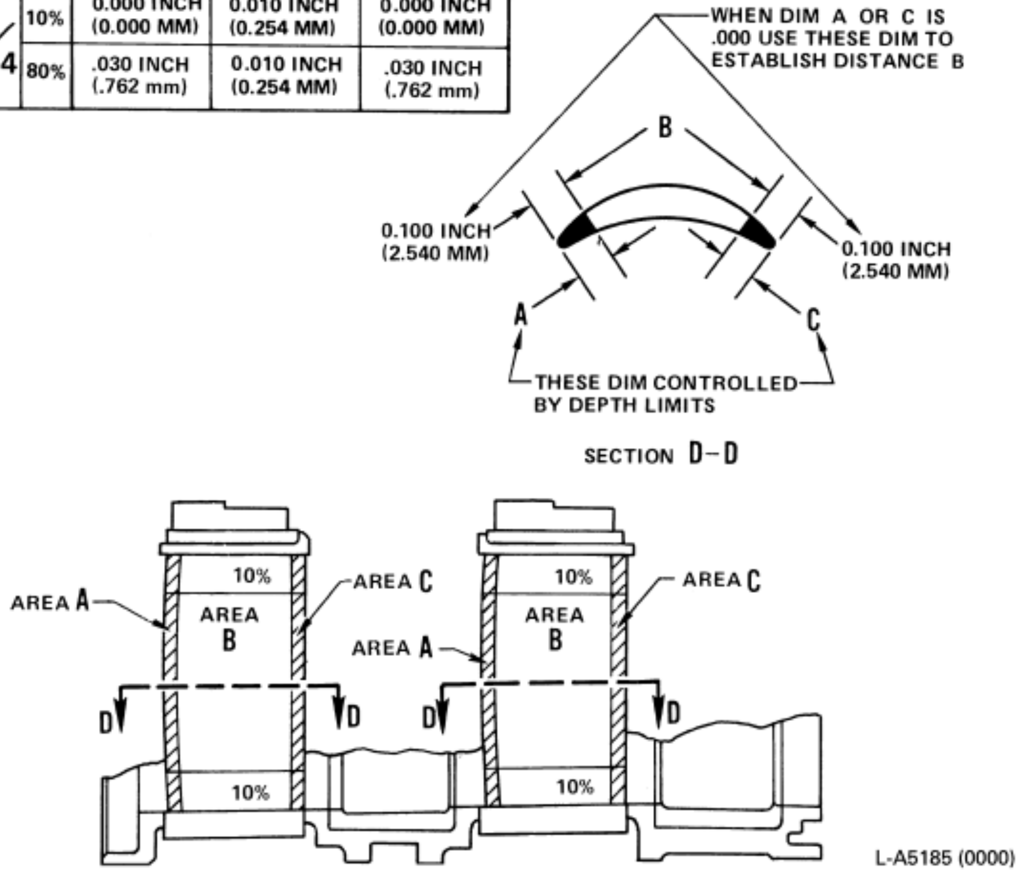
HPC Vane Nick Limits (Stages 9 And 10)
Figure 812 (Sheet 2)
(Task 72−00−00−210−004)

VANE AREA		MAX DEPTH SERVICE LIMIT		
		A	B	C
11/12	10%	0.000 INCH (0.000 MM)	0.010 INCH (0.254 MM)	0.000 INCH (0.000 MM)
	80%	.030 INCH (.762 mm)	0.010 INCH (0.254 MM)	.030 INCH (.762 mm)

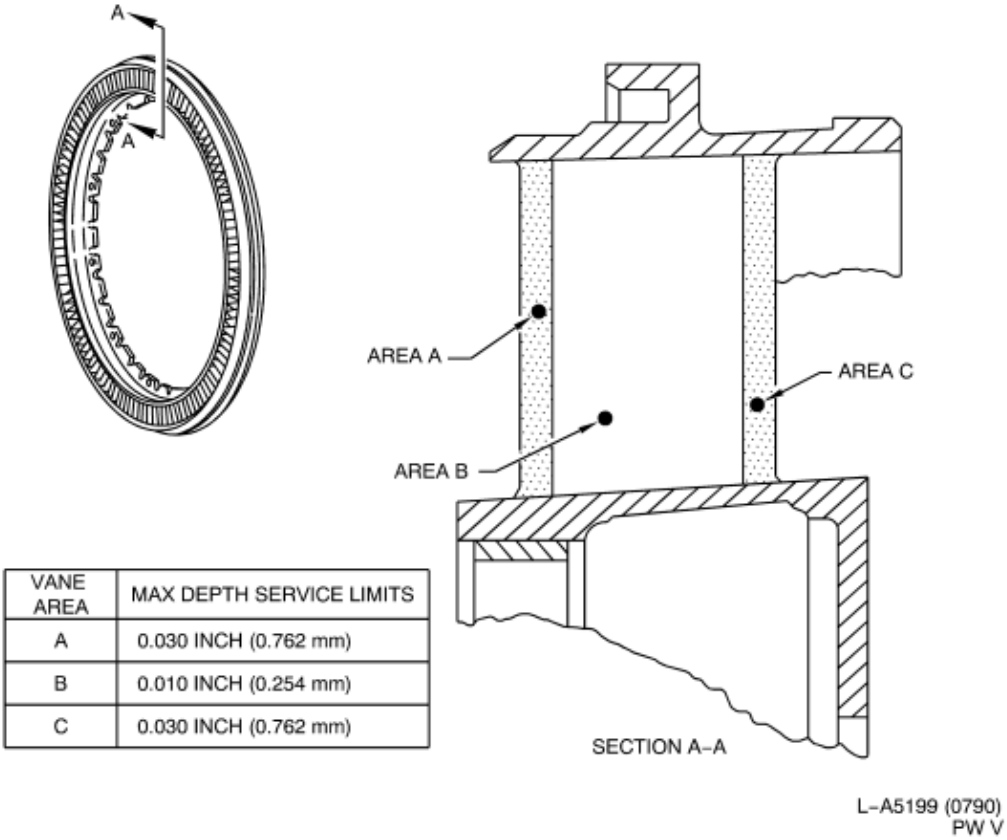

WHEN DIM A OR C IS .000 USE THESE DIM TO ESTABLISH DISTANCE B
B
0.100 INCH (2.540 MM)
0.100 INCH (2.540 MM)
A
C
THESE DIM CONTROLLED BY DEPTH LIMITS
SECTION D−D
10%
10%
D
D
D
D
AREA B
AREA B
AREA A
AREA C
AREA A
AREA C
10%
10%
L-A5179

HPC Vane Nick Limits (Stages 11 And 12)
Figure 812 (Sheet 3)
(Task 72−00−00−210−004)

VANE AREA		MAX DEPTH SERVICE LIMIT		
		A	B	C
13/14	10%	0.000 INCH (0.000 MM)	0.010 INCH (0.254 MM)	0.000 INCH (0.000 MM)
	80%	.030 INCH (.762 mm)	0.010 INCH (0.254 MM)	.030 INCH (.762 mm)

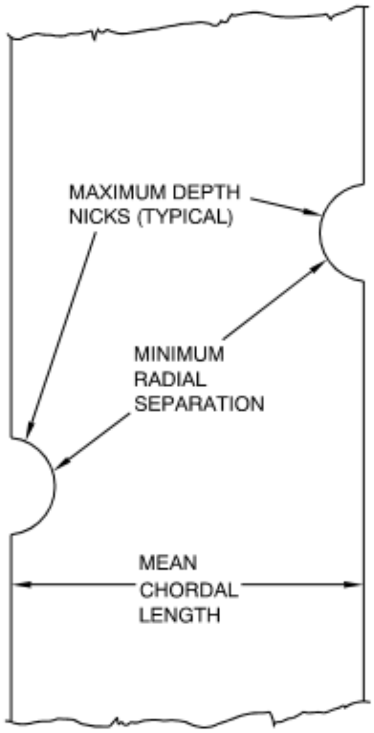

WHEN DIM A OR C IS .000 USE THESE DIM TO ESTABLISH DISTANCE B
B
0.100 INCH (2.540 MM)
0.100 INCH (2.540 MM)
A
C
THESE DIM CONTROLLED BY DEPTH LIMITS
SECTION D-D
AREA A
10%
AREA B
AREA C
AREA A
10%
AREA B
AREA C
D
D
D
D
10%
10%
L-A5185 (0000)

HPC Vane Nick Limits (Stages 13 And 14)
Figure 812 (Sheet 4)
(Task 72-00-00-210-004)


A
A
AREA A
AREA B
AREA C
SECTION A−A
L−A5199 (0790)
PW V

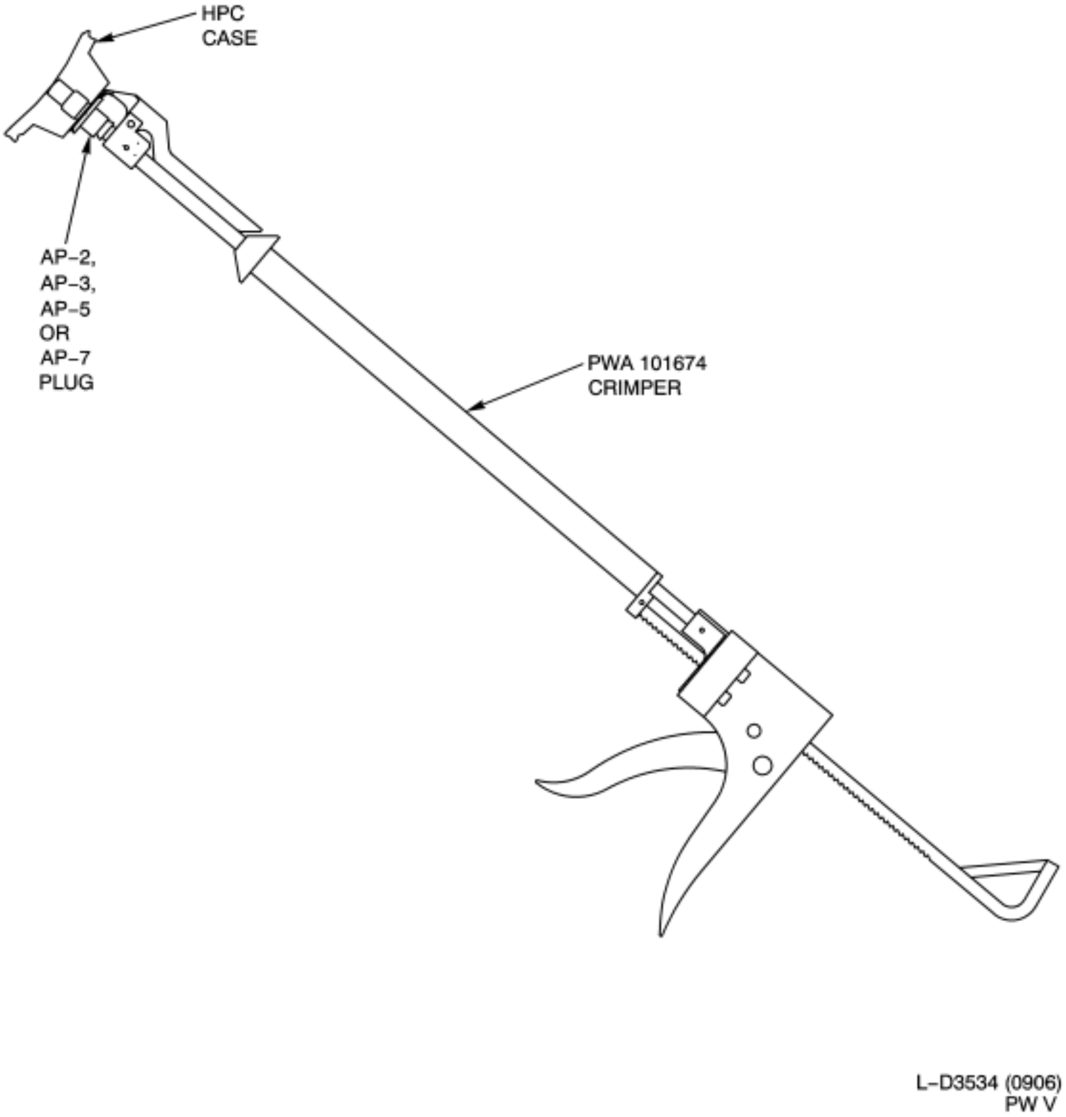
VANE AREA	MAX DEPTH SERVICE LIMITS
A	0.030 INCH (0.762 mm)
B	0.010 INCH (0.254 mm)
C	0.030 INCH (0.762 mm)

HPC Vane Nick Limits (Stage 15 Exit Stator)
Figure 812 (Sheet 5)
(Task 72−00−00−210−004)


MAXIMUM DEPTH NICKS (TYPICAL)
MINIMUM RADIAL SEPARATION
MEAN CHORDAL LENGTH

L−A1135
PW V

Compressor Vanes Proximity Of Nicks
Between Leading And Trailing Edges
Figure 813
(Task 72−00−00−210−004)


HPC CASE
AP−2, AP−3, AP−5 OR AP−7 PLUG
PWA 101674 CRIMPER
L−D3534 (0906)
PW V

R PWA 101674 Crimper Mechanical (AP−2, AP−3, AP−5 Or AP−7 Plugs)
R Figure 814
R (Task 72−00−00−210−004)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-00-210-020:

1. Perform Borescope Inspection Of Combustion Chamber Area (AP-8, AP-9)

A. Equipment And Materials Necessary

Standard Tools:
See Inspection/Check-01A for borescope equipment.

Consumable Materials:

Item No.	Designation
P06-023	Silver Goop (PWA 36001)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	6	72-41-00/1/130 Pre SB PW4ENG 72-567
Or		
Gasket	6	72-41-00/1/130A Post SB PW4ENG 72-567
Safety Cable And	AR	72-41-00/1/141
Ferrule Or Lockwire	AR	72-41-00/1/142

B. General
See Figure 801, Figure 802, Figure 803, Figure 804, Figure 805, Figure 806, Figure 807, Figure 808 and Figure 809.

(1) To ensure consistency and to eliminate confusion in reports or inspection standards, use nomenclature for various components of the inner and outer combustion chamber assembly as shown in Figure 801, Figure 802, Figure 803, and Figure 805.

(2) As an aid to documenting and maintaining inspection records, Figure 807, Figure 808 and Figure 809 are included. Copies may be made and used for documenting inner and outer combustion chamber assembly distress for ready reference and communications.

C. Definitions Of Terms

(1) Following terms are used in describing inner and outer combustion chamber assembly borescope distress and related limits.

(a) Burned or missing material - an area in which a louver is discolored, distorted, or louver lip material is missing as a result of burning.

(b) Burn streak - an axial series of louvers exhibiting burning and missing material.

(c) Hole - an area in which complete penetration of combustion chamber wall has resulted from material being burned away. Holes normally appear in burn streak.

(d) See Figure 804, Figure 805, and Figure 806 for definition of terms axial, radial, and circumferential for inner and outer combustion chamber assemblies.

D. Inner And Outer Combustion Chamber Assembly Limits

(1) Borescope inspection limits are presented in tabular form, including all items for distress interpretation.

(2) Distress limits in the following Table 801 are based upon considerations of inner and outer combustion chamber assembly durability and component integrity only. If inner and outer chamber assemblies are allowed to distress to absolute maximum levels of reduced inspection intervals, part reparability could be affected. This data consists of deterioration and damage limits as follows:

(a) The inner and/or outer combustion chamber assembly is acceptable for continued service but with regular borescope inspection interval.

(b) The inner and/or outer combustion chamber assembly is acceptable for continued service but with a reduced borescope inspection interval. Chambers which have reached a level of distress exceeding regular inspection intervallimits may be continued in service by employing this reduced inspection interval, until distress level reaches one or more of conditions listed under this category.

(c) The inner and/or outer combustion chamber assembly should be replaced, with service use terminated. Combustion chamber assemblies exhibiting distress exceeding reduced inspection interval limits must be removed from service. Engines in this category may be operated for a maximum of five additional cycles in order to reach a repair facility. It is expected that if distress exceeds these limits, discretionary judgement will be exercised in continuing engine operation for the additional five cycles.

(d) Limits and conditions pertaining to the inner and outer combustion chamber assembly are addressed in Table 801.

		CONTINUE-IN-SERVICE LIMITS	
INSPECTION AREA	OBSERVED CONDITION	REGULAR INTERVAL INSPECTION	REDUCED INTERVAL INSPECTION
Inner Combustion Chamber Assembly and Outer Combustion Chamber Assembly, Except Bulkhead	Burn-through (Open holes)	See Figures 810 and 811	See Figures 810 and 811
		1. Maximum of four burn-through holes each assembly.	1. Maximum of six burn-through holes each assembly.
		2. Largest dimension of each hole may not exceed 0.500 inch (12.700 mm) or 0.19 square inch (123. mm^2)	2. Largest dimension of each hole may not exceed 0.500 inch (12.700 mm) or 0.19 square inch (123. mm^2)
		3. Burn-through holes must be separated by a minimum of 6 inches (152.400 mm) of	3. Burn-through holes must be separated by a minimum of 6 inches (152.400 mm) of

Combustion Chamber Area Borescope Inspection/Distress Limits
Table 801

		CONTINUE-IN-SERVICE LIMITS	
INSPECTION AREA	OBSERVED CONDITION	REGULAR INTERVAL INSPECTION	REDUCED INTERVAL INSPECTION
(CONTINUED)		sound material. (Axially and/or circumferentially)	sound material. (Axially and/or circumferentially)
	Burning, Distortion, Missing Louver Lips Material, Burn-streak	See Figure 812	See Figure 812
		1. Unlimited amount of burning distortion and missing louver lip material is permitted circumferentially on each louver provided other limits are not exceeded.	1. If more than three axially successive louvers exhibit significant distress, a burn-streak is developing. This burn-streak should be monitored according to burn-hole size, crack length and crack intersection limits. If these limits are exceeded the assembly should be removed.
		2. Significant distress appearing axially on three successive louvers	

Combustion Chamber Area Borescope Inspection/Distress Limits
Table 801 (Continued)

		CONTINUE-IN-SERVICE LIMITS	
INSPECTION AREA	OBSERVED CONDITION	REGULAR INTERVAL INSPECTION	REDUCED INTERVAL INSPECTION
(CONTINUED)		and limited to three successive louvers (indicates development of burn-streak).	
	Burning (Burned Areas), Missing Material Or Coating Depletion	See Figure 811 and Figure 812 1. Unlimited on each louver to burn-through or burn-streak limits. NOTE: If significant distress or missing material is found particularly on the last louver, a thorough inspection of the downstream turbine airfoils is recommended.	
	Chipped Coating, Thermal Barrier Ceramic Coating Loss	See Figure 812 1. Unlimited on each louver, however, loss of coating may accelerate deterioration.	
	Louver lip (gap) closure and burning exceeded.	See Figure 812 1. Unlimited, provided burn-through limits are not exceeded. However, excessive closure will accelerate	

Combustion Chamber Area Borescope Inspection/Distress Limits
Table 801 (Continued)

		CONTINUE-IN-SERVICE LIMITS	
INSPECTION AREA	OBSERVED CONDITION	REGULAR INTERVAL INSPECTION	REDUCED INTERVAL INSPECTION
(CONTINUED)		down-stream deterioration.	
	Bent, Buckled Or Distorted Louvers	See Figure 812 1. Unlimited on each louver provided other limits are not exceeded.	
	Individual Axial Cracks	See Figure 813	

NOTE: For axial cracks that enter combustion, dilution, ignitor holes. The diameter of the manufactured hole does not need to be added to determine the crack length until the crack is seen exiting from the opposite side of the hole.

		1. Unlimited number up to 0.75 inch (19.050 mm) long.	1. Cracks can completely traverse one louver. Maximum of 2 cracks every 6.0 inches (152.400 mm) of louver material. Cracks must be separated circumferentially by 0.75 inch (19.050 mm). 2. Cracks can completely traverse one louver. Maximum of 3 cracks every 6.0 inches (152.400 mm) of louver

Combustion Chamber Area Borescope Inspection/Distress Limits
Table 801 (Continued)

		CONTINUE-IN-SERVICE LIMITS	
INSPECTION AREA	OBSERVED CONDITION	REGULAR INTERVAL INSPECTION	REDUCED INTERVAL INSPECTION
(CONTINUED)			material. Cracks must be separated circumferentially by 1.5 inches (38.100 mm).
		If these limits are exceeded, contact Pratt & Whitney for reccommendation on disposition.	
		2. Cracks can completely traverse one louver, but must be separated cirumferentially by 6.0 inches (152.400 mm) minimum.	
		3. Cracks can completely traverse on OBL No. 9 (rear most) louver, but must be separated circumferentially by 2.5 inches (63.5 mm) minimum. On OLB No. 9 louver (rear most), the minimum separation of cracks must be 2.5 inches (63.5 mm).	

Combustion Chamber Area Borescope Inspection/Distress Limits
Table 801 (Continued)

INSPECTION AREA	OBSERVED CONDITION	CONTINUE-IN-SERVICE LIMITS REGULAR INTERVAL INSPECTION	 REDUCED INTERVAL INSPECTION
(CONTINUED)			
		NOTE: An individual crack is a crack confined to one louver.	
	Intersection Of Axial And Circumferential Cracks	See Figure 814	See Figure 814
		1. Intersection of individual or continuous axial cracks and circumferential cracks is not permitted unless the circumferential cracks are confined to the louver lip portion of the louver. Louver lip material missing as a result of such crack intersection is permitted. Maximum length of circumferential crack lip area is 2.0 inches (50.800 mm).	1. Intersection of individual or continuous axial cracks and circumferential cracks is not permitted unless the circumferential cracks are confined to the louver lip portion of the louver. Louver lip material missing as a result of such crack intersection is permitted. Maximum length of circumferential crack lip area is 2.0 inches (50.800 mm).

NOTE: Use the hot side inspection that follows only if a cold side inspection is not easily accessible. This inspection is used to find if a knuckle between two louvers is cracked by looking through a

Combustion Chamber Area Borescope Inspection/Distress Limits
Table 801 (Continued)

		CONTINUE-IN-SERVICE LIMITS	
INSPECTION AREA	OBSERVED CONDITION	REGULAR INTERVAL INSPECTION	REDUCED INTERVAL INSPECTION
(CONTINUED)			
	borescope at the inner (hot side) surface of the burner rather than the outer (cold side) surface.		
	NOTE: To use the inner surface inspection method, all cracked surfaces in the continuous axial crack must be inspected for crack width. If all the louver cracks are less than 0.060 inch (1.524 mm) wide, they should be classified as individual cracks. If 2 consecutive louvers have crack widths that are more than 0.060 inch (1.524 mm), it should be classified as a 2 louver crack. If 3 consecutive louvers have crack widths that are more than 0.060 inch (1.524 mm), it should be classified as a 3 louver crack. This same inspection method should also be used for cracks that extend more than 3 louvers.		
	NOTE: Cracks are classified as individual axial cracks if they do not go through the louver knuckle area. An outer (cold side) inspection is optional to check if the cracks go through the louver knuckle area. If the outer (cold side) inspection shows that the cracks do not go through the louver knuckle area, then cracks are classified as individual axial cracks.		
	Continuous Axial Cracks	See Figures 813 and 814 (Continuous axial cracks must be monitored with reduced time interval)	See Figures 813 and 814 1. Two louver crack, if the measured crack width on each of the adjacent louvers is greater than 0.060 inch (1.524 mm) wide, AND/OR

Combustion Chamber Area Borescope Inspection/Distress Limits
Table 801 (Continued)

		CONTINUE−IN−SERVICE LIMITS	
INSPECTION AREA	OBSERVED CONDITION	REGULAR INTERVAL INSPECTION	REDUCED INTERVAL INSPECTION
(CONTINUED)			the louver wall deformation or surface mismatch is greater than 0.060 inch (1.524 mm). Individual crack separation limits apply for two louver cracks. 2. Three louver crack, if the measured crack width on each of the three adjacent louvers is greater than 0.060 inch (1.524 mm) wide, AND/OR the louver wall deformation or surface mismatch is greater than 0.060 inch (1.524 mm). Three louver cracks must be separated cirumferentially by 20.0 inches (508.00 mm) minimum. 3. Four louver crack, if the measured

Combustion Chamber Area Borescope Inspection/Distress Limits
Table 801 (Continued)

		CONTINUE-IN-SERVICE LIMITS	
INSPECTION AREA	OBSERVED CONDITION	REGULAR INTERVAL INSPECTION	REDUCED INTERVAL INSPECTION
(CONTINUED)			crack width on each of the four adjacent louvers is greater than 0.060 inch (1.524 mm) wide, but less than 0.150 inch (3.810 mm) AND/OR the louver wall deformation or surface mismatch is greater than 0.060 inch (1.524 mm) but less than 0.150 inch (3.810 mm). Engine must be scheduled off wing within 40 hours. 4. Greater than three louver crack, engine must be removed immediately if the crack is greater than 0.150 inch (3.810 mm) wide AND/OR thelouver wall deformation or surface mismatch is greater than 0.150 inch

Combustion Chamber Area Borescope Inspection/Distress Limits
Table 801 (Continued)

INSPECTION AREA	OBSERVED CONDITION	CONTINUE-IN-SERVICE LIMITS REGULAR INTERVAL INSPECTION	CONTINUE-IN-SERVICE LIMITS REDUCED INTERVAL INSPECTION
(CONTINUED)			(3.810 mm).
		NOTE: As a burn streak develops, louver material distorts, cracks and/or burns away. Individual axial louver cracks may continue to propagate and, although axially askew, join together to form a continuous crack within the burn streak, which penetrates the liner wall.	
	Circumferential Cracks	See Figure 814 1. None permitted except in lip region 2. Maximum length of circumferential crack in lip region is 2.0 inches (50.800 mm).	See Figure 814 1. None permitted except in lip region
	Intersection Of Burn-Holes By Axial Cracks	Refer to Figure 810 Intersection of burn holes by axial cracks is permitted. The previously established burn-hole and crack length dimension should be applied separately. However, when defining crack length, the hole width should be considered as part of the overall crack length.	

Combustion Chamber Area Borescope Inspection/Distress Limits
Table 801 (Continued)

		CONTINUE-IN-SERVICE LIMITS	
INSPECTION AREA	OBSERVED CONDITION	REGULAR INTERVAL INSPECTION	REDUCED INTERVAL INSPECTION
Fuel Injector Guide Heat Shield	Cracks in Heat Shield Face	See Figure 815	See Figure 815
		1. Unlimited cracks less than 1/4 inch or 0.25 inch (6.350 mm) in length are permitted. Two cracks (per heat shield) maximum may progress completely across each face, but cracks (on both heat shields) must be separated by 45°. No intersecting cracks.	1. Unlimited cracks less than 1/4 inch or 0.25 inch (6.350 mm) in length are permitted. Two cracks (per heat shield) maximum may progress completely across each face, but cracks (on both heat shields) must be separated by 30°. No intersecting cracks.
	Heat Shield Face Erosion, Missing Material, And Burning	See Figure 815	See Figure 815
		1. Erosion and burning is permitted provided none of the impingement holes beneath the heat shield inner face are exposed when viewing the heat shield from the rear	1. Erosion and burning in the heat shield inner face is permitted to expose up to four impingement cooling holes beneath the heat shield inner face.

Combustion Chamber Area Borescope Inspection/Distress Limits
Table 801 (Continued)

		CONTINUE-IN-SERVICE LIMITS	
INSPECTION AREA	OBSERVED CONDITION	REGULAR INTERVAL INSPECTION	REDUCED INTERVAL INSPECTION
		2. Outer face erosion can extend 0.2 inch (5.08 mm) inward from outer face for 360 degrees.	2. Outer face erosion can extend inward to within 0.025 inch (0.635 mm) of inner rear for 360 degrees.
		3. Heat shield distortion and burning is permitted provided that the heat shield face erosion and crack limits are not exceeded. The resulting distress to the bulkhead must not exceed the bulkhead distress limits.	
	Magnesium Zirconate Coating Loss	See Figure 812	
		1. Any amount permitted; however, loss of coating will accelerate deterioration.	
Fuel Injector End Cap/Tip Heat Shield	1. Radial cracks	1. Any amount permitted. See Figure 817.	
	2. Circumferential cracks along the outer DIA	2. Any amount permitted. See Figure 817.	
	3. End Cap Material Liberation (segments broken away)	3. Any amount permitted. See Figure 817.	

Combustion Chamber Area Borescope Inspection/Distress Limits
Table 801 (Continued)

		CONTINUE-IN-SERVICE LIMITS	
INSPECTION AREA	OBSERVED CONDITION	REGULAR INTERVAL INSPECTION	REDUCED INTERVAL INSPECTION
Bulkhead	Burned, Eroded, Distorted Areas Or Holes	See Figures 816 and 817	See Figures 816 and 817
		1. None permitted.	1. None permitted.
	Individual Cracks (Radial & Circumferential)	See Figures 816 and 817	See Figures 816 and 817
		1. Individual radial or circumferential cracks to 0.50 inch (12.700 mm) in length are permitted.	1. Individual radial or circumferential cracks to 1.00 inch (25.400 mm) in length are permitted. Cracks must be isolated circumferentially by 6.00 inches (152.400 mm) of solid material.
		2. Cracks must be isolated circumferentially by 6.00 inches (152.400 mm) of solid material.	2. Multiple cracks, with less than 6.00 inches (152.400 mm) circumferential separation, are permitted if the sum of crack lengths is not greater than 2.00 inches (50.800 mm) and the maximum individual crack length

Combustion Chamber Area Borescope Inspection/Distress Limits
Table 801 (Continued)

		CONTINUE-IN-SERVICE LIMITS	
INSPECTION AREA	OBSERVED CONDITION	REGULAR INTERVAL INSPECTION	REDUCED INTERVAL INSPECTION
			is not greater than 0.75 inch (19.050 mm).
		3. No cracks that extend below a fuel injector heat shield are permitted.	3. No cracks that extend below a fuel injector heat shield are permitted.
			4. Cracks which if extended would form a loop are not permitted.

Combustion Chamber Area Borescope Inspection/Distress Limits
Table 801 (Continued)

E. Procedure

(1) Remove Lockwire or Safety Cable and Ferrules, plugs and gaskets from the six AP-8 borescope access ports located on the diffuser case assembly. See Figure 801 (Sheets 1 and 2) Inspection/Check-01A Task 72-00-00-990-010 .

NOTE: Borescope access port AP-9 may also be used if desired. Remove and install AP-9 plug per Inspection/Check-01E Task 72-00-00-210-017.

CAUTION: TEMPERATURES IN AREAS TO BE BORESCOPED SHOULD BE PERMITTED TO COOL TO BELOW 150°F (65.6°C) FOLLOWING ENGINE OPERATION. DAMAGE MAY RESULT TO BORESCOPE EQUIPMENT IF EQUIPMENT IS EXPOSED TO GASPATH OR METAL TEMPERATURES IN EXCESS OF 150°F (65.6°C). AS A GUIDE - IF ADJACENT CASES ARE TOO HOT TO TOUCH COMFORTABLY, INSPECTION SHOULD BE DELAYED.

(2) Insert borescope through port and inspect condition of inner combustion chamber assembly, outer combustion

chamber assembly, bulkhead, fuel injectors, and heat shields per step (3) inspection limits.

NOTE: Maximum borescope insertion depth and borescope limiting access hole diameter specifications for AP−8 and AP−9 borescope ports are provided in Table 801 (Sheet 3) Inspection/Check−01A Task 72−00−00−990−010.

(3) Inspection limits.

CAUTION: FOLLOWING LIMITS ARE APPLICABLE ON A CONTINUE−IN−SERVICE BASIS ONLY. LIMIT IS BASED ON PART STRUCTURAL REQUIREMENTS AND DOES NOT IMPLY THAT ENGINE PERFORMANCE, STABILITY, OPERATING LIMITS, OR PART REPARABILITY WILL BE MAINTAINED.

(a) Limits for conditions observed during borescope inspection of combustion area are provided in Table 801 and Figure 810 through Figure 817.

R (4) After you complete the borescope inspection, install
R the AP−8 plugs as follows: See Table 802.

R (a) Use a nylon brush to clean the old antigalling
R compound from the threads of each AP plug.

R (b) Apply a thin layer of new antigalling compound to
R the threads and to the plug head washer contact
R surface area, see Figure 818. See Table 802 for
R the necessary antigalling compound.

R NOTE: Do not use Engine Oil P03−001 on the AP
R plug threads.

R (c) If you apply more antigalling compound than
R is necessary to the plug, remove the unwanted
R compound with a rag or cloth.

R (d) Put a new gasket or washer on each AP plug. See
R Table 802 or the necessary gasket or washer.

R NOTE: Always use a new gasket or washer. Do not
R use an old gasket or washer.

R (e) Install the AP plugs and gaskets or washers in the applicable borescope boss on the engine. See Table 802 for the necessary AP plug and gasket or washer part numbers for each location. Use a standard socket drive extension and ratchet to turn each AP plug into the boss. Hand tighten the plug only with the ratchet wrench.

R (f) Use a standard torque wrench to torque the AP plugs. See Table 802 for the necessary torque specifications.

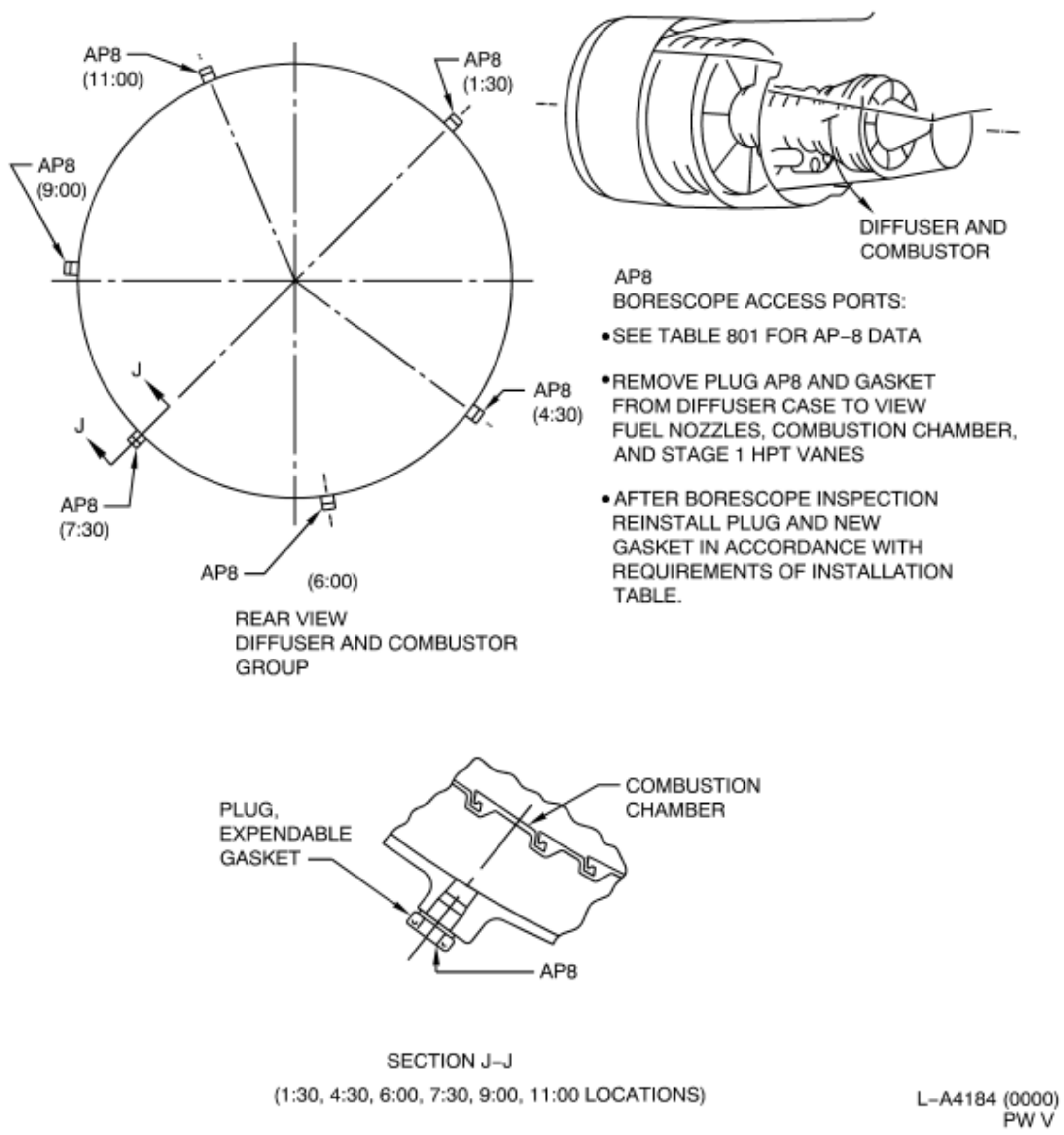
R (g) Safety all the AP plugs with Lockwire P05-289.

R	AP Number And Diffuser Case Location	Gasket PN	Plug PN	Plug Replacement Lubricant	Plug Torque lb-in. (N.m)
R	AP-8 1:30 o'clock	673049	50A725	P06-023 Silver Goop	40 - 50 (4.519 - 5.649)
R	AP-8 4:30 o'clock	673049	50A725	P06-023 Silver Goop	40 - 50 (4.519 - 5.649)
R	AP-8 6:00 o'clock	673049	50A725	P06-023 Silver Goop	40 - 50 (4.519 - 5.649)
R	AP-8 7:30 o'clock	673049	50A725	P06-023 Silver Goop	40 - 50 (4.519 - 5.649)
R	AP-8 9:00 o'clock	673049	50A725	P06-023 Silver Goop	40 - 50 (4.519 - 5.649)
R	AP-8 11:00 o'clock	673049	50A725	P06-023 Silver Goop	40 - 50 (4.519 - 5.649)

For Engines Equipped:

NOTE: If the high stage temperature sensor was removed to borescope through the (338°C) 11:00 o'clock port, reinstall per Section 71-00-41, Installation-04 (Task 71-00-41-450-004).

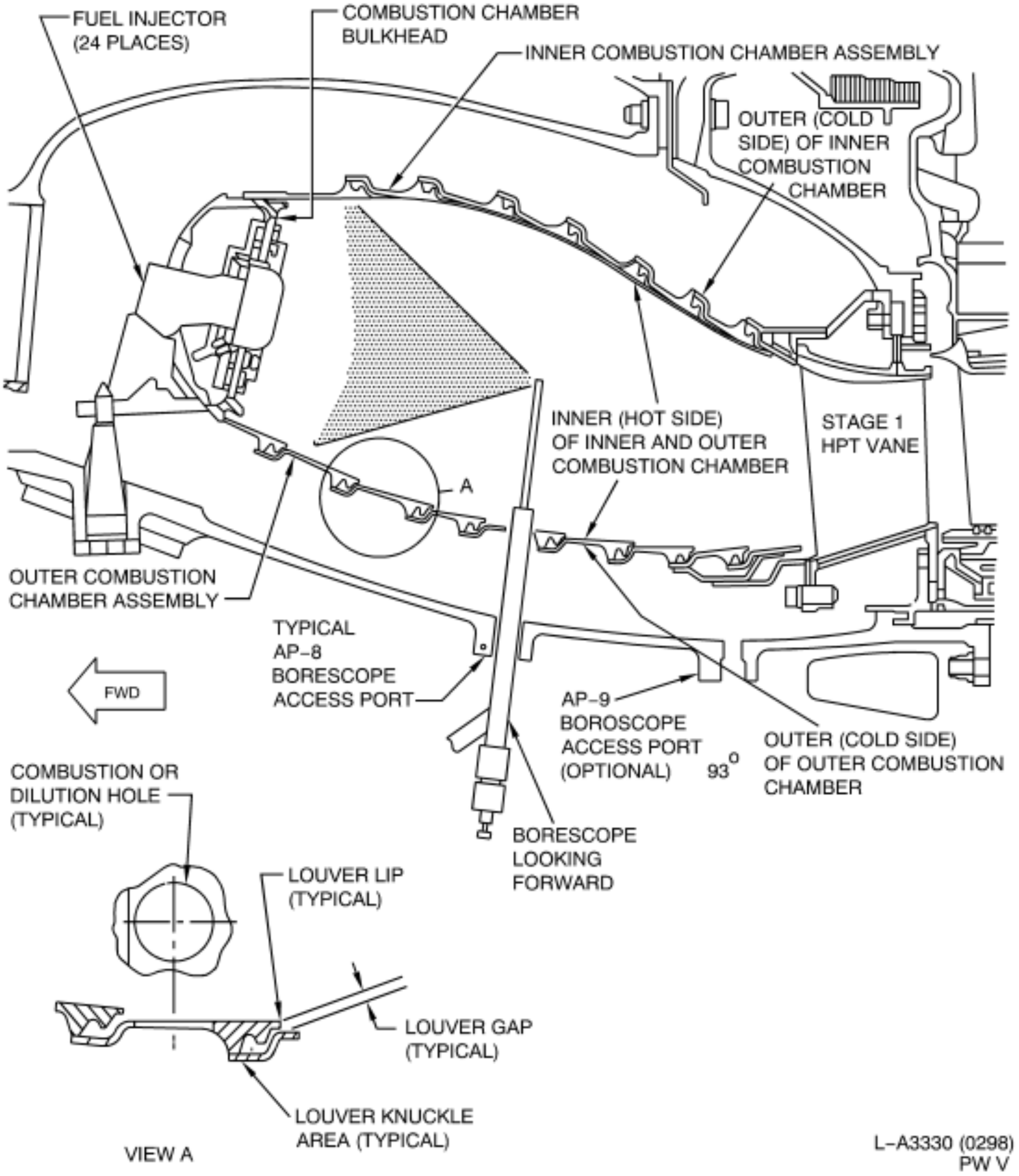
R AP-8 Borescope Plug Installation Data
R Table 802


AP8
(11:00)
AP8
(1:30)
AP8
(9:00)
AP8
(4:30)
J
J
AP8
(7:30)
AP8
(6:00)
REAR VIEW
DIFFUSER AND COMBUSTOR
GROUP
DIFFUSER AND
COMBUSTOR
PLUG,
EXPENDABLE
GASKET
COMBUSTION
CHAMBER
AP8
SECTION J−J
(1:30, 4:30, 6:00, 7:30, 9:00, 11:00 LOCATIONS)
L−A4184 (0000)
PW V

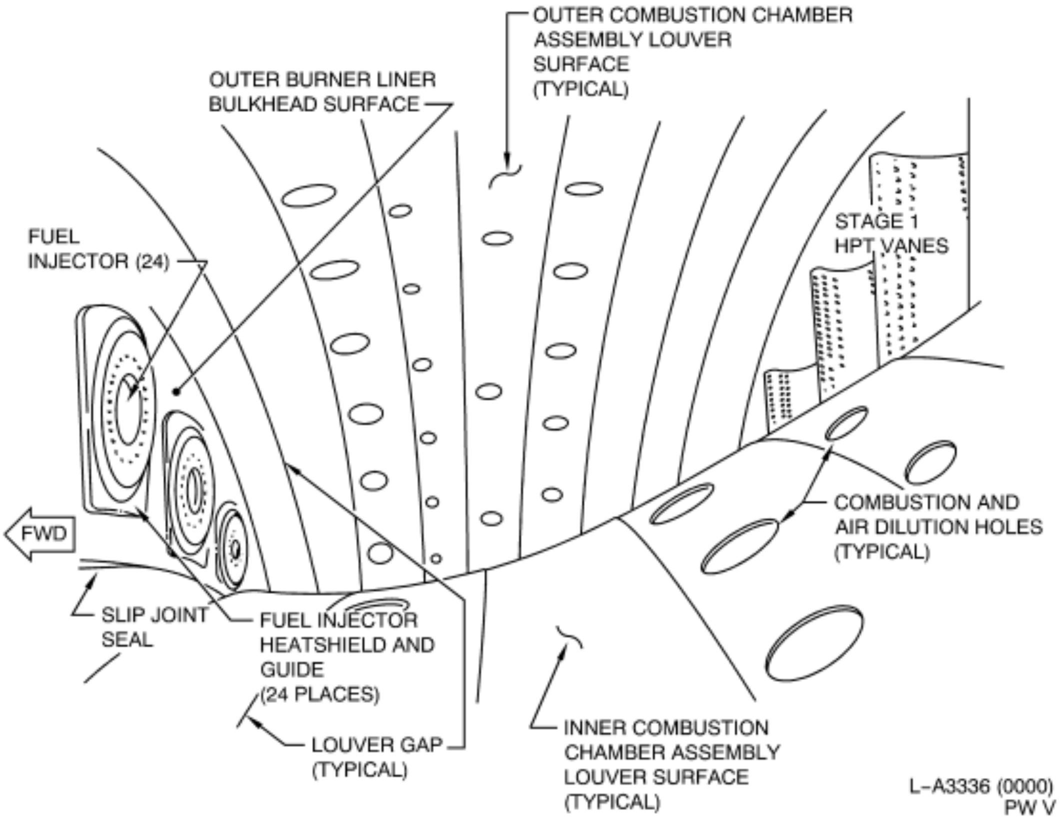
AP8
BORESCOPE ACCESS PORTS:

- SEE TABLE 801 FOR AP−8 DATA
- REMOVE PLUG AP8 AND GASKET FROM DIFFUSER CASE TO VIEW FUEL NOZZLES, COMBUSTION CHAMBER, AND STAGE 1 HPT VANES
- AFTER BORESCOPE INSPECTION REINSTALL PLUG AND NEW GASKET IN ACCORDANCE WITH REQUIREMENTS OF INSTALLATION TABLE.

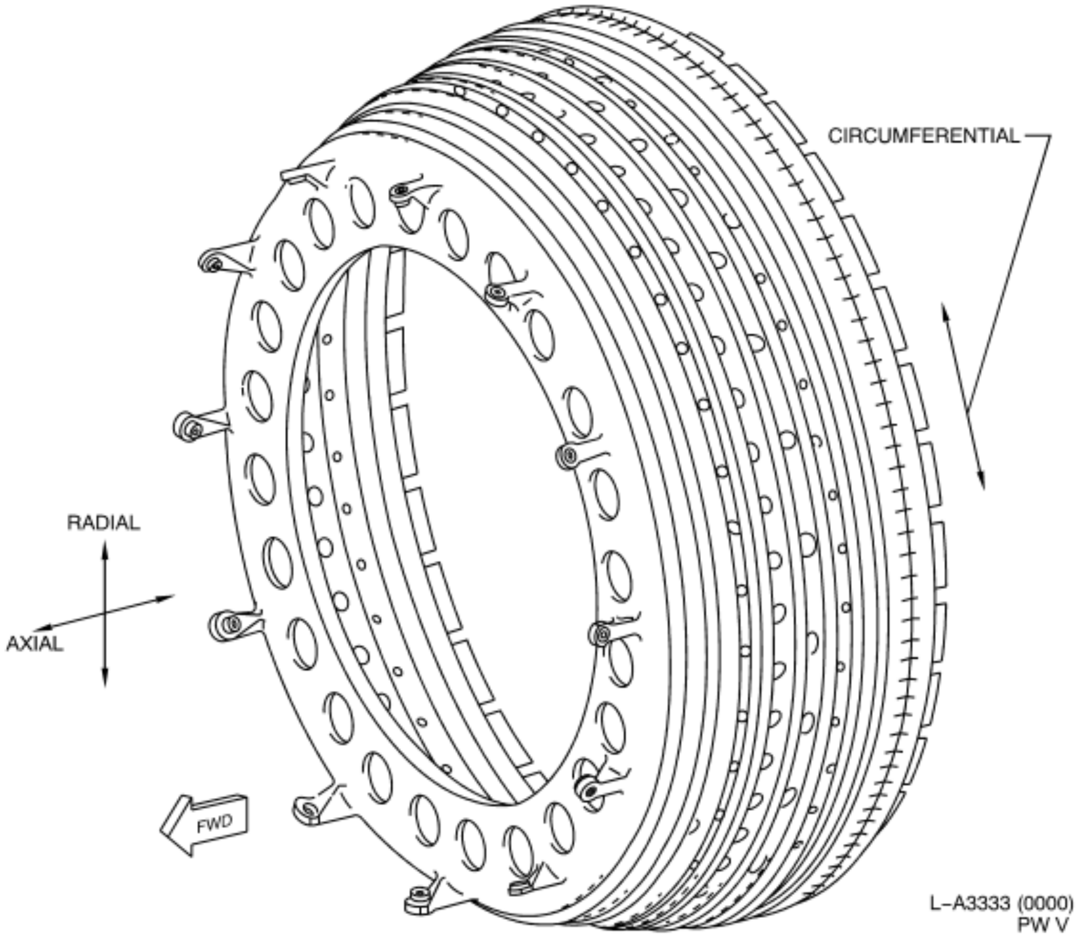
Borescope AP−8 Access Port Locations On Diffuser Case Assembly
Figure 801
(Task 72−00−00−210−020)


FUEL INJECTOR (24 PLACES)
COMBUSTION CHAMBER BULKHEAD
INNER COMBUSTION CHAMBER ASSEMBLY
OUTER (COLD SIDE) OF INNER COMBUSTION CHAMBER
INNER (HOT SIDE) OF INNER AND OUTER COMBUSTION CHAMBER
STAGE 1 HPT VANE
A
OUTER COMBUSTION CHAMBER ASSEMBLY
TYPICAL AP−8 BORESCOPE ACCESS PORT
FWD
AP−9 BOROSCOPE ACCESS PORT (OPTIONAL)
93°
OUTER (COLD SIDE) OF OUTER COMBUSTION CHAMBER
BORESCOPE LOOKING FORWARD
COMBUSTION OR DILUTION HOLE (TYPICAL)
LOUVER LIP (TYPICAL)
LOUVER GAP (TYPICAL)
LOUVER KNUCKLE AREA (TYPICAL)
VIEW A
L−A3330 (0298)
PW V

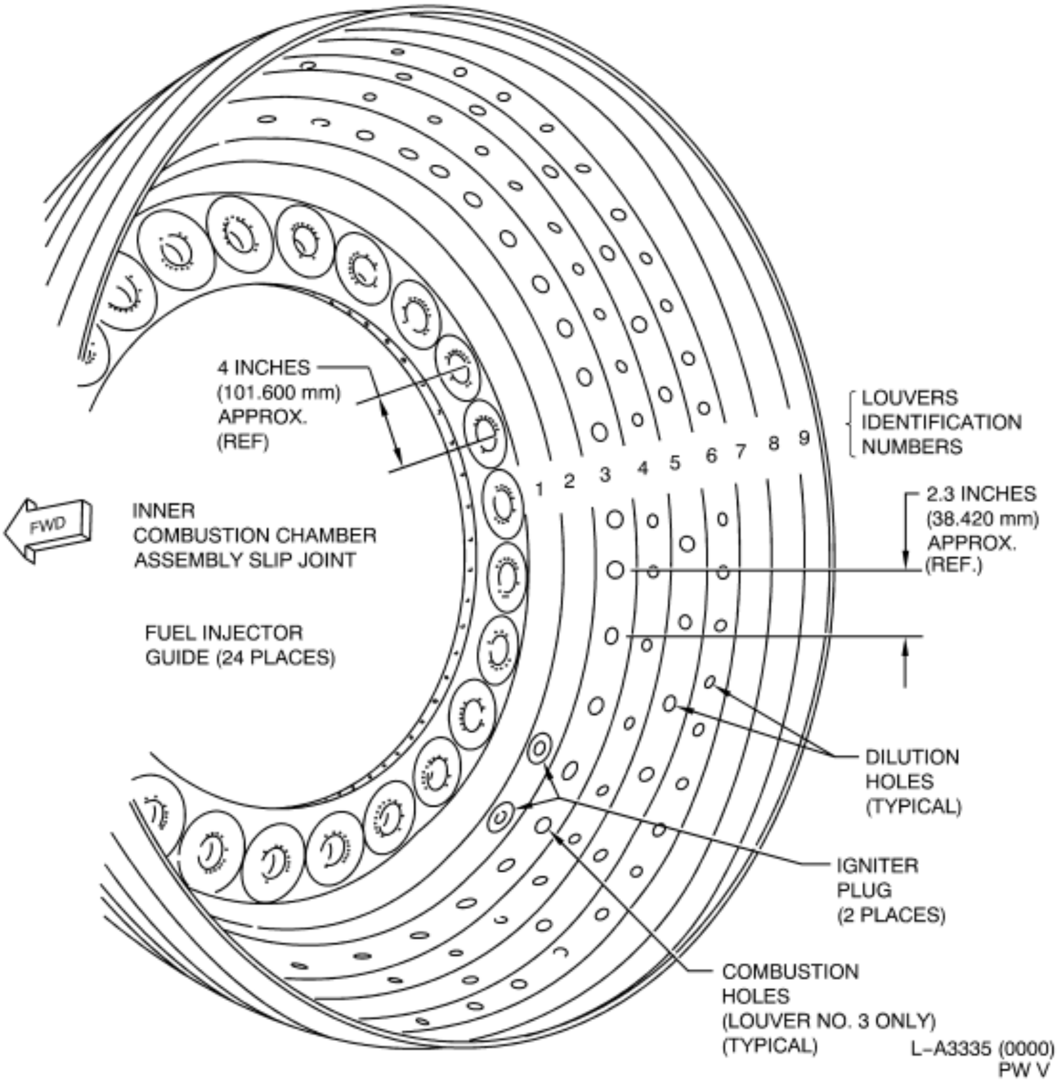
Borescope View Of Diffuser And Combustor Area (AP−8)
Figure 802
(Task 72−00−00−210−020)


OUTER COMBUSTION CHAMBER ASSEMBLY LOUVER SURFACE (TYPICAL)
OUTER BURNER LINER BULKHEAD SURFACE
FUEL INJECTOR (24)
STAGE 1 HPT VANES
FWD
COMBUSTION AND AIR DILUTION HOLES (TYPICAL)
SLIP JOINT SEAL
FUEL INJECTOR HEATSHIELD AND GUIDE (24 PLACES)
LOUVER GAP (TYPICAL)
INNER COMBUSTION CHAMBER ASSEMBLY LOUVER SURFACE (TYPICAL)
L−A3336 (0000)
PW V

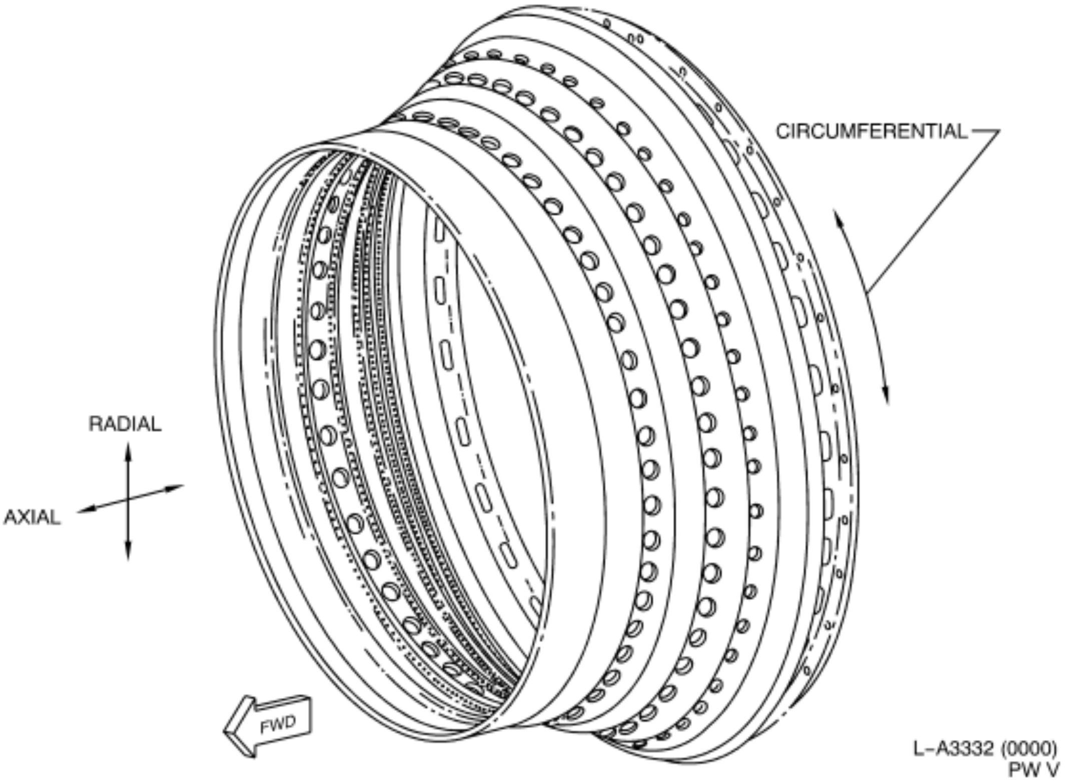
Borescope View And Visual Identification Of Combustion Chamber Area
Figure 803
(Task 72−00−00−210−020)


CIRCUMFERENTIAL
RADIAL
AXIAL
FWD
L−A3333 (0000)
PW V

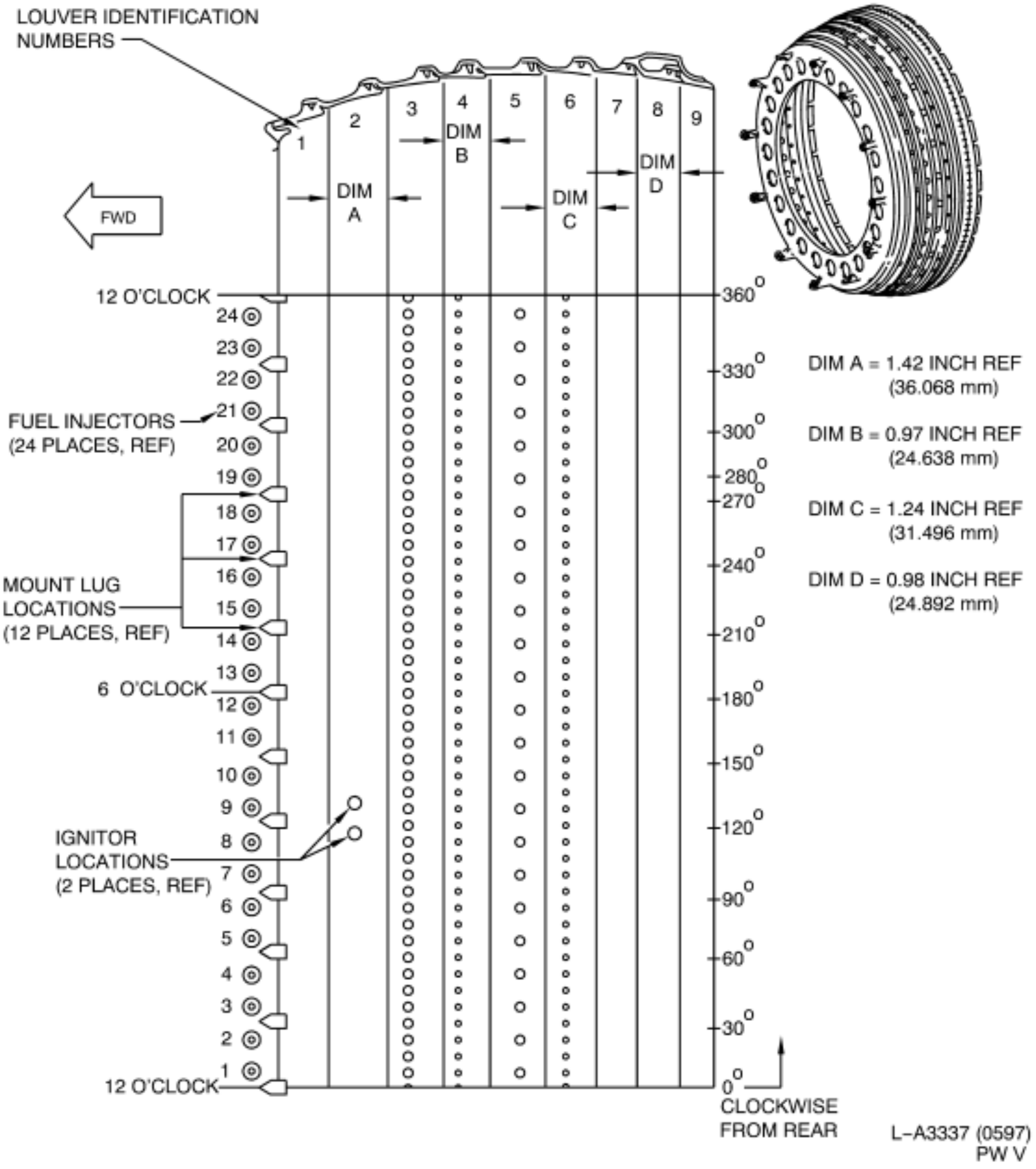
Outer Combustion Chamber Assembly Definition Of Terms
Figure 804
(Task 72−00−00−210−020)


4 INCHES
(101.600 mm)
APPROX.
(REF)
LOUVERS
IDENTIFICATION
NUMBERS
1
2
3
4
5
6
7
8
9
FWD
INNER
COMBUSTION CHAMBER
ASSEMBLY SLIP JOINT
2.3 INCHES
(38.420 mm)
APPROX.
(REF.)
FUEL INJECTOR
GUIDE (24 PLACES)
DILUTION
HOLES
(TYPICAL)
IGNITER
PLUG
(2 PLACES)
COMBUSTION
HOLES
(LOUVER NO. 3 ONLY)
(TYPICAL)
L−A3335 (0000)
PW V

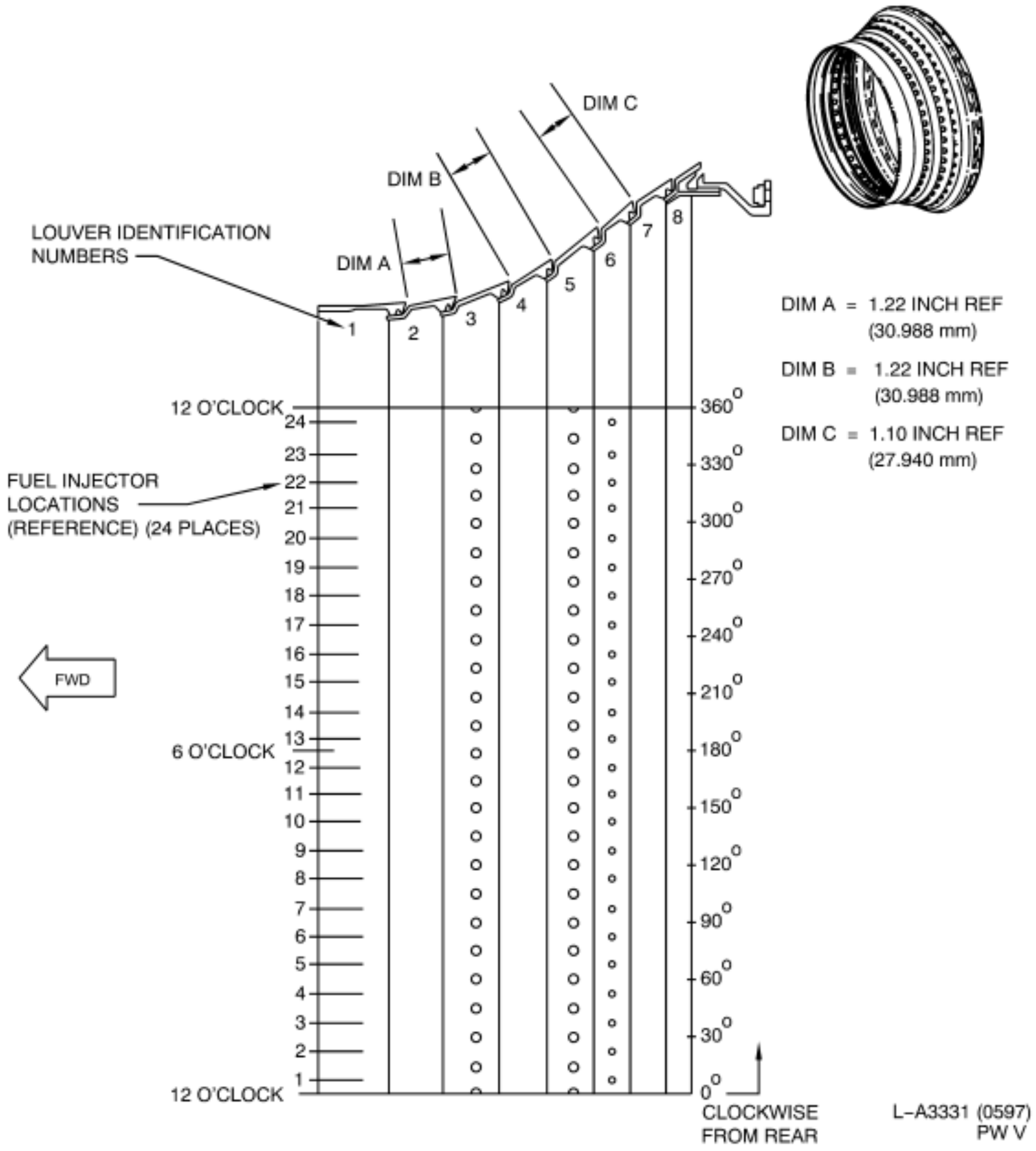
Outer Combustion Chamber Assembly Definition Of Terms (ID)
Figure 805
(Task 72−00−00−210−020)


CIRCUMFERENTIAL
RADIAL
AXIAL
FWD
L−A3332 (0000)
PW V

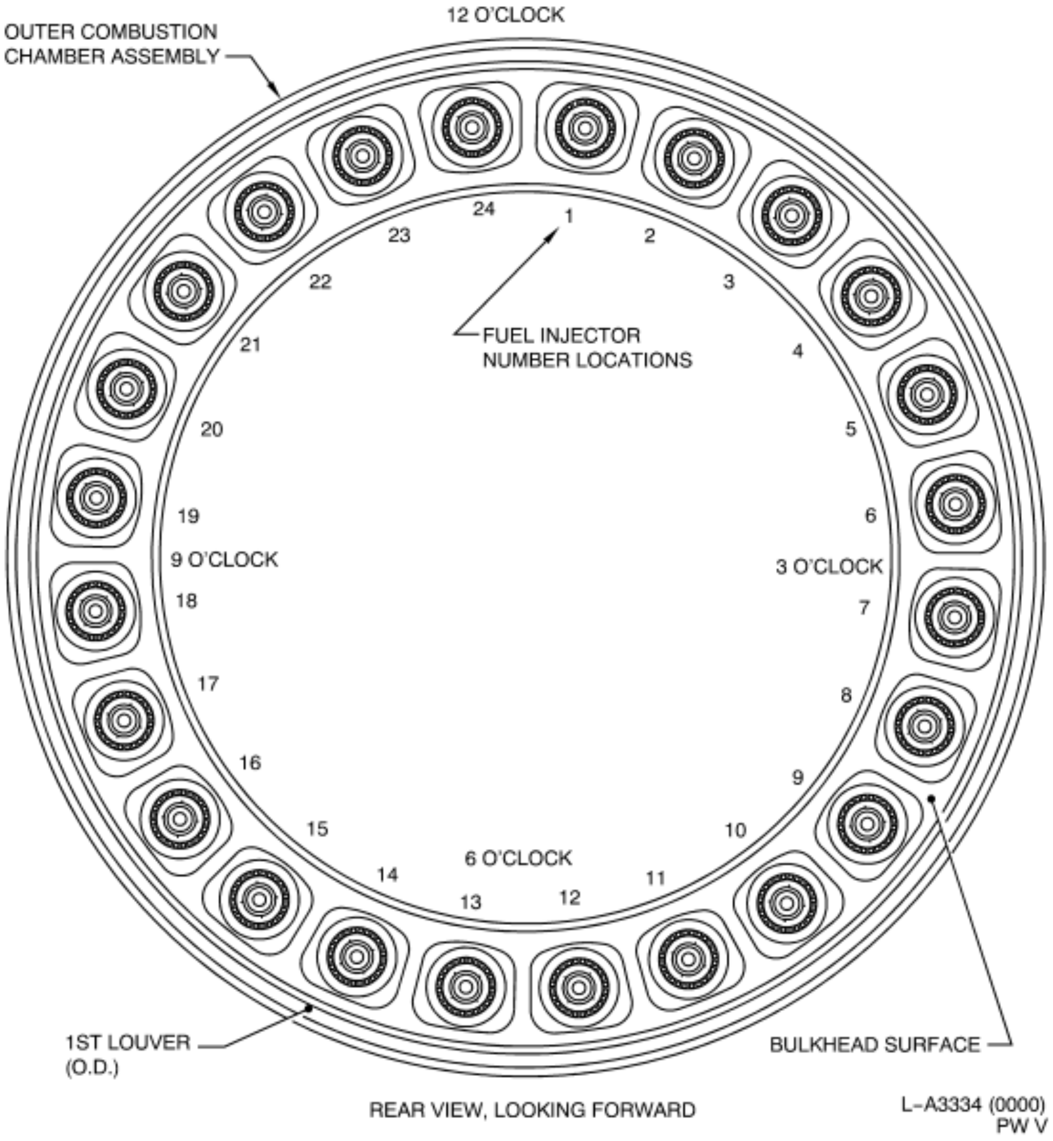
Inner Combustion Chamber Assembly Definition Of Terms
Figure 806
(Task 72−00−00−210−020)


LOUVER IDENTIFICATION NUMBERS
1
2
3
4
5
6
7
8
9
DIM A
DIM B
DIM C
DIM D
FWD
12 O'CLOCK
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
FUEL INJECTORS (24 PLACES, REF)
MOUNT LUG LOCATIONS (12 PLACES, REF)
6 O'CLOCK
IGNITOR LOCATIONS (2 PLACES, REF)
12 O'CLOCK
360°
330°
300°
280°
270°
240°
210°
180°
150°
120°
90°
60°
30°
0°
CLOCKWISE FROM REAR
DIM A = 1.42 INCH REF (36.068 mm)
DIM B = 0.97 INCH REF (24.638 mm)
DIM C = 1.24 INCH REF (31.496 mm)
DIM D = 0.98 INCH REF (24.892 mm)
L-A3337 (0597)
PW V

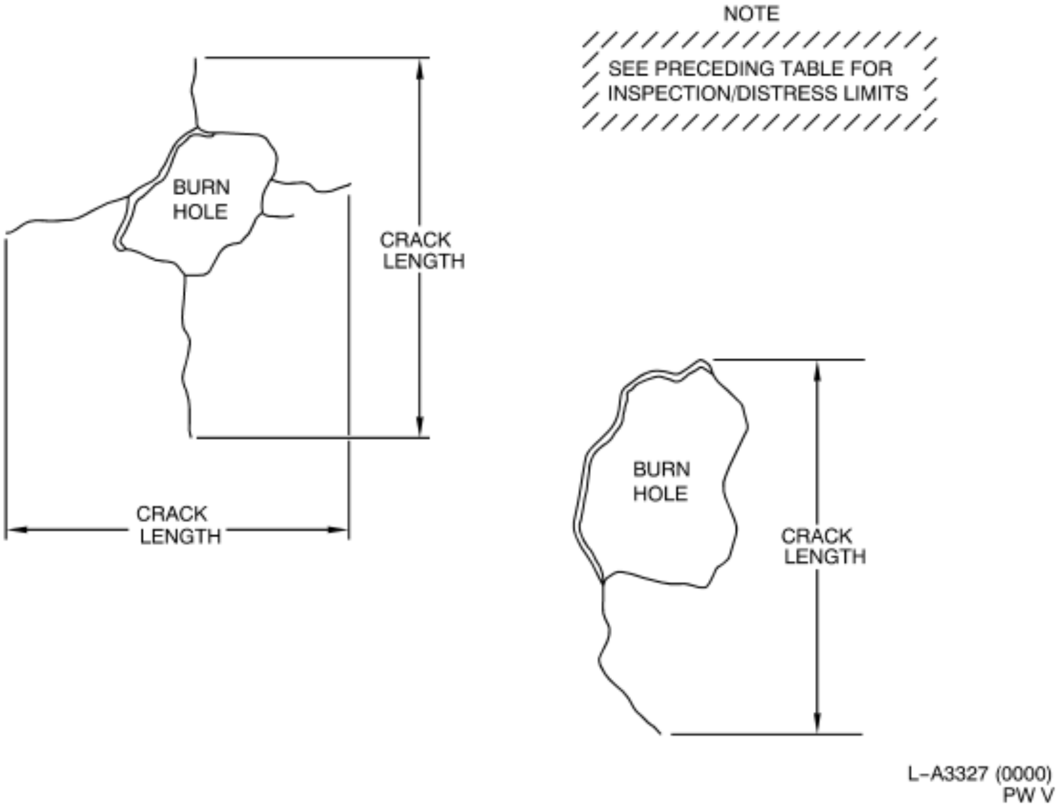
Outer Combustion Chamber Assembly Planview - Inboard Surface
Figure 807
(Task 72-00-00-210-020)


DIM C
DIM B
DIM A
LOUVER IDENTIFICATION NUMBERS
1
2
3
4
5
6
7
8
DIM A = 1.22 INCH REF (30.988 mm)
DIM B = 1.22 INCH REF (30.988 mm)
DIM C = 1.10 INCH REF (27.940 mm)
12 O'CLOCK
FUEL INJECTOR LOCATIONS (REFERENCE) (24 PLACES)
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
FWD
6 O'CLOCK
12 O'CLOCK
360°
330°
300°
270°
240°
210°
180°
150°
120°
90°
60°
30°
0°
CLOCKWISE FROM REAR
L−A3331 (0597)
PW V

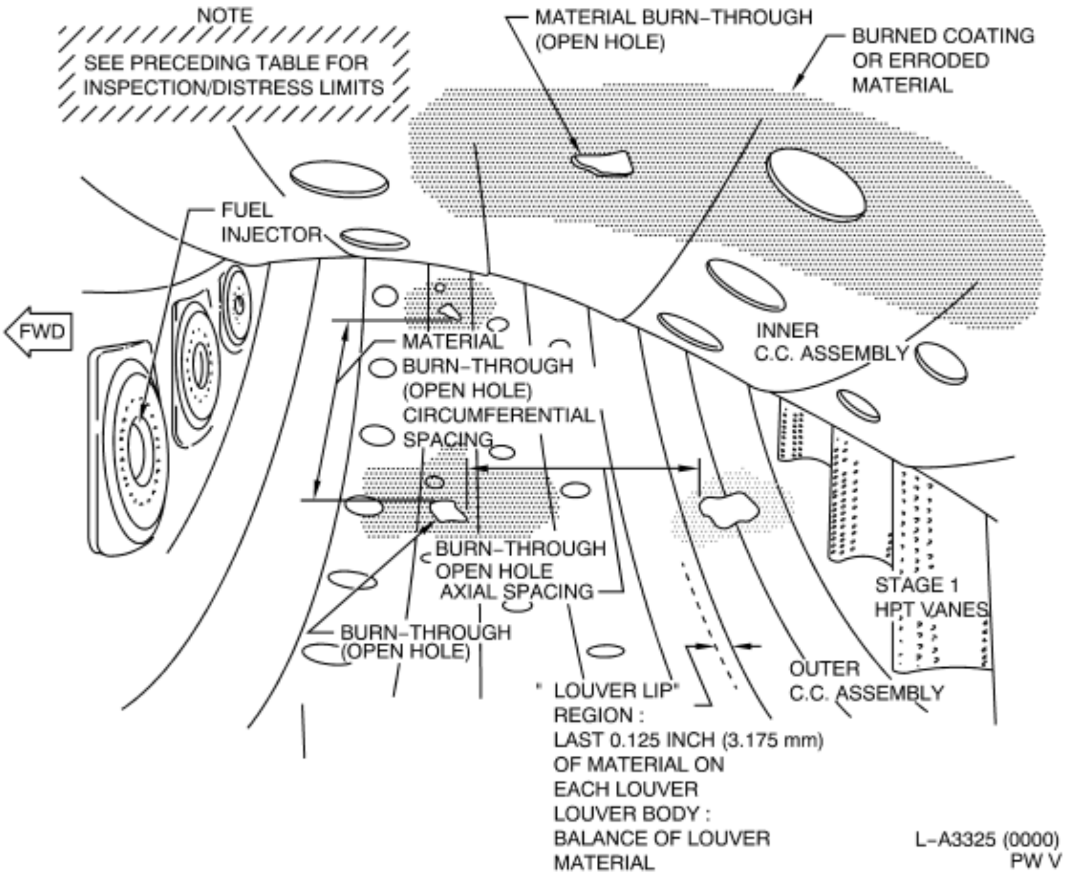
Inner Combustion Chamber Assembly Planview − Outboard Surface
Figure 808
(Task 72−00−00−210−020)


12 O'CLOCK
OUTER COMBUSTION CHAMBER ASSEMBLY
24
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
FUEL INJECTOR NUMBER LOCATIONS
9 O'CLOCK
3 O'CLOCK
6 O'CLOCK
1ST LOUVER (O.D.)
BULKHEAD SURFACE
REAR VIEW, LOOKING FORWARD
L−A3334 (0000)
PW V

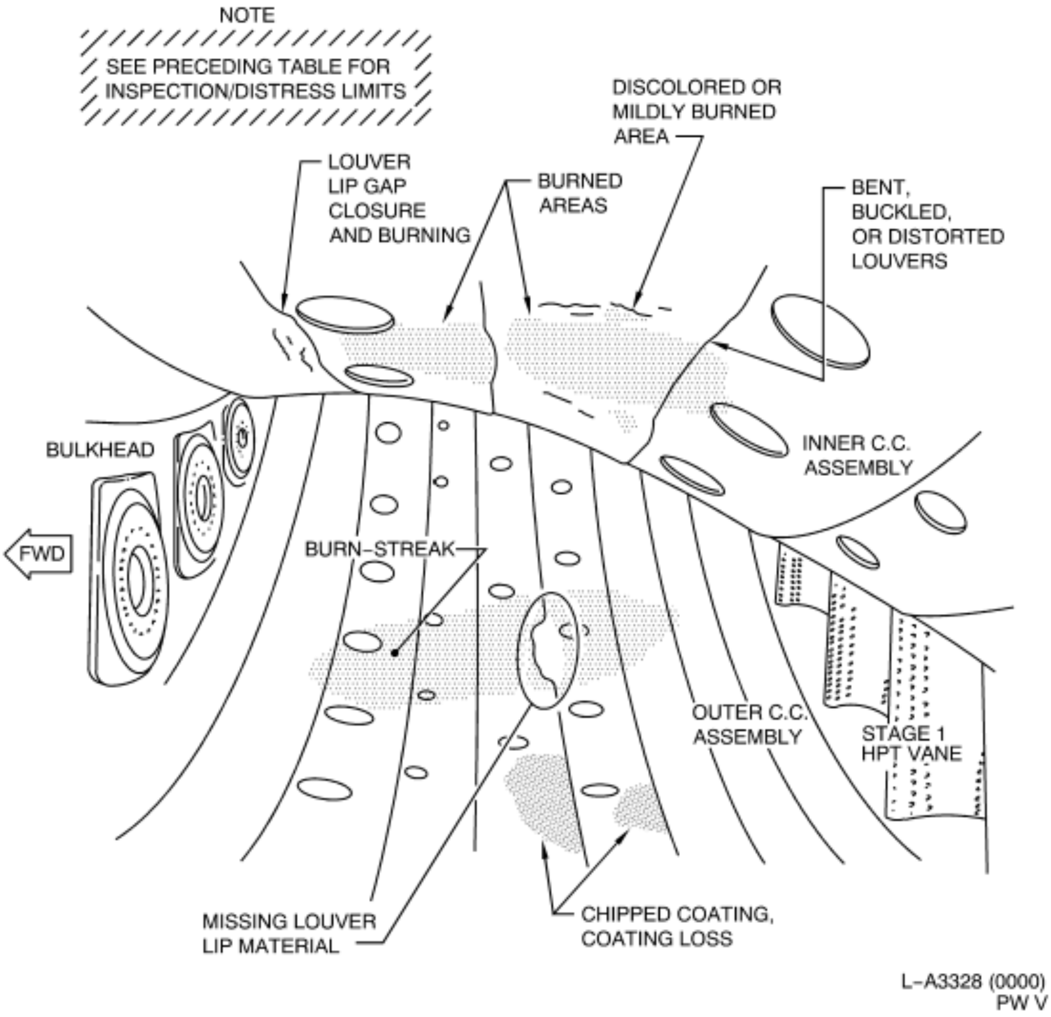
Outer Combustion Chamber Assembly Bulkhead/Fuel Injector Area
Figure 809
(Task 72−00−00−210−020)


NOTE
SEE PRECEDING TABLE FOR INSPECTION/DISTRESS LIMITS
BURN HOLE
CRACK LENGTH
CRACK LENGTH
BURN HOLE
CRACK LENGTH
L−A3327 (0000)
PW V

Inner And Outer Combustion Chamber
Assemblies Burn−Hole And Crack Intersection
Figure 810
(Task 72−00−00−210−020)

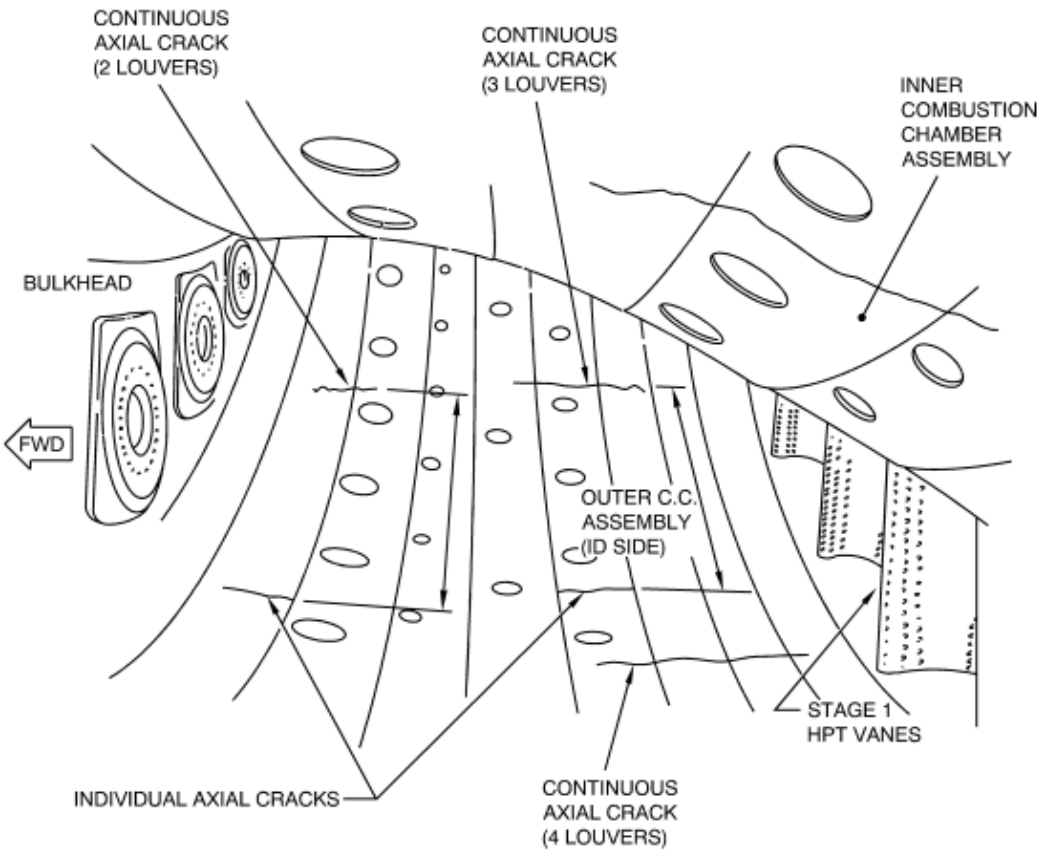

NOTE
SEE PRECEDING TABLE FOR INSPECTION/DISTRESS LIMITS
MATERIAL BURN−THROUGH (OPEN HOLE)
BURNED COATING OR ERRODED MATERIAL
FUEL INJECTOR
FWD
MATERIAL BURN−THROUGH (OPEN HOLE) CIRCUMFERENTIAL SPACING
INNER C.C. ASSEMBLY
BURN−THROUGH OPEN HOLE AXIAL SPACING
BURN−THROUGH (OPEN HOLE)
STAGE 1 HPT VANES
OUTER C.C. ASSEMBLY
" LOUVER LIP" REGION : LAST 0.125 INCH (3.175 mm) OF MATERIAL ON EACH LOUVER
LOUVER BODY : BALANCE OF LOUVER MATERIAL
L−A3325 (0000)
PW V

Combustion Chamber (C.C) Assembly Inspection/Distress Limits
Figure 811
(Task 72−00−00−210−020)


NOTE
SEE PRECEDING TABLE FOR INSPECTION/DISTRESS LIMITS
DISCOLORED OR MILDLY BURNED AREA
LOUVER LIP GAP CLOSURE AND BURNING
BURNED AREAS
BENT, BUCKLED, OR DISTORTED LOUVERS
INNER C.C. ASSEMBLY
BULKHEAD
FWD
BURN−STREAK
OUTER C.C. ASSEMBLY
STAGE 1 HPT VANE
MISSING LOUVER LIP MATERIAL
CHIPPED COATING, COATING LOSS
L−A3328 (0000)
PW V

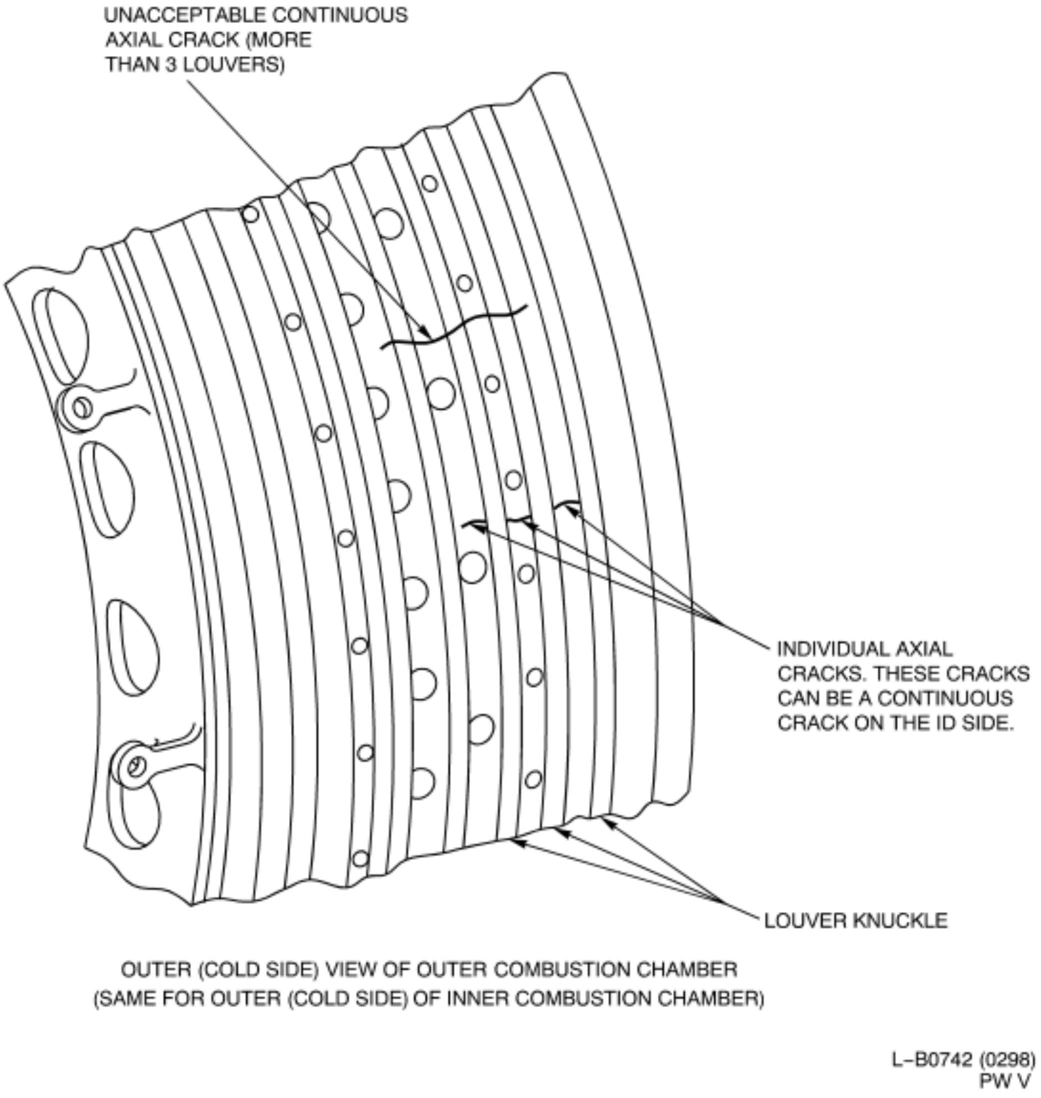
Combustion Chamber (C.C) Assembly Inspection/Distress Limits
Figure 812
(Task 72−00−00−210−020)

NOTE
SEE PRECEDING TABLE FOR INSPECTION/DISTRESS LIMITS

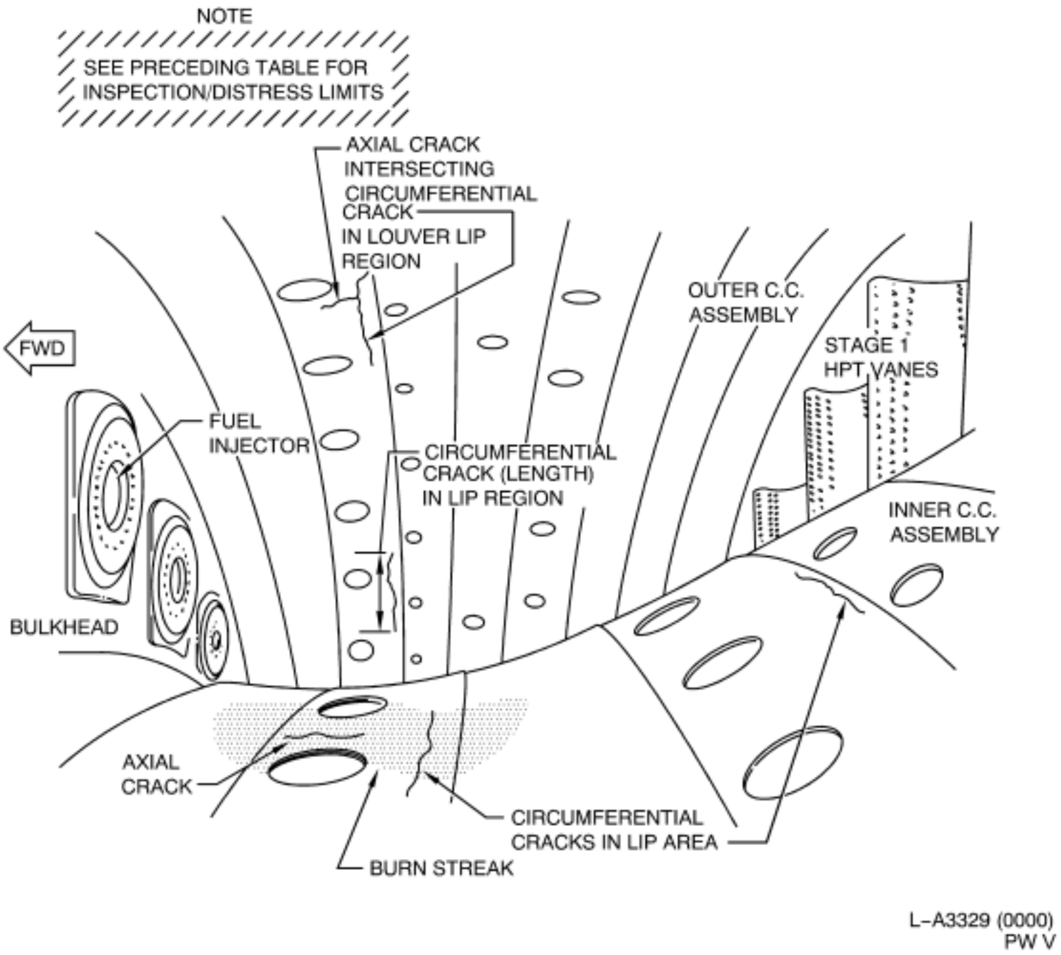

CONTINUOUS AXIAL CRACK (2 LOUVERS)
CONTINUOUS AXIAL CRACK (3 LOUVERS)
INNER COMBUSTION CHAMBER ASSEMBLY
BULKHEAD
FWD
OUTER C.C. ASSEMBLY (ID SIDE)
STAGE 1 HPT VANES
INDIVIDUAL AXIAL CRACKS
CONTINUOUS AXIAL CRACK (4 LOUVERS)

L-B7800 (0200)
PW V

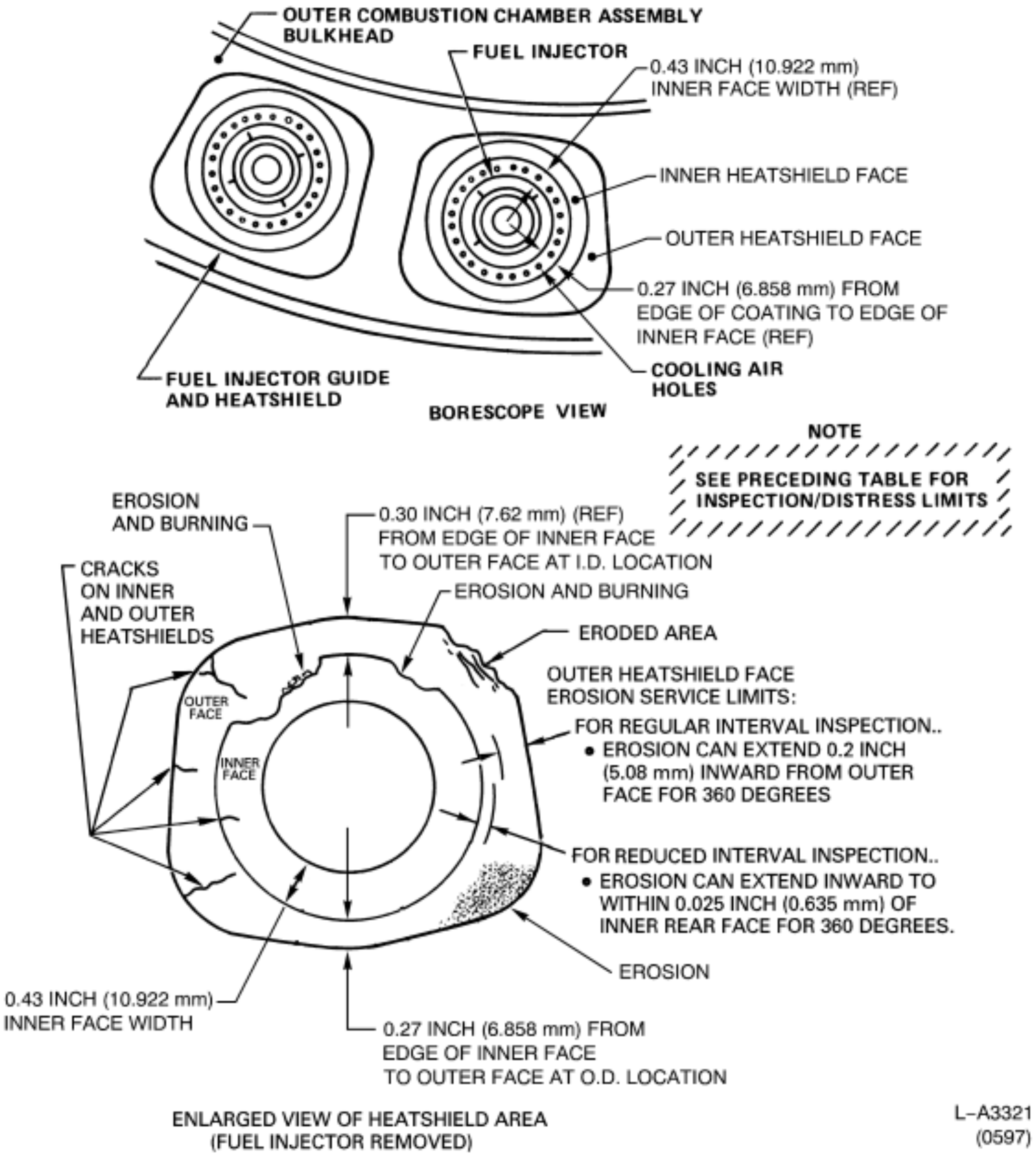
Combustion Chamber (C.C) Assembly Inspection/Distress Limits
Figure 813 (Sheet 1)
(Task 72-00-00-210-020)


UNACCEPTABLE CONTINUOUS AXIAL CRACK (MORE THAN 3 LOUVERS)
INDIVIDUAL AXIAL CRACKS. THESE CRACKS CAN BE A CONTINUOUS CRACK ON THE ID SIDE.
LOUVER KNUCKLE
OUTER (COLD SIDE) VIEW OF OUTER COMBUSTION CHAMBER
(SAME FOR OUTER (COLD SIDE) OF INNER COMBUSTION CHAMBER)
L−B0742 (0298)
PW V

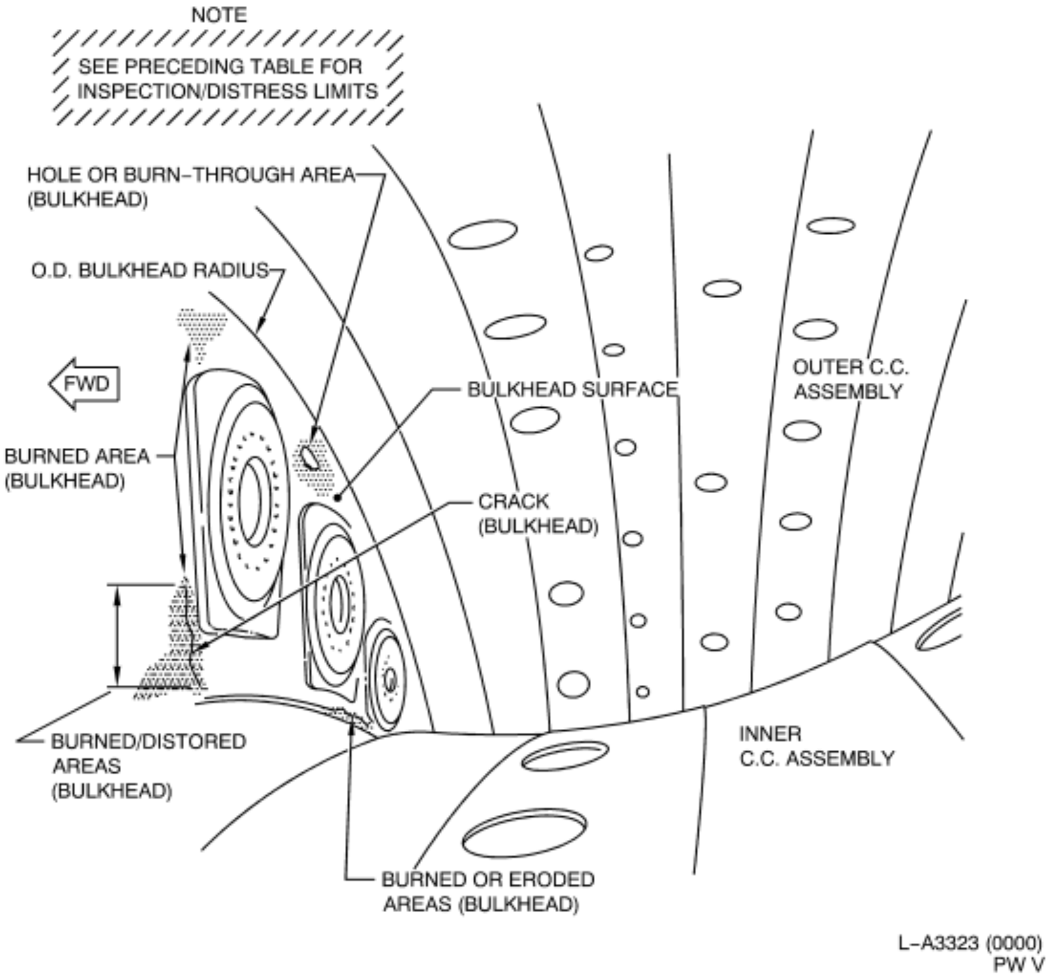
Combustion Chamber (C.C) Assembly Inspection/Distress Limits
Figure 813 (Sheet 2)
(Task 72−00−00−210−020)


NOTE
SEE PRECEDING TABLE FOR INSPECTION/DISTRESS LIMITS
AXIAL CRACK INTERSECTING CIRCUMFERENTIAL CRACK IN LOUVER LIP REGION
FWD
OUTER C.C. ASSEMBLY
STAGE 1 HPT VANES
FUEL INJECTOR
CIRCUMFERENTIAL CRACK (LENGTH) IN LIP REGION
INNER C.C. ASSEMBLY
BULKHEAD
AXIAL CRACK
CIRCUMFERENTIAL CRACKS IN LIP AREA
BURN STREAK
L−A3329 (0000)
PW V

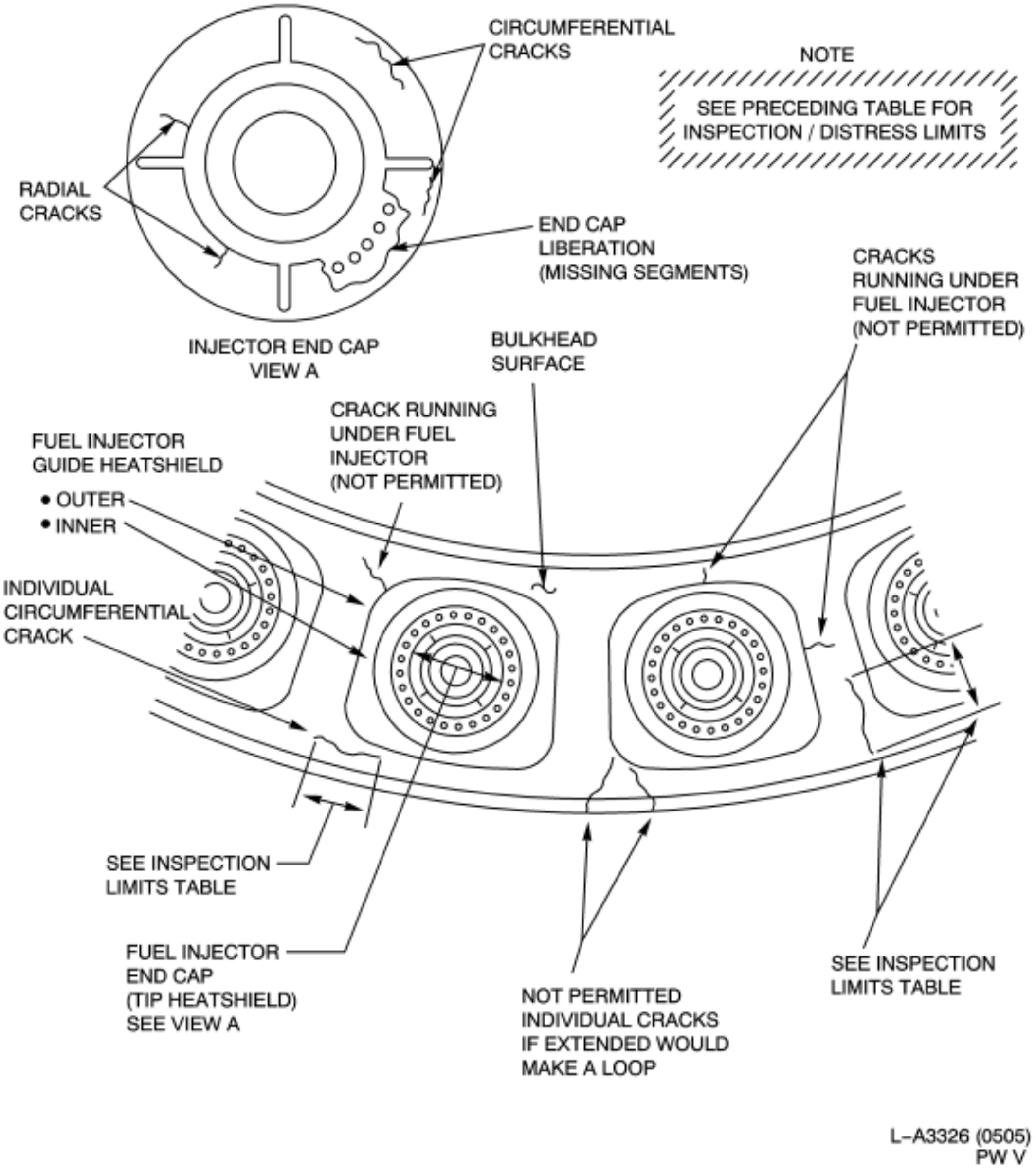
Combustion Chamber (C.C) Assembly Inspection/Distress Limits
Figure 814
(Task 72−00−00−210−020)


OUTER COMBUSTION CHAMBER ASSEMBLY BULKHEAD
FUEL INJECTOR
0.43 INCH (10.922 mm) INNER FACE WIDTH (REF)
INNER HEATSHIELD FACE
OUTER HEATSHIELD FACE
0.27 INCH (6.858 mm) FROM EDGE OF COATING TO EDGE OF INNER FACE (REF)
COOLING AIR HOLES
FUEL INJECTOR GUIDE AND HEATSHIELD
BORESCOPE VIEW
NOTE
SEE PRECEDING TABLE FOR INSPECTION/DISTRESS LIMITS
EROSION AND BURNING
CRACKS ON INNER AND OUTER HEATSHIELDS
0.30 INCH (7.62 mm) (REF) FROM EDGE OF INNER FACE TO OUTER FACE AT I.D. LOCATION
EROSION AND BURNING
ERODED AREA
OUTER HEATSHIELD FACE EROSION SERVICE LIMITS:
FOR REGULAR INTERVAL INSPECTION..
• EROSION CAN EXTEND 0.2 INCH (5.08 mm) INWARD FROM OUTER FACE FOR 360 DEGREES
OUTER FACE
INNER FACE
FOR REDUCED INTERVAL INSPECTION..
• EROSION CAN EXTEND INWARD TO WITHIN 0.025 INCH (0.635 mm) OF INNER REAR FACE FOR 360 DEGREES.
EROSION
0.43 INCH (10.922 mm) INNER FACE WIDTH
0.27 INCH (6.858 mm) FROM EDGE OF INNER FACE TO OUTER FACE AT O.D. LOCATION
ENLARGED VIEW OF HEATSHIELD AREA (FUEL INJECTOR REMOVED)
L-A3321
(0597)

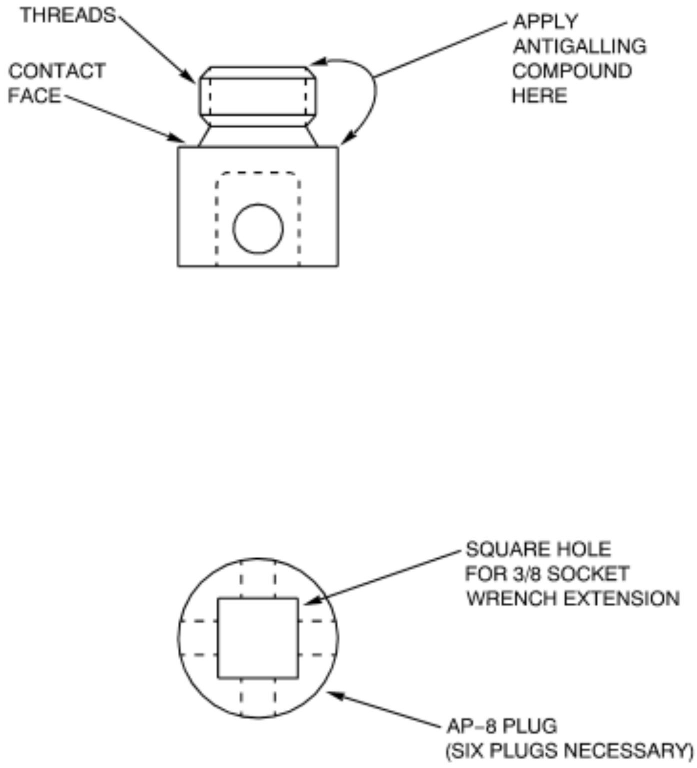
Combustion Chamber (C.C) Assembly Inspection/Distress Limits
Figure 815
(Task 72-00-00-210-020)


NOTE
SEE PRECEDING TABLE FOR INSPECTION/DISTRESS LIMITS
HOLE OR BURN-THROUGH AREA (BULKHEAD)
O.D. BULKHEAD RADIUS
FWD
BURNED AREA (BULKHEAD)
BULKHEAD SURFACE
OUTER C.C. ASSEMBLY
CRACK (BULKHEAD)
BURNED/DISTORED AREAS (BULKHEAD)
INNER C.C. ASSEMBLY
BURNED OR ERODED AREAS (BULKHEAD)
L-A3323 (0000)
PW V

Combustion Chamber (C.C) Assembly Inspection/Distress Limits
Figure 816
(Task 72-00-00-210-020)


CIRCUMFERENTIAL CRACKS
NOTE
SEE PRECEDING TABLE FOR INSPECTION / DISTRESS LIMITS
RADIAL CRACKS
END CAP LIBERATION (MISSING SEGMENTS)
CRACKS RUNNING UNDER FUEL INJECTOR (NOT PERMITTED)
INJECTOR END CAP VIEW A
BULKHEAD SURFACE
CRACK RUNNING UNDER FUEL INJECTOR (NOT PERMITTED)
FUEL INJECTOR GUIDE HEATSHIELD
• OUTER
• INNER
INDIVIDUAL CIRCUMFERENTIAL CRACK
SEE INSPECTION LIMITS TABLE
FUEL INJECTOR END CAP (TIP HEATSHIELD) SEE VIEW A
NOT PERMITTED INDIVIDUAL CRACKS IF EXTENDED WOULD MAKE A LOOP
SEE INSPECTION LIMITS TABLE
L-A3326 (0505)
PW V

Combustion Chamber (C.C) Assembly Inspection/Distress Limits
Figure 817
(Task 72-00-00-210-020)


THREADS
CONTACT FACE
APPLY ANTIGALLING COMPOUND HERE
SQUARE HOLE FOR 3/8 SOCKET WRENCH EXTENSION
AP−8 PLUG (SIX PLUGS NECESSARY)

L−B8277 (0800)
PW V

R View Of AP−8 Plugs Removed From The Engine
R Figure 818
R (Task 72−00−00−210−020)

ENGINE GENERAL − INSPECTION/CHECK−01D

Task 72−00−00−210−029:

1. Perform Borescope Inspection Of Combustion Chamber Area (AP−8)

A. General

CAUTION: IT IS NOT RECOMMENDED THAT A LARGE QUANTITY OF PARTS CONTINUE IN SERVICE THAT ARE DAMAGED TO THE MAXIMUM LIMITS. IF THEY DO CONTINUE, DECREASED ENGINE PERFORMANCE AND DECREASED PART LIFE CAN BE THE RESULT. THE BORESCOPE DAMAGE LIMITS IN THIS PROCEDURE ARE CALCULATED FROM TESTING AND STRUCTURAL ANALYSIS SPECIFICATIONS.

(1) Use this borescope procedure to examine the combustion chamber area for damage.

B. Equipment And Materials Necessary

Standard Tools:
See Inspection/Check−01A (Task 72−00−00−990−011) for borescope equipment.

Consumable Materials:

Item No.	Designation
P05−289	Lockwire
P06−023	Thread Lubricant (PWA 36001 or PMC 9940)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	6	72−41−00/1/130A

C. Procedure

(1) Remove the six AP−8 access port plugs from the diffuser case as follows: See Figure 801.

NOTE: Table 801 shows more specifications for the plugs at location AP−8.

(a) Cut the safety wire and remove the safety wire from the plugs that will be removed.

(b) Use a standard 3/8 socket drive extension and a breaker bar or ratchet to remove the AP−8 plugs.

(c) Remove the six AP−8 plugs and gaskets for the examination of the combustion chamber assembly.

NOTE: Although there are six usable AP−8 plugs, it is not necessary to remove all six plugs for every combustion chamber borescope inspection. Remove the number of AP−8 plugs that are necessary to do a 100 percent inspection of the combustion chamber assembly.

(d) Discard all the old gaskets.

Access Port & (Stage)	Angular Location Clockwise From Rear	Gasket P/N	Plug P/N	Plug Thread Lubricant	Plug Torque lb−in. (N.m)
AP−8	45° (1:30 o'clock)	512640	50A725	P06−023	40 − 50 (4.519 − 5.649)
AP−8	127° (4:30 o'clock)	512640	50A725	P06−023	40 − 50 (4.519 − 5.649)
AP−8	172° (6:00 o'clock)	512640	50A725	P06−023	40 − 50 (4.519 − 5.649)
AP−8	225° (7:30 o'clock)	512640	50A725	P06−023	40 − 50 (4.519 − 5.649)
AP−8	277° (9:00 o'clock)	512640	50A725	P06−023	40 − 50 (4.519 − 5.649)
AP−8	338° (11:00 o'clock)	512640	50A725	P06−023	40 − 50 (4.519 − 5.649)

For Engines Equipped:

NOTE: If the high stage temp sensor was removed to borescope through the (338°C) 11:00 o'clock port, reinstall per Section 71−00−41, Installation−04.

Borescope Access Port (AP) Data
Table 801

CAUTION: THE TEMPERATURES IN THE AREA OF THE ENGINE TO BE EXAMINED WITH THE BORESCOPE MUST BE LESS THAN 150°F (65.6°C). DAMAGE CAN RESULT TO THE BORESCOPE EQUIPMENT IF THE GASPATH OR METAL TEMPERATURES ARE MORE THAN 150°F (65.6°C). IF YOU CAN COMFORTABLY TOUCH THE CASES ADJACENT TO THE BORESCOPE PORT, IT IS SAFE TO DO THE BORESCOPE INSPECTION.

(2) Carefully put a flexible borescope through each of the access ports (AP-8) for the examination of the combustion chamber assembly. See Figure 802.

NOTE: A flexible borescope is necessary for the borescope inspection of the combustion chamber. Since holes in the combustion liner do not exactly align with the AP-8 ports in the diffuser case. See Figure 802. Do not use a ridge borescope.

(3) Carefully examine the inner combustion chamber assembly liner segments for damage.

(4) Carefully examine the outer combustion chamber assembly liner segments for damage.

(5) Carefully examine the combustion chamber bulkhead segments for damage.

(6) Carefully examine the fuel injector end caps and guides for damage.

(7) Technical names for combustion chamber parts for this inspection procedure. Use the names shown when you write inspection reports to prevent errors. See Figure 803 (Sheets 1 and 2).

(a) Use the part names shown in the figures for all the different parts and shapes of the inner and outer combustion chamber assembly.

(b) See the figures for the specifications of the names of axial, radial, and circumferential for the inner and outer combustion chamber assemblies.

(8) Technical names for combustion chamber damage. Use the names that follow when you write about damage in inspection reports. See Figure 804 and Figure 805.

(a) Burned material is an area in which a louver is discolored, distorted, or liner segment material is not there.

(b) A burn streak is an axial damage area of liner segments with burned material and material that is not there.

(c) A hole is an area which has burned fully through a liner segment. Holes frequently occur with burn streaks.

(9) To help you measure the crack or damage length, use the figures that follow. These figures give combustion hole dimensions for reference. See Figure 806 and Figure 807.

(10) Permitted service damage limits for the combustion chamber assembly are as follows.

(a) Borescope inspection limits are shown in tabular form. See Table 802.

(b) The permitted service damage limits shown in Table 802 are calculated from structural analysis specifications only. If the parts are operated when damaged to the maximum limits, it is possible that the parts can not be repaired at overhaul.

(c) If the combustion chamber assembly is damaged to the Regular Inspection Interval limits (shown in Table 802) the engine can continue in service. This engine must have the combustion chamber examined again at the Regular Inspection Interval.

NOTE: See the Aircraft Maintenance Planning Document for the time limits for each type inspection interval.

(d) If the combustion chamber assembly is damaged to the Reduced Inspection Interval limits (half the Regular Inspection Interval) the engine can continue in service. This engine must have the combustion chamber examined again at the Reduced Inspection Interval.

(e) If the combustion chamber assembly is damaged to the Additional Reduced Inspection Interval limits (1/4 the Regular Inspection Interval) the engine can continue in service. This engine must have the combustion chamber examined again at the Additional Reduced Inspection Interval.

(f) If the combustion chamber assembly is damaged more than the Additional Reduced Inspection Interval limits, the engine can not continue in service. It is permitted to ferry the aircraft for a maximum of five cycles only to a repair station. This engine must be removed for repair of the combustion chamber assembly.

COMBUSTION CHAMBER PERMITTED DAMAGE LIMITS

EXAMINE	DAMAGE	DISPOSITION
Liner segments with combustion or igniter holes or igniter holes for cracks (with or without burning)	One axial crack for the full length of the segment and through a combustion or igniter hole. See Figure 808 (Sheets 1 and 2).	Permitted for Regular Inspection Interval.
	One axial crack with burning downstream of any combustion or igniter hole. The width of distress must be less than the diameter of the hole. See Figure 808 (Sheet 2).	Permitted for Regular Inspection Interval.
	Two axial cracks, each for the full length of the segment and through a combustion hole. Both cracks must be apart by one combustion hole without a crack. Two axial cracks, each for the full length of the segment through each igniter hole. See Figure 808 (Sheets 1 and 2).	Permitted for Reduced Inspection Interval.
	Two or more cracks downstream of a combustion or igniter hole. One crack goes from a combustion or igniter hole to the trailing edge and no other crack goes more than half the distance to the same	Permitted for Additional Reduced Inspection Interval.

Combustion Chamber Area Borescope Inspection Damage Limits
Table 802

COMBUSTION CHAMBER PERMITTED DAMAGE LIMITS

EXAMINE	DAMAGE	DISPOSITION
(CONTINUED)	combustion hole or trailing edge. See Figure 808 (Sheet 3).	
	For igniter segment, one axial crack with burning around and downstream of the hole. The width of the ditress must be less than 0.9 inch (22.86 mm). See Figure 808 (Sheet 2).	Permitted for Reduced Inspection Interval.
	For igniter segment, one axial crack with burning around and downstream of the hole. The width of the ditress must be less than 1.2 inch (30.480 mm). See Figure 808 (Sheet 2).	Permitted for Addition Reduced Inspection Interval.
	A crack in any area that goes in the direction to an other crack. The other crack goes 0.25 inch (6.35 mm) minimum distance to the first crack. Both cracks start from the same edge or combustion hole. See Figure 808 (Sheet 4).	Permitted for Additional Reduced Inspection Interval.
	A cracked piece of liner that is less than 0.3 inch (7.62 mm) on the longest side that could soon break off with continued use.	Permitted for Additional Reduced Inspection Interval.
	A cracked piece of liner that is more than 0.3 inch (7.62 mm) on the longest side that could soon break off with continued use.	Remove Engine in 5 Cycles Maximum or less.
Liner segments without combustion holes for cracks (with or without burning)	One axial crack for the full length of the segment. See Figure 808 (Sheet 4).	Permitted for Regular Inspection Interval.

Combustion Chamber Area Borescope Inspection Damage Limits
Table 802 (Continued)

COMBUSTION CHAMBER PERMITTED DAMAGE LIMITS

EXAMINE	DAMAGE	DISPOSITION
(CONTINUED)		
	One axial crack for the full length of the segment and a second crack that goes 1/2 the axial distance (or more) of the segment.	Permitted for Additional Reduced Inspection Interval.
	A crack in any area that goes in a direction to another crack. the other crack goes 0.25 inch (6.35 mm) minium distance to the first crack. Both cracks start from the same edge. See Figure 808 (Sheet 4).	Permitted for Additional Reduced Inspection Interval.
	A cracked piece of liner that is less than 0.3 inch (7.62 mm) on the longest side that could soon break off with contuied use.	Permitted for Additional Reduced Inspection Interval.
	A cracked piece of liner that is more than 0.3 inch (7.62 mm) on the longest side that could soon break off with continued use.	Remove Engine in 5 Cycles Maximum or less.
Outer liner segments for burn-back on the trailing edge, leading edge, or side edge of Rows 1 thru 6 and inner liner segments Rows 1 thru 6.	Burn-back area for an axial distance of 0.3 - 0.5 inch (7.6 - 12.7 mm) from the trailing edge, (measure to a not burned edge surface). See Figure 808 (Sheet 5).	Permitted for Reduced Inspection Interval.
	Burn-back area for an axial distance of 0.5 - 1.0 inch (12.7 - 25.4 mm) from the trailing edge, (measure to a not burned edge surface). Attachment posts may be visible, but not missing. See Figure 808 (Sheet 5).	Permitted for Additional Reduce Inspection Interval

Combustion Chamber Area Borescope Inspection Damage Limits
Table 802 (Continued)

COMBUSTION CHAMBER PERMITTED DAMAGE LIMITS

EXAMINE	DAMAGE	DISPOSITION
(CONTINUED)		
	Burn-back area for an axial distance of more than 1.0 inch (25.400 mm) from the edge, (measure to a not burned trailing edge surface). Attachment posts may be visible, but not missing. See Figure 808 (Sheet 5).	Permitted for 50 hour inspection interval.
	Burn-back has caused liner shell damage or missing an attachment post because of burn-back.	Remove Engine in 5 Cycles Maximum or less.
Outer liner segments for thermal barrier coating that is not there, (gone).	Any quantity of thermal barrier coating is permitted to not be there but can cause increased liner segment deterioration.	Permitted for Regular Inspection Interval.
Liner segments for surface burns or burn holes.	Any quantity of surface burn (but not burned through).	Permitted for Regular Inspection Interval.
	A burn hole larger than 0.25 inch (6.350 mm). See Figure 808 (Sheet 6).	Permitted for Reduced Inspection Interval
	A burn hole larger than 0.40 inch (10.16 mm) See Figure 808 (Sheet 6).	Permitted for Additional Reduced Inspection Interval.
	Burn holes and cracks that will soon cause a piece of material that is less than 0.3 inch (7.62 mm) on the longest side to break off with continued use. See Figure 808 (Sheet 6).	Permitted for Additional Reduced Inspection Interval.

Combustion Chamber Area Borescope Inspection Damage Limits
Table 802 (Continued)

COMBUSTION CHAMBER PERMITTED DAMAGE LIMITS

EXAMINE	DAMAGE	DISPOSITION
(CONTINUED)		
	Burn holes and cracks that will soon cause a piece of material that is larger than 0.3 inch (7.6 mm) on the longest side to break off with continued use.	Remove Engine in 5 Cycles Maximum or less.
	Surface burns or burn holes that cause liner shell damage or you can see an attachment post because of surface burns or burn holes.	Remove Engine in 5 Cycles Maximum or less.
Liner segments, bulkhead, and fuel injector guide cone for material that is not there, (gone/broken off).	Any material that is gone (broken off) now but was there at the last inspection interval.	Do a borescope inspection of the HPT Stage 1 vanes, Stage 1 and 2 blades for impact damage. (If the material was gone at the last inspection interval, it is not necessary to do the HPT borescope inspection again). If no damage is seen on the HPT, apply burn back or burn hole limits to each respective area.
Bulkhead segments for thermal barrier coating that is not there, (gone).	Any quantity of thermal barrier coating not there (gone) is permitted but can cause increased liner segment deterioration. See Figure 809 (Sheets 1 and 2).	Permitted for Regular inspection interval.

Combustion Chamber Area Borescope Inspection Damage Limits
Table 802 (Continued)

COMBUSTION CHAMBER PERMITTED DAMAGE LIMITS

EXAMINE	DAMAGE	DISPOSITION
Bulkhead segments for burning.	Any quantity of surface burn (but not a burn hole).	Permitted for Regular inspection interval.
Bulkhead segments for burnback on trailing edges, side edges, or edge of fuel injector hole.	Erosion on edges less than 0.500 inch (12.700 mm) in length by 0.100 inch (2.540 mm) in width.	Permitted for Regular inspection interval.
Bulkhead segments for burned holes.	Burn holes.	Permitted for Reduced inspection interval.
Bulkhead segments for cracks, (radial and circumferential).	Cracks less than 0.2 inch (5.08 mm) in length. See Figure 809 (Sheet 2).	Permitted for Regular Inspection Interval.
	Radial and circumferential cracks are permitted to a 0.50 inch (12.7 mm) maximum length and separated by 2.0 inches (50.8 mm). See Figure 809 (Sheet 2).	Permitted for Reduced Inspection Interval.
	A cracked piece of bulkhead segment that is less than 0.3 inch (7.62 mm) on the longest side that could break off with continued use. See Figure 809 (Sheet 2).	Permitted for Additional Reduced inspection interval.
	Cracks that will soon make a closed loop and cause a piece of material (larger than 0.3 inch (7.620 mm) on the longest side) to break off are not permitted. See Figure 809 (Sheet 2).	Remove Engine in 5 Cycles Maximum or less.

Combustion Chamber Area Borescope Inspection Damage Limits
Table 802 (Continued)

COMBUSTION CHAMBER PERMITTED DAMAGE LIMITS

EXAMINE	DAMAGE	DISPOSITION
Fuel injector guide cone for cracks.	Any number of cracks less than 0.1 inch (2.54 mm). A crack is not permitted to touch another crack. See Figure 809 (Sheet 2).	Permitted for Regular Inspection Interval.
	Any number of cracks less than 0.15 inch (3.81 mm). A crack is not permitted to touch another crack. See Figure 809 (Sheet 2).	Permitted for Reduced Inspection Interval.
Fuel injector guide cone for erosion, material that is not there, (gone) and burning.	Edge erosion can go 0.1 inch (2.54 mm) forward from the rear face, all around for 360°.	Permitted for Regular Inspection Interval.
	Edge erosion can go to a distance of 0.15 inch (3.81 mm) forward from the rear face, all around for 360°. See Figure 809 (Sheet 2).	Permitted for Reduced Inspection Interval.
Fuel injector guide cone for thermal barrier coating that is not there, (gone).	Any quantity of thermal barrier coating is permitted to not be there but can cause increased deterioration.	Permitted for Regular Inspection Interval.
Fuel injector end cap for radial cracks.	No cracks permitted.	Remove Engine in 5 Cycles Maximum or less.
Fuel injector end cap for material that is not there, (gone).	Material that is not there, (gone) is not permitted.	Remove Engine in 5 Cycles Maximum or less.

Combustion Chamber Area Borescope Inspection Damage Limits
Table 802 (Continued)

(11) After you complete the borescope inspection, install the AP−8 plugs as follows: See Figure 810.

(a) Use a nylon brush to clean the old antigalling compound from the threads of each AP plug.

(b) Apply a thin layer of new antigalling compound to the threads and to the plug head washer contact surface area, see Figure 810. See Table 801 for the necessary antigalling compound.

NOTE: Do not use Engine Oil P03−001 on the AP plug threads.

(c) If you apply more antigalling compound than is necessary to the plug, remove the unwanted compound with a rag or cloth.

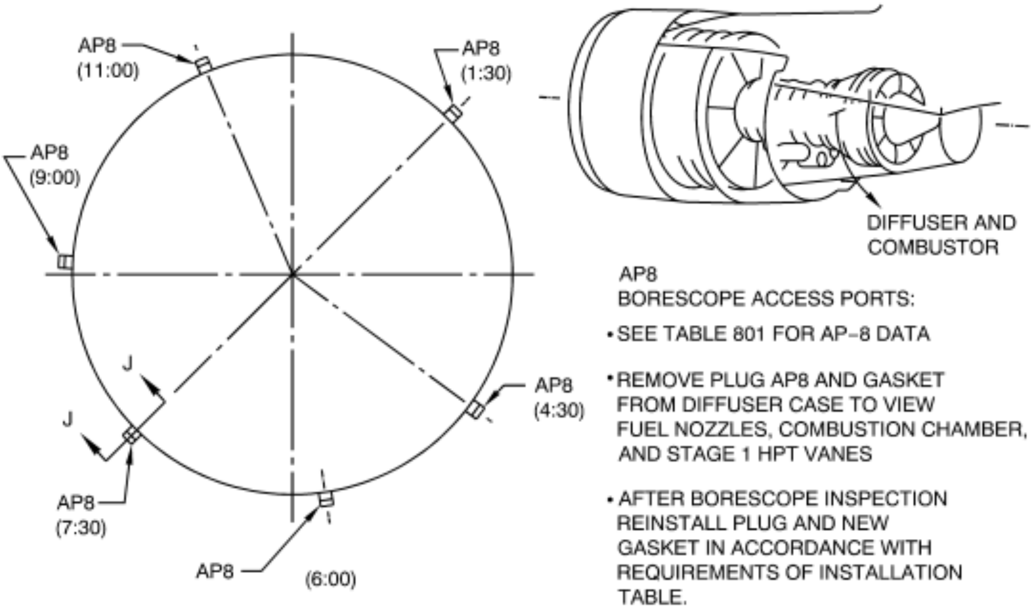
(d) Put a new gasket or washer on each AP plug. See Table 801 for the necessary gasket or washer.

NOTE: Always use a new gasket or washer. Do not use an old gasket or washer.

(e) Install the AP plugs and gaskets or washers in the applicable borescope boss on the engine. See Table 801 for the necessary AP plug and gasket or washer part numbers for each location. Use a standard socket drive extension and ratchet to turn each AP plug into the boss. Hand tighten the plug only with the ratchet wrench.

(f) Use a standard torque wrench to torque the AP plugs. See Table 801 for the necessary torque specifications.

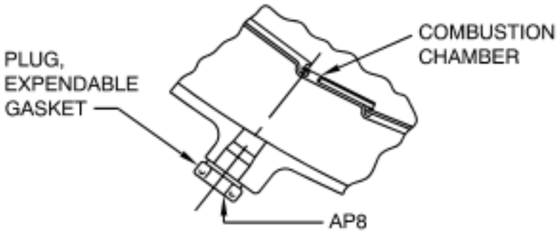
(g) Safety all the AP plugs with Lockwire P05−289.


AP8 (11:00)
AP8 (1:30)
AP8 (9:00)
J
J
AP8 (4:30)
AP8 (7:30)
AP8
(6:00)
DIFFUSER AND COMBUSTOR

AP8
BORESCOPE ACCESS PORTS:

- SEE TABLE 801 FOR AP−8 DATA
- REMOVE PLUG AP8 AND GASKET FROM DIFFUSER CASE TO VIEW FUEL NOZZLES, COMBUSTION CHAMBER, AND STAGE 1 HPT VANES
- AFTER BORESCOPE INSPECTION REINSTALL PLUG AND NEW GASKET IN ACCORDANCE WITH REQUIREMENTS OF INSTALLATION TABLE.

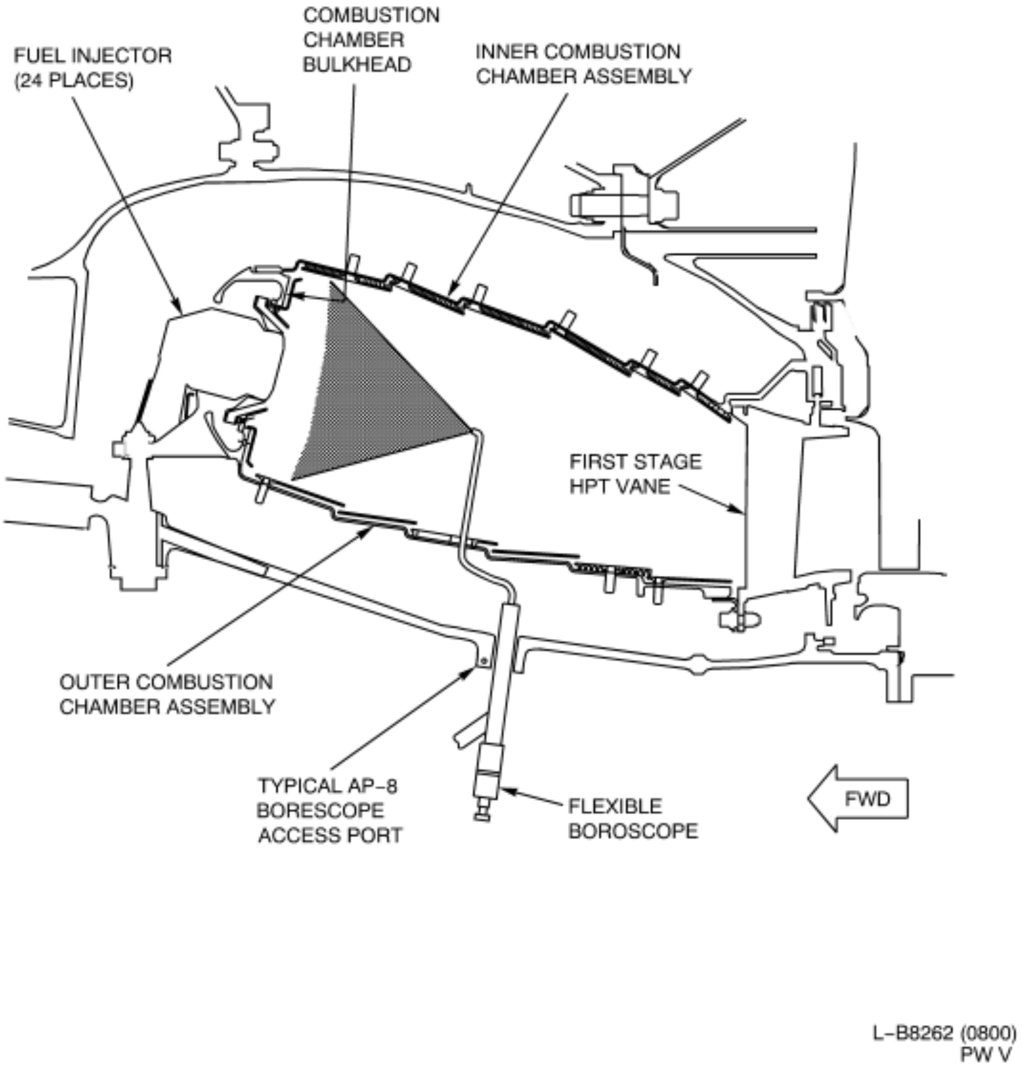
REAR VIEW
DIFFUSER AND COMBUSTOR
GROUP


COMBUSTION CHAMBER
PLUG, EXPENDABLE
GASKET
AP8

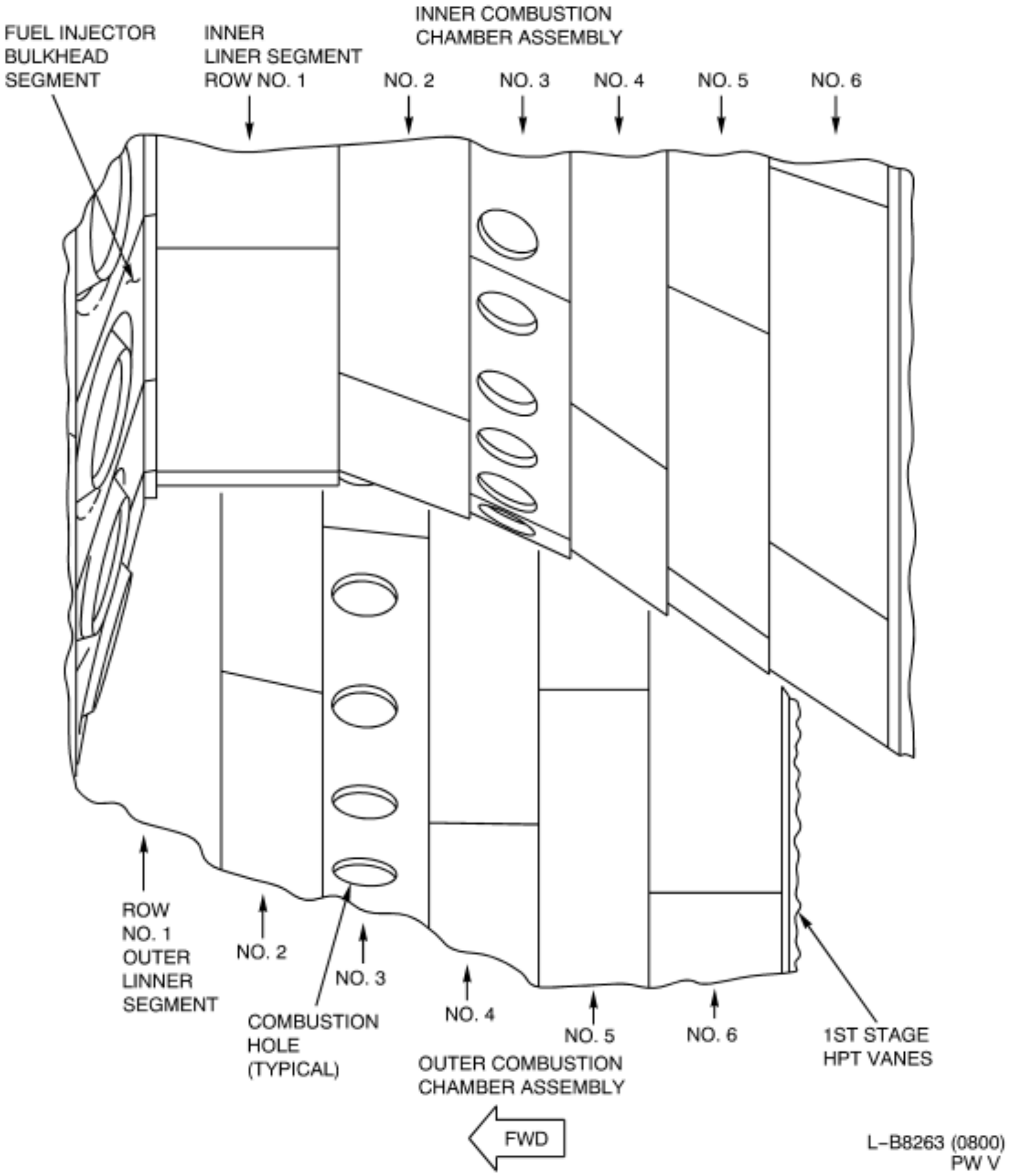
SECTION J−J
(1:30, 4:30, 6:00, 7:30, 9:00, 11:00 LOCATIONS)

L−B8280 (0800)
PW V

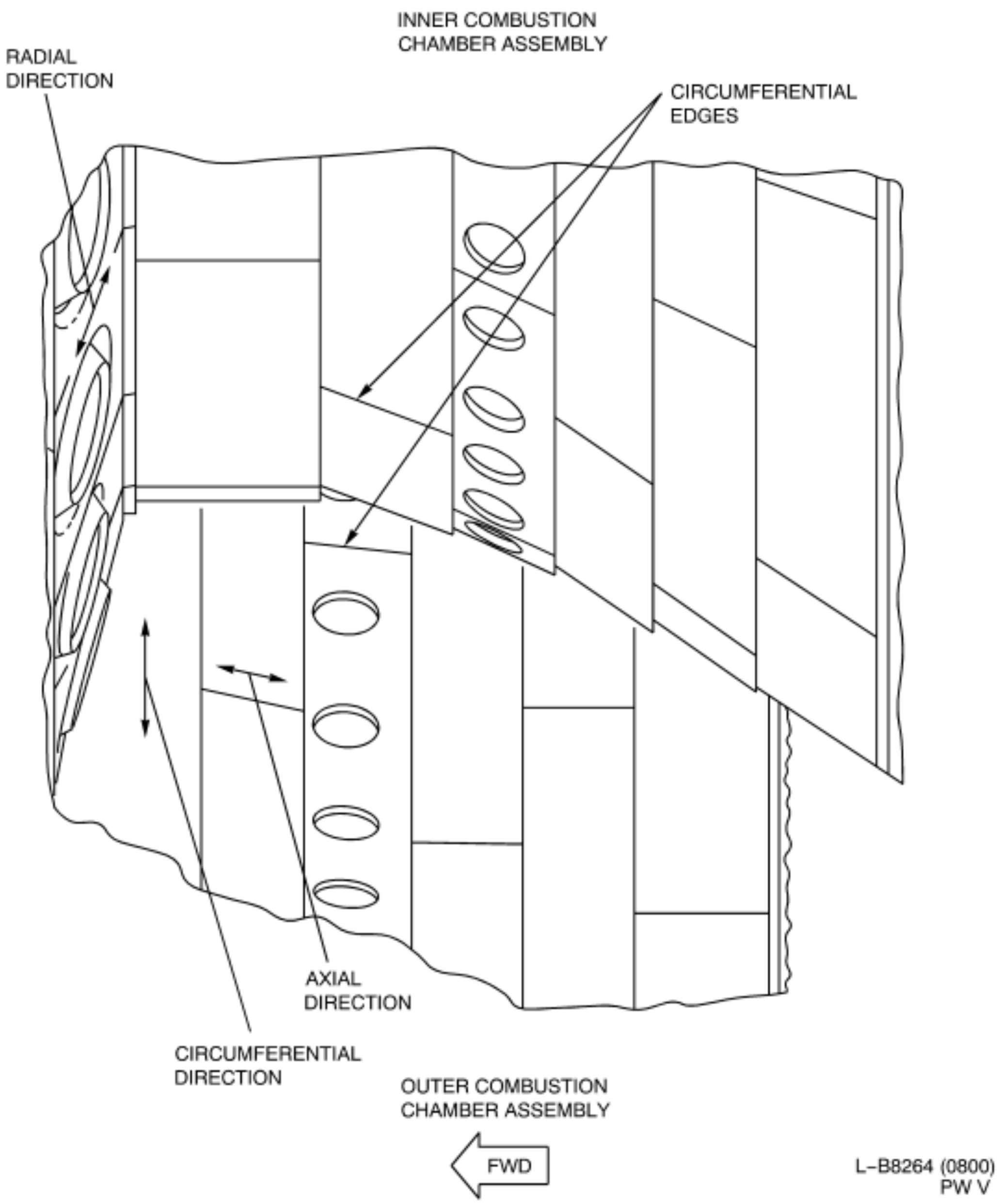
Diffuser Case Borescope Access Port AP−8
Figure 801
(Task 72−00−00−210−029)


COMBUSTION CHAMBER BULKHEAD
FUEL INJECTOR (24 PLACES)
INNER COMBUSTION CHAMBER ASSEMBLY
FIRST STAGE HPT VANE
OUTER COMBUSTION CHAMBER ASSEMBLY
TYPICAL AP−8 BORESCOPE ACCESS PORT
FLEXIBLE BOROSCOPE
FWD
L−B8262 (0800)
PW V

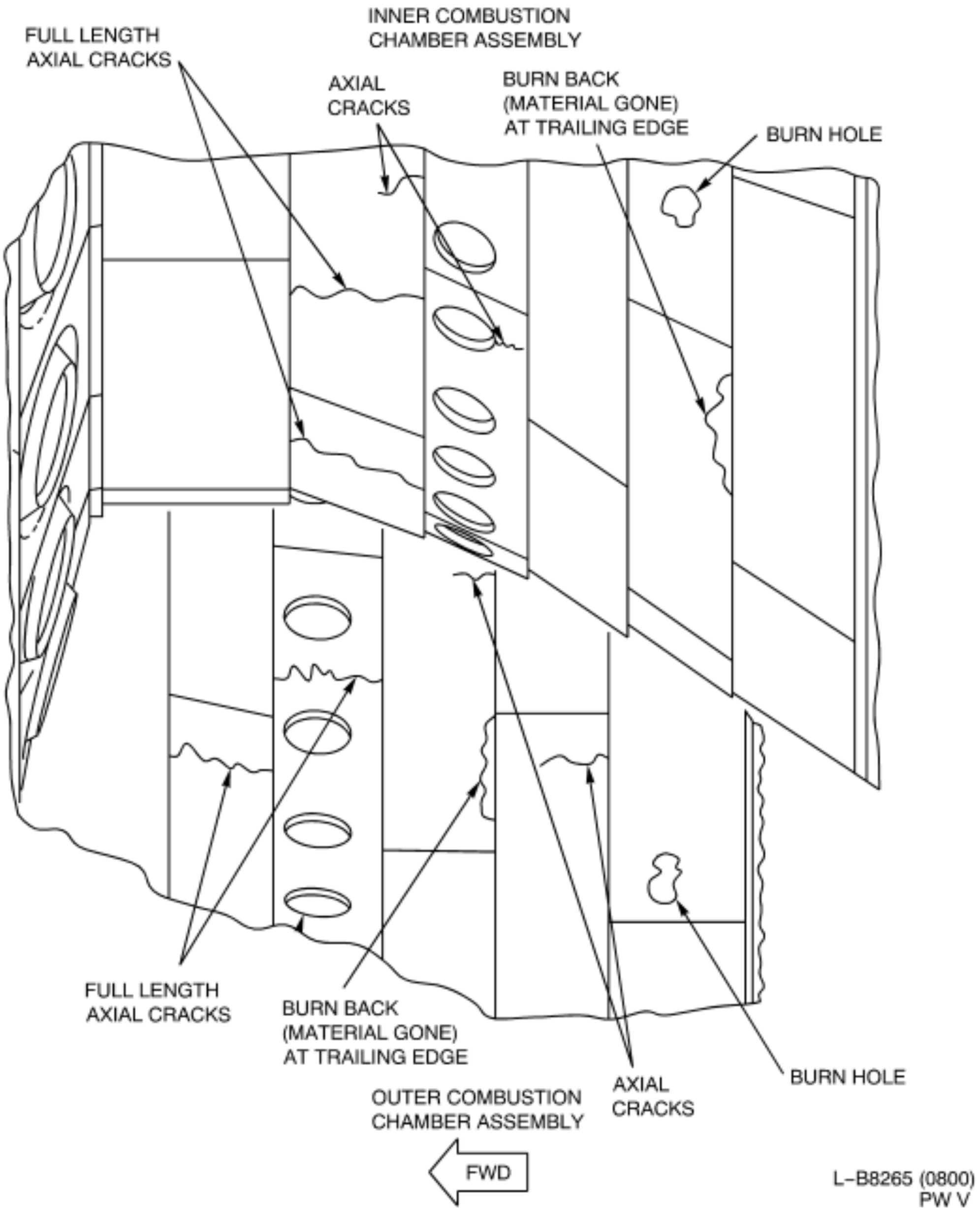
Borescope View Of Diffuser And Combuster Area (AP−8)
Figure 802
(Task 72−00−00−210−029)


FUEL INJECTOR BULKHEAD SEGMENT
INNER LINER SEGMENT ROW NO. 1
INNER COMBUSTION CHAMBER ASSEMBLY
NO. 2
NO. 3
NO. 4
NO. 5
NO. 6
ROW NO. 1 OUTER LINNER SEGMENT
NO. 2
COMBUSTION HOLE (TYPICAL)
NO. 3
NO. 4
NO. 5
NO. 6
OUTER COMBUSTION CHAMBER ASSEMBLY
1ST STAGE HPT VANES
FWD
L-B8263 (0800)
PW V

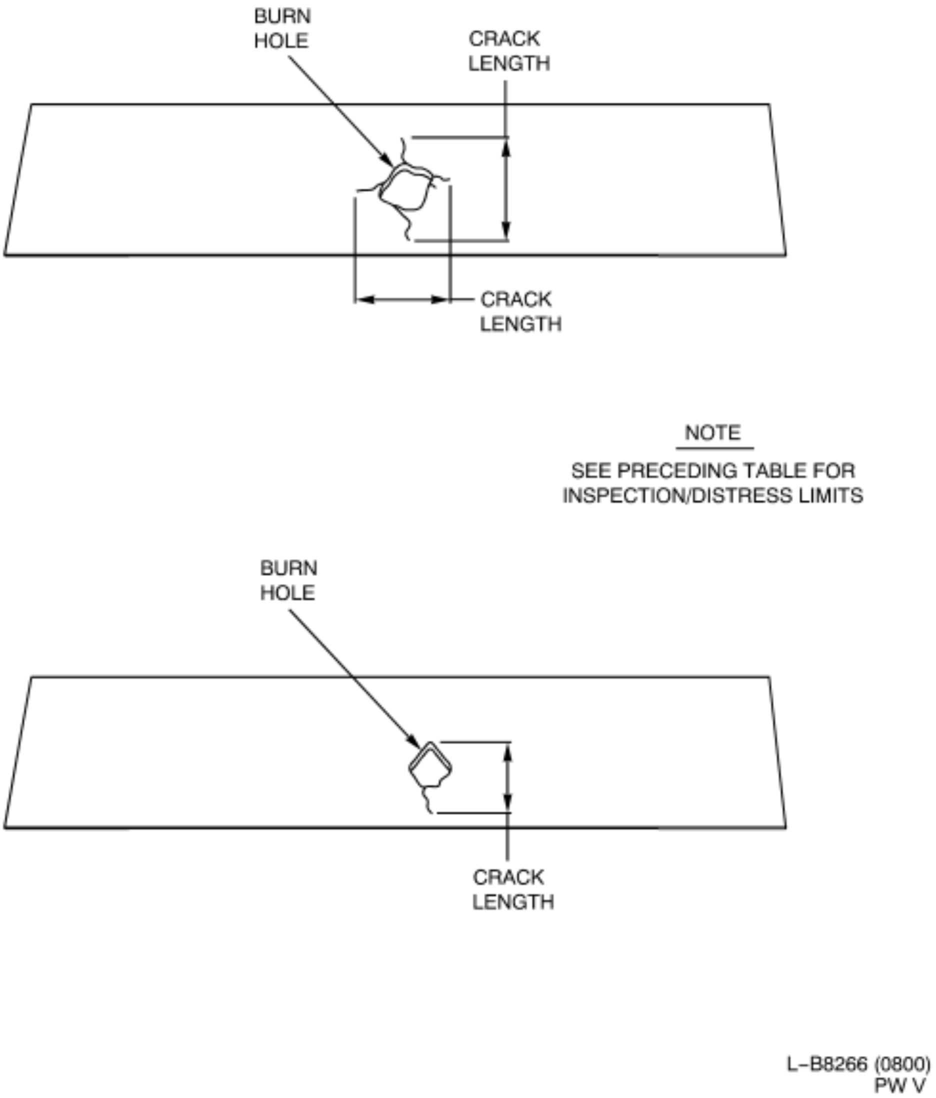
Identification Of Combustion Chamber Parts And Shapes
Figure 803 (Sheet 1)
(Task 72-00-00-210-029)


INNER COMBUSTION CHAMBER ASSEMBLY
RADIAL DIRECTION
CIRCUMFERENTIAL EDGES
AXIAL DIRECTION
CIRCUMFERENTIAL DIRECTION
OUTER COMBUSTION CHAMBER ASSEMBLY
FWD
L−B8264 (0800)
PW V

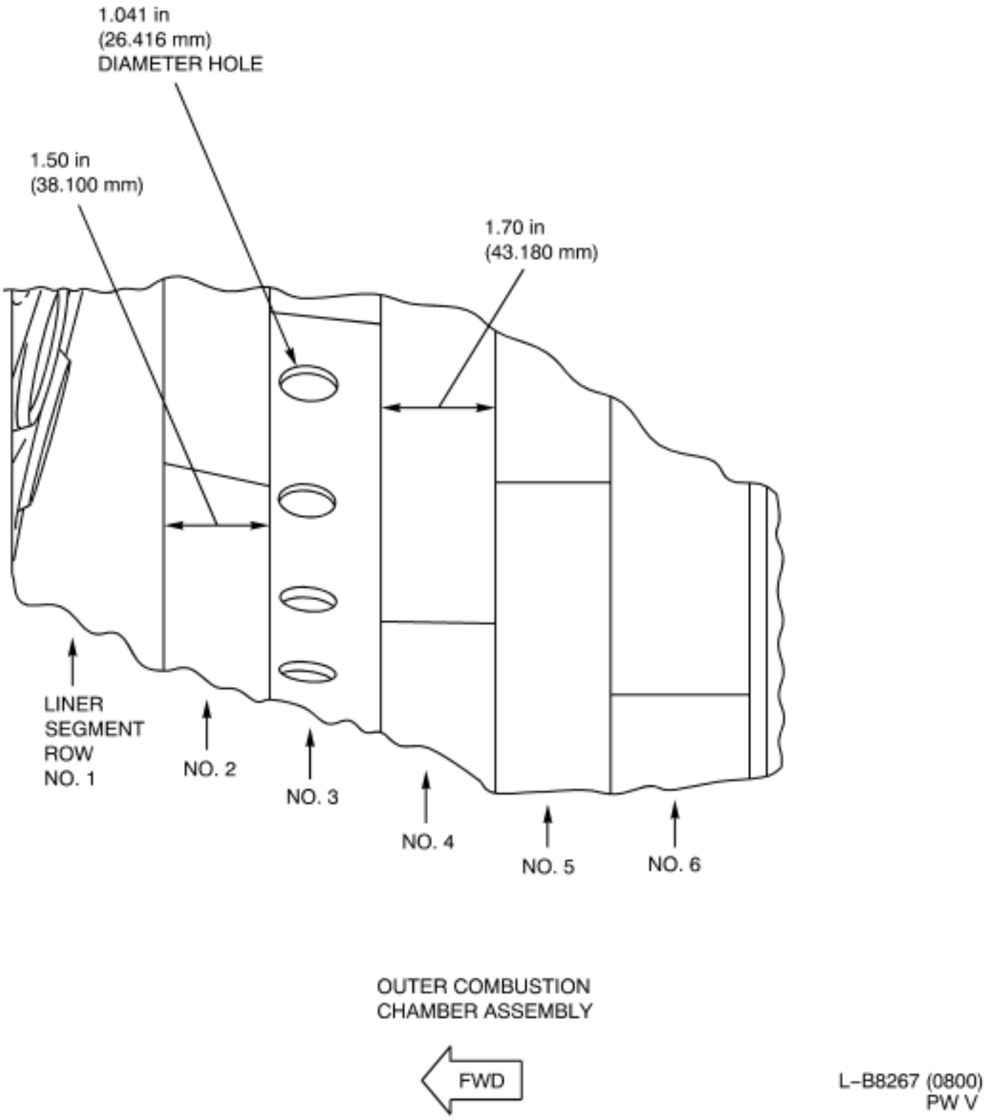
Identification Of Combustion Chamber Parts And Shapes
Figure 803 (Sheet 2)
(Task 72−00−00−210−029)


FULL LENGTH AXIAL CRACKS
INNER COMBUSTION CHAMBER ASSEMBLY
AXIAL CRACKS
BURN BACK (MATERIAL GONE) AT TRAILING EDGE
BURN HOLE
FULL LENGTH AXIAL CRACKS
BURN BACK (MATERIAL GONE) AT TRAILING EDGE
OUTER COMBUSTION CHAMBER ASSEMBLY
AXIAL CRACKS
BURN HOLE
FWD
L-B8265 (0800)
PW V

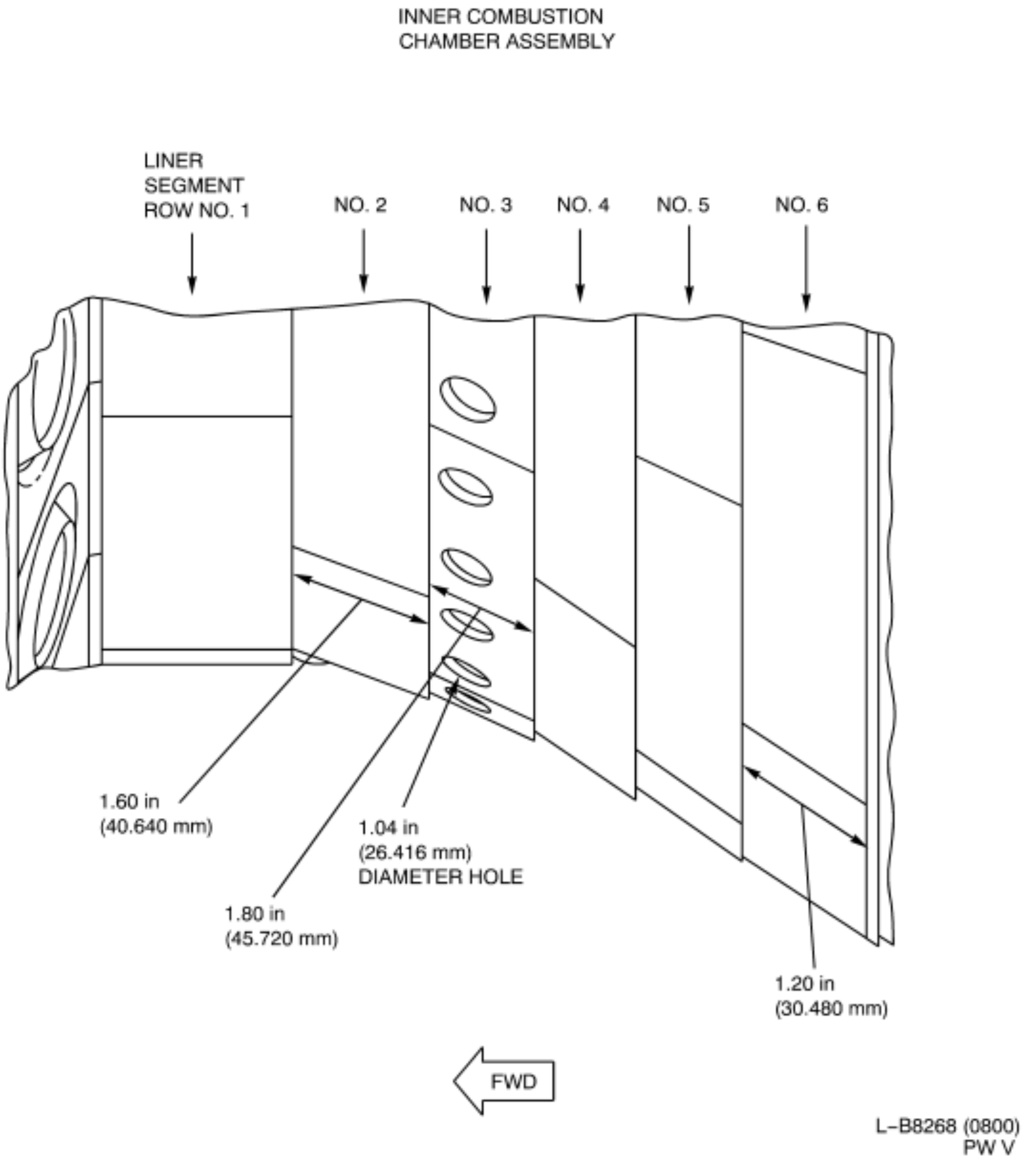
Borescope View Of Combustion Chamber Cracks and Damage
Figure 804
(Task 72-00-00-210-029)


BURN HOLE
CRACK LENGTH
CRACK LENGTH
NOTE
SEE PRECEDING TABLE FOR INSPECTION/DISTRESS LIMITS
BURN HOLE
CRACK LENGTH
L−B8266 (0800)
PW V

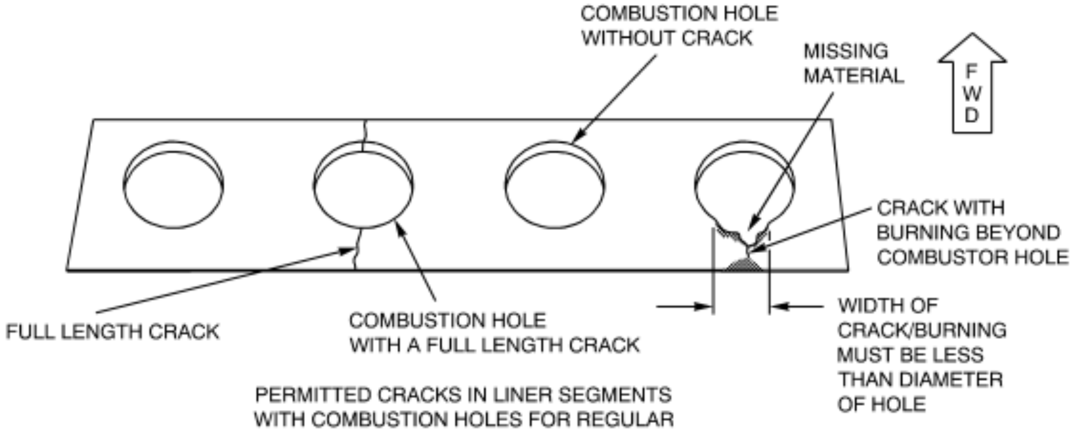
Identification Of Combustion Chamber Burn Holes And Cracks
Figure 805
(Task 72−00−00−210−029)


1.041 in
(26.416 mm)
DIAMETER HOLE
1.50 in
(38.100 mm)
1.70 in
(43.180 mm)
LINER
SEGMENT
ROW
NO. 1
NO. 2
NO. 3
NO. 4
NO. 5
NO. 6
OUTER COMBUSTION
CHAMBER ASSEMBLY
FWD
L-B8267 (0800)
PW V

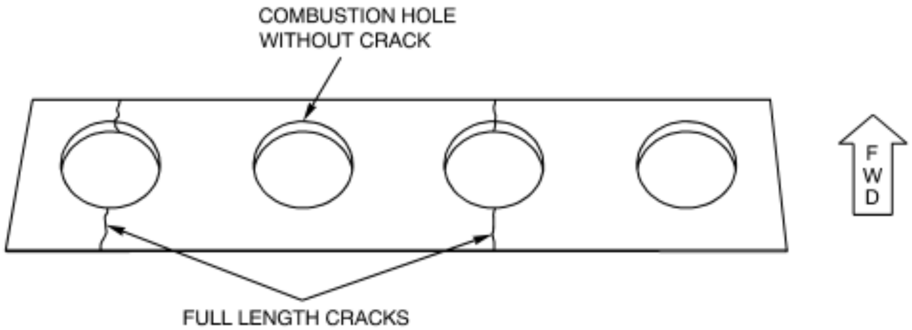
Outer Combustion Chamber, Inboard Surface, Dimensions
Figure 806
(Task 72-00-00-210-029)


INNER COMBUSTION CHAMBER ASSEMBLY
LINER SEGMENT ROW NO. 1
NO. 2
NO. 3
NO. 4
NO. 5
NO. 6
1.60 in (40.640 mm)
1.04 in (26.416 mm) DIAMETER HOLE
1.80 in (45.720 mm)
1.20 in (30.480 mm)
FWD
L−B8268 (0800)
PW V

Inner Combustion Chamber, Outboard Surface, Dimensions
Figure 807
(Task 72−00−00−210−029)


COMBUSTION HOLE WITHOUT CRACK
MISSING MATERIAL
F W D
CRACK WITH BURNING BEYOND COMBUSTOR HOLE
FULL LENGTH CRACK
COMBUSTION HOLE WITH A FULL LENGTH CRACK
WIDTH OF CRACK/BURNING MUST BE LESS THAN DIAMETER OF HOLE

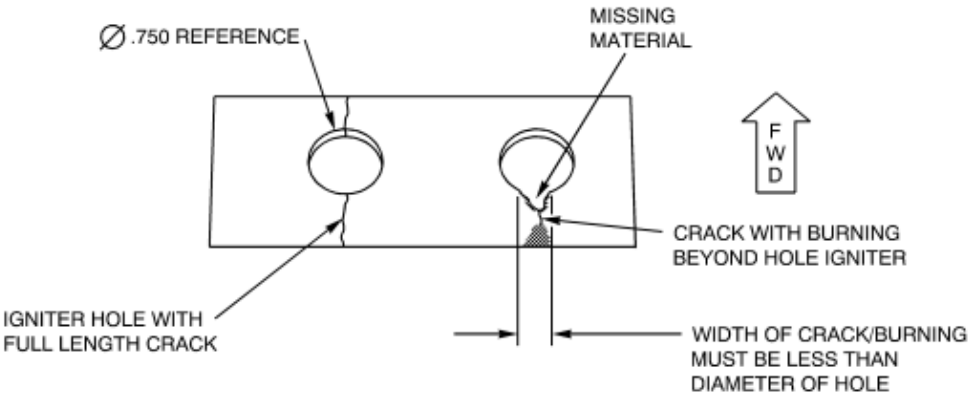
PERMITTED CRACKS IN LINER SEGMENTS
WITH COMBUSTION HOLES FOR REGULAR
INSPECTION INTERVAL


COMBUSTION HOLE WITHOUT CRACK
F W D
FULL LENGTH CRACKS

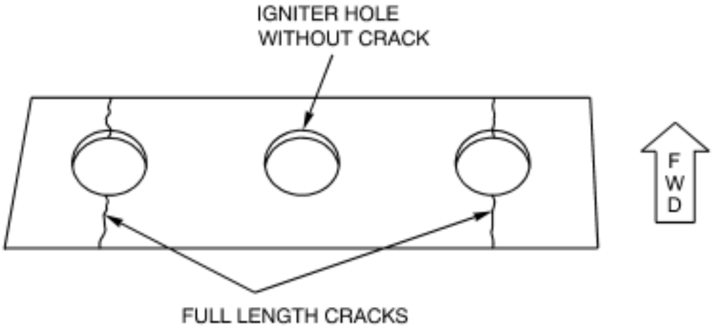
PERMITTED CRACKS IN LINER SEGMENTS
WITH COMBUSTION HOLES FOR REDUCED
INSPECTION INTERVAL

L−B8269 (0101)
PW V

Combustion Chamber Liner Segment Damage Areas
Figure 808 (Sheet 1)
(Task 72−00−00−210−029)


∅ .750 REFERENCE
MISSING MATERIAL
F W D
CRACK WITH BURNING BEYOND HOLE IGNITER
IGNITER HOLE WITH FULL LENGTH CRACK
WIDTH OF CRACK/BURNING MUST BE LESS THAN DIAMETER OF HOLE

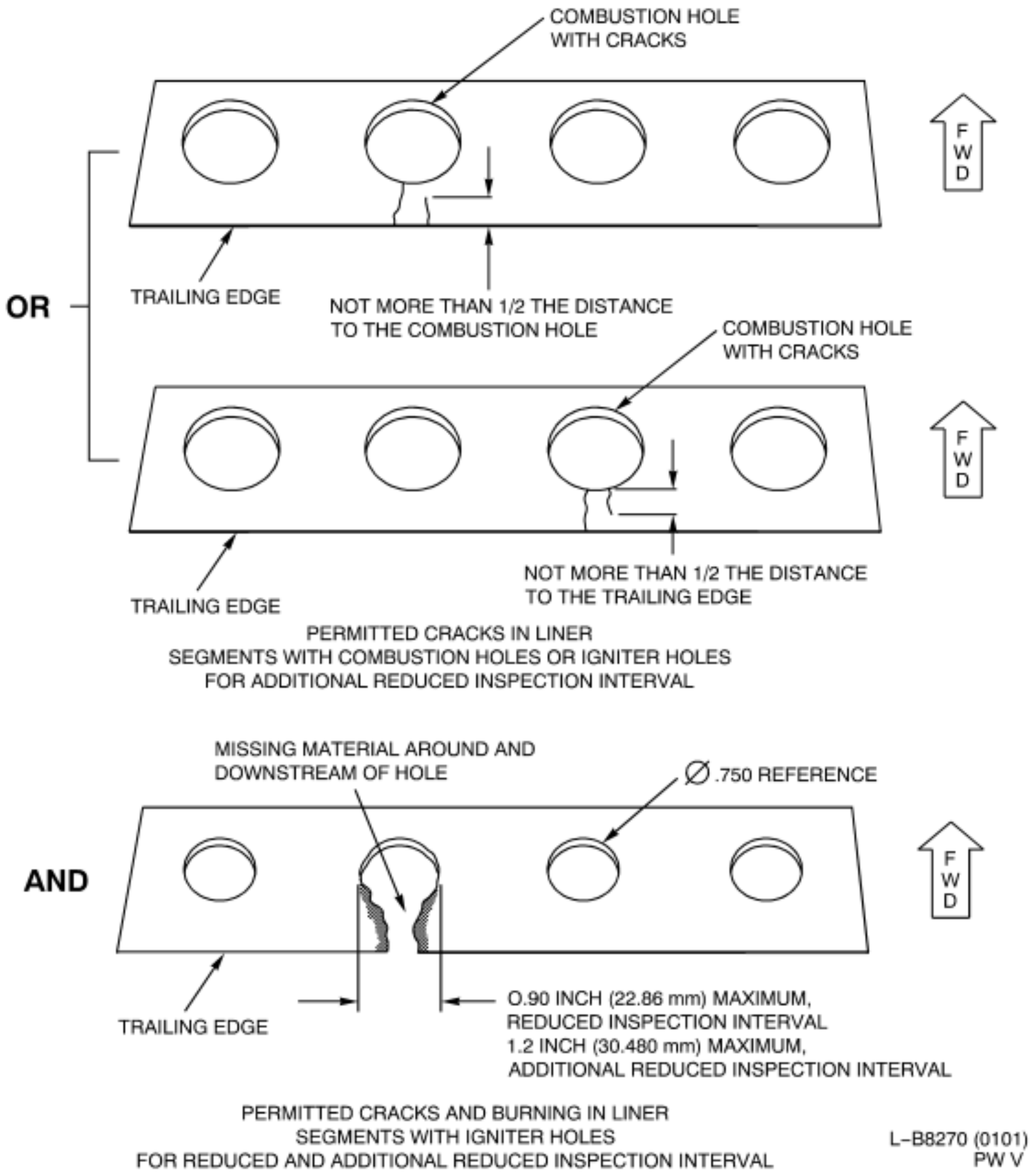
PERMITTED CRACKS IN LINER SEGMENTS
WITH IGNITER HOLES FOR REGULAR
INSPECTION INTERVAL


IGNITER HOLE WITHOUT CRACK
F W D
FULL LENGTH CRACKS

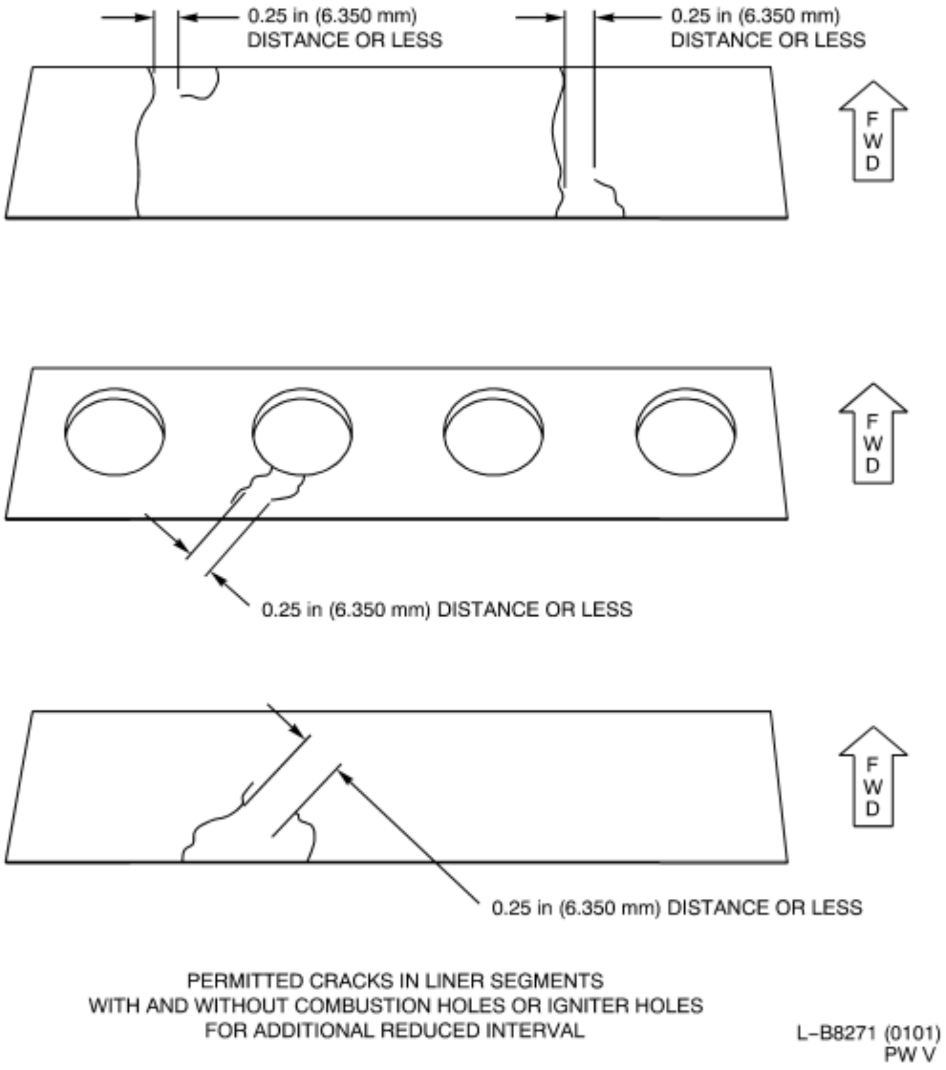
PERMITTED CRACKS IN LINER SEGMENTS
WITH IGNITER HOLES FOR REDUCED
INSPECTION INTERVAL

L-B8568 (0101)
PW V

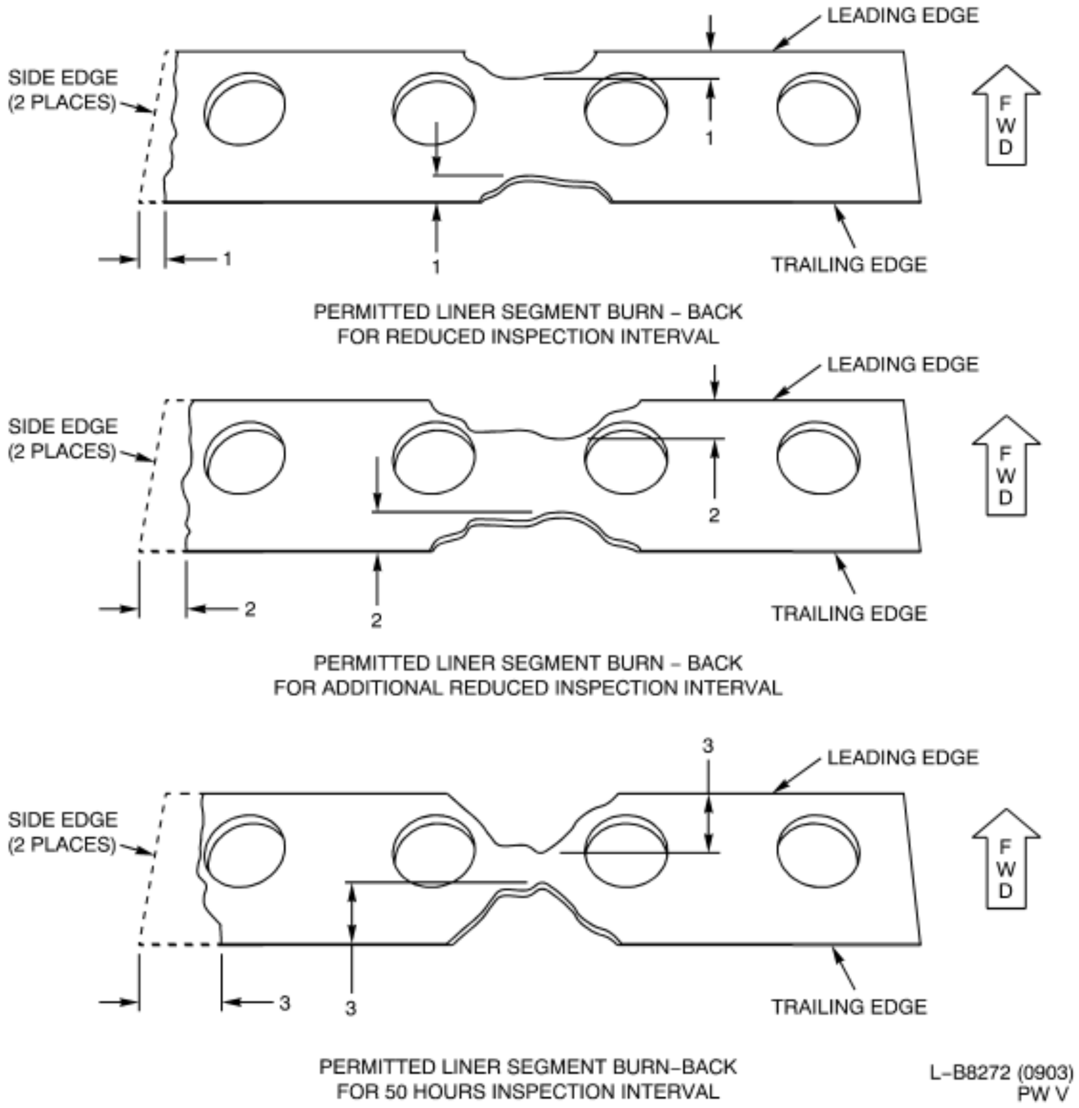
Combustion Chamber Liner Segment Damage Areas
Figure 808 (Sheet 2)
(Task 72-00-00-210-029)


COMBUSTION HOLE WITH CRACKS
TRAILING EDGE
NOT MORE THAN 1/2 THE DISTANCE TO THE COMBUSTION HOLE
FWD
OR
COMBUSTION HOLE WITH CRACKS
TRAILING EDGE
NOT MORE THAN 1/2 THE DISTANCE TO THE TRAILING EDGE
FWD
PERMITTED CRACKS IN LINER SEGMENTS WITH COMBUSTION HOLES OR IGNITER HOLES FOR ADDITIONAL REDUCED INSPECTION INTERVAL
MISSING MATERIAL AROUND AND DOWNSTREAM OF HOLE
∅ .750 REFERENCE
AND
FWD
TRAILING EDGE
O.90 INCH (22.86 mm) MAXIMUM, REDUCED INSPECTION INTERVAL
1.2 INCH (30.480 mm) MAXIMUM, ADDITIONAL REDUCED INSPECTION INTERVAL
PERMITTED CRACKS AND BURNING IN LINER SEGMENTS WITH IGNITER HOLES FOR REDUCED AND ADDITIONAL REDUCED INSPECTION INTERVAL
L-B8270 (0101)
PW V

Combustion Chamber Liner Segment Damage Areas
Figure 808 (Sheet 3)
(Task 72-00-00-210-029)

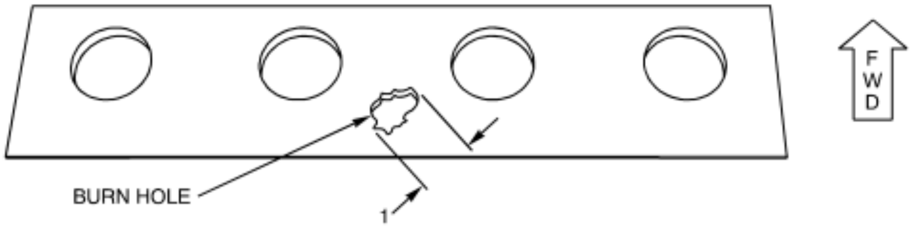

0.25 in (6.350 mm)
DISTANCE OR LESS
0.25 in (6.350 mm)
DISTANCE OR LESS
FWD
FWD
0.25 in (6.350 mm) DISTANCE OR LESS
FWD
0.25 in (6.350 mm) DISTANCE OR LESS
PERMITTED CRACKS IN LINER SEGMENTS
WITH AND WITHOUT COMBUSTION HOLES OR IGNITER HOLES
FOR ADDITIONAL REDUCED INTERVAL
L−B8271 (0101)
PW V

Combustion Chamber Liner Segment Damage Areas
Figure 808 (Sheet 4)
(Task 72−00−00−210−029)

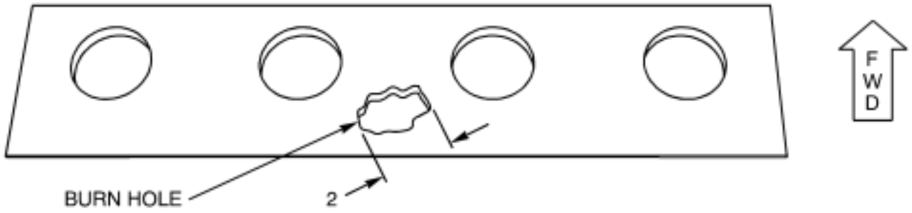

LEADING EDGE
SIDE EDGE
(2 PLACES)
F
W
D
1
1
1
TRAILING EDGE
PERMITTED LINER SEGMENT BURN – BACK
FOR REDUCED INSPECTION INTERVAL
LEADING EDGE
SIDE EDGE
(2 PLACES)
F
W
D
2
2
2
TRAILING EDGE
PERMITTED LINER SEGMENT BURN – BACK
FOR ADDITIONAL REDUCED INSPECTION INTERVAL
3
LEADING EDGE
SIDE EDGE
(2 PLACES)
F
W
D
3
3
TRAILING EDGE
PERMITTED LINER SEGMENT BURN-BACK
FOR 50 HOURS INSPECTION INTERVAL
L-B8272 (0903)
PW V

1. 0.3 − 0.5 Inch (7.6 − 12.7 mm)
2. 0.5 − 1.0 Inch (12.7 − 25.4 mm)
3. More Than 1.0 Inch (25.4 mm)

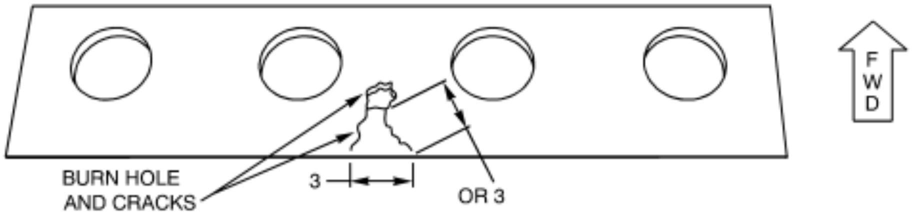
Combustion Chamber Liner Segment Damage Areas
Figure 808 (Sheet 5)
(Task 72−00−00−210−029)



PERMITTED BURN HOLE FOR
REDUCED INSPECTION INTERVAL



PERMITTED BURN HOLE FOR
ADDITIONAL REDUCED INSPECTION INTERVAL

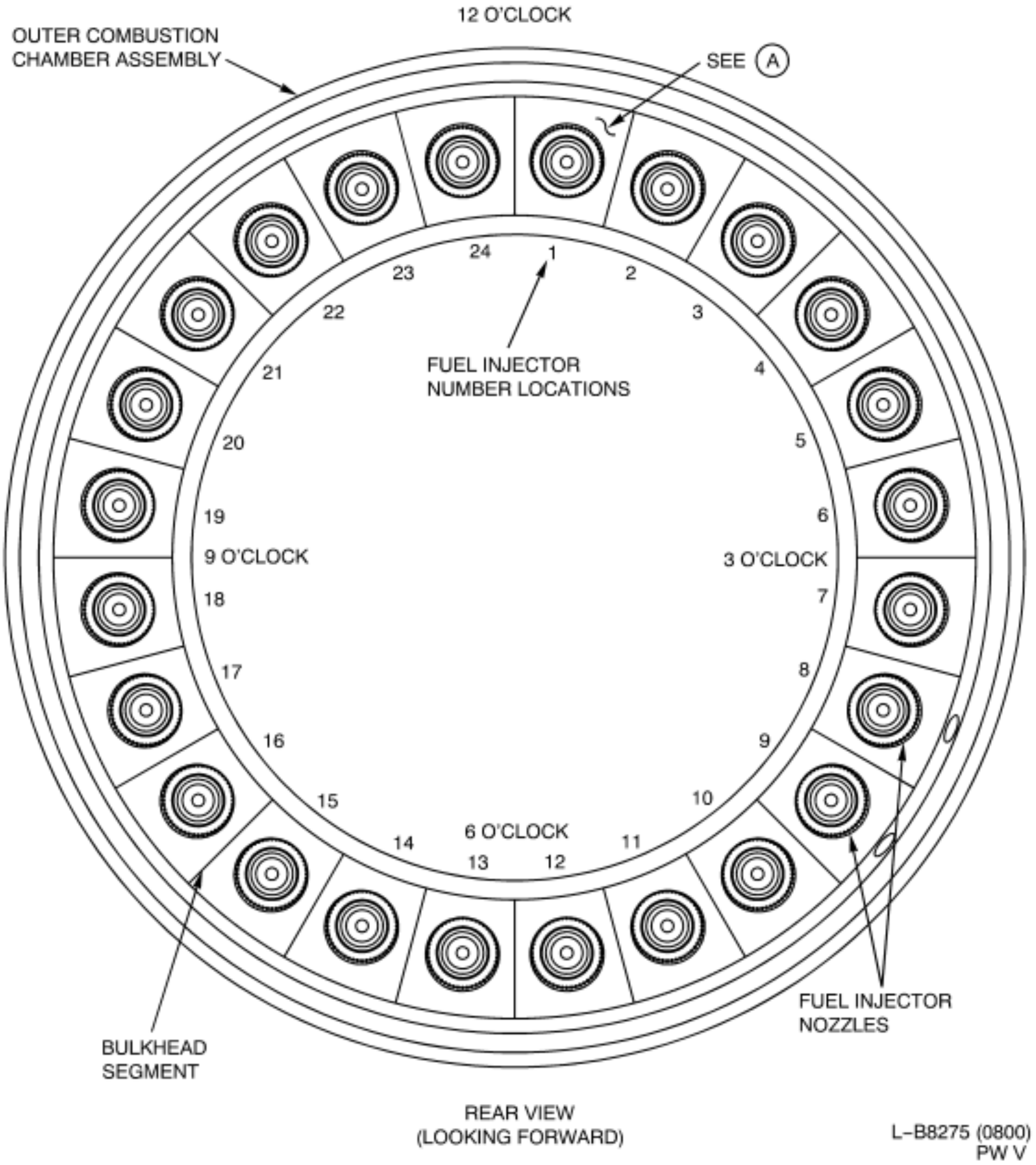


PERMITTED BURN HOLE AND CRACKS FOR
ADDITIONAL REDUCED INSPECTION INTERVAL

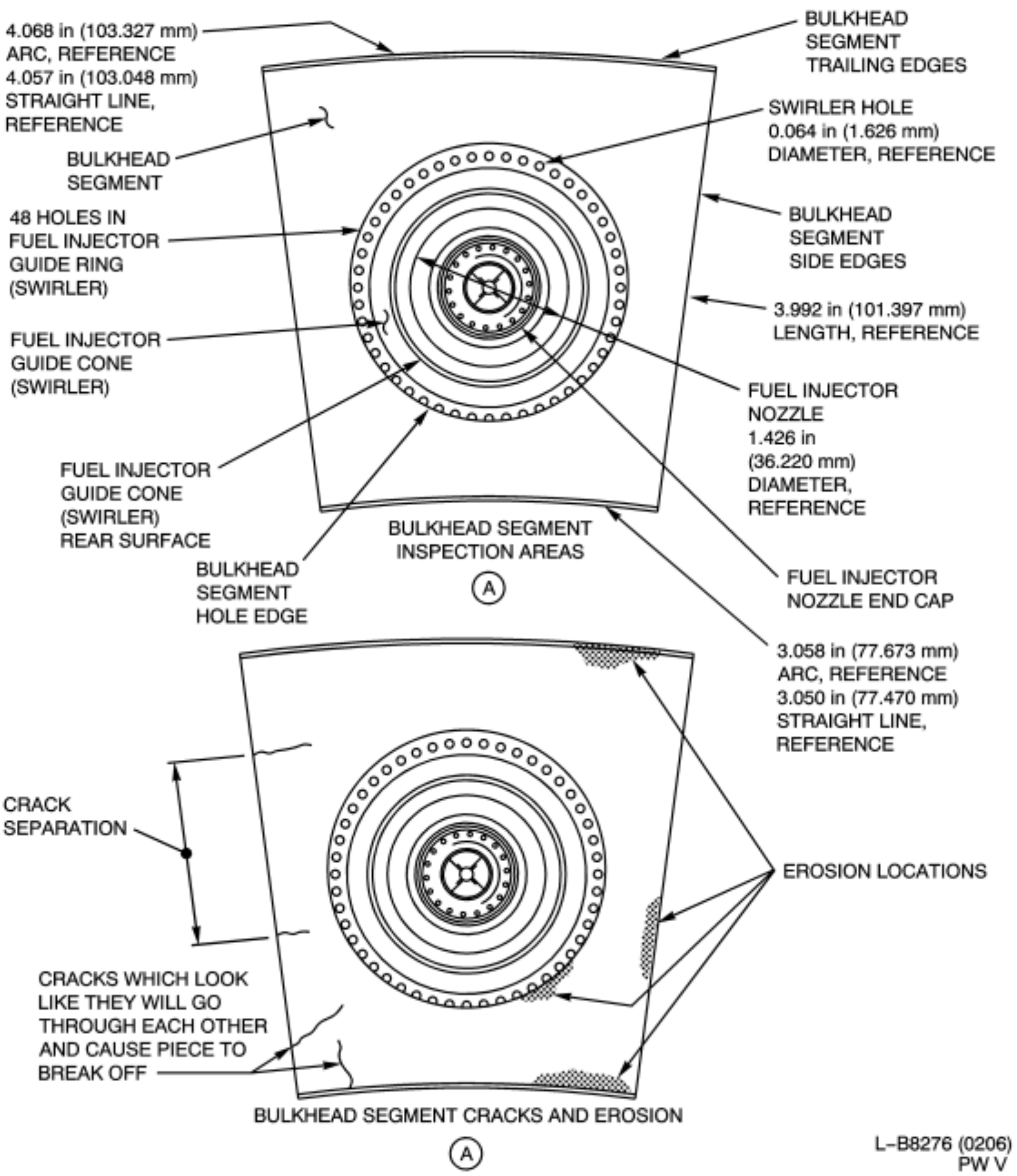
L-B8273 (0800)
PW V

1. 0.25 Inch (6.350 mm) Size Hole Or Larger.
2. 0.4 Inch (10.160 mm) Size Hole Or Larger.
3. 0.3 Inch (7.620 mm) On Longest Side.

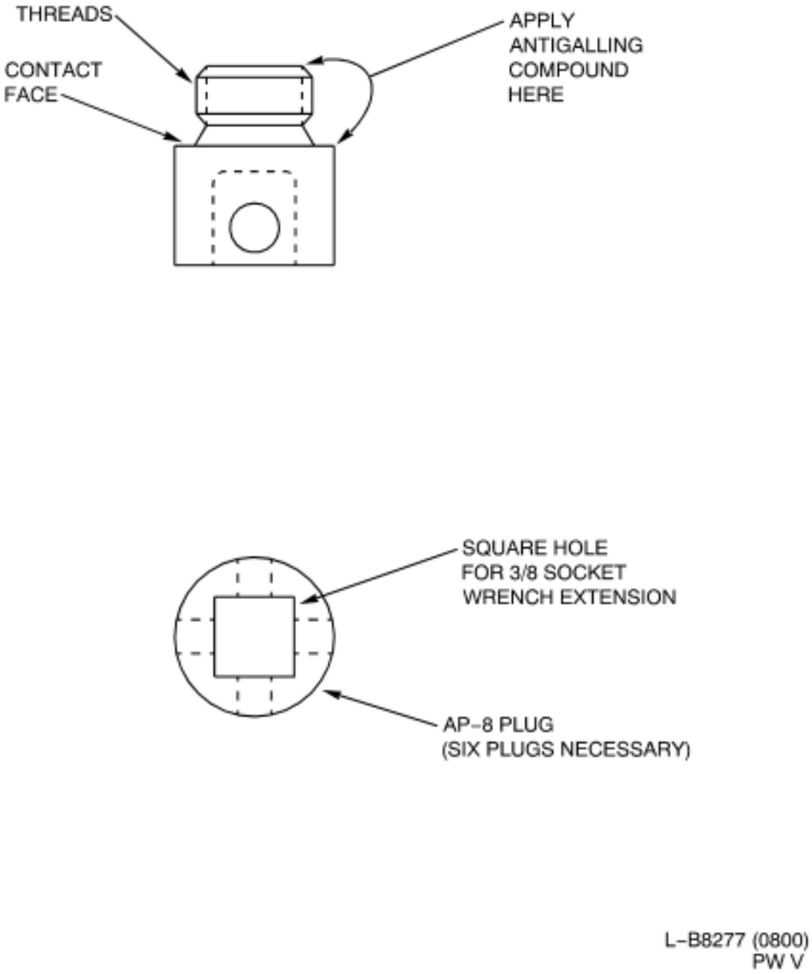
Combustion Chamber Liner Segment Damage Areas
Figure 808 (Sheet 6)
(Task 72-00-00-210-029)


OUTER COMBUSTION CHAMBER ASSEMBLY
12 O'CLOCK
SEE Ⓐ
24
1
23
2
22
3
21
4
FUEL INJECTOR NUMBER LOCATIONS
20
5
19
6
9 O'CLOCK
3 O'CLOCK
18
7
17
8
16
9
15
10
14
6 O'CLOCK
11
13
12
FUEL INJECTOR NOZZLES
BULKHEAD SEGMENT
REAR VIEW (LOOKING FORWARD)
L−B8275 (0800)
PW V

Outer Combustion Chamber, View Of Bulkhead And Fuel Nozzle Area
Figure 809 (Sheet 1)
(Task 72−00−00−210−029)


4.068 in (103.327 mm) ARC, REFERENCE
4.057 in (103.048 mm) STRAIGHT LINE, REFERENCE
BULKHEAD SEGMENT TRAILING EDGES
SWIRLER HOLE 0.064 in (1.626 mm) DIAMETER, REFERENCE
BULKHEAD SEGMENT
48 HOLES IN FUEL INJECTOR GUIDE RING (SWIRLER)
BULKHEAD SEGMENT SIDE EDGES
3.992 in (101.397 mm) LENGTH, REFERENCE
FUEL INJECTOR GUIDE CONE (SWIRLER)
FUEL INJECTOR NOZZLE 1.426 in (36.220 mm) DIAMETER, REFERENCE
FUEL INJECTOR GUIDE CONE (SWIRLER) REAR SURFACE
BULKHEAD SEGMENT INSPECTION AREAS
A
BULKHEAD SEGMENT HOLE EDGE
FUEL INJECTOR NOZZLE END CAP
3.058 in (77.673 mm) ARC, REFERENCE
3.050 in (77.470 mm) STRAIGHT LINE, REFERENCE
CRACK SEPARATION
EROSION LOCATIONS
CRACKS WHICH LOOK LIKE THEY WILL GO THROUGH EACH OTHER AND CAUSE PIECE TO BREAK OFF
BULKHEAD SEGMENT CRACKS AND EROSION
A
L-B8276 (0206)
PW V

Outer Combustion Chamber, View Of Bulkhead And Fuel Nozzle Area
Figure 809 (Sheet 2)
(Task 72-00-00-210-029)


THREADS
CONTACT FACE
APPLY ANTIGALLING COMPOUND HERE
SQUARE HOLE FOR 3/8 SOCKET WRENCH EXTENSION
AP−8 PLUG (SIX PLUGS NECESSARY)
L−B8277 (0800)
PW V

View Of AP−8 Plugs Removed From Engine
Figure 810
(Task 72−00−00−210−029)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-00-210-017:

1. Perform Borescope Inspection Of Stage 1 HPT Vanes (AP-8/AP-9)

A. Equipment And Materials Necessary

Standard Tools:
See Inspection/Check-01A for borescope equipment.

Special Tools:
PWA 86411 Guide Tube, AP-8 Port (for flexible borescope)

Consumable Materials:

Item No.	Designation
P06-023	Silver Goop (PWA 36001)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Washer	1	72-41-00/1/155
Lockwire	1	72-41-00/1/160

B. Procedure

(1) Remove plug and washer from borescope access port Number AP-9 (see Figure 801 and Figure 802) located on the rear of the diffuser case at the 3 o'clock location. See Table 801 Inspection/Check-01A for additional AP-9 borescope access port data.

(a) Make an inspection of the AP-9 plug. Measure the shaft diameter for wear. If the shaft diameter minimum dimension is less than 0.100 inch (2.540 mm), the AP-9 plug must be replaced.

(2) Refer to preceding paragraph and remove plugs and gaskets from AP-8 borescope access ports.

(a) Put PWA 86411 Guide Tube through the diffuser case access port at the AP-8 location with the tip pointed toward the front of the engine. Turn and position the tube such that the flexible borescope, when installed, will point rearwards towards the first stage nozzle guide vanes. Lock the guide tube in position by use of the compression nut.

CAUTION: TEMPERATURES IN AREAS TO BE BORESCOPED SHOULD BE PERMITTED TO COOL TO BELOW 150°F (65.6°C) FOLLOWING ENGINE OPERATION. DAMAGE MAY RESULT TO BORESCOPE EQUIPMENT IF EQUIPMENT IS EXPOSED TO GASPATH OR METAL TEMPERATURES IN EXCESS OF 150°F (65.6°C). AS A GUIDE - IF ADJACENT CASES ARE TOO HOT TO TOUCH COMFORTABLY, INSPECTION SHOULD BE DELAYED.

(3) Insert borescope through port and inspect Stage 1 HPT vanes for nicks, dents, base material breakthrough/burnthrough, cracks, burning, erosion, coating loss, blocked cooling air holes, sulfidation and damage caused by passage of foreign material.

NOTE: Maximum borescope insertion depth and borescope limiting access hole diameter specifications for AP-8 and AP-9 borescope ports are specified in Table 801 (Sheet 3) Inspection/Check-01A. R

(4) Borescope inspection limits for Stage 1 vanes.

CAUTION: FOLLOWING LIMITS ARE APPLICABLE ON A CONTINUE-IN-SERVICE BASIS ONLY. LIMIT IS BASED ON PART STRUCTURAL REQUIREMENTS AND DOES NOT IMPLY THAT ENGINE PERFORMANCE, STABILITY, OPERATING LIMITS, OR PART REPARABILITY WILL BE MAINTAINED.

(a) Limits for vane conditions observed during borescope inspection are given in Table 802 thru Table 806, and Figure 803 thru Figure 809. R R

(5) After borescope inspection, install AP-9 plug and new washer per requirements of Table 801.

(6) Refer to Inspection/Check-01D and install AP-8 plugs and gaskets per installation instructions.

AP Number And Location	Washer Required	Plug Locking Method	Plug Replacement Lubricant	Plug Torque lb-in. (N.m)
AP-9 Rear of Diffuser Case	Yes PN 580777	Lockwire (AS3214-02)	P06-023 Silver Goop	40 - 50 (4.519 - 5.649)

AP-9 Borescope Plug Installation Data
Table 801

Observed Condition: Nicks And Dents
See Figure 803.

Examine	Damage	Disposition
Leading edge, concave and convex airfoils, ID and OD platforms	Nicks and round bottomed dents (803/2) to 0.125 inch (3.175 mm) in length or diameter are permitted.	Permitted for regular inspection interval.
Trailing edge	Two nicks or dents (803/1) maximum on the trailing edge, separated by at least 0.750 inch (19.050 mm). Five vanes maximum on each engine.	Permitted for regular inspection interval.
	More than the above interval inspection limits.	Remove engine in 5 cycles maximum or less.

NOTE: If the view angle is such that the depth can be determined. The maximum nick and round bottom dent depth is 0.312 inch (7.925 mm).

Nicks And Dents Inspection
Table 802

R Observed Condition: Damaged Or Missing Thermal Barrier Coating
R See Figure 803.

	Examine	Damage	Disposition
R	Leading edge, concave and convex airfoils, ID and OD platforms, trailing edge	No limit on the quantity of chipped coating, coating loss, checking, crazed or cracked thermal barrier coating. See (803/3) and (803/4).	Permitted for regular inspection interval.

R NOTE: If a large quantity of thermal barrier coating is missing, (gone), and the vane is operated for a long time, it is possible that the vane cannot be repaired at overhaul. The vane base metal can become burned and eroded.

R Thermal Barrier Coating Inspection
R Table 803

Observed Condition: Burning and Erosion
See Figure 804.

Examine	Damage	Disposition
Leading edge, concave and convex airfoils, ID and OD platforms, trailing edge	No limit on the quantity of burning (804/1) and erosion (804/2) as long as it is not burned completely through the wall. See (804/1), (804/2), and (804/3).	Permitted for regular inspection interval.

Burning and Erosion Inspection
Table 804

Observed Condition: Material Breakthrough Or Burnthrough
See Figure 805.

Examine	Damage	Disposition
Leading edge, concave and convex airfoils, ID and OD platforms	One material breakthrough or burnthrough (805/2) with an open area (material that is not there) to 0.157 inch (3.988 mm) diameter or 0.019 sq-in. (12. sq-mm).	Permitted for regular inspection interval.
	One material breakthrough or burnthrough (805/1) and (805/4) with an open area (material that is not there) more than 0.157 inch (3.988 mm) but less than 0.300 inch (7.620 mm) diameter or to 0.070 sq-in. (45. sq-mm) maximum.	Permitted for 300 cycle reduced inspection interval.
	A maximum of five vanes for each engine with one material breakthrough or burnthrough (805/1), (805/4), and (805/6) more than 0.300 inch (7.620 mm) but less than 0.500 inch (12.700 mm) diameter or 0.196 sq-inch (126. sq-mm) into the internal cavity.	Permitted for 300 cycle reduced inspection interval.
	More than 5 vanes with one material breakthrough or burnthrough (805/1) and (805/6) more than 0.300 inch (7.620 mm) but less than 0.500 inch (12.700 mm) diameter or up 0.196 sq-inch (126. sq-mm) maximum.	Permitted for 150 cycle reduced inspection interval.
	For leading edge burnthrough more than	Permitted for 50 cycle reduced

Material Breakthrough Or Burnthrough Inspection
Table 805

R Observed Condition: Material Breakthrough Or Burnthrough
R See Figure 805.

R	Examine	Damage	Disposition
R		0.500 inch (12.700 mm) diameter: No limit on the number of vanes with leading edge burnthrough to 1.614 inch (40.996 mm) maximum radial length that does not go axially more than the first row of concave side cooling holes and does not go axially more than the second row of convex side cooling holes is permitted if there is no burning on the internal baffle.	inspection interval.
R		Vane baffle burned through.	Not permitted.
R		More than the above interval inspection limits.	Remove engine in 5 cycles maximum or less.
R	Concave side trailing edge	Burnthrough (805/3) less than 75% span of axial length from the trailing edge to the rear cooling holes and up 1.575 inches (40.005 mm) maximum width.	Permitted for regular inspection interval.
R		Burnthrough (805/5) more than 75% span of axial length from the trailing edge to the rear cooling holes and to 1.575 inches (40.005 mm) maximum width.	Permitted for 300 cycle reduced inspection interval.
R		Burnthrough (805/7) to 0.512 inch (13 mm) forward of the rear two rows of cooling holes and up to 1.575 inches (40.005 mm) maximum width.	Permitted for 150 cycle reduced inspection interval.

R Material Breakthrough Or Burnthrough Inspection
R Table 805 (Continued)

R Observed Condition: Material Breakthrough Or Burnthrough
R See Figure 805.

R	Examine	Damage	Disposition
	(CONTINUED)		
R		Burnthrough more than 0.511 inch (12.979 mm) forward of the rear two rows of cooling holes, or is more than 1.575 inches (40.005 mm) in width, or if the internal baffle is burned through.	Remove engine in 5 cycles maximum or less.
R	Convex side trailing edge	Burnthrough (805/8) less than 50% span from the trailing edge to the rear cooling holes.	Permitted for regular inspection interval.
R		Burnthrough (805/9) more than 50% span from the trailing edge to the rear cooling holes.	Permitted for 150 cycle reduced inspection interval.
R		Burnthrough is forward of the rear cooling holes.	Remove engine in 5 cycles maximum or less.

R Material Breakthrough Or Burnthrough Inspection
R Table 805 (Continued)

R Observed Condition: Cracks, (Axial And Radial)
R See Figure 806 thru Figure 809.

Examine	Damage	Disposition
Leading edge surface	No limit on the quantity of tight cracks (806/3). Closed loop cracks (806/4) are not permitted.	Permitted for regular inspection interval.
	One crack (806/5) in each vane starting at the ID or OD platform, to a maximum height of 0.500 inch (12.700 mm).	Permitted for regular inspection interval.
	A maximum of 3 cracks in each vane (806/1) which go to a concave or convex airfoil cooling hole. Closed loop cracks (806/4) are not permitted.	Permitted for regular inspection interval.
	Two cracks (806/2) in each vane starting at the ID or OD platforms, to a maximum height of 0.750 inch (19.050 mm).	Permitted for 300 cycle reduced inspection interval.
	More than the above interval inspection limits.	Remove engine in 5 cycles maximum or less.
Concave airfoil surface	No limit on the quantity of axial (807/1) or radial cracks (807/1A) less than 0.157 inch (3.988 mm) are permitted. Closed loop cracks (807/4) are not permitted.	Permitted for regular inspection interval.
	A maximum of three axial cracks (807/2) that go from one cooling hole	Permitted for regular inspection interval.

R NOTE: A crack or part length of a crack that has burned or eroded to a width more than 0.050 inch (1.270 mm) must be identified as a hole. The breakthrough or burnthrough limits apply.

R Crack Inspection
R Table 806

R Observed Condition: Cracks, (Axial And Radial)
R See Figure 806 thru Figure 809.

Examine	Damage	Disposition
(CONTINUED)	group to the next cooling hole group or from the trailing edge to the rear cooling hole group are permitted. One of the above three axial cracks can go forward or rearward to the next cooling hole group or from the trailing edge through the rear cooling hole group to the next cooling hole group.	
	No limit on the quantity of axial cracks (807/6) that go from one cooling hole group to the next cooling hole group or from the trailing edge to the rear cooling hole group if the cracks do not form a closed loop.	Permitted for 300 cycle reduced inspection interval.
	Radial cracks (807/3) that go from the ID or OD platform to the concave airfoil are permitted. The maximum crack length on the airfoil from the platform is 0.500 inch (12.700 mm). Cracks from a platform that go to the airfoil surface cannot intersect other cracks on the airfoil surface.	Permitted for regular inspection interval.

R Crack Inspection
R Table 806 (Continued)

R Observed Condition: Cracks, (Axial And Radial)
R See Figure 806 thru Figure 809.

Examine	Damage	Disposition
	Radial cracks (807/8) that go from the ID or OD platform to the concave airfoil surface more than 0.500 inch (12.700 mm) but less than 0.800 inch (20.320 mm). Cracks from a platform that go to the airfoil surface cannot intersect other cracks on the airfoil surface.	Permitted for 300 cycle reduced inspection interval.
	Three radial cracks (807/1A) maximum to 0.500 inch (12.700 mm) maximum length are permitted.	Permitted for regular inspection interval.
	No limit on the quantity of radial cracks (807/6A) to 0.800 inch (20.320 mm) length.	Permitted for 300 cycle reduced inspection interval.
	A crack (807/5) can intersect with another crack, except for cracks that start at the ID or OD platform. The maximum length for either crack leg is 0.400 inch (10.160 mm). The intersection of platform cracks with airfoil cracks is not permitted.	Permitted for regular inspection interval.
	An intersecting crack (807/7) with a leg more than 0.400 inch (10.160 mm) and less than 0.800 inch (20.320 mm) except for cracks that start at the ID or OD platform. The intersection of	Permitted for 300 cycle reduced inspection interval.

R Crack Inspection
R Table 806 (Continued)

Observed Condition: Cracks, (Axial And Radial)
See Figure 806 thru Figure 809.

Examine	Damage	Disposition
	platform cracks with airfoil cracks is not permitted.	
	More than the above interval inspection limits.	Remove engine in 5 cycles maximum or less.
Convex airfoil surface	No limit on the quantity of axial (808/1) or radial cracks (808/1A) less than 0.157 inch (3.988 mm) are permitted. Closed loop cracks (808/5) are not permitted.	Permitted for regular inspection interval.

NOTE: A crack or part length of a crack that has burned or eroded to a width more than 0.050 inch (1.270 mm) must be identified as a hole. The breakthrough or burnthrough limits apply.

Examine	Damage	Disposition
	Three axial cracks maximum to 0.500 inch (12.700 mm) maximum length except as follows: One of the three axial cracks (808/3) can traverse from the trailing edge for a maximum distance of 0.750 inch (19.050 mm).	Permitted for regular inspection interval.
	Six axial cracks (808/6) maximum to 0.800 inch (20.320 mm) maximum length except as follows: One of the six axial cracks (808/8) can traverse from the trailing edge for a maximum distance of 1.300 inches (33.020 mm), or to the last row of cooling holes.	Permitted for 300 cycle reduced inspection interval.

Crack Inspection
Table 806 (Continued)

Observed Condition: Cracks, (Axial And Radial)
See Figure 806 thru Figure 809.

Examine	Damage	Disposition
(CONTINUED)		
	One axial crack (808/3) from the trailing edge to a maximum of 1.181 inches (29.997 mm).	Permitted for regular inspection interval.
	One axial crack (808/8) from the trailing edge more than 1.181 inches (29.997 mm) to 2.362 inches (59.995 mm) maximum is permitted.	Permitted for 300 cycle reduced inspection interval.
	Three radial cracks (808/1A) to 0.500 inch (12.700 mm) maximum length.	Permitted for regular inspection interval.
	No limit on the quantity of radial cracks (808/6A) to 0.800 inch (20.320 mm) maximum.	Permitted for 300 cycle reduced inspection interval.
	A crack can intersect with another crack (808/4) except for cracks that start at the ID or OD platforms. The maximum length for either crack leg is 0.500 inch (12.700 mm). Intersection of platform cracks with airfoil cracks is not permitted.	Permitted for regular inspection interval.
	An intersecting crack (808/9) with a leg more than 0.500 inch (12.700 mm) and less than 0.800 inch (20.320 mm) except for cracks that start at the ID or OD platform. Intersection of platform	Permitted for 300 cycle reduced inspection interval.

Crack Inspection
Table 806 (Continued)

Observed Condition: Cracks, (Axial And Radial)
See Figure 806 thru Figure 809.

Examine	Damage	Disposition
(CONTINUED)		
	cracks with airfoil cracks is not permitted.	
	Radial cracks (808/2) that go from the ID or OD platforms to the convex airfoil are permitted. The maximum crack length on the airfoil from the platform is 0.500 inch (12.700 mm). Cracks from a platform (808/2) that go to the airfoil surface cannot intersect other cracks on the airfoil surface.	Permitted for regular inspection interval.
	Radial cracks (808/7) that go from the ID or OD platform to the convex airfoil surface more than 0.500 inch (12.700 mm) but less than 0.800 inch (20.320 mm) are permitted. Cracks from a platform that go to the airfoil surface cannot intersect other cracks on the airfoil surface.	Permitted for 300 cycle reduced inspection interval.
	More than the above interval inspection limits.	Remove engine in 5 cycles maximum or less.
ID and OD platform surfaces (buttresses)	No limit on the quantity of cracks less than 0.250 inch (6.350 mm) in length on the platform surfaces are permitted. Intersecting cracks are permitted if no closed loop is formed.	Permitted for regular inspection interval.

Crack Inspection
Table 806 (Continued)

R Observed Condition: Cracks, (Axial And Radial)
R See Figure 806 thru Figure 809.

	Examine	Damage	Disposition
	(CONTINUED)		
R		Closed loop cracks are not permitted. See Figure 809 (Sheet 1).	

R NOTE: A crack or part length of a crack that has burned or eroded to a width of more than 0.050 inch (1.270 mm) must be identified as a hole. The breakthrough or burnthrough limits apply.

	Examine	Damage	Disposition
R		Four cracks (809/4) more than 0.250 inch (6.350 mm) long, three cracks more than 0.700 inch (17.780 mm), and one crack to (no length limit) are permitted on the OD platform concave airfoil side. These cracks can go to the airfoil concave surface to a height of 0.500 inch (12.70 mm).	Permitted for regular inspection interval.
R		Six cracks (809/9) more than 0.250 inch (6.350 mm) long, four cracks more than 0.700 inch (17.780 mm), and two cracks to (no length limit) are permitted on the OD platform concave airfoil side. These cracks can go to the airfoil concave surface to a height of 0.800 inch (20.320 mm).	Permitted for 300 cycle reduced inspection interval.
R		Two cracks (809/4A) more than 0.250 inch (6.350 mm) long are permitted on the OD platform convex airfoil side, from the airfoil fillet to platform edge.	Permitted for regular inspection interval.

R Crack Inspection
R Table 806 (Continued)

R Observed Condition: Cracks, (Axial And Radial)
R See Figure 806 thru Figure 809.

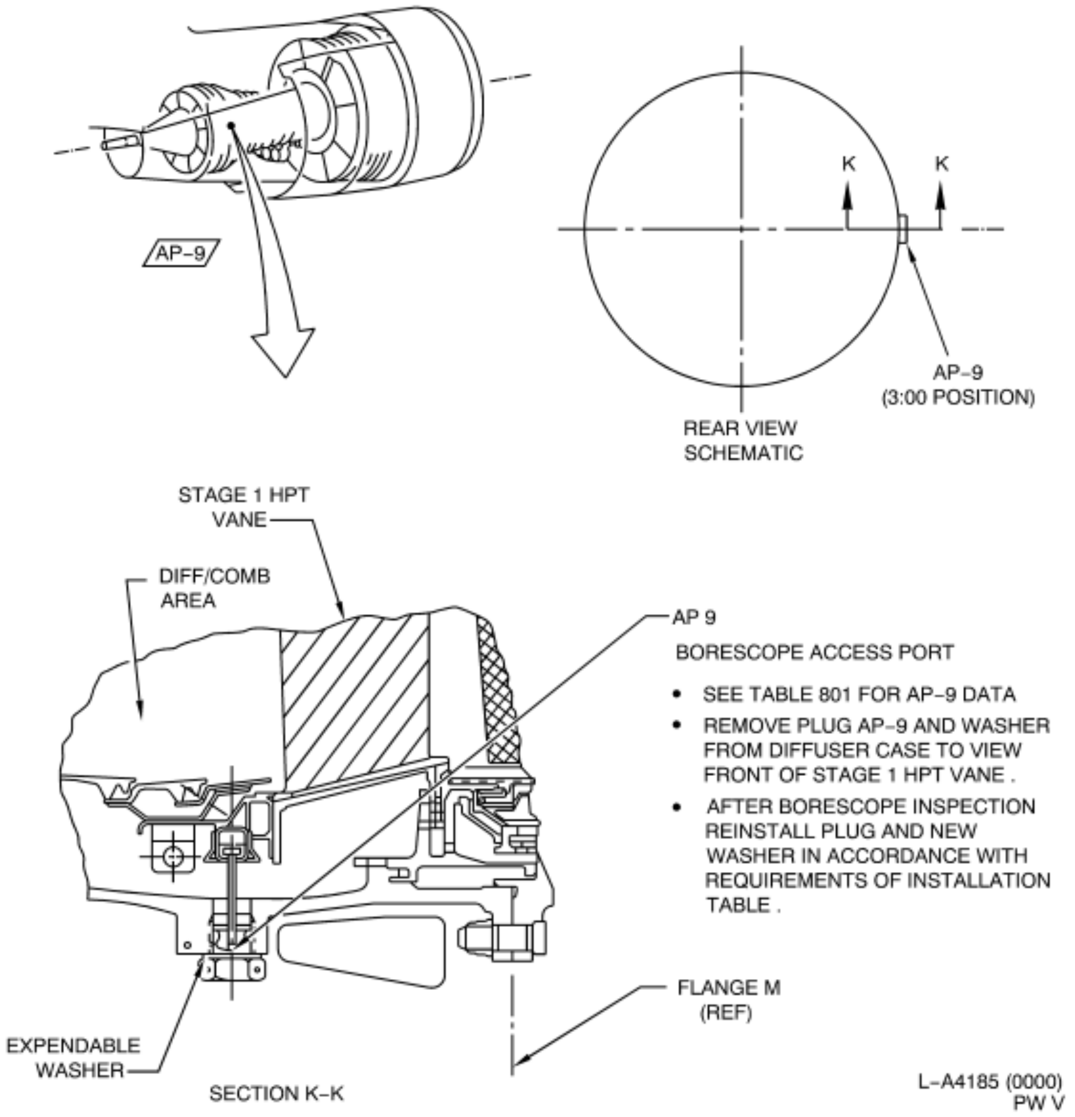
Examine	Damage	Disposition
(CONTINUED)		
	Four cracks (809/9A) more than 0.250 inch (6.350 mm) long are permitted on the OD platform convex airfoil side, from the airfoil fillet to platform edge.	Permitted for 300 cycle reduced inspection interval.
	Two cracks (809/4B) more than 0.250 inch (6.350 mm) long are permitted on the ID platform, concave or convex airfoil side, from the airfoil fillet to platform edge.	Permitted for regular inspection interval.
	Four cracks (809/9B) more than 0.250 inch (6.350 mm) long are permitted on the ID platform, concave or convex airfoil side, from the airfoil fillet to platform edge.	Permitted for 300 cycle reduced inspection interval.
	One crack (809/1) maximum for each side and two cracks total for each vane in the ID or OD fillet radius that goes parallel or axially along the fillet radius surface. The maximum length is 0.600 inch (15.240 mm). Airfoil/platform fillet radius cracks can intersect other cracks, if the total length is less than 1.0 inch (25.400 mm). No circumferential cracks in the leading edge fillet.	Permitted for regular inspection interval.
	One crack (809/6) maximum	Permitted for 300

R Crack Inspection
R Table 806 (Continued)

Observed Condition: Cracks, (Axial And Radial)
See Figure 806 thru Figure 809.

Examine	Damage	Disposition
(CONTINUED)		
	for each side and two cracks total for each vane in the ID or OD fillet radius that goes parallel or axially along the fillet radius surface. The maximum length is 1.000 inch (25.400 mm). Airfoil/platform fillet radius cracks can intersect other cracks, if the total length is less than 1.750 inches (44.450 mm). One crack maximum in the ID or OD leading edge fillet radius surface (809/8) that goes circumferentially around the leading edge to a length of 0.400 inch (10.160 mm) maximum.	cycle reduced inspection interval.
	More than the above interval inspection limits.	Remove engine in 5 cycles maximum or less.

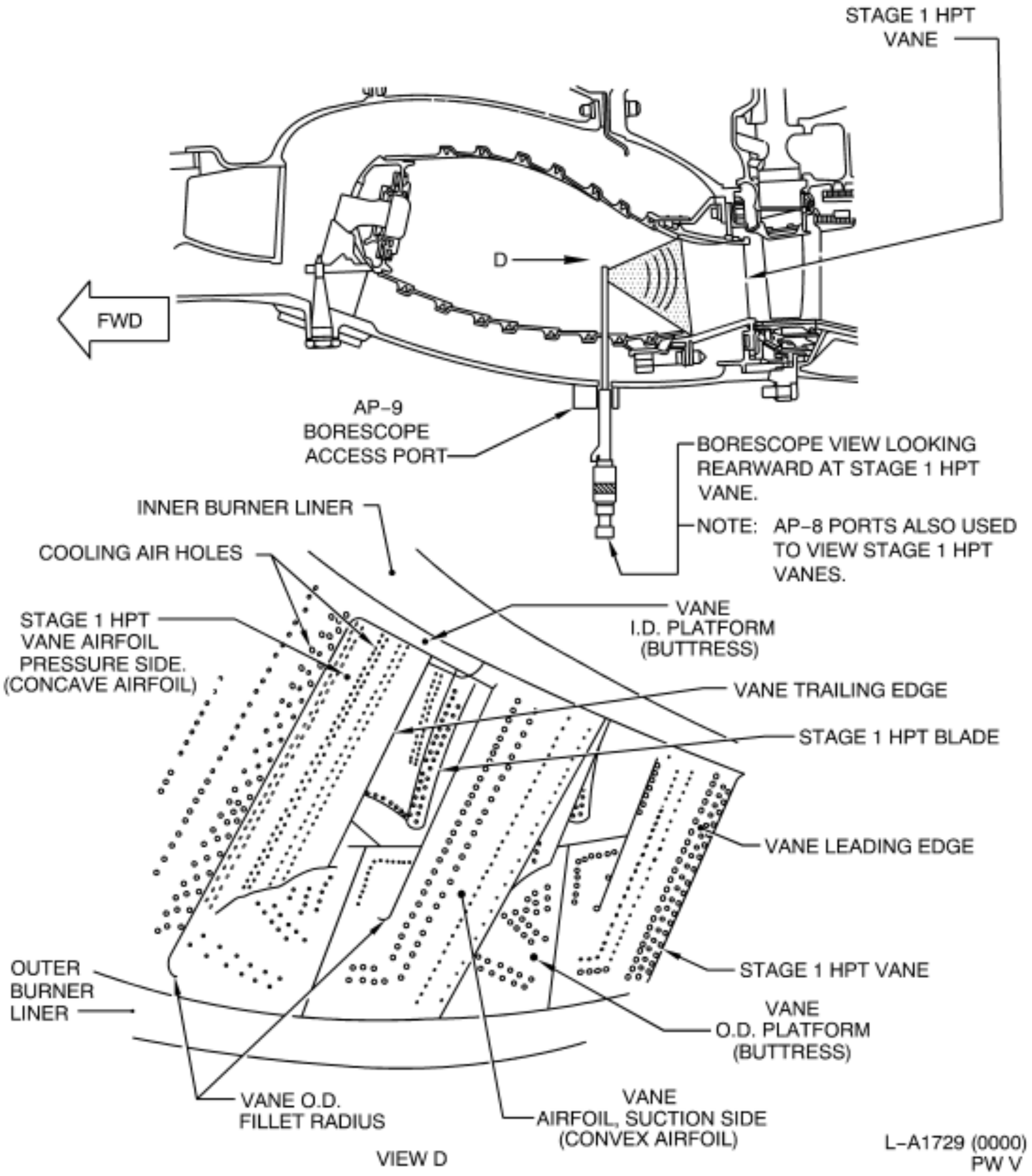
Crack Inspection
Table 806 (Continued)


AP−9
K
K
AP−9
(3:00 POSITION)
REAR VIEW
SCHEMATIC
STAGE 1 HPT
VANE
DIFF/COMB
AREA
AP 9
FLANGE M
(REF)
EXPENDABLE
WASHER
SECTION K−K
L−A4185 (0000)
PW V

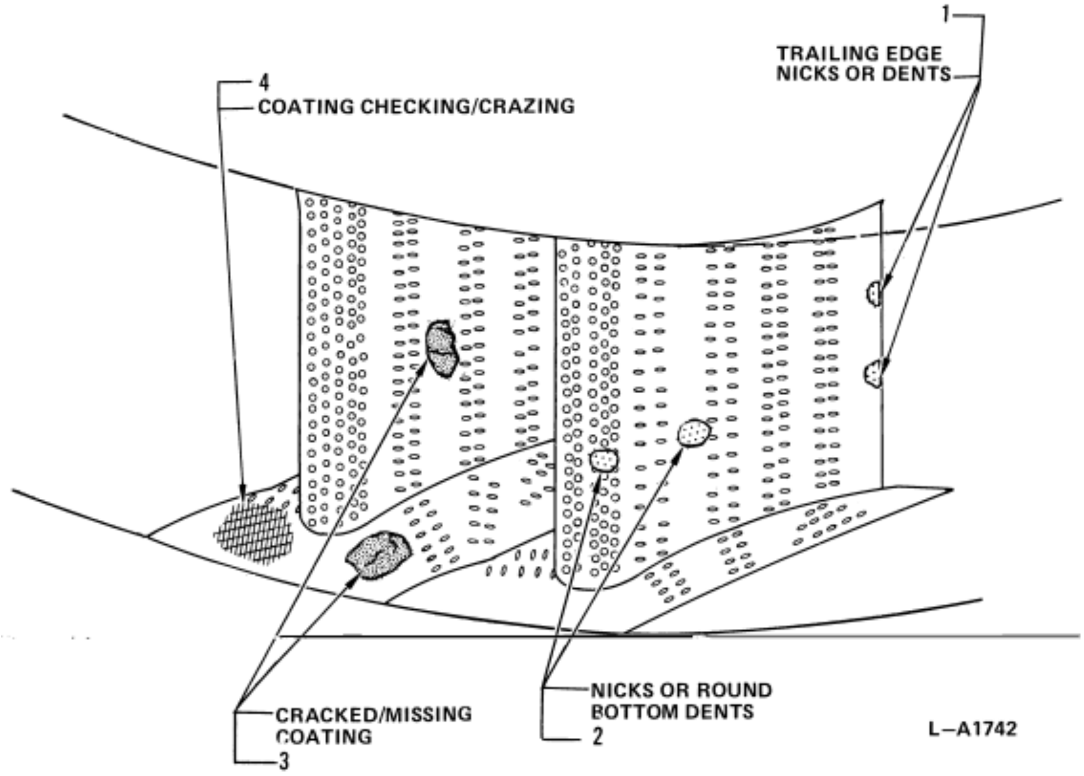
BORESCOPE ACCESS PORT

- SEE TABLE 801 FOR AP−9 DATA
- REMOVE PLUG AP−9 AND WASHER FROM DIFFUSER CASE TO VIEW FRONT OF STAGE 1 HPT VANE .
- AFTER BORESCOPE INSPECTION REINSTALL PLUG AND NEW WASHER IN ACCORDANCE WITH REQUIREMENTS OF INSTALLATION TABLE .

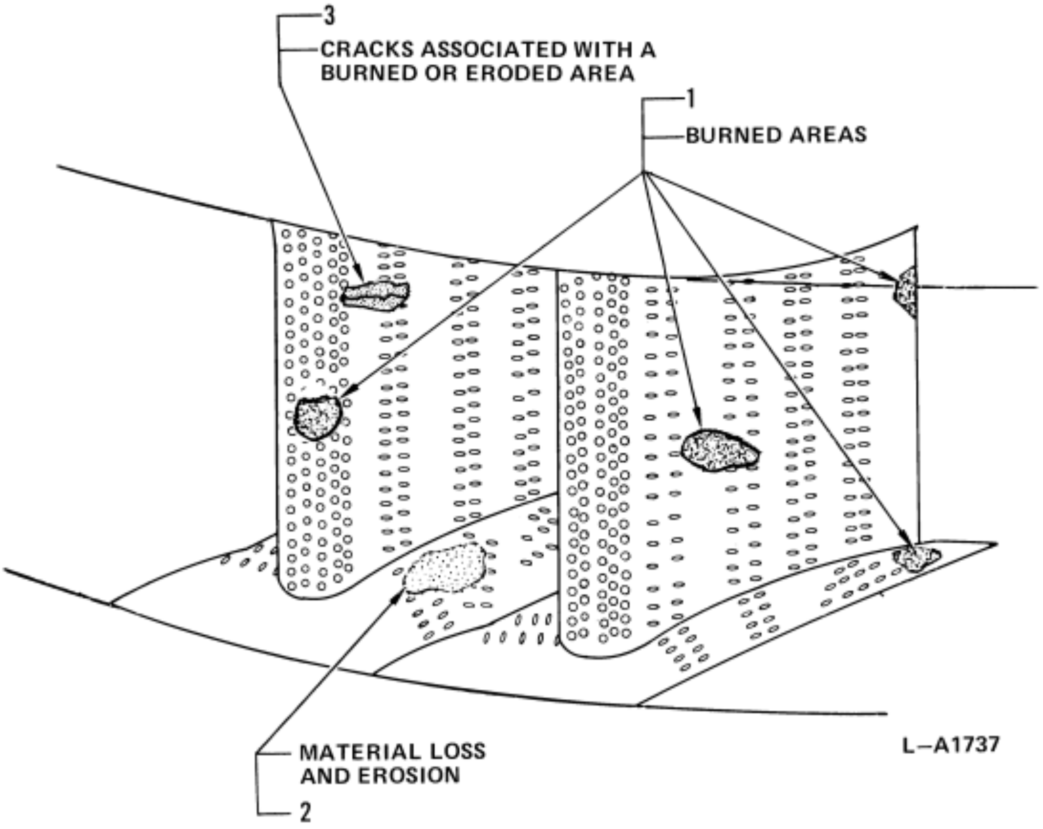
Stage 1 HPT Vane Borescope Access Port (AP−9) Location
Figure 801
(Task 72−00−00−210−017)


STAGE 1 HPT VANE
D
FWD
AP-9 BORESCOPE ACCESS PORT
BORESCOPE VIEW LOOKING REARWARD AT STAGE 1 HPT VANE.
NOTE: AP-8 PORTS ALSO USED TO VIEW STAGE 1 HPT VANES.
INNER BURNER LINER
COOLING AIR HOLES
STAGE 1 HPT VANE AIRFOIL PRESSURE SIDE. (CONCAVE AIRFOIL)
VANE I.D. PLATFORM (BUTTRESS)
VANE TRAILING EDGE
STAGE 1 HPT BLADE
VANE LEADING EDGE
STAGE 1 HPT VANE
OUTER BURNER LINER
VANE O.D. PLATFORM (BUTTRESS)
VANE O.D. FILLET RADIUS
VANE AIRFOIL, SUCTION SIDE (CONVEX AIRFOIL)
VIEW D
L-A1729 (0000)
PW V

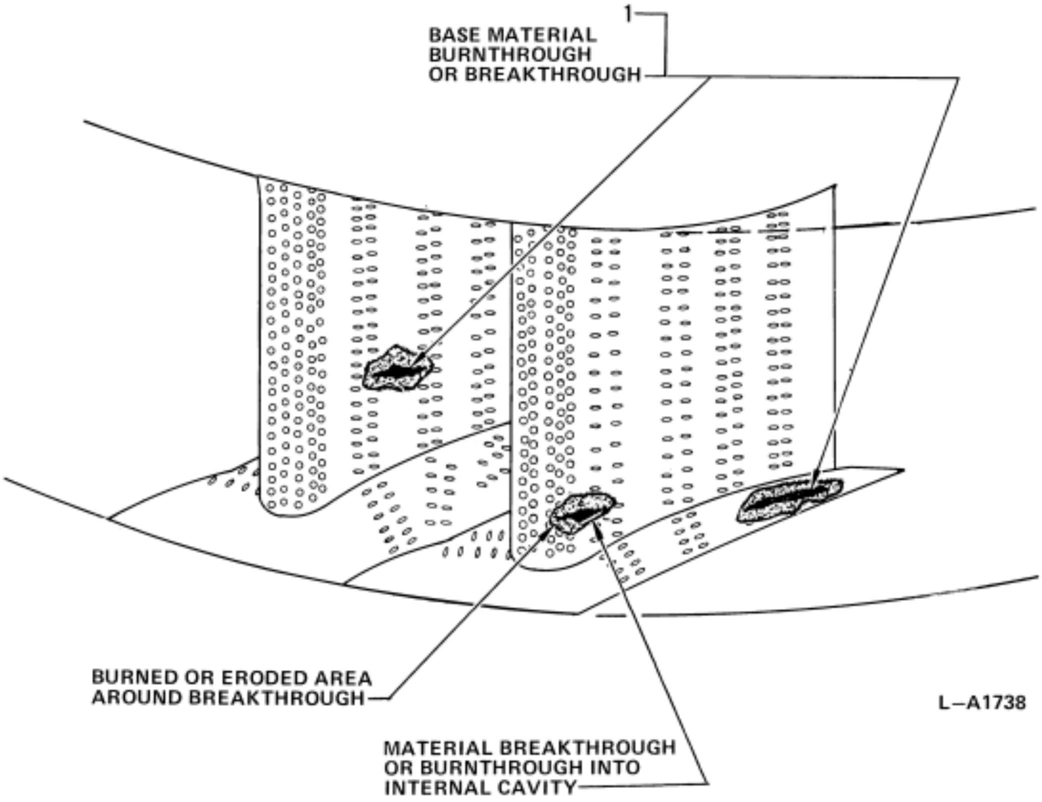
Borescope View Of Stage 1 HPT Vanes (AP-8 And AP-9)
Figure 802
(Task 72-00-00-210-017)


1
TRAILING EDGE
NICKS OR DENTS
4
COATING CHECKING/CRAZING
CRACKED/MISSING
COATING
3
NICKS OR ROUND
BOTTOM DENTS
2
L−A1742

Stage 1 HPT Vane Observed Damage −
Nicks/Dents/Coating Loss (AP−8 Or AP−9 Viewing)
R Figure 803
(Task 72−00−00−210−017)


3
CRACKS ASSOCIATED WITH A BURNED OR ERODED AREA
1
BURNED AREAS
MATERIAL LOSS AND EROSION
2
L−A1737

Stage 1 HPT Vane Observed Damage −
Burning/Erosion/Material Loss (AP−8 Or AP−9 Viewing)
R Figure 804
(Task 72−00−00−210−017)


1
BASE MATERIAL BURNTHROUGH OR BREAKTHROUGH
BURNED OR ERODED AREA AROUND BREAKTHROUGH
MATERIAL BREAKTHROUGH OR BURNTHROUGH INTO INTERNAL CAVITY
L-A1738

Stage 1 HPT Vane Observed Damage - Base
Material Burnthrough (AP-8 Or AP-9 Viewing)
R Figure 805 (Sheet 1)
R (Task 72-00-00-210-017)

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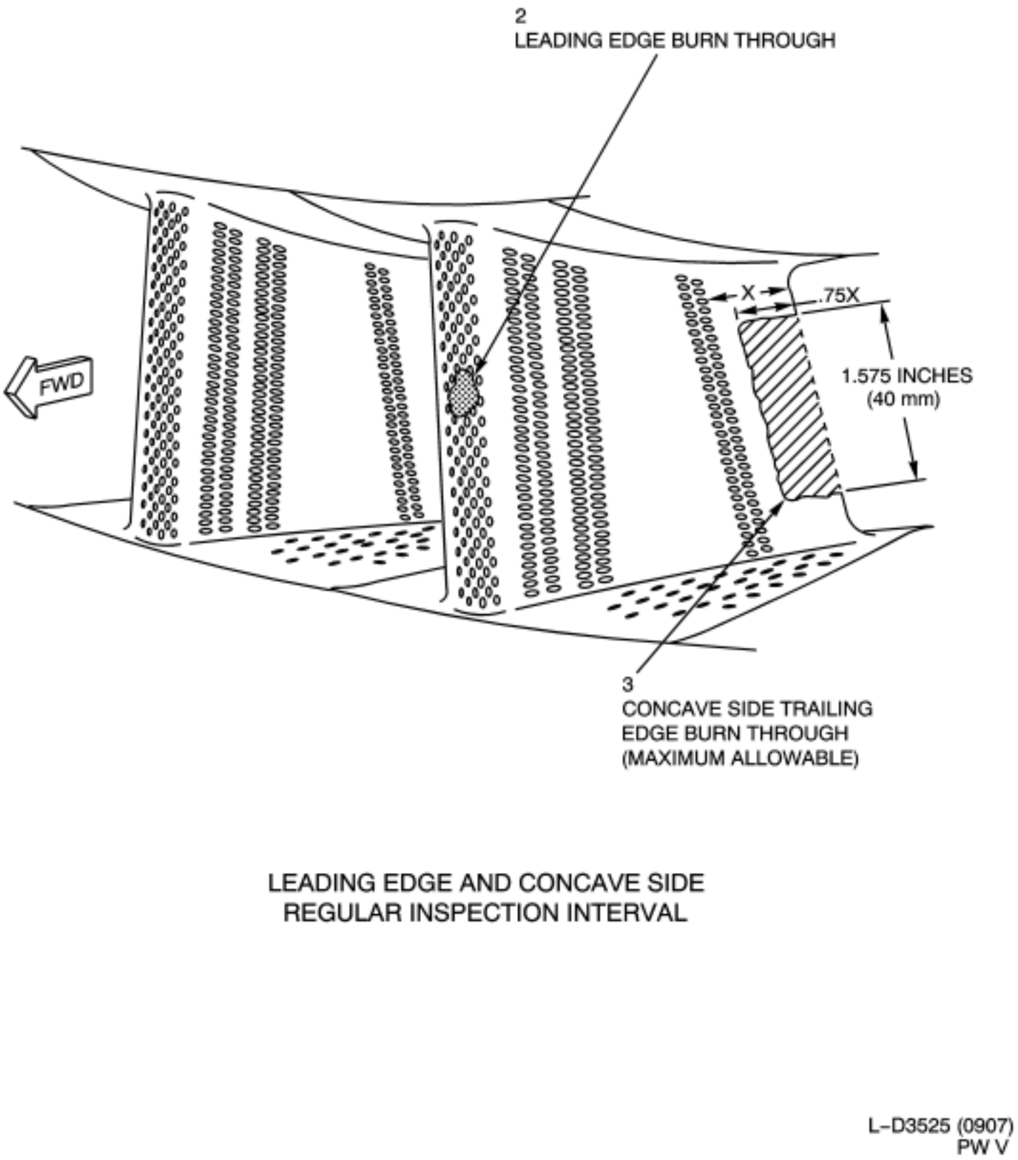
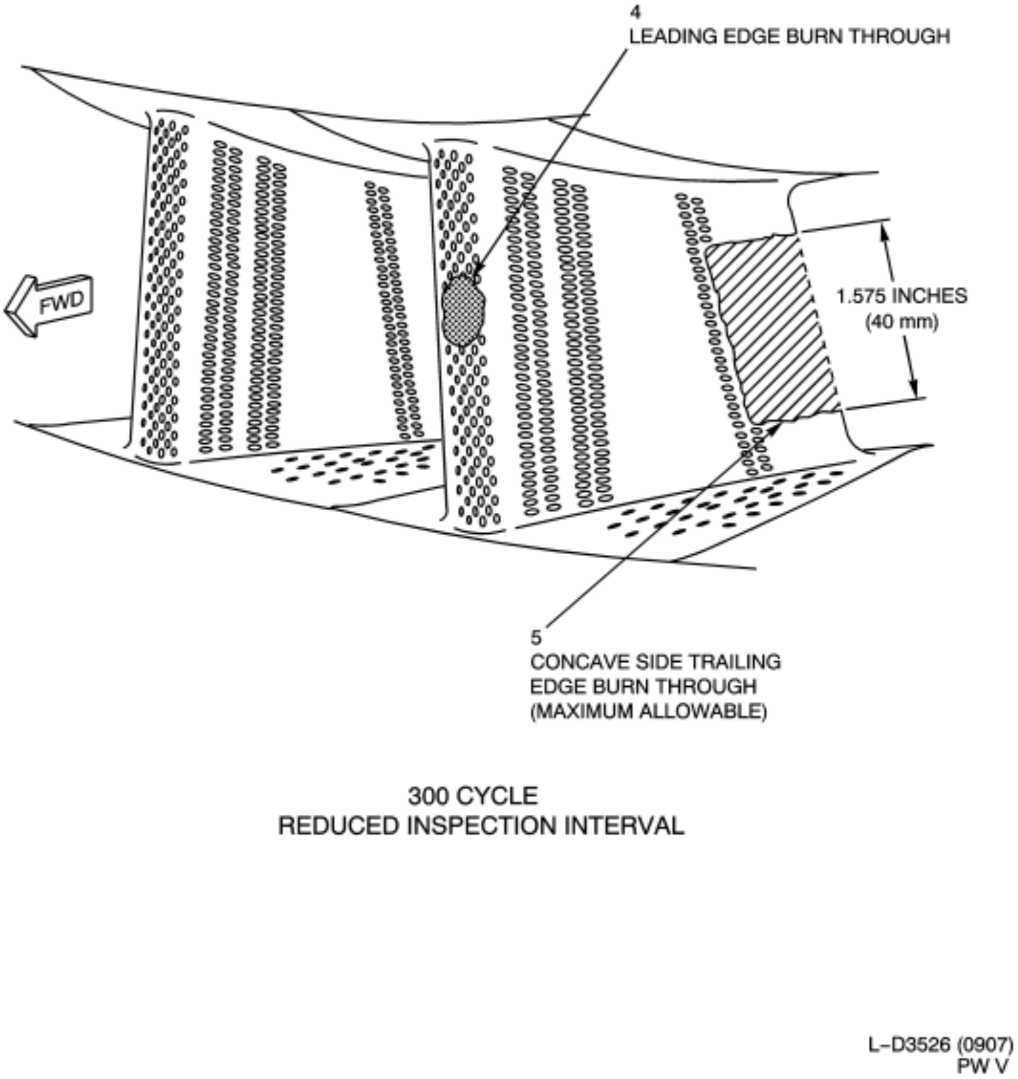
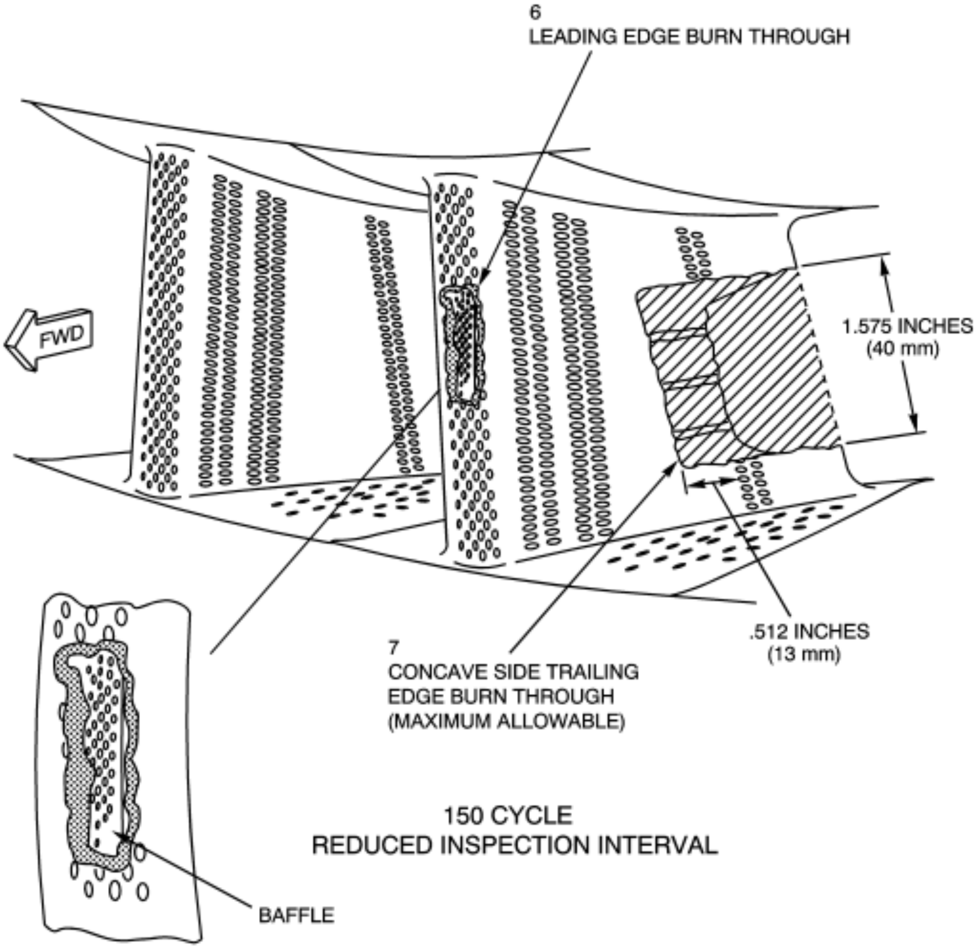

2
LEADING EDGE BURN THROUGH
FWD
X
.75X
1.575 INCHES
(40 mm)
3
CONCAVE SIDE TRAILING
EDGE BURN THROUGH
(MAXIMUM ALLOWABLE)
LEADING EDGE AND CONCAVE SIDE
REGULAR INSPECTION INTERVAL
L-D3525 (0907)
PW V

R Leading Edge And Concave Side Trailing
R Edge Inspection Interval (Regular Inspection)
R Figure 805 (Sheet 2)
R (Task 72-00-00-210-017)


4
LEADING EDGE BURN THROUGH
FWD
1.575 INCHES
(40 mm)
5
CONCAVE SIDE TRAILING
EDGE BURN THROUGH
(MAXIMUM ALLOWABLE)
300 CYCLE
REDUCED INSPECTION INTERVAL
L-D3526 (0907)
PW V

R Leading Edge And Concave Side Trailing
R Edge Reduced Inspection Interval (300 Cycle)
R Figure 805 (Sheet 3)
R (Task 72-00-00-210-017)


6
LEADING EDGE BURN THROUGH
FWD
1.575 INCHES
(40 mm)
.512 INCHES
(13 mm)
7
CONCAVE SIDE TRAILING
EDGE BURN THROUGH
(MAXIMUM ALLOWABLE)
150 CYCLE
REDUCED INSPECTION INTERVAL
BAFFLE

L-D3527 (0907)
PW V

R Leading Edge And Concave Side Trailing
R Edge Reduced Inspection Interval (150 Cycle)
R Figure 805 (Sheet 4)
R (Task 72-00-00-210-017)

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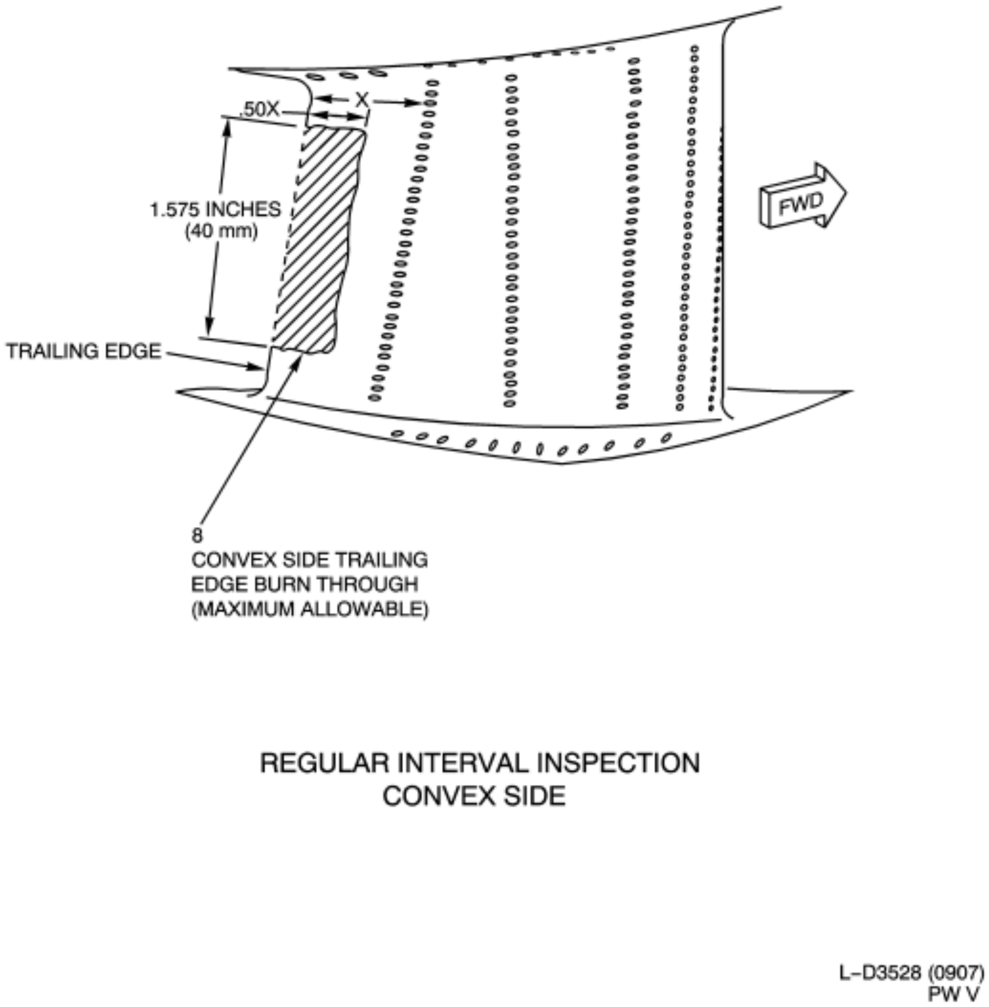
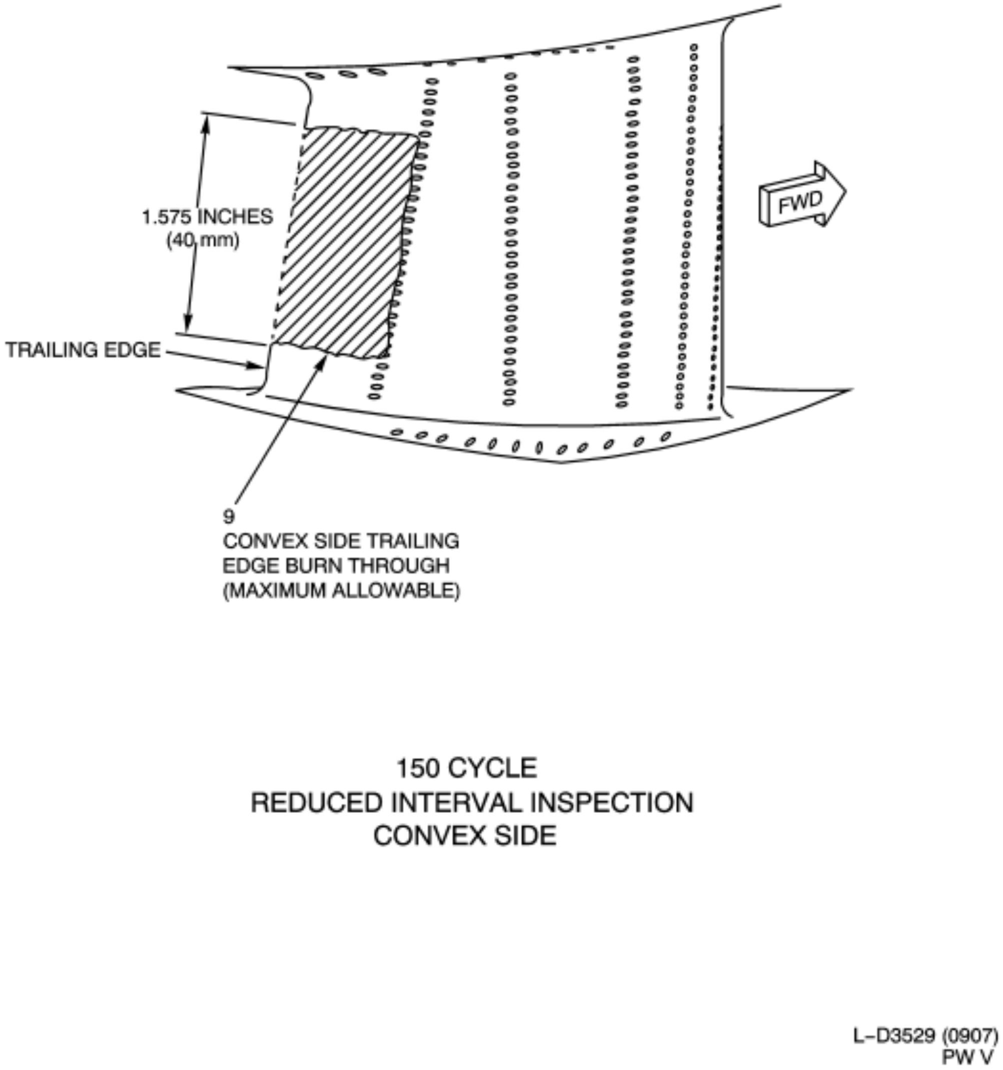

.50X
X
1.575 INCHES
(40 mm)
TRAILING EDGE
FWD
8
CONVEX SIDE TRAILING
EDGE BURN THROUGH
(MAXIMUM ALLOWABLE)
REGULAR INTERVAL INSPECTION
CONVEX SIDE
L−D3528 (0907)
PW V

R Convex Side Trailing Edge Regular
R Inspection Interval (Regular Inspection)
R Figure 805 (Sheet 5)
R (Task 72−00−00−210−017)


1.575 INCHES
(40 mm)
TRAILING EDGE
FWD
9
CONVEX SIDE TRAILING
EDGE BURN THROUGH
(MAXIMUM ALLOWABLE)
150 CYCLE
REDUCED INTERVAL INSPECTION
CONVEX SIDE
L-D3529 (0907)
PW V

R Convex Side Trailing Edge Inspection (150 Cycle)
R Figure 805 (Sheet 6)
R (Task 72-00-00-210-017)

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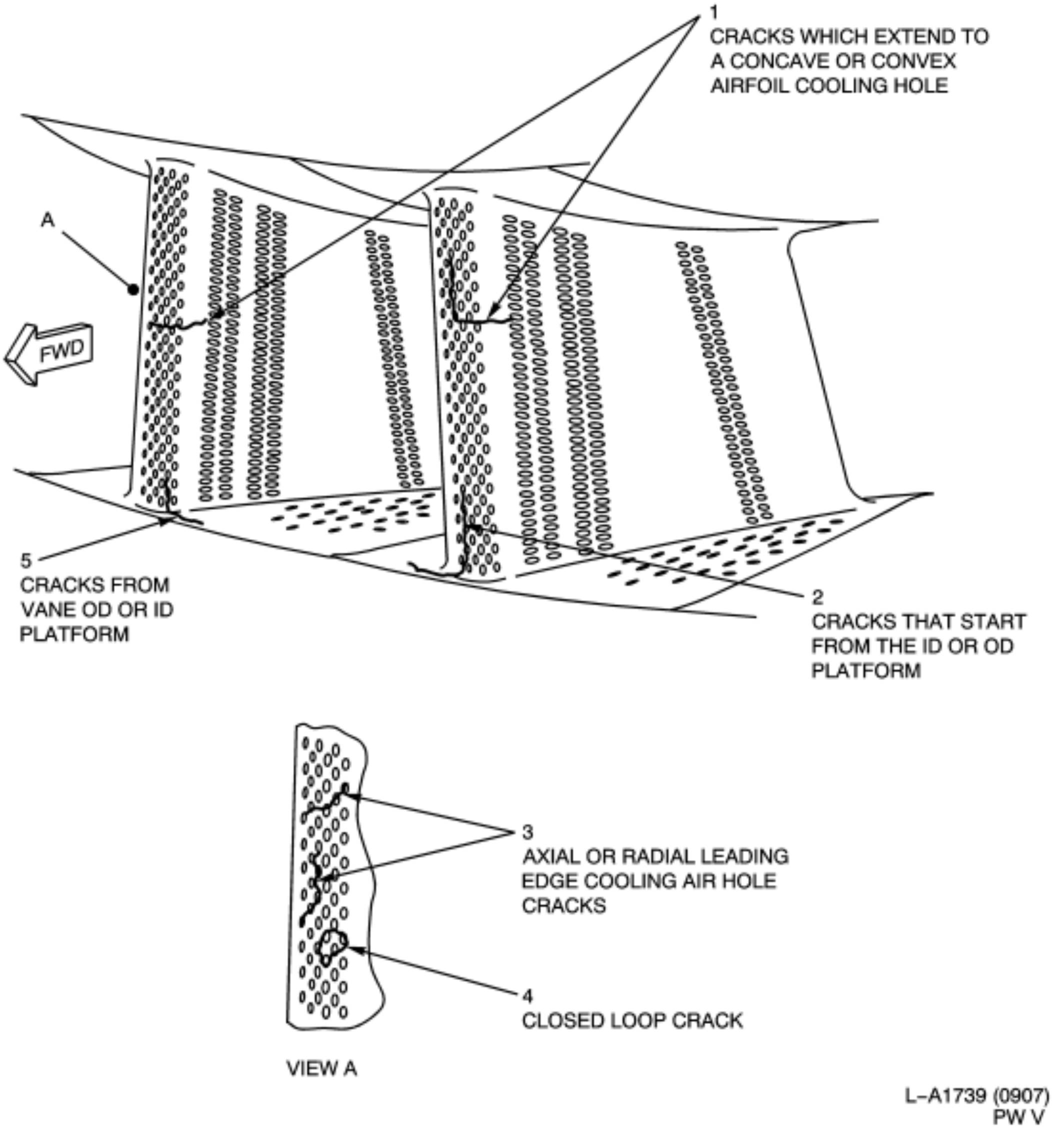
1
CRACKS WHICH EXTEND TO A CONCAVE OR CONVEX AIRFOIL COOLING HOLE
A
FWD
5
CRACKS FROM VANE OD OR ID PLATFORM
2
CRACKS THAT START FROM THE ID OR OD PLATFORM
3
AXIAL OR RADIAL LEADING EDGE COOLING AIR HOLE CRACKS
4
CLOSED LOOP CRACK
VIEW A
L−A1739 (0907)
PW V

Stage 1 HPT Vane Observed Damage − Leading
Edge Cracks (AP−8 Or AP−9 Viewing)
R Figure 806
(Task 72−00−00−210−017)

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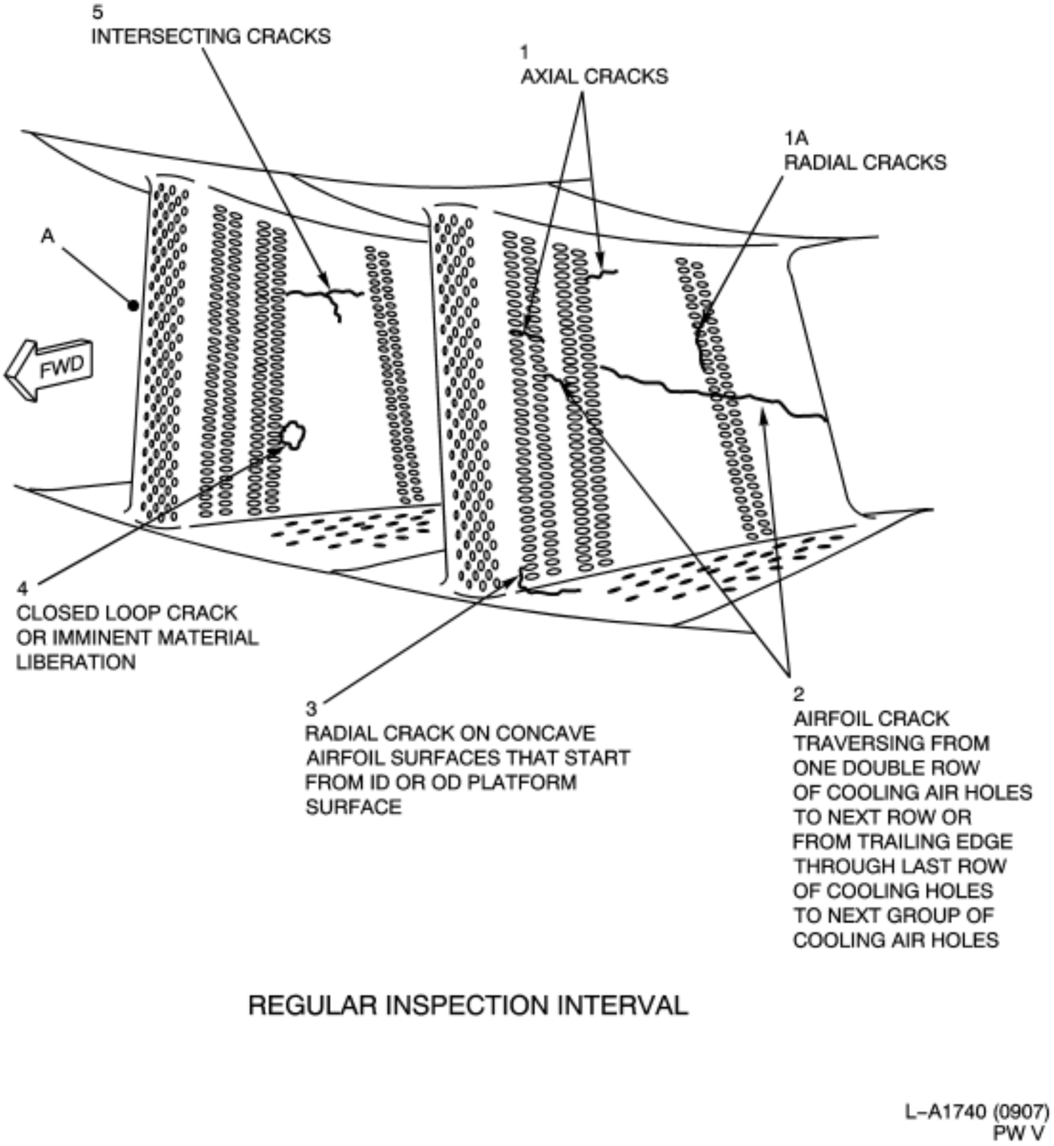
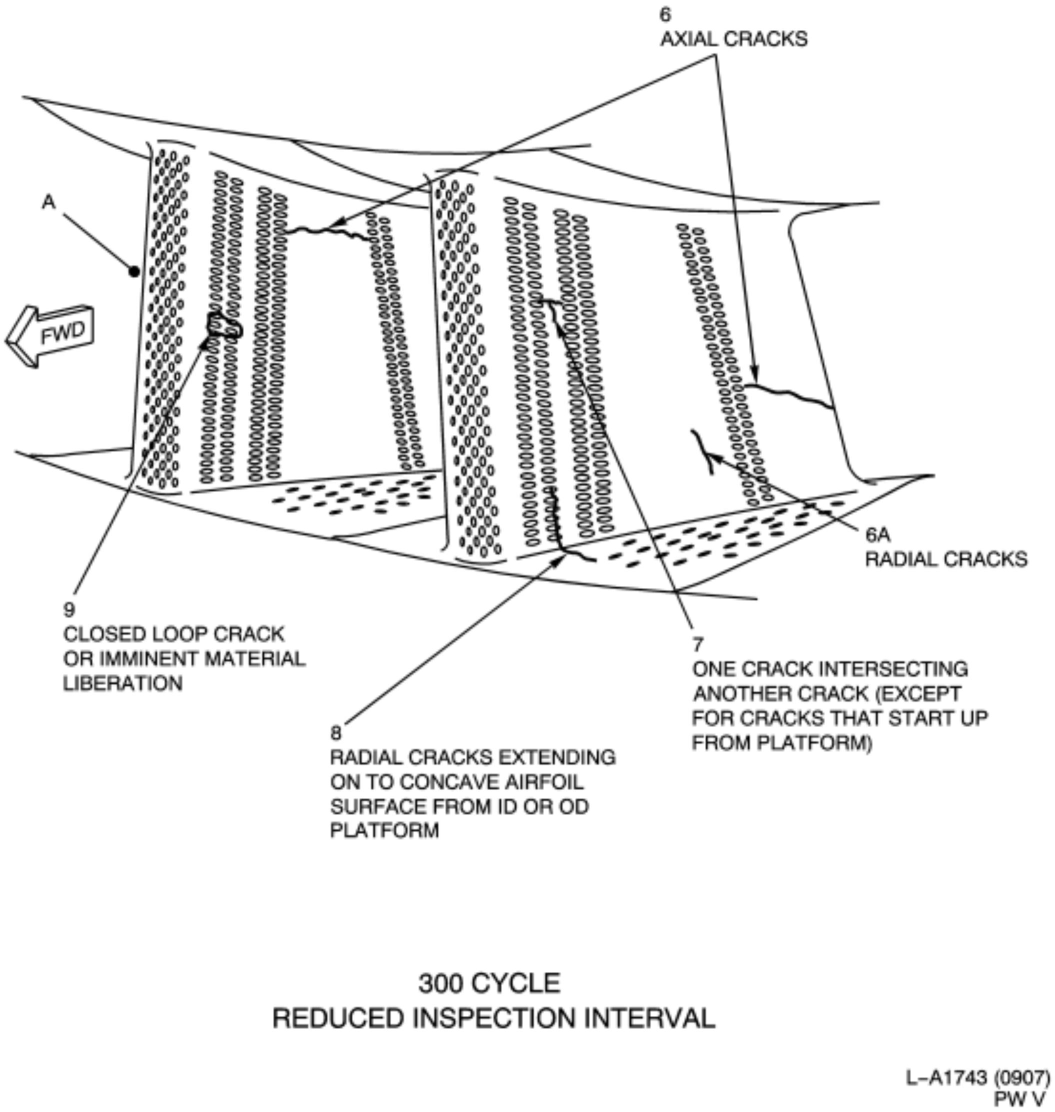
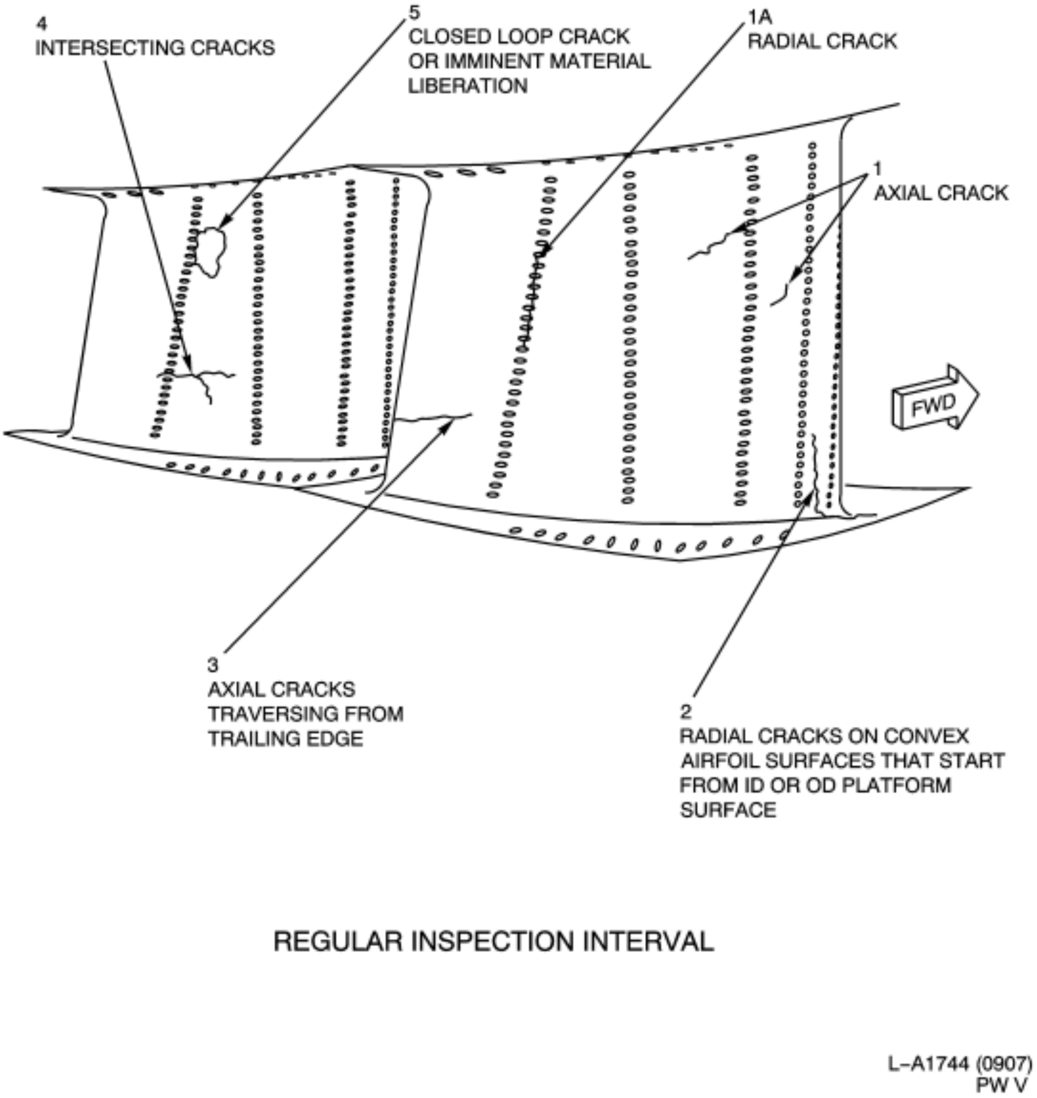

5
INTERSECTING CRACKS
1
AXIAL CRACKS
1A
RADIAL CRACKS
A
FWD
4
CLOSED LOOP CRACK
OR IMMINENT MATERIAL
LIBERATION
3
RADIAL CRACK ON CONCAVE
AIRFOIL SURFACES THAT START
FROM ID OR OD PLATFORM
SURFACE
2
AIRFOIL CRACK
TRAVERSING FROM
ONE DOUBLE ROW
OF COOLING AIR HOLES
TO NEXT ROW OR
FROM TRAILING EDGE
THROUGH LAST ROW
OF COOLING HOLES
TO NEXT GROUP OF
COOLING AIR HOLES
REGULAR INSPECTION INTERVAL
L−A1740 (0907)
PW V

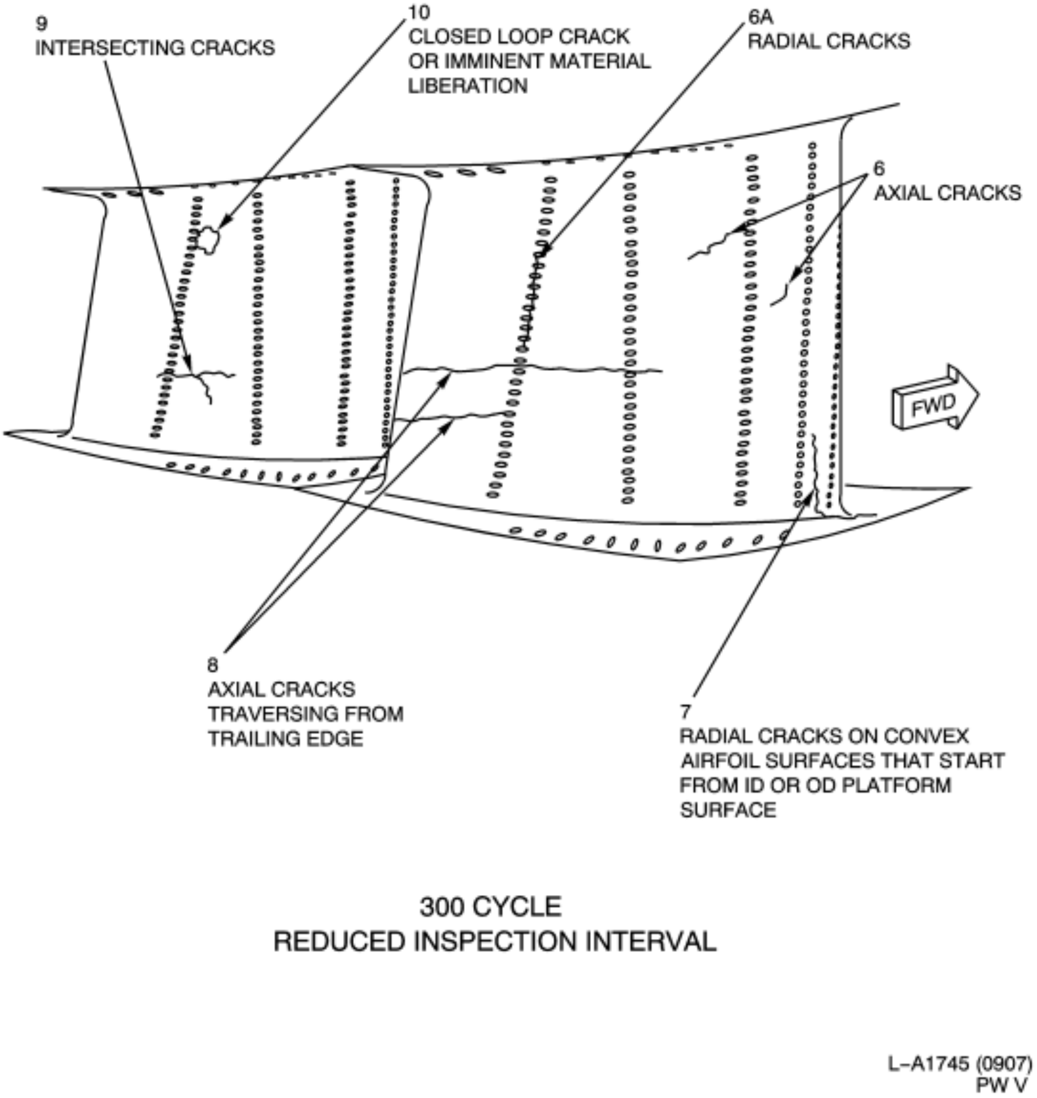
Stage 1 HPT Vane Observed Damage − Airfoil
Cracks On Concave Side (AP−8 Or AP−9 Viewing)
R Figure 807 (Sheet 1)
(Task 72−00−00−210−017)


6
AXIAL CRACKS
A
FWD
6A
RADIAL CRACKS
9
CLOSED LOOP CRACK
OR IMMINENT MATERIAL
LIBERATION
7
ONE CRACK INTERSECTING
ANOTHER CRACK (EXCEPT
FOR CRACKS THAT START UP
FROM PLATFORM)
8
RADIAL CRACKS EXTENDING
ON TO CONCAVE AIRFOIL
SURFACE FROM ID OR OD
PLATFORM
300 CYCLE
REDUCED INSPECTION INTERVAL
L−A1743 (0907)
PW V

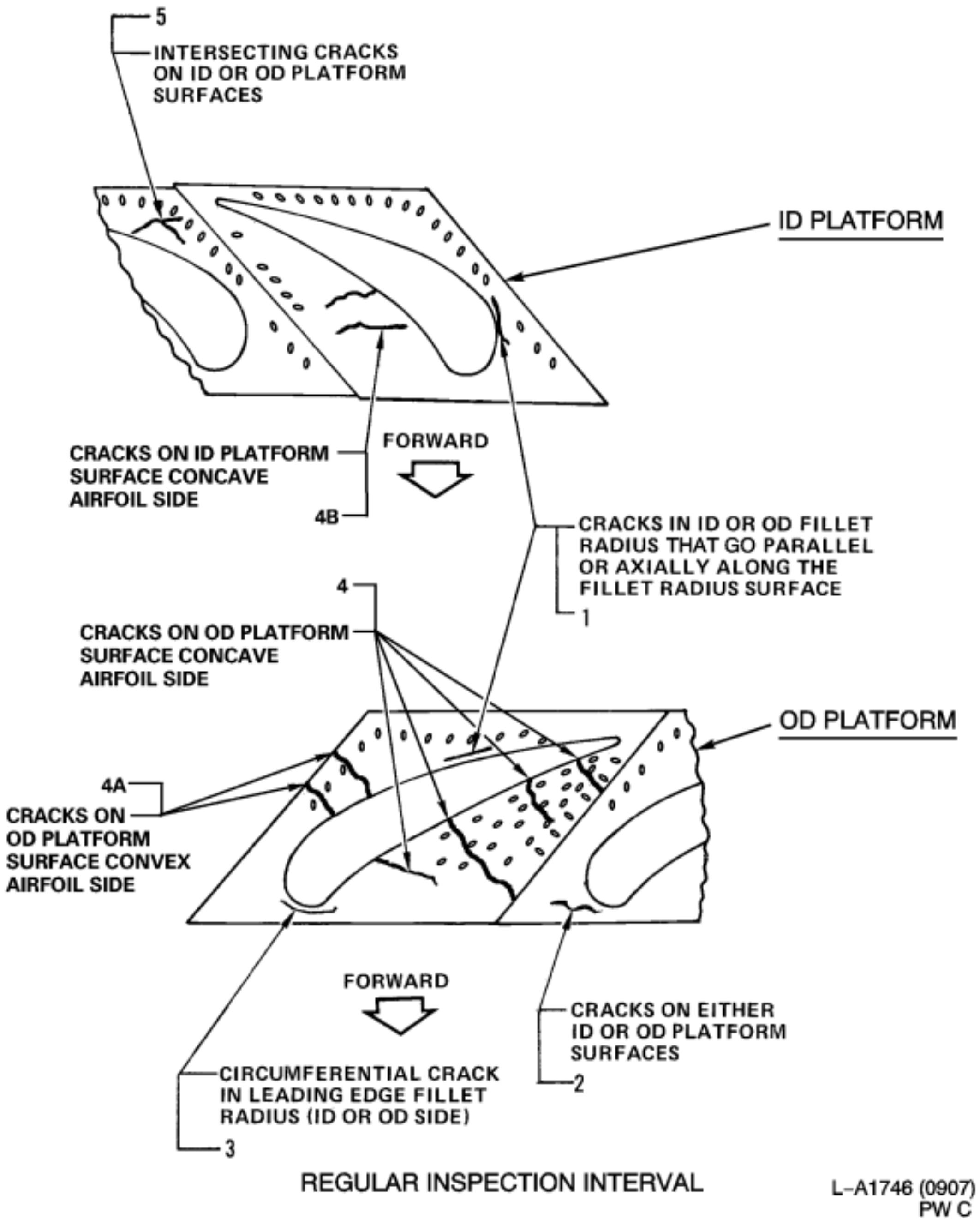
Stage 1 HPT Vane Observed Damage − Airfoil
Cracks On Concave Side (AP−8 Or AP−9 Viewing)
Figure 807 (Sheet 2)
(Task 72−00−00−210−017)


4
INTERSECTING CRACKS
5
CLOSED LOOP CRACK
OR IMMINENT MATERIAL
LIBERATION
1A
RADIAL CRACK
1
AXIAL CRACK
FWD
3
AXIAL CRACKS
TRAVERSING FROM
TRAILING EDGE
2
RADIAL CRACKS ON CONVEX
AIRFOIL SURFACES THAT START
FROM ID OR OD PLATFORM
SURFACE
REGULAR INSPECTION INTERVAL
L-A1744 (0907)
PW V

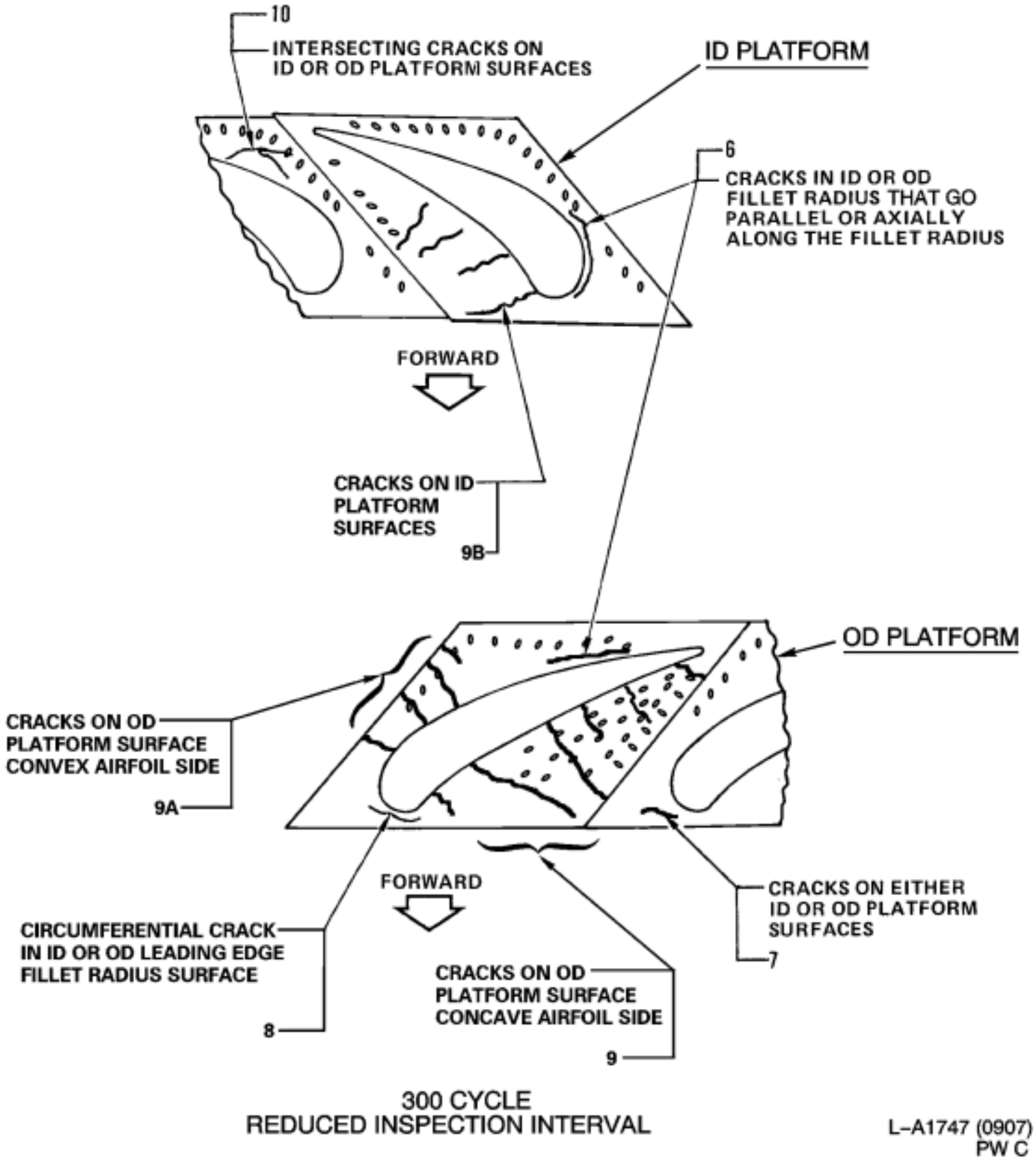
Stage 1 HPT Vane Observed Damage - Airfoil
Cracks On Convex Side (AP-8 Or AP-9 Viewing)
R Figure 808 (Sheet 1)
(Task 72-00-00-210-017)


9
INTERSECTING CRACKS
10
CLOSED LOOP CRACK
OR IMMINENT MATERIAL
LIBERATION
6A
RADIAL CRACKS
6
AXIAL CRACKS
FWD
8
AXIAL CRACKS
TRAVERSING FROM
TRAILING EDGE
7
RADIAL CRACKS ON CONVEX
AIRFOIL SURFACES THAT START
FROM ID OR OD PLATFORM
SURFACE
300 CYCLE
REDUCED INSPECTION INTERVAL
L-A1745 (0907)
PW V

Stage 1 HPT Vane Observed Damage - Airfoil
Cracks On Convex Side (AP-8 Or AP-9 Viewing)
R Figure 808 (Sheet 2)
(Task 72-00-00-210-017)


5
INTERSECTING CRACKS ON ID OR OD PLATFORM SURFACES
ID PLATFORM
CRACKS ON ID PLATFORM SURFACE CONCAVE AIRFOIL SIDE
4B
FORWARD
CRACKS IN ID OR OD FILLET RADIUS THAT GO PARALLEL OR AXIALLY ALONG THE FILLET RADIUS SURFACE
1
4
CRACKS ON OD PLATFORM SURFACE CONCAVE AIRFOIL SIDE
OD PLATFORM
4A
CRACKS ON OD PLATFORM SURFACE CONVEX AIRFOIL SIDE
FORWARD
CRACKS ON EITHER ID OR OD PLATFORM SURFACES
2
CIRCUMFERENTIAL CRACK IN LEADING EDGE FILLET RADIUS (ID OR OD SIDE)
3
REGULAR INSPECTION INTERVAL
L-A1746 (0907)
PW C

Stage 1 HPT Vane Observed Damage - ID, OD
Platform (Buttress) Cracks (AP-8 Or AP-9 Viewing)
Figure 809 (Sheet 1)
(Task 72-00-00-210-017)


10
INTERSECTING CRACKS ON ID OR OD PLATFORM SURFACES
ID PLATFORM
6
CRACKS IN ID OR OD FILLET RADIUS THAT GO PARALLEL OR AXIALLY ALONG THE FILLET RADIUS
FORWARD
CRACKS ON ID PLATFORM SURFACES
9B
OD PLATFORM
CRACKS ON OD PLATFORM SURFACE CONVEX AIRFOIL SIDE
9A
FORWARD
CIRCUMFERENTIAL CRACK IN ID OR OD LEADING EDGE FILLET RADIUS SURFACE
8
CRACKS ON EITHER ID OR OD PLATFORM SURFACES
7
CRACKS ON OD PLATFORM SURFACE CONCAVE AIRFOIL SIDE
9
300 CYCLE
REDUCED INSPECTION INTERVAL
L−A1747 (0907)
PW C

Stage 1 HPT Vane Observed Damage − ID, OD
Platform (Buttress) Cracks (AP−8 Or AP−9 Viewing)
R Figure 809 (Sheet 2)
(Task 72−00−00−210−017)

Task 72-00-00-210-028:

1. Perform Borescope Inspection Of Stage 1 HPT Vanes (AP-8)

A. Equipment And Materials Necessary

Standard Tools:
See Inspection/Check-01A (Task 72-00-00-990-011) for borescope equipment.

Consumable Materials:

Item No.	Designation
P05-289	Lockwire
P06-023	Thread Lubricant (PWA 36001 or PMC 9940)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	6	72-41-00/1/130A

B. Procedure

(1) Remove the AP-8 access port plugs from the diffuser case as follows: See Figure 801.

NOTE: Table 801 shows more specifications for the plugs at location AP-8.

(a) Cut the safety wire and remove the safety wire from the plugs that will be removed.

(b) Use a standard 3/8 socket drive extension and a breaker bar or ratchet to remove the AP-8 plugs.

(c) Remove the AP-8 plugs and gaskets, as necessary, for the examination of the stage 1 HPT vanes.

(d) Discard all the old gaskets.

Access Port & (Stage)	Angular Location Clockwise From Rear	Gasket P/N	Plug P/N	Plug Thread Lubricant	Plug Torque lb-in. (N.m)
AP-8	45° (1:30 o'clock)	512640	50A725	P06-023	40 - 50 (4.519 - 5.649)

Borescope Access Port (AP) Data
Table 801

Access Port & (Stage)	Angular Location Clockwise From Rear	Gasket P/N	Plug P/N	Plug Thread Lubricant	Plug Torque lb-in. (N.m)
AP-8	127° (4:30 o'clock)	512640	50A725	P06-023	40 - 50 (4.519 - 5.649)
AP-8	172° (6:00 o'clock)	512640	50A725	P06-023	40 - 50 (4.519 - 5.649)
AP-8	225° (7:30 o'clock)	512640	50A725	P06-023	40 - 50 (4.519 - 5.649)
AP-8	277° (9:00 o'clock)	512640	50A725	P06-023	40 - 50 (4.519 - 5.649)
AP-8	338° (11:00 o'clock)	512640	50A725	P06-023	40 - 50 (4.519 - 5.649)

For Engines Equipped:

NOTE: If the high stage temp sensor was removed to borescope through the (338°C) 11:00 o'clock port, reinstall per Section 71-00-41, Installation-04.

Borescope Access Port (AP) Data
Table 801 (Continued)

CAUTION: TEMPERATURES IN AREAS TO BE BORESCOPED SHOULD BE PERMITTED TO COOL TO BELOW 150°F (65.6°C) FOLLOWING ENGINE OPERATION. DAMAGE MAY RESULT TO BORESCOPE EQUIPMENT IF EQUIPMENT IS EXPOSED TO GASPATH OR METAL TEMPERATURES IN EXCESS OF 150°F (65.6°C). AS A GUIDE - IF ADJACENT CASES ARE TOO HOT TO TOUCH COMFORTABLY, INSPECTION SHOULD BE DELAYED.

(2) Insert the flexible borescope through the port and inspect the Stage 1 HPT vanes for nicks, dents, base material breakthrough/burnthrough, cracks, burning, erosion, coating loss, blocked cooling air holes,

sulfidation and damage caused by passage of foreign material.

NOTE: Maximum borescope insertion depth and borescope limiting access hole diameter specifications for AP−8 borescope ports are given in Table 801 Inspection/Check−01A Task 72−00−00−990−011.

(3) Borescope inspection limits for Stage 1 vanes.

CAUTION: FOLLOWING LIMITS ARE APPLICABLE ON A CONTINUE−IN−SERVICE BASIS ONLY. LIMIT IS BASED ON PART STRUCTURAL REQUIREMENTS AND DOES NOT IMPLY THAT ENGINE PERFORMANCE, STABILITY, OPERATING LIMITS, OR PART REPARABILITY WILL BE MAINTAINED.

(a) Limits for vane conditions observed during
R borescope inspection are given in Table 802 thru
R Table 806 and Figure 803 thru Figure 809.

(4) After you complete the borescope inspection, install the AP−8 plugs as follows:

(a) Use a nylon brush to clean the old antigalling compound from the threads of each AP plug.

(b) Apply a thin layer of new antigalling compound to the threads and to the plug head washer contact surface area. See Table 801 for the necessary antigalling compound.

NOTE: Do not use Engine Oil P03−001 on the AP plug threads.

(c) If you apply more antigalling compound than is necessary to the plug, remove the unwanted compound with a rag or cloth.

(d) Put a new gasket or washer on each AP plug, as necessary. See Table 801 for the necessary gasket or washer.

NOTE: Always use a new gasket or washer. Do not use an old gasket or washer.

(e) Install the AP plugs and gaskets or washers in the applicable borescope boss on the engine. See Table 801 for the necessary AP plug and gasket or washer part numbers for each location. Use a standard socket drive extension and ratchet to turn each AP plug into the boss. Hand tighten the plug only with the ratchet wrench.

(f) Use a standard torque wrench to torque the AP plugs. See Table 801 for the necessary torque specifications.

(g) Safety all the AP plugs with Lockwire P05-289.

Observed Condition: Nicks And Dents
See Figure 803.

Examine	Damage	Disposition
Leading edge, concave and convex airfoils, ID and OD platforms	Nicks and round bottomed dents (803/2) to 0.125 inch (3.175 mm) in length or diameter are permitted.	Permitted for regular inspection interval.

NOTE: If the view angle is such that the depth can be determined. The maximum nick and round bottom dent depth is 0.312 inch (7.925 mm).

Examine	Damage	Disposition
Trailing edge	Two nicks or dents (803/1) maximum on the trailing edge, separated by at least 0.750 inch (19.050 mm). Five vanes maximum on each engine.	Permitted for regular inspection interval.
	More than the above interval inspection limits.	Remove engine in 5 cycles maximum or less.

Nicks And Dents Inspection
Table 802

Observed Condition: Damaged Or Missing Thermal Barrier Coating
See Figure 803.

Examine	Damage	Disposition
Leading edge, concave and convex airfoils, ID and OD platforms, trailing edge	No limit on the quantity of chipped coating, coating loss, checking, crazed or cracked thermal barrier coating. See (803/3) and (803/4).	Permitted for regular inspection interval.

NOTE: If a large quantity of thermal barrier coating is missing, (gone), and the vane is operated for a long time, it is possible that the vane cannot be repaired at overhaul. The vane base metal can become burned and eroded.

Thermal Barrier Coating Inspection
Table 803

Observed Condition: Burning and Erosion
See Figure 804.

Examine	Damage	Disposition
Leading edge, concave and convex airfoils, ID and OD platforms, trailing edge	No limit on the quantity of burning (804/1) and erosion (804/2) as long as it is not burned completely through the wall. See (804/1), (804/2), and (804/3).	Permitted for regular inspection interval.

Burning and Erosion Inspection
Table 804

Observed Condition: Material Breakthrough Or Burnthrough
See Figure 805.

Examine	Damage	Disposition
Leading edge, concave and convex airfoils, ID and OD platforms	One material breakthrough or burnthrough (805/2) with an open area (material that is not there) to 0.157 inch (3.988 mm) diameter or 0.019 sq-in. (12. sq-mm).	Permitted for regular inspection interval.
	One material breakthrough or burnthrough (805/1) and (805/4) with an open area (material that is not there) more than 0.157 inch (3.988 mm) but less than 0.300 inch (7.620 mm) diameter or to 0.070 sq-in. (45. sq-mm) maximum.	Permitted for 300 cycle reduced inspection interval.
	A maximum of five vanes for each engine with one material breakthrough or burnthrough (805/1), (805/4), and (805/6) more than 0.300 inch (7.620 mm) but less than 0.500 inch (12.700 mm) diameter or 0.196 sq-inch (126. sq-mm) into the internal cavity.	Permitted for 300 cycle reduced inspection interval.
	More than 5 vanes with one material breakthrough or burnthrough (805/1) and (805/6) more than 0.300 inch (7.620 mm) but less than 0.500 inch (12.700 mm) diameter or up 0.196 sq-inch (126. sq-mm) maximum.	Permitted for 150 cycle reduced inspection interval.
	For leading edge burnthrough more than	Permitted for 50 cycle reduced

Material Breakthrough Or Burnthrough Inspection
Table 805

Observed Condition: Material Breakthrough Or Burnthrough
See Figure 805.

Examine	Damage	Disposition
	0.500 inch (12.700 mm) diameter: No limit on the number of vanes with leading edge burnthrough to 1.614 inch (40.996 mm) maximum radial length that does not go axially more than the first row of concave side cooling holes and does not go axially more than the second row of convex side cooling holes is permitted if there is no burning on the internal baffle.	inspection interval.
	Vane baffle burned through.	Not permitted.
	More than the above interval inspection limits.	Remove engine in 5 cycles maximum or less.
Concave side trailing edge	Burnthrough (805/3) less than 75% span of axial length from the trailing edge to the rear cooling holes and up 1.575 inches (40.005 mm) maximum width.	Permitted for regular inspection interval.
	Burnthrough (805/5) more than 75% span of axial length from the trailing edge to the rear cooling holes and to 1.575 inches (40.005 mm) maximum width.	Permitted for 300 cycle reduced inspection interval.
	Burnthrough (805/7) to 0.512 inch (13 mm) forward of the rear two rows of cooling holes and up to 1.575 inches (40.005 mm) maximum width.	Permitted for 150 cycle reduced inspection interval.

Material Breakthrough Or Burnthrough Inspection
Table 805 (Continued)

R Observed Condition: Material Breakthrough Or Burnthrough
R See Figure 805.

R	Examine	Damage	Disposition
	(CONTINUED)		
R		Burnthrough more than 0.511 inch (12.979 mm) forward of the rear two rows of cooling holes, or is more than 1.575 inches (40.005 mm) in width, or if the internal baffle is burned through.	Remove engine in 5 cycles maximum or less.
R	Convex side trailing edge	Burnthrough (805/8) less than 50% span from the trailing edge to the rear cooling holes.	Permitted for regular inspection interval.
R		Burnthrough (805/9) more than 50% span from the trailing edge to the rear cooling holes.	Permitted for 150 cycle reduced inspection interval.
R		Burnthrough is forward of the rear cooling holes.	Remove engine in 5 cycles maximum or less.

R Material Breakthrough Or Burnthrough Inspection
R Table 805 (Continued)

Observed Condition: Cracks, (Axial And Radial)
See Figure 806 thru Figure 809.

Examine	Damage	Disposition
Leading edge surface	No limit on the quantity of tight cracks (806/3). Closed loop cracks (806/4) are not permitted.	Permitted for regular inspection interval.
	One crack (806/5) in each vane starting at the ID or OD platform, to a maximum height of 0.500 inch (12.700 mm).	Permitted for regular inspection interval.
	A maximum of 3 cracks in each vane (806/1) which go to a concave or convex airfoil cooling hole. Closed loop cracks (806/4) are not permitted.	Permitted for regular inspection interval.
	Two cracks (806/2) in each vane starting at the ID or OD platforms, to a maximum height of 0.750 inch (19.050 mm).	Permitted for 300 cycle reduced inspection interval.
	More than the above interval inspection limits.	Remove engine in 5 cycles maximum or less.
Concave airfoil surface	No limit on the quantity of axial (807/1) or radial cracks (807/1A) less than 0.157 inch (3.988 mm) are permitted. Closed loop cracks (807/4) are not permitted.	Permitted for regular inspection interval.

NOTE: A crack or part length of a crack that has burned or eroded to a width more than 0.050 inch (1.270 mm) must be identified as a hole. The breakthrough or burnthrough limits apply.

	A maximum of three axial cracks (807/2) that go from one cooling hole	Permitted for regular inspection interval.

Crack Inspection
Table 806

R Observed Condition: Cracks, (Axial And Radial)
R See Figure 806 thru Figure 809.

(CONTINUED)

Examine	Damage	Disposition
	group to the next cooling hole group or from the trailing edge to the rear cooling hole group are permitted. One of the above three axial cracks can go forward or rearward to the next cooling hole group or from the trailing edge through the rear cooling hole group to the next cooling hole group.	
	No limit on the quantity of axial cracks (807/6) that go from one cooling hole group to the next cooling hole group or from the trailing edge to the rear cooling hole group if the cracks do not form a closed loop.	Permitted for 300 cycle reduced inspection interval.
	Radial cracks (807/3) that go from the ID or OD platform to the concave airfoil are permitted. The maximum crack length on the airfoil from the platform is 0.500 inch (12.700 mm). Cracks from a platform that go to the airfoil surface cannot intersect other cracks on the airfoil surface.	Permitted for regular inspection interval.

R Crack Inspection
R Table 806 (Continued)

Observed Condition: Cracks, (Axial And Radial)
See Figure 806 thru Figure 809.

Examine	Damage	Disposition
	Radial cracks (807/8) that go from the ID or OD platform to the concave airfoil surface more than 0.500 inch (12.700 mm) but less than 0.800 inch (20.320 mm). Cracks from a platform that go to the airfoil surface cannot intersect other cracks on the airfoil surface.	Permitted for 300 cycle reduced inspection interval.
	Three radial cracks (807/1A) maximum to 0.500 inch (12.700 mm) maximum length are permitted.	Permitted for regular inspection interval.
	No limit on the quantity of radial cracks (807/6A) to 0.800 inch (20.320 mm) length.	Permitted for 300 cycle reduced inspection interval.
	A crack (807/5) can intersect with another crack, except for cracks that start at the ID or OD platform. The maximum length for either crack leg is 0.400 inch (10.160 mm). The intersection of platform cracks with airfoil cracks is not permitted.	Permitted for regular inspection interval.
	An intersecting crack (807/7) with a leg more than 0.400 inch (10.160 mm) and less than 0.800 inch (20.320 mm) except for cracks that start at the ID or OD platform. The intersection of	Permitted for 300 cycle reduced inspection interval.

Crack Inspection
Table 806 (Continued)

Observed Condition: Cracks, (Axial And Radial)
See Figure 806 thru Figure 809.

Examine	Damage	Disposition
	platform cracks with airfoil cracks is not permitted.	
	More than the above interval inspection limits.	Remove engine in 5 cycles maximum or less.
Convex airfoil surface	No limit on the quantity of axial (808/1) or radial cracks (808/1A) less than 0.157 inch (3.988 mm) are permitted. Closed loop cracks (808/5) are not permitted.	Permitted for regular inspection interval.

NOTE: A crack or part length of a crack that has burned or eroded to a width more than 0.050 inch (1.270 mm) must be identified as a hole. The breakthrough or burnthrough limits apply.

Examine	Damage	Disposition
	Three axial cracks maximum to 0.500 inch (12.700 mm) maximum length except as follows: One of the three axial cracks (808/3) can traverse from the trailing edge for a maximum distance of 0.750 inch (19.050 mm).	Permitted for regular inspection interval.
	Six axial cracks (808/6) maximum to 0.800 inch (20.320 mm) maximum length except as follows: One of the six axial cracks (808/8) can traverse from the trailing edge for a maximum distance of 1.300 inches (33.020 mm), or to the last row of cooling holes.	Permitted for 300 cycle reduced inspection interval.

Crack Inspection
Table 806 (Continued)

Observed Condition: Cracks, (Axial And Radial)
See Figure 806 thru Figure 809.

Examine	Damage	Disposition
(CONTINUED)		
	One axial crack (808/3) from the trailing edge to a maximum of 1.181 inches (29.997 mm).	Permitted for regular inspection interval.
	One axial crack (808/8) from the trailing edge more than 1.181 inches (29.997 mm) to 2.362 inches (59.995 mm) maximum is permitted.	Permitted for 300 cycle reduced inspection interval.
	Three radial cracks (808/1A) to 0.500 inch (12.700 mm) maximum length.	Permitted for regular inspection interval.
	No limit on the quantity of radial cracks (808/6A) to 0.800 inch (20.320 mm) maximum.	Permitted for 300 cycle reduced inspection interval.
	A crack can intersect with another crack (808/4) except for cracks that start at the ID or OD platforms. The maximum length for either crack leg is 0.500 inch (12.700 mm). Intersection of platform cracks with airfoil cracks is not permitted.	Permitted for regular inspection interval.
	An intersecting crack (808/9) with a leg more than 0.500 inch (12.700 mm) and less than 0.800 inch (20.320 mm) except for cracks that start at the ID or OD platform. Intersection of platform	Permitted for 300 cycle reduced inspection interval.

Crack Inspection
Table 806 (Continued)

Observed Condition: Cracks, (Axial And Radial)
See Figure 806 thru Figure 809.

Examine	Damage	Disposition
(CONTINUED)		
	cracks with airfoil cracks is not permitted.	
	Radial cracks (808/2) that go from the ID or OD platforms to the convex airfoil are permitted. The maximum crack length on the airfoil from the platform is 0.500 inch (12.700 mm). Cracks from a platform (808/2) that go to the airfoil surface cannot intersect other cracks on the airfoil surface.	Permitted for regular inspection interval.
	Radial cracks (808/7) that go from the ID or OD platform to the convex airfoil surface more than 0.500 inch (12.700 mm) but less than 0.800 inch (20.320 mm) are permitted. Cracks from a platform that go to the airfoil surface cannot intersect other cracks on the airfoil surface.	Permitted for 300 cycle reduced inspection interval.
	More than the above interval inspection limits.	Remove engine in 5 cycles maximum or less.
ID and OD platform surfaces (buttresses)	No limit on the quantity of cracks less than 0.250 inch (6.350 mm) in length on the platform surfaces are permitted. Intersecting cracks are permitted if no closed loop is formed.	Permitted for regular inspection interval.

Crack Inspection
Table 806 (Continued)

Observed Condition: Cracks, (Axial And Radial)
See Figure 806 thru Figure 809.

Examine	Damage	Disposition
(CONTINUED)	Closed loop cracks are not permitted. See Figure 809 (Sheet 1).	

NOTE: A crack or part length of a crack that has burned or eroded to a width of more than 0.050 inch (1.270 mm) must be identified as a hole. The breakthrough or burnthrough limits apply.

Examine	Damage	Disposition
	Four cracks (809/4) more than 0.250 inch (6.350 mm) long, three cracks more than 0.700 inch (17.780 mm), and one crack to (no length limit) are permitted on the OD platform concave airfoil side. These cracks can go to the airfoil concave surface to a height of 0.500 inch (12.70 mm).	Permitted for regular inspection interval.
	Six cracks (809/9) more than 0.250 inch (6.350 mm) long, four cracks more than 0.700 inch (17.780 mm), and two cracks to (no length limit) are permitted on the OD platform concave airfoil side. These cracks can go to the airfoil concave surface to a height of 0.800 inch (20.320 mm).	Permitted for 300 cycle reduced inspection interval.
	Two cracks (809/4A) more than 0.250 inch (6.350 mm) long are permitted on the OD platform convex airfoil side, from the airfoil fillet to platform edge.	Permitted for regular inspection interval.

Crack Inspection
Table 806 (Continued)

Observed Condition: Cracks, (Axial And Radial)
See Figure 806 thru Figure 809.

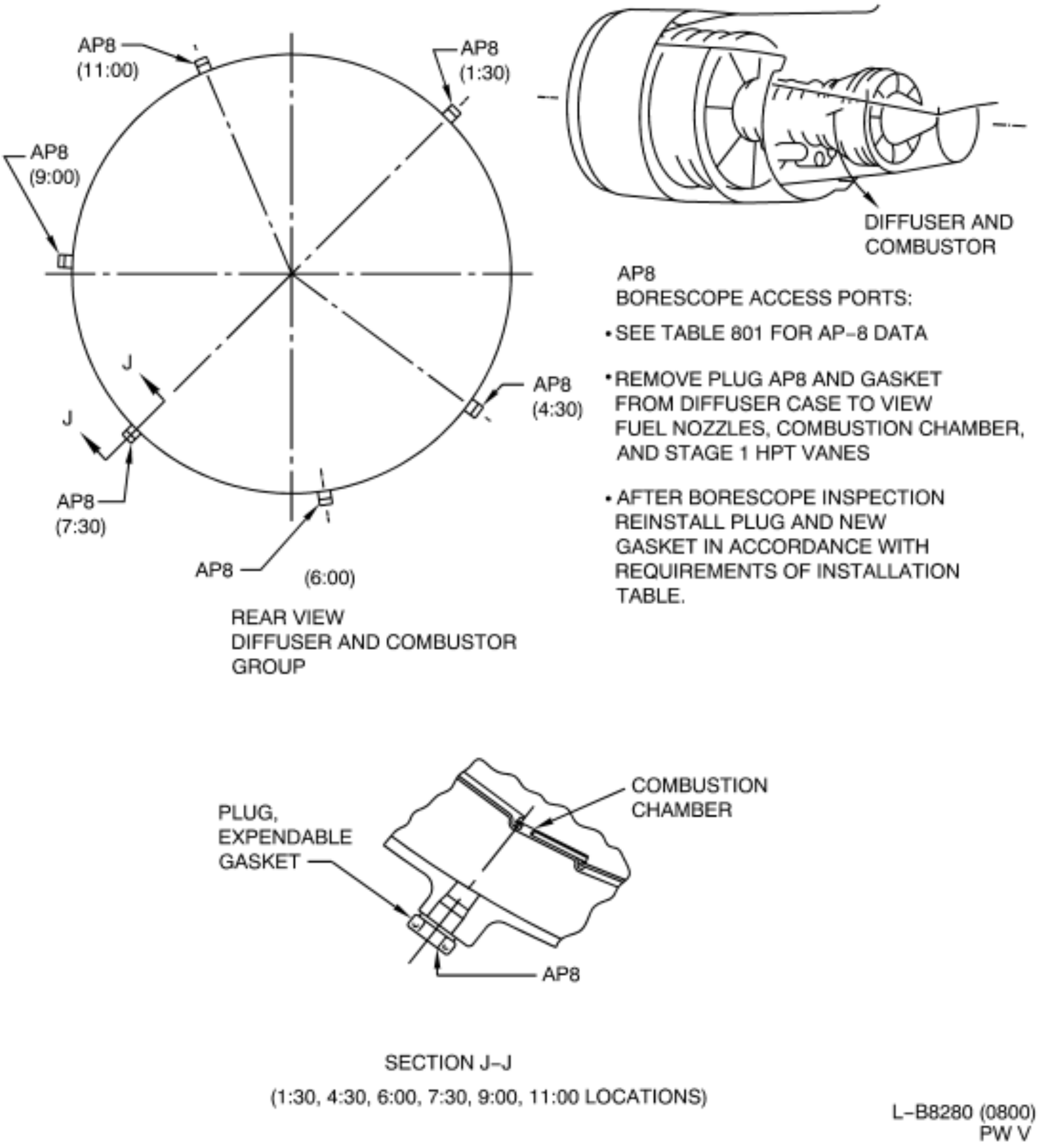
Examine	Damage	Disposition
(CONTINUED)		
	Four cracks (809/9A) more than 0.250 inch (6.350 mm) long are permitted on the OD platform convex airfoil side, from the airfoil fillet to platform edge.	Permitted for 300 cycle reduced inspection interval.
	Two cracks (809/4B) more than 0.250 inch (6.350 mm) long are permitted on the ID platform, concave or convex airfoil side, from the airfoil fillet to platform edge.	Permitted for regular inspection interval.
	Four cracks (809/9B) more than 0.250 inch (6.350 mm) long are permitted on the ID platform, concave or convex airfoil side, from the airfoil fillet to platform edge.	Permitted for 300 cycle reduced inspection interval.
	One crack (809/1) maximum for each side and two cracks total for each vane in the ID or OD fillet radius that goes parallel or axially along the fillet radius surface. The maximum length is 0.600 inch (15.240 mm). Airfoil/platform fillet radius cracks can intersect other cracks, if the total length is less than 1.0 inch (25.400 mm). No circumferential cracks in the leading edge fillet.	Permitted for regular inspection interval.
	One crack (809/6) maximum	Permitted for 300

Crack Inspection
Table 806 (Continued)

Observed Condition: Cracks, (Axial And Radial)
See Figure 806 thru Figure 809.

Examine	Damage	Disposition
(CONTINUED)		
	for each side and two cracks total for each vane in the ID or OD fillet radius that goes parallel or axially along the fillet radius surface. The maximum length is 1.000 inch (25.400 mm). Airfoil/platform fillet radius cracks can intersect other cracks, if the total length is less than 1.750 inches (44.450 mm). One crack maximum in the ID or OD leading edge fillet radius surface (809/8) that goes circumferentially around the leading edge to a length of 0.400 inch (10.160 mm) maximum.	cycle reduced inspection interval.
	More than the above interval inspection limits.	Remove engine in 5 cycles maximum or less.

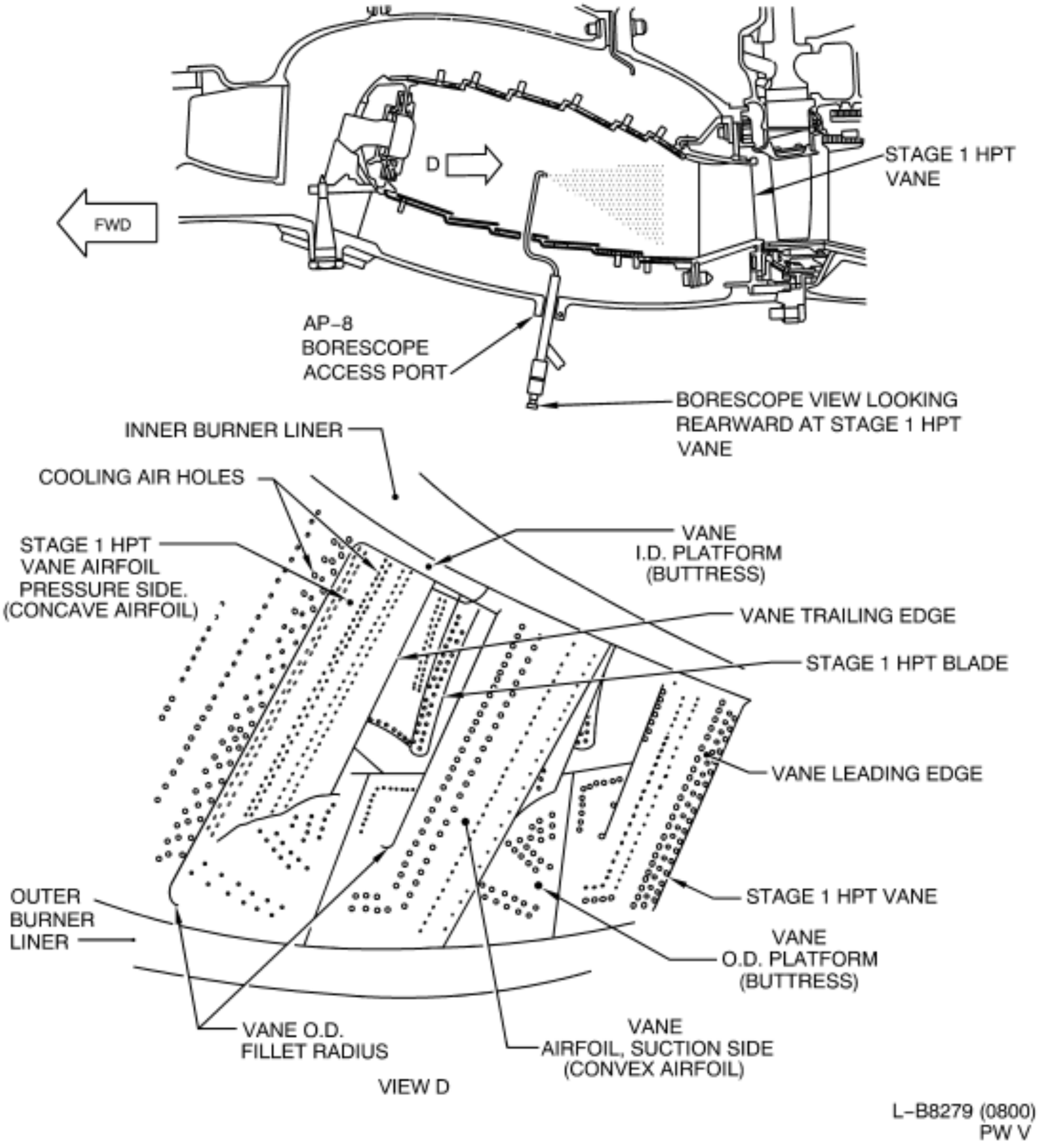
Crack Inspection
Table 806 (Continued)


AP8
(11:00)
AP8
(1:30)
AP8
(9:00)
AP8
(4:30)
J
J
AP8
(7:30)
AP8
(6:00)
REAR VIEW
DIFFUSER AND COMBUSTOR
GROUP
DIFFUSER AND
COMBUSTOR
COMBUSTION
CHAMBER
PLUG,
EXPENDABLE
GASKET
AP8
SECTION J−J
(1:30, 4:30, 6:00, 7:30, 9:00, 11:00 LOCATIONS)
L−B8280 (0800)
PW V

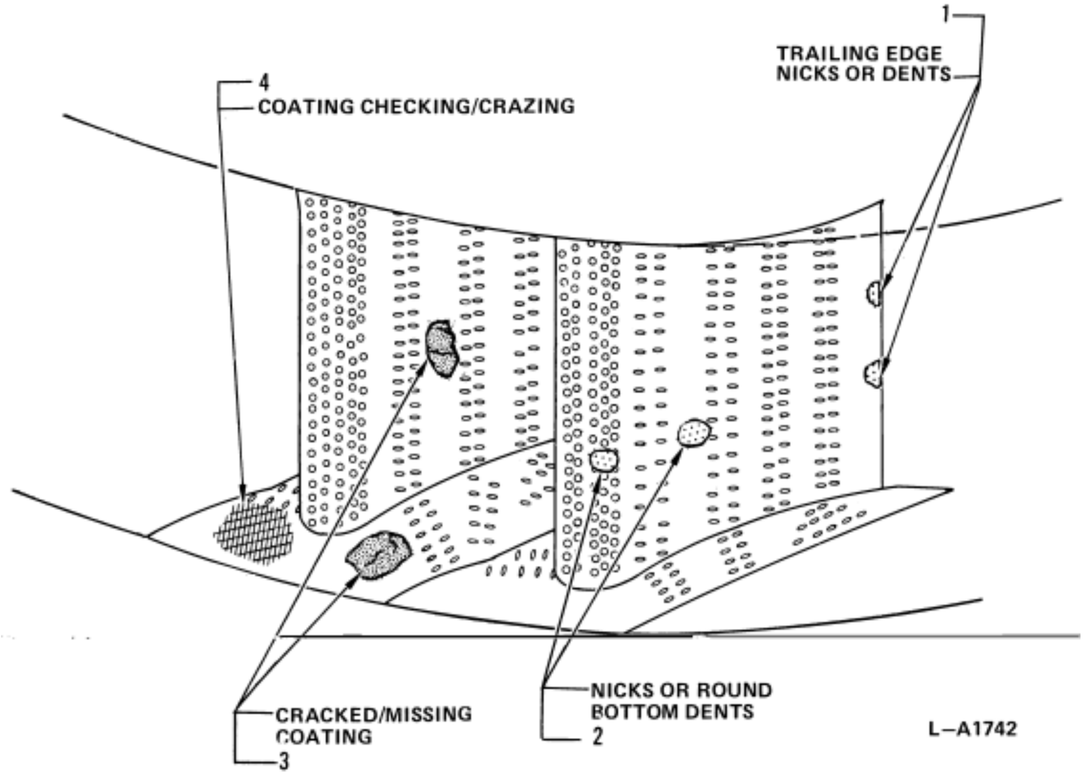
AP8
BORESCOPE ACCESS PORTS:

- SEE TABLE 801 FOR AP−8 DATA
- REMOVE PLUG AP8 AND GASKET FROM DIFFUSER CASE TO VIEW FUEL NOZZLES, COMBUSTION CHAMBER, AND STAGE 1 HPT VANES
- AFTER BORESCOPE INSPECTION REINSTALL PLUG AND NEW GASKET IN ACCORDANCE WITH REQUIREMENTS OF INSTALLATION TABLE.

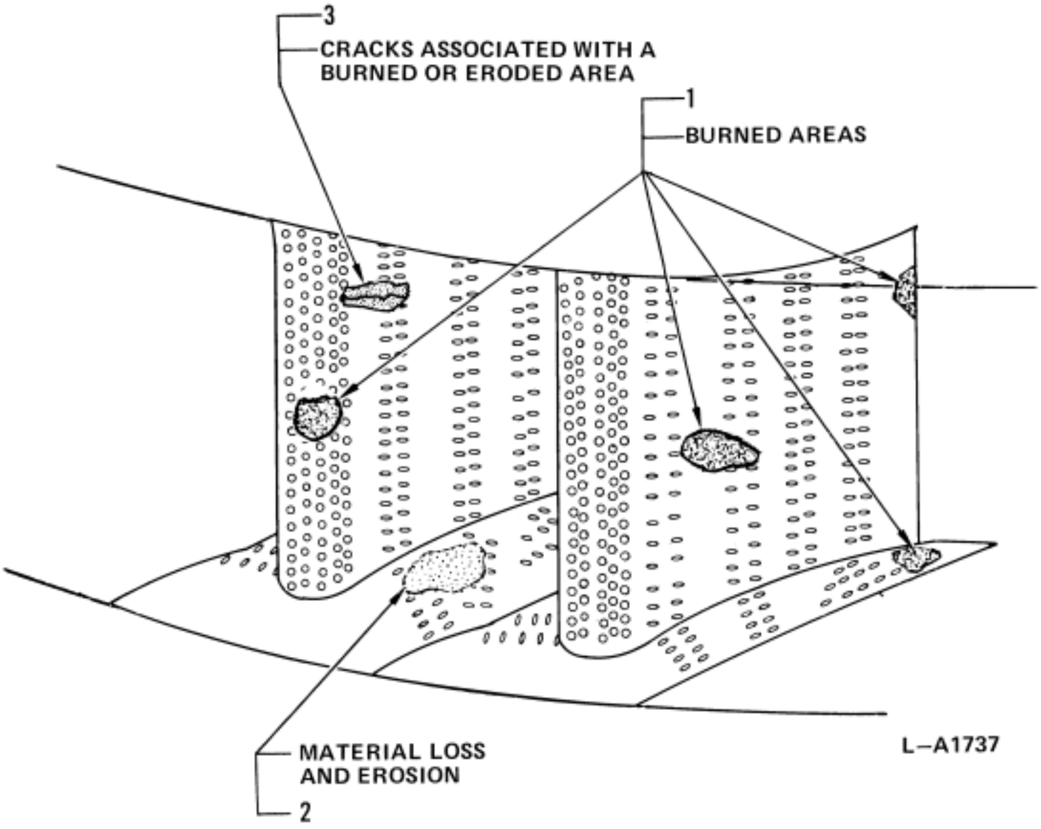
Stage 1 HPT Vane Borescope Access Port (AP−8) Locations
Figure 801
(Task 72−00−00−210−028)


D
FWD
STAGE 1 HPT VANE
AP-8 BORESCOPE ACCESS PORT
BORESCOPE VIEW LOOKING REARWARD AT STAGE 1 HPT VANE
INNER BURNER LINER
COOLING AIR HOLES
STAGE 1 HPT VANE AIRFOIL PRESSURE SIDE. (CONCAVE AIRFOIL)
VANE I.D. PLATFORM (BUTTRESS)
VANE TRAILING EDGE
STAGE 1 HPT BLADE
VANE LEADING EDGE
OUTER BURNER LINER
STAGE 1 HPT VANE
VANE O.D. PLATFORM (BUTTRESS)
VANE O.D. FILLET RADIUS
VANE AIRFOIL, SUCTION SIDE (CONVEX AIRFOIL)
VIEW D
L-B8279 (0800)
PW V

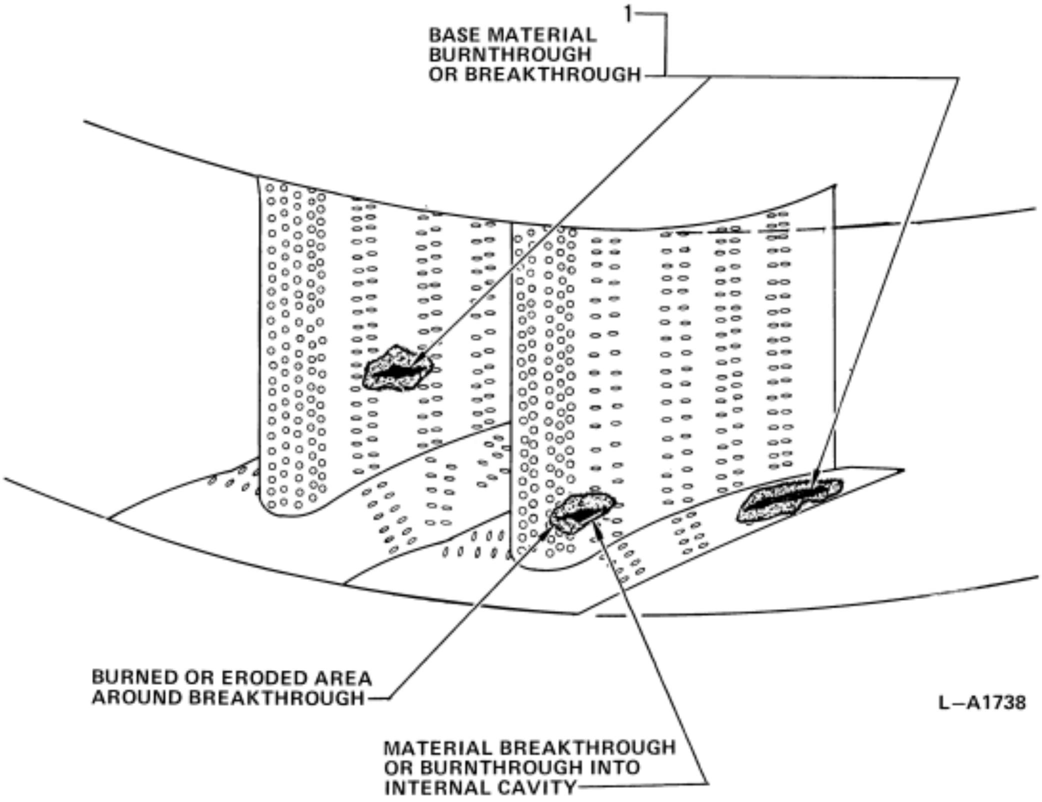
Borescope View Of Stage 1 HPT Vanes (AP-8)
Figure 802
(Task 72-00-00-210-028)


1
TRAILING EDGE NICKS OR DENTS
4
COATING CHECKING/CRAZING
CRACKED/MISSING COATING
3
NICKS OR ROUND BOTTOM DENTS
2
L−A1742

Stage 1 HPT Vane Observed Damage − Nicks/Dents/Coating Loss (AP−8 Viewing)
R Figure 803
(Task 72−00−00−210−028)


3
CRACKS ASSOCIATED WITH A BURNED OR ERODED AREA
1
BURNED AREAS
MATERIAL LOSS AND EROSION
2
L−A1737

Stage 1 HPT Vane Observed Damage −
Burning/Erosion/Material Loss (AP−8 Viewing)
R Figure 804
(Task 72−00−00−210−028)


1
BASE MATERIAL
BURNTHROUGH
OR BREAKTHROUGH
BURNED OR ERODED AREA
AROUND BREAKTHROUGH
MATERIAL BREAKTHROUGH
OR BURNTHROUGH INTO
INTERNAL CAVITY
L-A1738

Stage 1 HPT Vane Observed Damage - Base
Material Burn Through (AP-8 Viewing)
R Figure 805 (Sheet 1)
(Task 72-00-00-210-028)

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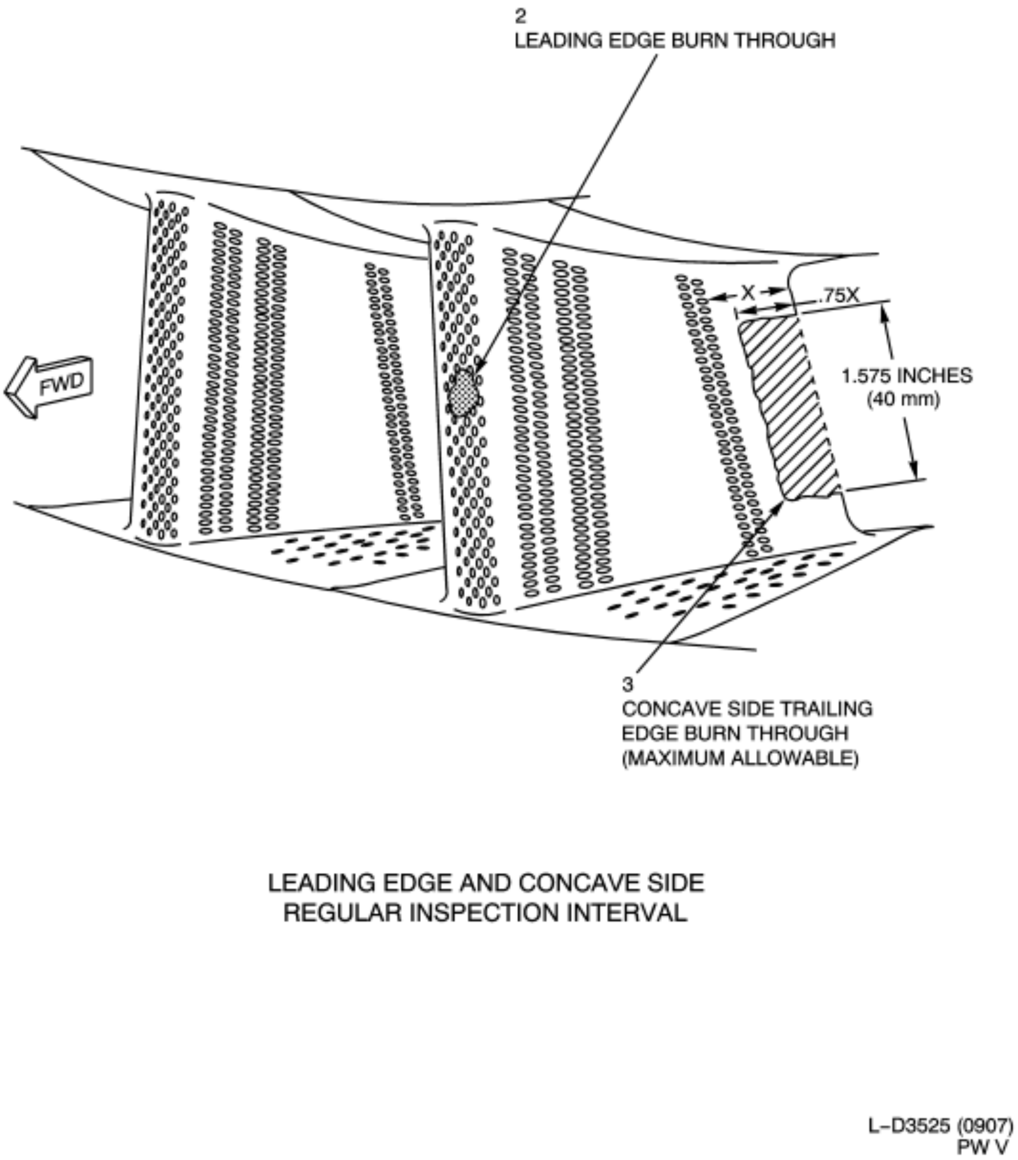
2
LEADING EDGE BURN THROUGH
X
.75X
1.575 INCHES
(40 mm)
FWD
3
CONCAVE SIDE TRAILING
EDGE BURN THROUGH
(MAXIMUM ALLOWABLE)
LEADING EDGE AND CONCAVE SIDE
REGULAR INSPECTION INTERVAL
L-D3525 (0907)
PW V

R Leading Edge And Concave Side Trailing
R Edge Inspection Interval (Regular Inspection)
R Figure 805 (Sheet 2)
R (Task 72-00-00-210-028)

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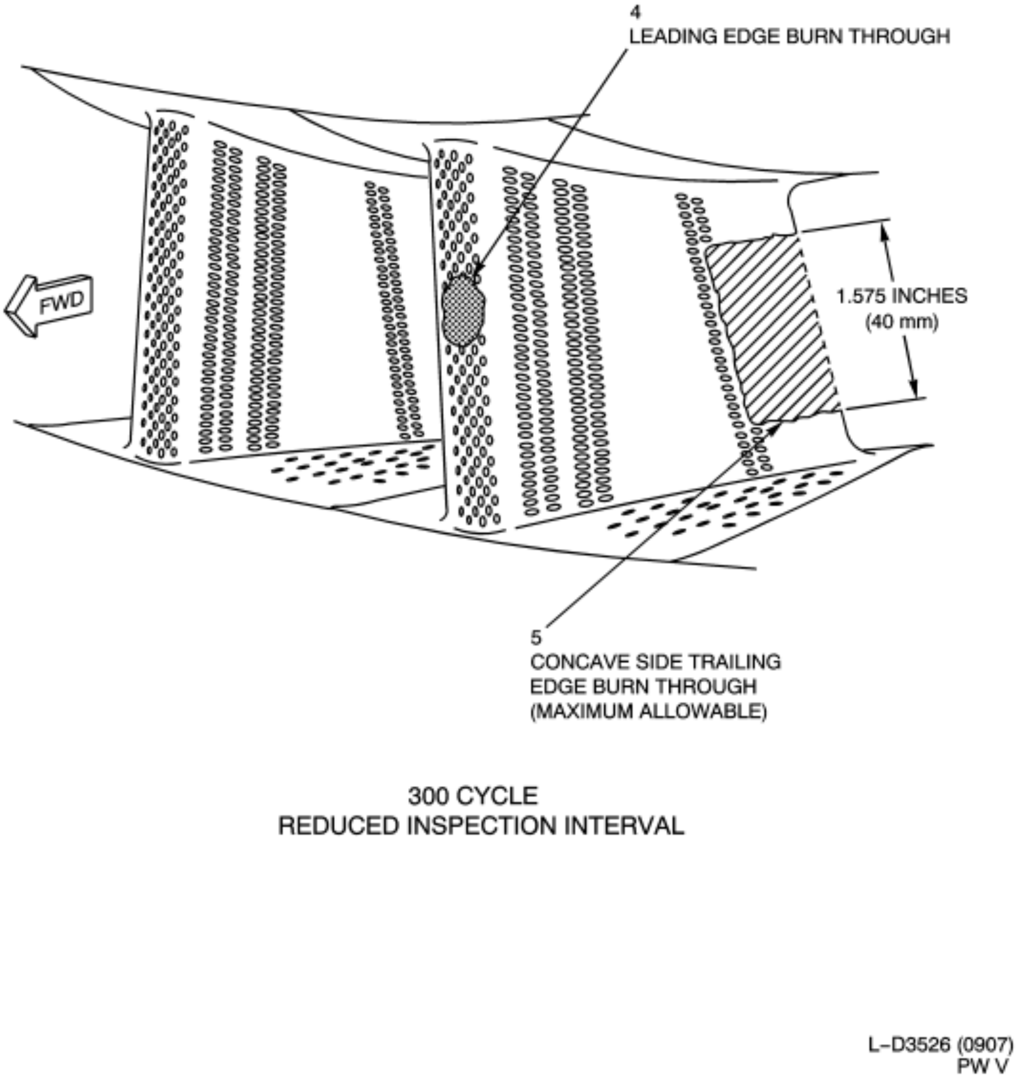
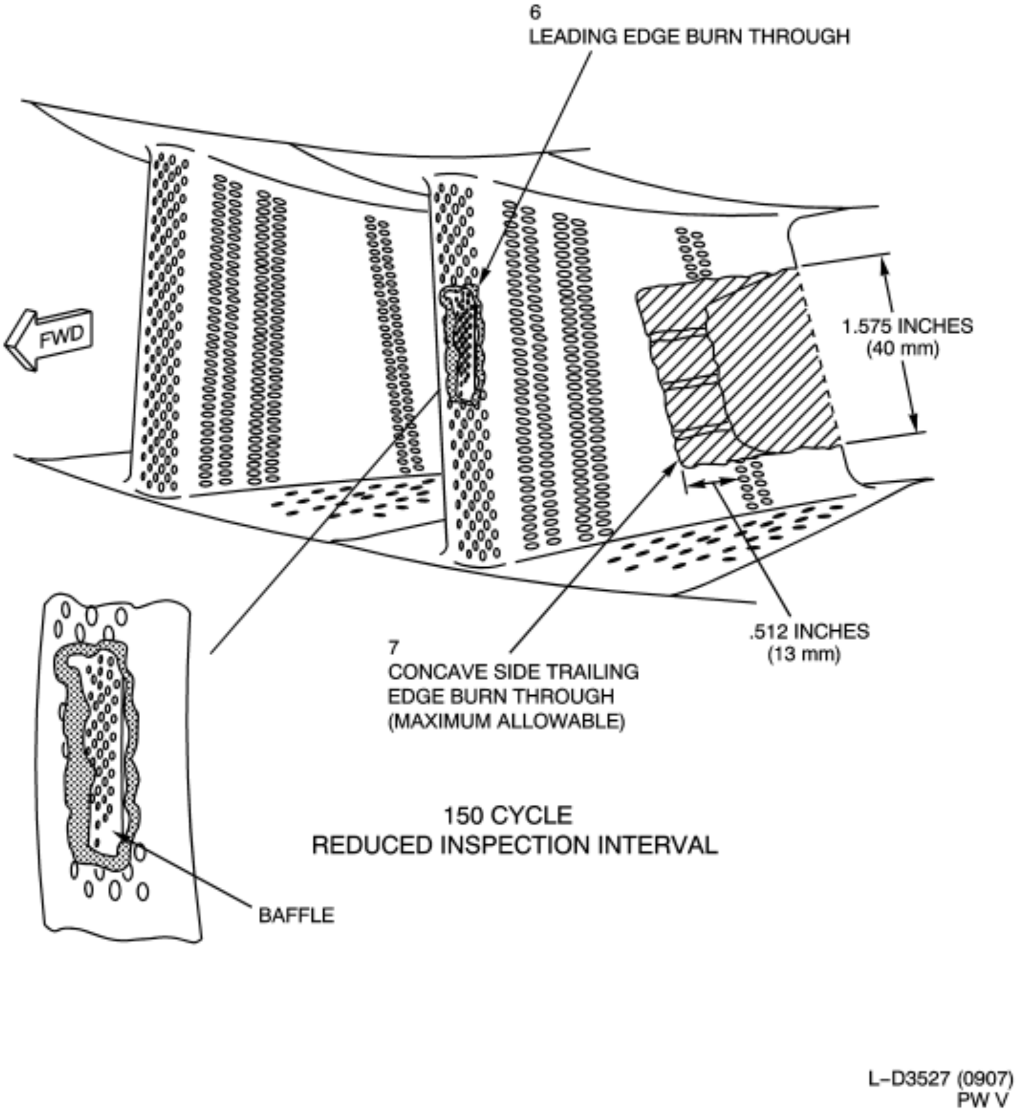
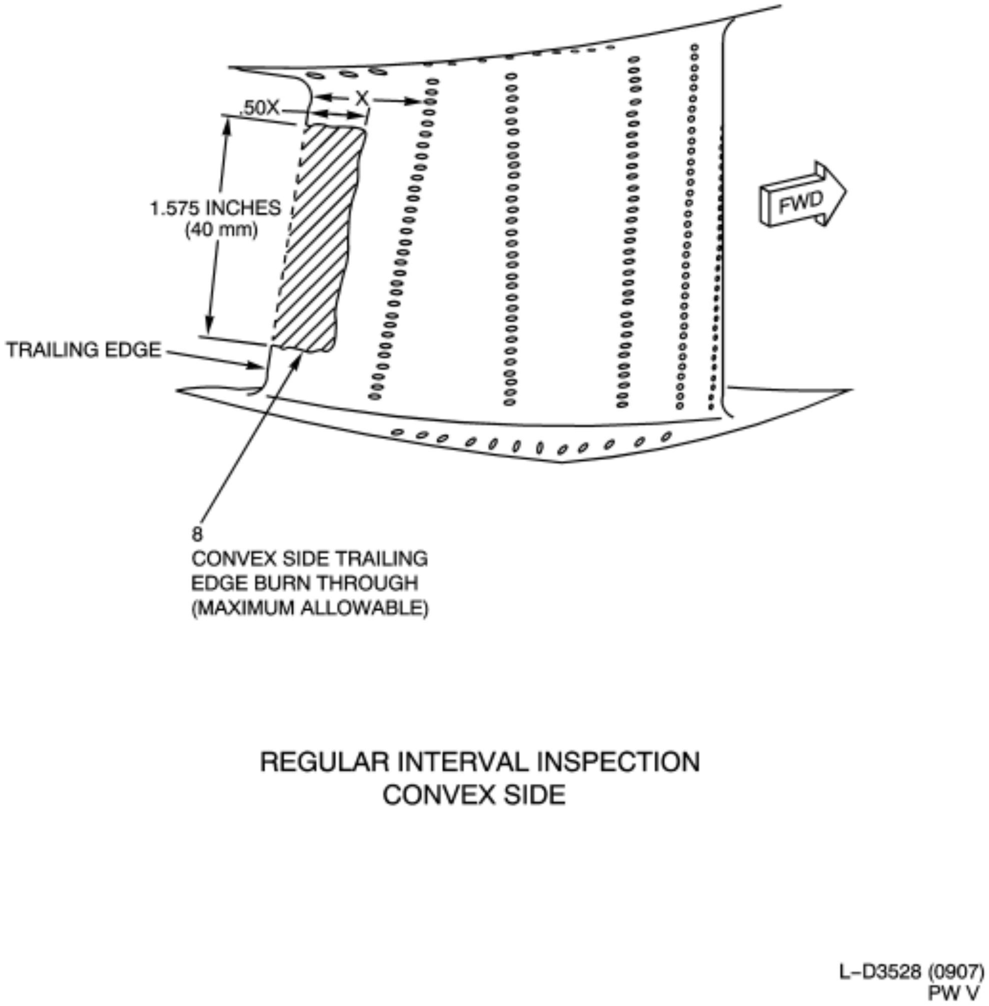

4
LEADING EDGE BURN THROUGH
FWD
1.575 INCHES
(40 mm)
5
CONCAVE SIDE TRAILING
EDGE BURN THROUGH
(MAXIMUM ALLOWABLE)
300 CYCLE
REDUCED INSPECTION INTERVAL
L-D3526 (0907)
PW V

R Leading Edge And Concave Side Trailing
R Edge Reduced Inspection Interval (300 Cycle)
R Figure 805 (Sheet 3)
R (Task 72-00-00-210-028)


6
LEADING EDGE BURN THROUGH
FWD
1.575 INCHES
(40 mm)
.512 INCHES
(13 mm)
7
CONCAVE SIDE TRAILING
EDGE BURN THROUGH
(MAXIMUM ALLOWABLE)
150 CYCLE
REDUCED INSPECTION INTERVAL
BAFFLE
L−D3527 (0907)
PW V

R Leading Edge And Concave Side Trailing
R Edge Reduced Inspection Interval (150 Cycle)
R Figure 805 (Sheet 4)
R (Task 72−00−00−210−028)


.50X
X
1.575 INCHES
(40 mm)
TRAILING EDGE
FWD
8
CONVEX SIDE TRAILING
EDGE BURN THROUGH
(MAXIMUM ALLOWABLE)
REGULAR INTERVAL INSPECTION
CONVEX SIDE
L−D3528 (0907)
PW V

R Convex Side Trailing Edge Regular
R Inspection Interval (Regular Inspection)
R Figure 805 (Sheet 5)
R (Task 72−00−00−210−028)

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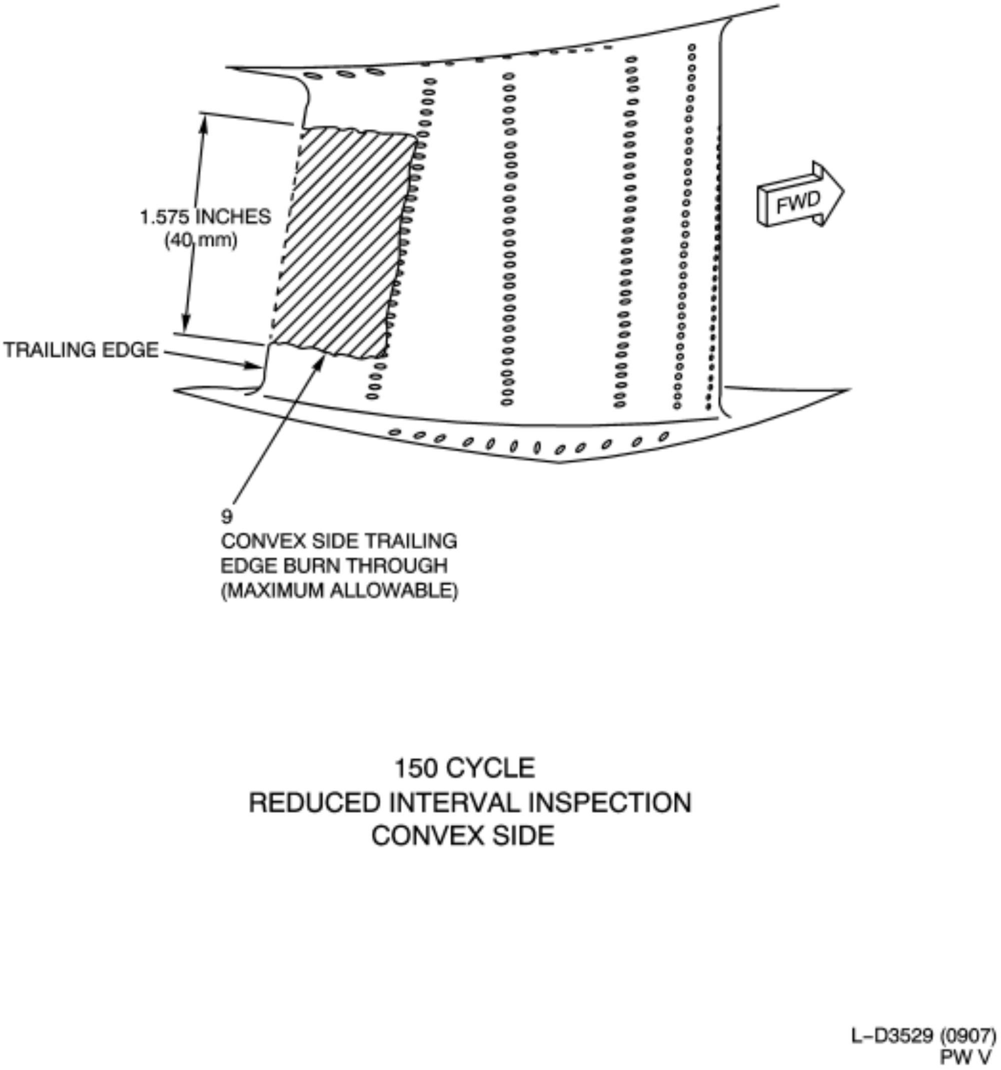
1.575 INCHES
(40 mm)
TRAILING EDGE
FWD
9
CONVEX SIDE TRAILING
EDGE BURN THROUGH
(MAXIMUM ALLOWABLE)
150 CYCLE
REDUCED INTERVAL INSPECTION
CONVEX SIDE
L−D3529 (0907)
PW V

R Convex Side Trailing Edge Inspection (150 Cycle)
R Figure 805 (Sheet 6)
R (Task 72−00−00−210−028)

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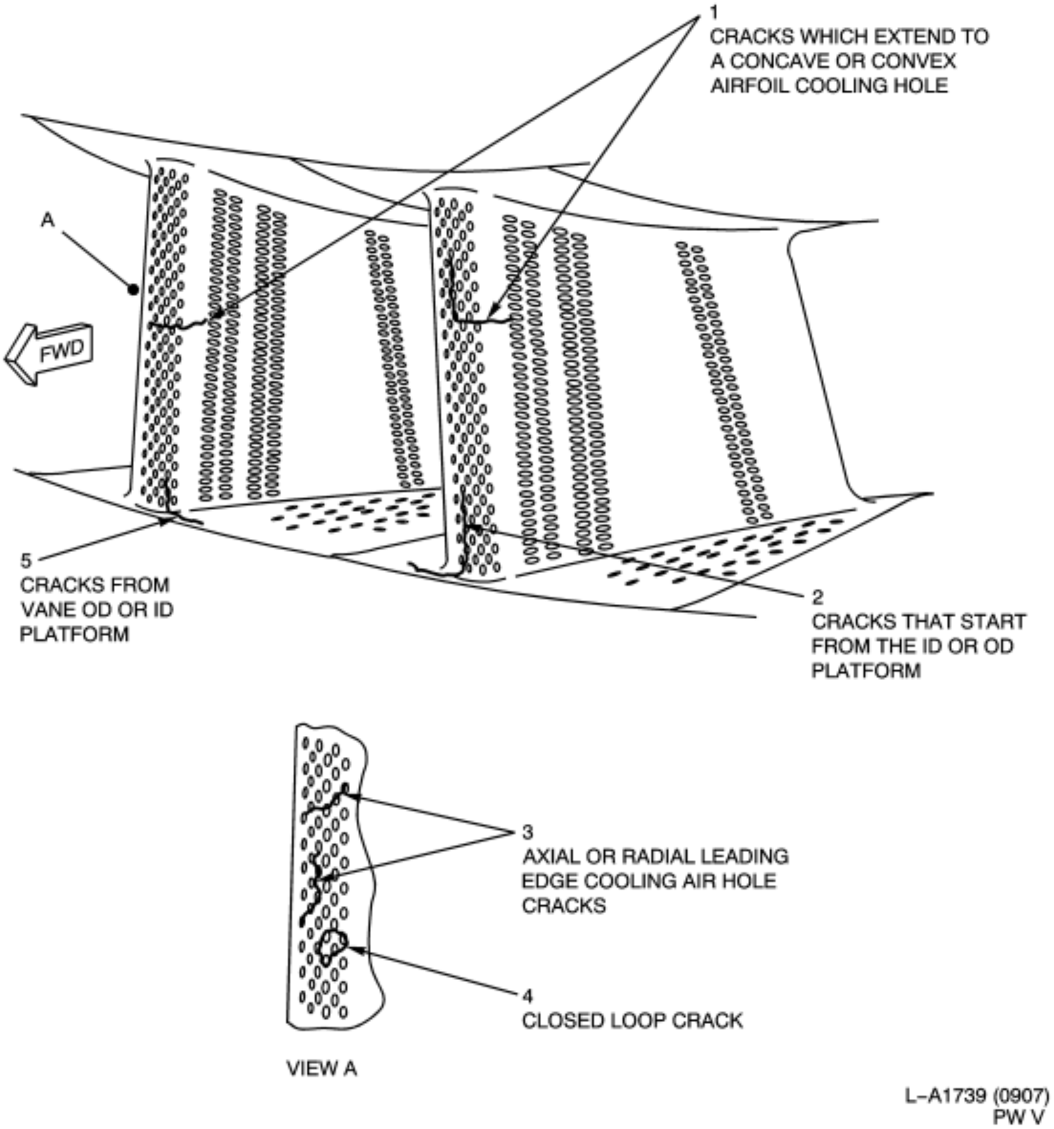
1
CRACKS WHICH EXTEND TO A CONCAVE OR CONVEX AIRFOIL COOLING HOLE
A
FWD
5
CRACKS FROM VANE OD OR ID PLATFORM
2
CRACKS THAT START FROM THE ID OR OD PLATFORM
3
AXIAL OR RADIAL LEADING EDGE COOLING AIR HOLE CRACKS
4
CLOSED LOOP CRACK
VIEW A
L-A1739 (0907)
PW V

Stage 1 HPT Vane Observed Damage -
Leading Edge Cracks (AP-8 Viewing)
R Figure 806
(Task 72-00-00-210-028)

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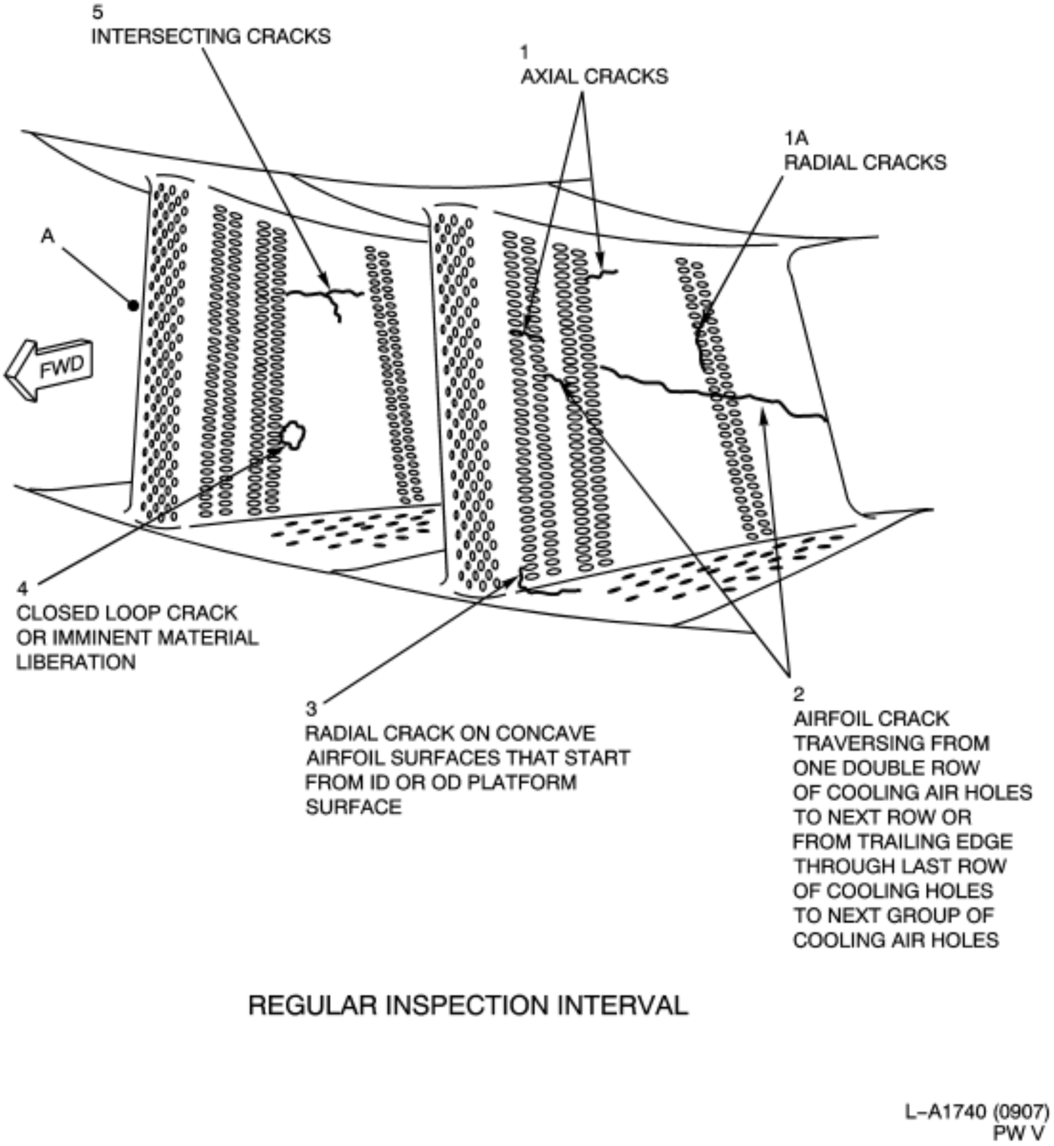
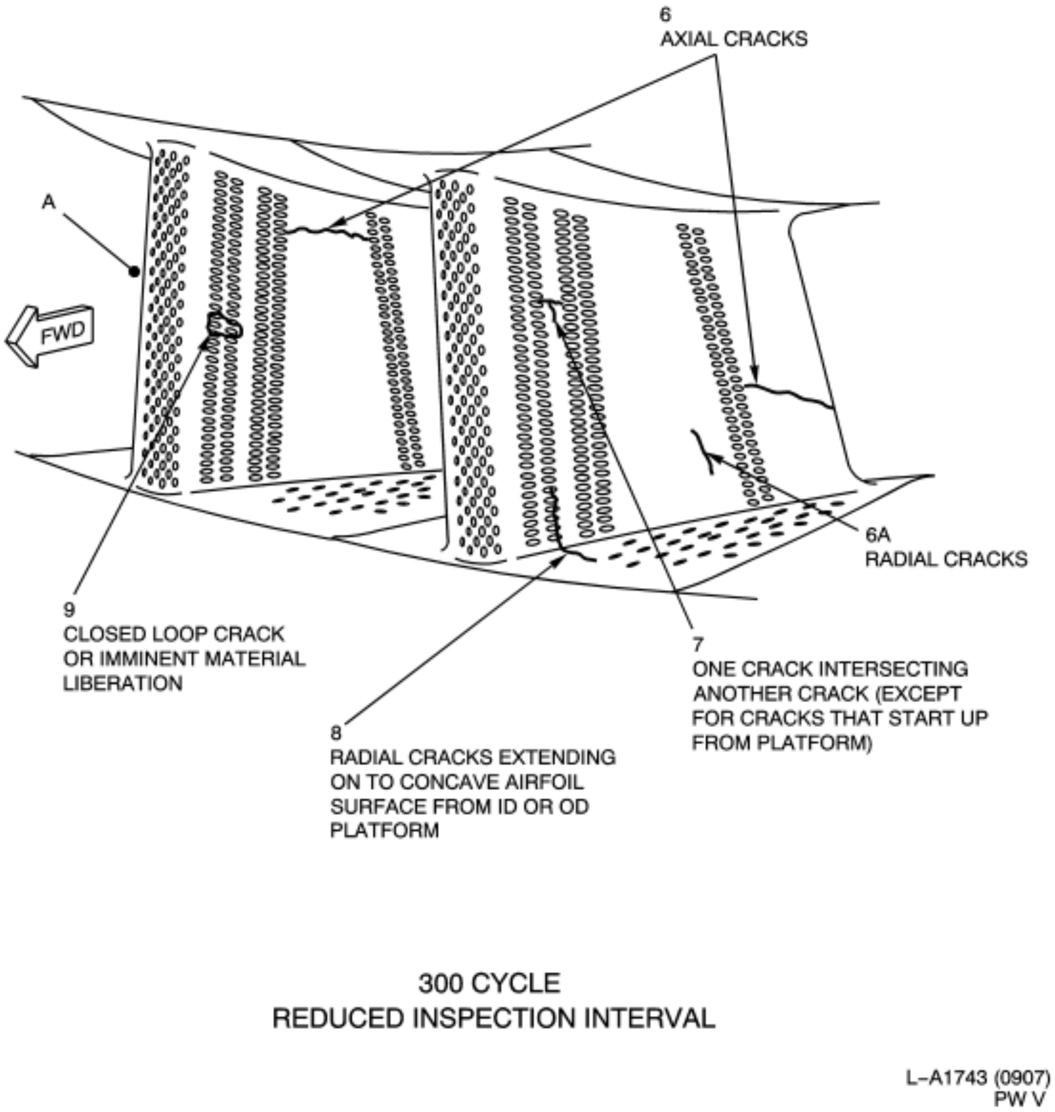

5
INTERSECTING CRACKS
1
AXIAL CRACKS
1A
RADIAL CRACKS
A
FWD
4
CLOSED LOOP CRACK
OR IMMINENT MATERIAL
LIBERATION
3
RADIAL CRACK ON CONCAVE
AIRFOIL SURFACES THAT START
FROM ID OR OD PLATFORM
SURFACE
2
AIRFOIL CRACK
TRAVERSING FROM
ONE DOUBLE ROW
OF COOLING AIR HOLES
TO NEXT ROW OR
FROM TRAILING EDGE
THROUGH LAST ROW
OF COOLING HOLES
TO NEXT GROUP OF
COOLING AIR HOLES
REGULAR INSPECTION INTERVAL
L−A1740 (0907)
PW V

Stage 1 HPT Vane Observed Damage − Airfoil
Cracks On Concave Side (AP−8 Viewing)
R Figure 807 (Sheet 1)
(Task 72−00−00−210−028)


6
AXIAL CRACKS
A
FWD
6A
RADIAL CRACKS
9
CLOSED LOOP CRACK OR IMMINENT MATERIAL LIBERATION
7
ONE CRACK INTERSECTING ANOTHER CRACK (EXCEPT FOR CRACKS THAT START UP FROM PLATFORM)
8
RADIAL CRACKS EXTENDING ON TO CONCAVE AIRFOIL SURFACE FROM ID OR OD PLATFORM
300 CYCLE
REDUCED INSPECTION INTERVAL
L−A1743 (0907)
PW V

Stage 1 HPT Vane Observed Damage − Airfoil
Cracks On Concave Side (AP−8 Viewing)
Figure 807 (Sheet 2)
(Task 72−00−00−210−028)

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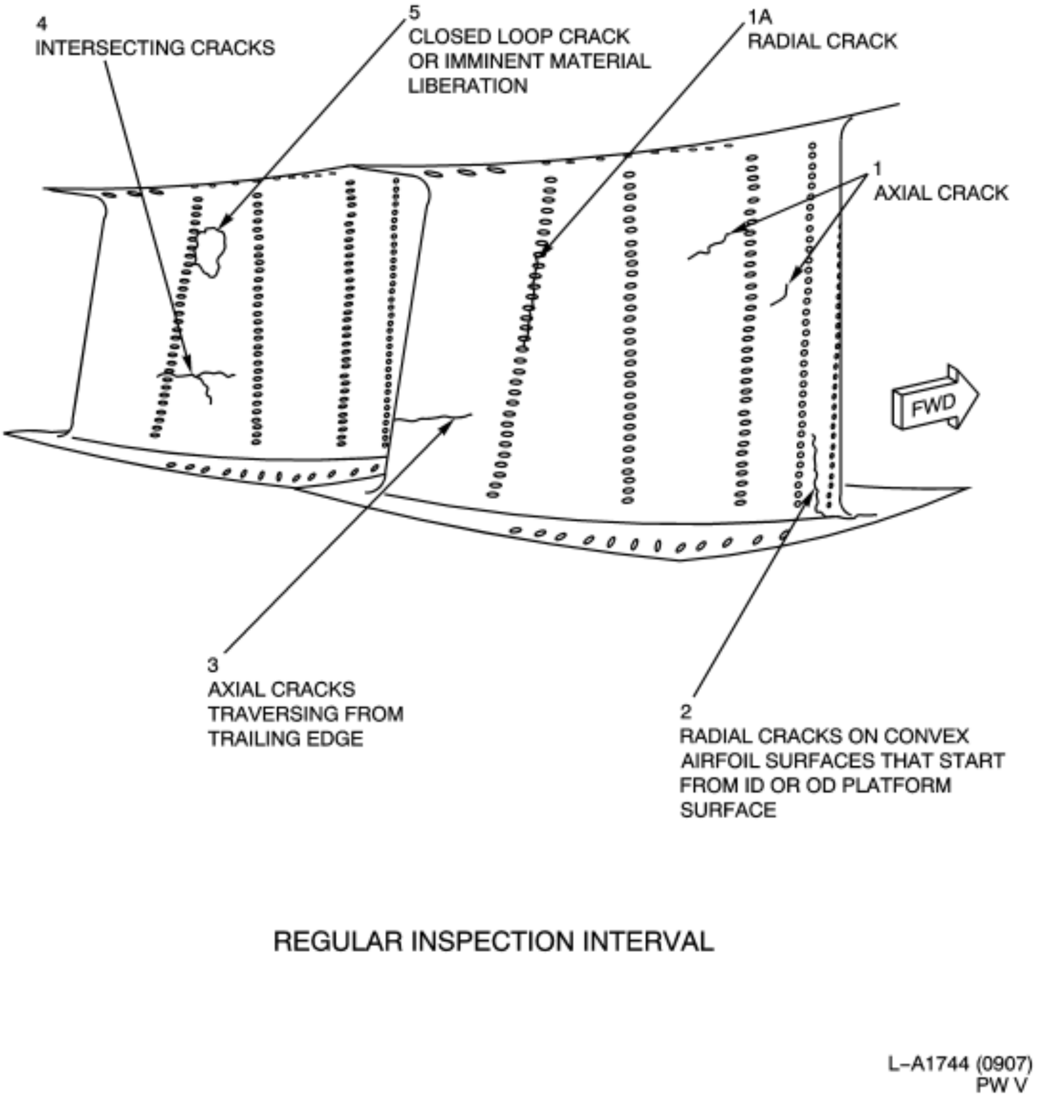
4
INTERSECTING CRACKS
5
CLOSED LOOP CRACK
OR IMMINENT MATERIAL
LIBERATION
1A
RADIAL CRACK
1
AXIAL CRACK
FWD
3
AXIAL CRACKS
TRAVERSING FROM
TRAILING EDGE
2
RADIAL CRACKS ON CONVEX
AIRFOIL SURFACES THAT START
FROM ID OR OD PLATFORM
SURFACE
REGULAR INSPECTION INTERVAL
L-A1744 (0907)
PW V

Stage 1 HPT Vane Observed Damage - Airfoil
Cracks On Convex Side (AP-8 Viewing)
R Figure 808 (Sheet 1)
(Task 72-00-00-210-028)

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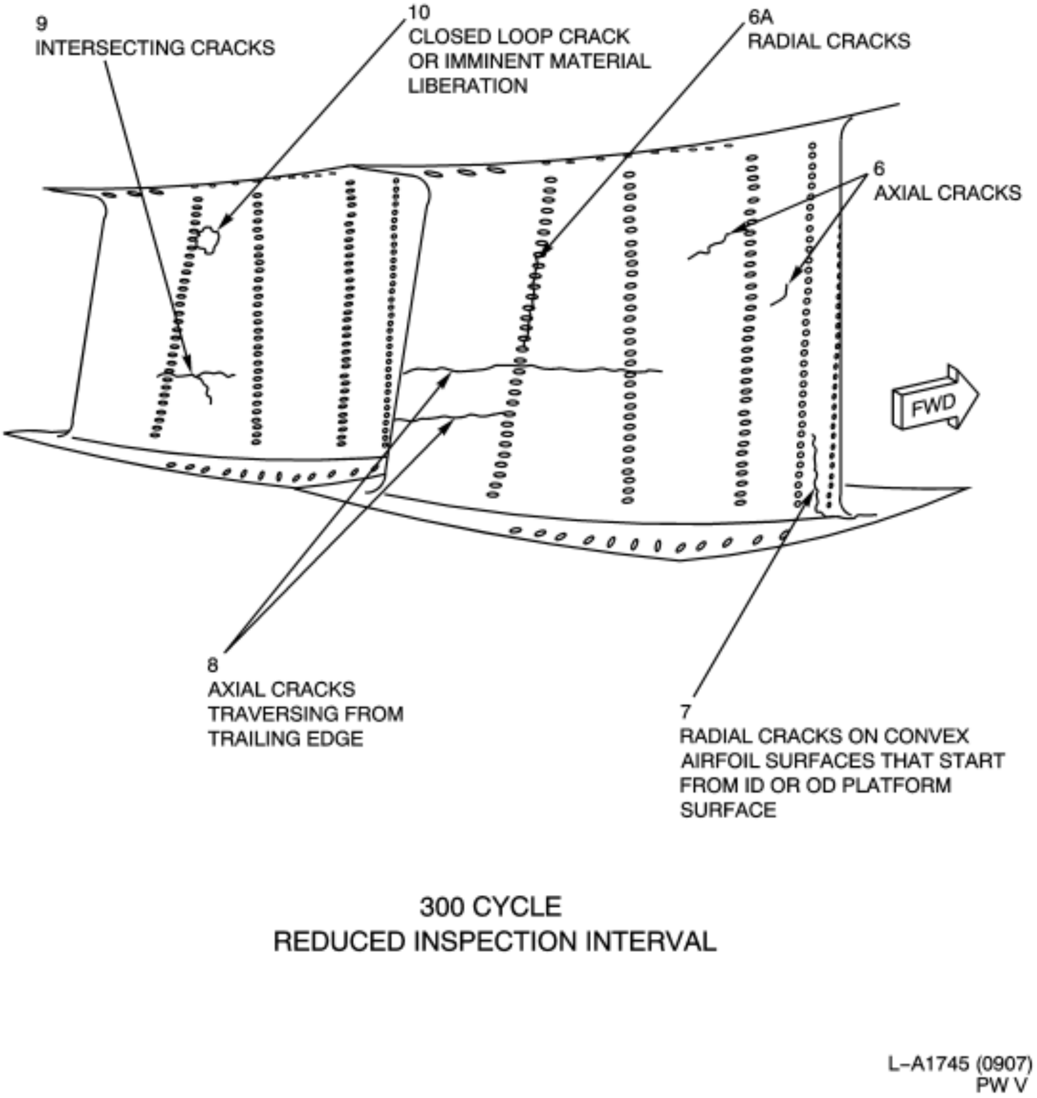
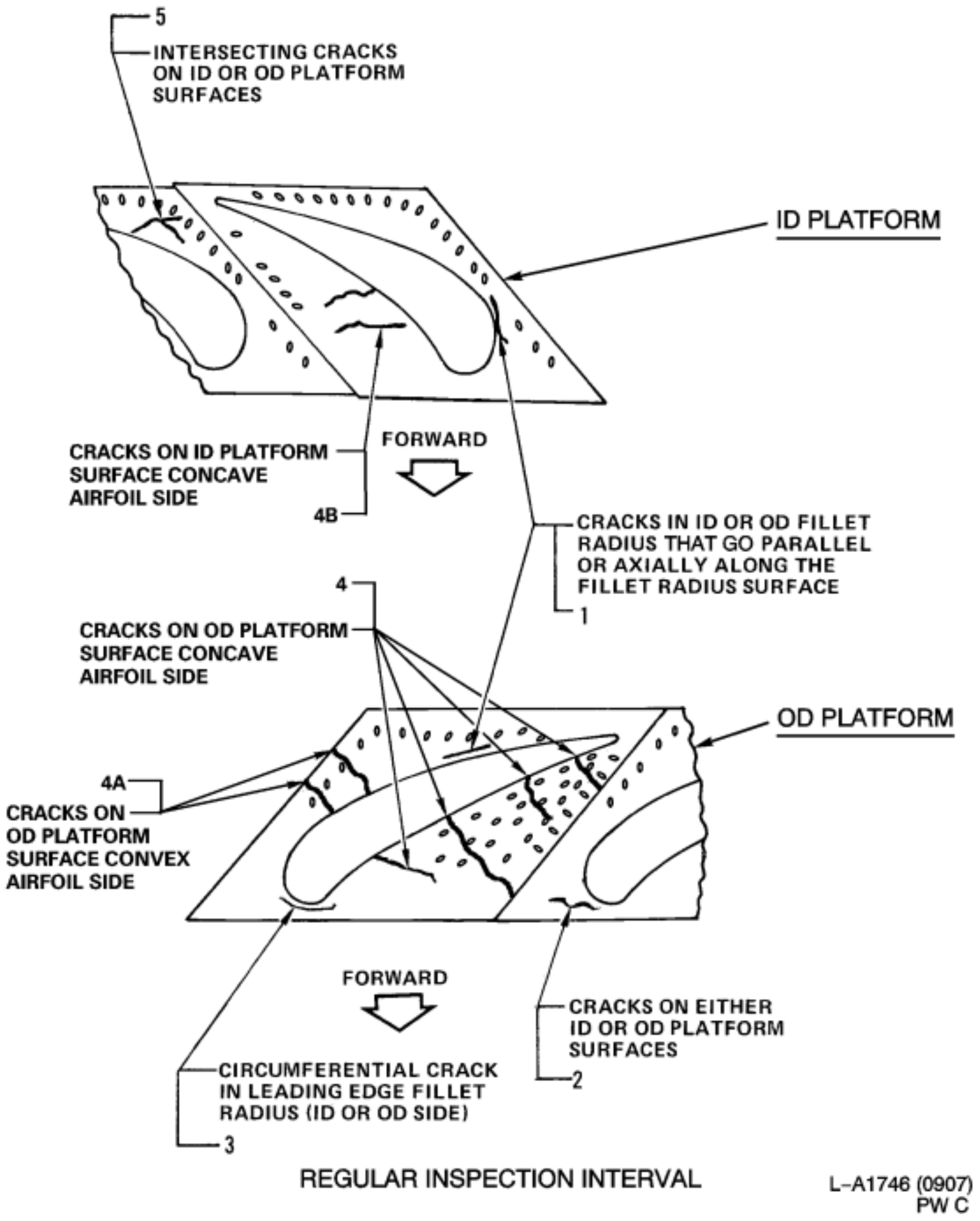
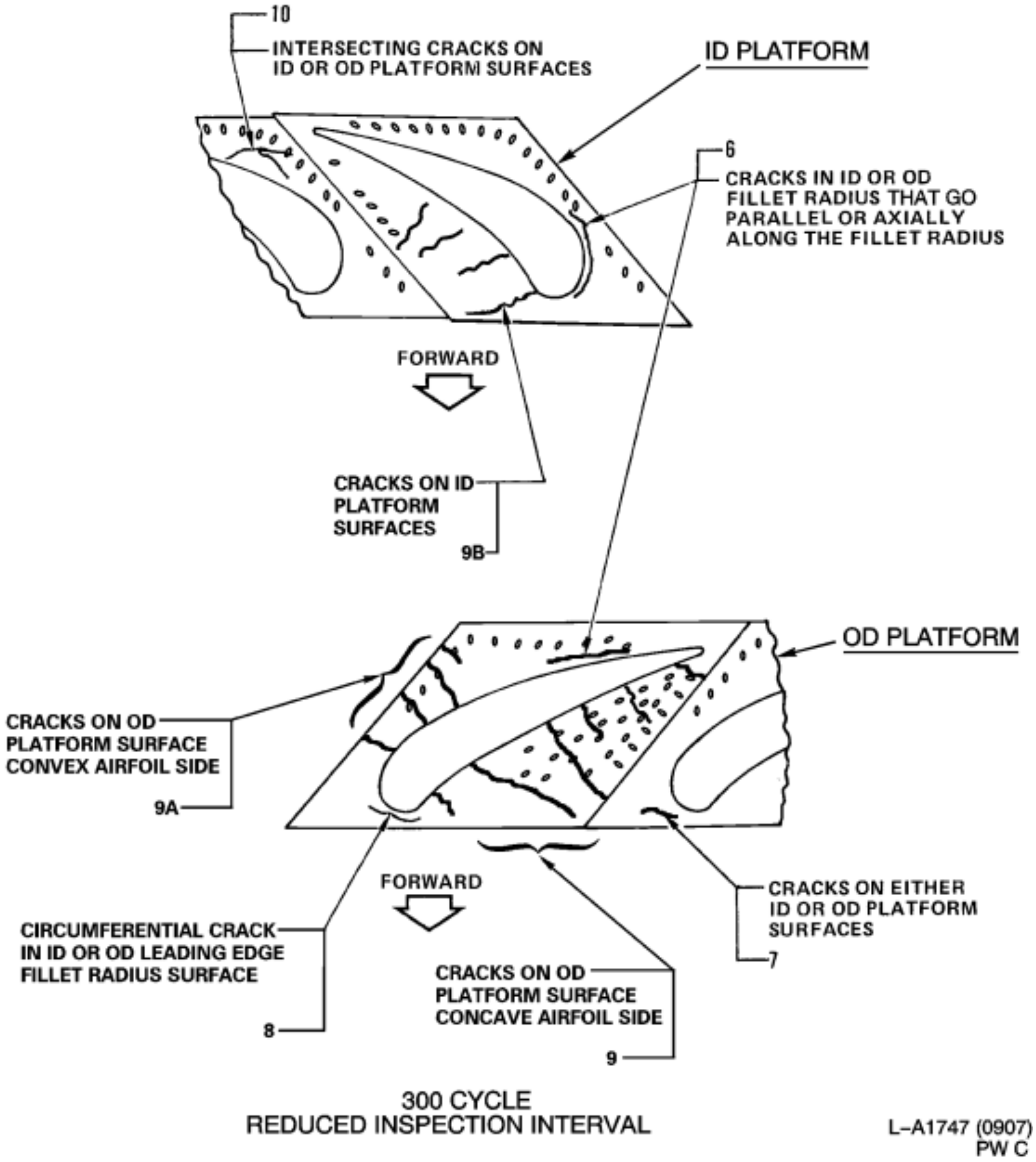

9
INTERSECTING CRACKS
10
CLOSED LOOP CRACK
OR IMMINENT MATERIAL
LIBERATION
6A
RADIAL CRACKS
6
AXIAL CRACKS
FWD
8
AXIAL CRACKS
TRAVERSING FROM
TRAILING EDGE
7
RADIAL CRACKS ON CONVEX
AIRFOIL SURFACES THAT START
FROM ID OR OD PLATFORM
SURFACE
300 CYCLE
REDUCED INSPECTION INTERVAL
L-A1745 (0907)
PW V

Stage 1 HPT Vane Observed Damage - Airfoil
Cracks On Convex Side (AP-8 Viewing)
R Figure 808 (Sheet 2)
(Task 72-00-00-210-028)


5
INTERSECTING CRACKS ON ID OR OD PLATFORM SURFACES
ID PLATFORM
CRACKS ON ID PLATFORM SURFACE CONCAVE AIRFOIL SIDE
4B
FORWARD
CRACKS IN ID OR OD FILLET RADIUS THAT GO PARALLEL OR AXIALLY ALONG THE FILLET RADIUS SURFACE
1
4
CRACKS ON OD PLATFORM SURFACE CONCAVE AIRFOIL SIDE
OD PLATFORM
4A
CRACKS ON OD PLATFORM SURFACE CONVEX AIRFOIL SIDE
FORWARD
CRACKS ON EITHER ID OR OD PLATFORM SURFACES
2
CIRCUMFERENTIAL CRACK IN LEADING EDGE FILLET RADIUS (ID OR OD SIDE)
3
REGULAR INSPECTION INTERVAL
L-A1746 (0907)
PW C

Stage 1 HPT Vane Observed Damage - ID, OD
Platform (Buttress) Cracks (AP-8 Viewing)
R Figure 809 (Sheet 1)
(Task 72-00-00-210-028)


10
INTERSECTING CRACKS ON ID OR OD PLATFORM SURFACES
ID PLATFORM
6
CRACKS IN ID OR OD FILLET RADIUS THAT GO PARALLEL OR AXIALLY ALONG THE FILLET RADIUS
FORWARD
CRACKS ON ID PLATFORM SURFACES
9B
OD PLATFORM
CRACKS ON OD PLATFORM SURFACE CONVEX AIRFOIL SIDE
9A
FORWARD
CIRCUMFERENTIAL CRACK IN ID OR OD LEADING EDGE FILLET RADIUS SURFACE
8
CRACKS ON OD PLATFORM SURFACE CONCAVE AIRFOIL SIDE
9
CRACKS ON EITHER ID OR OD PLATFORM SURFACES
7
300 CYCLE
REDUCED INSPECTION INTERVAL
L-A1747 (0907)
PW C

Stage 1 HPT Vane Observed Damage - ID, OD
Platform (Buttress) Cracks (AP-8 Viewing)
Figure 809 (Sheet 2)
(Task 72-00-00-210-028)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − INSPECTION/CHECK−01F

Task 72−00−00−210−005:

1. Perform Borescope Inspection Of Stage 1 HPT Blades And Duct Segments (AP−8/AP−9/ AP−11)

A. Equipment And Materials Necessary

Standard Tools:

See 72−00−00 Inspection/Check−01A (Task 72−00−00−990−010) for borescope equipment.

Special Tools:

PWA 86411	Guide Tube, AP−8 Port (use with flexible scope)

Consumable Materials:

Item No.	Designation
P03−001	Engine Oil (PWA 521B)
P06−023	Silver Goop (PWA 36001)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Washer AP−9	1	72−00−51/4/1
Safety Cable or Lockwire AP−9	1	72−00−51/4/11
Ferrule, Safety Cable AP−9	1	72−00−51/4/12
Gasket AP−11	1	75−24−00/3/55

B. Procedure
See Figure 801, Figure 802, Figure 803, Figure 804 and Figure 805.

(1) Remove plug and washer from borescope access port number AP−9, located on the rear of the diffuser case at the 3 o'clock location. See Table 801 of 72−00−00 Inspection/Check−01A, General Borescope Inspection Procedures And Borescope Access Port (AP) Data, Task 72−00−00−990−010.

(a) Make an inspection of the AP−9 plug. Measure the shaft diameter for wear. If the shaft diameter minimum dimension is less than 0.100 inch (2.540 mm), the AP−9 plug must be replaced.

(2) For engines equipped, remove three bolts, plug and gasket from borescope access port AP−11 located on the lower turbine cooling air tube elbow at the 7 o'clock position.

(3) To inspect stage 1 blades through AP−8 port, refer to 72−00−00 Inspection/Check−01D Task 72−00−00−210−020 and remove plugs and gaskets from the AP−8 access port(s).

(a) Put PWA 86411 Guide Tube through the diffuser case access port at the AP−8 location with the tip pointed toward the front of the engine. Turn and position the tube such that the flexible borescope when installed, will point rearwards towards the 1st stage nozzle guide vanes. Lock the guide tube in position by use of the compression nut.

CAUTION: TEMPERATURES IN AREAS TO BE BORESCOPED SHOULD BE PERMITTED TO COOL TO BELOW 150°F (65.6°C) FOLLOWING ENGINE OPERATION. DAMAGE MAY RESULT TO BORESCOPE EQUIPMENT IF EQUIPMENT IS EXPOSED TO GASPATH OR METAL TEMPERATURES IN EXCESS OF 150°F (65.6°C). AS A GUIDE − IF ADJACENT CASES ARE TOO HOT TO TOUCH COMFORTABLY, INSPECTION SHOULD BE DELAYED.

(4) Insert borescope through port and inspect Stage 1 blades for nicks, dents, cracks, tip damage, erosion, coating loss, liberated material, bent tips, tip rub, airfoil growth, blocked cooling holes, airfoil bulging and burning, sulfidation and damage caused by passage of foreign material. See Figure 803. To view each blade, rotate high rotor using hand or power operated equipment. See 72−00−00 Inspection/Check−01A, Installation Of The Rotator Used To Turn The N2 Rotor, Task 72−00−00−480−001.

NOTE: Conditions noted above are per blade and unless otherwise stated all blades may exhibit conditions described within limits provided.

NOTE: Maximum borescope insertion depth and borescope limiting access hole diameter specifications for AP−9, AP−11 and AP−8 are provided in Table 801 of 72−00−00 Inspection/Check−01A, General Borescope Inspection Procedures And Borescope Access Port (AP) Data, Task 72−00−00−990−010.

(5) Borescope inspection limits for Stage 1 HPT blades.

NOTE: Additional borescope recommendations for certain part number (configuration) high pressure turbine 1st stage blades are contained in SB PW4ENG 72−422. The information in SB PW4ENG 72−422 must be combined with the information that follows to form a complete inspection program for high pressure turbine 1st stage blades (applicable only to engines with 1st stage blades addressed by SB PW4ENG 72−422).

CAUTION: FOLLOWING LIMITS ARE APPLICABLE ON A CONTINUE−IN−SERVICE BASIS ONLY. LIMIT IS BASED ON PART STRUCTURAL REQUIREMENTS AND DOES NOT IMPLY THAT ENGINE PERFORMANCE, STABILITY, OPERATING LIMITS, OR PART REPARABILITY WILL BE MAINTAINED.

(a) Limits for blade conditions observed during borescope inspection are given in Figure 802 through Figure 805.

NOTE: Additional borescope recommendations for certain part number (configuration) high pressure turbine 1st stage blades are contained in SB PW4ENG 72−422. The information in SB PW4ENG 72−422 must be combined with the information that follows to form a complete inspection program for high pressure turbine 1st stage blades (applicable only to engines with 1st stage blades addressed by SB PW4ENG 72−422).

(b) Blade cracking. The limits for blade cracking observed during borescope inspection are given in Figure 802 through Figure 805.

CAUTION: LOSS OF BLADE COATING MAY RESULT IN DEGRADATION OF THE BASE ALLOY. THIS CONDITION, AS WELL AS HOT CORROSION ATTACK (SULFIDATION), CAN AFFECT BLADE REPARABILITY.

(c) Airfoil bulging.

1 Inspect for concave side bulging. Using a flexible borescope through AP−11 it is possible to detect a bulge by keeping the borescope parallel and very close to the concave airfoil surface. Small bulges may be detectable by a shadow seen beyond the bulge. See Figure 804. Using a flexible borescope through AP−8 with a guide tube it may also be possible to detect larger bulges.

2 For engines not equipped with AP−11, or as an alternate method, inspect for concave side airfoil dark spots using a flexible borescope with a guide tube through AP−8. First stage HPT blades which have bulged airfoils typically exhibit a large dark spot in the region of the bulge. Dark spots extending forward of the fifth tip cooling hole are indicative of hot operating conditions, for the blade, which may result in bulging. See Figure 805 for dark spot and fifth tip cooling hole identification.

(d) Blade erosion/corrosion.

NOTE: First indication of corrosion is circular shaped stains or markings on blade outer surfaces. Characteristic of sulfidation corrosive attack is a greenish to pale blue color. See the Standard Practices Manual, Section 70.

(6) Examine the HPT 1st stage duct segments for spalling (ceramic coating which is not there).

(a) All quantities of spalling are permitted.

(b) Ceramic spalling causes the conditions that follow:

1 Increased tip clearance of the HPT 1st stage blade.

2 Increased EGT.

3 Increased fuel consumption.

4 Possible damage to the tip of the HPT 1st stage blades.

5 Possible damage to the HPT 2nd stage blades.

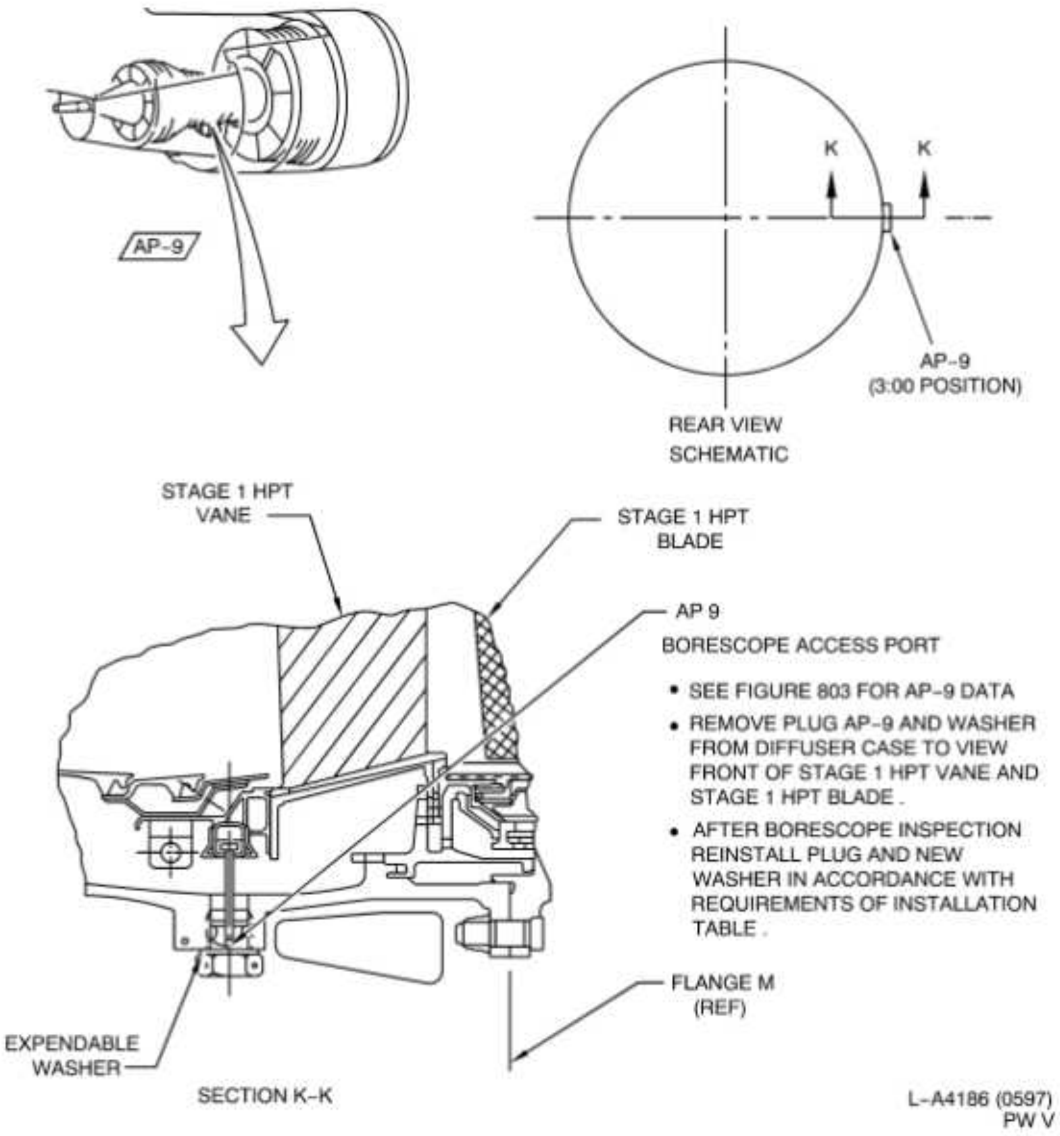
(7) If the HPT 1st stage duct segments are spalled, do the inspection of the HPT 1st and 2nd stage blades for damage.

(8) After borescope inspection, install AP-9 plug and new washer and, for engines equipped, install AP-11 plug, new gasket and three bolts per requirements of Table 801.

AP Number And Location	Washer Required	Plug Locking Method	Plug Replacement Lubricant	Plug Torque lb-in. (N.m)
AP-9 Rear of Diffuser Case	Yes PN 584977 (Washer)	Lockwire (AS3214-02)	P06-023 Silver Goop	40 - 50 (4.519 - 5.649)
AP-11 Lower TCA Tube	Yes PN ST 1142-011 (Gasket)	Self Locking	P03-001 Engine Oil	75 - 85 (8.474 - 9.604)

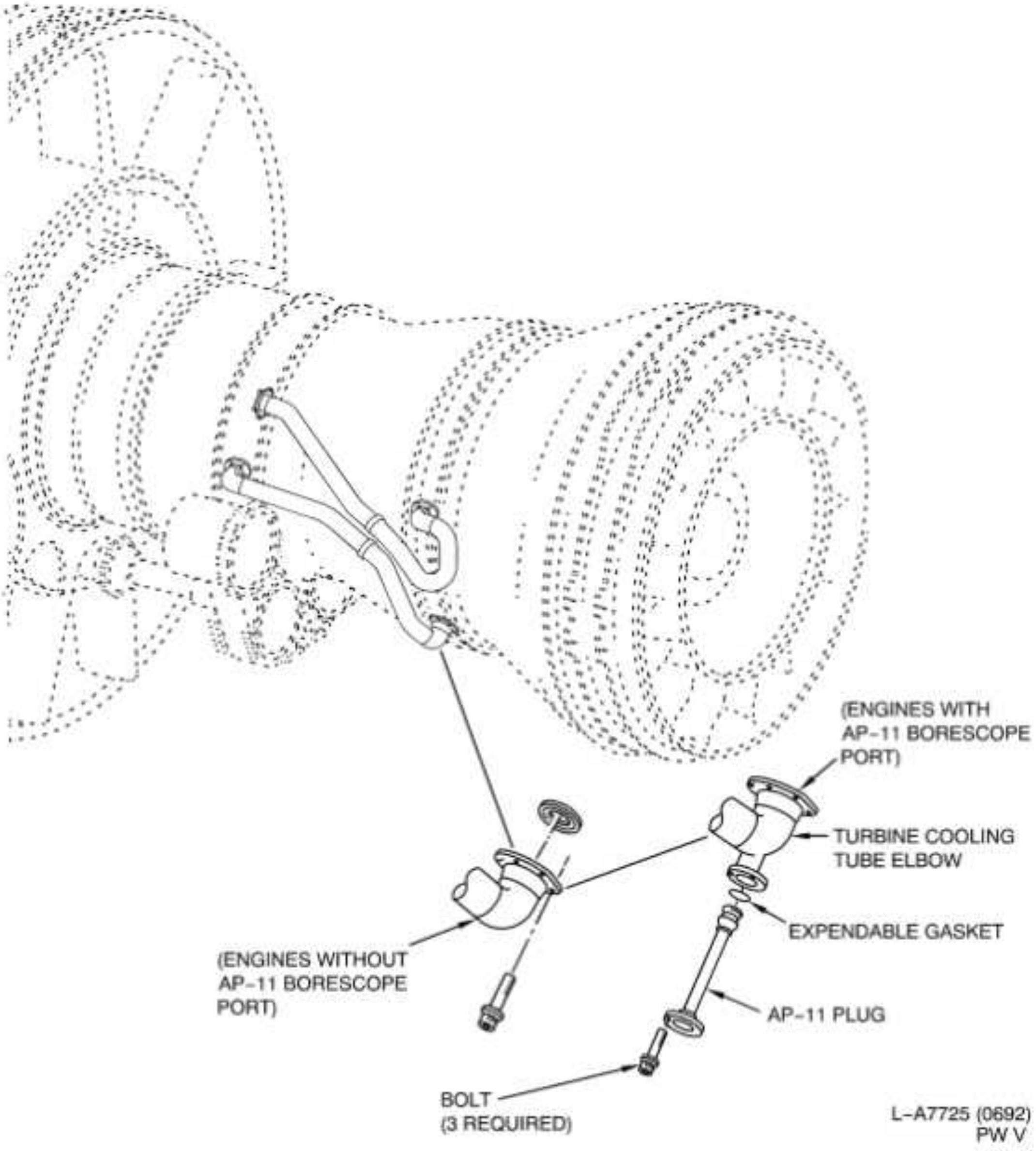
AP-9 And AP-11 Borescope Plug Installation Data
Table 801

(9) Remove PWA 86441 Guide Tube from AP-8 port. Refer to 72-00-00 Inspection/Check-01D Task 72-00-00-210-020 and install the AP-8 plugs and gaskets per the installation data in Table 801.

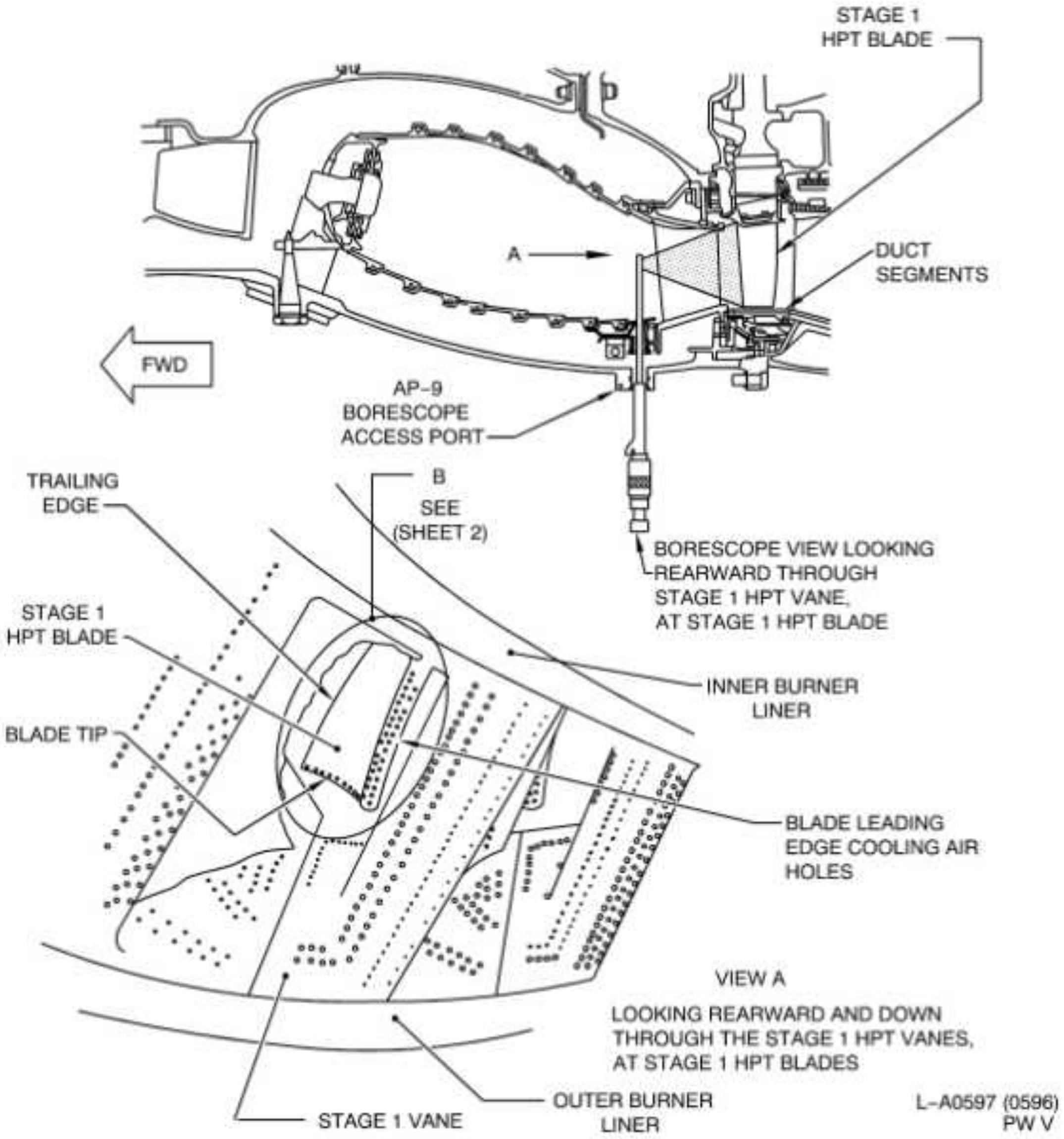

AP-9
K
K
AP-9
(3:00 POSITION)
REAR VIEW
SCHEMATIC
STAGE 1 HPT
VANE
STAGE 1 HPT
BLADE
AP 9
BORESCOPE ACCESS PORT
FLANGE M
(REF)
EXPENDABLE
WASHER
SECTION K-K
L-A4186 (0597)
PW V

- SEE FIGURE 803 FOR AP-9 DATA
- REMOVE PLUG AP-9 AND WASHER FROM DIFFUSER CASE TO VIEW FRONT OF STAGE 1 HPT VANE AND STAGE 1 HPT BLADE.
- AFTER BORESCOPE INSPECTION REINSTALL PLUG AND NEW WASHER IN ACCORDANCE WITH REQUIREMENTS OF INSTALLATION TABLE.

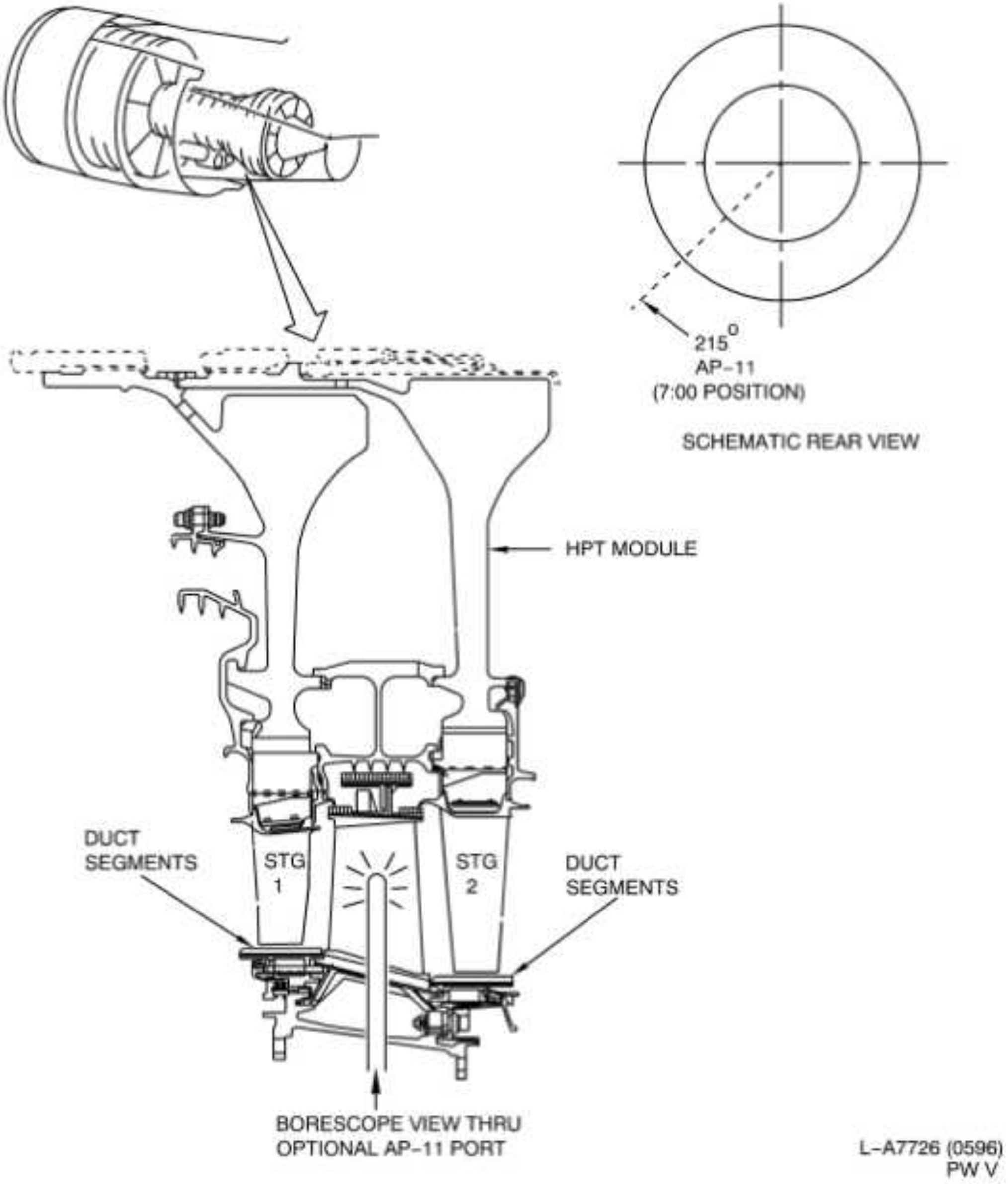
Stage 1 HPT Blade Borescope Access Port (AP−9) Location
Figure 801 (Sheet 1)
(Task 72−00−00−210−005)


(ENGINES WITH
AP−11 BORESCOPE
PORT)
TURBINE COOLING
TUBE ELBOW
EXPENDABLE GASKET
AP−11 PLUG
(ENGINES WITHOUT
AP−11 BORESCOPE
PORT)
BOLT
(3 REQUIRED)
L−A7725 (0692)
PW V

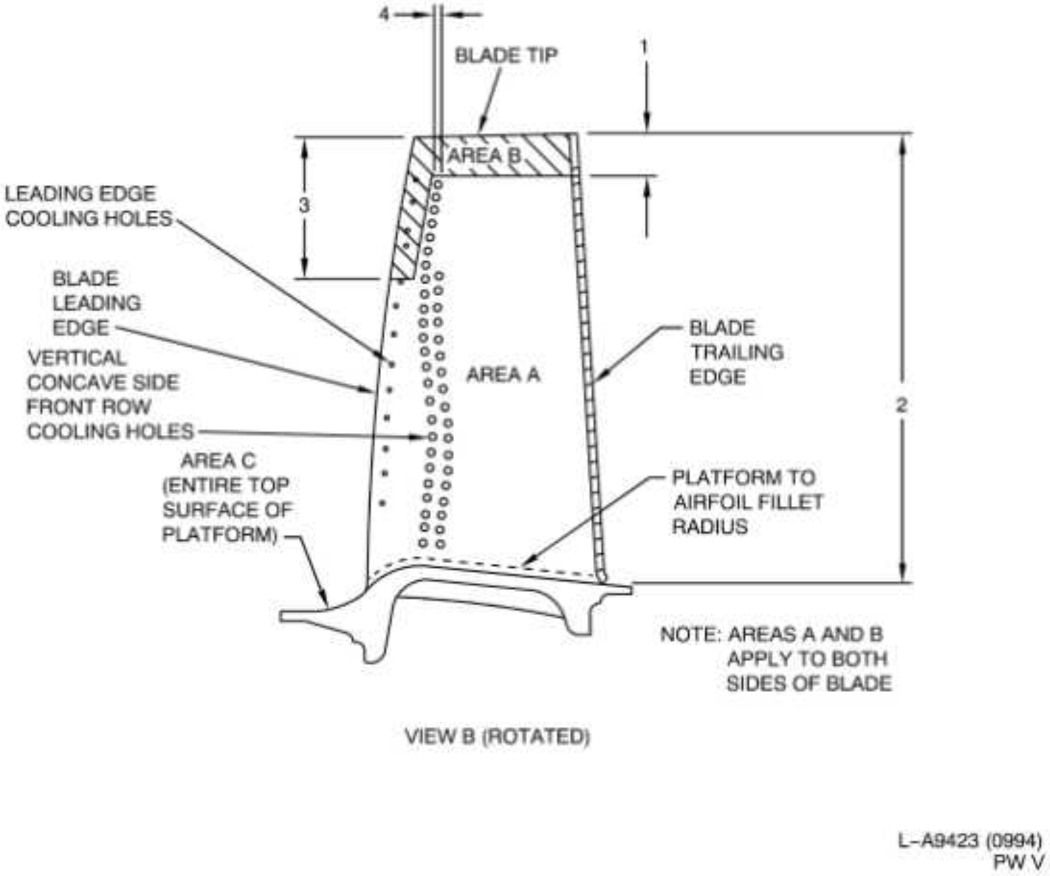
Stage 1 HPT Blade Borescope Access Port (AP−11) Location
Figure 801 (Sheet 2)
(Task 72−00−00−210−005)


STAGE 1
HPT BLADE
DUCT
SEGMENTS
A
FWD
AP-9
BORESCOPE
ACCESS PORT
TRAILING
EDGE
B
SEE
(SHEET 2)
BORESCOPE VIEW LOOKING
REARWARD THROUGH
STAGE 1 HPT VANE,
AT STAGE 1 HPT BLADE
STAGE 1
HPT BLADE
BLADE TIP
INNER BURNER
LINER
BLADE LEADING
EDGE COOLING AIR
HOLES
VIEW A
LOOKING REARWARD AND DOWN
THROUGH THE STAGE 1 HPT VANES,
AT STAGE 1 HPT BLADES
STAGE 1 VANE
OUTER BURNER
LINER
L-A0597 (0596)
PW V

Borescope Viewing Of Stage 1 HPT Blades (AP-9)
Figure 802 (Sheet 1)
(Task 72-00-00-210-005)


215°
AP−11
(7:00 POSITION)
SCHEMATIC REAR VIEW
HPT MODULE
DUCT SEGMENTS
STG 1
STG 2
DUCT SEGMENTS
BORESCOPE VIEW THRU OPTIONAL AP−11 PORT
L−A7726 (0596)
PW V

Borescope Viewing Of Stage 1 HPT Blades (AP−11)
Figure 802 (Sheet 2)
(Task 72−00−00−210−005)


4
BLADE TIP
1
AREA B
3
LEADING EDGE COOLING HOLES
BLADE LEADING EDGE
VERTICAL CONCAVE SIDE FRONT ROW COOLING HOLES
AREA A
BLADE TRAILING EDGE
2
AREA C (ENTIRE TOP SURFACE OF PLATFORM)
PLATFORM TO AIRFOIL FILLET RADIUS
NOTE: AREAS A AND B APPLY TO BOTH SIDES OF BLADE
VIEW B (ROTATED)
L−A9423 (0994)
PW V

1. 0.250 Inch (6.350 mm)
2. 2.8 Inches (71.120 mm)
3. 1.0 Inch (25.400 mm)
4. 0.100 Inch (2.540 mm) Forward Of The Vertical Concave Side Front Row Cooling Holes.

Stage 1 HPT Blade Inspection Areas
Figure 802 (Sheet 3)
(Task 72−00−00−210−005)

OBSERVED CONDITION	BLADE INSPECT-ION AREA	MAXIMUM DAMAGE FOR REGULAR INTERVAL INSPECTION	MAXIMUM DAMAGE FOR REDUCED INTERVAL INSPECTION	REMOVE ENGINE WITHIN 5 CYCLES OR IMMEDIATE ENGINE REMOVAL
Nicks And Dents Note: NO Crack Associated With A Nick Or dent Is Permitted Except As Noted in "Axial or Radial Cracks" Observed Condition	A	Not Permitted	One Nick Or Dent Per Blade To 0.080 Inch (2.032 mm) In Length Or Diameter Is Permitted.	Exceedance Of Reduced Interval Inspection Limit
	B	Any Amount Of Nicks Or Dents To 0.080 Inch (2.032 mm) In Length Or Diameter Is Permitted.	Any Amount Of Nicks Or Dents To 0.125 Inch (3.175 mm) In Length Or Diameter Is Permitted.	Immediate Engine Removal Required For Imminent Part Failure OR Imminent Material Liberation
Burning NOTE: Burning That Causes A Decrease In Cooling Air Flow Is Not Permitted	A , B and C	Burning Not Permitted	Burned Areas To 0.750 Inch (19.050mm) Diameter Or 0.442 Square Inch (285. Square mm). Leading Edge Burned Area To 0.400 Inch (10.160 mm) Diameter Or 0.126 Square Inch (81.0 Square mm).	
Spalled Or Eroded Coating	A, B and C	Any Amount Permitted	Any Amount Permitted	

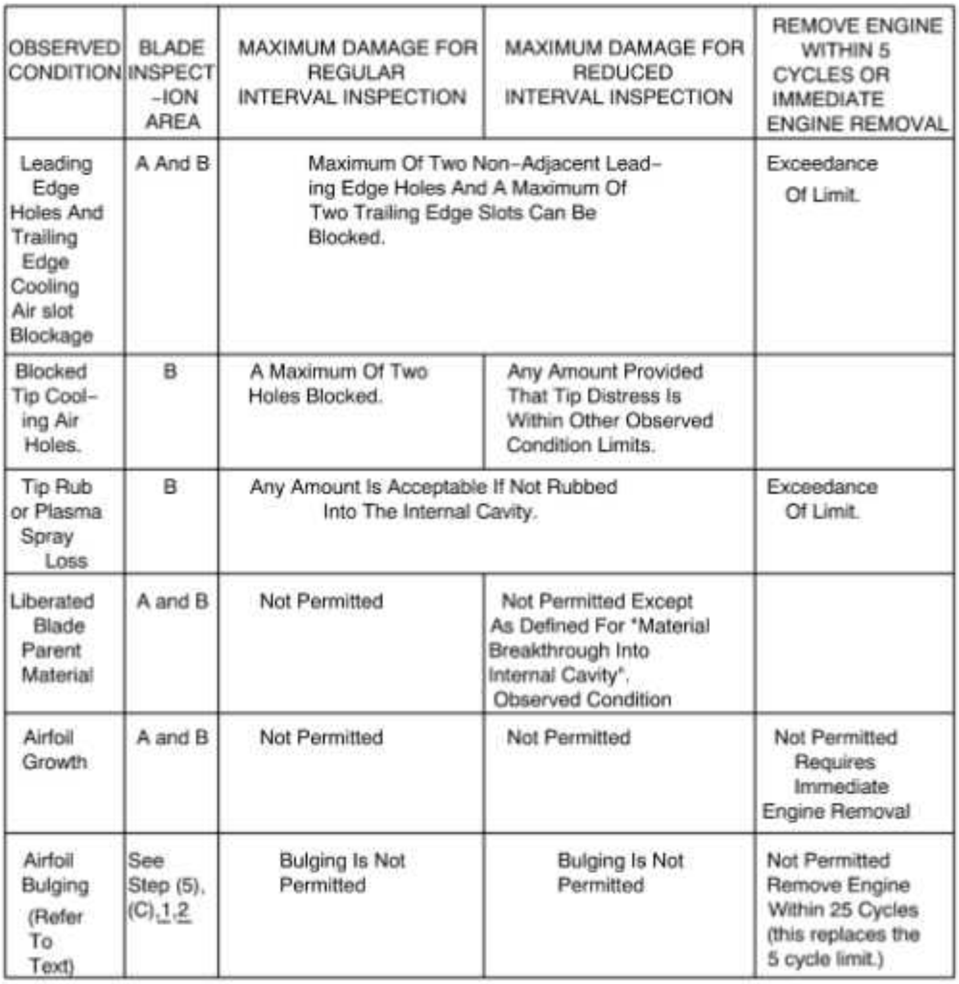
L-A9424 (0000)
PW V

Stage 1 HPT Blade Borescope Inspection Limits
Figure 803 (Sheet 1)
(Task 72−00−00−210−005)

OBSERVED CONDITION	BLADE INSPECTION AREA	MAXIMUM DAMAGE FOR REGULAR INTERVAL INSPECTION	MAXIMUM DAMAGE FOR REDUCED INTERVAL INSPECTION	REMOVE ENGINE WITHIN 5 CYCLES OR IMMEDIATE ENGINE REMOVAL
AXIAL OR RADIAL CRACKS NOTES: 1) SEE "MATERIAL BREAK−THROUGH TO INTERNAL CAVITY" FOR OPEN AREA DEFINITION 2) MATERIAL TEARS TO BE TREATED AS A CRACK.	A	NOT PERMITTED	ONE HOLE TO HOLE CRACK ON THE LEADING EDGE ONLY. NO AIRFOIL CRACKS.	EXCEEDANCE OF REDUCED INSPECTION LIMIT. IMMEDIATE ENGINE REMOVAL FOR IMMINENT PART FAILURE OR IMMINENT MATERIAL LIBERATION.
	B	AXIAL OR RADIAL CRACKS OR HOLE TO HOLE CRACKS AT TIP OR LEADING EDGE PERMITTED. NO BREAKTHROUGH OR OPEN AREAS. NO INTERSECTING CRACKS OR IMMINENT MATERIAL LIBERATION.	AXIAL OR RADIAL CRACKS ON THE LEADING EDGE, AIRFOIL OR TIP AREA ARE PERMITTED. BREAKTHROUGH TO INTERNAL CAVITY WITH OPEN AREA TO BREAKTHROUGH LIMIT IS PERMITTED.	
	C	ANY NUMBER OF PLATFORM EDGE CRACKS ARE PERMITTED IF THEY DO NOT GO TO THE PLATFORM TO AIRFOIL FILLET RADIUS. THE PLATFORM MUST NOT CURL (BEND).	ANY NUMBER OF PLATFORM EDGE CRACKS ARE PERMITTED IF THEY GO TO THE PLATFORM TO AIRFOIL FILLET RADIUS UP TO 0.250 INCH (6.350 mm) RADIALLY PAST THE RADIUS INTO THE AIRFOIL.	ANY NUMBER OF PLATFORM EDGE CRACKS THAT GO MORE THAN 0.250 INCH (6.350 mm) RADIALLY PAST THE RADIUS INTO THE AIRFOIL. ANY CRACKS IN THE RADIUS THAT GO IN A CHORDWISE DIRECTION.
MATERIAL BREAK-THROUGH OR BURN-THROUGH INTO INTERNAL CAVITY	A	NOT PERMITTED	NOT PERMITTED	NOT PERMITTED REQUIRES ENGINE REMOVAL.
	B	NOT PERMITTED	ONE DEFECT PER BLADE CONSISTING OF PARTIAL TIP LOSS OR OPEN AREA TO .125 SQUARE INCH (81 sq mm) OPENING, INTO THE INTERNAL CAVITY. MAXIMUM OF FIVE BLADES PER ROTOR.	IF THE OPEN AREA IS MORE THAN THE REDUCED INTERVAL INSPECTION LIMIT BUT WITHIN AREA B, REMOVE THE ENGINE WITHIN 50 CYCLES. IF THE OPEN AREA IS MORE THAN AREA B, (OUSIDE OF) REMOVE THE ENGINE WITHIN 5 CYCLES OR IMMEDIATELY.
BENT TIP	B	PERMITTED IF OTHER CONDITIONS ARE NOT EXCEEDED.		

L−A9425 (1197)
PW V

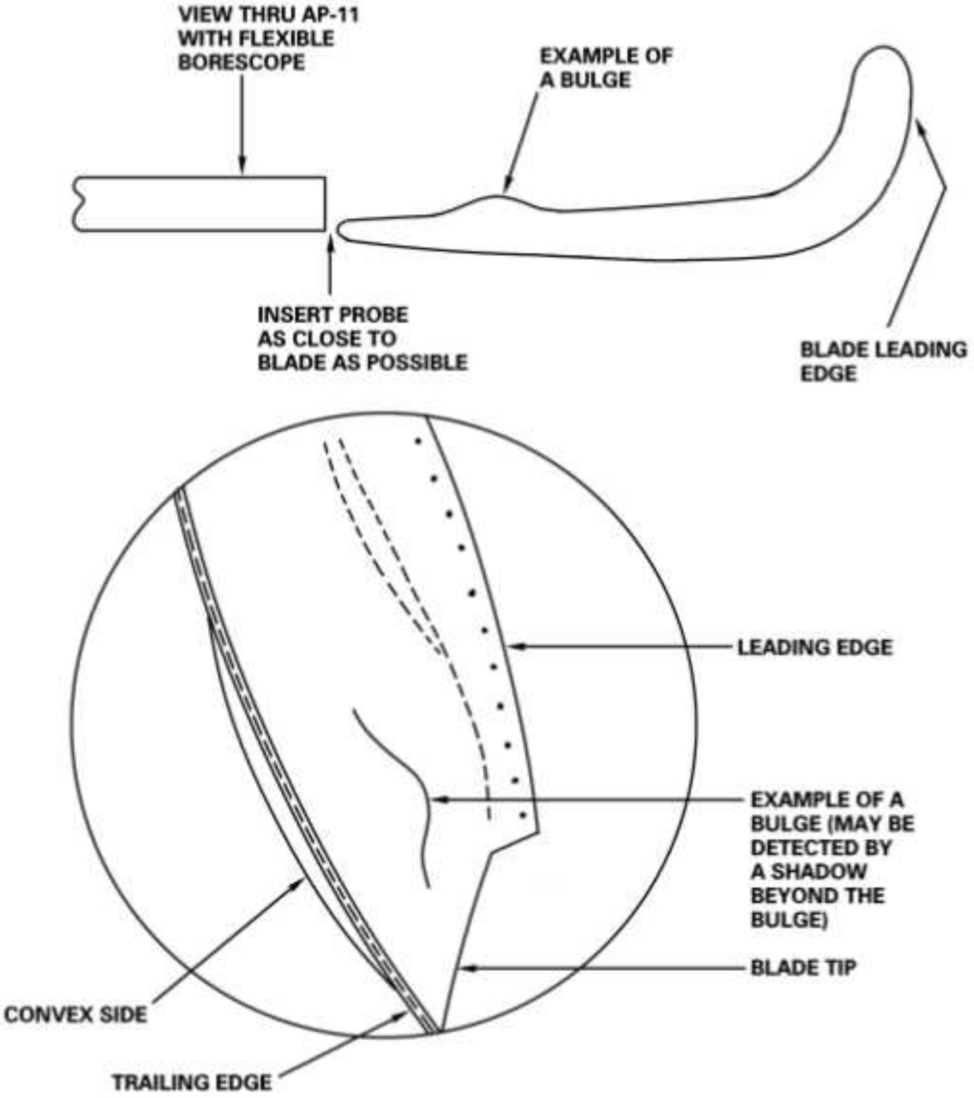
Stage 1 HPT Blade Borescope Inspection Limits
Figure 803 (Sheet 2)
(Task 72−00−00−210−005)



OBSERVED CONDITION	BLADE INSPECT-ION AREA	MAXIMUM DAMAGE FOR REGULAR INTERVAL INSPECTION	MAXIMUM DAMAGE FOR REDUCED INTERVAL INSPECTION	REMOVE ENGINE WITHIN 5 CYCLES OR IMMEDIATE ENGINE REMOVAL
Leading Edge Holes And Trailing Edge Cooling Air slot Blockage	A And B	Maximum Of Two Non-Adjacent Leading Edge Holes And A Maximum Of Two Trailing Edge Slots Can Be Blocked.		Exceedance Of Limit.
Blocked Tip Cooling Air Holes.	B	A Maximum Of Two Holes Blocked.	Any Amount Provided That Tip Distress Is Within Other Observed Condition Limits.	
Tip Rub or Plasma Spray Loss	B	Any Amount Is Acceptable If Not Rubbed Into The Internal Cavity.		Exceedance Of Limit.
Liberated Blade Parent Material	A and B	Not Permitted	Not Permitted Except As Defined For "Material Breakthrough Into Internal Cavity", Observed Condition	
Airfoil Growth	A and B	Not Permitted	Not Permitted	Not Permitted Requires Immediate Engine Removal
Airfoil Bulging (Refer To Text)	See Step (5).(C).1.2	Bulging Is Not Permitted	Bulging Is Not Permitted	Not Permitted Remove Engine Within 25 Cycles (this replaces the 5 cycle limit.)

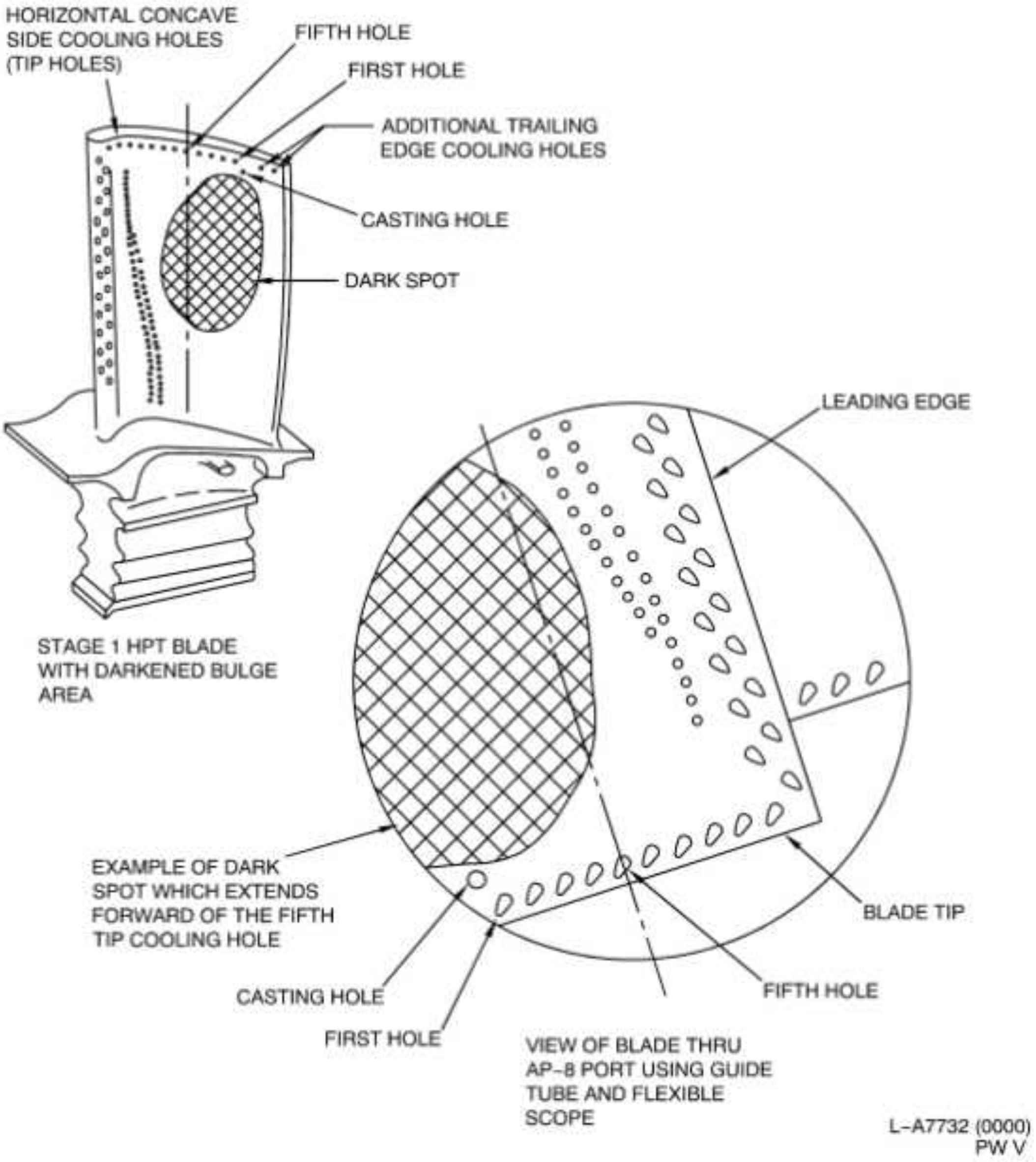
L-A9426 (0000)
PW V

Stage 1 HPT Blade Borescope Inspection Limits
Figure 803 (Sheet 3)
(Task 72−00−00−210−005)


VIEW THRU AP-11 WITH FLEXIBLE BORESCOPE
EXAMPLE OF A BULGE
INSERT PROBE AS CLOSE TO BLADE AS POSSIBLE
BLADE LEADING EDGE
LEADING EDGE
EXAMPLE OF A BULGE (MAY BE DETECTED BY A SHADOW BEYOND THE BULGE)
BLADE TIP
CONVEX SIDE
TRAILING EDGE

L-A7731 (0000)

Borescope Inspection Of Stage 1 HPT Blade Through AP−11 (Flex Probe)
Figure 804
(Task 72−00−00−210−005)


HORIZONTAL CONCAVE SIDE COOLING HOLES (TIP HOLES)
FIFTH HOLE
FIRST HOLE
ADDITIONAL TRAILING EDGE COOLING HOLES
CASTING HOLE
DARK SPOT
STAGE 1 HPT BLADE WITH DARKENED BULGE AREA
LEADING EDGE
EXAMPLE OF DARK SPOT WHICH EXTENDS FORWARD OF THE FIFTH TIP COOLING HOLE
BLADE TIP
CASTING HOLE
FIFTH HOLE
FIRST HOLE
VIEW OF BLADE THRU AP−8 PORT USING GUIDE TUBE AND FLEXIBLE SCOPE
L−A7732 (0000)
PW V

Borescope Inspection Of Stage 1 HPT Blade Through AP−8 (Flex Probe)
Figure 805
(Task 72−00−00−210−005)

ENGINE GENERAL − INSPECTION/CHECK−01F

Task 72−00−00−210−030:

1. Perform Borescope Inspection Of Stage 1 HPT Blades And Duct Segments (AP−8/AP−11)

A. Equipment And Materials Necessary

Standard Tools:

See 72−00−00 Inspection/Check−01A Task 72−00−00−990−011 for borescope equipment.

Consumable Materials:

Item No.	Designation
P03−001	Engine Oil (PWA 521B)
P05−289	Lockwire
P06−023	Thread Lubricant (PWA 36001 or PMC 9940)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	6	72−41−00/1/130A
Gasket AP−11	1	75−24−00/3/55

B. Procedure

(1) Remove the AP−8 access port plugs, as necessary, from the diffuser case as follows: See Figure 801 (Sheet 1) for AP−8 locations.

NOTE: Table 801 shows more specifications for the plugs at location AP−8.

(a) Cut the safety wire and remove the safety wire from the plugs that will be removed.

(b) Use a standard 3/8 socket drive extension and a breaker bar or ratchet to remove the AP−8 plugs.

(c) Remove the AP−8 plugs and gaskets, as necessary, for the examination of the stage 1 HPT vanes.

(d) Discard all the old gaskets.

Access Port & (Stage)	Angular Location Clockwise From Rear	Gasket P/N	Plug P/N	Plug Thread Lubricant	Plug Torque lb−in. (N.m)
AP−8	45° (1:30 o'clock)	512640	50A725	P06−023	40 − 50 (4.519 − 5.649)
AP−8	127° (4:30 o'clock)	512640	50A725	P06−023	40 − 50 (4.519 − 5.649)
AP−8	172° (6:00 o'clock)	512640	50A725	P06−023	40 − 50 (4.519 − 5.649)
AP−8	225° (7:30 o'clock)	512640	50A725	P06−023	40 − 50 (4.519 − 5.649)
AP−8	277° (9:00 o'clock)	512640	50A725	P06−023	40 − 50 (4.519 − 5.649)
AP−8	338° (11:00 o'clock)	512640	50A725	P06−023	40 − 50 (4.519 − 5.649)
For Engines Equipped:					
NOTE: If the high stage temp sensor was removed to borescope through the (338°C) 11:00 o'clock port, reinstall per Section 71−00−41, Installation−04.					
AP−11	Lower TCA Tube	ST 1142−011	50L509−01	P03−001	75 − 85 (8.474 − 9.604)

Borescope Access Port (AP−8 And AP−11) Data
Table 801

(2) For engines equipped, remove three bolts, plug and gasket from borescope access port AP−11 located on the lower turbine cooling air tube elbow at the 7 o'clock position. See Figure 801 (Sheet 2).

CAUTION: TEMPERATURES IN AREAS TO BE BORESCOPED SHOULD BE PERMITTED TO COOL TO BELOW 150°F (65.6°C) FOLLOWING ENGINE OPERATION. DAMAGE MAY RESULT TO BORESCOPE EQUIPMENT IF EQUIPMENT IS EXPOSED TO GASPATH OR METAL TEMPERATURES IN EXCESS OF 150°F (65.6°C). AS A GUIDE − IF ADJACENT CASES ARE TOO HOT TO TOUCH COMFORTABLY, INSPECTION SHOULD BE DELAYED.

(3) Insert the borescope through the port (AP−8 or AP−11) and inspect the Stage 1 blades for nicks, dents, cracks, tip damage, erosion, coating loss, liberated material, bent tips, tip rub, airfoil growth, blocked cooling holes, airfoil bulging and burning, sulfidation and damage caused by passage of foreign material. See Figure 803. To view each blade, rotate the high rotor using hand or power operated equipment. See 72−00−00 Inspection/Check−01A, Installation Of The Rotator Used To Turn The N2 Rotor, (Task 72−00−00−480−002).

NOTE: Conditions noted above are for each blade and unless otherwise stated all blades can exhibit conditions described within the limits given.

NOTE: Maximum borescope insertion depth and borescope limiting access hole diameter specifications for AP−8 and AP−11 are given in Table 801 of 72−00−00 Inspection/Check−01A, General Borescope Inspection Procedures And Borescope Access Port (AP) Data, Task 72−00−00−990−011.

(4) Borescope inspection limits for the Stage 1 HPT blades.

NOTE: Additional borescope recommendations for certain part number (configuration) high pressure turbine 1st stage blades are contained in SB PW4ENG 72−422. The information in SB PW4ENG 72−422 must be combined with the information that follows to form a complete inspection program for high pressure turbine 1st stage blades (applicable only to engines with 1st stage blades addressed by SB PW4ENG 72−422).

CAUTION: FOLLOWING LIMITS ARE APPLICABLE ON A CONTINUE−IN−SERVICE BASIS ONLY. LIMIT IS BASED ON PART STRUCTURAL REQUIREMENTS AND DOES NOT IMPLY THAT ENGINE PERFORMANCE, STABILITY, OPERATING

LIMITS, OR PART REPARABILITY WILL BE MAINTAINED.

(a) Limits for blade conditions observed during borescope inspection are given in Figure 802 through Figure 805.

NOTE: Additional borescope recommendations for certain part number (configuration) high pressure turbine 1st stage blades are contained in SB PW4ENG 72−422. The information in SB PW4ENG 72−422 must be combined with the information that follows to form a complete inspection program for high pressure turbine 1st stage blades (applicable only to engines with 1st stage blades addressed by SB PW4ENG 72−422).

(b) Blade cracking. The limits for blade cracking observed during borescope inspection are given in Figure 802 through Figure 805.

CAUTION: LOSS OF BLADE COATING MAY RESULT IN DEGRADATION OF THE BASE ALLOY. THIS CONDITION, AS WELL AS HOT CORROSION ATTACK (SULFIDATION), CAN AFFECT BLADE REPARABILITY.

(c) Airfoil bulging.

1 Inspect for concave side bulging. Using a flexible borescope through AP−11 it is possible to detect a bulge by keeping the borescope parallel and very close to the concave airfoil surface. Small bulges may be detectable by a shadow seen beyond the bulge. See Figure 804. Using a flexible borescope through AP−8 it may also be possible to detect larger bulges.

2 For engines not equipped with AP−11, or as an alternate method, inspect for concave side airfoil dark spots using a flexible borescope through AP−8. First stage HPT blades which have bulged airfoils typically exhibit a large dark spot in the region of the bulge. Dark spots extending forward of the fifth tip cooling hole are indicative of hot operating conditions, for the blade, which may result

in bulging. See Figure 805 for dark spot and fifth tip cooling hole identification.

(d) Blade erosion/corrosion.

NOTE: First indication of corrosion is circular shaped stains or markings on blade outer surfaces. Characteristic of sulfidation corrosive attack is a greenish to pale blue color. See the Standard Practices Manual, Section 70.

(5) Examine the HPT 1st stage duct segments for spalling (ceramic coating which is not there).

(a) All quantities of spalling are permitted.

(b) Ceramic spalling causes the conditions that follow:

1 Increased tip clearance of the HPT 1st stage blade.

2 Increased EGT.

3 Increased fuel consumption.

4 Possible damage to the tip of the HPT 1st stage blades.

5 Possible damage to the HPT 2nd stage blades.

(6) If the HPT 1st stage duct segments are spalled, do the inspection of the HPT 1st and 2nd stage blades for damage.

(7) After you complete the borescope inspection, install the AP−8 plugs as follows. For engines equipped, install the AP−11 plug, new gasket and three bolts by the information given in Table 801:

(a) Use a nylon brush to clean the old antigalling compound from the threads of each AP plug.

(b) Apply a thin layer of new antigalling compound to the threads and to the plug head washer contact surface area. See Table 801 for the necessary antigalling compound.

NOTE: Do not use Engine Oil P03−001 on the AP−8 plug threads.

(c) If you apply more antigalling compound than is necessary to the plug, remove the unwanted compound with a rag or cloth.

(d) Put a new gasket on each AP plug, as necessary. See Table 801 for the necessary gasket.

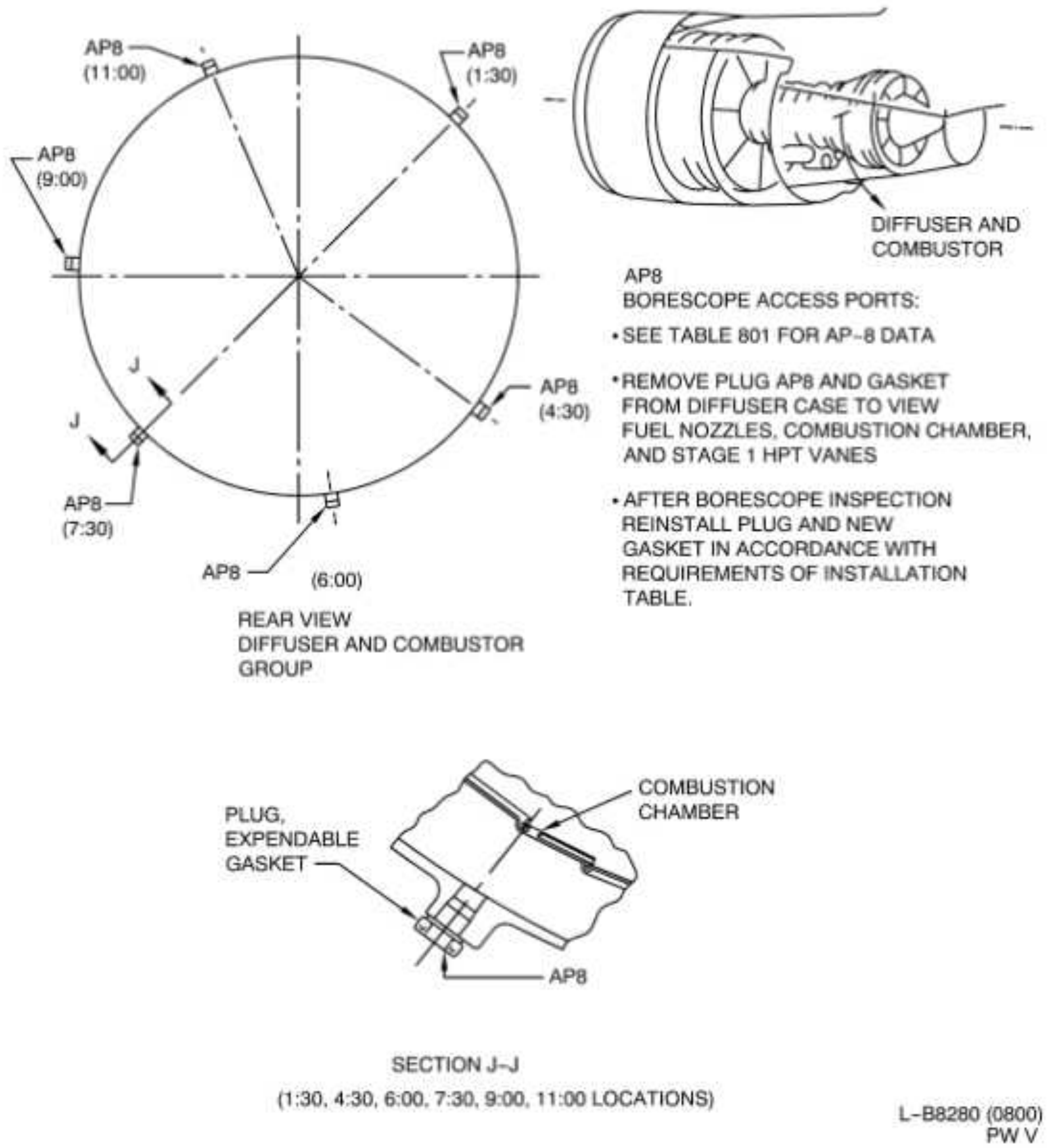
NOTE: Always use a new gasket or washer. Do not use an old gasket.

(e) Install the AP plugs and gaskets in the applicable borescope boss on the engine. See Table 801 for the necessary AP plug and gasket part numbers for each location. Use a standard socket drive extension and ratchet to turn each AP plug into the boss. Hand tighten the plug only with the ratchet wrench.

(f) Use a standard torque wrench to torque the AP plugs. See Table 801 for the necessary torque specifications.

(g) Safety all the AP−8 plugs with Lockwire P05−289.

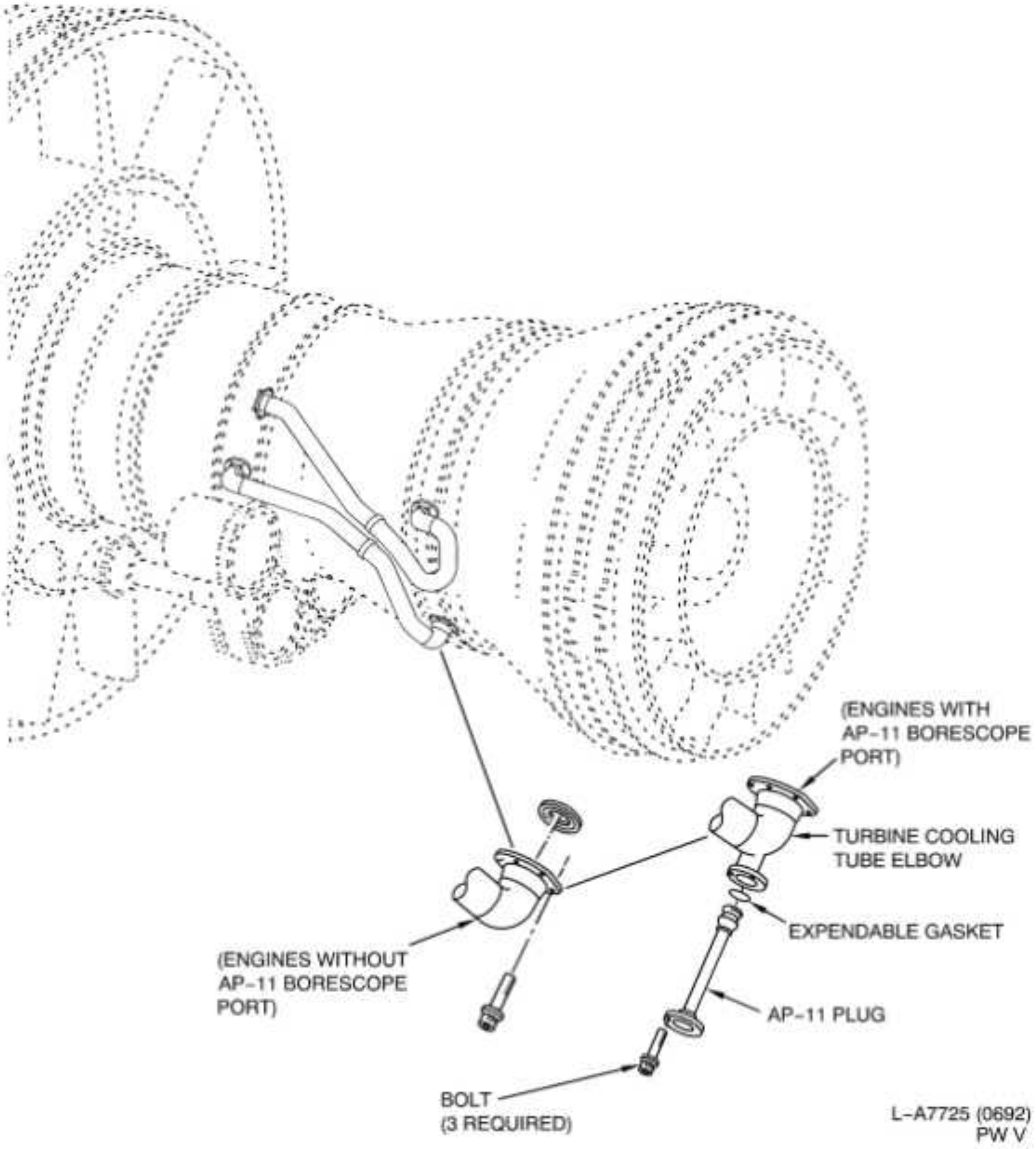
NOTE: The AP−11 plug is self locking and does not need to safetied with lockwire.


AP8
(11:00)
AP8
(1:30)
AP8
(9:00)
J
J
AP8
(4:30)
AP8
(7:30)
AP8
(6:00)
REAR VIEW
DIFFUSER AND COMBUSTOR
GROUP
DIFFUSER AND
COMBUSTOR
PLUG,
EXPENDABLE
GASKET
COMBUSTION
CHAMBER
AP8
SECTION J-J
(1:30, 4:30, 6:00, 7:30, 9:00, 11:00 LOCATIONS)
L-B8280 (0800)
PW V

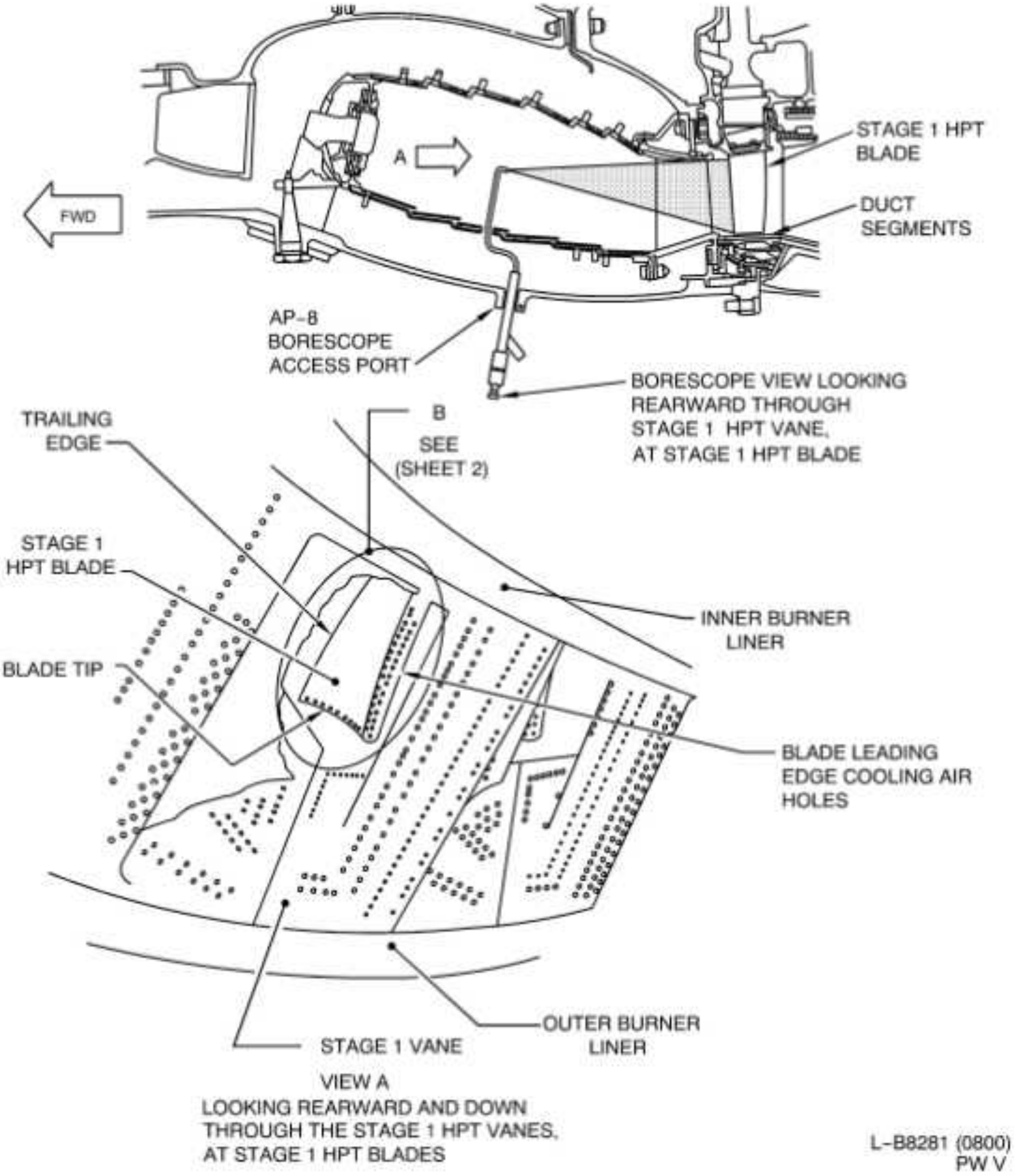
AP8
BORESCOPE ACCESS PORTS:

- SEE TABLE 801 FOR AP-8 DATA
- REMOVE PLUG AP8 AND GASKET FROM DIFFUSER CASE TO VIEW FUEL NOZZLES, COMBUSTION CHAMBER, AND STAGE 1 HPT VANES
- AFTER BORESCOPE INSPECTION REINSTALL PLUG AND NEW GASKET IN ACCORDANCE WITH REQUIREMENTS OF INSTALLATION TABLE.

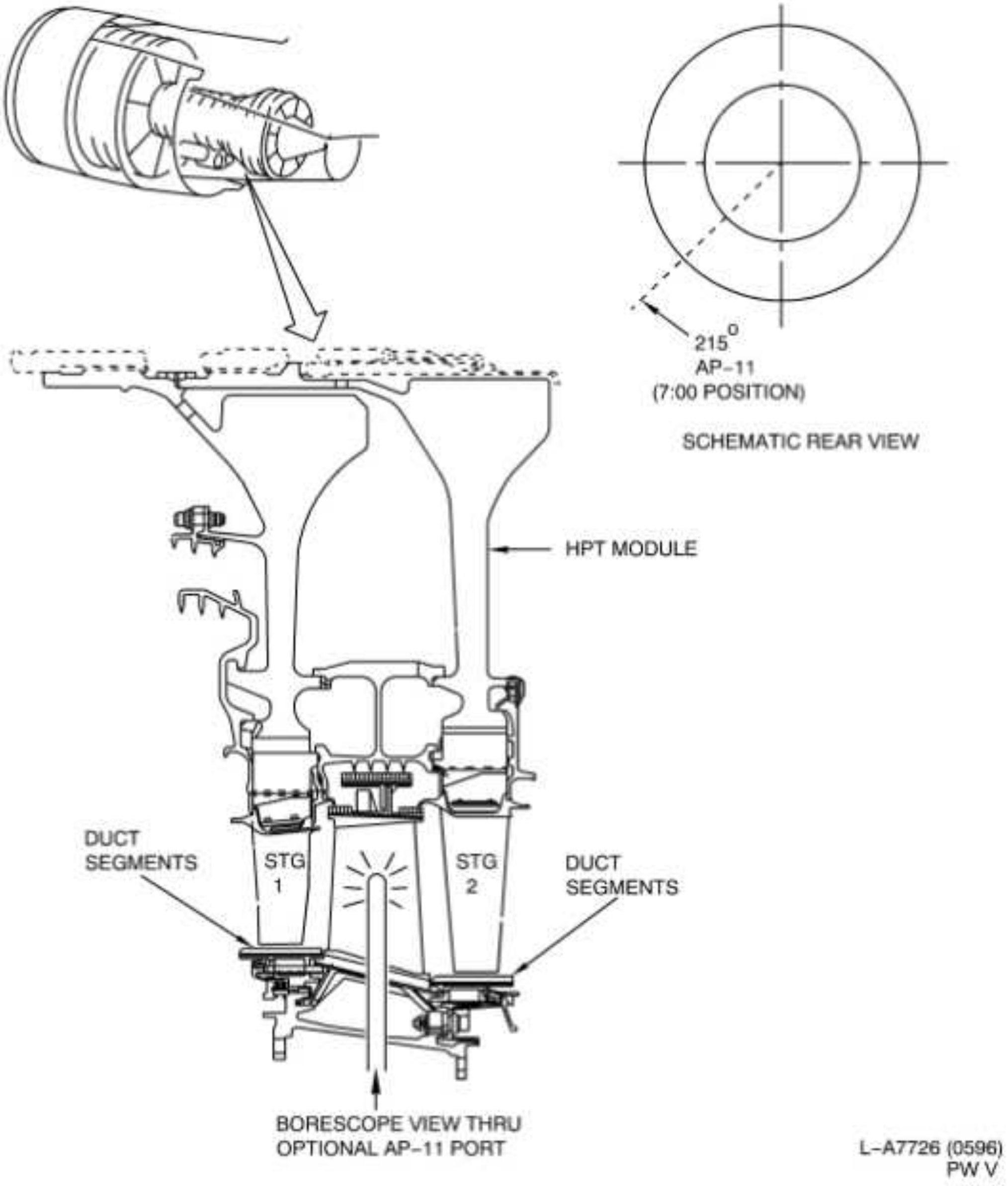
Stage 1 HPT Blade Borescope Access Port (AP−8) Locations
Figure 801 (Sheet 1)
(Task 72−00−00−210−030)


(ENGINES WITH
AP-11 BORESCOPE
PORT)
TURBINE COOLING
TUBE ELBOW
EXPENDABLE GASKET
AP-11 PLUG
(ENGINES WITHOUT
AP-11 BORESCOPE
PORT)
BOLT
(3 REQUIRED)
L-A7725 (0692)
PW V

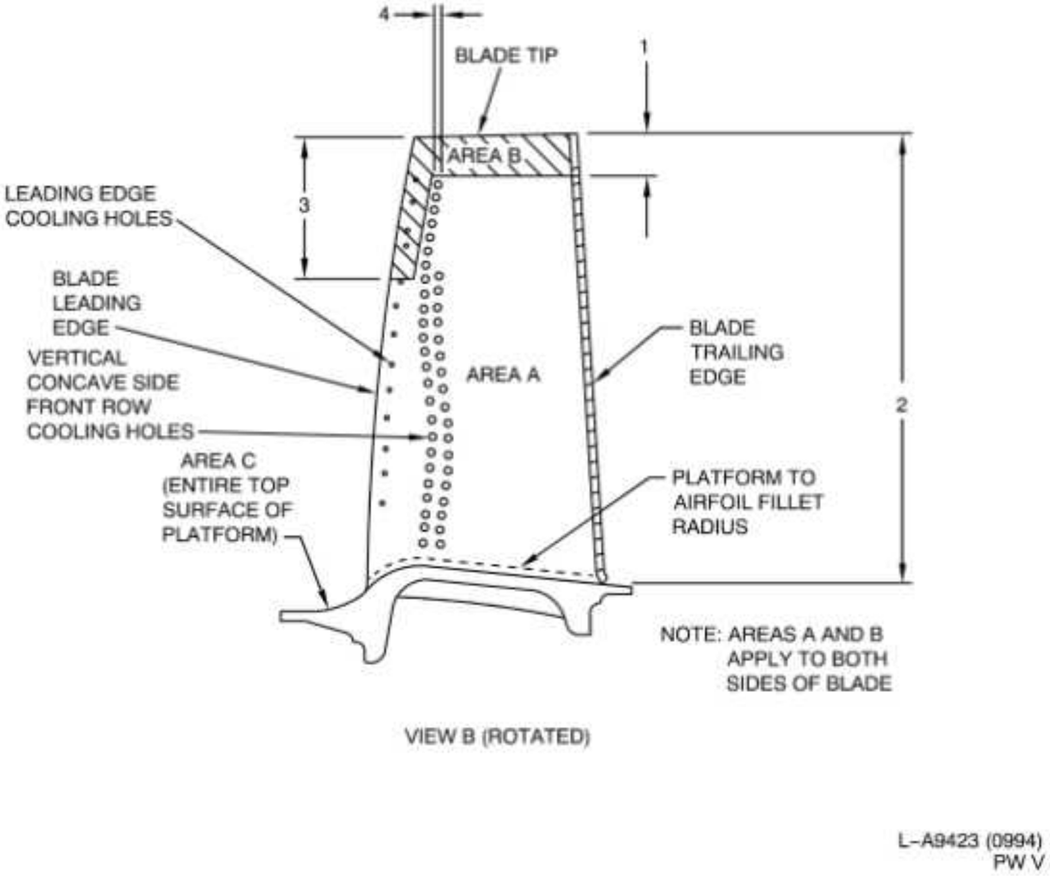
Stage 1 HPT Blade Borescope Access Port (AP-11) Location
Figure 801 (Sheet 2)
(Task 72-00-00-210-030)


FWD
A
STAGE 1 HPT BLADE
DUCT SEGMENTS
AP-8 BORESCOPE ACCESS PORT
BORESCOPE VIEW LOOKING REARWARD THROUGH STAGE 1 HPT VANE, AT STAGE 1 HPT BLADE
TRAILING EDGE
B
SEE (SHEET 2)
STAGE 1 HPT BLADE
BLADE TIP
INNER BURNER LINER
BLADE LEADING EDGE COOLING AIR HOLES
STAGE 1 VANE
OUTER BURNER LINER
VIEW A
LOOKING REARWARD AND DOWN THROUGH THE STAGE 1 HPT VANES, AT STAGE 1 HPT BLADES
L-B8281 (0800)
PW V

Borescope Viewing Of Stage 1 HPT Blades (AP−8)
Figure 802 (Sheet 1)
(Task 72−00−00−210−030)


215°
AP−11
(7:00 POSITION)
SCHEMATIC REAR VIEW
HPT MODULE
DUCT SEGMENTS
STG 1
STG 2
DUCT SEGMENTS
BORESCOPE VIEW THRU OPTIONAL AP−11 PORT
L−A7726 (0596)
PW V

Borescope Viewing Of Stage 1 HPT Blades (AP−11)
Figure 802 (Sheet 2)
(Task 72−00−00−210−030)


4
BLADE TIP
1
AREA B
3
LEADING EDGE COOLING HOLES
BLADE LEADING EDGE
VERTICAL CONCAVE SIDE FRONT ROW COOLING HOLES
AREA A
BLADE TRAILING EDGE
2
AREA C (ENTIRE TOP SURFACE OF PLATFORM)
PLATFORM TO AIRFOIL FILLET RADIUS
NOTE: AREAS A AND B APPLY TO BOTH SIDES OF BLADE
VIEW B (ROTATED)
L−A9423 (0994)
PW V

1. 0.250 Inch (6.350 mm)
2. 2.8 Inches (71.120 mm)
3. 1.0 Inch (25.400 mm)
4. 0.100 Inch (2.540 mm) Forward Of The Vertical Concave Side Front Row Cooling Holes.

Stage 1 HPT Blade Inspection Areas
Figure 802 (Sheet 3)
(Task 72−00−00−210−030)

OBSERVED CONDITION	BLADE INSPECT-ION AREA	MAXIMUM DAMAGE FOR REGULAR INTERVAL INSPECTION	MAXIMUM DAMAGE FOR REDUCED INTERVAL INSPECTION	REMOVE ENGINE WITHIN 5 CYCLES OR IMMEDIATE ENGINE REMOVAL
Nicks And Dents	A	Not Permitted	One Nick Or Dent Per Blade To 0.080 Inch (2.032 mm) In Length Or Diameter Is Permitted.	Exceedance Of Reduced Interval Inspection Limit
Note: NO Crack Associated With A Nick Or dent Is Permitted Except As Noted in "Axial or Radial Cracks" Observed Condition	B	Any Amount Of Nicks Or Dents To 0.080 Inch (2.032 mm) In Length Or Diameter Is Permitted.	Any Amount Of Nicks Or Dents To 0.125 Inch (3.175 mm) In Length Or Diameter Is Permitted.	Immediate Engine Removal Required For Imminent Part Failure OR Imminent Material Liberation
Burning NOTE: Burning That Causes A Decrease In Cooling Air Flow Is Not Permitted	A , B and C	Burning Not Permitted	Burned Areas To 0.750 Inch (19.050mm) Diameter Or 0.442 Square Inch (285. Square mm). Leading Edge Burned Area To 0.400 Inch (10.160 mm) Diameter Or 0.126 Square Inch (81.0 Square mm).	
Spalled Or Eroded Coating	A, B and C	Any Amount Permitted	Any Amount Permitted	

L-A9424 (0000)
PW V

Stage 1 HPT Blade Borescope Inspection Limits
Figure 803 (Sheet 1)
(Task 72−00−00−210−030)

OBSERVED CONDITION	BLADE INSPECTION AREA	MAXIMUM DAMAGE FOR REGULAR INTERVAL INSPECTION	MAXIMUM DAMAGE FOR REDUCED INTERVAL INSPECTION	REMOVE ENGINE WITHIN 5 CYCLES OR IMMEDIATE ENGINE REMOVAL
AXIAL OR RADIAL CRACKS NOTES: 1) SEE "MATERIAL BREAK−THROUGH TO INTERNAL CAVITY" FOR OPEN AREA DEFINITION 2) MATERIAL TEARS TO BE TREATED AS A CRACK.	A	NOT PERMITTED	ONE HOLE TO HOLE CRACK ON THE LEADING EDGE ONLY. NO AIRFOIL CRACKS.	EXCEEDANCE OF REDUCED INSPECTION LIMIT. IMMEDIATE ENGINE REMOVAL FOR IMMINENT PART FAILURE OR IMMINENT MATERIAL LIBERATION.
	B	AXIAL OR RADIAL CRACKS OR HOLE TO HOLE CRACKS AT TIP OR LEADING EDGE PERMITTED. NO BREAKTHROUGH OR OPEN AREAS. NO INTERSECTING CRACKS OR IMMINENT MATERIAL LIBERATION.	AXIAL OR RADIAL CRACKS ON THE LEADING EDGE, AIRFOIL OR TIP AREA ARE PERMITTED. BREAKTHROUGH TO INTERNAL CAVITY WITH OPEN AREA TO BREAKTHROUGH LIMIT IS PERMITTED.	
	C	ANY NUMBER OF PLATFORM EDGE CRACKS ARE PERMITTED IF THEY DO NOT GO TO THE PLATFORM TO AIRFOIL FILLET RADIUS. THE PLATFORM MUST NOT CURL (BEND).	ANY NUMBER OF PLATFORM EDGE CRACKS ARE PERMITTED IF THEY GO TO THE PLATFORM TO AIRFOIL FILLET RADIUS UP TO 0.250 INCH (6.350 mm) RADIALLY PAST THE RADIUS INTO THE AIRFOIL.	ANY NUMBER OF PLATFORM EDGE CRACKS THAT GO MORE THAN 0.250 INCH (6.350 mm) RADIALLY PAST THE RADIUS INTO THE AIRFOIL. ANY CRACKS IN THE RADIUS THAT GO IN A CHORDWISE DIRECTION.
MATERIAL BREAK−THROUGH OR BURN−THROUGH INTO INTERNAL CAVITY	A	NOT PERMITTED	NOT PERMITTED	NOT PERMITTED REQUIRES ENGINE REMOVAL.
	B	NOT PERMITTED	ONE DEFECT PER BLADE CONSISTING OF PARTIAL TIP LOSS OR OPEN AREA TO .125 SQUARE INCH (81 sq mm) OPENING, INTO THE INTERNAL CAVITY. MAXIMUM OF FIVE BLADES PER ROTOR.	IF THE OPEN AREA IS MORE THAN THE REDUCED INTERVAL INSPECTION LIMIT BUT WITHIN AREA B, REMOVE THE ENGINE WITHIN 50 CYCLES. IF THE OPEN AREA IS MORE THAN AREA B, (OUSIDE OF) REMOVE THE ENGINE WITHIN 5 CYCLES OR IMMEDIATELY.
BENT TIP	B	PERMITTED IF OTHER CONDITIONS ARE NOT EXCEEDED.		

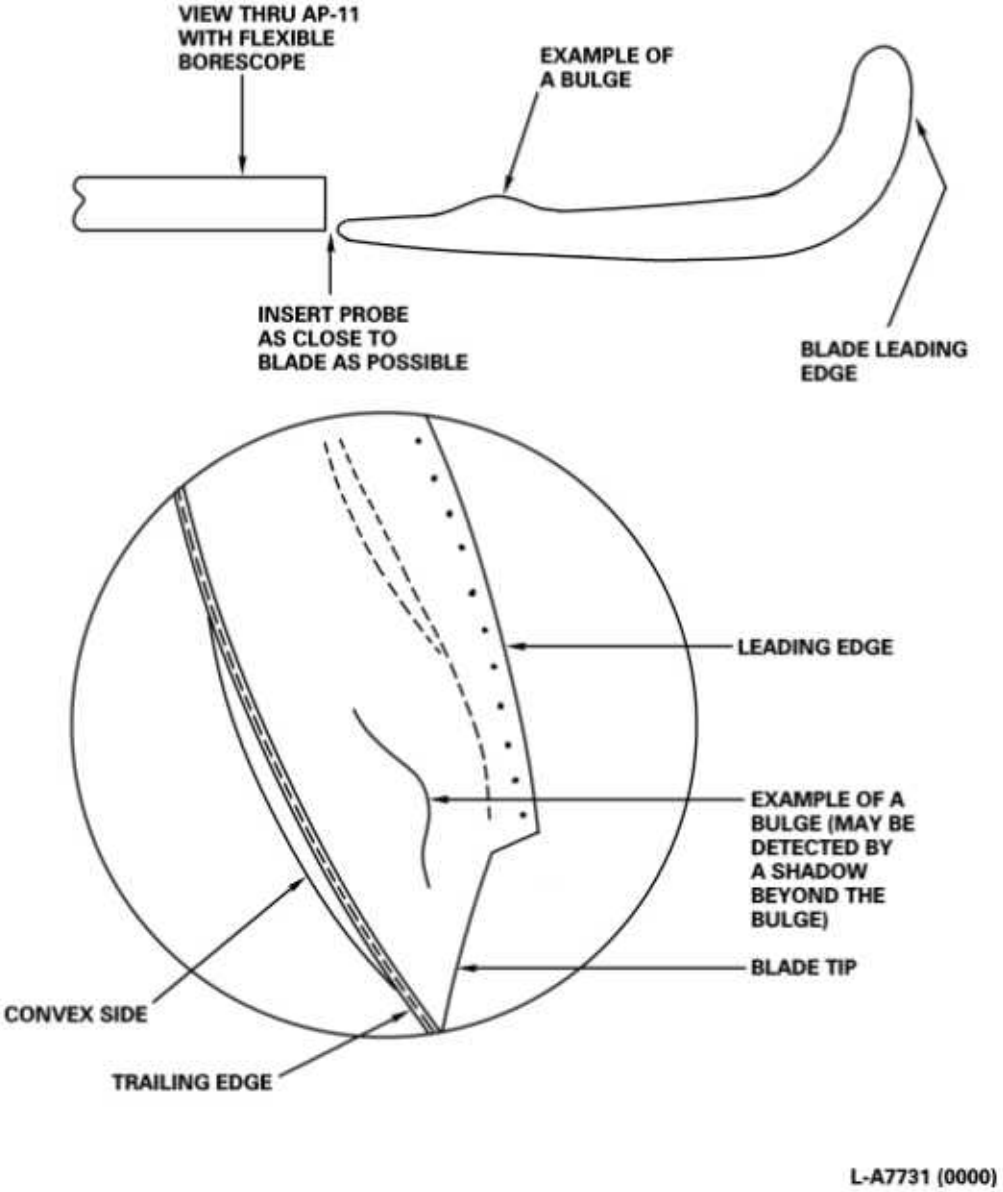
L−A9425 (1197)
PW V

Stage 1 HPT Blade Borescope Inspection Limits
Figure 803 (Sheet 2)
(Task 72−00−00−210−030)

OBSERVED CONDITION	BLADE INSPECT -ION AREA	MAXIMUM DAMAGE FOR REGULAR INTERVAL INSPECTION	MAXIMUM DAMAGE FOR REDUCED INTERVAL INSPECTION	REMOVE ENGINE WITHIN 5 CYCLES OR IMMEDIATE ENGINE REMOVAL
Leading Edge Holes And Trailing Edge Cooling Air slot Blockage	A And B	Maximum Of Two Non−Adjacent Leading Edge Holes And A Maximum Of Two Trailing Edge Slots Can Be Blocked.		Exceedance Of Limit.
Blocked Tip Cooling Air Holes.	B	A Maximum Of Two Holes Blocked.	Any Amount Provided That Tip Distress Is Within Other Observed Condition Limits.	
Tip Rub or Plasma Spray Loss	B	Any Amount Is Acceptable If Not Rubbed Into The Internal Cavity.		Exceedance Of Limit.
Liberated Blade Parent Material	A and B	Not Permitted	Not Permitted Except As Defined For "Material Breakthrough Into Internal Cavity", Observed Condition	
Airfoil Growth	A and B	Not Permitted	Not Permitted	Not Permitted Requires Immediate Engine Removal
Airfoil Bulging (Refer To Text)	See Step (5).(C).1.2	Bulging Is Not Permitted	Bulging Is Not Permitted	Not Permitted Remove Engine Within 25 Cycles (this replaces the 5 cycle limit.)

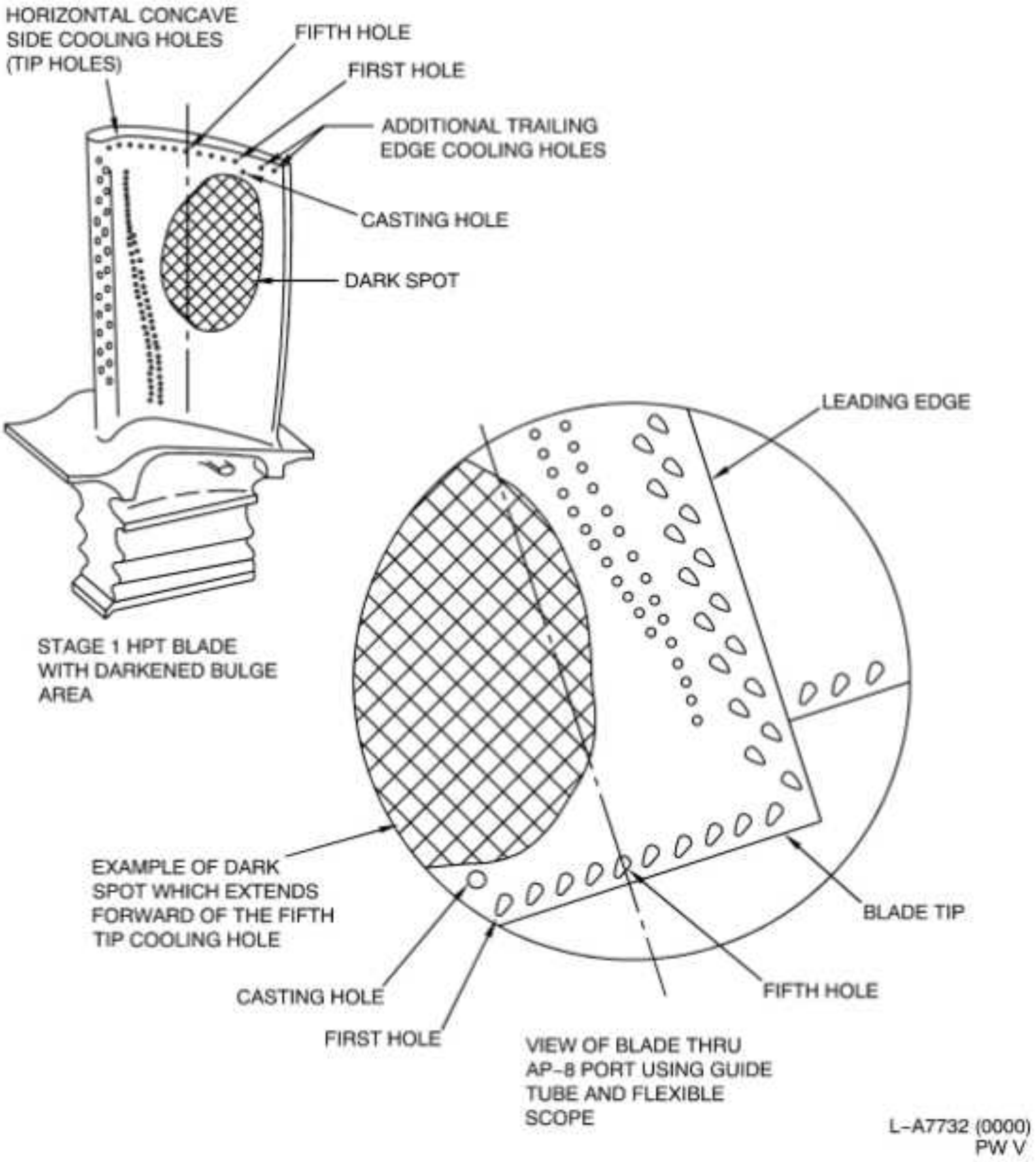
L−A9426 (0000)
PW V

Stage 1 HPT Blade Borescope Inspection Limits
Figure 803 (Sheet 3)
(Task 72−00−00−210−030)


VIEW THRU AP-11 WITH FLEXIBLE BORESCOPE
EXAMPLE OF A BULGE
INSERT PROBE AS CLOSE TO BLADE AS POSSIBLE
BLADE LEADING EDGE
LEADING EDGE
EXAMPLE OF A BULGE (MAY BE DETECTED BY A SHADOW BEYOND THE BULGE)
BLADE TIP
CONVEX SIDE
TRAILING EDGE
L-A7731 (0000)

Borescope Inspection Of Stage 1 HPT Blade Through AP−11 (Flex Probe)
Figure 804
(Task 72−00−00−210−030)

ENGINE GENERAL − INSPECTION/CHECK−01F


HORIZONTAL CONCAVE SIDE COOLING HOLES (TIP HOLES)
FIFTH HOLE
FIRST HOLE
ADDITIONAL TRAILING EDGE COOLING HOLES
CASTING HOLE
DARK SPOT
LEADING EDGE
STAGE 1 HPT BLADE WITH DARKENED BULGE AREA
EXAMPLE OF DARK SPOT WHICH EXTENDS FORWARD OF THE FIFTH TIP COOLING HOLE
BLADE TIP
CASTING HOLE
FIFTH HOLE
FIRST HOLE
VIEW OF BLADE THRU AP−8 PORT USING GUIDE TUBE AND FLEXIBLE SCOPE
L−A7732 (0000)
PW V

Borescope Inspection Of Stage 1 HPT Blade Through AP−8 (Flex Probe)
Figure 805
(Task 72−00−00−210−030)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72−00−00−210−006:

1. Perform Borescope Inspection Of Stage 2 HPT Blades And Duct Segments (AP−10/AP−11)

A. Equipment And Materials Required

Standard Tools:

See 72−00−00 Inspection/Check−01A Task 72−00−00−990−010 for borescope equipment.

Special Tools:

PWA 86081 Puller, AP−10 Borescope Plug Assembly

Consumable Materials:

Item No.	Designation
P03−001	Engine Oil (PWA 521B)
P06−023	Silver Goop (PWA 36001)
R P06−054	Paste, Anti−Seize (PWA 36246)
P11−027	Petroleum Solvent (PMC 9001) (Varsol No. 1)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket AP−10	1	72−53−00/3/170
Gasket AP−11	1	75−24−00/3/55

B. Procedure

See Figure 801, Figure 802 and Figure 803.

(1) Remove lockwire, and two bolts from borescope access port AP−10 located in LPT case at 4:30 o'clock position. Using PWA 86081 Puller, remove (as an assembly), the boss plug, plug stop (cover), spring washer, and cotter pin. Discard the boss plug gasket.

(2) For engines equipped, remove three bolts, plug, and gasket from the AP−11 borescope access port located on the turbine cooling air tube elbow at the 7 o'clock position. See Table 801 of 72−00−00 Inspection/Check−01A, Task 72−00−00−990−010 for additional AP−10/AP−11 access port data.

CAUTION: TEMPERATURES IN AREAS TO BE BORESCOPED SHOULD BE PERMITTED TO COOL TO BELOW 150°F (65.6°C) FOLLOWING ENGINE OPERATION. DAMAGE MAY RESULT TO BORESCOPE EQUIPMENT IF EQUIPMENT IS EXPOSED TO GASPATH OR METAL TEMPERATURES IN EXCESS OF 150°F (65.6°C). AS A GUIDE − IF ADJACENT CASES ARE TOO HOT TO TOUCH COMFORTABLY, INSPECTION SHOULD BE DELAYED.

(3) Do a borescope inspection of the Stage 2 blades.

NOTE: Maximum borescope insertion depth and borescope limiting access hole diameter specifications for AP−10 and AP−11 are provided in Table 801 of 72−00−00 Inspection/Check−01A, General Borescope Inspection Procedures And Borescope Access (Task 72−00−00−990−010).

(a) Carefully insert the borescope through the port and inspect the Stage 2 blades.

(b) To view each blade, rotate high rotor using hand or power operated equipment.

(c) See 72−00−00 Inspection/Check−01A, for Installation Of The Rotator Used To Turn The N2 Rotor, (Task 72−00−00−480−001).

(4) Borescope inspection limits for Stage 2 blades

NOTE: Conditions noted below are per blade and unless otherwise stated all blades can exhibit conditions described within limits provided.

(a) Examine the blades for nicks, dents, cracks, tip damage, erosion, coating loss, liberated material, bent tips, tip rub, airfoil growth, blocked cooling holes, sulfidation and damage caused by passage of foreign material.

CAUTION: FOLLOWING LIMITS ARE APPLICABLE ON A CONTINUE−IN−SERVICE BASIS ONLY. LIMIT IS BASED ON PART STRUCTURAL REQUIREMENTS AND DOES NOT IMPLY THAT ENGINE PERFORMANCE, STABILITY, OPERATING

LIMITS, OR PART REPARABILITY WILL BE MAINTAINED.

(b) Limits for blade conditions, including blade cracking, observed during borescope inspection are given in Figure 802 (Sheet 3) for blade inspection areas, and Figure 803 (Sheet 1) through Figure 803 (Sheet 3) for inspection limits.

(c) Examine the Stage 2 blades for signs of blade tip displacement and related conditions. See Figure 802 (Sheet 3) for blade inspection areas, and Figure 803 (Sheet 4) for inspection limits. See Figure 804 which shows a typical displaced Stage 2 blade.

CAUTION: LOSS OF BLADE COATING MAY RESULT IN DEGRADATION OF THE BASE ALLOY. THIS CONDITION, AS WELL AS HOT CORROSION ATTACH (SULFIDATION), CAN AFFECT BLADE REPARABILITY.

(d) Blade erosion/corrosion.

NOTE: First indication of corrosion is circular shaped stains or markings on blade outer surfaces. Characteristic of sulfidation corrosive attack is a greenish to pale blue color. See the Standard Practices Manual, PN 585005, Section 70.

(5) Examine the HPT 2nd stage duct segments for spalling (ceramic coating which is not there).

(a) All quantities of spalling are permitted.

(b) Ceramic spalling causes the conditions that follow:

1 Increased tip clearance of the HPT 2nd stage blade.

2 Increased EGT.

3 Increased fuel consumption.

4 Possible damage to the tip of the HPT 2nd stage blades.

5 Possible damage to the HPT 2nd stage blades.

(6) If the HPT 2nd stage duct segments are spalled, do the inspection of the HPT 1st and 2nd stage blades for damage.

(7) After borescope inspection, install as an assembly, the AP-10 plug, spring tension washer, plug stop, cotter pin and a new gasket. Install gasket into boss with split facing inward. See Table 801 before you install this assembly.

NOTE: If plug, washer and plug stop (cover) have been disassembled, reassemble and install per step (9) procedure.

(8) If required, assemble AP-10 borescope plug, spring tension washer, plug stop (cover) and cotter pin as follows:

NOTE: When plug, spring tension washer and cover are properly assembled and installed to turbine case, plug should be loaded inward, by spring washer, to seat in case boss.

(a) Place washer into cover recess so that washer OD contacts cover and concave surface of washer is towards cover recess.

(b) Insert plug into cover and washer from washer side.

(c) Install cotter pin into hole in plug, with cotter pin head seated firmly on flat side of plug. Bend cotter pin prongs so that head and prongs are firmly seated against plug.

(d) Install new gasket, split facing inward, into borescope boss on turbine case.

(9) Secure plug stop to AP-10 boss.

(a) Thoroughly clean bolt threads and AP-10 boss threads with Petroleum Solvent P11-027 to remove carbon deposits and any deposits of the before
R you apply Anti-Seize Paste P06-054. Remove the
R unwanted paste.

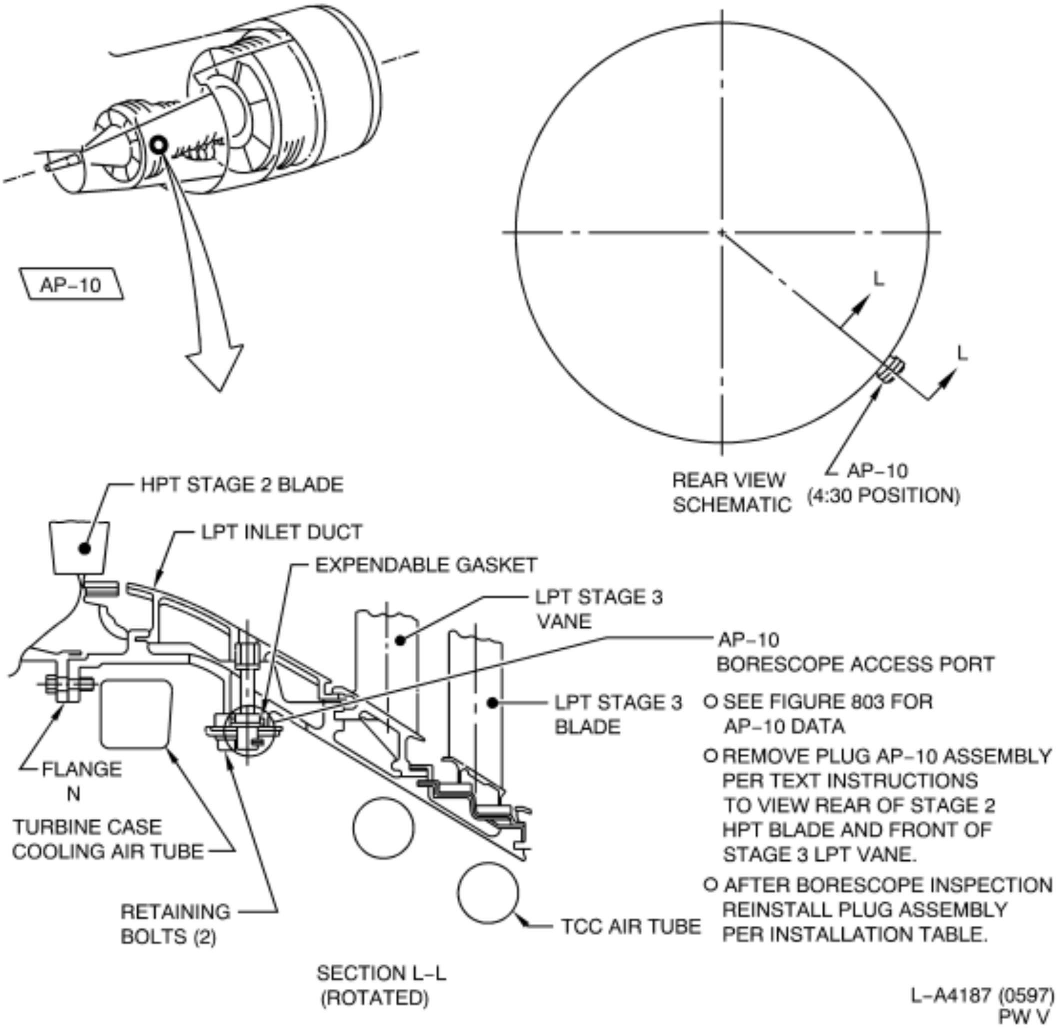
(b) Treat threads of two bolts with Silver Goop P06-023. Remove excess compound.

(c) Secure plug to AP-10 borescope boss on case with two bolts (above). Torque and lockwire bolts per Table 801.

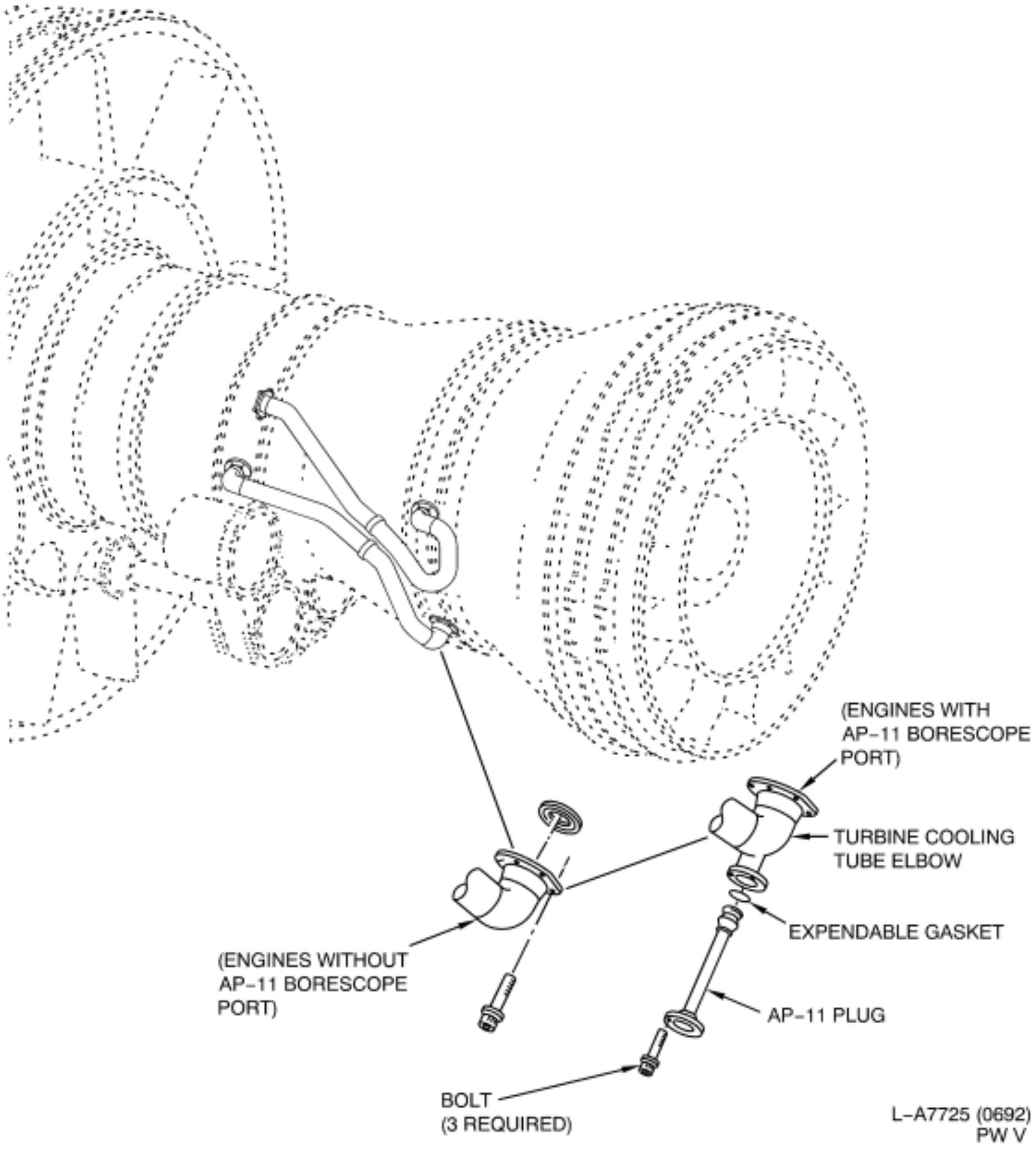
(10) For engines equipped, install AP-11 plug and a new gasket per the requirements of Table 801.

AP Number And Location	Gasket Required	Bolt(2) Locking Method	Bolt(2) Replacement Lubricant	Bolt(2) Torque lb-in. (N.m)
AP-10 Stage 2 HPT Blades	Yes PN ST1146-08	Lockwire (MS9226-04)	P06-023 Silver Goop	54 - 60 (6.101 - 6.779)
AP-11 Lower TCA Tube	Yes PN ST1142-011 (Gasket)	Self Locking	P03-001 Engine Oil	75 - 85 (8.474 - 9.604)

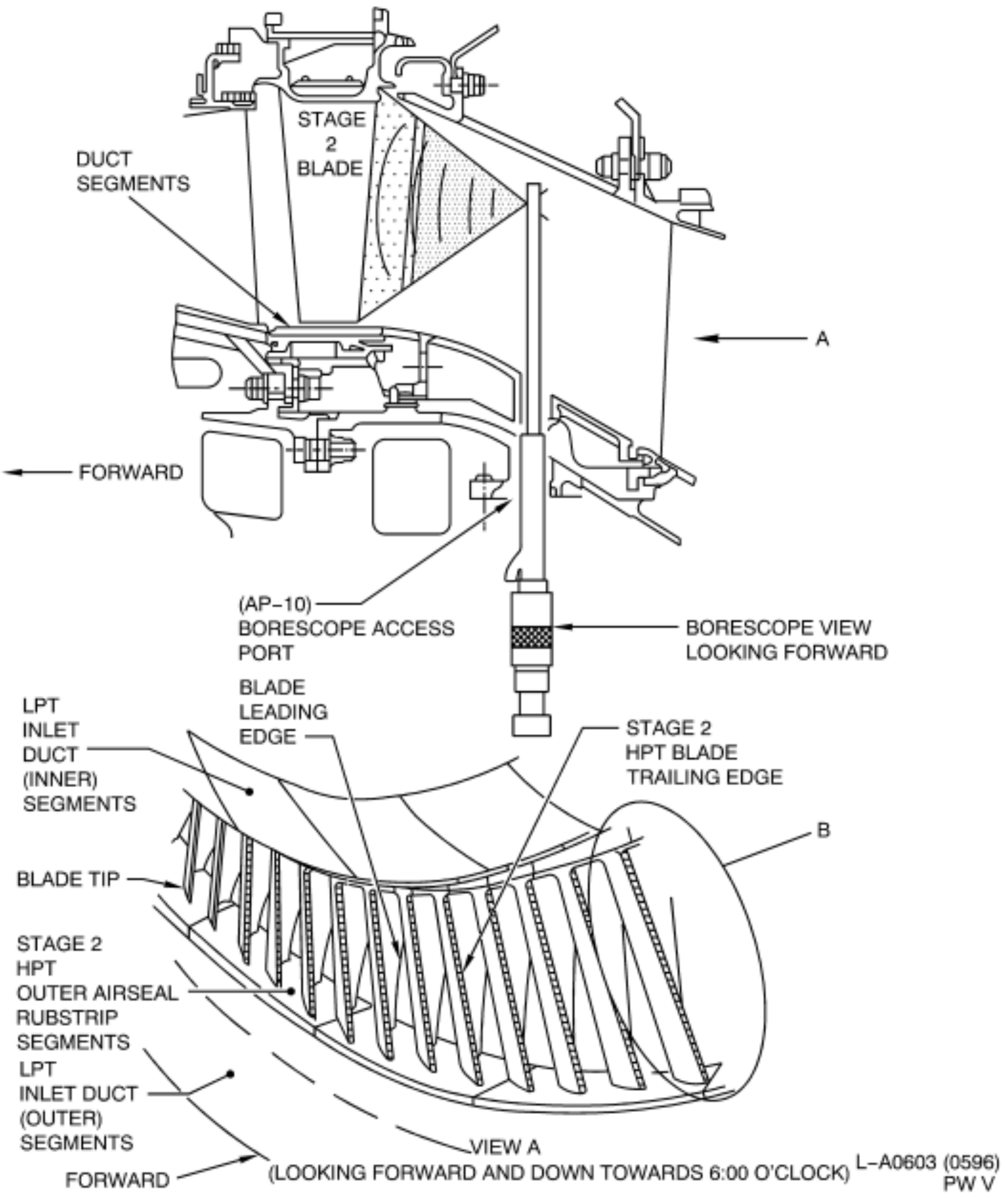
AP-10 Borescope Plug Installation Data -
Table 801


AP-10
REAR VIEW SCHEMATIC
L
L
AP-10 (4:30 POSITION)
HPT STAGE 2 BLADE
LPT INLET DUCT
EXPENDABLE GASKET
LPT STAGE 3 VANE
AP-10 BORESCOPE ACCESS PORT
LPT STAGE 3 BLADE
O SEE FIGURE 803 FOR AP-10 DATA
O REMOVE PLUG AP-10 ASSEMBLY PER TEXT INSTRUCTIONS TO VIEW REAR OF STAGE 2 HPT BLADE AND FRONT OF STAGE 3 LPT VANE.
O AFTER BORESCOPE INSPECTION REINSTALL PLUG ASSEMBLY PER INSTALLATION TABLE.
FLANGE N
TURBINE CASE COOLING AIR TUBE
RETAINING BOLTS (2)
TCC AIR TUBE
SECTION L-L (ROTATED)
L-A4187 (0597)
PW V

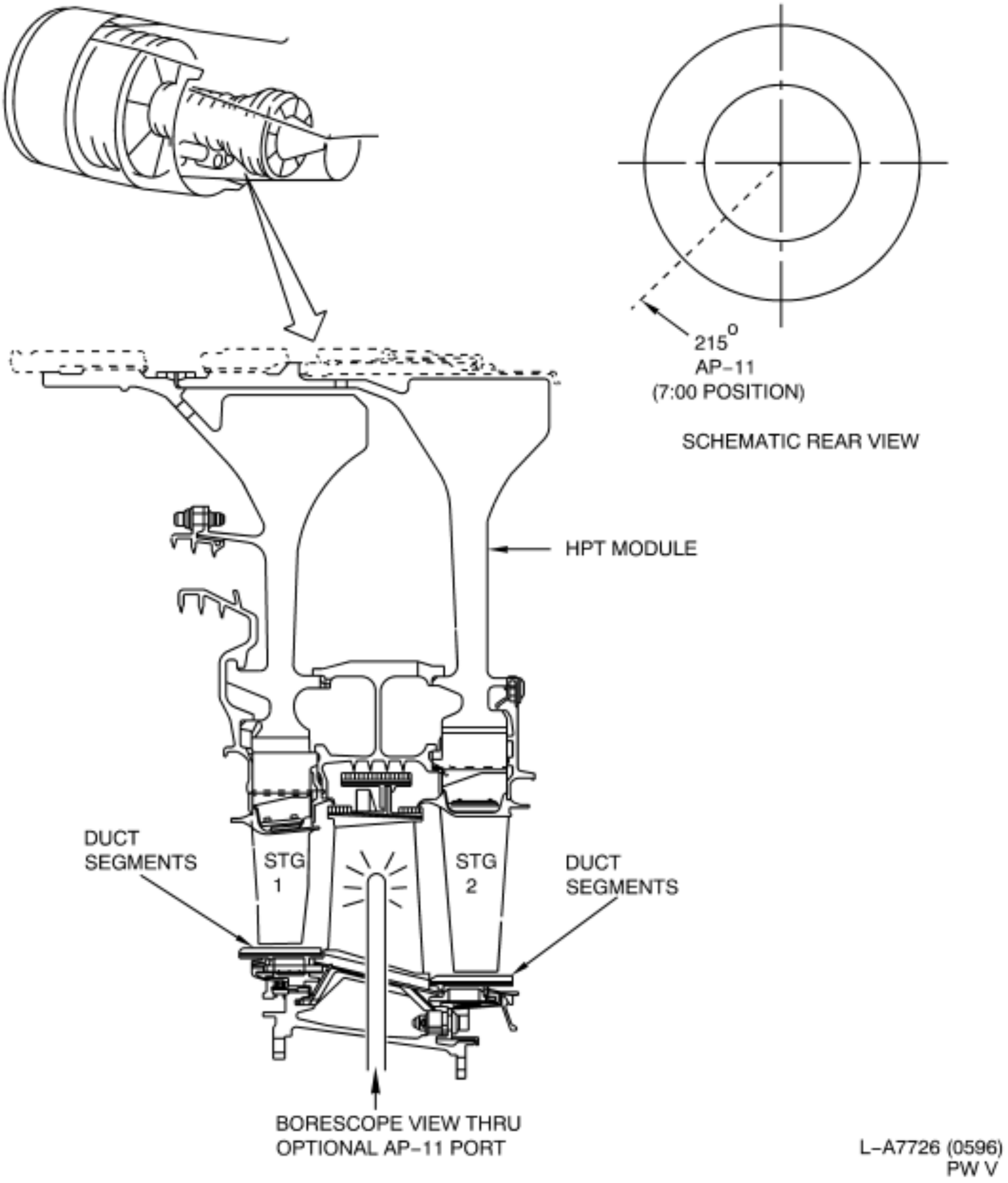
Stage 2 HPT Blade Borescope Access Port (AP-10) Location
Figure 801 (Sheet 1)
(Task 72-00-00-210-006)


(ENGINES WITH AP−11 BORESCOPE PORT)
TURBINE COOLING TUBE ELBOW
EXPENDABLE GASKET
(ENGINES WITHOUT AP−11 BORESCOPE PORT)
AP−11 PLUG
BOLT (3 REQUIRED)
L−A7725 (0692)
PW V

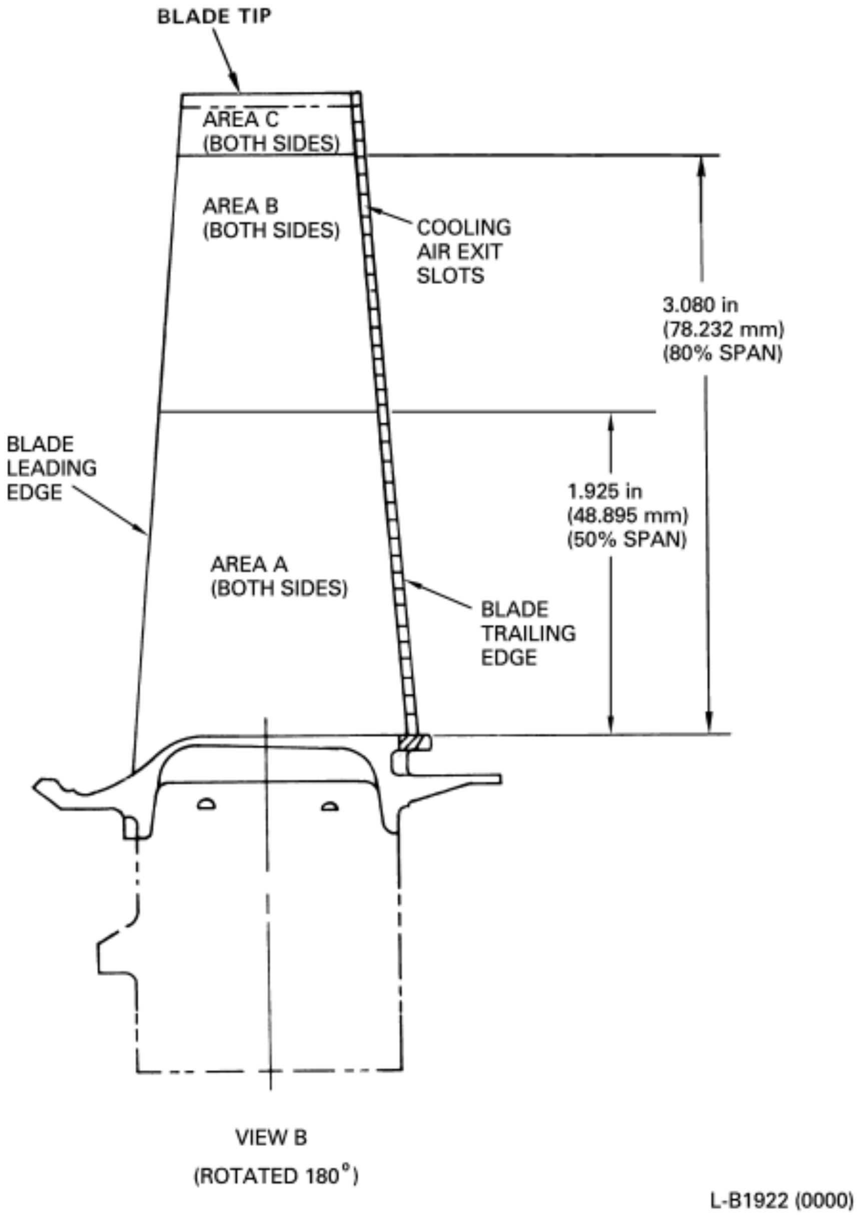
Stage 2 HPT Blade Borescope Access Port (AP−11) Location
Figure 801 (Sheet 2)
(Task 72−00−00−210−006)


STAGE 2 BLADE
DUCT SEGMENTS
A
FORWARD
(AP−10) BORESCOPE ACCESS PORT
BORESCOPE VIEW LOOKING FORWARD
LPT INLET DUCT (INNER) SEGMENTS
BLADE LEADING EDGE
STAGE 2 HPT BLADE TRAILING EDGE
B
BLADE TIP
STAGE 2 HPT OUTER AIRSEAL RUBSTRIP SEGMENTS
LPT INLET DUCT (OUTER) SEGMENTS
FORWARD
VIEW A
(LOOKING FORWARD AND DOWN TOWARDS 6:00 O'CLOCK)
L−A0603 (0596)
PW V

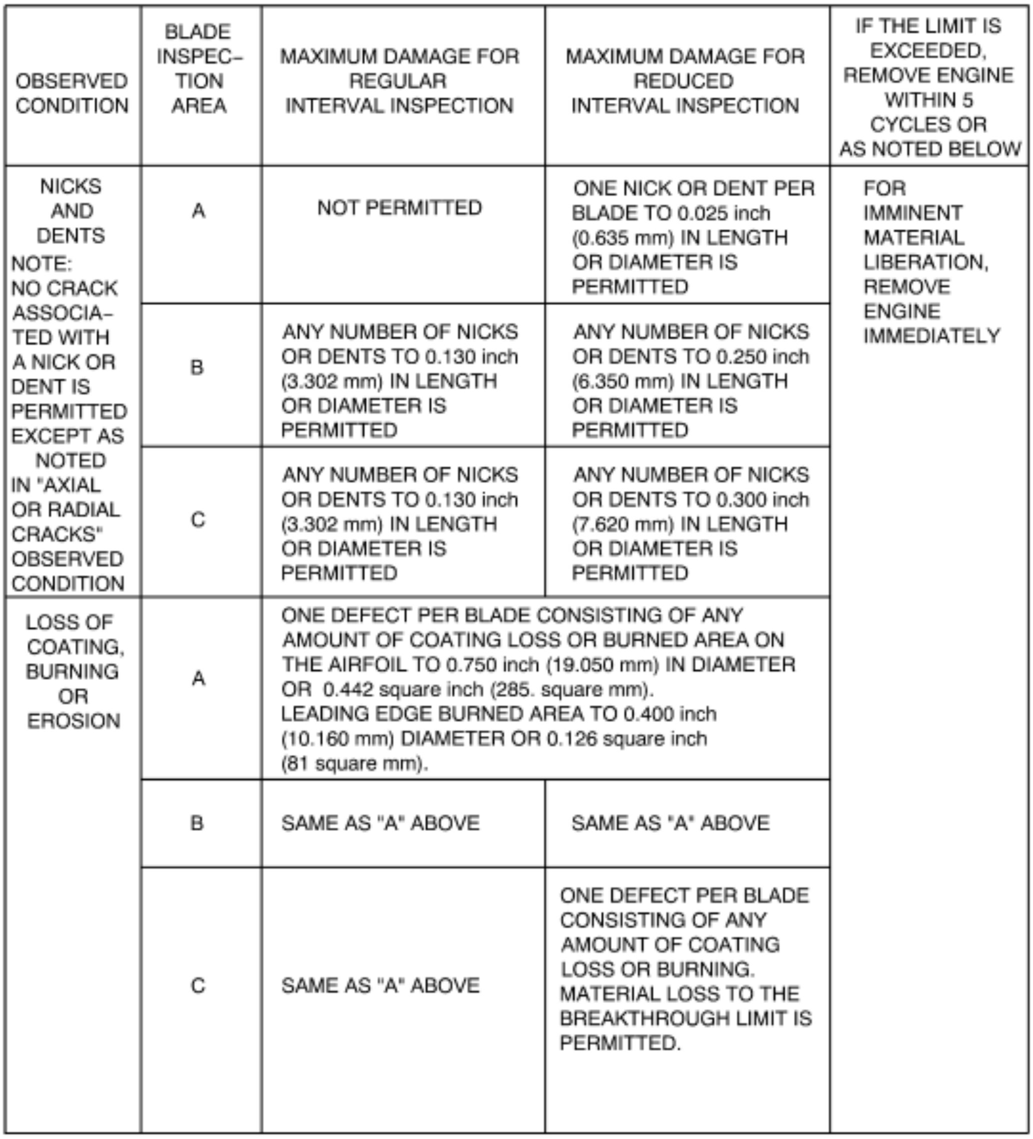
Borescope Viewing Of Stage 2 HPT Blades (AP−10)
Figure 802 (Sheet 1)
(Task 72−00−00−210−006)


215°
AP−11
(7:00 POSITION)
SCHEMATIC REAR VIEW
HPT MODULE
DUCT SEGMENTS
STG 1
STG 2
DUCT SEGMENTS
BORESCOPE VIEW THRU OPTIONAL AP−11 PORT
L−A7726 (0596)
PW V

Borescope Viewing Of Stage 2 HPT Blades (AP−11)
Figure 802 (Sheet 2)
(Task 72−00−00−210−006)


BLADE TIP
AREA C
(BOTH SIDES)
AREA B
(BOTH SIDES)
COOLING
AIR EXIT
SLOTS
3.080 in
(78.232 mm)
(80% SPAN)
BLADE
LEADING
EDGE
1.925 in
(48.895 mm)
(50% SPAN)
AREA A
(BOTH SIDES)
BLADE
TRAILING
EDGE
VIEW B
(ROTATED 180°)
L-B1922 (0000)

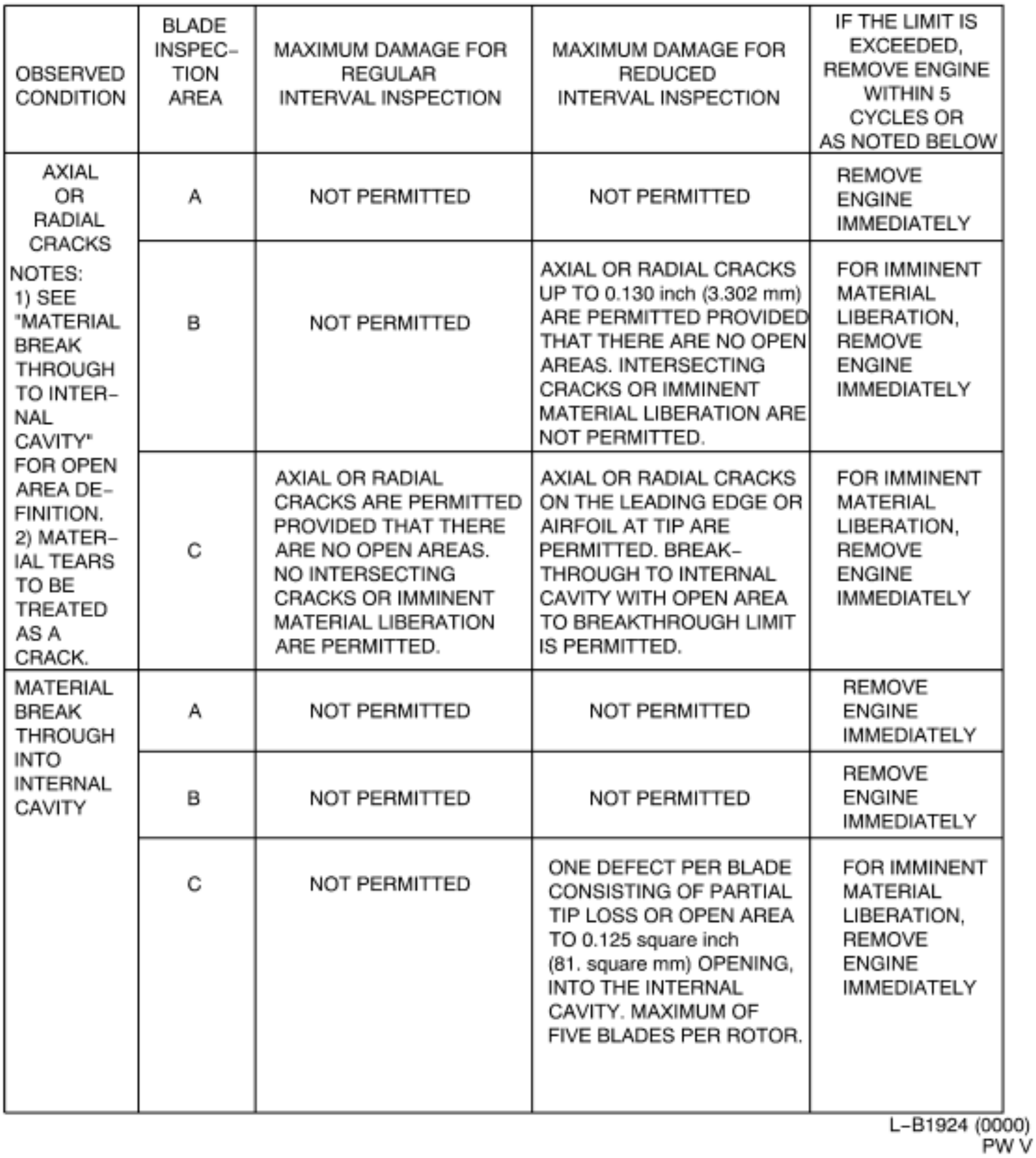
Stage 2 HPT Blade Inspection Areas
Figure 802 (Sheet 3)
(Task 72−00−00−210−006)



OBSERVED CONDITION	BLADE INSPEC-TION AREA	MAXIMUM DAMAGE FOR REGULAR INTERVAL INSPECTION	MAXIMUM DAMAGE FOR REDUCED INTERVAL INSPECTION	IF THE LIMIT IS EXCEEDED, REMOVE ENGINE WITHIN 5 CYCLES OR AS NOTED BELOW
NICKS AND DENTS NOTE: NO CRACK ASSOCIATED WITH A NICK OR DENT IS PERMITTED EXCEPT AS NOTED IN "AXIAL OR RADIAL CRACKS" OBSERVED CONDITION	A	NOT PERMITTED	ONE NICK OR DENT PER BLADE TO 0.025 inch (0.635 mm) IN LENGTH OR DIAMETER IS PERMITTED	FOR IMMINENT MATERIAL LIBERATION, REMOVE ENGINE IMMEDIATELY
	B	ANY NUMBER OF NICKS OR DENTS TO 0.130 inch (3.302 mm) IN LENGTH OR DIAMETER IS PERMITTED	ANY NUMBER OF NICKS OR DENTS TO 0.250 inch (6.350 mm) IN LENGTH OR DIAMETER IS PERMITTED	
	C	ANY NUMBER OF NICKS OR DENTS TO 0.130 inch (3.302 mm) IN LENGTH OR DIAMETER IS PERMITTED	ANY NUMBER OF NICKS OR DENTS TO 0.300 inch (7.620 mm) IN LENGTH OR DIAMETER IS PERMITTED	
LOSS OF COATING, BURNING OR EROSION	A	ONE DEFECT PER BLADE CONSISTING OF ANY AMOUNT OF COATING LOSS OR BURNED AREA ON THE AIRFOIL TO 0.750 inch (19.050 mm) IN DIAMETER OR 0.442 square inch (285. square mm). LEADING EDGE BURNED AREA TO 0.400 inch (10.160 mm) DIAMETER OR 0.126 square inch (81 square mm).		
	B	SAME AS "A" ABOVE	SAME AS "A" ABOVE	
	C	SAME AS "A" ABOVE	ONE DEFECT PER BLADE CONSISTING OF ANY AMOUNT OF COATING LOSS OR BURNING. MATERIAL LOSS TO THE BREAKTHROUGH LIMIT IS PERMITTED.	

L-B1923 (0000)
PW V

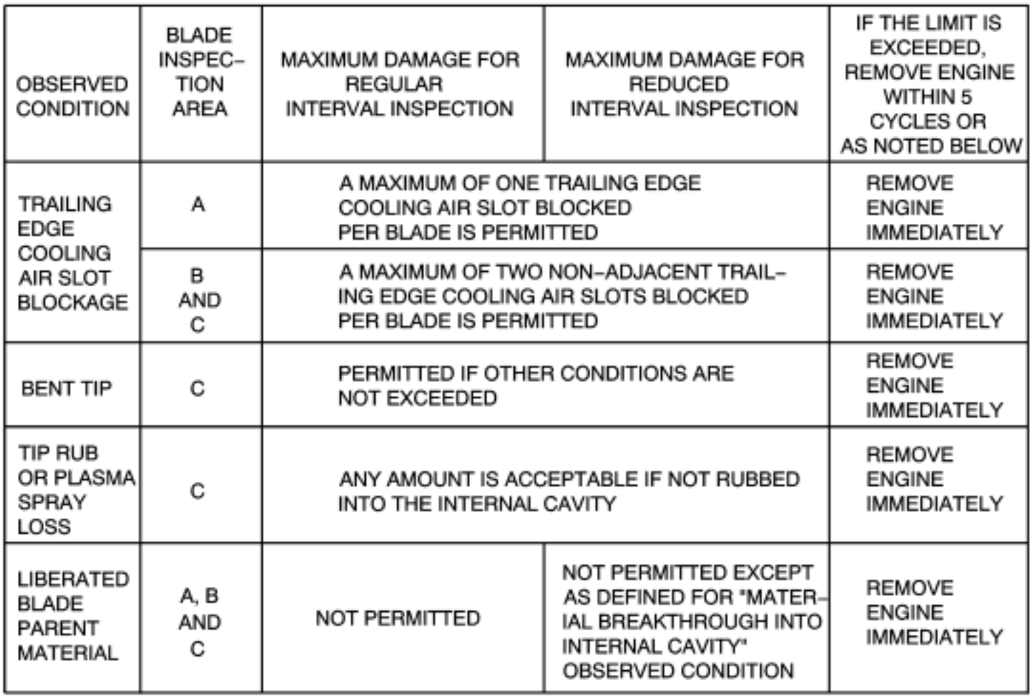
Stage 2 HPT Blade Borescope Inspection Limits
Figure 803 (Sheet 1)
(Task 72-00-00-210-006)



OBSERVED CONDITION	BLADE INSPEC-TION AREA	MAXIMUM DAMAGE FOR REGULAR INTERVAL INSPECTION	MAXIMUM DAMAGE FOR REDUCED INTERVAL INSPECTION	IF THE LIMIT IS EXCEEDED, REMOVE ENGINE WITHIN 5 CYCLES OR AS NOTED BELOW
AXIAL OR RADIAL CRACKS NOTES: 1) SEE "MATERIAL BREAK THROUGH TO INTERNAL CAVITY" FOR OPEN AREA DEFINITION. 2) MATERIAL TEARS TO BE TREATED AS A CRACK.	A	NOT PERMITTED	NOT PERMITTED	REMOVE ENGINE IMMEDIATELY
	B	NOT PERMITTED	AXIAL OR RADIAL CRACKS UP TO 0.130 inch (3.302 mm) ARE PERMITTED PROVIDED THAT THERE ARE NO OPEN AREAS. INTERSECTING CRACKS OR IMMINENT MATERIAL LIBERATION ARE NOT PERMITTED.	FOR IMMINENT MATERIAL LIBERATION, REMOVE ENGINE IMMEDIATELY
	C	AXIAL OR RADIAL CRACKS ARE PERMITTED PROVIDED THAT THERE ARE NO OPEN AREAS. NO INTERSECTING CRACKS OR IMMINENT MATERIAL LIBERATION ARE PERMITTED.	AXIAL OR RADIAL CRACKS ON THE LEADING EDGE OR AIRFOIL AT TIP ARE PERMITTED. BREAK-THROUGH TO INTERNAL CAVITY WITH OPEN AREA TO BREAKTHROUGH LIMIT IS PERMITTED.	FOR IMMINENT MATERIAL LIBERATION, REMOVE ENGINE IMMEDIATELY
MATERIAL BREAK THROUGH INTO INTERNAL CAVITY	A	NOT PERMITTED	NOT PERMITTED	REMOVE ENGINE IMMEDIATELY
	B	NOT PERMITTED	NOT PERMITTED	REMOVE ENGINE IMMEDIATELY
	C	NOT PERMITTED	ONE DEFECT PER BLADE CONSISTING OF PARTIAL TIP LOSS OR OPEN AREA TO 0.125 square inch (81. square mm) OPENING, INTO THE INTERNAL CAVITY. MAXIMUM OF FIVE BLADES PER ROTOR.	FOR IMMINENT MATERIAL LIBERATION, REMOVE ENGINE IMMEDIATELY

L-B1924 (0000)
PW V

Stage 2 HPT Blade Borescope Inspection Limits
Figure 803 (Sheet 2)
(Task 72-00-00-210-006)



OBSERVED CONDITION	BLADE INSPECTION AREA	MAXIMUM DAMAGE FOR REGULAR INTERVAL INSPECTION	MAXIMUM DAMAGE FOR REDUCED INTERVAL INSPECTION	IF THE LIMIT IS EXCEEDED, REMOVE ENGINE WITHIN 5 CYCLES OR AS NOTED BELOW
TRAILING EDGE COOLING AIR SLOT BLOCKAGE	A	A MAXIMUM OF ONE TRAILING EDGE COOLING AIR SLOT BLOCKED PER BLADE IS PERMITTED		REMOVE ENGINE IMMEDIATELY
	B AND C	A MAXIMUM OF TWO NON−ADJACENT TRAILING EDGE COOLING AIR SLOTS BLOCKED PER BLADE IS PERMITTED		REMOVE ENGINE IMMEDIATELY
BENT TIP	C	PERMITTED IF OTHER CONDITIONS ARE NOT EXCEEDED		REMOVE ENGINE IMMEDIATELY
TIP RUB OR PLASMA SPRAY LOSS	C	ANY AMOUNT IS ACCEPTABLE IF NOT RUBBED INTO THE INTERNAL CAVITY		REMOVE ENGINE IMMEDIATELY
LIBERATED BLADE PARENT MATERIAL	A, B AND C	NOT PERMITTED	NOT PERMITTED EXCEPT AS DEFINED FOR "MATERIAL BREAKTHROUGH INTO INTERNAL CAVITY" OBSERVED CONDITION	REMOVE ENGINE IMMEDIATELY

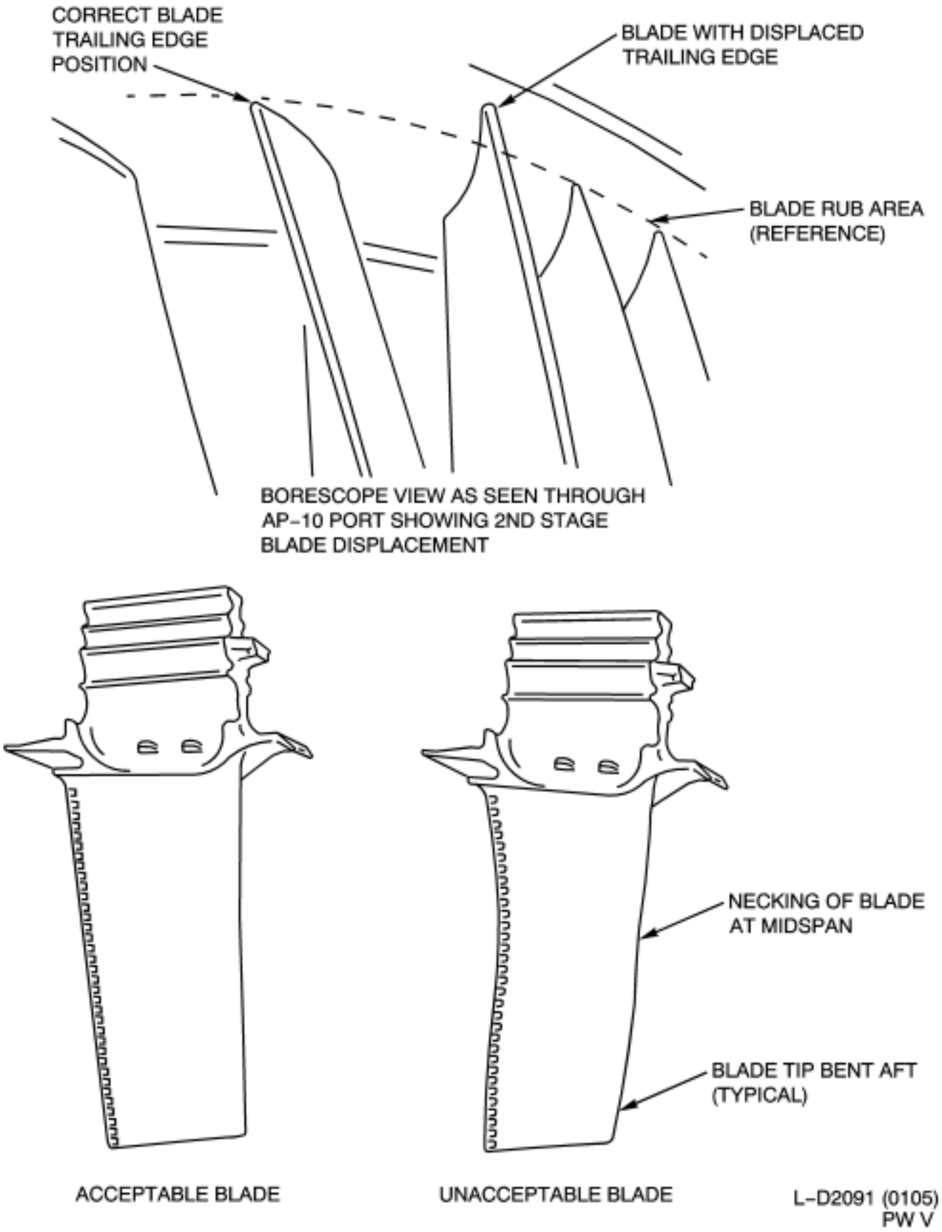
L−B1925 (0105)
PW V

Stage 2 HPT Blade Borescope Inspection Limits
Figure 803 (Sheet 3)
(Task 72−00−00−210−006)

OBSERVED CONDITION	BLADE INSPEC- TION AREA	MAXIMUM DAMAGE FOR REGULAR INTERVAL INSPECTION	MAXIMUM DAMAGE FOR REDUCED INTERVAL INSPECTION	IF THE LIMIT IS EXCEEDED, REMOVE ENGINE WITHIN 5 CYCLES OR AS NOTED BELOW
AIRFOIL GROWTH (AS EVID- ENCED BY: BENT OR DISPLACED 2ND STAGE BLADE(S) RELATIVE TO ADJACENT BLADES IN ROTOR	A, B AND C	NOT PERMITTED SEE FIGURE 804	NOT PERMITTED SEE FIGURE 804	REMOVE ENGINE IMMEDIATELY
ABNORMAL/ EXCESSIVE TIP RUB				
WAVY/ DEFORMED TRAILING EDGE				
NECKING/ THINNING OF AIRFOIL PROFILE AT MIDSPAN REGION				
CRACKS IN THE MID- SPAN TRAILING EDGE COOLING HOLE OPENINGS				

L-D2090 (0105)
PW V

Stage 2 HPT Blade Borescope Inspection Limits
Figure 803 (Sheet 4)
(Task 72-00-00-210-006)


CORRECT BLADE TRAILING EDGE POSITION
BLADE WITH DISPLACED TRAILING EDGE
BLADE RUB AREA (REFERENCE)
BORESCOPE VIEW AS SEEN THROUGH AP-10 PORT SHOWING 2ND STAGE BLADE DISPLACEMENT
NECKING OF BLADE AT MIDSPAN
BLADE TIP BENT AFT (TYPICAL)
ACCEPTABLE BLADE
UNACCEPTABLE BLADE
L-D2091 (0105)
PW V

Borescope View Showing A Typical Displaced
Stage 2 Blade Caused By Airfoil Growth
Figure 804
(Task 72-00-00-210-006)

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Task 72-00-00-210-007:

1. Perform Borescope Inspection Of Stage 3 LPT Vanes (AP-10)

A. Equipment And Materials Required

Standard Tools:

See Inspection/Check-01A for borescope equipment.

Special Tools:

PWA 86081	Puller, AP-10 Borescope Plug Assembly

Consumable Materials:

Item No.	Designation
P06-023	Silver Goop (PWA 36001)
P11-027	Petroleum Solvent (PMC 9001)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72-53-00/3/120
Lockwire	1	72-53-00/3/160

B. Procedure

See Figures 801, 802 and 803.

(1) Remove lockwire, and two bolts from borescope access port AP-10 located on LPT case at 4:30 o'clock position. Using PWA 86081 Puller, remove (as an assembly), the boss plug, plug stop (cover), spring washer, and cotter pin. Discard gasket on boss plug.

CAUTION: TEMPERATURES IN AREAS TO BE BORESCOPED SHOULD BE PERMITTED TO COOL TO BELOW 150°F (65.6°C) FOLLOWING ENGINE OPERATION. DAMAGE MAY RESULT TO BORESCOPE EQUIPMENT IF EQUIPMENT IS EXPOSED TO GASPATH OR METAL TEMPERATURES IN EXCESS OF 150°F (65.6°C). AS A GUIDE - IF ADJACENT CASES ARE TOO HOT TO TOUCH COMFORTABLY, INSPECTION SHOULD BE DELAYED.

(2) Insert borescope through port and inspect Stage 3 vanes for nicks, dents, cracks and other damage caused by passage of foreign material. See Figure 802 for inspection limits.

(a) If there has been a sudden increase in EGT, check for a possible missing or liberated LPT 3rd stage outer transition duct segment. No missing or liberated outer transition duct segments are permitted.

NOTE: Maximum borescope insertion depth and borescope limiting access hole diameter specifications for AP−10 are provided in Table 801, 72−00−00 Inspection/Check−01A Task 72−00−00−990−010.

(3) After borescope inspection, install as an assembly, the AP−10 plug, spring tension washer, plug stop, cotter pin and a new gasket. Install gasket into boss with split facing inward. See Table 801 and Figure 803 before installing this assembly.

NOTE: If plug, washer and plug stop (cover) have been disassembled, reassemble per step (4) procedure.

AP Number And Location	Gasket Required	Bolt(2) Locking Method	Bolt(2) Replacement Lubricant	Bolt(2) Torque lb−in. (N.m)
AP−10 Stage 3 LPT Vanes	Yes PN ST1146−08	Lockwire (MS9226−04)	P06−023 Silver Goop	54 − 60 (6.101 − 6.779)

AP−10 Borescope Plug Installation Data − Table 801

(4) If required, assemble borescope plug, spring tension washer, plug stop (cover) and cotter pin.

NOTE: When plug, spring tension washer and cover are properly assembled and installed to turbine case, plug should be loaded inward, by spring washer, to seat in case boss.

(a) Place washer into cover recess so that washer OD contacts cover, and concave surface of washer is towards cover recess.

(b) Insert plug into cover and washer from washer side.

(c) Install cotter pin into hole in plug, with cotter pin head seated firmly on flat side of plug. Bend cotter pin prongs so that head and prongs are firmly seated against plug.

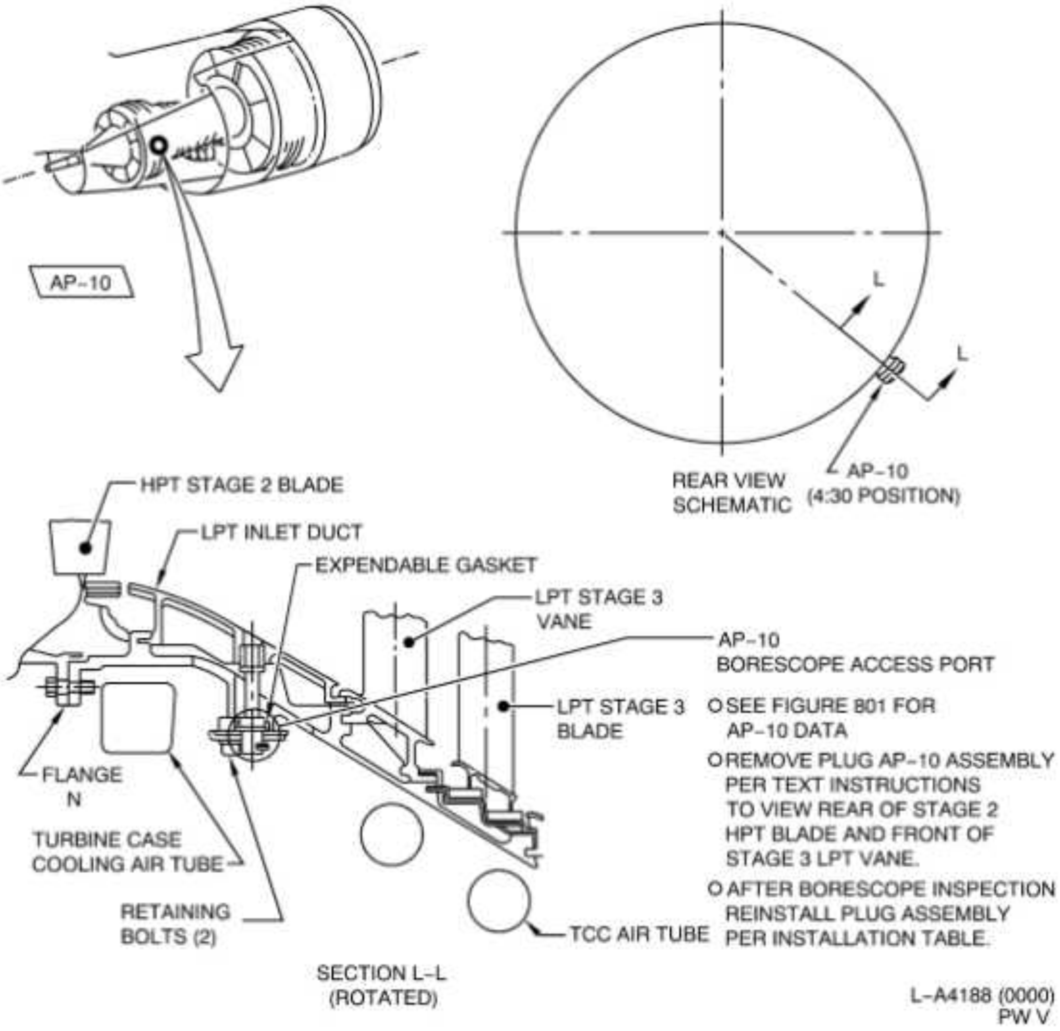
(d) Install new gasket, split facing inward, into borescope boss on turbine case.

(5) Install plug stop to boss and torque bolts.

(a) Thoroughly clean bolt threads and AP−10 boss threads with Petroleum Solvent P11−027 to remove carbon deposits and any deposits of previously applied antigalling compound.

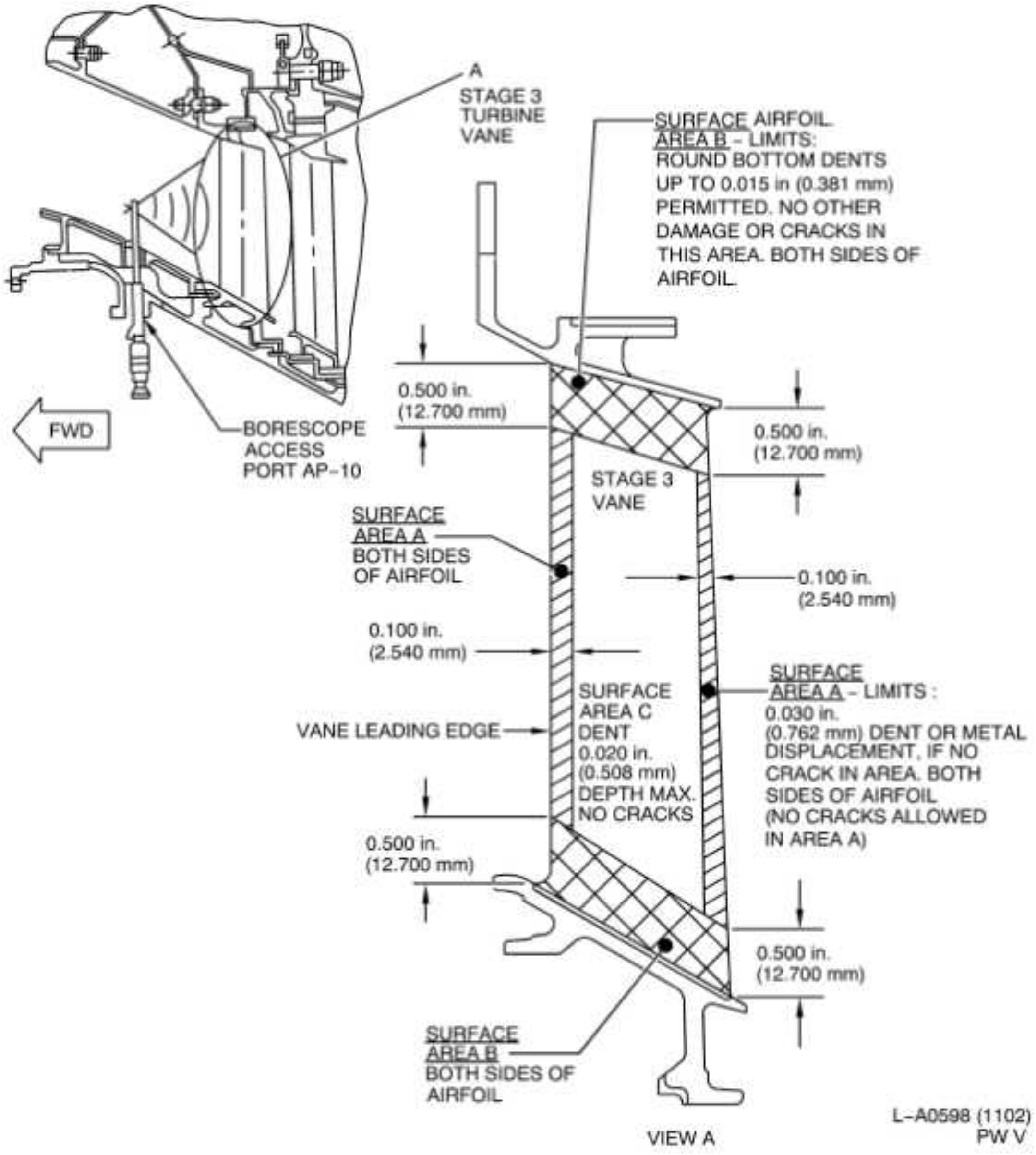
(b) Treat threads of two bolts with Silver Goop P06−023. Remove excess compound.

(c) Secure plug to AP−10 borescope boss on case with two bolts (above). Torque and lockwire bolts per Table 801.

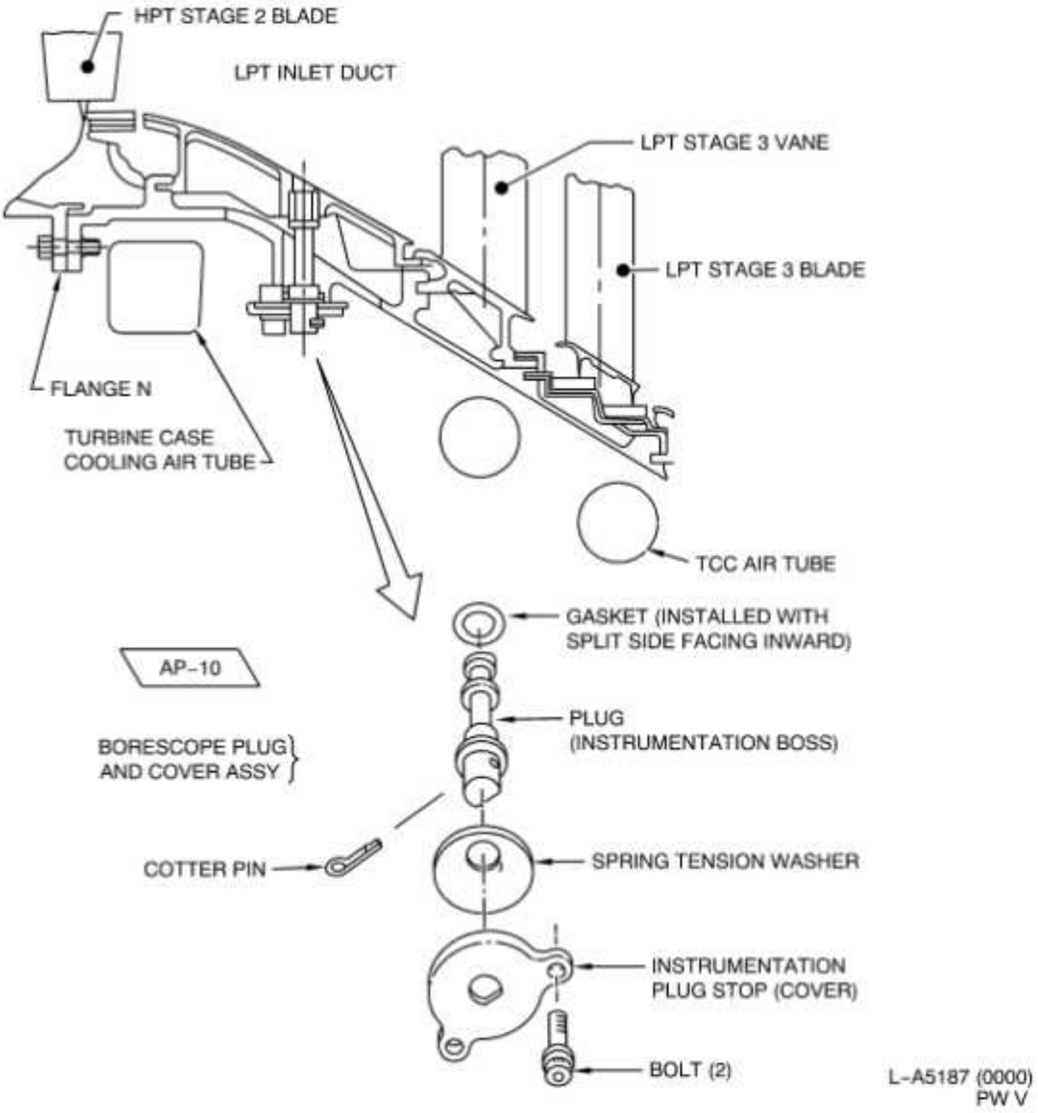

AP−10
L
L
REAR VIEW
SCHEMATIC
AP−10
(4:30 POSITION)
HPT STAGE 2 BLADE
LPT INLET DUCT
EXPENDABLE GASKET
LPT STAGE 3
VANE
AP−10
BORESCOPE ACCESS PORT
LPT STAGE 3
BLADE
FLANGE
N
TURBINE CASE
COOLING AIR TUBE
RETAINING
BOLTS (2)
TCC AIR TUBE
SECTION L−L
(ROTATED)
L−A4188 (0000)
PW V

- SEE FIGURE 801 FOR AP−10 DATA
- REMOVE PLUG AP−10 ASSEMBLY PER TEXT INSTRUCTIONS TO VIEW REAR OF STAGE 2 HPT BLADE AND FRONT OF STAGE 3 LPT VANE.
- AFTER BORESCOPE INSPECTION REINSTALL PLUG ASSEMBLY PER INSTALLATION TABLE.

Stage 3 LPT Vane/Blade Borescope Access Port (AP−10) Location
Figure 801
(Task 72−00−00−210−007)


A
STAGE 3 TURBINE VANE
FWD
BORESCOPE ACCESS PORT AP-10
SURFACE AIRFOIL AREA B - LIMITS: ROUND BOTTOM DENTS UP TO 0.015 in (0.381 mm) PERMITTED. NO OTHER DAMAGE OR CRACKS IN THIS AREA. BOTH SIDES OF AIRFOIL.
0.500 in. (12.700 mm)
0.500 in. (12.700 mm)
STAGE 3 VANE
SURFACE AREA A BOTH SIDES OF AIRFOIL
0.100 in. (2.540 mm)
0.100 in. (2.540 mm)
SURFACE AREA A - LIMITS : 0.030 in. (0.762 mm) DENT OR METAL DISPLACEMENT, IF NO CRACK IN AREA. BOTH SIDES OF AIRFOIL (NO CRACKS ALLOWED IN AREA A)
VANE LEADING EDGE
SURFACE AREA C DENT 0.020 in. (0.508 mm) DEPTH MAX. NO CRACKS
0.500 in. (12.700 mm)
0.500 in. (12.700 mm)
SURFACE AREA B BOTH SIDES OF AIRFOIL
VIEW A
L-A0598 (1102)
PW V

Stage 3 LPT Vane AP−10 Borescope Viewing/Vane Inspection Areas
Figure 802
(Task 72−00−00−210−007)


HPT STAGE 2 BLADE
LPT INLET DUCT
LPT STAGE 3 VANE
LPT STAGE 3 BLADE
FLANGE N
TURBINE CASE COOLING AIR TUBE
TCC AIR TUBE
GASKET (INSTALLED WITH SPLIT SIDE FACING INWARD)
AP−10
PLUG (INSTRUMENTATION BOSS)
BORESCOPE PLUG AND COVER ASSY
COTTER PIN
SPRING TENSION WASHER
INSTRUMENTATION PLUG STOP (COVER)
BOLT (2)
L−A5187 (0000)
PW V

AP−10 Borescope Port Plug And Cover Assembly
Figure 803
(Task 72−00−00−210−007)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-00-210-025:

1. Perform Borescope Inspection Of Stage 3 LPT Blades (AP-10)

A. Equipment And Materials Required

Standard Tools:
See Inspection/Check-01A for borescope equipment.

Special Tools:

PWA 86081	Puller, AP-10 Borescope Plug Assembly

Consumable Materials:

Item No.	Designation
P06-023	Silver Goop (PWA 36001)
P11-027	Petroleum Solvent (PMC 9001)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72-53-00/3/120
Lockwire	1	72-53-00/3/160

B. Stage 3 LPT Blade Borescope Inspection Limits

See Figure 801 and Table 801.

CAUTION: IF DAMAGE IS FOUND THAT EXCEEDS THE REMOVE ENGINE WITHIN 5 CYCLES LIMITS, THE ENGINE IS NOT SERVICEABLE AND IT MUST BE REMOVED IMMEDIATELY.

CAUTION: THE FOLLOWING LIMITS ARE APPLICABLE ON A CONTINUE-IN-SERVICE BASIS ONLY. THE LIMITS ARE BASED ON PART STRUCTURAL REQUIREMENTS AND DOES NOT IMPLY THAT ENGINE PERFORMANCE, STABILITY, OPERATING LIMITS, OR PART REPAIRABILITY WILL BE MAINTAINED.

INSPECT	SERVICEABLE LIMITS	REMOVE ENGINE WITHIN 5 CYCLES LIMITS
INSPECT BLADE AREA A FOR: (See Figure 801)		
Cracks, Tears	None	None

Stage 3 LPT Blade Borescope Inspection Limits
Table 801

INSPECT	SERVICEABLE LIMITS	REMOVE ENGINE WITHIN 5 CYCLES LIMITS
Nicks	Any quantity to 0.015 inch (0.381 mm) maximum depth.	Any quantity to 0.050 inch (1.270 mm) maximum depth.
Dents (Round Bottomed)	Any quantity to 0.020 inch (0.508 mm) maximum depth or 0.125 inch (3.175 mm) diameter metal displacement.	Any quantity to 0.050 inch (1.270 mm) maximum depth.
Loss Of Coating	Any quantity	Any quantity
Burning And Erosion	Any quantity to 0.020 inch (0.508 mm) depth and 0.300 inch (7.620 mm) diameter maximum.	Any exceedance of serviceable limit.
Sulfidation	None	A single area on each blade to 0.200 square inch (5.080 mm²). There can not be any associated material loss. Five blades maximum on each rotor stage can have sulfidation to the above limits.
Blade Growth	None	None

NOTE: Blade growth is shown as necking down or thinning of the blade airfoil.

INSPECT AREA B FOR:
(See Figure 801)

Cracks, Tears	None	None

Stage 3 LPT Blade Borescope Inspection Limits
Table 801 (Continued)

INSPECT	SERVICEABLE LIMITS	REMOVE ENGINE WITHIN 5 CYCLES LIMITS
Nicks	None	Any quantity to 0.030 inch (0.762 mm) maximum depth.
Dents (Round Bottom)	Any quantity to 0.010 inch (0.254 mm) maximum depth or 0.125 inch (3.175 mm) diameter metal displacement.	Any quantity to 0.030 inch (0.762 mm) maximum depth.
Loss Of Coating	Any quantity	Any quantity
Burning And Erosion	Any quantity to 0.010 inch (0.254 mm) depth and 0.300 inch (7.620 mm) diameter maximum.	Any exceedance of serviceable limit.
Sulfidation	None	A single area on each blade to 0.200 square inch (5.080 mm² There can not be any associated material loss. Five blades maximum on each rotor stage can have sulfidation to the above limits.
INSPECT AREA C FOR: (See Figure 801)		
Cracks, Tears	None	None
Nicks	Any quantity to 0.015 inch (0.381 mm) maximum depth.	Any quantity to 0.050 inch (1.270 mm) maximum depth.

Stage 3 LPT Blade Borescope Inspection Limits
Table 801 (Continued)

INSPECT	SERVICEABLE LIMITS	REMOVE ENGINE WITHIN 5 CYCLES LIMITS
Dents (Round Bottomed)	Any quantity to 0.020 inch (0.508 mm) maximum depth or 0.125 inch (3.175 mm) diameter metal displacement.	Any quantity to 0.050 inch (1.270 mm) maximum depth.
Loss Of Coating	Any quantity	Any quantity
Burning And Erosion	Any quantity to 0.020 inch (0.508 mm) depth and 0.300 inch (7.620 mm) diameter maximum.	Any exceedance of serviceable limit.
Sulfidation	None	A single area on each blade to 0.200 square inch (5.080 mm^2). There can not be any associated crack or material loss. Five blades maximum on each rotor can have sulfidation to the above limits.
INSPECT AREA D FOR: (See Figure 801)		
Cracks, Tears	None	A tight radial crack or tear to 0.100 inch (2.540 mm) maximum length.
Nicks	Any quantity to 0.015 inch (0.381 mm) maximum depth.	Any quantity to 0.050 inch (1.270 mm) maximum depth.

Stage 3 LPT Blade Borescope Inspection Limits
Table 801 (Continued)

INSPECT	SERVICEABLE LIMITS	REMOVE ENGINE WITHIN 5 CYCLES LIMITS
Dents (Round Bottom)	Any quantity to 0.020 inch (0.508 mm) maximum depth 0.125 inch (3.175 mm) diameter metal displacement.	Any quantity to 0.050 inch (1.270 mm) maximum depth.
Loss Of Coating	Any quantity	Any quantity
Burning And Erosion	Any quantity to 0.020 inch (0.508 mm) depth and 0.300 inch (7.620 mm) diameter maximum.	Any exceedance of serviceable limit.
Sulfidation	None	A single area on each blade to 0.200 square inch (5.080 mm^2). There can not be any associated material loss. Five blades maximum on each rotor stage can have sulfidation to the above limits.

CAUTION: WHERE DAMAGE EXCEEDS THE SERVICEABLE LIMITS AND PART FAILURE OR MATERIAL LIBERATION IS IMMINENT, REMOVE ENGINE IMMEDIATELY.

INSPECT BLADE AREA E FOR:
(See Figure 801)

Cracks, tears	None	None
Nicks	Any quantity to 0.015 inch (0.381 mm) maximum depth.	Any quantity to 0.050 inch (1.270 mm) maximum depth.

Stage 3 LPT Blade Borescope Inspection Limits
Table 801 (Continued)

INSPECT	SERVICEABLE LIMITS	REMOVE ENGINE WITHIN 5 CYCLES LIMITS
Dents (round−bottomed, a scuffed surface texture is acceptable)	Any quantity less than 0.100 inch (2.54 mm) diameter to a 0.020 inch (0.508 mm) depth or a single dent 0.100 inch (2.54 mm) to 0.500 inch (12.7 mm) diameter to a 0.030 inch (0.762 mm) depth.	Any exceedance of serviceable limit.
Loss of coating	Any quantity	
Burning and erosion	Any quantity to 0.020 inch (0.508 mm) depth and 0.300 inch (7.620 mm) diameter maximum.	Any exceedance of serviceable limit.
Sulfication	None	A single area on each blade to 0.200 square inch (5.080 mm^2). There can not be any associated crack or material loss. Five blades maximum on each rotor can have sulfication to the above limits.

Stage 3 LPT Blade Borescope Inspection Limits
Table 801 (Continued)

C. Procedure

ENGINE GENERAL − INSPECTION/CHECK−01I

(1) Remove lockwire, and two bolts from borescope access port AP−10 located on LPT case at 4:30 o'clock position. Using PWA 86081 Puller, remove (as an assembly), the boss plug, plug stop (cover), spring washer, and cotter pin. Discard gasket on boss plug.

CAUTION: TEMPERATURES IN AREAS TO BE BORESCOPED SHOULD BE PERMITTED TO COOL TO BELOW 150°F (65.6°C) FOLLOWING ENGINE OPERATION. DAMAGE MAY RESULT TO BORESCOPE EQUIPMENT IF EQUIPMENT IS EXPOSED TO GASPATH OR METAL TEMPERATURES IN EXCESS OF 150°F (65.6°C). AS A GUIDE − IF ADJACENT CASES ARE TOO HOT TO TOUCH COMFORTABLY, INSPECTION SHOULD BE DELAYED.

(2) Insert borescope through port and inspect Stage 3 blades for nicks, dents, cracks and other damage caused by passage of foreign material. See Figure 801 and Table 801 for inspection limits.

(a) If there has been a sudden increase in EGT, check for a possible missing or liberated LPT 3rd stage outer transition duct segment. No missing or liberated outer transition duct segments are permitted.

NOTE: Maximum borescope insertion depth and borescope limiting access hole diameter specifications for AP−10 are provided in Table 801, 72−00−00 Inspection/Check−01A Task 72−00−00−990−010.

(3) After borescope inspection, install as an assembly, the AP−10 plug, spring tension washer, plug stop, cotter pin and a new gasket. Install gasket into boss with split facing inward. See Figure 803 and Table 801, 72−00−00 Inspection/Check−01H Task 72−00−00−210−007 before you install this assembly.

NOTE: If plug, washer and plug stop (cover) have been disassembled, reassemble per step (4) procedure.

(4) If required, assemble borescope plug, spring tension washer, plug stop (cover) and cotter pin.

NOTE: When plug, spring tension washer and cover are properly assembled and installed to turbine case, plug should be loaded inward, by spring washer, to seat in case boss.

(a) Place washer into cover recess so that washer OD contacts cover, and concave surface of washer is towards cover recess.

(b) Insert plug into cover and washer from washer side.

(c) Install cotter pin into hole in plug, with cotter pin head seated firmly on flat side of plug. Bend cotter pin prongs so that head and prongs are firmly seated against plug.

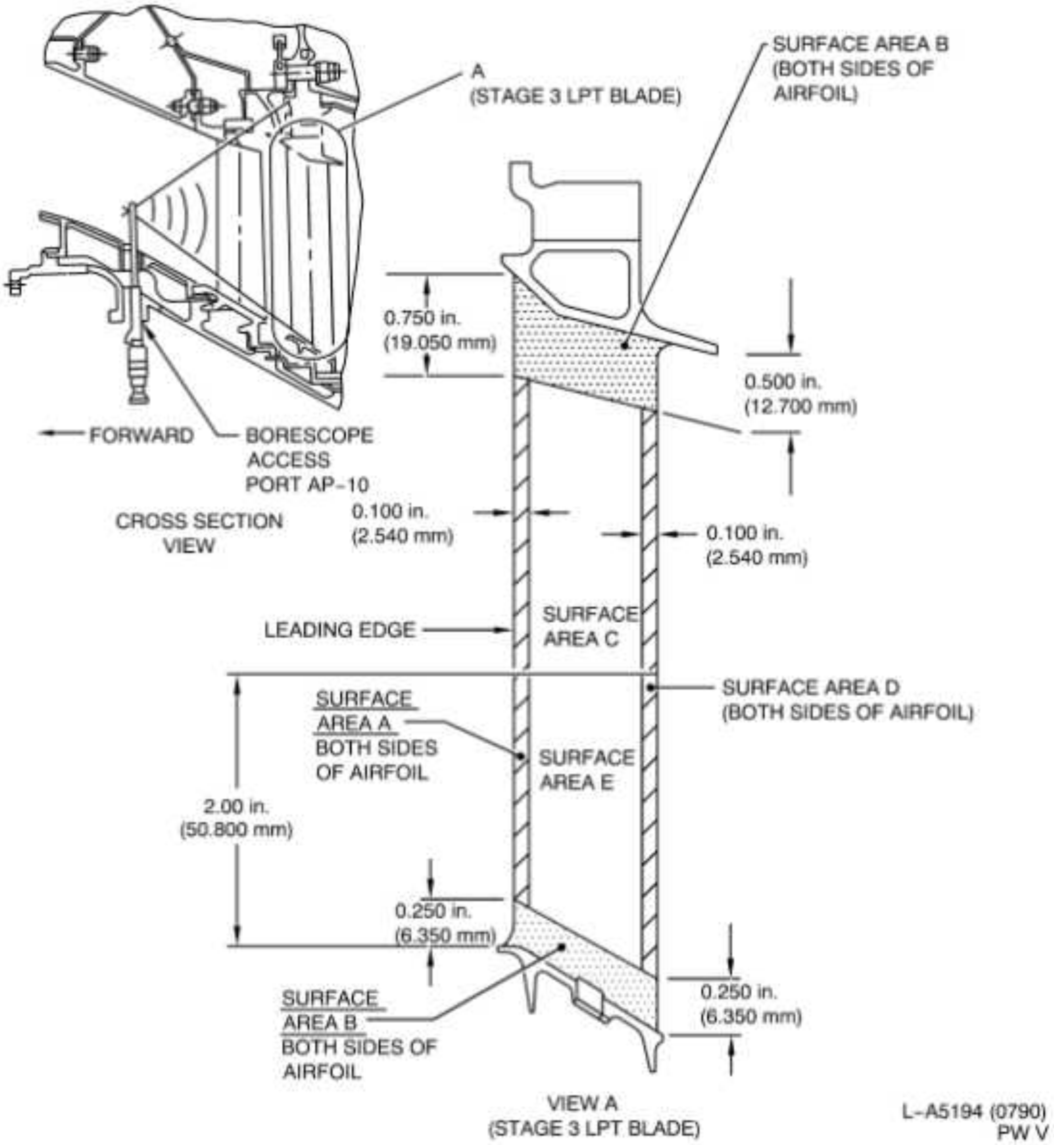
(d) Install new gasket, split facing inward, into borescope boss on turbine case.

(5) Install plug stop to boss and torque bolts.

(a) Thoroughly clean bolt threads and AP−10 boss threads with Petroleum Solvent P11−027 to remove carbon deposits and any deposits of previously applied antigalling compound.

(b) Treat threads of two bolts with Silver Goop P06−023. Remove excess compound.

(c) Secure plug to AP−10 borescope boss on case with two bolts (above). Torque and lockwire bolts per Table 801, 72−00−00 Inspection/Check−01H Task 72−00−00−210−007.


A
(STAGE 3 LPT BLADE)
SURFACE AREA B
(BOTH SIDES OF
AIRFOIL)
0.750 in.
(19.050 mm)
0.500 in.
(12.700 mm)
FORWARD
BORESCOPE
ACCESS
PORT AP-10
CROSS SECTION
VIEW
0.100 in.
(2.540 mm)
0.100 in.
(2.540 mm)
LEADING EDGE
SURFACE
AREA C
SURFACE AREA D
(BOTH SIDES OF AIRFOIL)
SURFACE
AREA A
BOTH SIDES
OF AIRFOIL
SURFACE
AREA E
2.00 in.
(50.800 mm)
0.250 in.
(6.350 mm)
0.250 in.
(6.350 mm)
SURFACE
AREA B
BOTH SIDES OF
AIRFOIL
VIEW A
(STAGE 3 LPT BLADE)
L-A5194 (0790)
PW V

Stage 3 LPT Blade AP−10 Borescope Viewing/Blade Inspection Areas
Figure 801
(Task 72−00−00−210−025)

ENGINE GENERAL − INSPECTION/CHECK−01J

Task 72−00−00−230−001:

1. Perform Dye Penetrant Inspection Of Stage 1 HPT Blades, Stage 2 HPT Blades And Stage 3 LPT Vanes − Deleted

NOTE: This inspection procedure has been deleted.

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ENGINE GENERAL - INSPECTION/CHECK-01K

Task 72-00-00-210-008:

1. Perform Visual Inspection Of Stage 6 LPT Blades And Stage 6 LPT Vanes

   A. Equipment And Materials Required - None

   B. Inspect Stage 6 LPT Blades For Damage Per Limits Given In Figure 801.

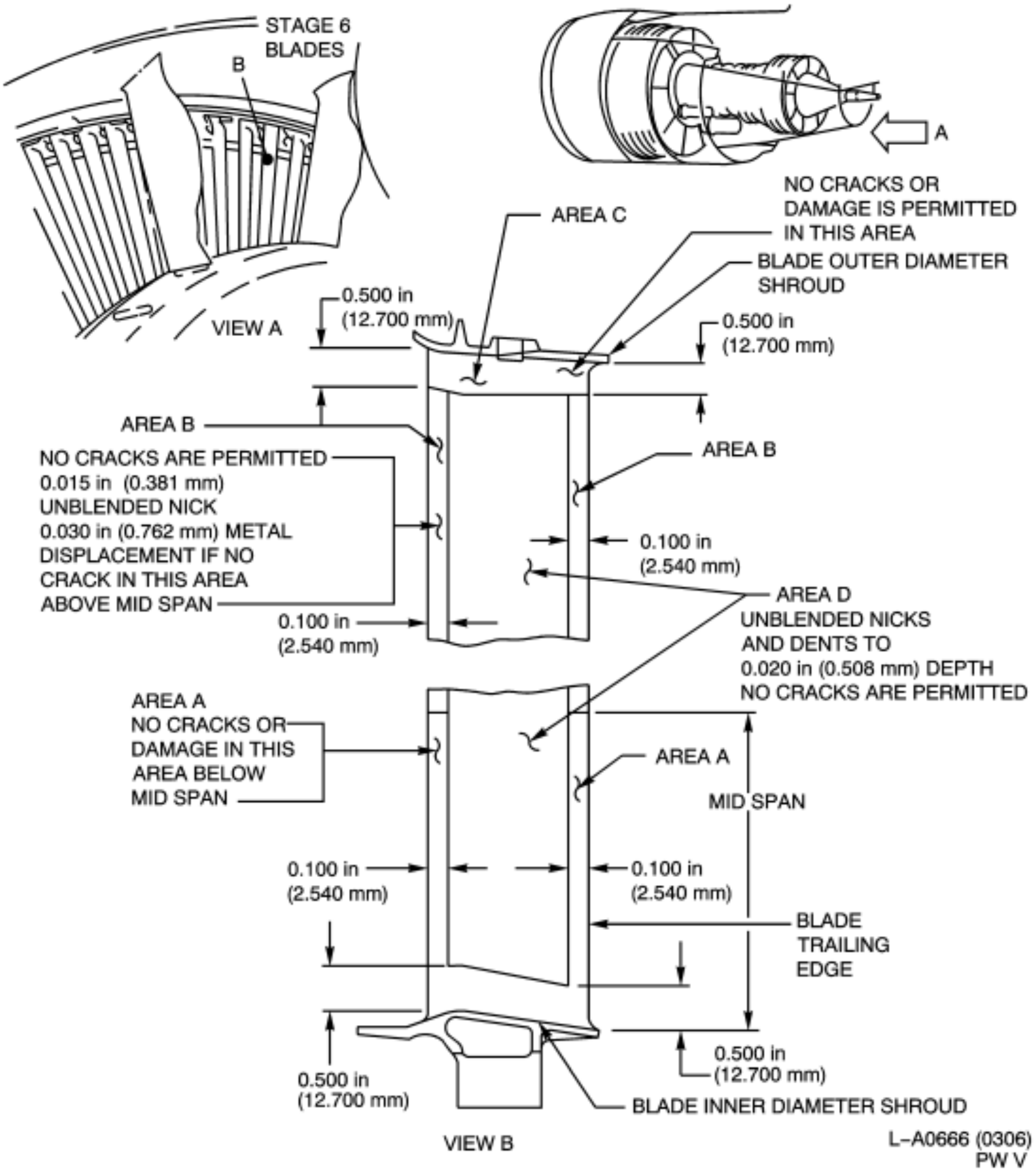
   NOTE: Inspection of Stage 6 LPT blades in accomplished by looking forward through turbine exhaust area.

   C. Inspect Stage 6 LPT Vanes For Damage Per Limits Given In Figure 802.

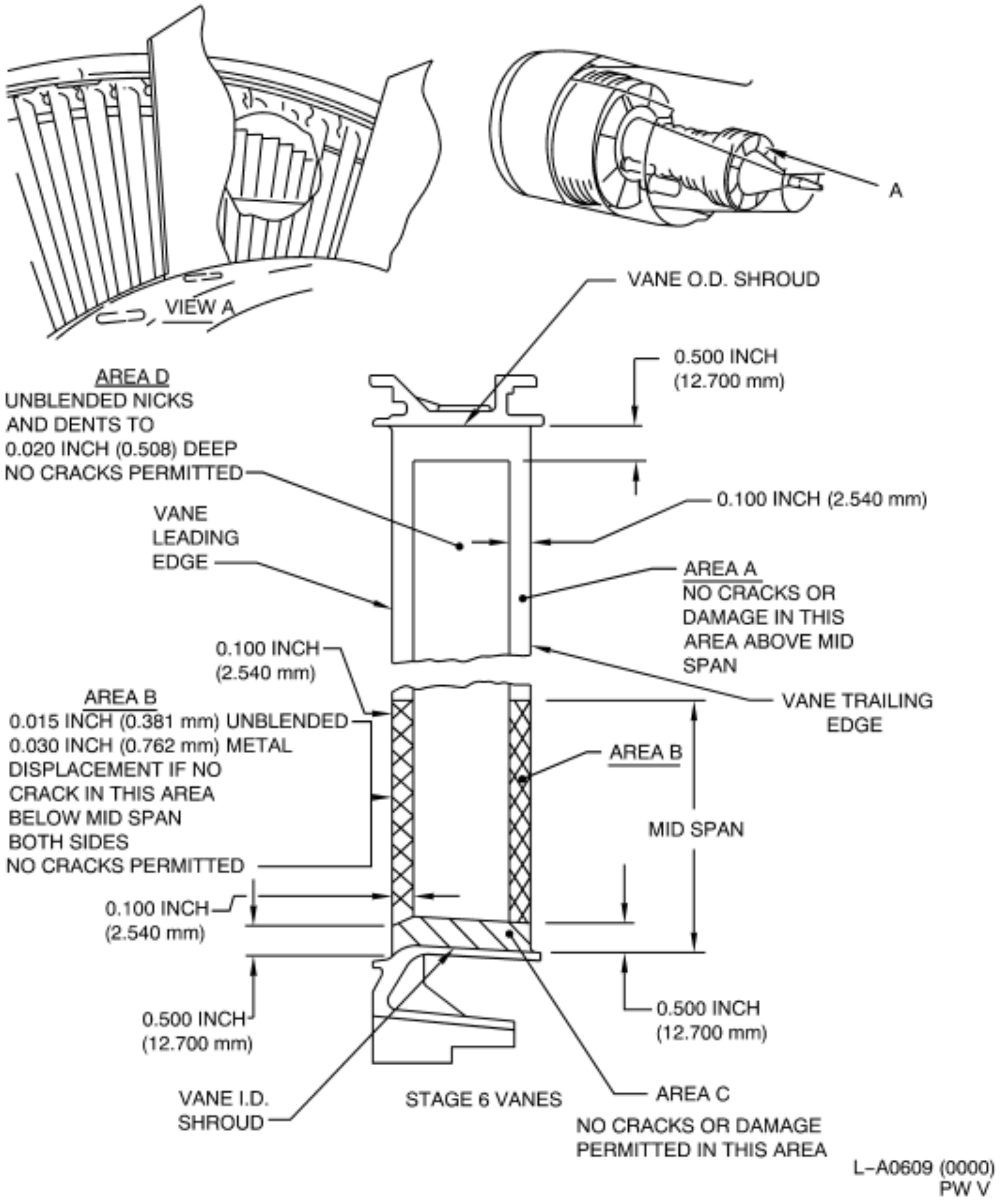
   NOTE: Inspection of Stage 6 LPT vanes is accomplished by looking forward through turbine exhaust area and Stage 6 LPT blades.

   (1) Inspect the visible areas of the vane trailing edge, shrouds and airfoil for damage. See Areas A, B, C and D on Figure 802.

   NOTE: Only one airfoil side, shrouds and trailing edge are visible. If damage is present on the visible areas of the vane, a complete inspection of the vane should be accomplished. This should be done utilizing a borescope, mirrors or other necessary tooling to observe the vane leading edge and remainder of the airfoil surfaces. (Borescope tooling is provided in Paragraph 1.) Inspection/Check-01A.


STAGE 6 BLADES
B
VIEW A
A
AREA C
NO CRACKS OR DAMAGE IS PERMITTED IN THIS AREA
BLADE OUTER DIAMETER SHROUD
0.500 in (12.700 mm)
0.500 in (12.700 mm)
AREA B
NO CRACKS ARE PERMITTED 0.015 in (0.381 mm) UNBLENDED NICK 0.030 in (0.762 mm) METAL DISPLACEMENT IF NO CRACK IN THIS AREA ABOVE MID SPAN
AREA B
0.100 in (2.540 mm)
0.100 in (2.540 mm)
AREA D UNBLENDED NICKS AND DENTS TO 0.020 in (0.508 mm) DEPTH NO CRACKS ARE PERMITTED
AREA A NO CRACKS OR DAMAGE IN THIS AREA BELOW MID SPAN
AREA A
MID SPAN
0.100 in (2.540 mm)
0.100 in (2.540 mm)
BLADE TRAILING EDGE
0.500 in (12.700 mm)
0.500 in (12.700 mm)
BLADE INNER DIAMETER SHROUD
VIEW B
L−A0666 (0306)
PW V

Stage 6 LPT Blade Foreign Object Damage Limits
Figure 801
(Task 72−00−00−210−008)


A
VIEW A
VANE O.D. SHROUD
0.500 INCH
(12.700 mm)
AREA D
UNBLENDED NICKS
AND DENTS TO
0.020 INCH (0.508) DEEP
NO CRACKS PERMITTED
0.100 INCH (2.540 mm)
VANE
LEADING
EDGE
AREA A
NO CRACKS OR
DAMAGE IN THIS
AREA ABOVE MID
SPAN
0.100 INCH
(2.540 mm)
VANE TRAILING
EDGE
AREA B
0.015 INCH (0.381 mm) UNBLENDED
0.030 INCH (0.762 mm) METAL
DISPLACEMENT IF NO
CRACK IN THIS AREA
BELOW MID SPAN
BOTH SIDES
NO CRACKS PERMITTED
AREA B
MID SPAN
0.100 INCH
(2.540 mm)
0.500 INCH
(12.700 mm)
0.500 INCH
(12.700 mm)
VANE I.D.
SHROUD
STAGE 6 VANES
AREA C
NO CRACKS OR DAMAGE
PERMITTED IN THIS AREA
L-A0609 (0000)
PW V

Stage 6 LPT Vane Foreign Object Damage Limits
Figure 802
(Task 72-00-00-210-008)

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Task 72−00−00−210−024:

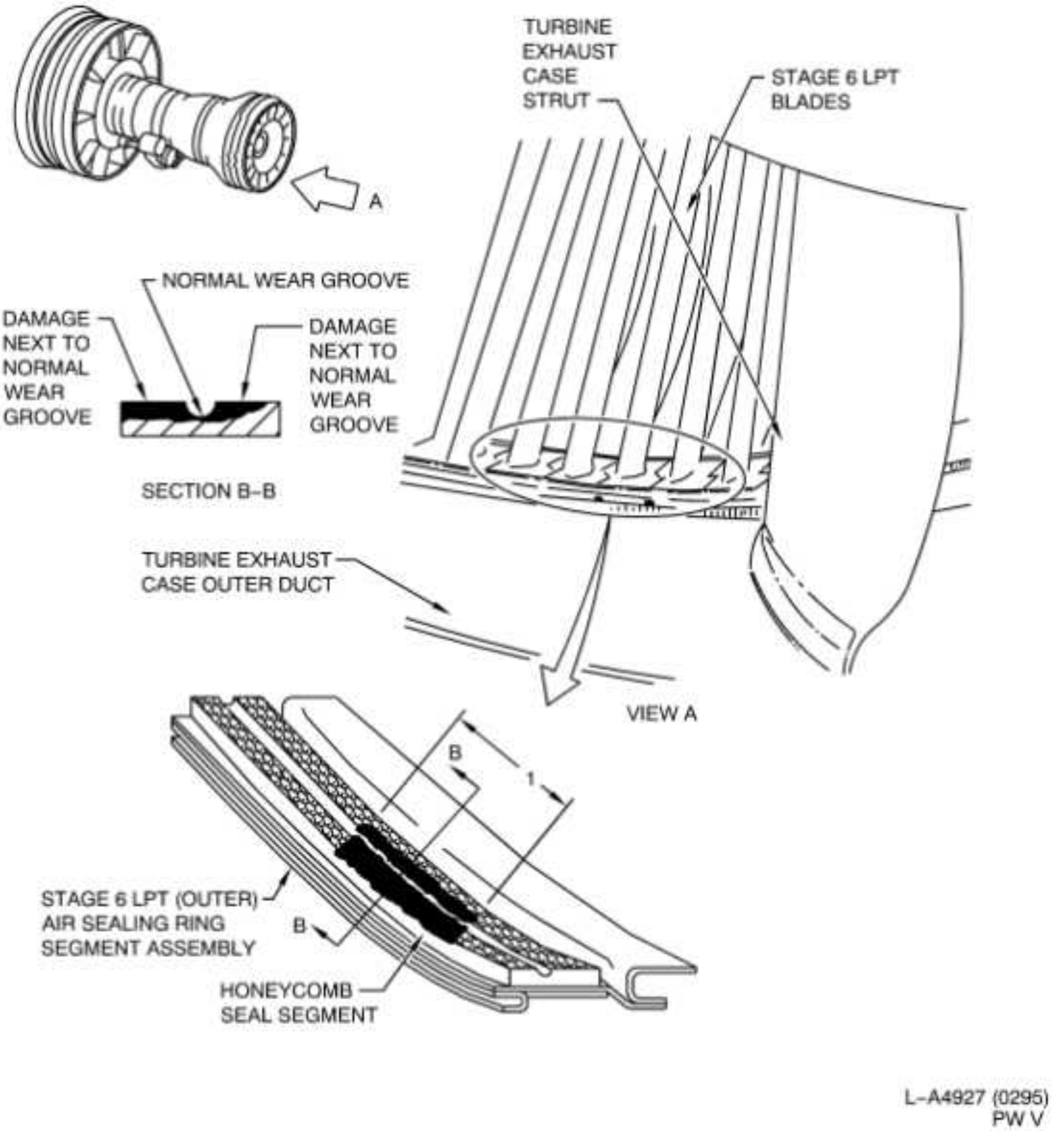
1. Perform Visual Inspection Of The Stage 6 LPT (Outer) Airsealing Ring Segment Assembly
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figure 801.
     - (1) Make an inspection of the Stage 6 LPT (outer) airsealing ring segment assemblies.
       - (a) Damage that is next to the wear groove and is greater than 3.0 inches (76.200 mm) in length in each segment, unlimited segments, is not permitted.

         NOTE: Make an inspection of the Stage 6 LPT (outer) airsealing ring segment assemblies by looking forward through the turbine exhaust case.

         An increase in segment damage will show a decrease in performance.

       - (b) If it is necessary to remove the airsealing ring, remove the engine.


A
TURBINE EXHAUST CASE STRUT
STAGE 6 LPT BLADES
NORMAL WEAR GROOVE
DAMAGE NEXT TO NORMAL WEAR GROOVE
DAMAGE NEXT TO NORMAL WEAR GROOVE
SECTION B−B
TURBINE EXHAUST CASE OUTER DUCT
VIEW A
B
1
STAGE 6 LPT (OUTER) AIR SEALING RING SEGMENT ASSEMBLY
B
HONEYCOMB SEAL SEGMENT
L−A4927 (0295)
PW V

1. Length Of Damage

Stage 6 LPT (Outer) Airsealing
Ring Segment Assembly Inspection
Figure 801
(Task 72−00−00−210−024)

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ENGINE GENERAL - INSPECTION/CHECK-01M

Task 72-00-00-210-009:

1. Perform Visual Inspection Of Turbine Exhaust Case

A. Equipment And Materials Necessary - None

B. General

(1) The regular inspection interval referred to in this procedure is obtained from the Maintenance Planning Guide. The reduced inspection interval is set at half that value. These inspection intervals may be adjusted based on operator experiences and consultation with the local regulatory agency.

C. Case Exterior Inspection For Cracks And Damage See Figure 801 and Figure 802.

NOTE: All cracks should be repaired at next removal of turbine exhaust case from engine.

(1) Case rail flange inspection. See Figure 802 and Table 801.

INSPECTION AREA AND OBSERVED CONDITION	MAXIMUM DAMAGE PERMITTED FOR A REGULAR INTERVAL INSPECTION	MAXIMUM DAMAGE PERMITTED FOR A REDUCED INTERVAL INSPECTION
Flanges R and S Rail cracks (See Figure 802, View B)	1. Radial or circumferential cracks to 0.75 inch (19.050 mm) in length are permitted.	1. Radial or circumferential cracks 1.5 inches (38.100 mm) length permitted. No axial cracks into the fillet radius permitted.
	2. Cracks at the same circumferential location are NOT permitted on adjacent rails.	2. Cracks at the same circumferential locations are NOT permitted on adjacent rails.
	3. No circumferential or axial cracks permitted in the fillet radius.	3. Single circumferential cracks to 1.0 inches (25.400 mm) confined to fillet radius

Turbine Exhaust Case (Exterior) Inspection Limits
Table 801

INSPECTION AREA AND OBSERVED CONDITION	MAXIMUM DAMAGE PERMITTED FOR A REGULAR INTERVAL INSPECTION	MAXIMUM DAMAGE PERMITTED FOR A REDUCED INTERVAL INSPECTION
(CONTINUED)		permitted.
Flanges R and S Engine mount ground handling mount, rail slots and through hole cracks. (See Figure 802, View A & D)	1. A single radial crack in a slot to the rail OD is permissible.	1. A single radial or circumferential crack on the ID side of a slot or through hole is permitted to a maximum length of 1.0 inch (25.400 mm).
	2. Cracks from engine mount bushing hole or ground handling bushing holes at 10:30, 11:30, 12:30 and 1:30, 3:00 and 9:00 o'clock positions are NOT permitted.	
Flanges P and T, T1 OD Flanges And ID Flange T1 (See Figure 801)	1. Radial crack from flange OD to bolt hole permitted.	1. Radial crack from flange OD to bolt bolt hole inward to the fillet radius is permitted. NO cracks in the fillet radius.
	2. Radial crack from the bolt hole running inward is NOT permitted.	

Turbine Exhaust Case (Exterior) Inspection Limits
Table 801 (Continued)

(a) Visually inspect Flanges R and S for cracks and damage. Maximum permissible damage and crack conditions for Regular Interval or Reduced Interval inspections are defined in Table 801.

(2) Case outer flange inspection. See Figure 801 and Table 801.

(a) Visually inspect Flanges P and T for cracks and damage. Maximum permissible damage and crack conditions for Regular Interval or Reduced Interval inspections are defined in Table 801.

D. Turbine Exhaust Case Gaspath Area Inspection

(1) General Damage − Nicks, Dents And Cracks

(a) Turbine exhaust case strut and duct inspection. Turbine exhaust case struts having surface skin bulges or depressions, buckling and distorted leading and/or trailing edges may continue−inservice provided following limits are not exceeded.

1 Leading and trailing edge contours are smooth and crack limits do not exceed Paragraph (2).

2 Skin separation from strut stiffeners is not allowed.

3 Angular dents appearing as a straight line crease, holes and tears, are to be treated as cracks. Length of crease, hole or tear to be added to length of cracks when assessing acceptance.

NOTE: Acceptable cracking in vanes may allow hot exhaust gases to flow through vanes into surrounding cowled area. Inspection of engine/aircraft services (tubes and cables) in this area is recommended as part of the overall inspection for continued operation.

(2) Turbine exhaust case strut and duct crack limits. See Figure 803, Figure 804, Figure 805, Figure 806 and Figure 807.

(a) Turbine exhaust case struts, and OD and ID duct area crack limits are defined in Table 802.

INSPECTION AREA AND OBSERVED CONDITION	MAXIMUM DAMAGE PERMITTED FOR A REGULAR INTERVAL INSPECTION	MAXIMUM DAMAGE PERMITTED FOR A REDUCED INTERVAL INSPECTION
	(See Figure 804)	(See Figure 806)
Strut airfoil and trailing edge area for cracks	1. Three cracks maximum on a single strut over .75 inch (19.050 mm)	1. Three cracks maximum on a single strut over 1.25 inches (31.750 mm). One crack maximum over 1.75 inches (44.450 mm).

Turbine Exhaust Case (Gaspath Area) Inspection Limits
Table 802

INSPECTION AREA AND OBSERVED CONDITION	MAXIMUM DAMAGE PERMITTED FOR A REGULAR INTERVAL INSPECTION	MAXIMUM DAMAGE PERMITTED FOR A REDUCED INTERVAL INSPECTION
(CONTINUED)		
	2. Radial cracks 1.25 inches (31.750 mm) maximum permitted.	2. Radial (spanwise) and axial (chordwise) cracks to a maximum of 2.5 inches (63.500 mm) in length permitted on airfoil areas. Cracks can pass through the fillet radius or leading edge.
	3. Axial cracks through the airfoil to leading edge, 1.25 inches (31.750 mm) maximum permitted.	3. NO "U" shaped cracks or impending material liberation permitted.
	4. Any number of cracks under .75 inch (19.050 mm) confined to airfoil area only, are permitted.	4. Total cumulative length of all cracks must not exceed 5.00 inches (127.000 mm).
	5. Cracks permitted to enter leading edge or fillet radius	
	6. NO "U" shaped cracks or impending material liberation permitted.	
Strut leading edge area for cracks	(See Figure 804) 1. Radial crack on, or adjacent to strut leading edge weld, to a maximum of 1.25 inches (31.750 mm). Crack must NOT enter ID or OD fillet radius.	(See Figure 806) 1. Radial crack on or adjacent to strut leading edge weld to a maximum of 2.5 inches (63.500 mm). Crack can pass through the fillet radius.
	2. Axial or	

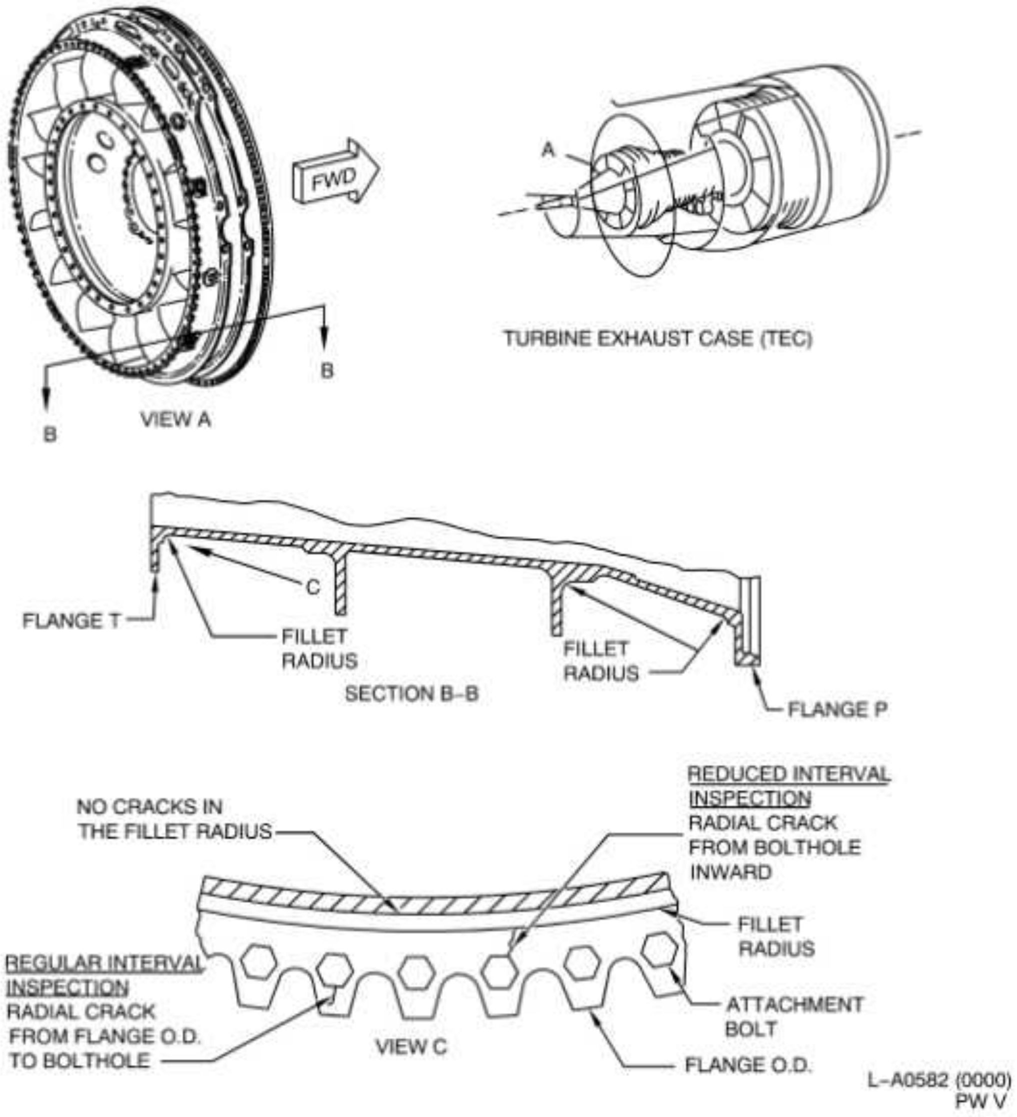
Turbine Exhaust Case (Gaspath Area) Inspection Limits
Table 802 (Continued)

INSPECTION AREA AND OBSERVED CONDITION	MAXIMUM DAMAGE PERMITTED FOR A REGULAR INTERVAL INSPECTION	MAXIMUM DAMAGE PERMITTED FOR A REDUCED INTERVAL INSPECTION
(CONTINUED)		
	chordwise crack through the leading edge to the airfoil surface permissible. Length of airfoil area crack applies.	
Strut for cracks	(See Figure 804) 1. Radial cracks to a maximum of two, per strut can pass through the fillet radius. The maximum length is 1.25 inches (31.750 mm) and includes any portion of the crack on the airfoil or duct surfaces.	(See Figure 806) 1. Radial cracks to a maximum of two per strut can pass through the fillet radius. The maximum length is 2.5 inches (63.500 mm) and includes any portion of the crack on the airfoil or duct surfaces.
	2. Axial crack along the airfoil ID or OD weld line to 1.25 inches (31.750 mm) maximum. One crack per strut. Crack cannot pass around leading edge.	2. Axial crack along the airfoil ID or OD weld line to 2.5 inches (63.500 mm) maximum. One crack per strut. Crack can pass around leading edge.
Struts inner trailing edge stand−up. Area C	Crack up to 1.00 inch (25.400 mm) long from trailing edge.	Crack up to 2.00 inch (50.800 mm) long from trailing edge.
Struts outer trailing edge stand−up. Area D	Crack up to 1.25 inch (31.750 mm) long from trailing edge.	Crack up to 2.5 inches (63.500 mm) long from trailing edge.

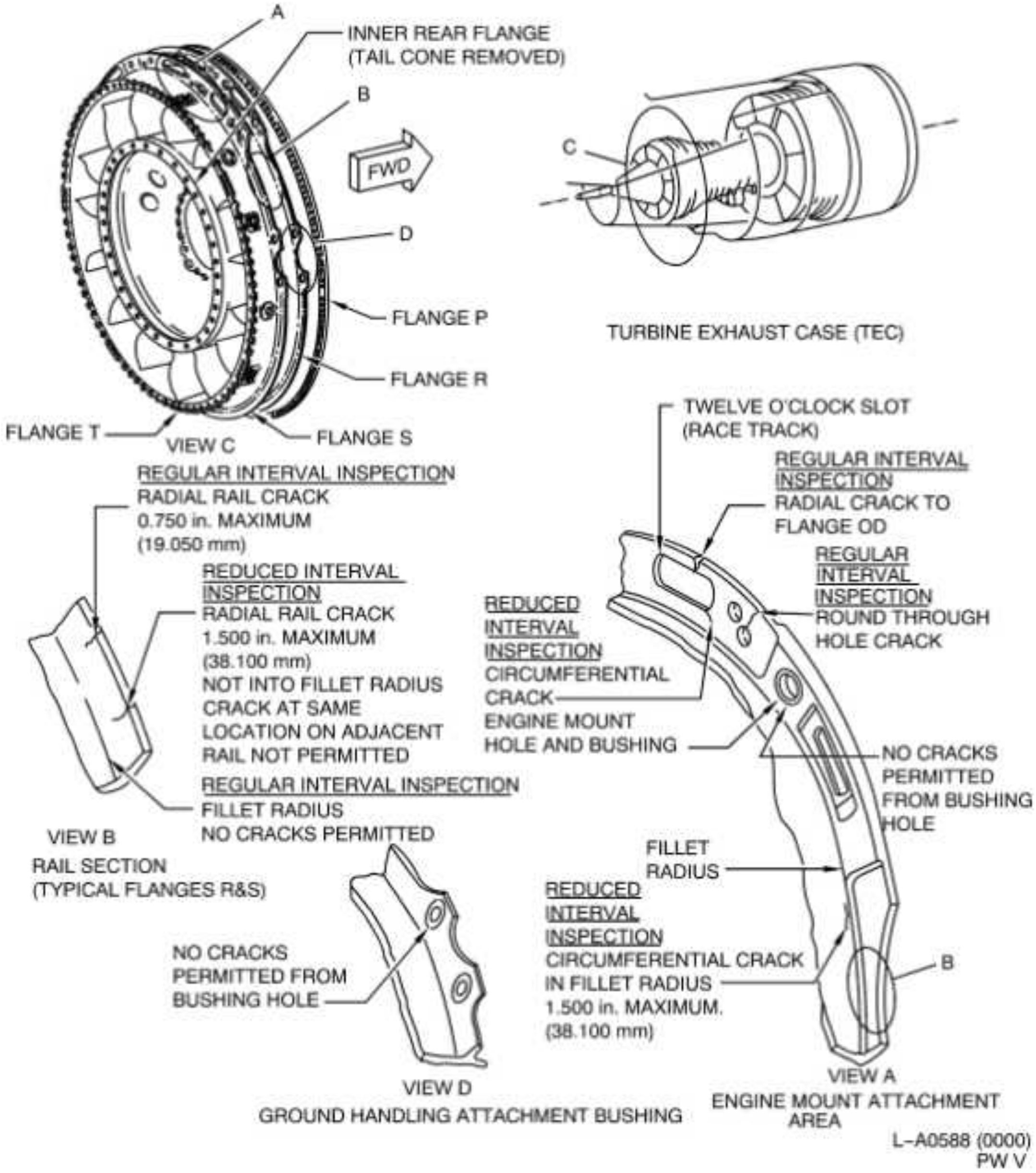
Turbine Exhaust Case (Gaspath Area) Inspection Limits
Table 802 (Continued)

INSPECTION AREA AND OBSERVED CONDITION	MAXIMUM DAMAGE PERMITTED FOR A REGULAR INTERVAL INSPECTION	MAXIMUM DAMAGE PERMITTED FOR A REDUCED INTERVAL INSPECTION
Inner and outer duct areas for cracks	(See Figure 805)	(See Figure 807)
	1. Circumferential or axial cracks to a maximum length of 1.25 inches (31.750 mm) with a maximum quantity of three.	1. Circumferential or axial cracks to a maximum length of 2.5 inches (63.500 mm) with a maximum quantity of three.
	2. A continuous crack or two intersecting cracks maximum between any two struts considered to be a single crack. NO "U" shaped cracks or impending material liberation permitted.	2. A continuous crack or two intersecting cracks maximum between any two struts are to be considered a single crack.
	3. Three cracks maximum between any two adjacent struts, over .75 inch (19.050 mm). Maximum length is 1.25 inches (31.750 mm).	3. NO "U" shaped cracks or impending material liberation is permitted.
	4. Any number of cracks under .75 inch (19.050 mm) confined to duct area only, are permitted.	
		5. Three cracks maximum between any two struts over 1.25 inches (31.750 mm). The maximum length is 2.5 inches (63.500 mm).

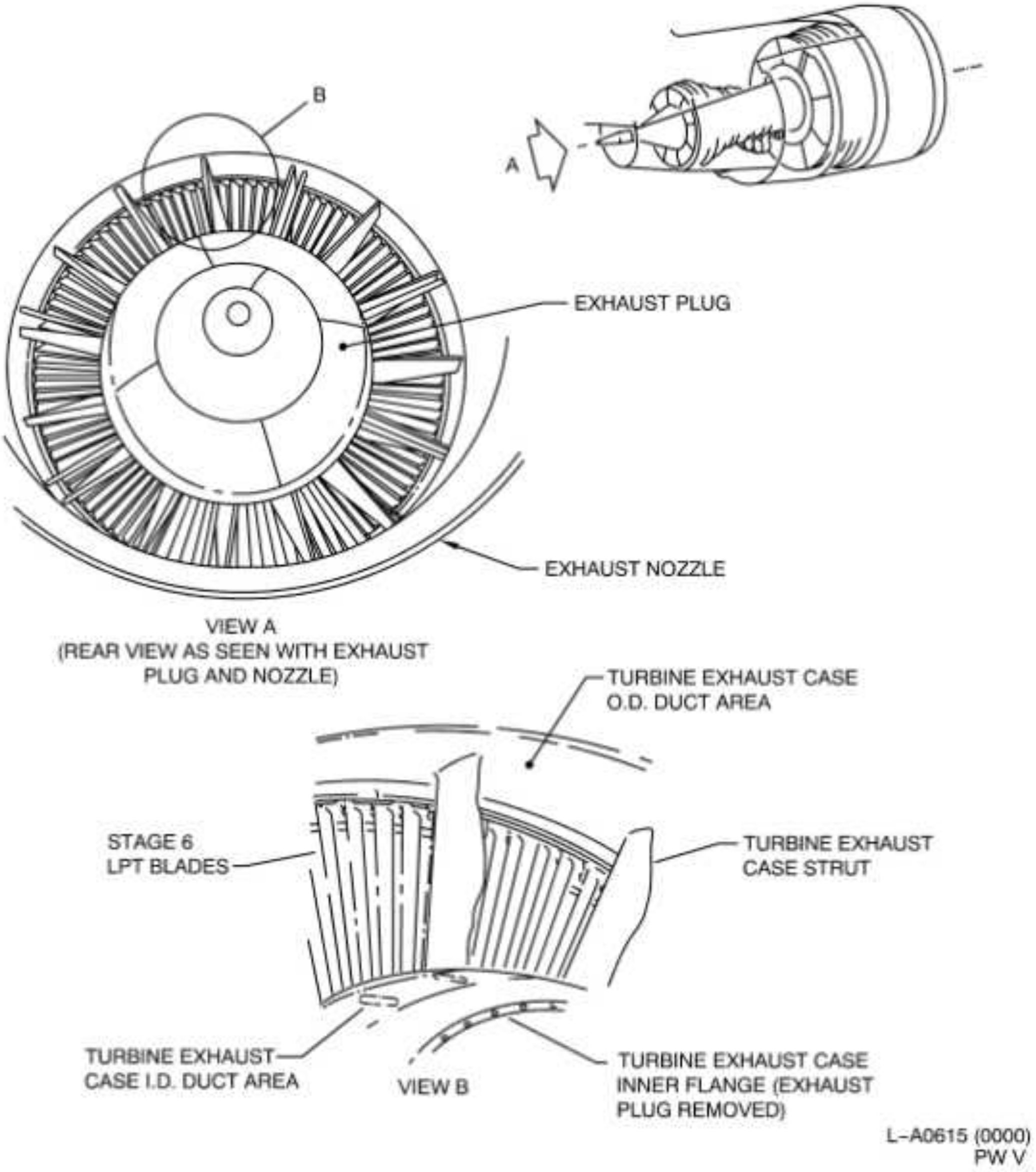
Turbine Exhaust Case (Gaspath Area) Inspection Limits
Table 802 (Continued)


FWD
A
TURBINE EXHAUST CASE (TEC)
B
B
VIEW A
C
FLANGE T
FILLET RADIUS
SECTION B-B
FILLET RADIUS
FLANGE P
NO CRACKS IN THE FILLET RADIUS
REDUCED INTERVAL INSPECTION
RADIAL CRACK FROM BOLTHOLE INWARD
FILLET RADIUS
REGULAR INTERVAL INSPECTION
RADIAL CRACK FROM FLANGE O.D. TO BOLTHOLE
VIEW C
ATTACHMENT BOLT
FLANGE O.D.
L-A0582 (0000)
PW V

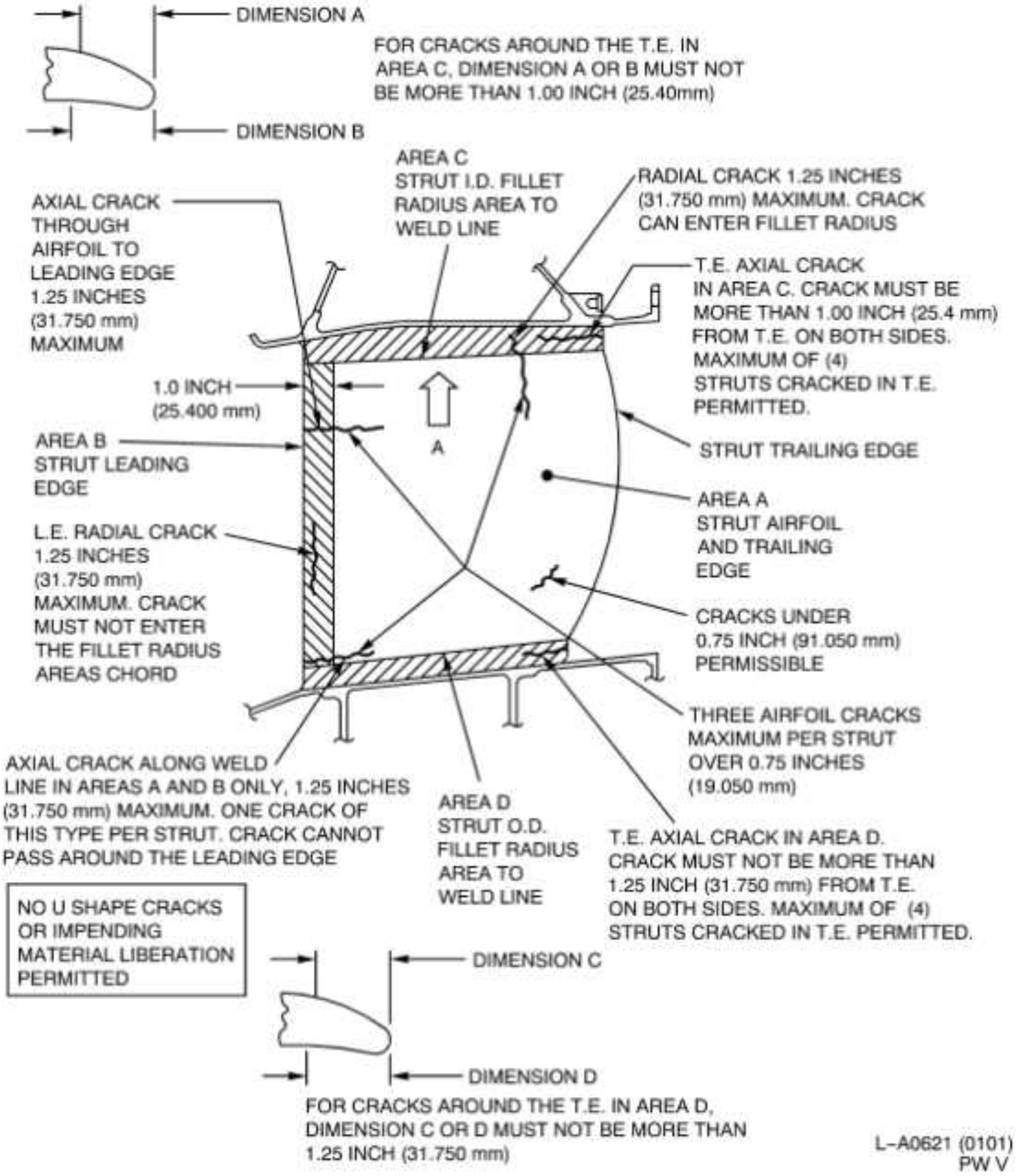
Turbine Exhaust Case Exterior Inspection
Figure 801
(Task 72−00−00−210−009)


A
INNER REAR FLANGE
(TAIL CONE REMOVED)
B
FWD
D
FLANGE P
FLANGE R
FLANGE T
VIEW C
FLANGE S
C
TURBINE EXHAUST CASE (TEC)
TWELVE O'CLOCK SLOT
(RACE TRACK)
REGULAR INTERVAL INSPECTION
RADIAL CRACK TO FLANGE OD
REGULAR INTERVAL INSPECTION
ROUND THROUGH HOLE CRACK
REGULAR INTERVAL INSPECTION
RADIAL RAIL CRACK
0.750 in. MAXIMUM
(19.050 mm)
REDUCED INTERVAL INSPECTION
RADIAL RAIL CRACK
1.500 in. MAXIMUM
(38.100 mm)
NOT INTO FILLET RADIUS
CRACK AT SAME LOCATION ON ADJACENT RAIL NOT PERMITTED
REGULAR INTERVAL INSPECTION
FILLET RADIUS
NO CRACKS PERMITTED
REDUCED INTERVAL INSPECTION
CIRCUMFERENTIAL CRACK
ENGINE MOUNT HOLE AND BUSHING
NO CRACKS PERMITTED FROM BUSHING HOLE
VIEW B
RAIL SECTION
(TYPICAL FLANGES R&S)
FILLET RADIUS
REDUCED INTERVAL INSPECTION
CIRCUMFERENTIAL CRACK IN FILLET RADIUS
1.500 in. MAXIMUM.
(38.100 mm)
B
NO CRACKS PERMITTED FROM BUSHING HOLE
VIEW D
GROUND HANDLING ATTACHMENT BUSHING
VIEW A
ENGINE MOUNT ATTACHMENT AREA
L-A0588 (0000)
PW V

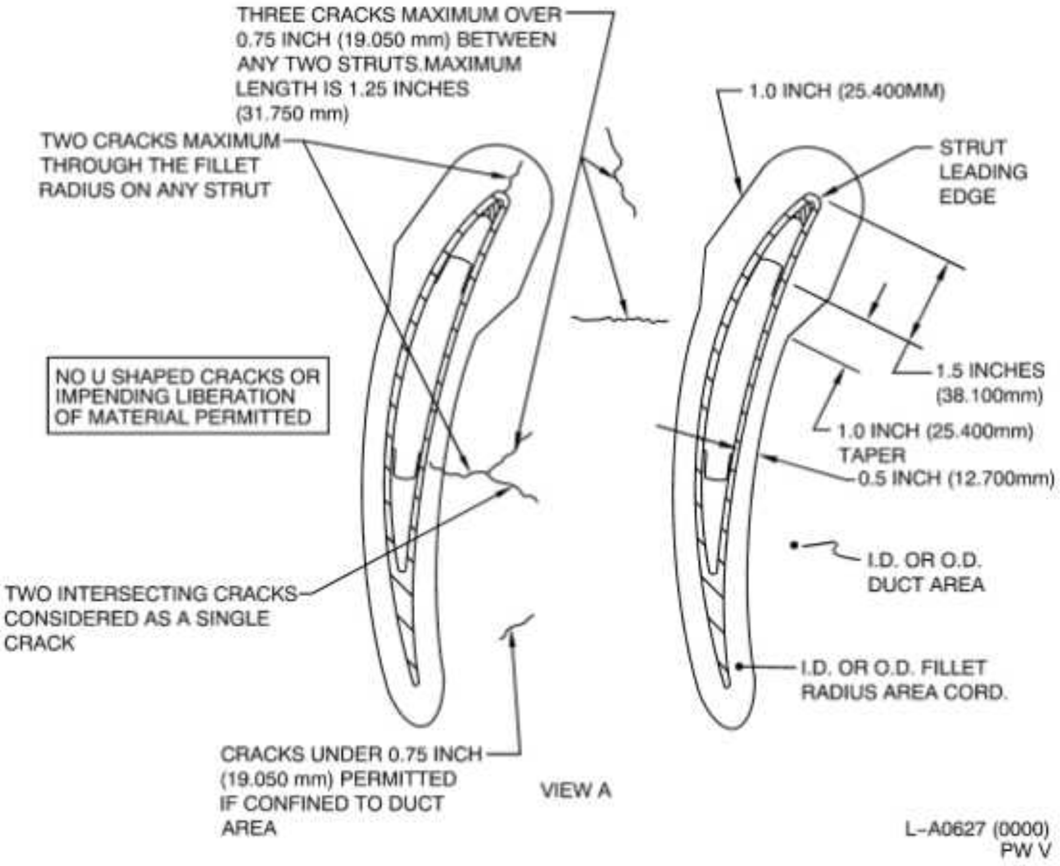
Turbine Exhaust Case Exterior Inspection
Figure 802
(Task 72−00−00−210−009)


B
A
EXHAUST PLUG
EXHAUST NOZZLE
VIEW A
(REAR VIEW AS SEEN WITH EXHAUST PLUG AND NOZZLE)
TURBINE EXHAUST CASE O.D. DUCT AREA
STAGE 6 LPT BLADES
TURBINE EXHAUST CASE STRUT
TURBINE EXHAUST CASE I.D. DUCT AREA
VIEW B
TURBINE EXHAUST CASE INNER FLANGE (EXHAUST PLUG REMOVED)
L−A0615 (0000)
PW V

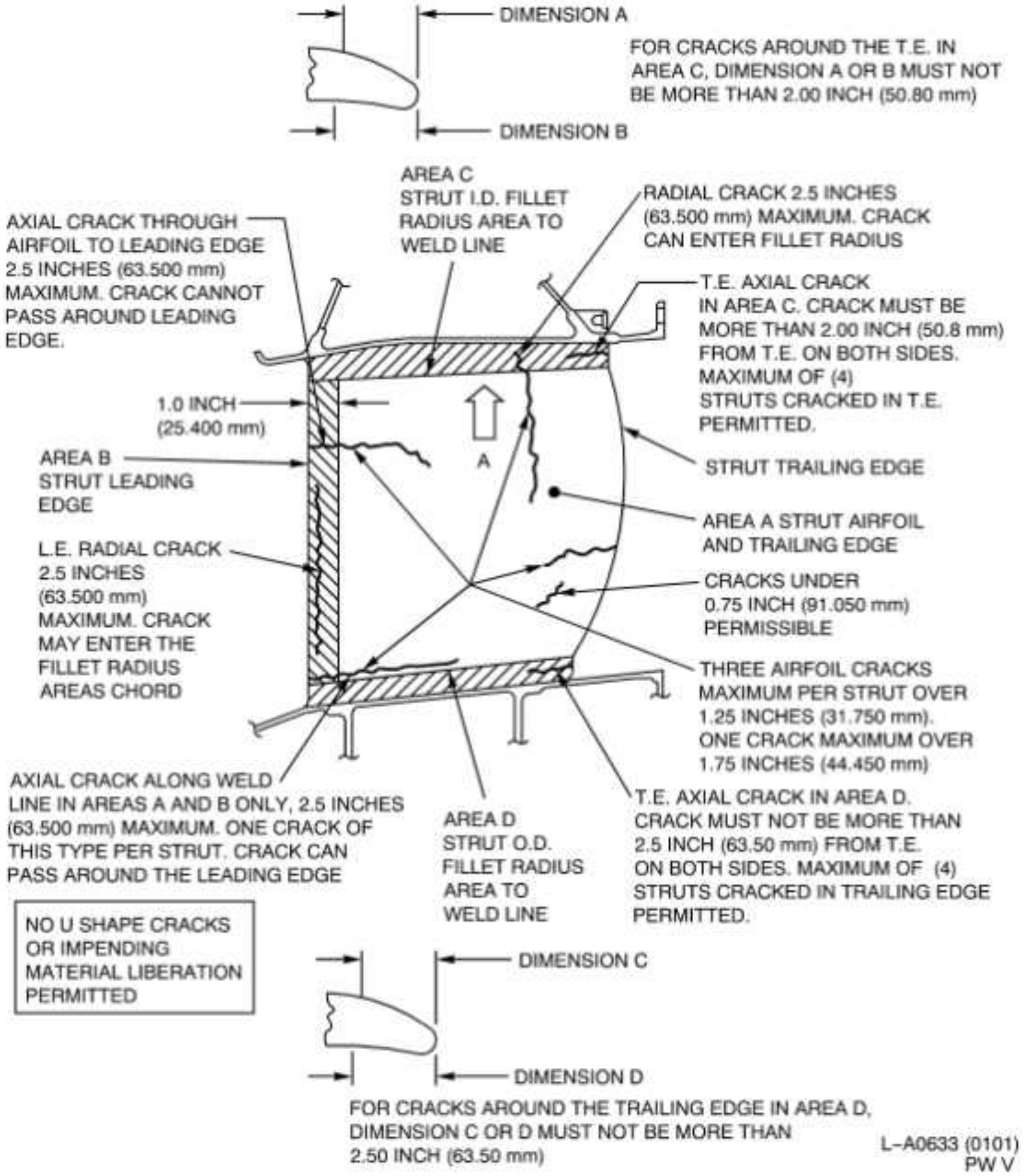
Turbine Exhaust Case Assembly Gaspath Inspection Areas
Figure 803
(Task 72−00−00−210−009)


DIMENSION A
FOR CRACKS AROUND THE T.E. IN AREA C, DIMENSION A OR B MUST NOT BE MORE THAN 1.00 INCH (25.40mm)
DIMENSION B
AREA C STRUT I.D. FILLET RADIUS AREA TO WELD LINE
RADIAL CRACK 1.25 INCHES (31.750 mm) MAXIMUM. CRACK CAN ENTER FILLET RADIUS
AXIAL CRACK THROUGH AIRFOIL TO LEADING EDGE 1.25 INCHES (31.750 mm) MAXIMUM
T.E. AXIAL CRACK IN AREA C. CRACK MUST BE MORE THAN 1.00 INCH (25.4 mm) FROM T.E. ON BOTH SIDES. MAXIMUM OF (4) STRUTS CRACKED IN T.E. PERMITTED.
1.0 INCH (25.400 mm)
A
STRUT TRAILING EDGE
AREA B STRUT LEADING EDGE
AREA A STRUT AIRFOIL AND TRAILING EDGE
L.E. RADIAL CRACK 1.25 INCHES (31.750 mm) MAXIMUM. CRACK MUST NOT ENTER THE FILLET RADIUS AREAS CHORD
CRACKS UNDER 0.75 INCH (91.050 mm) PERMISSIBLE
THREE AIRFOIL CRACKS MAXIMUM PER STRUT OVER 0.75 INCHES (19.050 mm)
AXIAL CRACK ALONG WELD LINE IN AREAS A AND B ONLY, 1.25 INCHES (31.750 mm) MAXIMUM. ONE CRACK OF THIS TYPE PER STRUT. CRACK CANNOT PASS AROUND THE LEADING EDGE
AREA D STRUT O.D. FILLET RADIUS AREA TO WELD LINE
T.E. AXIAL CRACK IN AREA D. CRACK MUST NOT BE MORE THAN 1.25 INCH (31.750 mm) FROM T.E. ON BOTH SIDES. MAXIMUM OF (4) STRUTS CRACKED IN T.E. PERMITTED.
NO U SHAPE CRACKS OR IMPENDING MATERIAL LIBERATION PERMITTED
DIMENSION C
DIMENSION D
FOR CRACKS AROUND THE T.E. IN AREA D, DIMENSION C OR D MUST NOT BE MORE THAN 1.25 INCH (31.750 mm)
L-A0621 (0101)
PW V

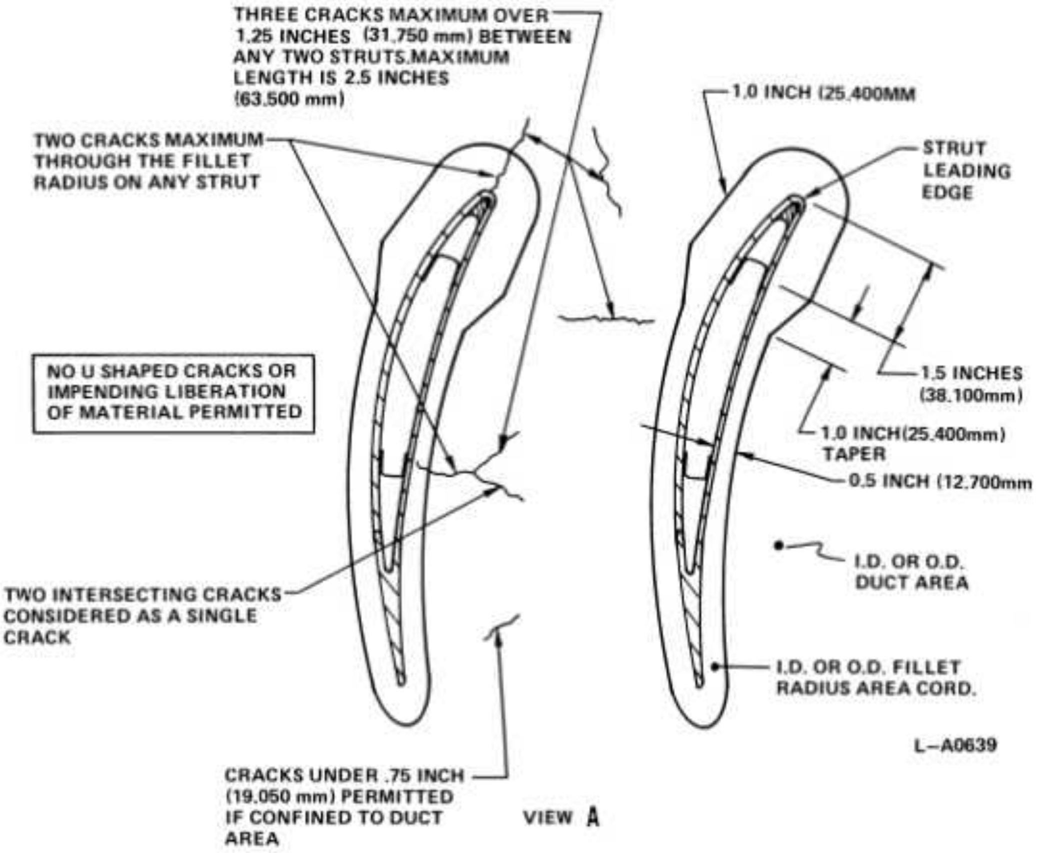
Turbine Exhaust Case Regular Interval Inspection Maximum Damage
Figure 804
(Task 72−00−00−210−009)


THREE CRACKS MAXIMUM OVER 0.75 INCH (19.050 mm) BETWEEN ANY TWO STRUTS.MAXIMUM LENGTH IS 1.25 INCHES (31.750 mm)
TWO CRACKS MAXIMUM THROUGH THE FILLET RADIUS ON ANY STRUT
NO U SHAPED CRACKS OR IMPENDING LIBERATION OF MATERIAL PERMITTED
TWO INTERSECTING CRACKS CONSIDERED AS A SINGLE CRACK
CRACKS UNDER 0.75 INCH (19.050 mm) PERMITTED IF CONFINED TO DUCT AREA
VIEW A
1.0 INCH (25.400MM)
STRUT LEADING EDGE
1.5 INCHES (38.100mm)
1.0 INCH (25.400mm) TAPER
0.5 INCH (12.700mm)
I.D. OR O.D. DUCT AREA
I.D. OR O.D. FILLET RADIUS AREA CORD.
L−A0627 (0000)
PW V

Turbine Exhaust Case Regular Interval
Inspection Maximum Damage (View−A−)
Figure 805
(Task 72−00−00−210−009)


DIMENSION A
FOR CRACKS AROUND THE T.E. IN AREA C, DIMENSION A OR B MUST NOT BE MORE THAN 2.00 INCH (50.80 mm)
DIMENSION B
AREA C STRUT I.D. FILLET RADIUS AREA TO WELD LINE
AXIAL CRACK THROUGH AIRFOIL TO LEADING EDGE 2.5 INCHES (63.500 mm) MAXIMUM. CRACK CANNOT PASS AROUND LEADING EDGE.
RADIAL CRACK 2.5 INCHES (63.500 mm) MAXIMUM. CRACK CAN ENTER FILLET RADIUS
T.E. AXIAL CRACK IN AREA C. CRACK MUST BE MORE THAN 2.00 INCH (50.8 mm) FROM T.E. ON BOTH SIDES. MAXIMUM OF (4) STRUTS CRACKED IN T.E. PERMITTED.
1.0 INCH (25.400 mm)
A
AREA B STRUT LEADING EDGE
STRUT TRAILING EDGE
AREA A STRUT AIRFOIL AND TRAILING EDGE
L.E. RADIAL CRACK 2.5 INCHES (63.500 mm) MAXIMUM. CRACK MAY ENTER THE FILLET RADIUS AREAS CHORD
CRACKS UNDER 0.75 INCH (91.050 mm) PERMISSIBLE
THREE AIRFOIL CRACKS MAXIMUM PER STRUT OVER 1.25 INCHES (31.750 mm). ONE CRACK MAXIMUM OVER 1.75 INCHES (44.450 mm)
AXIAL CRACK ALONG WELD LINE IN AREAS A AND B ONLY, 2.5 INCHES (63.500 mm) MAXIMUM. ONE CRACK OF THIS TYPE PER STRUT. CRACK CAN PASS AROUND THE LEADING EDGE
AREA D STRUT O.D. FILLET RADIUS AREA TO WELD LINE
T.E. AXIAL CRACK IN AREA D. CRACK MUST NOT BE MORE THAN 2.5 INCH (63.50 mm) FROM T.E. ON BOTH SIDES. MAXIMUM OF (4) STRUTS CRACKED IN TRAILING EDGE PERMITTED.
NO U SHAPE CRACKS OR IMPENDING MATERIAL LIBERATION PERMITTED
DIMENSION C
DIMENSION D
FOR CRACKS AROUND THE TRAILING EDGE IN AREA D, DIMENSION C OR D MUST NOT BE MORE THAN 2.50 INCH (63.50 mm)
L-A0633 (0101)
PW V

Turbine Exhaust Case Reduced Interval Inspection Maximum Damage
Figure 806
(Task 72−00−00−210−009)


THREE CRACKS MAXIMUM OVER 1.25 INCHES (31.750 mm) BETWEEN ANY TWO STRUTS.MAXIMUM LENGTH IS 2.5 INCHES (63.500 mm)
TWO CRACKS MAXIMUM THROUGH THE FILLET RADIUS ON ANY STRUT
NO U SHAPED CRACKS OR IMPENDING LIBERATION OF MATERIAL PERMITTED
TWO INTERSECTING CRACKS CONSIDERED AS A SINGLE CRACK
CRACKS UNDER .75 INCH (19.050 mm) PERMITTED IF CONFINED TO DUCT AREA
VIEW A
1.0 INCH (25.400MM
STRUT LEADING EDGE
1.5 INCHES (38.100mm)
1.0 INCH(25.400mm) TAPER
0.5 INCH (12.700mm
I.D. OR O.D. DUCT AREA
I.D. OR O.D. FILLET RADIUS AREA CORD.
L−A0639

Turbine Exhaust Case Reduced Interval
Inspection Maximum Damage (View−A−)
Figure 807
(Task 72−00−00−210−009)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INSPECTION/CHECK-02

Task 72-00-00-210-001:

1. Inspect The Turbine Cooling Air (TCA) System And The Turbine Case Cooling (TCC) System

A. Equipment And Materials Required - None

B. Inspect Manifolds And Tubes

(1) Visually inspect manifolds for cracks, nicks and dents.

(a) No cracks or nicks are permitted.

(b) Dents are permitted in any quantity provided they are round bottom and exhibit no sharp edges or corners.

(2) Visually inspect supply tubes for cracks, nicks and dents.

(a) Cracks or nicks are not acceptable.

(b) Dents are permitted in any quantity provided they are round bottom and exhibit no sharp edges or corners.

(3) Inspect manifolds and tubes for chafing and corrosion.

(a) Chafing up to maximum of 0.004 inch (0.102 mm) deep present on any manifold is acceptable.

(b) Corrosion up to maximum of 0.004 inch (0.102 mm) deep present on any manifold is acceptable.

C. Inspect Supports And Clamps

(1) Evidence of looseness, cracks or damage to cushion material is acceptable within limits specified below.

(a) Looseness of supports or clamps attached to the manifolds is not acceptable and must be corrected.

(b) Inspect supports and clamps for cracks. None are acceptable.

(c) Inspect clamps for damage to cushion material. Any extent is acceptable unless looseness or chafing occur.

D. Inspect Valves, Solenoids, And Actuators
See Figure 801 and Figure 802.

(1) Functional checks − see appropriate Component Maintenance Manual.

(2) Physical inspection of supports/brackets.

(a) Looseness of supports/brackets attached to any valve/solenoid is not acceptable and must be corrected.

(3) Examine the valves, solenoids and actuators for condition and serviceable installation.

(4) Examine the position indication pin in each turbine vane and blade cooling air valve. See Figure 801.

NOTE: Valves are spring loaded open when not in operation.

(a) An extended pin shows the valve is fully open (normal condition).

(b) If the pin is not fully extended, the valve is not fully open. Replace valve.

E. Inspect The Turbine Case Cooling (TCC) Control System And Linkage.
See Figure 803.

NOTE: Use this check to:

- Do a general inspection when a damaged or defective component is not suspected.
- Do a general inspection without any disassembly.
- Also see the check in Paragraph F when you do suspect improper operation of the system.

(1) Examine the clamps that attach the actuator to the bracket for looseness, wear, and cracks. Replace the clamps if necessary.

(2) Examine the clamps that attach the control cable to the brackets for looseness, wear, and cracks. Replace the clamps if necessary.

(3) Examine the cable rod end and the adjuster rod ends for wear. If you find any worn rod end, replace the rod end and adjust the system per 72-00-00, Special Procedures-11 Task 72-00-00-830-005.

(4) Examine the cable rod end and the adjuster rod ends that they are correctly attached.

(5) Examine the air valves and be sure that the valves are in the full closed (shut down) position.

F. Inspect Turbine Case Cooling Control (TCC) System And Linkage
See Figure 803.

NOTE: Use this check and the check in Paragraph E. to:

- Find any secondary damage caused by a known defective component
- Find the cause of damage to a component.

NOTE: Use the check in Paragraph E. to:

- Do a general inspection when a damaged or defective component is not suspected
- Do a general inspection without any disassembly.

(1) Remove the bolt and nut that attach the cable rod end to the idler arm.

(2) Manually pull the cable rod end rearward. If the cable rod end separates from the cable, the shear pin is defective. If necessary, replace the cable per 72-00-53, Removal-06 Task 72-00-53-050-004 and 72-00-53, Installation-06 Task 72-00-53-450-004.

(3) Remove the two bolts, nuts, and front bushing that attach the adjuster to the valve lever arms.

(4) Examine the adjuster rod end bearings for wear and if the bearings turn freely in the rod ends. If necessary, replace the adjuster rod ends as follows.

(a) Remove lockwire and loosen the applicable jamnut. Replace the rod end and jamnut.

(b) Adjust and rig the system per Special Procedures-06 Task 72-00-00-830-004.

(5) Examine the idler arm for wear and see if it turns freely on the valve shaft. If not, replace the idler arm or bearing as follows.

(a) Remove the nut that attaches the idler arm with the bearing and retaining ring. Remove the arm. If equipped with a spacer replace the nut on the shaft and tighten by hand.

(b) Remove the retaining ring and bearing from the idler arm.

(c) Replace the defective part and install the bearing to the arm. Install the retaining ring.

(d) Remove the nut from the shaft. Install the arm, and if equipped with the spacer in position. Install the nut, lubricated with Engine Oil P03-001. Torque the nut to 36 - 40 lb-in. (4.067 - 4.519 N.m). Adjust and rig the system per Special Procedures-06 Task 72-00-00-830-004.

(6) Manually turn the HPT and LPT valve lever arms clockwise to the full open position. Release the lever arms and be sure the valves go back to full closed position. If a lever arm does not go back or does not turn freely, replace the defective valve. See 72-00-52, Removal-04 Task 72-00-52-050-001 and Installation-04 Task 72-00-52-450-001 or 72-00-53, Removal-07 Task 72-00-53-050-001 and Installation-07 Task 72-00-53-450-001 as applicable.

(7) If the control cable or the actuator is suspected of seizure, do as follows.

(a) Remove the actuator per 72-00-35, Removal-05 Task 72-00-35-050-002.

(b) Use the soft drift and manually push the piston shaft into the actuator. If the shaft does not move freely or does not come back, replace the actuator per 72-00-35, Installation-05 Task 72-00-35-450-002.

(c) Manually push and pull the control cable for the full travel. If the cable does not move freely, replace the cable per 72-00-53, Removal-06 Task 72-00-53-050-004 and 72-00-53, Installation-06 Task 72-00-53-450-004.

(8) If the adjustment of the system is suspected of being off, check the rigging per Special Procedures−06 Task 72−00−00−830−004.

(9) Install the adjustor assembly as follows.

(a) Install the bushing (flange outward) to the outside of the idler arm bolt hole.

(b) Position the adjustor assembly to the valve lever arm and the idler arm.

(c) Attach the adjustor assembly with two bolts, lubricated with Engine Oil P03−001, and nuts. Torque the nuts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

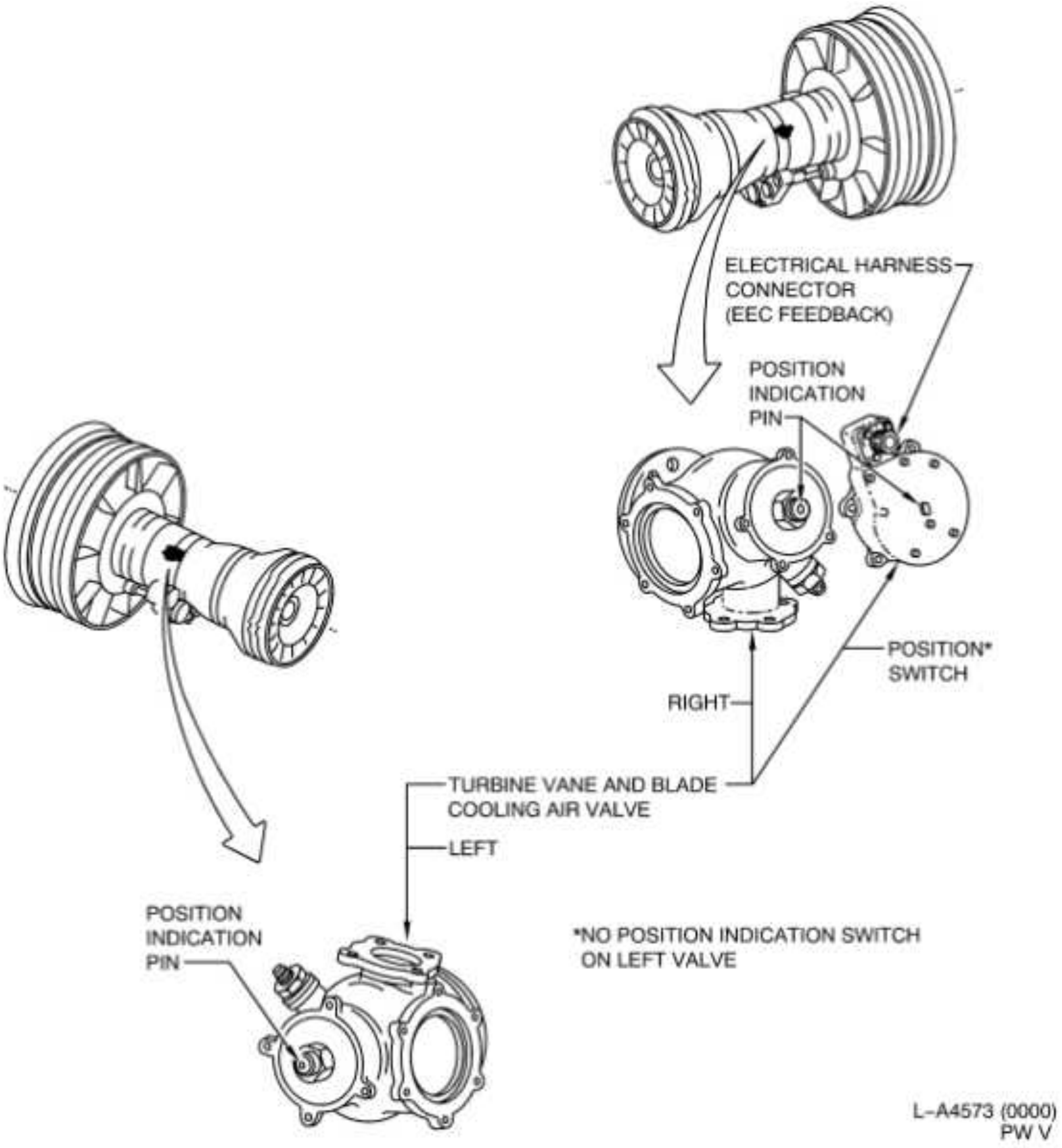
NOTE: Install the bolts from the inside of the arms.

(10) Attach the cable rod end to the inside of the idler arm with the bolt, lubricated with Engine Oil P03−001. Install the nut and torque it to 36 − 40 lb−in. (4.067 − 4.519 N.m).

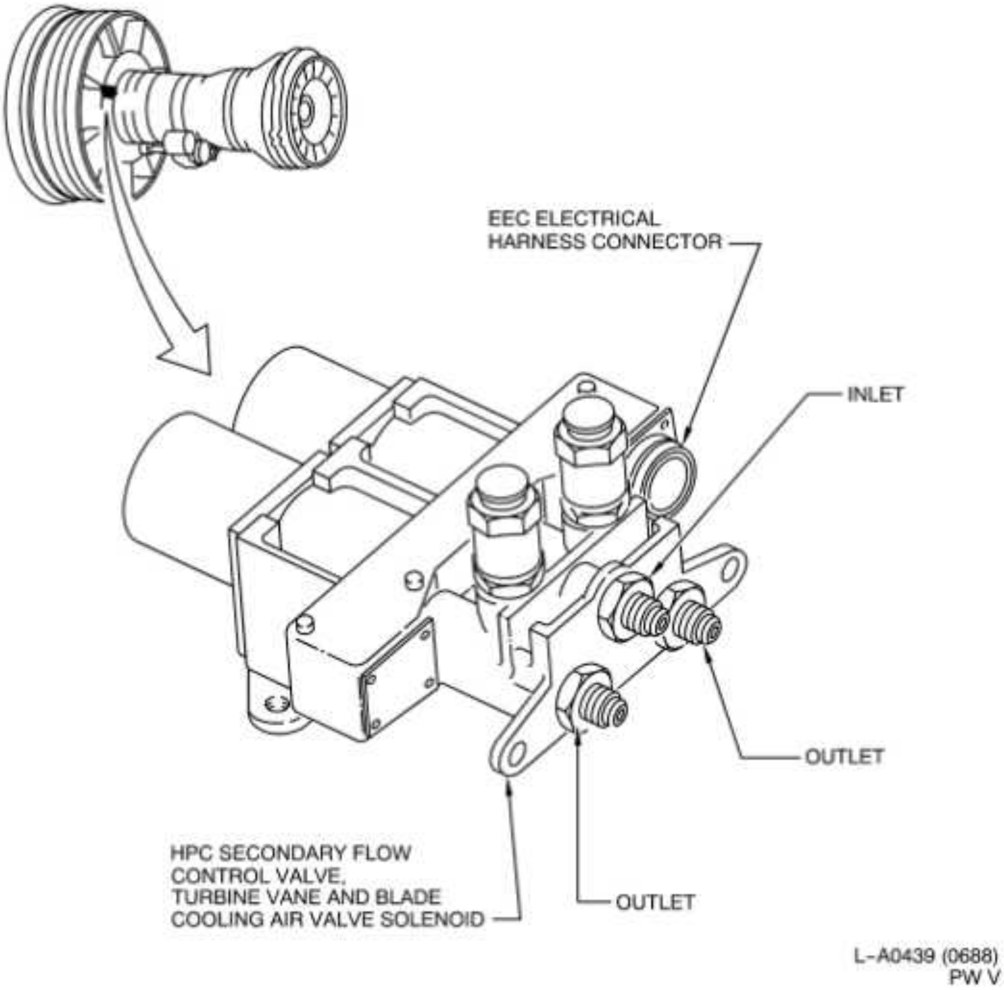
NOTE: Install the bolt from the inside of the rod end.

G. Examine Electrical Harnesses For Signs Of Rub, Wear, And/Or Loose Connectors. Replace As Required.

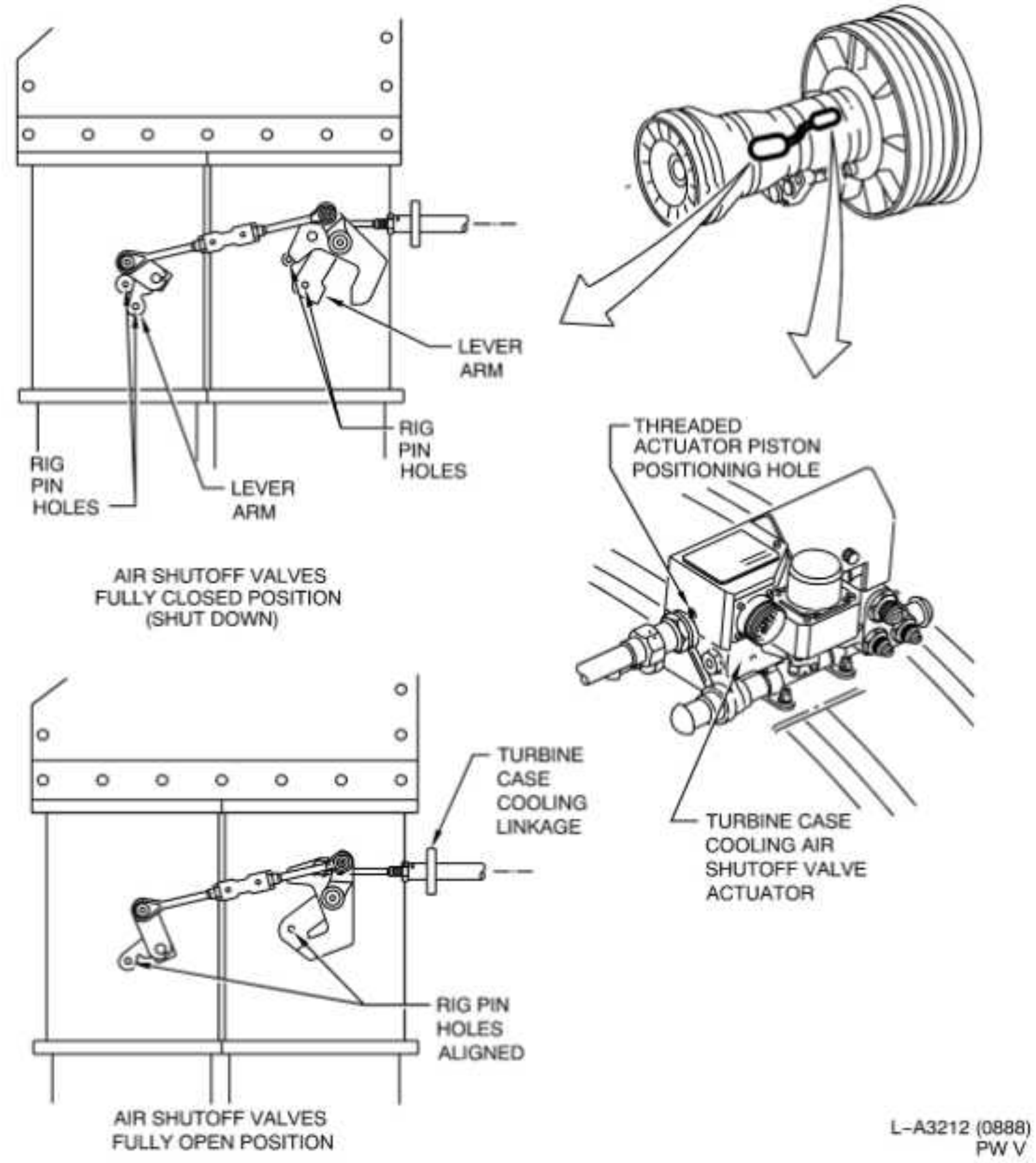
NOTE: See Installation−00 Task 72−00−00−990−009 for the torque procedure if you find any loose connectors.


ELECTRICAL HARNESS CONNECTOR (EEC FEEDBACK)
POSITION INDICATION PIN
POSITION* SWITCH
RIGHT
TURBINE VANE AND BLADE COOLING AIR VALVE
LEFT
POSITION INDICATION PIN
*NO POSITION INDICATION SWITCH ON LEFT VALVE
L−A4573 (0000)
PW V

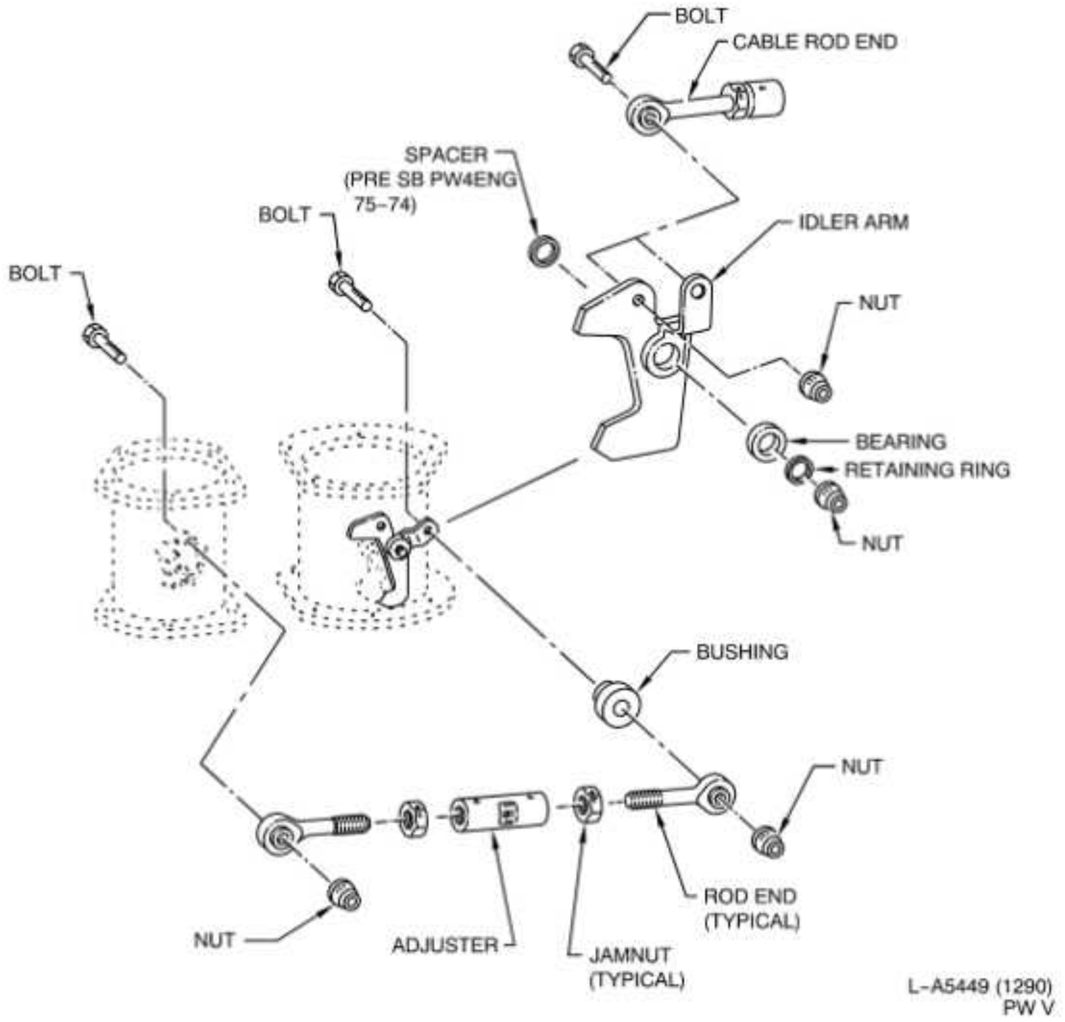
Turbine Vane And Blade Cooling Air Valves
Figure 801
(Task 72−00−00−210−001)


EEC ELECTRICAL HARNESS CONNECTOR
INLET
OUTLET
HPC SECONDARY FLOW CONTROL VALVE, TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
OUTLET
L-A0439 (0688)
PW V

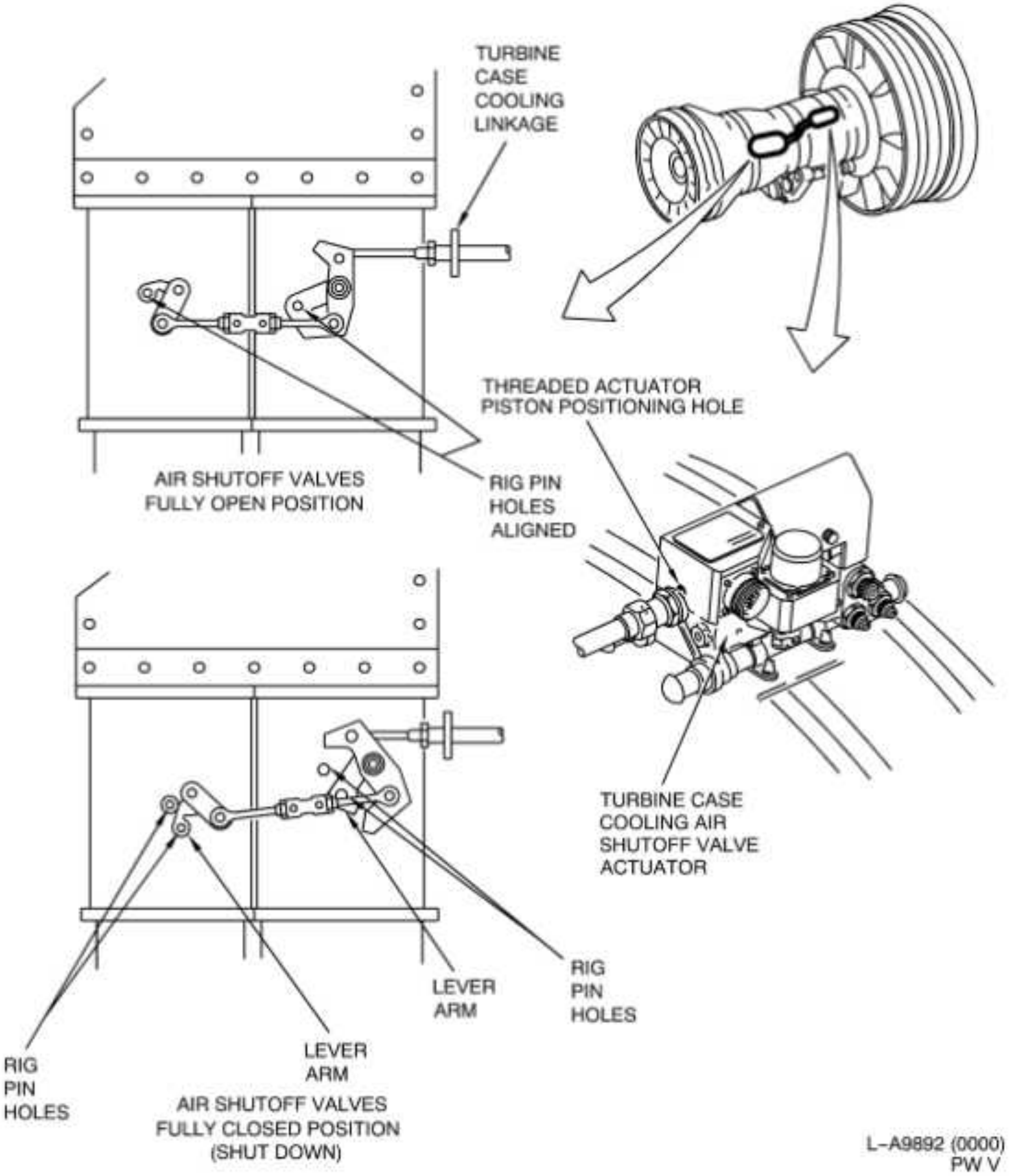
HPC Secondary Flow Control Valve, Turbine
Vane And Blade Cooling Air Valve Solenoid
Figure 802
(Task 72-00-00-210-001)


LEVER ARM
RIG PIN HOLES
RIG PIN HOLES
LEVER ARM
AIR SHUTOFF VALVES FULLY CLOSED POSITION (SHUT DOWN)
THREADED ACTUATOR PISTON POSITIONING HOLE
TURBINE CASE COOLING LINKAGE
TURBINE CASE COOLING AIR SHUTOFF VALVE ACTUATOR
RIG PIN HOLES ALIGNED
AIR SHUTOFF VALVES FULLY OPEN POSITION
L−A3212 (0888)
PW V

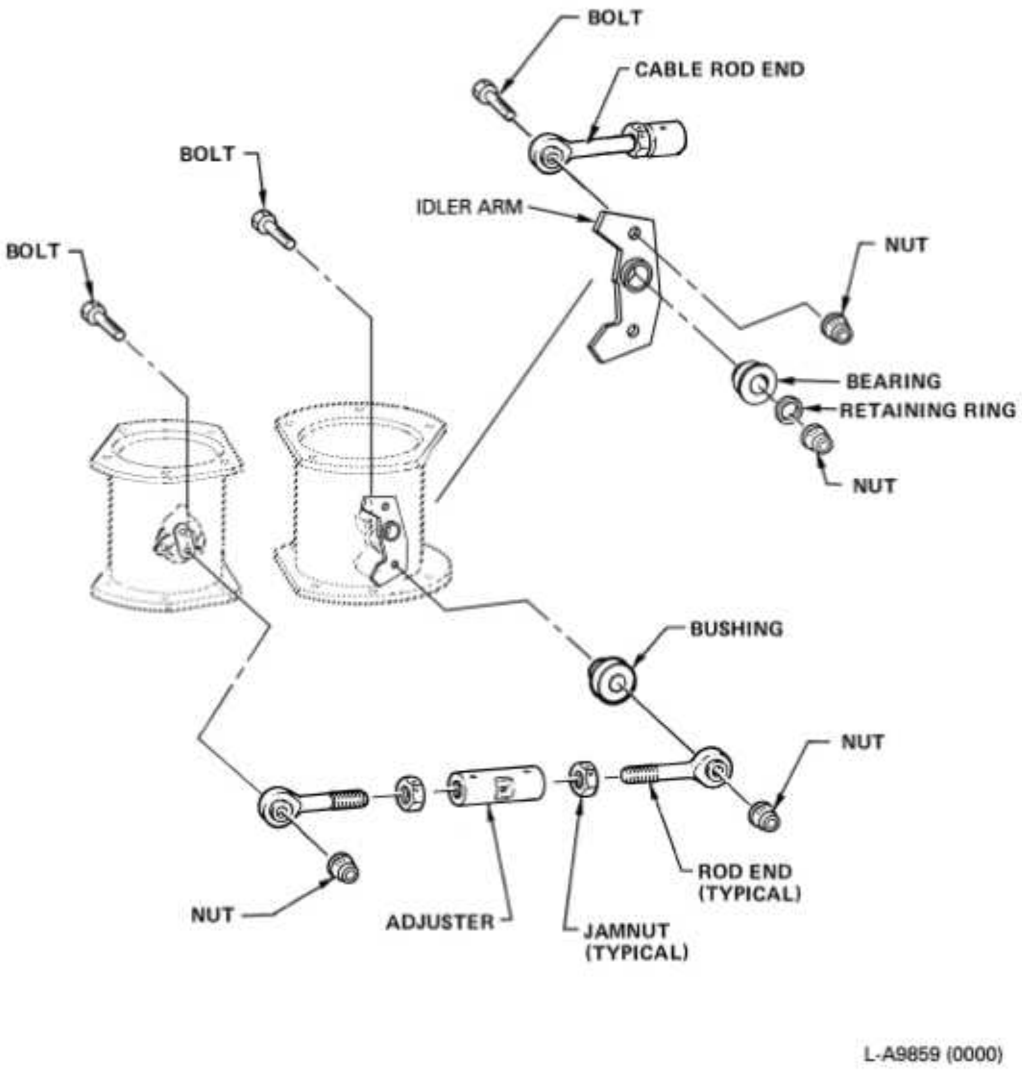
Turbine Case Cooling System Linkage Inspection (Pre And Post SB PW4ENG 72−572 And Post SB PW4ENG 72−592 Engines)
Figure 803 (Sheet 1)
(Task 72−00−00−210−001)


BOLT
CABLE ROD END
SPACER (PRE SB PW4ENG 75-74)
BOLT
IDLER ARM
BOLT
NUT
BEARING
RETAINING RING
NUT
BUSHING
NUT
ROD END (TYPICAL)
NUT
ADJUSTER
JAMNUT (TYPICAL)
L-A5449 (1290)
PW V

Turbine Case Cooling System Linkage Inspection (Pre And
Post SB PW4ENG 72−572 And Post SB PW4ENG 72−592 Engines)
Figure 803 (Sheet 2)
(Task 72−00−00−210−001)


TURBINE
CASE
COOLING
LINKAGE
THREADED ACTUATOR
PISTON POSITIONING HOLE
AIR SHUTOFF VALVES
FULLY OPEN POSITION
RIG PIN
HOLES
ALIGNED
TURBINE CASE
COOLING AIR
SHUTOFF VALVE
ACTUATOR
LEVER
ARM
RIG
PIN
HOLES
RIG
PIN
HOLES
LEVER
ARM
AIR SHUTOFF VALVES
FULLY CLOSED POSITION
(SHUT DOWN)
L−A9892 (0000)
PW V

Turbine Case Cooling System Linkage
Inspection (Phase 3 Engines As Built By P&W)
Figure 803 (Sheet 3)
(Task 72−00−00−210−001)


BOLT
CABLE ROD END
BOLT
IDLER ARM
BOLT
NUT
BEARING
RETAINING RING
NUT
BUSHING
NUT
ROD END
(TYPICAL)
NUT
ADJUSTER
JAMNUT
(TYPICAL)
L-A9859 (0000)

Turbine Case Cooling System Linkage
Inspection (Phase 3 Engines As Built By P&W)
Figure 803 (Sheet 4)
(Task 72−00−00−210−001)

Task 72-00-00-280-053:

1. Perform Oil Overtemperature Inspection

A. Equipment And Materials Required

Standard Tools:
0.190-32 Jackscrews (8 Required) (Post SB PW4ENG 72-385)
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 85307	Puller, Jackscrew
PWA 85518	Puller
PWA 86018	Adapter, Oil Sampler

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
R P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72-54-00/5/90
Packing	1	72-62-00/3/130
Packing	1	79-22-00/3/1
Packing	1	79-23-00/2/1

B. Introduction

(1) See Table 801 for necessary procedures.

Range Of High Oil Temperature	Length Of High Temperature	Conditions of Engine Operation	Steps You Must Do Before You Can Use The Engine
325° - 350°F (163° - 177°C)	Less than 20 minutes	During a change from high power*	(1) None. Engine operation is correct.

Table 801

Range Of High Oil Temperature	Length Of High Temperature	Conditions of Engine Operation	Steps You Must Do Before You Can Use The Engine
325° − 350°F 163° − 177°C)	More than 20 minutes	Steady state operation	(1) Do "Inspections For Moderately High Temperature" (2) Correct the cause of the problem
351° − 400°F (177° − 204°C)	Any length of time	Any conditions of operation	(1) Correct any damage that the high temperature caused.
400°F + (204.4°C)+	Any length of time	Any conditions of operation	(1) Do "Inspections For Moderately High Temperature" (2) Do "Inspections For Very High Temperature" (3) Correct the cause of the problem (4) Correct any engine damage that the high temperature caused.

*High oil temperature and low fuel flow

Table 801 (Continued)

C. Inspections For Moderately High Temperature

(1) Examine the data from the aircraft indicating system that is related to:

(a) The engine oil system.

(b) The integrated−drive generator system (IDGS).

(2) Examine the instruments for correct operation.

(3) Do 71−00−00, Testing−07 Task 71−00−00−760−038.

(a) Examine the results for EEC/fuel/oil system defects.

(4) Do a check of the fuel/oil-cooler bypass valve.

(a) Remove the old valve. Install a new one. Refer to 72-00-35, Removal-11 Task 72-00-35-050-008 and 72-00-35, Installation-11 Task 72-00-35-450-008.

(b) Do 71-00-00, Testing-04 Task 71-00-00-760-031.

1 Do not do the acceleration/deceleration test.

2 Write down the new oil temperature data.

(c) Compare the new oil temperature data:

1 With the data from before replacement of the valve.

2 With the data from an engine which has correct temperature.

(d) If the oil temperature data from the test are satisfactory, the removed bypass valve was defective.

(5) Examine the engine air/oil heat exchanger and valve for satisfactory operation. See Figure 801.

(a) Disconnect W3P17. When W3P17 is disconnected, the valve is in the "open" position.

(b) Do 71-00-00, Testing-04 Task 71-00-00-760-031.

1 Do not do the acceleration/deceleration test.

2 Write down the new oil temperature data.

(c) Compare the new oil temperature data:

1 With the data from before W3P17 was disconnected.

2 With the data from an engine which has correct temperature.

(d) If the oil temperature data from the test are much better than the data from before, the valve is defective. Refer to 72-00-34, Removal-11 (Task 720034050008) and Installation-11 (Task 72-00-34-450-008) for replacement of the valve.

(6) Examine the oil system for contamination. Do Inspection/Check-04 (Task 72-00-00-280-054).

(a) Do not do the "Hydraulic Fluid Contamination Inspection".

NOTE: The procedures to drain and flush that are in Inspection/Check-04 are also in the procedures that follow. You will want to schedule operations to keep to a minimum the number of times you do the same operation.

(7) Get a sample of oil.

(a) Use PWA 86018 Adapter as follows:

1 Remove the magnetic chip detector assembly in the oil tank. Refer to 72-00-61, Removal-36 (Task 72-00-61-050-017).

2 Install PWA 86018 Adapter in the hole for the magnetic chip detector assembly.

3 Get a sample of oil.

(b) Examine the oil. If the answer to the three questions that follow is "no", do not continue the inspections. If the answer to any of the questions is "yes", do all the inspections in this section. Refer to SB PW4ENG 238 for oil quality limits.

1 Look at the color. Is the oil much darker than usual?

2 Is the oil more viscous?

3 Has the Total Acid Number (TAN) increased?

(c) Examine the main gearbox for discoloration, distortion, and burned areas. None is permitted. If there is any indication of this type of damage, remove and repair the engine.

(d) Drain the engine. Do 72-00-00, Servicing-01 Task 72-00-00-610-001.

NOTE: The procedures that follow will let you examine the engine for coke and deterioration of packings. Coke and packings with deterioration are possible indications of clogged oil nozzles or defective carbon seal assemblies. These two conditions can cause high oil temperature.

(e) Look in the angle gearbox. See Figure 802 and Figure 803.

1 Open the angle gearbox.

a Remove the liner segment that is below the angle gearbox. Refer to 72-00-33, Removal-16 Task 72-00-33-040-001.

b Remove the retaining ring that keeps the plug in the angle-gearbox cover-assembly installed.

c Remove the plug. Use PWA 85518 Puller.

2 Examine the internal part of the angle gearbox.

a Examine the packing that is on the plug for deterioration.

b Examine the gears for coke.

3 If you find coke, the No. 1, 1.5 and 2 bearing compartment carbon seals and/or oil nozzles are possibly damaged. Remove and repair the engine.

4 If you do not find coke, close the angle gearbox.

a Lubricate a new packing for the plug with Engine Oil P03-001.

b Install the packing on the plug.

c Install the plug in the angle-gearbox cover assembly.

d Install the retaining ring.

e Install the liner segment that is at 6 o'clock. Refer to 72-00-33, Installation-16 Task 72-00-33-440-001.

(f) Look in the No. 4 bearing compartment. See Figure 804.

1 Open the No. 4 bearing compartment.

a Remove the bolts (804/3) that attach the No. 4 bearing shield (804/4) to the rear inner flange of the turbine exhaust case. Remove the shield (804/4).

b Remove the No. 4 bearing heat shield (804/5).

2 Open the No. 4 bearing compartment.

a Remove the bolts (804/3) that attach the No. 4 bearing shield (804/4) to the rear inner flange of the turbine exhaust case. Remove the shield (804/4).

b Remove the No. 4 bearing heat shield (804/5).

c For No. 4 bearing cover (804/2) that has six small threaded holes (Pre SB PW4ENG 72-385), install the PWA 85307 Jackscrew Puller to the rear inner bolt hole flange (Flange T1) of the exhaust case and attach with two bolts, washers and nut details. Install the small plate of the puller to the six threaded holes in the cover and attach with six knurled screw details. Turn the jackscrew to disengage the cover from the exhaust case. Remove the puller and the cover from the exhaust case. Remove the cover from the puller. Discard the packing (804/1).

d For No. 4 bearing cover (804/2) that has eight jackscrew holes (Post SB PW4ENG 72-385), install and evenly tighten eight 0.190-32 jackscrews to remove the cover. Discard the packing (804/1).

3 Examine the internal part of the No. 4 bearing compartment.

a Examine the packing for signs of deterioration.

b Examine the cover for signs of coke.

c Look in the compartment for signs of coke.

4 If you find coke, the No. 4 bearing carbon seal and/or oil nozzle is possibly damaged. Remove and repair the engine.

CAUTION: YOU MUST APPLY ENGINE OIL FULLY TO THE COVER PACKING OR YOU WILL CUT THE PACKING DURING INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN-FLIGHT SHUTDOWN.

CAUTION: INSTALL THE COVER INTO POSITION USING FOUR WORK BOLTS EQUALLY SPACED AROUND THE COVER. TIGHTEN THE BOLTS EQUALLY IN SMALL INCREMENTS TO PULL THE COVER INTO POSITION EQUALLY. MONITOR THE ENGAGEMENT OF THE COVER TO MAKE SURE THAT THE PACKING IS NOT CUT DURING INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN-FLIGHT SHUTDOWN.

5 If you do not find coke, close the No. 4 bearing compartment as follows.

a Apply Engine Oil P03-001 fully to the new packing (804/1).

b Install the new packing into the groove at the rear flange of the No. 4 bearing cover (804/2).

c Install the cover into the rear inner flange of the exhaust case.

d Install 4 work bolts equally spaced around the cover.

e Tighten the bolts equally in small increments to pull the cover into position equally.

f Monitor the engagement of the cover to make sure the packing is not cut.

g Remove the work bolts.

h Put the heat shield (804/5) in the recess in the shield (804/4).

i Lubricate the threads of 30 bolts (804/3) with Engine Oil P03−001.

j Attach the shield with the bolts. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(g) Examine the No. 3 bearing oil scavenge manifold assembly (LR04) for coke and other deterioration as follows. See Figure 805.

1 Remove the (LR04) manifold assembly as follows.

a Remove the lockwire. Disconnect the nut from the manifold elbow that is on the diffuser case.

b Remove the bolts that attach the manifold to the oil pump port.

c Remove the clamp bolt and nut that attach the manifold.

d Remove the manifold.

e Discard the packing.

2 Look for coke in the manifold and in the diffuser case internal tube.

3 If you find coke in the manifold, the No. 3 bearing carbon seals or oil nozzle are possibly damaged. Remove and repair the engine.

4 If you do not find coke in the manifold, install the (LR04) manifold as follows.

R a Lubricate with Antiseize Paste P06-054 the threads of the bolts that will go into the
R oil pump. Wipe off unwanted paste.

b Lubricate with Engine Oil P03-001:
- The threads of all other bolts
- A packing
- The threads of the manifold elbow

c Install the packing in the packing groove near the flange of the manifold.

d Install the manifold, at one end, to the tube nut of the diffuser case internal tube. Tighten the tube nut by hand.

e Attach the manifold, at the other end, to the oil pump port with bolts. Tighten the bolts by hand.

f Attach the (LR05) tube and (LR04) manifold to the oil pump bracket with clamps, a bolt, and a nut.

g (Post SB PW4ENG 79-46) Attach the (LR04) manifold to the (LR05) tube with the clamps, bolt, and nut. Be sure the (clip-on) loop clamp grommet halves are on the (LR04) manifold and the (LR05) tube at this clamping location.

h Torque the bolts/nuts to these torques:
- Clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m)
- Tube nut to 650 - 700 lb-in. (73.440 - 79.089 N.m)
- Other bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m)

i Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 in the tube nut and the manifold/oil pump bolts.

(h) Examine the No. 3 bearing breather tube assemblies (LB03 and LB04) for coke. See Figure 806.

1 Remove the upper tube (LB03) as follows:

a Remove the lockwire from the upper and lower tube nuts of the upper tube.

b Disconnect the tube from the diffuser case internal tube nut at approximately 1 o'clock position.

c Disconnect the tube from the lower tube nut at approximately 10 o'clock position.

d Remove the clamp bolts and nuts that attach the tube to brackets.

e Remove the tube.

2 Remove the lower tube (LB04) as follows:

a Remove the three bolts that attach the tube to the gearbox deoiler.

b Remove the clamp bolt that attaches the tube to the bracket.

c Disengage the tube. Discard the packing.

3 Examine in the breather tubes and in the diffuser case internal tube for coke.

4 If you find coke, the No. 3 bearing carbon seals and/or oil nozzle are possibly damaged. Remove and repair the engine.

5 If you do not find coke in the tubes, install the lower tube (LB04) as follows:

a Lubricate with Engine Oil P03−001:
− The packing
− The threads of all the bolts

b Install a new packing in the groove at the flanged end of the tube.

c Attach the tube to the gearbox pad with three bolts. Tighten the bolts by hand.

d Attach the clamp to the bracket with one bolt.

e Torque the:
- Clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m)
- Other bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m)

f Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the gearbox pad bolts.

6 If you do not find coke in the tubes, install the upper tube (LB03).

R a Lubricate with Antiseize Paste P06−054 and
R wipe off unwanted paste:
- The threads of the lower tube nut

b Lubricate with Engine Oil P03−001:
- The threads of the tube nut (internal tube of the diffuser case)

c Install the tube to the tube nuts. Tighten the tube nuts by hand.

d Attach the clamps to the brackets with bolts and nuts.

e Torque the:
- Clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m)
- Tube nut (internal tube of the diffuser case) to 650 − 700 lb−in. (73.440 − 79.089 N.m)
- Tube nut (lower) to 675 − 750 lb−in. (76.265 − 84.739 N.m)

f Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 in the tube nuts.

(i) If you found no coke:

1 Flush the oil system. Refer to Servicing-05 Task 72-00-00-610-004.

2 Do 71-00-00, Testing-12 Task 71-00-00-760-050.

3 Do 71-00-00, Testing-03 Task 71-00-00-760-030.

4 Examine the color, viscosity, and acidity of the oil after 50 hours of service. If any of these properties is not correct, remove the engine and do the "Inspections For Very High Temperature".

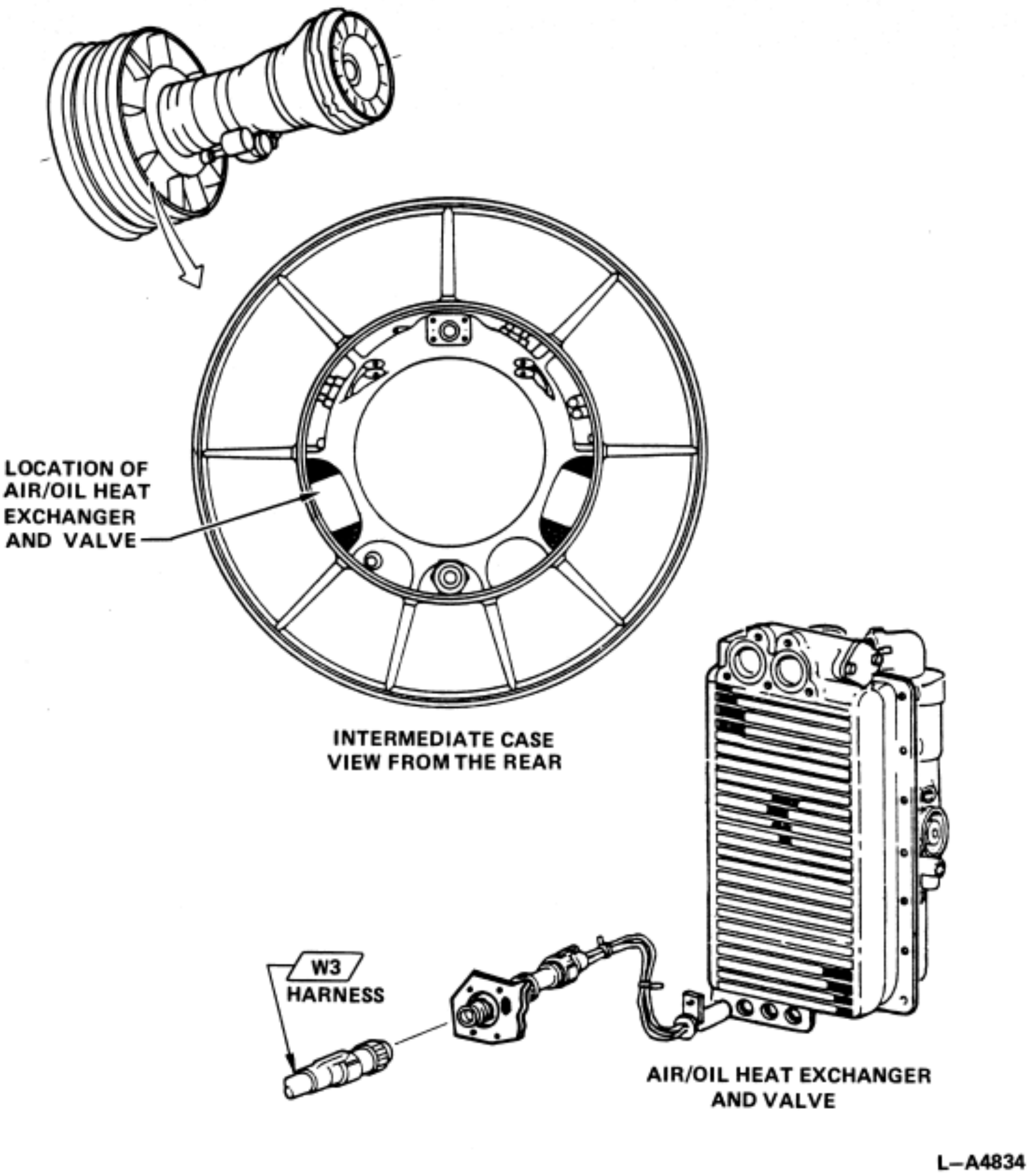
D. Inspections For Very High Temperature

(1) Disassemble the engine to get access to all the main and accessory drive bearings, seals, and nozzles.

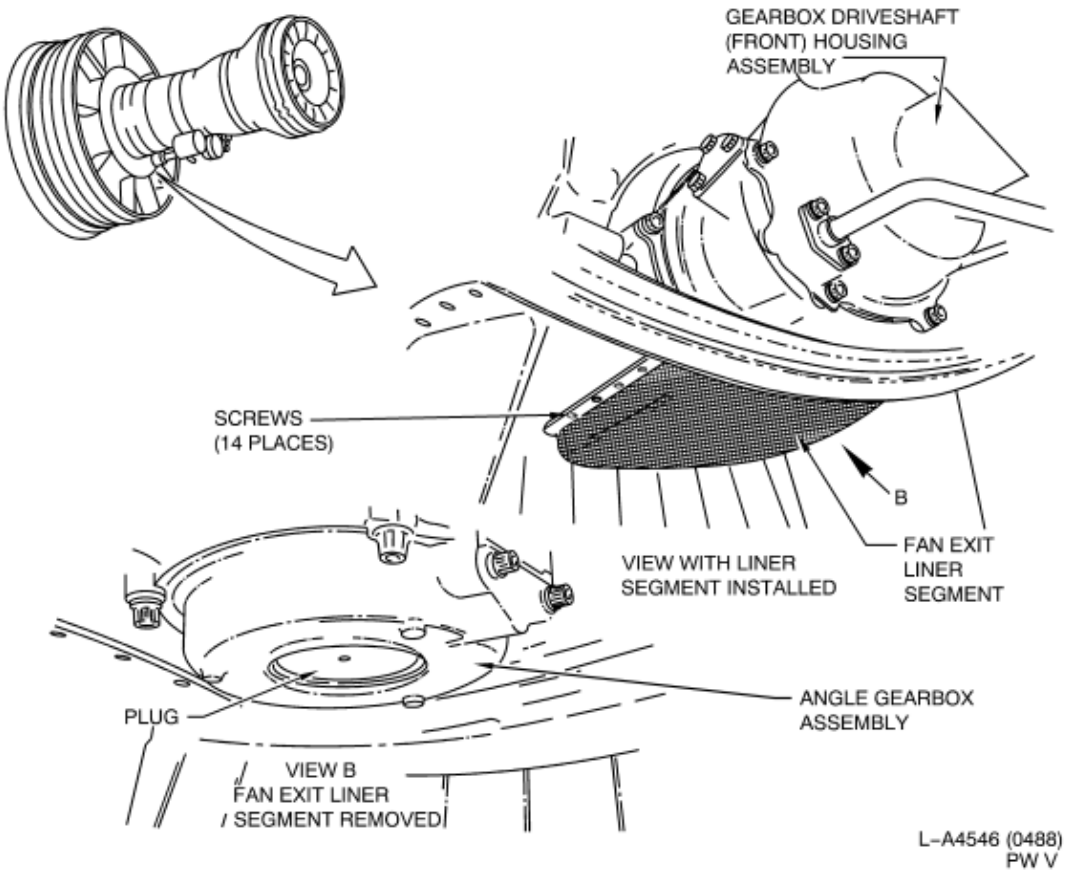
(2) Examine all the main bearings, seals, seal seats, and nozzles.

(3) Examine all the accessory drive bearings, seals, seal seats, and nozzles.

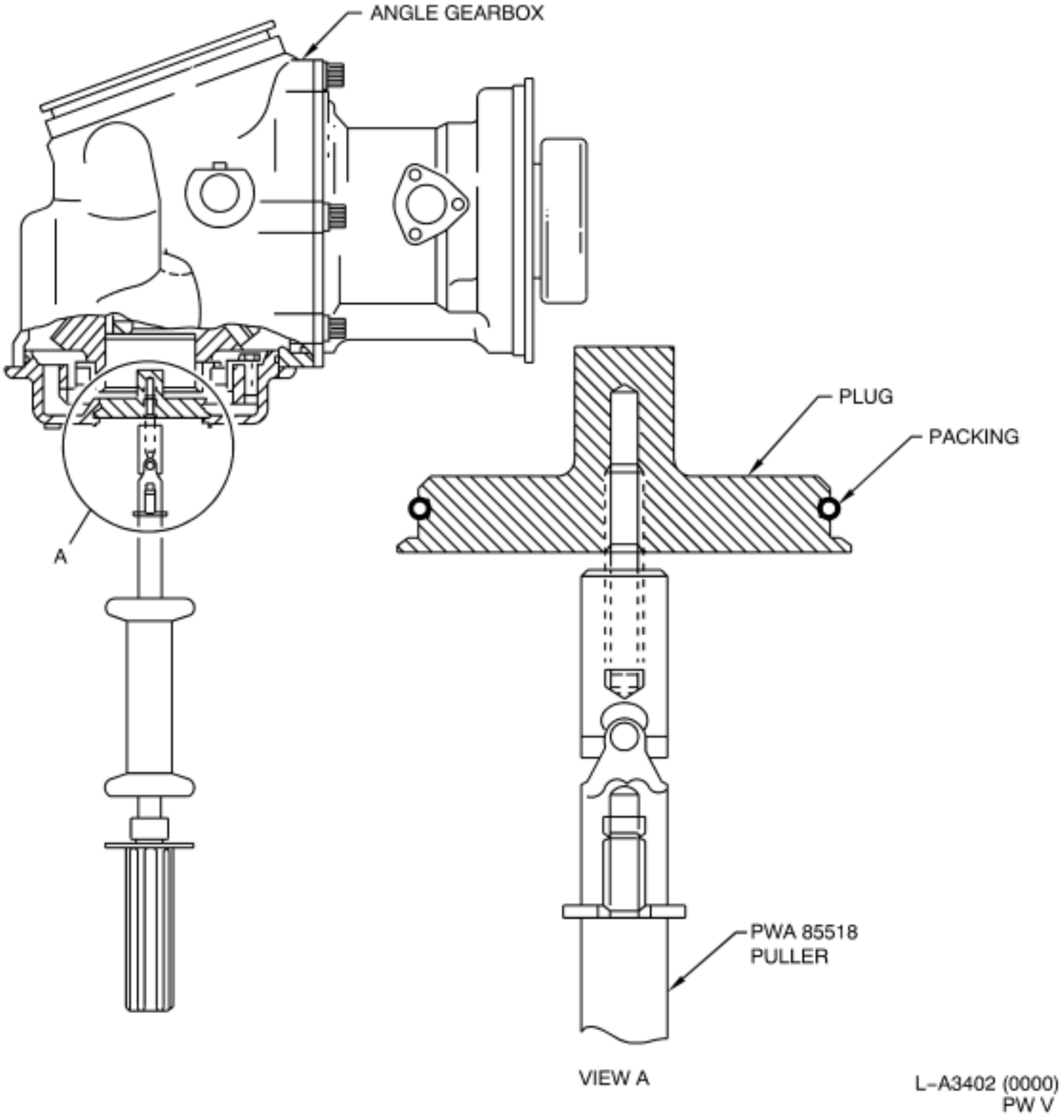
(4) Repair or replace any damaged parts.


LOCATION OF AIR/OIL HEAT EXCHANGER AND VALVE
INTERMEDIATE CASE VIEW FROM THE REAR
W3 HARNESS
AIR/OIL HEAT EXCHANGER AND VALVE
L-A4834

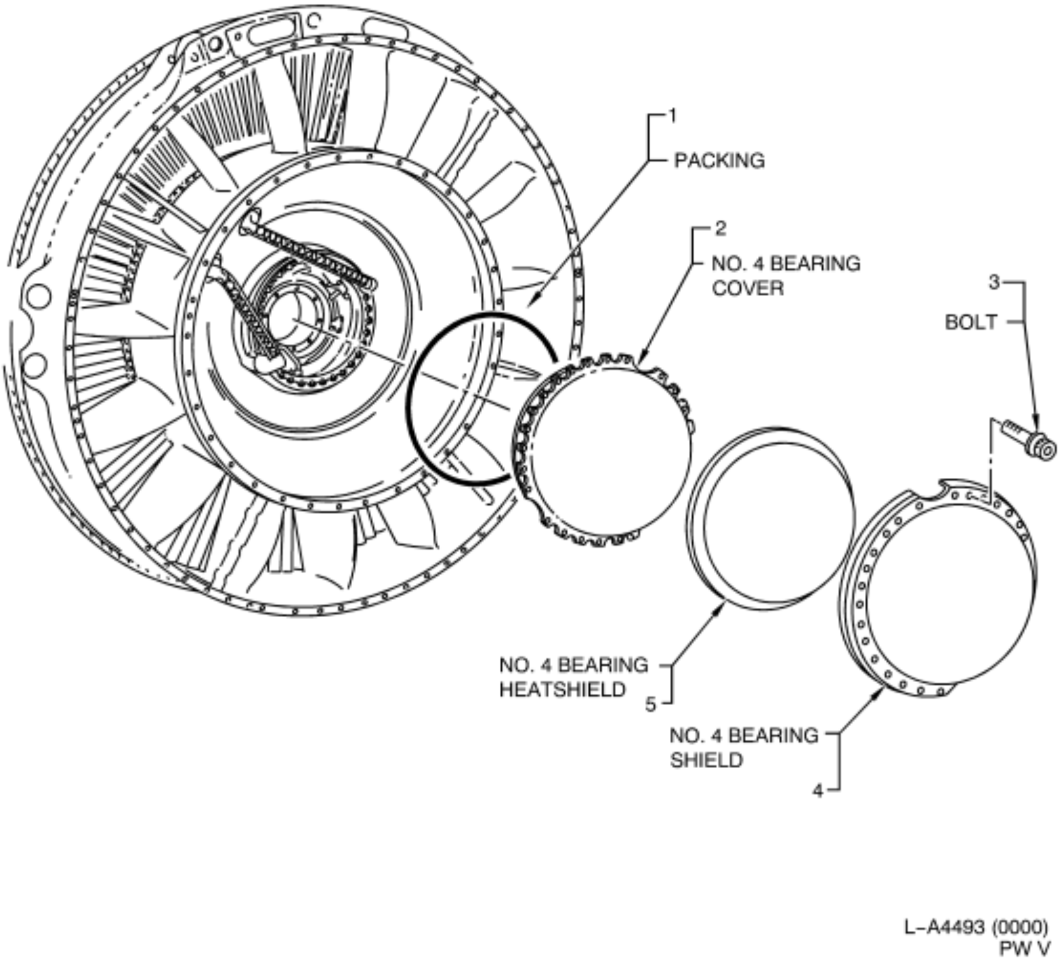
Location Of The Air/Oil Heat Exchanger And Valve
Figure 801
(Task 72-00-00-280-053)


GEARBOX DRIVESHAFT (FRONT) HOUSING ASSEMBLY
SCREWS (14 PLACES)
B
FAN EXIT LINER SEGMENT
VIEW WITH LINER SEGMENT INSTALLED
ANGLE GEARBOX ASSEMBLY
PLUG
VIEW B
FAN EXIT LINER SEGMENT REMOVED
L−A4546 (0488)
PW V

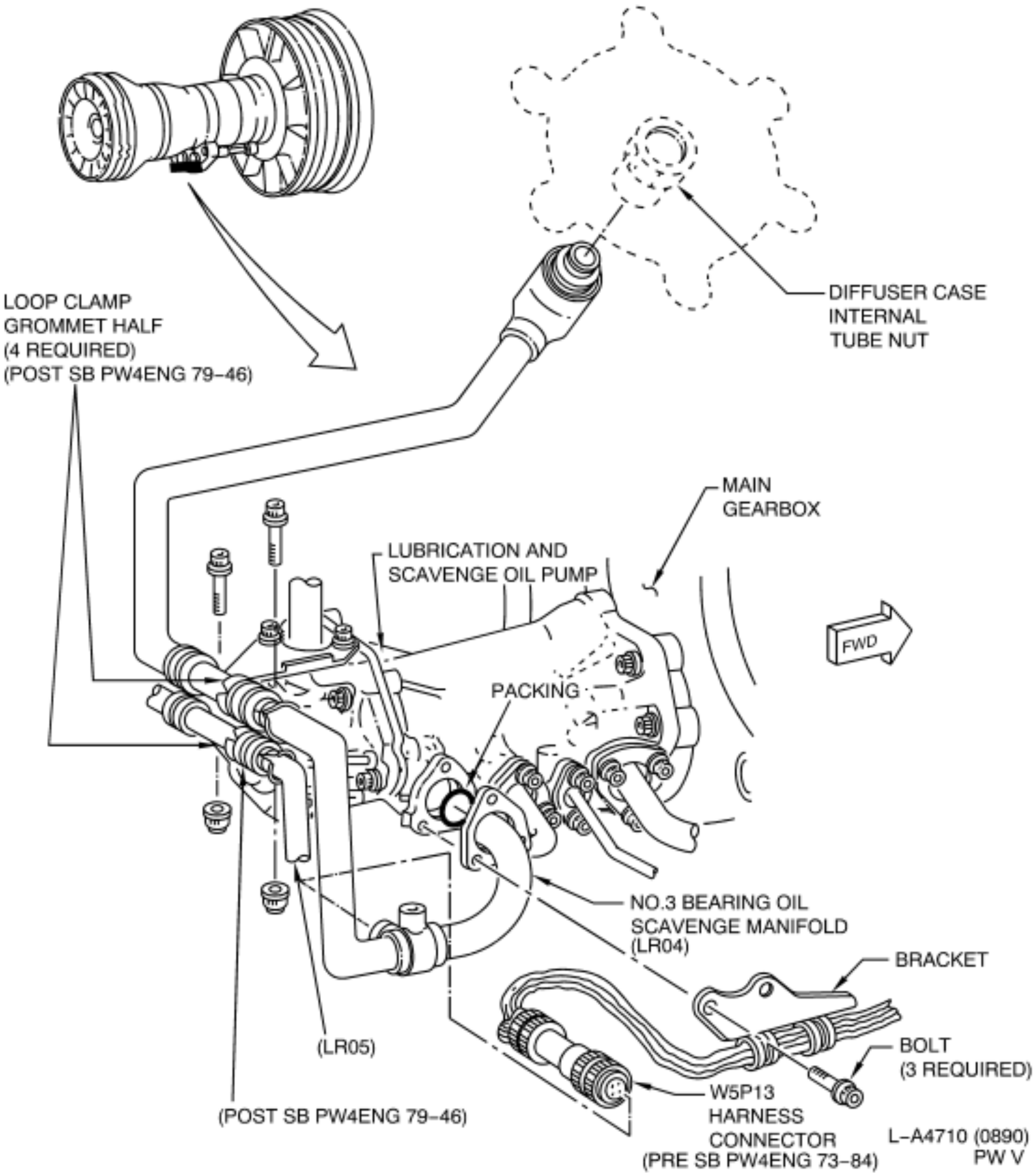
Access To Angle Gearbox
Figure 802
(Task 72−00−00−280−053)


ANGLE GEARBOX
PLUG
PACKING
A
PWA 85518
PULLER
VIEW A
L−A3402 (0000)
PW V

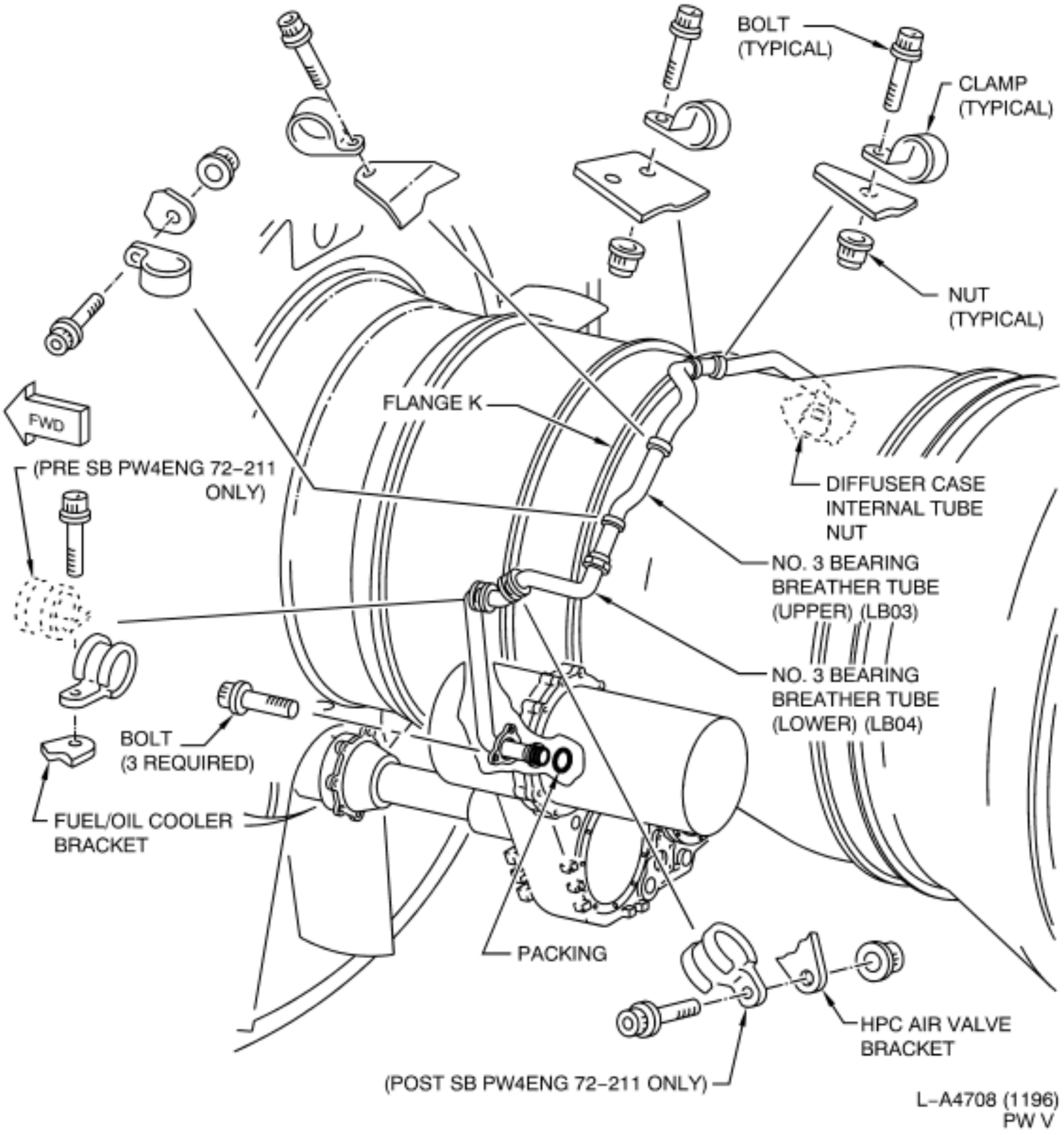
Use The Puller
Figure 803
(Task 72−00−00−280−053)


1
PACKING
2
NO. 4 BEARING COVER
3
BOLT
NO. 4 BEARING HEATSHIELD
5
NO. 4 BEARING SHIELD
4
L−A4493 (0000)
PW V

No. 4 Bearing Shield And Cover Removal/Installation
Figure 804
(Task 72−00−00−280−053)


LOOP CLAMP
GROMMET HALF
(4 REQUIRED)
(POST SB PW4ENG 79−46)
DIFFUSER CASE
INTERNAL
TUBE NUT
MAIN
GEARBOX
LUBRICATION AND
SCAVENGE OIL PUMP
FWD
PACKING
NO.3 BEARING OIL
SCAVENGE MANIFOLD
(LR04)
BRACKET
BOLT
(3 REQUIRED)
(LR05)
(POST SB PW4ENG 79−46)
W5P13
HARNESS
CONNECTOR
(PRE SB PW4ENG 73−84)
L−A4710 (0890)
PW V

No. 3 Bearing Oil−Scavenge Manifold Removal/Installation
Figure 805
(Task 72−00−00−280−053)


BOLT
(TYPICAL)
CLAMP
(TYPICAL)
NUT
(TYPICAL)
FWD
FLANGE K
(PRE SB PW4ENG 72-211
ONLY)
DIFFUSER CASE
INTERNAL TUBE
NUT
NO. 3 BEARING
BREATHER TUBE
(UPPER) (LB03)
NO. 3 BEARING
BREATHER TUBE
(LOWER) (LB04)
BOLT
(3 REQUIRED)
FUEL/OIL COOLER
BRACKET
PACKING
HPC AIR VALVE
BRACKET
(POST SB PW4ENG 72-211 ONLY)
L-A4708 (1196)
PW V

No. 3 Bearing Breather Tube Removal/Installation
Figure 806
(Task 72-00-00-280-053)

Task 72−00−00−280−054:

1. Examine The Oil System For Contamination

A. Equipment And Materials

Special Tools:

PWA 86018	Adapter, Oil Sampler

Consumable Materials:

Item No.	Designation
P11−027	Solvent Petroleum (PMC 9001)

B. Sources Of Contamination

(1) There are four primary sources of contamination of the oil system:

(a) Unwanted material that is in the engine from the time of its assembly (called build debris) and pieces of a repair.

1 This includes pieces of gasket or packing, sealing compound, pieces of metal, etc.

2 These pieces are frequently non−metallic.

3 If metallic, these pieces are frequently larger than the particles that come from a bearing or gear.

(b) Metal particles from a bearing or gear.

1 This contamination is important.

2 You must find the source of the contamination and correct the problem before the engine goes back in service.

(c) Hydraulic fluid (e.g. Skydrol).

CAUTION: HIGH TEMPERATURES CAN CAUSE OIL TO BECOME BLACK. IF HIGH TEMPERATURES ARE A POSSIBLE CAUSE OF BLACK OIL, REFER TO 71−00−00, FAULT ISOLATION−01 TASK 71−00−00−810−001.

1 This contamination is important.

2 Oil that has hydraulic fluid in it is black, thick, and gummy. This oil causes a blockage of jets, nozzles, and small−mesh screens.

3 Oil that has hydraulic fluid in it can cause damage to packings. The quantity of damage depends on the quantity, temperature, and length of time of contamination. If packings are damaged, leaks and corrosion of oil system parts is possible.

4 Hydraulic fluid can get into the oil system if:

a There was a failure of a hydraulic pump

b Someone put hydraulic fluid in the oil tank in error.

(d) Jet fuel.

1 This contamination is important.

2 If oil has fuel in it, you can smell the fuel. Also, the viscosity of oil that has fuel in it is less than for oil that does not have fuel contamination. Engine symptoms are high oil temperature and overservicing of (too much oil in) the oil tank.

3 Oil that has fuel in it causes damage to packings. Damaged packings cause oil leaks in the gearbox accessory seals. Depending on the quantity and length of time of the fuel contamination, damage to the bearings is possible.

4 It is possible that an internal leak in the fuel−oil cooler is the cause of fuel contamination.

C. Inspection For Contamination From Solids (Build Debris, Pieces From A Repair, Bearing, Or Gear)

(1) Do the inspections that follow.

(a) Do an inspection of the magnetic chip detector assemblies. Refer to 72-00-61, Inspection/Check-04 (Task 72-00-61-210-002).

NOTE: You must keep to a minimum the quantity of times that the main oil filter delta-P warning light comes on. Do the inspection/replacement of the main oil filter at the recommended times.

(b) If not done during the inspection of the magnetic chip detectors, examine the main oil filter for contamination as follows.

1 Remove the main oil filter. Refer to 72-00-61, Removal-35 (Task 72-00-61-030-001).

2 Flush the filter with Solvent P11-027.

3 Strain the solvent through filter paper or a clean cloth. Keep any contamination you find for analysis.

4 Identify the contamination. Refer to 72-00-61, Inspection/Check-04 Task 72-00-61-210-002.

5 Install a new main oil filter. Refer to 72-00-61, Installation-35 Task 72-00-61-430-001.

(c) Examine the last chance oil strainers for contamination.

1 Remove all the last chance oil strainers. Refer to Removal-01 Task 72-00-00-050-001, Removal-02 Task 72-00-00-050-002, Removal-03 Task 72-00-00-050-003, and Removal-04 Task 72-00-00-050-004.

2 Examine and clean the strainer elements. Refer to Cleaning-01 Task 72-00-00-110-001. Keep any contamination that you find for analysis.

3 Install the last chance oil strainers. Refer to Installation-01 Task 72-00-00-450-001, Installation-02 Task 72-00-00-450-002, Installation-03 Task 72-00-00-450-003, and Installation-04 Task 72-00-00-450-004.

(d) If there was no contamination, you can put the engine back in service.

(2) Identify the contamination. If necessary, Refer to 72-00-61, Inspection/Check-04 Task 72-00-61-210-002 for spectroscopic analysis.

(a) If the particles are from the bearings or gears, you must correct the problem before you can use the engine.

(b) If the particles/pieces are not from the bearings or gears (that is, if they are pieces from a repair, etc.), do as follows.

1 Flush the engine oil system. Refer to 72-00-00, Servicing-05 Task 72-00-00-610-004.

2 Operate the engine at idle until the temperature of the oil is more than 150°F (65.6°C). Refer to 71-00-00, Testing-00 (Task 71-00-00-990-003), "Engine Starting Procedures (Normal)".

3 Accelerate from idle to 1.35 - 1.40 EPR, then go back to idle. Do this five times.

4 Operate the engine at 1.35 - 1.40 EPR for 10 minutes.

5 Shut down the engine. Refer to 71-00-00, Maintenance Practices-01, "Engine Shutdown Procedure," (Normal).

6 Examine the main oil filter and magnetic chip detectors for contamination. Refer to Paragraphs C.(1)(a) and (b).

a If there is no contamination, continue to use the engine. Do a magnetic chip detector inspection at 50 hours of service. Refer to 72-00-61, Inspection/Check-04 (Task 72-00-61-210-002).

b If there is contamination, do the "Inspection For Contamination From Solids" again. If there is still contamination, remove the engine from service. You must find the source of the contamination and correct the problem before you put the engine back in service.

NOTE: It is not necessary to remove the last chance oil strainers.

D. Inspection For Black Oil

NOTE: Dark oil can be an indication of a serious problem or it can be a condition that requires no maintenance action. The dark oil condition "black oil" is the result of some additives in the oil that oxidize as the oil ages. This can cause very fine carbon particulate which darkens the oil without an effect on the properties which lubricate and cool (Total acid number and viscosity are not changed).

(1) If you see dark oil, you can determine if maintenance action is necessary with the steps that follow:

(a) Does the oil have an unusual smell (burnt or equivalent to fuel or hydraulic fluid)?

(b) Is the oil thick or gummy?

(c) Did an engine oil over temperature ever occur?

(2) If you answer "yes" to any of the above questions, you must do the procedures that follow:

(a) Do the inspection for contamination from hydraulic fluid.

(b) Perform Oil Overtemperature Inspection. See 72-00-00, Inspection/Check-03 Task 72-00-00-280-053.

(3) If you answer "no" to these questions, the engine can continue in service.

E. Inspection For Contamination From Hydraulic Fluid

ENGINE GENERAL − INSPECTION/CHECK−04

CAUTION: HIGH TEMPERATURES CAN CAUSE OIL TO BECOME BLACK. IF HIGH TEMPERATURES ARE A POSSIBLE CAUSE OF BLACK OIL, REFER TO 71−00−00, FAULT ISOLATION−01 TASK 71−00−00−810−001.

(1) Do an inspection for contamination from hydraulic fluid if one or more of the items that follows is true.

(a) There was failure of a hydraulic pump, and it is possible that hydraulic fluid went in the gearbox drain

(b) There is corrosion of metal adjacent to the gearbox in the cavity of the hydraulic pump drive pad

(c) There is hydraulic fluid in the cavity of the hydraulic pump drive pad

(d) The engine oil is black, thick, and gummy.

(2) The inspection for contamination from hydraulic fluid is as follows.

R (a) Examine the viscosity of the oil. Refer to SB
R 72−238 for oil quality limits.

1 Compare the oil that you think is dirty with oil of the same brand that you know is good.

2 A large difference in viscosity is an indication of contamination by either jet fuel or hydraulic fluid.

(b) Do a check of the phosphorus content of the oil. This is the best check of hydraulic fluid contamination. Use either the wet chemical test (ASTM D−1091−64) or spectroscopic oil analysis.

1 Compare the oil that you think is dirty with oil of the same brand that you know is good.

2 A large difference in the results of the test is an indication of contamination by hydraulic fluid.

(3) If the inspection of the oil shows that there is contamination from hydraulic fluid or if you think a hydraulic pump is damaged, repair the damaged engine parts as follows.

(a) Remove the hydraulic pump(s) that failed. Refer to 71-00-61, Installation-16 Task 71-00-61-050-012 or Installation-17 Task 71-00-61-050-013, as applicable.

(b) Remove the fluid from the cavity in the drive pad.

(c) Remove the carbon seal from the hydraulic pump drive pad. Refer to 72-00-61, Removal-16 Task 72-00-61-030-007 or 72-00-61, Removal-17 Task 72-00-61-030-008, as applicable.

1 Examine the seal and the packing for deterioration. Replace them if necessary.

2 Examine the driveshaft bearing support and bearings.

a Try to move the driveshaft axially and radially.

b If the driveshaft is loose, remove the bearing. Examine the bearing for damage. If damaged, you must replace the bearing.

(d) Install or, if damaged, replace the carbon seal. Refer to 72-00-61, Installation-16 Task 72-00-61-430-007 or Installation-17 Task 72-00-61-430-008.

(e) Install or, if damaged, replace the hydraulic pump(s). Refer to 71-00-61, Installation-12 Task 71-00-61-450-012 or 71-00-61, Installation-13 Task 71-00-61-450-013.

(f) Do the "Procedure To Put The Oil System Back To A Serviceable Condition".

F. Inspection For Contamination From Jet Fuel

(1) When to do an inspection for contamination from jet fuel:

(a) If you smell jet fuel in the oil.

(b) If there was overservicing of (too much oil in) the oil tank.

(c) If there is an indication of high oil temperature.

(2) The inspection for contamination from jet fuel is as follows.

R (a) Examine the viscosity of the oil. Refer to SB 72-238 for oil quality limits.

1 Compare the oil that you think is dirty with oil of the same brand that you know is good.

2 A large difference in viscosity is an indication of contamination by either jet fuel or hydraulic fluid.

(b) Do a check of the phosphorus content of the oil to know if the contamination is from hydraulic fluid or jet fuel. Use either the wet chemical test (ASTM D-1091-64) or spectroscopic oil analysis.

1 Compare the oil that you think is dirty with oil of the same brand that you know is good.

2 A large difference in the results of the tests is an indication of contamination by hydraulic fluid, not jet fuel.

(3) If there is jet fuel contamination, do as follows.

(a) Remove the fuel/oil cooler. Refer to 72-00-35, Removal-04 Task 72-00-35-050-001-A00 or Task 72-00-35-050-001-B00.

(b) Do an inspection of the fuel/oil cooler. Refer to the CMM, 79-21-15. Repair or replace the component as necessary.

(c) Do the "Procedure To Put The Oil System Back To A Serviceable Condition".

G. Procedure To Put The Oil System Back To A Serviceable Condition

(1) Flush the engine oil system. Refer to Servicing-05 Task 72-00-00-610-004.

(2) Start the engine. Refer to 71-00-00, Testing-00 (Task 71-00-00-990-003), "Engine Starting Procedures (Normal)".

(3) Operate the engine at idle until the temperature of the oil is more than 150°F (65.6°C).

(4) Accelerate from idle to 1.35 - 1.40 EPR and go back to idle, five times.

(5) Operate the engine at 1.35 - 1.40 EPR for 10 minutes.

(6) Shut down the engine. Refer to 71-00-00, Testing-00 (Task 71-00-00-990-003), "Engine Shutdown Procedure," (Normal).

(7) Get a sample of oil as follows.

  (a) Remove the magnetic probe from the chip detector assembly that is in the oil tank. Refer to 72-00-61, Removal-36 (Task 72-00-61-050-017).

  (b) Install PWA 86018 Adapter in the valve of the magnetic chip detector assembly.

  (c) Get a sample of oil.

  (d) Make an analysis of the oil. Refer to Paragraph E. (2) or F.(2).

  (e) You can use the engine while you make the analysis for contamination.

  (f) If the sample of oil shows contamination, do Paragraphs E. or F. and G. again.

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ENGINE GENERAL - INSPECTION/CHECK-05

Task 72-00-00-210-002:

1. Inspect Engine Fuel And Control System
   A. Equipment And Materials Required - None
   B. Procedure
      See Table 801.
      (1) Inspection Reference Table is intended to serve as an aid for identifying certain areas and conditions whenever disassembly time permits inspection. Disassembly inspection should not be accomplished solely on basis of these tables. Tables should be used when disassembly is required as a result of other maintenance actions.
      (2) Table 801 does not imply that items or conditions listed are all-inclusive. Experience and judgement will continue to be an important part of any inspection program.

Table 801 - Inspection Reference Table.

ITEM	INSPECT FOR	COMPONENT MAINTENANCE MANUAL CHAPTER/ SECTION REFERENCE
Fuel Pump	External Leakage	73-11-04
	Security of mounting.	
Fuel Pump Filter	Contamination of paper (cartridge) filter element.	73-11-04
	NOTE: Pump filter element must be checked frequently in new aircraft and after rework of fuel tanks.	
Fuel Distribution Valve	External fuel leakage.	73-11-08
	Security of mounting.	
Fuel Distribution Valve Strainer	Inlet screen contamination and damage.	73-11-08

ENGINE GENERAL - INSPECTION/CHECK-05

ITEM	INSPECT FOR	COMPONENT MAINTENANCE MANUAL CHAPTER/ SECTION REFERENCE
Fuel Metering Unit	External fuel leakage.	73-21-38
	Security of fuel metering unit to pump.	
	Security of electrical connectors.	
EEC Inlet Pressure/ Temperature (PT2/TT2) Probe	Security of electrical connector.	73-21-33
	Security of mounting.	

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Task 72−00−00−790−001:

1. Leak Check Fuel Distribution System

A. Equipment And Materials Required

Special Tools:

PWA 85579	Adapter
PWA 86459	Puller, Strainer

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Material:

	Item No.	Designation
	P03−001	Oil, Engine (PWA 521B)
	P05−007	Fluid, Leak Check (PMC 9569 or PMC 2277)
	P05−289	Lockwire (AS3214−02)
	P05−291	Cable, Safety (Optional)
	P05−292	Ferrule, Safety Cable (Optional)
R	P06−053	Lubricant, Sealing Ring (PWA 36500)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	2	73−13−00/4/70
Packing	1	73−13−00/5/10
Packing	1	73−13−00/5/30

B. Procedure

See Figure 801.

NOTE: Minimum clearance between any two adjacent tubes or between one single tube and any other adjacent engine part shall be 0.125 inch (3.175 mm) unless otherwise specified. Exceptions to this clearance requirement are permitted at specific locations where adjacent tubes are clipped together or where other local constraints will prevent tube contact at clearances below 0.125 inch (3.175 mm) minimum.

NOTE: Minimum clearance refers only to clearance relative to tube and not to fittings or other attached hardware.

(1) Remove the bolts that secure the front rear flanges of the fuel flowmeter support and the bracket (Pre SB PW4ENG 73-163 only) to the fuel flowmeter and to the fuel distribution valve. Remove the fuel flowmeter support and the bracket from the engine.

(2) Translate packing transfer tube assembly rearward into fuel distribution valve cover.

(3) Remove bolts securing strainer housing cover to distribution valve and remove cover and tube from valve. Remove tube from cover. Discard packings from tube and cover.

CAUTION: USE THE PWA 86459 PULLER TO AVOID DAMAGE TO THE STRAINER.

(4) Engage the PWA 86459 Puller to the strainer and pull the strainer from the housing. Disengage the puller from the strainer and remove the puller and strainer from the engine separately. Discard the packing.

(5) Inspect fuel distribution valve strainer per 72-00-41, Inspection/Check-05.

(6) Clean fuel distribution valve strainer per 72-00-41, Cleaning-03 or -04.

R (7) Install a packing, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the groove on end of the strainer and install the strainer into the fuel distribution valve housing.

(8) Install PWA 85579 Adapter to four hole pad on valve aligning offset bolt hole and secure with detail bolts.

(9) Using available air supply through above adapter pressurize fuel manifold and distribution valve to 95 - 105 psig (655.0 - 723.9 kPa) with air and check for leaks by applying Leak Check Fluid P05-007, for five (5) minutes. There shall be no visible leakage from any surface, joint or connection.

(10) If any leakage is present, replace and/or repair as required and repeat Step (9) as required.

(11) If for any reason any portion of subject system has been removed or replaced at assembly, repeat Step (9) as required.

(12) Disconnect air supply and remove adapter from fuel distribution valve. Store bolts in threaded holes in adapter.

R (13) Install the two packings, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the grooves in packing transfer tube assembly. Install the transfer tube into distribution valve cover.

R (14) Install a packing, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the cover and install the cover (with tube) to the fuel distribution valve housing. Secure strainer cover with washers and bolts, threads lubricated with Engine Oil P03-001. Torque bolts to 30 - 33 lb-in. (762.00 - 838.20 N.m).

(15) Translate transfer tube forward with dowel pin and boltholes aligned.

NOTE: Ensure sealplate is installed against rear flange of fuel flowmeter and dowel pin is aligned.

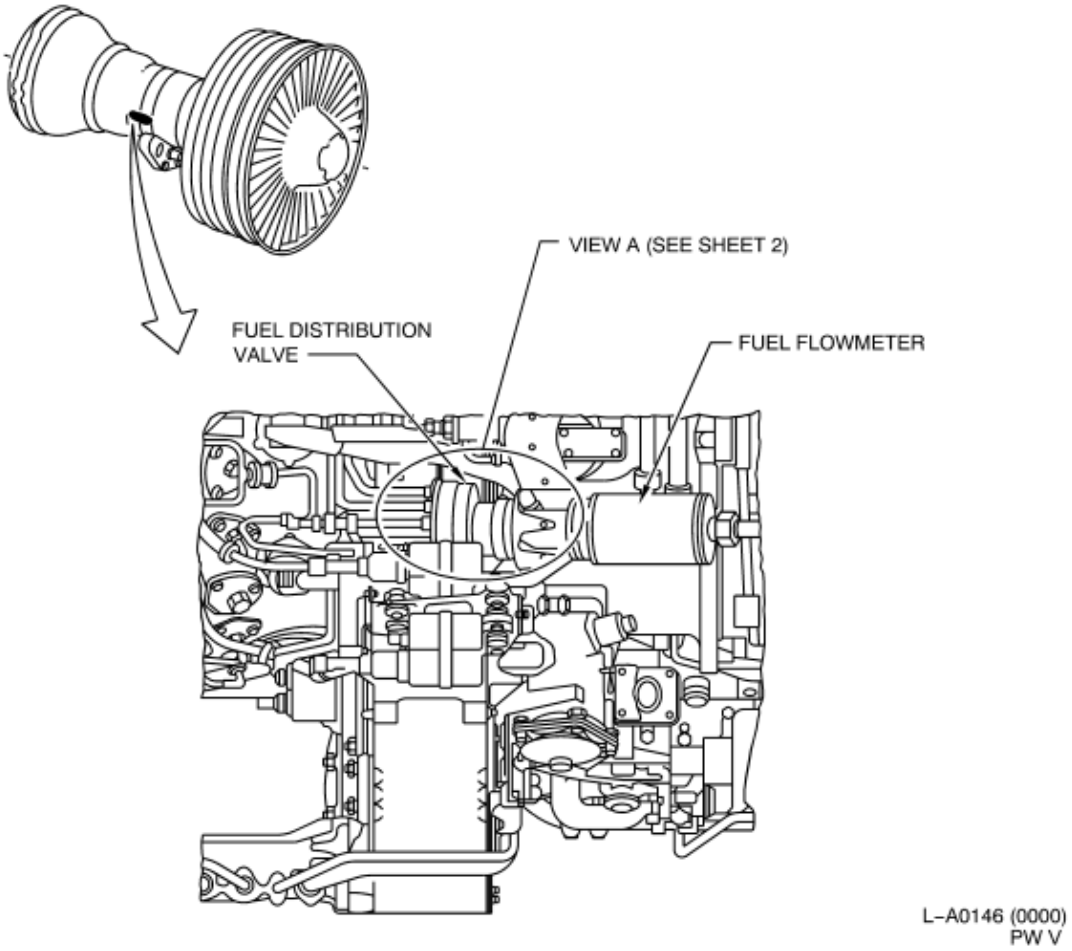
(16) Install fuel flowmeter support over transfer tube aligning dowel pin on transfer tube with slot in support and aligning boltholes in rear (larger) flange. Install bracket over support and position as shown in Figure 801.

(17) Secure rear flange with bolts (without drilled heads) lubricated with Engine Oil P03-001. Secure front flange with drilled head bolts lubricated with Engine Oil P03-001.

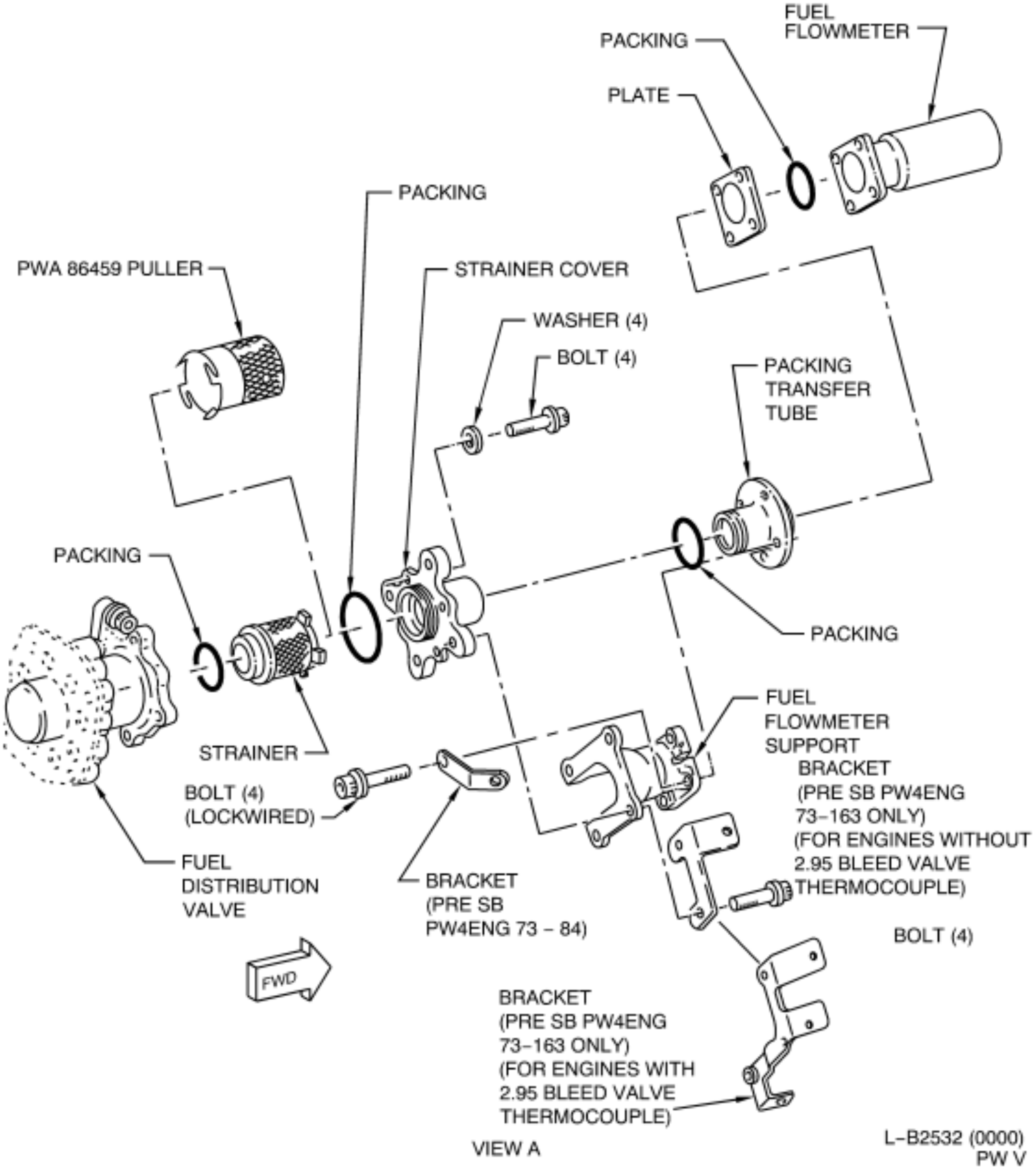
(18) Torque all bolts at front and rear flanges to 85 - 95 lb-in. (9.604 - 10.734 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 the bolts on the front flange.

C. Postrequisites

(1) Test engine per Repair Test Reference Table. See 71-00-00 Adjustment/Test-00.


VIEW A (SEE SHEET 2)
FUEL DISTRIBUTION VALVE
FUEL FLOWMETER
L-A0146 (0000)
PW V

Fuel Distribution Valve Inlet Connection
Figure 801 (Sheet 1)
(Task 72-00-00-790-001)


FUEL FLOWMETER
PACKING
PLATE
PACKING
PWA 86459 PULLER
STRAINER COVER
WASHER (4)
BOLT (4)
PACKING TRANSFER TUBE
PACKING
PACKING
FUEL FLOWMETER SUPPORT
BRACKET (PRE SB PW4ENG 73-163 ONLY) (FOR ENGINES WITHOUT 2.95 BLEED VALVE THERMOCOUPLE)
STRAINER
BOLT (4) (LOCKWIRED)
FUEL DISTRIBUTION VALVE
BRACKET (PRE SB PW4ENG 73 - 84)
BOLT (4)
FWD
BRACKET (PRE SB PW4ENG 73-163 ONLY) (FOR ENGINES WITH 2.95 BLEED VALVE THERMOCOUPLE)
VIEW A
L-B2532 (0000)
PW V

Fuel Distribution Valve Inlet Connection
Figure 801 (Sheet 2)
(Task 72-00-00-790-001)

ENGINE GENERAL - INSPECTION/CHECK-07

Task 72-00-00-210-015:

1. Engine Windmilling Inspection

This Procedure Has Been Deleted

Task 72-00-00-210-016:

1. Procedures Following Ingestion Of High Concentration Of Volcanic Ash Or Sand

A. Equipment And Materials Required

Special Tools:

PWA 86018	Adapter, Oil Sampler

B. Procedure

CAUTION: INGESTION OF HIGH CONCENTRATION OF VOLCANIC ASH OR SAND INTO AN ENGINE CAN CAUSE OPERATIONAL PROBLEMS INCLUDING LOSS OF POWER. EVEN IF OPERATIONAL PROBLEMS ARE NOT EXPERIENCED, ASH OR SAND CONTAMINATION OF ENGINE SYSTEMS COULD RESULT IN PROBLEMS SUCH AS PERFORMANCE DETERIORATION, BLOCKED COOLING AIR PASSAGES AND ABRASIVE DAMAGE. IF ENGINES HAVE BEEN SUBJECTED TO VOLCANIC ASH OR SAND INGESTION, THE FOLLOWING PROCEDURE SHOULD BE COMPLIED WITH:

(1) If engines have experienced operational problems resulting from ash or sand ingestion:

(a) Remove engine(s), disassemble, inspect and repair as necessary, paying particular attention to oil system, air supplied components, turbine cooling passages and fuel system components.

(2) If engines have not experienced operational problems resulting from ash or sand ingestion:

(a) Visually inspect engine inlet and exhaust areas for evidence of damage or excessive erosion. Refer to 72-00-00, Inspection/Check-12 Task 72-00-00-210-010.

(b) Borescope inspect high pressure compressor and high pressure turbine for evidence of following:

1 Excessive erosion

2 Foreign object damage (FOD)

3 Blockage of high pressure turbine airfoil cooling holes

4 Build-up of ash deposits

NOTE: For borescope inspection procedures refer to 72-00-00, Inspection/Check-01A (Task 72-00-00-990-010) and inspection limits refer to 72-00-00, Inspection/Check-01C (Task 72-00-00-210-004), 72-00-00, Inspection/Check-01E (Task 72-00-00-210-017), 72-00-00, Inspection/Check-01F (Task 72-00-00-210-005) and 72-00-00, Inspection/Check-01G (Task 72-00-00-210-006).

(c) Do an inspection of the magnetic chip detector and the oil, as follows.

1 Examine the magnetic plugs for contamination. Refer to 72-00-61, Inspection/Check-04 (Task 72-00-61-210-002).

2 Do a spectroscopic analysis of the oil, as follows.

a With the magnetic chip detector removed from the oil tank, install PWA 86018 Adapter at that location. Get a sample of oil.

b Do a spectroscopic analysis of the oil to know if there is engine damage. Refer to 72-00-61, Inspection/Check-04 (Task 72-00-61-210-002).

3 If the oil is not satisfactory, flush the oil system. Refer to Servicing-05 (Task 72-00-00-610-004). Then make another analysis of the oil.

(d) Install the magnetic chip detector assemblies. Refer to 72-00-61, Installation-36 (Task 72-00-61-450-017).

(e) Remove, clean, and replace oil, fuel, and air filters. If contamination is found, retain sample for analysis. See following substeps for specific items to be checked.

1 Oil System

- a Main oil filter. See 72-00-61, Removal-35 Task 72-00-61-030-001 and Installation-35 Task 72-00-61-430-001.

- b No. 1, 1.5 and 2 bearing oil pressure strainer (last chance). See 72-00-00, Removal-01 Task 72-00-00-050-001 and Installation-01 Task 72-00-00-450-001.

- c No. 3 bearing oil pressure strainer (last chance). See 72-00-00, Removal-03 Task 72-00-00-050-003 and Installation-03 Task 72-00-00-450-003.

- d No. 4 bearing oil pressure strainer (last chance). See 72-00-00, Removal-04 Task 72-00-00-050-004 and Installation-04 Task 72-00-00-450-004.

- e Angle and main gearbox strainer (last chance). See 72-00-00, Removal-02 Task 72-00-00-050-002 and Installation-02 Task 72-00-00-450-002.

2 Fuel System

- a Fuel pump filter. See 72-00-61, Removal-24 Task 72-00-61-060-001 and Installation-24 Task 72-00-61-460-001.

  NOTE: If fuel filter bypass light indication was noted during last operation or during exposure to high concentrations of sand or volcanic ash contaminants the following additional fuel filters should be checked.

- b Fuel distribution valve inlet screen. See 72-00-41, Removal-10 Task 72-00-41-060-001 and Installation-10 Task 72-00-41-460-001.

3 Air System

- a HPC bleed air filters. See 72-00-35, Removal-15 Task 72-00-35-050-012 and Installation-15 Task 72-00-35-450-012.

(f) Ground run engine to determine if a shift in performance parameters has occurred. If parameters are abnormal, engine should be replaced. See 71-00-00, Testing-09 Task 71-00-00-760-020.

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ENGINE GENERAL - INSPECTION/CHECK-09

Task 72-00-00-210-018:

1. Use Of Damaged Engines And Parts

   A. Equipment And Materials Required - None

   B. Procedure

      (1) Engines and engine parts involved in abnormal operational circumstances require special disposition before a determination can be made as to their continued serviceability.

      (2) Abnormal operational circumstances are defined as events which fall outside the operating envelope for the engine, aircraft, or engine/aircraft combination as originally certified. These circumstances include such events as:

         (a) Accidents

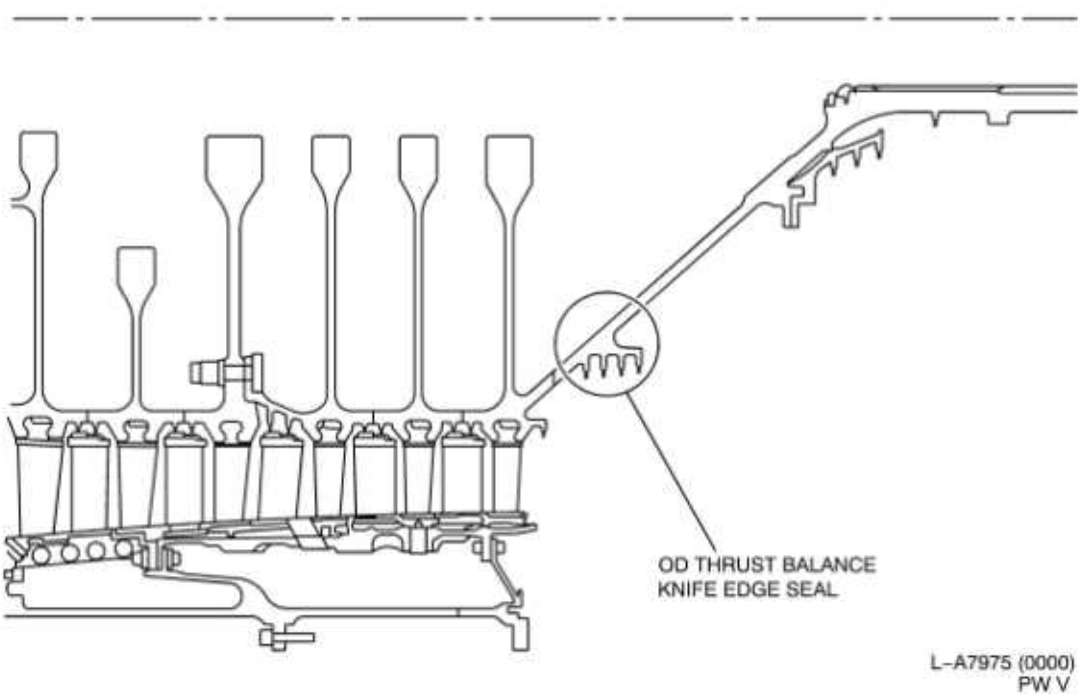
         (b) Serious Operational Events

         (c) Impacted/Dropped Engines

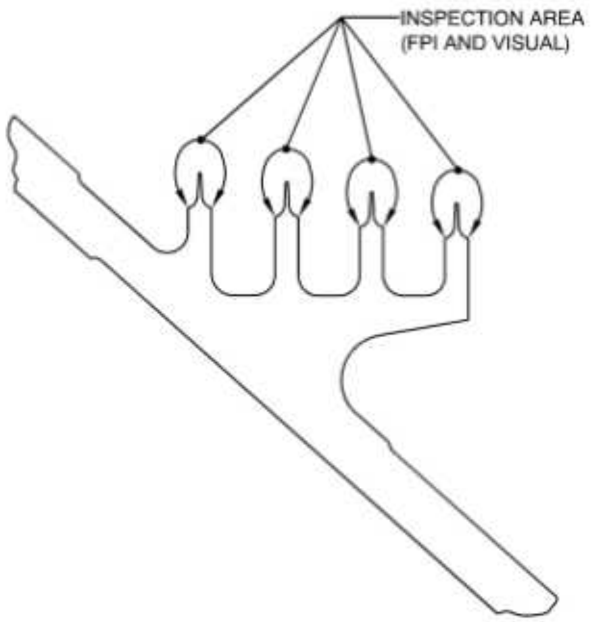
         (d) Tailpipe Fires

      (3) See Standard Practices Manual, Chapter/Section 70-00-00, for detailed instructions regarding disposition of engines and parts involved in abnormal operational circumstances.

         NOTE: HPC rear drum OD thrust balance knife-edge seal must be inspected per Inspection/Check-04 (Task 72-00-35-210-004) in the event of turbine rotating part fractures accompanied by high vibration. See Figure 801.


OD THRUST BALANCE
KNIFE EDGE SEAL
L−A7975 (0000)
PW V

HPC Rear Drum OD Thrust Balance Seal Inspection
Figure 801 (Sheet 1)
(Task 72−00−00−210−018)


INSPECTION AREA
(FPI AND VISUAL)

L-A8038 (0000)
PW V

HPC Rear Drum OD Thrust Balance Seal Inspection
Figure 801 (Sheet 2)
(Task 72-00-00-210-018)

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ENGINE GENERAL - INSPECTION/CHECK-10

Task 72-00-00-210-022:

1. Engine Inspection Following Overtemperature

A. General

(1) Use this inspection procedure to examine the engine after exhaust gas (EGT) overtemperature operation.

(2) An EGT overtemperature condition occurs when the engine is operated for more than the exhaust gas temperature (EGT) limits. The EGT limits are shown in Chapter 71-00-00 Power Plant General - Testing-00, Engine Operation Limits Task 71-00-00-990-007.

(3) To tell which inspections from this procedure are necessary after EGT overtemperature, obey the instructions shown in Figure 1306 of 71-00-00 Power Plant General - Testing-00, Engine Operation Limits Task 71-00-00-990-007.

B. Equipment And Tools Necessary - None

C. Visual Inspection

(1) Visually check exhaust duct, plug and rear of front compressor drive turbine for burning, distortion, metal particles, or evidence of upstream blade and/or vane distress. If acceptable, continue-in-service after cause of overtemperature has been found and corrected.

D. Hot Section Inspection

(1) Igniter Plug High Tension Leads

(a) If engine was rapidly shut down per the emergency shutdown procedure, the high tension leads must be inspected, particularly at igniter plug terminal, to assure that excessive temperatures did not affect lead insulator.

NOTE: Heat dissipation through igniter plug and high tension lead, caused by a lack of sufficient cooling air during rapid shutdown, can cause deterioration of rubber insulation and result in arcing at terminal area.

(2) Combustion Chamber Area

(a) Using a rigid or flexible borescope, check for signs of cracks, burning, overheating, erosion, distortion, combustion liner shift (movement), pin wear, wear at nozzle and mounts. See 72-00-00, Inspection/Check-01D Task 72-00-00-210-020.

(3) Check fuel injectors, using same borescope holes as in step B.(2).

(a) Check for carbon deposits, cracks, distortion, wear, rupture, and burn through. See 72-00-00, Inspection/Check-01D Task 72-00-00-210-020.

(4) Check Stage 1 HPT vanes, using same borescope holes as in step B.(2).

(a) Check for cracks, FOD, erosion, corrosion, burning excessive bow. See 72-00-00, Inspection/Check-01E Task 72-00-00-210-017.

(5) Check Stage 1 HPT blades.

(a) Check for cracks, FOD, tip rub, erosion, corrosion. Discoloration in form of bullseye on airfoil. See 72-00-00, Inspection/Check-01F Task 72-00-00-210-005.

(6) Borescope Stage 2 HPT blades.

(a) Examine each blade individually for cracks or evidence of obvious growth such as localized thinning of airfoil in mid-span region, tip rub, erosion and FOD. See 72-00-00, Inspection/Check-01G Task 72-00-00-210-006.

(7) Borescope Stage 3 LPT vanes and blades.

(a) Check for cracks, FOD, tip rub and erosion. See 72-00-00, Inspection/Check-01H Task 72-00-00-210-007 and Inspection/Check-01I Task 72-00-00-210-025.

(b) If there has been a sudden increase in EGT, check for a possible missing or liberated LPT 3rd stage outer transition duct segment. No missing or liberated outer transition duct segments are permitted.

E. Engine Removal/Repair Following Overtemperature Condition

ENGINE GENERAL − INSPECTION/CHECK−10

(1) When engine has been subjected to overtemperature condition which necessitates engine removal or repair, tag the engine or the build group being replaced indicating maximum temperature reached, duration, whether overtemperature occurred under steady state or surge conditions, and other pertinent information.

(2) Referring to the applicable sections in the PW4000 Series CIR, PN 51A357 engine manual, make a hot section inspection. Accomplish repair as required to restore engine to serviceable condition. This should include removal and disassembly of the high pressure turbine rotors. Do a metallurgical analysis on one Stage 1 HPT blade assembly by the procedure shown in PW4000 Series CIR, PN 51A357 Chapter/Section 72−52−07 Inspection/Check−05 − Functional Check Blade Overtemperature Inspection − Stage 1 HPT Blade Assembly Task 72−52−07−200−006. This task will give a metallurgical analysis procedure with temperature limits for the Stage 1 HPT blade. It will also provide additional inspection requirements for other parts if the stage 1 HPT blade is over the temperature limits.

(3) Disassembly of Diffuser and Combustor Group and Low Pressure Turbine Assembly is not necessary unless distress is evident or suspected. However, visual and borescope inspections should be performed in these areas and in high and low pressure compressor groups to ensure entire engine gaspath is free of damage.

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ENGINE GENERAL - INSPECTION/CHECK-11

Task 72-00-00-210-023:

1. Engine Inspection Following Overspeed

See Figure 801.

A. No maintenance action is required if N1 is operating below:

4012 rpm (111.4% N1) - PW4152, PW4156, PW4156A and PW4158 Engines and............................if N2 is operating below:

10300 rpm (104% N2) - PW4152 Engine
10450 rpm (105.5% N2) - PW4156, PW4156A and PW4158 Engines

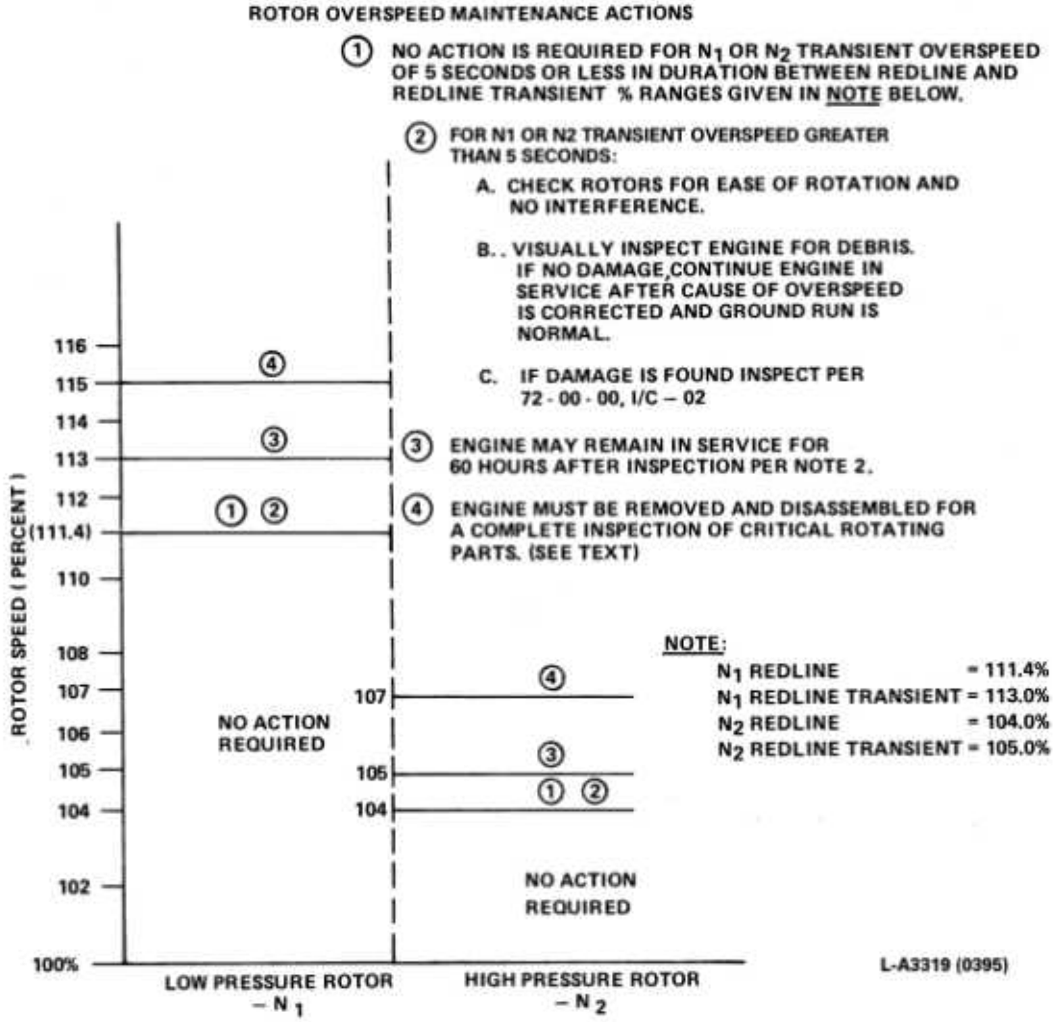
B. If N1 speed exceeds 4012 rpm (111.4 percent N1) but does not exceed 4070 rpm (113 percent N1) perform following inspection procedure.
  (1) Visually inspect inlet and exhaust duct for debris.
  (2) Check rotors for freedom of rotation.
  (3) Check engine speed indicating system for faults.
    (a) If inspection does not reveal any damage, continue engine in service after cause of overspeed is corrected and test run indicates normal operation.
    (b) If damage is evident, further inspection should be performed including gaspath borescope inspection as required and appropriate corrective action taken. See 72-00-00, Inspection/Check-01 (Task 72-00-00-990-009).

C. If N1 speed exceeds 4070 rpm (113 percent N1) but does not exceed 4140 rpm (115 percent N1) perform following inspection procedure.
  (1) Perform inspection procedures specified in Paragraph B.
  (2) Engine may remain in service for 60 hours after performing inspection specified above.

D. If N1 speed exceeds 4140 rpm (115 percent N1), engine must be shut down as soon as possible and inspected per following:

NOTE: Before removing an engine because of an overspeed indication, correct operation of the N1 speed indicating system should be verified.

  (1) Remove front compressor and fan and perform a complete overhaul inspection of rotating parts.
  (2) Inspect low pressure turbine blades for growth and for worn knife-edge seals.
  (3) Inspect low pressure turbine disks for growth.
  (4) Inspect front compressor drive turbine shaft for growth.
  (5) Inspect low pressure turbine disks and blades by fluorescent penetrant method.



ROTOR OVERSPEED MAINTENANCE ACTIONS

① NO ACTION IS REQUIRED FOR N_1 OR N_2 TRANSIENT OVERSPEED OF 5 SECONDS OR LESS IN DURATION BETWEEN REDLINE AND REDLINE TRANSIENT % RANGES GIVEN IN NOTE BELOW.

② FOR N1 OR N2 TRANSIENT OVERSPEED GREATER THAN 5 SECONDS:

A. CHECK ROTORS FOR EASE OF ROTATION AND NO INTERFERENCE.

B. . VISUALLY INSPECT ENGINE FOR DEBRIS. IF NO DAMAGE,CONTINUE ENGINE IN SERVICE AFTER CAUSE OF OVERSPEED IS CORRECTED AND GROUND RUN IS NORMAL.

C. IF DAMAGE IS FOUND INSPECT PER 72 - 00 - 00, I/C - 02

③ ENGINE MAY REMAIN IN SERVICE FOR 60 HOURS AFTER INSPECTION PER NOTE 2.

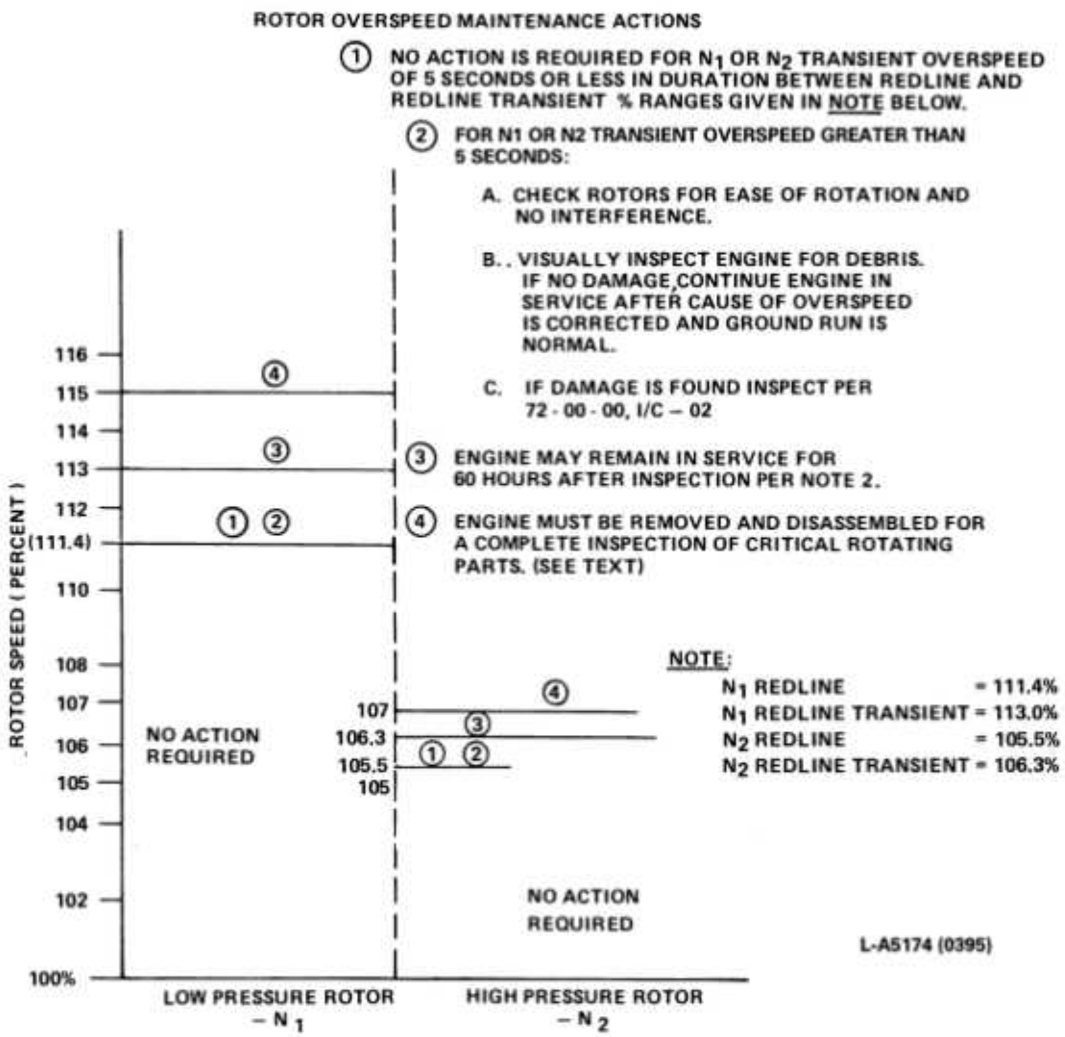
④ ENGINE MUST BE REMOVED AND DISASSEMBLED FOR A COMPLETE INSPECTION OF CRITICAL ROTATING PARTS. (SEE TEXT)

NOTE:

N_1 REDLINE = 111.4%
N_1 REDLINE TRANSIENT = 113.0%
N_2 REDLINE = 104.0%
N_2 REDLINE TRANSIENT = 105.0%

ROTOR SPEED (PERCENT)
116
115
114
113
112
(111.4)
110
108
107
106
105
104
102
100%
④
③
① ②
NO ACTION REQUIRED
107
105
104
④
③
① ②
NO ACTION REQUIRED
LOW PRESSURE ROTOR - N 1
HIGH PRESSURE ROTOR - N 2
L-A3319 (0395)

(PW4152)
N1 And N2 Rotor Overspeed
Maintenance Actions
Figure 801 (Sheet 1)
(Task 72-00-00-210-023)



ROTOR OVERSPEED MAINTENANCE ACTIONS

① NO ACTION IS REQUIRED FOR N_1 OR N_2 TRANSIENT OVERSPEED OF 5 SECONDS OR LESS IN DURATION BETWEEN REDLINE AND REDLINE TRANSIENT % RANGES GIVEN IN NOTE BELOW.

② FOR N1 OR N2 TRANSIENT OVERSPEED GREATER THAN 5 SECONDS:

- A. CHECK ROTORS FOR EASE OF ROTATION AND NO INTERFERENCE.
- B. . VISUALLY INSPECT ENGINE FOR DEBRIS. IF NO DAMAGE,CONTINUE ENGINE IN SERVICE AFTER CAUSE OF OVERSPEED IS CORRECTED AND GROUND RUN IS NORMAL.
- C. IF DAMAGE IS FOUND INSPECT PER 72 - 00 - 00, I/C – 02

③ ENGINE MAY REMAIN IN SERVICE FOR 60 HOURS AFTER INSPECTION PER NOTE 2.

④ ENGINE MUST BE REMOVED AND DISASSEMBLED FOR A COMPLETE INSPECTION OF CRITICAL ROTATING PARTS. (SEE TEXT)

NOTE:

N_1 REDLINE = 111.4%
N_1 REDLINE TRANSIENT = 113.0%
N_2 REDLINE = 105.5%
N_2 REDLINE TRANSIENT = 106.3%

ROTOR SPEED (PERCENT)
116
115
114
113
112
(111.4)
110
108
107
106
105
104
102
100%
④
③
① ②
NO ACTION REQUIRED
107
106.3
105.5
105
④
③
① ②
NO ACTION REQUIRED
LOW PRESSURE ROTOR – N_1
HIGH PRESSURE ROTOR – N_2
L-A5174 (0395)

(PW4156, PW4156A And PW4158)
N1 And N2 Rotor Overspeed
Maintenance Actions
Figure 801 (Sheet 2)
(Task 72-00-00-210-023)

E. If N2 speed exceeds:

10300 rpm (104% N2) − PW4152 Engine
10450 rpm (105.5% N2) − PW4156, PW4156A and PW4158 Engines

but does not exceed.......

10400 rpm (105% N2) − PW4152 Engine
10525 rpm (106.3% N2) − PW4156, PW4156A and PW4158 Engines

(1) No action is required for a transient overspeed of five seconds or less in duration.
(2) Perform following inspection procedure if step (1) is exceeded.
  (a) Visually inspect inlet and exhaust duct for debris.
  (b) Check rotors for freedom of rotation.
  (c) Check engine speed indicating system for faults.
    1 If inspection does not reveal any damage, continue engine in service after cause of overspeed is corrected and test run indicates normal operation.
    2 If damage is evident, further inspection should be performed including gaspath borescope inspection as required and appropriate corrective action taken. See 72−00−00, Inspection/Check−02.

F. If N2 speed exceeds:

10400 rpm (105% N2) − PW4152 Engine
10525 rpm (106.3% N2) − PW4156, PW4156A and PW4158 Engines

but does not exceed.......

10600 rpm (107% N2) − PW4152, PW4156, PW4156A and PW4158 Engines

(1) Perform inspection procedures specified in Paragraph E.(2).
(2) Engine may remain in service for 60 hours after performing inspection specified above.

G. If N2 speed exceeds 10600 rpm (107 percent N2). Engine must be shut down as soon as possible and inspected per the following. (PW4152, PW4156, PW4156A and PW4158 Engines)

NOTE: Before removing an engine because of an overspeed indication, correct operation of the N2 speed indicating system should be verified.

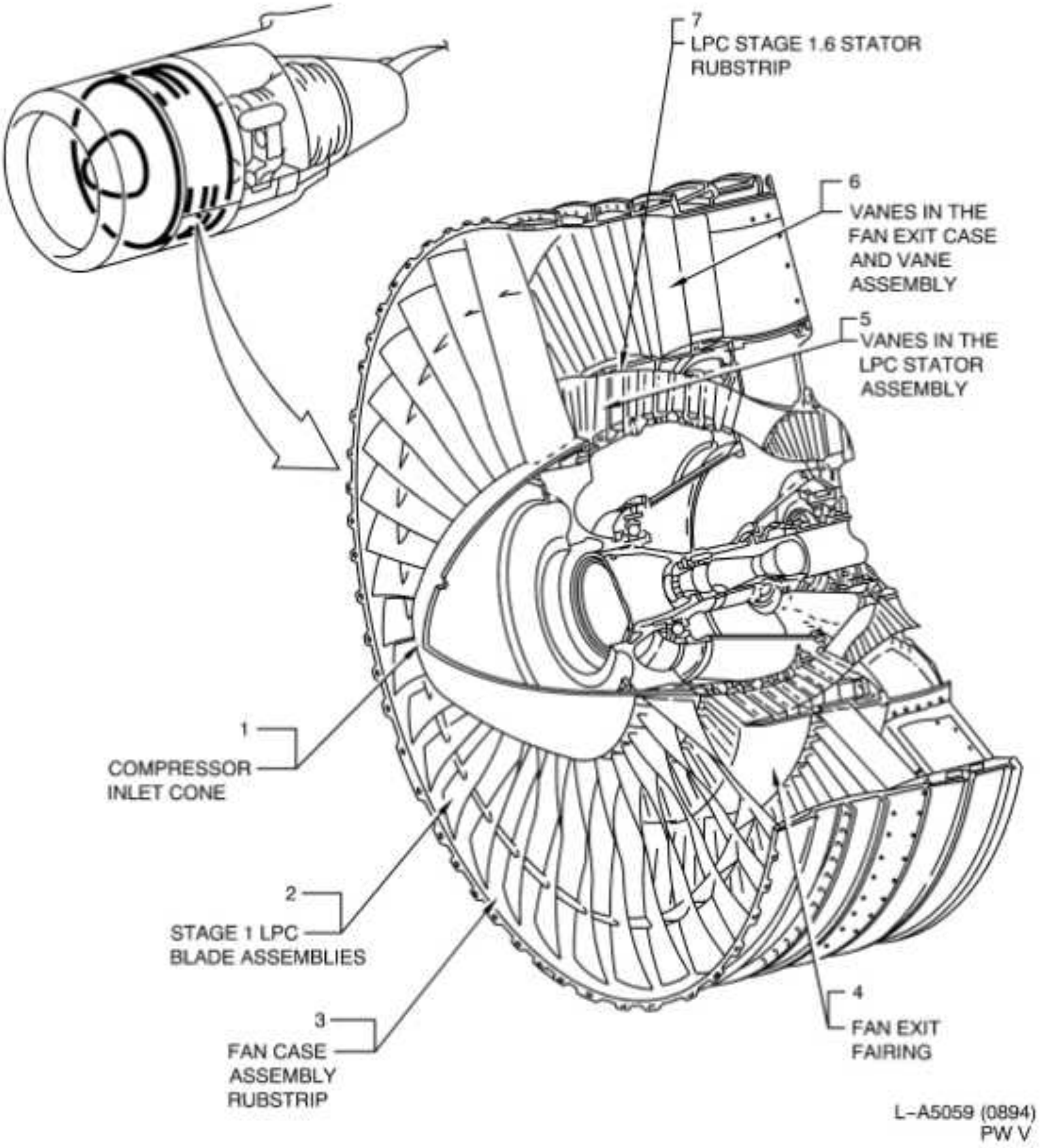
ENGINE GENERAL − INSPECTION/CHECK−11

(1) Remove rear compressor and perform a complete overhaul inspection.
(2) Inspect high pressure turbine blades for growth and for worn knife−edge seals.
(3) Inspect high pressure turbine disks for growth.
(4) Inspect high pressure turbine disks and blades by fluorescent penetrant method.

ENGINE GENERAL − INSPECTION/CHECK−12

Task 72−00−00−210−010:

1. Examine The Inlet, Exhaust Areas, And Externals
    - A. Equipment And Materials Required − None
    - B. Procedure
        - (1) Examine the inlet areas of the engine. Refer to Figure 801 and Table 801.


7
LPC STAGE 1.6 STATOR RUBSTRIP
6
VANES IN THE FAN EXIT CASE AND VANE ASSEMBLY
5
VANES IN THE LPC STATOR ASSEMBLY
1
COMPRESSOR INLET CONE
2
STAGE 1 LPC BLADE ASSEMBLIES
3
FAN CASE ASSEMBLY RUBSTRIP
4
FAN EXIT FAIRING
L−A5059 (0894)
PW V

Inspection Of The Inlet Area
Figure 801
(Task 72−00−00−210−010)

ENGINE GENERAL − INSPECTION/CHECK−12

Figure 801 Item	Examine These Parts	Damage, Look For This Damage	Disposition
1	Compressor Inlet Cone	Cracks, Dents, Cuts, Delamination	See 72−31−80 Insp/ Chk−03 (Task 72−31−80−200−003) and 72−31−81 Insp/Chk−03 (Task72−31−81−200−003)
2	Stage 1 LPC Blade Assemblies	Foreign Object Damage (FOD), Part Span Shrouds That Are Not There, Part Span Shrouds With Cracks, Cracks In Other Areas, Tears, Sharp Nicks Or Dents, Bends In Tip Or Leading Edge	See 72−31−82 Insp/ Chk−03 (Task 72−31−82−200−003)
3	Rubstrip In The Fan Case Assembly	Rubstrip That Is Not There, No Bond	See 72−33−01 Insp/ Chk−03 (Task 72−33−01−200−003)
4	Fan Exit Fairing	Foreign Object Damage (FOD), Cracks, Dents. Screws That Are Not There	See 72−31−84 Insp/ Chk−03 (Task 72−31−84−200−003) Replace The Screws
5	Vanes In The LPC Stage 1 Stator Assembly	Foreign Object Damage (FOD)	See 72−31−09 Insp/ Chk−03 (Task 72−31−09−200−003)
6	Vanes In The Fan Exit Case And Vane Assembly	Cracks, Delamination, Vanes That Are Not There	See 72−33−02 Insp/ Chk−03 (Task 72−33−02−200−003)
7	Rubstrip In The LPC Stage 1.6 Stator Assembly	Rubber Rubstrip Material That Is Not There	Any Quantity (Up To 100%) Can Be Gone But The Engine Must Operate Satisfactorily And The Engine EGT Must Be Within The Limits.

Inspection Of The Inlet Area
Table 801

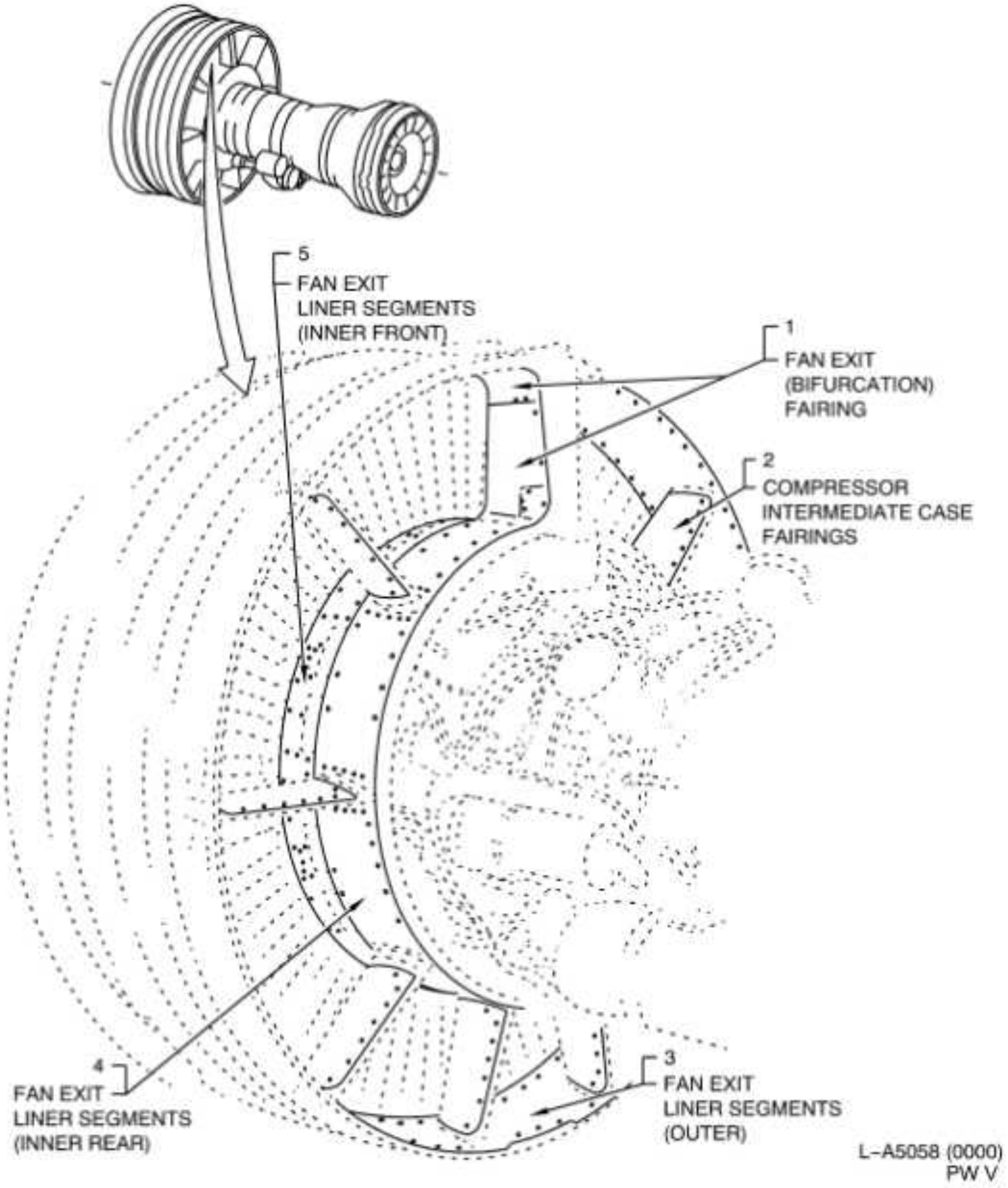
(2) Examine the liners and fairings of the intermediate case assembly and fan case. Refer to Figure 802 and Table 802. Examine them for:
- (a) Loose parts
- (b) Parts that are not there
- (c) Nicks, dents, gouges
- (d) Punctures, holes
- (e) Delamination
- (f) Cracks
- (g) Areas of broken or fuzzy stray fibers
- (h) Loose patches
- (i) Erosion

Item	Name
1	Fan Exit (Bifurcation) Fairing
2	Compressor Intermediate Case Fairings
3	Fan Exit Liner Segments (Outer)
4	Fan Exit Liner Segments (Inner Rear)
5	Fan Exit Liner Segments (Inner Front)

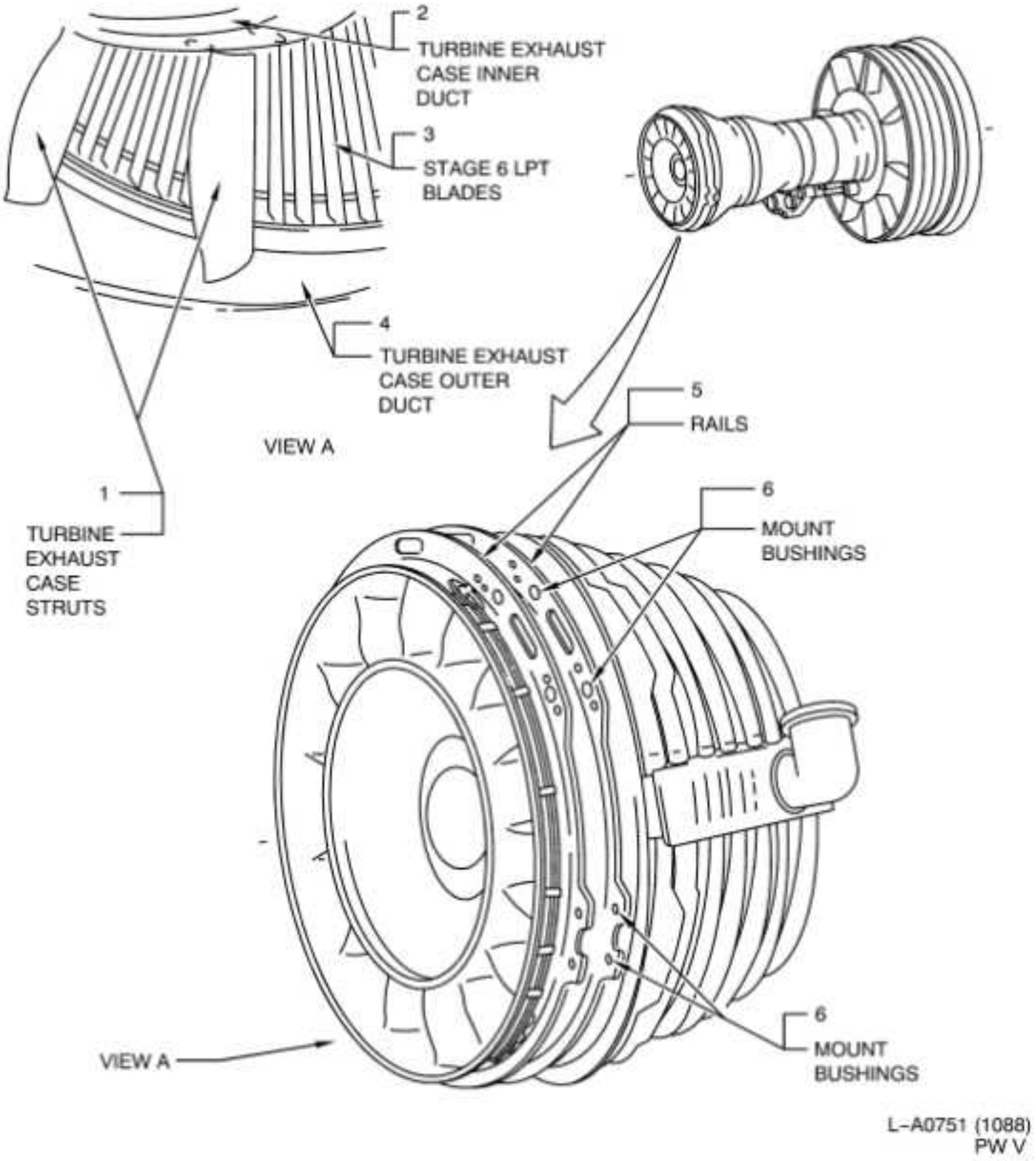
Inspection Of The Sound Absorbing Liners
Table 802

(3) Examine the exhaust areas of the engine. Refer to Figure 803 and Table 803.

ENGINE GENERAL − INSPECTION/CHECK−12


5
FAN EXIT
LINER SEGMENTS
(INNER FRONT)
1
FAN EXIT
(BIFURCATION)
FAIRING
2
COMPRESSOR
INTERMEDIATE CASE
FAIRINGS
4
FAN EXIT
LINER SEGMENTS
(INNER REAR)
3
FAN EXIT
LINER SEGMENTS
(OUTER)
L−A5058 (0000)
PW V

Inspection Of The Liners
Figure 802
(Task 72−00−00−210−010)


2
TURBINE EXHAUST CASE INNER DUCT
3
STAGE 6 LPT BLADES
4
TURBINE EXHAUST CASE OUTER DUCT
VIEW A
1
TURBINE EXHAUST CASE STRUTS
5
RAILS
6
MOUNT BUSHINGS
6
MOUNT BUSHINGS
VIEW A
L−A0751 (1088)
PW V

Inspection Of The Exhaust Area
Figure 803
(Task 72−00−00−210−010)

Item	Examine
1, 2, 4, 5, 6	Struts, Inner Duct, Outer Duct, Rails, Mount Bushings For: Cracks Nicks Dents
3	Stage 6 LPT Blades For: Tears Cracks Nicks Dents
5	Rails For: Deformation

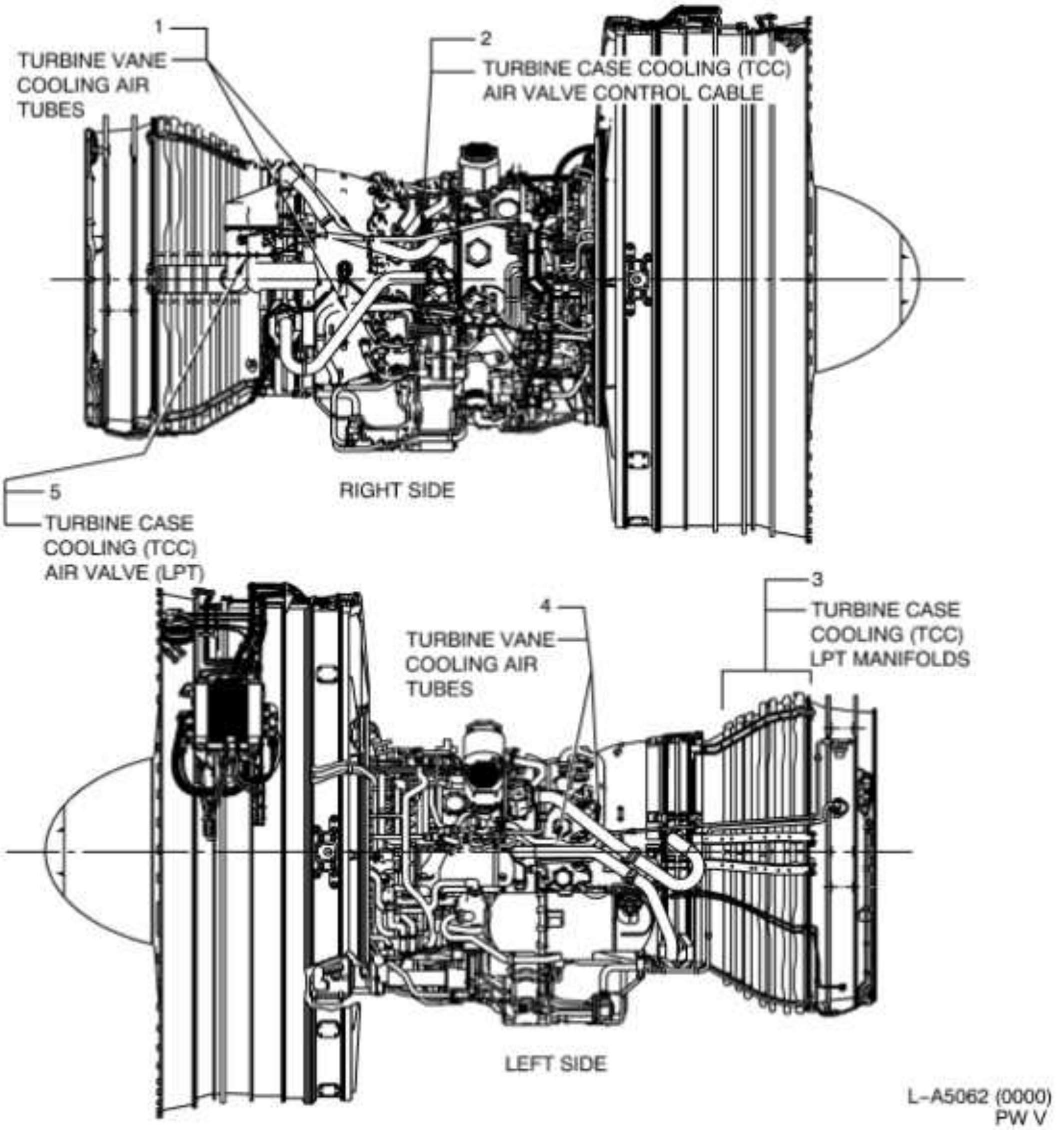
Inspection Of The Exhaust Area
Table 803

(a) Also, examine the tail cone area of the turbine exhaust case for metal particles. If there is a large quantity of metal particles, examine the engine with a borescope. Refer to Inspection/ Check-01 (Task 72-00-00-990-009).

CAUTION: A VERY CAREFUL INSPECTION OF THE TURBINE COOLING AIR TUBES (804/1 AND 804/4) IS VERY IMPORTANT. CRACKED OR BROKEN TURBINE COOLING AIR (TCA) TUBES CAN DAMAGE THE HIGH PRESSURE TURBINE.

A VERY CAREFUL INSPECTION OF THE LPT TCC SYSTEM MANIFOLDS (804/3) VALVES (804/5) AND CABLE (804/2) IS VERY IMPORTANT. A DEFECTIVE TURBINE CASE COOLING (TCC) SYSTEM CAN STRUCTURALLY DAMAGE THE LOW PRESSURE TURBINE (LPT).

(4) Examine the externals. See Figure 804 and Table 804.


1
TURBINE VANE COOLING AIR TUBES
2
TURBINE CASE COOLING (TCC) AIR VALVE CONTROL CABLE
5
TURBINE CASE COOLING (TCC) AIR VALVE (LPT)
RIGHT SIDE
4
TURBINE VANE COOLING AIR TUBES
3
TURBINE CASE COOLING (TCC) LPT MANIFOLDS
LEFT SIDE
L−A5062 (0000)
PW V

Location Of TCA And TCC Parts
Figure 804
(Task 72−00−00−210−010)

ENGINE GENERAL − INSPECTION/CHECK−12

Examine	Condition	Repair
All Tubes For:	Cracks	Replace
	Erosion	Replace
	Fretting	Replace
	Interference With Other Tubes	Inspect Clamps, Bolts
All Tube Nuts For:	Looseness	Tighten
	Corrosion	Replace
All Clamps, Bolts For:	Looseness	Tighten
All Cables, Wires For:	Damage	Replace
	Corrosion	Replace
All Brackets For:	Looseness	Tighten
	Breaks	Replace
(TCC) Air Valve (LPT) For:	Cracks	Replace
	Looseness	Tighten

Inspection Of Externals
Table 804

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INSPECTION/CHECK-13

Task 72-00-00-210-026:

1. Engine Inspection Following Birdstrike With Rear Compressor Damage Beyond Acceptable Limits
   A. Equipment And Materials Required - None
   B. Procedure
      (1) Complete engine and rear compressor section disassembly must be accomplished to remove affected stages. See 72-00-35, Removal-01 or 72-00-35, Removal-02. Disassemble the rear compressor per 72-35-00, Disassembly-03, to remove the axial compressor rotor assembly. Disassemble the axial compressor rotor assembly per 72-35-01, Disassembly-01 and 72-35-38, Disassembly-01 to remove the affected stages.
      (2) Carefully inspect the Stage 5, 6, and 7 HPC blades paying particular attention to the blade tips for tip cracks. See 72-35-11, Inspection/Check-02, 72-35-12, Inspection/Check-02 and 72-35-13, Inspection/Check-02.

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Task 72-00-00-210-027:

1. Examine The Variable Stator Vane Control System Rigging

A. General

WARNING: DO NOT PUT YOUR FINGERS IN THE WAY OF THE LINKAGES, UNISON RINGS, OR LEVERS WHEN YOU OPERATE THE STATOR VANE SYSTEM.

CAUTION: IT IS VERY IMPORTANT TO DO THIS MECHANICAL RIGGING CHECK WITH PRECISION. BAD RIGGING CAN CAUSE INCREASED HPC BLADE FATIGUE, INTERNAL ENGINE DAMAGE, OR COMPLETE ENGINE FAILURE.

ALWAYS REMOVE ALL RIG CHECK PINS BEFORE YOU MOVE THE STATOR VANE SYSTEM.

NOTE: Use this check procedure only:
-for a fast check of the compressor stator vane control system
-with the undersize Rig Check Pins.
Use the rig procedure in Special Procedure-05:
-if you find unsatisfactory rigging during the check and/or
-if you replace parts of the system.

B. Equipment And Materials Required

Special Tools:
PWA 86331 Rig Check Pin (3 Required)
PWA 86332 Rig Check Pin
PWA 86333 Rig Check Pin (Pre SB PW4ENG 72-246)
PWA 86334 Rig Check Pin (Post SB PW4ENG 72-246)
PWA 86344 Holder, Rigging

NOTE: The PWA 86335 Rigging Check Pin Kit contains the above undersize rig pins for only a check of the system. Do not rig the system with these pins.

The rig check pins used in this check procedure have a smaller diameter than the rig pins used in the rigging adjustment (ref. Special Procedure-05). This will permit a satisfactory check on systems with some wear from engine operation.

C. Procedure

See Figures 801 and 802.

CAUTION: BE SURE AND USE THE CORRECT BELLCRANK RIG CHECK PIN. USE THE LARGER PWA 86333 RIG CHECK PIN FOR (PRE SB PW4ENG 72−246 ENGINES). USE THE SMALLER PWA 86334 RIG CHECK PIN FOR (POST SB PW4ENG 72−246 ENGINES).

BE SURE THAT THE END OF THE RIG PINS ARE PROPERLY AND FULLY INSTALLED.

BE SURE YOU KEEP THE ACTUATOR ROD FULLY EXTENDED WHEN YOU INSTALL THE BELLCRANK RIG CHECK PIN. IF YOU LET THE ACTUATOR ROD RETRACT, THIS CHECK WILL NOT BE ACCURATE. THIS CAN RESULT IN HARMFUL STABILITY AND/OR DURABILITY EFFECTS.

TOO MUCH TORQUE WITH THE WRENCH ON THE BELLCRANK DURING THIS CHECK CAN BEND THE BELLCRANK BRACKET. THIS CAN RESULT IN BAD RIGGING.

(1) Use a standard crowsfoot and wrench on the flats of the bellcrank adjacent to the 5th stage adjuster. Pull down on the wrench and hold the bellcrank (801/3) so that the actuator rod is fully extended against the internal stop (vanes open). Hold the actuator fully extended against the internal stop with 300 − 400 lb−in. (33.895 − 45.194 N.m) on the crowsfoot. While you hold the actuator fully extended against the internal stop, install the PWA 86344 Holder between the jamnut and the top of the actuator housing. Tighten and torque the detail bolt to 8 − 10 lb−in. (0.904 − 1.130 N.m). Do not tighten the bolt too much. Tighten the detail jamnut by hand. Install the bellcrank PWA 86333 Rig Check Pin or the bellcrank PWA 86334 Rig Check Pin into the bellcrank arm slot (801/2) and into both holes of the support (801/1).

(2) If you can install the bellcrank rig check pin, remove the rig check pin. Remove the Holder (PWA 86344). Push up on the wrench and retract the actuator rod. Pull down again to fully extend the actuator rod again. Hold the actuator fully extended against the internal stop with 300 − 400 lb−in. (33.895 − 45.194 N.m) on the crowsfoot. While you hold the actuator fully extended against the internal stop, install the Holder (PWA 86344) between the jamnut and the top of the actuator housing. Tighten and torque the detail bolt to 8 − 10 lb−in. (0.904 − 1.130 N.m). Do not tighten the

bolt too much. Tighten the detail jamnut by hand. Install the bellcrank rig check pin again with the actuator rod fully extended. Go to step (4).

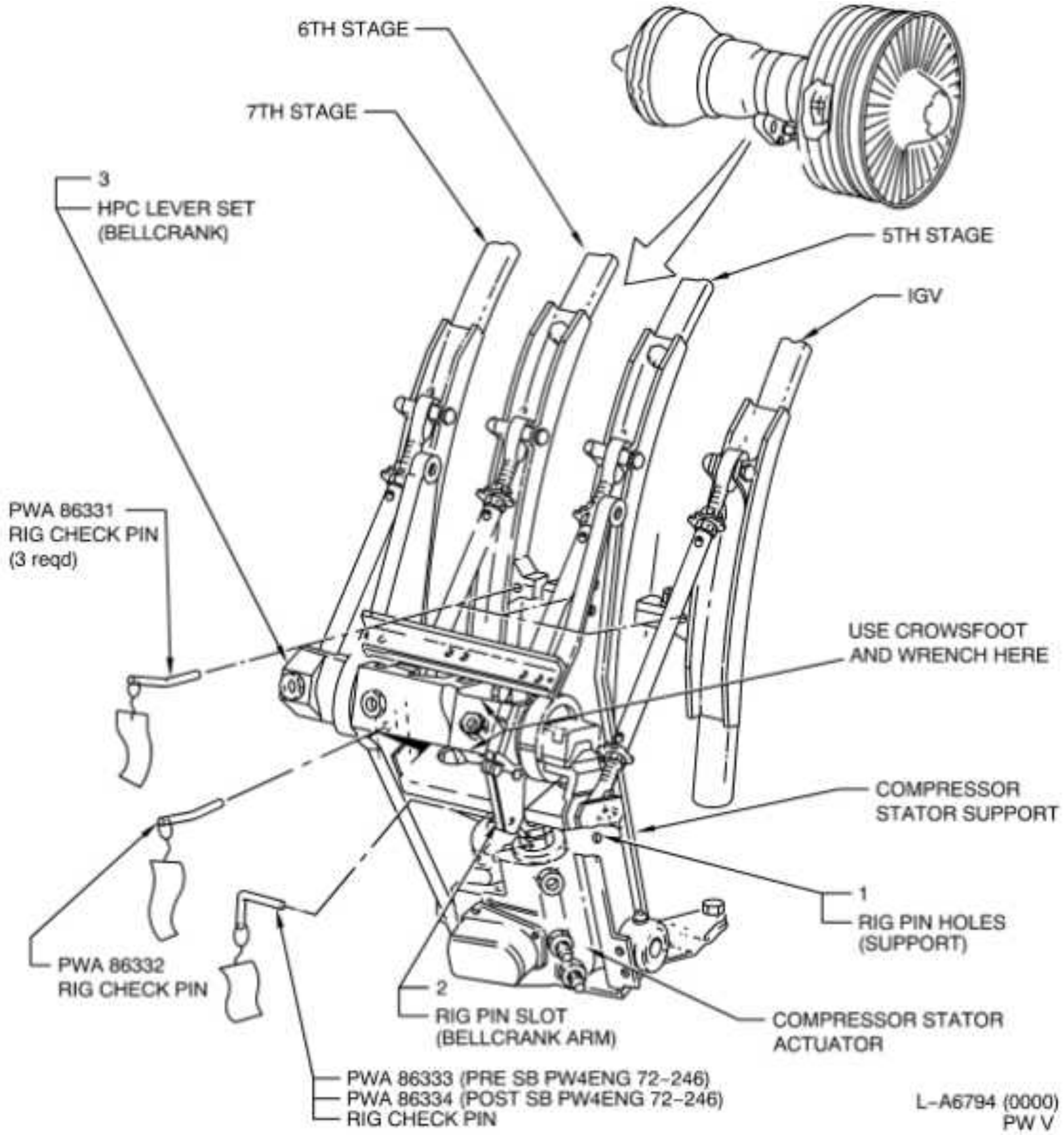
(3) If you can not install the bellcrank rig check pin, adjust the entire compressor stator vane control system per Special Procedure−05.

(4) With the actuator rod fully extended and the bellcrank rig check pin fully installed, install three PWA 86331 Rig Check Pins into the IGV, 5th, and 6th stage unison ring rig pin holes. Install the PWA 86332 Rig Check Pin into the 7th stage unison ring rig pin hole.

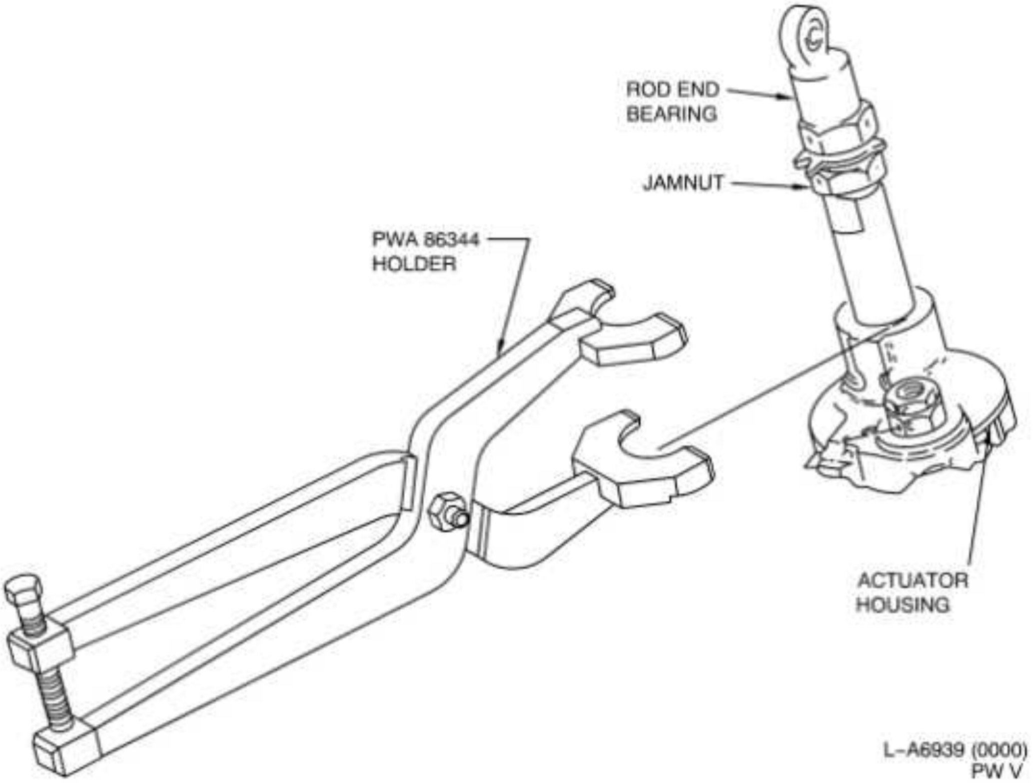
(5) If you can put all the rig check pins in, then remove all the check rig pins from the unison rings and the bellcrank. Remove the Holder (PWA 86344). The system is properly adjusted.

(6) If you can not put any one of the unison ring rig check pins in, adjust the entire compressor stator vane control system per Special Procedure−05.

CAUTION: BE SURE YOU REMOVE ALL OF THE RIG CHECK PINS AND THE HOLDER AFTER THE CHECK. DAMAGE TO THE COMPRESSOR STATOR VANE CONTROL SYSTEM CAN RESULT.


6TH STAGE
7TH STAGE
3
HPC LEVER SET (BELLCRANK)
5TH STAGE
IGV
PWA 86331 RIG CHECK PIN (3 reqd)
USE CROWSFOOT AND WRENCH HERE
COMPRESSOR STATOR SUPPORT
1
RIG PIN HOLES (SUPPORT)
PWA 86332 RIG CHECK PIN
2
RIG PIN SLOT (BELLCRANK ARM)
COMPRESSOR STATOR ACTUATOR
PWA 86333 (PRE SB PW4ENG 72-246)
PWA 86334 (POST SB PW4ENG 72-246)
RIG CHECK PIN
L-A6794 (0000)
PW V

Variable Stator Vane Control System Rigging Check
(Rigging Locations)
Figure 801
(Task 72−00−00−210−027)


ROD END BEARING
JAMNUT
PWA 86344 HOLDER
ACTUATOR HOUSING
L−A6939 (0000)
PW V

Variable Stator Vane Control System Rigging Check
(PWA 86344 Holder Installation)
Figure 802
(Task 72−00−00−210−027)

ENGINE GENERAL - INSPECTION/CHECK-15

Task 72-00-00-990-015:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are for the length of the designated tube or manifold.

(3) Numbers in all columns must be interpreted in inches and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned.

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B, or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.

IFR Code	Definition
(CONTINUED)	
C	Clearance or fit is not subject to change in normal engine operation.

C. Limits

(1) The minimum clearance between any two adjacent tubes or between one tube and any other adjacent engine part must be 0.125 inch (3.175 mm) unless otherwise specified.

(2) The exceptions to this clearance requirement are permitted at specific locations where adjacent tubes are clipped together or where other local constraints will prevent tube contact at clearances below the 0.125 inch (3.175 mm) minimum. Acceptable minimum clearances for those exceptions permitted are specified in the Fits And Clearances table.

NOTE: The minimum clearance refers only to the clearance relative to the tube and not the fittings or other attached hardware.

(3) Limits are applicable to any combination of new or used parts.

(a) The MIN column provides the acceptable minimum clearance in inches (and millimeters). This limit can be applied to any combination of new or used parts.

D. Part Dimensions

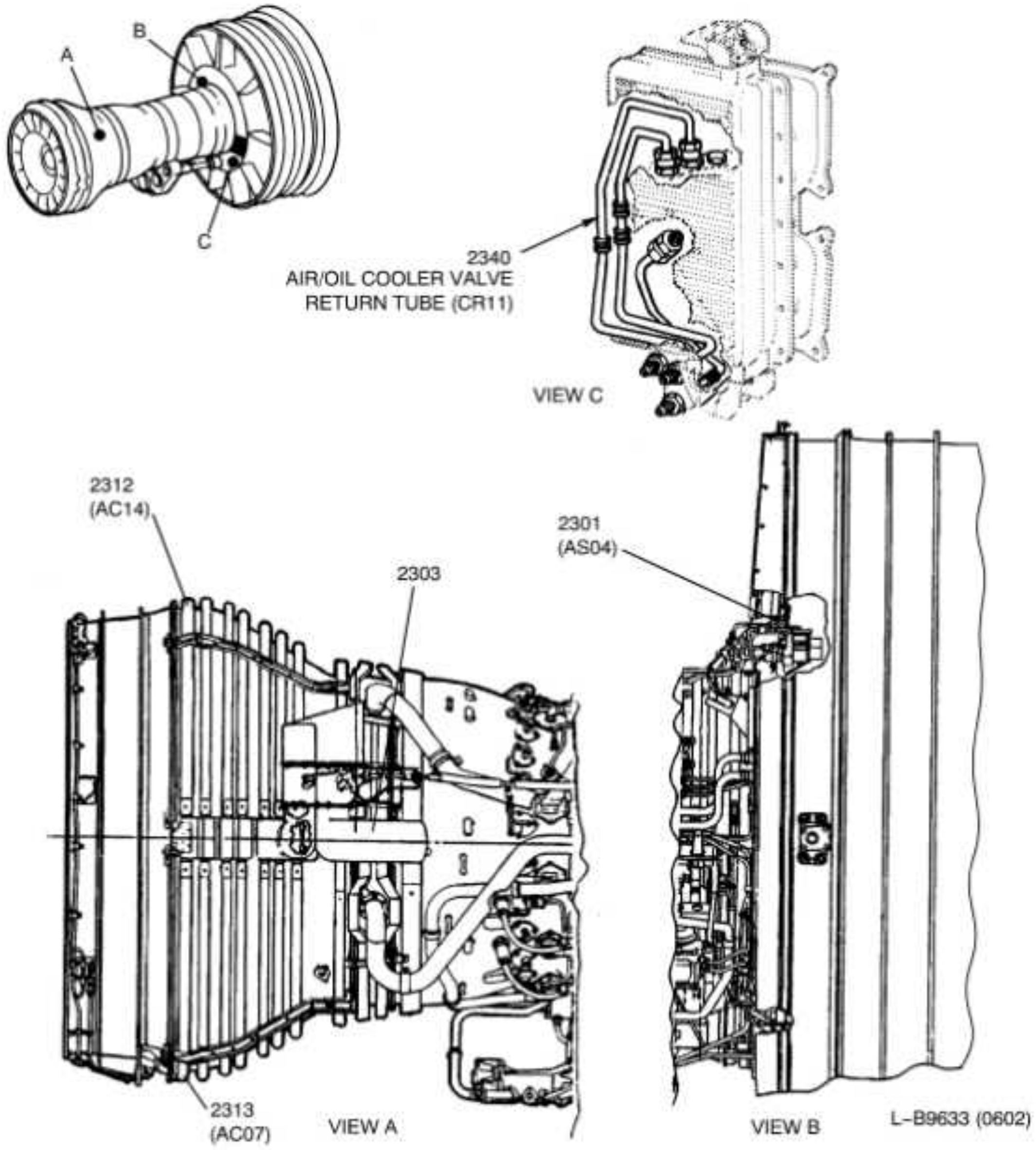
(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permitted if the related Fit or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth or shrinkage.

E. Fits And Clearances

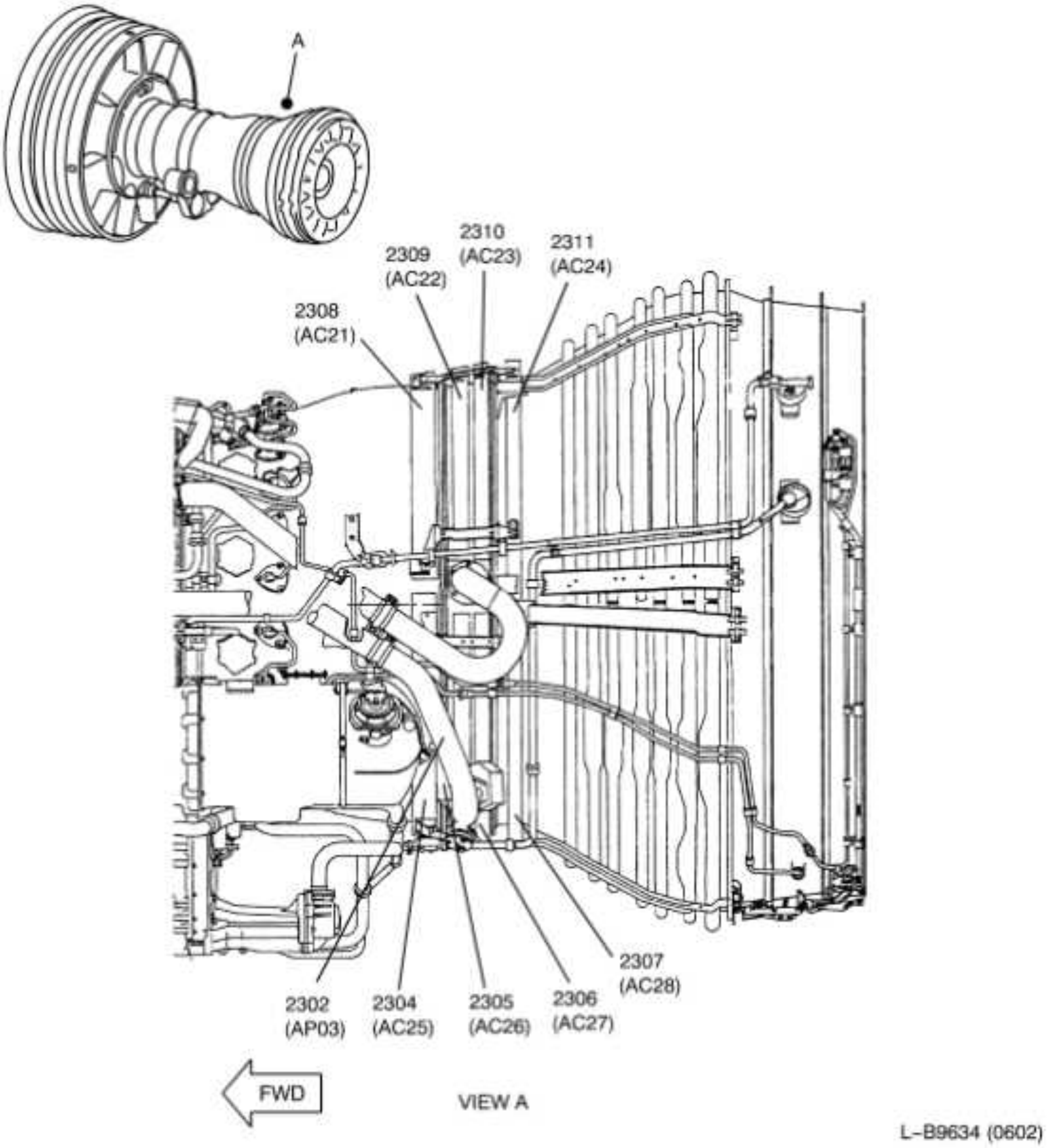
Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
2301		Tube − PT 4.95 Bracket − Loop Clamp, Assembly (See Figure 801, Sheet 1)			0.040 (1.016)	
2302		Turbine Cooling Air Tube Assembly Total length of tube (See Figure 801 Sheet 2)			0.040 (1.016)	
2303		HPT Turbine Case Cooling Collector Total length of tube (See Figure 801, Sheet 1)			0.040 (1.016)	
2304		Manifold − Assembly, Cooling Turbine Case Total length of tube (See Figure 801, Sheet 2)			0.030 (0.762)	
2305		Manifold − Assembly, Cooling Turbine Case Total length of tube (See Figure 801, Sheet 2)			0.040 (1.016)	
2306		Manifold − Assembly, Cooling Turbine Case Total length of tube (See Figure 801, Sheet 2)			0.040 (1.016)	
2307		Manifold − Assembly, Cooling Turbine Case Total length of tube (See Figure 801, Sheet 2)			0.040 (1.016)	

ENGINE GENERAL − INSPECTION/CHECK−15

Ref. No.	IFR	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
2308		Manifold − Assembly, Cooling Turbine Case Total length of tube (See Figure 801, Sheet 2)			0.030 (0.762)	
2309		Manifold − Assembly, Cooling, Turbine Case Total length of tube (See Figure 801, Sheet 2)			0.040 (1.016)	
2310		Manifold − Assembly, Cooling Turbine Case Total length of tube (See Figure 801, Sheet 2)			0.040 (1.016)	
2311		Manifold − Assembly, Cooling, Turbine Case Total length of tube (See Figure 801, Sheet 2)			0.040 (1.016)	
2312		Manifold − Assembly, Cooling Turbine Case Total length of tube (See Figure 801, Sheet 1)			0.040 (1.016)	
2313		Manifold − Assembly, Cooling Turbine Case Total length of tube (See Figure 801, Sheet 1)			0.040 (1.016)	


A
B
C
2340
AIR/OIL COOLER VALVE
RETURN TUBE (CR11)
VIEW C
2312
(AC14)
2303
2301
(AS04)
2313
(AC07)
VIEW A
VIEW B
L-B9633 (0602)

Engine General Tube Clearances
Figure 801 (Sheet 1)
(Task 72−00−00−990−015)


A
2309
(AC22)
2310
(AC23)
2311
(AC24)
2308
(AC21)
2307
(AC28)
2302
(AP03)
2304
(AC25)
2305
(AC26)
2306
(AC27)
FWD
VIEW A
L-B9634 (0602)

Engine General Tube Clearances
Figure 801 (Sheet 2)
(Task 72−00−00−990−015)

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ENGINE GENERAL − REPAIR−01

Task 72−00−00−300−001:

1. Repair The Sealant Around The Bifurcation Fairing

This Repair Is Relocated To 72−00−33, Repair−01

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ENGINE GENERAL - REPAIR-02

Task 72-00-00-300-002:

1. In-situ HPC Blend Repair

A. Equipment And Materials Necessary - None

B. General

(1) This repair applies to all HPC blades part numbers on Stages 5 through 15 except as follows:

(a) It is not possible to In-situ blend the leading edge of Stages 10 and 12 HPC blades or the trailing edge of Stages 9, 11, and 15 due to tooling access.

(b) It is not possible to In-situ blend Stages 12 and 13 blades on engines that incorporate the HPC Ring Case Configuration, since you can not insert the blending tool through the AP-6 borescope port.

(2) This repair can be used to blend minor damage on the leading and/or trailing edges of the HPC blades in assembled engines. See 70-00-00, Inspection/Check-01C (Task 72-00-00-210-004) for repairable damage limits and blade locations that can be accessed, by stage.

(3) Authorization to perform this repair must be obtained in writing from Pratt & Whitney. Only sources that have demonstrated the capability of satisfying the technical requirements of this procedure can become qualified for this source demonstration repair. Sources interested in being considered for qualification should contact:

Pratt & Whitney
Manager, Repair Development Engineering
400 Main Street
MS 163-20
East Hartford, CT 06108

(FAX 860-565-9825)

ENGINE GENERAL − REPAIR−02

(4) Sources that are approved to do this repair are in the list that follows by source code number. Refer to the Standard Practices Manual, 70−40−00, General−01 in the Repair Vendors List for the company names and addresses identified by these numbers:

R C0040
C0098

(5) It is to be understood that Pratt & Whitney does not endorse the work performed by the company or companies named herein or any other company and does not accept responsibility to any degree for the selection of such company or companies for the performance of any work or procurement of supplies. The preceding does not apply to Pratt & Whitney Overhaul Center.

Task 72-00-00-610-001:

1. Drain Engine Oil System

A. Equipment And Materials Required

Special Tools:

PWA 86018	Adapter, Oil Sampler (Optional)

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
R	P06-054	Paste, Antiseize (PWA 36246)
	P11-004	Solvent, Cleaning (PMC 9010)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72-62-00/3/190

B. Procedure
See Figure 1101.

NOTE: If you see "black oil" in the oil system, refer to the inspection for black oil, 72-00-00, Inspection/Check-04 Task 72-00-00-280-054. Black oil can be an indication of a serious problem or it can be a condition that requires no maintenance action.

WARNING: A MINIMUM OF FIVE MINUTES SHOULD ELAPSE AFTER ENGINE SHUTDOWN BEFORE REMOVING OIL TANK CAP OR DRAIN PLUGS TO ALLOW TANK PRESSURE TO BLEED OFF.

WARNING: USE CARE WHEN OPENING OIL TANK CAP OR REMOVING OIL TANK OR GEARBOX DRAIN PLUGS ON A RECENTLY RUN ENGINE. HOT OIL UNDER PRESSURE COULD BE RELEASED FROM TANK TO CAUSE SEVERE BURNS ON CONTACT WITH EYES OR SKIN.

(1) Loosen oil tank cap.

(2) Drain oil from oil tank and main gearbox by removing oil tank magnetic chip detector assembly and main gearbox magnetic chip detector assembly. See 72-00-61 Removal-36 (Task 72-00-61-050-017).

NOTE: You can use the PWA 86018 Adapter to drain the oil from the oil tank as an option to the magnetic chip detector removal.

(3) After removing the probes from the chip detector assemblies, clean the probes in Cleaning Solvent P11-004.

CAUTION: DO NOT MOTOR THE ENGINE WHEN YOU DRAIN THE ENGINE OIL. YOU CAN DAMAGE THE ENGINE IF YOU MOTOR THE ENGINE WITHOUT OIL IN THE SYSTEM.

(4) Drain oil from angle gearbox. See Figure 1102.

(a) Remove the fan exit liner segment from the 6 o'clock location. Refer to 72-00-33, Removal-16 Task 72-00-33-040-001.

(b) Remove bolts, washers, and plug on right side of angle gearbox bottom cover. Discard packing.

NOTE: Catch oil in container with a capacity of approximately 10 U.S. gallons (38 liters).

(5) Remove and discard main oil filter. See 72-00-61, Removal-35 (Task 72-00-61-030-001).

(6) Allow engine oil to slow drip from drains for approximately thirty (30) minutes.

(a) Lubricate a new packing with Engine Oil P03-001.

R (b) Apply Aniseize Paste P06-054 to the threads of two
R plug bolts. Wipe off unwanted paste.

(c) Install the packing on the plug.

(d) Install the plug in the cover.

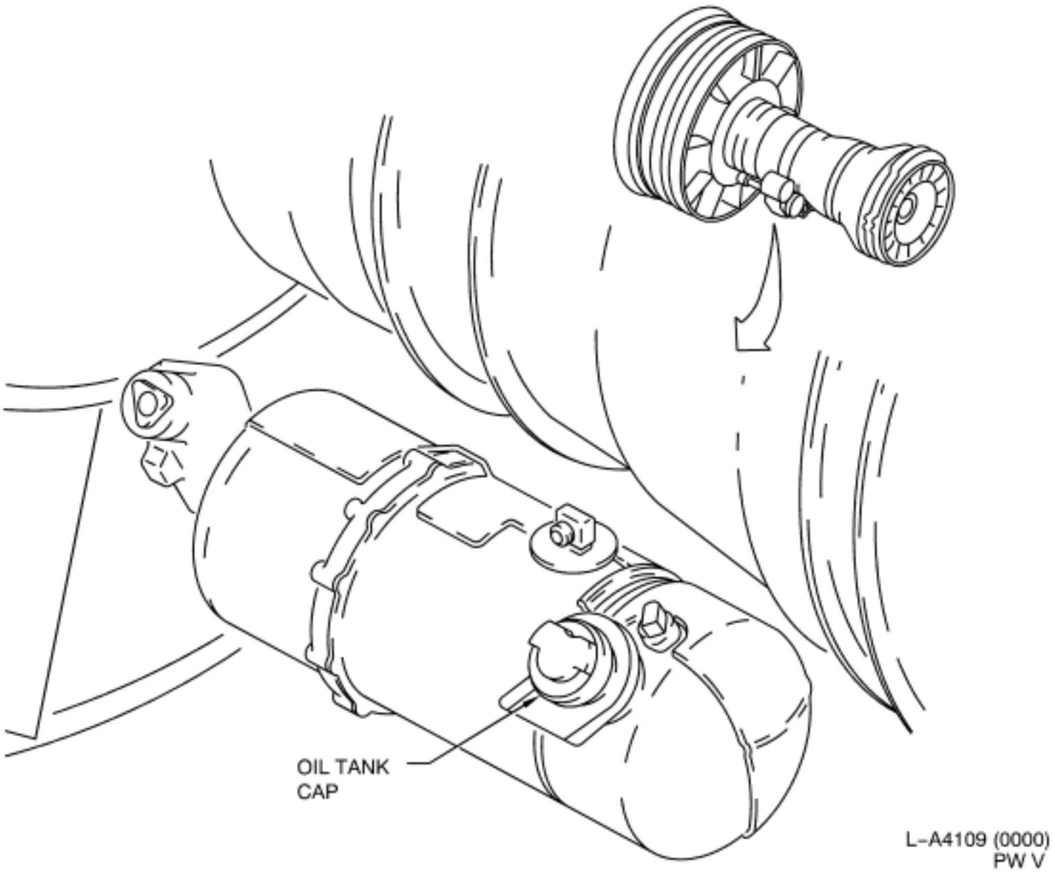
(e) Attach the plug to the cover with two washers and the two bolts. Torque the bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(7) Install the fan exit liner segment. Refer to 72-00-33, Installation-16 (Task 72-00-33-440-001).

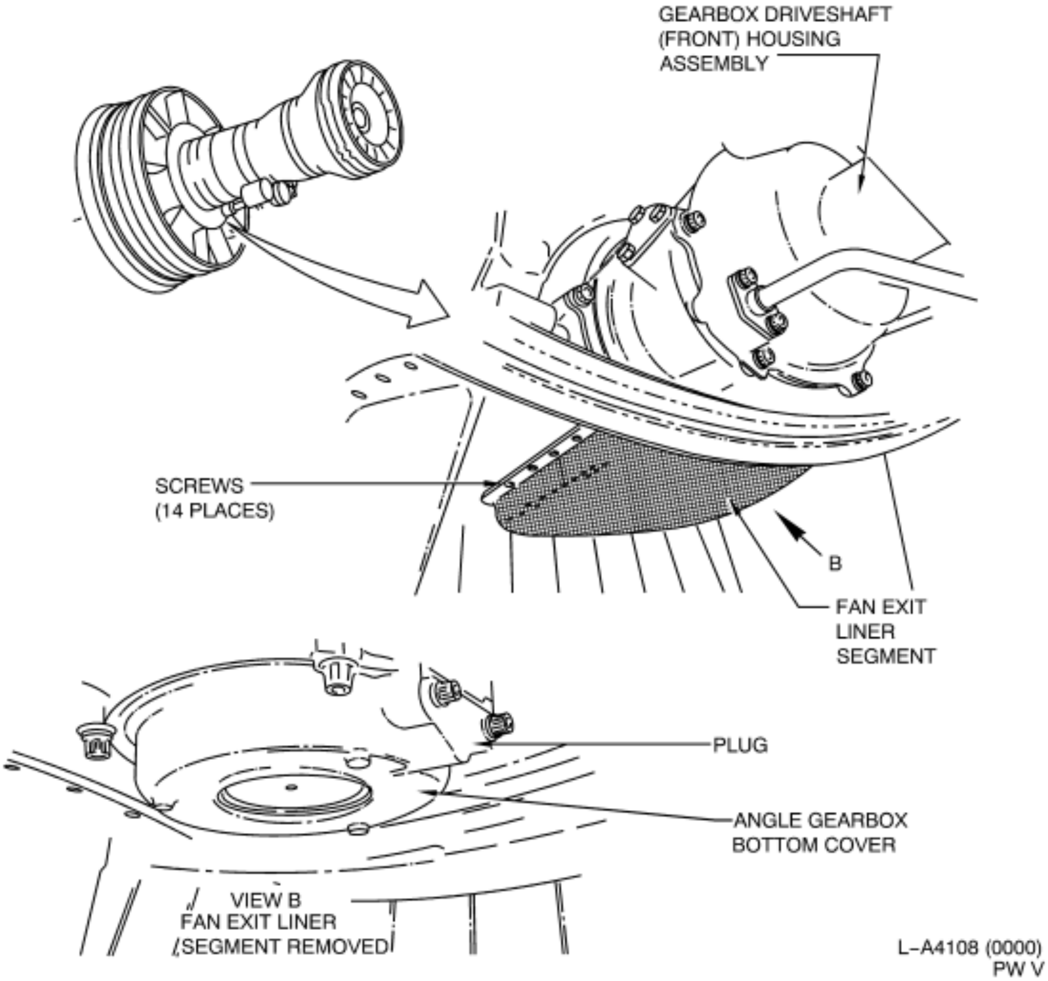
C. Postrequisites

(1) Install the main oil filter. See 72-00-61, Installation-35 (Task 72-00-61-430-001).

(2) Install the oil tank and main gearbox magnetic chip detector assemblies. Refer to 72-00-61, Installation-36 (Task 72-00-61-450-017).


OIL TANK
CAP
L−A4109 (0000)
PW V

Location Of Oil Tank Cap
Figure 1101
(Task 72−00−00−610−001)


GEARBOX DRIVESHAFT (FRONT) HOUSING ASSEMBLY
SCREWS (14 PLACES)
B
FAN EXIT LINER SEGMENT
PLUG
ANGLE GEARBOX BOTTOM COVER
VIEW B
FAN EXIT LINER SEGMENT REMOVED
L-A4108 (0000)
PW V

Access To Angle Gearbox Drain Plug
Figure 1102
(Task 72-00-00-610-001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - SERVICING-02

Task 72-00-00-610-002:

1. Fill The Engine Oil System

A. Prerequisites

(1) Drain the engine oil system. See Servicing-01 Task 72-00-00-610-001.

(2) Remove the oil tank cap. Refer to 72-00-61, Removal-38 Task 72-00-61-040-002.

B. Equipment And Materials Required

Special Tools:

PWA 86018	Adapter, Oil Sampler (Optional)

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

C. Procedure
See Figure 1101.

CAUTION: MAKE SURE THAT THE MAGNETIC CHIP DETECTOR ASSEMBLIES ARE INSTALLED.

(1) (Post SB PW4ENG 79-18) Fill the oil system.

NOTE: The correct level of oil is at the bottom of the "V" made by the valve of the filler neck valve.

CAUTION: DO NOT USE THE PRESSURE FILL METHOD. THE MANUAL FILL METHOD ONLY IS PERMITTED.

(a) Put Engine Oil P03-001 in the filler neck valve until the level of oil reaches the bottom of the "V".

(b) Write down the quantity of oil added.

CAUTION: DO NOT USE THE OIL TANK SIGHT GAGE TO DO A CHECK OF THE OIL LEVEL. YOU MUST LOOK INSIDE THE OIL TANK TO CORRECTLY MEASURE THE OIL.

(2) (Pre SB PW4ENG 79-18 or Post SB PW4ENG 79-47) Fill the oil system.

NOTE: The correct oil level is at the top of the filler neck valve.

(a) Add Engine Oil P03-001 as necessary to reach the top of the filler neck valve.

(b) Write down the quantity of oil added.

(3) Install the oil tank cap. Refer to 72-00-61, Installation-38 Task 72-00-61-440-002.

(4) Dry motor the engine until the oil pressure is stable. Do the procedure in 71-00-00, Testing-02 Task 71-00-00-760-029.

(5) Examine the engine oil level between 15 minutes and 2 hours after shutdown of the engine.

CAUTION: DO NOT USE THE OIL TANK SIGHT GAGE TO DO A CHECK OF THE OIL LEVEL. YOU MUST LOOK INSIDE THE OIL TANK TO CORRECTLY MEASURE THE OIL.

(6) (Post SB PW4ENG 79-18) Do a check of the oil level.

(a) Remove the oil tank cap. Refer to 72-00-61, Removal-38 Task 72-00-61-040-002.

NOTE: The correct level of oil is at the bottom of the "V" made by the valve of the filler neck valve.

(b) If you DO NOT see oil (the oil is below the bottom of the "V"):

1 With a clean screwdriver, push open the valve of the filler neck.

2 With a strong light, look at the oil.

CAUTION: DO NOT USE THE PRESSURE FILL METHOD. THE MANUAL FILL METHOD ONLY IS PERMITTED.

3 Add Engine Oil P03-001 until the level of oil reaches the bottom of the "V".

4 Write down the quantity of oil added.

(c) If you DO see oil (the oil is above the bottom of the "V"):

1 Drain 10 quarts (9.46 l) of oil from the oil tank by removing and installing the oil tank magnetic chip detector assembly. See 72-00-61, Removal-36 (Task 72-00-61-050-017) and Installation-36 (Task 72-00-61-450-017).

NOTE: You can use the PWA 86018 Adapter to drain the oil from the oil tank as an option to the magnetic chip detector removal.

2 Install the oil tank cap. Refer to 72-00-61, Installation-38 (Task 72-00-61-440-002).

3 Dry motor the engine. Refer to 71-00-00, Testing-02 (Task 71-00-00-760-029).

4 Do another check of the oil level.

CAUTION: DO NOT USE THE OIL TANK SIGHT GAGE TO DO A CHECK OF THE OIL LEVEL. YOU MUST LOOK INSIDE THE OIL TANK TO CORRECTLY MEASURE THE OIL.

(7) (Pre SB PW4ENG 79-18 or Post SB PW4ENG 79-47) Do a check of the oil level. Examine the engine oil level between 15 minutes and 2 hours after shutdown of the engine.

(a) Remove the oil tank cap. Refer to 72-00-61, Removal-38 Task 72-00-61-040-002.

NOTE: The correct oil level is at the top of the filler neck valve.

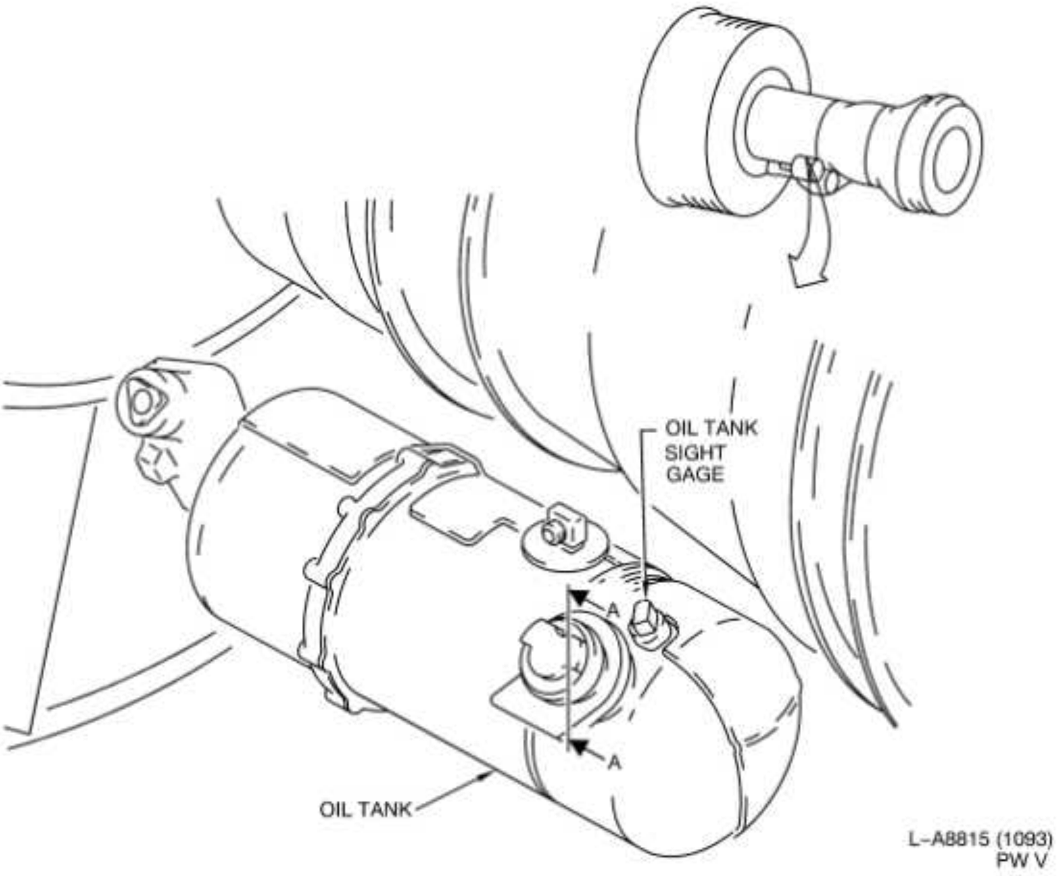
CAUTION: DO NOT USE THE PRESSURE FILL METHOD. THE MANUAL FILL METHOD ONLY IS PERMITTED.

(b) Add Engine Oil P03-001 as necessary to reach the top of the filler neck valve.

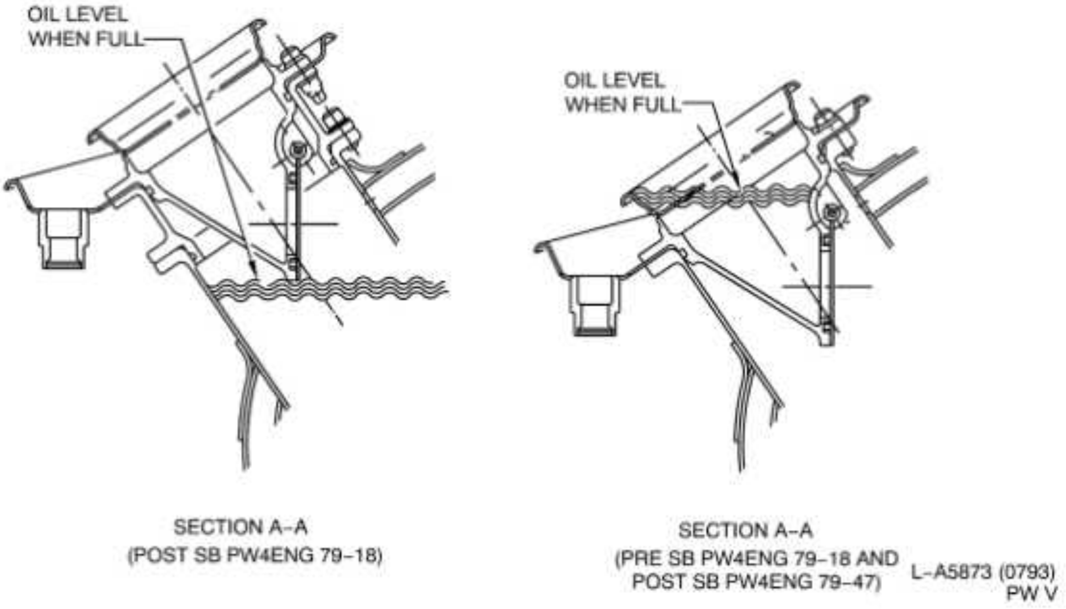
(c) Write down the quantity of oil added.

D. Postrequisites

(1) Install the oil tank cap. Refer to 72-00-61, Installation-38 Task 72-00-61-440-002.


OIL TANK
SIGHT
GAGE
A
A
OIL TANK
L−A8815 (1093)
PW V

Servicing The Engine Oil System (Location Of The Oil Tank Cap)
Figure 1101 (Sheet 1)
(Task 72−00−00−610−002)


OIL LEVEL WHEN FULL
OIL LEVEL WHEN FULL
L-A5873 (0793)
PW V

SECTION A-A
(POST SB PW4ENG 79-18)

SECTION A-A
(PRE SB PW4ENG 79-18 AND
POST SB PW4ENG 79-47)

Servicing The Engine Oil System (Correct Oil Levels)
Figure 1101 (Sheet 2)
(Task 72-00-00-610-002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - SERVICING-03

Task 72-00-00-610-003:

1. Service The Engine Oil System

A. Equipment And Materials Required

Special Tools:

PWA 86018	Adapter, Oil Sampler (Optional)

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

B. When To Do A Check Of The Oil Level

CAUTION: YOU MUST EXAMINE THE OIL LEVEL BETWEEN 15 MINUTES AND 2 HOURS AFTER ENGINE SHUTDOWN. IF YOU DO NOT, THE OIL LEVEL SIGHTGLASS INDICATION WILL NOT BE ACCURATE.

(1) Examine the engine oil level between 15 minutes and 2 hours after shutdown of the engine.

(2) If engine shutdown occurred more than two hours before, you must dry motor the engine until the oil pressure is stable. Refer to 71-00-00, Testing-02 Task 71-00-00-760-029 for the dry motor procedure. The dry motor procedure returns to the oil tank any oil that drained from the oil tank. This makes it possible to know if the quantity of oil in the oil tank is correct.

C. Do A Check Of The Oil Level
See Figure 1101.

NOTE: If you see "black oil" in the oil system, refer to the inspection for black oil, 72-00-00, Inspection/Check-04 Task 72-00-00-280-054. Black oil can be an indication of a serious problem or it can be a condition that requires no maintenance action.

(1) Open the oil-fill access door.

WARNING: DO NOT OPEN THE OIL TANK CAP FOR FIVE MINUTES AFTER SHUTDOWN OF THE ENGINE. A MINIMUM OF FIVE MINUTES IS NECESSARY TO LET PRESSURE IN THE OIL TANK BLEED OFF.

WARNING: BE CAREFUL WHEN YOU OPEN THE OIL TANK CAP ON AN ENGINE THAT HAS JUST SHUT DOWN. HOT OIL THAT IS UNDER PRESSURE IS DANGEROUS. IT CAN BADLY BURN EYES AND SKIN.

(2) Remove the oil tank cap. Refer to 72-00-61, Removal-38 Task 72-00-61-040-002.

CAUTION: DO NOT USE THE OIL TANK SIGHT GAGE TO DO A CHECK OF THE OIL LEVEL. YOU MUST LOOK INSIDE THE OIL TANK TO CORRECTLY MEASURE THE OIL.

(3) (Post SB PW4ENG 79-18) Do a check of the oil level.

NOTE: The correct level of oil is at the bottom of the "V" made by the valve of the filler neck valve.

(a) If you DO NOT see oil (the oil is below the bottom of the "V"):

1 With a clean screwdriver, push open the valve of the filler neck.

2 With a strong light, look at the oil.

CAUTION: DO NOT USE THE PRESSURE FILL METHOD. THE MANUAL FILL METHOD ONLY IS PERMITTED.

3 Add Engine Oil P03-001 until the level of oil reaches the bottom of the "V".

4 Write down the quantity of oil added.

(b) If you DO see oil (the oil is above the bottom of the "V"):

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM AN ENGINE THAT HAS JUST SHUT DOWN. HOT OIL THAT IS UNDER PRESSURE IS DANGEROUS. IT CAN BADLY BURN EYES AND SKIN.

1 Drain 10 quarts (9.46 l) of oil from the oil tank by removing and installing the oil tank

magnetic chip detector assembly. See 72-00-61, Removal-36 (Task 72-00-61-050-017).

NOTE: You can use the PWA 86018 Adapter to drain the oil from the oil tank as an option to the magnetic chip detector removal.

2 Install the oil tank cap. Refer to 72-00-61, Installation-38 (Task 72-00-61-440-002).

3 Dry motor the engine. Refer to 71-00-00, Testing-02 (Task 71-00-00-760-029).

4 Do another check of the oil level.

CAUTION: DO NOT USE THE OIL TANK SIGHT GAGE TO DO A CHECK OF THE OIL LEVEL. YOU MUST LOOK INSIDE THE OIL TANK TO CORRECTLY MEASURE THE OIL.

(4) (Pre SB PW4ENG 79-18 or Post SB PW4ENG 79-47) Do a check of the oil level.

NOTE: The correct oil level is at the top of the filler neck valve.

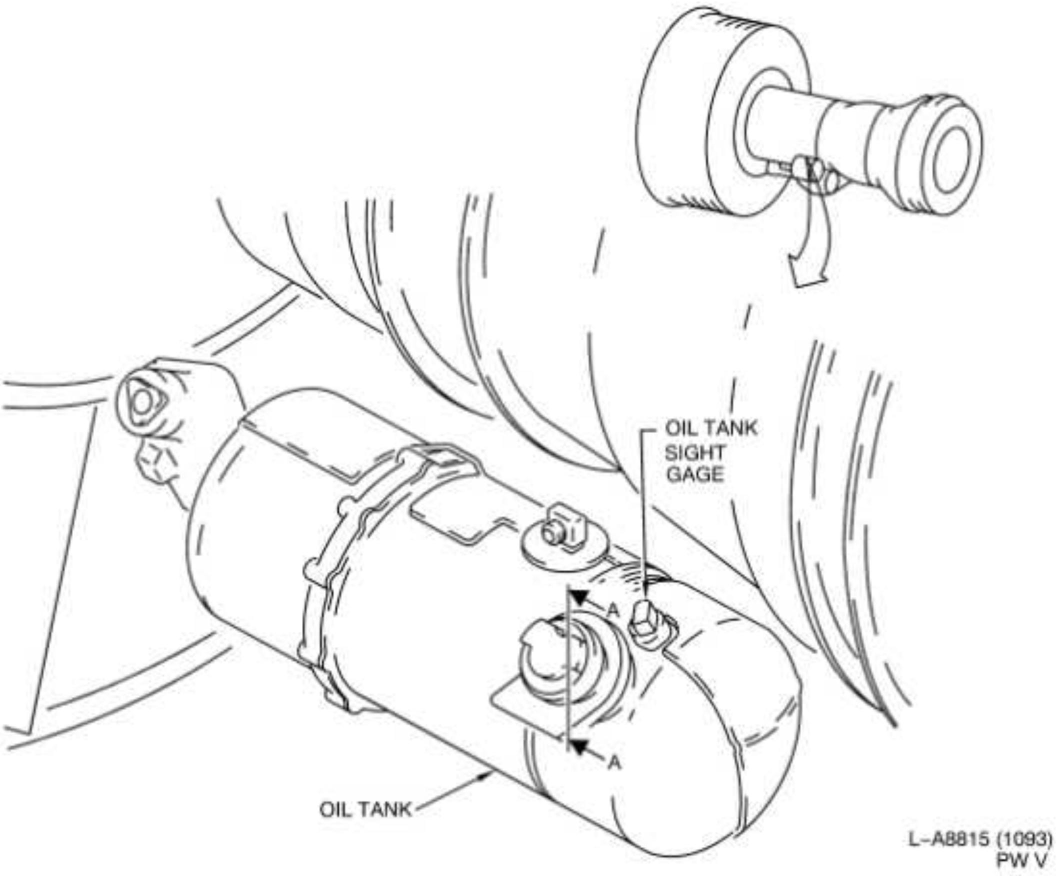
(a) Add Engine Oil P03-001 as necessary to reach the top of the filler neck valve.

(b) Write down the quantity of oil added.

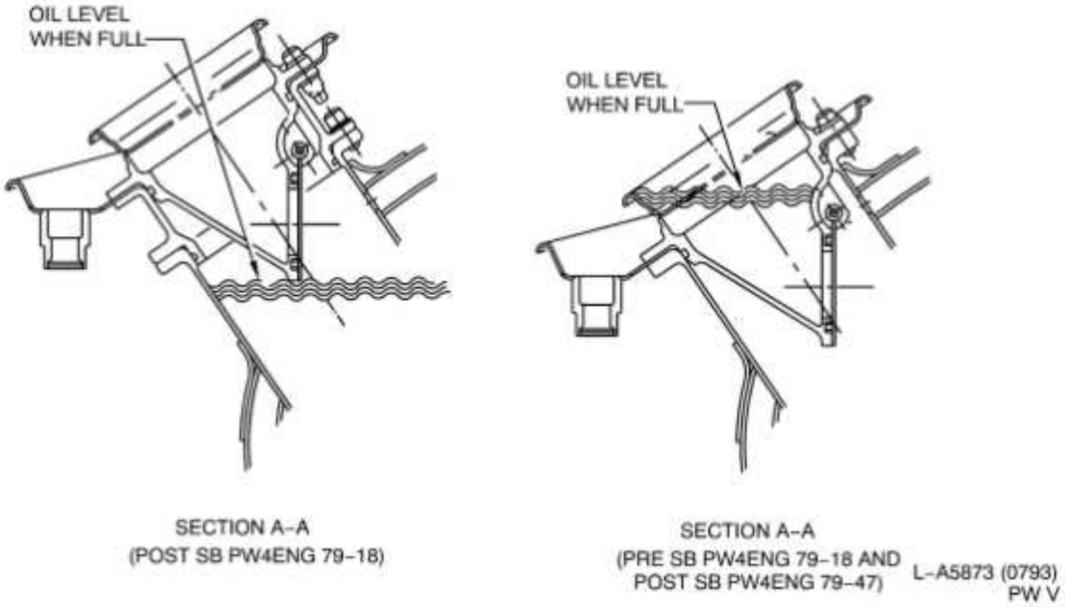
D. Postrequisites

(1) Install the oil tank cap. Refer to 72-00-61, Installation-38 Task 72-00-61-440-002.

(2) Close the oil-fill access door.


OIL TANK SIGHT GAGE
A
A
OIL TANK
L−A8815 (1093)
PW V

Servicing Of The Engine Oil System (Location Of The Oil Tank Cap)
Figure 1101 (Sheet 1)
(Task 72−00−00−610−003)


OIL LEVEL
WHEN FULL
OIL LEVEL
WHEN FULL
L-A5873 (0793)
PW V

SECTION A-A
(POST SB PW4ENG 79-18)

SECTION A-A
(PRE SB PW4ENG 79-18 AND
POST SB PW4ENG 79-47)

Servicing Of The Engine Oil System (Correct Oil Levels)
Figure 1101 (Sheet 2)
(Task 72-00-00-610-003)

Task 72-00-00-640-002:

1. Hot Oil Flush Procedure

A. Equipment And Materials Necessary

Special Tools:

CTE 9060	Hot Oil Cart
PWA 85525	Adapter
PWA 85526	Adapter
PWA 86018	Adapter, Oil Sampler (Optional)

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
R	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	2	79-21-00/7/1

B. Procedure

(1) If engine can be motored without further damage, hot oil flush operable and inoperable engines.

(a) Service cart, CTE 9060.

1 Drain any residual water or contaminants from reservoir, connecting lines and hydraulic system.

2 Close outlet valve from reservoir. Remove cap and connect oil supply to filling connection.

NOTE: Reservoir may be filled through inlet line if more convenient.

3 Open vent valve and inlet valve. Fill reservoir with approximately 50 gallons (189 l) of, jet engine oil or until overflow occurs from vent.

NOTE: Engine Oil P03−001 of same type and brand as used in engine must be used to service cart.

4 Close inlet valve and cap filling connection.

5 Set temperature controller in control cabinet at 300°F (149°C).

WARNING: CUT OFF POWER SUPPLY BEFORE CONNECTING OR DISCONNECTING LEADS TO CART OR BEFORE OPENING CONTROL CABINET.

(b) Perform following heating cycle.

1 Connect electrical leads to cart, to facility power supplies.

NOTE: When heating a charge in reservoir for recycling, initially set temperature controller at 225°F (107.2°C) and allow approximately one hour stabilizing period, or until evaporation of moisture through vent is complete, before heating to 300°F (149°C).

2 Energize cart electrical circuits sequentially.

a Power supply

b Circulating pump

c Heating elements

CAUTION: TEMPERATURE INDICATOR AND TEMPERATURE CONTROLLER ARE RED LINED AT 310°F (154°C) TO PREVENT INADVERTANT

OVERTEMPERATURE OF OIL AND FORMING OF COKE ON HEATING ELEMENTS.

3 Stabilize at set temperature until ready to service engine.

NOTE: Check for overflow from vent when set temperature is reached. Add oil as necessary to completely fill reservoir.

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE ETERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(c) Prepare engine for motoring per standard procedure including the following.

1 Remove inlet, duct and tailpipe covers as applicable.

2 Remove rotor and bleed actuator locking devices as applicable.

3 Install necessary air ducts to starter duct system and connect to ground starting units.

4 Remove main oil filter tube assembly (LP01) from engine as follows.

a Remove bolts securing forward end of tube to main oil filter and rear end of tube to top of oil pump. See Figure 1101.

b Remove clamps from tube and remove tube from engine. Discard packings.

5 Install PWA 85525 Adapter to pad on main oil filter housing and secure with bolts.

NOTE: Ensure packing is installed on adapter prior to installation.

6 Install PWA 85526 Adapter to pad on top, rear of oil pump and secure with bolts.

NOTE: Ensure packing is installed on adapter prior to installation.

7 Drain the oil tank by removing the oil tank magnetic chip detector assembly. See 72-00-61, Removal-36 (Task 72-00-61-050-017).

NOTE: You can use the PWA 86018 Adapter to drain the oil from the oil tank as an option to the magnetic chip detector removal.

8 Terminate heat cycle on cart, disconnect power leads and transport cart to service area.

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE ETERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(d) Service engine. See Servicing-03 (Task 72-00-00-610-003).

1 Connect outlet hose from hot oil cart to adapter on main oil filter housing and inlet hose to adapter on top rear of oil pump.

2 Close vent valve on reservoir.

3 Open inlet and outlet valve to reservoir.

4 Prepare engine for motoring.

CAUTION: RESERVOIR MUST BE FULL, INLET AND OUTLET VALVES OPEN, AND VENT VALVE CLOSED TO PREVENT POSSIBLE DAMAGE TO BEARINGS WHEN MOTORING ENGINE.

5 Motor engine for minimum period of three minutes. Monitor build up and stabilized level of pressure in reservoir during motoring of engine.

6 Terminate motoring of engine.

CAUTION: USE CARE WHEN HANDLING FITTINGS AND LINES AFTER MOTORING TO PREVENT INJURY FROM HOT OIL IN SYSTEMS.

7 Disconnect inlet and outlet lines and remove adapters from main oil filter housing and from top rear of oil pump housing.

8 Install main oil filter tube assembly (LP01) to engine.

a Install packings, lubricated with Engine Oil P03−001, to grooves on both ends of tube.

b Install tube to port on main oil filter housing and port on top rear of oil pump. Secure tube flange on forward end of tube to filter housing with bolts, threads lubricated with Engine Oil P03−001. Secure rear end of tube to pump with bolts, threads
R lubricated with Antiseize Paste P06−054.
R Remove unwanted paste.

c Install clamps to tube as shown in Figure 1101. Secure clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

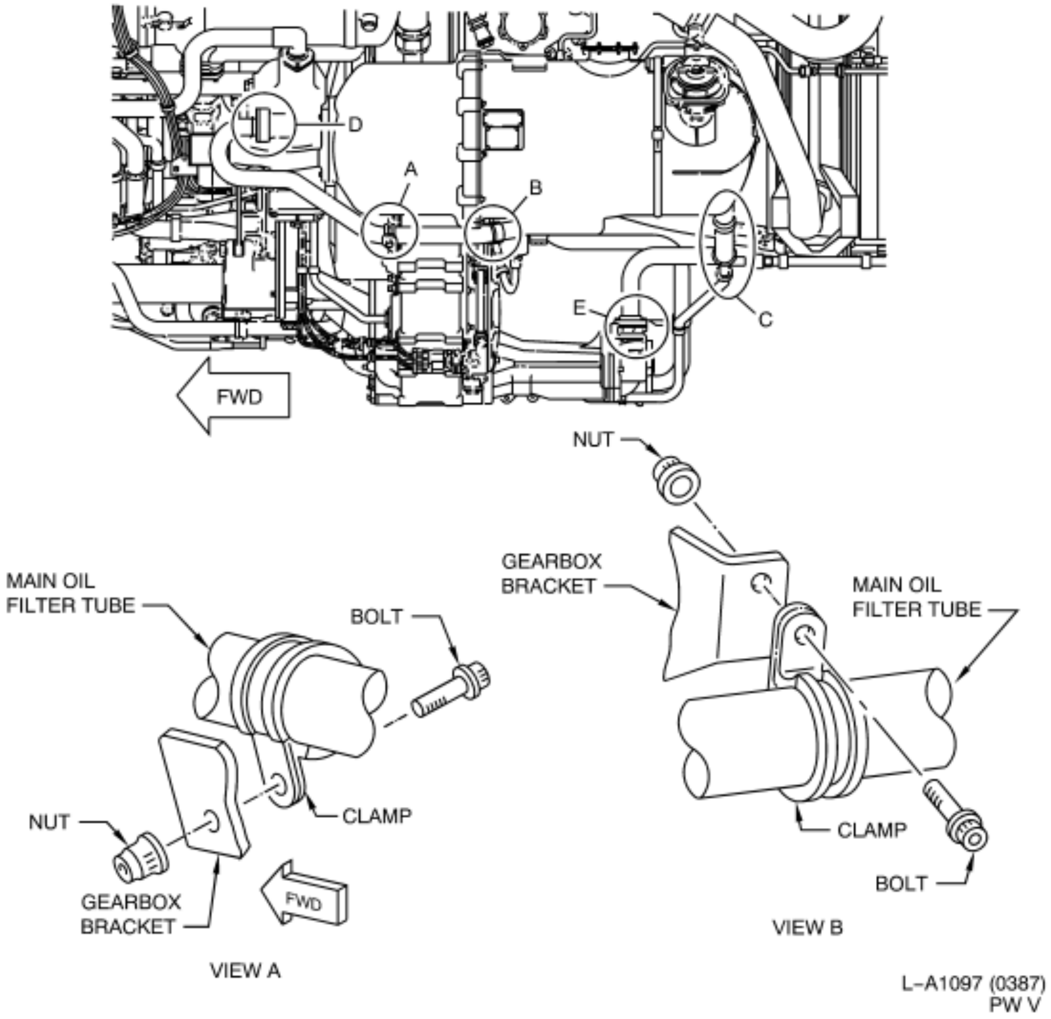
d Torque the bolts that attach the tube to the oil filter housing to 85 − 95 lb−in. (9.604 − 10.734 N.m). Torque the bolts that attach the tube to the oil pump to 67 − 72 lb−in. (7.005 − 8.135 N.m).

e Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

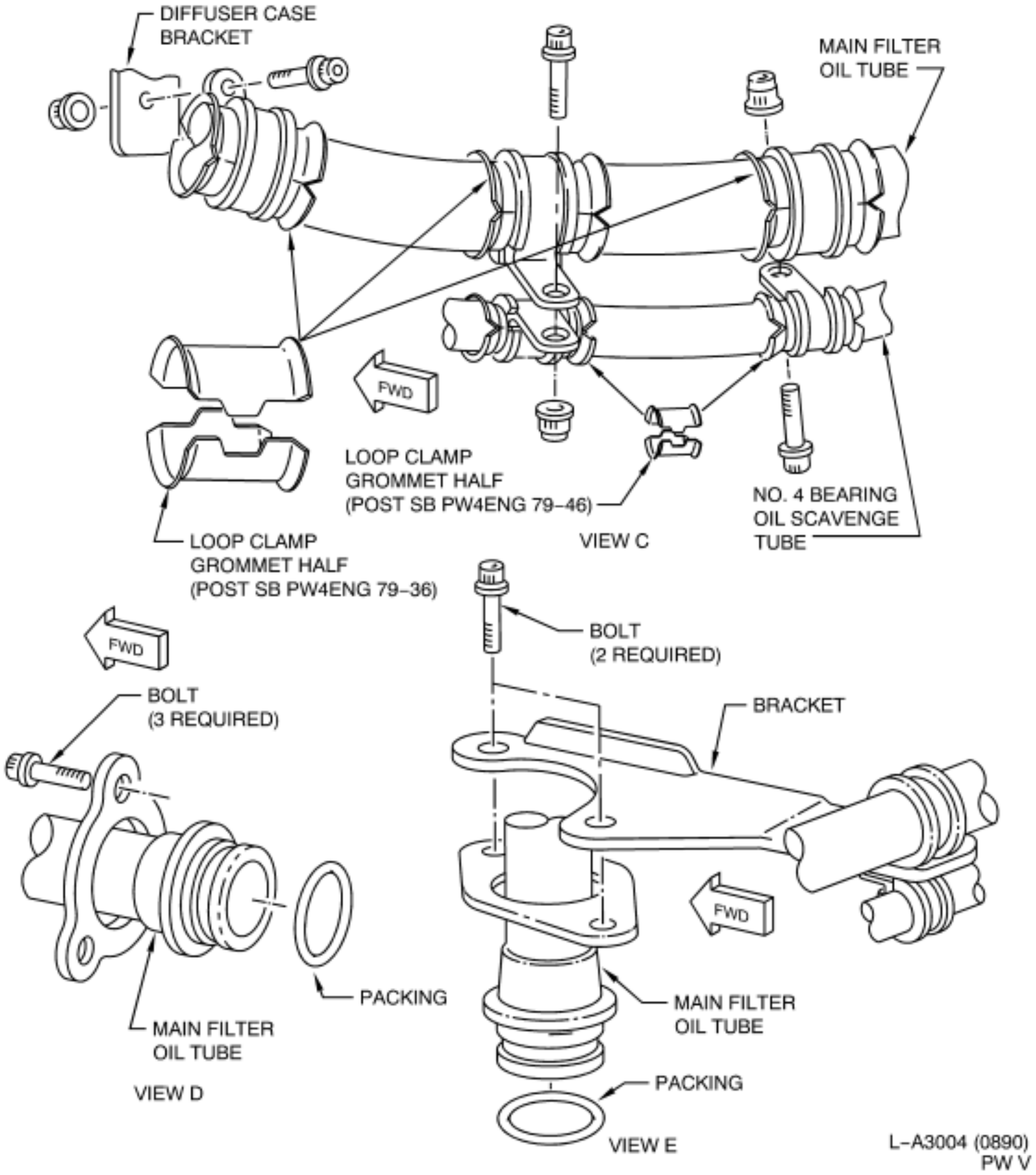
9 Install all caps, plugs, and closures on connecting lines and hydraulic system of cart.

10 Prepare engine for installation or storage as applicable.

NOTE: For optimum results, two motoring periods may be run with initial charge, after repeating heating cycle. If oil used in flushing process is to be stored in cart, it is recommended that a heating cycle be run prior to storage to eliminate any condensation and that periodic samples of oil be taken to ensure that no degradation of oil occurs.


D
A
B
C
E
FWD
NUT
GEARBOX BRACKET
MAIN OIL FILTER TUBE
BOLT
CLAMP
NUT
GEARBOX BRACKET
FWD
VIEW A
MAIN OIL FILTER TUBE
CLAMP
BOLT
VIEW B
L−A1097 (0387)
PW V

Main Filter Oil Tube
Figure 1101 (Sheet 1)
(Task 72−00−00−640−002)


DIFFUSER CASE BRACKET
MAIN FILTER OIL TUBE
FWD
LOOP CLAMP GROMMET HALF (POST SB PW4ENG 79-46)
NO. 4 BEARING OIL SCAVENGE TUBE
LOOP CLAMP GROMMET HALF (POST SB PW4ENG 79-36)
VIEW C
BOLT (2 REQUIRED)
FWD
BOLT (3 REQUIRED)
BRACKET
FWD
PACKING
MAIN FILTER OIL TUBE
MAIN FILTER OIL TUBE
VIEW D
PACKING
VIEW E
L-A3004 (0890)
PW V

Main Filter Oil Tube
Figure 1101 (Sheet 2)
(Task 72-00-00-640-002)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-00-610-004:

1. Flush The Engine Oil System

A. Equipment And Materials

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P11-004	Solvent, Cleaning (PMC 9010)

B. Procedure

See Figure 301.

NOTE: If you see "black oil" in the oil system, refer to the inspection for black oil, 72-00-00, Inspection/Check-04 (Task 72-00-00-280-054). Black oil can be an indication of a serious problem or it can be a condition that requires no maintenance action.

WARNING: DO NOT LOOSEN THE OIL TANK CAP OR REMOVE THE MAGNETIC CHIP DETECTORS ASSEMBLIES FOR FIVE MINUTES, MINIMUM, AFTER ENGINE SHUTDOWN (THIS WILL LET THE PRESSURE IN THE OIL TANK BECOME LOWER). HOT OIL CAN CAUSE BURNS. HOT OIL CAN FLOW FROM THE OIL TANK IF THE PRESSURE IS NOT RELEASED.

WARNING: BE CAREFUL WHEN YOU WORK WITH THE OIL SYSTEM AND USE SUFFICIENT PROTECTION FOR THE HANDS AND EYES. THE OIL IS HOT AND CAN CAUSE BURNS.

R R R (1) Drain the oil that is in the engine oil system. See Drain Engine Oil System, 72-00-00, Servicing-01 (Task 72-00-00-610-001).

(2) Fill the oil tank with oil as follows.

(a) Remove the oil tank cap. Refer to 72-00-61, Removal-38 (Task 72-00-61-040-002).

CAUTION: DO NOT USE THE OIL LEVEL INDICATOR TO DO A CHECK OF THE OIL LEVEL. YOU MUST LOOK INSIDE THE OIL TANK TO CORRECTLY MEASURE THE OIL.

(b) Fill the oil tank as follows.

1 (Pre SB PW4ENG 79-18 or Post SB PW4ENG 79-47) Put Engine Oil P03-001 in the filler neck valve until the level of oil reaches the top of the "V".

CAUTION: DO NOT USE THE PRESSURE FILL METHOD. THE MANUAL FILL METHOD ONLY IS PERMITTED.

2 (Post SB PW4ENG 79-18) Put Engine Oil P03-001 in the filler neck valve until the level of oil reaches the bottom of the "V".

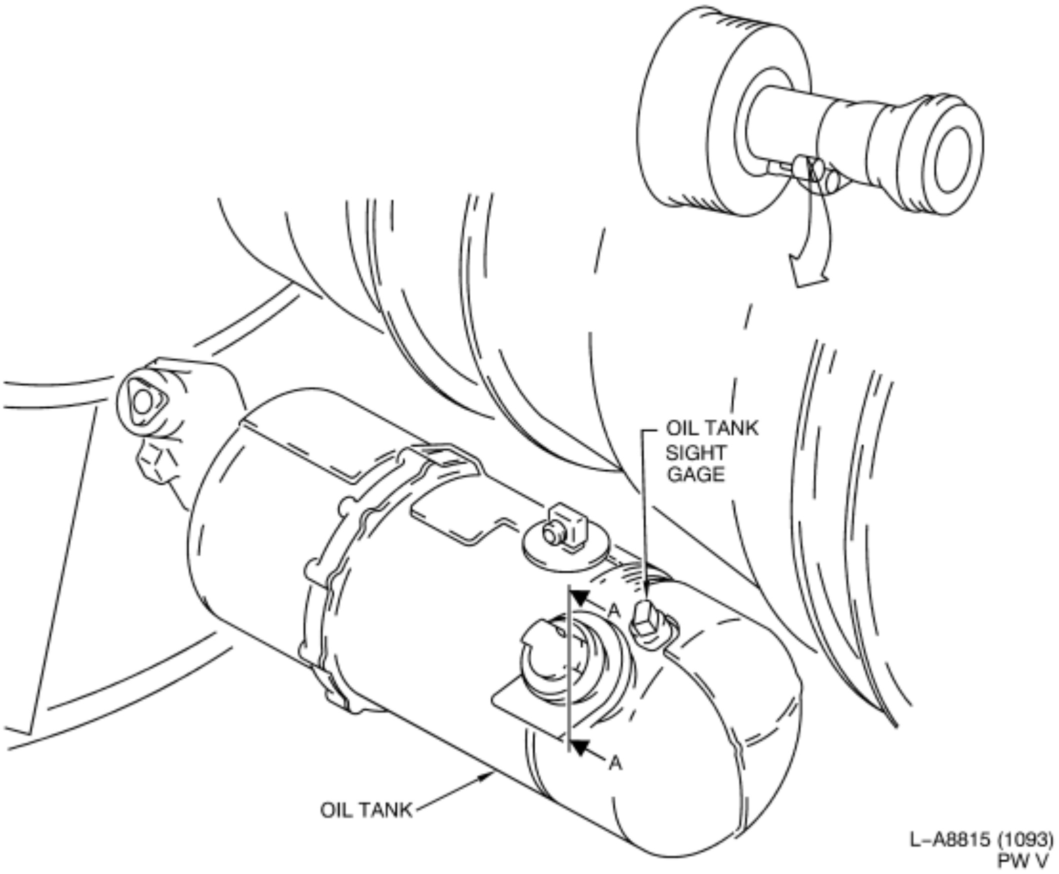
(c) Install the oil tank cap. Refer to 72-00-61, Installation-38 Task 72-00-61-040-002.

(3) Motor the engine as follows.

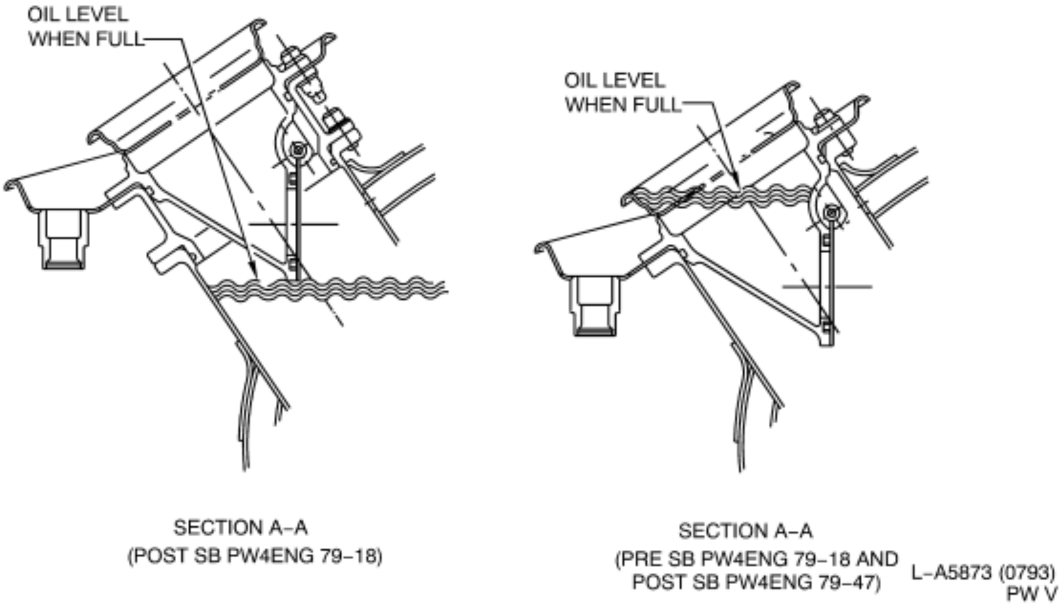
(a) Dry motor the engine until the oil pressure is stable. Do the procedure in 71-00-00, Testing-02 Task 71-00-00-760-029.

(4) Drain the oil system again. Refer to Step (1).

(5) Fill the oil system. Refer to Servicing-02 Task 72-00-00-610-002.


OIL TANK
SIGHT
GAGE
A
A
OIL TANK
L-A8815 (1093)
PW V

Location Of The Oil Tank Cap
Figure 301 (Sheet 1)
(Task 72-00-00-610-004)


OIL LEVEL
WHEN FULL
SECTION A-A
(POST SB PW4ENG 79-18)
OIL LEVEL
WHEN FULL
SECTION A-A
(PRE SB PW4ENG 79-18 AND
POST SB PW4ENG 79-47)
L-A5873 (0793)
PW V

Correct Oil Levels
Figure 301 (Sheet 2)
(Task 72-00-00-610-004)

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Pratt & Whitney

PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

Tab Separator - Engine General

List of Effective Pages - Engine General
See end of list.

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		05		DEC 15/06
		06		DEC 15/06
		07		DEC 15/06
		08		DEC 15/06
		09/ 10		DEC 15/06
72-00-00				
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		027		SEP 15/01
		028		SEP 15/01
		029		SEP 15/01
		030		SEP 15/01

	031		SEP 15/01
	032		SEP 15/01
	033		SEP 15/01
	034		SEP 15/01
	035		SEP 15/01
	036		SEP 15/01
	037		SEP 15/01
	038		SEP 15/01
	039		SEP 15/01
	040		SEP 15/01
72-00-00			
72-00-00	201	ALL	JUL 15/91
SPEC PRO-01	202		JUL 15/91
	203		APR 15/89
	204		JAN 15/87
	205		JUL 15/91
	206		JUL 15/91
72-00-00			
72-00-00	201	ALL	JUL 15/91
SPEC PRO-02	202		JUL 15/91
	203/204		MAR 1/86
72-00-00			
72-00-00	201	ALL	DEC 15/06
SPEC PRO-03	202		DEC 15/06
	203		DEC 15/06
	204		DEC 15/06
	205/206		DEC 15/98
72-00-00			
72-00-00	201	ALL	DEC 15/06
SPEC PRO-04	202		DEC 15/06
	203		MAR 15/99
	204		MAR 15/99
	205		MAR 15/99
	206		MAR 15/99
	207		DEC 15/06
	208		DEC 15/06
	209		DEC 15/06
	210		DEC 15/06
	211		MAR 15/99
	212		MAR 15/99
	213		MAR 15/99
	214		MAR 15/99
	215		MAR 15/99
	216		MAR 15/99
	217		DEC 15/06
	218		DEC 15/06
	219/220		DEC 15/06
72-00-00			
72-00-00	201	ALL	DEC 15/06
SPEC PRO-05	202		DEC 15/06
	203		JUN 15/00
	204		JUN 15/00
	205		JUN 15/00
	206		JUN 15/00
	207		JUN 15/00
	208		JUN 15/00
	209		JUN 15/00
	210		JUN 15/00
	211		DEC 15/06
	212		DEC 15/06
	213		MAR 15/99
	214		MAR 15/99
	215		MAR 15/99
	216		MAR 15/99
	217		MAR 15/99
	218		MAR 15/99
	219		MAR 15/99
	220		MAR 15/99
	221		MAR 15/99
	222		MAR 15/99
	223		MAR 15/99
	224		MAR 15/99

	225		MAR 15/99
	226		MAR 15/99
	227		MAR 15/99
	228		MAR 15/99
72-00-00			
72-00-00	201	ALL	SEP 15/98
SPEC PRO-06	202		SEP 15/98
	203		SEP 15/98
	204		SEP 15/98
	205		SEP 15/98
	206		SEP 15/98
	207		SEP 15/98
	208		SEP 15/98
	209/210		SEP 15/98
72-00-00			
72-00-00	201	ALL	SEP 15/96
SPEC PRO-07	202		SEP 15/96
	203/204		SEP 15/94
72-00-00			
72-00-00	201	ALL	SEP 15/94
SPEC PRO-08	202		SEP 15/94
	203/204		SEP 15/94
72-00-00			
72-00-00	201	ALL	SEP 15/96
SPEC PRO-09	202		SEP 15/96
	203		SEP 15/96
	204		SEP 15/96
	205/206		DEC 15/95
72-00-00			
72-00-00	201	ALL	SEP 15/96
SPEC PRO-10	202		SEP 15/96
	203		DEC 15/95
	204		DEC 15/95
	205/206		DEC 15/95
72-00-00			
72-00-00	201	ALL	SEP 15/98
SPEC PRO-11	202		SEP 15/98
	203		SEP 15/98
	204		SEP 15/98
	205		SEP 15/98
	206		SEP 15/98
	207		SEP 15/98
	208		SEP 15/98
	209		SEP 15/98
	210		SEP 15/98
	211		SEP 15/98
	212		SEP 15/98
72-00-00			
72-00-00	201	ALL	DEC 15/98
SPEC PRO-12	202		DEC 15/98
	203/204		DEC 15/98
72-00-00			
72-00-00	201	ALL	DEC 15/01
SPEC PRO-13	202		DEC 15/01
	203/204		JUN 15/98
72-00-00			
72-00-00	201	ALL	DEC 15/05
SPEC PRO-16	202		DEC 15/05
	203		DEC 15/05
	204		DEC 15/05
	205		DEC 15/05
	206		DEC 15/05
	207		DEC 15/05
	208		DEC 15/05
72-00-00			
72-00-00	201	ALL	DEC 15/97
SPEC PRO-17	202		DEC 15/97
	203		DEC 15/97
	204		DEC 15/97
	205		DEC 15/97
	206		DEC 15/97
72-00-00			

72-00-00	201	ALL	DEC 15/98
SPEC PRO-18	202		DEC 15/98
72-00-00			
72-00-00	201	ALL	DEC 15/97
SPEC PRO-19	202		DEC 15/97
	203		DEC 15/97
	204		DEC 15/97
	205/206		DEC 15/97
72-00-00			
72-00-00	201	ALL	DEC 15/98
SPEC PRO-20	202		DEC 15/98
72-00-00			
72-00-00	201	ALL	DEC 15/06
SPEC PRO-21	202		DEC 15/06
72-00-00			
72-00-00	201	ALL	JAN 15/93
SPEC PRO-22	202		JAN 15/93
	203/204		JAN 15/93
72-00-00			
72-00-00	201	ALL	MAR 15/99
SPEC PRO-23	202		MAR 15/99
	203		MAR 15/99
	204		MAR 15/99
	205		MAR 15/99
	206		MAR 15/99
	207		MAR 15/99
	208		MAR 15/99
	209		MAR 15/99
	210		MAR 15/99
	211/212		MAR 15/99
72-00-00			
72-00-00	201	ALL	DEC 15/98
SPEC PRO-24	202		DEC 15/98
	203		MAR 15/99
	204		MAR 15/99
	205		MAR 15/99
	206		MAR 15/99
	207		JUN 15/98
	208		JUN 15/98
	209		JUN 15/98
	210		JUN 15/98
	211		MAR 15/99
	212		MAR 15/99
	213		MAR 15/99
	214		MAR 15/99
	215		MAR 15/99
	216		MAR 15/99
	217/218		MAR 15/99
72-00-00			
72-00-00	201	ALL	SEP 15/05
SPEC PRO-25	202		SEP 15/05
	203		SEP 15/05
	204		SEP 15/05
	205		SEP 15/05
	206		SEP 15/05
	207		SEP 15/05
	208		SEP 15/05
	209		SEP 15/05
	210		SEP 15/05
	211		SEP 15/05
	212		SEP 15/05
	213		SEP 15/05
	214		SEP 15/05
	215		SEP 15/05
	216		SEP 15/05
	217		SEP 15/05
	218		SEP 15/05
	219		SEP 15/05
	220		SEP 15/05
	221		SEP 15/05
	222		SEP 15/05
	223		SEP 15/05

	224		SEP 15/05
	225		SEP 15/05
	226		SEP 15/05
	227		SEP 15/05
	228		SEP 15/05
	229		SEP 15/05
	230		SEP 15/05
	231		SEP 15/05
	232		SEP 15/05
	233		SEP 15/05
	234		SEP 15/05
	235		SEP 15/05
	236		SEP 15/05
	237		SEP 15/05
	238		SEP 15/05
	239		SEP 15/05
	240		SEP 15/05
	241		SEP 15/05
	242		SEP 15/05
	243		SEP 15/05
	244		SEP 15/05
	245		SEP 15/05
	246		SEP 15/05
	247		SEP 15/05
	248		SEP 15/05
	249		SEP 15/05
	250		SEP 15/05
	251		SEP 15/05
	252		SEP 15/05
	253		SEP 15/05
	254		SEP 15/05
	255		SEP 15/05
	256		SEP 15/05
	257		SEP 15/05
	258		SEP 15/05
	259		SEP 15/05
	260		SEP 15/05
	261		SEP 15/05
	262		SEP 15/05
	263		SEP 15/05
	264		SEP 15/05
	265		SEP 15/05
	266		SEP 15/05
72-00-00			
72-00-00	301	ALL	JAN 15/92
REMOVAL-00	302		JAN 15/92
	303		JAN 15/92
	304		JAN 15/92
	305		JAN 15/92
	306		JAN 15/92
	307		JAN 15/92
	308		JAN 15/92
	309		JAN 15/92
	310		JAN 15/92
72-00-00			
72-00-00	301	ALL	APR 15/88
REMOVAL-01	302		JUL 15/87
72-00-00			
72-00-00	301	ALL	APR 15/88
REMOVAL-02	302		APR 15/88
72-00-00			
72-00-00	301	ALL	JUN 15/93
REMOVAL-03	302		JUN 15/93
	303		JUN 15/93
	304		JUN 15/93
	305		JUN 15/93
	306		JUN 15/93
72-00-00			
72-00-00	301	ALL	APR 15/88
REMOVAL-04	302		APR 15/88
72-00-00			
72-00-00	301	ALL	JUL 15/88

REMOVAL-05	302		OCT 15/89
72-00-00			
72-00-00	401	ALL	JUL 15/91
INSTALL-00	402		JUL 15/91
	403		JUL 15/91
	404		JUL 15/91
	405		JUL 15/91
	406		JUL 15/91
	407		OCT 15/89
	408		JUL 15/86
	409		OCT 15/89
	410		OCT 15/86
	411		JUL 15/91
	412		JUL 15/91
	413		OCT 15/89
	414		JUL 15/86
	415		JUL 15/91
	416		JUL 15/91
	417		OCT 15/86
	418		JUL 15/86
	419		JUL 15/86
	420		JUL 15/86
72-00-00			
72-00-00	401	ALL	DEC 15/96
INSTALL-01	402		DEC 15/96
72-00-00			
72-00-00	401	ALL	APR 15/88
INSTALL-02	402		APR 15/88
72-00-00			
72-00-00	401	ALL	DEC 15/06
INSTALL-03	402		DEC 15/06
	403		DEC 15/06
	404		DEC 15/06
	405		DEC 15/06
	406		DEC 15/06
	407		DEC 15/06
	408		DEC 15/06
	409		DEC 15/06
	410		DEC 15/06
72-00-00			
72-00-00	401	ALL	DEC 15/96
INSTALL-04	402		DEC 15/96
72-00-00			
72-00-00	401	ALL	SEP 15/99
INSTALL-05	402		SEP 15/99
72-00-00			
72-00-00	601	ALL	DEC 15/97
CLEANING-00	602		DEC 15/97
72-00-00			
72-00-00	601	ALL	DEC 15/94
CLEANING-01	602		DEC 15/94
72-00-00			
72-00-00	601	ALL	MAR 15/93
CLEANING-02	602		MAR 15/93
72-00-00			
72-00-00	601	ALL	DEC 15/06
CLEANING-03	602		DEC 15/06
	603		JUN 15/06
	604		JUN 15/06
	605		JUN 15/06
	606		JUN 15/06
	607		DEC 15/06
	608		DEC 15/06
	609		JUN 15/06
	610		JUN 15/06
	611		JUN 15/06
	612		JUN 15/06
	613		JUN 15/06
	614		JUN 15/06
	615		JUN 15/06
	616		JUN 15/06
	617		JUN 15/06

	618		JUN 15/06
	619		JUN 15/06
	620		JUN 15/06
	621		JUN 15/06
	622		JUN 15/06
	623		JUN 15/06
	624		JUN 15/06
	625		JUN 15/06
	626		JUN 15/06
	627		DEC 15/97
	628		DEC 15/97
	629		DEC 15/97
	630		DEC 15/97
	631		DEC 15/97
	632		DEC 15/97
	633		DEC 15/97
	634		DEC 15/97
72−00−00			
72−00−00	801	ALL	DEC 15/97
INSP/CHK−00	802		DEC 15/97
72−00−00			
72−00−00	801	CONFIG−1	DEC 15/00
INSP/CHK−01A		4152 4152−3	
		4156A 4156A−3	
		4158 4158−3	
	802		DEC 15/00
	803		DEC 15/00
	804		DEC 15/00
	805		DEC 15/06
	806		DEC 15/06
	807		DEC 15/06
	808		DEC 15/06
	809		DEC 15/00
	810		DEC 15/00
	811		DEC 15/06
	812		DEC 15/06
	813		DEC 15/00
	814		DEC 15/00
72−00−00			
72−00−00	801	CONFIG−2	DEC 15/00
INSP/CHK−01A		4152 4152−3	
		4156A 4156A−3	
		4158 4158−3	
	802		DEC 15/00
	803		DEC 15/00
	804		DEC 15/00
	805		DEC 15/06
	806		DEC 15/06
	807		DEC 15/00
	808		DEC 15/00
	809		DEC 15/00
	810		DEC 15/00
	811		DEC 15/06
	812		DEC 15/06
	813		DEC 15/00
	814		DEC 15/00
72−00−00			
72−00−00	801	ALL	DEC 15/06
INSP/CHK−01B	802		DEC 15/06
	803		DEC 15/06
	804		DEC 15/06
	805		DEC 15/06
	806		DEC 15/06
	807/808		DEC 15/06
72−00−00			
72−00−00	801	ALL	DEC 15/06
INSP/CHK−01C	802		DEC 15/06
	803		SEP 15/04
	804		SEP 15/04
	805		SEP 15/05
	806		SEP 15/05
	807		DEC 15/06

	808		DEC 15/06
	809		DEC 15/06
	810		DEC 15/06
	811		DEC 15/06
	812		DEC 15/06
	813		MAR 15/05
	814		MAR 15/05
	815		MAR 15/05
	816		MAR 15/05
	817		MAR 15/05
	818		MAR 15/05
	819		MAR 15/05
	820		MAR 15/05
	821		SEP 15/05
	822		SEP 15/05
	823		MAR 15/05
	824		MAR 15/05
	825		SEP 15/05
	826		SEP 15/05
	827		MAR 15/05
	828		MAR 15/05
	829		MAR 15/05
	830		MAR 15/05
	831		MAR 15/05
	832		MAR 15/05
	833		MAR 15/05
	834		MAR 15/05
	835/836		DEC 15/06
72-00-00			
72-00-00	801	CONFIG-1	DEC 15/00
INSP/CHK-01D		4152 4152-3	
		4156A 4156A-3	
		4158 4158-3	
	802		DEC 15/00
	803		DEC 15/00
	804		DEC 15/00
	805		SEP 15/03
	806		SEP 15/03
	807		SEP 15/03
	808		SEP 15/03
	809		MAR 15/05
	810		MAR 15/05
	811		MAR 15/05
	812		MAR 15/05
	813		SEP 15/03
	814		SEP 15/03
	815		SEP 15/05
	816		SEP 15/05
	817		SEP 1/07
	818		SEP 1/07
	819		SEP 1/07
	820		SEP 1/07
	821		SEP 1/07
	822		SEP 1/07
	823		SEP 1/07
	824		SEP 1/07
	825		SEP 1/07
	826		SEP 1/07
	827		SEP 1/07
	828		SEP 1/07
	829		SEP 1/07
	830		SEP 1/07
	831		SEP 1/07
	832		SEP 1/07
	833		SEP 1/07
	834		SEP 1/07
	835		SEP 1/07
	836		SEP 1/07
	837		SEP 1/07
	838		SEP 1/07
72-00-00			
72-00-00	801	CONFIG-2	DEC 15/00

INSP/CHK-01D			4152 4152-3	
			4156A 4156A-3	
			4158 4158-3	
		802		DEC 15/00
		803		DEC 15/00
		804		DEC 15/00
		805		JUN 15/01
		806		JUN 15/01
		807		DEC 15/03
		808		DEC 15/03
		809		JUN 15/06
		810		JUN 15/06
		811		JUN 15/06
		812		JUN 15/06
		813		DEC 15/00
		814		DEC 15/00
		815		DEC 15/00
		816		DEC 15/00
		817		DEC 15/00
		818		DEC 15/00
		819		DEC 15/00
		820		DEC 15/00
		821		JUN 15/01
		822		JUN 15/01
		823		JUN 15/01
		824		JUN 15/01
		825		DEC 15/03
		826		DEC 15/03
		827		JUN 15/06
		828		JUN 15/06
		829/830		DEC 15/03
72-00-00				
72-00-00	R	801	CONFIG-1	JAN 1/08
INSP/CHK-01E			4152 4152-3	
			4156A 4156A-3	
			4158 4158-3	
	R	802		JAN 1/08
	R	803		JAN 1/08
	R	804		JAN 1/08
	R	805		JAN 1/08
	R	806		JAN 1/08
	R	807		JAN 1/08
	R	808		JAN 1/08
	R	809		JAN 1/08
	R	810		JAN 1/08
	R	811		JAN 1/08
	R	812		JAN 1/08
	R	813		JAN 1/08
	R	814		JAN 1/08
	R	815		JAN 1/08
	R	816		JAN 1/08
	R	817		JAN 1/08
	R	818		JAN 1/08
	R	819		JAN 1/08
	R	820		JAN 1/08
	R	821		JAN 1/08
	R	822		JAN 1/08
	R	823		JAN 1/08
	R	824		JAN 1/08
	R	825		JAN 1/08
	A	826		JAN 1/08
	A	827		JAN 1/08
	A	828		JAN 1/08
	A	829		JAN 1/08
	A	830		JAN 1/08
	A	831		JAN 1/08
	A	832		JAN 1/08
	A	833		JAN 1/08
	A	834		JAN 1/08
72-00-00				
72-00-00		801	CONFIG-2	DEC 15/00
INSP/CHK-01E			4152 4152-3	

			4156A 4156A−3	
			4158 4158−3	
		802		DEC 15/00
	R	803		JAN 1/08
	R	804		JAN 1/08
	R	805		JAN 1/08
	R	806		JAN 1/08
	R	807		JAN 1/08
	R	808		JAN 1/08
	R	809		JAN 1/08
	R	810		JAN 1/08
	R	811		JAN 1/08
	R	812		JAN 1/08
	R	813		JAN 1/08
	R	814		JAN 1/08
	R	815		JAN 1/08
	R	816		JAN 1/08
	R	817		JAN 1/08
	R	818		JAN 1/08
	R	819		JAN 1/08
	R	820		JAN 1/08
	R	821		JAN 1/08
	R	822		JAN 1/08
	R	823		JAN 1/08
	R	824		JAN 1/08
	R	825		JAN 1/08
	R	826		JAN 1/08
	A	827		JAN 1/08
	A	828		JAN 1/08
	A	829		JAN 1/08
	A	830		JAN 1/08
	A	831		JAN 1/08
	A	832		JAN 1/08
	A	833		JAN 1/08
	A	834		JAN 1/08
	A	835		JAN 1/08
	A	836		JAN 1/08
72−00−00				
72−00−00		801	CONFIG−1	DEC 15/00
INSP/CHK−01F			4152 4152−3	
			4156A 4156A−3	
			4158 4158−3	
		802		DEC 15/00
		803		DEC 15/00
		804		DEC 15/00
		805		DEC 15/00
		806		DEC 15/00
		807		DEC 15/00
		808		DEC 15/00
		809		DEC 15/00
		810		DEC 15/00
		811		DEC 15/00
		812		DEC 15/00
		813		DEC 15/00
		814		DEC 15/00
		815/816		DEC 15/00
72−00−00				
72−00−00		801	CONFIG−2	DEC 15/00
INSP/CHK−01F			4152 4152−3	
			4156A 4156A−3	
			4158 4158−3	
		802		DEC 15/00
		803		DEC 15/00
		804		DEC 15/00
		805		DEC 15/00
		806		DEC 15/00
		807		DEC 15/00
		808		DEC 15/00
		809		DEC 15/00
		810		DEC 15/00
		811		DEC 15/00
		812		DEC 15/00

	813		DEC 15/00
	814		DEC 15/00
	815		DEC 15/00
	816		DEC 15/00
72-00-00			
72-00-00	801	ALL	DEC 15/06
INSP/CHK-01G	802		DEC 15/06
	803		DEC 15/06
	804		DEC 15/06
	805		DEC 15/06
	806		DEC 15/06
	807		DEC 15/97
	808		DEC 15/97
	809		DEC 15/97
	810		DEC 15/97
	811		DEC 15/97
	812		DEC 15/97
	813		MAR 15/05
	814		MAR 15/05
	815/816		MAR 15/05
72-00-00			
72-00-00	801	ALL	MAR 15/99
INSP/CHK-01H	802		MAR 15/99
	803		MAR 15/99
	804		MAR 15/99
	805		MAR 15/03
	806		MAR 15/03
72-00-00			
72-00-00	801	ALL	JUN 15/02
INSP/CHK-01I	802		JUN 15/02
	803		JUN 15/02
	804		JUN 15/02
	805		JUN 15/02
	806		JUN 15/02
	807		MAR 15/99
	808		MAR 15/99
	809/810		MAR 15/99
72-00-00			
72-00-00	801/802	ALL	MAR 15/99
INSP/CHK-01J			
72-00-00			
72-00-00	801	ALL	JUN 15/06
INSP/CHK-01K	802		JUN 15/06
	803/804		JUN 15/06
72-00-00			
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TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 85 DATED JANUARY 1, 2008

HIGHLIGHTS - ENGINE GENERAL

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
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72-00-00 INSP/CHK-01E	803 805 -819 822 -836	Relocated material and revised borescope inspection limits and related figures for the Stage 1 HPT vanes. (IEN 06KC957B) Revised the table format. (Editorial)	CONFIG-2 4152 4152-3 4156A 4156A-3 4158 4158-3

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ENGINE GENERAL

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ENGINE GENERAL − STORAGE/TRANSPORT−00

Task 72−00−00−510−001:

1. Transporting Engine By Truck

CAUTION: ALL PW4000 SERIES ENGINE BEING TRANSPORTED BY TRUCK, REQUIRE THAT BOTH TRACTOR AND TRAILER BE EQUIPPED WITH AN AIR SUSPENSION SYSTEM REGARDLESS OF DISTANCE TO BE TRANSPORTED. IT IS STRONGLY RECOMMENDED THAT ALL ENGINE TRANSPORT STANDS BE PURCHASED PER 70−80, STANDARD PRACTICES MANUAL.

A. Transport Engine By Truck And Trailer, Equipped With An Air Suspension System, After Engine Has Been Properly Packaged

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Task 72-00-00-620-001:

1. Preservation Of The Engine For 60 Days Or Less (Method I)

A. General

(1) This task gives instructions to preserve the engine for 60 days or less.

(2) If the engine is to be stored for more than 60 days, refer to Preserve The Engine (For More Than 60 Days).

(3) If you are not sure how much time the engine will not be used, use the preservation procedure that is necessary for the longer time.

(4) As an ALTERNATE procedure for preservation as specified in the following schedules, engines may be left in an inactive status up to seven days with no preservation as long as the following is met:

(a) The engine is sheltered. In other words, keep the engine inside or if kept outside, install a tarp or PVC plastic sheet over the inlet cowl, fan exhaust area and the engine exhaust area.

(b) The humidity is not excessive, not to exceed 60 percent.

(c) The engine is not subjected to extreme temperature changes, which produce condensation.

(d) After a maximum of seven days and every seven days thereafter, counting from the first day of inactivity, the engine should be run up to boil off condensation in the engine oil.

(5) For general preservation procedures, refer to SPOP 428 shown in the Standard Practices Manual, PN 585005.

(a) Refer to the method shown for "New Delivered Engines" for a new engine received from Pratt and Whitney.

(b) (To Preserve Engines For 60 Days Or Less) Refer to "In-Service Engine Going Into Storage For 60 Days Or Less (Method I)" for in service engines.

B. Procedure

(1) Preserve the engine oil system as follows.

(a) Flush the engine oil if the engine was not run within the last seven days. Refer to Drain The Engine Oil System, 72−00−00, Servicing−01 (Task 72−00−00−610−001) and Fill The Engine Oil System, 72−00−00, Servicing−02 (Task 72−00−00−610−002).

NOTE: If the engine was run within the last seven days, it is not necessary to flush the engine oil.

NOTE: You can perform sample testing of the engine oil by ASTM procedure D3604−00 as an option to flushing the engine oil system as specified in the Preservation Method Chart shown in Figure 1201.

(b) Drain the engine oil. Refer to Drain The Engine Oil System, 72−00−00, Servicing−01 (Task 72−00−00−610−001).

(2) Preserve the main gearbox as follows.

CAUTION: DO NOT SPRAY PRESERVATIVE OIL P03−002 INTO THE ENGINE GASPATH AS POSSIBLE DIRT DEPOSITION ON THE BLADES AND VANES WILL REDUCE ENGINE EFFICIENCY.

CAUTION: HYDRAULIC FLUID CAN SERIOUSLY CORRODE THE MAIN GEARBOX HOUSING DURING PROLONGED PERIODS OF INOPERATION. ANY HYDRAULIC FLUID SPILLED ON THE MAIN GEARBOX HOUSING SHOULD BE IMMEDIATELY CLEANED OFF BY THE SPOP 208 WIPE METHOD OF THE Standard Practices Manual, PN 585005.

(a) Examine the main gearbox for hydraulic fluid on the gearbox housing. If necessary, remove hydraulic fluid as follows:

1 Use aqueous cleaner to degrease the engine externals by SPOP 1 (Task 70−21−00−110−047). Refer to Standard Practices Manual, PN 585005.

2 Solvent wipe Degrease the engine externals by SPOP 208 (Task 70−21−00−110−040). Refer to Standard Practices Manual, PN 585005.

(b) If any gearbox accessories have been removed, do the steps that follow.

1 Spray Engine Oil P03-001 on the gearbox drive pad.

2 Install a covers on the gearbox drive pad.

(3) Seal the engine for storage as follows.

(a) Install all necessary caps, plugs and covers over all bleed valve openings, hoses, electrical connectors and other openings.

R (b) You must store the engine inside, or if kept
R outside do as follows:

R 1 Install a cover, tarp or PVC plastic sheet over the engine intake area and fan discharge area.

R 2 Install a cover, tarp or PVC plastic sheet over the engine exhaust area.

(4) Make a preservation record for each engine as follows:

(a) Record the method of the preservation.

(b) Record the date of the preservation.

(5) If the engine will stay in storage after the initial 60 days, you must do one of the options that follow. See Figure 1201.

(a) OPTION 1: Preserve the engine by Method II (Task 72-00-00-610-005).

NOTE: The Preservation Of The Engine For More Than 60 Days (Method II) requires both the Oil System and Fuel System preservation.

(b) OPTION 2: Run (operate) the engine, as necessary. Refer to the procedure specified in SPOP 428 (Task 70-80-00-620-001).

NOTE: It is permitted to use OPTION 2 only when Method I is repeated a maximum of one time (that is, it can not be used if the engine will stay in storage more than 120 days).

1 The referenced procedures specified in SPOP 428 are as follows:

- a Service the oil system. Refer to Drain The Engine Oil System, 72-00-00, Servicing-01 (Task 72-00-00-610-001) and Fill The Engine Oil System, 72-00-00, Servicing-02 (Task 72-00-00-610-002).
- b Start the engine. Refer to 71-00-00, Testing-00 (Task 71-00-00-760-003).
- c Do an engine shutdown by the Normal Engine Shutdown Procedure. Refer to 71-00-00, Testing-00 (Task 71-00-00-760-004).

Task 72-00-00-610-005:

2. Preservation Of The Engine For More Than 60 Days (Method II)

A. General

(1) This task gives instructions to preserve the engine when it is stored for more than 60 days.

(2) It will be necessary to air motor or run the engine in a test cell to preserve the engine for more than 60 days.

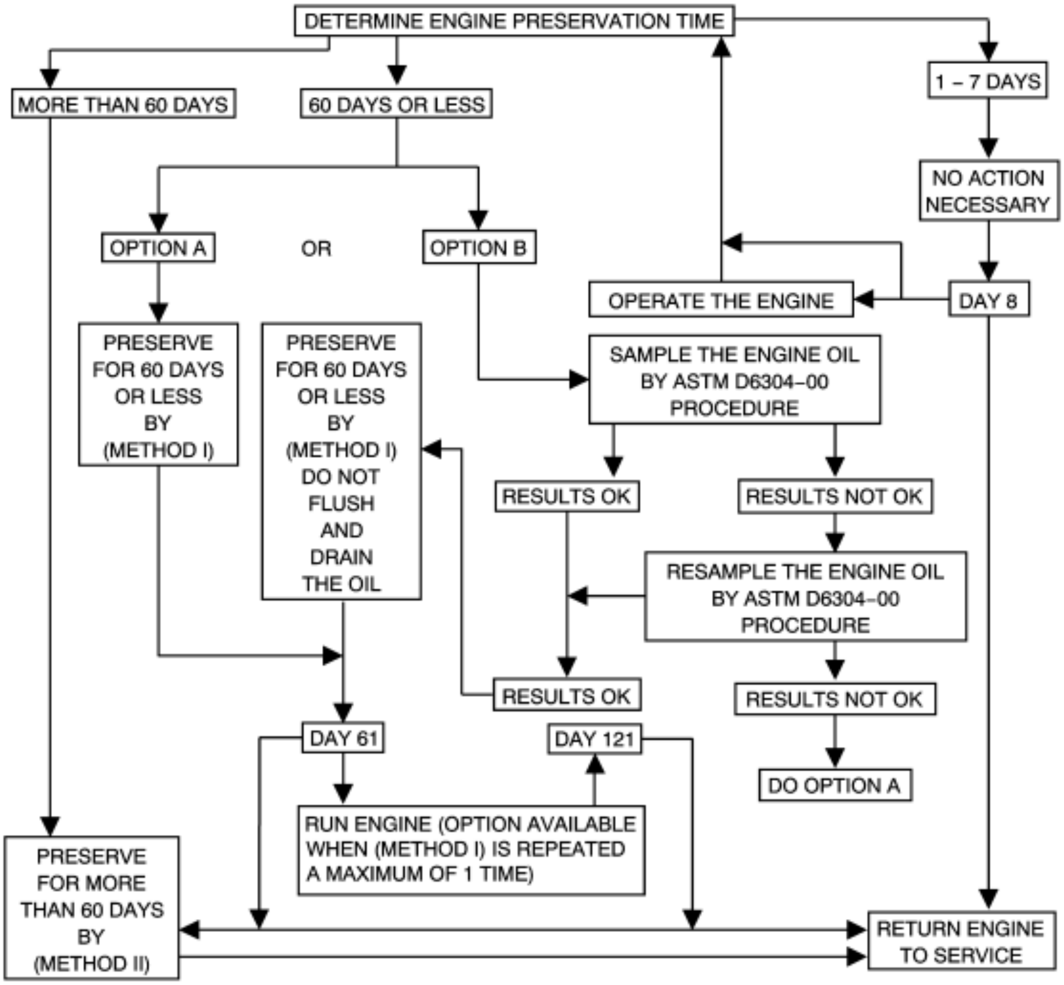
(3) For general preservation procedures, refer to SPOP 428 shown in the Standard Practices Manual, PN 585005. Refer to the method shown for "Preservation Of Engine For More Than 60 Days (Method II)".

B. Equipment And Materials Necessary

Standard Tools:
CTE 3160 Cart, Preservation or Equivalent

Special Tools:

PWA 85433	Adapter, Fuel Preserve, Fuel Pump Inlet
PWA 85451	Adapter, Fuel Preserve, Fuel Flowmeter Outlet
PWA 86018	Adapter, Oil Sampler (Optional)


DETERMINE ENGINE PRESERVATION TIME
MORE THAN 60 DAYS
60 DAYS OR LESS
1 - 7 DAYS
NO ACTION NECESSARY
OPTION A
OR
OPTION B
OPERATE THE ENGINE
DAY 8
PRESERVE FOR 60 DAYS OR LESS BY (METHOD I)
PRESERVE FOR 60 DAYS OR LESS BY (METHOD I) DO NOT FLUSH AND DRAIN THE OIL
SAMPLE THE ENGINE OIL BY ASTM D6304-00 PROCEDURE
RESULTS OK
RESULTS NOT OK
RESAMPLE THE ENGINE OIL BY ASTM D6304-00 PROCEDURE
RESULTS OK
RESULTS NOT OK
DAY 61
DAY 121
DO OPTION A
RUN ENGINE (OPTION AVAILABLE WHEN (METHOD I) IS REPEATED A MAXIMUM OF 1 TIME)
PRESERVE FOR MORE THAN 60 DAYS BY (METHOD II)
RETURN ENGINE TO SERVICE

NOTES TO THE PRESERVATION CHART:

1. THIS CHART DOES NOT SPECIFY ALL THE STEPS BY SPOP 428 (REFER TO SPOP 428 FOR DETAILS).
2. SAMPLING OPTION IS RESTRICTED TO ONE 60 DAY PERIOD.
3. IN OPTION B, OIL SYSTEM FLUSH IS NOT NECESSARY (REF. METHOD I) IF SAMPLE TEST RESULTS ARE OK.
4. WHEN PRESERVING FOR MORE THAN 60 DAYS, FUEL SYSTEM PRESERVATION IS ALSO REQUIRED.
5. IF THE ENGINE WILL STAY IN STORAGE AFTER 60 DAYS (METHOD I), YOU CAN PRESERVE THE ENGINE AGAIN AFTER THE INITIAL 60-DAY PERIOD. SEE TEXT FOR INSTRUCTIONS.

L-D2111 (0805)
PW V

Preservation Method Chart
Figure 1201
(Task 72-00-00-620-001)

ENGINE GENERAL - STORAGE/TRANSPORT-03

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P03-002	Oil, Lubricating (PMC 9852)
R P06-053	Lubricant, Sealing Ring (PWA 36500)
P15-001	Dehydrator

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Fuel Filter Element	1	73-12-00/2/10
Packing	1	73-12-00/2/20
Packing	3	73-12-00/2/60
Packing	2	73-13-00/4/70
Packing	1	73-13-00/5/30
Oil Filter Element	1	79-21-00/2/140
Packing	1	72-61-00/12/270
Packing	1	79-11-00/2/1
Packing	1	79-21-00/2/180
Packing	1	79-21-00/2/230

C. Procedure

(1) Preserve the engine oil system as follows.

(a) If necessary, remove protective covers form the engine.

(b) Drain and fill the engine oil. Refer to Drain The Engine Oil System, 72-00-00, Servicing-01 (Task 72-00-00-610-001) and Fill The Engine Oil System, 72-00-00, Servicing-01 (Task 72-00-00-610-002).

NOTE: You must replace the oil filter element when you change the oil.

R (2) Air motor the engine by the Test Cell (Method A) or Transport Stand (Method B) as specified in SPOP 428 (Task 70-80-00-620-001), Section 70-80-00, Standard Practices Manual, PN 585005 and as follows:

R (a) When specified in SPOP 428, the referenced Engine Manual procedures are as follows:

R R 1 Start the engine. Refer to 71-00-00, Testing-00 (Task 71-00-00-760-003).

R R R 2 Do an engine shutdown by the Normal Engine Shutdown Procedure. Refer to 71-00-00, Testing-00 (Task 71-00-00-760-004).

R R R 3 Dry motor the engine with the starter. Refer to 71-00-00, Power Plant General Testing-00 (Task 71-00-00-760-007)

R R R R 4 Install the starter (if not previously installed). Refer to 71-00-61, Installation-04 (Task 71-00-61-450-014). Be sure the starter is serviced.

(3) Ground run the engine, (optional to motor procedure).

NOTE: You can use this method for engine motoring when a test cell is not available.

(a) Start the engine. See 71-00-00, Testing-00 (Task 71-00-00-760-003) Engine Starting, Procedure (Normal).

(b) Operate the engine as required until the oil temperature is 220°F (104.4°C) or more. Continue to operate the engine for 5 minutes. Return engine to MIN IDLE and allow engine to stabilize for 5 minutes.

(c) Do an engine shutdown by the Normal Engine Shutdown Procedure, See 71-00-00, Testing-00 (Task 71-00-00-760-004).

(d) For engines that can not be started and operated, motor the engine with the starter at a starter inlet air pressure of 15 psig (103.4 kPa) minimum. Make sure that the fan (LPC) is turning during motoring. If necessary increase the starter inlet air pressure to turn the fan (LPC). The maximum starter inlet air pressure is 50 psig (344.7 kPa). Continue to motor the engine for five minutes. This will flow the oil through the engine. Be sure not to exceed the starter operation time limits.

(4) Motor the engine in the transport stand (optional to engine operation).

(a) Install the starter (if not previously installed). See 71-00-61, Installation-04 (Task 71-00-61-450-014). Be sure the starter is serviced.

(b) Remove the engine hydraulic pumps.

(c) Connect the external supply pressure source to before the starter air valve.

NOTE: You can use a standard aircraft pneumatic start cart and a locally manufactured coupling to connect the eternal supply pressure source to the starter air valve.

(d) If any of the accessories were removed from the main gearbox, make sure the pad covers and gaskets are installed. Put a cap on the pad cavity drains to prevent the loss of engine oil.

(e) Make sure that no lines in the fuel and oil system were disconnected and/or removed. If necessary, connect and/or install the lines by the applicable procedures.

(f) Use a wrench and extension to manually open the starter air valve.

CAUTION: DO NOT OPERATE THE STARTER FOR MORE THAN THE STARTER TIME LIMIT AND PRESSURE LIMIT. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE STARTER.

(g) Dry motor the engine with the starter for 3 minutes. See 71-00-00, Power Plant General Testing-00 (Task 71-00-00-760-007). If necessary increase the starter inlet air pressure to turn the fan (LPC). The maximum starter inlet air pressure is 50 psi (344.7 kPa).

NOTE: When you motor the engine, the fan (LPC) must turn. This is necessary to get oil through all the engine oil systems.

(h) Stop motoring the engine and permit the engine to come to a complete stop.

NOTE: Do not drain the engine oil until after you preserve the fuel system.

(5) Preserve the engine fuel system (Optional Pressure Feed Method) See Figure 1202, Figure 1203, Figure 1204, Figure 1205, Figure 1206, and Figure 1207.

NOTE: The Pressure Feed Method is optional to the Gravity Feed Method and Test Stand Method.

(a) Remove the lockwire and drain plugs for the FP1 and FP3 ports of the fuel pump. Let the fuel drain into a 5 U.S. gallons (19 liters) fluid drain container.

(b) Drain the fuel system as follows:

1 If installed, disconnect the main fuel supply line as follows:

a Remove the four bolts and washers that attach the line to the pump.

b Disengage the line and remove the gasket.

(c) Remove the fuel pump filter. See 72-00-61, Removal-24 (Task 72-00-61-060-001).

(d) Install the new fuel pump filter. See 72-00-61, Installation-24 (Task 72-00-61-460-001).

(e) Install the PWA 85451 Adapter to the fuel flowmeter as follows:

1 Remove the lockwire and eight bolts that attach the rear fuel flowmeter support. Remove the support.

2 Move the transfer tube rearward into the fuel distribution valve strainer cover. Remove the four bolts and washers that attach the cover to the valve. Remove the cover and transfer tube together as a unit.

3 Install the PWA 85451 Adapter with the gasket and four bolts to the fuel flowmeter outlet.

4 Attach a hose to the adapter. Put the other end in a container with a minimum capacity of 5 U.S. gallons (19 liters).

(f) Install the PWA 85433 Adapter with the gasket and four nuts to the fuel pump inlet.

(g) Install the two drain plugs with the new packings, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053. Torque the plugs to 45 - 55 lb-in. (5.084 - 6.214 N.m). Install the lockwire.

CAUTION: BE SURE THE PRESERVATION CART HAS FILTERS OR STRAINERS OF NO COARSER MESH THAN USED IN THE ENGINE FUEL SYSTEM.

CAUTION: DO NOT SPRAY PRESERVATION OIL P03-002 INTO THE ENGINE GASPATH. THE OIL CAN CAUSE UNWANTED MATERIAL TO STICK TO THE BLADES AND VANES. REDUCED ENGINE PERFORMANCE CAN RESULT.

CAUTION: MAKE SURE THE ENGINE OIL SYSTEM HAS THE CORRECT AMOUNT OF OIL IN THE SYSTEM OR DAMAGE TO THE ENGINE CAN OCCUR.

(h) Attach the Fuel Accessory Preservation Cart Assembly CTE 3160 or equivalent pressure hose to the PWA 85433 Adapter on the fuel pump inlet port.

(i) Make sure the preservation cart is away from the engine inlet, exhaust and fan discharge area(s).

R
R
R (j) In the following steps, use the airframe electrical connector J3 on the fuel metering unit (called FMU) (with a 28 volt DC power source) to power up the Start/Run solenoid and power up the Shut-off solenoid with the FMU. The airframe connector pin identifiers are as follows:

1 Pins 3 (+) and 4 (-) are powered for Start (to allow flow through the FMU).

2 Pins 1 and 6 (+) and 14 (-) are powered for Shut-Off (stop flow through the FMU).

(k) Use the cart and flush Lubricating Oil P03-002, at a pressure of 5 - 25 psig (34.5 - 172.4 kPa) and at 60°F (15.6°C) minimum, and wet motor the engine (See 71-00-00, Testing-02, Task 71-00-00-760-029) until approximately 2 U.S. gallons (8 liters) is discharged into the fluid drain container.

(l) Stop the wet motor and the pump on the fuel accessory preservation cart and disconnect the cart and let the system drain.

(m) Remove the adapters and gasket from the rear of the fuel flowmeter and the fuel pump inlet port.

(n) Connect the main fuel supply line as follows:

1 Install a new gasket and the main fuel supply line flange to the fuel pump port.

2 Install the four bolts and washers. Torque the bolts to 180 - 200 lb-in. (20.337 - 22.597 N.m).

(o) Install the fuel flowmeter transfer tube and rear support as follows:

1 Install the two new packings, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the transfer tube. Install the transfer tube to the fuel distribution valve strainer cover.

2 Install a new packing, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the strainer cover. Install the cover and transfer tube to the fuel distribution valve and attach with the four bolts, lubricated with Engine Oil P03-001, and washers. Torque the bolts to 30 - 33 lb-in. (3.390 - 3.728 N.m).

3 Slide the transfer tube forward and engage the fuel flowmeter and dowel pin. Place the support in position and align the brackets. Install the eight bolts, lubricated with Engine Oil P03-001.

NOTE: Install the drilled head bolts to the front.

4 Torque the eight bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). Install the lockwire to the front four bolts.

(p) Write the date and the method of preservation on a tag and attach it to the fuel metering unit.

(6) Preserve the engine fuel system (Optional Gravity Feed Method) as follows.

NOTE: The Gravity Feed Method is optional to the Pressure Feed Method and Test Stand Method.

(a) Remove the lockwire and drain plugs for the FP1 and FP3 ports of the fuel pump. Let the fuel drain into a 5 U.S. gallons (19 liters) fluid drain container.

(b) If installed, disconnect the main fuel supply line as follows:

1 Remove the four bolts and washers that attach the line to the pump.

2 Disengage the line and remove the gasket.

(c) Remove the fuel pump filter. See 72-00-61, Removal-24 (Task 72-00-61-060-001).

(d) Install the new fuel pump filter. See 72-00-61, Installation-24 (Task 72-00-61-460-001).

(e) Install the PWA 85451 Adapter to the fuel flowmeter as follows:

1 Remove the lockwire and eight bolts that attach the rear fuel flowmeter support. Remove the support.

2 Move the transfer tube rearward into the fuel distribution valve strainer cover. Remove the four bolts and washers that attach the cover to the valve. Remove the cover and transfer tube together as a unit.

3 Install the PWA 85451 Adapter with the gasket and four bolts to the fuel flowmeter outlet.

4 Attach a hose to the adapter. Put the other end in a container with a minimum capacity of 5 U.S. gallons (19 liters).

(f) Install the PWA 85433 Adapter with the gasket and four nuts to the fuel pump inlet.

R
R

(g) Install the two drain plugs with the new packings, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053. Torque the plugs to 45 - 55 lb-in. (5.084 - 6.214 N.m). Install the lockwire.

CAUTION: DO NOT SPRAY PRESERVATION OIL P03-002 INTO THE ENGINE GASPATH. THE OIL CAN CAUSE UNWANTED MATERIAL TO STICK TO THE BLADES AND VANES. REDUCED ENGINE PERFORMANCE CAN RESULT.

CAUTION: MAKE SURE THE ENGINE OIL SYSTEM HAS THE CORRECT AMOUNT OF OIL IN THE SYSTEM OR DAMAGE TO THE ENGINE CAN OCCUR.

(h) Use a clean dry tank with a capacity of 5 - 10 U.S. gallons (19 - 38 liters) and assemble a gravity feed preservation tank as follows:

1 The tank must be vented and have a fitting at the bottom to attach a valve and hose.

NOTE: The hose must be 0.5 inch (12.70 mm) inside diameter (ID) minimum, approximately 20 feet (6.10 m) in length, and must not collapse under negative pressure.

2 Install a shutoff valve to the bottom of the tank with an in-line 40 micron filter.

3 Attach the hose to the PWA 85433 Adapter on the fuel pump inlet port.

4 Position the tank away from the engine fan discharge air and 5 feet (1.52 m) minimum above the fuel pump inlet.

5 Shut the valve at the bottom of the tank.

6 Fill the tank with 5 U.S. gallons (19 liters) minimum of Flushing Oil P03-002.

R (i) In the following steps, use the airframe electrical connector J3 on the FMU (with a 28 volt DC power source) to power up the Start/Run solenoid and power up the Shut-off solenoid with the FMU. The airframe connector pin identifiers are as follows:

R 1 Pins 3 (+) and 4 (-) are powered for Start (to allow flow through the FMU).

R 2 Pins 1 and 6 (+) and 14 (-) are powered for Shut-Off (stop flow through the FMU).

R (j) Open the valve at the bottom of the tank and wet motor the engine (see 71-00-00, Testing-02, (Task 71-00-00-760-029)) until approximately 2 U.S. gallons (8 liters) of flushing oil comes out of the drain adapter and into the fluid drain container.

R (k) Stop the wet motor and close the valve at the bottom of the tank.

R (l) Disconnect the hose and let the fuel system drain.

R (m) Remove the adapters and gasket from the rear of the fuel flowmeter and the fuel pump inlet port.

R (n) Connect the main fuel supply line as follows:

1 Install a new gasket and the main fuel supply line flange to the fuel pump port.

2 Install the four bolts and washers. Torque the bolts to 180 - 200 lb-in. (20.337 - 22.597 N.m).

R (o) Install the fuel flowmeter transfer tube and rear support as follows:

1 Install the two new packings, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the transfer tube. Install the transfer tube to the fuel distribution valve strainer cover.

2 Install a new packing, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the strainer cover. Install the cover and transfer tube to the fuel distribution valve and attach with the four bolts, lubricated with Engine Oil P03-001, and washers. Torque the bolts to 30 - 33 lb-in. (3.390 - 3.728 N.m).

3 Slide the transfer tube forward and engage the fuel flowmeter and dowel pin. Place the support in position and align the brackets. Install the eight bolts, lubricated with Engine Oil P03-001.

NOTE: Install the drilled head bolts to the front.

4 Torque the eight bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). Install the lockwire to the front four bolts.

R (p) Write the date and the method of preservation on a tag and attach it to the fuel metering unit.

(7) Preserve the engine fuel system (Optional Test Cell Method) as follows:

NOTE: The Test Cell Method is optional to the Pressure Feed Method and Gravity Feed Method.

(a) After all testing is complete, prior to shut-down, shut off the main fuel supply from the test cell to the engine.

(b) Pump Flushing Oil P03-002 from the test cell main fuel supply to the engine.

(c) Operate the engine at idle until white smoke comes out the tail pipe. Refer to Test No. 3 - Idle Power Test, 71-00-00, Testing-03 (Task 71-00-00-760-030).

(d) Do an engine shutdown by the Normal Engine Shutdown Procedure. See 71-00-00, Power Plant General - Testing-00 (Task 71-00-00-760-004).

(8) Drain the engine oil from the oil tank and main gearbox. Remove the magnetic chip detectors and main oil filter element. See 72-00-00, Servicing-01 (Task 72-00-00-610-001).

(9) Perserve the main gearbox as follows.

CAUTION: DO NOT LET AIRCRAFT HYDRAULIC FLUID STAY ON THE MAIN GEARBOX DURING THE PRESERVATION TIME. THE HYDRAULIC FLUID CAN CAUSE CORROSION AND DAMAGE TO THE GEARBOX HOUSING. CLEAN ALL THE HYDRAULIC FLUID FROM THE GEARBOX BEFORE THE ENGINE IS PRESERVED. USE SPOP 208 TO CLEAN THE HOUSING.

(a) Examine the main gearbox for hydraulic fluid on the gearbox housings. If necessary, remove any hydraulic fluid as follows.

1 Use aqueous cleaner to degrease the engine externals by SPOP 1 (Task 70-21-00-110-047). Refer to Standard Practices Manual, PN 585005.

2 Solvent wipe Degrease the engine externals by SPOP 208 (Task 70-21-00-110-040). Refer to Standard Practices Manual, PN 585005.

(b) Examine the hydraulic pump overboard drain tube(s) for any hydraulic fluid leakage.

(c) If any of the accessories are removed from the main gearbox and covers are installed do as follows:

1 Remove the covers.

2 Spray Engine Oil P03-001 on the gearbox drive pads.

3 Install the accessory gearbox covers on the gearbox again.

(10) Preserve the engine for relative humidity as follows.

(a) It is recommended that the relative humidity be at 40 percent or less inside the engine during the preservation time for optimal preservation.

CAUTION: DO NOT PUT THE DEHYDRATING AGENT (DESICCANT) NEAR THE FAN OR TURBINE BLADES BECAUSE THE ROTATION OF THE BLADES CAN CAUSE THE DESICCANT BAGS TO TEAR.

R (b) Put 25 - 125 lb (11.34 - 56.70 kg) of Dehydrator P15-001 in the bottom of the engine bag. Put half in the inlet and half in the tail pipe areas.

(c) Put relative humidity indicators inside the inlet and exhaust areas.

(11) Seal the engine for storage as follows.

(a) Seal all the engine and thrust reverser openings. Install a tarp or PVC plastic sheet over the intake area, fan exhaust area and the engine exhaust area.

(b) The protective covers must have windows so that you can see the relative humidity indicators inside the engine.

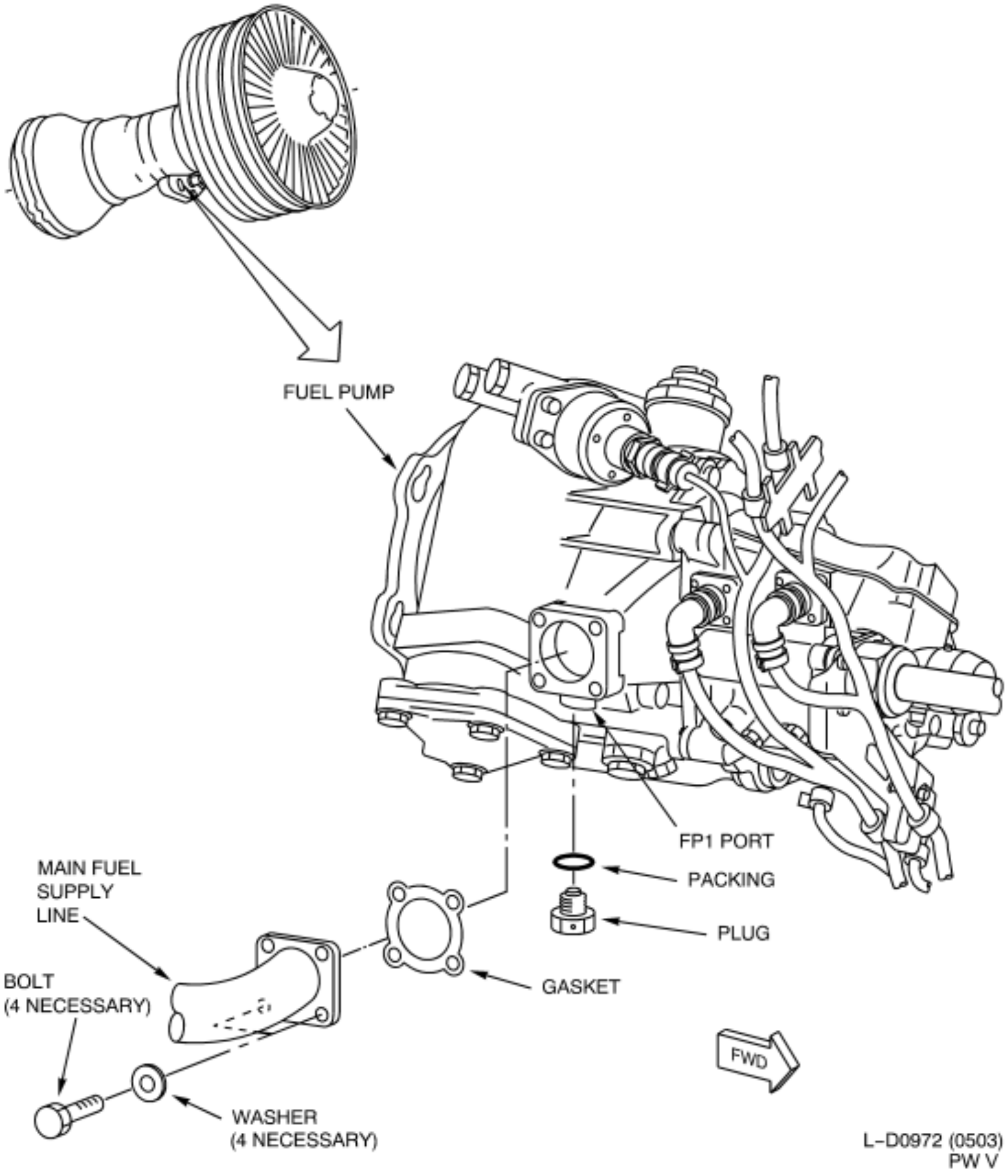
(12) Examine the engine during preservation every 15 days
R (or less) by the instructions specified in SPOP 428
R (Task 70-80-00-620-001). Refer to Section 70-80-00, Standard Practices Manual, PN 585005.

(13) Make a preservation record for each engine as follows.

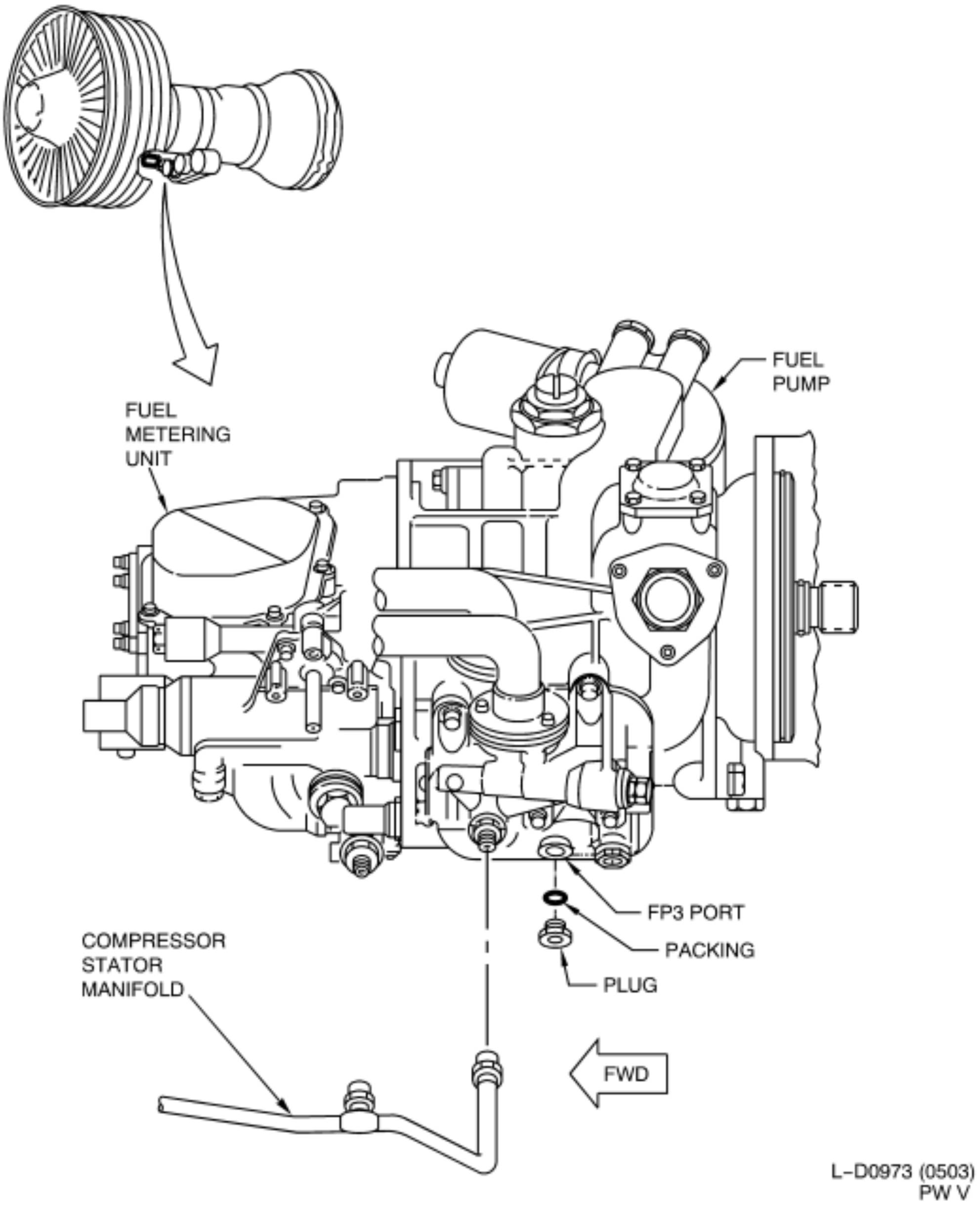
(a) Record the method of the preservation.

(b) Record the date of the preservation.

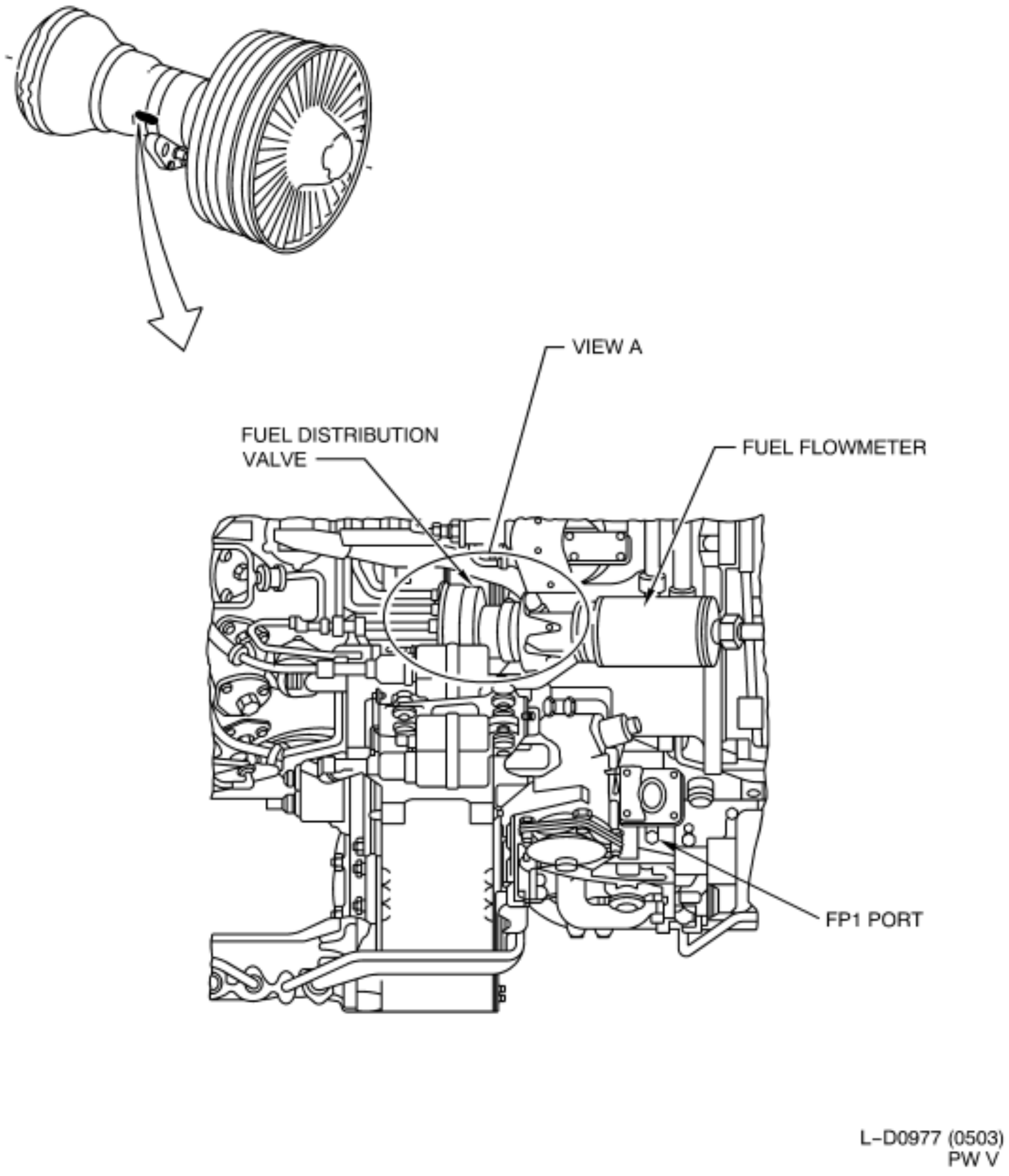
(c) Record the procedures used for the oil (oil drained) and fuel systems (flushing oil).


FUEL PUMP
FP1 PORT
PACKING
PLUG
MAIN FUEL SUPPLY LINE
GASKET
BOLT (4 NECESSARY)
WASHER (4 NECESSARY)
FWD
L-D0972 (0503)
PW V

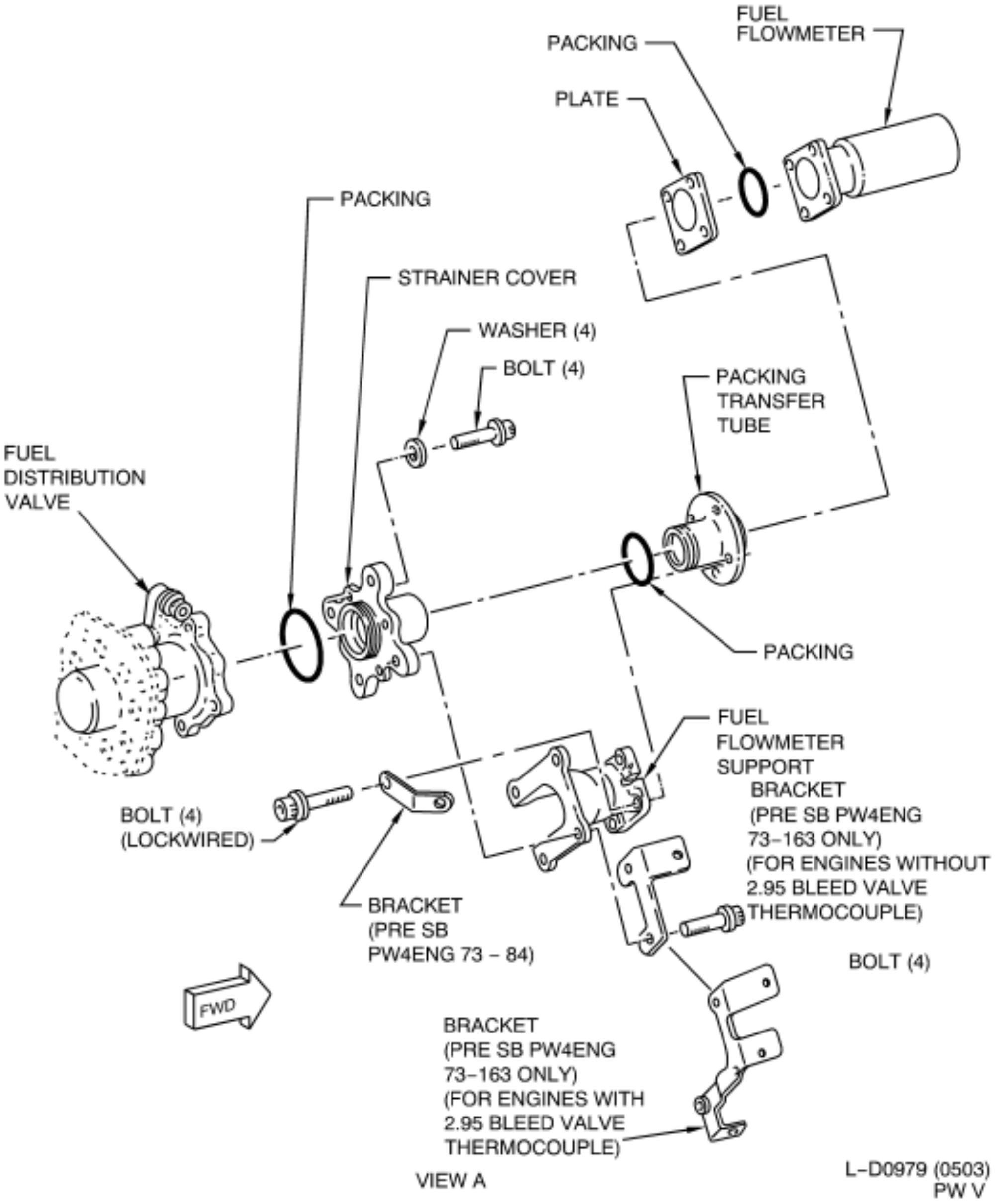
Engine Preservation
Figure 1202
(Task 72-00-00-610-005)


FUEL PUMP
FUEL METERING UNIT
FP3 PORT
PACKING
PLUG
COMPRESSOR STATOR MANIFOLD
FWD
L-D0973 (0503)
PW V

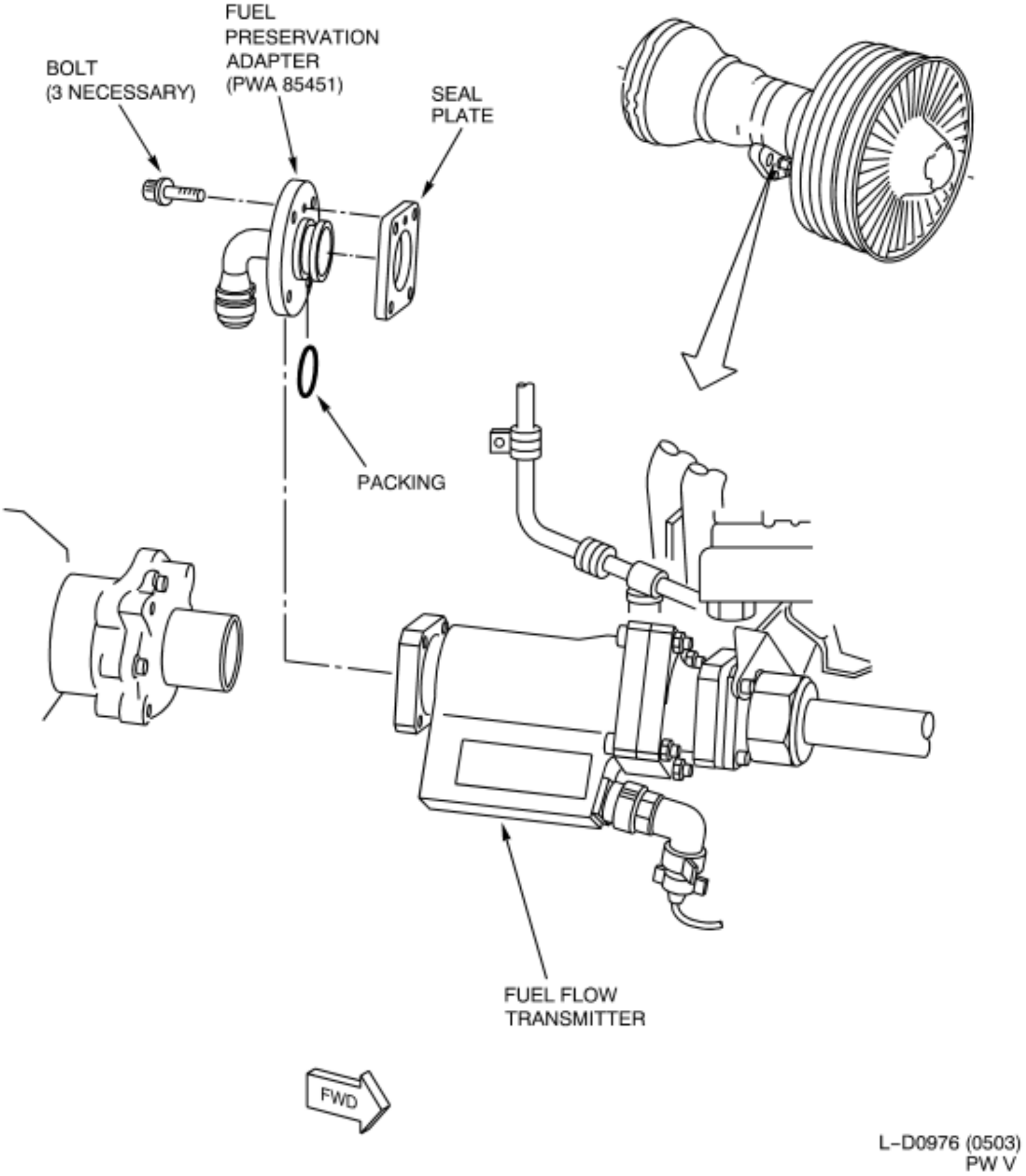
Engine Preservation
Figure 1203
(Task 72-00-00-610-005)


VIEW A
FUEL DISTRIBUTION VALVE
FUEL FLOWMETER
FP1 PORT
L-D0977 (0503)
PW V

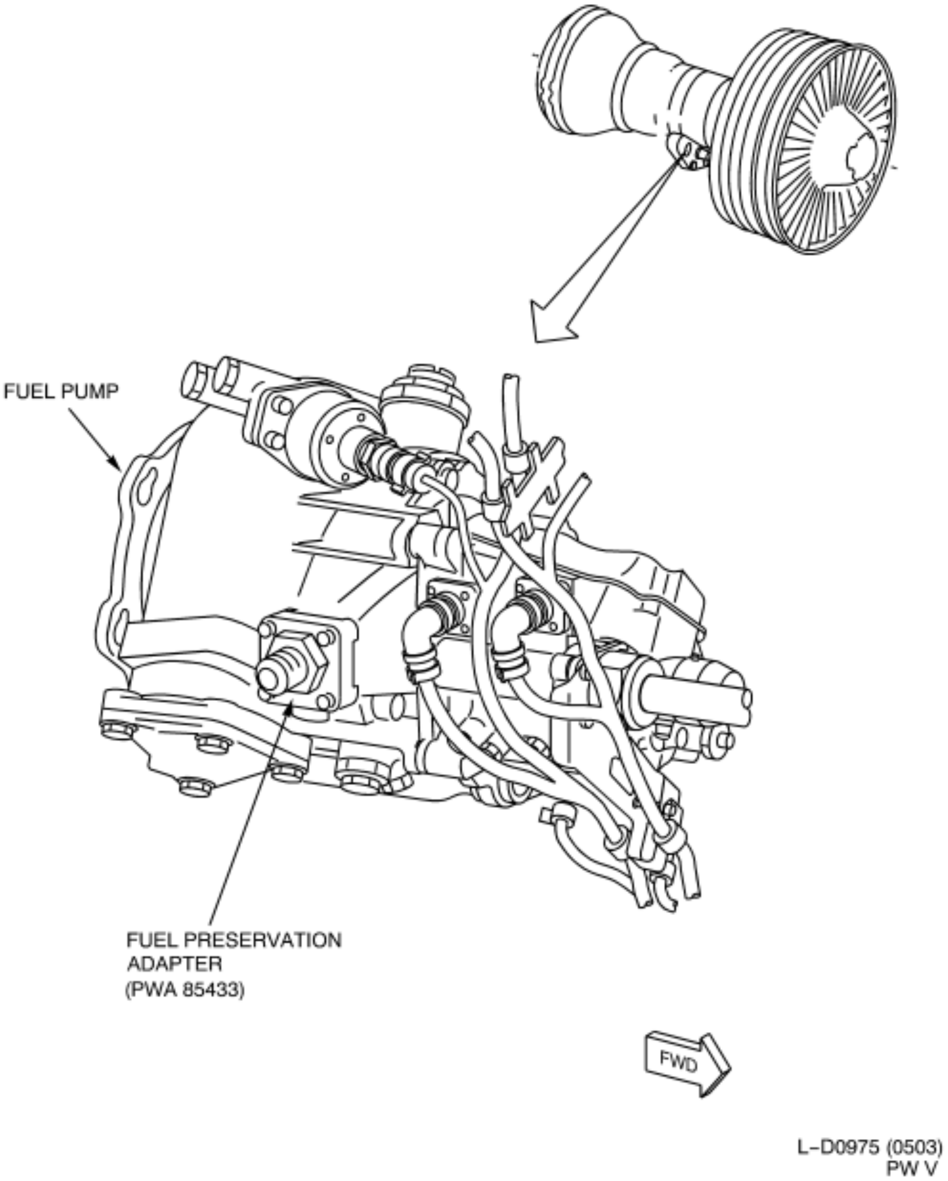
Engine Preservation
Figure 1204
(Task 72-00-00-610-005)


FUEL FLOWMETER
PACKING
PLATE
PACKING
STRAINER COVER
WASHER (4)
BOLT (4)
PACKING TRANSFER TUBE
FUEL DISTRIBUTION VALVE
PACKING
FUEL FLOWMETER SUPPORT
BRACKET (PRE SB PW4ENG 73-163 ONLY) (FOR ENGINES WITHOUT 2.95 BLEED VALVE THERMOCOUPLE)
BOLT (4) (LOCKWIRED)
BRACKET (PRE SB PW4ENG 73 - 84)
BOLT (4)
FWD
BRACKET (PRE SB PW4ENG 73-163 ONLY) (FOR ENGINES WITH 2.95 BLEED VALVE THERMOCOUPLE)
VIEW A
L-D0979 (0503)
PW V

Engine Preservation
Figure 1205
(Task 72-00-00-610-005)


FUEL PRESERVATION ADAPTER (PWA 85451)
BOLT (3 NECESSARY)
SEAL PLATE
PACKING
FUEL FLOW TRANSMITTER
FWD
L−D0976 (0503)
PW V

Engine Preservation
Figure 1206
(Task 72−00−00−610−005)


FUEL PUMP
FUEL PRESERVATION
ADAPTER
(PWA 85433)
FWD
L-D0975 (0503)
PW V

Engine Preservation
Figure 1207
(Task 72-00-00-610-005)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-00-620-002:

1. Accomplish Engine Depreservation

A. General

(1) This task gives the instructions to put the engine back into service after preservation.

(2) To depreserve an engine that was preserved for more than 60 days, it will be necessary to run the engine in a test cell.

(3) For general depreservation procedures, refer to SPOP 428 shown in the Standard Practices Manual, PN 585005.

NOTE: Transport the engine to a test cell or to an aircraft for a test run. Transport the engine by an approved method only to prevent damage to the engine.

(a) Refer to the method shown for "Depreservation of the engine for engines preserved for 60 days or less (Method I)".

(b) Refer to the method shown for "Depreservation of the engine for engines preserved for more than 60 days (Method II)".

B. Equipment And Materials Necessary - None

C. Depreservation Procedure For Engines That Were Preserved For 60 days Or Less

(1) Remove all covers, tarps or PVC plastic sheets from the engine intake and exhaust area.

(2) Depreserve the main gearbox as follows.

(a) Examine the main gearbox for corrosion damage from hydraulic fluid.

(b) If necessary, repair any hydraulic fluid leaks.

(c) If any gearbox accessories have been removed, do the steps that follow.

1 Remove the covers on the gearbox drive pads.

2 Install the gearbox accessories.

(3) Fill the engine oil system. See 72-00-00, Engine General Servicing-02, (Task 72-00-00-610-002).

D. Depreservation Procedure For Engines That Were Preserved For More Than 60 days

(1) Remove all covers, tarps or PVC plastic sheets from the engine intake and exhaust area.

(2) Remove all dehydrating agents from inside the engine.

(3) Depreserve the main gearbox as follows.

(a) Examine the main gearbox for corrosion damage from hydraulic fluid.

(b) If necessary, repair any hydraulic fluid leaks.

(c) If any gearbox accessories have been removed, do the steps that follow.

1 Remove the covers on the gearbox drive pads.

2 Install the gearbox accessories.

(4) Fill the engine oil system. See 72-00-00, Engine General Servicing-02, (Task 72-00-00-610-002).

(5) Wet motor the engine with the starter until fuel comes out the exhaust. See 71-00-00, Power Plant General - Testing-00, (Task 71-00-00-760-010).

(6) Start the engine by the Normal Engine Start Procedure. See 71-00-00 Power Plant General - Testing-00, (Task 71-00-00-760-003).

(7) Operate the engine at idle power to burn off the remaining flushing oil in the fuel system.

(8) Do Test No. 3 Idle Power Test and check the fuel and oil systems for leaks. See 71-00-00, Power Plant General - Testing-03, (Task 71-00-00-760-030).

(9) Do an engine shutdown by the Normal Engine Shutdown Procedure. See 71-00-00, Power Plant General - Testing-00, (Task 71-00-00-760-004).

(10) Do all the other depreservation steps shown in SPOP 428 for engines preserved for more than 60 days.

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ENGINE GENERAL - STORAGE/TRANSPORT-05

Task 72-00-00-510-004:

1. Remove The Supplemental Control Unit (SCU) From Flight Position On The Fan Case For Engine Transport

NOTE: This procedure gives instructions for the removal of the supplemental control unit (SCU) from the right side of the fan case for engine transport.

A. Equipment And Materials Required

Special Tools:
P60165 Container, Shipping, Reusable, SCU

B. Procedure

See Figure 1201.

NOTE: Two persons are necessary to do the following procedure.

(1) Disconnect the connector assembly (SCU programming plug) (1201/4) from the lower rear side connector of the supplemental control unit. Keep the connector assembly attached to the engine by its lanyard.

(2) Disconnect the W11P34 connector (1201/1) and the W11P33 connector (1201/2) from the rear side of the supplemental control unit.

(3) Remove the bolt (1201/7) from the top rear side of the supplemental control unit and disconnect the ground cable.

(4) If the supplemental control unit has the multiplexing option, disconnect the top connector of the hose assembly (1201/3) from the bottom side of the supplemental control unit.

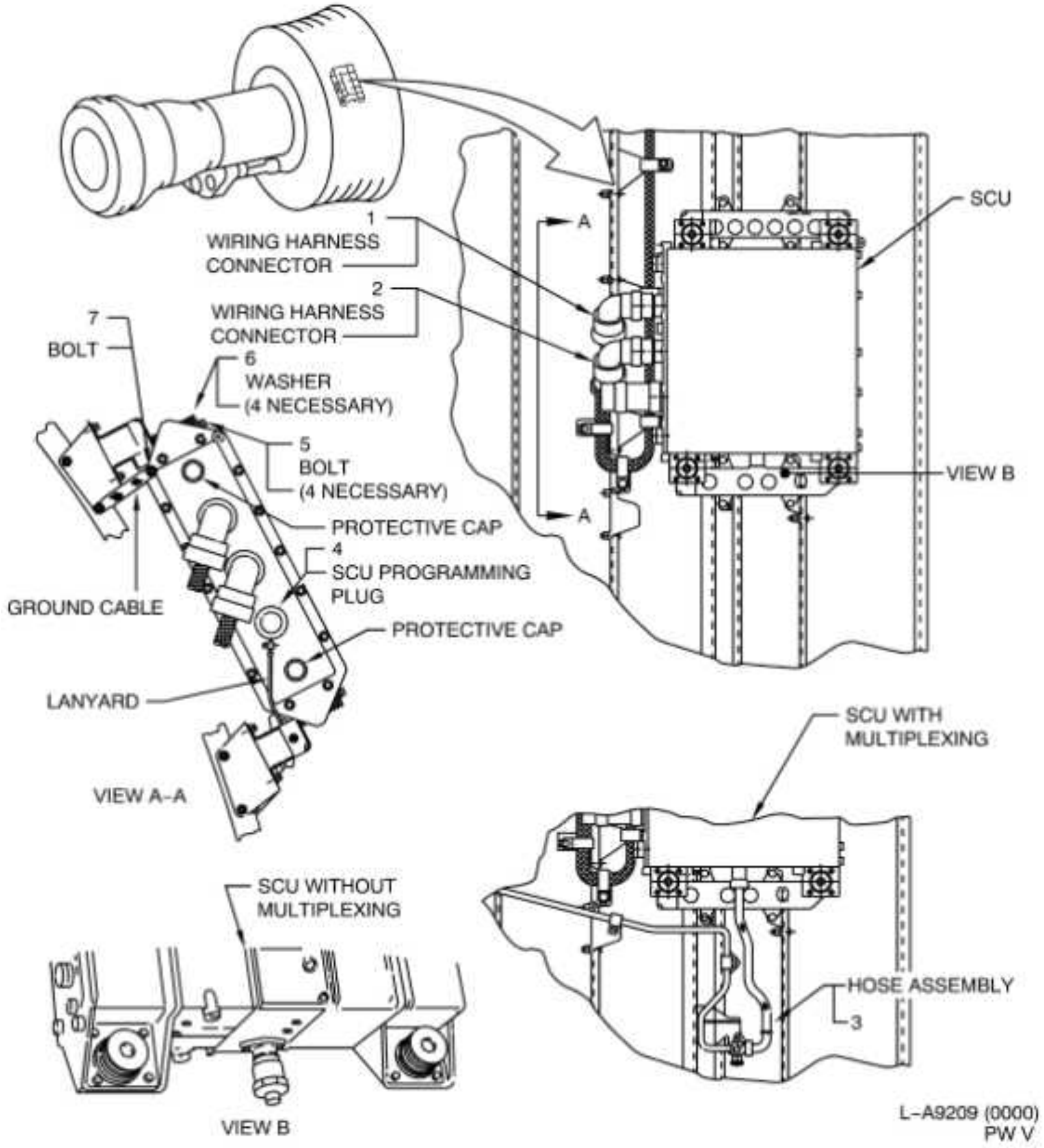
(5) Have another person hold the supplemental control unit (SCU) and remove the bolts (1201/5) and washers (1201/6) from the mounts at the four corners. Remove the supplemental control unit (SCU) from the engine.

(6) Install protection covers to the openings and electrical connectors on the supplemental control unit, the wiring harness and the SCU programming plug.

(7) Attach the wiring harness connectors (W11P33 and W11P34) and the connector assembly (SCU programming plug) (1201/4) to the supplemental control unit (SCU) mount brackets.

(8) Install the four bolts (1201/5) and four washers (1201/6) to the supplemental control unit (SCU) mount brackets sufficiently to engage the locking feature.

(9) Put the supplemental control unit (SCU) in the P60165 Shipping Container and attach the container to the fork lift tunnel on the transport stand at the rear of the engine.


SCU
1
WIRING HARNESS CONNECTOR
2
WIRING HARNESS CONNECTOR
7
BOLT
6
WASHER (4 NECESSARY)
5
BOLT (4 NECESSARY)
A
A
VIEW B
PROTECTIVE CAP
4
SCU PROGRAMMING PLUG
GROUND CABLE
PROTECTIVE CAP
LANYARD
VIEW A-A
SCU WITH MULTIPLEXING
SCU WITHOUT MULTIPLEXING
HOSE ASSEMBLY
3
VIEW B
L-A9209 (0000)
PW V

Supplemental Control Unit (SCU)
Figure 1201
(Task 72-00-00-510-004)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-00-510-005:

1. Install The Supplemental Control Unit (SCU) To Flight Position On The Fan Case After Engine Transport

NOTE: This procedure gives instructions for the installation of the supplemental control unit (SCU) to the right side of the fan case after engine transport.

A. Equipment And Materials Required

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P11-014	Alcohol, Isopropyl (PMC 9094)

B. Procedure

See Figure 1201.

NOTE: Two persons are necessary to do the procedure that follows.

(1) Remove the supplemental control unit from the shipping container attached to the fork lift tunnel on the transport stand at the rear of the engine.

(2) Remove the four bolts (1201/5) and four washers (1201/6) from the supplemental control unit (SCU) mount brackets on the right side of the fan case.

(3) Release the wiring harness connectors (W11P33 and W11P34) and the connector assembly (SCU programming plug) from the SCU mount brackets.

(4) Remove the protection covers from the openings and the electrical connectors on the supplemental control unit, the wiring harness and the SCU programming plug.

(5) With two persons, install the supplemental control unit to the mount brackets on the fan case at approximately the 2:30 o'clock position with the electrical connectors rearward. Attach the supplemental control unit to the brackets with four bolts (1201/5) and washers (1201/6), threads lubricated with Engine Oil (P03−001). Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

CAUTION: BEFORE YOU CONNECT THE GROUND CABLE TO THE SCU, EXAMINE THE CABLE MOUNTING LUGS TO MAKE SURE THE LUGS ARE SECURED TO THE CABLE AND THE CABLE WIRE (STRANDS) ARE AT LEAST 75 PERCENT NOT BROKEN. LOOSE LUGS OR TOO MANY BROKEN WIRES (STRANDS) CAN NOT GIVE SUFFICIENT PROTECTION FROM A LIGHTNING STRIKE.

(6) Put the ground cable to the threaded hole in the top rear side of the supplemental control unit. Attach the cable to the supplemental control unit with a bolt (1201/7), threads lubricated with Engine Oil (P03−001). Torque the bolt to 85 − 95 lb−in. (9.604 − 10.734 N.m).

CAUTION: DO NOT USE LUBRICANTS ON THE SENSING HOSE, OR GASKET UNLESS SPECIFIED DIFFERENTLY. LUBRICANT CAN CAUSE CONTAMINATION OF THE SCU.

(7) If the supplemental control unit has the multiplexing option, install the top hose connector of the hose assembly (1201/3) to the bottom side of the supplemental control unit. Torque the hose connector to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292).

(8) Connect the W11P34 (1201/1) and the W11P33 (1201/2) harness connectors to the mating SCU harness receptacles as follows. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Isopropyl Alcohol (P11−014). Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the (Glenair TG−70) strap wrench or the (Glenair TG−69) soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

See the instructions given with the strap wrench for correct use.

(9) Connect the SCU programming plug (1201/4) to the mating SCU receptacle as follows.

(a) Remove the protection covers. Examine the programming plug and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the plug and receptacle with Isopropyl Alcohol (P11−014). Let dry.

(b) Align the plug keyways and engage the plug to the mating receptacle. Tighten the plug coupling nut by hand until you cover the witness (color) band and the plug coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the plug coupling nut.

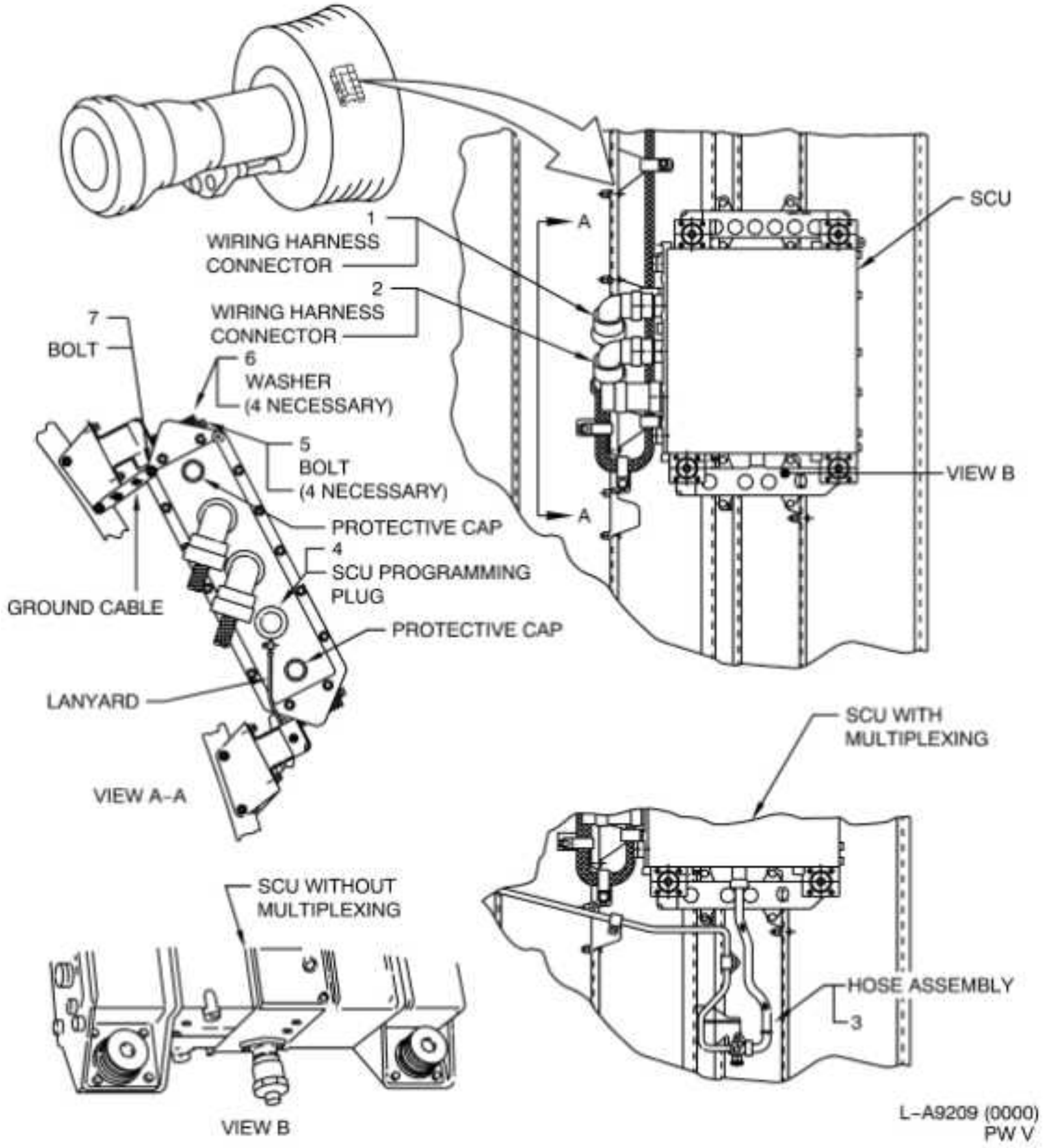
CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN PLUG DAMAGE OR A LOOSE PLUG. A LOOSE PLUG PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the (Glenair TG−70) strap wrench or the (Glenair TG−69) soft−jawed pliers and tighten the plug coupling nut. Use sufficient force to be sure:
- the plug coupling nut is fully tight
- the plug fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the plug is tight.

NOTE: If you use too much force, the tools (above) will turn around on the plug coupling nut. This will prevent too much torque.

See the instructions given with the strap wrench for correct use.


SCU
1
WIRING HARNESS CONNECTOR
2
WIRING HARNESS CONNECTOR
7
BOLT
6
WASHER (4 NECESSARY)
5
BOLT (4 NECESSARY)
A
A
VIEW B
PROTECTIVE CAP
4
SCU PROGRAMMING PLUG
GROUND CABLE
PROTECTIVE CAP
LANYARD
VIEW A-A
SCU WITH MULTIPLEXING
SCU WITHOUT MULTIPLEXING
HOSE ASSEMBLY
3
VIEW B
L-A9209 (0000)
PW V

Supplemental Control Unit
Figure 1201
(Task 72−00−00−510−005)

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Pratt & Whitney

PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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List of Effective Pages - Storage/Transport
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	R	1212		DEC 15/06
	R	1213		DEC 15/06
	R	1214		DEC 15/06
	R	1215		DEC 15/06
	R	1216		DEC 15/06
	R	1217		DEC 15/06
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TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 82 DATED DECEMBER 15, 2006

HIGHLIGHTS - STORAGE/TRANSPORT

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72−00−31	ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC) − INSTALLATION−05 • 72−00−31−420−004: Install LPC Stage 1 Compressor Stator Assembly
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Task 72-00-31-020-003:

1. Remove Low Pressure Compressor (LPC)

NOTE: See Figure 301 for part/assembly removal procedure sequence.

A. Prerequisites

(1) Remove electronic engine control (EEC) speed transducer (N1). See 72-00-34, Removal-03 Task 72-00-34-050-001.

(2) Remove compressor inlet cone. See Removal-02 Task 72-00-31-020-001.

(3) Remove all Stage 1 LPC blade assemblies. See Removal-04 (Task 72-00-31-020-002-002).

(4) Remove LPC/LPT coupling. See 72-00-32, Removal-01 Task 72-00-32-020-001.

B. Equipment And Materials Necessary

Special Tools:
PWA 28657 Sling
PWA 76154 Adapter, Lift And Trunnion (2 Required)
PWA 85292 Adapter, Torque (Optional To PWA 86227)
PWA 85520 Fixture, Install And Remove
PWA 85521 Arm, Lifting
PWA 85584 Protector, Plastic
PWA 85660 Stand, Build/Storage (Optional To PWA 88183)
PWA 85685 Puller, Knocker
PWA 86227 Adapter, Torque
PWA 88183 Stand, Build/Storage

Standard Tools:
0.375 - 24 x 1 3/4 Inch Allen Head Bolts
0.190 - 32 x 1 Inch Hex Head Bolts

C. Procedure
See Figure 302.

R (1) Remove the 36 screws that attach the fan exit
R fairing (splitter). If necessary you can use one of
R the penetrating oils specified in SPOP 427 (Task
R 70-00-00-050-001) to help remove the screws. Refer to
R Section 70-00-00 in the Standard Practices Manual, PN
R 585005.

(2) Position PWA 85685 Puller, small tooth side, in one of nine slots on rear OD of fairing. Remove fairing until able to use opposite side of puller jaw to complete removal of fairing.

(3) Remove 38 bolts from No. 1 bearing to No. 1 bearing front support with PWA 86227 or PWA 85292 Adapter. If the engine has a No. 1 bearing vibration transducer, this includes the two bolts and washers that attach the transducer to the front support. Leave two equally spaced.

(4) Remove 46 bolts and washers from LPC compressor stator assembly to fan exit case and vane assembly. Leave four equally spaced.

(5) Attach PWA 85521 Arm to PWA 85520 Fixture using six shoulder screws and washers. Using hoist raise arm and fixture.

(6) Position fixture to LPC and secure to LPC hub using 19 bolts and to shroud using six clamps.

(7) Remove remaining bolts securing No. 1 bearing and LPC stators.

CAUTION: DO NOT EXCEED RECOMMENDED TORQUE LIMIT OF 26 LB−IN. (2.938 N.m) OR DAMAGE TO LPC STATOR ASSEMBLY COULD RESULT.

(8) Insert three jackscrews in threaded holes of No. 1 bearing front support. Install eight jackscrews in threaded holes of LPC compressor stator assembly. Using jackscrews simultaneously remove low pressure compressor from engine. A torque limit of 26 lb−in. (2.939 N.m) should be used on LPC stator jackscrews during removal.

(9) Remove packing from carbon seal support and discard. Remove packing from stator and discard. Install PWA 85584 Protector over bearing and seal assembly.

WARNING: USE SPOOLS ON PWA 85520 FIXTURE MARKED "LIFT FIXTURE AND LPC MODULE ONLY" WHEN TRUNNIONING LPC MODULE. FAILURE TO USE CORRECT SPOOLS

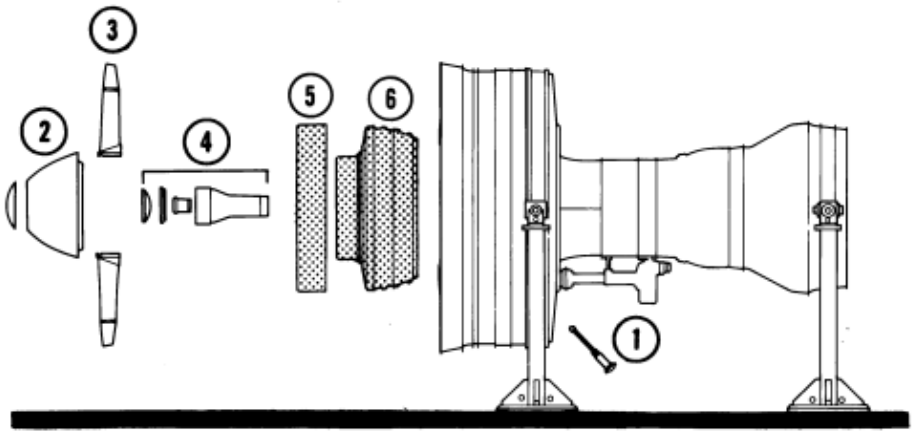
COULD RESULT IN INJURY TO PERSONNEL AND/OR PARTS.

(10) Attach hoist to PWA 28657 Sling with with two PWA 76154 Adapter and slip onto spools of fixture.

NOTE: If No. 1 bearing is to be removed trunnion LPC assembly to front end down on bench, pallet or floor.

(11) Trunnion LPC assembly to front end up and lower onto either PWA 88183 or PWA 85660 Stand. Remove fixture from LPC. Remove hoist, sling, and adapters from fixture. Remove arm from fixture.

ENGINE GENERAL - LOW PRESSURE COMPRESSOR (LPC) - REMOVAL-01

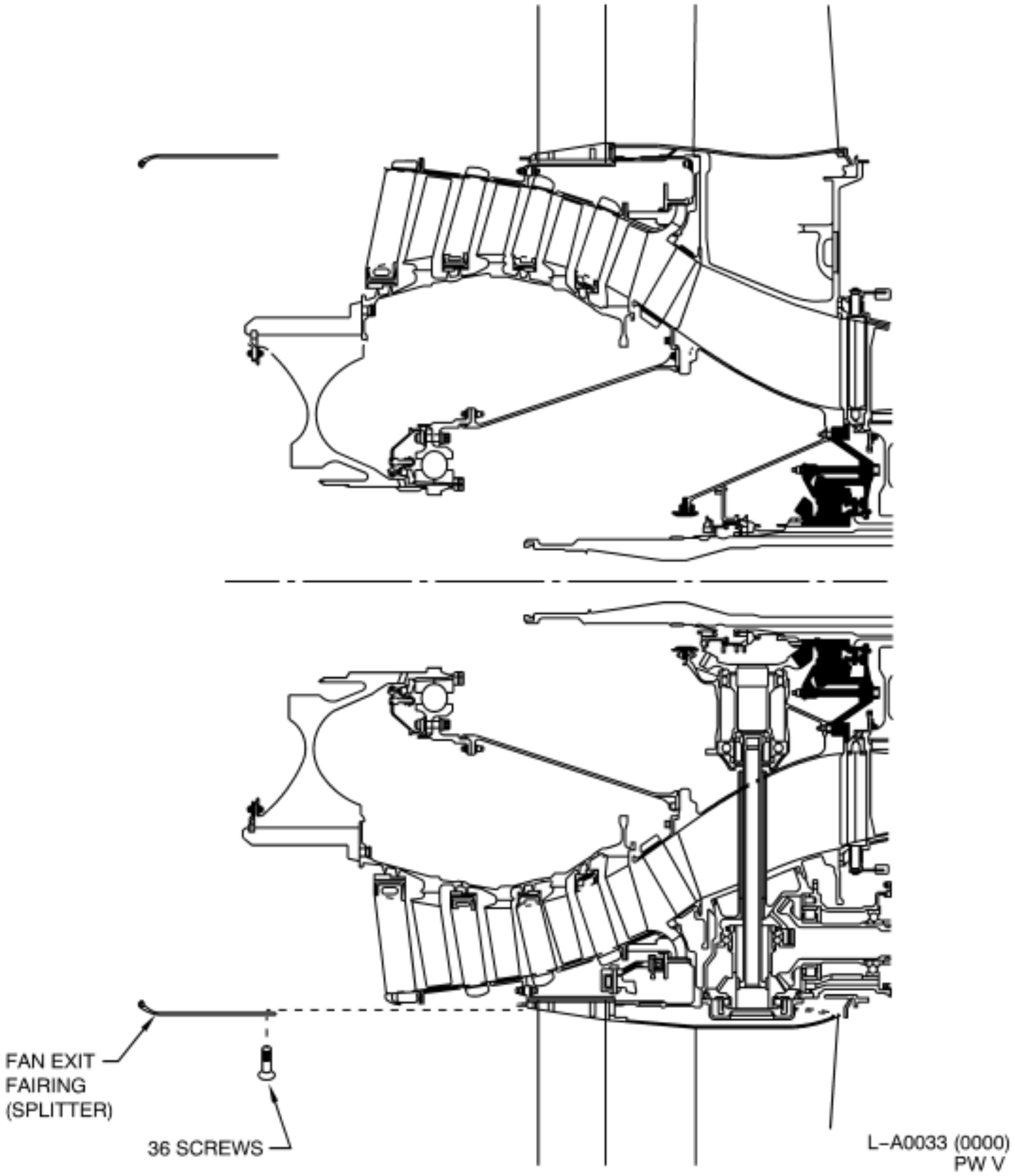


1. REMOVE ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
2. REMOVE COMPRESSOR INLET CONE.
3. REMOVE STAGE 1 LPC BLADE ASSEMBLIES.
4. REMOVE LPC/LPT COUPLING.
5. REMOVE FAN EXIT FAIRING.
6. REMOVE LOW PRESSURE COMPRESSOR (LPC).

L-A0053

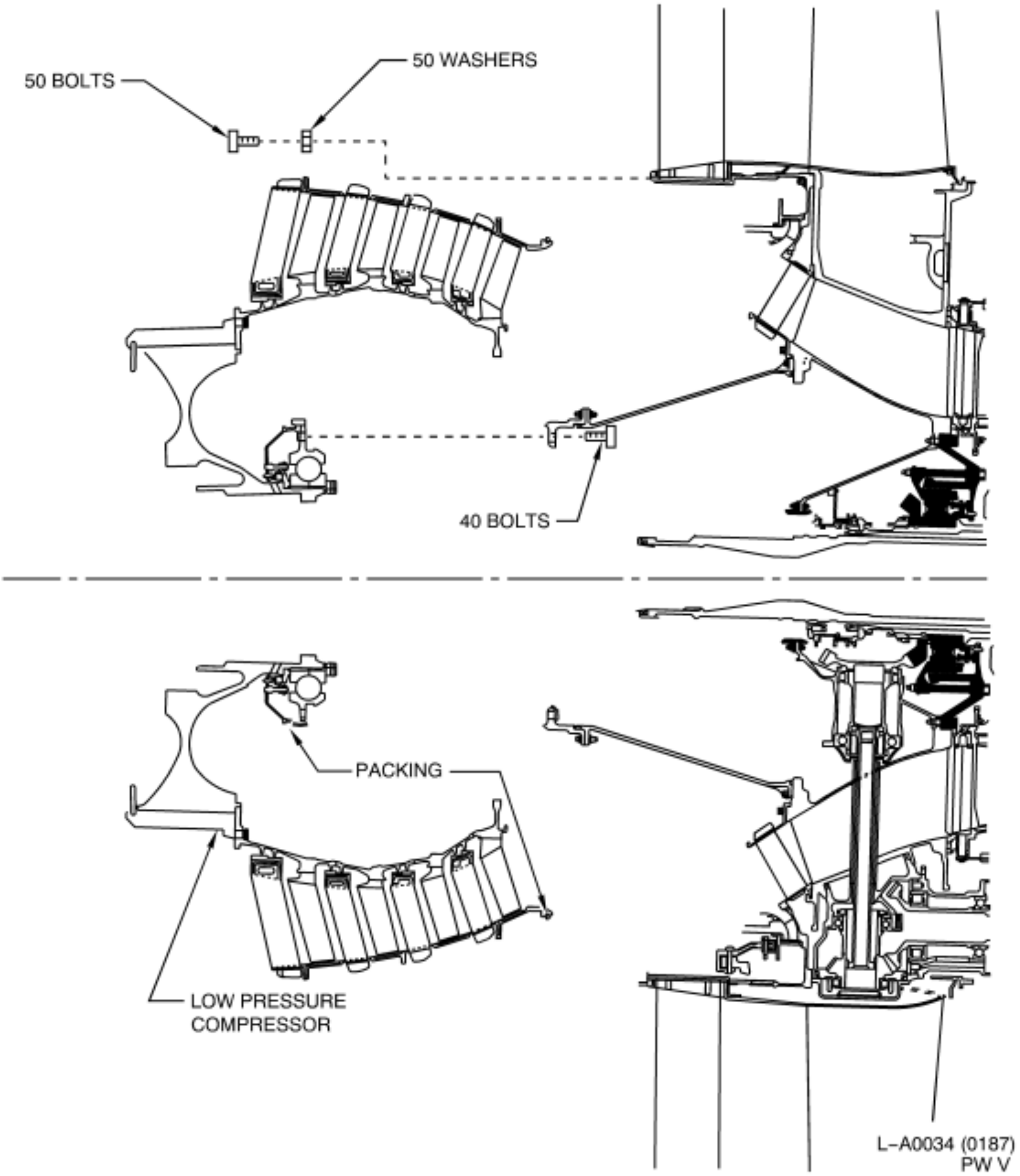
Procedure Sequence
Figure 301
(Task 72-00-31-020-003)

ENGINE GENERAL - LOW PRESSURE COMPRESSOR (LPC) - REMOVAL-01


FAN EXIT
FAIRING
(SPLITTER)
36 SCREWS
L-A0033 (0000)
PW V

Low Pressure Compressor Removal
Figure 302 (Sheet 1)
(Task 72-00-31-020-003)

R
R


50 BOLTS
50 WASHERS
40 BOLTS
PACKING
LOW PRESSURE COMPRESSOR
L-A0034 (0187)
PW V

Low Pressure Compressor Removal
Figure 302 (Sheet 2)
(Task 72-00-31-020-003)

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ENGINE GENERAL - LOW PRESSURE COMPRESSOR (LPC) - REMOVAL-02

Task 72-00-31-020-001:

1. Remove Compressor Inlet Cone
   A. Equipment And Materials Required

Special Tools:
PWA 86122 Puller, Knocker

Consumable Materials:

Item No.	Designation
P05-045	Pen, Marking

B. Procedure
See Figures 301 and 302.

(1) Using Marking Pen (P05-045), or equivalent, mark the inlet cone front segment, the inlet cone (rear) segment, and the front compressor hub to ensure alignment during reinstallation.

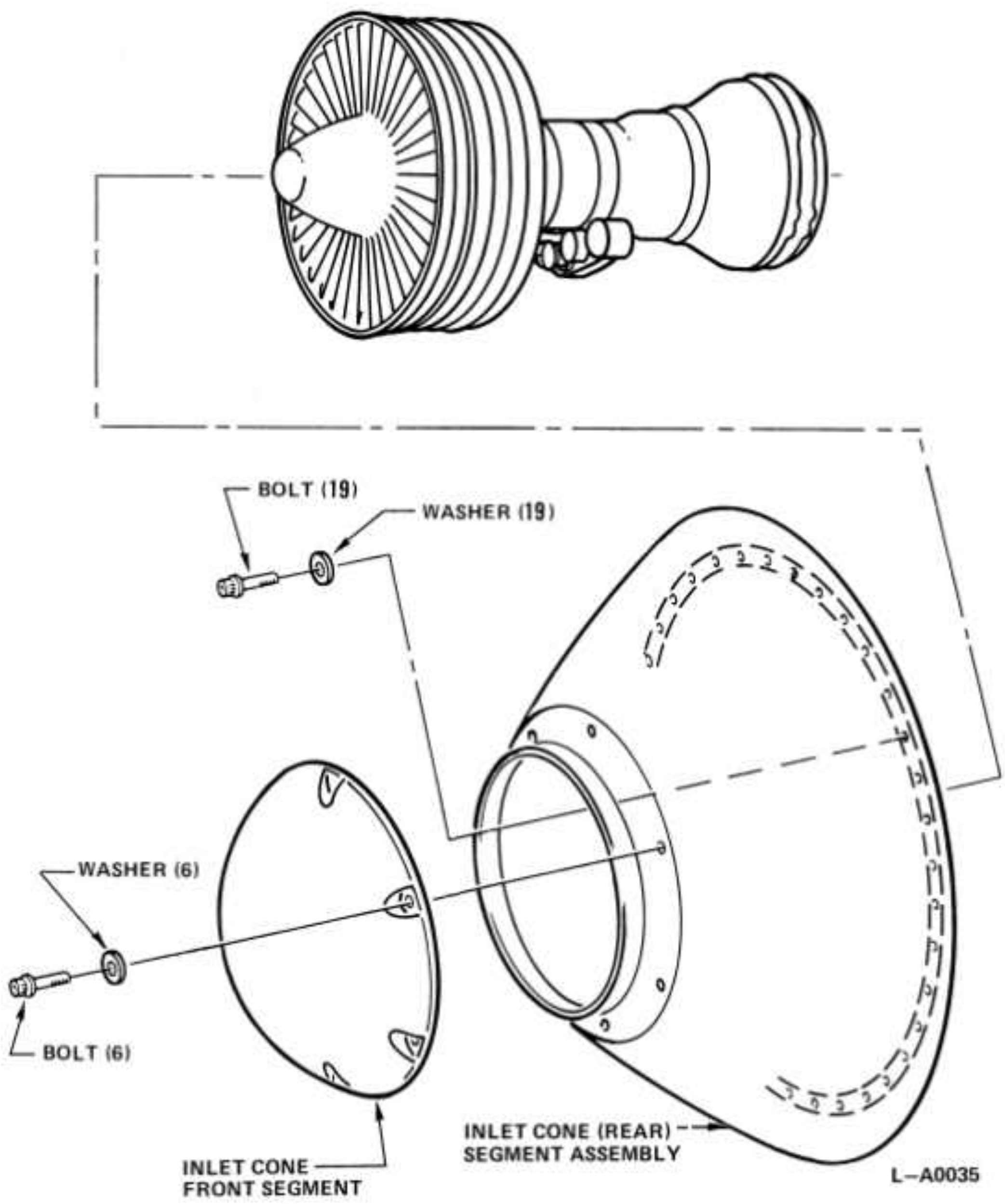
(2) Remove six bolts and washers securing compressor inlet cone front segment to compressor inlet cone (rear) segment assembly and remove front segment.

(3) Remove 19 bolts and washers securing compressor inlet cone (rear) segment assembly to front compressor hub assembly.

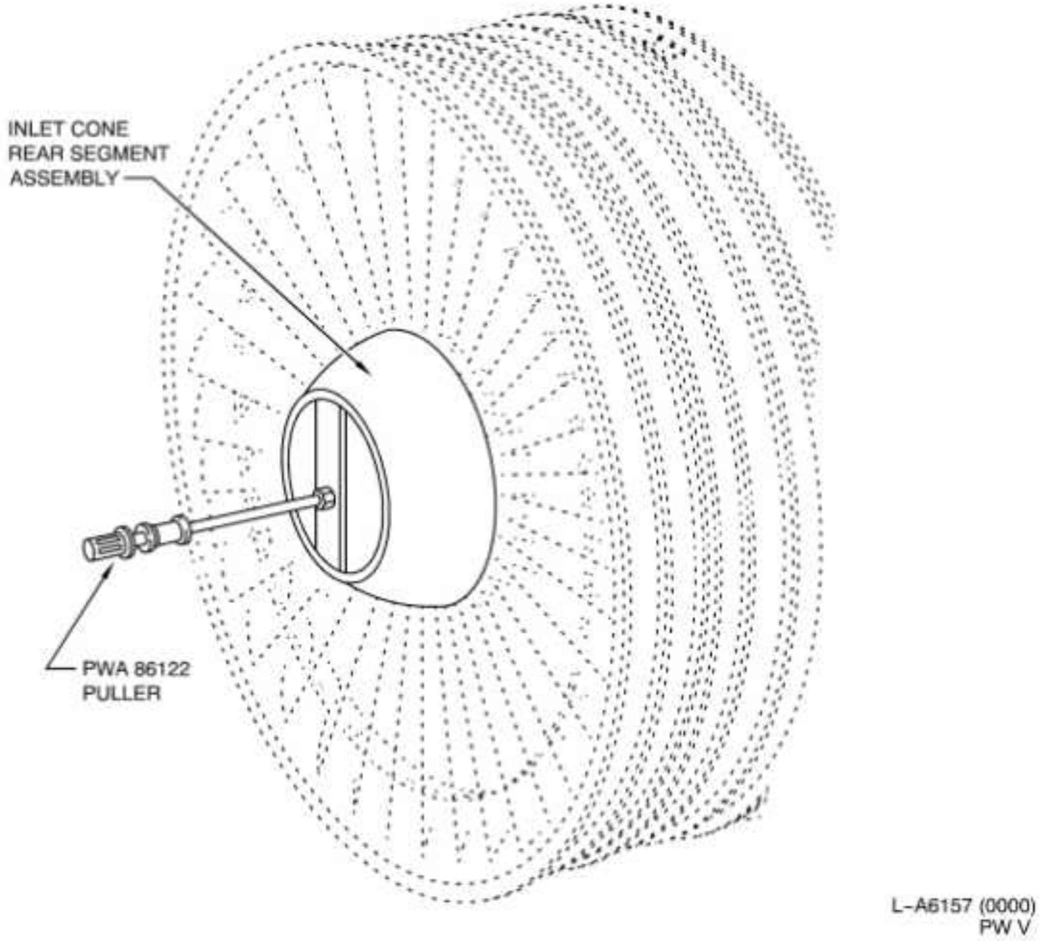
CAUTION: DAMAGE TO NUT PLATES AND/OR INLET CONE CAN OCCUR IF PWA 86122 PULLER IS NOT INSTALLED BETWEEN INLET CONE NUT PLATES.

(4) Install PWA 86122 Puller to the inner side of inlet cone. Precaution must be used not to install puller on inlet cone nut plates. See Figure 302.

(5) Remove compressor inlet cone (rear) segment assembly and place on pallet or workbench.


BOLT (19)
WASHER (19)
WASHER (6)
BOLT (6)
INLET CONE (REAR) SEGMENT ASSEMBLY
INLET CONE FRONT SEGMENT
L-A0035

Compressor Inlet Cone Removal
Figure 301
(Task 72-00-31-020-001)


INLET CONE
REAR SEGMENT
ASSEMBLY
PWA 86122
PULLER
L−A6157 (0000)
PW V

Compressor Inlet Cone Removal
Figure 302
(Task 72−00−31−020−001)

ENGINE GENERAL - LOW PRESSURE COMPRESSOR (LPC) - REMOVAL-03

Task 72-00-31-020-002-001:

1. Remove Individual Or Matched Moment Weighted Set Of Stage 1 LPC Blade Assemblies

NOTE: See Figure 301 for part/assembly removal procedure sequence.

A. Prerequisites

(1) Remove compressor inlet cone. See Removal-02 (Task 72-00-31-020-001).

B. Equipment And Materials Necessary

Special Tools:

PWA 85035	Fixture, Support
PWA 102828	Mechanical Compressor (Fan Blade Lock)

C. Procedure

NOTE: Following procedure provides for removal of blades for selective replacement purposes. See Removal-04 (Task 72-00-31-020-002-002) for removal of blades as a complete set.

WARNING: TO AVOID POSSIBLE INJURY TO HANDS GLOVES SHOULD BE WORN WHEN HANDLING FAN BLADES.

CAUTION: DO NOT LEAVE ENGINE UNATTENDED WITHOUT BLADE LOCK INSTALLED. IF ENGINE WINDMILLS WITH FAN BLADES IN FORWARD POSITION BLADES COULD BE DAMAGED.

(1) Remove compressor blade (Stage 1) lock using small pin punch in hole located near lock joint or PWA 102828 Mechanical Compressor. See Figure 302.

(2) Install PWA 85035Fixture to hub and secure with six fasteners equally spaced around hub.

CAUTION: WHEN REMOVING FAN BLADE(S), USE CARE TO AVOID DAMAGE TO RUBBER SEAL BONDED TO BOTTOM OF FAN BLADE PLATFORM.

(3) To prevent fan blade shroud and root binding during blade removal, proceed as follows:

(a) Position each fan blade at 12 o'clock position.

(b) Working in a counterclockwise direction (as viewed from front), carefully pull each blade forward, in hub slot, in small increments.

(c) Continue sliding all blades forward, one at a time, at 12 o'clock position, until stopped by fixture.

(d) Blade at 12 o'clock position should then be free to slide completely out of slot.

(e) Rotate cut−out in fixture to line up with blade to be removed at 12 o'clock position. See Figure 303 and Figure 304.

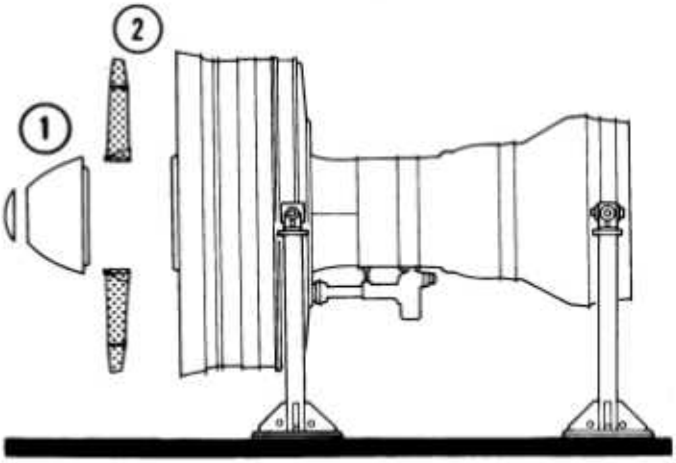
(4) Remove selected blade.

(5) If replacing matched moment weighed blade set:

(a) Turn rotor 180 degrees.

(b) Rotate ring assembly until cut−out in ring lines up with blade to be removed.

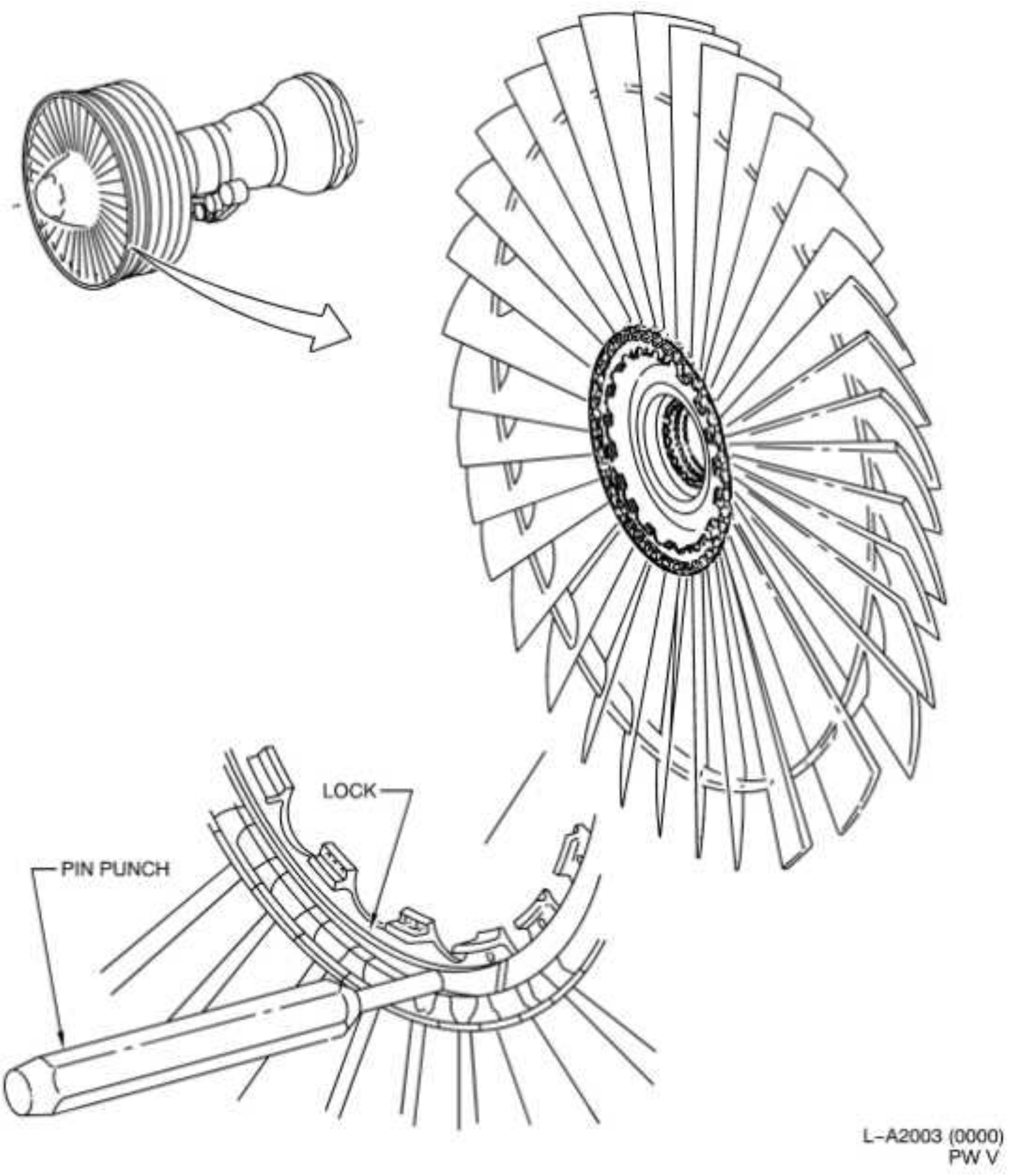
(c) Remove blade located 180 degrees from previously removed blade.



1. REMOVE COMPRESSOR INLET CONE.
2. REMOVE STAGE 1 LPC BLADE ASSEMBLIES.

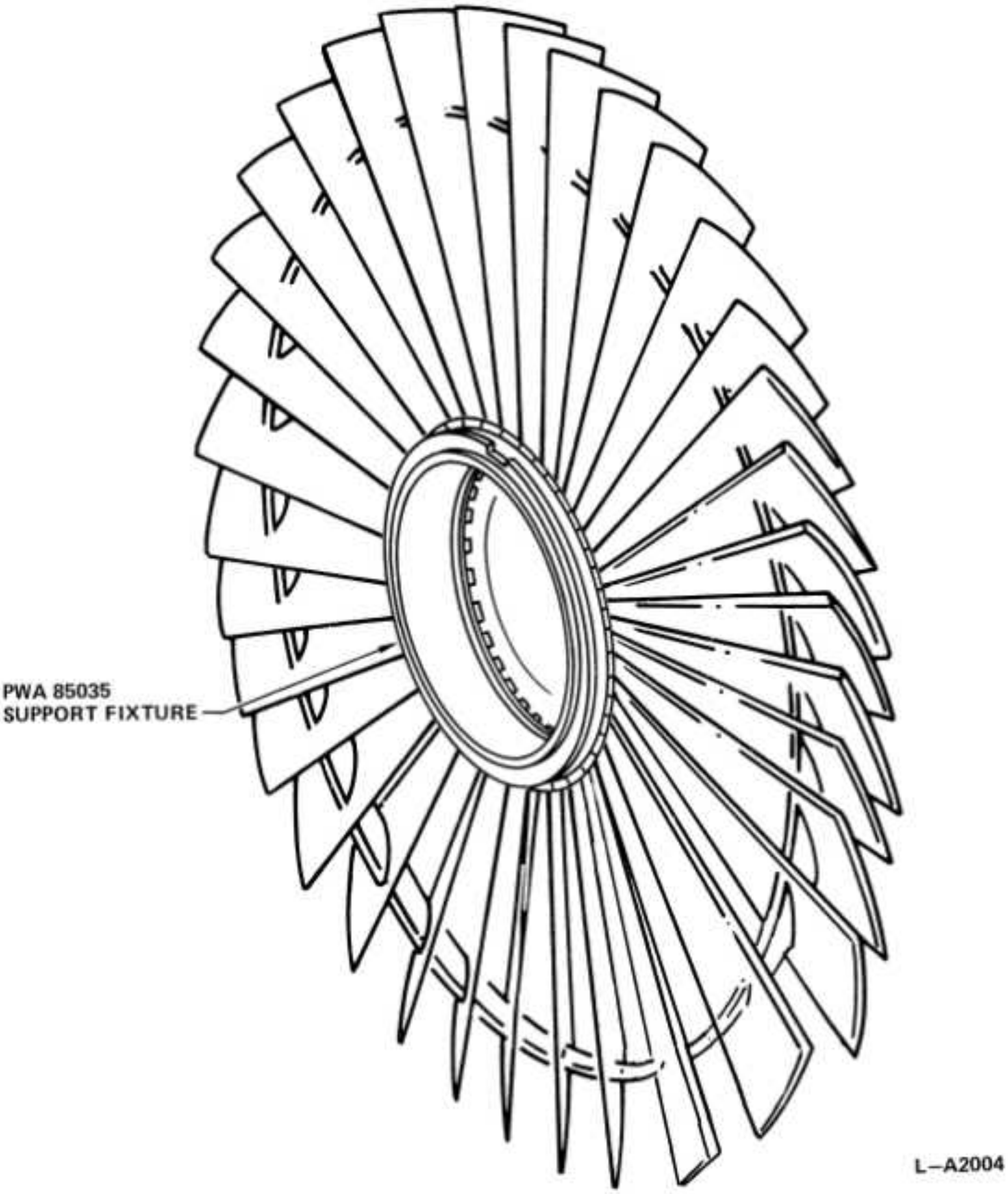
L−A0055

Procedure Sequence
Figure 301
(Task 72−00−31−020−002−001)

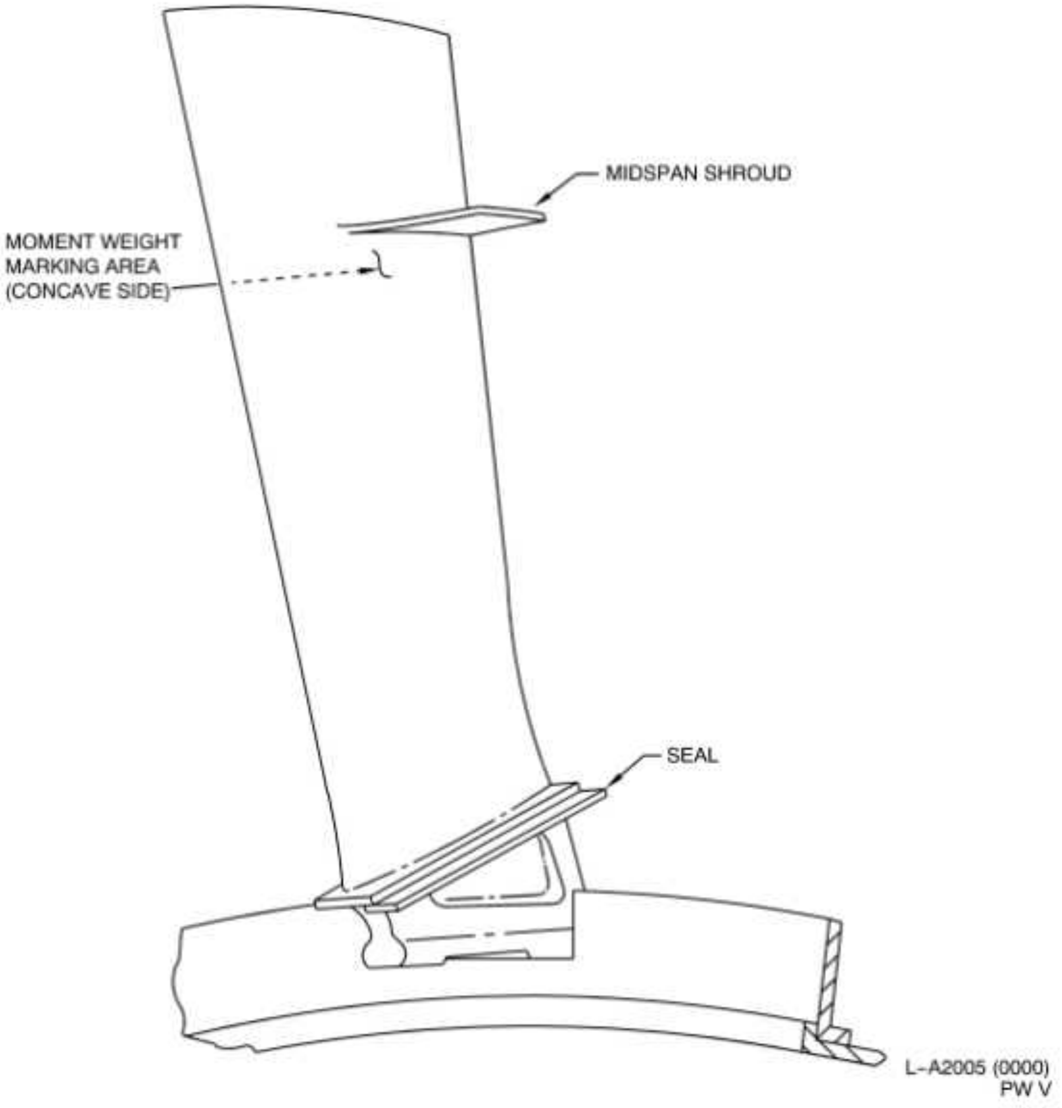

LOCK
PIN PUNCH
L−A2003 (0000)
PW V

Stage 1 LPC Blade Lock Removal
Figure 302
(Task 72−00−31−020−002−001)

ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC) − REMOVAL−03


PWA 85035
SUPPORT FIXTURE
L−A2004

Support Fixture Installation
Figure 303
(Task 72−00−31−020−002−001)


MIDSPAN SHROUD
MOMENT WEIGHT MARKING AREA (CONCAVE SIDE)
SEAL
L-A2005 (0000)
PW V

Fan Blade Removal
Figure 304
(Task 72−00−31−020−002−001)

ENGINE GENERAL - LOW PRESSURE COMPRESSOR (LPC) - REMOVAL-04

Task 72-00-31-020-002-002:

1. Remove All Stage 1 LPC Blade Assemblies

NOTE: See Figure 301 for part/assembly removal procedure sequence.

A. Prerequisites

(1) Remove compressor inlet cone. See Removal-02 (Task 72-00-31-020-001).

B. Equipment And Materials Necessary

Special Tools

PWA 85035	Fixture, Support
PWA 86651	Cart, Storage
PWA 102828	Mechanical Compressor (Fan Blade Lock) (Optional)

Consumable Materials:

Item No.	Designation
P05-045	Pen, Marker

C. Procedure

NOTE: Following procedure provides for removal of blades as a complete set. For selective blade replacement requirements, see Removal-03 (Task 72-00-31-020-002-001).

WARNING: TO AVOID POSSIBLE INJURY TO HANDS GLOVES SHOULD BE WORN WHEN HANDLING FAN BLADES.

CAUTION: DO NOT LEAVE ENGINE UNATTENDED. IF ENGINE WINDMILLS WITH BLADES IN FORWARD POSITION BLADES COULD BE DAMAGED.

(1) Remove compressor blade (Stage 1) lock assembly using small pin punch in hole near lock joint or PWA 102828 Mechanical Compressor. See Figure 302.

(2) Install PWA 85035 Fixture to hub and secure with work bolts or inlet cone bolts. Rotate ring assembly until cut-out in ring lines up with blade to be removed at 12 o'clock location. See Figure 303.

(3) Progressing in clockwise direction (as viewed from front), number blades 1 to 38 using temporary white Marker P05−045, or equivalent.

(4) Mark corresponding hub slots with matching blade numbers.

NOTE: Marking requirement is waived if rotor assembly is scheduled to be balanced.

CAUTION: WHEN REMOVING FAN BLADE(S), USE CARE TO AVOID DAMAGE TO RUBBER SEAL BONDED TO BOTTOM OF FAN BLADE PLATFORM.

(5) To prevent fan blade shroud and root binding during blade removal, proceed as follows:

(a) Position each fan blade at 12 o'clock position.

(b) Working in a counterclockwise direction (as viewed from front), carefully pull each blade forward, in hub slot, in small increments.

(c) Continue sliding all blades forward, one at a time, at 12 o'clock position, until stopped by fixture.

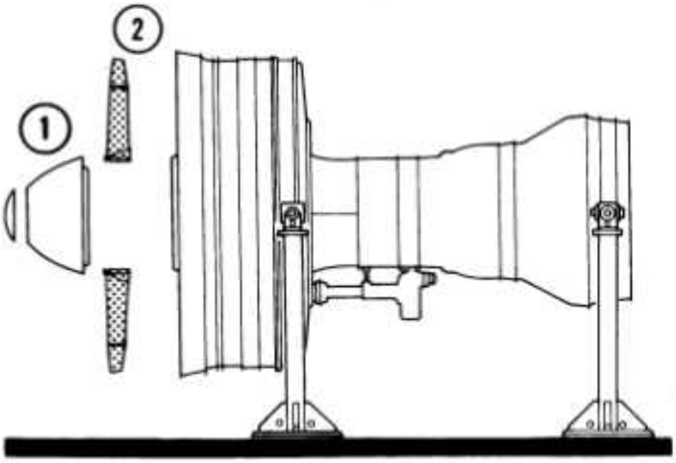
(d) Blade at 12 o'clock position should then be free to slide completely out of slot.

(e) Rotate cut−out in fixture to line up with blade to be removed at 12 o'clock position. See Figure 304.

(6) Install removed blades in PWA 86651 Cart.

(7) Remove fixture from hub.

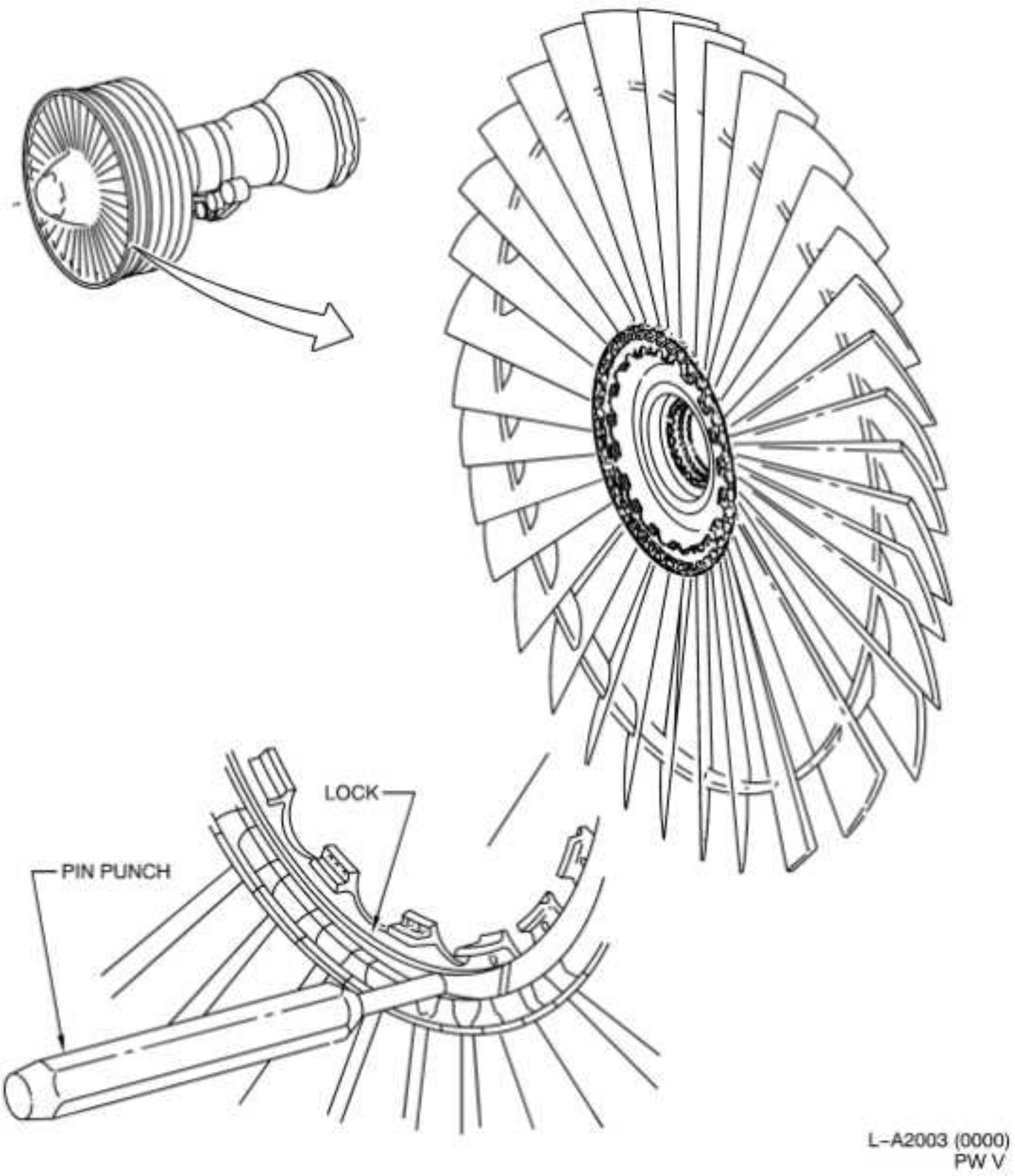
(8) If the ribs of the duct segment assemblies in the fan case are badly worn or if the wear is not equal, examine the duct segment assemblies for wear. Refer to 72−33−01, Inspection/Check−04 in the PW4000 Series CIR, PN 51A357. See Figure 305.



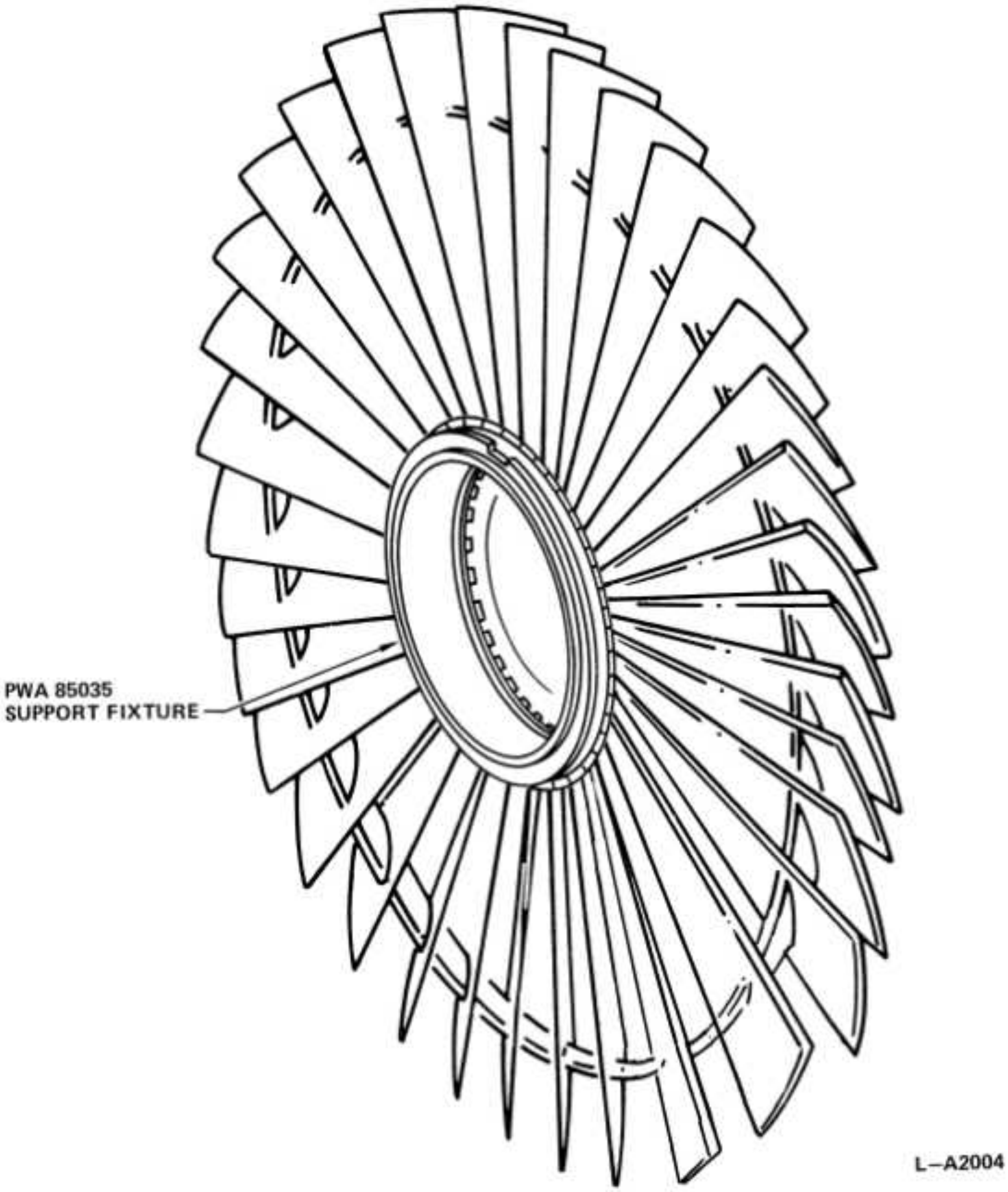
1. REMOVE COMPRESSOR INLET CONE.
2. REMOVE STAGE 1 LPC BLADE ASSEMBLIES.

L-A0055

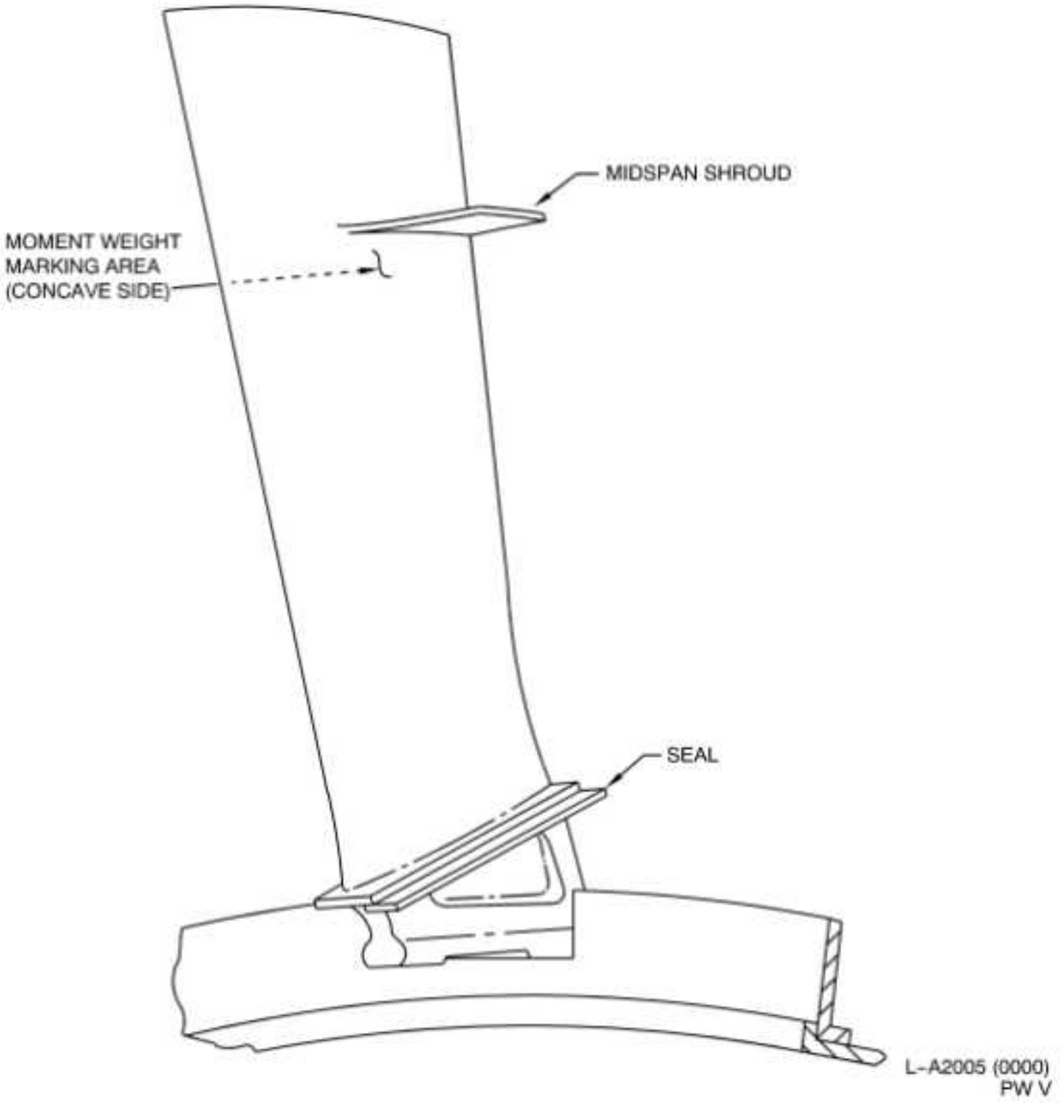
Procedure Sequence
Figure 301
(Task 72-00-31-020-002-002)


LOCK
PIN PUNCH
L-A2003 (0000)
PW V

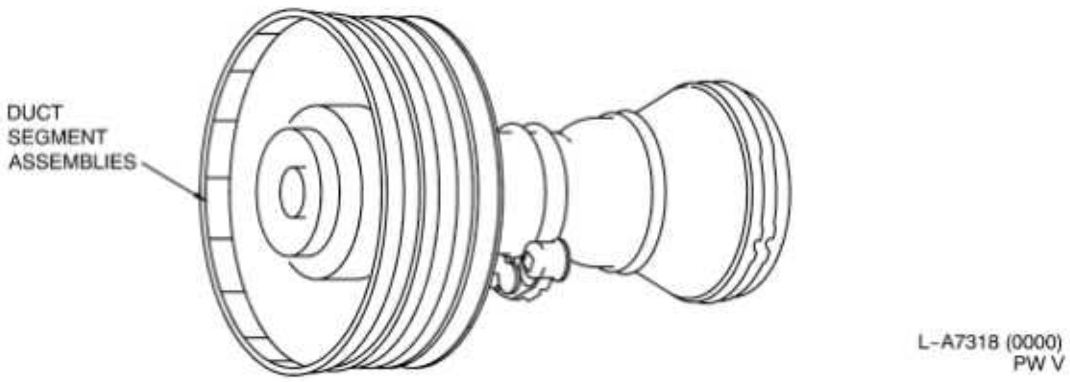
Stage 1 LPC Blade Lock Removal
Figure 302
(Task 72-00-31-020-002-002)


PWA 85035
SUPPORT FIXTURE
L−A2004

Support Fixture Installation
Figure 303
(Task 72−00−31−020−002−002)


MIDSPAN SHROUD
MOMENT WEIGHT MARKING AREA (CONCAVE SIDE)
SEAL
L-A2005 (0000)
PW V

Fan Blade Removal
Figure 304
(Task 72−00−31−020−002−002)


DUCT SEGMENT ASSEMBLIES
L-A7318 (0000)
PW V

Inspection Of The Duct Segment Assemblies
Figure 305
(Task 72−00−31−020−002−002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC) − REMOVAL−05

Task 72−00−31−020−004:

1. Remove LPC Stage 1 Compressor Stator Assembly

A. Prerequisites

(1) Remove all Stage 1 LPC blade assemblies. See Removal−04 (Task 72−00−31−020−001).

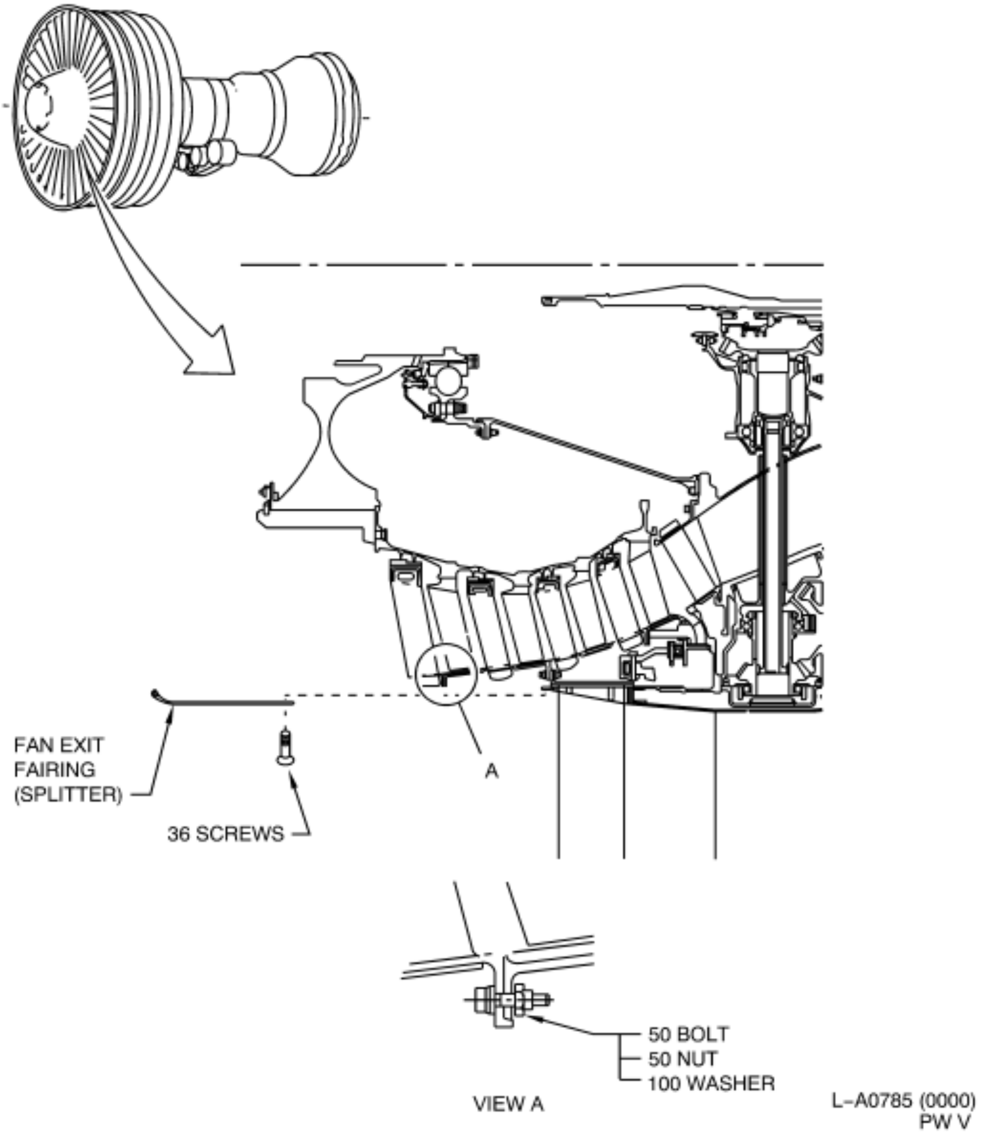
B. Equipment And Materials Necessary − None

C. Procedure
See Figure 301.

(1) Remove 36 screws that attach the fan exit fairing
R (splitter). If necessary you can use one of the
R penetrating oils specified in SPOP 427 to help remove
R the screws. See Standard Practices Manual, PN 585005
R PN 585005.

R (2) Remove fairing from the engine.

R (3) Remove 50 nuts, washers and bolts securing LPC Stage 1 compressor stator assembly to LPC (Stage 1.6, 2 and 3) compressor stator assembly. Remove stator assembly from engine.


FAN EXIT
FAIRING
(SPLITTER)
36 SCREWS
A
50 BOLT
50 NUT
100 WASHER
VIEW A
L−A0785 (0000)
PW V

LPC Stage 1 Compressor Stator Assembly
Figure 301
(Task 72−00−31−020−004)

ENGINE GENERAL - LOW PRESSURE COMPRESSOR (LPC) - REMOVAL-06

Task 72-00-31-030-001:

1. Remove The No. 1 Bearing And Seal Assembly

A. Prerequisites

(1) Remove The Low Pressure Compressor (LPC). Refer to 72-00-31, Removal-01 (Task 72-00-31-020-003).

B. Equipment And Materials Necessary

Special Tools:

PWA 25000	Wrench, Hydraulic
PWA 28657	Sling
PWA 28668	Pump, Hydraulic (Electric) (Use With Hydraulic Wrench)
PWA 28669	Cart, Storage (Optional) (Use With Hydraulic Wrench)
PWA 29389	Hydraulic Pump
PWA 29510	Pump, Hydraulic (Hand) (Use With Hydraulic Wrench)
PWA 29614	Wrench, Mechanical
PWA 29615	Holder, Plate (Use With Mechanical Wrench)
PWA 45419	Air Torque Multiplier (Use With Mechanical Wrench)
PWA 76154	Adapter, Lift And Trunnion (2 Necessary)
PWA 80651	Multiplier, Pneumatic (Use With Mechanical Wrench)
PWA 85200	Puller
PWA 85201	Puller
PWA 85520	Fixture, Install And Remove
PWA 85590	Protector, Plastic
PWA 85641	Wrench, Torque (Use With Hydraulic Wrench)
PWA 85653	Wrench, Torque (Use With Mechanical Wrench)
PWA 85791	Adapter, Counter-Torque
PWA 85792	Adapter, Handling (Use With Hydraulic Wrench)
PWA 85793	Adapter, Handling (Use With Mechanical Wrench)
PWA 102125	Drift, Removal

C. Procedure

(1) Install the PWA 85520 Fixture onto the axial compressor rotor assembly located in the Stand (PWA 85660).

(2) Install the PWA 85791 Adapter into the hub ID and attach with the detail nut.

(3) Attach hoist to the PWA 28657 Sling with two PWA 76154 Adapters to the spools on the fixture. Use the spools marked for fixture LPC. Trunnion the axial compressor rotor assembly to the rear end up and place on the work area.

(4) Remove the sling and adapters from the fixture.

(5) Remove the rivets that hold the No. 1 bearing retaining nut to the hub assembly as follows:

  (a) Install PWA 102125 Removal Drift into the inside diameter of the rear end of the fan hub.

  (b) Align the drift so that the detail shear block is over one of the two rivets that hold the nut in position on the fan hub.

  (c) Turn the two detail swivel screws until they are tight. This will push the drift tight against the fan hub inside diameter where the detail shear block is located.

  (d) Adjust the three clamps assemblies to lock the drift to the fan hub. Use a wrench and turn the detail large hex head cap screw. This will move the detail shear block which will remove the head of the rivet.

  (e) Use a fabricated drift and remove the rivet shank from the fan hub.

  (f) Do the above steps again to remove the other rivet from the fan hub.

  (g) Remove the removal drift from the fan hub.

(6) For operators that use the mechanical wrench, loosen the nut on the hub as follows.

  NOTE: See the following step to remove loosen the nut with the optional Hydraulic Wrench.

  (a) Install the detail adapter of the PWA 85793 Torque Adapter onto the Adapter (PWA 85791).

  (b) Install the PWA 85653 Wrench over the adapter and onto the nut.

(c) Use the PWA 29614 Wrench, PWA 29615 Holder, and either the PWA 45419 or PWA 80651 Multiplier, to loosen the nut on the hub.

(d) Remove the tooling and nut from the hub.

(7) For operators that use the hydraulic wrench, loosen the nut on the hub as follows.

(a) Install PWA 85792 Adapter onto Adapter (PWA 85791).

(b) Install PWA 85641 Wrench on nut.

(c) Remove PWA 25000 Wrench from PWA 28669 Cart and install on wrench and adapter.

(d) Using PWA 28668 or PWA 29510 Pump actuate wrench to loosen nut on hub.

(e) Remove tooling and nut from hub.

(8) Install the PWA 85200 Puller to the inner race puller groove. Attach the PWA 29389 Pump and remove the upper half of the inner race. Remove the tooling and inner race half.

(9) Remove three screws that attach the No. 1 bearing seal assembly to the No. 1 bearing outer race flange. Carefully lower the seal assembly to rest on the hub flange. Remove the No. 1 bearing outer race and balls from the hub.

(10) Install the PWA 85201 Puller to the inner race front half (front side). Attach the PWA 29389 Pump and remove the front half of the inner race. Remove the tooling and front inner race.

(11) Remove the seal seat from the hub. Remove the No. 1 bearing seal assembly from the hub. Install the PWA 85590 Protector over the hub.

(12) Protect the carbon seal, seal seat and bearing with a protective wrapper.

ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC) − REMOVAL−07

Task 72−00−31−030−001−002:

1. Remove The No. 1 Bearing And Seal Assembly (Hydraulic Method) − Deleted

A. Procedure

(1) This procedure is relocated to 72−00−31, Removal−06 (Task 72−00−31−030−001).

Previous Pageblock   Return to Previous Menu   Next Pageblock

Task 72-00-31-420-003:

1. Install Low Pressure Compressor (LPC)

NOTE: See Figure 401 for part/assembly installation procedure sequence.

A. Prerequisites

(1) Vacuum check No. 1 bearing compartment per Inspection/ Check-03 Task 72-00-31-990-003.

(2) See Inspection/Check-01 Task 72-00-31-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Necessary

Special Tools:

PWA 28657	Sling
PWA 76154	Adapter, Lift And Trunnion (2 Necessary)
PWA 85292	Adapter, Torque (Optional To PWA 86227)
PWA 85483	Plate, Gaging
PWA 85520	Fixture, Install And Remove
PWA 85521	Arm, Lifting
PWA 85861	Bolt, Alignment (6 Required)
PWA 86227	Adapter, Torque
PWA 87515	Locator
PWA 102787	Fixture, Alignment

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-045	Pen, Marker
P06-002	Petrolatum White (PMC 9609)
R P06-054	Anti-Seize Compound (PWA 36246)
P09-014	Sealant, Silicone Rubber (PWA 36003)

Expendable Parts:

		PARTS CATALOG REFERENCE
PART NAME	QUANTITY	SECTION/FIGURE/ITEM
Packing	1	72-00-31/2/1
Packing	1	72-31-00/6/370

C. Procedure
See Figure 402.

(1) Make a mark on the LPC case and the fan exit case to help align the two cases during assembly as follows:

(a) Locate the LPC engine identification tag attached to the LPC case at the 10:30 o'clock position.

(b) Place the PWA 87515 Locator on the LPC case at the 9:00 o'clock position of the flange which attaches to the fan exit case. Make sure the locator dowel pins are installed and the slot is over the case split line.

(c) Make a mark with a Pen Marker P05−045 on the flange at each "V" groove. Remove the locator from the LPC case.

(d) Place the Locator (PWA 87515) on the fan exit case at the 9:00 o'clock position of the flange which the LPC case is attached. Make sure the four locator dowel pins are installed in the flange.

(e) Make a mark with a Pen Marker P05−045 on the flange at each "V" groove. Remove the locator from the fan exit case.

(2) Attach PWA 85521 Arm to PWA 85520 Fixture using six shoulder screws and washers. Attach hoist to outer hole on arm and raise fixture.

WARNING: USE SPOOLS ON PWA 85520 FIXTURE MARKED "LIFT FIXTURE AND LPC MODULE ONLY" WHEN TRUNNIONING LPC MODULE. FAILURE TO USE CORRECT SPOOLS COULD RESULT IN INJURY TO PERSONNEL AND/OR PARTS.

(3) Attach hoist to PWA 28657 Sling with two PWA 76154 Adapters to spools on fixture. Use spools marked for fixture and LPC. Trunnion fixture to horizontal for assembly to LPC.

NOTE: LPC may already be stored in fixture on bench, pallet or floor.

(4) Install fixture to LPC.

(a) Locate identification bracket attached to first stage stator shroud approximately 10 o'clock viewed from front. Moving counterclockwise (CCW) find split in case (approximately 9 o'clock). Count CCW 14 holes. This is approximately 6 o'clock position.

(b) Lower fixture to LPC. Using detail−21 dowel pin, position V−groove locator, detail−5, against bolt head determined in above. First stage stator is now timed to engine. Using two detail−16 handles rotate to lock fingers in position.

(c) Secure fixture to hub with 19 bolts and to stator with clamps.

(d) Raise LPC and trunnion to horizontal position.

(5) Install packing around groove in 4th stage stator support. Overlap ends and cut packing diagonally using sharp blade. Secure butt ends with Silicone Rubber P09−014. Apply Petrolatum White P06−002 to packing.

(6) Install packing, lubricated with Engine Oil P03−001, to groove in No. 1 bearing carbon seal support.

(7) (Post PW4ENG−72−660) Install the PWA 102787 Alignment Fixture to the front lip of the inner fan exit case assembly and attach with the six detail bolts.

CAUTION: DO NOT SEAT THE LPC TO THE NO. 1 BEARING SUPPORT WITH THE PWA 85861 ALIGNMENT BOLTS, AS DAMAGE WILL OCCUR TO THE NO. 1 BEARING SEAL SUPPORT IN THIS LPC.

(8) Position LPC on the engine approximately 0.250 inch (6.350 mm) from engagement with the No. 1 bearing front support. Make sure the offset holes, at approximately 7 o'clock viewed front, are aligned. Also, the pen marks made before on the cases can be used to help align the cases.

CAUTION: BEFORE BOLTS ARE TIGHTENED, CHECK WITH MIRROR THROUGH THE 2.5 BLEED PORT AT 7:30 (VIEWED FROM REAR) TO MAKE SURE THE 2.5 BLEED ROD IS IN LINE WITH SCALLOPED CLEARANCE CUT IN THE

LPC OUTER CASE OR DAMAGE CAN OCCUR TO LPC STATOR.

(9) Install six PWA 85861 Alignment Bolts, one in offset hole and the others equally spaced from the back side of the No. 1 bearing support into the correct holes of the LPC. Be sure to engage all six alignment bolts approximately 5 − 6 turns each. Tighten bolts in an alternating procedure to draw the LPC into the No. 1 bearing support only to the point of engagement.

(10) Install four bolts, threads lubricated with Engine Oil P03−001 equally spaced in No. 1 bearing front support. Install eight bolts, threads lubricated with Engine Oil P03−001, with washers, equally spaced in LPC compressor stator assembly bolt circle. Tighten to secure LPC.

(11) Remove alignment bolts from No. 1 bearing support. Remove fixture from LPC.

(12) (Post PW4ENG−72−660) Loosen and remove the six detail bolts that attach the alignment fixture to the front lip of the inner fan exit case assembly and remove the fixture.

(13) Apply Engine Oil P03−001 to the threads of 36 front support bolts.

(a) If applicable, attach the No. 1 bearing vibration transducer to the front support in the two offset holes at 4:30 o'clock with two washers and two of the bolts. See Figure 403.

(b) Install the remaining bolts in the front support.

(c) Install 42 bolts, threads lubricated with Engine Oil P03−001 with washers into LPC compressor stator assembly flange.

(d) Torque both sets of bolts simultaneously.

(14) Torque No. 1 bearing support bolts to 180 − 200 lb−in. (20.337 − 22.597 N.m) with PWA 86227 or PWA 85292 Adapter. Torque LPC compressor stator assembly bolts 36 − 40 lb−in. (4.067 − 4.519 N.m). Using opposite bolt pattern torque bolts to minimum torque. Then retorque bolts within specified limit.

(15) Install fan exit fairing (splitter) to the engine as follows:

(a) Loosely install the fairing on the LPC, visually align the holes in the fairing with the holes in the LPC.

(b) Lubricate the threads of 36 screws with Anti−Seize Compound P06−054.

(c) Install the fairing with the 36 lubricated screws.

(d) Tighten and torque the screws to 27 − 30 lb−in. (3.051 − 3.390 N.m).

(e) Wipe off any excess anti−seize compound.

(16) If LPC or LPC/LPT coupling or No. 1 bearing and seal assembly or No. 1 bearing support assembly is installed due to replacement or repair then LPT running position spacer must be removed and spacer thickness calculated as follows:

(a) Position PWA 85483 Gaging Plate on shoulder inside front compressor front hub and secure.

(b) Measure and record distance from front face of plate to front face on LPT shaft that spacer locates on.

(c) Measure and record distance from shoulder on turbine shaft coupling which locates on front hub to shoulder that contacts LPT running position spacer.

(d) Spacer thickness is determined by measured distance from gaging plate to LPT shaft minus dimension stamped on plate minus dimension measured on turbine shaft coupling.

D. Postrequisites

(1) Install The LPC/LPT Coupling. Refer to 72−00−32, Installation−01 (Task 72−00−32−420−001).

(2) Install All Stage 1 LPC Blade Assemblies. Refer to 72−00−31, Installation−04 (Task 72−00−31−420−002−002).

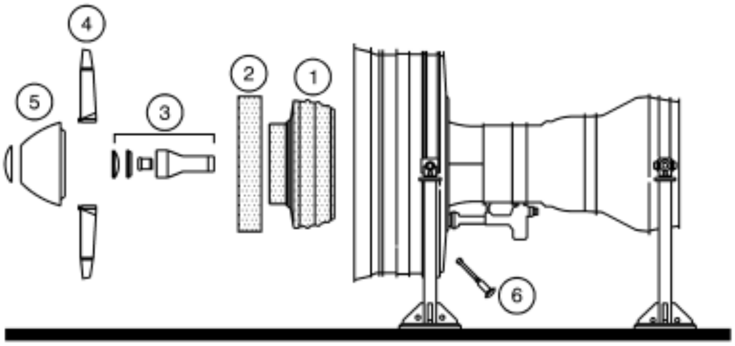
ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC) − INSTALLATION−01

(3) Install The Compressor Inlet Cone. Refer to 72−00−31, Installation−02 (Task 72−00−31−420−001).

(4) Install The Electronic Engine Control (EEC) Speed, Transducer (N1). Refer to 72−00−34, Installation−03 (Task 72−00−34−450−001).

(5) Test the engine per the Test Reference Table. Refer to 71−00−00, Testing−00 (Task 71−00−00−990−003).

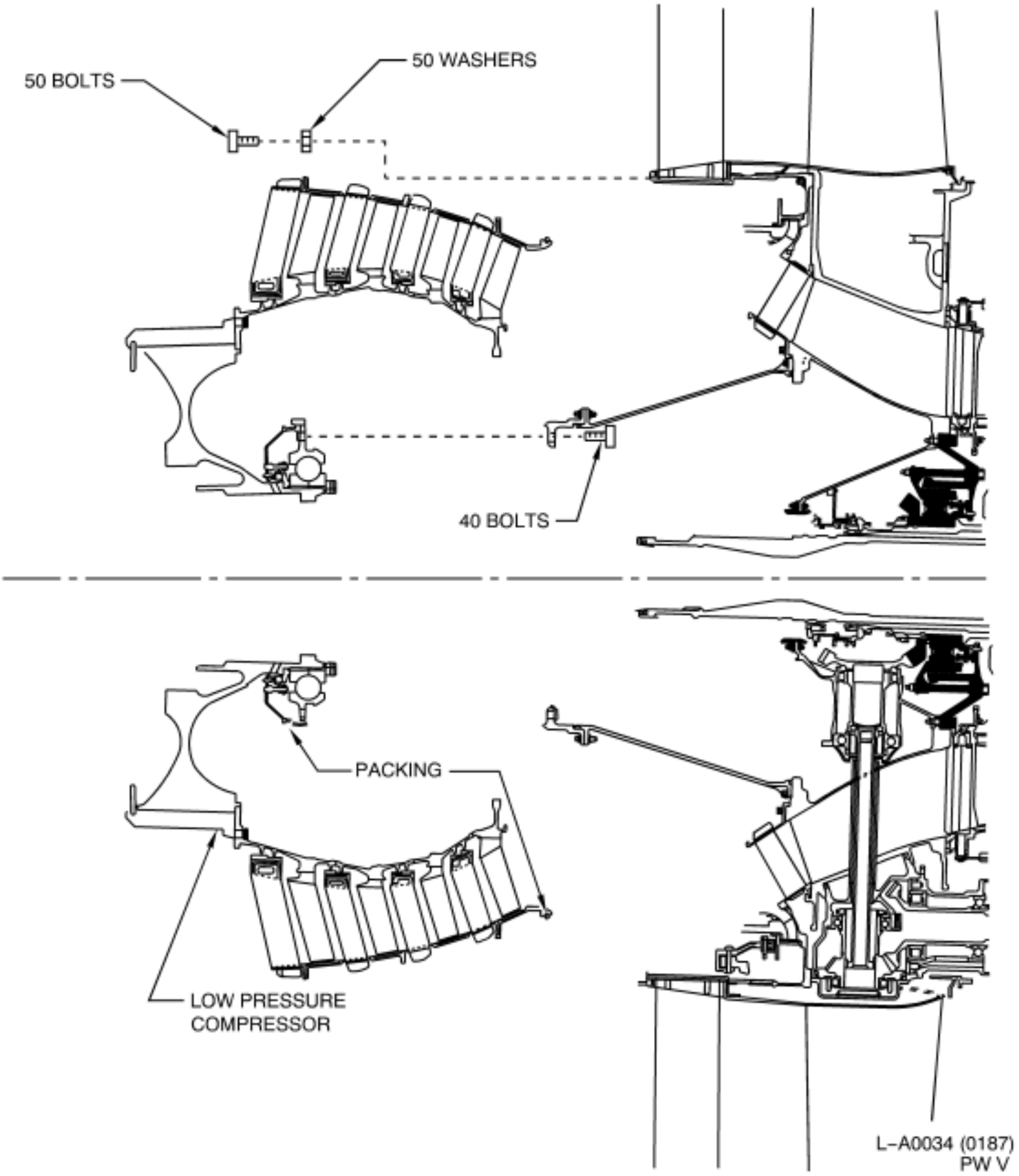
ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC) − INSTALLATION−01



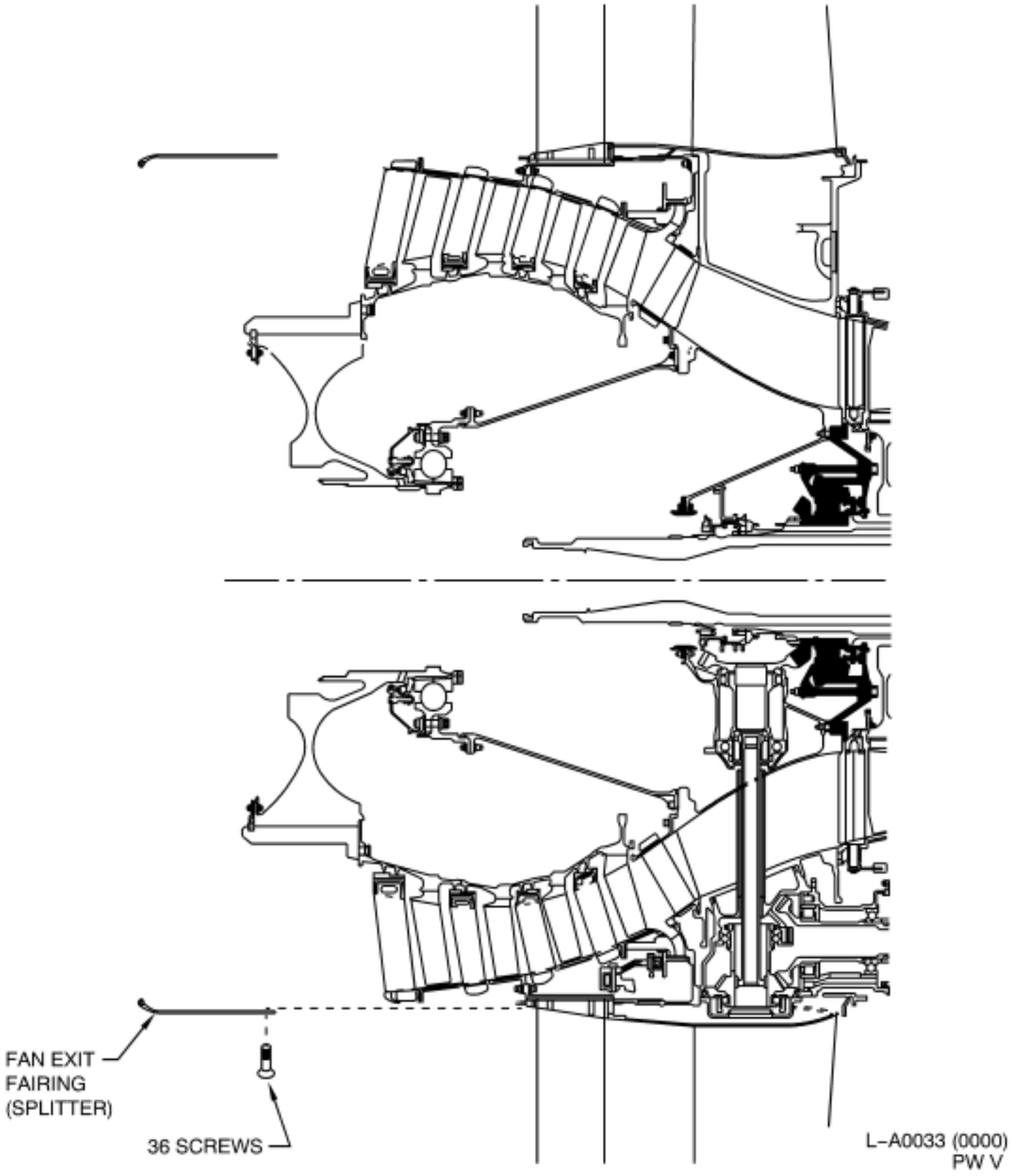
1. INSTALL LOW PRESSURE COMPRESSOR (LPC).
2. INSTALL FAN EXIT FAIRING.
3. INSTALL LPC/LPT COUPLING.
4. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
5. INSTALL COMPRESSOR INLET CONE.
6. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).

L−A0054 (0000)
PW V

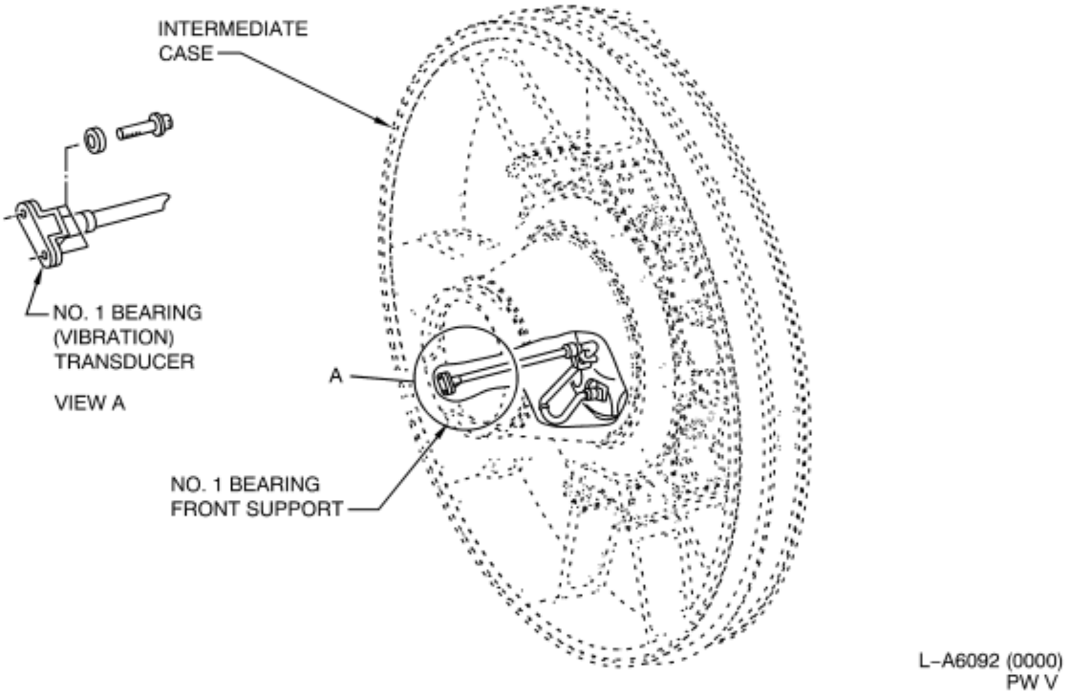
Procedure Sequence
Figure 401
(Task 72−00−31−420−003)


50 BOLTS
50 WASHERS
40 BOLTS
PACKING
LOW PRESSURE COMPRESSOR
L-A0034 (0187)
PW V

Low Pressure Compressor Installation
Figure 402 (Sheet 1)
(Task 72-00-31-420-003)


FAN EXIT
FAIRING
(SPLITTER)
36 SCREWS
L−A0033 (0000)
PW V

Low Pressure Compressor Installation
Figure 402 (Sheet 2)
(Task 72−00−31−420−003)


INTERMEDIATE CASE
NO. 1 BEARING (VIBRATION) TRANSDUCER
VIEW A
A
NO. 1 BEARING FRONT SUPPORT
L−A6092 (0000)
PW V

No. 1 Bearing Vibration Transducer
Figure 403
(Task 72−00−31−420−003)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LOW PRESSURE COMPRESSOR (LPC) - INSTALLATION-02

Task 72-00-31-420-001:

1. Install Compressor Inlet Cone

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

B. Procedure
See Figure 401.

(1) If installed, remove any shims between the tips of the lower fan blades and the fan case rubstrip.

(2) Align marking pen mark on inlet cone (rear) segment with pen mark on front compressor hub. Install and secure cone segment to hub with 19 washers and bolts, threads lubricated with Engine Oil P03-001. Use a non-metalic blunt object (plastic scrapper or equivalent) and make sure the seal is tucked under the fan blade platform leading edge before you tighten the bolts. Tighten and torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

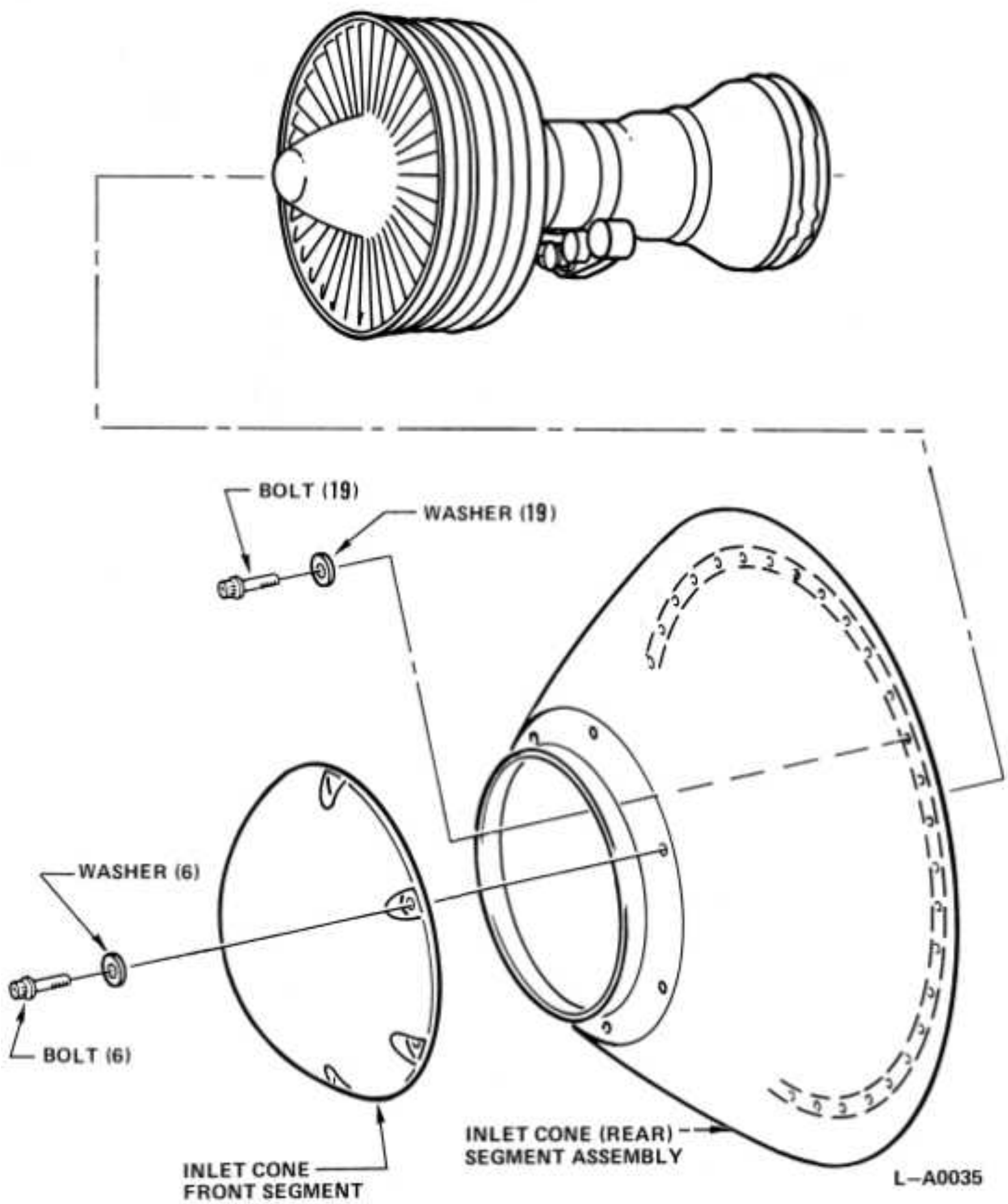
(3) Align the pen mark on the inlet cone front segment with the pen mark on the inlet cone (rear) segment. Install and attach the cone front segment with the six washers and bolts, threads lubricated with Engine Oil P03-001.

NOTE: It is not necessary to line up any marks during installation of a NEW inlet cone or one that has been repaired and balanced. New and repaired inlet cones are balanced to within 1.0 oz-in (720.0 g.mm) and do not need to be aligned at installation.

NOTE: You must use the alignment marks when you install an inlet cone that was removed and then installed on the same engine to make sure that any operational imbalance in the inlet cone from operation is not disturbed during reinstallation.

(4) (Reference 984) Tighten and torque the bolts to 45 - 50 lb-in. (5.084 - 5.649 N.m).

ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC) − INSTALLATION−02


BOLT (19)
WASHER (19)
WASHER (6)
BOLT (6)
INLET CONE FRONT SEGMENT
INLET CONE (REAR) SEGMENT ASSEMBLY
L−A0035

Compressor Inlet Cone Installation
Figure 401
(Task 72−00−31−420−001)

Task 72-00-31-420-002-001:

1. Install Individual Or Matched Moment Weighed Set Of Stage 1 LPC Blade Assemblies

NOTE: See Figure 401 for part/assembly installation procedure sequence.

A. Prerequisites

(1) See Inspection/Check-01 (Task 72-00-31-990-001) for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Necessary

Consumable Materials:

	Item No.	Designation
R R	P06-005	Compound, Antigalling, Metal Assembly Paste (PWA 587)

C. Procedure

NOTE: Following procedure provides for installation of blades for selective replacement purposes. See Installation-04 (Task 72-00-31-420-002-002) for installation of blades as a complete set.

WARNING: TO AVOID POSSIBLE INJURY TO HANDS, GLOVES SHOULD BE WORN WHEN HANDLING FAN BLADES.

CAUTION: DO NOT LEAVE ENGINE UNATTENDED WITHOUT BLADE LOCK INSTALLED. IF ENGINE WINDMILLS WITH FAN BLADES IN FORWARD POSITION, BLADES COULD BE DAMAGED.

(1) Select blades as follows:

NOTE: Blade replacement may be accomplished using single blades selected by moment weight or by using matched set. When replacing matched set, rotor must have been previously assembled on matched set basis.

(a) When replacing a moment weight set of fan blades, installation of each blade must be 180 degrees apart. Two moment weight blades must be paired by matching like moment weights within 1.0 oz−in. (720 g.mm).

(b) When replacing one blade in a full rotor set, the replacement blade must be within 1.0 oz−in. (720 g.mm) of the 180 degree opposite moment weight blade.

R R R (c) Make a temporary mark with a marker. Refer to Section 70−11−00 in the Standard Practices Manual, PN 585005.

NOTE: Blade moment weight markings are found on concave side of blade airfoil section. See Figure 403.

(d) If two or more blended blades are grouped together, then blended blades and their matching blades should be evenly distributed around hub. Unless this process can be successfully completed a vibration check is recommended.

R R R (2) Apply Antigalling Compound P06−005 to the mid−span shrouds and blade roots of the blades by the procedure that follows:

R R R WARNING: DO NOT LET THE ANTIGALLING COMPOUND P06−005 TO TOUCH YOUR SKIN. IF IT DOES, WASH IMMEDIATELY WITH SOAP AND WATER.

R R R (a) Apply Antigalling Compound P06−005 to the touch faces of the mid−span shrouds of the blades. Use a brush application procedure.

R R R R R R R (b) Apply Antigalling Compound P06−005 to the dovetail area of the fan blade root. Do not apply antigalling compound to the fan hub slots or bottom face of the fan blade root. Some antigalling compound is permitted on the area between the dovetail area and platform. See Figure 404.

(3) Position rotor (with support fixture in place) to locate empty blade slot at 12 o'clock position.

(4) Ensure that blades are positioned forward in slots until stopped by fixture.

CAUTION: WHEN INSTALLING FAN BLADE(S), USE CARE TO AVOID DAMAGE TO RUBBER SEAL BONDED TO BOTTOM OF FAN BLADE PLATFORM.

(5) To prevent fan blade shroud and root binding during blade installation, proceed as follows:

(a) Install replacement blade.

(b) Position each fan blade at 12 o'clock position.

(c) Working in a clockwise direction (as viewed from front), carefully push each blade rearward, into hub slot in small increments.

(d) Continue sliding all blades rearward, one at a time, at 12 o'clock position, until seated. See Figure 402.

(6) If replacing matched moment weighed set:

(a) Turn rotor 180 degrees to position empty blade slot at 12 o'clock position.

(b) Reposition fixture slot and repeat blade installation procedure.

(7) Remove Fixture PWA 85035 from hub flange. Install compressor blade (Stage 1) lock assembly. See Figure 403.

(a) Position lock to align anti-rotation pin of lock with anti-rotation slot of hub.

(b) Install lock starting at lock joint.

(c) Seat lock using fiber drift.

(d) (Reference 761) Make sure the lock is correctly installed by measurement of the gap between the lock ends. The gap must be 0.010 - 0.060 inch (0.25 - 1.52 mm). If you can not get the correct gap measurement, you must make sure the lock is fully seated.

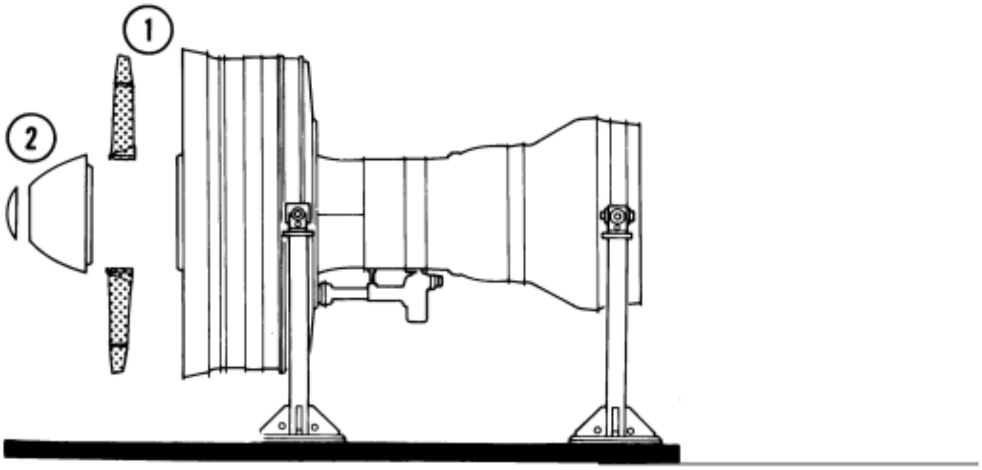
D. Postrequisites

ENGINE GENERAL - LOW PRESSURE COMPRESSOR (LPC) - INSTALLATION-03

(1) Install compressor inlet cone. See 72-00-31, Installation-02 (Task 72-00-31-420-001).

(2) Test engine per Repair Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).

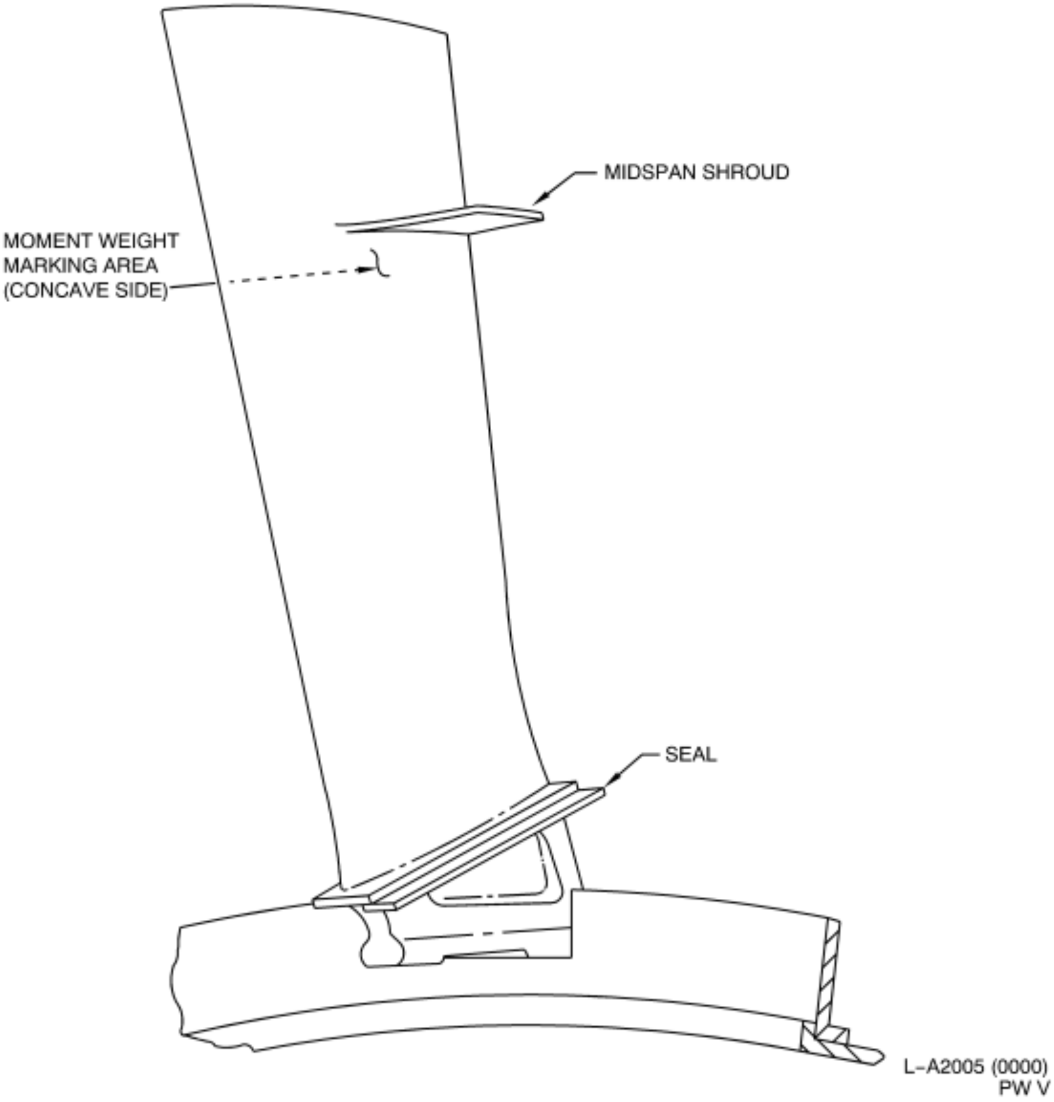
ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC) − INSTALLATION−03



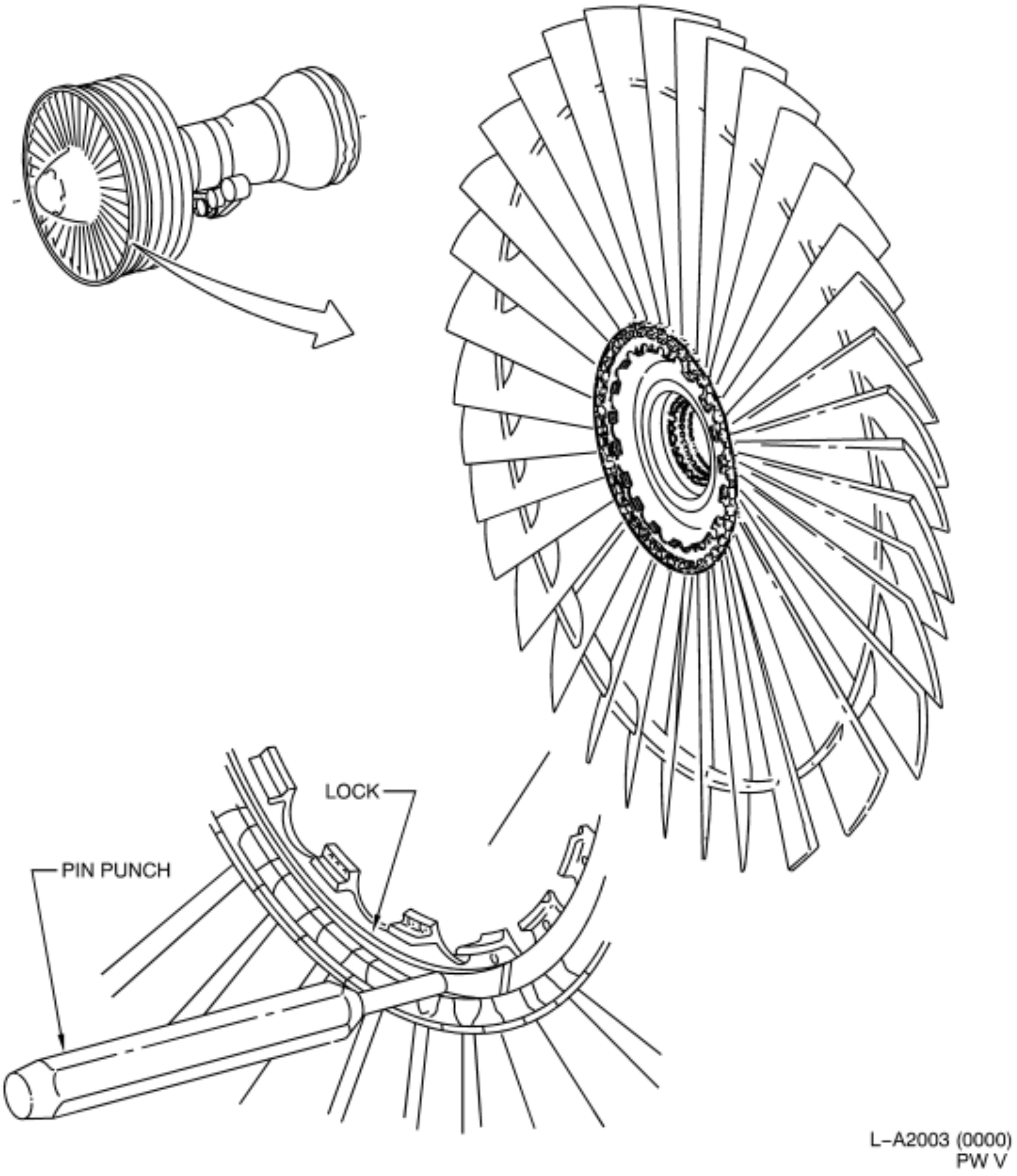
1. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
2. INSTALL COMPRESSOR INLET CONE.

L−A0056

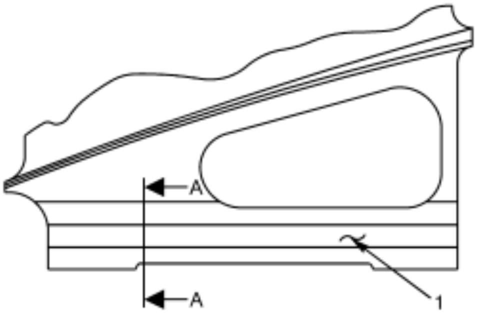
Procedure Sequence
Figure 401
(Task 72−00−31−420−002−001)


MIDSPAN SHROUD
MOMENT WEIGHT
MARKING AREA
(CONCAVE SIDE)
SEAL
L−A2005 (0000)
PW V

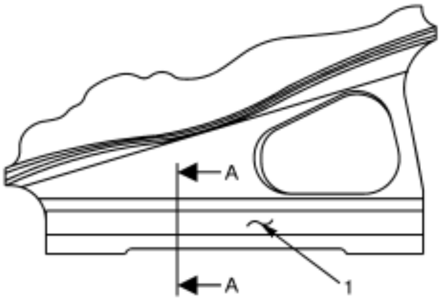
Blade Installation
Figure 402
(Task 72−00−31−420−002−001)


LOCK
PIN PUNCH
L−A2003 (0000)
PW V

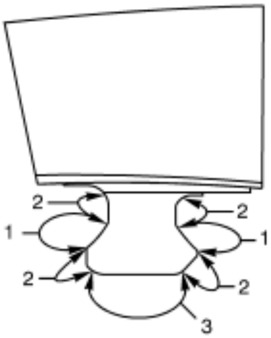
Blade Lock Installation
Figure 403
(Task 72−00−31−420−002−001)



(TYPICAL FOR PN 52A121, 52A121−001, 52A121−002, 52A121−003, 53A321, 53A321−001, 56A511 AND 56A821)



(TYPICAL FOR PN 54A821 AND 56A621)



SECTION A−A

G−12247 (0806)
PW V

R 1. Blade Root Application Area
R 2. A Small Quantity Of Antigalling Compound Is Permitted In
R This Area.
R 3. Antigalling Compound Is Not Permitted In This Area.

R Blade Root Dovetail Antigalling Compound Area
R Figure 404
R (Task 72−00−31−420−002−001)

Previous Pageblock   Return to Previous Menu   Next Pageblock

Task 72-00-31-420-002-002:

1. Install All Stage 1 LPC Blade Assemblies

NOTE: See Figure 401 for part/assembly installation procedure sequence.

A. Prerequisites

(1) See Inspection/Check-01 Task 72-00-31-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Necessary

Special Tools:

PWA 85035	Fixture, Support
PWA 86651	Cart, Storage

Consumable Materials:

	Item No.	Designation
R	P06-005	Compound, Antigalling, Metal Assembly Paste
R		(PWA 587)

C. Procedure

NOTE: Following procedure provides for installation of all blades as a complete set. See Installation-03 (Task 72-00-31-420-002-001) for installation of blades for selective replacement.

WARNING: TO AVOID POSSIBLE INJURY TO HANDS, GLOVES SHOULD BE WORN WHEN HANDLING FAN BLADES.

CAUTION: DO NOT LEAVE ENGINE UNATTENDED WITHOUT BLADE LOCK INSTALLED. IF ENGINE WINDMILLS WITH FAN BLADES IN FORWARD POSITION, BLADES COULD BE DAMAGED.

(1) Install PWA 85035 Support Fixture to hub and secure with work bolts or inlet cone bolts.

(2) Remove blades from PWA 86651 Cart and arrange in order, as previously numbered, or lay out blades in moment weighed sets. If necessary, number blades, with heaviest pair as 1 and 20, next heaviest as 2 and 21, next heaviest as 3 and 22, continuing to lightest matched set, 19 and 38. Make a temporary mark with a marker. Refer to Section 70-11-00 in the Standard Practices Manual, PN 585005.

NOTE: Blade moment weight markings are located on concave side of blade airfoil section. See Figure 402.

(3) Apply Antigalling Compound P06-005 to the mid-span shrouds and blade roots of the blades by the procedure that follows:

WARNING: DO NOT LET THE ANTIGALLING COMPOUND P06-005 TO TOUCH YOUR SKIN. IF IT DOES, WASH IMMEDIATELY WITH SOAP AND WATER.

(a) Apply Antigalling Compound P06-005 to the touch faces of the mid-span shrouds of the blades. Use a brush application procedure.

(b) Apply Antigalling Compound P06-005 to the dovetail area of the fan blade root. Do not apply antigalling compound to the fan hub slots or bottom face of the fan blade root. Some antigalling compound is permitted on the area between the dovetail area and platform. See Figure 404.

CAUTION: WHEN INSTALLING FAN BLADE(S), USE CARE TO AVOID DAMAGE TO RUBBER SEAL BONDED TO BOTTOM OF FAN BLADE PLATFORM.

(4) Working in counter-clockwise (hub rotation) direction (6 o'clock position as viewed from front), install blades in numerical order in matching numbered blade slots, until last blade is ready for installation.

(5) Turn rotor to locate remaining open blade slot at 12 o'clock position and install last blade.

(6) To prevent fan blade shroud and root binding during blade installation, proceed as follows:

(a) Position each fan blade at 12 o'clock position.

(b) Working in a clockwise direction (as viewed from front), carefully push each blade rearward, into hub slot in small increments.

(c) Continue sliding all blades rearward, one at a time, at 12 o'clock position, until seated.

(7) Remove fixture from hub.

(8) Install blade (Stage 1) lock assembly into slot in hub and blades. See Figure 403.

(a) Position lock to align anti-rotation pin of lock with anti-rotation slot of hub.

(b) Install lock, starting at lock joint.

(c) Seat lock using fiber drift.

(d) (Reference 761) Make sure the lock is correctly installed by measurement of the gap between the lock ends. The gap must be 0.010 - 0.060 inch (0.25 - 1.52 mm). If you can not get the correct gap measurement, you must make sure the lock is fully seated.

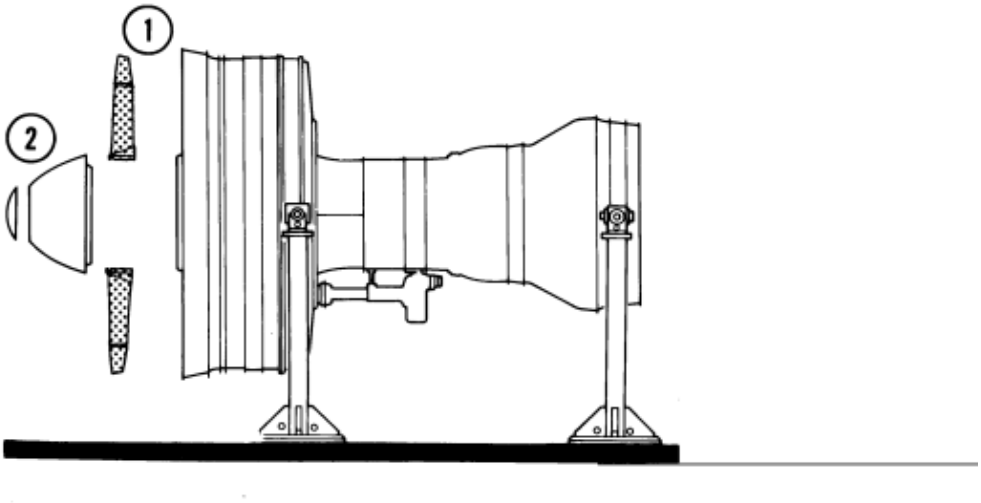
(9) If the turbine shaft coupling assembly is not installed, install six shims between the lower fan blade tips and the fan case rubstrip. The shims support the LPC rotor.

D. Postrequisites

(1) Install compressor inlet cone. See Installation-02 (Task 72-00-31-420-001).

(2) Test engine per Repair Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).

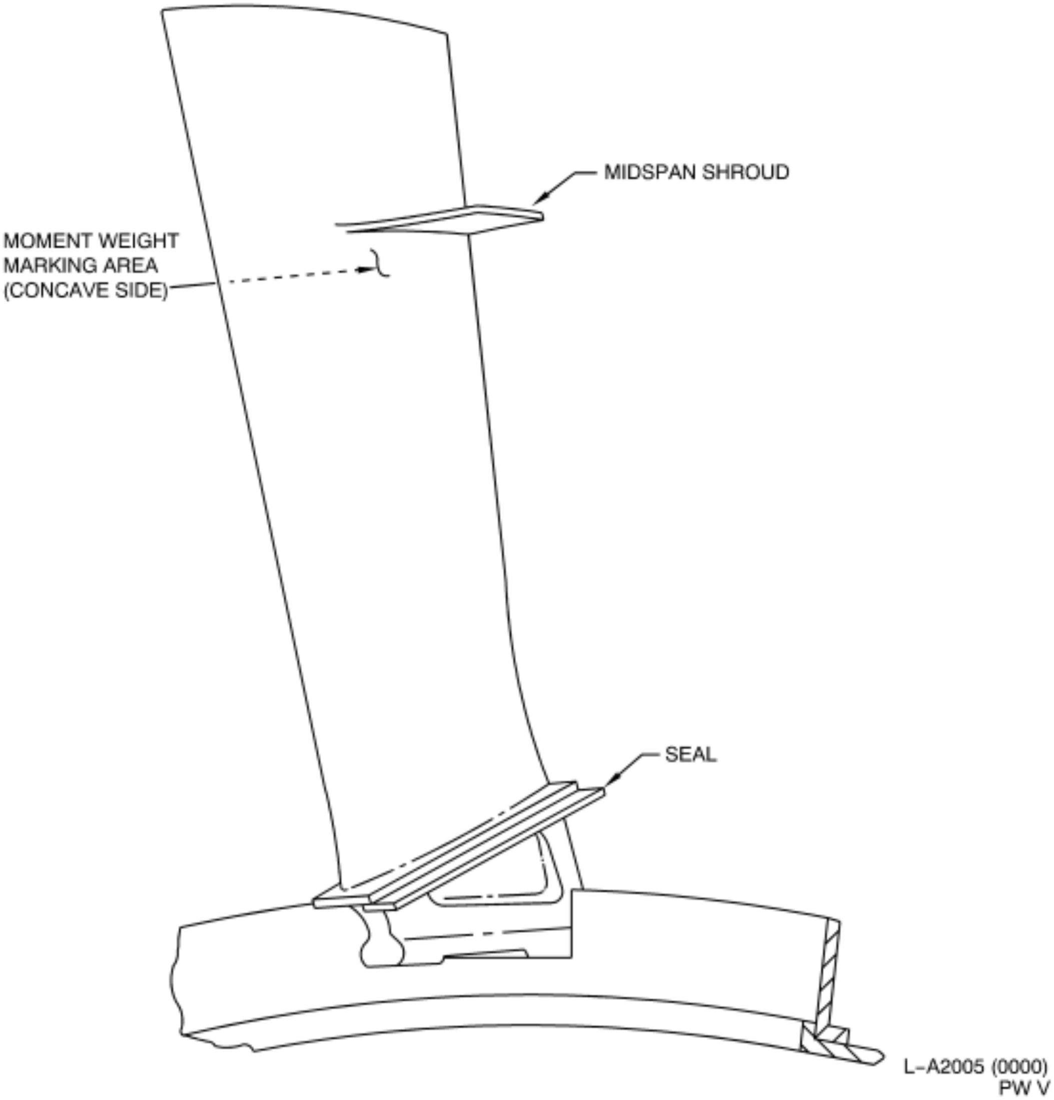
ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC) − INSTALLATION−04



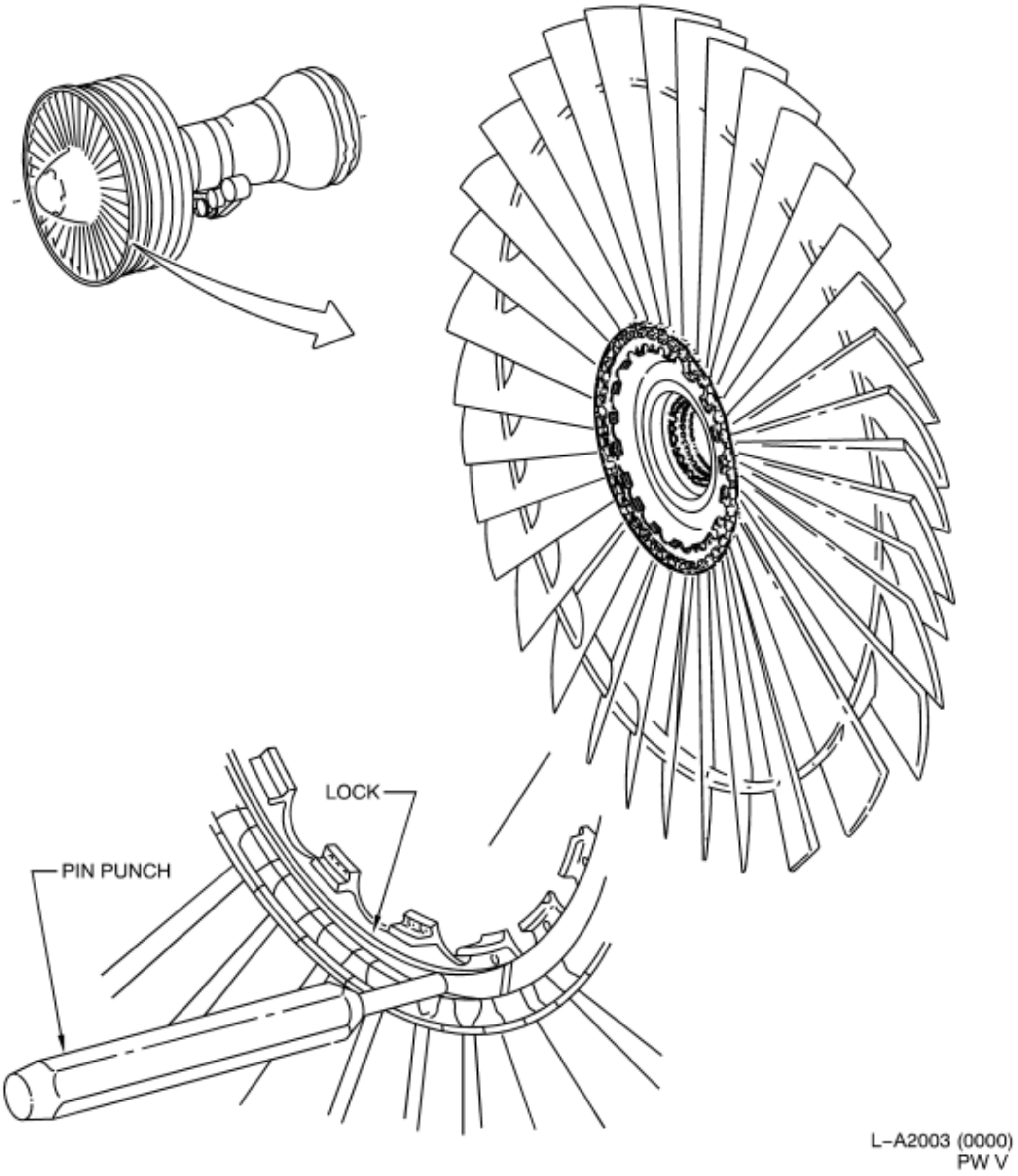
1. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
2. INSTALL COMPRESSOR INLET CONE.

L−A0056

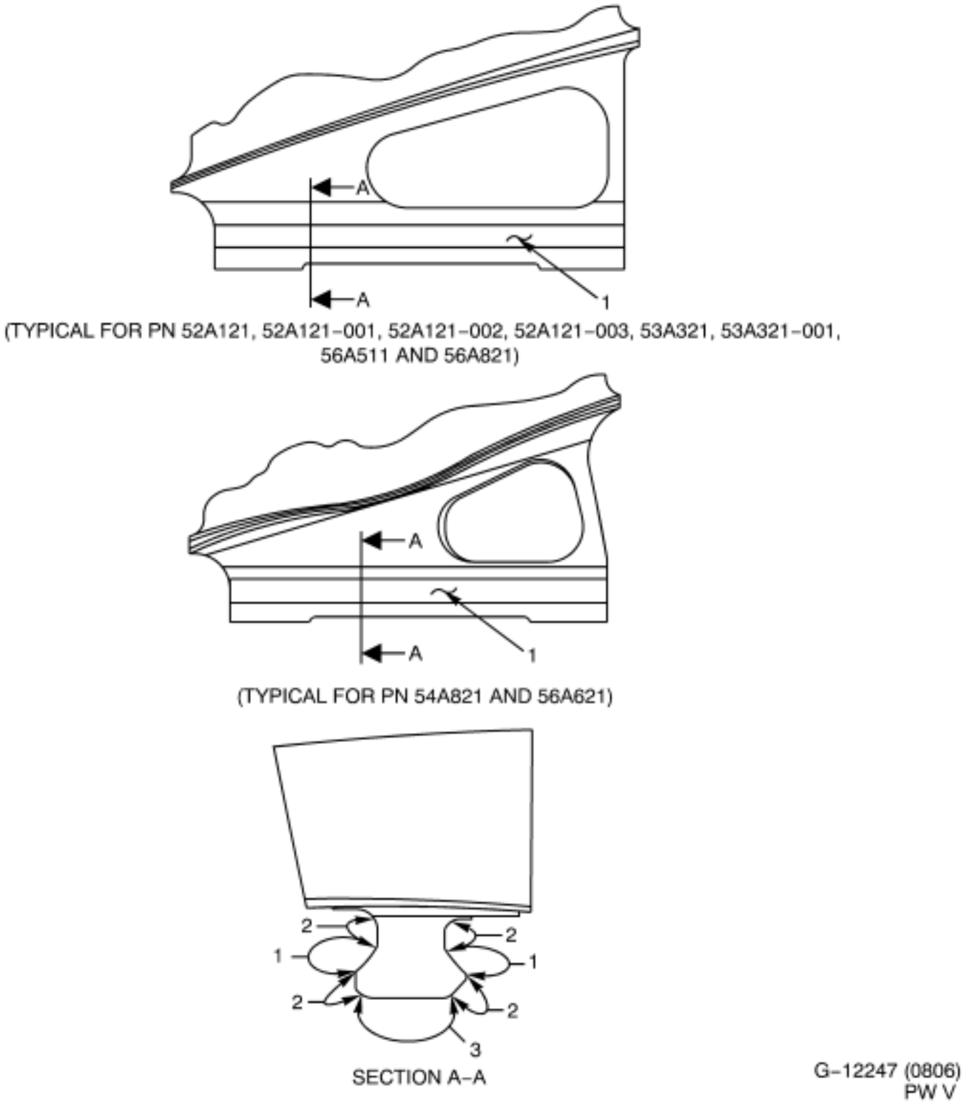
Procedure Sequence
Figure 401
(Task 72−00−31−420−002−002)


MIDSPAN SHROUD
MOMENT WEIGHT MARKING AREA (CONCAVE SIDE)
SEAL
L−A2005 (0000)
PW V

Fan Blade Installation
Figure 402
(Task 72−00−31−420−002−002)


LOCK
PIN PUNCH
L−A2003 (0000)
PW V

Blade Lock Installation
Figure 403
(Task 72−00−31−420−002−002)


A
A
1
(TYPICAL FOR PN 52A121, 52A121-001, 52A121-002, 52A121-003, 53A321, 53A321-001, 56A511 AND 56A821)
A
A
1
(TYPICAL FOR PN 54A821 AND 56A621)
2
1
2
2
1
2
3
SECTION A-A
G-12247 (0806)
PW V

R 1. Blade Root Application Area
R 2. A Small Quantity Of Antigalling Compound Is Permitted In This Area.
R 3. Antigalling Compound Is Not Permitted In This Area.

R Blade Root Dovetail Antigalling Compound Area
R Figure 404
R (Task 72-00-31-420-002-002)

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Task 72-00-31-420-004:

1. Install LPC Stage 1 Compressor Stator Assembly

A. Equipment And Materials Necessary

Consumable Materials:

	Item No.	Designation
R	P03-001	Engine Oil
R	P06-054	Anti-Seize Compound (PWA 36246)

B. Procedure
See Figure 401.

(1) Install LPC Stage 1 compressor stator assembly aligning offset holes in stator flange with offset holes in Stage 1.6 stator located at approximately 3 and 9 o'clock locations. Install 50 bolts, threads lubricated with Engine Oil P03-001, 100 washers and 50 nuts. With bolt heads forward, tighten and torque nuts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(2) Install the fan exit fairing (splitter) to the engine as follows:

(a) Loosely install the fairing on the LPC, visually align the holes in the fairing with the holes in the LPC.

(b) Lubricate the threads of 36 screws with Anti-Seize Compound P06-054.

(c) Install the fairing with the 36 lubricated screws.

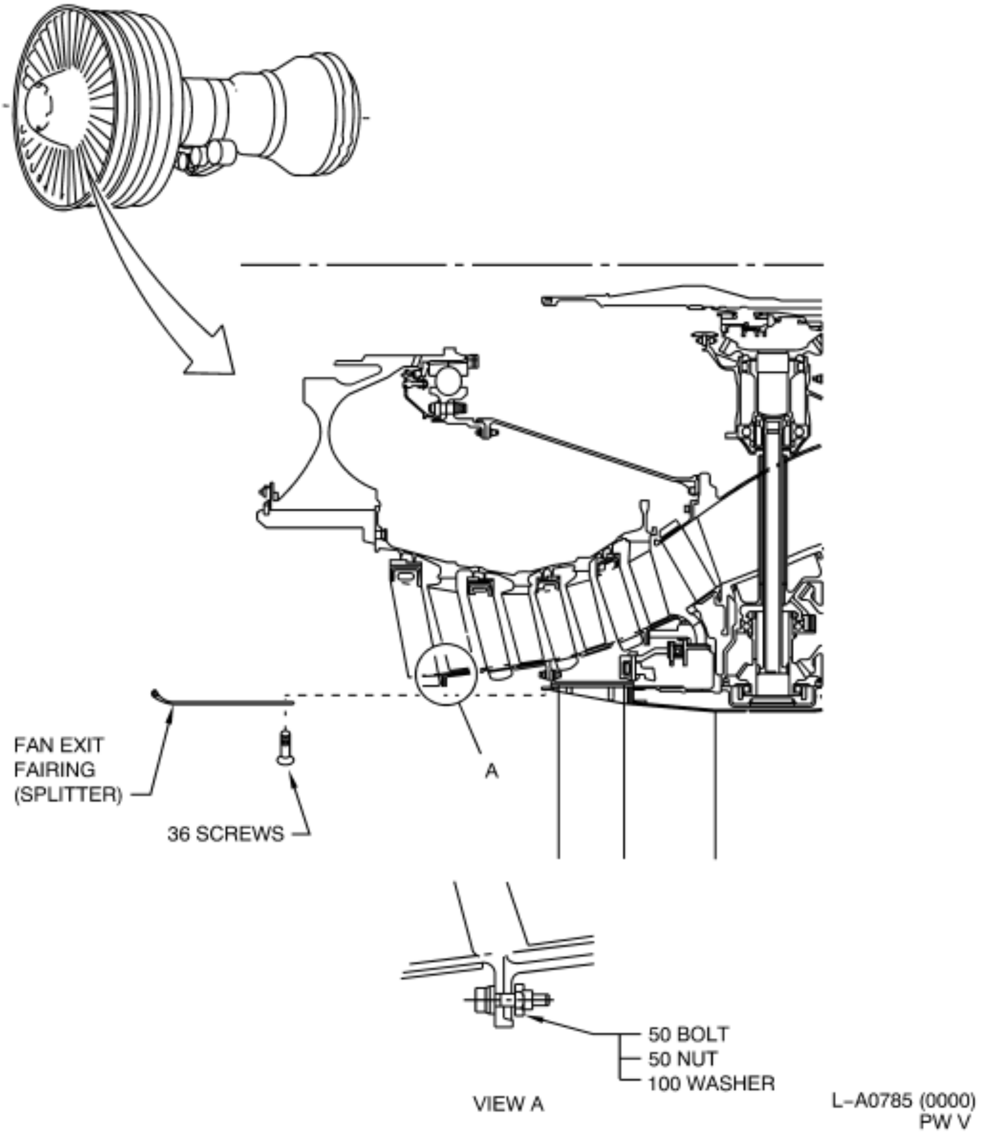
(d) Tighten and torque the screws to 27 - 30 lb-in. (3.051 - 3.390 N.m).

(e) Wipe off any excess anti-seize compound.

C. Postrequisites

(1) Install all (Stage 1) LPC blade assemblies. See Installation-04 (Task 72-00-31-420-002-002).

ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC) − INSTALLATION−05


FAN EXIT
FAIRING
(SPLITTER)
36 SCREWS
A
50 BOLT
50 NUT
100 WASHER
VIEW A
L−A0785 (0000)
PW V

LPC Stage 1 Compressor Stator Assembly
Figure 401
(Task 72−00−31−420−004)

Task 72-00-31-430-002:

1. Install The No. 1 Bearing And Seal Assembly

A. Prerequisites

(1) Assemble The Axial Compressor Rotor Assembly. Refer to 72-31-01, Assembly-01 (Task 72-31-01-440-001).

(2) Assemble The No. 1 Bearing (Carbon) Seal Assembly. Refer to 72-31-17, Assembly-01 (Task 72-31-17-440-001).

(3) Vacuum Check The No. 1 Bearing Compartment. Refer to 72-00-31, Inspection/Check-03 (Task 72-00-31-990-003).

(4) See 72-31-00, Inspection/Check-04 (Task 72-31-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Necessary

Special Tools:

PWA 25000	Wrench, Hydraulic
PWA 26523	Riveter (Optional To PWA 86338)
PWA 28657	Sling
PWA 28668	Pump, Hydraulic (Electric) (Use With Hydraulic Wrench)
PWA 28669	Cart, Storage (Optional) (Use With Hydraulic Wrench)
PWA 29510	Pump, Hydraulic (Hand) (Use With Hydraulic Wrench)
PWA 29614	Wrench, Mechanical
PWA 29615	Holder
PWA 45419	Air Torque Multiplier (Use With Mechanical Wrench)
PWA 75046	Cart (Optional) (Use With Hydraulic Wrench)
PWA 76154	Adapter, Lift And Trunnion (2 Necessary)
PWA 80651	Multiplier, Pneumatic (Use With Mechanical Wrench)
PWA 85178	Gage, Assembly
PWA 85186	Drift
PWA 85520	Fixture, Install And Remove
PWA 85524	Ring, Alignment
PWA 85584	Protector, Plastic
PWA 85653	Wrench, Torque
PWA 85654	Adapter, Handling
PWA 85791	Adapter, Counter-Torque

Special Tools:

(CONTINUED)

PWA 85793	Adapter, Holding
PWA 86338	Riveter

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−045	Pen, Marker (PMC 4092)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Rivet	2	72−31−00/7/200

C. Procedure

NOTE: The LPC is front end up in PWA 85660 Stand.

(1) Trunnion the LPC from front end up to rear end up as follows. See Figure 401.

(a) Install PWA 85791 Adapter in the ID of the front compressor hub assembly (called hub). Attach the adapter with the detail nut.

(b) Install PWA 85520 Fixture on the LPC.

(c) Lift PWA 28657 Sling with a hoist. Install two PWA 76154 Adapters on the sling. Install the adapters on the spools of the fixture. Use the spools marked "LPC Module Only".

(d) Trunnion the LPC to rear end up.

(e) Remove the sling and adapters from the fixture.

(2) (Reference 460) Measure Dimension F as follows (Method 1). See Figure 402.

NOTE: To measure Dimension F, use either this method or Method 2.

(a) Install the No. 1 bearing seal seat (called seal seat), the bearing inner races, and the No. 1 bearing (inner race) retaining nut (called nut), lubricated with Engine Oil P03−001, on PWA 85178 Gage. The diametral empty space between the gage and the stacked parts must be 0.001 − 0.005 inch (0.026 − 0.127 mm).

(b) For operators that use the mechanical wrench, install PWA 85654 Adapter on the gage. Install PWA 85653 Wrench in the nut. Install PWA 29614 Wrench on PWA 85653 Wrench. Install PWA 29615 Holder. Tighten and torque the nut to 33,600 − 37,200 lb−in. (3796.289 − 4203.035 N.m). There must be zero clearance between all mating parts.

(c) For operators that use the hydraulic wrench, attach PWA 85792 Adapter to the gage. Install PWA 85641 Wrench on the nut. Remove PWA 25000 Wrench from the PWA 28669 Cart and install it on the PWA 85641 Wrench. With a PWA 28668 or PWA 29510 Pump, tighten and torque the nut to 33,600 − 37,200 lb−in. (3796.289 − 4203.035 N.m). There must be zero clearance between all mating parts.

R (d) Put the detail−8 bar and dial indicator of the gage on top of the nut. Move the dial indicator off the detail−16 flush pin to set the indicator on zero.

(e) Move the dial indicator on the flush pin. Read the measurement (Dimension M). Write the measurement. Do this measurement at several positions. Calculate the average value of Dimension M. Add this value to the basic gage size
R stamped on the detail−8 bar (Dimension X). Call this sum Dimension F.

$$F = X + \text{Average } M$$

(f) Remove the engine parts from the gage.

(3) (Reference 460) Measure Dimension F as follows (Method 2).

NOTE: To measure Dimension F, use either this method or Method 1.

(a) Measure the thickness of each of the parts that follow. Do the measurements at four positions that are at the same distance from each other. Write the measurements.

1 The seal seat (Dimension K)

2 The inner races (Dimensions N and P)

3 The nut (Dimension Q).

(b) Add together the maximum thicknesses from each part. Call this sum Dimension F.

F = Maximum K + Maximum N + Maximum P + Maximum Q

(4) (Reference 460) Measure Dimension B as follows. See Figure 403.

(a) Measure the dimension from the rear (top) face of the fan hub to the shoulder of the hub. Use the detail−8 bar, detail−21 flush pin, and detail dial indicator of PWA 85178 Gage. Call this Dimension Y.

NOTE: It is permitted to use standard shop equipment to measure Dimension B.

(b) Add Dimension Y to the basic gage size stamped on the detail−8 bar (Dimension X) if the flush pin is below the top of the bar. Subtract Dimension Y from Dimension X if the flush pin is above the top of the bar. Call this Dimension B.

B = X + Y OR B = X − Y

NOTE: This equation does not apply if you do not use the gage.

(5) Install the No. 1 bearing (carbon) seal assembly on the hub as follows. See Figure 404.

(6) Install the seal seat on the hub. The flat face marked FRONT must be face down.

(7) Install the No. 1 ball bearing on the hub as follows.

(a) Heat the inner races. See Standard Practices Manual, PN 585005.

R
R

(b) With correct gloves on your hands, remove the front half of the inner race (without the puller groove). Install the inner race on the hub. Use PWA 85186 Drift.

(c) Install the outer race on the hub.

(d) Lift the outer race to put it a little above the inner race. Install the bearing balls and cage in the outer race. Lower the outer race.

(e) With correct gloves on your hands, remove the rear half of the inner race from the heat source. Hold the inner race with the puller groove up. Align the X marks on the front and rear inner races. Install the inner race on the hub. Use PWA 85186 Drift.

CAUTION: IF THE NUT YOU INSTALL IS NOT NEW, YOU MUST PUT NEW SILVER PLATE ON IT BEFORE YOU INSTALL IT. IF YOU DO NOT, IT WILL CAUSE DAMAGE TO THE MATING PARTS. TO PLATE THE NUT, REFER TO PW4000 SERIES CIR, PN 51A357.

(8) For operators that use the mechanical wrench, install the nut on the hub as follows. See Figure 405.

(a) Install the nut, threads lubricated with Engine Oil P03−001, on the hub.

(b) Install the PWA 85793 Adapter on the PWA 85791 Adapter.

(c) Install the PWA 85653 Torque Wrench on the adapter.

(d) With a hoist, lift the PWA 29614 Mechanical Wrench.

(e) Install the mechanical wrench and PWA 29615 Holder on the adapter.

(f) Install either the PWA 45419 Multiplier or the PWA 80651 Multiplier on the wrench.

(g) Tighten the nut with the PWA 29614 Wrench in the following step.

CAUTION: IF THE NUT YOU INSTALL IS NOT NEW, YOU MUST PUT NEW SILVER PLATE ON IT BEFORE YOU INSTALL IT. IF YOU DO NOT, IT WILL CAUSE DAMAGE TO THE MATING PARTS. TO PLATE THE NUT, REFER TO PW4000 SERIES CIR, PN 51A357.

(9) For operators that use the hydraulic wrench, install the nut on the hub as follows. See Figure 406.

- (a) Install the nut, threads lubricated with Engine Oil P03−001, on the hub.
- (b) Install the PWA 85792 Adapter on the PWA 85791 Adapter.
- (c) Install the PWA 85641 Wrench on the nut.
- (d) With a hoist, lift the PWA 25000 Hydraulic Wrench from the PWA 28669 Cart.
- (e) Install the wrench on the PWA 85792 Adapter.
- (f) Use either a PWA 28668 or PWA 29510 Pump to torque the nut in the following step.

CAUTION: IF, TO INSTALL THIS NUT, YOU MUST TORQUE THE NUT MORE THAN THREE TIMES, YOU MUST REMOVE THE NUT AND PLATE IT AGAIN BEFORE YOU TORQUE IT THE FOURTH TIME. THE MAXIMUM NUMBER OF TIMES YOU CAN TORQUE THE NUT BEFORE IT IS NECESSARY TO RE−PLATE IT IS THREE. TO PLATE THE NUT, REFER TO PW4000 SERIES CIR, PN 51A357.

(10) (Reference 460) Torque the nut as follows.

- (a) Torque the nut to 33,600 − 37,200 lb−in. (3796.289 − 4203.035 N.m). Turn the nut through an angle of 14 − 16 degrees. Loosen the nut to zero.
- (b) Torque the nut to 33,600 − 37,200 lb−in. (3796.289 − 4203.035 N.m).
- (c) Use a Marker Pen P05−045 and make a reference point mark on the nut and an adjacent part. Marks must be aligned.
- (d) Measure Dimension L as follows.

1 The temperature of all parts must be within ± 5°F (2.8°C) of room temperature when you measure the parts.

2 Set the dial indicator of PWA 85178 Gage to zero.

3 Measure the dimension from the rear (top) face of the nut to the rear (top) face of the hub (Dimension Z). Use the detail−15 bar and the detail−16 flush pin. Do the measurement several times. Calculate the value of average Dimension Z.

NOTE: It is permitted to use standard shop equipment to measure Dimension L.

4 Add Dimension Z to the basic gage size stamped on the detail bar if the flush pin is below the top of the detail bar. Subtract Dimension Z from the basic gage size stamped on the detail bar if the flush pin is above the top of the detail bar.

L = detail−15 basic gage size + Average Z OR
L = detail−15 basic gage size − Average Z

NOTE: This equation does not apply if you do not use the gage.

5 The statements that follow must be true:

L <= F − B + 0.000 inch (0.0000 mm) AND
L >= F − B − 0.001 inch (0.025 mm)

(e) Turn the nut through an angle of 14 − 16 degrees. Loosen the nut to zero.

(f) Torque the nut to 33,600 − 37,200 lb−in. (3796.289 − 4203.035 N.m).

(g) Do a check of the reference points as follows.

1 The reference point on the nut must be either aligned with the reference point on the mating part or beyond it within 1 degree 30 minutes.

2 If the reference points are within limits, turn the nut through an angle of 14 − 16 degrees. If necessary, advance 2 degrees 30 minutes, maximum, to the next locking feature.

3 If the reference points are not within limits, do steps (d), (e), and (f), in that order, until the reference points are within limits. Then do step (g).

(11) Remove from the hub the tools that you used to torque the nut.

(12) Install the rivets in the nut as follows.

(a) Install two rivets, 180 degrees apart, through the hub and the nut. The head of the rivet must be in the ID of the hub.

(b) Flare the heads of the rivets. Use PWA 86338 Riveter or PWA 26523 Riveter.

(13) Put PWA 85524 Ring over the flange of the bearing. With the detail foolproof and location pins, align the bearing with the seal assembly.

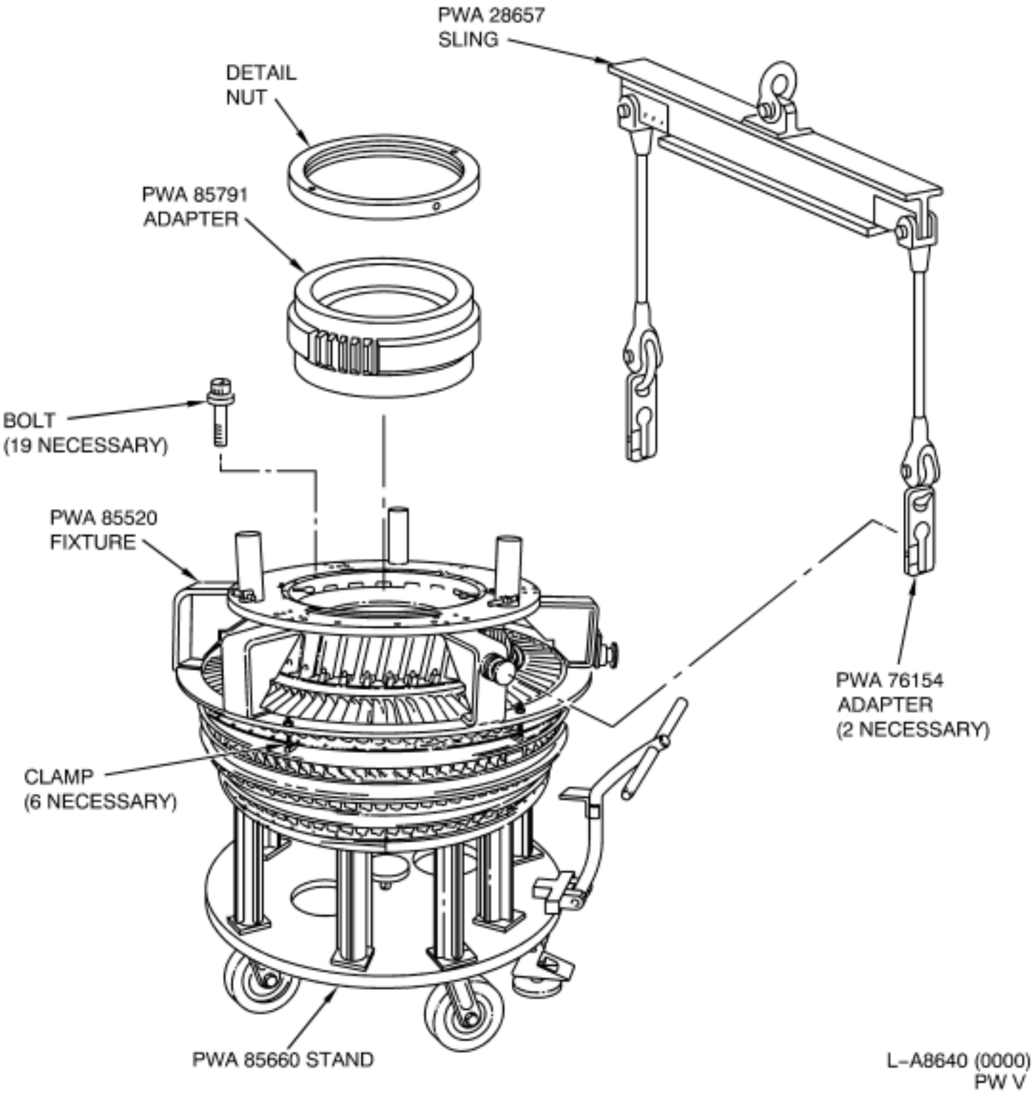
(14) Attach the bearing to the seal assembly as follows.

(a) Apply Engine Oil P03−001 to the threads of three fillister head screws.

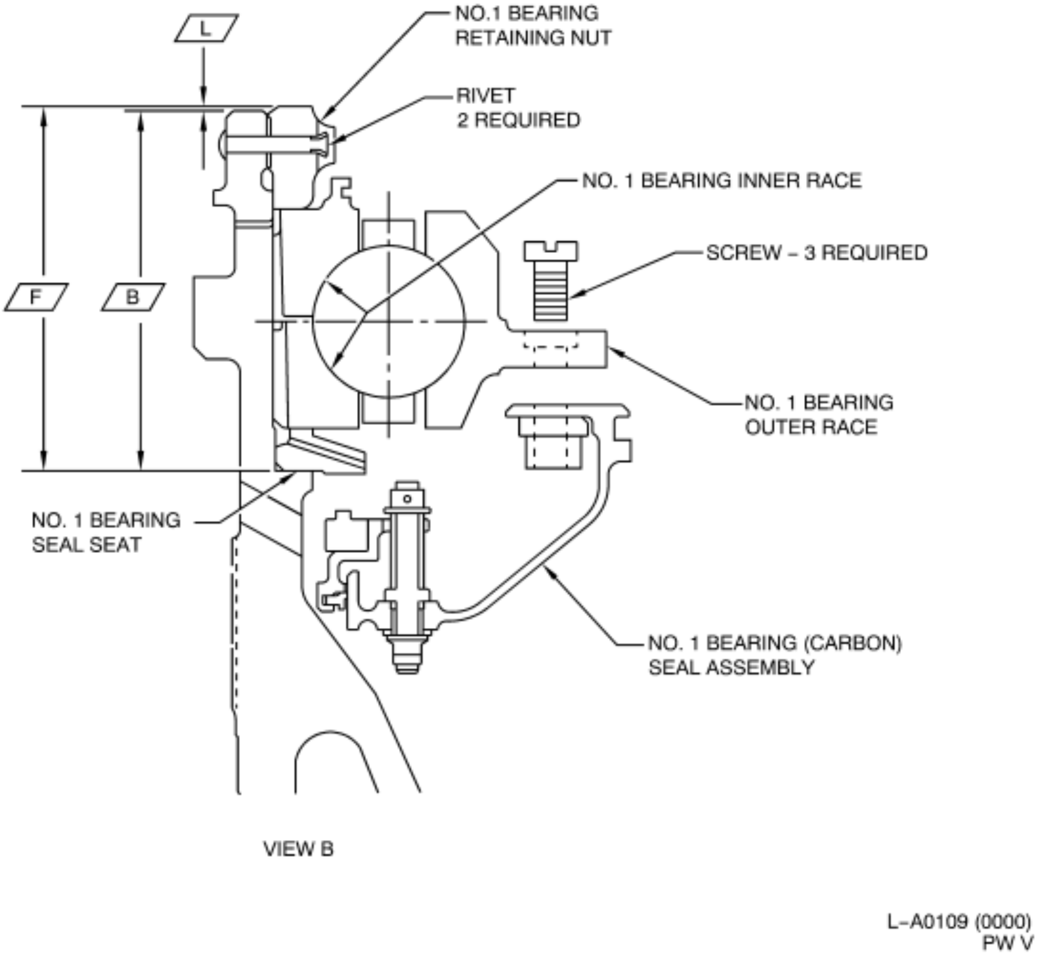
(b) Lift the seal assembly to touch the flange of the bearing outer race.

(c) Install the three screws in the outer race. Tighten and torque the screws to 22 lb−in. (2.486 N.m) plus the torque necessary to turn the screw through the self−locking threads. The maximum torque permitted is 95 lb−in. (10.734 N.m).

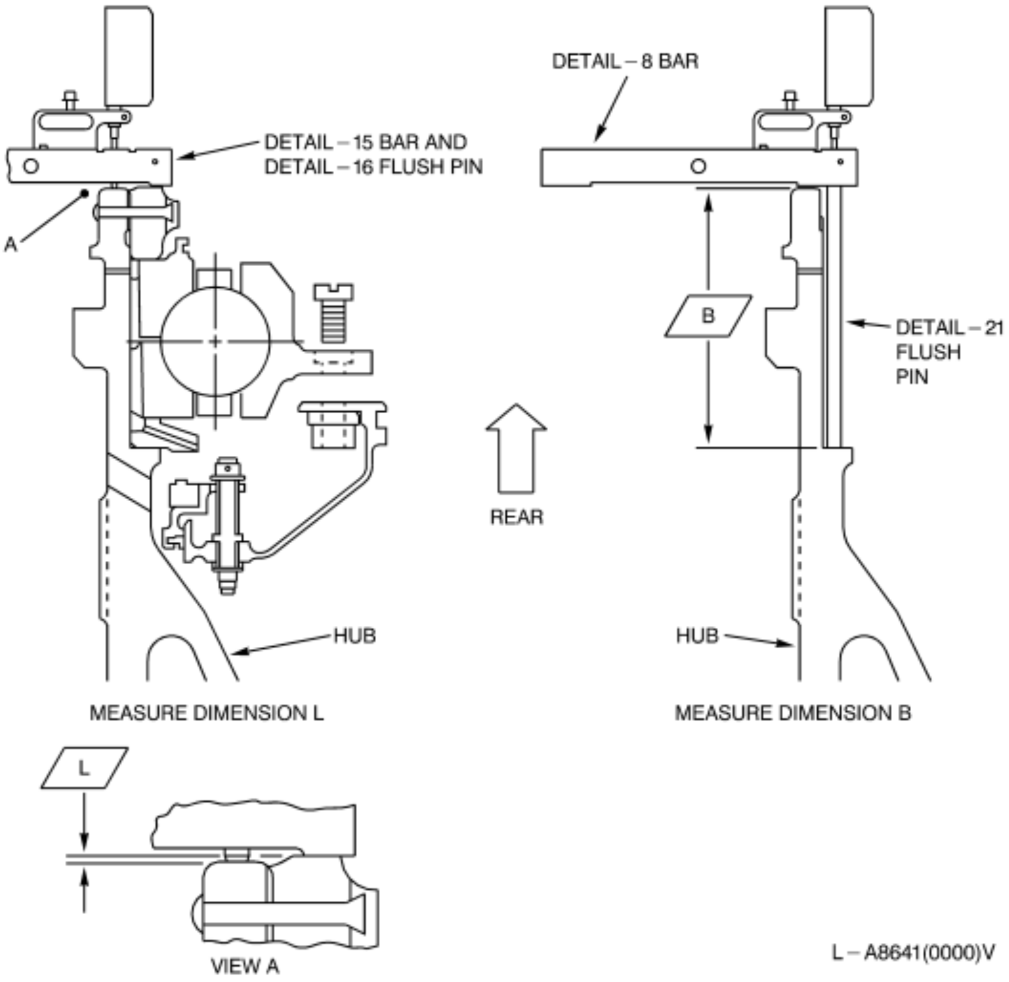
(15) Remove the ring from the hub. Install PWA 85584 Protector over the bearing and seal assembly.


PWA 28657
SLING
DETAIL
NUT
PWA 85791
ADAPTER
BOLT
(19 NECESSARY)
PWA 85520
FIXTURE
PWA 76154
ADAPTER
(2 NECESSARY)
CLAMP
(6 NECESSARY)
PWA 85660 STAND
L-A8640 (0000)
PW V

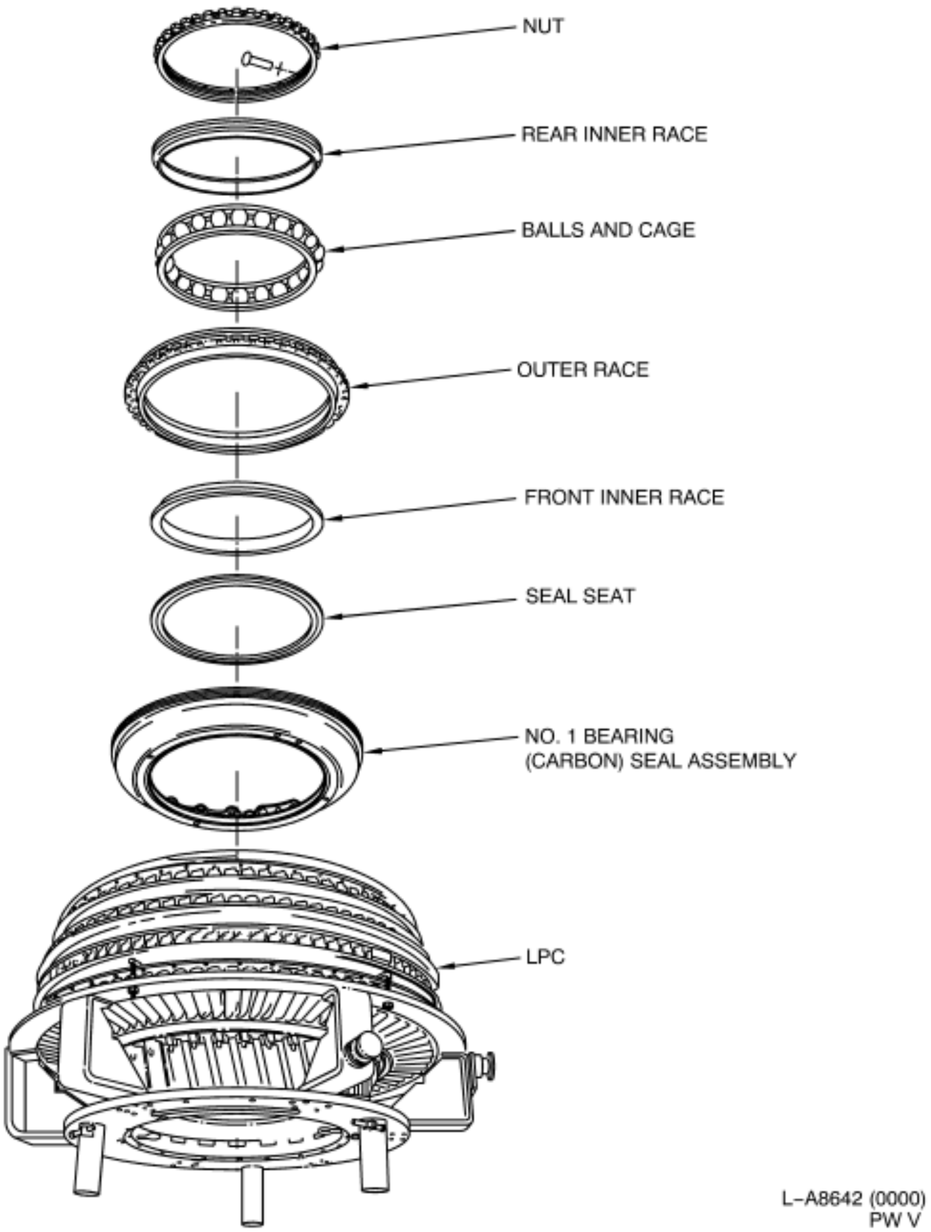
Trunnion The Axial Compressor Rotor Assembly
Figure 401
(Task 72-00-31-430-002)


L
NO.1 BEARING RETAINING NUT
RIVET 2 REQUIRED
NO. 1 BEARING INNER RACE
SCREW − 3 REQUIRED
F
B
NO. 1 BEARING OUTER RACE
NO. 1 BEARING SEAL SEAT
NO. 1 BEARING (CARBON) SEAL ASSEMBLY
VIEW B
L−A0109 (0000)
PW V

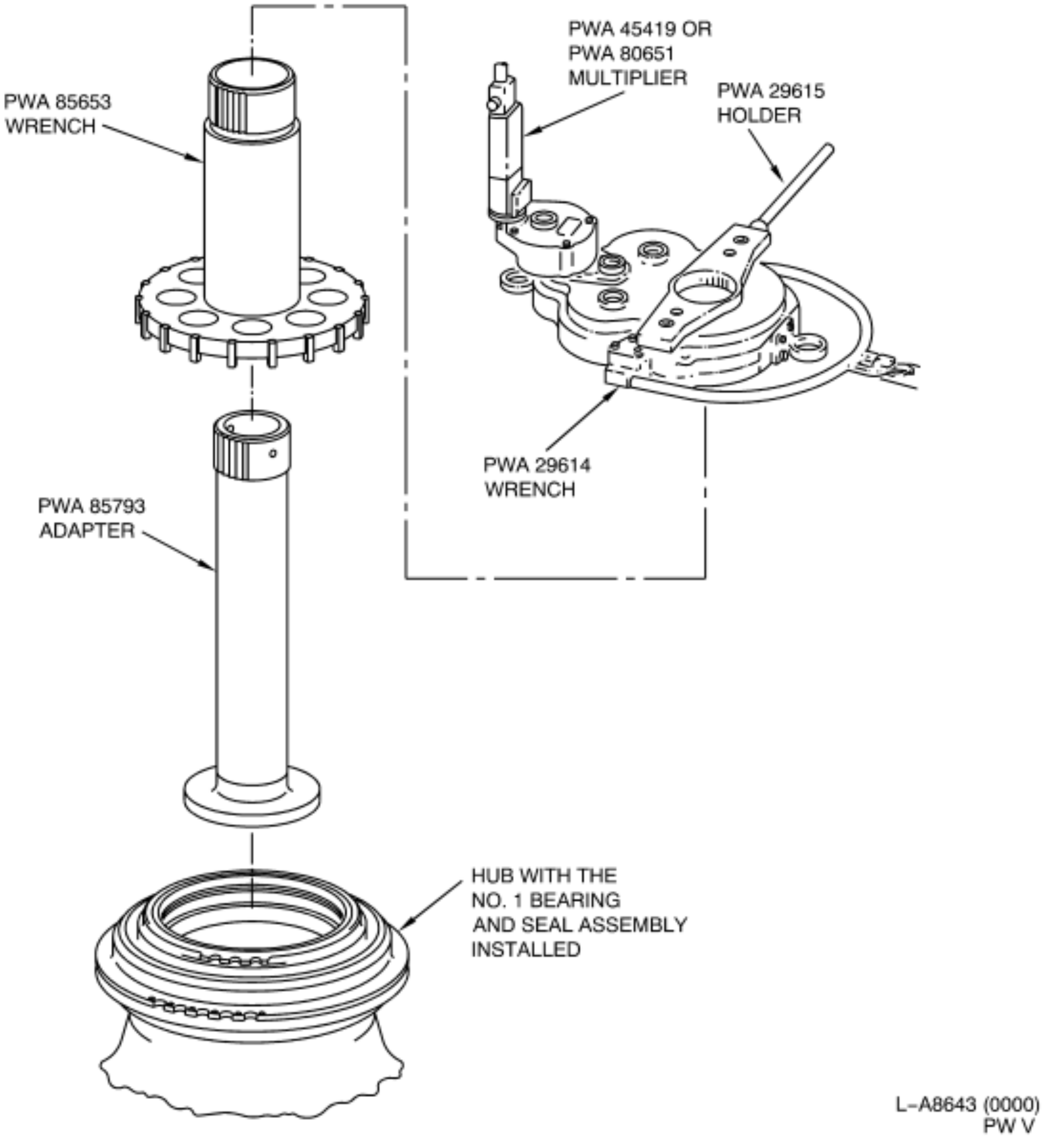
Dimensions F, B, And L
Figure 402
(Task 72−00−31−430−002)


DETAIL - 8 BAR
DETAIL - 15 BAR AND
DETAIL - 16 FLUSH PIN
A
B
DETAIL - 21
FLUSH
PIN
REAR
HUB
HUB
MEASURE DIMENSION L
MEASURE DIMENSION B
L
VIEW A
L - A8641(0000)V

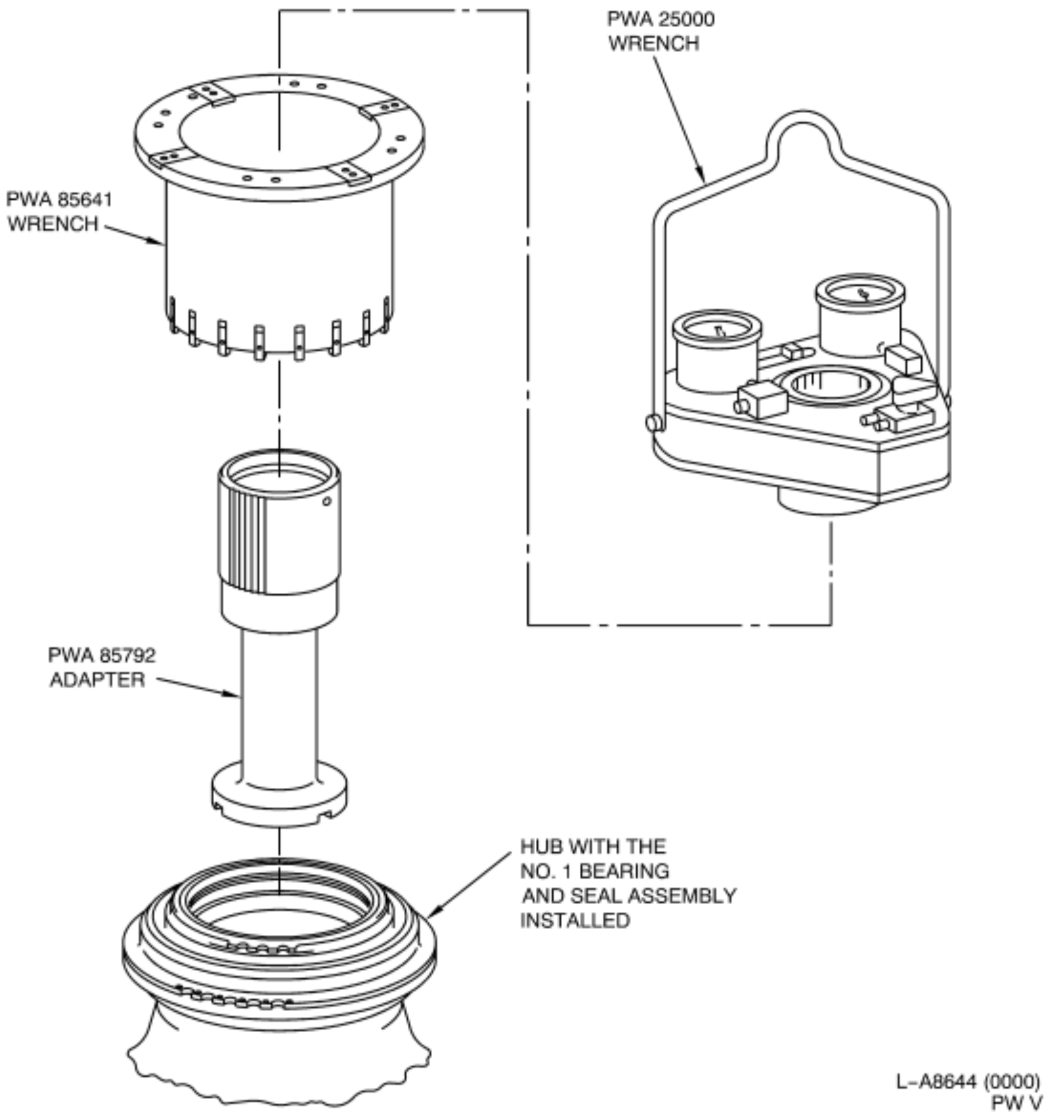
Measure Dimensions B And L
Figure 403
(Task 72-00-31-430-002)


NUT
REAR INNER RACE
BALLS AND CAGE
OUTER RACE
FRONT INNER RACE
SEAL SEAT
NO. 1 BEARING
(CARBON) SEAL ASSEMBLY
LPC
L-A8642 (0000)
PW V

Seal Assembly And No. 1 Bearing On The Hub Installation
Figure 404
(Task 72-00-31-430-002)


PWA 45419 OR
PWA 80651
MULTIPLIER
PWA 29615
HOLDER
PWA 85653
WRENCH
PWA 29614
WRENCH
PWA 85793
ADAPTER
HUB WITH THE
NO. 1 BEARING
AND SEAL ASSEMBLY
INSTALLED
L−A8643 (0000)
PW V

Torque The No. 1 Bearing (Inner Race)
Retaining Nut (Mechanical Wrench)
Figure 405
(Task 72−00−31−430−002)


PWA 25000
WRENCH
PWA 85641
WRENCH
PWA 85792
ADAPTER
HUB WITH THE
NO. 1 BEARING
AND SEAL ASSEMBLY
INSTALLED
L−A8644 (0000)
PW V

Torque The No. 1 Bearing (Inner Race)
Retaining Nut (Hydraulic Wrench)
Figure 406
(Task 72−00−31−430−002)

ENGINE GENERAL - LOW PRESSURE COMPRESSOR (LPC) - INSTALLATION-07

Task 72-00-31-430-001-002:

1. Install The No. 1 Bearing And Seal Assembly (Hydraulic Method) - Deleted

A. Procedure

(1) This procedure is relocated to 72-00-31, Installation-06 (Task 72-00-31-430-002).

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Task 72-00-31-990-001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (-) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (-) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

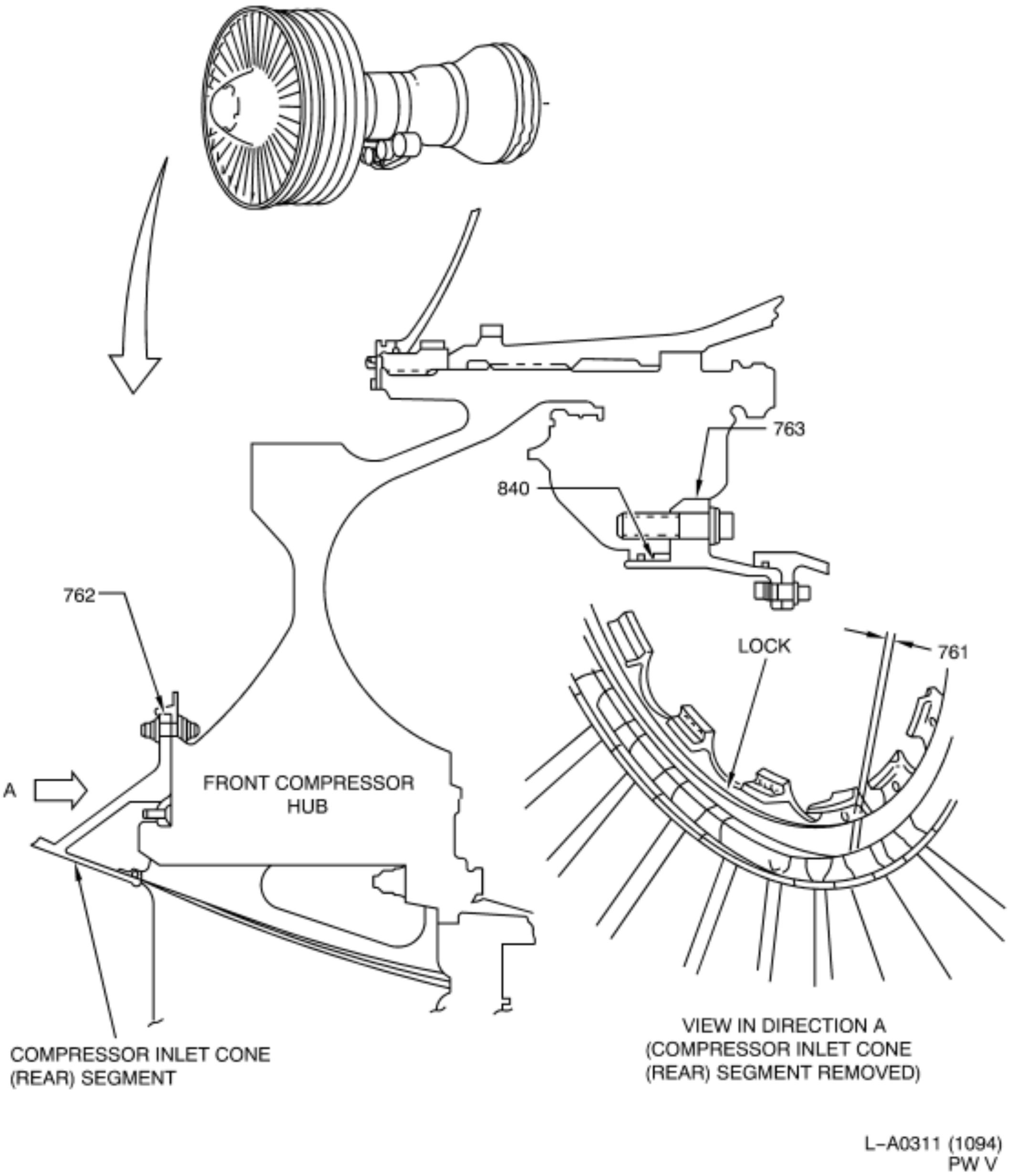
F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
761	A	Gap, Compressor Blade (Stage 1) Lock (See Figure 801)				
		Gap			.010 (0.254)	.060 (1.524)
		Blade Lock Installed To Front Compressor Hub Assembly 32.989 (837.921) 32.999 (838.175) Diameter (Retaining Groove)				
762	B	Front Compressor Hub Assembly (72−31−07) Compressor Inlet Cone (Rear) Segment Assembly (72−31−81) (See Figure 801)				
		Hub	27.377 (695.376)	27.383 (695.528)		
		Segment	27.376 (695.350)	27.384 (695.554)	.007T (0.178T)	.032L* (0.813L)*

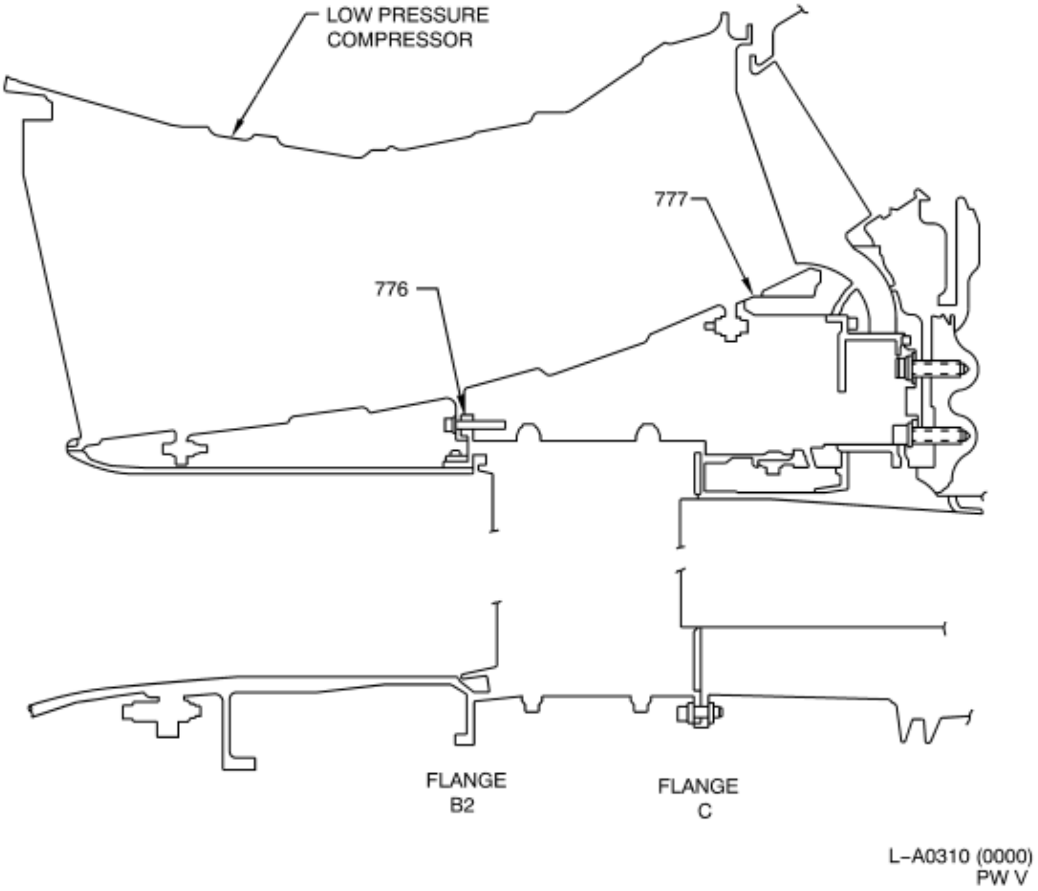
		I		New Part Reference			
	Ref.	F		Dimensions		Limits	
	No.	R	Description	Min	Max	Min	Max
	763	A	No. 1 Ball Bearing (72−31−14)				
			No. 1 Bearing Front Support (72−34−82)				
			(See Figure 801)				
			Bearing	17.6605	17.6613		
				(448.5767)	(448.5970)		
			Support	17.6589	17.6599	.0006T	.0024T
				(448.537)	(448.561)	(0.016T)	(0.060T)
	776	B	LPC (Stage 1.6, 2, 3) Compressor				
			Stator Assembly (72−31−10)				
			Fan Case Assembly (72−33−04)				
			(See Figure 802)				
			Stator	52.403	52.409		
				(1331.036)	(1331.189)		
			Case	52.397	52.403	.000T	.013T*
				(1330.884)	(1331.036)	(0.00T)	(0.330T)*
	777	B	LPC Stage 4 Duct (72−31−11)				
			Bleed Valve Duct (72−33−08)				
			(See Figure 802)				
			LPC Duct	46.791	46.801		
				(1188.49)	(1188.75)		
R			Bleed Duct	46.798	46.802	.003T	.071*
R				(1188.670)	(1188.770)	(0.076T)	(1.803)*
	840	B	No. 1 Bearing Front Support (72−34−82)				
			No. 1 Bearing (Carbon) Seal Assembly				
			(72−31−17)				
			(See Figure 801)				
			Support	20.135	20.139		
				(511.429)	(511.530)		
			Seal Assembly	20.131	20.133	.002	.008
				(511.328)	(511.378)	(0.051)	(0.203)

G. Special Torques

	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Desciption	Min	Max	Min	Max
984	A	Bolts, Front Compressor Cone Segment				
		See 72−00−32, Installation−02				
		Task 72−00−31−420−001				


763
840
762
LOCK
761
A
FRONT COMPRESSOR HUB
COMPRESSOR INLET CONE (REAR) SEGMENT
VIEW IN DIRECTION A (COMPRESSOR INLET CONE (REAR) SEGMENT REMOVED)
L−A0311 (1094)
PW V

Low Pressure Compressor (LPC)
Figure 801
(Task 72−00−31−990−001)


LOW PRESSURE COMPRESSOR
777
776
FLANGE B2
FLANGE C
L−A0310 (0000)
PW V

Low Pressure Compressor (LPC)
Figure 802
(Task 72−00−31−990−001)

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ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC) − INSPECTION/CHECK−02

Task 72−00−31−990−002:

1. Eddy Current Inspect Leading And Trailing Edge Of Stage 1 LPC Blade Assembly
   - A. Equipment And Materials Required − None
   - B. Procedure
     - (1) Eddy current inspect (fan) blades per 72−31−82, Inspection/Check−02 (Task 72−31−82−200−002).

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ENGINE GENERAL - LOW PRESSURE COMPRESSOR (LPC) - INSPECTION/CHECK-03

Task 72-00-31-990-003:

1. Vacuum Check No. 1 Bearing Compartment

A. Equipment And Materials Required

Special Tools:
CTE 6075 Cart, Vacuum
PWA 85478 Adapter, Vacuum Check
PWA 85584 Protector

B. Procedure

See Figure 801.

(1) Ensure that packing is installed in OD groove of seal assembly and in OD groove of adapter.

(2) Attach hoist to eye bolt on PWA 85478 Adapter and lift to position it over hub and No. 1 bearing.

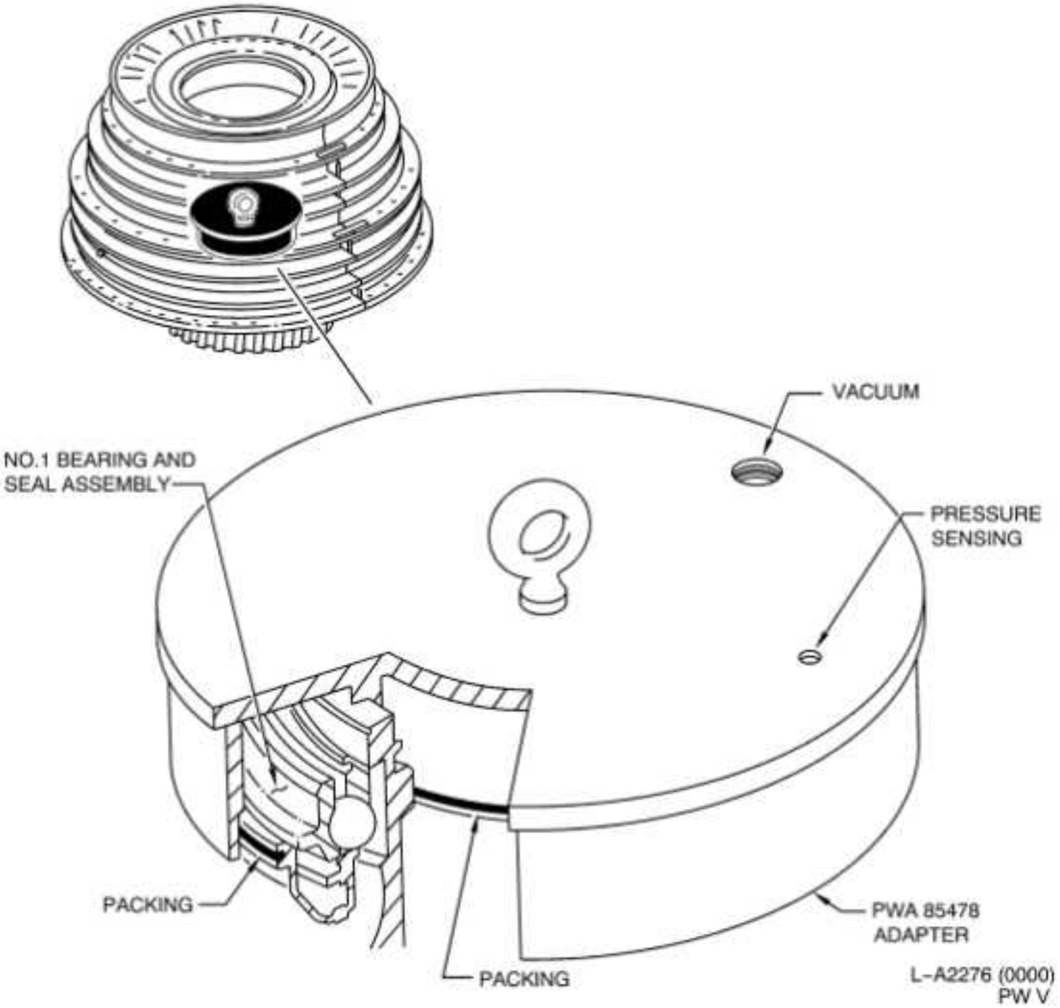
(3) Attach vacuum hose and pressure sense line from CTE 6075 Vacuum Cart and vacuum check No. 1 bearing compartment by setting the vacuum cart pressure at PAMB minus 10 psi (69 kPa), or PAMB minus 20 inches (508 mm) HG. At sea level this is 5.0 psia (34.5 kPa absolute).

  (a) (Pre SB PW4ENG 72-245) Airflow must not exceed 14 lbs. (6.36 kg) per hour.

  (b) (Post SB PW4ENG 72-245) Airflow must not exceed 5 lbs. (2.27 kg) per hour.

(4) Disconnect lines from adapter. Attach hoist to eye bolt on adapter and remove from No. 1 bearing.

(5) Install PWA 85584 Protector over No. 1 bearing assembly.


VACUUM
NO.1 BEARING AND
SEAL ASSEMBLY
PRESSURE
SENSING
PACKING
PWA 85478
ADAPTER
PACKING
L-A2276 (0000)
PW V

Vacuum Check No. 1 Bearing Compartment
Figure 801
(Task 72-00-31-990-003)

ENGINE GENERAL - LOW PRESSURE COMPRESSOR (LPC) - INSPECTION/CHECK-10

Task 72-00-31-990-010:

1. Visually Inspect The Low Pressure Compressor (LPC) Module Assembly

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P09-014	Sealant, Silicone Rubber (PWA 36003-1)

B. General Inspection Limits

NOTE: All applicable Airworthiness Directives (AD's) must be complied with these directives take precedence over all inspections or repairs given in this module inspection.

(1) This inspection does not permit time since overhaul to be set to zero.

(2) These procedures give instructions for the visual inspection of the low pressure compressor module assembly after removal from the engine. Do these procedures before you do the preservation, packing or module installation procedure. This procedure is used to find those easy to see types of damage, which can make it necessary to do more disassembly, inspection or repair. Refer to Section 70-31-00 for the general visual inspection instructions in the Standard Practices Manual, PN 585005.

(3) The inspection table in this section is applicable to the low pressure compressor modules with some, none or all of the components installed. You do not have to disassemble the module assembly to do this inspection. You can choose to apply individual limits to those areas that are visible at all stages of disassembly. If a condition shows that there can be damage that you cannot see, remove a component to fully examine the damaged area. Use the applicable procedures in this manual to remove the component and do an inspection by step (4).

(4) Remove all the components that you find not serviceable at the modular level. Send the applicable components for more inspection and repair at the component level maintenance. Refer to Section 72−31−00 in the PW4000 Series CIR, PN 51A357. Components that you remove from the low pressure compressor module, will need a Cleaning, Inspection and Repair Manual component level inspection/check.

(5) Unless given differently, the not toleranced areas given in this section are to corners, points of tangency between surfaces or at the points opposite to one of these locations. The areas shown will have a tolerance of plus 0.125 inch (3.175 mm) in all directions unless adjacent areas are given as areas where damage is not permitted.

C. Procedure

(1) Visually examine the areas of the drum rotor which you can access with a fluorescent (white) light and use a 3X magnifying glass to examine the surface damage such as nicks, dents, scratches and corrosion pits. See Table 801, Figure 801 (Sheet 1) and Figure 801 (Sheet 2).

NOTE: It is recommended to clean the drum rotor before this inspection procedure by SPOP 209 (Task 70−21−00−110−041). Refer to Section 70−21−00 in the Standard Practices Manual, PN 585005.

(2) Visually examine the knife−edge seals for damage. See Table 802 and Figure 802.

NOTE: Unless the stage 1 stator has been removed for other reasons only the front face of the front knife−edge is seen.

(3) Visually examine the areas of the front compressor hub assembly, that you access with a fluorescent (white) light and use a 3X magnifying glass and a mirror as necessary. See Table 803, Figure 803 (Sheet 1), Figure 803 (Sheet 2), Figure 803 (Sheet 3) and Figure 803 (Sheet 4).

NOTE: It is recommended to clean the hub immediately before this inspection procedure by SPOP 209 (Task 70−21−00−110−041). Refer to Section

70−21−00 in the Standard Practices Manual, PN 585005

(4) Visually examine the No. 1 bearing assembly. Refer to Section 72−09−50, Inspection/Check−03 in the PW4000 Series CIR, PN 51A357 and Section 70−52−00 in the Standard Practices Manual, PN 585005.

(5) Visually examine the fillets of bearing flange and the puller groove for the indication of cracks. Use a 10X magnification. No cracks are permitted.

(6) Visually examine the No. 1 bearing assembly retaining nut. See Table 804 and Figure 804.

(7) Visually examine the stage 1.6, stage 2 and stage 4 LPC blades that can be seen without LPC module disassembly. See Table 805 and Figure 805.

(8) Visually examine the stage 3 LPC blades that can be seen without LPC module disassembly. See Table 806 and Figure 806.

(9) Visually examine the Outer Shroud Assembly. See Table 807, Figure 807 (Sheet 1), Figure 807 (Sheet 2) and Figure 807 (Sheet 3).

(10) Visually examine the blade tip rubstrips that can be seen without module disassembly. See Table 808, Figure 808 (Sheet 1) and Figure 808 (Sheet 2).

(11) Visually examine the LPC stage 4 duct areas that can be seen without disassembly. See Table 809 and Figure 809 (Sheet 1) and Figure 809 (Sheet 2).

(12) Visually examine the LPC stage 1 stator vanes that can be seen without LPC module disassembly. See Table 810 and Figure 810.

(13) Visually examine the stage 1 and stage 3 LPC stator inner shrouds that can be seen without disassembly. See Table 811, Table 812, Figure 811 and Figure 812.

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Drum rotor for: See Figure 801 (Sheet 2)			
1 Weld area for surface damage	No surface damage is permitted without repair	Scattered surface damage to a maximum of 0.010 inch (0.254 mm) in depth is permitted, if blended smooth with the adjacent area.	Refer to Section 72−31−08, Repair−03 in the PW4000 Series CIR, PN 51A357
2 Tierod holes for surface damage. Area is not seen if the fan hub is installed.	No surface damage is permitted other than for very light marks	Hone the tierod holes oversize. Refer to Section 72−31−08, Inspection/ Check−04 in the PW4000 Series CIR, PN 51A357 for the repair limits.	Refer to Section 72−31−08, Repair−08 in the PW4000 Series CIR, PN 51A357
		If the damage cannot be removed by the hone repair, machine the tierod holes oversize and install the bushings. Refer to Section 72−31−08, Inspection/ Check−04 in the PW4000 Series CIR, PN 51A357 for the repair limits.	Refer to Section 72−31−08, Repair−05 in the PW4000 Series CIR, PN 51A357

Drum Rotor Assembly Visual Inspection
Table 801

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
3 Web surface for surface damage. Some areas are not seen if the fan hub is installed.	Smooth marks made by mating parts to a maximum of 0.005 inch (0.127 mm) in depth is permitted. No damage is permitted in 0.125 inch (3.175 mm) of all holes.	Scattered surface damage to a maximum of 0.010 inch (0.254 mm) in depth is permitted only if blended smooth with the adjacent area	Refer to Section 72-31-08, Repair-03 in the PW4000 Series CIR, PN 51A357
4 Cones and bores for surface damage. Some areas are not seen if the module is assembled.	Scattered surface damage to a maximum of 0.003 inch (0.076 mm) in depth is permitted without repair	Scattered surface damage to a maximum of 0.010 inch (0.254 mm) in depth is permitted only if blended smooth with the adjacent area. No damage is permitted in 0.125 inch (3.175 mm) of all holes or blade slot.	Refer to Section 72-31-08, Repair-03 in the PW4000 Series CIR, PN 51A357
5 Rim dovetail slot for damage. This area is not seen when bladed.	No surface damage is permitted without repair	A maximum of 0.002 inch (0.051 mm) in depth is permitted only if blended smooth with the adjacent area	Blend to remove the damage. Refer to Section 70-45-00, SPOP 532 in the Standard Practices Manual, PN 585005.

Drum Rotor Assembly Visual Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
6 Axial blade slot for surface damage. Some areas are not seen when bladed.	Scattered surface damage to a maximum of 0.005 inch (0.127 mm) in depth is permitted	Scattered surface damage to a maximum of 0.015 inch (0.381 mm) in depth is permitted only if blended smooth with the adjacent area	Refer to Section 72−31−08, Repair−03 in the PW4000 Series CIR, PN 51A357
7 Upper axial blade slot for surface damage. This area is not seen when bladed.	Scattered surface damage to a maximum of 0.003 inch (0.076 mm) in depth is permitted	Scattered surface damage to a maximum of 0.010 inch (0.254 mm) in depth is permitted only if blended smooth with the adjacent area	Refer to Section 72−31−08, Repair−03 in the PW4000 Series CIR, PN 51A357
8 Inside rim dovetail slot for surface damage. This area is not seen when bladed.	Scattered surface damage to a maximum of 0.001 inch (0.025 mm) in depth is permitted	Scattered surface damage to a maximum of 0.002 inch (0.051 mm) in depth is permitted only if blended smooth with the adjacent area	Refer to Section 72−31−08, Repair−03 in the PW4000 Series CIR, PN 51A357
9 Front flange inner mating diameter for surface damage. Area is not seen if the fan hub is installed.	Not permitted	Scattered surface damage to a maximum of 0.010 inch (0.254 mm) in depth is permitted only if blended smooth with the adjacent area. Blends cannot take up more than half of the full	Refer to Section 72−31−08, Repair−03 in the PW4000 Series CIR, PN 51A357

Drum Rotor Assembly Visual Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)		surface. Blends cannot remove all the materials directly inboard of a bolthole.	
10 Rear flange inner surface for surface damage	Not permitted	Scattered surface damage to a maximum of 0.005 inch (0.127 mm) in depth is permitted only if blended smooth with adjacent area	Refer to Section 72-31-08, Repair-03 in the PW4000 Series CIR, PN 51A357
		Rear flange balance tabs can be blended to 0.250 inch (6.350 mm) radius or the full tab can be removed. A total of four tabs can be removed. No more than two adjacent tabs can be blended and pairs of blended tabs must be separated from the other blended tabs by a minimum of three functional tabs.	Refer to Section 72-31-08, Repair-04 in the PW4000 Series CIR, PN 51A357
11 Balance weight rivet holes for surface damage. Rivet holes are not seen if weights are installed.	No surface damage is permitted other than for marks that have almost	All holes can be honed 0.001 inch (0.025 mm) diameter oversize. Local blend to a maximum of 0.005	Refer to Section 72-31-08, Repair-10 in the PW4000 Series CIR, PN 51A357

Drum Rotor Assembly Visual Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			
	no depth (superficial)	inch (0.127 mm) is permitted in counterweight holes.	
Balance weight rivets for loose or damaged condition	No damage is permitted	Replace the loose or damaged rivets	Refer to Section 72−31−08, Repair−11 in the PW4000 Series CIR, PN 51A357
12 Inner bore	Scattered surface damage to a maximum of 0.003 inch (0.076 mm) in depth is permitted	Scattered surface damage to a maximum of 0.010 inch (0.254 mm) in depth is permitted only if blended smooth with adjacent area	Refer to Section 72−31−08, Repair−03 in the PW4000 Series CIR, PN 51A357
13 Drum rotor rear flange	Scattered surface damage to a maximum of 0.003 inch (0.076 mm) in depth is permitted	Scattered surface damage to a maximum of 0.010 inch (0.254 mm) in depth is permitted only if blended smooth with the adjacent area	Refer to Section 72−31−08, Repair−03 in the PW4000 Series CIR, PN 51A357
	No damage is permitted within 0.125 inch (3.175 mm) of any hole.	No blends are permitted 0.125 inch (3.175 mm) of any hole.	

Drum Rotor Assembly Visual Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair

NOTE: Any drum rotor disk assembly that is damaged or worn more than the limits of the above repair limits or damage or worn in other areas, can have the individual disks replaced by PW4000 Series CIR, PN 51A357, 72−31−08 Repair−12.

Drum Rotor Assembly Visual Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Drum rotor for: See Figure 802			
1 Knife-edge seal for bends. Some areas of knife-edge seal are not seen in module assembly.	0.015 inch (0.381 mm) (axial) maximum is permitted with no limit on quantity of bent seals or length. No crack indications in either the bent area or the seal root is permitted.	A maximum of 0.075 inch (1.905 mm) can be made straight	Refer to Section 72-31-08, Repair-01 in the PW4000 Series CIR, PN 51A357
Knife-edge seals for cracks or surface damage	Not permitted	Seals cracked or damaged 0.075 inch (1.905 mm) maximum depth can be blended to a total of 7.900 inch (200.660 mm) maximum circumferential length. The blend must be made smooth to the adjacent knife-edge seal areas that are not blended.	Refer to Section 72-31-08, Repair-02 in the PW4000 Series CIR, PN 51A357
2 Knife-edge seals for cracks	Not permitted	Seals cracked or damaged from 0.075 - 0.167 inch (1.90 - 4.24 mm) maximum depth or damaged more	Refer to Section 72-31-08, Repair-06 in the PW4000 Series CIR, PN 51A357

Drum Rotor Knife-Edge Seals Visual Inspection
Table 802

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			
		than 7.900 inch (200.660 mm) circumferential length can be weld repaired.	

Drum Rotor Knife-Edge Seals Visual Inspection
Table 802 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Hub: See Figure 803 (Sheet 1), Figure 803 (Sheet 2), Figure 803 (Sheet 3) and Figure 803 (Sheet 4)			
For cracks	Not permitted	Not repairable	Remove from service

CAUTION: IF THE SPECIFIC DAMAGE AREA BOUNDARIES ARE PRESENT, SEE FIGURE 803 (SHEET 1) FOR THE DIMENSIONS.

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
1 For surface damage such as nicks, dents and scratches. See Figure 803 (Sheet 1) and Figure 803 (Sheet 2)	Superficial imperfections only	Scattered surface damage to a maximum of 0.005 inch (0.127 mm) in depth	Refer to Section 72−31−07, Repair−01 in the PW4000 Series CIR, PN 51A357
2 For surface damage such as nicks, dents and scratches. Some areas are not seen when bearing is installed. See Figure 803 (Sheet 1) and Figure 803 (Sheet 2)	Scattered surface damage to a maximum of 0.003 inch (0.076 mm) in depth is permitted without repair. Burns or sharp edges are not permitted.	Scattered surface damage to a maximum of 0.010 inch (0.254 mm) in depth	Refer to Section 72−31−07, Repair−01 in the PW4000 Series CIR, PN 51A357

Compressor (Fan) Hub Visual Inspection
Table 803

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
3 For surface damage such as scratches. This area is not seen when bearing is installed. See Figure 803 (Sheet 2)	No surface damage is permitted without repair	Scattered surface damage to a maximum of 0.002 inch (0.051 mm) in depth	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357
4 Rear threads for surface damage such as nicks, dents and scratches. This area is not seen when bearing is installed. See Figure 803 (Sheet 2)	No surface damage is permitted without repair	2.500 inch (63.500 mm) maximum thread removed in one of the directions	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357
		3.500 inches (88.900 mm) minimum undamaged thread between any two repaired sections.	
		A maximum of eight nicks of 0.040 inch (1.016 mm) maximum width in all the not damaged areas along the outer diameter	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357
		8.000 inch (203.200 mm) maximum total	Refer to Section 72-31-07,

Compressor (Fan) Hub Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			
		damaged thread can be removed along the outer diameter	Repair−01 in the PW4000 Series CIR, PN 51A357

NOTE: Damaged rear threads can be removed for full length of thread and to depth necessary to clean up damaged threads when held to the minimum value as noted above.

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
5 Surface for damage such as nicks, dents and scratches. See Figure 803 (Sheet 2)	Scattered surface damage to a maximum of 0.003 inch (0.076 mm) in depth is permitted. Burrs or sharp edges are not permitted.	Scattered surface damage to a maximum of 0.005 inch (0.127 mm) in depth	Refer to Section 72−31−07, Repair−01 in the PW4000 Series CIR, PN 51A357
6 Spline surface for nicks, dents and scratches. See Figure 803 (Sheet 2)	No surface damage is permitted without repair	Scattered surface damage to a maximum of 0.005 inch (0.127 mm) in depth	Refer to Section 72−31−07, Repair−01 in the PW4000 Series CIR, PN 51A357
		Five percent of the total spline surface can be blended	Refer to Section 72−31−07, Repair−01 in the PW4000 Series CIR, PN 51A357
	20 percent of the spline tooth can be missing if the tooth has two not blended teeth on one of	20 percent of the spline tooth can be blended if the tooth has two not blended teeth on one of	Refer to Section 72−31−07, Repair−01 in the PW4000 Series CIR, PN 51A357

Compressor (Fan) Hub Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	the two sides	the two sides	
7 Front threads for nicks, dents and scratches. See Figure 803 (Sheet 2)	No surface damage is permitted without repair	2.500 inch (63.500 mm) maximum thread removed in one of the directions	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357
		3.500 inch (88.900 mm) minimum not damaged thread between all the two repaired sections	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357
		A maximum of eight nicks of 0.040 inch (1.016 mm) maximum width in all the not damaged areas along the inner diameter	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357
		8.000 inch (203.200 mm) maximum total damaged thread can be removed along the inner diameter	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357

NOTE: Damaged front threads can be removed for full length of thread and to depth necessary to clean up damaged threads when held to the minimum value as noted above. All dimensions are taken from thread circumference ID.

Compressor (Fan) Hub Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
8 Holes for nicks, dents and scratches. See Figure 803 (Sheet 2)	Scattered surface damage to a maximum of 0.003 inch (0.076 mm) in depth is permitted. Burrs or sharp edges are not permitted.	Not permitted	Not serviceable
9 Holes (rear flange) for nicks, dents and scratches. See Figure 803 (Sheet 2)	Scattered surface damage to a maximum of 0.005 inch (0.127 mm) in depth is permitted. Burrs or sharp edges are not permitted.	Not permitted	Not serviceable
10 Dovetail slot area for: See Figure 803 (Sheet 2) and Figure 803 (Sheet 3)			
Nicks, dents and scratches	Scattered surface damage to a maximum of 0.005 inch (0.127 mm) in depth is permitted. Burrs or sharp edges are not permitted.	Scattered surface damage to a maximum of 0.010 inch (0.254 mm) in depth	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357

Compressor (Fan) Hub Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Surface wear	0.005 inch (0.127 mm) in depth is permitted. Burrs or sharp edges are not permitted.	0.010 inch (0.254 mm) in depth	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357
11 Dovetail pressure faces for: See Figure 803 (Sheet 3)			
Nicks, dents and scratches	No surface damage is permitted without repair	Scattered surface damage to a maximum of 0.001 inch (0.025 mm) in depth	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357
Wear step on the pressure face	0.001 inch (0.025 mm) maximum step for height	0.005 inch (0.127 mm) maximum step height	Refer to Section 72-31-07, Repair-02 in the PW4000 Series CIR, PN 51A357
Galling	Galling surface damage to a maximum of 0.001 inch (0.025 mm) depth is permitted on the dovetail pressure face as long as the fan hub has less than 5000 cycles since last overhaul	Galled surface damage to a maximum of 0.003 inch (0.076 mm) in depth	Refer to Section 72-31-07, Repair-02 in the PW4000 Series CIR, PN 51A357

Compressor (Fan) Hub Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
12 Antigalling area. See Figure 803 (Sheet 1)	Presence or absence of antigalling compound is permitted	Not permitted	Not permitted
13 Dovetail slot area for: See Figure 803 (Sheet 3)			
Nicks, dents and scratches	No surface damage is permitted without repair	Scattered surface damage to a maximum of 0.003 inch (0.076 mm) in depth	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357
14 Holes for nicks, dents and scratches. See Figure 803 (Sheet 2)	Very light marks are permitted	If the rivet holes are damaged or oversize, the counterweight balance flange tang (with damaged hole) can be machined away. See Index 17 for the limits.	Refer to Section 72-31-07, Repair-16 in the PW4000 Series CIR, PN 51A357
15 Nuts for looseness. See Figure 803 (Sheet 2)	Not permitted	Replace the nut	Refer to Section 72-31-07, Repair-03 in the PW4000 Series CIR, PN 51A357

Compressor (Fan) Hub Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
16 Anti-torque slots for surface damage such as nicks, dents, scratches and burrs or rolled material	A maximum of 0.003 inch (0.076 mm) in depth is permitted without repair. Burrs, rolled material or sharp edges are not permitted.	A maximum of 0.040 inch (1.016 mm) in depth	Refer to Section 72-31-07, Repair-15 in the PW4000 Series CIR, PN 51A357
17 Counterweight balance flange	One counterweight balance flange tang can be bent or moved to a maximum of 0.060 inch (1.524 mm) axially rearward. Measure the rearward movement of the flange at the tip. The damage must not extend more than the area shown. The bent tang must be examined by SPOP 70 at ultra high sensitivity. Refer to Section 70-33-00 in the Standard Practices Manual, PN 585005. Cracks are not permitted.	If bent more than 0.060 inch (1.524 mm) or if more than one balance flange tang is damaged, machine away the balance flange tang. Refer to Section 72-31-07, Inspection/ Check-03 in the PW4000 Series CIR, PN 51A357 for the limits on how many and how much of the tangs can be removed.	Refer to Section 72-31-07, Repair-16 in the PW4000 Series CIR, PN 51A357

Compressor (Fan) Hub Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
18 Counterweight balance flange damage. See Figure 803 (Sheet 4)		A total of three tangs can be removed from the hub if no other counterweight tangs are damaged or have been repaired. Only two complete tangs can be removed over a 180 degree arc of the hub if at least two not damaged tangs are between the removed tangs. If only a part of a tang is removed for multiple flange tangs, the total material removed can not add up to more than three complete flange tangs. Two consecutive damaged flange tangs can be repaired if there is at least one remaining rivet hole in each tang. After all the necessary balance flange tangs are removed (either partial or	Refer to Section 72-31-07, Repair-16 in the PW4000 Series CIR, PN 51A357

Compressor (Fan) Hub Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
		complete tangs) the hub must be balanced again by the procedures shown in the repair.	
19 Rear edge and corner of lugs for surface damage such as nicks, dents and scratches. See Figure 803 (Sheet 3)	Scattered surface damage to a maximum of 0.005 inch (0.127 mm) in depth is permitted. Burrs or sharp edges are not permitted.	Scattered surface damage to a maximum of 0.035 inch (0.889 mm) in depth	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357
20 For surface damage such as nicks, dents and scratches. See Figure 803 (Sheet 2)	No surface damage is permitted without repair	Scattered surface damage to a maximum of 0.004 inch (0.102 mm) in depth	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357
21 For surface damage such as nicks, dents and scratches. See Figure 803 (Sheet 1)	Scattered round bottom nicks and dents to a maximum of 0.005 inch (0.127 mm) in depth with no sharp edges or raised material scratches of all depth are not serviceable without repair. Burrs or sharp edges are not serviceable.	Scattered surface damage to a maximum of 0.010 inch (0.254 mm) in depth	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357

Compressor (Fan) Hub Visual Inspection
Table 803 (Continued)

R
R

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
NOTE: Blending or polishing requires subsequent peening in some areas by Repair-01.			
22 For surface damage such as nicks, dents and scratches. See Figure 803 (Sheet 2)	Superficial imperfections are serviceable. Scratches and scattered nicks and dents to a maximum of 0.005 inch (127.000 mm) in depth with raised material to a maximum of 0.001 inch (0.025 mm) is serviceable. Damage in 0.125 inch (3.175 mm) spinner boltholes or fillets are not permitted.	Nicks, dents and scratches to a maximum of 0.010 inch (0.254 mm) depth. Surface damage in 0.125 inch (3.175 mm) of spinner bolthole or fillets to a maximum of 0.005 inch (0.127 mm) in depth.	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357
23 For surface damage around the clinch nut hole such as nicks, dents and scratches. See Figure 803 (Sheet 4)	Scattered surface damage to a maximum of 0.002 inch (0.051 mm) in depth are serviceable. Raised material is not permitted. Burrs or sharp edges are not serviceable. Scratches from blending or polishing operations are not serviceable	Scattered surface damage to a maximum of 0.005 inch (0.127 mm) inch	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357

Compressor (Fan) Hub Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	without subsequent peening by Repair-01. Damage leading into spinner bolt holes is not permitted.		
24 For surface damage such as nicks, dents and scratches. See Figure 803 (Sheet 2)	Scattered surface damage to a maximum of 0.003 inch (0.076 mm) in depth is permitted without repair. Burrs or sharp edges are not permitted.	Scattered surface damage to a maximum of 0.010 inch (0.254 mm) in depth is repairable. For one location circumferential radial depth to a maximum of 0.075 inch (1.905 mm) axial depth to a maximum of 0.075 inch (1.905 mm) circumferential length to a maximum of 0.500 inch (12.700 mm).	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357
25 Counterweight balance flange damage such as nicks, dents and scratches. See Figure 803 (Sheet 2)	Scattered surface damage to a maximum of 0.005 inch (0.127 mm) in depth is permitted without repair. Burrs or sharp	Scattered surface damage to a maximum of 0.015 inch (0.381 mm).	Refer to Section 72-31-07, Repair-01 in the PW4000 Series CIR, PN 51A357

Compressor (Fan) Hub Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	edges not permitted.		
26 Blade lock groove for: See Figure 803 (Sheet 2)			
Surface damage such as nicks, dents and scratches	Superficial imperfections are serviceable. Scattered nicks and dents to a maximum of 0.002 inch (0.051 mm) in depth with raised material to a maximum of 0.001 inch (0.025 mm) is serviceable. Scratches of all depth are not serviceable without repair. Burrs or sharp edges not serviceable.	Nicks, dents and scratches to a maximum of 0.005 inch (0.127 mm) in depth	

Index 27, Index 28 and Index 29 refer to the critical dimensions. See Figure 803 (Sheet 1).

27	0.950 inch (24.130 mm) maximum distance
28	2.850 inch (72.390 mm) maximum distance
29	1.850 inch (46.990 mm) maximum distance

Compressor (Fan) Hub Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
See Figure 804			
Bearing retaining nut bare flat surfaces for burrs, galling and scoring and/or tool damage	0.005 inch (0.127 mm) depth maximum. Manual blend to remove the raised material and sharp edges by Section 70-45-00, SPOP 533 in the Standard Practices Manual, PN 585005.	No limit	Repair all the quantities by manual blending. Use abrasive stones, abrasive paper, abrasive pads, files, emery cloth and/or crocus cloth.
Retaining nut wrenching slots for damage such as nicks, burrs or rolled metal	0.005 inch (0.127 mm) depth maximum. Manual blend to remove the raised material and sharp edges by Section 70-45-00, SPOP 533 in the Standard Practices Manual, PN 585005.	A maximum of 0.060 inch (1.524 mm) depth is permitted for blend repair	Repair by manual blending. Use abrasive stones, abrasive paper, abrasive pads, files, emery cloth and/or crocus cloth.

No. 1 Bearing Retaining Nut Visual Inspection
Table 804

R
R

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 1.6, 2 and Stage 4 blades for: See Figure 805			
Area A Tip of blade for:			
Metal tears	Not Permitted	Blend by repair	Refer to Section 72-31-03, 72-31-04 and 72-31-06, Repair-01 in the PW4000 Series CIR, PN 51A357
Area B Airfoils for:			
Surface indications, nicks and scratches	Not Permitted	Not more than 25 percent of the local thickness	Refer to Section 72-31-03, 72-31-04 and 72-31-06, Repair-01 in the PW4000 Series CIR, PN 51A357
Dents	Any number up to 0.050 inch maximum depth, spaced 0.400 inch (10.160 mm) apart with no evidence of cracks.	Greater than 0.050 inch (1.270 mm) is not permitted	Replace the damaged blade
Area C Leading and trailing edges, center of tip for:			

LPC Blade Assembly, Stage 1.6, 2 And 4 Visual Inspection
Table 805

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Nicks and dents	Not permitted	Blend by repair limits	Refer to Section 72−31−03, 72−31−04 and 72−31−06, Repair−01 in the PW4000 Series CIR, PN 51A357
Area D Fillet area for:			
Cracks	No damage permitted	None	Replace damaged blade
Area E			
Leading and trailing	0.005 inch (0.127 mm)	0.032 inch (0.813 mm) depth maximum	Refer to Section 72−31−03, 72−31−04 and 72−31−06, Repair−01 in the PW4000 Series CIR, PN 51A357
Pits	No damage permitted	None	Replace damaged blade

LPC Blade Assembly, Stage 1.6, 2 And 4 Visual Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 3 blades for: See Figure 806			
Maximum permitted blend limits			
Area C		0.125 inch (3.175 mm) depth	Refer to Section 72-31-05, Repair-01 in the PW4000 Series CIR, PN 51A357
Area E		0.032 inch (0.813 mm) depth	Refer to Section 72-31-05, Repair-01 in the PW4000 Series CIR, PN 51A357

LPC Blade Assembly, Stage 3, Visual Inspection
Table 806

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Outer shroud assembly. See Figure 807 (Sheet 1) and Figure 807 (Sheet 2)			
Surface damage on shroud flanges, fillet areas and boltholes	Not permitted	0.010 inch (0.254 mm) maximum depth, a maximum of 25 percent of the total area	Refer to Section 72-31-10, Repair-05 in the PW4000 Series CIR, PN 51A357
Areas where there is no anodize coat	Not permitted	No limit	Refer to Section 72-31-10, Repair-01 in the PW4000 Series CIR, PN 51A357

NOTE: Par particular attention to corrosion pitted areas. Protective anodized coating is destroyed by corrosive agents which cause pitting.

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Areas where there is no silicone rubber sealant at the outer diameter end of the vane	Not permitted	No limit	Seal with Silicone Rubber Sealant P09-014. Refer to Section 72-31-10, Repair-06 in the PW4000 Series CIR, PN 51A357.
Surface damage at the perimeter of the vane platform if the sealant is missing	Not permitted	0.015 inch (0.381 mm) maximum depth, all length	Refer to Section 72-31-10, Repair-06 in the PW4000 Series CIR, PN 51A357

Stage 1.6, 2, & 3 Compressor Stator Assembly
Outer Shroud Assembly Visual Inspection
Table 807

R
R

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Rivets that are loose or missing	Not permitted	Tighten the loose or replace the missing rivets	Refer to Section 72-31-10, Repair-06 in the PW4000 Series CIR, PN 51A357
Center flange with jackscrew inserts for: See Figure 807 (Sheet 2)			
Damaged or missing jackscrew inserts, oversize holes	Not permitted	No limit	Refer to Section 72-31-10, Repair-12 in the PW4000 Series CIR, PN 51A357
Cracks in the areas where the flange is bent	Not permitted	Not repairable	Remove from service
Cracks in the middle flange at the cutouts for the jackscrew inserts	Damage is not permitted	No limit	Refer to Section 72-31-10, Repair-16 in the PW4000 Series CIR, PN 51A357.
1 Vane inner diameter sealant distance from bottom of the shroud to the bottom of the sealant	0.050 inch (1.270 mm) maximum all around	No limit	Refer to Section 72-31-10, Repair-46 in the PW4000 Series CIR, PN 51A357

Stage 1.6, 2, & 3 Compressor Stator Assembly
Outer Shroud Assembly Visual Inspection
Table 807 (Continued)

R
R

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
2 Sealant coverage	Must fill between the vanes and shroud all around	No limit	Refer to Section 72-31-10, Repair-46 in the PW4000 Series CIR, PN 51A357
3 Bent flange	0.025 inch (0.635 mm) maximum	0.250 inch (6.350 mm) maximum deflection in a 6.000 inch (152.400 mm) maximum circular length	Refer to Section 72-31-10, Repair-39 in the PW4000 Series CIR, PN 51A357
See Figure 807 (Sheet 3)			
Surface damage Area A if erosion of the rubstrip bare surface	Not permitted	0.025 inch (0.635 mm) maximum depth, a maximum of 25 percent of the total area	Refer to Section 72-31-10, Repair-05 in the PW4000 Series CIR, PN 51A357
Surface damage on shroud wall Area B. Rivet area is not included.	Not permitted	For areas other than around the edge of vane slots: 0.025 inch (0.635 mm) maximum depth, a maximum of 25 percent of the total area.	Refer to Section 72-31-10, Repair-05 in the PW4000 Series CIR, PN 51A357
		For areas around the edge of vane slots: 0.020 inch (0.508 mm)	Refer to Section 72-31-10, Repair-05 in the PW4000

Stage 1.6, 2, & 3 Compressor Stator Assembly
Outer Shroud Assembly Visual Inspection
Table 807 (Continued)

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
	(CONTINUED)		maximum depth, a maximum of 25 percent of the total area.	Series CIR, PN 51A357
R	Surface damage on the outer shroud wall Area D and flanges Area F (Other than stator flange boltholes)	Scattered 0.005 inch (0.127 mm) maximum depth	0.010 inch (0.254 mm) maximum depth, a maximum of 25 percent of the total area	Refer to Section 72-31-10, Repair-05 in the PW4000 Series CIR, PN 51A357
R	Stator flange boltholes inner diameter damage	0.003 inch (0.076 mm) maximum depth	0.010 inch (0.254 mm) maximum depth	Refer to Section 72-31-10, Repair-05 in the PW4000 Series CIR, PN 51A357
R	Surface damage on the outer shroud wall, Area E, outer diameter area	Scattered 0.005 inch (0.127 mm) maximum depth	For areas that are not under the vane platform 0.025 inch (0.635 mm) maximum depth, a maximum of 25 percent of the total area	Refer to Section 72-31-10, Repair-05 in the PW4000 Series CIR, PN 51A357

Stage 1.6, 2, & 3 Compressor Stator Assembly
Outer Shroud Assembly Visual Inspection
Table 807 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Blade tip rubstrips for: See Figure 808 (Sheet 1) and Figure 808 (Sheet 2)			
LPC stage 1.6, 2 and stage 3 wear and erosion	All quantities, all locations to the extent where the base metal is bare, is permitted for continued operation	See the repair	Remove and replace the rubstrip. Refer to Section 72−31−10, Repair−13 in the PW4000 Series CIR, PN 51A357.

NOTE: There will be performance deterioration (EGT and TSFC) if the LPC blade tip rubstrip is missing more than 10 sq−in (6452 sq−mm) each stage of rubber down to the base metal. Consult workscope to determine appropriate action for planned use of the module.

LPC Blade Tip Rubstrip Inspection
Table 808

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 4 duct for: See Figure 809 (Sheet 1) and Figure 809 (Sheet 2)			
1 Front flange for cracks	Not permitted	Repair of radial flange cracks limited to 10 cracks. Repair of circumferential cracks are not permitted. Cracks that measure 0.064 inch (1.626 mm) maximum in radial length can be repaired.	Refer to Section 72-31-11, Repair-14 in the PW4000 Series CIR, PN 51A357
2 Damage to the outer O-ring groove and the adjacent surface for surface damage and corrosion pitting	Smooth bottom damage 0.010 inch (0.254 mm) maximum depth with no sharp edges and free from cracks	0.010 inch (0.254 mm) maximum depth of blend for 25 percent of the area	Smooth by Section 70-45-00, SPOP 533 in the Standard Practices Manual, PN 585005. Use the tool instruction.
		All damages that measure 2.000 inch (50.800 mm) maximum in circumferential direction and 0.028 inch (0.711 mm) can be weld	Refer to Section 72-31-11, Repair-15 in the PW4000 Series CIR, PN 51A357

LPC Stage 4 Duct Visual Inspection
Table 809

R
R

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			
		repaired	
3 Outer front diameter area for galling	0.010 inch (0.254 mm) maximum radial depth		Refer to Section 72-31-11, Repair-16 in the PW4000 Series CIR, PN 51A357
	4.000 inch (101.600 mm) maximum circumferential length total		
	No galling is permitted in radius		
4 Rubstrip for:			
Nicks, gouges, tears and other abrasions	0.500 inch (12.700 mm) maximum length in all directions		
	Damage separated by 2.000 inches (50.800 mm) minimum. Five damaged locations maximum.		

LPC Stage 4 Duct Visual Inspection
Table 809 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Loss of surface bond	Not serviceable	No limit	Refer to Section 72−31−11, Repair−02 and Repair−06 in the PW4000 Series CIR, PN 51A357
Rubstrip wear area erosion or blade path rub	Depth that is less than 0.050 inch (1.270 mm) average or 0.080 inch (2.032 mm) locally is permitted without repair.		

NOTE: Replacement of a portion of a rubstrip wear area for engines in service is not recommended because of the problems that can occur in getting a correct bond on surfaces that are not clean.

LPC Stage 4 Duct Visual Inspection
Table 809 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stator vane areas for: See Figure 810			
Cracks	Not permitted	No limit	Refer to Section 72-31-09, Repair-09 in the PW4000 Series CIR, PN 51A357
Corrosion and pits	Not permitted	Depth of pits equals 12 percent of the local vane thickness maximum	Refer to Section 72-31-09, Repair-02 and Repair-09 in the PW4000 Series CIR, PN 51A357
Area A and Area C Leading edges and trailing edges for nicks and dents. See Figure 810.	Not permitted	0.100 inch (2.540 mm) depth maximum	Refer to Section 72-31-09, Repair-02 in the PW4000 Series CIR, PN 51A357
		Greater than 0.100 inch (2.540 mm). Two nicks or dents on each edge maximum. Position of indications on both edges must not be opposite each other. Diagonal distance between leading edge and	Contact P&W Customer Technical Service

LPC Stage 1 Stator Vane Assembly Visual Inspection
Table 810

R
R

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			
		trailing edge blends must equal the chordal length of the blade minimum	
Area E Airfoils for surface indications	Not permitted	Convex side to a maximum of 5 percent of the surface maximum, concave side to a maximum of 20 percent of the surface maximum	Refer to Section 72-31-09, Repair-02 in the PW4000 Series CIR, PN 51A357
Concave side dents with round bottoms	Permitted	No limit	Refer to Section 72-31-09, Repair-02 and Repair-09 in the PW4000 Series CIR, PN 51A357
Separation of the aluminum band	No damage is permitted		Refer to Section 72-31-09, Repair-14 in the PW4000 Series CIR, PN 51A357

LPC Stage 1 Stator Vane Assembly Visual Inspection
Table 810 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Outer shroud Stage 1 for: See Figure 811			
Area A Surface damage, nicks and scratches in the shroud flanges and the fillet areas (Other than boltholes)	Scattered surface damage to a maximum of 0.005 inch (0.127 mm) depth. No raised material is permitted on the mating flange faces or snaps.	0.010 inch (0.254 mm) maximum depth. A maximum of 25 percent of the total area. See the repair for minimum wall thickness limits.	Refer to Section 72-31-09, Repair-07 in the PW4000 Series CIR, PN 51A357
Stator flange boltholes inner diameter damage	0.003 inch (0.076 mm) maximum depth	0.010 inch (0.254 mm) maximum depth	Refer to Section 72-31-09, Repair-07 in the PW4000 Series CIR, PN 51A357
Inner shroud stage 1 for: See Figure 811			
Shroud area where there is no anodize coat	Not permitted	None	Refer to Section 72-31-09, Repair-01 in the PW4000 Series CIR, PN 51A357

LPC Stage 1 Inner And Outer Shroud Assembly Visual Inspection
Table 811

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Sealing compound around the vanes for nicks and gouges	Permitted if the vane is not loose	0.250 inch (6.350 mm) maximum depth	Refer to Section 72−31−09, Repair−24 (It is necessary to disassemble the module for this repair) in the PW4000 Series CIR, PN 51A357
Very small cracks and dryness (called crazing)	Permitted if the vane is not loose	0.250 inch (6.350 mm) maximum depth	Refer to Section 72−31−09, Repair−01 in the PW4000 Series CIR, PN 51A357
9Areas where there is little bond between the sealing compound and the vane or shroud	Not permitted if the vane is loose. Replace the sealing compound.	No limit	Refer to Section 72−31−09, Repair−12 (It is necessary to disassemble the module for this repair) in the PW4000 Series CIR, PN 51A357
Cracks in the adhesive bond joints between the segments of the inner shroud assembly	Not permitted	No limit	Refer to Section 72−31−09, Repair−05 and Repair−13 (It is necessary to disassemble the module for this repair) in the PW4000 Series CIR, PN 51A357

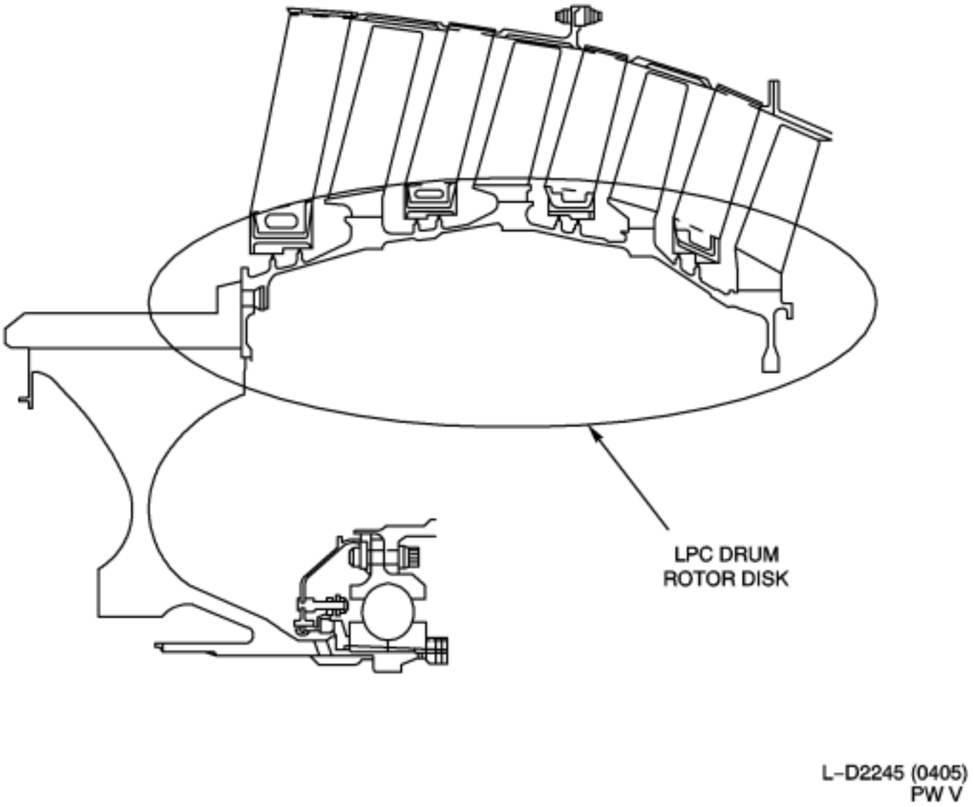
R LPC Stage 1 Inner And Outer Shroud Assembly Visual Inspection
R Table 811 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Cracks/splits in the inner airseal rubstrip	Not permitted	No limit	Refer to Section 72−31−09, Repair−06 in the PW4000 Series CIR, PN 351A357

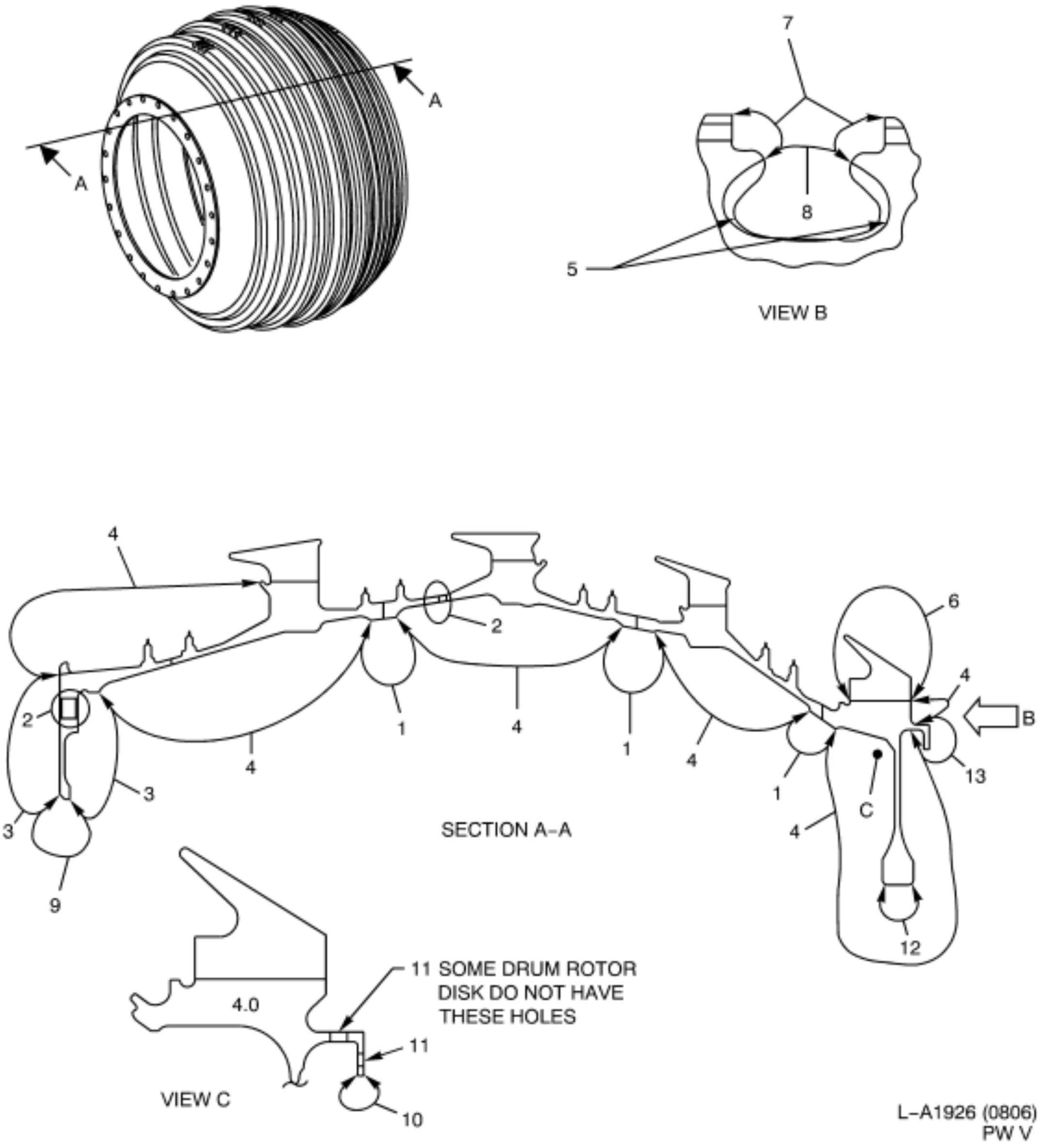
R LPC Stage 1 Inner And Outer Shroud Assembly Visual Inspection
R Table 811 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Inner shroud stage 3 for: See Figure 812			
Very small cracks and dryness (called crazing) and areas where there is little bond between the sealing compound and the vane or shroud. Refer to Section 70−31−00 in the Standard Practices Manual, PN 585005.	All quantities are permitted if the vane is not loose	A maximum of 0.250 inch (6.350 mm) depth	Refer to Section 72−31−10, Repair−30 in the PW4000 Series CIR, PN 51A357
	Not permitted if the vane is loose		Refer to Section 72−31−10, Repair−06 in the PW4000 Series CIR, PN 51A357

LPC Stage 3 Inner Shroud Assembly Visual Inspection
Table 812

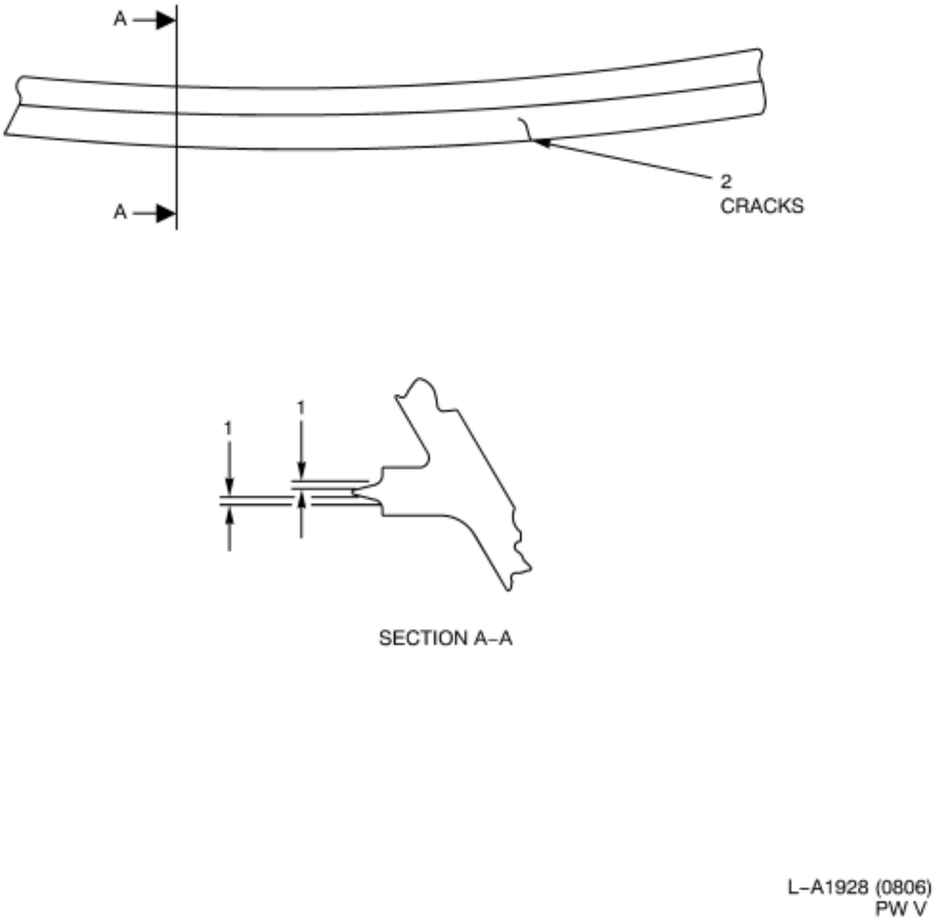

LPC DRUM
ROTOR DISK
L−D2245 (0405)
PW V

Drum Rotor Disk Assembly Visual Inspection
Figure 801 (Sheet 1)
(Task 72−00−31−990−010)


A
A
7
8
5
VIEW B
4
2
6
4
B
2
1
4
1
4
13
3
1
C
3
4
SECTION A−A
4
9
12
11 SOME DRUM ROTOR DISK DO NOT HAVE THESE HOLES
4.0
11
VIEW C
10
L−A1926 (0806)
PW V

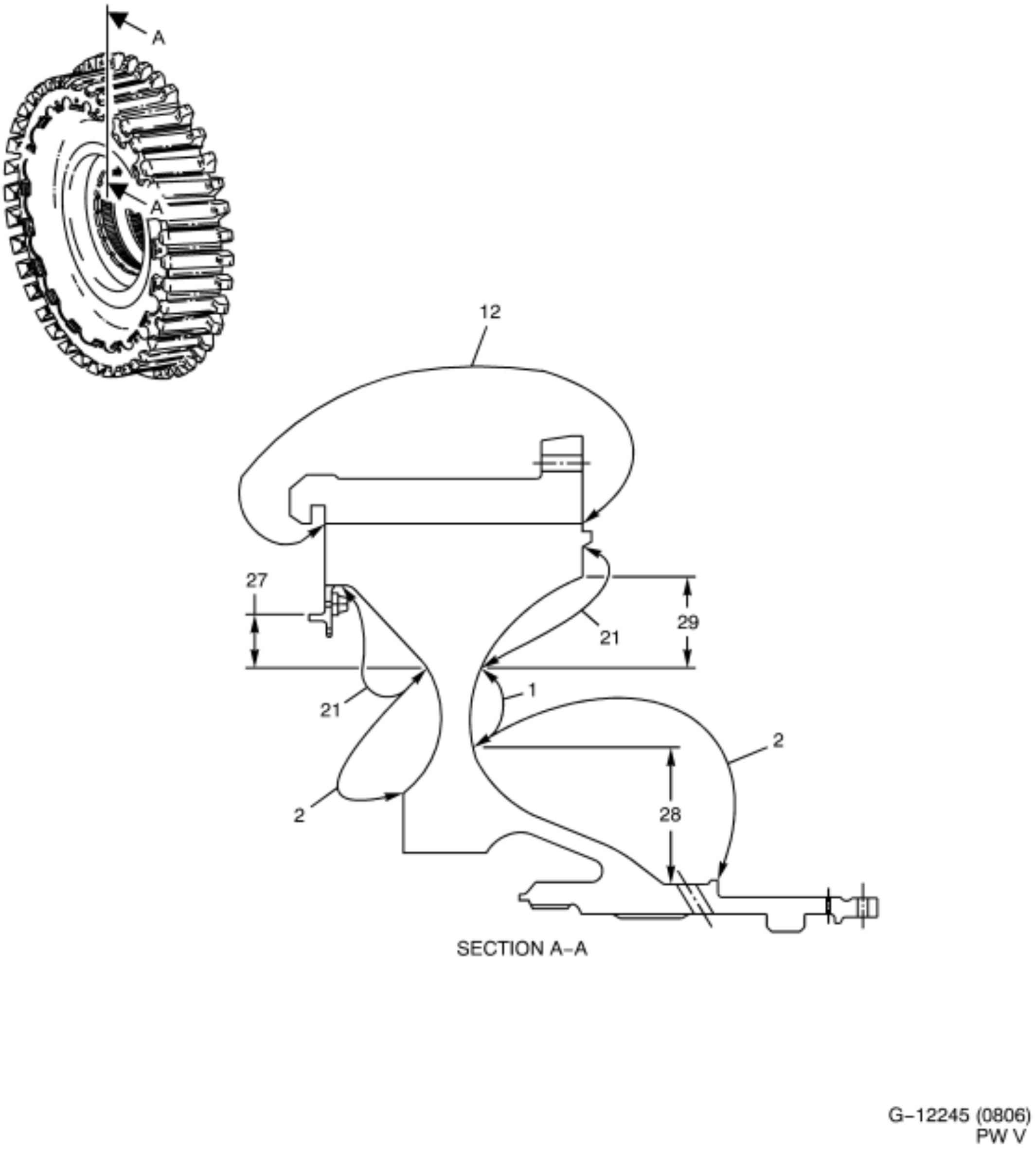
Note: Some areas may not be visible when assembled in module.
See Table 801 For Index Definitions.

Drum Rotor Disk Assembly Visual Inspection
Figure 801 (Sheet 2)
(Task 72−00−31−990−010)


A
A
2
CRACKS
1
1
SECTION A-A
L-A1928 (0806)
PW V

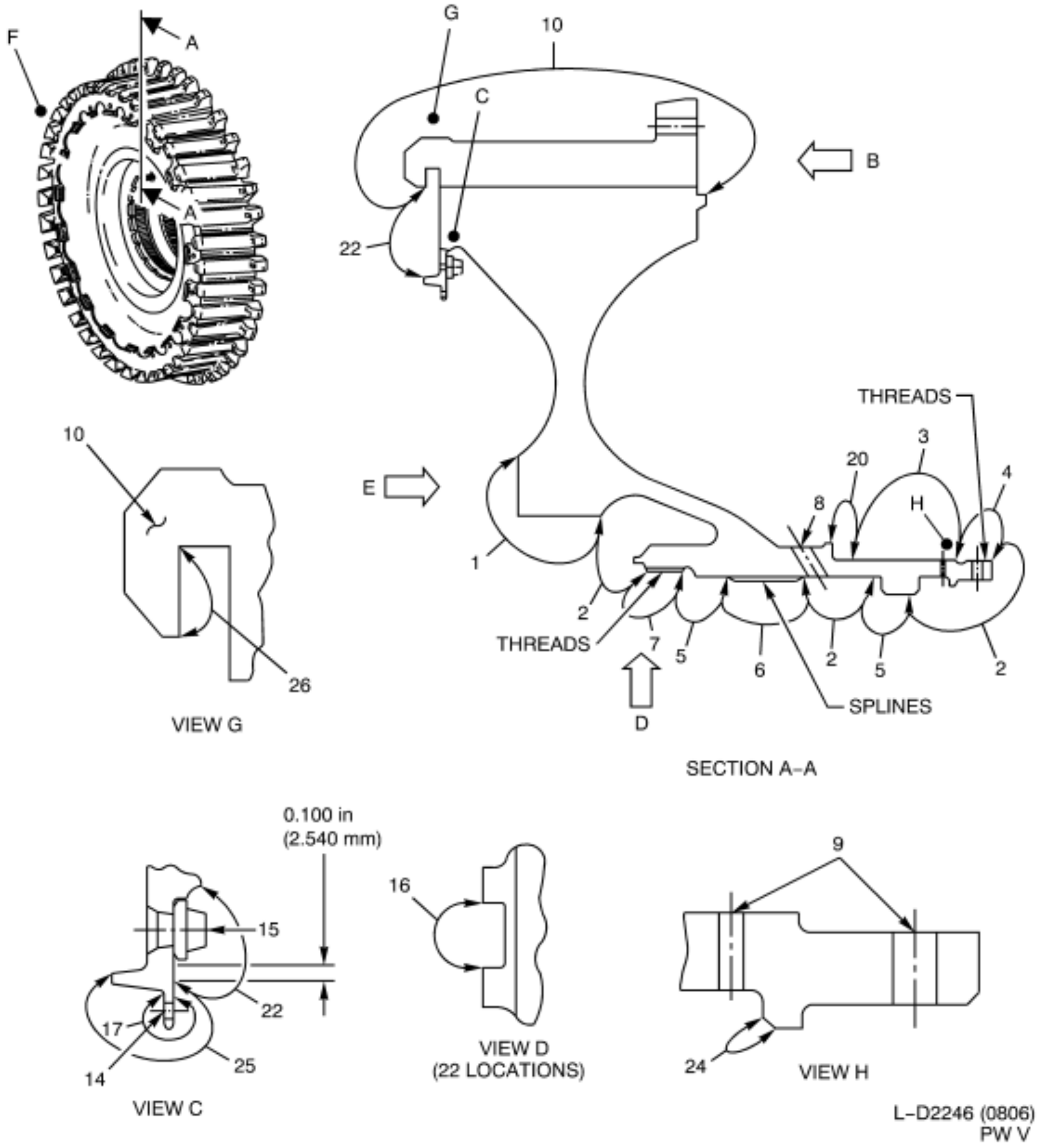
See Table 802 For Index Definitions.

Knife-Edge Seals Visual Inspection
Figure 802
(Task 72-00-31-990-010)


A
A
12
27
29
21
21
1
2
2
28
SECTION A−A
G−12245 (0806)
PW V

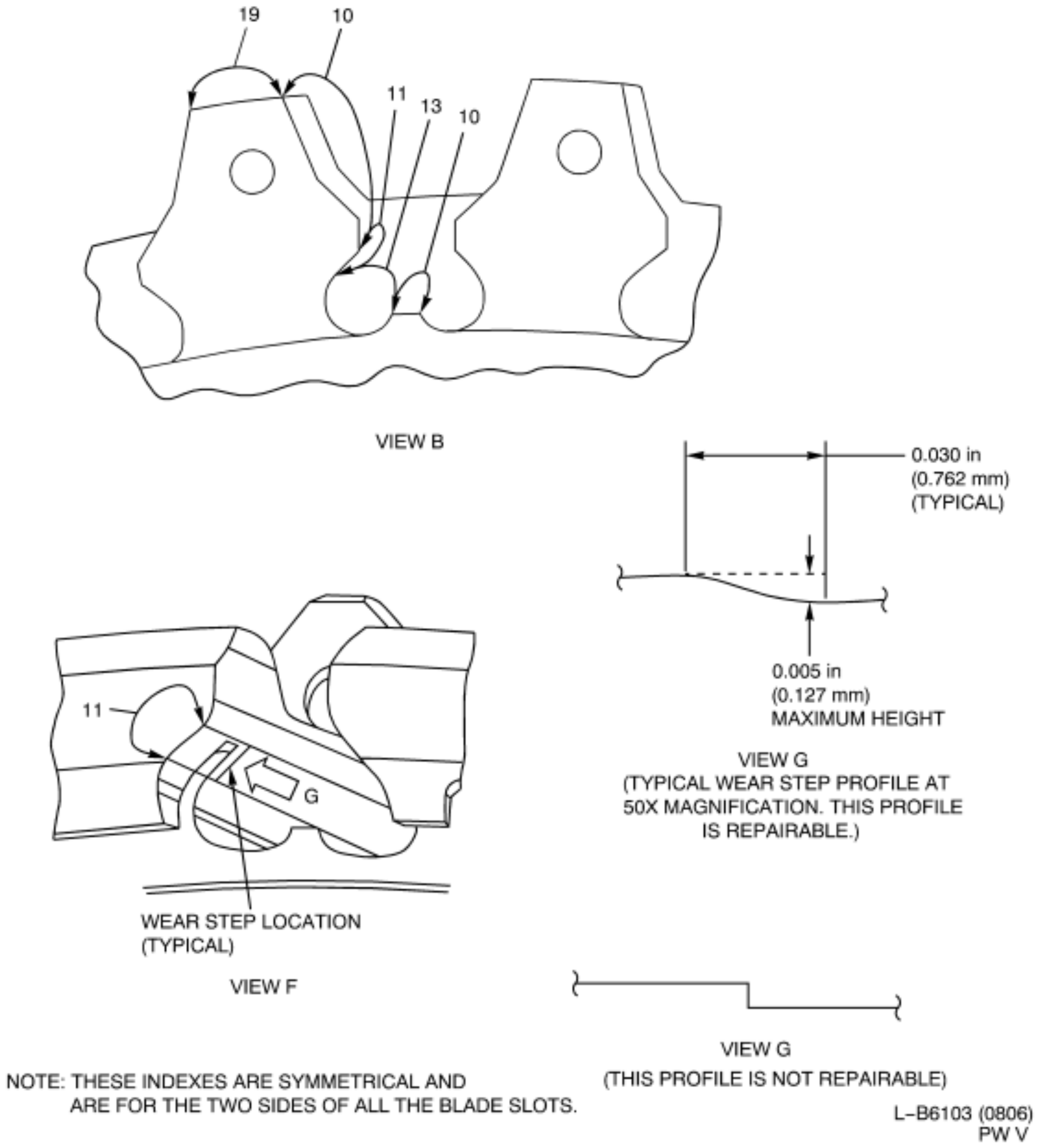
See Table 803 For Index Definitions.

Compressor (Fan) Hub Visual Inspection
Figure 803 (Sheet 1)
(Task 72−00−31−990−010)


F
A
A
G
10
C
B
22
10
26
VIEW G
E
THREADS
3
20
4
8
H
1
2
THREADS
7
5
6
2
5
2
SPLINES
D
SECTION A-A
0.100 in
(2.540 mm)
15
22
17
25
14
VIEW C
16
VIEW D
(22 LOCATIONS)
9
24
VIEW H
L-D2246 (0806)
PW V

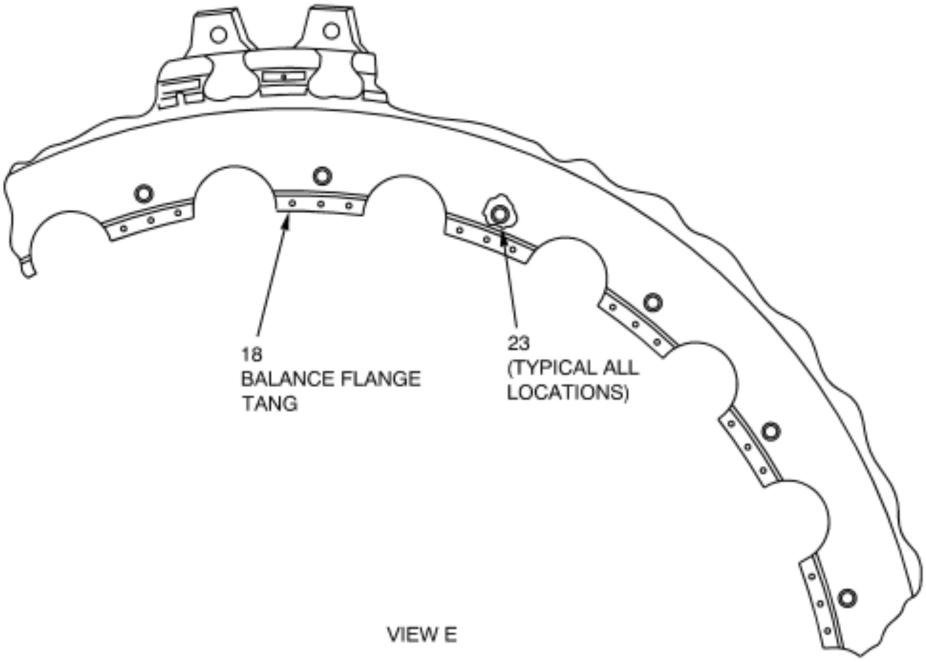
See Table 803 For Index Definitions.

Compressor (Fan) Hub Visual Inspection
Figure 803 (Sheet 2)
(Task 72−00−31−990−010)


19
10
11
13
10
VIEW B
0.030 in
(0.762 mm)
(TYPICAL)
0.005 in
(0.127 mm)
MAXIMUM HEIGHT
VIEW G
(TYPICAL WEAR STEP PROFILE AT 50X MAGNIFICATION. THIS PROFILE IS REPAIRABLE.)
11
G
WEAR STEP LOCATION
(TYPICAL)
VIEW F
VIEW G
(THIS PROFILE IS NOT REPAIRABLE)
NOTE: THESE INDEXES ARE SYMMETRICAL AND ARE FOR THE TWO SIDES OF ALL THE BLADE SLOTS.
L−B6103 (0806)
PW V

See Table 803 For Index Definitions.

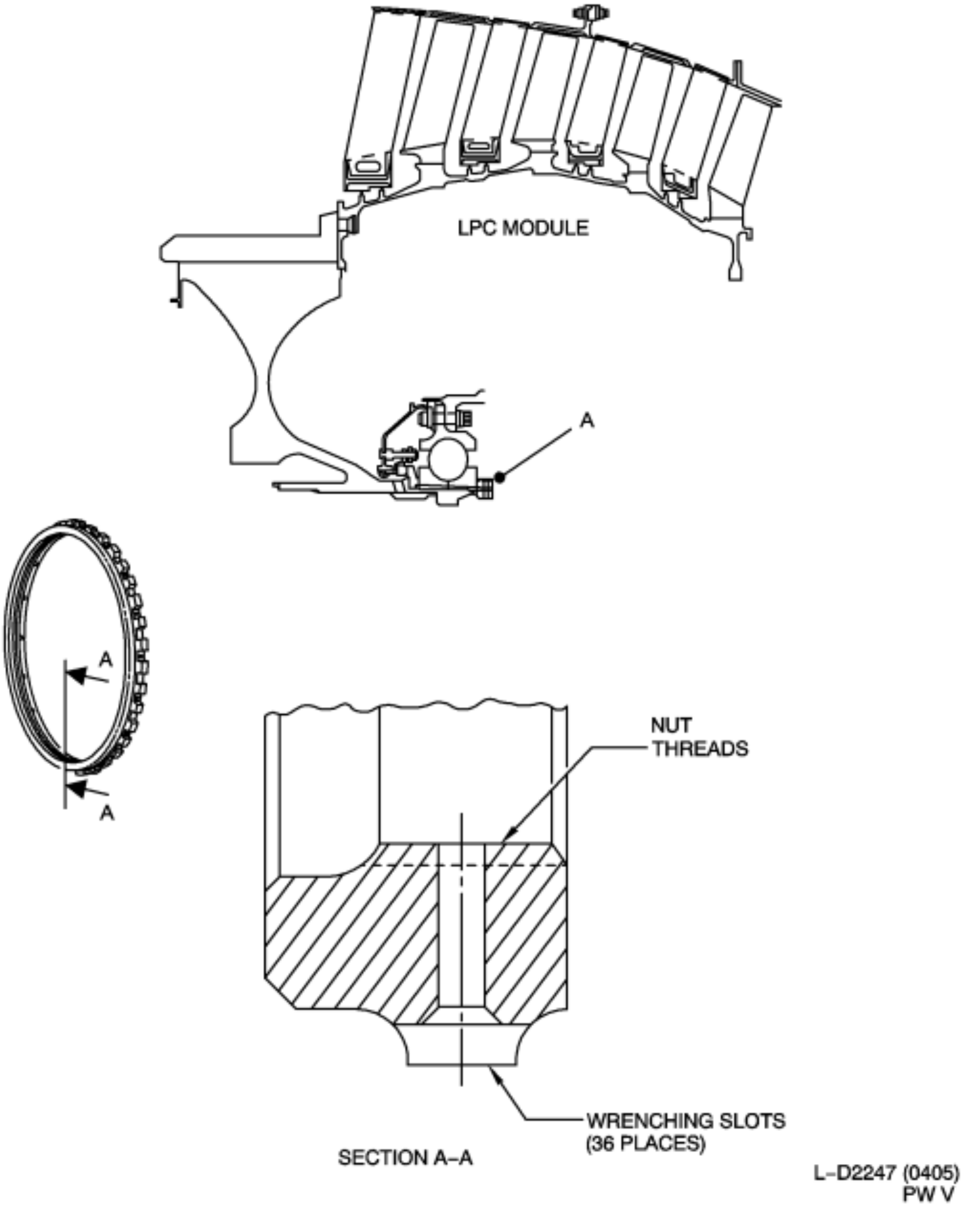
Compressor (Fan) Hub Visual Inspection
Figure 803 (Sheet 3)
(Task 72−00−31−990−010)


18
BALANCE FLANGE
TANG
23
(TYPICAL ALL
LOCATIONS)
VIEW E

L−B6773 (0806)
PW V

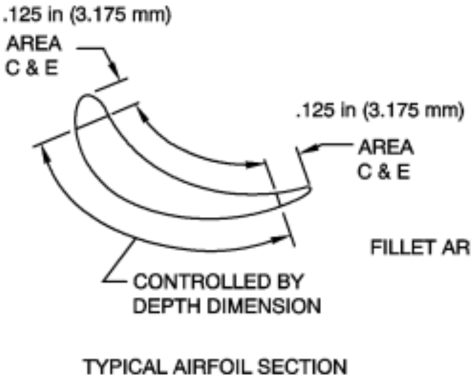
See Table 803 For Index Definitions.

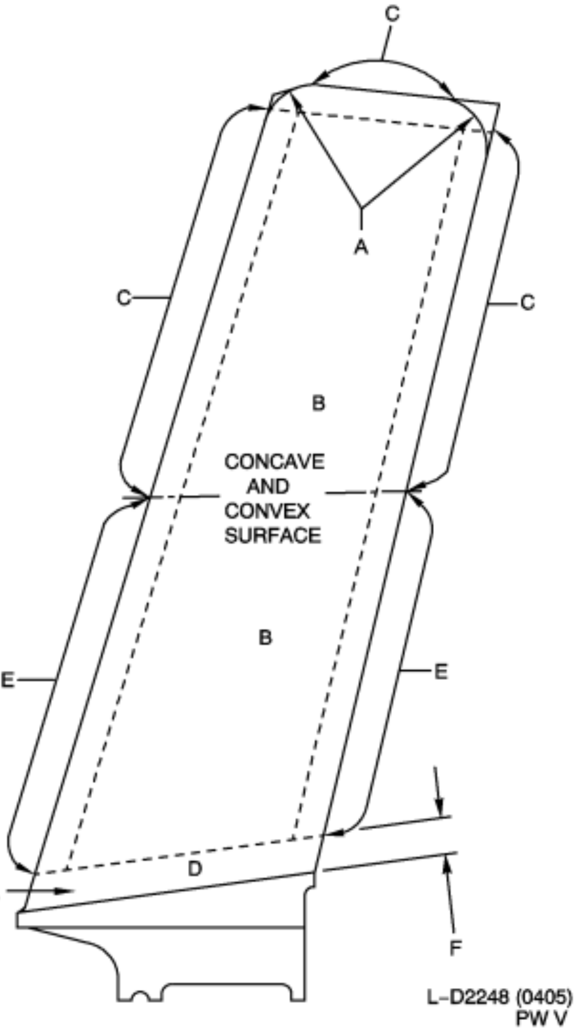
Compressor (Fan) Hub Visual Inspection
Figure 803 (Sheet 4)
(Task 72−00−31−990−010)


LPC MODULE
A
A
A
NUT THREADS
WRENCHING SLOTS (36 PLACES)
SECTION A-A
L-D2247 (0405)
PW V

No. 1 Bearing Retaining Nut Visual Inspection
Figure 804
(Task 72-00-31-990-010)

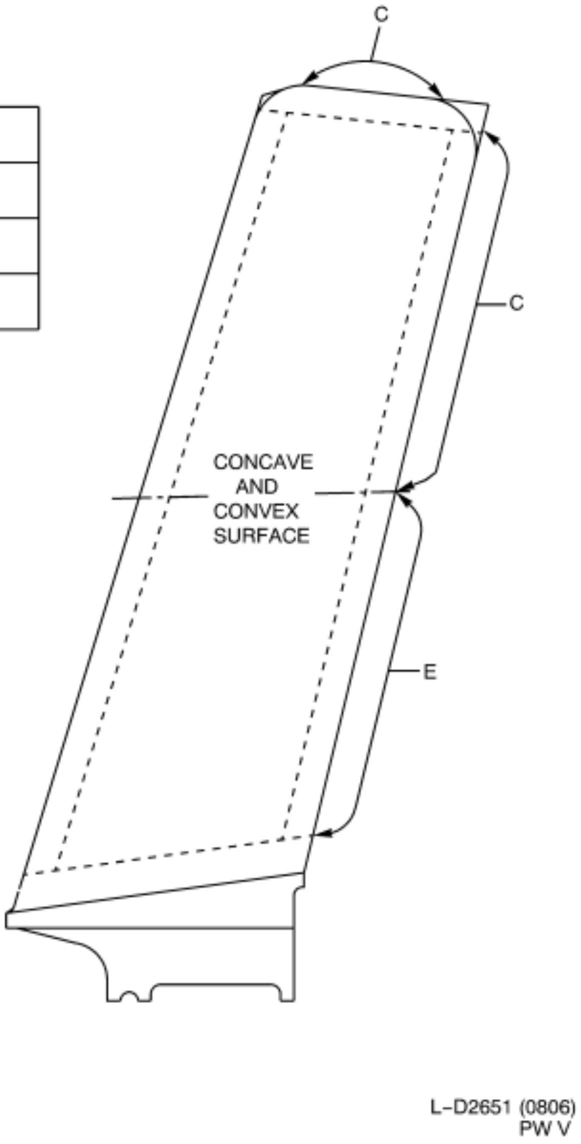
MAX ALLOWABLE BLEND LIMITS	
BLADE AREA	LIMIT
A	.375 in RADIUS (9.525 mm)
B	NO GREATER THAN 25% OF LOCAL THICKNESS MEASURED FROM ADJACENT NON-BLENDED SURFACE USAGE OF ANOTHER NON-BLENDED BLADE FOR COMPARISON IS PERMITTED
C	.125 in DEEP (3.175 mm)
D	NONE
E	.032 in DEEP (0.813 mm)
F 1.6 BLADES ONLY	.160 in (4.064 mm)


.125 in (3.175 mm)
AREA C & E
.125 in (3.175 mm)
AREA C & E
CONTROLLED BY DEPTH DIMENSION
TYPICAL AIRFOIL SECTION

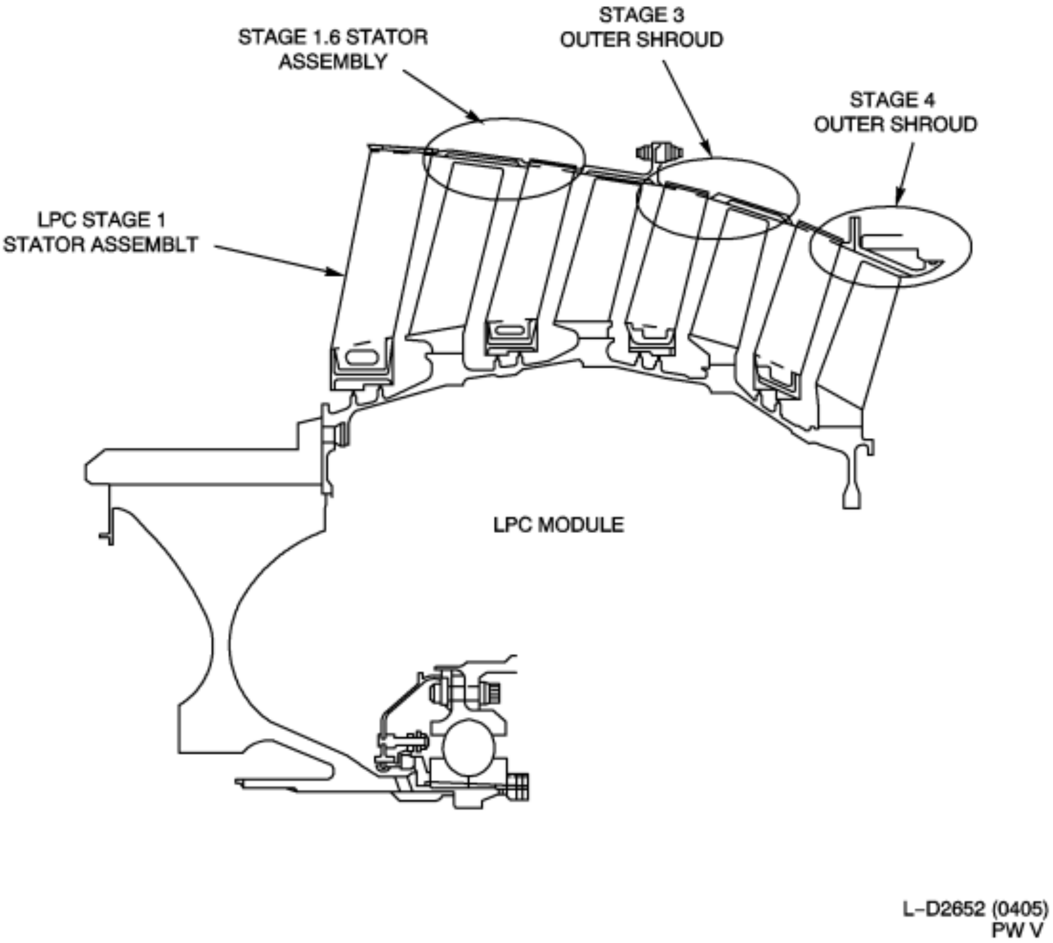

C
C
A
C
B
CONCAVE AND CONVEX SURFACE
B
E
E
D
FILLET AREA
F
L-D2248 (0405)
PW V

LPC Blade Assembly (Stage 1.6, 2 and 4) Visual Inspection
Figure 805
(Task 72-00-31-990-010)

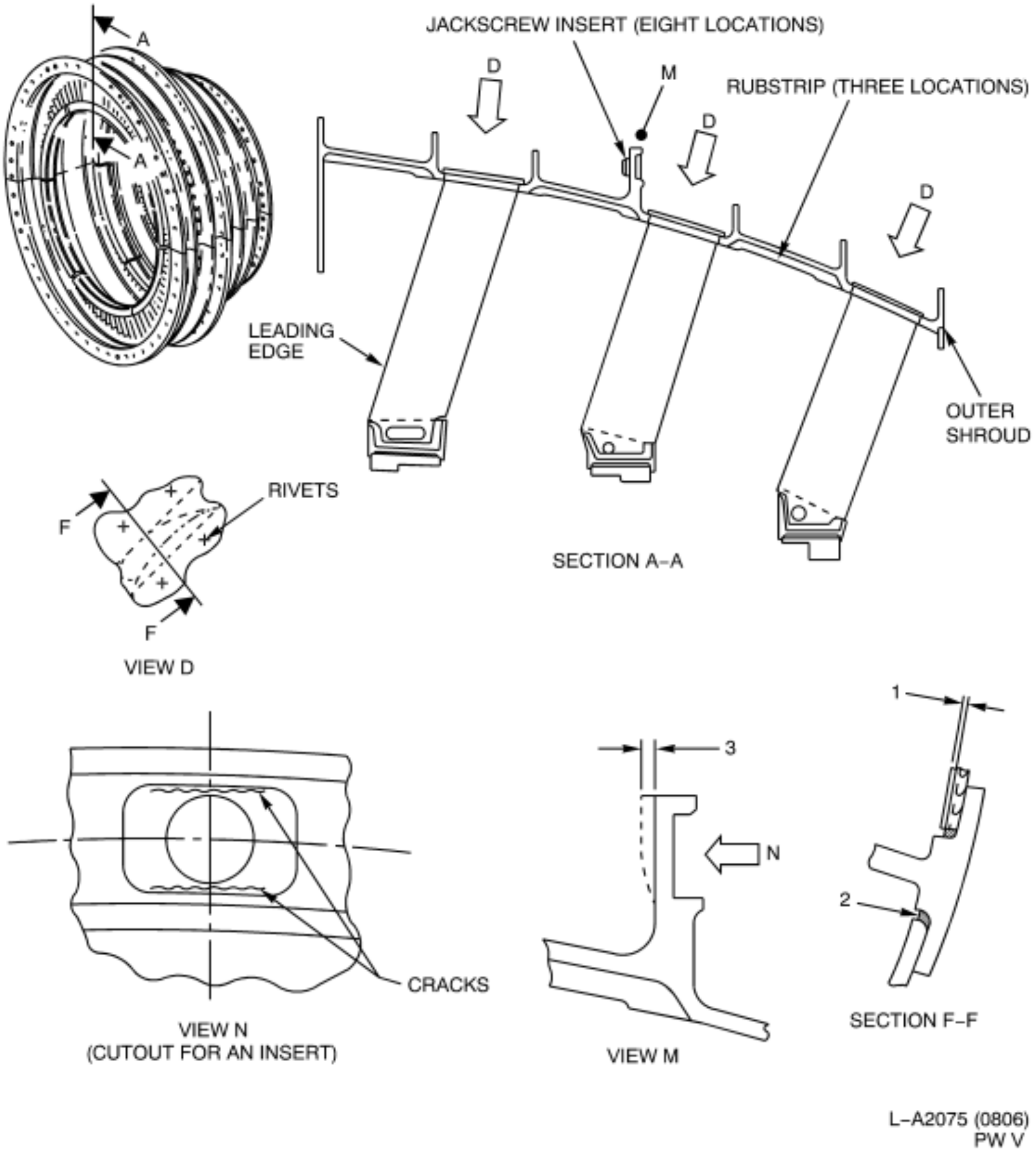
MAXIMUM PERMITTED BLEND LIMITS	
BLADE AREA	LIMIT
C	0.125 in (3.175 mm) DEPTH
E	0.032 in (0.813 mm) DEPTH


C
C
CONCAVE
AND
CONVEX
SURFACE
E
L-D2651 (0806)
PW V

LPC Blade Assembly (Stage 3) Visual Inspection
Figure 806
(Task 72-00-31-990-010)

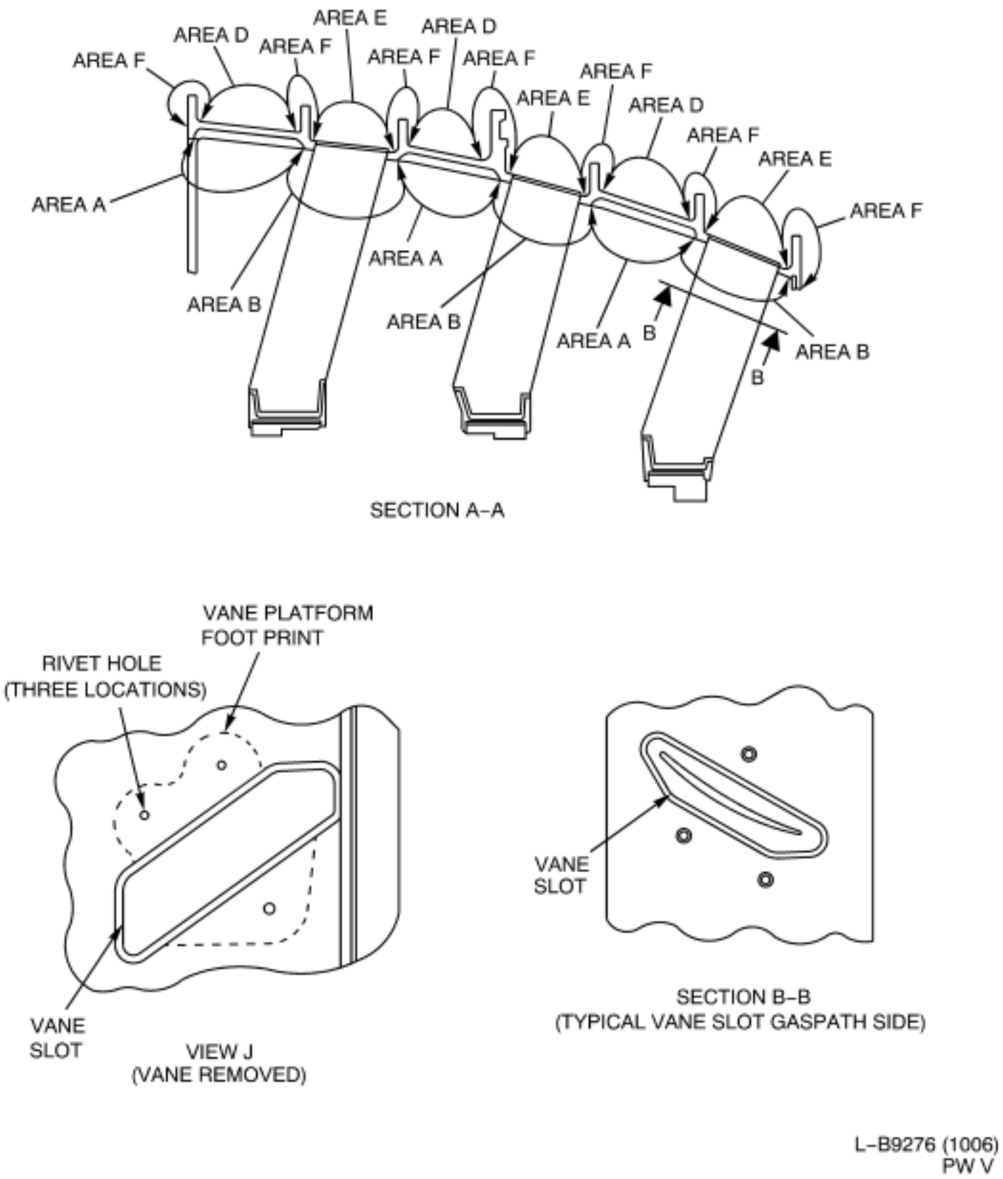

STAGE 1.6 STATOR
ASSEMBLY
STAGE 3
OUTER SHROUD
STAGE 4
OUTER SHROUD
LPC STAGE 1
STATOR ASSEMBLT
LPC MODULE
L−D2652 (0405)
PW V

Outer Shroud Assembly (Stage 1.6, 2 and 3) Visual Inspection
Figure 807 (Sheet 1)
(Task 72−00−31−990−010)

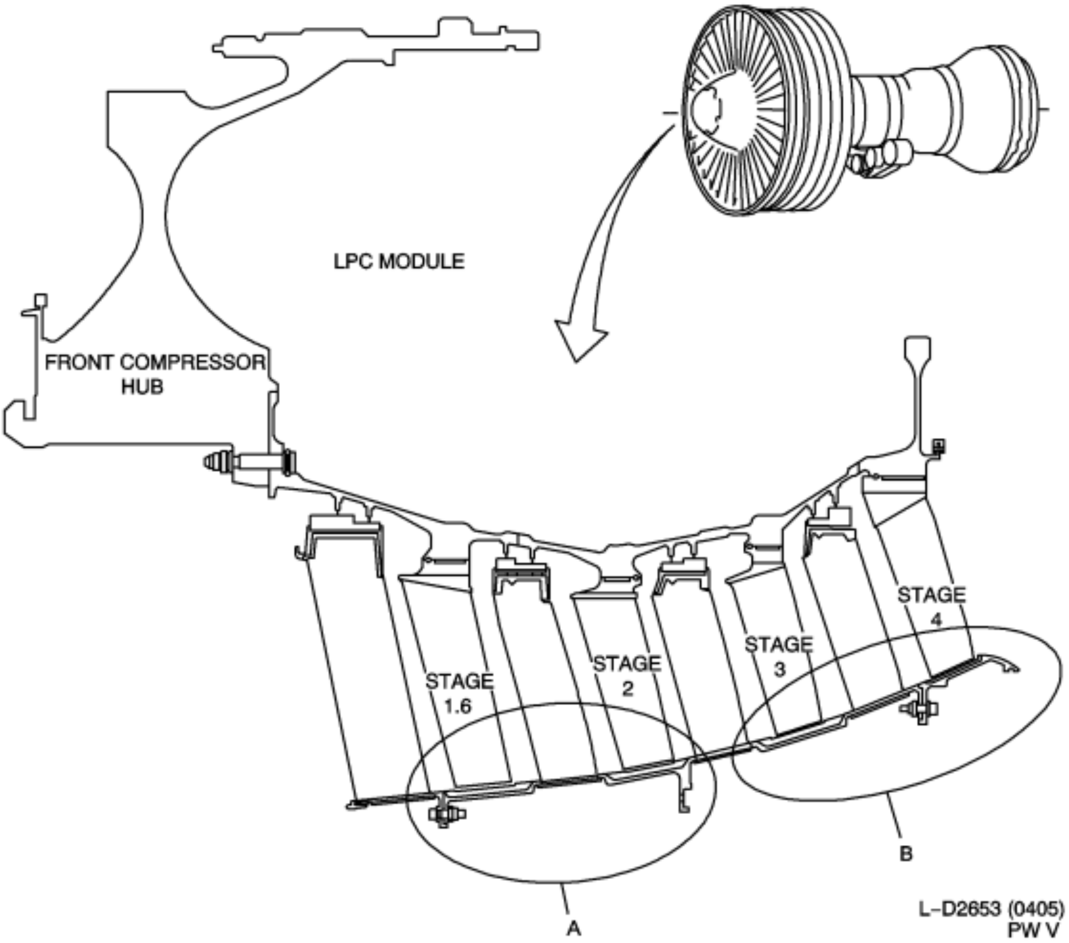

A
A
JACKSCREW INSERT (EIGHT LOCATIONS)
D
M
RUBSTRIP (THREE LOCATIONS)
D
D
LEADING EDGE
OUTER SHROUD
SECTION A−A
F
RIVETS
F
VIEW D
1
3
N
2
CRACKS
VIEW N (CUTOUT FOR AN INSERT)
VIEW M
SECTION F−F
L−A2075 (0806)
PW V

See Table 807 For Index Definitions.

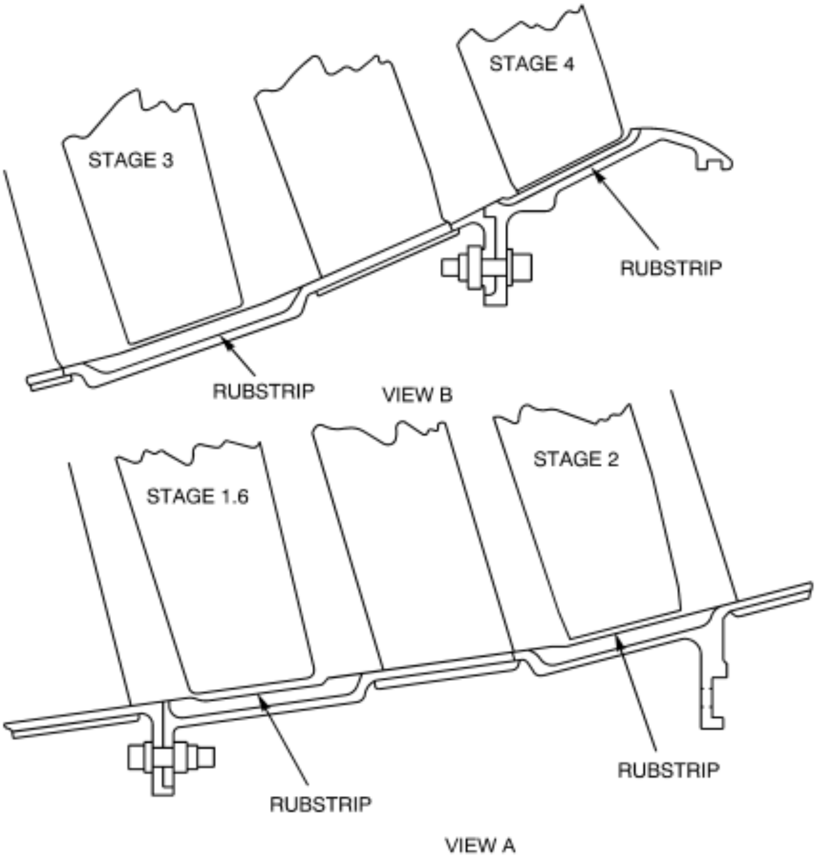
Outer Shroud Assembly (Stage 1.6, 2 and 3) Visual Inspection
Figure 807 (Sheet 2)
(Task 72−00−31−990−010)


AREA E
AREA D
AREA D
AREA F
AREA F
AREA F
AREA F
AREA F
AREA E
AREA D
AREA F
AREA E
AREA F
AREA A
AREA A
AREA B
AREA B
AREA A
B
B
AREA B
SECTION A-A
VANE PLATFORM
FOOT PRINT
RIVET HOLE
(THREE LOCATIONS)
VANE
SLOT
VIEW J
(VANE REMOVED)
VANE
SLOT
SECTION B-B
(TYPICAL VANE SLOT GASPATH SIDE)
L-B9276 (1006)
PW V

Outer Shroud Assembly (Stage 1.6, 2 and 3) Visual Inspection
Figure 807 (Sheet 3)
(Task 72-00-31-990-010)

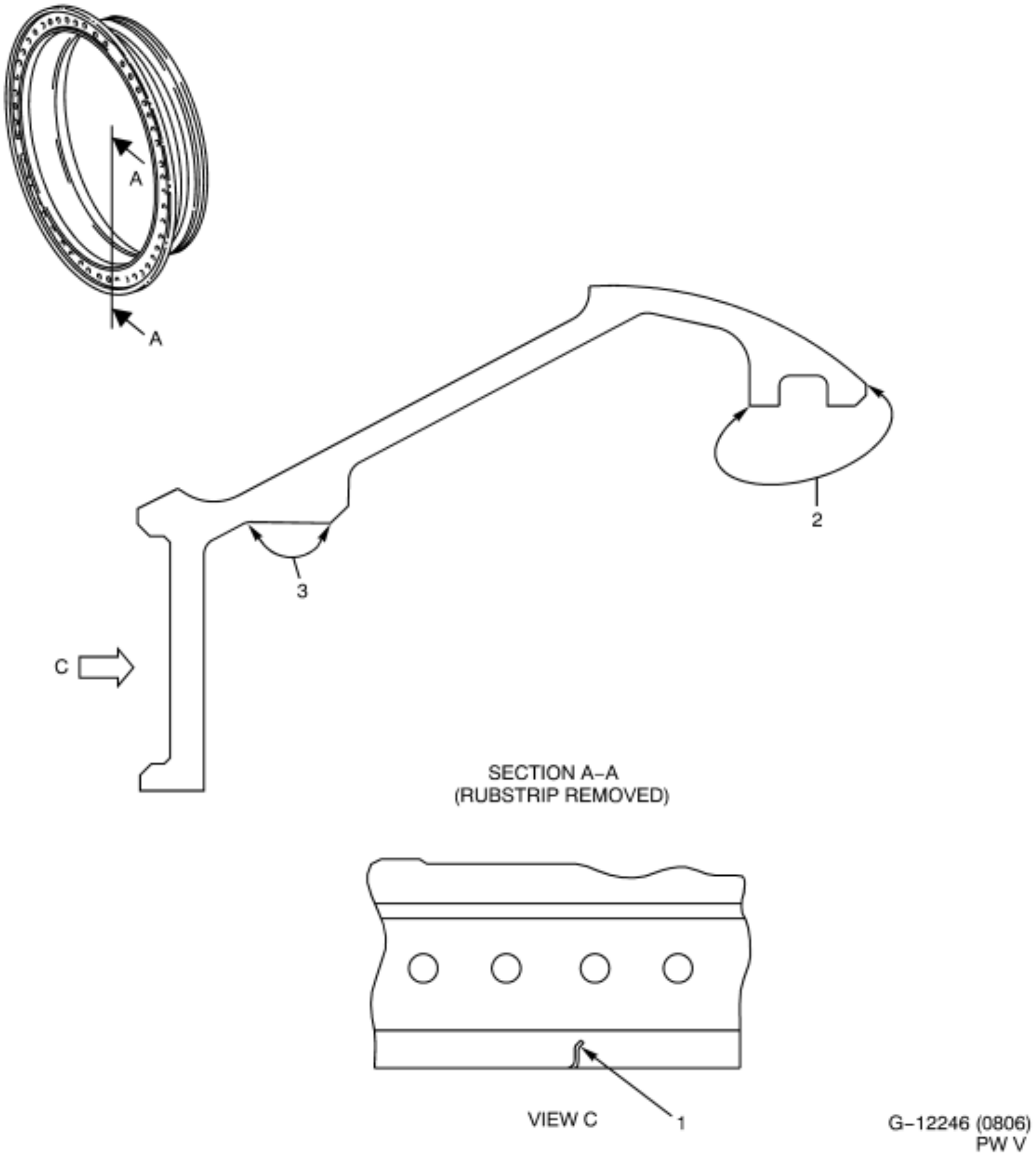

LPC MODULE
FRONT COMPRESSOR HUB
STAGE 1.6
STAGE 2
STAGE 3
STAGE 4
A
B
L−D2653 (0405)
PW V

LPC Blade Tip Rubstrip Visual Inspection
Figure 808 (Sheet 1)
(Task 72−00−31−990−010)


STAGE 4
STAGE 3
RUBSTRIP
RUBSTRIP
VIEW B
STAGE 2
STAGE 1.6
RUBSTRIP
RUBSTRIP
VIEW A

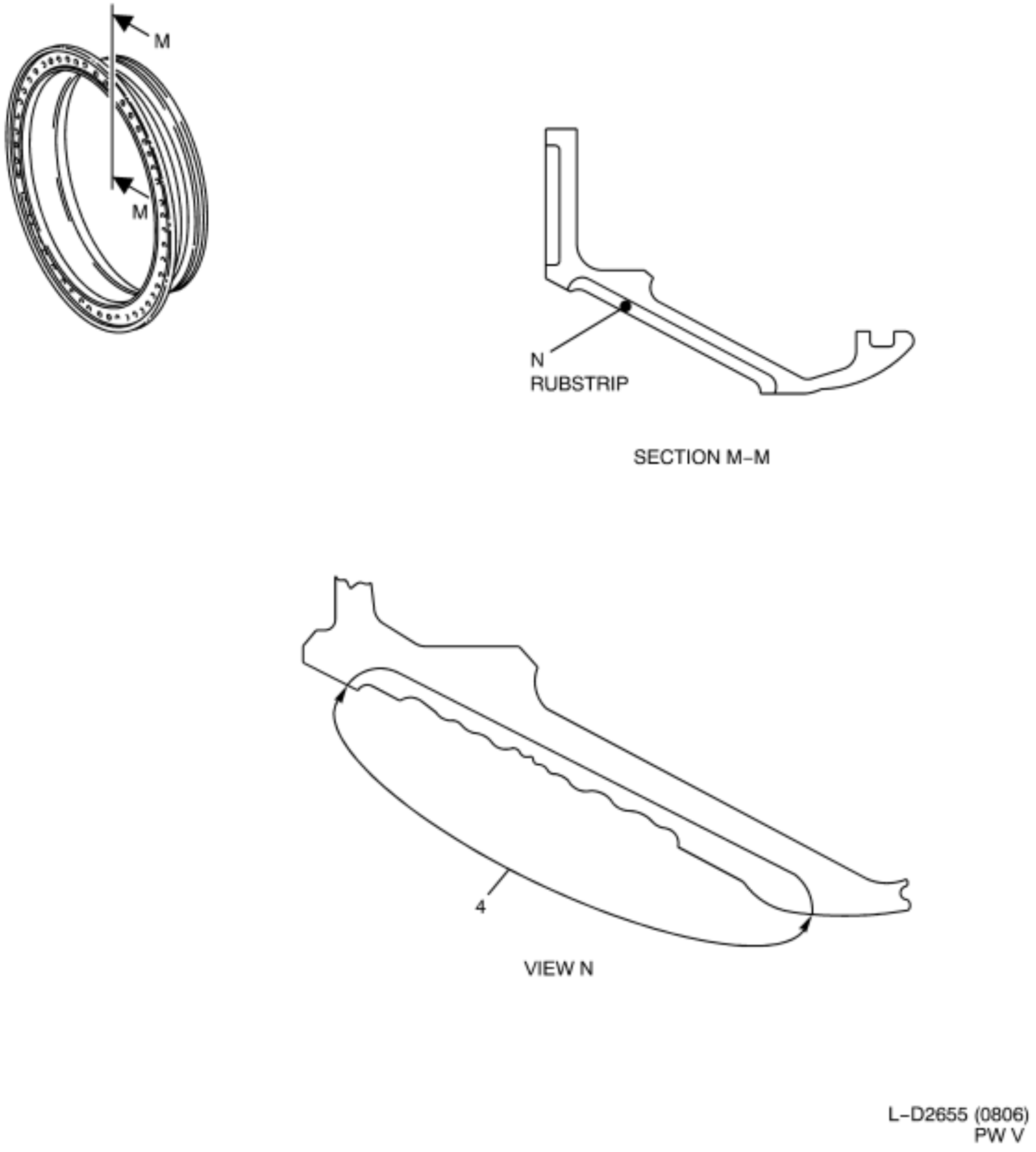
L−D2654 (0806)
PW V

LPC Blade Tip Rubstrip Visual Inspection
Figure 808 (Sheet 2)
(Task 72−00−31−990−010)


A
A
2
3
C
SECTION A−A
(RUBSTRIP REMOVED)
VIEW C
1
G−12246 (0806)
PW V

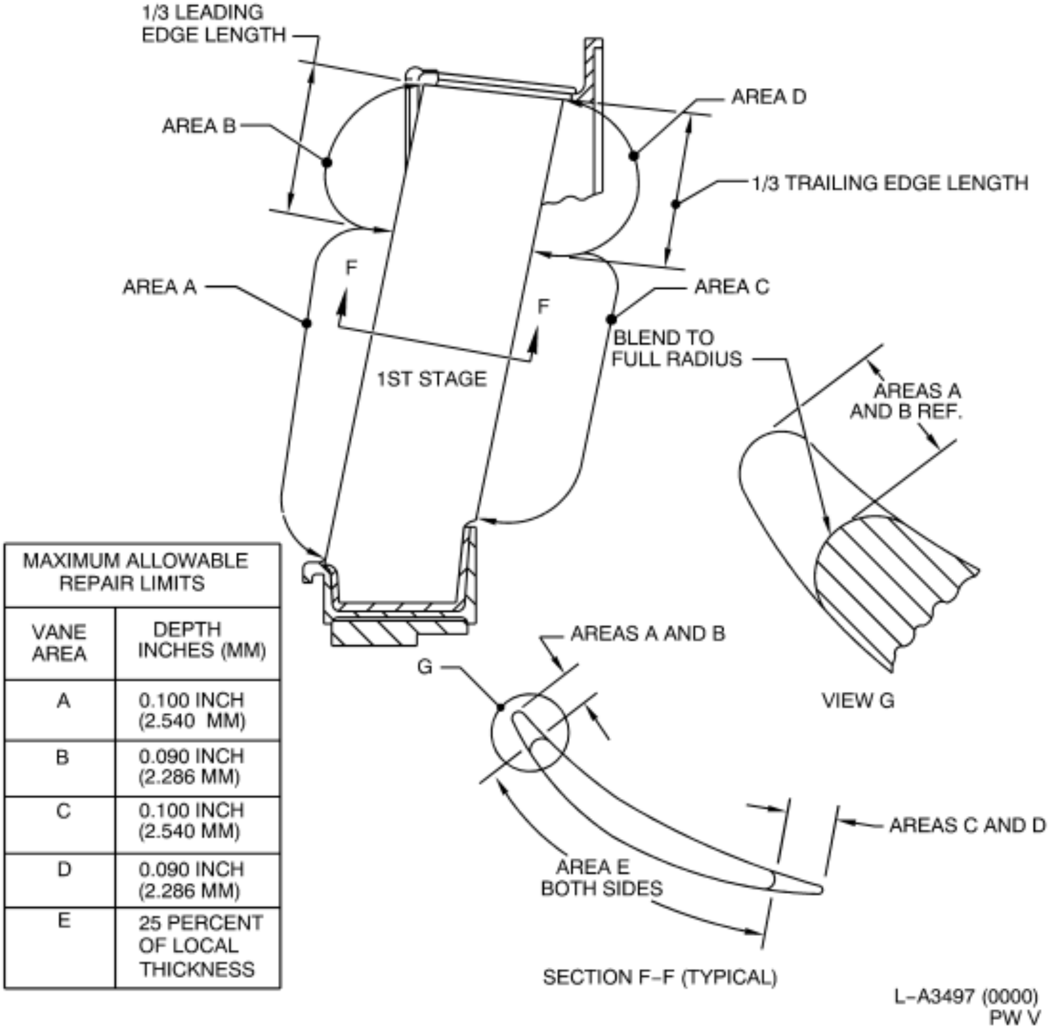
See Table 809 For Index Definitions.

LPC Stage 4 Duct Visual Inspection
Figure 809 (Sheet 1)
(Task 72−00−31−990−010)


M
M
N
RUBSTRIP
SECTION M−M
4
VIEW N
L−D2655 (0806)
PW V

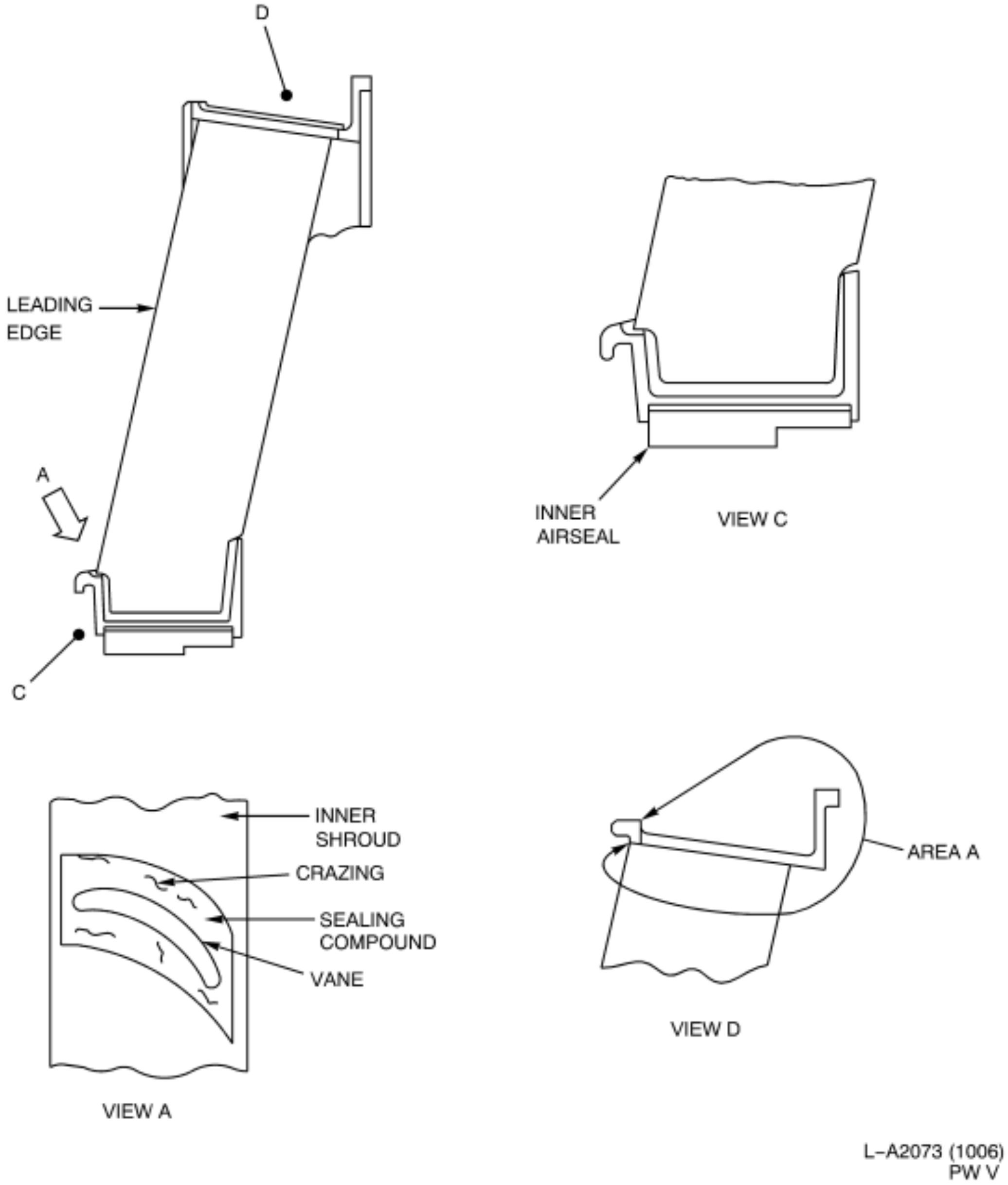
See Table 809 For Index Definitions.

LPC Stage 4 Duct Visual Inspection
Figure 809 (Sheet 2)
(Task 72−00−31−990−010)

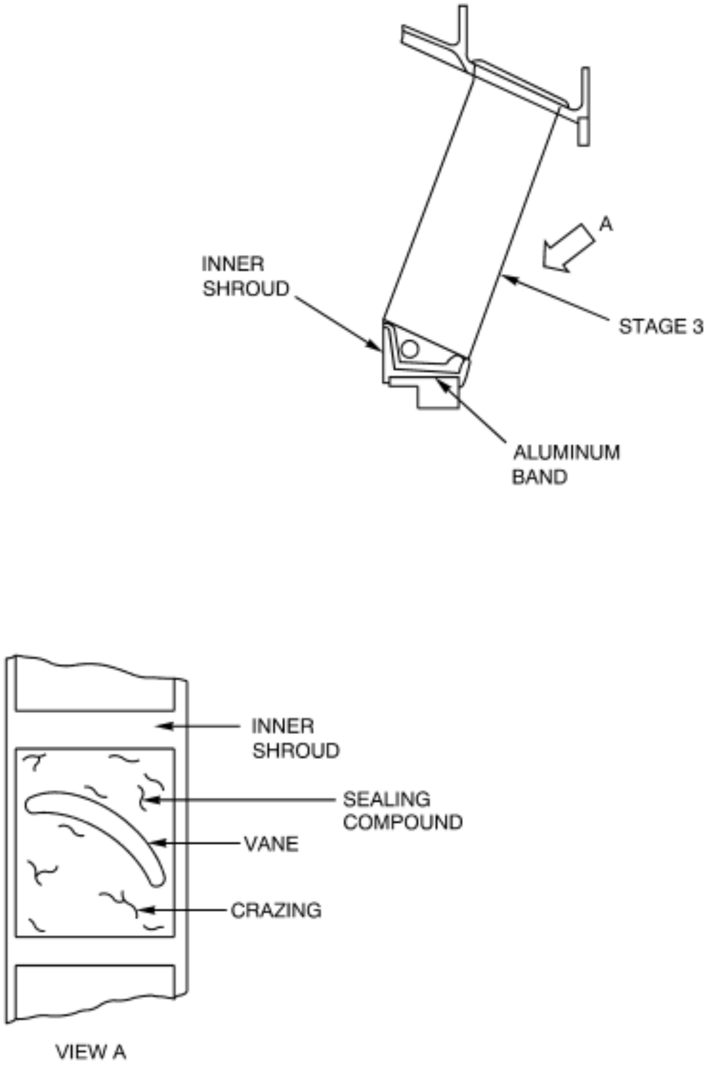

1/3 LEADING EDGE LENGTH
AREA B
AREA D
1/3 TRAILING EDGE LENGTH
AREA A
F
F
AREA C
BLEND TO FULL RADIUS
1ST STAGE
AREAS A AND B REF.
AREAS A AND B
G
VIEW G
AREAS C AND D
AREA E BOTH SIDES
SECTION F−F (TYPICAL)
L−A3497 (0000)
PW V

MAXIMUM ALLOWABLE REPAIR LIMITS	
VANE AREA	DEPTH INCHES (MM)
A	0.100 INCH (2.540 MM)
B	0.090 INCH (2.286 MM)
C	0.100 INCH (2.540 MM)
D	0.090 INCH (2.286 MM)
E	25 PERCENT OF LOCAL THICKNESS

LPC Stage 1 Stator Vane Assembly Visual Inspection
Figure 810
(Task 72−00−31−990−010)


D
LEADING EDGE
A
C
INNER AIRSEAL
VIEW C
INNER SHROUD
CRAZING
SEALING COMPOUND
VANE
VIEW A
AREA A
VIEW D
L-A2073 (1006)
PW V

R LPC Stage 1 Inner And Outer Shroud Assembly Visual Inspection
Figure 811
(Task 72-00-31-990-010)


A
INNER SHROUD
STAGE 3
ALUMINUM BAND
INNER SHROUD
SEALING COMPOUND
VANE
CRAZING
VIEW A

L-D2656 (0806)
PW V

LPC Stage 3 Inner Shroud Assembly Visual Inspection
Figure 812
(Task 72-00-31-990-010)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-31-300-001:

1. Restore Stage 1 LPC Blade Assembly Leading Edge Contour

NOTE: This repair is for engines that had unsatisfactory fan operation during the engine acceptance in 71-00-00, Testing-09. This repair can be used to clean and remove fan blade leading edge damage. After this repair you can test the engine again.

A. Prerequisites

(1) This repair is applicable to fan blade assemblies PN 52A121, 52A121-001, 52A121-002, 52A121-003, 53A321-001, 56A621, 56A821, 53A321, 54A821 and 56A511.

(2) Remove all fan blade assemblies. Refer to Removal-04 (Task 72-00-31-020-002-001 or Task 72-00-31-020-002-002).

(3) Refer to Maintenance Advisory Manual No. MAN-PW4000-2-91 Revision 1 or subsequent for time/cycle information (for airfoil bead peen, blade root shotpeen and antigalling compound application). R

B. Equipment And Materials Necessary

Standard Tools:

3013 Vise	Wilton Tool Company 9525 Irving Park Rd. Schiler Park, IL 60176

Special Tools:

PWA 29646	Gage, Inspection
PWA 29836	Sighting Template
PWA 29914	Angle Cutter
PWA 49065	Template (Optional)
PWA 75431	Marking Template
PWA 75432	Radius Cutter (For PN 52A121, 52A121-001 Blades)
PWA 86054	Handle, Edge Scraper (For PN 53A321, 53A321-001, 56A511, 56A821, 52A121-003, 52A121-002, 54A821, 56A621 Blades)
PWA 86055	Insert, Edge Scraper (For PN 56A621, 53A321-001, 52A121-002, 52A121-003 Blades)
PWA 101157	Insert, Edge Scraper (For 52A121-002, 52A121-003, 53A321-001, 56A821, 56A621

Special Tools:

(CONTINUED)

	Blades)
PWA 101801	Marking Template (For 56A621 Blades)

Consumable Materials:

Item No.	Designation
P05−062	Cloth, Emery #400 grit
P05−252	Pad, Scotch Brite (Very Fine, Type A)
P06−003	Compound, Antigalling (PWA 586) (Fel−Pro C−200)
P06−005	Lubricant (PWA 587)(G−N Metal Assembly Paste)

C. Procedure
See Figure 901 or Figure 902.

Subtask 72−00−31−350−051:

WARNING: TO AVOID POSSIBILITY OF INJURY TO HANDS, GLOVES SHOULD BE WORN WHEN HANDLING BLADES AND USING TOOLS.

CAUTION: USE OF POWER TOOLS OR GRINDING IS NOT PERMITTED.

(1) Clean the blade with a Scotch Brite Pad P05−252 and water. Pay special attention to the leading edge and the first few inches (76.2 mm) of the convex side of the blade.

Subtask 72−00−31−220−051:

(2) Visually inspect blade root attachment surface for galling, pits and depressions.

(3) Blades that have heavy galling wear adjacent to fillet radius, sharp pits and sharp depressions are unacceptable. These blades must be repaired. Refer to the PW4000 Series CIR, PN 51A357, 72−31−82, Repair−05 (Task 72−31−82−300−005).

(4) Check each blade leading edge with PWA 29836 Sighting Template and PWA 29646 Thickness Gage to assure that sufficient material exists to incorporate new leading edge configuration.

NOTE: Thinning or dressing can be accomplished with hand held scraping tools, files and abrasive paper or cloth.

Subtask 72−00−31−350−052:

(5) Clean and paint both sides of the blade leading edge with non−etching, non−corrosive ink, or equivalent coating fluid in preparation for marking work area.

CAUTION: DO NOT USE AN AWL OR METAL SCRIBER WHEN MARKING LOCATIONS ON BLADE, IT CAN LEAVE A STRESS RISER ON BLADE. USE A SHARPENED PIECE OF HARD PLASTIC OR OTHER NON−METALLIC MATERIAL.

(6) With PWA 75431 Marking Template (for PN 52A121 and 52A121−001 blades), scribe a line on the blade to mark the blades transition zones.

(7) Apply masking tape aft of blade leading edge to protect the blade during rework.

(8) Install blade in a Wilton Tool Company Vise 3013 or equivalent soft−jaw vise that will permit blade to be correctly positioned during repair.

(9) Machine the blade leading edge as shown in the referenced figure for the entire length of the blade. Remove material as necessary with PWA 29914 Cutter to form the 10 degree angle. To form the blade leading edge radius, use PWA 75432 Cutter (for PN 52A121 and 52A121−001 blades) or PWA 86054 Handle with PWA 86055 Scraper (for PN 53A321−001, 52A121−002, 53A121−003, 56A821 and 56A621 blades). Hand held scrapping tools, files and abrasive paper or cloth can be used but material removal must be uniform along leading edge.

(10) Do not remove more material than necessary and limit removal to 0.100 inch (2.540 mm) maximum.

NOTE: A tapered cut, starting at tip and extending to blade root fillet is optional.

(a) If necessary, after material has been removed, use the optional PWA 49065 Template to check the blade chord length. The minimum chord length at each section of blade as specified in Figure 903 or 904 as applicable must be maintained.

Subtask 72−00−31−320−003−001:

(11) Polish repair area to remove scratches and machine marks. Refer to SPOP 532 in the Standard Practices Manual, PN 585005.

Subtask 72−00−31−300−003:

(12) See Maintenance Advisory Notice No. MAN−PW4000−2−91 for airfoil bead peen requirements.

(a) If not beyond the limits specified in the MAN, bead peen is not required.

(b) If beyond the limits specified in the MAN, bead peen is required. Refer to the PW4000 Series CIR, PN 51A357, 72−31−82, Repair−03 (Task 72−31−82−300−003).

Subtask 72−00−31−300−007:

(13) See Maintenance Advisory Notice No. MAN−PW4000−2−91 for blade root shotpeen requirements.

(a) If not beyond the limits specified in the MAN, blade root shotpeen is not required.

(b) If beyond the limits specified in the MAN, blade root shotpeen is required. Refer to the PW4000 Series CIR, PN 51A357, 72−31−82, Repair−07 (Task 72−31−82−300−007).

Subtask 72−00−31−300−006:

(14) See Maintenance Advisory Notice No. MAN−PW4000−2−91 for blade root antigallant compound requirements.

(a) If not beyond the limits specified in the MAN, you can lubricate the blade root with Antigalling Compound P06−003.

(b) If beyond the limits specified in the MAN, you must replace the blade root antigalling compound. Refer to the PW4000 Series CIR, PN 51A357, 72−31−82, Repair−06 (Task 72−31−82−300−006).

Subtask 72−00−31−350−053:

(15) Lubricate each shroud hardface contact surface with Lubricant P06−005.

Subtask 72−00−31−300−008:

(16) If necessary, install new blade platform seal. Refer to the PW4000 Series CIR, PN 51A357 72−31−82, Repair−08 (Task 72−31−82−300−008).

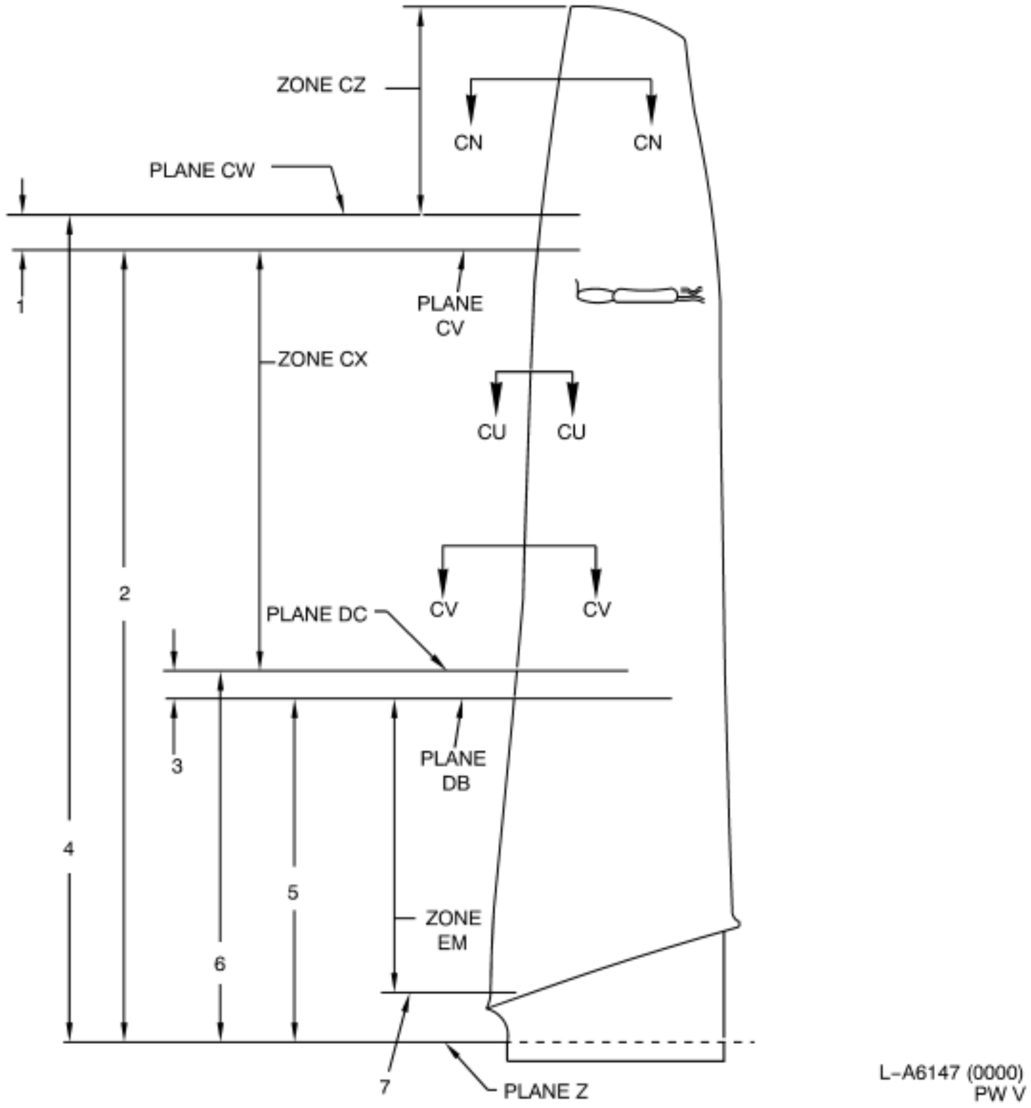
Subtask 72−00−31−220−052:

(17) Measure depth of cut made in leading edge.

(18) Use the vibropeen marking method to record the depth of cut on the blade platform.

D. Postrequisites

(1) Install all fan blade assemblies. Refer to Installation−04 (Task 72−00−31−420−002−002).


ZONE CZ
CN
CN
PLANE CW
1
PLANE CV
ZONE CX
CU
CU
2
CV
CV
PLANE DC
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PLANE DB
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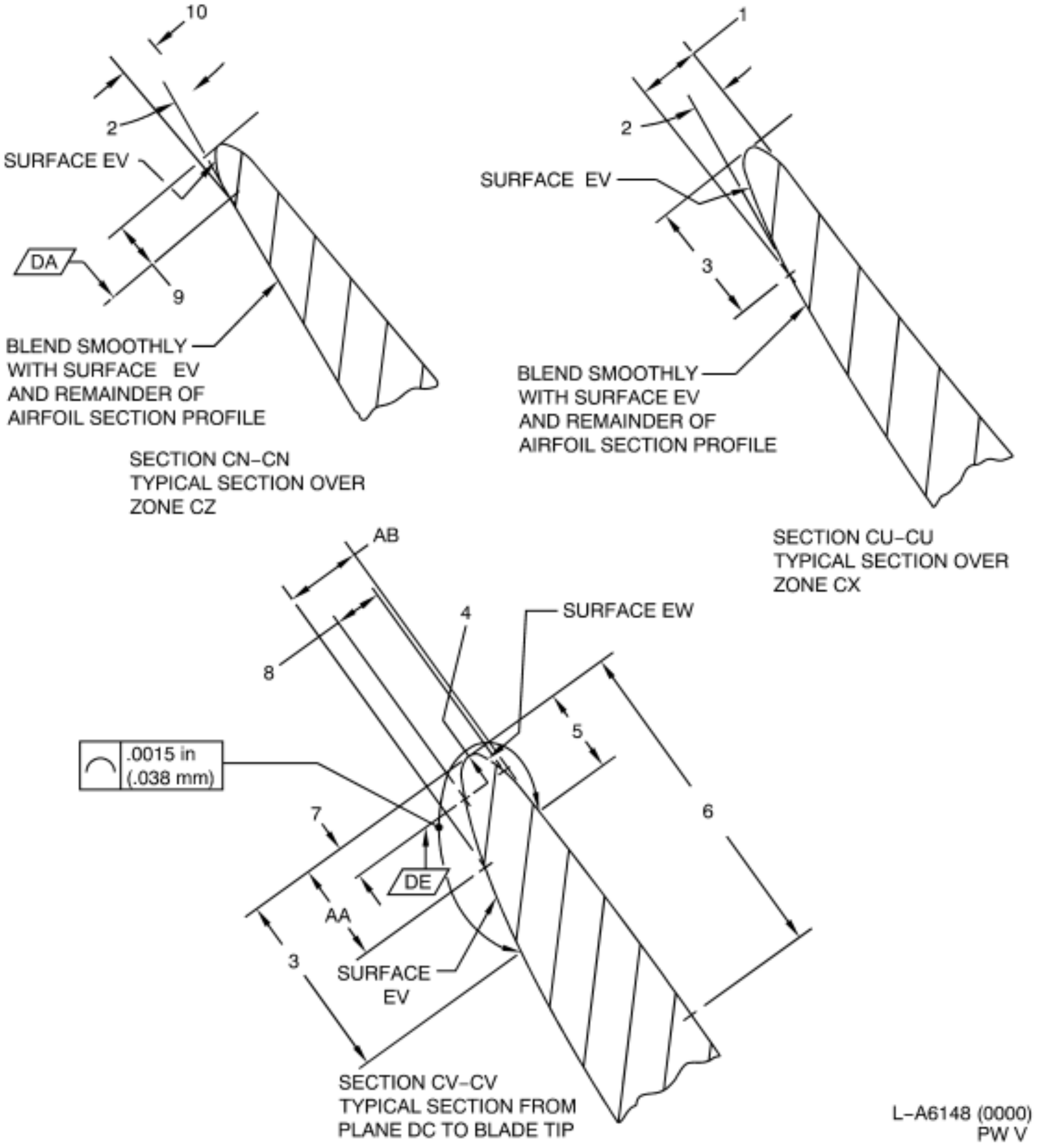
6
ZONE EM
7
PLANE Z
L−A6147 (0000)
PW V

Leading Edge Contour Repair (For PN 56A621, 56A821,
53A321−001, 52A121−002 and 52A121−003 Blades)
Figure 901 (Sheet 1)
(Task 72−00−31−300−001)

ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC) − REPAIR−01

1. Make Smooth Between Zones CZ And CX Within Index 1. Minimum Thickness Within Index 1 Is Not To Be Less Than The Actual Thickness Of Leading Edge At Location DA Of Adjacent Zone Above Plane CW.
2. 23.465 − 23.715 Inches (596.0 − 602.4 mm)
3. Make Smooth Between Zones CX And EM Within Index 3. Minimum Thickness Within Index 3 Is Not To Be Less Than The Actual Thickness Of Leading Edge At Location DE Of Adjacent Zone Above Plane DC.
4. 24.215 − 24.465 Inches (615.1 − 621.4 mm)
5. 7.812 − 8.062 Inches (198.4 − 204.8 mm)
6. 8.562 − 8.812 Inches (217.5 − 223.8 mm)
7. Tangent Of Platform Root Fillet Radius

Key to Figure 901 (Sheet 1)


10
2
SURFACE EV
DA
9
BLEND SMOOTHLY WITH SURFACE EV AND REMAINDER OF AIRFOIL SECTION PROFILE
SECTION CN−CN
TYPICAL SECTION OVER ZONE CZ
1
2
SURFACE EV
3
BLEND SMOOTHLY WITH SURFACE EV AND REMAINDER OF AIRFOIL SECTION PROFILE
SECTION CU−CU
TYPICAL SECTION OVER ZONE CX
AB
4
SURFACE EW
8
5
.0015 in
(.038 mm)
6
7
DE
AA
3
SURFACE EV
SECTION CV−CV
TYPICAL SECTION FROM PLANE DC TO BLADE TIP
L−A6148 (0000)
PW V

Leading Edge Contour Repair (For PN 56A621, 56A821, 53A321−001, 52A121−002 and 52A121−003 Blades)
Figure 901 (Sheet 2)
(Task 72−00−31−300−001)

ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC) − REPAIR−01

1. 0.041 − 0.047 Inch (1.042 − 1.193 mm) (Chamfer If necessary To Maintain This Dimension From Plane CV To Plane DC).
2. 8° − 12°
3. 0.086 Inch (2.184 mm)
4. 0.007 Inch (0.178 mm) Radius
5. 0.040 Inch (1.016 mm)
6. 0.750 Inch (19.050 mm)
7. 0.015 Inch (0.381 mm)
8. 0.020 − 0.026 Inch (0.508 − 0.660 mm)
9. 0.032 Inch (0.813 mm)
10. 0.025 − 0.031 Inch (0.635 − 0.787 mm)

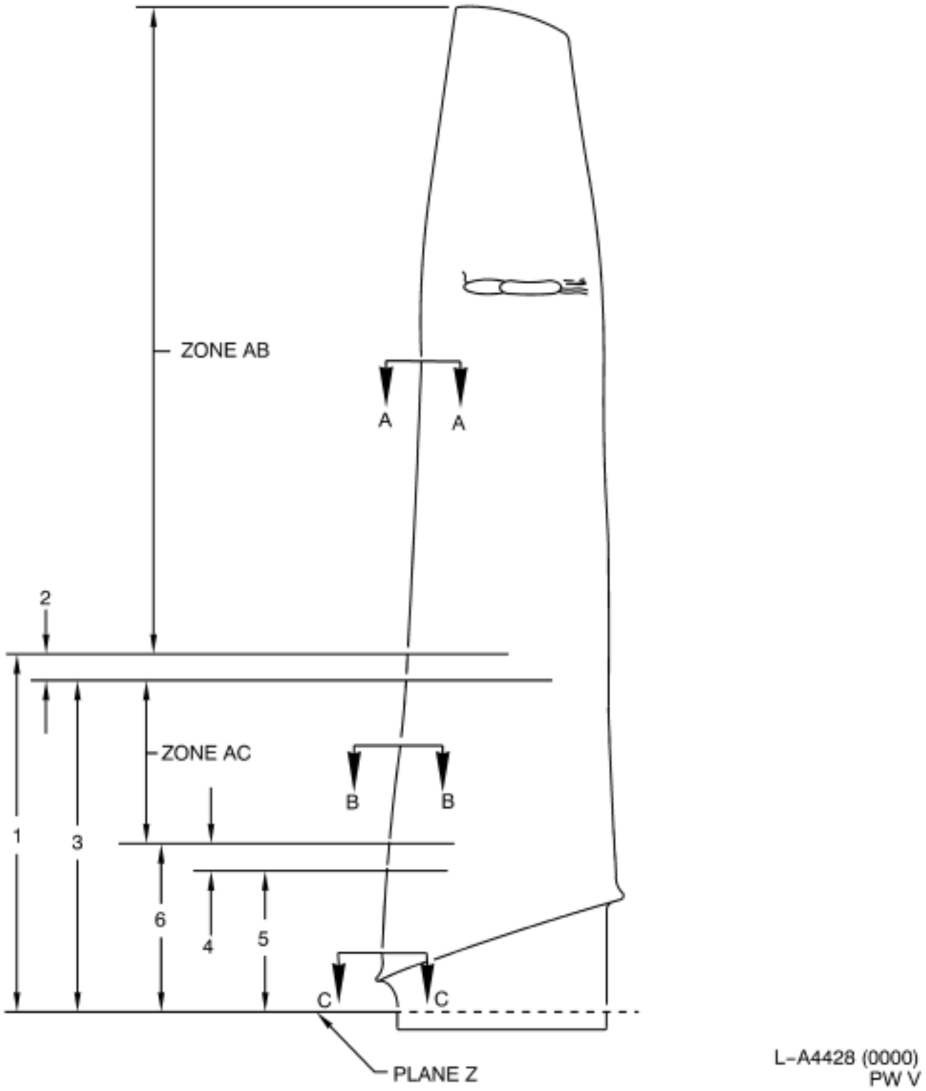
Key to Figure 901 (Sheet 2)

SURFACE EV	
AA	AB
0.0021 in. (0.053 mm)	0.0162 in (0.411 mm)
0.0074 in (0.188 mm)	0.0202 in (0.513 mm)
0.0168 in (0.427 mm)	0.0251 in (0.638 mm)
0.0263 in (0.688 mm)	0.0290 in (0.737 mm)
0.0359 in (0.912 mm)	0.0323 in (0.820 mm)
0.0456 in (1.158 mm)	0.0352 in (0.894 mm)
0.0553 in (1.405 mm)	0.0378 in (0.960 mm)
0.0651 in (1.654 mm)	0.0401 in (1.019 mm)
0.0749 in (1.902 mm)	0.0422 in (1.072 mm)
0.0862 in (2.189 mm)	0.0443 in (1.125 mm)

SURFACE EW	
AA	AB
0.0039 in (0.099 mm)	0.0048 in (0.122 mm)
0.0102 in (0.259 mm)	0.0027 in (0.069 mm)
0.0206 in (0.523 mm)	0.0009 in (0.023 mm)
0.0309 in (0.785 mm)	0.0002 in (0.0051 mm)
0.0397 in (1.008 mm)	0.0000 in (0.0000 mm)

L−A6149 (0000)
PW V

Leading Edge Contour Repair (For PN 56A621, 56A821,
53A321−001, 52A121−002 and 52A121−003 Blades)
Figure 901 (Sheet 3)
(Task 72−00−31−300−001)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A
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ZONE AC
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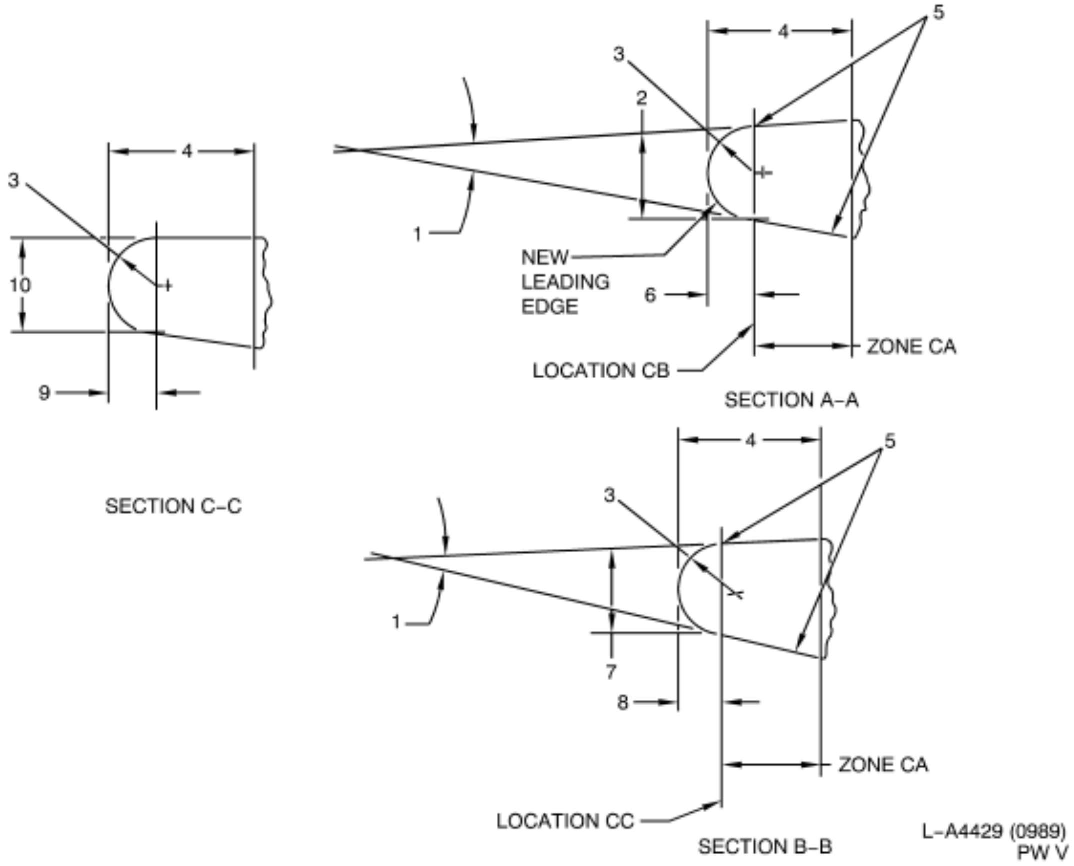
C
C
PLANE Z
L−A4428 (0000)
PW V

Leading Edge Contour Repair (For PN 52A121 and 52A121−001 Blades)
Figure 902 (Sheet 1)
(Task 72−00−31−300−001)

ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC) − REPAIR−01

1. 10.545 − 10.795 Inches (267.8 − 274.2 mm)
2. Transition In This Area Must Be Blended Smoothly. Minimum Thickness In This Area Is Not To Be Less Than The Actual Thickness Of Leading Edge At Location CB In Zone AB.
3. 9.795 − 10.045 Inches (248.8 − 255.1 mm)
4. Transition In This Area Must Be Blended Smoothly. Minimum Thickness In This Area Is Not To Be Less Than The Actual Thickness Of Leading Edge At Location CC In Zone AC.
5. 4.100 − 4.350 Inches (104.1 − 110.5 mm)
6. 4.850 − 5.100 Inches (123.2 − 129.5 mm)

Key to Figure 902 (Sheet 1)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10
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SECTION C−C
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NEW LEADING EDGE
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LOCATION CB
ZONE CA
SECTION A−A
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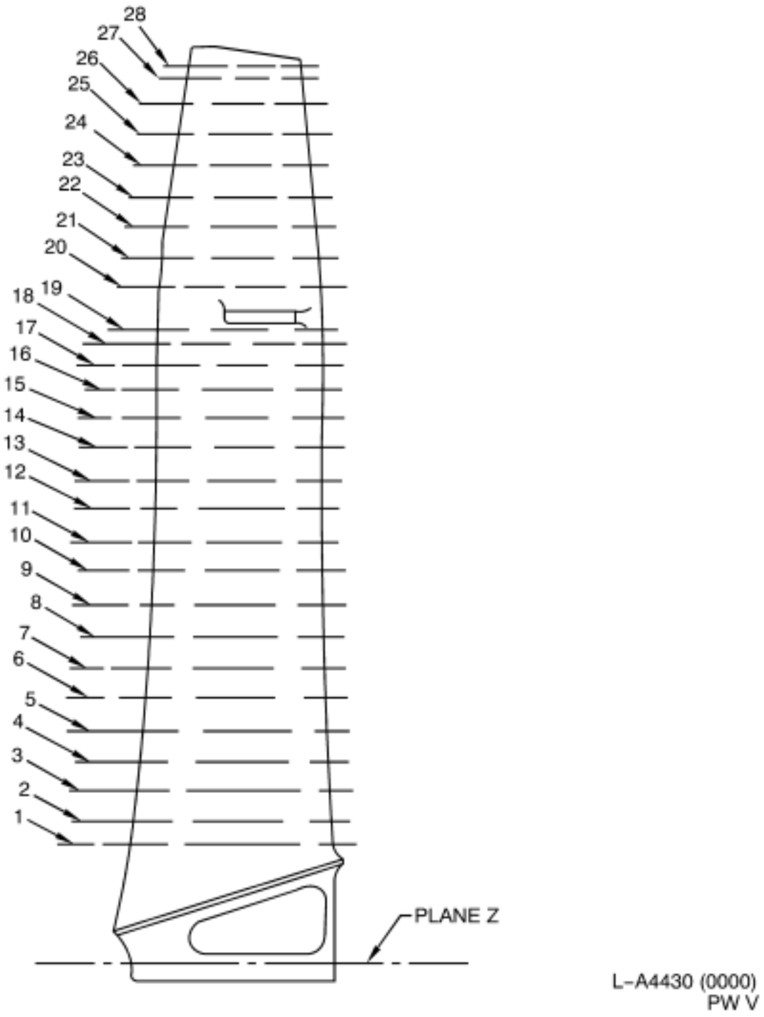
5
3
1
7
8
ZONE CA
LOCATION CC
SECTION B−B
L−A4429 (0989)
PW V

Leading Edge Contour Repair (For PN 52A121 and 52A121−001 Blades)
Figure 902 (Sheet 2)
(Task 72−00−31−300−001)

ENGINE GENERAL − LOW PRESSURE COMPRESSOR (LPC) − REPAIR−01

2. 8° − 12°
2. 0.022 − 0.028 Inch (0.559 − 0.711 mm)
3. This Radius Must Be Blended Smoothly With Remainder Of Airfoil Contour.
4. 0.380 Inch (9.652 mm) Maximum
5. Blend Smoothly Within Remainder Of Airfoil Section. Profile Thickness In Zone CA Must Not Be Less Than Thickness Measured At Locations CB or CC As Applicable.
6. 0.013 Inch (0.330 mm), Measure Thickness At This Dimension.
7. 0.033 − 0.039 Inch (0.838 − 0.991 mm)
8. 0.018 Inch (0.457 mm), Measure Thickness At This Dimension
9. 0.0165 Inch (0.419 mm), Measure Thickness At This Location.
10. 0.033 Inch (0.838 mm), Minimum Thickness

Key to Figure 902 (Sheet 2)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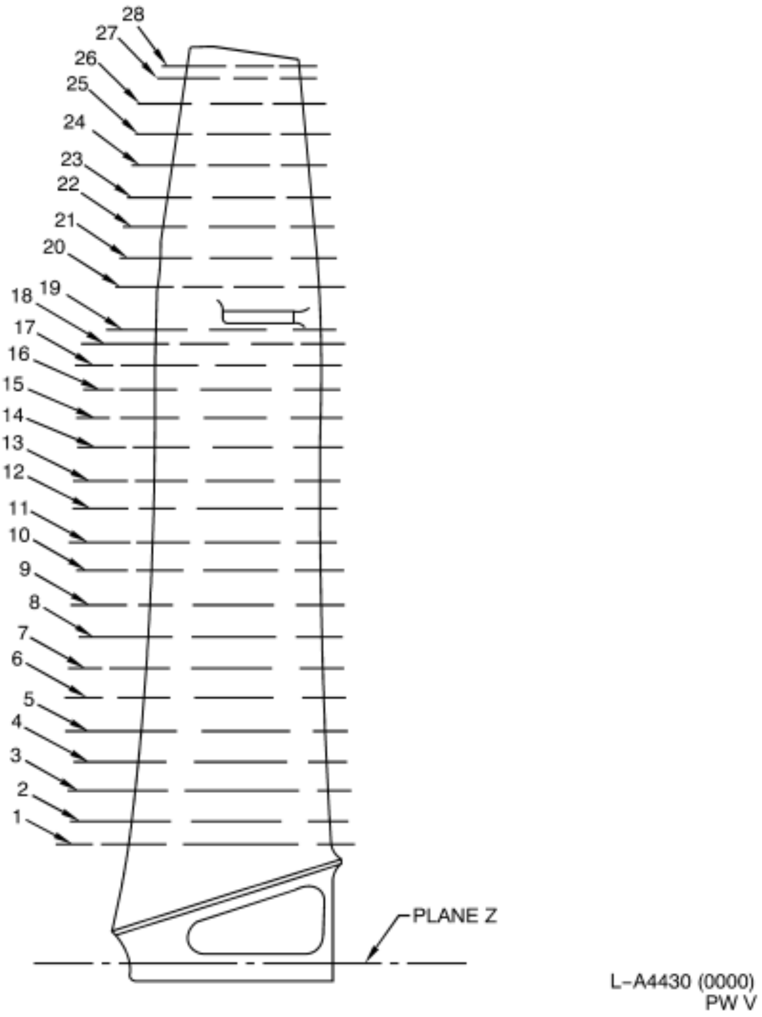
PLANE Z
L−A4430 (0000)
PW V

Minimum Fan Blade Chord Length (PN 52A121,
52A121−001, 52A121−002 and 52A121−003 Blades)
Figure 903
(Task 72−00−31−300−001)

Dimensions For PN 52A121, 52A121−001, 52A121−002
and 52A121−003 Blades

	Dimension From Plane Z	Minimum Chord Dimension
1.	4.009 Inches (101.829 mm)	6.999 Inches (177.775 mm)
2.	4.669 Inches (118.593 mm)	7.013 Inches (178.130 mm)
3.	5.669 Inches (143.993 mm)	7.028 Inches (178.511 mm)
4.	6.669 Inches (169.393 mm)	7.080 Inches (179.832 mm)
5.	7.669 Inches (194.793 mm)	7.159 Inches (181.839 mm)
6.	8.669 Inches (220.193 mm)	7.233 Inches (183.718 mm)
7.	9.669 Inches (245.593 mm)	7.296 Inches (185.318 mm)
8.	10.669 Inches (270.993 mm)	7.367 Inches (187.122 mm)
9.	11.669 Inches (296.393 mm)	7.455 Inches (189.357 mm)
10.	12.669 Inches (321.793 mm)	7.555 Inches (191.897 mm)
11.	13.669 Inches (347.193 mm)	7.657 Inches (194.488 mm)
12.	14.669 Inches (372.593 mm)	7.746 Inches (196.748 mm)
13.	15.669 Inches (397.993 mm)	7.836 Inches (199.034 mm)
14.	16.669 Inches (423.393 mm)	7.933 Inches (201.498 mm)
15.	17.669 Inches (448.793 mm)	8.028 Inches (203.911 mm)
16.	18.669 Inches (474.193 mm)	8.124 Inches (206.350 mm)
17.	19.669 Inches (499.593 mm)	8.230 Inches (209.042 mm)
18.	20.289 Inches (515.341 mm)	8.297 Inches (210.744 mm)
19.	20.809 Inches (528.549 mm)	8.346 Inches (211.988 mm)
20.	22.249 Inches (565.125 mm)	8.529 Inches (216.637 mm)
21.	22.719 Inches (577.063 mm)	8.599 Inches (218.415 mm)
22.	22.469 Inches (570.713 mm)	8.714 Inches (221.336 mm)
23.	24.469 Inches (621.513 mm)	8.876 Inches (225.450 mm)
24.	25.469 Inches (646.913 mm)	9.048 Inches (229.819 mm)
25.	26.469 Inches (672.313 mm)	9.188 Inches (233.375 mm)
26.	27.469 Inches (697.713 mm)	9.342 Inches (237.287 mm)
27.	28.469 Inches (723.113 mm)	9.503 Inches (241.376 mm)
28.	29.189 Inches (741.401 mm)	9.628 Inches (244.551 mm)

Key to Figure 903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PLANE Z
L−A4430 (0000)
PW V

Minimum Fan Blade Chord Length (PN 56A821 and 53A321−001 Blades)
Figure 904
(Task 72−00−31−300−001)

Dimensions For PN 56A821 and 53A321−001 Blades

	Dimension From Plane Z	Minimum Chord Dimension
1.	4.009 Inches (101.829 mm)	6.994 Inches (177.648 mm)
2.	4.669 Inches (118.593 mm)	7.008 Inches (178.003 mm)
3.	5.669 Inches (143.993 mm)	7.023 Inches (178.384 mm)
4.	6.669 Inches (169.393 mm)	7.075 Inches (179.705 mm)
5.	7.669 Inches (194.793 mm)	7.154 Inches (181.712 mm)
6.	8.669 Inches (220.193 mm)	7.228 Inches (183.591 mm)
7.	9.669 Inches (245.593 mm)	7.291 Inches (185.191 mm)
8.	10.669 Inches (270.993 mm)	7.362 Inches (186.995 mm)
9.	11.669 Inches (296.393 mm)	7.450 Inches (189.230 mm)
10.	12.669 Inches (321.793 mm)	7.550 Inches (191.770 mm)
11.	13.669 Inches (347.193 mm)	7.652 Inches (194.361 mm)
12.	14.669 Inches (372.593 mm)	7.740 Inches (196.596 mm)
13.	15.669 Inches (397.993 mm)	7.831 Inches (198.907 mm)
14.	16.669 Inches (423.393 mm)	7.928 Inches (201.371 mm)
15.	17.669 Inches (448.793 mm)	8.023 Inches (203.784 mm)
16.	18.669 Inches (474.193 mm)	8.119 Inches (206.223 mm)
17.	19.669 Inches (499.593 mm)	8.225 Inches (208.915 mm)
18.	20.289 Inches (515.341 mm)	8.292 Inches (210.617 mm)
19.	20.809 Inches (528.549 mm)	8.338 Inches (211.785 mm)
20.	22.249 Inches (565.125 mm)	8.524 Inches (216.510 mm)
21.	22.719 Inches (577.063 mm)	8.594 Inches (218.288 mm)
22.	22.469 Inches (570.713 mm)	8.664 Inches (220.066 mm)
23.	24.469 Inches (621.513 mm)	8.826 Inches (224.180 mm)
24.	25.469 Inches (646.913 mm)	8.998 Inches (228.549 mm)
25.	26.469 Inches (672.313 mm)	9.188 Inches (233.375 mm)
26.	27.469 Inches (697.713 mm)	9.292 Inches (236.017 mm)
27.	28.469 Inches (723.113 mm)	9.453 Inches (240.106 mm)
28.	29.189 Inches (741.401 mm)	9.578 Inches (243.281 mm)

Key to Figure 904

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72−00−32

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	HIGHLIGHTS
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72−00−32	ENGINE GENERAL − LPC/LPT COUPLING − REMOVAL−02 • 72−00−32−020−001−002: Remove The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed) (Hydraulic Wrench) − Deleted
72−00−32	ENGINE GENERAL − LPC/LPT COUPLING − REMOVAL−03 • 72−00−32−030−001: Remove The No. 1.5 Bearing And Seal Seat
72−00−32	ENGINE GENERAL − LPC/LPT COUPLING − REMOVAL−04 • 72−00−32−030−001−002: Remove The No. 1.5 Bearing And Seal Seat (Hydraulic Method) − Deleted
72−00−32	ENGINE GENERAL − LPC/LPT COUPLING − REMOVAL−05 • 72−00−32−020−005: Remove The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Removed)
72−00−32	ENGINE GENERAL − LPC/LPT COUPLING − REMOVAL−06 • 72−00−32−020−005−002: Remove The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Removed) (Hydraulic Wrench) − Deleted
72−00−32	ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−01 • 72−00−32−420−001: Install LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed)
72−00−32	ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−02 • 72−00−32−420−001−002: Install The LPC/LPT Coupling (Front Compressor Drive Turbine Shaft Installed (Hydraulic Wrench) − Deleted
72−00−32	ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−03 • 72−00−32−430−001: Install No. 1.5 Bearing And Seal
72−00−32	ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−04

	• 72−00−32−430−001−002: Install The No. 1.5 Bearing And Seal (Hydraulic Method) − Deleted
72−00−32	ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−05 • 72−00−32−420−005: Install The LPT/LPC Coupling (With The Front Compressor Drive Turbine Shaft Removed)
72−00−32	ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−06 • 72−00−32−420−005−002: Install The LPT/LPC Coupling (With The Front Compressor Drive Turbine Shaft Removed) (Hydraulic Wrench) − Deleted
72−00−32	ENGINE GENERAL − LPC/LPT COUPLING − INSPECTION/CHECK−01 • 72−00−32−990−001: Specific Fits And Clearances
72−00−32	ENGINE GENERAL − LPC/LPT COUPLING − TESTING−01 • 72−00−32−790−001: Do A Vacuum Check Of The No. 1, 1.5, And 2 Bearing Compartments

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LPC/LPT COUPLING - REMOVAL-01

Task 72-00-32-020-001:

1. Remove The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed)

NOTE: See Figure 301 for Part/Assembly Removal Procedure Sequence.

A. Prerequisites

(1) Remove The Electronic Engine Control (EEC) Speed Transducer (N1). Refer to 72-00-34, Removal-03 (Task 72-00-34-050-001).

(2) Remove The Compressor Inlet Cone. Refer to 72-00-31, Removal-02 (Task 72-00-31-020-001).

(3) Remove All Stage 1 LPC Blade Assemblies. Refer to 72-00-31, Removal-04 (Task 72-00-31-020-002-002).

NOTE: Coupling may be removed with fan blades installed provided no further disassembly is anticipated. However, six (6) shims must be placed between lower fan blade tips and fan case rubstrip to support LPC rotor.

B. Equipment And Materials Necessary

Standard Tools:
.190-32 Jackscrews, Eight Necessary Per Text

Special Tools:

PWA 3755	Hydraulic Pump (Optional To PWA 29389)
PWA 18872	Wrench, Hydraulic*
PWA 25000	Wrench, Hydraulic*
PWA 28668	Pump, Hydraulic (Use With Hydraulic Wrench)
PWA 28669	Cart (Optional) (Use With Hydraulic Wrench)
PWA 28814	Pump, Hydraulic* (Use With Hydraulic Wrench)
PWA 29389	Hydraulic Pump
PWA 29510	Pump, Hydraulic (Hand) (Use With Hydraulic Wrench)
PWA 29614	Wrench, Mechanical*
PWA 29615	Holder (Use With Mechanical Wrench)
PWA 33732	Wrench, Hydraulic*
PWA 45418	Wrench, Mechanical*
PWA 45419	Air Torque Multiplier* (Use With Mechanical Wrench)

ENGINE GENERAL − LPC/LPT COUPLING − REMOVAL−01

Special Tools:

(CONTINUED)

PWA 75046	Cart, Storage* (Optional) (Use With Hydraulic Wrench)
PWA 80070	Wrench, Hydraulic*
PWA 80071	Multiplier, Torque* (Use With Mechanical Wrench)
PWA 80187	Wrench, Mechanical*
PWA 80651	Multiplier, Pneumatic* (Use With Mechanical Wrench)
PWA 85298	Puller, Jackscrew
PWA 85299	Adapter, Wrench* (Use With Mechanical Wrench)
PWA 85300	Wrench, Torque*
PWA 85301	Adapter, Holding (Use With Mechanical Wrench)
PWA 85302	Wrench, Torque (Use With Mechanical Wrench)
PWA 85306	Puller, Knocker
PWA 85307	Puller, Jackscrew
PWA 85507	Adapter, Holding (Use With Hydraulic Wrench)
PWA 85508	Wrench, Torque (Use With Hydraulic Wrench)
PWA 85514	Wrench, Torque* (Use With Hydraulic Wrench)
PWA 85515	Adapter, Holding* (Use With Hydraulic Wrench)
PWA 85769	Fixture, Install/Remove
PWA 86325	Fixture, Retainer (Optional To PWA 86437)
PWA 86437	Fixture, Retainer (Optional To PWA 88222)
PWA 86515	Protector, Plastic
PWA 86604	Stand, Transport
PWA 87354	Wrench, Hydraulic*
PWA 88222	Fixture, Retainer
PWA 102460	Adapter, Wrench* (Use With Mechanical And Hydraulic Wrench)

*Refer to Table 301 for the mechanical wrench tools or Table 302 for the hydraulic wrench tool as applicable. Tables 301 and 302 showthe correct combinations of tools for the removal of the turbine shaft nut.

C. Procedure

(1) Install PWA 86515 Protector in the ID of the front compressor hub assembly (called hub). The tabs of the protector snap in the bore of the hub.

(2) Remove the key washer retaining ring and retaining nut key washer that attach the turbine shaft plug at the front of the turbine shaft coupling assembly (called coupling). With PWA 85306 Puller, remove the plug and discard the packing. See Figure 302.

(3) For operators that use the mechanical wrench, remove the turbine shaft (coupling/retaining) nut (called nut) as follows.

NOTE: See the following step to remove the turbine shaft (coupling/retaining) nut with the optional Hydraulic Wrench.

(a) Install PWA 85301 Adapter in the coupling. See Figure 303.

1 Slide three "L" shaped clamps toward adapter centerline.

2 Place adapter into coupling against inner slotted flange until keys locate slots of coupling. Slide "L" clamps outward and secure.

(b) Install PWA 85302 Torque Wrench on the nut.

1 Slide wrench over adapter and index wrench to engage slots in the nut.

2 Slide clamps radially outward to engage grooves in nut. Install wrench so that wrench holes are at 3 and 9 o'clock locations.

3 Secure wrench in place using three clamps.

(c) With a hoist, lift PWA 29614 Mechanical Wrench. Install it on the torque wrench.

(d) Install PWA 29615 Holder on the mechanical wrench. As you install the holder, engage the pins on the mechanical wrench and the splines on the adapter.

(e) Install either PWA 80651 Pneumatic Multiplier or PWA 45419 Pneumatic Multiplier on the mechanical wrench.

(f) Loosen the nut. Remove the tools and the nut from the hub.

(4) For operators that use the Hydraulic Wrench, remove the turbine shaft (coupling/retaining) nut (called nut) as follows.

(a) Install PWA 85507 Adapter into coupling. See Figure 304.

1 Slide three wing nuts toward adapter centerline.

2 Place adapter into front end of coupling until keys locate slots of coupling. Slide clamps outward and secure.

(b) Install PWA 85508 Torque Wrench and PWA 25000 Hydraulic Wrench.

1 With a hoist, remove the hydraulic wrench from PWA 28669 Cart.

2 Attach torque wrench to the hydraulic wrench and install both as a unit over adapter using hoist and nylon strap.

3 Engage teeth of torque wrench with slots in nut. Align splines of adapter with splines in hydraulic wrench.

4 Attach either PWA 28668 Pump or PWA 29510 Pump to the hydraulic wrench. Loosen the nut.

(c) Remove tooling and nut from hub.

(5) Remove key washer retaining ring and key washer securing turbine shaft nut to LPC shaft. See Figure 302.

(6) For operators that use the mechanical wrench, remove the turbine shaft nut as follows. See Table 301 for the correct combinations of tools. Refer to Figure 305.

NOTE: See the following step to remove the turbine shaft nut with the optional Hydraulic Wrench.

PWA Torque Wrench	PWA Holder Adapter	PWA Mechanical Wrench or Torque Multiplier	PWA Pneumatic Multiplier
85300	102460 or 85299	80187	80651 or 45419
85300	102460 or 85299	45418	45419

Turbine Shaft Nut Removal Tools (Mechanical Wrench)
Table 301

(a) Install PWA 102460 Adapter or PWA 85299 Adapter into coupling.

1 Loosen wing nuts and slide three clamps radially inward.

2 Align keys in adapter with slots in coupling and install. Adjust adapter for mechanical wrench attachment at 3 and 9 o'clock location.

3 Slide three clamps radially outward to engage lugs of coupling. Tighten wing nuts to secure clamps.

(b) Install PWA 85300 Torque Wrench.

1 Install the torque wrench in the center of the adapter. Align the splines of the wrench with the splines of the nut. Push the wrench until it touches the face of the turbine shaft nut.

(c) With a hoist, lift a mechanical wrench. Refer to Table 301 for tool choices. Install the mechanical wrench on the torque wrench, splines engaged. Push the mechanical wrench to touch the face of the adapter. Engage the pins of the mechanical wrench with the holes in the torque wrench.

(d) Install a pneumatic multiplier on the mechanical wrench.

(e) Loosen the turbine shaft nut. Remove the tools, nut, and flat washer.

(7) For operators that use the Hydraulic Wrench, remove the turbine shaft nut (called nut) as follows. See Table 302 for the correct combinations of tools.

PWA Torque Wrench	PWA Holding Adapter	PWA Hydraulic Wrench	PWA Pump	PWA Cart
85514	85515	33732	28814 or 29510	75046
85514	85515	18872	28814 or 29510	75046
85300	102460 or 85299	87354	28814 or 29510	75046
85300	102460 or 85299	80070	28814 or 29510	75046

Turbine Shaft Nut Removal Tools (Hydraulic Wrench)
Table 302

(a) (Method 1) See Figure 306 (Sheet 1).

1 Attach PWA 85515 Adapter to a hydraulic wrench. Install the adapter/wrench in the coupling. Lock the detail clamps behind the lugs in the coupling.

2 Install PWA 85514 Torque Wrench in the adapter, engaging the splines of the wrench with the splines in the coupling and the hydraulic wrench.

3 Connect a pump to the hydraulic wrench.

4 Remove the tools, nut, and flat washer.

(b) (Method 2) See Figure 306 (Sheet 2).

1 Install PWA 102460 Adapter or PWA 85299 Adapter in the coupling, the detail keys in the slots of the coupling. With the three detail clamps to the rear of the slots in the coupling, tighten the clamps.

2 Install PWA 85300 Torque Wrench in the center of the adapter, engaging the splines of the nut.

3 Push the torque wrench until it touches the face of the nut.

4 With a hoist, lift a hydraulic wrench and install it on the torque wrench, engaging splines. Engage the pins of the hydraulic wrench in the holes of the adapter.

5 Connect a pump to the hydraulic wrench.

6 Remove the tools, nut, and flat washer.

(8) (Post SB PW4ENG 79−76) Remove No. 4 bearing (oil) pressure tube. See Figure 307.

NOTE: It is not necessary to remove the (Pre SB PW4ENG 79−76) No. 4 bearing (oil) pressure tube.

(a) Remove the No. 4 pressure tube (307/10) from the turbine exhaust case at the 4:30 o'clock position.

1 Remove two bolts (307/1) that attach the tube shield (307/16) and bracket (307/2) to the turbine exhaust case.

2 Remove the tube shield (307/16), bracket (307/2), thrust wire (307/18) and nut (307/17) from the outboard end of the pressure tube.

3 Remove the bolt (307/6) and nut (307/12) that attach the tube clamp (307/7) and tube to the bracket (307/8).

4 Cut the restraining straps (307/3) and remove the insulation slide clamp (307/13) and shield sets (307/9) and (307/4) from the tube.

5 Remove the tube nut from the adapter (307/14) and move the tube radially inward and remove the pressure tube from the case.

(b) Install a protective cover on the adapter (307/14).

(c) Secure bolts (307/5) and bracket (307/8) on the turbine exhaust case.

(9) Remove 30 bolts (308/6) securing No. 4 bearing shield (308/5) to turbine exhaust case (rear inner flange) (308/1). Remove shield. Remove No. 4 bearing heat shield (308/4). See Figure 308.

(10) Remove No. 4 bearing cover (308/3).

(a) For No. 4 bearing cover (308/3) that has six small threaded holes (Pre SB PW4ENG 72−385), install the PWA 85307 Jackscrew Puller to the rear inner bolt hole flange (Flange T1) of the exhaust case and attach with two bolts, washers and nut details. Install the small plate of the puller to the six threaded holes in the cover and attach with six knurled screw details. Turn the jackscrew to disengage the cover from the exhaust case. Remove the puller and the cover from the exhaust case. Remove the cover from the puller. Discard the packing (308/2).

(b) For cover that has eight jackscrew holes (Post SB PW4ENG 72−385), install and evenly tighten eight 0.190−32 Jackscrews to remove the cover. Discard the packing (308/2).

(11) (Pre SB PW4ENG 72−472) Remove the No. 4 bearing (oil) nozzle and No. 4 bearing packing transfer tube from boss in the exhaust case (No. 4 bearing compartment) at 1:30 o'clock position. See Figure 309.

(a) Remove bolts (309/8) and key washers (309/6) and (309/7) securing No. 4 bearing packing transfer tube (309/5) to No. 4 bearing nozzle (309/4). Remove tube.

(b) Remove bolts (309/1) and key washers (309/2) and (309/3) securing No. 4 bearing nozzle (309/4) to exhaust case. Remove nozzle.

(12) (Post SB PW4ENG 72−472) Remove the No. 4 bearing (oil) nozzle and front No. 4 bearing nozzle. See Figure 310.

(a) Remove the bolts and key washer (310/1) that attach the front No. 4 bearing nozzle to the No. 4 bearing support flange at the 12 o'clock position. Discard the key washer.

(b) Move the packing transfer tube (310/15) into the elbow of the No. 4 bearing damper supply tube (310/12). Remove the nozzle.

(c) Remove the packing transfer tube from the damper supply tube. Discard the two packings (310/14).

(d) Remove the bolts and key washers (310/16) and (310/17) that attach the No. 4 bearing damper supply tube (310/12) to the No. 4 bearing oil nozzle (310/11). Remove the tube.

(e) Remove the bolts and key washers (310/16) and (310/17) that attach the No. 4 bearing nozzle (310/11) to the exhaust case. Remove the nozzle.

(13) Remove the No. 4 bearing oil scavenge (inner) tube. See Figure 311.

(a) Remove Bolts (311/5 and 311/6) and key washers (311/4 and 311/7). Remove oil scavenge (inner) tube (311/8) from the turbine exhaust case.

(b) Remove and discard gasket (311/3).

(c) Cover hole in tube attachment pad on the case with a protective cover.

(14) Remove the eight bolts (312/1) that attach the No. 4 bearing retaining plate to the front compressor drive shaft (312/2). See Figure 312.

(15) Install PWA 86437 Fixture or PWA 86325 Fixture to attach the low pressure turbine shaft to the turbine exhaust case. See Figure 313 (Sheet 1).

NOTE: Use PWA 86325 Fixture with turbine exhaust cases that are (Pre SB PW4ENG 72−456). Use PWA 86437 Fixture with either (Pre or Post SB PW4ENG 72−456) turbine exhaust cases.

(a) Remove eight bolts securing No. 4 bearing retaining plate.

(b) Install inner slide (313/5) in ID of No. 4 bearing retaining plate and secure with eight detail screws (313/1).

(c) Install outer slide (313/4) over inner slide, locating slot in outer slide over key on inner slide.

(d) Rotate turbine shaft until scallops in flange of outer slide assembly align oil pressure and scavenge tubes protruding from exhaust case flange. Secure outer slide to exhaust case with eight detail bolts (313/2).

(e) Tighten eight cap screws (313/3).

(16) Install PWA 88222 Fixture or PWA 86437 Fixture to attach the low pressure turbine shaft to the turbine exhaust case. See Figure 313 (Sheet 2).

NOTE: Use PWA 88222 Fixture with (Pre or Post SB PW4ENG 72−456) turbine exhaust cases.

(a) Remove the eight bolts that attach the No. 4 bearing retaining plate.

(b) Loosen the locknuts that hold the tube and guide assemblies together and install the fixture to the ID of the turbine exhaust case. The tube assembly detail will mate against the No. 4 bearing retaining plate and the guide assembly detail will mate against the rear inner flange of the exhaust case. Attach the fixture with the captured capscrews of both details.

NOTE: If necessary, turn the LPT rotor to align the holes in the end of the 7th stage disk or LPT shaft, as applicable, with the captured capscrews of the tube assembly detail.

(c) Tighten the capscrews of both details to lock the fixture in position.

(17) Install PWA 85769 Fixture to remove the turbine shaft coupling assembly as follows. See Figure 314.

(a) Thread detail−35 shaft into LPT shaft until it bottoms on shoulder.

(b) Guide assembly of details −8 body, −9 adapter, −10 rod, −21 plate, −29 housing and −31 pin over installed detail−35.

(c) Retract spring loaded pin and rotate detail−21 to position lugs on plate behind lugs in front end of coupling. Release spring loaded pin to lock tooling.

(d) Thread detail−27 locator into front end of No. 1 hub until it bottoms out. Thread detail−15 backup nut assembly, handle end first onto threaded end of detail−35.

(e) Secure detail−7 cover to detail−27 with six bolts in locator. Be sure detail−15 nut does not contact detail−27 locator with detail−7 cover.

(f) Install the two detail−12 hydraulic rams over detail−10 threaded rods and secure with detail−11 nuts fingertight.

(g) Rotate detail−15 nut to contact detail−7 cover.

(h) Install detail−11 nut over detail−35 shaft assembly until it also contacts detail−7 cover.

(i) Attach hydraulic hose assembly and PWA 3755 Hydraulic Pump or PWA 29389 Hydraulic Pump to hydraulic rams. Actuate pump enough to disengage interference fit diameters of coupling. Release pressure.

(18) Remove hydraulics cover and backup nut. Secure detail−3 adapter to detail−9 adapter located at center of fixture with detail−4 bolts in adapter.

(19) With hoist, lift detail−1 arm and secure it to end of detail−9 adapter with detail−2 eye bolts.

(20) With slight tension on hoist, remove coupling from engine. Attach second hoist to eye bolt and trunnion coupling rear end down onto work bench. Remove tooling from coupling. Put the details of PWA 85769 Fixture on PWA 86604 Transport Stand. See Figure 315.

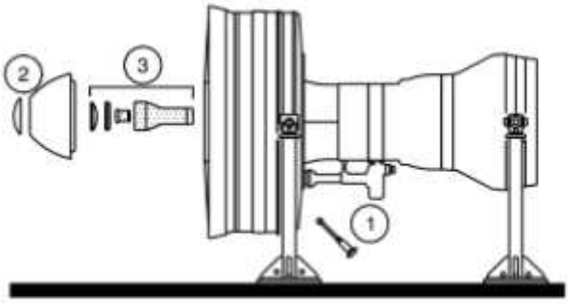
NOTE: Classified spacer will remain in LPT shaft. If spacer is to be removed use PWA 85298 Puller to remove spacer.

ENGINE GENERAL − LPC/LPT COUPLING − REMOVAL−01

D. Postrequisites

(1) Remove The No. 1.5 Bearing And Seal Seat. Refer to 72−00−32, Removal−03 (Task 72−00−32−030−001).

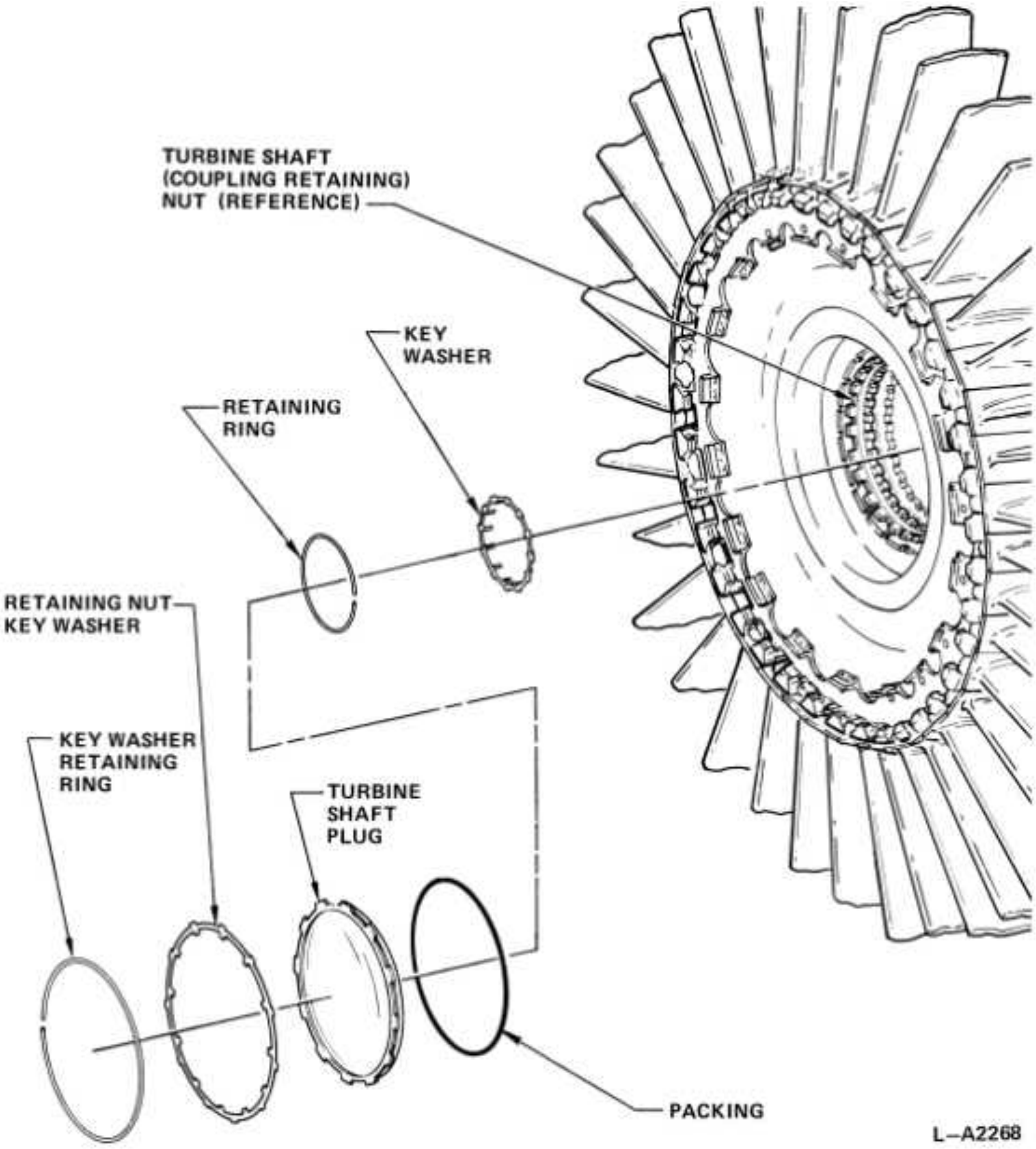
ENGINE GENERAL − LPC/LPT COUPLING − REMOVAL−01



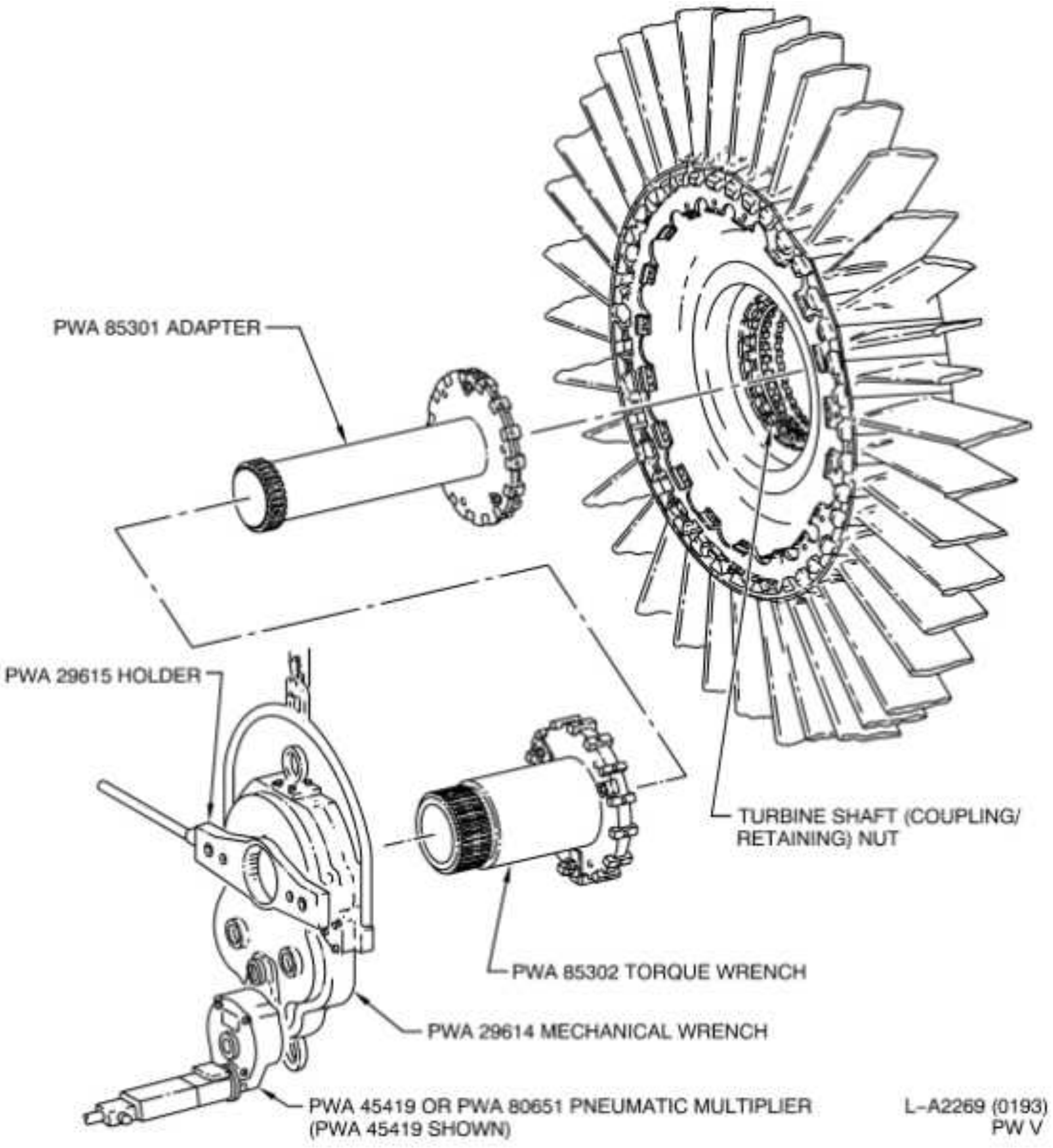
1. REMOVE ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
2. REMOVE COMPRESSOR INLET CONE.
3. REMOVE LPC/LPT COUPLING.

L-A0057 (0000)
PW V

Procedure Sequence
Figure 301
(Task 72−00−32−020−001)

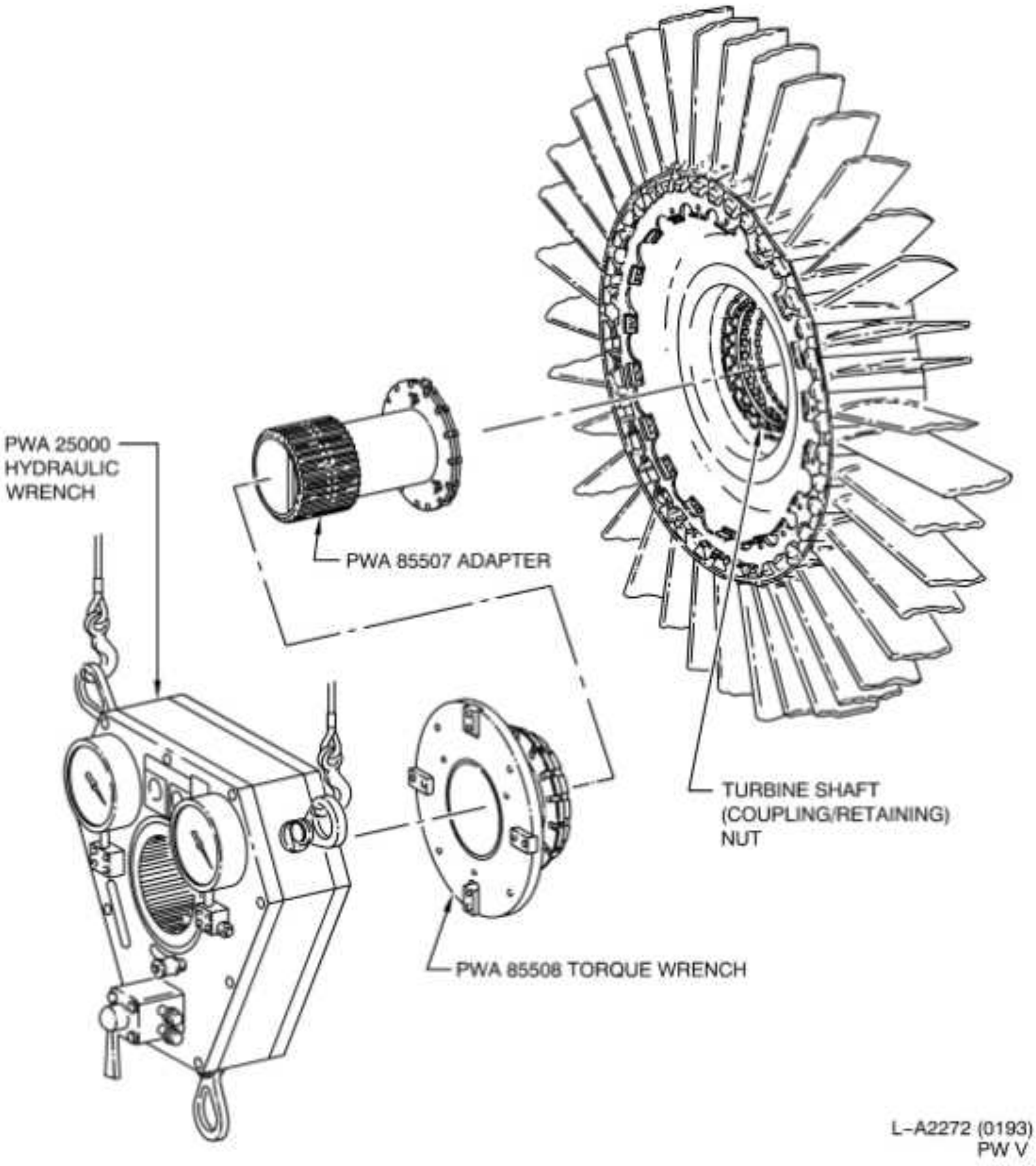

TURBINE SHAFT (COUPLING RETAINING) NUT (REFERENCE)
KEY WASHER
RETAINING RING
RETAINING NUT KEY WASHER
KEY WASHER RETAINING RING
TURBINE SHAFT PLUG
PACKING
L−A2268

Removal Of The Turbine Shaft Plug And Key Washers
Figure 302
(Task 72−00−32−020−001)

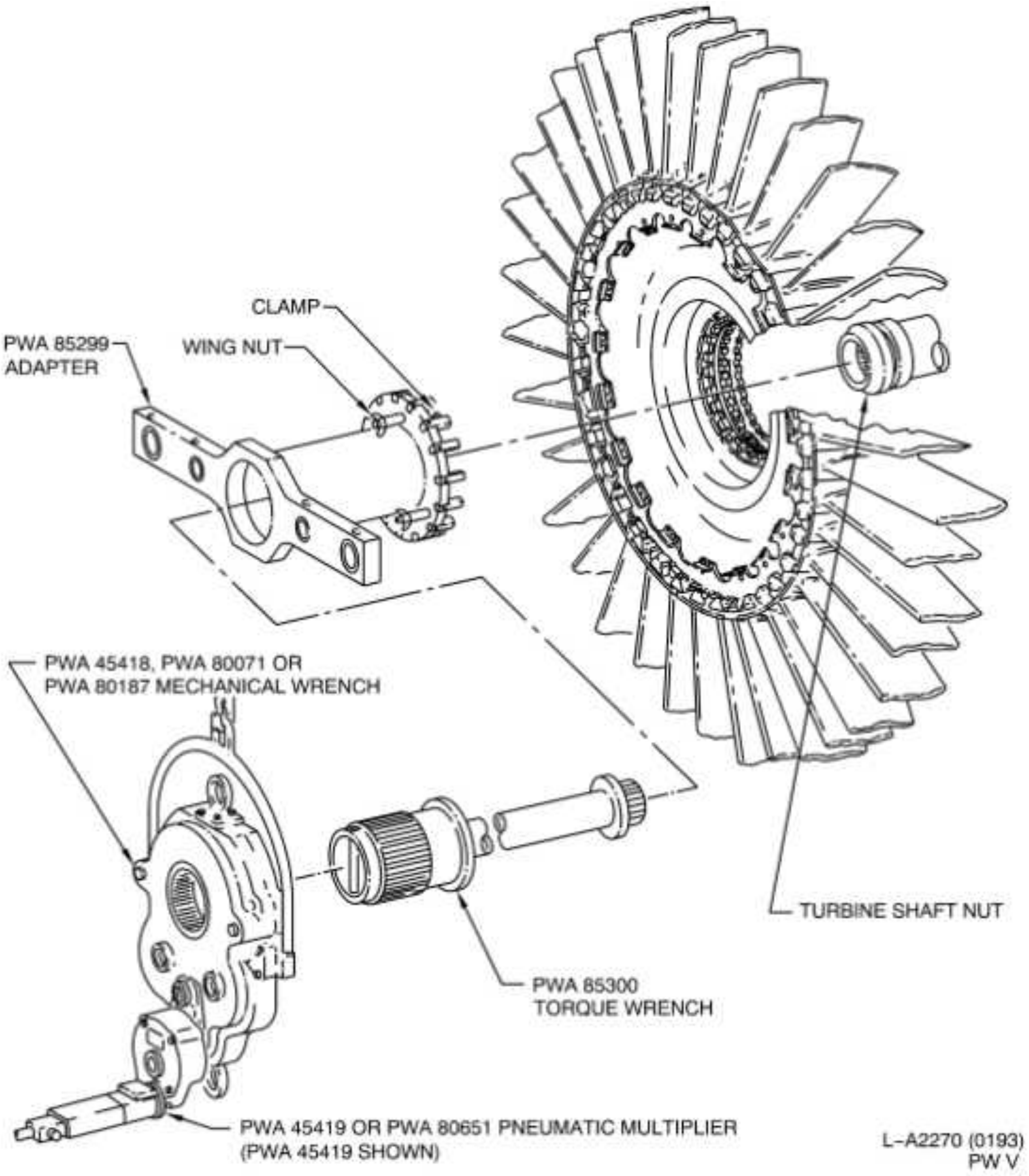

PWA 85301 ADAPTER
PWA 29615 HOLDER
TURBINE SHAFT (COUPLING/
RETAINING) NUT
PWA 85302 TORQUE WRENCH
PWA 29614 MECHANICAL WRENCH
PWA 45419 OR PWA 80651 PNEUMATIC MULTIPLIER
(PWA 45419 SHOWN)
L−A2269 (0193)
PW V

Removal Of The Turbine Shaft
(Coupling/Retaining) Nut (Mechanical Wrench)
Figure 303
(Task 72−00−32−020−001)

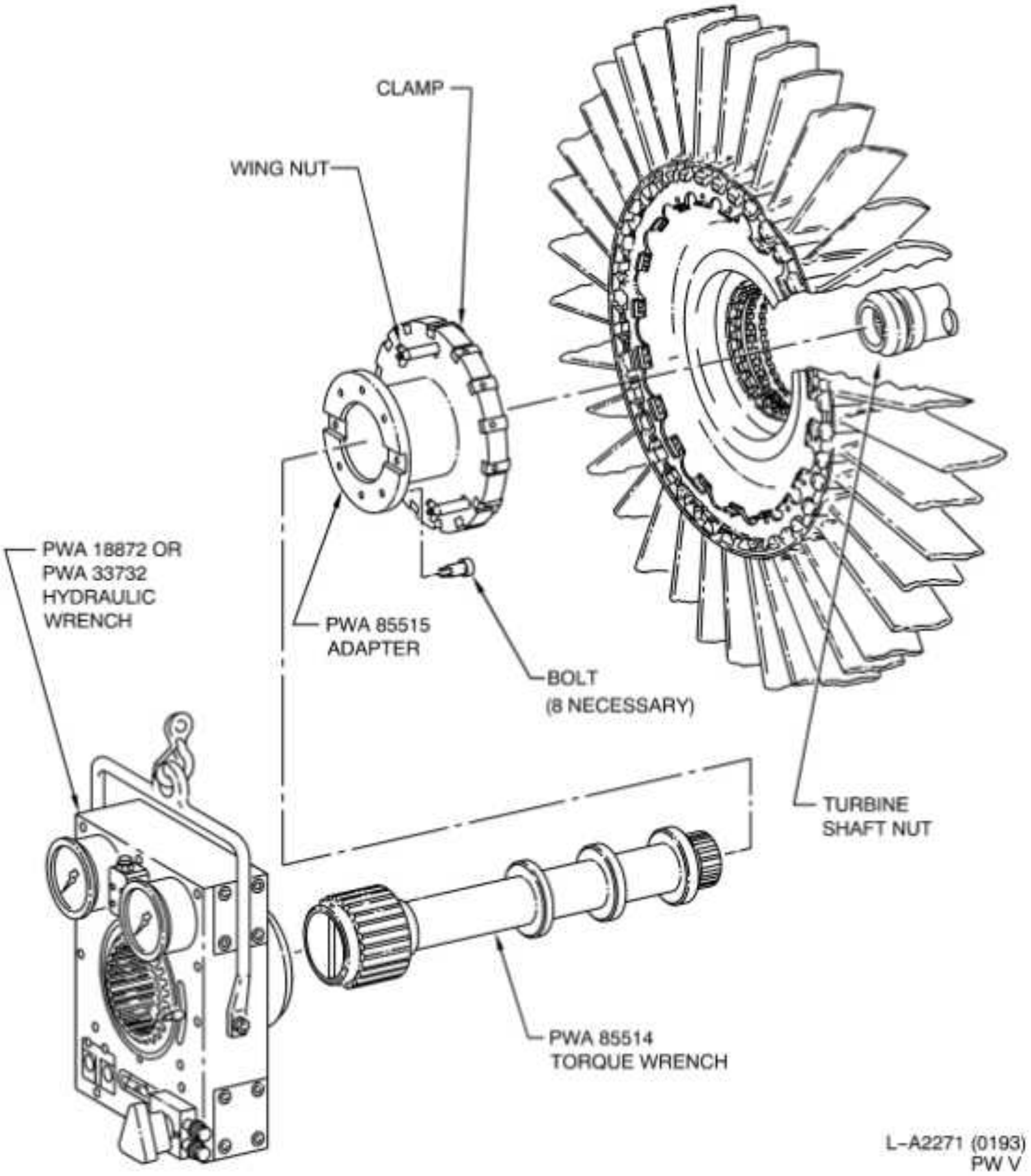
ENGINE GENERAL − LPC/LPT COUPLING − REMOVAL−01


PWA 25000
HYDRAULIC
WRENCH
PWA 85507 ADAPTER
TURBINE SHAFT
(COUPLING/RETAINING)
NUT
PWA 85508 TORQUE WRENCH
L−A2272 (0193)
PW V

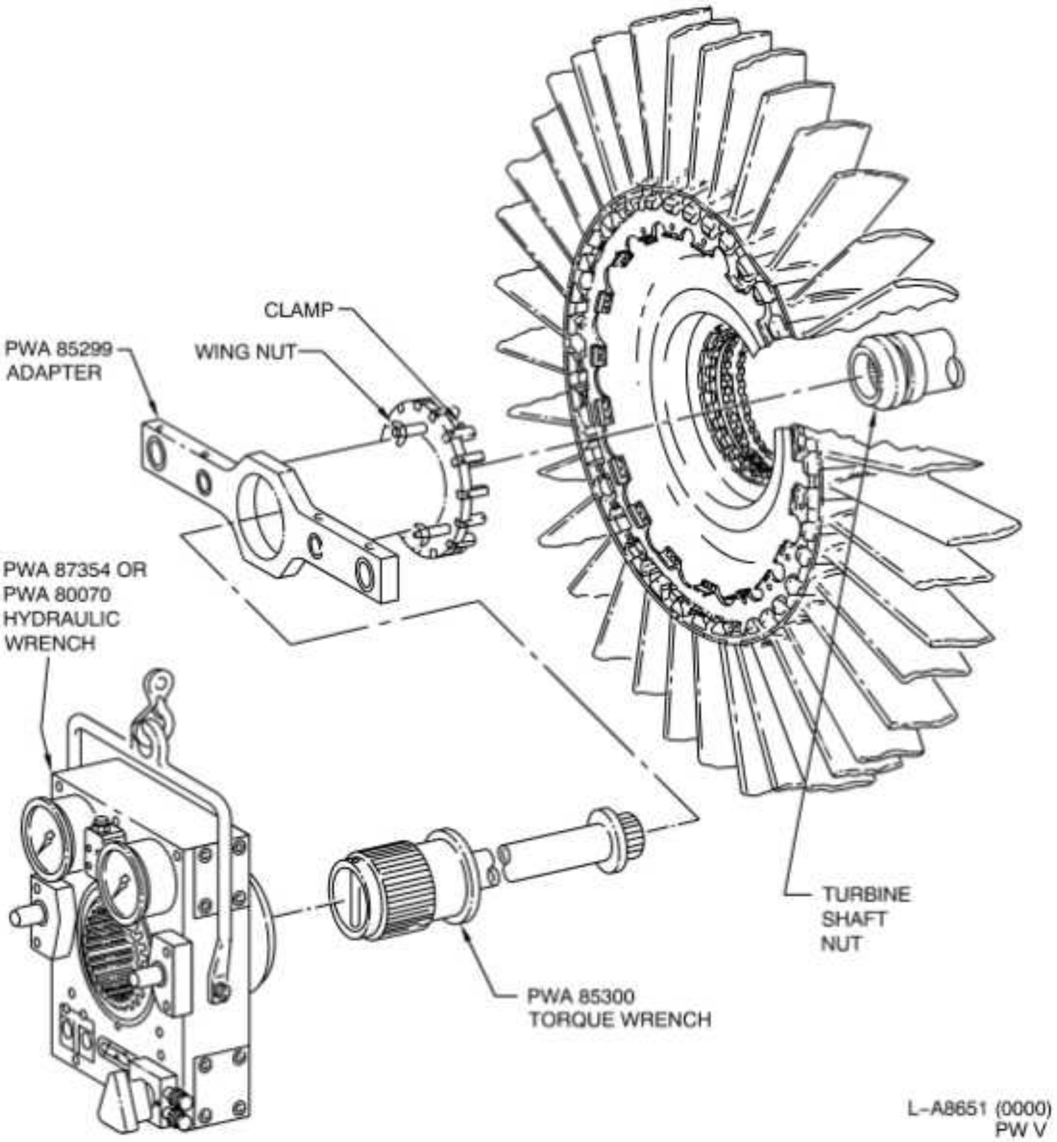
Removal Of The Turbine Shaft
(Coupling/Retaining) Nut (Hydraulic Wrench)
Figure 304
(Task 72−00−32−020−001)


CLAMP
PWA 85299 ADAPTER
WING NUT
PWA 45418, PWA 80071 OR PWA 80187 MECHANICAL WRENCH
TURBINE SHAFT NUT
PWA 85300 TORQUE WRENCH
PWA 45419 OR PWA 80651 PNEUMATIC MULTIPLIER (PWA 45419 SHOWN)
L−A2270 (0193)
PW V

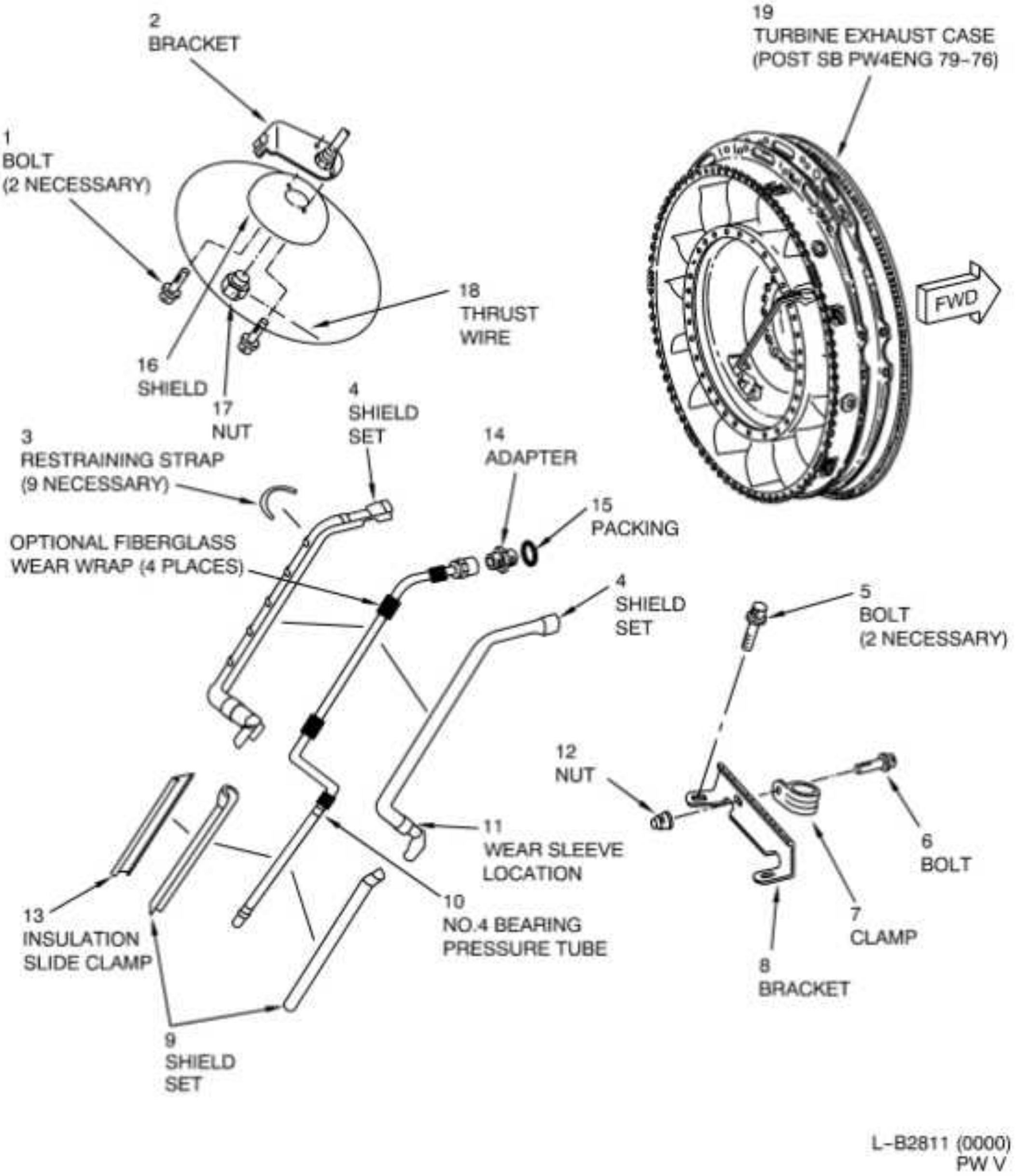
Turbine Shaft Nut Removal (Mechanical Wrench)
Figure 305
(Task 72−00−32−020−001)


CLAMP
WING NUT
PWA 18872 OR
PWA 33732
HYDRAULIC
WRENCH
PWA 85515
ADAPTER
BOLT
(8 NECESSARY)
TURBINE
SHAFT NUT
PWA 85514
TORQUE WRENCH
L−A2271 (0193)
PW V

Turbine Shaft Nut Removal (Hydraulic Wrench) (Method 1)
Figure 306 (Sheet 1)
(Task 72−00−32−020−001)

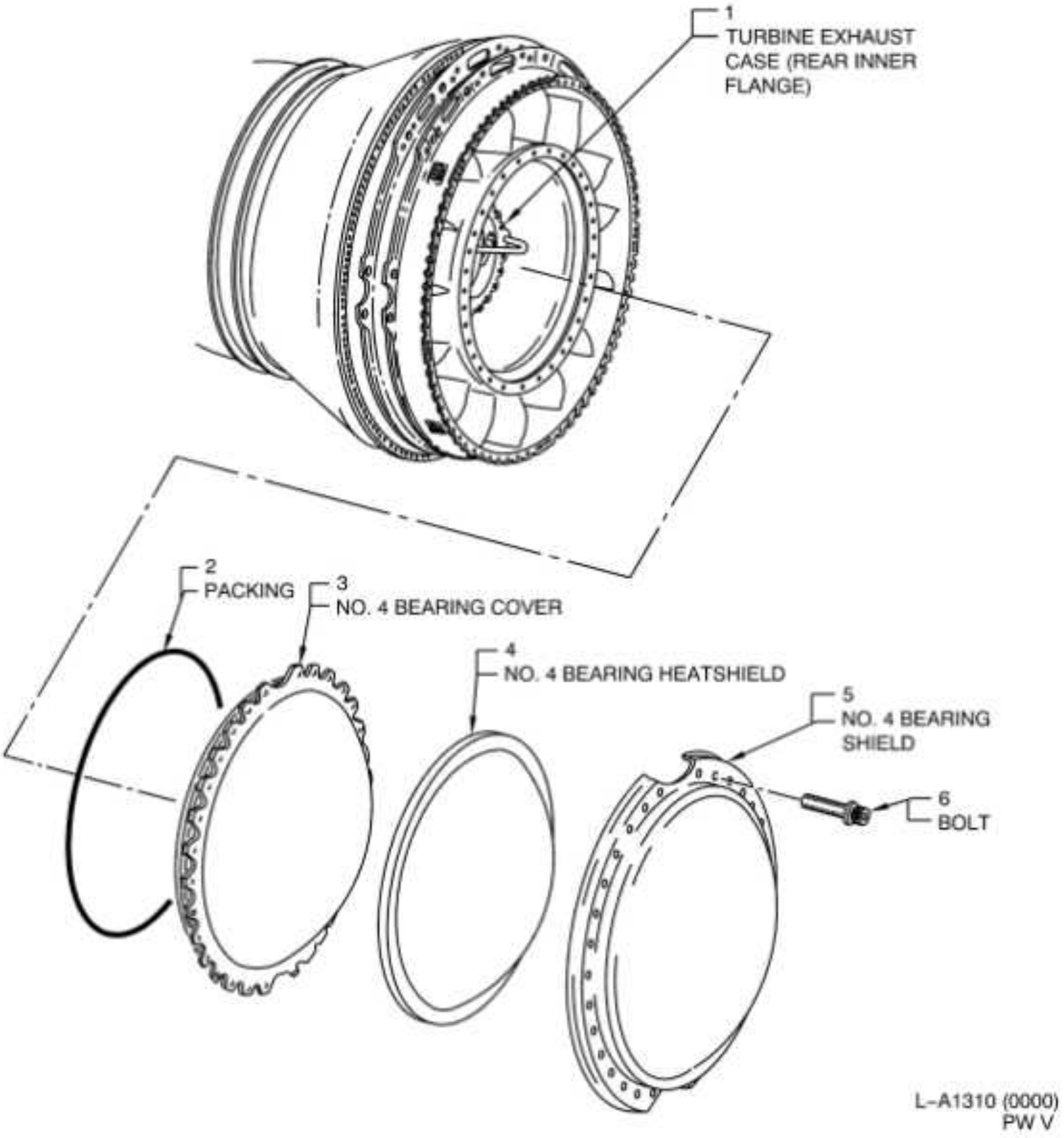

CLAMP
PWA 85299 ADAPTER
WING NUT
PWA 87354 OR PWA 80070 HYDRAULIC WRENCH
TURBINE SHAFT NUT
PWA 85300 TORQUE WRENCH
L−A8651 (0000)
PW V

Turbine Shaft Nut Removal (Hydraulic Wrench) (Method 2)
Figure 306 (Sheet 2)
(Task 72−00−32−020−001)

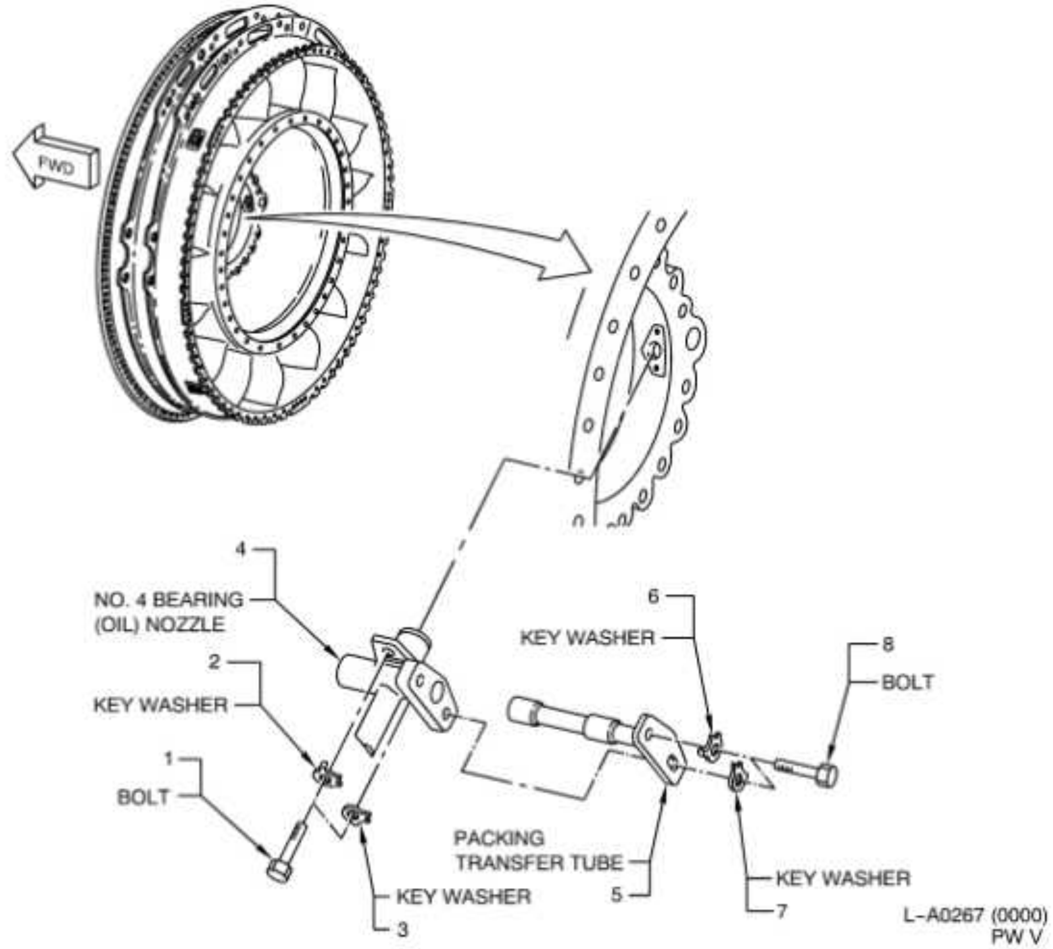

2
BRACKET
19
TURBINE EXHAUST CASE
(POST SB PW4ENG 79-76)
1
BOLT
(2 NECESSARY)
FWD
18
THRUST
WIRE
16
SHIELD
17
NUT
4
SHIELD
SET
3
RESTRAINING STRAP
(9 NECESSARY)
14
ADAPTER
15
PACKING
OPTIONAL FIBERGLASS
WEAR WRAP (4 PLACES)
4
SHIELD
SET
5
BOLT
(2 NECESSARY)
12
NUT
6
BOLT
11
WEAR SLEEVE
LOCATION
7
CLAMP
13
INSULATION
SLIDE CLAMP
10
NO.4 BEARING
PRESSURE TUBE
8
BRACKET
9
SHIELD
SET
L-B2811 (0000)
PW V

No. 4 Bearing Pressure Tube Removal
Figure 307
(Task 72−00−32−020−001)

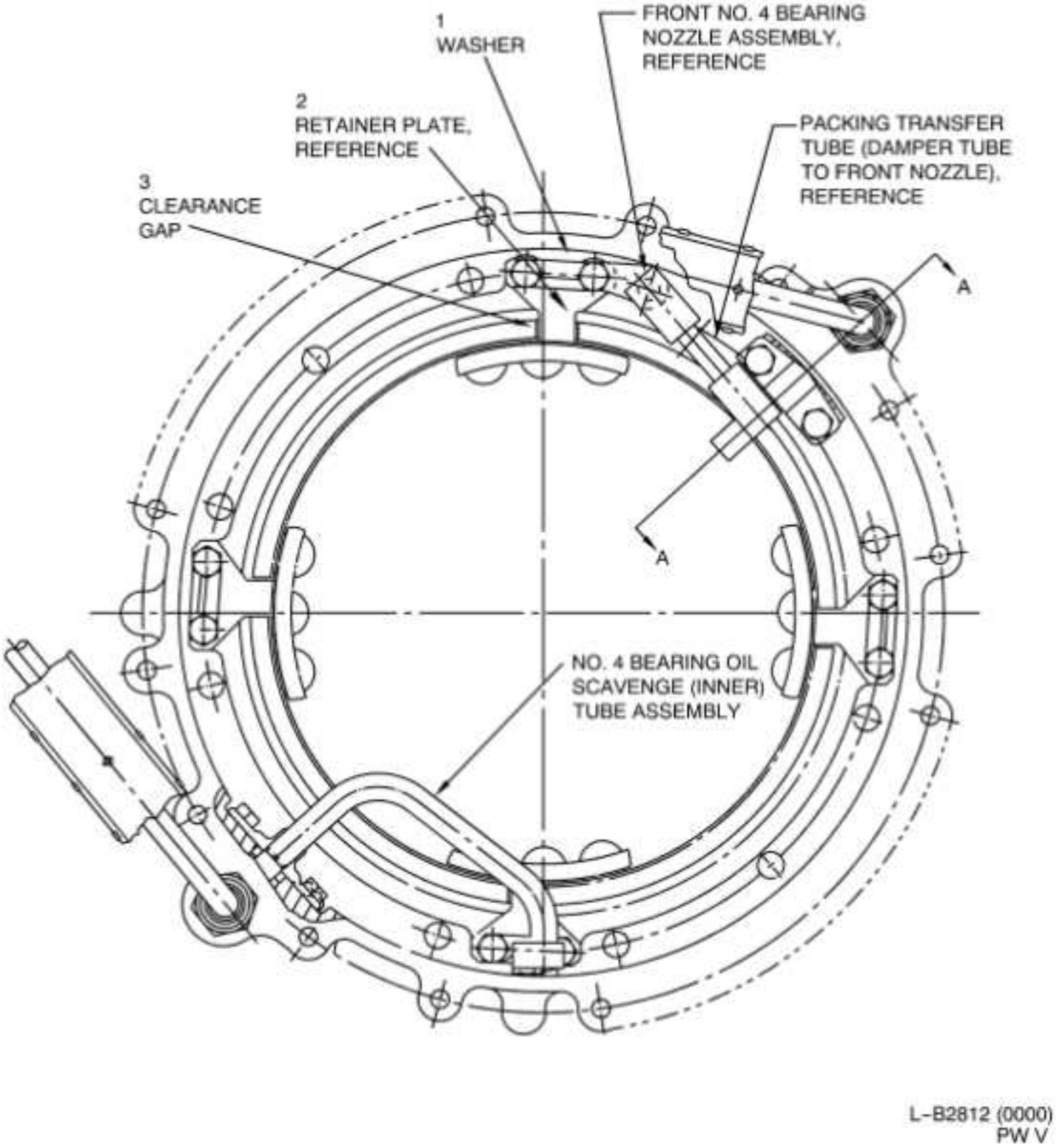
ENGINE GENERAL − LPC/LPT COUPLING − REMOVAL−01


1
TURBINE EXHAUST CASE (REAR INNER FLANGE)
2
PACKING
3
NO. 4 BEARING COVER
4
NO. 4 BEARING HEATSHIELD
5
NO. 4 BEARING SHIELD
6
BOLT
L−A1310 (0000)
PW V

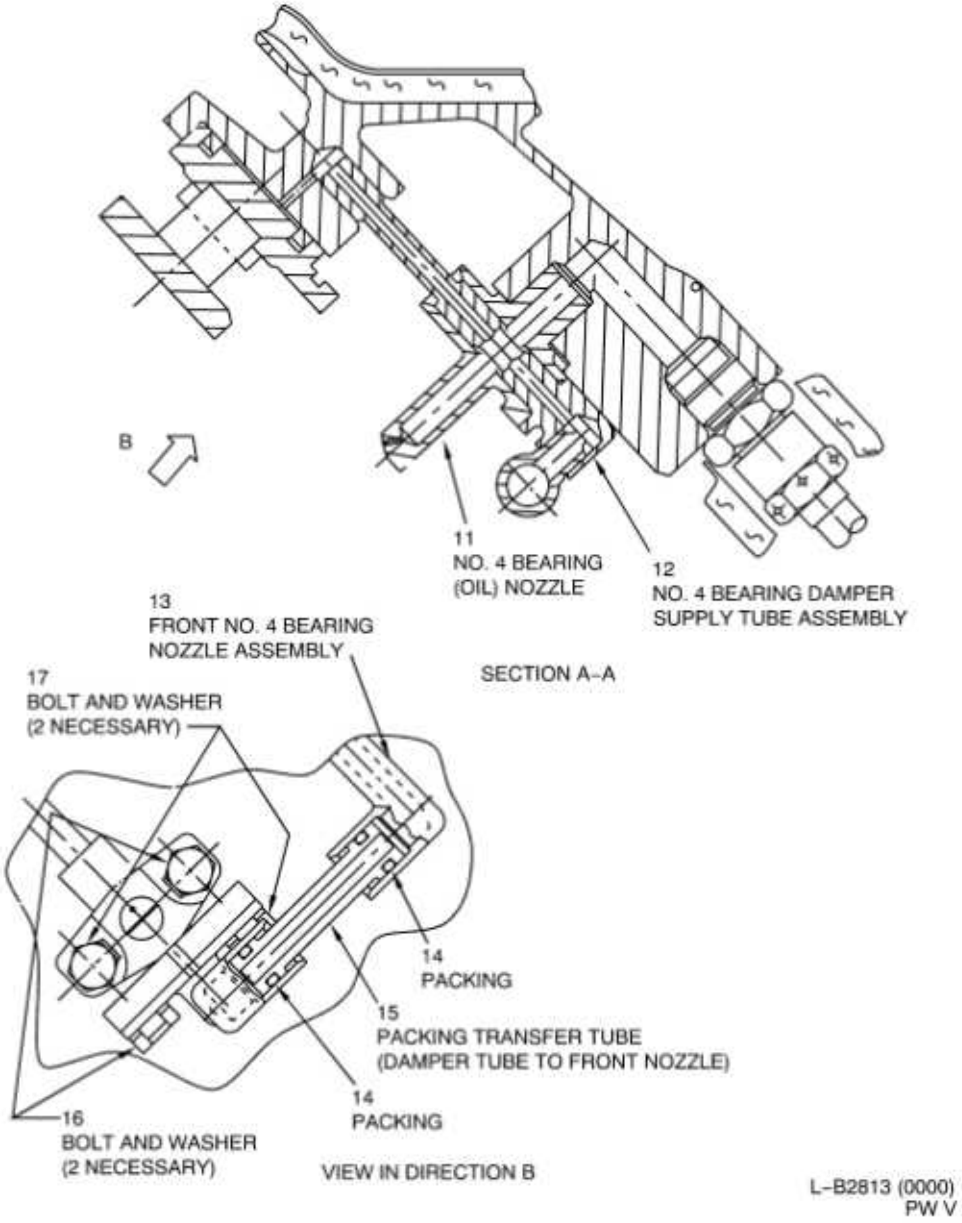
No. 4 Bearing Shield And Cover Removal
Figure 308
(Task 72−00−32−020−001)


FWD
4
NO. 4 BEARING (OIL) NOZZLE
2
KEY WASHER
1
BOLT
KEY WASHER
3
6
KEY WASHER
8
BOLT
PACKING
TRANSFER TUBE
5
KEY WASHER
7
L-A0267 (0000)
PW V

No. 4 Bearing (Oil) Nozzle Removal (Pre SB PW4ENG 72−472)
Figure 309
(Task 72−00−32−020−001)

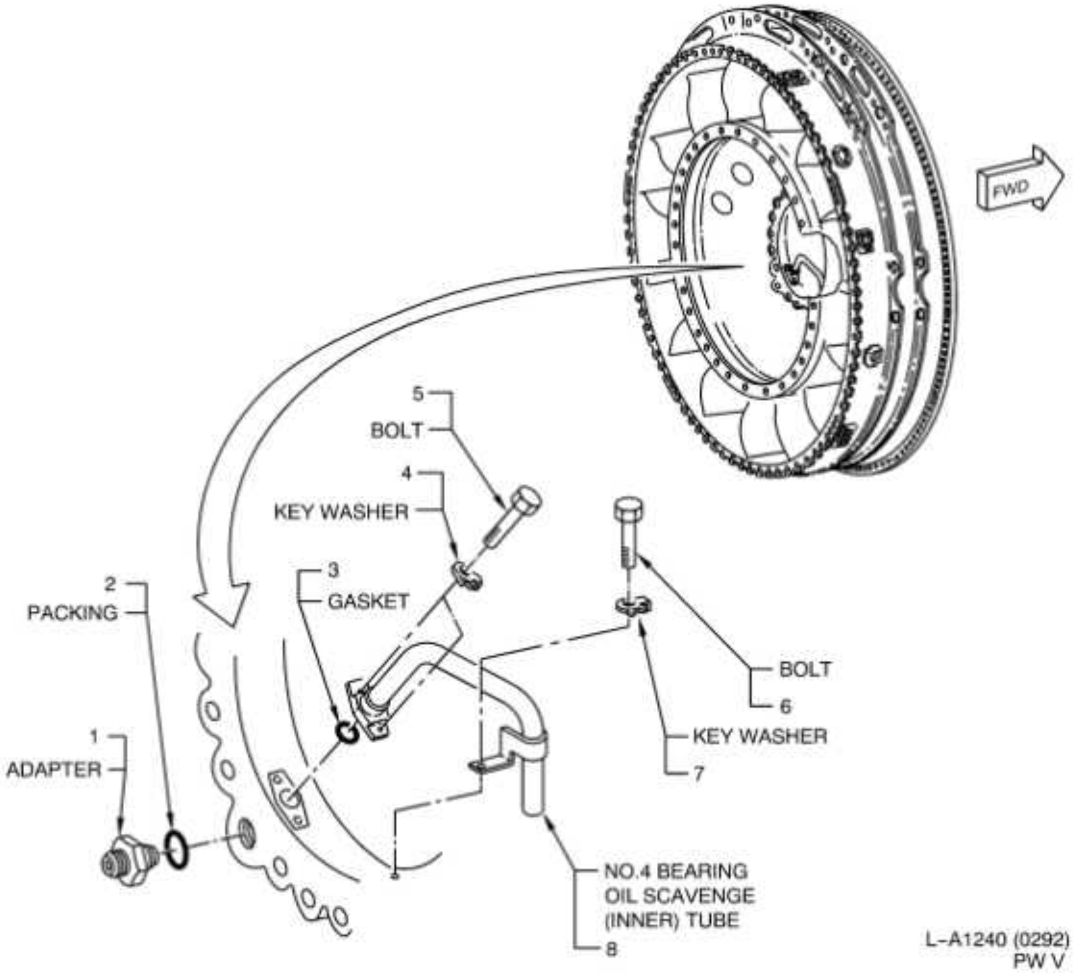

1
WASHER
FRONT NO. 4 BEARING
NOZZLE ASSEMBLY,
REFERENCE
2
RETAINER PLATE,
REFERENCE
PACKING TRANSFER
TUBE (DAMPER TUBE
TO FRONT NOZZLE),
REFERENCE
3
CLEARANCE
GAP
A
A
NO. 4 BEARING OIL
SCAVENGE (INNER)
TUBE ASSEMBLY
L−B2812 (0000)
PW V

No. 4 Bearing (Oil) Nozzles Removal (Post SB PW4ENG 72−472)
Figure 310 (Sheet 1)
(Task 72−00−32−020−001)

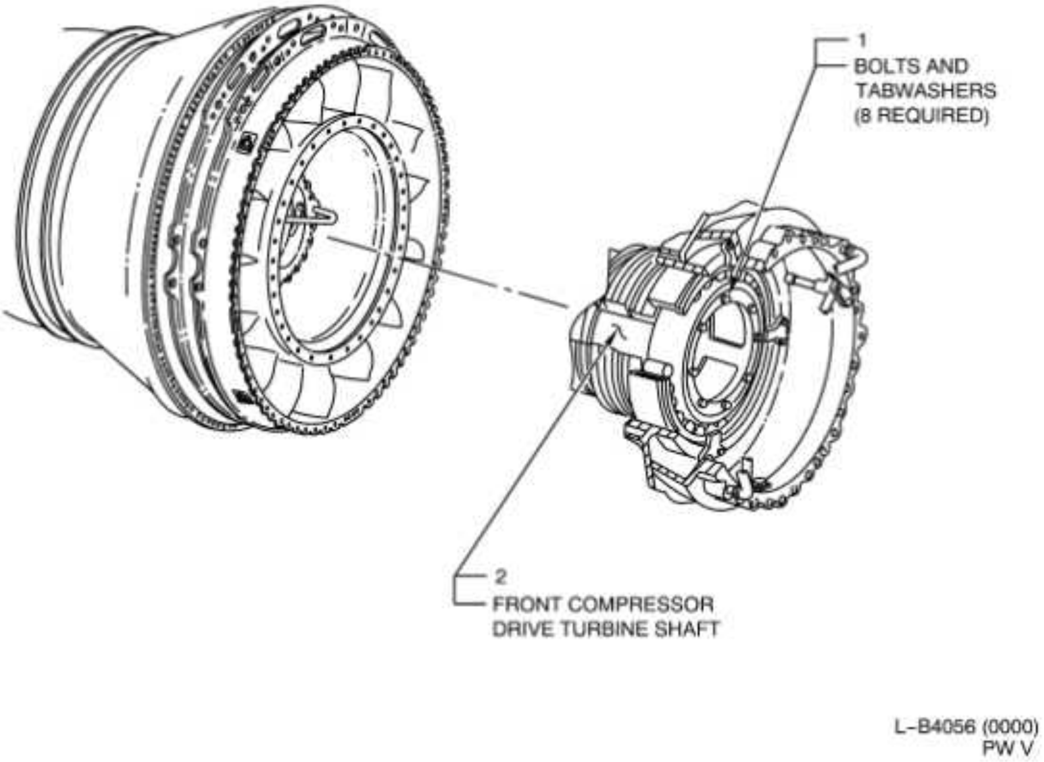

B
11
NO. 4 BEARING
(OIL) NOZZLE
12
NO. 4 BEARING DAMPER
SUPPLY TUBE ASSEMBLY
13
FRONT NO. 4 BEARING
NOZZLE ASSEMBLY
SECTION A-A
17
BOLT AND WASHER
(2 NECESSARY)
14
PACKING
15
PACKING TRANSFER TUBE
(DAMPER TUBE TO FRONT NOZZLE)
14
PACKING
16
BOLT AND WASHER
(2 NECESSARY)
VIEW IN DIRECTION B
L-B2813 (0000)
PW V

No. 4 Bearing (Oil) Nozzles Removal (Post SB PW4ENG 72-472)
Figure 310 (Sheet 2)
(Task 72-00-32-020-001)

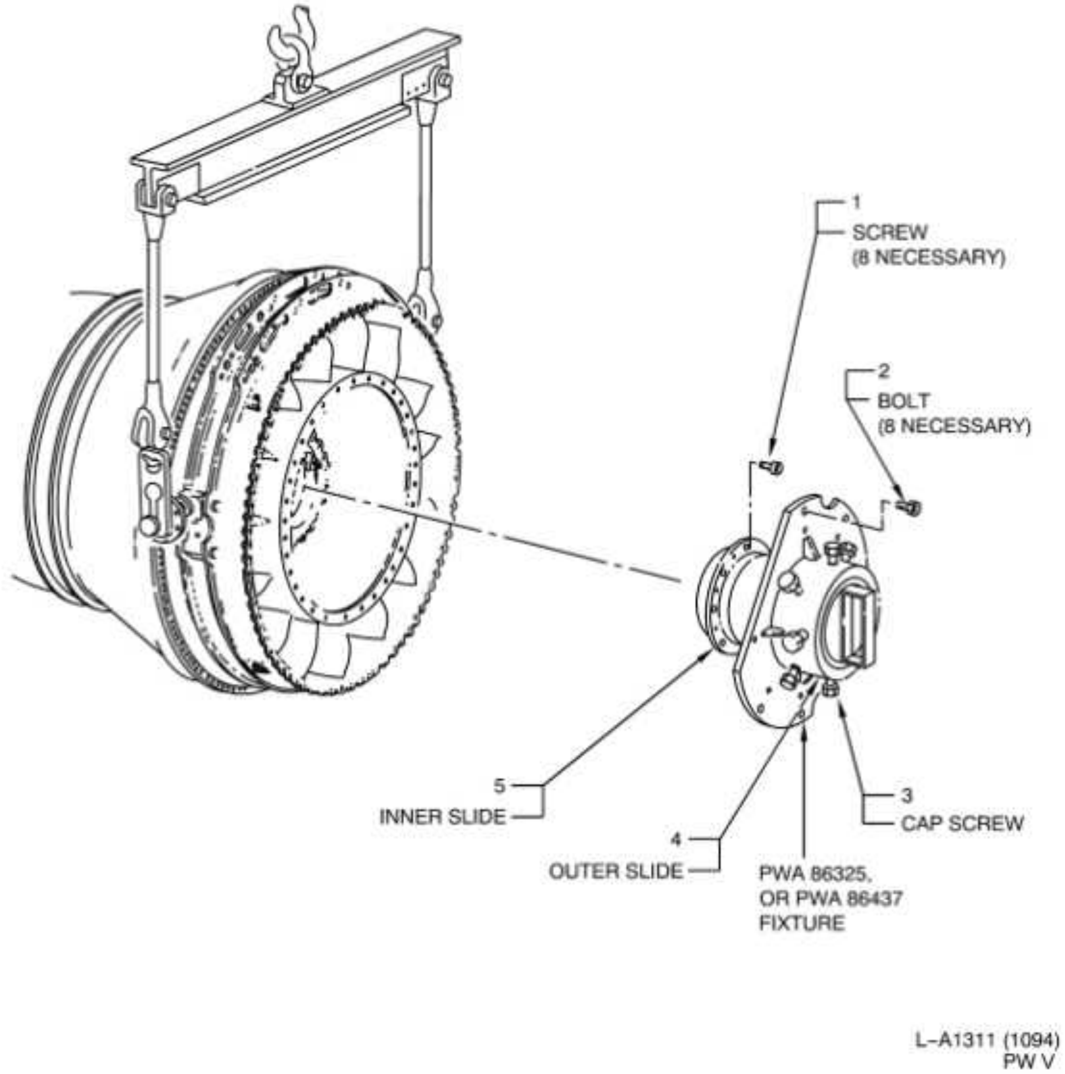
ENGINE GENERAL − LPC/LPT COUPLING − REMOVAL−01


FWD
5
BOLT
4
KEY WASHER
3
GASKET
2
PACKING
1
ADAPTER
BOLT
6
KEY WASHER
7
NO.4 BEARING
OIL SCAVENGE
(INNER) TUBE
8
L-A1240 (0292)
PW V

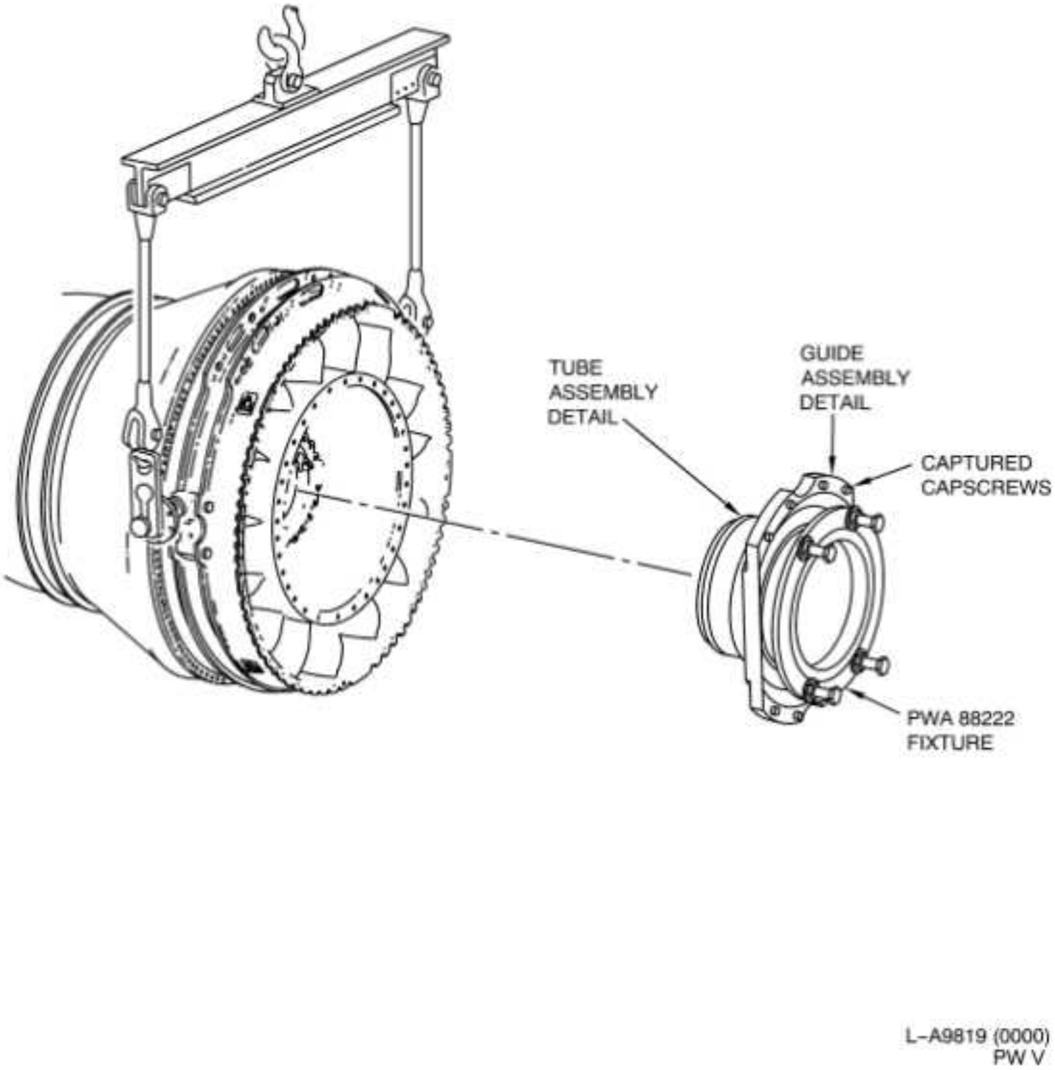
No. 4 Bearing Oil (Inner) Scavenge Tube Removal
Figure 311
(Task 72−00−32−020−001)


1
BOLTS AND
TABWASHERS
(8 REQUIRED)
2
FRONT COMPRESSOR
DRIVE TURBINE SHAFT
L−B4056 (0000)
PW V

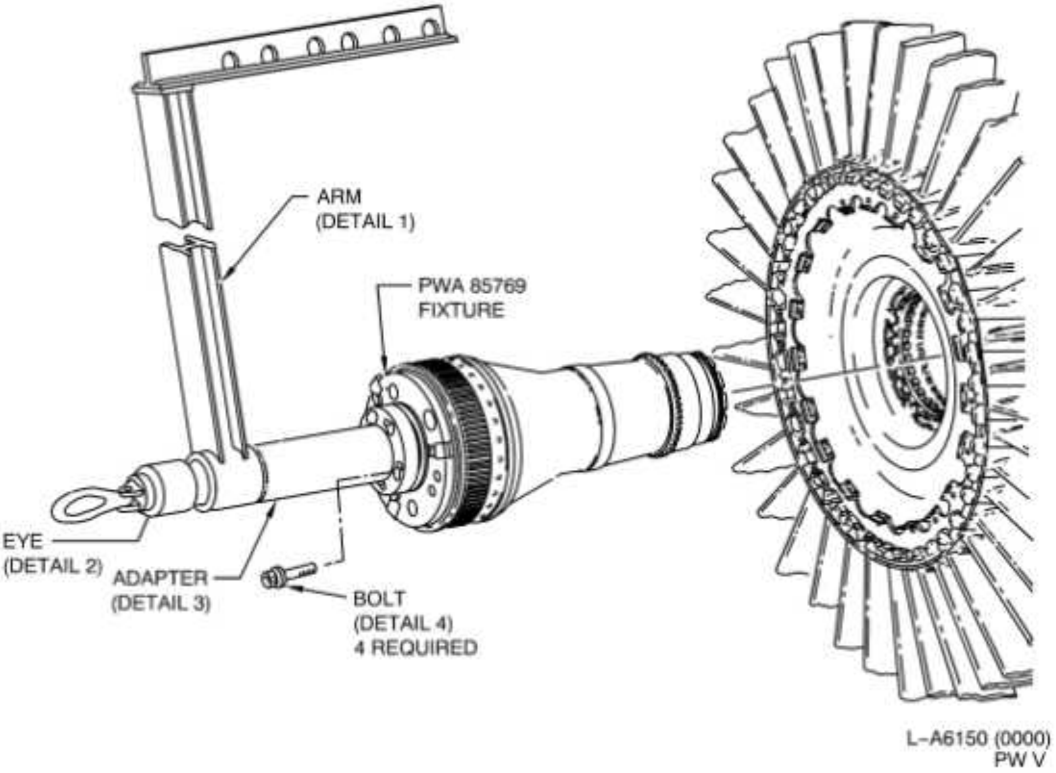
No. 4 Bearing Retaining Plate Bolts And Tabwashers Removal
Figure 312
(Task 72−00−32−020−001)


1
SCREW
(8 NECESSARY)
2
BOLT
(8 NECESSARY)
3
CAP SCREW
PWA 86325,
OR PWA 86437
FIXTURE
4
OUTER SLIDE
5
INNER SLIDE
L−A1311 (1094)
PW V

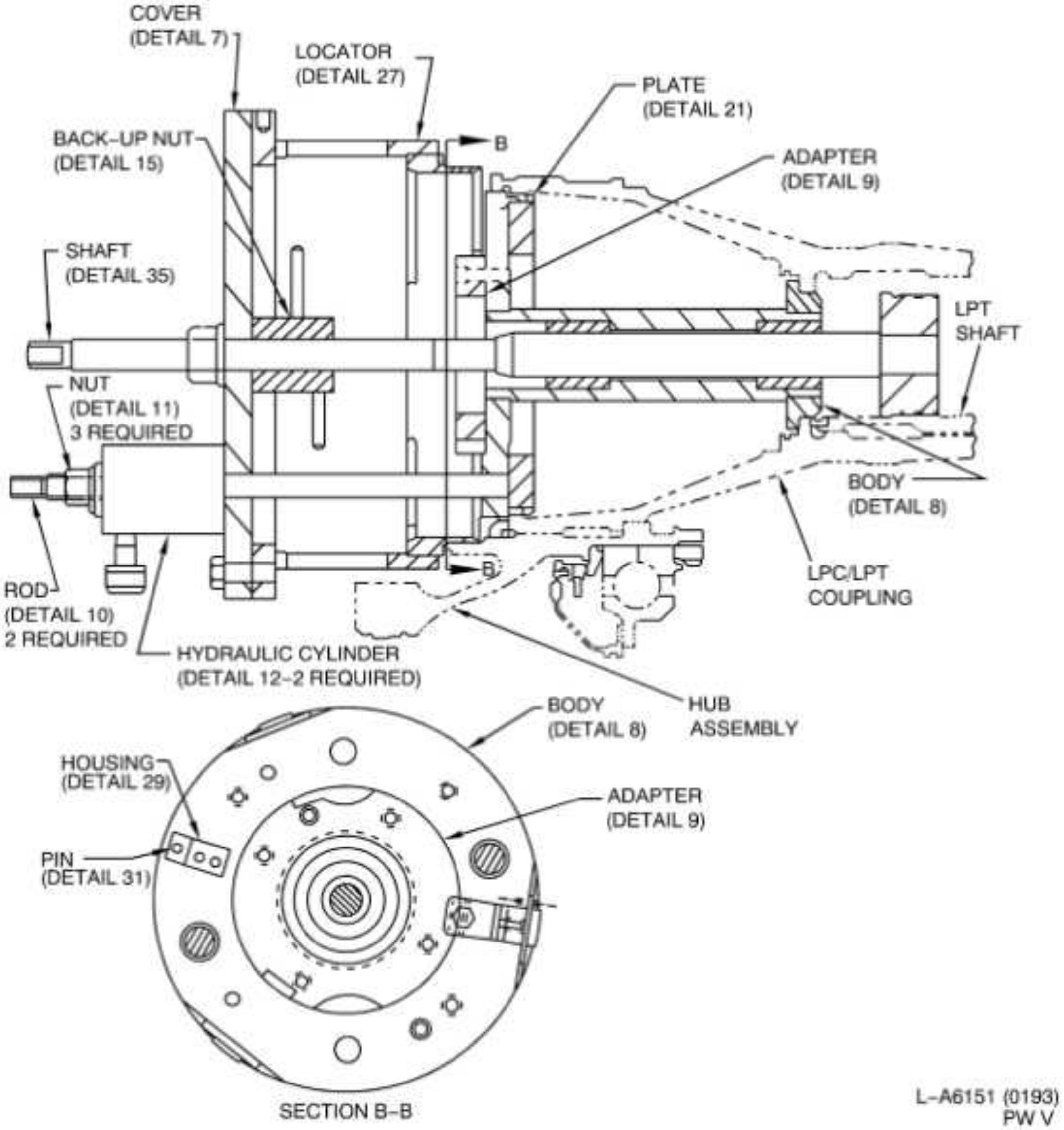
Low Pressure Turbine Rear Retainer Installation
Figure 313 (Sheet 1)
(Task 72−00−32−020−001)


TUBE ASSEMBLY DETAIL
GUIDE ASSEMBLY DETAIL
CAPTURED CAPSCREWS
PWA 88222 FIXTURE
L−A9819 (0000)
PW V

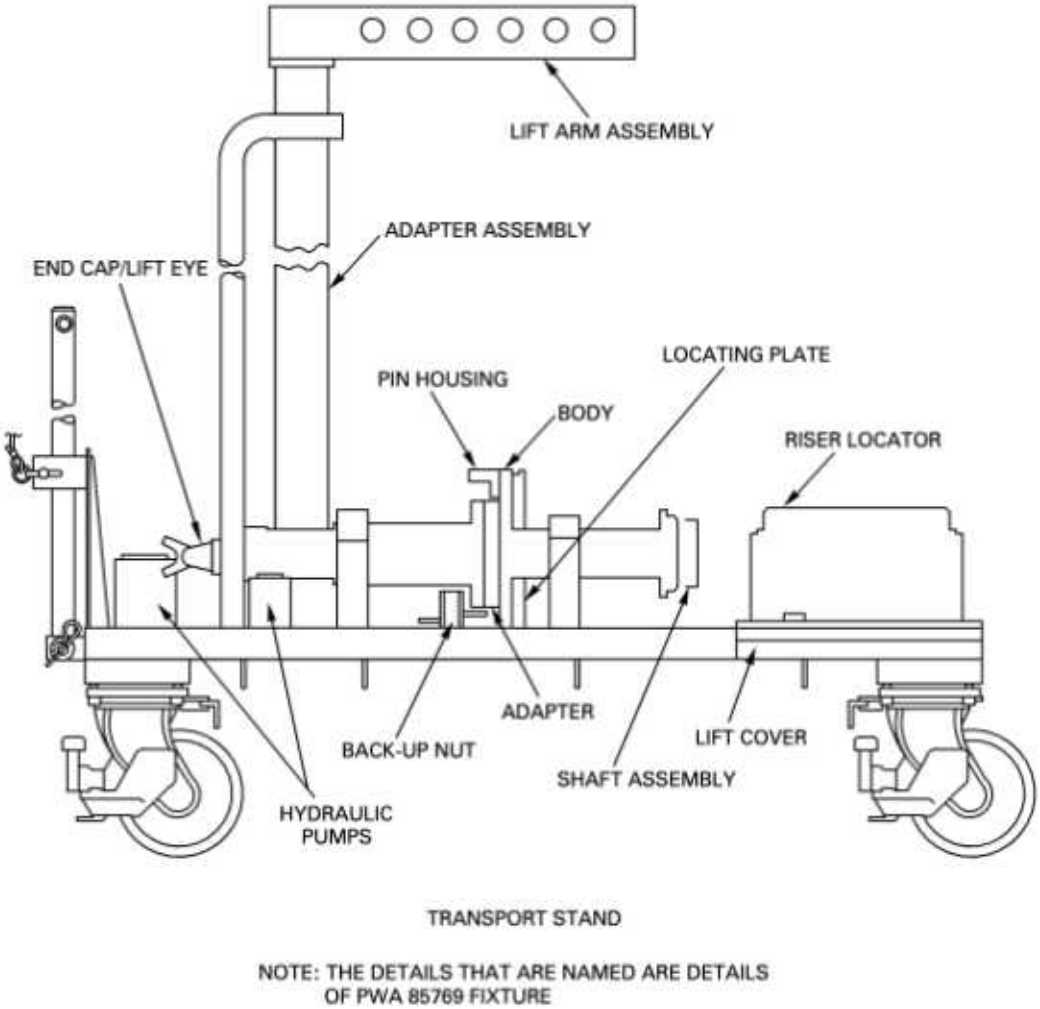
Low Pressure Turbine Rear Retainer Installation
Figure 313 (Sheet 2)
(Task 72−00−32−020−001)


ARM
(DETAIL 1)
PWA 85769
FIXTURE
EYE
(DETAIL 2)
ADAPTER
(DETAIL 3)
BOLT
(DETAIL 4)
4 REQUIRED
L−A6150 (0000)
PW V

LPC/LPT Coupling Removal
Figure 314 (Sheet 1)
(Task 72−00−32−020−001)


COVER (DETAIL 7)
LOCATOR (DETAIL 27)
PLATE (DETAIL 21)
BACK-UP NUT (DETAIL 15)
B
ADAPTER (DETAIL 9)
SHAFT (DETAIL 35)
LPT SHAFT
NUT (DETAIL 11) 3 REQUIRED
BODY (DETAIL 8)
B
LPC/LPT COUPLING
ROD (DETAIL 10) 2 REQUIRED
HYDRAULIC CYLINDER (DETAIL 12-2 REQUIRED)
BODY (DETAIL 8)
HUB ASSEMBLY
HOUSING (DETAIL 29)
ADAPTER (DETAIL 9)
PIN (DETAIL 31)
SECTION B-B
L-A6151 (0193)
PW V

LPC/LPT Coupling Removal
Figure 314 (Sheet 2)
(Task 72−00−32−020−001)


LIFT ARM ASSEMBLY
ADAPTER ASSEMBLY
END CAP/LIFT EYE
LOCATING PLATE
PIN HOUSING
BODY
RISER LOCATOR
ADAPTER
LIFT COVER
BACK-UP NUT
SHAFT ASSEMBLY
HYDRAULIC PUMPS
TRANSPORT STAND
NOTE: THE DETAILS THAT ARE NAMED ARE DETAILS OF PWA 85769 FIXTURE

L-A9290 (0695)

Transport Stand For PWA 85769 Fixture
Figure 315
(Task 72-00-32-020-001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LPC/LPT COUPLING - REMOVAL-02

Task 72-00-32-020-001-002:

1. Remove The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed) (Hydraulic Wrench) - Deleted

   A. Procedure

      (1) This procedure is relocated to 72-00-32, Removal-01 (Task 72-00-32-020-001).

Task 72-00-32-030-001:

1. Remove The No. 1.5 Bearing And Seal Seat

A. Prerequisites

(1) Remove The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed). See Removal-01 (Task 72-00-32-020-001).

B. Equipment And Materials Necessary

Special Tools:

PWA 3755	Pump, Hydraulic (Optional To PWA 29389)
PWA 18872	Wrench, Hydraulic*
PWA 28814	Pump, Hydraulic* (Use With Hydraulic Wrench)
PWA 28815	Cart, Storage (Optional)* (Use With Hydraulic Wrench)
PWA 29389	Hydraulic Pump
PWA 29510	Pump, Hydraulic (Hand)* (Use With Hydraulic Wrench)
PWA 33732	Wrench, Hydraulic*
PWA 45418	Wrench, Mechanical*
PWA 45419	Air Torque Multiplier* (Use With Mechanical Wrench)
PWA 75046	Cart (Optional)* (Use With Hydraulic Wrench)
PWA 76154	Adapter
PWA 80070	Wrench, Hydraulic*
PWA 80071	Multiplier, Torque* (Use With Mechanical Wrench)
PWA 80187	Wrench, Mechanical*
PWA 80651	Multiplier, Pneumatic* (Use With Mechanical Wrench)
PWA 85261	Adapter
PWA 85264	Adapter, Holding* (Use With Mechanical And Hydraulic Wrench)
PWA 85265	Wrench, Torque* (Use With Mechanical And Hydraulic Wrench)
PWA 85266	Puller
PWA 85375	Plate, Anchor* (Use With Mechanical Wrench)
PWA 85468	Stand
PWA 85516	Wrench, Torque* (Use With Hydraulic Wrench)
PWA 85517	Adapter, Holding* (Use With Hydraulic Wrench)
PWA 85632	Puller, Jackscrew
PWA 87354	Wrench, Hydraulic*

Special Tools:

(CONTINUED)

PWA 88100	Plate, Anchor* (Use With Mechanical And Hydraulic Wrench)
R PWA 101263	Protector, Plastic (No. 1.5 Bearing Carbon Seal)

*See Table 301 for mechanical wrench or Table 302 for hydraulic wrench tool options as applicable. The tables show the correct combinations of tools to remove the No. 1.5 bearing (inner race) retaining nut.

C. Procedure

(1) Install PWA 85261 Adapter to coupling. Attach PWA 76154 Adapter to suitable sling to lift and/or trunnion coupling. Install coupling in PWA 85468 Stand, bearing end up. See Figure 301.

(2) For operators that use the mechanical wrench, remove the No. 1.5 bearing (inner race) retaining nut (called nut) as follows. See Figure 302 and Table 301 for the correct combination of tools.

NOTE: See the following step to remove the No. 1.5 bearing (inner race) retaining nut with the optional Hydraulic Wrench.

PWA Torque Wrench	PWA Holding Adapter	PWA Mechanical Wrench or Torque Multiplier	PWA Pneumatic Multiplier	PWA Anchor Plate
85265	85264	80187	80651 or 45419	88100 or 85375
85265	85264	45418	45419	88100 or 85375
85265	85264	80071	80651 or 45419	88100

Retaining Nut Removal (Mechanical Wrench)
Table 301

(a) Remove the retaining ring. Remove the key washer.

(b) Install the big end of PWA 85264 Adapter in the coupling, aligning splines.

(c) Install PWA 85265 Torque Wrench on the coupling, with the teeth of the wrench and the slots of the nut aligned.

(d) Install a mechanical wrench on the torque wrench.

(e) Install an anchor plate on the mechanical wrench, with the pins of the wrench engaged with the holes of the anchor plate.

(f) Loosen and remove the nut. Remove the tools.

(3) For operators that use the hydraulic wrench, remove the No. 1.5 bearing (inner race) retaining nut (called nut) as follows. See Table 302 for the correct combinations of tools.

(a) Remove the retaining ring. Remove the key washer.

PWA Torque Wrench	PWA Holding Adapter	PWA Hydraulic Wrench	PWA Pump	PWA Cart
85516	85517	33732	28814 or 29510	75046
85516	85517	18872	28814 or 29510	75046 or 28815
85265	85264	87354	28814 or 29510	75046
85265	85264	80070	28814 or 29510	75046

Retaining Nut Removal (Hydraulic Wrench)
Table 302

(b) (Method 1) See Figure 303 (Sheet 1).

1 Install the big end of PWA 85517 Adapter in the coupling, aligning splines.

2 Install PWA 85516 Torque Wrench on the coupling, with the teeth of the wrench and the slots of the nut aligned.

3 Attach a hydraulic wrench to the adapter.

4 Attach a pump to the hydraulic wrench. Loosen and remove the nut. Remove the tools.

(c) (Method 2) See Figure 303 (Sheet 2).

1 Install the big end of PWA 85264 Adapter in the coupling, aligning splines.

2 Install PWA 85265 Torque Wrench on the coupling, with the teeth of the wrench and the slots of the nut aligned.

3 Install a hydraulic wrench on the torque wrench.

4 Install PWA 88100 Anchor Plate on the adapter and engage the holes of the anchor plate with the pins of the hydraulic wrench.

5 Attach a pump to the hydraulic wrench. Loosen and remove the nut. Remove the tools.

(4) Remove the seal seat from the coupling. Put the seal seat in a container that prevents contamination.

(5) Remove the No. 1.5 roller bearing from the coupling. Figure 304.

(a) Install PWA 85266 Puller on the bearing. With PWA 3755 or PWA 29389 Hydraulic Pump, remove the bearing from the coupling.

NOTE: Use gloves when you touch the bearing. Refer to the Standard Practices Manual.

(b) Put the bearing in a container that prevents damage and contamination.

(6) Remove the bearing outer race from the No. 1.5 bearing support. Refer to Figure 305.

(a) Remove sixteen (16) retaining bolts, nine (9) washers, and bracket from 1.5 bearing outer race flange.

R
R

R CAUTION: BE CAREFUL NOT TO DAMAGE THE NO. 1.5
R BEARING CARBON SEAL WHEN YOU INSTALL OR
R REMOVE THE PWA 101263 PLASTIC PROTECTOR.

R (b) Install the PWA 101263 Plastic Protector onto the
R No. 1.5 bearing carbon seal.

R (c) Install three (3) guide pin details of PWA 85632 Puller into approximately equally spaced clinch nuts in front flange of bearing support.

R (d) Slide puller jaws inboard. Secure jaws in position with retaining bolts.

R (e) Turn three (3) jackscrews to bottom six 0.250 inch (6.350 mm) diameter dowel pins against outer ring of puller.

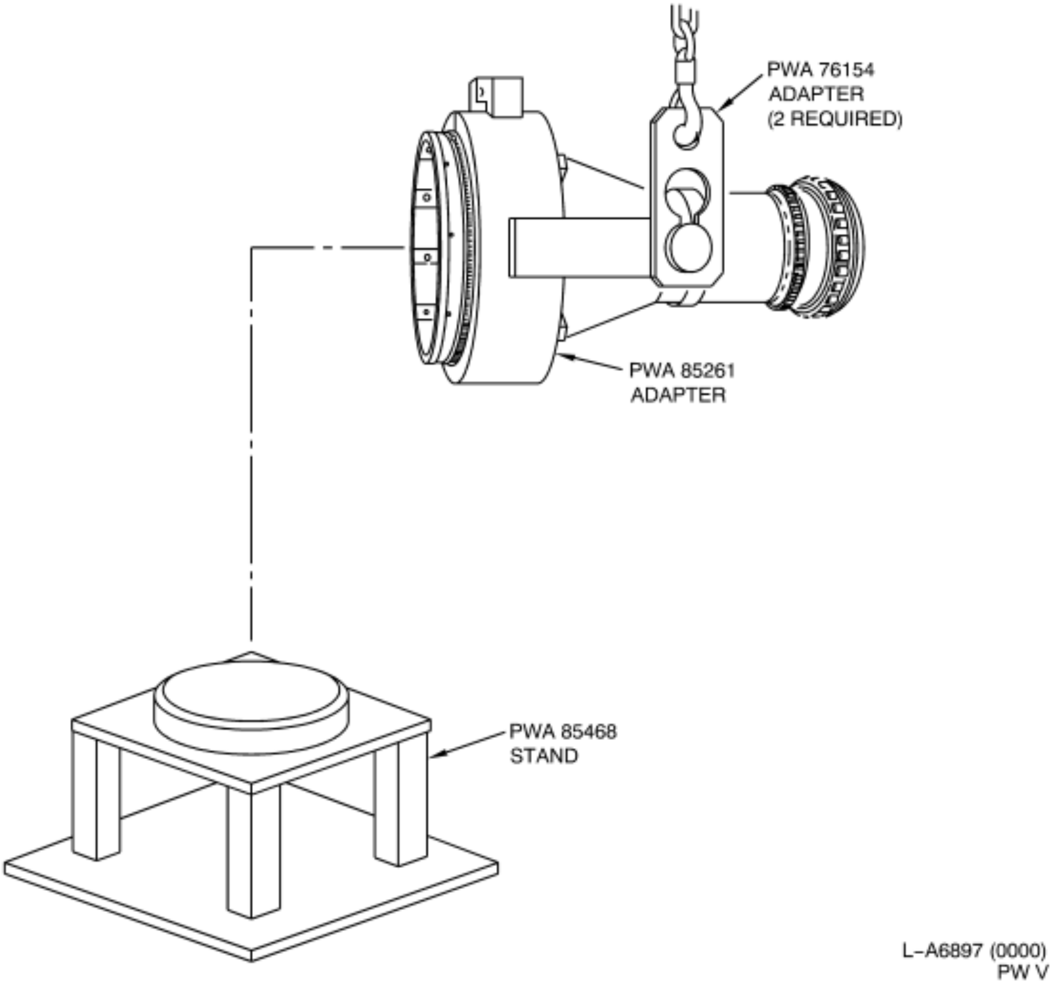
CAUTION: ENSURE PULLER LEGS DO NOT CONTACT NUMBER 1 1/2 AND 2 BEARING CARBON SEAL ASSEMBLY WHILE INSTALLING PULLER.

R (f) Carefully guide puller over previously installed guide pins. Bottom inner ring detail against front flange of bearing support.

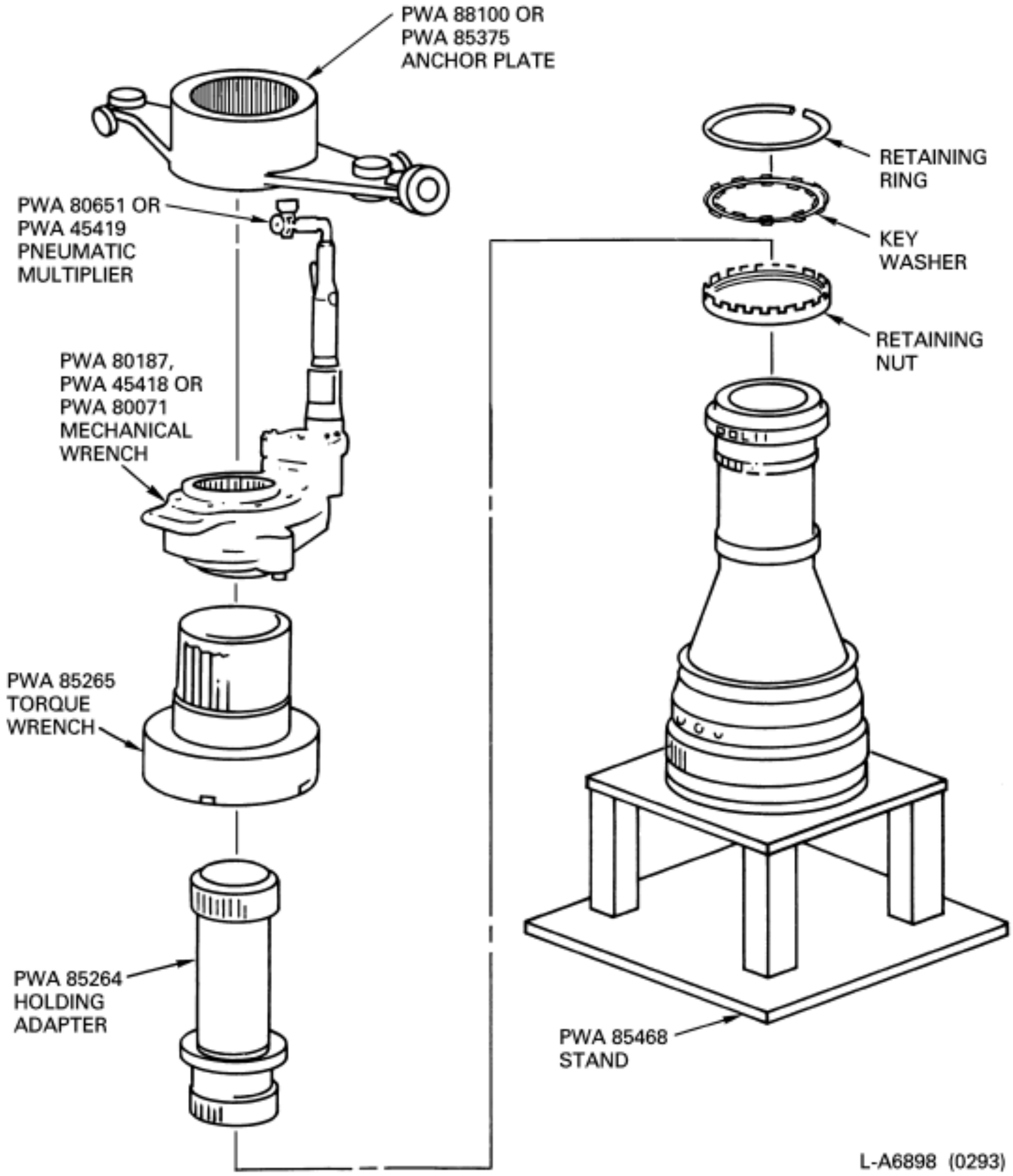
R (g) Slide three (3) puller legs outboard to engage bearing outer race. Secure puller legs in position with bolts.

R (h) Turn all three (3) jackscrews equally to remove bearing outer race from support.

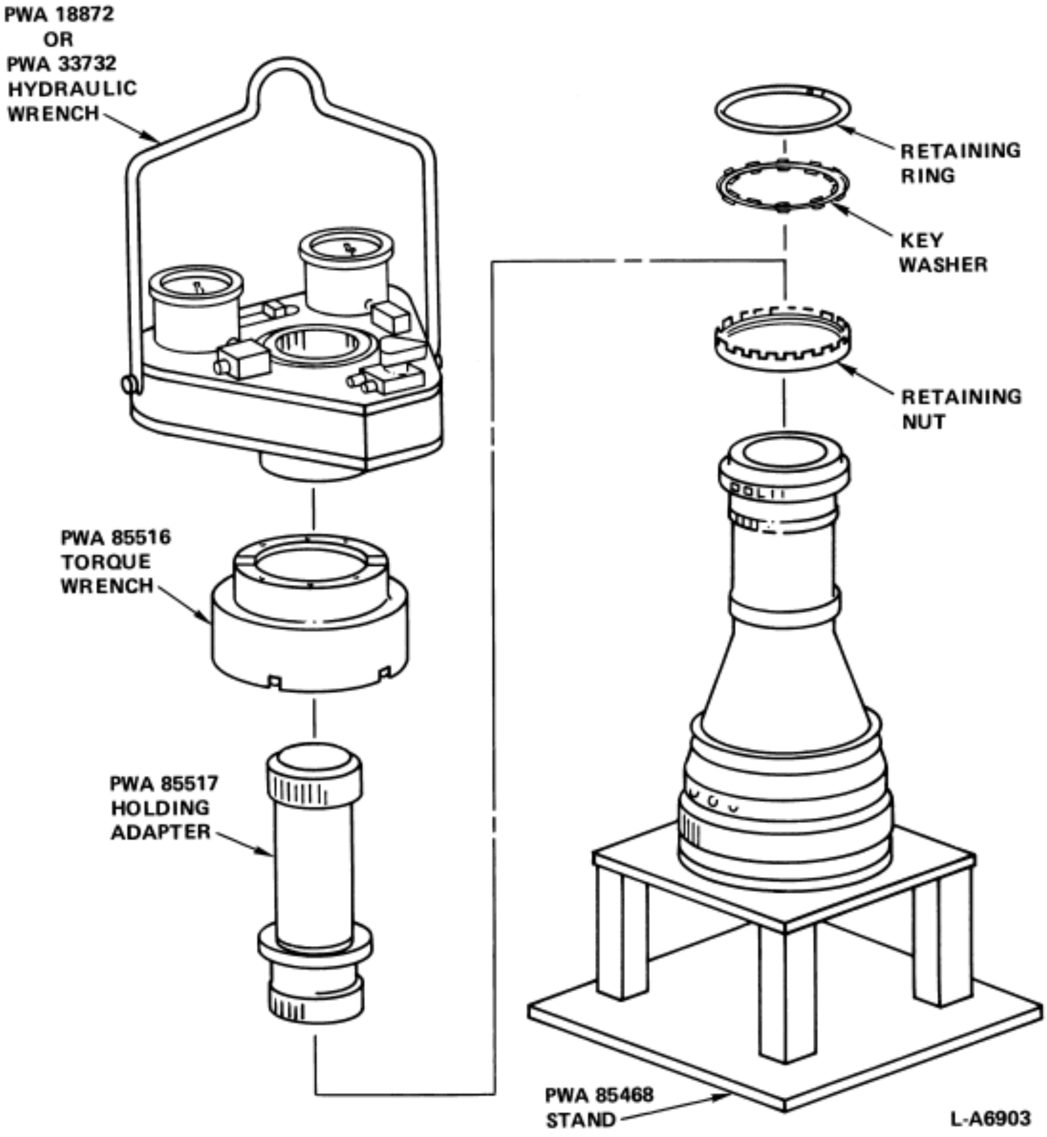
NOTE: To prevent puller from binding, turn each jackscrew one turn at a time.


PWA 76154
ADAPTER
(2 REQUIRED)
PWA 85261
ADAPTER
PWA 85468
STAND
L−A6897 (0000)
PW V

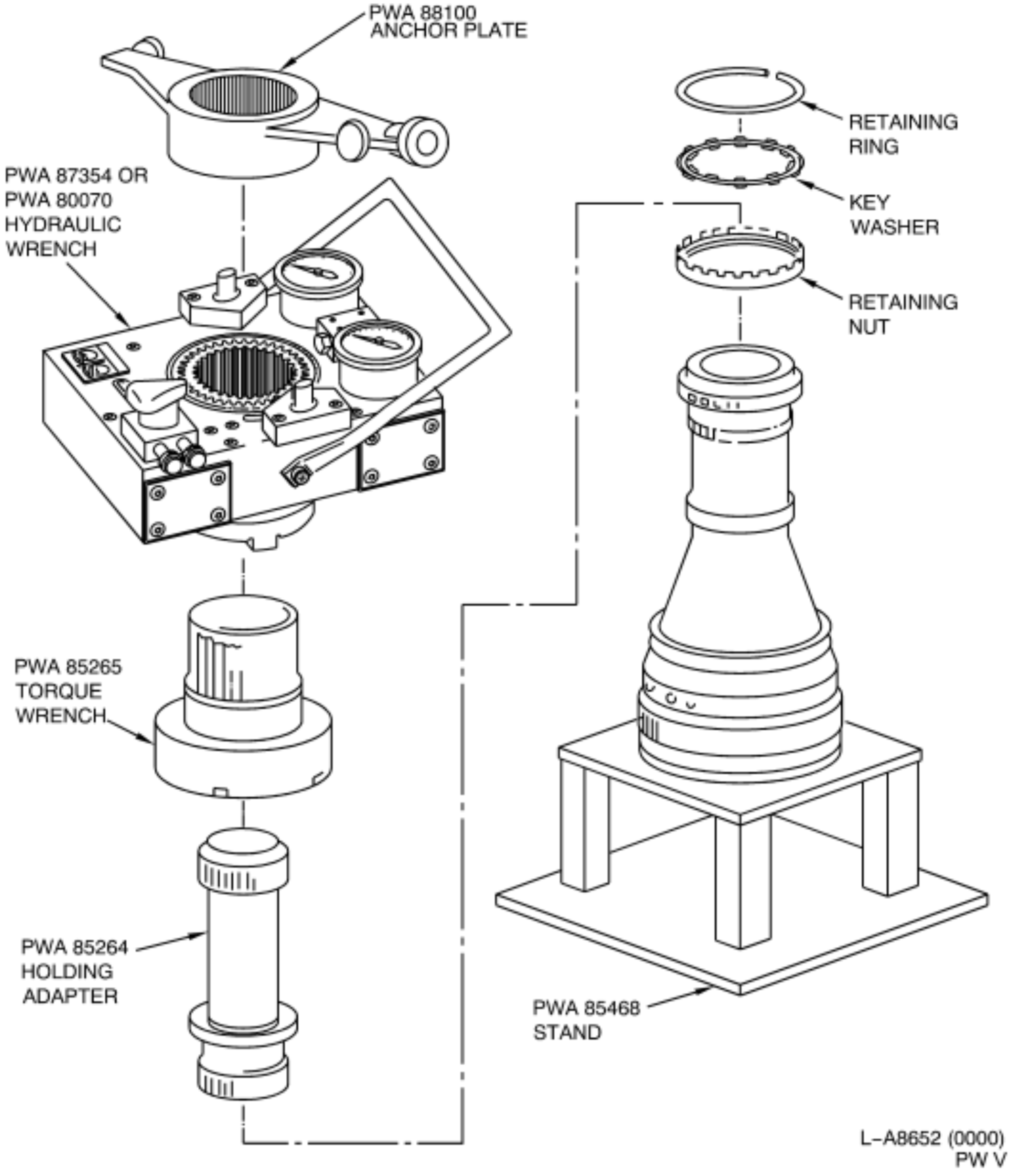
Installation Of The Coupling In A Stand
Figure 301
(Task 72−00−32−030−001)


PWA 88100 OR
PWA 85375
ANCHOR PLATE
PWA 80651 OR
PWA 45419
PNEUMATIC
MULTIPLIER
PWA 80187,
PWA 45418 OR
PWA 80071
MECHANICAL
WRENCH
PWA 85265
TORQUE
WRENCH
PWA 85264
HOLDING
ADAPTER
RETAINING
RING
KEY
WASHER
RETAINING
NUT
PWA 85468
STAND
L-A6898 (0293)

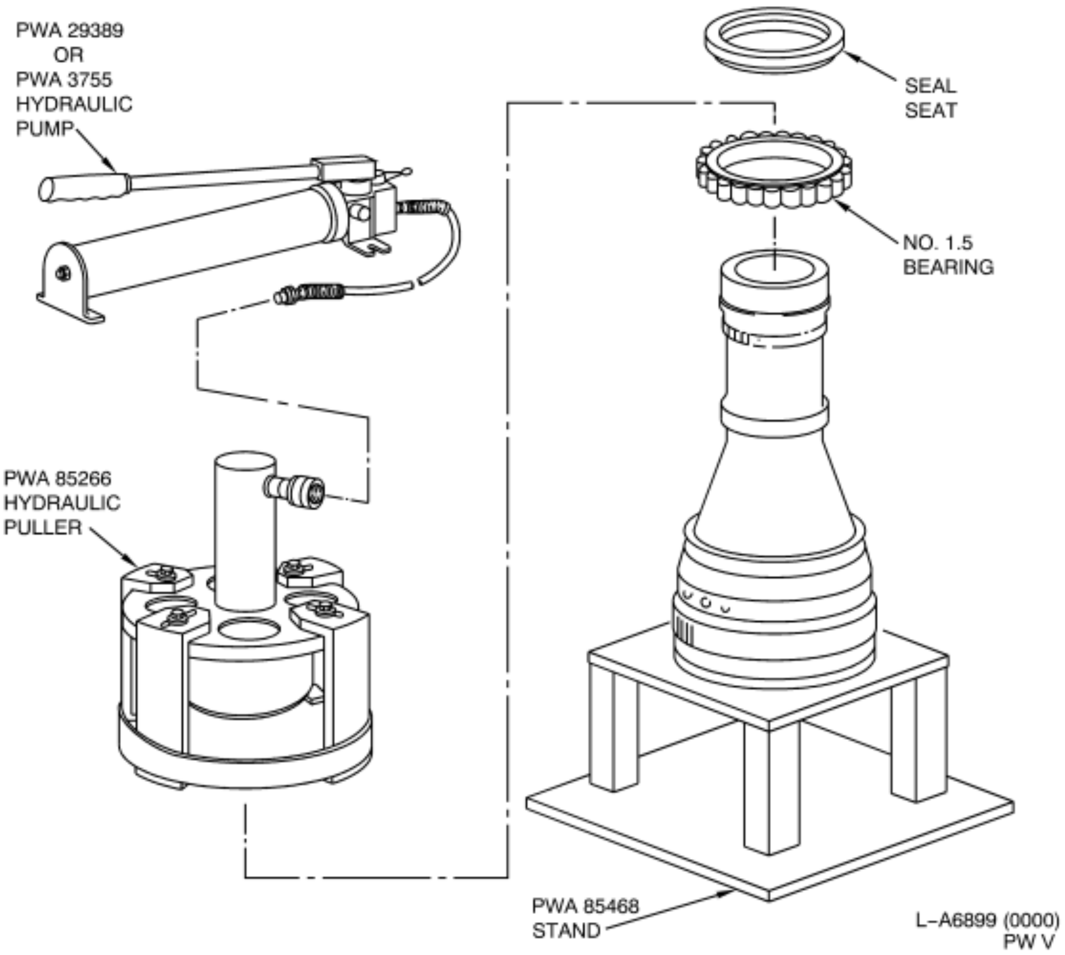
No. 1.5 Bearing (Inner Race) Retaining
Nut Removal (Mechanical Wrench)
Figure 302
(Task 72−00−32−030−001)


PWA 18872
OR
PWA 33732
HYDRAULIC
WRENCH
RETAINING
RING
KEY
WASHER
RETAINING
NUT
PWA 85516
TORQUE
WRENCH
PWA 85517
HOLDING
ADAPTER
PWA 85468
STAND
L-A6903

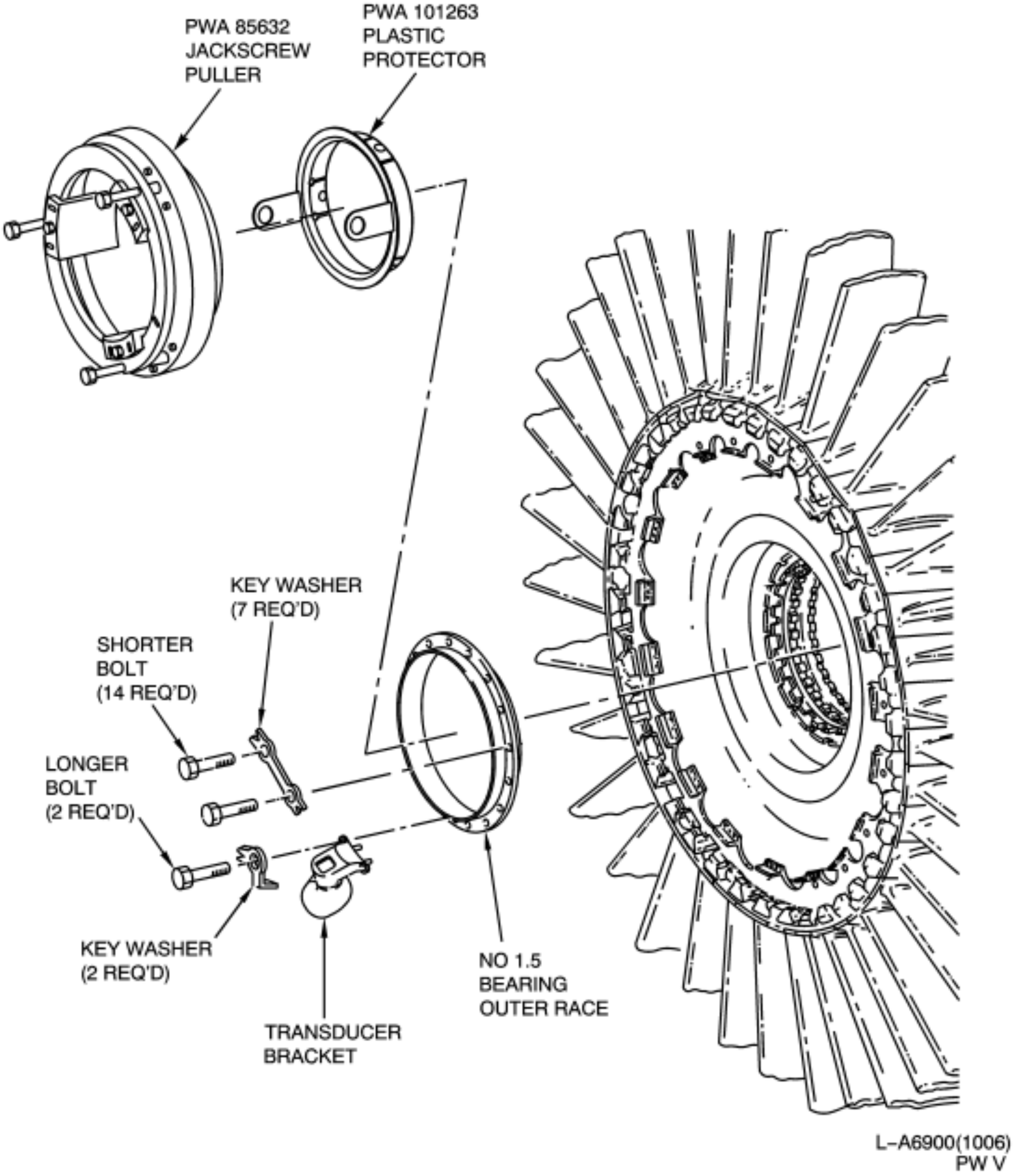
No. 1.5 Bearing (Inner Race) Retaining Nut
Removal (Hydraulic Wrench) − (Method 1)
Figure 303 (Sheet 1)
(Task 72−00−32−030−001)


PWA 88100
ANCHOR PLATE
PWA 87354 OR
PWA 80070
HYDRAULIC
WRENCH
RETAINING
RING
KEY
WASHER
RETAINING
NUT
PWA 85265
TORQUE
WRENCH
PWA 85264
HOLDING
ADAPTER
PWA 85468
STAND
L−A8652 (0000)
PW V

No. 1.5 Bearing (Inner Race) Retaining Nut
Removal (Hydraulic Wrench) − (Method 2)
Figure 303 (Sheet 2)
(Task 72−00−32−030−001)


PWA 29389
OR
PWA 3755
HYDRAULIC
PUMP
SEAL
SEAT
NO. 1.5
BEARING
PWA 85266
HYDRAULIC
PULLER
PWA 85468
STAND
L-A6899 (0000)
PW V

No. 1.5 Bearing Inner Race And Rollers Removal
Figure 304
(Task 72-00-32-030-001)


PWA 85632
JACKSCREW
PULLER
PWA 101263
PLASTIC
PROTECTOR
KEY WASHER
(7 REQ'D)
SHORTER
BOLT
(14 REQ'D)
LONGER
BOLT
(2 REQ'D)
KEY WASHER
(2 REQ'D)
TRANSDUCER
BRACKET
NO 1.5
BEARING
OUTER RACE
L-A6900(1006)
PW V

No. 1.5 Bearing Outer Race Removal
Figure 305
(Task 72-00-32-030-001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − LPC/LPT COUPLING − REMOVAL−04

Task 72−00−32−030−001−002:

1. Remove The No. 1.5 Bearing And Seal Seat (Hydraulic Method) − Deleted

A. Procedure

(1) This procedure is relocated to 72−00−32, Removal−03 (Task 72−00−32−030−001).

ENGINE GENERAL - LPC/LPT COUPLING - REMOVAL-05

Task 72-00-32-020-005:

1. Remove The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Removed)

NOTE: See Figure 301 for Part/Assembly Removal Procedure Sequence.

A. Prerequisites

(1) Remove The Electronic Engine Control (EEC) Speed Transducer (N1). Refer to 72-00-34, Removal-03 (Task 72-00-34-050-001) or The EEC Speed Transducer (N1) Multiplexer Input Probe, 72-00-34, Removal-17 (Task 72-00-34-050-014).

(2) Remove The Compressor Inlet Cone. Refer to 72-00-31, Removal-02 (Task 72-00-31-020-001).

(3) Remove All Stage 1 LPC Blade Assemblies. Refer to 72-00-31, Removal-04 (Task 72-00-31-020-002-002).

NOTE: If you do not disassemble the engine after this procedure, it is not necessary to remove the fan blades. If you do not remove the fan blades, you must put six shims between the tips of the lower fan blades and the fan case rubstrip to support the LPC rotor.

(4) Remove The Low Pressure Turbine And Turbine Exhaust Case With Shaft. Refer to 72-00-53, Removal-08 (Task 72-00-53-020-002).

B. Equipment And Materials Necessary

Special Tools:

PWA 3755	Pump, Hydraulic
PWA 25000	Wrench, Hydraulic
PWA 28668	Pump, Hydraulic (Use With Hydraulic Wrench)
PWA 28669	Cart (Optional) (Use With Hydraulic Wrench)
PWA 29389	Pump, Hydraulic
PWA 29510	Pump, Hydraulic (Hand) (Use With Hydraulic Wrench)
PWA 29614	Wrench, Mechanical
PWA 29615	Holder, Plate (Use With Mechanical Wrench)
PWA 45419	Air Torque Multiplier (Use With Mechanical Wrench)
PWA 80651	Multiplier, Pneumatic (Use With Mechanical Wrench)
PWA 85301	Adapter, Holding (Use With Mechanical

Special Tools:

(CONTINUED)

	Wrench)
PWA 85302	Wrench, Torque (Use With Mechanical Wrench)
PWA 85507	Adapter, Holding (Use With Hydraulic Wrench)
PWA 85508	Wrench, Torque (Use With Hydraulic Wrench)
PWA 85769	Fixture, Install/Remove
PWA 86515	Protector, Plastic
PWA 86604	Stand, Transport

C. Procedure

(1) Install PWA 86515 Protector in the ID of the front compressor hub assembly (called hub). It snaps in the bore of the hub.

(2) For operators that use the mechanical wrench, remove the turbine shaft (coupling/retaining) nut (called nut) from the front compressor hub assembly (called hub) as follows. Refer to Figure 302.

(a) Install PWA 85301 Adapter in the coupling as follows.

1 Move the three detail clamps toward the center of the adapter.

2 Install the adapter in the coupling. Engage the keys of the adapter in the inner slots of the coupling. Move the clamps outward, behind the lugs in the coupling, and tighten them.

(b) Install PWA 85302 Wrench in the nut as follows.

1 Install the wrench over the adapter. Engage the keys of the wrench in the slots of the nut.

2 Move the detail clamps outward to engage the groove in the nut. Tighten the clamps.

(c) Hold PWA 29614 Mechanical Wrench with a hoist.

(d) Install the mechanical wrench on PWA 85302 Wrench.

ENGINE GENERAL − LPC/LPT COUPLING − REMOVAL−05

(e) Install PWA 29615 Holder on the mechanical wrench. Engage the holes in the holder with the pins on the wrench. Engage the splines of the holder with the splines of the adapter.

(f) Operate the wrench to loosen the nut.

NOTE: It is permitted to use PWA 80651 or PWA 45419 Pneumatic Multiplier.

(g) Remove the removal tools and nut from the hub.

(3) For operators that use the hydraulic wrench, remove the turbine shaft (coupling/retaining) nut (called nut) from the hub. See Figure 303.

(a) Install PWA 85507 Adapter in the coupling as follows.

1 Move the three detail clamps toward the center of the adapter.

2 Install the adapter in the coupling.

3 Engage the keys of the adapter in the inner slots of the coupling. Move the clamps outward behind the lugs of the coupling and tighten them.

(b) Install PWA 85508 Torque Wrench in the nut as follows.

1 With a hoist and sling, lift PWA 25000 Hydraulic Wrench from PWA 28669 Cart.

2 Attach the torque wrench to the hydraulic wrench. Install them together over the adapter.

3 Install the wrenches over the adapter.

4 Engage the keys of the wrench in the slots of the nut. Align the splines of the hydraulic wrench with the splines of the adapter.

(c) Attach either PWA 28668 or PWA 29510 Pump to the hydraulic wrench.

(d) Operate the hydraulic wrench and loosen the nut.

(e) Remove the removal tools and nut from the hub.

(4) Install PWA 85769 Fixture on the coupling as follows. See Figure 304.

(a) Install the assembly of the detail body, locating plate, and detail−10 rods in the coupling. The lugs on the locating plate must be aligned with the slots in the ID of the coupling.

(b) Pull back the detail dowel pin and turn the detail locating plate until the lugs on the plate are behind the lugs that are in the ID of the coupling. Release the pin to lock the locating plate in position.

(c) Install the detail locator in the hub. Turn the locator in the threads in the ID of the hub.

(d) Attach the detail cover to the detail locator with the three detail screws.

(e) Install the two hydraulic cylinders over the two detail−10 rods. Attach the cylinders with two detail nuts. Tighten the nuts with your fingers.

(5) Remove the coupling as follows.

(a) Attach the hydraulic hose assembly and PWA 3755 or PWA 29389 Hydraulic Pump to the hydraulic cylinders.

(b) Operate the pump to disengage the coupling from the hub, but not more. Release the pressure.

(c) Remove the hydraulic cylinders and the detail cover.

(d) Attach the detail−3 adapter to the detail−9 adapter at the center of the fixture with the four detail hex head bolts.

(e) Lift the detail−1 arm with a hoist. Attach it to the end of the detail−9 adapter with the detail−2 eyebolt.

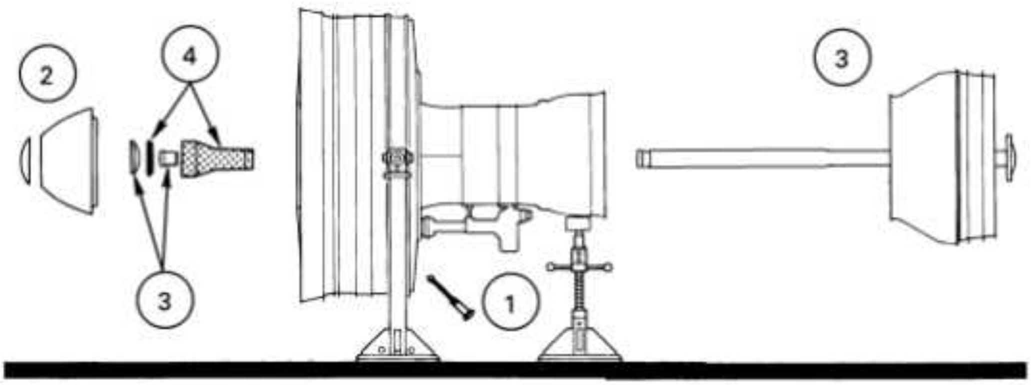
(f) With light tension on the hoist, remove the coupling from the engine. Attach a second hoist to the eyebolt. Trunnion the coupling to rear end down on a work bench. Remove the tool details from the coupling. Put them on PWA 86604 Transport Stand. See Figure 305.

(6) Remove the protector from the hub.

D. Postrequisites

(1) If you will replace the No. 1.5 bearing or if you will disassemble the engine, do Removal−03 (Task 72−00−32−030−001).

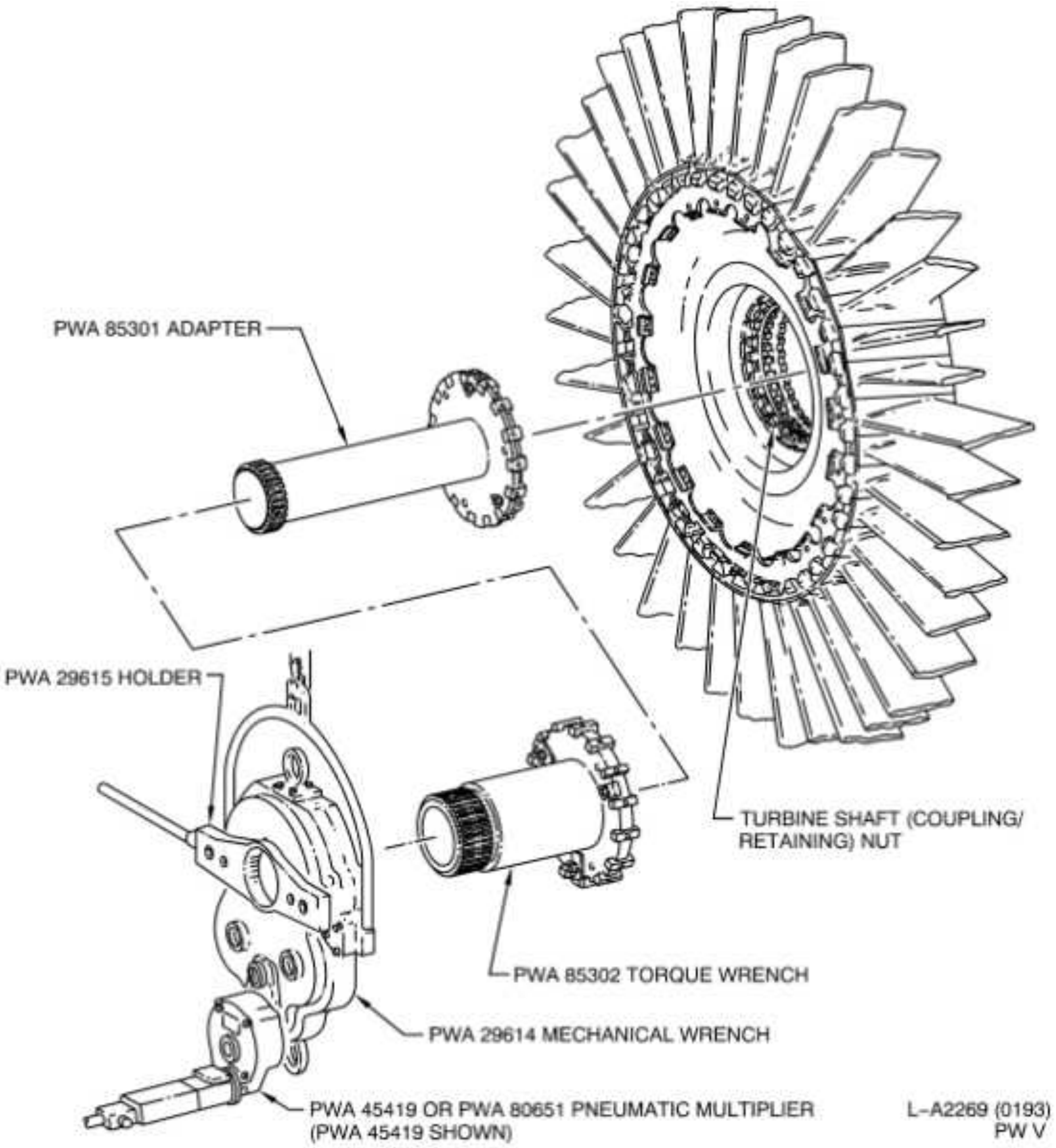
ENGINE GENERAL − LPC/LPT COUPLING − REMOVAL−05



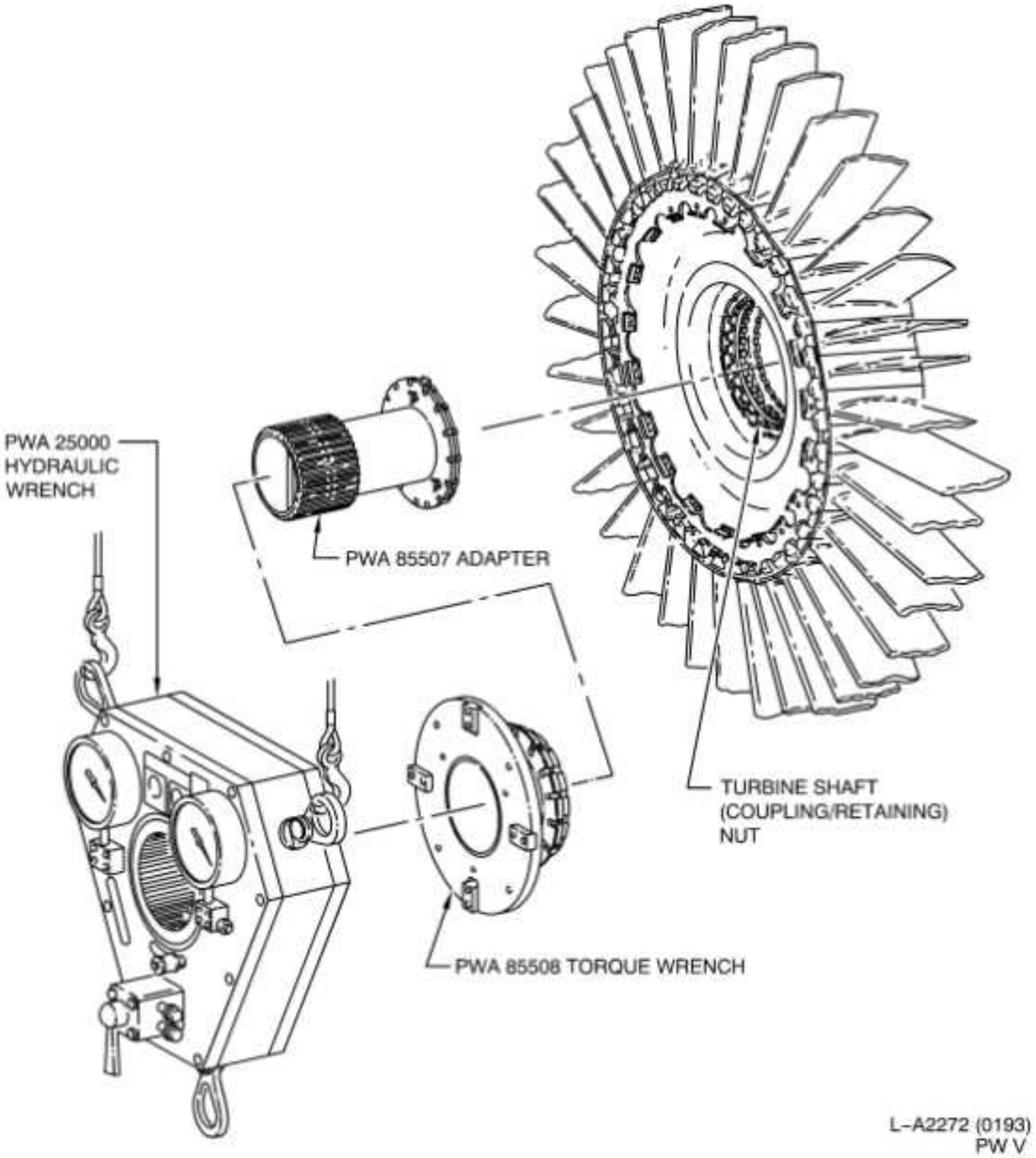
1. REMOVE ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
2. REMOVE COMPRESSOR INLET CONE.
3. REMOVE THE LOW PRESSURE TURBINE AND TURBINE EXHAUST CASE WITH THE SHAFT.
4. REMOVE LPC/LPT COUPLING.

L-A8553 (0293)

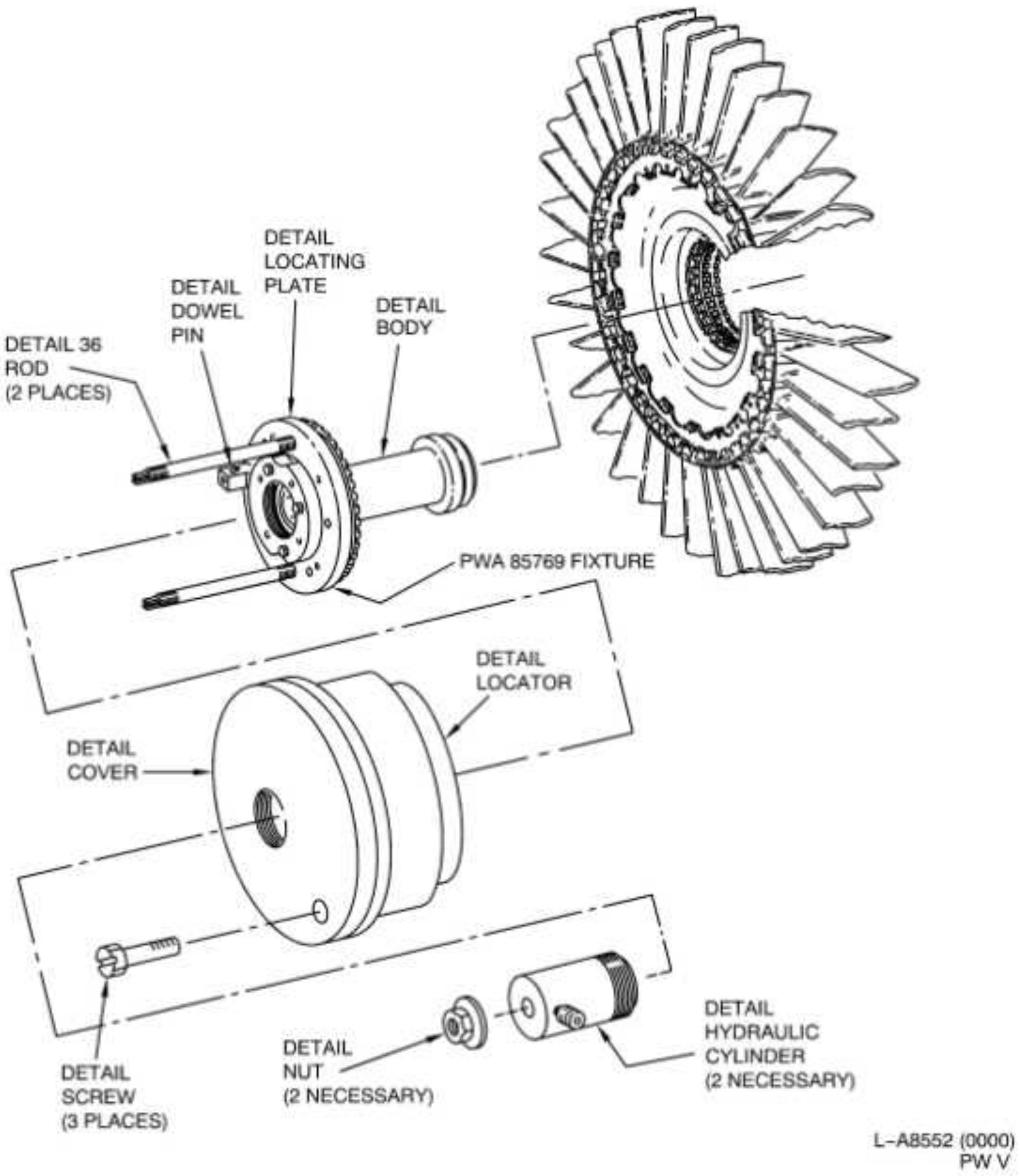
Procedure Sequence
Figure 301
(Task 72−00−32−020−005)


PWA 85301 ADAPTER
PWA 29615 HOLDER
TURBINE SHAFT (COUPLING/ RETAINING) NUT
PWA 85302 TORQUE WRENCH
PWA 29614 MECHANICAL WRENCH
PWA 45419 OR PWA 80651 PNEUMATIC MULTIPLIER (PWA 45419 SHOWN)
L−A2269 (0193)
PW V

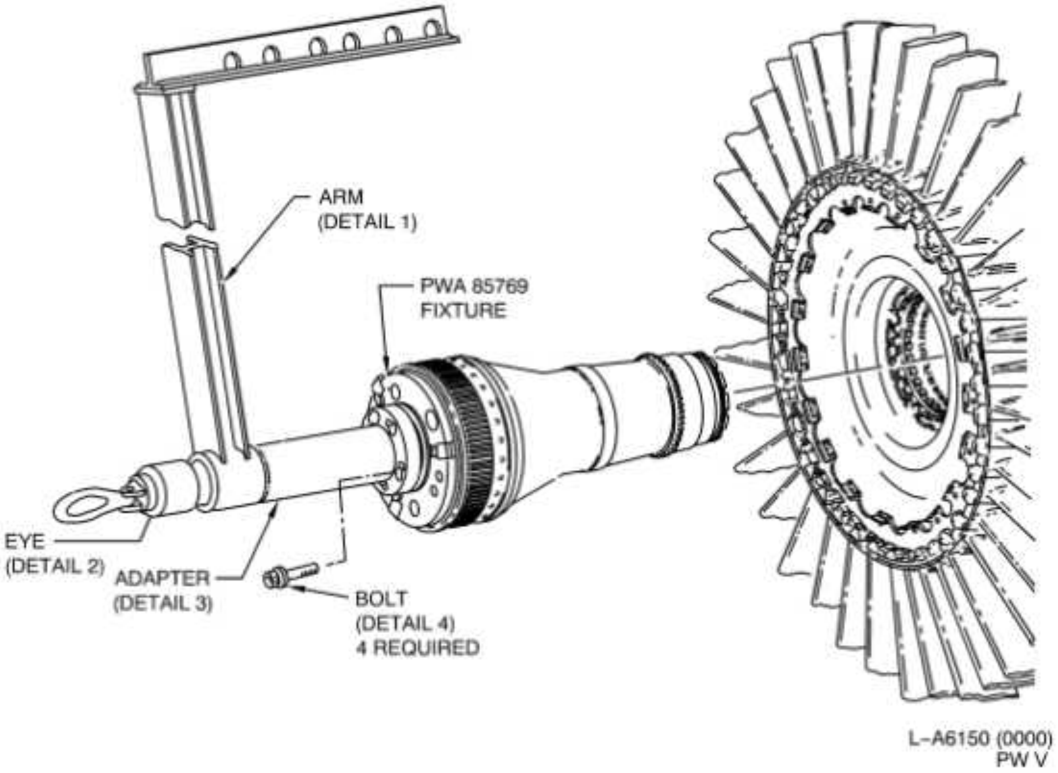
Removal Of The Turbine Shaft
(Coupling/Retaining) Nut (Mechanical Wrench)
Figure 302
(Task 72−00−32−020−005)


PWA 25000
HYDRAULIC
WRENCH
PWA 85507 ADAPTER
TURBINE SHAFT
(COUPLING/RETAINING)
NUT
PWA 85508 TORQUE WRENCH
L-A2272 (0193)
PW V

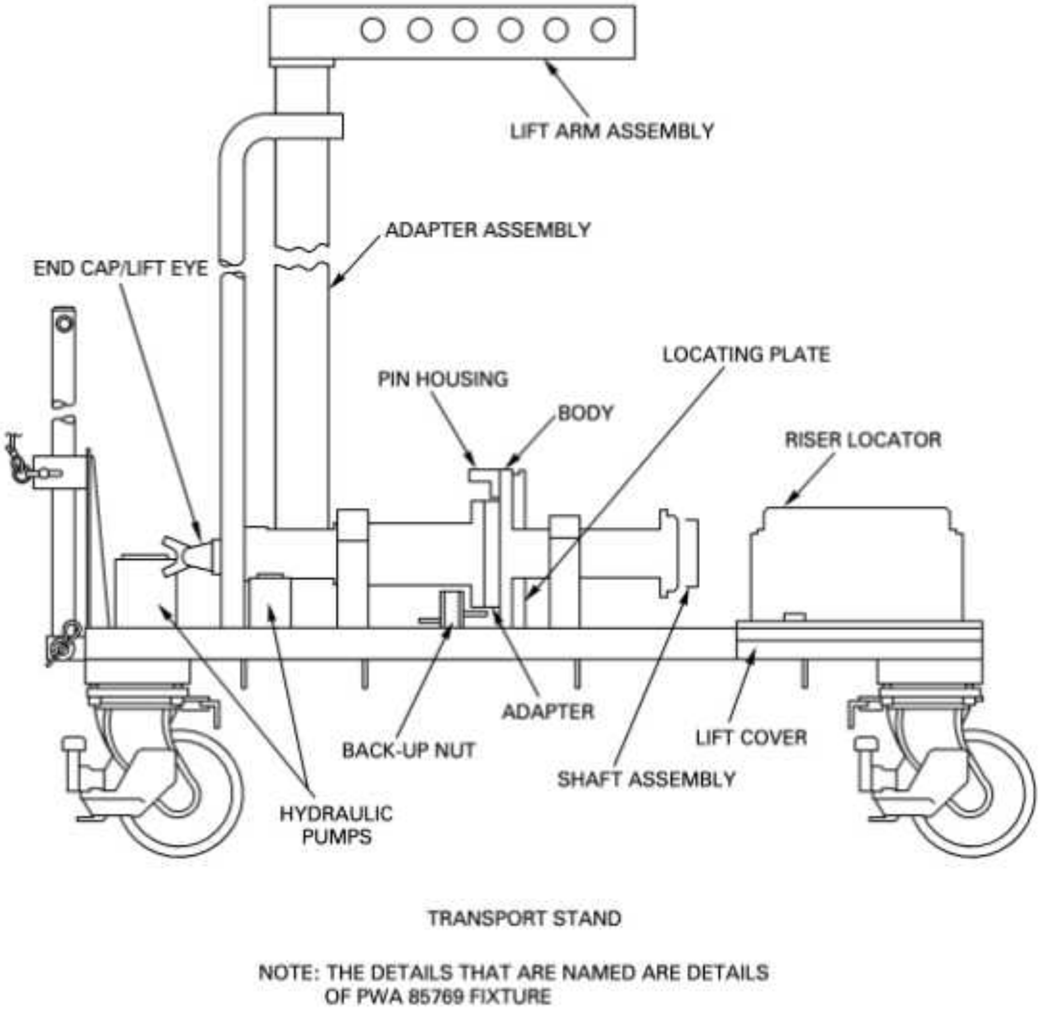
Removal Of The Turbine Shaft
(Coupling/Retaining) Nut (Hydraulic Wrench)
Figure 303
(Task 72−00−32−020−005)


DETAIL
LOCATING
PLATE
DETAIL
DOWEL
PIN
DETAIL
BODY
DETAIL 36
ROD
(2 PLACES)
PWA 85769 FIXTURE
DETAIL
LOCATOR
DETAIL
COVER
DETAIL
HYDRAULIC
CYLINDER
(2 NECESSARY)
DETAIL
NUT
(2 NECESSARY)
DETAIL
SCREW
(3 PLACES)
L-A8552 (0000)
PW V

Removal Of The Turbine Shaft Coupling Assembly
Figure 304 (Sheet 1)
(Task 72−00−32−020−005)


ARM
(DETAIL 1)
PWA 85769
FIXTURE
EYE
(DETAIL 2)
ADAPTER
(DETAIL 3)
BOLT
(DETAIL 4)
4 REQUIRED
L-A6150 (0000)
PW V

Removal Of The Turbine Shaft Coupling Assembly
Figure 304 (Sheet 2)
(Task 72-00-32-020-005)


LIFT ARM ASSEMBLY
ADAPTER ASSEMBLY
END CAP/LIFT EYE
LOCATING PLATE
PIN HOUSING
BODY
RISER LOCATOR
ADAPTER
BACK-UP NUT
LIFT COVER
SHAFT ASSEMBLY
HYDRAULIC PUMPS
TRANSPORT STAND
NOTE: THE DETAILS THAT ARE NAMED ARE DETAILS OF PWA 85769 FIXTURE
L-A9290 (0695)

Transport Stand For PWA 85769 Fixture
Figure 305
(Task 72−00−32−020−005)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LPC/LPT COUPLING - REMOVAL-06

Task 72-00-32-020-005-002:

1. Remove The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Removed) (Hydraulic Wrench) - Deleted

A. Procedure

(1) This procedure is relocated to 72-00-32, Removal-05 (Task 72-00-32-020-005).

Task 72−00−32−420−001:

1. Install LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed)

NOTE: See Figure 401 for Part/Assembly Installation Procedure Sequence.

A. Prerequisites

(1) See 72−00−32, Inspection/Check−01 (Task 72−00−32−990−001) for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by reference number. For example: (Reference 1234) Torque retaining nut as follows.

(2) Install The No. 1.5 Bearing And Seal. Refer to 72−00−32, Installation−03 (Task 72−00−32−430−001).

B. Equipment And Materials Required

Special Tools:

PWA 3755	Pump, Hydraulic
PWA 18872	Wrench, Hydraulic*
PWA 25000	Wrench, Hydraulic*
PWA 28668	Pump, Hydraulic (Use With Hydraulic Wrench)
PWA 28669	Cart (Optional) (Use With Hydraulic Wrench)
PWA 28814	Pump, Hydraulic* (Use With Hydraulic Wrench)
PWA 28815	Cart (Use With Hydraulic Wrench)
PWA 29389	Hydraulic Pump
PWA 29510	Pump, Hydraulic* (Hand) (Use With Hydraulic Wrench)
PWA 29614	Wrench, Mechanical
PWA 29615	Holder, Plate (Use With Mechanical Wrench)
PWA 33732	Wrench, Hydraulic*
PWA 45418	Wrench, Mechanical*
PWA 45419	Air Torque Multiplier* (Use With Mechanical Wrench)
PWA 75046	Cart* (Use With Hydraulic Wrench)
PWA 80070	Wrench, Hydraulic*
PWA 80071	Multiplier, Torque* (Use With Hydraulic Wrench)
PWA 80187	Wrench, Mechanical*
PWA 80651	Multiplier, Pneumatic* (Use With Mechanical Wrench)
PWA 85299	Adapter, Wrench* (Use With Mechanical And Hydraulic Wrench)
PWA 85300	Wrench, Torque* (Use With Hydraulic Wrench)

Special Tools:

(CONTINUED)

PWA 85301	Adapter, Holding (Use With Mechanical Wrench)
PWA 85302	Wrench, Torque (Use With Mechanical Wrench)
PWA 85483	Plate, Gage
PWA 85490	Drift
PWA 85504	Gage
PWA 85507	Adapter, Holding (Use With Hydraulic Wrench)
PWA 85508	Wrench, Torque (Use With Hydraulic Wrench)
PWA 85514	Wrench, Torque* (Use With Hydraulic Wrench)
PWA 85515	Adapter, Holding* (Use With Hydraulic Wrench)
PWA 85769	Fixture, Install/Remove
PWA 86325	Fixture, Retainer (Optional To PWA 86437)
PWA 86437	Fixture, Retainer (Optional To PWA 88222)
PWA 86515	Protector, Plastic
PWA 86604	Stand, Transport
PWA 87354	Wrench, Hydraulic*
PWA 88222	Fixture, Retainer
PWA 101021	Rod, Installation
PWA 102460	Adapter, Wrench* (Use With Mechanical And Hydraulic Wrench)

*Refer to Table 402 for the mechanical wrench or Table 403 the hydraulic wrench tool options. These tables show the correct combinations of tools for the installation of the turbine shaft nut.

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P06-002	Petrolatum, White (PMC 9609)
P06-021	Compound, Antigalling (PWA 550-3)
P06-054	Paste, Anti-Seize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	8	72-54-00/4/110
Packing	1	72-32-00/2/30
Packing	1	72-54-00/5/90

Lockwire, AS3214-02

ENGINE GENERAL - LPC/LPT COUPLING - INSTALLATION-01

C. Procedure

NOTE: Calculation of the spacer classification is not necessary if the associated and mating parts have not changed. The original removed spacer can be used.

(1) Install PWA 86515 Protector in the ID of the front compressor hub assembly (called hub). It snaps in the bore of the hub. See Figure 402.

(2) Measure Dimension AJ on the hub and Dimension AK on the LPC/LPT coupling. Record these dimensions.

(3) Measure Dimension C on the coupling. Record Dimension C. See Figure 403.

(4) Calculate Dimension AL: subtract Dimension AK from Dimension AJ. Write Dimension AL.

$$AL = AJ - AK$$

(5) If PWA 86325 Fixture or PWA 86437 Fixture is not installed, install fixture to the low pressure turbine shaft and the turbine exhaust case as follows. See Figure 404 (Sheet 1).

NOTE: Use PWA 86325 Fixture with turbine exhaust cases that are (Pre SB PW4ENG 72-456). Use PWA 86437 Fixture with (Pre or Post SB PW4ENG 72-456) turbine exhaust cases.

(a) Install inner slide (404/5) in ID of No. 4 bearing retaining plate and secure with eight detail screws (404/1).

(b) Install outer slide (404/4) over inner slide, locating slot in outer slide over key on inner slide.

(c) Rotate turbine shaft until scallops in flange of outer slide assembly align oil pressure and scavenge tubes protruding from exhaust case flange. Secure outer slide to exhaust case with eight detail bolts (404/2).

(d) Tighten eight cap screws (404/3).

(6) If PWA 88222 Fixture or PWA 86437 Fixture is not installed, install the fixture to the low pressure turbine shaft and the turbine exhaust case. See Figure 404 (Sheet 2).

NOTE: Use PWA 88222 Fixture with (Pre or Post SB PW4ENG 72-456) turbine exhaust cases.

(a) Loosen the locknuts that hold the tube and guide assemblies together and install the fixture to the ID of the turbine exhaust case. The tube assembly detail will mate against the No. 4 bearing retaining plate and the guide assembly detail will mate against the rear inner flange of the exhaust case. Attach the fixture with the captured capscrews of both details.

NOTE: If necessary, turn the LPT rotor to align the holes in the end of the 7th stage disk or LPT shaft, as applicable, with the captured capscrews of the tube assembly detail.

(b) Tighten the capscrews of both details to lock the fixture in position.

(7) Use PWA 85504 Gage to measure low pressure turbine axial position (Dimension A). See Figure 405.

NOTE: Measurement should be an average of at least two measurements, 180 degrees apart.

(a) (Pre SB PW4ENG 72-256) You must remove two screws (405/7) and gage plate (405/8) from the top of the bar if it is there. Put the gage plate and screws in the storage location on the bar.

(b) (Post SB PW4ENG 72-256) Install the gage plate (405/8) on the top of the bar (405/2) with two screws (405/7).

(c) Move the dial indicator and the support block away from the spring-loaded rod (405/4).

(d) Push the spring-loaded flush pin assembly (405/6) into tubular housing and rotate to engage the dowel pin (405/5) in the slot to secure the flush pin.

(e) Find the 1.0 inch (25.400 mm) by 1.5 inch (38.100 mm) slot in the inner front flange of the turbine exhaust case at the 6 and 12 o'clock location.

(f) Put the bar (405/2) between two exhaust case struts and next to one of the slots in the case inner front flange.

(g) Put the gage bar on two rear flanges (inner and outer) of the turbine exhaust case and put the flush pin assembly over the 6th stage LPT disk (405/9). Hold the gage to the case with two bolts (405/3) and nuts (405/1).

(h) Release the rod from the locked position and allow the flush pin to touch the disk. Make sure that the flush pin touches the disk and nut the blade (you can rotate the rotor if necessary).

(i) Zero the dial indicator on the back face of the bar.

(j) Move the slide dial indicator into position over the end of the spring-loaded rod (405/4) to read the turbine running position.

(k) Dimension A must be within the limits specified in Figure 406.

NOTE: Reference 847 is applicable to engines that are Pre SB PW4ENG 72-256. Reference 851 is applicable to engines that are Post SB PW4ENG 72-256.

1 If the indicator reading is zero, Dimension A is at its mean.

a (Reference 847) Mean Dimension A is 12.380 inches (314.452 mm).

b (Reference 851) Mean Dimension A is 12.330 inches (313.182 mm).

2 If the indicator reading is "+", the 6th stage disk is to the rear of Mean Dimension A. You must subtract the indicator reading from the mean dimension.

3 If the indicator reading is "-", the 6th stage disk is forward of Mean Dimension A. You must add the indicator reading to the mean dimension.

(l) Remove the gage and repeat measurement at the opposite slot location.

(m) Remove gage. Record Dimension A.

(8) Measure Dimension B as follows. Refer to Figure 407.

(a) Install PWA 85483 Gage Plate on hub. Use a standard depth micrometer.

(b) Dimension B is the measured dimension (M) minus the thickness (X) of the gaging plate. This thickness is stamped on the tool.

B = M - X

(9) Find the correct spacer classification as follows.

(a) Subtract Dimension A (the value of Dimension A is either positive or negative) and Dimension C from Dimension B. This result equals the correct spacer thickness (Dimension D).

B - A - C = D

(b) Find the correct spacer classification. See Table 401.

NOTE: Turbine shaft spacer class may be changed per 72-53-81, Repair-01. See PW4000 Series CIR, PN 51A357.

Class	Thickness (D)
1	0.550 - 0.555 Inch (13.970 - 14.097 mm)
2	0.555 - 0.560 Inch (14.097 - 14.224 mm)
3	0.560 - 0.565 Inch (14.224 - 14.351 mm)
4	0.565 - 0.570 Inch (14.351 - 14.478 mm)
5	0.570 - 0.575 Inch (14.478 - 14.605 mm)
6	0.575 - 0.580 Inch (14.605 - 14.732 mm)
7	0.580 - 0.585 Inch (14.732 - 14.859 mm)
8	0.585 - 0.590 Inch (14.859 - 14.986 mm)
9	0.590 - 0.595 Inch (14.986 - 15.113 mm)
10	0.595 - 0.600 Inch (15.113 - 15.240 mm)
11	0.600 - 0.605 Inch (15.240 - 15.367 mm)

Spacer Classification Data
Table 401

Class	Thickness (D)
(CONTINUED)	
12	0.605 - 0.610 Inch (15.367 - 15.494 mm)
13	0.610 - 0.615 Inch (15.494 - 15.621 mm)
14	0.615 - 0.620 Inch (15.621 - 15.748 mm)
15	0.620 - 0.625 Inch (15.748 - 15.875 mm)
16	0.625 - 0.630 Inch (15.875 - 16.002 mm)
17	0.630 - 0.635 Inch (16.002 - 16.129 mm)
18	0.635 - 0.640 Inch (16.129 - 16.256 mm)
19	0.640 - 0.645 Inch (16.256 - 16.383 mm)
20	0.645 - 0.650 Inch (16.383 - 16.510 mm)
21	0.650 - 0.655 Inch (16.510 - 16.637 mm)
22	0.655 - 0.660 Inch (16.637 - 16.764 mm)
23	0.660 - 0.665 Inch (16.764 - 16.891 mm)
24	0.665 - 0.670 Inch (16.891 - 17.018 mm)
25	0.670 - 0.675 Inch (17.018 - 17.145 mm)
26	0.675 - 0.680 Inch (17.145 - 17.272 mm)
27	0.680 - 0.685 Inch (17.272 - 17.399 mm)

Spacer Classification Data
Table 401 (Continued)

CAUTION: ENSURE CLASSIFIED SPACER IS INSTALLED ON LPT SHAFT. MISALIGNMENT CAN OCCUR IF SPACER IS NOT PRESENT.

(10) Use PWA 85490 Drift and install spacer on shaft.

(11) Apply Antigalling Compound P06-021 to the external splines of the turbine shaft coupling assembly (called coupling). Cure the compound for five minutes, minimum. Refer to Figure 408.

CAUTION: UNWANTED MATERIAL IN THE NO. 1 AND 2 BEARING SUMP CAUSED AN IN-FLIGHT-SHUTDOWN.

CAUTION: MAKE AN INSPECTION OF THE NO. 1 AND 2 BEARING SUMP AREA BEFORE YOU INSTALL THE COUPLING. USE GLOVES. REMOVE ALL UNWANTED MATERIAL BEFORE YOU INSTALL THE COUPLING. See Figure 409.

(12) Install the coupling as follows. Use PWA 85769 Fixture. See Figure 410, Figure 411, Figure 412 and Figure 413.

NOTE: The fixture is installed on PWA 86604 Transport Stand. See Figure 410.

(a) Install shaft (detail−35) to the end of the LPT shaft. Tighten by hand. See Figure 410.

(b) Install the arm (detail−1) to the adapter (detail−3) and eye (detail−2).

(c) Lift and turn the coupling to the horizontal position.

(d) Apply Engine Oil P03−001 to the seal seat and to the coupling as shown in Figure 412.

(e) Install the coupling into the engine over shaft (detail−35). Align the disassembly vector (DV) marks and engage the splines of the coupling to the LPT shaft and fan hub. See Figure 413.

(f) Remove end cap/lift eye (detail−2) from adapter assembly (detail−3).

(g) Install PWA 101021 Rod into the adapter assembly (detail−3) and turn the rod so that it is attached to the shaft assembly (detail−35).

(h) Use a standard one inch (or equivalent) wrench to turn PWA 101021 Rod until the coupling is installed onto the LPT shaft.

(i) Remove the PWA 101021 Rod, the lift arm assembly (detail−1) and the adapter assembly (detail−3) from the tool.

(j) Install the locator (detail−27) to the front fan hub and tighten by hand.

(k) Install and tighten the two rods (detail−36) to the body.

(l) Install the two hydraulic cylinders (detail−24) and the two spacers (detail−26) over the rods.

(m) Install the cover (detail−7) to the locator (detail−27) and attach with the six bolts (detail−41).

(n) Install the nut (detail−11) to the shaft (detail−35) and tighten by hand.

R (o) Loosen the retainer at the rear of the engine as
R follows:

R 1 If the PWA 86325 or PWA 86437 Fixture is
R installed on the turbine exhaust case, loosen
R the eight cap screws (404/3). See Figure 404
R (Sheet 1).

R 2 If the PWA 88222 Fixture is installed on the
R turbine exhaust case, loosen the eight lock
R nuts (404/6). See Figure 404 (Sheet 2).

(p) Connect the hydraulic hoses to the cylinders and to the PWA 29389 Pump. Operate the pump to install the coupling fully.

(q) Disconnect the pump and hoses. Remove the nut (detail-11), six bolts (detail-41), and the cover (detail-7). Remove the two spacers (detail-26), hydraulic cylinders, and the rods (detail-36). Remove the locator (detail-27) from the fan hub.

(r) Use the hoist and install the adapter (detail-3), arm (detail-1), and eye with the four bolts (detail-4).

(s) Retract the locating pin. Turn the plate (detail-21) to put the plate lugs between the coupling lugs. Release the locating pin.

(t) Remove the tool. Remove the shaft (detail-35).

CAUTION: FOR EACH INSTALLATION, A NEW OR TREATED TURBINE SHAFT NUT MUST BE INSTALLED. NUT MAY BE TREATED PER 72-32-84, REPAIR-01. SEE PW4000 SERIES CIR, PN 51A357.

(13) Apply Antigalling Compound P06-021 to the threads and face of the turbine shaft nut (called nut). Cure the compound for five minutes before assembly. Install the washer to the coupling ID. Apply Antigalling Compound P06-021 to coupling. See Figure 408.

(14) For operators that use the mechanical wrench, install the turbine shaft nut on the LPT shaft as follows. Refer to Figure 414.

NOTE: See the following step to install the turbine shaft nut on the LPT shaft with the hyraulic wrench tooling.

(a) Install the nut on the LPT shaft. Tighten it with your hand.

(b) Install PWA 102460 Adapter or PWA 85299 Adapter in the coupling as follows.

1 Loosen the wing nuts and move the three clamps radially inward.

2 Install the adapter to coupling with the keys of the tool aligned with the slots in the coupling. Adjust the adapter at 3 and 9 o'clock for the attachment of the mechanical wrench.

3 Move the three clamps radially outward to engage the lugs of the coupling. Tighten the wing nuts and secure the clamps.

(c) Install PWA 85300 Torque Wrench into the center of the adapter. With the splines aligned, push the wrench into the nut until the wrench touches the face of the nut.

(d) Use a hoist and install a mechanical wrench on the torque wrench and adapter. Push the mechanical wrench to touch the face of the adapter. Engage the pins of the mechanical wrench with the holes in the torque wrench. See Table 402 for the correct combinations of tools.

PWA Torque Wrench	PWA Holder Adapter	PWA Mechanical Wrench or Torque Multiplier	PWA Pneumatic Multiplier
85300	102460 or 85299	80187	80651 or 45419
85300	102460 or 85299	45418	45419
85300	102460 or 85299	80071	80651 or 45419

Turbine Shaft Nut Installation (Mechanical Wrench) - Table 402

(15) For operators that use the hydraulic wrench, install the turbine shaft nut on the LPT shaft as follows. Refer to Table 403 for the correct combinations of tools. Refer to Figure 414.

(a) Install the nut on the LPT shaft. Tighten it with your hand.

PWA Torque Wrench	PWA Holding Adapter	PWA Hydraulic Wrench	PWA Pump	PWA Cart
85514	85515	33732	28814 or 29510	75046
85514	85515	18872	28814 or 29510	75046 or 28815
85300	102460 or 85299	87354	28814 or 29510	75046
85300	102460 or 85299	80070	28814 or 29510	75046

Turbine Shaft Nut Installation − (Hydraulic Wrench) − Table 403

(b) (Method 1)

1 Attach PWA 85515 Adapter to a hydraulic wrench. Install the adapter/wrench in the coupling. Lock the detail clamps behind the lugs in the coupling.

2 Install PWA 85514 Torque Wrench in the adapter, engaging the splines of the torque wrench with the splines in the coupling and the hydraulic wrench.

3 Connect a pump to the hydraulic wrench.

(c) (Method 2)

1 Install PWA 102460 Adapter or PWA 85299 Adapter in the coupling, the detail keys in the slots of the coupling. With the three detail clamps to the rear of the slots in the coupling, tighten the clamps.

2 Install PWA 85300 Torque Wrench in the center of the adapter, engaging the splines of the nut.

3 Push the torque wrench until it touches the face of the nut.

4 With a hoist, lift a hydraulic wrench and install it on the torque wrench, engaging splines. Engage the pins of the hydraulic wrench in the holes of the adapter.

5 Connect a pump to the hydraulic wrench.

(16) (Reference 971) Tighten the turbine shaft nut with the wrench as follows.

(a) Tighten nut to 5000 − 7000 lb−in. (564.924 − 790.894 N.m). Turn the nut through an angle of 43 − 47 degrees. Loosen the nut (to zero).

(b) Tighten the nut to 4000 − 6000 lb−in. (451.939 − 677.909 N.m).

(c) Find a reference point on the nut and an adjacent part.

(d) Turn the nut through an angle of 43 − 47 degrees.

(e) Loosen the nut (to zero) and do step (b) again.

(f) If the nut reference point is aligned with adjacent part reference point or beyond it within two degrees maximum, apply final angle of turn by step (d).

(g) If reference points are not within limits, do steps (c), (d) and (e) again, in order, until reference points are within limits. Then do step (f).

(17) Remove the tools from the coupling.

(18) (Reference 1008) Measure Dimension AL from the front face of the hub to the front face of the coupling. See Figure 402 (Sheet 2).

R
R

(a) Measured Dimension AL must not be more than calculated Dimension AL plus 0.003 inch (0.076 mm) nor less than calculated Dimension AL minus 0.003 inch (0.076 mm).

Measured AL <= Calculated AL + 0.003 inch (0.076 mm) AND
Measured AL >= Calculated AL − 0.003 inch (0.076 mm)

NOTE: See step (4) for Calculated Dimension AL.

(b) If Measured Dimension AL is not within limits, remove the nut and do this procedure again until measured Dimension AL is within limits.

(19) Make sure that turbine shaft spacer is seated.

(20) (References 847 and 851) Do a check of the low pressure turbine axial position as follows.

(a) Use PWA 85504 Gage. If the engine is Pre SB PW4ENG 72−256, do not use the detail gage plate. If the engine is Post SB PW4ENG 72−256, use the detail gage plate.

(b) The reading on the indicator must be between minus 0.025 inch (0.635 mm) and plus 0.025 inch (0.635 mm). If it is not, replace the spacer as necessary.

NOTE: If the indicator reading is outside of the limits and is "+", a thinner spacer is necessary. If the reading is outside of the limits and is "−", a thicker spacer is necessary.

(21) Install the key washer and the retaining ring to hold the turbine shaft nut. See Figure 415.

(22) At the rear of the engine, remove the 16 tool bolts that attach the PWA 86437 Fixture, or PWA 86325 Fixture to the exhaust case and the LPT shaft, if used. See Figure 404 (Sheet 1). If PWA 88222 Fixture was used, loosen the captured capscrews on the tube assembly detail and the guide assembly detail. See Figure 404 (Sheet 2). Remove the retainer fixture from the turbine exhaust case.

(23) For operators that use a mechanical wrench, install the turbine shaft (coupling/retaining) nut (called nut) tooling as follows.

NOTE: See the following step to install the turbine shaft (coupling/retaining) nut (called nut) with the hyraulic wrench tooling.

CAUTION: YOU MUST TREAT THE NUT EACH TIME YOU INSTALL IT.

(a) Apply Anti-Seize Paste P06-054 to the nut. Remove the unwanted paste. Refer to Figure 408.

(b) Install the nut on the hub. Tighten it with your hand.

(c) Install PWA 85301 Adapter into the coupling. See Figure 417.

1 Slide the three "L" shaped clamps toward the centerline of the adapter.

2 Install the adapter into the coupling with the inner slotted flange engaged with the slots on the coupling. Move the "L" shaped clamps outward and tighten the wing nuts.

(d) Install PWA 85302 Torque Wrench into the nut.

1 Move the wrench over the adapter and turn the wrench to engage the slots in the nut.

2 Move the clamps radially outward to engage the grooves in the nut. Install the wrench so that the wrench holes are at the 3 and 9 o'clock locations.

3 Keep the wrench in position with the three wing nuts.

(e) Use a hoist and install PWA 29614 Mechanical Wrench over the adapter. Engage the splines of the torque wrench.

(f) Install PWA 29615 Holder on the mechanical wrench. Engage the pins of the mechanical wrench with the holes in the holder.

(g) Install either PWA 45419 Pneumatic Multiplier or PWA 80651 Pneumatic Multiplier on the mechanical wrench.

(24) For operators that use the hydraulic wrench to install the turbine shaft (coupling/retaining) nut (called nut), install tooling as follows.

CAUTION: YOU MUST TREAT THE NUT EACH TIME YOU INSTALL IT.

(a) Apply Anti-Seize Paste P06-054 to the nut. Remove the unwanted paste. Refer to Figure 408.

(b) Install the nut on the hub. Tighten it with your hand.

(c) Install PWA 85507 Adapter into the coupling. See Figure 418.

1 Slide three wing nuts toward adapter centerline.

2 Place adapter into front end of coupling until keys locate slots of coupling. Slide clamps outward and secure.

(d) Install PWA 85508 Torque Wrench and PWA 25000 Hydraulic Wrench.

1 With a hoist, remove the hydraulic wrench from PWA 28669 Cart.

2 Attach torque wrench to the hydraulic wrench and install both as a unit over adapter using hoist and nylon strap.

3 Engage teeth of torque wrench with slots in nut. Align splines of adapter with splines in hydraulic wrench.

4 Attach either PWA 28668 Pump or PWA 29510 Pump to the hydraulic wrench.

(25) (Reference 970) Tighten the turbine shaft (coupling/retaining) nut with the wrench as follows.

(a) Tighten the nut to 24,200 - 26,800 lb-in. (2734.232 - 3027.993 N.m). Turn the nut through an angle of 18 - 20 degrees. Loosen the nut (to zero).

(b) Tighten the nut to 24,200 - 26,800 lb-in. (2734.232 - 3027.993 N.m).

(c) Find a reference point between the nut and an adjacent part.

(d) Turn the nut through an angle of 18 - 20 degrees.

(e) Loosen the nut (to zero) and do step (b) again.

(f) If the nut reference point is in line with the adjacent part reference point or beyond it within two degrees maximum, apply final angle of turn per step (d). If necessary, tighten nut three degrees maximum to align locking feature.

(g) If reference points are not within limits, repeat steps (c), (d) and (e) in order, until reference points are within limits. Then perform step (f).

(26) Remove the tooling from the coupling.

(27) Install a new packing, lubricated with Petrolatum White P06-002, to the turbine shaft plug. Install the plug to the coupling ID and secure with a key washer and a retaining ring. See Figure 416.

NOTE: Make sure retaining ring is fully inserted in the retaining nut groove, all around, and ring end gap is 0.010 inch (0.254 mm) minimum.

(28) Attach the No. 4 bearing retaining plate to the turbine exhaust case with the eight bolts lubricated with Engine Oil P03-001 and key washers PN MS 9276-10. Torque the bolts to 75 - 85 lb-in. (8.474 - 9.604 N.m). Bend the key washer tabs against the bolthead flats. See Figure 419.

(29) Install No. 4 bearing oil scavenge (inner) tube. See Figure 420.

(a) Remove protective cover from the mount pad recess in turbine exhaust case rear inner diameter.

(b) Install new gasket (420/3) in groove in recess in exhaust case rear inner diameter.

(c) Align boltholes in flange of No. 4 bearing oil scavenge tube (420/8) with boltholes in recessed mount pad in exhaust case rear inner diameter. Align bolthole in detail tube bracket with bolthole in exhaust case rear inner diameter. Secure tube using three bolts (420/6) lubricated with Engine Oil P03-001 and key washers (420/7). Torque bolts to 32 - 36 lb-in. (3.616 - 4.067 N.m). Bend tabs of key washers.

(30) (Pre SB PW4ENG 72-472) Install the No. 4 bearing (oil) nozzle and the No. 4 bearing packing transfer tube in the exhaust case No. 4 bearing compartment at the 1:30 o'clock position. See Figure 421.

(a) Install the nozzle (421/4) in the exhaust case and secure with key washers (421/2 and (421/3) and bolts (421/1). Bend the tabs on the key washers.

(b) Install the No. 4 bearing packing transfer tube (421/5) to the No. 4 bearing nozzle (421/4) and secure with key washers (421/6 and 421/7) and bolts (421/8). Bend the tabs on the key washers.

(31) (Post SB PW4ENG 72-472) Install No. 4 bearing (oil) nozzle and No. 4 bearing damper supply tube. See Figure 422 (Sheet 1) and (Sheet 2).

(a) Install the No. 4 bearing nozzle (422/11) in the port in the pad on the exhaust case rear inner diameter at the 1:30 o'clock position. Install the nozzle with two bolts (422/16) and (422/17), with threads lubricated with Engine Oil P03-001, and two washers (422/16) and (422/17).

(b) Install the No. 4 bearing damper supply tube (422/12) through the 0.380 inch (9.652 mm) diameter hole in the nozzle (422/11) and into the port in the exhaust case rear flange. Install the damper tube with two bolts (422/16) and (422/17) with threads lubricated with Engine Oil P03-001, and washers (422/16) and (422/17). Torque the bolts that attach the nozzle to the exhaust case and bolts that attach the damper supply tube to the nozzle to 75 - 85 lb-in. (8.474 - 9.604 N.m). Bend the tabs of washers.

(32) (Post SB PW4ENG 72-472) Install No. 4 bearing front nozzle assembly and the packing transfer tube (damper tube to front nozzle). See Figure 422.

(a) Lubricate two packings (422/14) with Engine Oil P03-001. Install the packings in the grooves of the packing transfer tube (422/15). Insert one end of the tube into the port in the front No. 4 bearing nozzle (422/13).

(b) Align the boltholes in the flange of the front nozzle with the two retainer plate boltholes at the 12 o'clock position; and insert the nozzle through the hole in the No. 4 bearing support flange at the 1:30 o'clock position. Insert the end of the transfer tube in the port in the elbow of the No. 4 bearing damper supply tube. Put the retaining plate (422/2), chamfered side out, on the retainer plate pad (under the nozzle flange). Put the key washer (422/1) over the oil nozzle flange, and install two bolts, with threads lubricated with Engine Oil P03-001.

(c) (Reference 90) Make sure that the clearance gap (422/3) between the retaining plate and the grooves in the bearing outer race is in the limit specified in Index 2, Figure 423. Torque the bolts that attach the retainer plate to 75 - 85 lb-in. (8.474 - 9.604 N.m). Bend the tabs of washer (422/1).

CAUTION: YOU MUST APPLY ENGINE OIL FULLY TO THE COVER PACKING OR YOU WILL CUT THE PACKING DURING INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN-FLIGHT SHUTDOWN.

CAUTION: INSTALL THE COVER INTO POSITION USING FOUR WORK BOLTS EQUALLY SPACED AROUND THE COVER. TIGHTEN THE BOLTS EQUALLY IN SMALL INCREMENTS TO PULL THE COVER INTO POSITION EQUALLY. MONITOR THE ENGAGEMENT OF THE COVER TO MAKE SURE THAT THE PACKING IS NOT CUT DURING INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN-FLIGHT SHUTDOWN.

(33) Install the No. 4 bearing cover as follows: See Figure 424.

(a) Apply Engine Oil P03-001 fully to the new packing (424/2).

(b) Install the new packing into the groove at the rear flange of the No. 4 bearing cover (424/3).

(c) Install the cover into the rear inner flange of the exhaust case (424/1).

(d) Install 4 work bolts equally spaced around the cover.

(e) Tighten the bolts equally in small increments to pull the cover into position equally.

(f) Monitor the engagement of the cover to make sure the packing is not cut.

(g) Remove the work bolts.

(34) Install the No. 4 bearing heat shield (424/4) into recess in the No. 4 bearing shield (424/5). Align bolt holes and install shield over No. 4 bearing cover at the rear inner flange of the exhaust case. Install the shield with 30 bolts, lubricated with Engine Oil P03-001. Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(35) (Post SB PW4ENG 79-76) Install No. 4 bearing (oil) pressure tube. See Figure 425 (Sheet 1) and (Sheet 2).

(a) Remove protective cover from adapter (425/5).

NOTE: The No. 4 bearing (oil) pressure tube of (Pre SB PW4ENG 79-76) would not have been removed for split-shipment.

(b) No. 4 bearing pressure tube option to prevent possible wear to the No. 4 bearing pressure tube (425/14), a fiberglass tape wear Wrap P05-136, (425/17) is provided as an option.

(c) Install the shield set (425/15) and the heat shield insulation slide clamp (425/16) on the elliptical section of the No. 4 scavenge tube (425/14).

NOTE: The shield is installed on the section of the tube that goes through the strut of the turbine exhaust case.

(d) Install the shield set (425/7) on the No. 4 pressure tube as follows.

1 Place the two halves over the round section of tube.

2 Install one restraining strap (425/18) through the loops on the section of the shield that overlaps the shield set (425/15).

3 Make tight the shield set on the tube by pulling the strap tight. Cut off excess strap material.

4 Put the loop clamp (425/10) on the wear sleeve of the shield set and secure temporarily with a work bolt and nut.

(e) Attach bracket (425/11) to the turbine exhaust case with two bolts (425/8). Torque the bolts to 75 − 85 lb−in. (8.474 − 9.604 N.m).

(f) Install the No. 4 pressure tube through the strut at the 4:30 o'clock position.

1 Attach the tube nut to the adapter (425/5), handtight.

NOTE: The shield may be separated to attach the tube nut to the adapter.

2 Remove the work bolt and replace with bolt (425/9) and nut (425/12) and attach to the bracket (425/11).

3 Torque the tube nut to the adapter (425/5) to 225 − 250 lb−in. (25.422 − 28.246 N.m). Safety the tube nut with lockwire.

R
R

4 Torque the bolt (425/9) that attaches the clamp (425/10) to the bracket (425/11) to 32 - 36 lb-in. (3.616 - 4.067 N.m).

5 Install the four additional straps (425/18) to hold the shield in place.

6 Make tight the shield set on the tube by pulling the straps tight. Cut off excess strap material.

7 Install bracket (425/2) over the outboard end of the tube.

8 Position the nut (425/4) on the outboard end of the tube and secure the nut to the tube with thrust wire (425/19).

9 Attach the tube shield (425/3) to the turbine exhaust case at the 4:30 o'clock position, pushing it on over the nut (425/4). Line up the shield with the bracket (425/2).

10 Install two bolts (425/1) to retain shield and bracket and torque to 32 - 36 lb-in. (3.616 - 4.067 N.m). Safety the bolts with lockwire.

D. Postrequisites

(1) Do a vacuum check of the No. 1, 1.5, and 2 bearing compartments. Refer to 72-00-32, Testing-01 (Task 72-00-32-790-001).

(2) Airflow check No. 4 bearing oil nozzle. Refer to 72-54-00, Assembly-01 (Task 72-54-00-400-001).

(3) Install all stage 1 LPC blade assemblies. See 72-00-31, Installation-04 (Task 72-00-31-420-002-002).

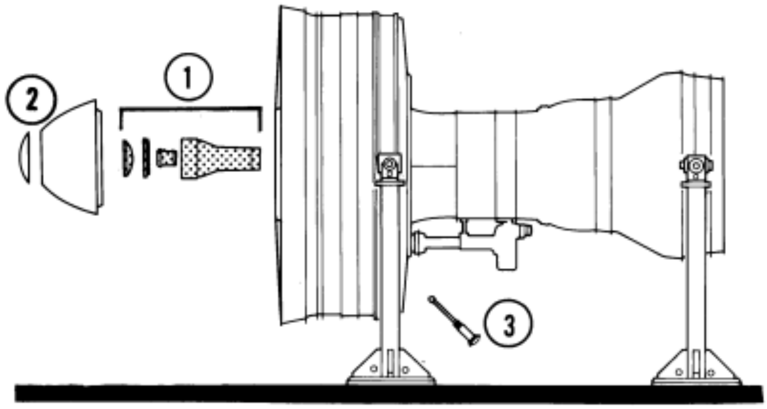
NOTE: If blades were not removed during coupling removal procedure, then shims should be taken out at this time.

(4) Install compressor inlet cone. See 72-00-31, Installation-02 (Task 72-00-31-420-001).

(5) Install electronic engine control (EEC) speed transducer (N1). See 72-00-34, Installation-03 (Task 72-00-34-450-001).

(6) Test the engine. Refer to the Test Reference Table. Refer to 71−00−00, Testing−00 (Task 71−00−00−990−003).

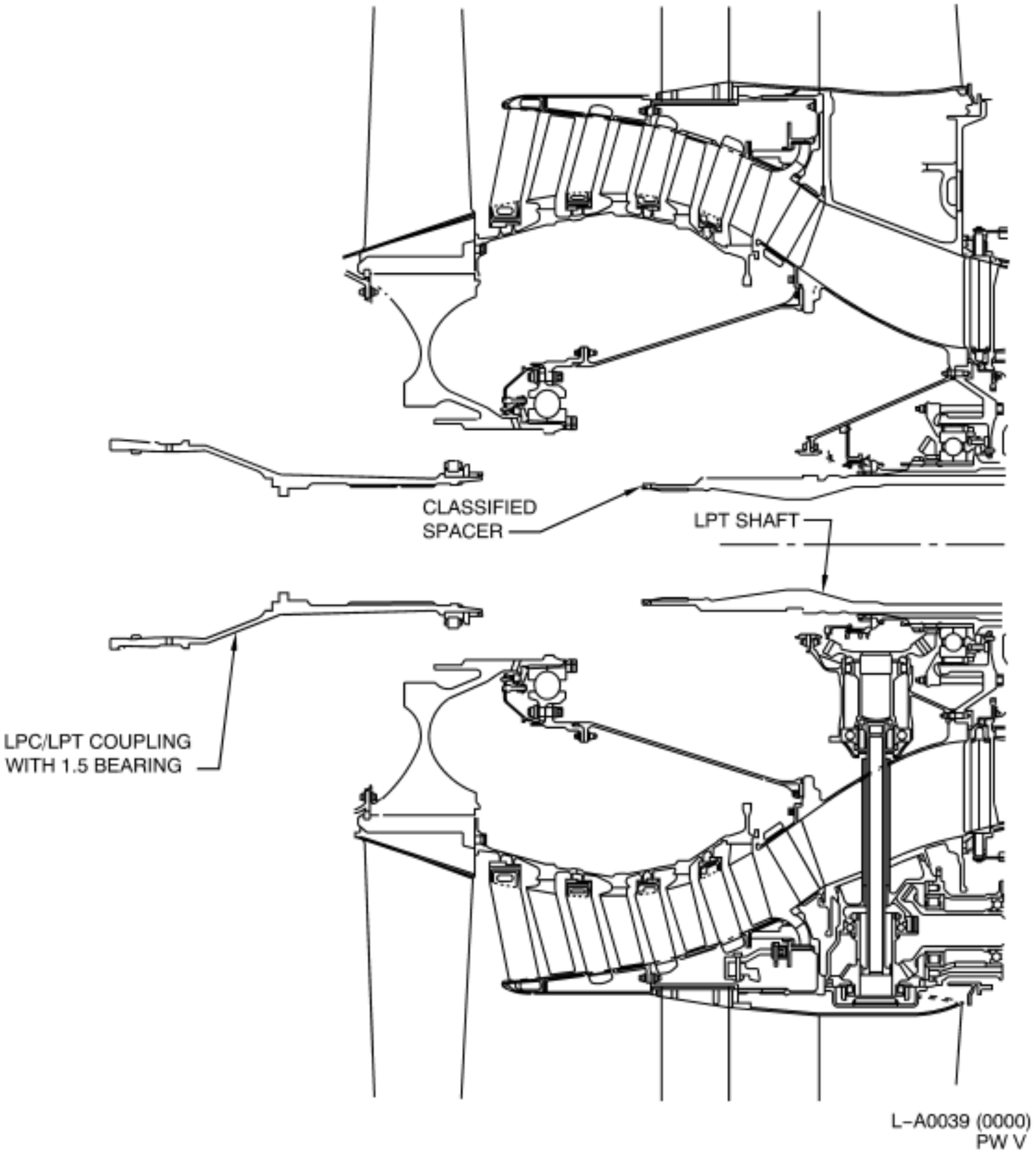
ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−01



1. INSTALL LPC/LPT COUPLING.
2. INSTALL COMPRESSOR INLET CONE.
3. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).

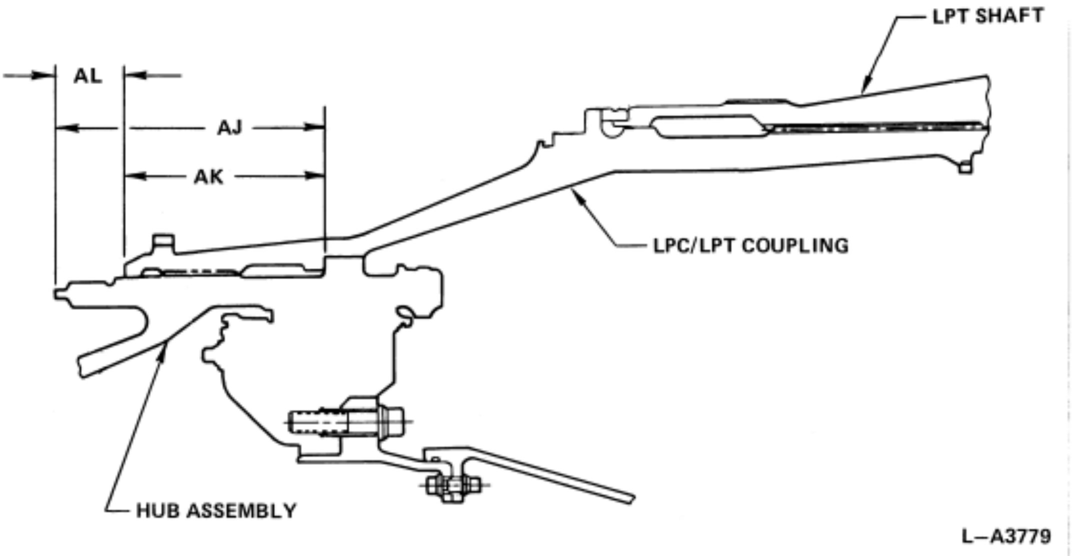
L-A0058

Procedure Sequence
Figure 401
(Task 72−00−32−420−001)

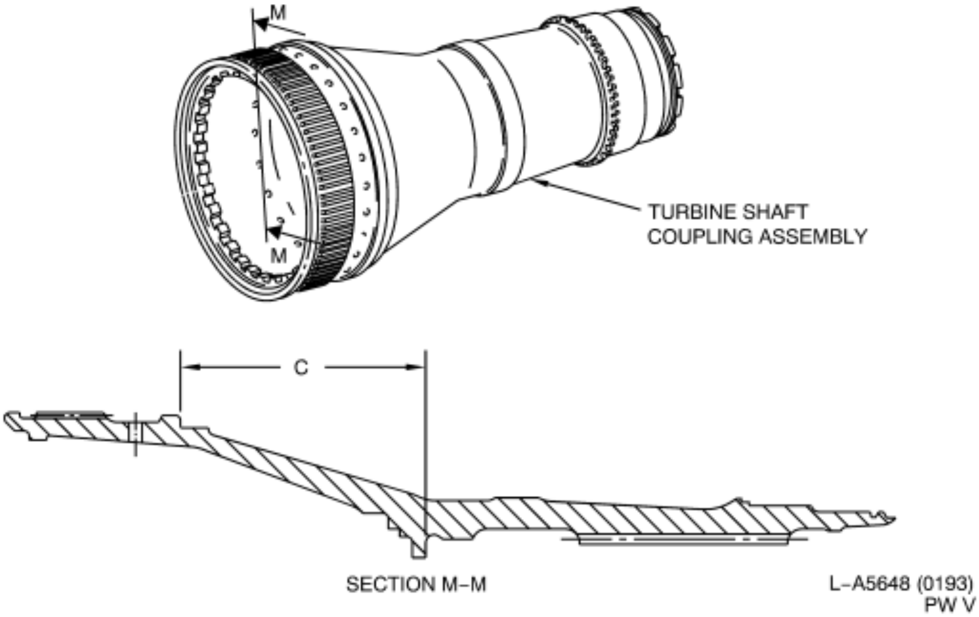

CLASSIFIED
SPACER
LPT SHAFT
LPC/LPT COUPLING
WITH 1.5 BEARING
L-A0039 (0000)
PW V

LPC/LPT Coupling Installation (Position Of The LPC/LPT Coupling)
Figure 402 (Sheet 1)
(Task 72-00-32-420-001)

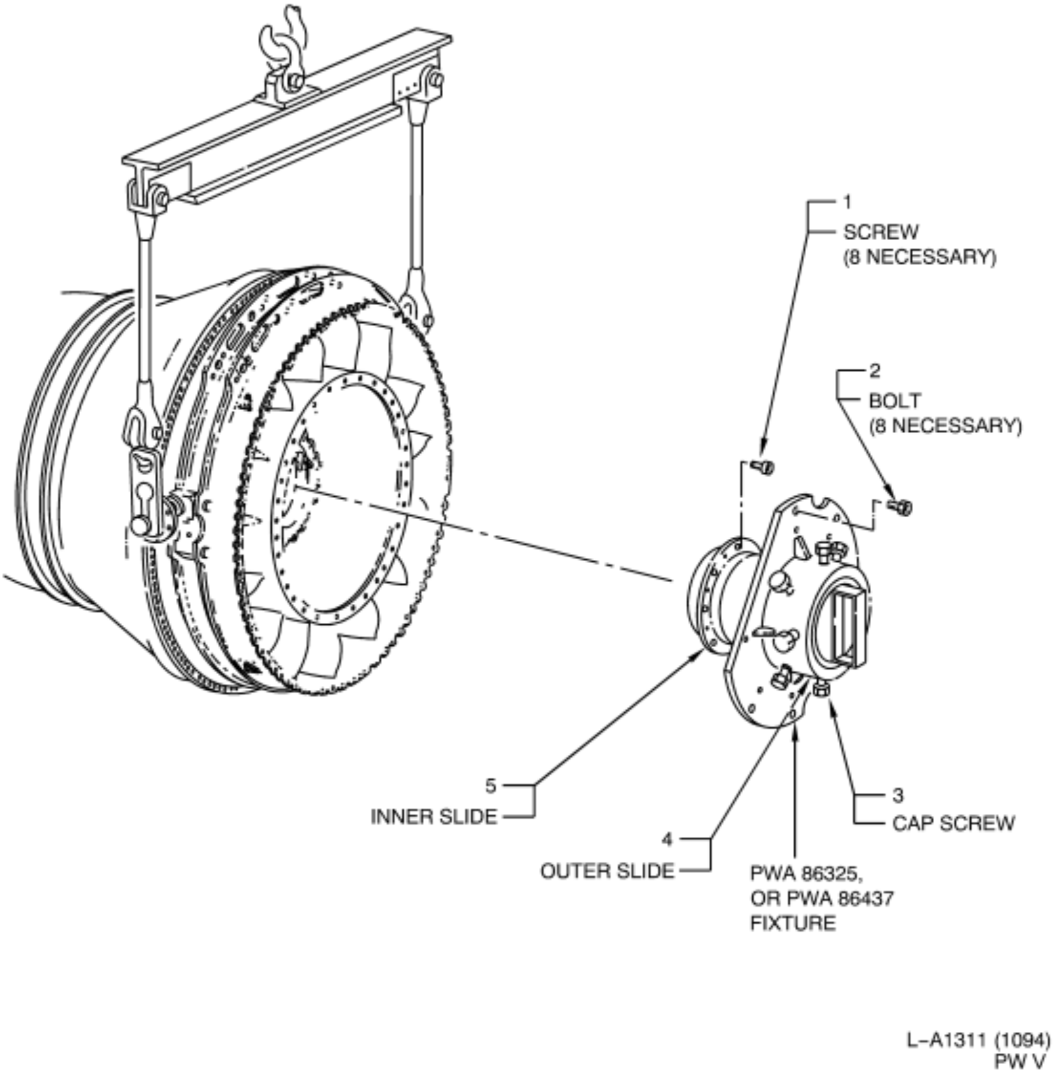
ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−01


LPT SHAFT
AL
AJ
AK
LPC/LPT COUPLING
HUB ASSEMBLY
L−A3779

LPC/LPT Coupling Installation (Dimensions AJ, AK, And AL)
Figure 402 (Sheet 2)
(Task 72−00−32−420−001)

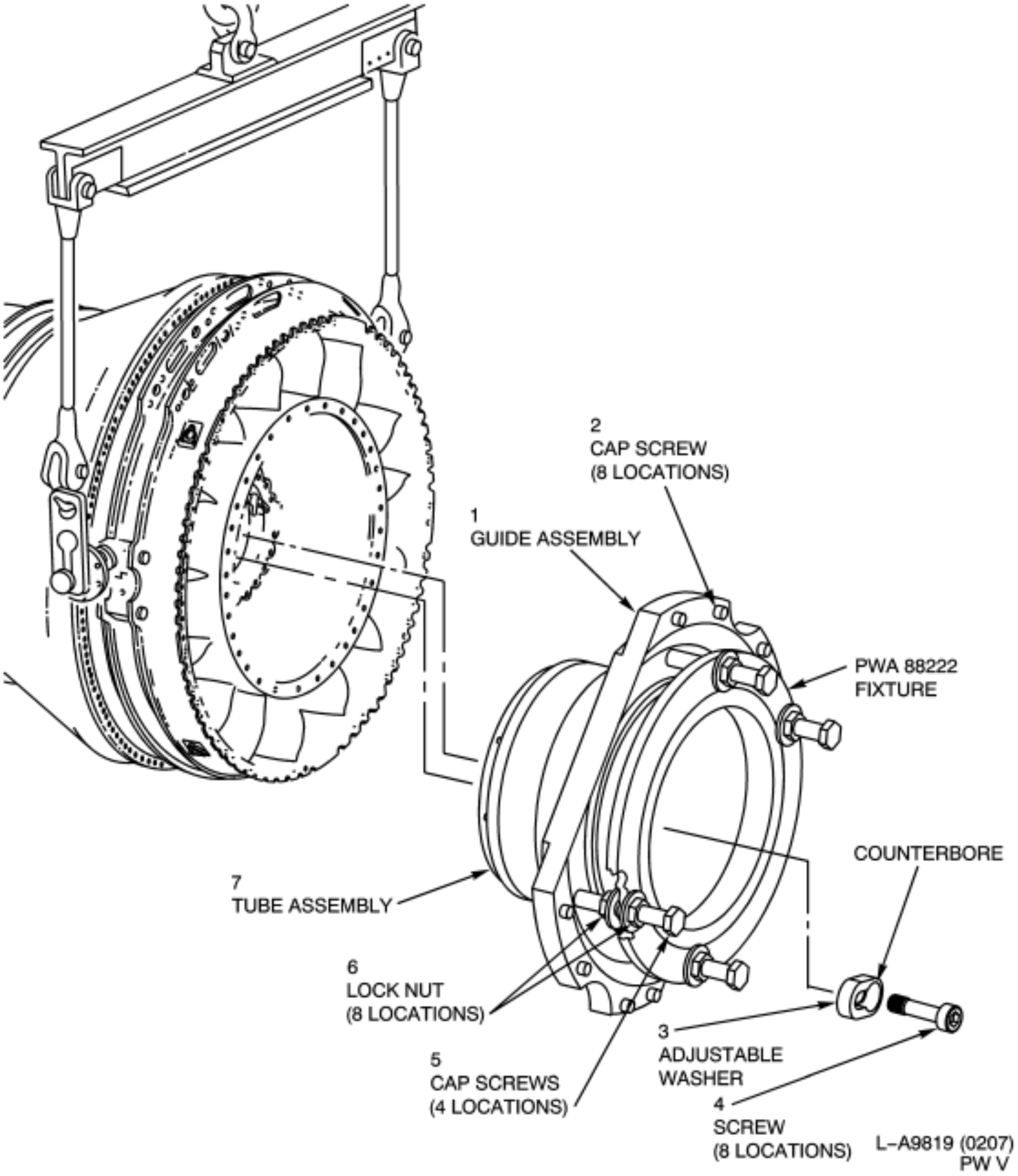

M
M
TURBINE SHAFT
COUPLING ASSEMBLY
C
SECTION M−M
L−A5648 (0193)
PW V

Dimension C
Figure 403
(Task 72−00−32−420−001)

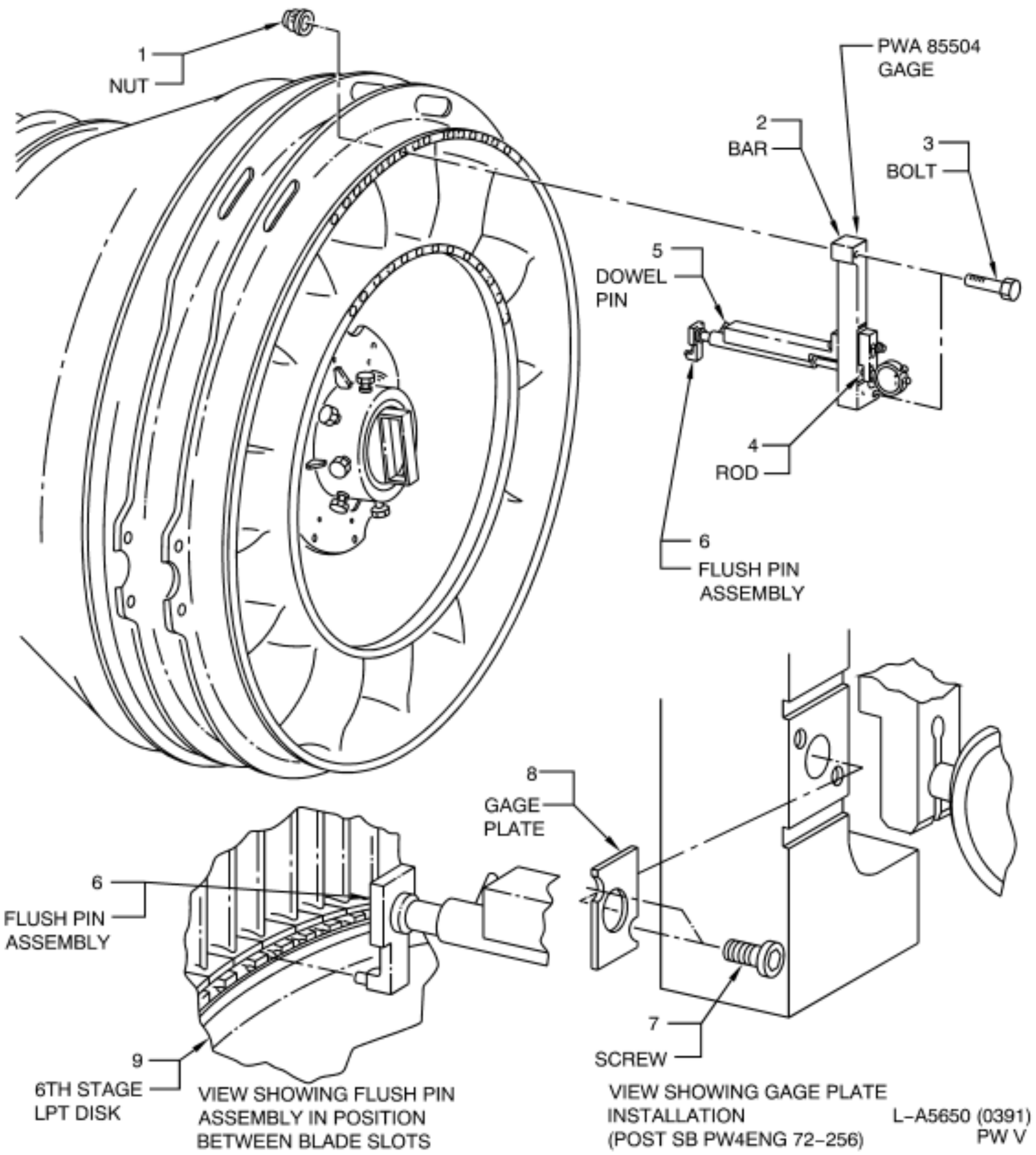

1
SCREW
(8 NECESSARY)
2
BOLT
(8 NECESSARY)
5
INNER SLIDE
4
OUTER SLIDE
3
CAP SCREW
PWA 86325,
OR PWA 86437
FIXTURE
L-A1311 (1094)
PW V

Low Pressure Turbine Rear Retainer Installation
Figure 404 (Sheet 1)
(Task 72-00-32-420-001)

R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R

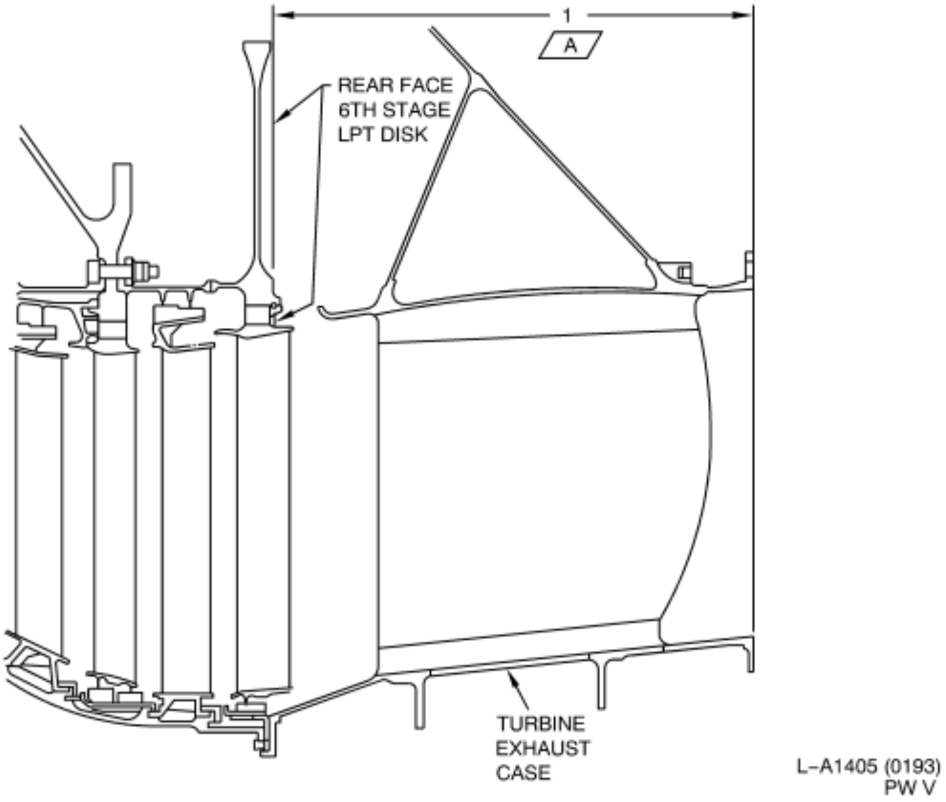

2
CAP SCREW
(8 LOCATIONS)
1
GUIDE ASSEMBLY
PWA 88222
FIXTURE
COUNTERBORE
7
TUBE ASSEMBLY
6
LOCK NUT
(8 LOCATIONS)
3
ADJUSTABLE
WASHER
5
CAP SCREWS
(4 LOCATIONS)
4
SCREW
(8 LOCATIONS)
L−A9819 (0207)
PW V

Low Pressure Turbine Rear Retainer Installation
Figure 404 (Sheet 2)
(Task 72−00−32−420−001)


1
NUT
PWA 85504
GAGE
2
BAR
3
BOLT
5
DOWEL
PIN
4
ROD
6
FLUSH PIN
ASSEMBLY
8
GAGE
PLATE
6
FLUSH PIN
ASSEMBLY
7
SCREW
9
6TH STAGE
LPT DISK
VIEW SHOWING FLUSH PIN
ASSEMBLY IN POSITION
BETWEEN BLADE SLOTS
VIEW SHOWING GAGE PLATE
INSTALLATION
(POST SB PW4ENG 72-256)
L-A5650 (0391)
PW V

Gage To Measure Low Pressure Turbine Axial Position
Figure 405
(Task 72−00−32−420−001)

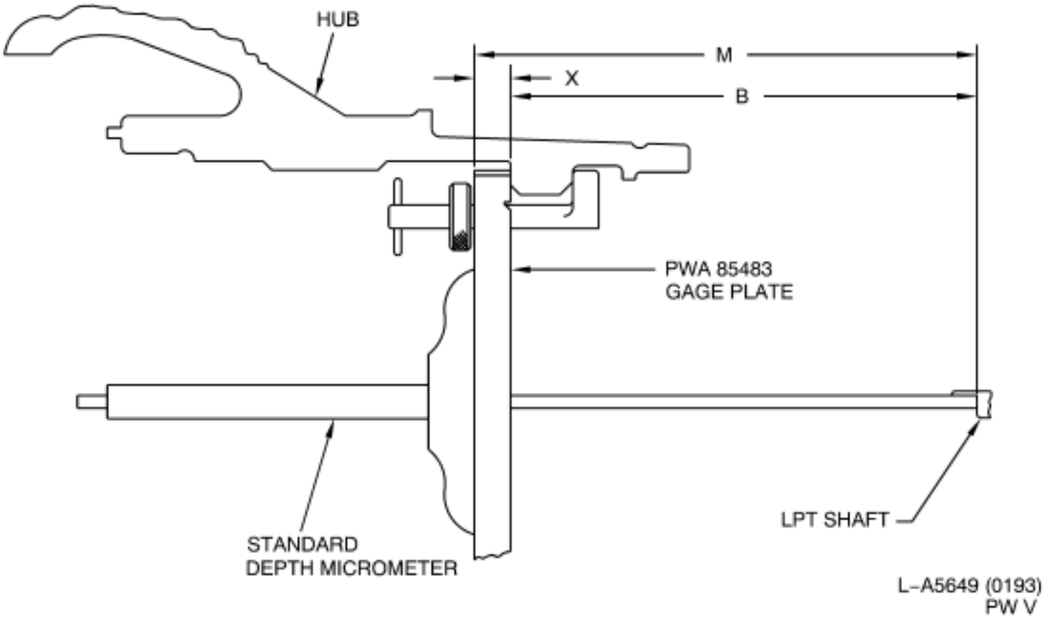
ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−01


1
A
REAR FACE
6TH STAGE
LPT DISK
TURBINE
EXHAUST
CASE
L−A1405 (0193)
PW V

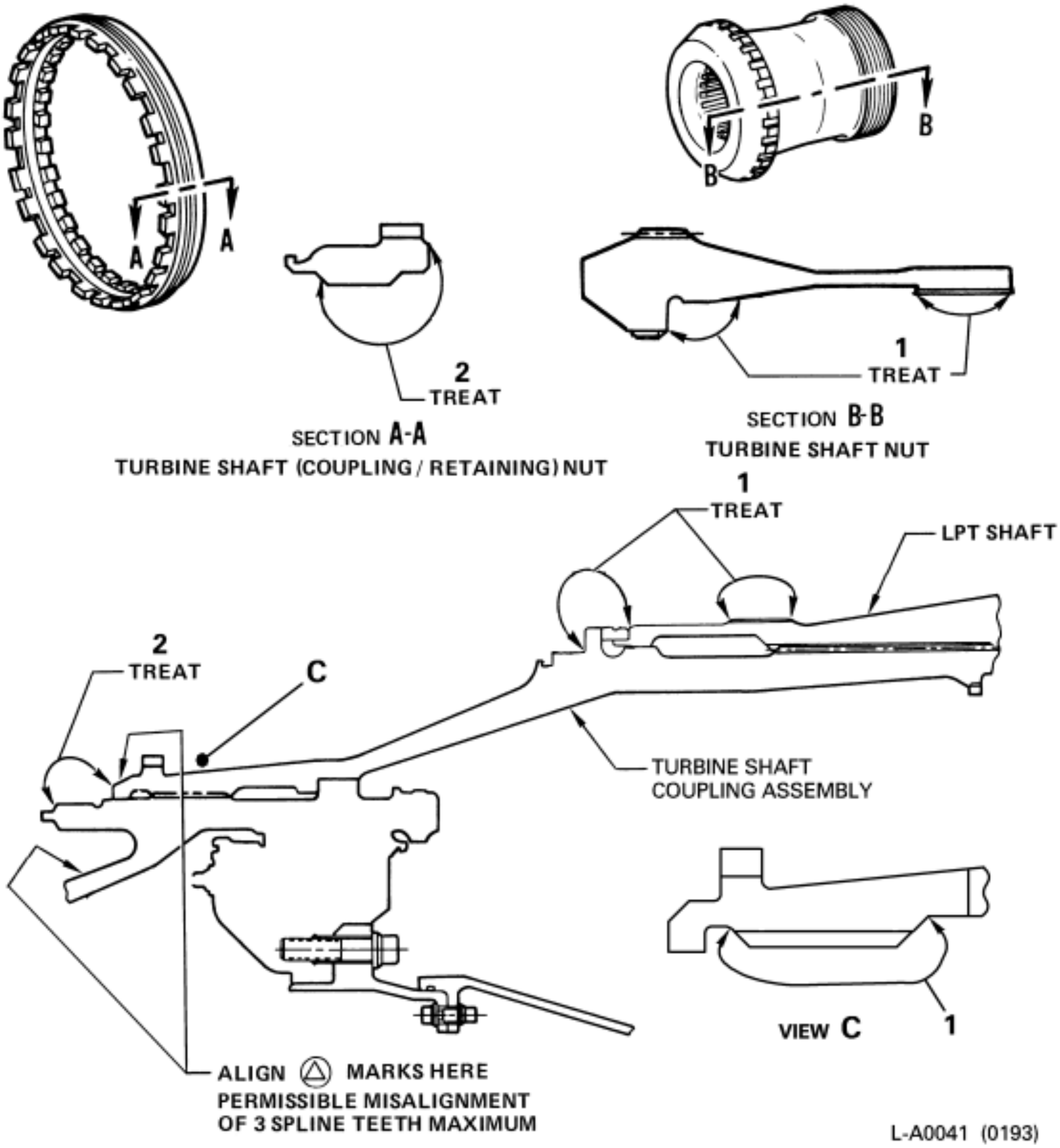
1. (Reference 847) 12.355 − 12.405 Inches (313.82 − 315.09 mm)
   (Reference 851) 12.305 − 12.355 Inches (312.55 − 313.82 mm)

Low Pressure Turbine Axial Position Check
Figure 406
(Task 72−00−32−420−001)

ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−01


HUB
M
X
B
PWA 85483
GAGE PLATE
LPT SHAFT
STANDARD
DEPTH MICROMETER
L−A5649 (0193)
PW V

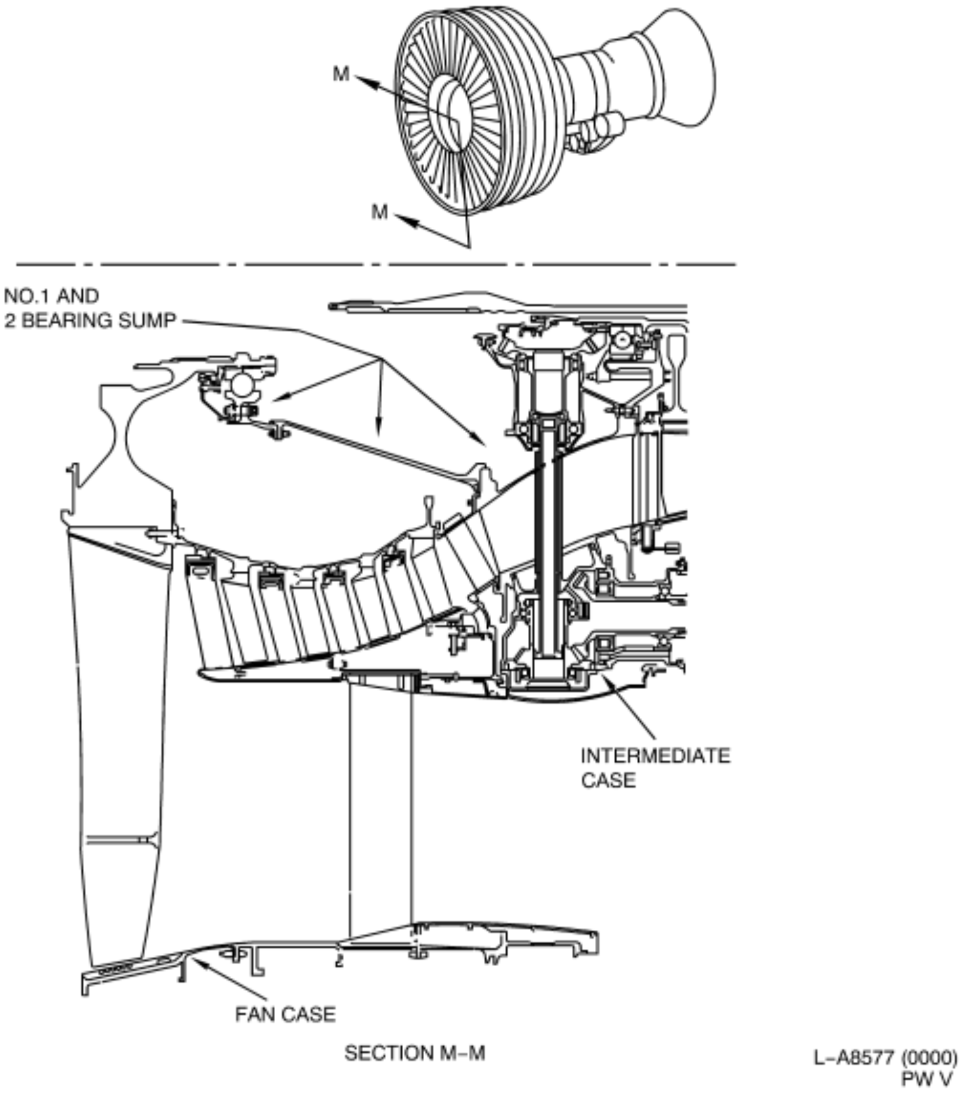
Measurement Of Dimension B
Figure 407
(Task 72−00−32−420−001)


A
A
2
TREAT
SECTION A-A
TURBINE SHAFT (COUPLING / RETAINING) NUT
B
B
1
TREAT
SECTION B-B
TURBINE SHAFT NUT
1
TREAT
LPT SHAFT
2
TREAT
C
TURBINE SHAFT
COUPLING ASSEMBLY
VIEW C
1
ALIGN △ MARKS HERE
PERMISSIBLE MISALIGNMENT
OF 3 SPLINE TEETH MAXIMUM
L-A0041 (0193)

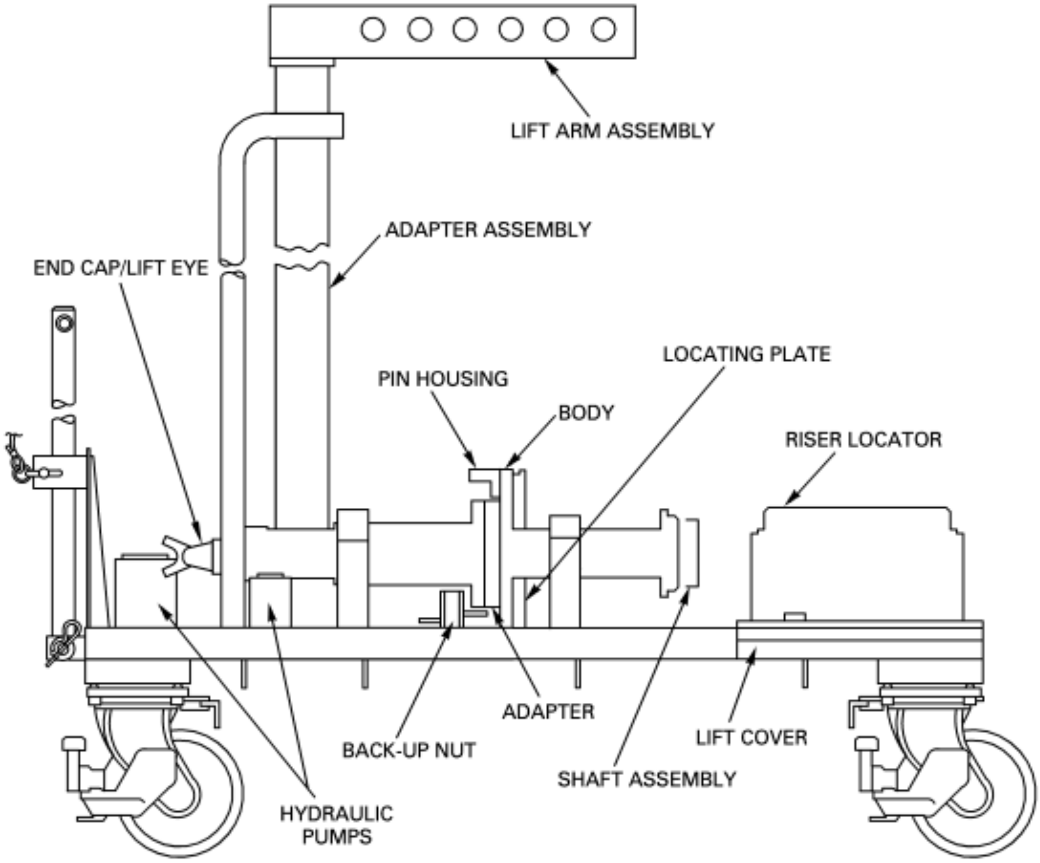
1. Apply To The Areas Shown With Compound (P06−021)
2. Apply To The Areas Shown With Anti−Seize Paste (P06−054)

Application Of Antigalling Compound
Figure 408
(Task 72−00−32−420−001)

ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−01


M
M
NO.1 AND
2 BEARING SUMP
INTERMEDIATE
CASE
FAN CASE
SECTION M−M
L−A8577 (0000)
PW V

No. 1 And 2 Bearing Sump Area
Figure 409
(Task 72−00−32−420−001)

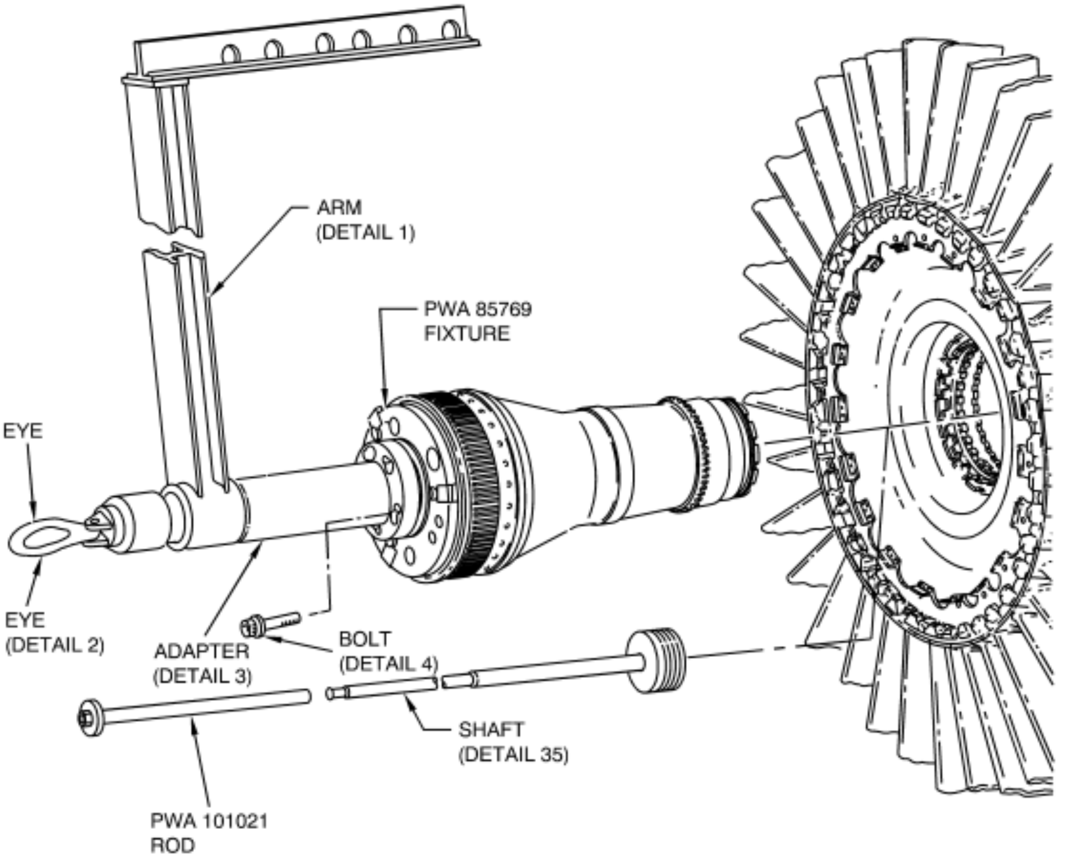

LIFT ARM ASSEMBLY
ADAPTER ASSEMBLY
END CAP/LIFT EYE
LOCATING PLATE
PIN HOUSING
BODY
RISER LOCATOR
ADAPTER
LIFT COVER
BACK-UP NUT
SHAFT ASSEMBLY
HYDRAULIC PUMPS

TRANSPORT STAND

NOTE: THE DETAILS THAT ARE NAMED ARE DETAILS OF PWA 85769 FIXTURE

L-A9290 (0695)

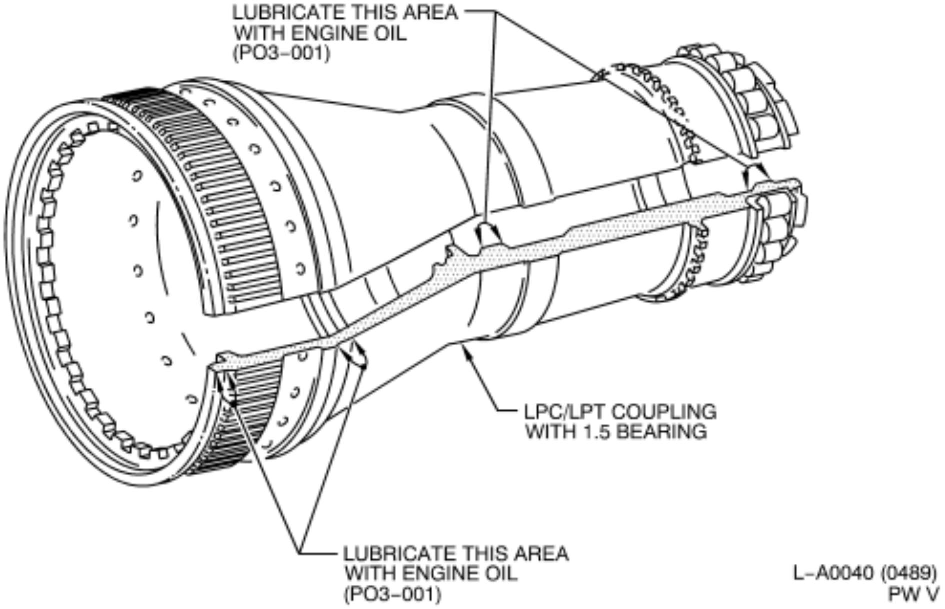
Transport Stand For PWA 85769 Fixture
Figure 410
(Task 72-00-32-420-001)


ARM
(DETAIL 1)
PWA 85769
FIXTURE
EYE
EYE
(DETAIL 2)
ADAPTER
(DETAIL 3)
BOLT
(DETAIL 4)
SHAFT
(DETAIL 35)
PWA 101021
ROD

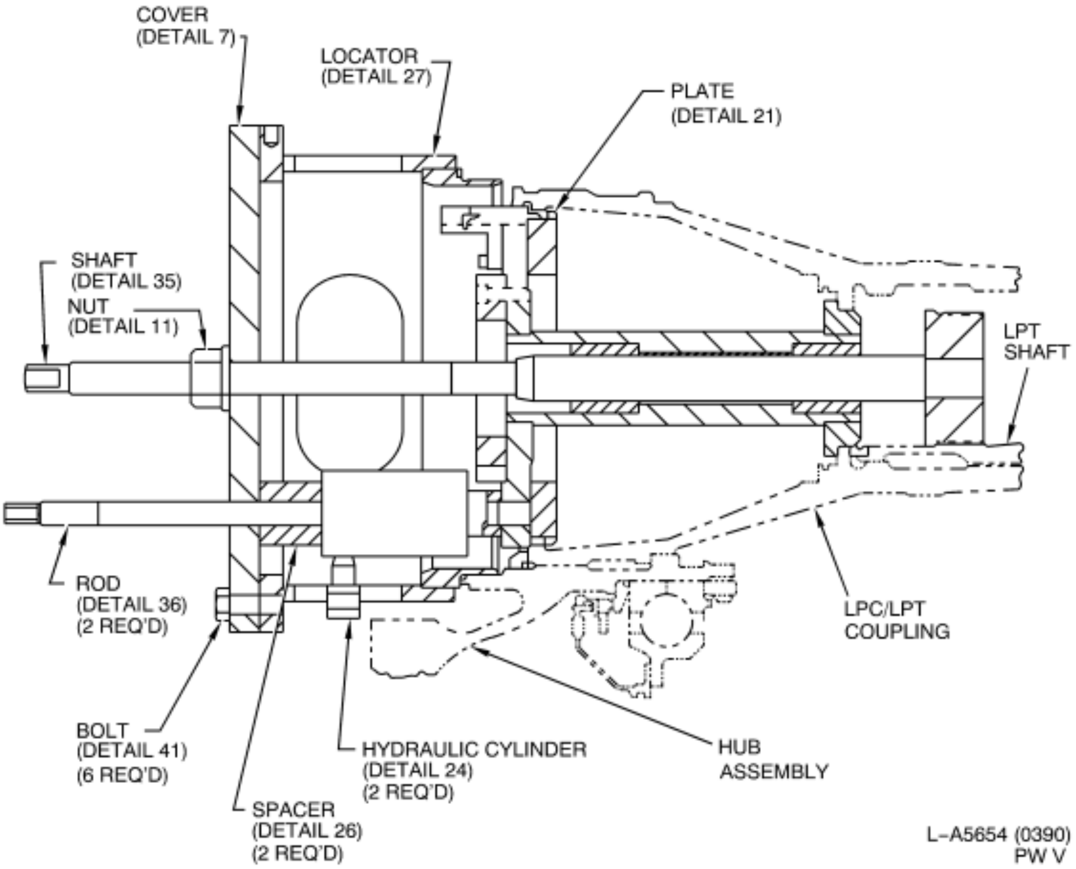
L−A5653 (0695)
PW V

Installation Of The Turbine Shaft Coupling Assembly
Figure 411
(Task 72−00−32−420−001)

ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−01

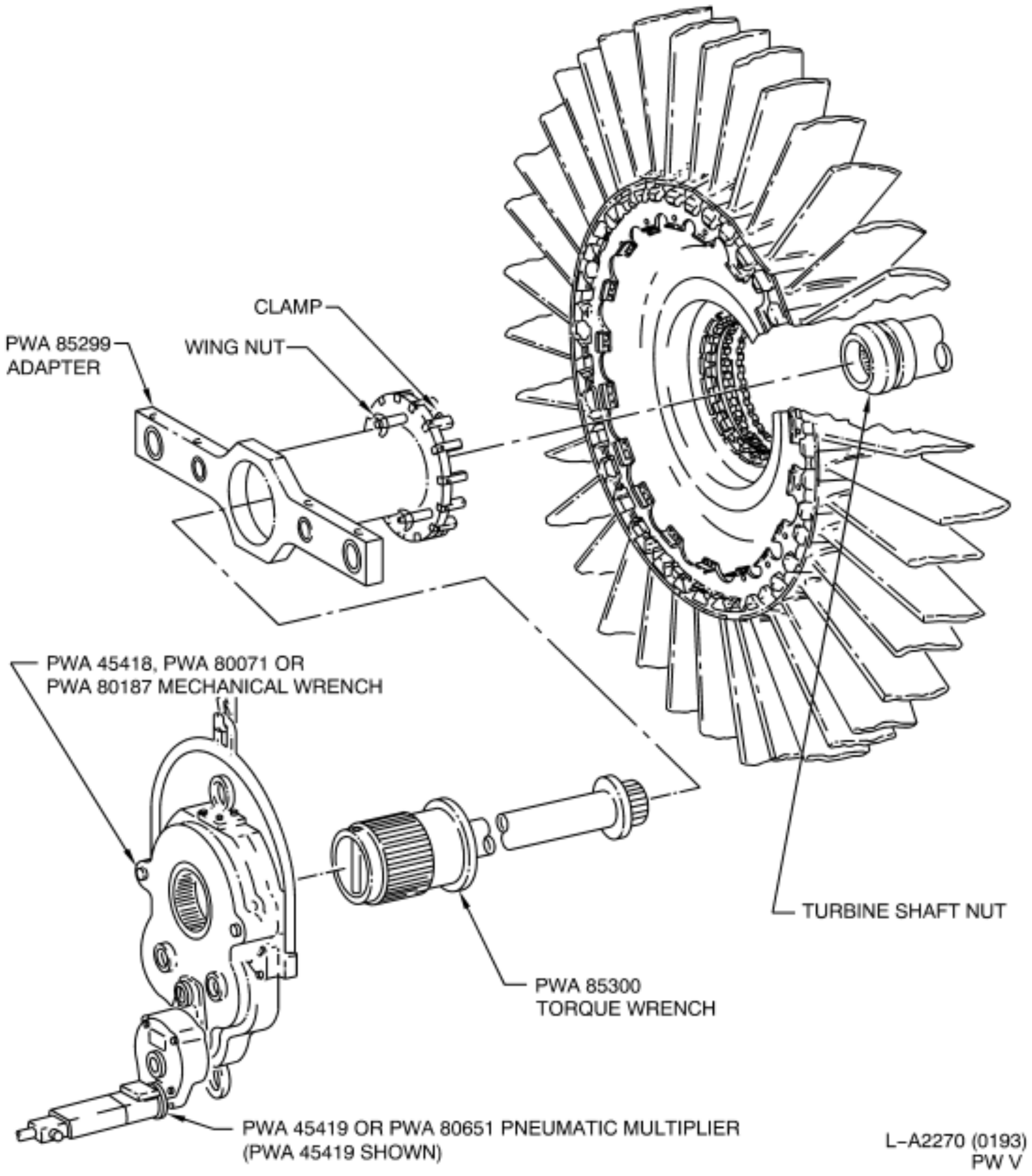

LUBRICATE THIS AREA
WITH ENGINE OIL
(PO3−001)
LPC/LPT COUPLING
WITH 1.5 BEARING
LUBRICATE THIS AREA
WITH ENGINE OIL
(PO3−001)
L−A0040 (0489)
PW V

Installation Of The Turbine Shaft Coupling Assembly
Figure 412
(Task 72−00−32−420−001)


COVER
(DETAIL 7)
LOCATOR
(DETAIL 27)
PLATE
(DETAIL 21)
SHAFT
(DETAIL 35)
NUT
(DETAIL 11)
LPT
SHAFT
ROD
(DETAIL 36)
(2 REQ'D)
LPC/LPT
COUPLING
BOLT
(DETAIL 41)
(6 REQ'D)
HYDRAULIC CYLINDER
(DETAIL 24)
(2 REQ'D)
HUB
ASSEMBLY
SPACER
(DETAIL 26)
(2 REQ'D)
L-A5654 (0390)
PW V

Installation Of The Turbine Shaft Coupling Assembly
Figure 413
(Task 72−00−32−420−001)

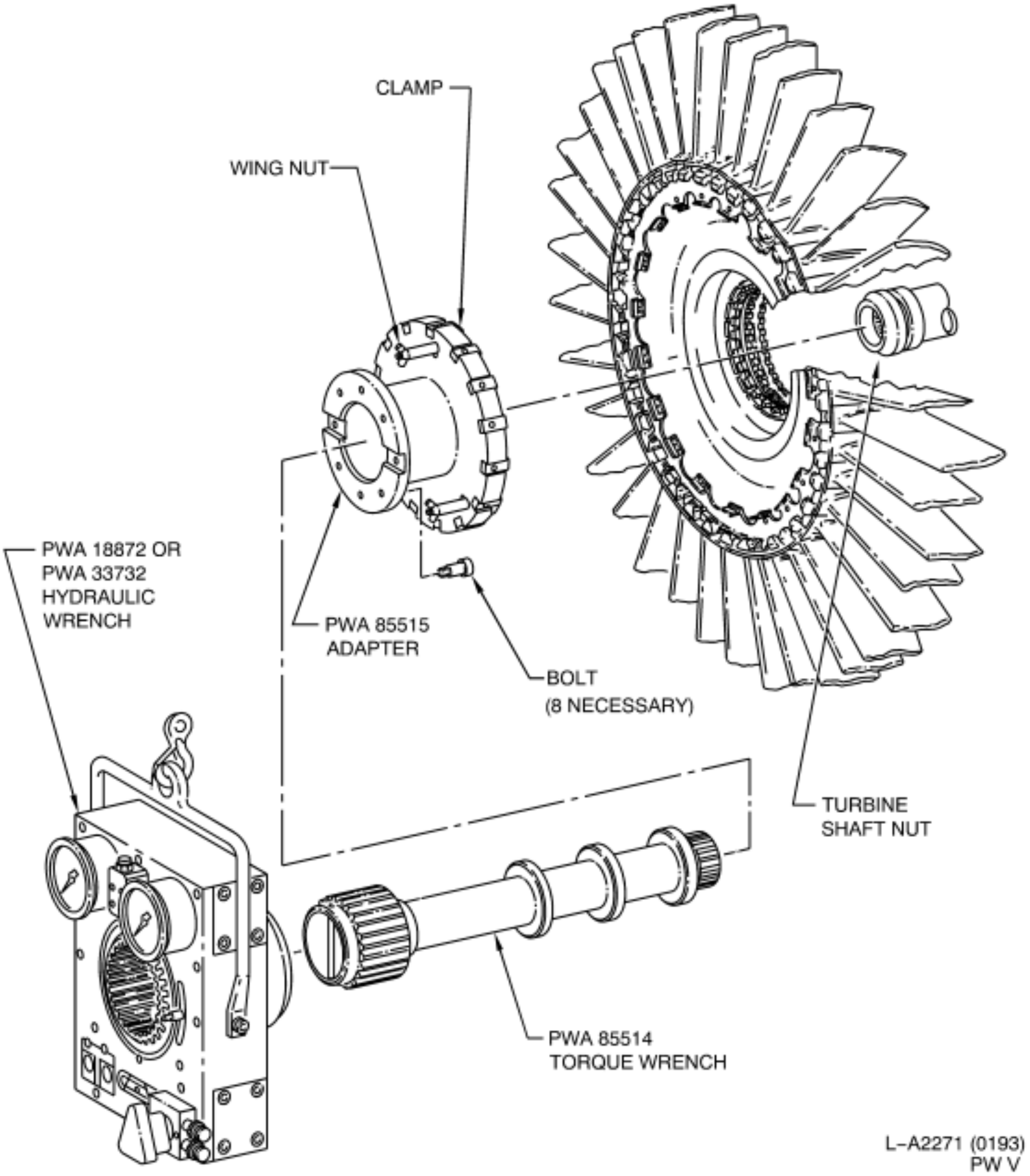
ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−01


CLAMP
PWA 85299
ADAPTER
WING NUT
PWA 45418, PWA 80071 OR
PWA 80187 MECHANICAL WRENCH
TURBINE SHAFT NUT
PWA 85300
TORQUE WRENCH
PWA 45419 OR PWA 80651 PNEUMATIC MULTIPLIER
(PWA 45419 SHOWN)
L−A2270 (0193)
PW V

Turbine Shaft Nut Installation (Mechanical Wrench)
Figure 414
(Task 72−00−32−420−001)

R
R

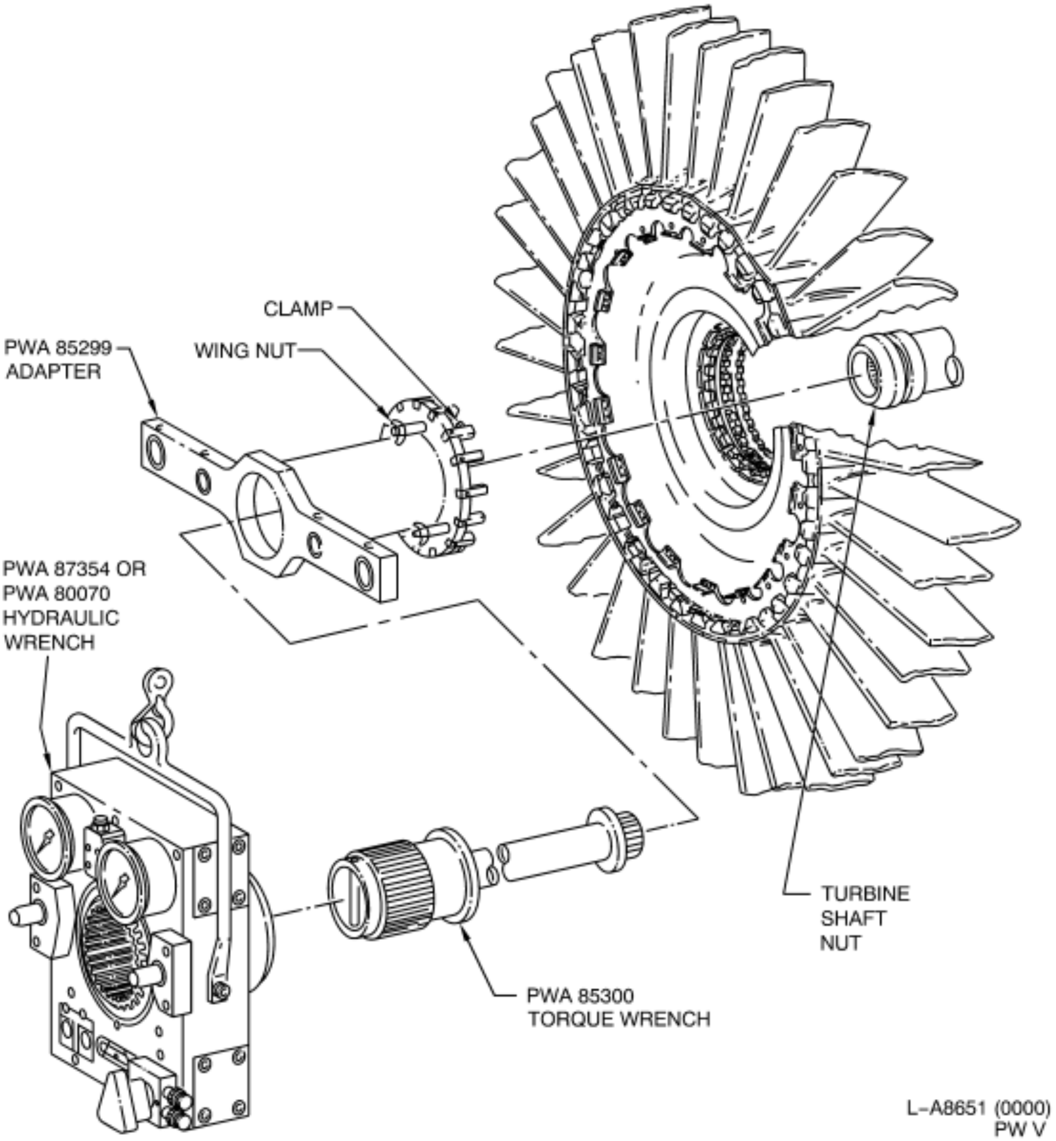
ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−01


CLAMP
WING NUT
PWA 18872 OR
PWA 33732
HYDRAULIC
WRENCH
PWA 85515
ADAPTER
BOLT
(8 NECESSARY)
TURBINE
SHAFT NUT
PWA 85514
TORQUE WRENCH
L−A2271 (0193)
PW V

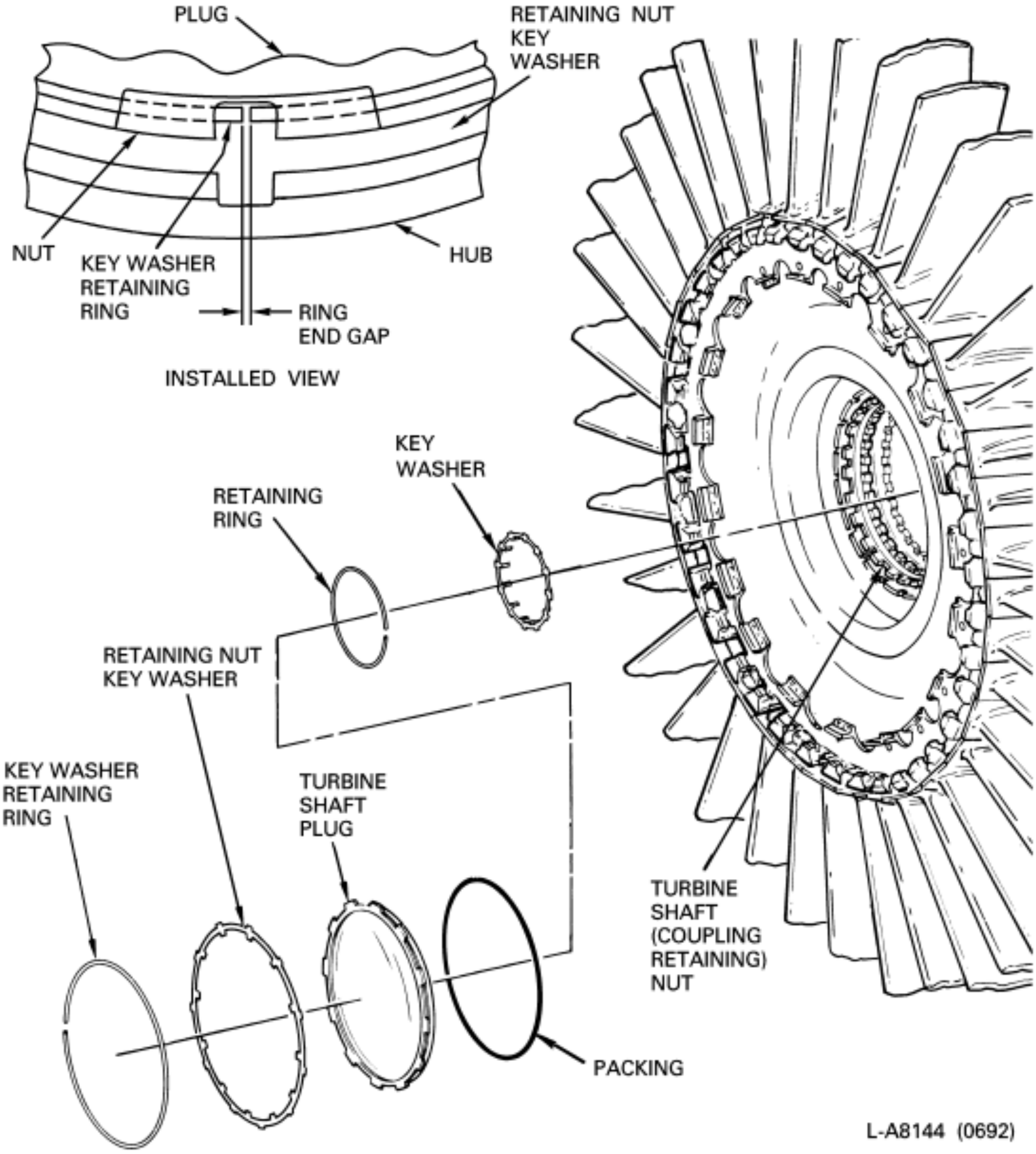
Turbine Shaft Nut Installation (Hydraulic Wrench)
Figure 415 (Sheet 1)
(Task 72−00−32−420−001)

R
R

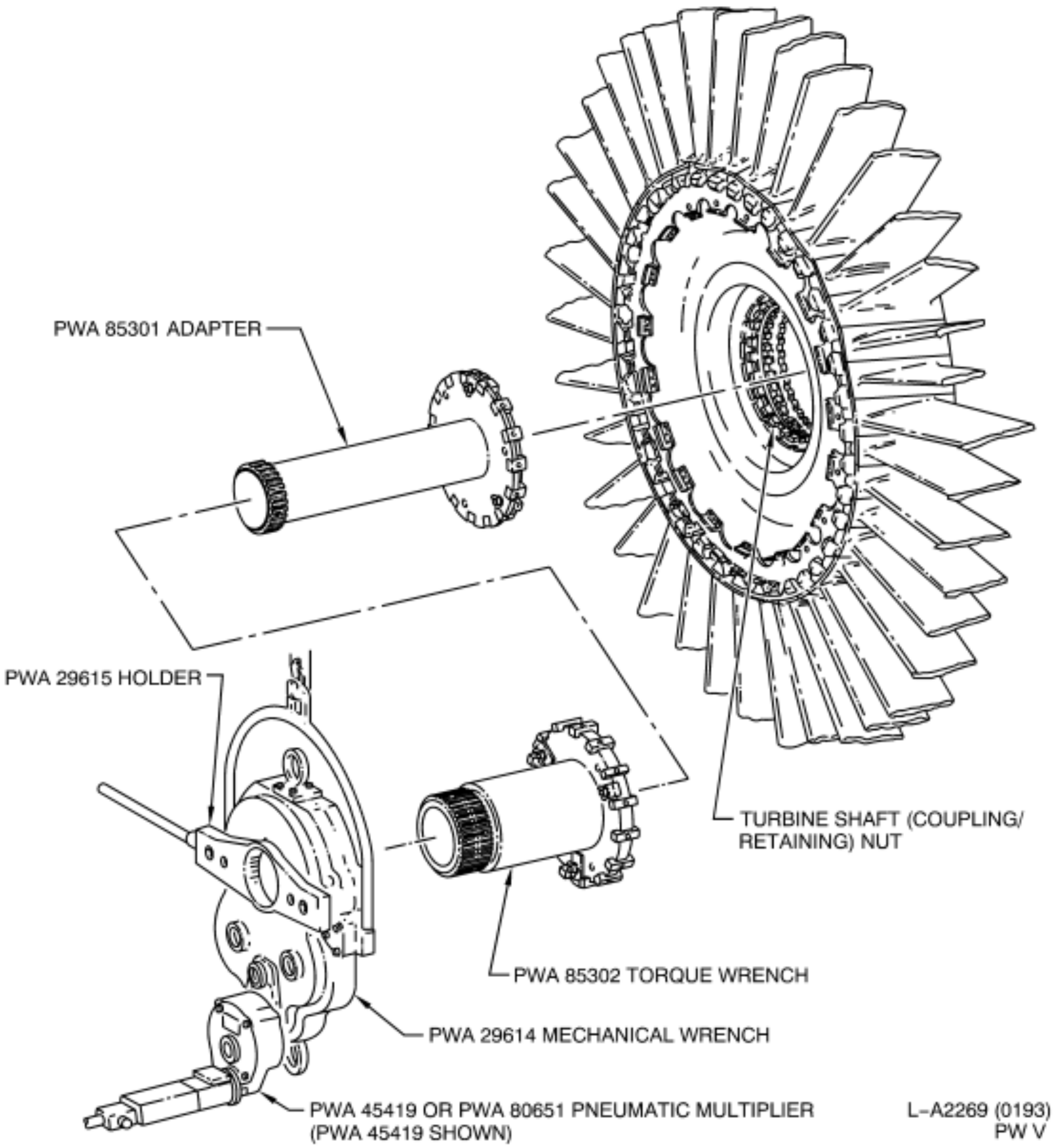
ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−01


CLAMP
PWA 85299
ADAPTER
WING NUT
PWA 87354 OR
PWA 80070
HYDRAULIC
WRENCH
TURBINE
SHAFT
NUT
PWA 85300
TORQUE WRENCH
L−A8651 (0000)
PW V

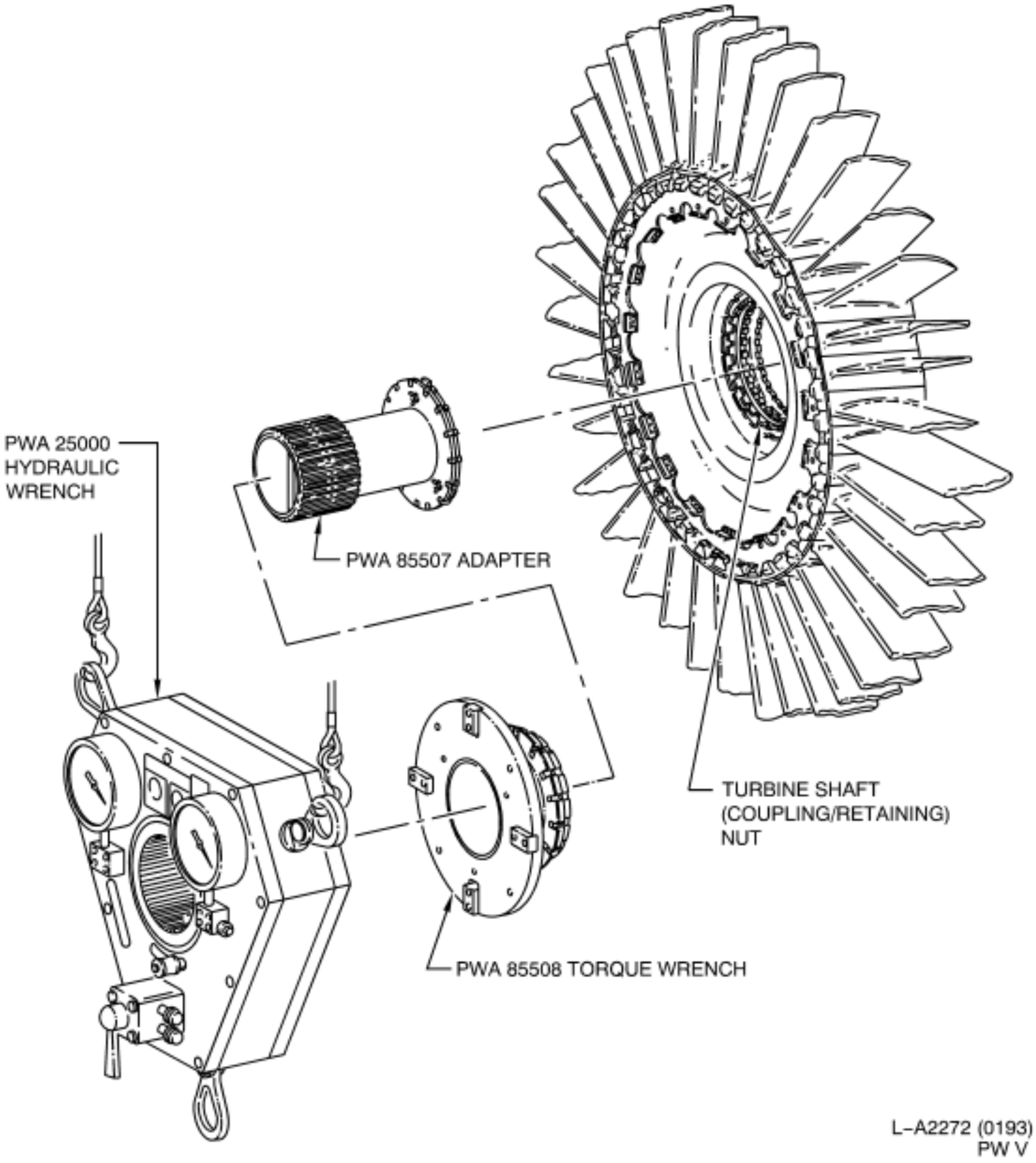
Turbine Shaft Nut Installation (Hydraulic Wrench)
Figure 415 (Sheet 2)
(Task 72−00−32−420−001)


PLUG
RETAINING NUT
KEY
WASHER
NUT
KEY WASHER
RETAINING
RING
HUB
RING
END GAP
INSTALLED VIEW
KEY
WASHER
RETAINING
RING
RETAINING NUT
KEY WASHER
KEY WASHER
RETAINING
RING
TURBINE
SHAFT
PLUG
TURBINE
SHAFT
(COUPLING
RETAINING)
NUT
PACKING
L-A8144 (0692)

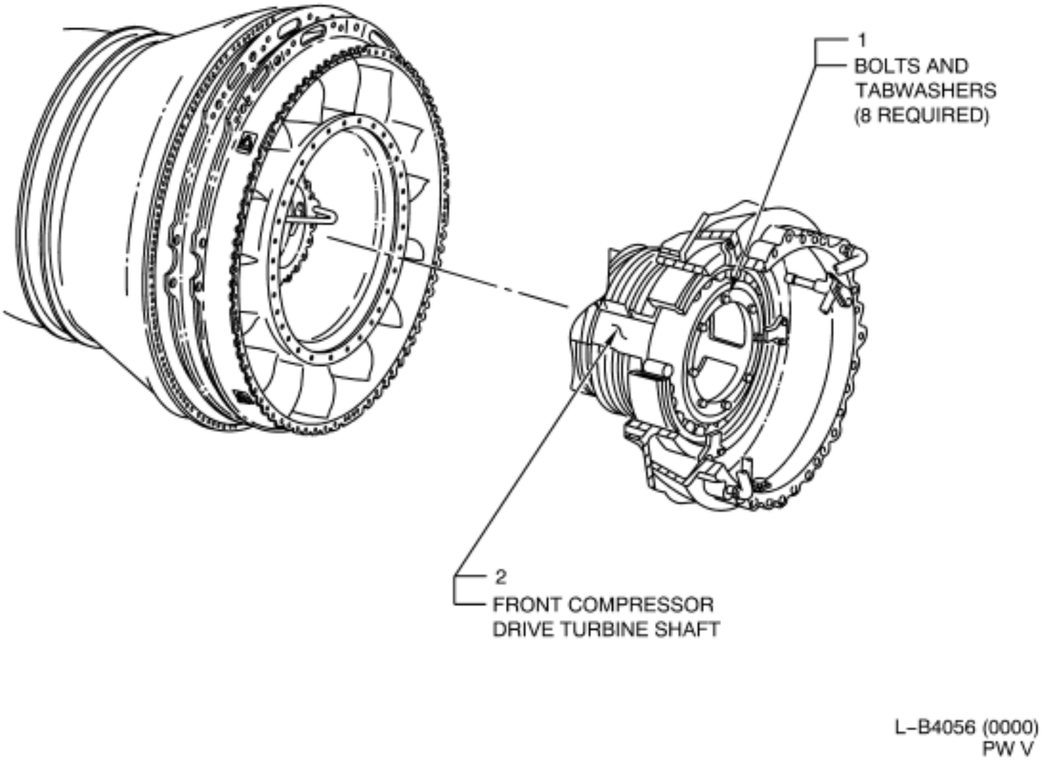
Key Washer And Plug Installation
Figure 416
(Task 72−00−32−420−001)


PWA 85301 ADAPTER
PWA 29615 HOLDER
TURBINE SHAFT (COUPLING/ RETAINING) NUT
PWA 85302 TORQUE WRENCH
PWA 29614 MECHANICAL WRENCH
PWA 45419 OR PWA 80651 PNEUMATIC MULTIPLIER (PWA 45419 SHOWN)
L-A2269 (0193)
PW V

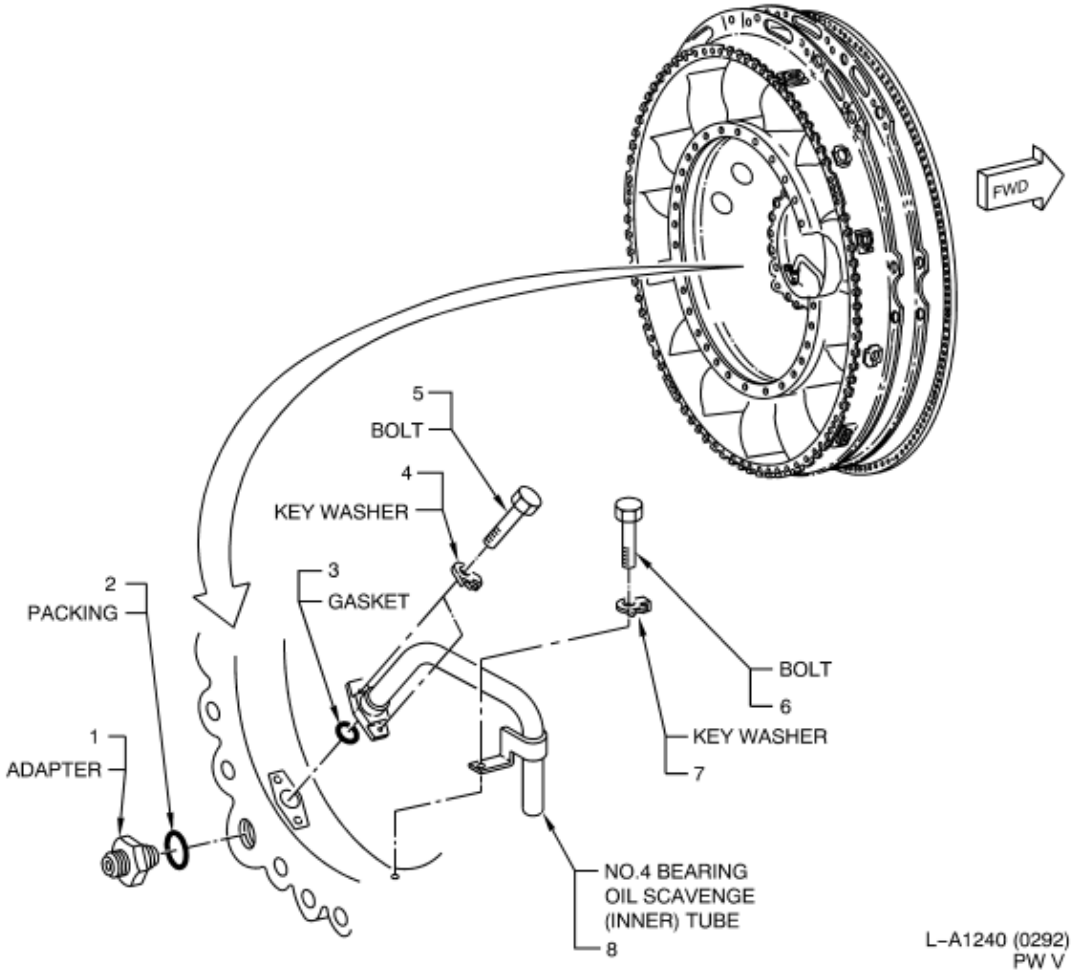
Turbine Shaft (Coupling/Retaining)
Nut Installation (Mechanical Wrench)
Figure 417
(Task 72-00-32-420-001)


PWA 25000
HYDRAULIC
WRENCH
PWA 85507 ADAPTER
TURBINE SHAFT
(COUPLING/RETAINING)
NUT
PWA 85508 TORQUE WRENCH
L-A2272 (0193)
PW V

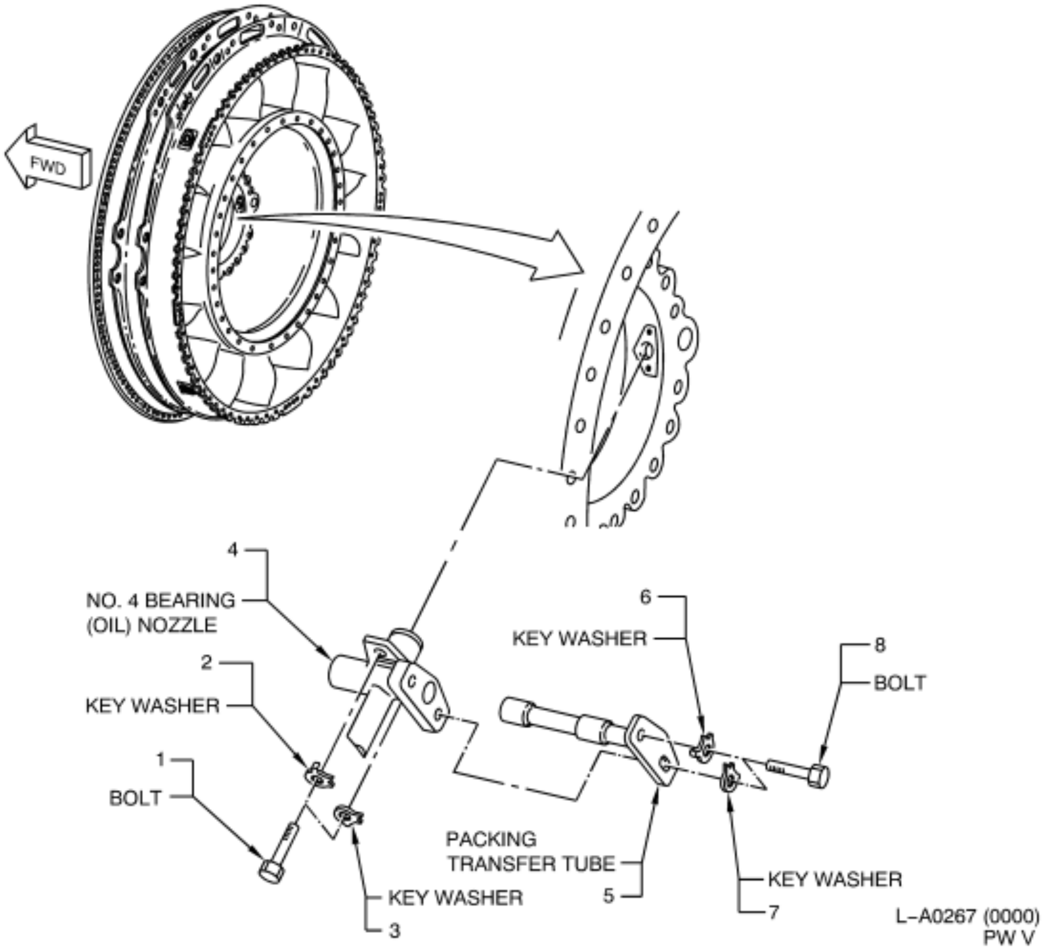
Turbine Shaft (Coupling/Retaining)
Nut Installation (Hydraulic Wrench)
Figure 418
(Task 72-00-32-420-001)


1
BOLTS AND
TABWASHERS
(8 REQUIRED)
2
FRONT COMPRESSOR
DRIVE TURBINE SHAFT
L−B4056 (0000)
PW V

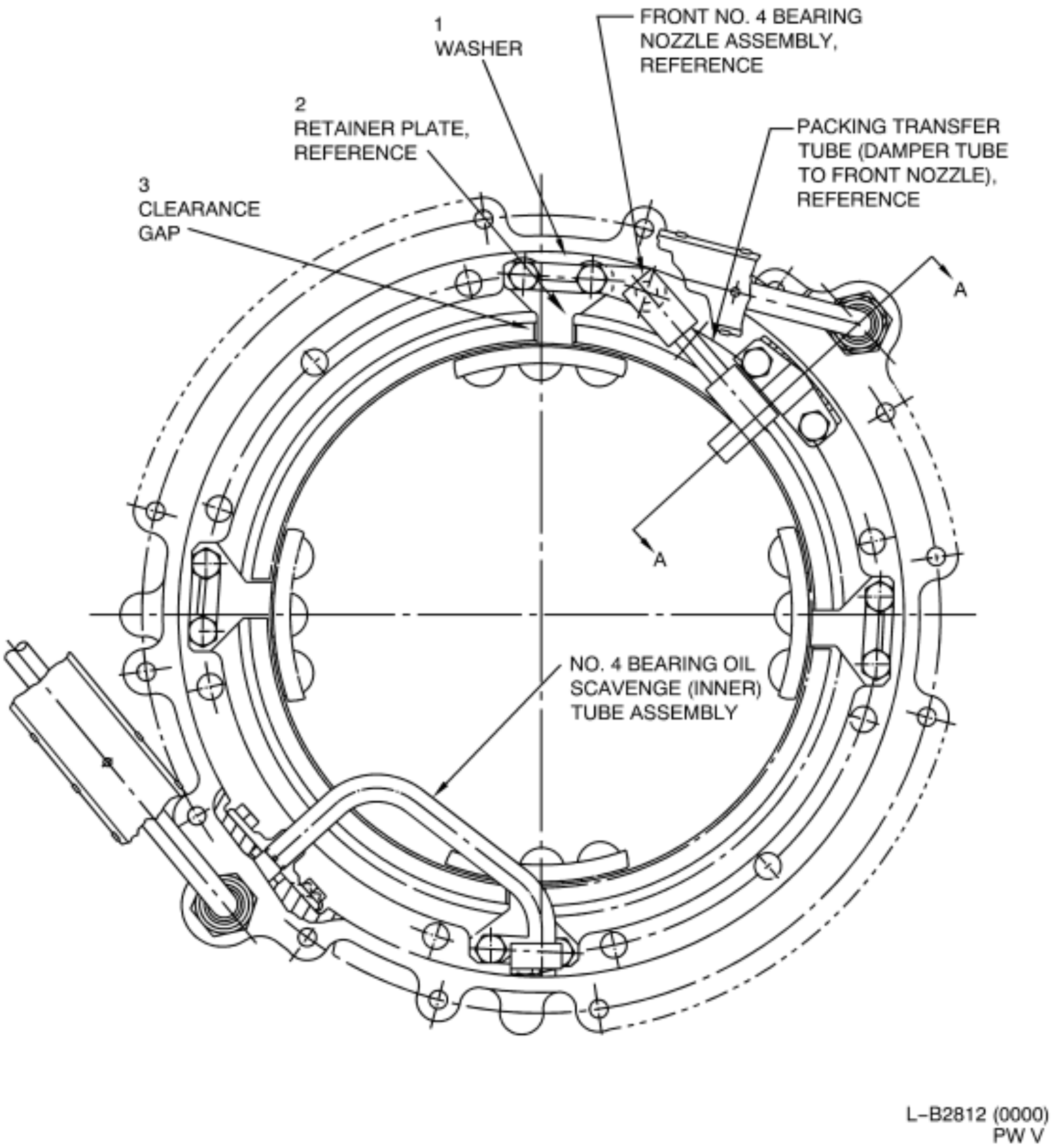
No. 4 Bearing Retaining Plate Bolts And Tabwashers Installation
Figure 419
(Task 72−00−32−420−001)


FWD
5
BOLT
4
KEY WASHER
3
GASKET
2
PACKING
1
ADAPTER
BOLT
6
KEY WASHER
7
NO.4 BEARING
OIL SCAVENGE
(INNER) TUBE
8
L−A1240 (0292)
PW V

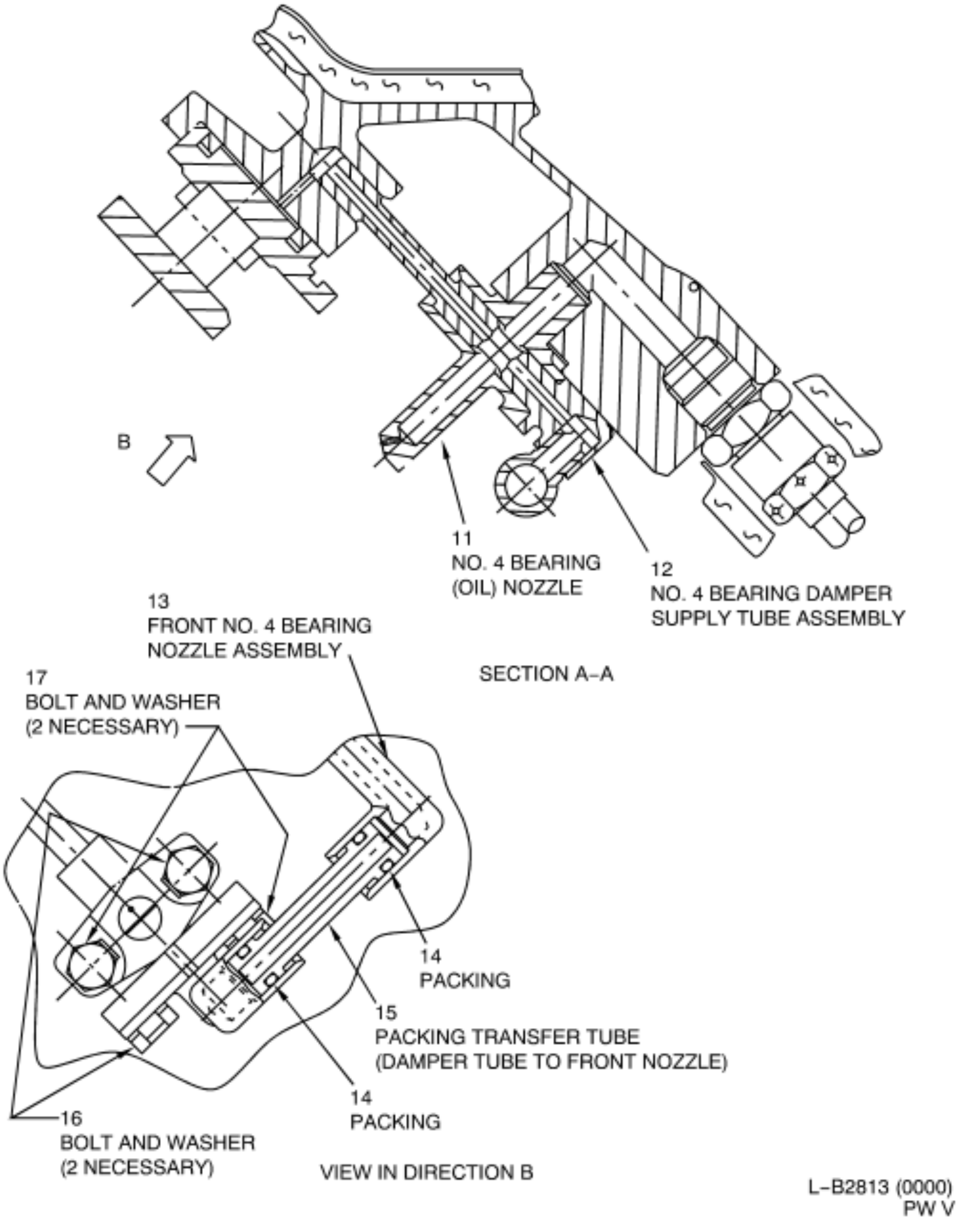
No. 4 Bearing Scavenge Tubes Installation
Figure 420
(Task 72−00−32−420−001)


FWD
4
NO. 4 BEARING (OIL) NOZZLE
2
KEY WASHER
1
BOLT
6
KEY WASHER
8
BOLT
PACKING TRANSFER TUBE
5
KEY WASHER
3
KEY WASHER
7
L-A0267 (0000)
PW V

No. 4 Bearing (Oil) Nozzle And Front
Nozzle Installation (Pre SB PW4ENG 72-472)
Figure 421
(Task 72-00-32-420-001)

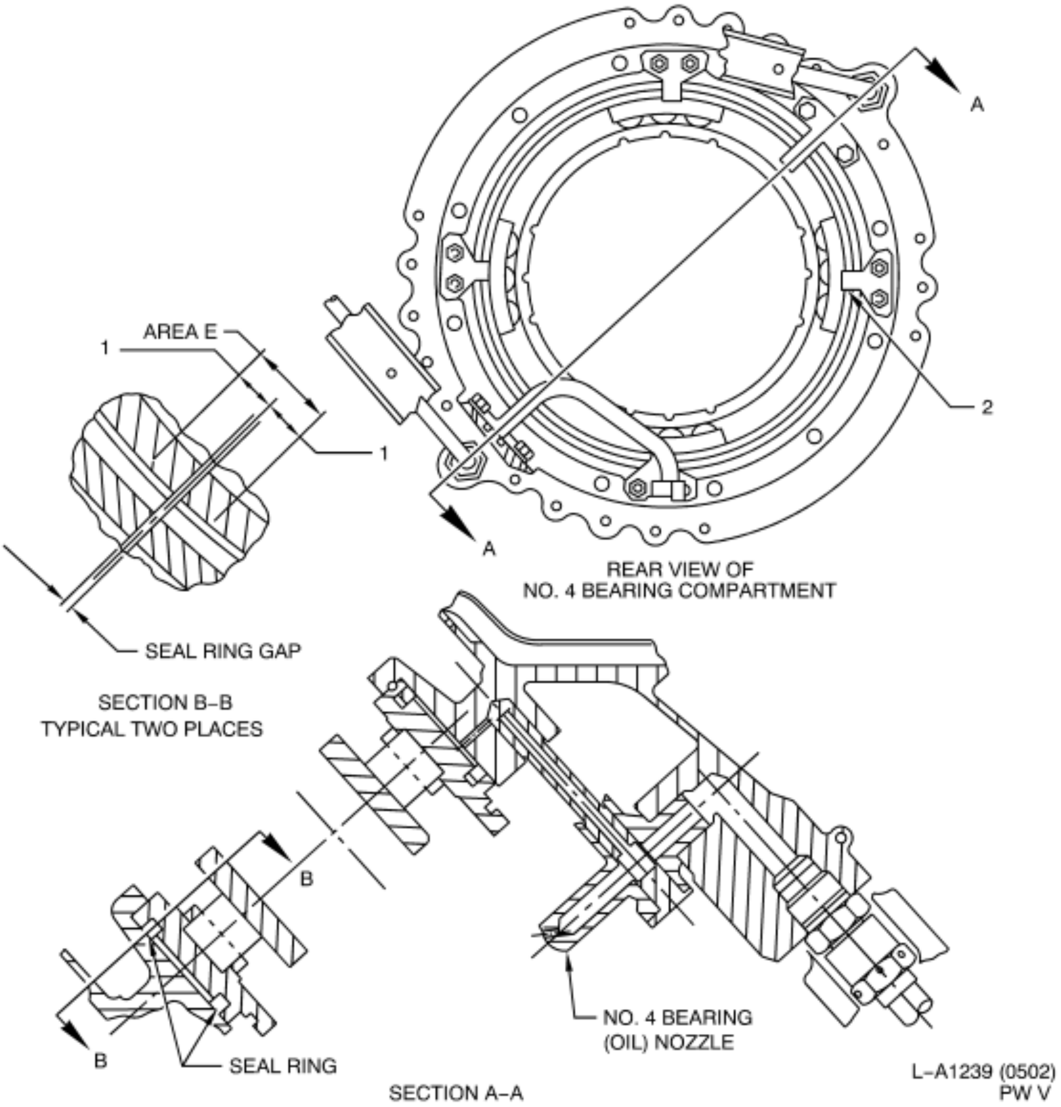

1
WASHER
FRONT NO. 4 BEARING
NOZZLE ASSEMBLY,
REFERENCE
2
RETAINER PLATE,
REFERENCE
PACKING TRANSFER
TUBE (DAMPER TUBE
TO FRONT NOZZLE),
REFERENCE
3
CLEARANCE
GAP
A
A
NO. 4 BEARING OIL
SCAVENGE (INNER)
TUBE ASSEMBLY
L-B2812 (0000)
PW V

No. 4 Bearing (Oil) Nozzle And Front
Nozzle Installation (Post SB PW4ENG 72-472)
Figure 422 (Sheet 1)
(Task 72-00-32-420-001)


B
11
NO. 4 BEARING (OIL) NOZZLE
12
NO. 4 BEARING DAMPER SUPPLY TUBE ASSEMBLY
13
FRONT NO. 4 BEARING NOZZLE ASSEMBLY
SECTION A−A
17
BOLT AND WASHER (2 NECESSARY)
14
PACKING
15
PACKING TRANSFER TUBE (DAMPER TUBE TO FRONT NOZZLE)
14
PACKING
16
BOLT AND WASHER (2 NECESSARY)
VIEW IN DIRECTION B
L−B2813 (0000)
PW V

No. 4 Bearing (Oil) Nozzle And Front
Nozzle Installation (Post SB PW4ENG 72−472)
Figure 422 (Sheet 2)
(Task 72−00−32−420−001)

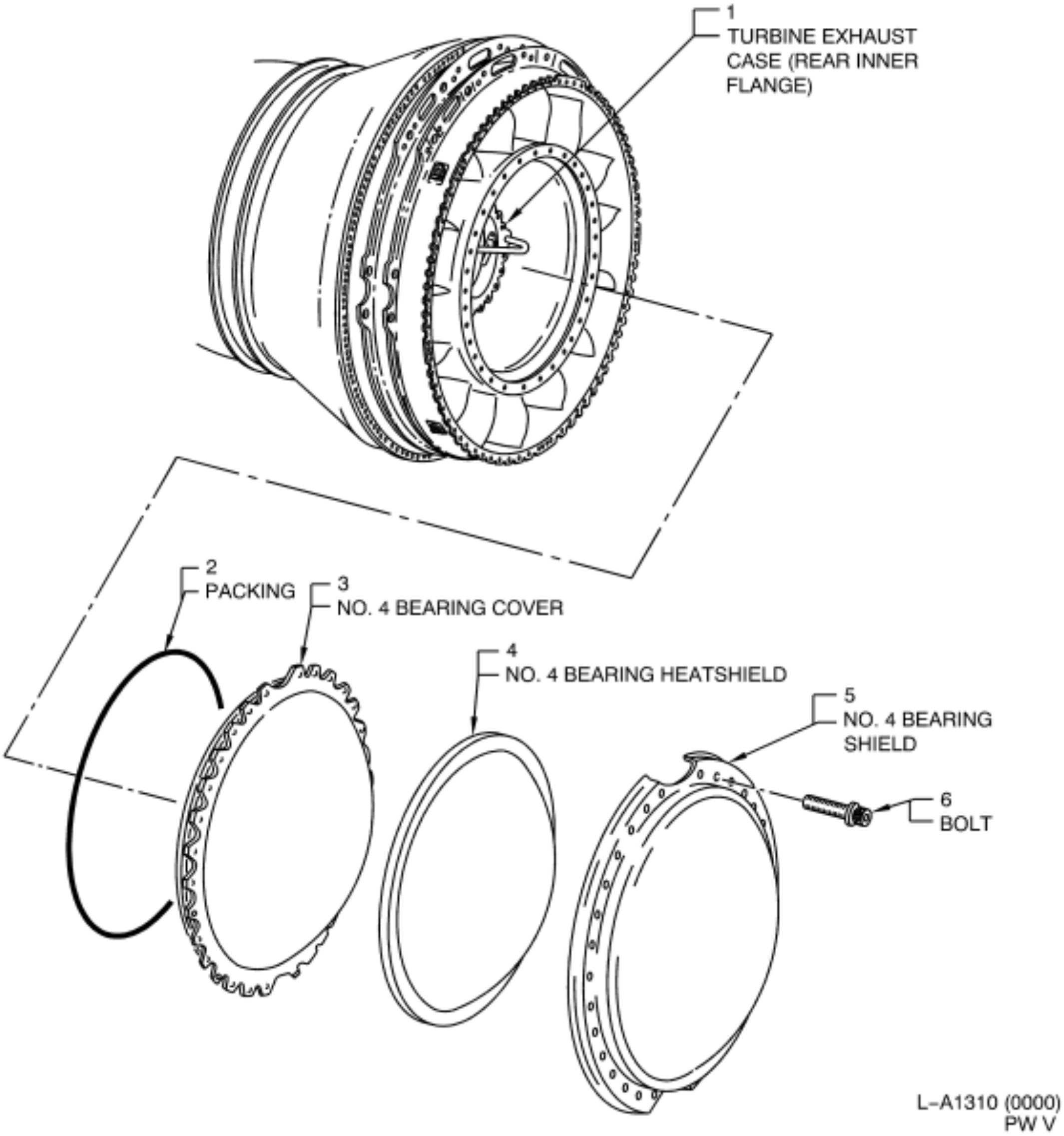
ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−01


AREA E
1
1
SEAL RING GAP
SECTION B−B
TYPICAL TWO PLACES
A
A
2
REAR VIEW OF
NO. 4 BEARING COMPARTMENT
B
B
SEAL RING
NO. 4 BEARING
(OIL) NOZZLE
SECTION A−A
L−A1239 (0502)
PW V

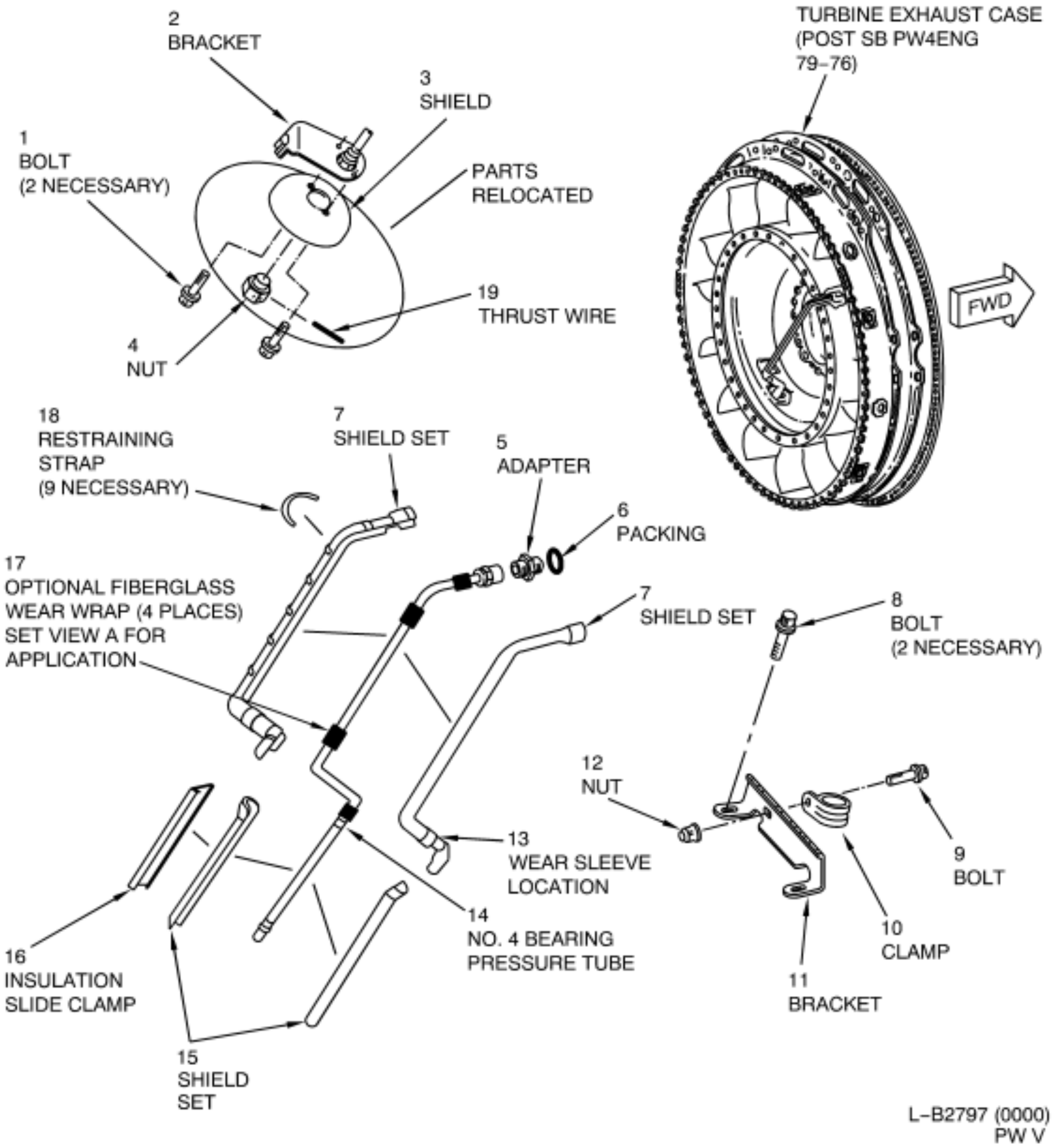
1. 0.500 Inch (12.700 mm) Maximum
2. (Reference 90) 0.010 − 0.050 Inch (0.254 − 1.270 mm),
   Four Locations

No. 4 Bearing Outer Race Installation
Figure 423
(Task 72−00−32−420−001)

ENGINE GENERAL - LPC/LPT COUPLING - INSTALLATION-01


1
TURBINE EXHAUST CASE (REAR INNER FLANGE)
2
PACKING
3
NO. 4 BEARING COVER
4
NO. 4 BEARING HEATSHIELD
5
NO. 4 BEARING SHIELD
6
BOLT
L-A1310 (0000)
PW V

Installation Of The No. 4 Bearing Cover And Shield
Figure 424
(Task 72-00-32-420-001)


2
BRACKET
3
SHIELD
1
BOLT
(2 NECESSARY)
PARTS
RELOCATED
TURBINE EXHAUST CASE
(POST SB PW4ENG
79−76)
FWD
19
THRUST WIRE
4
NUT
18
RESTRAINING
STRAP
(9 NECESSARY)
7
SHIELD SET
5
ADAPTER
6
PACKING
17
OPTIONAL FIBERGLASS
WEAR WRAP (4 PLACES)
SET VIEW A FOR
APPLICATION
7
SHIELD SET
8
BOLT
(2 NECESSARY)
12
NUT
13
WEAR SLEEVE
LOCATION
9
BOLT
14
NO. 4 BEARING
PRESSURE TUBE
10
CLAMP
11
BRACKET
16
INSULATION
SLIDE CLAMP
15
SHIELD
SET
L−B2797 (0000)
PW V

Installation Of The No. 4 Bearing
Pressure Tube (Post SB PW4ENG 79−76)
Figure 425 (Sheet 1)
(Task 72−00−32−420−001)

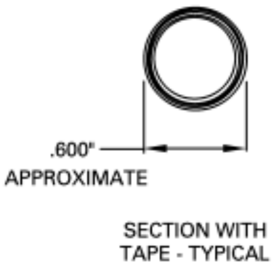
R
R

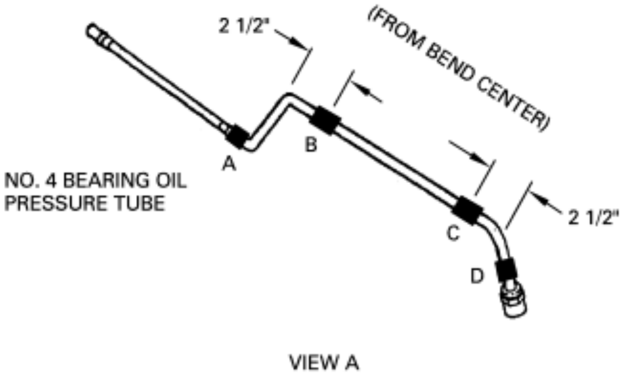
1. WRAP 1.00 INCH (25.400 mm) WIDE FIBERGLASS TAPE, P05-136, AT FOUR (4) LOCATIONS:

   -A & D AT TUBE ENDS AS SHOWN

   -B & C AT STRAIGHT SECTION AS SHOWN

2. WRAP TAPE TO BE 0.600 INCH DIAMETER (15.240 mm) AND ABOUT 0.100 INCH (2.54 mm) HEIGHT ABOVE TUBE SURFACE.


.600"
APPROXIMATE
SECTION WITH
TAPE - TYPICAL


2 1/2"
(FROM BEND CENTER)
A
B
C
D
2 1/2"
NO. 4 BEARING OIL
PRESSURE TUBE
VIEW A

L-B2800 (0000)

No. 4 Bearing Pressure Tube Installation Optional
Chafing Wear Prevention (Post SB PW4ENG 79−76)
Figure 425 (Sheet 2)
(Task 72−00−32−420−001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−02

Task 72−00−32−420−001−002:

1. Install The LPC/LPT Coupling (Front Compressor Drive Turbine Shaft Installed (Hydraulic Wrench) − Deleted

A. Procedure

(1) This procedure is relocated to 72−00−32, Installation−01 (Task 72−00−32−420−001).

Task 72-00-32-430-001:

1. Install No. 1.5 Bearing And Seal

A. Equipment And Materials Necessary

Special Tools:

PWA 18872	Wrench, Hydraulic*
PWA 28814	Pump, Hydraulic* (Use With Hydraulic Wrench)
PWA 28815	Cart, Storage (Optional)* (Use With Hydraulic Wrench)
PWA 29510	Pump, Hydraulic (Hand)* (Use With Hydraulic Wrench)
PWA 33732	Wrench, Hydraulic*
PWA 45418	Wrench, Mechanical*
PWA 45419	Air Torque Multiplier* (Use With Mechanical Wrench)
PWA 75046	Cart (Optional)* (Use With Hydraulic Wrench)
PWA 76154	Adapter
PWA 80070	Wrench, Hydraulic*
PWA 80071	Multiplier, Torque* (Use With Mechanical Wrench)
PWA 80187	Wrench, Mechanical*
PWA 80651	Multiplier, Pneumatic* (Use With Mechanical Wrench)
PWA 85261	Adapter
PWA 85262	Guide, Piloting
PWA 85263	Drift
PWA 85264	Adapter, Holding* (Use With Mechanical And Hydraulic Wrenches)
PWA 85265	Wrench, Torque* (Use With Mechanical And Hydraulic Wrenches)
PWA 85375	Plate, Anchor* (Use With Mechanical Wrench)
PWA 85468	Stand
PWA 85516	Wrench, Torque* (Use With Hydraulic Wrench)
PWA 85517	Adapter, Holding* (Use With Hydraulic Wrench)
PWA 87354	Wrench, Hydraulic*
PWA 88100	Plate, Anchor* (Use With Mechanical And Hydraulic Wrenches)

*See Table 401 for Mechanical Wrench or Table 402 for Hydraulic Wrench tool options. These tables show the correct combinations of tools for the installation of the No. 1.5 bearing (inner race) retaining nut.

ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−03

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)

B. Procedure

(1) Install bearing outer race.

(a) Position bracket to front face of outer race aligning dowel pins with dowel pin holes in flange.

NOTE: Front face of bearing outer race is adjacent to chamfer on ID.

(b) Position and install outer race and bracket to No. 1 1/2 bearing support aligning dowel pins of bracket with dowel pin holes in support flange.

(c) (Post SB PW4ENG 72−253) Install bolts and key washers through bearing outer race as follows. See Figure 401.

1 Install fourteen (14) bolts with seven (7) double key washers.

2 Install two (2) longer bolts with key washers at bracket location.

3 (Reference 981) Tighten two adjacent bolts and then the opposite bolts until all bolts are tight and the outer race is installed in the support. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

4 Bend the key washers to safety the bolt.

(2) Heat the No. 1.5 bearing inner race and rollers. See Standard Practices Manual, PN 585005.

(3) Install PWA 85261 Adapter to coupling. Attach PWA 76154 Adapter to suitable sling to lift and/or trunnion coupling. Position coupling on PWA 85468 Stand front end down. See Figure 402.

ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−03

(4) Install the bearing inner race and rollers on the coupling. Do the procedure that follows as quickly as possible. See Figure 403.

(a) With correct gloves, position the heated No. 1.5 bearing on the coupling (mating mark up).

(b) Install PWA 85263 Drift to pilot on rod of guide on coupling. Drift bearing to seat on coupling.

(c) Leave the drift on the bearing until it cools to 75° − 85°F (23.9° − 29.4°C).

(d) Remove drift from coupling.

(e) Make sure the inner race of the bearing has cooled to 75° − 85°F (23.9° − 29.4°C) before you continue with the assembly procedure.

(5) Install seal seat over coupling with "REAR" up and butt against bearing. See Figure 404.

CAUTION: FOR EACH ENGINE BUILD, IT WILL BE NECESSARY TO INSTALL A NEW OR REFURBISHED NO. 1.5 BEARING (INNER RACE) RETAINING NUT OR DAMAGE TO MATING PARTS CAN OCCUR. NUT MAY BE REFURBISHED PER PW4000 SERIES CIR, PN 51A357.

(6) Install the No. 1.5 bearing (inner race) retaining nut (called nut) on the coupling as follows.

(a) Apply Engine Oil P03−001 to the nut.

(b) Install the nut on the coupling. Tighten the nut with your fingers.

(7) For operators that use a mechanical wrench to install the nut, install tooling as follows. See Table 401 for the correct combinations of tools.

PWA Torque Wrench	PWA Holding Adapter	PWA Mechanical Wrench or Torque Multiplier	PWA Pneumatic Multiplier	PWA Anchor Plate
85265	85264	80187	80651 or 45419	88100 or 85375
85265	85264	45418	45419	88100 or 85375

Retaining Nut Installation (Mechanical Wrench)
Table 401

PWA Torque Wrench	PWA Holding Adapter	PWA Mechanical Wrench or Torque Multiplier	PWA Pneumatic Multiplier	PWA Anchor Plate
85265	85264	80071	80651 or 45419	88100

Retaining Nut Installation (Mechanical Wrench)
Table 401 (Continued)

(a) Install PWA 85264 Adapter in the coupling, aligning splines.

(b) Install PWA 85265 Torque Wrench on coupling, aligning slots in wrench with slots in retaining nut.

(c) Install a mechanical wrench on the adapter.

(d) Install an anchor plate on the adapter, engaging the pins on the mechanical wrench with the holes in the anchor plate.

(e) If you want, install a pneumatic multiplier on the mechanical wrench.

(8) For operators that use a hydraulic wrench to install the nut, install tooling as follows. See Table 402 for the correct combinations of tools.

(a) (Method 1) See Figure 405 (Sheet 1).

1 Install PWA 85517 Adapter in the rear of the coupling, large end first.

2 Install PWA 85516 Wrench over the adapter and engage the teeth of the wrench in the slots of the nut.

3 With a hoist, remove a hydraulic wrench from the cart. Install the hydraulic wrench on the adapter.

4 Attach a pump to the hydraulic wrench.

ENGINE GENERAL - LPC/LPT COUPLING - INSTALLATION-03

PWA Torque Wrench	PWA Holding Adapter	PWA Hydraulic Wrench	PWA Anchor Plate	PWA Pump	PWA Cart
85516	85517	33732	-----	28814 or 29510	75046
85516	85517	18872	-----	28814 or 29510	75046 or 28815
85265	85264	87354	88100	28814 or 29510	75046
85265	85264	80070	88100	28814 or 29510	75046

Retaining Nut Installation (Hydraulic Wrench)
Table 402

(b) (Method 2) See Figure 405 (Sheet 2).

1 Install PWA 85264 Adapter in the rear of the coupling, large end first.

2 Install PWA 85265 Torque Wrench over the adapter and engage the teeth of the wrench in the slots of the nut.

3 With a hoist, lift a hydraulic wrench from a cart. Install a hydraulic wrench on the torque wrench.

4 Install PWA 88100 Anchor Plate on the adapter. Engage the holes of the anchor plate with the pins of the hydraulic wrench.

5 Connect a pump to the hydraulic wrench.

CAUTION: NO. 1.5 BEARING (INNER RACE) RETAINING NUT MUST BE REFURBISHED AFTER EACH COMPLETE TORQUE APPLICATION SPECIFIED IN THE FOLLOWING STEPS.

(9) (Reference 972) Torque nut as follows:

(a) Tighten nut to 2200 - 2800 lb-in. (248.567 -
R 316.357 N.m). Turn nut through angle of 11 - 12
R degrees 12 minutes and loosen nut to zero.

(b) Tighten nut to 2200 - 2800 lb-in. (248.567 - 316.357 N.m).

ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−03

(c) Establish common reference points between nut and its mating part.

R (d) Turn nut through angle of 11 − 12 degrees 12
R minutes.

(e) Loosen nut to zero and repeat step (b).

(f) If nut reference point is in line with mating part reference point or beyond it within 2 degrees maximum, apply final angle of turn per step (d).

(g) If reference points are not within limits, repeat steps (c), (d) and (e) in order until reference points are within limits. Then perform step (f).

(10) Remove tooling from coupling.

(11) Check, with a 0.001 inch (0.025 mm) feeler gage, that the seal seat and bearing are correctly seated on the coupling. The seal seat and bearing are correctly seated if you are unable to fit the 0.001 inch (0.025 mm) feeler gage between the coupling shoulder, bearing and seal seat.

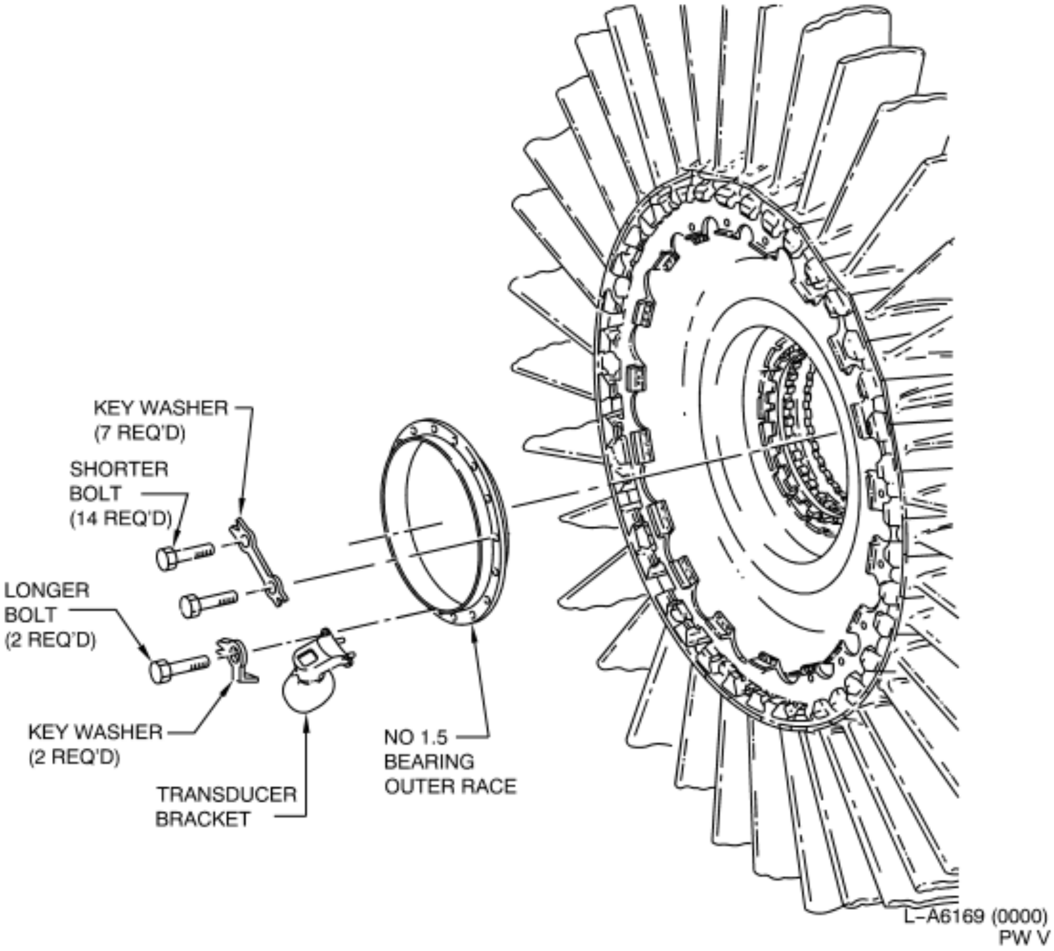
(12) Install key washer to nut and coupling. Install retaining ring to secure key washer.

(13) Install protector around bearing and seal seat.

C. Postrequisites

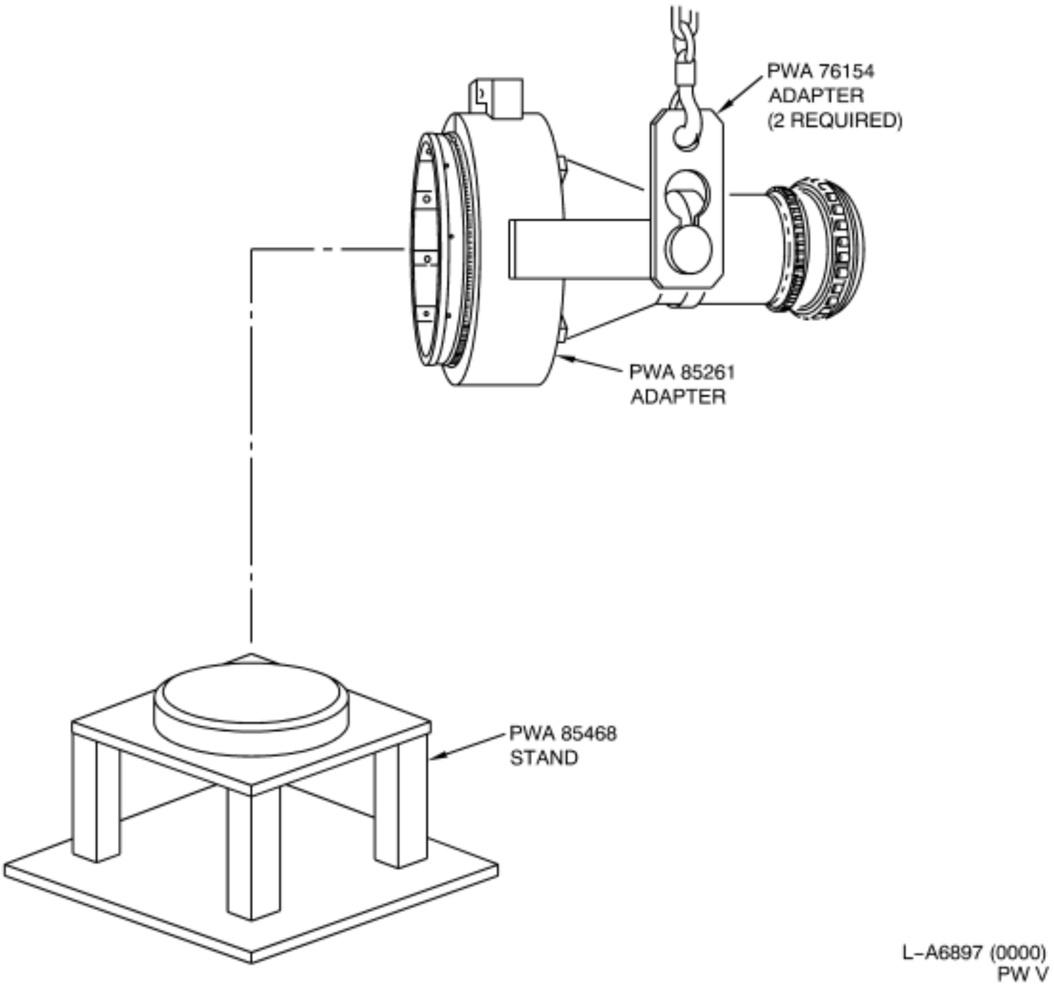
(1) Install The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed). Refer to 73−00−32, Installation−01 (Task 72−00−32−420−001).

ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−03

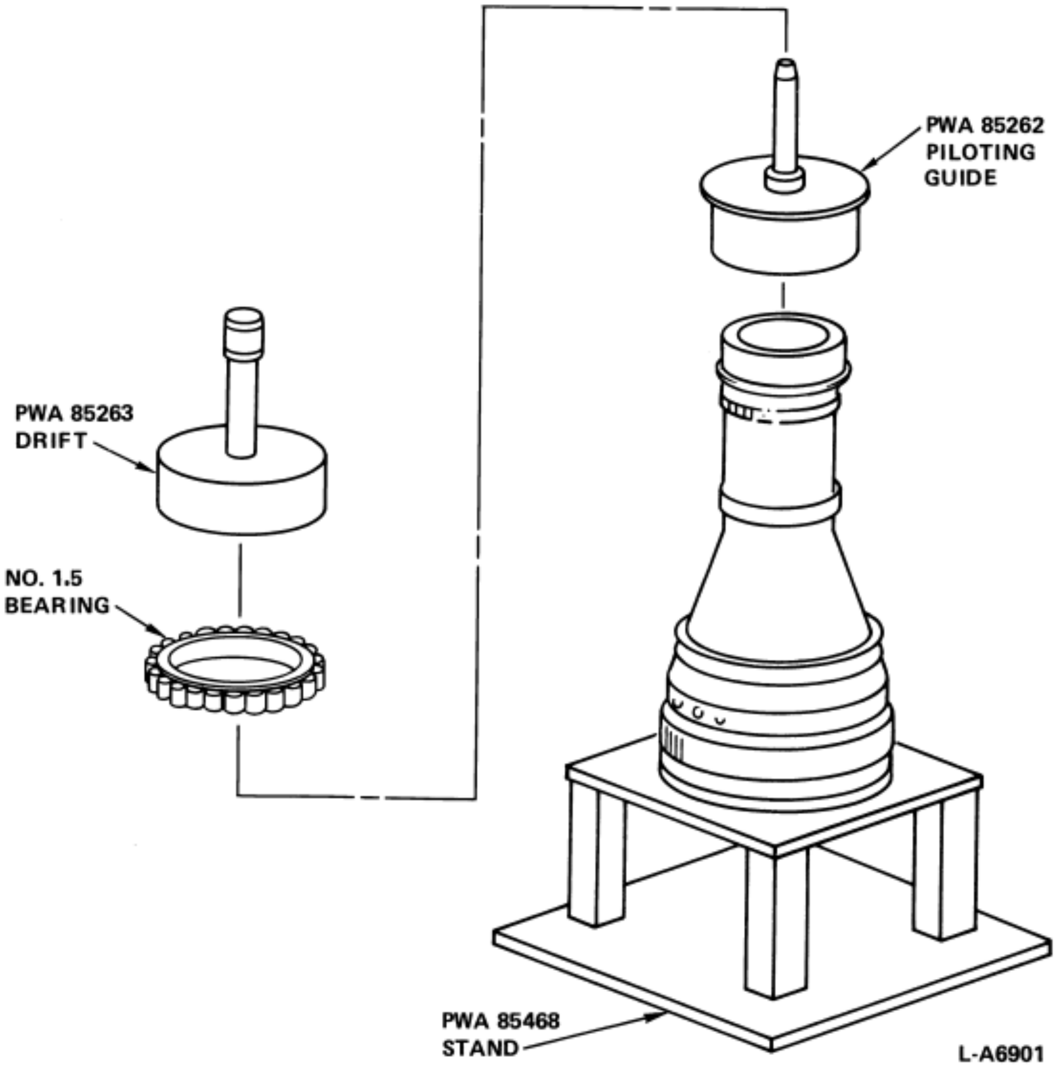

KEY WASHER
(7 REQ'D)
SHORTER
BOLT
(14 REQ'D)
LONGER
BOLT
(2 REQ'D)
KEY WASHER
(2 REQ'D)
TRANSDUCER
BRACKET
NO 1.5
BEARING
OUTER RACE
L−A6169 (0000)
PW V

No. 1.5 Bearing Outer Race Installation
Figure 401
(Task 72−00−32−430−001)

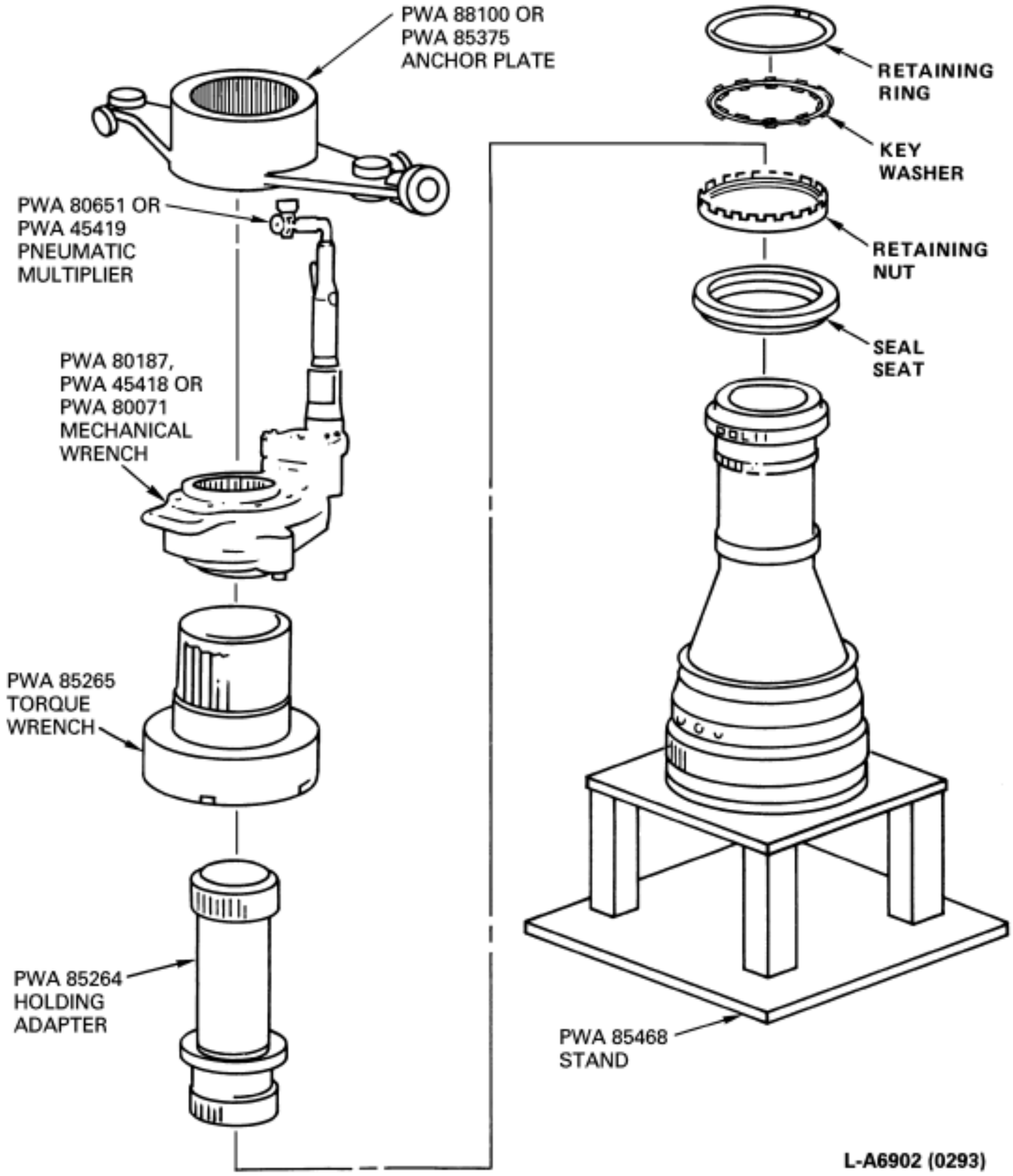
ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−03


PWA 76154
ADAPTER
(2 REQUIRED)
PWA 85261
ADAPTER
PWA 85468
STAND
L−A6897 (0000)
PW V

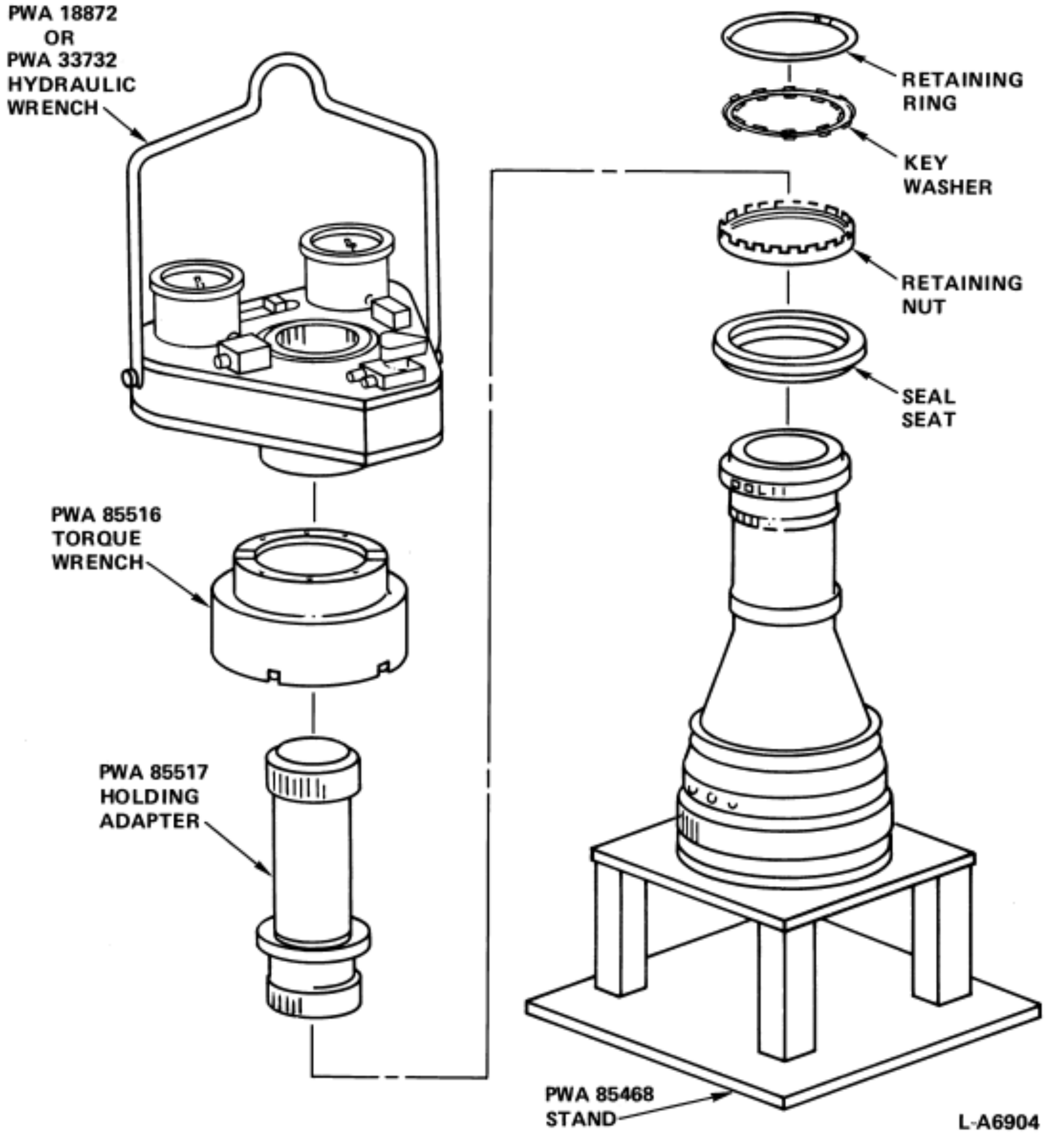
Coupling On The Stand Installation
Figure 402
(Task 72−00−32−430−001)


PWA 85262
PILOTING
GUIDE
PWA 85263
DRIFT
NO. 1.5
BEARING
PWA 85468
STAND
L-A6901

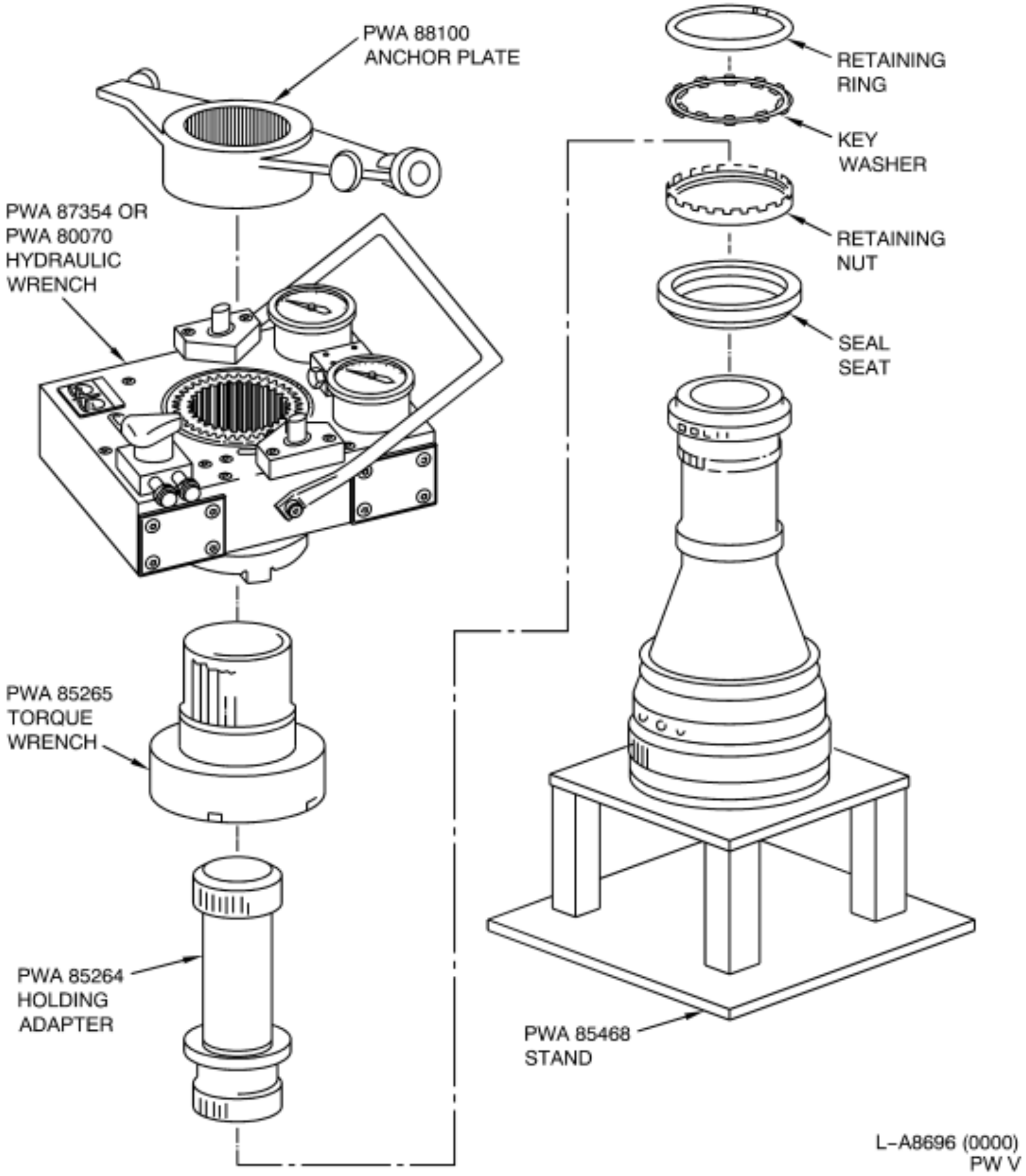
No. 1.5 Bearing Inner Race And Rollers Installation
Figure 403
(Task 72−00−32−430−001)


PWA 88100 OR
PWA 85375
ANCHOR PLATE
PWA 80651 OR
PWA 45419
PNEUMATIC
MULTIPLIER
PWA 80187,
PWA 45418 OR
PWA 80071
MECHANICAL
WRENCH
PWA 85265
TORQUE
WRENCH
PWA 85264
HOLDING
ADAPTER
RETAINING
RING
KEY
WASHER
RETAINING
NUT
SEAL
SEAT
PWA 85468
STAND
L-A6902 (0293)

No. 1.5 Bearing And Seal Seat Installation (Mechanical Wrench)
Figure 404
(Task 72−00−32−430−001)


PWA 18872
OR
PWA 33732
HYDRAULIC
WRENCH
PWA 85516
TORQUE
WRENCH
PWA 85517
HOLDING
ADAPTER
RETAINING
RING
KEY
WASHER
RETAINING
NUT
SEAL
SEAT
PWA 85468
STAND
L-A6904

No. 1.5 Bearing (Inner Race) Retaining Nut
Installation (Hydraulic Wrench) (Method 1)
Figure 405 (Sheet 1)
(Task 72−00−32−430−001)


PWA 88100
ANCHOR PLATE
PWA 87354 OR
PWA 80070
HYDRAULIC
WRENCH
PWA 85265
TORQUE
WRENCH
PWA 85264
HOLDING
ADAPTER
RETAINING
RING
KEY
WASHER
RETAINING
NUT
SEAL
SEAT
PWA 85468
STAND
L−A8696 (0000)
PW V

No. 1.5 Bearing (Inner Race) Retaining Nut
Installation (Hydraulic Wrench) (Method 2)
Figure 405 (Sheet 2)
(Task 72−00−32−430−001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LPC/LPT COUPLING - INSTALLATION-04

Task 72-00-32-430-001-002:

1. Install The No. 1.5 Bearing And Seal (Hydraulic Method) - Deleted

    A. Procedure

        (1) This procedure is relocated to 72-00-32, Installation-03 (Task 72-00-32-430-001).

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Task 72-00-32-420-005:

1. Install The LPT/LPC Coupling (With The Front Compressor Drive Turbine Shaft Removed)

NOTE: See Figure 401 for Part/Assembly Installation Procedure Sequence.

A. Prerequisites

(1) See Inspection/Check-01 (Task 72-00-32-990-001) for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by reference number. For example: (Reference 1234) Torque retaining nut as follows.

(2) If removed, Install The No. 1.5 Bearing And Seal. Refer to 72-00-32, Installation-03 (Task 72-00-32-430-001).

B. Equipment And Materials Necessary

Special Tools:

PWA 3755	Pump, Hydraulic
PWA 25000	Wrench, Hydraulic
PWA 28668	Pump, Hydraulic (Use With Hydraulic Wrench)
PWA 28669	Cart (Optional) (Use With Hydraulic Wrench)
PWA 29389	Pump, Hydraulic
PWA 29510	Pump, Hydraulic (Hand) (Use With Hydraulic Wrench)
PWA 29614	Wrench, Mechanical
PWA 29615	Holder, Plate (Use With Mechanical Wrench)
PWA 45419	Air Torque Multiplier (Use With Mechanical Wrench)
PWA 80651	Multiplier, Pneumatic (Use With Mechanical Wrench)
PWA 85301	Adapter, Holding (Use With Mechanical Wrench)
PWA 85302	Wrench, Torque (Use With Mechanical Wrench)
PWA 85507	Adapter, Holding (Use With Hydraulic Wrench)
PWA 85508	Wrench, Torque (Use With Hydraulic Wrench)
PWA 85769	Fixture, Install/Remove
PWA 86604	Stand, Transport

R
R

ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−05

Consumable Materials:

	Item No.	Designation
	P03−001	Oil, Engine (PWA 521B)
R	P06−002	Petrolatum, White (PMC 9609)
	P06−021	Compound, Antigalling (PWA 550−3)
R	P06−054	Paste, Antiseize (PWA 36246)

C. Procedure
See Figure 402.

(1) Measure Dimension AJ on the front compressor hub assembly (called hub) and Dimension AK on the turbine shaft coupling assembly (called coupling). Write these dimensions. See Figure 403.

(2) Calculate Dimension AL as follows: Subtract Dimension AK from Dimension AJ. Write Dimension AL.

$$AL = AJ - AK$$

(3) Apply Antigalling Compound P06−021 to the external splines of the coupling. Cure the compound for five minutes, minimum. Apply Engine Oil P03−001 to the areas of the coupling shown in the figure. See Figure 404.

(4) Install PWA 85769 Fixture in the coupling as follows. See Figure 405 and Figure 406.

NOTE: The fixture is installed on PWA 86604 Transport Stand. See Figure 405.

(a) With the coupling front end up on a work bench, install the assembly of the detail body, locating plate, and detail−36 rods. The lugs on the locating plate must be aligned with the slots in the ID of the coupling.

(b) Pull back the detail dowel pin and turn the detail locating plate until the lugs on the plate are behind the lugs that are in the ID of the coupling. Release the pin to lock the locating plate in position.

(c) Attach the detail−9 adapter to the detail locating plate.

(d) Attach the detail−3 adapter, detail arm, and detail eye bolt to the tools on the coupling.

(e) Lift the tool and coupling with a hoist. Trunnion the assembly to a horizontal position.

CAUTION: UNWANTED MATERIAL IN THE NO. 1 AND 2 BEARING SUMP CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: MAKE AN INSPECTION OF THE NO. 1 AND 2 BEARING SUMP AREA BEFORE YOU INSTALL THE COUPLING. USE GLOVES. REMOVE ALL UNWANTED MATERIAL BEFORE YOU INSTALL THE COUPlING. See Figure 407.

(5) Install the coupling in the engine as follows.

(a) With the splines on the coupling aligned with the splines in the ID of the hub, install the coupling in the engine until it does not go in any further.

1 With a borescope through the N1 speed transducer hole, make sure that the balls of the No. 1.5 bearing are to the rear of the chamfer on the No. 1.5 bearing outer race. See Figure 408.

NOTE: The N1 transducer boss is at 5 o'clock on the intermediate case.

(b) Remove the fixture's detail eye bolt, detail−3 adapter, and detail arm.

(c) Install the detail locator in the hub. Turn the locator in the threads in the ID of the hub until it cannot turn any more.

(d) Install the two detail hydraulic cylinders and detail spacers on the detail rods.

(e) Attach the detail cover to the detail locator with the three detail screws.

(f) Attach the hydraulic hose assembly and PWA 29389 Pump or PWA 3755 Pump to the hydraulic cylinders.

(g) Operate the pump to make the shoulder of the coupling touch the shoulder in the ID of the hub.

R
R

(h) Remove the fixture from the coupling.

(6) (Reference 1008) Measure Dimension AL from the front face of the hub to the front face of the coupling. See Figure 403.

(a) Measured Dimension AL must not be more than Calculated Dimension AL plus 0.003 inch (0.076 mm) nor less than Calculated Dimension AL minus 0.003 inch (0.076 mm).

Measured AL <= Calculated AL + 0.003 inch (0.076 mm) AND
Measured AL >= Calculated AL − 0.003 inch (0.076 mm)

(b) If Measured Dimension AL is not within limits, it is necessary to install the coupling again.

R (7) Apply Antiseize Paste P06−054 to the turbine shaft (coupling/retaining) nut (called nut) in the area shown
R on Figure 407. Apply Antiseize Paste P06−054 to the
R hub in the area shown on Figure 409. Remove unwanted
R paste.

(8) For operators that use the mechanical wrench, install the nut in the hub as follows.

(a) Install the nut in the hub. Tighten it with your hand.

(b) Install PWA 85301 Adapter in the coupling as follows. See Figure 410.

1 Move the three detail clamps toward the center of the adapter.

2 Install the adapter in the coupling. Engage the keys of the adapter in the inner slots of the coupling. Move the clamps outward behind the lugs of the coupling and tighten them.

(c) Install PWA 85302 Wrench in the nut as follows.

1 Install the wrench over the adapter. Engage the keys of the wrench in the slots of the nut.

2 Move the detail clamps outward to engage the groove in the nut. Tighten the clamps.

(d) Lift PWA 29614 Mechanical Wrench with a hoist. Install the mechanical wrench on the adapter.

(e) Install PWA 29615 Holder on the mechanical wrench. Engage the pins of the mechanical wrench with the holes in the holder.

(f) If you want, install either PWA 80651 or PWA 45419 Pneumatic Multiplier on the mechanical wrench.

(9) For operators that use the hydraulic wrench, install the nut in the hub as follows.

(a) Install the nut in the hub and tighten it with your hand.

(b) Install a PWA 85507 Adapter in the coupling as follows. See Figure 411.

1 Move the three detail clamps toward the center of the adapter.

2 Install the adapter in the coupling.

3 Engage the keys of the adapter in the inner slots of the coupling.

4 Move the clamps outward behind the lugs of the coupling and tighten them.

(c) Install PWA 85508 Torque Wrench in the nut as follows.

1 With a hoist, remove PWA 25000 Hydraulic Wrench from PWA 28669 Cart.

2 Attach the torque wrench to the hydraulic wrench.

3 Engage the teeth of the torque wrench with the slots of the nut.

4 Align the splines of the hydraulic wrench with the splines of the adapter.

5 Attach either PWA 28668 or PWA 29510 Pump to the hydraulic wrench.

(10) (Reference 970) Tighten the nut as follows.

(a) Tighten the nut to 24,200 - 26,800 lb-in. (2734.232 - 3027.993 N.m). Turn the nut through an angle of 18 - 20 degrees. Loosen the nut to zero.

(b) Tighten the nut to 24,200 - 26,800 lb-in. (2734.232 - 3027.993 N.m).

(c) Find a reference point between the nut and an adjacent part.

(d) Turn the nut through an angle of 18 - 20 degrees.

(e) Loosen the nut to zero. Do step (b) again.

(f) If the nut reference point is in line with the adjacent part reference point, or beyond it within two degrees maximum, do step (d) again. If necessary, tighten the nut three degrees maximum to align the locking features.

(g) If the reference points are not within limits, do steps (c), (d) and (e) again, in that order, until the reference points are within limits. Then do step (f).

(11) Remove the tools from the coupling.

D. Postrequisites

(1) Do a vacuum check of the No. 1, 1.5, and 2 bearing compartments. Refer to Testing-01 (Task 72-00-32-790-001).

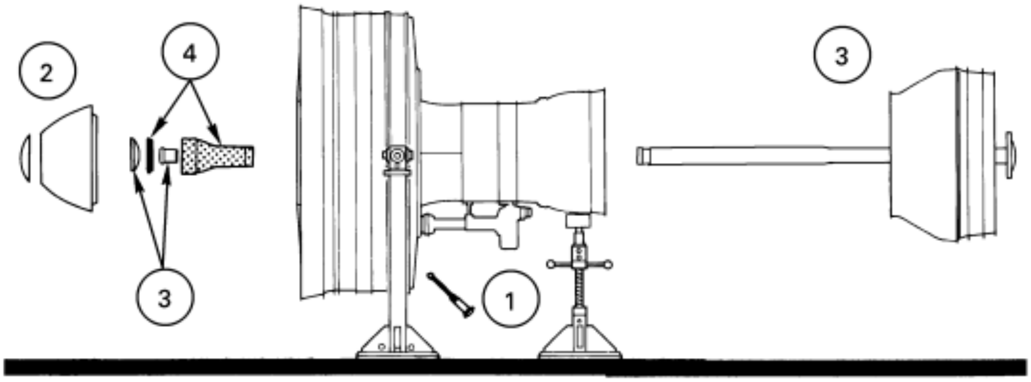
(2) Install The Low Pressure Turbine And Turbine Exhaust Case With The Shaft. Refer to 72-00-53, Installation-08 (Task 72-00-53-420-002).

(3) If not installed, install all Stage 1 LPC blade assemblies. Refer to 72-00-31, Installation-04 (Task 72-00-31-420-002-002). If the blades are installed, remove the shims that are under the tips of the lower fan blades.

(4) Install The Compressor Inlet Cone. Refer to 72-00-31, Installation-02 (Task 72-00-31-420-001).

(5) Install The Electronic Engine Control (EEC) Speed Transducer (N1). Refer to 72−00−34, Installation−03 (Task 72−00−34−450−001) or the EEC speed transducer (N1) multiplexer input probe, 72−00−34, Installation−17 (Task 72−00−34−450−013) as applicable.

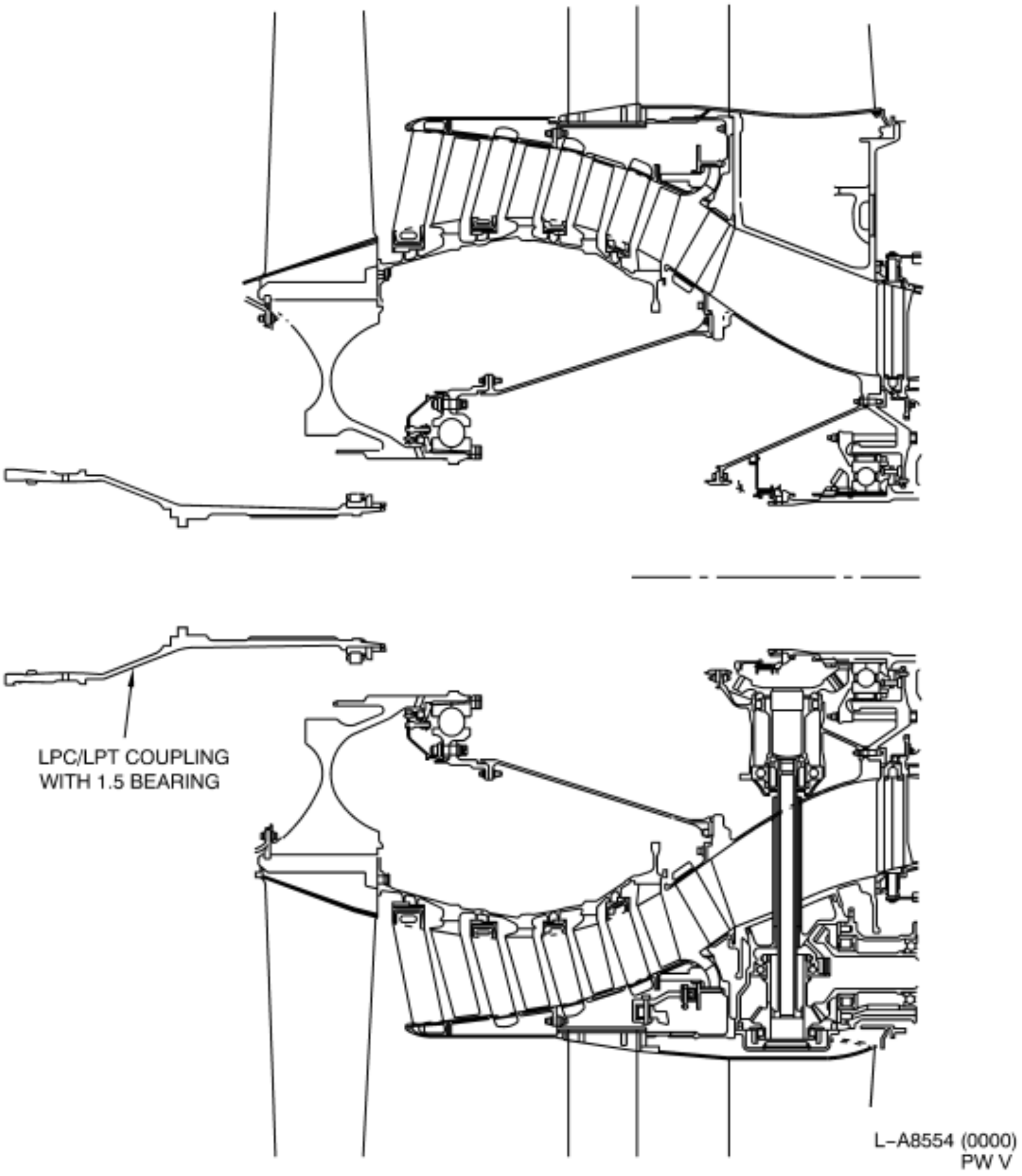
(6) Test the engine. Refer to the Test Reference Table per 71−00−00, Testing−00 (Task 71−00−00−990−003).



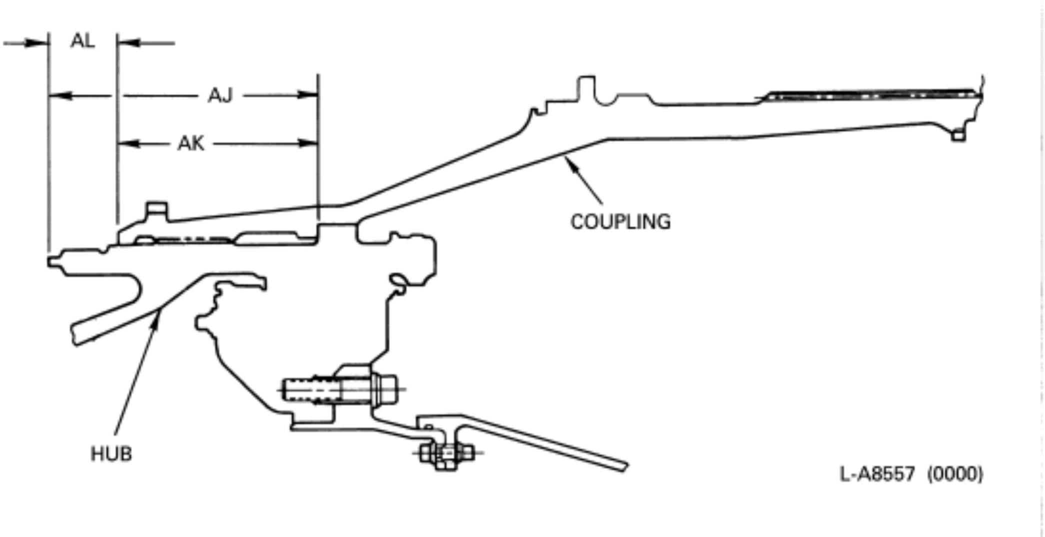
1. REMOVE ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
2. REMOVE COMPRESSOR INLET CONE.
3. REMOVE THE LOW PRESSURE TURBINE AND TURBINE EXHAUST CASE WITH THE SHAFT.
4. REMOVE LPC/LPT COUPLING.

L-A8553 (0293)

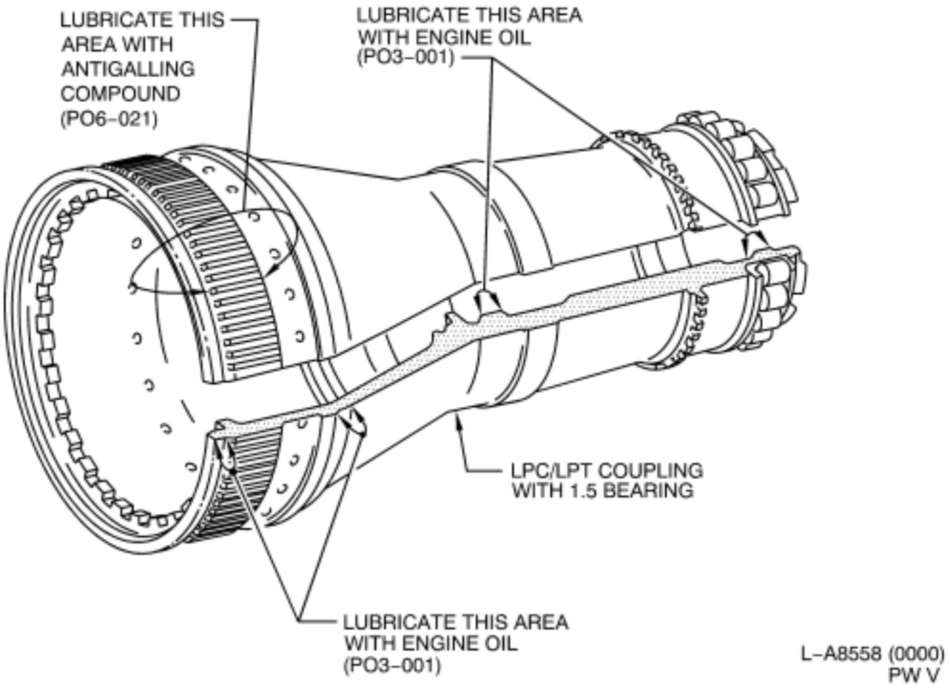
Procedure Sequence
Figure 401
(Task 72–00–32–420–005)


LPC/LPT COUPLING
WITH 1.5 BEARING
L-A8554 (0000)
PW V

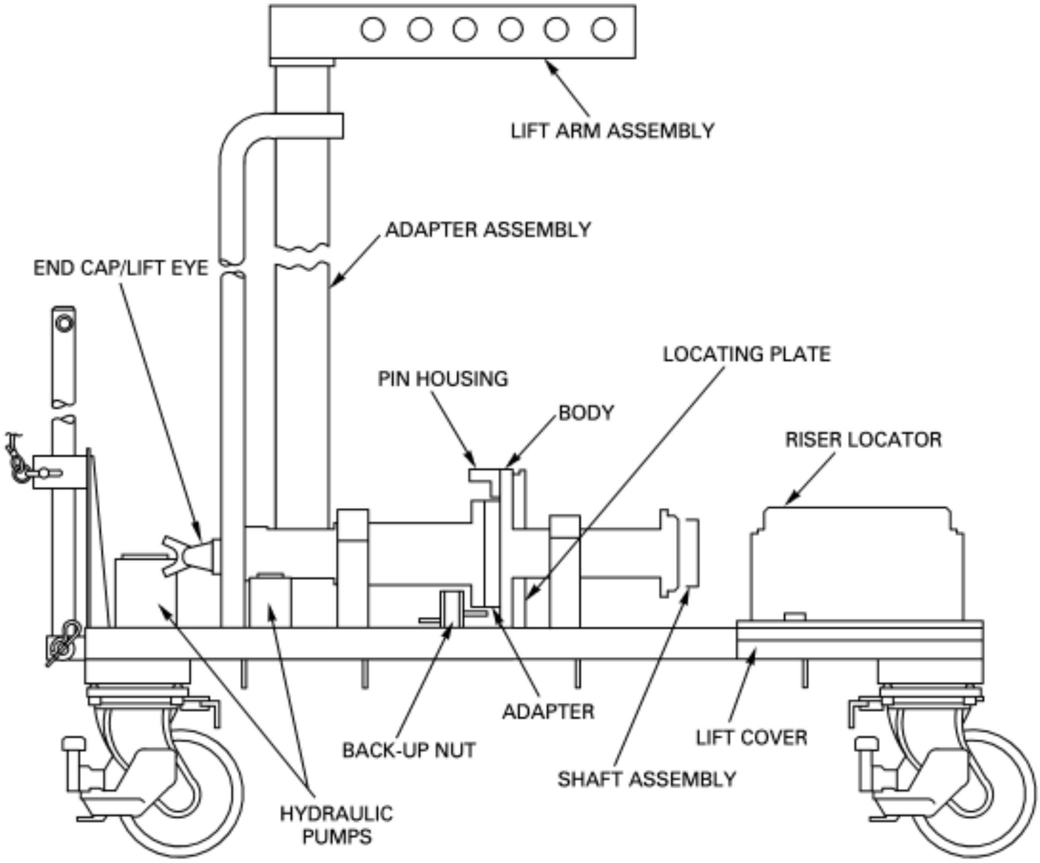
Installation Of The LPC/LPT Coupling
Figure 402
(Task 72-00-32-420-005)


AL
AJ
AK
COUPLING
HUB
L-A8557 (0000)

Installation Of The LPC/LPT Coupling
Figure 403
(Task 72−00−32−420−005)


LUBRICATE THIS AREA WITH ANTIGALLING COMPOUND (PO6−021)
LUBRICATE THIS AREA WITH ENGINE OIL (PO3−001)
LPC/LPT COUPLING WITH 1.5 BEARING
LUBRICATE THIS AREA WITH ENGINE OIL (PO3−001)
L−A8558 (0000)
PW V

Areas Of Lubrication On The Coupling
Figure 404
(Task 72−00−32−420−005)

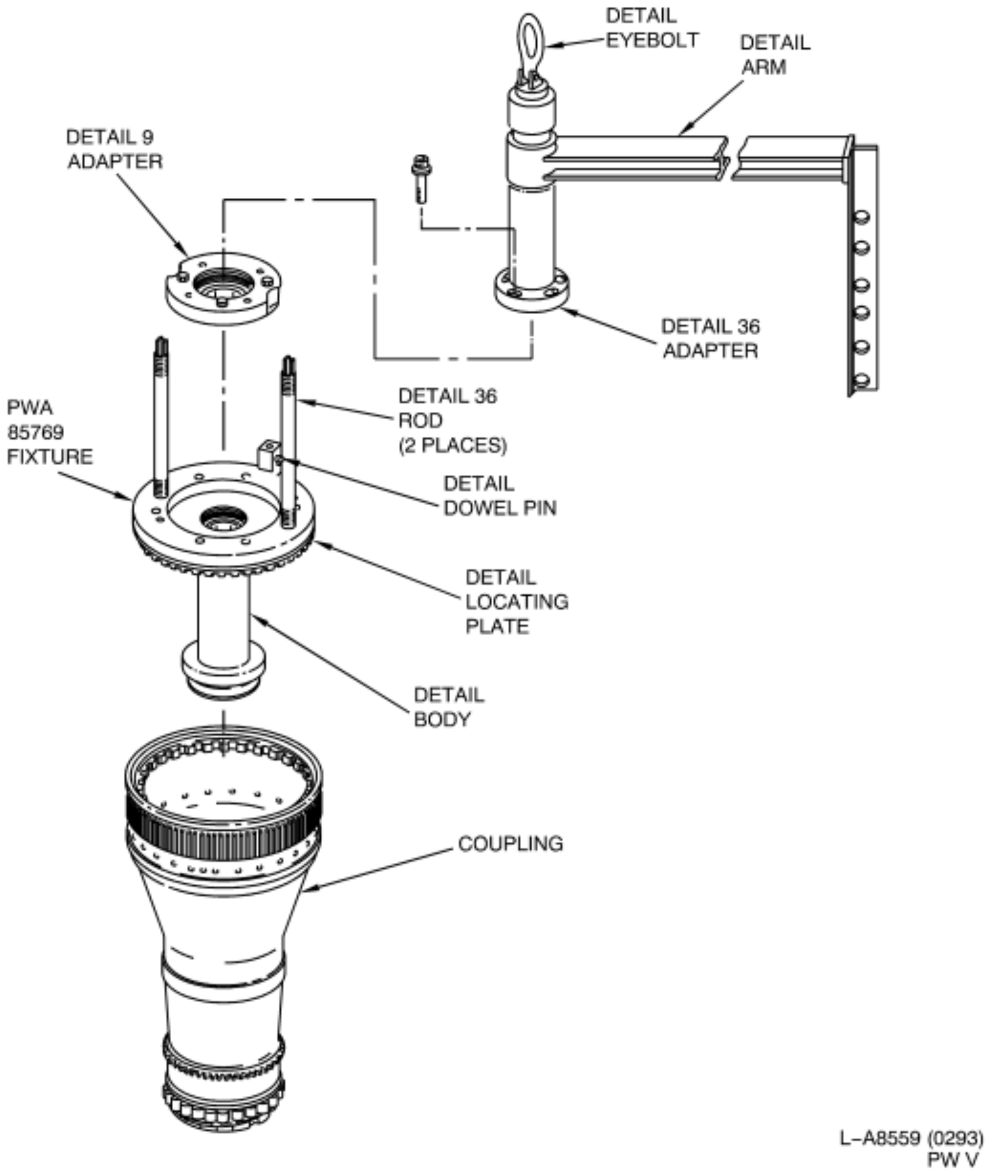

LIFT ARM ASSEMBLY
ADAPTER ASSEMBLY
END CAP/LIFT EYE
LOCATING PLATE
PIN HOUSING
BODY
RISER LOCATOR
ADAPTER
LIFT COVER
BACK-UP NUT
SHAFT ASSEMBLY
HYDRAULIC PUMPS

TRANSPORT STAND

NOTE: THE DETAILS THAT ARE NAMED ARE DETAILS OF PWA 85769 FIXTURE

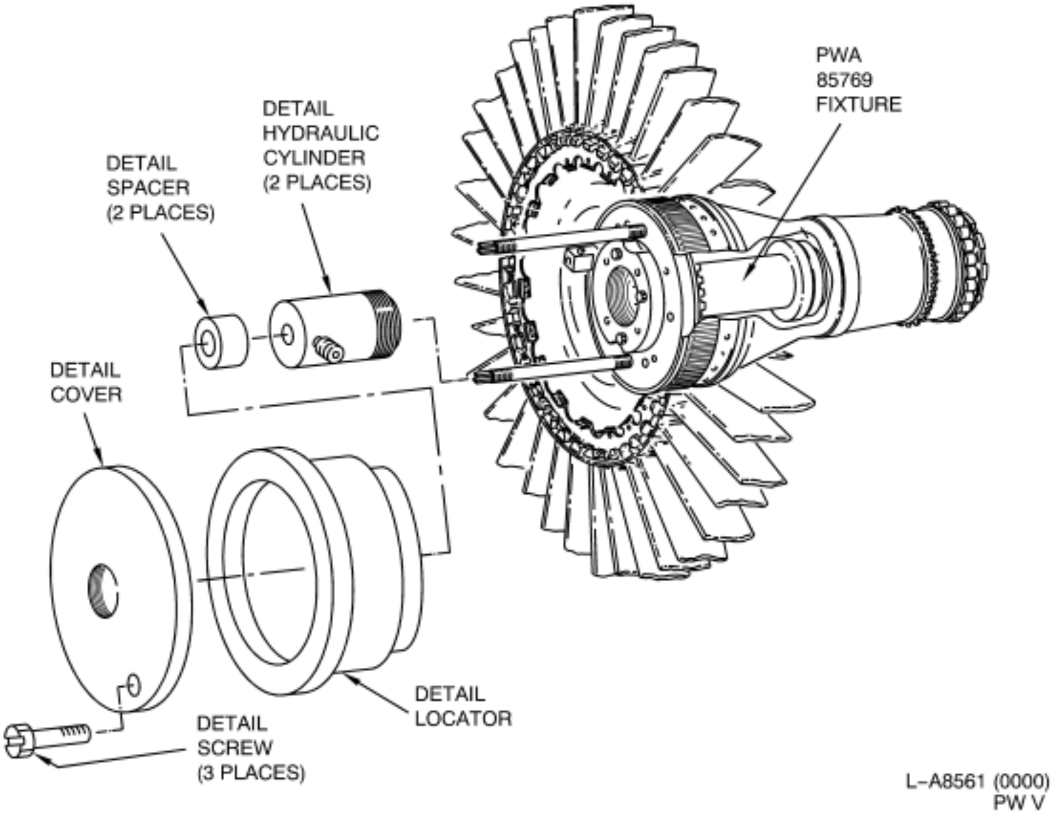
L-A9290 (0695)

Transport Stand For PWA 85769 Fixture
Figure 405
(Task 72−00−32−420−005)

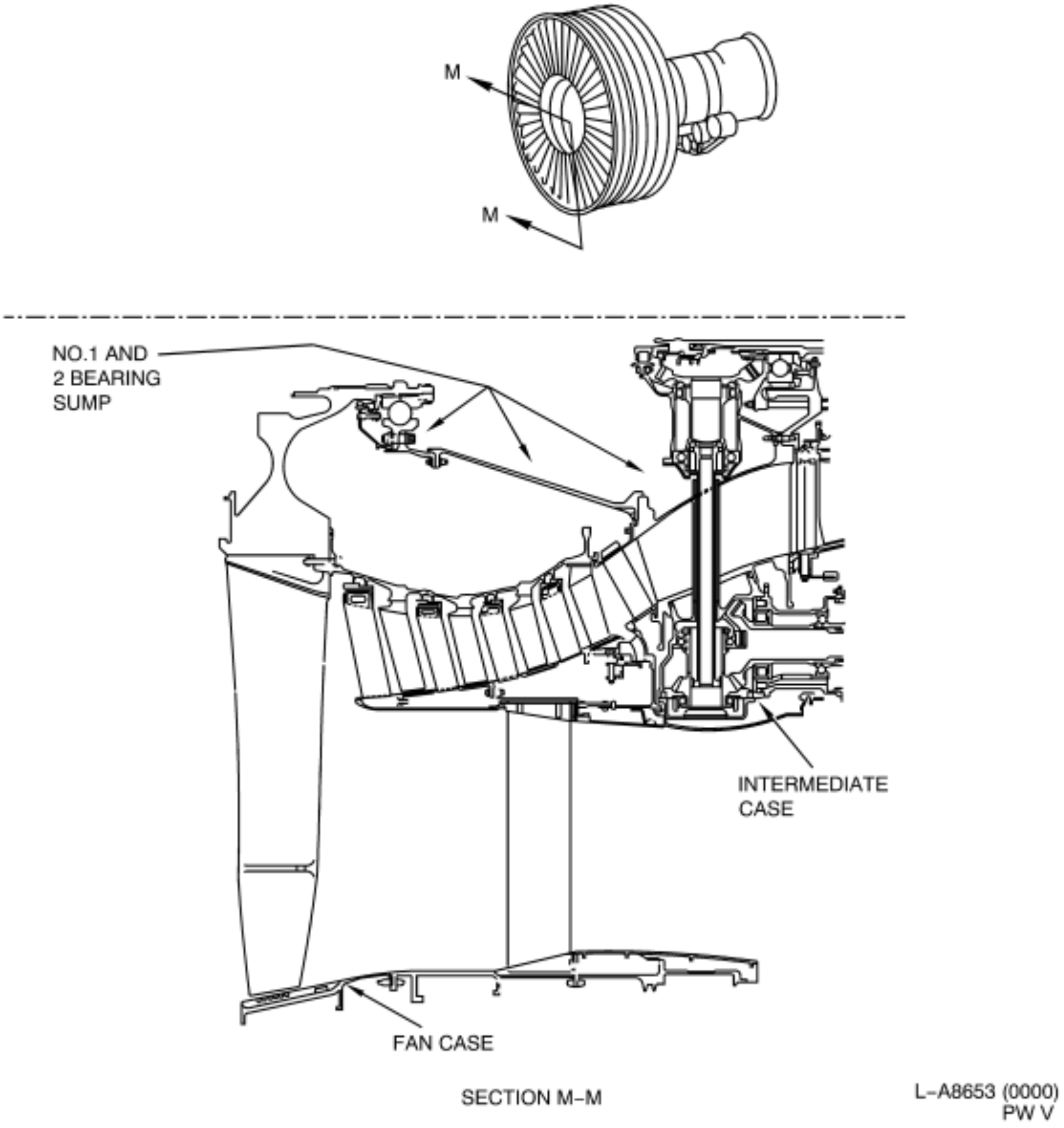

DETAIL
EYEBOLT
DETAIL
ARM
DETAIL 9
ADAPTER
DETAIL 36
ADAPTER
PWA
85769
FIXTURE
DETAIL 36
ROD
(2 PLACES)
DETAIL
DOWEL PIN
DETAIL
LOCATING
PLATE
DETAIL
BODY
COUPLING
L−A8559 (0293)
PW V

Installation Of The Coupling With PWA 85769
Figure 406 (Sheet 1)
(Task 72−00−32−420−005)

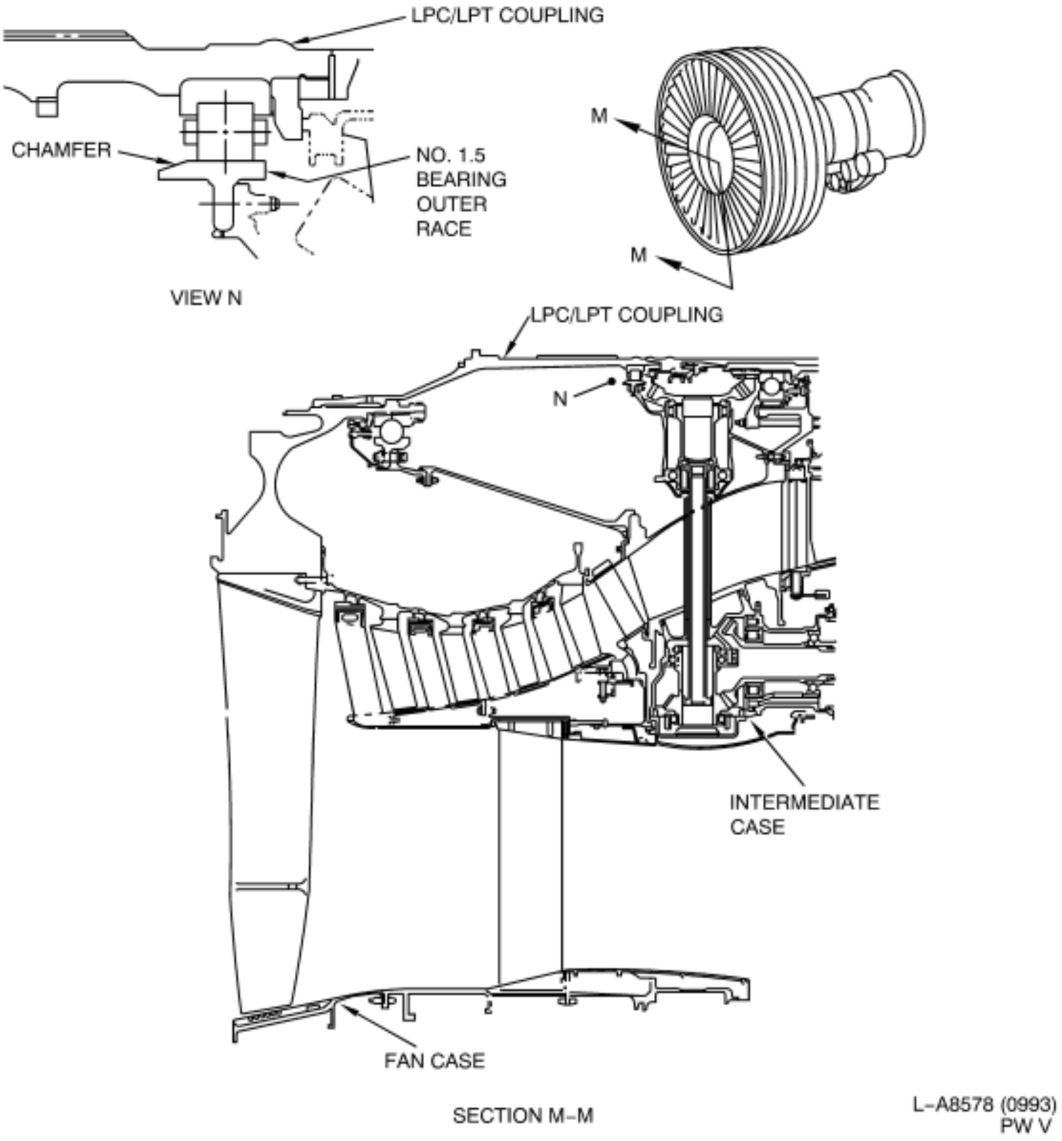
ENGINE GENERAL − LPC/LPT COUPLING − INSTALLATION−05


PWA
85769
FIXTURE
DETAIL
HYDRAULIC
CYLINDER
(2 PLACES)
DETAIL
SPACER
(2 PLACES)
DETAIL
COVER
DETAIL
LOCATOR
DETAIL
SCREW
(3 PLACES)
L−A8561 (0000)
PW V

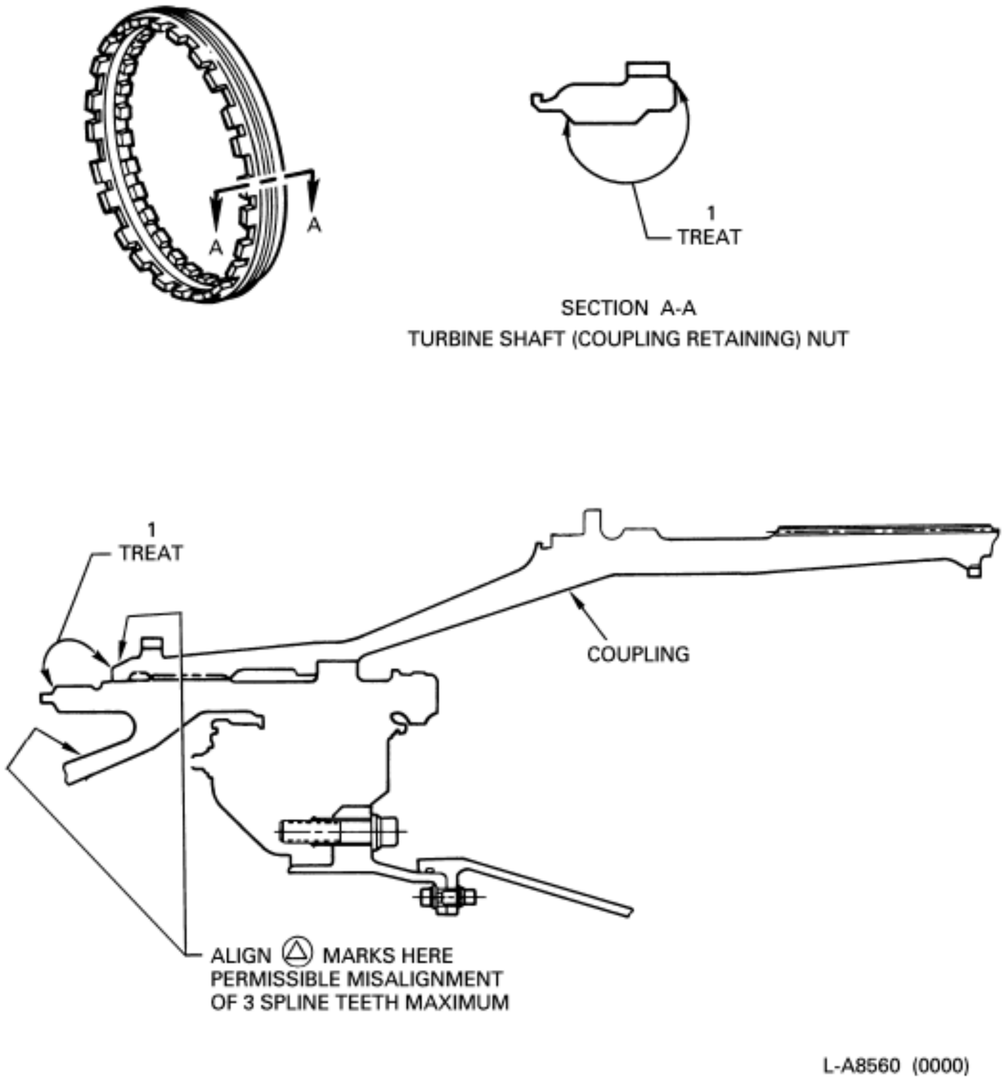
Installation Of The Coupling With PWA 85769
Figure 406 (Sheet 2)
(Task 72−00−32−420−005)


M
M
NO.1 AND
2 BEARING
SUMP
INTERMEDIATE
CASE
FAN CASE
SECTION M−M
L−A8653 (0000)
PW V

The No. 1 And 2 Bearing Sump Area
Figure 407
(Task 72−00−32−420−005)

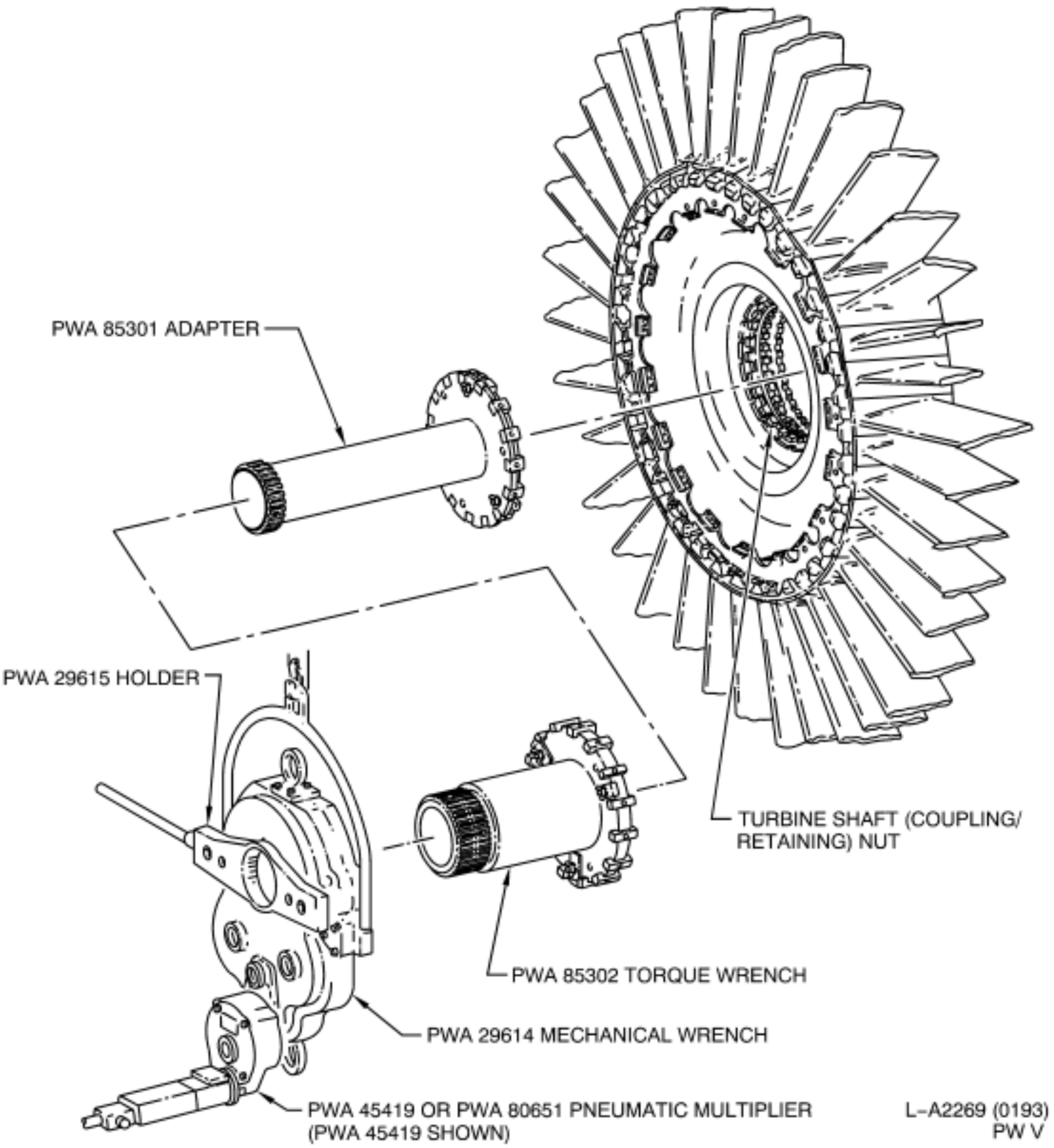

LPC/LPT COUPLING
CHAMFER
NO. 1.5
BEARING
OUTER
RACE
VIEW N
M
M
LPC/LPT COUPLING
N
INTERMEDIATE
CASE
FAN CASE
SECTION M-M
L-A8578 (0993)
PW V

The Position Of The No. 1.5 Bearing Outer Race
Figure 408
(Task 72-00-32-420-005)


A
A
1
TREAT
SECTION A-A
TURBINE SHAFT (COUPLING RETAINING) NUT
1
TREAT
COUPLING
ALIGN △ MARKS HERE
PERMISSIBLE MISALIGNMENT
OF 3 SPLINE TEETH MAXIMUM
L-A8560 (0000)

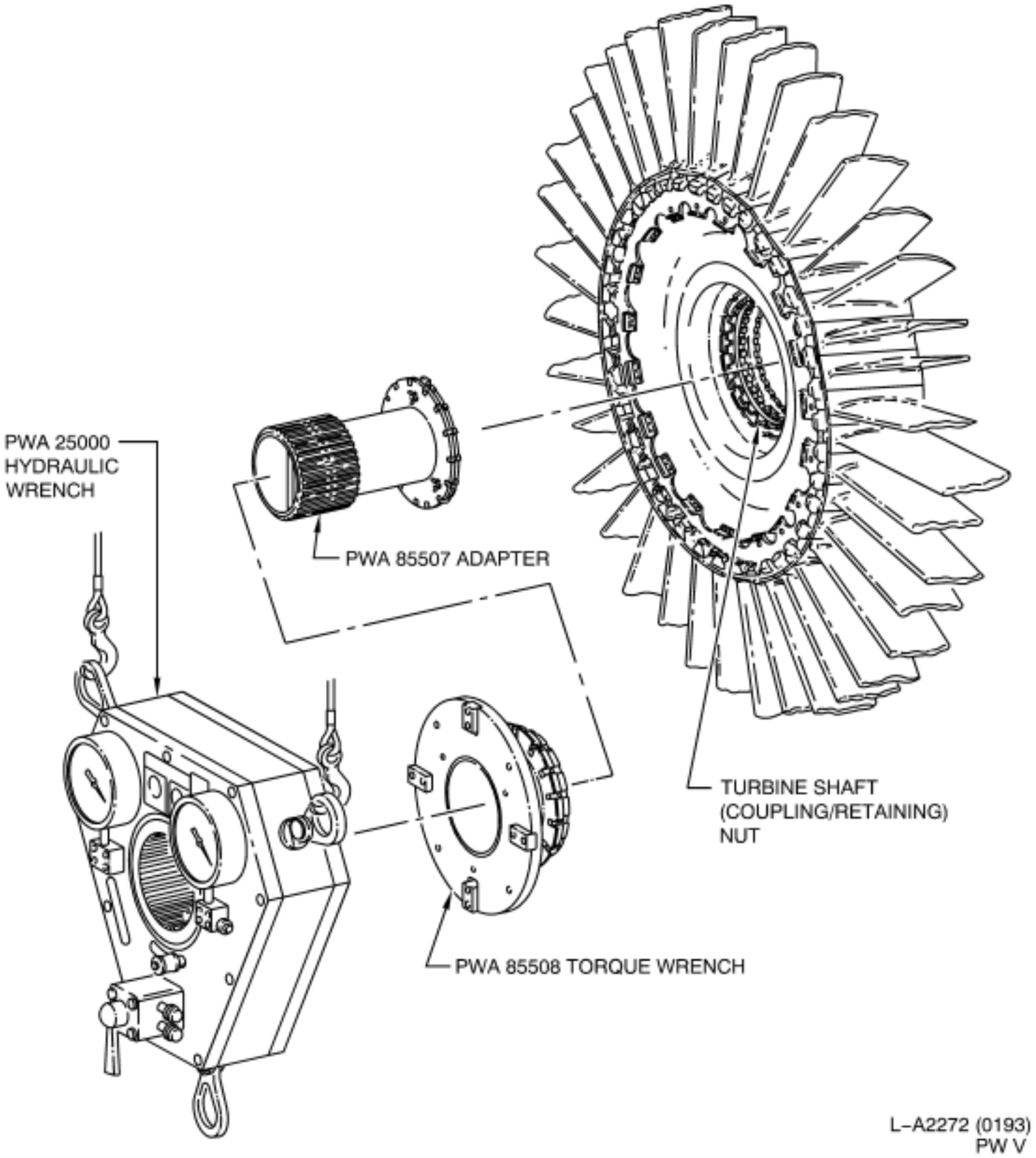
R 1. Treat Areas Shown With Paste (P06-054)

R Application Of Antiseize Paste To The Hub And The Nut
Figure 409
(Task 72-00-32-420-005)


PWA 85301 ADAPTER
PWA 29615 HOLDER
TURBINE SHAFT (COUPLING/ RETAINING) NUT
PWA 85302 TORQUE WRENCH
PWA 29614 MECHANICAL WRENCH
PWA 45419 OR PWA 80651 PNEUMATIC MULTIPLIER (PWA 45419 SHOWN)
L-A2269 (0193)
PW V

Turbine Shaft (Coupling/Retaining)
Nut Installation (Mechanical Wrench)
Figure 410
(Task 72-00-32-420-005)

R
R


PWA 25000
HYDRAULIC
WRENCH
PWA 85507 ADAPTER
TURBINE SHAFT
(COUPLING/RETAINING)
NUT
PWA 85508 TORQUE WRENCH
L-A2272 (0193)
PW V

Turbine Shaft (Coupling/Retaining)
Nut Installation (Hydraulic Wrench)
Figure 411
(Task 72-00-32-420-005)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LPC/LPT COUPLING - INSTALLATION-06

Task 72-00-32-420-005-002:

1. Install The LPT/LPC Coupling (With The Front Compressor Drive Turbine Shaft Removed) (Hydraulic Wrench) - Deleted

A. Procedure

(1) This procedure is relocated to 72-00-32, Installation-05 (Task 72-00-32-420-005).

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LPC/LPT COUPLING - INSPECTION/CHECK-01

Task 72-00-32-990-001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	I F R	Description	New Part Reference Dimensions Min		Limits Min	
			Min	Max	Min	Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131)	(−)	0.512 (13.005)	=	.005 (0.126)
0.527 (13.385)	(−)	0.508 (12.903)	=	.019 (0.482)

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets andlines may be provided.See Example 3.These enclosed limits are less restrictive and areintended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
765	B	Turbine Shaft Coupling Assembly (72−32−01) Front Compressor Hub Assembly (72−31−07) (See Figure 801, Sheet 2)				
		Coupling	12.0630 (306.401)	12.0640 (306.425)		
		Hub	12.0610 (306.350)	12.0630 (306.400)	.003T (0.076T)	.000 (0.000)
766	B	Turbine Shaft Coupling Assembly (72−32−01) Front Compressor Hub Assembly (72−31−07) (See Figure 801, Sheet 1)				
		Coupling	11.1253 (282.583)	11.1263 (282.608)		
		Hub	11.1195 (282.436)	11.1205 (282.460)	.0068T (0.172T)	.0048T (0.122T)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
767	B	Turbine Shaft (Coupling Retaining) Nut (72−32−80)				
		Front Compressor Hub Assembly (72−31−07)				
		(See Figure 801, Sheet 2)				
		Nut	12.057 (306.248)	12.060 (306.324)		
		Hub	12.061 (306.350)	12.063 (306.400)	.001 (0.025)	.006 (0.152)
768	B	Turbine Shaft (LPT To Coupling) Nut (72−32−84)				
		Turbine Shaft Coupling Assembly (72−32−01)				
		(See Figure 801, Sheet 1)				
		Nut	4.438 (112.726)	4.440 (112.776)		
		Coupling	4.443 (112.853)	4.445 (112.903)	.003 (0.077)	.007 (0.177)
769	B	Front Compressor Drive Turbine (LPT) Shaft (72−53−80)				
		Turbine Shaft Coupling Assembly (72−32−01)				
		(See Figure 801, Sheet 1)				
		Shaft	5.2995 (134.608)	5.3005 (134.632)		
		Coupling	5.2975 (134.557)	5.2985 (134.581)	.003T (0.076T)	.001T (0.025T)
771	B	Front Compressor Drive Turbine (LPT) Shaft (72−53−80)				
		Turbine Shaft Coupling Assembly (72−32−01)				
		(See Figure 801, Sheet 2)				
		Shaft	5.6995 (144.768)	5.7005 (144.792)		
		Coupling	5.6975 (144.717)	5.6985 (144.741)	.003T (0.076T)	.001T (0.026T)
772	A	Turbine Shaft Coupling Assembly (72−32−01)				
		No. 1.5 Roller Bearing (Inner Race) (72−32−02)				
		(See Figure 801, Sheet 2)				
		Shaft	6.5593 (166.607)	6.5603 (166.631)		
		Bearing	6.5585 (166.5859)	6.5591 (166.6011)	.0018T (0.045T)	.0002T (0.006T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
773	B	Turbine Shaft Coupling Assembly (72-32-01) No. 1.5 Bearing Seal Seat (72-32-03) (See Figure 801, Sheet 2)				
		Coupling	6.545 (166.243)	6.546 (166.268)		
		Seat	6.547 (166.294)	6.549 (166.344)	.001 (0.026)	.004 (0.101)
774	A	No. 1.5 Roller Bearing (Outer Race) (72-32-02) No. 1.5 Bearing Support Assembly (72-34-20) (See Figure 801, Sheet 2)				
		Bearing	10.4695 (265.9253)	10.4702 (265.9430)		
		Support	10.4671 (265.865)	10.4684 (265.897)	.0031T (0.078T)	.0011T (0.028T)
775	C	Gap, Turbine Shaft Coupling Assembly N1 Speed Sense (See Figure 801, Sheet 2)				
		Coupling	7.693 (195.40)	7.706 (195.73)		
		Gap			.020 (0.51)	.050 (1.27)

G. Spline Data

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
950	B	1. Front Compressor Hub Assembly (72-31-07) Internal Spline (See Figure 801, Sheet 2)				
		A. Effective Space Width	.0982 (2.494)	---		
		B. Actual Space Width	---	.1023 (2.598)		
		2. Turbine Shaft Coupling Assembly (72-31-01) External Spline				

ENGINE GENERAL − LPC/LPT COUPLING − INSPECTION/CHECK−01

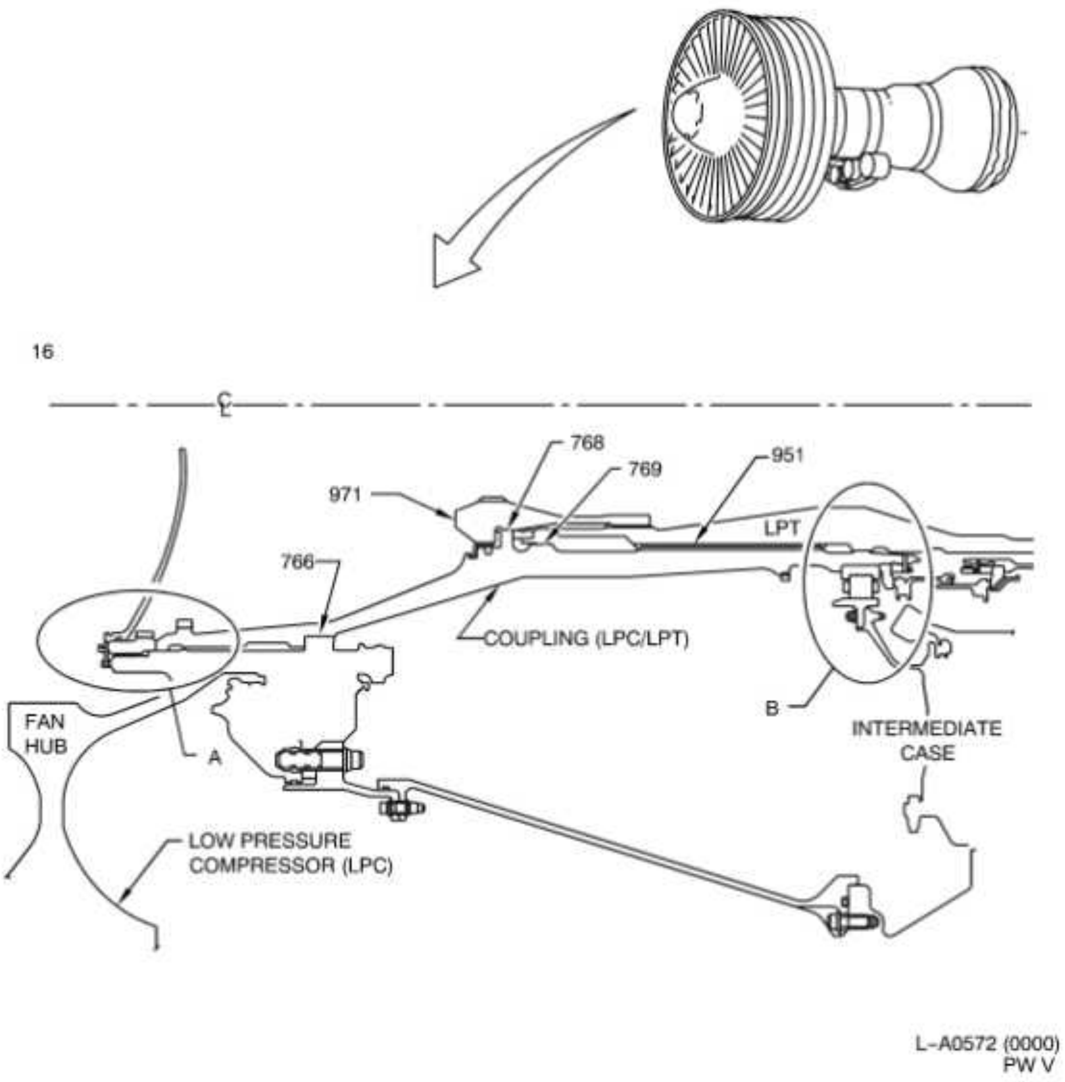
	I		New Part Reference Dimensions		Limits	
Ref. No.	F R	Description	Min	Max	Min	Max
(CONTINUED)						
		(See Figure 801, Sheet 2)				
		A. Effective Tooth Thickness	---	.0967 (2.456)		
		B. Actual Tooth Thickness	.0926 (2.352)	---		
		3. Fit			.0015 (0.038)	---
951	B	1. Turbine Shaft Coupling Assembly (72−32−01) Internal Spline (Straight, Uncrowned, Portion Of Spline) (See Figure 801, Sheet 1)				
		A. Effective Space Width	.1309 (3.325)	---		
		B. Actual Space Width	---	.1341 (3.406		
		2. Front Compressor Drive Turbine (LPT) Shaft (72−53−80) External Spline (See Figure 801, Sheet 1)				
		A. Effective Tooth Thickness	---	.1294 (3.287)		
		B. Actual Tooth Thickness	.1262 (3.205)	---		
		3. Fit			.0015 (0.038)	---

H. Special Torques

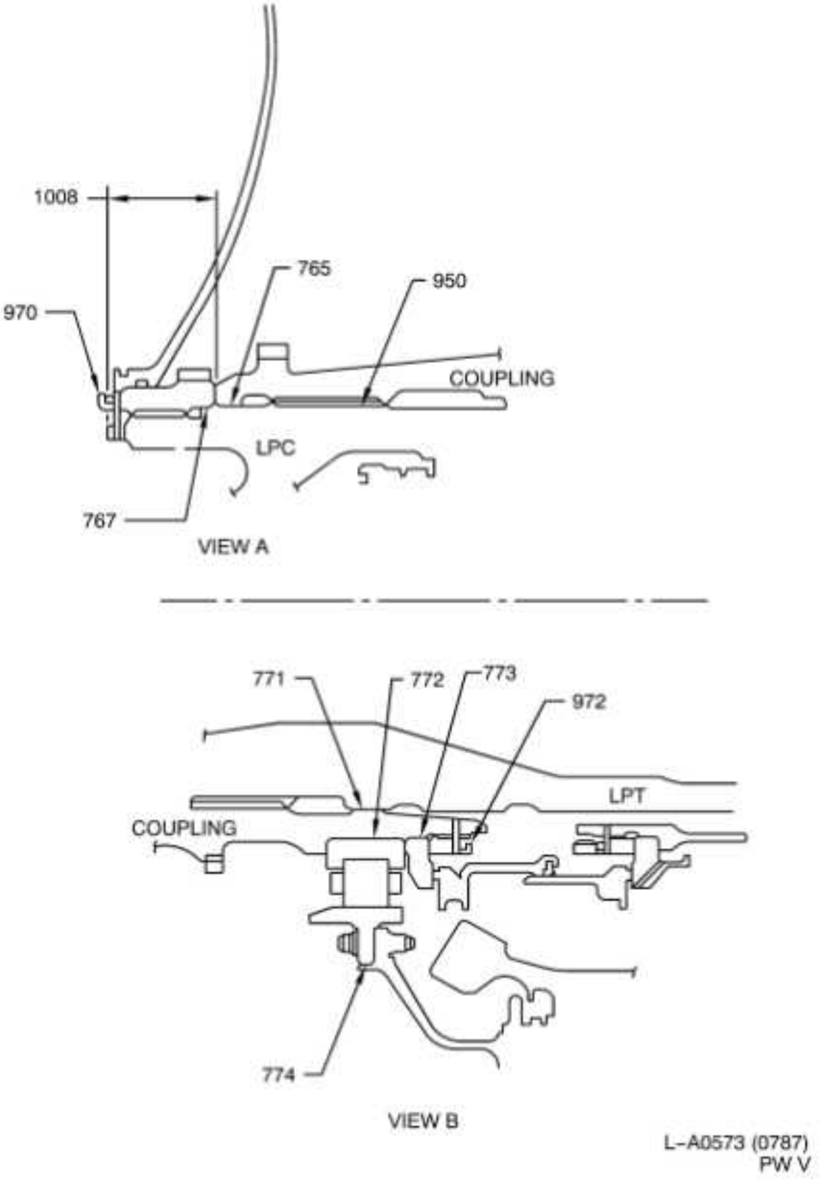
Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
970	A	Turbine Shaft Coupling Retaining Nut Torque (See Figure 801, Sheet 2) See 72−00−32, Installation−01 (Task 72−00−32−420−001)				
971	A	Turbine Shaft (LPT To Coupling) Nut (See Figure 801, Sheet 1) See 72−00−32, Installation−01 (Task 72−00−32−420−001)				
972	A	No. 1.5 Bearing (Inner Race) Retaining Nut (See Figure 801, Sheet 2) See 72−00−32, Installation−03 (Task 72−00−32−430−001) See 72−32−00, Assembly−01 (Task 72−32−00−400−001−001)				
981	A	N1 Transducer Bracket Assembly Bolts (2) (See Figure 802) See 72−00−32, Installation−01 (Task 72−00−32−420−001) See 72−00−32, Installation−03 (Task 72−00−32−430−001)				

I. Special Assembly Procedures

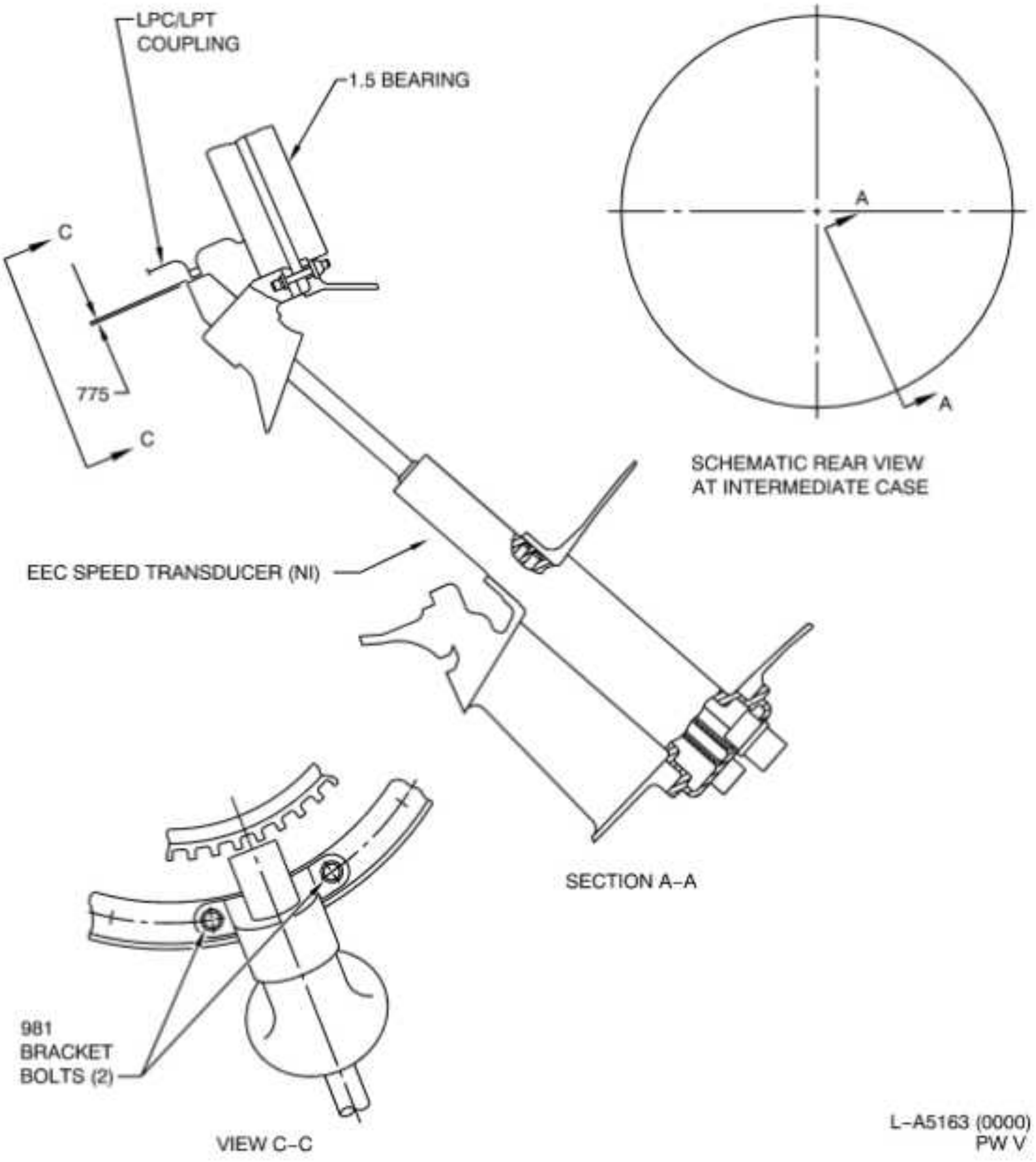
Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1008	A	Procedure For Insuring Bottoming Of Coupling Shaft In Fan Hub (See Figure 801, Sheet 2) See 72−00−32, Installation−01 (Task 72−00−32−420−001)				


16
℄
768
769
951
971
LPT
766
COUPLING (LPC/LPT)
FAN HUB
A
B
INTERMEDIATE CASE
LOW PRESSURE COMPRESSOR (LPC)
L-A0572 (0000)
PW V

LPC/LPT Coupling
Figure 801 (Sheet 1)
(Task 72−00−32−990−001)


1008
765
950
970
COUPLING
LPC
767
VIEW A
771
772
773
972
LPT
COUPLING
774
VIEW B
L−A0573 (0787)
PW V

LPC/LPT Coupling
Figure 801 (Sheet 2)
(Task 72−00−32−990−001)


LPC/LPT COUPLING
1.5 BEARING
C
775
C
A
A
SCHEMATIC REAR VIEW AT INTERMEDIATE CASE
EEC SPEED TRANSDUCER (NI)
SECTION A–A
981 BRACKET BOLTS (2)
VIEW C–C
L–A5163 (0000)
PW V

LPC/LPT Coupling
Figure 802
(Task 72−00−32−990−001)

Task 72-00-32-790-001:

1. Do A Vacuum Check Of The No. 1, 1.5, And 2 Bearing Compartments

A. Equipment And Materials Required

Standard Tools:
Rubber Plugs

Special Tools:
CTE 6075 Vacuum Cart
PWA 85474 Cover
PWA 85475 Plug (Optional to PWA 101110)
PWA 85481 Adapter (Optional to PWA 86315)
PWA 85497 Cover
PWA 85768 Puller
PWA 86315 Adapter
PWA 101110 Plug

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
R P06-054	Paste, Anti-Seize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72-61-00 /8/160
Packing	1	72-62-00/6/30

B. Procedure

(1) Attach PWA 85481 Adapter to the rear of the angle gearbox with the detail washers and screws. See Figure 1301. If the gearbox driveshaft (front) housing assembly is attached to the angle gearbox, you must first disconnect it. See Figure 1302.

(a) Remove the lockwire and bolts that attach the brackets on the gearbox-driveshaft-(front)-housing (called front housing) to the HPC.

CAUTION: DO NOT USE A TOOL SUCH AS A SCREWDRIVER TO MOVE THE FRONT HOUSING AWAY FROM THE ANGLE GEARBOX. SUCH TOOLS CAN DAMAGE THE PARTS.

(b) Remove the bolts, nuts, and washers that attach the front housing and brackets to the angle gearbox.

(c) Carefully pull the front housing to the rear.

(d) Remove the retaining ring from the angle gearbox.

(e) Carefully pull the gearbox driveshaft to the rear.

(f) Discard the packing at the front of the front housing.

(2) If installation of the N1 bearing transducer is necessary but the transducer is not installed, install PWA 85474 Cover . See Figure 1301.

(a) Locate the three hole pad on the ID of the intermediate case at 4:30 o'clock.

(b) Attach the cover with bolts.

(c) Tighten the bolts by hand.

(3) If the N1 speed sensor is not installed, install PWA 101110 or PWA 85475 Plug. See Figure 1301.

(a) Locate the N1 speed sensor port at 4:30 o'clock.

(b) Lubricate two packings with White Petrolatum P06-002. Install the packings on the plug.

(c) Install the plug. The shoulder of the plug must touch the chamfer of the hole in the inner strut wall.

(4) Seal the oil pressure line.

(a) If the oil pressure tube is not connected to the intermediate case, install PWA 85497 Cover in the pressure tube pad of the intermediate case (at 9 o'clock). See Figure 1301.

(b) Attach the cover with detail screws.

(c) If the oil pressure tube is connected, break the oil pressure line where shown in the referenced figure. Install a standard rubber plug. See Figure 1303.

(5) Install a rubber plug.

(a) In the oil breather line at 11:30 o'clock. See Figure 1304.

(b) In the oil scavenge line at 7:30 o'clock. See Figure 1305.

(6) Attach the hoses of CTE 6075 Vacuum Cart to the fitting on the adapter.

(a) Set the vacuum cart pressure at PAMB minus 10 psi (69 kPa), or PAMB minus 20 inches (508 mm) HG. At sea level this is 5.0 psia (34.5 kPa absolute).

(b) (Pre SB PW4ENG 72-245) Airflow must not be greater than 32 lbs. (14.51 kg) per hour.

(c) (Post SB PW4ENG 72-245) Airflow must not be greater than 8 lbs. (3.63 kg) per hour.

(7) Disconnect the cart from the adapter. Remove the tools.

(8) Remove the rubber plug from the breather line at 11:30 o'clock. Connect the breather line. See Figure 1304.

R R (a) Apply Anti-Seize Paste P06-054 to the upper tube coupling threads. Remove the unwanted paste.

(b) Tighten and torque the tube nut to 1150 - 1300 lb-in. (129.933 - 146.880 N.m).

(c) Install lockwire.

(9) Remove the rubber plug from the scavenge line at 7:30 o'clock. Connect the scavenge line. See Figure 1305.

(a) Apply Engine Oil P03-001 to the coupling threads of the mating tubes.

(b) Tighten and torque the tube nut to 1300 - 1400 lb-in. (146.880 - 158.179 N.m).

(c) Install lockwire.

(10) If applicable, remove the rubber plug from the pressure line at 9:00 o'clock. Connect the pressure line. See Figure 1303.

R R (a) Apply Anti-Seize Paste P06-054 to the threads on the strainer housing. Remove the unwanted paste. Attach the tube nut of the main bearing oil pressure tube.

(b) Install and torque the clamp bolt that attaches the tube to the Flange E bracket to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Tighten and torque the tube nut to 675 - 750 lb-in. (76.265 - 84.739 N.m).

(d) Install lockwire.

(11) Connect the gearbox driveshaft and the gearbox driveshaft front housing (called front housing) to the angle gearbox. See Figure 1302.

(a) Lubricate with Engine Oil P03-001 one packing. Install the packing on the front of the front housing.

(b) Move the retaining ring to the front of the driveshaft.

(c) Carefully push the driveshaft forward to mate with the internal splines in the angle gearbox.

(d) If the splines of the gearbox driveshaft and angle gearbox are not aligned, turn the gearshaft in the main gearbox. See Figure 1306.

1 Remove the two bolts and washers that attach the cover (manual crank) to the (scavenge pump drive) bearing housing assembly. Use PWA 85768Puller to remove the cover.

2 To align the splines of the gearbox driveshaft and the angle gearbox, turn the gearshaft in the main gearbox with a wrench.

3 Mate the gearbox driveshaft with the splines in the angle gearbox.

4 Lubricate the Engine Oil P03-001 a packing.

5 Install the packing on the cover (manual crank).

6 Install the cover in the main gearbox.

R R 7 Lubricate with Anti-Seize Paste P06-054 to the two bolts. Remove the unwanted paste.

8 Install two washers and the two bolts.

9 Torque the bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(e) Install the retaining ring in the internal groove on the angle gearbox.

(f) Attach the front housing to the angle gearbox.

R R R 1 Lubricate with Anti-Seize Paste P06-054 to the threads of six nuts. Remove the unwanted paste.

2 Attach the front housing and brackets to the angle gearbox with two bolts, two washers, and two of the nuts.

3 Attach the front housing to the angle gearbox with four bolts, eight washers, and four nuts.

4 Torque the bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

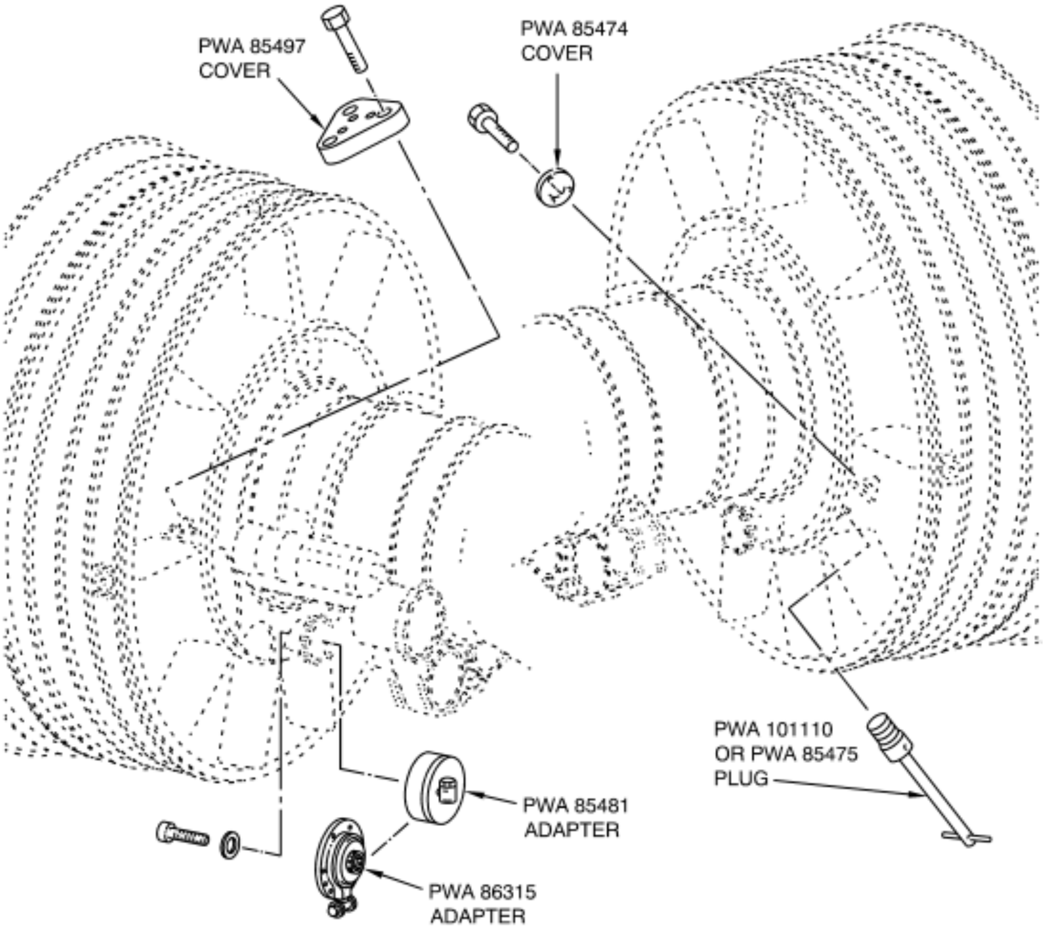
(g) Attach the front housing brackets to the HPC.

1 Lubricate with Engine Oil P03-001 the threads of four bolts.

2 Attach the brackets to the HPC with the four bolts.

3 Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

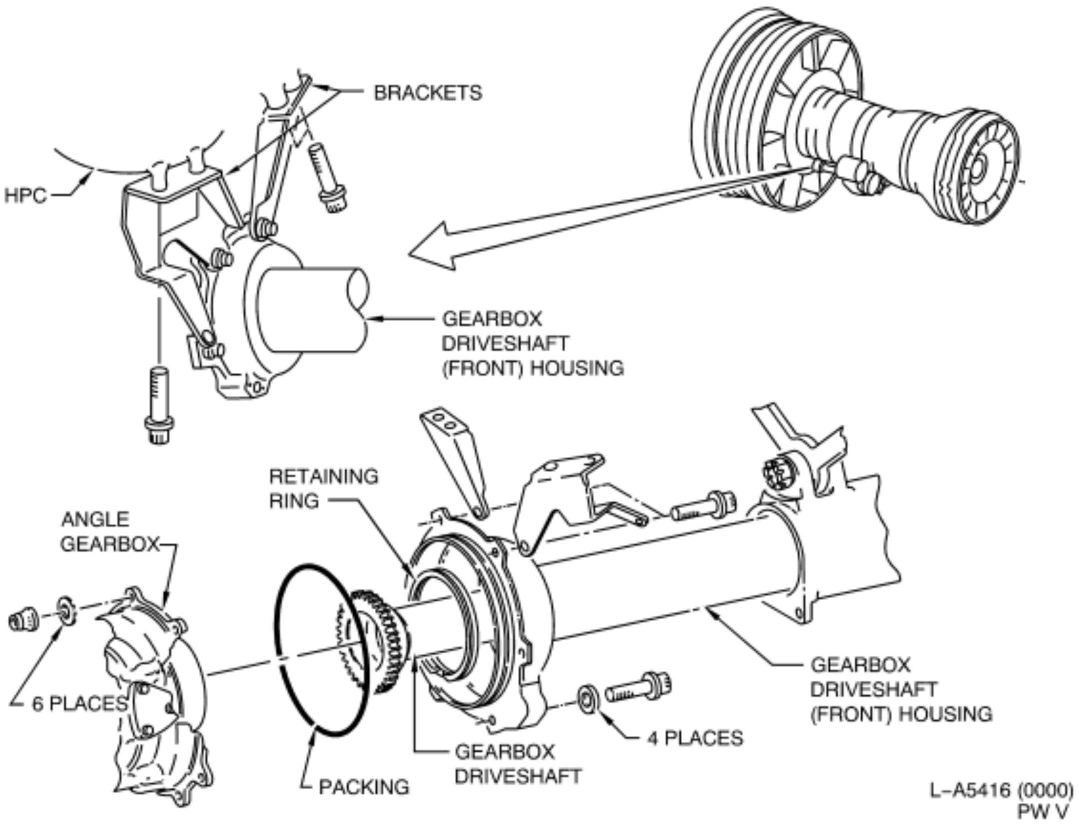
4 Install lockwire in the bolts.


PWA 85497
COVER
PWA 85474
COVER
PWA 101110
OR PWA 85475
PLUG
PWA 85481
ADAPTER
PWA 86315
ADAPTER

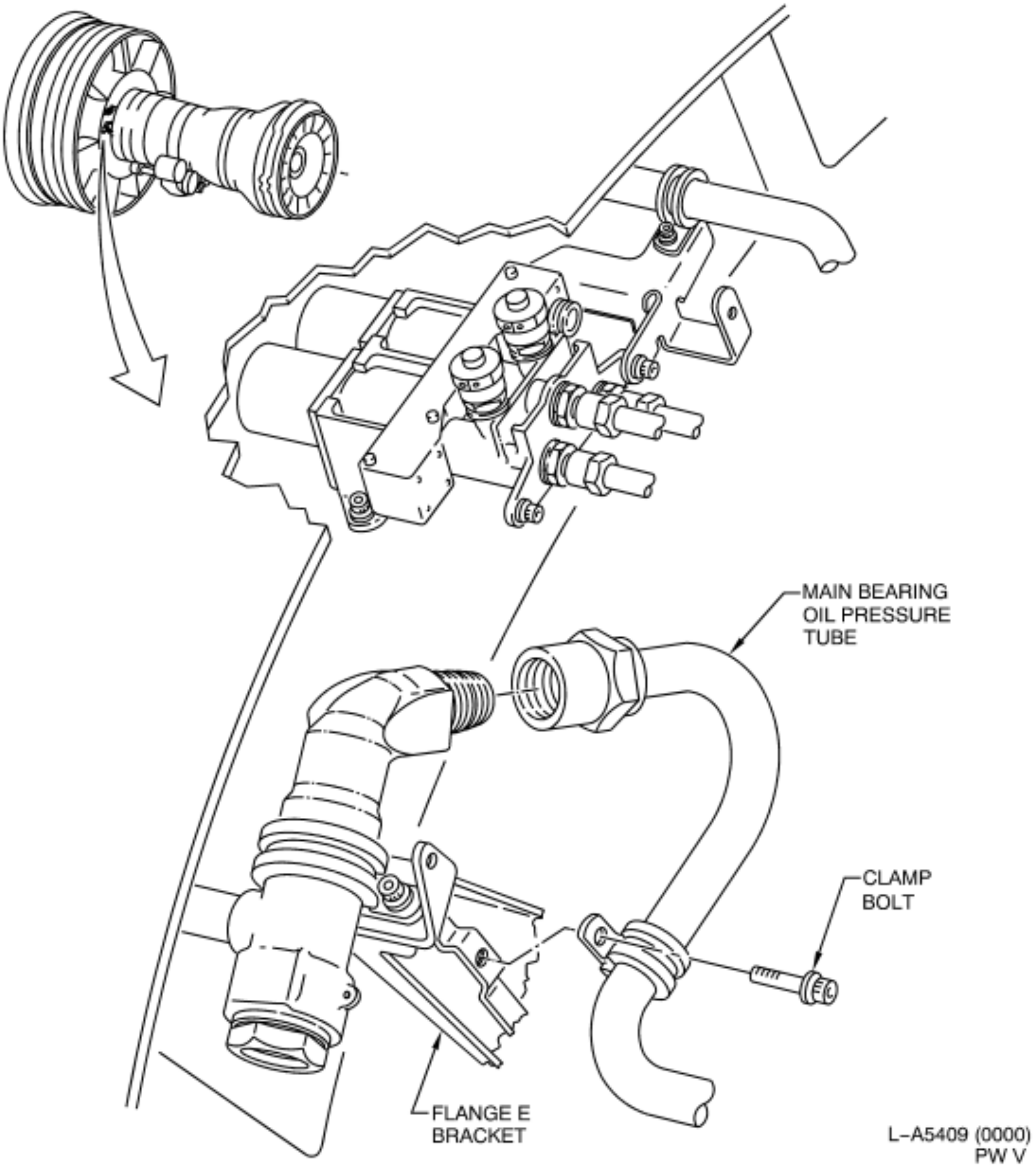
L-A5407 (0695)
PW V

Location Of The Tools
Figure 1301
(Task 72-00-32-790-001)

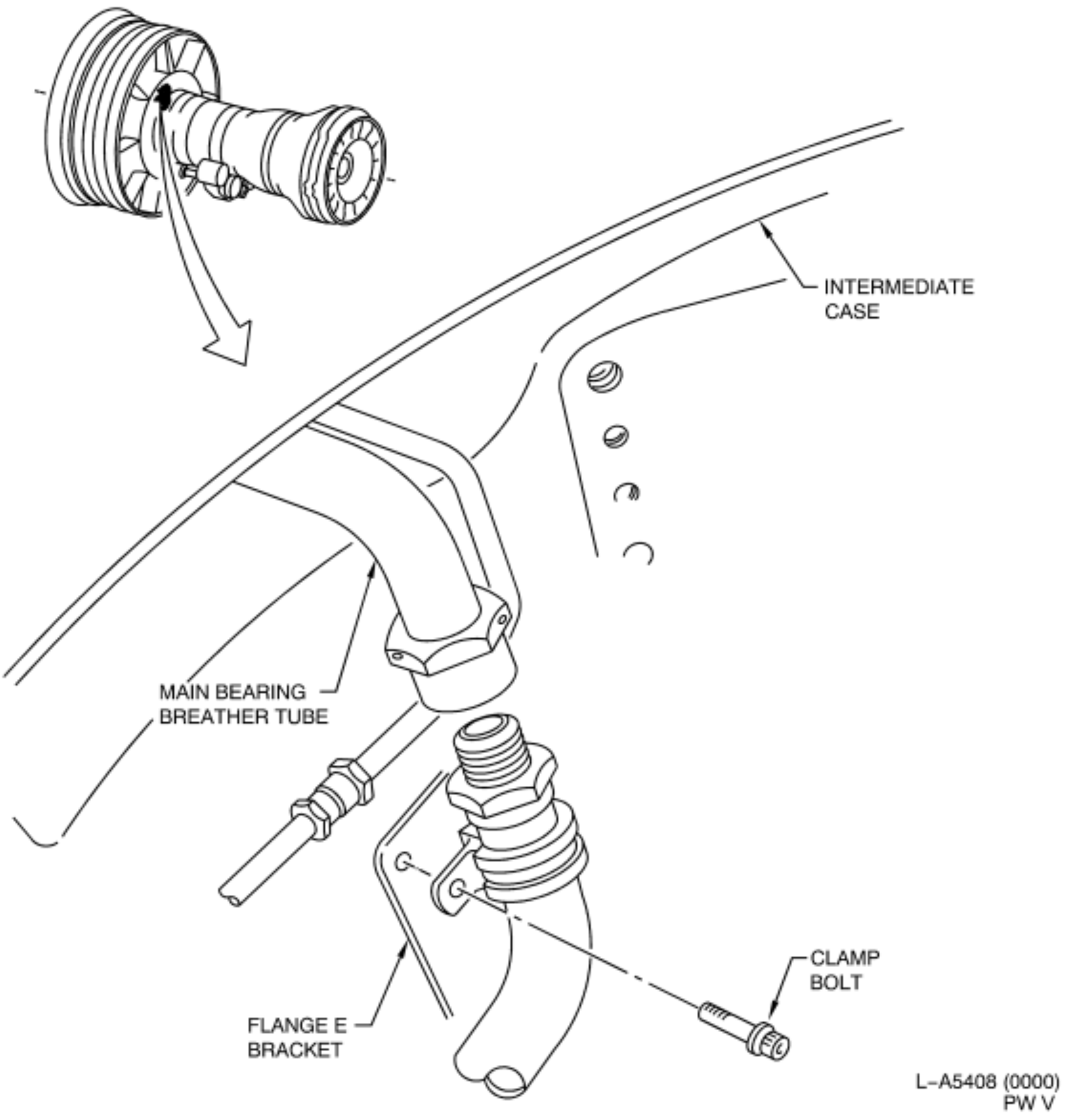
ENGINE GENERAL − LPC/LPT COUPLING − TESTING−01


BRACKETS
HPC
GEARBOX DRIVESHAFT (FRONT) HOUSING
RETAINING RING
ANGLE GEARBOX
6 PLACES
PACKING
GEARBOX DRIVESHAFT
4 PLACES
GEARBOX DRIVESHAFT (FRONT) HOUSING
L−A5416 (0000)
PW V

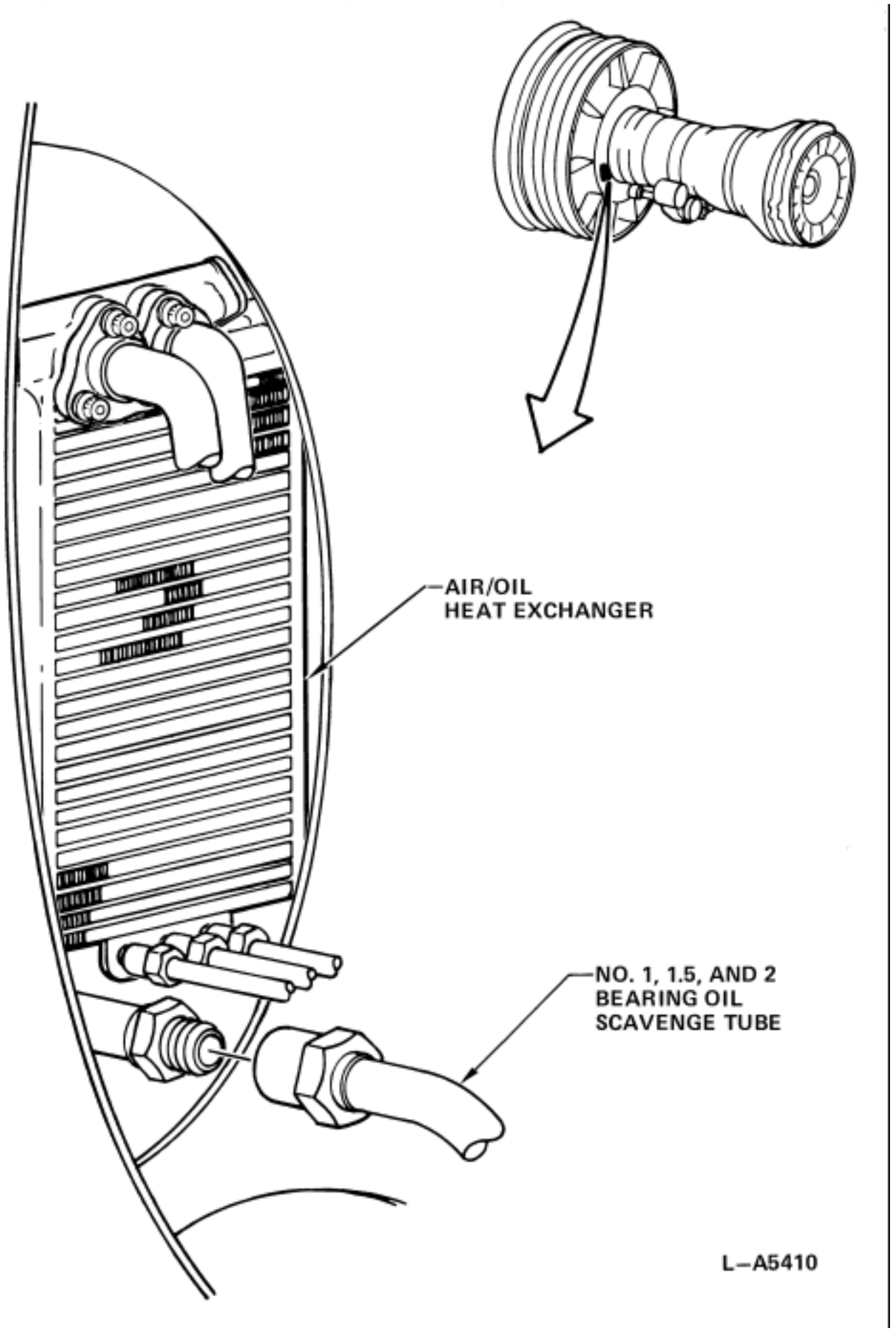
Separation Of The Front Housing From The Angle Gearbox
Figure 1302
(Task 72−00−32−790−001)


MAIN BEARING OIL PRESSURE TUBE
CLAMP BOLT
FLANGE E BRACKET
L−A5409 (0000)
PW V

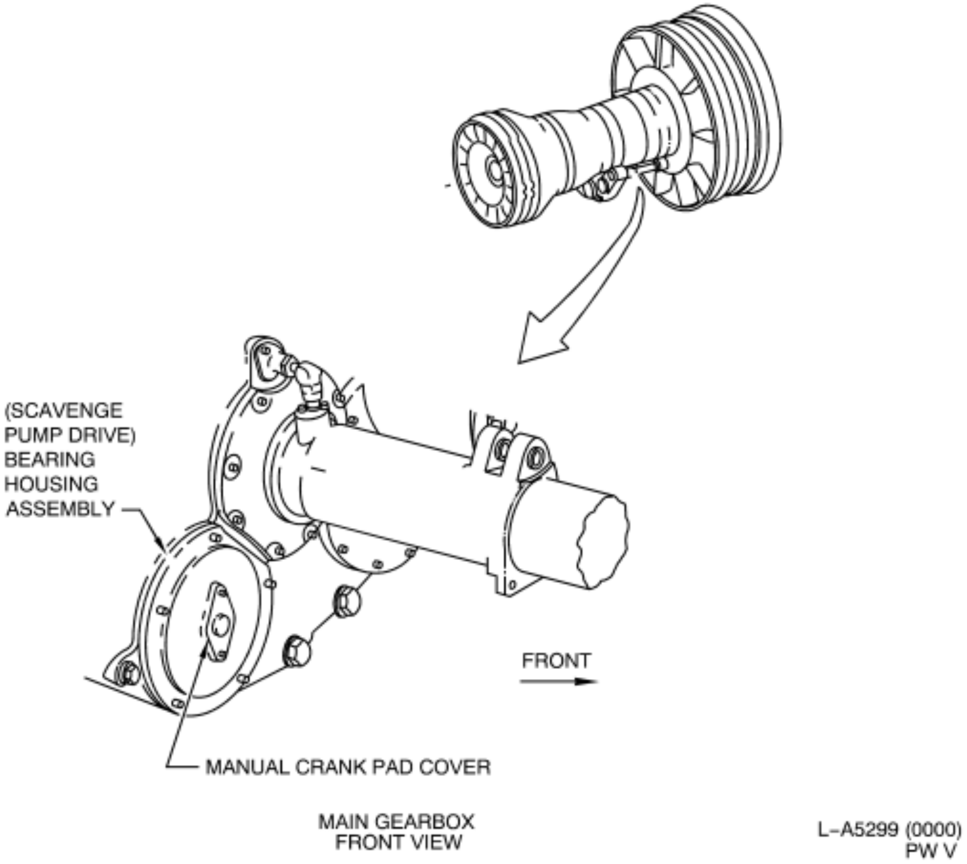
Location Of The Break In The Oil Pressure Line
Figure 1303
(Task 72−00−32−790−001)


INTERMEDIATE CASE
MAIN BEARING BREATHER TUBE
CLAMP BOLT
FLANGE E BRACKET
L−A5408 (0000)
PW V

Location Of The Break In The Oil Breather Line
Figure 1304
(Task 72−00−32−790−001)


AIR/OIL
HEAT EXCHANGER
NO. 1, 1.5, AND 2
BEARING OIL
SCAVENGE TUBE
L-A5410

Location Of The Break In The Oil Scavenge Line
Figure 1305
(Task 72-00-32-790-001)


(SCAVENGE PUMP DRIVE) BEARING HOUSING ASSEMBLY
FRONT
MANUAL CRANK PAD COVER
MAIN GEARBOX FRONT VIEW
L−A5299 (0000)
PW V

Location Of The Manual Crank Pad Cover
Figure 1306
(Task 72−00−32−790−001)

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72−00−33

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72−00−33	ENGINE GENERAL − FAN CASE − REMOVAL−10

	- 72−00−33−050−005: Remove PMUX Programming Plug
72−00−33	ENGINE GENERAL − FAN CASE − REMOVAL−11 - 72−00−33−050−006: Remove 2.5 Bleed Valve Actuator
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72−00−33	ENGINE GENERAL − FAN CASE − REMOVAL−13 - 72−00−33−050−008: Remove The Supplemental Control Unit
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72−00−33	ENGINE GENERAL − FAN CASE − REMOVAL−20 - 72−00−33−020−020: Remove The Flange C Brackets And Hardware
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72−00−33	ENGINE GENERAL − FAN CASE − INSTALLATION−02 - 72−00−33−420−003−A: Install Fan Case Plumbing For Basic Engines - 72−00−33−420−003−B: Install Fan Case Plumbing For Engines With The Airbus/McDonnell Douglas Common Parts Configuration
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	- 72−00−33−420−002−B: Install Front Fan Case For Engines With The Airbus/McDonnell Douglas Common Parts Configuration
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72−00−33	ENGINE GENERAL − FAN CASE − INSTALLATION−07 - 72−00−33−420−005: Install Bleed Valve Assembly
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72−00−33	ENGINE GENERAL − FAN CASE − INSTALLATION−13 - 72−00−33−450−008: Install The Supplemental Control Unit
72−00−33	ENGINE GENERAL − FAN CASE − INSTALLATION−14 - 72−00−33−450−009: Install The Fan Exit (Bifurcation) Fairing Assemblies (Pre SB PW4ENG 72−370) - 72−00−33−450−009−A: Install The Fan Exit (Bifurcation) Fairing Assemblies (Post SB PW4ENG 72−370)

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72−00−33	ENGINE GENERAL − FAN CASE − INSTALLATION−16 - 72−00−33−440−001: Install The Fan Exit Liner Segment Assemblies (Procedure To Use With The Installation Of A Component)
72−00−33	ENGINE GENERAL − FAN CASE − INSTALLATION−17 - 72−00−33−440−002: Install A Fan Exit Liner Seal
72−00−33	ENGINE GENERAL − FAN CASE − INSTALLATION−18 - 72−00−33−440−004: Install Fan Exit Liner Seal (Engines With Seal Installed To Inner Fan Exit Case Assembly)
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72−00−33	ENGINE GENERAL − FAN CASE − INSPECTION/CHECK−04 - 72−00−33−210−003: Examine The Sealant At The Bifurcation Fairing
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	- 72−00−33−300−001−002: Repair The Sealant Around The Bifurcation Fairing (Post SB PW4ENG 72−370)
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ENGINE GENERAL - FAN CASE - REMOVAL-01

Task 72-00-33-020-001:

1. Remove Fan Case

NOTE: See Figure 301 for Part/Assembly Removal Procedure Sequence.

A. Prerequisites

(1) Remove low pressure compressor (LPC). See 72-00-31, Removal-01 (Task 72-00-31-020-003).

(2) Remove No. 3 bearing buffer air cooler. See Removal-05 (Task 72-00-33-050-002).

(3) For engines equipped with propulsion multiplexer unit (PMUX) remove multiplexer unit. See Removal-09 Task 72-00-33-050-004.

(4) Remove the fan exit fairing (bifurcation). See Removal-14 Task 72-00-33-050-009.

(5) Remove EEC fan case wiring harnesses W1 and W2. See
R Removal-06 (Task 72-00-33-050-003-A00).

(6) Remove fan case external plumbing. See Removal-02
R (Task 72-00-33-020-003-A00).

(7) Remove the compressor bleed actuator. See Removal-11 Task 72-00-33-050-006.

(8) If intermediate case is to be removed or replaced, remove air/oil heat exchanger and valve (engine). See 72-00-34 Removal-10 Task 72-00-34-050-007.

(9) If intermediate case is to be removed or replaced, remove air/oil heat exchanger and valve (IDGS). See 72-00-34, Removal-08 Task 72-00-34-050-005.

B. Equipment And Materials Required

Standard Tools:
1/4-28 Jackscrews (4 Necessary)
No. 10 Torq-set Drive

ENGINE GENERAL - FAN CASE - REMOVAL-01

Special Tools:

PWA 76154	Adapter (2 Necessary)
PWA 76155	Sling
PWA 85450	Stand, Storage/Transport (Optional to PWA 87078)
PWA 85678	Stand, Support (3 Necessary) (Optional to PWA 87166/PWA 101960)
PWA 85698	Adapter, Lift And Trunnion (2 Necessary) (Optional to PWA 86431)
PWA 85750	Block, Support (4 Necessary) (Optional to PWA 87166/PWA 101960)
PWA 85905	Fixture, Assemble Disassemble
PWA 86431	Adapter (2 Necessary)
PWA 87078	Stand, Storage/Transport
PWA 87166	Stand, Support (3 Necessary)
PWA 101224	Dolly, Support
PWA 101960	Adapter, Support (3 or 4 Necessary)

C. Procedure

(1) Install either PWA 86431 or PWA 85698 Adapters to fan case at 3 and 9 o'clock positions. Using hoist attach PWA 76155 Sling with PWA 76154 Adapters to adapters and place a slight tension on sling cables. As options, the following procedures for vertical support of the fan case may be used. See Figure 302.

(a) Use three PWA 85678 or PWA 87166 Stands with three PWA 101960 Adapters to support the fan case.

(b) Use four PWA 101224 Support Dollys with four PWA 101960 or PWA 85750 Adapters to support the fan case. The fan case assembly can be moved with this support system.

CAUTION: BE VERY CAREFUL WHEN YOU MOVE THE INNER (BIFURCATION) FAIRING. IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THE FAIRING. IT IS EASY FOR THESE WASHERS TO BECOME DISCONNECTED FROM THE FAIRING.

(2) Be sure the fan exit fairing (bifurcation) at the 12 o'clock position strut is temporarily repositioned away from the fan case. See Removal-14 Task 72-00-33-050-009. See Figure 303.

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE A LINER SEGMENT. IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THE LINER. IT IS EASY FOR THESE WASHERS TO BECOME DISCONNECTED FROM THE LINER.

(3) Cut the sealant that is at the edges of the fan exit (front) liner segment assembly at 6 o'clock. Remove the liner. Use a No. 10 Torq−set drive. See Figure 304.

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE A LINER SEGMENT. IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THE LINER BRACKET. IT IS EASY FOR THESE WASHERS TO BECOME DISCONNECTED FROM THE BRACKET. ALSO, IF THE EDGE OF THE LINER SEGMENT HITS SOMETHING, IT CAN DELAMINATE.

(4) Remove all the screws/bolts that attach the fan exit (rear) liner segment assemblies. Remove the liners and spacers. Mark location of liners and spacers for assembly. See Figure 305.

NOTE: If the engine has acoustical fan exit liner segment assemblies, first remove the sealant that covers the screws, then remove the screws. To remove the sealant, use mechanical means. Be careful not to damage the engine parts.

(a) Mechanically remove the sealant that is at the trailing edges of the intermediate case struts.

(b) Remove the spacers.

NOTE: It is possible that the spacers are attached to the intermediate case with adhesive tape.

(c) Repair any loose or damaged intermediate case strut seals. Refer to Figure 306 and 72−00−34, Repair−03 Task 72−00−34−300−003.

(5) If it is there, cut and mechanically remove the optional sealant from the rear edge of the fan exit guide vane inner and outer bases.

(6) If air/oil heat exchangers and valves (IDGS and engine) are installed, remove 16 bolts and washers attaching valve inlet collars at 4 and 8 o'clock locations at 2.5 bleed support flange. See Figure 307.

(7) Remove the 4th stage compressor stator assembly (called stator assembly). See Figure 308.

  (a) Remove the 24 bolts and washers that attach the stator assembly to the intermediate case.

  (b) Assemble PWA 85905 Fixture.

    1 Put the jaw marked "Remove" on the screw.

    2 Put the jaw approximately 1.5 inch (38.100 mm) from the body.

    3 Have the same quantity of threads at both ends.

  (c) Engage the fixture in the tabs of the stator assembly and intermediate case at 11 o'clock.

  (d) While you hold the stator assembly, turn the screw to disengage the tabs of the two assemblies.

  (e) Remove the stator assembly. Discard the packings.

(8) Remove 36 bolts and washers securing 2.5 bleed support flange to intermediate case. See Figure 309.

(9) Disconnect W3P15 harness connector from 2.5 bleed valve actuator.

(10) Remove lockwire from compressor bleed actuator pressure and return tube coupling nuts. Disconnect tube coupling nuts from adapters on actuator and from tee fittings on connecting manifolds. Remove both tubes.

CAUTION: CASE ASSEMBLY SHOULD ONLY BE PLACED FRONT END DOWN (FLANGE A) TO PREVENT DAMAGE TO FAN EXIT GUIDE VANES.

(11) Remove the Flange C haredware as follows. Refer to 72-00-33, Removal-20 (Task 72-00-33-020-020).

(12) Using 1/4−28 Jackscrews at four equally spaced locations, approximately 3, 6, 9, and 12 o'clock, remove fan case from engine and install in either PWA 87078 or PWA 85450 Stand. Remove hoist, sling and adapters from fan case adapters.

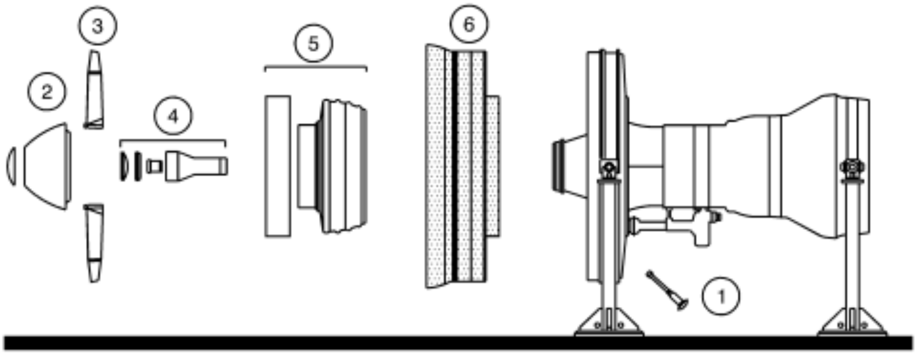
NOTE: Removal of fan case requires lowering and pulling radially inward from the actuator pad to allow fan case removal from intermediate case.

NOTE: Case assembly may be placed front end down (Flange A) on pallet, on three PWA 85678 Stands, on four PWA 85750 Blocks or on three PWA 87166 Stands with PWA 101960 Adapter.

(13) If air/oil heat exchangers and valves (IDGS and engine) are installed, remove four packings from four inlet sleeves (collars). Discard packings.

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE THE INNER (BIFURCATION) FAIRING. IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THE FAIRING. IT IS EASY FOR THESE WASHERS TO BECOME DISCONNECTED FROM THE FAIRING.

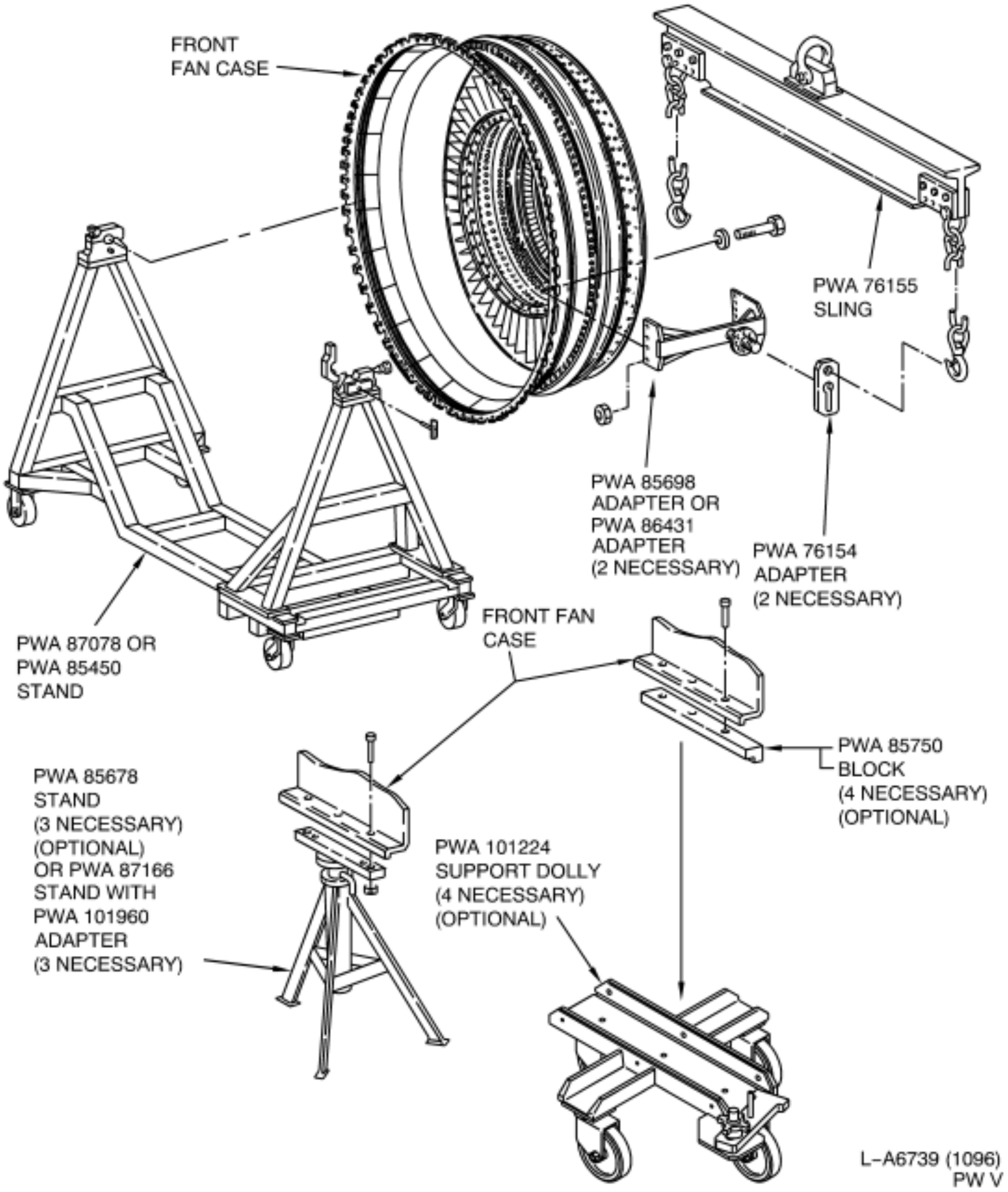
(14) Remove the loose (bifurcation) fairings from the strut at 12 o'clock position.



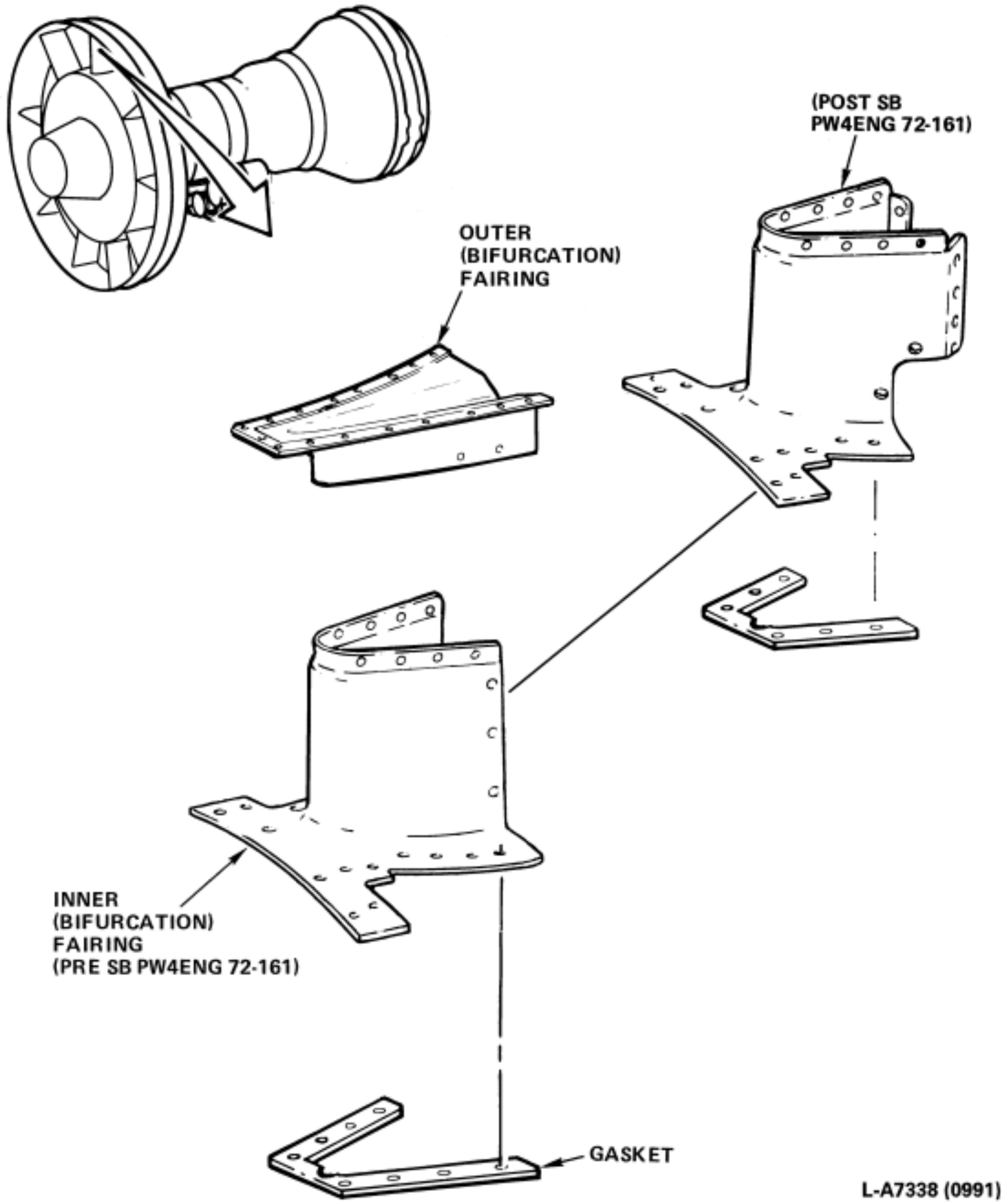
1. REMOVE ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
2. REMOVE COMPRESSOR INLET CONE.
3. REMOVE STAGE 1 LPC BLADE ASSEMBLIES.
4. REMOVE LPC/LPT COUPLING.
5. REMOVE LOW PRESSURE COMPRESSOR (LPC).
6. REMOVE FAN CASE.

L−A0060 (0000)
PW V

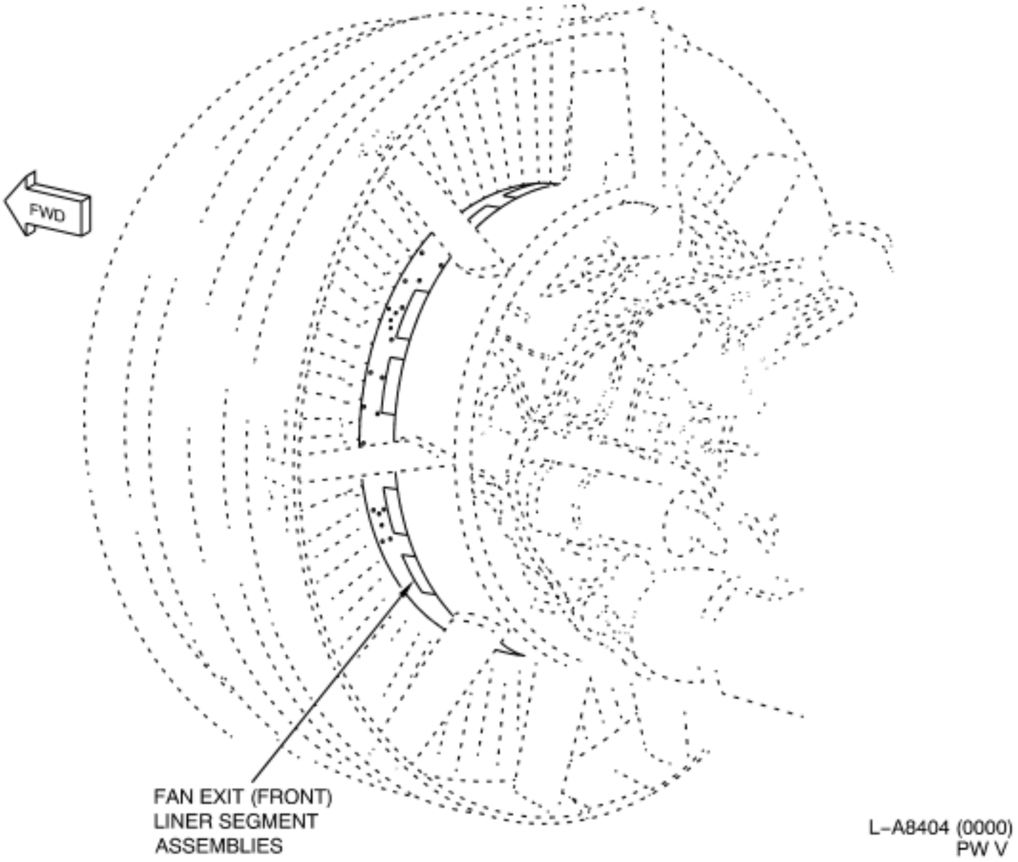
Procedure Sequence
Figure 301
(Task 72−00−33−020−001)


FRONT FAN CASE
PWA 76155 SLING
PWA 85698 ADAPTER OR PWA 86431 ADAPTER (2 NECESSARY)
PWA 76154 ADAPTER (2 NECESSARY)
FRONT FAN CASE
PWA 87078 OR PWA 85450 STAND
PWA 85750 BLOCK (4 NECESSARY) (OPTIONAL)
PWA 85678 STAND (3 NECESSARY) (OPTIONAL) OR PWA 87166 STAND WITH PWA 101960 ADAPTER (3 NECESSARY)
PWA 101224 SUPPORT DOLLY (4 NECESSARY) (OPTIONAL)
L−A6739 (1096)
PW V

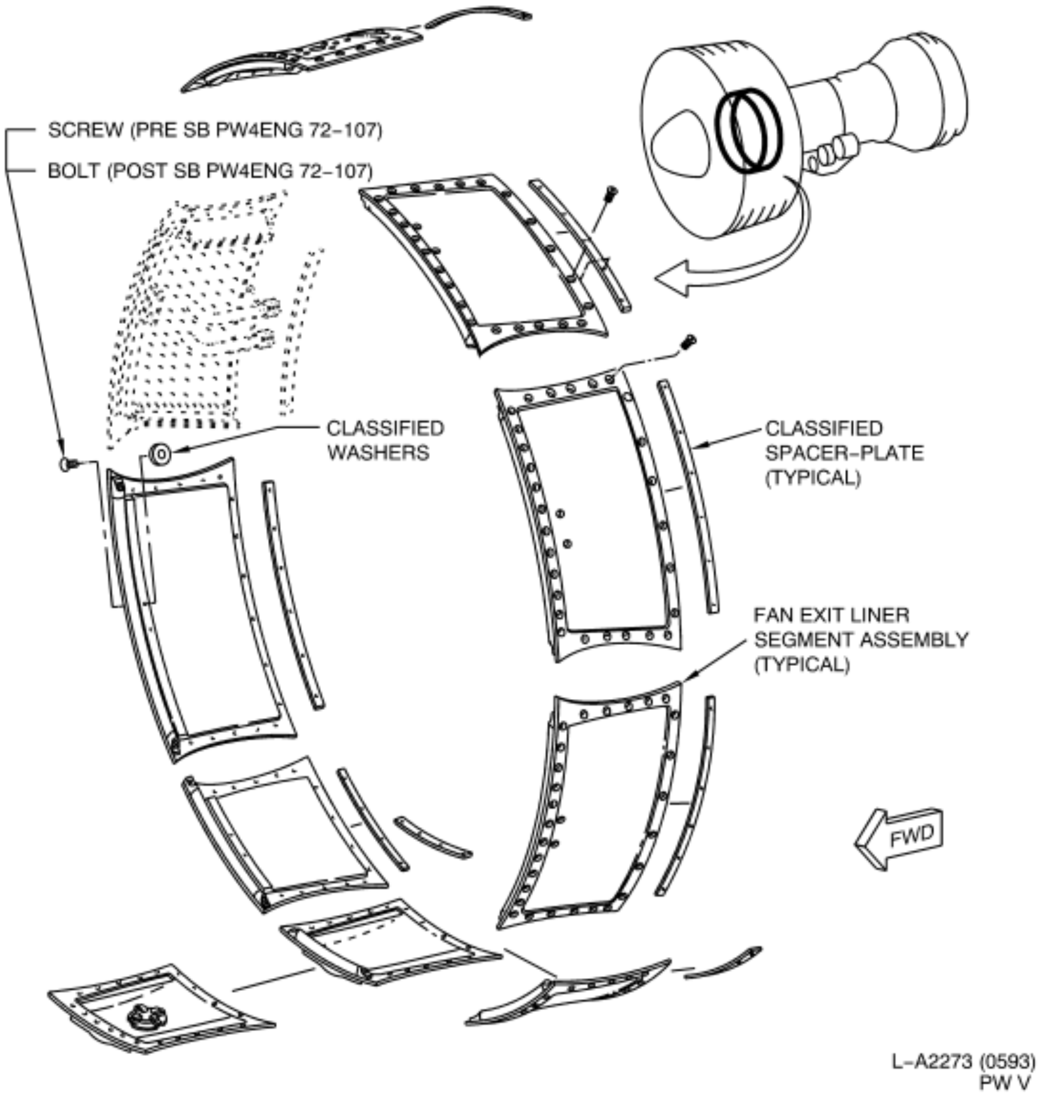
Removal Of The Fan Case
Figure 302
(Task 72−00−33−020−001)


(POST SB
PW4ENG 72-161)
OUTER
(BIFURCATION)
FAIRING
INNER
(BIFURCATION)
FAIRING
(PRE SB PW4ENG 72-161)
GASKET
L-A7338 (0991)

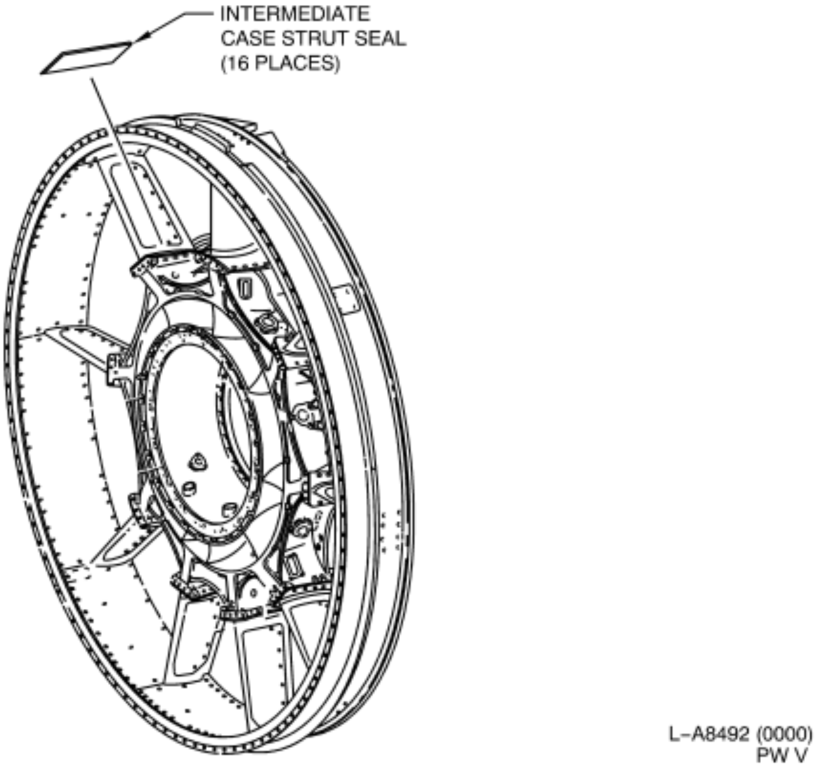
Removal Of The Fan Exit (Bifurcation) Fairing Assemblies
Figure 303
(Task 72-00-33-020-001)


FWD
FAN EXIT (FRONT) LINER SEGMENT ASSEMBLIES
L−A8404 (0000)
PW V

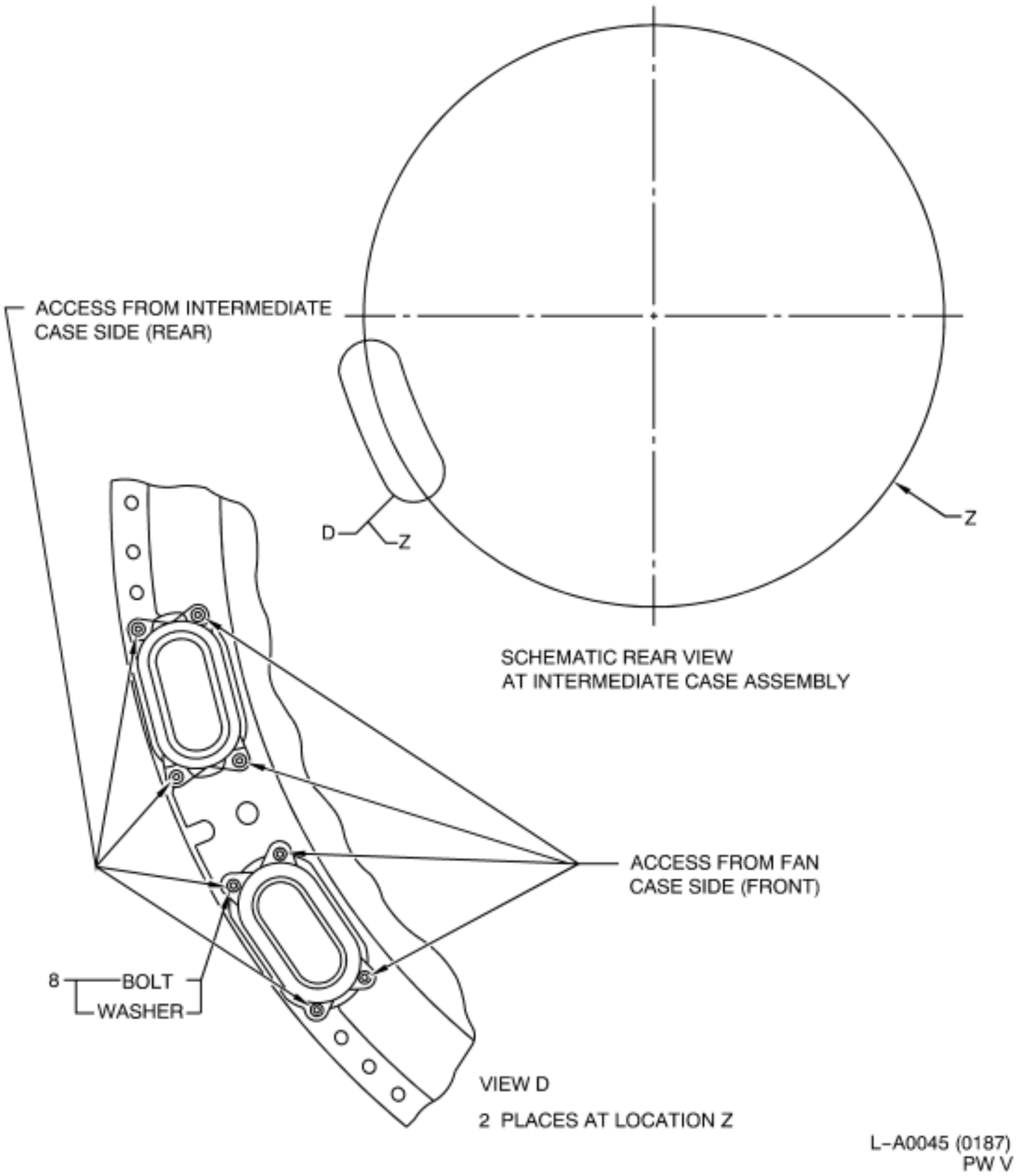
The Fan Exit (Front) Liner Segment Assembly
Figure 304
(Task 72−00−33−020−001)


SCREW (PRE SB PW4ENG 72-107)
BOLT (POST SB PW4ENG 72-107)
CLASSIFIED WASHERS
CLASSIFIED SPACER-PLATE (TYPICAL)
FAN EXIT LINER SEGMENT ASSEMBLY (TYPICAL)
FWD
L-A2273 (0593)
PW V

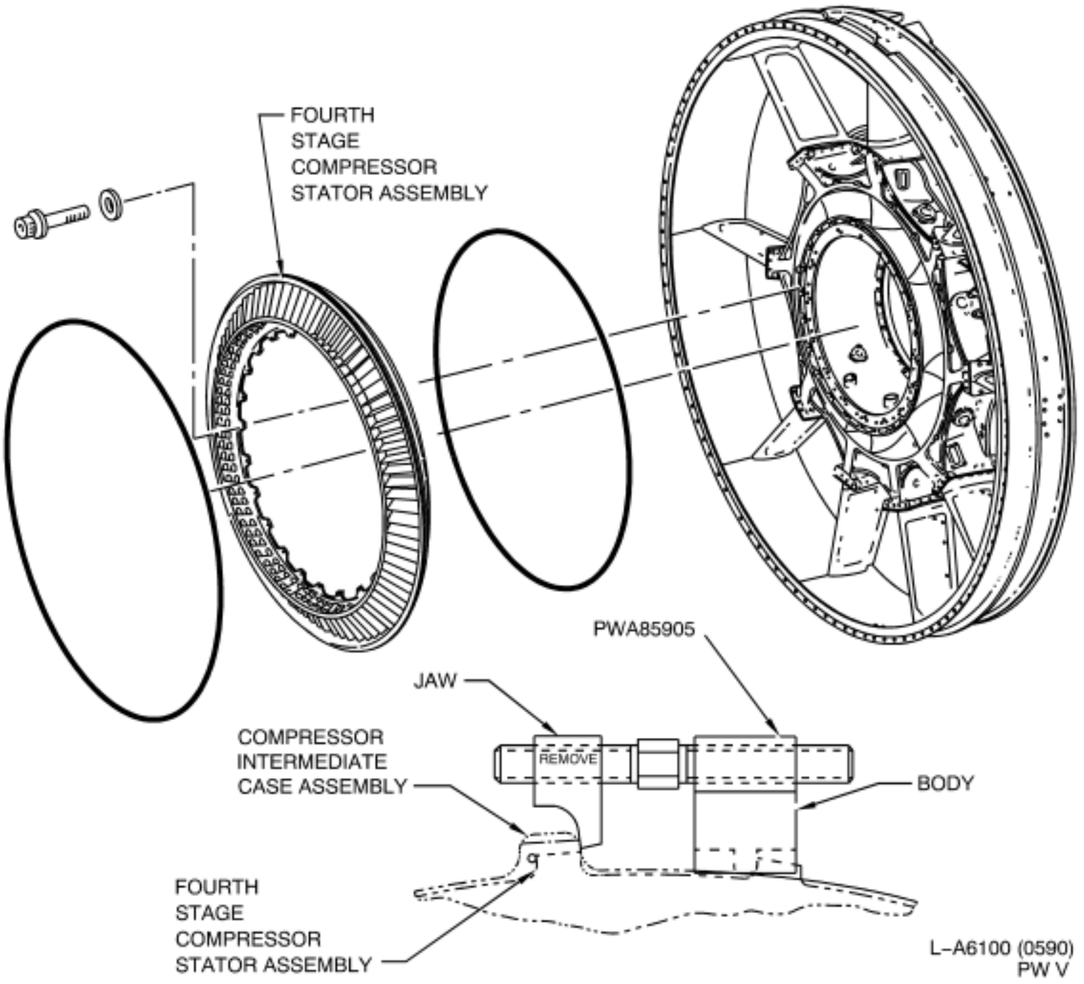
Removal Of The Fan Exit (Rear) Liner Segment Assemblies
Figure 305
(Task 72-00-33-020-001)


INTERMEDIATE CASE STRUT SEAL (16 PLACES)
L−A8492 (0000)
PW V

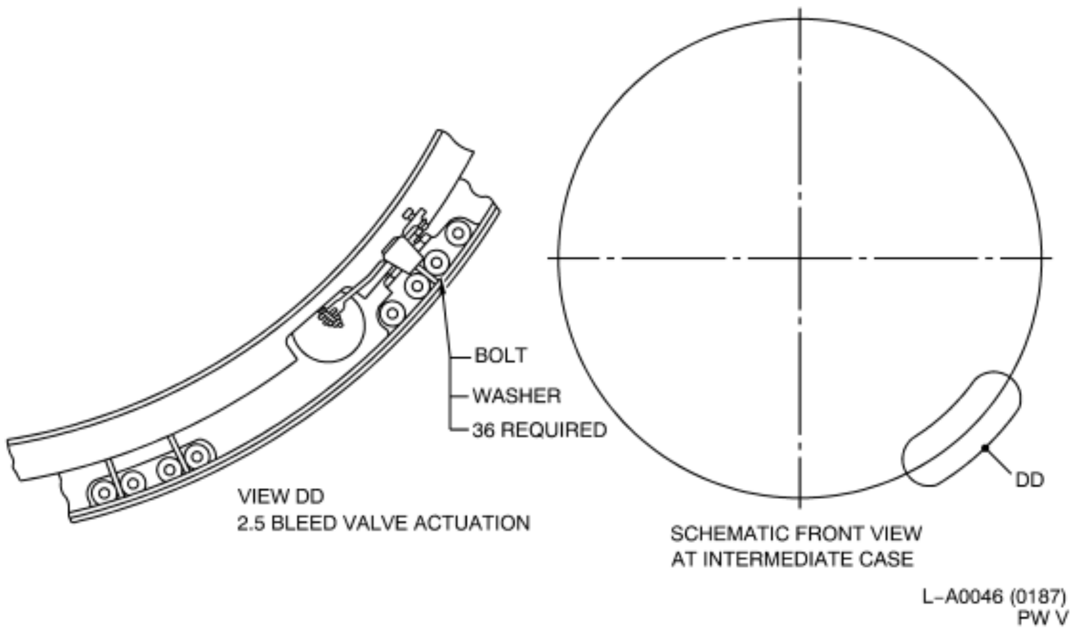
Position Of The Intermediate Case Strut Seal
Figure 306
(Task 72−00−33−020−001)


ACCESS FROM INTERMEDIATE
CASE SIDE (REAR)
D
Z
Z
SCHEMATIC REAR VIEW
AT INTERMEDIATE CASE ASSEMBLY
ACCESS FROM FAN
CASE SIDE (FRONT)
8
BOLT
WASHER
VIEW D
2 PLACES AT LOCATION Z
L−A0045 (0187)
PW V

Fan Case Removal
Figure 307
(Task 72−00−33−020−001)


FOURTH STAGE COMPRESSOR STATOR ASSEMBLY
PWA85905
JAW
REMOVE
COMPRESSOR INTERMEDIATE CASE ASSEMBLY
BODY
FOURTH STAGE COMPRESSOR STATOR ASSEMBLY
L−A6100 (0590)
PW V

Remove The 4th Stage Compressor Stator Assembly
Figure 308
(Task 72−00−33−020−001)


BOLT
WASHER
36 REQUIRED
VIEW DD
2.5 BLEED VALVE ACTUATION
DD
SCHEMATIC FRONT VIEW
AT INTERMEDIATE CASE
L-A0046 (0187)
PW V

Fan Case Removal
Figure 309
(Task 72-00-33-020-001)

ENGINE GENERAL - FAN CASE - REMOVAL-01

Task 72-00-33-020-006:

1. Remove Fan Case

NOTE: See Figure 301 for part/assembly removal procedure sequence.

A. Prerequisites

(1) Remove the low pressure compressor (LPC). See 72-00-31, Removal-01 Task 72-00-31-020-003.

(2) Remove the No. 3 bearing buffer air cooler. See 72-00-33, Removal-05 Task 72-00-33-050-002.

(3) For engines with the propulsion multiplexer unit (PMUX) remove the multiplexer unit. See 72-00-33, Removal-09 Task 72-00-33-050-004.

(4) Remove the fan exit fairing (bifurcation). See 72-00-33, Removal-14 Task 72-00-33-050-009.

(5) Remove the EEC fan case wiring harnesses W1 and W2.
R See 72-00-33, Removal-06 (Task 72-00-33-050-003-B00).

(6) Remove the fan case external plumbing. See 72-00-33, Removal-02 Task 72-00-33-020-003-A00.

(7) Remove the compressor bleed actuator. See 72-00-33, Removal-11 Task 72-00-33-050-006.

(8) If the intermediate case must be removed or replaced, remove air/oil heat exchanger and valve (engine). See 72-00-34, Removal-10 Task 72-00-34-050-007.

(9) If the intermediate case must be removed or replaced, remove the air/oil heat exchanger and valve (IDGS). See 72-00-34, Removal-08 Task 72-00-34-050-005.

B. Equipment And Materials Required

Standard Tools:
1/4-28 Jackscrews (4 Necessary)
No. 10 Torq-set Drive

ENGINE GENERAL - FAN CASE - REMOVAL-01

Special Tools:

PWA 76154	Adapter (2 Necessary)
PWA 76155	Sling
PWA 85450	Stand, Storage/Transport (Optional to PWA 87078)
PWA 85678	Stand, Support (3 Necessary) (Optional to PWA 87166/PWA 101960)
PWA 85698	Adapter, Lift And Trunnion (2 Necessary) (Optional to PWA 86431)
PWA 85750	Block, Support (4 Necessary) (Optional to PWA 87166/PWA 101960)
PWA 85905	Fixture, Assemble Disassemble
PWA 86431	Adapter (2 Necessary)
PWA 87078	Stand, Storage/Transport
PWA 87166	Stand, Support (3 Necessary)
PWA 101224	Dolly, Support
PWA 101960	Adapter, Support (3 or 4 Necessary)

C. Procedure

(1) Install either PWA 86431 Adapters or PWA 85698 Adapters to fan case at 3 and 9 o'clock positions. Using hoist, attach PWA 76155 Sling with PWA 76154 Adapters to adapters and place a slight tension on sling cables. As options, the following procedures for vertical support of the fan case may be used. See Figure 302.

(a) Use three PWA 85678 Stands or PWA 87166 Stands with three PWA 101960 Adapters to support the fan case.

(b) Use four PWA 101224 Support Dollys with four PWA 101960 Adapters or PWA 85750 Adapters to support the fan case. The fan case assembly can be moved with this support system.

CAUTION: BE VERY CAREFUL WHEN YOU MOVE THE INNER (BIFURCATION) FAIRING. IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THE FAIRING. IT IS EASY FOR THESE WASHERS TO BECOME DISCONNECTED FROM THE FAIRING.

(2) Make sure the fan exit fairing (bifurcation) at the 12 o'clock position strut is temporarily moved away from the fan case. See 72-00-33, Removal-14 Task 72-00-33-050-009. See Figure 303.

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE A LINER SEGMENT. IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THE LINER. IT IS EASY FOR THESE WASHERS TO BECOME DISCONNECTED FROM THE LINER.

(3) Cut the sealant that is at the edges of the fan exit (front) liner segment assembly at the 6 o'clock. Remove the liner. Use a No. 10 Torq-set drive. See Figure 304.

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE A LINER SEGMENT. IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THE LINER BRACKET. IT IS EASY FOR THESE WASHERS TO BECOME DISCONNECTED FROM THE BRACKET. ALSO, IF THE EDGE OF THE LINER SEGMENT HITS SOMETHING, IT CAN DELAMINATE.

(4) Remove all the screws/bolts that attach the fan exit (rear) liner segment assemblies. Remove the liners and spacers. Mark the location of the liners and spacers for assembly. See Figure 305.

(a) Mechanically remove the sealant that is at the trailing edges of the intermediate case struts.

(b) Cut the sealant that is at the forward edge of the liners.

(c) Remove the spacers.

NOTE: It is possible that the spacers are attached to the intermediate case with adhesive tape.

(d) Repair any loose or damaged intermediate case strut seals. Refer to Figure 306 and 72-00-34, Repair-03 Task 72-00-34-300-003.

(e) Replace a fan exit liner seal if one of the items that follows applies. For replacement, refer to 72-00-33, Removal-17 Task 72-00-33-040-002 and Installation-17 Task 72-00-33-440-002. Refer to Figure 307.

1 The seal is loose or damaged

2 It is necessary to do an inspection of the fan exit inner case assembly.

(5) If it is there, cut and mechanically remove the optional sealant from the rear edge of the fan exit guide vane inner and outer bases.

(6) If the air/oil heat exchangers and valves (IDGS and engine) are installed, remove the 16 bolts and washers that attach the valve inlet collars at the 4 and 8 o'clock positions at the 2.5 bleed support flange. See Figure 308.

(7) Remove the 4th stage compressor stator assembly (called stator assembly). See Figure 309.

(a) Remove the 24 bolts and washers that attach the stator assembly to the intermediate case.

(b) Assemble PWA 85905 Fixture.

1 Put the jaw marked "Remove" on the screw.

2 Put the jaw approximately 1.5 inch (38.100 mm) from the body.

3 Have the same quantity of threads at both ends.

(c) Engage the fixture in the tabs of the stator assembly and intermediate case at 11 o'clock.

(d) While you hold the stator assembly, turn the screw to disengage the tabs of the two assemblies.

(e) Remove the stator assembly. Discard the packings.

(8) Remove 36 bolts and washers that attach the 2.5 bleed support flange to the intermediate case. See Figure 310.

(9) Disconnect the W3P15 harness connector from the 2.5 bleed valve actuator.

(10) Remove the lockwire from the compressor bleed actuator pressure and return tube coupling nuts. Disconnect the tube coupling nuts from the adapters on the actuator and from the tee fittings on the connecting manifolds. Remove both tubes.

CAUTION: CASE ASSEMBLY SHOULD ONLY BE PLACED FRONT END DOWN (FLANGE A) TO PREVENT DAMAGE TO FAN EXIT GUIDE VANES.

(11) Remove the Flange C hardware as follows. Refer to 72-00-33, Removal-20 (Task 72-00-33-020-020).

(12) Use 1/4-28 Jackscrews at four equally spaced locations, approximately 3, 6, 9, and 12 o'clock, remove the fan case from the engine and install into the PWA 87078 Stand or PWA 85450 Stand. Remove the hoist, sling and adapters from the fan case adapters.

NOTE: It is necessary for fan case removal to lower and pull radially inward from the actuator pad to permit fan case removal from the intermediate case.

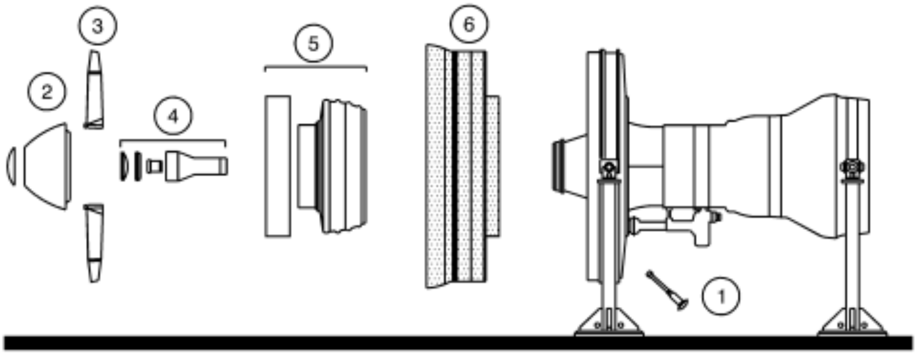
NOTE: The case assembly can be placed front end down (Flange A) on a pallet, on three PWA 85678 Stands, on four PWA 85750 Blocks or on three PWA 87166 Stands with PWA 101960 Adapters.

(13) If the air/oil heat exchangers and valves (IDGS and engine) are installed, remove the four packings from the four inlet sleeves (collars). Discard the packings.

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE THE INNER (BIFURCATION) FAIRING. IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THE FAIRING. IT IS EASY FOR THESE WASHERS TO BECOME DISCONNECTED FROM THE FAIRING.

(14) Remove the loose (bifurcation) fairings from the strut at the 12 o'clock position.

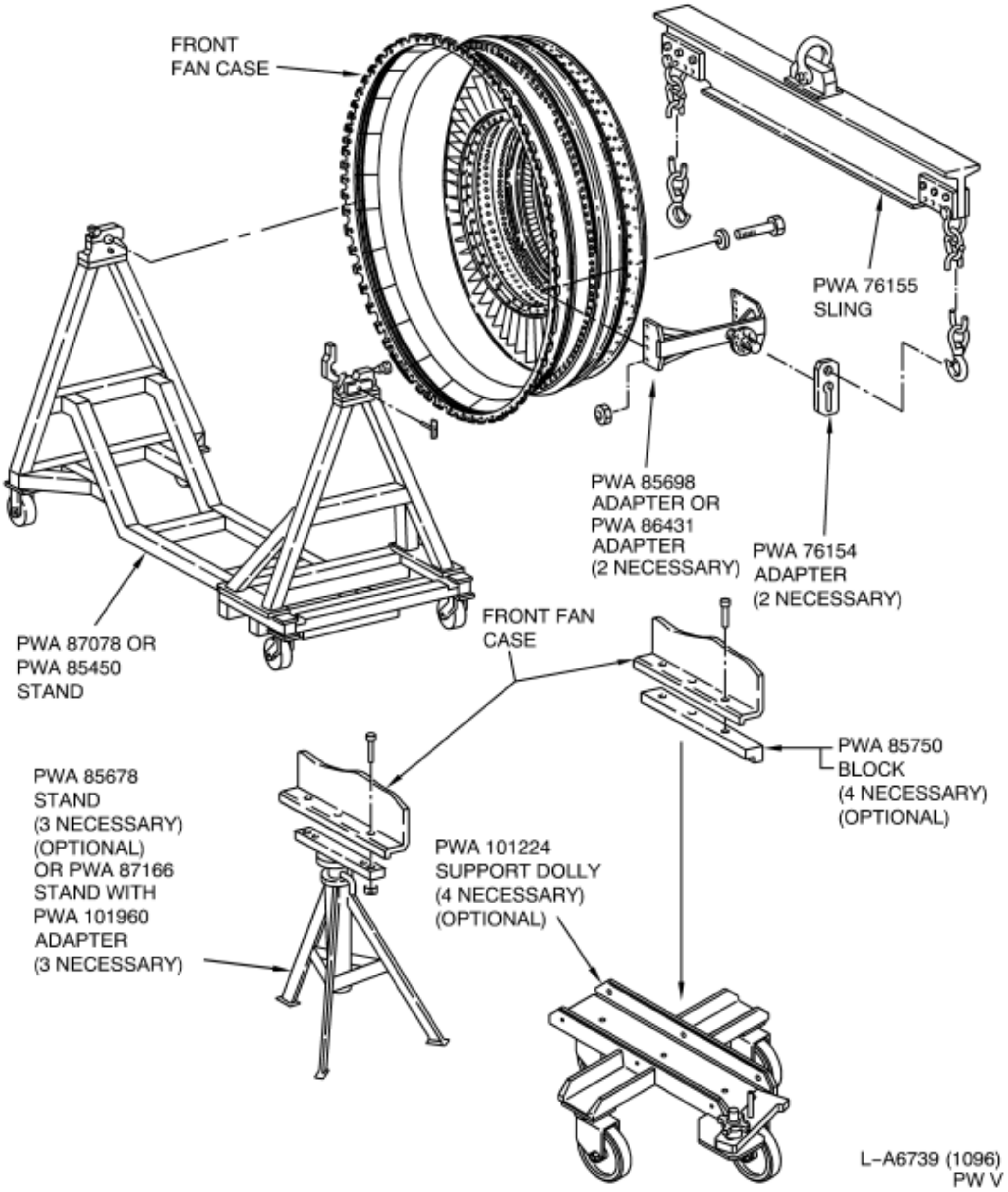
ENGINE GENERAL − FAN CASE − REMOVAL−01



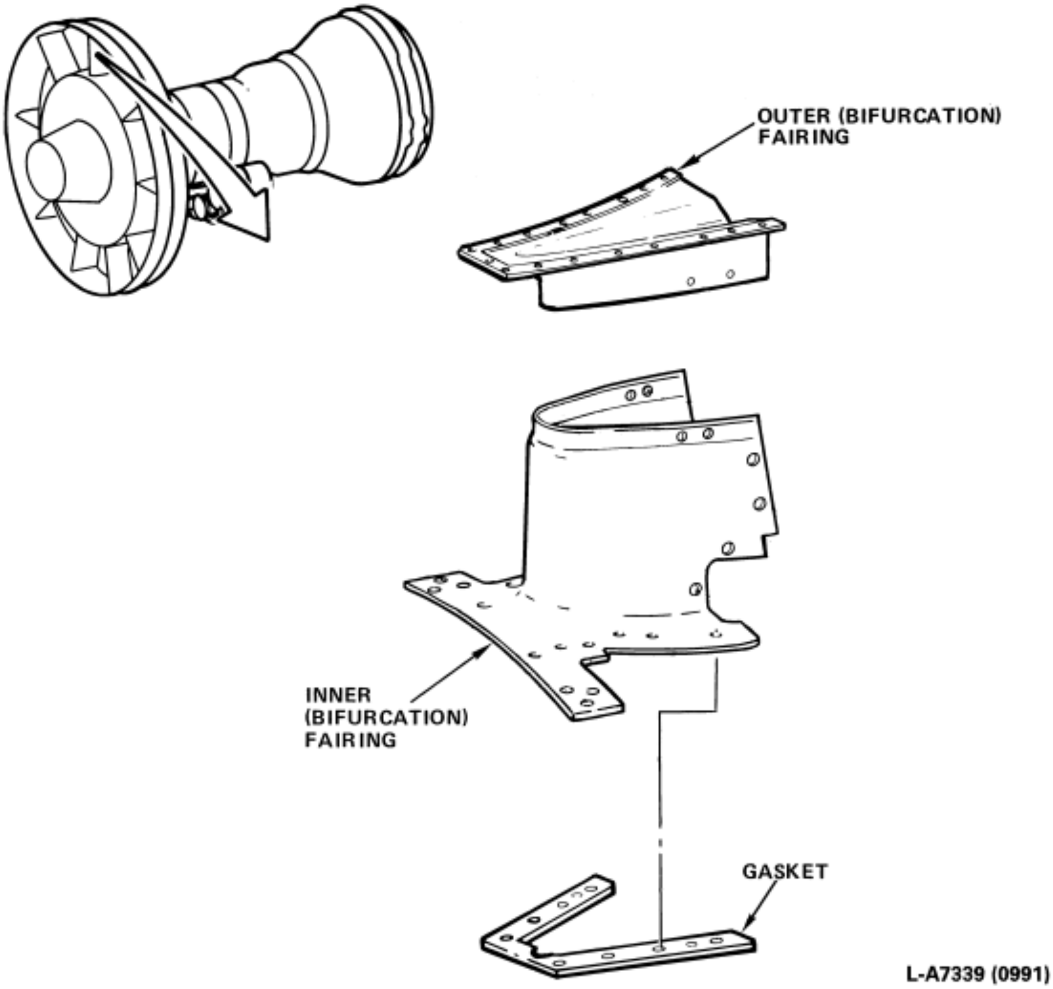
1. REMOVE ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
2. REMOVE COMPRESSOR INLET CONE.
3. REMOVE STAGE 1 LPC BLADE ASSEMBLIES.
4. REMOVE LPC/LPT COUPLING.
5. REMOVE LOW PRESSURE COMPRESSOR (LPC).
6. REMOVE FAN CASE.

L−A0060 (0000)
PW V

Procedure Sequence
Figure 301
(Task 72−00−33−020−006)

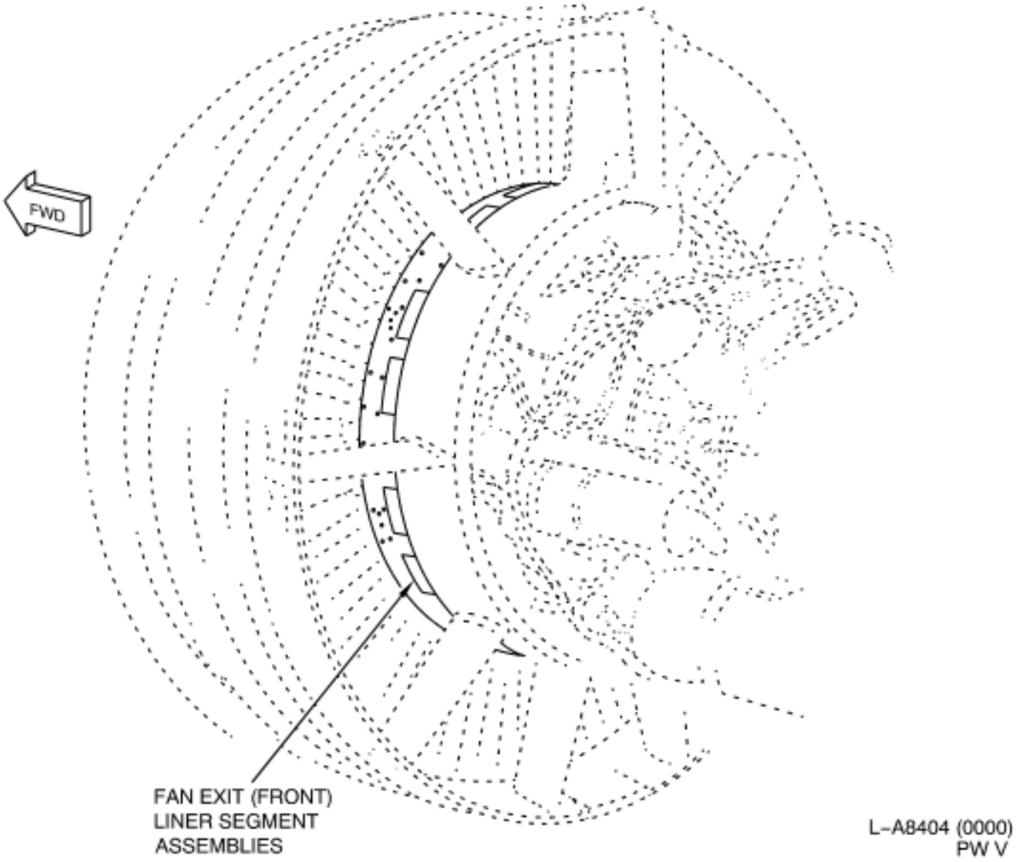

FRONT FAN CASE
PWA 76155 SLING
PWA 85698 ADAPTER OR PWA 86431 ADAPTER (2 NECESSARY)
PWA 76154 ADAPTER (2 NECESSARY)
PWA 87078 OR PWA 85450 STAND
FRONT FAN CASE
PWA 85750 BLOCK (4 NECESSARY) (OPTIONAL)
PWA 85678 STAND (3 NECESSARY) (OPTIONAL) OR PWA 87166 STAND WITH PWA 101960 ADAPTER (3 NECESSARY)
PWA 101224 SUPPORT DOLLY (4 NECESSARY) (OPTIONAL)
L-A6739 (1096)
PW V

Removal Of The Fan Case
Figure 302
(Task 72-00-33-020-006)

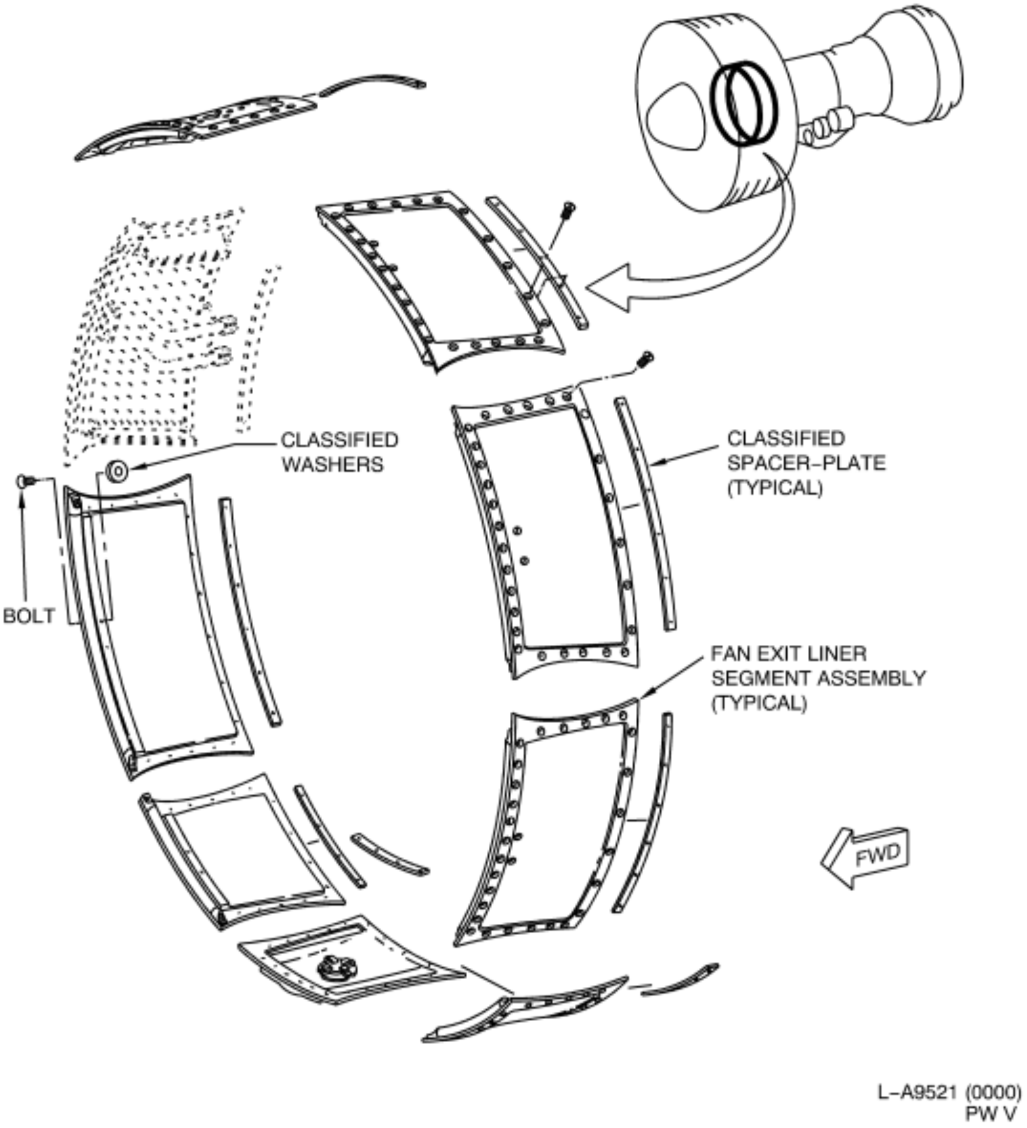

OUTER (BIFURCATION) FAIRING
INNER (BIFURCATION) FAIRING
GASKET
L-A7339 (0991)

Removal Of The Fan Exit (Bifurcation) Fairing Assemblies
Figure 303
(Task 72−00−33−020−006)

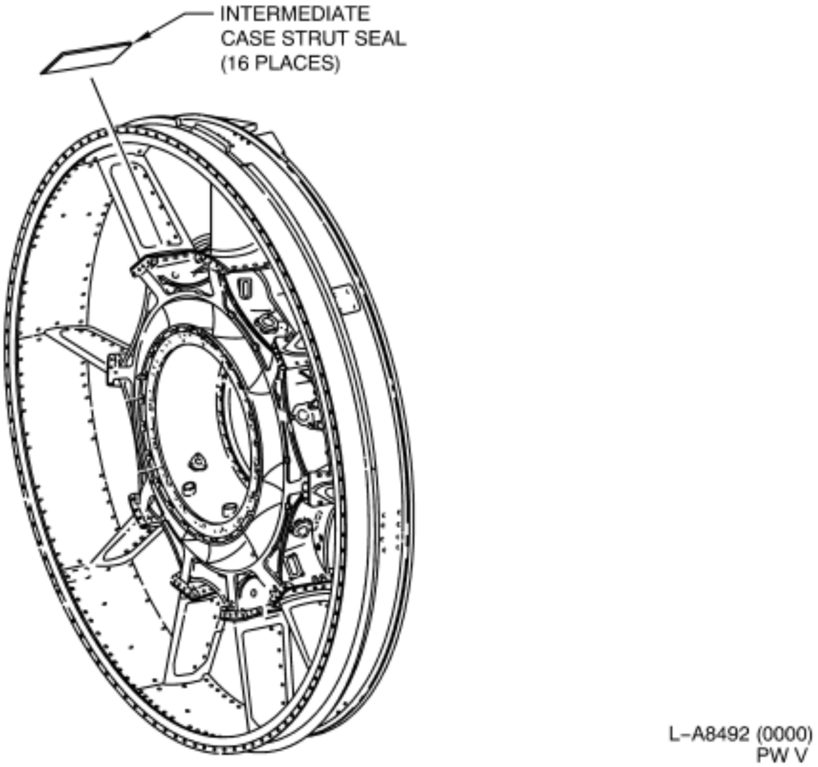
ENGINE GENERAL − FAN CASE − REMOVAL−01


FWD
FAN EXIT (FRONT) LINER SEGMENT ASSEMBLIES
L−A8404 (0000)
PW V

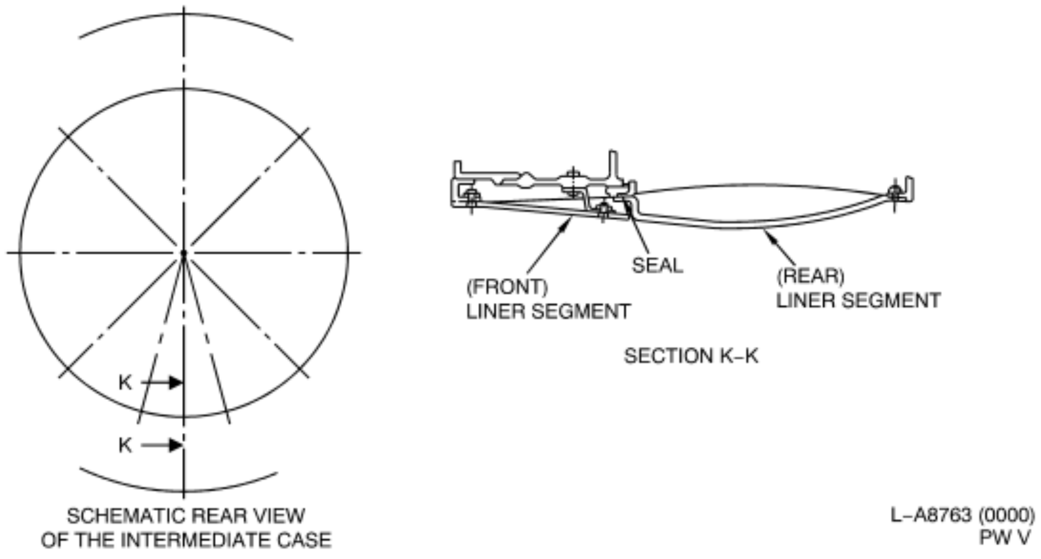
The Fan Exit (Front) Liner Segment Assembly
Figure 304
(Task 72−00−33−020−006)


CLASSIFIED
WASHERS
CLASSIFIED
SPACER−PLATE
(TYPICAL)
BOLT
FAN EXIT LINER
SEGMENT ASSEMBLY
(TYPICAL)
FWD
L−A9521 (0000)
PW V

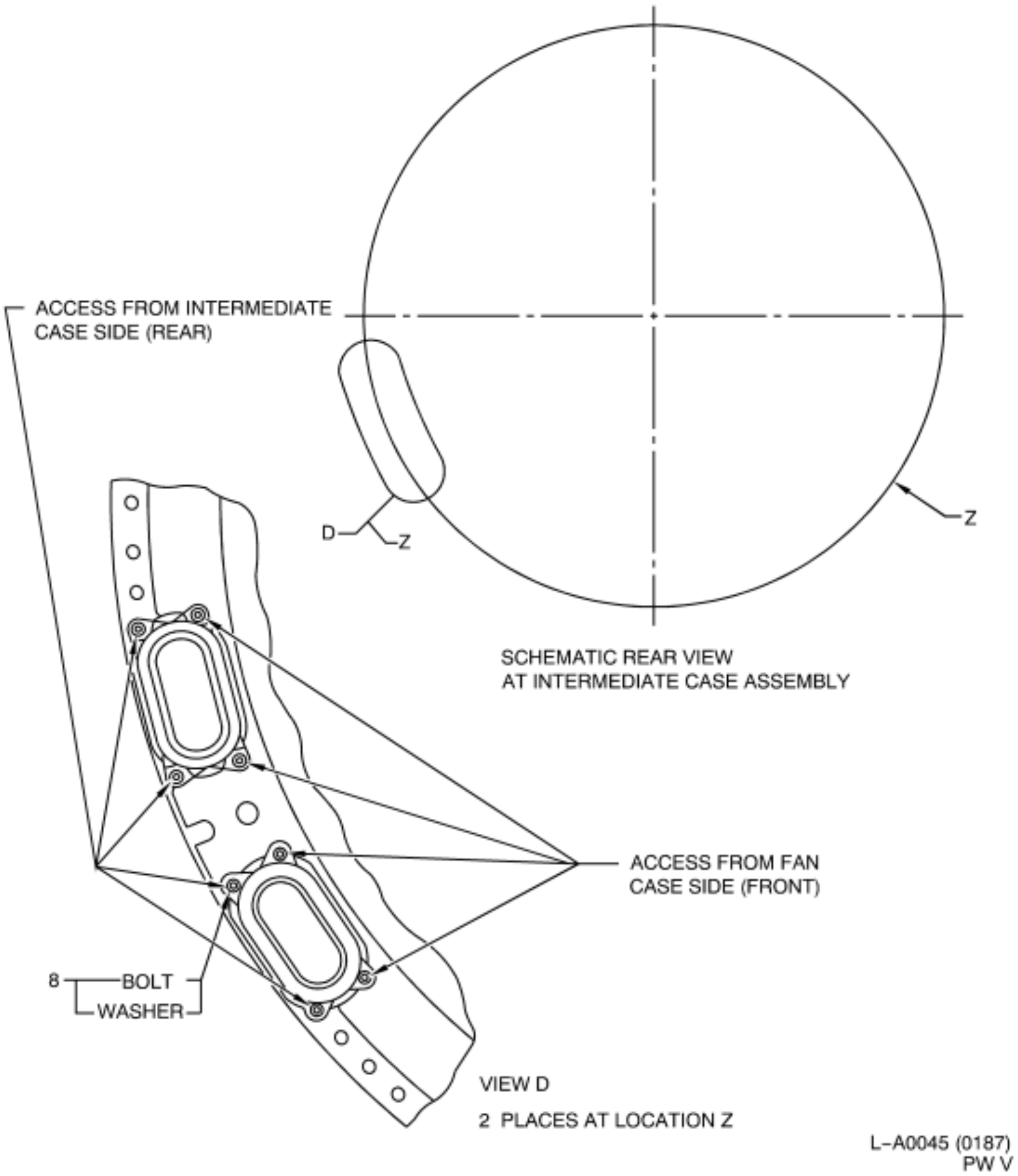
Removal Of The Fan Exit (Rear) Liner Segment Assemblies
Figure 305
(Task 72−00−33−020−006)


INTERMEDIATE
CASE STRUT SEAL
(16 PLACES)
L-A8492 (0000)
PW V

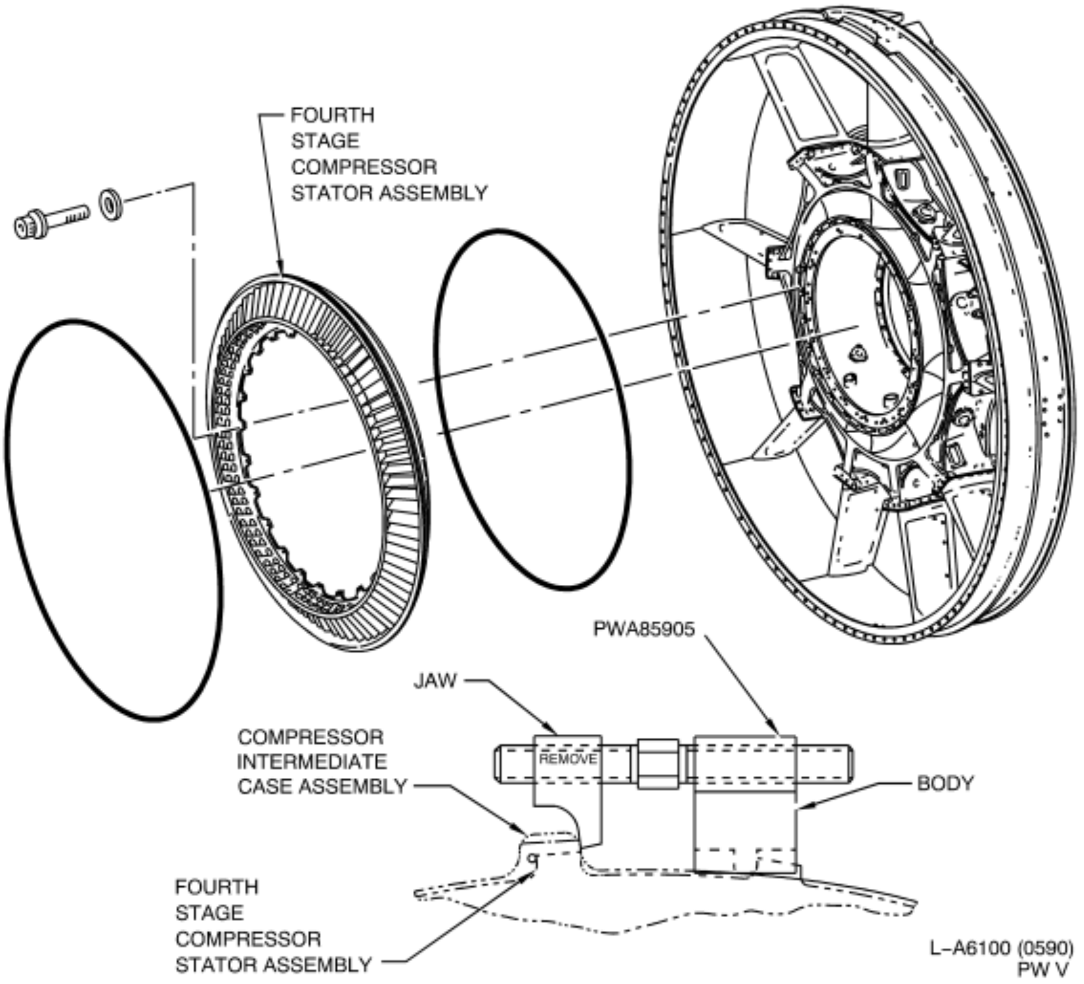
Position Of The Intermediate Case Strut Seal
Figure 306
(Task 72-00-33-020-006)


K
K
SCHEMATIC REAR VIEW
OF THE INTERMEDIATE CASE
(FRONT)
LINER SEGMENT
SEAL
(REAR)
LINER SEGMENT
SECTION K−K
L−A8763 (0000)
PW V

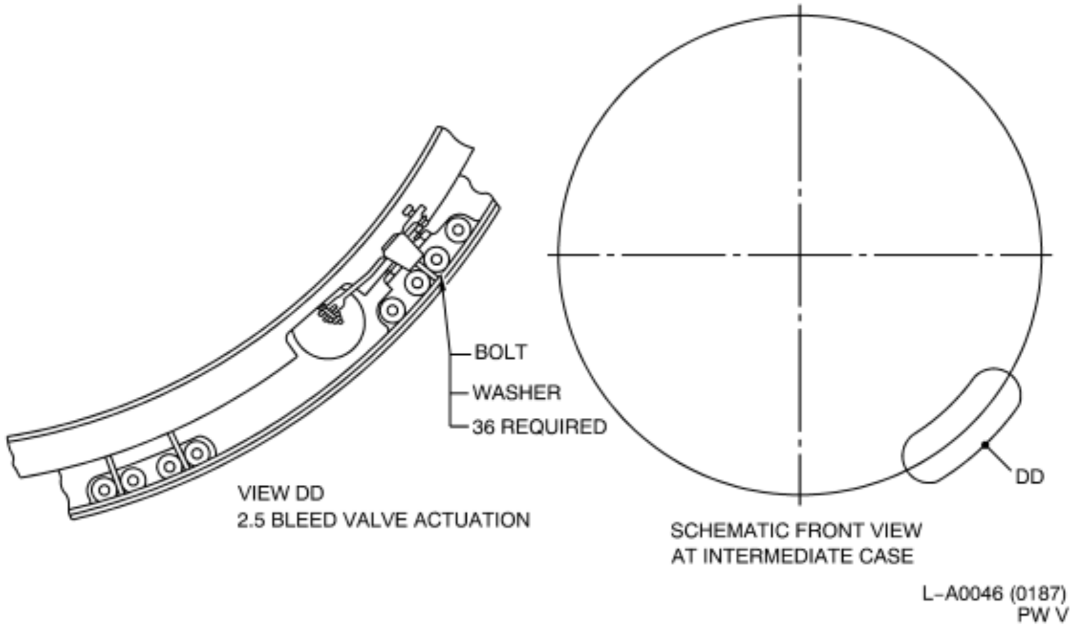
Location Of The Fan Exit Liner Seals
Figure 307
(Task 72−00−33−020−006)


ACCESS FROM INTERMEDIATE CASE SIDE (REAR)
D
Z
Z
SCHEMATIC REAR VIEW AT INTERMEDIATE CASE ASSEMBLY
ACCESS FROM FAN CASE SIDE (FRONT)
8
BOLT
WASHER
VIEW D
2 PLACES AT LOCATION Z
L-A0045 (0187)
PW V

Fan Case Removal
Figure 308
(Task 72-00-33-020-006)


FOURTH STAGE COMPRESSOR STATOR ASSEMBLY
PWA85905
JAW
REMOVE
COMPRESSOR INTERMEDIATE CASE ASSEMBLY
BODY
FOURTH STAGE COMPRESSOR STATOR ASSEMBLY
L−A6100 (0590)
PW V

Remove The 4th Stage Compressor Stator Assembly
Figure 309
(Task 72−00−33−020−006)


BOLT
WASHER
36 REQUIRED
VIEW DD
2.5 BLEED VALVE ACTUATION
DD
SCHEMATIC FRONT VIEW
AT INTERMEDIATE CASE
L−A0046 (0187)
PW V

Fan Case Removal
Figure 310
(Task 72−00−33−020−006)

ENGINE GENERAL - FAN CASE - REMOVAL-02

Task 72-00-33-020-003-A:

1. Remove Fan Case Plumbing For Engines With Basic Parts

A. Equipment And Materials Necessary - None

B. Procedure
See Figure 301.

R CAUTION: BE CAREFUL WHEN YOU HANDLE, REMOVE OR INSTALL ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTIONS USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(1) Remove PT2 (AS11) and PAM (AS10) flex hose assemblies as follows.

(a) Disconnect hose nuts from tube tees at approximately 9 o'clock position.

(b) Remove bolt, spacer, nut and clamps securing hoses to Flange B2 bracket at approximately 9 o'clock position.

(c) Remove hoses from engine and install protective closures.

(2) Remove PT4.95 (AS13) and PB (AS12) flex hose assemblies as follows.

(a) Disconnect hose nuts from tube tees at approximately 9 o'clock position.

(b) Remove bolt, spacer, nut and clamps securing hoses to Flange B bracket at approximately 9 o'clock position.

(c) Remove hoses from engine and install protective closures.

(3) Remove EEC PT4.95 (AS24) and EEC PB (AS23) manifold assemblies as follows.

(a) Remove bolts, spacer nuts and clamps securing manifolds to Flange B2 bracket and Flange B brackets.

(b) Remove manifolds from engine and install protective closures.

(4) Remove EEC PT2 (AS16) and EEC PAM (AS17) tube assemblies as follows.

(a) Remove lockwire and disconnect tube nuts from tube adapters at approximately 12 o'clock position rearward of Flange A1 and at approximately 11 o'clock position rearward of Flange B1.

(b) Remove jamnuts and adapters from Flange A1 bracket at approximately 12 o'clock position.

(c) Remove bolts, nuts and clamps securing tubes to Flange B brackets and Flange B1 bracket.

(d) Remove tubes from engine and install protective closures.

(5) Remove EEC PT4.95 (AS05) and EEC PB (AS19) tube assemblies as follows.

(a) Remove lockwire and disconnect tube nuts from tube coupling at approximately 12 o'clock rearward of Flange D and at approximately 11 o'clock position rearward of Flange B1.

(b) Remove bolts, nuts and clamps securing tubes to Flange B2 brackets, Flange C bracket and intermediate case.

(c) Remove tubes from engine and install protective closures.

(6) Remove EEC PT2 (AS22) and EEC PAM (AS21) manifold assemblies as follows.

(a) Remove bolts, spacer nuts and clamps securing manifolds to Flange B2 brackets.

(b) Remove manifolds from engine and install protective closures.

(7) For engines equipped with propulsion multiplexer unit (PMUX), remove PT2.5 sensing air tube assembly (AS28), data entry plug, and ground cable as follows. See Figure 302.

(a) Remove lockwire and disconnect hose and cap from tube at approximately 1 o'clock position.

(b) Remove lockwire and disconnect manifold nut from tube coupling just rear of Flange C at approximately 12 o'clock position.

(c) Remove bolts, nuts, and clamps securing tube to Flanges C and B2 brackets. Remove tube from engine.

(d) Install protective closures.

(e) Remove bolt and nut securing ground cable to Flange B2 bracket. Remove ground cable.

(f) Remove bolt and nut securing PMUX data entry plug lanyard to lower front PMUX mounting bracket on Flange B. Remove data entry plug.

Task 72−00−33−020−003−B:

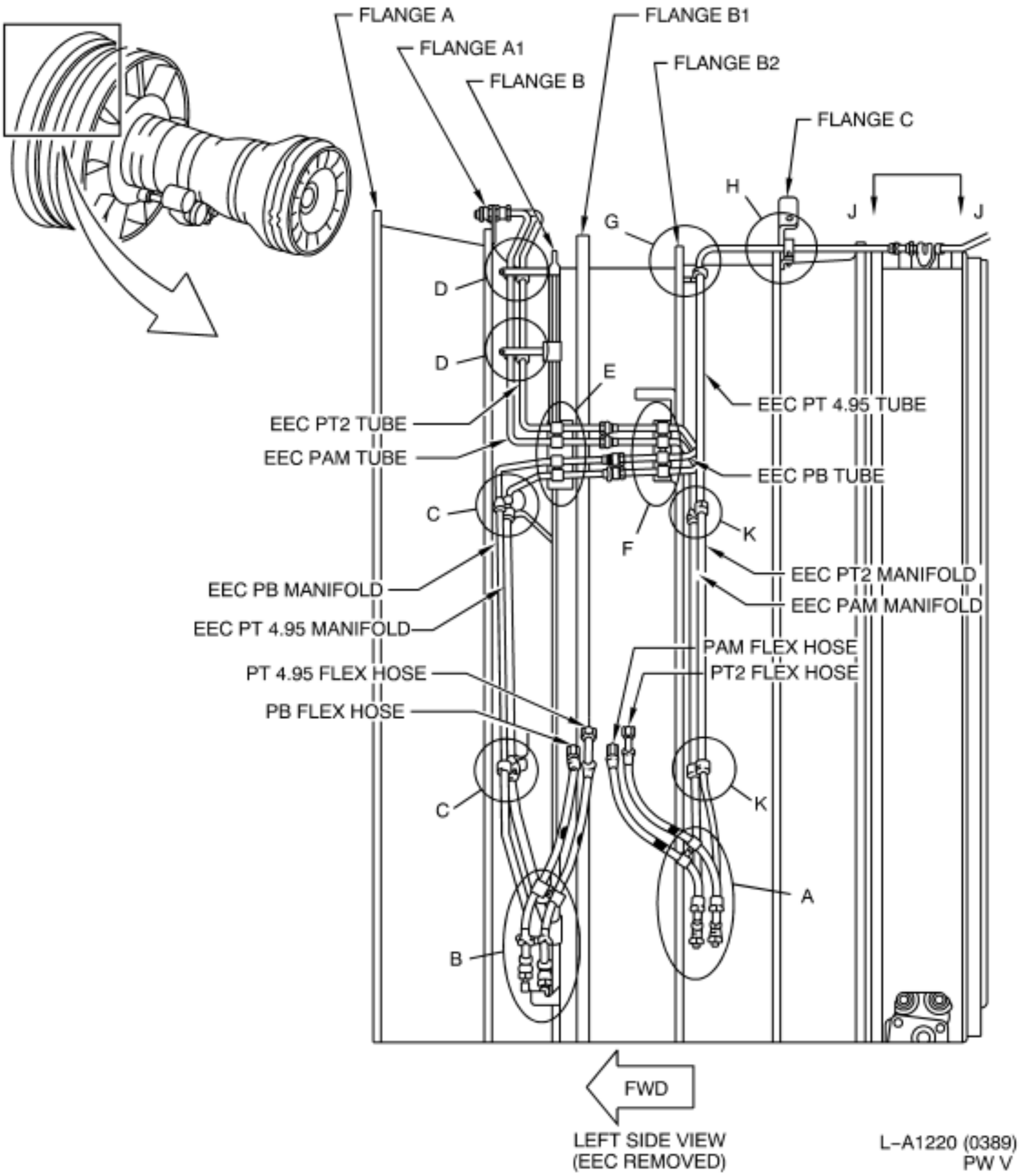
2. Remove Fan Case Plumbing For Engines With Commonality Parts Between Airbus And McDonnell Douglas

A. Equipment And Materials Necessary − None

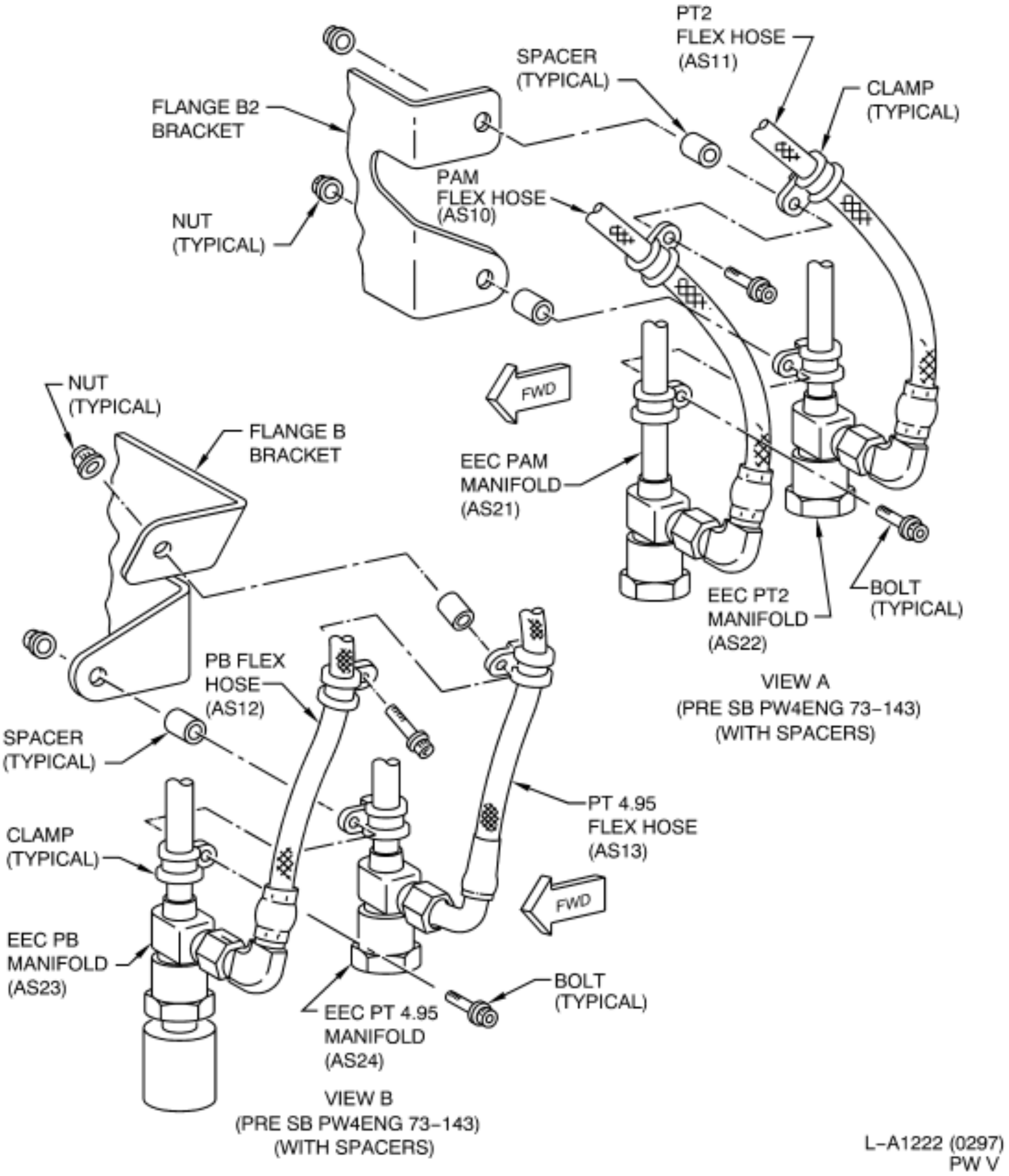
B. Procedure
See Figure 303.

R CAUTION: BE CAREFUL WHEN YOU HANDLE, REMOVE OR INSTALL
R ALL TUBES WHICH CONTAIN A FLEX DESIGN
R SEGMENT. REMOVE AND INSTALL A TUBE WITH A
R FLEX SEGMENT WITH THE SAME PRECAUTIONS
R USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO
R NOT BEND THE FLEXHOSE OF A TUBE TO HELP
R WITH THE INSTALLATION OR REMOVAL OF AN
R ATTACHED COMPONENT. IF A FLEX SEGMENT IS
R BENT TOO MUCH, THIS CAN CAUSE A KINK IN
R THE EXTERNAL WIRE BRAID AND IN THE INNER
R POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS
R OR TUBE RUPTURE CAN BE THE RESULT.

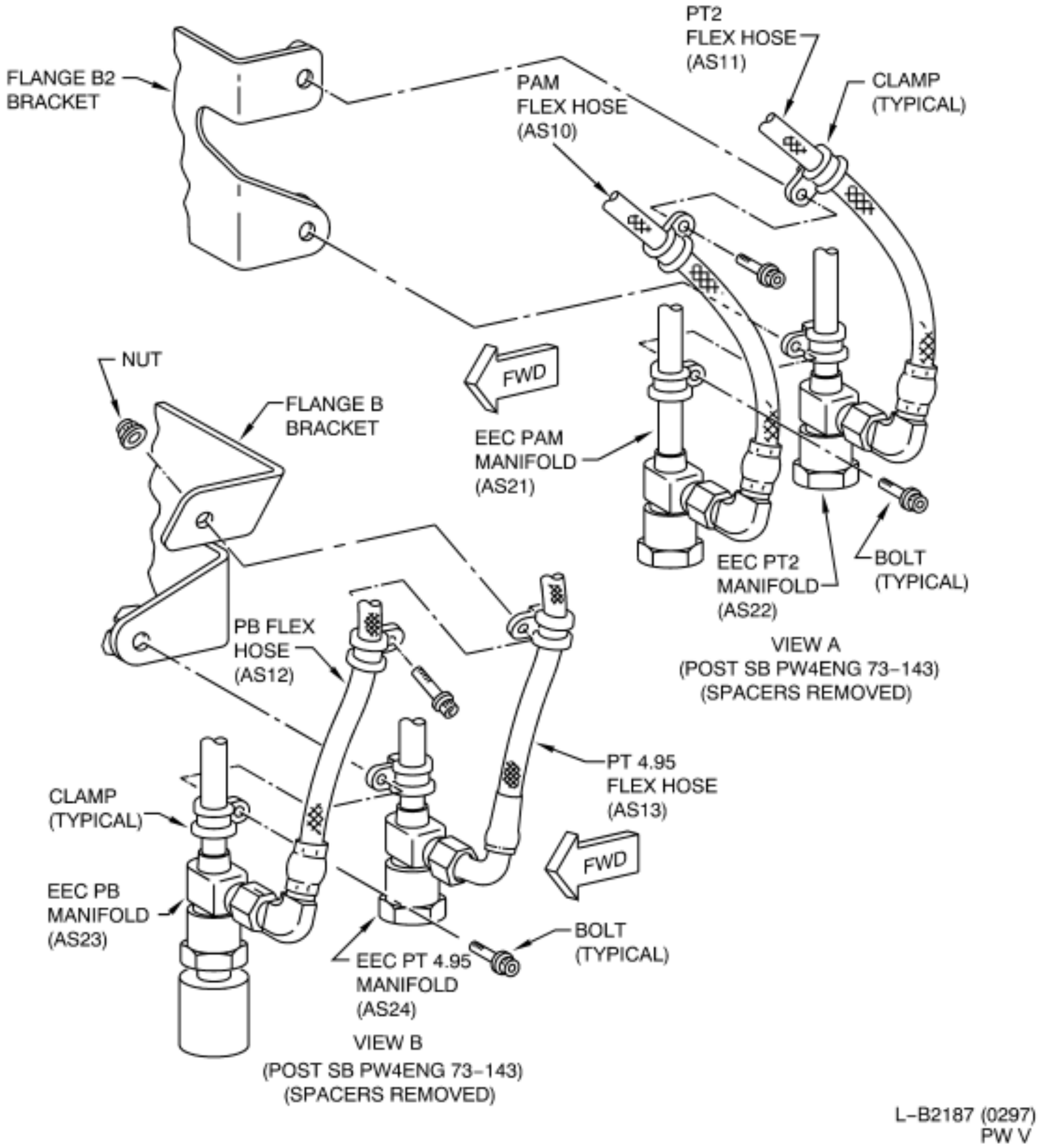
(1) Remove the PT2 (AS11), PAM (AS10), PT4.95 (AS13) and PB (AS12) flex hose assemblies.


FLANGE A
FLANGE A1
FLANGE B
FLANGE B1
FLANGE B2
FLANGE C
H
J
J
G
D
D
E
EEC PT 4.95 TUBE
EEC PT2 TUBE
EEC PAM TUBE
EEC PB TUBE
C
F
K
EEC PT2 MANIFOLD
EEC PB MANIFOLD
EEC PAM MANIFOLD
EEC PT 4.95 MANIFOLD
PAM FLEX HOSE
PT2 FLEX HOSE
PT 4.95 FLEX HOSE
PB FLEX HOSE
C
K
A
B
FWD
LEFT SIDE VIEW
(EEC REMOVED)
L-A1220 (0389)
PW V

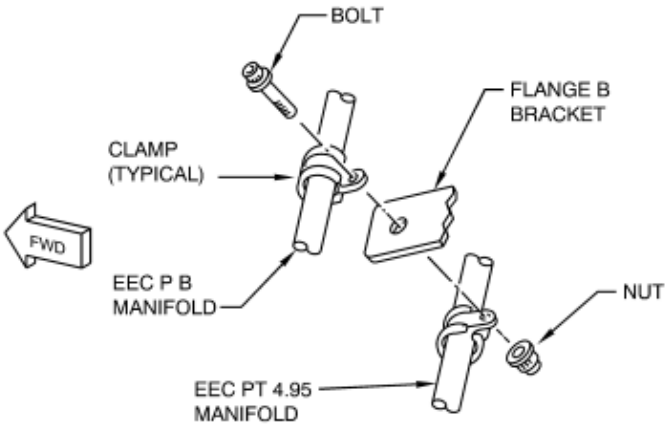
Fan Case Plumbing
Figure 301 (Sheet 1)
(Task 72-00-33-020-003-A)


PT2
FLEX HOSE
(AS11)
SPACER
(TYPICAL)
CLAMP
(TYPICAL)
FLANGE B2
BRACKET
PAM
FLEX HOSE
(AS10)
NUT
(TYPICAL)
FWD
NUT
(TYPICAL)
FLANGE B
BRACKET
EEC PAM
MANIFOLD
(AS21)
EEC PT2
MANIFOLD
(AS22)
BOLT
(TYPICAL)
VIEW A
(PRE SB PW4ENG 73-143)
(WITH SPACERS)
PB FLEX
HOSE
(AS12)
SPACER
(TYPICAL)
CLAMP
(TYPICAL)
PT 4.95
FLEX HOSE
(AS13)
FWD
EEC PB
MANIFOLD
(AS23)
BOLT
(TYPICAL)
EEC PT 4.95
MANIFOLD
(AS24)
VIEW B
(PRE SB PW4ENG 73-143)
(WITH SPACERS)
L-A1222 (0297)
PW V

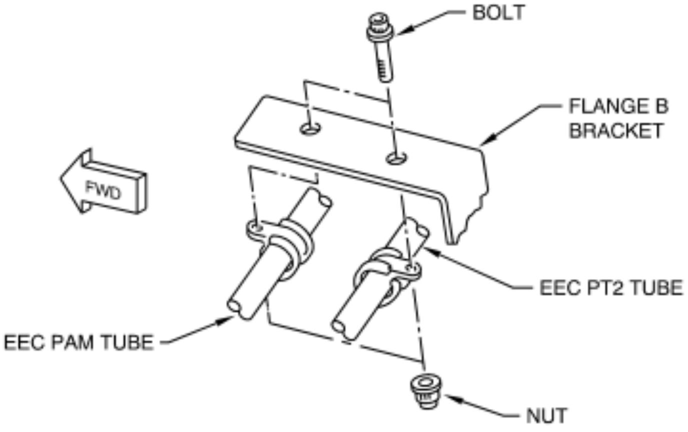
Fan Case Plumbing
Figure 301 (Sheet 2)
(Task 72-00-33-020-003-A)


PT2
FLEX HOSE
(AS11)
FLANGE B2
BRACKET
PAM
FLEX HOSE
(AS10)
CLAMP
(TYPICAL)
NUT
FWD
FLANGE B
BRACKET
EEC PAM
MANIFOLD
(AS21)
EEC PT2
MANIFOLD
(AS22)
BOLT
(TYPICAL)
VIEW A
(POST SB PW4ENG 73-143)
(SPACERS REMOVED)
PB FLEX
HOSE
(AS12)
PT 4.95
FLEX HOSE
(AS13)
CLAMP
(TYPICAL)
FWD
EEC PB
MANIFOLD
(AS23)
BOLT
(TYPICAL)
EEC PT 4.95
MANIFOLD
(AS24)
VIEW B
(POST SB PW4ENG 73-143)
(SPACERS REMOVED)
L-B2187 (0297)
PW V

Fan Case Plumbing
Figure 301 (Sheet 3)
(Task 72-00-33-020-003-A)


BOLT
FLANGE B
BRACKET
CLAMP
(TYPICAL)
FWD
EEC P B
MANIFOLD
NUT
EEC PT 4.95
MANIFOLD

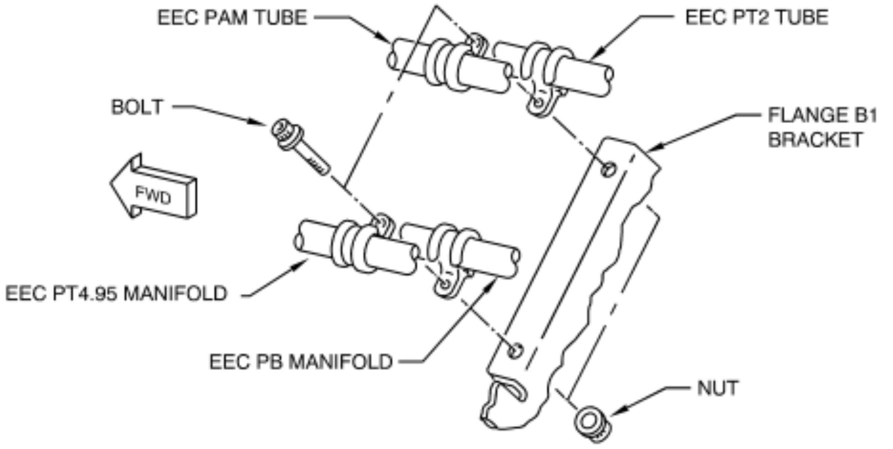
VIEW C
(2 LOCATIONS)


BOLT
FLANGE B
BRACKET
FWD
EEC PT2 TUBE
EEC PAM TUBE
NUT

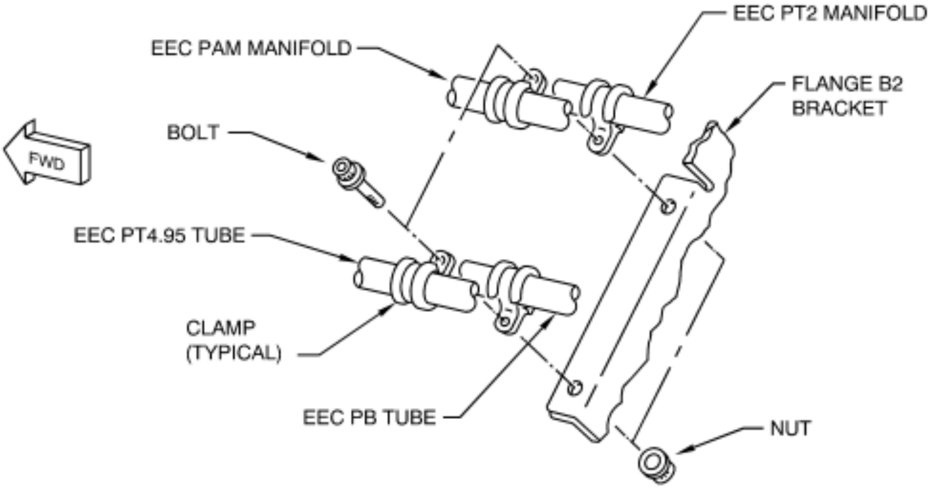
VIEW D
(2 LOCATIONS)

L-A1223 (0389)
PW V

Fan Case Plumbing
Figure 301 (Sheet 4)
(Task 72-00-33-020-003-A)


EEC PAM TUBE
EEC PT2 TUBE
BOLT
FLANGE B1 BRACKET
FWD
EEC PT4.95 MANIFOLD
EEC PB MANIFOLD
NUT

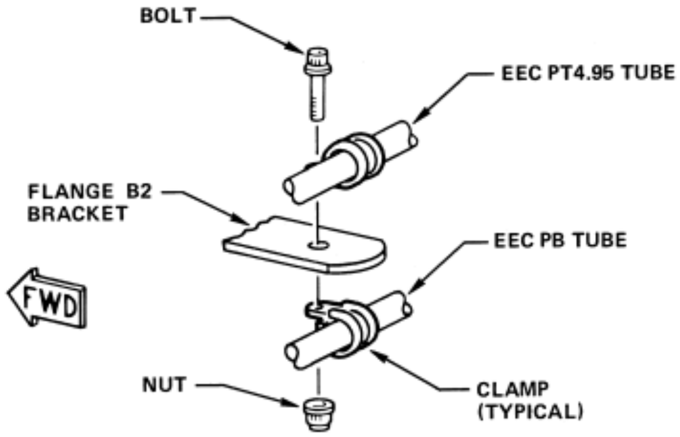
VIEW E


EEC PT2 MANIFOLD
EEC PAM MANIFOLD
FLANGE B2 BRACKET
BOLT
FWD
EEC PT4.95 TUBE
CLAMP (TYPICAL)
EEC PB TUBE
NUT

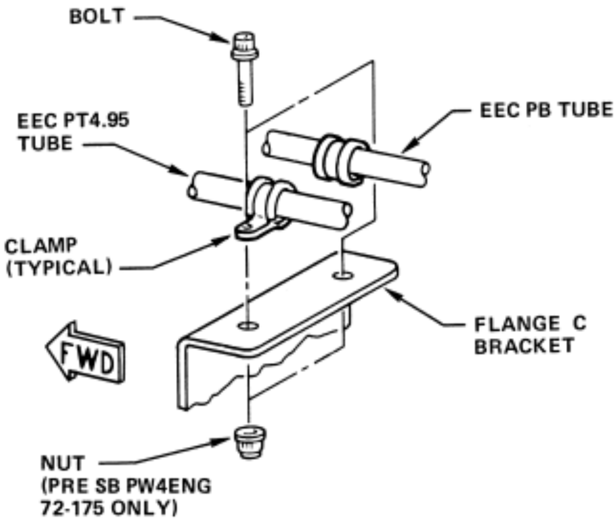
VIEW F

L-A1224 (0389)
PW V

Fan Case Plumbing
Figure 301 (Sheet 5)
(Task 72-00-33-020-003-A)


BOLT
EEC PT4.95 TUBE
FLANGE B2
BRACKET
EEC PB TUBE
FWD
NUT
CLAMP
(TYPICAL)

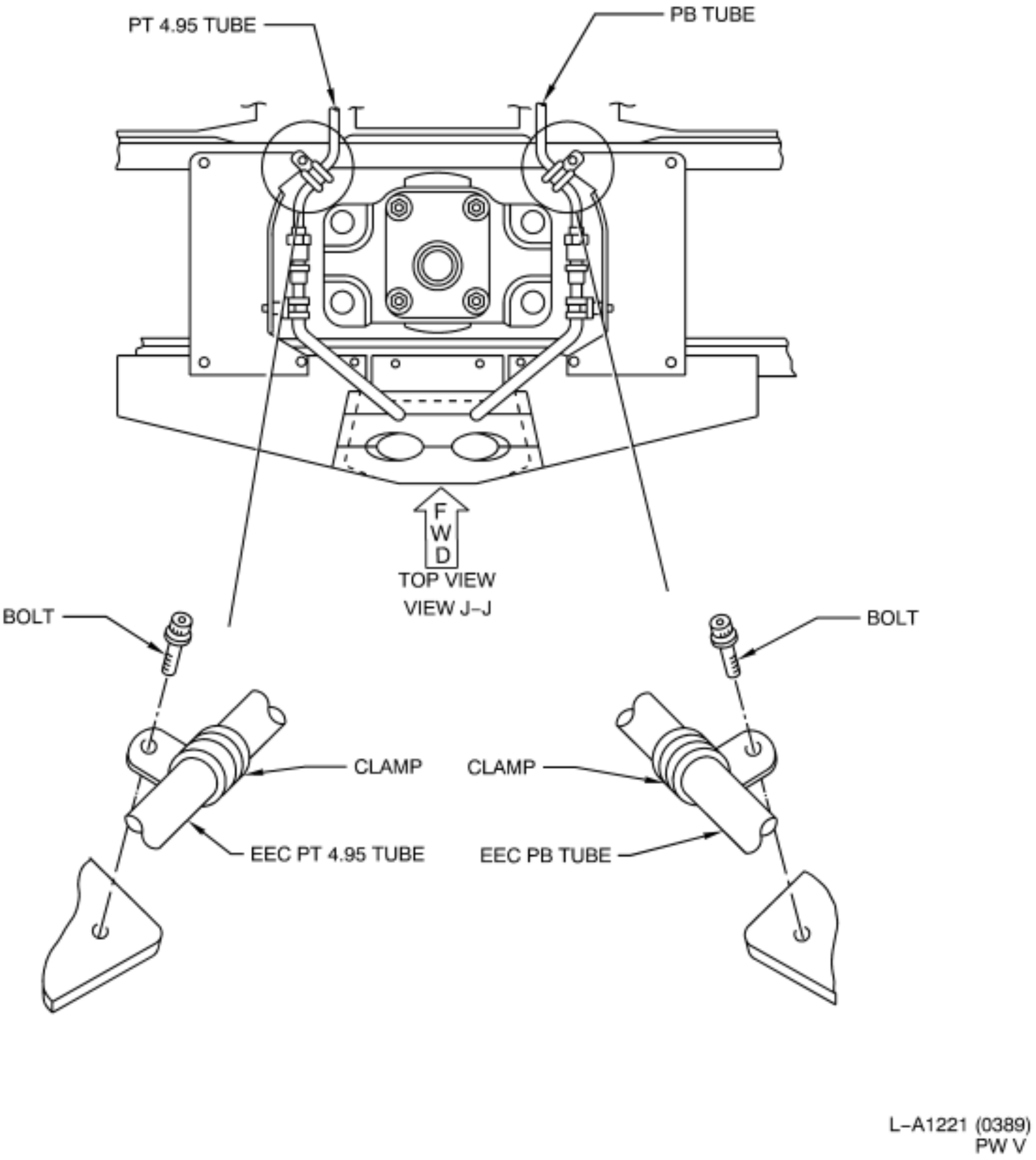
VIEW G


BOLT
EEC PT4.95
TUBE
EEC PB TUBE
CLAMP
(TYPICAL)
FLANGE C
BRACKET
FWD
NUT
(PRE SB PW4ENG
72-175 ONLY)

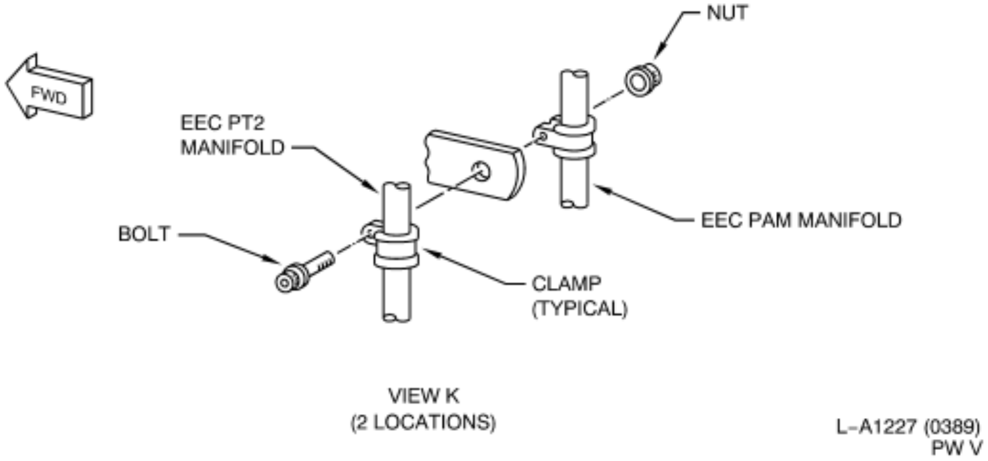
VIEW H

L−A1225
0389

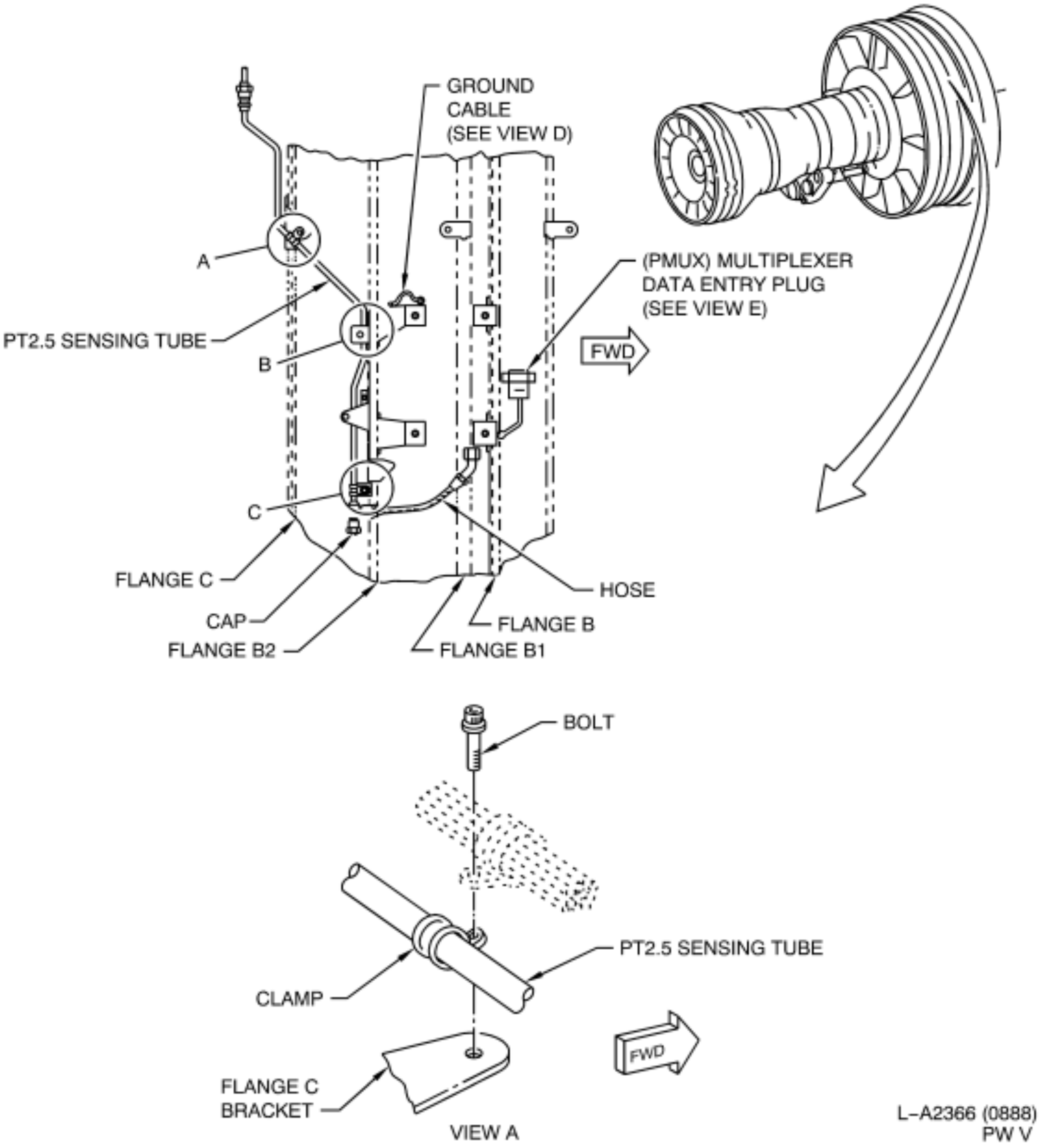
Fan Case Plumbing
Figure 301 (Sheet 6)
(Task 72−00−33−020−003−A)


PT 4.95 TUBE
PB TUBE
F W D
TOP VIEW
VIEW J-J
BOLT
BOLT
CLAMP
CLAMP
EEC PT 4.95 TUBE
EEC PB TUBE
L-A1221 (0389)
PW V

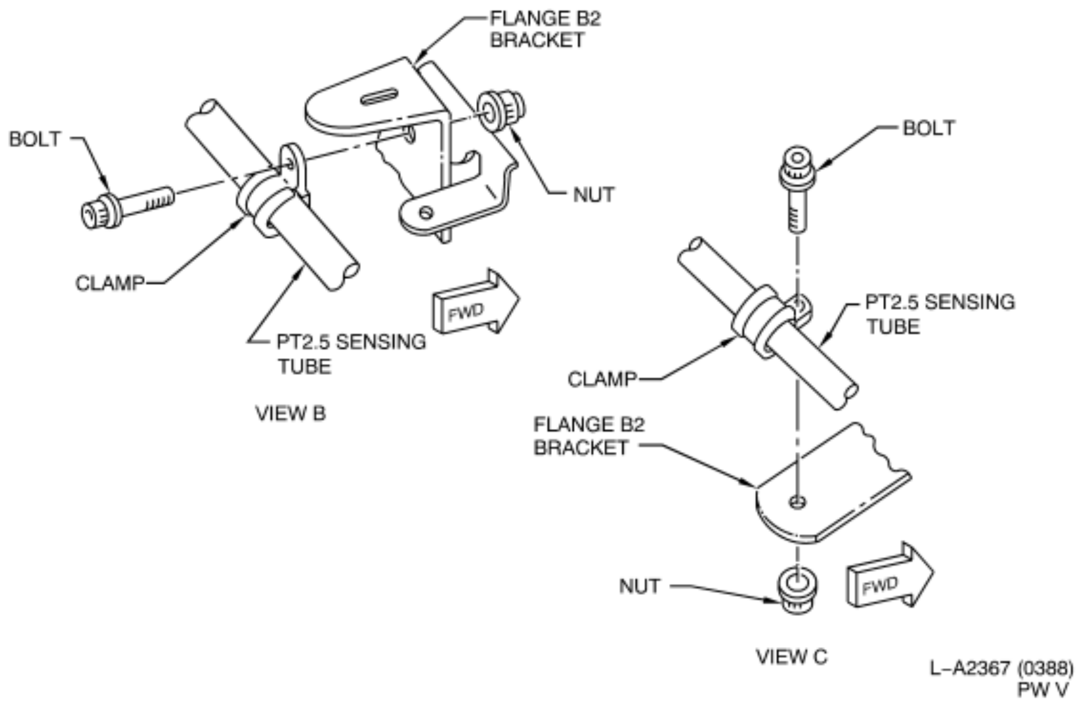
Fan Case Plumbing
Figure 301 (Sheet 7)
(Task 72-00-33-020-003-A)


NUT
FWD
EEC PT2 MANIFOLD
BOLT
EEC PAM MANIFOLD
CLAMP (TYPICAL)
VIEW K
(2 LOCATIONS)
L-A1227 (0389)
PW V

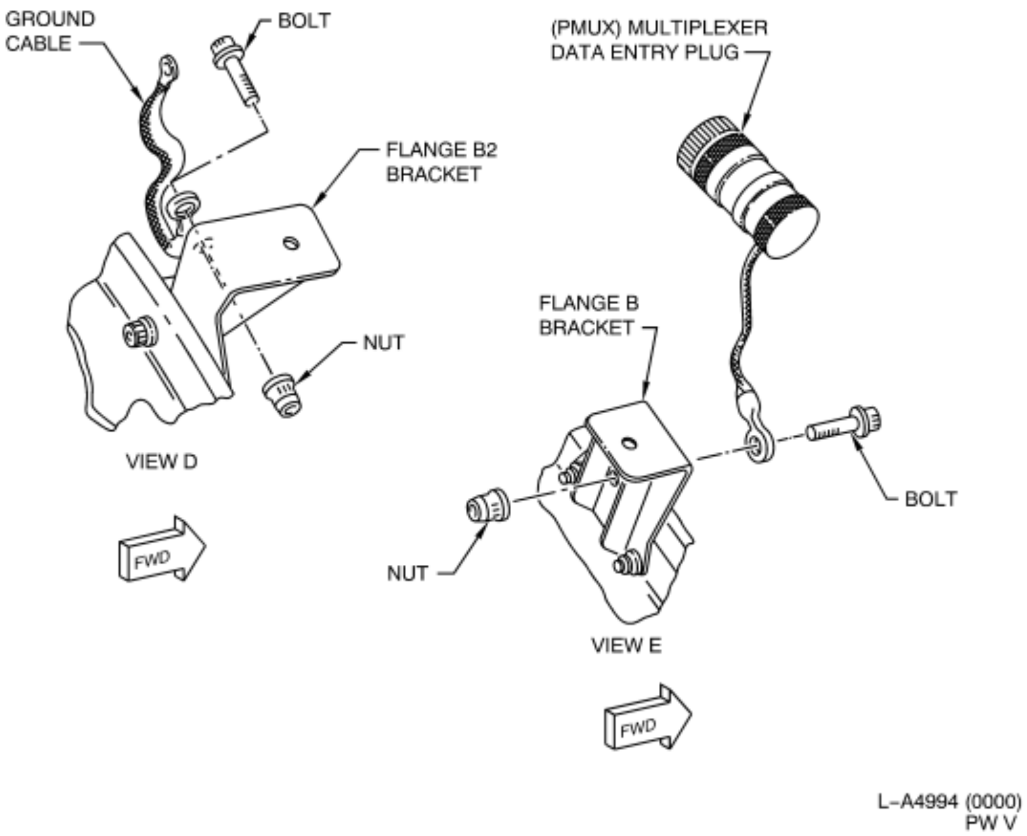
Fan Case Plumbing
Figure 301 (Sheet 8)
(Task 72-00-33-020-003-A)


GROUND CABLE (SEE VIEW D)
A
PT2.5 SENSING TUBE
B
(PMUX) MULTIPLEXER DATA ENTRY PLUG (SEE VIEW E)
FWD
C
FLANGE C
HOSE
CAP
FLANGE B
FLANGE B2
FLANGE B1
BOLT
PT2.5 SENSING TUBE
CLAMP
FWD
FLANGE C BRACKET
VIEW A
L-A2366 (0888)
PW V

Engine Propulsion Multiplexer Unit Plumbing
Figure 302 (Sheet 1)
(Task 72-00-33-020-003-A)


FLANGE B2
BRACKET
BOLT
NUT
CLAMP
PT2.5 SENSING
TUBE
FWD
VIEW B
BOLT
PT2.5 SENSING
TUBE
CLAMP
FLANGE B2
BRACKET
NUT
FWD
VIEW C
L-A2367 (0388)
PW V

Engine Propulsion Multiplexer Unit Plumbing
Figure 302 (Sheet 2)
(Task 72-00-33-020-003-A)


GROUND CABLE
BOLT
FLANGE B2 BRACKET
NUT
VIEW D
FWD
(PMUX) MULTIPLEXER DATA ENTRY PLUG
FLANGE B BRACKET
BOLT
NUT
VIEW E
FWD
L−A4994 (0000)
PW V

Engine Propulsion Multiplexer Unit Plumbing
Figure 302 (Sheet 3)
(Task 72−00−33−020−003−A)

   - (a) Disconnect the hose nuts from the manifold tees at a bracket between Flanges A1 and B1 at the 9 o'clock position.

   - (b) Remove the flex hoses from the engine and install protection covers.

- (2) Remove the lockwire from the three cap assemblies and the trap assembly. Remove the cap assemblies and trap assembly from the manifold tees and install protection covers.

- (3) Remove the EEC PB sensing manifold (AS23).

   - (a) Remove the lockwire and disconnect the tube nut from the manifold assembly at the 10:30 o'clock position.

   - (b) Remove the bolt and clamp that attaches the manifold to a bracket on Flange B1 at the 9 o'clock position.

   - (c) Remove the nuts and clamps that attach the manifold to three brackets (rearward of Flange B2) on the fan case.

   - (d) Remove the bolt that attaches the tee of the manifold to a bracket between Flanges A1 and B1 at the 9 o'clock position.

   - (e) Remove the clamp from the manifold at a bracket located between Flanges B2 and C at the 9:30 o'clock position. (Bolt and nut was previously removed with the fan case harnesses).

   - (f) Remove the manifold assembly from the engine and install protection covers.

- (4) Remove the EEC PAM manifold assembly (AS17).

   - (a) Remove the lockwire and disconnect the manifold nut from the bulkhead adapter on a bracket at Flange A1 at the 12 o'clock position.

   - (b) Remove the bolts and clamps that attach the manifold to seven brackets on Flange B.

(c) Remove the bolt that attaches the tee of the manifold to a bracket located between Flanges A1 and B1 at the 9 o'clock position.

(d) Remove the manifold from the engine and install protection covers.

(5) Remove the EEC PT4.95 sensing manifold assembly (AS24).

(a) Remove the lockwire and disconnect the tube nut from the manifold assembly at the 10:30 o'clock position.

(b) Remove the bolt and clamp that attaches the manifold to a bracket on Flange B1 at the 9 o'clock position.

(c) Remove the clamps that attach the manifold to three brackets (rearward of Flange B2) on the fan case.

(d) Remove the clamp from the manifold at a bracket located between Flanges B2 and C at the 9:30 o'clock position. (Bolt and nut was previously removed with the fan cases harnesses).

(e) Remove the bolt that attaches the tee of the manifold to a bracket between Flanges A1 and B1 at the 9 o'clock position.

(f) Remove the manifold assembly from the engine and install protection covers.

(6) Remove the EEC PT2 manifold assembly (AS16).

(a) Remove the lockwire and disconnect the manifold nut from the bulkhead adapter in a bracket on Flange A1 at the 12 o'clock position.

(b) Remove the clamps that attach the manifold to seven brackets on Flange B.

(c) Remove the bolt that attaches the tee of the manifold to a bracket located between Flanges A1 and B1 at the 9 o'clock position.

(d) Remove the manifold from the engine and install protection covers.

(e) Remove the lockwire from the jamnuts on the two adapters on a bracket located at the 12 o'clock position on Flange A1. Remove the adapters from the engine.

(f) For center engine configurations only, remove the lockwire and the EEC vent cap from the larger adapter at the 12 o'clock position on Flange A1.

(7) Remove the EEC PT4.95 sensing (AS05) and the EEC PB sensing (AS19) tube assemblies.

(a) Remove the lockwire and disconnect the tube nuts from tube couplings at the 12 o'clock position (rearward of Flange C).

(b) Remove the nuts and clamps that attach the tube assemblies to five brackets located rearward of Flange B2 on the fan case.

(c) Remove the bolts, nuts and clamps that attach the tube assemblies to brackets on Flange C at the 12 o'clock position.

(d) Remove the tubes from the engine and install protection covers.

(8) For engines not equipped with the supplemental control unit (SCU), remove the lockwire and the cap assembly (located at the 12:30 o'clock position) from the (AS29) tube. Install a protection cover to the end of tube.

(9) For engines equipped with the supplemental control unit (SCU) with multiplexing, remove the PT2.5 sensing hose (AS38), PT2.5 sensing manifold assembly (AS36), and PT2.5 sensing tube assembly (AS28). See Figure 304.

(a) Remove the (AS38) hose from the tee of the (AS36) manifold at the 3 o'clock position. Install protection covers on the hose assembly.

(b) Remove the lockwire and the cap assembly from the tee of the (AS36) manifold.

(c) Remove the lockwire and disconnect the tube nut to the coupling of the (AS36) manifold at the 2 o'clock position.

(d) Remove the bolts, nuts and clamps that attach the (AS36) manifold to brackets on Flanges B, B2 and C.

(e) Remove the bolt from the tee of the (AS36) manifold that attaches the manifold to a bracket on Flange B at the 3 o'clock position. Remove the manifold from the engine and install protection covers to the manifold openings.

(f) Remove the lockwire and disconnect the tube nut from the coupling of the (AS28) tube at the 12:30 o'clock position.

(g) Remove the bolts, nuts and clamps that attach the (AS28) tube to brackets on Flange C.

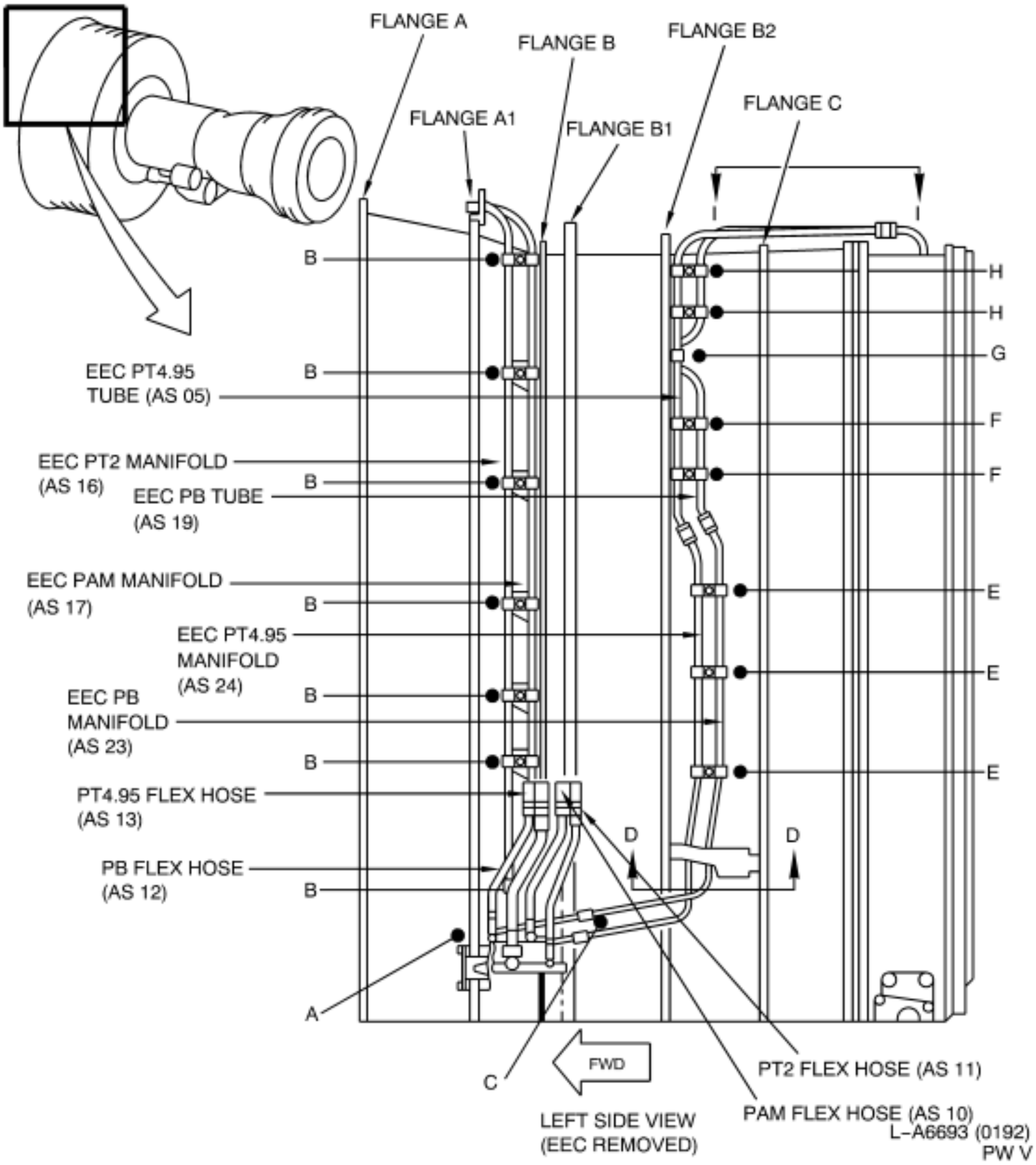
(h) Remove the (AS28) tube from the engine. Install protection covers to the tube assembly.

(10) For engines equipped with the supplemental control unit (SCU), remove the SCU programming plug and the SCU ground cable. See Figure 304.

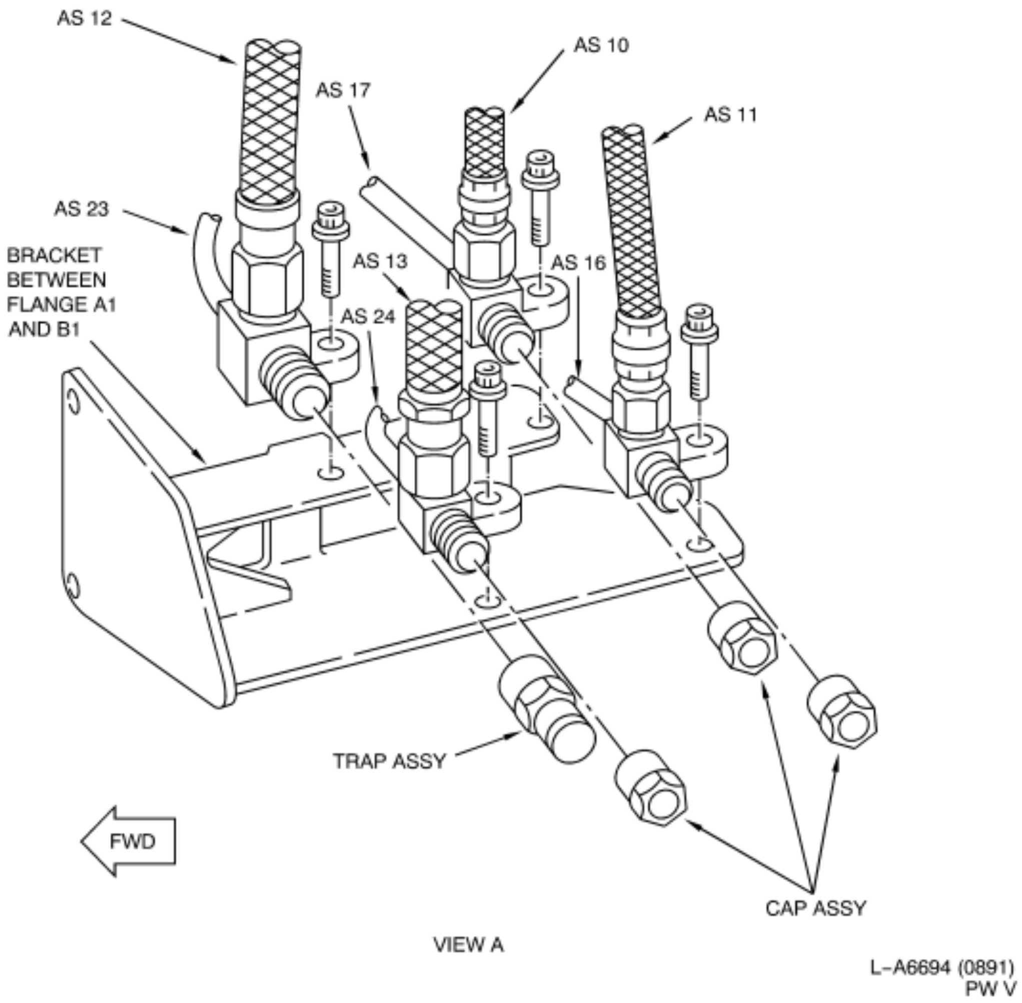
(a) Remove the rivet pin and collar that attach the lanyard of the programming plug to the rearward side of the lower SCU mount bracket. Remove the SCU programming plug.

NOTE: The programming plug must stay with the engine when the SCU is removed or replaced.

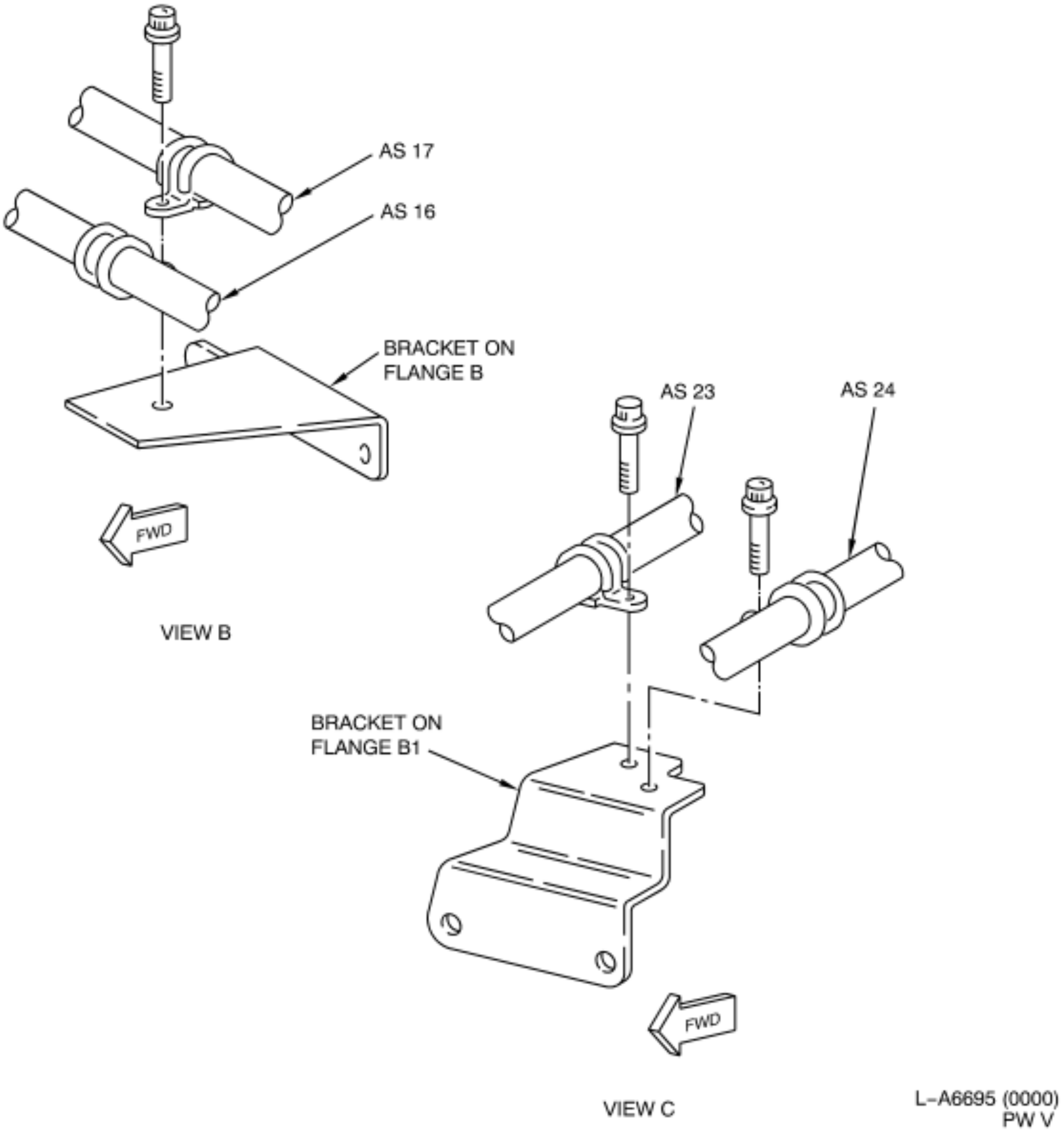
(b) Remove the bolt, washer and nut that attach the SCU ground cable to a bracket on Flange B1. Remove the ground cable.


FLANGE A
FLANGE B
FLANGE B2
FLANGE A1
FLANGE B1
FLANGE C
B
B
B
B
B
B
B
H
H
G
F
F
E
E
E
D
D
A
C
EEC PT4.95 TUBE (AS 05)
EEC PT2 MANIFOLD (AS 16)
EEC PB TUBE (AS 19)
EEC PAM MANIFOLD (AS 17)
EEC PT4.95 MANIFOLD (AS 24)
EEC PB MANIFOLD (AS 23)
PT4.95 FLEX HOSE (AS 13)
PB FLEX HOSE (AS 12)
FWD
PT2 FLEX HOSE (AS 11)
PAM FLEX HOSE (AS 10)
LEFT SIDE VIEW (EEC REMOVED)
L-A6693 (0192)
PW V

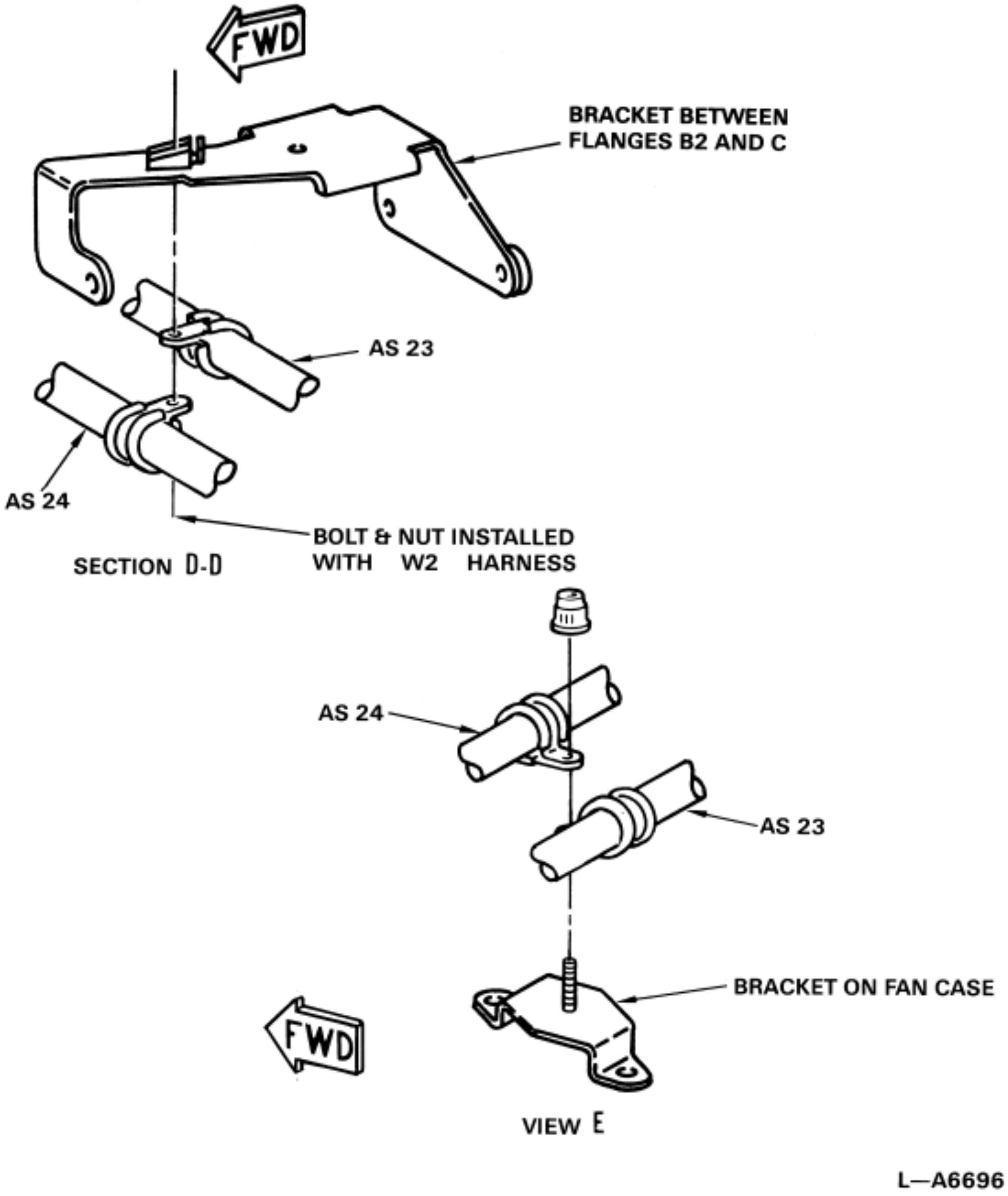
Fan Case Plumbing
Figure 303 (Sheet 1)
(Task 72-00-33-020-003-B)


AS 12
AS 10
AS 17
AS 11
AS 23
BRACKET BETWEEN FLANGE A1 AND B1
AS 13
AS 16
AS 24
TRAP ASSY
FWD
CAP ASSY
VIEW A
L-A6694 (0891)
PW V

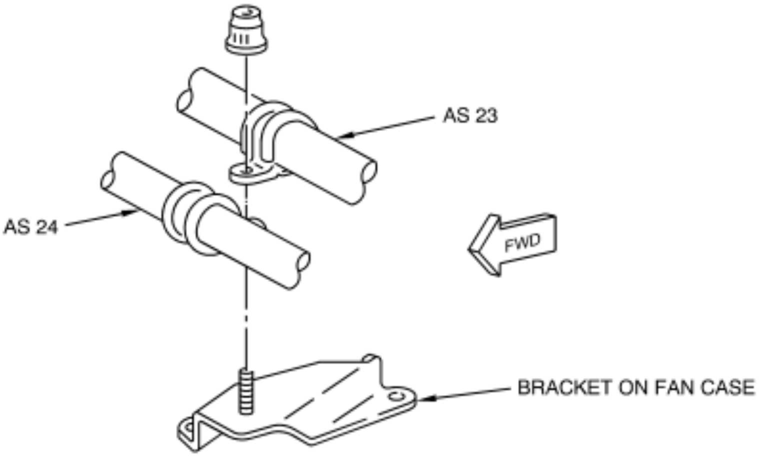
Fan Case Plumbing
Figure 303 (Sheet 2)
(Task 72-00-33-020-003-B)


AS 17
AS 16
BRACKET ON FLANGE B
FWD
VIEW B
AS 23
AS 24
BRACKET ON FLANGE B1
FWD
VIEW C
L-A6695 (0000)
PW V

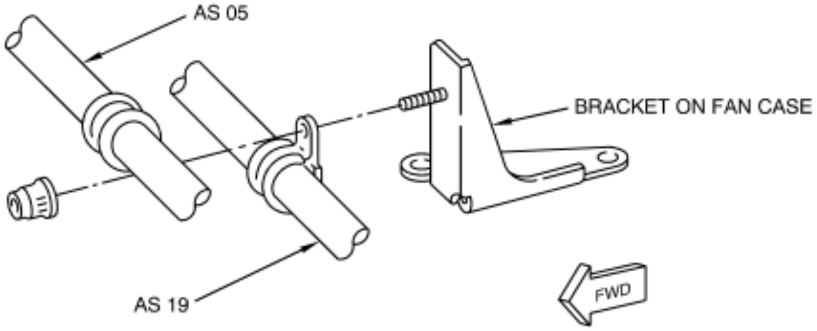
Fan Case Plumbing
Figure 303 (Sheet 3)
(Task 72-00-33-020-003-B)


FWD
BRACKET BETWEEN FLANGES B2 AND C
AS 23
AS 24
BOLT & NUT INSTALLED WITH W2 HARNESS
SECTION D-D
AS 24
AS 23
BRACKET ON FAN CASE
FWD
VIEW E
L—A6696

Fan Case Plumbing
Figure 303 (Sheet 4)
(Task 72-00-33-020-003-B)


AS 23
AS 24
FWD
BRACKET ON FAN CASE

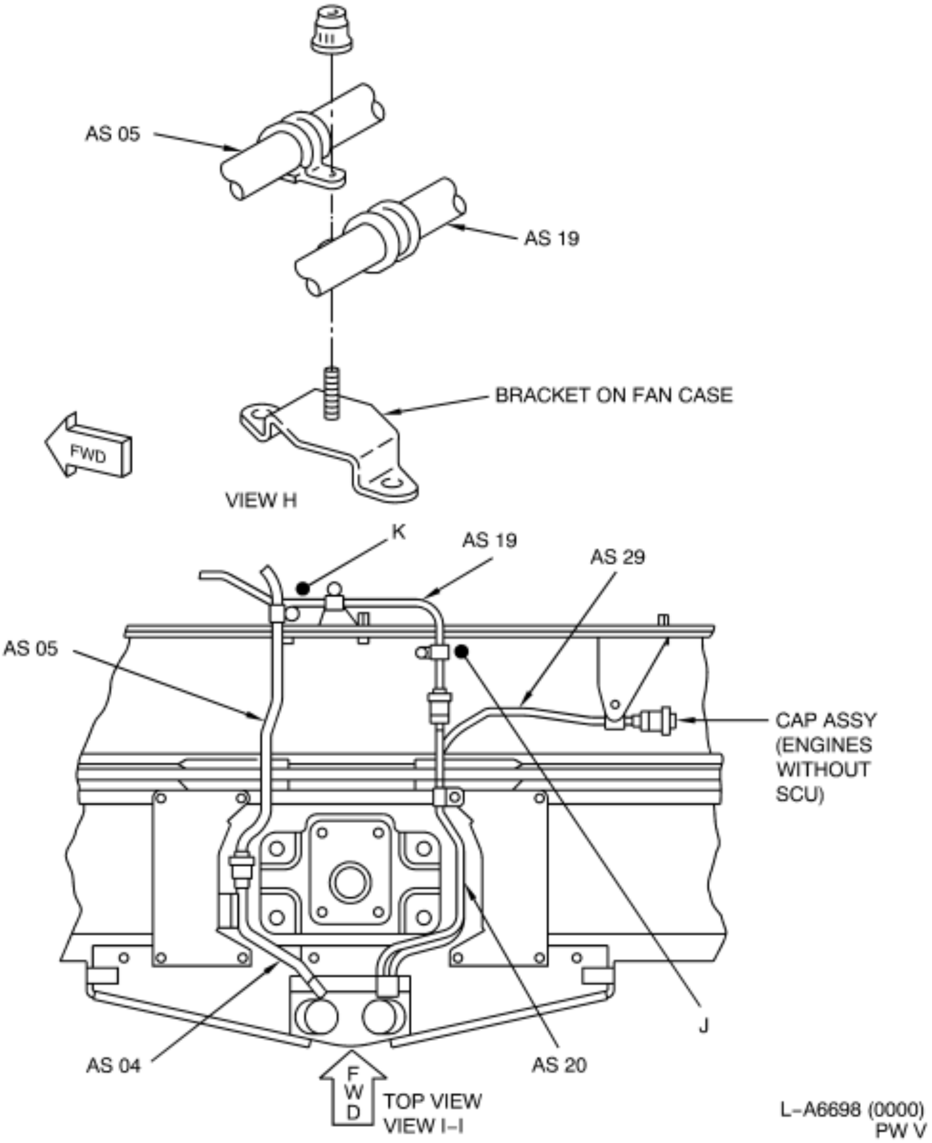
VIEW F


AS 05
BRACKET ON FAN CASE
FWD
AS 19

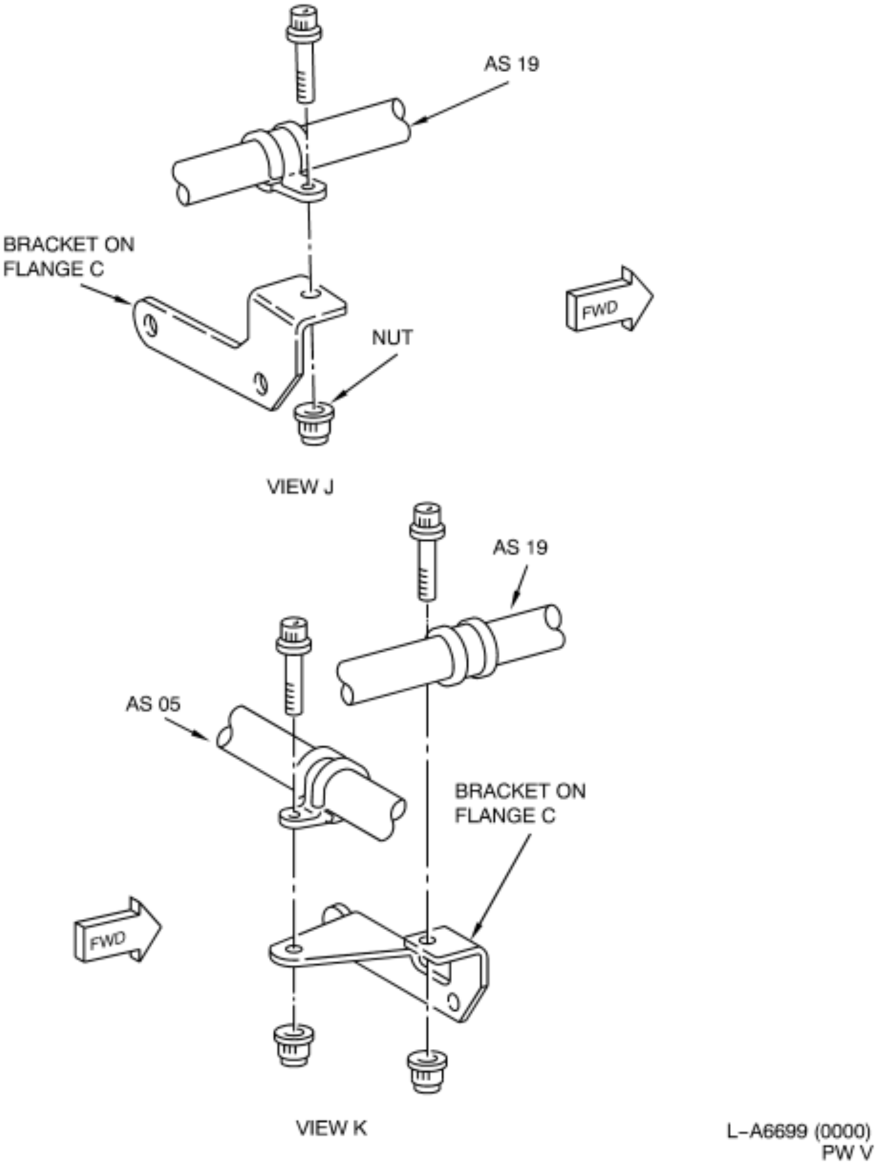
VIEW G

L-A6697 (0000)
PW V

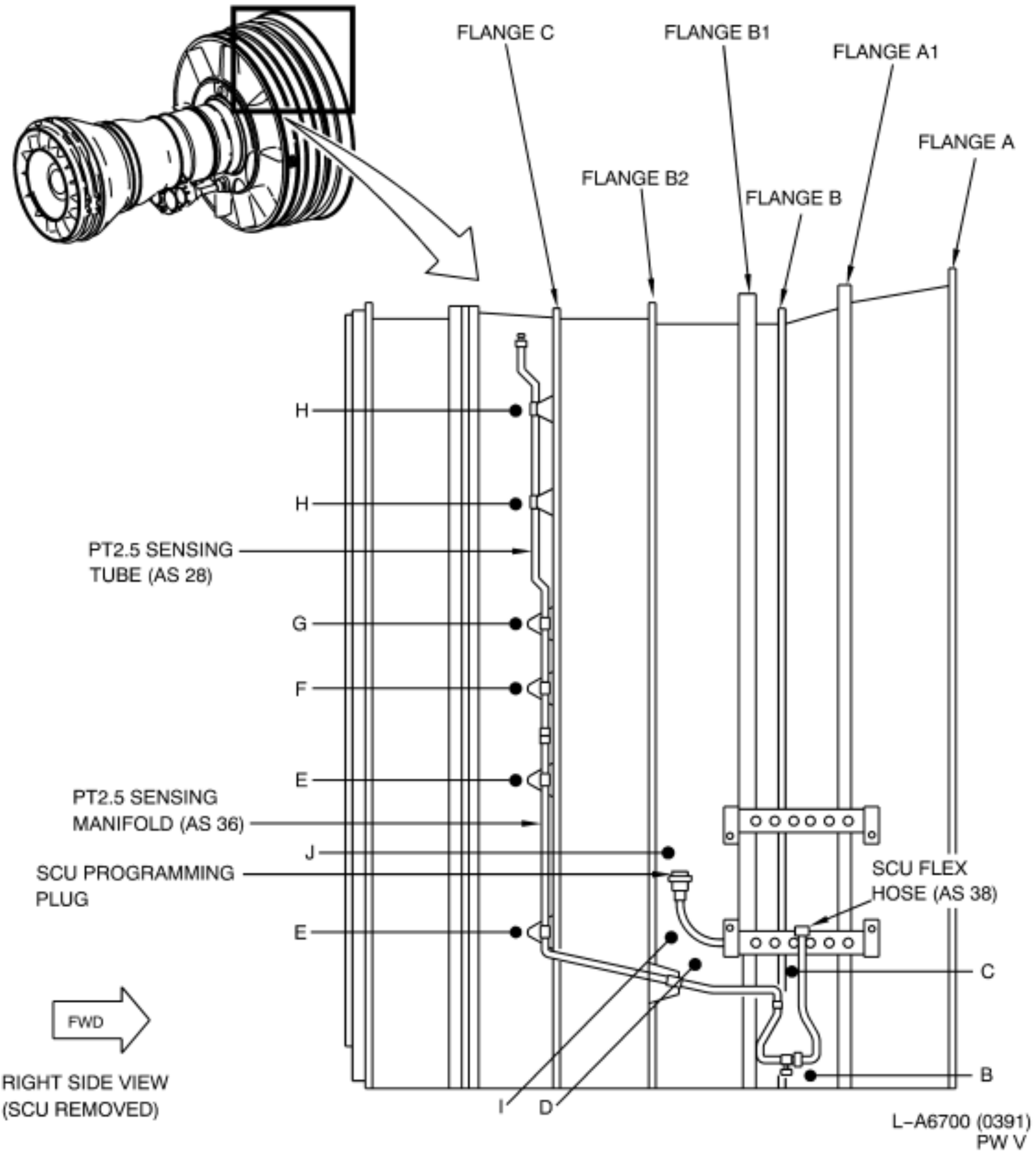
Fan Case Plumbing
Figure 303 (Sheet 5)
(Task 72-00-33-020-003-B)


AS 05
AS 19
BRACKET ON FAN CASE
FWD
VIEW H
K
AS 19
AS 29
AS 05
CAP ASSY (ENGINES WITHOUT SCU)
J
AS 04
AS 20
FWD
TOP VIEW
VIEW I-I
L-A6698 (0000)
PW V

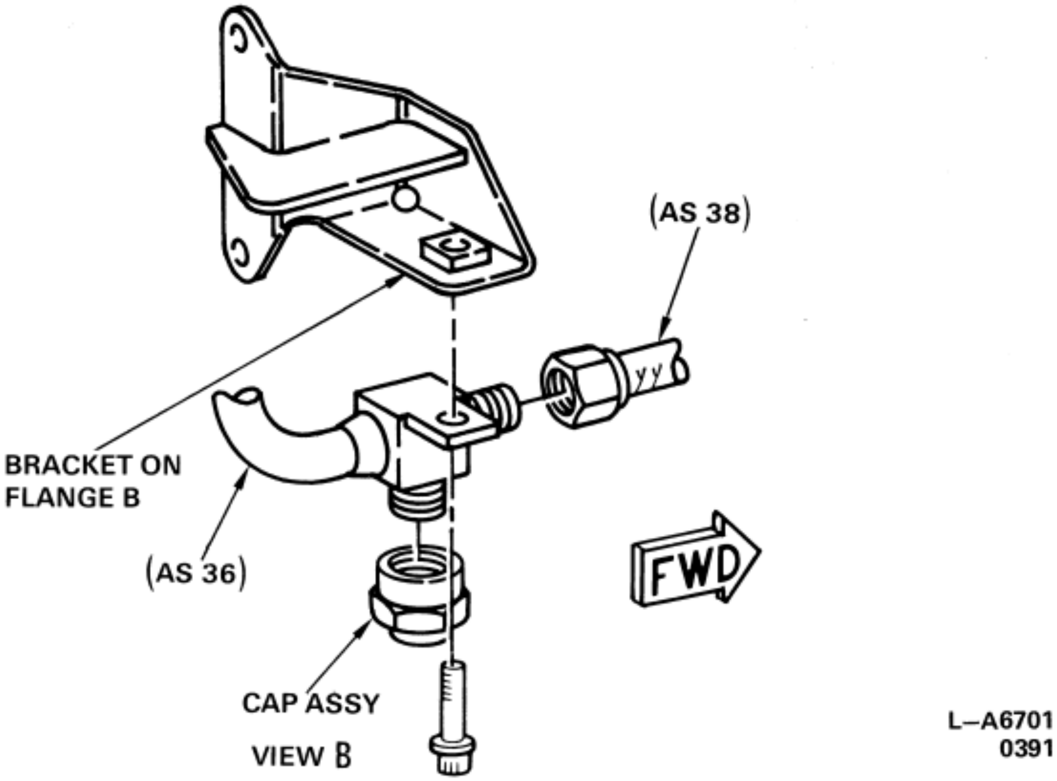
Fan Case Plumbing
Figure 303 (Sheet 6)
(Task 72-00-33-020-003-B)


AS 19
BRACKET ON FLANGE C
NUT
FWD
VIEW J
AS 19
AS 05
BRACKET ON FLANGE C
FWD
VIEW K
L−A6699 (0000)
PW V

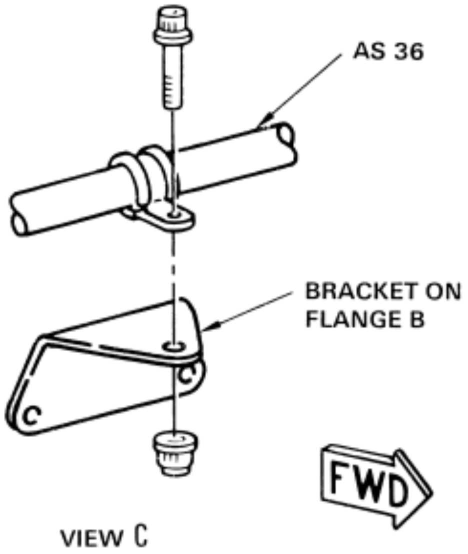
Fan Case Plumbing
Figure 303 (Sheet 7)
(Task 72−00−33−020−003−B)

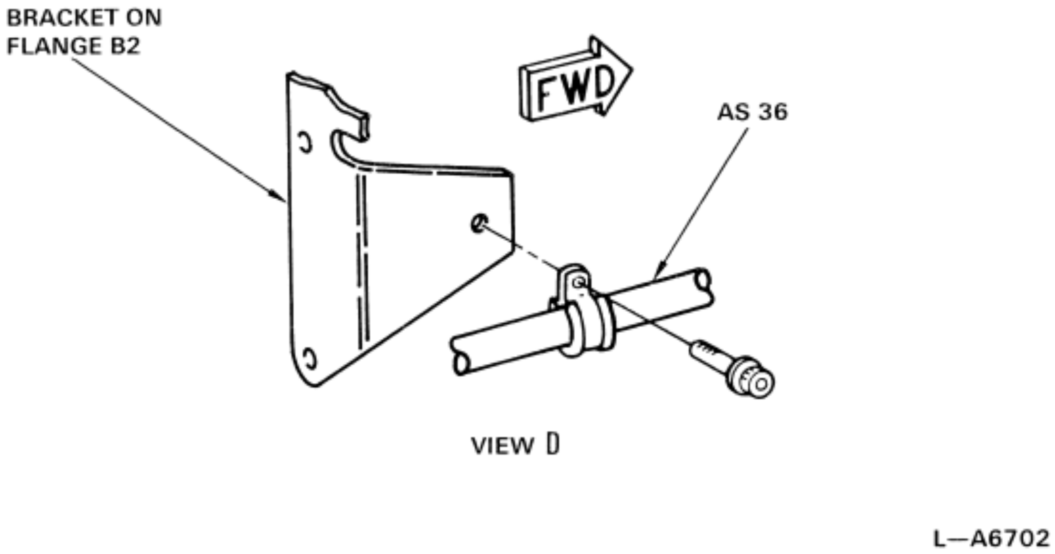

FLANGE C
FLANGE B1
FLANGE A1
FLANGE A
FLANGE B2
FLANGE B
H
H
PT2.5 SENSING TUBE (AS 28)
G
F
E
PT2.5 SENSING MANIFOLD (AS 36)
J
SCU PROGRAMMING PLUG
E
SCU FLEX HOSE (AS 38)
C
B
FWD
RIGHT SIDE VIEW (SCU REMOVED)
I
D
L-A6700 (0391)
PW V

Supplemental Control Unit Plumbing
Figure 304 (Sheet 1)
(Task 72-00-33-020-003-B)

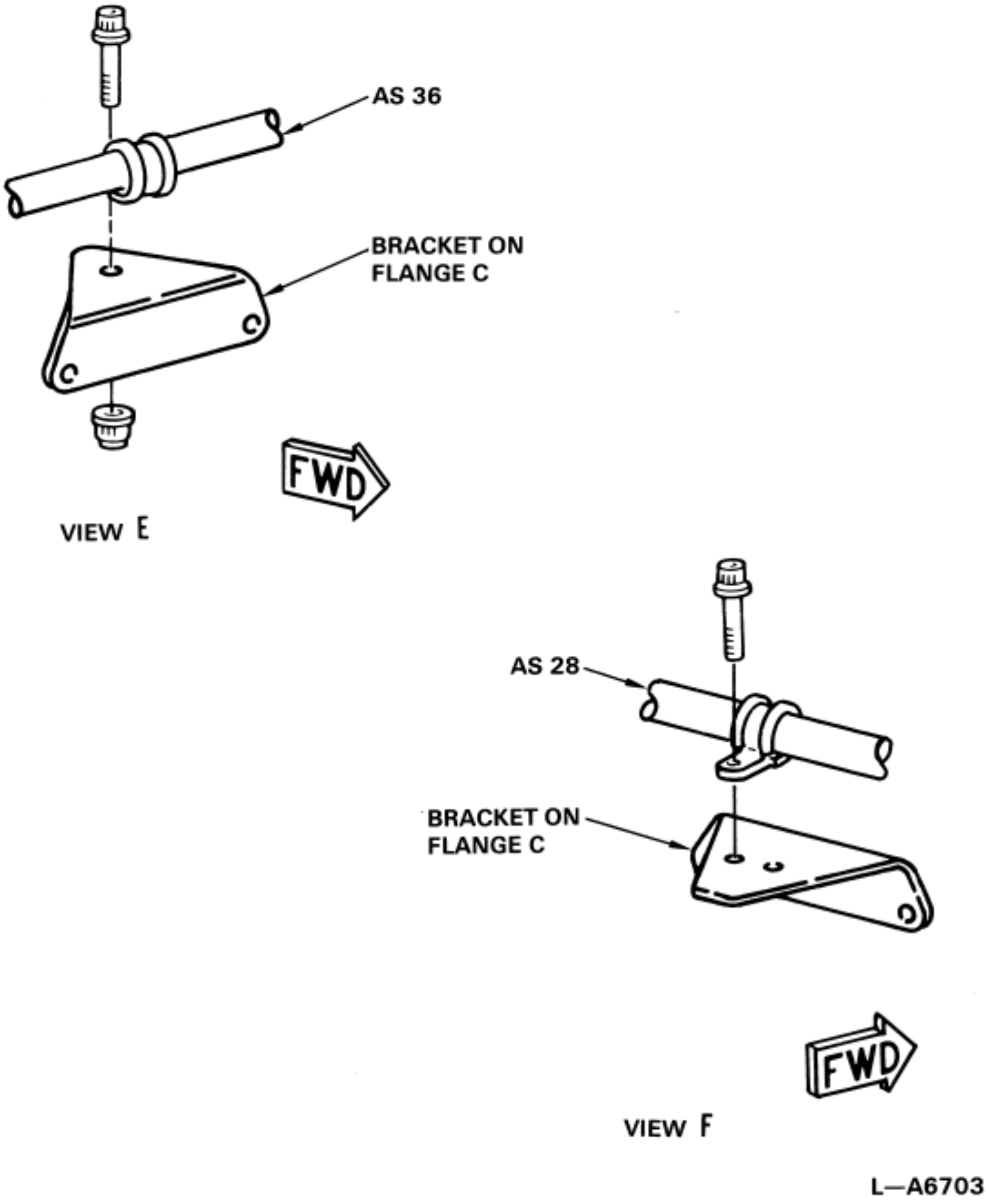

(AS 38)
BRACKET ON FLANGE B
(AS 36)
FWD
CAP ASSY
VIEW B
L−A6701
0391

Supplemental Control Unit Plumbing
Figure 304 (Sheet 2)
(Task 72−00−33−020−003−B)

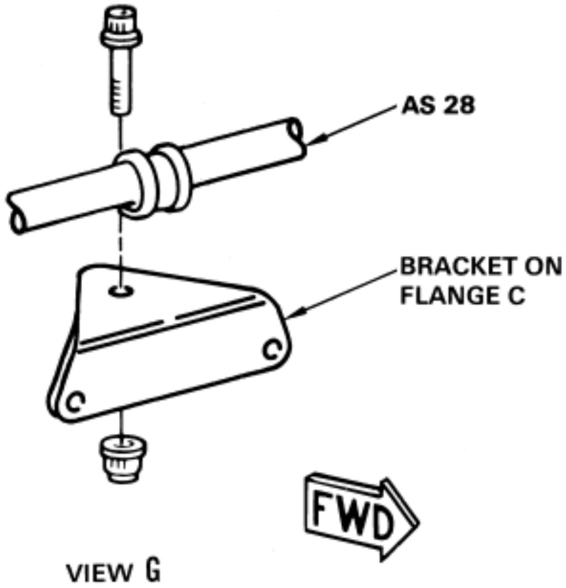

AS 36
BRACKET ON
FLANGE B
FWD
VIEW C

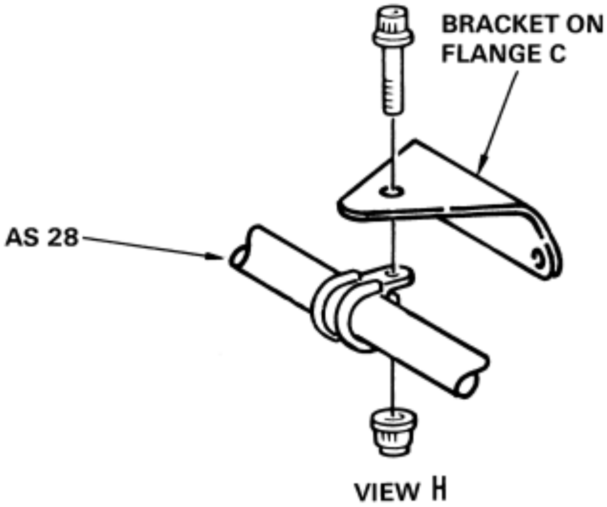

BRACKET ON
FLANGE B2
FWD
AS 36
VIEW D
L—A6702

Supplemental Control Unit Plumbing
Figure 304 (Sheet 3)
(Task 72-00-33-020-003-B)


AS 36
BRACKET ON FLANGE C
FWD
VIEW E
AS 28
BRACKET ON FLANGE C
FWD
VIEW F
L—A6703

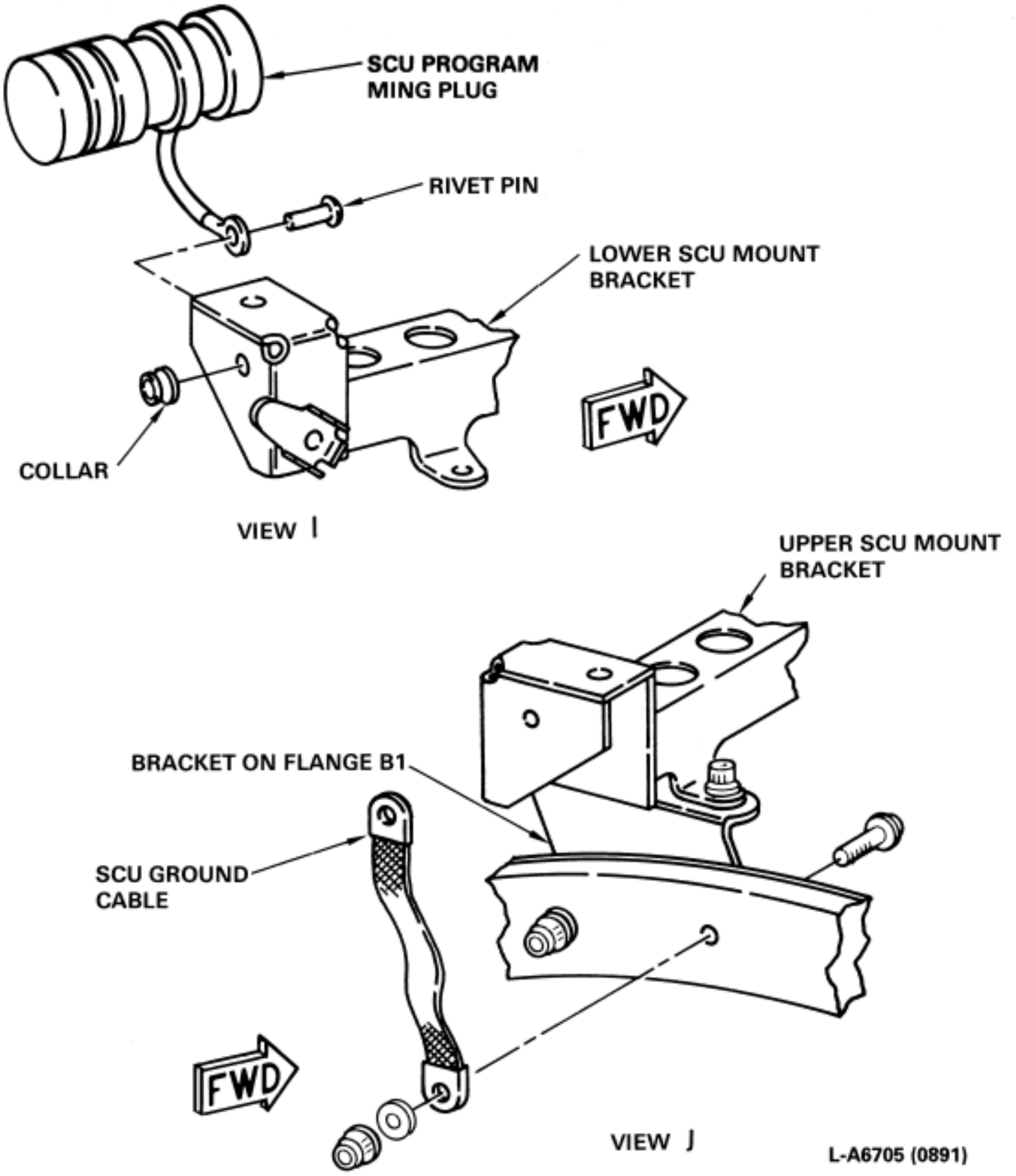
Supplemental Control Unit Plumbing
Figure 304 (Sheet 4)
(Task 72−00−33−020−003−B)


AS 28
BRACKET ON
FLANGE C
FWD
VIEW G


BRACKET ON
FLANGE C
AS 28
VIEW H

L—A6704

Supplemental Control Unit Plumbing
Figure 304 (Sheet 5)
(Task 72-00-33-020-003-B)


SCU PROGRAMMING PLUG
RIVET PIN
LOWER SCU MOUNT BRACKET
FWD
COLLAR
VIEW I
UPPER SCU MOUNT BRACKET
BRACKET ON FLANGE B1
SCU GROUND CABLE
FWD
VIEW J
L-A6705 (0891)

Supplemental Control Unit Plumbing
Figure 304 (Sheet 6)
(Task 72-00-33-020-003-B)

ENGINE GENERAL - FAN CASE - REMOVAL-03

Task 72-00-33-020-002-A:

1. Remove Front Fan Case For Basic Engines

A. Prerequisites

(1) Remove all Stage 1 LPC blade assemblies. See 72-00-31, Removal-04 Task 72-00-31-020-002-002.

(2) Remove electronic engine control. See Removal-04 Task 72-00-33-050-001.

(3) For engines equipped, remove propulsion multiplexer unit. See Removal-09 Task 72-00-33-050-004.

B. Equipment And Materials Required

Special Tools:

PWA 76154	Adapter (2 Necessary)
PWA 76155	Sling
PWA 85450	Stand, Storage/Transport (Optional to PWA 87078)
PWA 85676	Adapter, Lift And Trunnion (2 Necessary) (Optional to PWA 86423)
PWA 85677	Bracket, Handling
PWA 85678	Stand, Support (3 Necessary) (Optional to PWA 87166/PWA 101960)
PWA 85750	Block, Support (4 Necessary) (Optional to PWA 87166/PWA 101960)
PWA 86423	Adapter, Lift And Trunnion (2 Necessary)
PWA 87078	Stand, Storage/Transport
PWA 87166	Stand, Support (3 Necessary)
PWA 101224	Dolly, Support
PWA 101960	Adapter, Support (3 or 4 Necessary)

C. Procedure
See Figure 301.

(1) Remove bolt, nut and washers securing EEC data entry plug lanyard to Flange A1.

(2) Remove bolt and nut securing EEC ground strap to upper front mount bracket.

(3) Remove EEC PT4.95 (AS13) and EEC PB (AS12) flex hose assemblies as follows.

(a) Disconnect hose nuts from manifold tees at approximately 9 o'clock position.

(b) Remove bolt, spacer, nut and clamps securing hoses to Flange B bracket at approximately 9 o'clock position and remove hoses from engine.

(c) Install protective closures.

(4) Remove EEC PT4.95 (AS24) and EEC PB (AS23) manifold assemblies as follows.

(a) Remove lockwire and disconnect tube nuts from manifold couplings rearward of Flange B1 at approximately 11 o'clock position.

(b) Remove bolts, spacer, nuts and clamps securing manifolds to Flanges B and Flange B1 bracket between 9 and 10 o'clock positions.

(c) Remove manifolds from engine and install protective closures.

(5) Remove EEC PT2 (AS16) and EEC PAM (AS17) tube assemblies as follows.

(a) Remove lockwire and disconnect tube nuts from adapters at approximately 12 o'clock position on Flange A1 bracket. Remove lockwire and disconnect tube nuts from tube couplings rearward of Flange B1 at approximately 11 o'clock position.

(b) Remove bolts, nuts and clamps securing tubes to Flange B brackets between 12 and 11 o'clock positions.

(c) Remove bolt, nut and clamps securing tubes to Flange B1 bracket at approximately 11 o'clock position and remove tubes from engine.

(d) Install protective closures.

(6) Remove bolts, nut and clamp securing EEC wiring harness to Flange A1 bracket at approximately 9 o'clock position. Secure EEC wiring harness rearward of Flange B temporarily.

ENGINE GENERAL - FAN CASE - REMOVAL-03

CAUTION: AVOID TWISTING OR SEVERE BENDING OF WIRING HARNESS AT ANYTIME DURING REMOVAL OR DAMAGE TO HARNESS MAY RESULT.

(7) Remove bolt, nut and clamps securing EEC wiring harness to Flange A1 bracket at approximately 1 o'clock position. Secure EEC wiring harnesses rearward of Flange B temporarily.

(8) For engines equipped with propulsion multiplexer unit (PMUX), remove (PMUX) multiplexer data entry plug as follows:

(a) Remove bolt and nut securing plug lanyard to lower front PMUX support bracket on Flange B.

(b) Remove plug.

(9) Install either PWA 86423 or PWA 85676 Adapters at 3 and 9 o'clock of the front fan case. See Figure 304.

NOTE: If you do not store the front fan case, use PWA 85677 Bracket at 12 o'clock on the front flange as an alternative to the adapter and sling. Attach a hoist to the bracket.

(10) Remove the Flange B hardware as follows. Refer to 72-33-00, Disassembly-21 (Task 72-33-00-030-021).

(11) Using fiber mallet, gently tap front fan case to loosen flange.

(12) Remove front fan case from engine. Install PWA 76155 Sling on a hoist. Install two PWA 76154 Adapters on the sling. Install the adapters over the adapters on the front fan case. Install the fan case in either PWA 87078 Stand or PWA 85450 Stand. Remove the hoist, sling, and adapters.

NOTE: As alternatives to storage in the stand, the following two procedures for vertical support of the fan case may be used. See Figure 304.

NOTE: Use three PWA 85678 or PWA 87166 Stands with three PWA 101969 Adapters to support the fan case.

NOTE: Use four PWA 101224 Support Dollys with four PWA 101960 Adapters or PWA 85750 Adapters to support the fan case. The fan case assembly can be moved with this support system.

(13) If new case is to be installed comply with the following:

(a) Remove the Flange A1 hardware as follows. Refer to 72-33-00, Disassembly-20 (Task 72-33-00-030-020).

(14) If the ribs of the duct segment assemblies in the fan case are badly worn, or if the wear is not equal, do an inspection of the duct segment assemblies. See Figure 305. Refer to 72-33-01, Inspection/Check-04 (Task 72-33-01-200-004).

Task 72-00-33-020-002-B:

2. Remove Front Fan Case For Engines With The Airbus/McDonnell Douglas Common Parts Configuration

A. Prerequisites

(1) Remove all the Stage 1 LPC blade assemblies. See 72-00-31, Removal-04 (Task 72-00-31-020-002-002).

(2) Remove the electronic engine control (EEC). See 72-00-33, Removal-04 (Task 72-00-33-050-001).

(3) For engines equipped, remove the supplemental control unit (SCU). See 72-00-33, Removal-13 (Task 72-00-33-050-008).

B. Equipment And Materials Required

Special Tools:

PWA 76154	Adapter (2 Necessary)
PWA 76155	Sling
PWA 85450	Stand, Storage/Transport (Optional to PWA 87078)
PWA 85676	Adapter, Lift And Trunnion (2 Necessary) (Optional to PWA 86423)
PWA 85677	Bracket, Handling
PWA 85678	Stand, Support (3 Necessary) (Optional to PWA 87166/PWA 101960)
PWA 85750	Block, Support (4 Necessary) (Optional to PWA 87166/PWA 101960)
PWA 86423	Adapter, Lift And Trunnion (2 Necessary)

Special Tools:

(CONTINUED)

PWA 87078	Stand, Storage/Transport
PWA 87166	Stand, Support (3 Necessary)
PWA 101960	Adapter, Support (3 Necessary)

C. Procedure
See Figure 306.

NOTE: The ground cable and the programming plug can stay attached to the front upper mount bracket.

(1) Remove the PT2 (AS11), PAM (AS10), PT4.95 (AS13) and PB (AS12) flex hose assemblies.

(a) Disconnect the hose nuts from the manifold tees at a bracket between Flanges A1 and B1 at the 9 o'clock position.

(b) Remove the flex hoses from the engine and install protection covers.

(2) Remove the EEC PB sensing manifold (AS23).

(a) Remove the lockwire and disconnect the tube nut from the manifold assembly at the 10:30 o'clock position.

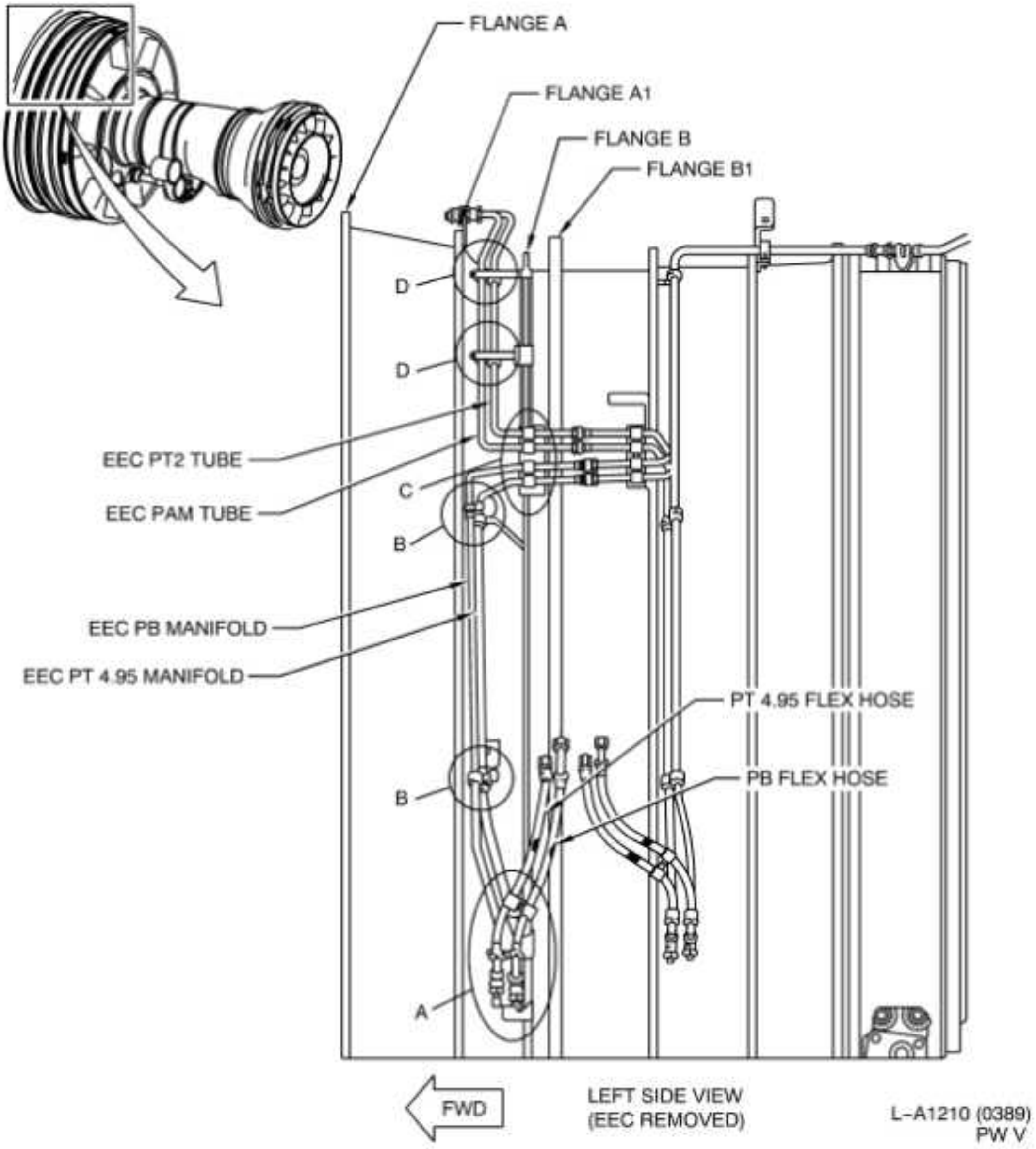
(b) Remove the bolt and clamp that attaches the manifold to a bracket on Flange B1 at the 9 o'clock position.

(c) Remove the bolt, clamp and nut that attach the W2 harness and the (AS23) manifold and the EEC PT4.95 manifold (AS24) to a bracket between (bridged) Flanges B2 and C at the 9:30 o'clock position.

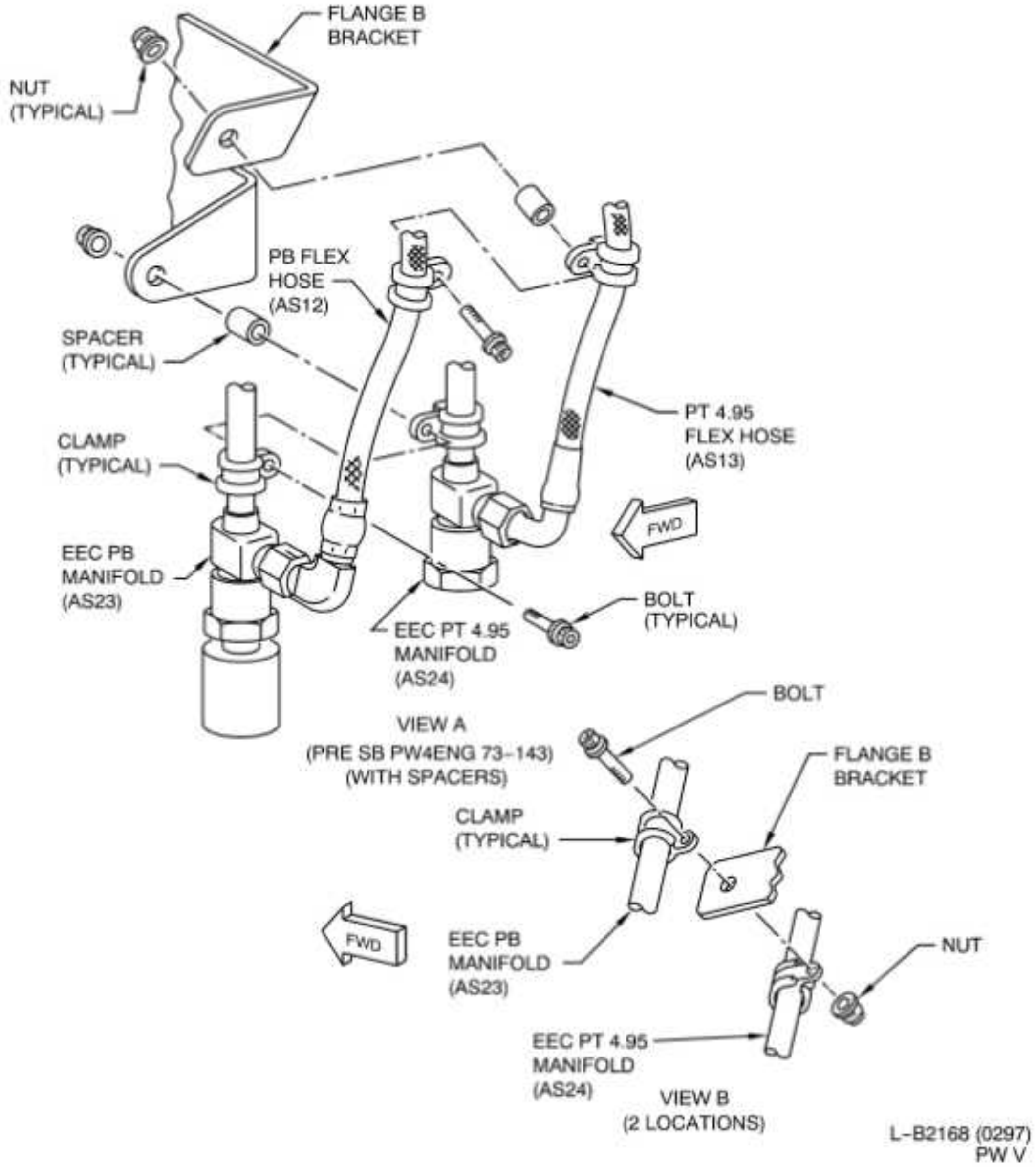
(d) Remove the nuts and clamps that attach the manifold to three brackets (rearward of Flange B2) on the fan case.

(e) Remove the bolt that attaches the tee of the manifold to a bracket between Flanges A1 and B1 at the 9 o'clock position.

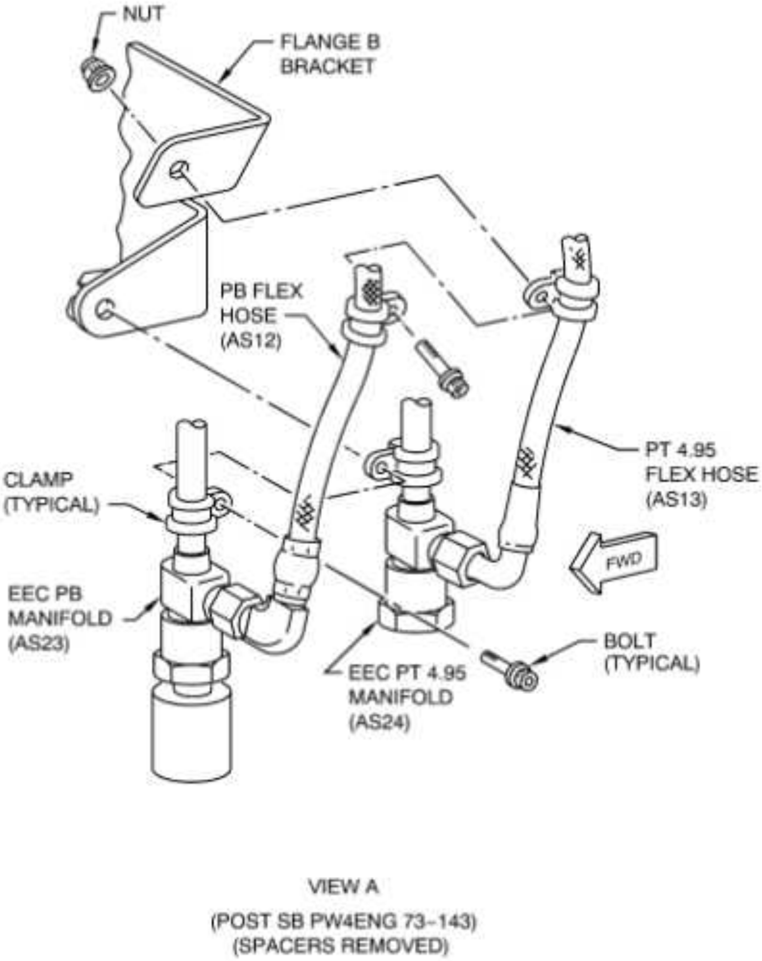
(f) Remove the manifold assembly from the engine and install protection covers.


FLANGE A
FLANGE A1
FLANGE B
FLANGE B1
D
D
EEC PT2 TUBE
EEC PAM TUBE
C
B
EEC PB MANIFOLD
EEC PT 4.95 MANIFOLD
PT 4.95 FLEX HOSE
PB FLEX HOSE
B
A
FWD
LEFT SIDE VIEW
(EEC REMOVED)
L-A1210 (0389)
PW V

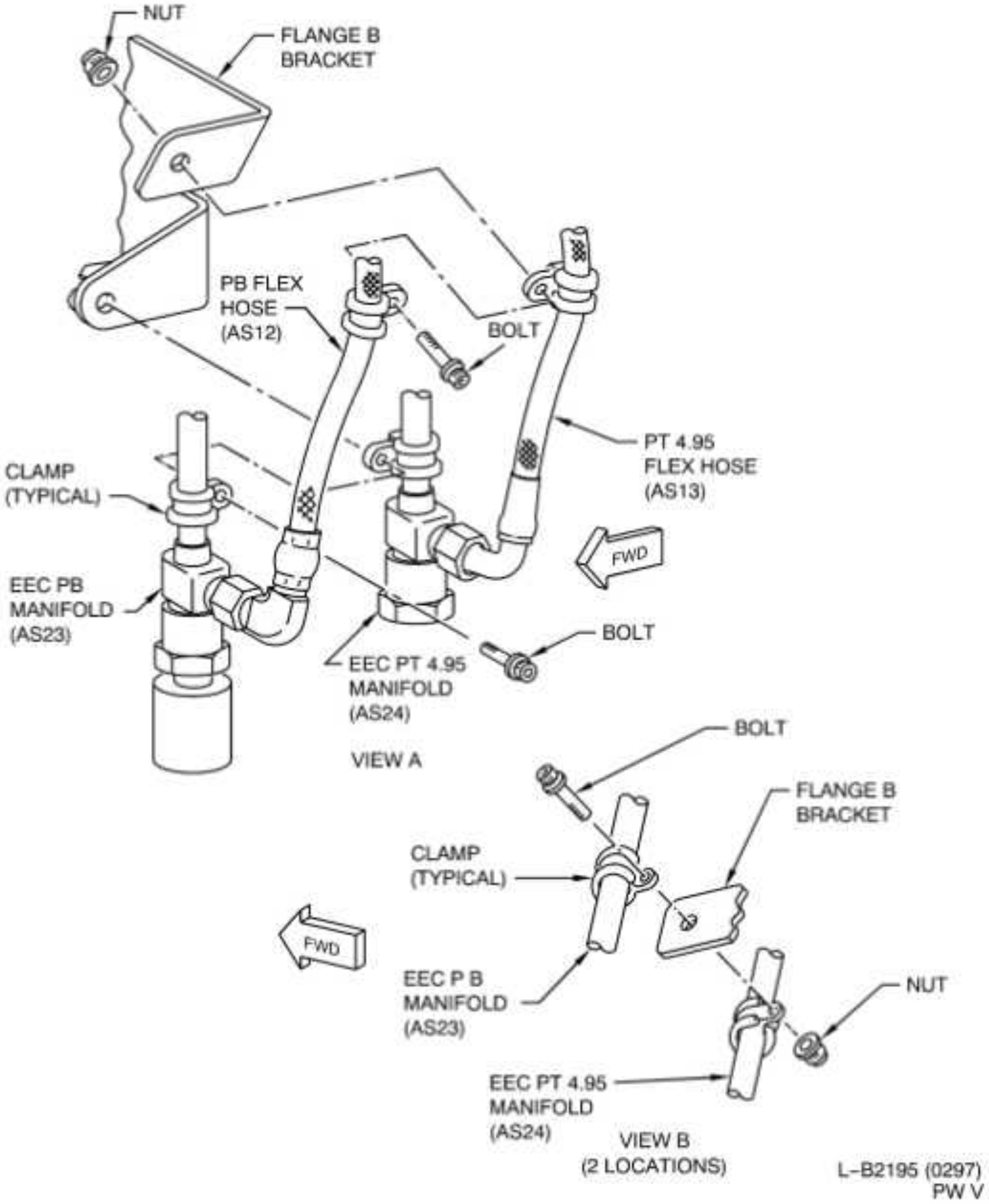
External Plumbing Removal
Figure 301 (Sheet 1)
(Task 72-00-33-020-002-A)


FLANGE B BRACKET
NUT (TYPICAL)
PB FLEX HOSE (AS12)
SPACER (TYPICAL)
PT 4.95 FLEX HOSE (AS13)
CLAMP (TYPICAL)
FWD
EEC PB MANIFOLD (AS23)
BOLT (TYPICAL)
EEC PT 4.95 MANIFOLD (AS24)
VIEW A
(PRE SB PW4ENG 73-143)
(WITH SPACERS)
BOLT
FLANGE B BRACKET
CLAMP (TYPICAL)
FWD
EEC PB MANIFOLD (AS23)
NUT
EEC PT 4.95 MANIFOLD (AS24)
VIEW B
(2 LOCATIONS)
L-B2168 (0297)
PW V

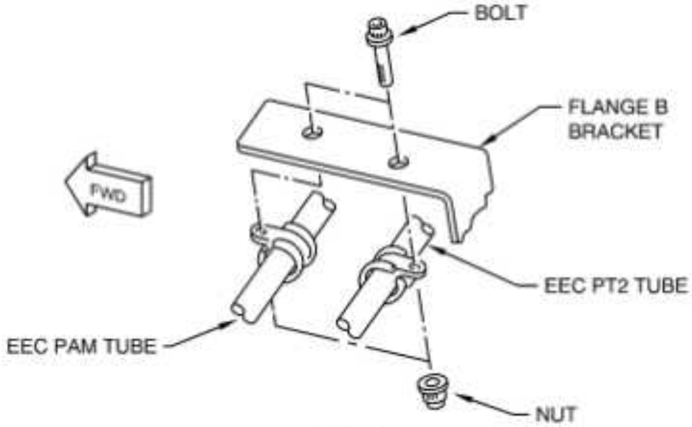
External Plumbing Removal
Figure 301 (Sheet 2)
(Task 72-00-33-020-002-A)


NUT
FLANGE B BRACKET
PB FLEX HOSE (AS12)
PT 4.95 FLEX HOSE (AS13)
CLAMP (TYPICAL)
FWD
EEC PB MANIFOLD (AS23)
BOLT (TYPICAL)
EEC PT 4.95 MANIFOLD (AS24)
VIEW A
(POST SB PW4ENG 73-143)
(SPACERS REMOVED)
L-B2193 (0297)
PW V

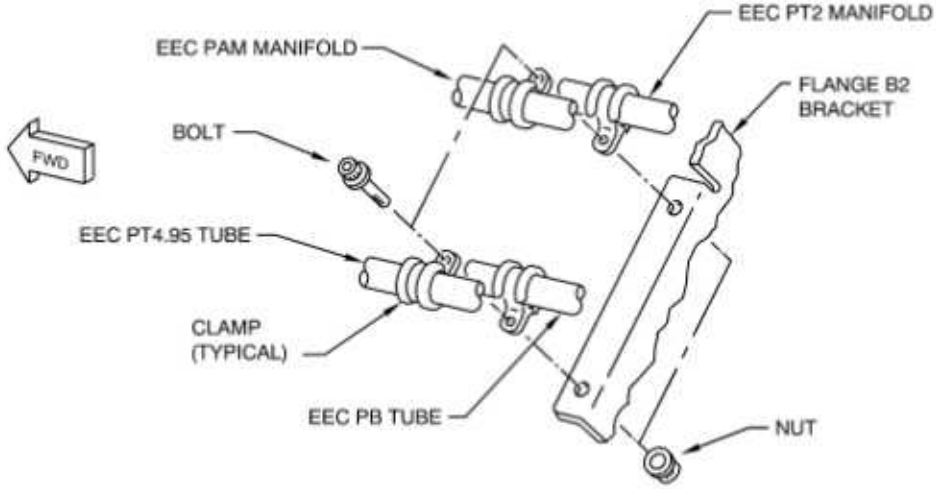
External Plumbing Removal
Figure 301 (Sheet 3)
(Task 72−00−33−020−002−A)


NUT
FLANGE B BRACKET
PB FLEX HOSE (AS12)
BOLT
PT 4.95 FLEX HOSE (AS13)
CLAMP (TYPICAL)
EEC PB MANIFOLD (AS23)
FWD
BOLT
EEC PT 4.95 MANIFOLD (AS24)
VIEW A
BOLT
FLANGE B BRACKET
CLAMP (TYPICAL)
FWD
EEC P B MANIFOLD (AS23)
NUT
EEC PT 4.95 MANIFOLD (AS24)
VIEW B (2 LOCATIONS)
L−B2195 (0297)
PW V

External Plumbing Removal
Figure 301 (Sheet 4)
(Task 72−00−33−020−002−A)


BOLT
FLANGE B
BRACKET
FWD
EEC PT2 TUBE
EEC PAM TUBE
NUT

VIEW C
(2 LOCATIONS)

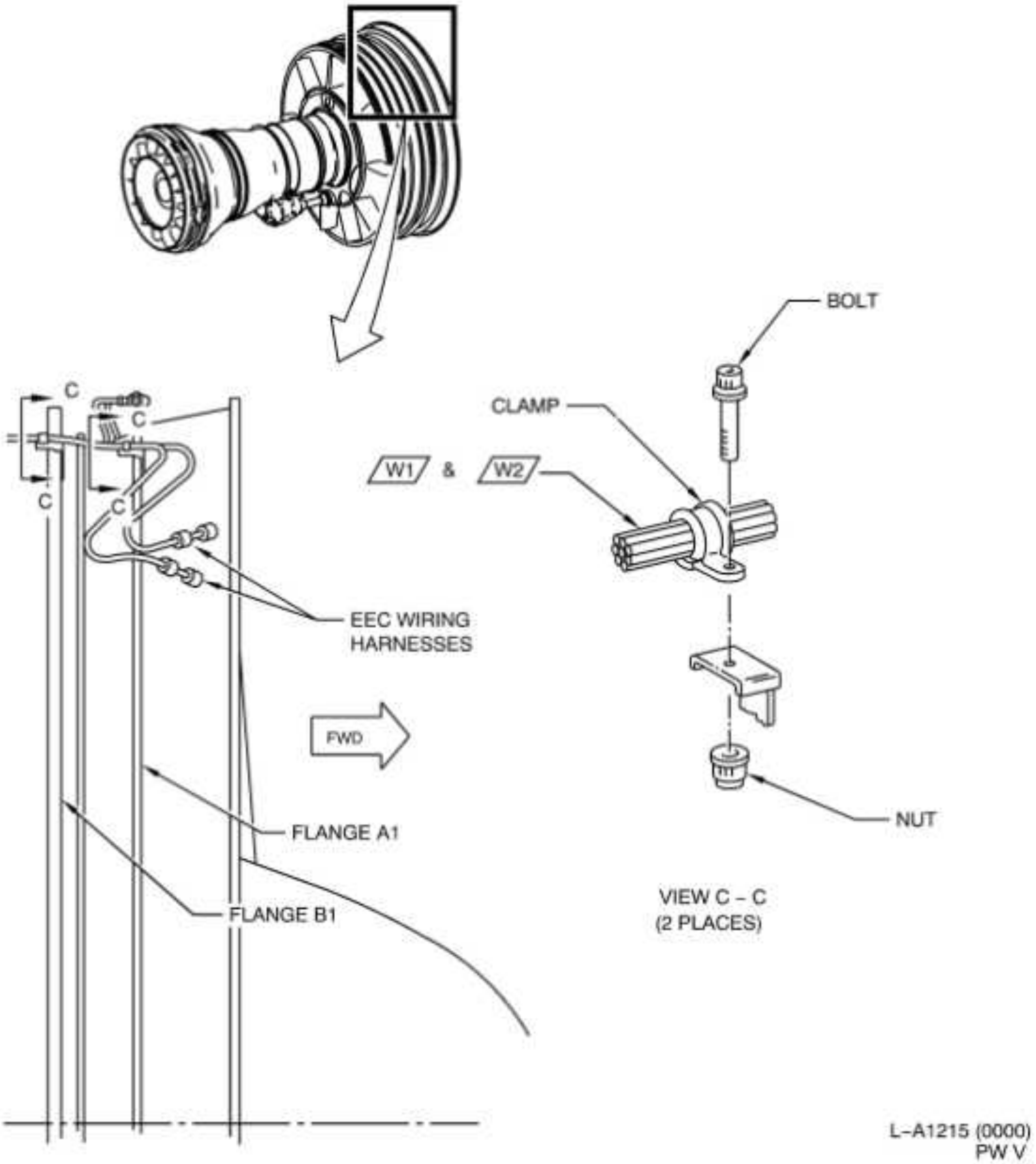

EEC PT2 MANIFOLD
EEC PAM MANIFOLD
FLANGE B2
BRACKET
BOLT
FWD
EEC PT4.95 TUBE
CLAMP
(TYPICAL)
EEC PB TUBE
NUT

VIEW D

L−A1212 (0389)
PW V

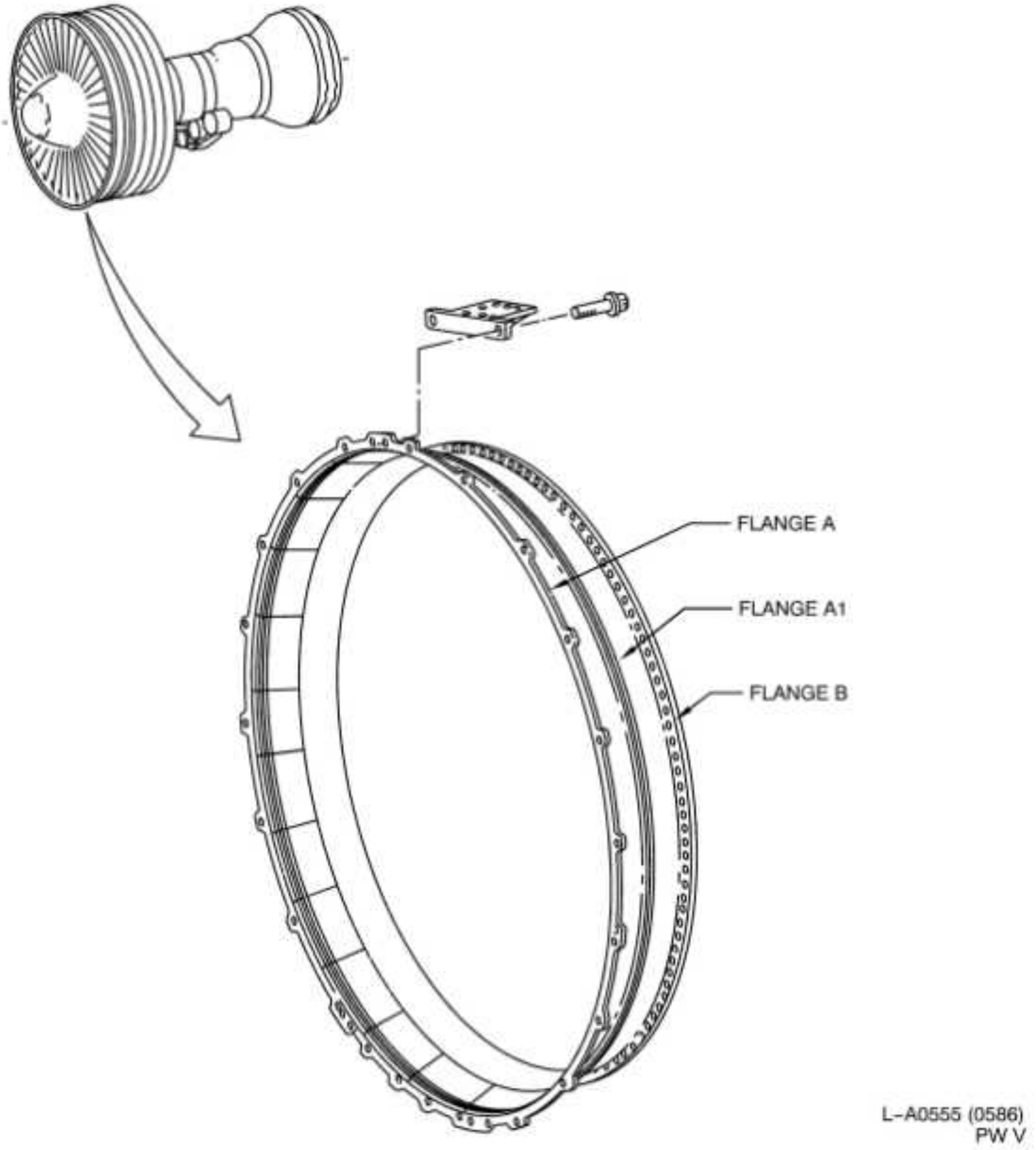
External Plumbing Removal
Figure 301 (Sheet 5)
(Task 72−00−33−020−002−A)

ENGINE GENERAL − FAN CASE − REMOVAL−03

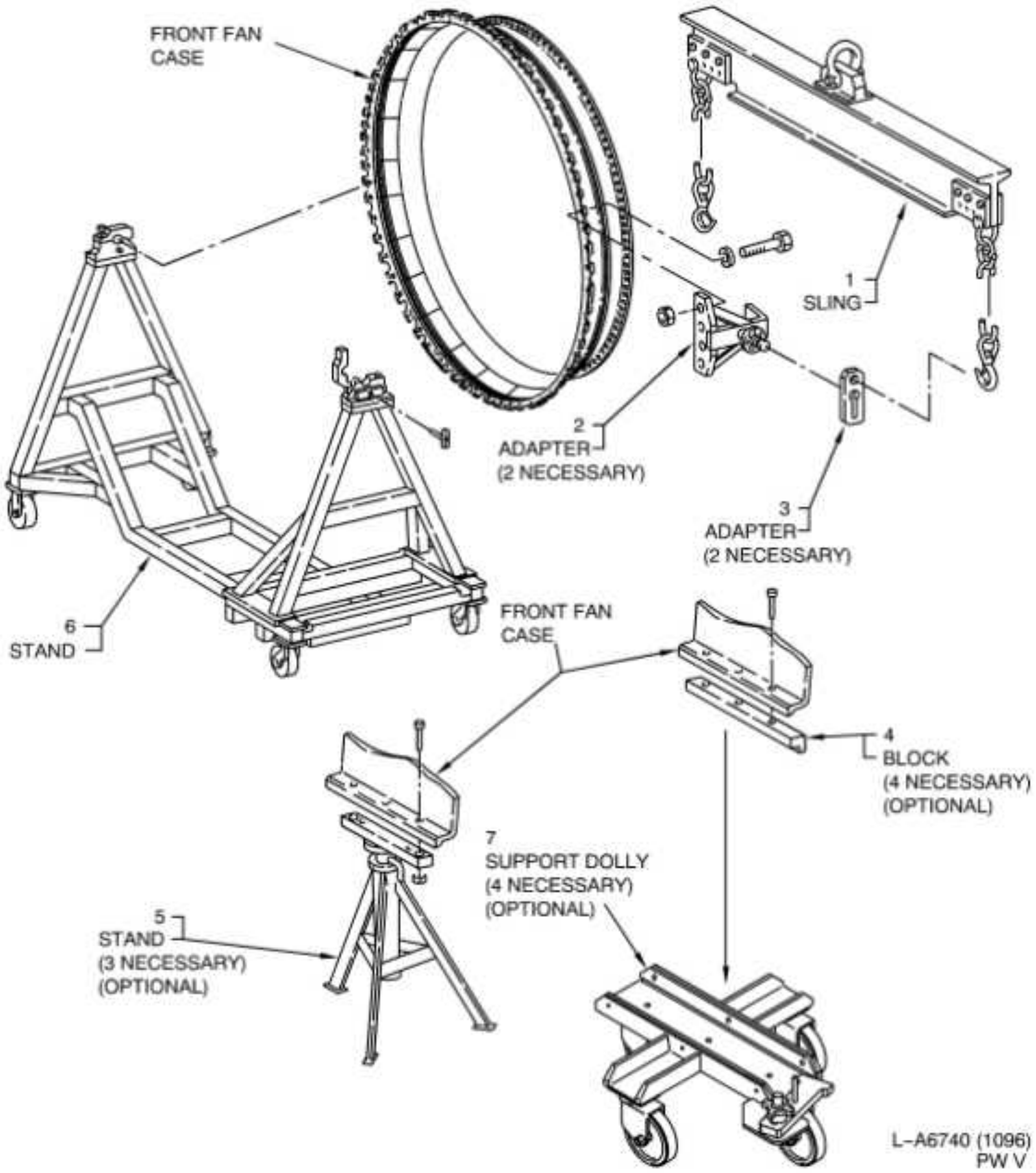

C
C
C
C
BOLT
CLAMP
W1
&
W2
EEC WIRING HARNESSES
FWD
FLANGE A1
FLANGE B1
NUT
VIEW C – C
(2 PLACES)
L−A1215 (0000)
PW V

Wiring Harness Removal
Figure 302
(Task 72−00−33−020−002−A)

ENGINE GENERAL − FAN CASE − REMOVAL−03


FLANGE A
FLANGE A1
FLANGE B
L−A0555 (0586)
PW V

Front Fan Case
Figure 303
(Task 72−00−33−020−002−A)


FRONT FAN CASE
1 SLING
2 ADAPTER (2 NECESSARY)
3 ADAPTER (2 NECESSARY)
6 STAND
FRONT FAN CASE
4 BLOCK (4 NECESSARY) (OPTIONAL)
7 SUPPORT DOLLY (4 NECESSARY) (OPTIONAL)
5 STAND (3 NECESSARY) (OPTIONAL)
L−A6740 (1096)
PW V

Removal Of The Front Fan Case From The Stand
Figure 304
(Task 72−00−33−020−002−A)

1. PWA 76155 Sling
2. PWA 86423 Or PWA 85676 Adapter
3. PWA 76154 Adapter
4. PWA 85750 Or PWA 101960 Adapter Or Block
5. PWA 85678 Or PWA 87166 Stand With PWA 101960 Adapter
6. PWA 87078 Or PWA 85450 Stand
7. PWA 101224 Support Dolly

Key to Figure 304

(3) Remove the EEC PAM manifold assembly (AS17).

(a) Remove the lockwire and disconnect the manifold nut from the bulkhead adapter on a bracket at Flange A1 at the 12 o'clock position.

(b) Remove the bolts and clamps that attach the manifold to seven brackets on Flange B.

(c) Remove the bolt that attaches the tee of the manifold to a bracket located between Flanges A1 and B1 at the 9 o'clock position.

(d) Remove the manifold from the engine and install protection covers.

(4) Remove the EEC PT4.95 sensing manifold assembly (AS24).

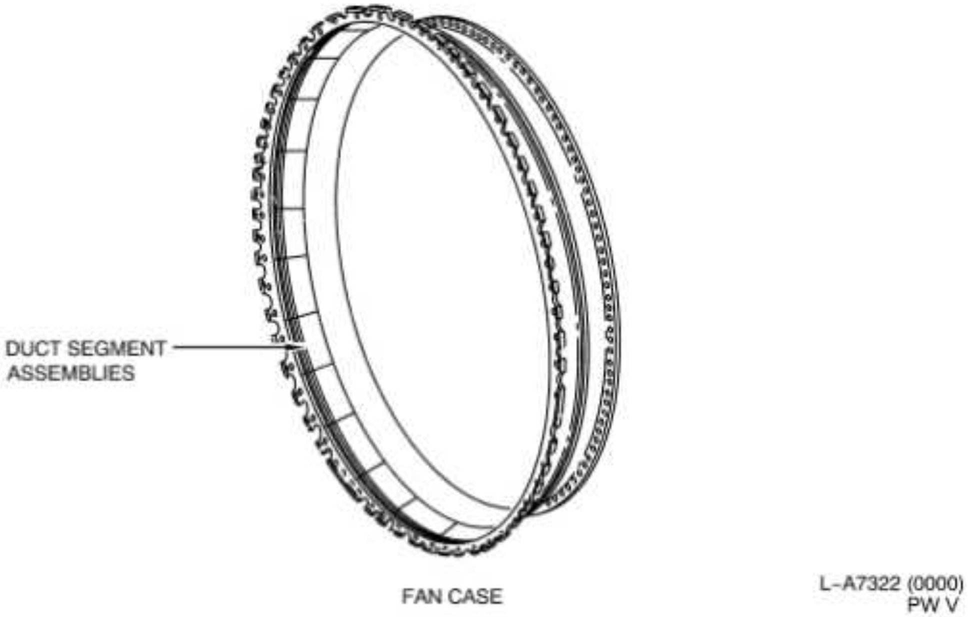
(a) Remove the lockwire and disconnect the tube nut from the manifold assembly at the 10:30 o'clock position.

(b) Remove the bolt and clamp that attaches the manifold to a bracket on Flange B1 at the 9 o'clock position.

(c) Remove the clamps that attach the manifold to three brackets (rearward of Flange B2) on the fan case.

(d) Remove the clamp from the manifold at a bracket located between Flanges B2 and C at the 9:30 o'clock position. (Bolt and nut was previously removed with the (AS23) manifold).

(e) Remove the bolt that attaches the tee of the manifold to a bracket between Flanges A1 and B1 at the 9 o'clock position.


DUCT SEGMENT ASSEMBLIES
FAN CASE
L-A7322 (0000)
PW V

Inspection Of The Ribs Of The Duct Segment Assemblies
Figure 305
(Task 72−00−33−020−002−A)

(f) Remove the manifold assembly from the engine and install protection covers.

(5) Remove the EEC PT2 manifold assembly (AS16).

(a) Remove the lockwire and disconnect the manifold nut from the bulkhead adapter in a bracket on Flange A1 at the 12 o'clock position.

(b) Remove the clamps that attach the manifold to seven brackets on Flange B.

(c) Remove the bolt that attaches the tee of the manifold to a bracket located between Flanges A1 and B1 at the 9 o'clock position.

(d) Remove the manifold from the engine and install protection covers.

(6) For engines equipped with the supplemental control unit (SCU) with multiplexing, remove the PT2.5 sensing manifold assembly (AS38), and PT2.5 sensing manifold assembly (AS36). See Figure 307.

NOTE: The programming plug can stay attached to the rear of the lower SCU mount bracket.

(a) Remove the (AS38) hose from the tee of the (AS36) manifold at the 3 o'clock position. Install protection covers on the hose assembly.

(b) Remove the lockwire and disconnect the tube nut to the coupling of the (AS36) manifold at the 2 o'clock position.

(c) Remove the bolts, nuts and clamps that attach the (AS36) manifold to brackets on Flanges B, B2 and C.

(d) Remove the bolt from the tee of the (AS36) manifold that attaches the manifold to a bracket on Flange B at the 3 o'clock position. Remove the manifold from the engine and install protection covers to the manifold openings.

CAUTION: DO NOT TWIST OR BADLY BEND THE WIRING HARNESS DURING REMOVAL. TWISTING OR BADLY BENDING THE WIRING HARNESS CAN DAMAGE THE WIRING HARNESS.

(7) For engines equipped with the supplemental control unit (SCU) do the following. See Figure 308.

(a) Remove the bolt, washer and nut that attach the SCU ground cable to a bracket on Flange B1. Remove the ground cable. See Figure 307, View F.

(8) Remove the eight bolts and clamps that attach the harness (W12 harness without SCU or W11 harness with SCU) to brackets on Flange A1 approximately at the 1:30 o'clock position. Temporarily attach the wiring harness rearward of Flange B.

(9) Remove the nut and clamp that attach the W2 harness to a bracket on Flange A1 at the 9:30 o'clock position. Temporarily attach the wiring harness rearward of Flange B.

(10) Install either PWA 86423 or PWA 85676 Adapters at the 3 and 9 o'clock positions on the front fan case. See Figure 309 and Figure 311.

NOTE: If you do not store the front fan case, use PWA 85677 Bracket at 12 o'clock on the front flange as an alternative to the adapters and sling. Attach a hoist to the bracket.

(11) Remove the Flange B hardware as follows. Refer to 72-33-00, Disassembly-21 (Task 72-33-00-030-021).

(12) Carefully tap the front fan case with a fiber mallet to loosen the flange.

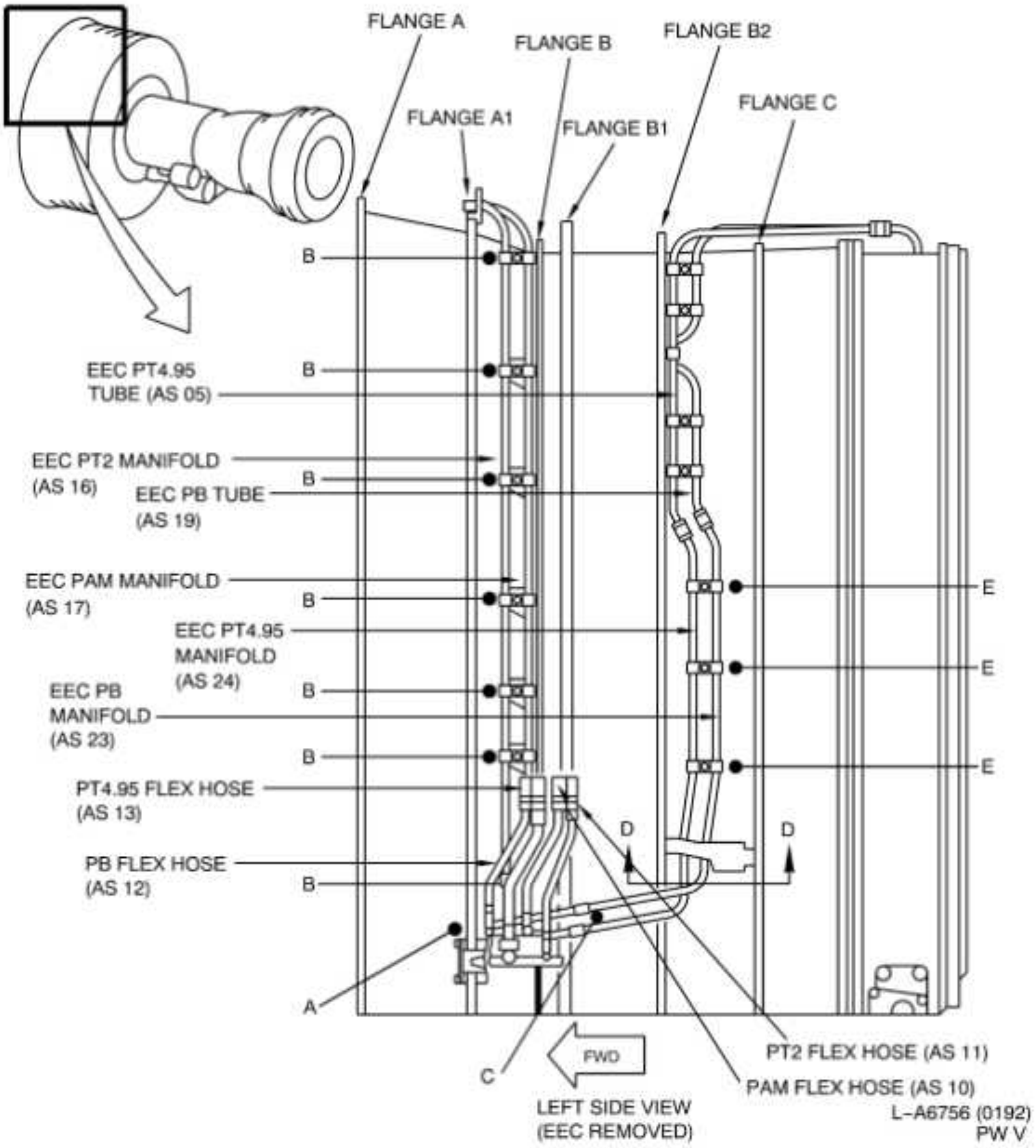
(13) Remove the front fan case from the engine. Install PWA 76155 Sling on a hoist. Install two PWA 76154 Adapters on the sling. Install the adapters over the adapters on the front fan case. Install the fan case in either PWA 87078 or PWA 85450 Stand. Remove the hoist, sling and adapters.

NOTE: As an alternative to the storage stand, it is permitted to store the front fan case on four PWA 85750 Support Blocks, on three PWA 85678Stands, on three PWA 87166 Stands with PWA 101960 Adapters, or on a pallet.

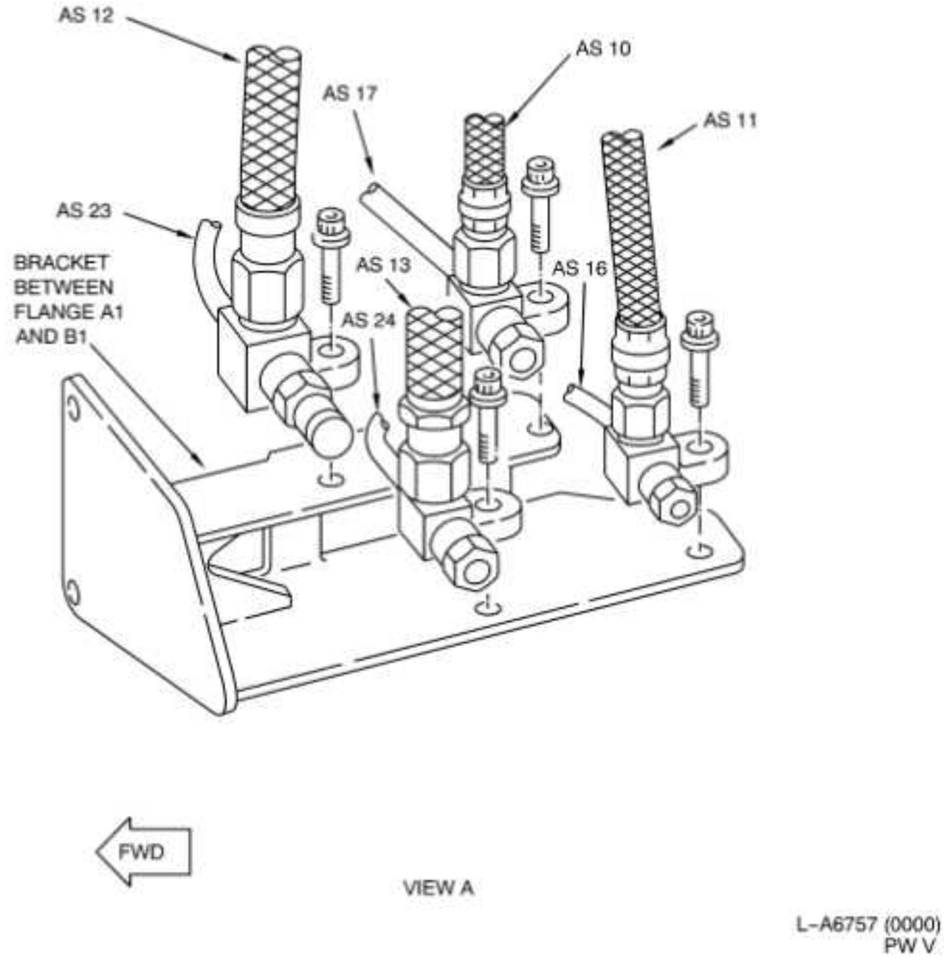
(14) If a new case is to be installed comply with the following:

   (a) Remove the Flange A1 hardware as follows. Refer to 72−33−00, Disassembly−20 (Task 72−33−00−030−020).

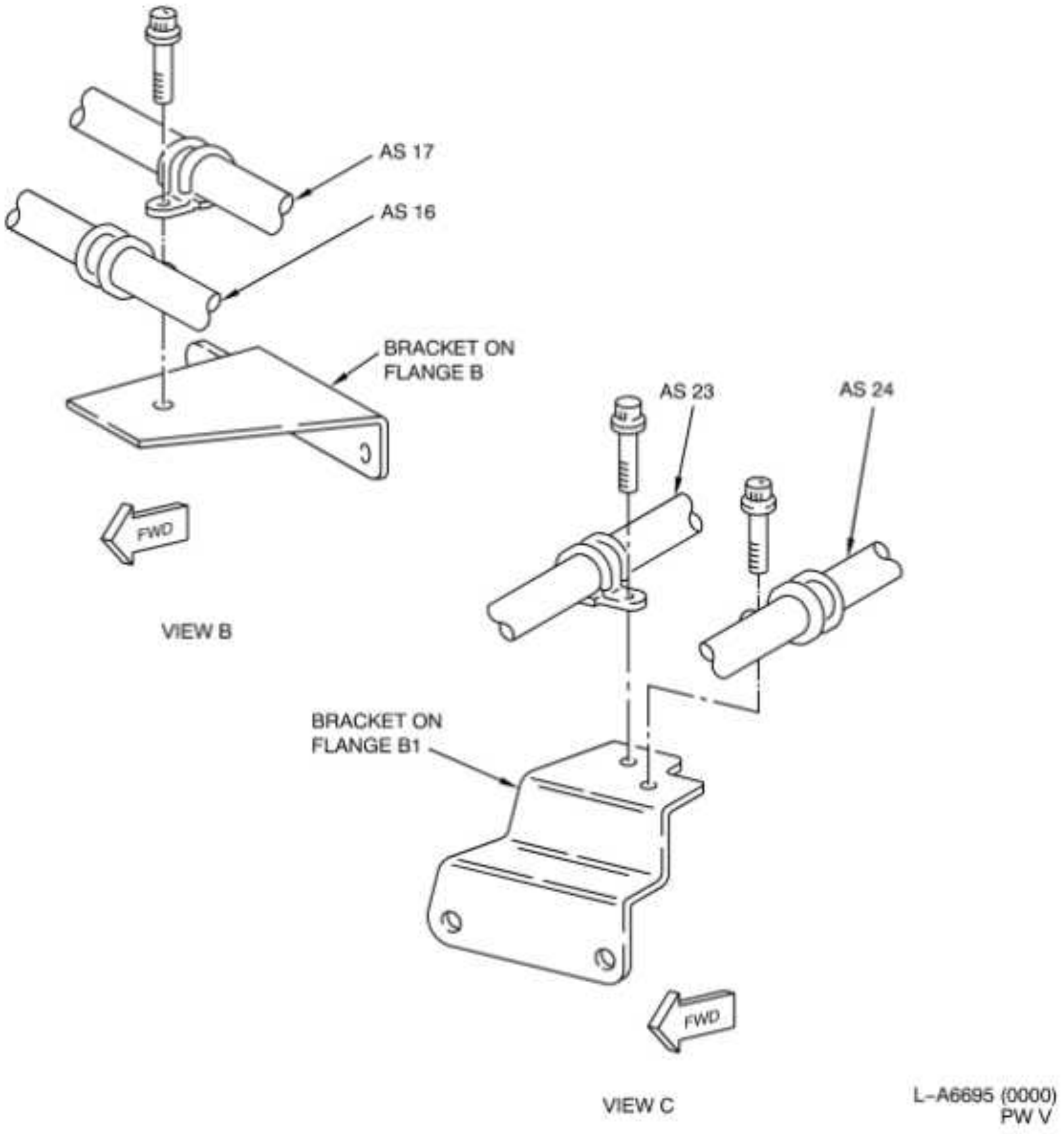
(15) If the ribs of the duct segment assemblies in the fan case are badly worn, or if the wear is not equal, do an inspection of the duct segment assemblies. See Figure 311. Refer to 72−33−01, Inspection/Check−04 Task 72−33−01−200−004.


FLANGE A
FLANGE B
FLANGE B2
FLANGE A1
FLANGE B1
FLANGE C
B
EEC PT4.95 TUBE (AS 05)
EEC PT2 MANIFOLD (AS 16)
EEC PB TUBE (AS 19)
EEC PAM MANIFOLD (AS 17)
EEC PT4.95 MANIFOLD (AS 24)
EEC PB MANIFOLD (AS 23)
PT4.95 FLEX HOSE (AS 13)
PB FLEX HOSE (AS 12)
E
D
A
C
FWD
PT2 FLEX HOSE (AS 11)
PAM FLEX HOSE (AS 10)
LEFT SIDE VIEW (EEC REMOVED)
L-A6756 (0192)
PW V

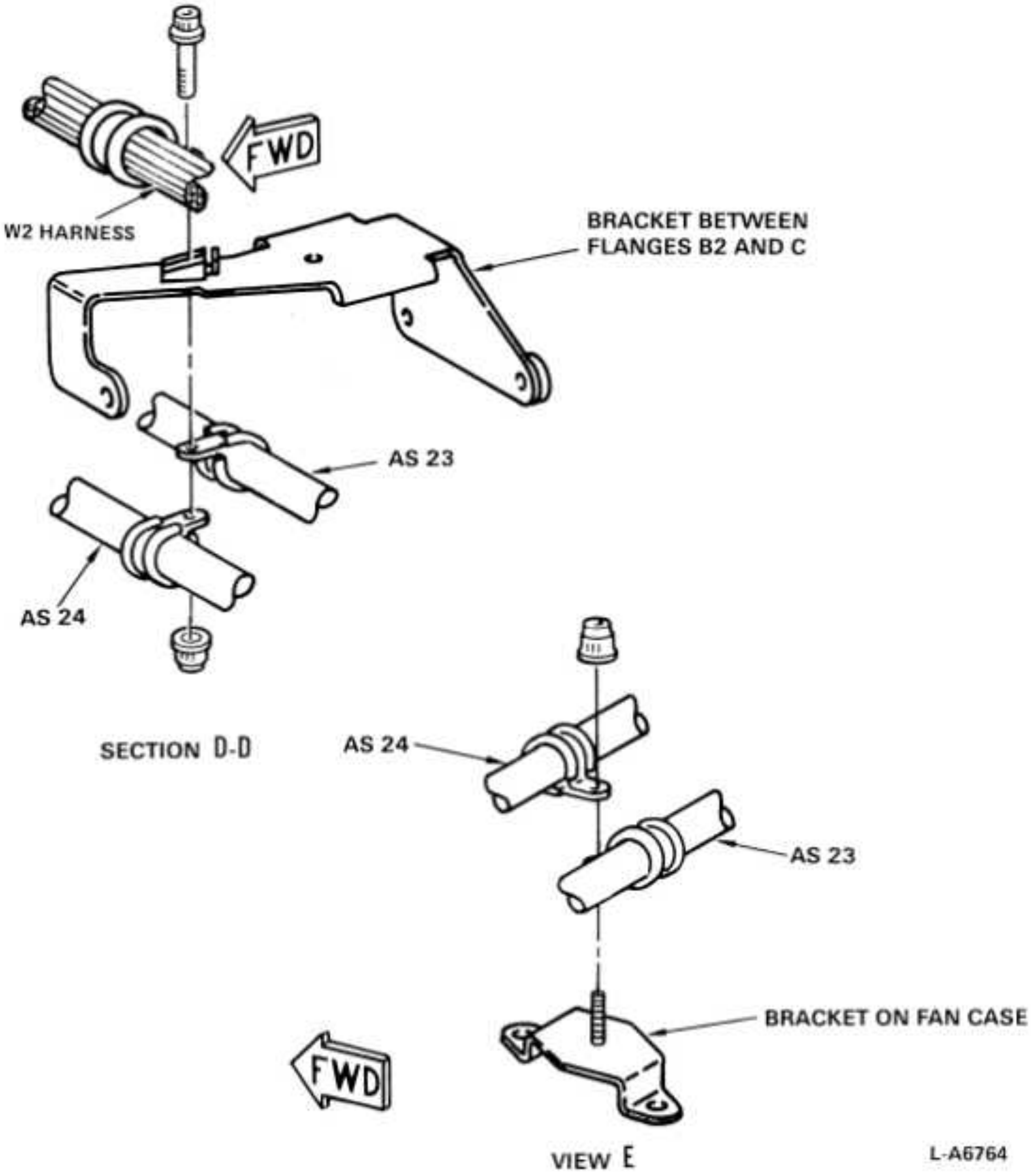
External Plumbing Removal
Figure 306 (Sheet 1)
(Task 72-00-33-020-002-B)


AS 12
AS 10
AS 17
AS 11
AS 23
BRACKET BETWEEN FLANGE A1 AND B1
AS 13
AS 16
AS 24
FWD
VIEW A
L-A6757 (0000)
PW V

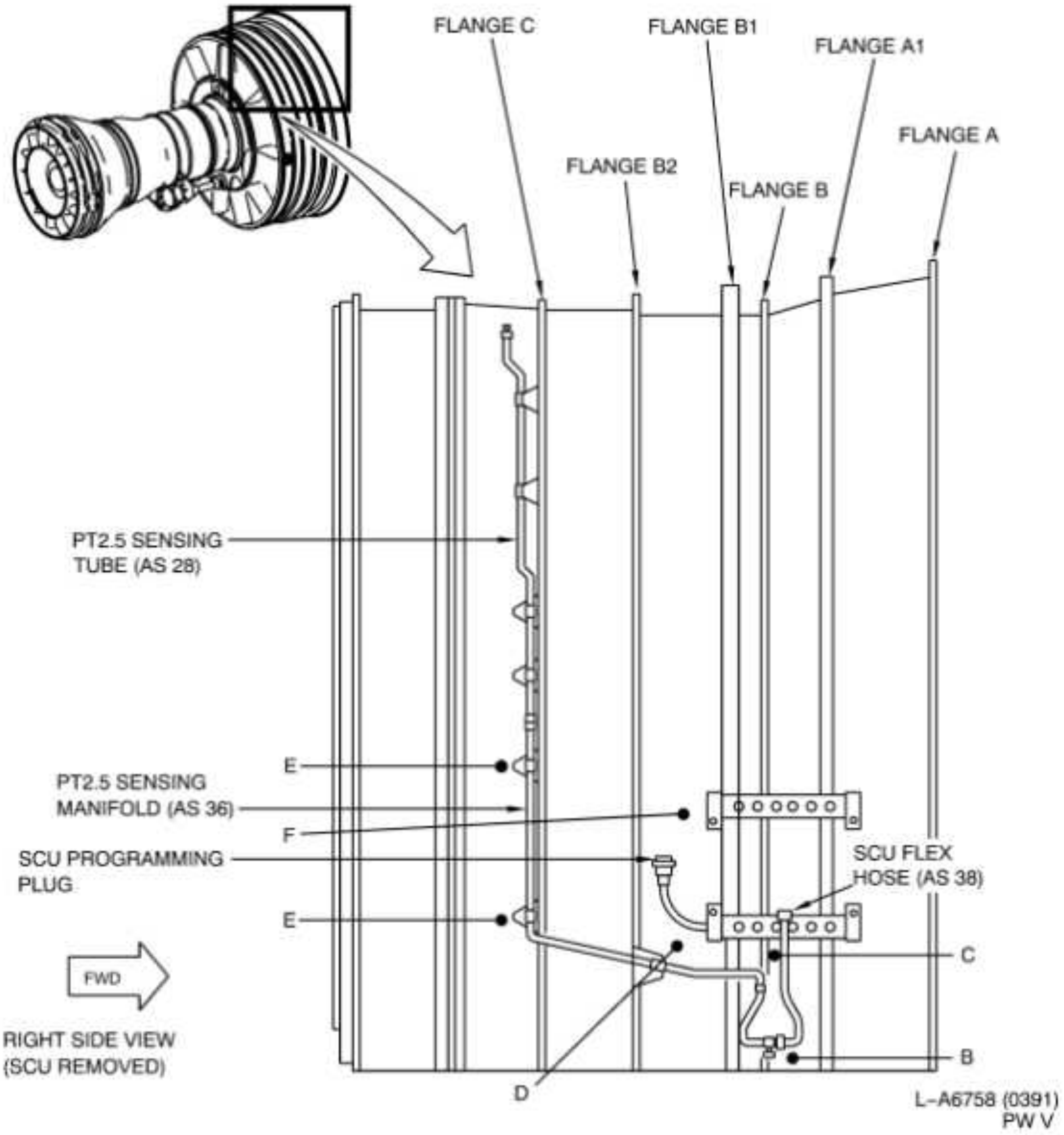
External Plumbing Removal
Figure 306 (Sheet 2)
(Task 72-00-33-020-002-B)


AS 17
AS 16
BRACKET ON FLANGE B
FWD
VIEW B
AS 23
AS 24
BRACKET ON FLANGE B1
FWD
VIEW C
L−A6695 (0000)
PW V

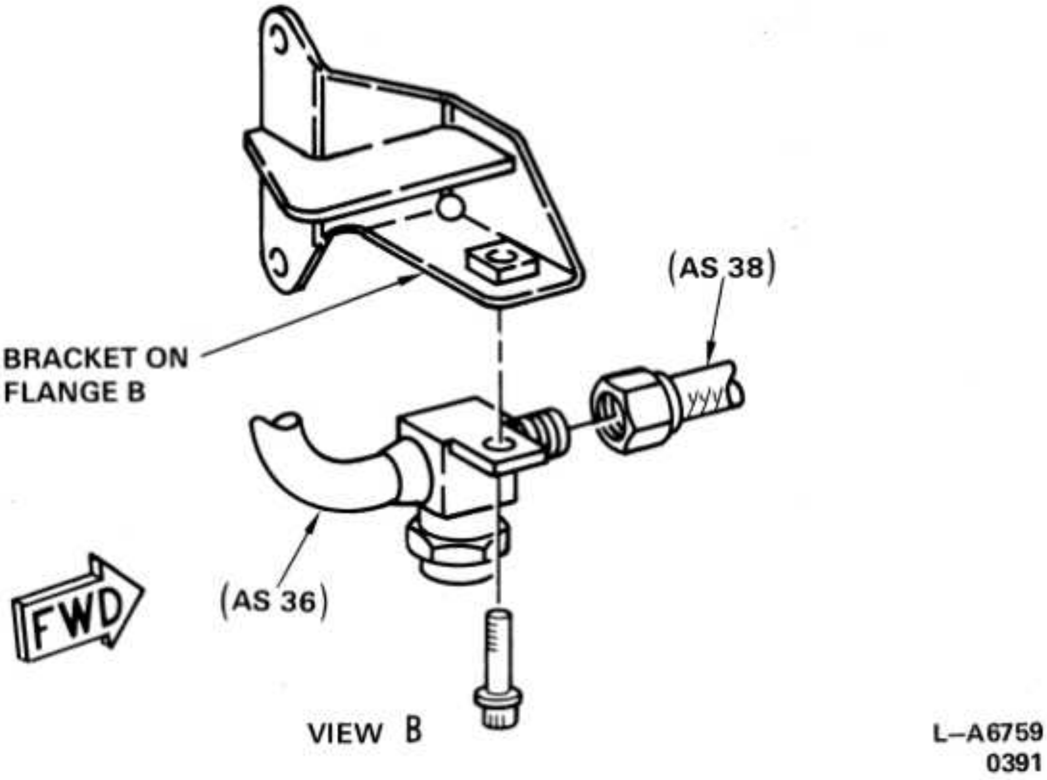
External Plumbing Removal
Figure 306 (Sheet 3)
(Task 72−00−33−020−002−B)


FWD
W2 HARNESS
BRACKET BETWEEN FLANGES B2 AND C
AS 23
AS 24
SECTION D-D
AS 24
AS 23
BRACKET ON FAN CASE
FWD
VIEW E
L-A6764

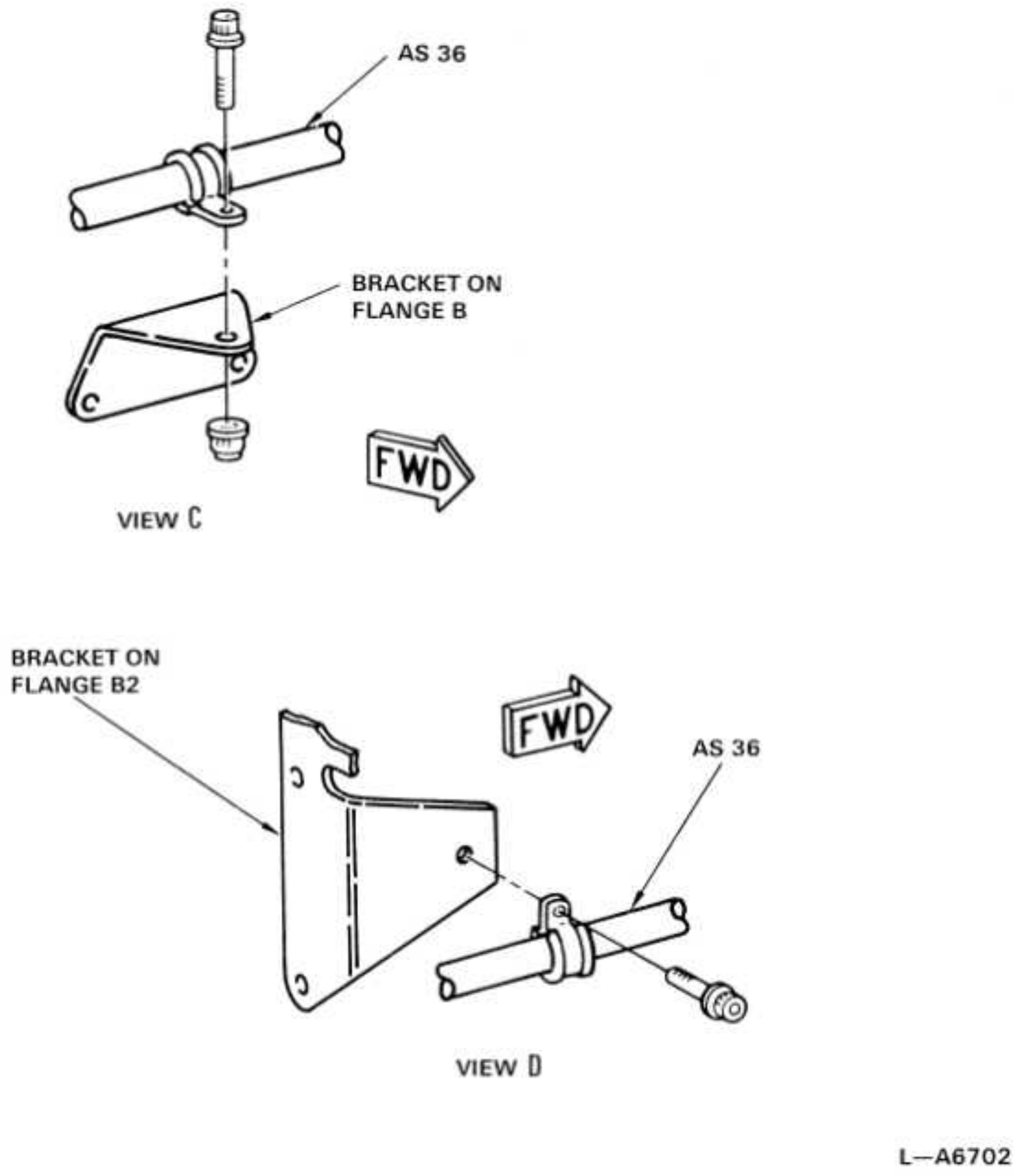
External Plumbing Removal
Figure 306 (Sheet 4)
(Task 72−00−33−020−002−B)


FLANGE C
FLANGE B1
FLANGE A1
FLANGE A
FLANGE B2
FLANGE B
PT2.5 SENSING TUBE (AS 28)
E
PT2.5 SENSING MANIFOLD (AS 36)
F
SCU PROGRAMMING PLUG
SCU FLEX HOSE (AS 38)
E
C
FWD
B
RIGHT SIDE VIEW (SCU REMOVED)
D
L-A6758 (0391)
PW V

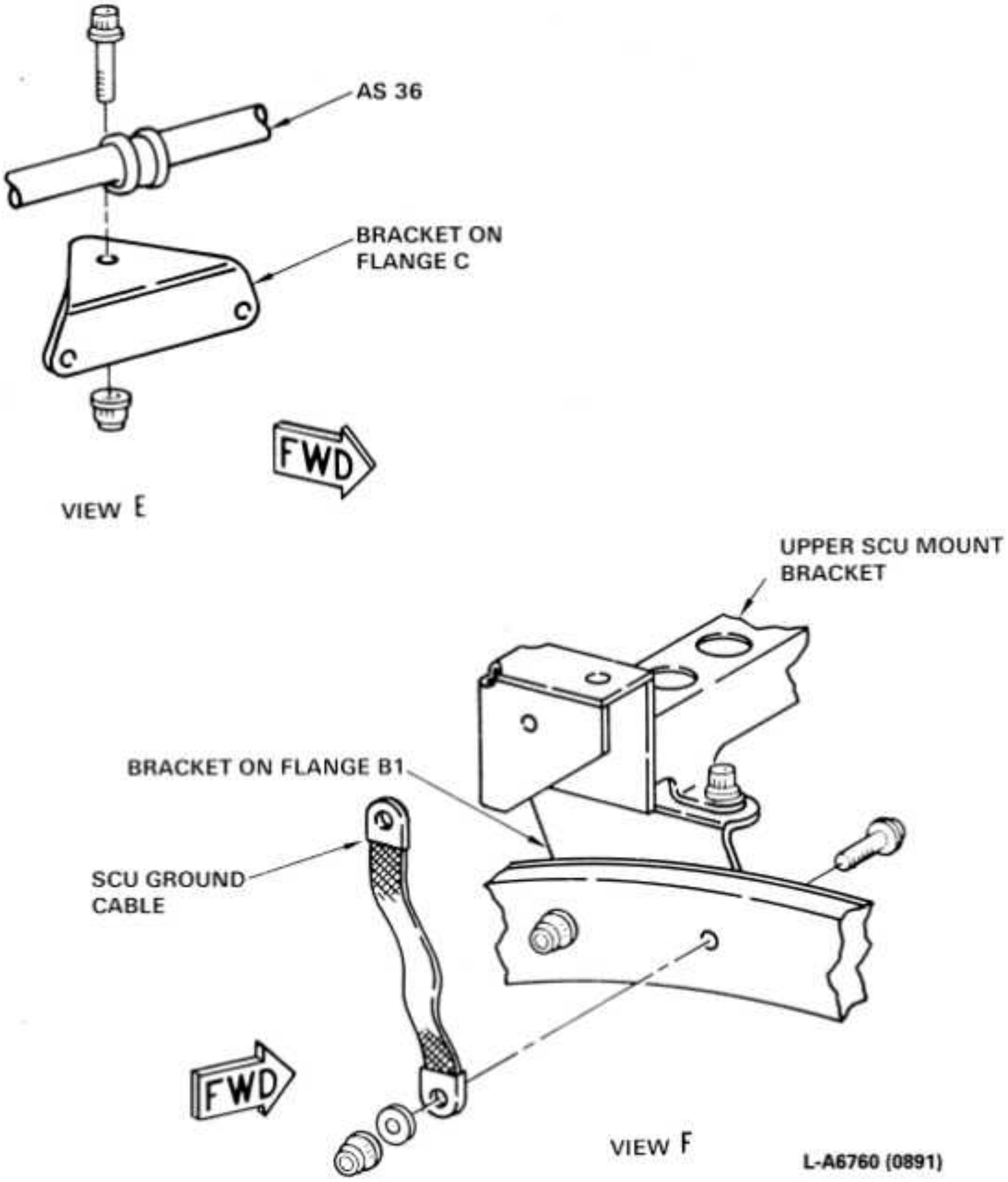
External Plumbing (SCU) Removal
Figure 307 (Sheet 1)
(Task 72-00-33-020-002-B)


(AS 38)
BRACKET ON FLANGE B
(AS 36)
FWD
VIEW B
L-A6759
0391

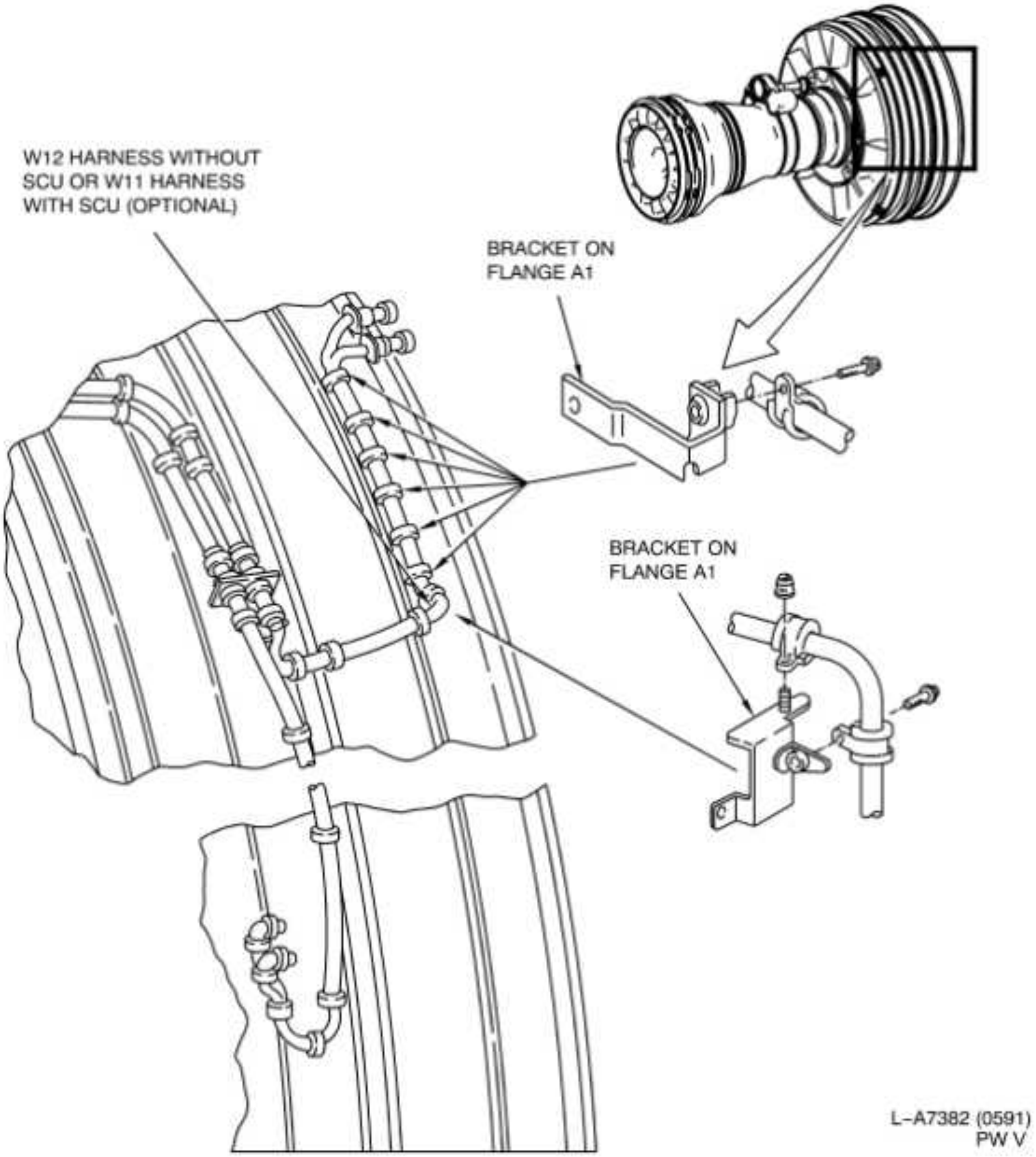
External Plumbing (SCU) Removal
Figure 307 (Sheet 2)
(Task 72-00-33-020-002-B)


AS 36
BRACKET ON
FLANGE B
FWD
VIEW C
BRACKET ON
FLANGE B2
FWD
AS 36
VIEW D
L—A6702

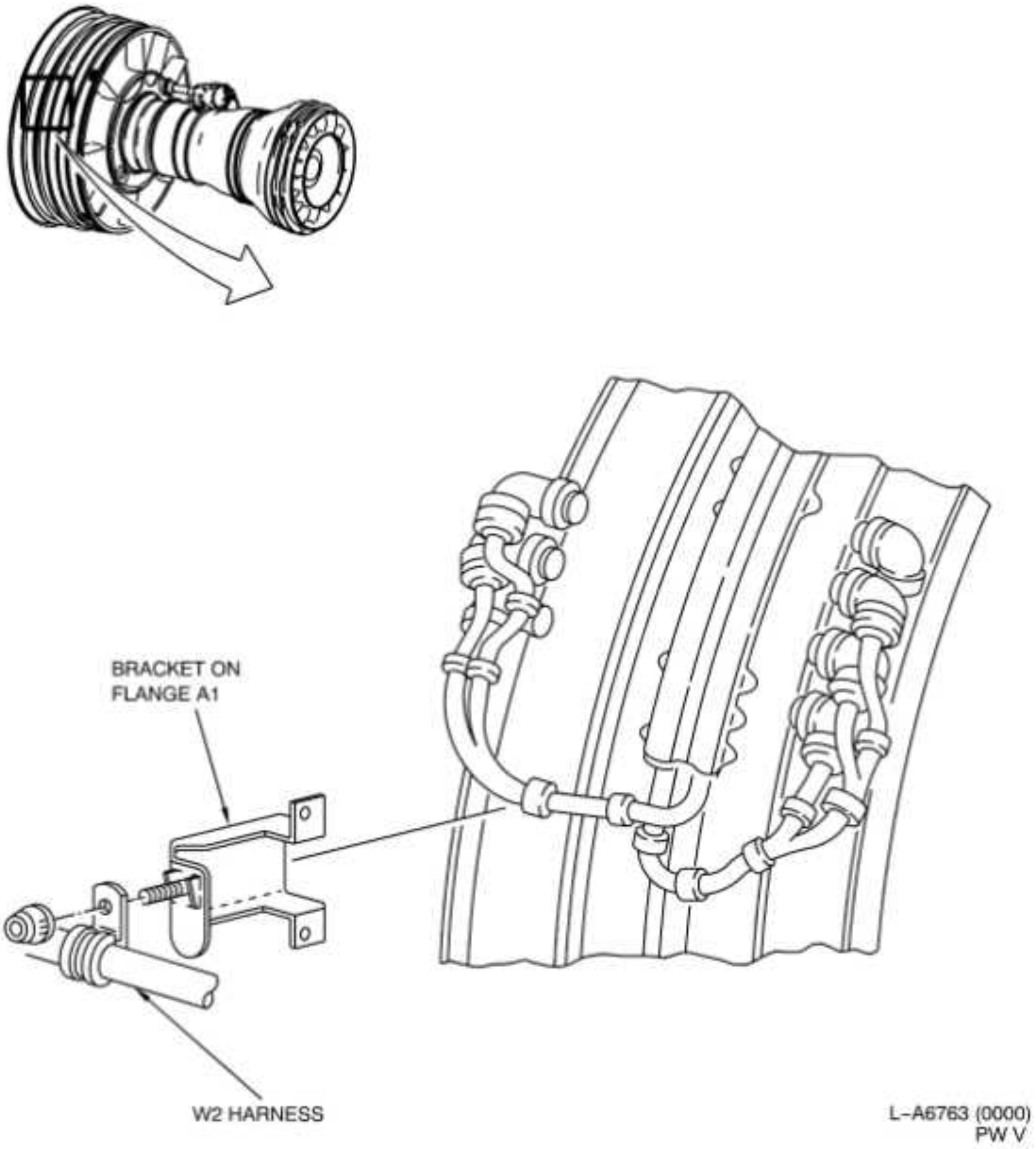
External Plumbing (SCU) Removal
Figure 307 (Sheet 3)
(Task 72-00-33-020-002-B)


AS 36
BRACKET ON FLANGE C
FWD
VIEW E
UPPER SCU MOUNT BRACKET
BRACKET ON FLANGE B1
SCU GROUND CABLE
FWD
VIEW F
L-A6760 (0891)

External Plumbing (SCU) Removal
Figure 307 (Sheet 4)
(Task 72-00-33-020-002-B)

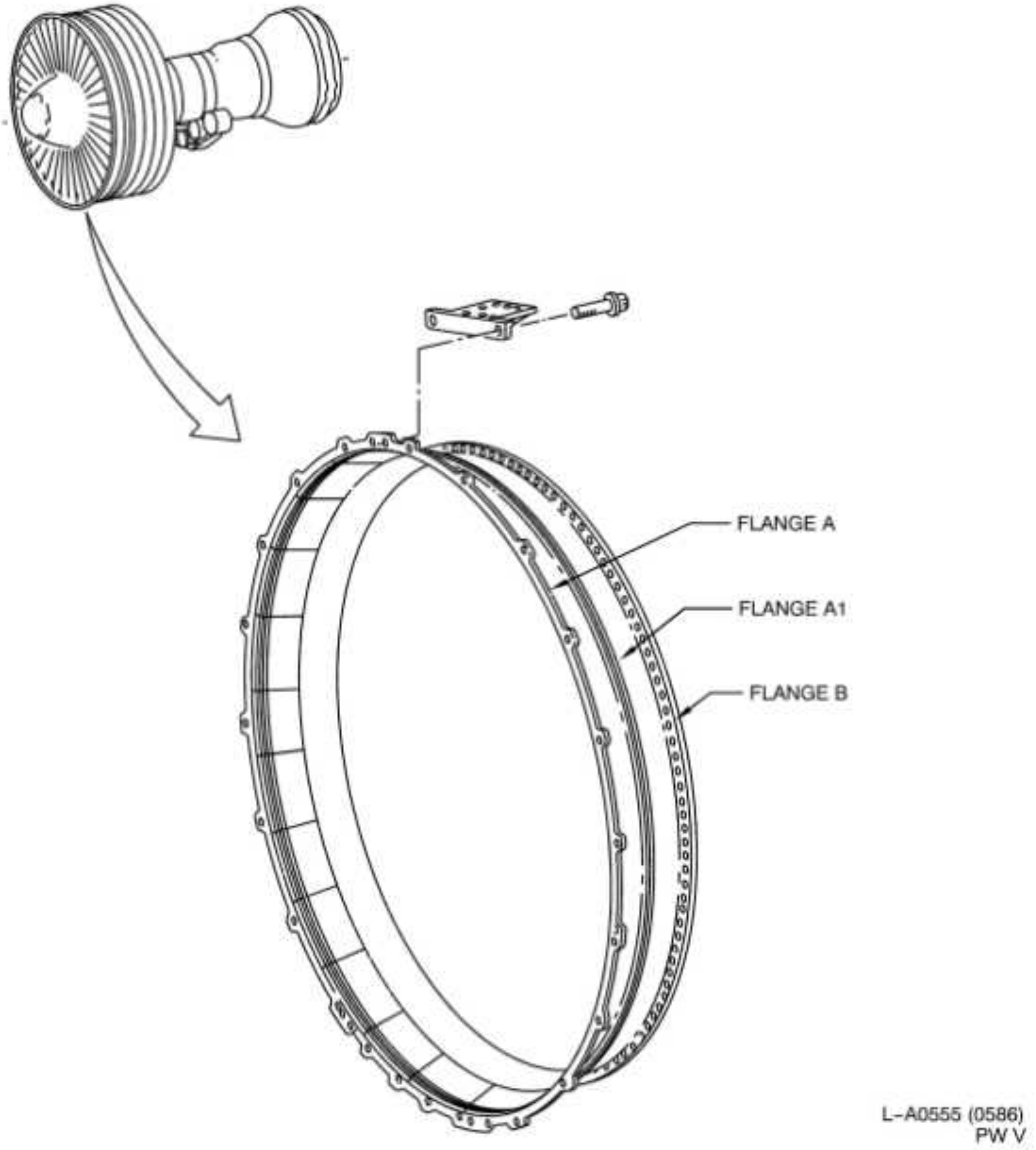

W12 HARNESS WITHOUT SCU OR W11 HARNESS WITH SCU (OPTIONAL)
BRACKET ON FLANGE A1
BRACKET ON FLANGE A1
L−A7382 (0591)
PW V

Wiring Harness Removal
Figure 308 (Sheet 1)
(Task 72−00−33−020−002−B)

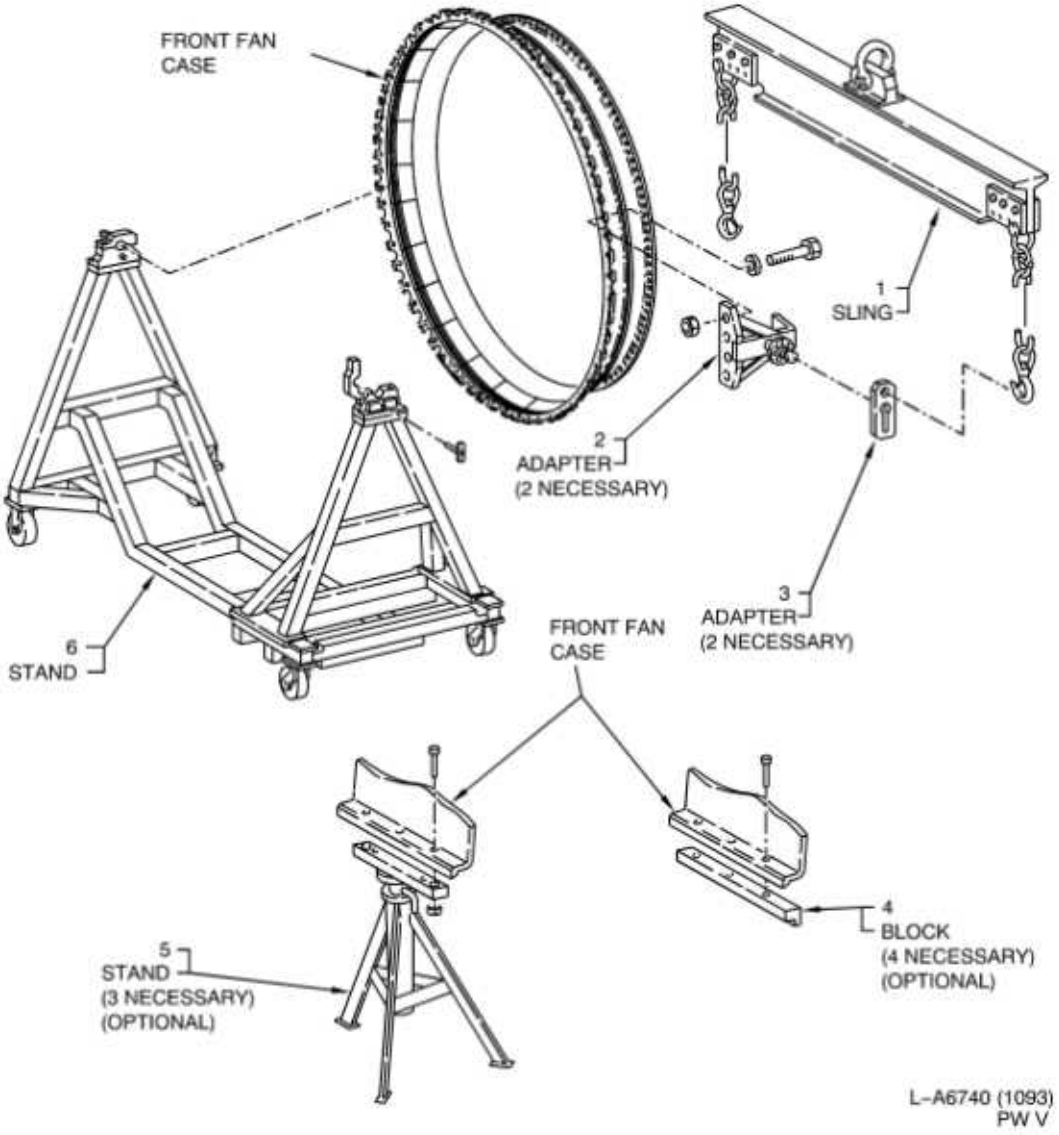

BRACKET ON
FLANGE A1
W2 HARNESS
L−A6763 (0000)
PW V

Wiring Harness Removal
Figure 308 (Sheet 2)
(Task 72−00−33−020−002−B)

ENGINE GENERAL − FAN CASE − REMOVAL−03


FLANGE A
FLANGE A1
FLANGE B
L−A0555 (0586)
PW V

Front Fan Case
Figure 309
(Task 72−00−33−020−002−B)

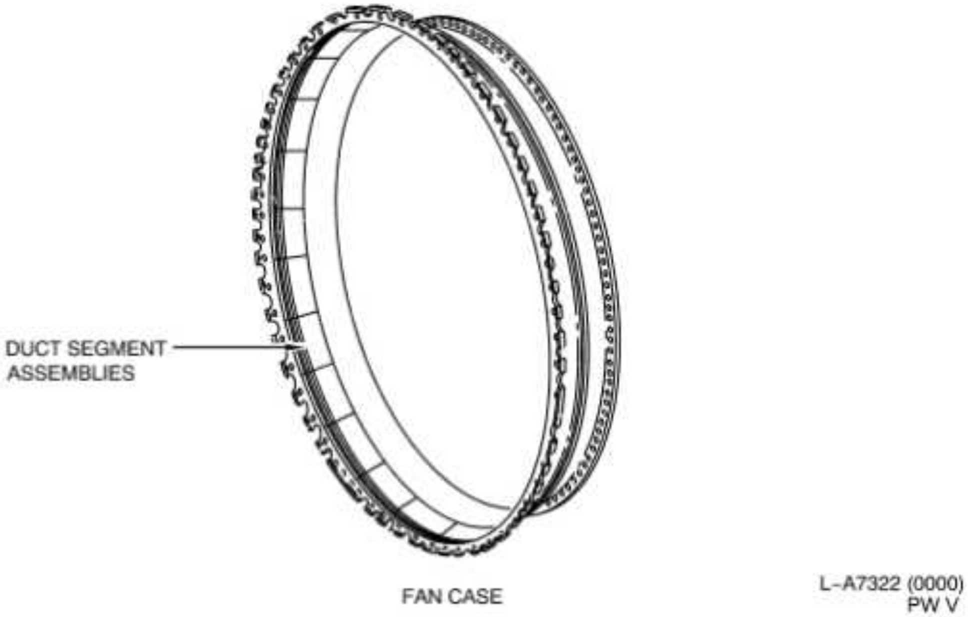

FRONT FAN CASE
1 SLING
2 ADAPTER (2 NECESSARY)
3 ADAPTER (2 NECESSARY)
6 STAND
FRONT FAN CASE
4 BLOCK (4 NECESSARY) (OPTIONAL)
5 STAND (3 NECESSARY) (OPTIONAL)
L-A6740 (1093)
PW V

Removal Of The Front Fan Case From The Stand
Figure 310
(Task 72-00-33-020-002-B)

ENGINE GENERAL − FAN CASE − REMOVAL−03

1. PWA 76155
2. PWA 86423 Or PWA 85676
3. PWA 76154
4. PWA 85750
5. PWA 85678 Or PWA 87166 With PWA 101960
6. PWA 87078 Or PWA 85450

Key to Figure 310


DUCT SEGMENT ASSEMBLIES
FAN CASE
L-A7322 (0000)
PW V

Inspection Of The Ribs Of The Duct Segment Assemblies
Figure 311
(Task 72-00-33-020-002-B)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-33-050-001:

1. Remove Electronic Engine Control

A. Equipment And Materials Necessary - None

B. Procedure
See Figure 301.

R CAUTION: BE CAREFUL WHEN YOU HANDLE, REMOVE OR INSTALL
R ALL TUBES WHICH CONTAIN A FLEX DESIGN
R SEGMENT. REMOVE AND INSTALL A TUBE WITH A
R FLEX SEGMENT WITH THE SAME PRECAUTIONS
R USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO
R NOT BEND THE FLEXHOSE OF A TUBE TO HELP
R WITH THE INSTALLATION OR REMOVAL OF AN
R ATTACHED COMPONENT. IF A FLEX SEGMENT IS
R BENT TOO MUCH, THIS CAN CAUSE A KINK IN
R THE EXTERNAL WIRE BRAID AND IN THE INNER
R POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS
R OR TUBE RUPTURE CAN BE THE RESULT.

CAUTION: INSPECT THE ENGINE FAN CASE AT APPROXIMATELY THE ONE O'CLOCK POSITION FOR A FADEC CAUTION LABEL. THIS LABEL SHOWS THAT A UNIQUE MOUNTING EEC IS NECESSARY BECAUSE RING CASE HPC CONFIGURATION OR CUTBACK HPC STATORS ARE INSTALLED IN THE ENGINE. MAKE SURE THE CORRECT EEC IS INSTALLED.

(1) Disconnect EEC programming plug from electronic engine control upper left connector and leave plug attached to engine by its lanyard.

(2) Disconnect W1P6, W1P7 and W1P8 harness connectors from rear side of control (Channel A).

(3) Disconnect W2P2, W2P3 and W2P4 harness connectors from front side of control (Channel B).

(4) Disconnect four flex hoses from bottom of control.

(5) Remove bolt from upper front corner of control and disconnect ground strap.

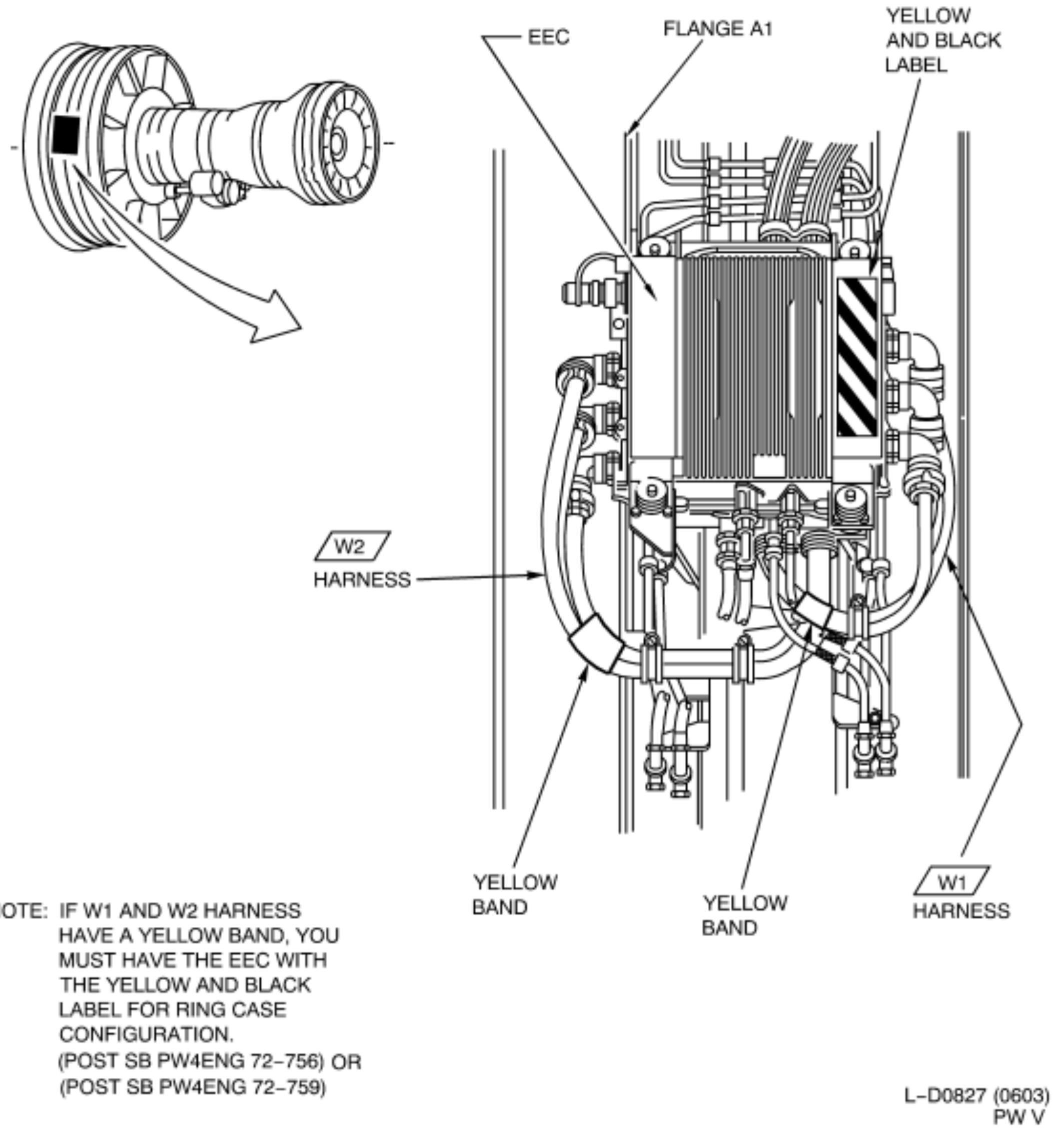
(6) Remove bolts and washers from mounts at four corners and remove control from engine.

(7) Remove four adapters from control (where flex hoses were attached). Discard packings.

ENGINE GENERAL − FAN CASE − REMOVAL−04

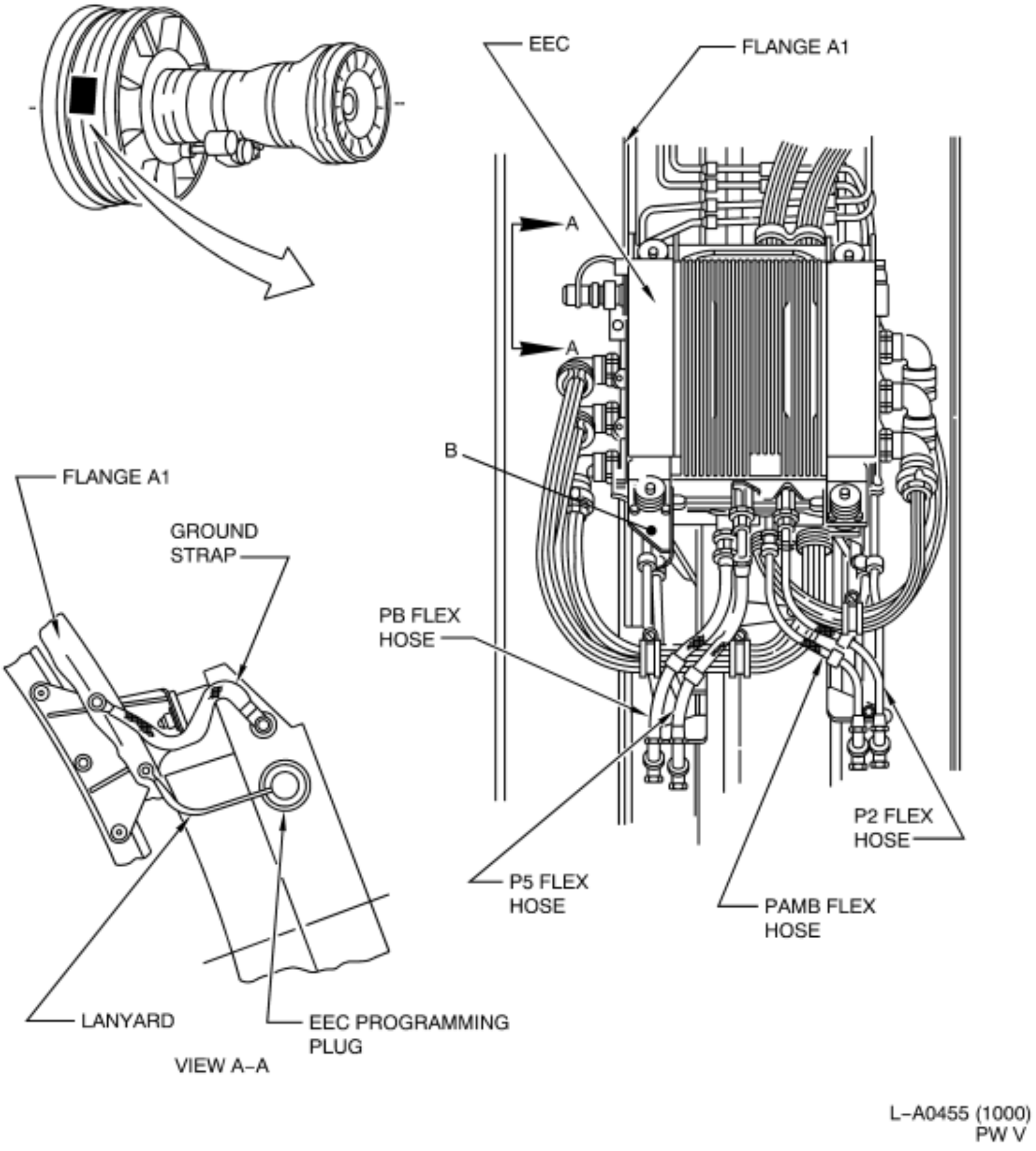
(8) Install protective closures.

NOTE: For additional information concerning detailed maintenance of this component see Electronic Engine Control Component Maintenance Manual, 73−21−25 (Hamilton Standard Division).

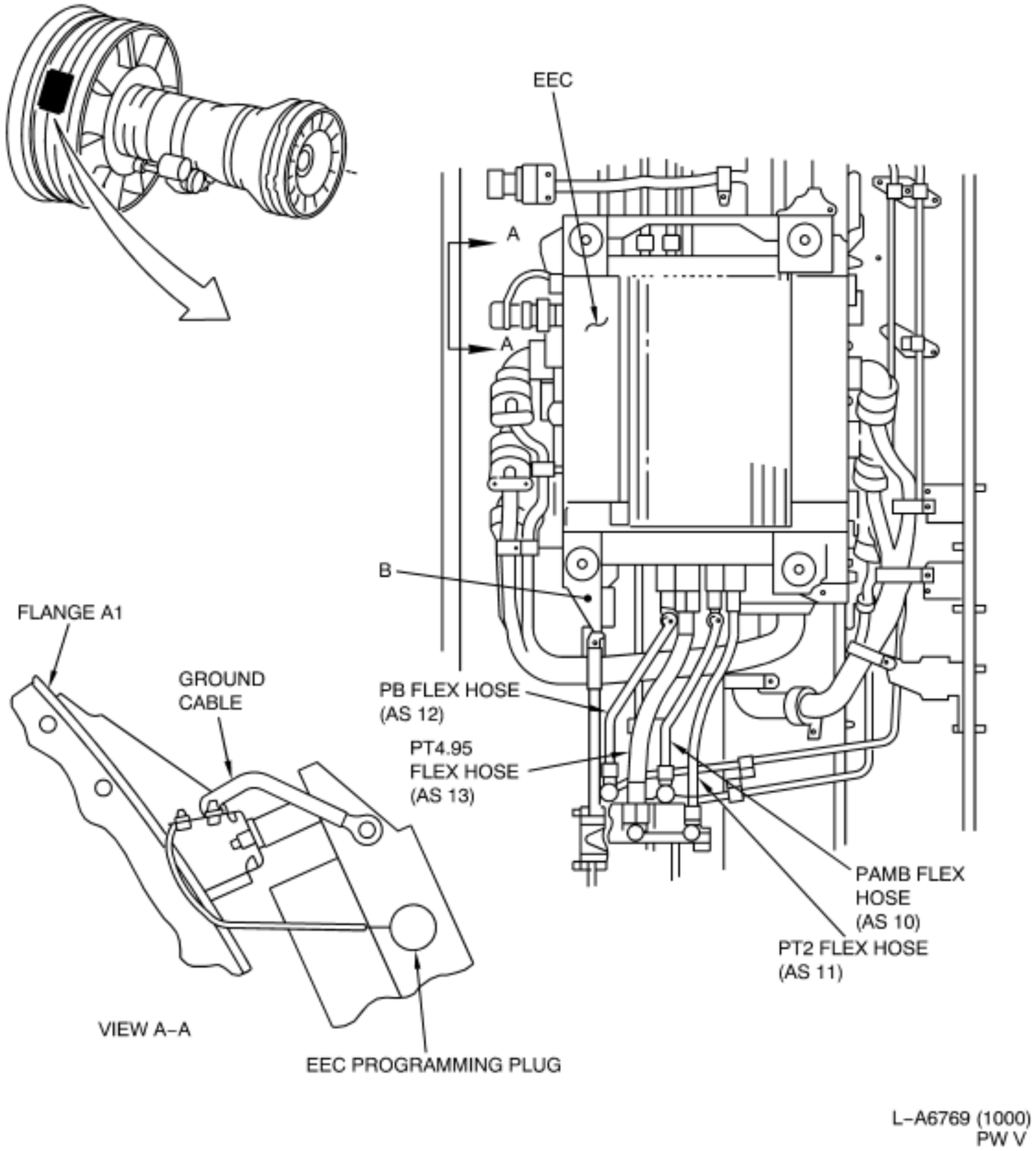

EEC
FLANGE A1
YELLOW AND BLACK LABEL
W2 HARNESS
YELLOW BAND
YELLOW BAND
W1 HARNESS
L-D0827 (0603)
PW V

NOTE: IF W1 AND W2 HARNESS HAVE A YELLOW BAND, YOU MUST HAVE THE EEC WITH THE YELLOW AND BLACK LABEL FOR RING CASE CONFIGURATION.
(POST SB PW4ENG 72-756) OR
(POST SB PW4ENG 72-759)

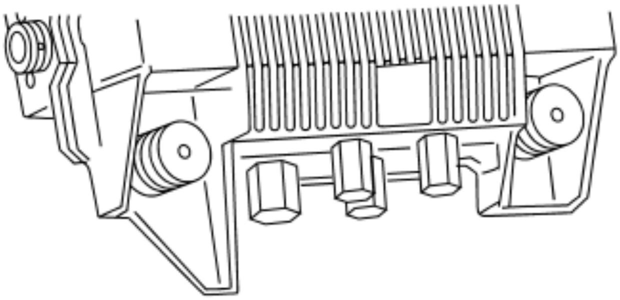
Electronic Engine Control
Figure 301 (Sheet 1)
(Task 72-00-33-050-001)


EEC
FLANGE A1
A
A
B
PB FLEX HOSE
P2 FLEX HOSE
P5 FLEX HOSE
PAMB FLEX HOSE
FLANGE A1
GROUND STRAP
LANYARD
EEC PROGRAMMING PLUG
VIEW A-A
L-A0455 (1000)
PW V

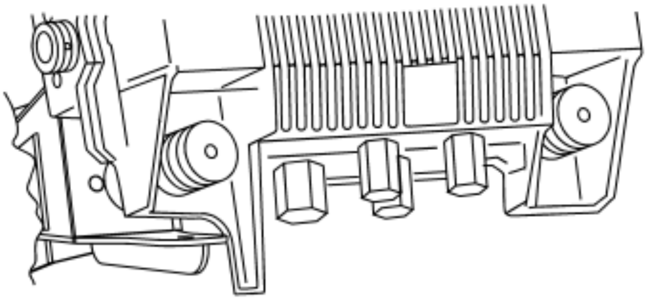
Electronic Engine Control (For Basic Engines)
Figure 301 (Sheet 2)
(Task 72-00-33-050-001)


EEC
A
A
B
FLANGE A1
GROUND
CABLE
PB FLEX HOSE
(AS 12)
PT4.95
FLEX HOSE
(AS 13)
PAMB FLEX
HOSE
(AS 10)
PT2 FLEX HOSE
(AS 11)
VIEW A-A
EEC PROGRAMMING PLUG
L-A6769 (1000)
PW V

Electronic Engine Control (For Commonality
Between Airbus And McDonnell Douglas)
Figure 301 (Sheet 3)
(Task 72-00-33-050-001)



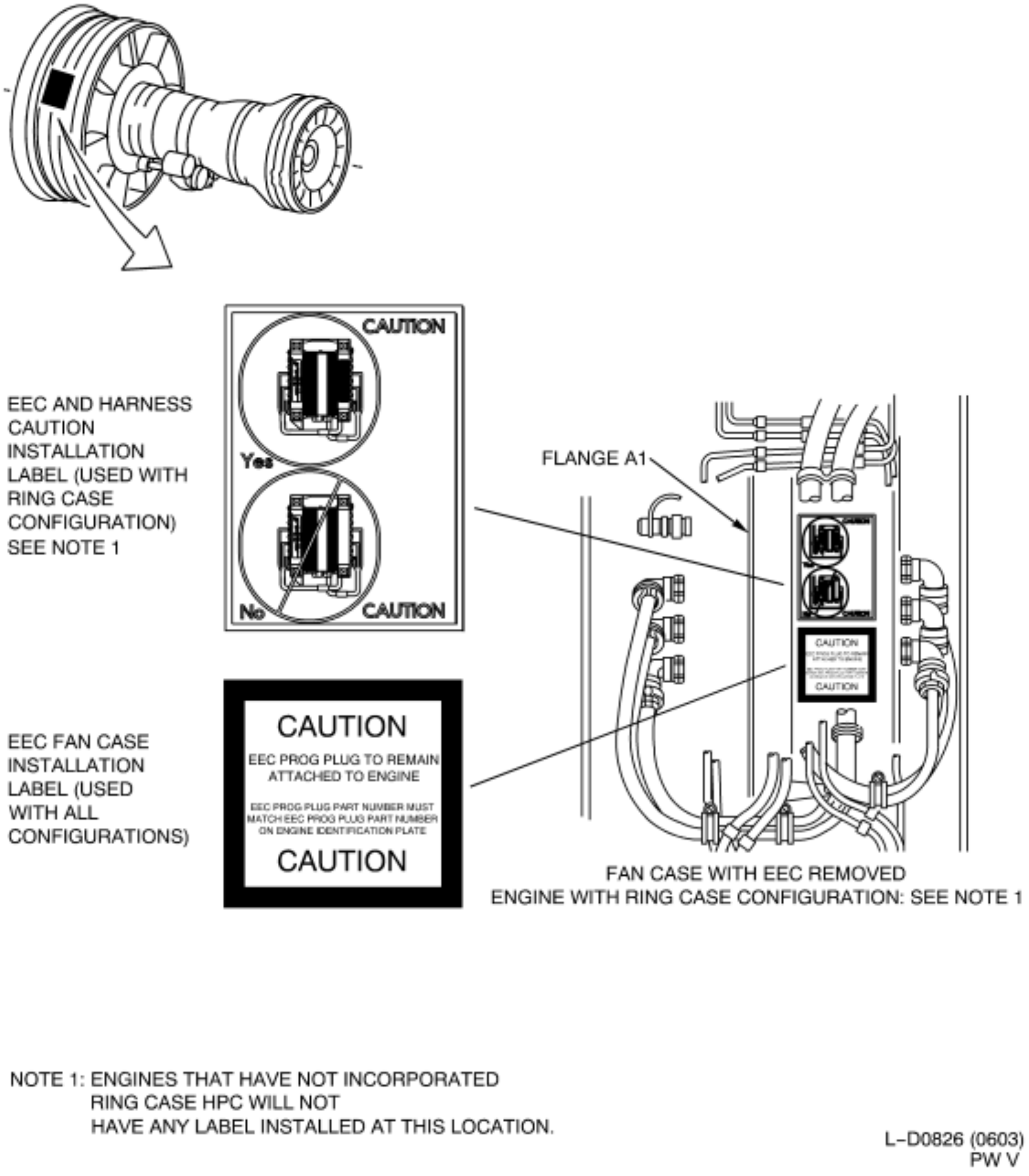
VIEW B
(PRE SB PW4ENG 72-704)
(POST SB PW4ENG 72-728)



VIEW B
(PRE SB PW4ENG 72-728)
(POST SB PW4ENG 72-704)

L-B8426 (0601)
PW V

EEC Mounts
Figure 301 (Sheet 4)
(Task 72-00-33-050-001)


EEC AND HARNESS CAUTION INSTALLATION LABEL (USED WITH RING CASE CONFIGURATION) SEE NOTE 1
CAUTION
Yes
No
CAUTION
FLANGE A1
EEC FAN CASE INSTALLATION LABEL (USED WITH ALL CONFIGURATIONS)
CAUTION
EEC PROG PLUG TO REMAIN ATTACHED TO ENGINE
EEC PROG PLUG PART NUMBER MUST MATCH EEC PROG PLUG PART NUMBER ON ENGINE IDENTIFICATION PLATE
CAUTION
FAN CASE WITH EEC REMOVED
ENGINE WITH RING CASE CONFIGURATION: SEE NOTE 1
NOTE 1: ENGINES THAT HAVE NOT INCORPORATED RING CASE HPC WILL NOT HAVE ANY LABEL INSTALLED AT THIS LOCATION.
L-D0826 (0603)
PW V

Fan Case EEC Installation Labels
Figure 301 (Sheet 5)
(Task 72-00-33-050-001)

Previous Pageblock Return to Previous Menu Next Pageblock

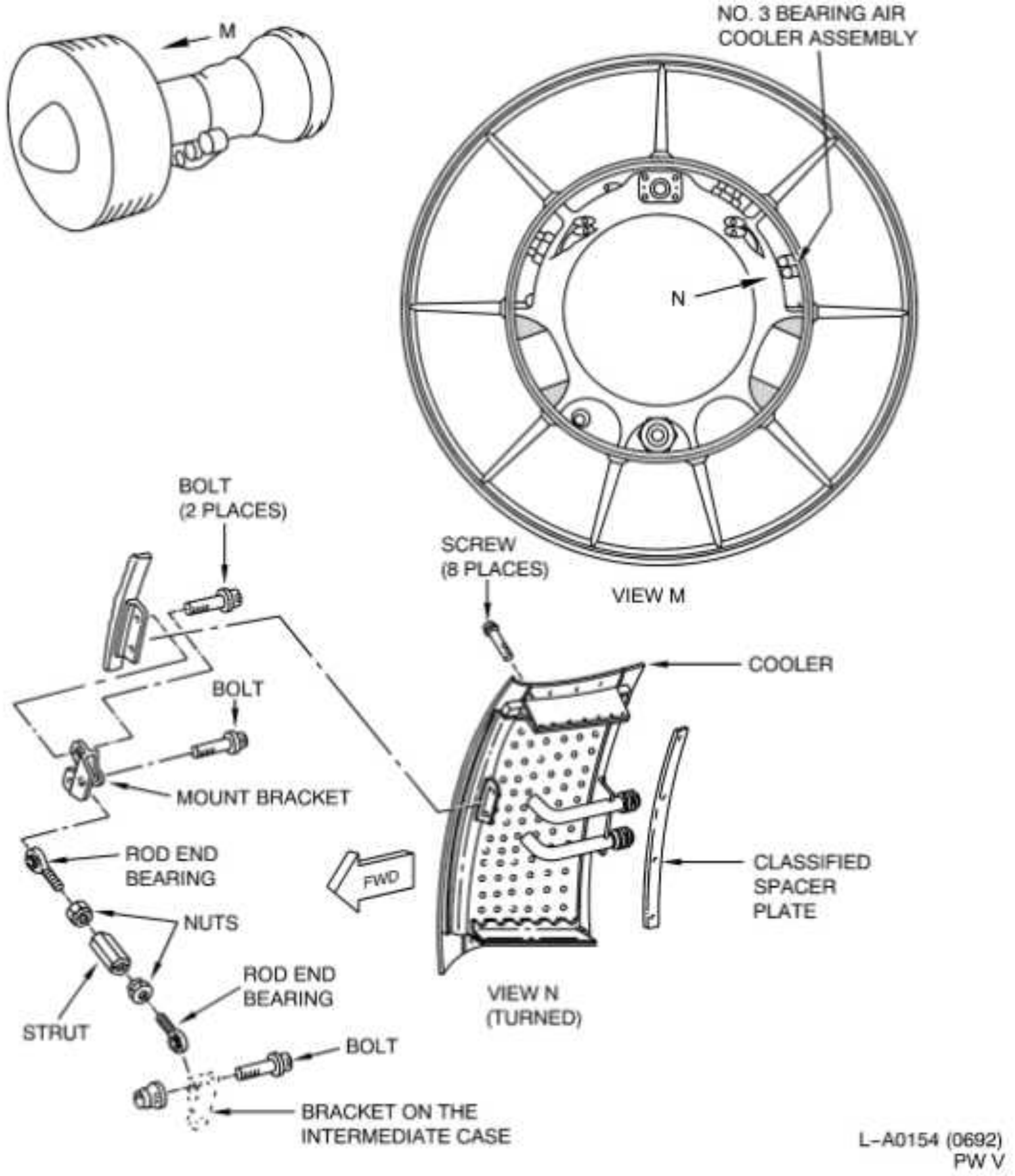
ENGINE GENERAL - FAN CASE - REMOVAL-05

Task 72-00-33-050-002:

1. Remove The No. 3 Bearing Air Cooler Assembly
    - A. Equipment And Materials - None
    - B. Procedure
      See Figure 301.
        - (1) If there is sealant around the edges of the air cooler, cut the sealant.
        - (2) Remove lockwire and disconnect the two tube nuts attached to the No. 3 bearing air cooler assembly (called cooler).
        - (3) Remove the screws securing cooler to the intermediate case.
        - (4) Remove the bolts securing cooler to the mount bracket. Remove the cooler and classified spacer.

          NOTE: Keep the classified spacer with the cooler.

        - (5) Remove the midspan support as follows:
            - (a) Remove the bolt securing outer rod end bearing to the mount bracket. Remove the mount bracket.
            - (b) Remove lockwire from the nuts. Loosen the outer nut. Remove the outer rod end bearing from the strut. Remove the nut from the rod end bearing.
            - (c) Loosen the inner nut and remove the strut. Remove the nut from the inner rod end bearing.
            - (d) Remove the bolt and nut securing the inner rod end bearing to the bracket on the intermediate case. Remove the rod end bearing from the bracket.
        - (6) (Post SB PW4ENG 72-433) If necessary, remove the bolts and nuts that attach the supports along the axial edges of the cooler. Remove the supports.
        - (7) Install protective closures to the cooling air tubes.
        - (8) Mechanically remove any remaining sealant from the case and cooler.


M
NO. 3 BEARING AIR COOLER ASSEMBLY
N
VIEW M
BOLT (2 PLACES)
SCREW (8 PLACES)
BOLT
COOLER
MOUNT BRACKET
ROD END BEARING
FWD
CLASSIFIED SPACER PLATE
NUTS
ROD END BEARING
STRUT
VIEW N (TURNED)
BOLT
BRACKET ON THE INTERMEDIATE CASE
L−A0154 (0692)
PW V

No. 3 Bearing Air Cooler Assembly And Support
Figure 301
(Task 72−00−33−050−002)

ENGINE GENERAL - FAN CASE - REMOVAL-06

Task 72-00-33-050-003-A:

1. Remove EEC Fan Case Wiring Harnesses W1 And W2 For Basic Engines

NOTE: This procedure gives instructions for the complete removal of both the W1 and W2 harnesses. If only the fan case is to be removed, do not remove the harnesses rearward of Flange C.

A. Prerequisites
- (1) Remove the electronic engine control. See Removal-04 (Task 72-00-33-050-001).
- (2) If the fan exit fairing (bifurcation) does not have (access) covers for harness access, remove the fairing. See Removal-14 (Task 72-00-33-050-009).
- (3) Remove the fan exit liner segments (inner rear) that are at 11 and 1 o'clock. Refer to 72-00-33, Removal-16 (Task 72-00-33-040-001).

B. Equipment And Materials Required

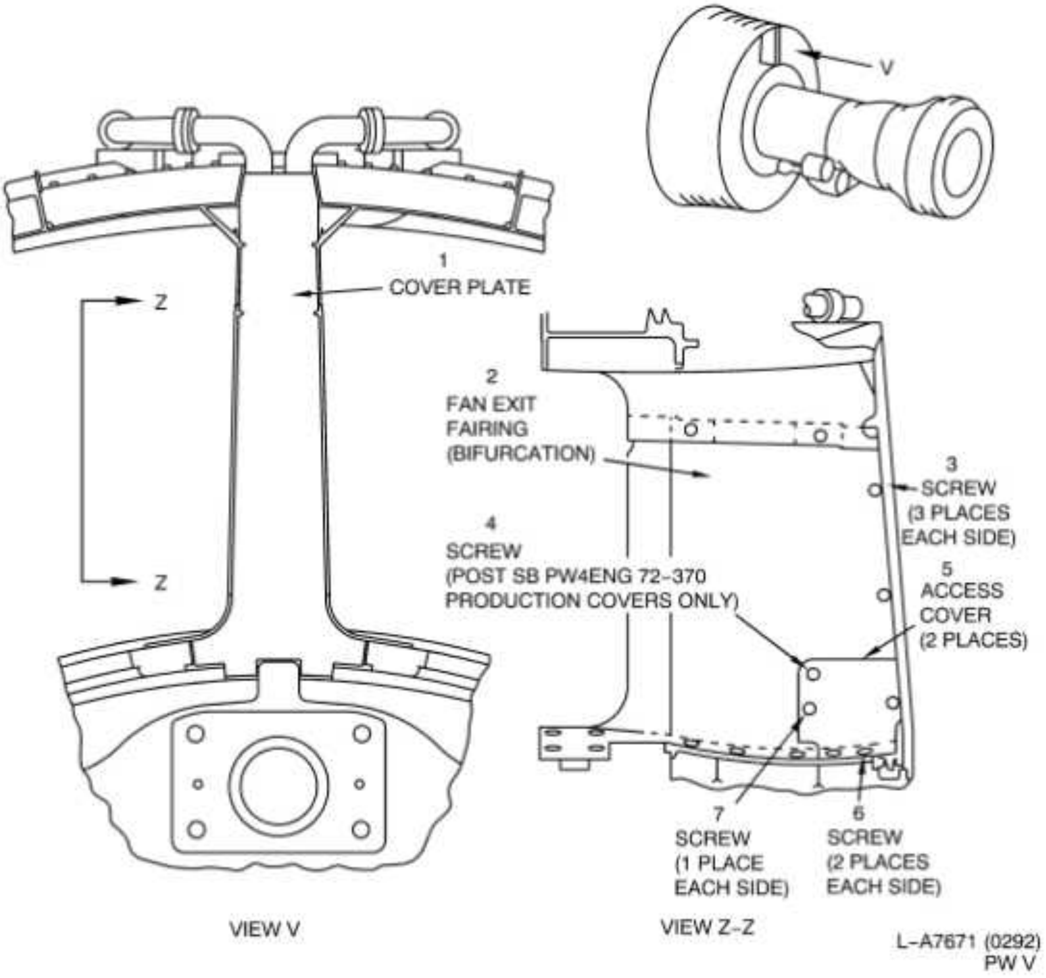
Standard Tools:
No. 10 Torq-set Drive

Special Tools:
PWA 85749 Torque Adapter, Electronic Harness Connectors

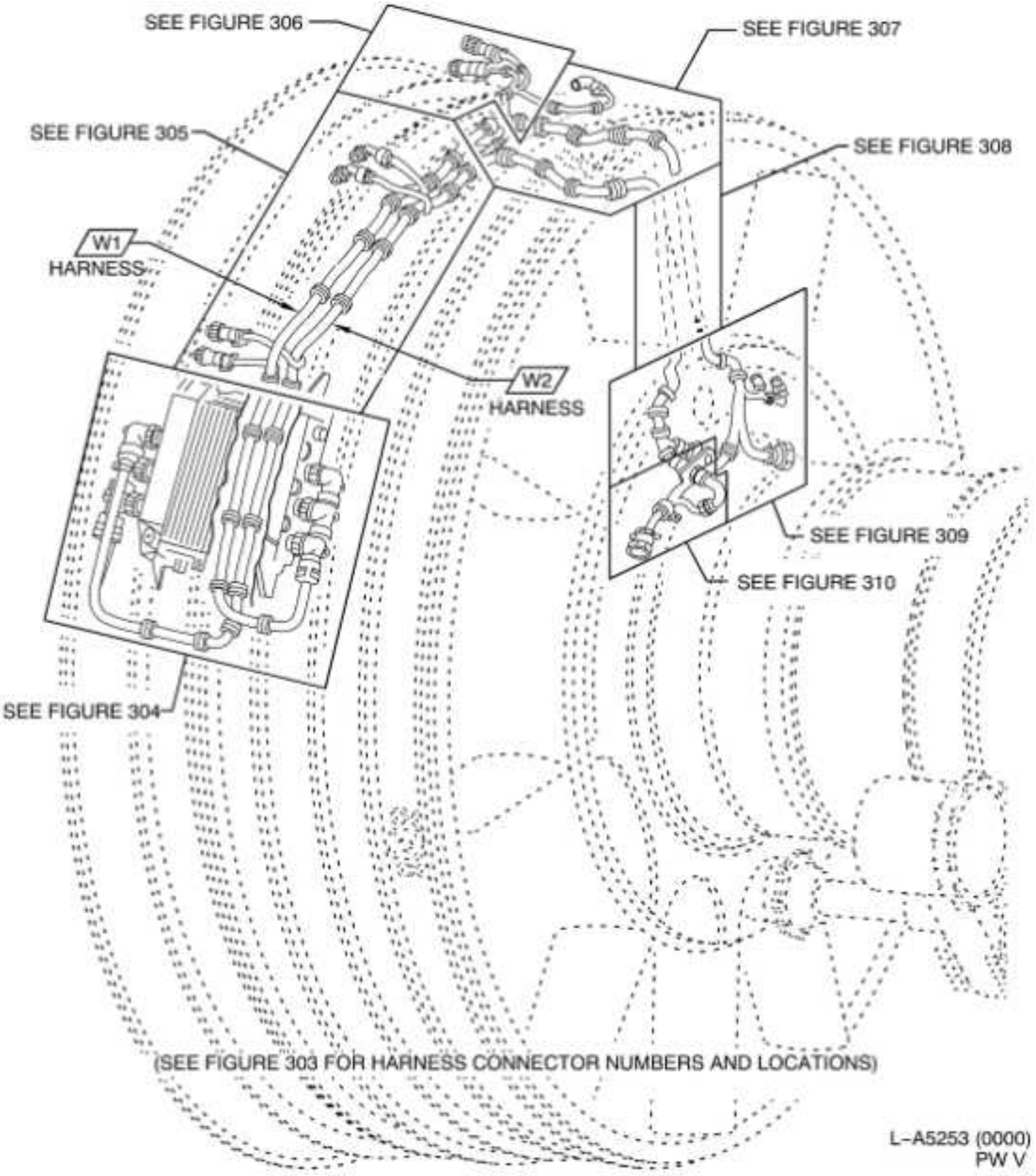
C. Procedure
See Figures 301 through 310.

CAUTION: DO NOT TWIST OR BEND THE HARNESSES BADLY DURING REMOVAL OR DAMAGE TO HARNESSES CAN RESULT.

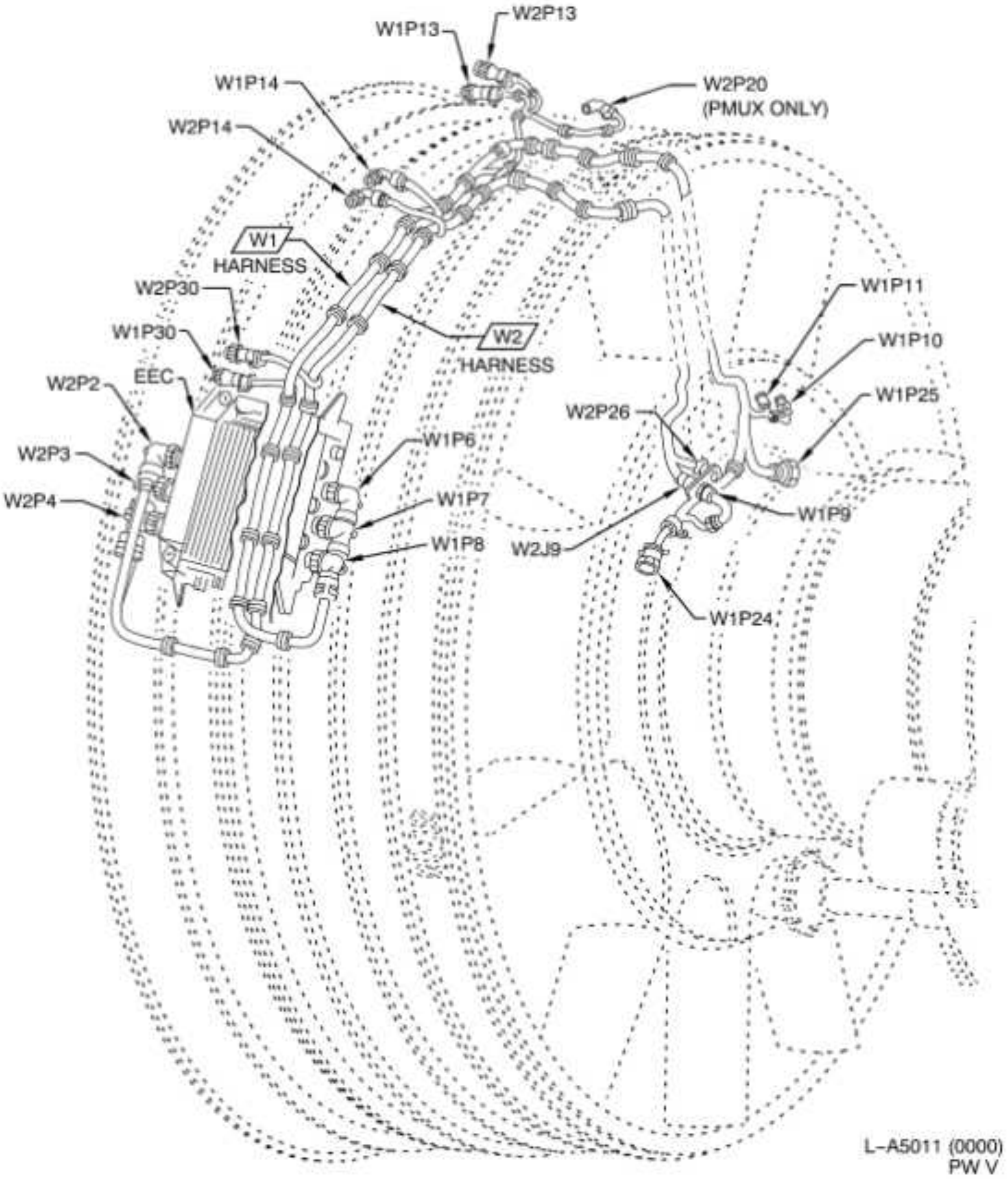
- (1) For engines with the fairing (access) covers (301/5), do as follows. Use a No. 10 Torq-set drive to remove the screws.
  - (a) Cut and remove the sealant from around the (rear) cover plate (301/1). Remove the screws (301/3) and cover plate (301/1).
  - (b) Cut and remove the sealant from around the two (access) covers (301/5). Remove the screws (301/4), (301/7), and (301/6) and the two (access) covers (301/5).
- (2) For engines incorporating propulsion multiplexer unit (PMUX), disconnect W2P20 harness connector from multiplexer unit. Install protective closure on harness and unit connectors.
- (3) Remove bolts, nuts and clamps securing W1 and W2 harnesses to brackets on Flanges A1, B1, B2 and C on fan case.


V
1
COVER PLATE
Z
Z
2
FAN EXIT
FAIRING
(BIFURCATION)
3
SCREW
(3 PLACES
EACH SIDE)
4
SCREW
(POST SB PW4ENG 72-370
PRODUCTION COVERS ONLY)
5
ACCESS
COVER
(2 PLACES)
7
SCREW
(1 PLACE
EACH SIDE)
6
SCREW
(2 PLACES
EACH SIDE)
VIEW V
VIEW Z-Z
L-A7671 (0292)
PW V

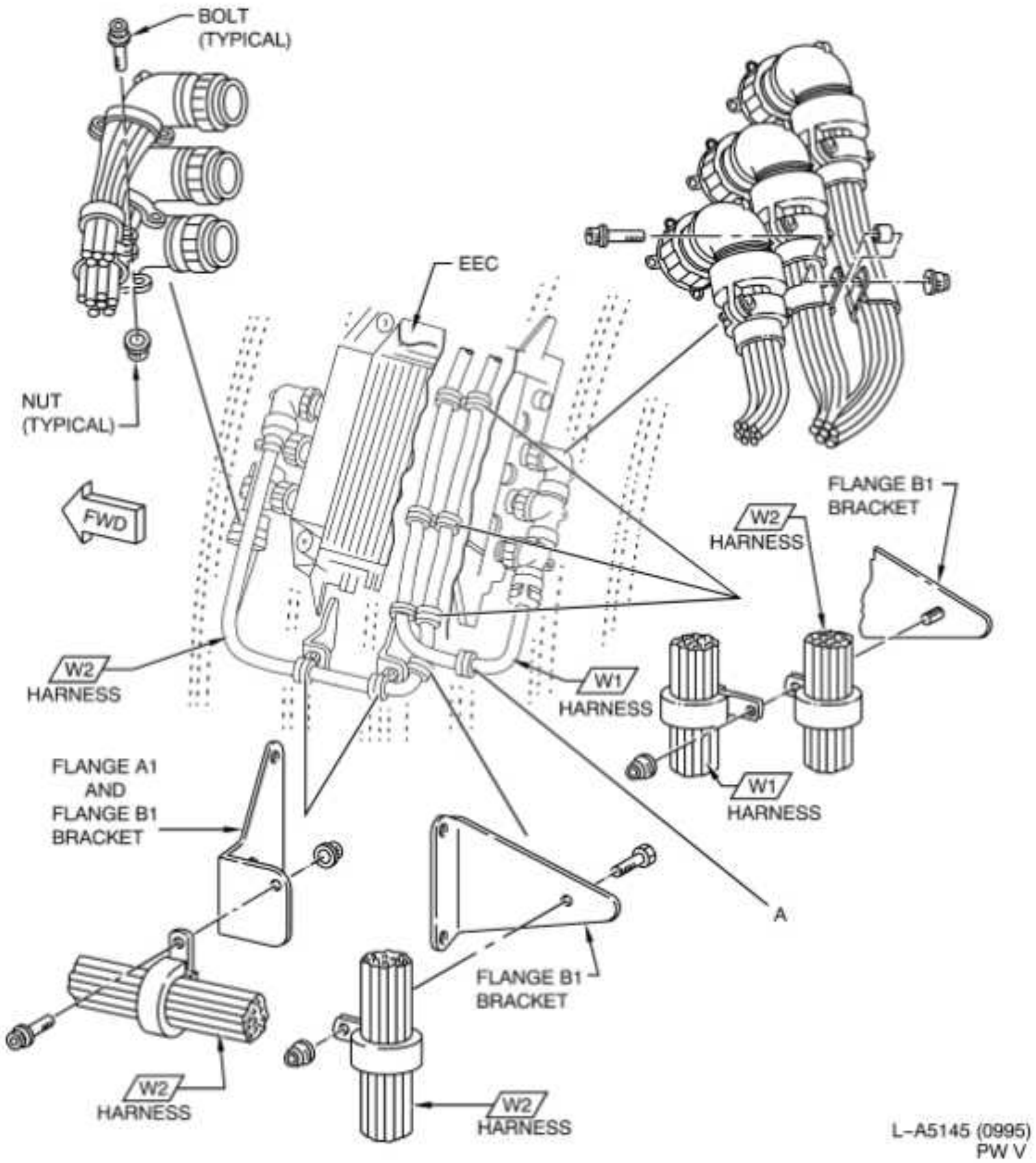
Fan Exit Fairing (Bifurcation)
Figure 301
(Task 72−00−33−050−003−A)


SEE FIGURE 306
SEE FIGURE 307
SEE FIGURE 305
SEE FIGURE 308
W1
HARNESS
W2
HARNESS
SEE FIGURE 309
SEE FIGURE 310
SEE FIGURE 304
(SEE FIGURE 303 FOR HARNESS CONNECTOR NUMBERS AND LOCATIONS)
L-A5253 (0000)
PW V

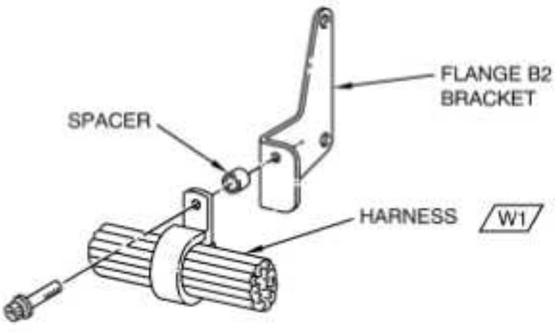
EEC Fan Case Wiring Harnesses
Figure 302
(Task 72-00-33-050-003-A)


W2P13
W1P13
W2P20 (PMUX ONLY)
W1P14
W2P14
W1 HARNESS
W2P30
W1P30
W2 HARNESS
W1P11
W1P10
EEC
W2P2
W1P25
W2P26
W1P6
W2P3
W2P4
W1P7
W1P9
W1P8
W2J9
W1P24
L-A5011 (0000)
PW V

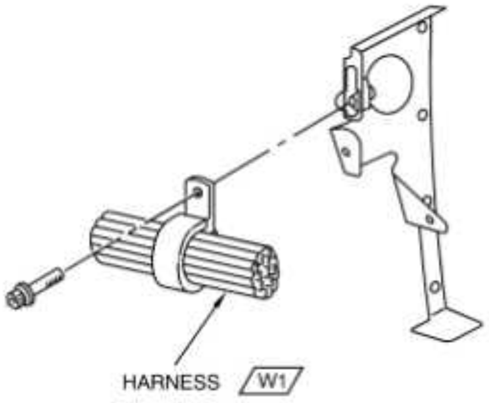
EEC Fan Case Wiring Harnesses
Figure 303
(Task 72-00-33-050-003-A)


BOLT (TYPICAL)
EEC
NUT (TYPICAL)
FWD
FLANGE B1 BRACKET
W2 HARNESS
W2 HARNESS
W1 HARNESS
W1 HARNESS
FLANGE A1 AND FLANGE B1 BRACKET
A
FLANGE B1 BRACKET
W2 HARNESS
W2 HARNESS
L-A5145 (0995)
PW V

EEC Fan Case Wiring Harnesses
Figure 304 (Sheet 1)
(Task 72-00-33-050-003-A)


FLANGE B2
BRACKET
SPACER
HARNESS
W1

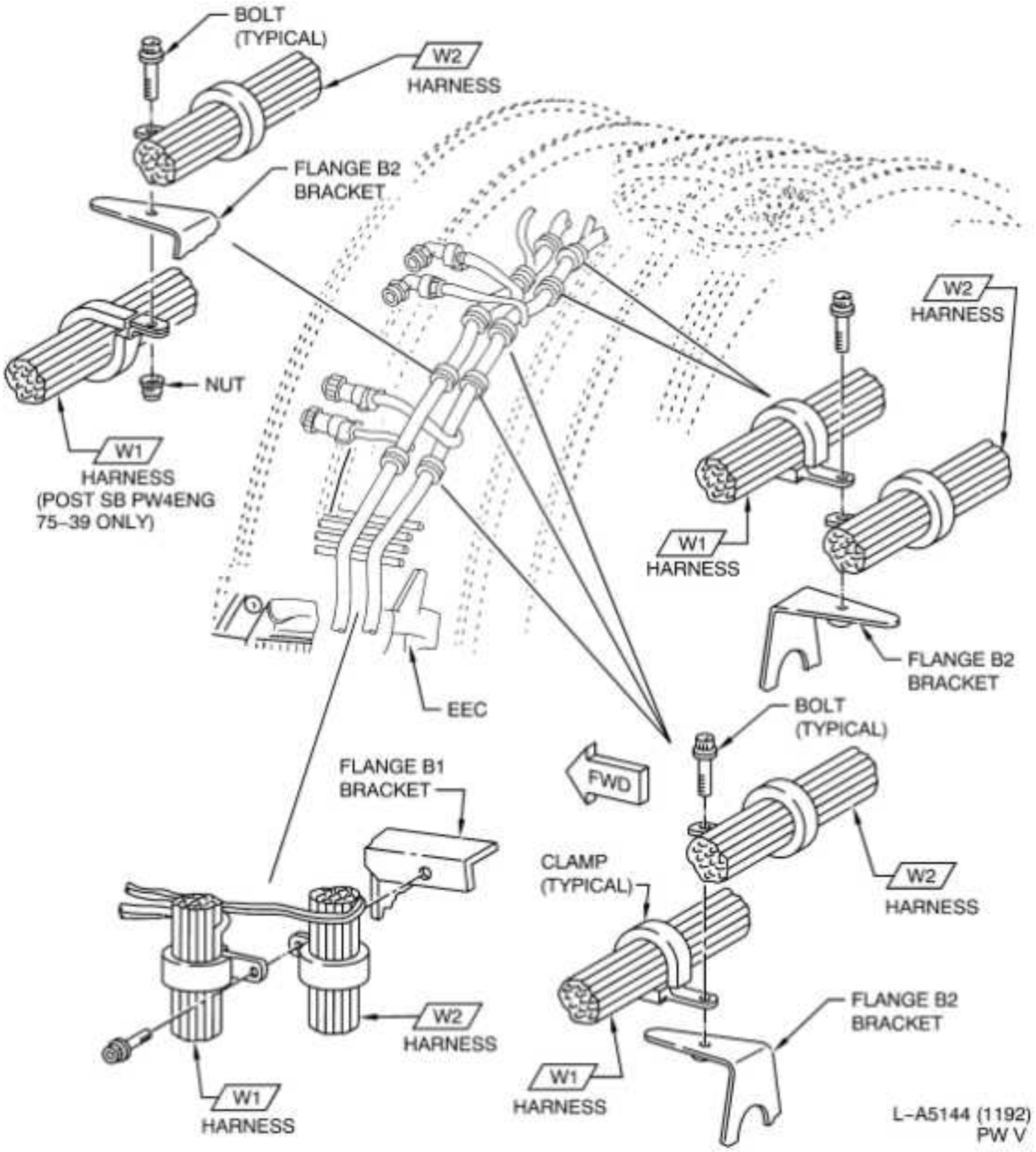
VIEW A
(PRE SB PW4ENG 73-143)



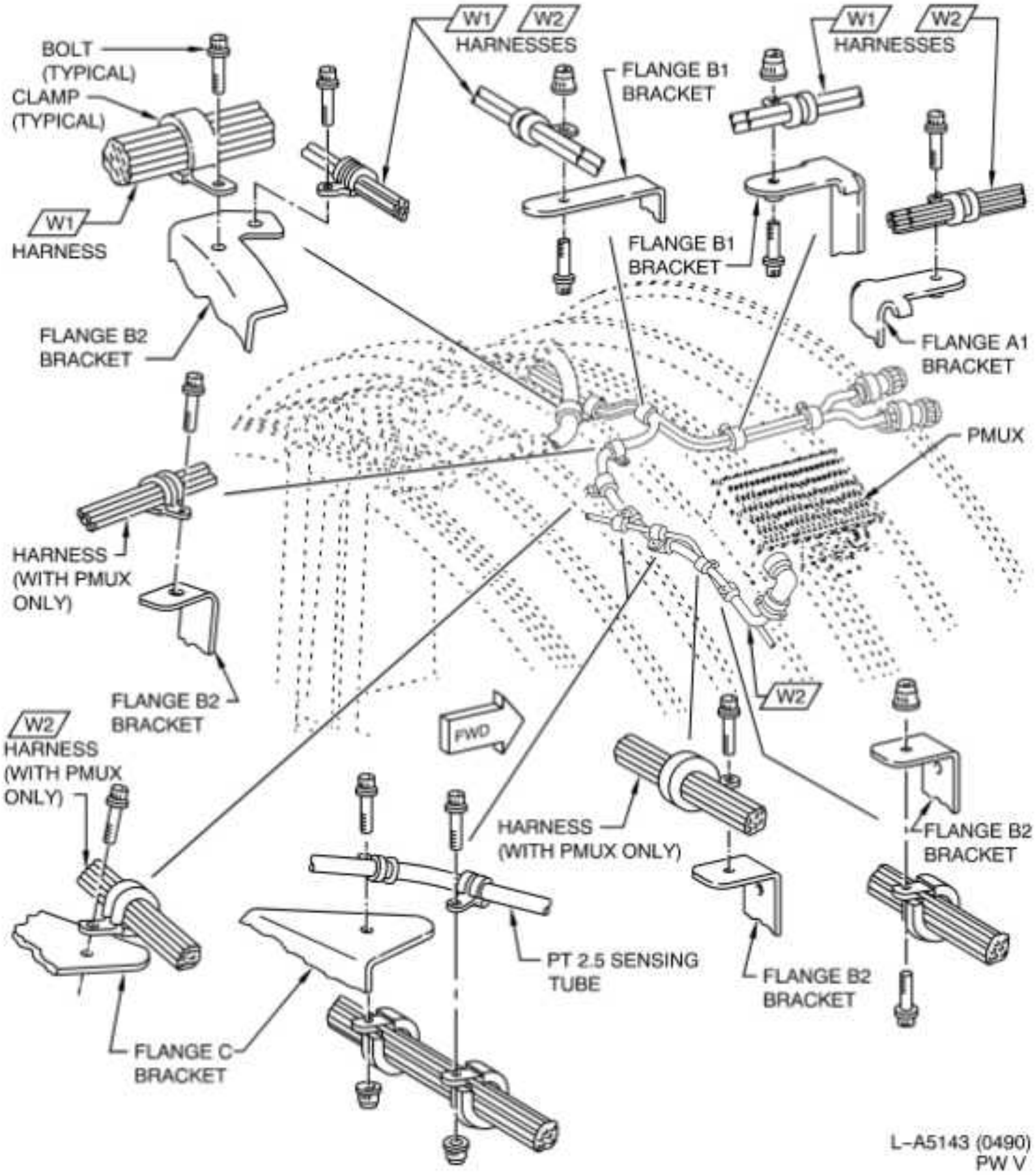
VIEW A
(POST SB PW4ENG 73-143)

L-B2205 (0000)
PW V

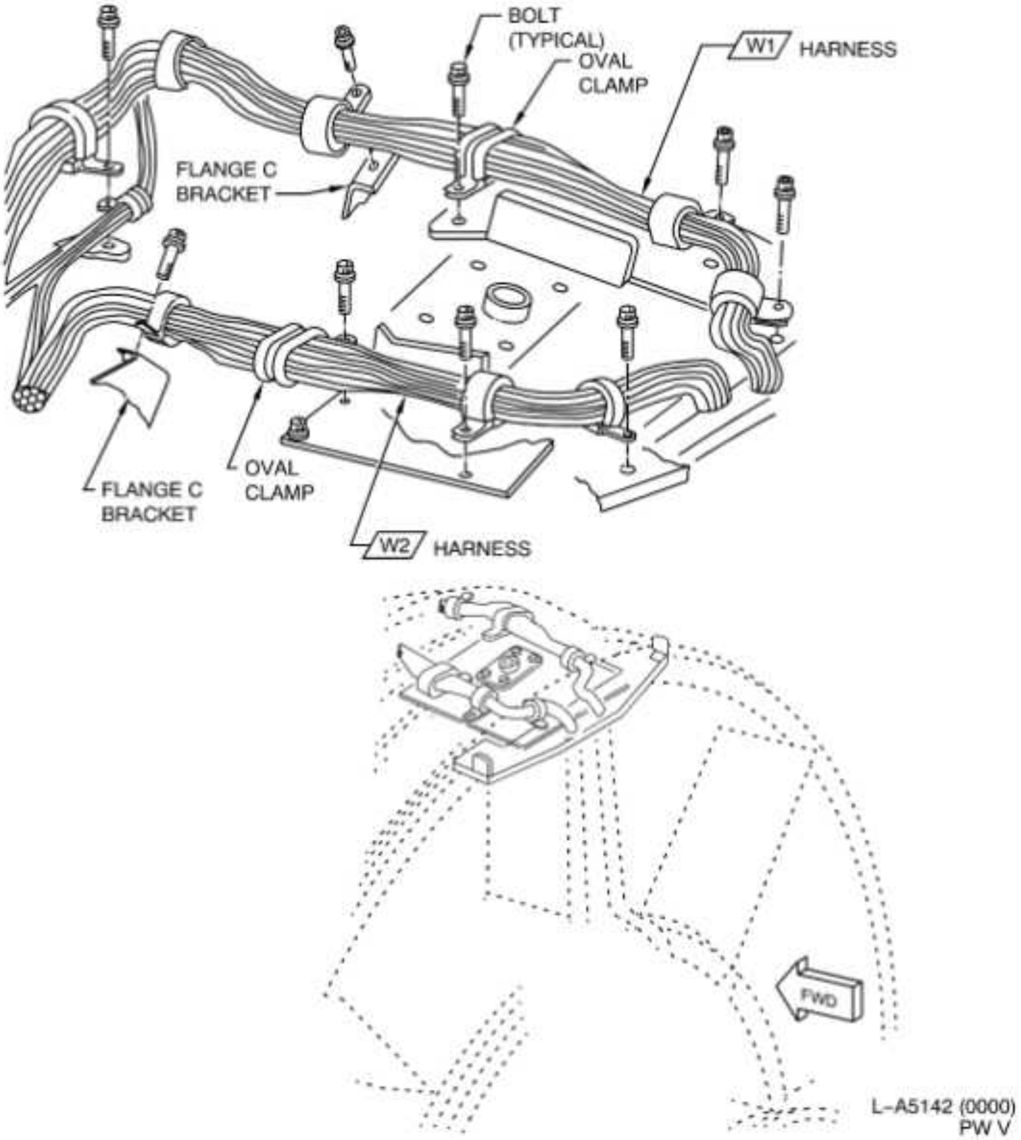
EEC Fan Case Wiring Harnesses
Figure 304 (Sheet 2)
(Task 72−00−33−050−003−A)


BOLT (TYPICAL)
W2 HARNESS
FLANGE B2 BRACKET
NUT
W1 HARNESS (POST SB PW4ENG 75-39 ONLY)
W2 HARNESS
W1 HARNESS
FLANGE B2 BRACKET
EEC
BOLT (TYPICAL)
FWD
FLANGE B1 BRACKET
CLAMP (TYPICAL)
W2 HARNESS
W2 HARNESS
FLANGE B2 BRACKET
W1 HARNESS
W1 HARNESS
L-A5144 (1192)
PW V

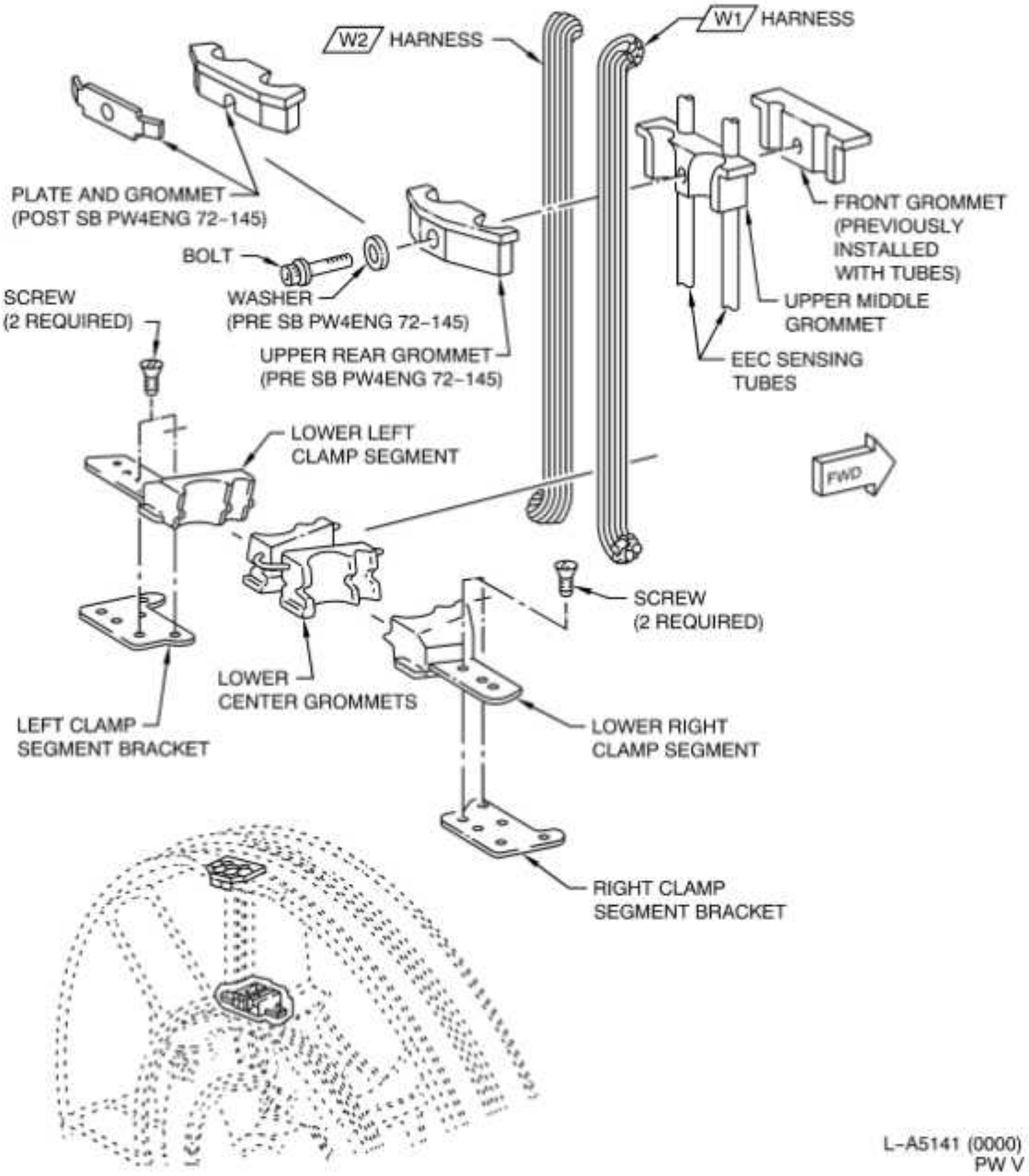
EEC Fan Case Wiring Harnesses
Figure 305
(Task 72−00−33−050−003−A)


W1
W2
HARNESSES
BOLT (TYPICAL)
CLAMP (TYPICAL)
W1 HARNESS
FLANGE B1 BRACKET
W1
W2
HARNESSES
FLANGE B1 BRACKET
FLANGE B2 BRACKET
FLANGE A1 BRACKET
PMUX
HARNESS (WITH PMUX ONLY)
FLANGE B2 BRACKET
W2
W2 HARNESS (WITH PMUX ONLY)
FWD
HARNESS (WITH PMUX ONLY)
FLANGE B2 BRACKET
PT 2.5 SENSING TUBE
FLANGE B2 BRACKET
FLANGE C BRACKET
L-A5143 (0490)
PW V

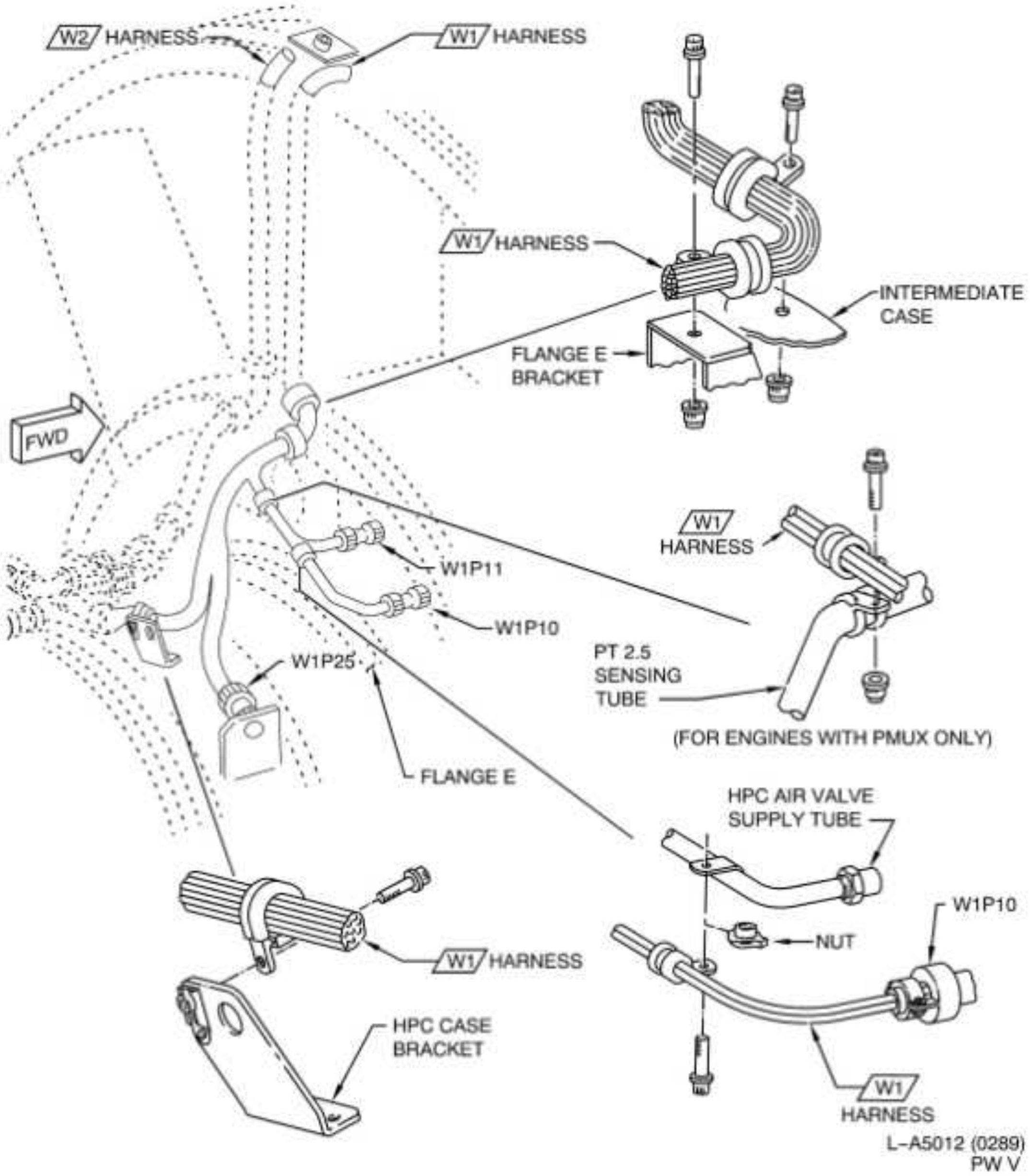
EEC Fan Case Wiring Harnesses
Figure 306
(Task 72-00-33-050-003-A)


BOLT
(TYPICAL)
OVAL
CLAMP
W1 HARNESS
FLANGE C
BRACKET
FLANGE C
BRACKET
OVAL
CLAMP
W2 HARNESS
FWD
L-A5142 (0000)
PW V

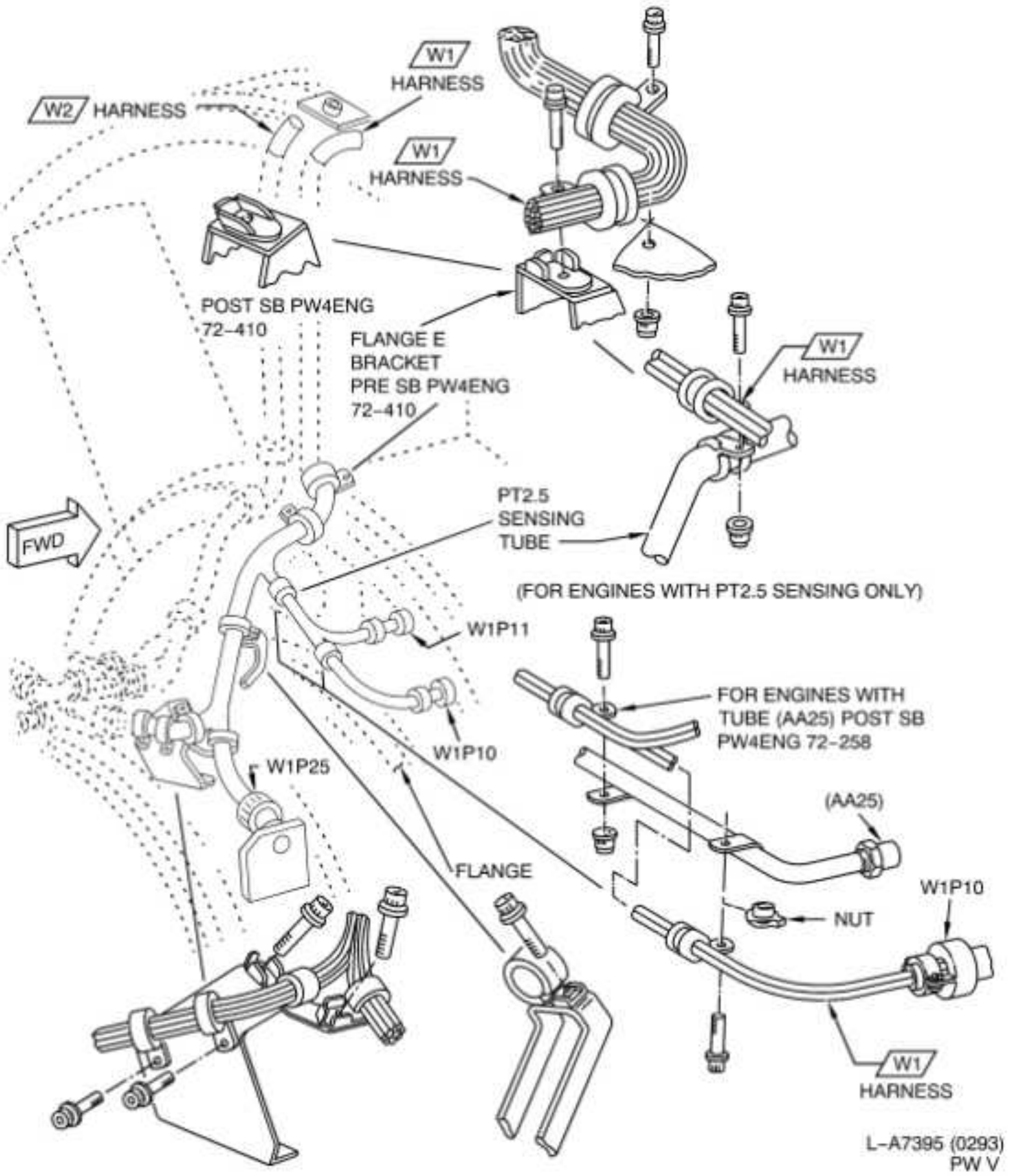
EEC Fan Case Wiring Harnesses
Figure 307
(Task 72-00-33-050-003-A)


W2 HARNESS
W1 HARNESS
PLATE AND GROMMET
(POST SB PW4ENG 72-145)
BOLT
SCREW
(2 REQUIRED)
WASHER
(PRE SB PW4ENG 72-145)
UPPER REAR GROMMET
(PRE SB PW4ENG 72-145)
FRONT GROMMET
(PREVIOUSLY
INSTALLED
WITH TUBES)
UPPER MIDDLE
GROMMET
EEC SENSING
TUBES
LOWER LEFT
CLAMP SEGMENT
FWD
SCREW
(2 REQUIRED)
LOWER
CENTER GROMMETS
LEFT CLAMP
SEGMENT BRACKET
LOWER RIGHT
CLAMP SEGMENT
RIGHT CLAMP
SEGMENT BRACKET
L-A5141 (0000)
PW V

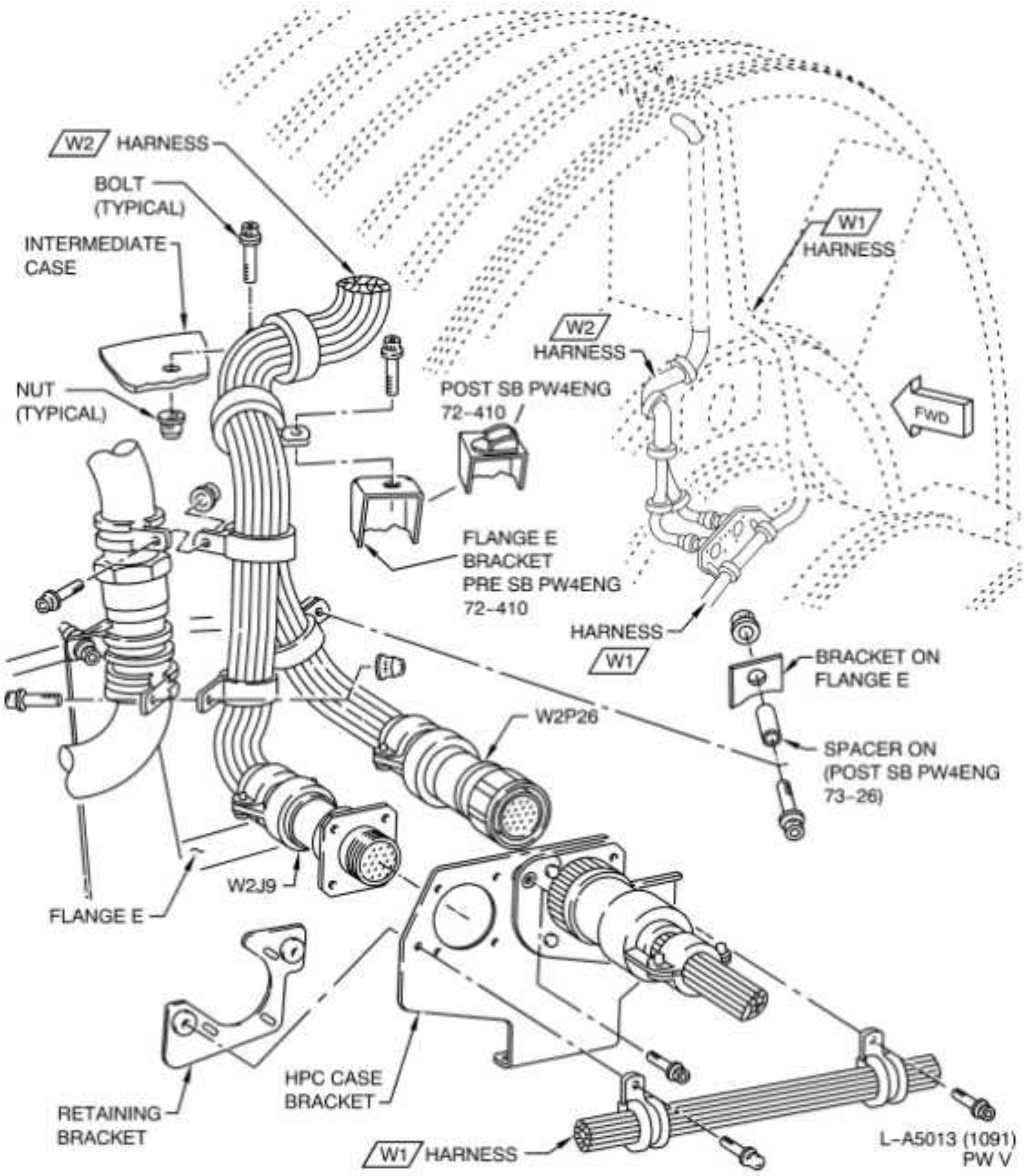
EEC Fan Case Wiring Harnesses
Figure 308
(Task 72-00-33-050-003-A)


W2 HARNESS
W1 HARNESS
W1 HARNESS
INTERMEDIATE CASE
FLANGE E BRACKET
FWD
W1 HARNESS
W1P11
W1P10
PT 2.5 SENSING TUBE
(FOR ENGINES WITH PMUX ONLY)
W1P25
FLANGE E
HPC AIR VALVE SUPPLY TUBE
W1P10
NUT
W1 HARNESS
HPC CASE BRACKET
W1 HARNESS
L-A5012 (0289)
PW V

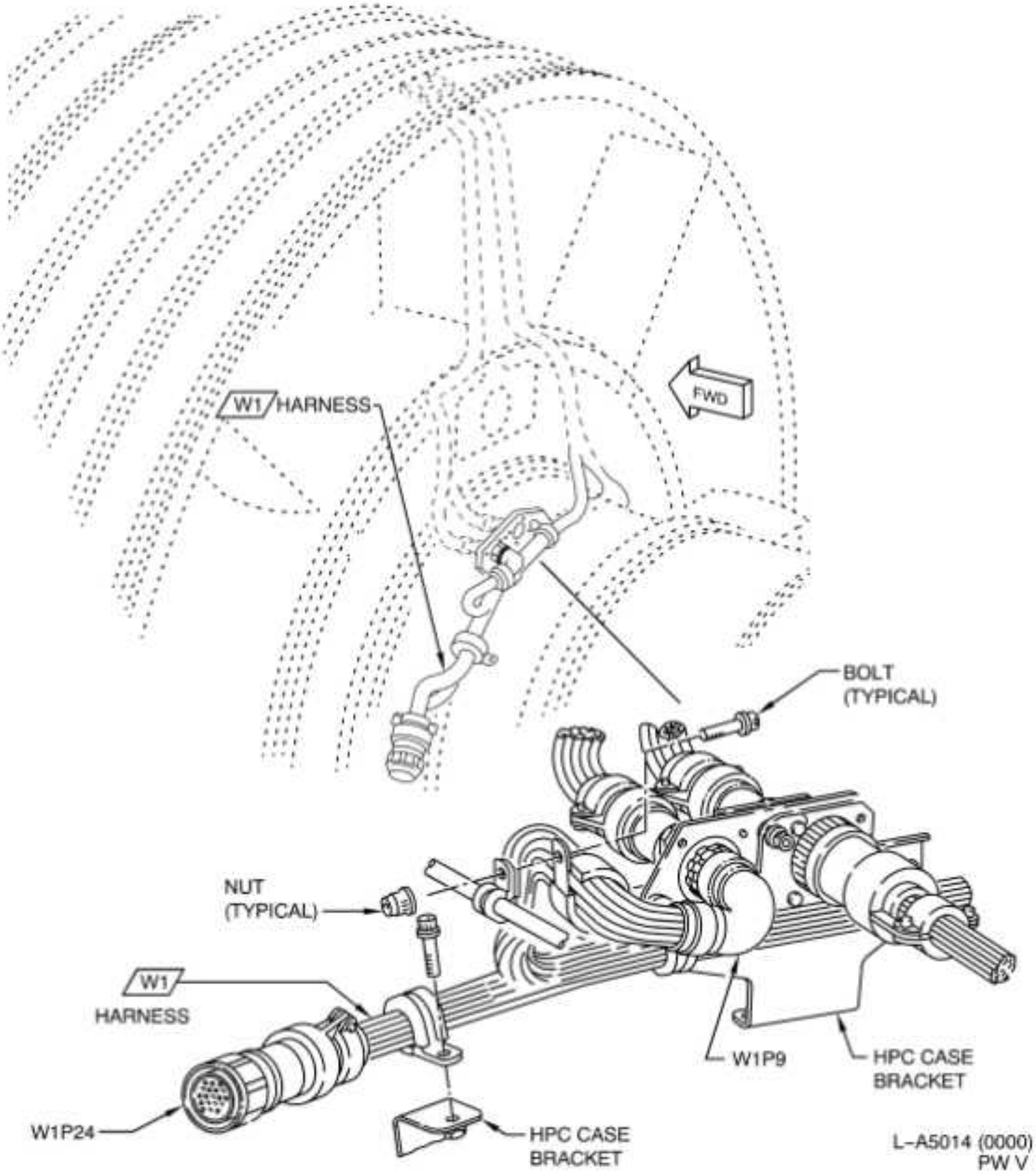
EEC Fan Case Wiring Harnesses
Pre SB PW4ENG 72−258
Figure 309 (Sheet 1)
(Task 72−00−33−050−003−A)


W1 HARNESS
W2 HARNESS
W1 HARNESS
POST SB PW4ENG 72−410
FLANGE E BRACKET PRE SB PW4ENG 72−410
W1 HARNESS
PT2.5 SENSING TUBE
FWD
(FOR ENGINES WITH PT2.5 SENSING ONLY)
W1P11
FOR ENGINES WITH TUBE (AA25) POST SB PW4ENG 72−258
W1P10
W1P25
(AA25)
FLANGE
W1P10
NUT
W1 HARNESS
L−A7395 (0293)
PW V

EEC Fan Case Wiring Harnesses
Post SB PW4ENG 72−258
Figure 309 (Sheet 2)
(Task 72−00−33−050−003−A)


W2 HARNESS
BOLT (TYPICAL)
INTERMEDIATE CASE
NUT (TYPICAL)
W1 HARNESS
W2 HARNESS
POST SB PW4ENG 72-410
FWD
FLANGE E BRACKET PRE SB PW4ENG 72-410
HARNESS W1
BRACKET ON FLANGE E
W2P26
SPACER ON (POST SB PW4ENG 73-26)
W2J9
FLANGE E
RETAINING BRACKET
HPC CASE BRACKET
W1 HARNESS
L-A5013 (1091) PW V

EEC Fan Case Wiring Harnesses
Figure 310 (Sheet 1)
(Task 72−00−33−050−003−A)


W1 HARNESS
FWD
BOLT (TYPICAL)
NUT (TYPICAL)
W1 HARNESS
W1P9
HPC CASE BRACKET
W1P24
HPC CASE BRACKET
L-A5014 (0000)
PW V

EEC Fan Case Wiring Harnesses
Figure 310 (Sheet 2)
(Task 72-00-33-050-003-A)

(4) If the intermediate case is to be removed, continue to remove the harnesses from the strut and the HPC as follows.

CAUTION: DO NOT DAMAGE THE HARNESSES WHEN YOU REMOVE THE SEALANT.

(5) Cut and remove the sealant around the grommets. Remove the sealant from around the harnesses.
(6) Remove the screws and the bolt that attach the harnesses to the intermediate case strut. Remove the clamp segment brackets, clamp segments, and grommets (upper and lower) that attach the harnesses. See Figure 308.
(7) Disconnect the W1P10 and W1P11 harness connectors from the solenoid valve located in the intermediate case at approximately 1 o'clock position. Use a PWA 85749 Torque Adapter if necessary. Install protective closures on the harness connectors and receptacles. See Figures 309 and 310.
(8) Disconnect the W1P24, W1P9, W1P25, and W2P26 harness connectors from the receptacles attached to the HPC case brackets. Install protective closures on the harness connectors and receptacles.
(9) Remove two bolts and the retaining bracket that attach the W2J9 harness receptacle to the HPC bracket. Install protective closures on the harness connector and receptacle.
(10) Remove the bolts, nuts, and clamps that attach the W1 and W2 harnesses to the brackets and tubes.
(11) Remove the harness ties as necessary. Remove the harnesses from the engine.

Task 72−00−33−050−003−B:

2. Remove EEC Fan Case Wiring Harnesses W1, W2, W11 (SCU Only) And W12 For Engines With Commonality Parts Between Airbus And McDonnell Douglas

NOTE: This procedure gives instructions for the complete removal of both the W1, W2, W11 (SCU only), and W12 harnesses. If only the fan case is to be removed, do not remove the harnesses rearward of Flange C.

A. Prerequisites
(1) Remove the electronic engine control. See Removal−04 (Task 72−00−33−050−001).
(2) Remove the fan exit liner segments (inner rear) that are at 11 and 1 o'clock. Refer to 72−00−33, Removal−16 (Task 72−00−33−040−001).

B. Equipment And Materials Required

Standard Tools:
No. 10 Torq−set Drive

Special Tools:
PWA 85749 Torque Adapter, Electronic Harness Connectors

C. Procedure
See Figures 311 through 323.

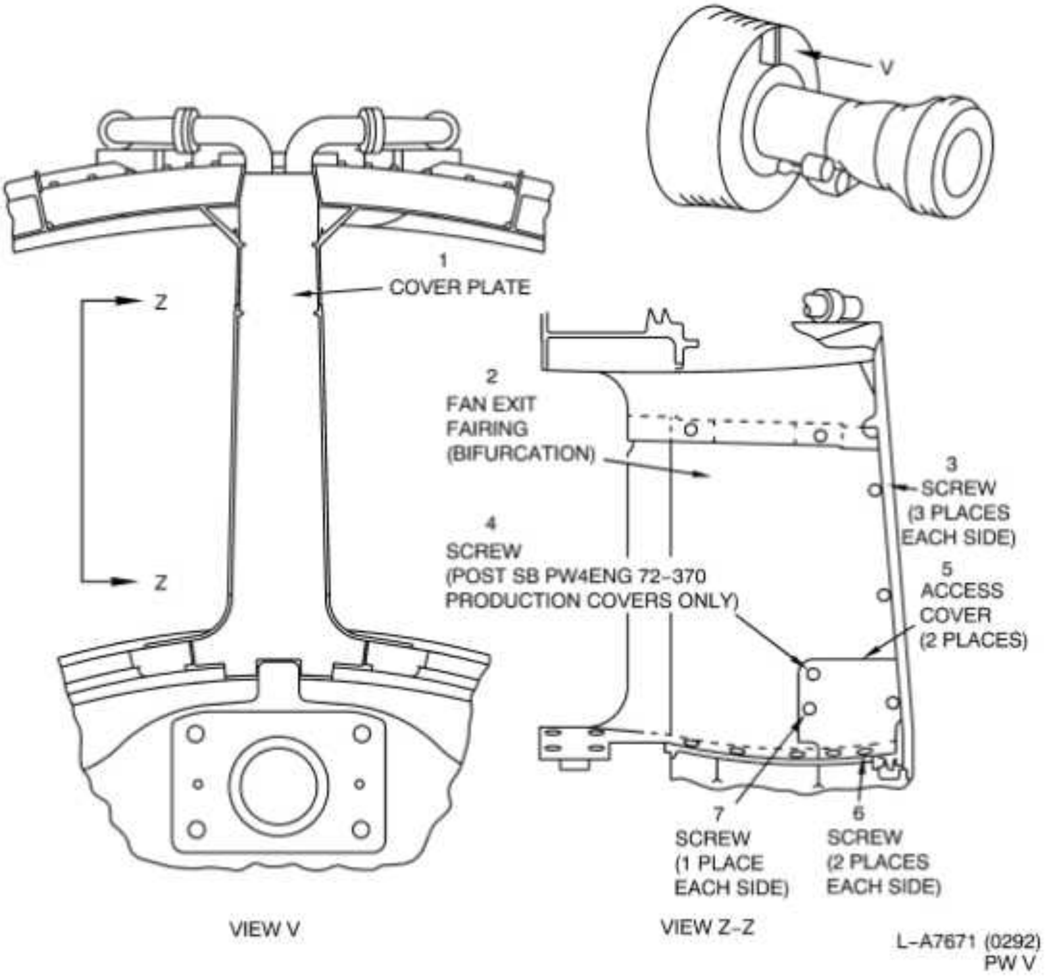
CAUTION: DO NOT TWIST OR BEND THE HARNESSES BADLY DURING REMOVAL OR DAMAGE TO HARNESSES CAN RESULT.

(1) Remove the fairing (access) covers as follows. Use a No. 10 Torq−set drive to remove the screws.
  (a) Cut and remove the sealant from around the rear cover plate (311/1). Remove the screws (301/3) and cover plate (311/1).
  (b) Cut and remove the sealant from around the two (access) covers (311/5). Remove the screws (311/4), (311/7), and (311/6) and the two (access) covers (311/5).

(2) For engines incorporating the supplemental control unit (SCU), disconnect W11P33 and W11P34 harness connectors from the supplemental control unit (SCU).
(3) Remove bolts, nuts and clamps securing W1, W2, W11 (SCU only) and W12 harnesses to brackets on Flanges A1, B1, B2 and C on fan case.
(4) If the intermediate case is to be removed, continue to remove the harnesses from the strut and the HPC as follows.

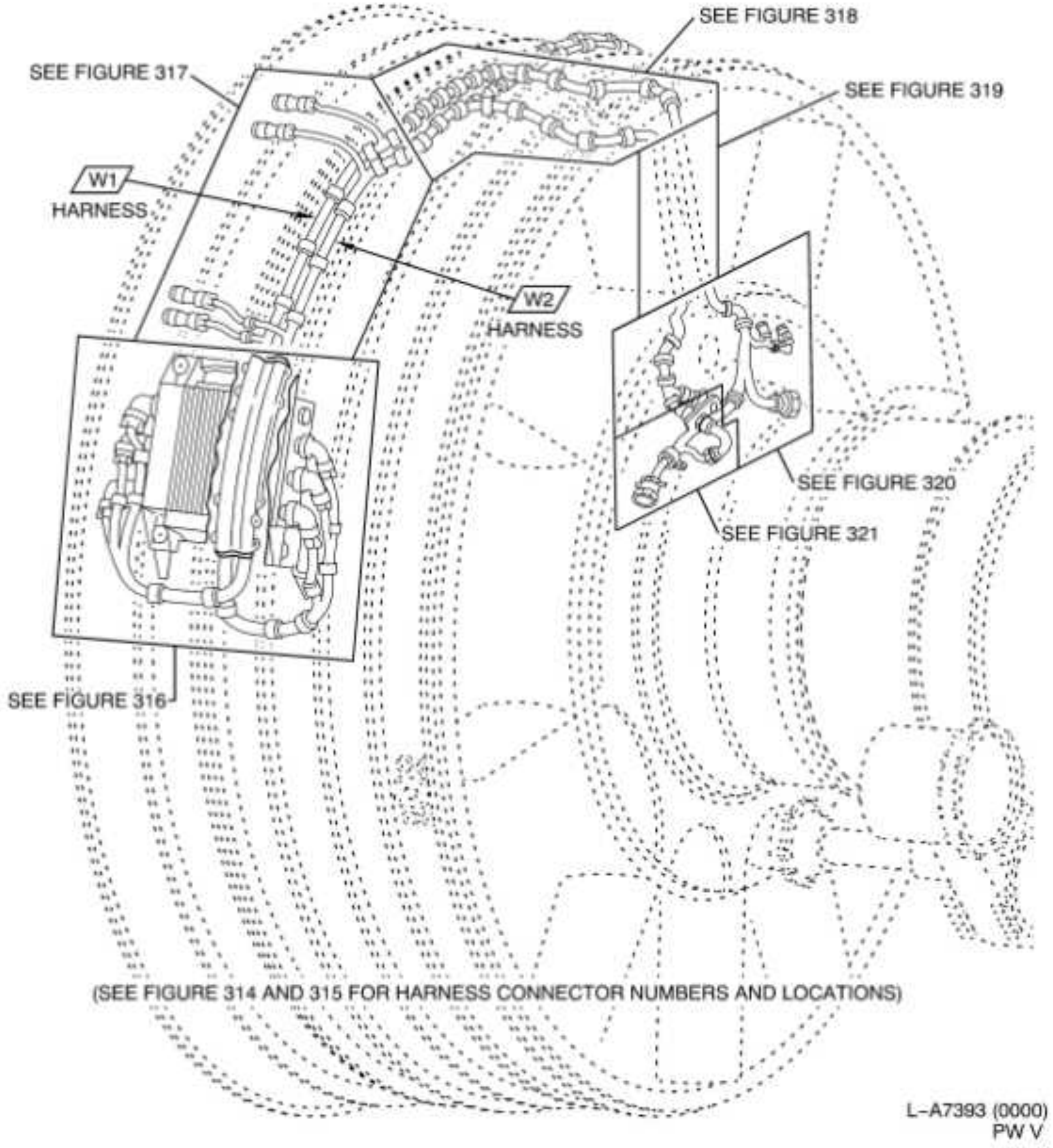
CAUTION: DO NOT DAMAGE THE HARNESSES WHEN YOU REMOVE THE SEALANT.

(5) Cut and remove the sealant around the grommets. Remove the sealant from around the harnesses.
(6) Remove the screws and the bolt that attach the harnesses to the intermediate case strut. Remove the clamp segment brackets, clamp segments, and grommets (upper and lower) that attach the harnesses. See Figure 319.

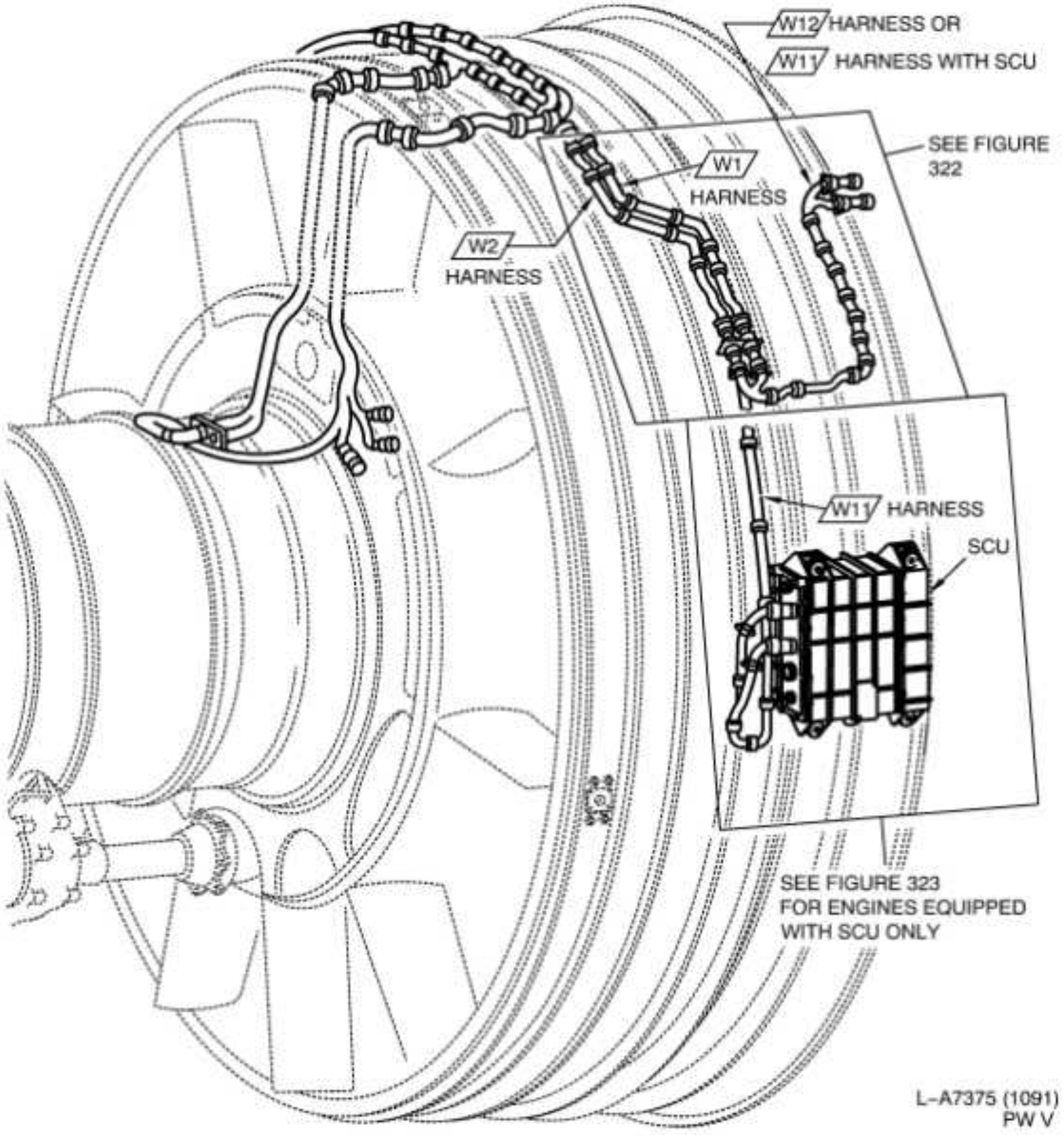

V
1
COVER PLATE
Z
Z
2
FAN EXIT
FAIRING
(BIFURCATION)
3
SCREW
(3 PLACES
EACH SIDE)
4
SCREW
(POST SB PW4ENG 72-370
PRODUCTION COVERS ONLY)
5
ACCESS
COVER
(2 PLACES)
7
SCREW
(1 PLACE
EACH SIDE)
6
SCREW
(2 PLACES
EACH SIDE)
VIEW V
VIEW Z-Z
L-A7671 (0292)
PW V

Fan Exit Fairing (Bifurcation)
Figure 311
(Task 72-00-33-050-003-B)

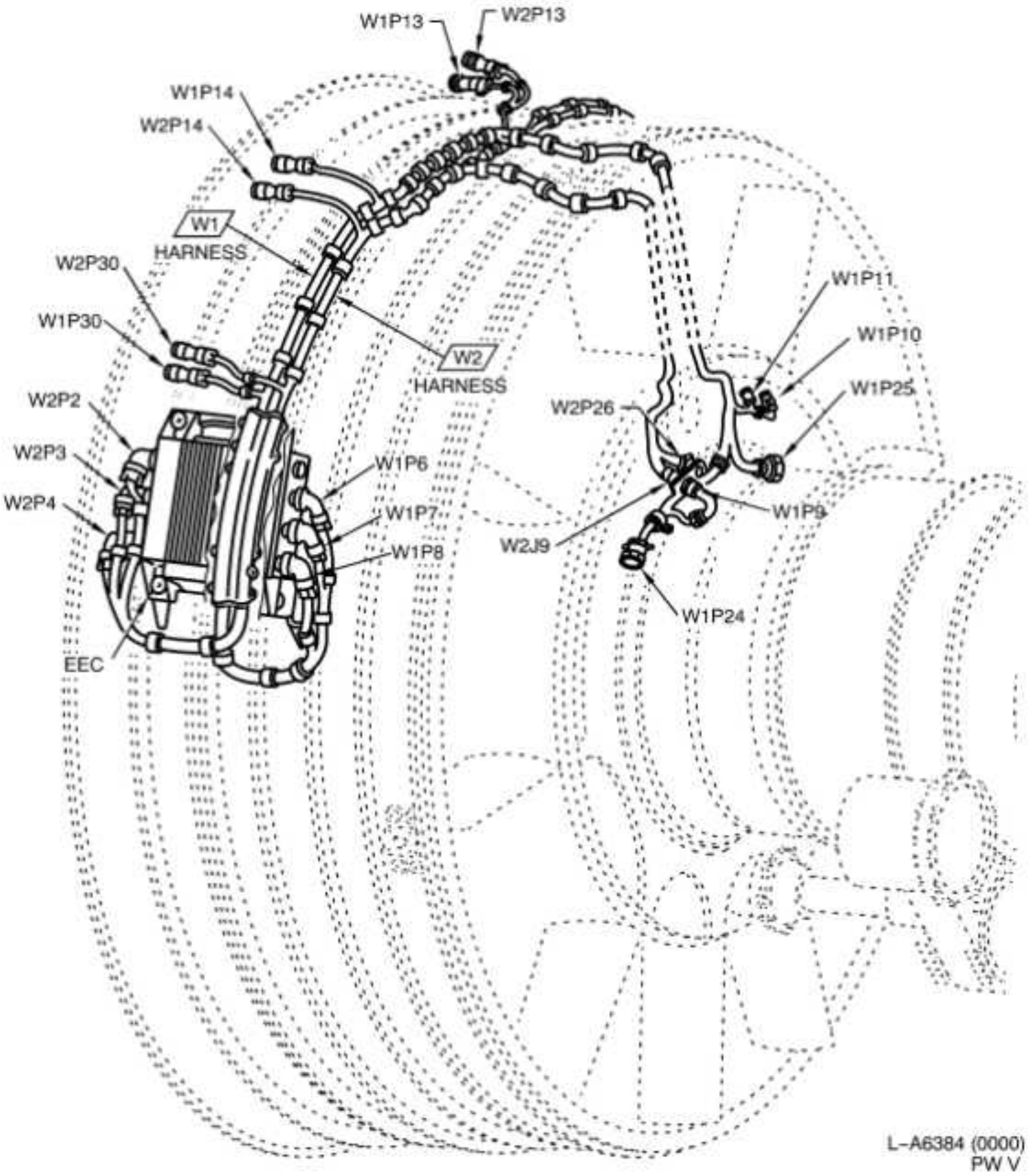
ENGINE GENERAL − FAN CASE − REMOVAL−06


SEE FIGURE 318
SEE FIGURE 317
SEE FIGURE 319
W1
HARNESS
W2
HARNESS
SEE FIGURE 320
SEE FIGURE 321
SEE FIGURE 316
(SEE FIGURE 314 AND 315 FOR HARNESS CONNECTOR NUMBERS AND LOCATIONS)
L-A7393 (0000)
PW V

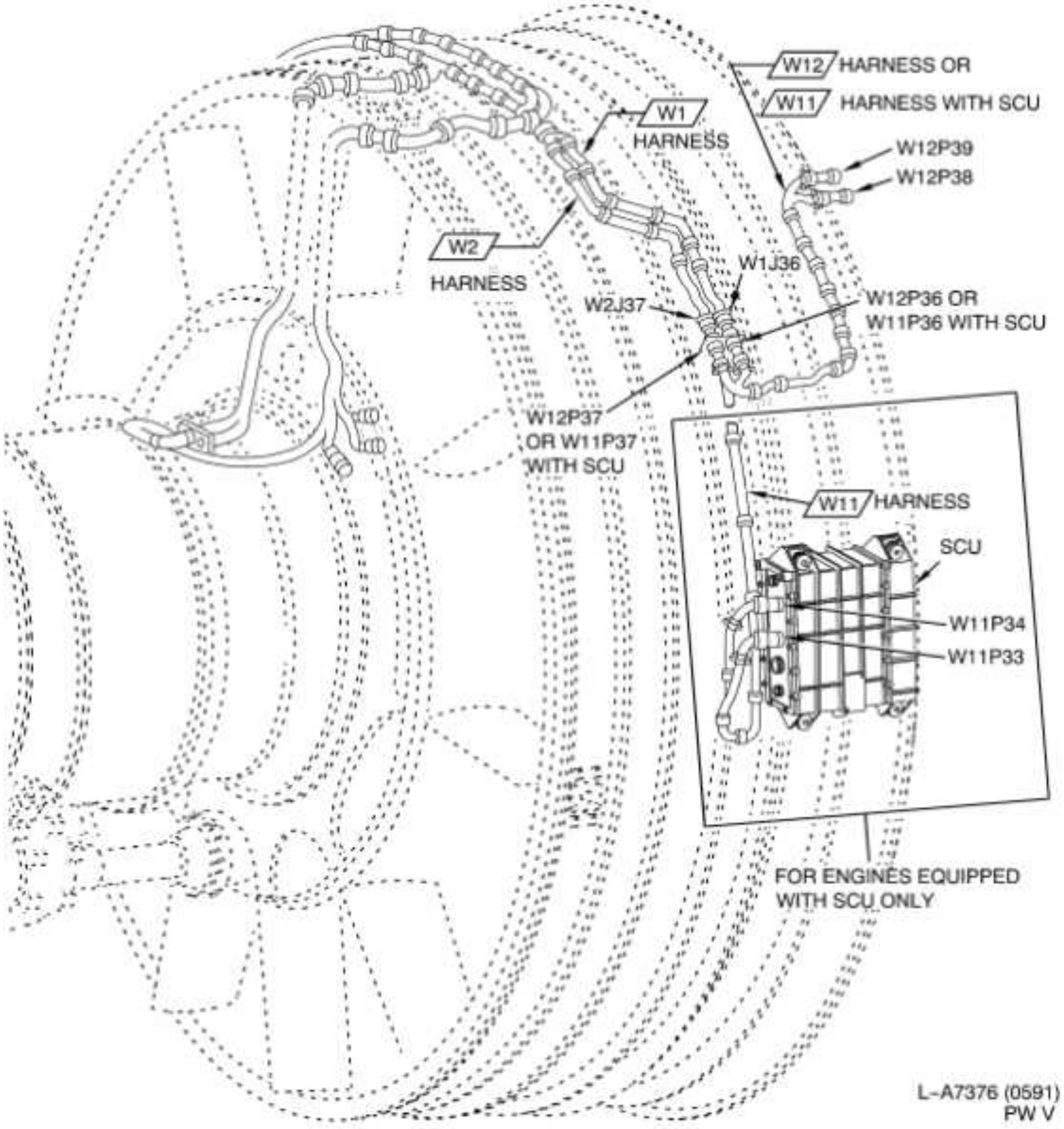
EEC Wiring Harness − W1, W2, W11
And W12 (Fan Case)
Figure 312
(Task 72−00−33−050−003−B)


W12 HARNESS OR
W11 HARNESS WITH SCU
SEE FIGURE 322
W1 HARNESS
W2 HARNESS
W11 HARNESS
SCU
SEE FIGURE 323 FOR ENGINES EQUIPPED WITH SCU ONLY
L-A7375 (1091)
PW V

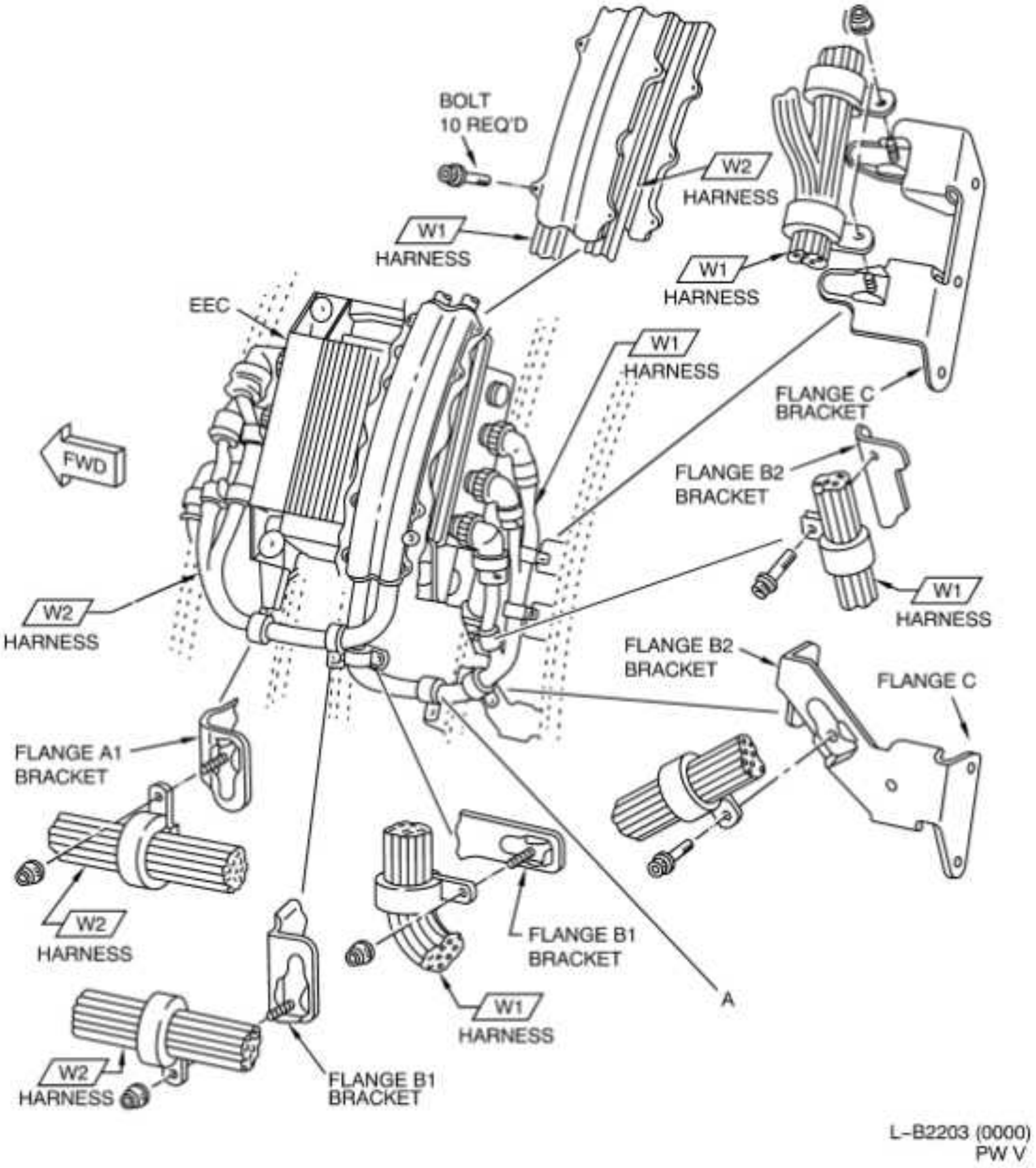
EEC Wiring Harness - W1, W2, W11
And W12 (Fan Case)
Figure 313
(Task 72-00-33-050-003-B)


W1P13
W2P13
W1P14
W2P14
W1 HARNESS
W2P30
W1P30
W2P2
W2P3
W2P4
EEC
W2 HARNESS
W1P11
W1P10
W1P25
W2P26
W1P6
W1P7
W1P8
W2J9
W1P9
W1P24
L-A6384 (0000)
PW V

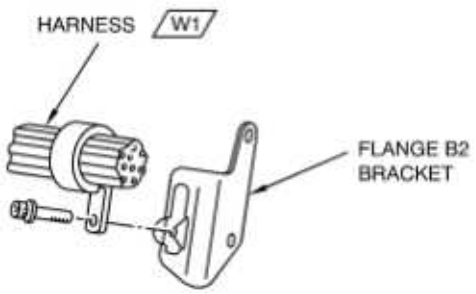
EEC Wiring Harness − W1, W2, W11
And W12 (Fan Case)
Figure 314
(Task 72−00−33−050−003−B)


W12 HARNESS OR
W11 HARNESS WITH SCU
W1
HARNESS
W12P39
W12P38
W2
HARNESS
W1J36
W2J37
W12P36 OR
W11P36 WITH SCU
W12P37
OR W11P37
WITH SCU
W11 HARNESS
SCU
W11P34
W11P33
FOR ENGINES EQUIPPED
WITH SCU ONLY
L-A7376 (0591)
PW V

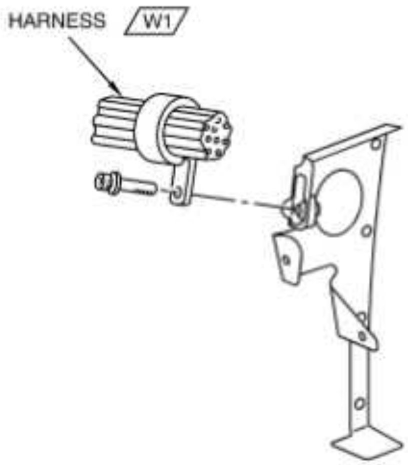
EEC Wiring Harness – W1, W2, W11
And W12 (Fan Case)
Figure 315
(Task 72–00–33–050–003–B)


BOLT
10 REQ'D
W2
HARNESS
W1
HARNESS
W1
HARNESS
EEC
W1
HARNESS
FLANGE C
BRACKET
FWD
FLANGE B2
BRACKET
W2
HARNESS
W1
HARNESS
FLANGE B2
BRACKET
FLANGE C
FLANGE A1
BRACKET
W2
HARNESS
FLANGE B1
BRACKET
A
W1
HARNESS
W2
HARNESS
FLANGE B1
BRACKET
L−B2203 (0000)
PW V

EEC Wiring Harness − W1, W2, W11
And W12 (Fan Case)
Figure 316 (Sheet 1)
(Task 72−00−33−050−003−B)


HARNESS W1
FLANGE B2
BRACKET

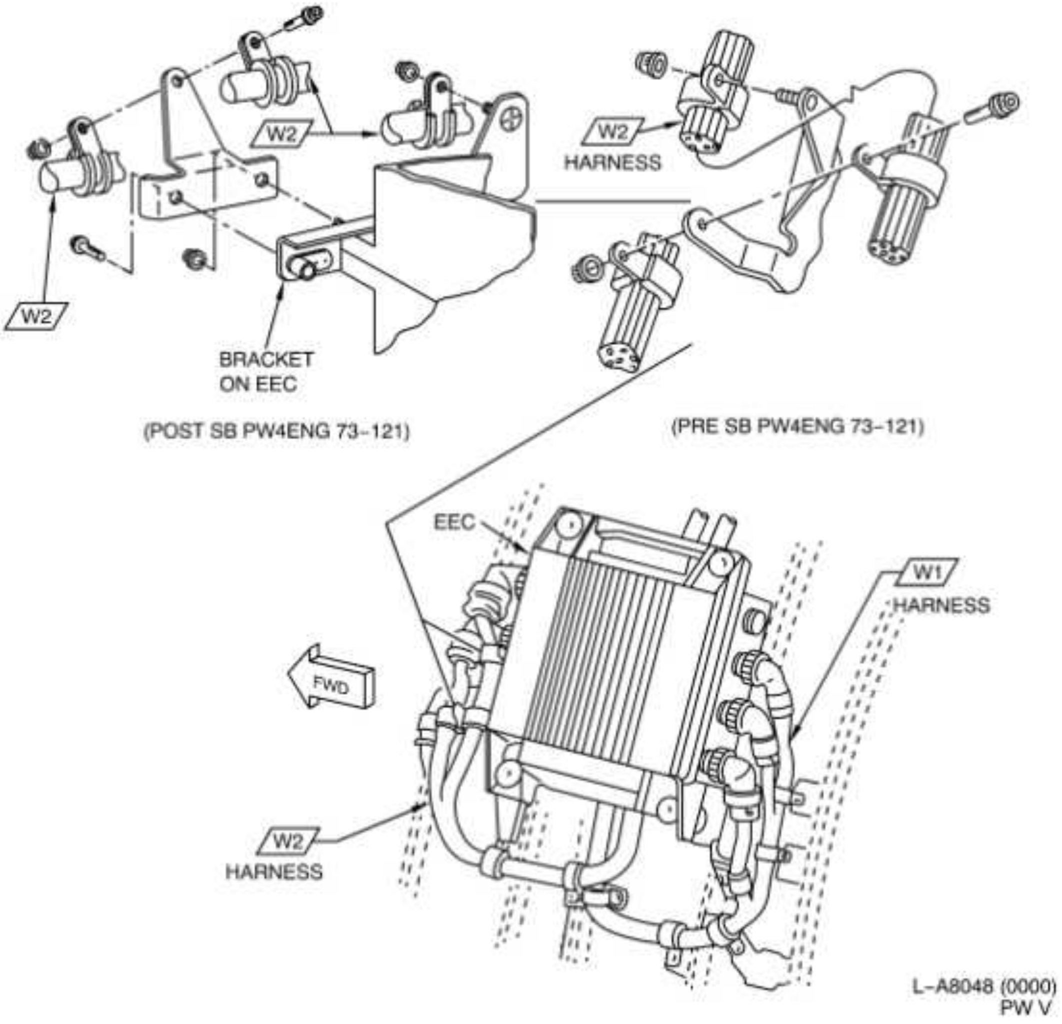
VIEW A
(PRE SB PW4ENG 73-143)



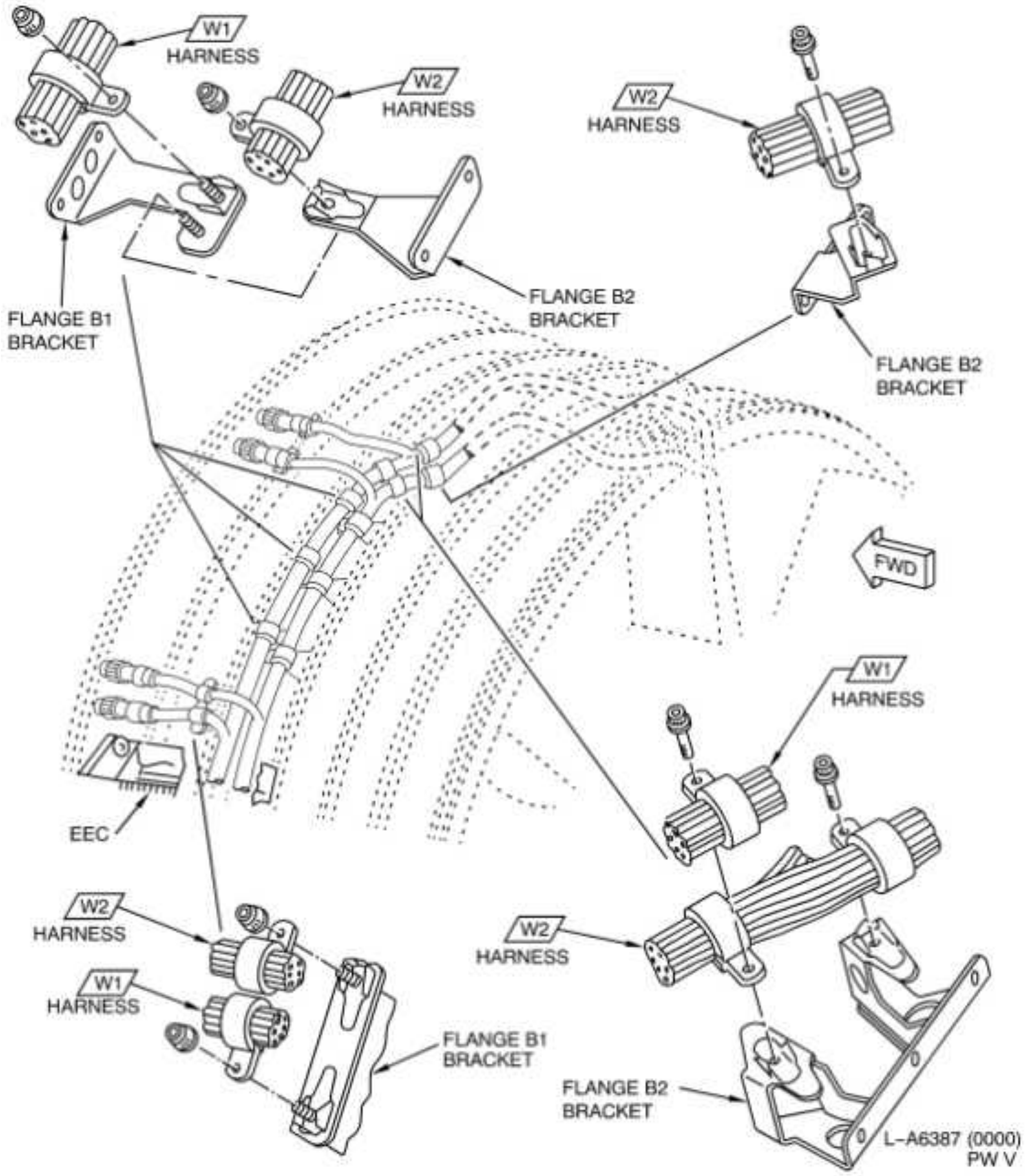
VIEW A
(POST SB PW4ENG 73-143)

L-B2204 (0000)
PW V

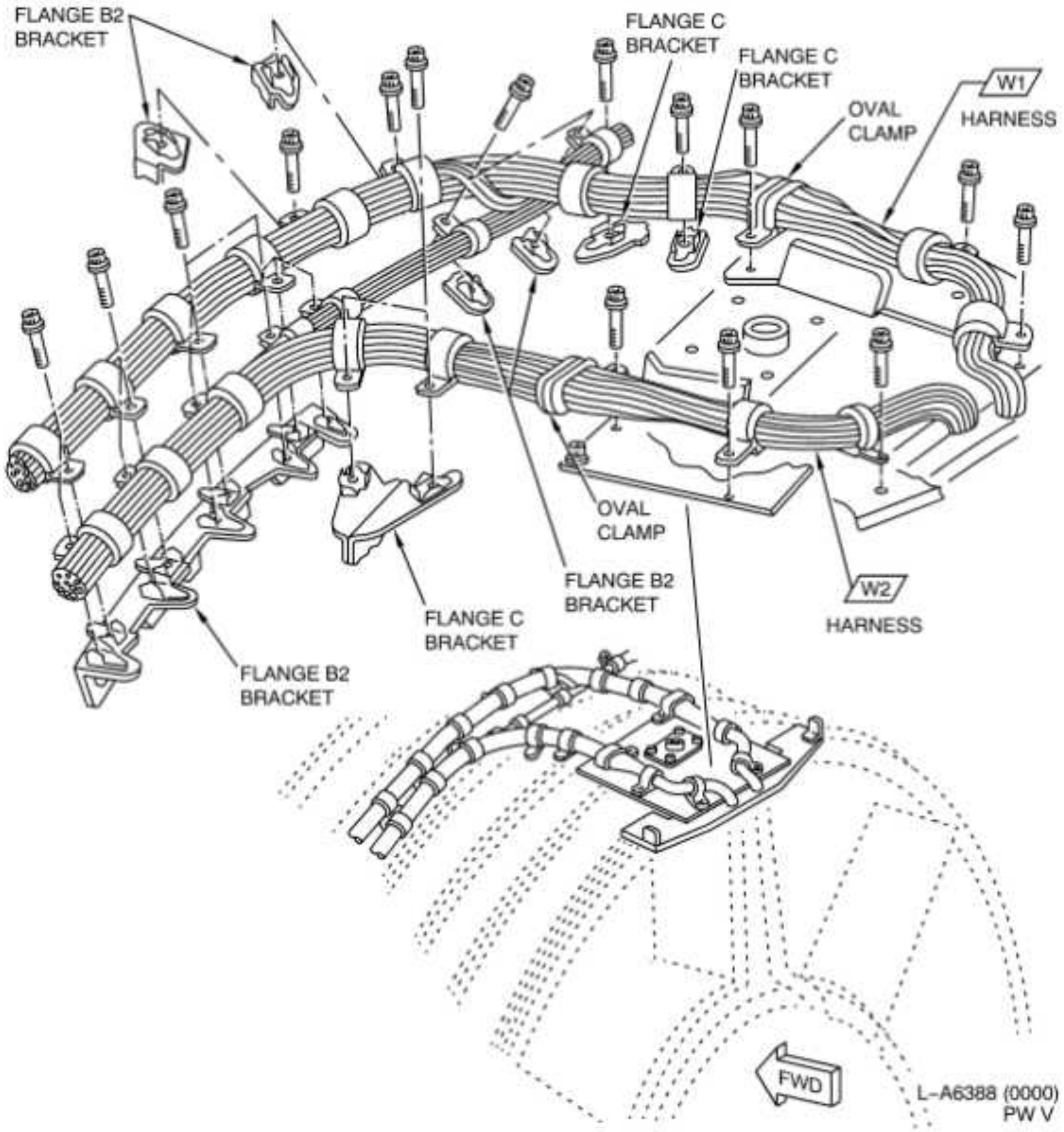
EEC Wiring Harness - W1, W2, W11
And W12 (Fan Case)
Figure 316 (Sheet 2)
(Task 72-00-33-050-003-B)


W2
W2
W2
BRACKET
ON EEC
(POST SB PW4ENG 73-121)
W2
HARNESS
(PRE SB PW4ENG 73-121)
EEC
W1
HARNESS
FWD
W2
HARNESS
L-A8048 (0000)
PW V

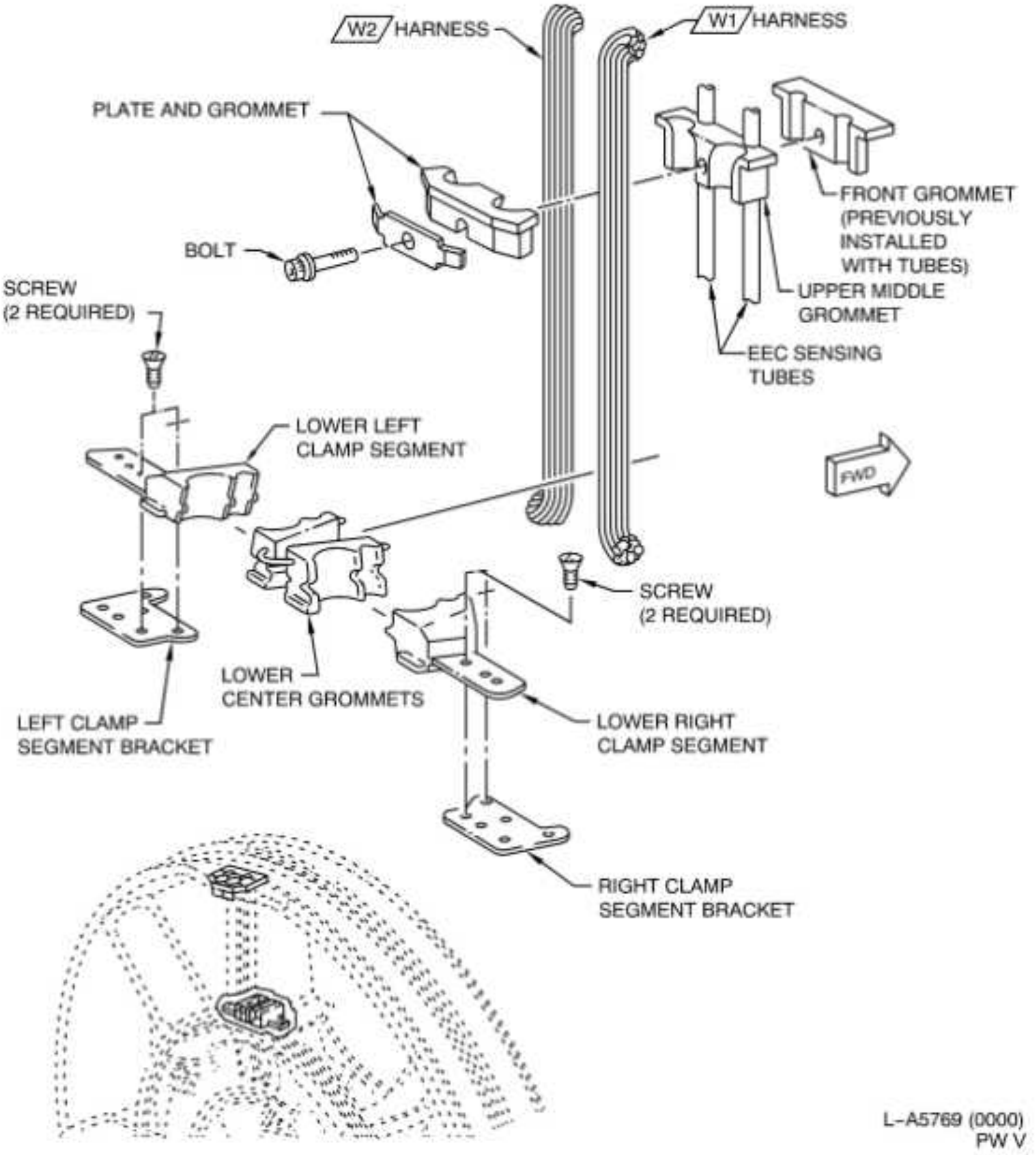
EEC Wiring Harness - W1, W2, W11
And W12 (Fan Case)
Figure 316 (Sheet 3)
(Task 72-00-33-050-003-B)


W1
HARNESS
W2
HARNESS
W2
HARNESS
FLANGE B1
BRACKET
FLANGE B2
BRACKET
FLANGE B2
BRACKET
FWD
W1
HARNESS
EEC
W2
HARNESS
W1
HARNESS
W2
HARNESS
FLANGE B1
BRACKET
FLANGE B2
BRACKET
L−A6387 (0000)
PW V

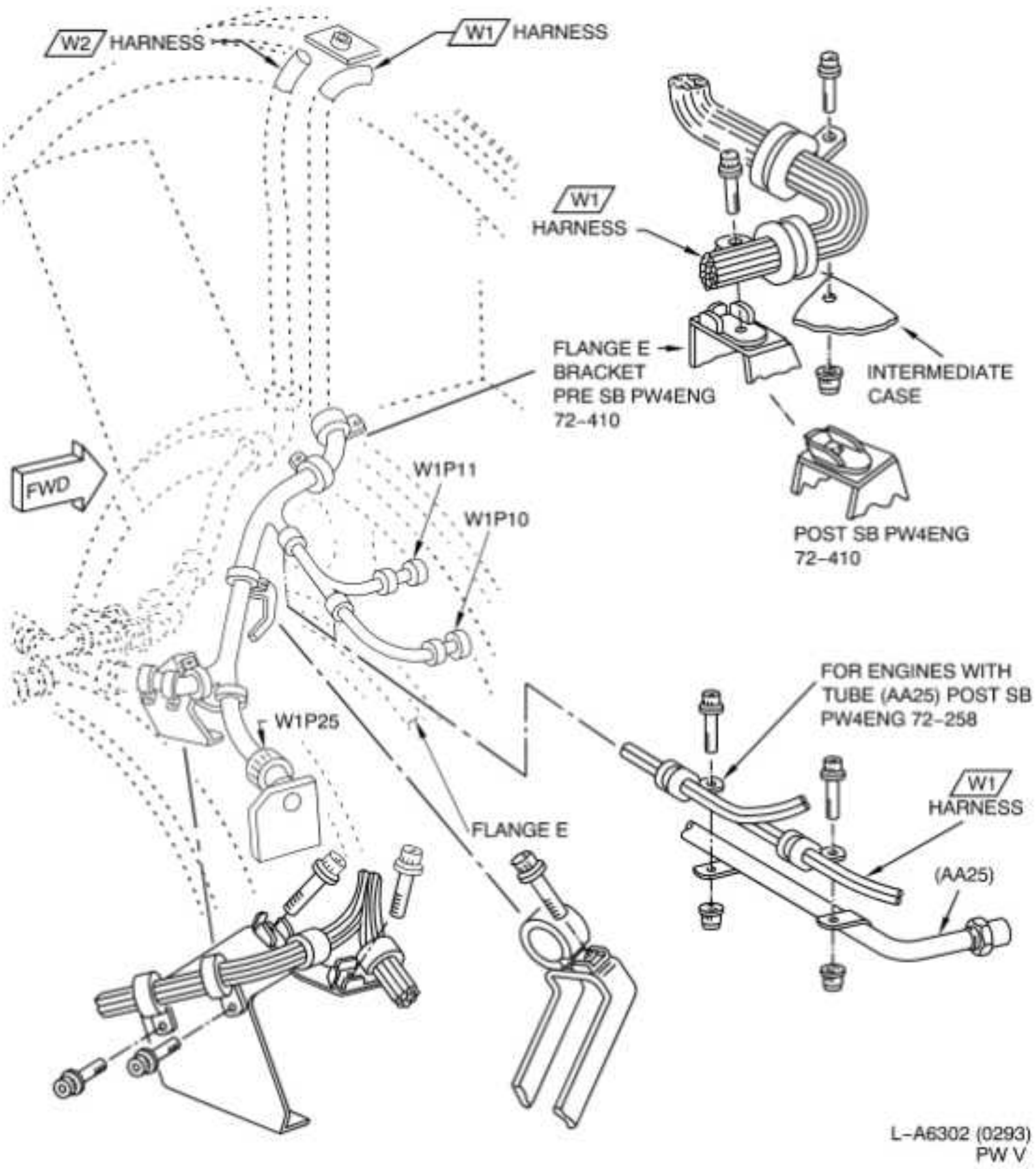
EEC Wiring Harness − W1, W2, W11
And W12 (Fan Case)
Figure 317
(Task 72−00−33−050−003−B)


FLANGE B2 BRACKET
FLANGE C BRACKET
FLANGE C BRACKET
OVAL CLAMP
W1
HARNESS
OVAL CLAMP
FLANGE B2 BRACKET
W2
HARNESS
FLANGE C BRACKET
FLANGE B2 BRACKET
FWD
L-A6388 (0000)
PW V

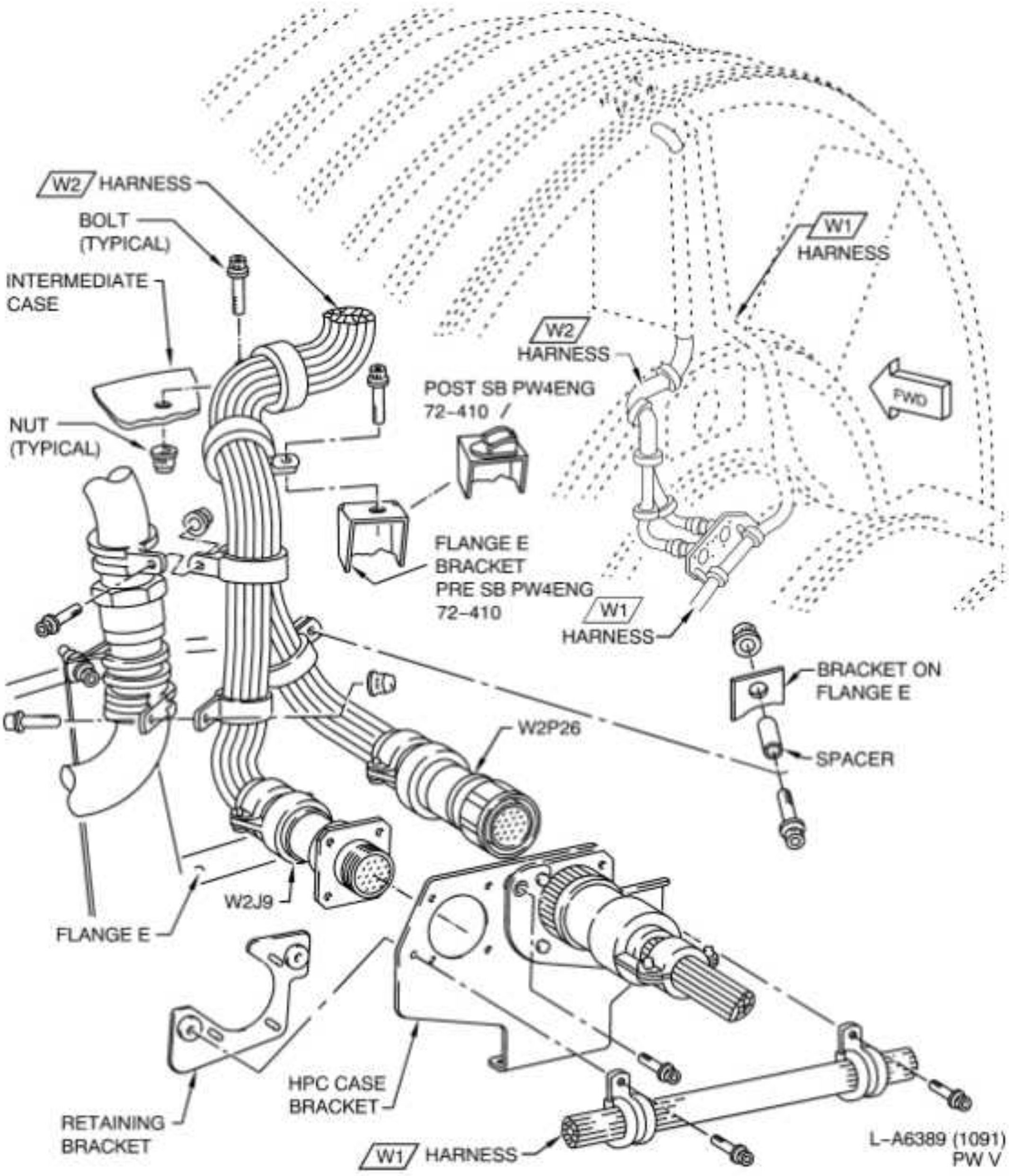
EEC Wiring Harness - W1, W2, W11
And W12 (Fan Case)
Figure 318
(Task 72-00-33-050-003-B)


W2 HARNESS
W1 HARNESS
PLATE AND GROMMET
BOLT
SCREW
(2 REQUIRED)
FRONT GROMMET
(PREVIOUSLY
INSTALLED
WITH TUBES)
UPPER MIDDLE
GROMMET
EEC SENSING
TUBES
LOWER LEFT
CLAMP SEGMENT
FWD
SCREW
(2 REQUIRED)
LOWER
CENTER GROMMETS
LEFT CLAMP
SEGMENT BRACKET
LOWER RIGHT
CLAMP SEGMENT
RIGHT CLAMP
SEGMENT BRACKET
L−A5769 (0000)
PW V

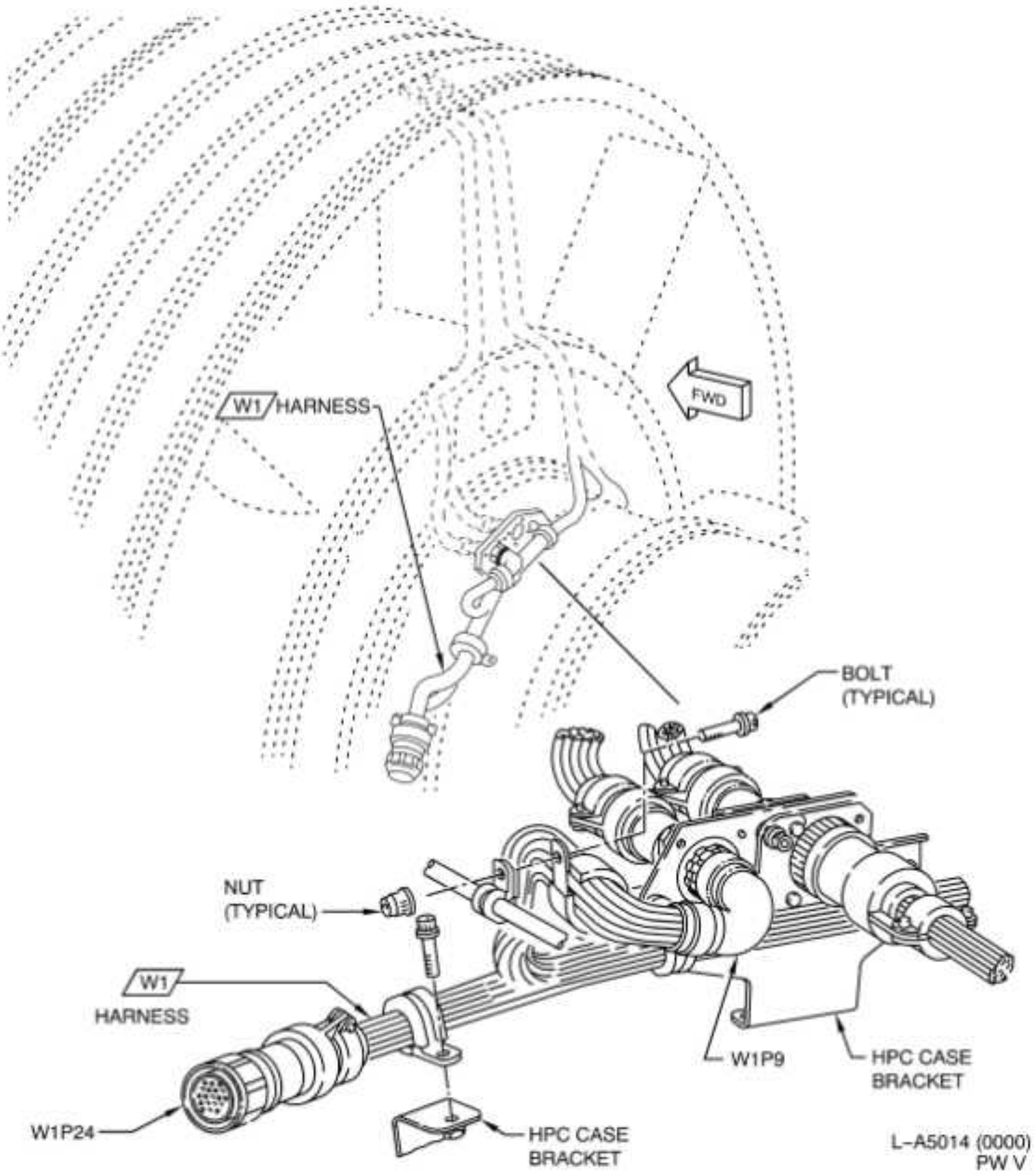
EEC Wiring Harness − W1, W2, W11
And W12 (Fan Case)
Figure 319
(Task 72−00−33−050−003−B)


W2 HARNESS
W1 HARNESS
W1 HARNESS
FLANGE E BRACKET PRE SB PW4ENG 72-410
INTERMEDIATE CASE
POST SB PW4ENG 72-410
FWD
W1P11
W1P10
W1P25
FLANGE E
FOR ENGINES WITH TUBE (AA25) POST SB PW4ENG 72-258
W1 HARNESS
(AA25)
L-A6302 (0293)
PW V

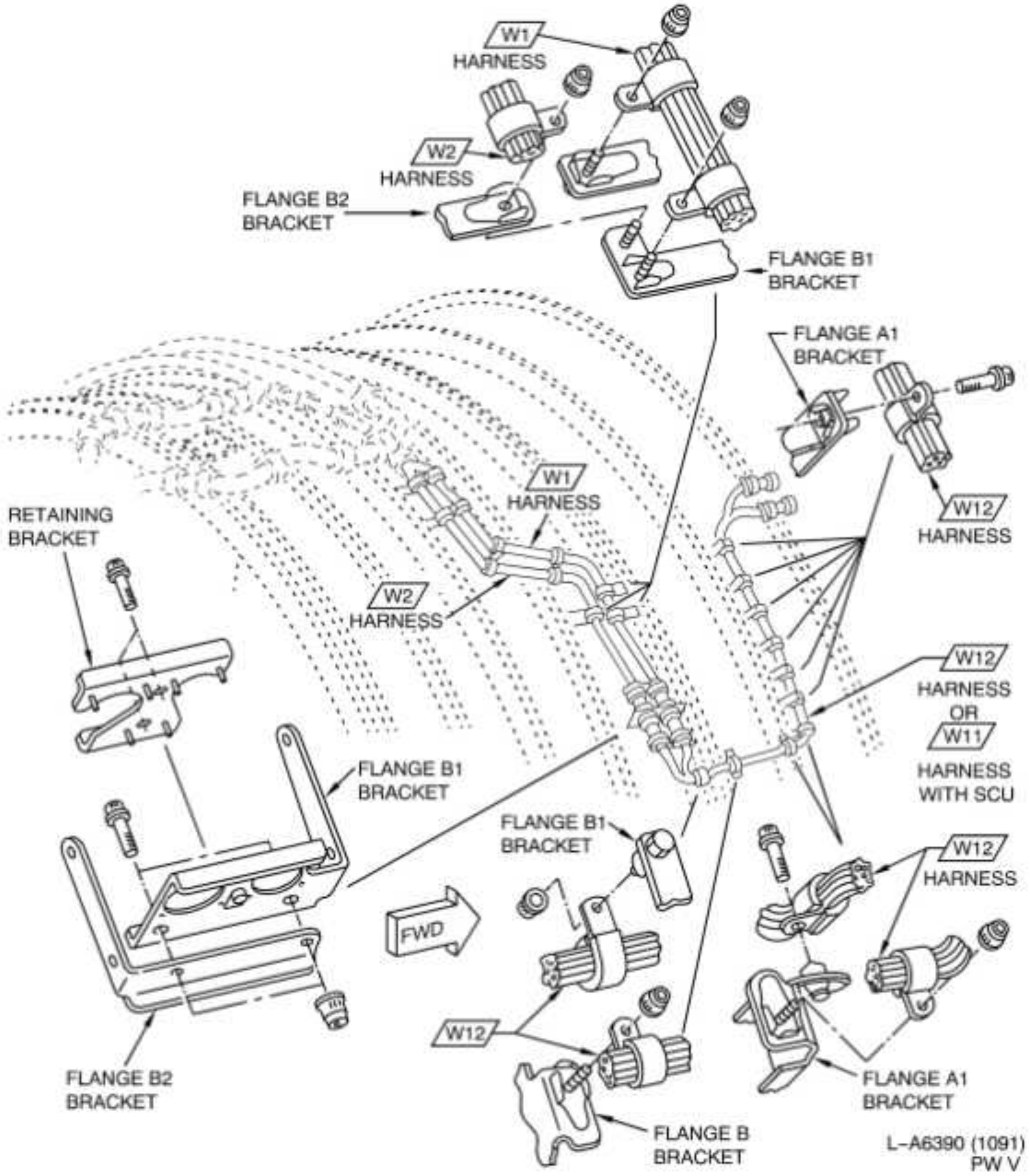
EEC Wiring Harness − W1, W2, W11
And W12 (Fan Case)
Figure 320 (Sheet 1)
(Task 72−00−33−050−003−B)


W2 HARNESS
BOLT (TYPICAL)
INTERMEDIATE CASE
NUT (TYPICAL)
W1 HARNESS
W2 HARNESS
POST SB PW4ENG 72−410
FWD
FLANGE E BRACKET PRE SB PW4ENG 72−410
W1 HARNESS
BRACKET ON FLANGE E
SPACER
W2P26
W2J9
FLANGE E
RETAINING BRACKET
HPC CASE BRACKET
W1 HARNESS
L−A6389 (1091)
PW V

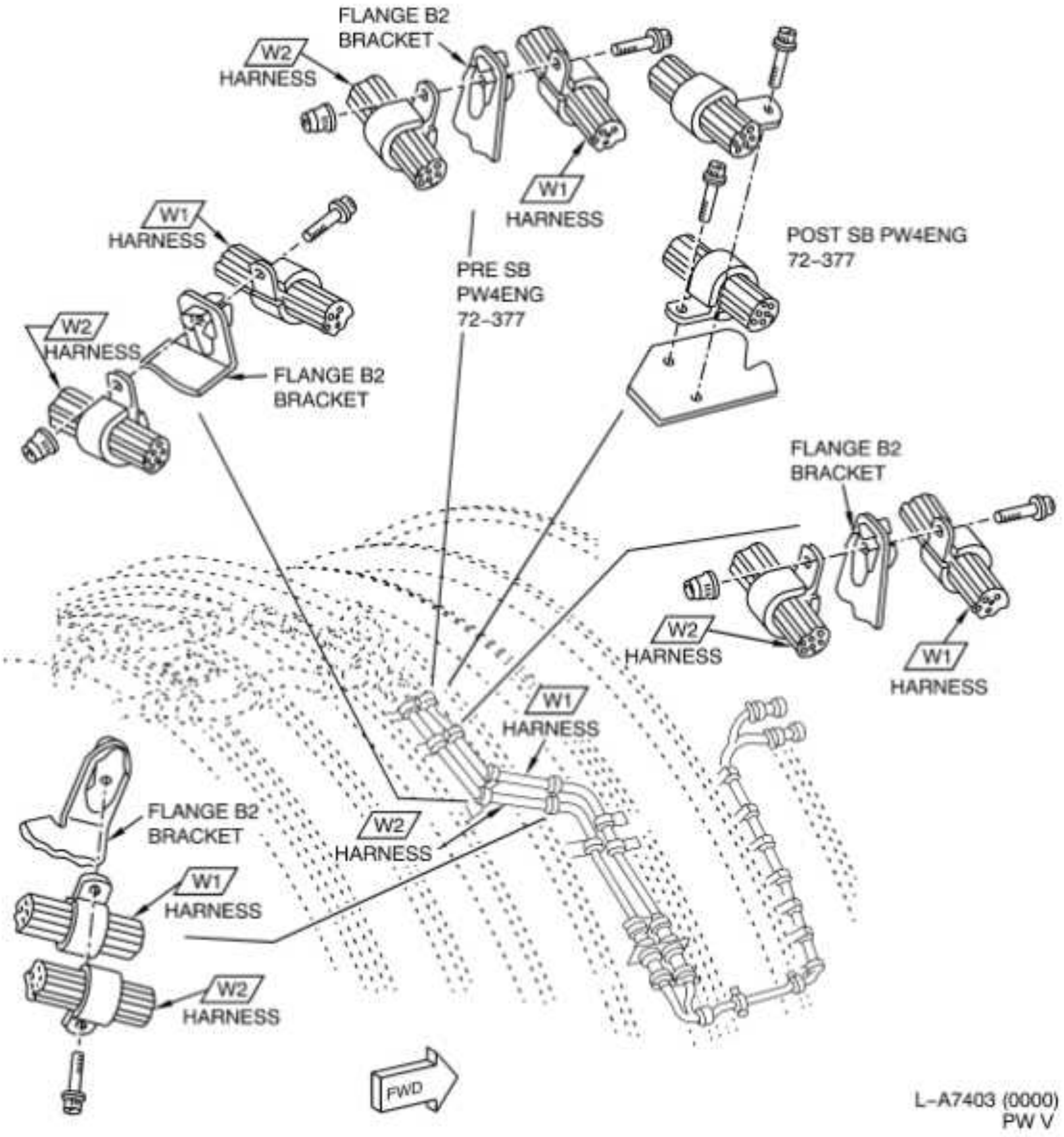
EEC Wiring Harness − W1, W2, W11
And W12 (Fan Case)
Figure 320 (Sheet 2)
(Task 72−00−33−050−003−B)


W1 HARNESS
FWD
BOLT (TYPICAL)
NUT (TYPICAL)
W1 HARNESS
W1P9
HPC CASE BRACKET
W1P24
HPC CASE BRACKET
L-A5014 (0000)
PW V

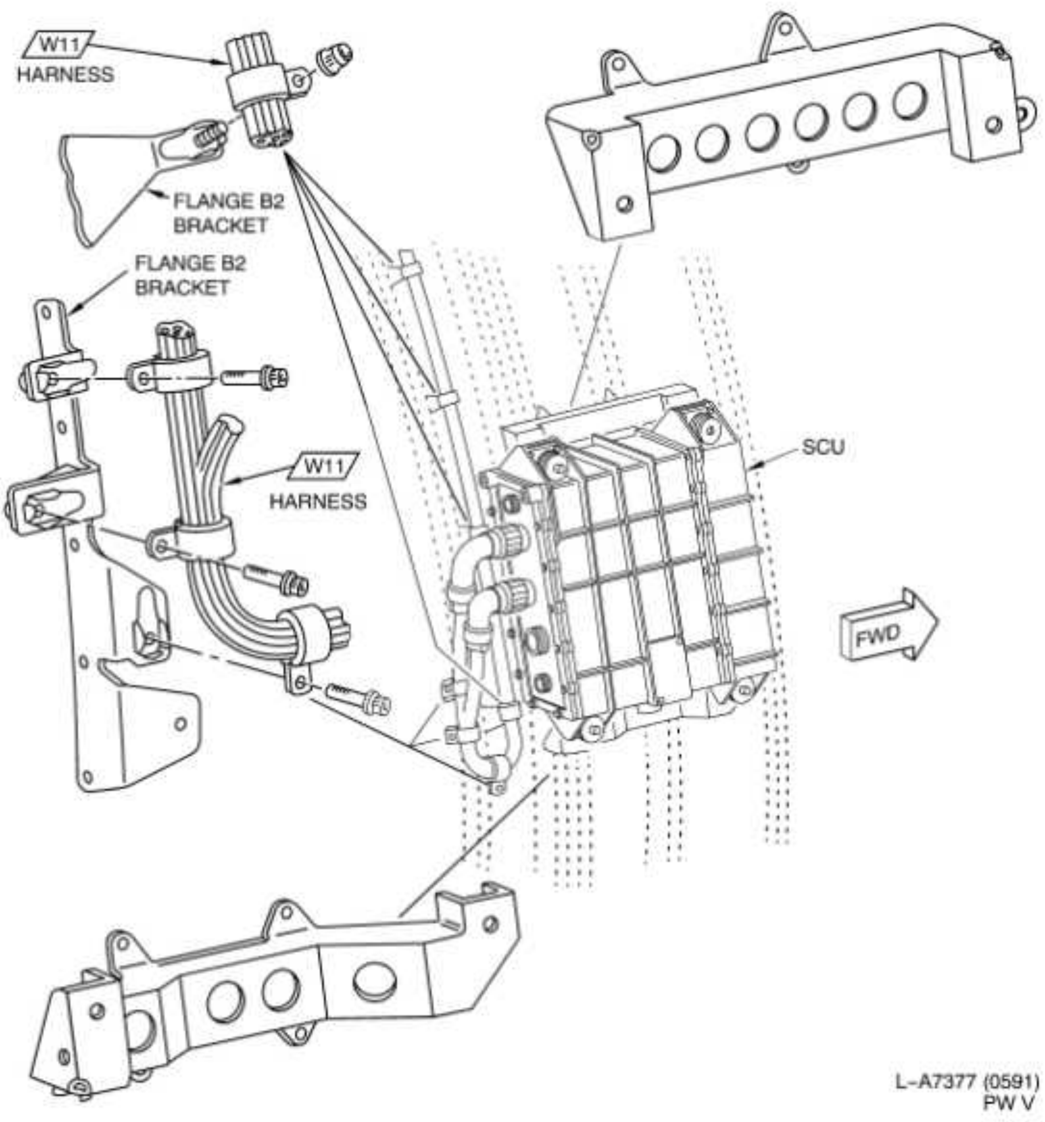
EEC Wiring Harness - W1, W2, W11
And W12 (Fan Case)
Figure 321
(Task 72-00-33-050-003-B)


W1
HARNESS
W2
HARNESS
FLANGE B2
BRACKET
FLANGE B1
BRACKET
FLANGE A1
BRACKET
W12
HARNESS
W1
HARNESS
RETAINING
BRACKET
W2
HARNESS
W12
HARNESS
OR
W11
HARNESS
WITH SCU
FLANGE B1
BRACKET
FLANGE B1
BRACKET
W12
HARNESS
FWD
W12
FLANGE B2
BRACKET
FLANGE A1
BRACKET
FLANGE B
BRACKET
L-A6390 (1091)
PW V

EEC Wiring Harness - W1, W2, W11
And W12 (Fan Case)
Figure 322 (Sheet 1)
(Task 72-00-33-050-003-B)


FLANGE B2
BRACKET
W2
HARNESS
W1
HARNESS
W1
HARNESS
PRE SB
PW4ENG
72-377
POST SB PW4ENG
72-377
W2
HARNESS
FLANGE B2
BRACKET
FLANGE B2
BRACKET
W2
HARNESS
W1
HARNESS
W1
HARNESS
FLANGE B2
BRACKET
W2
HARNESS
W1
HARNESS
W2
HARNESS
FWD
L-A7403 (0000)
PW V

EEC Wiring Harness - W1, W2, W11
And W12 (Fan Case)
Figure 322 (Sheet 2)
(Task 72-00-33-050-003-B)


W11
HARNESS
FLANGE B2
BRACKET
FLANGE B2
BRACKET
W11
HARNESS
SCU
FWD
L-A7377 (0591)
PW V

EEC Wiring Harness − W1, W2, W11
And W12 (Fan Case)
Figure 323
(Task 72−00−33−050−003−B)

ENGINE GENERAL – FAN CASE – REMOVAL–06

(7) Disconnect the W1P10 and W1P11 harness connectors from the solenoid valve located in the intermediate case at approximately 1 o'clock position. Use a PWA 85749 Torque Adapter if necessary. Install protective closures on the harness connectors and receptacles. See Figure 320.

(8) Disconnect the W1P24, W1P9, W1P25, and W2P26 harness connectors from the receptacles attached to the HPC case brackets. Install protective closures on the harness connectors and receptacles.

(9) Remove two bolts and the retaining bracket that attach the W2J9 harness receptacle to the HPC bracket. Install protective closures on the harness connector and receptacle.

(10) Remove the bolts, nuts, and clamps that attach the W1, W2, W11 (with SCU) and W12 harnesses to the brackets and tubes.

(11) Remove the bolts that attach the harnesses clamp segments at the 10 o'clock position on the fan case. Remove the clamp segments. Remove the harnesses from the engine.

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ENGINE GENERAL − FAN CASE − REMOVAL−07

Task 72−00−33−020−005:

1. Remove Bleed Valve Assembly
   - A. Prerequisites
     - (1) Remove low pressure compressor (LPC). See 72−00−31, Removal−01 (Task 72−00−31−020−003).
   - B. Equipment And Materials Required − None
   - C. Procedure
     - (1) Remove cotter pin from 2.5 bleed actuator link to bell crank. Remove collar and pin from link. Discard cotter pin.
     - (2) Remove cotter pin from bell crank pivot pin and remove pin. Discard cotter pin.
     - (3) Remove 2.5 bleed valve with bell crank from front of engine.

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Task 72−00−33−020−004:

1. Remove The Fan Exit Base And Vane Assemblies

A. Prerequisites

(1) Remove all Stage 1 LPC blade assemblies. See 72−00−31, Removal−04 (Task 72−00−31−020−002−002).

(2) Remove EEC wiring harnesses W1 and W2. See Removal−06
R (Task 72−00−33−050−003−A00).

(3) Remove the fan case external plumbing. See Removal−02
R (Task 72−00−33−020−003−B00).

B. Equipment And Materials

Special Tools:

PWA 76154	Adapter (2 Necessary)
PWA 76155	Sling
PWA 85698	Adapter, Lift And Trunnion (2 Necessary) (Optional to PWA 86431)
PWA 86431	Adapter (2 Necessary)

C. Procedure

(1) Install two PWA 86431 Adapters or PWA 85698 Lifting Adapters to the fan case at 3 and 9 o'clock positions. Lift PWA 76155 Sling with a hoist. Put two PWA 76154 Adapters on the sling. Put the spools of the lifting adapters in the other adapters. Put the fan case load on the hoist. See Figure 301.

(2) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 72−262) Remove the lockwire and 168 bolts and washers that attach the base and vane assemblies to the fan exit (outer) case (called outer case). See Figure 302.

(3) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 72−262) Remove the nuts, brackets (if applicable), and washers that attach the base and vane assemblies to the outer case. Remove the slab−bolts that attach the bases to the outer case.

(4) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the nuts, brackets, and washers that attach the base and vane assemblies to the fan exit (outer) case (called outer case). Remove the slab−bolts that attach the bases to the outer case. See Figure 302.

(5) Remove the Flange C hardware as follows. Refer to 72-00-33, Removal-20 (Task 72-00-33-020-020).

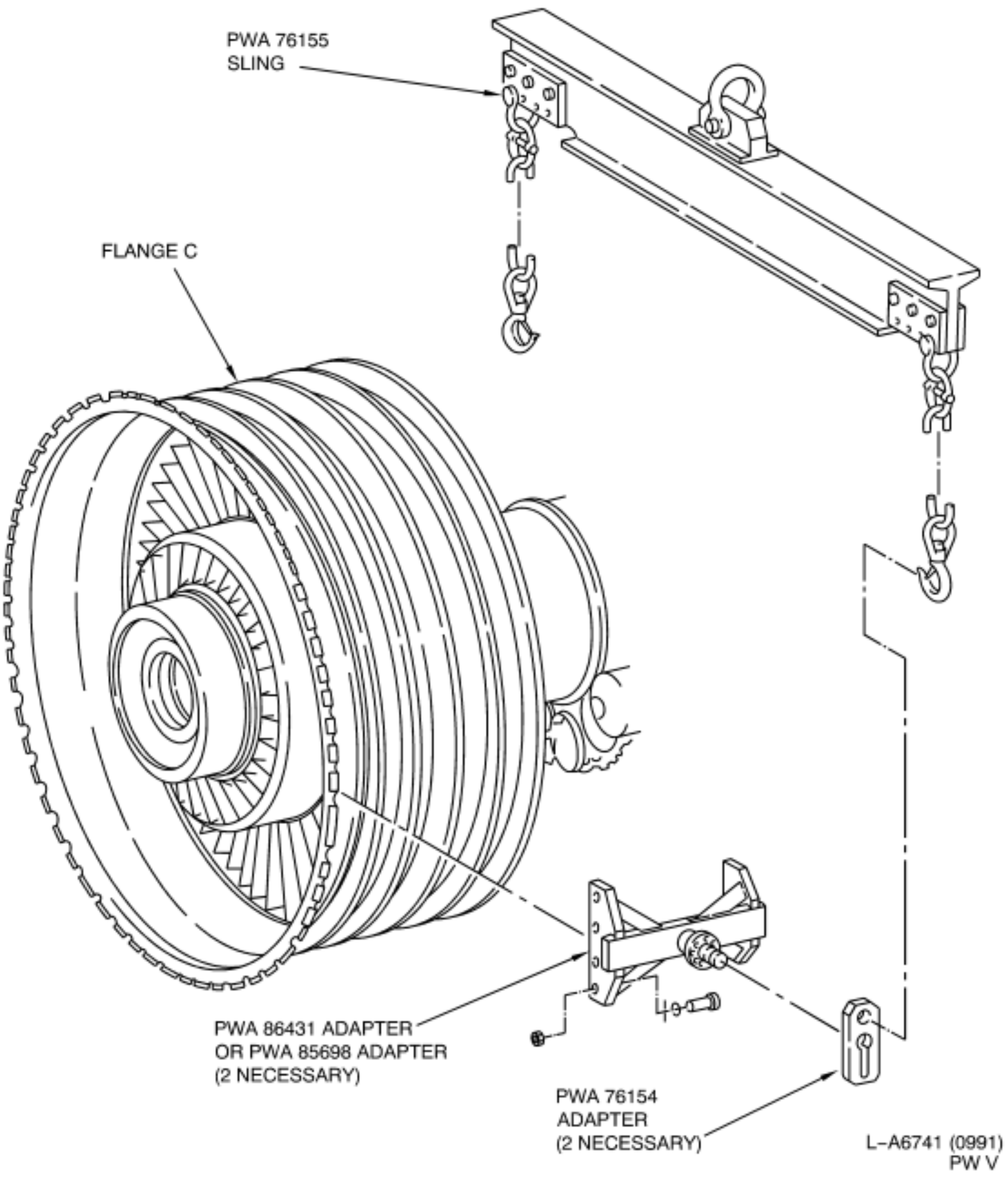
CAUTION: DO NOT MOVE THE FRONT FAN CASE AND OUTER CASE TOO FAR FORWARD. IF YOU DO YOU CAN DAMAGE THE VANES.

(6) Carefully move the front fan case and outer case forward sufficiently to install a strap that will keep the vanes in position. Do not move the cases forward more than necessary.

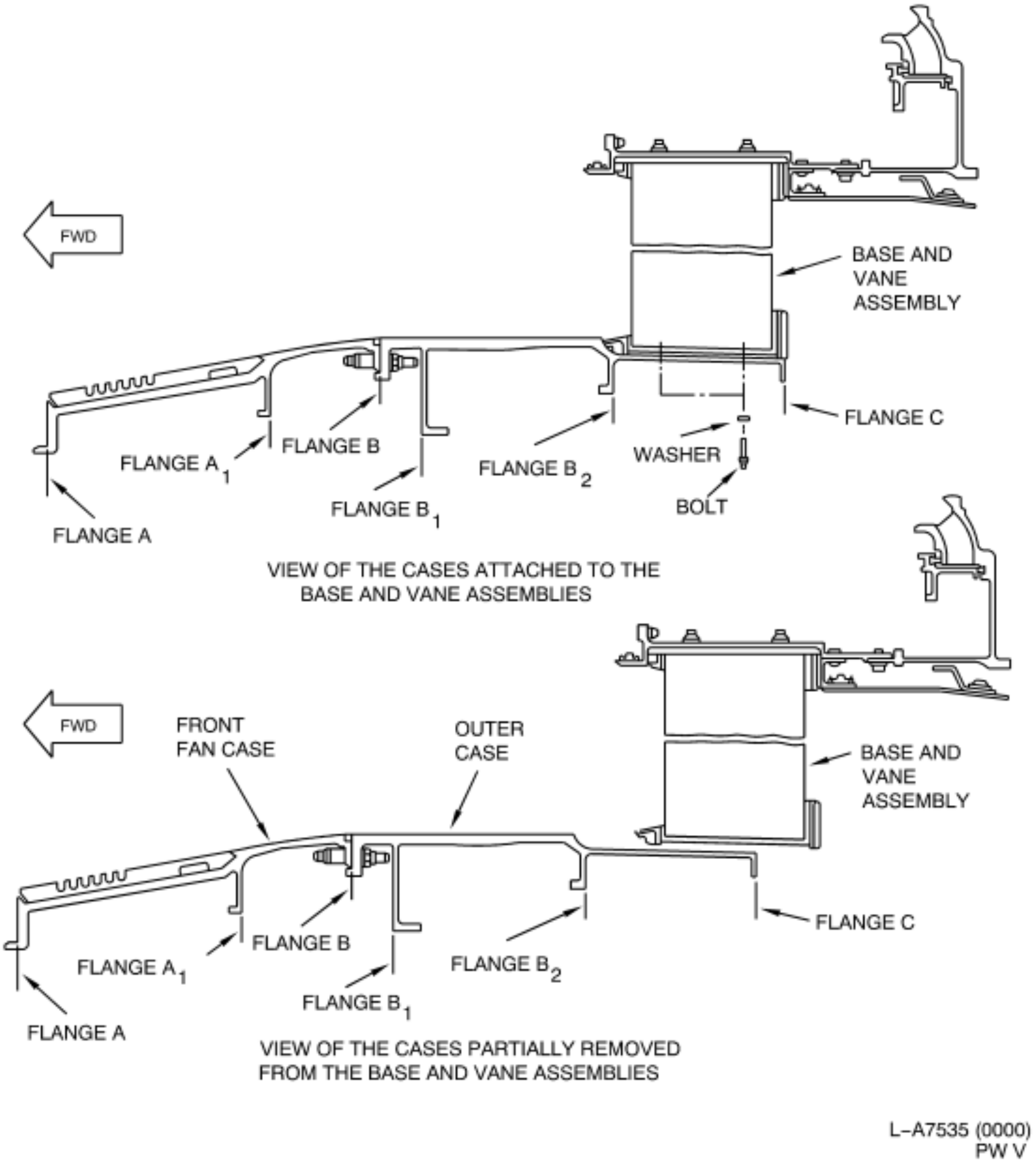
(7) Put a strap around the OD of the vanes to keep them in the correct position.

(8) Remove the front fan case and outer case from the engine. Put them on a pallet front end down. Remove the sling and lifting adapters from fan case.

(9) See Installation-08 (Task 72-00-33-420-005) for vane replacement.


PWA 76155
SLING
FLANGE C
PWA 86431 ADAPTER
OR PWA 85698 ADAPTER
(2 NECESSARY)
PWA 76154
ADAPTER
(2 NECESSARY)
L-A6741 (0991)
PW V

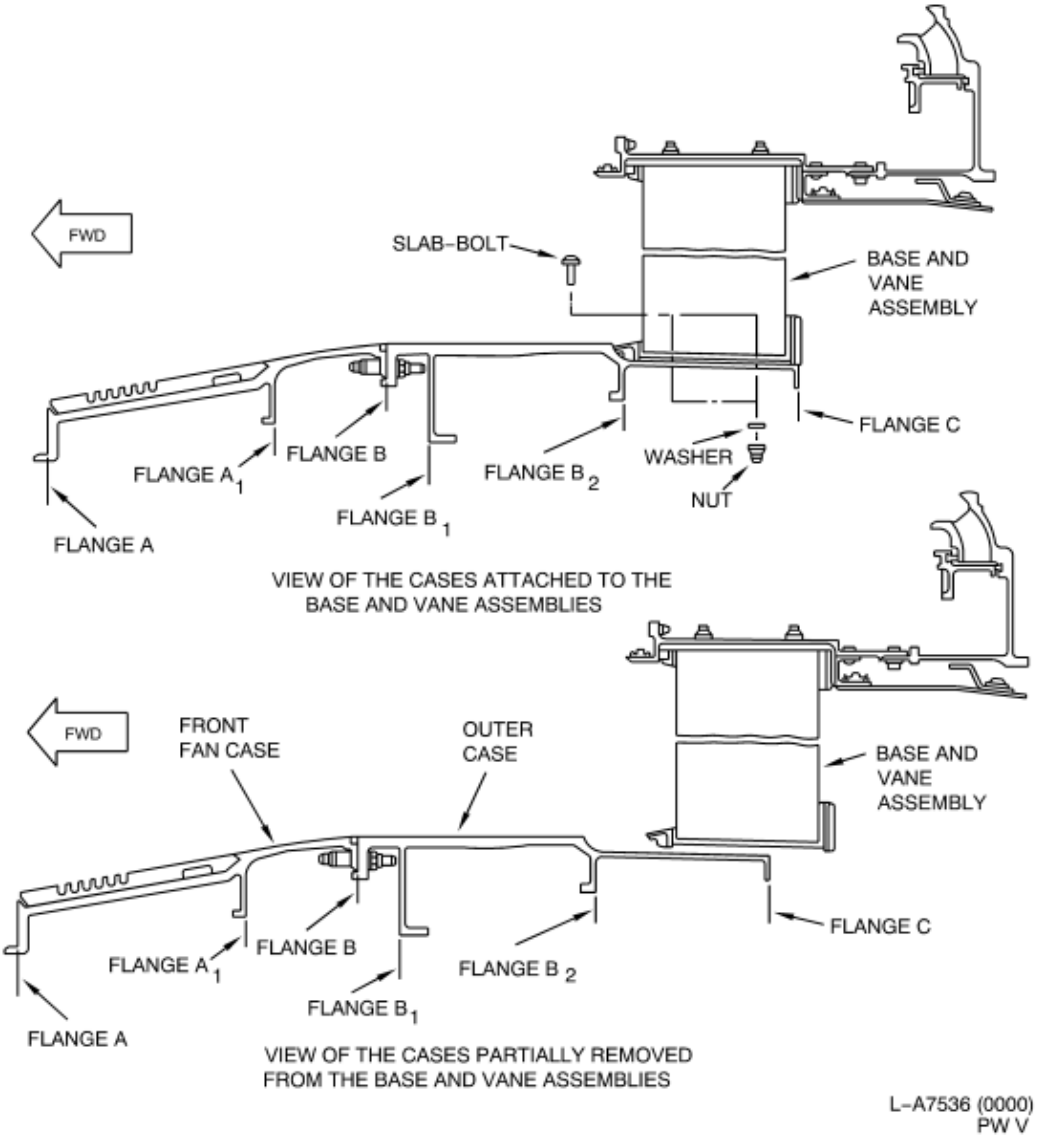
Installation Of The Tools
Figure 301
(Task 72-00-33-020-004)


FWD
BASE AND VANE ASSEMBLY
FLANGE C
WASHER
BOLT
FLANGE B
FLANGE B_2
FLANGE B_1
FLANGE A_1
FLANGE A
FWD
FRONT FAN CASE
OUTER CASE
BASE AND VANE ASSEMBLY
FLANGE C
FLANGE B
FLANGE B_2
FLANGE B_1
FLANGE A_1
FLANGE A
L-A7535 (0000)
PW V

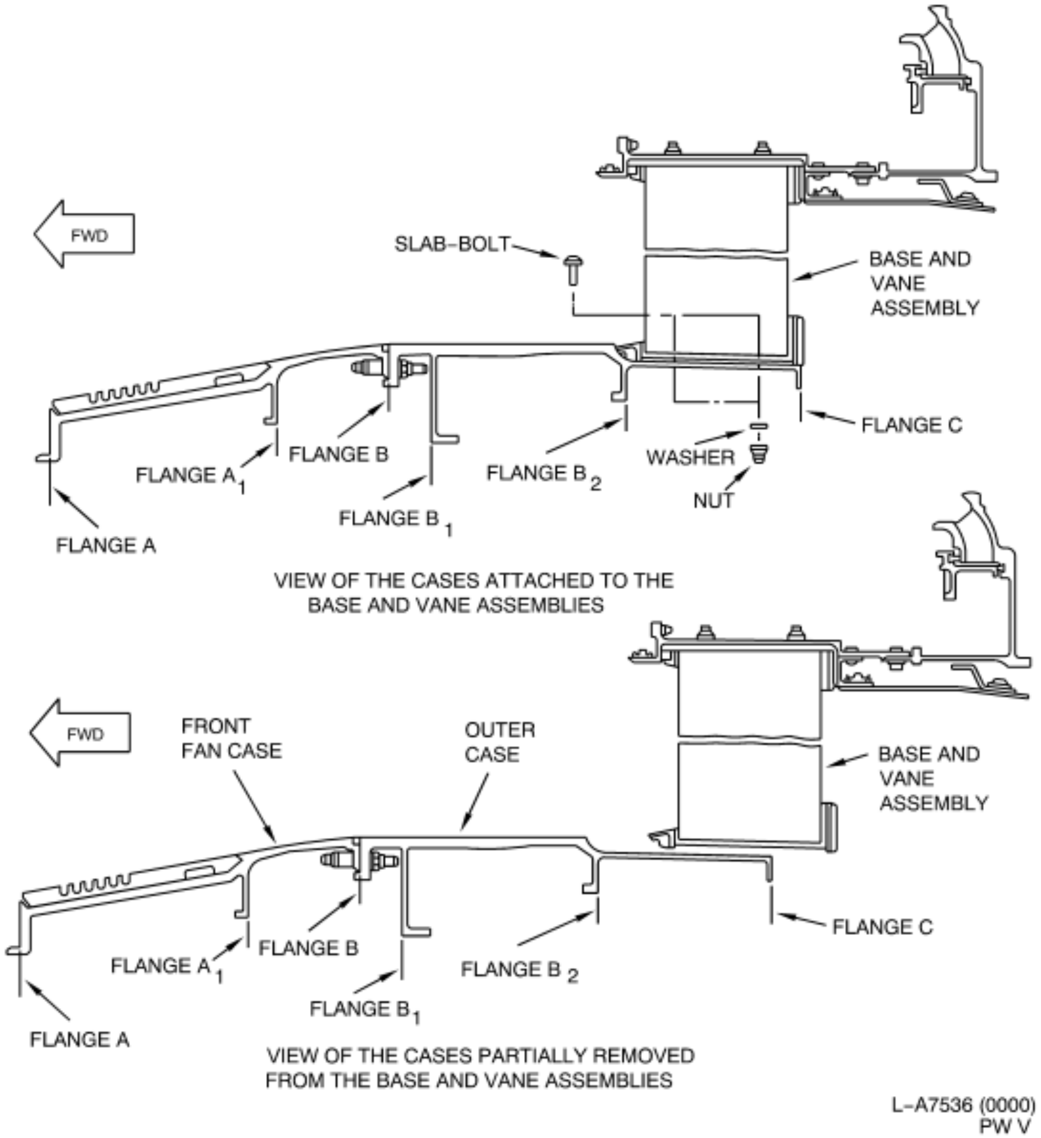
VIEW OF THE CASES ATTACHED TO THE BASE AND VANE ASSEMBLIES

VIEW OF THE CASES PARTIALLY REMOVED FROM THE BASE AND VANE ASSEMBLIES

Attachment Of The Vanes And Removal
Of The Cases (Pre SB PW4ENG 72-262)
Figure 302 (Sheet 1)
(Task 72-00-33-020-004)


FWD
SLAB-BOLT
BASE AND VANE ASSEMBLY
FLANGE C
WASHER
NUT
FLANGE B_2
FLANGE B
FLANGE A_1
FLANGE B_1
FLANGE A
VIEW OF THE CASES ATTACHED TO THE BASE AND VANE ASSEMBLIES
FWD
FRONT FAN CASE
OUTER CASE
BASE AND VANE ASSEMBLY
FLANGE C
FLANGE B
FLANGE A_1
FLANGE B_2
FLANGE B_1
FLANGE A
VIEW OF THE CASES PARTIALLY REMOVED FROM THE BASE AND VANE ASSEMBLIES
L-A7536 (0000)
PW V

Attachment Of The Vanes And Removal
Of The Cases (Post SB PW4ENG 72-262)
Figure 302 (Sheet 2)
(Task 72-00-33-020-004)


FWD
SLAB–BOLT
BASE AND VANE ASSEMBLY
FLANGE C
WASHER
NUT
FLANGE B_2
FLANGE B
FLANGE A_1
FLANGE B_1
FLANGE A
FWD
FRONT FAN CASE
OUTER CASE
BASE AND VANE ASSEMBLY
FLANGE C
FLANGE B
FLANGE A_1
FLANGE B_2
FLANGE B_1
FLANGE A
L–A7536 (0000)
PW V

VIEW OF THE CASES ATTACHED TO THE BASE AND VANE ASSEMBLIES

VIEW OF THE CASES PARTIALLY REMOVED FROM THE BASE AND VANE ASSEMBLIES

Attachment Of The Vanes And Removal Of The Cases
Figure 302 (Sheet 3)
(Task 72–00–33–020–004)

ENGINE GENERAL - FAN CASE - REMOVAL-09

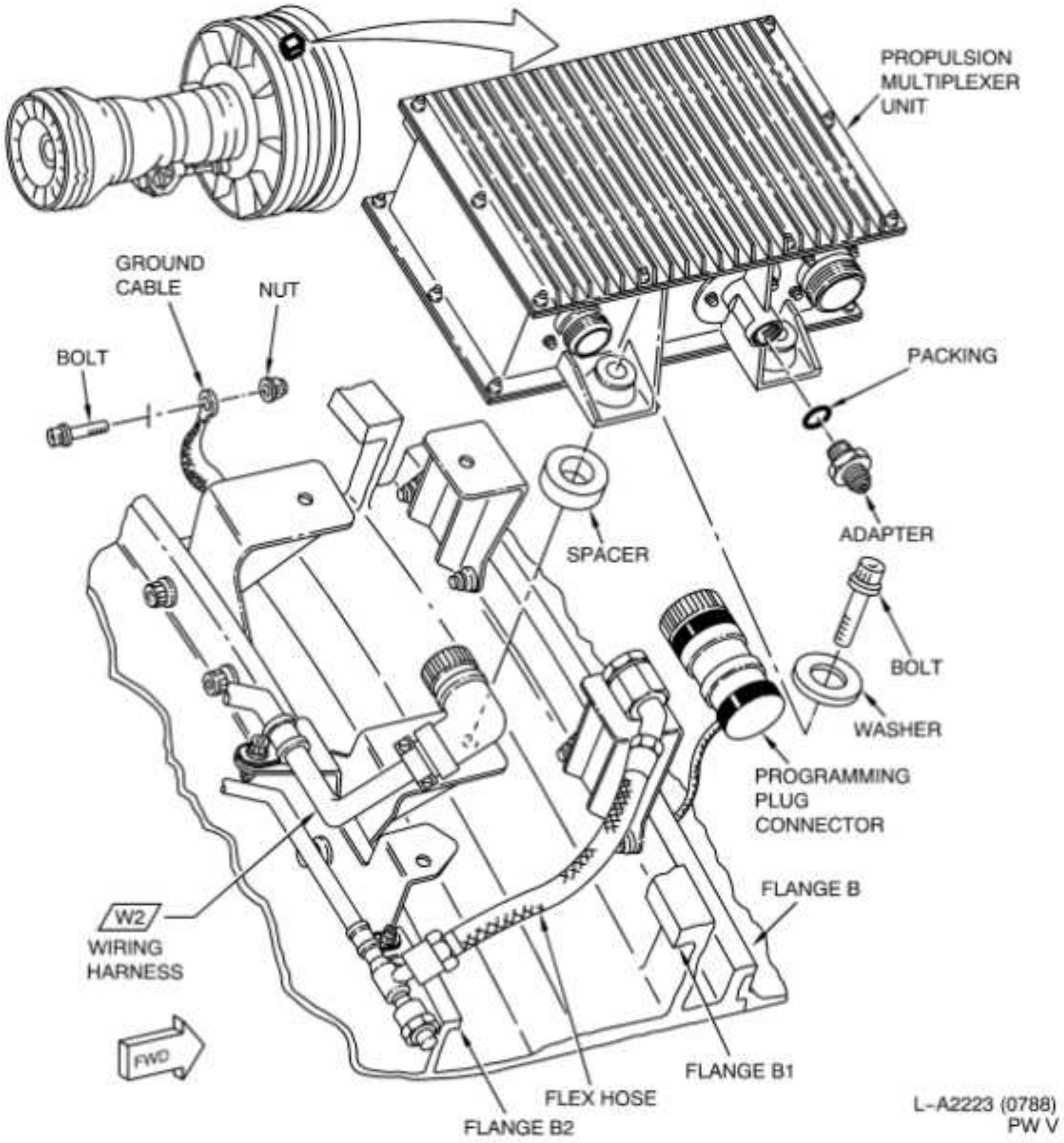
Task 72-00-33-050-004:

1. Remove Propulsion Multiplexer Unit (PMUX)
    A. Equipment And Materials Required - None
    B. Procedure
        See Figure 301.
        (1) Remove bolt and nut securing ground cable to top of unit at approximately 1 o'clock position between Flange B and Flange B2.
        (2) Disconnect and remove PMUX programming plug from unit and leave attached to engine by its lanyard.

CAUTION: HOLD ADAPTER WITH WRENCH WHILE LOOSENING FLEX HOSE NUT, TO AVOID DAMAGE TO PROPULSION MULTIPLEXER UNIT PORT.

        (3) Disconnect flex hose from adapter on PMUX.
        (4) Disconnect W2P20 harness connector from PMUX and let lay on fan case.
        (5) Remove the four mounting bolts and washers from the PMUX. Remove the unit and four mounting spacers from the engine. Insall protective closures to the PMUX, harness connector, and hose connector.
        (6) If PMUX is to be replaced or repaired, remove adapter and discard packing. Install protective closures.

NOTE: For additional information concerning detailed maintenance of this component, see Propulsion Multiplexer Unit Component Maintenance Manual, 77-31-06 (Hamilton Standard Div.).


PROPULSION MULTIPLEXER UNIT
GROUND CABLE
NUT
BOLT
PACKING
ADAPTER
SPACER
BOLT
WASHER
PROGRAMMING PLUG CONNECTOR
FLANGE B
W2
WIRING HARNESS
FWD
FLANGE B1
FLEX HOSE
FLANGE B2
L-A2223 (0788)
PW V

Propulsion Multiplexer Unit (PMUX)
Figure 301
(Task 72−00−33−050−004)

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ENGINE GENERAL - FAN CASE - REMOVAL-10

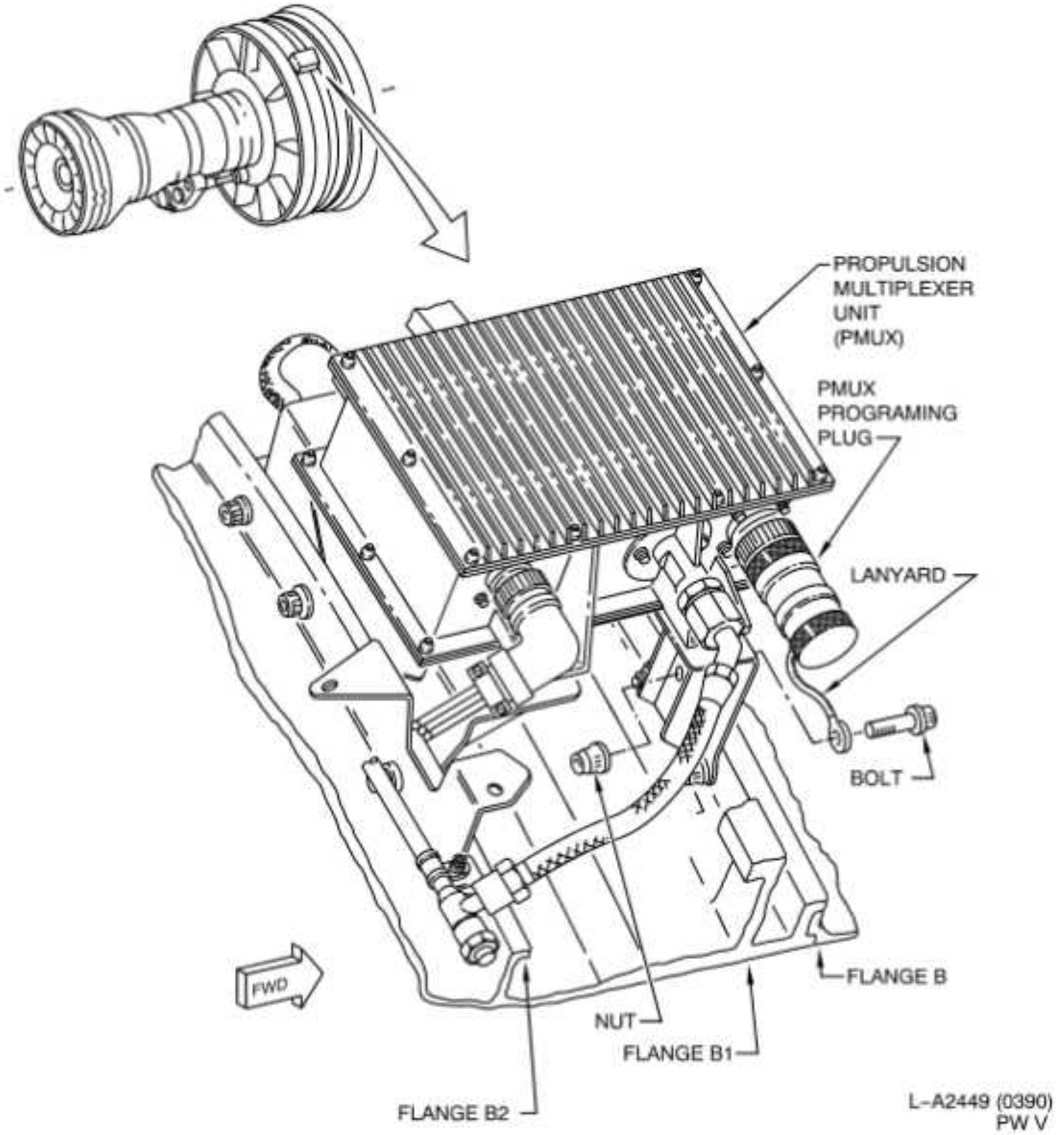
Task 72-00-33-050-005:

1. Remove PMUX Programming Plug
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 301.
     - (1) Remove the bolt and nut that attach the PMUX programming plug lanyard to the Flange B bracket.
     - (2) Loosen and remove the plug from the multiplexer unit (PMUX). Install the protection covers.

       NOTE: For additional information concerning detailed maintenance of this component, see PMUX Programming Plug Component Maintenance Manual, 77-32-11, PN 50A638.

ENGINE GENERAL − FAN CASE − REMOVAL−10


PROPULSION MULTIPLEXER UNIT (PMUX)
PMUX PROGRAMING PLUG
LANYARD
BOLT
FLANGE B
NUT
FLANGE B1
FLANGE B2
FWD
L−A2449 (0390)
PW V

PMUX Programming Plug
Figure 301
(Task 72−00−33−050−005)

ENGINE GENERAL − FAN CASE − REMOVAL−11

Task 72−00−33−050−006:

1. Remove 2.5 Bleed Valve Actuator

A. Prerequisites

(1) Remove the fan exit liner segment (inner rear) that is at 7 o'clock. Refer to 72−00−33, Removal−16 (Task 72−00−33−040−001).

B. Equipment And Materials Required − None

C. Procedure

See Figure 301.

(1) Remove the lockwire and disconnect the hydraulic pressure tube (CP06) and the hydraulic return tube (CR02) from the actuator and from the manifold tees. Collect the residual fuel. Remove the tubes. If equipped (Post SB PW4ENG 75−45), remove the bolt, nut, and clamps. Install the protection covers.

NOTE: Approximately 1/2 pint (1/4 liter) of fuel will drain from actuator.

(2) Disconnect W3P15 harness connector from actuator.

(3) For engines with the 2.5 bleed actuator support bracket do the following.

(a) (Post SB PW4ENG 75−84 and Pre SB PW4ENG 75−126) Remove the three bolts and nuts that attach the support bracket to a bracket on Flange E.

(b) (Post SB PW4ENG 75−126) Remove the three bolts from the nutplates on the the support bracket that attaches it to a bracket on Flange E.

(c) Remove the lockwire and the two bolts that attach the support bracket to the 2.5 bleed actuator. Remove the bracket from the actuator.

ENGINE GENERAL − FAN CASE − REMOVAL−11

CAUTION: TO AVOID SHOULDER BOLTS DAMAGE, BE AWARE THAT SHOULDER BOLT IS LEFT HAND THREAD AND HOLD ACTUATOR PISTON SHAFT HEX WHILE LOOSENING SHOULDER BOLT.

(4) Remove cotter pin securing shoulder bolt to bleed valve rod end clevis and remove shoulder bolt (left hand thread).

(5) Remove four bolts and washers securing actuator to intermediate case.

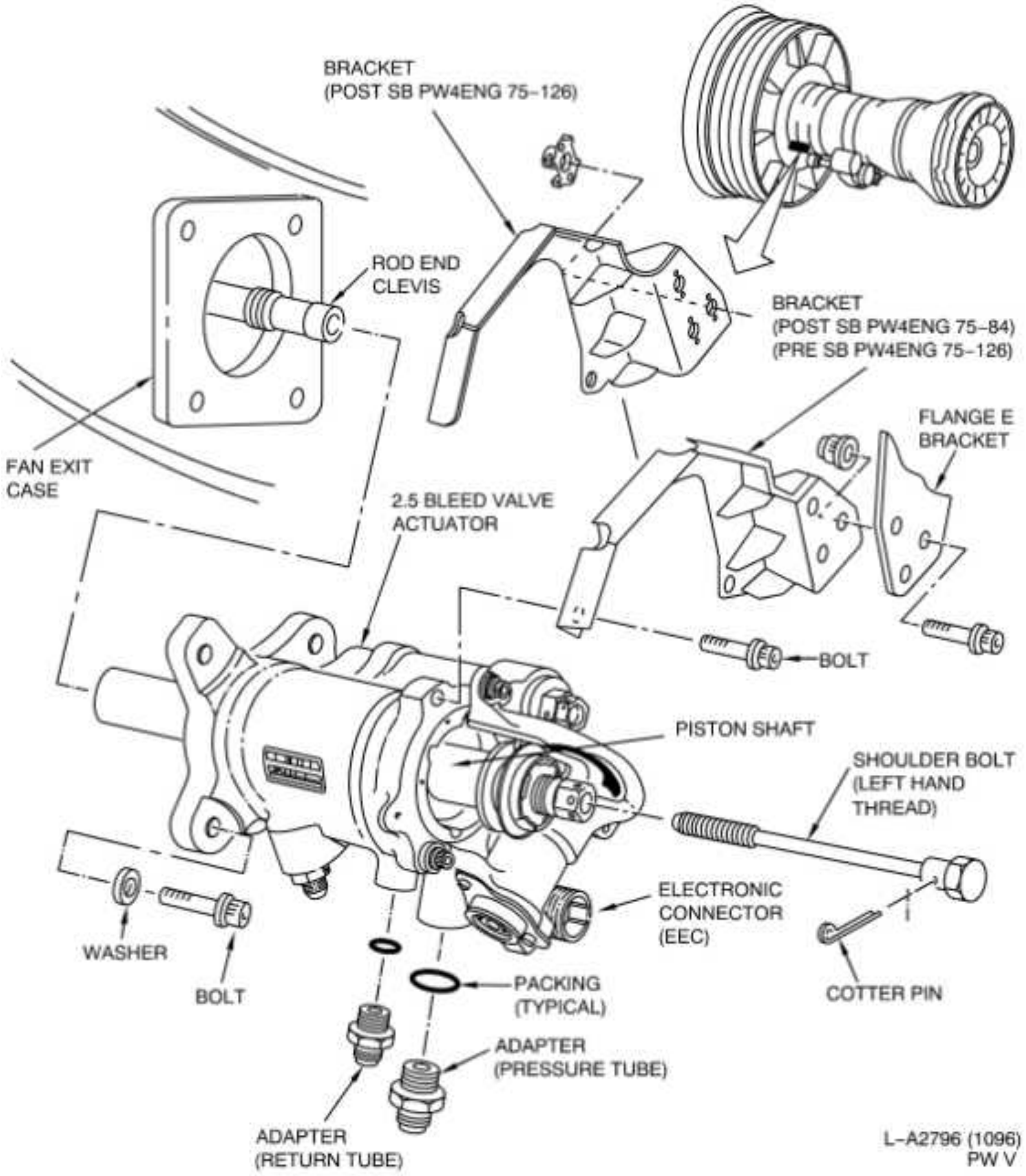
CAUTION: ENSURE CRIMPED LOCKING CUP AND RETAINING NUT DO NOT TURN WHEN PISTON SHAFT HEX IS ROTATED AS SUCH ROTATION WILL AFFECT ACTUATOR INTERNAL ADJUSTMENT.

(6) Remove actuator by rotating piston shaft hex counterclockwise to disengage internal threads securing piston shaft to rod end clevis.

(7) If new actuator is to be installed, remove adapters and from ports and discard packings.

(8) Install protective closures.

NOTE: For additional information concerning detailed maintenance of the component, see Intercompressor (2.5) Bleed Actuator Component Maintenance Manual, 75−31−34 (Hamilton Standard).


BRACKET
(POST SB PW4ENG 75-126)
ROD END
CLEVIS
BRACKET
(POST SB PW4ENG 75-84)
(PRE SB PW4ENG 75-126)
FLANGE E
BRACKET
FAN EXIT
CASE
2.5 BLEED VALVE
ACTUATOR
BOLT
PISTON SHAFT
SHOULDER BOLT
(LEFT HAND
THREAD)
ELECTRONIC
CONNECTOR
(EEC)
WASHER
BOLT
PACKING
(TYPICAL)
COTTER PIN
ADAPTER
(PRESSURE TUBE)
ADAPTER
(RETURN TUBE)
L-A2796 (1096)
PW V

2.5 Bleed Valve Actuator Removal
Figure 301
(Task 72-00-33-050-006)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - FAN CASE - REMOVAL-12

Task 72-00-33-050-007-A:

1. Remove The EEC Programming Plug For Basic Engines
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 301.
     - (1) Remove the bolt, nut and washers that attach the lanyard to the inlet case Flange A1.
     - (2) Loosen and remove the EEC programming plug from the EEC.
     - (3) Install protection covers to the EEC connector and the programming plug.

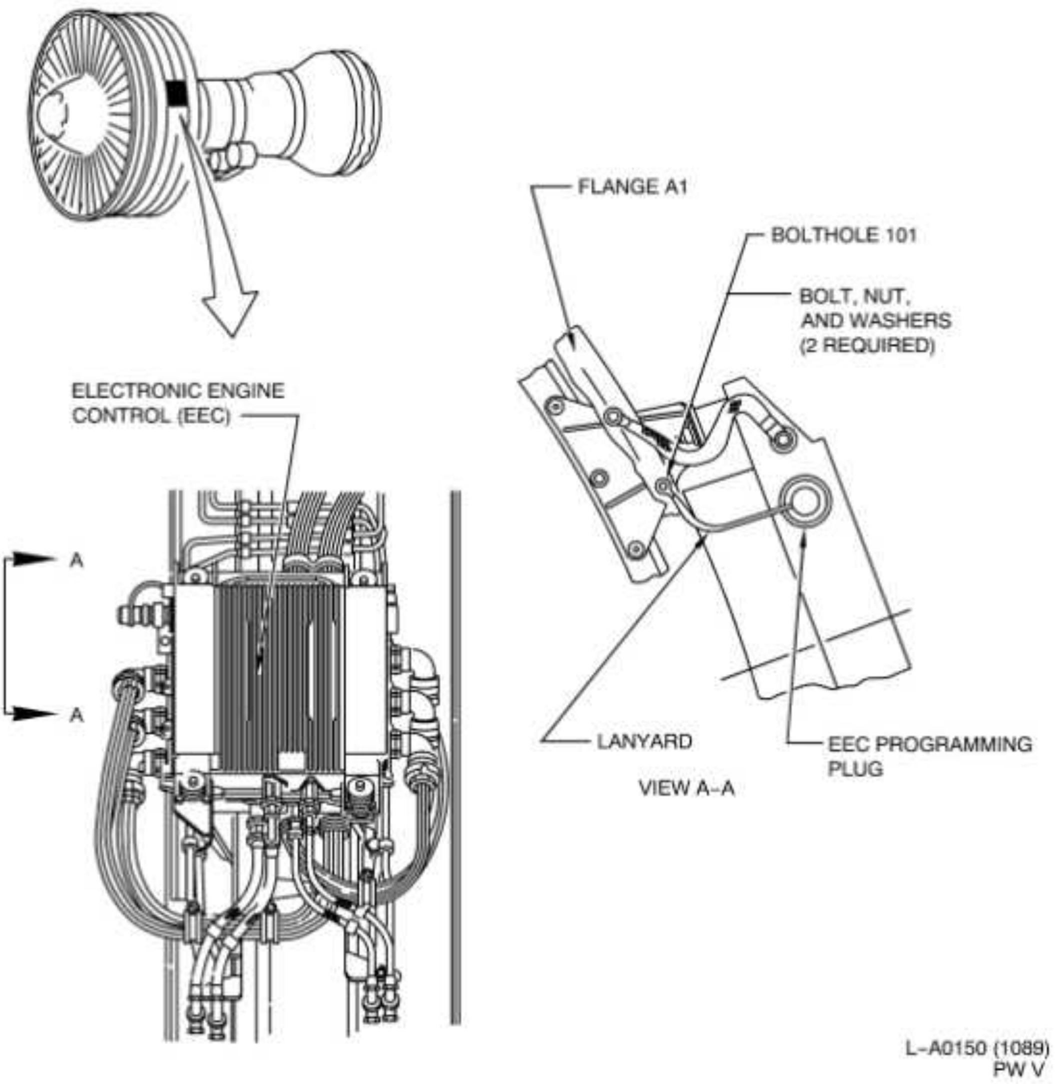
       NOTE: For additional information concerning the detailed maintenance of this component, see the EEC Data Entry Plug Component Maintenance Manual, 73-21-56 (PW Manual PN 50A450).

Task 72-00-33-050-007-B:

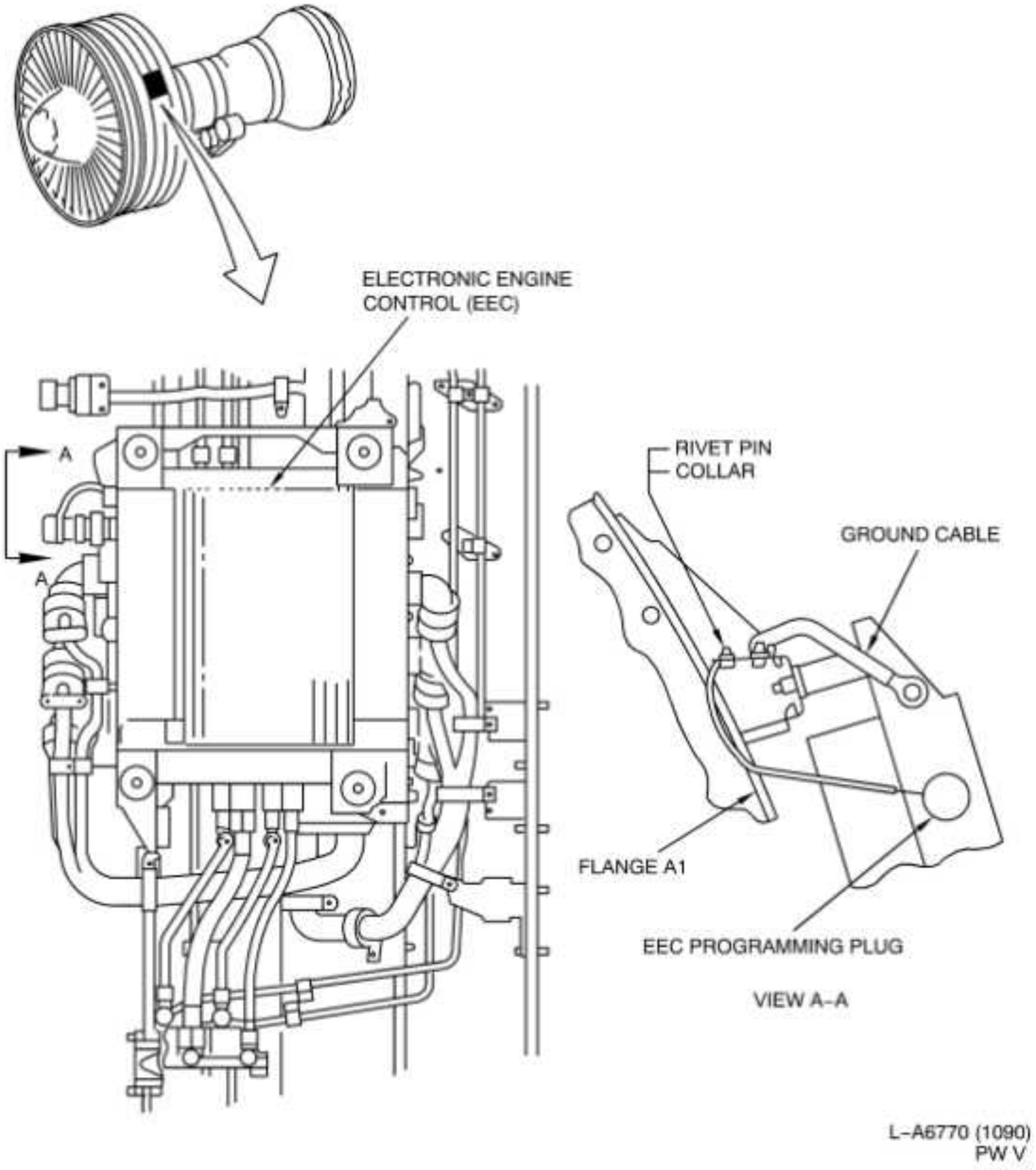
2. Remove The EEC Programming Plug For Engines With Commonality Parts Between Airbus And McDonnell Douglas
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 301.
     - (1) Remove the rivet pin and collar that attach the lanyard to the upper forward mount bracket of the electronic engine control (EEC).
     - (2) Loosen and remove the EEC programming plug from the EEC.
     - (3) Install protection covers to the EEC connector and the programming plug.

       NOTE: See the EEC Programming Plug Component Maintenance Manual, 73-21-56 (PW Manual PN 50A450) for additional information and detailed maintenance of this component.


ELECTRONIC ENGINE CONTROL (EEC)
A
A
FLANGE A1
BOLTHOLE 101
BOLT, NUT, AND WASHERS (2 REQUIRED)
LANYARD
EEC PROGRAMMING PLUG
VIEW A-A
L-A0150 (1089)
PW V

EEC Programming Plug
Figure 301
(Task 72−00−33−050−007−A)


ELECTRONIC ENGINE CONTROL (EEC)
A
A
RIVET PIN
COLLAR
GROUND CABLE
FLANGE A1
EEC PROGRAMMING PLUG
VIEW A−A
L−A6770 (1090)
PW V

EEC Programming Plug
Figure 301
(Task 72−00−33−050−007−B)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - FAN CASE - REMOVAL-13

Task 72-00-33-050-008:

1. Remove The Supplemental Control Unit

   A. Equipment And Materials Required - None

   B. Procedure

   See Figure 301.

   (1) Disconnect the connector assembly (SCU programming plug) (301/7) from the lower rear side connector of the supplemental control unit. Keep the connector assembly attached to the engine by its lanyard.

   (2) Disconnect the W11P34 connector (301/1) and the W11P33 connector (301/2) from the rear side of the supplemental control unit.

   (3) Remove the bolt (301/9) from the top rear side of the supplemental control unit and disconnect the ground cable.

   (4) If the supplemental control unit has the multiplexing option, remove the top connector of the hose assembly (301/3) from the bottom side of the supplemental control unit.

   (5) Remove the bolts and washers (301/8) from the mounts at the four corners and remove the supplemental control unit from the engine.

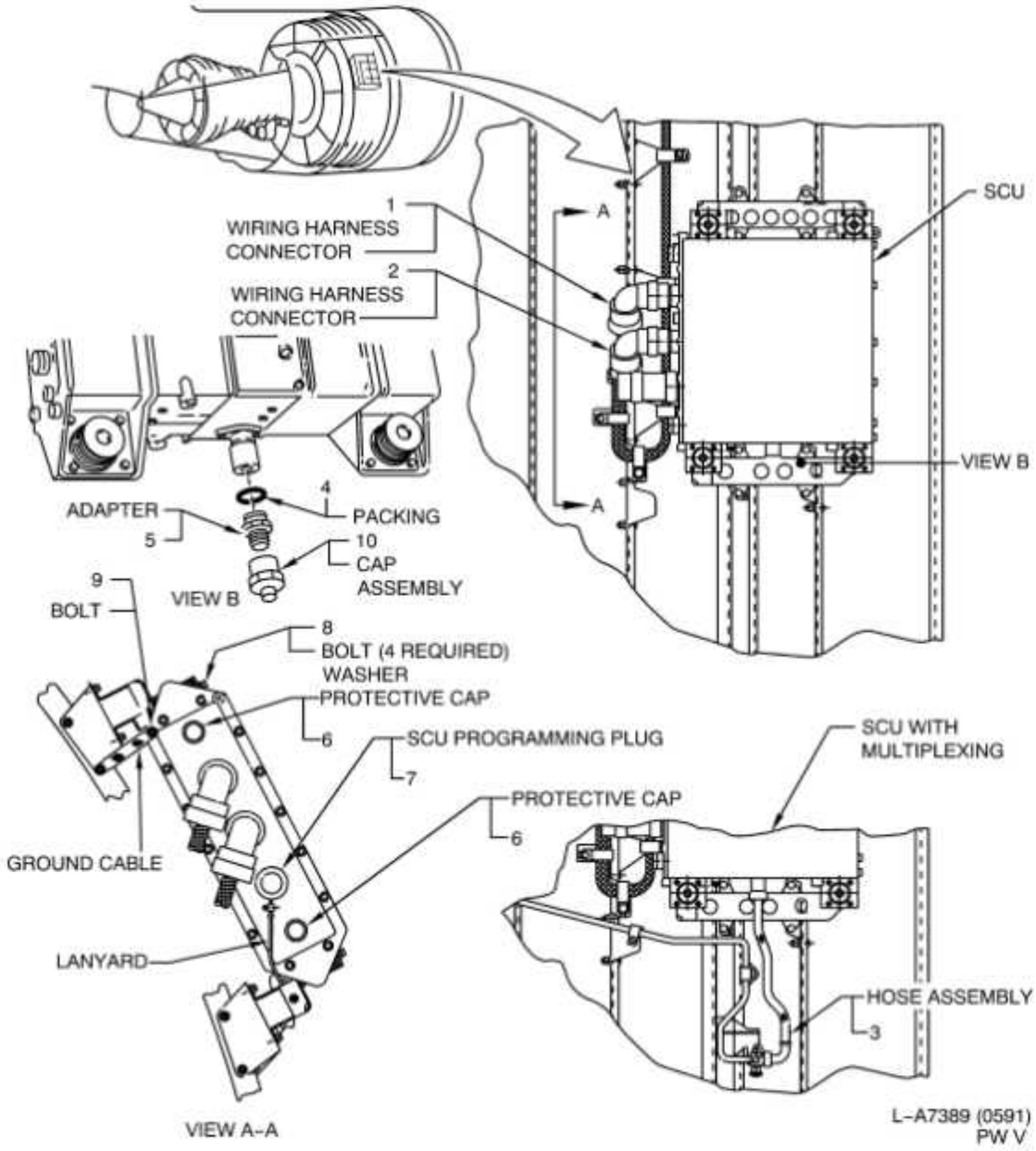
   (6) If the supplemental control unit does not have the multiplexing option and the unit is to be replaced, remove the cap assembly (301/10) from the bottom side of the supplemental control unit.

   (7) If the supplemental control unit is to be replaced, remove the adapter (301/5) from the bottom side of the supplemental control unit. Discard the packing (301/4).

   (8) If the supplemental control unit does not have the auto-start option and the unit is to be replaced, remove the two protective caps (301/6) from the rear side of the supplemental control unit.

(9) Install protection covers to the openings and electrical connectors on the supplemental control unit and the wiring harness.

NOTE: For more maintenance data of this component, see the Supplemental Control Unit Component Maintenance Manual, 73−21−24 (Bendix Engine Controls Division).


SCU
1
WIRING HARNESS CONNECTOR
2
WIRING HARNESS CONNECTOR
A
A
VIEW B
4
PACKING
ADAPTER
5
10
CAP ASSEMBLY
VIEW B
9
BOLT
8
BOLT (4 REQUIRED)
WASHER
PROTECTIVE CAP
6
SCU PROGRAMMING PLUG
7
SCU WITH MULTIPLEXING
PROTECTIVE CAP
6
GROUND CABLE
LANYARD
HOSE ASSEMBLY
3
VIEW A-A
L-A7389 (0591)
PW V

Supplemental Control Unit
Figure 301
(Task 72−00−33−050−008)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - FAN CASE - REMOVAL-14

Task 72-00-33-050-009:

1. Remove The Fan Exit (Bifurcation) Fairing Assemblies (Pre SB PW4ENG 72-370)

A. Equipment And Materials Required

Standard Tools:
No. 3 Cross-Drive (Phillips)
No. 10 Torq-set Drive

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Lockwire, AS3214-02				

B. Procedure

See Figure 301.

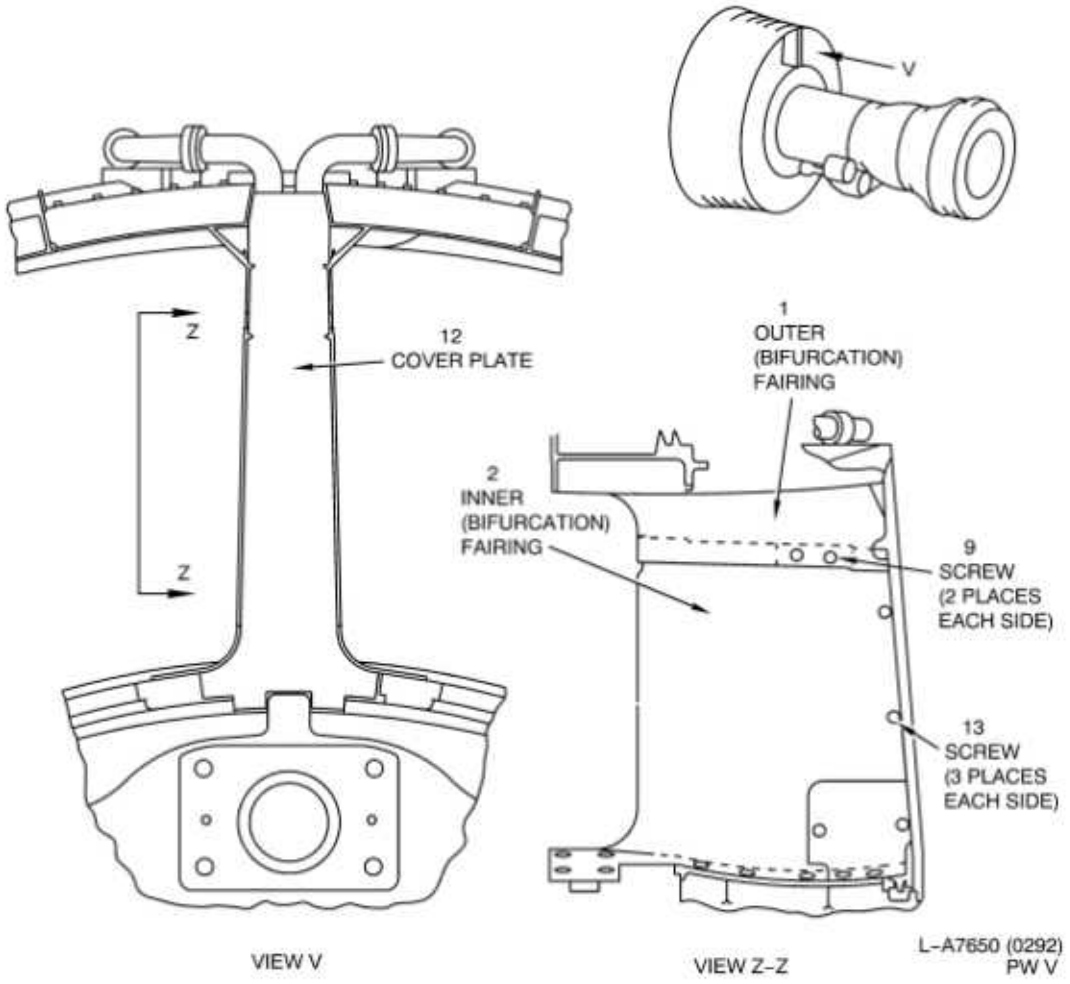
NOTE: Use a No. 3 Cross-Drive (Phillips) with the shoulder screws. Use a No. 10 Torq-set drive with all the other screws.

(1) Disassemble the fan exit (bifurcation) fairing assemblies as follows.

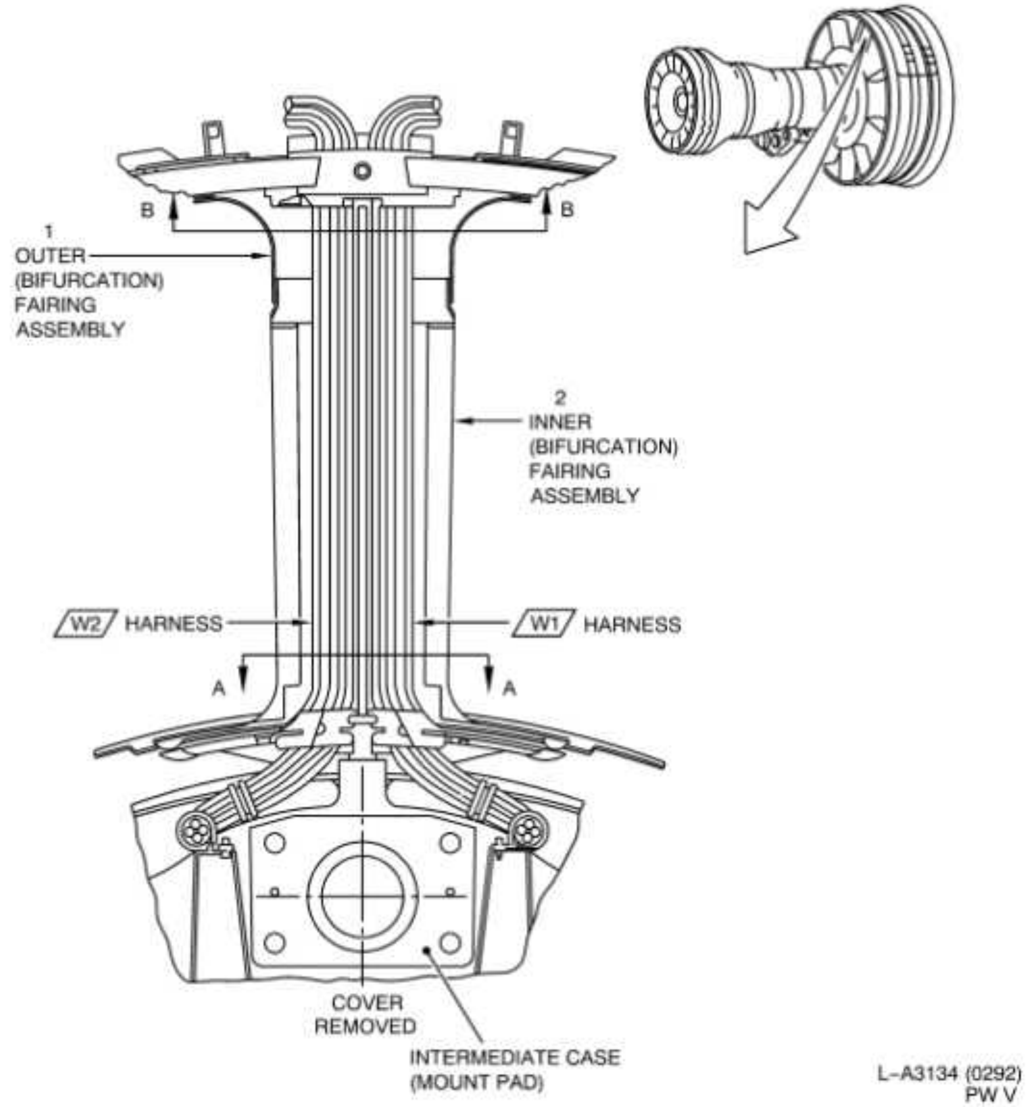
(a) For engines with the cover plate (301/12) installed, cut and remove the sealant from around the cover plate. Remove the screws (301/13) and cover plate.

(b) (Post SB PW4ENG 72-161) Cut and remove the sealant from around the access covers (301/6). Remove the screws (301/7) and (301/8) and the two access covers.

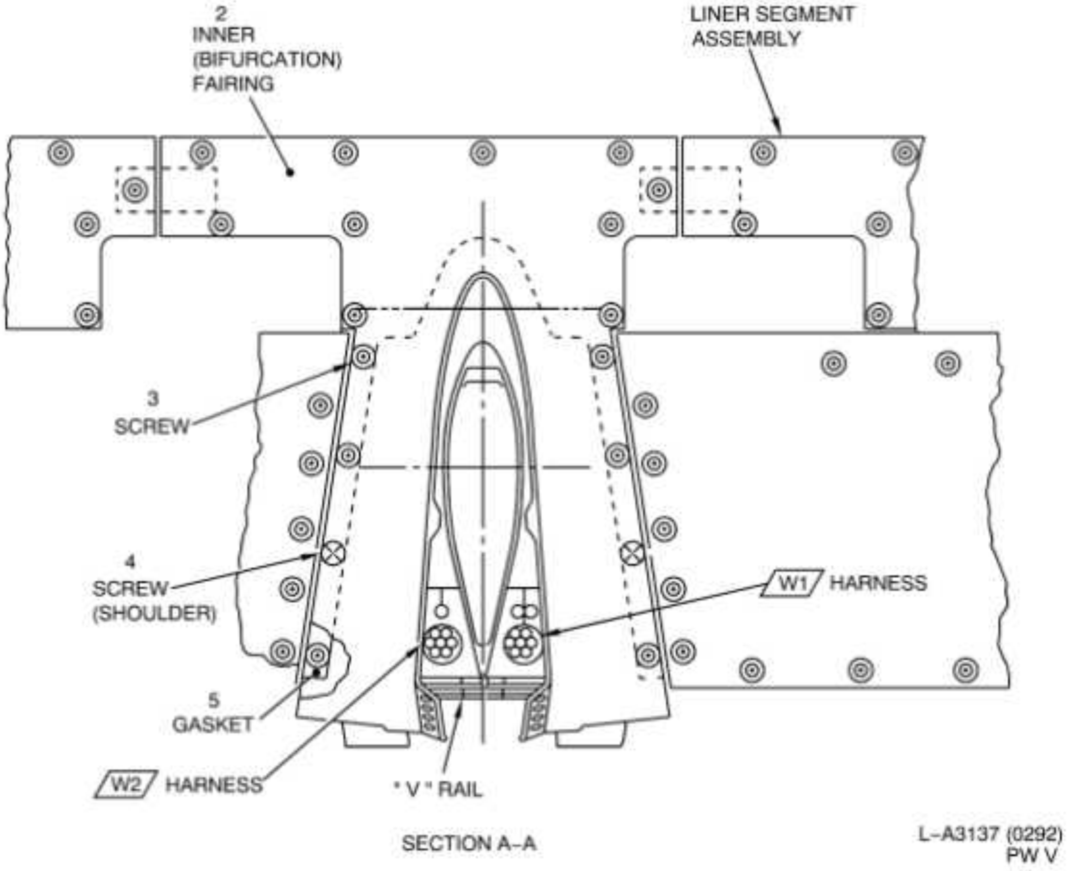
(c) Cut and remove the sealant from around the bottom of the inner (bifurcation) fairing (301/2) and the top of the outer (bifurcation) fairing (301/1). Remove the screws (301/3), (301/4) (301/9), (301/10), and (301/11).


V
Z
Z
12
COVER PLATE
1
OUTER
(BIFURCATION)
FAIRING
2
INNER
(BIFURCATION)
FAIRING
9
SCREW
(2 PLACES
EACH SIDE)
13
SCREW
(3 PLACES
EACH SIDE)
VIEW V
VIEW Z−Z
L−A7650 (0292)
PW V

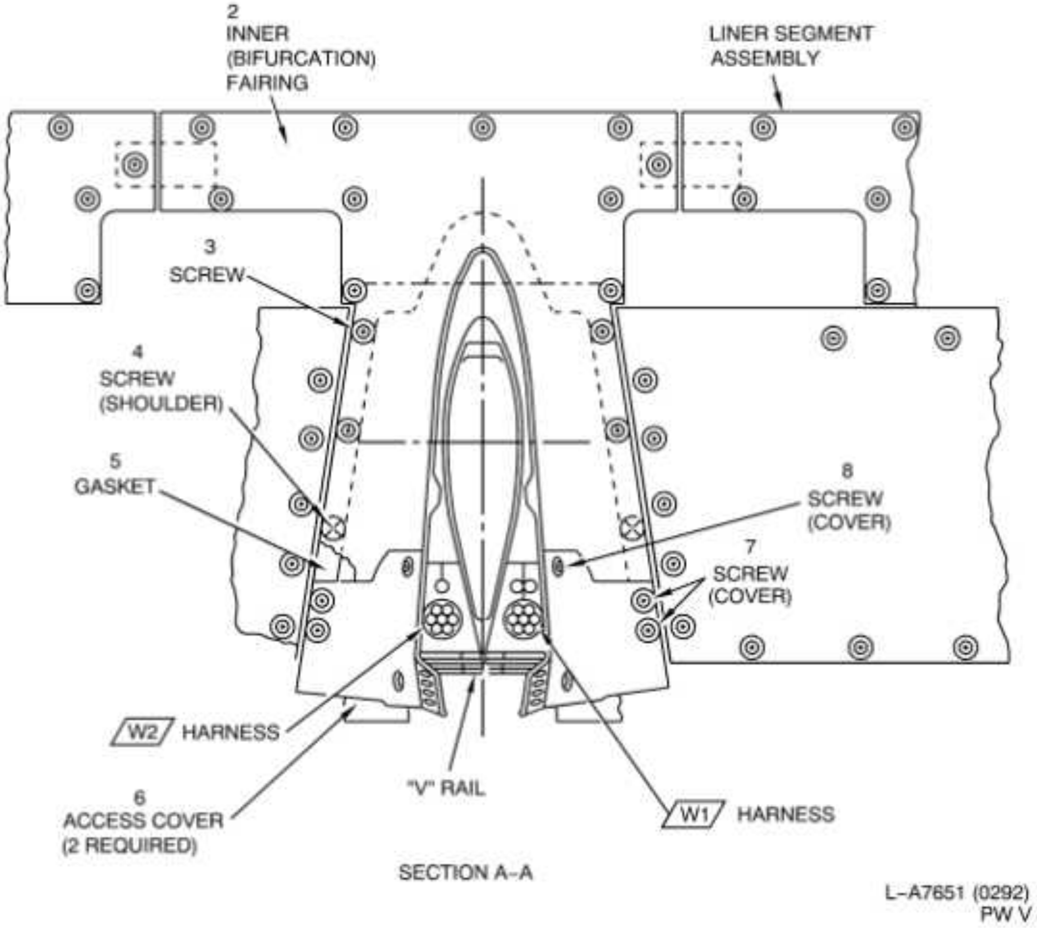
Fan Exit (Bifurcation) Fairing Assembly
Figure 301 (Sheet 1)
(Task 72−00−33−050−009)


B
B
1
OUTER
(BIFURCATION)
FAIRING
ASSEMBLY
2
INNER
(BIFURCATION)
FAIRING
ASSEMBLY
W2 HARNESS
W1 HARNESS
A
A
COVER
REMOVED
INTERMEDIATE CASE
(MOUNT PAD)
L−A3134 (0292)
PW V

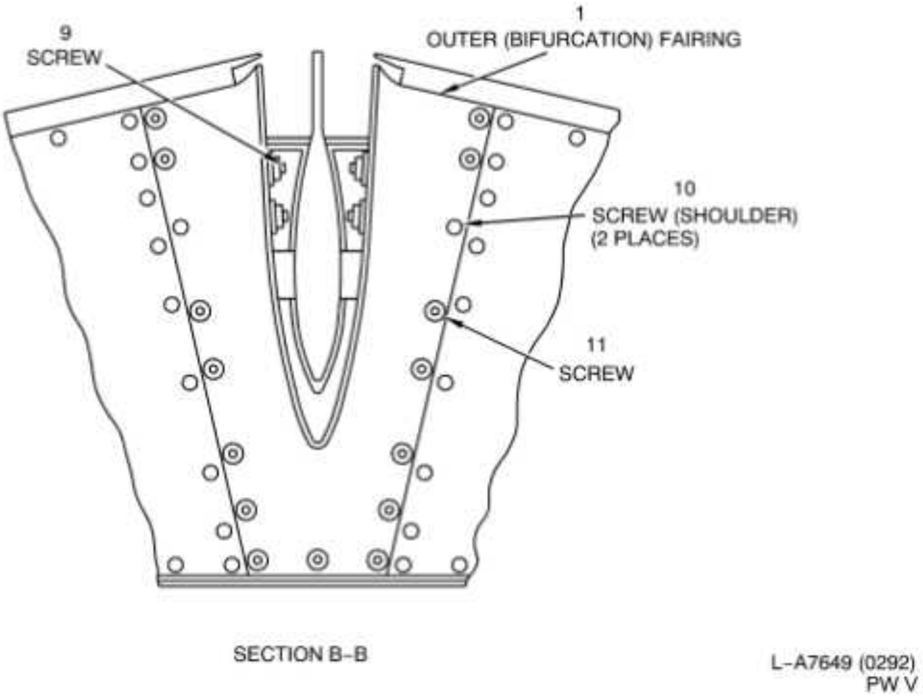
Fan Exit (Bifurcation) Fairing Assembly
Figure 301 (Sheet 2)
(Task 72−00−33−050−009)


2
INNER
(BIFURCATION)
FAIRING
LINER SEGMENT
ASSEMBLY
3
SCREW
4
SCREW
(SHOULDER)
W1
HARNESS
5
GASKET
W2
HARNESS
"V" RAIL
SECTION A-A
L-A3137 (0292)
PW V

Fan Exit (Bifurcation) Fairing Assembly
(Pre SB PW4ENG 72-161)
Figure 301 (Sheet 3)
(Task 72-00-33-050-009)


2
INNER
(BIFURCATION)
FAIRING
LINER SEGMENT
ASSEMBLY
3
SCREW
4
SCREW
(SHOULDER)
5
GASKET
8
SCREW
(COVER)
7
SCREW
(COVER)
W2 HARNESS
6
ACCESS COVER
(2 REQUIRED)
"V" RAIL
W1 HARNESS
SECTION A-A
L-A7651 (0292)
PW V

Fan Exit (Bifurcation) Fairing Assembly
(Post SB PW4ENG 72-161)
Figure 301 (Sheet 4)
(Task 72-00-33-050-009)


9
SCREW
1
OUTER (BIFURCATION) FAIRING
10
SCREW (SHOULDER)
(2 PLACES)
11
SCREW
SECTION B-B
L-A7649 (0292)
PW V

Fan Exit (Bifurcation) Fairing Assembly
Figure 301 (Sheet 5)
(Task 72−00−33−050−009)

CAUTION: BE VERY CAREFUL WHEN YOU MOVE THE INNER (BIFURCATION) FAIRING. IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THE FAIRING. IT IS EASY FOR THESE WASHERS TO BECOME DISCONNECTED FROM THE FAIRING.

(d) Temporarily attach the fairings away from the harness grommets and the fan cases with lockwire.

(2) If the complete removal of the fairings is necessary, remove the fan case. See Removal−01 (Task 72−00−33−020−001).

Task 72−00−33−050−009−A:

2. Remove The Fan Exit (Bifurcation) Fairing Assemblies (Post SB PW4ENG 72−370)

A. Equipment And Materials

Standard Tools:
No. 3 Cross−Drive (Phillips)
No. 10 Torq−set Drive
T−10 Torx Tip

B. Procedure

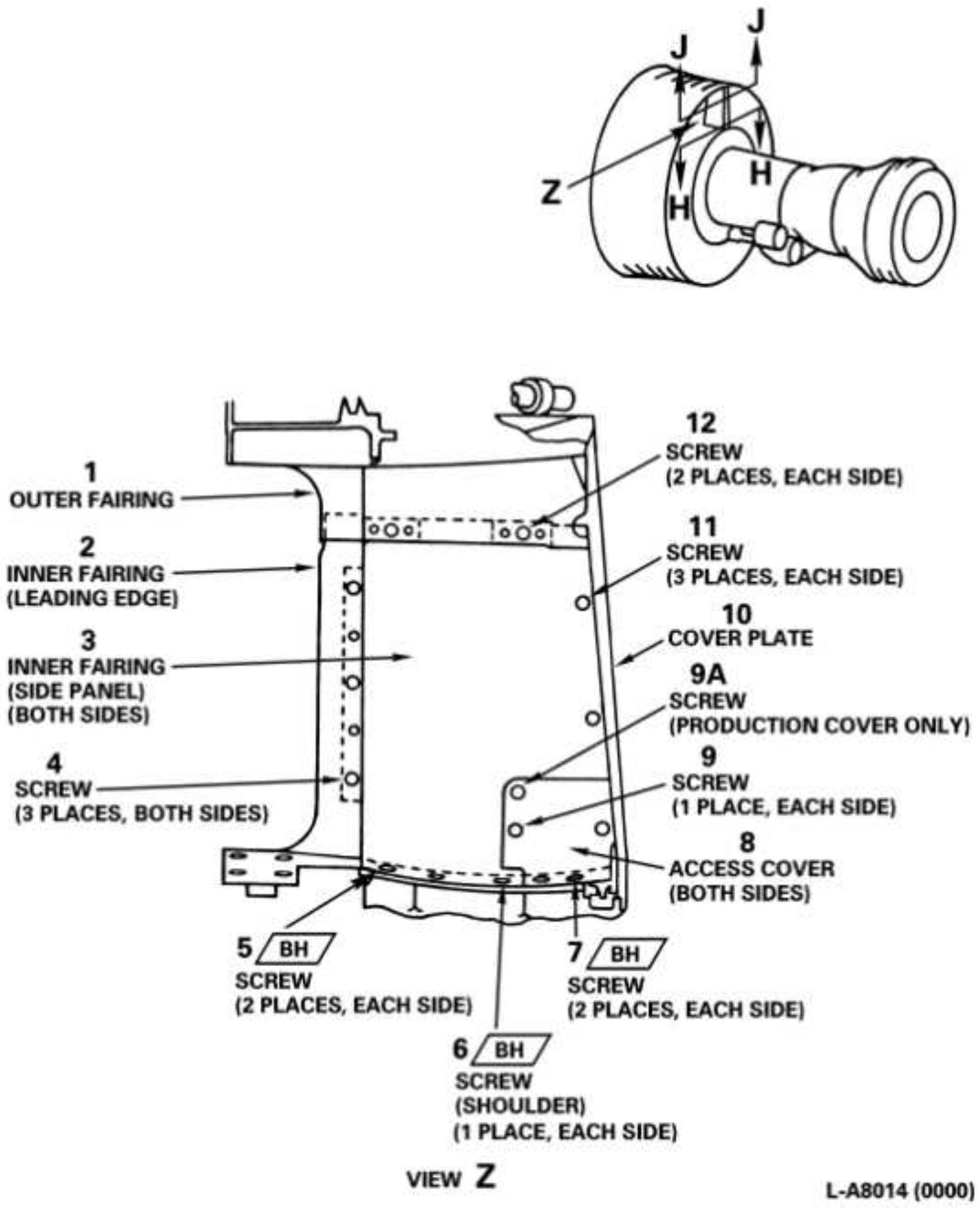
See Figure 302.

NOTE: Unless otherwise specified, use a No. 3 Cross−Drive (Phillips) with the shoulder screws. Use a No. 10 Torq−set drive with all the other screws.

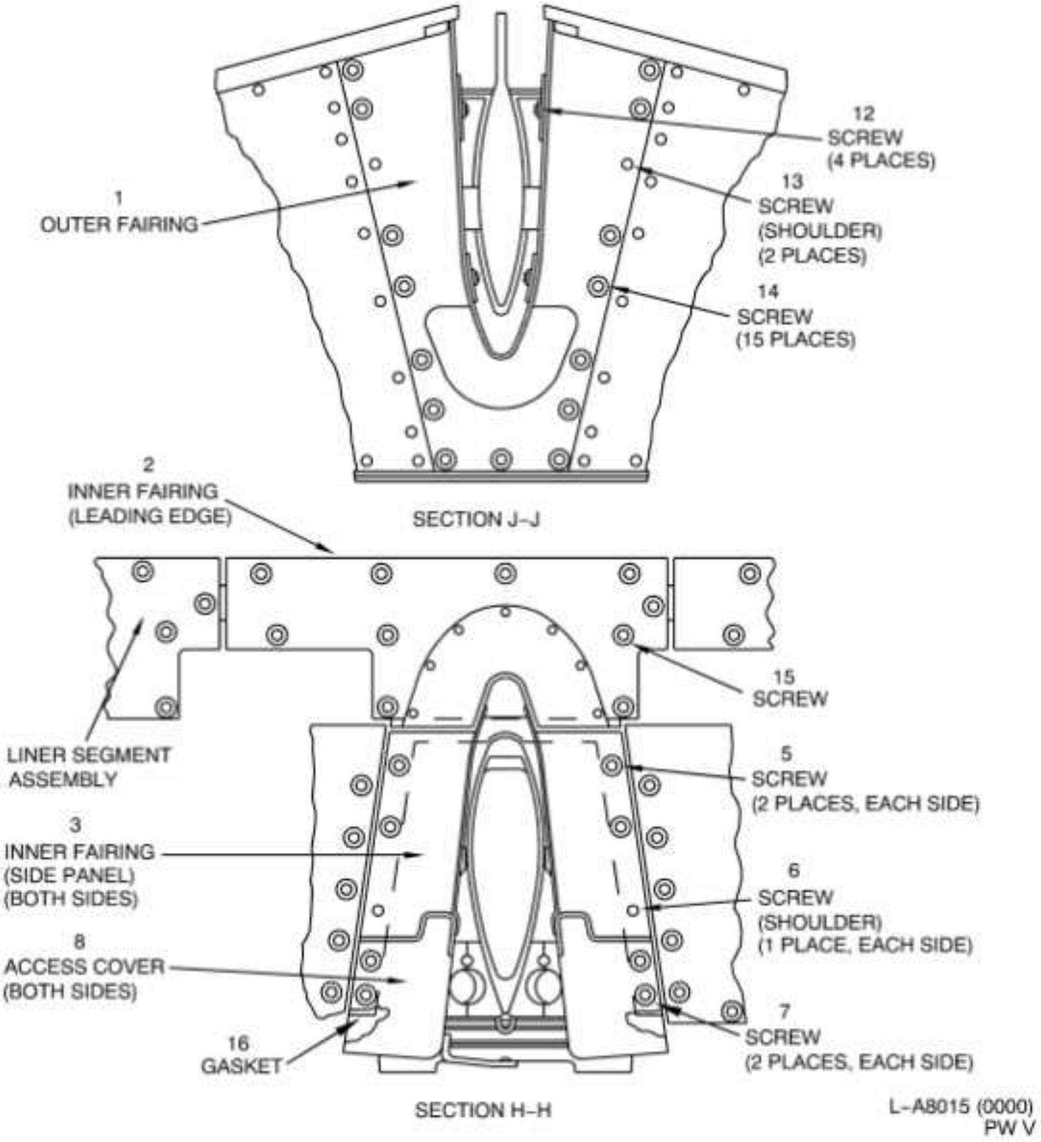
(1) Cut and remove the sealant from around the cover plate (302/10). Remove the screws (302/11) and the cover plate.

(2) Cut and remove the sealant from around the access covers (302/8). Remove the screws (302/9), (302/9A), and (302/7) and the access covers.

(3) Cut and remove the sealant from around the top of the outer fairing (302/1). Remove the screws (302/12) and (302/13), and (302/14) and the outer fairing.


J
J
Z
H
H
1
OUTER FAIRING
2
INNER FAIRING
(LEADING EDGE)
3
INNER FAIRING
(SIDE PANEL)
(BOTH SIDES)
4
SCREW
(3 PLACES, BOTH SIDES)
12
SCREW
(2 PLACES, EACH SIDE)
11
SCREW
(3 PLACES, EACH SIDE)
10
COVER PLATE
9A
SCREW
(PRODUCTION COVER ONLY)
9
SCREW
(1 PLACE, EACH SIDE)
8
ACCESS COVER
(BOTH SIDES)
5 BH
SCREW
(2 PLACES, EACH SIDE)
7 BH
SCREW
(2 PLACES, EACH SIDE)
6 BH
SCREW
(SHOULDER)
(1 PLACE, EACH SIDE)
VIEW Z
L-A8014 (0000)

Fan Exit (Bifurcation) Fairing Assembly
Figure 302 (Sheet 1)
(Task 72−00−33−050−009−A)


12
SCREW
(4 PLACES)
1
OUTER FAIRING
13
SCREW
(SHOULDER)
(2 PLACES)
14
SCREW
(15 PLACES)
2
INNER FAIRING
(LEADING EDGE)
SECTION J−J
15
SCREW
LINER SEGMENT
ASSEMBLY
5
SCREW
(2 PLACES, EACH SIDE)
3
INNER FAIRING
(SIDE PANEL)
(BOTH SIDES)
6
SCREW
(SHOULDER)
(1 PLACE, EACH SIDE)
8
ACCESS COVER
(BOTH SIDES)
7
SCREW
(2 PLACES, EACH SIDE)
16
GASKET
SECTION H−H
L−A8015 (0000)
PW V

Fan Exit (Bifurcation) Fairing Assembly
Figure 302 (Sheet 2)
(Task 72−00−33−050−009−A)

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE THE FAIRINGS. IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THE FAIRINGS. IT IS EASY FOR THESE WASHERS TO BECOME DISCONNECTED FROM THE FAIRINGS.

(4) Cut and remove the sealant around the inner fairing (leading edge) (302/2). Remove the screws (302/4) and (302/15). Remove the inner fairing (leading edge).

NOTE: Use a Torx T−10 tip with screws (302/4).

(5) Cut and remove the sealant around the inner fairing (side panels) (302/3). Remove the screws (302/5) and (302/6). Remove the inner fairing (side panels).

(6) Remove the gasket (302/16).

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72−00−33−050−010:

1. Remove The Supplemental Control Unit (SCU) Programming Plug

A. Equipment And Materials Required − None

B. Procedure

See Figure 301.

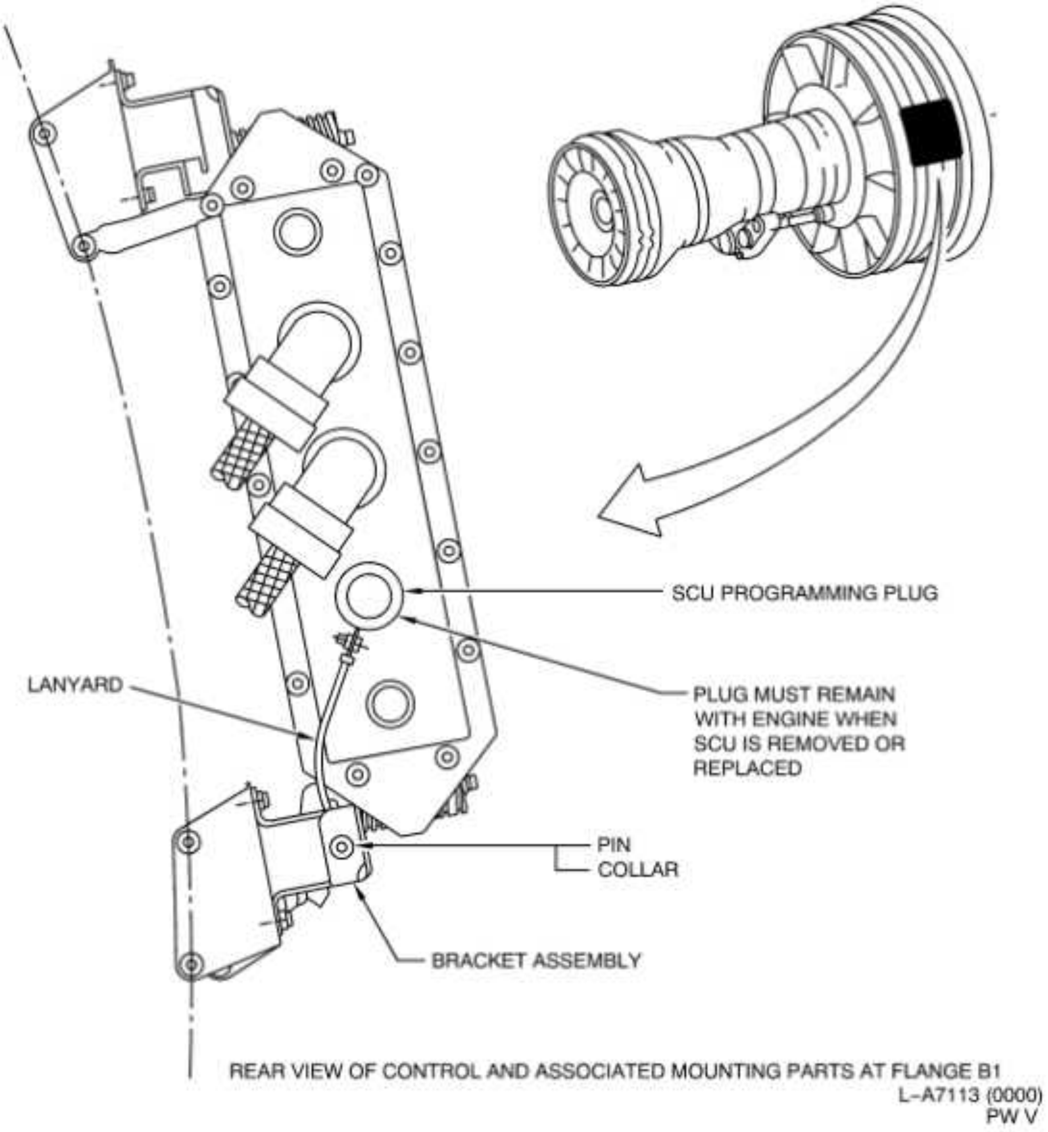
NOTE: Inside the programming plug, the engine serial number is identified (by electronics) to a specified engine (by serial number). Programming plugs are not interchangeable with each other unless a new plug is made to the same engine serial number.

(1) Remove the collar and pin that attach the lanyard to the SCU lower (rearward) mount bracket.

(2) Loosen and remove the programming plug from the SCU.

(3) Install protection covers to the SCU connector and to the programming plug.

ENGINE GENERAL − FAN CASE − REMOVAL−15


SCU PROGRAMMING PLUG
PLUG MUST REMAIN WITH ENGINE WHEN SCU IS REMOVED OR REPLACED
LANYARD
PIN
COLLAR
BRACKET ASSEMBLY
REAR VIEW OF CONTROL AND ASSOCIATED MOUNTING PARTS AT FLANGE B1
L−A7113 (0000)
PW V

SCU Programming Plug
Figure 301
(Task 72−00−33−050−010)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - FAN CASE - REMOVAL-16

Task 72-00-33-040-001:

1. Remove The Fan Exit Liner Segment Assemblies (Procedure To Use With The Removal Of A Component)

A. Equipment And Materials

Standard Tools:
No. 10 Torq-set Drive

B. Procedure

See Figure 301.

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE A LINER SEGMENT. IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THE FRONT LINER BRACKET. IT IS EASY FOR THESE WASHERS TO BECOME DISCONNECTED FROM THE BRACKET. ALSO, IF THE EDGE OF THE LINER SEGMENT HITS SOMETHING, IT CAN DELAMINATE.

(1) If the liner is at 11 or 1 o'clock, cut the sealant that is at the axial edge of the liner.

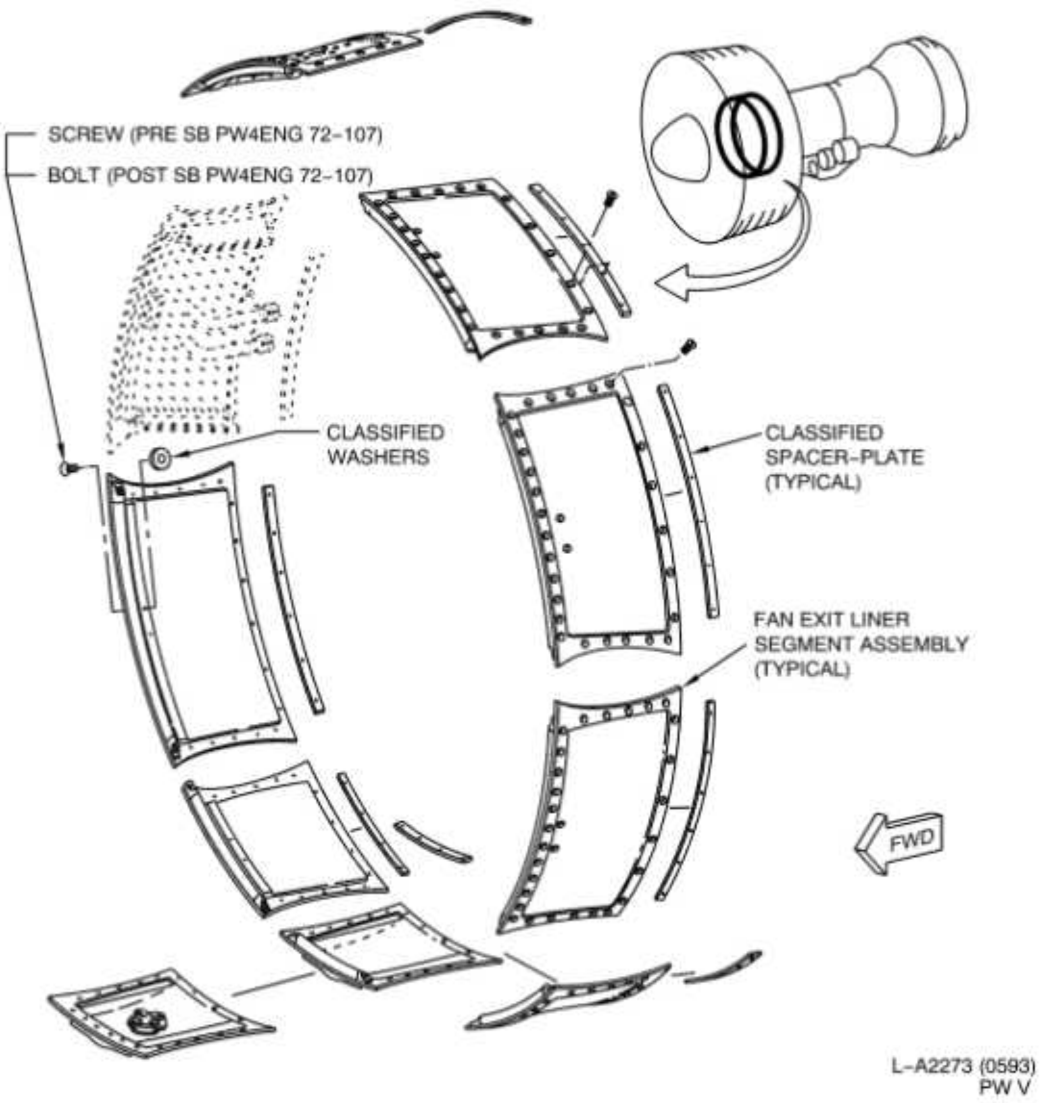
(2) Remove all the screws/bolts that attach the liners. Remove the liners.

(3) If you remove more than one liner, make marks on the case to show the locations of the liners.

NOTE: If the engine has acoustical fan exit liner segment assemblies, first remove the sealant that covers the screws, then remove the screws. To remove the sealant, use mechanical means. Be careful not to damage the engine parts.

(4) If the spacer plates (called spacers) are not bonded to the case, remove the spacers. Keep each spacer with its liner.

(5) If the spacers are bonded to the case, do not remove the spacers.


SCREW (PRE SB PW4ENG 72-107)
BOLT (POST SB PW4ENG 72-107)
CLASSIFIED WASHERS
CLASSIFIED SPACER-PLATE (TYPICAL)
FAN EXIT LINER SEGMENT ASSEMBLY (TYPICAL)
FWD
L-A2273 (0593)
PW V

Removal Of The Fan Exit (Rear) Liner Segment Assemblies
Figure 301
(Task 72−00−33−040−001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - FAN CASE - REMOVAL-17

Task 72-00-33-040-002:

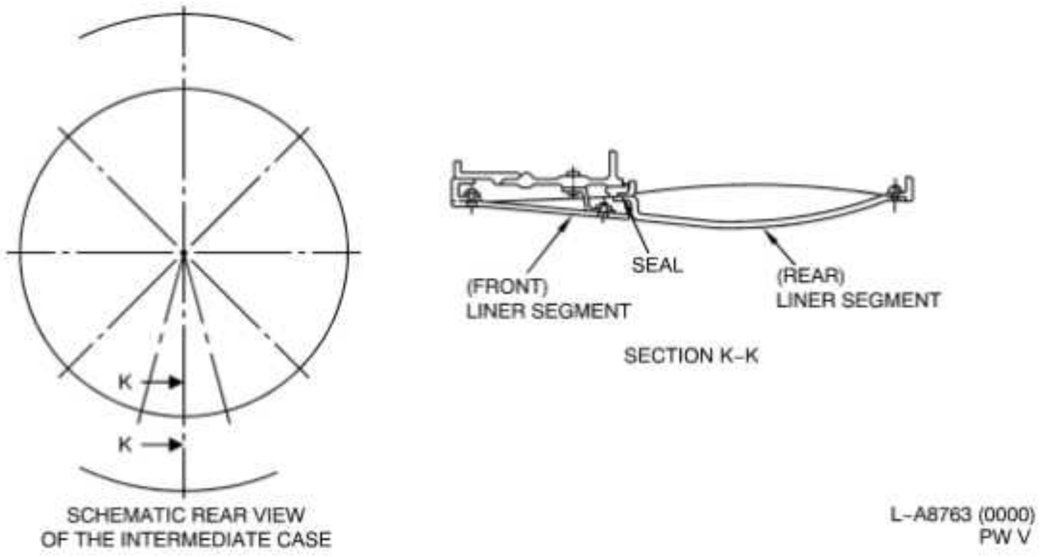
1. Remove A Fan Exit Liner Seal

A. Equipment And Materials - None

B. Procedure

See Figure 301.

(1) Mechanically remove damaged or loose seals. Mechanically remove any sealant from the case.


SEAL
(FRONT)
LINER SEGMENT
(REAR)
LINER SEGMENT
SECTION K−K
K
K
SCHEMATIC REAR VIEW
OF THE INTERMEDIATE CASE
L−A8763 (0000)
PW V

Removal Of The Fan Exit Liner Seals
Figure 301
(Task 72−00−33−040−002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - FAN CASE - REMOVAL-20

Task 72-00-33-020-020:

1. Remove The Flange C Brackets And Hardware

   A. Equipment And Materials Necessary - None

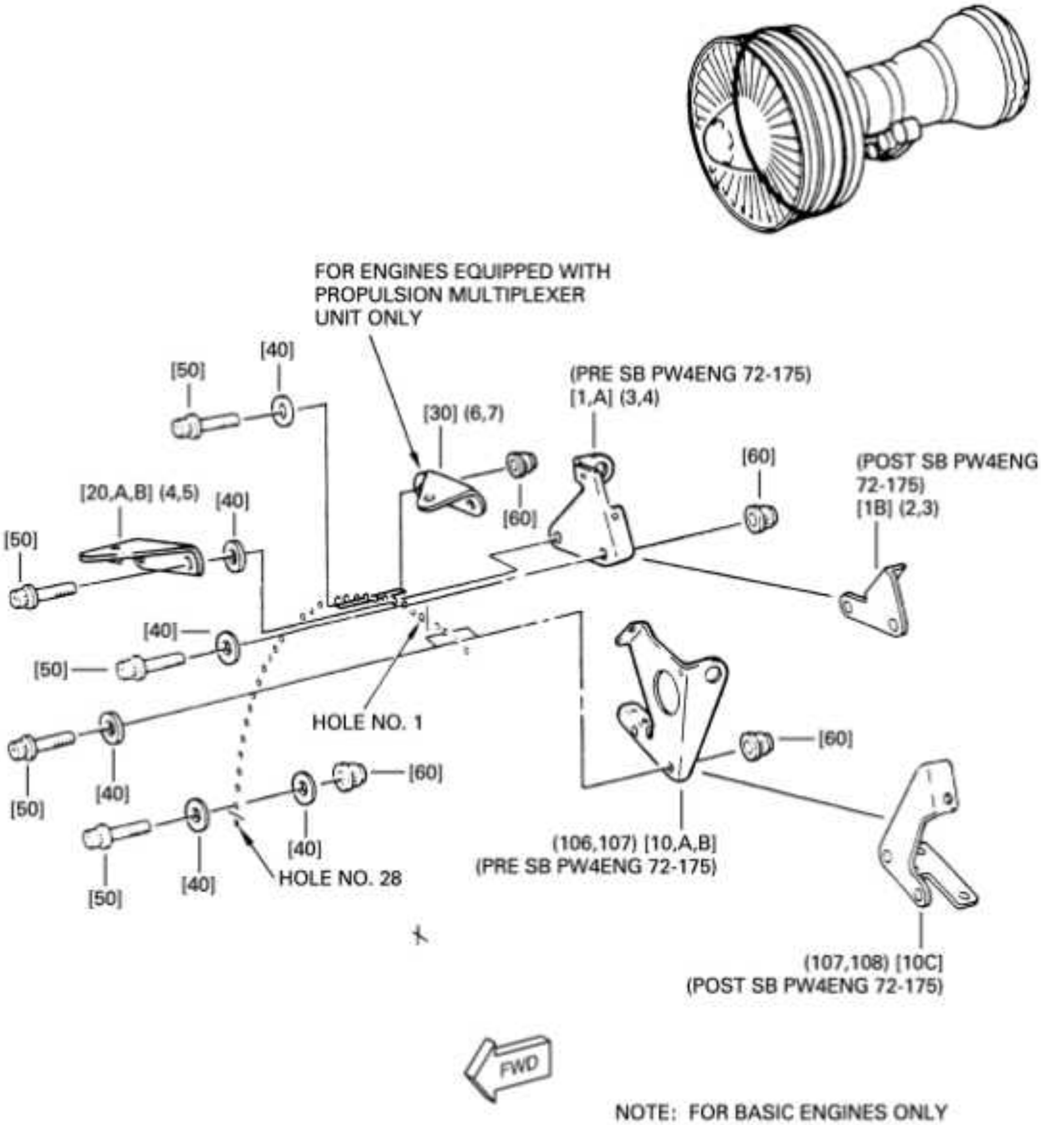
   B. Procedure

      (1) Remove the Flange C brackets as follows. See Figure 301.

         (a) Tag and identify the flange C hardware for the correct bolthole locations.

            NOTE: All the part item numbers in the figures are the same as the item numbers in the IPC.

         (b) Remove 108 nuts, washers, bolts, and brackets securing cases at Flange C.

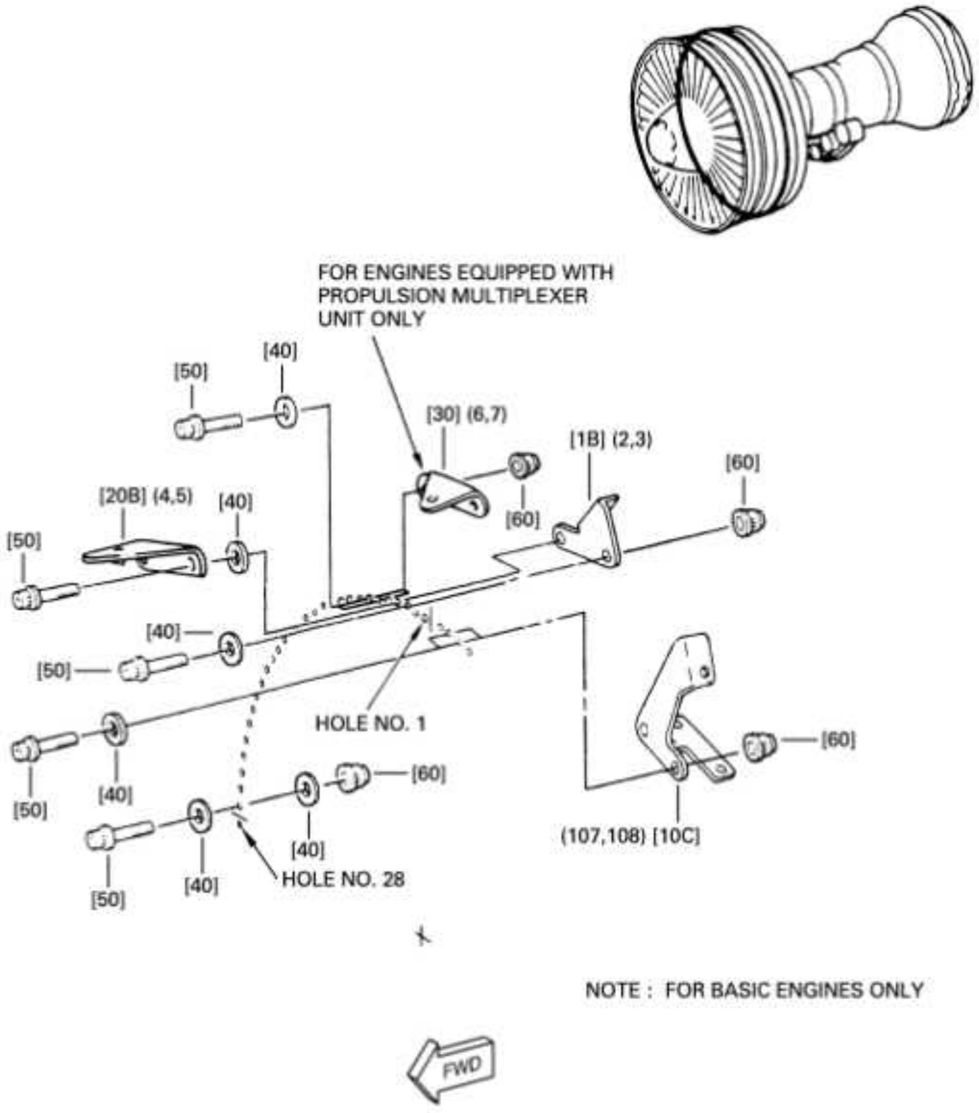

FOR ENGINES EQUIPPED WITH PROPULSION MULTIPLEXER UNIT ONLY
[50]
[40]
(PRE SB PW4ENG 72-175)
[1,A] (3,4)
[30] (6,7)
[60]
[60]
(POST SB PW4ENG 72-175)
[1B] (2,3)
[20,A,B] (4,5)
[40]
[50]
[40]
[50]
HOLE NO. 1
[60]
[50]
[40]
[60]
[40]
(106,107) [10,A,B]
(PRE SB PW4ENG 72-175)
[50]
[40]
HOLE NO. 28
(107,108) [10C]
(POST SB PW4ENG 72-175)
FWD

NOTE: FOR BASIC ENGINES ONLY

(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)

L-A7387 (0502)

Flange C Bracket Locations
Figure 301 (Sheet 1)
(Task 72−00−33−020−020)

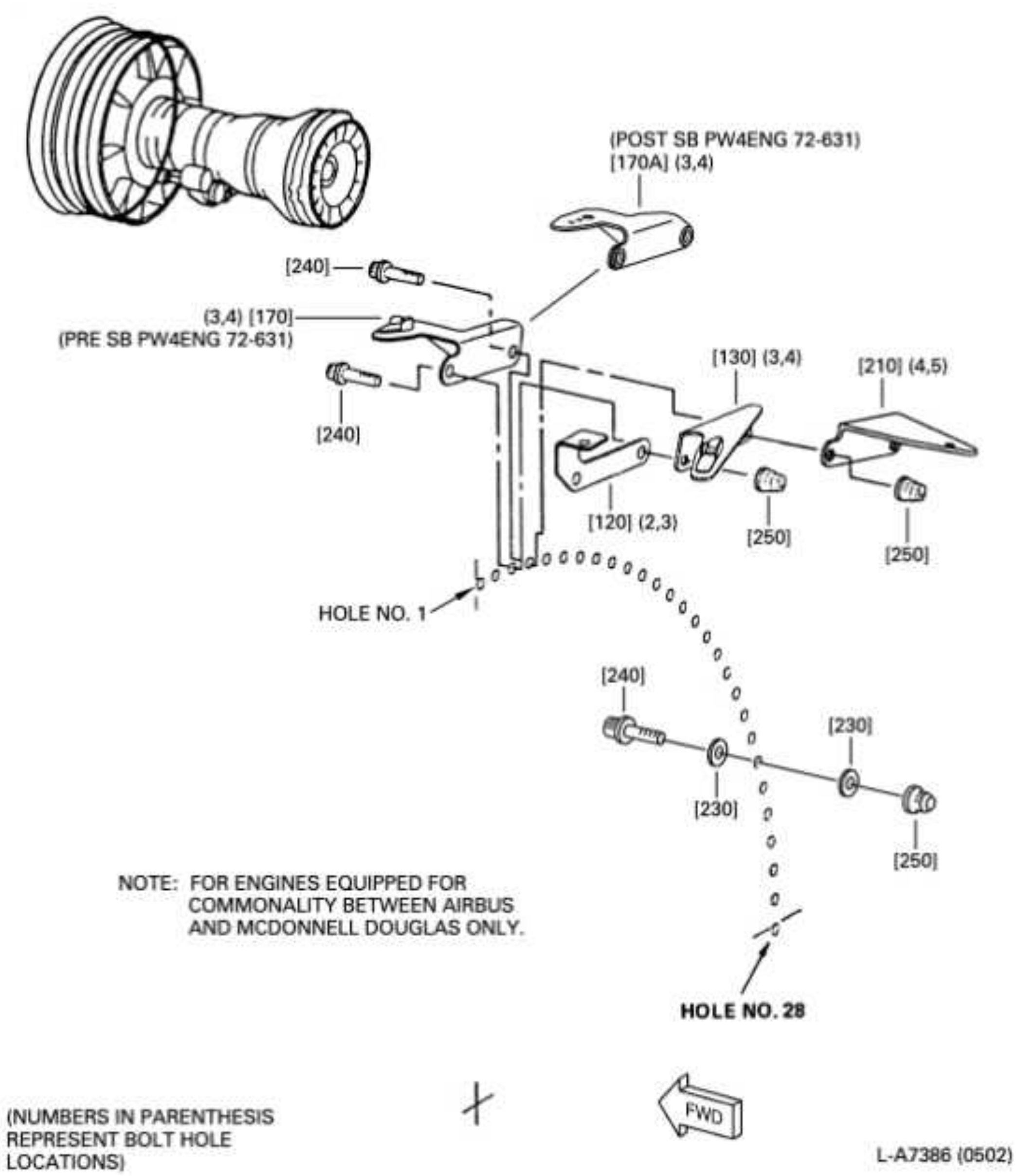

FOR ENGINES EQUIPPED WITH PROPULSION MULTIPLEXER UNIT ONLY
[50]
[40]
[30] (6,7)
[1B] (2,3)
[60]
[20B] (4,5)
[40]
[50]
[60]
[40]
[50]
HOLE NO. 1
[60]
[50]
[40]
[60]
[40]
(107,108) [10C]
[50]
[40]
HOLE NO. 28
FWD

NOTE : FOR BASIC ENGINES ONLY

(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)

L-A9519 (0502)

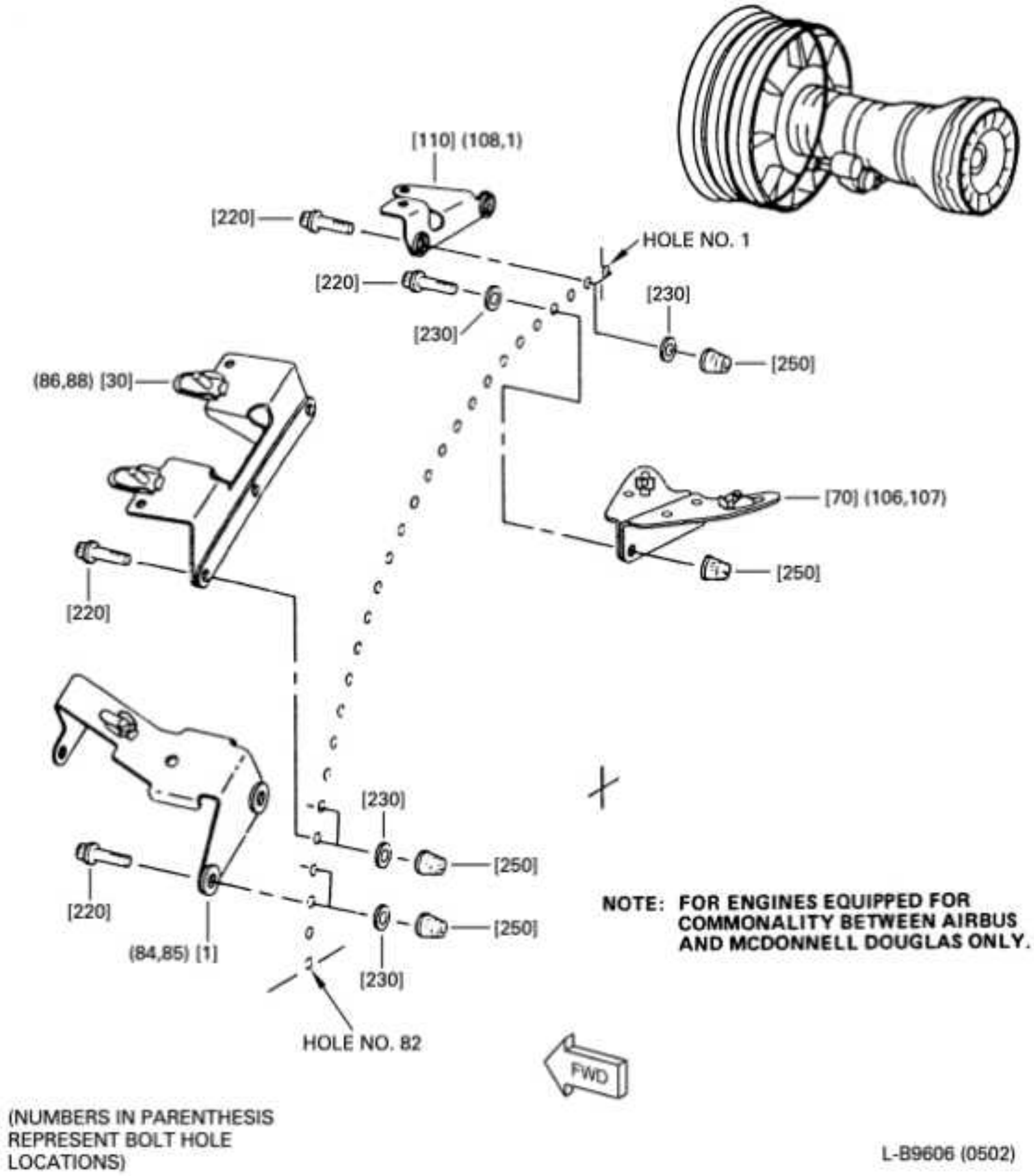
Flange C Bracket Locations
Figure 301 (Sheet 2)
(Task 72−00−33−020−020)


(POST SB PW4ENG 72-631)
[170A] (3,4)
[240]
(3,4) [170]
(PRE SB PW4ENG 72-631)
[240]
[130] (3,4)
[210] (4,5)
[120] (2,3)
[250]
[250]
HOLE NO. 1
[240]
[230]
[230]
[250]
HOLE NO. 28
FWD
L-A7386 (0502)

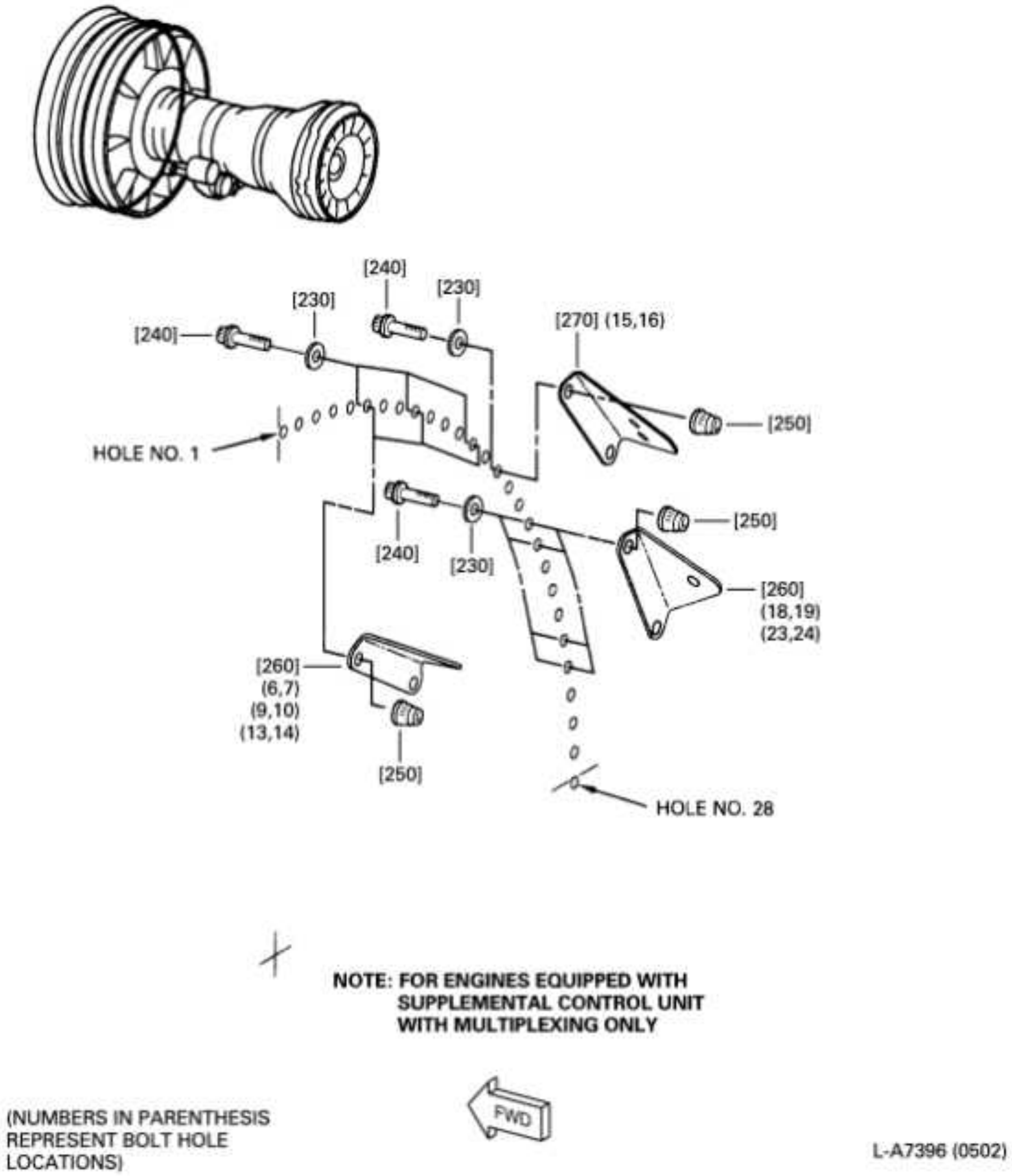
NOTE: FOR ENGINES EQUIPPED FOR COMMONALITY BETWEEN AIRBUS AND MCDONNELL DOUGLAS ONLY.

(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)

Flange C Bracket Locations
Figure 301 (Sheet 3)
(Task 72−00−33−020−020)


[110] (108,1)
[220]
HOLE NO. 1
[220]
[230]
[230]
[250]
(86,88) [30]
[70] (106,107)
[250]
[220]
[230]
[250]
[220]
[250]
(84,85) [1]
[230]
HOLE NO. 82
NOTE: FOR ENGINES EQUIPPED FOR COMMONALITY BETWEEN AIRBUS AND MCDONNELL DOUGLAS ONLY.
FWD
(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)
L-B9606 (0502)

Flange C Bracket Locations
Figure 301 (Sheet 4)
(Task 72−00−33−020−020)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(18,19)
(23,24)
[260]
(6,7)
(9,10)
(13,14)
[250]
HOLE NO. 28
FWD
L-A7396 (0502)

NOTE: FOR ENGINES EQUIPPED WITH SUPPLEMENTAL CONTROL UNIT WITH MULTIPLEXING ONLY

(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)

Flange C Bracket Locations
Figure 301 (Sheet 5)
(Task 72-00-33-020-020)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-33-420-001:

1. Install Fan Case

NOTE: See Figure 401 for part/assembly installation procedure sequence.

A. Prerequisites

(1) See Inspection/Check-01 Task 72-00-33-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Standard Tools:
Glenair TG-69 Soft Jawed Pliers or
Glenair TG-70 Strap Wrench
0.020 Inch (0.508 mm) Shim Stock
1 Inch (25.400 mm) Depth Micrometer
No. 10 Torq-set Drive
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 76154	Adapter (2 Necessary)
PWA 76155	Sling
PWA 85698	Adapter, Lift And Trunnion (2 Necessary) (Optional to PWA 86431)
PWA 85905	Fixture, Assemble Disassemble
PWA 86431	Adapter, Lift And Trunnion (2 Necessary)

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-038	Cheesecloth, Unsized
P05-099	Tape, Moisture Resistant (PMC 4141)
P05-133	Mold Release (PWA 36007-1)
P05-137	Bonding Preventative, Teflon S (PWA 36038)
P05-231	Tape, Adhesive Transfer (PWA 36745)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-053	Lubricant, Sealing Ring (PWA 36500)

Consumable Materials:

Item No.	Designation
(CONTINUED)	
P06-054	Paste, Antiseize (PWA 36246)
P09-014	Sealant, Silicone Rubber (PWA 36003)
P09-027	Sealant, Silicone Rubber (PWA 36003-2)
P09-029	Sealant, Silicone Rubber
P11-014	Alcohol, Isopropyl (PMC 9094)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	2	24-11-00/1/6
Packing	1	72-34-00/12/40
Packing	1	72-34-00/12/140
Packing	2	79-21-00/3/4

C. Procedure To Install Parts Other Than the Fan Exit Liner Segment Assemblies

(1) If not installed on the intermediate case, loosely attach the gasket, and inner and outer (bifurcation) fairings to the front of the intermediate case at the 12 o'clock strut. See Figure 402.

NOTE: Installation of fairing to be completed after installation of W1 and W2 wiring harnesses through fairings.

(2) If the air/oil heat exchangers and valves (engine and IDGS) were left installed, lubricate the four new packings with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 and install to the four inlet sleeves (collars) on the two heat exchangers at approximately 4 o'clock and 8 o'clock positions on the intermediate case. See Figure 403.

(3) If not installed, install either PWA 86431 or PWA 85698 Adapter to the flanges of the fan case at 3 and 9 o'clock. Using hoist and PWA 76155 Sling with PWA 76154 Adapters, raise fan case from stand and install

on engine, aligning dowel and dowel pin hole. See Figure 404.

NOTE: Installation of fan case requires raising and pulling radially inward to outward from actuator pad to allow fan case assembly to engage intermediate case.

(4) Install eight equally spaced washers and bolts, threads lubricated with Engine Oil P03-001, to secure 2.5 bleed valve support flange. Install 27 bolts, threads lubricated with Engine Oil P03-001, equally spaced around Flange C with heads forward. Secure with washers and nuts. See Figure 405.

(5) Using opposite bolt pattern draw cases together alternating between Flange C and 2.5 bleed valve support bolts. Torque 2.5 bleed valve support bolts to 290 - 325 lb-in. (32.776 - 36.720 N.m). Torque Flange C nuts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(6) Install remaining 28 bleed valve support bolts, threads lubricated with Engine Oil P03-001, and washers for total of 36 bolts. Torque bolts to 290 - 325 lb-in. (32.776 - 36.720 N.m).

(7) Install Flange C hardware as follows. Refer to 72-00-33, Installation-20 (Task 72-00-33-420-020).

(8) Remove hoist, sling, and adapters from fan case adapters. Remove adapters from fan case.

(9) If air/oil heat exchangers and valves (engine and IDGS) are installed, secure inlet sleeves (collars) to 2.5 bleed support with 16 bolts, threads lubricated with Engine Oil P03-001, and washers. Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). See Figure 403.

NOTE: Install outer bolts from intermediate case side and inner bolts from (front) fan case side.

(10) Install the 4th stage compressor stator assembly (called stator assembly). See Figure 406.

(a) Apply Sealing Ring Lubricant P06-053 or Engine Oil P03-001 to the stator assembly packings.

(b) Put the packings in the grooves on the front and rear OD of the stator assembly.

(c) Assemble PWA 85905 Fixture.

1 Put the jaw marked "install" on the tool 1.5 inch (38.100 mm) from the body.

2 Make the quantity of threads the same at both ends of the screw.

(d) Put the stator assembly against the intermediate case. The dowel pin in the rear of the stator assembly will engage the offset hole at 12 o'clock. Rotate the stator assembly to partially engage the tabs of the intermediate case.

(e) At 11 o'clock, engage the fixture in the tabs of the stator assembly and the intermediate case. Turn the screw of the fixture to fully engage the tabs of the stator assembly and intermediate case.

(f) Apply Engine Oil P03-001 to the threads of 24 bolts.

(g) Attach the stator assembly to the intermediate case with washers and the 24 bolts. Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(h) Remove the fixture.

(11) If not installed, install compressor bleed actuator pressure and return tubes. See Figure 407.

(a) Remove protective closures.

(b) Lubricate return tube (CR02) nut threads with Engine Oil P03-001 and connect to manifold tee and to forward adapter on the actuator.

(c) Lubricate pressure tube (CP06) nut threads with Antiseize Paste P06-054 and connect tube to manifold tee and to rear adapter on the actuator. Wipe off unwanted paste.

(d) For (Post SB PW4ENG 75-45) engines, install clamps, bolt, lubricated with Engine Oil P03-001, and nut that attach the tube together. Torque the clamp bolt to 30 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque return tube (CR02) nuts to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(f) Torque pressure tube (CP06) nut at manifold tee to 340 - 375 lb-in. (38.415 - 42.369 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(g) Torque pressure tube (CP06) nut at actuator to 225 - 250 lb-in. (25.422 - 28.246 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(12) Connect the W3P15 harness connector to the compressor bleed actuator as follows.

(a) Remove protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight all the bent pins. If necessary, clean the connector and receptacle by SPOP 6 (Task 70-21-00-110-900). Refer to Section 70-21-00 in the Standard Practices Manual, PN 585005.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG-70 strap wrench or the Glenair TG-69 soft-jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal). This procedure

will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

D. Procedure To Install The Fan Exit Liner Segment Assemblies See Figure 408.

CAUTION: ACOUSTICAL AND NONACOUSTICAL LINERS ARE IN SETS. BUT THE LINER THAT IS AT 6 O'CLOCK IS A NONACOUSTICAL LINER.

(1) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
If not installed, install the fan exit liner seals. Refer to Installation-17 (Task 72-00-33-440-002).

(2) (Reference 1005) Find the washer thickness necessary to make a 0.005 - 0.020 inch (0.127 - 0.508 mm) thick empty space between the washers and fan exit (rear) liner segment assemblies (called liners), as follows. See Figure 409.

(a) Attach 0.020 inch (0.508 mm) shim stock to the OD of the bracket at the rear of the case and vane assembly. Use Tape P05-099.

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE OR INSTALL A LINER SEGMENT. IF THE EDGE OF THE LINER SEGMENT HITS SOMETHING, IT CAN DELAMINATE.

(b) Temporarily attach the liner to the case with screws or bolts.

(c) With a depth micrometer in the two forward holes, measure the depth from the top surface of the liner to the surface of the shim stock (Dimension A).

(d) Remove the liner and shim stock.

(e) Measure the thickness of the liner (Dimension B).

(f) Subtract Dimension B from Dimension A to know the necessary thickness of the washers.

(g) Use Table 401 to choose the correct washer classification. Zero to three washers are necessary.

Class	Washer Thickness - Inch (mm)
1	0.009 - 0.011 (0.229 - 0.279)
2	0.019 - 0.021 (0.483 - 0.503)
3	0.029 - 0.031 (0.737 - 0.787)
4	0.039 - 0.041 (0.991 - 1.041)
5	0.049 - 0.051 (1.244 - 1.295)
6	0.099 - 0.101 (2.514 - 2.565)

Fan Exit (Rear) Liners - Washer Thickness
Table 401

(3) Attach the washers to the brackets, as follows.

(a) Use SPOP 208 Wipe Method (Task 70-21-00-110-040) to clean the areas you will bond.

(b) Dry the areas fully in air that is at room temperature. When dry, there must be no solvent on the parts.

(c) Apply Sealant P09-014 to the edges of the washers. Do not apply sealant to the mating surfaces of the washer and bracket. Use screws/bolts to temporarily hold the washers in position.

(4) Find the correct classification of spacer plate (called spacer). The surface of the liner must be flush within 0.020 inches (0.508 mm) of the platform of the strut. See Table 402. See Figure 410 or 411. Install the spacer as follows.

NOTE: Refer to the key of Figure 411 or 412 for the necessary tolerance in Area AH.

NOTE: Only a Class 4 spacer is permitted with an acoustical liner.

Class	Spacer Thickness - Inch (mm)
1	0.022 - 0.028 (0.559 - 0.711)
2	0.036 - 0.044 (0.914 - 1.118)
3	0.058 - 0.068 (1.473 - 1.727)
4	0.075 - 0.085 (1.905 - 2.159)
5	0.095 - 0.105 (2.413 - 2.667)
6	0.120 - 0.130 (3.048 - 3.302)

Spacer Plate Thickness
Table 402

(a) Prepare the spacer and V-groove rail for the installation of tape as follows.

1 With a piece of clean Cheesecloth P05-038 that is moist with Alcohol P11-014, wipe the areas you will bond.

2 Dry the surfaces fully in air that is at room temperature. When dry, there must be no alcohol on the parts.

(b) Install Tape P05-231 on either the V-groove rail or the spacer. Remove tape from the bolt holes.

(c) Align the holes of the V-groove rail and the spacer. Install the spacer on the V-groove rail.

(5) Apply sealant to the space on the V-groove rail between the ends of the spacers as follows.

(a) Mechanically remove any sealant that is in the applicable area of the V-groove rail.

(b) Prepare the V-groove rail as follows.

1 Clean the area where you will apply the sealant. Use a piece of clean Cheesecloth P05-038 that is moist with Alcohol P11-014.

2 Dry the surface fully in air that is at room temperature. When dry, there must be no alcohol on the parts.

(c) Apply Sealant P09-027 to the area of the V-groove rail that you cleaned.

(d) Apply Mold Release P05-133 to the mating area of the liner.

(6) Install the liners as follows.

(a) Remove the temporary screws/bolts that attach the washers to the brackets.

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE OR INSTALL A LINER SEGMENT. THE WASHERS THAT ARE ATTACHED TO THE FRONT LINER BRACKET CAN BECOME DISCONNECTED FROM THE BRACKET. ALSO, IF THE EDGE OF THE LINER SEGMENT HITS SOMETHING, IT CAN DELAMINATE.

(b) Attach the liners to the cases with screws/bolts, threads lubricated with Engine Oil P03-001. Tighten the screws/bolts with your hand. Engines with non-acoustical liners, refer to Figure 411. Engines with acoustical liners, refer to Figure 411.

NOTE: Screws are (Pre SB PW4ENG 72-107). Bolts are (Post SB PW4ENG 72-107).

NOTE: The liner that is at 6 o'clock does not use screws/bolts at the leading edge.

(c) Torque all the screws/bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m) in the order that follows:

1 Front fasteners.

2 Rear fasteners.

3 Fasteners adjacent to the intermediate case struts.

(d) Visually examine each fastener to make sure that it is correctly installed and touches the washer. If the fastener does not touch the washer, remove it, apply new lubricant and install it again.

NOTE: It is not necessary for the fastener to be symmetrically installed in the washer recess.

(e) Permit the sealant at the trailing edge to cure in air that is at room temperature and has a relative humidity of 25 percent, for two hours, minimum, and until no longer tacky. Remove unwanted sealant from the flowpath.

(7) For engines with the acoustical fan exit liner segment assemblies (inner rear), use one of the methods that follow to fill the screw holes in the liners. See Figure 411.

NOTE: The liner at 6 o'clock is a non-acoustical liner.

(a) First method:

1 Clean the screw heads and holes with Alcohol P11-014.

2 Cover the screw heads only with Sealant P09-029.

3 Fill the outer part of the holes and an area approximately 0.125 inch (3.175 mm) larger than the hole with Sealant P09-014.

(b) Second method:

1 Cover the screw heads with Tape P05-231, film side up.

2 Clean the holes with Alcohol P11-014.

3 Fill the outer part of the holes and an area approximately 0.125 inch (3.175 mm) larger than the hole with Sealant P09-014.

(c) Third method:

1 Cover the screw heads with Bonding Preventative P05-137. Cure at 400°F (204.4°C) for one hour.

2 Clean the holes with Alcohol P11-014.

3 Fill the outer part of the holes and an area approximately 0.125 inch (3.175 mm) larger than the hole with Sealant P09-014.

(d) Fourth method:

1 Fill the screw holes with AMS 7267 or AMS 7276 packing material.

2 Clean the packing material and holes with Alcohol P11-014.

3 Fill the outer part of the holes and an area approximately 0.125 inch (3.175 mm) larger than the hole with Sealant P09-014.

(8) Apply sealant at the trailing edges of the intermediate case struts, as follows. See Figure 412.

(a) Clean the areas that the sealant will touch. Use a clean piece of Cheesecloth P05-038 that is moist with Alcohol P11-014.

(b) Dry the surfaces fully in air that is at room temperature. There must be no alcohol on the parts when sealant is applied.

(c) Apply Sealant P09-027 at the trailing edges of the struts.

(d) Cure the sealant in air that is at room temperature and has a relative humidity of 25 percent, minimum, for eight hours before engine operation.

(9) Install the fan exit (front) liner segment assembly at 6 o'clock as follows. See Figure 413.

CAUTION: BE VERY CAREFUL WHEN YOU INSTALL A LINER SEGMENT. IT IS POSSIBLE THAT WASHERS ARE ATTACHED TO THE LINER. IT IS EASY FOR THE WASHERS TO BECOME DISCONNECTED FROM THE LINER.

(a) Attach the liner to the fan case with 20 screws, threads lubricated with Engine Oil P03-001. Torque the screws to 36 - 40 lb-in. (4.067 - 4.519 N.m). Refer to Table 403 for screw lengths.

Screw PN	Screw Length Inches (mm)	Washer Thickness Inches (mm)	Quantity of Screws
593111	0.495 - 0.505 (12.57 - 12.83)	0.000 - 0.015 (0.00 - 0.38)	0 - 20 As Necessary

Fan Exit (Front) Liners - Washer Thickness And Screw Length
Table 403

Screw PN	Screw Length Inches (mm)	Washer Thickness Inches (mm)	Quantity of Screws
ST1382-09	0.542 - 0.562 (13.77 - 14.27)	0.016 - 0.070 (0.41 - 1.78)	0 - 20 As Necessary
ST1382-10	0.594 - 0.625 (15.09 - 15.88)	0.071 - 0.130 (1.80 - 3.30)	0 - 20 As Necessary
ST1382-11	0.656 - 0.687 (16.66 - 17.45)	0.131 - 0.210 (3.33 - 5.33)	0 - 20 As Necessary

Fan Exit (Front) Liners - Washer Thickness And Screw Length
Table 403 (Continued)

(b) Do a check of the clearance between the trailing edges of all the fan exit (front) liner segment assemblies and the fan exit (rear) liner segment assemblies. See Inspection/Check-05 (Task 72-00-33-210-004).

(c) Clean the mating axial edges of the front liner at 6 o'clock. Also clean the rear cutouts of all the front liners. Use a clean piece of Cheesecloth P05-038 that is moist with Alcohol P11-014.

(d) Dry the surfaces fully in air that is at room temperature. There must be no alcohol on the parts when sealant is applied.

(e) Apply Sealant P09-027 to the mating axial edges of the (front) liner. Also apply Sealant P09-027 to the rear cutouts of all the front liners. Cure the sealant in air that is at room temperature, and has a relative humidity of 25 percent, minimum, for eight hours before engine operation.

(f) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Apply sealant to the empty spaces between the front liner and the rear liner at the 6 o'clock panel location as follows. See Figure 413 (Sheet 2).

1 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Clean the surfaces that are in touch with the sealant by SPOP 208 (Task 70-21-00-110-040). Refer to Section 70-21-00 in the Standard Practices Manual, PN 585005.

2 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Dry the surfaces fully in air that is at room temperature. When dry, there must be no sign of solvent on the parts.

3 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Apply sealant P09-027 to the empty space between the front liner and the rear liner at the 6 o'clock panel location. The surface of the sealant must be smooth and continuous.

4 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Cure the sealant for eight hours, minimum, before you touch the parts.

(10) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Apply sealant to the leading edges of the intermediate case struts, as follows. See Figure 414.

(a) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Clean the areas that the sealant will touch. Refer to PWA 83-D2 (Task 70-48-00-360-001).

(b) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Apply sealant P09-027 at the leading edges of the struts. The surface of the sealant must be smooth and continuous.

(c) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Cure the sealant for eight hours, minimum, before you touch the parts.

(11) Optional, apply sealant to the space between the inner fan exit guide vane bases and the fan exit inner liner segments; and the outer fan exit guide vane bases and the intermediate case as follows: See Figure 415.

NOTE: The optional sealant can be applied to help reduce erosion of the vane base material.

(a) Remove any loose sealant.

(b) Clean the areas that the sealant will touch. Refer to PWA 83-D4 (Task 70-48-00-360-001) in section 70-48, Standard Practices Manual, PN 585005.

NOTE: The fan exit guide vane base material is polyetherimide.

R
R

(c) Apply Sealant P09−029 at the rear of the inner and outer fan exit guide vane bases as shown in the referenced figure. The surface of the sealant must be smooth and continuous and flush to 0.040 inch (1.016 mm) below the adjacent surface.

(d) Remove excess sealant.

(e) Cure the sealant in air with a relative humidity of 50 percent minimum at 75° F (23.9° C) or equivalent. Cure the sealant for 24 hours, minimum, before you touch the parts.

NOTE: The sealant is fully cured in 72 hours.

E. Postrequisites

(1) If intermediate case was removed or replaced, install air/oil heat exchanger and valve (engine). See 72−00−34, Installation−10 (Task 72−00−34−450−006).

(2) If intermediate case was removed or replaced, install air/oil heat exchanger and valve (IDGS). See 72−00−34, Installation−08 (Task 72−00−34−450−004).

(3) Install No. 3 bearing buffer air cooler. See Installation−05 (Task 72−00−33−450−002).

(4) Install low pressure compressor (LPC). See 72−00−31, Installation−01 (Task 72−00−31−420−003).

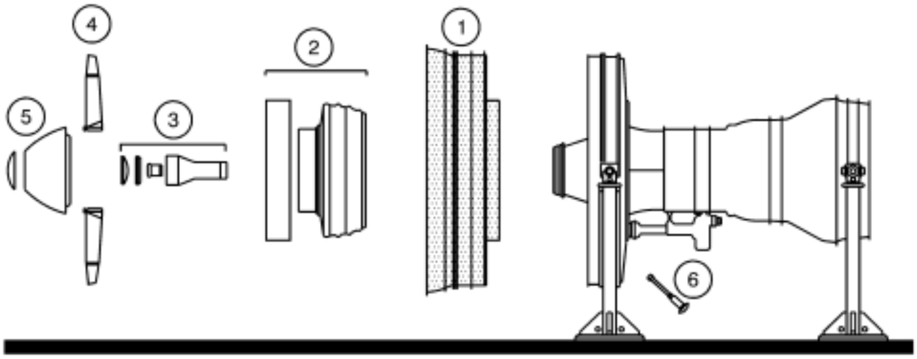
(5) Install fan case external plumbing. See
R Installation−02 (Task 72−00−33−420−003−A00).

(6) Install EEC fan case wiring harnesses W1 and W2. See
R Installation−06 (Task 72−00−33−450−003−A00).

(7) Install the fan exit fairing (bifurcation). See Installation−14 (Task 72−00−33−450−009).

(8) For engines equipped with propulsion multiplexer unit, install multiplexer unit. See Installation−09 (Task 72−00−33−450−004).

(9) Test engine per Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).

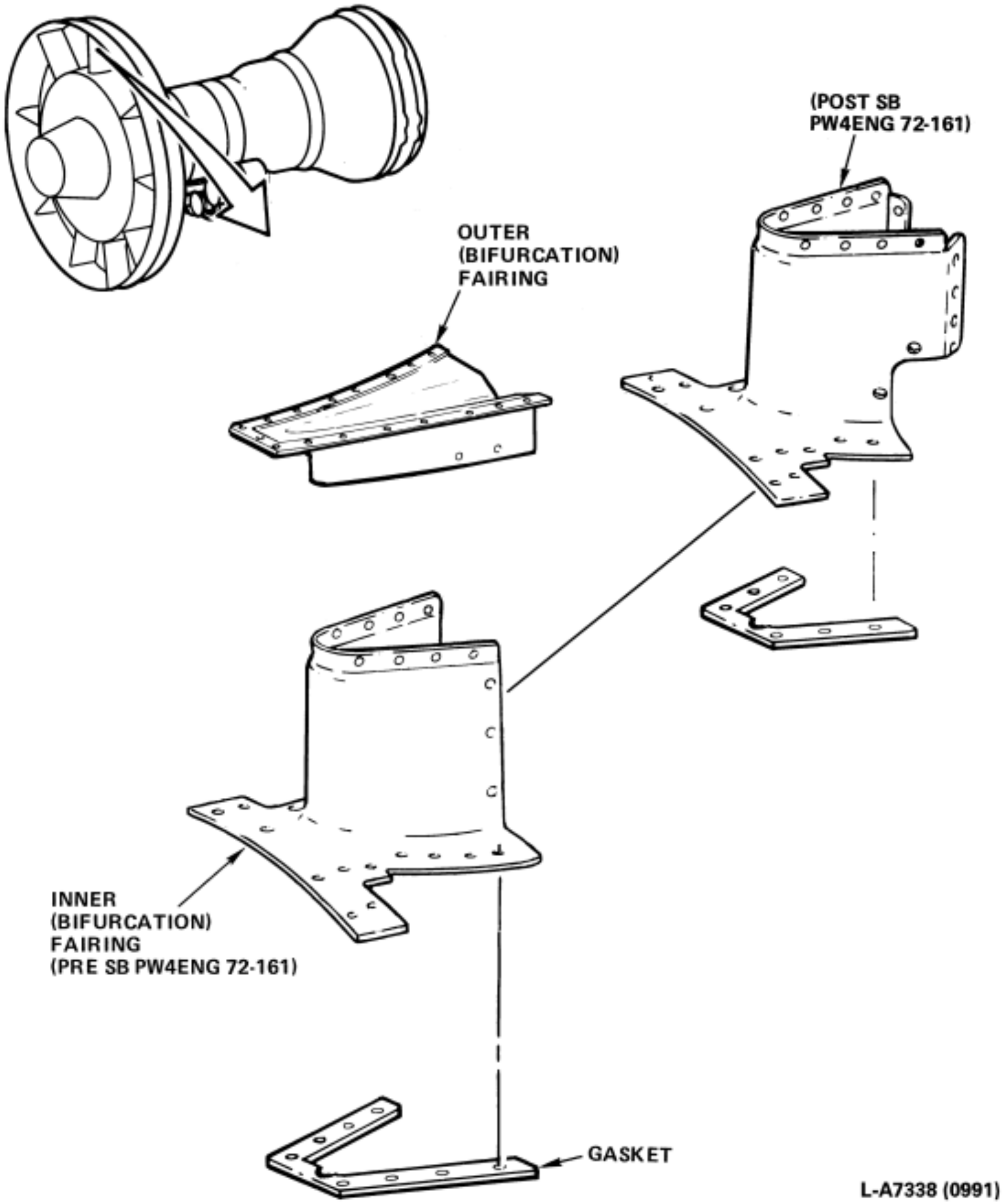


1. INSTALL FAN CASE.
2. INSTALL LOW PRESSURE COMPRESSOR (LPC).
3. INSTALL LPC/LPT COUPLING.
4. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
5. INSTALL COMPRESSOR INLET CONE.
6. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).

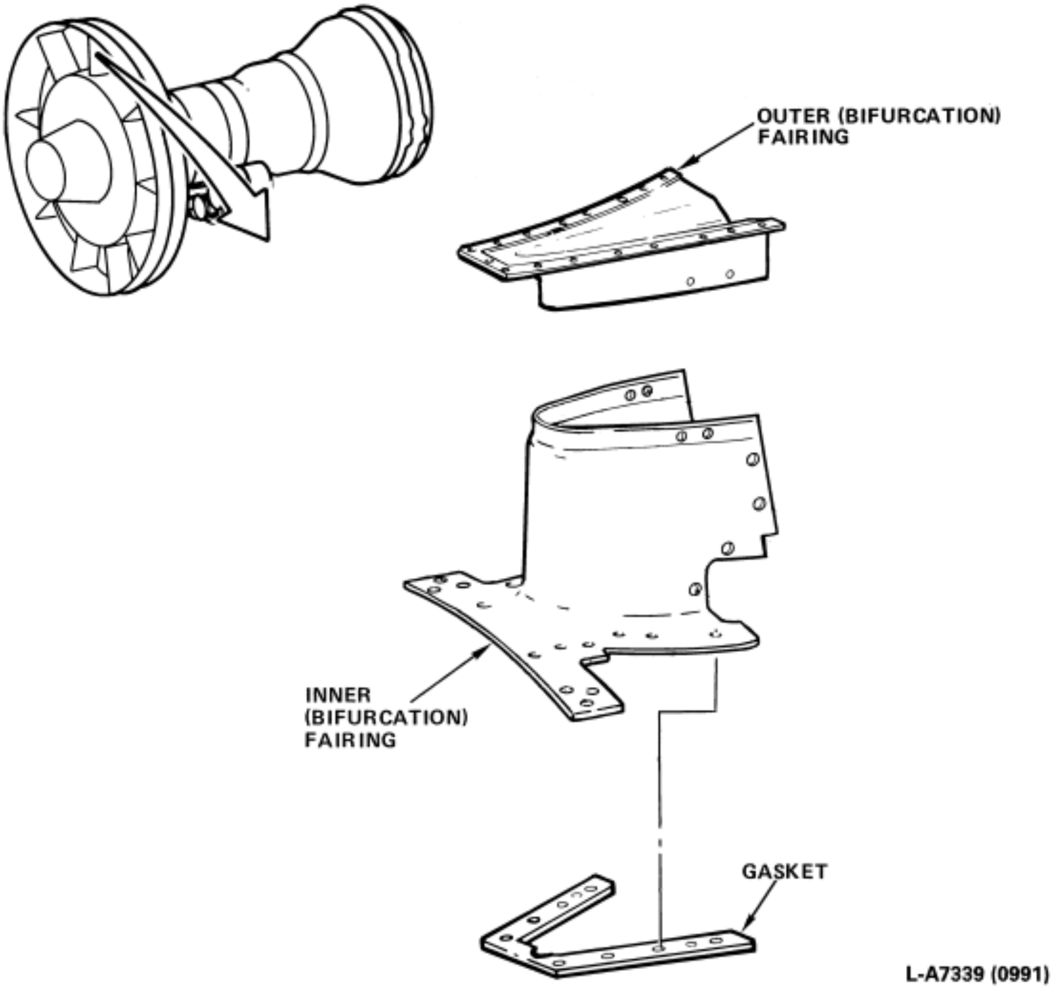
L−A0101 (0000)
PW V

Procedure Sequence
Figure 401
(Task 72−00−33−420−001)

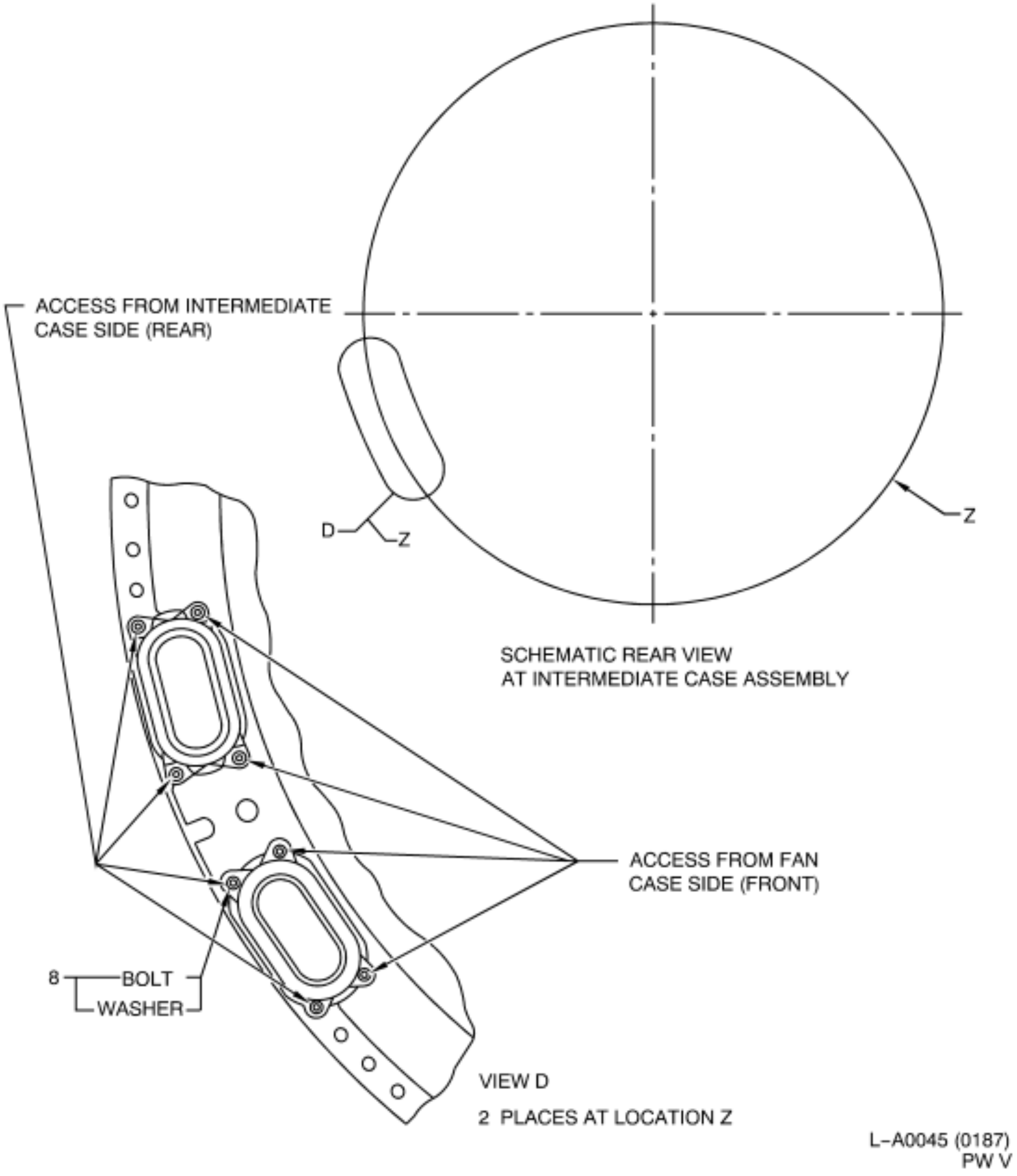
ENGINE GENERAL − FAN CASE − INSTALLATION−01


(POST SB
PW4ENG 72-161)
OUTER
(BIFURCATION)
FAIRING
INNER
(BIFURCATION)
FAIRING
(PRE SB PW4ENG 72-161)
GASKET
L-A7338 (0991)

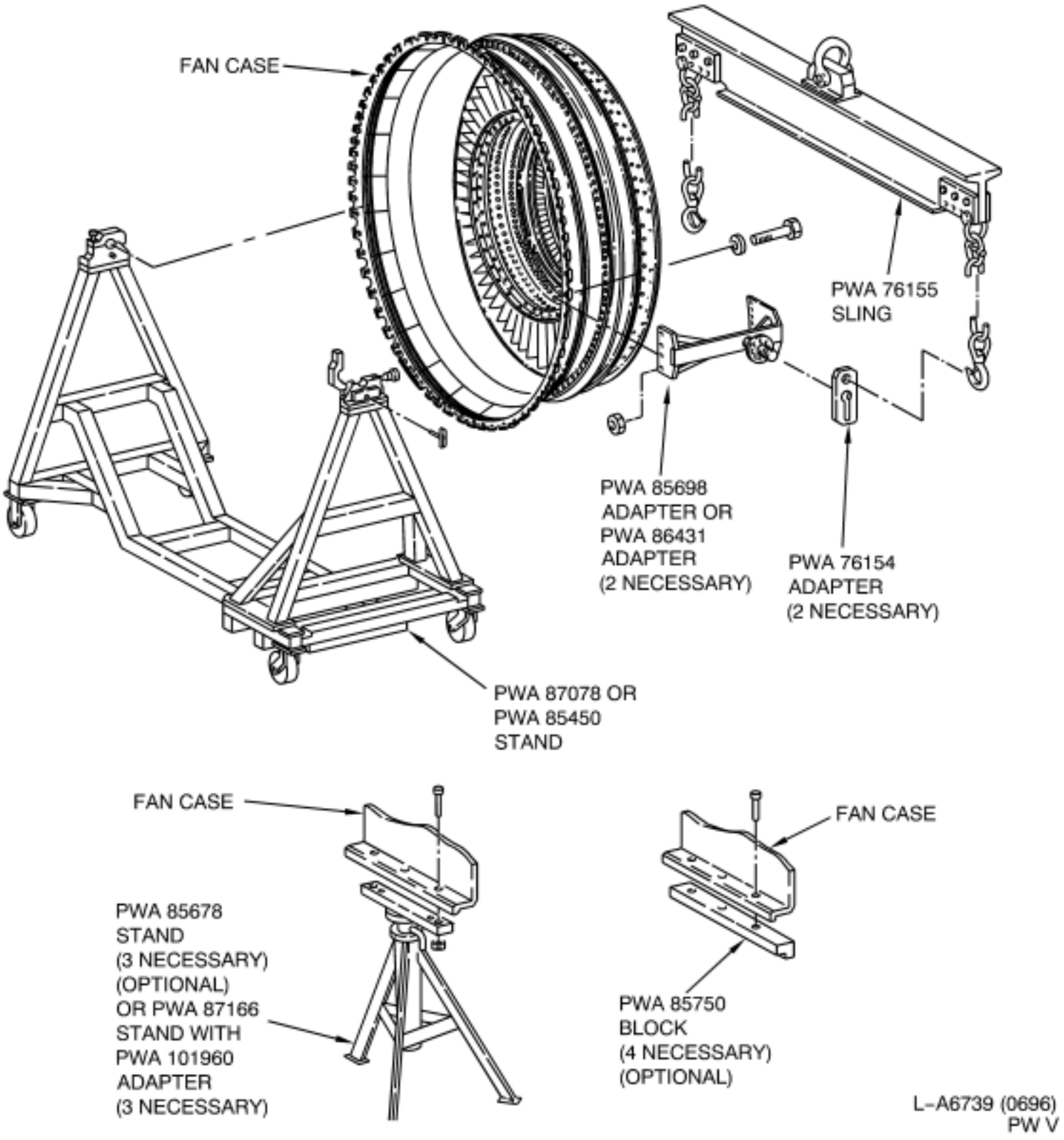
Installation Of The Inner And Outer (Bifurcation) Fairings
Figure 402 (Sheet 1)
(Task 72−00−33−420−001)


OUTER (BIFURCATION) FAIRING
INNER (BIFURCATION) FAIRING
GASKET
L-A7339 (0991)

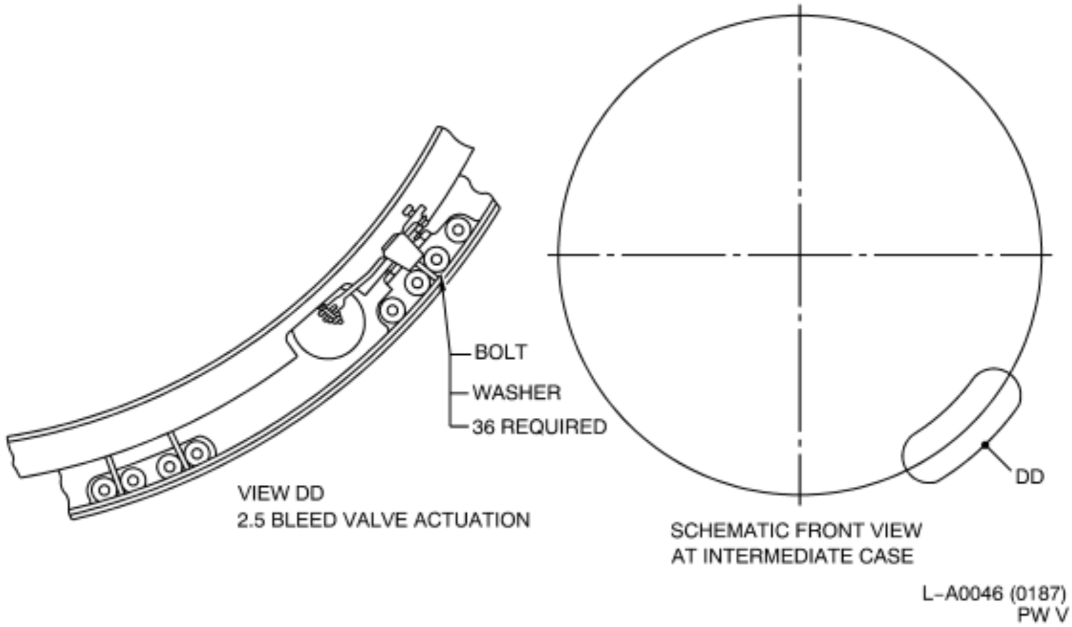
Installation Of The Inner And Outer (Bifurcation) Fairings
Figure 402 (Sheet 2)
(Task 72−00−33−420−001)


ACCESS FROM INTERMEDIATE
CASE SIDE (REAR)
D
Z
Z
SCHEMATIC REAR VIEW
AT INTERMEDIATE CASE ASSEMBLY
ACCESS FROM FAN
CASE SIDE (FRONT)
8
BOLT
WASHER
VIEW D
2 PLACES AT LOCATION Z
L-A0045 (0187)
PW V

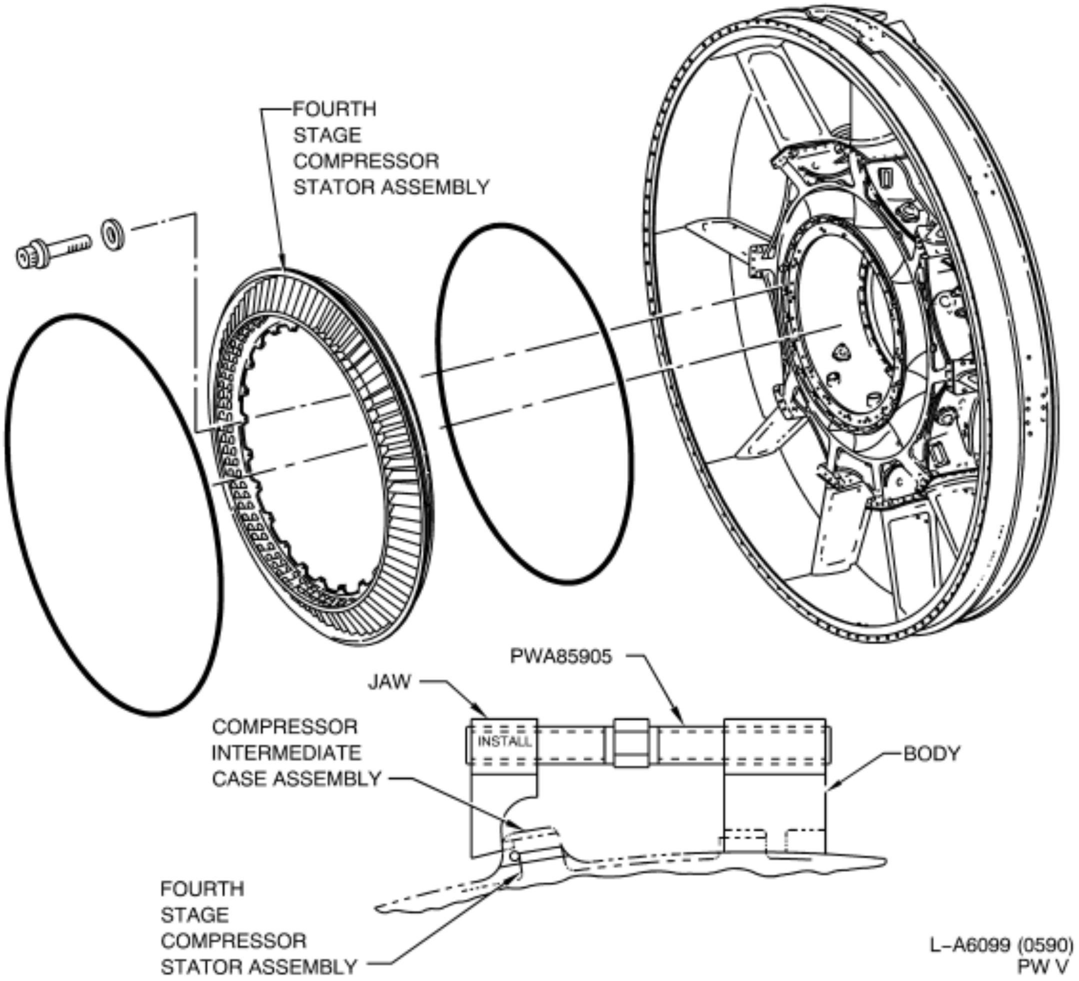
Air/Oil Heat Exchanger
Figure 403
(Task 72-00-33-420-001)


FAN CASE
PWA 76155
SLING
PWA 85698
ADAPTER OR
PWA 86431
ADAPTER
(2 NECESSARY)
PWA 76154
ADAPTER
(2 NECESSARY)
PWA 87078 OR
PWA 85450
STAND
FAN CASE
FAN CASE
PWA 85678
STAND
(3 NECESSARY)
(OPTIONAL)
OR PWA 87166
STAND WITH
PWA 101960
ADAPTER
(3 NECESSARY)
PWA 85750
BLOCK
(4 NECESSARY)
(OPTIONAL)
L−A6739 (0696)
PW V

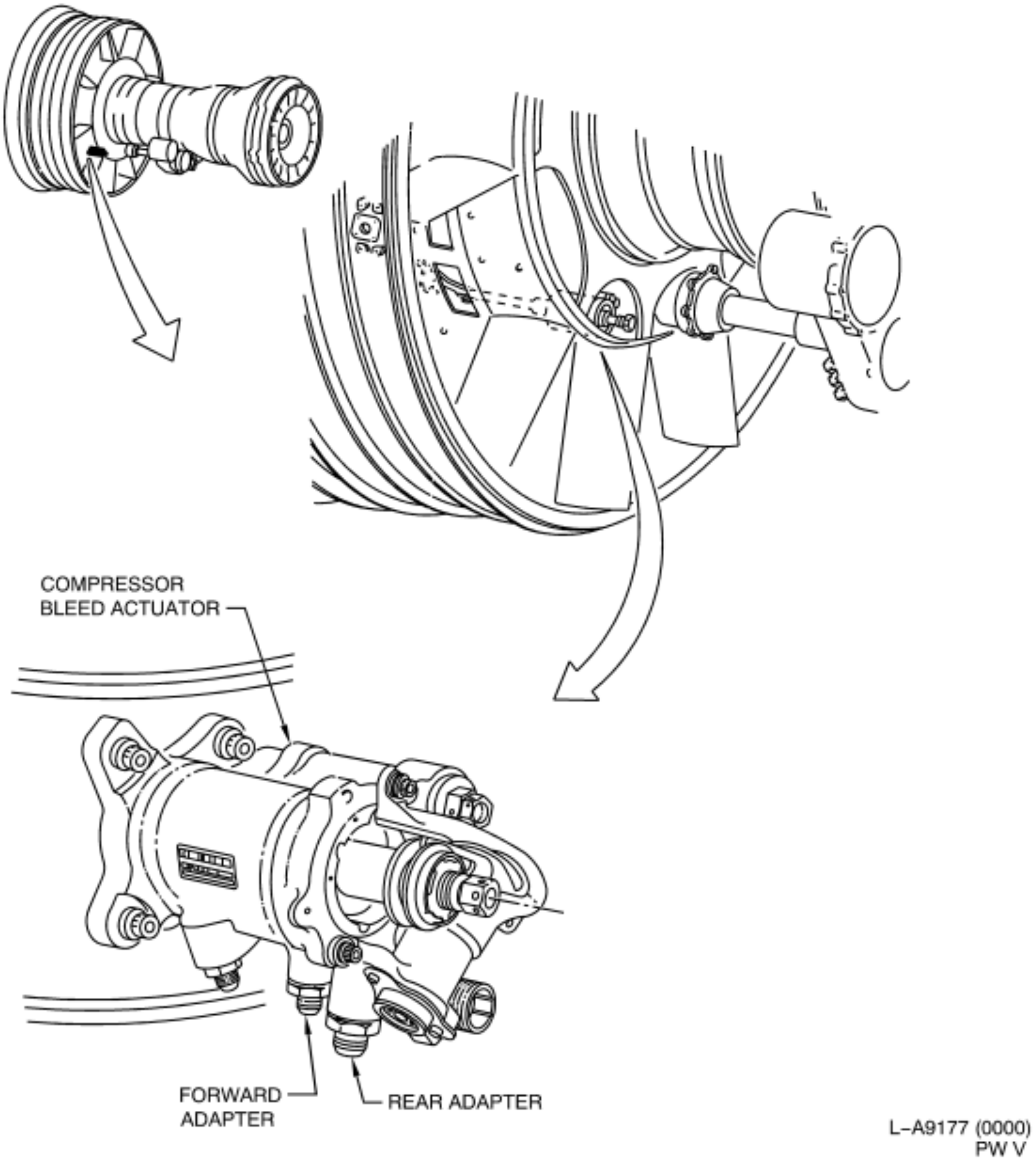
Installation Of The Fan Case Tools
Figure 404
(Task 72−00−33−420−001)


BOLT
WASHER
36 REQUIRED
VIEW DD
2.5 BLEED VALVE ACTUATION
DD
SCHEMATIC FRONT VIEW
AT INTERMEDIATE CASE
L−A0046 (0187)
PW V

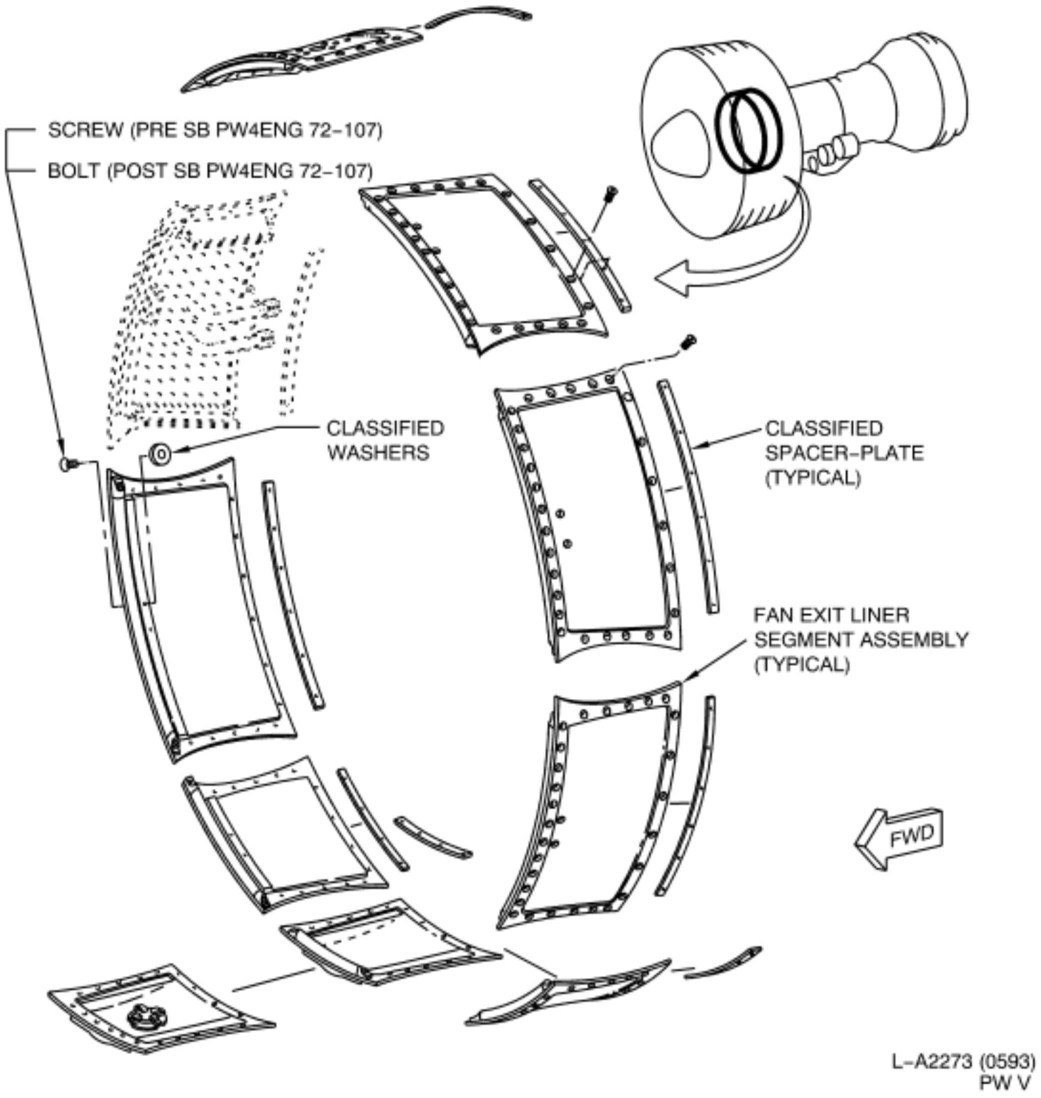
Fan Case Installation (Bleed Valve)
Figure 405
(Task 72−00−33−420−001)


FOURTH
STAGE
COMPRESSOR
STATOR ASSEMBLY
PWA85905
JAW
INSTALL
COMPRESSOR
INTERMEDIATE
CASE ASSEMBLY
BODY
FOURTH
STAGE
COMPRESSOR
STATOR ASSEMBLY
L−A6099 (0590)
PW V

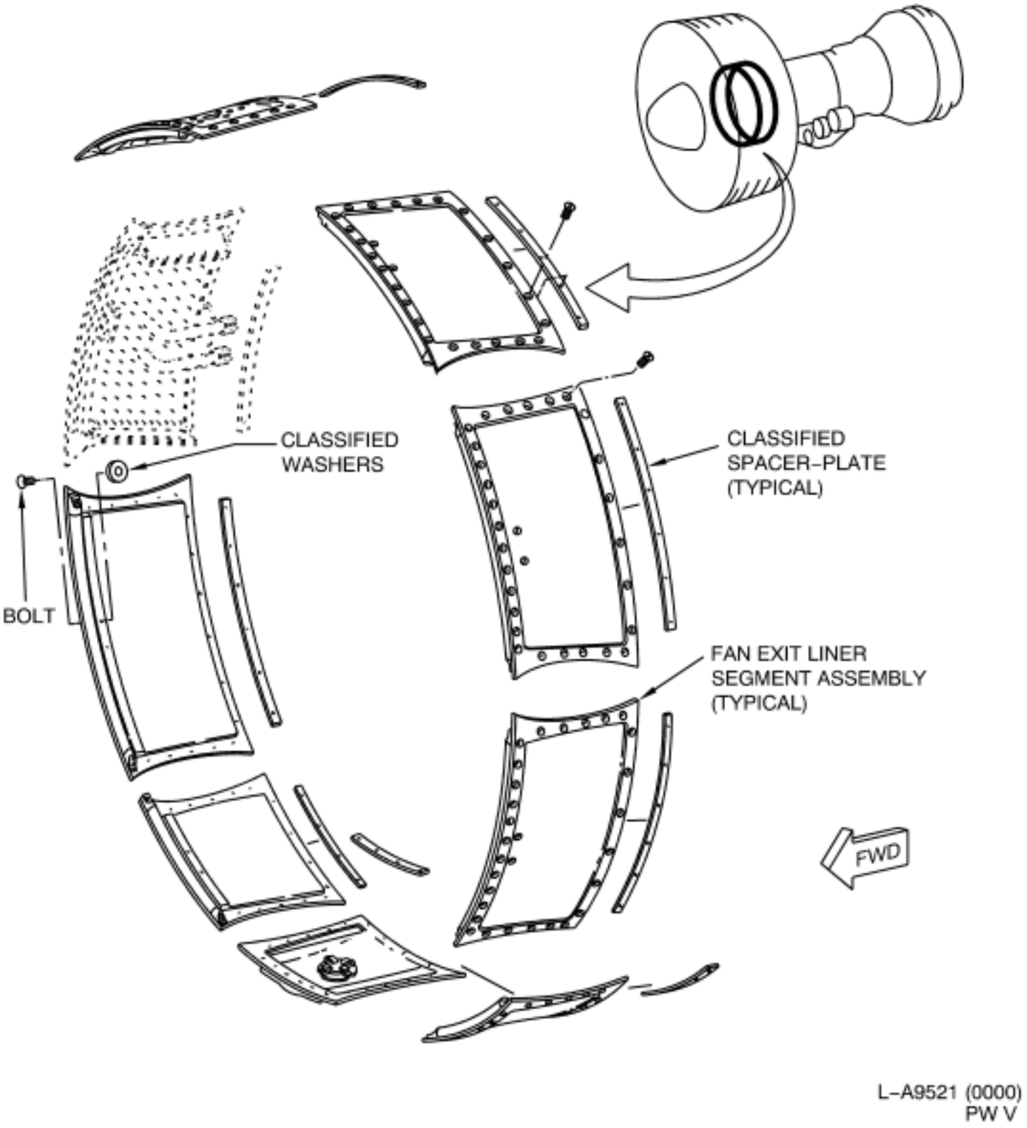
Install The 4th Stage Compressor Stator Assembly
Figure 406
(Task 72−00−33−420−001)


COMPRESSOR BLEED ACTUATOR
FORWARD ADAPTER
REAR ADAPTER
L−A9177 (0000)
PW V

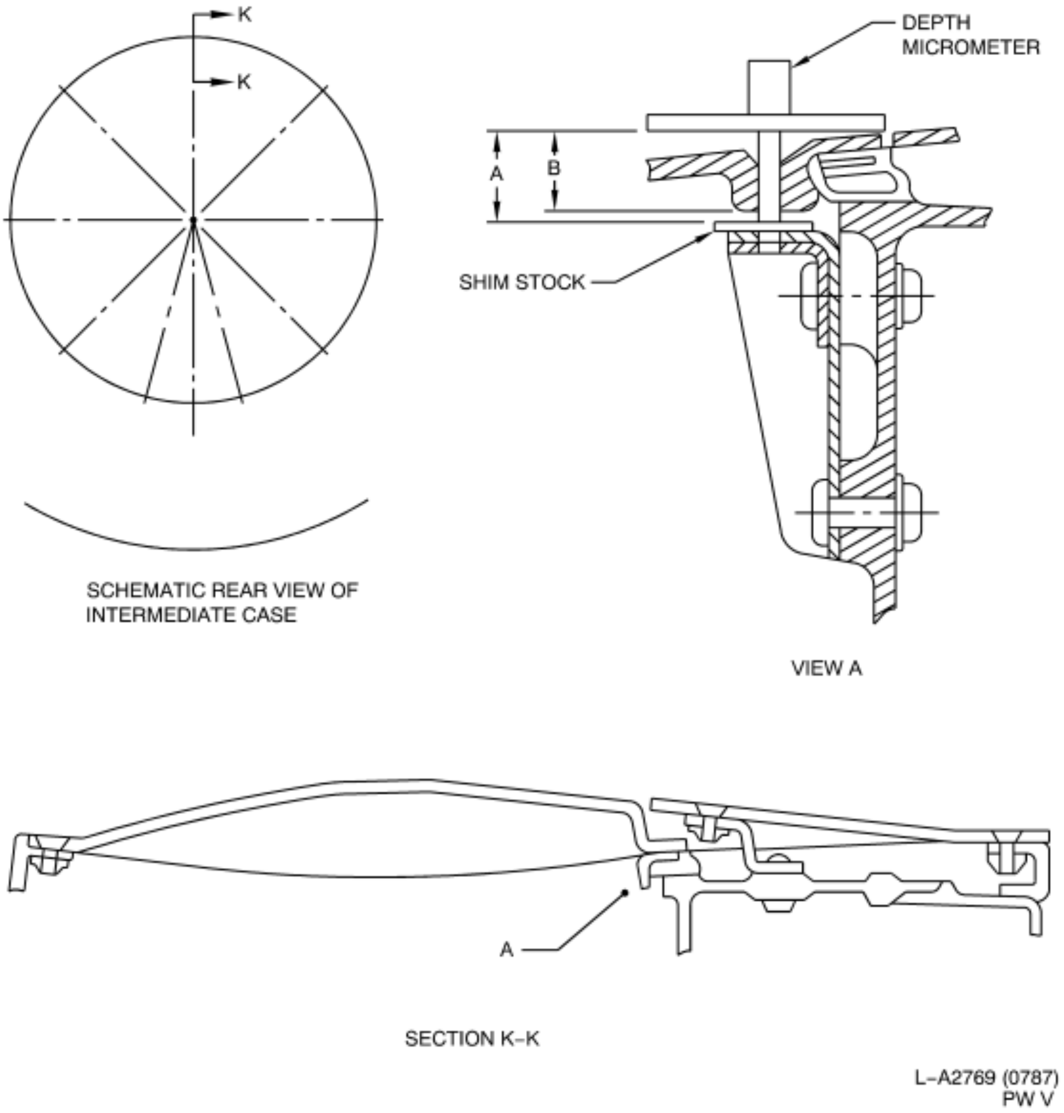
Installation Of The Compressor Bleed Actuator Tubes
Figure 407
(Task 72−00−33−420−001)


SCREW (PRE SB PW4ENG 72−107)
BOLT (POST SB PW4ENG 72−107)
CLASSIFIED WASHERS
CLASSIFIED SPACER−PLATE (TYPICAL)
FAN EXIT LINER SEGMENT ASSEMBLY (TYPICAL)
FWD
L−A2273 (0593)
PW V

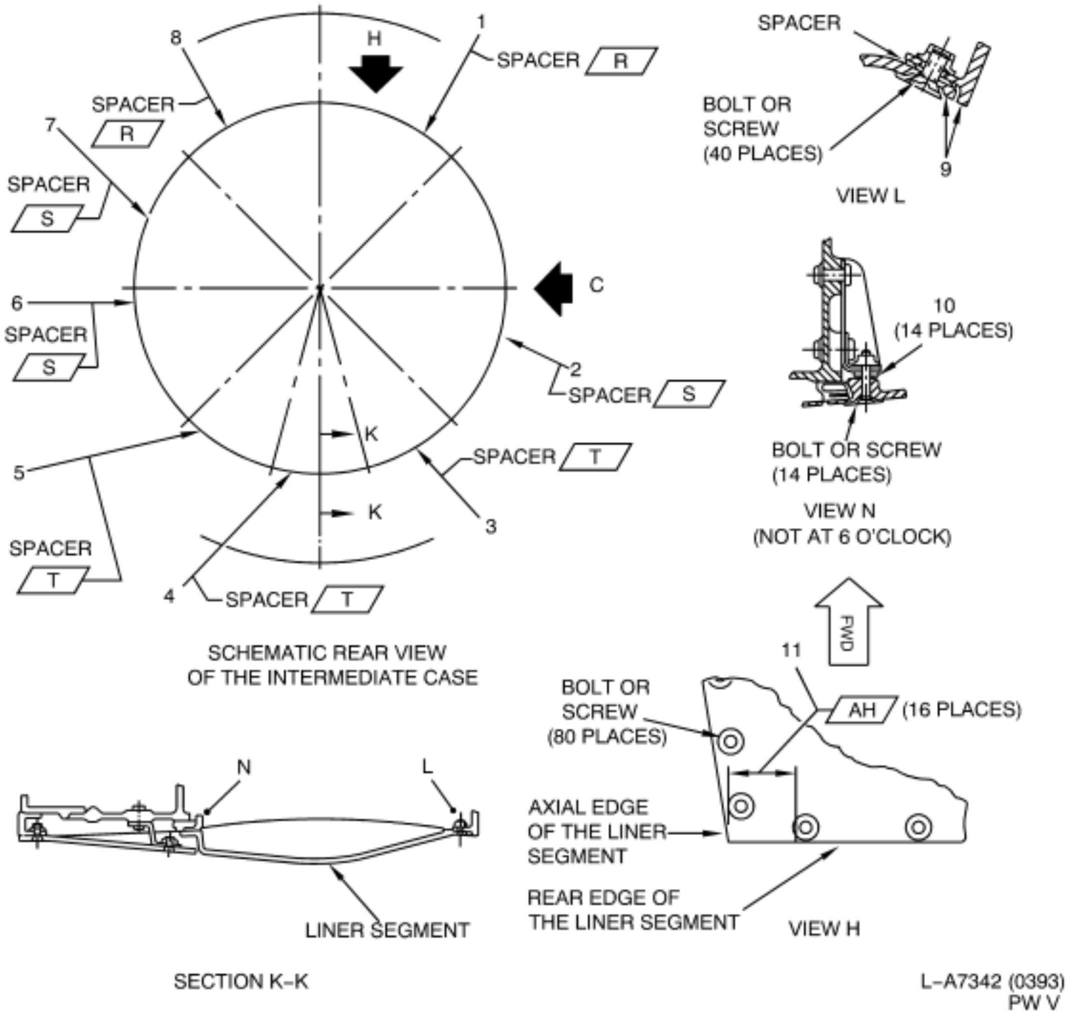
Installation Of The Fan Exit (Rear) Liner Segment Assemblies
Figure 408 (Sheet 1)
(Task 72−00−33−420−001)


CLASSIFIED WASHERS
CLASSIFIED SPACER−PLATE (TYPICAL)
BOLT
FAN EXIT LINER SEGMENT ASSEMBLY (TYPICAL)
FWD
L−A9521 (0000)
PW V

Installation Of The Fan Exit (Rear) Liner Segment Assemblies
Figure 408 (Sheet 2)
(Task 72−00−33−420−001)


K
K
DEPTH MICROMETER
A
B
SHIM STOCK
SCHEMATIC REAR VIEW OF INTERMEDIATE CASE
VIEW A
A
SECTION K−K
L−A2769 (0787)
PW V

Washer Thickness Measurement
Figure 409
(Task 72−00−33−420−001)

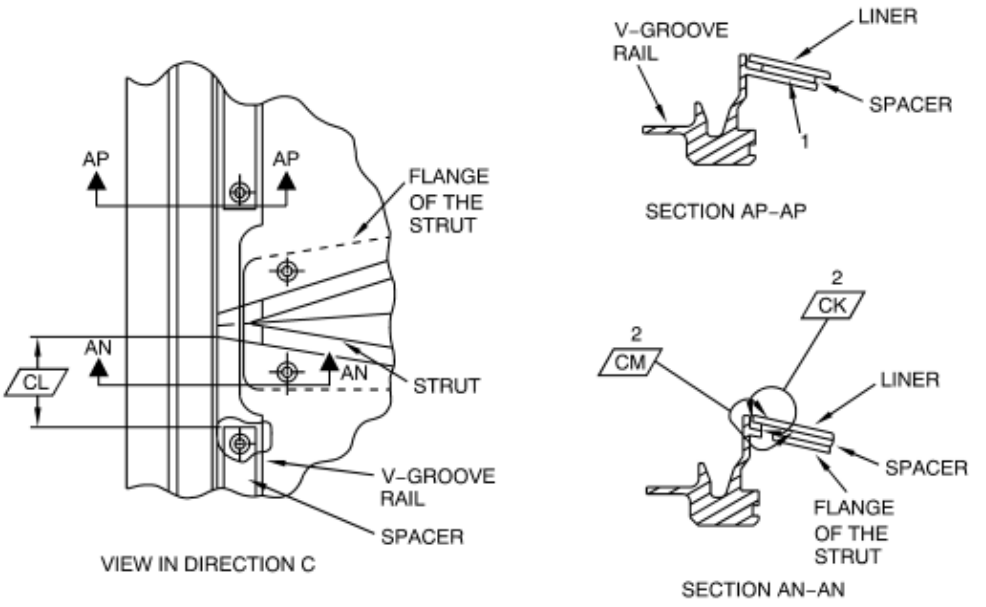

8
H
1
SPACER
R
SPACER
R
7
SPACER
S
6
SPACER
S
C
2
SPACER
S
K
SPACER
T
5
K
3
SPACER
T
4
SPACER
T
SCHEMATIC REAR VIEW
OF THE INTERMEDIATE CASE
SPACER
BOLT OR
SCREW
(40 PLACES)
9
VIEW L
10
(14 PLACES)
BOLT OR SCREW
(14 PLACES)
VIEW N
(NOT AT 6 O'CLOCK)
FWD
11
BOLT OR
SCREW
(80 PLACES)
AH
(16 PLACES)
AXIAL EDGE
OF THE LINER
SEGMENT
REAR EDGE OF
THE LINER SEGMENT
VIEW H
N
L
LINER SEGMENT
SECTION K−K
L−A7342 (0393)
PW V

Installation Of The Fan Exit (Rear) Liner
Segment Assemblies (Non−Acoustical Liners)
Figure 410 (Sheet 1)
(Task 72−00−33−420−001)

ENGINE GENERAL − FAN CASE − INSTALLATION−01

1. PN 50A508 Or 51A166−01 Liner Assembly
2. PN 50G281 Or 51A163−01 Liner Assembly
3. PN 50G279 Or 51A162−01 Liner Assembly
4. (Pre PW4ENG 72−196) PN 50G280 Liner Assembly
   (Post PW4ENG 72−196) PN 51G273 Or 51A173 Liner Assembly
5. PN 50G440 Or 51A164−01 Liner Assembly
6. PN 50G278 Or 51A161−01 Liner Assembly
7. PN 50G277 Or 51A160−01 Liner Assembly
8. PN 50G276 Or 51A159−01 Liner Assembly
9. Except In Area AH, These Surfaces Must Be Flush Within 0.020 Inch (0.508 mm). Choose The Class Of Spacer Necessary To Have This. In Area AH, These Surfaces Must Be Flush Within 0.040 Inch (1.016 mm), Maximum.
10. 0−3 Washers, As Necessary.
11. 2.000 Inches (50.800 mm) Maximum, Or To The Nearest Screw, At Position AH

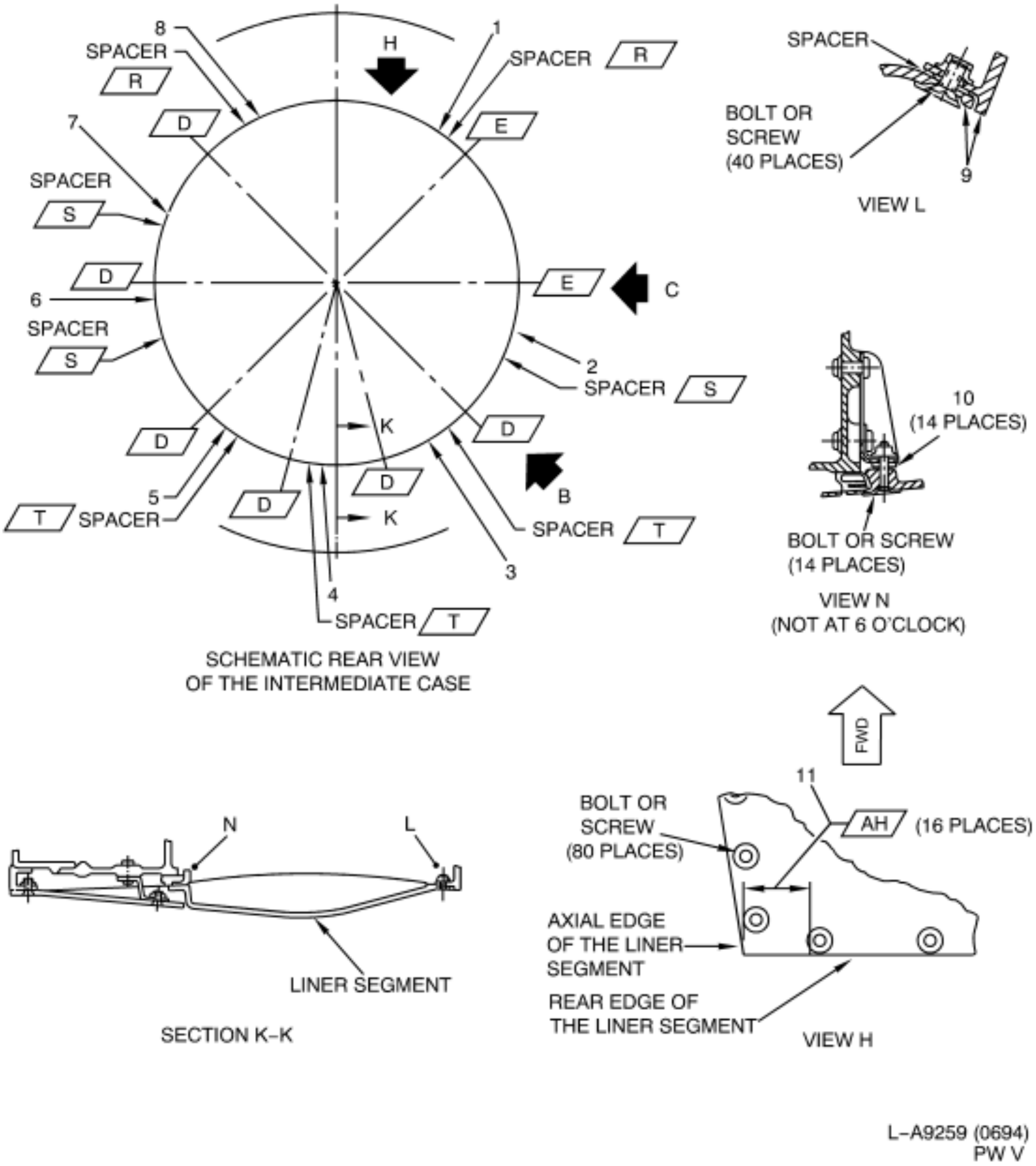
Key to Figure 410 (Sheet 1)


AP
AP
FLANGE OF THE STRUT
AN
AN
CL
STRUT
V-GROOVE RAIL
SPACER
VIEW IN DIRECTION C
V-GROOVE RAIL
LINER
SPACER
1
SECTION AP-AP
2
CK
2
CM
LINER
SPACER
FLANGE OF THE STRUT
SECTION AN-AN

L-A8697 (0000)
PW V

1. Bond The Spacers.
2. Apply Sealant In Area CK For Distance CL. Apply Mold Release To The Liner.

Installation Of The Fan Exit (Rear) Liner Segment Assemblies
(Non-Acoustical Liners) (Procedure At The V-Groove Rail)
Figure 410 (Sheet 2)
(Task 72-00-33-420-001)

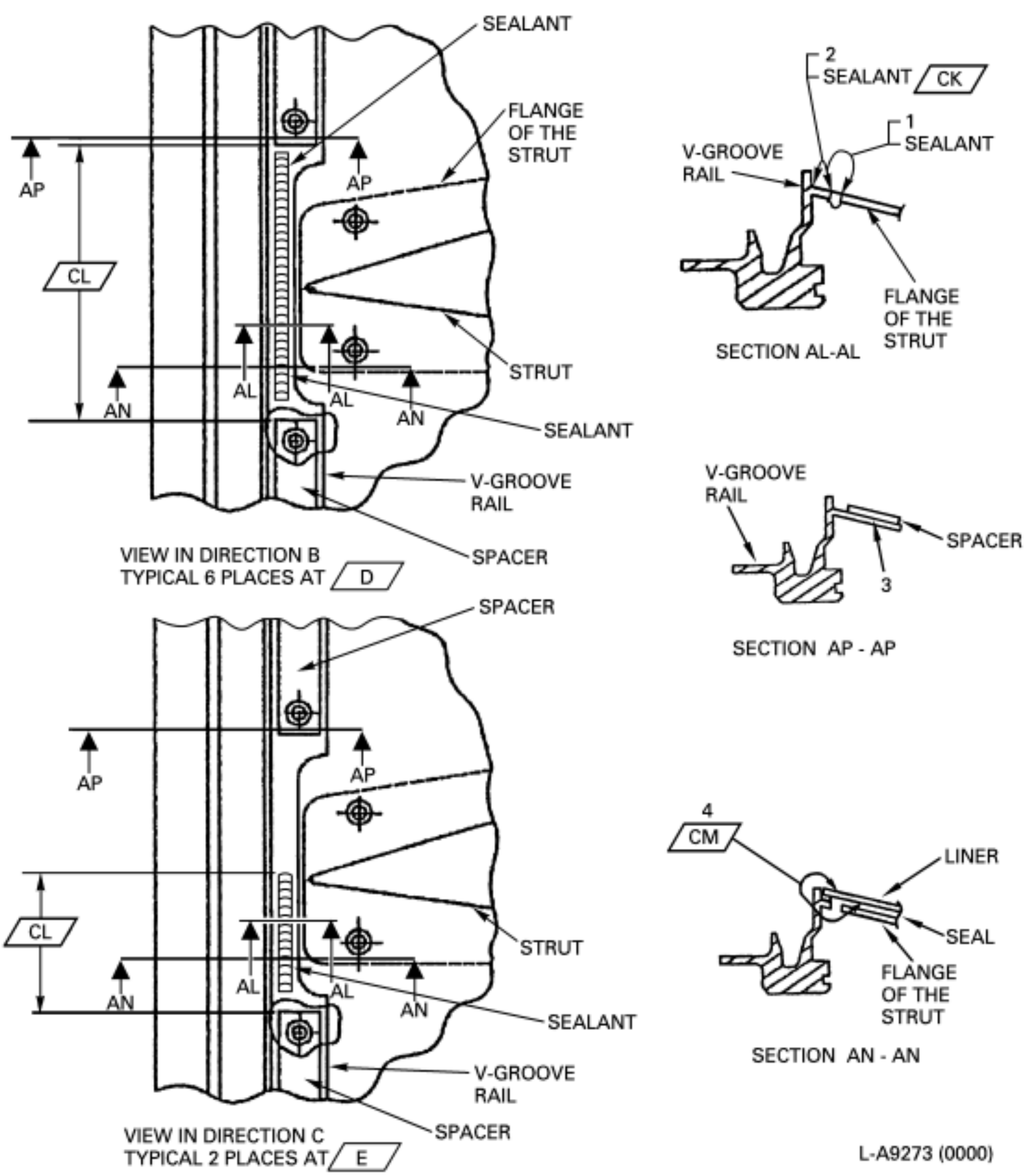

8
SPACER
R
D
7
SPACER
S
D
6
SPACER
S
D
5
SPACER
T
D
4
SPACER
T
D
K
K
H
1
SPACER
R
E
E
C
2
SPACER
S
D
B
SPACER
T
3
SCHEMATIC REAR VIEW
OF THE INTERMEDIATE CASE
SPACER
BOLT OR
SCREW
(40 PLACES)
9
VIEW L
10
(14 PLACES)
BOLT OR SCREW
(14 PLACES)
VIEW N
(NOT AT 6 O'CLOCK)
FWD
N
L
LINER SEGMENT
SECTION K−K
11
BOLT OR
SCREW
(80 PLACES)
AH
(16 PLACES)
AXIAL EDGE
OF THE LINER
SEGMENT
REAR EDGE OF
THE LINER SEGMENT
VIEW H
L−A9259 (0694)
PW V

Installation Of The Fan Exit (Rear) Liner Segment Assemblies
Figure 410 (Sheet 3)
(Task 72−00−33−420−001)

ENGINE GENERAL − FAN CASE − INSTALLATION−01

1. PN 51A387−01 Liner Assembly
2. PN 51A384−01 Liner Assembly
3. PN 51A383−01 Liner Assembly
4. PN 51A386 Liner Assembly
5. PN 51A385−01 Liner Assembly
6. PN 51A382−01 Liner Assembly
7. PN 51A381−01 Liner Assembly
8. PN 51A380−01 Liner Assembly
9. Except In Area AH, These Surfaces Must Be Flush Within 0.020 Inch (0.508 mm). Choose The Class Of Spacer Necessary To Have This. In Area AH, These Surfaces Must Be Flush Within 0.040 Inch (1.016 mm), Maximum.
10. 0−3 Washers, As Necessary.
11. 2.000 Inches (50.800 mm) Maximum, Or To The Nearest Screw, At Position AH

Key to Figure 410 (Sheet 3)


SEALANT
FLANGE OF THE STRUT
AP
AP
CL
AL
AL
AN
AN
STRUT
SEALANT
V-GROOVE RAIL
SPACER
VIEW IN DIRECTION B
TYPICAL 6 PLACES AT D
2
SEALANT CK
1
SEALANT
V-GROOVE RAIL
FLANGE OF THE STRUT
SECTION AL-AL
V-GROOVE RAIL
SPACER
3
SECTION AP - AP
SPACER
AP
AP
CL
AL
AL
AN
AN
STRUT
SEALANT
V-GROOVE RAIL
SPACER
VIEW IN DIRECTION C
TYPICAL 2 PLACES AT E
4
CM
LINER
SEAL
FLANGE OF THE STRUT
SECTION AN - AN
L-A9273 (0000)

Installation Of The Fan Exit (Rear) Liner Segment
Assemblies (Procedure At The V−Groove Rail)
Figure 410 (Sheet 4)
(Task 72−00−33−420−001)

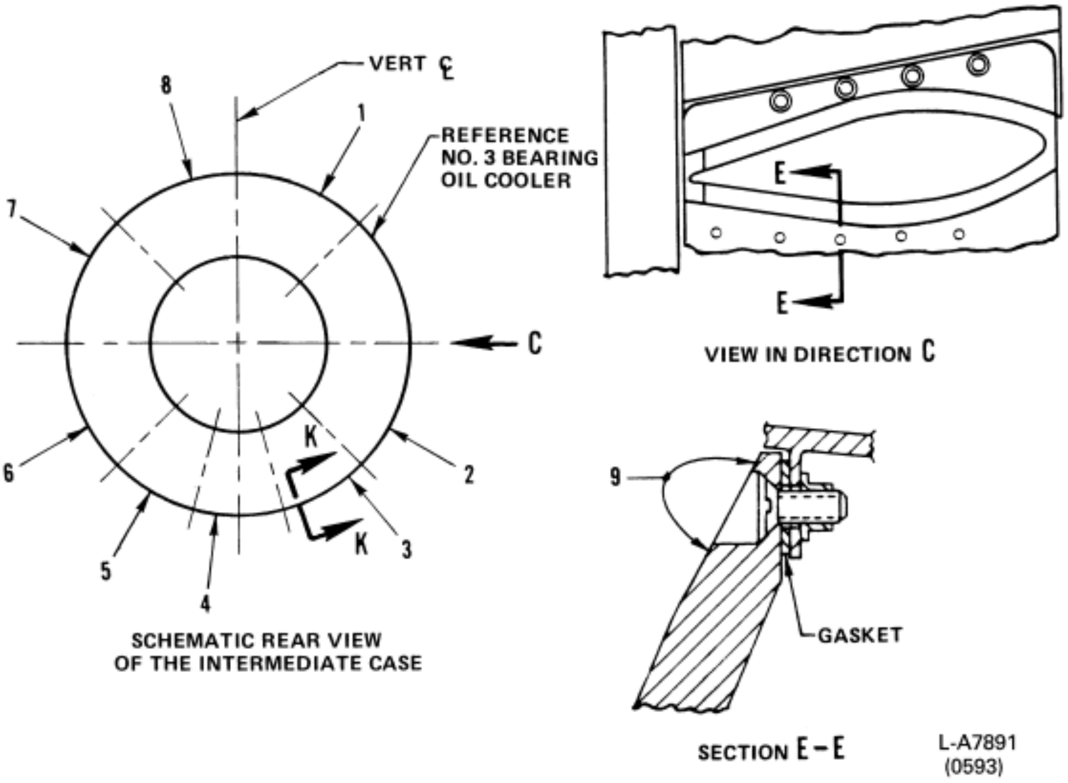
ENGINE GENERAL − FAN CASE − INSTALLATION−01

1. Make Sure There Is Sealant Between The Flange Of The Strut And The V−Groove Rail. If The Sealant Is Not There, Apply New Sealant. Refer To 72−34−00, Assembly−01 (Task 72−34−00−400−001).

   NOTE: This sealant, Index 1, must be cured before you apply sealant, Index 2.
2. Apply Sealant In Area CK For Distance CL.

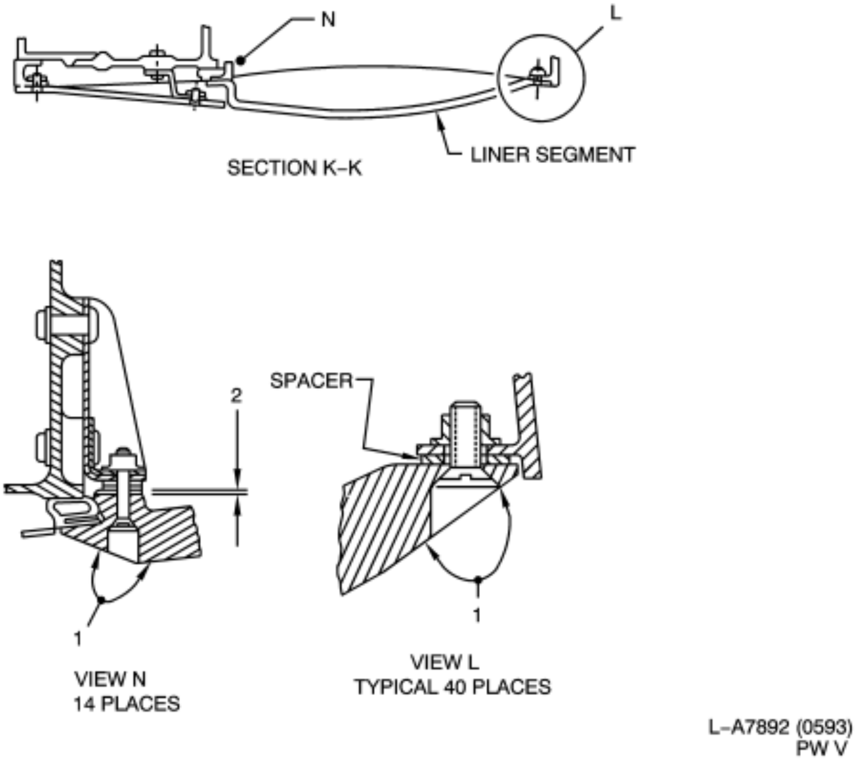
   NOTE: Do not apply sealant in the area between the second and third struts at Locations E. This area will be sealed when the No. 3 bearing air cooler assembly is installed in Installation−05 (Task 72−00−33−450−002).
3. Bond The Spacers.
4. Apply Mold Release To The Rear Edge Of The Liner In Area CM From The Edge Of The Liner To The First Bolthole. This Is The Area That Will Contact The Sealant For Distance CL.

Key to Figure 410 (Sheet 4)


VERT ℄
8
1
REFERENCE NO. 3 BEARING OIL COOLER
7
C
6
K
2
K
3
5
4
SCHEMATIC REAR VIEW OF THE INTERMEDIATE CASE
E
E
VIEW IN DIRECTION C
9
GASKET
SECTION E − E
L-A7891
(0593)

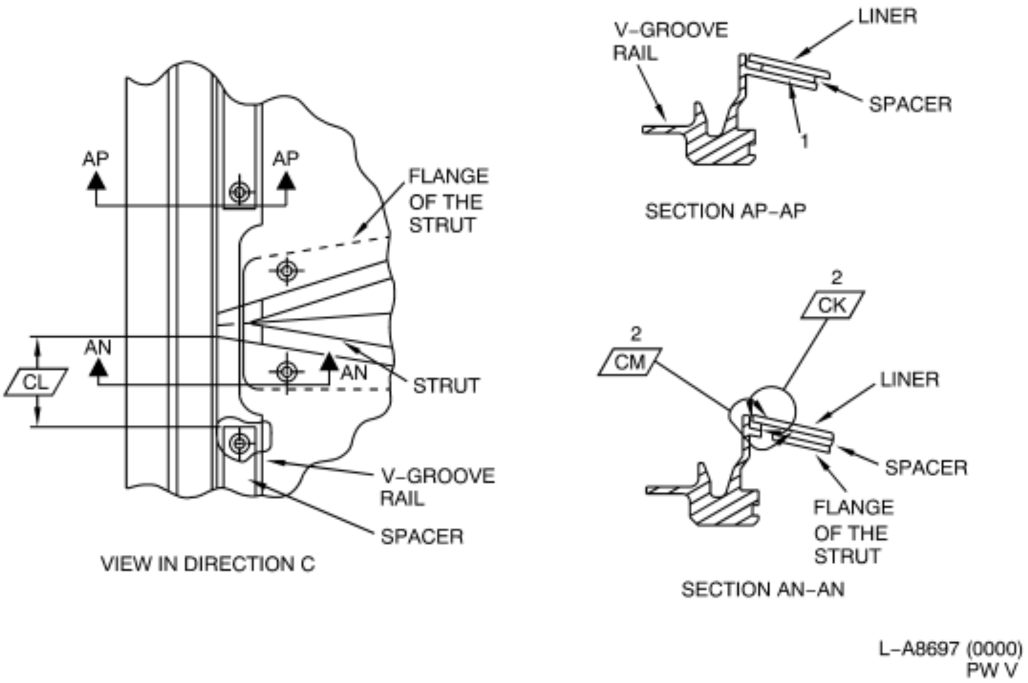
1. PN 50A668
2. PN 50G771
3. PN 50G773
4. (Pre PW4ENG 72−196) PN 50G280 Liner Assembly
   (Post PW4ENG 72−196) PN 51G273 Liner Assembly
5. PN 50G769
6. PN 50G770
7. PN 50G774
8. PN 50G772
9. The Area Of Sealant

Installation Of The Fan Exit (Rear) Liner
Segment Assemblies (Acoustical Liners)
Figure 411 (Sheet 1)
(Task 72−00−33−420−001)


N
L
SECTION K−K
LINER SEGMENT
SPACER
2
1
VIEW N
14 PLACES
1
VIEW L
TYPICAL 40 PLACES
L−A7892 (0593)
PW V

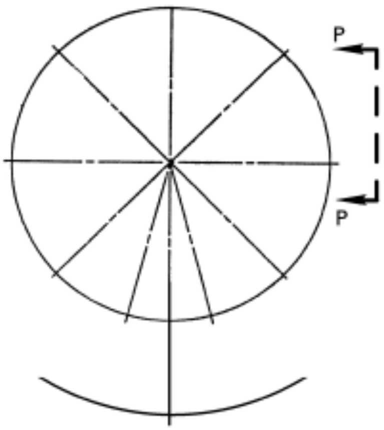
1. The Area Of Sealant.
2. 0.005 − 0.020 Inch (0.13 − 0.51 mm). Choose The Correct Class Of Washer Before You Install The Screws.

Installation Of The Fan Exit (Rear) Liner Segment Assemblies (Acoustical Liners)
Figure 411 (Sheet 2)
(Task 72−00−33−420−001)

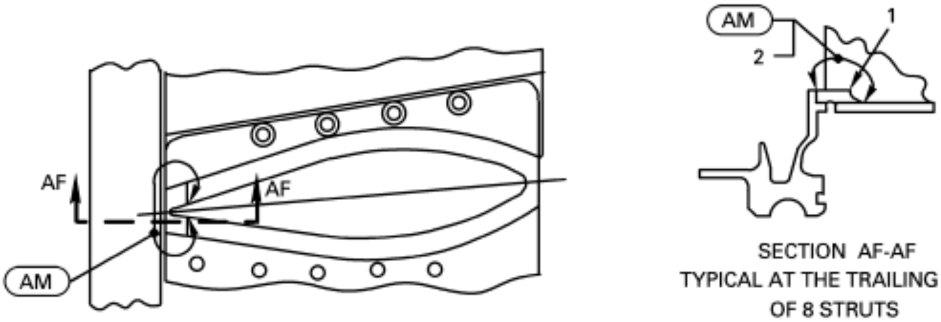

V−GROOVE RAIL
LINER
SPACER
1
SECTION AP−AP
AP
AP
FLANGE OF THE STRUT
AN
AN
CL
STRUT
V−GROOVE RAIL
SPACER
VIEW IN DIRECTION C
2
CK
2
CM
LINER
SPACER
FLANGE OF THE STRUT
SECTION AN−AN
L−A8697 (0000)
PW V

1. Bond The Spacers.
2. Apply Sealant In Area CK For Distance CL. Apply Mold Release To The Liner.

Installation Of The Fan Exit (Rear) Liner Segment Assemblies (Acoustical Liners) (Procedure At The V−Groove Rail)
Figure 411 (Sheet 3)
(Task 72−00−33−420−001)



SCHEMATIC REAR VIEW
OF THE INTERMEDIATE CASE



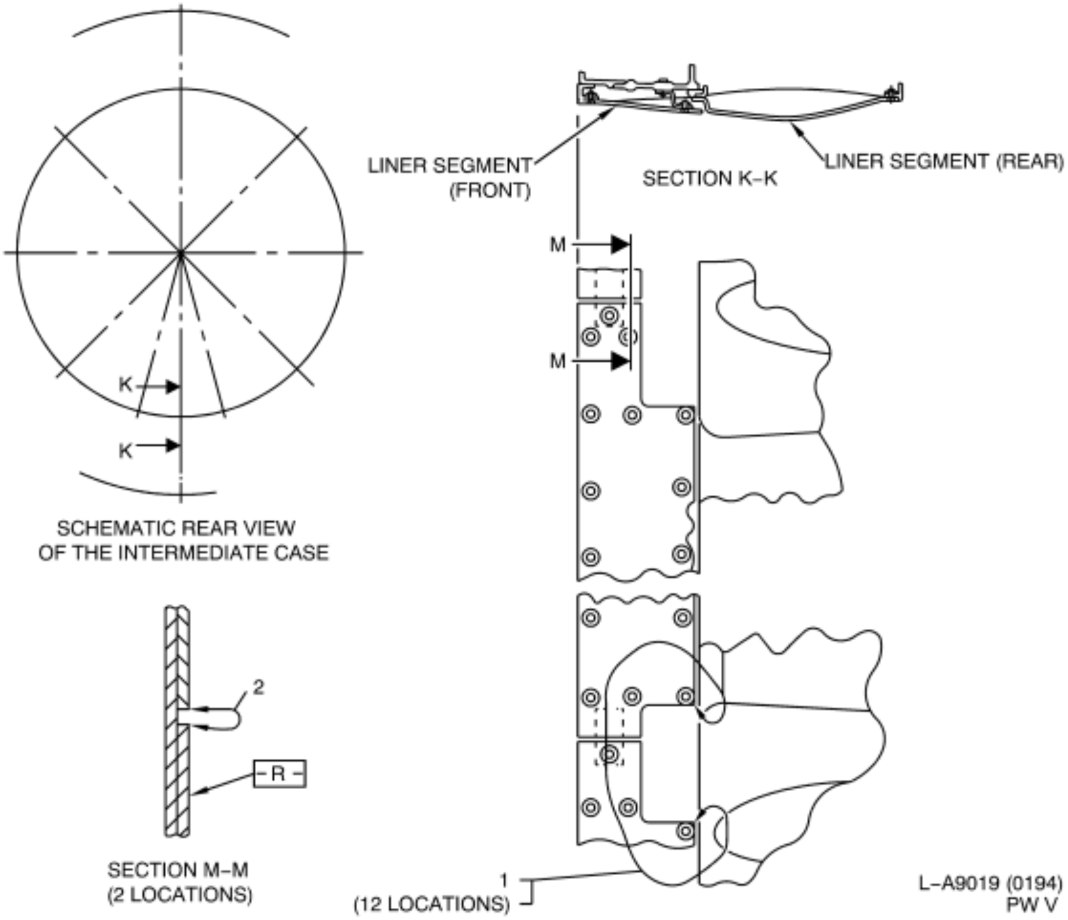
VIEW P-P

SECTION AF-AF
TYPICAL AT THE TRAILING EDGE
OF 8 STRUTS

L-A7681 (0593)

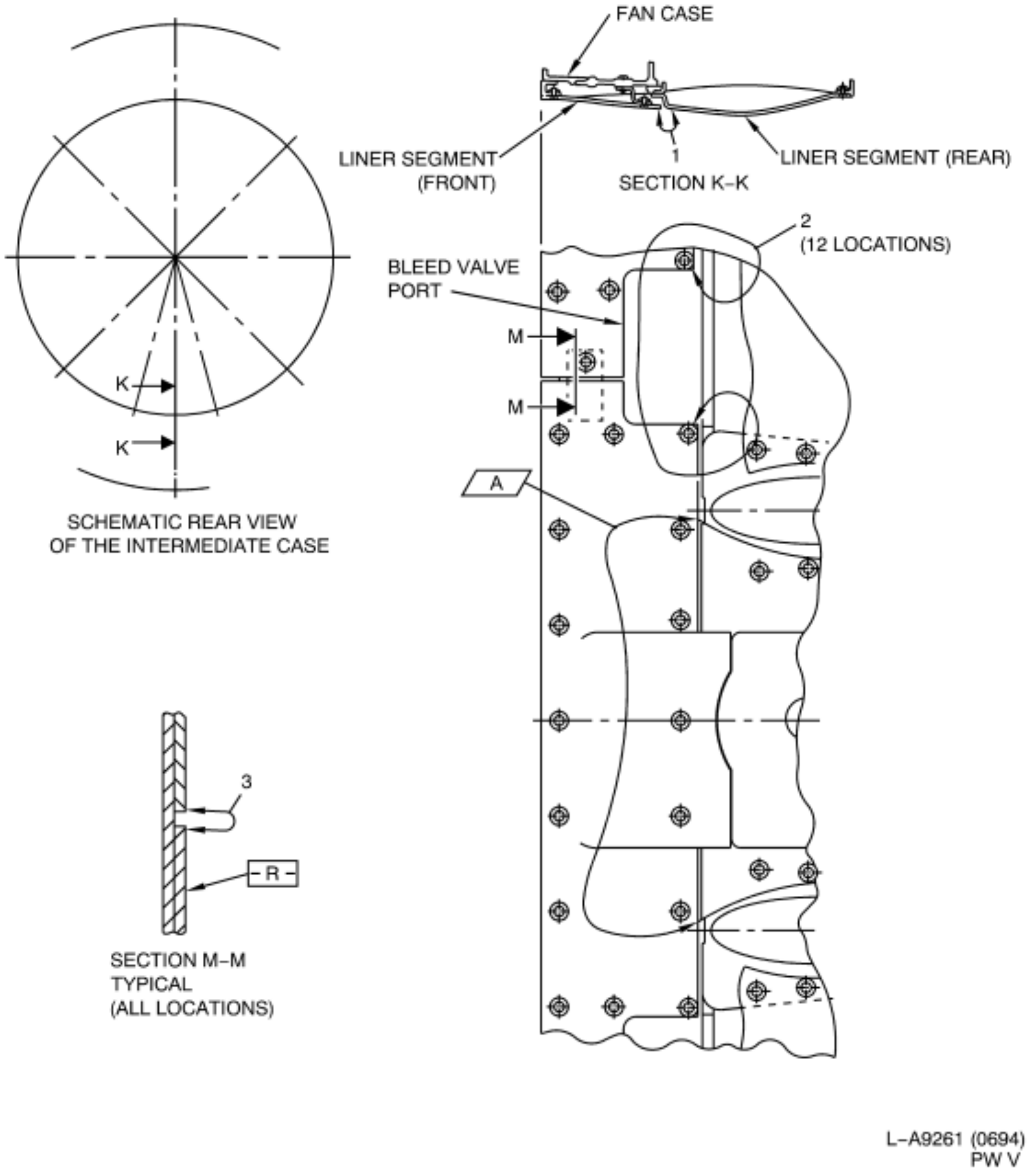
1. 0.250 − 0.500 Inch (6.4 − 12.7 mm) Modified Radius
2. Apply Sealant Flush With, To 0.010 Inch (0.254 mm) Below, The Adjacent Surfaces

Application Of Sealant At The Edges Of The (Rear) Liners
Figure 412
(Task 72−00−33−420−001)


LINER SEGMENT (FRONT)
SECTION K−K
LINER SEGMENT (REAR)
M
M
K
K
SCHEMATIC REAR VIEW OF THE INTERMEDIATE CASE
2
R
SECTION M−M (2 LOCATIONS)
1 (12 LOCATIONS)
L−A9019 (0194) PW V

1. Apply Sealant
2. The Surface Of The Sealant Must Be Continuous With, To 0.010 Inch (0.254 mm) Above, Surface R.

Installation Of The Fan Exit (Front) Liner
Figure 413 (Sheet 1)
(Task 72−00−33−420−001)

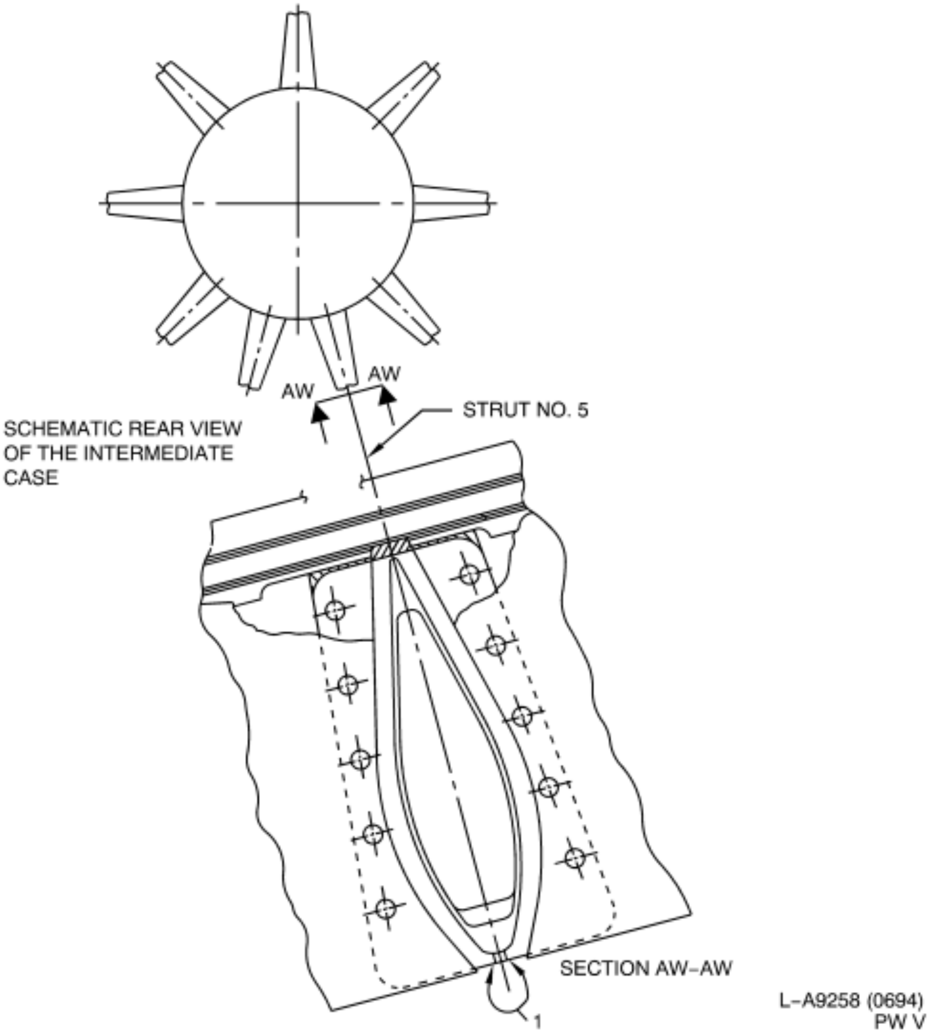

FAN CASE
LINER SEGMENT (FRONT)
1
SECTION K−K
LINER SEGMENT (REAR)
2 (12 LOCATIONS)
BLEED VALVE PORT
M
M
K
K
A
SCHEMATIC REAR VIEW OF THE INTERMEDIATE CASE
3
R
SECTION M−M TYPICAL (ALL LOCATIONS)
L−A9261 (0694)
PW V

Installation Of The Fan Exit (Front) Liner
Figure 413 (Sheet 2)
(Task 72−00−33−420−001)

ENGINE GENERAL − FAN CASE − INSTALLATION−01

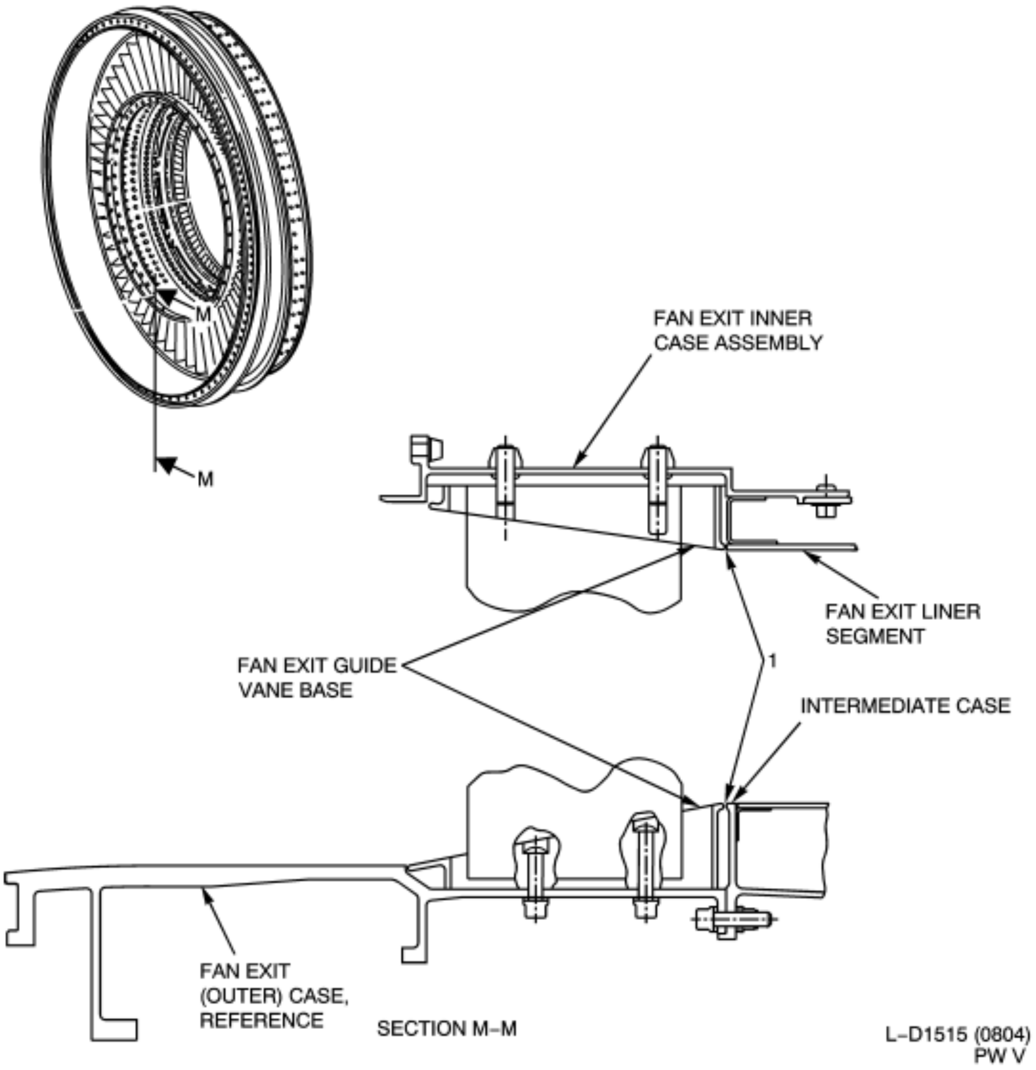
1. Apply Sealant To The Empty Spaces Between The Front And The Rear Liners At The 6 O'Clock Panel Location For Distance A.
2. Apply Sealant To Fill All Gaps In Area Around The Bleed Valve Ports.
3. Apply Sealant. The Surface Of The Sealant Must Be Continuous With, To 0.010 Inch (0.254 mm) Above Surface R.

Key to Figure 413 (Sheet 2)


AW
AW
STRUT NO. 5
SCHEMATIC REAR VIEW
OF THE INTERMEDIATE
CASE
SECTION AW−AW
1
L−A9258 (0694)
PW V

1. Apply Sealant In This Area, Eight Places. The Surface Of The Sealant Must Be Smooth And Continuous.
   NOTE: Omit sealant at the 12 o'clock position.

Application Of Sealant At The Strut (Leading Edge)
Figure 414
(Task 72−00−33−420−001)


M
M
FAN EXIT INNER CASE ASSEMBLY
FAN EXIT LINER SEGMENT
FAN EXIT GUIDE VANE BASE
1
INTERMEDIATE CASE
FAN EXIT (OUTER) CASE, REFERENCE
SECTION M−M
L−D1515 (0804)
PW V

1. Optional, Apply Sealant All Around. See The Text.

Application Of Sealant At The Rear Of the Fan Exit Guide Vane Bases
Figure 415
(Task 72−00−33−420−001)

Task 72-00-33-420-003-A:

1. Install Fan Case Plumbing For Basic Engines

A. Equipment And Materials Necessary

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 Or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

B. Procedure
See Figure 401.

CAUTION: DO NOT USE LUBRICANTS ON EEC OR PMUX SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF EEC OR PMUX CAN RESULT.

R CAUTION: BE CAREFUL WHEN YOU HANDLE, REMOVE OR INSTALL
R ALL TUBES WHICH CONTAIN A FLEX DESIGN
R SEGMENT. REMOVE AND INSTALL A TUBE WITH A
R FLEX SEGMENT WITH THE SAME PRECAUTIONS
R USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO
R NOT BEND THE FLEXHOSE OF A TUBE TO HELP
R WITH THE INSTALLATION OR REMOVAL OF AN
R ATTACHED COMPONENT. IF A FLEX SEGMENT IS
R BENT TOO MUCH, THIS CAN CAUSE A KINK IN
R THE EXTERNAL WIRE BRAID AND IN THE INNER
R POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS
R OR TUBE RUPTURE CAN BE THE RESULT.

(1) Install EEC PT2 (AS22) and EEC PAM (AS21) manifold assemblies as follows.

(a) Install manifolds with clamps, spacer, bolts, threads lubricated with Engine Oil P03-001, and nuts to Flange B2 brackets at four locations.

(b) Torque clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(2) Install EEC PT2 (AS16) and EEC PAM (AS17) tube assemblies as follows.

(a) Install smaller adapter to rear right hole of Flange A1 bracket at approximately 12 o'clock position. Install jamnut to front of adapter and torque nut to 58 − 62 lb−in. (6.553 − 7.005 N.m).

(b) Install larger adapter to rear left hole of Flange A1 bracket at approximately 12 o'clock position. Install jamnut to front of adapter and torque nut to 70 − 80 lb−in. (7.903 − 9.039 N.m).

(c) Remove protective closures and install tubes to adapters at approximately 12 o'clock position and to manifold couplings rearward of Flange B1 at approximately 11 o'clock position handtight only.

(d) Secure tubes with clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts to Flange B brackets and Flange B1 bracket. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque PT2 tube (smaller nuts) to 135 − 150 lb−in. (15.253 − 16.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nuts. Torque PAM tube (larger nuts) to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nuts.

(3) Install EEC PT4.95 (AS24) and EEC PB (AS23) manifold assemblies as follows.

(a) Remove protective closures and install manifolds with clamps, spacer, bolts, threads lubricated with Engine Oil P03−001, and nuts to Flange B brackets (three locations) and to Flange B1 bracket.

(b) Torque clamp bolts to 36 − 40 lb−in.(4.067 − 4.519 N.m).

(4) Install EEC PT4.95 (AS05) and EEC PB (AS19) tube assemblies as follows.

ENGINE GENERAL − FAN CASE − INSTALLATION−02

(a) Remove protective closures and install tubes to tube couplings at approximately 12 o'clock position rearward of Flange D and at approximately 11 o'clock rearward of Flange B1 handtight only.

(b) Secure tubes with clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts to Flange B2 brackets (two locations), Flange C bracket, and intermediate case. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) For engines not equipped with propulsion multiplexer unit (PMUX), torque tube nuts to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nuts.

(d) For engines equipped with propulsion multiplexer unit (PMUX) torque PT4.95 tube nuts to 270 − 300 lb−in. (30.506 − 33.895 N.m) and PB tube nuts to 135 − 150 lb−in. (15.253 − 169.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nuts. (Engines with PMUX incorporate smaller diameter PB tube and manifold).

(5) Install PT4.95 (AS13) and PB flex (AS12) hose assemblies as follows.

(a) Remove protective closures and install PT4.95 and PB flex hoses to forward two manifold tees, at approximately 9 o'clock position, handtight only.

(b) Secure hoses with clamps, bolt, threads lubricated with Engine Oil P03−001, spacer, and nut to Flange B bracket at approximately 9 o'clock position. Torque clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Torque smaller nut (PB hose) to 200 − 225 lb−in. (22.597 − 25.422 N.m).

(d) Torque larger nut (PT4.95 hose) to 450 − 500 lb−in. (50.843 − 56.492 N.m).

1 (Post SPN No. P3042 and Post SB PW4ENG 72−645) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(6) Install PT2 (AS11) and PAM (AS10) flex hose assemblies as follows.

(a) Remove protective closures and install PT2 and PAM flex hoses to rearward two manifold tees, at approximately 9 o'clock position, handtight only.

(b) Secure hoses with clamps, bolt, threads lubricated with Engine Oil P03-001, spacer, and nut to Flange B2 bracket at approximately 9 o'clock position. Torque clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Torque smaller nut (PT2 hose) to 90 - 100 lb-in. (10.169 - 11.298 N.m).

1 (Post SPN No. P3042) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the hose nut(s) as applicable.

(d) Torque larger nut (PAM hose) to 135 - 150 lb-in. (15.253 - 16.948 N.m).

1 (Post SPN No. P3042) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the hose nut(s) as applicable.

(7) For engines equipped with propulsion multiplexer unit (PMUX), install PT2.5 sensing air tube assembly (AS28) as follows. See Figure 402.

(a) Remove protective closures.

(b) Install tube to Flange C bracket with clamp, bolt, threads lubricated with Engine Oil P03-001, handtight only.

NOTE: Flange C clamp bolt to be torqued with wire harness installation. See Installation-06.

(c) Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts securing tube to Flange B2 brackets. Torque clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Torque manifold nut to tube coupling, at approximately 12 o'clock position, to 135 − 150 lb−in. (15.253 − 16.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nut.

(e) Install (PT2.5) hose and cap to tee end of tube handtight only.

(f) Torque cap to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the cap.

(g) Position hose and torque hose nut to tube tee to 270 − 300 lb−in. (30.506 − 33.895 N.m).

(h) Secure (PMUX) multiplexer data entry plug lanyard to front of Flange B bracket with bolt, threads lubricated with Engine Oil P03−001, and nut. Position lanyard away from case and torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(i) Secure ground cable to Flange B2 bracket with bolt, threads lubricated with Engine Oil P03−001, and nut. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

Task 72−00−33−420−003−B:

2. Install Fan Case Plumbing For Engines With The Airbus/McDonnell Douglas Common Parts Configuration

A. Equipment And Materials Necessary

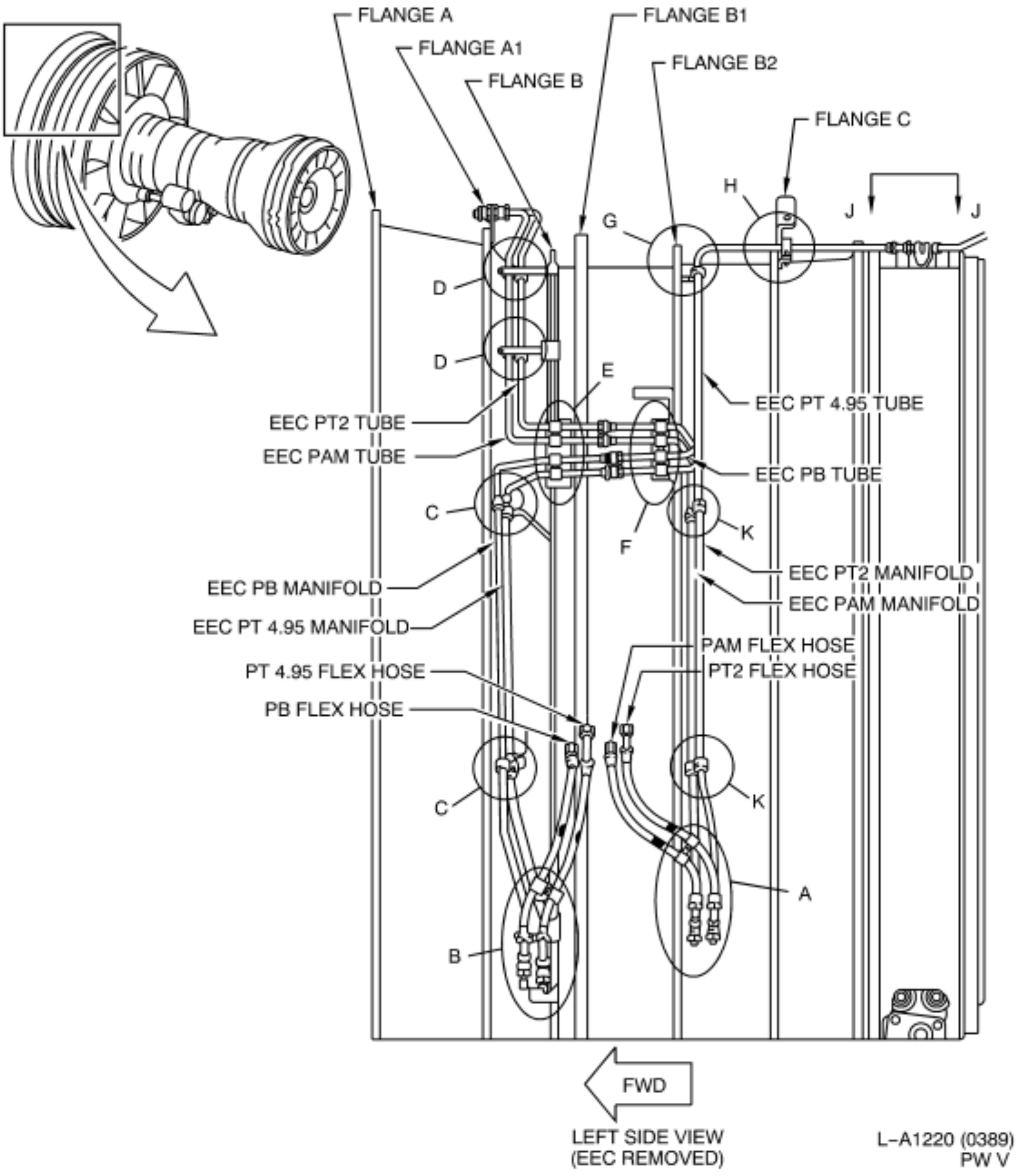
Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 Or M307

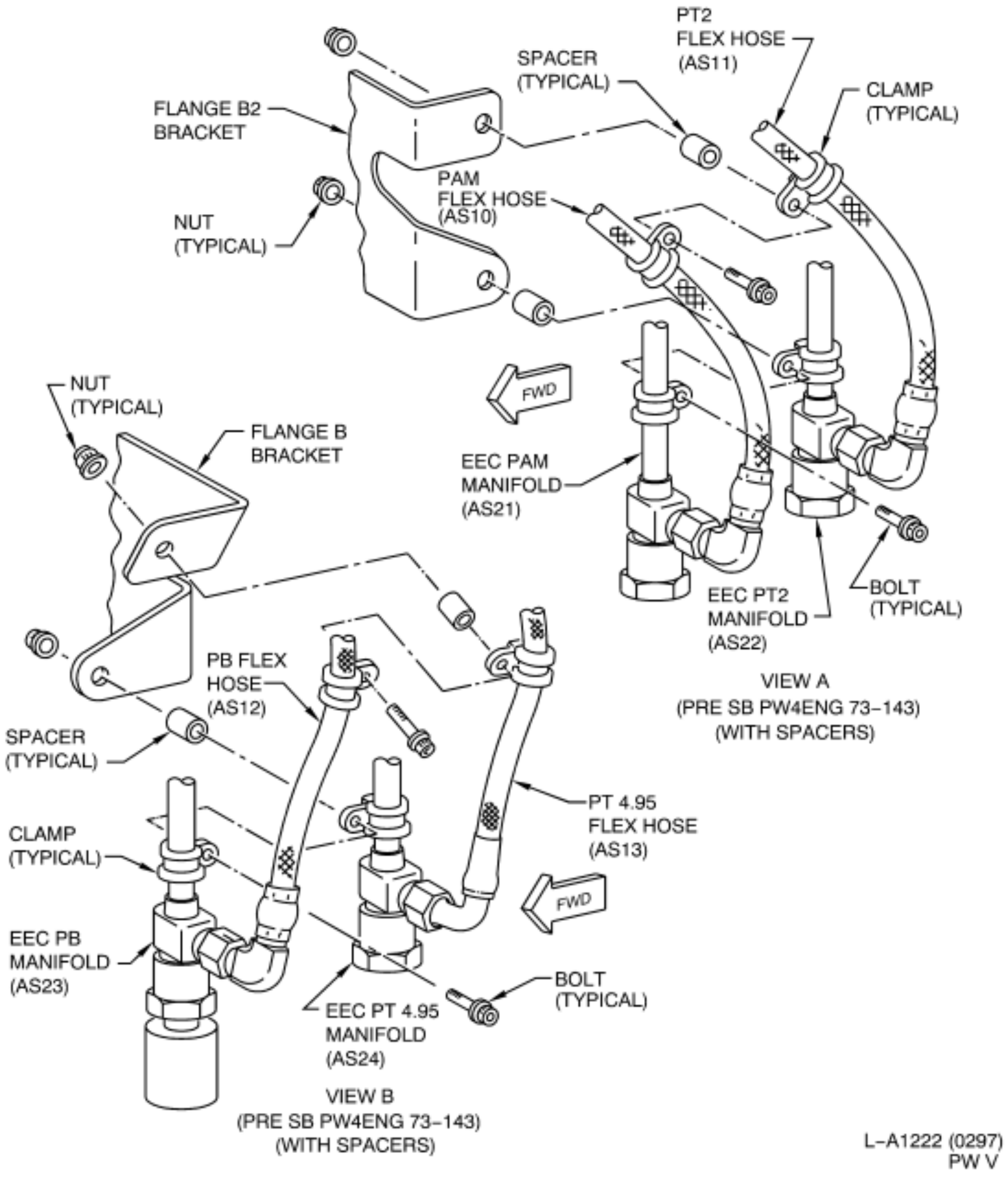
Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−289	Lockwire (AS3214−02)
P05−291	Cable, Safety (Optional)
P05−292	Ferrule, Safety Cable (Optional)

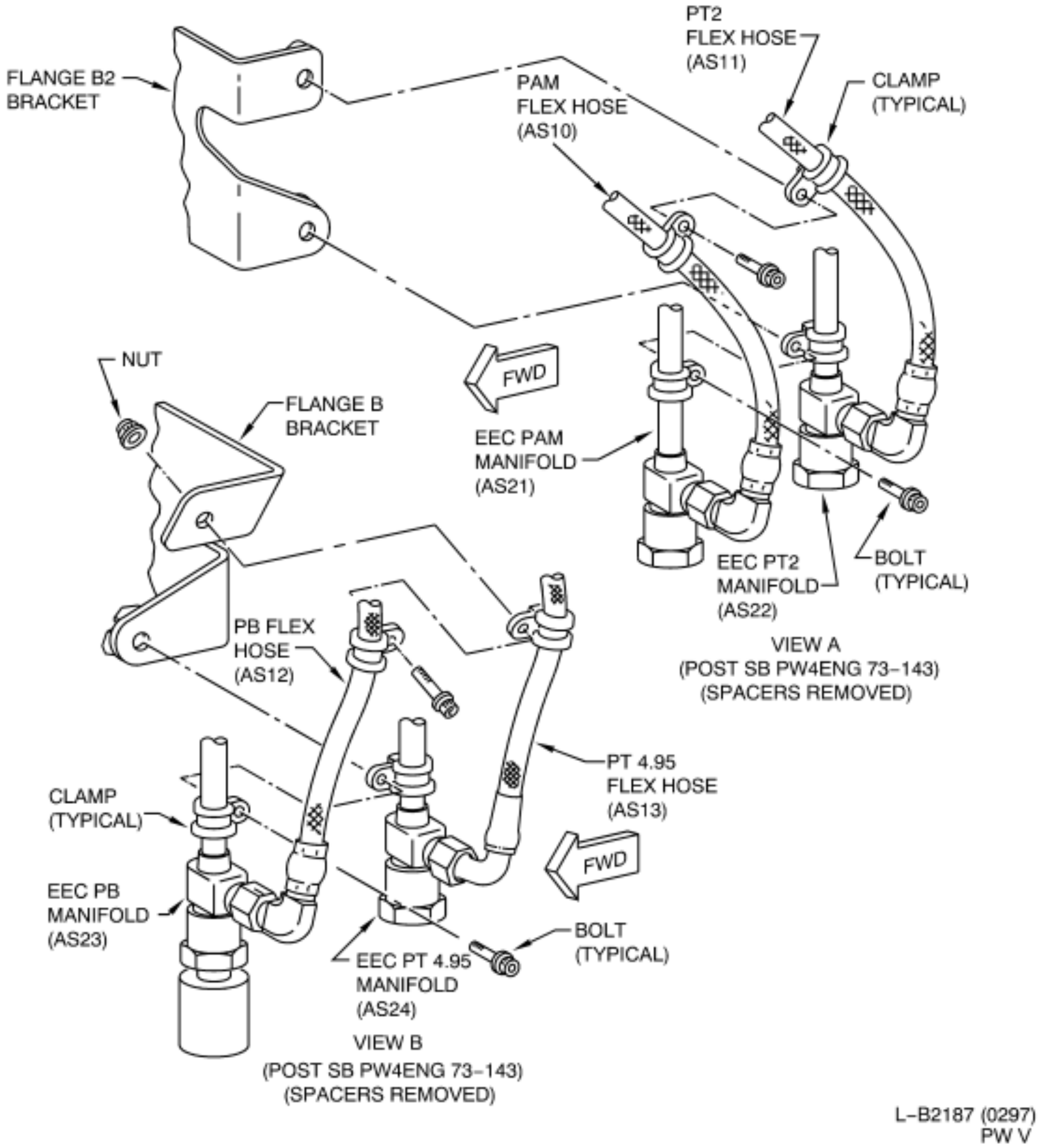
R
R


FLANGE A
FLANGE A1
FLANGE B
FLANGE B1
FLANGE B2
FLANGE C
H
J
J
G
D
D
E
EEC PT 4.95 TUBE
EEC PT2 TUBE
EEC PAM TUBE
EEC PB TUBE
C
K
F
EEC PB MANIFOLD
EEC PT 4.95 MANIFOLD
EEC PT2 MANIFOLD
EEC PAM MANIFOLD
PAM FLEX HOSE
PT2 FLEX HOSE
PT 4.95 FLEX HOSE
PB FLEX HOSE
C
K
A
B
FWD
LEFT SIDE VIEW
(EEC REMOVED)
L-A1220 (0389)
PW V

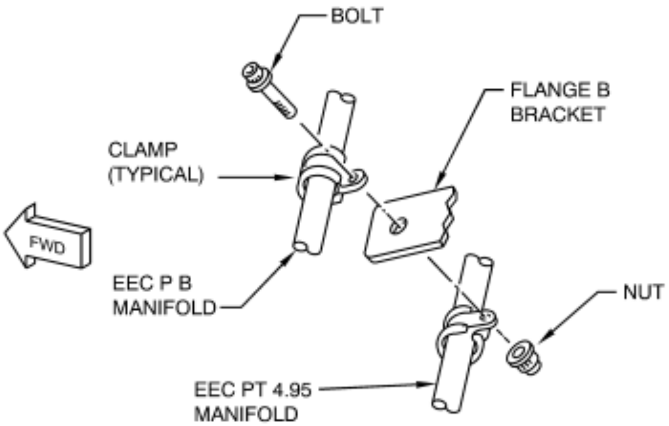
Fan Case Plumbing
Figure 401 (Sheet 1)
(Task 72-00-33-420-003-A)


PT2
FLEX HOSE
(AS11)
SPACER
(TYPICAL)
CLAMP
(TYPICAL)
FLANGE B2
BRACKET
PAM
FLEX HOSE
(AS10)
NUT
(TYPICAL)
FWD
NUT
(TYPICAL)
FLANGE B
BRACKET
EEC PAM
MANIFOLD
(AS21)
EEC PT2
MANIFOLD
(AS22)
BOLT
(TYPICAL)
VIEW A
(PRE SB PW4ENG 73−143)
(WITH SPACERS)
PB FLEX
HOSE
(AS12)
SPACER
(TYPICAL)
CLAMP
(TYPICAL)
PT 4.95
FLEX HOSE
(AS13)
FWD
EEC PB
MANIFOLD
(AS23)
EEC PT 4.95
MANIFOLD
(AS24)
BOLT
(TYPICAL)
VIEW B
(PRE SB PW4ENG 73−143)
(WITH SPACERS)
L−A1222 (0297)
PW V

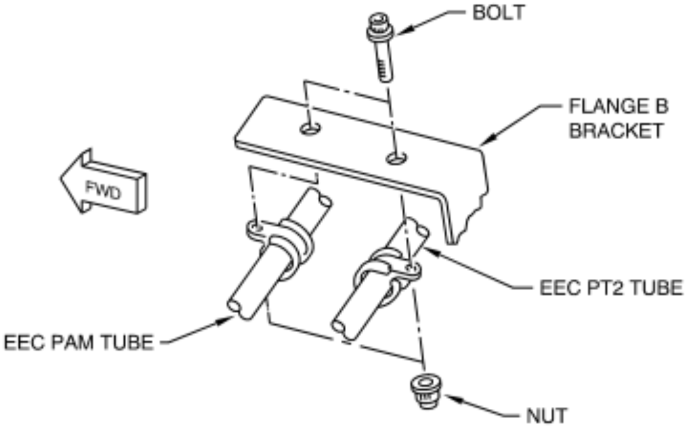
Fan Case Plumbing
Figure 401 (Sheet 2)
(Task 72−00−33−420−003−A)


PT2
FLEX HOSE
(AS11)
FLANGE B2
BRACKET
PAM
FLEX HOSE
(AS10)
CLAMP
(TYPICAL)
NUT
FWD
FLANGE B
BRACKET
EEC PAM
MANIFOLD
(AS21)
EEC PT2
MANIFOLD
(AS22)
BOLT
(TYPICAL)
VIEW A
(POST SB PW4ENG 73-143)
(SPACERS REMOVED)
PB FLEX
HOSE
(AS12)
PT 4.95
FLEX HOSE
(AS13)
CLAMP
(TYPICAL)
FWD
EEC PB
MANIFOLD
(AS23)
BOLT
(TYPICAL)
EEC PT 4.95
MANIFOLD
(AS24)
VIEW B
(POST SB PW4ENG 73-143)
(SPACERS REMOVED)
L-B2187 (0297)
PW V

Fan Case Plumbing
Figure 401 (Sheet 3)
(Task 72-00-33-420-003-A)


BOLT
FLANGE B BRACKET
CLAMP (TYPICAL)
FWD
EEC P B MANIFOLD
NUT
EEC PT 4.95 MANIFOLD

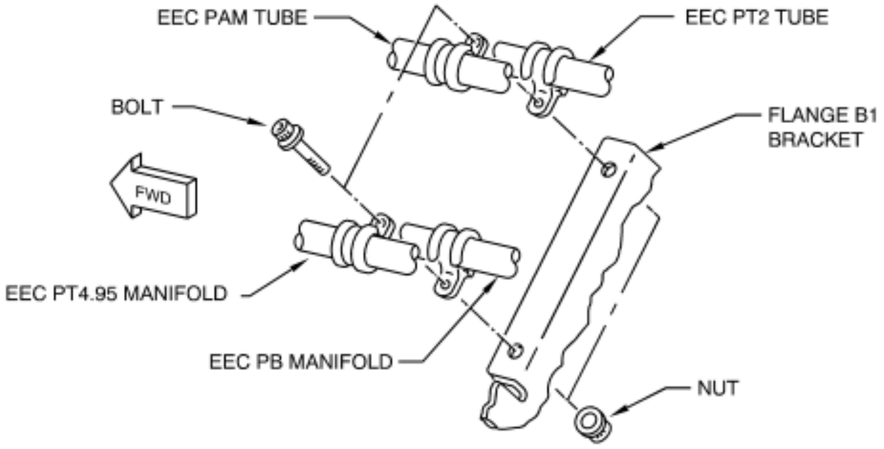
VIEW C
(2 LOCATIONS)


BOLT
FLANGE B BRACKET
FWD
EEC PT2 TUBE
EEC PAM TUBE
NUT

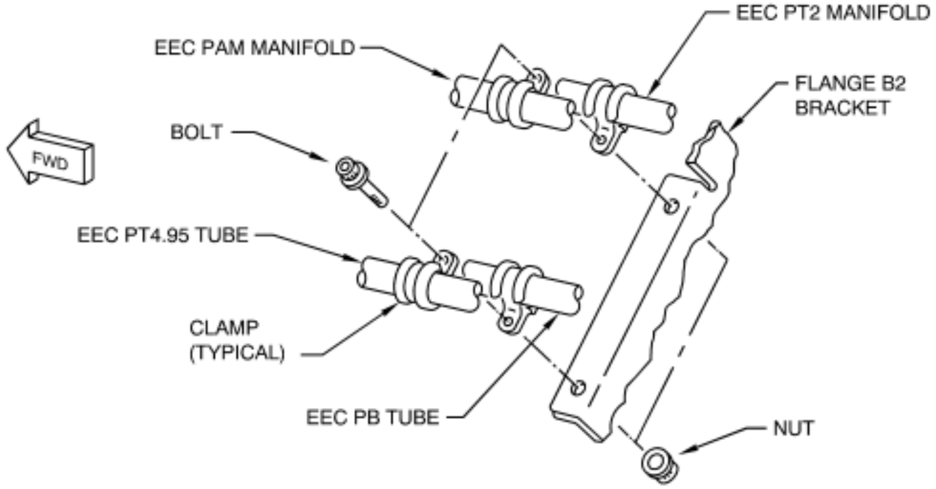
VIEW D
(2 LOCATIONS)

L-A1223 (0389)
PW V

Fan Case Plumbing
Figure 401 (Sheet 4)
(Task 72-00-33-420-003-A)


EEC PAM TUBE
EEC PT2 TUBE
BOLT
FLANGE B1
BRACKET
FWD
EEC PT4.95 MANIFOLD
EEC PB MANIFOLD
NUT

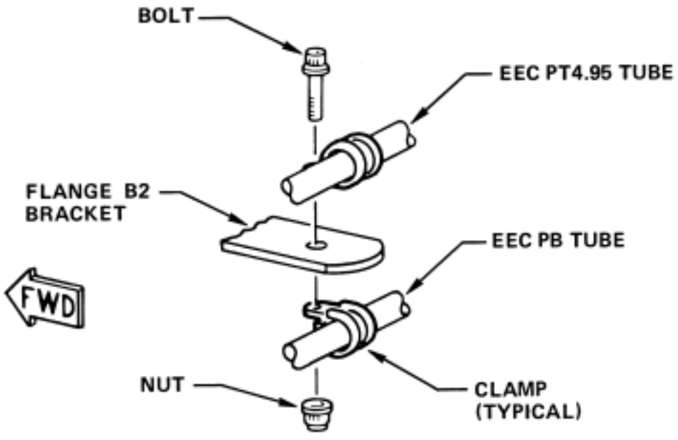
VIEW E


EEC PT2 MANIFOLD
EEC PAM MANIFOLD
FLANGE B2
BRACKET
BOLT
FWD
EEC PT4.95 TUBE
CLAMP
(TYPICAL)
EEC PB TUBE
NUT

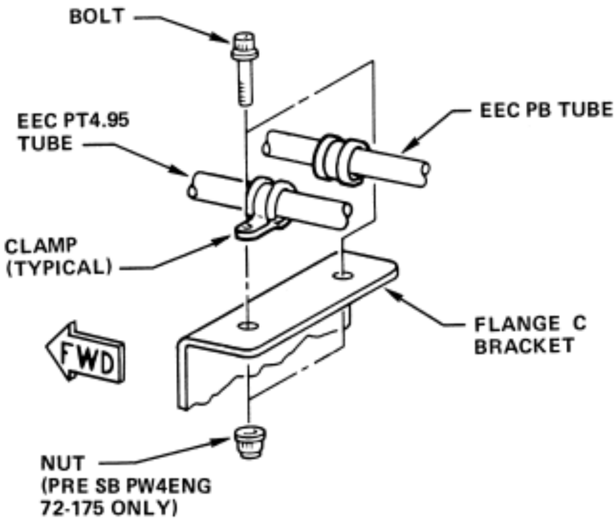
VIEW F

L-A1224 (0389)
PW V

Fan Case Plumbing
Figure 401 (Sheet 5)
(Task 72-00-33-420-003-A)


BOLT
EEC PT4.95 TUBE
FLANGE B2
BRACKET
EEC PB TUBE
FWD
NUT
CLAMP
(TYPICAL)

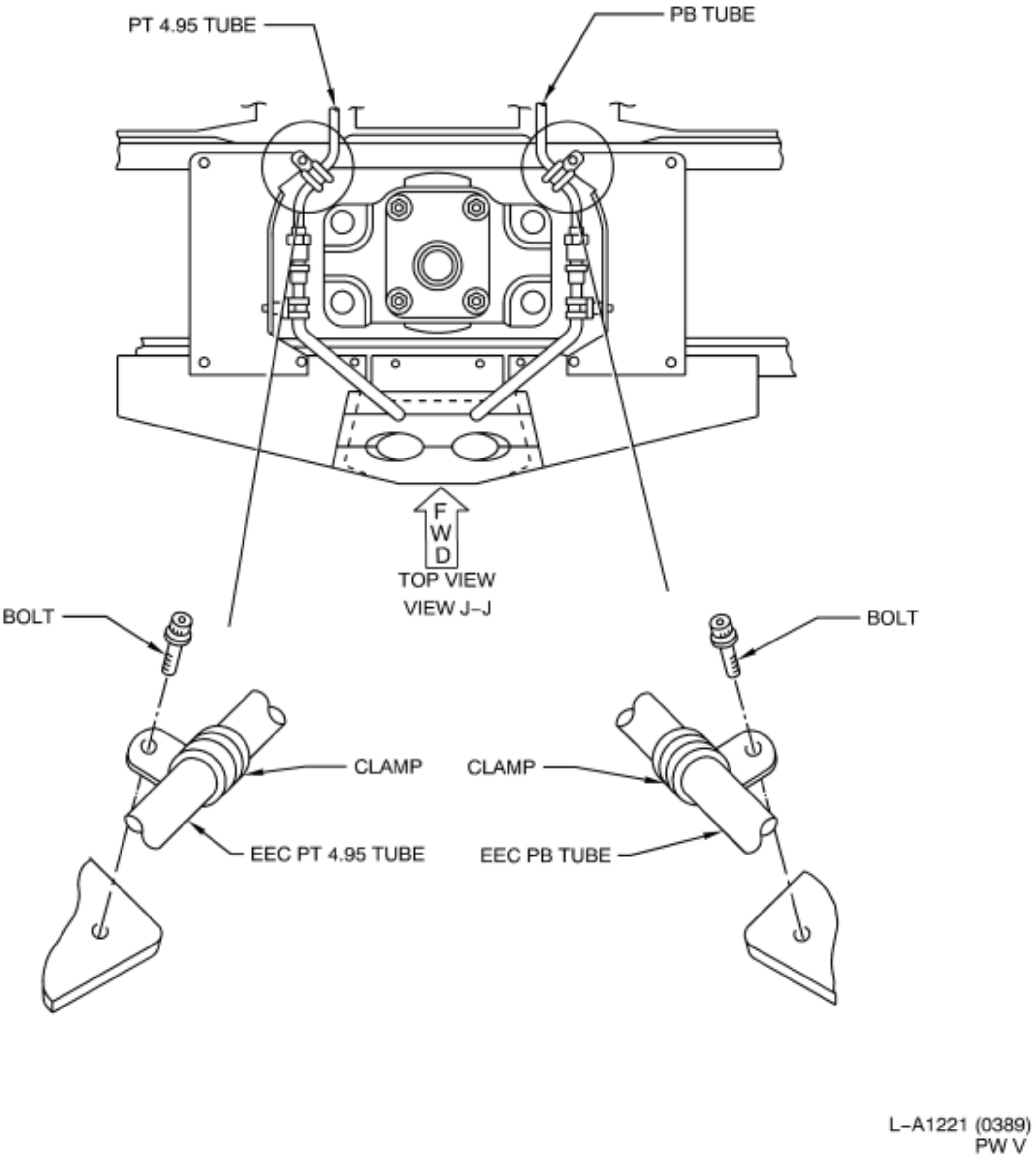
VIEW G


BOLT
EEC PB TUBE
EEC PT4.95
TUBE
CLAMP
(TYPICAL)
FLANGE C
BRACKET
FWD
NUT
(PRE SB PW4ENG
72-175 ONLY)

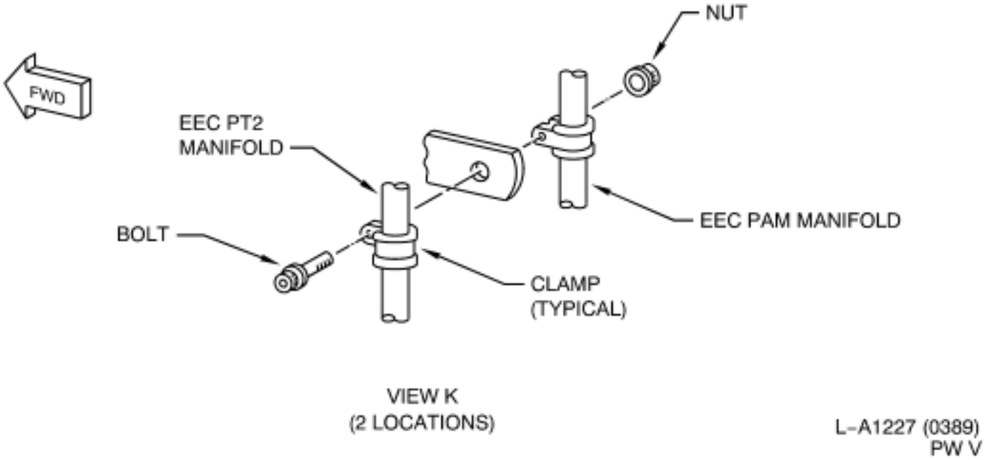
VIEW H

L−A1225
0389

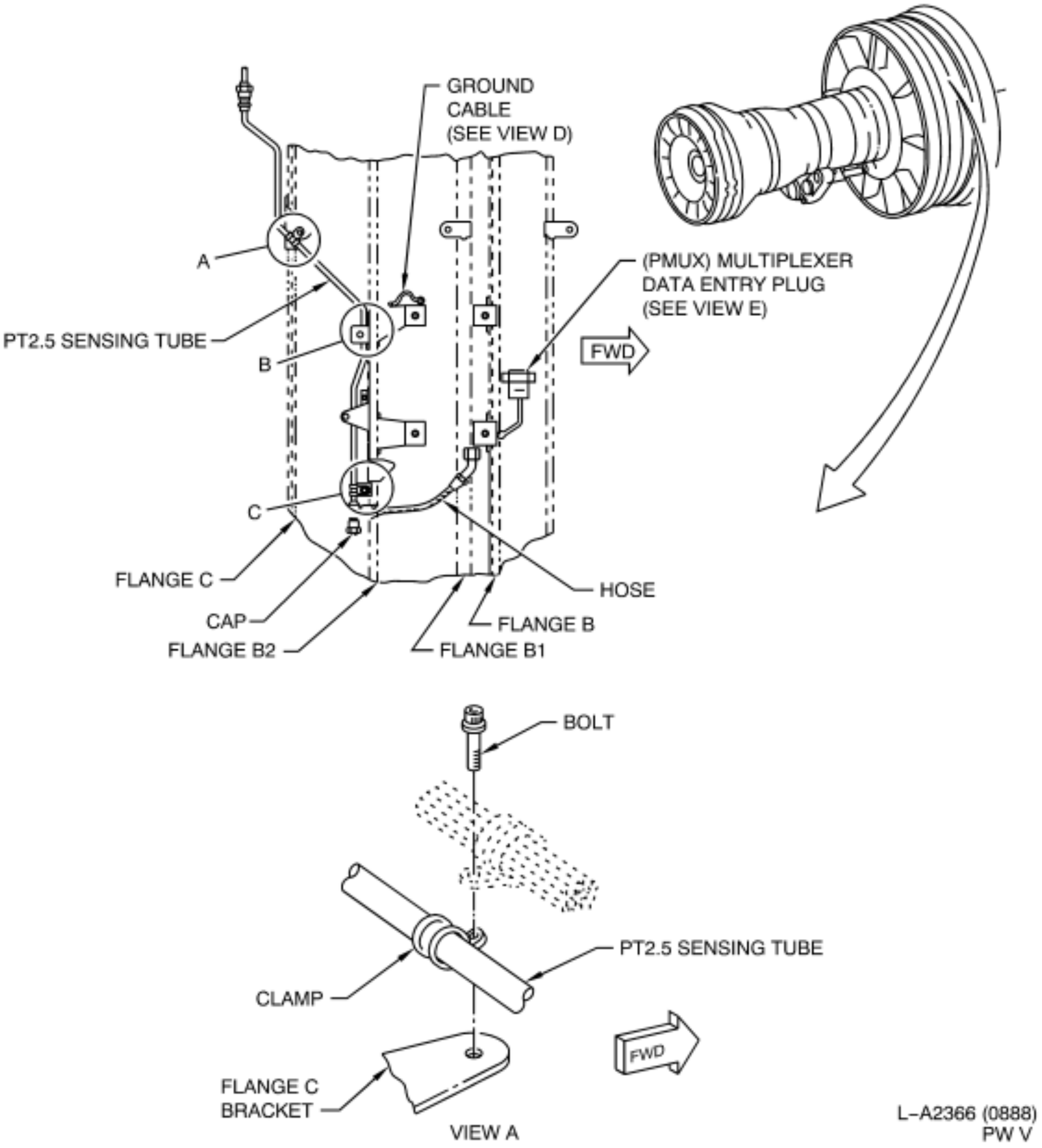
Fan Case Plumbing
Figure 401 (Sheet 6)
(Task 72−00−33−420−003−A)


PT 4.95 TUBE
PB TUBE
F W D
TOP VIEW
VIEW J−J
BOLT
BOLT
CLAMP
CLAMP
EEC PT 4.95 TUBE
EEC PB TUBE
L−A1221 (0389)
PW V

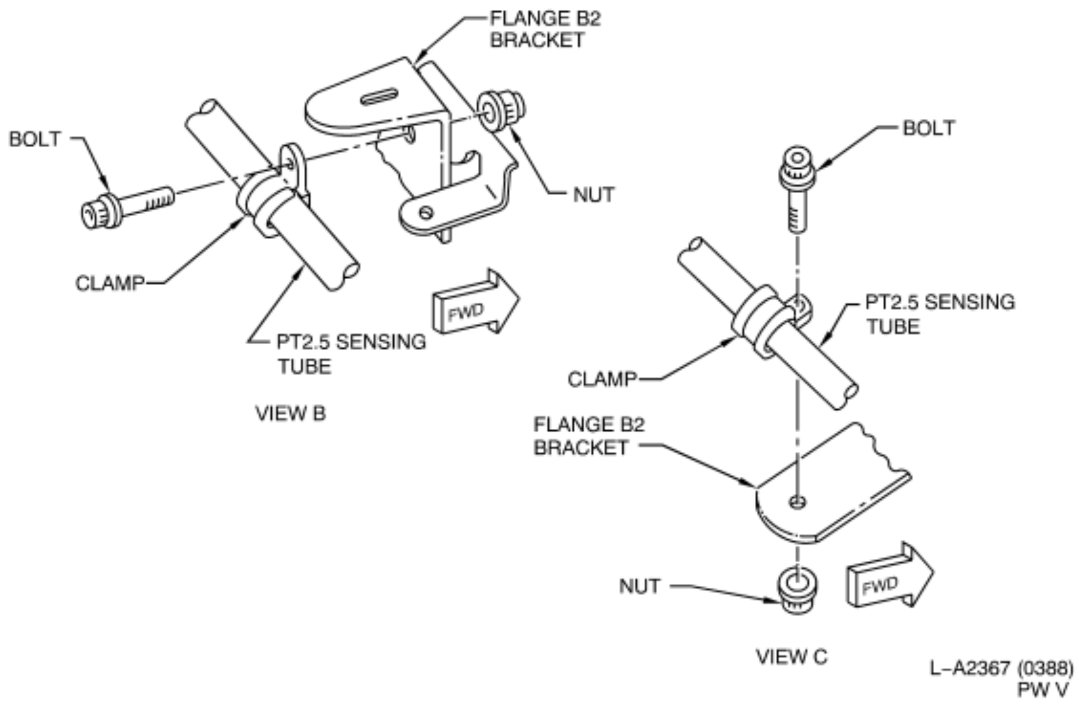
Fan Case Plumbing
Figure 401 (Sheet 7)
(Task 72−00−33−420−003−A)


NUT
FWD
EEC PT2 MANIFOLD
BOLT
EEC PAM MANIFOLD
CLAMP (TYPICAL)
VIEW K
(2 LOCATIONS)
L−A1227 (0389)
PW V

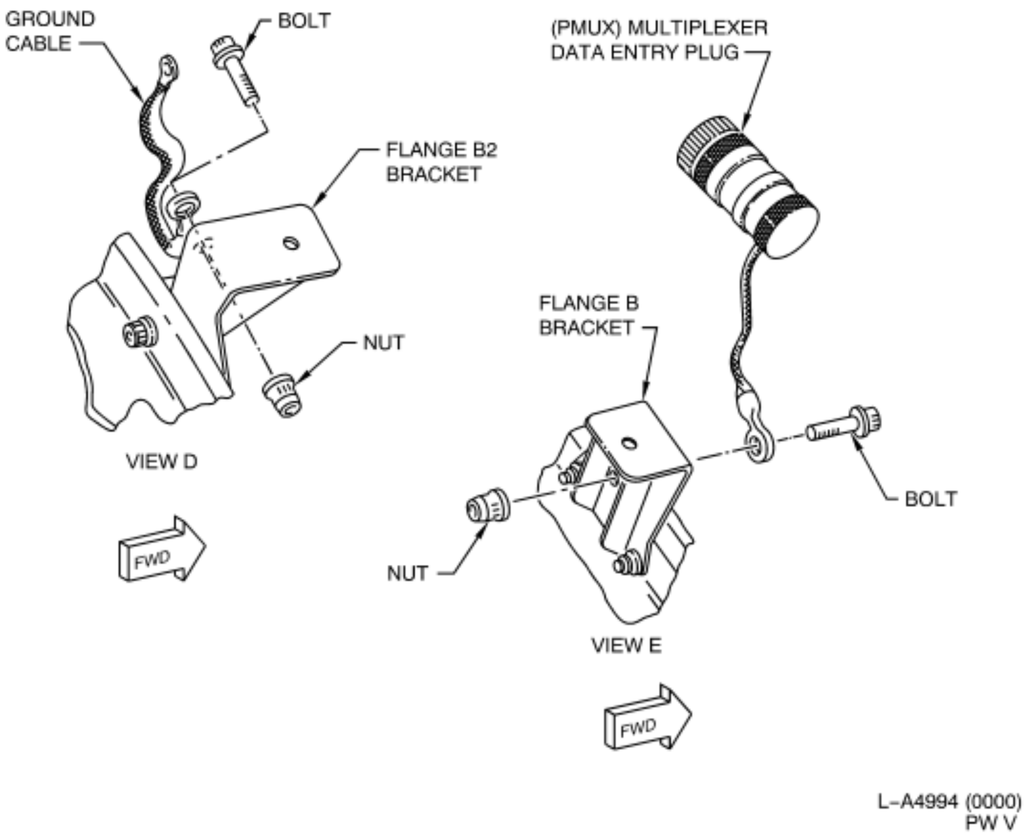
Fan Case Plumbing
Figure 401 (Sheet 8)
(Task 72−00−33−420−003−A)


GROUND
CABLE
(SEE VIEW D)
A
(PMUX) MULTIPLEXER
DATA ENTRY PLUG
(SEE VIEW E)
PT2.5 SENSING TUBE
B
FWD
C
FLANGE C
HOSE
CAP
FLANGE B
FLANGE B2
FLANGE B1
BOLT
PT2.5 SENSING TUBE
CLAMP
FWD
FLANGE C
BRACKET
VIEW A
L−A2366 (0888)
PW V

Engine Propulsion Multiplexer Unit Plumbing
Figure 402 (Sheet 1)
(Task 72−00−33−420−003−A)


FLANGE B2
BRACKET
BOLT
NUT
CLAMP
PT2.5 SENSING
TUBE
FWD
VIEW B
BOLT
PT2.5 SENSING
TUBE
CLAMP
FLANGE B2
BRACKET
NUT
FWD
VIEW C
L−A2367 (0388)
PW V

Engine Propulsion Multiplexer Unit Plumbing
Figure 402 (Sheet 2)
(Task 72−00−33−420−003−A)


GROUND CABLE
BOLT
FLANGE B2 BRACKET
NUT
VIEW D
FWD
(PMUX) MULTIPLEXER DATA ENTRY PLUG
FLANGE B BRACKET
BOLT
NUT
VIEW E
FWD
L−A4994 (0000)
PW V

Engine Propulsion Multiplexer Unit Plumbing
Figure 402 (Sheet 3)
(Task 72−00−33−420−003−A)

B. Procedure
See Figure 403.

CAUTION: DO NOT USE LUBRICANTS ON THE EEC AND THE SCU SENSING MANIFOLD, TUBE AND HOSE ASSEMBLIES. CONTAMINATION OF THE EEC OR SCU UNITS CAN RESULT.

R CAUTION: BE CAREFUL WHEN YOU HANDLE, REMOVE OR INSTALL
R ALL TUBES WHICH CONTAIN A FLEX DESIGN
R SEGMENT. REMOVE AND INSTALL A TUBE WITH A
R FLEX SEGMENT WITH THE SAME PRECAUTIONS
R USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO
R NOT BEND THE FLEXHOSE OF A TUBE TO HELP
R WITH THE INSTALLATION OR REMOVAL OF AN
R ATTACHED COMPONENT. IF A FLEX SEGMENT IS
R BENT TOO MUCH, THIS CAN CAUSE A KINK IN
R THE EXTERNAL WIRE BRAID AND IN THE INNER
R POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS
R OR TUBE RUPTURE CAN BE THE RESULT.

(1) Install the EEC PT2 manifold assembly (AS16).

(a) Install a larger adapter into the rear right hole in a bracket on Flange A1 at the 12 o'clock position. Install a jamnut onto the front of the adapter and torque the nut to 70 − 80 lb−in. (7.903 − 9.039 N.m).

(b) Install a smaller adapter into the rear left hole in a bracket on Flange A1 of the 12 o'clock position. Install a jamnut onto the front of the adapter and torque the nut to 58 − 62 lb−in. (6.553 − 7.005 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the jamnuts.

(c) Remove the protection covers and install the tee end of the manifold to a bracket between Flanges A1 and B1 located at the 9 o'clock position. Install the opposite end of the manifold to the smaller adapter at the 12 o'clock position and tighten the manifold nut by hand.

(d) Attach the manifold (tee) to the bracket at the 9 o'clock position with a bolt, threads lubricated with Engine Oil P03−001 and tighten by hand.

(e) Install seven clamps to the manifold assembly at seven bracket locations on Flange B.

(2) Install the EEC PT4.95 sensing manifold assembly (AS24).

NOTE: If necessary loosen the bracket (bridged between Flanges B2 and C) to install the tube clamps and tubes (AS23) and (AS24).

(a) Remove the protection covers and install the tee end of the manifold to a bracket between Flanges A1 and B1 located at the 9 o'clock position. Install the coupling end of the manifold rearward of Flange B2 at the 10:30 o'clock position.

(b) Attach the manifold (tee) to the bracket at the 9 o'clock position with a bolt, threads lubricated with Engine Oil P03−001 and tighten by hand.

(c) Attach the manifold to a bracket on Flange B1 at the 9 o'clock position with a clamp and a bolt, threads lubricated with Engine Oil P03−001. Tighten the bolt by hand.

(d) Install a clamp to the manifold at a bracket location (bridged) between Flanges B2 and C at the 9:30 o'clock position. (Bolt is installed with the fan case harnesses).

(e) Install three clamps to the manifold assembly of three bracket locations between Flanges B2 and C.

(3) Install the EEC PAM manifold assembly (AS17).

(a) Remove the protection covers and install the tee end of the manifold to a bracket between Flanges A1 and B1 located at the 9 o'clock position. Install the opposite end of the manifold to the larger adapter at the 12 o'clock position and tighten the manifold nut by hand.

(b) Attach the manifold (tee) to the bracket at the 9 o'clock position with a bolt, threads lubricated with Engine Oil P03−001 and tighten by hand.

(c) Install seven clamps to the manifold assembly at seven bracket locations on Flange B.

(d) Attach the seven clamps on the EEC PT2 manifold (AS16) and the seven clamps on the EEC PAM manifold (AS17) to the brackets on Flange B with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque the bolt that attaches the manifold tee to the bracket at the 9 o'clock position to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Torque the manifold nut to the adapter at the 12 o'clock position to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the manifold nut.

(g) For center engine configurations only, install the EEC vent cap to the front of the larger adapter at the 12 o'clock position. Torque the cap to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the cap.

(4) Torque the EEC PT2 manifold assembly (AS16).

(a) Torque the bolt that attaches the manifold tee to the bracket at the 9 o'clock position to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(b) Torque the manifold nut to the adapter at the 12 o'clock position to 135 − 150 lb−in. (15.253 − 16.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the manifold nut.

(5) Install the EEC PB manifold assembly (AS23).

(a) Remove the protection covers and install the tee end of the manifold to a bracket between Flanges A1 and B1 located at the 9 o'clock position. Install the coupling end of the manifold rearward of Flange B2 at the 10:30 o'clock position.

(b) Attach the manifold (tee) to the bracket at the 9 o'clock position with a bolt, threads lubricated with Engine Oil P03−001 and tighten by hand.

(c) Attach the manifold to a bracket on Flange B1 at the 9 o'clock position with a clamp and a bolt, threads lubricated with Engine Oil P03−001. Tighten the bolt by hand.

(d) Install a clamp to the manifold at a bracket location (bridged) between Flanges B2 and C at the 9:30 o'clock position. (Bolt is installed with the fan case harnesses).

NOTE: If the bracket (bridged between Flanges B2 and C) has been loosened for installation of the tube clamps and tubes (AS23) and (AS24) do as follows. Torque again the nuts that attach the bracket to the flanges to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(e) Install three clamps to the manifold assembly at three bracket locations between Flanges B2 and C.

(f) Attach the three clamps on the PT4.95 sensing manifold (AS24) and the three clamps on the EEC PB manifold (AS23) to the three brackets located between Flanges B2 and C with bolts, threads lubricated with Engine Oil P03−001 and tighten by hand.

(6) Install the PB sensing tube assembly (AS19).

(a) Remove the protection covers and install the tube to the coupling end of the EEC PB manifold (AS23) located rearward of Flange B2 at the 10:30 o'clock position. Install the opposite end of the tube to the coupling end of a tube (AS20) located at the 12 o'clock (strut) position. Tighten the tube nuts by hand.

(b) Install five clamps onto the tube assembly at five brackets located between Flanges B2 and C.

(c) Install two clamps onto the tube assembly at two brackets located on Flange C. Attach the clamps to the brackets with nuts and bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(7) Install the PT4.95 sensing tube assembly (AS05).

(a) Remove the protection covers and install the tube to the coupling end of the PT4.95 sensing manifold (AS24) located rearward of Flange B2 at the 10:30 o'clock position. Install the opposite end of the tube to the coupling end of a tube (AS04) located at the 12 o'clock (strut) position. Tighten the tube nuts by hand.

(b) Install five clamps onto the tube assembly at five brackets located between Flanges B2 and C.

(c) Attach the five clamps on PT4.95 sensing tube (AS05) and the five clamps on the PB sensing tube (AS19) to the five brackets located between Flanges B2 and C with nuts, threads lubricated with Engine Oil P03−001. Torque the five nuts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Attach the tube to a bracket on Flange C located at the 12 o'clock position with a clamp, nut and bolt, threads lubricated with Engine Oil P03−001. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(8) Torque the bolts that attach the tee of the EEC PB manifold (AS23) and the tee of the PT4.95 sensing manifold (AS24) to the bracket (bridged) between Flanges A1 and B1 at the 9 o'clock position to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(9) Torque the nuts that attach the clamps on the PB sensing manifold (AS23) and the clamps on the PT4.95 sensing manifold (AS24) to the three brackets located between Flanges B2 and C to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(10) Torque the two bolts that attach the clamp on the PB sensing manifold (AS23) and the clamp on the PT4.95 sensing manifold (AS24) to the bracket on Flange B1 at the 9 o'clock position to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(11) Torque the tube nuts on the PT4.95 sensing tube (AS05) at the 12 o'clock (strut) position and at the 10:30 o'clock position located between Flanges B2 and C to 150 − 175 lb−in. (16.948 − 19.772 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the tube nuts.

(12) Torque the tube nuts on the PB sensing tube (AS19) at the 12 o'clock (strut) position and at the 10:30 o'clock position located between Flanges B2 and C to 90 - 100 lb-in. (10.169 - 11.298 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the tube nuts.

(13) Install the PB flex hose assembly (AS12) and a trap assembly to the EEC PB manifold assembly (AS23).

(a) Remove the protection covers and install the flex hose to the tee of the manifold (AS23) located on a bracket (bridged) between Flanges A1 and B1 at the 9 o'clock position.

(b) Torque the flex hose nut to 270 - 300 lb-in. (30.506 - 33.895 N.m). (Post SB PW4ENG 72-645) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the hose nut(s) as applicable.

(c) Install a trap assembly to the tee of the manifold. Torque the trap assembly to 320 - 350 lb-in. (36.155 - 39.545 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the trap assembly.

(d) (For engines equipped with the supplemental control unit (SCU) only). Install a trap assembly (Post SB PW4ENG 73-137) to the tee of the manifold. Torque the trap assembly to 320 - 350 lb-in. (36.155 - 39.545 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the trap assembly.

(e) (Post SB PW4ENG 73-137) (For engines equipped with the supplemental control unit (SCU) only). Installation of the insulation blankets.

1 Cut the blanket open. Trim the length of the blanket sufficiently to be installed between each tube clamp and tube connector.

2 Install the insulation blanket around the EEC PB sensing tube (AS19) and the EEC PB manifold (AS23) between each clamp.

3 Install the lacing tape between 0.75 − 1.00 inch (19.050 − 25.400 mm) along the blanket. See Figure 403 (Sheet 8).

NOTE: Longitudinal bulges and open distances between the tie points on the insulation blanket is permitted. Longitudinal overlap between the insulation blankets is not permitted.

NOTE: The insulation blanket may contact the fan case, other tubes, and brackets.

(14) Install the PT4.95 flex hose assembly (AS13) and a cap assembly to the PT4.95 sensing manifold (AS24).

(a) Remove the protection covers and install the flex hose to the tee of the manifold (AS24) located on a bracket (bridged) between Flanges A1 and B1 at the 9 o'clock position.

(b) Torque the flex hose nut to 450 − 500 lb−in. (50.843 − 56.492 N.m).

1 (Post SPN No. P3042) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(c) Install a cap assembly to the tee of the manifold and torque to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the cap assembly.

(15) Install the PAM flex hose assembly (AS10) and a cap assembly to the EEC PAM manifold (AS17).

(a) Remove the protection covers and install the flex hose to the tee of the manifold (AS17) located on a bracket (bridged) between Flanges A1 and B1 at the 9 o'clock position.

(b) Torque the flex hose nut to 135 − 150 lb−in. (15.253 − 16.948 N.m).

R
R

1 (Post SPN No. P3042) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(c) Install a cap assembly to the tee of the manifold and torque to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the cap assembly.

(16) Install the PT2 flex hose assembly (AS11) and a cap assembly to the EEC PT2 manifold (AS16).

(a) Remove the protection covers and install the flex hose to the tee of the manifold (AS16) located on a bracket (bridged) between Flanges A1 and B1 at the 9 o'clock position.

(b) Torque the flex hose nut to 90 − 100 lb−in. (10.169 − 11.298 N.m).

1 (Post SPN No. P3042) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(c) Install a cap assembly to the tee of the manifold and torque to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the cap assembly.

(17) For engines not equipped with a supplemental control unit (SCU), install a cap assembly to the tube coupling at the 12:30 o'clock position on the (AS29) tube assembly. Torque the cap assembly to 135 − 150 lb−in. (15.253 − 16.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the cap assembly.

(18) For engines equipped with a supplemental control unit (SCU) with multiplexing, install the PT2.5 sensing tube assembly (AS28), the PT2.5 sensing manifold assembly (AS36), and the PT2.5 sensing hose (AS38). See Figure 404.

(a) Remove the protection covers and install the PT2.5 sensing tube (AS28) to the coupling end of the (AS29) tube located at the 12:30 o'clock position. Tighten the tube nut by hand. See Figure 403, View I−I.

  1 Attach the lower end of the tube to the bracket on Flange C with a clamp and a bolt, threads lubricated with Engine Oil P03−001.

  2 Attach the remaining piece of the tube to three brackets on Flange C with clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts.

(b) Remove the protection covers and install the coupling end of the PT2.5 sensing manifold (AS36) to the (AS28) tube assembly. Tighten the tube nut by hand. Install the tee end of the manifold to the bracket on Flange B with a bolt, threads lubricated with Engine Oil P03−001 and tighten by hand.

  1 Attach the manifold to two brackets on Flange C with clamps, bolts, threads lubricated with Engine Oil P03−001 and nuts.

  2 Attach the manifold to the bracket on Flange B with a clamp, bolt, threads lubricated with Engine Oil P03−001 and a nut.

(c) Torque the eight bolts and/or nuts that attach the (AS28) tube and (AS36) manifold to brackets on Flanges B, B2 and C to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Torque the tube nuts of the (AS28) tube assembly to the (AS29) tube at the 12:30 o'clock position and to the (AS36) manifold to 135 − 150 lb−in. (15.253 − 16.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nuts.

(e) Torque the bolt that attaches the tee end of the manifold to a bracket on Flange B to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Remove the protection covers and install the hose assembly (AS38) to the tee of the (AS36) manifold. Tighten the tube nut on the hose by hand.

(g) Torque the hose assembly nut to the manifold tee to 270 − 300 lb−in. (30.506 − 33.895 N.m).

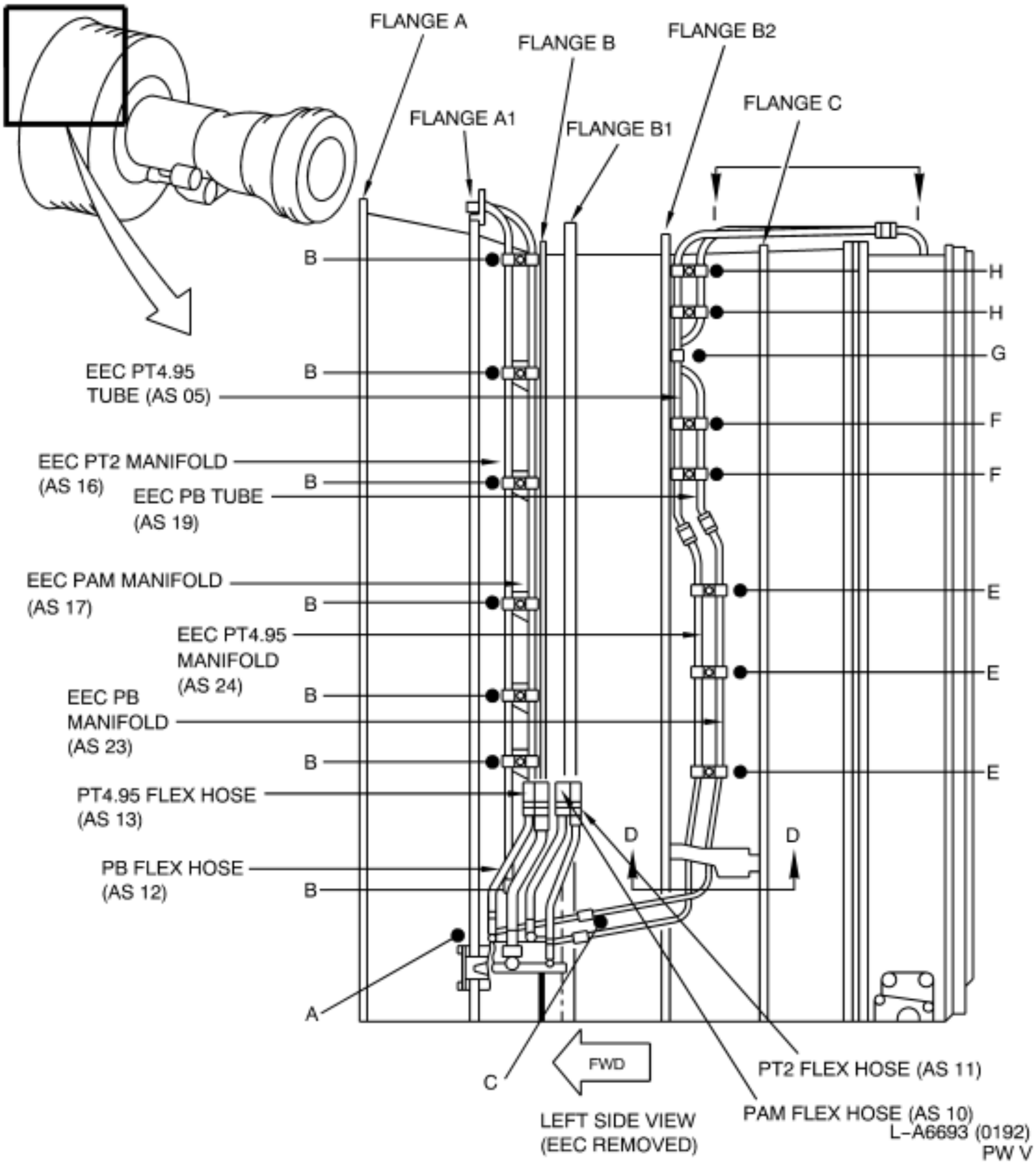
1 (Post SPN No. P3042) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(h) Install a cap assembly to the tee of the manifold. Torque the cap assembly to 90 − 100 lb−in. (10.169 − 11.298 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the cap assembly.

(19) For engines equipped with a supplemental control unit (SCU), install the SCU programming plug and the SCU ground cable. See Figure 404.

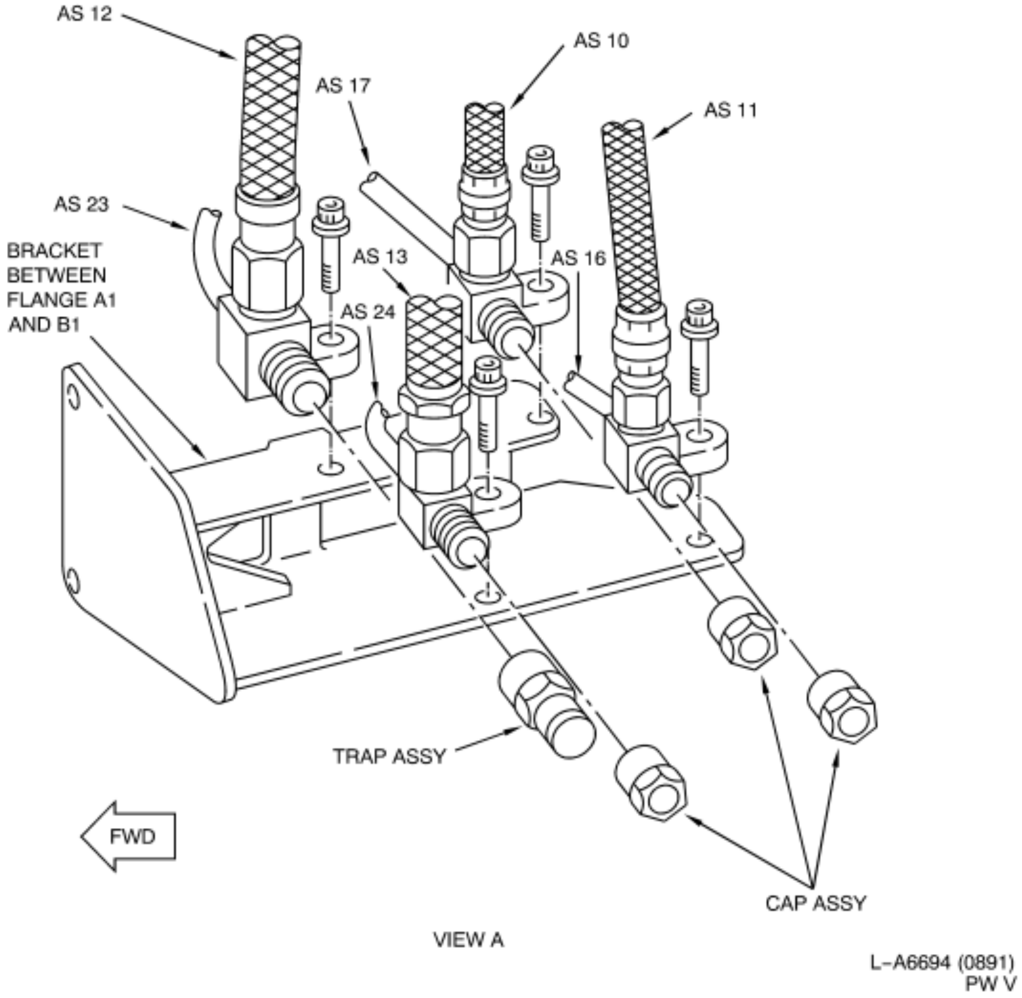
(a) Install the SCU programming plug lanyard to the rearward side of the lower SCU mount bracket. Attach the lanyard to the bracket with a rivet pin and collar. Torque the hex piece of the collar until it breaks from the threaded piece of the collar.

(b) Install the SCU ground cable on the rearward side of Flange B1 at the location where the upper SCU mount bracket is attached to the flange. Attach the cable with a bolt, threads lubricated with Engine Oil P03−001, a washer and a nut. Torque the bolt to 85 − 95 lb−in. (9.604 − 10.734 N.m).


FLANGE A
FLANGE B
FLANGE B2
FLANGE A1
FLANGE B1
FLANGE C
B
B
B
B
B
B
B
H
H
G
F
F
E
E
E
D
D
A
C
EEC PT4.95 TUBE (AS 05)
EEC PT2 MANIFOLD (AS 16)
EEC PB TUBE (AS 19)
EEC PAM MANIFOLD (AS 17)
EEC PT4.95 MANIFOLD (AS 24)
EEC PB MANIFOLD (AS 23)
PT4.95 FLEX HOSE (AS 13)
PB FLEX HOSE (AS 12)
FWD
LEFT SIDE VIEW (EEC REMOVED)
PT2 FLEX HOSE (AS 11)
PAM FLEX HOSE (AS 10)
L-A6693 (0192)
PW V

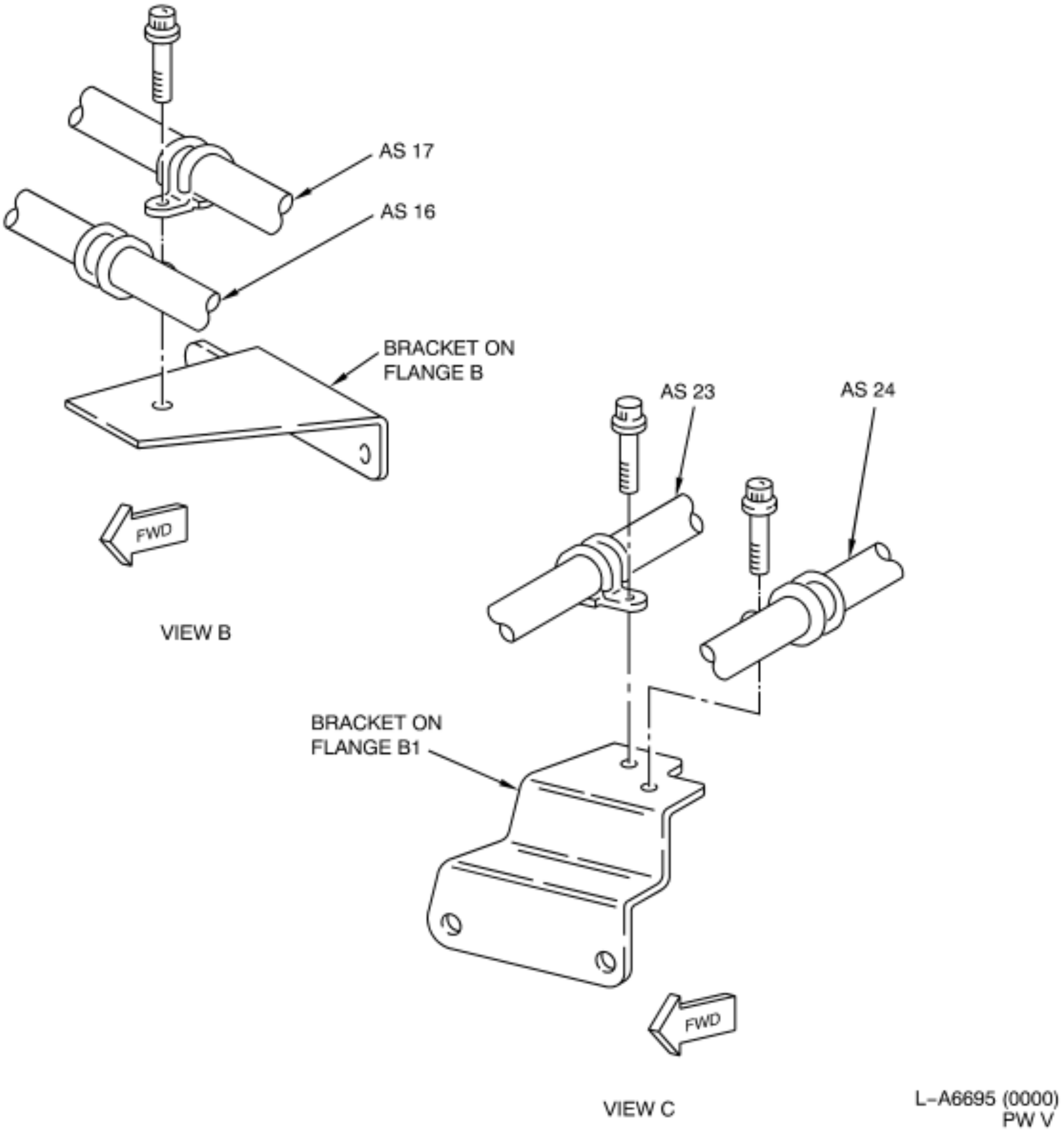
Fan Case Plumbing
Figure 403 (Sheet 1)
(Task 72-00-33-420-003-B)

ENGINE GENERAL − FAN CASE − INSTALLATION−02

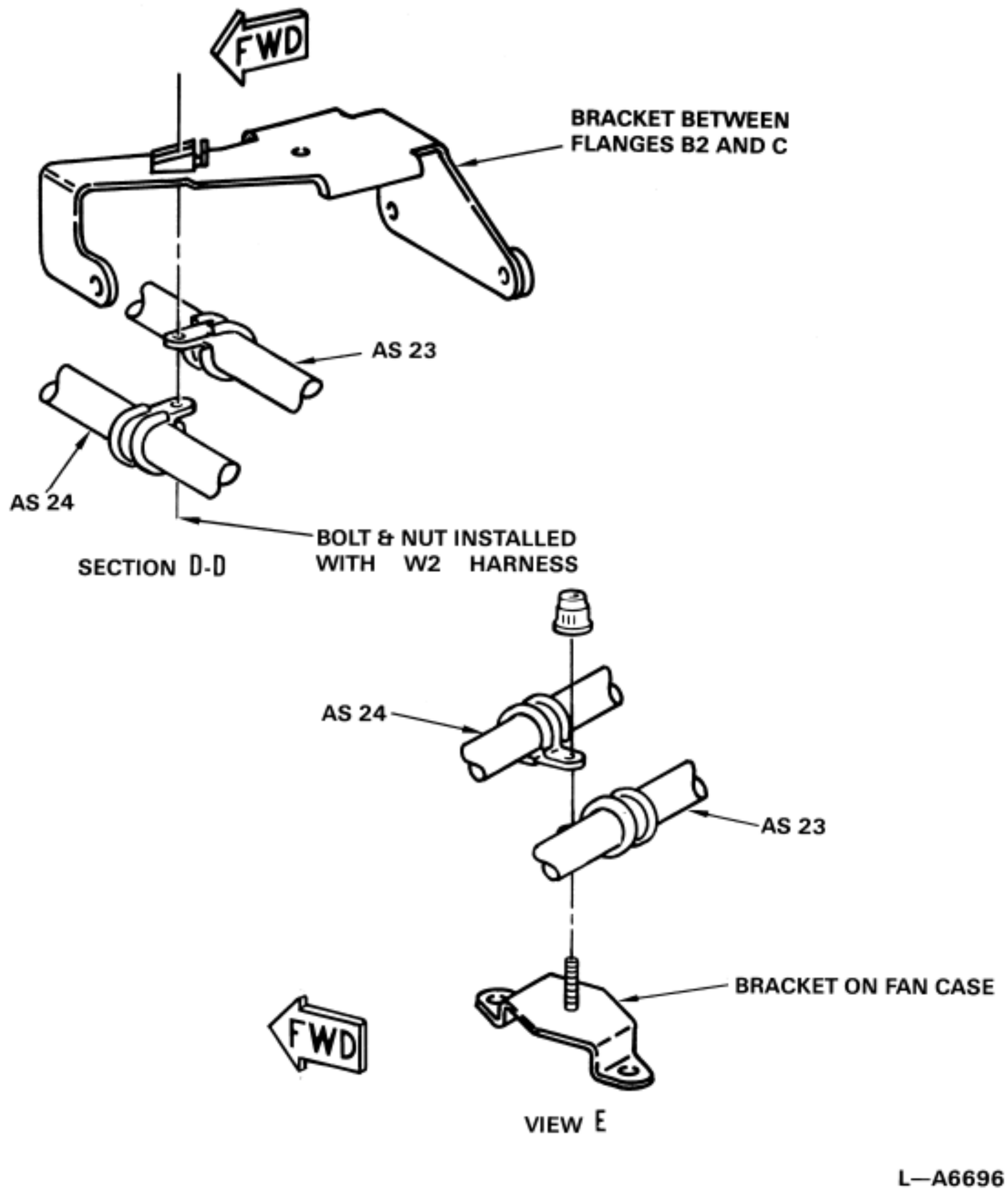

AS 12
AS 10
AS 17
AS 11
AS 23
BRACKET BETWEEN FLANGE A1 AND B1
AS 13
AS 16
AS 24
TRAP ASSY
FWD
CAP ASSY
VIEW A
L−A6694 (0891)
PW V

Fan Case Plumbing
Figure 403 (Sheet 2)
(Task 72−00−33−420−003−B)

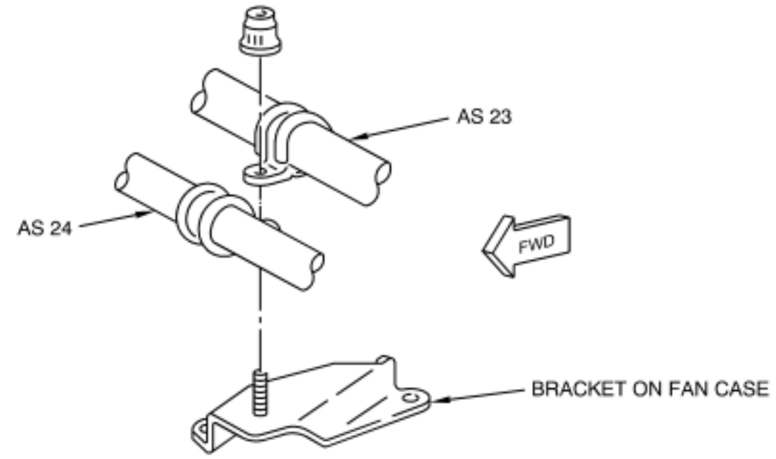
ENGINE GENERAL − FAN CASE − INSTALLATION−02


AS 17
AS 16
BRACKET ON FLANGE B
FWD
VIEW B
AS 23
AS 24
BRACKET ON FLANGE B1
FWD
VIEW C
L−A6695 (0000)
PW V

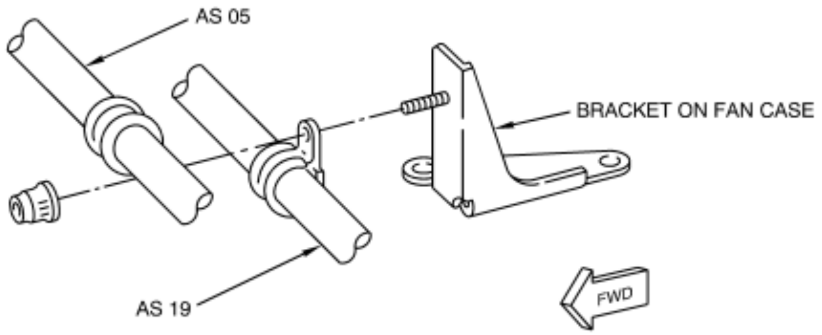
Fan Case Plumbing
Figure 403 (Sheet 3)
(Task 72−00−33−420−003−B)


FWD
BRACKET BETWEEN FLANGES B2 AND C
AS 23
AS 24
BOLT & NUT INSTALLED WITH W2 HARNESS
SECTION D-D
AS 24
AS 23
BRACKET ON FAN CASE
FWD
VIEW E
L—A6696

Fan Case Plumbing
Figure 403 (Sheet 4)
(Task 72−00−33−420−003−B)


AS 23
AS 24
FWD
BRACKET ON FAN CASE

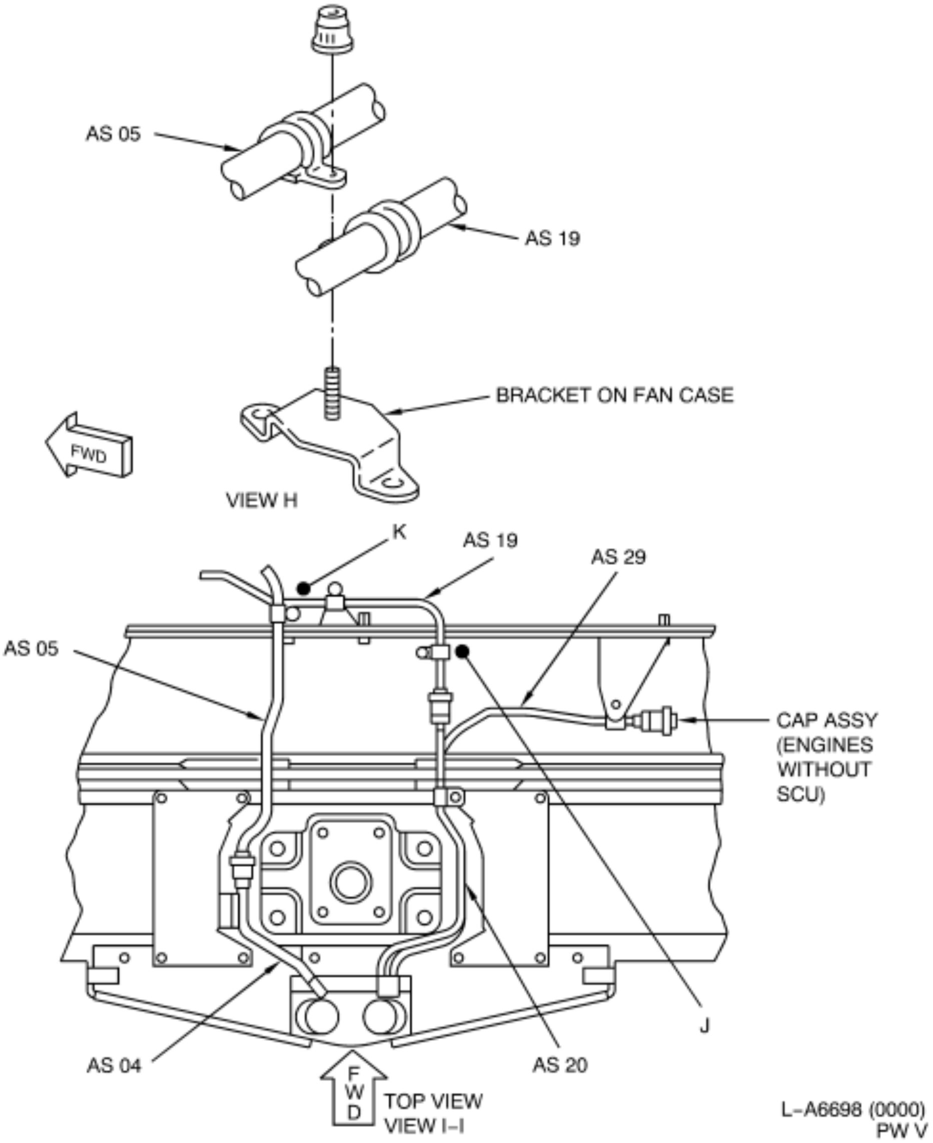
VIEW F


AS 05
BRACKET ON FAN CASE
FWD
AS 19

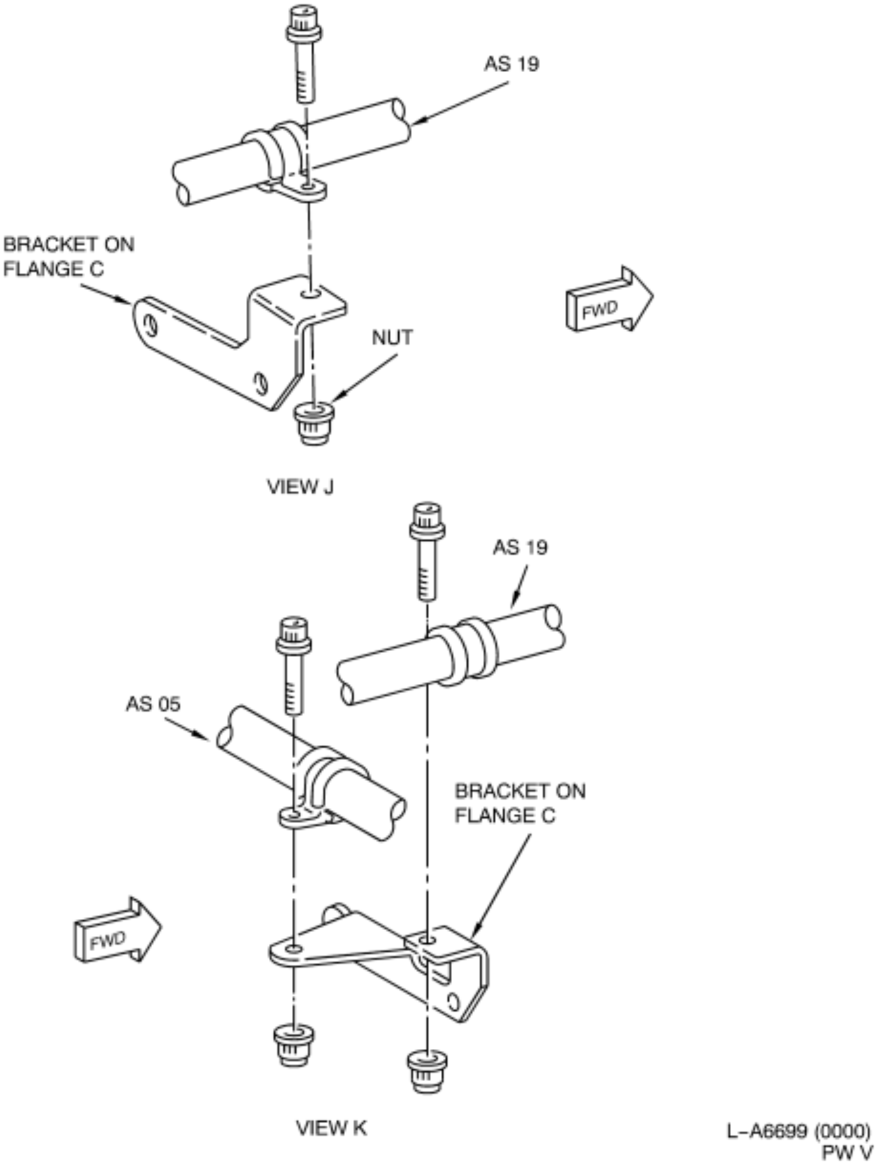
VIEW G

L−A6697 (0000)
PW V

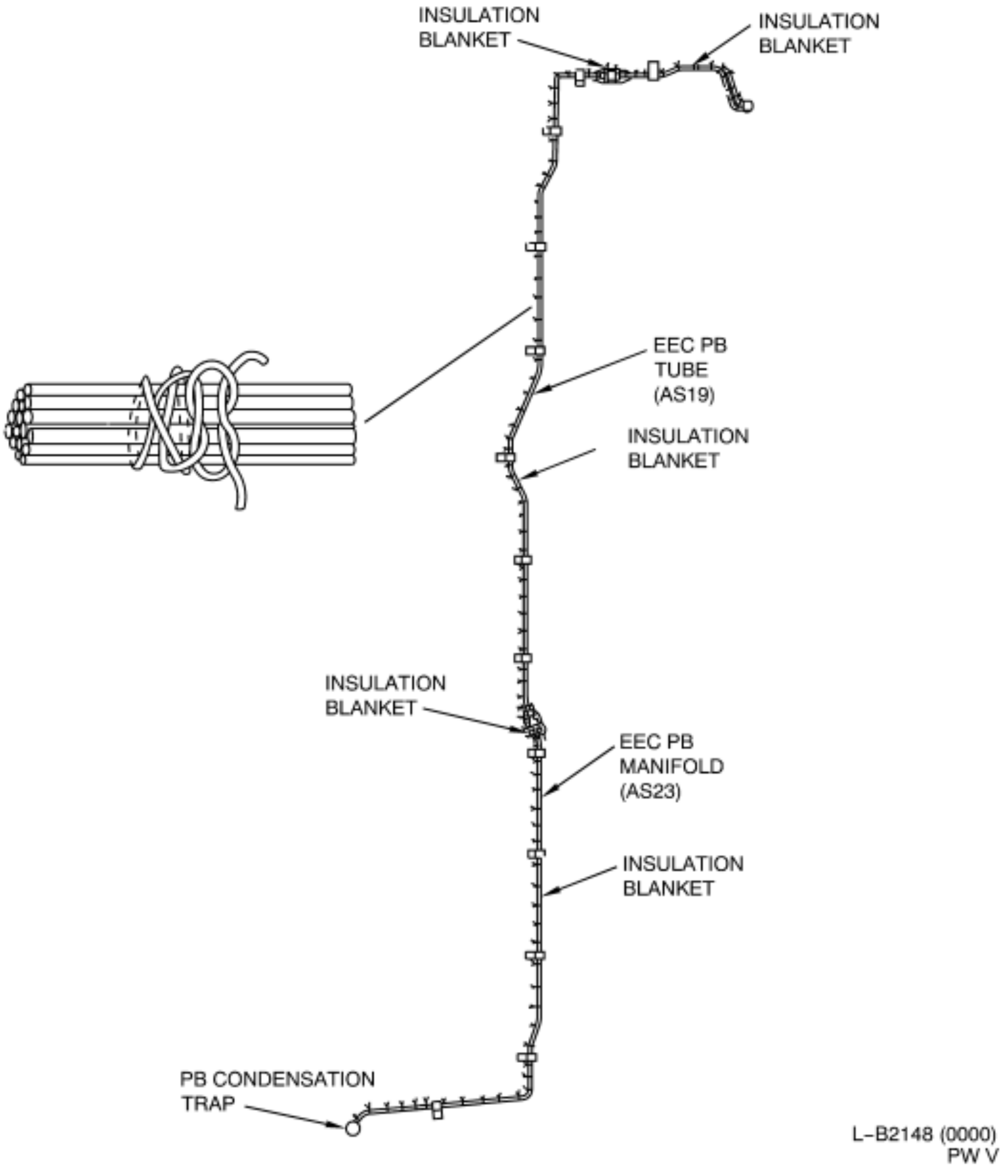
Fan Case Plumbing
Figure 403 (Sheet 5)
(Task 72−00−33−420−003−B)


AS 05
AS 19
BRACKET ON FAN CASE
FWD
VIEW H
K
AS 19
AS 29
AS 05
CAP ASSY (ENGINES WITHOUT SCU)
J
AS 04
AS 20
FWD
TOP VIEW
VIEW I-I
L-A6698 (0000)
PW V

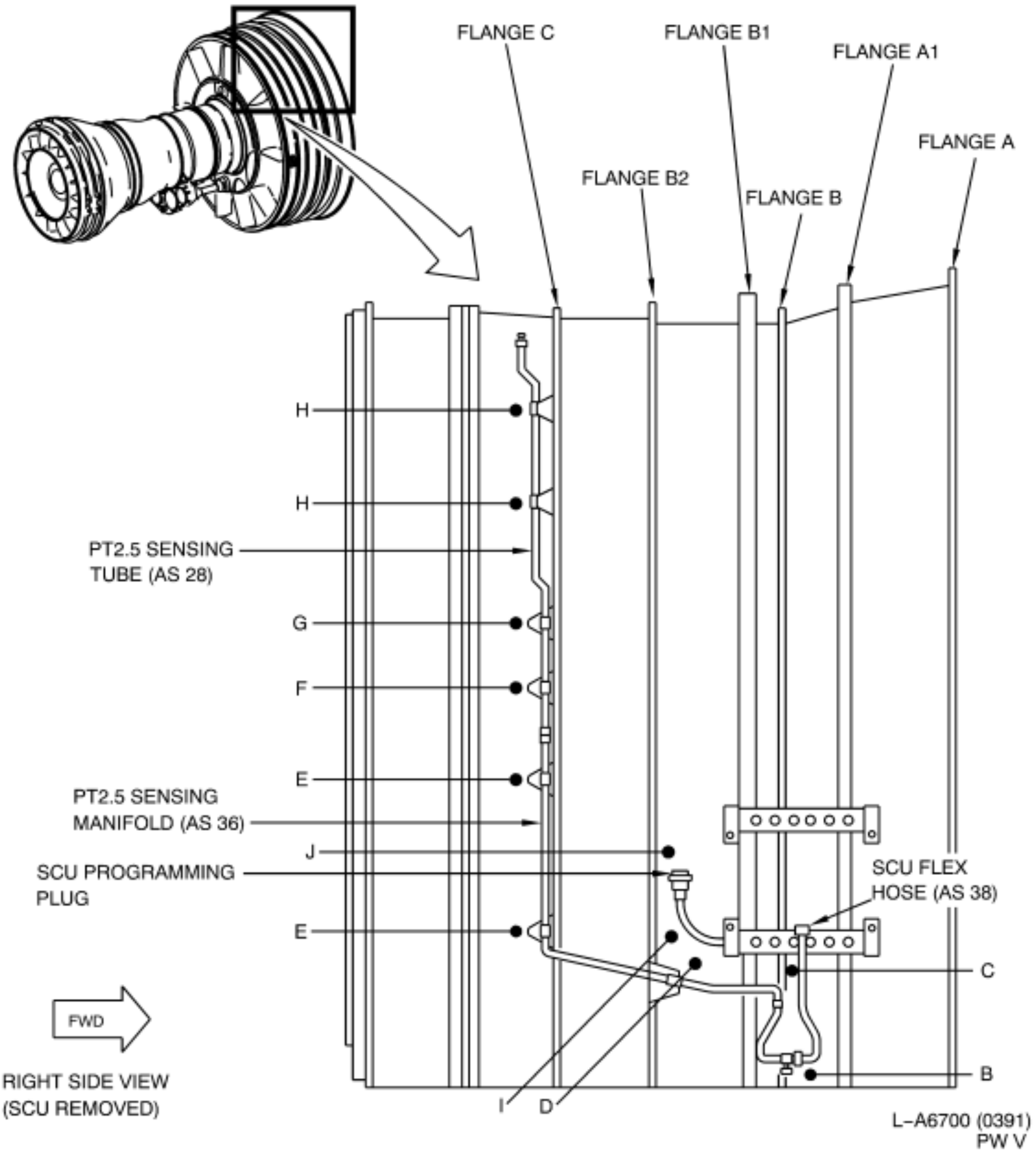
Fan Case Plumbing
Figure 403 (Sheet 6)
(Task 72-00-33-420-003-B)


AS 19
BRACKET ON FLANGE C
NUT
FWD
VIEW J
AS 19
AS 05
BRACKET ON FLANGE C
FWD
VIEW K
L−A6699 (0000)
PW V

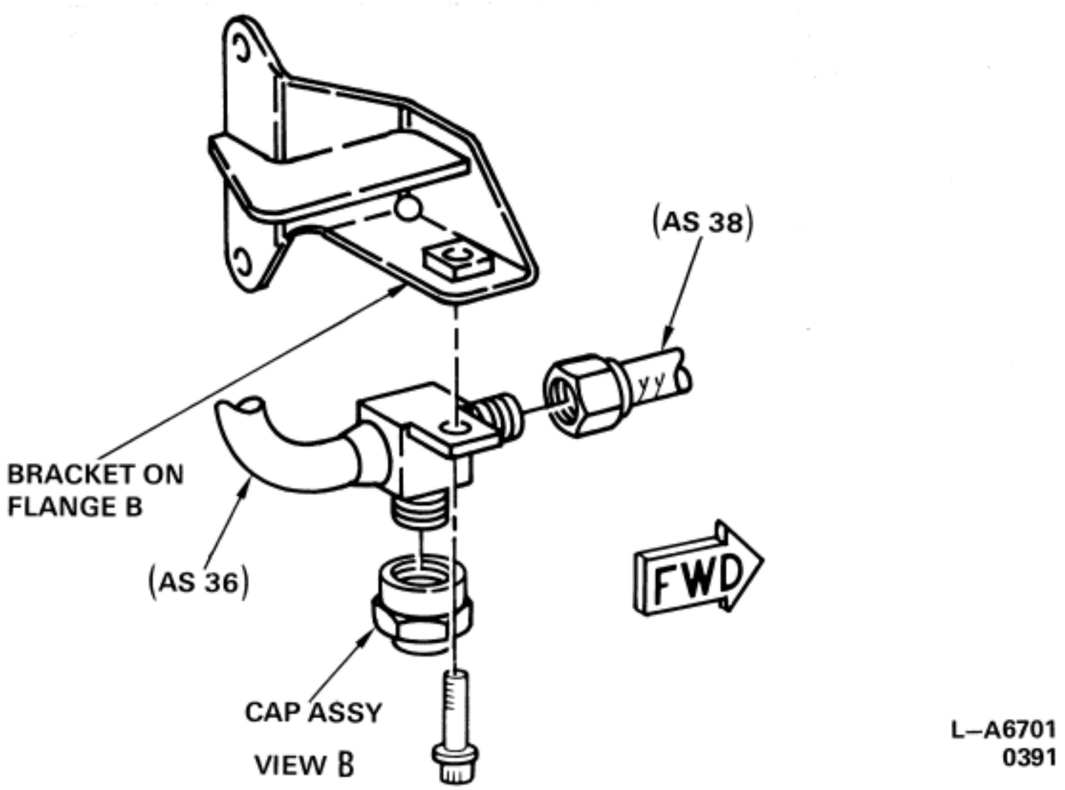
Fan Case Plumbing
Figure 403 (Sheet 7)
(Task 72−00−33−420−003−B)


INSULATION BLANKET
INSULATION BLANKET
EEC PB TUBE (AS19)
INSULATION BLANKET
INSULATION BLANKET
EEC PB MANIFOLD (AS23)
INSULATION BLANKET
PB CONDENSATION TRAP
L−B2148 (0000)
PW V

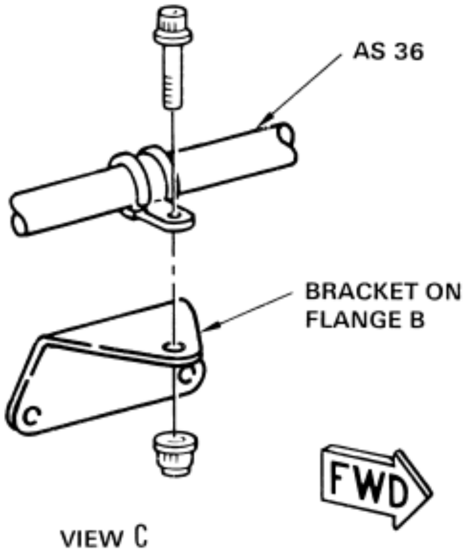
Fan Case Plumbing
Figure 403 (Sheet 8)
(Task 72−00−33−420−003−B)


FLANGE C
FLANGE B1
FLANGE A1
FLANGE A
FLANGE B2
FLANGE B
H
H
PT2.5 SENSING TUBE (AS 28)
G
F
E
PT2.5 SENSING MANIFOLD (AS 36)
J
SCU PROGRAMMING PLUG
E
SCU FLEX HOSE (AS 38)
C
B
FWD
RIGHT SIDE VIEW (SCU REMOVED)
I
D
L-A6700 (0391)
PW V

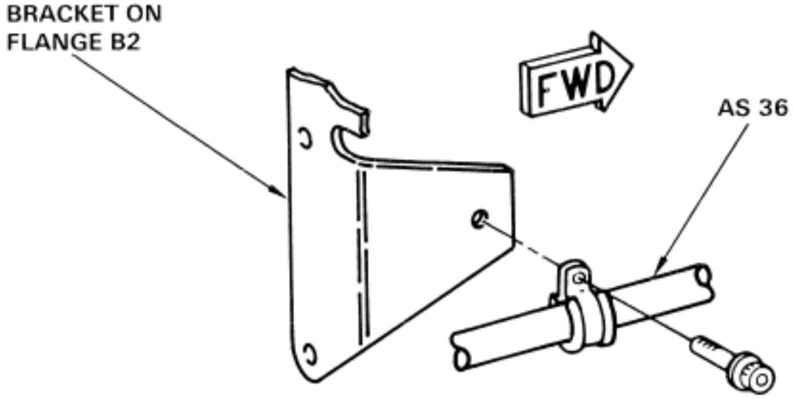
Supplemental Control Unit Plumbing
Figure 404 (Sheet 1)
(Task 72-00-33-420-003-B)


(AS 38)
BRACKET ON
FLANGE B
(AS 36)
FWD
CAP ASSY
VIEW B
L-A6701
0391

Supplemental Control Unit Plumbing
Figure 404 (Sheet 2)
(Task 72-00-33-420-003-B)


AS 36
BRACKET ON
FLANGE B
FWD

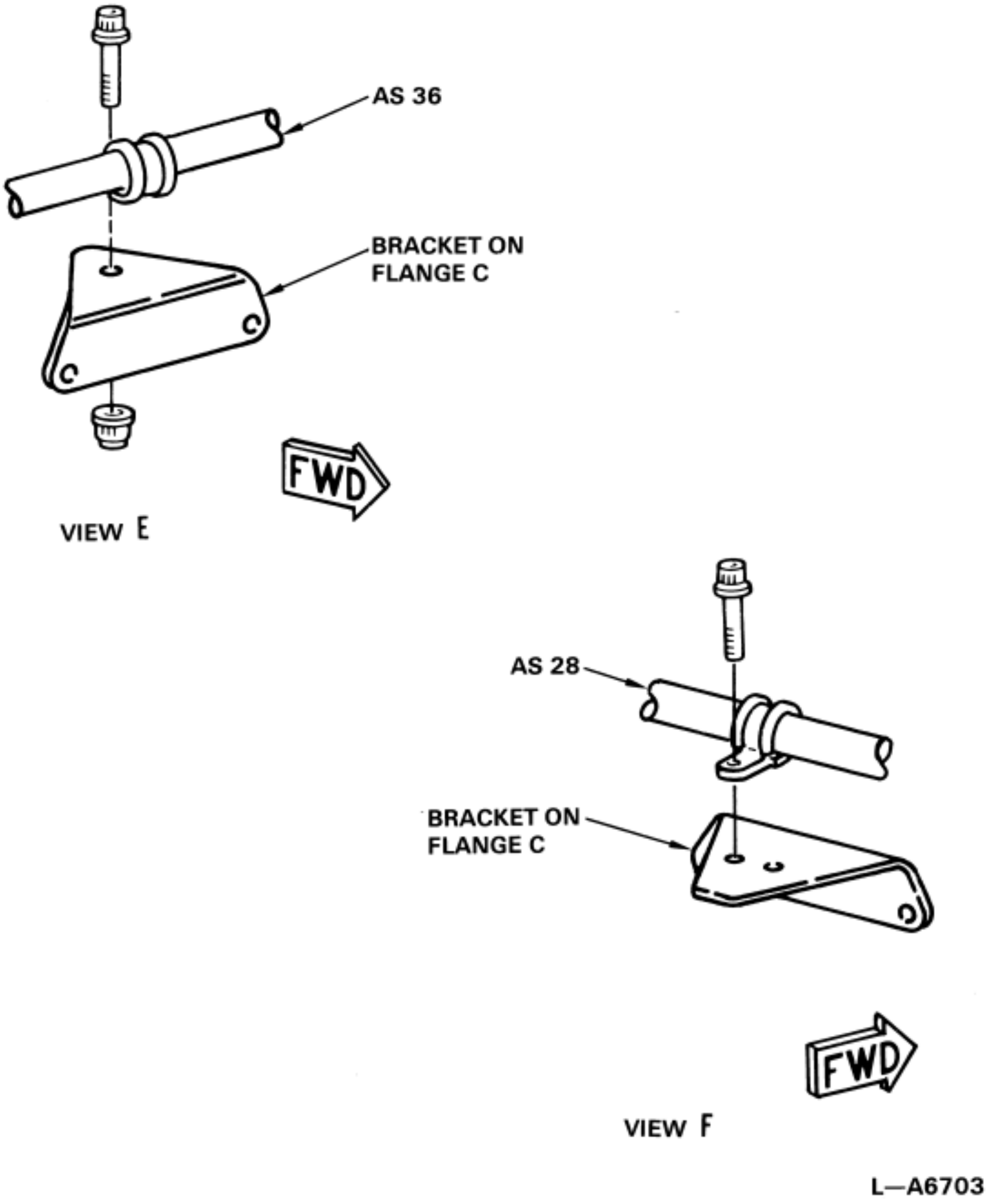
VIEW C


BRACKET ON
FLANGE B2
FWD
AS 36

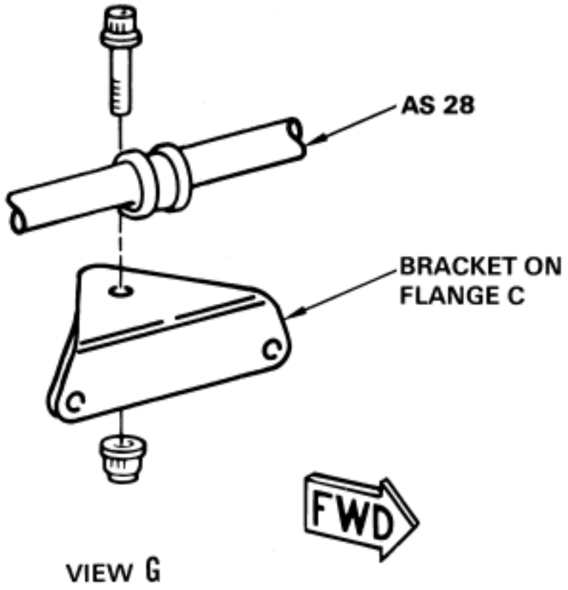
VIEW D

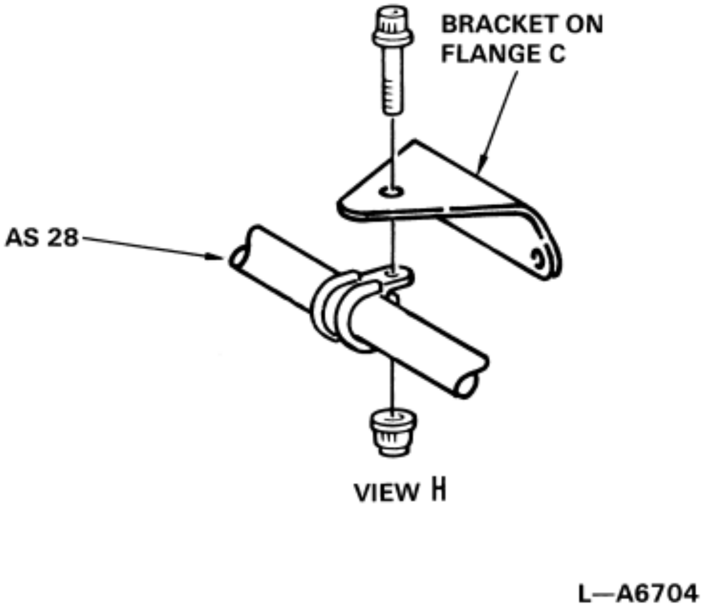
L—A6702

Supplemental Control Unit Plumbing
Figure 404 (Sheet 3)
(Task 72-00-33-420-003-B)

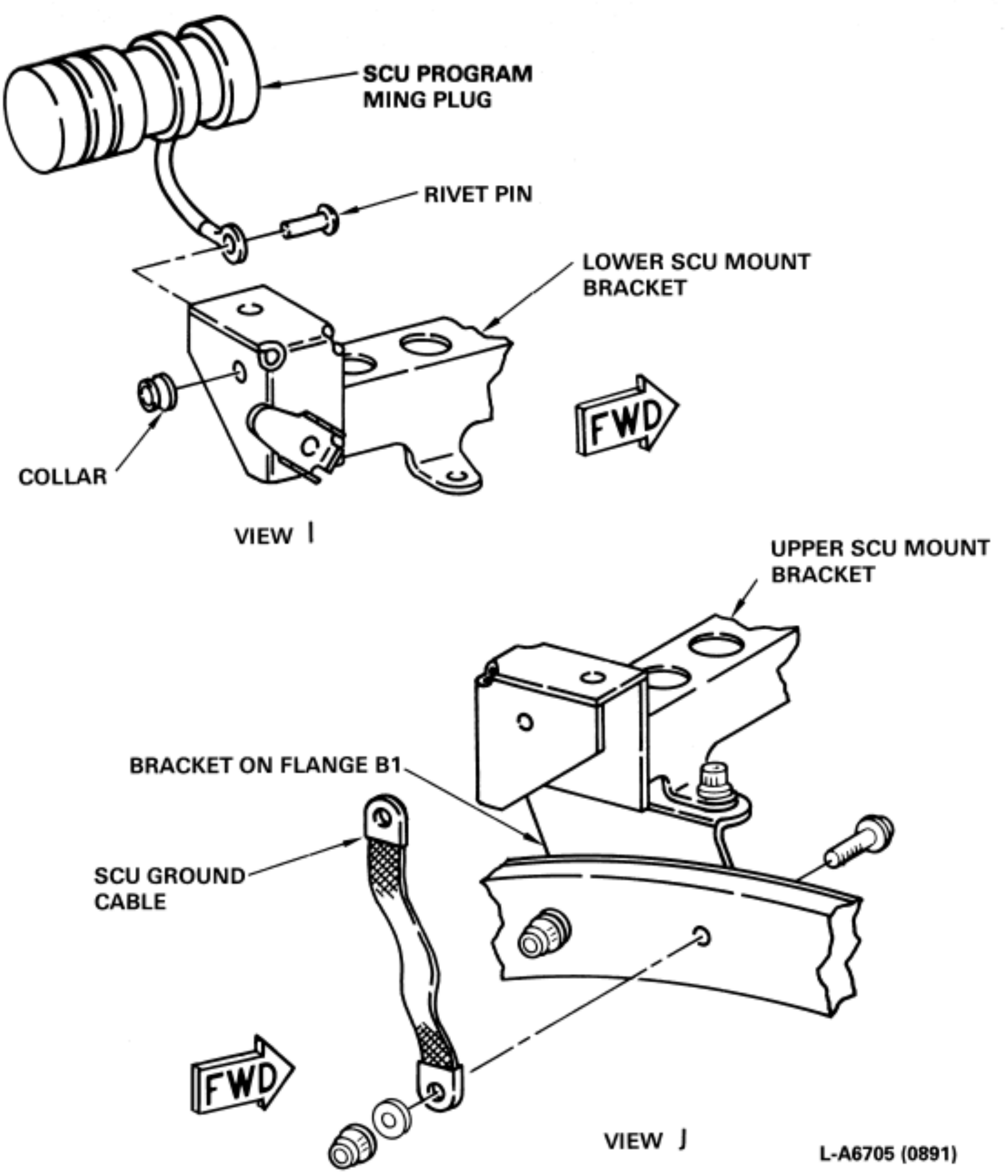

AS 36
BRACKET ON FLANGE C
FWD
VIEW E
AS 28
BRACKET ON FLANGE C
FWD
VIEW F
L—A6703

Supplemental Control Unit Plumbing
Figure 404 (Sheet 4)
(Task 72-00-33-420-003-B)


AS 28
BRACKET ON FLANGE C
FWD
VIEW G


BRACKET ON FLANGE C
AS 28
VIEW H
L—A6704

Supplemental Control Unit Plumbing
Figure 404 (Sheet 5)
(Task 72-00-33-420-003-B)


SCU PROGRAMMING PLUG
RIVET PIN
LOWER SCU MOUNT BRACKET
FWD
COLLAR
VIEW I
UPPER SCU MOUNT BRACKET
BRACKET ON FLANGE B1
SCU GROUND CABLE
FWD
VIEW J
L-A6705 (0891)

Supplemental Control Unit Plumbing
Figure 404 (Sheet 6)
(Task 72−00−33−420−003−B)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - FAN CASE - INSTALLATION-03

Task 72-00-33-420-002-A:

1. Install Front Fan Case For Basic Engines

A. Equipment And Materials Required

Special Tools:

PWA 76154	Adapter (2 Necessary)
PWA 76155	Sling
PWA 85676	Adapter (2 Necessary) (Optional to PWA 86423)
PWA 85677	Bracket, Handling
PWA 86423	Adapter, Lift And Trunnion (2 Necessary)
PWA 87166	Stand, Support
PWA 101960	Adapter, Support

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

B. Procedure
See Figure 401.

CAUTION: DO NOT USE LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF EEC CAN RESULT.

(1) If new case is to be installed, comply with the following:

(a) Install the Flange A1 hardware as follows. Refer to 72-33-00, Assembly-20 (Task 72-33-00-430-020).

(2) Install EEC data entry plug lanyard to Flange A1 at approximately 10 o'clock position with bolt, head forward, threads lubricated with Engine Oil P03-001, washers and nut. Torque bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

ENGINE GENERAL − FAN CASE − INSTALLATION−03

(3) Remove the front fan case from the stand as follows. See Figure 402.

(a) If not installed, install either PWA 86423 Adapters or PWA 85676Adapters on the front fan case at 3 and 9 o'clock.

(b) Install PWA 76155 Sling on a hoist.

(c) Install two PWA 76154 Adapters on the sling.

(d) Install the adapters over the adapters on the front fan case. Lift the front fan case.

NOTE: If the front fan case is in horizontal (flight) position, it is permitted to use PWA 85677 Bracket at 12 o'clock as an alternative to the adapters and sling.

(4) Position inlet case to case and vane assembly aligning dowel pin in fan case with dowel pin hole in case and vane assembly. Tap fan case with fiber mallet to seat.

(5) Install the Flange B hardware as follows. Refer to 72−33−00, Assembly−21 (Task 72−33−00−430−021).

(6) Install bolt, threads lubricated with Engine Oil P03−001, and nut to secure EEC ground strap to upper front mount bracket. Torque nut to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(7) Remove hoist, bracket and adapters from fan case.

(8) Install EEC PT4.95 (AS24) and EEC PB (AS23) manifold assemblies as follows. See Figure 403.

(a) Remove protective closures and install manifolds to tube nuts at approximately 11 o'clock position rearward of Flange B1 handtight only.

(b) Install bolts, threads lubricated with Engine Oil P03−001, spacer, nuts and clamps securing manifolds to Flange B brackets and Flange B1 bracket between 9 and 10 o'clock positions. Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) For engines not equipped with propulsion multiplexer unit (PMUX), torque tube nuts rearward of of Flange B1 at approximately 10:30 o'clock position to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nuts.

(d) For engines equipped with propulsion multiplexer unit (PMUX), torque PT4.95 tube nut to manifold coupling at approximately 10:30 o'clock position to 270 − 300 lb−in. (30.506 − 33.895 N.m) and PB tube nut to manifold coupling at approximately 10:30 o'clock position to 135 − 150 lb−in. (15.253 − 16.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nuts. (Engines with PMUX incorporate smaller Diameter PB tube and manifold).

(9) Install PT4.95 (AS13) and PB (AS12) hose assemblies as follows.

(a) Install hoses to manifold tees handtight only.

(b) Install bolt, threads lubricated with Engine Oil P03−001, spacer, nut and clamps securing hose to Flange B bracket at approximately 9 o'clock position. Torque clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Torque (larger) PT4.95 hose nut to 450 − 500 lb−in. (50.843 − 56.492 N.m).

1 (Post SPN No. P3042 and Post SB PW4ENG 72−645) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(d) Torque (smaller) PB hose nut to 200 − 225 lb−in. (22.597 − 25.422 N.m).

(10) Install EEC PT2 (AS16) and EEC PAM (AS17) tube assemblies as follows.

(a) Remove protective closures and install tubes to adapters on Flange A1 bracket at approximately 12 o'clock position and to tube couplings at approximately 11 o'clock position handtight only.

(b) Install bolts, threads lubricated with Engine Oil P03-001, nuts and clamps securing tubes to Flange B brackets between 12 and 11 o'clock positions.

(c) Install bolt, threads lubricated with Engine Oil P03-001, nut and clamps securing tubes to Flange B1 bracket at approximately 11 o'clock position. Torque all clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Torque (larger) PAM tube nuts to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(e) Torque (smaller) PT2 tube nuts to 135 - 150 lb-in. (15.253 - 16.948 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(11) Install bolt, threads lubricated with Engine Oil P03-001, nut and clamp securing EEC wiring harness to Flange A1 bracket at approximately 9 o'clock position. Torque clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m). See Figure 404.

NOTE: To allow for variances in harness diameter, it is permissible to select alternate clamp sizes, larger or smaller, to secure electrical harnesses and to prevent harness slipping and/or rotation. See Illustrated Parts Catalog for applicable clamp sizes.

(12) Install the Flange A1 hardware as follows. Refer to 72-33-00, Addembly-20 (Task 72-33-00-430-020).

C. Postrequisites

(1) Install electronic engine control. See 72-00-33, Installation-04 (Task 72-00-33-450-001).

(2) For engines equipped, install propulsion multiplexer unit. See 72-00-33, Installatin-09 (Task 72-00-33-450-004).

(3) Install all Stage 1 LPC blade assemblies. See 72-00-31, Installation-04 (Task 72-00-31-420-002-002).

(4) Test engine per Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).

Task 72-00-33-420-002-B:

2. Install Front Fan Case For Engines With The Airbus/McDonnell Douglas Common Parts Configuration

A. Equipment And Materials Required

Special Tools:

PWA 76154	Adapter (2 Necessary)
PWA 76155	Sling (Optional)
PWA 85676	Adapter (2 Necessary) (Optional To PWA 86423)
PWA 85677	Bracket, Handling
PWA 86423	Adapter, Lift And Trunnion (2 Necessary)
PWA 87166	Stand, Support
PWA 101960	Adapter, Support

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

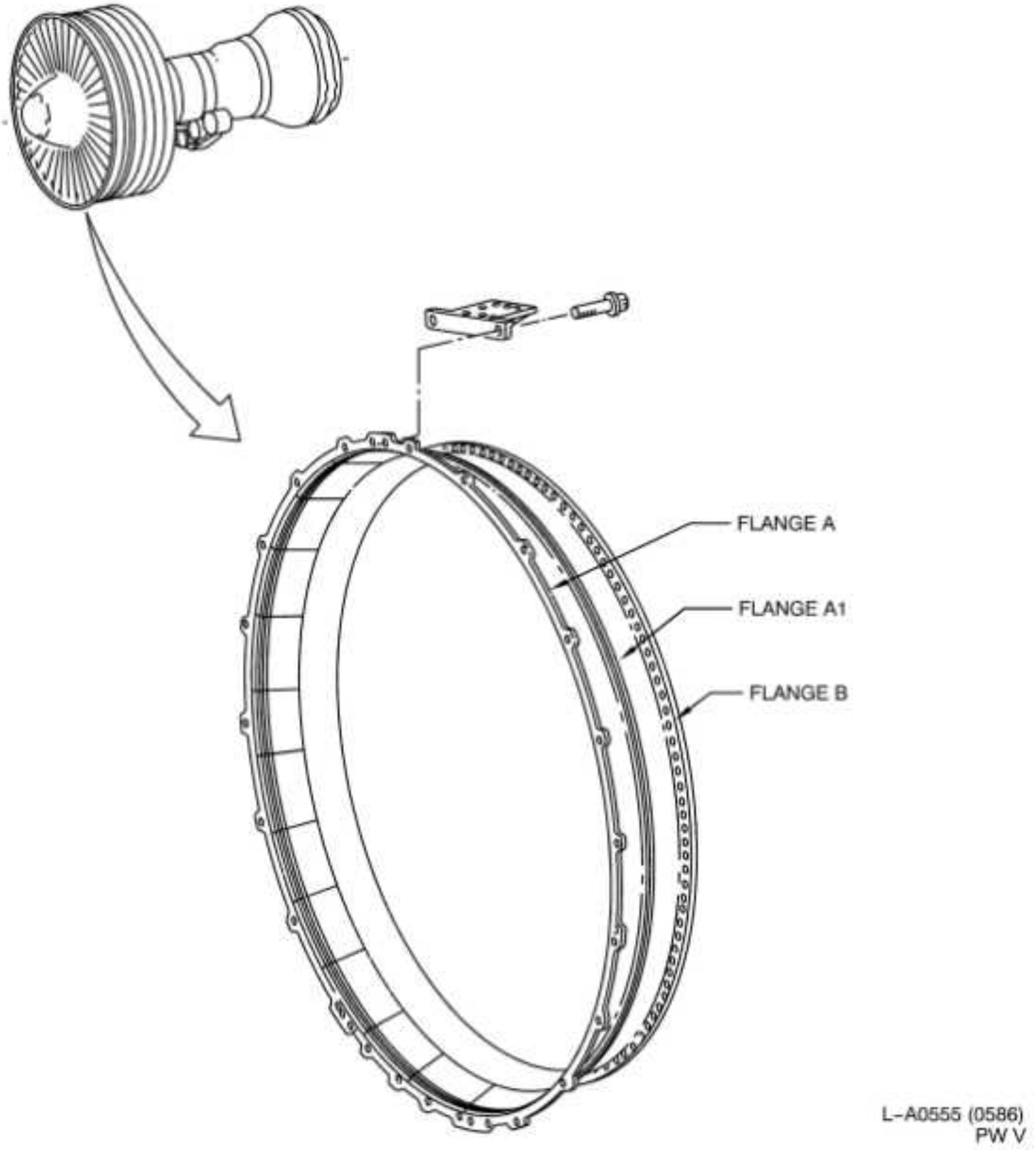
B. Procedure
See Figure 405.

CAUTION: DO NOT USE LUBRICANTS ON THE EEC OR SCU (OPTIONAL) SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF THE EEC OR SCU CAN RESULT.

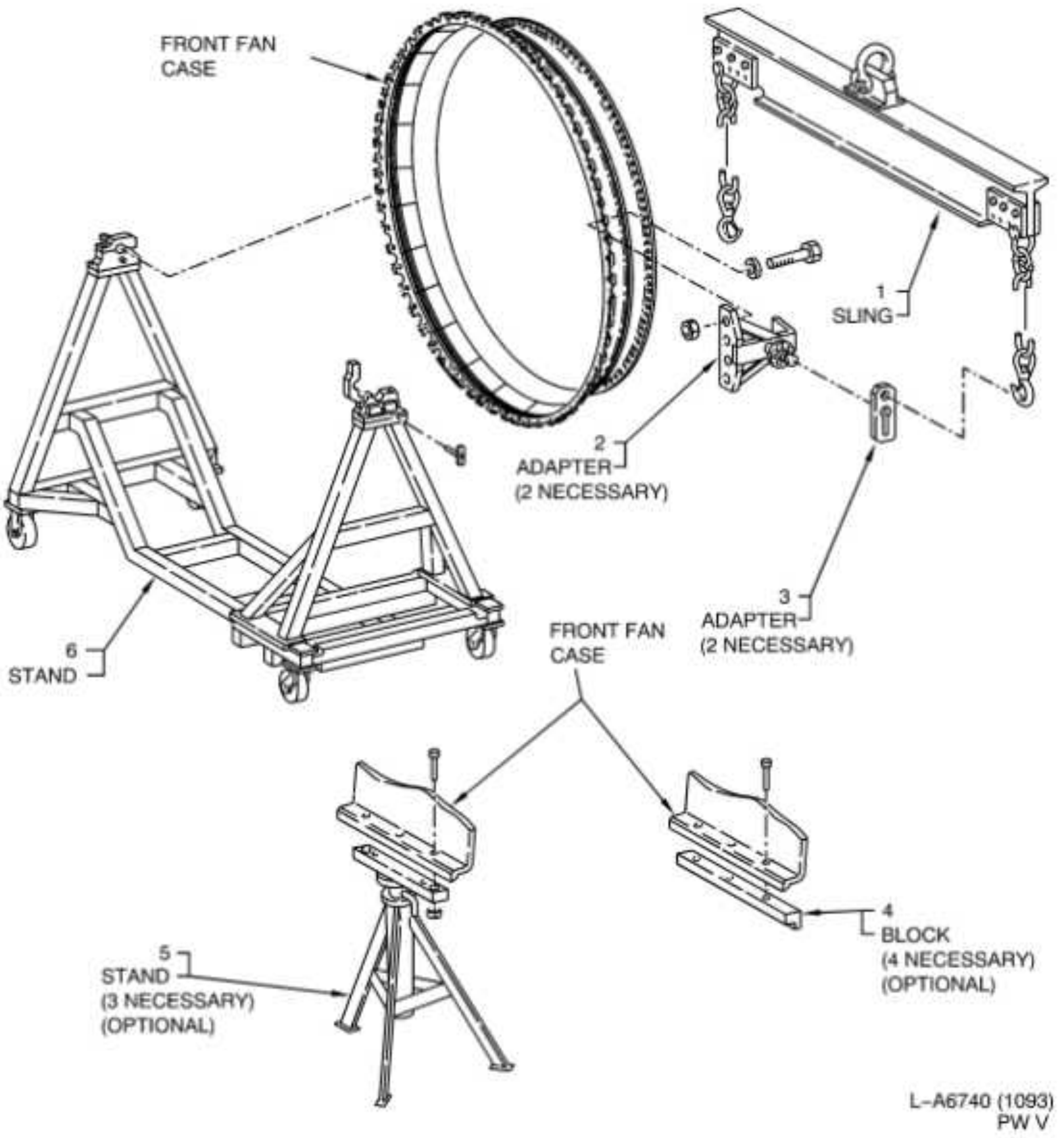
(1) If a new case is to be installed, do the following:

(a) Install the Flange A1 hardware as follows. Refer to 72-33-00, Assembly-20 (Task 72-33-00-430-020).

(2) Remove the front fan case from the stand as follows. See Figure 406.


FLANGE A
FLANGE A1
FLANGE B
L−A0555 (0586)
PW V

Procedure Sequence
Figure 401
(Task 72−00−33−420−002−A)


FRONT FAN CASE
1
SLING
2
ADAPTER
(2 NECESSARY)
3
ADAPTER
(2 NECESSARY)
6
STAND
FRONT FAN CASE
4
BLOCK
(4 NECESSARY)
(OPTIONAL)
5
STAND
(3 NECESSARY)
(OPTIONAL)
L-A6740 (1093)
PW V

Removal Of The Front Fan Case From The Stand
Figure 402
(Task 72-00-33-420-002-A)

1. PWA 76155
2. PWA 86423 Or PWA 85676
3. PWA 76154
4. PWA 85750
5. PWA 85678 Or PWA 87166 With PWA 101960
6. PWA 87078 Or PWA 85450

Key to Figure 402

(a) If not installed, install either PWA 86423 Adapters or PWA 85676 Adapters on the front fan case at 3 and 9 o'clock.

(b) Install PWA 76155 Sling on a hoist.

(c) Install two PWA 76154 Adapters on the sling.

(d) Install the adapters over the adapters on the front fan case. Lift the front fan case.

NOTE: If the front fan case is in the horizontal (flight) position, it is permitted to use the PWA 85677 Bracket at 12 o'clock as an alternative to the adapters and sling.

(3) Install the inlet case to the case and vane assembly by aligning the dowel pin in the fan case with the dowel pin hole in the case and vane assembly. Tap the fan case with a fiber mallet to have the case against the case and vane assembly.

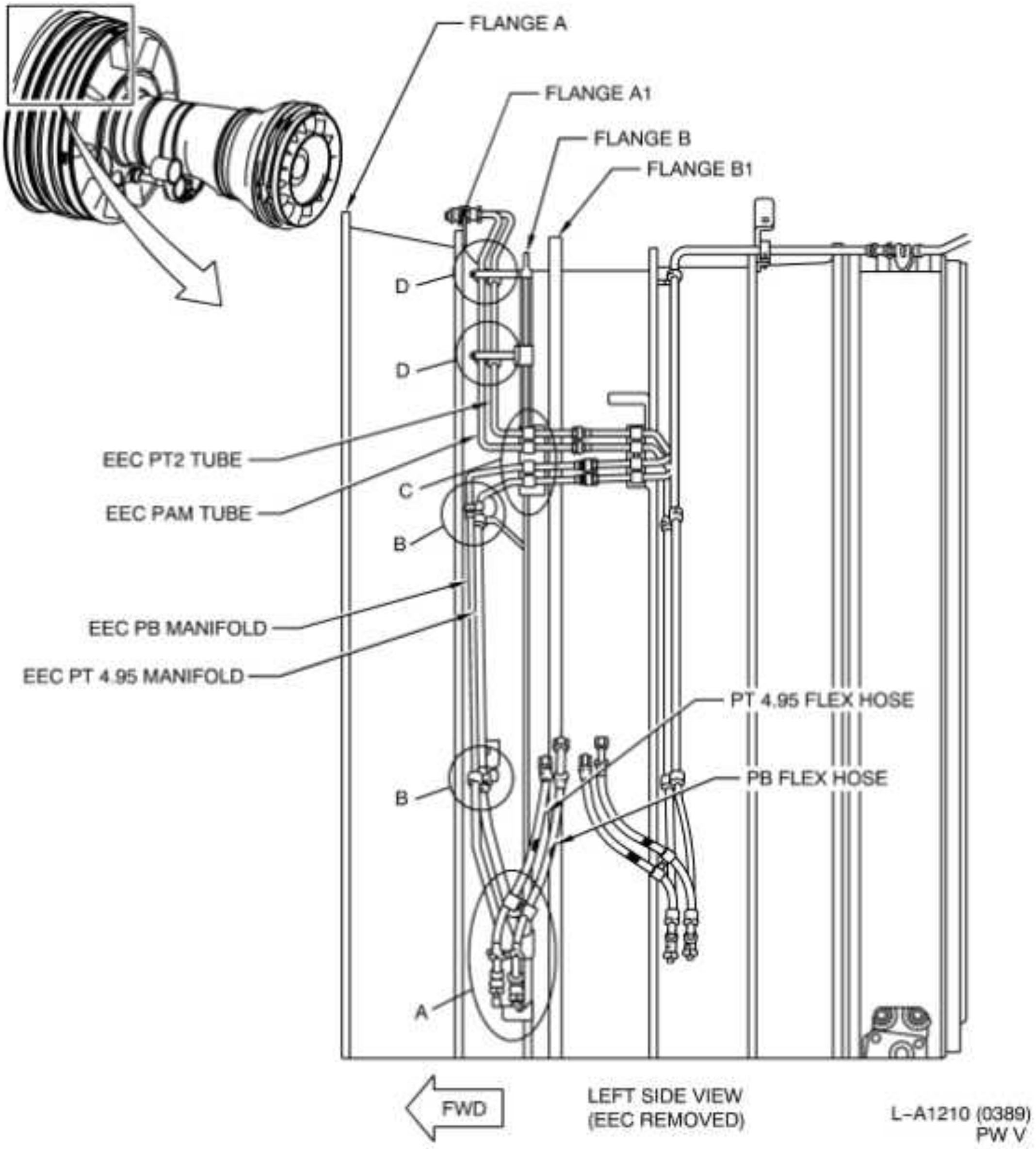
(4) Install the Flange B hardware as follows. Refer to 72−33−00, Assembly−21 (Task 72−33−00−430−021).

(5) Remove hoist, bracket and adapters from the fan case.

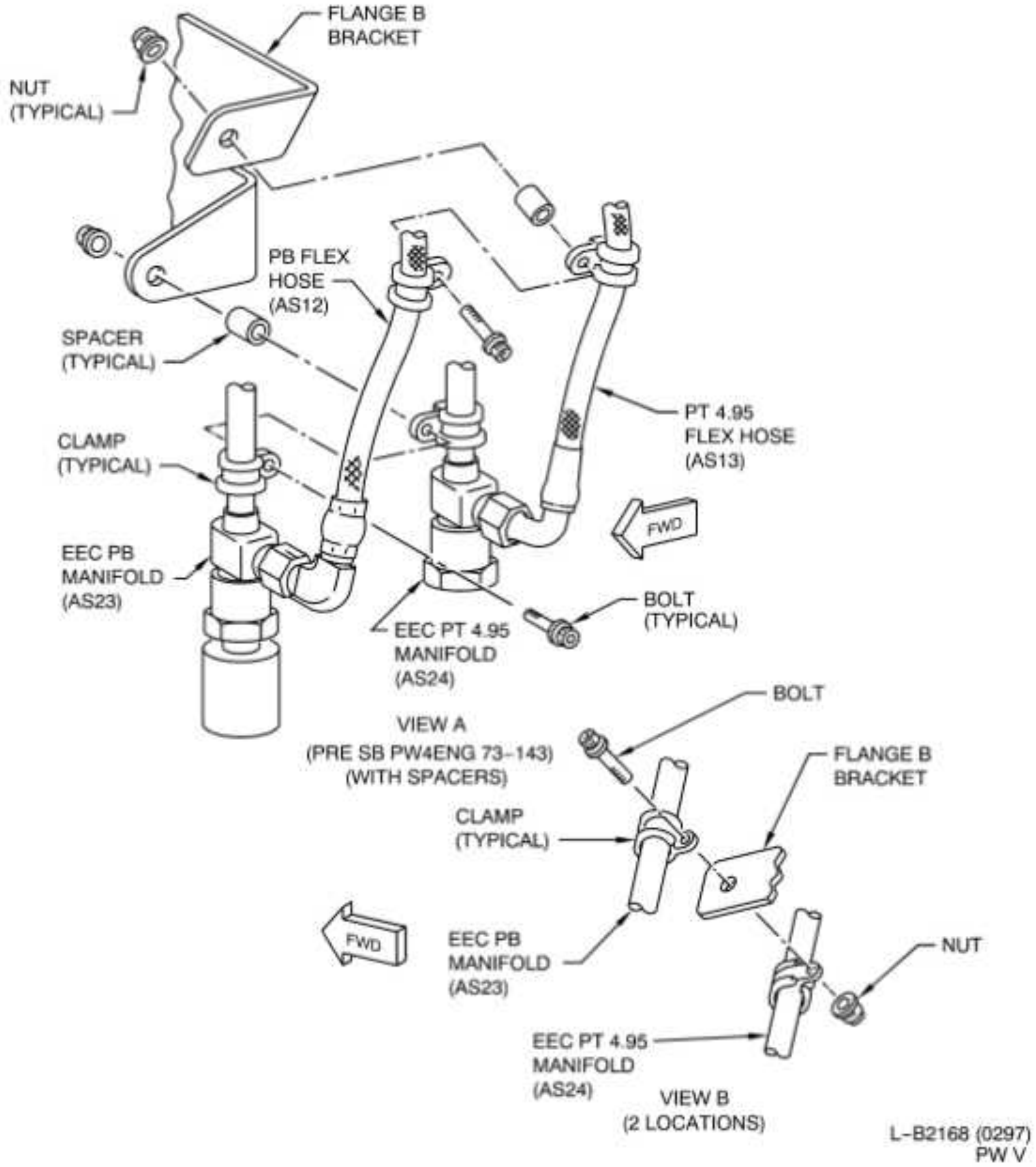
(6) Install the EEC PT2 manifold assembly (AS16) as follows. See Figure 407.

(a) Remove the protection covers and install the tee end of the manifold to a bracket between Flanges A1 and B1 located at the 9 o'clock position. Install the opposite end of the manifold to the smaller adapter at the 12 o'clock position and tighten the manifold nut by hand.

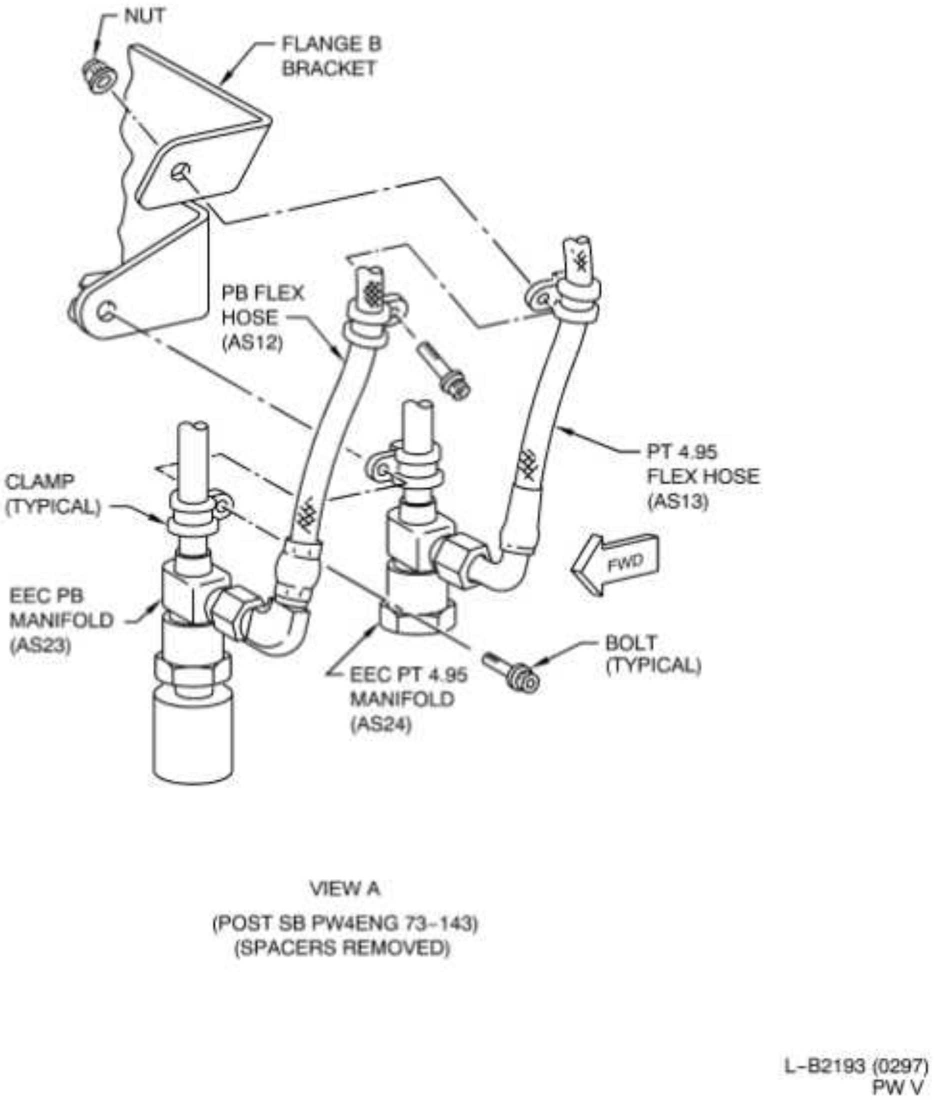
(b) Attach the manifold (tee) to the bracket at the 9 o'clock position with a bolt, threads lubricated with Engine Oil P03−001 and tighten by hand.


FLANGE A
FLANGE A1
FLANGE B
FLANGE B1
D
D
EEC PT2 TUBE
EEC PAM TUBE
C
B
EEC PB MANIFOLD
EEC PT 4.95 MANIFOLD
PT 4.95 FLEX HOSE
PB FLEX HOSE
B
A
FWD
LEFT SIDE VIEW
(EEC REMOVED)
L−A1210 (0389)
PW V

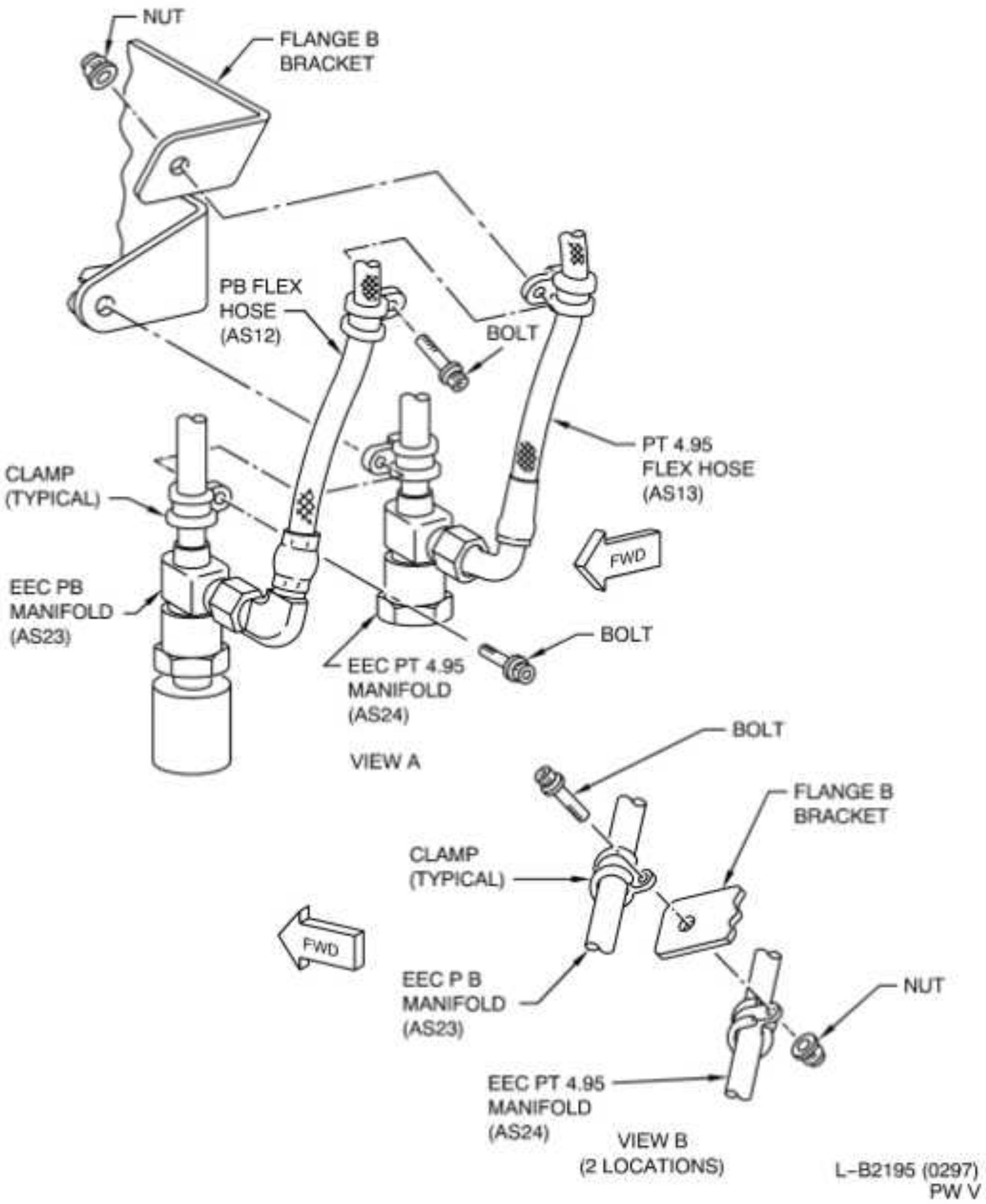
External Plumbing Installation
Figure 403 (Sheet 1)
(Task 72−00−33−420−002−A)


FLANGE B BRACKET
NUT (TYPICAL)
PB FLEX HOSE (AS12)
SPACER (TYPICAL)
PT 4.95 FLEX HOSE (AS13)
CLAMP (TYPICAL)
FWD
EEC PB MANIFOLD (AS23)
BOLT (TYPICAL)
EEC PT 4.95 MANIFOLD (AS24)
VIEW A
(PRE SB PW4ENG 73-143)
(WITH SPACERS)
BOLT
FLANGE B BRACKET
CLAMP (TYPICAL)
FWD
EEC PB MANIFOLD (AS23)
NUT
EEC PT 4.95 MANIFOLD (AS24)
VIEW B
(2 LOCATIONS)
L-B2168 (0297)
PW V

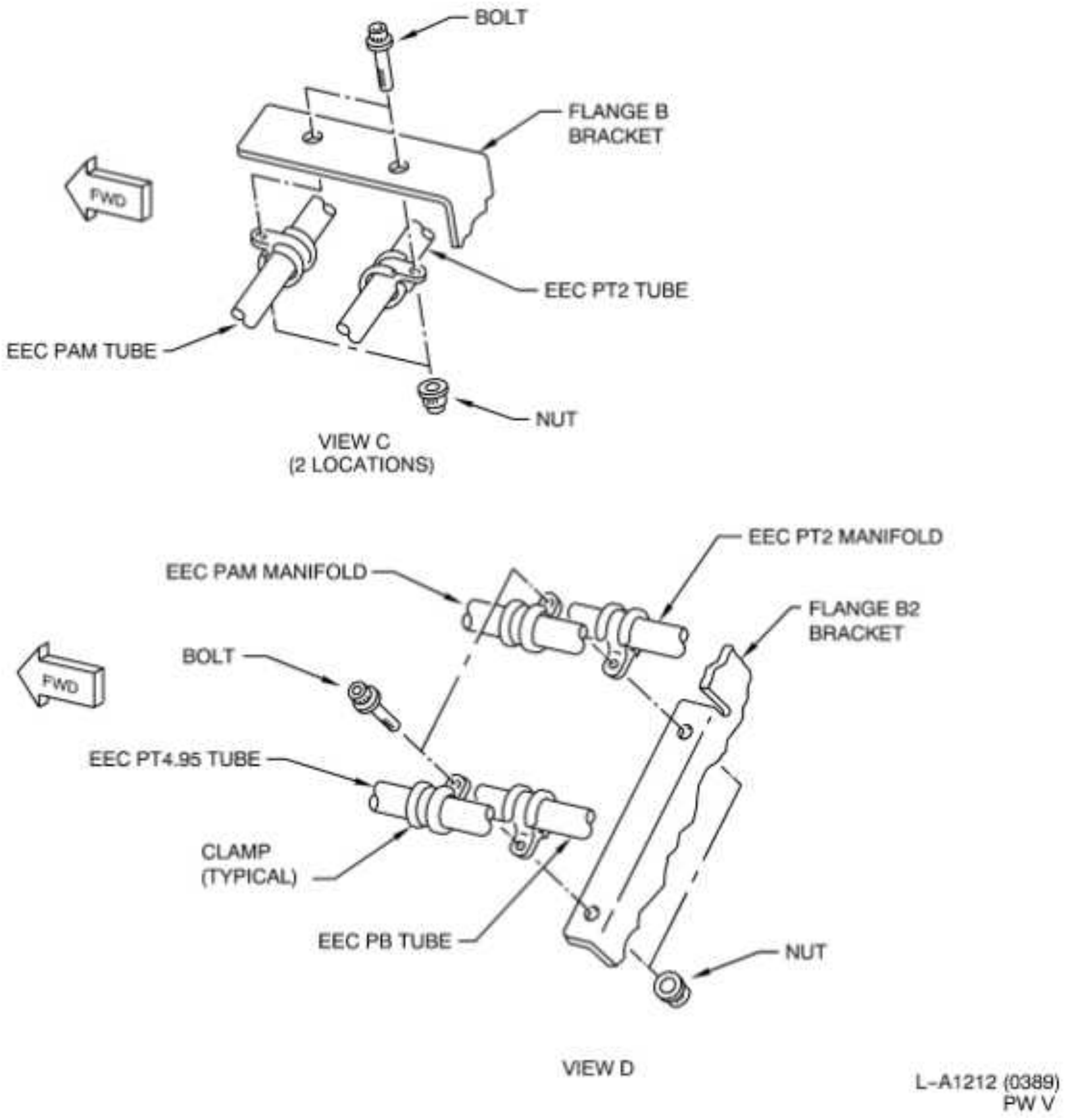
External Plumbing Installation
Figure 403 (Sheet 2)
(Task 72−00−33−420−002−A)


NUT
FLANGE B BRACKET
PB FLEX HOSE (AS12)
PT 4.95 FLEX HOSE (AS13)
CLAMP (TYPICAL)
FWD
EEC PB MANIFOLD (AS23)
BOLT (TYPICAL)
EEC PT 4.95 MANIFOLD (AS24)
VIEW A
(POST SB PW4ENG 73-143)
(SPACERS REMOVED)
L-B2193 (0297)
PW V

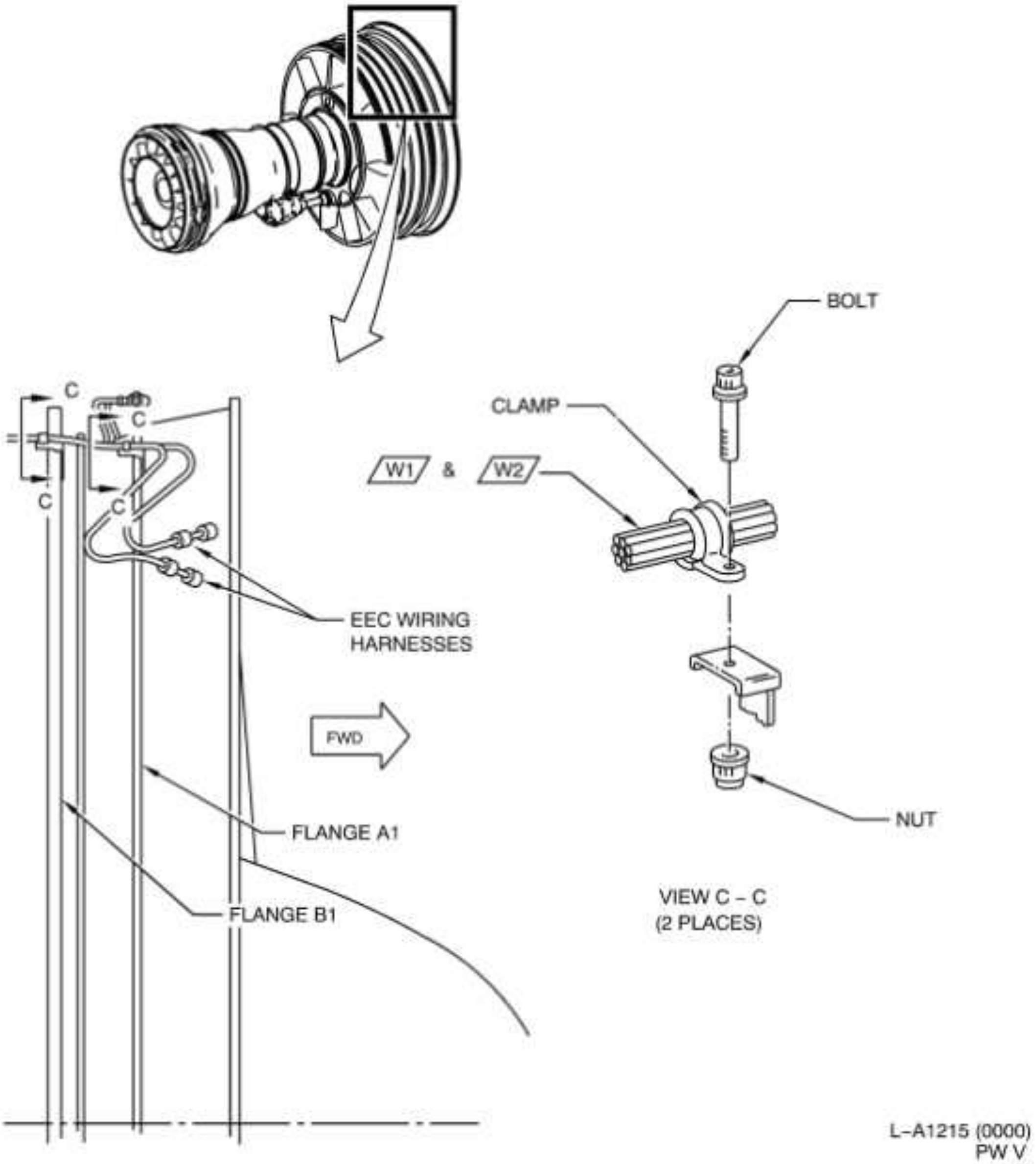
External Plumbing Installation
Figure 403 (Sheet 3)
(Task 72−00−33−420−002−A)


NUT
FLANGE B BRACKET
PB FLEX HOSE (AS12)
BOLT
PT 4.95 FLEX HOSE (AS13)
CLAMP (TYPICAL)
FWD
EEC PB MANIFOLD (AS23)
BOLT
EEC PT 4.95 MANIFOLD (AS24)
VIEW A
BOLT
FLANGE B BRACKET
CLAMP (TYPICAL)
FWD
EEC P B MANIFOLD (AS23)
NUT
EEC PT 4.95 MANIFOLD (AS24)
VIEW B (2 LOCATIONS)
L−B2195 (0297)
PW V

External Plumbing Installation
Figure 403 (Sheet 4)
(Task 72−00−33−420−002−A)


BOLT
FLANGE B BRACKET
FWD
EEC PT2 TUBE
EEC PAM TUBE
NUT
VIEW C
(2 LOCATIONS)
EEC PT2 MANIFOLD
EEC PAM MANIFOLD
FLANGE B2 BRACKET
BOLT
FWD
EEC PT4.95 TUBE
CLAMP
(TYPICAL)
EEC PB TUBE
NUT
VIEW D
L-A1212 (0389)
PW V

External Plumbing Installation
Figure 403 (Sheet 5)
(Task 72−00−33−420−002−A)


BOLT
CLAMP
W1 & W2
C
C
C
C
EEC WIRING HARNESSES
FWD
FLANGE A1
FLANGE B1
NUT
VIEW C - C
(2 PLACES)
L-A1215 (0000)
PW V

Wiring Harness Installation
Figure 404
(Task 72-00-33-420-002-A)

(c) Install seven clamps to the manifold assembly at seven bracket locations on Flange B.

(7) Install the EEC PT4.95 sensing manifold assembly (AS24) as follows.

NOTE: If necessary loosen the bracket (bridged between Flanges B2 and C) to install the tube clamps and tubes (AS23) and (AS24).

(a) Remove the protection covers and install the tee end of the manifold to a bracket between Flanges A1 and B1 located at the 9 o'clock position. Install the coupling end of the manifold rearward of Flange B2 at the 10:30 o'clock position.

(b) Attach the manifold (tee) to the bracket at the 9 o'clock position with a bolt, threads lubricated with Engine Oil P03−001 and tighten by hand.

(c) Attach the manifold to a bracket on Flange B1 at the 9 o'clock position with a clamp and a bolt, threads lubricated with Engine Oil P03−001. Tighten the bolt by hand.

(d) Install a clamp to the manifold at a bracket location (bridged) between Flanges B2 and C at the 9:30 o'clock position. (Bolt is installed with the fan case harnesses).

(e) Install three clamps to the manifold assembly at three bracket locations between Flanges B2 and C.

(8) Install the EEC PAM manifold assembly (AS17) as follows.

(a) Remove the protection covers and install the tee end of the manifold to a bracket between Flanges A1 and B1 located at the 9 o'clock position. Install the opposite end of the manifold to the adapter at the 12 o'clock position and tighten the manifold nut by hand.

(b) Attach the manifold (tee) to the bracket at the 9 o'clock position with a bolt, threads lubricated with Engine Oil P03−001 and tighten by hand.

(c) Install seven clamps to the manifold assembly at seven bracket locations on Flange B.

(d) Attach the seven clamps on the EEC PT2 manifold (AS16) and the seven clamps on the EEC PAM manifold (AS17) to the brackets on Flange B with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque the bolt that attaches the manifold tee to the bracket at the 9 o'clock position to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Torque the manifold nut to the adapter at the 12 o'clock position to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the manifold nut.

(9) Torque the EEC PT2 manifold assembly (AS16) as follows:

(a) Torque the bolt that attaches the manifold tee to the bracket at the 9 o'clock position to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(b) Torque the manifold nut to the adapter at the 12 o'clock position to 135 − 150 lb−in. (15.253 − 16.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the manifold nut.

(10) Install the EEC PB manifold assembly (AS23) as follows.

(a) Remove the protection covers and install the tee end of the manifold to a bracket between Flanges A1 and B1 located at the 9 o'clock position. Install the coupling end of the manifold rearward of Flange B2 at the 10:30 o'clock position.

(b) Attach the manifold (tee) to the bracket at the 9 o'clock position with a bolt, threads lubricated with Engine Oil P03−001 and tighten by hand.

(c) Attach the manifold to a bracket on Flange B1 at the 9 o'clock position with a clamp and a bolt, threads lubricated with Engine Oil P03−001. Tighten the bolt by hand.

(d) Install a clamp to the manifold at a bracket location (bridged) between Flanges B2 and C at the 9:30 o'clock position. Attach the clamps on the (AS23) and (AS24) manifolds, and the W1 harness to the bracket with a bolt, threads lubricated with Engine Oil P03−001 and nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

NOTE: If the bracket (bridged between Flanges B2 and C) has been loosened for installation of the tube clamps and tubes (AS23) and (AS24) do as follows. Torque again the nuts that attach the bracket to the flanges to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(e) Install three clamps to the manifold assembly at three bracket locations between Flanges B2 and C.

(f) Attach the three clamps on the PT4.95 sensing manifold (AS24) and the three clamps on the EEC PB manifold (AS23) to the three brackets located between Flanges B2 and C with nuts, threads lubricated with Engine Oil P03−001. Torque the nuts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(11) Torque the bolts that attach the tee of the EEC PB manifold (AS23) and the tee of the PT4.95 sensing manifold (AS24) to the bracket (bridged) between Flanges A1 and B1 at the 9 o'clock position to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(12) Torque the two bolts that attach the clamp on the PB sensing manifold (AS23) and the clamp on the PT4.95 sensing manifold (AS24) to the bracket on Flange B1 at the 9 o'clock position to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(13) Torque the tube nut on the (AS05) tube to the coupling on the (AS24) manifold at the 10:30 o'clock position located between Flanges B2 and C to 150 − 175 lb−in. (16.948 − 19.772 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the tube nut.

(14) Torque the tube nut on the (AS19) tube to the coupling on the (AS23) manifold at the 10:30 o'clock position located between Flanges B2 and C to 90 − 100 lb−in. (10.169 − 11.298 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the tube nut.

(15) Install the PB flex hose assembly (AS12) to the EEC PB manifold assembly (AS23) as follows.

(a) Remove the protection covers and install the flex hose to the tee of the (AS23) manifold located on a bracket (bridged) between Flanges A1 and B1 at the 9 o'clock position.

(b) Torque the flex hose nut to 270 − 300 lb−in. (30.506 − 33.895 N.m). (Post SB PW4ENG 72−645) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(16) Install the PT4.95 flex hose assembly (AS13) to the PT4.95 sensing manifold (AS24) as follows.

(a) Remove the protection covers and install the flex hose to the tee of the (AS24) manifold located on a bracket (bridged) between Flanges A1 and B1 at the 9 o'clock position.

(b) Torque the flex hose nut to 450 − 500 lb−in. (50.843 − 56.492 N.m).

1 (Post SPN No. P3042) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(17) Install the PAM flex hose assembly (AS10) to the EEC PAM manifold (AS17) as follows.

(a) Remove the protection covers and install the flex hose to the tee of the (AS17) manifold located on a bracket (bridged) between Flanges A1 and B1 at the 9 o'clock position.

(b) Torque the flex hose nut to 135 − 150 lb−in. (15.253 − 16.948 N.m).

1 (Post SPN No. P3042) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(18) Install the PT2 flex hose assembly (AS11) to the EEC PT2 manifold (AS16) as follows.

(a) Remove the protection covers and install the flex hose to the tee of the (AS16) manifold located on a bracket (bridged) between Flanges A1 and B1 at the 9 o'clock position.

(b) Torque the flex hose nut to 90 − 100 lb−in. (10.169 − 11.298 N.m).

1 (Post SPN No. P3042) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(19) For engines equipped with a supplemental control unit (SCU) with multiplexing, install the PT2.5 sensing manifold assembly (AS36) and the PT2.5 sensing hose (AS38). See Figure 408.

NOTE: The programming plug is (stayed) attached to the rear of the lower SCU mount bracket.

(a) Remove the protection covers and install the coupling end of the (AS36) manifold to the (AS28) tube assembly. Tighten the tube nut by hand. Install the tee end of the manifold to the bracket on Flange B with a bolt, threads lubricated with Engine Oil P03−001 and tighten by hand.

(b) Attach the manifold to two brackets on Flange C with clamps, bolts, threads lubricated with Engine Oil P03−001 and nuts.

(c) Attach the manifold to the bracket on Flange B2 with a clamp, bolt, threads lubricated with Engine Oil P03−001 and a nut.

(d) Attach the manifold to the bracket on Flange B with a clamp, bolt, threads lubricated with Engine Oil P03−001 and a nut.

(e) Torque the four bolts that attach the (AS36) manifold to brackets on Flange B, B2 and C to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(f) Torque the tube nut on the (AS28) tube assembly to the coupling on the (AS36) manifold at the 2 o'clock position to 135 − 150 lb−in. (15.253 − 16.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the tube nut.

(g) Torque the bolt that attaches the tee end of the (AS36) manifold to a bracket on Flange B to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(h) Remove the protection covers and install the hose assembly (AS38) to the tee of the (AS36) manifold. Tighten the tube nut on the hose by hand.

(i) Torque the hose assembly nut to the manifold tee to 90 − 100 lb−in. (10.169 − 11.298 N.m).

(j) (Post SPN No. P3042) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(20) For engines equipped with a supplemental control unit (SCU), install the ground cable as follows. See Figure 408, View F.

(a) Install the SCU ground cable on the rearward side of Flange B1 at the location where the upper SCU mount bracket is attached to the flange. Attach the cable with a bolt, threads lubricated with Engine Oil P03−001, a washer and a nut. Torque the bolt to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(21) Attach the harness (W12 without SCU or W11 with SCU) to the brackets on Flange A1 at approximately the 1 o'clock position with clamps and bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 409.

(22) Attach the W2 harness to a bracket on Flange A1 at the 9:30 o'clock position with a clamp and nut, threads lubricated with Engine Oil P03−001. Torque the nut to 36 − 40 lb−in. (4.067 − 4.519 N.m).

ENGINE GENERAL − FAN CASE − INSTALLATION−03

C. Postrequisites

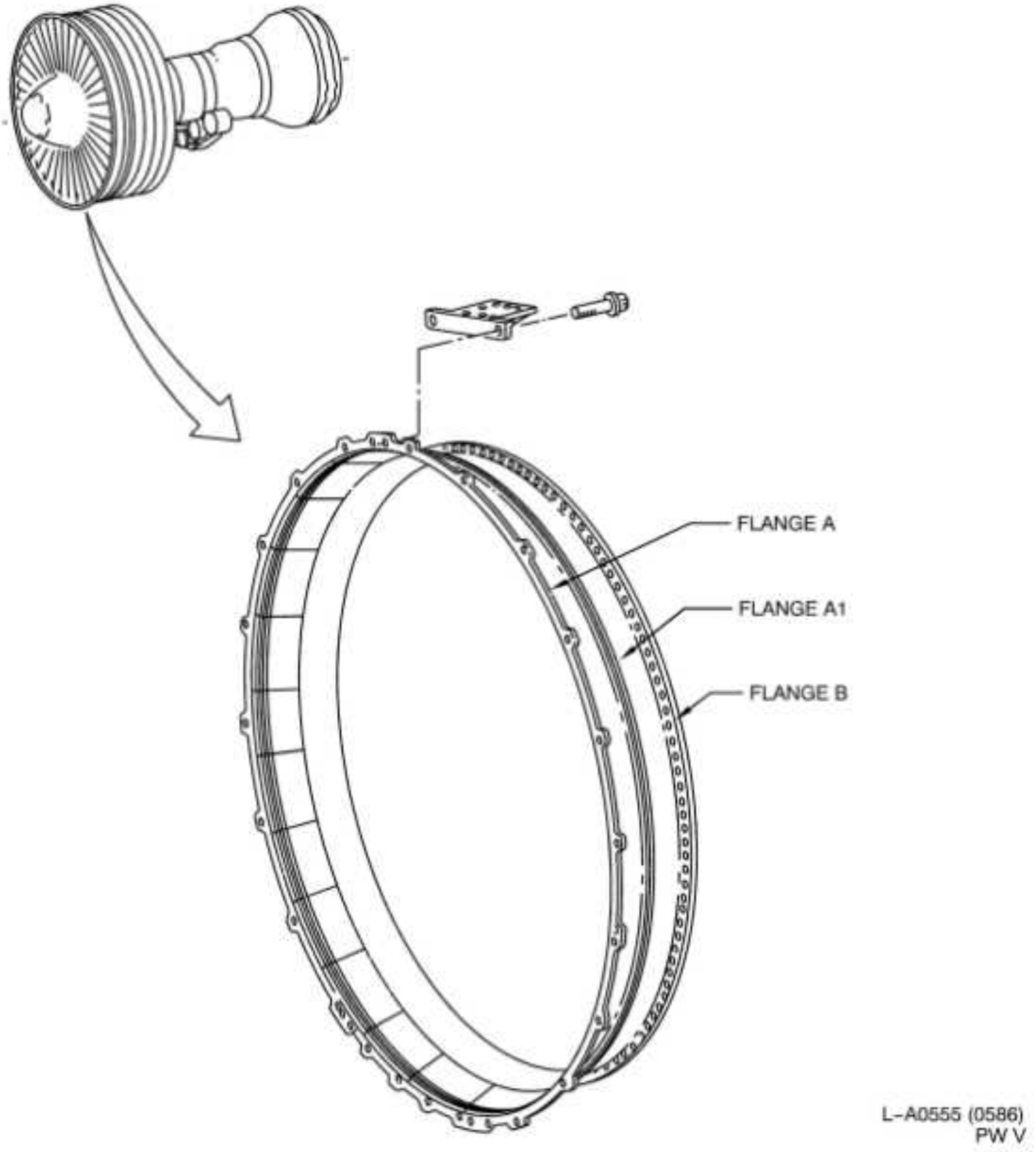
(1) Install electronic engine control. See 72−00−33, Installation−04 Task 72−00−33−450−001.

(2) For engines equipped, install the supplemental control unit (SCU). See 72−00−33, Installation−13 Task 72−00−33−450−008.

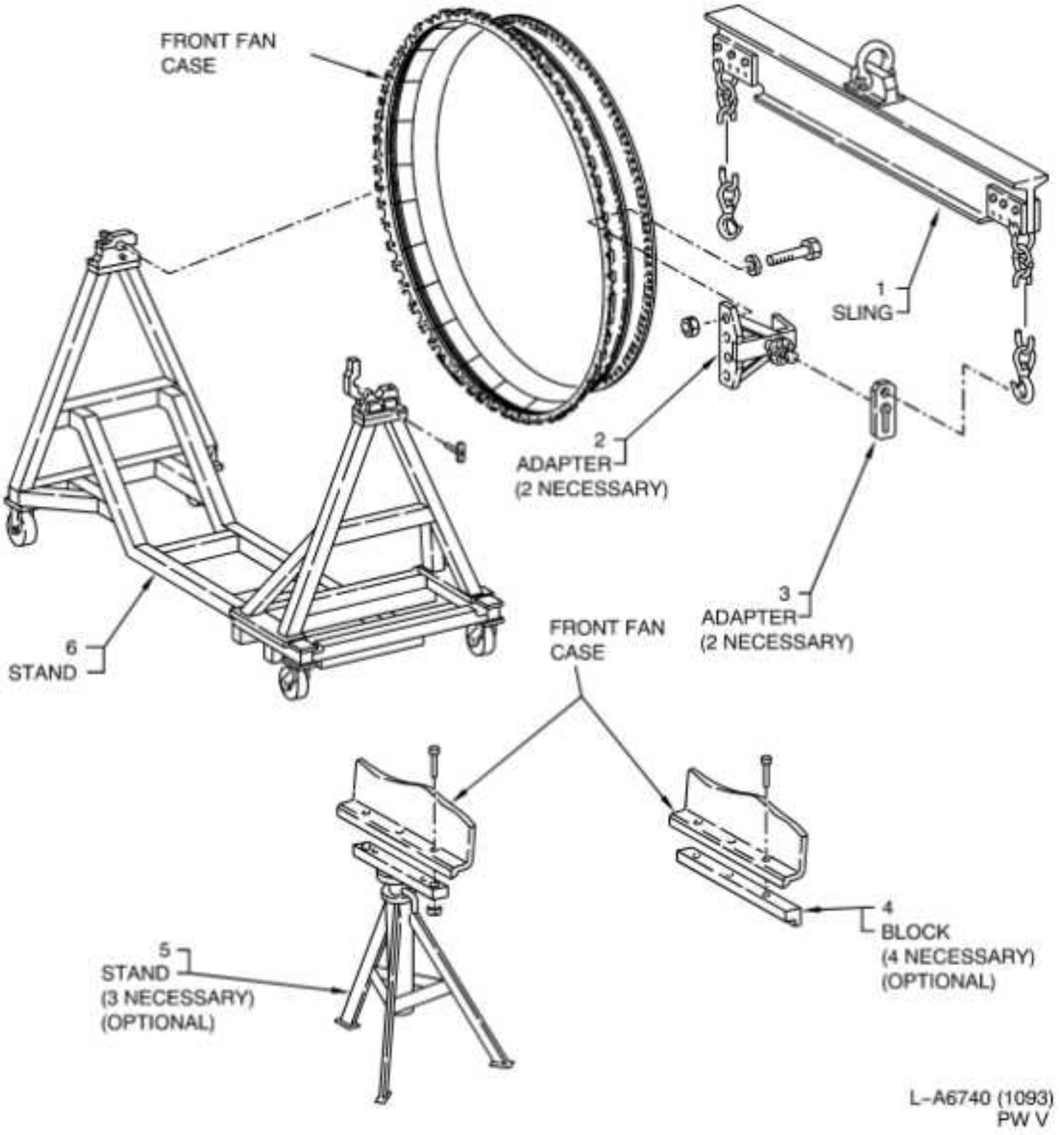
(3) Install all Stage 1 LPC blade assemblies. See 72−00−31, Installation−04 Task 72−00−31−420−002−002.

(4) To test the engine, see Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.

ENGINE GENERAL − FAN CASE − INSTALLATION−03


FLANGE A
FLANGE A1
FLANGE B
L-A0555 (0586)
PW V

Procedure Sequence
Figure 405
(Task 72−00−33−420−002−B)

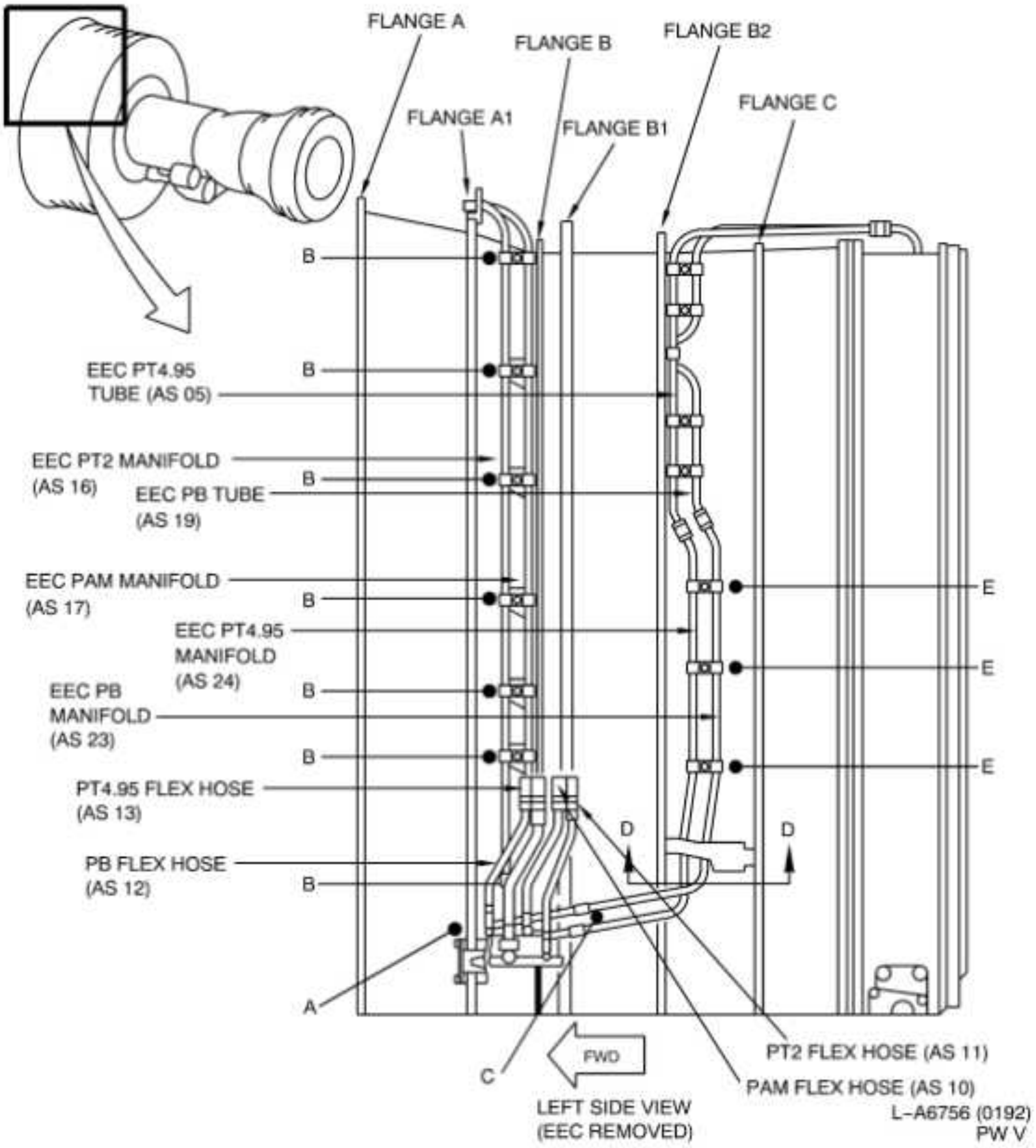

FRONT FAN CASE
1 SLING
2 ADAPTER (2 NECESSARY)
3 ADAPTER (2 NECESSARY)
6 STAND
FRONT FAN CASE
4 BLOCK (4 NECESSARY) (OPTIONAL)
5 STAND (3 NECESSARY) (OPTIONAL)
L−A6740 (1093)
PW V

Removal Of The Front Fan Case From The Stand
Figure 406
(Task 72−00−33−420−002−B)

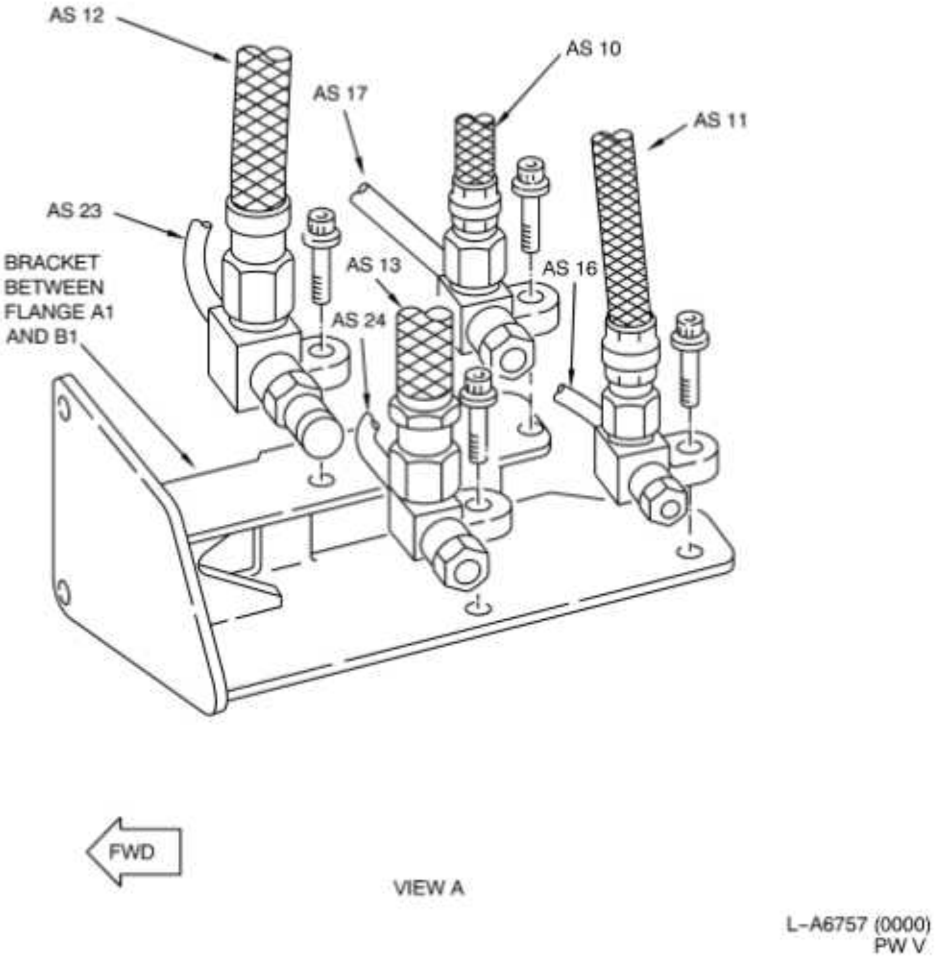
ENGINE GENERAL − FAN CASE − INSTALLATION−03

1. PWA 76155
2. PWA 86423 Or PWA 85676
3. PWA 76154
4. PWA 85750
5. PWA 85678 Or PWA 87166 With PWA 101960
6. PWA 87078 Or PWA 85450

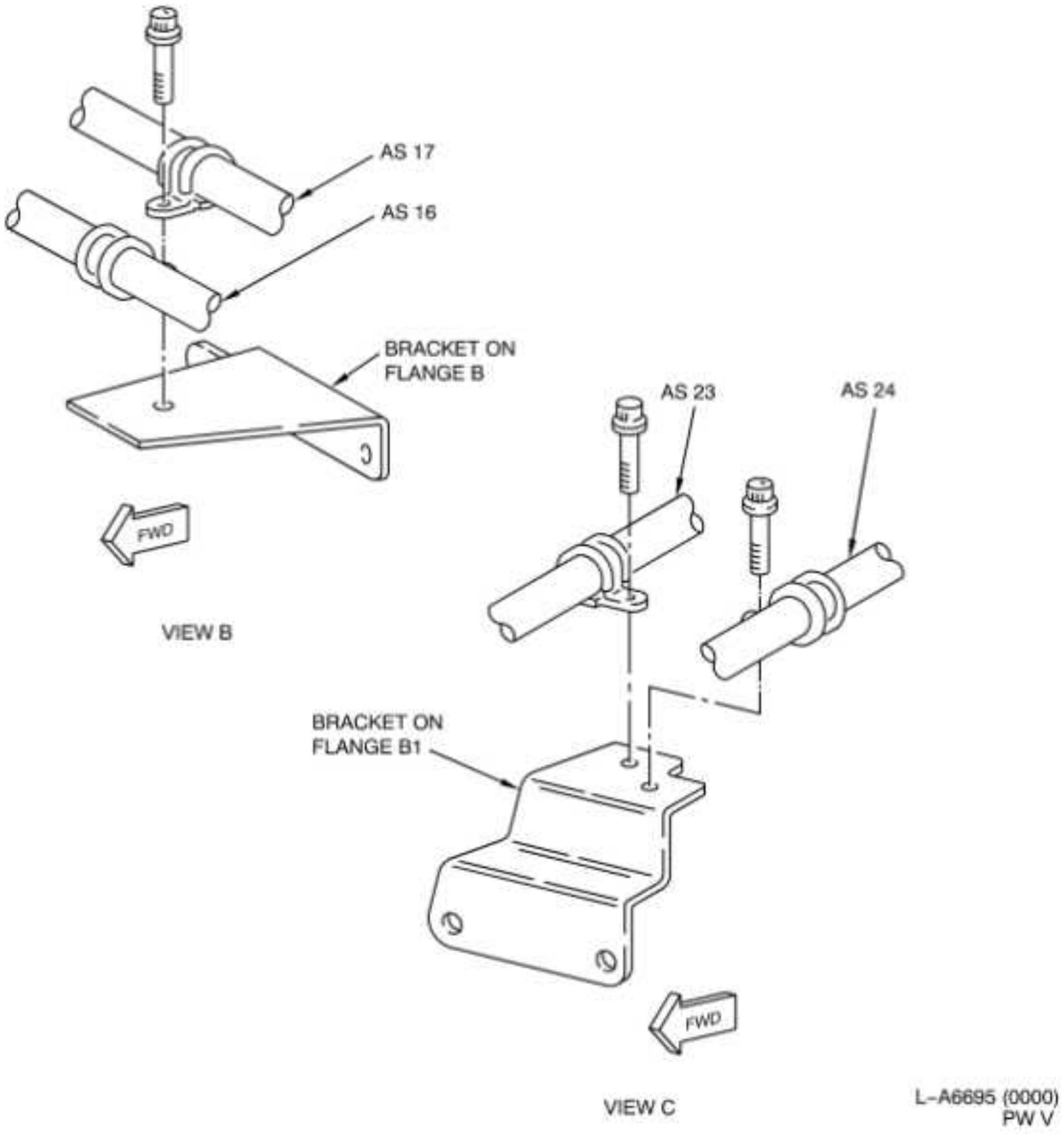
Key to Figure 406


FLANGE A
FLANGE B
FLANGE B2
FLANGE A1
FLANGE B1
FLANGE C
B
B
EEC PT4.95
TUBE (AS 05)
EEC PT2 MANIFOLD
(AS 16)
B
EEC PB TUBE
(AS 19)
EEC PAM MANIFOLD
(AS 17)
B
EEC PT4.95
MANIFOLD
(AS 24)
EEC PB
MANIFOLD
(AS 23)
B
B
PT4.95 FLEX HOSE
(AS 13)
PB FLEX HOSE
(AS 12)
B
E
E
E
D
D
A
C
FWD
PT2 FLEX HOSE (AS 11)
PAM FLEX HOSE (AS 10)
LEFT SIDE VIEW
(EEC REMOVED)
L−A6756 (0192)
PW V

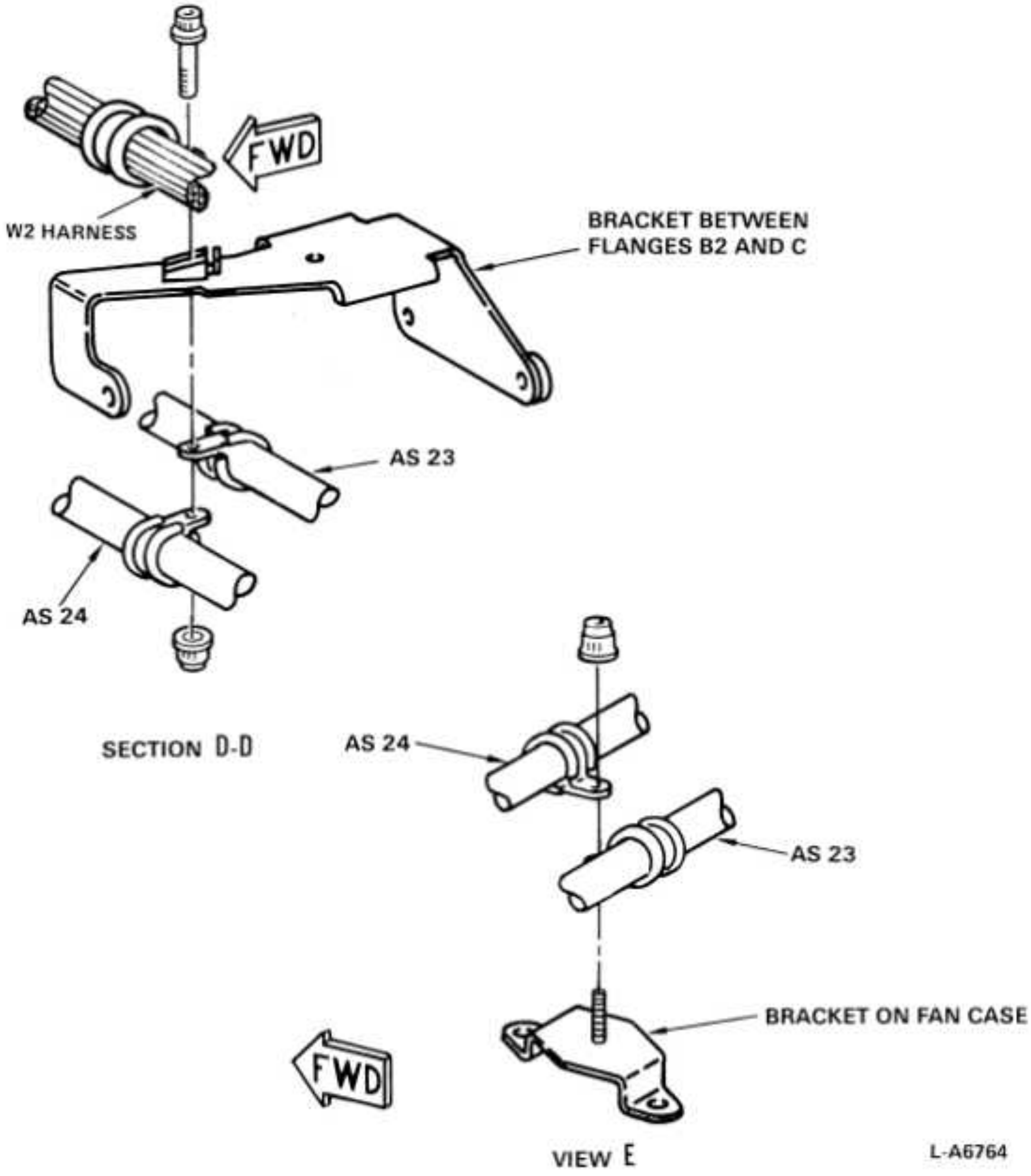
External Plumbing Installation
Figure 407 (Sheet 1)
(Task 72−00−33−420−002−B)


AS 12
AS 10
AS 17
AS 11
AS 23
BRACKET
BETWEEN
FLANGE A1
AND B1
AS 13
AS 16
AS 24
FWD
VIEW A
L−A6757 (0000)
PW V

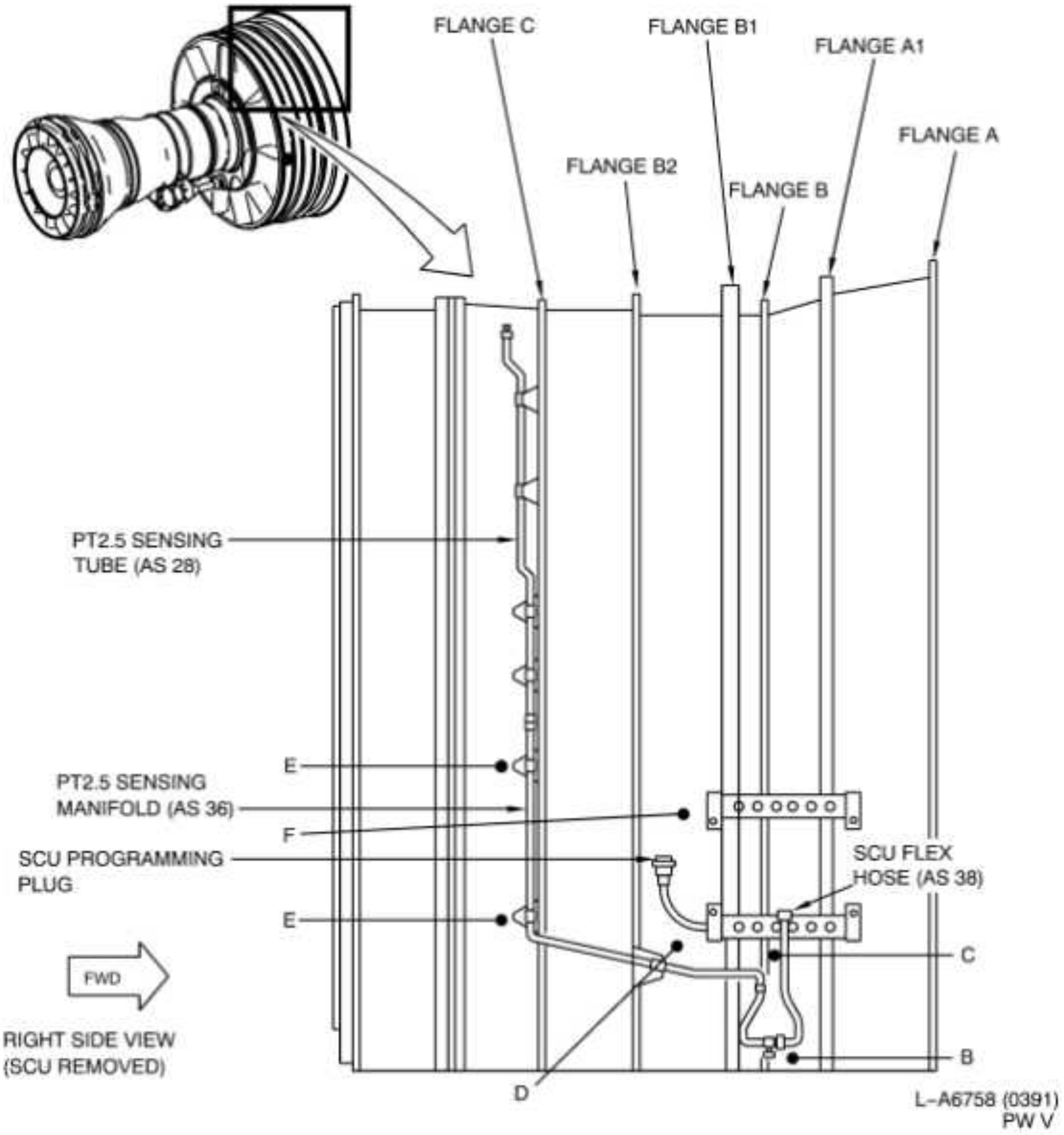
External Plumbing Installation
Figure 407 (Sheet 2)
(Task 72−00−33−420−002−B)


AS 17
AS 16
BRACKET ON FLANGE B
FWD
VIEW B
AS 23
AS 24
BRACKET ON FLANGE B1
FWD
VIEW C
L−A6695 (0000)
PW V

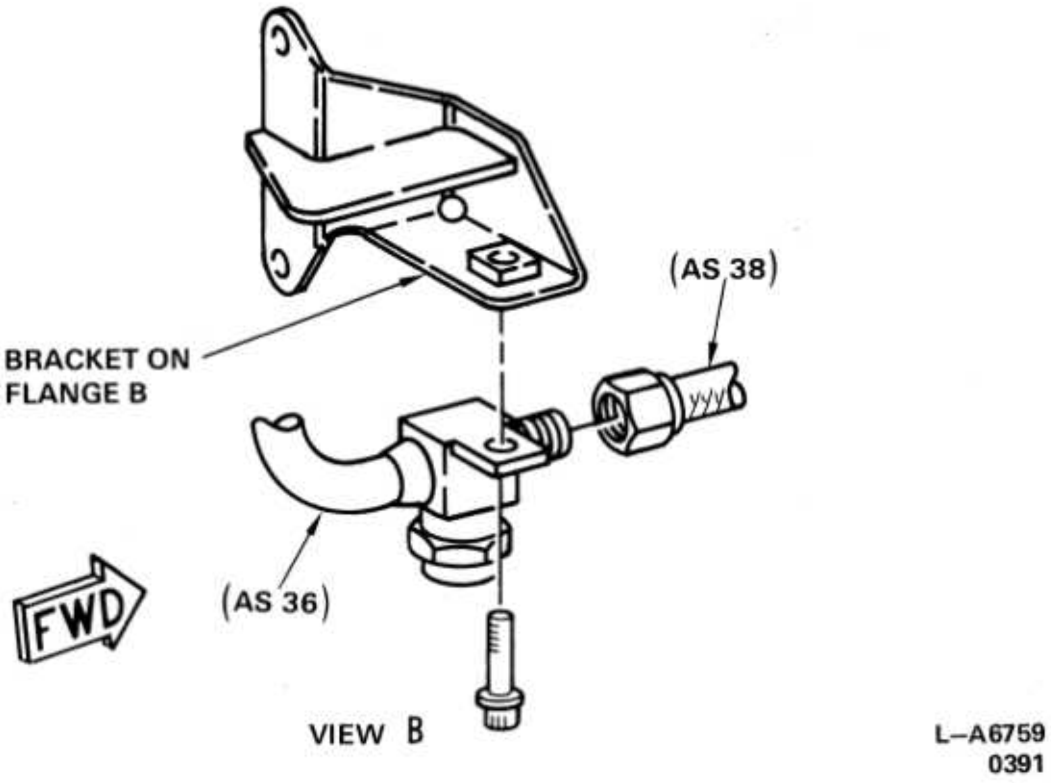
External Plumbing Installation
Figure 407 (Sheet 3)
(Task 72−00−33−420−002−B)


FWD
W2 HARNESS
BRACKET BETWEEN FLANGES B2 AND C
AS 23
AS 24
SECTION D-D
AS 24
AS 23
BRACKET ON FAN CASE
FWD
VIEW E
L-A6764

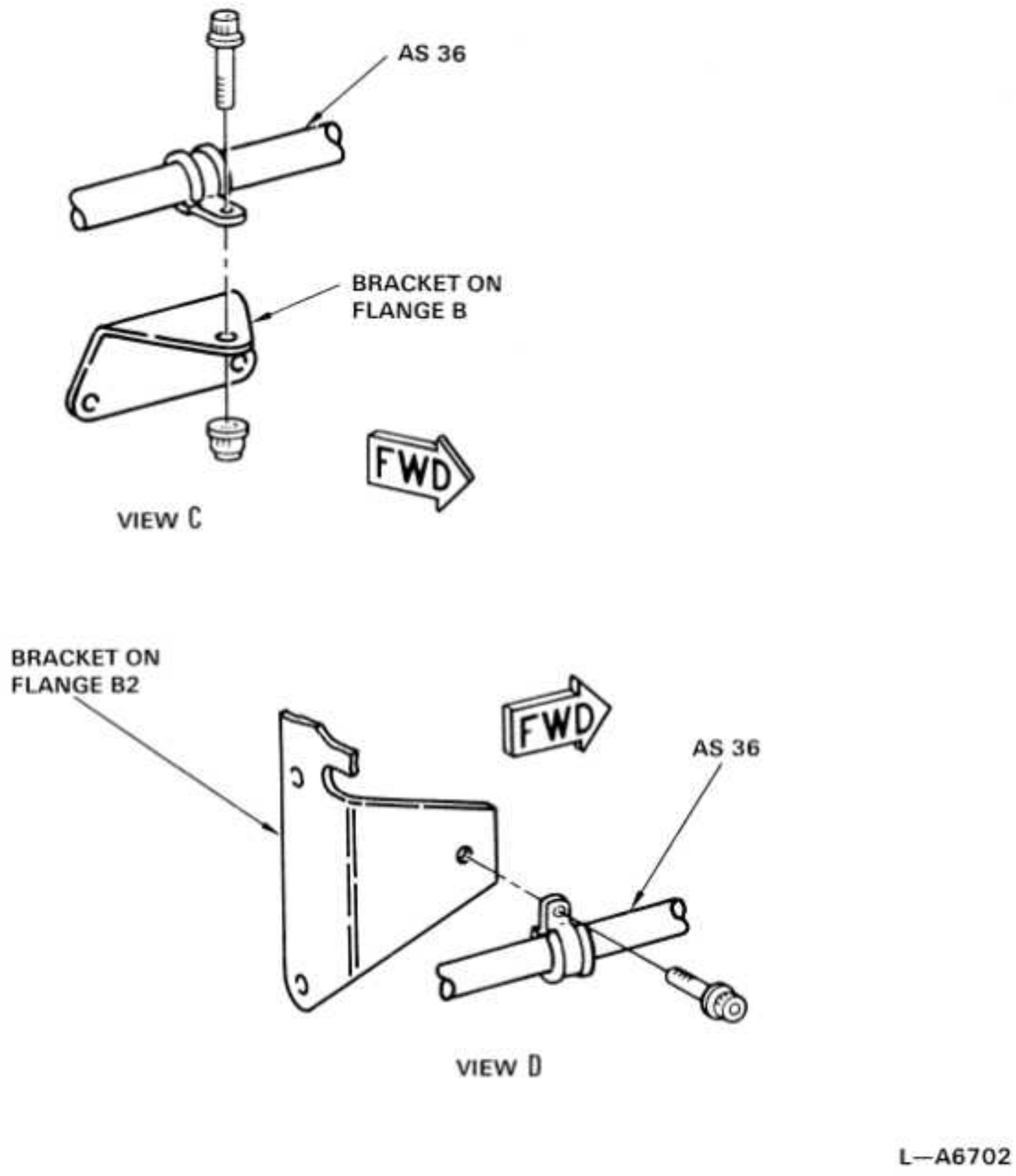
External Plumbing Installation
Figure 407 (Sheet 4)
(Task 72−00−33−420−002−B)


FLANGE C
FLANGE B1
FLANGE A1
FLANGE A
FLANGE B2
FLANGE B
PT2.5 SENSING TUBE (AS 28)
E
PT2.5 SENSING MANIFOLD (AS 36)
F
SCU PROGRAMMING PLUG
SCU FLEX HOSE (AS 38)
E
C
B
D
FWD
RIGHT SIDE VIEW (SCU REMOVED)
L−A6758 (0391)
PW V

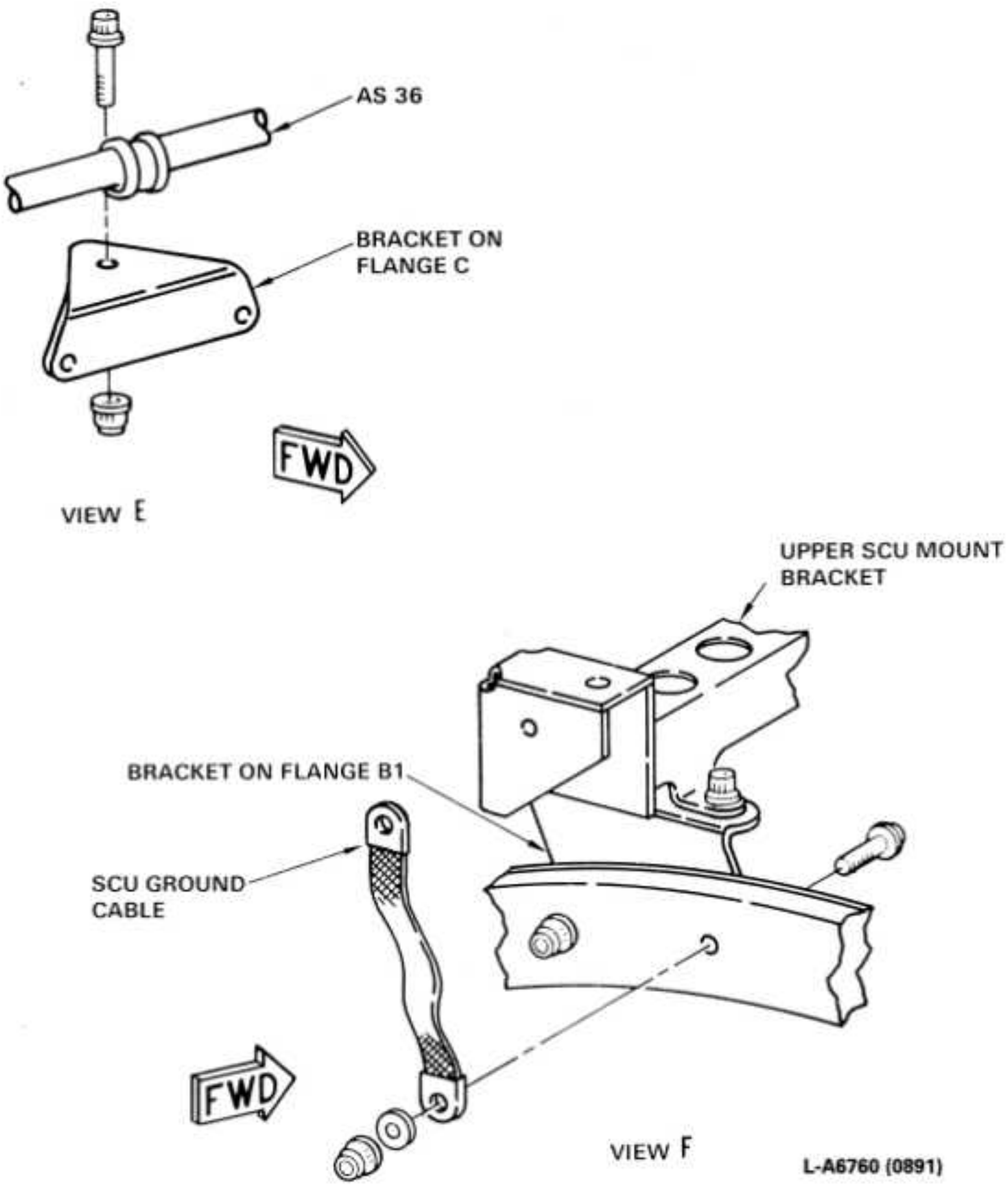
SCU External Plumbing Installation
Figure 408 (Sheet 1)
(Task 72−00−33−420−002−B)


(AS 38)
BRACKET ON FLANGE B
FWD
(AS 36)
VIEW B
L−A6759
0391

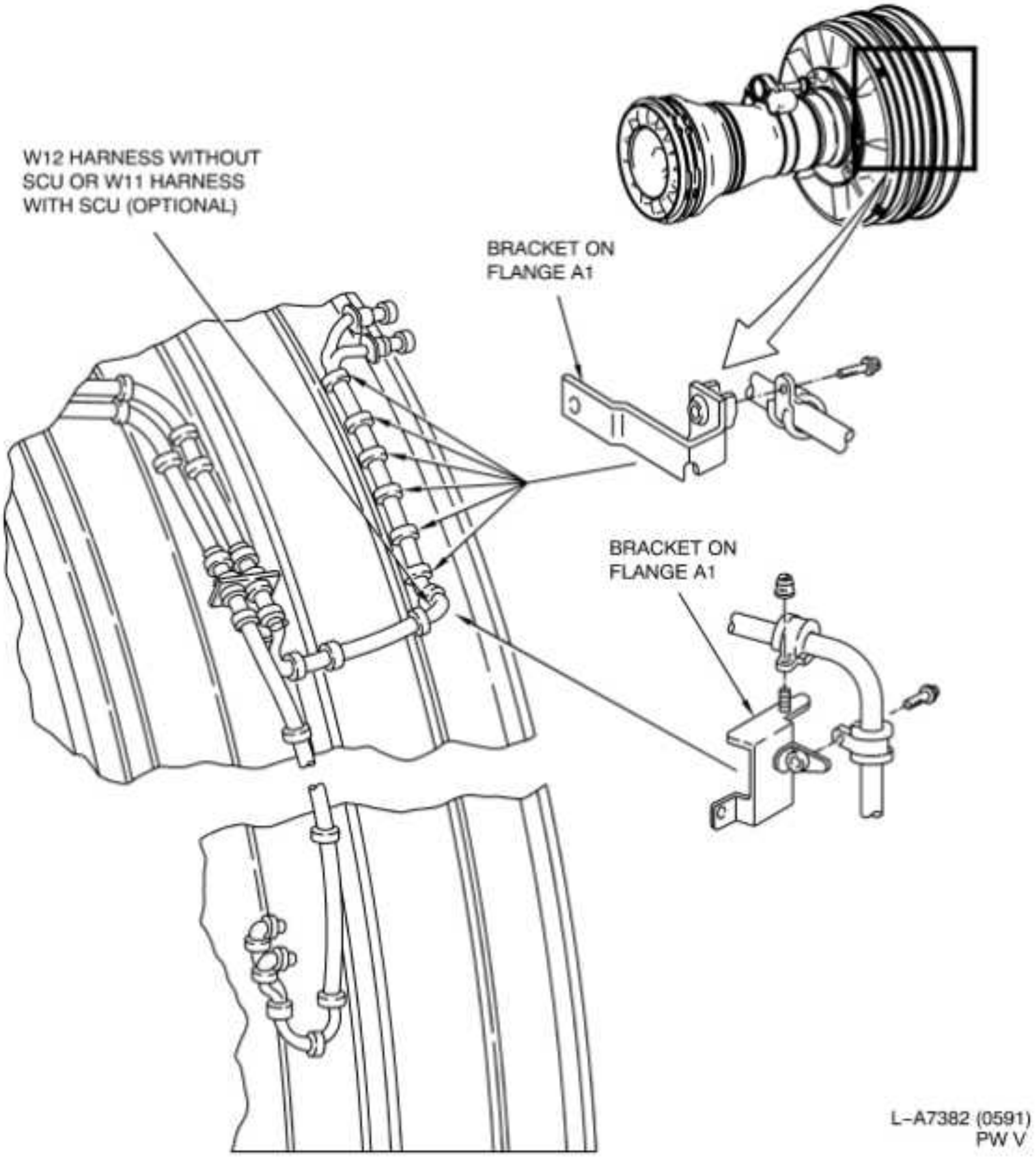
SCU External Plumbing Installation
Figure 408 (Sheet 2)
(Task 72−00−33−420−002−B)


AS 36
BRACKET ON
FLANGE B
FWD
VIEW C
BRACKET ON
FLANGE B2
FWD
AS 36
VIEW D
L—A6702

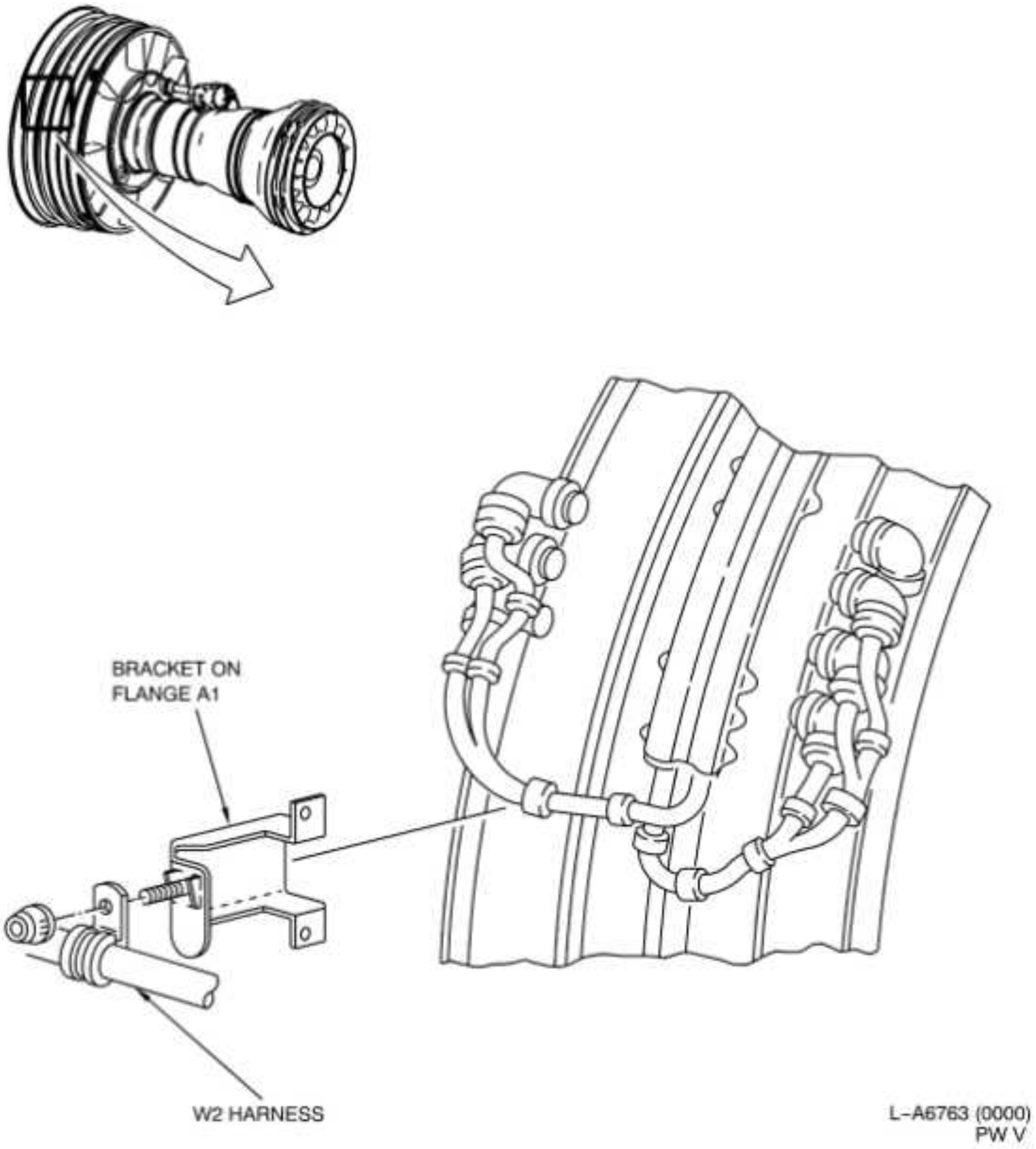
SCU External Plumbing Installation
Figure 408 (Sheet 3)
(Task 72−00−33−420−002−B)


AS 36
BRACKET ON FLANGE C
FWD
VIEW E
UPPER SCU MOUNT BRACKET
BRACKET ON FLANGE B1
SCU GROUND CABLE
FWD
VIEW F
L-A6760 (0891)

SCU External Plumbing Installation
Figure 408 (Sheet 4)
(Task 72-00-33-420-002-B)


W12 HARNESS WITHOUT
SCU OR W11 HARNESS
WITH SCU (OPTIONAL)
BRACKET ON
FLANGE A1
BRACKET ON
FLANGE A1
L−A7382 (0591)
PW V

Wiring Harness Installation
Figure 409 (Sheet 1)
(Task 72−00−33−420−002−B)


BRACKET ON
FLANGE A1
W2 HARNESS
L−A6763 (0000)
PW V

Wiring Harness Installation
Figure 409 (Sheet 2)
(Task 72−00−33−420−002−B)

Task 72-00-33-450-001:

1. Install Electronic Engine Control

A. Equipment And Materials Necessary

Standard Tools:
Glenair TG-70 Strap Wrench Or
Glenair TG-69 Soft Jawed Pliers

Consumable Material:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire,(AS3214-02)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	73-23-00/5/20
Packing	1	73-23-00/5/40
Packing	1	73-23-00/5/60
Packing	1	73-23-00/5/80

B. Procedure

See Figure 401.

R R R R R R R R R R R R CAUTION: BE CAREFUL WHEN YOU HANDLE, REMOVE OR INSTALL ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTIONS USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

CAUTION: USE OF LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS COULD RESULT IN CONTAMINATION OF EEC.

CAUTION: INSPECT THE ENGINE FAN CASE AT APPROXIMATELY THE TEN O'CLOCK POSITION FOR A FADEC CAUTION LABEL. THIS LABEL SHOWS THAT A UNIQUE

MOUNTING EEC IS NECESSARY BECAUSE RING CASE HPC CONFIGURATION OR CUTBACK HPC STATORS ARE INSTALLED IN THE ENGINE. MAKE SURE THE CORRECT EEC IS INSTALLED.

(1) Remove protective closures.

(2) If new EEC unit is to be installed comply with the following:

(a) Install packing to adapter, and install adapter to port marked P2. Torque adapter to 65 - 75 lb-in. (7.344 - 8.474 N.m).

(b) Install packing to adapter, and install adapter to port marked PAMB. Torque adapter to 90 - 100 lb-in. (10.169 - 11.298 N.m).

(c) Install packing to adapter, and install adapter to port marked PB. Torque adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m).

(d) Install packing to adapter, and install adapter to port marked P5. Torque adapter to 150 - 170 lb-in. (16.948 - 19.207 N.m).

CAUTION: IF ENGINE HAS W1 AND W2 HARNESS "WITH YELLOW BANDS", YOU MUST INSTALL AN EEC WITH THE YELLOW AND BLACK LABEL FOR RING CASE CONFIGURATION (POST SB PW4ENG 72-756 OR POST SB PW4ENG 72-759). IF YOU DO NOT INSTALL THE CORRECT HARDWARE, THE ENGINE WILL NOT OPERATE.

CAUTION: FOR ENGINES WITHOUT RING CASE CONFIGURATION (PRE SB PW4ENG 72-756 OR PRE SB PW4ENG 72-759), IT IS PERMITTED TO USE AN EEC WITH THE YELLOW AND BLACK LABEL.

(3) Position electronic engine control (EEC) to mounting brackets on fan case, at approximately the 10 o'clock position, with the four pressure sensing ports downward.

(4) (Reference 2030) Secure EEC with bolts, threads lubricated with Engine Oil P03-001. Torque bolts to 150 - 170 lb-in. (16.948 - 19.207 N.m).

CAUTION: WHEN YOU TORQUE THE FOLLOWING HOSE NUTS (AS12), (AS13), (AS10) AND (AS11), YOU MUST HOLD THE WRENCH FLATS OF THE ADAPTERS IN THE ELECTRONIC ENGINE CONTROL (EEC). THIS WILL PREVENT DAMAGE TO THE THREADS IN THE EEC.

(5) Attach front flex hose (AS12) to adapter in port marked PB. Torque flex hose nut to 200 - 225 lb-in. (22.597 - 25.422 N.m). (Post SB PW4ENG 72-645) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the PB sensing hose nut, on the EEC.

(6) Attach next flex hose (AS13) (moving rearward on fan case) to adapter in port marked P5. Torque flex hose nut to 450 - 500 lb-in. (50.843 - 56.492 N.m).

  (a) (Post SPN No. P3042) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the hose nut(s) as applicable.

(7) Attach third flex hose (AS10) rearward to adapter in port marked PAMB. Torque flex hose nut to 135 - 150 lb-in. (15.253 - 16.948 N.m).

  (a) (Post SPN No. P3042) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the hose nut(s) as applicable.

(8) Attach last flex hose (AS11) to adapter in port marked P2. Torque flex hose nut to 90 - 100 lb-in. (10.169 - 11.298 N.m).

  (a) (Post SPN No. P3042) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the hose nut(s) as applicable.

CAUTION: PRIOR TO CONNECTING GROUND CABLE TO EEC, CHECK TO ENSURE THAT CABLE MOUNTING LUGS ARE SECURE AND THAT CABLE STRANDS ARE AT LEAST 75 PERCENT UNBROKEN. LOOSE LUGS OR EXCESSIVE BREAKAGE IN CABLE STRANDS MAY RESULT IN INADEQUATE LIGHTNING STRIKE PROTECTION.

(9) Position ground strap to threaded hole in upper front corner of control and secure with bolt threads lubricated with Engine Oil P03-001. Torque bolt to 75 - 85 lb-in. (8.474 - 9.604 N.m).

CAUTION: CHECK HARNESS CONNECTOR AND/OR MATING COMPONENT CONNECTOR FOR BENT PINS AND CONTAMINATION. CAREFULLY STRAIGHTEN BENT PINS AND CLEAN CONNECTOR AS REQUIRED.

(10) Connect W1P6, W1P7, and W1P8 harness connectors to their respective connectors on rear (Channel A) of control as follows. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- The connector coupling nut is fully tight.
- The connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(11) Connect W2P2, W2P3, and W2P4 harness connectors to their respective connectors on front (Channel B) of control as follows. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- The connector coupling nut is fully tight.
- The connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(12) Install EEC programming plug (attached to engine by lanyard) to connector on upper left side of control as follows.

(a) Remove the protection covers. Examine the programming plug and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the plug and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the plug keyways and engage the plug to the mating receptacle. Tighten the plug coupling nut by hand until you cover the witness (color) band and the plug coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the plug coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN PLUG DAMAGE OR A LOOSE PLUG. A LOOSE PLUG PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the plug coupling nut. Use sufficient force to be sure:
- The plug coupling nut is fully tight.
- The plug fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the plug is tight.

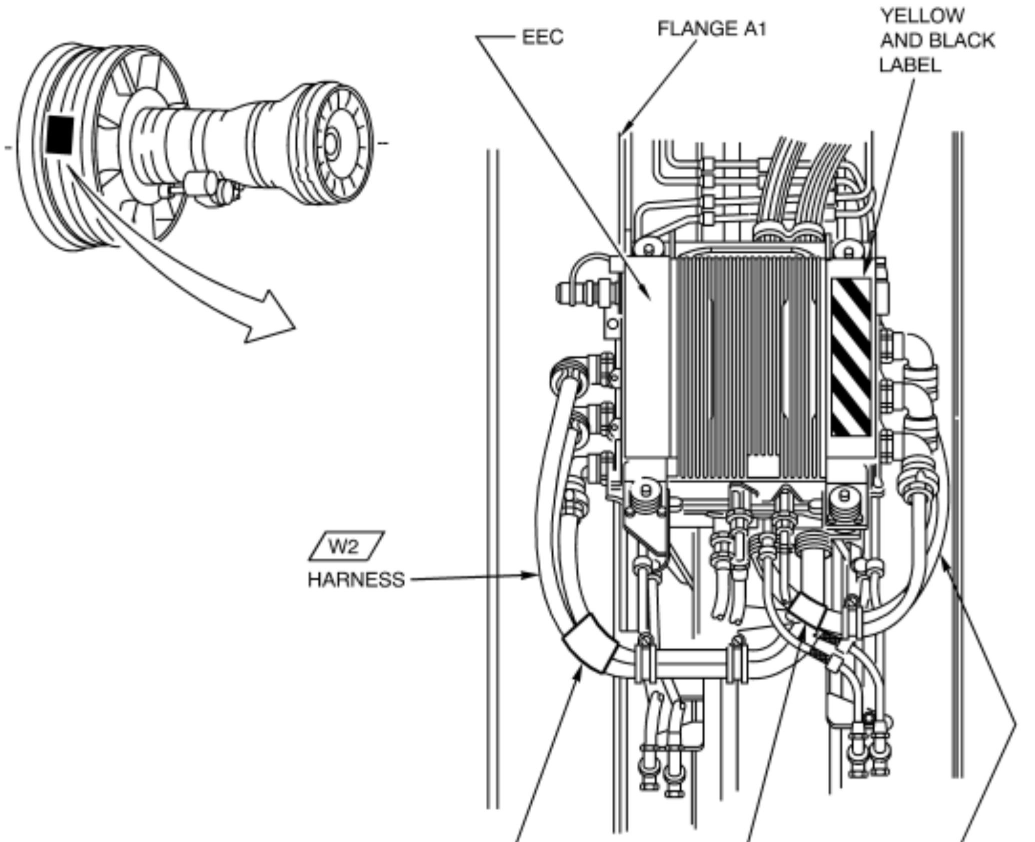
NOTE: If you use too much force, the tools (above) will turn around on the plug coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

C. Postrequisites

(1) Test engine per Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).

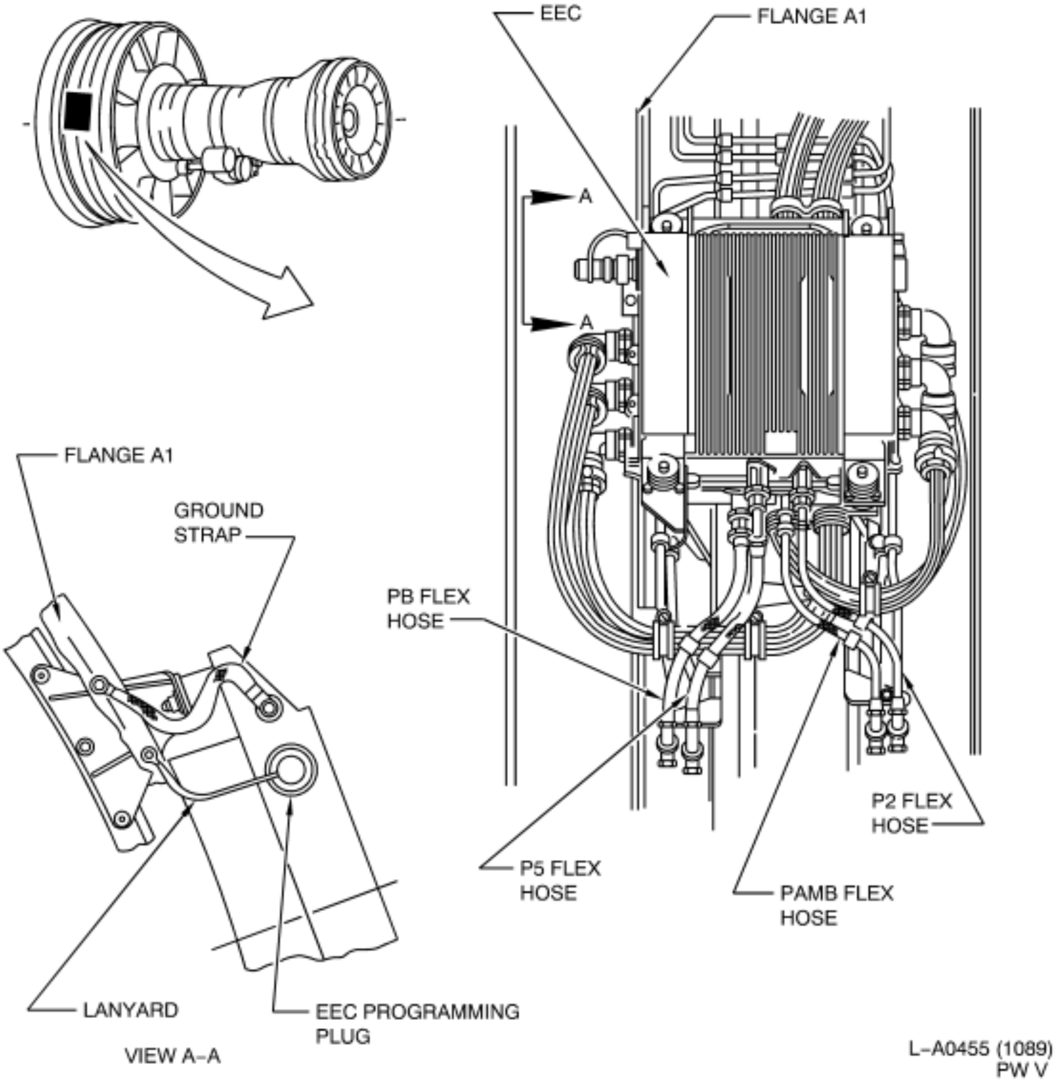
ENGINE GENERAL − FAN CASE − INSTALLATION−04


EEC
FLANGE A1
YELLOW AND BLACK LABEL
W2 HARNESS
YELLOW BAND
YELLOW BAND
W1 HARNESS

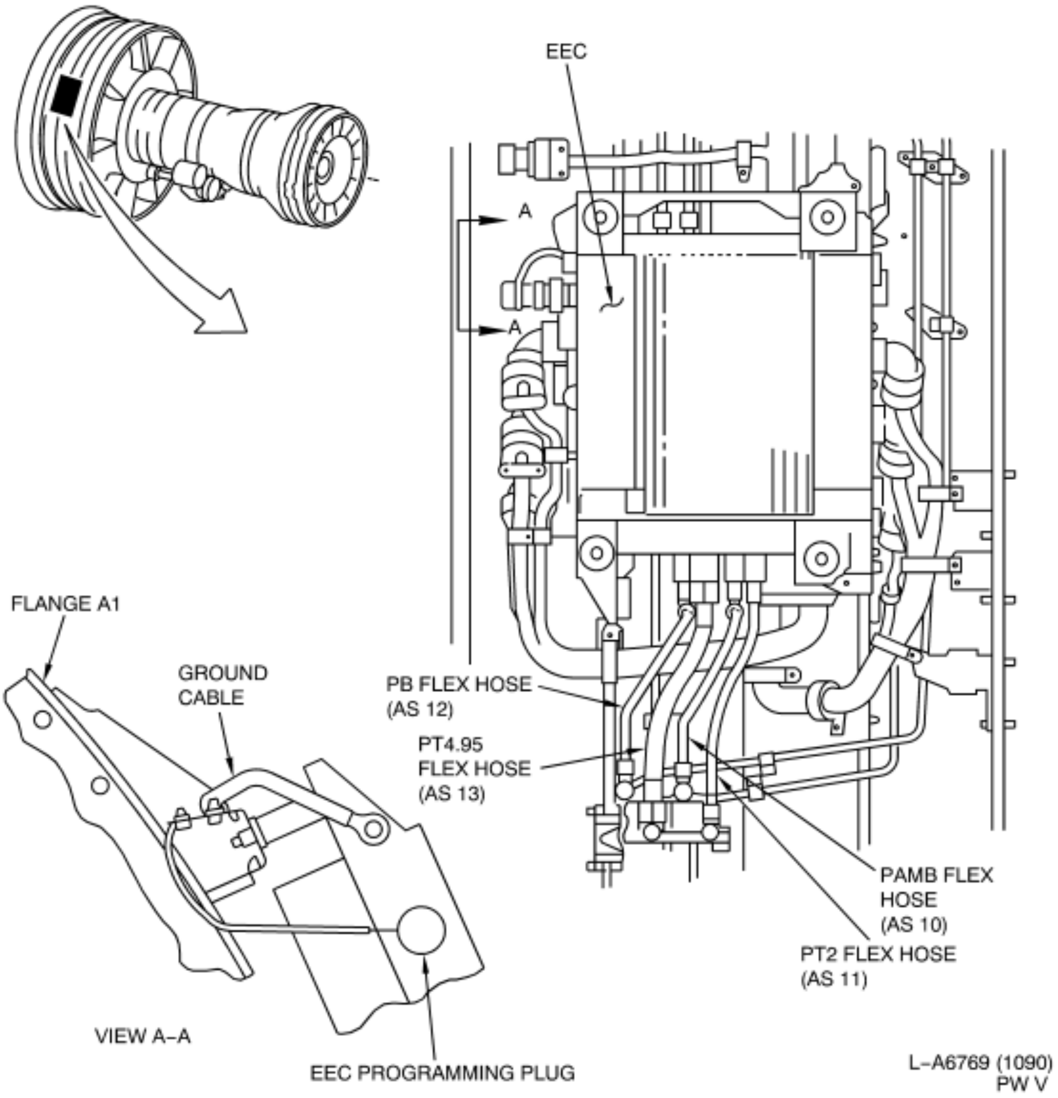
NOTE: IF W1 AND W2 HARNESS HAVE A YELLOW BAND, YOU MUST HAVE THE EEC WITH THE YELLOW AND BLACK LABEL FOR RING CASE CONFIGURATION.
(POST SB PW4ENG 72−756) OR
(POST SB PW4ENG 72−759)

L−D0827 (0603)
PW V

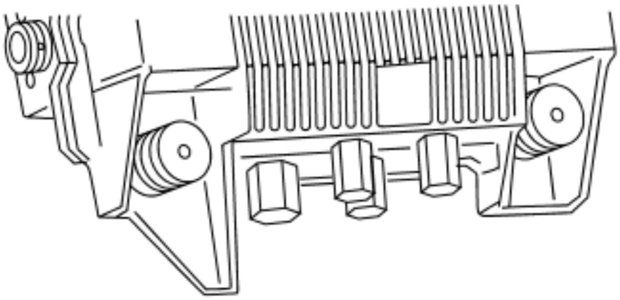
Electronic Engine Control
Figure 401 (Sheet 1)
(Task 72−00−33−450−001)


EEC
FLANGE A1
A
A
FLANGE A1
GROUND STRAP
PB FLEX HOSE
P2 FLEX HOSE
P5 FLEX HOSE
PAMB FLEX HOSE
LANYARD
EEC PROGRAMMING PLUG
VIEW A−A
L−A0455 (1089)
PW V

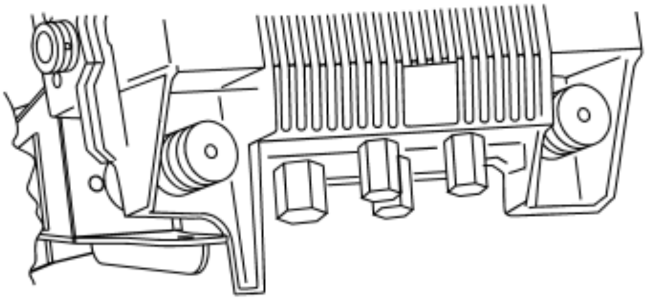
Electronic Engine Control For Basic Engines
Figure 401 (Sheet 2)
(Task 72−00−33−450−001)


EEC
A
A
FLANGE A1
GROUND CABLE
PB FLEX HOSE (AS 12)
PT4.95 FLEX HOSE (AS 13)
PAMB FLEX HOSE (AS 10)
PT2 FLEX HOSE (AS 11)
VIEW A−A
EEC PROGRAMMING PLUG
L−A6769 (1090)
PW V

Electronic Engine Control For Engines With Commonality
Parts Between Airbus And McDonnell Douglas
Figure 401 (Sheet 3)
(Task 72−00−33−450−001)



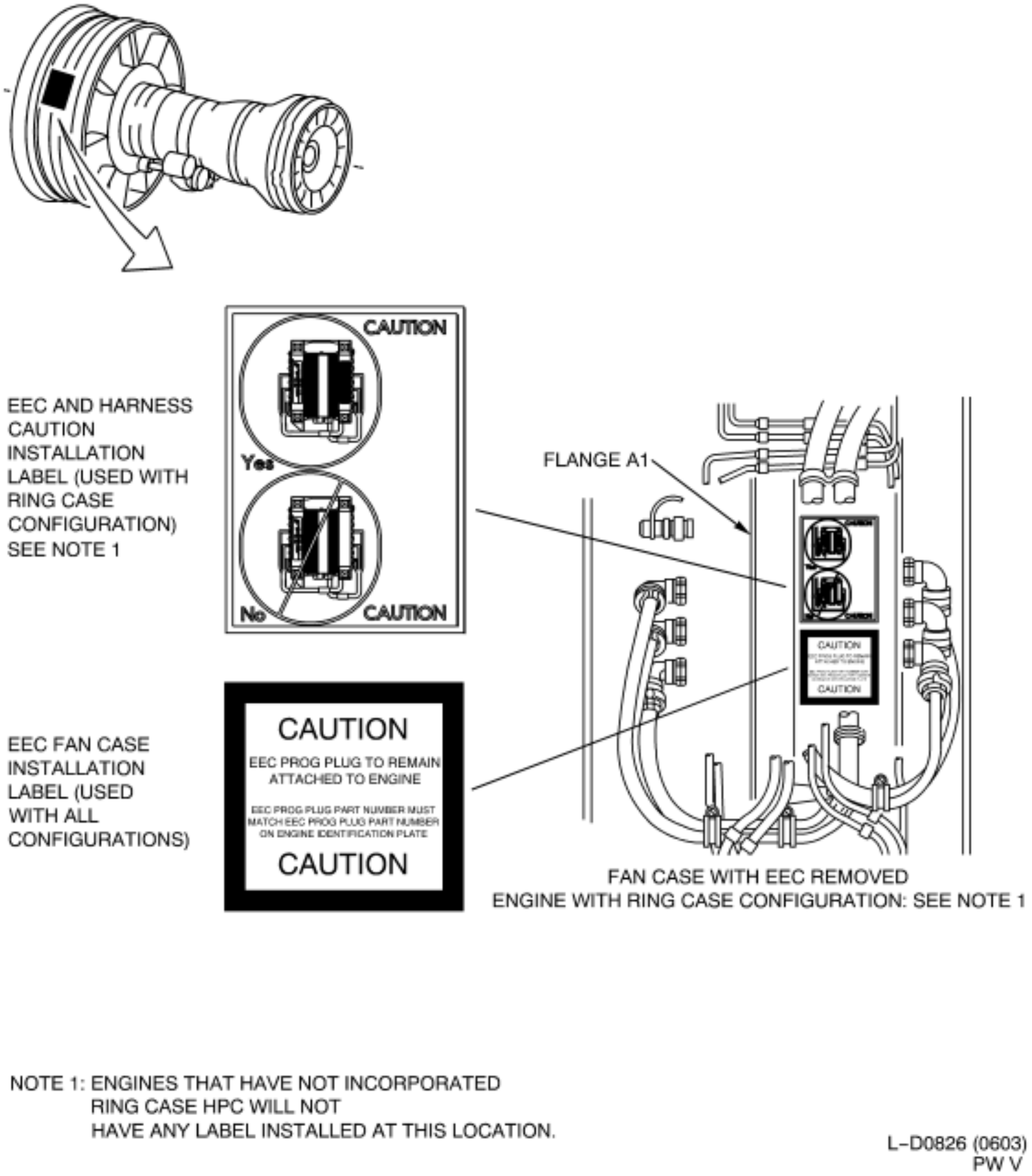
VIEW B
(PRE SB PW4ENG 72−704)
(POST SB PW4ENG 72−728)



VIEW B
(PRE SB PW4ENG 72−728)
(POST SB PW4ENG 72−704)

L−B8426 (0601)
PW V

EEC Mounts
Figure 401 (Sheet 4)
(Task 72−00−33−450−001)


EEC AND HARNESS CAUTION INSTALLATION LABEL (USED WITH RING CASE CONFIGURATION) SEE NOTE 1
CAUTION
Yes
No
CAUTION
FLANGE A1
EEC FAN CASE INSTALLATION LABEL (USED WITH ALL CONFIGURATIONS)
CAUTION
EEC PROG PLUG TO REMAIN ATTACHED TO ENGINE
EEC PROG PLUG PART NUMBER MUST MATCH EEC PROG PLUG PART NUMBER ON ENGINE IDENTIFICATION PLATE
CAUTION
FAN CASE WITH EEC REMOVED
ENGINE WITH RING CASE CONFIGURATION: SEE NOTE 1
NOTE 1: ENGINES THAT HAVE NOT INCORPORATED RING CASE HPC WILL NOT HAVE ANY LABEL INSTALLED AT THIS LOCATION.
L−D0826 (0603)
PW V

Fan Case EEC Installation Labels
Figure 401 (Sheet 5)
(Task 72−00−33−450−001)

Task 72-00-33-450-002:

1. Install The No. 3 Bearing Air Cooler Assembly

A. Equipment And Materials Necessary

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 Or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-038	Cheesecloth, Unsized
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
R	P06-054	Paste, Antiseize (PWA 36246)
	P09-027	Sealant, Silicone Rubber (PWA 36003-2)
	P11-014	Alcohol, Isopropyl (PMC 9094)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lockwire, AS3214-02		

B. Procedure

See Figure 401.

(1) If you do not already know if the spacer plate (called spacer) at the trailing edge of the No. 3 bearing air cooler assembly (called cooler) is the correct class of spacer, choose a classified spacer as follows.

(a) Install the cooler and a spacer on the intermediate case. Use workbolts.

(b) Measure the distance between the trailing edge of the cooler and the intermediate case. If the installed spacer does not give the correct fit, choose a spacer that does. Refer to Index 2 of the figure and Table 401.

(c) Remove the cooler and spacer.

(2) (Post SB PW4ENG 72-433) If removed, attach the two supports along the axial edges of the cooler with 14 bolts, threads lubricated with Engine Oil P03-001, and nuts.

Class	Spacer Thickness - Inch (mm)
1	0.022 - 0.028 (0.559 - 0.711)
2	0.036 - 0.044 (0.914 - 1.118)
3	0.058 - 0.068 (1.473 - 1.727)
4	0.075 - 0.085 (1.905 - 2.159)
5	0.095 - 0.105 (2.413 - 2.667)
6	0.120 - 0.130 (3.048 - 3.302)

Spacer Plate Thickness - Table 401

(3) (Reference 1004) Install the cooler as follows.

(a) Assemble the strut and one rod end bearing and nut, with the threads lubricated with Engine Oil P03-001, to Dimension AD. Tighten the nut with your hand.

(b) Install the rod end bearing in the bracket at 2 o'clock on the intermediate case. Attach the bearing to the intermediate case with a bolt and nut, threads lubricated with Engine Oil P03-001. Torque nut to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(c) Remove protective closures from ends of cooling tubes.

(d) Attach the mount bracket to the bracket at the front of the cooler with two bolts, lubricated with Engine Oil P03-001. Tighten the bolts with your hand.

(e) (Pre SB PW4ENG 72-433) Put the cooler and correct classified spacer in the correct position on the intermediate case.

1 Attach the cooler to the intermediate case with eight screws, lubricated with Engine Oil P03-001. Torque the screws to 36 - 40 lb-in. (4.067 - 4.519 N.m).

2 Do a check of the cooler. It must agree with Index 2 of the referenced figure. If not, remove the cooler and choose a new spacer.

(f) Assemble the remaining rod end bearing and nut, threads lubricated with Engine Oil P03-001, to the strut. Tighten the nut with your hand.

(g) Attach the outer rod end bearing to the mount bracket with a bolt lubricated with Engine Oil P03-001. Tighten the bolt with your hand.

(h) After final adjustment, examine the inspection holes on the strut. Obstruction of the holes indicates correct engagement.

(i) Torque the nuts at either end of the strut to 75 - 85 lb-in. (8.474 - 9.604 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 the nuts.

(j) Torque the bolt that attaches the outer rod end bearing to the mount bracket to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(k) Torque the bolts that attach the mount bracket to the cooler bracket to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(l) (Post SB PW4ENG 72-433) Install the cooler as follows:

1 Loosen the 14 bolts and nuts in the supports at the axial edges of the cooler.

2 Install the cooler and spacer on the intermediate case.

3 Measure the distance between the cooler and the intermediate case at the trailing edge. If necessary, choose a new spacer for the correct fit. Refer to the figure.

4 Tighten the bolts and nuts in the supports to 85 - 95 lb-in. (9.604 - 10.734 N.m).

5 Attach the cooler with eight screws, lubricated with Engine Oil P03-001. Torque the screws to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(m) Apply sealant around the edges of the cooler at AL as follows:

1 Make a piece of clean Cheesecloth P05-038 wet with Alcohol P11-014. Clean the edges of the cooler.

2 Dry the cleaned areas fully in the adjacent air. There must not be any alcohol remaining on the surfaces.

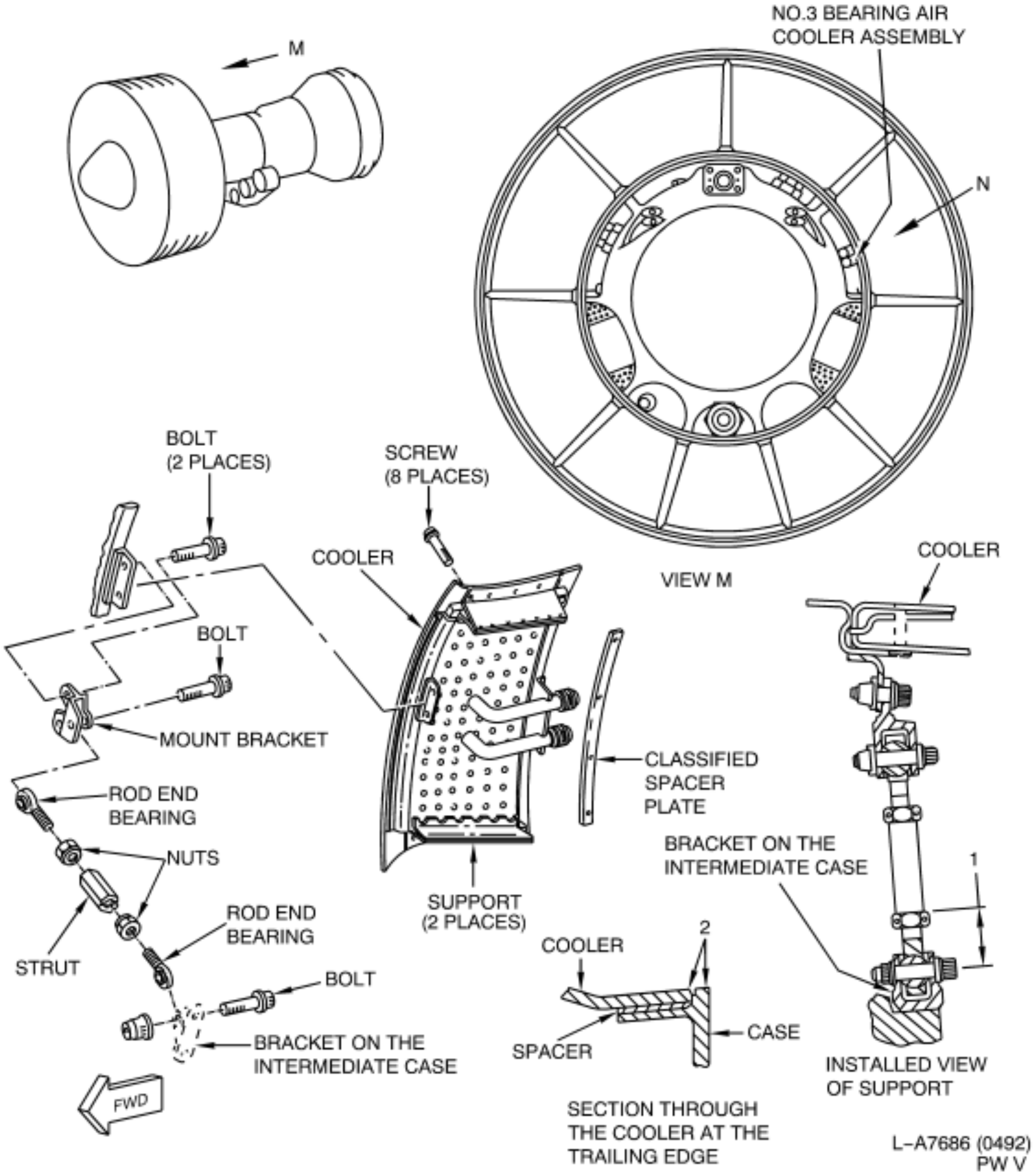
3 In less than two hours after you cleaned the parts, fill the spaces at AL with Sealant P09-027.

4 Cure the sealant in adjacent air that has a 25 percent relative humidity, minimum, for eight hours, minimum, before you run the engine.

(4) Attach cooling air tubes to adapters lubricated with
R Antiseize Paste P06-054, on cooler. Wipe off unwanted
R paste. Torque tube nuts to 825 - 900 lb-in. (93.212 - 101.686 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 the tube nuts.

C. Postrequisites

(1) Test engine per Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).

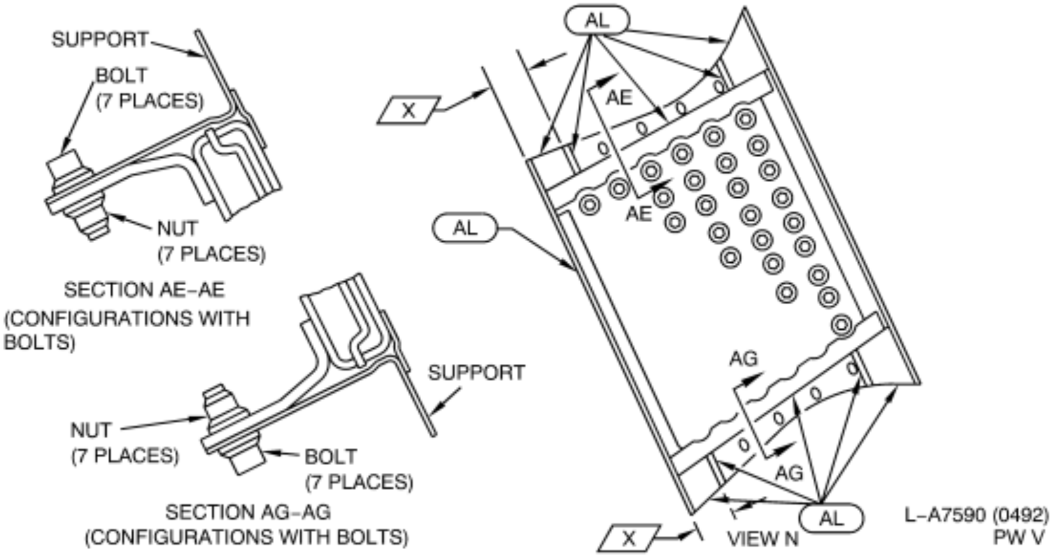

M
NO.3 BEARING AIR COOLER ASSEMBLY
N
VIEW M
BOLT (2 PLACES)
SCREW (8 PLACES)
COOLER
BOLT
MOUNT BRACKET
ROD END BEARING
NUTS
STRUT
ROD END BEARING
BOLT
BRACKET ON THE INTERMEDIATE CASE
FWD
SUPPORT (2 PLACES)
CLASSIFIED SPACER PLATE
COOLER
BRACKET ON THE INTERMEDIATE CASE
1
COOLER
2
CASE
SPACER
SECTION THROUGH THE COOLER AT THE TRAILING EDGE
INSTALLED VIEW OF SUPPORT
L-A7686 (0492)
PW V

No. 3 Bearing Air Cooler Assembly And Support
Figure 401 (Sheet 1)
(Task 72-00-33-450-002)

ENGINE GENERAL − FAN CASE − INSTALLATION−05

1. 1.000 Inch (25.400 mm) Reference Dimension AD
2. These Surfaces Must Be Even Within 0.020 Inch (0.508 mm), Except At X. These Surfaces Must Be Even Within 0.080 Inch (2.032 mm), Two Places At X. Choose The Correct Class Of Spacer.

Key to Figure 401 (Sheet 1)


SUPPORT
BOLT
(7 PLACES)
NUT
(7 PLACES)
SECTION AE-AE
(CONFIGURATIONS WITH BOLTS)
NUT
(7 PLACES)
BOLT
(7 PLACES)
SUPPORT
SECTION AG-AG
(CONFIGURATIONS WITH BOLTS)
AL
X
AE
AE
AL
AG
AG
AL
X
VIEW N
L-A7590 (0492)
PW V

No. 3 Bearing Air Cooler Assembly And Support
Figure 401 (Sheet 2)
(Task 72-00-33-450-002)

ENGINE GENERAL - FAN CASE - INSTALLATION-06

Task 72-00-33-450-003-A:

1. Install EEC Fan Case Wiring Harnesses W1 and W2 For Basic Engines

NOTE: This procedure provides for installation of the EEC fan case wiring harnesses W1 and W2 when the fan case is installed to the intermediate case.

A. Prerequisites

(1) If it is necessary to install a new access cover, refer to Repair-02 Task 72-00-33-300-002 for instructions on the installation of boltholes in the cover.

B. Equipment And Materials Required

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
No. 10 Torq-set Drive

Special Tools:
PWA 86157 Box, Simulator
PWA 86158 Box, Simulator
PWA 86159 Bar, Simulator
PWA 86211 Panel, Simulator
PWA 86212 Panel, Simulator

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-099	Tape, Moisture Resistant, Green (PMC 4141)
P05-124	Ties, Twist
P09-019	Sealant, Flame Resistant Silicone Rubber (PWA 36751-1)
P09-027	Sealant, Silicone Rubber (PWA 36003-2)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)
P18-007	Primer, Silicone (PWA 36086-2)

C. Procedure
See Figure 401, Figure 402,
Figure 403,
Figure 404, Figure 405, Figure 406, Figure 407, Figure 408,
Figure 409 and Figure 410.

ENGINE GENERAL − FAN CASE − INSTALLATION−06

CAUTION: SEE 72−00−00, INSTALLATION−00 FOR NECESSARY GENERAL INSTALLATION INSTRUCTIONS ABOUT THE WIRING HARNESSES, LEADS, AND CABLES.

CAUTION: DO NOT TWIST OR BEND THE HARNESSES BADLY DURING THE INSTALLATION OR DAMAGE TO THE HARNESSES CAN RESULT.

(1) Measure the W1 harness from the W1P25 harness connector and make a mark per dimension given in Figure 410 (Sheet 2).

(2) Measure the W2 harness from the W2J9 harness connector and make a mark per dimension given in Figure 410 (Sheet 2).

(3) Set the W1 and W2 wiring harnesses on the left side of the fan case and down through the intermediate case strut at 12 o'clock position. Keep the W1 harness to the right of the strut and the W2 harness to the left of the strut. Continue to set harnesses on to the HPC case. See Figure 401 for harness routing.

(4) Adjust harness positions and temporarily install Twist Ties P05−124 to attach the harnesses to engine brackets.

(5) Install the EEC over the harnesses and attach with work bolts temporarily.

(6) Connect the W1 and W2 harness connectors (given below) to the mating harness receptacles as follows. See Figure 402 for connector locations. For each connector:

CAUTION: IF ENGINE HAS THE HPC RING CASE CONFIGURATION (POST SB PW4ENG 72−756), MAKE SURE YOU INSTALL THE CORRECT W1 AND W2 HARNESS, PROGRAMMING PLUG AND EEC. IF YOU DO NOT INSTALL THE CORRECT HARDWARE, THE ENGINE WILL NOT OPERATE.

(a) If W1 and W2 harness have yellow bands, you must have an EEC with the yellow and black label (For Ring Case Configuration). (See Figure 409).

(b) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(c) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(d) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(e) Connect the W1P6, W1P7, and W1P8 harness connectors to the J6, J7, and J8 receptacles on the rear side of the EEC (Channel A).

(f) Connect the W2P2, W2P3, and W2P4 harness connectors to the J2, J3, and J4 receptacles on the front side of the EEC (Channel B).

NOTE: Be sure that each of the leads for all the connectors go out of the W1 and W2 harnesses as shown.

(g) Connect the W2P20 harness connector (if equipped) to the receptacle on the PMUX.

(h) Connect the W2P26 harness connector to the W5J26 harness receptacle attached to the HPC case bracket at approximately 12 o'clock position.

(i) Attach the W2J9 harness receptacle to the same HPC case bracket with the retaining bracket and two bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(j) Connect the W1P10 and W1P11 harness connectors to the receptacles of the solenoid at approximately 1 o'clock position above Flange E.

(k) Connect the W1P25 harness connector to the W4J25 harness receptacle attached to the HPC case bracket at approximately 1:30 o'clock position.

(l) Connect the W1P9 harness connector to the W2J9 harness receptacle attached to the HPC case bracket at approximately 12 o'clock position.

(m) Connect the W1P24 harness connector to the W3J24 harness receptacle attached to the HPC bracket at approximately 10 o'clock position.

(7) Attach the simulator panels to fan case as follows. See Figure 411.

(a) Install a PWA 86157 Pylon Interface Simulator Box to bolt holes 4 and 5, 116 and 117 on Flange B2, removing existing bolts at some locations to attach simulator to the flange. Secure the box to the corresponding bolt holes on Flange A1.

(b) Install a PWA 86158 Electrical Junction Box Simulator to bolt holes 108 through 110 on Flange B1. Secure the box to the flange with the receptacles pointing downward and attach it to the corresponding bolt holes on Flange A1.

(c) Install a PWA 86211 Inlet Cowl Simulator Panel to bolt holes 4 and 5 on the rear face of Flange A. Secure the panel to the flange with bolts and detail knobs.

(d) Install a PWA 86212 Junction Box Simulator Panel to bolt holes 104 and 106 on Flange A1 and the corresponding bolt holes on Flange B1. Secure the panel to the flange with bolts and washers and if required, spacers between Flange A1 and the panel.

(e) Attach the connector ends of the EEC harnesses to the proper receptacles on the simulators.

(8) Adjust the W1 and W2 harnesses for any necessary clearance as required. Install the clamps at all clamp points. Refer to figures. Attach the clamps loosely to the engine with bolts and/or nuts, threads lubricated with Engine Oil P03−001. Remove the Twist Ties P05−124 previously installed to position harnesses.

NOTE: Use different clamp sizes on the wiring harnesses to prevent harness movement when tightened. See the Illustrated Parts Catalog for selection of clamp sizes and part numbers.

(9) Attach the harnesses through the intermediate case strut as follows. See Figure 405.

(a) Make sure the upper front grommet is installed forward of the EEC sensing tubes at the top of the strut.

(b) Install the upper middle and rear grommets to the harnesses at the top of the strut. Install one bolt, threads lubricated with Engine Oil P03−001, and washer (Pre SB PW4ENG 72−145) or plate (Post SB PW4ENG 72−145). Tighten the bolt by hand.

(c) Install the lower center grommets and lower right and left clamp segments to the harnesses at the bottom of the strut. Attach each of the clamp segments to the intermediate case with two screws, threads lubricated with Engine Oil P03−001, and one bracket. Tighten screws by hand.

(d) Adjust the harnesses through the strut so that the harnesses are not loose. Make sure the marks previously made on each harness align with the rear surface of the clamps that attach the harnesses to the Flange E brackets. See Figure 410 (Sheet 2).

(e) Torque the clamp bolts that attach both harnesses to the intermediate case below the strut and to the Flange E brackets to 36 − 40 lb−in. (4.067 − 4.519 N.m). Remove all looseness from the harnesses through the strut area out the top of the strut.

(f) Tighten the four screws that attach the lower clamp segments. Loosen the screws one turn. Torque the screws to 22 lb−in. (2.486 N.m) plus the torque required to turn the screw through the locking property. The maximum torque for the screw is 40 lb−in. (4.519 N.m). Make sure the remaining screw holes in the clamp segment bracket align with the intermediate case screw holes.

(g) (Reference 2011) Tighten the upper grommet bolt at top of strut until locking property of nut is felt. Tighten bolt 10 complete turns more.

(10) Install a PWA 86159 Vee−band Anchor Fitting Simulator Bar to the outer fan case Vee−groove at the 12 o'clock position. Check the clearance of the harnesses as they cross the Vee−groove and travel under the Vee−band simulator bar. Adjust the harness as required to obtain a proper fit.

(11) Adjust harnesses for clearances and torque all the remaining clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(12) Tie harnesses and examine clearances as shown in Figure 410.

(13) Remove the EEC and torque the clamp bolts that were under the EEC to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(14) Disconnect the harness connectors from the simulator boxes and panels.

(15) Remove the simulators from the engine.

(16) Replace the previously removed bolts, washers and nuts to the open holes in the flange brackets. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER ACCESS COVER AND COVER PLATE. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 72−161 AND SB PW4ENG 72−370.

(17) For engines that are post SB PW4ENG 72−161 and have only the fan exit fairing access covers (412/5) removed, install the access covers (412/5) and the rear cover plate (412/1) as follows. Use a No. 10 Torq−set drive. See Figure 412.

(a) (Post SB PW4ENG 72−370) If the access covers (412/5) you install are new, bond washers to the two boltholes (412/6) that are at the bottom of the covers as follows. If the access covers you install are not new, skip this step.

1 Use the washers that were on the covers you removed. Use the same quantity of washer, in the same positions, on the new covers as on the old covers.

NOTE: Refer to the Standard Practices Manual, 70−48, for the cleaning procedures that follow.

2 Clean the areas the sealant will touch with PWA 83−D4, but do not use trichlorotrifluoroethane.

3 With Sealant P09−027, make a fillet all around the edges of the washers. Sealant is not permitted between the washers and the intermediate case nor between the washers and the fairing access covers.

4 Cure the sealant in air that is at room temperature, and has a relative humidity of 25 percent, for four hours before you touch it.

(b) Install the two access covers (412/5) to the fan exit fairing (412/2) with the four screws (412/6) and two screws (412/7), and if applicable two screws (412/4) lubricated with Engine Oil P03−001.

(c) Tighten the four screws (412/6) against the two covers (412/5) and then loosen them one complete turn. Tighten the four screws (412/7) and (412/4) against the two covers (412/5) and then loosen them one complete turn.

(d) Install the (rear) cover plate (412/1) to the fan exit fairing (412/2) with the six screws (412/3), lubricated with Engine Oil P03−001.

(e) Tighten the screws (412/3) against the cover plate (412/1) then loosen them one complete turn. Torque the screws (412/3) to 22 lb−in. (2.486 N.m) plus the torque necessary to turn them through the locking feature of the nuts. The maximum torque is 40 lb−in. (4.519 N.m).

(f) Torque the four screws (412/6) to 22 lb−in. (2.486 N.m) plus the torque necessary to turn them through the locking feature of the nuts. The maximum torque is 40 lb−in. (4.519 N.m).

(g) Torque the four screws (412/7) and (412/4) to 22 lb−in. (2.486 N.m) plus the torque necessary to turn them through the locking feature of the nuts. The maximum torque is 40 lb−in. (4.519 N.m).

(18) Apply sealant to Area AL. See Figure 413.

NOTE: Refer to the Standard Practices Manual, 70−48, for the cleaning procedures that follow.

(a) Clean the areas the sealant will touch. Use PWA 83−D4, but do not use trichlorotrifluoroethane.

(b) Apply Primer P18−007 to all cleaned surfaces.

1 It is necessary to apply the primer in less than two hours after you cleaned the area.

2 The primer must cure in air at ambient temperature for two hours, minimum. The air must have a relative humidity of 25 percent, minimum.

(c) Apply Sealant P09−019.

1 It is necessary to apply the sealant from 2 − 24 hours after you applied the primer.

2 Use a hot air gun at 175° − 225°F (79.° − 107.°C) for 5 − 7 minutes to dry the sealant.

3 After the hot air gun, cure the sealant in air that has a relative humidity of 25 percent, minimum, for eight hours, minimum, before you touch the parts.

(19) Apply sealant to Area AM:

(a) Clean the areas the sealant will touch. Use PWA 83−D4, but do not use trichlorotrifluoroethane.

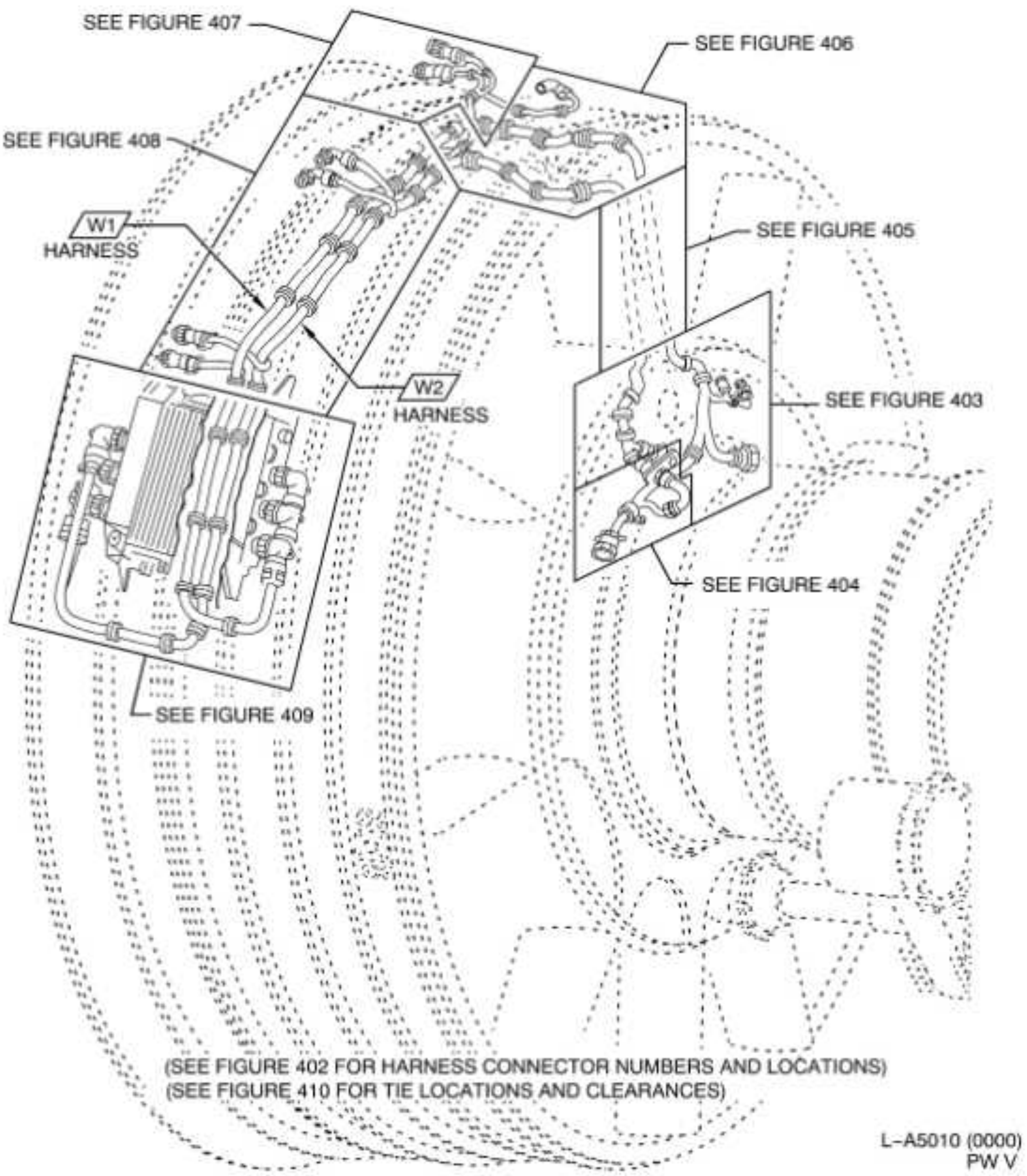
(b) Apply Sealant P09−027. Cure the sealant in air that is at room temperature, and has a relative humidity of 25 percent, minimum, for eight hours, minimum, before you touch the parts.

D. Postrequisites

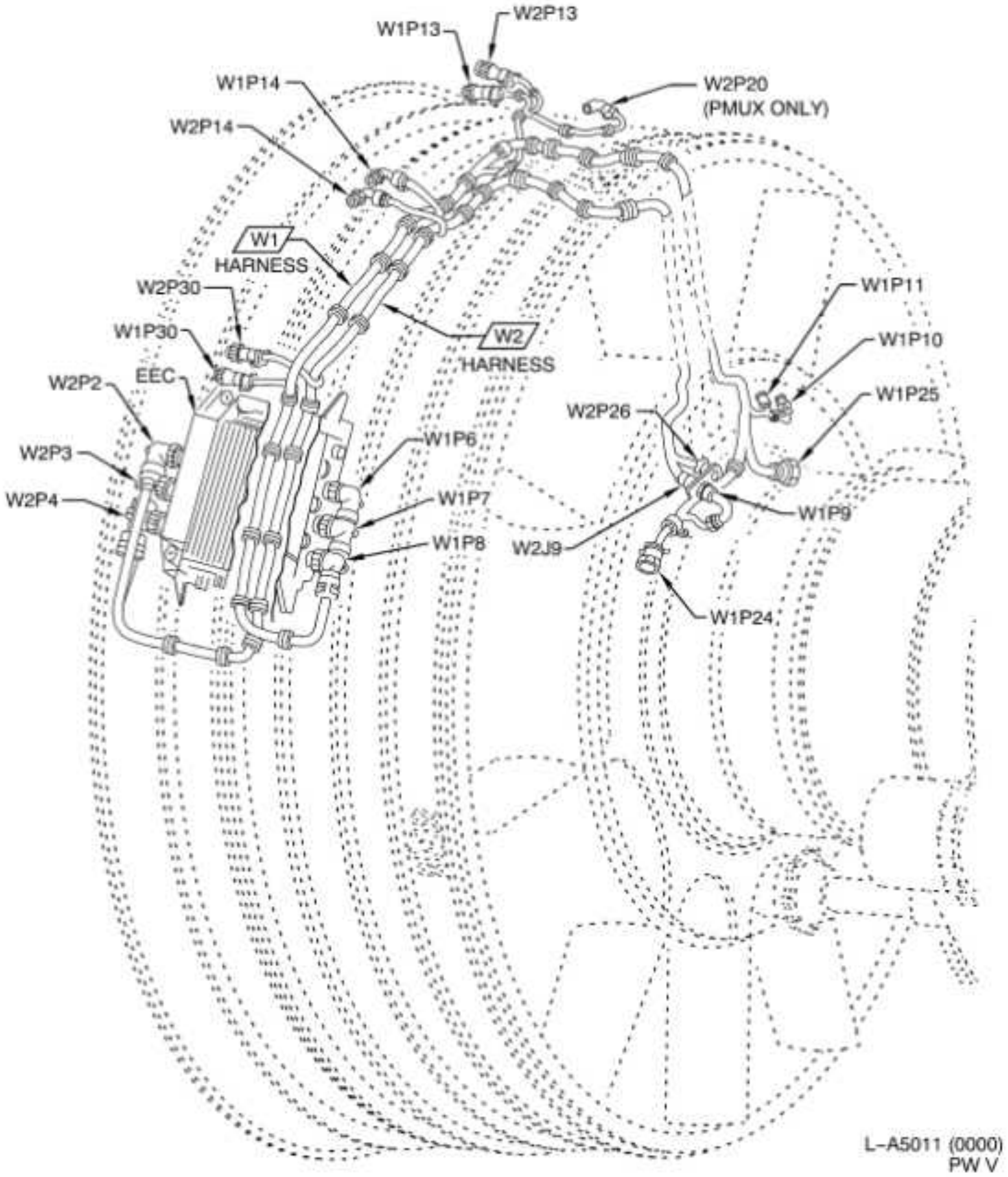
(1) For engines with the fan exit fairings disassembled from the intermediate case, install the fairings. See Installation−14 Task 72−00−33−450−009.

(2) Install the fan exit liner segments (inner rear) that you removed. Refer to 72−00−33, Installation−16 Task 72−00−33−440−001.

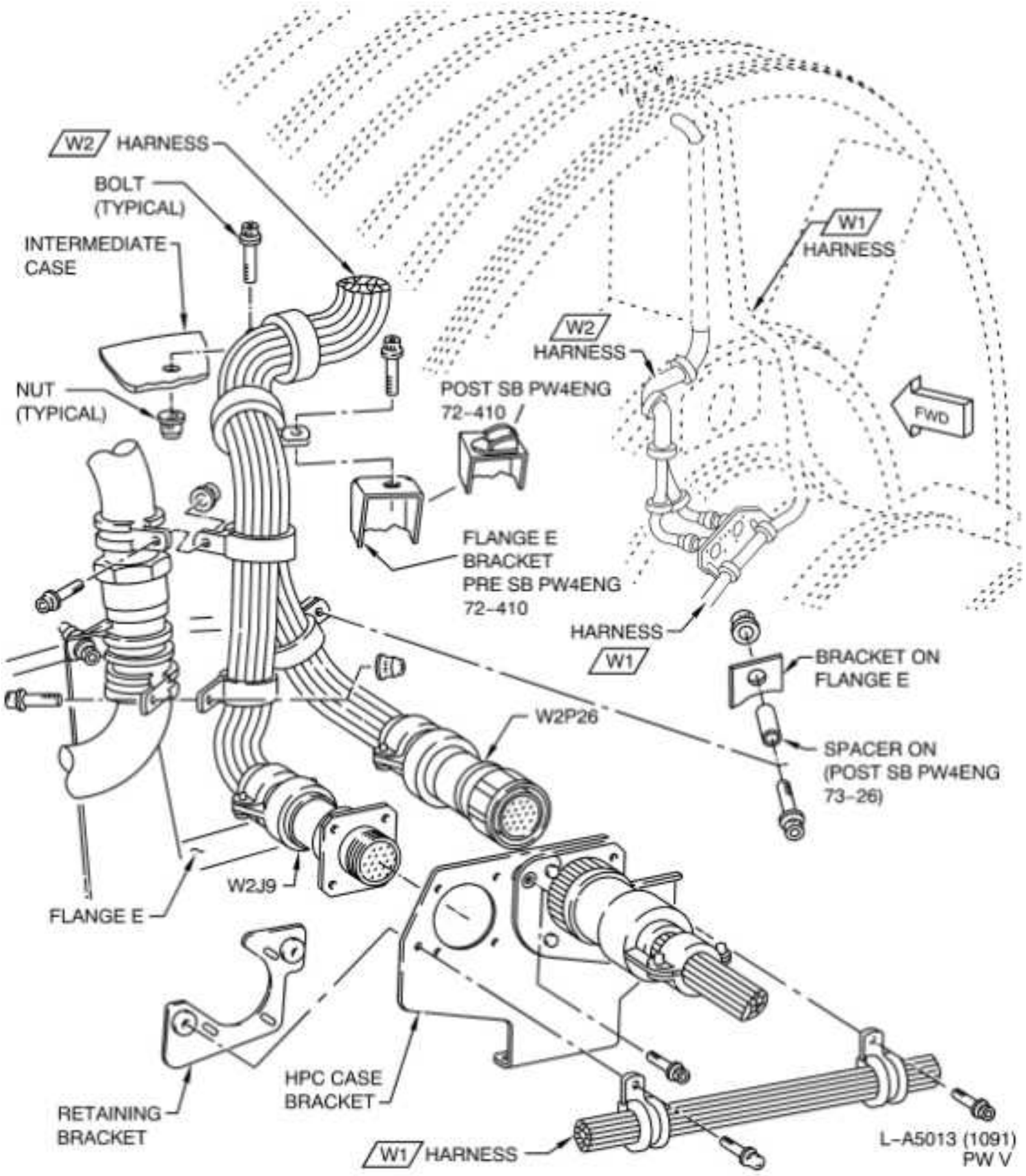
(3) Install the electronic engine control (EEC). See Installation−04 Task 72−00−33−450−001.


SEE FIGURE 407
SEE FIGURE 406
SEE FIGURE 408
W1
HARNESS
SEE FIGURE 405
W2
HARNESS
SEE FIGURE 403
SEE FIGURE 404
SEE FIGURE 409
(SEE FIGURE 402 FOR HARNESS CONNECTOR NUMBERS AND LOCATIONS)
(SEE FIGURE 410 FOR TIE LOCATIONS AND CLEARANCES)
L–A5010 (0000)
PW V

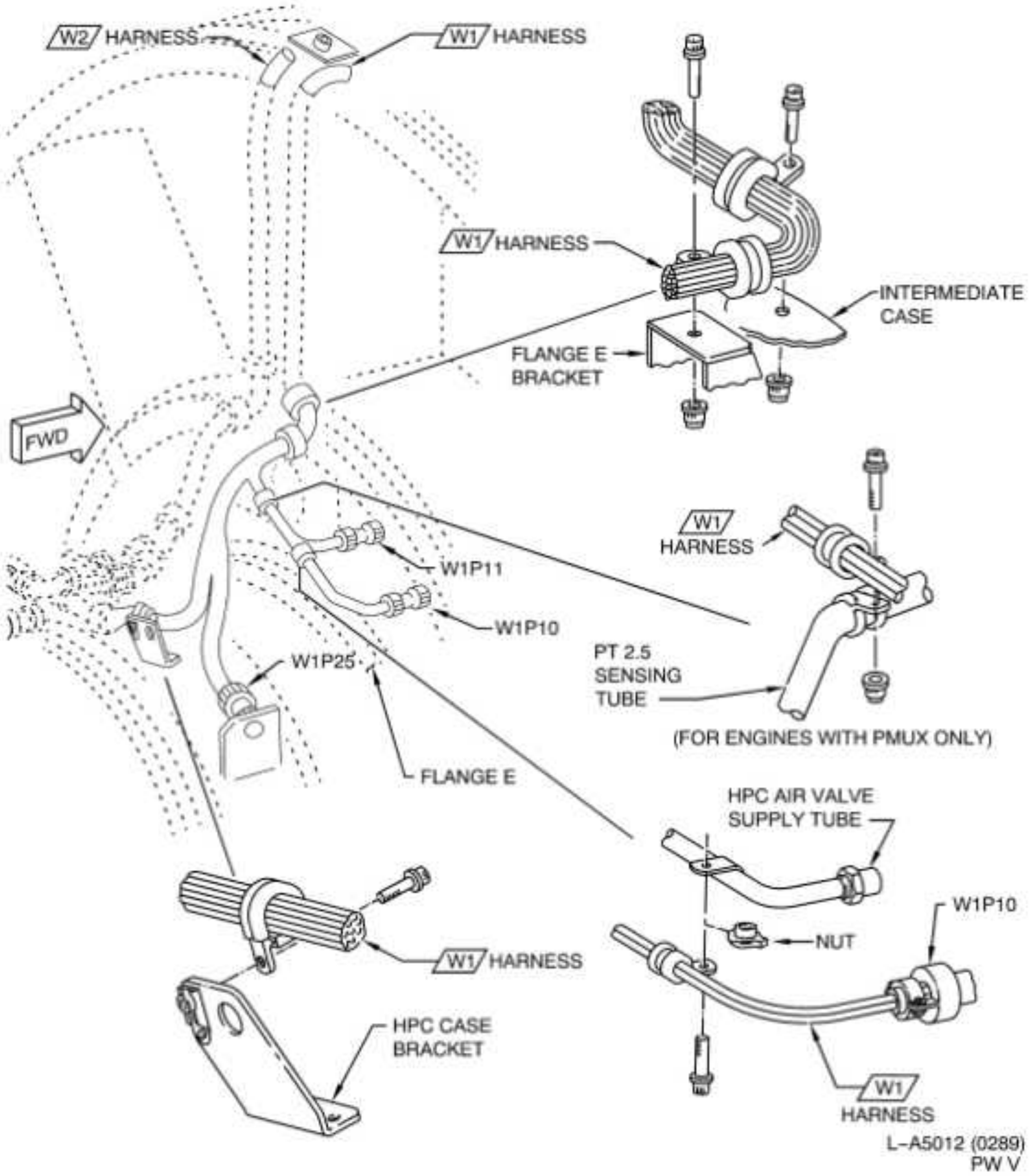
EEC Fan Case Wiring Harnesses
Figure 401
(Task 72–00–33–450–003–A)


W2P13
W1P13
W2P20
(PMUX ONLY)
W1P14
W2P14
W1
HARNESS
W2P30
W2
HARNESS
W1P30
EEC
W2P2
W1P11
W1P10
W1P25
W2P26
W1P6
W2P3
W2P4
W1P7
W1P9
W1P8
W2J9
W1P24
L-A5011 (0000)
PW V

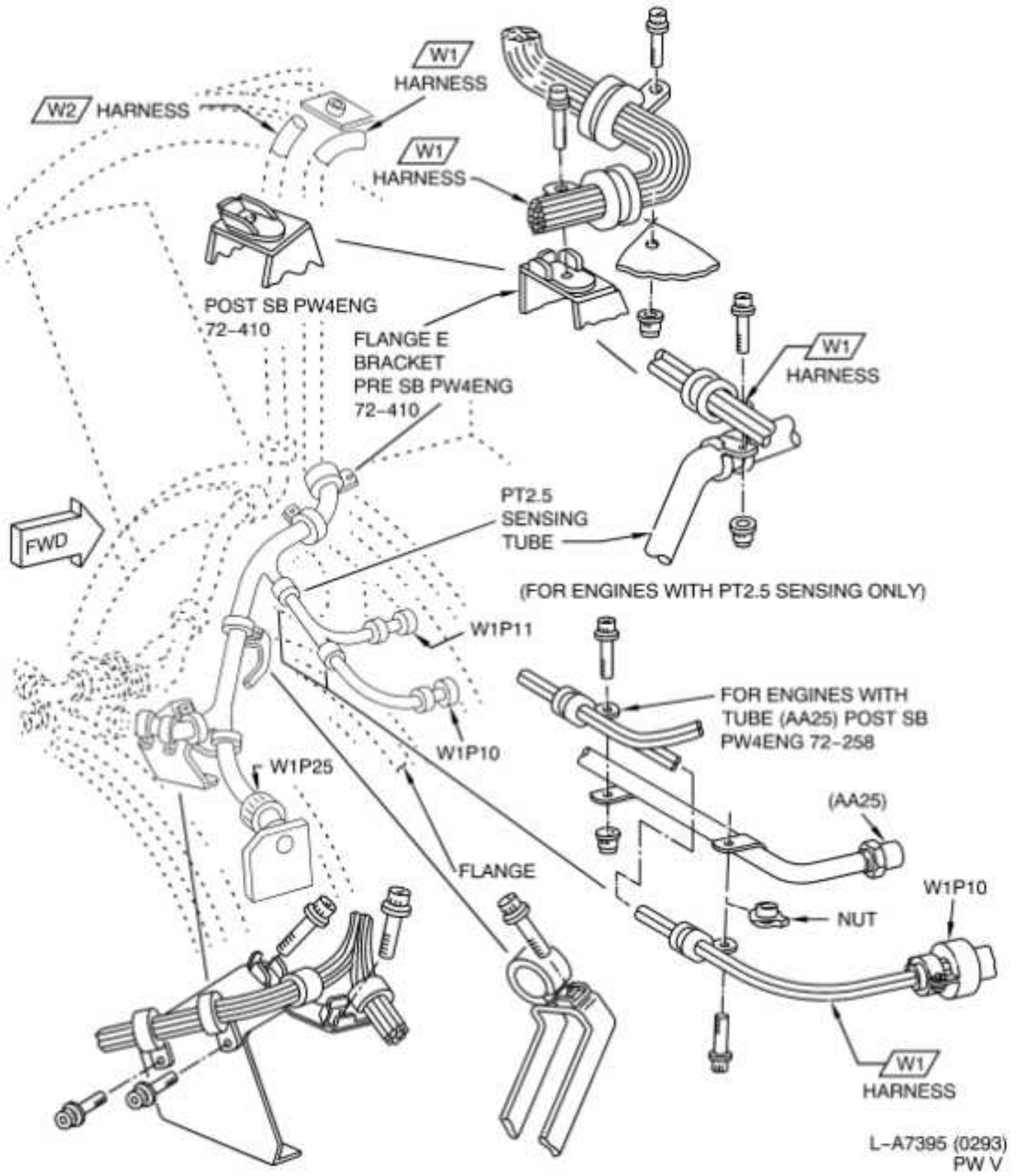
EEC Fan Case Wiring Harnesses
Figure 402
(Task 72−00−33−450−003−A)


W2 HARNESS
BOLT (TYPICAL)
INTERMEDIATE CASE
NUT (TYPICAL)
W1 HARNESS
W2 HARNESS
POST SB PW4ENG 72-410
FWD
FLANGE E BRACKET PRE SB PW4ENG 72-410
HARNESS W1
BRACKET ON FLANGE E
W2P26
SPACER ON (POST SB PW4ENG 73-26)
W2J9
FLANGE E
RETAINING BRACKET
HPC CASE BRACKET
W1 HARNESS
L-A5013 (1091) PW V

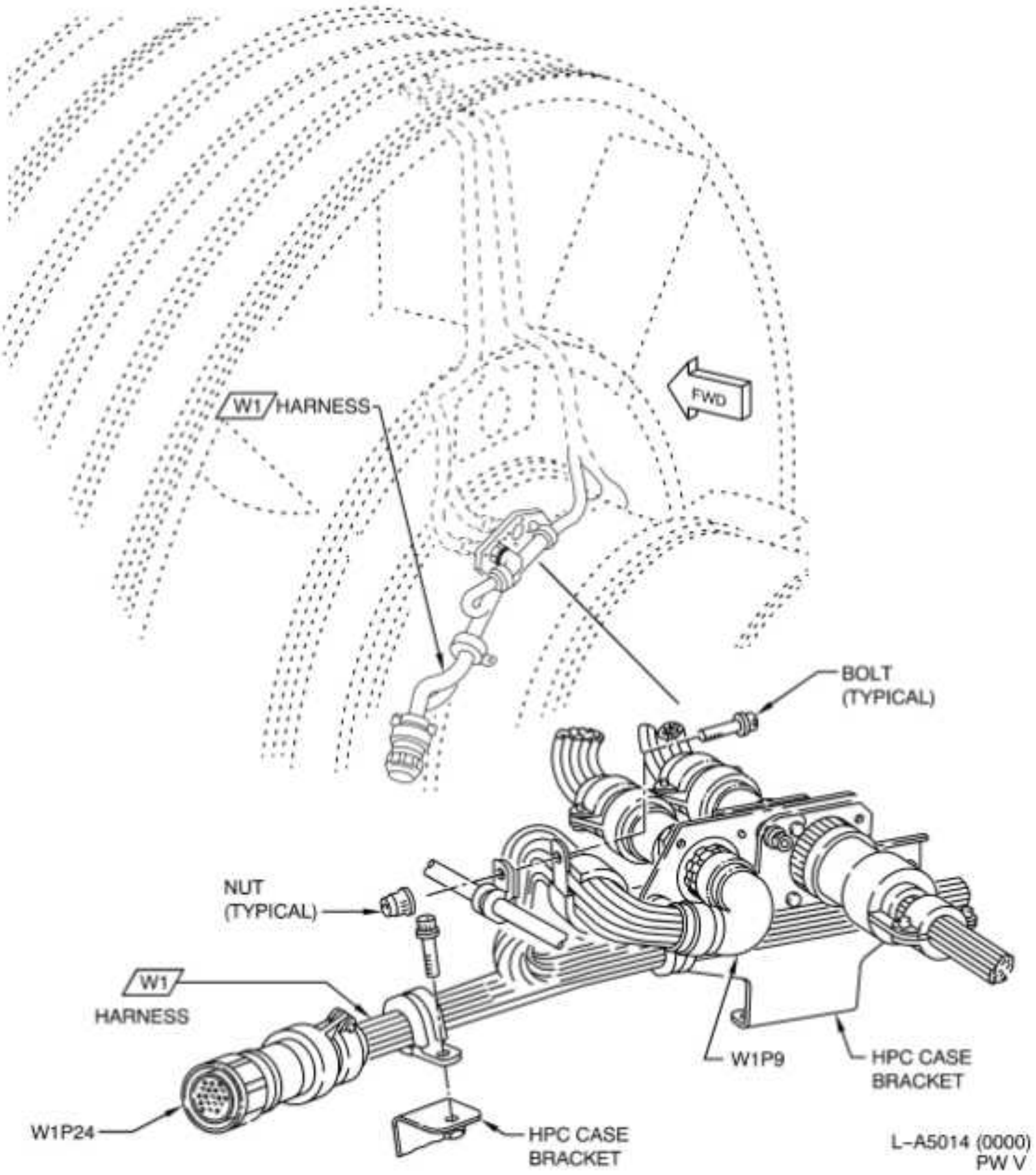
EEC Fan Case Wiring Harnesses
Figure 403 (Sheet 1)
(Task 72-00-33-450-003-A)


W2 HARNESS
W1 HARNESS
W1 HARNESS
INTERMEDIATE CASE
FLANGE E BRACKET
FWD
W1 HARNESS
W1P11
W1P10
PT 2.5 SENSING TUBE
(FOR ENGINES WITH PMUX ONLY)
W1P25
FLANGE E
HPC AIR VALVE SUPPLY TUBE
W1P10
NUT
W1 HARNESS
HPC CASE BRACKET
W1 HARNESS
L-A5012 (0289)
PW V

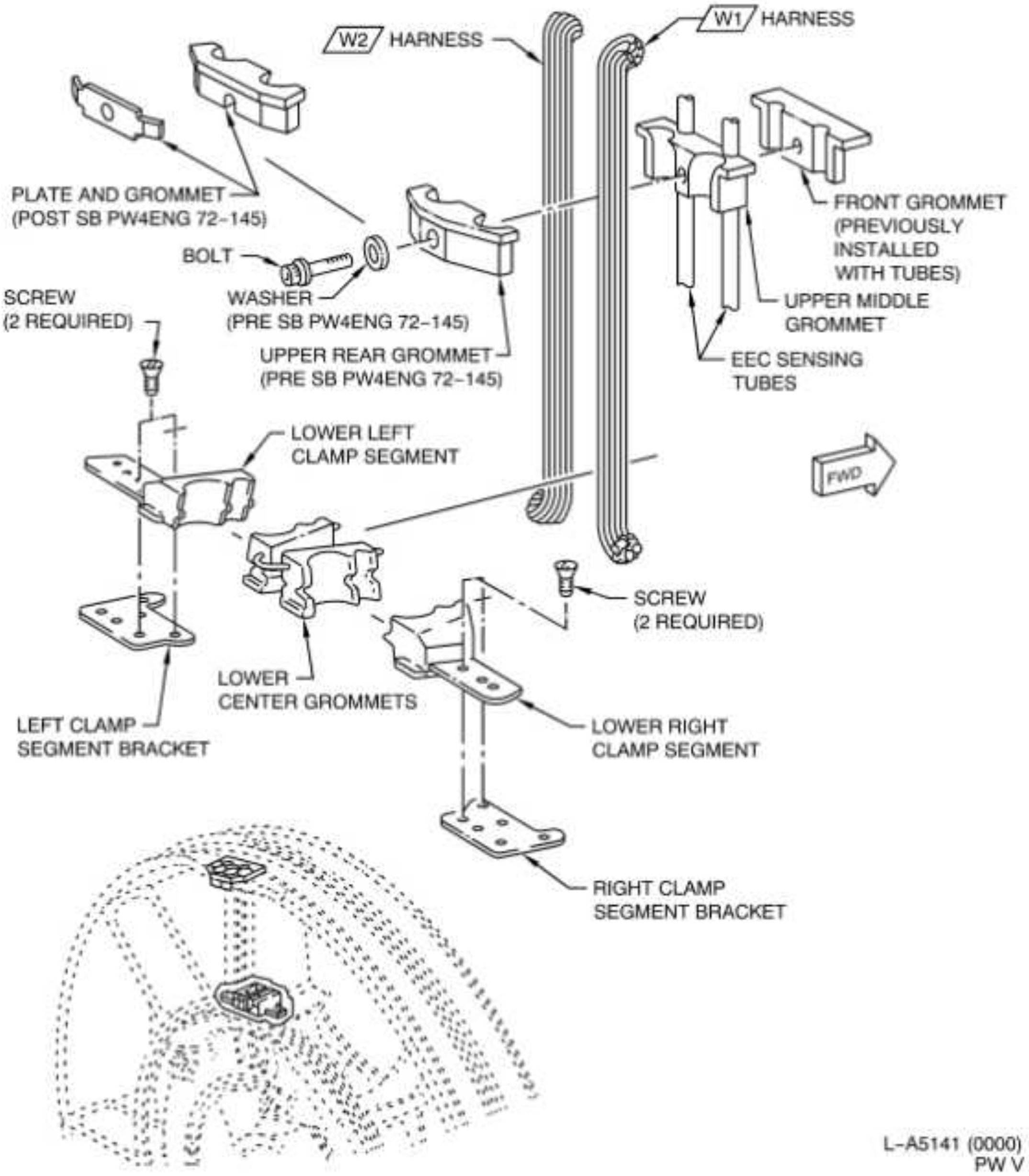
EEC Fan Case Wiring Harnesses (Pre SB PW4ENG 72-258)
Figure 403 (Sheet 2)
(Task 72-00-33-450-003-A)


W1 HARNESS
W2 HARNESS
W1 HARNESS
POST SB PW4ENG 72-410
FLANGE E BRACKET PRE SB PW4ENG 72-410
W1 HARNESS
PT2.5 SENSING TUBE
(FOR ENGINES WITH PT2.5 SENSING ONLY)
FWD
W1P11
FOR ENGINES WITH TUBE (AA25) POST SB PW4ENG 72-258
W1P10
W1P25
(AA25)
FLANGE
W1P10
NUT
W1 HARNESS
L-A7395 (0293)
PW V

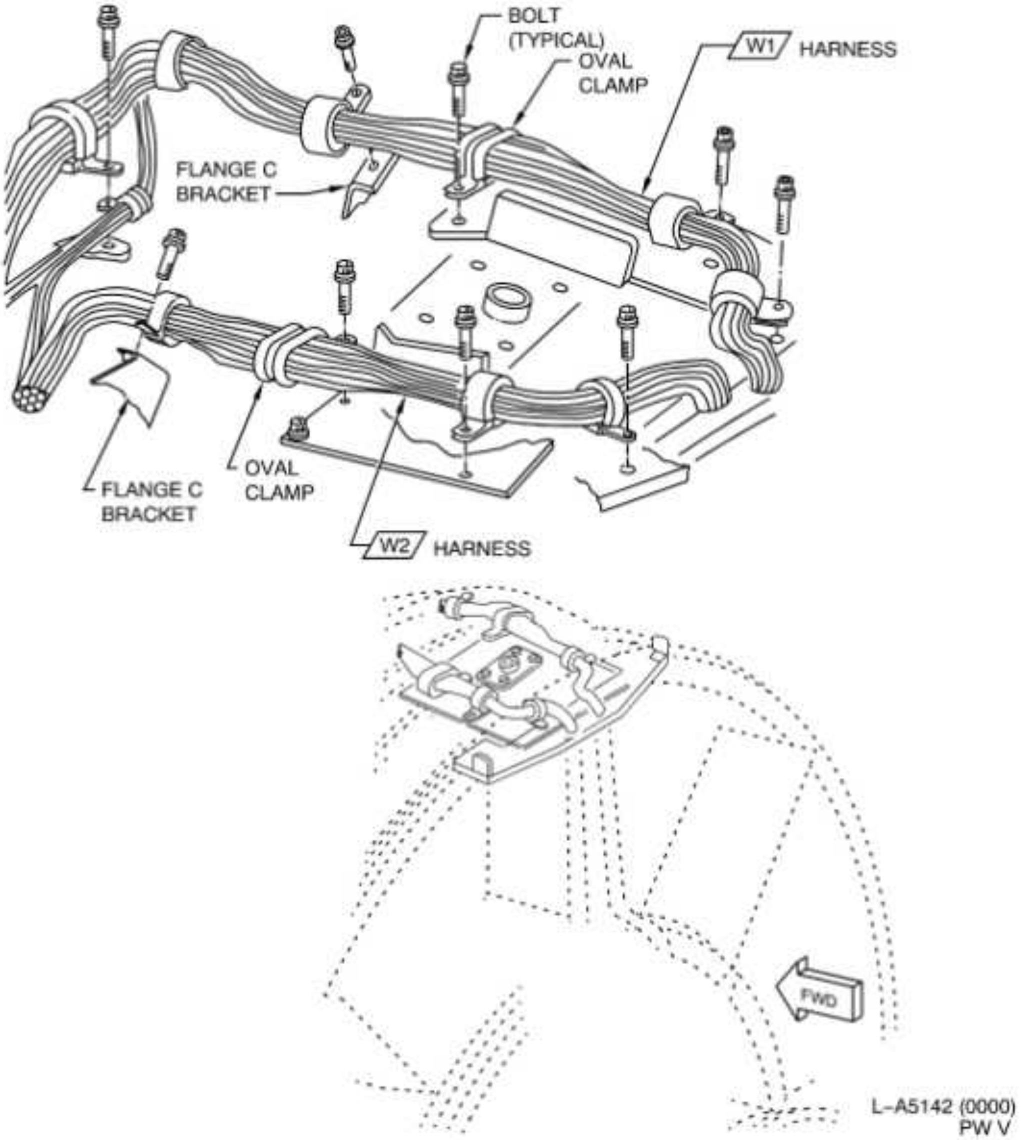
EEC Fan Case Wiring Harnesses (Post SB PW4ENG 72-258)
Figure 403 (Sheet 3)
(Task 72-00-33-450-003-A)


W1 HARNESS
FWD
BOLT (TYPICAL)
NUT (TYPICAL)
W1 HARNESS
W1P9
HPC CASE BRACKET
W1P24
HPC CASE BRACKET
L-A5014 (0000)
PW V

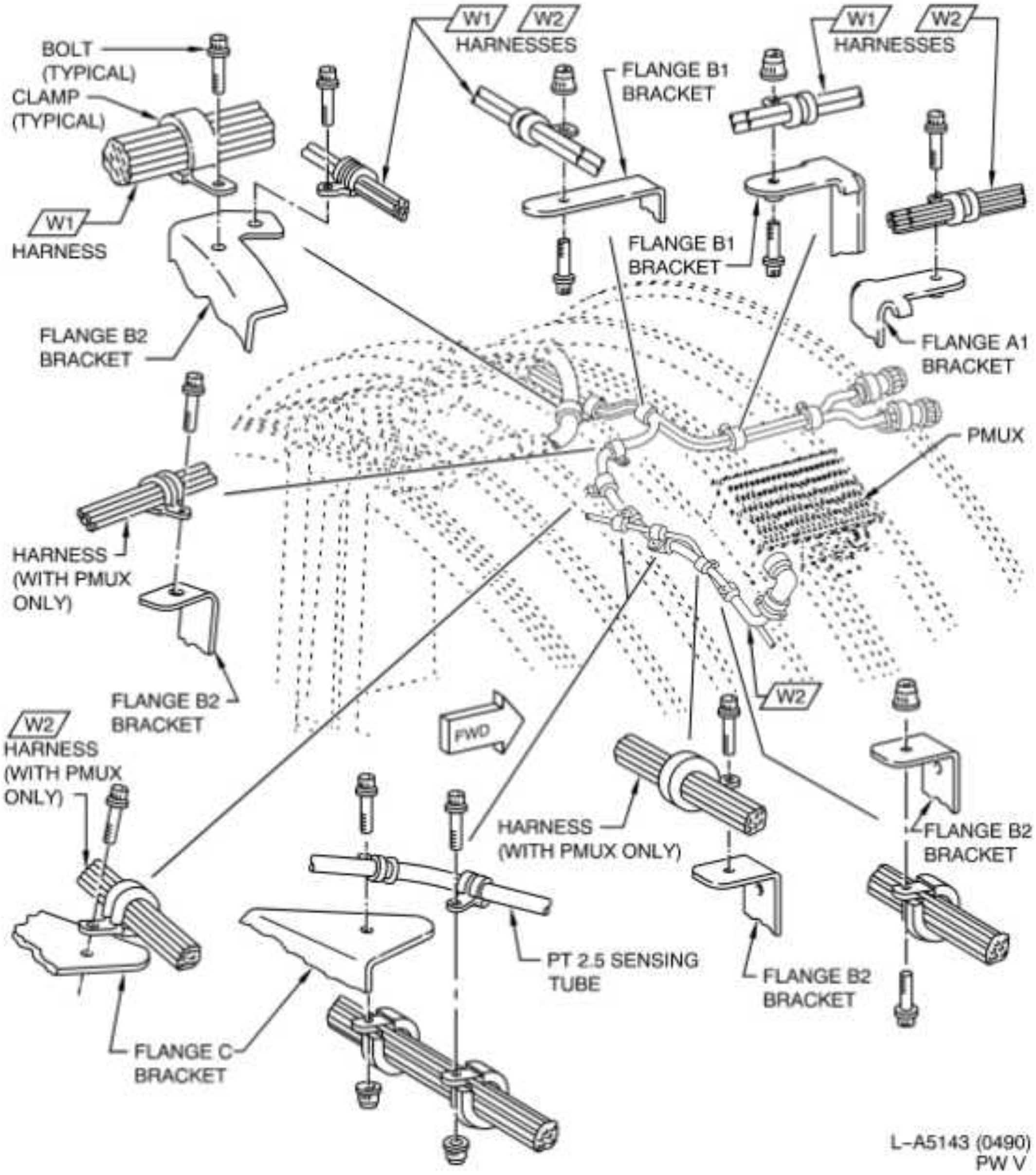
EEC Fan Case Wiring Harnesses
Figure 404
(Task 72−00−33−450−003−A)


W2 HARNESS
W1 HARNESS
PLATE AND GROMMET (POST SB PW4ENG 72-145)
BOLT
SCREW (2 REQUIRED)
WASHER (PRE SB PW4ENG 72-145)
UPPER REAR GROMMET (PRE SB PW4ENG 72-145)
FRONT GROMMET (PREVIOUSLY INSTALLED WITH TUBES)
UPPER MIDDLE GROMMET
EEC SENSING TUBES
LOWER LEFT CLAMP SEGMENT
FWD
SCREW (2 REQUIRED)
LOWER CENTER GROMMETS
LEFT CLAMP SEGMENT BRACKET
LOWER RIGHT CLAMP SEGMENT
RIGHT CLAMP SEGMENT BRACKET
L-A5141 (0000)
PW V

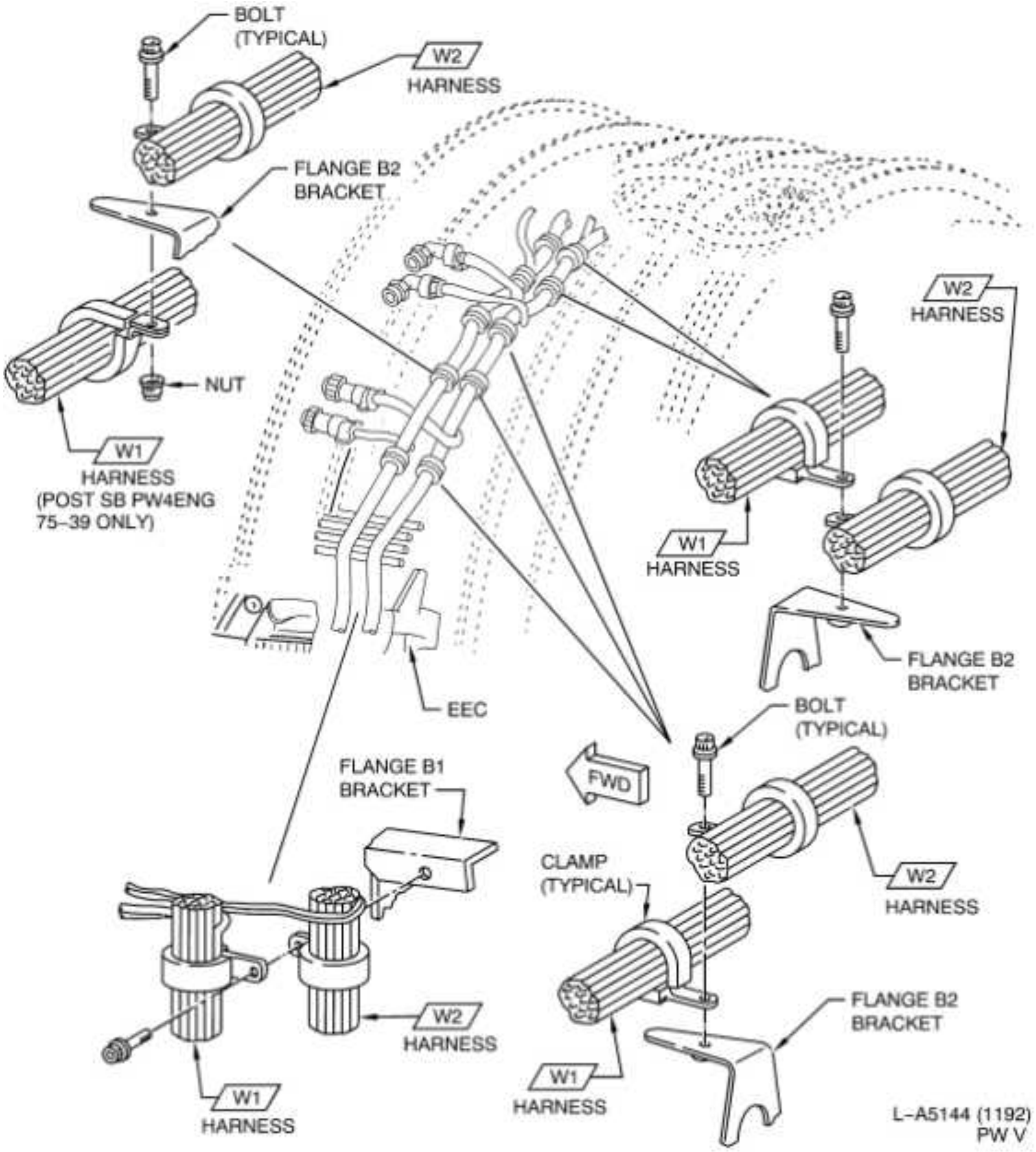
EEC Fan Case Wiring Harnesses
Figure 405
(Task 72−00−33−450−003−A)


BOLT (TYPICAL)
OVAL CLAMP
W1 HARNESS
FLANGE C BRACKET
FLANGE C BRACKET
OVAL CLAMP
W2 HARNESS
FWD
L−A5142 (0000)
PW V

EEC Fan Case Wiring Harnesses
Figure 406
(Task 72−00−33−450−003−A)

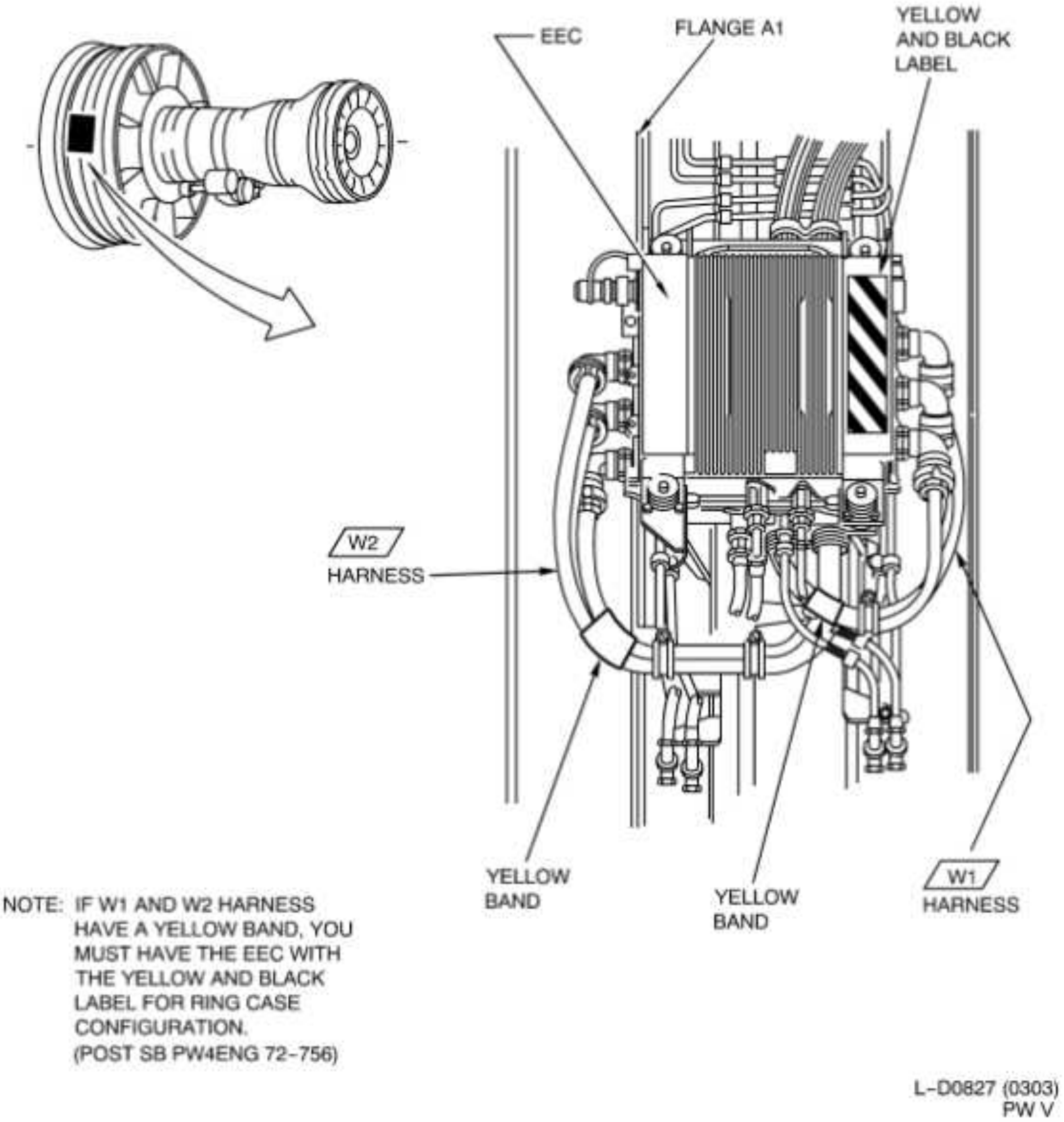

BOLT (TYPICAL)
CLAMP (TYPICAL)
W1 HARNESS
W1 W2 HARNESSES
FLANGE B1 BRACKET
W1 W2 HARNESSES
FLANGE B1 BRACKET
FLANGE B2 BRACKET
FLANGE A1 BRACKET
PMUX
HARNESS (WITH PMUX ONLY)
FLANGE B2 BRACKET
W2 HARNESS (WITH PMUX ONLY)
FWD
W2
HARNESS (WITH PMUX ONLY)
FLANGE B2 BRACKET
PT 2.5 SENSING TUBE
FLANGE B2 BRACKET
FLANGE C BRACKET
L-A5143 (0490)
PW V

EEC Fan Case Wiring Harnesses
Figure 407
(Task 72−00−33−450−003−A)


BOLT (TYPICAL)
W2 HARNESS
FLANGE B2 BRACKET
NUT
W1 HARNESS (POST SB PW4ENG 75-39 ONLY)
W2 HARNESS
W1 HARNESS
FLANGE B2 BRACKET
EEC
BOLT (TYPICAL)
FLANGE B1 BRACKET
FWD
CLAMP (TYPICAL)
W2 HARNESS
W2 HARNESS
FLANGE B2 BRACKET
W1 HARNESS
W1 HARNESS
L-A5144 (1192)
PW V

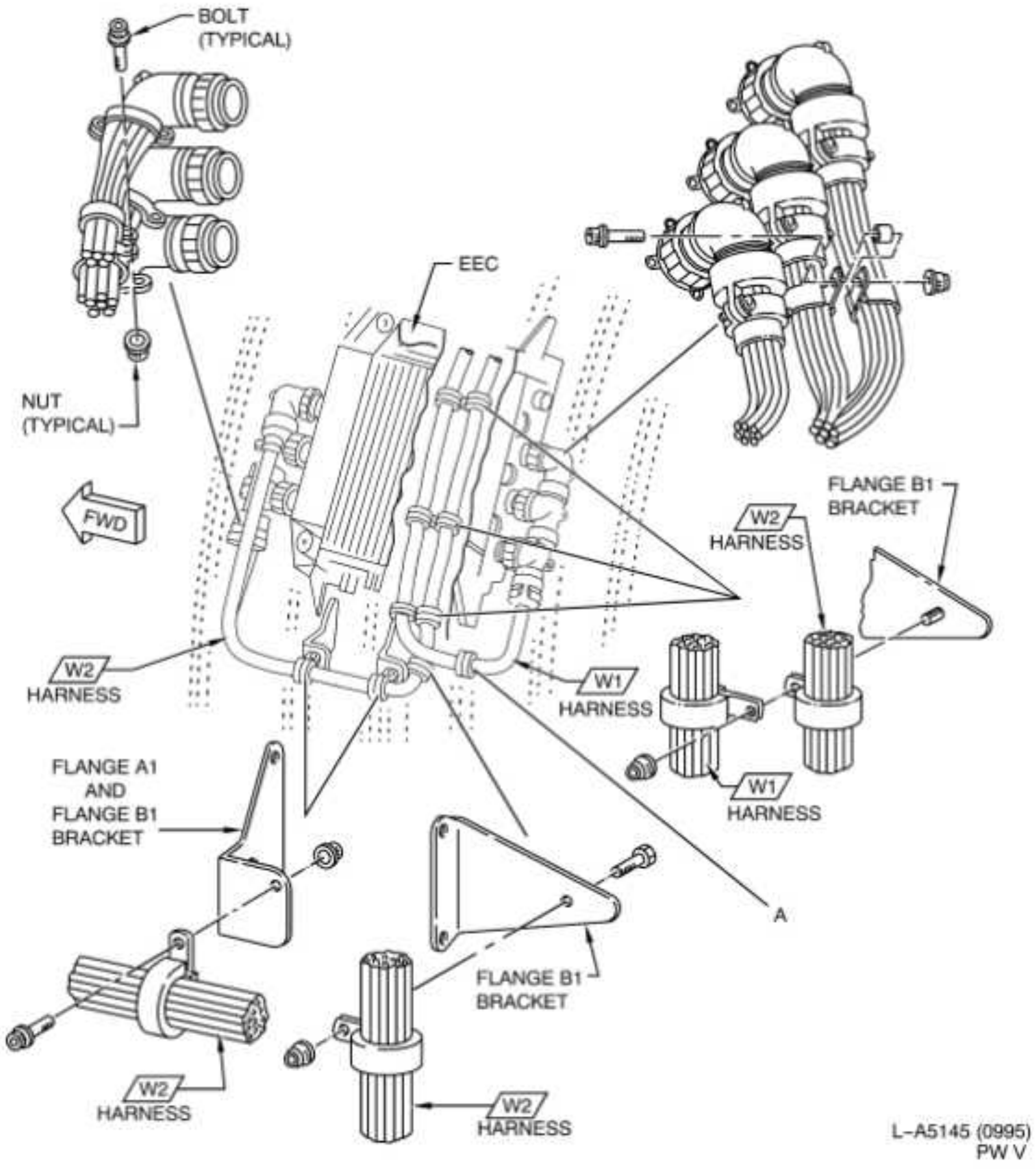
EEC Fan Case Wiring Harnesses
Figure 408
(Task 72−00−33−450−003−A)

ENGINE GENERAL − FAN CASE − INSTALLATION−06

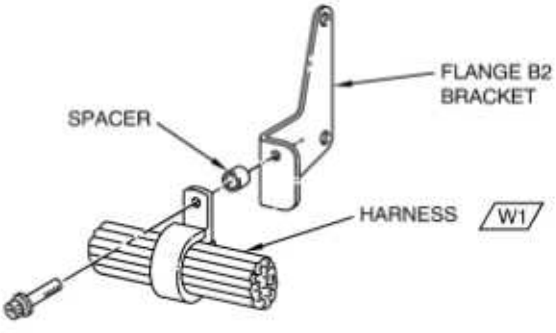

EEC
FLANGE A1
YELLOW AND BLACK LABEL
W2 HARNESS
YELLOW BAND
YELLOW BAND
W1 HARNESS
L-D0827 (0303)
PW V

NOTE: IF W1 AND W2 HARNESS HAVE A YELLOW BAND, YOU MUST HAVE THE EEC WITH THE YELLOW AND BLACK LABEL FOR RING CASE CONFIGURATION. (POST SB PW4ENG 72-756)

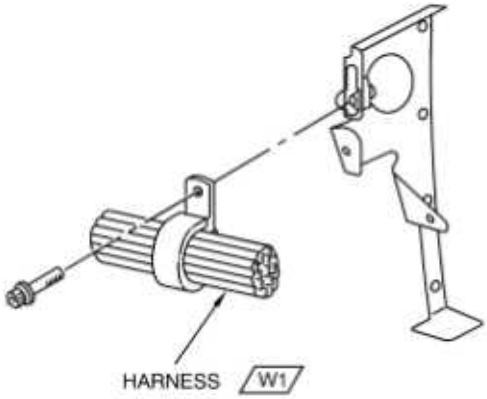
EEC Fan Case Wiring Harnesses − Post
SB PW4ENG 72−756 (Ring Case Configuration)
Figure 409 (Sheet 1)
(Task 72−00−33−450−003−A)


BOLT
(TYPICAL)
EEC
NUT
(TYPICAL)
FWD
FLANGE B1
BRACKET
W2
HARNESS
W2
HARNESS
W1
HARNESS
W1
HARNESS
FLANGE A1
AND
FLANGE B1
BRACKET
A
FLANGE B1
BRACKET
W2
HARNESS
W2
HARNESS
L−A5145 (0995)
PW V

EEC Fan Case Wiring Harnesses
Figure 409 (Sheet 2)
(Task 72−00−33−450−003−A)


FLANGE B2
BRACKET
SPACER
HARNESS
W1

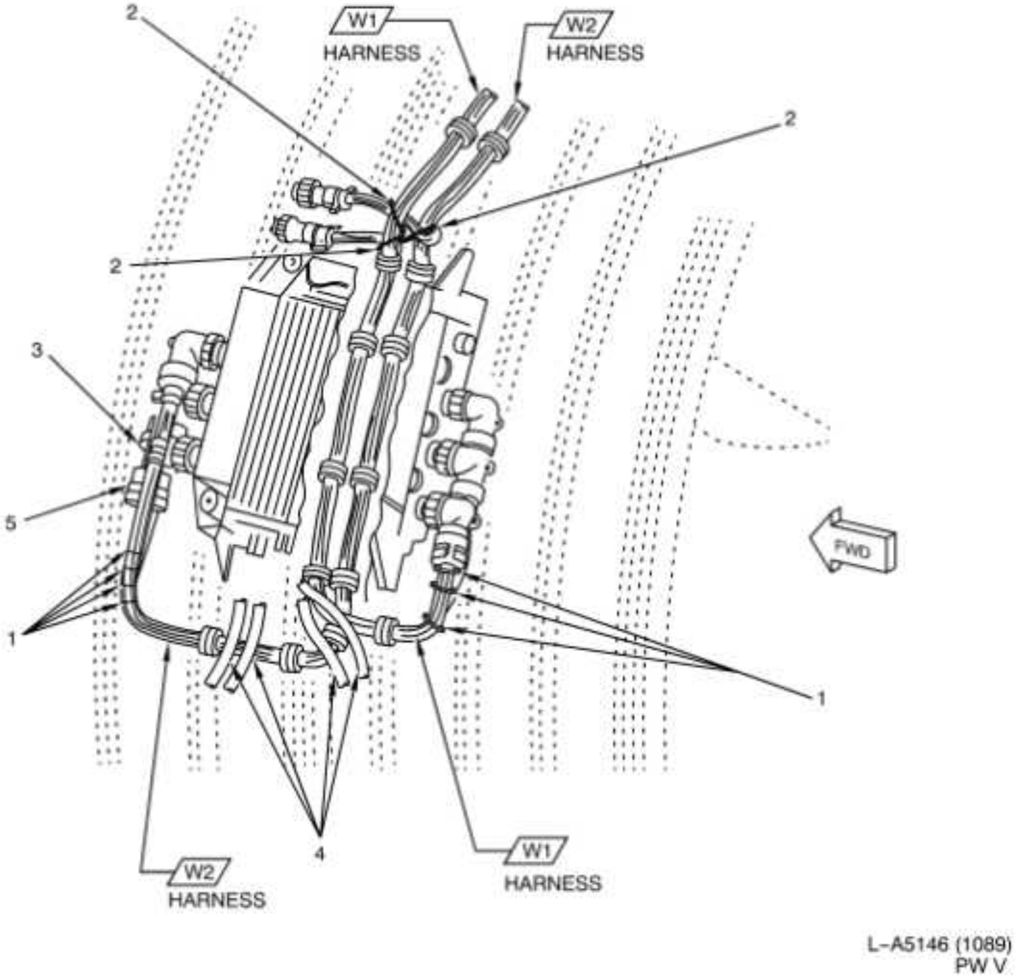
VIEW A
(PRE SB PW4ENG 73-143)



VIEW A
(POST SB PW4ENG 73-143)

L-B2205 (0000)
PW V

EEC Fan Case Wiring Harnesses
Figure 409 (Sheet 3)
(Task 72−00−33−450−003−A)


2
W1 HARNESS
W2 HARNESS
2
2
3
5
1
FWD
1
4
W2 HARNESS
W1 HARNESS
L-A5146 (1089)
PW V

EEC Fan Case Wiring Harnesses
Figure 410 (Sheet 1)
(Task 72-00-33-450-003-A)

1. Tie
2. Cross Tie
3. Harness Must Be Inboard Of The Outer Surface Of The EEC
4. 0.375 Inch (9.525 mm) Minimum Clearance Required Between The Harness And The Flex Hoses.
5. 0.380 Inch (9.652 mm) Minimum Clearance Required Between The W2 Harness And The W2P4 Connector Screws.

Key to Figure 410 (Sheet 1)

Task 72-00-33-450-003-B:

2. Install EEC Fan Case Wiring Harnesses W1, W2, W11 (SCU only) And W12 For Engines With Airbus/McDonnell Douglas Common Parts Configuration

NOTE: This procedure provides for installation of the EEC fan case wiring harnesses W1, W2, W11 (SCU only) and W12 when the fan case is installed to the intermediate case.

A. Prerequisites

(1) If it is necessary to install a new access cover, refer to Repair-02 Task 72-00-33-300-002 for instructions on the installation of boltholes in the cover.

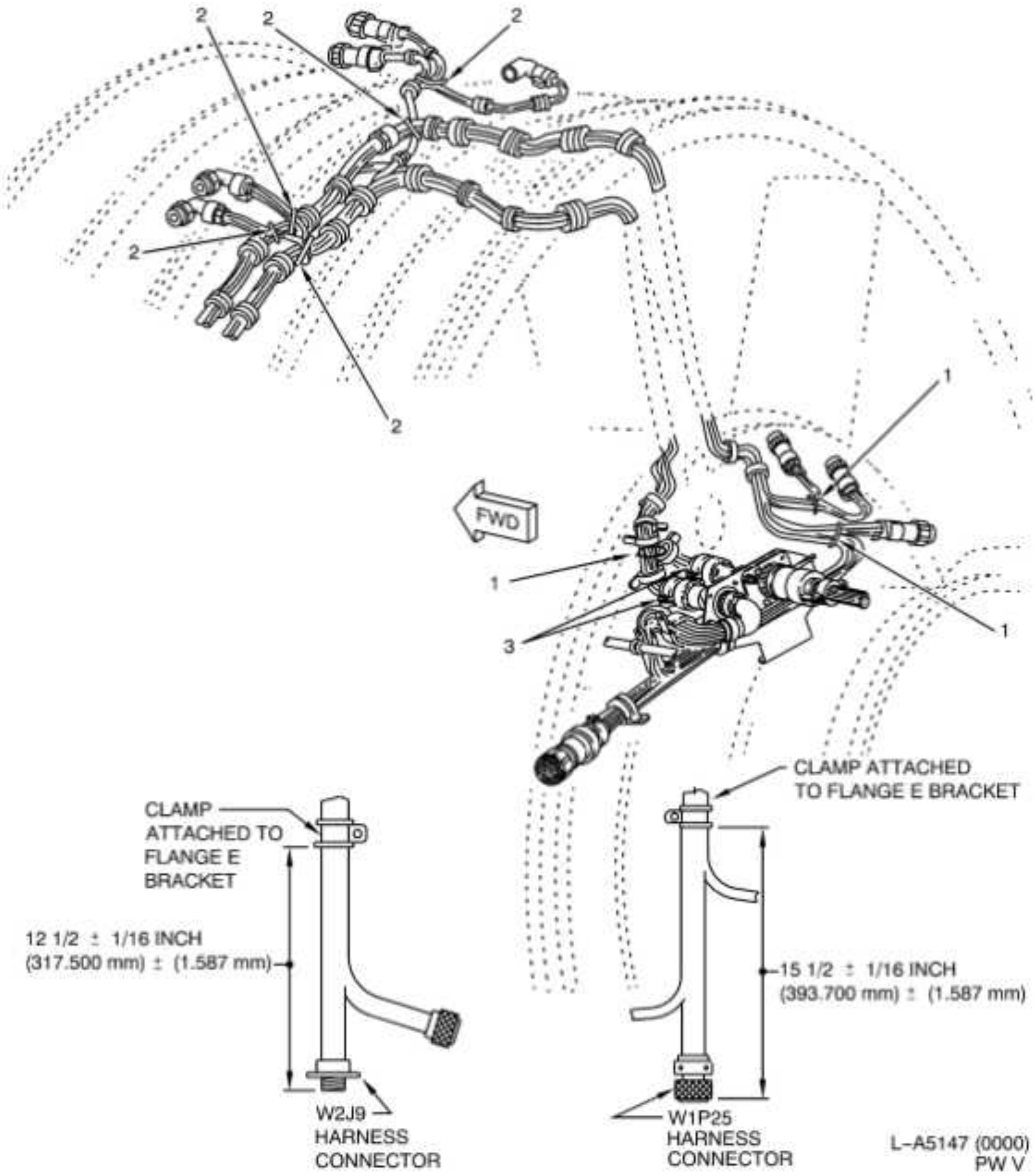
B. Equipment And Materials Required

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
No. 10 Torq-set Drive

Special Tools:
PWA 86211 Panel, Simulator
PWA 86212 Panel, Simulator

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-099	Tape, Moisture Resistant, Green (PMC 4141)
P05-124	Ties, Twist
P09-019	Sealant, Flame Resistant Silicone Rubber (PWA 36751-1)
P09-027	Sealant, Silicone Rubber (PWA 36003-2)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)
P18-007	Primer, Silicone (PWA 36086-2)


2
2
2
2
2
2
1
FWD
1
1
3
CLAMP ATTACHED TO FLANGE E BRACKET
CLAMP ATTACHED TO FLANGE E BRACKET
12 1/2 ± 1/16 INCH (317.500 mm) ± (1.587 mm)
15 1/2 ± 1/16 INCH (393.700 mm) ± (1.587 mm)
W2J9 HARNESS CONNECTOR
W1P25 HARNESS CONNECTOR
L-A5147 (0000)
PW V

EEC Fan Case Wiring Harnesses
Figure 410 (Sheet 2)
(Task 72−00−33−450−003−A)

ENGINE GENERAL − FAN CASE − INSTALLATION−06

1. Tie
2. Cross Tie
3. 0.375 Inch (9.525 mm) Clearance Required Between The W2 Wiring Harness And The Inlet Variable Vane Unison Ring.

Key to Figure 410 (Sheet 2)

C. Procedure
See Figure 414, Figure 415, Figure 416, Figure 417, Figure 418, Figure 419, Figure 420, Figure 421, Figure 422, Figure 423, Figure 424 and Figure 425.

CAUTION: SEE 72−00−00, INSTALLATION−00 FOR NECESSARY GENERAL INSTALLATION INSTRUCTIONS ABOUT THE WIRING HARNESSES, LEADS, AND CABLES.

CAUTION: DO NOT TWIST OR BEND THE HARNESSES BADLY DURING THE INSTALLATION OR DAMAGE TO THE HARNESSES CAN RESULT.

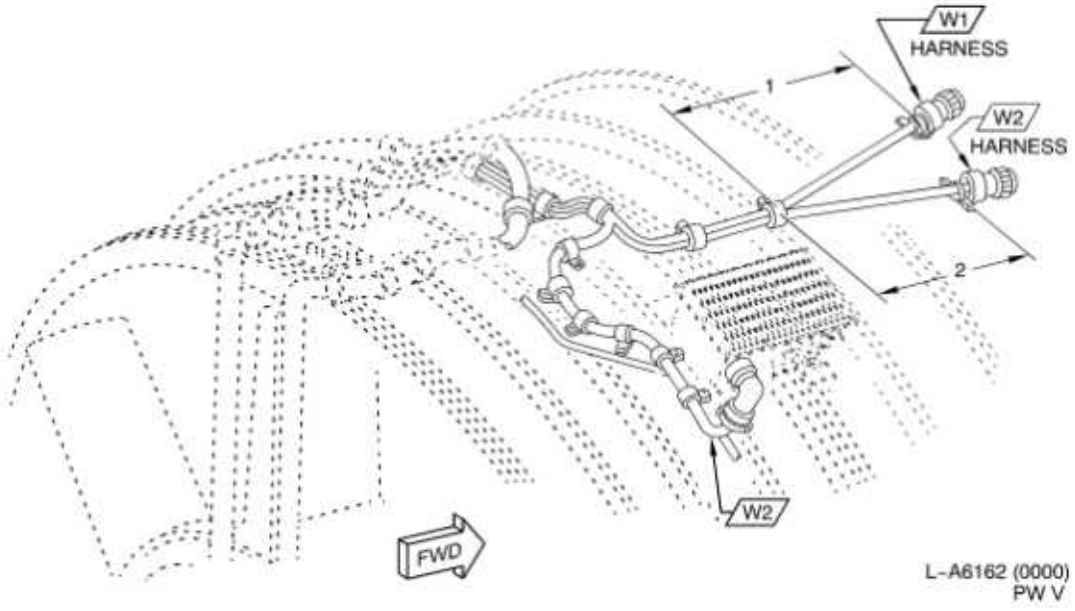
(1) Install the (inboard) clamp segment at the 10 o'clock position between Flanges B1 and B2. Attach the clamp segment to the flange brackets with two bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 423.

(2) Put the W1 and W2 wiring harnesses on the left side of the fan case and down through the intermediate case strut at the 12 o'clock position. Keep the W1 harness to the right of the strut and the W2 harness to the left of the strut. See Figure 414 and Figure 415 for the routing of the harness.

(3) Adjust the harness positions and install Twist Ties P05−124 to temporarily attach the harnesses to the engine brackets.

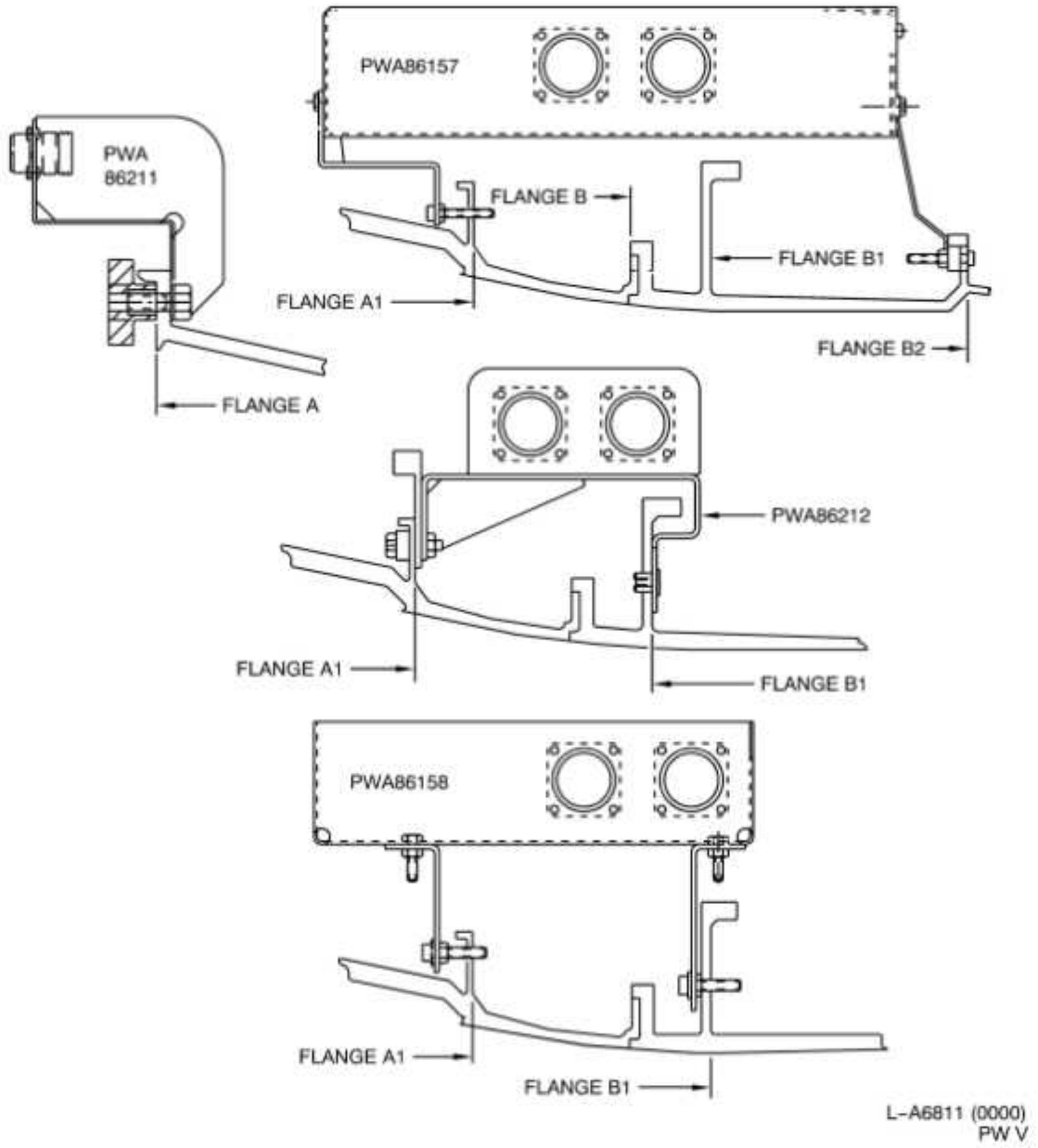
(4) Temporarily install the EEC over the harnesses and attach to the fan case brackets with work bolts.

(5) Temporarily connect the W1 and W2 harness connectors (given below) to the mating harness receptacles as follows. See Figure 416 and Figure 417. For each connector:

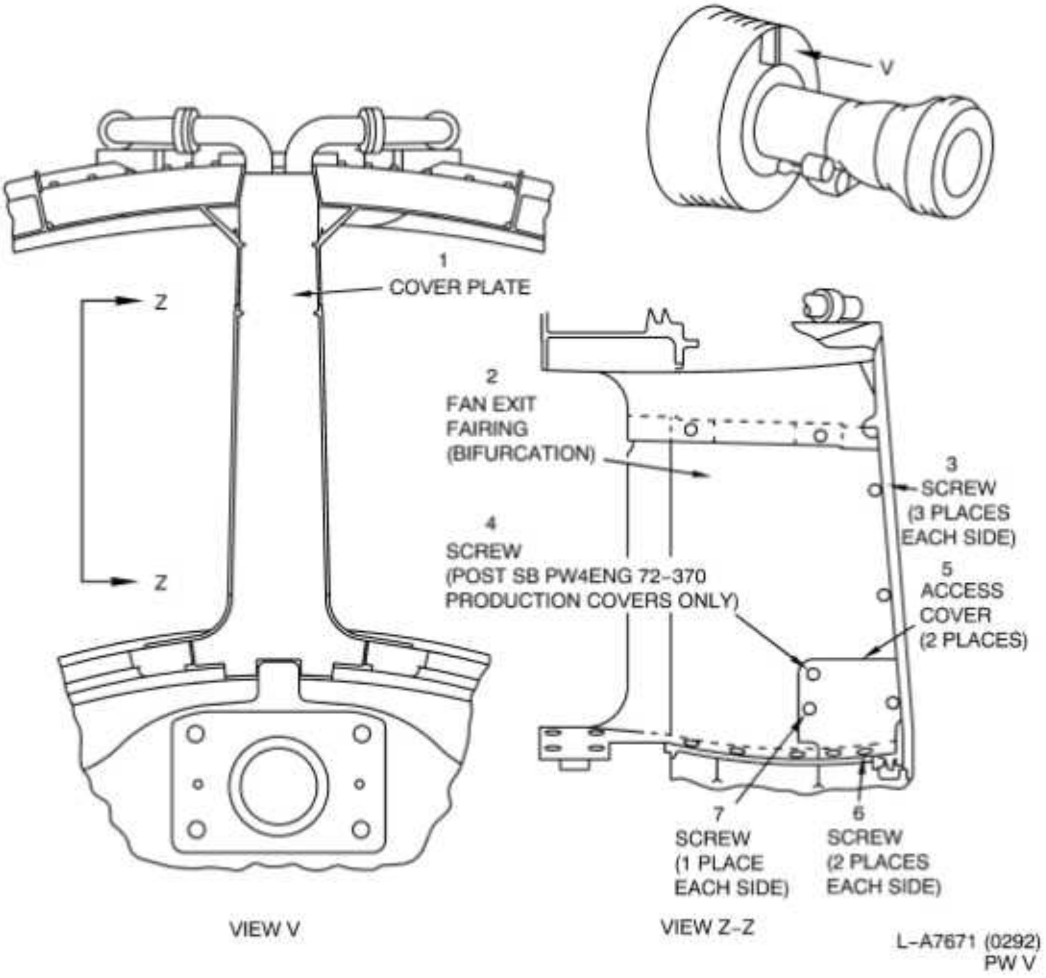

W1
HARNESS
W2
HARNESS
1
2
W2
FWD
L-A6162 (0000)
PW V

1. 8.750 - 9.250 Inch (222.250 - 234.950 mm) Between Clamp Center And Connector Screws.
2. 7.500 - 8.000 Inch (190.500 - 203.200 mm) Between Clamp Center And Connector Screws.

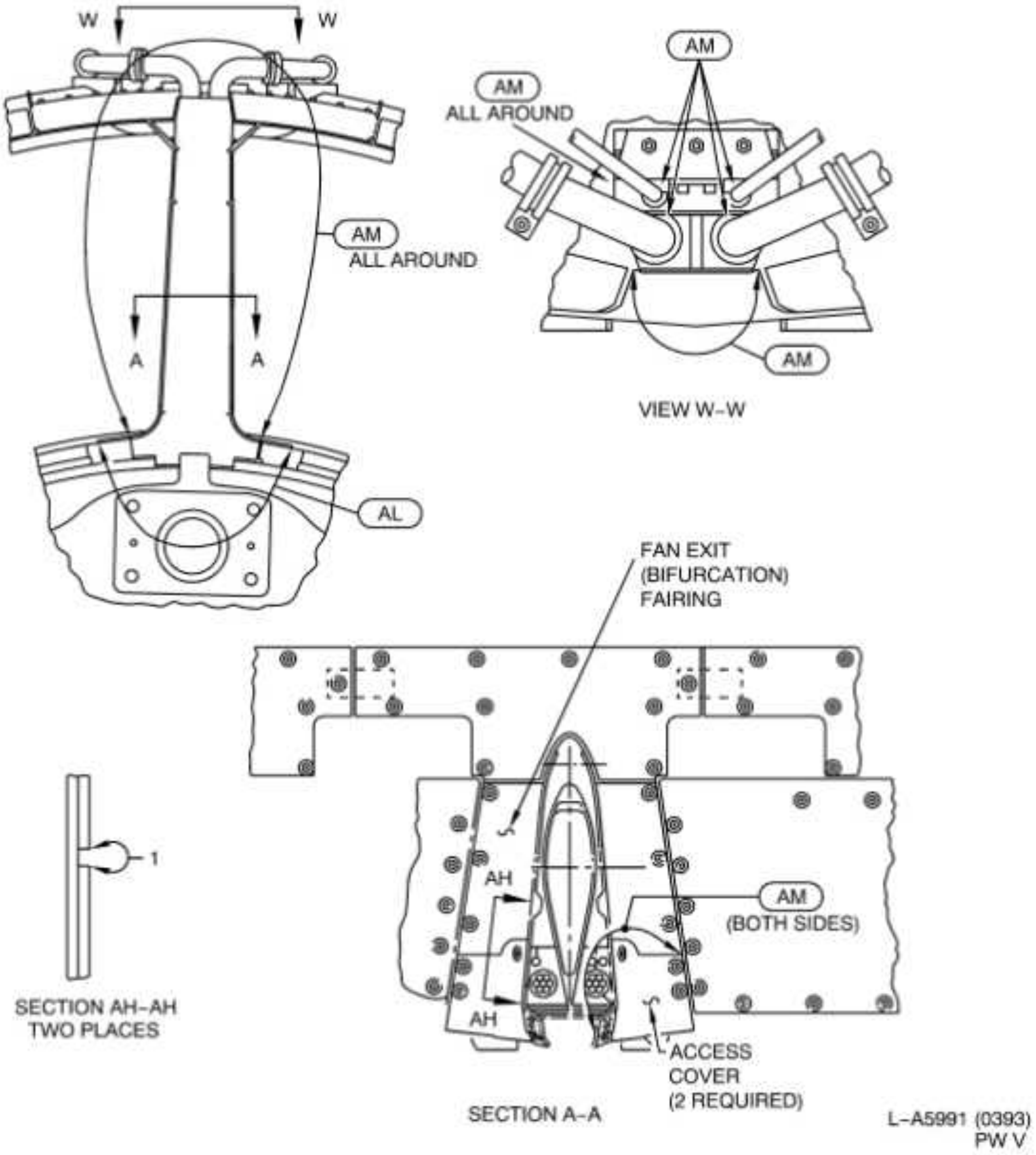
Fan Case W1 And W2 Wiring Harnesses
Figure 410 (Sheet 3)
(Task 72-00-33-450-003-A)


PWA86157
PWA 86211
FLANGE B
FLANGE B1
FLANGE A1
FLANGE B2
FLANGE A
PWA86212
FLANGE A1
FLANGE B1
PWA86158
FLANGE A1
FLANGE B1
L−A6811 (0000)
PW V

Fan Case Harness Junction Simulators
Figure 411
(Task 72−00−33−450−003−A)


V
1
COVER PLATE
Z
Z
2
FAN EXIT
FAIRING
(BIFURCATION)
3
SCREW
(3 PLACES
EACH SIDE)
4
SCREW
(POST SB PW4ENG 72-370
PRODUCTION COVERS ONLY)
5
ACCESS
COVER
(2 PLACES)
7
SCREW
(1 PLACE
EACH SIDE)
6
SCREW
(2 PLACES
EACH SIDE)
VIEW V
VIEW Z-Z
L-A7671 (0292)
PW V

Fan Exit Fairing (Bifurcation)
Figure 412
(Task 72−00−33−450−003−A)


W
W
AM
ALL AROUND
A
A
AL
AM
AM
ALL AROUND
AM
VIEW W-W
FAN EXIT
(BIFURCATION)
FAIRING
1
SECTION AH-AH
TWO PLACES
AH
AH
AM
(BOTH SIDES)
ACCESS
COVER
(2 REQUIRED)
SECTION A-A
L-A5991 (0393)
PW V

1. Apply The Sealant Even With, To 0.010 Inch (0.254 mm) Below, Two Places

Fan Exit Fairing (Bifurcation) Sealant Areas
Figure 413
(Task 72−00−33−450−003−A)

CAUTION: IF ENGINE HAS THE HPC RING CASE CONFIGURATION (POST SB PW4ENG 72−756), MAKE SURE YOU INSTALL THE CORRECT W1 AND W2 HARNESS, PROGRAMMING PLUG AND EEC. IF YOU DO NOT INSTALL THE CORRECT HARDWARE, THE ENGINE WILL NOT OPERATE.

(a) If W1 and W2 harness have yellow bands, you must have an EEC with the yellow and black label (For Ring Case Configuration). (See Figure 429).

(b) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(c) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(d) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(e) Connect the W1P6, W1P7, and W1P8 harness connectors to the J6, J7, and J8 receptacles on the rear side of the EEC (Channel A).

(f) Connect the W2P2, W2P3, and W2P4 harness connectors to the J2, J3, and J4 receptacles on the front side of the EEC (Channel B).

NOTE: Be sure that each of the leads for all the connectors go out of the W1 and W2 harnesses as shown.

(6) Adjust the W2 harness from the clamp segment (under EEC) to the three connectors on the EEC. At the 9:30 o'clock position install two clamps on the harness, one clamp to a bracket on Flange A1 and one clamp to a bracket on Flange B1. Attach clamps to brackets with nuts, threads lubricated with Engine Oil P03−001. Torque the nuts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 423.

(7) Adjust the W1 harness from the clamp segment (under EEC) to the three connectors on the EEC. At the 9:30 o'clock position install two clamps on the harness, one clamp to a bracket on Flange B1 and one clamp to a bracket on Flange B2. Upward from the last installed clamps, install four clamps on the harness, three clamps to brackets on Flange C and one small clamp to a bracket on Flange B2. Attach clamps to brackets with bolts and/ or nuts, threads lubricated with Engine Oil P03−001. Torque the bolts and/or nuts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 423.

(8) Disconnect the six connectors from the EEC receptacles. Remove the EEC from the fan case.

(9) Adjust the W1 and W2 harnesses through the (inboard) clamp segment at the 10 o'clock position. Install the (outboard) clamp segment over the harnesses and to the (inboard) clamp segment. Attach segments together with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 423.

(10) Connect the W1 and W2 harness connectors (given below) to the mating harness receptacles as follows. See Figure 426 and Figure 427. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(d) Connect the W1P6, W1P7, and W1P8 harness connectors to the J6, J7, and J8 receptacles on the rear side of the EEC (Channel A).

(e) Connect the W2P2, W2P3, and W2P4 harness connectors to the J2, J3, and J4 receptacles on the front side of the EEC (Channel B).

(f) Connect the W2P26 harness connector to the W5J26 harness receptacle attached to the HPC case bracket at approximately 12 o'clock position.

(g) Attach the W2J9 harness receptacle to the same HPC case bracket with the retaining bracket and two bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(h) Connect the W1P10 and W1P11 harness connectors to the receptacles of the solenoid at approximately 1 o'clock position above Flange E.

(i) Connect the W1P25 harness connector to the W4J25 harness receptacle attached to the HPC case bracket at approximately 1:30 o'clock position.

(j) Connect the W1P9 harness connector to the W2J9 harness receptacle attached to the HPC case bracket at approximately 12 o'clock position.

(k) Connect the W1P24 harness connector to the W3J24 harness receptacle attached to the HPC bracket at approximately 10 o'clock position.

(l) Install W1J36 and W2J37 harness receptacles to a bracket between Flanges B1 and B2 at approximately the 1:30 o'clock position. Attach the receptacles to the bracket with a retaining bracket and two bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 424.

(11) Attach the fan case simulator panels as follows. See Figure 426.

(a) Install a PWA 86211 Inlet Cowl Simulator Panel to bolts holes 4 and 5 on the rear face of Flange A. Secure the panel to the flange with bolts and detail knobs.

(b) Install a PWA 86212 Junction Box Simulator Panel to bolt holes 104 and 106 on Flange A1 and the corresponding bolt holes on Flange B1. Secure the panel to the flange with bolts and washers and if required, spacers between Flange A1 and the panel.

(c) Attach the connector ends of the EEC harness to the receptacles on the simulators. Adjust the harness as necessary to obtain the proper fits and clearances.

(12) Adjust the remaining portion of the W1 and W2 harnesses for any necessary clearance as required. Install the clamps at the remaining clamp points. Refer to figures. Attach the clamps loosely to the engine with bolts and/ or nuts, threads lubricated with Engine Oil P03−001. Remove the Twist Ties P05−124 previously installed to position harnesses.

NOTE: Use different clamp sizes on the wiring harnesses to prevent harness movement when tightened. See the Illustrated Parts Catalog for selection of clamp sizes and part numbers.

(13) Attach the harnesses through the intermediate case strut as follows. See Figure 420.

(a) Make sure the upper front grommet is installed forward of the EEC sensing tubes at the top of the strut.

(b) Install the upper middle and rear grommets to the harnesses at the top of the strut. Install one bolt, threads lubricated with Engine Oil P03−001, and plate. Tighten the bolt by hand.

(c) Install the lower center grommets and lower right and left clamp segments to the harnesses at the bottom of the strut. Attach each of the clamp segments to the intermediate case with two screws, threads lubricated with Engine Oil P03−001, and one bracket. Tighten screws by hand.

(d) Adjust the harnesses through the strut so that the harnesses are not loose.

(e) Torque the clamp bolts that attach both harnesses to the intermediate case below the strut and to the Flange E brackets to 36 − 40 lb−in. (4.067 − 4.519 N.m). Remove all looseness from the harnesses through the strut area out the top of the strut.

(f) Tighten the four screws that attach the lower clamp segments. Loosen the screws one turn. Torque the screws to 22 lb−in. (2.486 N.m) plus the torque required to turn the screw through the locking property. The maximum torque for the screw is 40 lb−in. (4.519 N.m). Make sure the remaining screw holes in the clamp segment bracket align with the intermediate case screw holes.

(g) (Reference 2011) Tighten the upper grommet bolt at top of strut until locking property of nut is felt. Tighten bolt 10 complete turns more.

(14) Adjust the W1 and W2 harnesses for clearances. Torque the remaining bolts and/or nuts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(15) Disconnect the harness connectors from the simulator panels. Remove the panels from the engine.

(16) For engines without the supplemental control unit (SCU), install the W12 wiring harness on the upper right side of the fan case as follows. See Figure 424.

(a) Connect the W12P37 harness connector to the W1J36 harness receptacles at the 1:30 0'clock position.

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure: − the connector coupling nut is fully tight − the connector fits tightly against the receptacle (metal to metal). This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque. See the instructions given with the strap wrench for correct use.

(b) Adjust the harness and install clamps to the harness. Attach the clamps to brackets with bolts and/or nuts, threads lubricated with Engine Oil P03−001. Torque the bolts and/or nuts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(17) For engines with the supplemental control unit (SCU), install the W11 wiring harness on the upper right side of the fan case as follows. See Figure 425.

(a) Connect the W11 harness connectors (given below) to the mating harness receptacles as follows. For each connector:

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure: − the connector coupling nut is fully tight − the connector fits tightly against the receptacle (metal to metal). This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque. See the instructions given with the strap wrench for correct use.

(b) Connect the W11P37 connector to the W2J37 receptacle and connect the W11P36 connector to the W1J36 receptacle located at the 1:30 o'clock position.

(c) Connect the W11P34 connector to the J2 receptacle and the W11P33 connector to the J3 receptacle on the SCU.

(d) Install the W11J32 harness receptacle to a bracket on Flange B1 at the 3 o'clock position. Attach the receptacle to the bracket with a retaining bracket and two bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Adjust the harness and install clamps to the harness. Attach the clamps to brackets with bolts and/or nuts, threads lubricated with Engine Oil P03−001. Torque the bolts and/or nuts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER ACCESS COVER AND COVER PLATE. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 72−161 AND SB PW4ENG 72−370.

(18) Install the fan exit fairing access covers (427/5) and the rear cover plate (427/1) as follows. Use a No. 10 Torq−set drive. See Figure 427.

(a) (Post SB PW4ENG 72−370) If the access covers (412/5) you install are new, bond washers to the two boltholes (412/6) that are at the bottom of the covers as follows. If the access covers you install are not new, skip this step.

1 Use the washers that were on the covers you removed. Use the same quantity of washer, in the same positions, on the new covers as on the old covers.

NOTE: Refer to the Standard Practices Manual, 70−48, for the cleaning procedures that follow.

2 Clean the areas the sealant will touch with PWA 83−D4, but do not use trichlorotrifluoroethane.

3 With Sealant P09−027, make a fillet all around the edges of the washers. Sealant is not permitted between the washers and the intermediate case nor between the washers and the fairing access covers.

4 Cure the sealant in air that is at room temperature, and has a relative humidity of 25 percent, for four hours before you touch it.

(b) Install the two access covers (427/5) to the fan exit fairing (427/2) with the four screws (427/6), two screws (427/7), and if applicable two screws (412/4), lubricated with Engine Oil P03−001.

(c) Tighten the four screws (427/6) against the two covers (427/5) and then loosen them one complete turn. Tighten the four screws (427/7) and (427/4) against the two covers (427/5) and then loosen them one complete turn.

(d) Install the (rear) cover plate (427/1) to the fan exit fairing (427/2) with the six screws (427/3), lubricated with Engine Oil P03−001.

(e) Tighten the screws (427/3) against the cover plate (427/1) then loosen them one complete turn. Torque the screws (427/3) to 22 lb−in. (2.486 N.m) plus the torque necessary to turn them through the locking feature of the nuts. The maximum torque is 40 lb−in. (4.519 N.m).

(f) Torque the four screws (427/6) to 22 lb−in. (2.486 N.m) plus the torque necessary to turn them through the locking feature of the nuts. The maximum torque is 40 lb−in. (4.519 N.m).

(g) Torque the four screws (427/7) and (427/4) to 22 lb−in. (2.486 N.m) plus the torque necessary to turn them through the locking feature of the nuts. The maximum torque is 40 lb−in. (4.519 N.m).

(19) Apply sealant to Area AL. See Figure 428.

NOTE: Refer to the Standard Practices Manual, 70−48, for the cleaning procedures that follow.

(a) Clean the areas the sealant will touch. Use PWA 83−D4, but do not use trichlorotrifluoroethane.

(b) Apply Primer P18−007 to all cleaned surfaces.

1 It is necessary to apply the primer in less than two hours after you cleaned the area.

2 The primer must cure in air at ambient temperature for two hours, minimum. The air must have a relative humidity of 25 percent, minimum.

(c) Apply Sealant P09−019.

1 It is necessary to apply the sealant from 2 − 24 hours after you applied the primer.

2 Use a hot air gun at 175° − 225°F (79.° − 107.°C) for 5 − 7 minutes to dry the sealant.

3 After the hot air gun, cure the sealant in air that has a relative humidity of 25 percent, minimum, for eight hours, minimum, before you touch the parts.

(20) Apply sealant to Area AM:

(a) Clean the areas the sealant will touch. Use PWA 83−D4, but do not use trichlorotrifluoroethane.

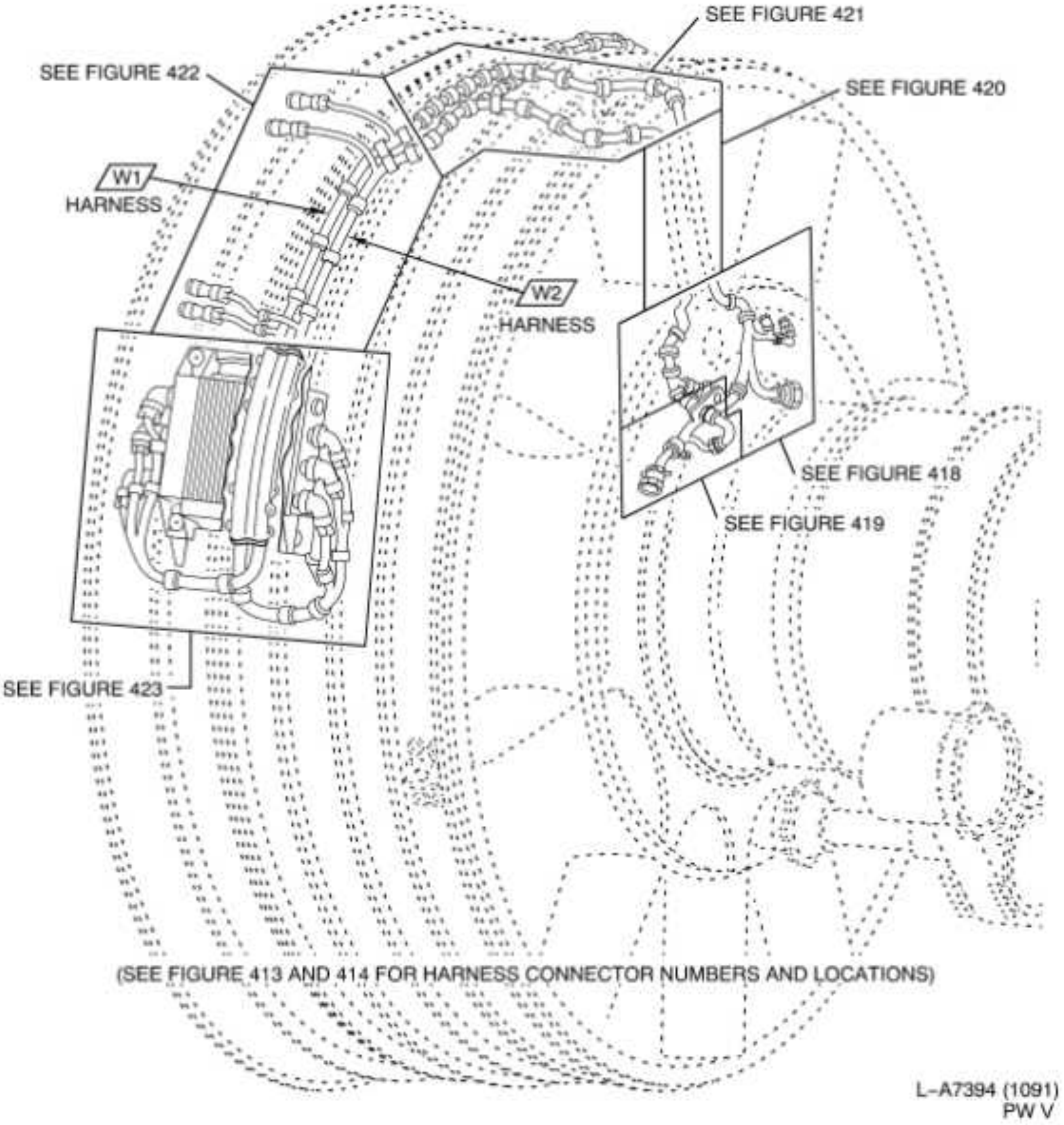
(b) Apply Sealant P09−027. Cure the sealant in air that is at room temperature, and has a relative humidity of 25 percent, minimum, for eight hours, minimum, before you touch the parts.

D. Postrequisites

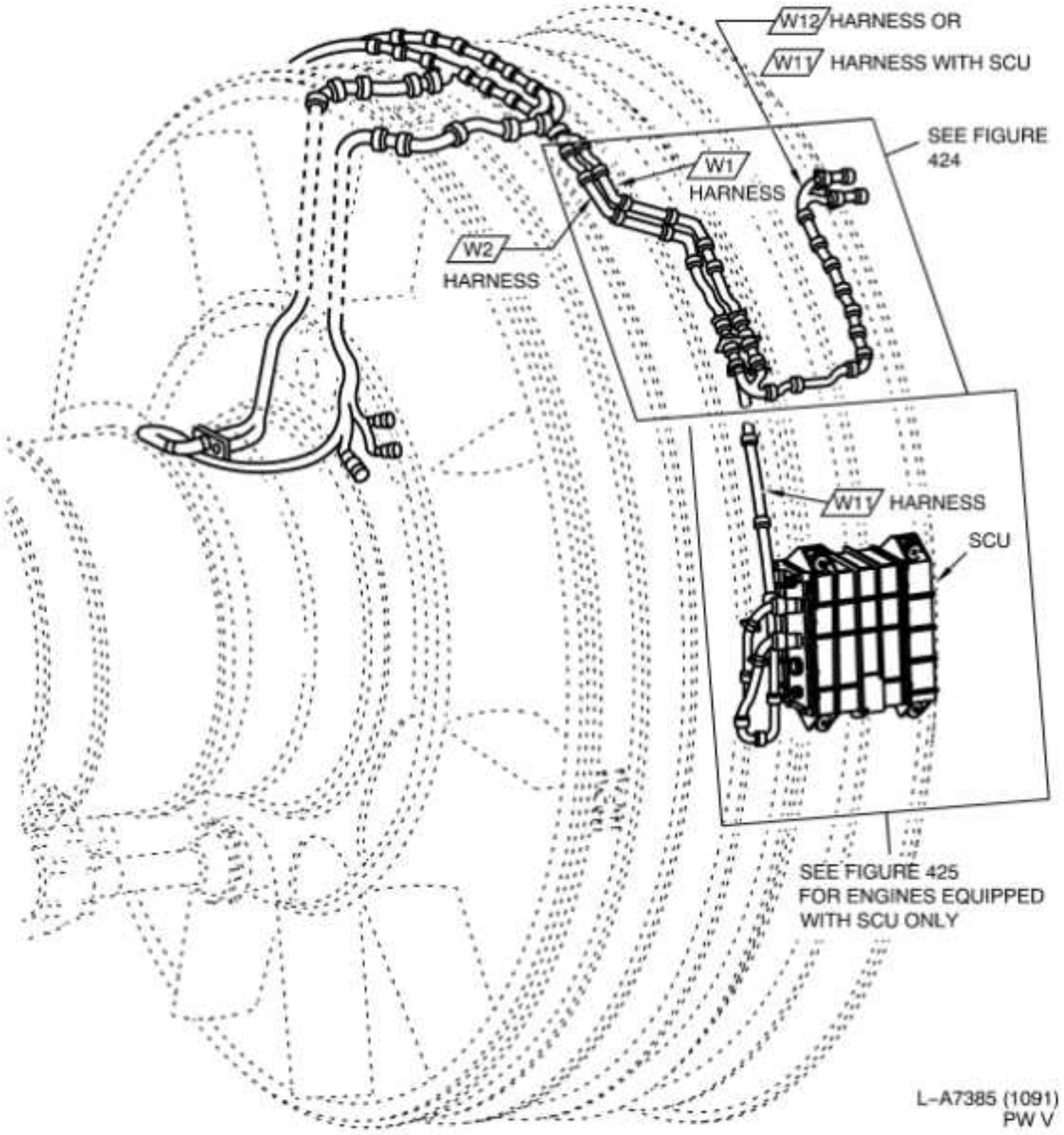
(1) For engines with the fan exit fairings disassembled from the intermediate case, install the fairings. See Installation−14 Task 72−00−33−450−009.

(2) Install the fan exit liner segments (inner rear) that you removed. Refer to 72−00−33, Installation−16 Task 72−00−33−440−001.

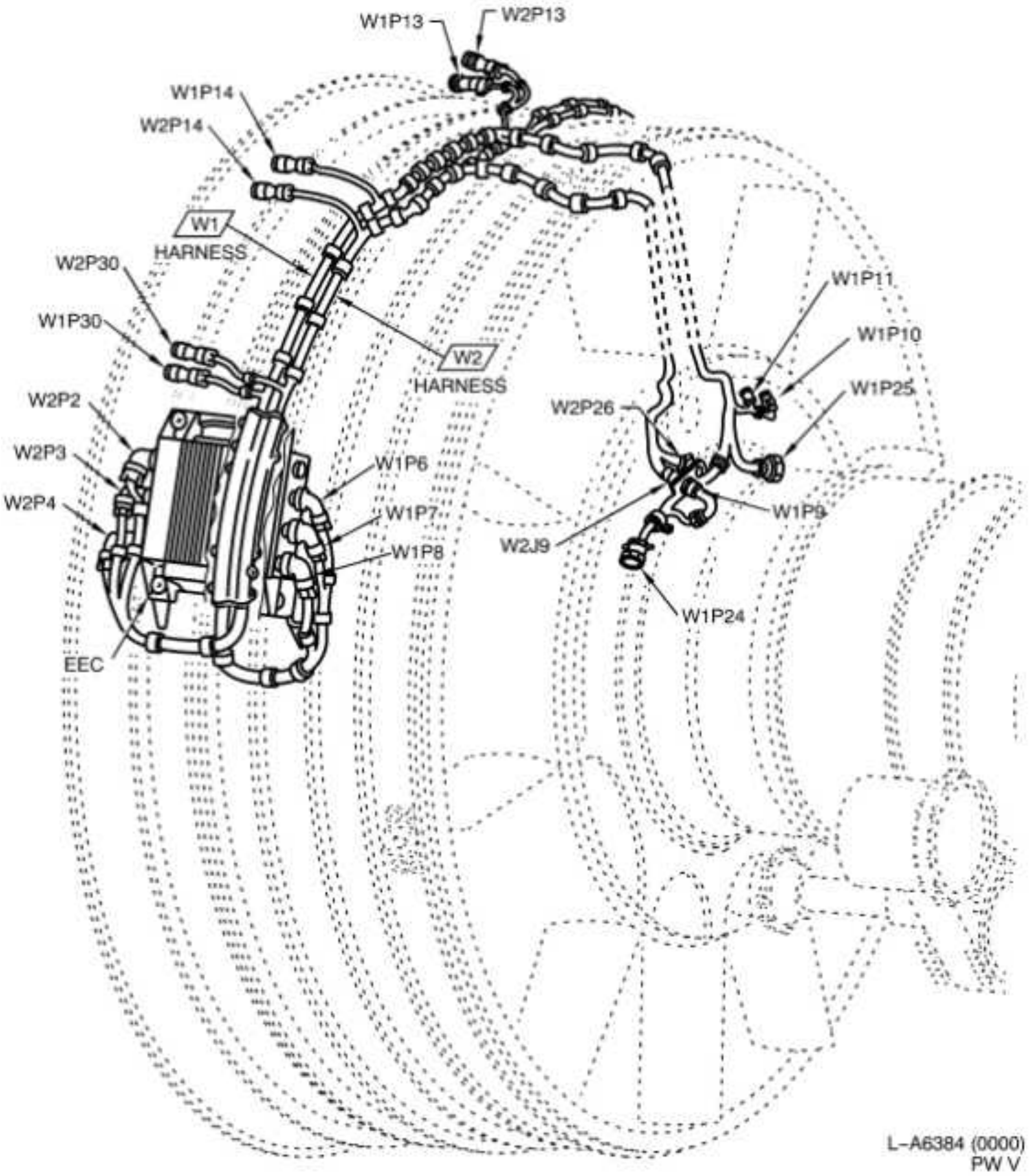
(3) Install the electronic engine control (EEC). See Installation−04 Task 72−00−33−450−001.


SEE FIGURE 421
SEE FIGURE 422
SEE FIGURE 420
W1
HARNESS
W2
HARNESS
SEE FIGURE 418
SEE FIGURE 419
SEE FIGURE 423
(SEE FIGURE 413 AND 414 FOR HARNESS CONNECTOR NUMBERS AND LOCATIONS)
L-A7394 (1091)
PW V

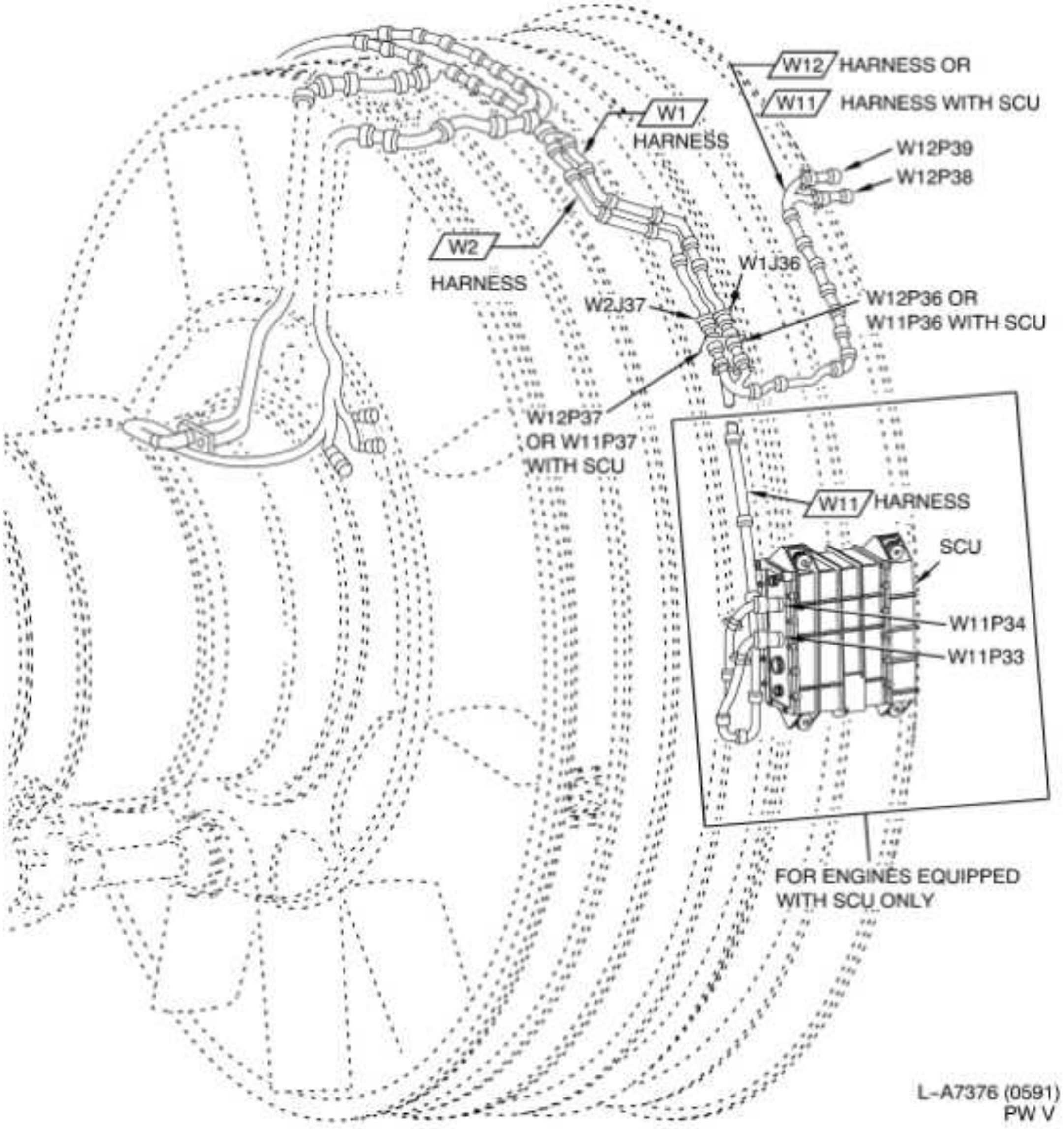
EEC Wiring Harness - W1, W2, W11 And W12 (Fan Case)
Figure 414
(Task 72-00-33-450-003-B)


W12 HARNESS OR
W11 HARNESS WITH SCU
SEE FIGURE 424
W1 HARNESS
W2 HARNESS
W11 HARNESS
SCU
SEE FIGURE 425 FOR ENGINES EQUIPPED WITH SCU ONLY
L−A7385 (1091)
PW V

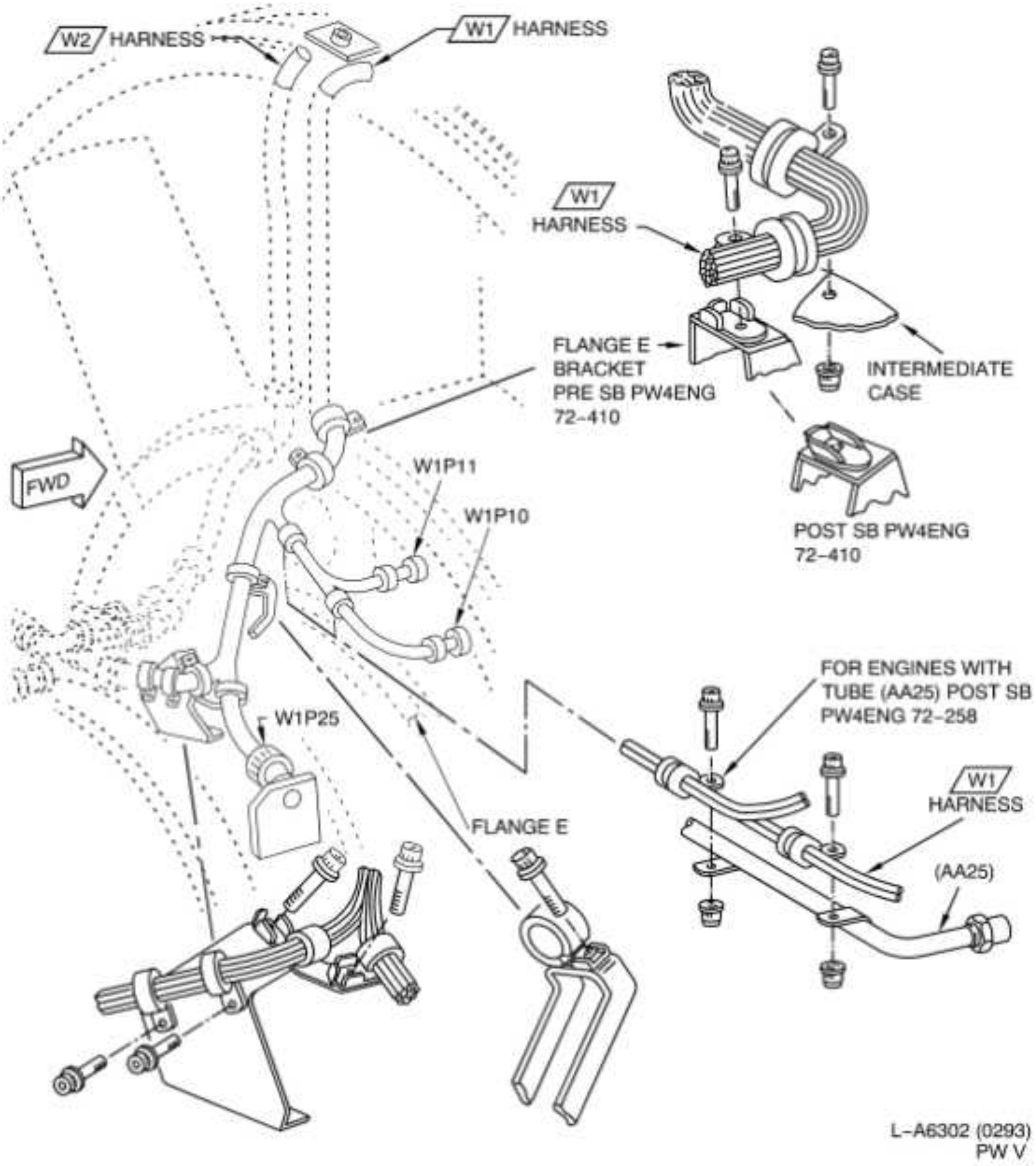
EEC Wiring Harness − W1, W2, W11 And W12 (Fan Case)
Figure 415
(Task 72−00−33−450−003−B)


W1P13
W2P13
W1P14
W2P14
W1
HARNESS
W2P30
W1P30
W2
HARNESS
W2P2
W2P3
W2P4
EEC
W1P6
W1P7
W1P8
W1P11
W1P10
W1P25
W2P26
W1P9
W2J9
W1P24
L-A6384 (0000)
PW V

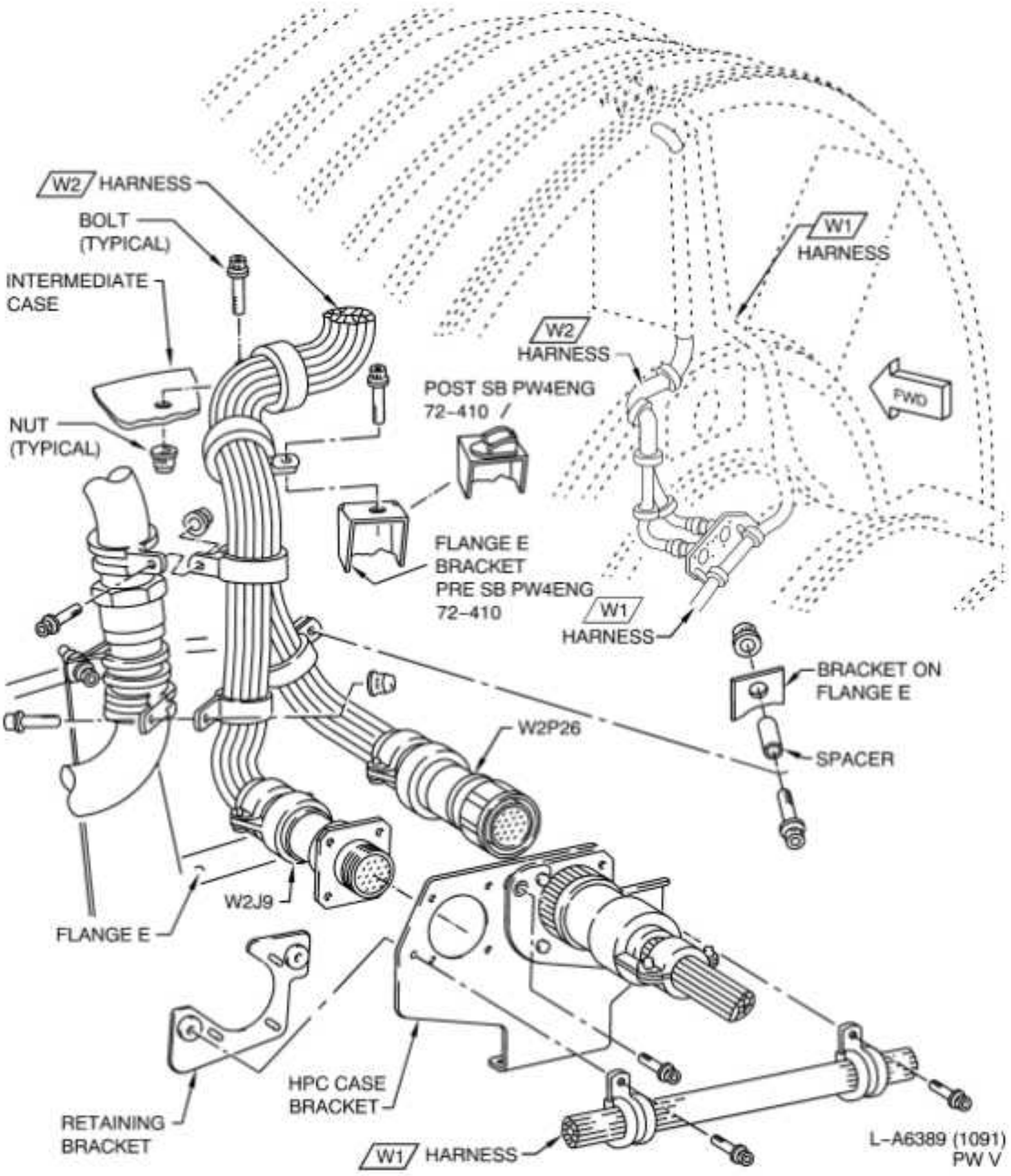
EEC Wiring Harness − W1, W2, W11 And W12 (Fan Case)
Figure 416
(Task 72−00−33−450−003−B)


W12 HARNESS OR
W11 HARNESS WITH SCU
W1 HARNESS
W12P39
W12P38
W2 HARNESS
W1J36
W2J37
W12P36 OR
W11P36 WITH SCU
W12P37
OR W11P37
WITH SCU
W11 HARNESS
SCU
W11P34
W11P33
FOR ENGINES EQUIPPED
WITH SCU ONLY
L-A7376 (0591)
PW V

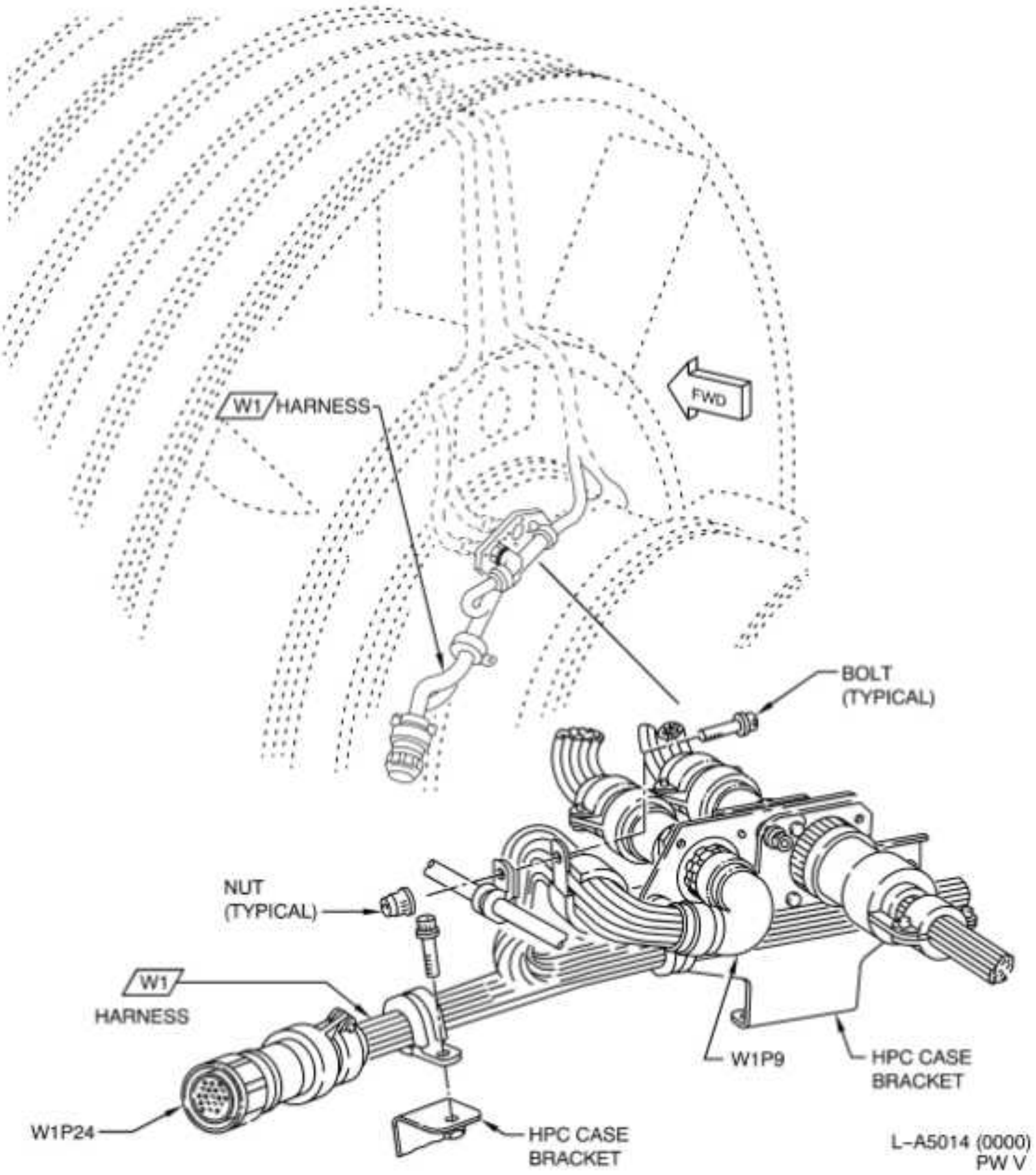
EEC Wiring Harness − W1, W2, W11 And W12 (Fan Case)
Figure 417
(Task 72−00−33−450−003−B)


W2 HARNESS
W1 HARNESS
W1 HARNESS
FLANGE E BRACKET PRE SB PW4ENG 72-410
INTERMEDIATE CASE
POST SB PW4ENG 72-410
FWD
W1P11
W1P10
W1P25
FOR ENGINES WITH TUBE (AA25) POST SB PW4ENG 72-258
W1 HARNESS
(AA25)
FLANGE E
L-A6302 (0293)
PW V

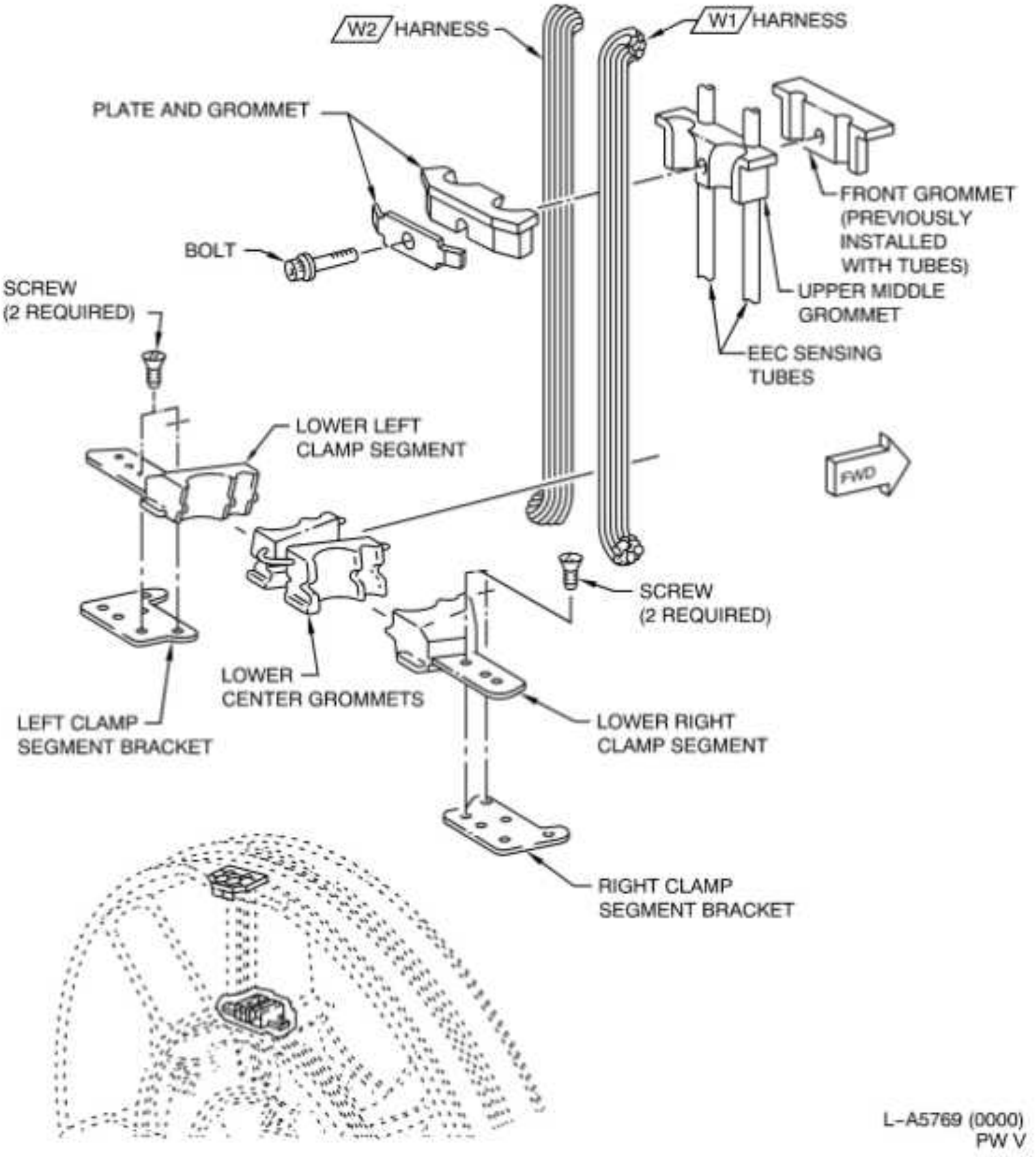
EEC Wiring Harness − W1, W2, W11 And W12 (Fan Case)
Figure 418 (Sheet 1)
(Task 72−00−33−450−003−B)


W2 HARNESS
BOLT (TYPICAL)
INTERMEDIATE CASE
NUT (TYPICAL)
W1 HARNESS
W2 HARNESS
POST SB PW4ENG 72-410
FWD
FLANGE E BRACKET PRE SB PW4ENG 72-410
W1 HARNESS
BRACKET ON FLANGE E
SPACER
W2P26
W2J9
FLANGE E
RETAINING BRACKET
HPC CASE BRACKET
W1 HARNESS
L-A6389 (1091) PW V

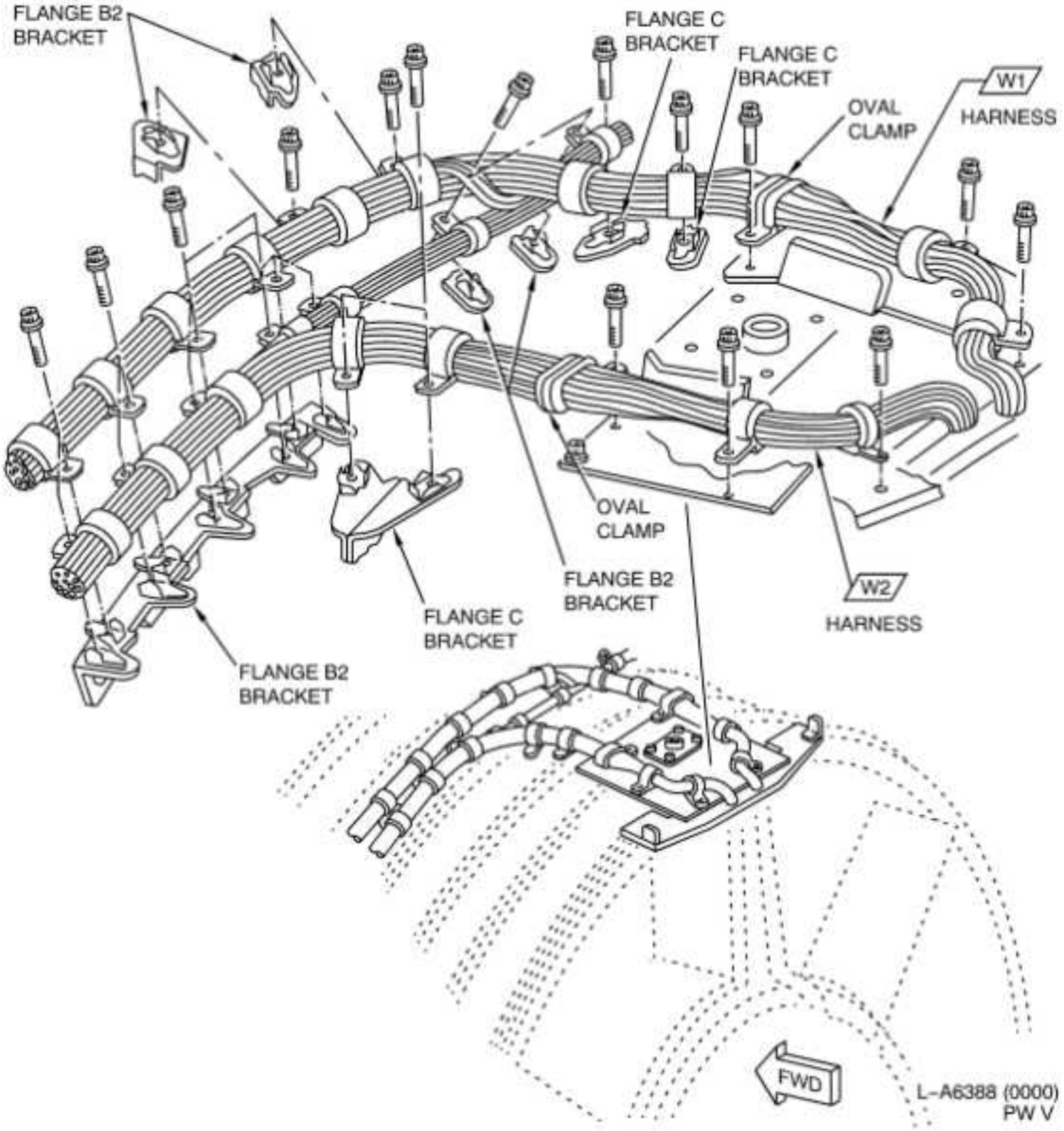
EEC Wiring Harness − W1, W2, W11 And W12 (Fan Case)
Figure 418 (Sheet 2)
(Task 72−00−33−450−003−B)


FWD
W1 HARNESS
BOLT (TYPICAL)
NUT (TYPICAL)
W1 HARNESS
W1P9
HPC CASE BRACKET
W1P24
HPC CASE BRACKET
L-A5014 (0000)
PW V

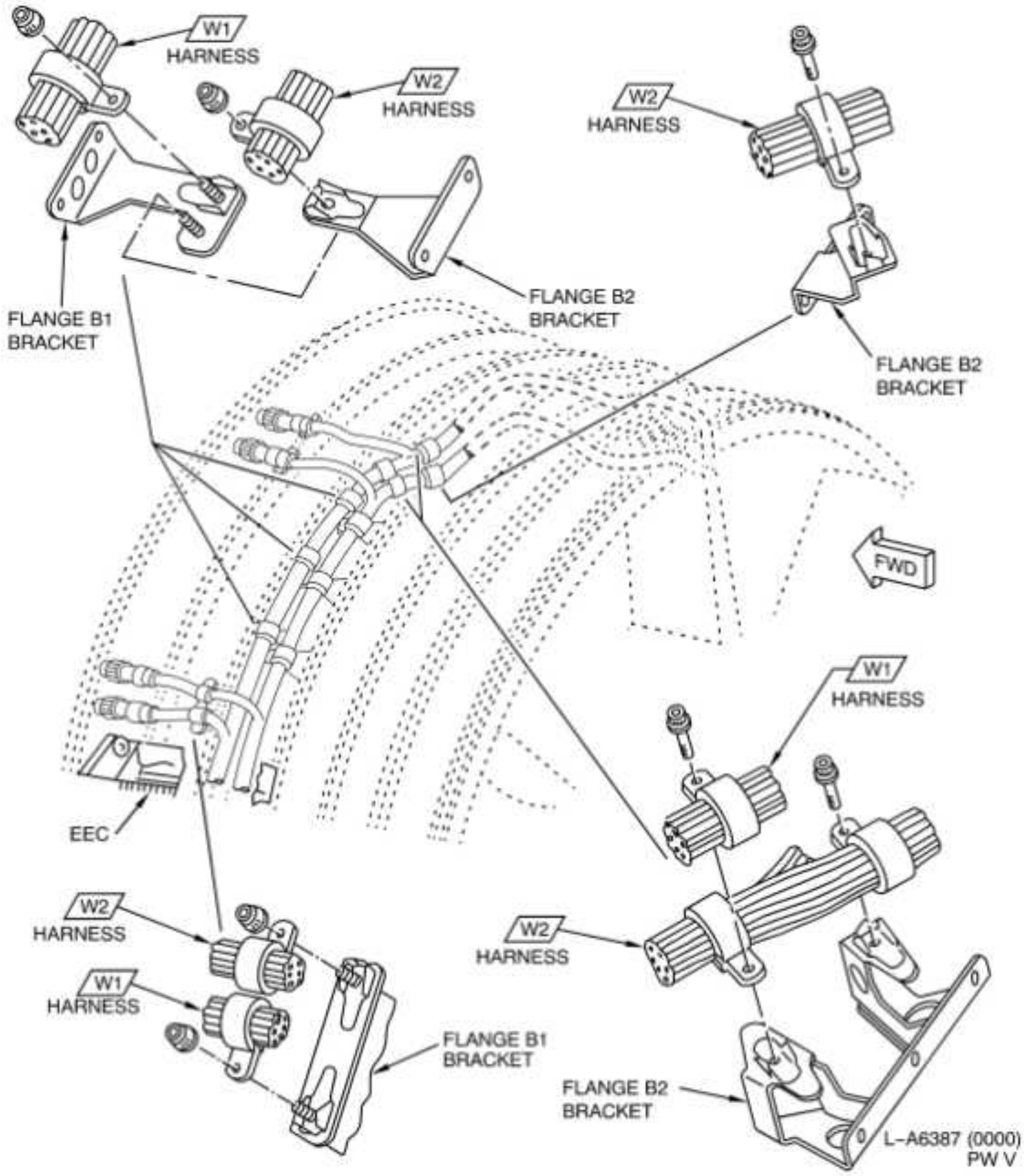
EEC Wiring Harness − W1, W2, W11 And W12 (Fan Case)
Figure 419
(Task 72−00−33−450−003−B)


W2 HARNESS
W1 HARNESS
PLATE AND GROMMET
FRONT GROMMET (PREVIOUSLY INSTALLED WITH TUBES)
BOLT
SCREW (2 REQUIRED)
UPPER MIDDLE GROMMET
EEC SENSING TUBES
LOWER LEFT CLAMP SEGMENT
FWD
SCREW (2 REQUIRED)
LOWER CENTER GROMMETS
LEFT CLAMP SEGMENT BRACKET
LOWER RIGHT CLAMP SEGMENT
RIGHT CLAMP SEGMENT BRACKET
L−A5769 (0000)
PW V

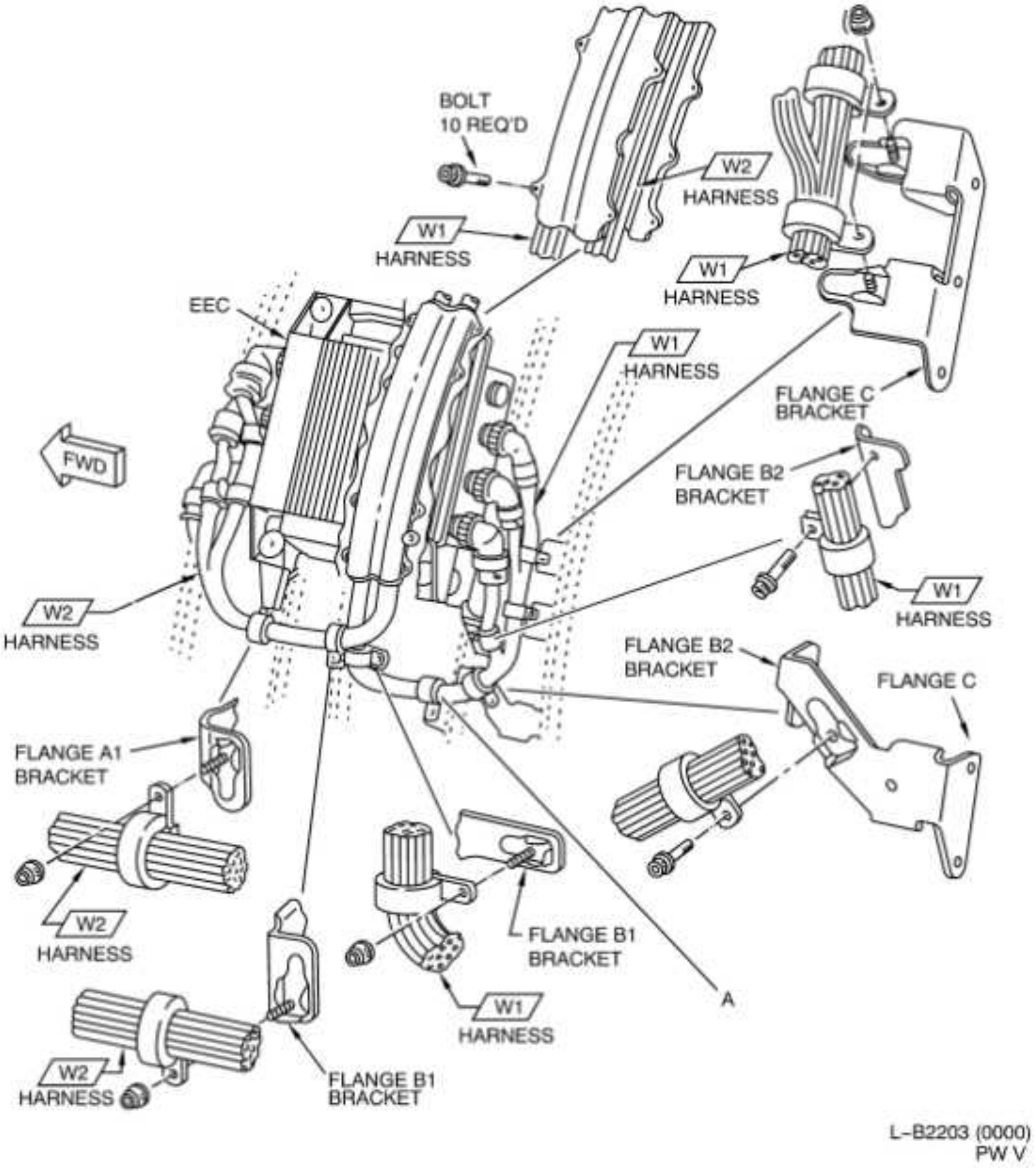
EEC Wiring Harness − W1, W2, W11 And W12 (Fan Case)
Figure 420
(Task 72−00−33−450−003−B)


FLANGE B2 BRACKET
FLANGE C BRACKET
FLANGE C BRACKET
OVAL CLAMP
W1 HARNESS
OVAL CLAMP
FLANGE B2 BRACKET
W2 HARNESS
FLANGE C BRACKET
FLANGE B2 BRACKET
FWD
L−A6388 (0000)
PW V

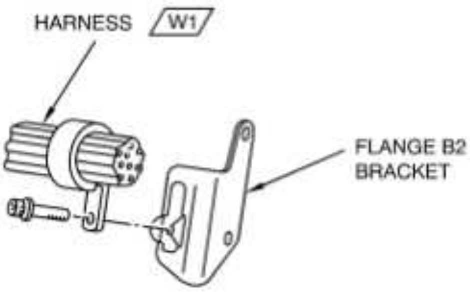
EEC Wiring Harness − W1, W2, W11 And W12 (Fan Case)
Figure 421
(Task 72−00−33−450−003−B)


W1
HARNESS
W2
HARNESS
W2
HARNESS
FLANGE B2
BRACKET
FLANGE B1
BRACKET
FLANGE B2
BRACKET
FWD
W1
HARNESS
EEC
W2
HARNESS
W2
HARNESS
W1
HARNESS
FLANGE B1
BRACKET
FLANGE B2
BRACKET
L-A6387 (0000)
PW V

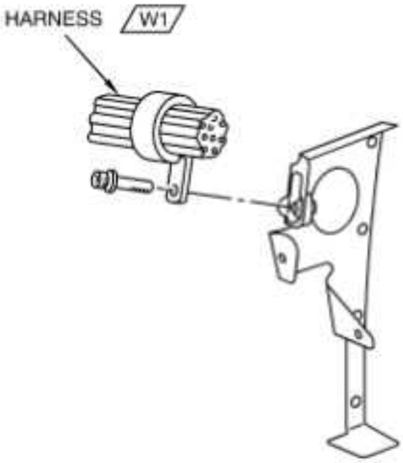
EEC Wiring Harness − W1, W2, W11 And W12 (Fan Case)
Figure 422
(Task 72−00−33−450−003−B)


BOLT
10 REQ'D
W2
HARNESS
W1
HARNESS
W1
HARNESS
EEC
W1
HARNESS
FLANGE C
BRACKET
FWD
FLANGE B2
BRACKET
W2
HARNESS
W1
HARNESS
FLANGE B2
BRACKET
FLANGE C
FLANGE A1
BRACKET
W2
HARNESS
FLANGE B1
BRACKET
A
W1
HARNESS
W2
HARNESS
FLANGE B1
BRACKET
L−B2203 (0000)
PW V

EEC Wiring Harness − W1, W2, W11 And W12 (Fan Case)
Figure 423 (Sheet 1)
(Task 72−00−33−450−003−B)


HARNESS
W1
FLANGE B2
BRACKET

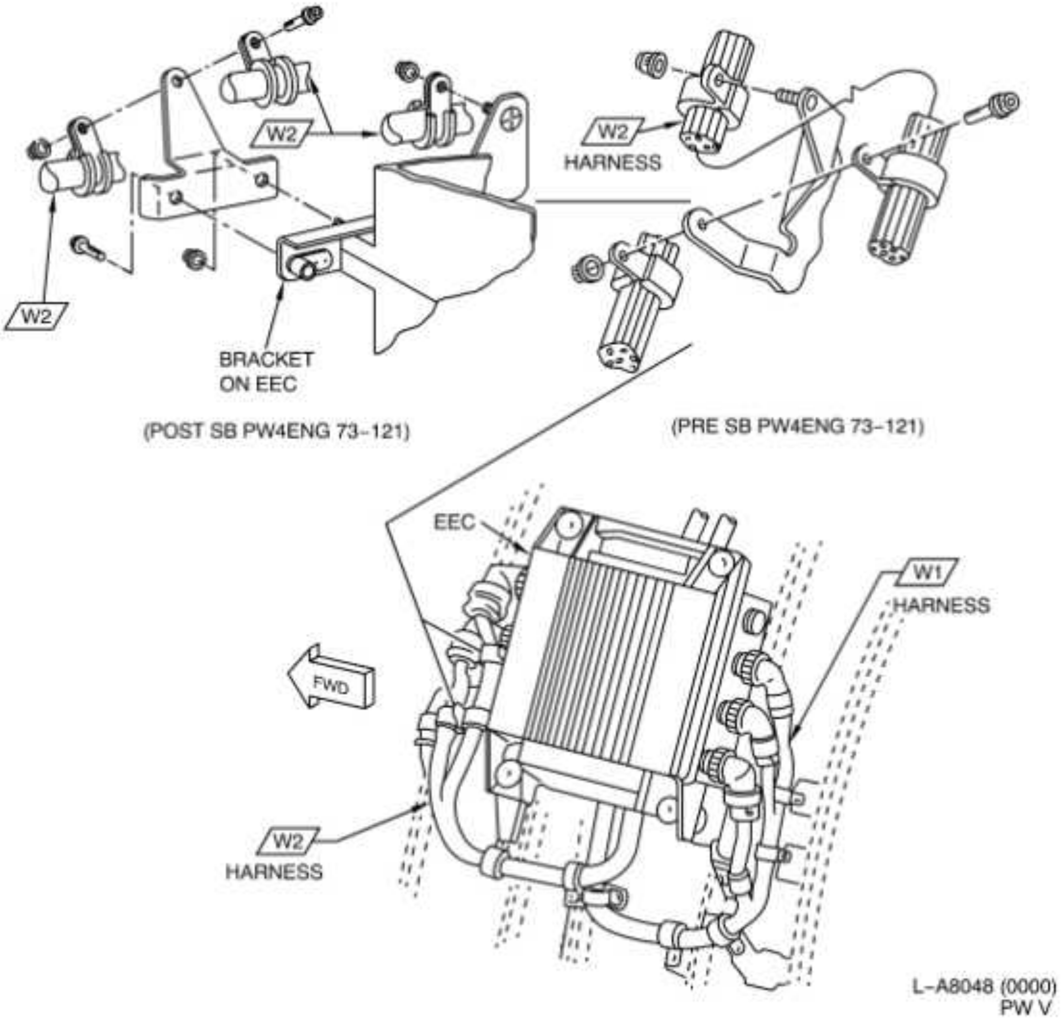
VIEW A
(PRE SB PW4ENG 73-143)



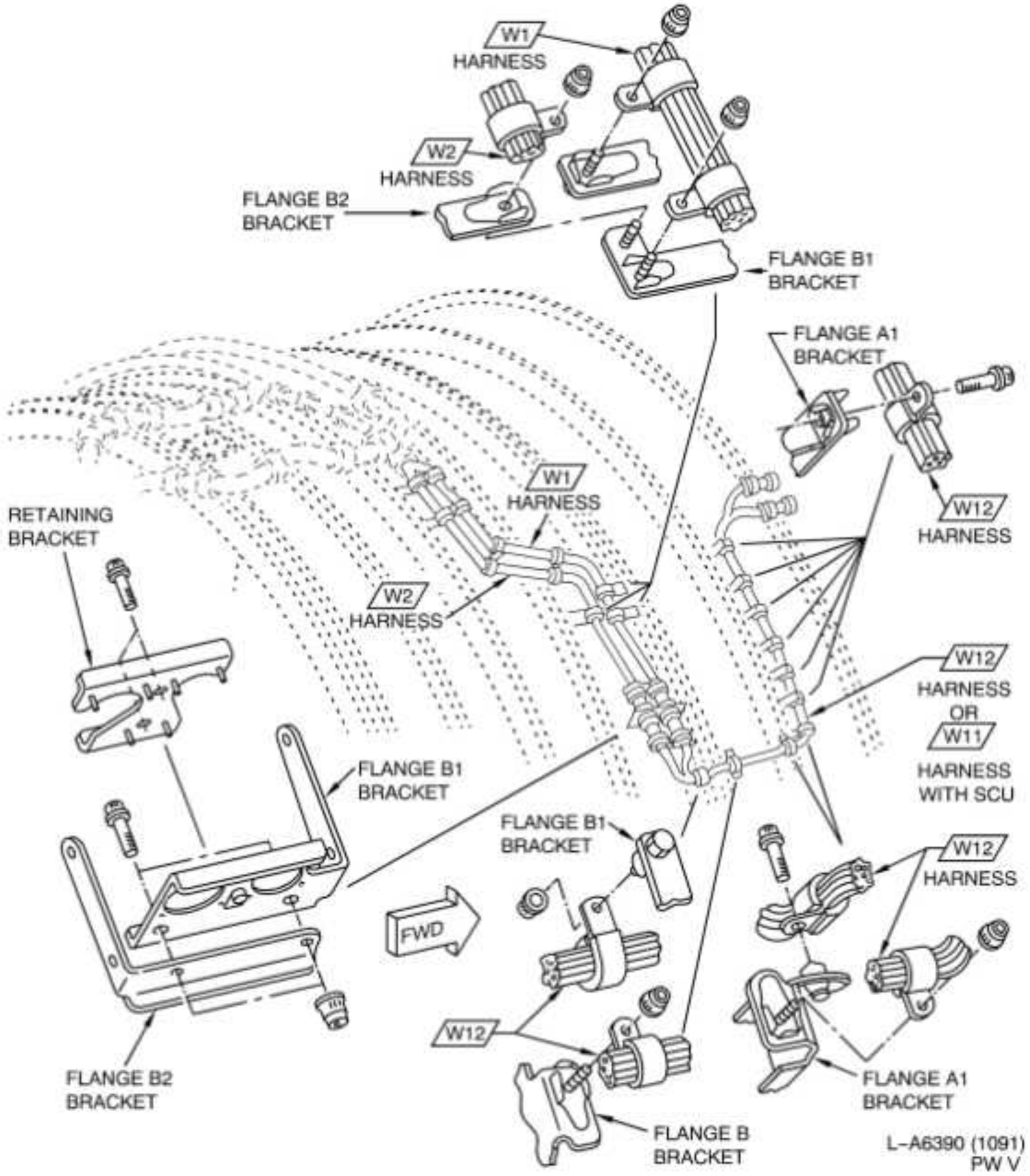
VIEW A
(POST SB PW4ENG 73-143)

L-B2204 (0000)
PW V

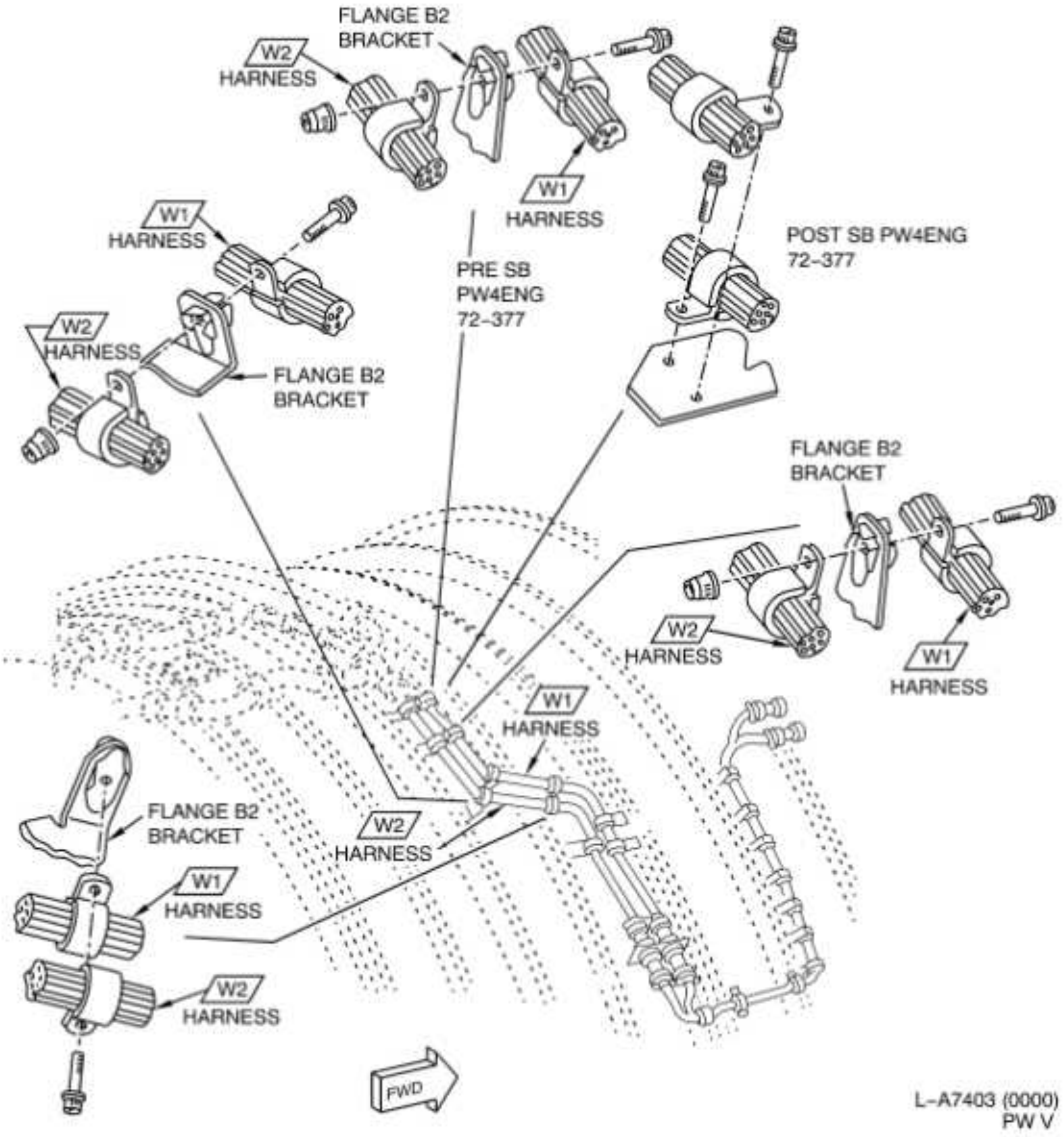
EEC Wiring Harness − W1, W2, W11 And W12 (Fan Case)
Figure 423 (Sheet 2)
(Task 72−00−33−450−003−B)


W2
W2
W2
HARNESS
W2
BRACKET
ON EEC
(POST SB PW4ENG 73-121)
(PRE SB PW4ENG 73-121)
EEC
W1
HARNESS
FWD
W2
HARNESS
L-A8048 (0000)
PW V

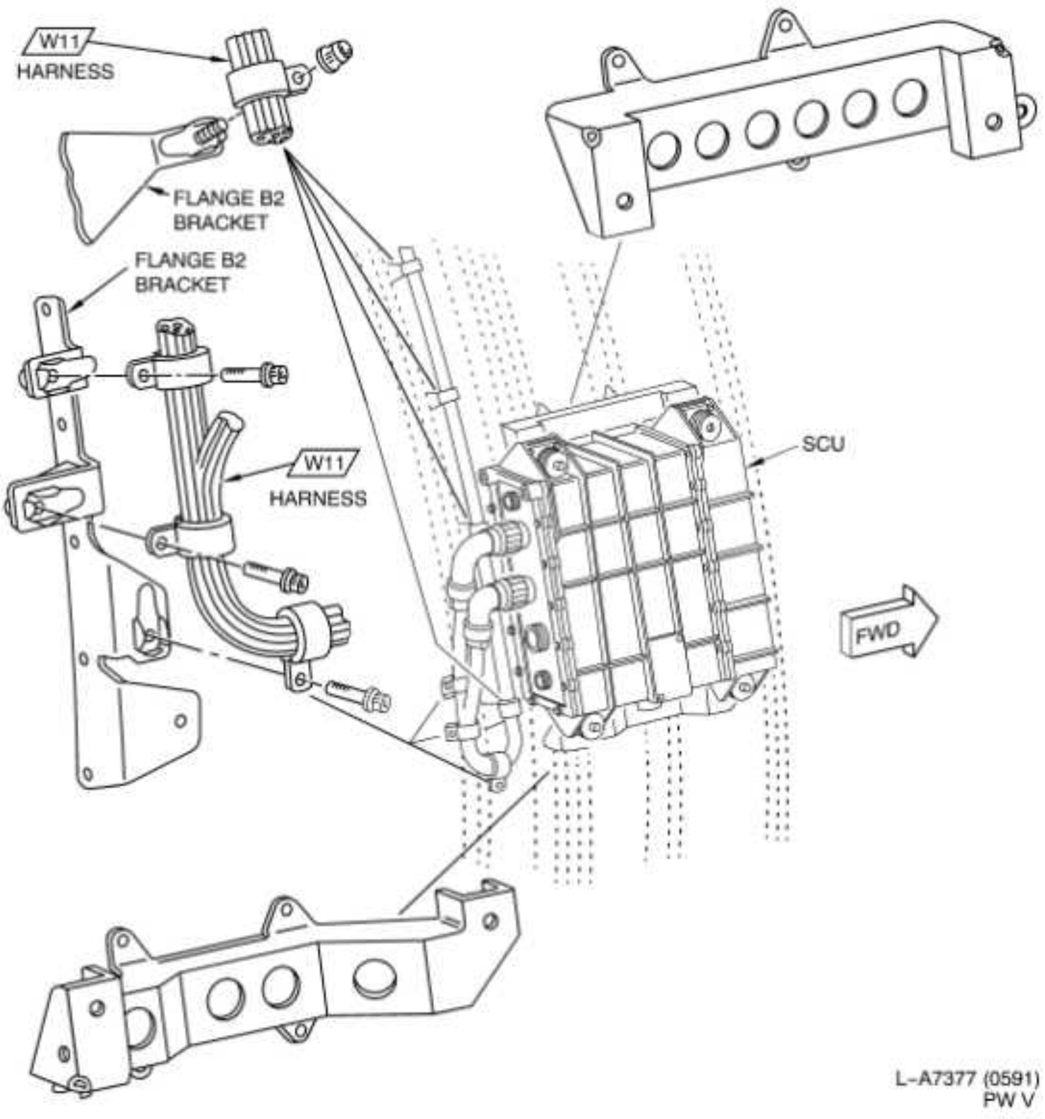
EEC Wiring Harness − W1, W2, W11 And W12 (Fan Case)
Figure 423 (Sheet 3)
(Task 72−00−33−450−003−B)


W1
HARNESS
W2
HARNESS
FLANGE B2
BRACKET
FLANGE B1
BRACKET
FLANGE A1
BRACKET
W12
HARNESS
W1
HARNESS
RETAINING
BRACKET
W2
HARNESS
W12
HARNESS
OR
W11
HARNESS
WITH SCU
FLANGE B1
BRACKET
FLANGE B1
BRACKET
W12
HARNESS
FWD
W12
FLANGE B2
BRACKET
FLANGE A1
BRACKET
FLANGE B
BRACKET
L−A6390 (1091)
PW V

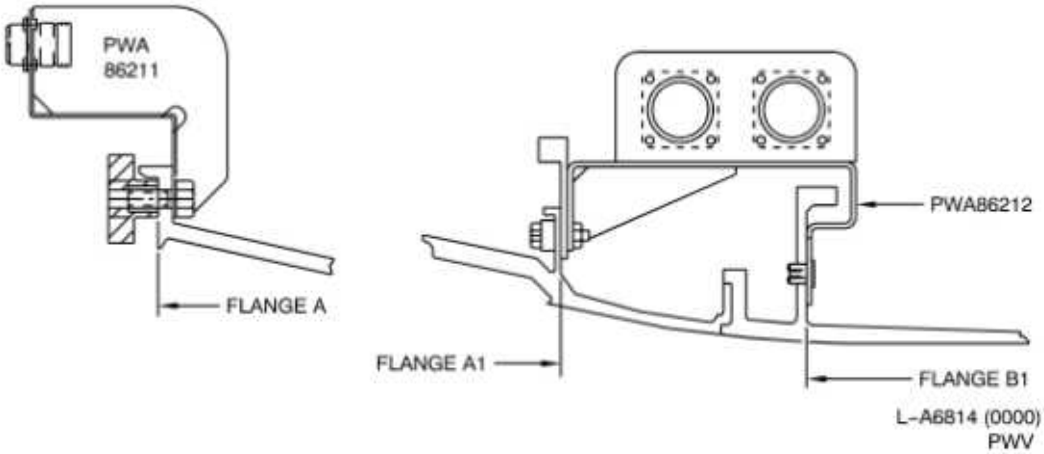
EEC Wiring Harness − W1, W2, W11 And W12 (Fan Case)
Figure 424 (Sheet 1)
(Task 72−00−33−450−003−B)


FLANGE B2
BRACKET
W2
HARNESS
W1
HARNESS
PRE SB
PW4ENG
72-377
POST SB PW4ENG
72-377
W1
HARNESS
W2
HARNESS
FLANGE B2
BRACKET
FLANGE B2
BRACKET
W2
HARNESS
W1
HARNESS
W1
HARNESS
W2
HARNESS
FLANGE B2
BRACKET
W1
HARNESS
W2
HARNESS
FWD
L-A7403 (0000)
PW V

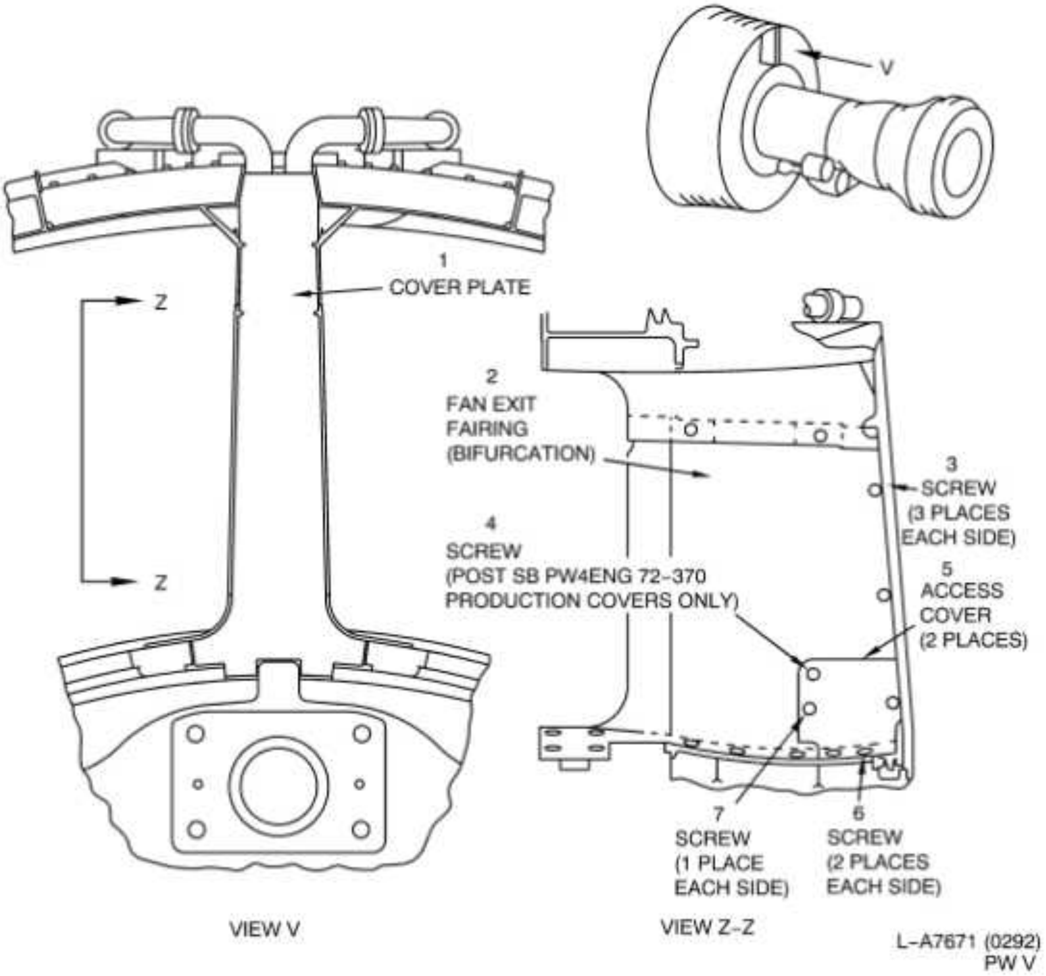
EEC Wiring Harness − W1, W2, W11 And W12 (Fan Case)
Figure 424 (Sheet 2)
(Task 72−00−33−450−003−B)


W11
HARNESS
FLANGE B2
BRACKET
FLANGE B2
BRACKET
W11
HARNESS
SCU
FWD
L-A7377 (0591)
PW V

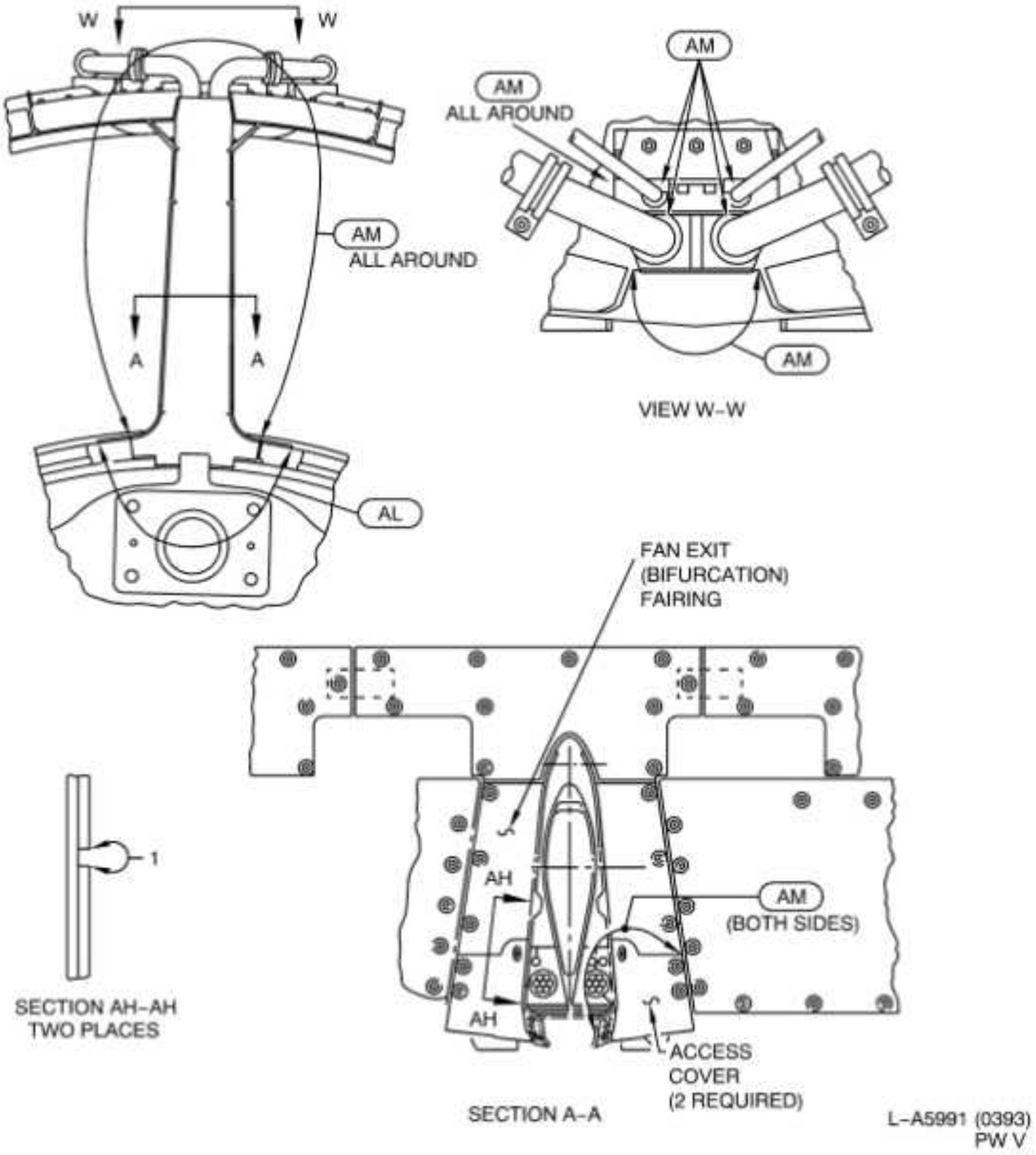
EEC Wiring Harness − W1, W2, W11 And W12 (Fan Case)
Figure 425
(Task 72−00−33−450−003−B)


PWA
86211
FLANGE A
PWA86212
FLANGE A1
FLANGE B1
L-A6814 (0000)
PWV

Fan Case Harness Junction Simulators
Figure 426
(Task 72−00−33−450−003−B)

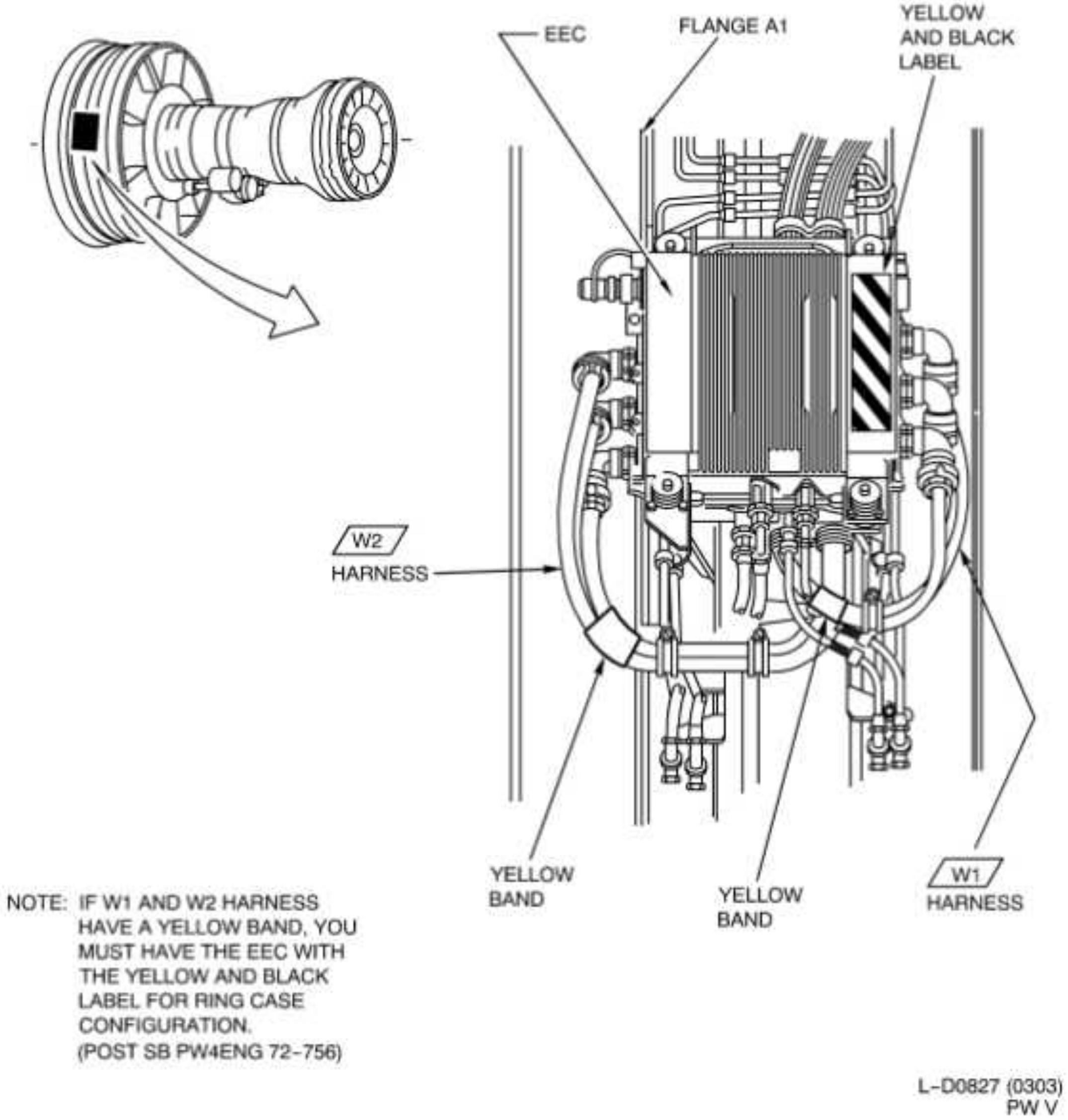

V
1
COVER PLATE
Z
Z
2
FAN EXIT
FAIRING
(BIFURCATION)
3
SCREW
(3 PLACES
EACH SIDE)
4
SCREW
(POST SB PW4ENG 72-370
PRODUCTION COVERS ONLY)
5
ACCESS
COVER
(2 PLACES)
7
SCREW
(1 PLACE
EACH SIDE)
6
SCREW
(2 PLACES
EACH SIDE)
VIEW V
VIEW Z-Z
L-A7671 (0292)
PW V

Fan Exit Fairing (Bifurcation)
Figure 427
(Task 72-00-33-450-003-B)


W
W
AM
ALL AROUND
A
A
AL
AM
AM
ALL AROUND
AM
VIEW W−W
FAN EXIT
(BIFURCATION)
FAIRING
1
SECTION AH−AH
TWO PLACES
AH
AH
AM
(BOTH SIDES)
ACCESS
COVER
(2 REQUIRED)
SECTION A−A
L−A5991 (0393)
PW V

1. Apply The Sealant Even With, To 0.010 Inch (0.254 mm) Below, Two Places

Fan Exit Fairing (Bifurcation) Sealant Areas
Figure 428
(Task 72−00−33−450−003−B)


EEC
FLANGE A1
YELLOW AND BLACK LABEL
W2 HARNESS
YELLOW BAND
YELLOW BAND
W1 HARNESS
NOTE: IF W1 AND W2 HARNESS HAVE A YELLOW BAND, YOU MUST HAVE THE EEC WITH THE YELLOW AND BLACK LABEL FOR RING CASE CONFIGURATION. (POST SB PW4ENG 72-756)
L-D0827 (0303)
PW V

EEC Wiring Harness − W1 And W2 (Fan Case) Post
SB PW4ENG 72−756 (Ring Case Configuration)
Figure 429
(Task 72−00−33−450−003−B)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − FAN CASE − INSTALLATION−07

Task 72−00−33−420−005:

1. Install Bleed Valve Assembly

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P09−014	Sealant, Silicone Rubber (PWA 36003)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Cotter Pin	1	72−33−00	12	150
Cotter Pin	1	72−33−00	12	130
Cotter Pin	1	72−33−00	12	160

B. Procedure

(1) Install 2.5 bleed valve aligning rollers with slotted guides and bell crank with bell crank bracket on fan case. Secure bell crank to bracket with pin and cotter pins. Bend tangs of cotter pins to secure pin.

(2) Install pin to secure bell crank and actuator link. Secure pin with collar and cotter pin. Bend tangs of cotter pin to secure pin.

(3) Clean both installed pin and cotter pin surrounding areas by SPOP 208 Wipe Method (Task 70−21−00−110−040). Surfaces shall be thoroughly dried in air at ambient temperature. Drying time shall be sufficient to remove traces of solvent detrimental to sealant. Apply Silicone Rubber Sealant (P09−014), to both ends of pins and cotter pins.

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Task 72-00-33-420-004:

1. Install The Fan Exit Base And Vane Assemblies

A. Equipment And Materials

Special Tools:

PWA 76154	Adapter, Lift And Trunnion (2 Necessary)
PWA 76155	Sling, Strongback
PWA 85698	Adapter, Lift And Trunnion (2 Necessary) (Optional to PWA 86431)
PWA 86431	Adapter, Lift And Trunnion (2 Necessary)

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P09-029	Sealant, Silicone Rubber (PWA 36029)

B. Procedure

WARNING: VANES MUST BE REPLACED INDIVIDUALLY (ONE-FOR-ONE) TO PREVENT DISENGAGEMENT OF ADJACENT VANES. IF SEVERAL VANES ARE REMOVED AT ONE TIME, ADJACENT VANES MAY DISENGAGE FROM INNER CASE AND FALL. POSSIBLE INJURY TO PERSONNEL AND DAMAGE TO VANE MAY RESULT.

CAUTION: REPLACEMENT VANE MUST BE SAME PART NUMBER AS REPLACED VANE.

Subtask 72-00-33-360-071:

(1) Replace individual vanes as necessary.

(a) Carefully lift retention strap at vane location. Pull vane radially out and forward to disengage from inner case locating pins.

(2) Install two PWA 86431 Adapters or PWA 85698 Lifting Adapters on the front fan case and outer case at 3 and 9 o'clock positions. With a hoist, PWA 76155 Sling, and two PWA 76154 Adapters, lift the front fan case. See Figure 401.

ENGINE GENERAL - FAN CASE - INSTALLATION-08

CAUTION: INSTALL THE FRONT FAN CASE AND OUTER CASE SUFFICIENTLY TO THE REAR TO PREVENT THE VANES FROM DISENGAGEMENT AND DAMAGE.

(3) Install the front fan case and outer case over the vanes on engine sufficiently to remove retention strap. See Figure 402.

(4) Remove vane retention strap from OD of vanes.

(5) Move fan cases and fan exit case rearward to mate with intermediate case.

(6) Install the Flange C hardware as follows. Refer to 72-00-33, Installation-20 (Task 72-00-33-420-020).

(7) Attach the vanes to the outer case. See Figure 402.

(a) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 72-262) Apply Engine Oil P03-001 to the threads of two bolts. Attach the outer case to the vanes with two washers and the bolts. Torque the bolts to 74 - 82 lb-in. (8.361 - 9.265 N.m). Install Lockwire P05-289.

(b) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 72-262) Apply Engine Oil P03-001 to the threads of two slab-bolts. Install the bolts through the vane, outer fairing, and outer case. Install washers and nuts on the bolts. Torque the nuts to 85 - 95 lb-in. (9.604 - 10.34 N.m).

(c) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Apply Engine Oil P03-001 to the threads of two slab-bolts. Install the bolts through the vane, outer fairing, and outer case. Install washers and nuts on the bolts. Torque the nuts to 85 - 95 lb-in. (9.604 - 10.34 N.m).

NOTE: FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Engines with the common Airbus-McDonnell Douglas fan case externals sales order option have eight brackets attached to the slab-bolts at the top left of the outer case. To install these brackets, first put the brackets and mating bolts in position over the slab-bolts, then install the nuts

(no washers at these positions). Tighten the nuts to the same torque as above.

(d) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 72-262) Clean and fill the holes where the heads of the slab-bolts are, as follows:

1 FOR THESE MODELS: 4152, 4156A, 4158
R Clean the surfaces the sealant will touch. Use
R PWA 83-D4 (Task 70-48-00-360-001). Refer to
R Section 70-48-00 in the Standard Practices Manual, PN 585005.

2 FOR THESE MODELS: 4152, 4156A, 4158
Fill the hole with Silicone Rubber Sealant P09-029. The sealant must be 0.040 inch (1.016 mm) above or below the adjacent surfaces.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
Do the fill operation at room temperature in a room that has 25 percent minimum relative humidity.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
It is permitted to have 0.060 inch (1.524 mm) surface voids in the rubber sealant.

(e) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Clean and fill the holes where the heads of the slab-bolts are, as follows:

Subtask 72-00-33-360-001-013:

1 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Clean the surfaces the sealant will touch. Use
R PWA 83-D4 (Task 70-48-00-360-001). Refer to
R Section 70-48-00, in the Standard Practices Manual, PN 585005.

Subtask 72-00-33-360-051:

2 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Fill the hole with Silicone Rubber Sealant P09-029. The sealant must be 0.040 inch (1.016 mm) above or below the adjacent surfaces.

NOTE: FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Do the fill operation at room

temperature in a room that has 25 percent minimum relative humidity.

NOTE: FOR THESE MODELS: 4152-3, 4156A-3, 4158-3 It is permitted to have 0.060 inch (1.524 mm) surface voids in the rubber sealant.

(8) Optional, apply Sealant P09-029 in the space between the ID and OD bases of the base and vane assemblies and the adjacent surfaces as follows: See Figure 403.

NOTE: The optional sealant can be applied to help reduce erosion of the vane base material.

(a) Remove any loose sealant.

(b) Clean the areas that the sealant will touch. Refer to PWA 83-D4 (Task 70-48-00-360-001) in section 70-48, Standard Practices Manual, PN 585005.

NOTE: The fan exit guide vane base material is polyetherimide.

(c) Apply Sealant P09-029 to the spaces between the ID and OD vane bases (fairings), and adjacent surfaces as shown in the reference figure. The surface of the sealant must be smooth and continuous and flush to 0.040 inch (1.016 mm) below the adjacent surface.

(d) Remove excess sealant.

(e) Permit the sealant to cure in air with a relative humidity of 50 percent minimum at 75° F (23.9° C) or equivalent. Cure the sealant for 24 hours, minimum, before you touch the sealant.

NOTE: The sealant is fully cured in 72 hours.

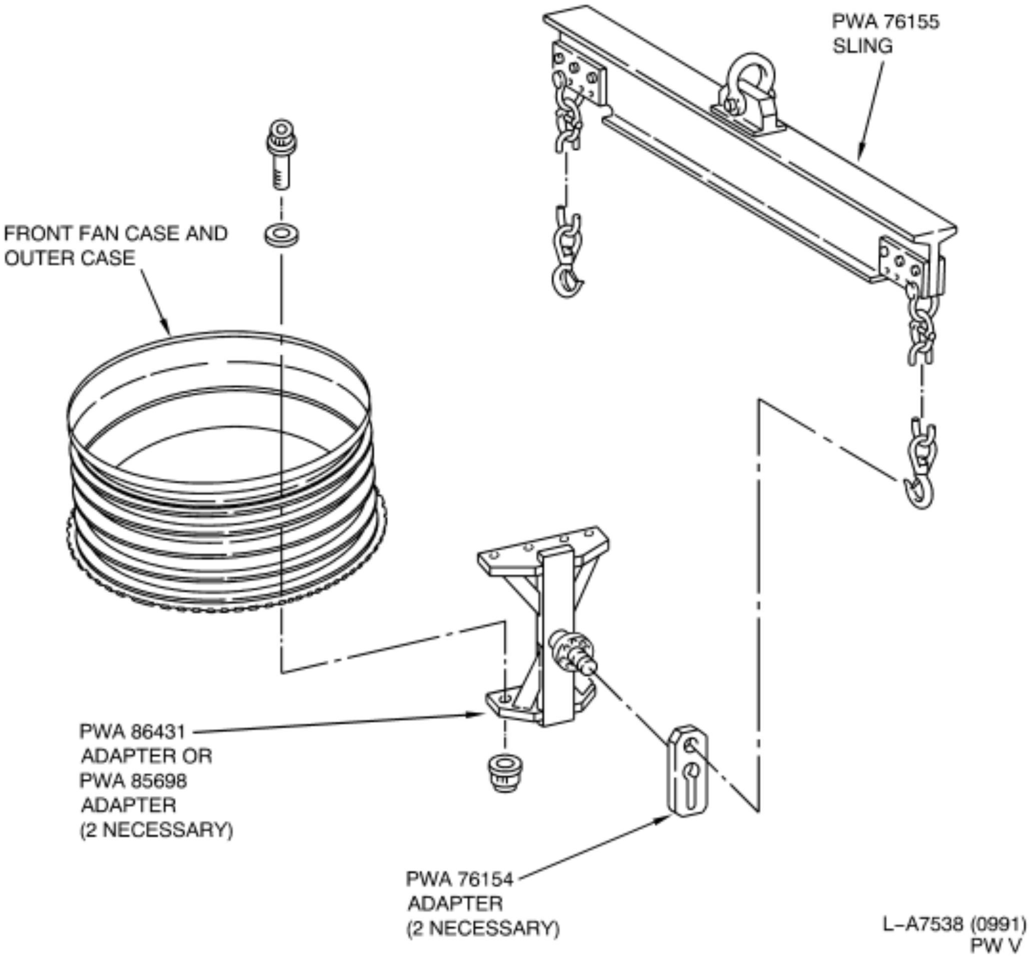
C. Postrequisites

(1) Install fan case external plumbing. See Installation-02 (Task 72-00-33-420-003-A) of (Task 72-00-33-420-003-B00) as applicable.

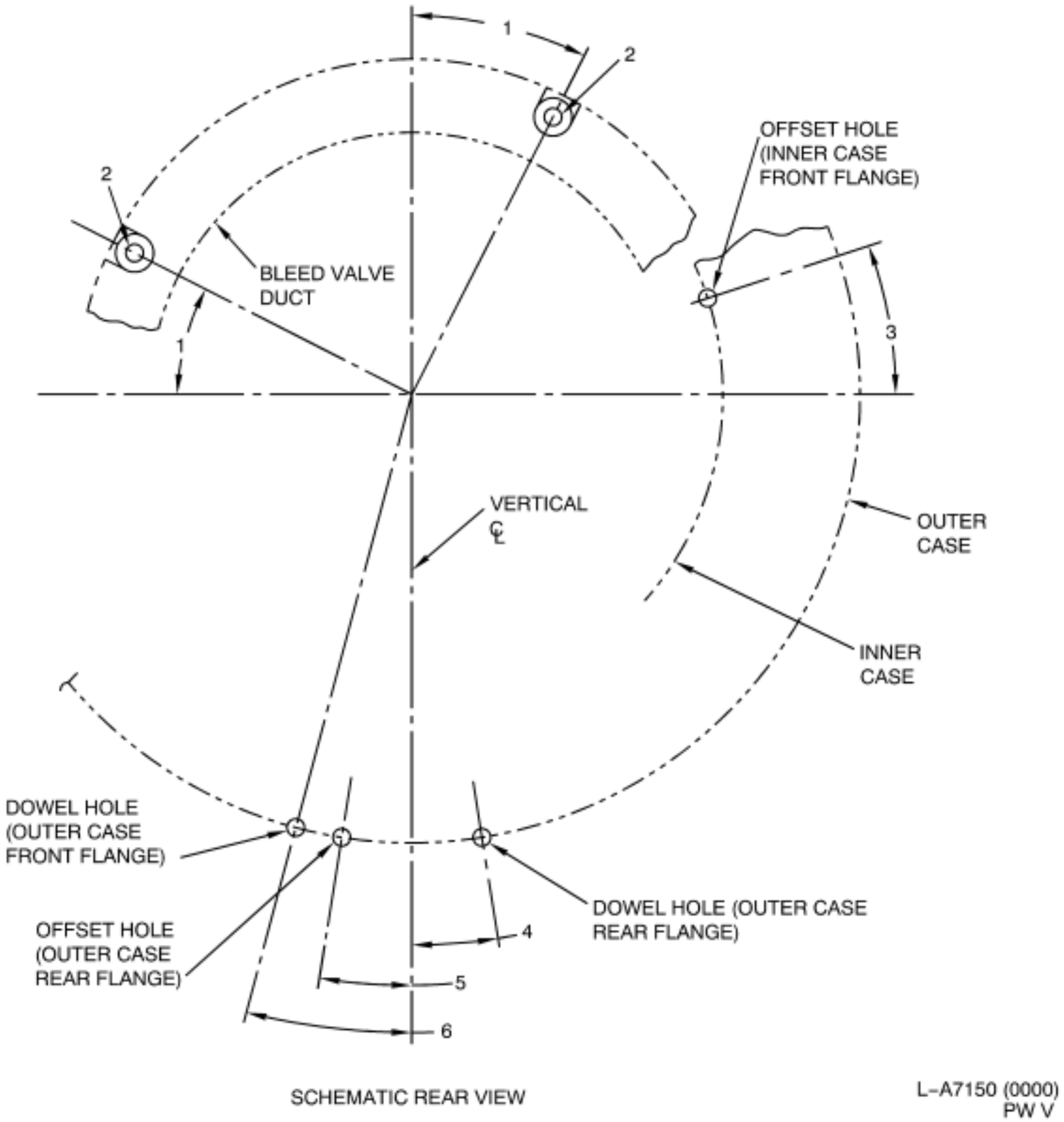
ENGINE GENERAL − FAN CASE − INSTALLATION−08

(2) Install EEC wiring harnesses W1 and W2. See Installation−06 (Task 72−00−33−450−003−A) or (Task 72−00−33−450−003−B) as applicable.

(3) Install all Stage 1 LPC blade assemblies. See Installation−04 (Task 72−00−31−420−002−002).


PWA 76155
SLING
FRONT FAN CASE AND
OUTER CASE
PWA 86431
ADAPTER OR
PWA 85698
ADAPTER
(2 NECESSARY)
PWA 76154
ADAPTER
(2 NECESSARY)
L−A7538 (0991)
PW V

Installation Of The Tools
Figure 401
(Task 72−00−33−420−004)

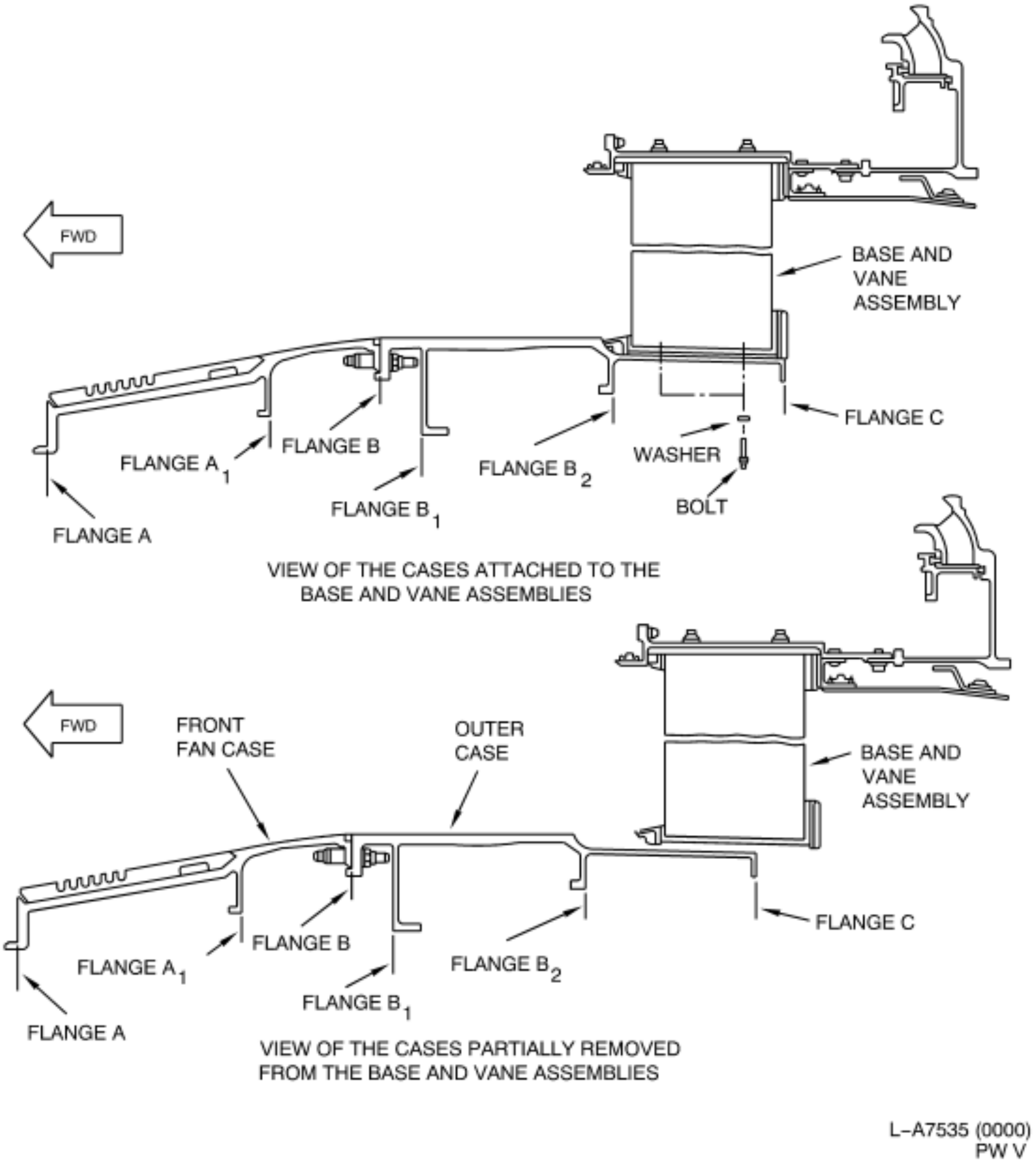

1
2
2
OFFSET HOLE
(INNER CASE
FRONT FLANGE)
BLEED VALVE
DUCT
1
3
VERTICAL
℄
OUTER
CASE
INNER
CASE
DOWEL HOLE
(OUTER CASE
FRONT FLANGE)
OFFSET HOLE
(OUTER CASE
REAR FLANGE)
DOWEL HOLE (OUTER CASE
REAR FLANGE)
4
5
6
SCHEMATIC REAR VIEW
L−A7150 (0000)
PW V

Alignment Of The Outer Case With The Inner Case
Figure 402 (Sheet 1)
(Task 72−00−33−420−004)

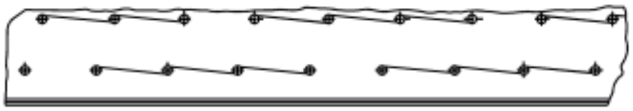
ENGINE GENERAL − FAN CASE − INSTALLATION−08

1. 25° 59' 58", Reference
2. 0.3755 Inch (9.538 mm) Diameter Reference
3. 2° 42' 30"
4. 1° 8'
5. 0° 55' Reference
6. 1° 30' Reference

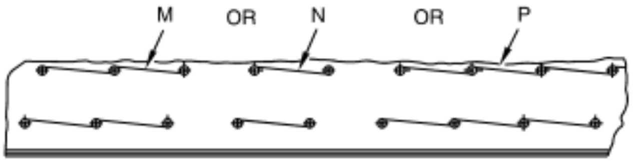
Key to Figure 402 (Sheet 1)


FWD
BASE AND VANE ASSEMBLY
FLANGE C
WASHER
BOLT
FLANGE B_2
FLANGE B
FLANGE A_1
FLANGE B_1
FLANGE A
VIEW OF THE CASES ATTACHED TO THE BASE AND VANE ASSEMBLIES
FWD
FRONT FAN CASE
OUTER CASE
BASE AND VANE ASSEMBLY
FLANGE C
FLANGE B
FLANGE A_1
FLANGE B_2
FLANGE B_1
FLANGE A
VIEW OF THE CASES PARTIALLY REMOVED FROM THE BASE AND VANE ASSEMBLIES
L-A7535 (0000)
PW V

Installation Of The Cases And Attachment
Of The Vanes (Pre SB PW4ENG 72-262)
Figure 402 (Sheet 2)
(Task 72-00-33-420-004)



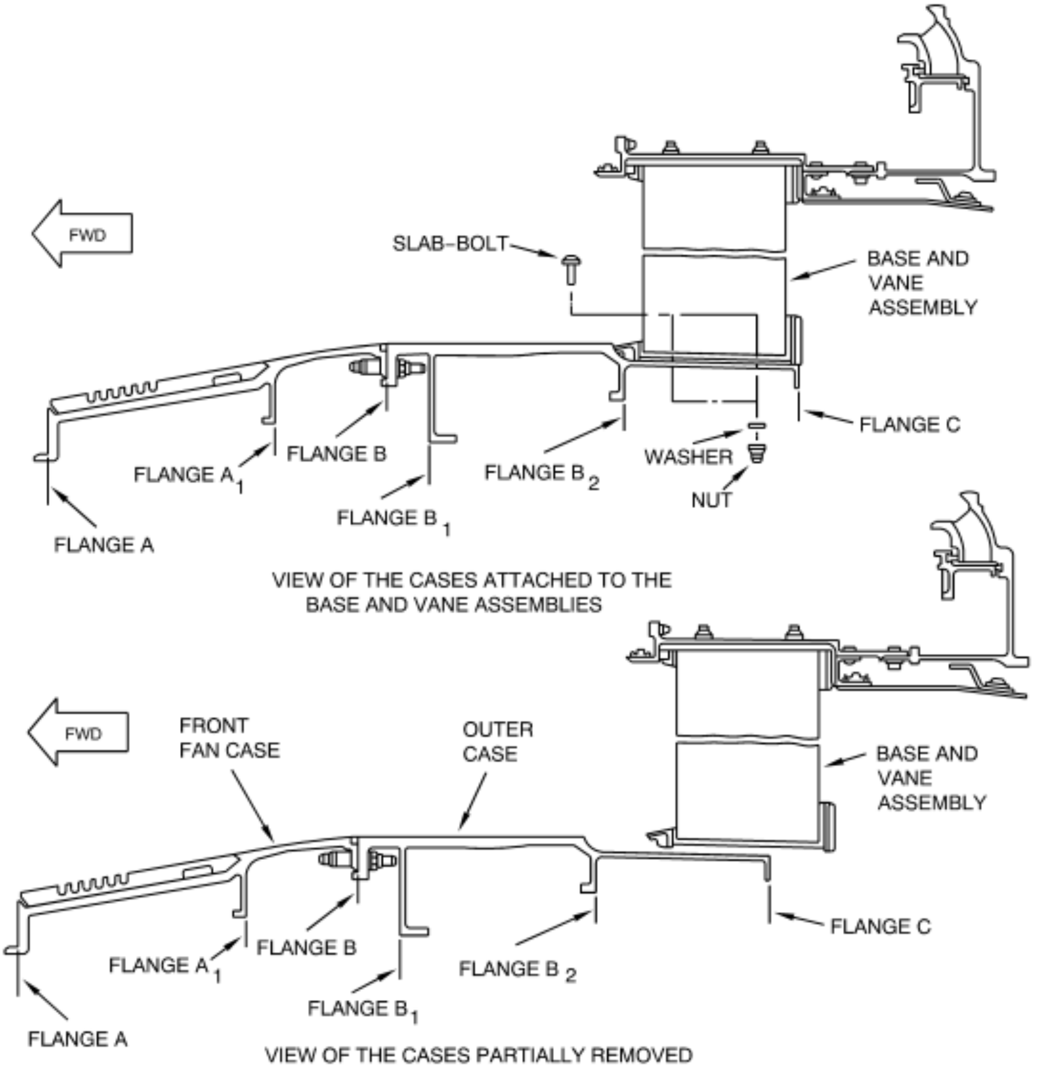
VIEW A−A
(PERMITTED LOCKWIRE PATTERN FOR ASSEMBLIES THAT ARE PRE SB PW4ENG 72−262)



VIEW A−A
(PERMITTED LOCKWIRE PATTERNS −M, N, OR P− FOR ASSEMBLIES
WITH PARTIAL INCORPORATION OF SB PW4ENG 72−262)

L−A7539 (0000)
PW V

Installation Of The Cases And Attachment Of The Vanes
Figure 402 (Sheet 3)
(Task 72−00−33−420−004)

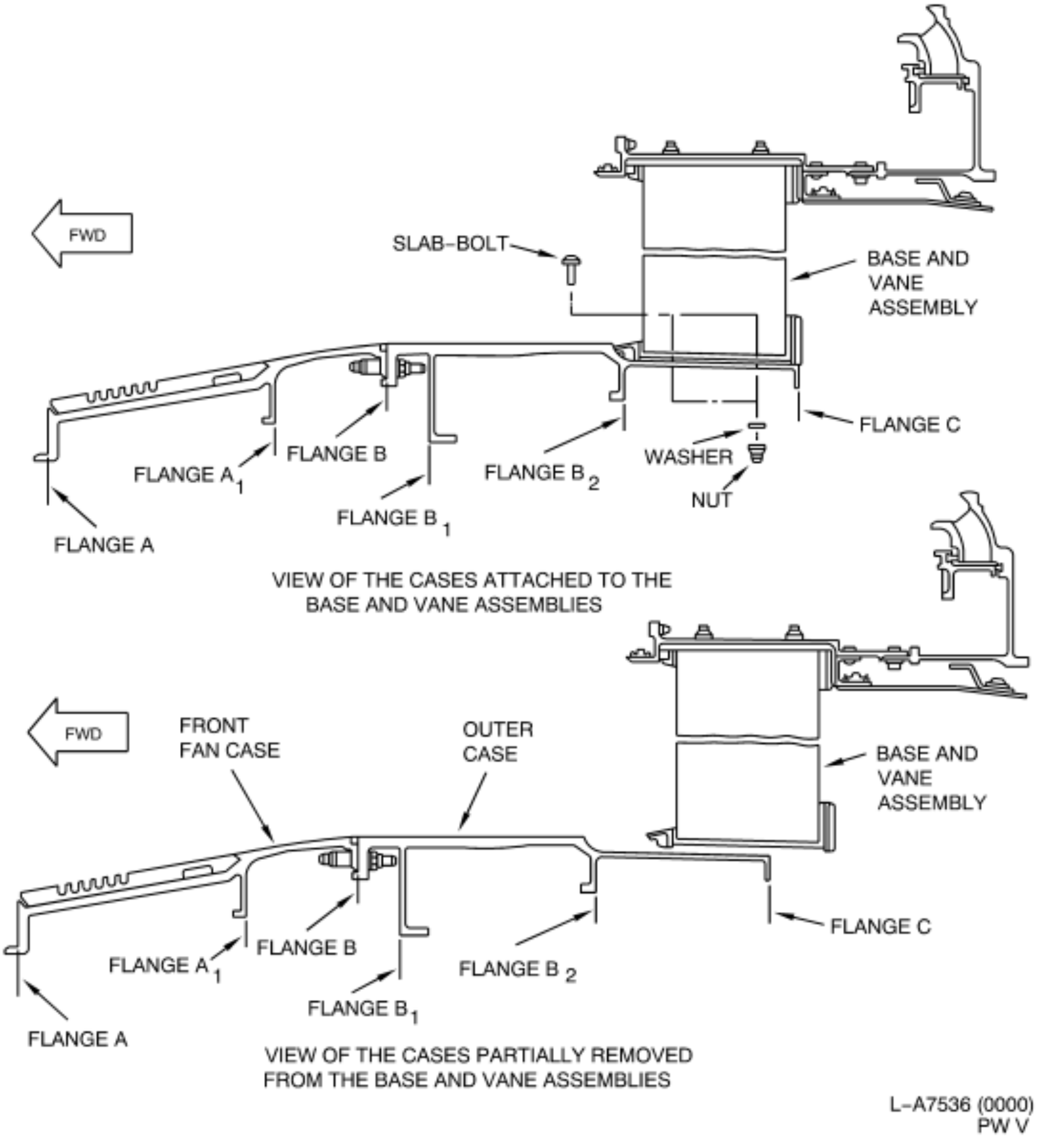

FWD
SLAB−BOLT
BASE AND VANE ASSEMBLY
FLANGE C
WASHER
NUT
FLANGE B_2
FLANGE B
FLANGE A_1
FLANGE B_1
FLANGE A
FWD
FRONT FAN CASE
OUTER CASE
BASE AND VANE ASSEMBLY
FLANGE B
FLANGE A_1
FLANGE B_2
FLANGE C
FLANGE B_1
FLANGE A

VIEW OF THE CASES ATTACHED TO THE BASE AND VANE ASSEMBLIES

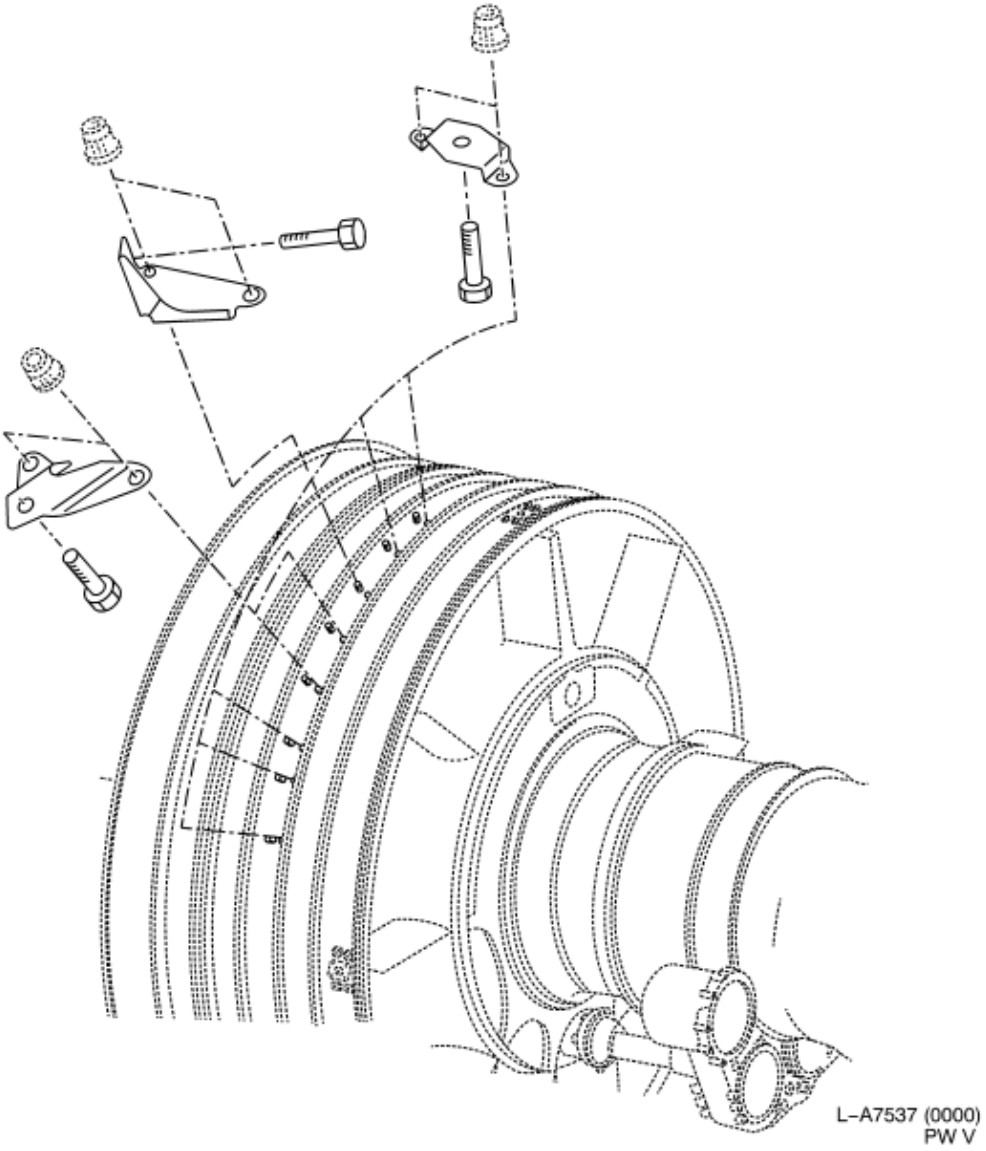
VIEW OF THE CASES PARTIALLY REMOVED FROM THE BASE AND VANE ASSEMBLIES

L−A7536 (0000)
PW V

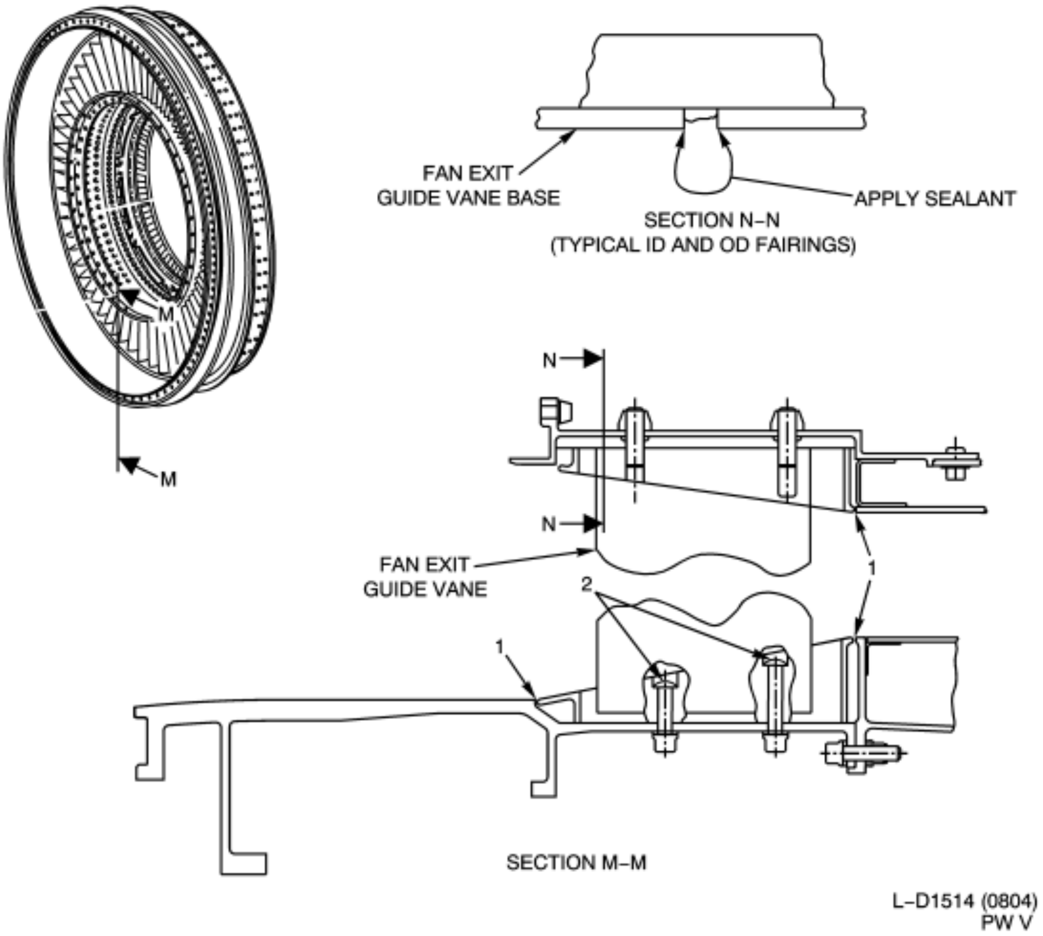
Installation Of The Cases And Attachment
Of The Vanes (Post SB PW4ENG 72−262)
Figure 402 (Sheet 4)
(Task 72−00−33−420−004)


FWD
SLAB-BOLT
BASE AND VANE ASSEMBLY
FLANGE C
WASHER
NUT
FLANGE A$_1$
FLANGE B
FLANGE B$_2$
FLANGE B$_1$
FLANGE A
VIEW OF THE CASES ATTACHED TO THE BASE AND VANE ASSEMBLIES
FWD
FRONT FAN CASE
OUTER CASE
BASE AND VANE ASSEMBLY
FLANGE C
FLANGE A$_1$
FLANGE B
FLANGE B$_2$
FLANGE B$_1$
FLANGE A
VIEW OF THE CASES PARTIALLY REMOVED FROM THE BASE AND VANE ASSEMBLIES
L-A7536 (0000)
PW V

Installation Of The Cases And Attachment Of The Vanes
Figure 402 (Sheet 5)
(Task 72-00-33-420-004)



Installation Of The Cases And Attachment Of
The Vanes (Airbus−McDonnell Douglas Common
Fan Case Externals Sales Order Option)
Figure 402 (Sheet 6)
(Task 72−00−33−420−004)


FAN EXIT
GUIDE VANE BASE
APPLY SEALANT
SECTION N−N
(TYPICAL ID AND OD FAIRINGS)
M
M
N
N
FAN EXIT
GUIDE VANE
2
1
1
SECTION M−M
L−D1514 (0804)
PW V

1. Optional, Apply Sealant All Around As Necessary
2. Fill This Hole With Sealant

Sealant Application Areas
Figure 403
(Task 72−00−33−420−004)

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ENGINE GENERAL - FAN CASE - INSTALLATION-09

Task 72-00-33-450-004:

1. Install Propulsion Multiplexer Unit (PMUX)

A. Equipment And Materials Required

Standard Tools:

Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	77-31-00/1/20
Lockwire, AS3214-02	As Required	

B. Procedure
See Figure 401.

CAUTION: DO NOT USE LUBRICANTS ON PMUX SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF PMUX CAN RESULT.

(1) If unit has been replaced or repaired and adapter was removed, comply with the following.

(a) Remove protective closures and install packing to adapter. Install adapter to port in unit and torque to 65 - 75 lb-in. (7.344 - 8.474 N.m).

(2) Lubricate the threads on the mounting bolts with Engine Oil P03-001. Install the unit, connections facing downward, to brackets on Flange B and Flange B2 at approximately the 1 o'clock position with a spacer between each bracket and the unit. Secure the spacers and the unit with bolts and washers. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(3) Connect the harness connector to the PMUX harness receptacle as follows.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- The connector coupling nut is fully tight
- The connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(4) Connect the PMUX programming plug to the receptacle on the PMUX as follows.

(a) Remove the protection covers. Examine the programming plug and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the plug and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the plug keyways and engage the plug to the mating receptacle. Tighten the plug coupling nut by hand until you cover the witness (color) band and the plug coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the plug coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN PLUG DAMAGE OR A LOOSE PLUG. A LOOSE PLUG PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the plug coupling nut. Use sufficient force to be sure:
- The plug coupling nut is fully tight
- The plug fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the plug is tight.

NOTE: If you use too much force, the tools (above) will turn around on the plug coupling nut. This will prevent too much torque.

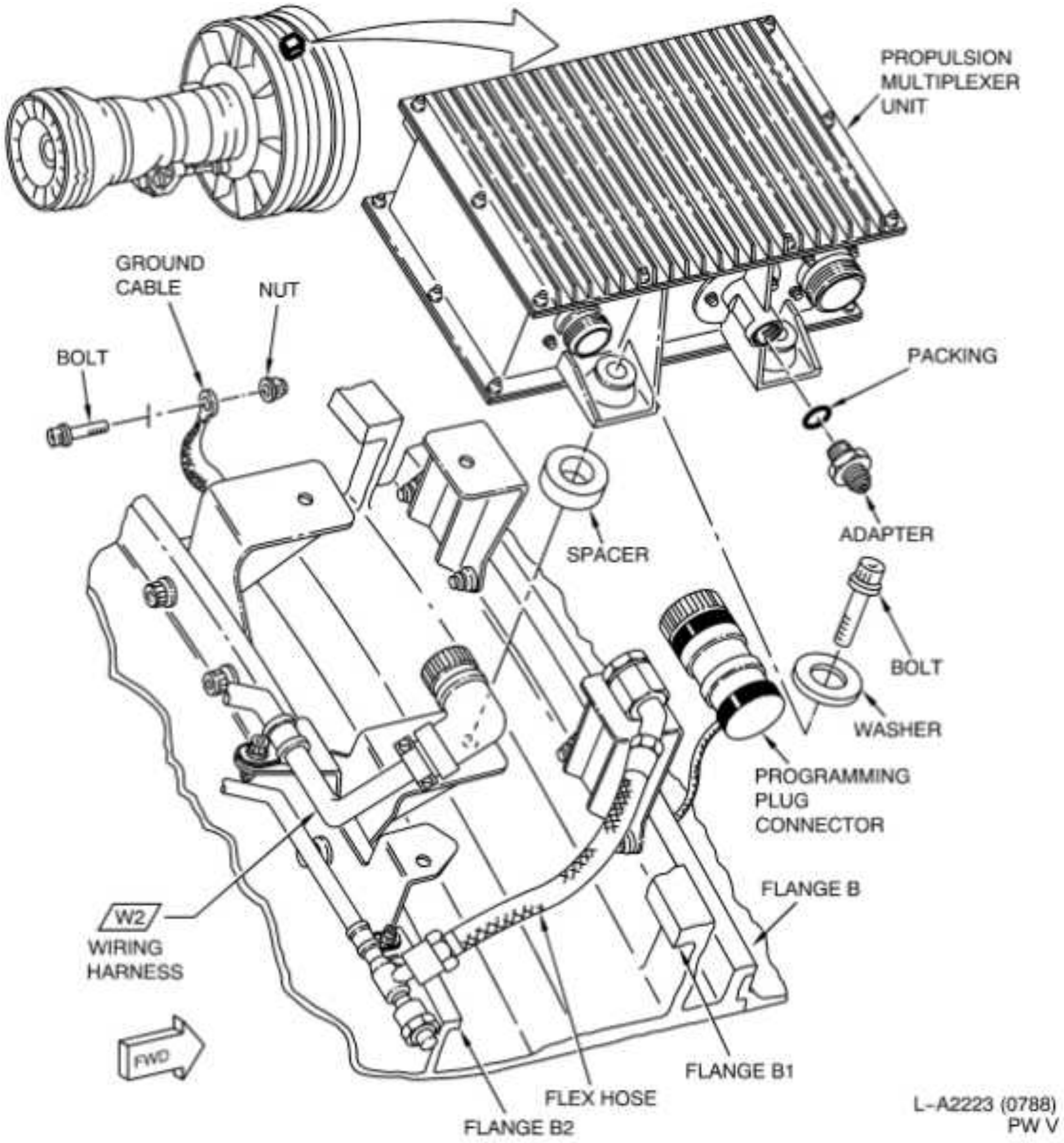
NOTE: See the instructions given with the strap wrench for correct use.

CAUTION: HOLD ADAPTER WITH WRENCH WHILE TORQUING FLEX HOSE NUT, TO AVOID DAMAGE TO MULTIPLEXER PORT.

(5) Attach flex hose (AS32) and torque hose nuts to 135 − 150 lb−in. (15.253 − 16.948 N.m).

(a) (Post SPN No. P3042) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hose nut(s) as applicable.

(6) Install bolt, threads lubricated with Engine Oil P03−001, and nut securing ground cable to top of unit. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).


PROPULSION MULTIPLEXER UNIT
GROUND CABLE
NUT
BOLT
PACKING
ADAPTER
SPACER
BOLT
WASHER
PROGRAMMING PLUG CONNECTOR
FLANGE B
W2
WIRING HARNESS
FWD
FLANGE B1
FLEX HOSE
FLANGE B2
L-A2223 (0788)
PW V

Propulsion Multiplexer Unit (PMUX)
Figure 401
(Task 72−00−33−450−004)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - FAN CASE - INSTALLATION-10

Task 72-00-33-450-005:

1. Install PMUX Programming Plug

A. Equipment And Materials Required

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers

Consumable Materials

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

B. Procedure

See Figure 401.

(1) If the PMUX programming plug requires programming to change engine serial number, refer to PMUX Programming Plug Component Maintenance Manual 77-32-11, PN 50A638.

(2) Connect the PMUX programming plug to the receptacle on the PMUX as follows.

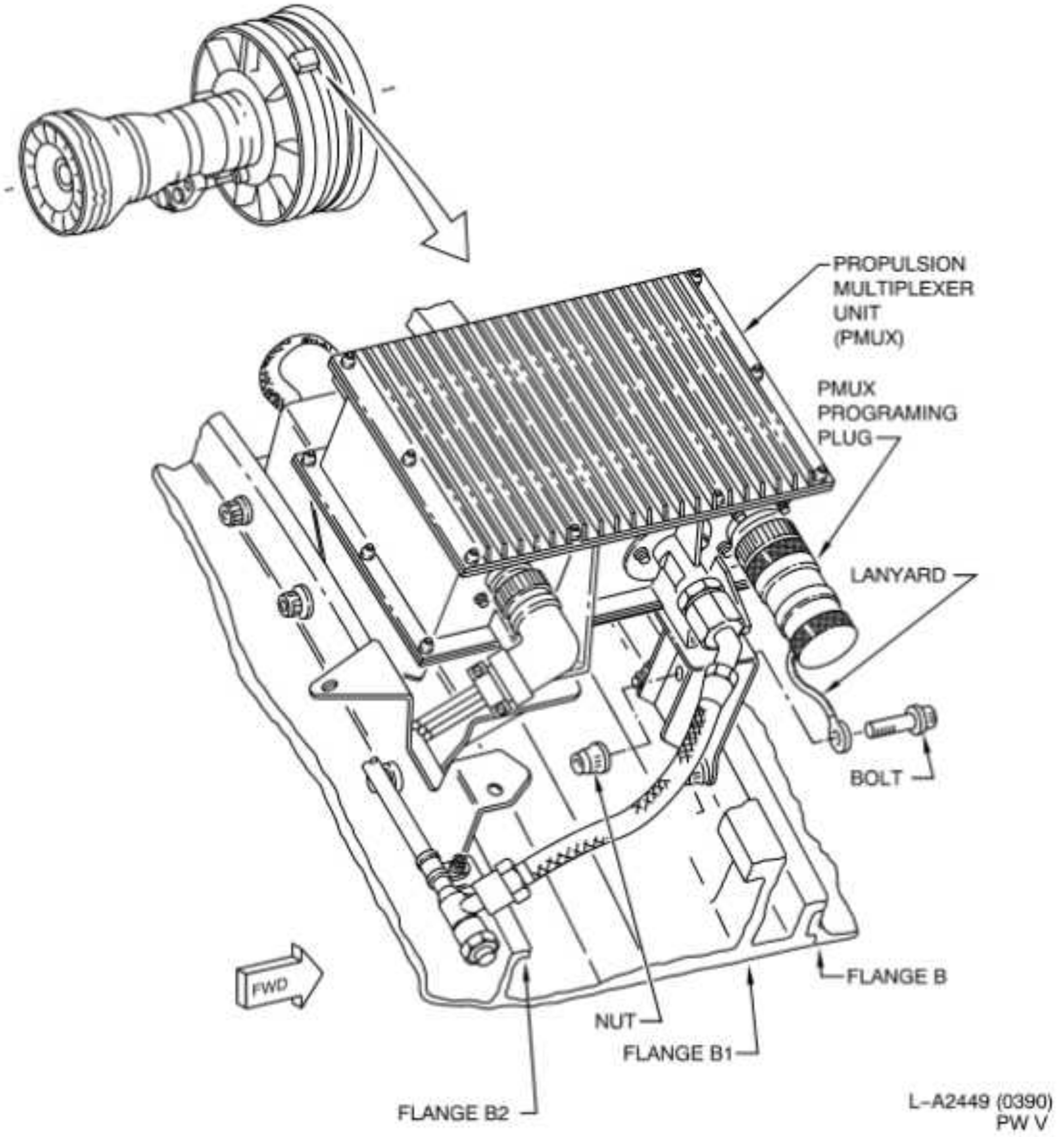
(a) Remove the protection covers. Examine the programming plug and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the plug and receptacle with Denatured Ethyl Alcohol (P11-009). Let dry.

(b) Align the plug keyways and engage the plug to the mating receptacle. Tighten the plug coupling nut by hand until you cover the witness (color) band and the plug coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the plug coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN PLUG DAMAGE OR A LOOSE PLUG. A LOOSE PLUG PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the (Glenair TG-70) strap wrench or the (Glenair TG-69) soft-jawed pliers and tighten the plug coupling nut. Use sufficient force to be sure:


PROPULSION MULTIPLEXER UNIT (PMUX)
PMUX PROGRAMING PLUG
LANYARD
BOLT
FWD
FLANGE B
NUT
FLANGE B1
FLANGE B2
L-A2449 (0390)
PW V

PMUX Programming Plug
Figure 401
(Task 72−00−33−450−005)

ENGINE GENERAL − FAN CASE − INSTALLATION−10

- the plug coupling nut is fully tight
- the plug fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the plug is tight.

NOTE: If you use too much force, the tools (above) will turn around on the plug coupling nut. This will prevent too much torque.

See the instructions given with the strap wrench for correct use.

(3) Install lanyard to forward side of Flange B bracket with bolt, threads lubricated with Engine Oil (P03−001), and nut. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

ENGINE GENERAL - FAN CASE - INSTALLATION-11

Task 72-00-33-450-006:

1. Install 2.5 Bleed Valve Actuator

A. Equipment And Materials Required

Standard Tools:

Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 85928	Torque Adapter

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	75-32-00/1/140
Packing	1	75-32-00/1/160

B. Procedure
See Figure 401.

(1) Remove protective closures.

(2) If actuator has been replaced or repaired and adapters were removed comply with the following:

(a) Remove protective closures and install packings lubricated with Engine Oil P03-001, to adapters. Install adapters, threads lubricated with Engine Oil P03-001, to ports in actuator and torque adapter to 150 - 170 lb-in. (16.948 - 19.207 N.m) and adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m).

CAUTION: DO NOT ROTATE BLEED VALVE ROD END CLEVIS. ROTATING CLEVIS MAY CAUSE DAMAGE TO BLEED VALVE LINKAGE.

(3) Lubricate OD threads of rod end clevis with Engine Oil P03−001, and slide hollow piston shaft of actuator over protruding rod end clevis. Rotate piston shaft hex clockwise to engage OD threads of rod end clevis with ID threads of piston shaft. Continue rotating until actuator is mated with intermediate case.

CAUTION: WITH THE PWA 85928 TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING (SEE STANDARD PRACTICES MANUAL). TOO MUCH TORQUE CAN DAMAGE THE THREADED PARTS.

(4) Secure actuator to intermediate case using bolts, threads lubricated with Engine Oil P03−001 and washers. Use PWA 85928 Torque Adapter and torque bolts to 180 − 200 lb−in. (20.337 − 22.597 N.m).

(5) For engines with the 2.5 bleed actuator support bracket (Post SB PW4ENG 75−84) do the following.

(a) Install the support bracket to the actuator with bolts, threads lubricated with Engine Oil P03−001. Tighten the bolts by hand.

(b) (Post SB PW4ENG 75−84 and Pre SB PW4ENG 75−126) Align the three boltholes in the support bracket with the three boltholes in the bracket on Flange E. Attach the two brackets together with nuts and bolts, threads lubricated with Engine Oil P03−001. Tighten the nuts by hand.

(c) (Post SB PW4ENG 75−126) Align the three boltholes in the support bracket with the three boltholes in the bracket on Flange E. Attach the two brackets together with bolts, threads lubricated with Engine Oil P03−001 and installed in the nutplates on the support bracket.

(d) Torque the bolts that attach the support bracket to the actuator 65 − 85 lb−in. (7.344 − 9.604 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

ENGINE GENERAL − FAN CASE − INSTALLATION−11

(e) Torque the bolts that attach the support bracket to bracket on Flange E to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(6) Connect the W3P15 harness connector to the 2.5 bleed valve harness receptacle as follows.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

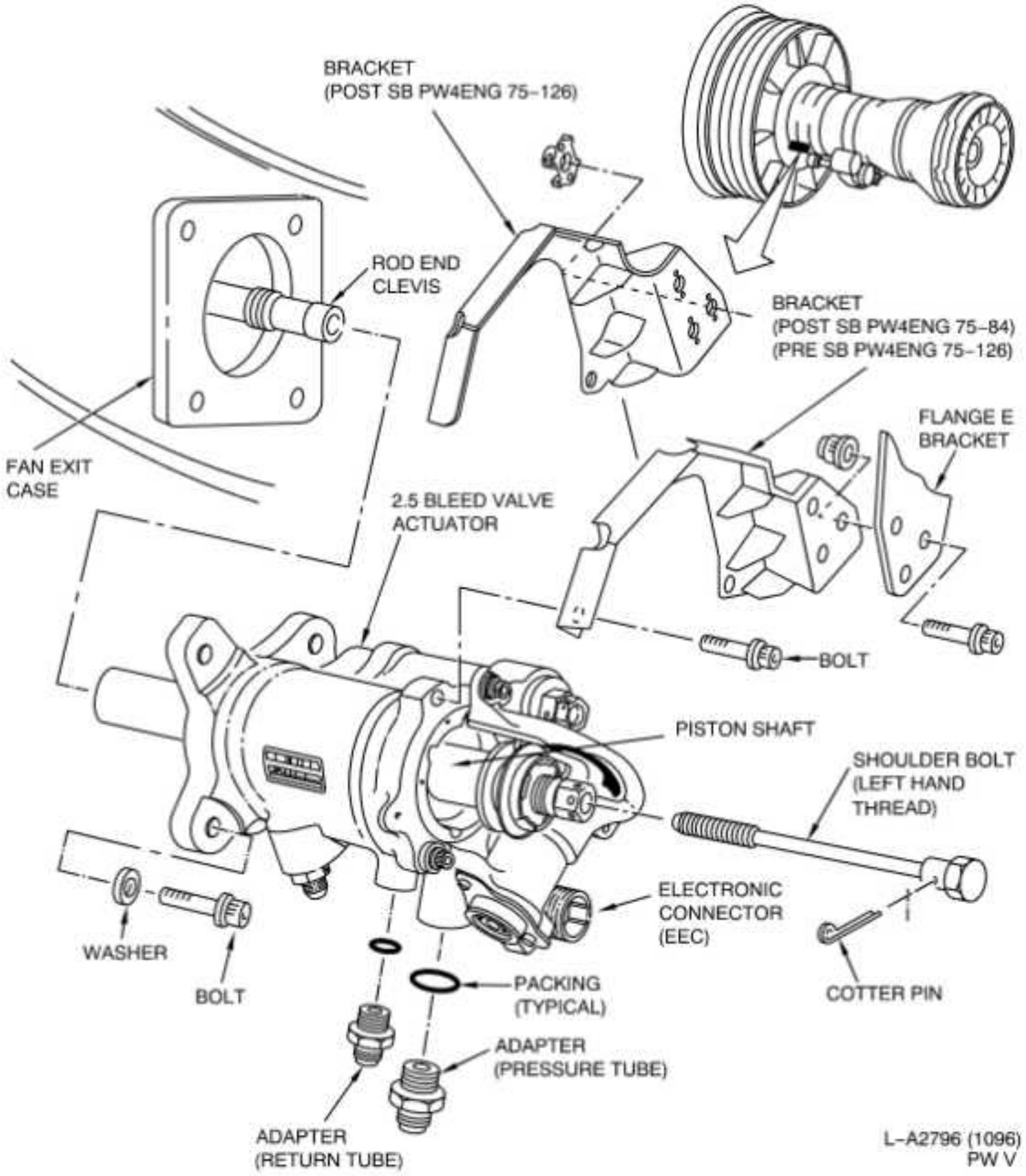
NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

NOTE: Install the inner liner. Refer to 72-00-33, Installation-16 Task 72-00-33-440-001. Install the hydraulic tubes. Refer to 72-00-00, Special Procedures-03 Task 72-00-00-830-001 or 72-00-00, Special Procedure-24 Task 72-00-00-830-006 after the rigging.

C. Postrequisites

(1) Rig 2.5 bleed valve actuator. See 72-00-00, Special Procedures-03 Task 72-00-00-830-001 to manually rig the bleed valve actuator or 72-00-00, Special Procedure-24 Task 72-00-00-830-006 to hydraulically rig the bleed valve actuator.


BRACKET
(POST SB PW4ENG 75-126)
ROD END
CLEVIS
BRACKET
(POST SB PW4ENG 75-84)
(PRE SB PW4ENG 75-126)
FLANGE E
BRACKET
FAN EXIT
CASE
2.5 BLEED VALVE
ACTUATOR
BOLT
PISTON SHAFT
SHOULDER BOLT
(LEFT HAND
THREAD)
ELECTRONIC
CONNECTOR
(EEC)
WASHER
BOLT
PACKING
(TYPICAL)
COTTER PIN
ADAPTER
(PRESSURE TUBE)
ADAPTER
(RETURN TUBE)
L-A2796 (1096)
PW V

2.5 Bleed Valve Actuator Installation
Figure 401
(Task 72−00−33−450−006)

ENGINE GENERAL - FAN CASE - INSTALLATION-12

Task 72-00-33-450-007-A:

1. Install The EEC Programming Plug

A. Equipment And Materials Required

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

B. Procedure
See Figure 401.

CAUTION: WHEN YOU REPLACE THE EEC PROGRAMMING PLUG, EXAMINE THE REPLACEMENT PLUG. BE SURE THAT THE REPLACEMENT PLUG IS THE SAME CLASS AND THE SAME PART NUMBER AS THE REMOVED PLUG.

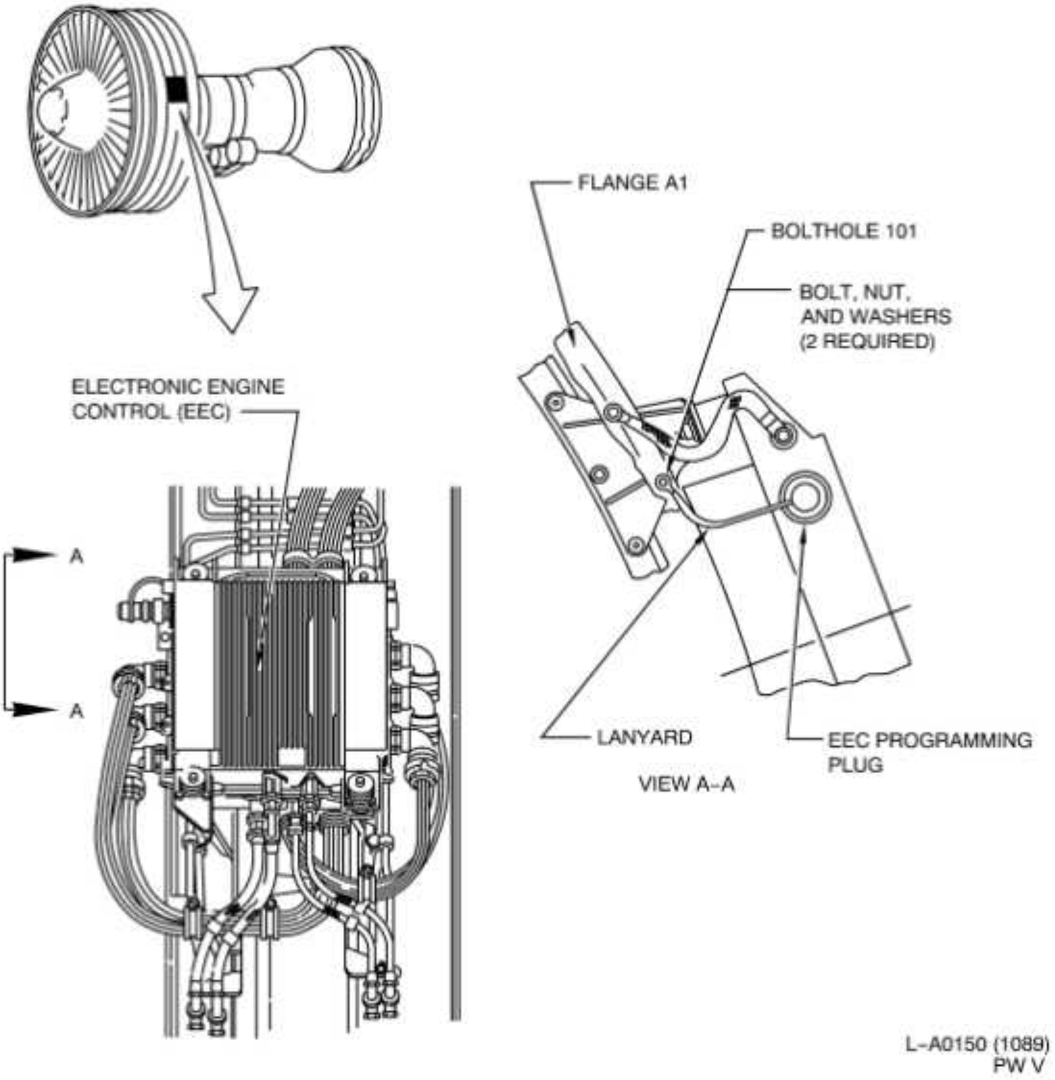
(1) Connect the EEC programming plug to the EEC plug receptacle as follows.

(a) Remove the protection covers. Examine the programming plug and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the plug and receptacle with Denatured Ethyl Alcohol (P11-009). Let dry.

(b) Align the plug keyways and engage the plug to the mating receptacle. Tighten the plug coupling nut by hand until you cover the witness (color) band and the plug coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the plug coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN PLUG DAMAGE OR A LOOSE PLUG. A LOOSE PLUG PERMITS VIBRATION AND CAN RESULT IN


FLANGE A1
BOLTHOLE 101
BOLT, NUT, AND WASHERS (2 REQUIRED)
ELECTRONIC ENGINE CONTROL (EEC)
A
A
LANYARD
EEC PROGRAMMING PLUG
VIEW A-A
L-A0150 (1089)
PW V

EEC Programming Plug
Figure 401
(Task 72-00-33-450-007-A)

CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the (Glenair TG−70) strap wrench or the (Glenair TG−69) soft−jawed pliers and tighten the plug coupling nut. Use sufficient force to be sure:
- the plug coupling nut is fully tight
- the plug fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the plug is tight.

NOTE: If you use too much force, the tools (above) will turn around on the plug coupling nut. This will prevent too much torque.

See the instructions given with the strap wrench for correct use.

(2) Attach the lanyard to the inlet case Flange A1 with the bolt, lubricated with Engine Oil (P03−001), washers (under bolthead and nut), and nut. Torque the nut to 36 − 40 lb−in. (4.067 − 4.519 N.m).

C. Postrequisites

(1) Test the engine per Test Reference Table. See 71−00−00, Adjustment/Test−00.

Task 72−00−33−450−007−B:

2. Install The EEC Programming Plug For Engines With Commonality Parts Between Airbus And McDonnell Douglas

A. Equipment And Materials Required

Standard Tools:
Glenair TG−70 Strap Wrench or
Glenair TG−69 Soft Jawed Pliers

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Pin, Rivet (ST1106−02)	1			
Collar (ST2185−06)	1			

Consumable Materials:

ENGINE GENERAL − FAN CASE − INSTALLATION−12

Item No.	Designation
P11−009	Alcohol, Denatured Ethyl (AMS 3002)

B. Procedure
See Figure 401.

CAUTION: WHEN YOU REPLACE THE EEC PROGRAMMING PLUG, EXAMINE THE REPLACEMENT PLUG TO MAKE SURE THE SAME CLASS AND THE SAME PART NUMBER IS USED AS THE PLUG THAT WAS REMOVED.

(1) Connect the EEC programming plug to the EEC plug receptacle as follows.

(a) Remove the protection covers. Examine the programming plug and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the plug and receptacle with Denatured Ethyl Alcohol (P11−009). Let dry.

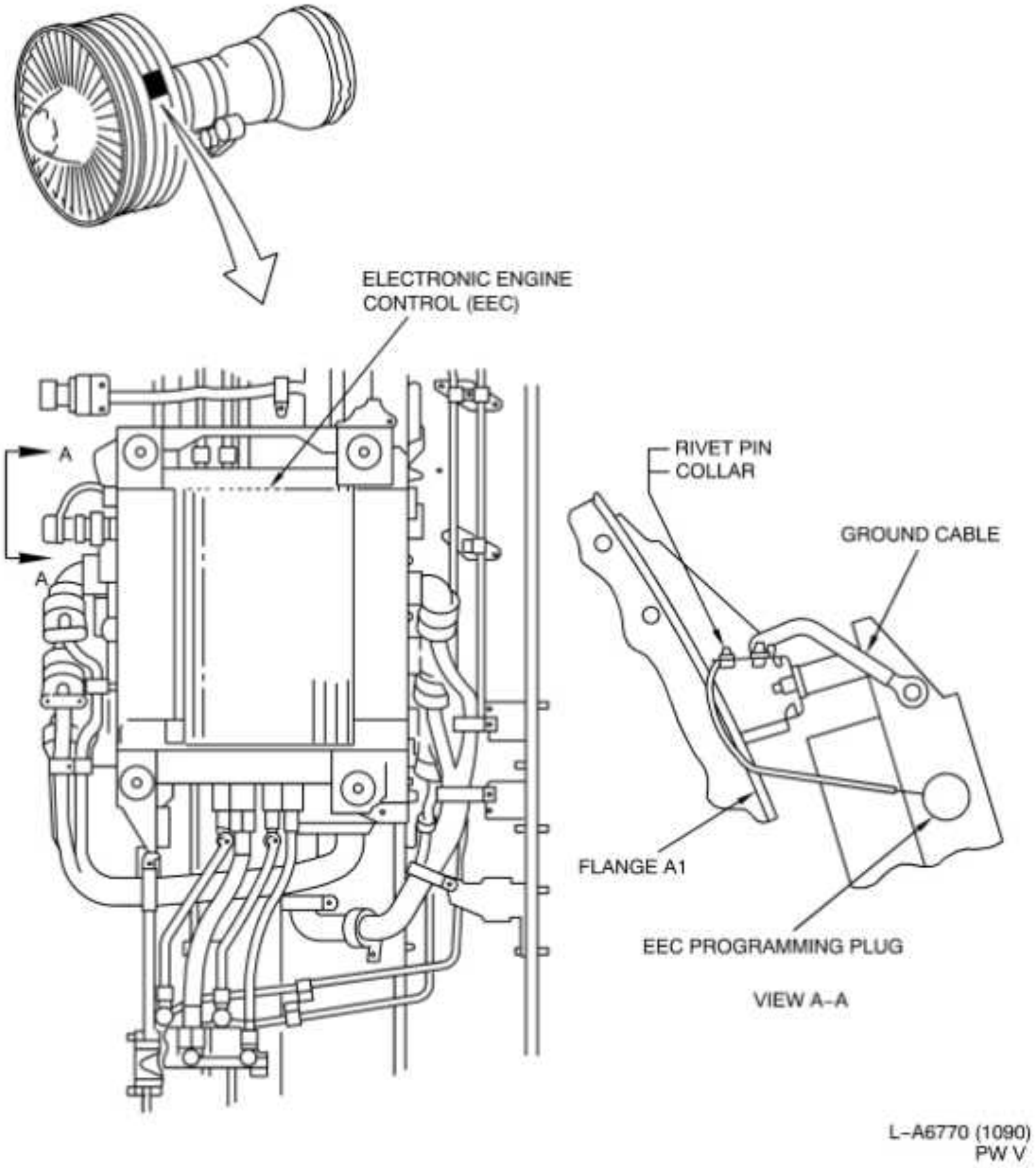
(b) Align the plug keyways and engage the plug to the mating receptacle. Tighten the plug coupling nut by hand until you cover the witness (color) band and the plug coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the plug coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN PLUG DAMAGE OR A LOOSE PLUG. A LOOSE PLUG PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the (Glenair TG−70) strap wrench or the (Glenair TG−69) soft−jawed pliers and tighten the plug coupling nut. Use sufficient force to be sure:

- the plug coupling nut is fully tight
- the plug fits tightly against the receptacle (metal to metal).


ELECTRONIC ENGINE CONTROL (EEC)
A
A
RIVET PIN
COLLAR
GROUND CABLE
FLANGE A1
EEC PROGRAMMING PLUG
VIEW A-A
L-A6770 (1090)
PW V

EEC Programming Plug
Figure 401
(Task 72−00−33−450−007−B)

This procedure will make sure the contacts are sufficiently engaged and the plug is tight.

NOTE: If you use too much force, the tools (above) will turn around on the plug coupling nut. This will prevent too much torque.

See the instructions given with the strap wrench for correct use.

(2) Attach the lanyard to the upper forward mount bracket of the EEC with a rivet pin and collar. See 70−43−00, Standard Practices Manual.

C. Postrequisites

(1) Test the engine per Test Reference Table. See 71−00−00, Adjustment/Test−00.

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ENGINE GENERAL - FAN CASE - INSTALLATION-13

Task 72-00-33-450-008:

1. Install The Supplemental Control Unit

A. Equipment And Materials Required

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-035	Fluid, Lubricating
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Packing, AS3208-04				

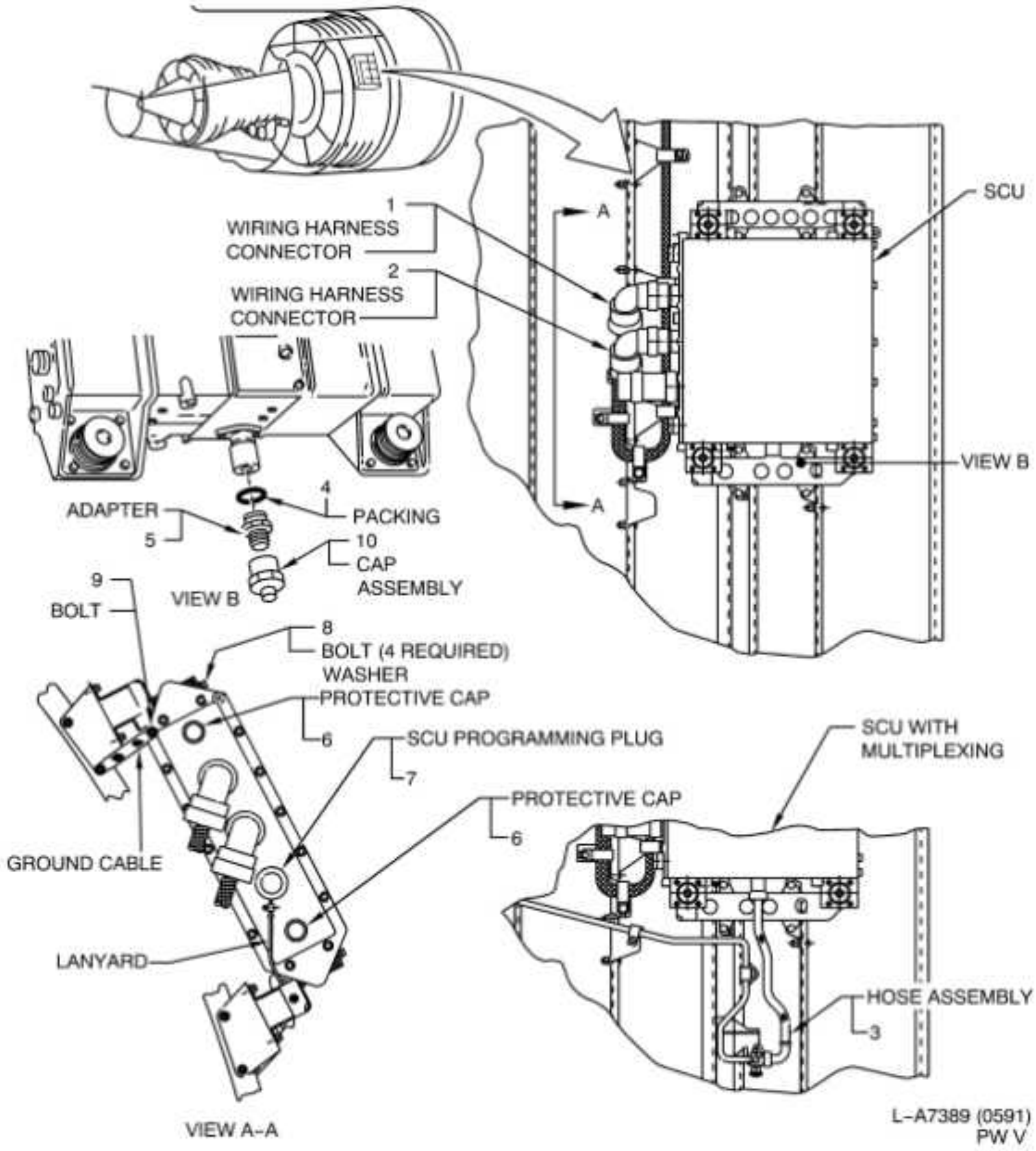
B. Procedure

See Figure 401.

(1) Remove the protection covers from the openings and the electrical connectors on the supplemental control unit and the wiring harness.

CAUTION: DO NOT USE LUBRICANTS ON THE SENSING HOSE, ADAPTER, OR GASKET UNLESS SPECIFIED DIFFERENTLY. LUBRICANTS CAN CAUSE CONTAMINATION OF THE SCU.

(2) If a new supplemental control unit is to be installed, do the following.


1
WIRING HARNESS
CONNECTOR
2
WIRING HARNESS
CONNECTOR
A
A
SCU
VIEW B
4
PACKING
ADAPTER
5
10
CAP
ASSEMBLY
VIEW B
9
BOLT
8
BOLT (4 REQUIRED)
WASHER
PROTECTIVE CAP
6
SCU PROGRAMMING PLUG
7
GROUND CABLE
LANYARD
PROTECTIVE CAP
6
SCU WITH
MULTIPLEXING
HOSE ASSEMBLY
3
VIEW A−A
L−A7389 (0591)
PW V

Supplemental Control Unit
Figure 401
(Task 72−00−33−450−008)

(a) Install a packing (410/4), lubricated with Lubricating Fluid (P06−035), onto an adapter (401/5). Install the adapter into the opening at the data plate end of the supplemental control unit. Torque the adapter to 65 − 75 lb−in. (7.344 − 8.474 N.m).

(b) If the supplemental control unit does not have the multiplexing option, install the cap assembly (410/10) to the adapter (410/5) at the data plate end of the supplemental control unit. Torque the cap assembly to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292) the cap assembly.

(3) If a new supplemental control unit does not have the auto−start option and the unit is to be replaced, install two protective caps (401/6) to the electrical connectors identified as J1 and J5. Carefully push the caps into the receptacles and tighten the cap assemblies by hand. Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292) the protective caps.

(4) Put the supplemental control unit to the mounting brackets on the fan case at approximately the 2:30 o'clock position with the electrical connectors pointing rearward. Attach the supplemental control unit to the brackets with four bolts and washers (401/8), threads lubricated with Engine Oil (P03−001). Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

CAUTION: BEFORE YOU CONNECT THE GROUND CABLE TO THE SCU, EXAMINE THE CABLE MOUNTING LUGS TO MAKE SURE THE LUGS ARE SECURED TO THE CABLE AND THE CABLE WIRE (STRANDS) ARE AT LEAST 75 PERCENT NOT BROKEN. LOOSE LUGS OR TOO MANY BROKEN WIRES (STRANDS) CAN NOT GIVE SUFFICIENT PROTECTION FROM A LIGHTNING STRIKE.

(5) Put the ground cable to the threaded hole in the top rear side of the supplemental control unit. Attach the cable to the supplemental control unit with a bolt (401/9), threads lubricated with Engine Oil (P03−001). If the ground cable was removed from Flange B1, put the opposite end of the ground cable to the bolt hole on Flange B1. Attach the cable to the flange with a bolt, threads lubricated with Engine Oil (P03−001), washer

and nut. Torque the two bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

CAUTION: DO NOT USE LUBRICANTS ON THE SENSING HOSE, OR GASKET UNLESS SPECIFIED DIFFERENTLY. LUBRICANT CAN CAUSE CONTAMINATION OF THE SCU.

(6) If the supplemental control unit has the multiplexing option, install the top hose connector of the hose assembly (401/3) to the adapter (401/5) at the bottom side of the supplemental control unit. Torque the hose connector to 270 − 300 lb−in. (30.506 − 33.895 N.m).

(7) Connect the W11P34 (401/1) and the W11P33 (401/2) harness connectors to the mating SCU harness receptacles as follows. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol (P11−009). Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the (Glenair TG−70) strap wrench or the (Glenair TG−69) soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

See the instructions given with the strap wrench for correct use.

(8) Connect the SCU programming plug (401/7) to the mating SCU receptacle as follows.

(a) Remove the protection covers. Examine the programming plug and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the plug and receptacle with Denatured Ethyl Alcohol (P11−009). Let dry.

(b) Align the plug keyways and engage the plug to the mating receptacle. Tighten the plug coupling nut by hand until you cover the witness (color) band and the plug coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the plug coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN PLUG DAMAGE OR A LOOSE PLUG. A LOOSE PLUG PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the (Glenair TG−70) strap wrench or the (Glenair TG−69) soft−jawed pliers and tighten the plug coupling nut. Use sufficient force to be sure:
- the plug coupling nut is fully tight
- the plug fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the plug is tight.

NOTE: If you use too much force, the tools (above) will turn around on the plug coupling nut. This will prevent too much torque.

See the instructions given with the strap wrench for correct use.

C. Postrequisites

(1) Test the engine as specified in the Test Reference Table. See 71−00−00, Adjustment/Test−00.

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ENGINE GENERAL - FAN CASE - INSTALLATION-14

Task 72-00-33-450-009:

1. Install The Fan Exit (Bifurcation) Fairing Assemblies (Pre SB PW4ENG 72-370)

A. Prerequisites

(1) If the fan cases were removed for the complete removal of the fairings, install the fan cases with the fairings in position. See Installation-01 (Task 72-00-33-420-001).

(2) If it is necessary to install a new access cover, refer to Repair-02 (Task 72-00-33-300-002) for instructions on the installation of boltholes in the cover.

B. Equipment And Materials Required

Standard Tools:
No. 3 Cross-Drive (Phillips)
No. 10 Torq-set Drive

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P09-019	Sealant, Flame Resistant Silicone Rubber (PWA 36751-1)
P09-027	Sealant, Silicone Rubber (PWA 36003-2)
P18-007	Primer, Silicone (PWA 36086-2)

C. Procedure

NOTE: Use a No. 3 cross-drive (Phillips) with the shoulder screws. Use a No. 10 Torq-set drive with all the other screws.

(1) Remove the lockwire that temporarily holds the fairings in position.

CAUTION: BE SURE TO USE THE CORRECT PART NUMBERS. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 72-161.

CAUTION: BE VERY CAREFUL WHEN YOU INSTALL THE INNER FAIRINGS. IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THE FAIRINGS. IT IS EASY

FOR THESE WASHERS TO BECOME DISCONNECTED FROM THE FAIRINGS.

(2) Install the fairings loosely. See Figure 401.

(a) Align the fan exit inner (bifurcation) fairing assembly (called inner fairing) (401/2), with the gasket (401/5), around the bottom of the 12 o'clock strut. Be sure the forward ends of the inner fairing overlap the previously installed front liner segments correctly.

(b) Install the countersunk screws (401/3), lubricated with Engine Oil (P03-001), in all the inner fairing boltholes except the two larger boltholes (401/4) near the rear of the inner fairing. Tighten the screws with your hand.

(c) (Post SB PW4ENG 72-161) Attach the two access covers (401/6) with screws (401/7) and (401/8), lubricated with Engine Oil (P03-001). Tighten the screws with your hand.

(d) Install the two shoulder screws (401/4), lubricated with Engine Oil (P03-001), in the inner fairing. Tighten the shoulder screws against the fairing (401/2).

(e) Tighten all the screws (401/3) against the fairing.

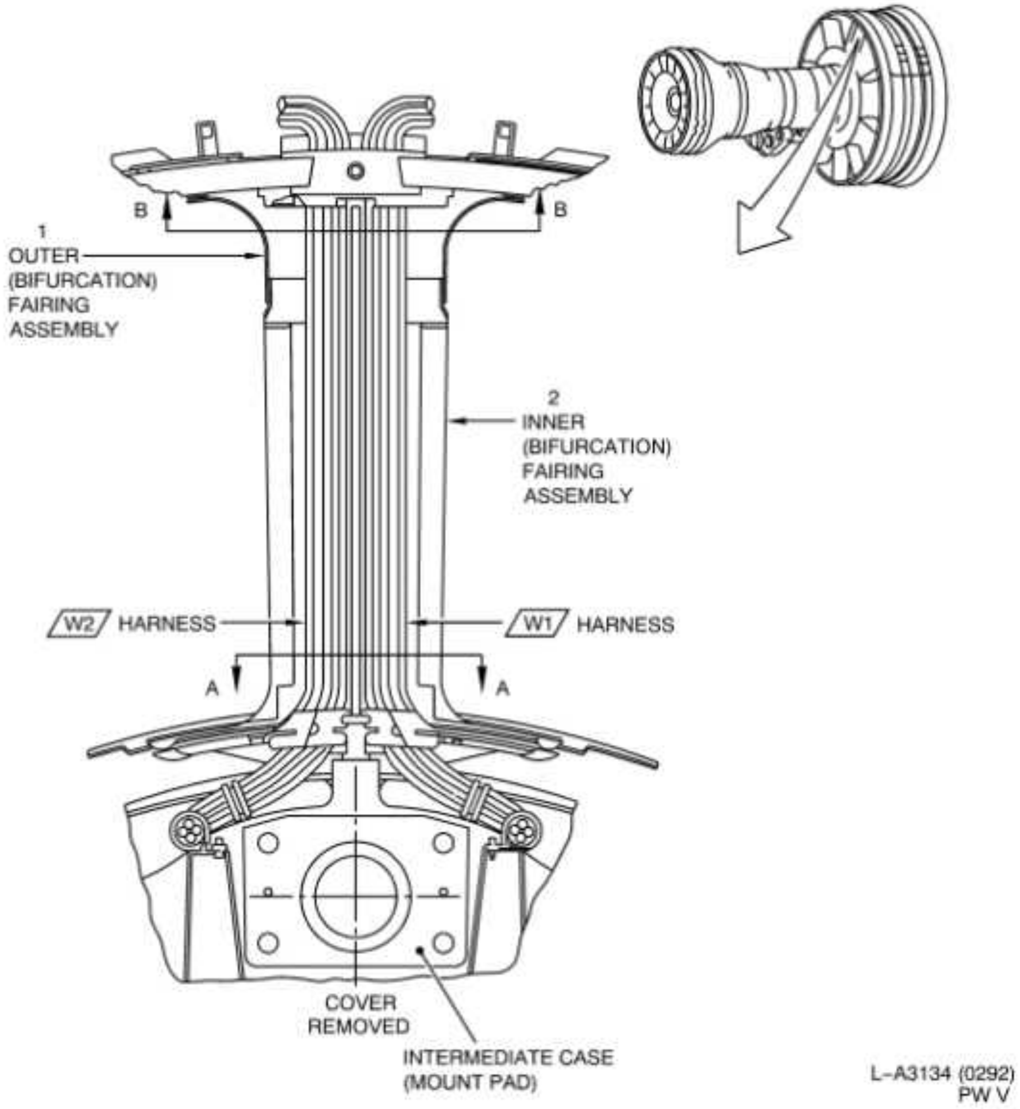
(f) (Post SB PW4ENG 72-161) Tighten the screws (401/7) and (401/8) against the access covers (401/6).

(3) (Reference 1012) Do a check of the clearance of the inner fairing at Flange D. Refer to Inspection/Check-05 (Task 72-00-33-210-004).

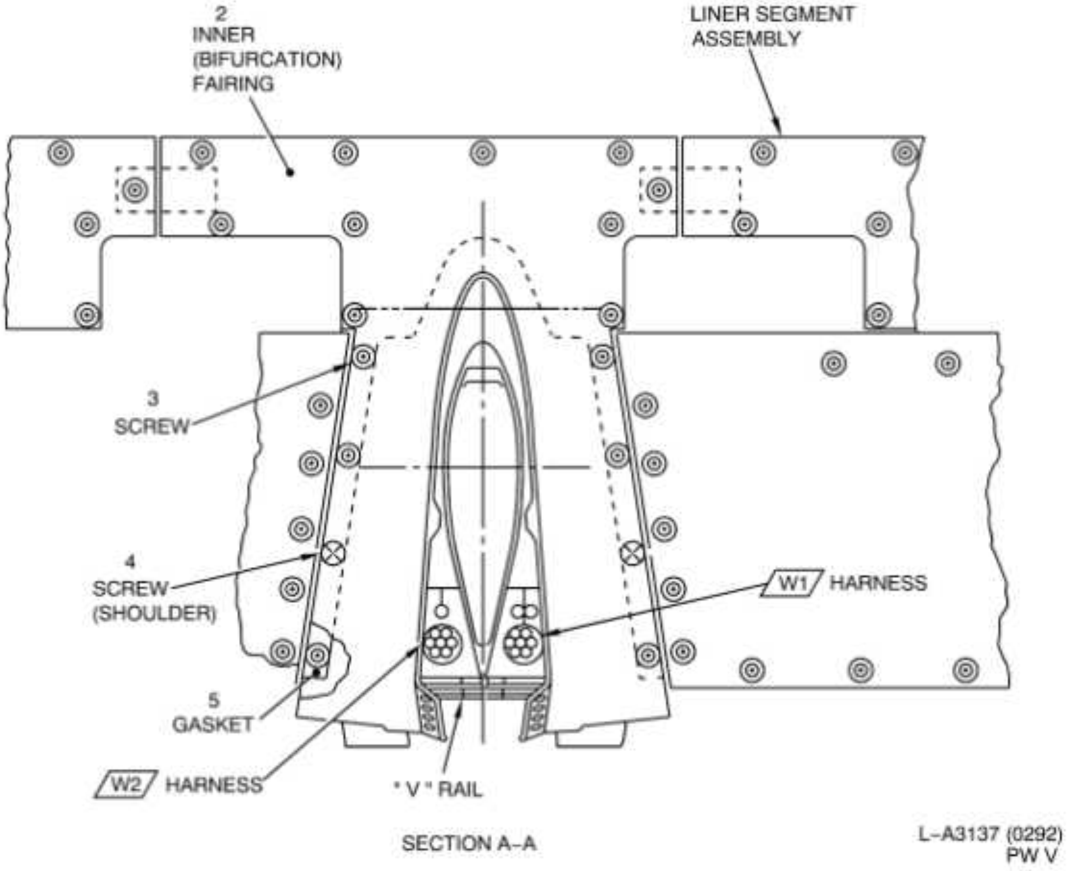
(4) Continue to install the fairings loosely. See Figure 401.

(a) Loosen the screws (401/4), (401/3), (401/7) and (401/8) one full turn.

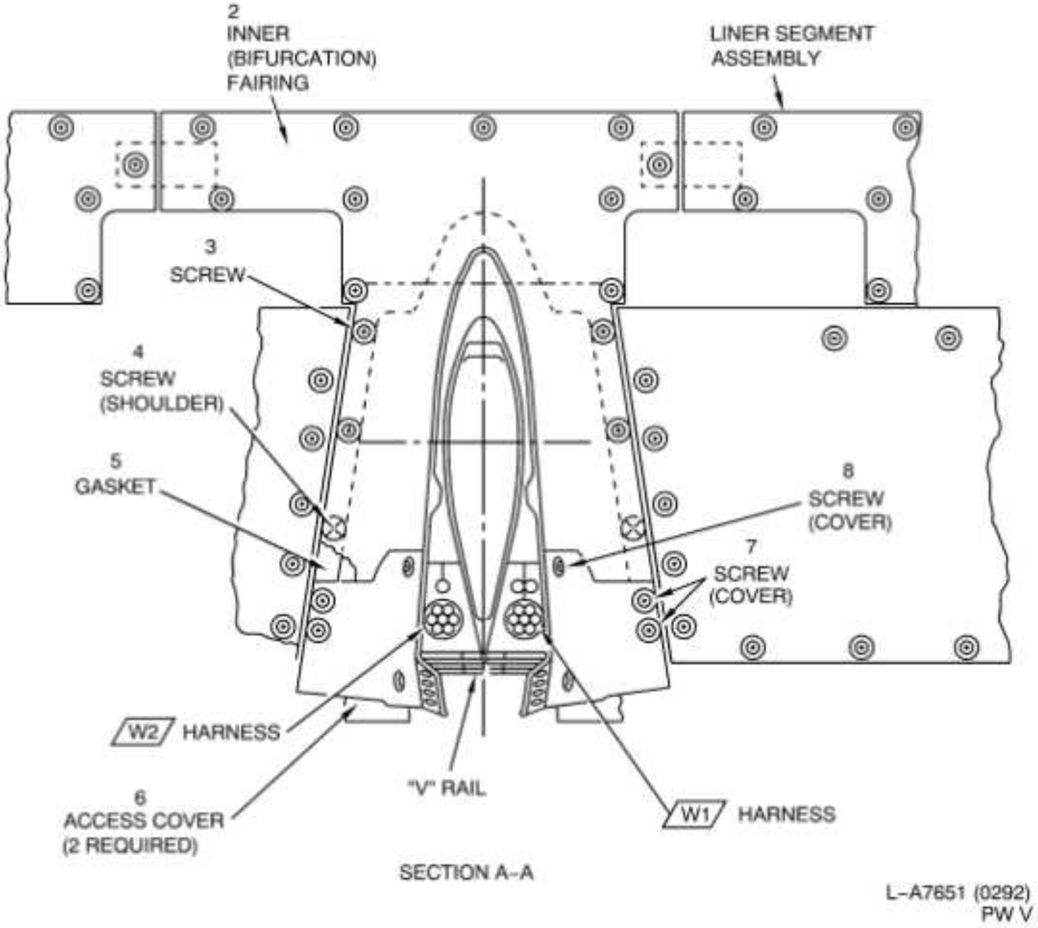
(b) Install the fan exit outer (bifurcation) fairing assembly (called outer fairing) (401/1). Attach the outer fairing to the inner fairing with screws (401/9), lubricated with Engine Oil (P03-001). Tighten the screws with your hand.


B
B
1
OUTER
(BIFURCATION)
FAIRING
ASSEMBLY
2
INNER
(BIFURCATION)
FAIRING
ASSEMBLY
W2 HARNESS
W1 HARNESS
A
A
COVER
REMOVED
INTERMEDIATE CASE
(MOUNT PAD)
L−A3134 (0292)
PW V

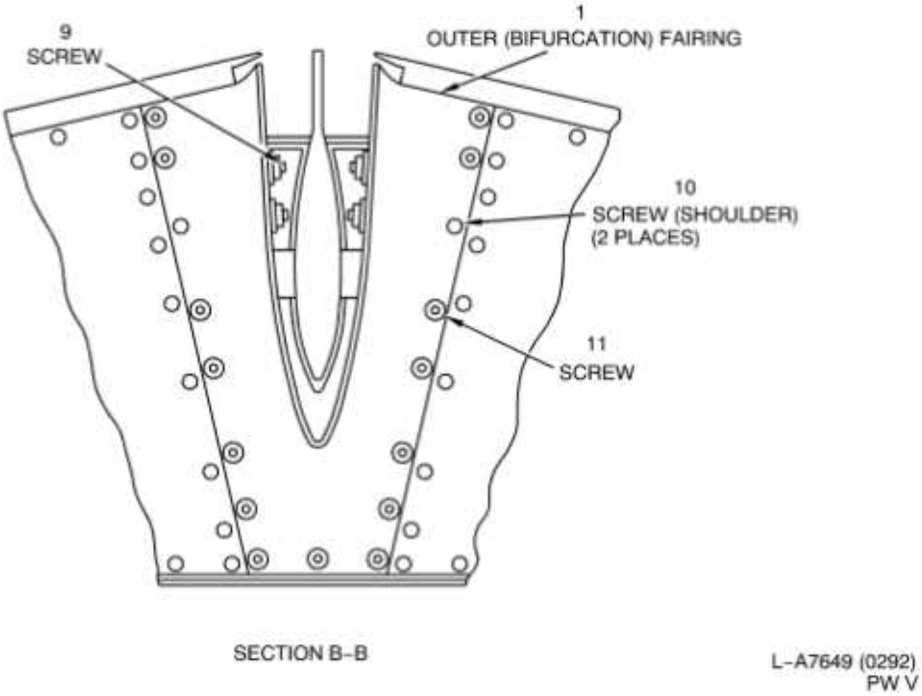
Fan Exit (Bifurcation) Fairing Assembly
Figure 401 (Sheet 1)
(Task 72−00−33−450−009)


2
INNER
(BIFURCATION)
FAIRING
LINER SEGMENT
ASSEMBLY
3
SCREW
4
SCREW
(SHOULDER)
W1 HARNESS
5
GASKET
W2 HARNESS
" V " RAIL
SECTION A–A
L–A3137 (0292)
PW V

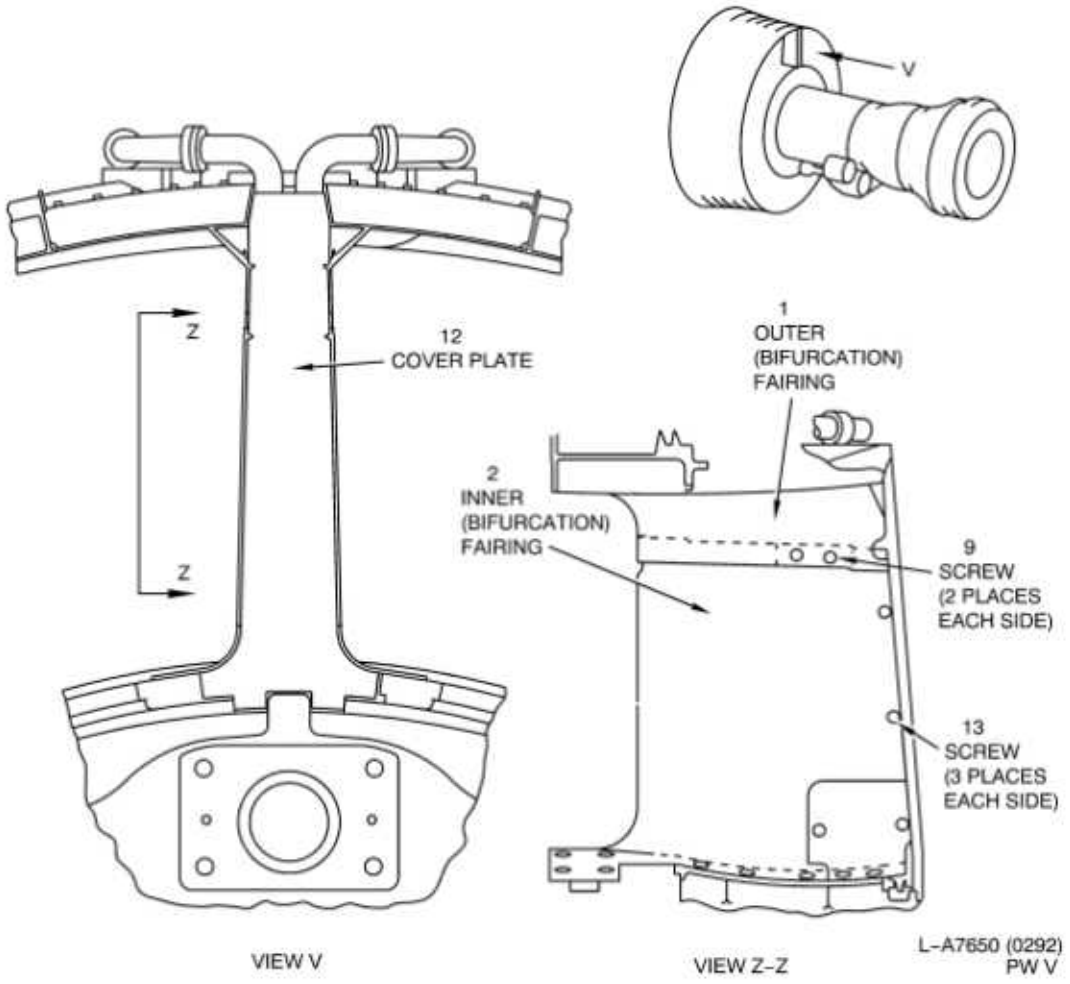
Fan Exit (Bifurcation) Fairing Assembly
(Pre SB PW4ENG 72−161)
Figure 401 (Sheet 2)
(Task 72−00−33−450−009)


2
INNER
(BIFURCATION)
FAIRING
LINER SEGMENT
ASSEMBLY
3
SCREW
4
SCREW
(SHOULDER)
5
GASKET
8
SCREW
(COVER)
7
SCREW
(COVER)
W2
HARNESS
6
ACCESS COVER
(2 REQUIRED)
"V" RAIL
W1
HARNESS
SECTION A-A
L-A7651 (0292)
PW V

Fan Exit (Bifurcation) Fairing Assembly
(Post SB PW4ENG 72−161)
Figure 401 (Sheet 3)
(Task 72−00−33−450−009)


9
SCREW
1
OUTER (BIFURCATION) FAIRING
10
SCREW (SHOULDER)
(2 PLACES)
11
SCREW
SECTION B−B
L−A7649 (0292)
PW V

Fan Exit (Bifurcation) Fairing Assembly
Figure 401 (Sheet 4)
(Task 72−00−33−450−009)


V
Z
Z
12
COVER PLATE
1
OUTER
(BIFURCATION)
FAIRING
2
INNER
(BIFURCATION)
FAIRING
9
SCREW
(2 PLACES
EACH SIDE)
13
SCREW
(3 PLACES
EACH SIDE)

VIEW V

VIEW Z−Z

L−A7650 (0292)
PW V

Fan Exit (Bifurcation) Fairing Assembly
Figure 401 (Sheet 5)
(Task 72−00−33−450−009)

(c) Attach the outer fairing (401/1) to the outer case with the screws (401/11) and shoulder screws (401/10), lubricated with Engine Oil (P03−001). Tighten the screws with your hand.

(d) Tighten all the outer fairing screws (401/10), (401/11), and (401/9) in the same sequence given. Loosen all the screws (401/10), (401/11), and (401/9) in the same sequence given, one full turn.

(e) Install the cover plate (401/12). Attach the cover plate to the inner and outer fairings with screws (401/13), lubricated with Engine Oil (P03−001). Tighten the screws against the cover, then loosen them one full turn.

(5) Torque the screws as follows.

(a) Torque the cover plate screws (401/13) to 22 lb−in. (2.486 N.m) plus the torque necessary to turn the screw through the self−locking feature. The maximum torque is 40 lb−in. (4.519 N.m).

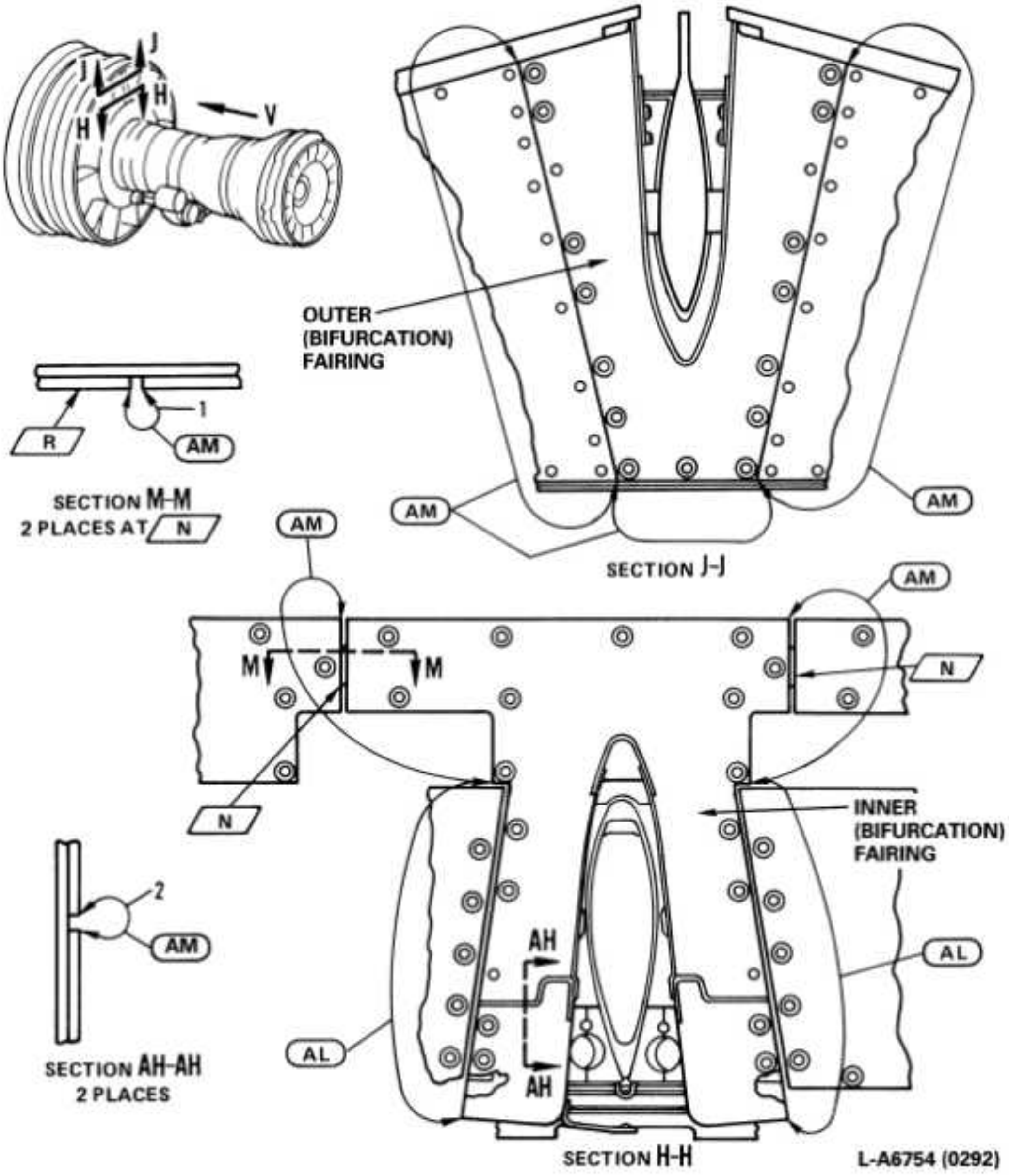
(b) Torque the four shoulder screws (401/4) and (401/10) to 22 lb−in. (2.486 N.m) plus the torque necessary to turn the screw through the self−locking feature. The maximum torque is 95 lb−in. (10.734 N.m).

(c) Torque the other inner and outer fairing screws (401/3), (401/11), and (401/9), in the same sequence given, to 22 lb−in. (2.486 N.m) plus the torque necessary to turn the screw through the self−locking feature. The maximum torque is 40 lb−in. (4.519 N.m).

(d) (Post SB PW4ENG 72−161) Torque the access cover screws (401/7) and (401/8), in the same sequence given, to 22 lb−in. (2.486 N.m) plus the torque necessary to turn the screw through the self−locking feature. The maximum torque is 40 lb−in. (4.519 N.m).

(6) Apply sealant to Area AL. See Figure 402.

NOTE: Refer to the Standard Practices Manual, 70−48, for the cleaning procedures that follow.


J
J
H
H
V
OUTER (BIFURCATION) FAIRING
R
1
AM
SECTION M-M
2 PLACES AT N
AM
AM
AM
SECTION J-J
AM
AM
M
M
N
N
INNER (BIFURCATION) FAIRING
2
AM
AH
AH
AL
AL
SECTION AH-AH
2 PLACES
SECTION H-H
L-A6754 (0292)

Fan Exit (Bifurcation) Fairing Assembly Sealant Areas
Figure 402 (Sheet 1)
(Task 72−00−33−450−009)

1. Apply The Sealant Even With, To 0.010 Inch (0.254 mm) Above, Surface R.
2. Apply The Sealant Even With, To 0.010 Inch (0.254 mm) Below, All Around The Access Cover, Two Places

Key To Figure 402 (Sheet 1)

(a) Clean the areas the sealant will touch. Use PWA 83−D4, but do not use trichlorotrifluoroethane.

(b) Apply Primer (P18−007) to all cleaned surfaces.

1 It is necessary to apply the primer in less than two hours after you cleaned the area.

2 The primer must cure in air at ambient temperature for two hours, minimum. The air must have a relative humidity of 25 percent, minimum.

(c) Apply Sealant (P09−019).

1 It is necessary to apply the sealant from 2 − 24 hours after you applied the primer.

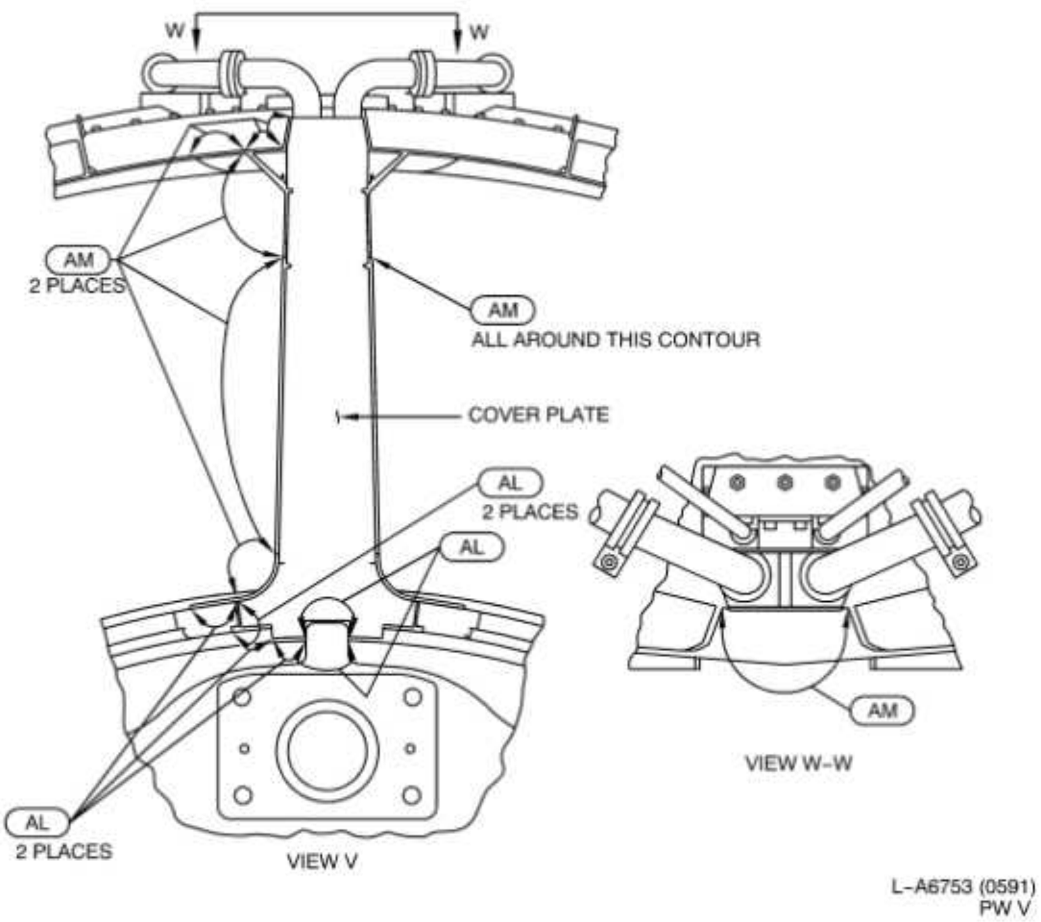
2 Use a hot air gun at 175° − 225°F (79.° − 107.°C) for 5 − 7 minutes to dry the sealant.

3 After the hot air gun, cure the sealant in air that has a relative humidity of 25 percent, minimum, for eight hours, minimum, before you touch the parts.

(7) Apply sealant to Area AM:

(a) Clean the areas the sealant will touch. Use PWA 83−D4, but do not use trichlorotrifluoroethane.

(b) Apply Sealant (P09−027). Dry the sealant in air that is at room temperature, and has a relative humidity of 25 percent, minimum, for eight hours, minimum, before you touch the parts.


W
W
AM
2 PLACES
AM
ALL AROUND THIS CONTOUR
COVER PLATE
AL
2 PLACES
AL
AL
2 PLACES
VIEW V
AM
VIEW W−W
L−A6753 (0591)
PW V

Fan Exit (Bifurcation) Fairing Assembly Sealant Areas
Figure 402 (Sheet 2)
(Task 72−00−33−450−009)

Task 72−00−33−450−009−A:

2. Install The Fan Exit (Bifurcation) Fairing Assemblies (Post SB PW4ENG 72−370)

A. Prerequisites

(1) If it is necessary to install a new access cover, refer to Repair−02 (Task 72−00−33−300−002) for instructions on the installation of boltholes in the cover.

B. Equipment And Materials Required

Standard Tools:
No. 3 Cross−Drive (Phillips)
No. 10 Torq−set Drive
T−10 Torx Tip

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P09−019	Sealant, Flame Resistant Silicone Rubber (PWA 36751−1)
P09−027	Sealant, Silicone Rubber (PWA 36003−2)
P18−007	Primer, Silicone (PWA 36086−2)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Washer	AR	73−33−00	9	585

C. Procedure

NOTE: Unless otherwise specified, use a No. 3 cross−drive (Phillips) with the shoulder screws and a No. 10 Torq−set drive with all the other screws.

CAUTION: BE SURE TO USE THE CORRECT PART NUMBERS. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 72−161, SB PW4ENG 72−370, AND SB PW4ENG 72−414.

BE VERY CAREFUL WHEN YOU INSTALL THE INNER FAIRINGS. IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THE FAIRINGS. IT IS EASY FOR THESE WASHERS TO BECOME DISCONNECTED FROM THE FAIRINGS.

(1) Install the fairings loosely. See Figure 403.

(a) Install the gasket (403/16), open end rearward, around the bottom of the 12 o'clock strut.

(b) Install the left and right fan exit inner (bifurcation) fairing side panels (called side panels) (403/3) over the gasket. Install the countersunk screws (403/5), lubricated with Engine Oil (P03−001), in the four forward boltholes. Tighten the screws with your hand.

(c) Install the fan exit inner (bifurcation) fairing leading edge (called leading edge) (403/2) to overlap the side panels. Be sure the forward ends of the leading edge overlap the previously installed front liner segments correctly.

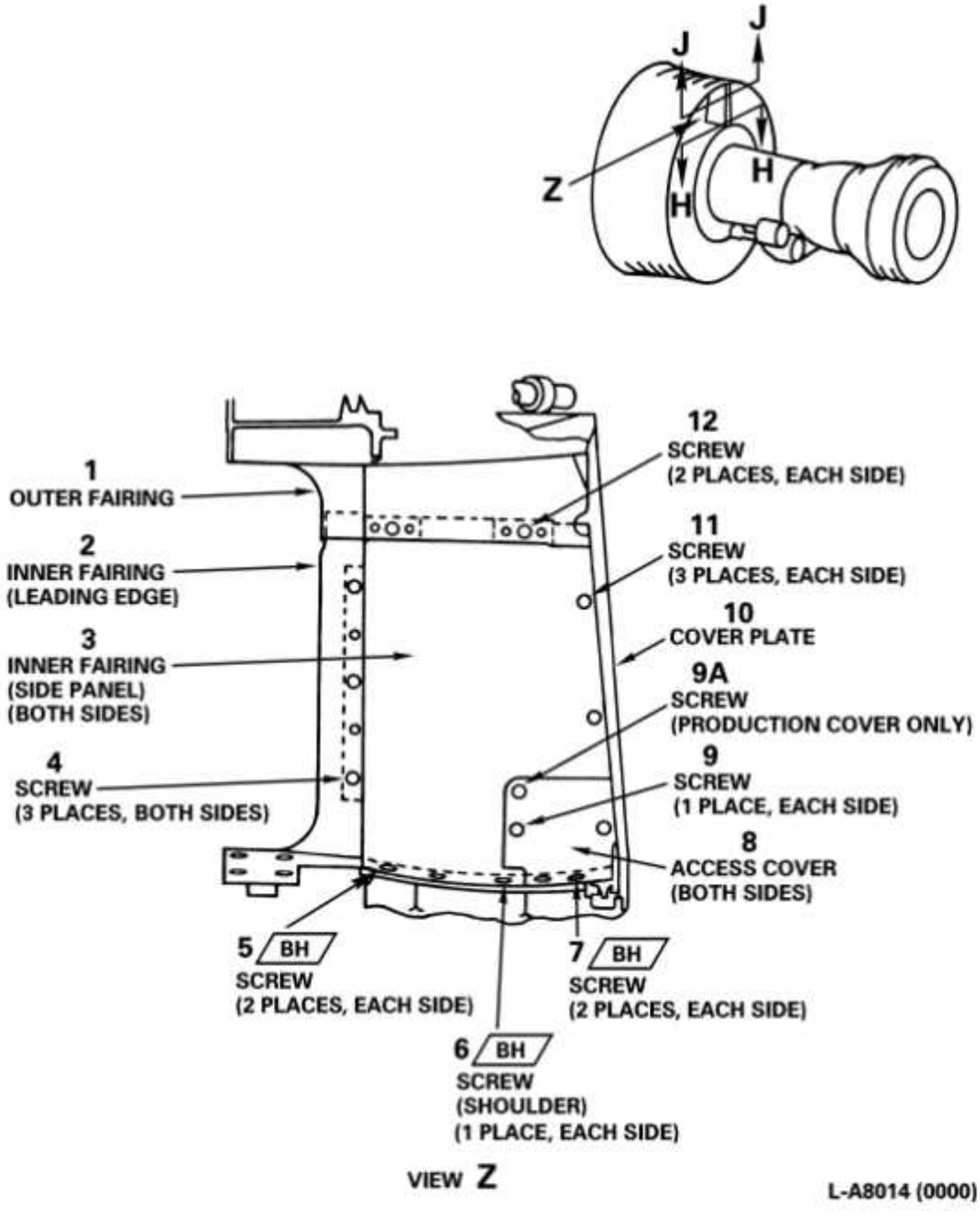
1 Attach the leading edge to the case. Install the screws (403/15), lubricated with Engine Oil (P03−001), in the boltholes. Tighten the screws with your hand.

2 Attach the leading edge to the side panels. Install the screws (403/4), lubricated with Engine Oil (P03−001), in the boltholes. Tighten the screws with your hand.

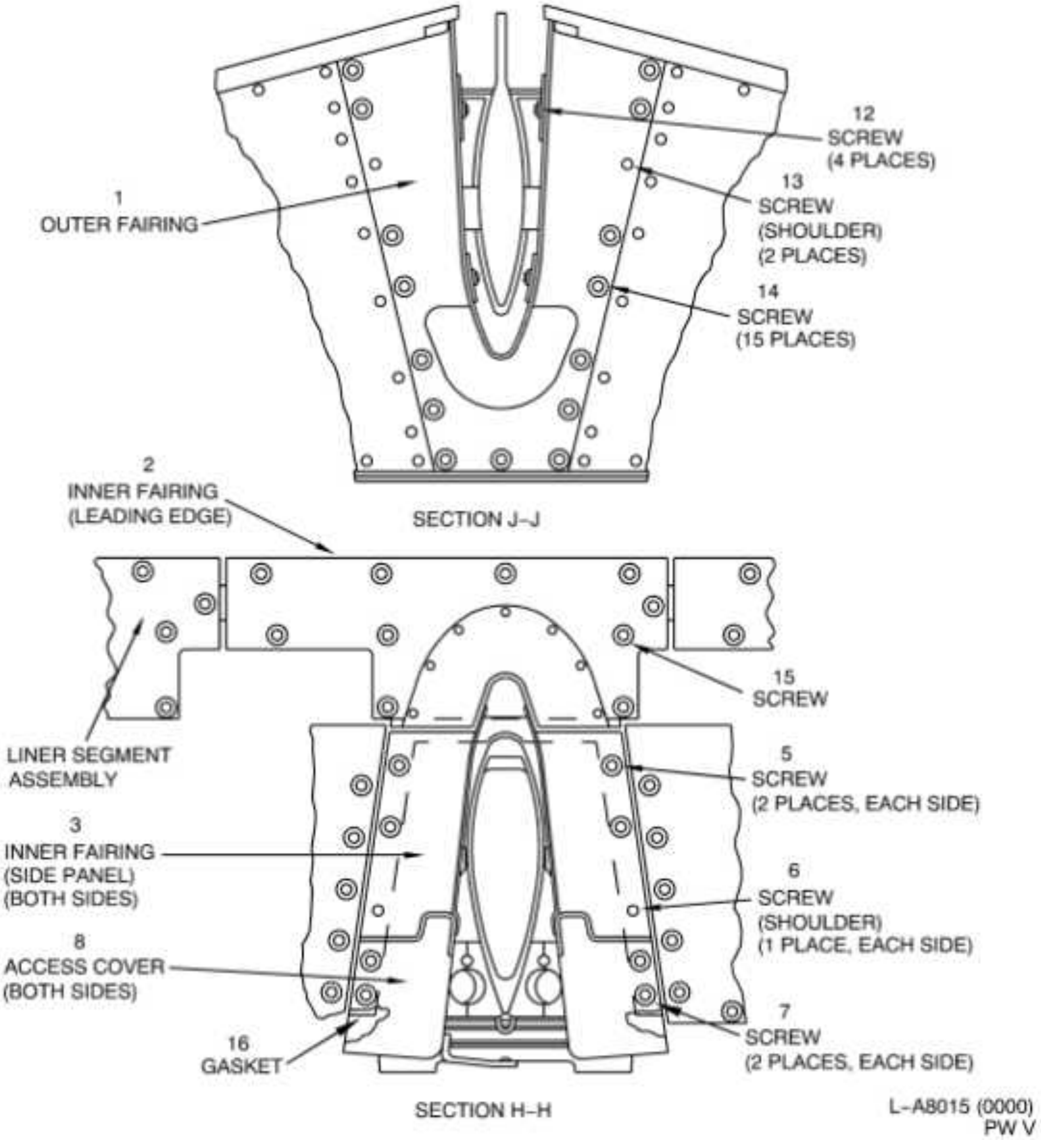
(d) Attach the two access covers (403/8) with screws (403/7) and (403/9), and if applicable (403/9A), lubricated with Engine Oil (P03−001). Tighten the screws with your hand.

NOTE: The side panels, leading edge, and access covers together are called the inner fairings.

(e) Install the two shoulder screws (403/6), lubricated with Engine Oil (P03−001), in the side panels. Tighten the shoulder screws against the panels (403/3).


J
J
Z
H
H
1
OUTER FAIRING
2
INNER FAIRING
(LEADING EDGE)
3
INNER FAIRING
(SIDE PANEL)
(BOTH SIDES)
4
SCREW
(3 PLACES, BOTH SIDES)
12
SCREW
(2 PLACES, EACH SIDE)
11
SCREW
(3 PLACES, EACH SIDE)
10
COVER PLATE
9A
SCREW
(PRODUCTION COVER ONLY)
9
SCREW
(1 PLACE, EACH SIDE)
8
ACCESS COVER
(BOTH SIDES)
5 BH
SCREW
(2 PLACES, EACH SIDE)
7 BH
SCREW
(2 PLACES, EACH SIDE)
6 BH
SCREW
(SHOULDER)
(1 PLACE, EACH SIDE)
VIEW Z
L-A8014 (0000)

Fan Exit (Bifurcation) Fairing Assembly
Figure 403 (Sheet 1)
(Task 72−00−33−450−009−A)


12
SCREW
(4 PLACES)
1
OUTER FAIRING
13
SCREW
(SHOULDER)
(2 PLACES)
14
SCREW
(15 PLACES)
2
INNER FAIRING
(LEADING EDGE)
SECTION J–J
15
SCREW
LINER SEGMENT
ASSEMBLY
5
SCREW
(2 PLACES, EACH SIDE)
3
INNER FAIRING
(SIDE PANEL)
(BOTH SIDES)
6
SCREW
(SHOULDER)
(1 PLACE, EACH SIDE)
8
ACCESS COVER
(BOTH SIDES)
7
SCREW
(2 PLACES, EACH SIDE)
16
GASKET
SECTION H–H
L–A8015 (0000)
PW V

Fan Exit (Bifurcation) Fairing Assembly
Figure 403 (Sheet 2)
(Task 72−00−33−450−009−A)

(f) Tighten the countersunk screws (403/5) of the side panels.

(g) Tighten the screws (403/4) and (403/15) of the leading edge.

NOTE: Use Torx tip T−10 with screws (403/4).

(h) Tighten the screws (403/7) and (403/9) agains the access covers.

(2) (Reference 1012) Do a check of the clearance between the trailing edge of the leading edge and the front of the side panels. Refer to Inspection/Check−05 (Task 72−00−33−210−004).

(3) Continue to install the fairings loosely. See Figure 403.

(a) Loosen the screws (403/6), (403/5), (403/15), (403/4), (403/7) and (403/9) one full turn.

(b) Tighten the screws (403/7), (403/9), and if applicable (403/9A), of the access covers against the covers (403/8). Loosen them one full turn.

(c) Install the fan exit outer (bifurcation) fairing assembly (called outer fairing) (403/1). Attach the outer fairing to the inner fairings with screws (403/12), lubricated with Engine Oil (P03−001). Tighten the screws with your hand.

(d) Attach the outer fairing (403/1) to the outer case with the screws (403/14) and shoulder screws (403/13), lubricated with Engine Oil (P03−001). Tighten the screws with your hand.

(e) Tighten all the outer fairing screws (403/13), (403/14), and (403/12) in the same sequence given. Loosen all the screws (403/13), (403/14), and (403/12) in the same sequence given, one full turn.

(f) Install the cover plate (403/10). Attach the cover plate to the inner and outer fairings with screws (403/11), lubricated with Engine Oil (P03−001). Tighten the screws against the cover, then loosen them one full turn.

(g) The fairings must be sufficiently loose to permit radial movement. If they are not, loosen the screws another quarter turn.

(4) (Reference 1010) Torque the cover plate screws (403/11).

(a) Torque the cover plate screws (403/11) to 22 lb−in. (2.486 N.m) plus the torque necessary to turn the screw through the self−locking feature. The maximum torque is 40 lb−in. (4.519 N.m).

(5) (Reference 1010) Adjust the height of the fairings/ cover plate as follows. See Figure 404.

(a) Lower the fairings/cover plate assembly against the intermediate case platform, while you keep to the dimensions in Figure 404.

(b) If there are gaps under the flaps of the side panels and access covers, install washers at the screws called BH.

(c) Bond the washers to the intermediate case as follows.

NOTE: Refer to the Standard Practices Manual, 70−48, for the cleaning procedures that follow.

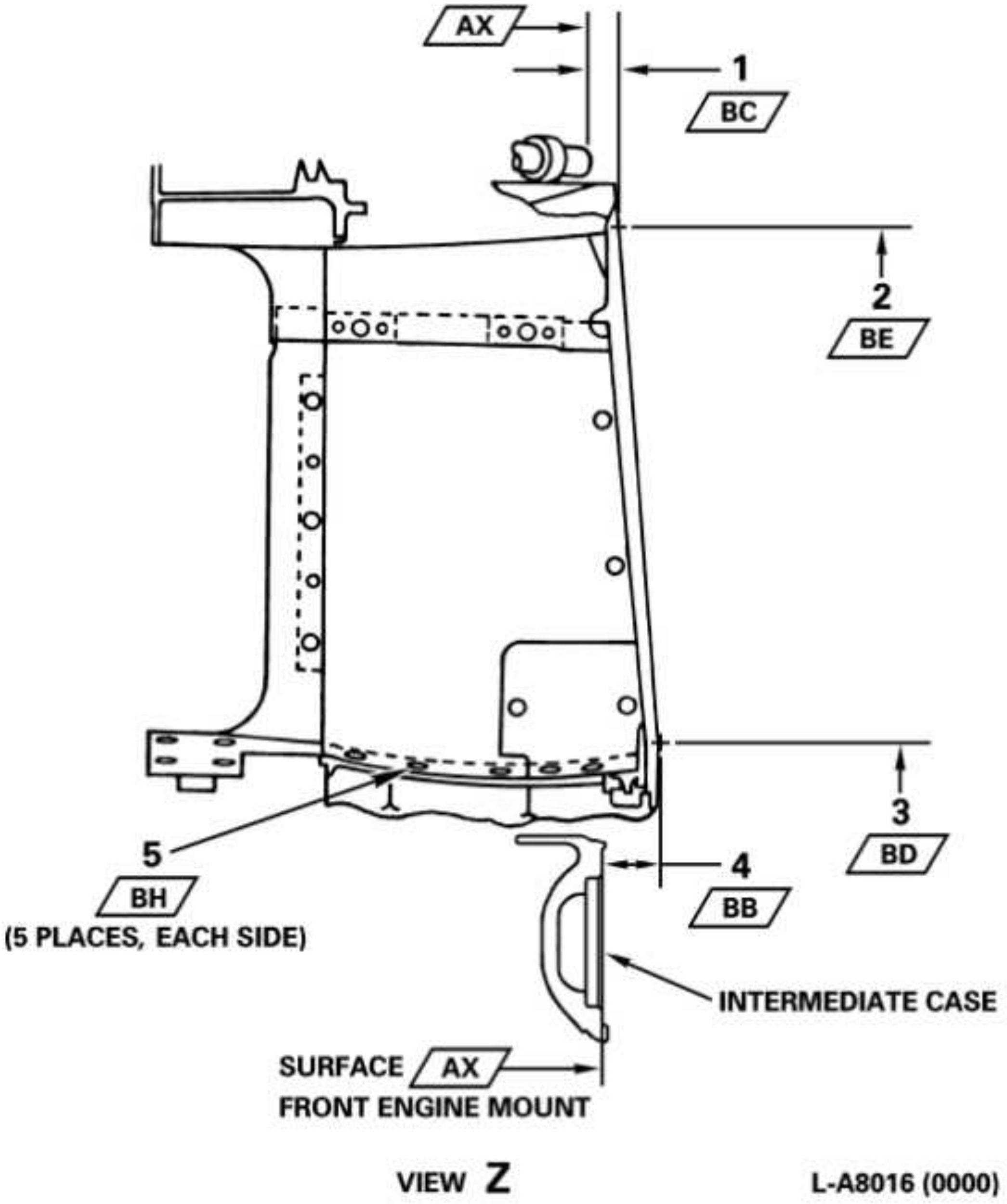
1 Clean the areas with PWA 83−D4, but do not use trichlorotrifluoroethane.

2 With Sealant (P09−027), make a fillet all around the edges of the washers. Sealant is not permitted between the washers and the intermediate case nor between the washers and the fairing access covers.

3 Cure the sealant in air that is at room temperature, and has a relative humidity of 25 percent, for four hours before you touch it.

(6) (Reference 1010) Torque the remaining screws as follows. See Figure 403.

ENGINE GENERAL − FAN CASE − INSTALLATION−14


AX
1
BC
2
BE
3
BD
4
BB
5
BH
(5 PLACES, EACH SIDE)
INTERMEDIATE CASE
SURFACE AX
FRONT ENGINE MOUNT
VIEW Z
L-A8016 (0000)

1. 0.345 − 0.445 Inch (8.8 − 11.3 mm)
2. 44.720 Inches (1135.888 mm) To The Engine Centerline
3. 28.120 Inches (714.248 mm) To The Engine Centerline
4. 1.620 − 1.720 Inch (41.1 − 43.7 mm)
5. Choose The Correct Class Of Washer, 0 To 3 Units As Necessary, At Positions BH. The Total Height Must Not Be More Than 0.253 Inch (6.426 mm).

Fan Exit (Bifurcation) Fairing Assembly
(Reference 1010)
Figure 404
(Task 72−00−33−450−009)

(a) Torque the access cover screws (403/9) and, if applicable (403/9A), to 22 lb−in. (2.486 N.m) plus the torque necessary to turn the screw through the self−locking feature. The maximum torque is 40 lb−in. (4.519 N.m).

(b) Torque the two shoulder screws (403/6) in the side panels to 22 lb−in. (2.486 N.m) plus the torque necessary to turn the screw through the self−locking feature. The maximum torque is 95 lb−in. (10.734 N.m).

(c) Torque the inner fairing screws (403/5), (403/15), and (403/7) that attach the fairings/access covers to the case to 22 lb−in. (2.486 N.m) plus the torque necessary to turn the screw through the self−locking feature. The maximum torque is 40 lb−in. (4.519 N.m).

(d) Torque the two shoulder screws (403/13) in the outer fairing to 22 lb−in. (2.486 N.m) plus the torque necessary to turn the screw through the self−locking feature. The maximum torque is 95 lb−in. (10.734 N.m).

(e) Torque the remaining outer fairing screws (403/14) that attach the outer fairing to the case. Torque them to to 22 lb−in. (2.486 N.m) plus the torque necessary to turn the screw through the self−locking feature. The maximum torque is 40 lb−in. (4.519 N.m).

(f) Examine the position of the cover plate to be sure that the dimensions in Figure 404 are still true. If necessary, loosen all the screws but the cover plate screws (403/11), and start again at step (3).

(g) Torque the leading edge screws (403/4) that attach the leading edge to the side panels to 22 lb−in. (2.486 N.m) plus the torque necessary to turn the screw through the self−locking feature. The maximum torque is 40 lb−in. (4.519 N.m).

NOTE: Use Torx tip T−10.

(h) Torque the outer fairing screws (403/12) that attach the outer fairing to the inner fairings to to 22 lb−in. (2.486 N.m) plus the torque necessary to turn the screw through the self−locking feature. The maximum torque is 40 lb−in. (4.519 N.m).

(7) Apply sealant to Area AL. See Figure 405.

NOTE: Refer to the Standard Practices Manual, 70−48, for the cleaning procedures that follow.

(a) Clean the areas the sealant will touch. Use PWA 83−D4, but do not use trichlorotrifluoroethane.

(b) Apply Primer (P18−007) to all cleaned surfaces.

1 It is necessary to apply the primer in less than two hours after you cleaned the area.

2 The primer must cure in air at ambient temperature for two hours, minimum. The air must have a relative humidity of 25 percent, minimum.

(c) Apply Sealant (P09−019).

1 It is necessary to apply the sealant from 2 − 24 hours after you applied the primer.

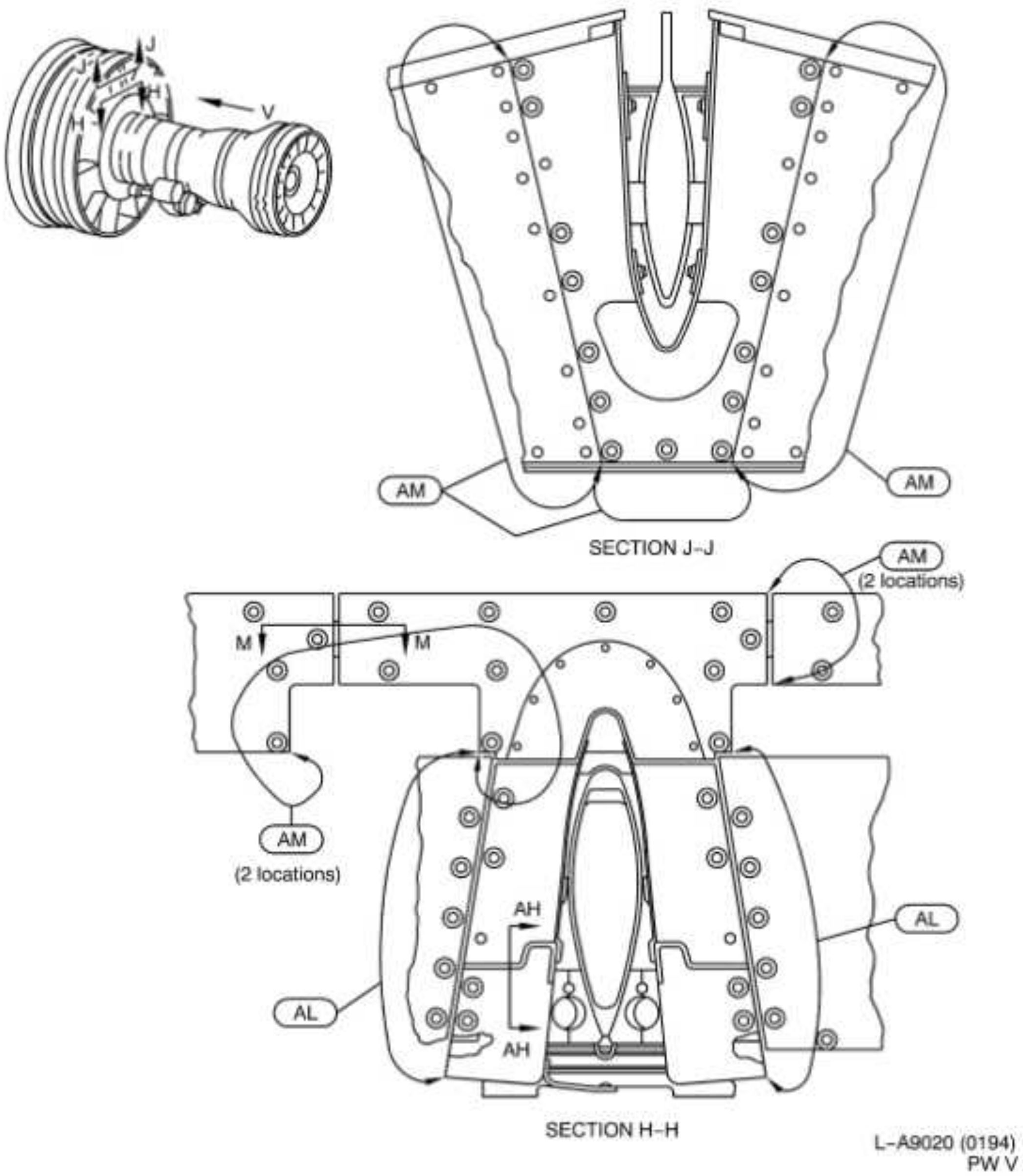
2 Use a hot air gun at 175° − 225°F (79.° − 107.°C) for 5 − 7 minutes to dry the sealant.

3 After the hot air gun, cure the sealant in air that has a relative humidity of 25 percent, minimum, for eight hours, minimum, before you touch the parts.

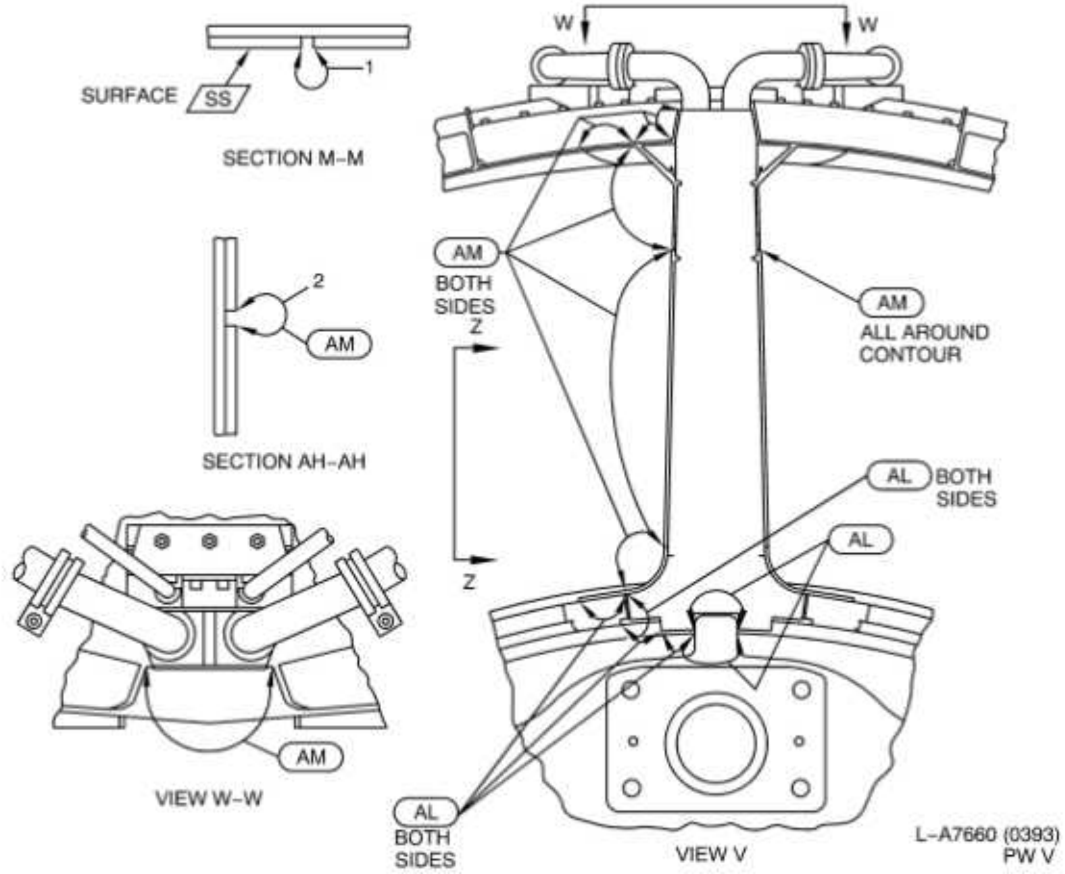
(8) Apply sealant to Area AM:

(a) Clean the areas the sealant will touch. Use PWA 83−D4, but do not use trichlorotrifluoroethane.

(b) Apply Sealant (P09−027). Dry the sealant in air that is at room temperature, and has a relative humidity of 25 percent, minimum, for eight hours, minimum, before you touch the parts.

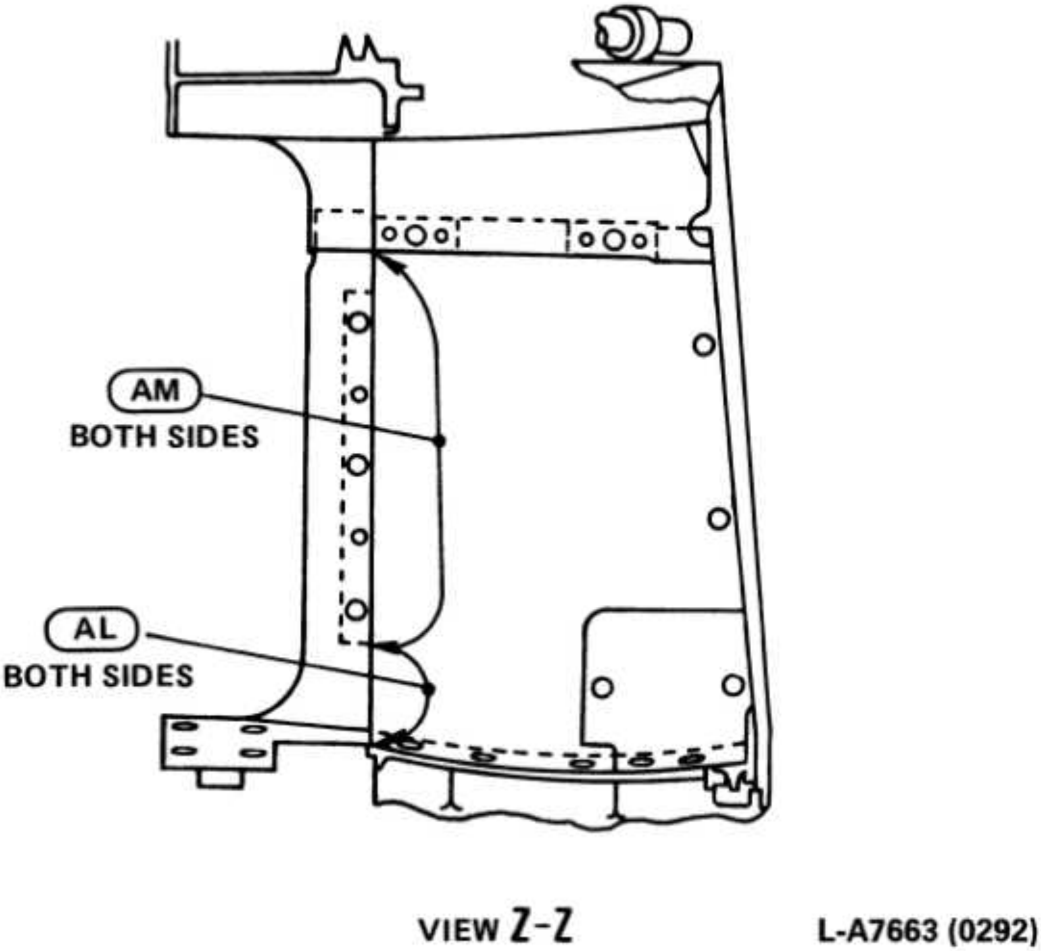

J
J
H
H
V
AM
AM
SECTION J-J
AM
(2 locations)
M
M
AM
(2 locations)
AH
AH
AL
AL
SECTION H-H
L-A9020 (0194)
PW V

Fan Exit (Bifurcation) Fairing Assembly Sealant Areas
Figure 405 (Sheet 1)
(Task 72-00-33-450-009-A)


SURFACE
SS
1
SECTION M-M
2
AM
SECTION AH-AH
AM
VIEW W-W
W
W
AM
BOTH SIDES
Z
Z
AM
ALL AROUND CONTOUR
AL
BOTH SIDES
AL
AL
BOTH SIDES
VIEW V
L-A7660 (0393)
PW V

1. Apply The Sealant To Make A Surface Continuous With, To 0.010 Inch (0.254 mm) Above, Surface SS.
2. Apply The Sealant To Make A Surface Continuous With, To 0.010 Inch (0.254 mm) Below, All Around The Access Cover, Two Places.

Fan Exit (Bifurcation) Fairing Assembly Sealant Areas
Figure 405 (Sheet 2)
(Task 72−00−33−450−009−A)


AM
BOTH SIDES
AL
BOTH SIDES
VIEW Z-Z
L-A7663 (0292)

Fan Exit (Bifurcation) Fairing Assembly Sealant Areas
Figure 405 (Sheet 3)
(Task 72−00−33−450−009−A)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - FAN CASE - INSTALLATION-15

Task 72-00-33-450-010:

1. Install The Supplemental Control Unit (SCU) Programming Plug

A. Equipment And Materials Required

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers

Consumable Materials:

Item No.	Designation
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Collar (ST2185-06)	1			
Pin-Rivet (ST1106-02)	1			

B. Procedure
See Figure 401.

NOTE: Inside the programming plug, the engine serial number is identified (by electronics) to a specified engine (by serial number). Programming plugs are not interchangeable with each other unless a new plug is made to the same engine serial number.

(1) Connect the SCU programming plug to the mating SCU receptacle as follows.

(a) Remove the protection covers. Examine the programming plug and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the plug and receptacle with Denatured Ethyl Alcohol (P11-009). Let dry.

(b) Align the plug keyways and engage the plug to the mating receptacle. Tighten the plug coupling nut by hand until you cover the witness (color) band and the plug coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the plug coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN PLUG DAMAGE OR A LOOSE PLUG.
A LOOSE PLUG PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

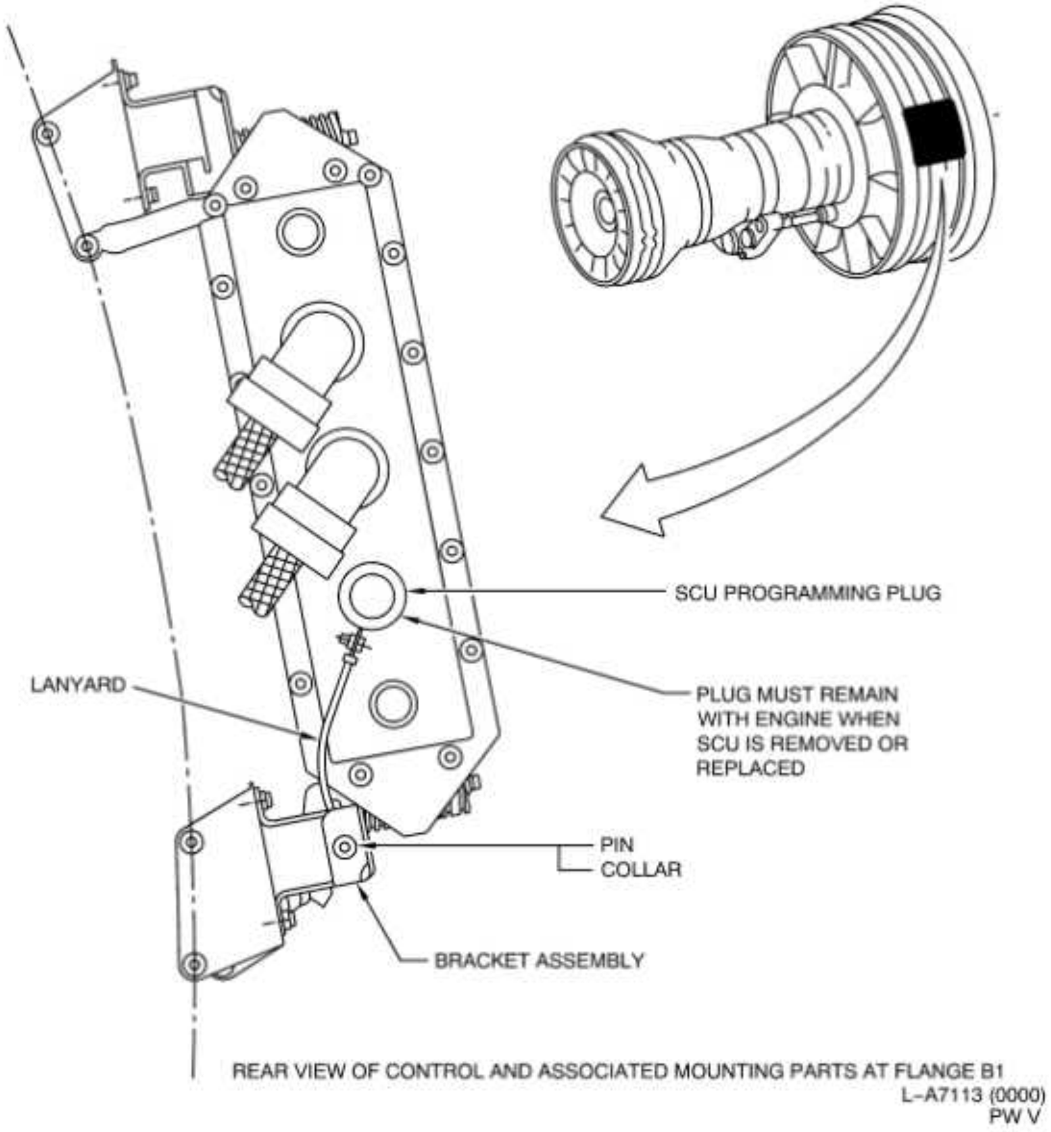
(c) Use the (Glenair TG−70) strap wrench or the (Glenair (TG−69) soft−jawed pliers and tighten the plug coupling nut. Use sufficient force to be sure:
- the plug coupling nut is fully tight
- the plug fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the plug is tight.

NOTE: If you use too much force, the tools (above) will turn around on the plug coupling nut. This will prevent too much torque.

See the instructions given with the strap wrench for correct use.

(2) Attach the lanyard to the lower (rearward) mount bracket for the SCU with a rivet pin and collar. See 70−43−00, Standard Practices Manual.


SCU PROGRAMMING PLUG
LANYARD
PLUG MUST REMAIN WITH ENGINE WHEN SCU IS REMOVED OR REPLACED
PIN
COLLAR
BRACKET ASSEMBLY
REAR VIEW OF CONTROL AND ASSOCIATED MOUNTING PARTS AT FLANGE B1
L−A7113 (0000)
PW V

SCU Programming Plug
Figure 401
(Task 72−00−33−450−010)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-33-440-001:

1. Install The Fan Exit Liner Segment Assemblies (Procedure To Use With The Installation Of A Component)

A. Equipment And Materials

Standard Tools:
No. 10 Torq-set Drive

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-038	Cheesecloth, Unsized (GA-100-11)
P05-137	Bonding Preventative, Teflon S (PWA 36038)
P05-231	Tape, Adhesive Transfer (PWA 36745)
P09-014	Sealant, Silicone Rubber (PWA 36003)
P09-019	Sealant, Flame Resistant Silicone Rubber (PWA 36751-1)
P09-029	Sealant, Silicone Rubber (PWA 36029)
P11-014	Alcohol, Isopropyl (PMC 9094)
P18-007	Primer, Silicone (PWA 36086-2)

B. Procedure To Install The Fan Exit (Rear) Liner Segment Assemblies

See Figure 401.

CAUTION: ACOUSTICAL AND NON-ACOUSTICAL LINERS ARE IN SETS. BUT THE LINER THAT IS AT 6 O'CLOCK IS A NON-ACOUSTICAL LINER.

(1) Install the liner as follows.

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE OR INSTALL A LINER SEGMENT. THE WASHERS THAT ARE ATTACHED TO THE FRONT LINER BRACKET CAN BECOME DISCONNECTED FROM THE BRACKET. ALSO, IF THE EDGE OF THE LINER SEGMENT HITS SOMETHING, IT CAN DELAMINATE.

(a) Attach the liners to the cases with screws/bolts, threads lubricated with Engine Oil (P03-001).

Tighten the screws/bolts with your hand. See Figure 402.

NOTE: Screws are (Pre SB PW4ENG 72−107). Bolts are (Post SB PW4ENG 72−107).

The liner that is at 6 o'clock does not use screws/bolts at the leading edge.

(b) (Reference 1013) Torque all the screws/bolts (fasteners) to 36 − 40 lb−in. (4.067 − 4.519 N.m) in the order that follows:

1 Front fasteners.

2 Rear fasteners.

3 Fasteners adjacent to the intermediate case struts.

(c) Visually examine each fastener to make sure that it is correctly installed and touches the washer. If the fastener does not touch the washer, remove it, apply new lubricant and install it again.

NOTE: It is not necessary for the fastener to be symmetrically installed in the washer recess.

Following the initial installation of the liner segments, a relaxation of the fastener torque can occur. Any subsequent check of the fastener torque that shows a value of 15 lb−in. (1.695 N.m) or more is acceptable. If the 15 lb−in. (1.695 N.m) minimum torque value is not met, remove, lubricate and install again the fastener.

(2) For engines with the acoustical fan exit liner segment assemblies (inner rear), use one of the methods that follow to fill the screw holes in the liners. See Figure 402.

NOTE: The liner at 6 o'clock is a non−acoustical liner.

(a) First method:

1 Clean the screw heads and holes with Alcohol (P11−014).

2 Cover the screw heads only with Sealant (P09−029).

3 Fill the outer part of the holes and an area approximately 0.125 inch (3.175 mm) larger than the hole with Sealant (P09−014).

(b) Second method:

1 Cover the screw heads with Tape (P05−231), film side up.

2 Clean the holes with Alcohol (P11−014).

3 Fill the outer part of the holes and an area approximately 0.125 inch (3.175 mm) larger than the hole with Sealant (P09−014).

(c) Third method:

1 Cover the screw heads with Bonding Preventative (P05−137). Cure at 400°F (204.4°C) for one hour.

2 Clean the holes with Alcohol (P11−014).

3 Fill the outer part of the holes and an area approximately 0.125 inch (3.175 mm) larger than the hole with Sealant (P09−014).

(d) Fourth method:

1 Fill the screw holes with AMS 7267 or AMS 7276 packing material.

2 Clean the packing material and holes with Alcohol (P11−014).

3 Fill the outer part of the holes and an area approximately 0.125 inch (3.175 mm) larger than the hole with Sealant (P09−014).

(3) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Apply sealant to the empty spaces between the front liners and the rear liners as follows. See Figure 403.

(a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Clean the surfaces the sealant will touch. Use PWA 83−D2.

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Apply Sealant (P09−027) to the empty spaces. The surface of the sealant must be smooth and continuous.

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Cure the sealant for eight hours, minimum, before you touch the parts.

(4) If the inner (bifurcation) fairing is already installed, apply sealant to the mating edges of the 11 and 1 o'clock liners and the inner (bifurcation) fairing, as follows (Area AL). See Figure 404.

(a) Clean the areas the sealant will touch. Use a piece of clean Cheesecloth (P05−038) that is moist with Alcohol (P11−014).

(b) Apply Primer (P18−007) to all cleaned surfaces.

1 It is necessary to apply the primer in less than two hours after you cleaned the area.

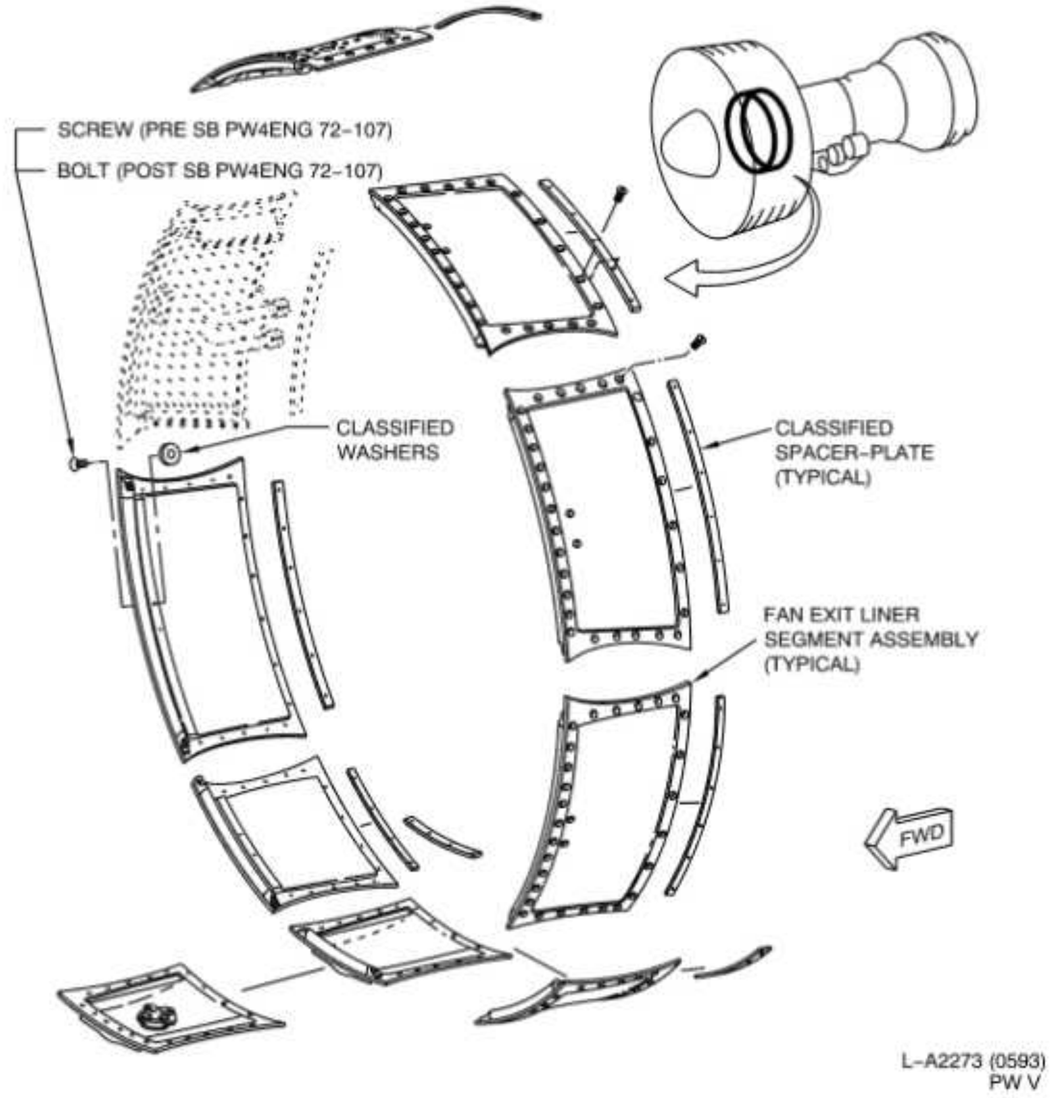
2 The primer must cure in air that is at ambient temperature for two hours, minimum. The air must have a relative humidity of 25 percent, minimum.

(c) Apply Sealant (P09−019) to the applicable areas.

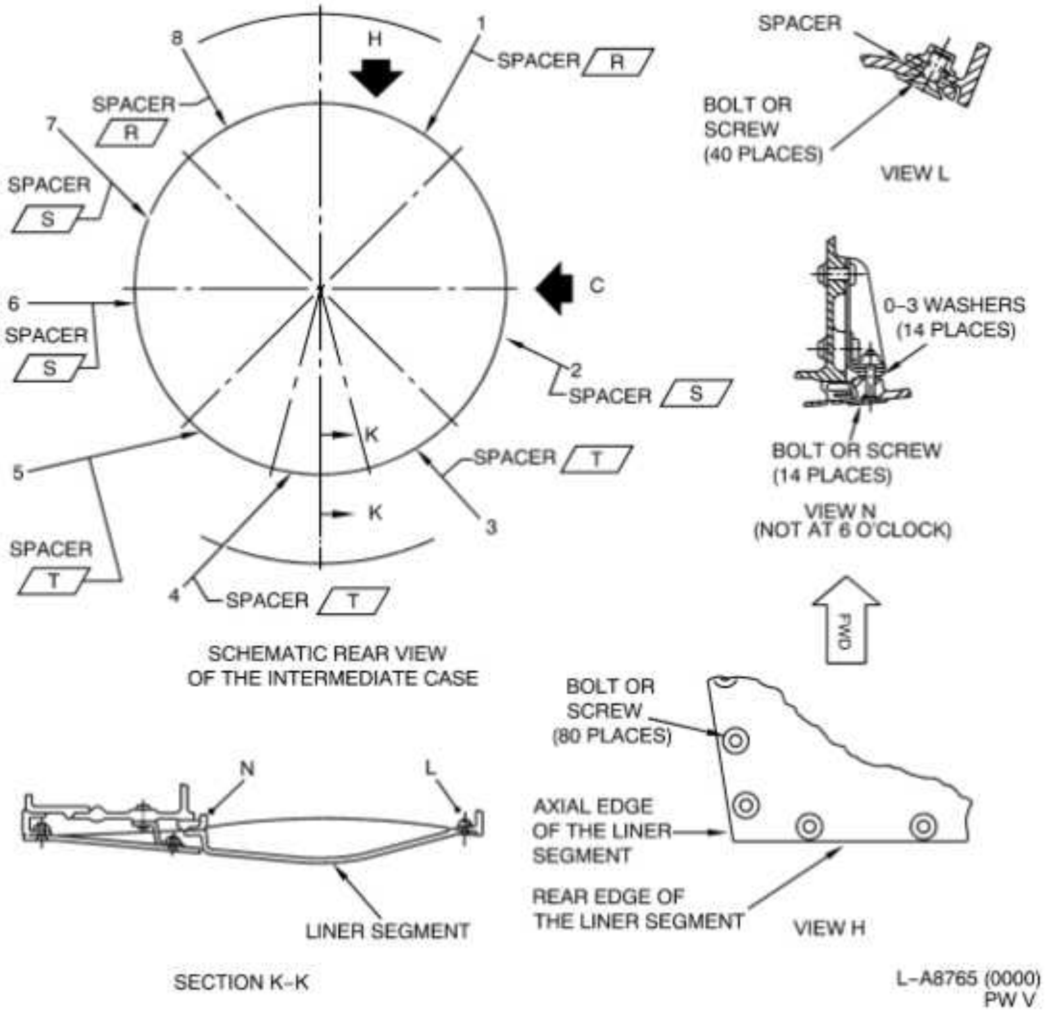
1 It is necessary to apply the sealant from 2 − 24 hours after you applied the primer.

2 Use a hot air gun at 175° − 225°F (79.° − 107.°C) for 5 − 7 minutes to dry the sealant.

3 After the hot air gun, cure the sealant in air that has a relative humidity of 25 percent, minimum, for eight hours, minimum, before you touch the parts.


SCREW (PRE SB PW4ENG 72-107)
BOLT (POST SB PW4ENG 72-107)
CLASSIFIED WASHERS
CLASSIFIED SPACER-PLATE (TYPICAL)
FAN EXIT LINER SEGMENT ASSEMBLY (TYPICAL)
FWD
L-A2273 (0593)
PW V

Installation Of The Fan Exit (Rear) Liner Segment Assemblies
Figure 401
(Task 72−00−33−440−001)

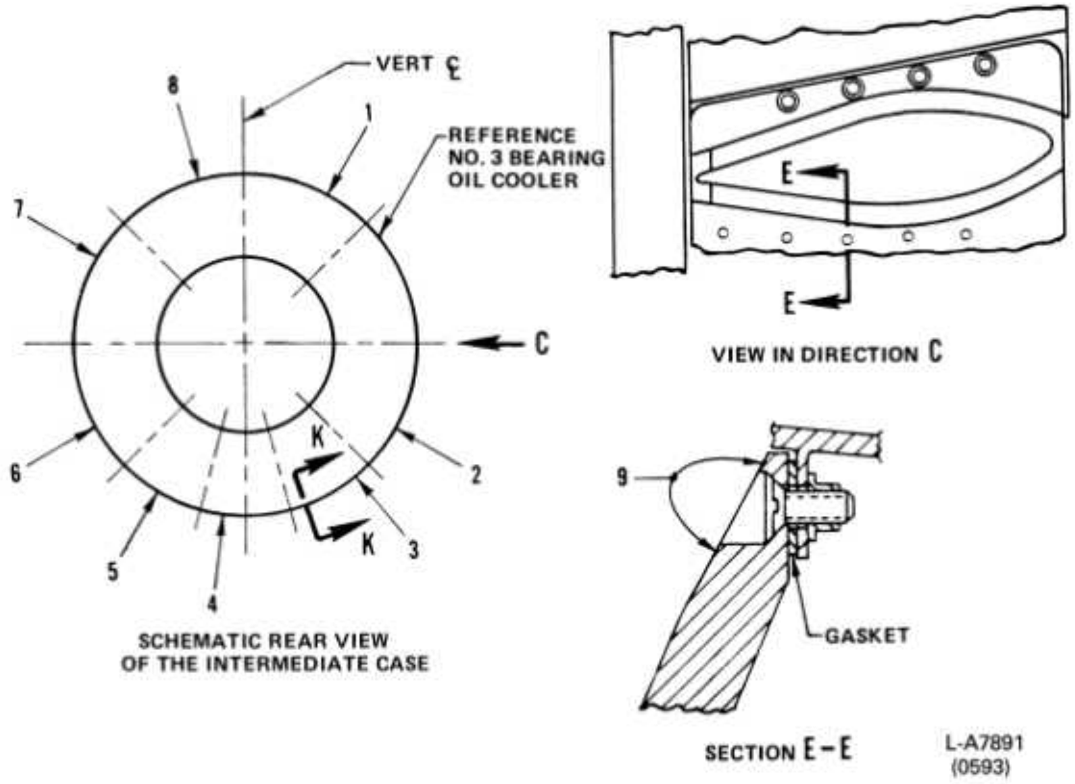

8
H
1
SPACER R
SPACER R
7
SPACER S
6
SPACER S
C
2
SPACER S
K
SPACER T
5
K
3
SPACER T
4
SPACER T
SCHEMATIC REAR VIEW
OF THE INTERMEDIATE CASE
SPACER
BOLT OR
SCREW
(40 PLACES)
VIEW L
0−3 WASHERS
(14 PLACES)
BOLT OR SCREW
(14 PLACES)
VIEW N
(NOT AT 6 O'CLOCK)
FWD
BOLT OR
SCREW
(80 PLACES)
AXIAL EDGE
OF THE LINER
SEGMENT
REAR EDGE OF
THE LINER SEGMENT
VIEW H
N
L
LINER SEGMENT
SECTION K−K
L−A8765 (0000)
PW V

Installation Of The Fan Exit (Rear) Liner Segment Assemblies
(Non−Acoustical Liners)
Figure 402 (Sheet 1)
(Task 72−00−33−440−001)

ENGINE GENERAL − FAN CASE − INSTALLATION−16

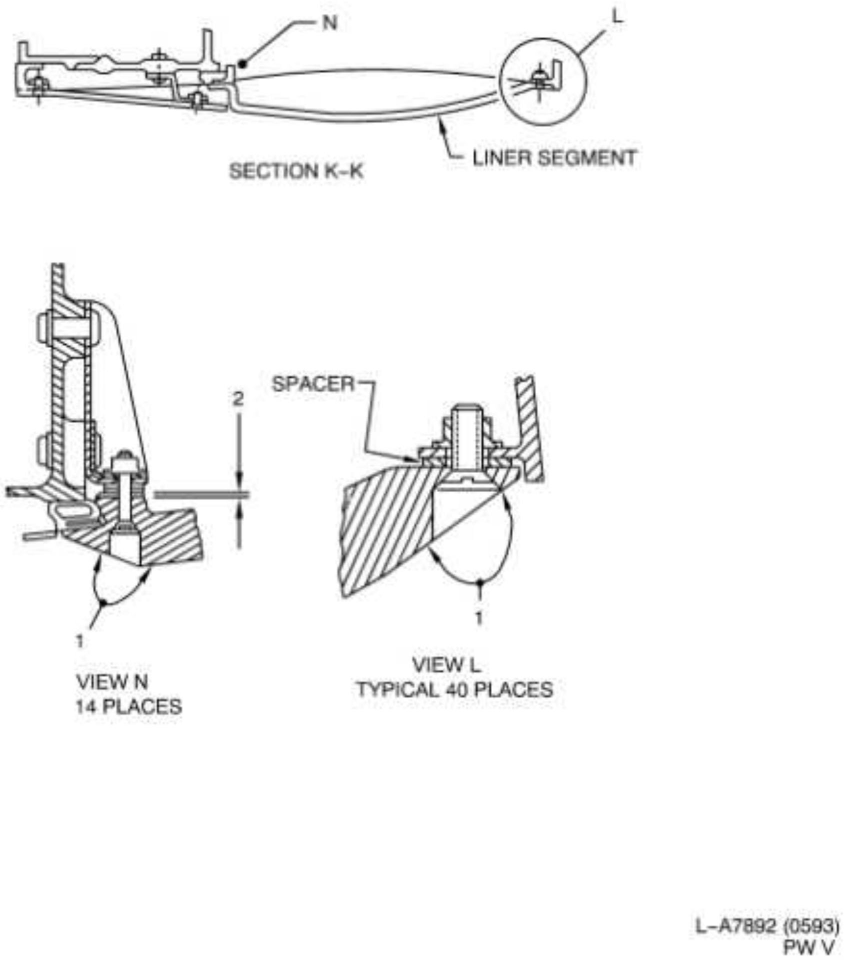
1. PN 50A508 Or 51A166−01 Liner Assembly
2. PN 50G281 Or 51A163−01 Liner Assembly
3. PN 50G279 Or 51A162−01 Liner Assembly
4. (Pre PW4ENG 72−196) PN 50G280 Liner Assembly
   (Post PW4ENG 72−196) PN 51G273 Or 51A173 Liner Assembly
5. PN 50G440 Or 51A164−01 Liner Assembly
6. PN 50G278 Or 51A161−01 Liner Assembly
7. PN 50G277 Or 51A160−01 Liner Assembly
8. PN 50G276 Or 51A159−01 Liner Assembly

Key To Figure 402 (Sheet 1)


VERT ℄
8
1
REFERENCE NO. 3 BEARING OIL COOLER
7
C
6
K
2
K
3
5
4
SCHEMATIC REAR VIEW OF THE INTERMEDIATE CASE
E
E
VIEW IN DIRECTION C
9
GASKET
SECTION E-E
L-A7891 (0593)

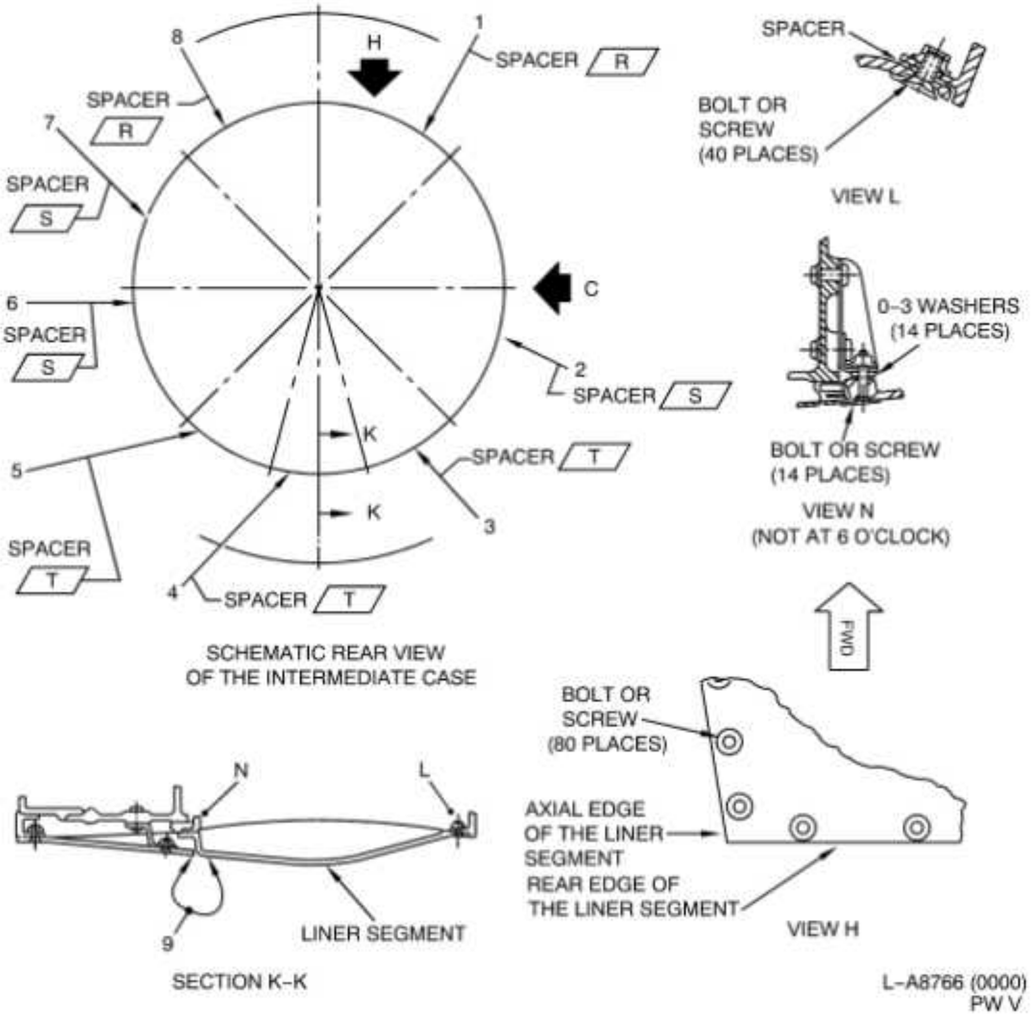
1. PN 50A668
2. PN 50G771
3. PN 50G773
4. (Pre PW4ENG 72-196) PN 50G280 Liner Assembly
   (Post PW4ENG 72-196) PN 51G273 Liner Assembly
5. PN 50G769
6. PN 50G770
7. PN 50G774
8. PN 50G772
9. The Area Of Sealant

Installation Of The Fan Exit (Rear) Liner Segment Assemblies
(Acoustical Liners)
Figure 402 (Sheet 2)
(Task 72-00-33-440-001)


N
L
SECTION K−K
LINER SEGMENT
2
SPACER
1
1
VIEW N
14 PLACES
VIEW L
TYPICAL 40 PLACES
L−A7892 (0593)
PW V

1. The Area Of Sealant
2. (Reference) 0.005 − 0.020 Inch (0.13 − 0.51 mm)

Installation Of The Fan Exit (Rear) Liner Segment Assemblies
(Acoustical Liners)
Figure 402 (Sheet 3)
(Task 72−00−33−440−001)

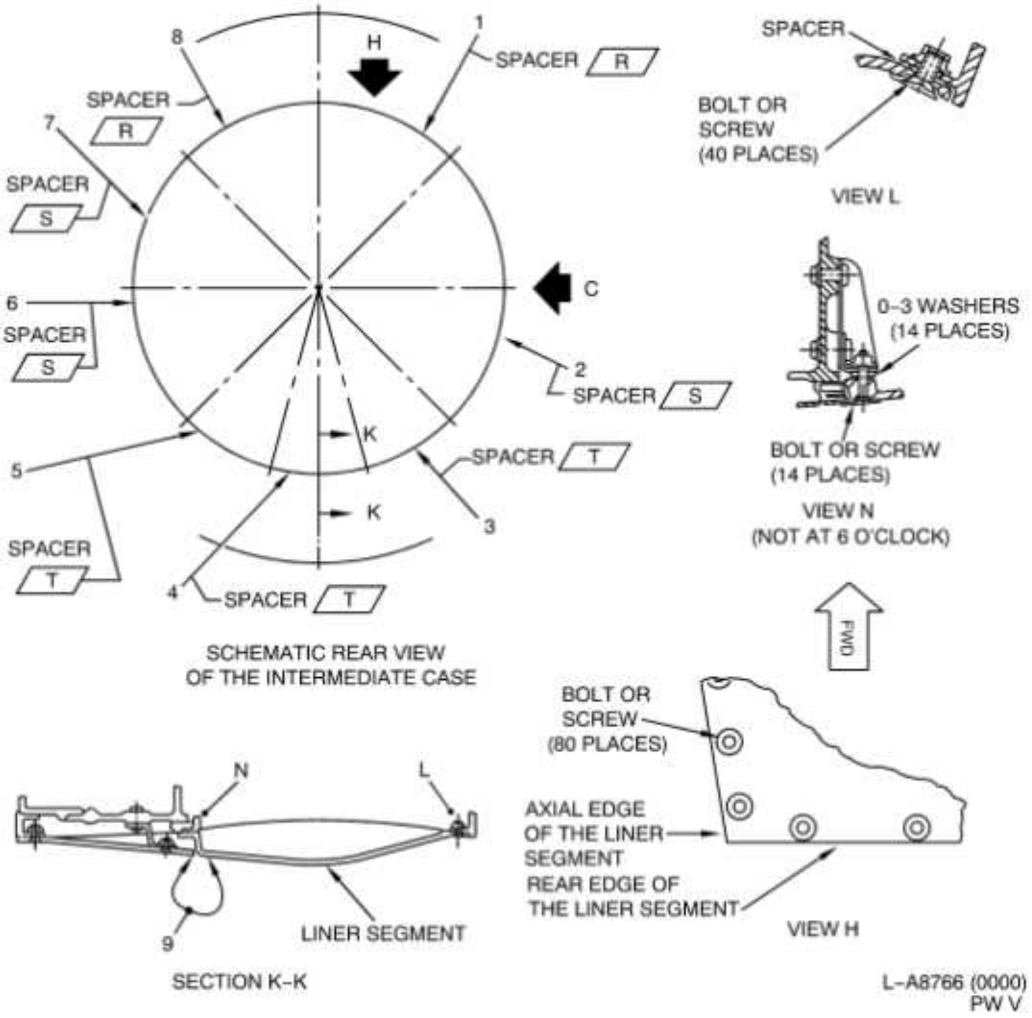

8
H
1
SPACER R
SPACER
BOLT OR
SCREW
(40 PLACES)
VIEW L
SPACER R
7
SPACER S
C
0-3 WASHERS
(14 PLACES)
6
SPACER S
2
SPACER S
K
SPACER T
BOLT OR SCREW
(14 PLACES)
VIEW N
(NOT AT 6 O'CLOCK)
5
K
3
SPACER T
4
SPACER T
FWD
SCHEMATIC REAR VIEW
OF THE INTERMEDIATE CASE
BOLT OR
SCREW
(80 PLACES)
N
L
AXIAL EDGE
OF THE LINER
SEGMENT
REAR EDGE OF
THE LINER SEGMENT
VIEW H
9
LINER SEGMENT
SECTION K-K
L-A8766 (0000)
PW V

Installation Of The Fan Exit (Rear) Liner Segment Assemblies
(Post SB PW4ENG 72−546)
Figure 402 (Sheet 4)
(Task 72−00−33−440−001)

ENGINE GENERAL - FAN CASE - INSTALLATION-16

PW4152, PW4156, PW4156A	PW4158 Only
1. PN 51A387-01 Liner Assembly	1. PN 52G116-01 Liner Assembly
2. PN 51A384-01 Liner Assembly	2. PN 52G119-01 Liner Assembly
3. PN 51A383-01 Liner Assembly	3. PN 52G121-01 Liner Assembly
4. PN 51A386-01 Liner Assembly	4. PN 52G386-01 Liner Assembly
5. PN 51A385-01 Liner Assembly	5. PN 52G117-01 Liner Assembly
6. PN 51A382-01 Liner Assembly	6. PN 52G118-01 Liner Assembly
7. PN 51A381-01 Liner Assembly	7. PN 52G122-01 Liner Assembly
8. PN 51A380-01 Liner Assembly	8. PN 52G120-01 Liner Assembly
9. Apply Sealant, Eight Locations	9. Apply Sealant, Eight Locations

Key To Figure 402 (Sheet 4)

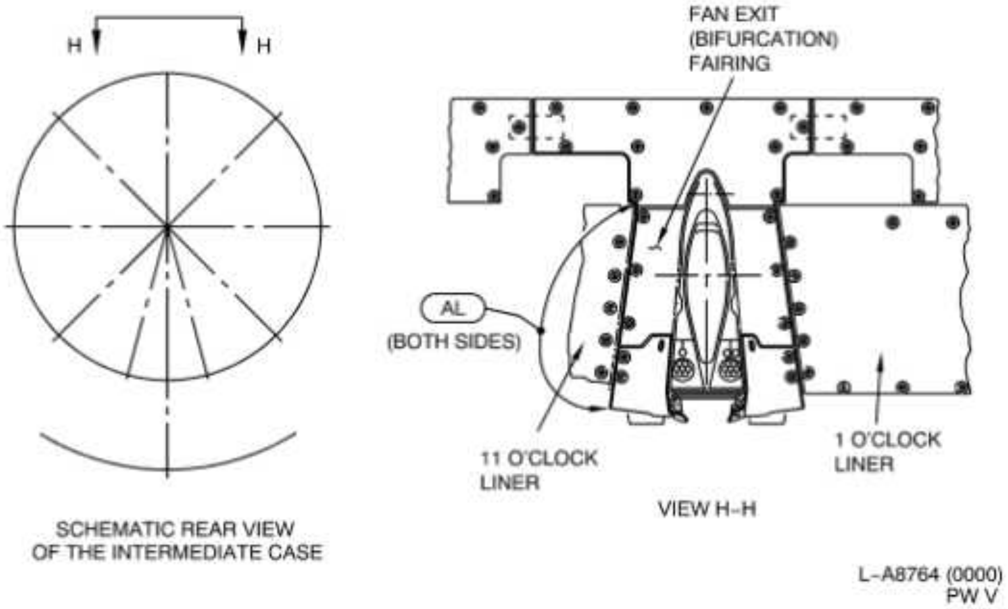

8
H
1
SPACER R
SPACER R
7
SPACER S
6
SPACER S
C
2
SPACER S
K
SPACER T
5
K
3
SPACER T
4
SPACER T
SCHEMATIC REAR VIEW
OF THE INTERMEDIATE CASE
SPACER
BOLT OR
SCREW
(40 PLACES)
VIEW L
0-3 WASHERS
(14 PLACES)
BOLT OR SCREW
(14 PLACES)
VIEW N
(NOT AT 6 O'CLOCK)
FWD
BOLT OR
SCREW
(80 PLACES)
AXIAL EDGE
OF THE LINER
SEGMENT
REAR EDGE OF
THE LINER SEGMENT
VIEW H
N
L
9
LINER SEGMENT
SECTION K-K
L-A8766 (0000)
PW V

Installation Of The Fan Exit (Rear) Liner Segment Assemblies
Figure 403
(Task 72-00-33-440-001)

ENGINE GENERAL − FAN CASE − INSTALLATION−16

1. PN 51A387−01 Liner Assembly
2. PN 51A384−01 Liner Assembly
3. PN 51A383−01 Liner Assembly
4. PN 51A386−01 Liner Assembly
5. PN 51A385−01 Liner Assembly
6. PN 51A382−01 Liner Assembly
7. PN 51A381−01 Liner Assembly
8. PN 51A380−01 Liner Assembly
9. Apply Sealant, Eight Locations

Key To Figure 403


H
H
SCHEMATIC REAR VIEW
OF THE INTERMEDIATE CASE
FAN EXIT
(BIFURCATION)
FAIRING
AL
(BOTH SIDES)
11 O'CLOCK
LINER
1 O'CLOCK
LINER
VIEW H−H
L−A8764 (0000)
PW V

Application Of Sealant At The Edges Of The (Rear) Liners
Figure 404
(Task 72−00−34−440−001)

ENGINE GENERAL - FAN CASE - INSTALLATION-17

Task 72-00-33-440-002:

1. Install A Fan Exit Liner Seal

A. Equipment and Materials

Consumable Materials:

Item No.	Designation
P05-038	Cheesecloth, Unsized
P09-014	Sealant, Silicone Rubber (PWA 36003)
P11-014	Alcohol, Isopropyl (PMC 9094)

Repair Details:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Seal	AR	72-33-00	9	325
Seal	AR	72-33-00	9	326
Seal	AR	72-33-00	9	327

B. Procedure

See Figure 401.

(1) Clean the surfaces of the inner fan exit case assembly where you will bond the seals. Use a piece of clean Cheesecloth (P05-038) that is moist with Isopropyl Alcohol (P11-014). Dry the surfaces fully in air that is at room temperature. There must be no solvent on the case when you apply the sealant.

(2) Clean the bonding surface of the seals. Use a non-metallic piece of cloth or paper that has grit in it. The cloth or paper must be free of contaminants. Remove particles of abrasive with a vacuum or use another method which keeps the surface free of contaminants.

(3) Bond the small end seals to the inner fan exit case assembly. Use Sealant (P09-014).

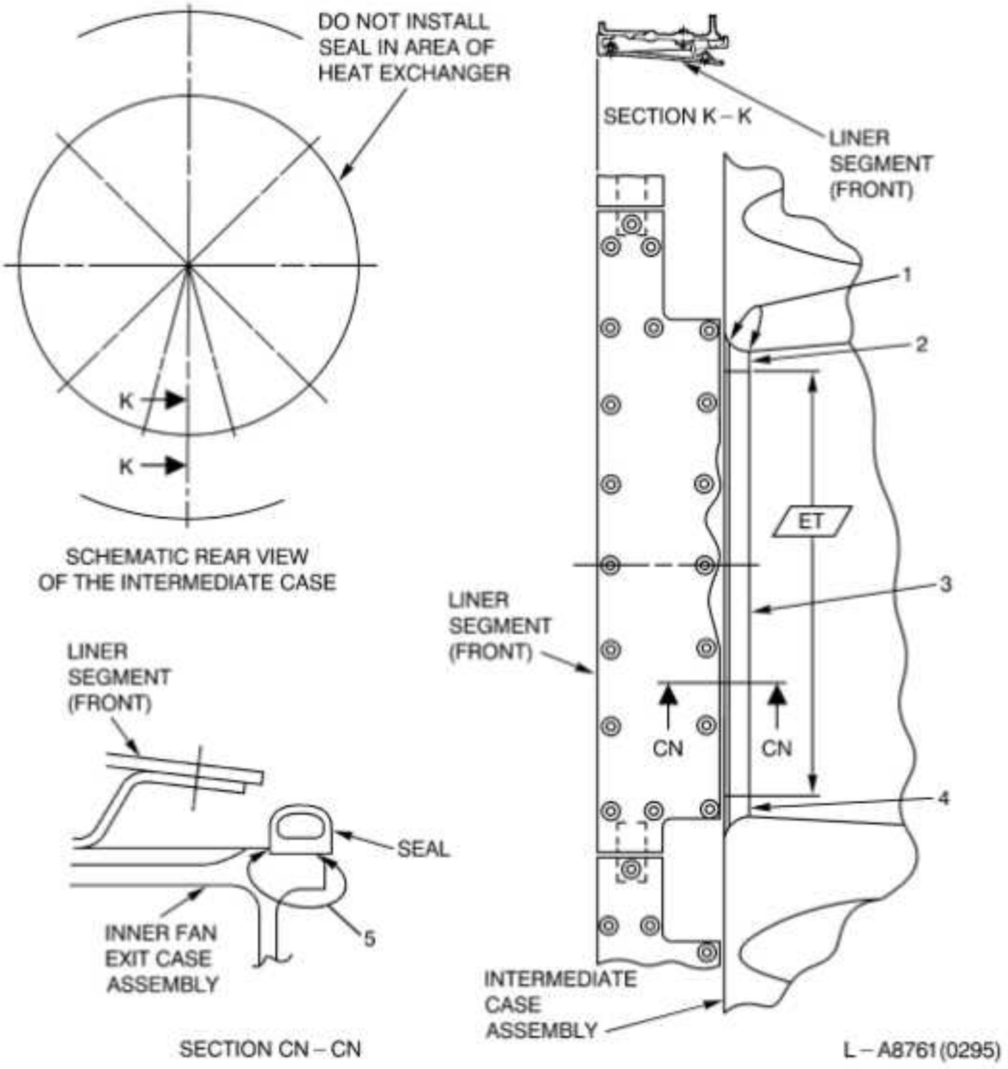
(4) Cut the center seal to Length ET for each seal location. See Figure 401.

(5) Bond the center seals to the inner fan exit case assembly and to the end seals. Use Sealant (P09-014).

(6) Apply Sealant (P09−014) to the ends of the seal ends to fill any empty spaces.

(7) The surface of sealant must be smooth and continuous.

(8) Cure the sealant in air that is at room temperature for eight hours, minimum.


DO NOT INSTALL SEAL IN AREA OF HEAT EXCHANGER
K
K
SCHEMATIC REAR VIEW OF THE INTERMEDIATE CASE
SECTION K − K
LINER SEGMENT (FRONT)
1
2
ET
3
LINER SEGMENT (FRONT)
CN
CN
4
LINER SEGMENT (FRONT)
SEAL
5
INNER FAN EXIT CASE ASSEMBLY
SECTION CN − CN
INTERMEDIATE CASE ASSEMBLY
L − A8761 (0295)

1. Fill Any Empty Spaces At The Seal Ends, 16 Places
2. PN 52G073, Eight Places
3. PN 52G100, Eight Places. Cut As Necessary.
4. PN 52G072, Eight Places
5. Bond The Seals To The Inner Fan Exit Case Assembly, 24 Locations.

Installation Of The Fan Exit Liner Seals
Figure 401
(Task 72−00−33−440−002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - FAN CASE - INSTALLATION-18

Task 72-00-33-440-004:

1. Install Fan Exit Liner Seal (Engines With Seal Installed To Inner Fan Exit Case Assembly)

A. Equipment and Materials

Consumable Materials:

Item No.	Designation
P05-038	Cheesecloth, Unsized
P09-014	Sealant, Silicone Rubber (PWA 36003)
P11-014	Alcohol, Isopropyl (PMC 9094)

Repair Details:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Seal	AR	72-33-00	9	325
Seal	AR	72-33-00	9	326
Seal	AR	72-33-00	9	327

B. Procedure

See Figure 401.

(1) Clean the surfaces of the inner fan exit case assembly where you will bond the seals. Use a piece of clean Cheesecloth (P05-038) that is moist with Isopropyl Alcohol (P11-014). Dry the surfaces fully in air that is at room temperature. There must be no solvent on the case when you apply the sealant.

(2) Clean the bonding surface of the seals. Use a non-metallic piece of cloth or paper that has grit in it. The cloth or paper must be free of contaminants. Remove particles of abrasive with a vacuum or use another method which keeps the surface free of contaminants.

(3) Bond the small end seals to the inner fan exit case assembly. Use Sealant (P09-014).

(4) Cut the center seal to Length ET for each seal location. See Figure 401.

(5) Bond the center seals to the inner fan exit case assembly and to the end seals. Use Sealant (P09-014).

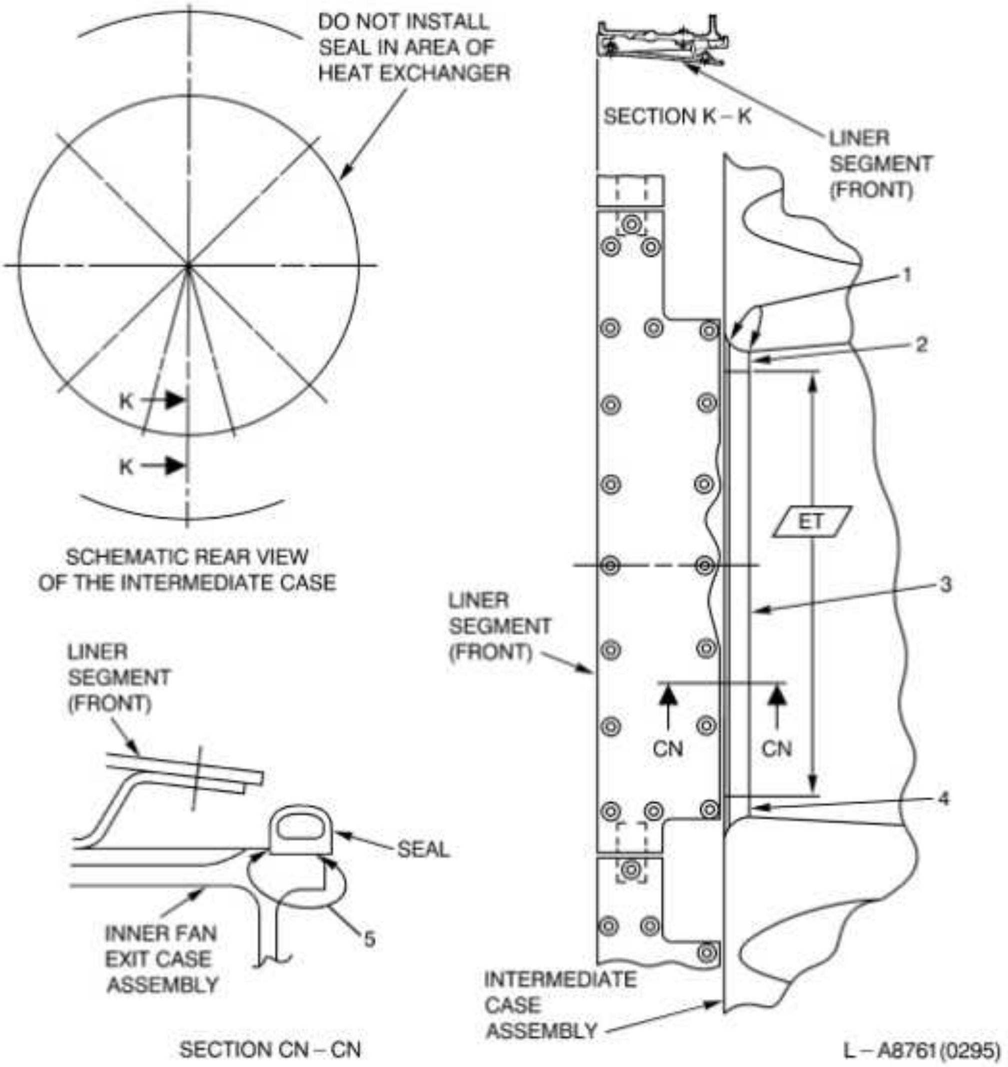
ENGINE GENERAL − FAN CASE − INSTALLATION−18

(6) Apply Sealant (P09−014) to the ends of the seal ends to fill any empty spaces.

(7) The surface of sealant must be smooth and continuous.

(8) Cure the sealant in air that is at room temperature for eight hours, minimum.

ENGINE GENERAL − FAN CASE − INSTALLATION−18


DO NOT INSTALL SEAL IN AREA OF HEAT EXCHANGER
K
K
SCHEMATIC REAR VIEW OF THE INTERMEDIATE CASE
SECTION K − K
LINER SEGMENT (FRONT)
1
2
ET
3
LINER SEGMENT (FRONT)
CN
CN
4
LINER SEGMENT (FRONT)
SEAL
5
INNER FAN EXIT CASE ASSEMBLY
SECTION CN − CN
INTERMEDIATE CASE ASSEMBLY
L − A8761 (0295)

1. Fill Any Empty Spaces At The Seal Ends, 16 Places
2. PN 52G073, Eight Places
3. PN 52G100, Eight Places. Cut As Necessary.
4. PN 52G072, Eight Places
5. Bond The Seals To The Inner Fan Exit Case Assembly, 24 Locations.

Installation Of The Fan Exit Liner Seals
Figure 401
(Task 72−00−33−440−004)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - FAN CASE - INSTALLATION-20

Task 72-00-33-420-020:

1. Install The Flange C Brackets And Hardware

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

B. Procedure

(1) Install Flange C hardware as follows. See Figure 401.

(2) Install the Flange C bolts, threads lubricated with Engine Oil P03-001, washers, brackets, and nuts.

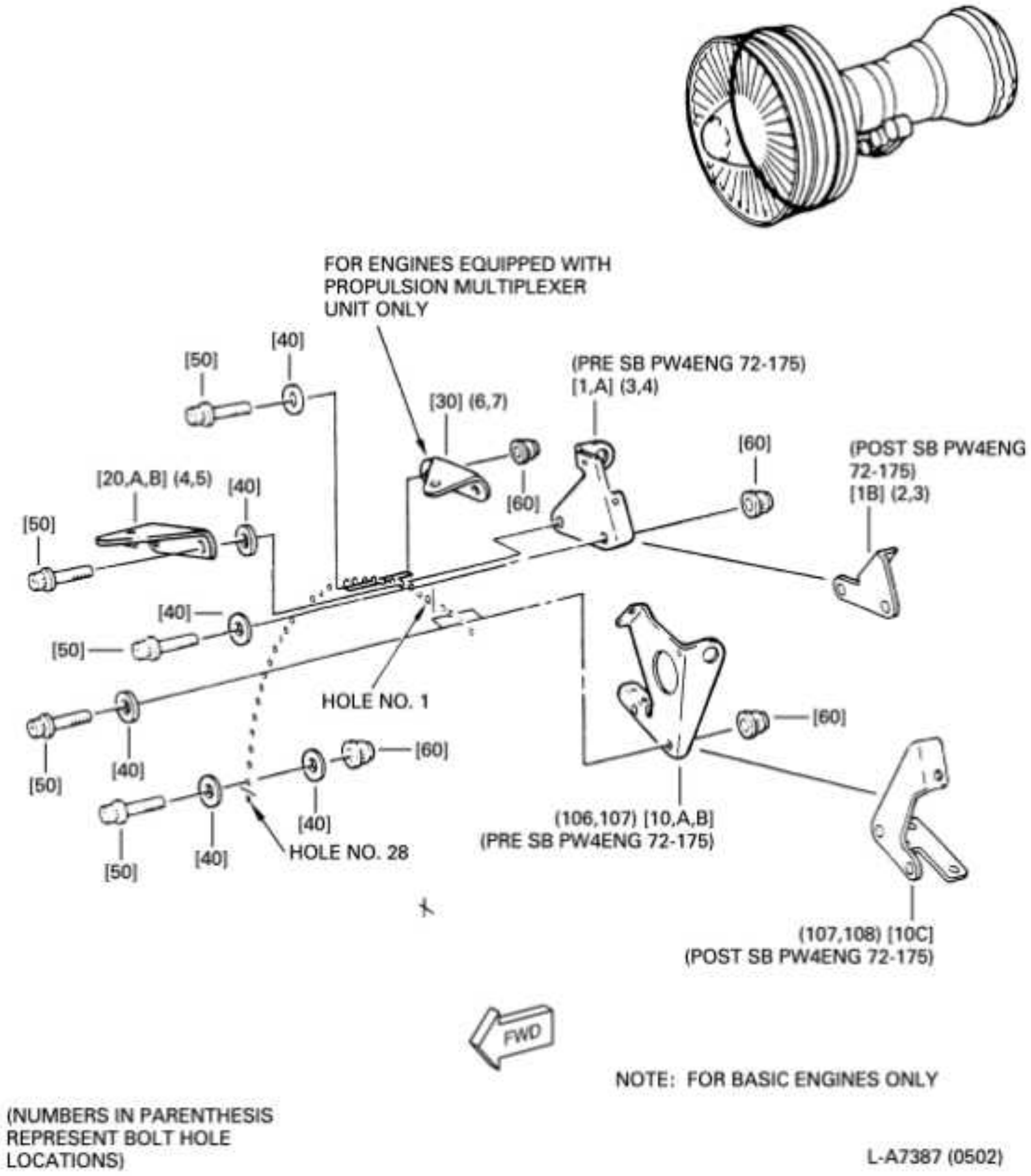
(3) Torque Flange C bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). Torque bolts securing guides to intermediate case to 36 - 40 lb-in. (4.067 - 4.519 N.m) if equipped.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
For engines with the data plate bracket attached to Flange C at boltholes 41 and 42 (Pre SB PW4ENG 72-140) or boltholes 38 and 39 (Post SB PW4ENG 72-140), omit washers at the bracket location.

NOTE: FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
For engines with the data plate bracket attached to Flange C at boltholes 38 and 39, omit the washers at the bracket location.

(4) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Remove any tags or markings on the brackets or flange.

(5) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Examine the assembly for foreign objects, damage, and correct assembly.

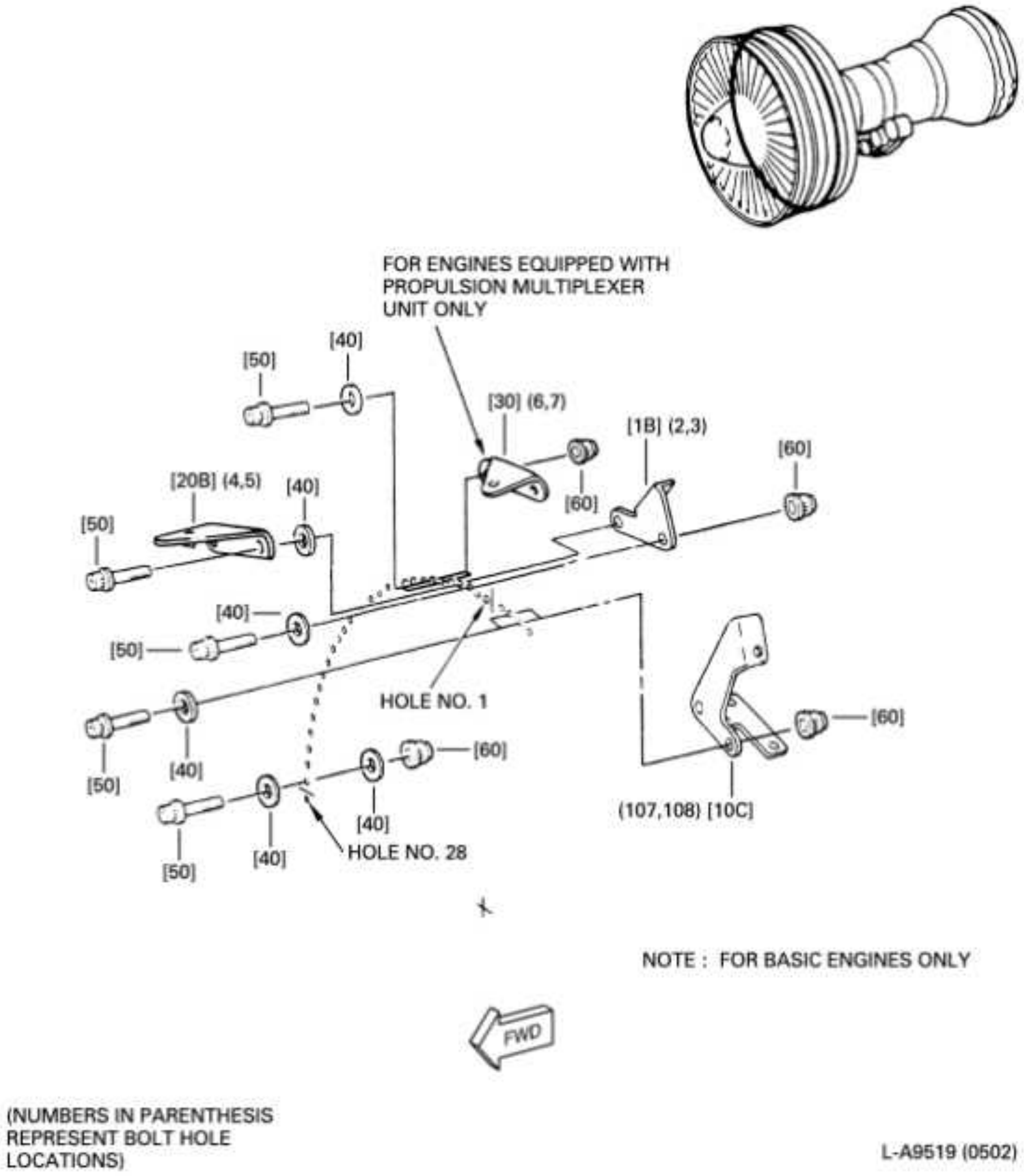

FOR ENGINES EQUIPPED WITH PROPULSION MULTIPLEXER UNIT ONLY
[50]
[40]
[30] (6,7)
(PRE SB PW4ENG 72-175) [1,A] (3,4)
[60]
(POST SB PW4ENG 72-175) [1B] (2,3)
[20,A,B] (4,5)
[40]
[50]
[60]
[40]
[50]
HOLE NO. 1
[60]
[50]
[40]
[60]
[40]
HOLE NO. 28
[50]
[40]
(106,107) [10,A,B] (PRE SB PW4ENG 72-175)
(107,108) [10C] (POST SB PW4ENG 72-175)
FWD

NOTE: FOR BASIC ENGINES ONLY

(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)

L-A7387 (0502)

Flange C Bracket Locations
Figure 401 (Sheet 1)
(Task 72−00−33−420−020)


[50]
[40]
[30] (6,7)
[1B] (2,3)
[60]
[20B] (4,5)
[40]
[50]
[60]
[40]
[50]
HOLE NO. 1
[60]
[50]
[40]
[60]
[40]
[50]
[40]
HOLE NO. 28
(107,108) [10C]
FWD

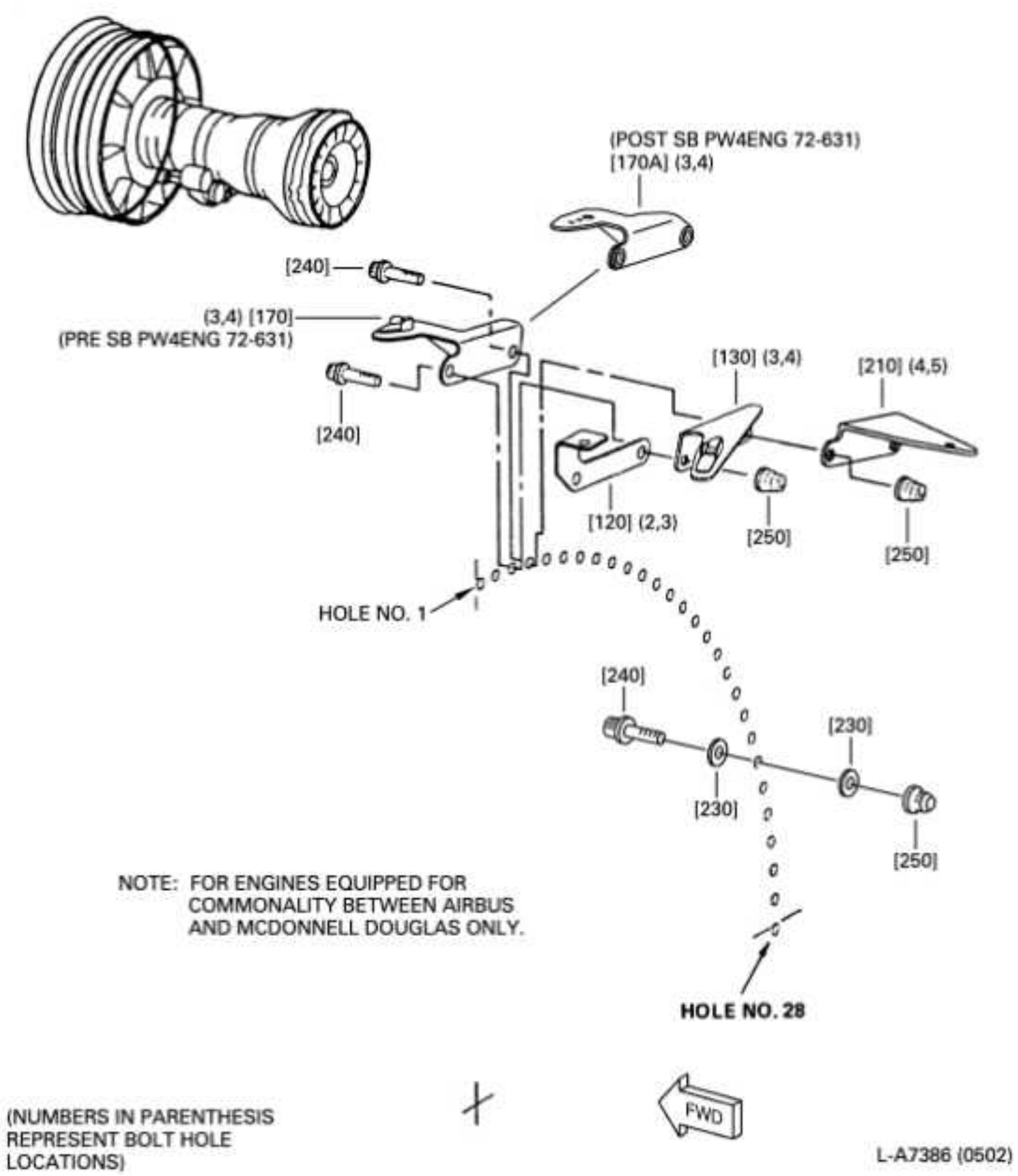
FOR ENGINES EQUIPPED WITH PROPULSION MULTIPLEXER UNIT ONLY

NOTE : FOR BASIC ENGINES ONLY

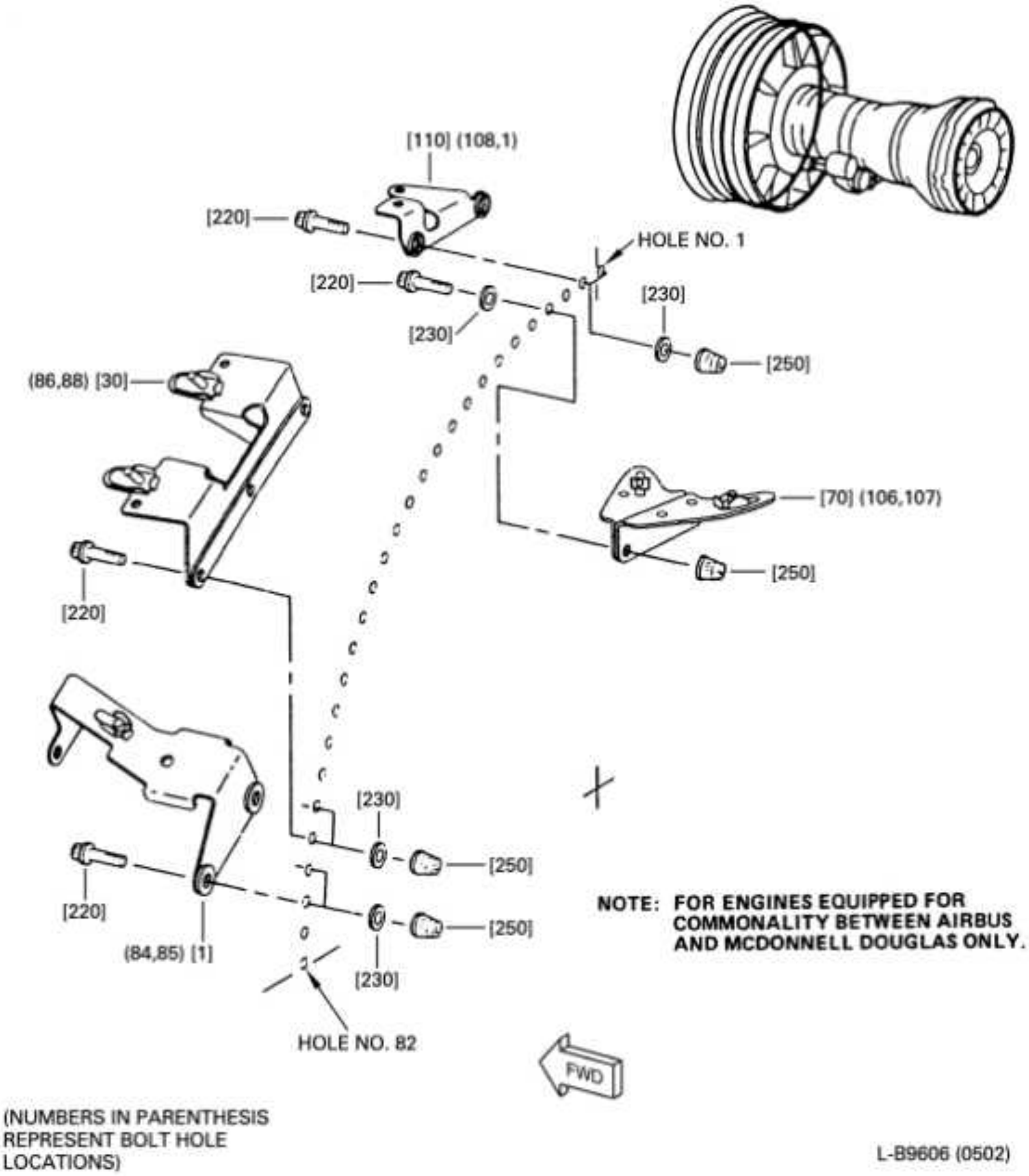
(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)

L-A9519 (0502)

Flange C Bracket Locations
Figure 401 (Sheet 2)
(Task 72−00−33−420−020)

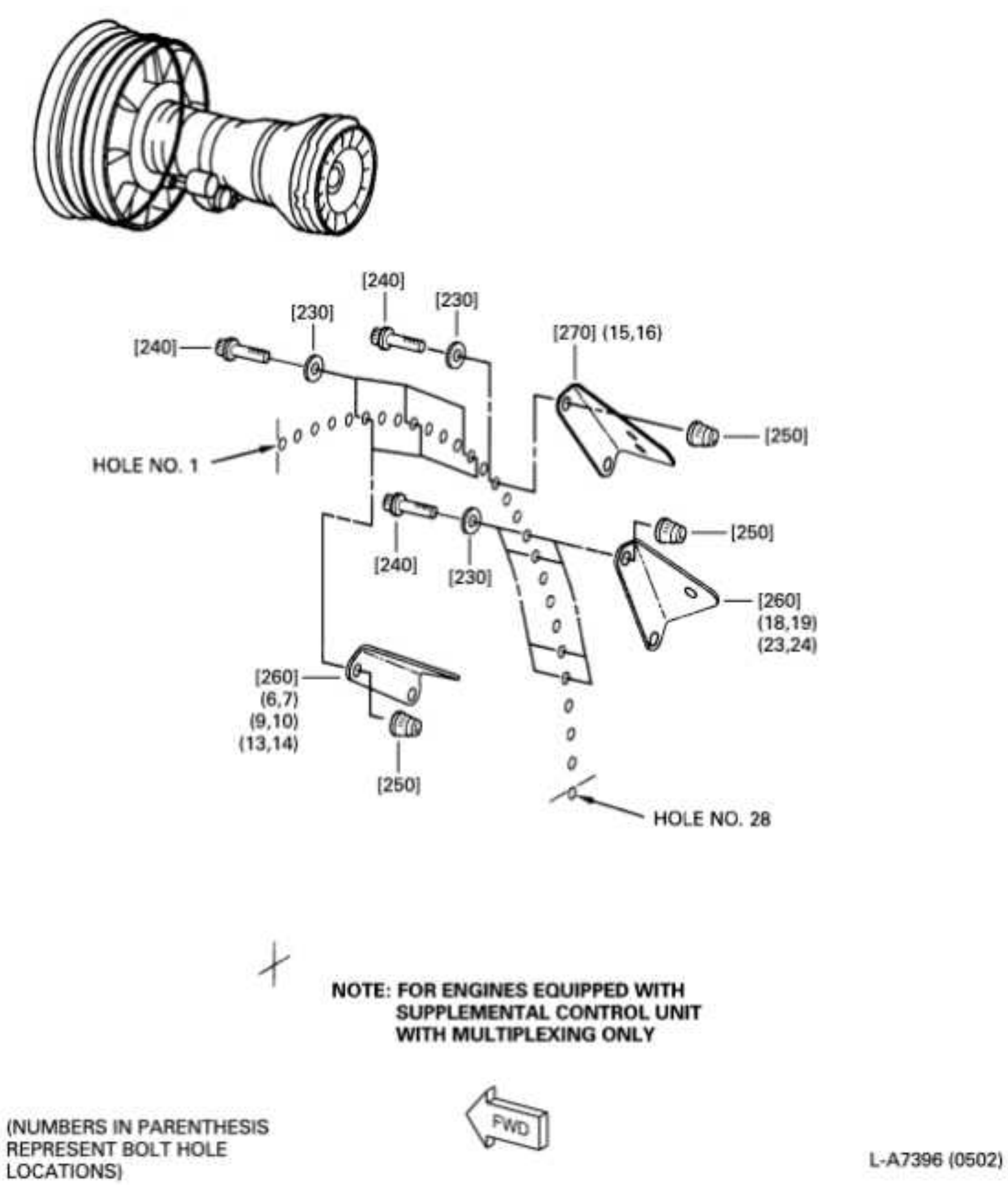

(POST SB PW4ENG 72-631)
[170A] (3,4)
[240]
(3,4) [170]
(PRE SB PW4ENG 72-631)
[240]
[130] (3,4)
[210] (4,5)
[120] (2,3)
[250]
[250]
HOLE NO. 1
[240]
[230]
[230]
[250]
NOTE: FOR ENGINES EQUIPPED FOR COMMONALITY BETWEEN AIRBUS AND MCDONNELL DOUGLAS ONLY.
HOLE NO. 28
(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)
FWD
L-A7386 (0502)

Flange C Bracket Locations
Figure 401 (Sheet 3)
(Task 72−00−33−420−020)


[110] (108,1)
[220]
HOLE NO. 1
[220]
[230]
[230]
[250]
(86,88) [30]
[70] (106,107)
[250]
[220]
[230]
[250]
[220]
[250]
(84,85) [1]
[230]
HOLE NO. 82
FWD
(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)
L-B9606 (0502)

NOTE: FOR ENGINES EQUIPPED FOR COMMONALITY BETWEEN AIRBUS AND MCDONNELL DOUGLAS ONLY.

Flange C Bracket Locations
Figure 401 (Sheet 4)
(Task 72-00-33-420-020)


[240]
[230]
[240]
[230]
[270] (15,16)
[250]
HOLE NO. 1
[250]
[240]
[230]
[260]
(18,19)
(23,24)
[260]
(6,7)
(9,10)
(13,14)
[250]
HOLE NO. 28
NOTE: FOR ENGINES EQUIPPED WITH SUPPLEMENTAL CONTROL UNIT WITH MULTIPLEXING ONLY
(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)
FWD
L-A7396 (0502)

Flange C Bracket Locations
Figure 401 (Sheet 5)
(Task 72−00−33−420−020)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - FAN CASE - INSPECTION/CHECK-01

Task 72-00-33-990-001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131)	(−)	0.512 (13.005)	=	.005 (0.126)
0.527 (13.385)	(−)	0.508 (12.903)	=	.019 (0.482)

EXAMPLE 2

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
490	B	Fan Exit (Outer) Case (72−33−03) Fan Case Assembly (72−33−01) (See Figure 801)				
		Exit Case	90.334 (2294.48)	90.344 (2294.74)		
		Fan Case	90.318 (2294.08)	90.328 (2294.33)	.026T (0.66T)	.006T (0.15T)
491	B	Axial Gap, Fan Exit (Outer) Case (72−33−03) Fan Case Assembly (72−33−01) (See Figure 801)				
		Outer Case	.215 (5.46)	.225 (5.72)		
		Fan Case	.225 (5.72)	.235 (5.97)	.000 (0.00)	.020 (0.51)

NOTE: See 72−00−33, Installation−03, for additional instructions regarding measurement of No. 491

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)		axial gap.				
778	B	Fan Exit Inner Case Assembly (72-33-04) Intermediate Case Assembly (72-34-01) (See Figure 801)				
		Inner Case	54.947 (1395.654)	54.953 (1395.806)		
		Intermediate Case	54.941 (1395.501)	54.947 (1395.654)	.000T (0.00T)	.012T (0.30T)
779	B	Fan Exit (Outer) Case (72-33-03) Intermediate Case Assembly (72-34-01) (See Figure 801)				
		Fan Case	92.108 (2339.54)	92.124 (2339.95)		
		Intmd. Case	92.092 (2339.14)	92.108 (2339.54)	.000T (0.00T)	.032T (0.81T)
837	B	Support Link Shoulder Bolt (72-33-87) No. 3 Bearing Air Cooler Assembly Support Brackets (72-33-85/72-34-55) (See Figure 804)				
		Bolt	.2494 (6.3348)	.2499 (6.3474)		
		Bracket	.2500 (6.350)	.2510 (6.375)	.0001 (0.003)	.0016 (0.040)
838	B	Support Link Shoulder Bolts (72-33-87) Support Link Rod End Bearing (72-33-86) (See Figure 804)				
		Bolt	.2494 (6.3348)	.2499 (6.3474)		
		Bearing	.2495 (6.3373)	.2500 (6.3500)	.0006 (0.0152)	.0004T (0.0102T)
839	B	Side Clearance, Support Link Rod End Bearing (72-33-86) No. 3 Bearing Air Cooler Assembly Support Brackets (72-33-85/72-34-55) (See Figure 804)				
		Bearing	.432 (10.973)	.437 (11.099)		
		Bracket	.4375 (11.113)	.4395 (11.163)	.0005 (0.013)	.0075 (0.190)

G. Special Torques

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
2011	A	Fan Exit Bifurcation Strut Grommet Bolt (See Figure 806) See 72-00-33, Installation-06 R (Task 72-00-33-450-003-A00) R (Task 72-00-33-450-003-B00)				
2033	A	Electronic Engine Control (EEC) Mounting Bolts (See Figure 805) See 72-00-33, Installation-04 Task 72-00-33-450-001				

Ref. No.	IFR	Description	New Parts Reference Dimensions Min	New Parts Reference Dimensions Max	Limits Min	Limits Max
2155	A	Electrical Connector See 72-00-33, Installation-06 R (Task 72-00-33-450-003-A00) R (Task 72-00-33-450-003-B00)				
2156	A	Electrical Connector See 72-00-33, Installation-06 R (Task 72-00-33-450-003-A00) R (Task 72-00-33-450-003-B00)				
2157	A	Electrical Connector See 72-00-33, Installation-04 Task 72-00-33-450-001 See 72-00-33, Installation-06 R (Task 72-00-33-450-003-A00) R (Task 72-00-33-450-003-B00)				
2159	A	Electrical Connector See 72-00-33, Installation-04 Task 72-00-33-450-001 See 72-00-33, Installation-06 R (Task 72-00-33-450-003-A00) R (Task 72-00-33-450-003-B00)				

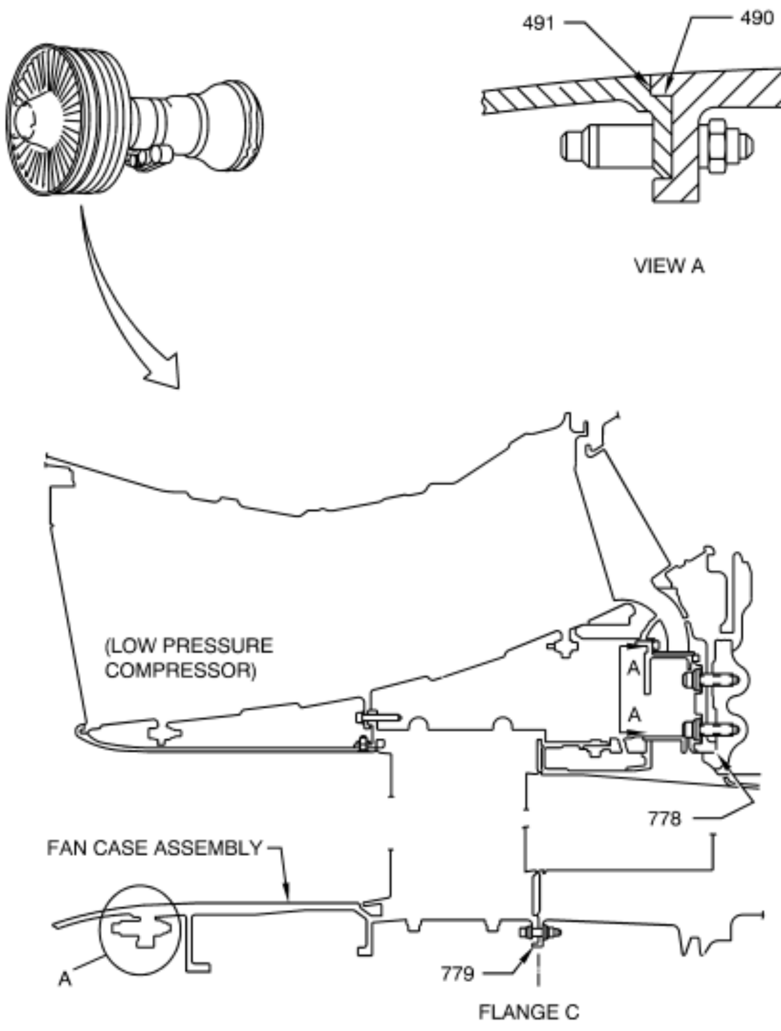
			New Parts Reference Dimensions		Limits	
Ref. No.	IFR	Description	Min	Max	Min	Max
2160	A	Electrical Connector See 72-00-33, Installation-06 R (Task 72-00-33-450-003-A00) R (Task 72-00-33-450-003-B00)				

H. Special Assembly Procedures

			New Parts Reference Dimensions		Limits	
Ref. No.	IFR	Description	Min	Max	Min	Max
750	A	Bleed Valve Rigging Procedure (See Figure 802) See 72-00-00, Special Procedures-03 Task 72-00-00-830-001				
751	B	Procedure For Checking Clearance Between Front And Rear Fan Exit Liners See 72-00-33, Inspection/Check-05 Task 72-00-33-210-004				
1004	A	Procedure For Assembling The No. 3 Bearing Air Cooler Assembly Midspan Support (See Figure 804 See 72-00-33, Installation-05 Task 72-00-33-450-002				
1005	B	Procedure For Maintaining Gap Between Fan Exit Case Bracket And Intermediate Case Liner (See Figure 803) See 72-00-33, Installation-01 Task 72-00-33-420-001				
1010	B	Procedure For Positioning Fan Exit Fairing Cover Plate See 72-00-33, Installation-06 R (Task 72-00-33-450-003-A00) R (Task 72-00-33-450-003-B00)				

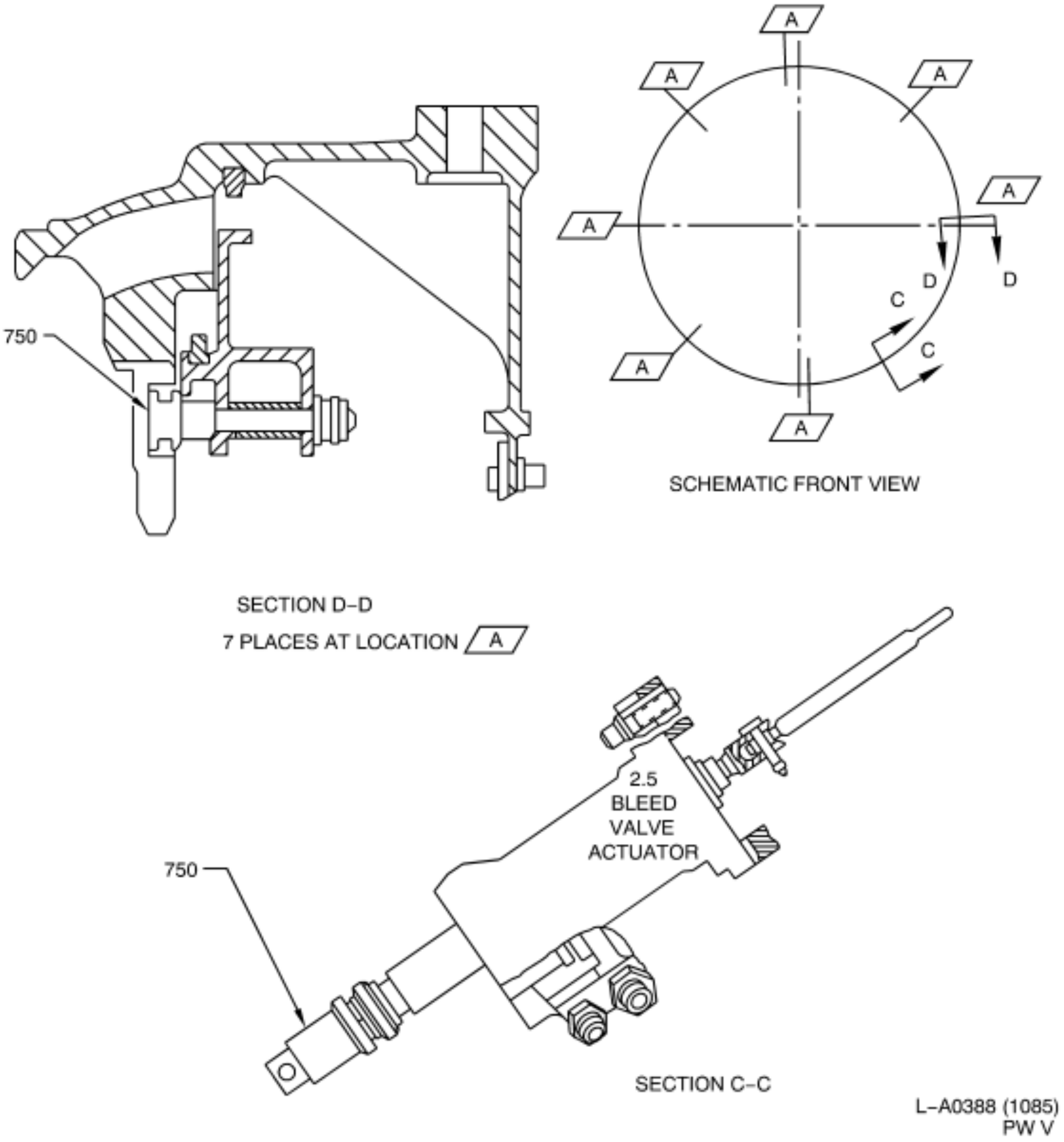
ENGINE GENERAL − FAN CASE − INSPECTION/CHECK−01

Ref. No.	I F R	Description	New Parts Reference Dimensions Min	New Parts Reference Dimensions Max	Limits Min	Limits Max
1012		Procedure For Checking Clearance Between Front And Rear Fan Exit Liners See 72−00−33, Inspection/Check−05 Task 72−00−33−210−004				
1013		Procedure For Torquing Inner Fan Exit Liner Segment Fasteners See 72−00−33, Installation−16 Task 72−00−33−440−001				

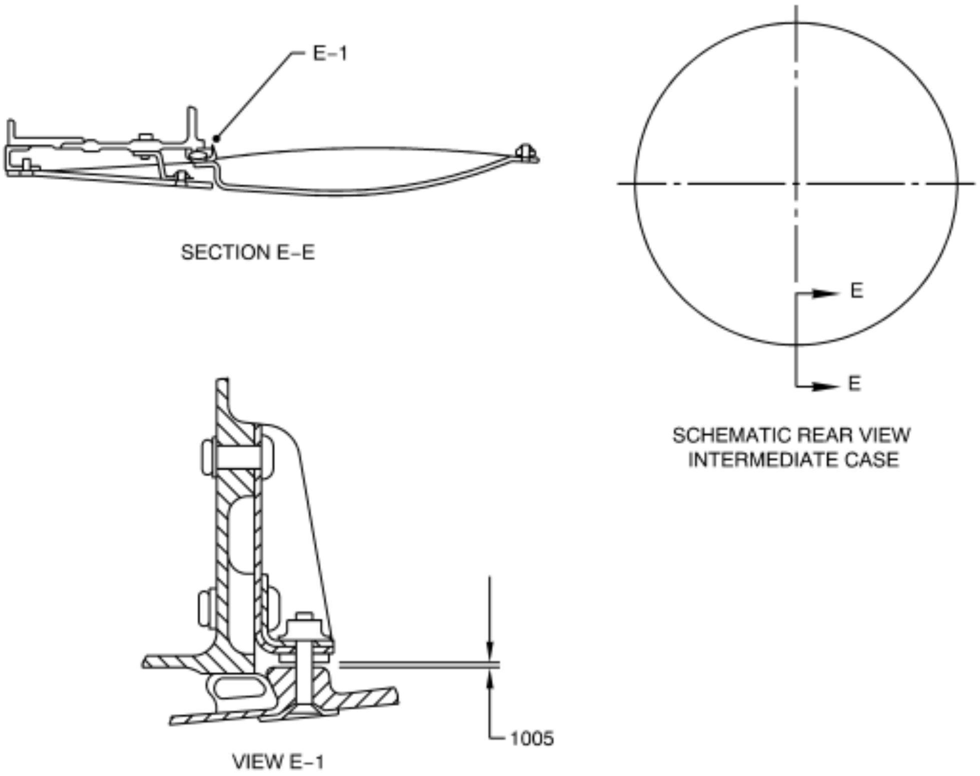

491
490
VIEW A
(LOW PRESSURE
COMPRESSOR)
A
A
778
FAN CASE ASSEMBLY
A
779
FLANGE C

L−A0486 (0387)
PW V

Fan Cases
Figure 801
(Task 72−00−33−990−001)

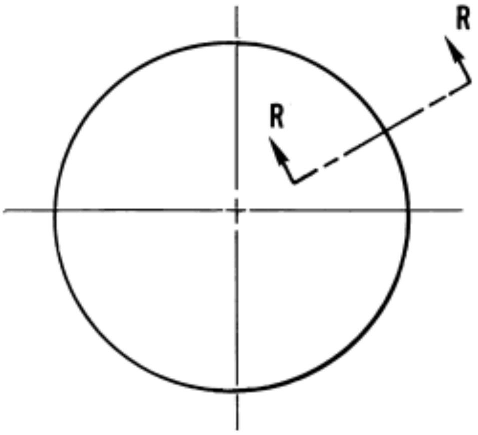

A
A
A
A
A
A
A
C
C
D
D
SCHEMATIC FRONT VIEW
750
SECTION D−D
7 PLACES AT LOCATION A
2.5
BLEED
VALVE
ACTUATOR
750
SECTION C−C
L−A0388 (1085)
PW V

Fan Cases
Figure 802
(Task 72−00−33−990−001)

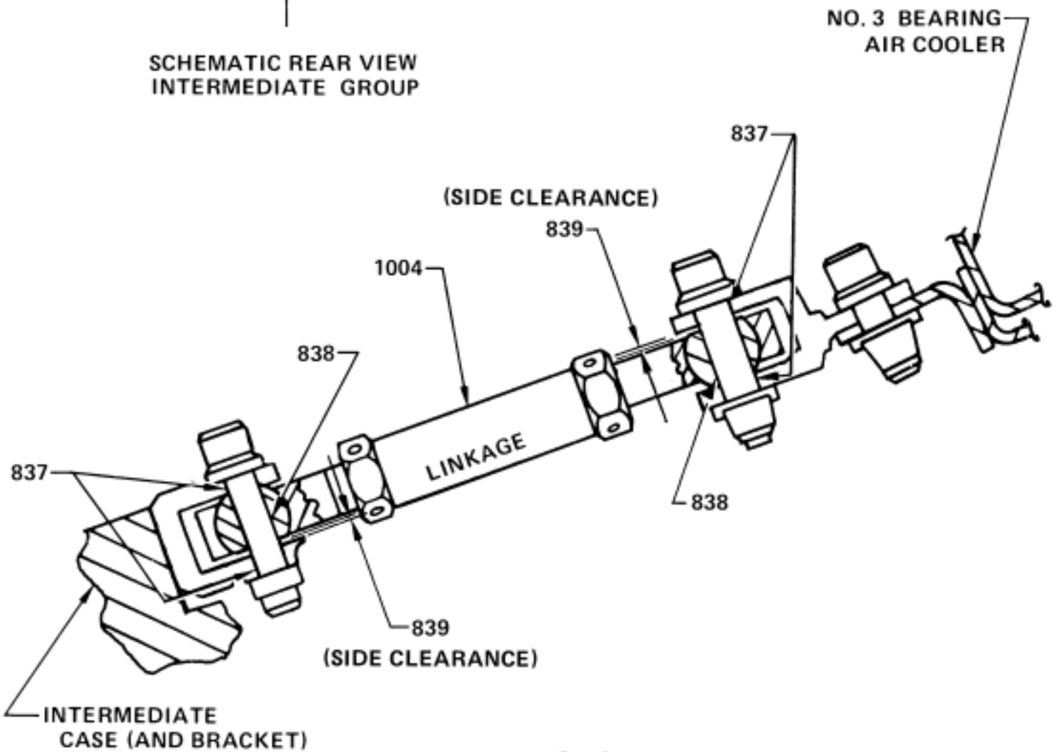

E−1
SECTION E−E
E
E
SCHEMATIC REAR VIEW
INTERMEDIATE CASE
VIEW E−1
1005

L−A0488 (0000)
PW V

Fan Cases
Figure 803
(Task 72−00−33−990−001)



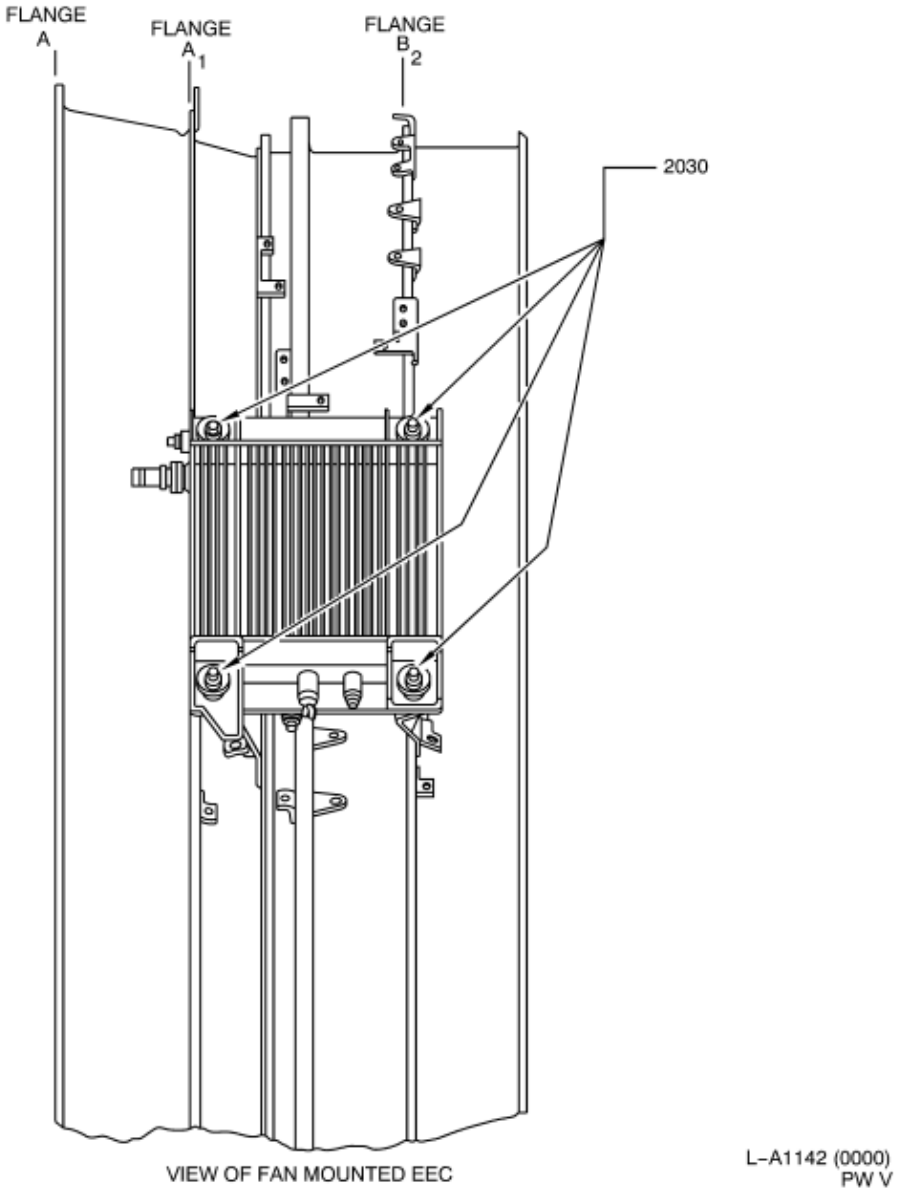
SCHEMATIC REAR VIEW
INTERMEDIATE GROUP


NO. 3 BEARING
AIR COOLER
837
(SIDE CLEARANCE)
839
1004
838
837
LINKAGE
838
839
(SIDE CLEARANCE)
INTERMEDIATE
CASE (AND BRACKET)

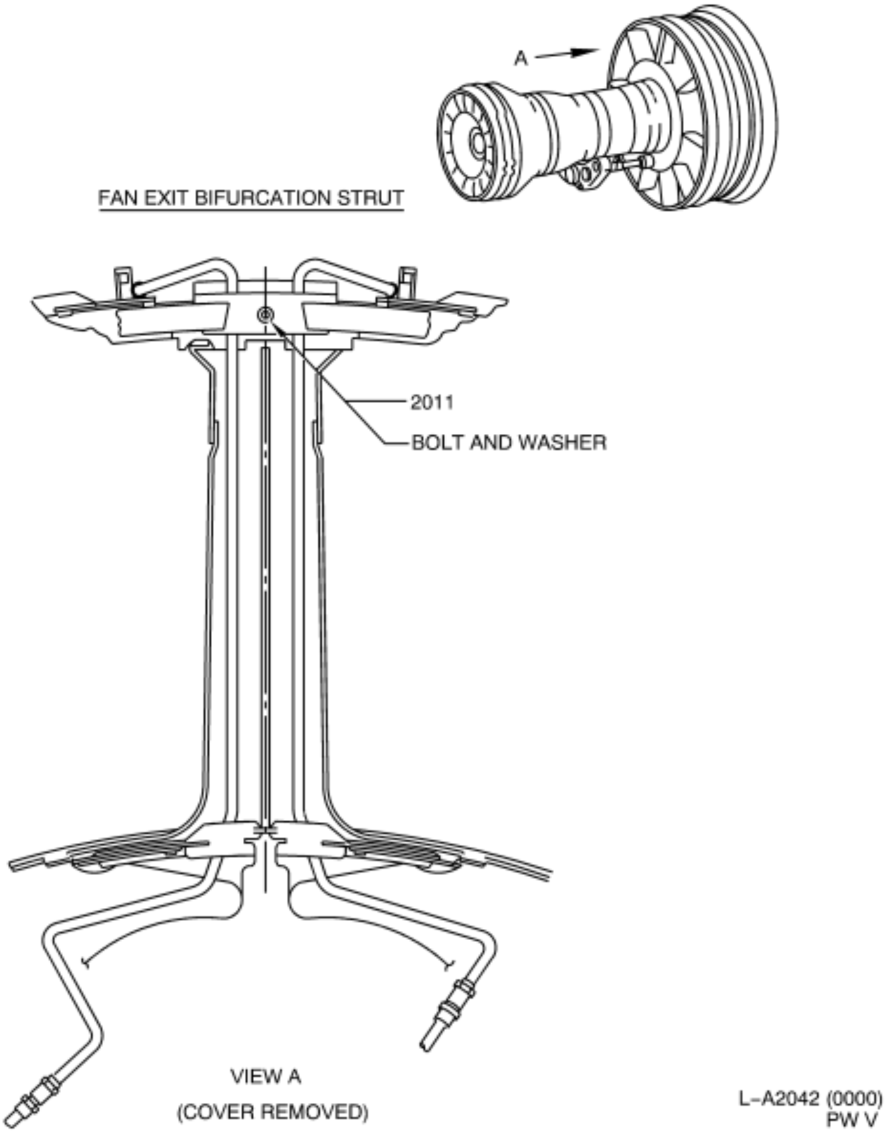
SECTION R - R
(NO. 3 BEARING AIR COOLER LINKAGE/ BRACKETS)

L-A0492
0989

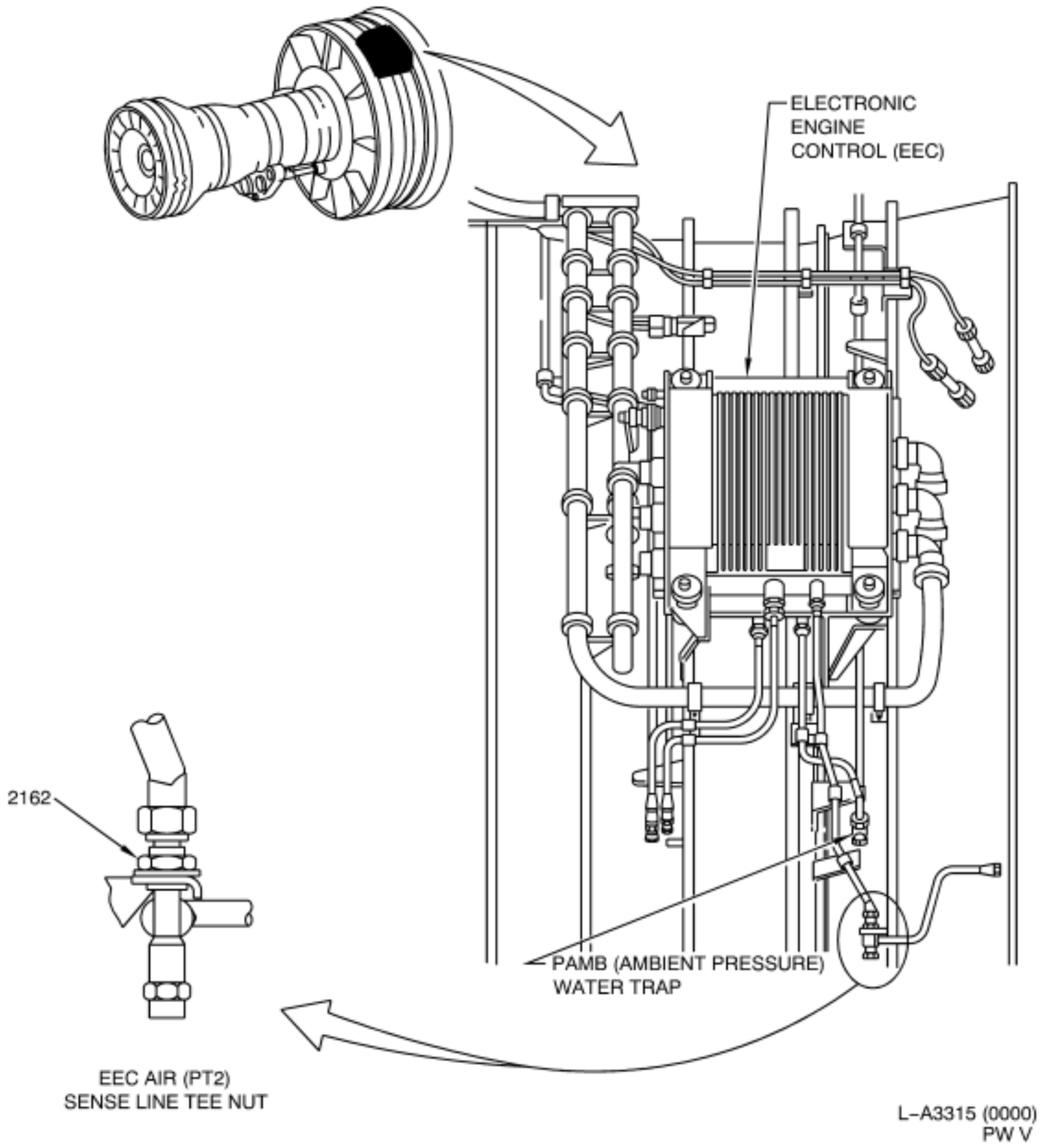
Fan Cases
Figure 804
(Task 72-00-33-990-001)


FLANGE A
FLANGE A1
FLANGE B2
2030
VIEW OF FAN MOUNTED EEC
L−A1142 (0000)
PW V

Fan Cases
Figure 805
(Task 72−00−33−990−001)


A
FAN EXIT BIFURCATION STRUT
2011
BOLT AND WASHER
VIEW A
(COVER REMOVED)
L-A2042 (0000)
PW V

Fan Cases
Figure 806
(Task 72-00-33-990-001)


ELECTRONIC ENGINE CONTROL (EEC)
2162
PAMB (AMBIENT PRESSURE) WATER TRAP
EEC AIR (PT2) SENSE LINE TEE NUT
L−A3315 (0000)
PW V

Fan Cases
Figure 807
(Task 72−00−33−990−001)

ENGINE GENERAL - FAN CASE - INSPECTION/CHECK-02

Task 72-00-33-210-001:

1. Inspect Electronic Engine Control (EEC) Water Traps

A. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P11-014	Alcohol, Isopropyl (PMC 9094)

B. Procedure
See Figure 801.

CAUTION: USE OF LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS COULD RESULT IN CONTAMINATION OF EEC.

(1) Inspect the PB (burner pressure) water trap.

(a) Remove the lockwire and remove the water trap from EEC, PB manifold.

(b) Empty the water trap and inspect the bleed hole to make sure it is clear.

(c) Clean the condensation trap by one of the methods that follow:

NOTE: Ultrasonic cleaning has proven to be effective in throughly cleaning water traps.

1 Preferred Method of Cleaning:

a Clean the hole in the condensation trap with a 0.010 - 0.015 inch (0.254 - 0.381 mm) diameter steel wire.

b Clean the side−walls of the trap with a rough cylindrical bristle brush (with strong fibers such as natural, nylon, polyester or tampico) that will not scratch the trap interior.

NOTE: Do not use ferrous material type brushes. Use a stainless steel brush only.

c Ultrasonic clean the condensation trap by SPOP 91, Section 70−21−00 of the Standard Practices Manual, PN 585005.

d After you have completed the ultrasonic cleaning, rinse the trap with water and blow compressed air through the trap to clean the condensation trap of any unwanted material. You can use a 0.010 − 0.015 inch (0.254 − 0.381 mm) diameter steel wire to remove any obstruction or blockage.

e Do a visual inspection of the trap to make sure there are no obstructions or blockages. A 10X magnifying glass with a light can be used to help in the inspection. If you can see through the hole, the trap can be considered clean and can be reinstalled.

f If any obstruction or blockage is seen, it is permitted to manually insert a 0.010 − 0.015 inch (0.254 − 0.381 mm) diameter drill bit through the hole to remove any blockage. It is permitted to manually insert the drill into the hole without making the hole oversize.

g If cleaning does not remove the unwanted material or blockage, replace the condensation trap.

2 Alternate Method of Cleaning

a Clean the hole in the condensation trap with a 0.010 − 0.015 inch (0.254 − 0.381 mm) diameter steel wire.

b Clean the side−walls of the trap with a rough cylindrical bristle brush (with strong fibers such as natural, nylon, polyester or tampico) that will not scratch the trap interior.

NOTE: Do not use ferrous material type brushes. Use a stainless steel brush only.

c Clean the bottom of the trap with a stainless steel brush (such as a Dremmel #532) and Isopropyl Alcohol P11−014 or equivalent. After you clean the bottom of the trap, check the inside of the trap and the bleed hole to make sure it is free of loose material, fluid, soot or scale deposits. A 0.010 − 0.015 inch (0.254 − 0.381 mm) diameter steel wire or drill bit must be able to easily pass through the bleed hole without collecting or dislodging debris. Do this procedure again, as necessary.

d Rinse the trap with water and blow compressed air through the trap to clean the condensation trap of any unwanted material.

e Do a visual inspection of the trap to make sure there are no obstructions or blockages. A 10X magnifying glass with a light can be used to help in the inspection. If you can see through the hole, the trap can be considered clean and can be reinstalled.

f If cleaning does not remove the unwanted material or blockage, replace the condensation trap.

(d) For basic engines install a water trap to the tee on the manifold. Torque the water trap to 270 − 300 lb−in. (30.506 − 33.895 N.m). Safety the nut with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292. See Figure 801 (Sheet 1).

(e) For engines with commonality parts between Airbus and McDonnell Douglas, install the water trap to the tee on the manifold. Torque the trap to 320 − 350 lb−in. (36.155 − 39.545 N.m). Safety the trap assembly with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292. See Figure 801 (Sheet 2).

(2) Inspect PT4.95 exhaust gas pressure water trap.

(a) Remove the lockwire and the cap and drain the water.

(b) Install the cap to the tee. Torque the cap to 270 − 300 lb−in. (30.506 − 33.895 N.m). Safety the cap with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(3) Inspect the PAMB (ambient pressure) water trap.

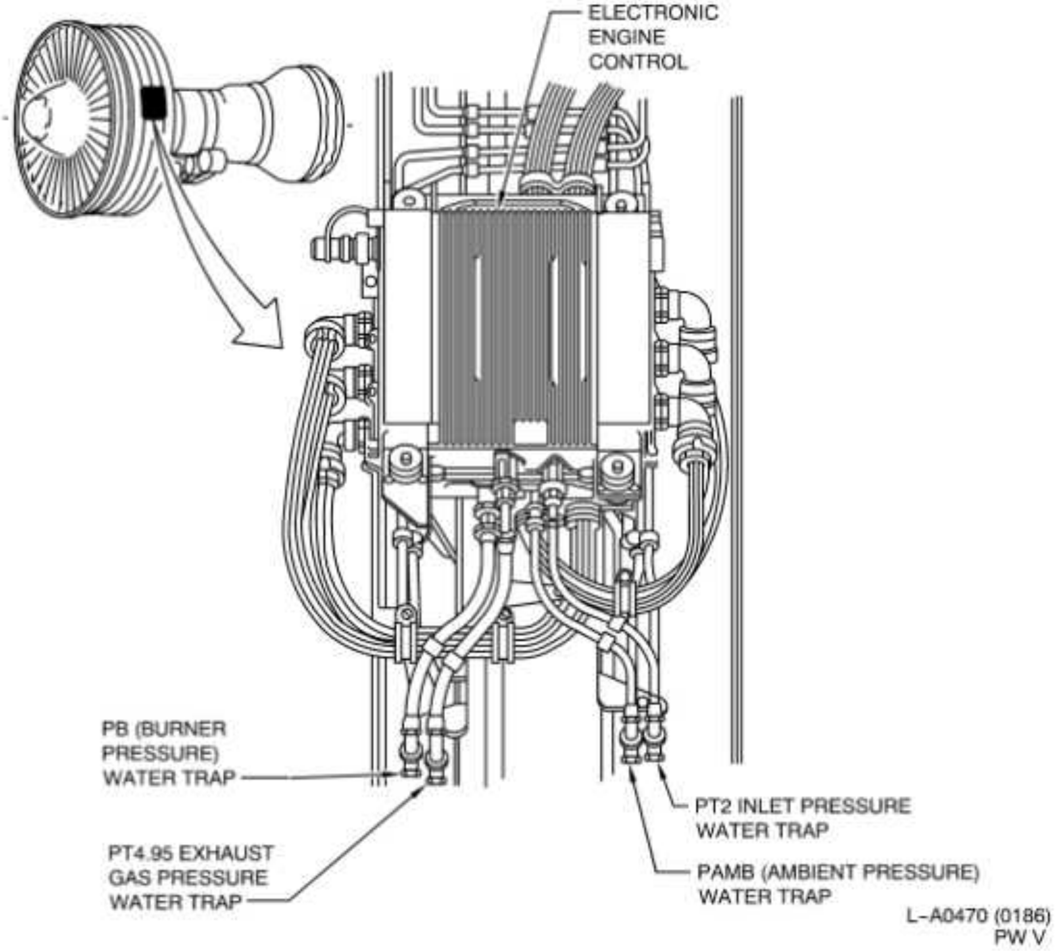
(a) Remove the lockwire and the cap and drain the water.

(b) Install the cap to the tee. Torque the cap to 270 − 300 lb−in. (30.506 − 33.895 N.m). Safety the cap with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

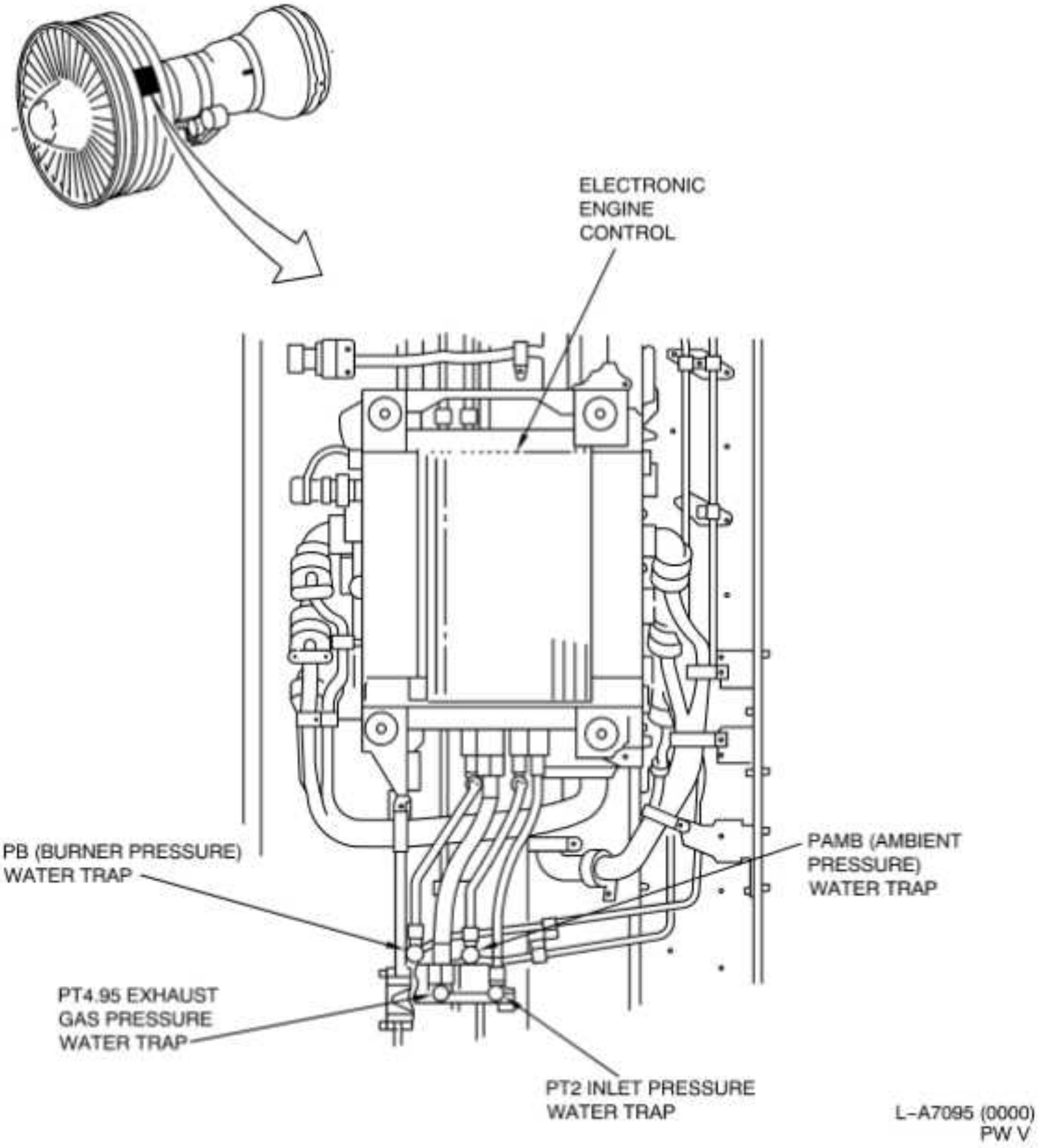
(4) Inspect the PT2 inlet pressure water trap.

(a) Remove the lockwire and the cap and drain the water.

(b) Install the cap to the tee. Torque the cap to 270 − 300 lb−in. (30.506 − 33.895 N.m). Safety the cap with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.


ELECTRONIC ENGINE CONTROL
PB (BURNER PRESSURE) WATER TRAP
PT4.95 EXHAUST GAS PRESSURE WATER TRAP
PT2 INLET PRESSURE WATER TRAP
PAMB (AMBIENT PRESSURE) WATER TRAP
L−A0470 (0186)
PW V

EEC Water Trap Locations (For Basic Engines)
Figure 801 (Sheet 1)
(Task 72−00−33−210−001)


ELECTRONIC ENGINE CONTROL
PB (BURNER PRESSURE) WATER TRAP
PAMB (AMBIENT PRESSURE) WATER TRAP
PT4.95 EXHAUST GAS PRESSURE WATER TRAP
PT2 INLET PRESSURE WATER TRAP
L−A7095 (0000)
PW V

EEC Water Trap Locations (For Engines With Commonality Parts Between Airbus And McDonnell Douglas)
Figure 801 (Sheet 2)
(Task 72−00−33−210−001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − FAN CASE − INSPECTION/CHECK−03

Task 72−00−33−210−002:

1. Inspect The Intercompressor (2.5) Bleed System

A. Equipment And Materials Required − None

B. Procedure

(1) Inspect the intercompressor (2.5) bleed valve actuator for leakage. Replace the actuator or the adapter packings if leaks are found.

(2) Inspect the 2.5 bleed valve screen. See Figure 801.

(a) Inspect the plastic bleed screen for cracks, missing pieces and distortion.

(b) Cracks through two adjacent webs in any direction or location are acceptable.

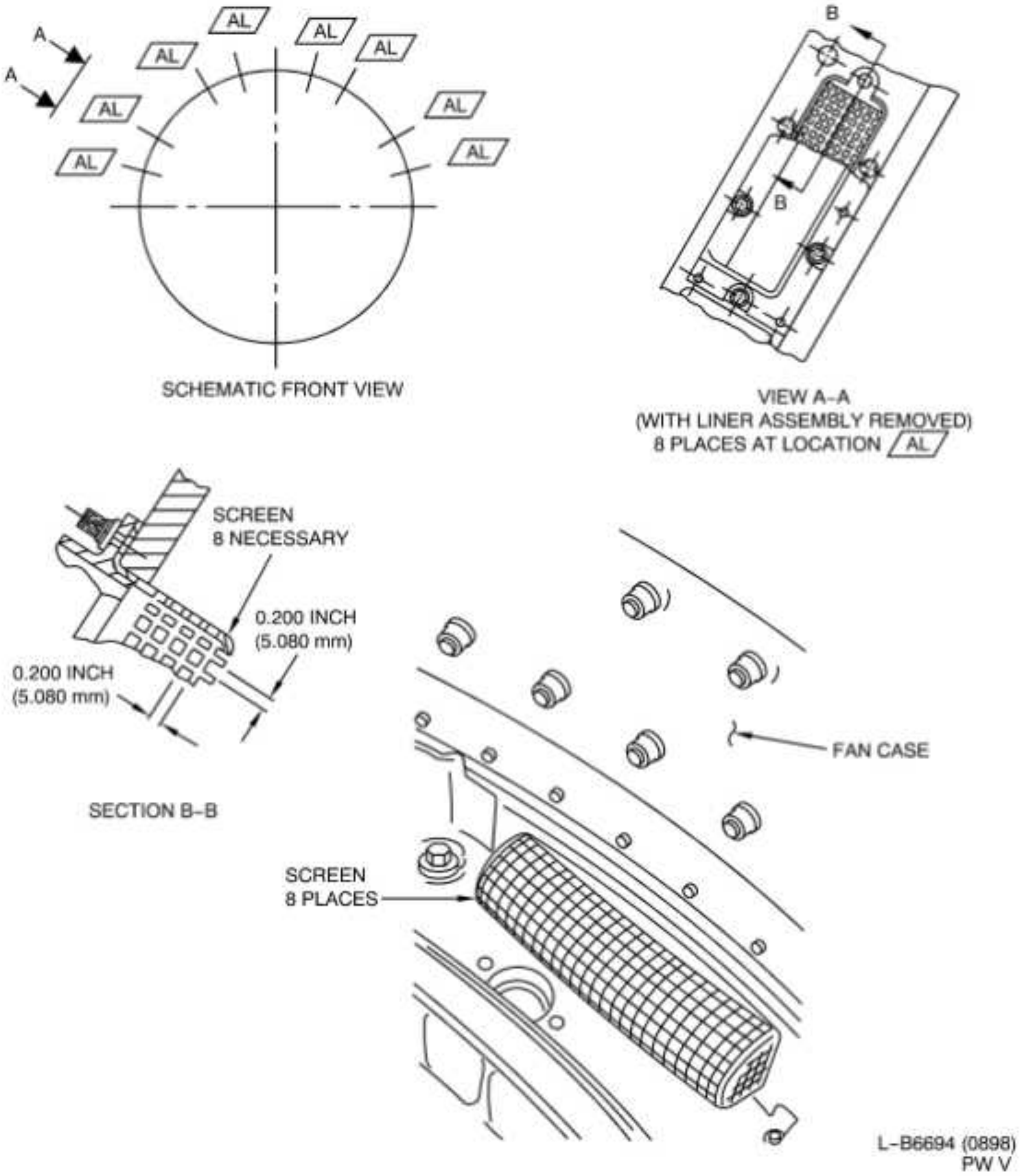
(c) Cracks are limited to three locations. The cracks must be separated by two or more webs which are not cracked.

(d) Missing pieces are not permitted.

(e) Unlimited distortion is permitted as follows:

1 Edge gaps caused by the distortion are no wider than the width of the screen mesh, 0.200 inch (5.080 mm).

(f) Replace screens that are more than the acceptable limits. See 72−33−00, Assembly−01 Task 72−33−00−400−001.


A
A
AL
AL
AL
AL
AL
AL
AL
AL
SCHEMATIC FRONT VIEW
B
B
VIEW A−A
(WITH LINER ASSEMBLY REMOVED)
8 PLACES AT LOCATION AL
SCREEN
8 NECESSARY
0.200 INCH
(5.080 mm)
0.200 INCH
(5.080 mm)
SECTION B−B
FAN CASE
SCREEN
8 PLACES
L−B6694 (0898)
PW V

Inspection Of The 2.5 Bleed Valve Screens
Figure 801
(Task 72−00−33−210−002)

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ENGINE GENERAL − FAN CASE − INSPECTION/CHECK−04

Task 72−00−33−210−003:

1. Examine The Sealant At The Bifurcation Fairing

A. Equipment And Materials − None

B. Procedure

(1) Examine the sealant at the bifurcation fairing. Refer
R to Figure 801, Figure 802, and Table 801.

NOTE: The access cover is (Post SB PW4ENG 72−161).

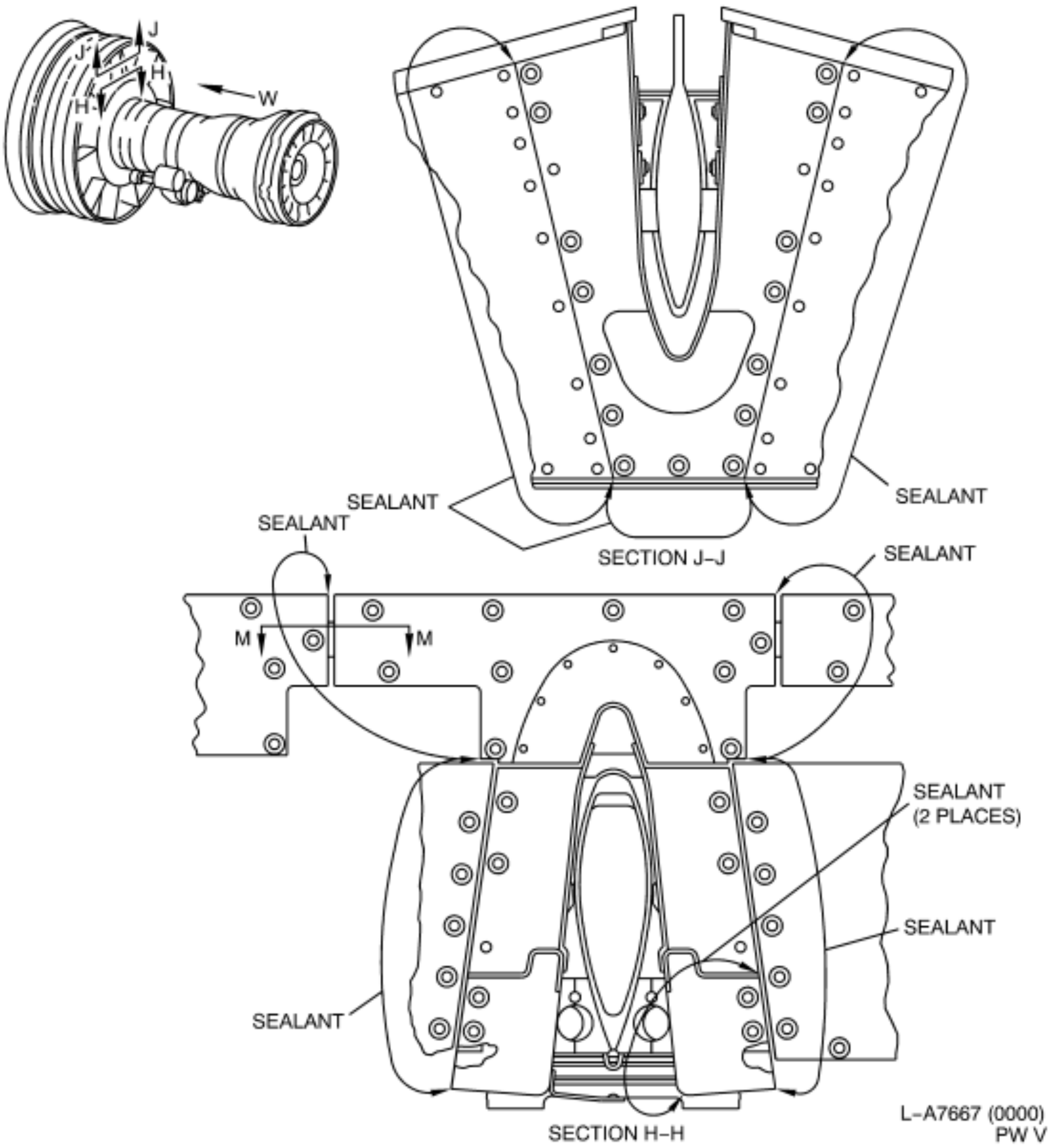
ENGINE GENERAL − FAN CASE − INSPECTION/CHECK−04

Inspect	Serviceable Limits	Repairable Limits	Repair
Fairings at 12 o'clock for damaged or loose sealant	Not permitted	No limit	−01

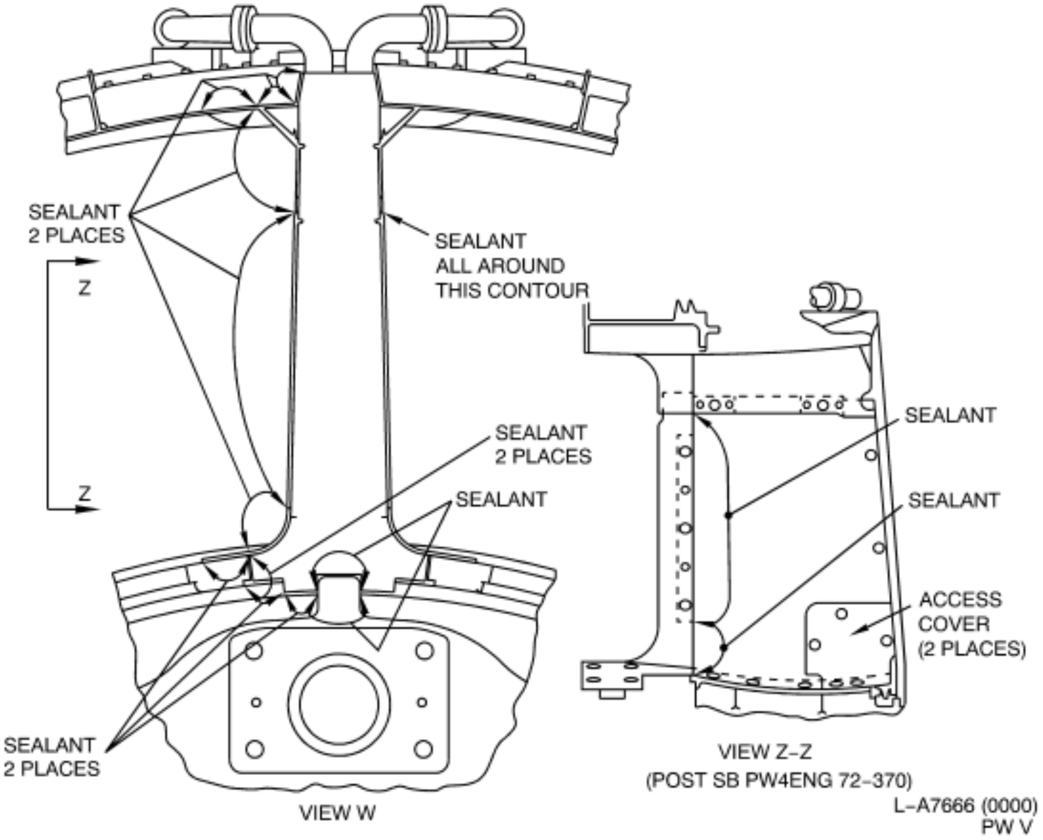
NOTE: The repairs and their task numbers are given below.

R   Repair−01 (Task 72−00−33−300−001−001)

Visual Inspection
Table 801


J
J
H
H
W
SEALANT
SEALANT
SEALANT
SECTION J−J
SEALANT
M
M
SEALANT
(2 PLACES)
SEALANT
SEALANT
SECTION H−H
L−A7667 (0000)
PW V

Visual Inspection
Figure 801
(Task 72−00−33−210−003)


SEALANT
2 PLACES
SEALANT
ALL AROUND
THIS CONTOUR
Z
Z
SEALANT
2 PLACES
SEALANT
SEALANT
2 PLACES
VIEW W
SEALANT
SEALANT
ACCESS
COVER
(2 PLACES)
VIEW Z−Z
(POST SB PW4ENG 72−370)
L−A7666 (0000)
PW V

Visual Inspection
R Figure 802
(Task 72−00−33−210−003)

ENGINE GENERAL - FAN CASE - INSPECTION/CHECK-05

Task 72-00-33-210-004:

1. Do A Check Of The Clearance Between The Trailing Edges Of The Fan Exit (Front) Liner Segment Assemblies And The (Rear) Liner Segment Assemblies

NOTE: This check is necessary if you replace a (front) liner in 72-33-02, Assembly-01 (Task 72-33-02-440-001), 72-00-33, Installation-01 (Task 72-00-33-420-001) or 72-00-33, Installation-14 (Task 72-00-33-450-001).

This check is not necessary if the (rear) liner is an acoustical (hush-kit) liner.

A. Equipment and Materials

Standard Tools:
No. 10 Torq-set Drive

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-038	Cheesecloth, Unsized
P09-014	Sealant, Silicone Rubber (PWA 36003)
P09-027	Sealant, Silicone Rubber (PWA 36003-2)
P11-014	Alcohol, Isopropyl (PMC 9094)

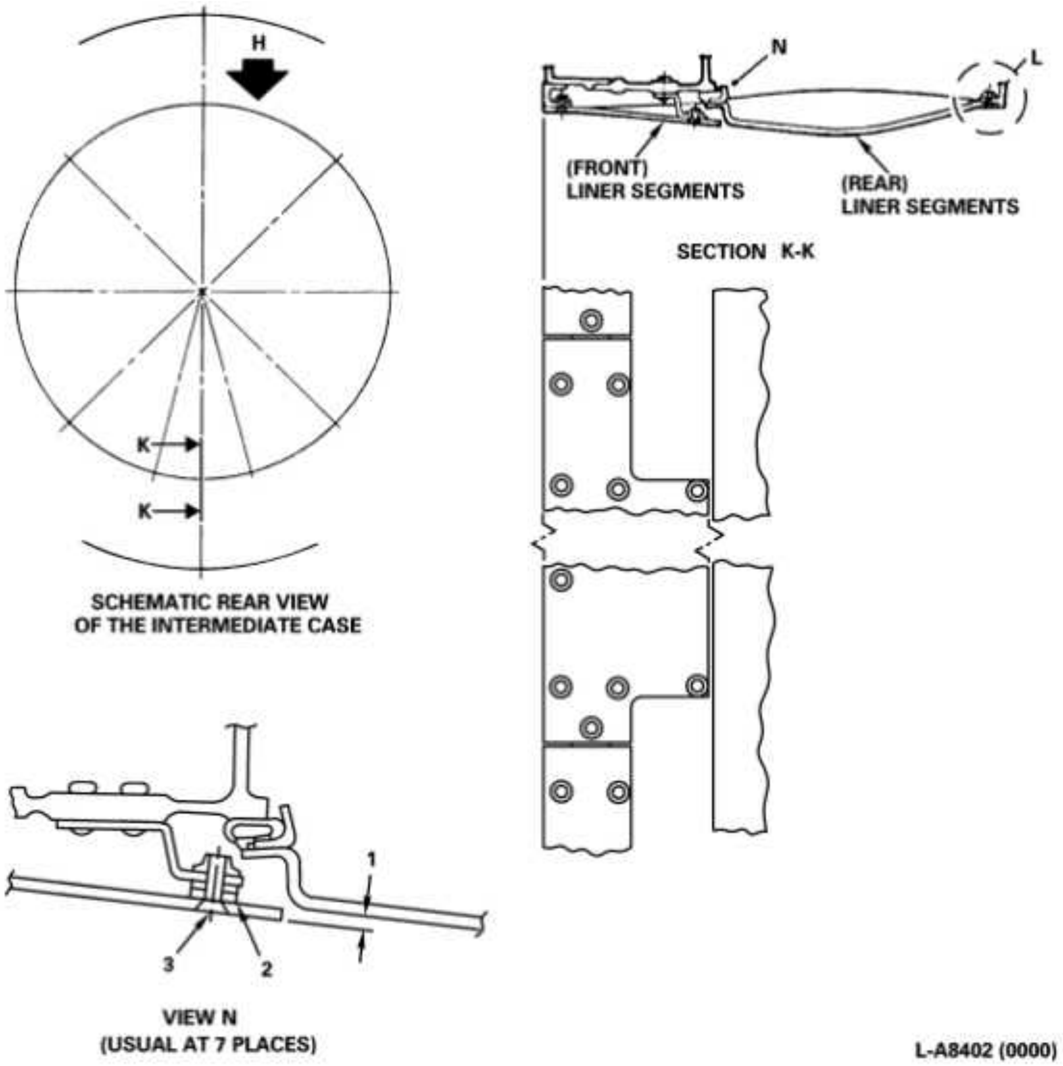
B. Procedure

(1) (References 751 and 1012) Do a check of the clearance between the trailing edges of all the fan exit (front) liner segment assemblies and the front of the fan exit (rear) liner segment assemblies. See Figure 401.

(2) (Reference 1012) Do a check of the clearance between the front and rear areas of the fan exit inner (bifurcation) fairing at Flange D. See Figure 401.

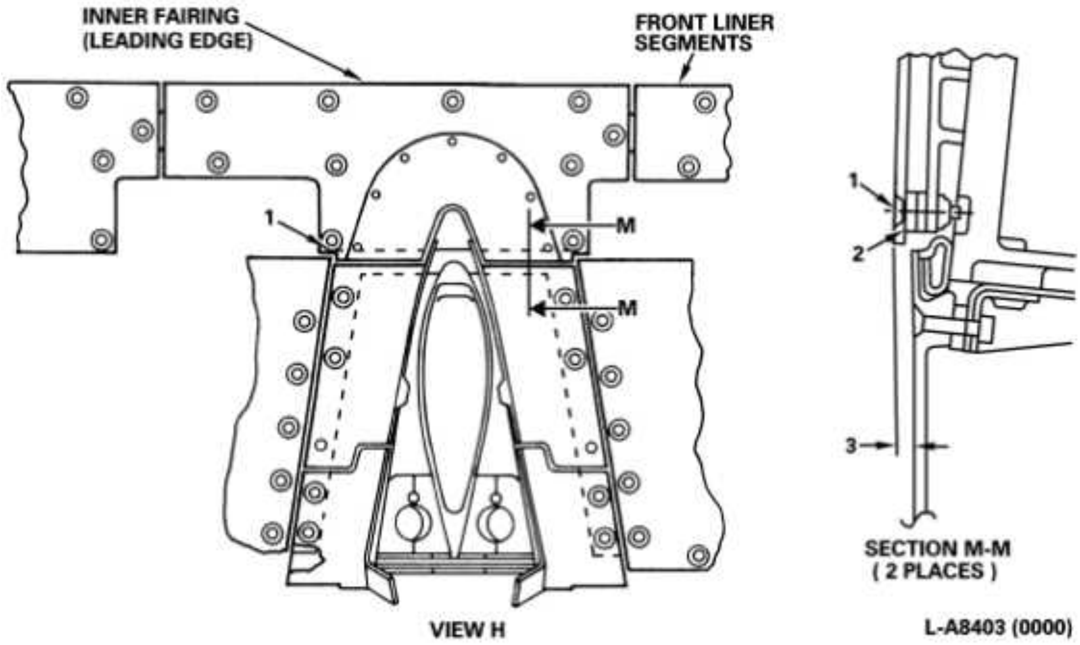
NOTE: Pre SB PW4ENG 72-370 inner fairings are one-piece. Post SB PW4ENG 72-370 inner fairings are two-piece.

(3) Where the clearance is not correct, attach washers to the boltholes at the trailing edges of the (front) liners as follows. See Table 401 for washer thicknesses.


H
K
K
SCHEMATIC REAR VIEW
OF THE INTERMEDIATE CASE
N
L
(FRONT)
LINER SEGMENTS
(REAR)
LINER SEGMENTS
SECTION K-K
1
3
2
VIEW N
(USUAL AT 7 PLACES)
L-A8402 (0000)

1. 0.000 - 0.040 Inch (0.00 - 1.02 mm) Clearance Necessary
2. Washers, 43 Places Possible. Choose The Correct Class And Quantity (0 - 4).
3. Trailing Edge Screws, 43 Places. Choose The Correct Screw.

Inspection Of The Clearance Between
The (Front) And (Rear) Liners
(Positions Other Than 12 O'Clock)
Figure 401 (Sheet 1)
(Task 72-00-33-210-004)


INNER FAIRING (LEADING EDGE)
FRONT LINER SEGMENTS
1
M
M
VIEW H
1
2
3
SECTION M-M (2 PLACES)
L-A8403 (0000)

1. Trailing Edge Screws, 2 Places. Choose The Correct Screw.
2. Washers, 2 Places Possible. Choose The Correct Class And Quantity (0 - 4).
3. 0.000 - 0.040 Inch (0.00 - 1.02 mm) Clearance Necessary

Inspection Of The Clearance Between
The (Front) And (Rear) Liners
(At 12 O'Clock Position)
Figure 401 (Sheet 2)
(Task 72-00-33-210-004)

Class	Washer Thickness − Inch (mm)
1	0.009 − 0.011 (0.229 − 0.279)
2	0.019 − 0.021 (0.483 − 0.503)
3	0.029 − 0.031 (0.737 − 0.787)
4	0.039 − 0.041 (0.991 − 1.041)
5	0.049 − 0.051 (1.244 − 1.295)
6	0.099 − 0.101 (2.514 − 2.565)

Washer Thickness
Table 401

(a) Remove the screws from the trailing edges of the (front) liners and/or fairing at Flange D.

(b) Clean the washers and the area around the boltholes. Use a clean piece of Cheesecloth (P05−038) that is moist with Alcohol (P11−014). Dry the surfaces fully in air that is at room temperature. There must be no alcohol on the parts when sealant is applied.

(c) Put the washers in the correct position on the liner. Install screws if necessary.

(d) Bond the washers to the (front) liners with a fillet of Sealant (P09−014) or (P09−027) all around. Cure the sealant in air that is at room temperature for four hours before you touch it.

NOTE: It is permitted to have a very small quantity of sealant between the washer and the liner.

(e) Attach the trailing edges of the liners with screws, threads lubricated with Engine Oil (P03−001). Refer to Table 402 for screw lengths. Torque the screws to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(f) Attach the edge of the inner fairing at Flange D with screws, threads lubricated with Engine Oil (P03−001). Refer to Table 402 for screw lengths. Tighten the screws against the fairing.

Screw PN	Screw Length	Washer Thickness	Quantity of Screws
593111	0.495 - 0.505	0.000 - 0.015	0 - 45 As Necessary
ST1382-09	0.542 - 0.562	0.016 - 0.070	0 - 45 As Necessary
ST1382-10	0.594 - 0.625	0.071 - 0.130	0 - 45 As Necessary
ST1382-11	0.656 - 0.687	0.131 - 0.210	0 - 45 As Necessary

Washer Thickness And Screw Lengths
Table 402

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-33-210-010:

1. Fan Case Module Assembly Visual Inspection

A. Equipment And Materials Necessary - None

B. General Inspection Limits

NOTE: All applicable Airworthiness Directives (AD's) must be complied with and these directives takes precedence over all inspections or repairs given in this module inspection.

(1) This inspection does not permit time since overhaul to be set to zero.

(2) These procedures give instructions for the visual inspection of the fan case module assembly after removal from the engine. Do these procedures before you do the preservation, packing or module installation procedure. This procedure is to find those easy to see types of damage, which can make it necessary to do more disassembly, inspection or repair. For the general visual inspection instructions, refer to Section 70-31-00 in the Standard Practices Manual, PN 585005.

(3) The inspection table in this section is applicable to the fan case modules with some, none or all of the components installed. You do not have to disassemble the module assembly to do this inspection. You can choose to apply individual limits to those areas that are visible at all stages of disassembly. If a condition shows that there can be damage that you cannot see, remove a component to fully examine the damaged area. Use the applicable procedures in this manual to remove the component and do an inspection by step (4).

(4) Remove all the components that you find not serviceable at the modular level. Send the applicable components for more inspection and repair at the component level maintenance. Refer to Section 72-33-00 in the PW4000 Series CIR, PN 51A357. Component that you remove from the fan case module, will need a Cleaning, Inspection and Repair Manual component level inspection/check.

(5) Unless given differently, non-toleranced the areas given in this section are to corners, points of tangency between surfaces or at the points opposite to one of these locations.

ENGINE GENERAL − FAN CASE − INSPECTION/CHECK−10

C. Procedure

(1) Visually examine the fan rotor duct segment assemblies for surface damage and wear. See Table 801 and Figure 801.

NOTE: The first configuration of duct segments has continuous grooves. The alternate configuration of duct segments has interrupted grooves.

(2) Visually examine the ID gaspath surface of the fan case and fan exit case between the fan rubstrip and fan exit guide vanes for surface damage. See Table 802 and Figure 802.

(3) Visually examine the external surfaces on the fan case and fan exit case and vane assembly for surface damage. See Table 803 and Figure 803.

(4) Visually examine the fan exit guide vane airfoils and ID and OD bases for surface damage. See Table 804 and Figure 804.

(5) Visually examine the fan exit inner case and 2.5 bleed duct assembly for wear and surface damage. See Table 805 and Figure 805.

(6) Visually examine the fan exit liner assemblies and bleed screens for damage. See Table 806 and Figure 806.

R (7) Visually examine the fan exit inner case rear side fire
R ablative blanket assembly or coat for missing or
R damaged areas, tears or punctures. See Table 807 and
R Figure 807.

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Duct segments for: (Figure 801, Sheet 2) Missing rib sections			
Total for one rib, each segment	3.000 inch (76.200 mm) maximum circumferential length	6.000 inch (152.400 mm) maximum circumferential length	Refer to Section 72-33-01, Repair-03, Repair-07, Repair-08 and Repair-09 in the PW4000 Series CIR, PN 51A357.
Total for one rib, all segments	10.000 inch (254.000 mm) maximum circumferential length	15.000 inch (381.000 mm) maximum circumferential length	Refer to Section 72-33-01, Repair-03, Repair-07, Repair-08 and Repair-09 in the PW4000 Series CIR, PN 51A357.
Separation from an area on an adjacent rib where there is no rib	6.000 inches (152.400 mm) minimum	12.000 inches (304.800 mm) minimum	Refer to Section 72-33-01, Repair-03, Repair-07, Repair-08 and Repair-09 in the PW4000 Series CIR, PN 51A357.
Cracks			

Fan (Rubstrip) Duct Segment Inspection
Table 801

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Crack width	0.015 inch (0.381 mm) maximum	0.125 inch (3.175 mm) maximum	Refer to Section 72−33−01, Repair−06, Repair−08 and Repair−09 in the PW4000 Series CIR, PN 51A357.
Crack spacing	4.000 inches (101.600 mm) minimum separation		Refer to Section 72−33−01, Repair−06, Repair−08 and Repair−09 in the PW4000 Series CIR, PN 51A357.
Circumferential crack length	4.000 inches (101.600 mm) maximum length	6.000 inches (152.400 mm) maximum	Refer to Section 72−33−01, Repair−06, Repair−08 and Repair−09 in the PW4000 Series CIR, PN 51A357.
Axial crack length	4.000 inches (101.600 mm) maximum length	Replace the segment	Refer to Section 72−33−01, Repair−08 and Repair−09 in the PW4000 Series CIR, PN 51A357.
	0.250 inch (6.350 mm) minimum distance from the axial edge of the panel		

Fan (Rubstrip) Duct Segment Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Holes duct segment surface (Figure 801, Sheet 2)			
Dimensions at widest point	0.125 inch (3.175 mm) maximum	6.000 inch (152.400 mm) maximum circumferential length of the repaired area, each segment. 12.000 inch (304.800 mm) minimum separation between the incidents. 15.000 inch (381.000 mm) maximum circumferential length, all segments.	Refer to Section 72-33-01, Repair-05, Repair-08 and Repair-09 in the PW4000 Series CIR, PN 51A357.
Depth	0.125 inch (3.175 mm) maximum	A maximum of full thickness of the duct segment	
Disbond			
NOTE: Examine the duct segments to know if they are bonded to the case by lightly tapping the rubstrip while you listen for a difference in sound. The machined hollow cavities can cause small differences in sound.			
Fully unbonded segment	Not permitted	Replace the fan duct segments	Refer to Section 72-33-01, Repair-08 and Repair-09 in the PW4000 Series CIR, PN 51A357.

Fan (Rubstrip) Duct Segment Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Not fully unbonded segment	See Figure 801, Sheet 2	Replace the fan duct segments with unbonded areas more than the serviceable limits.	Refer to Section 72-33-01, Repair-08 and Repair-09 in the PW4000 Series CIR, PN 51A357.
Leading edge retaining pins for looseness or missing	Not permitted	Replace the retaining pins.	Refer to Section 72-33-01, Repair-08 and Repair-09 in the PW4000 Series CIR, PN 51A357.

Examine the rib wear with PWA 29156 Gage by the procedure that follows:

(a) Take a measurement at each of the eight positions in the third groove from the front (large outer diameter) of the fan case. See Figure 801 (Sheet 1).

(b) Calculate the average of the readings for the three positions in a group as noted below. Do the same for the three positions that are in each of the other groups (Group A thru Group F).

(C) Locations of gage readings.

Group	Position
A	7, 8, 1
B	8, 1, 2
C	1, 2, 3
D	3, 4, 5
E	4, 5, 6
F	5, 6, 7

Fan (Rubstrip) Duct Segment Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Rib wear	0.140 inch (3.556 mm) minimum overall average depth Group A − Group F	Duct segments worn to values below the serviceable limits must be repaired.	Refer to Section 72−33−01, Repair−03, Repair−07, Repair−08 and Repair−09 in the PW4000 Series CIR, PN 51A357.
	No individual group value below 0.117 inch (2.972 mm).		
	No more than two group averages below 0.140 inch (3.556 mm).		

Fan (Rubstrip) Duct Segment Inspection
Table 801 (Continued)

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Case inner diameter surface for: (Figure 802)			
R	Cracks	Not permitted		Remove from service.
R	Rear retention lip for surface damage	Not permitted	Rubstrip rear retention lip damage can be blended to 0.130 inch (3.302 mm) maximum axially by 1.500 inch (38.100 mm) maximum circumferentially.	Blend to remove the damage. Refer to Section 70-45-00, SPOP 533 in the Standard Practices Manual, PN 585005.
R	1 Nicks, dents and other surface damage in the fan case	Not permitted	See the repair.	Refer to Section 72-33-01 Repair-02 in the PW4000 Series CIR, PN 51A357.
R	2 Superficial surface damage in the fan exit case	Not Permitted	See the repair.	Refer to Section 72-33-03, Repair-02 in the PW4000 Series CIR, PN 51A357.

Gaspath Surface Inspection
Table 802

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
External surfaces other than flanges: (Figure 803, Sheet 1)			
Cracks	Not Permitted		Replace from service.
1 Nicks, (sharp) dents, corrosion pits, other surface on the fan exit damage	Not Permitted	See the repair.	Refer to Section 72-33-01, Repair-02 in the PW4000 Series CIR, PN 51A357.
2 Superficial surface damage on the fan exit case	Not Permitted	See the repair.	Refer to Section 72-33-03, Repair-02 in the PW4000 Series CIR, PN 51A357.
		Corrosion adjacent to the fan exit guide vane outer diameter bolt holes 0.020 inch (0.508 mm) maximum depth.	Can be wire brush cleaned and anodized

NOTE: Examine the damage in the case by local fluorescent penetrant inspection to make sure that there are no cracks. Refer to Section 70-33-00 SPOP 70 (normal sensitivity) in the Standard Practices Manual, PN 585005.

External Surface Inspection
Table 803

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	FEGV retaining pin lockwire, missing, loose or damaged (Pre-SB PW4ENG 72-262) (Figure 803, Sheet 1)	Not permitted	Replace	Refer to Section 72-33-02, Assembly-01 in the PW4152 Series Engine Manual, PN 50A443.
R	FEGV retaining nuts, missing, loose or damaged (Post-SB PW4ENG 72-262) (Figure 803, Sheet 1)	Not permitted	Replace	Refer to Section 72-33-02, Assembly-01 in the PW4152 Series Engine Manual, PN 50A443.
R	External Flange A: (Figure 803, Sheet 1 and Figure 803, Sheet 2)			
R	Area A			
R	Cracks	Not permitted		Remove from service.
R	Surface damage, nicks, corrosion pits	0.005 inch (0.127 mm) depth maximum. Remove sharp edges and raised material.	0.010 inch (0.254 mm) maximum depth by 1.000 inch (25.400 mm) maximum circumferential length for each incident. 24.000 inch (609.600 mm) maximum total circumferential length, all blends.	Refer to Section 72-33-01, Repair-02 in the PW4000 Series CIR, PN 51A357.

External Surface Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Distortion or bending	0.020 inch (0.508 mm) maximum axial deflection		
Area G			
Cracks	Not permitted		Remove from service.
Surface damage, nicks, corrosion pits and dents	0.005 inch (0.127 mm) maximum depth with no sharp edges and raised material.	0.040 inch (1.016 mm) maximum depth by 1.000 inch (25.400 mm) maximum circumferential length for each incident. 24.000 inch (609.600 mm) maximum total circumferential length, all blends.	Refer to Section 72-33-01, Repair-02 in the PW4000 Series CIR, PN 51A357.
Distortion or bending	0.050 inch (1.270 mm) maximum axial deflection		
Flange A1: (Figure 803, Sheet 1 and Figure 803, Sheet 2)			
Area B			
Cracks	Not permitted		Remove from service.

External Surface Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Surface damage, nicks, corrosion pits and dents	0.005 inch (0.127 mm) maximum depth with no sharp edges and raised material.	0.010 inch (0.254 mm) maximum depth by 1.000 inch (25.400 mm) maximum circumferential length for each incident. 24.000 inch (609.600 mm) maximum total circumferential length, all blends.	Refer to Section 72-33-01, Repair-02 in the PW4000 Series CIR, PN 51A357.
Flange ring segment (if installed, Figure 803, Sheet 1 and Figure 803, Sheet 2)			
Area H for:			
Surface damage	0.015 inch (0.381 mm) maximum depth. No sharp edges or raised material is permitted.	0.025 inch (0.635 mm) maximum depth for each incident and must not be continuous around the flange. Fluorescent penetrant inspection is not necessary.	Refer to Section 72-33-01, Repair-02 in the PW4000 Series CIR, PN 51A357.
		0.025 - 0.050 inch (0.64 - 1.27 mm) depth. 1.000 inch minimum separation	Refer to Section 72-33-01, Repair-02 in the PW4000 Series CIR, PN

External Surface Inspection
Table 803 (Continued)

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
	(CONTINUED)			
R			from other. 0.025 − 0.050 inch (0.64 − 1.27 mm) depth damage. 10.000 inch maximum total circumferential length for each segment.	51A357.
R	Area J for:			
R	Surface damage	0.015 inch (0.381 mm) maximum depth. No sharp edges or raised material is permitted.	0.025 inch (0.635 mm) maximum depth for each incident and must not be continuous around the flange. Fluorescent penetrant inspection is not necessary.	Refer to Section 72−33−01, Repair−02 in the PW4000 Series CIR, PN 51A357.
R			0.025 − 0.050 inch (0.64 − 1.27 mm) depth. 1.000 inch minimum separation from other. 0.025 − 0.050 inch (0.64 − 1.27 mm) depth damage. 10.000 inch maximum total circumferential length for each segment.	Refer to Section 72−33−01, Repair−02 in the PW4000 Series CIR, PN 51A357.

External Surface Inspection
Table 803 (Continued)

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Surface damage, nicks, corrosion pits and dents	0.005 inch (0.127 mm) maximum depth with no sharp edges and raised material.	0.010 inch (0.254 mm) maximum depth by 1.000 inch (25.400 mm) maximum circumferential length for each incident. 24.000 inch (609.600 mm) maximum total circumferential length, all blends.	Refer to Section 72-33-01, Repair-02 in the PW4000 Series CIR, PN 51A357.
R	Distortion or bending	0.050 inch (1.270 mm) maximum axial deflection		
R	Flange B (fan exit outer case)			
R	Area J: (Figure 803, Sheet 1, Figure 803, Sheet 3 and Figure 803, Sheet 4)			
R	Cracks	Not permitted		Remove from service.
R	Surface damage, nicks, corrosion pits and dents (without corner areas)	0.005 inch (0.127 mm) maximum depth with no sharp edges and raised material.	0.010 inch (0.254 mm) maximum depth. 2.000 inch (50.800 mm) maximum circumferential length for each incident. 24.000 inch (609.600 mm)	Refer to Section 72-33-03, Repair-02 in the PW4000 Series CIR, PN 51A357.

External Surface Inspection
Table 803 (Continued)

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
	(CONTINUED)			
R			maximum total circumferential length, all incidents.	
R	Distortion, dents or bending	0.020 inch (0.508 mm) axial deflection maximum		
R	If you can access botlholes for:			
R	Corrosion	Not permitted	Remove the corrosion 0.365 inch (9.271 mm) maximum diameter. Repair 30 holes maximum.	Refer to Section 72-33-03, Repair-13 in the PW4000 Series CIR, PN 51A357.
R	Corner damage			
R	1 Distance from bolt holes		0.150 inch (3.810 mm) minimum	Refer to Section 72-33-03, Repair-02 in the PW4000 Series CIR, PN 51A357.
R	2 Depth of each incident	0.020 inch (0.508 mm) maximum	0.190 inch (4.826 mm) maximum depth. 2.000 inch (50.800 mm) maximum circumferential length for each incident.	Refer to Section 72-33-03, Repair-02 in the PW4000 Series CIR, PN 51A357.

External Surface Inspection
Table 803 (Continued)

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
	(CONTINUED)			
R			10.000 inch (254.000 mm) maximum total circumferential length of all corner area blends.	
R	3 Chamfer surface	0.020 inch (0.508 mm) maximum	Chamfer 0.065 inch (1.651 mm) maximum locally or all around.	Refer to Section 72-33-03, Repair-02 in the PW4000 Series CIR, PN 51A357.
R	4	0.020 inch (0.508 mm) maximum	Chamfer 0.030 inch (0.762 mm) maximum locally or all around.	
R	Flange B1			
R	Area G: (Figure 803, Sheet 1, Figure 803, Sheet 3 and Figure 803, Sheet 4)			
R	Cracks	Not permitted	Weld repair 12.000 inch (304.800 mm) maximum circumferential length and 8.00 sq-in (5161. sq-mm) maximum area for each incident. 0.500 inch (12.700 mm) minimum	Refer to Section 72-33-03, Repair-03 in the PW4000 Series CIR, PN 51A357.

External Surface Inspection
Table 803 (Continued)

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	(CONTINUED)		distance from the case wall. 0.500 inch (12.700 mm) minimum separation from other welds. 16.00 sq−in (10323. sq−mm) maximum total area of all welds.	
R	Surface damage, nicks, corrosion pits and dents (without outer diameter surface and outer diameter corner damage)	0.005 inch (0.127 mm) maximum depth with no sharp edges and raised material.	0.010 inch (0.254 mm) maximum depth. 2.000 inch (50.800 mm) maximum circumferential length for each incident. 24.000 inch (609.600 mm) maximum total circumferential length, all incidents.	Refer to Section 72−33−03, Repair−02 and Repair−03 in the PW4000 Series CIR, PN 51A357.
R	Outer diameter surface damage	Not permitted	0.040 inch (1.016 mm) maximum depth. 4.000 inch (101.600 mm) maximum circumferential length for each incident. 24.000 inch (609.600 mm) maximum total circumferential length, all incidents.	Refer to Section 72−33−03, Repair−02 and Repair−03 in the PW4000 Series CIR, PN 51A357.

External Surface Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Distortion or bending	Not permitted	See Repair-03. This repair is applicable to the parts with damage that results in a Flange B to B1 distance of 0.700 - 1.910 inch (18. - 49. mm).	Refer to Section 72-33-03, Repair-03 in the PW4000 Series CIR, PN 51A357.
Corner damage			
5 Depth of each incident.	0.020 inch (0.508 mm) maximum	0.060 inch (1.524 mm) maximum depth. 1.000 inch (25.400 mm) maximum circumferential length for each incident. 24.000 inch (609.600 mm) maximum total circumferential length, all incidents.	Refer to Section 72-33-03, Repair-02 and Repair-03 in the PW4000 Series CIR, PN 51A357.
Flange B2 (fan exit outer case)			
Area H: (Figure 803, Sheet 1 and Figure 803, Sheet 3)			
Cracks	Not permitted		Remove from service.

External Surface Inspection
Table 803 (Continued)

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Surface damage, nicks, corrosion pits and dents (without corner damage)	0.005 inch (0.127 mm) maximum depth with no sharp edges and raised material.	0.010 inch (0.254 mm) maximum depth. 2.000 inch (50.800 mm) maximum circumferential length for each incident. 24.000 inch (609.600 mm) maximum total circumferential length, all incidents.	Refer to Section 72-33-03, Repair-02 and Repair-03 in the PW4000 Series CIR, PN 51A357.
R	Distortion or bending	Not permitted		Remove from service.
R	Corner damage			
R	6 Depth of each incident.	0.020 inch (0.508 mm) maximum depth	0.060 inch (1.524 mm) maximum depth. 1.000 inch (25.400 mm) maximum circumferential length for each incident. 24.000 inch (609.600 mm) maximum total circumferential length, all incidents.	Refer to Section 72-33-03, Repair-02 in the PW4000 Series CIR, PN 51A357.
R	Flange C			
R	Area K: (Figure 803, Sheet 1, Figure 803, Sheet 3 and Figure 803, Sheet 4)			

External Surface Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Cracks	Not permitted		Remove from service.
7 Surface damage, nicks, corrosion pits and dents	0.005 inch (0.127 mm) maximum depth with no sharp edges and raised material.	0.015 inch (0.381 mm) maximum depth locally or all around	Refer to Section 72−33−03, Repair−02 in the PW4000 Series CIR, PN 51A357.
Distortion or bending	0.020 inch (0.508 mm) maximum axial deflection		
Bolthole corrosion	Not permitted	Remove the corrosion 0.315 inch (8.001 mm) maximum diameter. Three holes maximum.	Wire brush clean not to be more than the repairable limit. Fluorescent penetrant inspection by SPOP 70, normal sensitivity. Refer to Section 70−33−00 in the Standard Practices Manual, PN 585005. Anodize touch−up by SPOP 42. Refer to Section 70−44−01 in the Standard Practices Manual, PN 585005.

External Surface Inspection
Table 803 (Continued)

ENGINE GENERAL − FAN CASE − INSPECTION/CHECK−10

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Corner damage			
R	8 Depth	0.020 inch (0.508 mm) maximum	0.065 inch (1.651 mm) maximum locally or all around or 0.420 inch (10.668 mm) maximum for one location only.	Refer to Section 72−33−03, Repair−02 in the PW4000 Series CIR, PN 51A357.
R	9 Distance from bolthole		0.500 inch (12.700 mm) minimum distance from the nearest bolthole.	

External Surface Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Missing FEGV	Not permitted	Install replacement FEGV.	Refer to Section 72-33-02, Assembly-01 in the PW4152 Series Engine Manual, PN 50A443.
FEGV airfoil leading edge surface: (Without metal shield) (Figure 804, Sheet 1)			
Area F			
Nicks, dents, tears, decrease in chord (axial length)	0.030 inch (0.762 mm) maximum axial depth and 0.100 inch (2.540 mm) maximum radial length. 0.500 inch (12.700 mm) maximum total radial length each vane. 0.500 inch (12.700 mm) minimum separation for damage more than 0.050 inch (1.270 mm) in radial length.	0.100 inch (2.540 mm) maximum axial depth for each incident. No limit on the number of decreased chord length areas.	Refer to Section 72-33-02, Repair-06 and Section 72-33-05, Repair-02 and Repair-03 in the PW4000 Series CIR, PN 51A357.
Delamination in the wire mesh leading edge configuration	Not permitted	Local delamination. See Repair-02.	Refer to Section 72-33-05, Repair-02 in the PW4000 Series CIR, PN 51A357.

FEGV Airfoil And Base Inspection
Table 804

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area G			
Nicks, dents and tears, decrease in chord (axial length)	0.030 inch (0.762 mm) maximum axial depth by 0.100 inch (2.540 mm) maximum radial length. 0.500 inch (12.700 mm) maximum total radial length all damages. 0.500 inch (12.700 mm) minimum separation for damage more than 0.050 inch (1.270 mm) in radial length.	0.150 inch (2.540 mm) maximum axial depth. A maximum of full length of vane. No minimum separation.	Refer to Section 72−33−05, Repair−02 in the PW4000 Series CIR, PN 51A357.
		0.250 inch (6.350 mm) maximum depth. Total damage limited to 20 percent of the vane length. 3.000 inch (76.200 mm) minimum separation.	Refer to Section 72−33−05, Repair−03 in the PW4000 Series CIR, PN 51A357.
		0.375 inch (9.525 mm) maximum depth by 0.750 inch (19.050 mm) maximum radial length. One incident maximum for each vane.	Refer to Section 72−33−05, Repair−03 in the PW4000 Series CIR, PN 51A357.

FEGV Airfoil And Base Inspection
Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Delamination in the wire mesh leading edge configuration	Not permitted	Local delamination. See Repair-02.	Refer to Section 72-33-05, Repair-02 in the PW4000 Series CIR, PN 51A357.
Metal leading edge configuration (Figure 804, Sheet 2)			
1 Dents, damage or deformation in the metal leading edge shield	0.050 inch (1.270 mm) maximum axial depth. 0.200 inch (5.080 mm) maximum radial length for each incident. Four damaged areas for each vane maximum.	0.100 inch (2.540 mm) maximum axial depth and 0.200 inch (5.080 mm) maximum radial length for each incident. Four damaged areas for each vane maximum. 0.500 inch (12.700 mm) minimum separation.	Refer to Section 72-33-02, Repair-07 and Section 72-33-05, Repair-20 in the PW4000 Series CIR, PN 51A357.

NOTE: It is necessary to replace the leading edge, if dents or other damage to the leading edge are more than the stated limits. Do an inspection of the damage on the composite material under the leading edge by Table 804 and Figure 804, (Sheet 1).

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Punctures in the metal leading edge	Not permitted	0.100 inch (2.540 mm) maximum radial length. Four damaged areas for each vane maximum. 0.500 inch (12.700 mm) minimum separation.	Refer to Section 72-33-02, Repair-07 in the PW4000 Series CIR, PN 51A357.

FEGV Airfoil And Base Inspection
Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
2			
Delamination, tears, bubbles and missing material in viton film that extends on the airfoil surface more than the metal leading edge shield	Not permitted	Full viton area, if the composite vane substrate is not damaged and there are no broken fibers and delamination.	Refer to Section 72−33−05, Repair−19 in the PW4000 Series CIR, PN 51A357.
Trailing edge for: (Figure 804, Sheet 1)			
Decrease in chord length, Area D	0.030 inch (0.762 mm) maximum axial depth by 0.100 inch (2.540 mm) maximum radial length for each incident. 0.500 inch (12.700 mm) maximum total radial length, all damages for each vane.	0.150 inch (3.810 mm) maximum axial depth for each incident. No limit to the quantities of damage.	Refer to Section 72−33−05, Repair−02, Repair−08 in the PW4000 Series CIR, PN 51A357.
Decrease in chord length, Area E	0.030 inch (0.762 mm) maximum axial depth by 0.100 inch (2.540 mm) maximum radial length for each incident. 0.500 inch (12.700 mm) maximum total radial length, all damages for each vane.	0.100 inch (2.540 mm) maximum axial depth for each incident. No limit to the quantities of damage.	Refer to Section 72−33−05, Repair−02, Repair−08 in the PW4000 Series CIR, PN 51A357.

FEGV Airfoil And Base Inspection
Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
FEGV concave airfoil surfaces: (Figure 804, Sheet 3)			
Cracks	Not permitted	Install replacement FEGV.	Refer to Section 72-33-02, Assembly-01 in the PW4152 Series Engine Manual, PN 50A443.
Nicks, dents, chips and pits with no broken fibers	Damage is permitted		
Nicks, dents, chips and pits with broken fibers	0.100 inch (2.540 mm) maximum diameter and 0.010 inch (0.254 mm) maximum depth for each incident.	0.300 inch (7.620 mm) maximum diameter and 0.030 inch (0.762 mm) maximum depth for each incident.	Refer to Section 72-33-05 Repair-02, Repair-08 and Repair-21 in the PW4000 Series CIR, PN 51A357.
Delamination of the airfoil surface	Not permitted	Install replacement FEGV.	Refer to Section 72-33-02, Assembly-01 in the PW4152 Series Engine Manual, PN 50A443.

FEGV Airfoil And Base Inspection
Table 804 (Continued)

ENGINE GENERAL − FAN CASE − INSPECTION/CHECK−10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Erosion with damage to the fiberglass reinforced layer	10.00 sq−in (6452. sq−mm) maximum eroded top coat with no damage to the fiberglass ply and a smooth or shinny finish with no breaks in the surface.	Erosion damage into the fiberglass ply and the carbon plies with the limitations that follow:	Refer to Section 72−33−05, Repair−21 in the PW4000 Series CIR, PN 51A357.
		First carbon ply 35.00 sq−in (22581. sq−mm) maximum total of removed plus the bare material.	
		Second carbon ply 25.00 sq−in (16129. sq−mm) maximum total of removed plus the bare material.	
		Third carbon ply 15.00 sq−in (9677. sq−mm) maximum total of removed plus the bare material.	
		Fourth carbon ply 5.00 sq−in (3226. sq−mm) maximum total of removed plus the bare material.	

FEGV Airfoil And Base Inspection
Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
FEGV convex airfoil surfaces: (Figure 804, Sheet 4)			
Cracks	Not permitted	Install replacement FEGV.	Refer to Section 72-33-02, Assembly-01 in the PW4152 Series Engine Manual, PN 50A443.
Nicks, dents, chips and pits with no broken fibers	Damage is permitted		
Nicks, dents, chips and pits with broken fibers	0.100 inch (2.540 mm) maximum diameter and 0.010 inch (0.254 mm) maximum depth for each incident.	0.300 inch (7.620 mm) maximum diameter and 0.030 inch (0.762 mm) maximum depth for each incident.	Refer to Section 72-33-05 Repair-02, Repair-08 and Repair-21 in the PW4000 Series CIR, PN 51A357.
Delamination of the airfoil surface	Not permitted	Install replacement FEGV	Refer to Section 72-33-02, Assembly-01 in the PW4152 Series Engine Manual, PN 50A443.

FEGV Airfoil And Base Inspection
Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Erosion with damage to the protective coat or fiberglass play	10.00 sq-in (6452. sq-mm) maximum eroded top coat with no damage to the fiberglass ply and a smooth or shinny finish with no breaks in the surface.	Erosion damage into the fiberglass ply and the carbon plies with the limitations that follow:	Refer to Section 72-33-05, Repair-21 in the PW4000 Series CIR, PN 51A357.
		First carbon ply 7.00 sq-in (4516. sq-mm) maximum total removed plus the bare material.	
		No damage to the second carbon ply.	
FEGV, inner diameter base and outer diameter base for: (Figure 804, Sheet 5)			
Cracks			
Area G	The base section on one side of a crack makes a continuous surface with the section on the other side of the crack or one side of a crack is higher than the other side of a crack by less	The base on one side of a crack is 0.100 inch (2.540 mm) or more than the other side.	Refer to Section 72-33-02, Repair-04 in the PW4000 Series CIR, PN 51A357.

FEGV Airfoil And Base Inspection
Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	than 0.100 inch (2.540 mm)		
Cracks in the structural part of the base that cause the vane to be loose	Not permitted	Replace the vane.	Refer to Section 72-33-02, Assembly-01 in the PW4152 Series Engine Manual, PN 50A443.
	15 cracks maximum in each base with no separation between the mold and the base or vane. No damage to the attachment hole.	If cracks are more than the permitted limit, replace the vane and base assembly.	Refer to Section 72-33-02, Assembly-01 in the PW4152 Series Engine Manual, PN 50A443 or refer to Section 72-33-05, Repair-01 and Repair-04 in the PW4000 Series CIR, PN 51A357.
Piece of the inner or outer vane base missing with foam baffle intact	Not permitted	No limit in Area G	Refer to Section 72-33-02, Repair-04 in the PW4000 Series CIR, PN 51A357.
Piece missing in the structural part of the base that cause loose vane	Not permitted	Replace the vane.	Refer to Section 72-33-02, Assembly-01 in the PW4152 Series Engine Manual, PN 50A443.

FEGV Airfoil And Base Inspection
Table 804 (Continued)

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Separation of mold area from the vane airfoil	25 percent of the circumference separation at all locations. No cracks are permitted.	Replace the vane.	Refer to Section 72−33−02, Assembly−01 in the PW4152 Series Engine Manual, PN 50A443.
R	Erosion and deformation of the foam fairings between the FEGV bases	Not permitted	0.375 inch (9.525 mm) maximum depth and 0.250 inch (6.350 mm) maximum width. A maximum of full length of the vane platform can be filled.	Refer to Section 72−33−02, Repair−04 in the PW4000 Series CIR, PN 51A357.

R FEGV Airfoil And Base Inspection
R Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
1 Front splitter flange for: (Figure 805, Sheet 1)			
Nicks, dents or other surface damage	0.005 inch (0.127 mm) maximum	0.065 inch (1.651 mm) maximum depth. 0.500 inch (12.700 mm) minimum distance from the nearest bolthole. 0.050 inch (1.270 mm) maximum depth in 0.500 inch (12.700 mm) of a bolthole.	Refer to Section 72-33-04, Repair-48 in the PW4152 Series Engine Manual, PN 50A443.
Bending or distortion	0.020 inch (0.508 mm) maximum in local areas	0.250 inch (6.350 mm) maximum radial direction from the initial radius and 5.000 inch (127.000 mm) maximum total circumferential length.	Refer to Section 72-33-04, Repair-48 in the PW4152 Series Engine Manual, PN 50A443. NOTE: For in-situ bending to the front splitter flange, the stress- relief procedure is not necessary.
2 Splitter flange and fairing nut plates for: (Figure 805, Sheet 1)			

Fan Exit Inner Case Inspection
Table 805

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Looseness, stripped threads or damage	Not permitted	Replace the nut plates.	Refer to Section 72-33-04, Repair-01 and Repair-02 in the PW4000 Series CIR, PN 51A357.
3 Vane inner diameter attachment pins for: (Figure 805, Sheet 1)			
Loose or missing pins	Not permitted	Replace the pins.	Refer to Section 72-33-04, Repair-13 in the PW4000 Series CIR, PN 51A357.
4 Case gussets for: (Figure 805, Sheet 1)			
Cracks or surface damage	Not permitted	See repairs.	Refer to Section 72-33-02, Repair-02 and Section 72-33-04, Repair-26 and Repair-29 in the PW4000 Series CIR, PN 51A357.

Fan Exit Inner Case Inspection
Table 805 (Continued)

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	5 Bearing pads for: (Figure 805, Sheet 1 and Figure 805, Sheet 2)			
R	Looseness or missing pads	Not permitted	Replace the pad.	Refer to Section 72-33-04, Repair-17, Repair-24 in the PW4000 Series CIR, PN 51A357.
R	Wear	0.002 inch (0.051 mm) minimum protrusion above the retention pocket	Less than 0.002 inch (0.051 mm) protrusion above the retention pocket. Replace the pad.	Refer to Section 72-33-04, Repair-17, Repair-22 and Repair-24 in the PW4000 Series CIR, PN 51A357.
R	6 Fan exit inner case 2.5 bleed duct and internal vanes for: (Figure 805, Sheet 2 and Figure 805, Sheet 3)			
R	Sharp edges, raised material or other surface damage	0.005 inch (0.127 mm) maximum depth in local areas with no raised material or sharp edges	0.010 inch (0.254 mm) maximum depth	Blend smooth. Refer to Section 70-45-00, SPOP 533 in the Standard Practices Manual, PN 585005.

Fan Exit Inner Case Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Vane leading edge damage	Not permitted	0.250 inch (6.350 mm) maximum	Refer to Section 72-33-08, Repair-11 in the PW4000 Series CIR, PN 51A357.
7 Engines with and without cam slot liners parts seen: (Figure 805, Sheet 2)			
Sharp edges, raised material or other surface damage	0.010 inch (0.254 mm) maximum depth with no raised material or sharp edges	More than 0.010 inch (0.254 mm) depth	Refer to Section 72-33-04, Repair-45 in the PW4000 Series CIR, PN 51A357.
Liner and rivets loose condition	Not permitted	Replace the rivets.	Refer to Section 72-33-08, Repair-13 and Repair-45 in the PW4000 Series CIR, PN 51A357.
Liner and rivets	Not permitted	Cracked or too large holes	Refer to Section 72-33-08, Repair-14 in the PW4000 Series CIR, PN 51A357.
Engines without cam slot liners:			

Fan Exit Inner Case Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Wear or galling in the cam slot	0.010 inch (0.254 mm) maximum depth in local areas with no raised material or sharp edges	More than 0.010 inch (0.254 mm) depth	Refer to Section 72−33−04, Repair−27 in the PW4000 Series CIR, PN 51A357.
8 Fan exit inner case, 2.5 bleed duct, contact Surfaces for: (Figure 805, Sheet 2, Figure 805, sheet 4, and Figure 805, sheet 5)			
Surface damage and wear, Surface C	0.010 inch (0.254 mm) maximum depth with no raised material or sharp edges	0.070 inch (1.778 mm) maximum depth	Blend to remove the damage. Refer to Section 70−45−00, SPOP 533 in the Standard Practices Manual, PN 585005.
Surface damage, sharp edges, raised material, areas of Surface A seen. (Figure 805, Sheet 4)	0.005 inch (0.127 mm) maximum depth in local areas with no raised material or sharp edges	0.050 inch (1.270 mm) maximum depth	Refer to Section 72−33−08, Reapir−11 in the PW4000 Series CIR, PN 51A357.
9 2.5 bleed valve assembly for: (Figure 805, Sheet 2)			
Cracks	Not permitted		Remove from service.

Fan Exit Inner Case Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Duct sealing area wear, erosion or surface damage	0.005 inch (0.127 mm) maximum depth in local areas with no raised material or sharp edges	0.020 inch (0.508 mm) maximum depth	Blend to remove the damage. Refer to Section 70-45-00, SPOP 533 in the Standard Practices Manual, PN 585005.
Surface damage other surfaces	0.005 inch (0.127 mm) maximum depth in local areas with no raised material or sharp edges	See the Repair.	Refer to Section 72-33-09, Repair-07 in the PW4000 Series CIR, PN 51A357.
10 Loose, missing or damaged seals (Figure 805, Sheet 2)	Not permitted	Replace the rubber seal.	Refer to Section 72-33-04, Repair-16 or Section 72-33-09, Repair-02 in the PW4000 Series CIR, PN 51A357.
2.5 bleed valve actuator, bellcrank and linkages for: (Figure 805, Sheet 5)			
Worn, loose pins, bushings or cotter pins, nutplates	Not permitted	Replace the worn components.	Refer to Section 72-33-04, Repair-18 and Repair-44 in the PW4000 Series CIR, PN 51A357.

Fan Exit Inner Case Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Cracks	Not permitted	Replace the damaged components.	
Nicks, dents or other surface damage (other than the actuator shaft)	0.005 inch (0.127 mm) maximum with no raised material or sharp edges	Replace the damaged components.	
Bent or deformed bellcrank, linkages, support brackets or actuator shaft	Not permitted	Replace the damaged components.	
11 LPC module 2.5 bleed interface, sealing Surface D and Surface E for galling. Figure 805, Sheet 2 and Figure 805, Sheet 4)	0.015 inch (0.381 mm) maximum depth on Surface D. 0.010 inch (0.254 mm) maximum depth on Surface E. No damage is permitted in Area F. No raised material or sharp edges are permitted.	Greater than 0.015 inch (0.381 mm) depth on Surface D or more than 0.010 inch (0.254 mm) depth on Surface E.	Refer to Section 72-33-04 , Repair-19 and Repair-20 in the PW4000 Series CIR, PN 51A357.
12 Forward step inner diameter corner of inner case (aft of pins, facing forward) (Figure 805, Sheet 1)			

Fan Exit Inner Case Inspection
Table 805 (Continued)

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Surface damage	0.005 inch (0.127 mm) maximum depth with no raised material or sharp edges	0.012 inch (0.305 mm) maximum depth. 2.000 inch (50.800 mm) maximum total circumferential length.	Refer to Section 72−33−04, Repair−56 in the PW4000 Series CIR, PN 51A357.

Fan Exit Inner Case Inspection
Table 805 (Continued)

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	1 2.5 bleed valve duct screen for: (Figure 806, Sheet 1 and Figure 806, Sheet 2)			
R	Missing pieces	Not permitted	Not repairable, replace the screen.	Refer to Section 72-33-00 Assembly-01, Figure 1001 in the PW4152 Series Engine Manual, PN 50A443.
R	Cracks	Cracks in two adjacent webs, three locations maximum. Two web minimum separation.	Not repairable, replace the screens that are more than the permitted limits.	Refer to Section 72-33-00 Assembly-01, Figure 1001 in the PW4152 Series Engine Manual, PN 50A443.
R	Distortion	0.200 inch maximum clearance between screen and the case that is caused by distortion.	Not repairable, replace the screens that are more than the permitted limits.	Refer to Section 72-33-00 Assembly-01, Figure 1001 in the PW4152 Series Engine Manual, PN 50A443.
R	2 Fan exit liner segment assembly for: (Figure 806, Sheet 1 and Figure 806, Sheet 3)			

Fan Exit Liners And Bleed Screens Inspection
Table 806

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Missing, or loose washers, nut plates, rivets or splice plates	Not permitted	Replace the missing hardware.	Refer to Section 72-33-18, Repair-03, Repair-04 and Repair-05 in the PW4000 Series CIR, PN 51A357.
Surface damage on washers, nut plates, rivets or splice plates	0.005 inch (0.127 mm) maximum depth is permitted with no raised material or sharp edges	Replace the missing hardware.	Refer to Section 72-33-18, Repair-03, Repair-04 and Repair-05 in the PW4000 Series CIR, PN 51A357.
Nicks, dents or gouges	0.030 inch (0.762 mm) maximum depth. 1.000 inch (25.400 mm) maximum width or length. 2.000 inch (50.800 mm) minimum separation. Five damaged areas maximum for each segment.	Not repairable, replace segment that is more than the permitted limits.	Refer to Section 72-00-33, Installation-01 in the PW4152 Series Engine Manual, PN 50A443.
Cracks	1.000 inch (25.400 mm) maximum length. 0.500 inch (12.700 mm) minimum distance from the center of the screw hole.	Not repairable, replace the segment that is more than the permitted limits.	Refer to Section 72-00-33, Installation-01 in the PW4152 Series Engine Manual, PN 50A443.

Fan Exit Liners And Bleed Screens Inspection
Table 806 (Continued)

ENGINE GENERAL - FAN CASE - INSPECTION/CHECK-10

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Areas of broken or fuzzy stray fibers	0.030 inch (0.762 mm) maximum depth. 1.000 inch (25.400 mm) maximum diameter. 2.000 inch (50.800 mm) minimum separation.	Not repairable, replace segment that is more than the permitted limits.	Refer to Section 72-00-33, Installation-01 in the PW4152 Series Engine Manual, PN 50A443.
R	Punctures or holes	Not permitted	1.000 inch (25.400 mm) maximum diameter. 1.000 inch (25.400 mm) minimum separation. 1.000 inch (25.400 mm) minimum edge distance. 25 percent maximum repairable surface area.	Refer to Section 72-33-18, Repair-02 in the PW4000 Series CIR, PN 51A357.
R	Erosion at the leading edge (dull or rough surface finish, fibers seen)	0.020 inch (0.508 mm) maximum depth. 0.750 inch (19.050 mm) maximum width or length. No cracks or delamination is permitted. 2.000 inch (50.800 mm) minimum damage separation.	Not repairable, replace the segment that is more than the permitted limits.	Refer to Section 72-00-33, Installation-01 in the PW4152 Series Engine Manual, PN 50A443.

Fan Exit Liners And Bleed Screens Inspection
Table 806 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Delamination	0.030 inch (0.762 mm) maximum depth. 1.000 inch (25.400 mm) maximum length or width. 2.000 inch (50.800 mm) minimum damage separation.	Not repairable, replace the segment that is more than the permitted limits.	Refer to Section 72-00-33, Installation-01 in the PW4152 Series Engine Manual, PN 50A443.

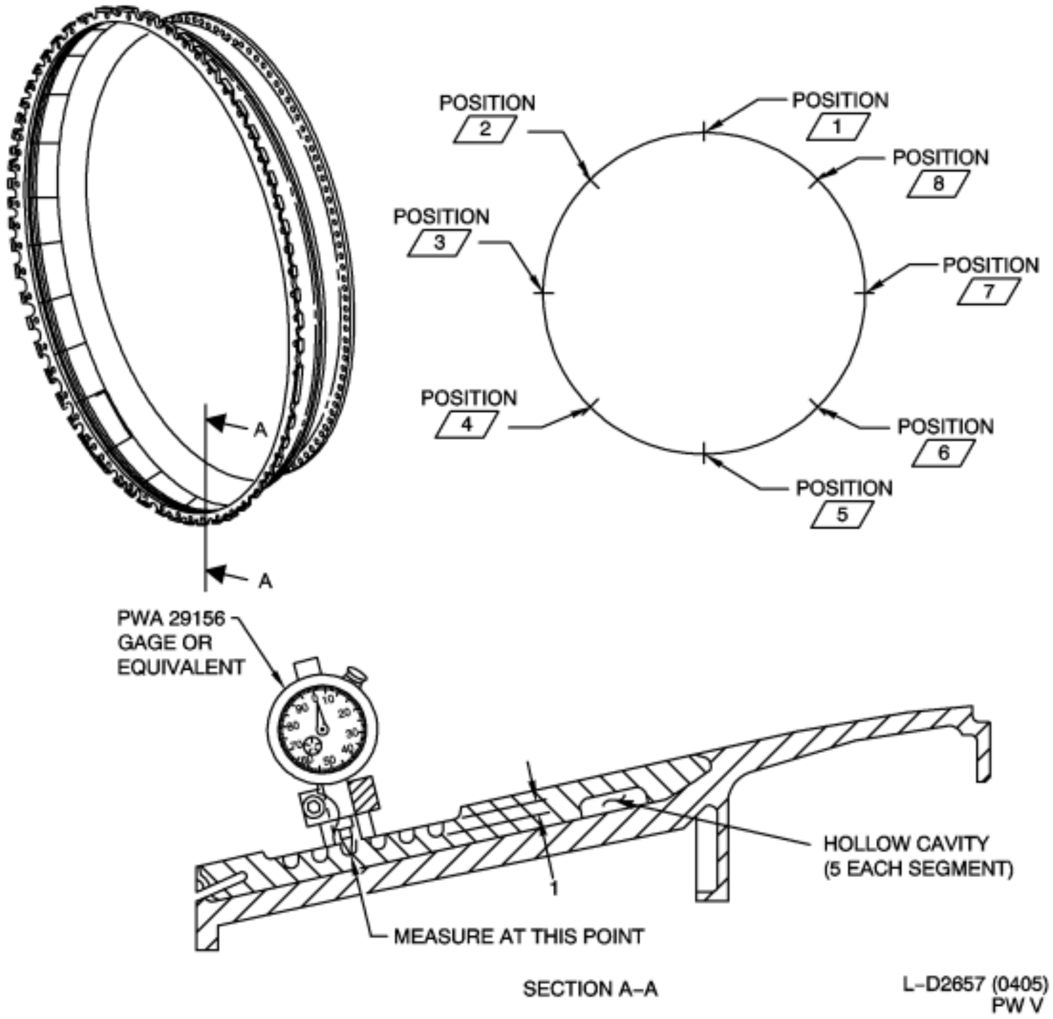
Fan Exit Liners And Bleed Screens Inspection
Table 806 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Fire ablative coat for: (Figure 807, Sheet 1 and Figure 807, Sheet 2)			
Areas of no coat, damaged coat or loose coat	Not permitted	Local areas less than the full coat thickness.	Refer to Section 72-33-04, Repair-25 in the Standard Practices Manual, PN 585005.
		All the areas to a maximum of full coat thickness.	Refer to Section 72-33-04, Repair-28 in the Standard Practices Manual, PN 585005.
Fire ablative blanket for: (Figure 807, Sheet 1 and Figure 807, Sheet 2)			
Disbonding or bubbling in the foil of the ablative blanket	Permitted, if the foil is not punctured, torn and you can not see the quartz fabric.	100 percent of the ablative blanket surface area.	Refer to Section 72-33-04, Repair-42 in the Standard Practices Manual, PN 585005.

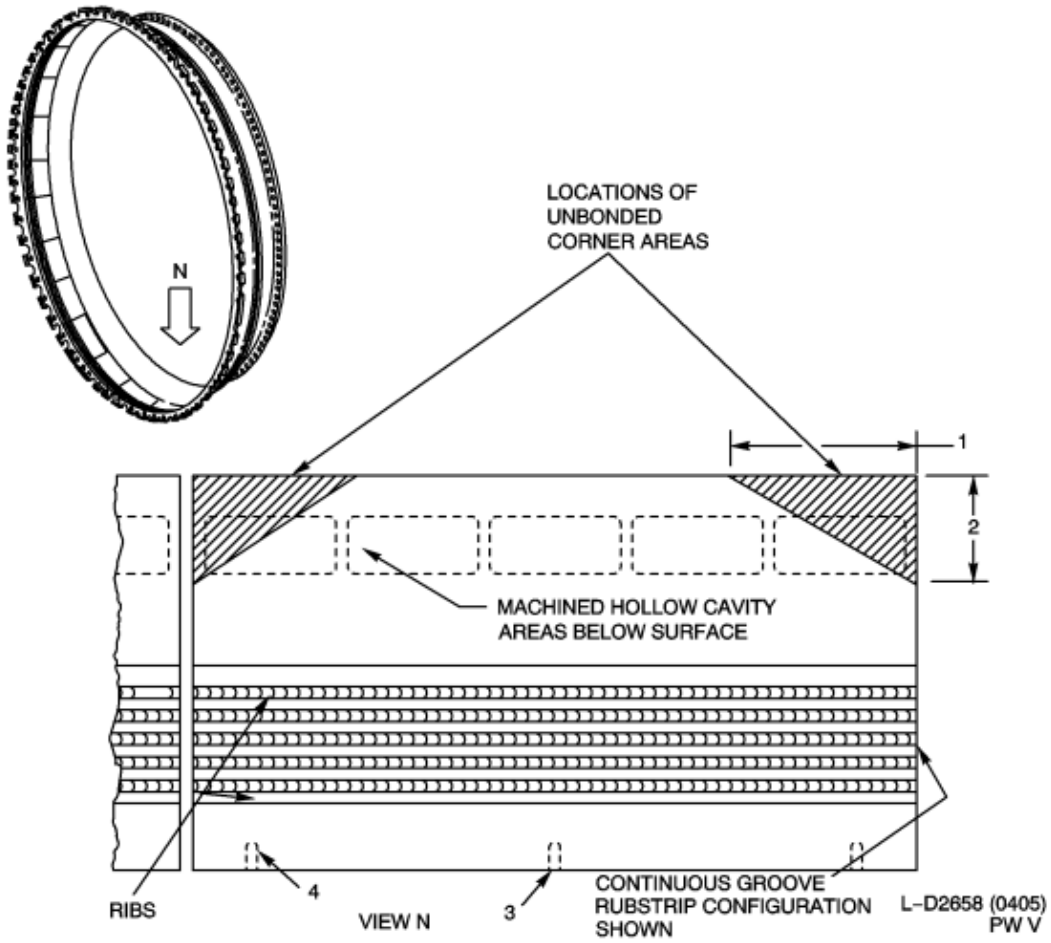
Inner Case Fire Ablative Blanket Or Coating Inspection
Table 807

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Punctures or tears in the foil of the ablative blanket	Not permitted	100 percent of the ablative blanket surface area.	Refer to Section 72−33−04, Repair−42 in the Standard Practices Manual, PN 585005.

Inner Case Fire Ablative Blanket Or Coating Inspection
Table 807 (Continued)

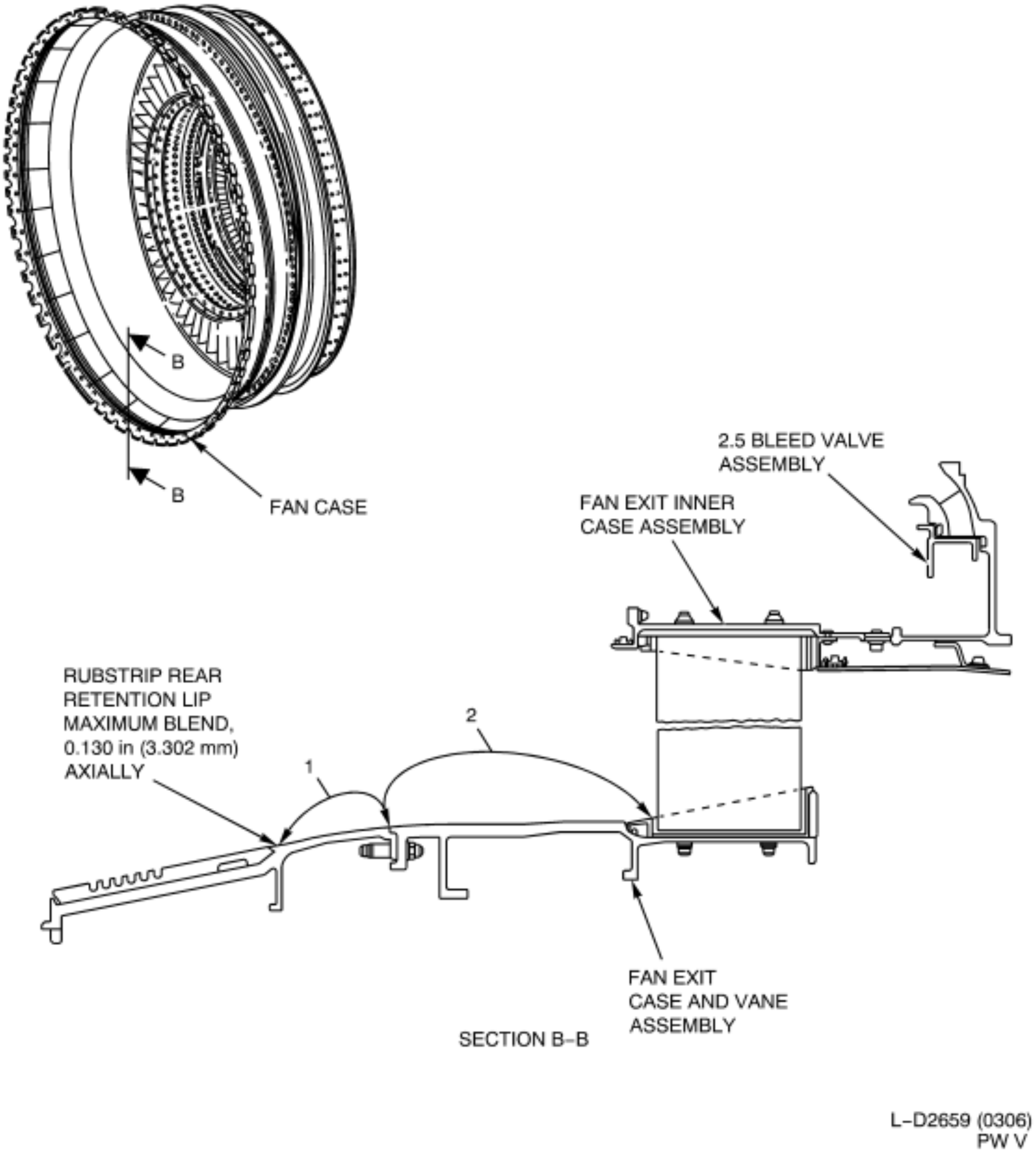

POSITION 1
POSITION 2
POSITION 8
POSITION 3
POSITION 7
POSITION 4
POSITION 6
POSITION 5
A
A
PWA 29156 GAGE OR EQUIVALENT
1
HOLLOW CAVITY (5 EACH SEGMENT)
MEASURE AT THIS POINT
SECTION A−A
L−D2657 (0405)
PW V

R Fan (Rubstrip) Duct Segment Inspection
Figure 801 (Sheet 1)
(Task 72−00−33−210−010)


N
LOCATIONS OF UNBONDED CORNER AREAS
1
2
MACHINED HOLLOW CAVITY AREAS BELOW SURFACE
RIBS
4
VIEW N
3
CONTINUOUS GROOVE RUBSTRIP CONFIGURATION SHOWN
L−D2658 (0405)
PW V

R 1. 2.000 Inch (50.800 mm) Maximum Circumferential Length
R 2. 1.250 Inch (31.750 mm) Maximum Axial Length
3. Pins Must Be Secure, Not Loose And Installed Flush To 0.010 Inch (0.254 mm) Below Flange Surface At All Locations.
4. 3 Places Each Segment

Fan (Rubstrip) Duct Segment Inspection
Figure 801 (Sheet 2)
(Task 72−00−33−210−010)


B
B
FAN CASE
2.5 BLEED VALVE ASSEMBLY
FAN EXIT INNER CASE ASSEMBLY
RUBSTRIP REAR RETENTION LIP MAXIMUM BLEND, 0.130 in (3.302 mm) AXIALLY
2
1
FAN EXIT CASE AND VANE ASSEMBLY
SECTION B-B
L-D2659 (0306)
PW V

R See Table 802 For Index Definitions.

Fan Case And Fan Exit Case And Vane Assembly Gaspath Inspection
Figure 802
(Task 72-00-33-210-010)

R
R
R
R
R
R
R
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R
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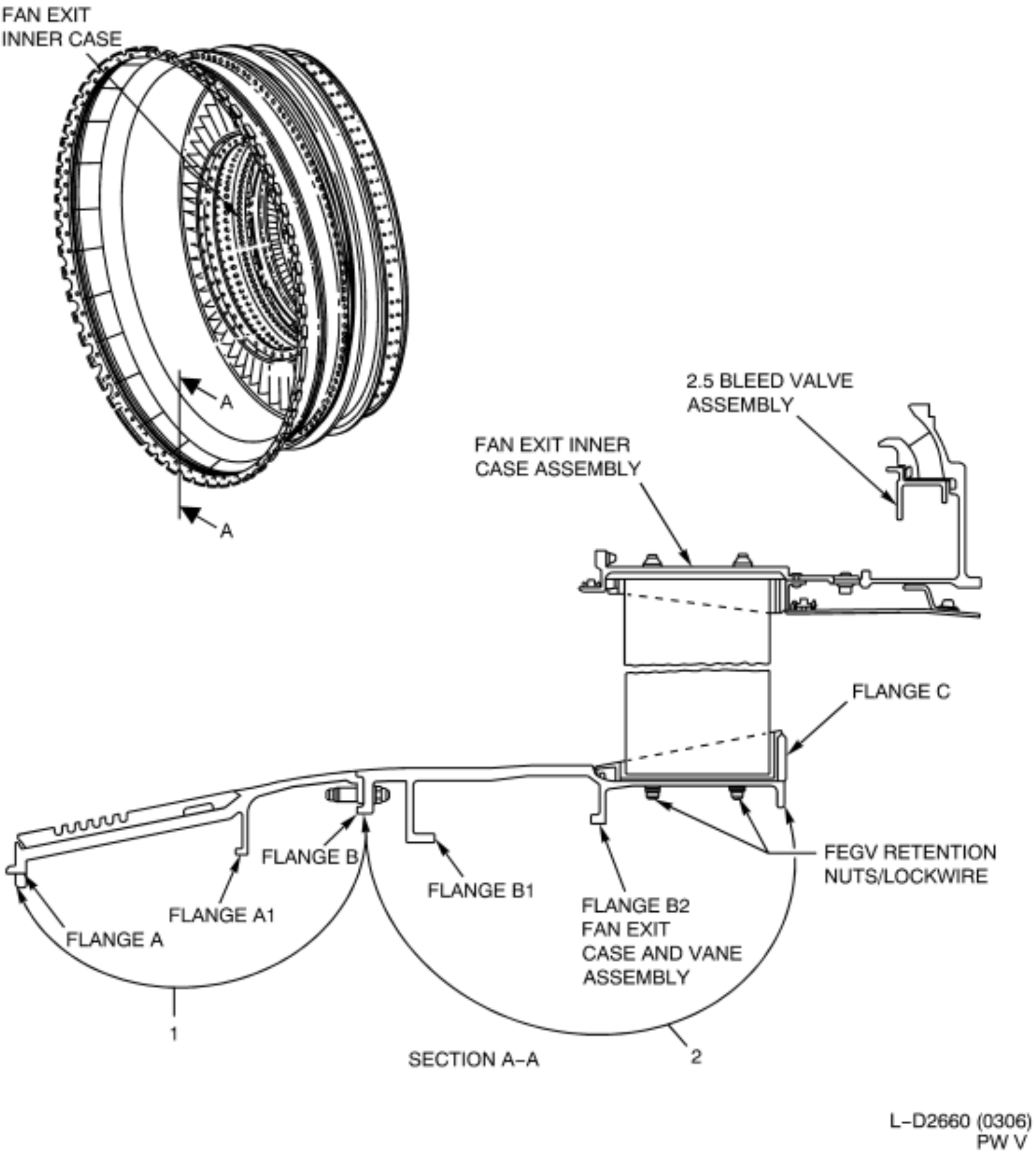
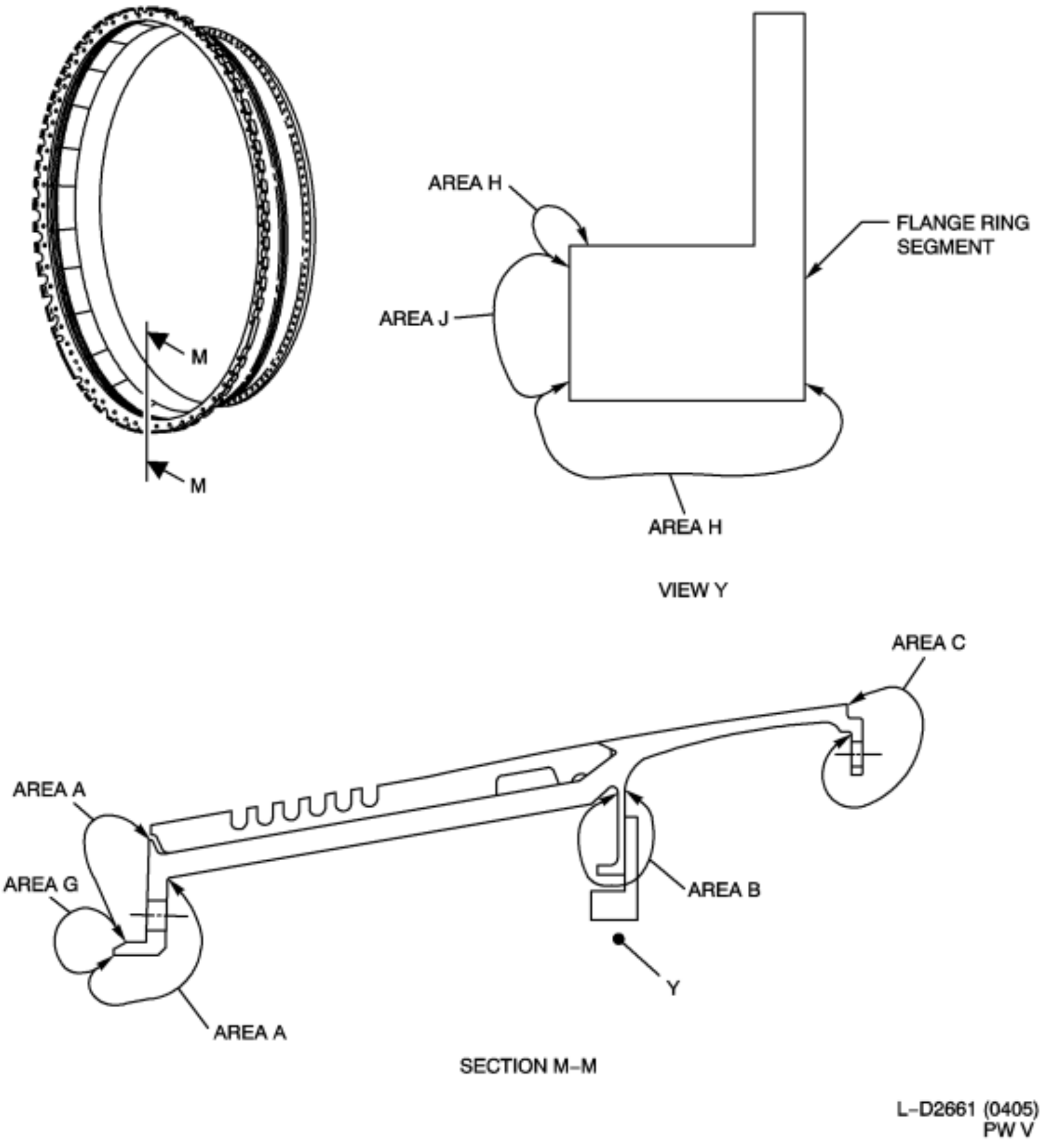
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R

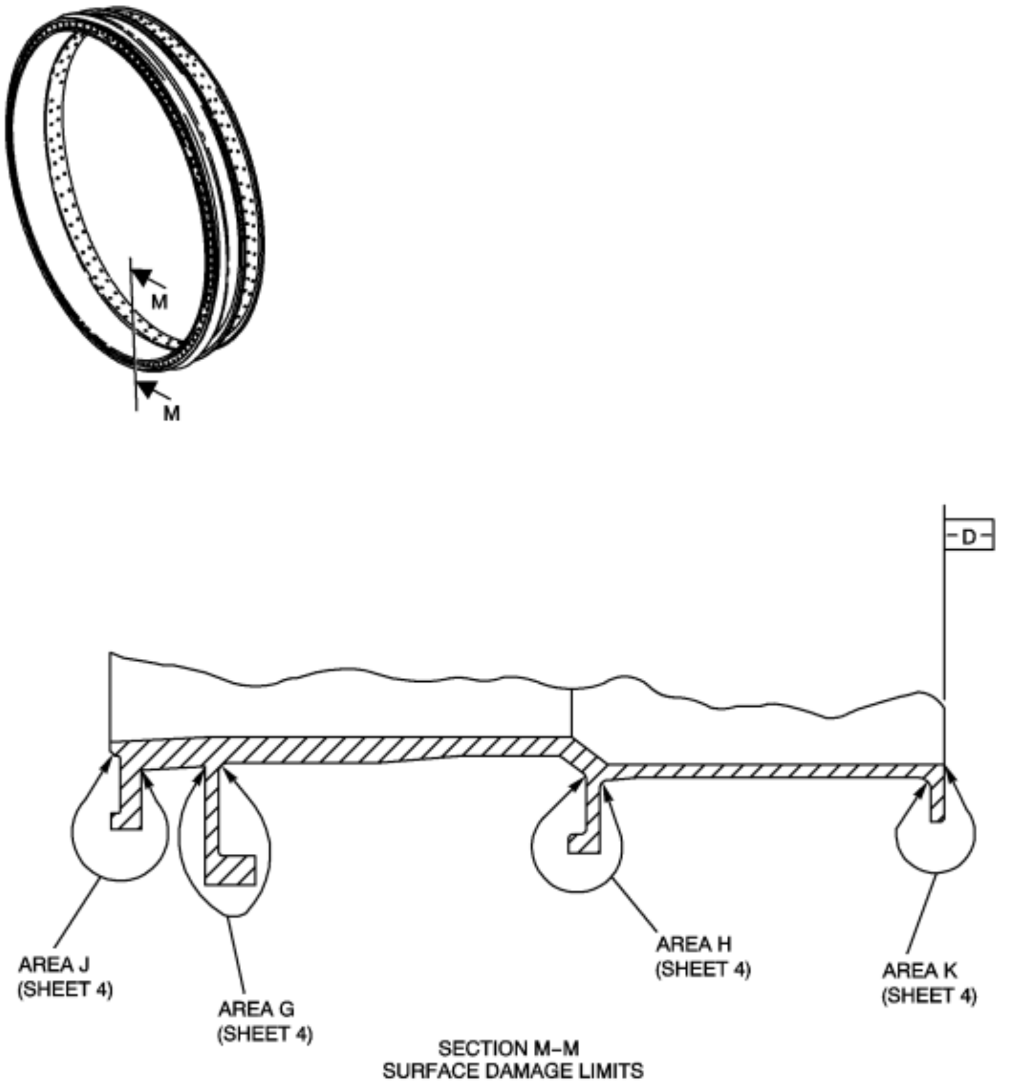

FAN EXIT INNER CASE
A
A
2.5 BLEED VALVE ASSEMBLY
FAN EXIT INNER CASE ASSEMBLY
FLANGE C
FLANGE B
FLANGE B1
FLANGE A1
FLANGE A
FLANGE B2 FAN EXIT CASE AND VANE ASSEMBLY
FEGV RETENTION NUTS/LOCKWIRE
1
SECTION A−A
2
L−D2660 (0306)
PW V

R See Table 803 For Index Definitions.

Fan Case And Fan Exit Case And Vane Assembly External Inspection
Figure 803 (Sheet 1)
(Task 72−00−33−210−010)

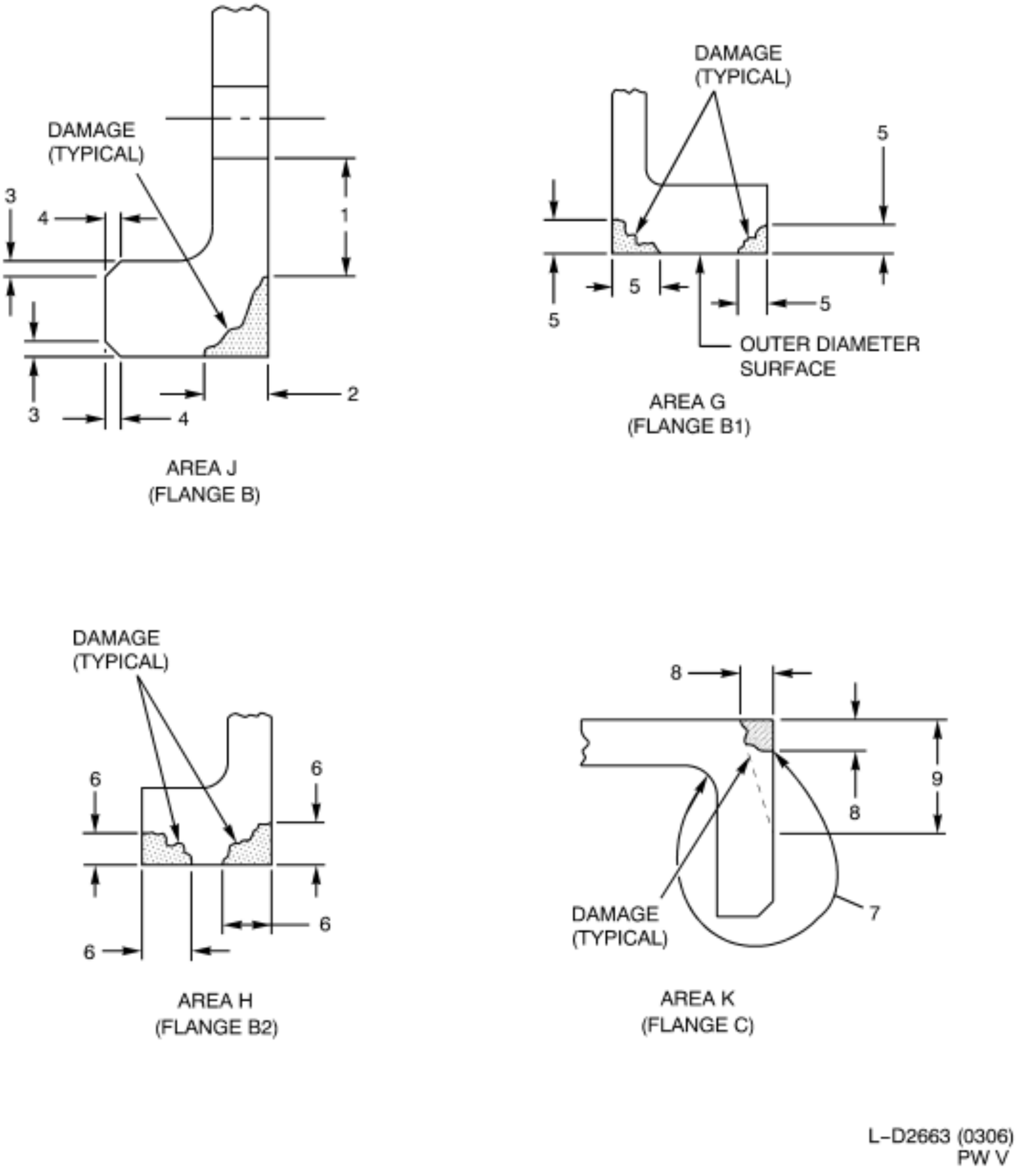

M
M
AREA H
FLANGE RING SEGMENT
AREA J
AREA H
VIEW Y
AREA C
AREA A
AREA G
AREA B
Y
AREA A
SECTION M−M
L−D2661 (0405)
PW V

R Fan Case External Inspection
Figure 803 (Sheet 2)
(Task 72−00−33−210−010)


M
M
D
AREA J
(SHEET 4)
AREA G
(SHEET 4)
AREA H
(SHEET 4)
AREA K
(SHEET 4)
SECTION M−M
SURFACE DAMAGE LIMITS

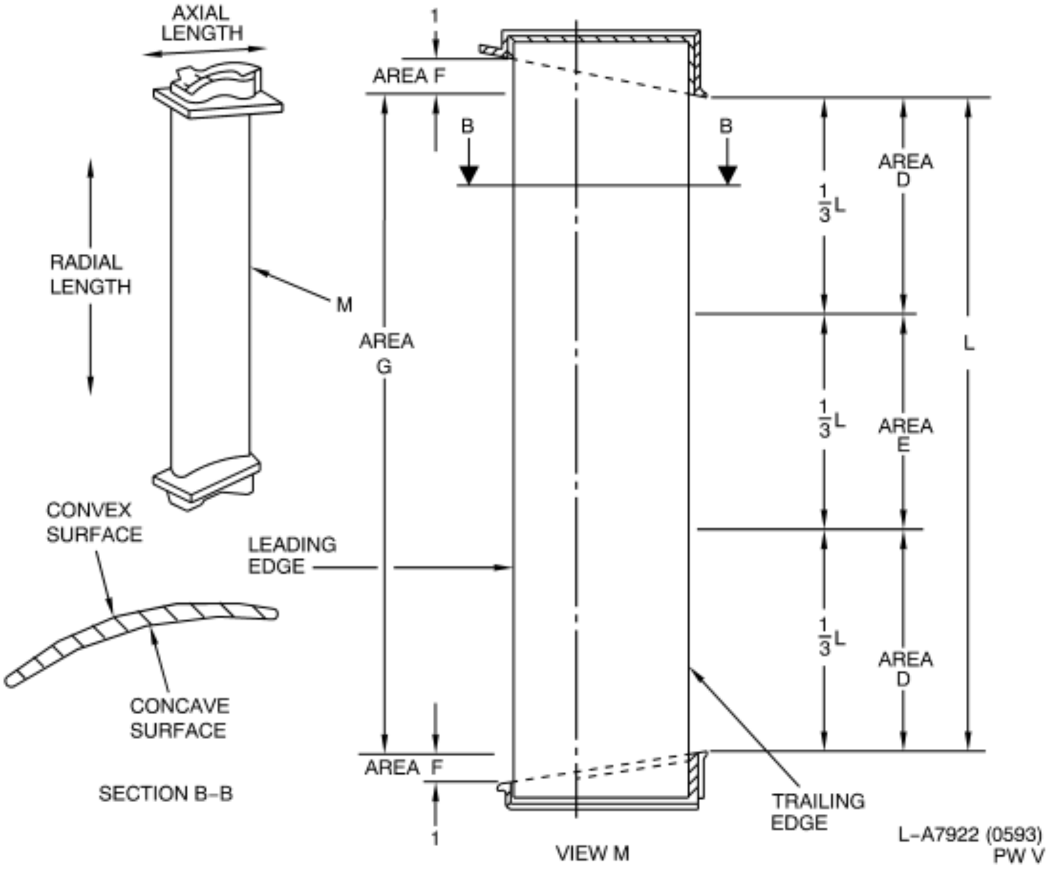
L−D2662 (0405)
PW V

R Fan Exit Case And Vane Assembly External Inspection
Figure 803 (Sheet 3)
(Task 72−00−33−210−010)


DAMAGE (TYPICAL)
3
4
1
2
3
4
AREA J (FLANGE B)
DAMAGE (TYPICAL)
5
5
5
5
OUTER DIAMETER SURFACE
AREA G (FLANGE B1)
DAMAGE (TYPICAL)
6
6
6
6
AREA H (FLANGE B2)
8
9
8
7
DAMAGE (TYPICAL)
AREA K (FLANGE C)
L−D2663 (0306)
PW V

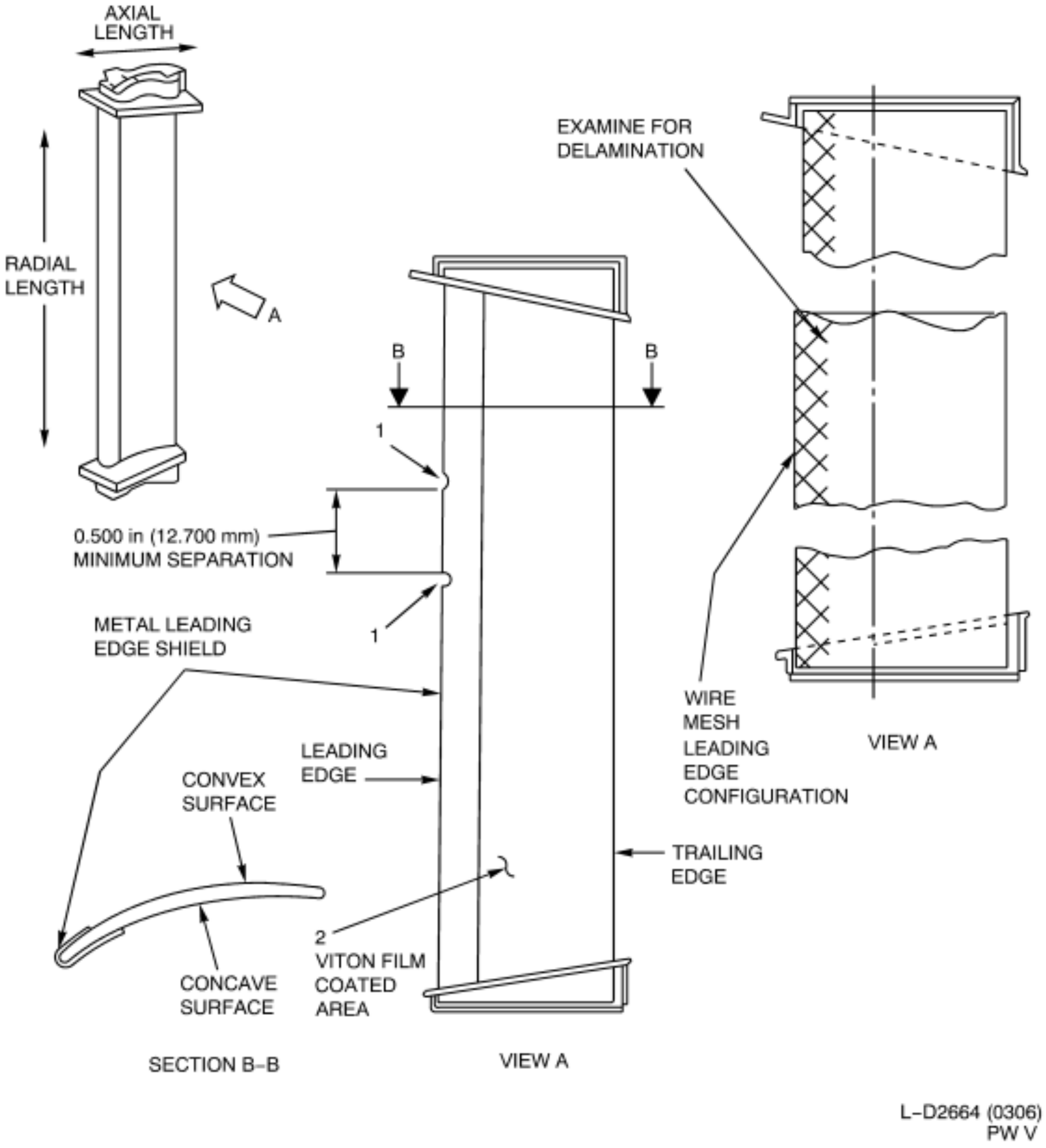
R See Table 803 For Index Definitions.

R Fan Exit Case And Vane Assembly Flanges Inspection
Figure 803 (Sheet 4)
(Task 72−00−33−210−010)


AXIAL LENGTH
RADIAL LENGTH
M
CONVEX SURFACE
CONCAVE SURFACE
SECTION B-B
LEADING EDGE
1
AREA F
AREA G
AREA F
1
B
B
1/3 L
1/3 L
1/3 L
AREA D
AREA E
AREA D
L
TRAILING EDGE
VIEW M
L-A7922 (0593)
PW V

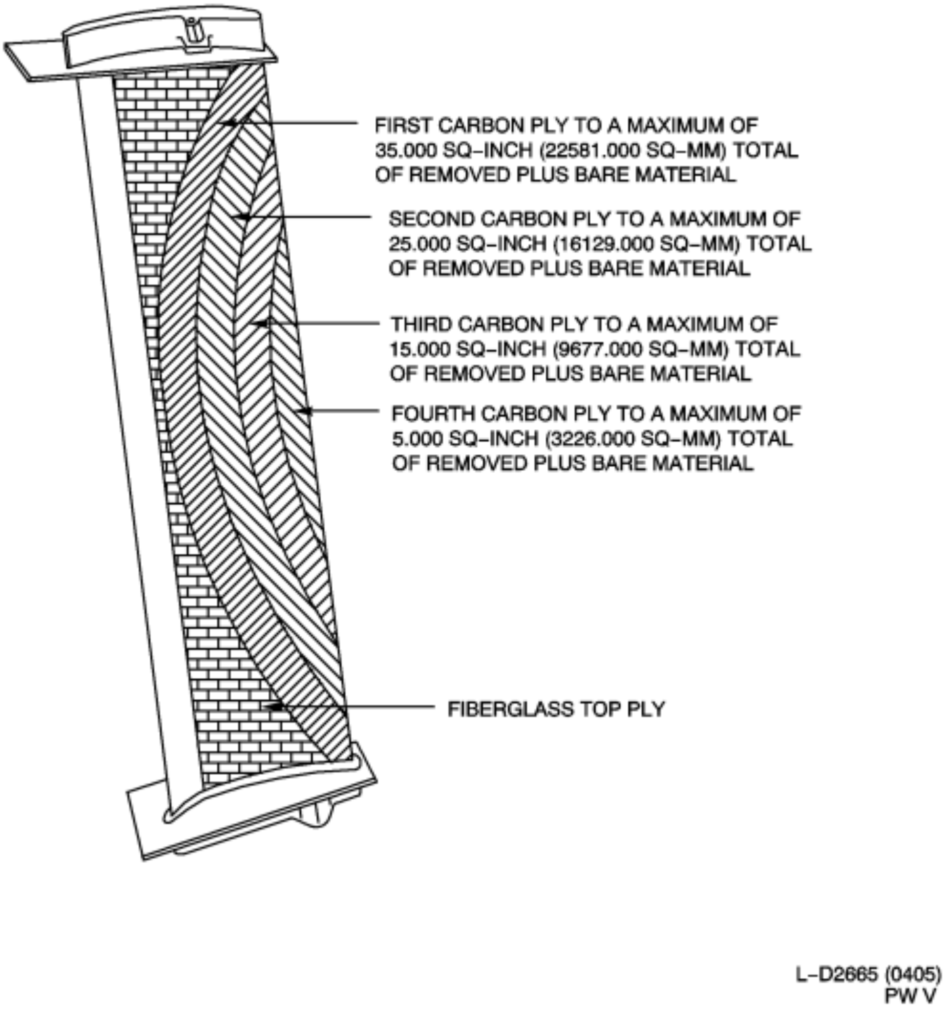
R 1. 0.500 Inch (12.700 mm), Reference

FEGV Airfoil Inspection
Figure 804 (Sheet 1)
(Task 72-00-33-210-010)


AXIAL LENGTH
RADIAL LENGTH
A
EXAMINE FOR DELAMINATION
B
B
1
0.500 in (12.700 mm) MINIMUM SEPARATION
1
METAL LEADING EDGE SHIELD
LEADING EDGE
CONVEX SURFACE
CONCAVE SURFACE
2
VITON FILM COATED AREA
TRAILING EDGE
WIRE MESH LEADING EDGE CONFIGURATION
VIEW A
SECTION B-B
VIEW A
L-D2664 (0306)
PW V

R See Table 804 For Index Definitions.

FEGV Airfoil Inspection
Figure 804 (Sheet 2)
(Task 72-00-33-210-010)


FIRST CARBON PLY TO A MAXIMUM OF 35.000 SQ−INCH (22581.000 SQ−MM) TOTAL OF REMOVED PLUS BARE MATERIAL
SECOND CARBON PLY TO A MAXIMUM OF 25.000 SQ−INCH (16129.000 SQ−MM) TOTAL OF REMOVED PLUS BARE MATERIAL
THIRD CARBON PLY TO A MAXIMUM OF 15.000 SQ−INCH (9677.000 SQ−MM) TOTAL OF REMOVED PLUS BARE MATERIAL
FOURTH CARBON PLY TO A MAXIMUM OF 5.000 SQ−INCH (3226.000 SQ−MM) TOTAL OF REMOVED PLUS BARE MATERIAL
FIBERGLASS TOP PLY
L−D2665 (0405)
PW V

R FEGV Airfoil Concave Side Inspection
Figure 804 (Sheet 3)
(Task 72−00−33−210−010)

R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
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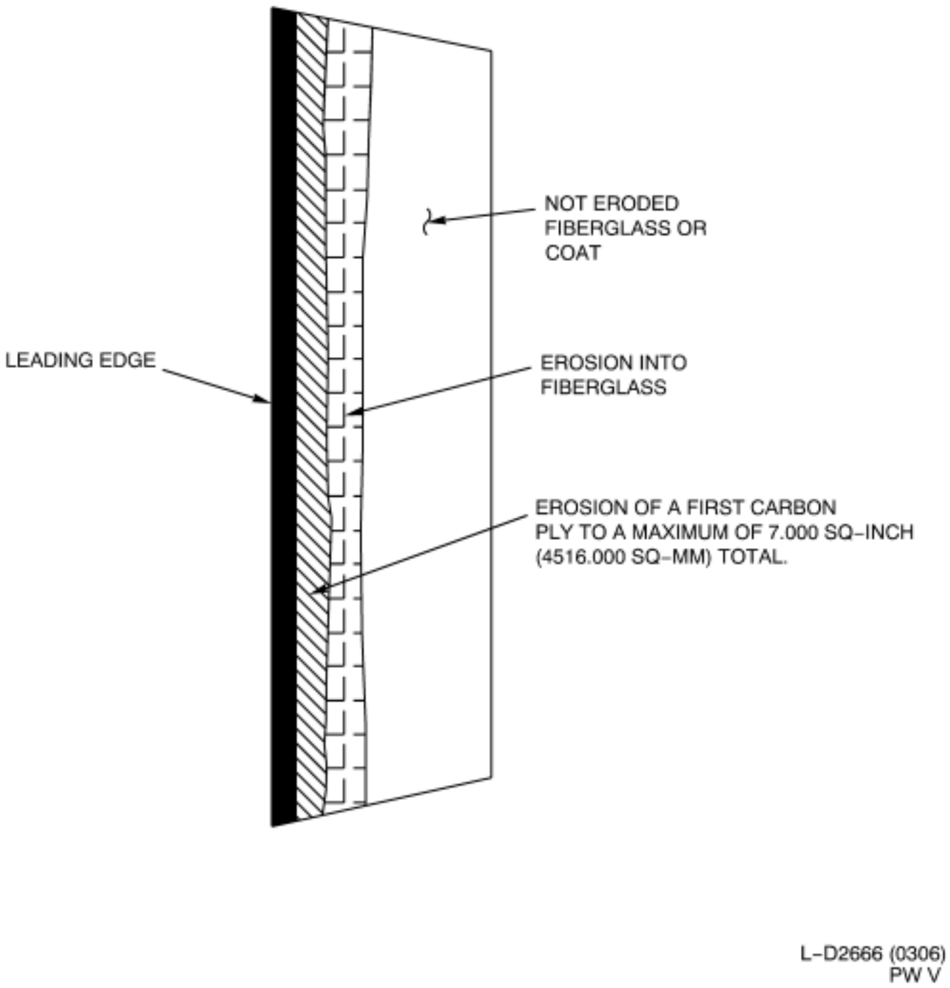
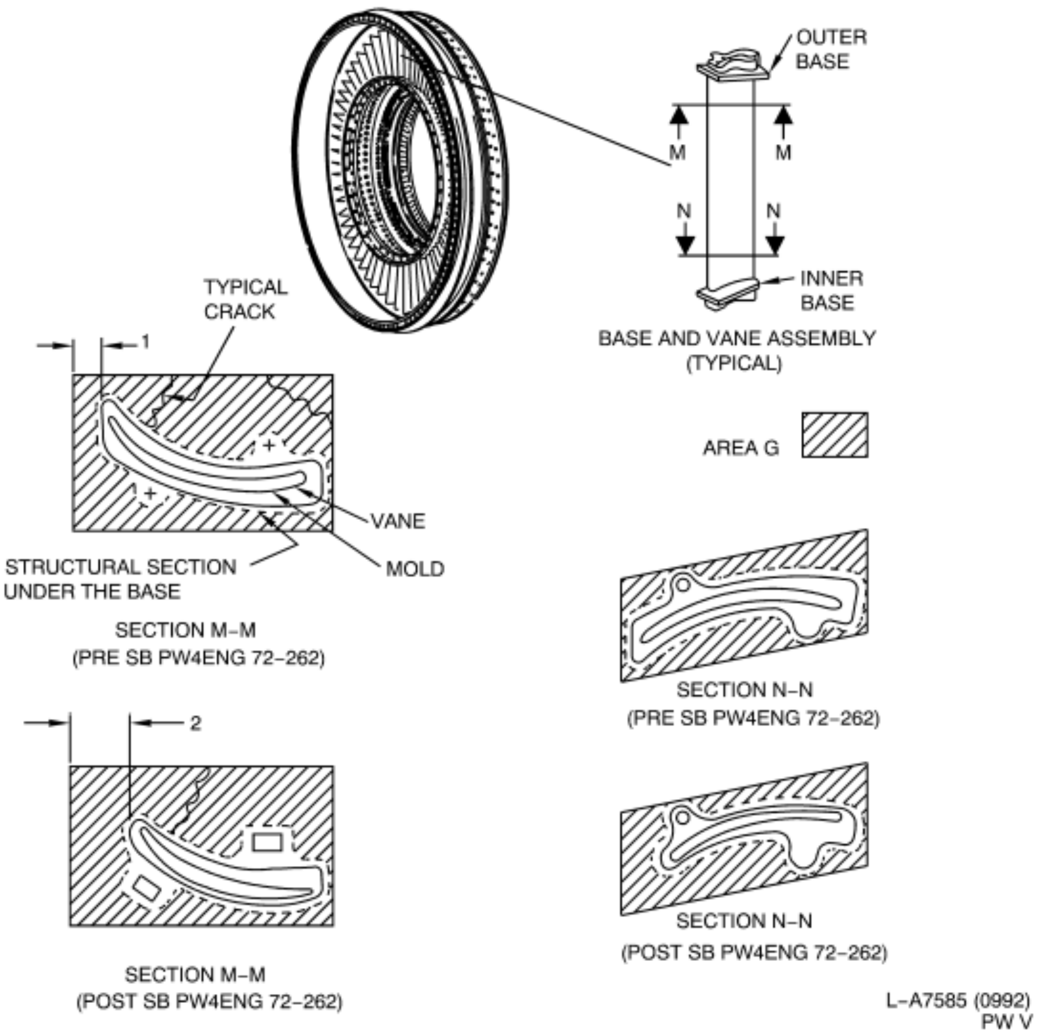
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R
R

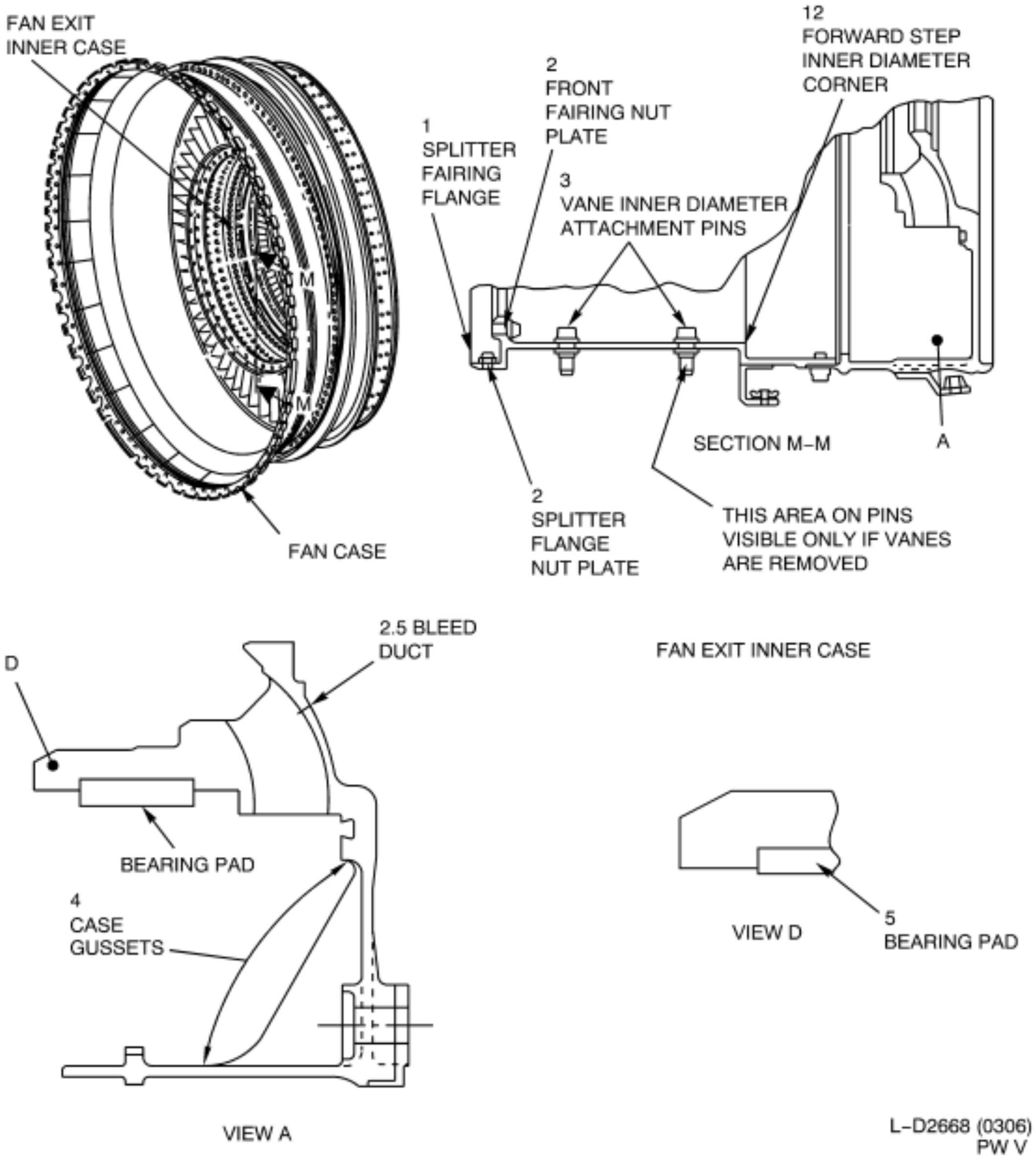

NOT ERODED FIBERGLASS OR COAT
LEADING EDGE
EROSION INTO FIBERGLASS
EROSION OF A FIRST CARBON PLY TO A MAXIMUM OF 7.000 SQ-INCH (4516.000 SQ-MM) TOTAL.
L-D2666 (0306)
PW V

R FEGV Airfoil Convex Side Inspection
Figure 804 (Sheet 4)
(Task 72-00-33-210-010)


OUTER BASE
M
M
N
N
INNER BASE
BASE AND VANE ASSEMBLY (TYPICAL)
TYPICAL CRACK
1
AREA G
VANE
MOLD
STRUCTURAL SECTION UNDER THE BASE
SECTION M-M (PRE SB PW4ENG 72-262)
SECTION N-N (PRE SB PW4ENG 72-262)
2
SECTION N-N (POST SB PW4ENG 72-262)
SECTION M-M (POST SB PW4ENG 72-262)
L-A7585 (0992)
PW V

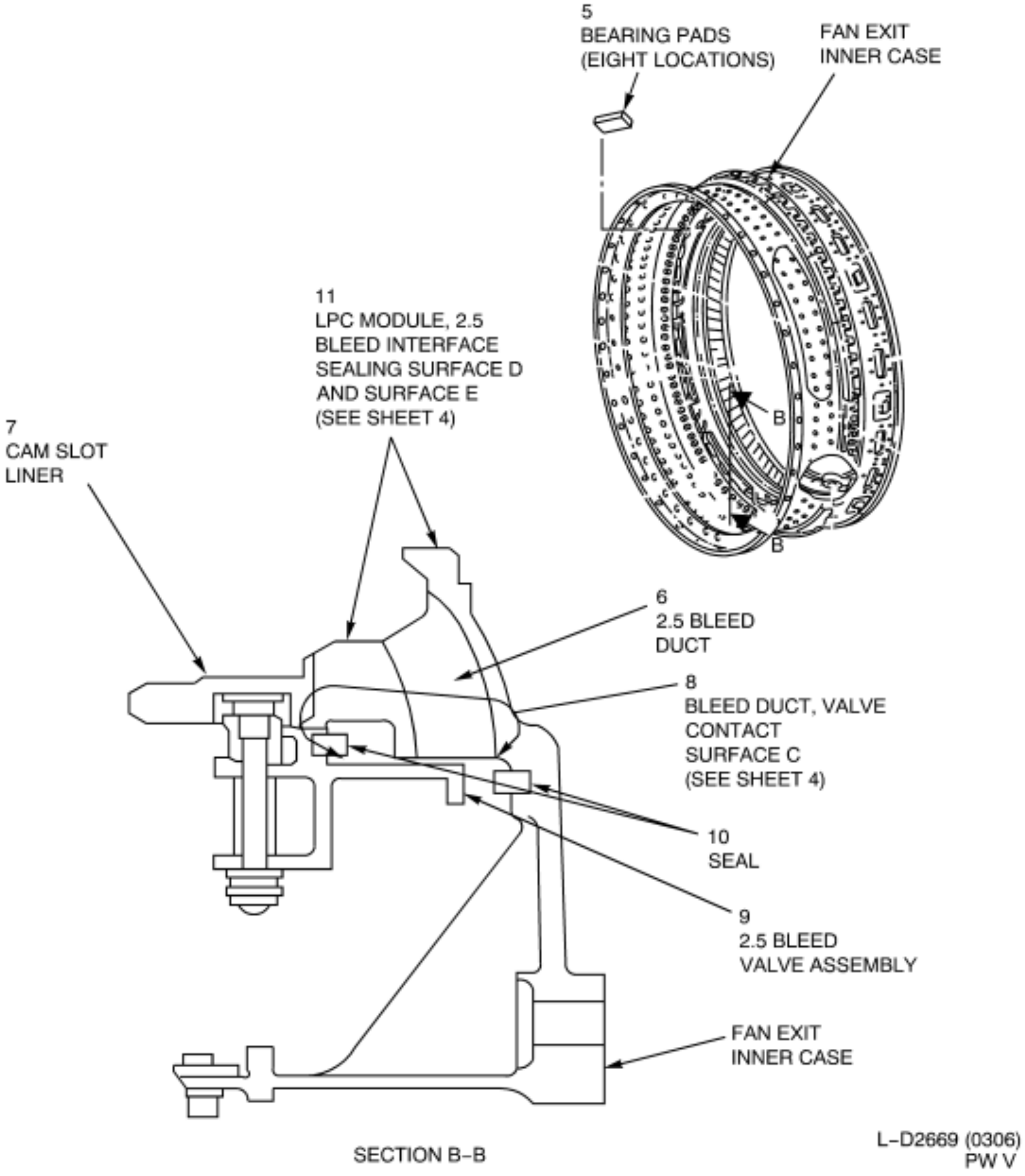
1. 0.075 Inch (1.905 mm) Reference
2. 1.380 Inches (35.052 mm) Reference

FEGV Airfoil Inspection
Figure 804 (Sheet 5)
(Task 72-00-33-210-010)


FAN EXIT INNER CASE
M
M
FAN CASE
1 SPLITTER FAIRING FLANGE
2 FRONT FAIRING NUT PLATE
3 VANE INNER DIAMETER ATTACHMENT PINS
12 FORWARD STEP INNER DIAMETER CORNER
SECTION M-M
A
2 SPLITTER FLANGE NUT PLATE
THIS AREA ON PINS VISIBLE ONLY IF VANES ARE REMOVED
D
2.5 BLEED DUCT
FAN EXIT INNER CASE
BEARING PAD
4 CASE GUSSETS
VIEW A
VIEW D
5 BEARING PAD
L-D2668 (0306)
PW V

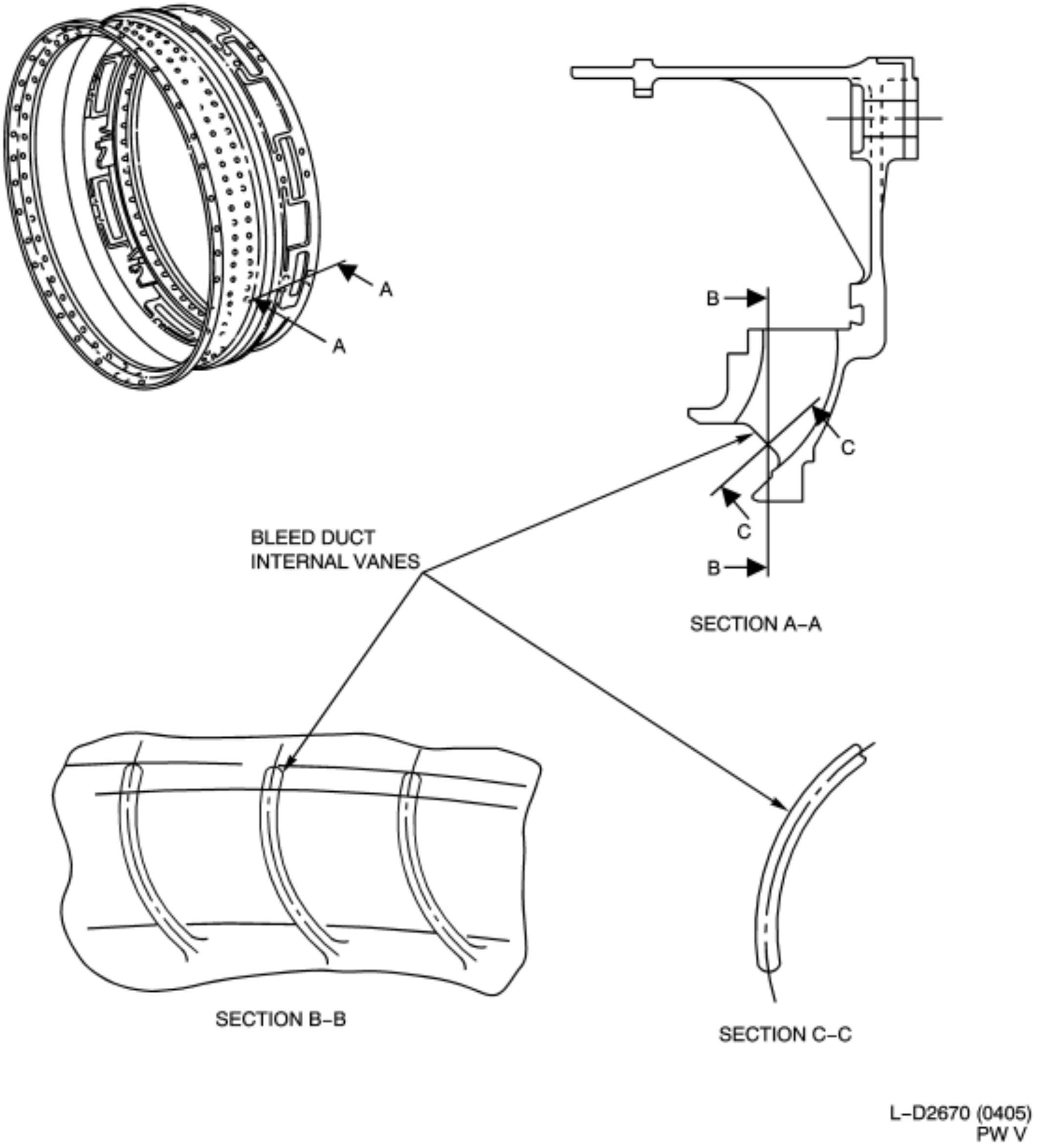
R See Table 805 For Index Definitions.

R Fan Exit Inner Case And 2.5 Bleed Duct Assembly Inspection
Figure 805 (Sheet 1)
(Task 72-00-33-210-010)

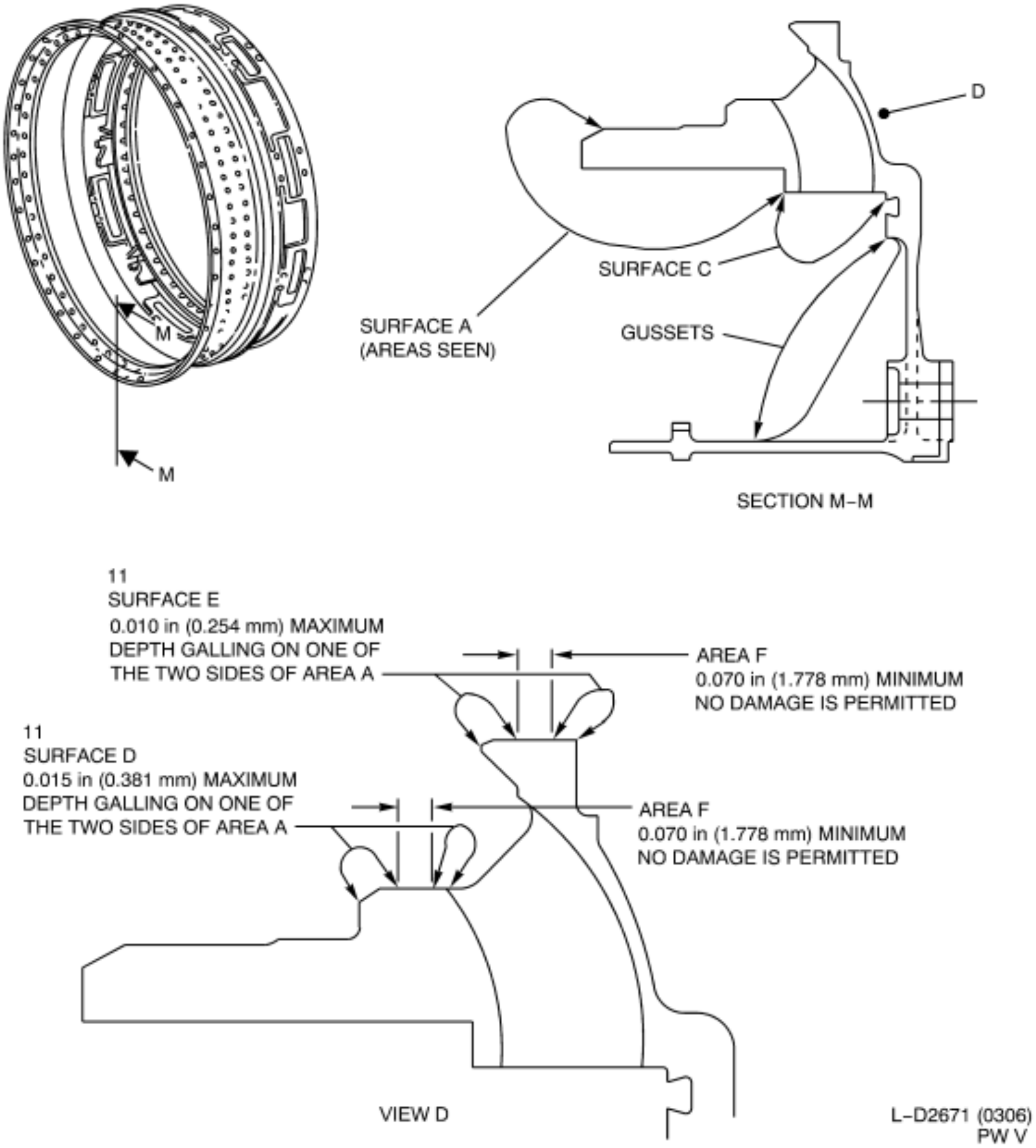

5
BEARING PADS
(EIGHT LOCATIONS)
FAN EXIT
INNER CASE
11
LPC MODULE, 2.5
BLEED INTERFACE
SEALING SURFACE D
AND SURFACE E
(SEE SHEET 4)
7
CAM SLOT
LINER
B
B
6
2.5 BLEED
DUCT
8
BLEED DUCT, VALVE
CONTACT
SURFACE C
(SEE SHEET 4)
10
SEAL
9
2.5 BLEED
VALVE ASSEMBLY
FAN EXIT
INNER CASE
SECTION B−B
L−D2669 (0306)
PW V

R See Table 805 For Index Definitions.

R Fan Exit Inner Case, 2.5 Bleed Duct
R And Bleed Valve Assembly Inspection
Figure 805 (Sheet 2)
(Task 72−00−33−210−010)


A
A
B
B
C
C
BLEED DUCT
INTERNAL VANES
SECTION A−A
SECTION B−B
SECTION C−C
L−D2670 (0405)
PW V

R 2.5 Bleed Duct Internal Vane Inspection
Figure 805 (Sheet 3)
(Task 72−00−33−210−010)


M
M
D
SURFACE C
SURFACE A
(AREAS SEEN)
GUSSETS
SECTION M−M
11
SURFACE E
0.010 in (0.254 mm) MAXIMUM
DEPTH GALLING ON ONE OF
THE TWO SIDES OF AREA A
AREA F
0.070 in (1.778 mm) MINIMUM
NO DAMAGE IS PERMITTED
11
SURFACE D
0.015 in (0.381 mm) MAXIMUM
DEPTH GALLING ON ONE OF
THE TWO SIDES OF AREA A
AREA F
0.070 in (1.778 mm) MINIMUM
NO DAMAGE IS PERMITTED
VIEW D
L−D2671 (0306)
PW V

R See Table 805 For Index Definitions.

R 2.5 Bleed Duct Surface Inspection
Figure 805 (Sheet 4)
(Task 72−00−33−210−010)

R
R
R
R
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R
R
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R
R
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R
R
R
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R
R
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R
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R
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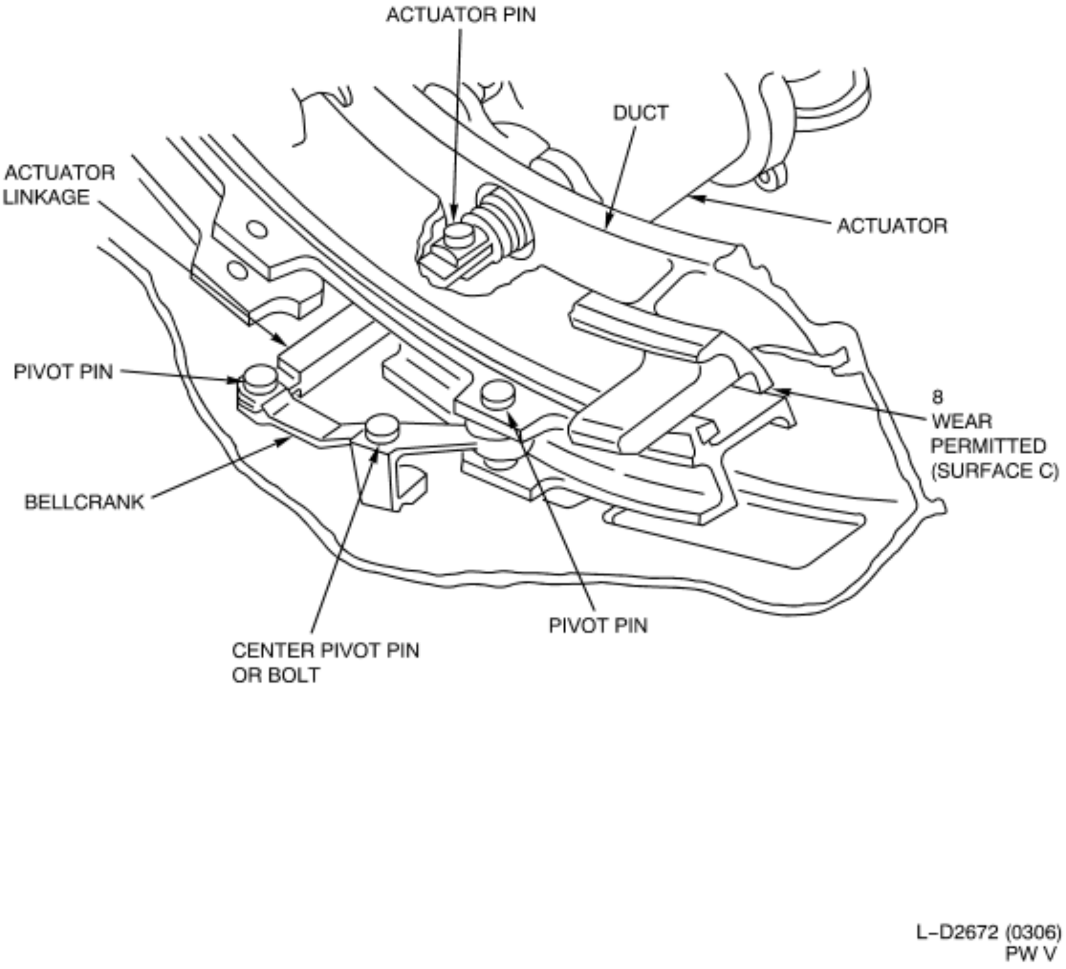
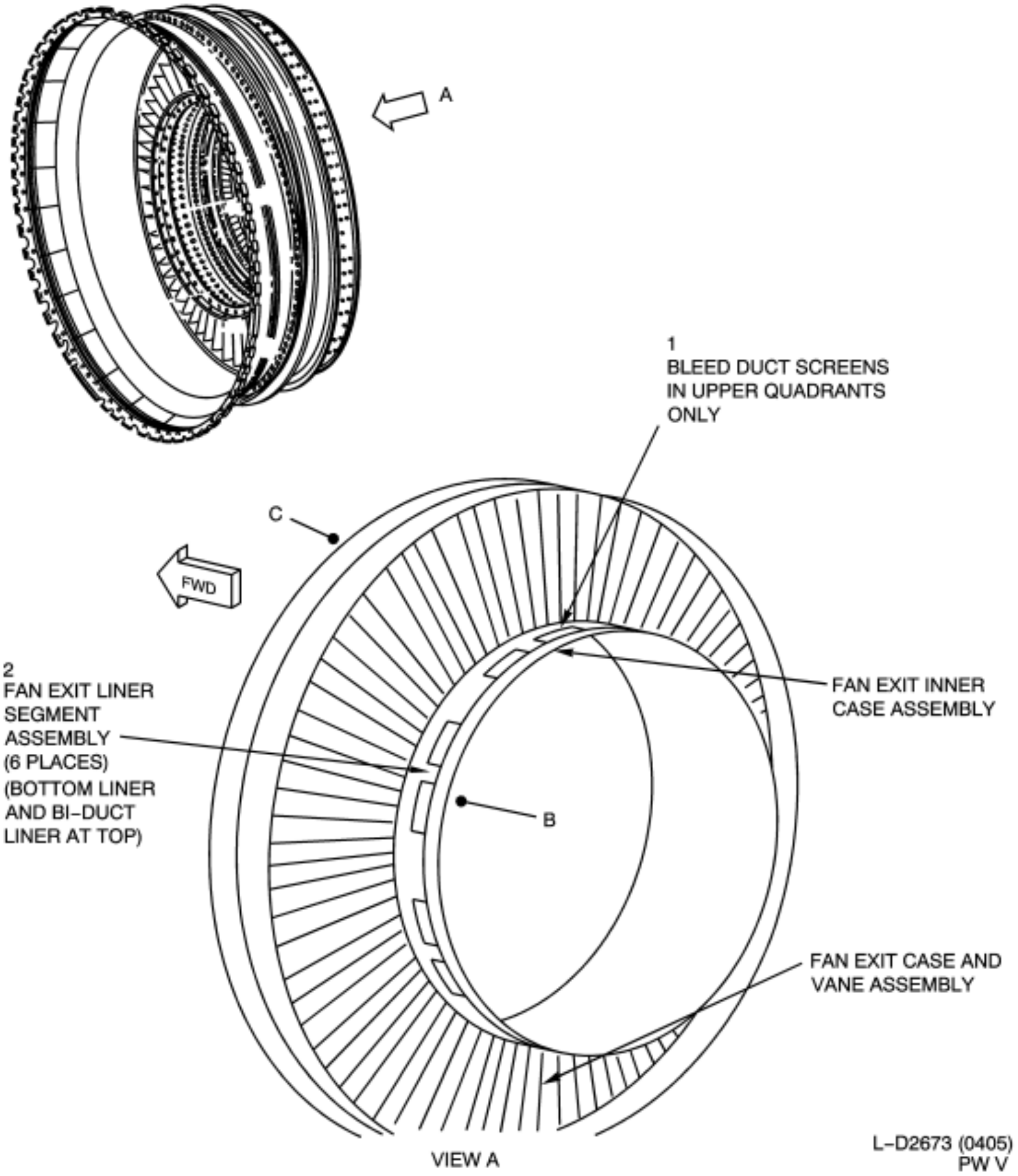
R
R
R

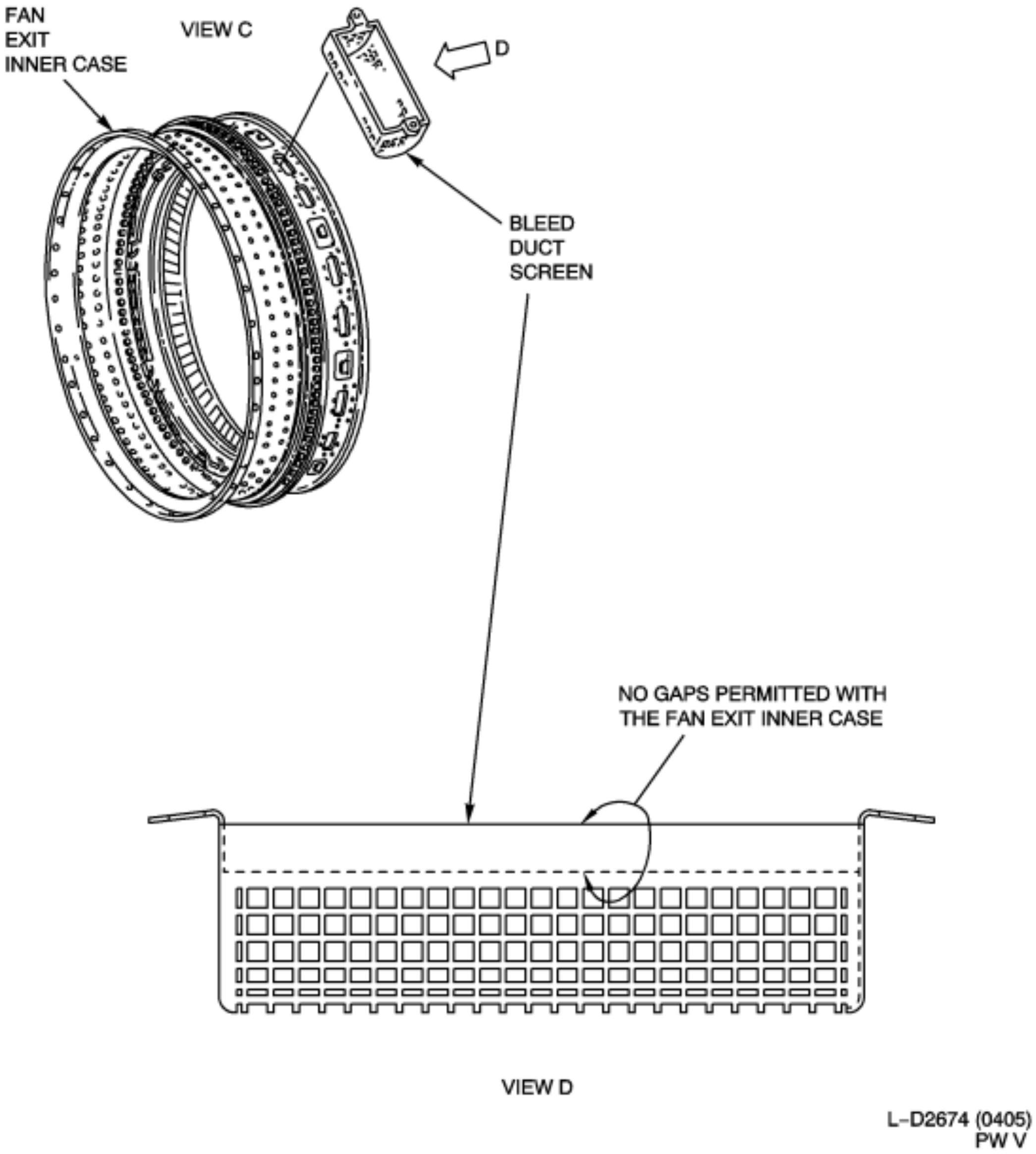

ACTUATOR PIN
DUCT
ACTUATOR LINKAGE
ACTUATOR
PIVOT PIN
8
WEAR PERMITTED (SURFACE C)
BELLCRANK
PIVOT PIN
CENTER PIVOT PIN OR BOLT
L−D2672 (0306)
PW V

R See Table 805 For Index Definitions.

R 2.5 Bleed Actuator And Linkage Inspection
Figure 805 (Sheet 5)
(Task 72−00−33−210−010)

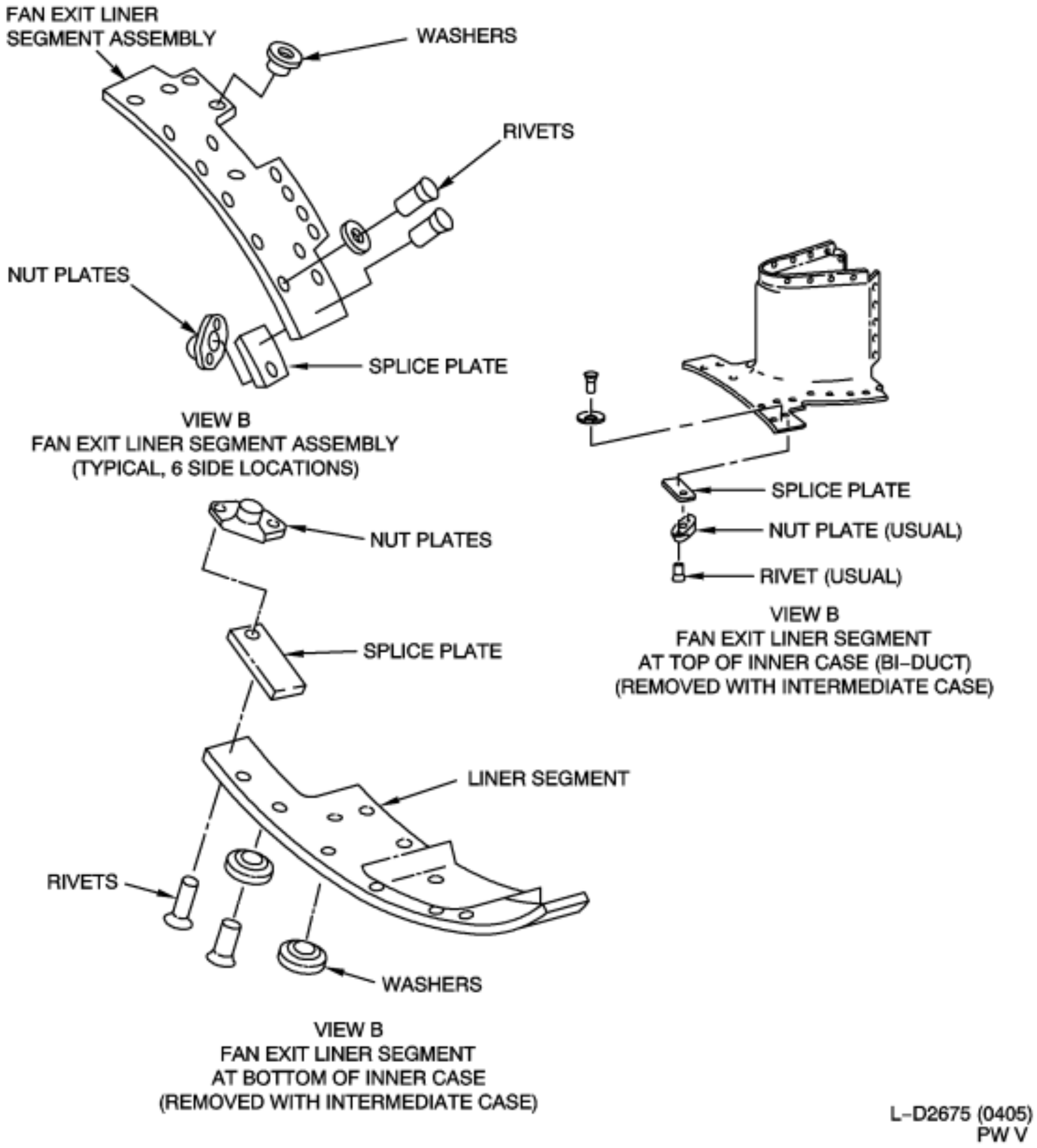

A
1
BLEED DUCT SCREENS
IN UPPER QUADRANTS
ONLY
C
FWD
2
FAN EXIT LINER
SEGMENT
ASSEMBLY
(6 PLACES)
(BOTTOM LINER
AND BI−DUCT
LINER AT TOP)
FAN EXIT INNER
CASE ASSEMBLY
B
FAN EXIT CASE AND
VANE ASSEMBLY
VIEW A
L−D2673 (0405)
PW V

Fan Exit Liners And Bleed Screens Inspection
Figure 806 (Sheet 1)
(Task 72−00−33−210−010)

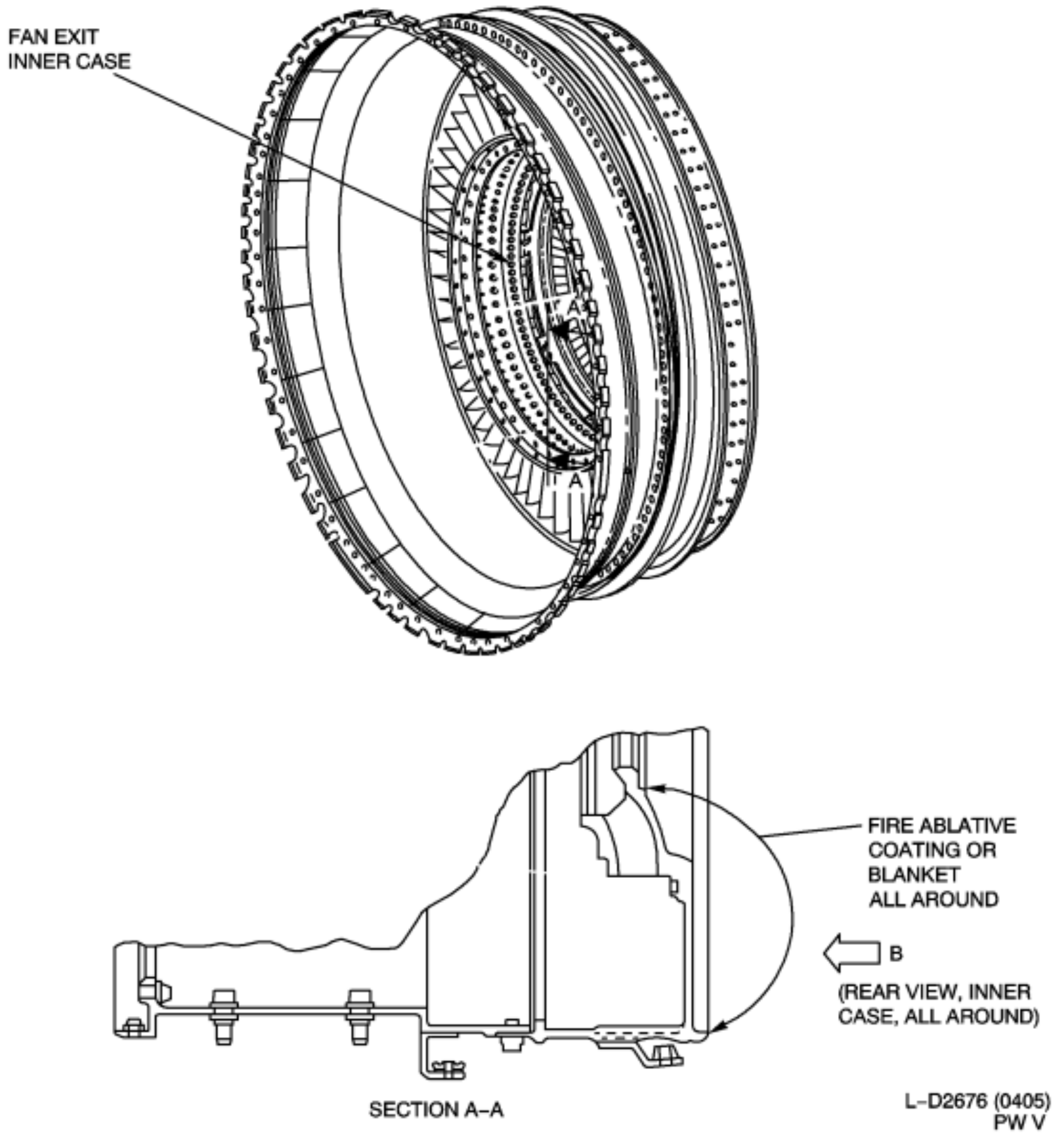

FAN EXIT INNER CASE
VIEW C
D
BLEED DUCT SCREEN
NO GAPS PERMITTED WITH THE FAN EXIT INNER CASE
VIEW D
L−D2674 (0405)
PW V

R

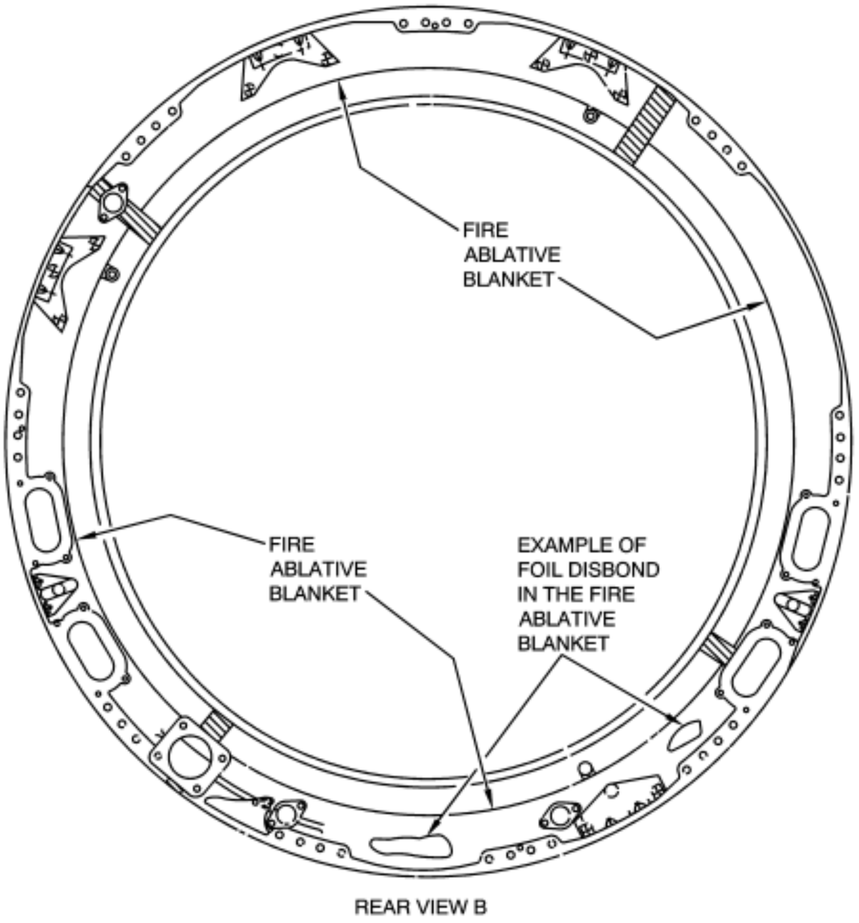
Bleed Screens Inspection
Figure 806 (Sheet 2)
(Task 72−00−33−210−010)


FAN EXIT LINER
SEGMENT ASSEMBLY
WASHERS
RIVETS
NUT PLATES
SPLICE PLATE
VIEW B
FAN EXIT LINER SEGMENT ASSEMBLY
(TYPICAL, 6 SIDE LOCATIONS)
NUT PLATES
SPLICE PLATE
LINER SEGMENT
RIVETS
WASHERS
VIEW B
FAN EXIT LINER SEGMENT
AT BOTTOM OF INNER CASE
(REMOVED WITH INTERMEDIATE CASE)
SPLICE PLATE
NUT PLATE (USUAL)
RIVET (USUAL)
VIEW B
FAN EXIT LINER SEGMENT
AT TOP OF INNER CASE (BI−DUCT)
(REMOVED WITH INTERMEDIATE CASE)
L−D2675 (0405)
PW V

R Fan Exit Liners Inspection
Figure 806 (Sheet 3)
(Task 72−00−33−210−010)


FAN EXIT INNER CASE
A
A
FIRE ABLATIVE COATING OR BLANKET ALL AROUND
B
(REAR VIEW, INNER CASE, ALL AROUND)
SECTION A−A
L−D2676 (0405)
PW V

Inner Case Fire Ablative Blanket Or Coating Inspection
Figure 807 (Sheet 1)
(Task 72−00−33−210−010)


FIRE
ABLATIVE
BLANKET
FIRE
ABLATIVE
BLANKET
EXAMPLE OF
FOIL DISBOND
IN THE FIRE
ABLATIVE
BLANKET
REAR VIEW B

L−D1534 (0905)
PW V

Inner Case Fire Ablative Blanket Or Coating Inspection
Figure 807 (Sheet 2)
(Task 72−00−33−210−010)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - FAN CASE - REPAIR-01

Task 72-00-33-300-001-001:

1. Repair The Sealant Around The Bifurcation Fairing (Pre SB PW4ENG 72-370)

A. Equipment And Materials

Consumable Materials:

Item No.	Designation
P09-019	Sealant, Flame Resistant Silicone Rubber (PWA 36751-1)
P09-027	Sealant, Silicone Rubber (PWA 36003-2)
P18-007	Primer, Silicone (PWA 36086-2)

B. Procedure

Subtask 72-00-33-350-051:

CAUTION: DO NOT DAMAGE THE PARENT METAL WHEN YOU REMOVE THE SEALANT.

(1) Mechanically remove any damaged or unbonded sealant from areas shown in Figure 901.

(2) If necessary, apply sealant to Area AL.

(a) Clean the areas the sealant will touch. Use PWA 83-D4, but do not use trichlorotrifluoroethane.

(b) Apply Primer P18-007 to all cleaned surfaces.

1 It is necessary to apply the primer in less than two hours after you cleaned the area.

2 The primer must cure in air at ambient temperature for two hours, minimum. The air must have a relative humidity of 25 percent, minimum.

(c) Apply Sealant P09-019.

1 It is necessary to apply the sealant from 2 - 24 hours after you applied the primer.

2 Use a hot air gun at 175° - 225°F (79.° - 107.°C) for 5 - 7 minutes to dry the sealant.

3 After the hot air gun, cure the sealant in air that has a relative humidity of 25 percent, minimum, for eight hours, minimum, before you touch the parts.

(3) If necessary, apply sealant to Area AM:

(a) Clean the areas the sealant will touch. Use PWA 83−D4, but do not use trichlorotrifluoroethane.

(b) Apply Sealant P09−027. Cure the sealant in air that has a relative humidity of 25 percent, minimum, for eight hours, minimum, before you touch the parts.

Task 72−00−33−300−001−002:

2. Repair The Sealant Around The Bifurcation Fairing (Post SB PW4ENG 72−370)

A. Equipment and Materials

Consumable Materials:

Item No.	Designation
P09−019	Sealant, Flame Resistant Silicone Rubber (PWA 36751−1)
P09−027	Sealant, Silicone Rubber (PWA 36003−2)
P18−007	Primer, Silicone (PWA 36086−2)

B. Procedure
See Figure 902.

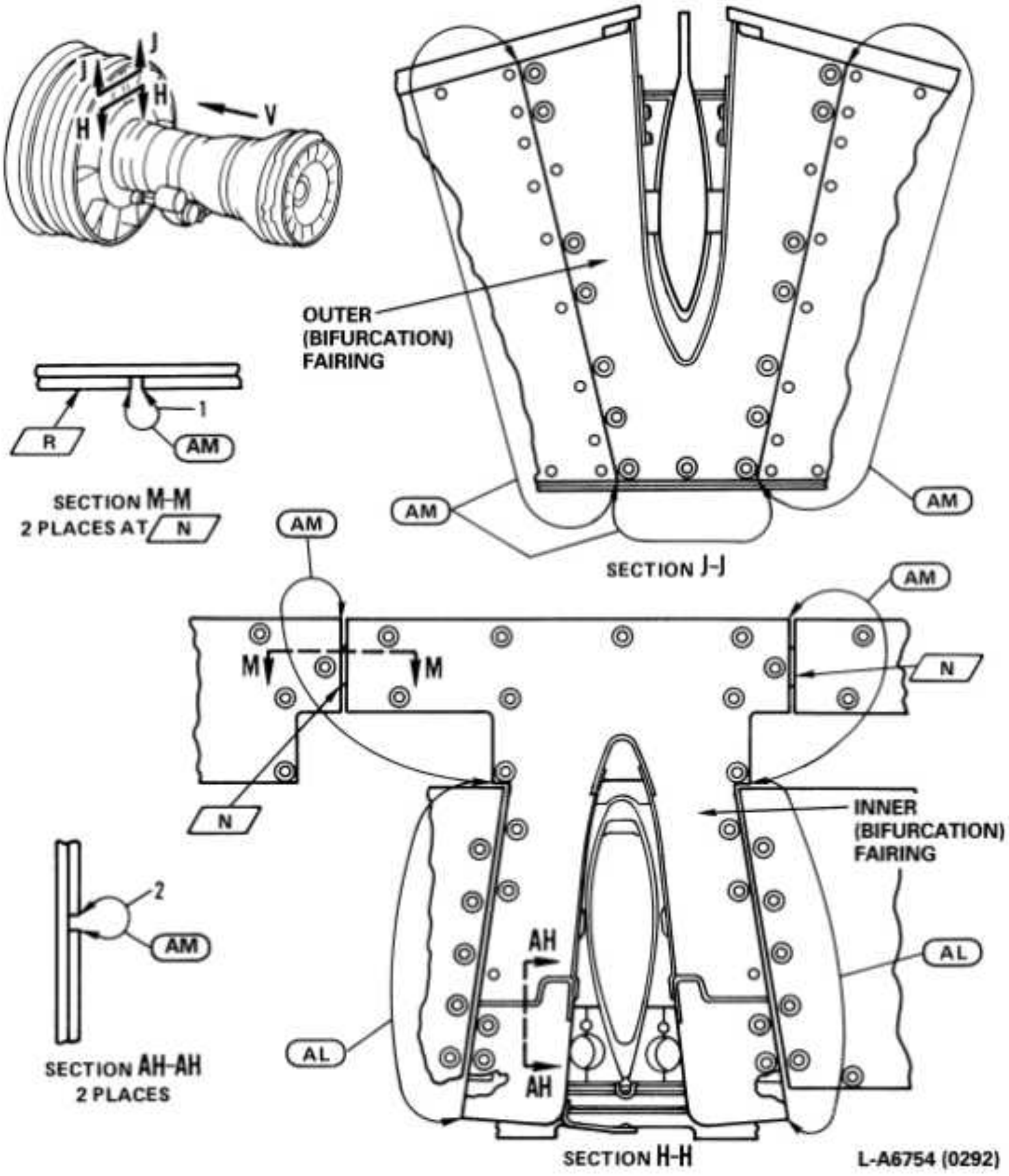
Subtask 72−00−33−350−052:

(1) Mechanically remove any damaged or unbonded sealant from areas shown in the referenced figure.

(2) If necessary, apply sealant at Area AM as follows:

(a) Before you bond the parts, clean them. Use PWA 83−D4 (Task 70−48−00−360−001), but do not use trichlorotrifluoroethane.

(b) Apply Sealant P09−027 to the clearances between the parts.


J
J
H
H
V
OUTER
(BIFURCATION)
FAIRING
1
R
AM
SECTION M-M
2 PLACES AT N
AM
AM
AM
SECTION J-J
AM
M
M
N
N
INNER
(BIFURCATION)
FAIRING
2
AM
AH
AL
AL
AH
SECTION AH-AH
2 PLACES
SECTION H-H
L-A6754 (0292)

Fan Exit Fairing (Bifurcation)
Figure 901 (Sheet 1)
(Task 72-00-33-300-001-001)

1. Apply The Sealant Even With, To 0.010 Inch (0.254 mm) Above, Surface R.
2. Apply The Sealant Even With, To 0.010 Inch (0.254 mm) Below, All Around The Access Cover, Two Places

Key to Figure 901 (Sheet 1)

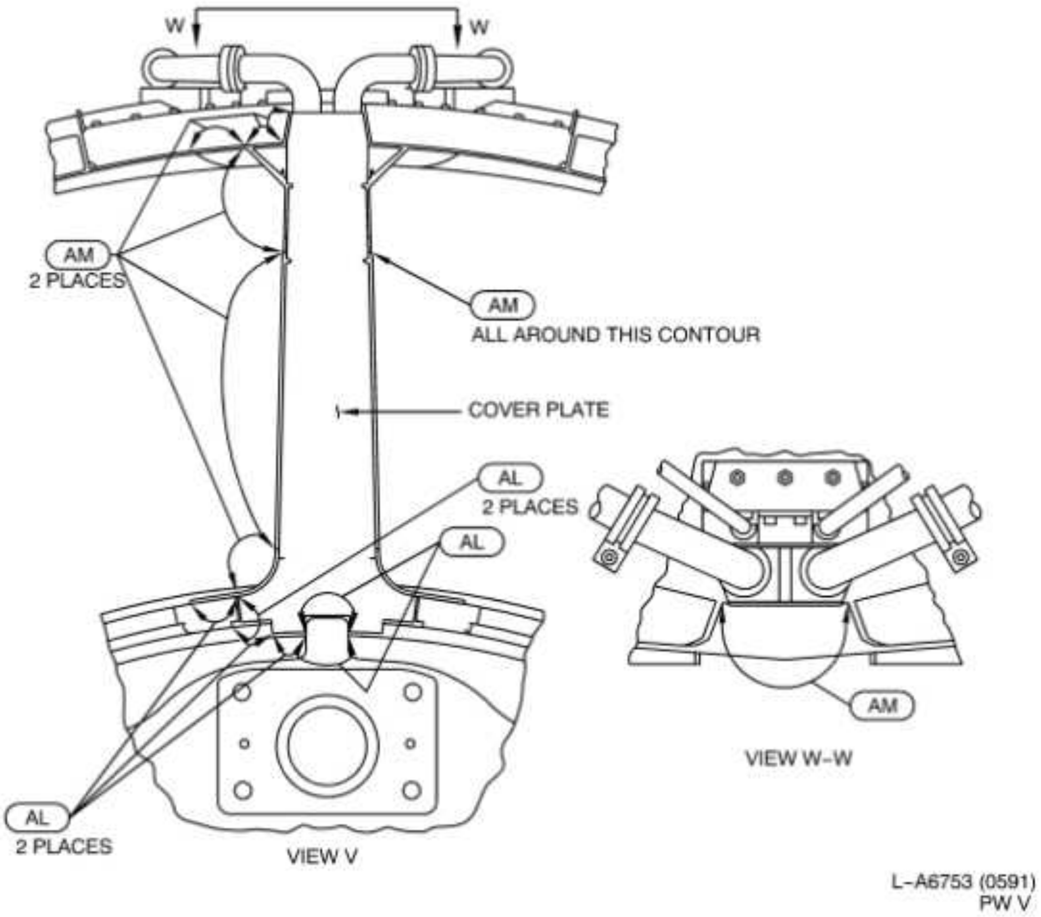
(c) Cure the parts in air that is at room temperature, has a relative humidity of 25 percent, minimum, for eight hours, before you touch the parts.

(3) If necessary, apply sealant at Area AL as follows:

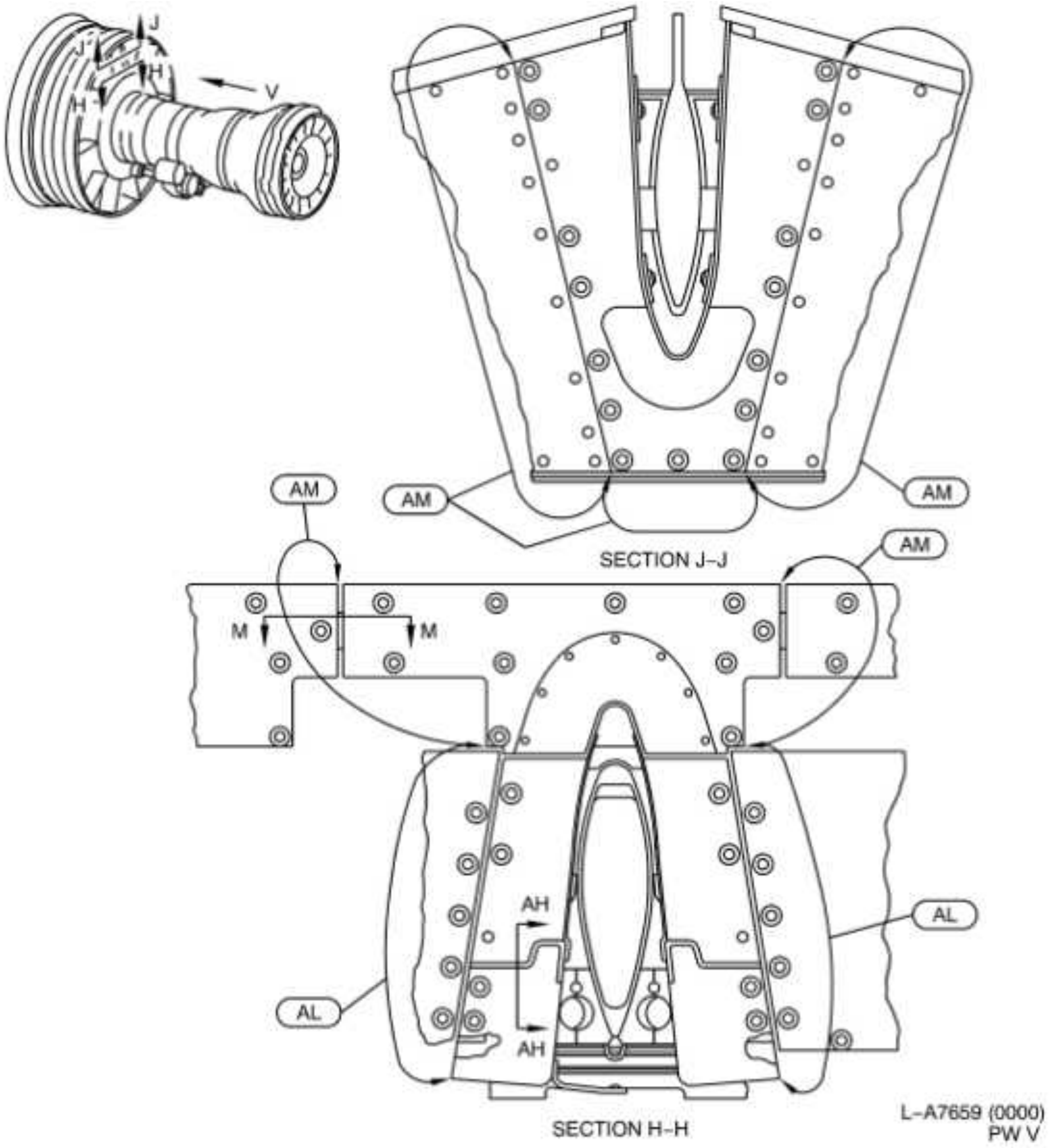
(a) Clean all areas. Use PWA 83−D4 (Task 70−48−00−360−001), but do not use trichlorotrifluoroethane.

(b) Prime all the surfaces you cleaned. Use Primer P18−007. You must apply the primer in less than two hours after you cleaned the parts. Cure the primer for two hours, minimum, in air that is at ambient temperature, and has a relative humidity of 25 percent, minimum, before you touch the parts.

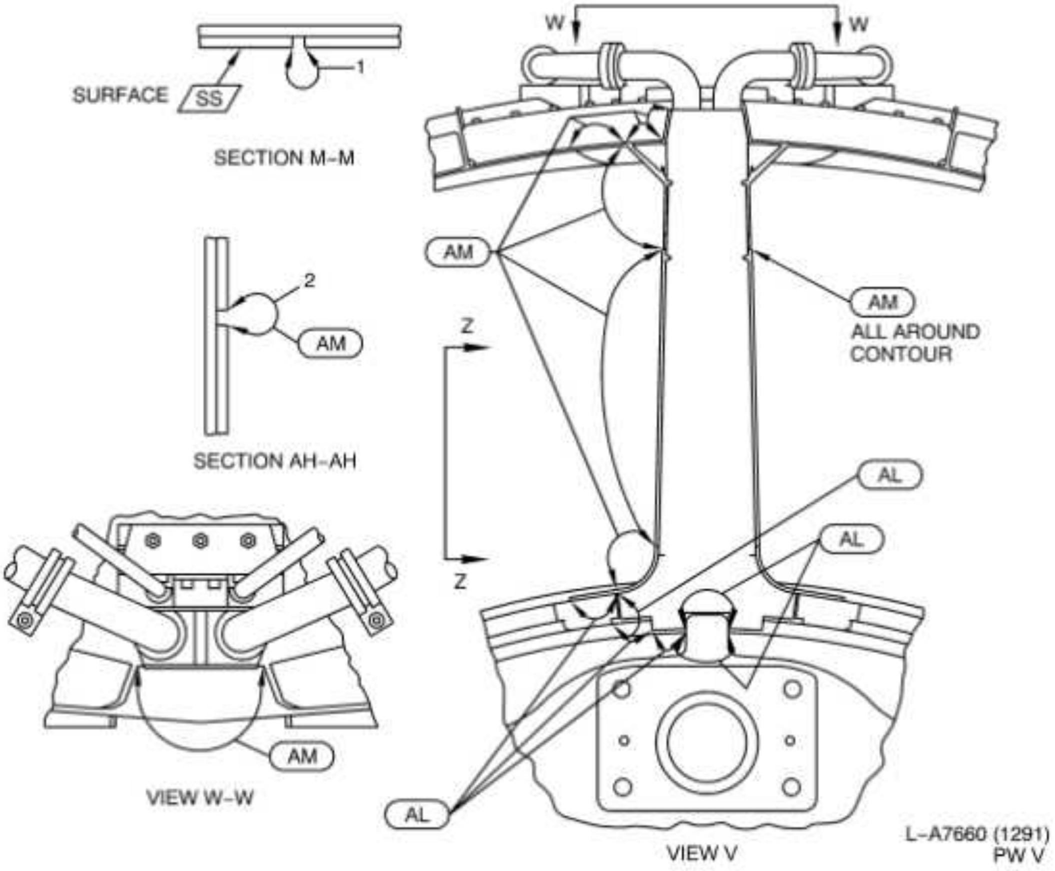
(c) Fill all cleaned and primed areas with Sealant P09−027. You must apply the sealant to the primed areas in 2 − 24 hours. Cure the sealant with a hot air gun at 175° − 200°F (79.° − 93.°C) for 5 − 7 minutes before you air cure the sealant. After you use the hot air gun, air cure the sealant for eight hours minimum in ambient air that has a relative humidity of 25 percent, minimum, before you touch the parts.


W
W
AM
2 PLACES
AM
ALL AROUND THIS CONTOUR
COVER PLATE
AL
2 PLACES
AL
AL
2 PLACES
VIEW V
AM
VIEW W−W
L−A6753 (0591)
PW V

Fan Exit Fairing (Bifurcation)
Figure 901 (Sheet 2)
(Task 72−00−33−300−001−001)

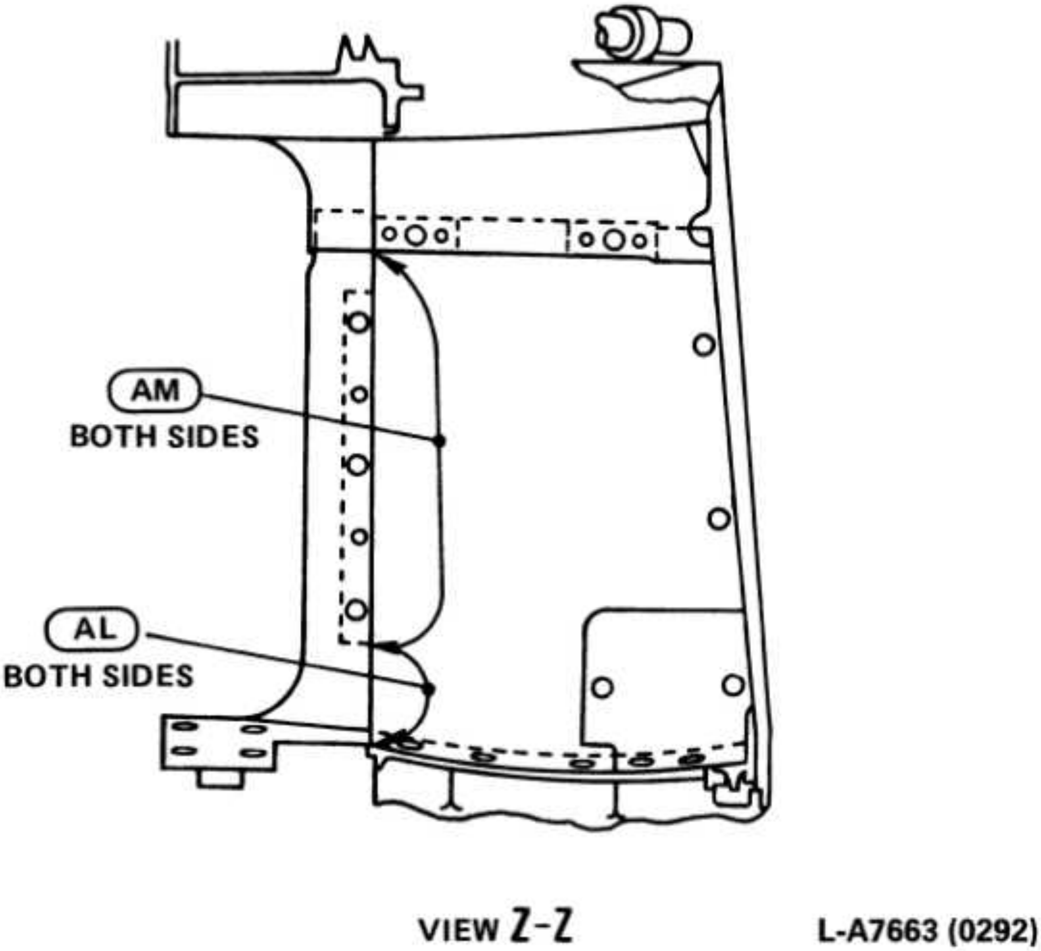

J
J
H
H
V
AM
AM
AM
AM
SECTION J-J
M
M
AH
AH
AL
AL
SECTION H-H
L-A7659 (0000)
PW V

Application Of Sealant
Figure 902 (Sheet 1)
(Task 72−00−33−300−001−002)


SURFACE
SS
1
SECTION M-M
2
AM
SECTION AH-AH
AM
VIEW W-W
W
W
AM
Z
Z
AM
ALL AROUND CONTOUR
AL
AL
AL
VIEW V
L-A7660 (1291)
PW V

1. The Sealant Must Be Even With, To 0.010 Inch (0.254 mm) Above, Surface SS.
2. The Sealant Must Be Even With, To 0.010 Inch (0.254 mm) Below, All Around The Access Cover

Application Of Sealant
Figure 902 (Sheet 2)
(Task 72−00−33−300−001−002)


AM
BOTH SIDES
AL
BOTH SIDES
VIEW Z-Z
L-A7663 (0292)

Application Of Sealant
Figure 902 (Sheet 3)
(Task 72−00−33−300−001−002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - FAN CASE - REPAIR-02

Task 72-00-33-300-002:

1. Install Boltholes In The Replacement Access Covers

A. Prerequisites

(1) Remove the cover plate and the damaged access cover from the 12 o'clock strut.

NOTE: Do not remove the other fairings from the 12 o'clock strut.

B. Equipment and Materials

Consumable Materials:

Item No.	Designation
P05-152	Agent, Wetting (PMC 1610)
P08-002	Resin, Liquid Epoxy (PWA 421-2)
P08-012	Agent, Epoxy Resin Curing (PWA 422)
P08-016	Epoxy, Adhesive Paste (PWA 457)

Repair Details:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cover	1	72-33-00/9/560B
Cover	1	72-33-00/9/570B
Washer	2	72-33-00/9/565

C. Procedure
See Figure 901.

Subtask 72-00-33-350-053:

(1) Find the positions of the new holes as follows.

(a) Attach a replacement access cover(s) and a cover plate to the inner fairing with bolts at the positions shown in the referenced figure.

(b) Mark the centerlines of all the hole diameters.

(c) Remove the previously installed workbolts.

(d) Remove the access cover and cover plate.

Subtask 72−00−33−350−054:

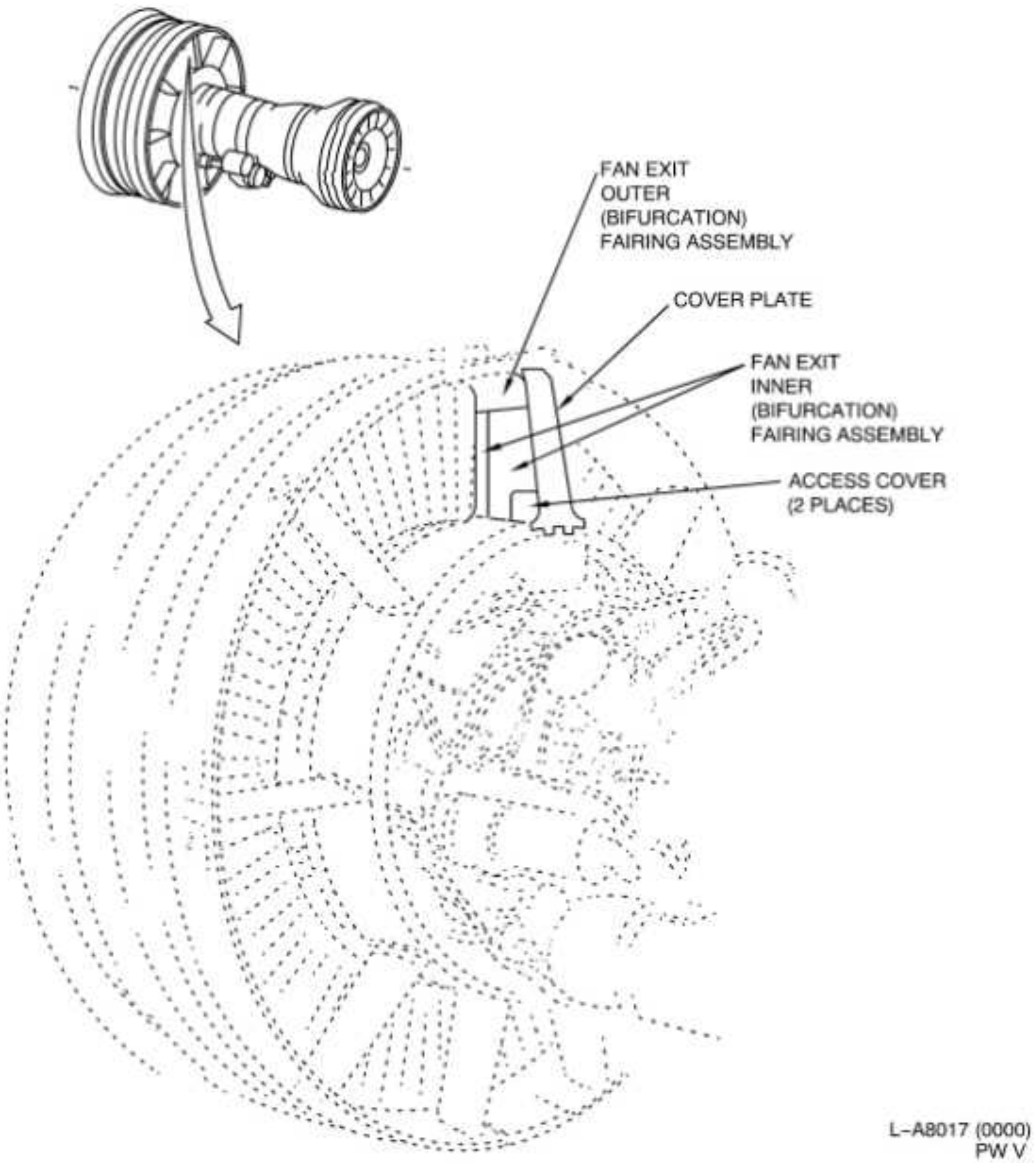
(2) Install the boltholes at the positions marked.

(3) Apply sealant to the machined surfaces of the cover(s) as follows.

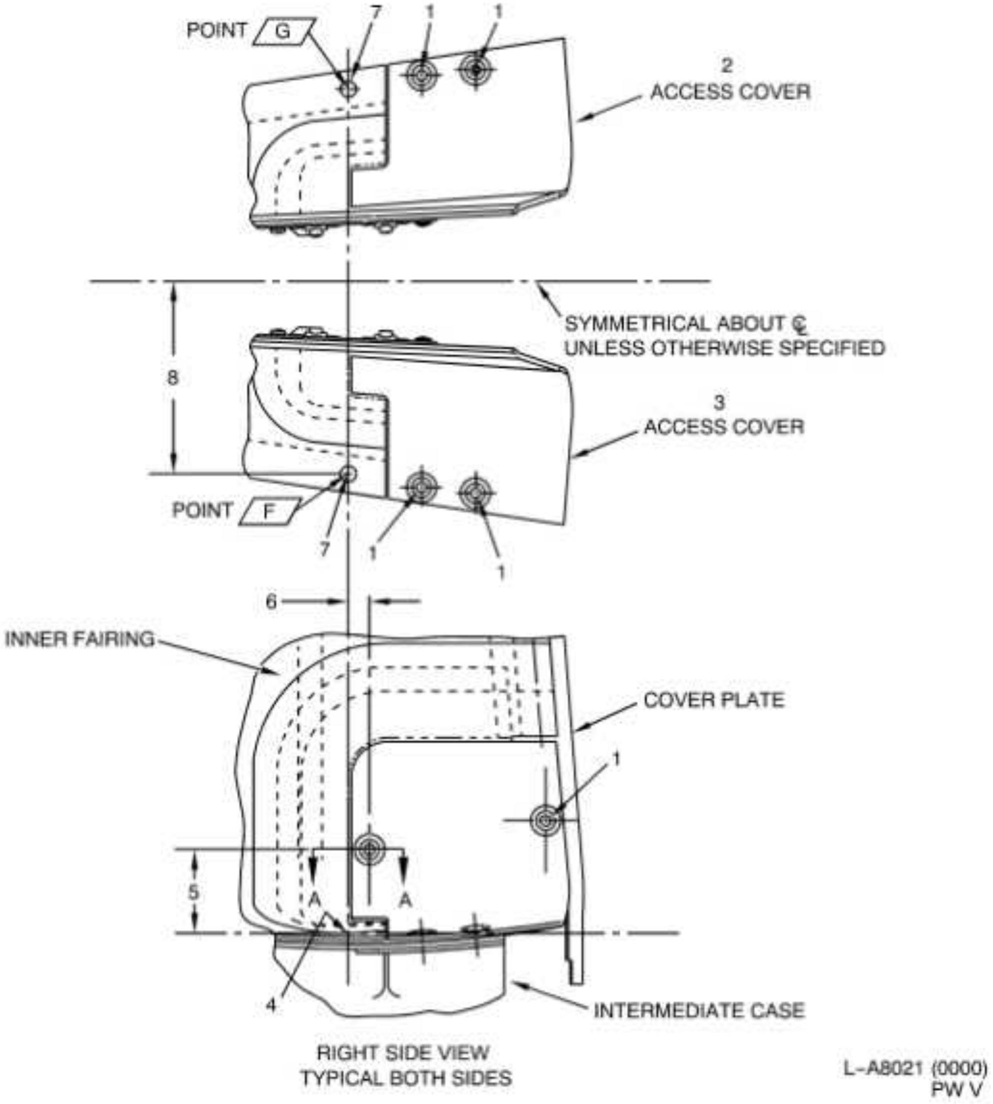
- (a) Wash the machined surfaces of the fairings and cover(s) with a solution of water and Wetting Agent P05−152.
- (b) Fully rinse the machined surfaces with clean water.
- (c) Dry the machined surfaces fully in air that is at room temperature.
- (d) Mix together, in a 4:1 proportion, Resin P08−002 and Curing Agent P08−012. Apply the epoxy mixture to the machined surfaces. Cure the epoxy mixture at 175°F (79.4°C) for one hour, minimum.

(4) Bond washers to the boltholes.

- (a) Clean the bond area of the boltholes. Use PWA 83−D2 (Task 70−48−00−360−001).
- (b) Clean the bond area of the washers with PWA 83−D4 (Task 70−48−00−360−001), but use isopropyl alcohol.
- (c) Apply a constant layer of Epoxy P08−016 to each bond area of the access cover(s) within 30 minutes after you cleaned it.
- (d) Bond the washers to the access cover(s).
- (e) Cure the epoxy at room temperature for two hours, minimum.


FAN EXIT OUTER (BIFURCATION) FAIRING ASSEMBLY
COVER PLATE
FAN EXIT INNER (BIFURCATION) FAIRING ASSEMBLY
ACCESS COVER (2 PLACES)
L−A8017 (0000)
PW V

Installation Of Boltholes In The Access Covers
Figure 901 (Sheet 1)
(Task 72−00−33−300−002)

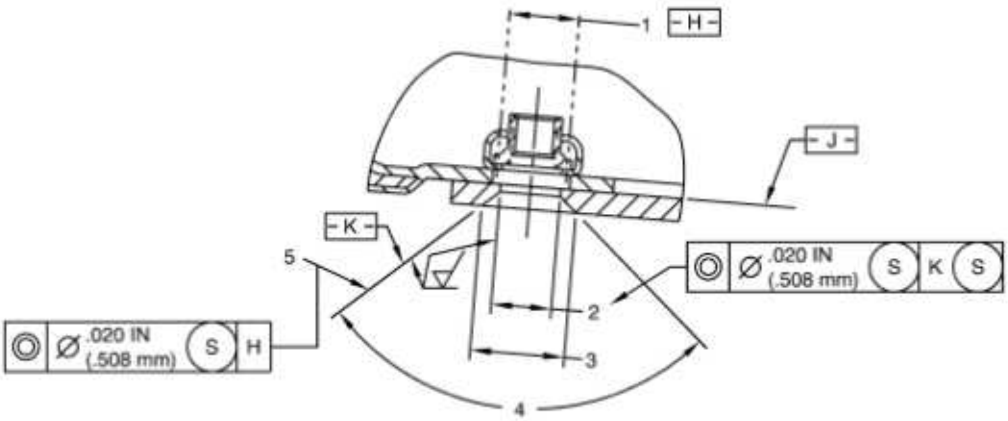

POINT G
7
1
1
2
ACCESS COVER
SYMMETRICAL ABOUT ℄
UNLESS OTHERWISE SPECIFIED
8
3
ACCESS COVER
POINT F
7
1
1
6
INNER FAIRING
COVER PLATE
1
5
A
A
4
INTERMEDIATE CASE
RIGHT SIDE VIEW
TYPICAL BOTH SIDES
L-A8021 (0000)
PW V

Installation Of Boltholes In The Access Covers
Figure 901 (Sheet 2)
(Task 72−00−33−300−002)

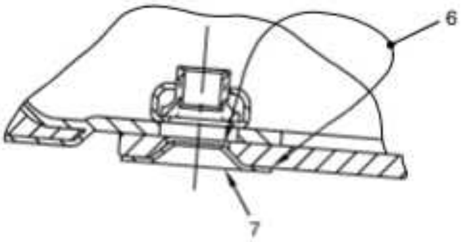
ENGINE GENERAL − FAN CASE − REPAIR−02

1. Install A Workbolt Here
2. PN 51G755−01
3. PN 51G753−01
4. Points F and G
5. 1.747 Inches (44.374 mm)
6. 0.425 Inch (10.795 mm)
7. 0.327 Inch (8.306 mm) Clearance Envelope
8. 4.011 Inches (101.870 mm)

Key to Figure 901 (Sheet 2)



SECTION A-A
WASHERS NOT SHOWN



SECTION A-A

L-A8022 (0000)
PW V

1. 0.354 Inch (8.992 mm) Diameter Clearance Envelope At Surface H Is Relative To Surface J.
2. 0.211 − 0.315 Inch (5.4 − 8.0 mm) Diameter. Keep The Clearance To This Diameter. Machine If Necessary.
3. 0.390 − 0.410 Inch (9.91 − 10.41 mm) Diameter
4. 100° − 102°
5. Two Holes Normal To Surface K.
6. Bond This Area All Around.
7. PN NAS1169C10L Washer, Two Places

Installation Of Boltholes In The Access Covers
Figure 901 (Sheet 3)
(Task 72−00−33−300−002)

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72−00−34

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	HIGHLIGHTS
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72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−03 • 72−00−34−050−001: Remove Electronic Engine Control (EEC) Speed Transducer (N1)
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−04 • 72−00−34−050−002: Remove No. 1 Bearing Support (Front And Rear) Assembly
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−05 • 72−00−34−050−003: Remove EEC Fan Case Wiring Harnesses W1 And W2 − Relocated • 72−00−34−050−004: Remove EEC Core Engine Wiring Harnesses W3, W4 And W5 − Relocated
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72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−07 • 72−00−34−030−002: Remove The 4th Stage Compressor Stator Assembly
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−08 • 72−00−34−050−005: Remove Air/Oil Heat Exchanger And Valve (IDGS)
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−09 • 72−00−34−050−006: Remove Valve From Air/Oil Heat Exchanger (IDGS)
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−10

	- 72−00−34−050−007: Remove Air/Oil Heat Exchanger And Valve (Engine)
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−11 - 72−00−34−050−008: Remove Valve From Air/Oil Heat Exchanger (Engine)
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−12 - 72−00−34−050−009: Remove HPC Secondary Flow Control Valve, IDGS Air/Oil Heat Exchanger Valve Override Solenoid
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−13 - 72−00−34−050−010: Remove The Start/Stability Bleed Valve Solenoid
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−14 - 72−00−34−050−011: Remove HPC Secondary Flow Control Valve, Turbine Vane And Blade Cooling Air Valve Solenoid
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−15 - 72−00−34−050−012: Remove IDGS Air/Oil Heat Exchanger Valve Override Pressure Switch
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−16 - 72−00−34−050−013: Remove The Stability Bleed Pneumatic Relay Valve
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−17 - 72−00−34−050−014: Remove EEC Speed Transducer (N1) Multiplexer Input Probe
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−18 - 72−00−34−050−018: Remove EEC Wiring Harness − W3 (Core Engine)
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−19 - 72−00−34−050−019: Remove EEC Wiring Harness − W4 (Core Engine)
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−20 - 72−00−34−020−020: Remove The Flange E Brackets And Hardware
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−21 - 72−00−34−020−004: Remove The Fan Unit From The Core Engine - 72−00−34−020−006: Remove The Fan Unit From The Core Engine
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−22

	- 72−00−34−040−001: Remove The No. 1 Bearing Vibration Transducer
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−23 - 72−00−34−050−020: Remove EEC Wiring Harness − W5 (Core Engine) - 72−00−34−050−024: Remove EEC Wiring Harness − W5 (Core Engine)
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−24 - 72−00−34−050−022: Remove Turbine Vane And Blade Cooling Air Valve, IDGS Air/Oil Heat Exchanger Valve Override Solenoid
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−25 - 72−00−34−050−023: Remove Turbine Vane Cooling Air Valve, Turbine Vane And Blade Cooling Air Valve Solenoid
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−01 - 72−00−34−420−001: Install The Intermediate Case
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−02 - 72−00−34−420−002: Install External Plumbing After Intermediate Case Installation
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−03 - 72−00−34−450−001: Install Electronic Engine Control (EEC) Speed Transducer (N1)
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−04 - 72−00−34−450−002: Install No. 1 Bearing Support (Front And Rear) Assembly
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−05 - 72−00−34−990−002: Install EEC Fan Case Wiring Harnesses W1 And W2 − Relocated - 72−00−34−450−003: Install EEC Core Engine Wiring Harnesses W3, W4 And W5 − Relocated
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−06 - 72−00−34−430−001: Install No. 1.5 Bearing Support Assembly
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−07 - 72−00−34−430−002: Install The 4th Stage Compressor Stator Assembly
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−08 - 72−00−34−450−004: Install Air/Oil Heat Exchanger And Valve (IDGS)

72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−09 • 72−00−34−450−005: Install Valve To Air/Oil Heat Exchanger (IDGS)
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−10 • 72−00−34−450−006: Install Air/Oil Heat Exchanger And Valve (Engine)
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−11 • 72−00−34−450−007: Install Valve To Air/Oil Heat Exchanger (Engine)
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−12 • 72−00−34−450−008: Install HPC Secondary Flow Control Valve, IDGS Air/Oil Heat Exchanger Valve Override Solenoid
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−13 • 72−00−34−450−009: Install Start/Stability Bleed Valve Solenoid
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−14 • 72−00−34−450−010: Install HPC Secondary Flow Control Valve, Turbine Vane And Blade Cooling Air Valve Solenoid
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−15 • 72−00−34−450−011: Install IDGS Air/Oil Heat Exchanger Valve Override Pressure Switch
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−16 • 72−00−34−450−012: Install The Stability Bleed Pneumatic Relay Valve
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−17 • 72−00−34−450−013: Install EEC Speed Transducer (N1) Multiplexer Input Probe
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−18 • 72−00−34−450−017: Install EEC Wiring Harness − W3 (Core Engine)
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−19 • 72−00−34−450−018: Install EEC Wiring Harness − W4 (Core Engine)
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−20 • 72−00−34−420−020: Install The Flange E Brackets And Hardware

72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−21 • 72−00−34−420−004: Install The Fan Unit On The Core Engine • 72−00−34−420−006: Install The Fan Unit On The Core Engine
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−22 • 72−00−34−440−001: Install The No. 1 Bearing Vibration Transducer
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−23 • 72−00−34−450−019: Install EEC Wiring Harness − W5 (Core Engine) • 72−00−34−450−023: Install EEC Wiring Harness − W5 (Core Engine)
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−24 • 72−00−34−450−021: Install Turbine Vane And Blade Cooling Air Valve, IDGS Air/Oil Heat Exchanger Valve Override Solenoid
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−25 • 72−00−34−450−022: Install Turbine Vane Cooling Air Valve, Turbine Vane And Blade Cooling Air Valve Solenoid
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−01 • 72−00−34−990−001: Specific Fits And Clearances
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10 • 72−00−34−990−010: Intermediate Case Module Assembly Visual Inspection
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REPAIR−01 • 72−00−34−300−001: Install Helical Coil Inserts In The Screw Thread Inserts In The Ground Handling Pad
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REPAIR−02 • 72−00−34−300−002: Replace The Screw Thread Inserts In The Ground Handling Pad
72−00−34	ENGINE GENERAL − INTERMEDIATE CASE − REPAIR−03 • 72−00−34−300−003: Replace Or Bond An Intermediate Case Strut Seal

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ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-01

Task 72-00-34-020-001:

1. Remove Intermediate Case

NOTE: See Figure 301 for Part/Assembly Removal Procedure Sequence.

A. Prerequisites

(1) For engines not equipped with engine multiplexer unit (PMUX) or the supplemental control unit (SCU), remove electronic engine control (EEC) speed transducer (N1). Refer to 72-00-34, Removal-03 (Task 72-00-34-050-001).

(2) For engines equipped with engine multiplexer unit (PMUX) or the supplemental control unit (SCU), remove electronic engine control (EEC) speed transducer (N1) multiplexer input probe. Refer to 72-00-34, Removal-17 (Task 72-00-34-050-014).

(3) Remove The Main Gearbox. Refer to 72-00-61, Removal-01 (Task 72-00-61-020-001).

(4) Remove The Compressor Inlet Cone. Refer to 72-00-31, Removal-02 (Task 72-00-31-020-001).

(5) Remove All Stage 1 LPC Blade Assemblies. Refer to 72-00-31, Removal-04 (Task 72-00-31-020-002-002).

(6) Remove The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed). Refer to 72-00-32, Removal-01 (Task 72-00-32-020-001).

(7) Remove The Low Pressure Compressor (LPC). Refer to 72-00-31, Removal-01 (Task 72-00-31-020-003).

(8) Remove The Turbine Exhaust Case. Refer to 72-00-54, Removal-01 (Task 72-00-54-020-001).

(9) Remove The Low Pressure Turbine (LPT) With Shaft. Refer to 72-00-53, Removal-01 (Task 72-00-53-020-001).

(10) Remove The Fan Case. Refer to 72-00-33, Removal-01 (Task 72-00-33-020-001).

(11) Remove The No. 1 Bearing Support (Front And Rear) Assembly. Refer to 72-00-34, Removal-04 (Task 72-00-34-050-002).

(12) Remove The No. 1 Bearing Vibration Transducer, if applicable. Refer to 72-00-34, Removal-22 (Task 72-00-34-040-001).

(13) Remove The No. 1.5 Bearing Support Assembly. Refer to 72-00-34, Removal-06 (Task 72-00-34-030-001).

(14) Remove The High Pressure Turbine (HPT). Refer to 72-00-52, Removal-01 (Task 72-00-52-020-001).

(15) Remove The Turbine Nozzle. Refer to 72-00-51, Removal-01 (Task 72-00-51-020-001).

(16) Remove No. 3 Bearing Rear (Carbon) Seal Assembly And Rear Seal Seat. Refer to 72-00-41, Removal-03 (Task 72-00-41-020-003).

(17) Disconnect/Remove Harnesses For Removal Of The Intermediate Case. Refer to 72-00-34, Removal-05 (Task 72-00-34-050-003).

(18) Disconnect/Remove External Plumbing For Removal Of The Intermediate Case. Refer to 72-00-34, Removal-02 (Task 72-00-34-020-002).

(19) Trunnion Intermediate Case Through Diffuser And Combustor From Horizontal To Front End Down Position. Refer to 72-00-00, Special Procedures-09 (Task 72-00-00-020-002-A00) or (Task 72-00-00-020-002-B00).

B. Equipment And Materials Necessary

Special Tools:

PWA 28657	Sling
PWA 85064	Fixture, Handling
PWA 85246	Plug, Holding
PWA 76156	Adapter, Lift And Trunnion
PWA 27424	Pin, Aligning (3 Necessary)
PWA 87022	Stand, Build And Storage
PWA 88709	Plug, Holding
PWA 101848	Puller, Jackscrew (6 Necessary)

C. Procedure
See Figure 302.

(1) Thread PWA 85246 Plug onto HPC rear hub at center of diffuser case.

(2) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
(Pre SB PW4ENG 72-562) Thread the PWA 85246 Plug onto the HPC rear hub at the center of the diffuser case.

(3) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
(Post SB PW4ENG 72-562) Thread the PWA 88709 Plug onto the HPC rear shaft at the center of the diffuser case.

(4) Attach two PWA 76156 Adapters to PWA 28657 Sling and attach adapters to trunnion spools of PWA 85064 Fixture.

(5) Loosen knobs in center hub of fixture and using hoist install fixture to rear of diffuser case. Align dowel pin in fixture with hole in case and secure with detail bolts. Tighten center hub knobs.

(6) Remove the workbolts from the 33 bolt circle at the front of the intermediate case at Flange E.

(7) Install a PWA 27424 Aligning Pin in three equally spaced holes in the 33 bolt circle.

(8) Remove the Flange E hardware as follows. Refer to 72-00-34, Removal-20 (Task 72-00-34-020-020).

NOTE: Flange E has two configurations, the UPS configuration has 72 bolts and the other configuration has 74 bolts.

(9) Install jackscrews at No. 2 bearing support location. Install PWA 101848 Jackscrew Plate under variable vane trunnion bosses at 5th stage location (6 places equally spaced).

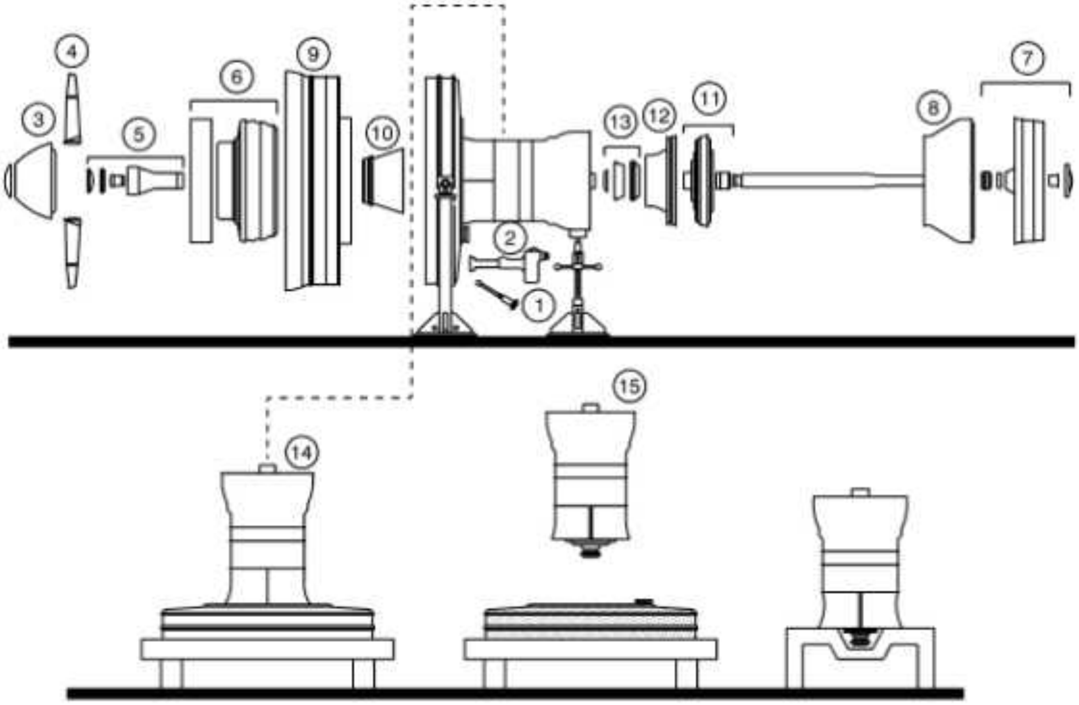
(10) With jackscrews, jacking plates and hoist, separate HPC and diffuser and combustion assembly from intermediate case.

(11) Remove HPC and diffuser and combustion assembly. Discard packing from OD of No. 2 bearing support. Lower the HPC and diffuser and combustion assembly onto PWA 87022 Build Stand. Remove jacking plates from HPC. Remove hoist, sling and adapters.

(12) If equipped, remove packing from intermediate case Flange E.

(13) Remove jackscrews from No. 2 bearing support one at a time and replace with 1/4−28 workbolts.

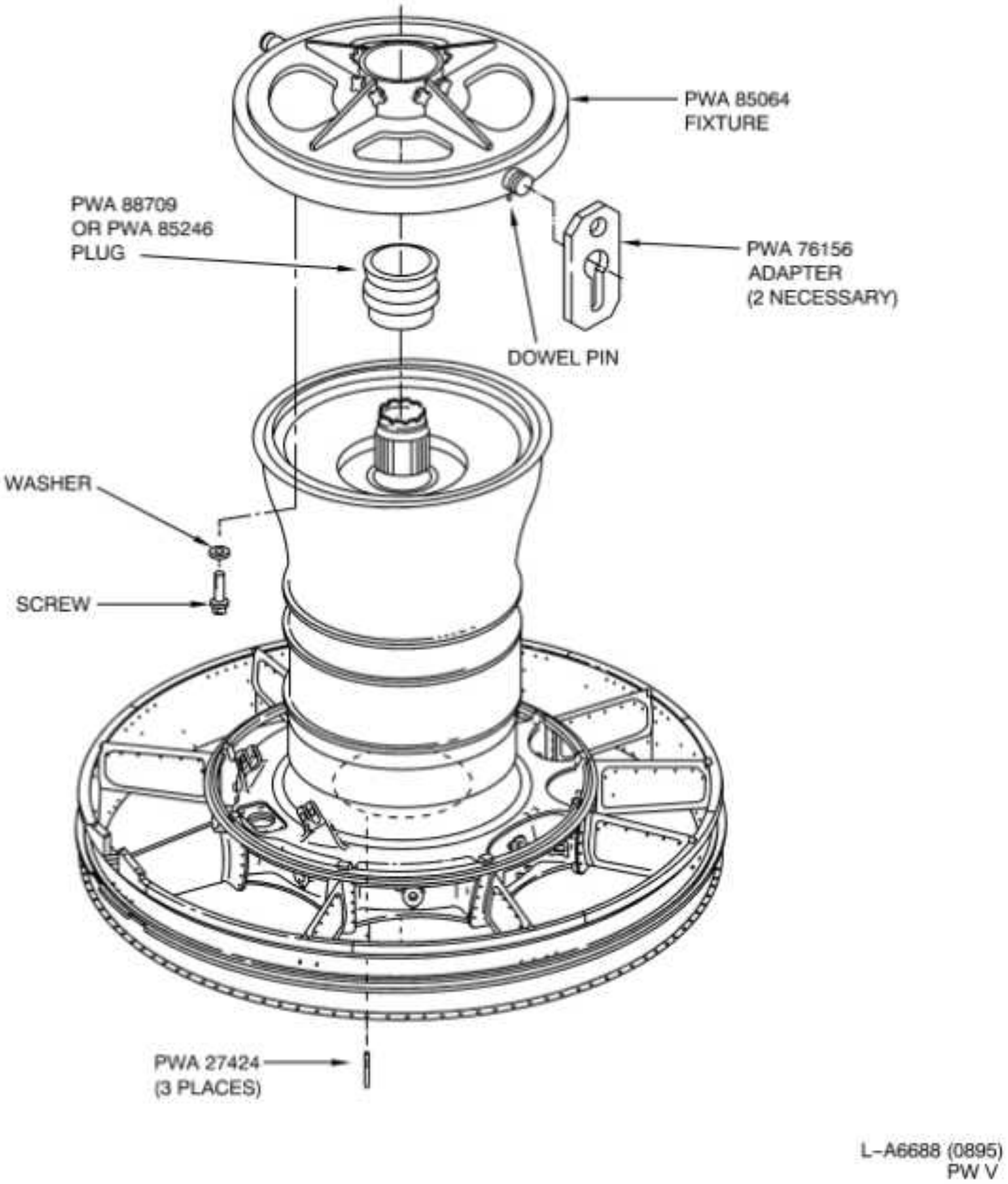
(14) Remove the three aligning pins.



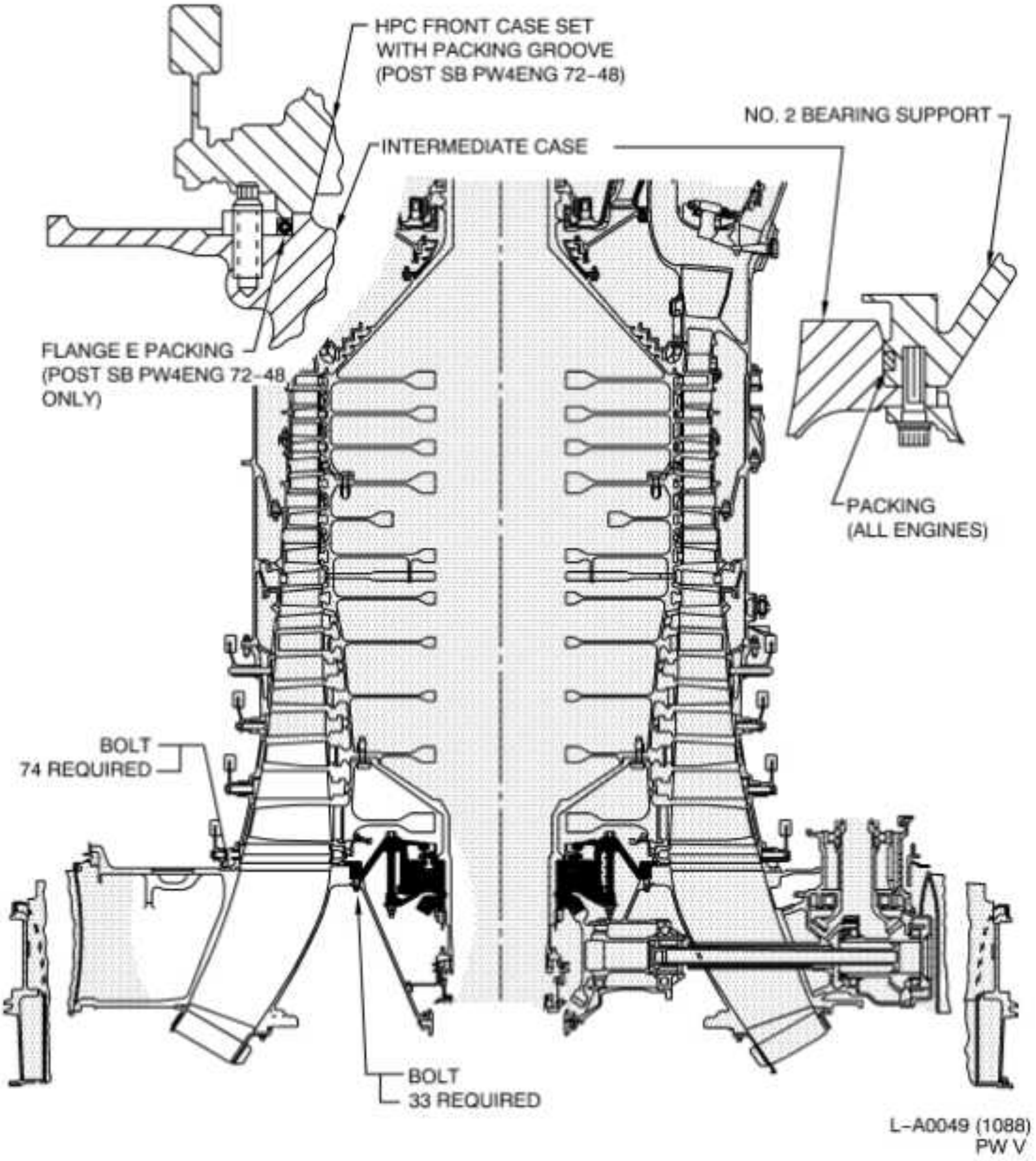
1. REMOVE ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
2. REMOVE MAIN GEARBOX.
3. REMOVE COMPRESSOR INLET CONE.
4. REMOVE STAGE 1 LPC BLADE ASSEMBLIES.
5. REMOVE LPC/LPT COUPLING.
6. REMOVE LOW PRESSURE COMPRESSOR (LPC).
7. REMOVE TURBINE EXHAUST CASE.
8. REMOVE LOW PRESSURE TURBINE (LPT).
9. REMOVE FAN CASE.
10. REMOVE NO. 1 BEARING SUPPORT ASSEMBLY.
11. REMOVE HIGH PRESSURE TURBINE (HPT).
12. REMOVE TURBINE NOZZLE.
13. REMOVE NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL PLATE.
14. TRUNNION INTERMEDIATE THROUGH DIFFUSER CASE TO FRONT END DOWN.
15. REMOVE DIFFUSER AND HIGH PRESSURE COMPRESSOR FROM INTERMEDIATE CASE.

L-A0104 (0187)
PW V

Procedure Sequence
Figure 301
(Task 72−00−34−020−001)


PWA 85064
FIXTURE
PWA 88709
OR PWA 85246
PLUG
PWA 76156
ADAPTER
(2 NECESSARY)
DOWEL PIN
WASHER
SCREW
PWA 27424
(3 PLACES)
L−A6688 (0895)
PW V

Intermediate Case Removal
Figure 302 (Sheet 1)
(Task 72−00−34−020−001)


HPC FRONT CASE SET
WITH PACKING GROOVE
(POST SB PW4ENG 72-48)
NO. 2 BEARING SUPPORT
INTERMEDIATE CASE
FLANGE E PACKING
(POST SB PW4ENG 72-48
ONLY)
PACKING
(ALL ENGINES)
BOLT
74 REQUIRED
BOLT
33 REQUIRED
L-A0049 (1088)
PW V

Intermediate Case Removal
Figure 302 (Sheet 2)
(Task 72−00−34−020−001)

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Task 72-00-34-020-002:

1. Remove External Plumbing For Intermediate Case Removal

A. Equipment And Materials Required

Special Tools:

CTE 5070	Cart, Airflow (Optional to CTE 6070)
CTE 6070	Cart, Airflow
PWA 85564	Adapter

B. Procedure
See Figure 301.

(1) For engines not equipped with engine multiplexer unit (PMUX), remove EEC PB tube assembly (AS20) from strut as follows.

(a) Remove lockwire and disconnect tube nut from tube coupling below strut at approximately 12:30 o'clock position.

(b) Remove bolt, nut and clamp securing tube to guide at top of intermediate case.

(c) Remove tube from grommets inside strut and install protective closures.

(2) For engines equipped with engine multiplexing unit (PMUX) or engines with common parts configuration Airbus/McDonnell Douglas, remove the EEC PT2.5 sensing and PB tube assembly (AS20/29) from the strut as follows.

(a) Remove the lockwire and disconnect both tube nuts from the tube couplings below the strut at approximately the 12:30 o'clock position.

(b) Remove the two bolts and clamps that attach the sensing tubes to a bracket on the solenoid switch at the 12:30 o'clock position below the strut.

(c) Remove the bolt and nut that attach the (AS29) tube to a bracket on Flange C at the 12:30 o'clock position. See View T.

NOTE: The bolt that attaches the clamp on tubes (AS20/29) to the guide on the intermediate case is removed with the W1 harness. See View S.

(d) Remove the grommet that attaches the (AS20/29) tube assemblies to the top inside of strut.

(e) Remove the assemblies from grommets inside the strut. Install protection covers to the tube assemblies.

(3) For engines equipped with common parts configuration Airbus/McDonnell Douglas, remove the EEC PT4.95 tube assembly (AS04) from the strut as follows.

(a) Remove the lockwire and disconnect the tube nut from the tube coupling at approximately the 11:30 o'clock position.

(b) Remove the bolt that attaches a tube clamp (welded) to a support assembly on the intermediate case assembly guide position. See View R.

(c) Remove the tube from the grommets inside the strut and install protection covers.

(4) For basic engines, remove EEC PT4.95 tube assembly (AS04) from strut as follows.

(a) Remove lockwire and disconnect tube nut from tube coupling at approximately 11:30 o'clock position.

(b) Remove bolt, nut, and clamp securing tube to guide at top of intermediate case.

(c) Remove bolt and clamp securing tube to top inside of strut.

(d) Remove tube from grommets inside strut and install protective closures.

(5) For engines with the PT4.95 maintenance break at Flange K (Post SB PW4ENG 73−106), remove the EEC PT4.95 tube assembly (AS41) as follows.

   (a) Remove lockwire and disconnect the tube at approximately 11:00 o'clock position adjacent to Flange K.

   (b) Remove the bolts, nuts, and clamps that attach the tube.

   (c) Remove the tube and install the protection covers.

(6) Remove air shutoff valve signal tube assembly (AA18) and HPC air valve signal tube assembly (AA06) as follows.

   (a) Remove lockwire and disconnect tubes from air filters above left side 2.9 bleed valve forward of Flange J.

   (b) Remove lockwire and disconnect tubes from air valve solenoid at approximately 10 o'clock position near Flange E.

   (c) Remove bolts, nuts, and clamps securing tubes to HPC case bracket and Flange H bracket and Flange E bracket. Remove tubes from engine and install protective closures.

(7) Remove HPC air valve and air shutoff valve supply tube assembly (AA22) as follows.

   (a) Remove lockwire and disconnect tube nut from tube coupling adjacent to air filters at approximately 11 o'clock position forward of Flange J.

   (b) Remove lockwire and disconnect tube nut from air valve solenoid at approximately 10 o'clock position near Flange E.

   (c) Remove bolts, nuts, and clamps securing tube to HPC case bracket, Flange H bracket and Flange E bracket. Remove tube from engine and install protective closures.

(8) Remove main bearing oil pressure tube (LP05) as follows:

   (a) Remove lockwire and disconnect tube from adapter on last chance strainer housing at approximately 9:30 o'clock position at Flange E.

(b) Remove lockwire and disconnect tube nut from fuel/oil cooler adapter at approximately 9 o'clock position.

(c) Remove the bolts, nuts, clamps and bracket that attaches the main bearing oil pressure tube (LP05) to the main bearing breather tube (LB06). See View N (Post SB PW4ENG 79-33).

(d) Remove bolt and clamp securing tube to Flange E bracket and remove tube from engine.

(e) Remove and discard retainer and packing. Install protective closures.

(9) Airflow check No. 1, 1.5, and 2 bearing oil nozzles. See Figure 302.

(a) Install PWA 85564 Adapter in the last chance strainer housing.

(b) Secure air supply hose from CTE 6070 Airflow Cart or CTE 5070 Airflow Cart to larger threaded hole of adapter. Secure pressure sensing line of the airflow cart to smaller threaded hole in adapter.

(c) Airflow check nozzles at 10 psig (68.9 kPa). Write the value of the airflow. Call this value the base airflow value.

NOTE: The airflow value that is for test equipment and reference only is 40 - 57 lb/hr (18.14 - 25.85 kg/hr).

(d) Remove the adapter and cart.

(10) Remove the main bearing oil pressure manifold assembly (LP07) as follows:

(a) Remove lockwire and last chance strainer from strainer housing attached to Flange E bracket. Remove and discard packing.

(b) Remove bolts securing front flanged end of manifold to case.

(c) Remove bolt, nut, and clamp securing strainer housing to Flange E bracket. Remove manifold from engine. Remove packing and install protective closures.

(11) Remove main bearing breather tube assemblies (LB06) and (LB01) as follows.

(a) Remove lockwire and disconnect (LB01) tube nut from (LB06) tube coupling at approximately 11:30 o'clock position near Flange E.

(b) Remove lockwire and disconnect (LB06) tube nut from tube coupling above fuel/oil cooler at approximately 9 o'clock position.

(c) Remove bolts, nuts, and clamps securing (LB06) tube to HPC case brackets at approximately 11:30 o'clock position and 10 o'clock position. Remove tube from engine and install protective closures.

(d) Remove bolts and lockwashers securing (LB01) tube to intermediate case. Remove tube from engine. Discard gasket and lockwashers. Install protective closures.

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH
R CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND
R INSTALL A TUBE WITH A FLEX SEGMENT WITH THE
R SAME PRECAUTION USED FOR A TUBE WITHOUT A
R FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A
R TUBE TO HELP WITH THE INSTALLATION OR REMOVAL
R OF THE TUBE OR AN ATTACHED COMPONENT. IF A
R FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE
R A KINK IN THE EXTERNAL WIRE BRAID AND IN THE
R INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND
R LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(12) Remove air/oil cooler outlet oil hose and tube assembly (LP03) as follows.

(a) Remove bolts securing tube flange to air/oil cooler port at approximately 9 o'clock position.

(b) Remove lockwire and disconnect tube nut from fuel/oil cooler bypass valve adapter.

(c) Remove bolt, nut, and clamp securing tube to HPC case bracket rearward of Flange E at approximately 8 o'clock position and remove tube from engine.

(d) Remove and discard packings and retainer. Install protective closures.

(13) Remove HPC valve cooling air tube assembly (AC35) as follows.

(a) Remove two bolts securing front of tube to case at approximately 10 o'clock position.

(b) Remove bolt, nut, and clamp securing tube to bracket and remove tube from engine.

(c) Install protective closures.

(14) Remove bleed valve cylinder hydraulic tube assembly (CP06) and bleed valve cylinder return tube assembly (CR02) as follows. See Figure 303.

NOTE: Be prepared to catch fuel in container with a minimum capacity of 5 U.S. gallons (19 liters).

(a) Remove lockwire and disconnect tube nuts from compressor bleed actuator adapters and from manifold tees at approximately 7 o'clock position.

(b) Remove tubes from engine and install protective closures.

(c) For engines with the two tubes clamped together (Post SB PW4ENG 75-45), remove the bolt, nut, and clamps.

(15) Remove (left) air/oil cooler valve hydraulic tube assembly (CP07) and (left) air/oil cooler valve return tube assembly (CR05) as follows.

(a) Remove lockwire and disconnect tube nuts from air/oil cooler tube adapters and from manifold tees at approximately 8 o'clock position.

(b) Remove return tube from engine and install protective closures.

(c) Remove bolts and clamps securing hydraulic tube to brackets.

(d) Remove hydraulic tube from engine and install protective closures.

(16) Remove compressor stator cylinder hydraulic tube assembly (CP12) and compressor stator cylinder return tube assembly (CR03) as follows.

(a) Remove lockwire and disconnect tube nuts from compressor stator vane actuator adapters and manifold tees at approximately 4:30 o'clock position.

(b) Remove bolts and clamps securing hydraulic and return tubes to Flange E bracket. Remove tubes and install protective closures.

(17) Remove (right) air/oil cooler valve hydraulic tube assembly (CP13) and (right) air/oil cooler valve return tube assembly (CR12) as follows.

(a) Remove lockwire and disconnect tube nuts from manifold tees and from air/oil heat exchanger tube adapters.

(b) Remove tubes from engine and install protective closures.

(18) Remove (right) hydraulic manifold assembly (CP05) and (right) oil cooler inlet return manifold assembly (CR01) as follows.

(a) Remove lockwire and disconnect flex hose nuts from manifold couplings at approximately 3 o'clock position.

(b) Remove lockwire and disconnect manifold nuts from manifold tees at approximately 5 o'clock position.

(c) Remove bolts, nuts, and clamps securing manifolds to brackets.

(d) Remove manifolds from engine and install protective closures.

(19) Remove (bottom) hydraulic manifold assembly (CP02) and (bottom) oil cooler inlet return manifold assembly (CR04) as follows.

R
R

(a) Remove lockwire and disconnect manifold nut from adapter located on front side of fuel/oil cooler.

(b) Remove bolts and clamps securing manifolds to brackets.

(c) Remove manifolds from engine and install protective closures.

(20) Remove angle gearbox oil pressure tube assembly (LP09) as follows.

(a) Remove lockwire and disconnect tube nut from adapter on right side of angle gearbox.

(b) Remove lockwire and disconnect tube nut from tube tee at approximately 7:30 o'clock position.

(c) Remove bolts, nuts, and clamps securing tube to brackets.

(d) Remove tube from engine and install protective closures.

(21) Remove (right) HPC air valve signal tube assembly (AA01) and (right) HPC air valve supply tube assembly (AA25) as follows. See Figure 304.

(a) Remove lockwire and disconnect tube nuts from air valve solenoid at approximately 1 o'clock position near Flange E.

(b) Remove lockwire and disconnect tube nuts from lower filter and tee forward of Flange J at approximately 2 o'clock position.

(c) Remove bolts, nuts, and clamps securing tubes to brackets.

(d) Remove tubes from engine and install protective closures.

(22) Remove (upper right) airframe cooler outlet oil tube assembly (LS03) and (lower right) airframe cooler outlet oil tube assembly (LS06) as follows.

(a) Remove three bolts securing (upper right) tube to air/oil heat exchanger at approximately 3 o'clock position near Flange E.

(b) Remove lockwire and disconnect (upper right) tube from (lower right) tube at approximately 3:30 o'clock position.

(c) Remove (upper right) tube and install protective closures.

(d) Remove lockwire and disconnect (lower right) tube nut from tube coupling at approximately 5 o'clock position.

(e) Remove bolt, nut, and clamp securing tube to bracket attached to stator vane lever support.

(f) Remove bolt, nut, and clamp securing tube to Flange H bracket at approximately 4:30 o'clock position. Remove (lower right) tube from engine.

(g) Remove packing and discard. Install protective closures.

(23) Remove bleed valve supply tube assemblies (AA26), (AA27), (AA29). See Figure 304 (Sheets 5 and 6) for (SB PW4ENG 75-28) configurations.

(a) Remove lockwire and disconnect tube nuts from tube couplings just below turbine cooling air valve actuator at approximately 2 o'clock position.

(b) For engines equipped with maintenance break in (left) bleed valve supply tube at 3 o'clock position (Pre SB PW4ENG 75-28), remove lockwire and disconnect.

(c) Remove lockwire and disconnect two tubes from solenoid at 5 o'clock position.

(d) For engines not equipped with maintenance break in (left) bleed valve supply tube at 5 o'clock position (Pre SB PW4ENG 75-28), remove lockwire and disconnect tube from pneumatic relay valve.

(e) For engines equipped with maintenance break in (left) bleed valve supply tube at 5 o'clock position (Post SB PW4ENG 75-28), remove lockwire and disconnect.

(f) Remove bolts, nuts, spacer, and clamps securing all supply tubes to brackets and to each other. Remove tubes and install protective closures.

(24) Disconnect No. 3 bearing air cooler tube assemblies (AP33) and (AP34) as follows.

(a) Remove lockwire and disconnect tube nuts from air cooler at approximately 2 o'clock position at Flange E.

(25) If HPC is to be disassembled further, comply with the following:

(a) Remove oil cooler inlet fuel tube assemblies (FM10) and (FM12) as follows. See Figure 305.

(b) Remove lockwire and disconnect (FM12) tube nut from fuel/oil cooler forward outboard adapter.

(c) Remove bolts, nuts, and clamps securing tube to HPC case brackets. Remove tube from engine.

(d) Remove and discard retainer and packing. Install protective closures.

(e) Remove lockwire and disconnect (FM10) tube nut from fuel/oil cooler forward inboard adapter.

(f) Remove bolts, nuts, and clamps securing tube to adjacent tube. Remove tube from engine.

(g) Remove and discard retainer and packing. Install protective closures.

(26) Remove (airframe) oil cooler inlet oil tube assembly (LS05) as follows.

(a) Remove lockwire and disconnect tube nut from oil bypass valve forward adapter. Remove tube from engine. Remove clamps.

(b) Remove and discard retainer and packing. Install protective closures.

(27) Remove oil cooler outlet fuel tube assembly (FM11) (Pre SB PW4ENG 73−35) or oil cooler outlet fuel hose and tube assembly (FM11) (Post SB PW4ENG 73−35) as follows.

(a) Remove lockwire and disconnect nut from fuel/oil cooler rearward adapter.

(b) (Post SB PW4ENG 75-95 and Pre SB PW4ENG 75-144) Remove the bolt, nut and clamps from the oil cooler outlet fuel tube (FM11) and the No. 3 bearing breather valve air supply tube assembly (AP39).

(c) Remove bolt, nut (if equipped), and clamp securing tube to Flange J bracket at approximately 7 o'clock position. Remove tube from engine.

(d) Remove and discard retainer and packing. Install protective closures.

(28) Remove (lower) No. 1, 1.5, and 2 bearing breather oil tube assembly (LB02). See Figure 306.

(a) Remove the bolt, nut and clamp that attaches the No. 1 and 2 bearing breather tube (lower (LB02) to the inboard oil cooler bracket (Post SB PW4ENG 79-33).

(b) Remove bolt, nut, and clamp securing tube to Flange H bracket at approximately 9 o'clock position and remove tube from engine.

(c) Install protective closures.

(29) Remove (front) No. 3 bearing pressure oil manifold assembly (LP18) and (lower) No. 3 bearing oil breather tube assembly (LB04) as follows.

CAUTION: YOU MUST USE THE WRENCHING FLATS ON THE MATTING PARTS WHEN YOU LOOSEN OR TIGHTEN THE RESTRICTOR OR TUBE NUTS. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

(a) Remove lockwire. While you hold the restrictor with a wrench, loosen and remove the restrictor from the oil trim pressure tube (LP31). While you hold the oil manifold tee (LP18) with a wrench, loosen and remove the oil trim pressure tube (LP31).

(b) Remove bolt and clamp securing pressure manifold to bracket attached to rear support of fuel/oil cooler. Remove pressure manifold from engine.

R
R

(c) Remove retainer and packing and discard. Install protective closures.

(d) Remove breather tube from engine and install protective closures.

(30) Remove gearbox oil pressure manifold assembly (LP08) as follows.

(a) Remove lockwire and disconnect manifold nut from inboard adapter at top of fuel/oil cooler.

(b) (Post SB PW4ENG 72-491) Remove bolt and clamp that holds the tube to Flange H bracket assembly at approximately 9 o'clock position.

(c) Remove tube from engine and install protective closures.

(31) For engines equipped with engine propulsion multiplexer unit (PMUX), remove (upper) PT2.5 sensing tube assembly (AS30) as follows. See Figure 307.

(a) Remove lockwire and disconnect lower manifold nut (AS31) from tube coupling at approximately 4 o'clock position rear of Flange E.

(b) Remove bolts and clamps securing tube to Flange E at three locations between 1 o'clock and 4 o'clock position.

(c) Remove tube from engine and install protective closures.

(32) For engines equipped with engine propulsion multiplexer unit (PMUX), remove (lower) PT2.5 sensing manifold assembly (AS31) as follows.

(a) Remove bolts, nuts, and clamps securing manifold to Flange E bracket, at approximately 5 o'clock position and HPC case bracket at approximately 4:30 o'clock position.

(b) Remove tube from engine and install protective closures.

(33) For engines with commonality parts between Airbus and McDonnell Douglas, remove the upper PT2.5 sensing tube assembly (AS30) as follows. See Figure 308.

(a) For engines not equipped with the supplemental control unit (SCU) with multiplexing, remove the lockwire from the cap assembly. Remove the cap assembly from the tube.

(b) For engines equipped with the supplemental control unit (SCU) with multiplexing, remove the lockwire and disconnect the lower tube nut from the tube coupling on tube (AS30) at approximately the 4 o'clock position rearward of Flange E.

(c) Remove the bolts, clamps and a nut that attach the tube (AS30) to brackets on Flange E at the 1, 1:30, 2:30 and 3:30 o'clock positions.

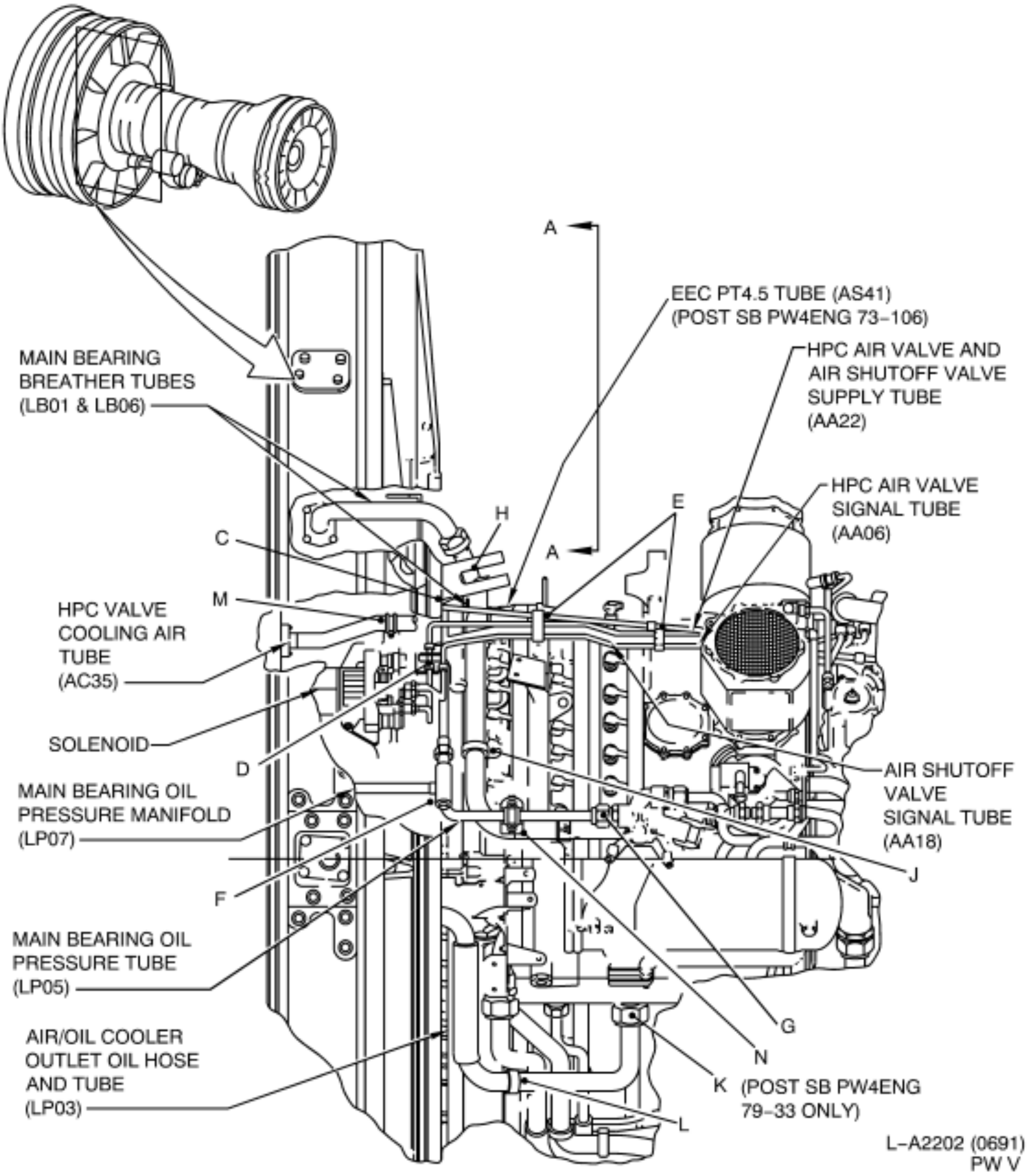
(d) Remove the tube from the engine and install protection covers.

(34) For engines with commonality parts between Airbus and McDonnell Douglas with the supplemental control unit (SCU) with multiplexing, remove the lower PT2.5 sensing tube assembly (AS35).

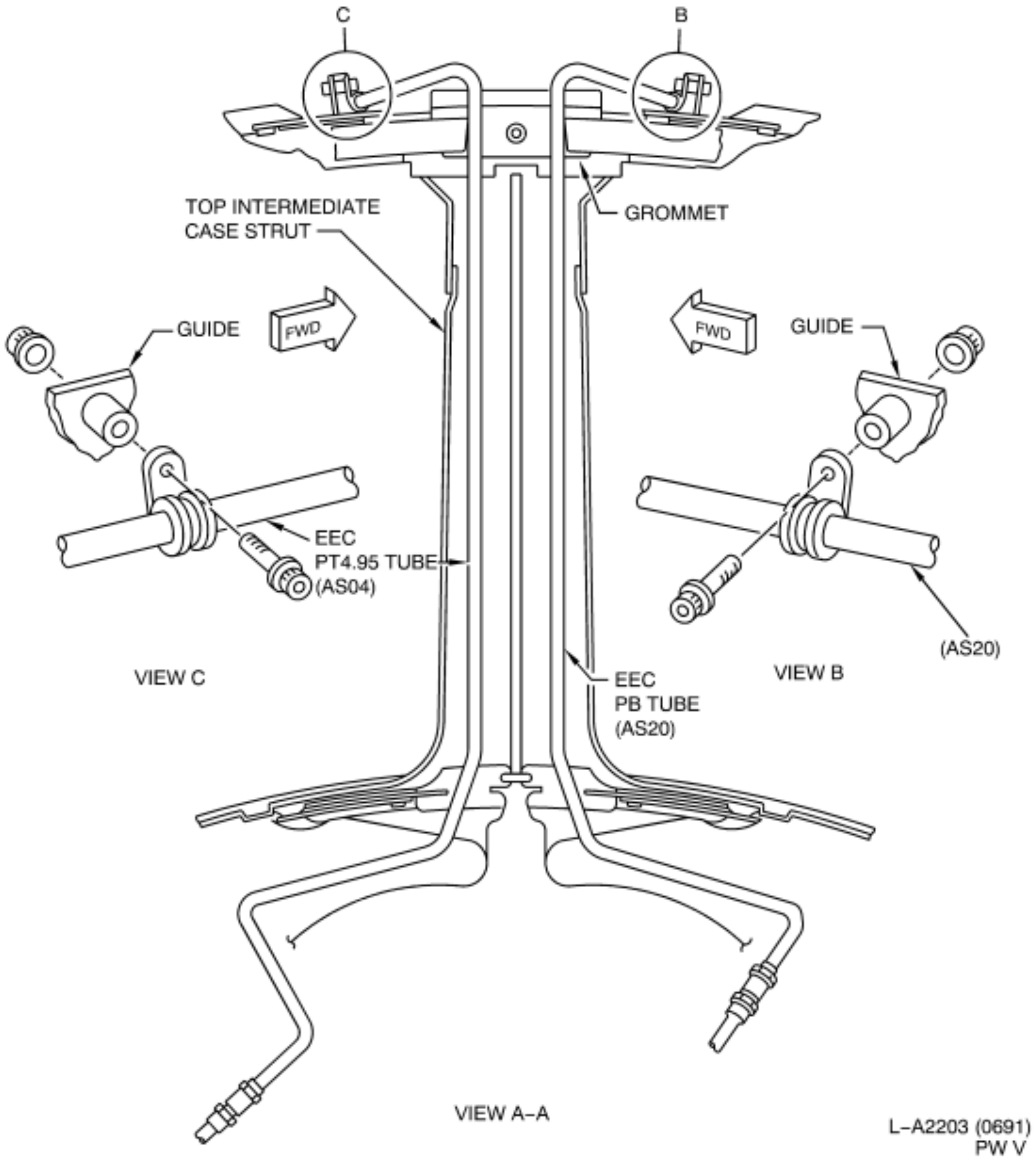
(a) Remove the bolts and clamps that attach the (AS35) tube to brackets on Flange E at the 4:30 and 5:00 o'clock positions.

(b) Remove the tube from the engine and install protection covers.

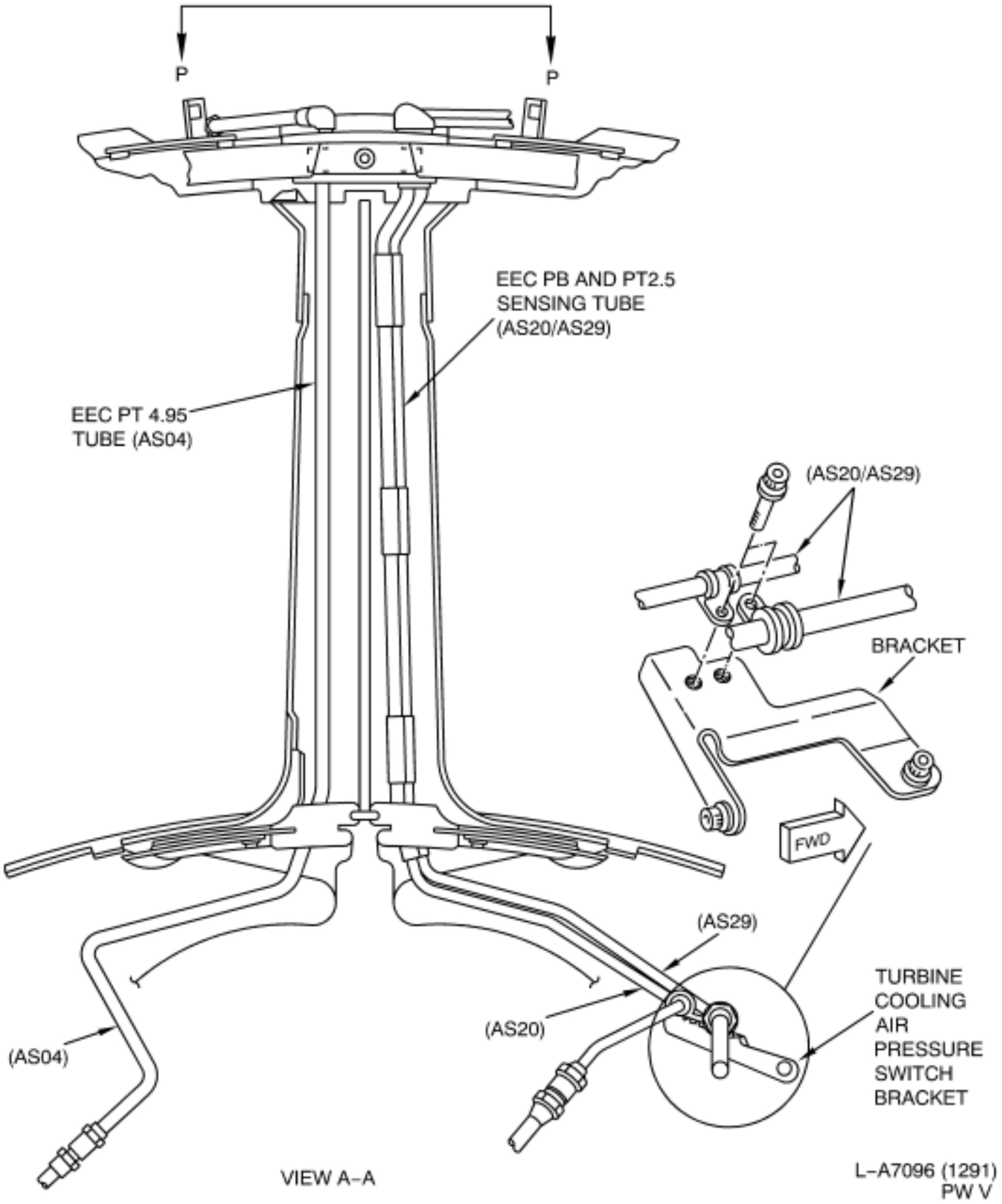
NOTE: The lower manifold (AS31) was previously removed with the EEC speed transducer (N1) multiplexer input probe.


A
EEC PT4.5 TUBE (AS41)
(POST SB PW4ENG 73-106)
HPC AIR VALVE AND
AIR SHUTOFF VALVE
SUPPLY TUBE
(AA22)
MAIN BEARING
BREATHER TUBES
(LB01 & LB06)
HPC AIR VALVE
SIGNAL TUBE
(AA06)
E
H
C
A
HPC VALVE
COOLING AIR
TUBE
(AC35)
M
SOLENOID
D
AIR SHUTOFF
VALVE
SIGNAL TUBE
(AA18)
MAIN BEARING OIL
PRESSURE MANIFOLD
(LP07)
J
F
MAIN BEARING OIL
PRESSURE TUBE
(LP05)
G
AIR/OIL COOLER
OUTLET OIL HOSE
AND TUBE
(LP03)
N
K
(POST SB PW4ENG
79-33 ONLY)
L
L-A2202 (0691)
PW V

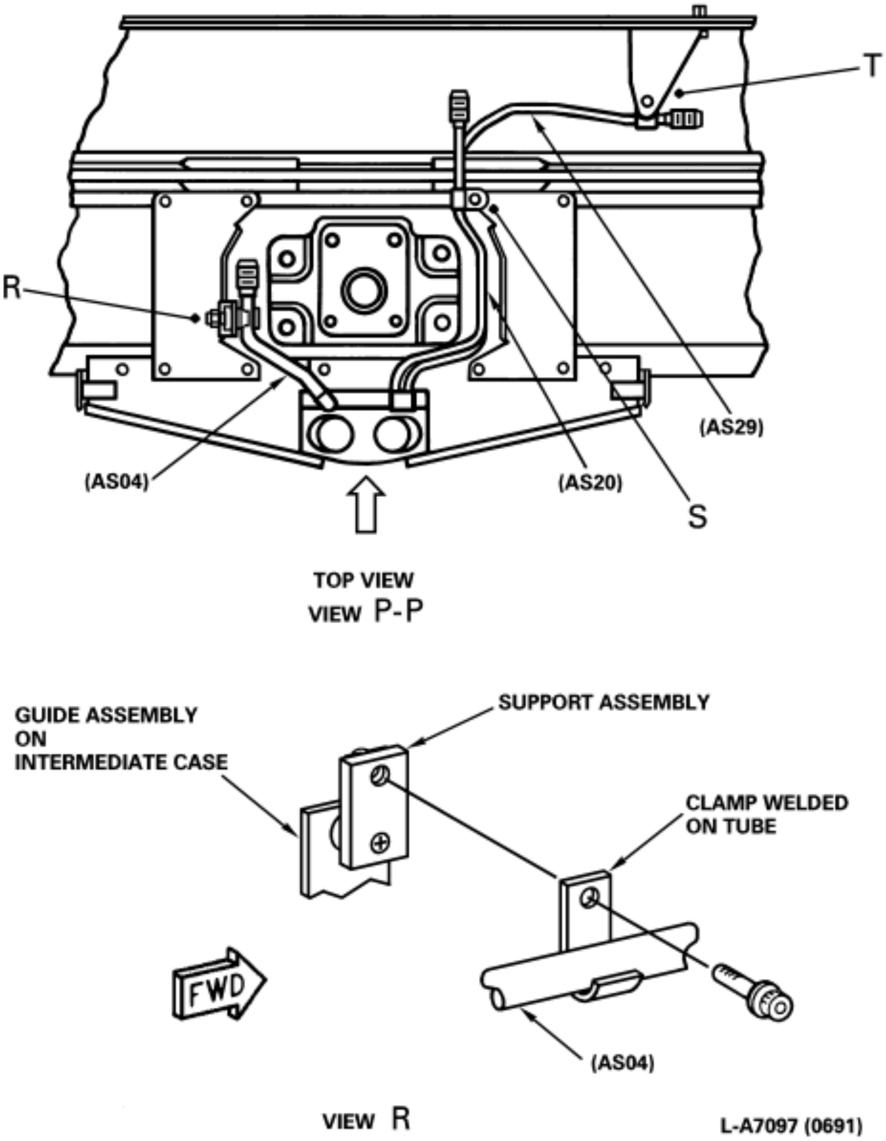
External Plumbing
Figure 301 (Sheet 1)
(Task 72-00-34-020-002)


C
B
TOP INTERMEDIATE CASE STRUT
GROMMET
GUIDE
FWD
FWD
GUIDE
EEC PT4.95 TUBE (AS04)
(AS20)
VIEW C
VIEW B
EEC PB TUBE (AS20)
VIEW A−A
L−A2203 (0691)
PW V

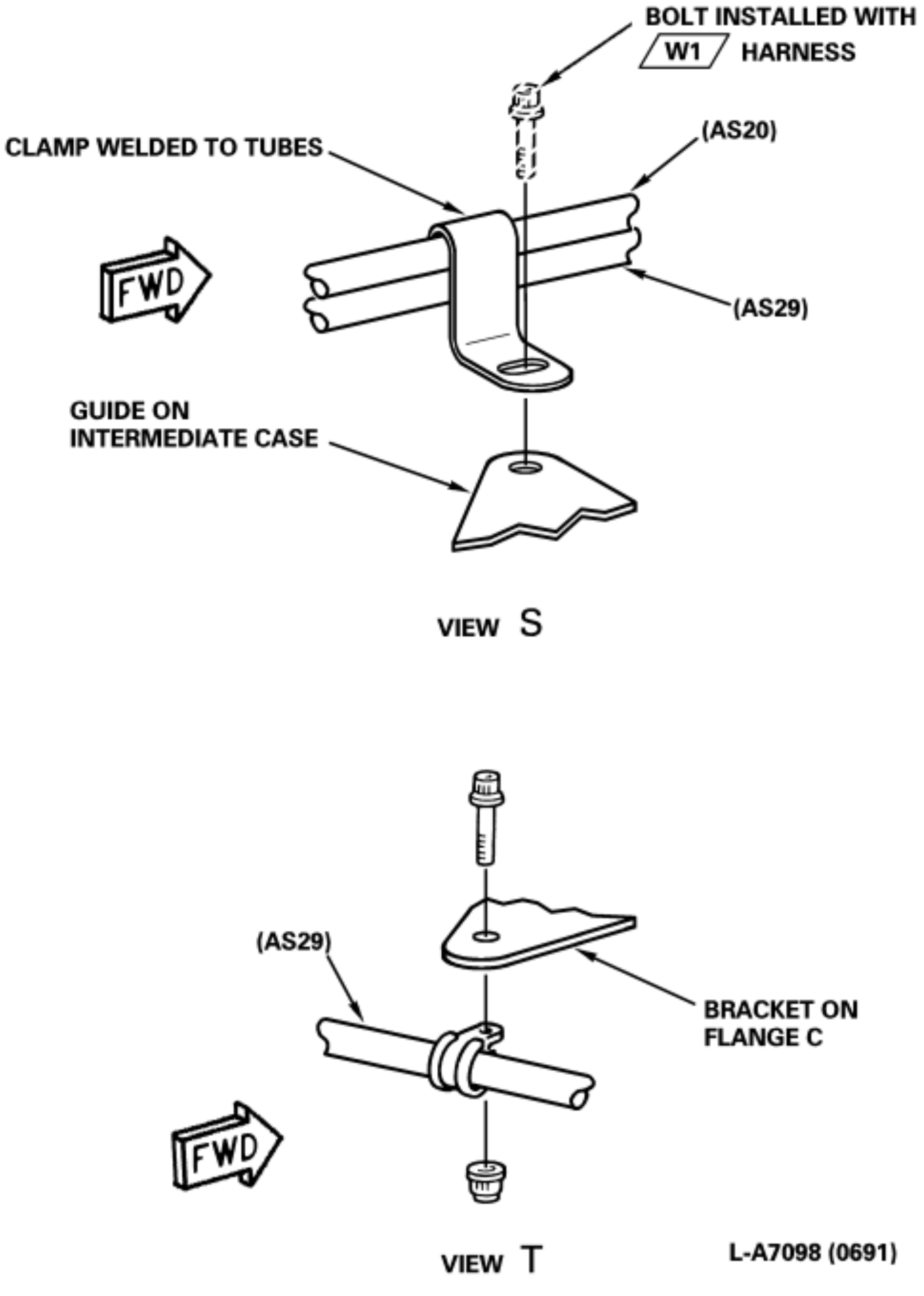
External Plumbing (For Basic Engines)
Figure 301 (Sheet 2)
(Task 72−00−34−020−002)


P
P
EEC PB AND PT2.5
SENSING TUBE
(AS20/AS29)
EEC PT 4.95
TUBE (AS04)
(AS20/AS29)
BRACKET
FWD
(AS29)
(AS20)
(AS04)
TURBINE
COOLING
AIR
PRESSURE
SWITCH
BRACKET
VIEW A-A
L-A7096 (1291)
PW V

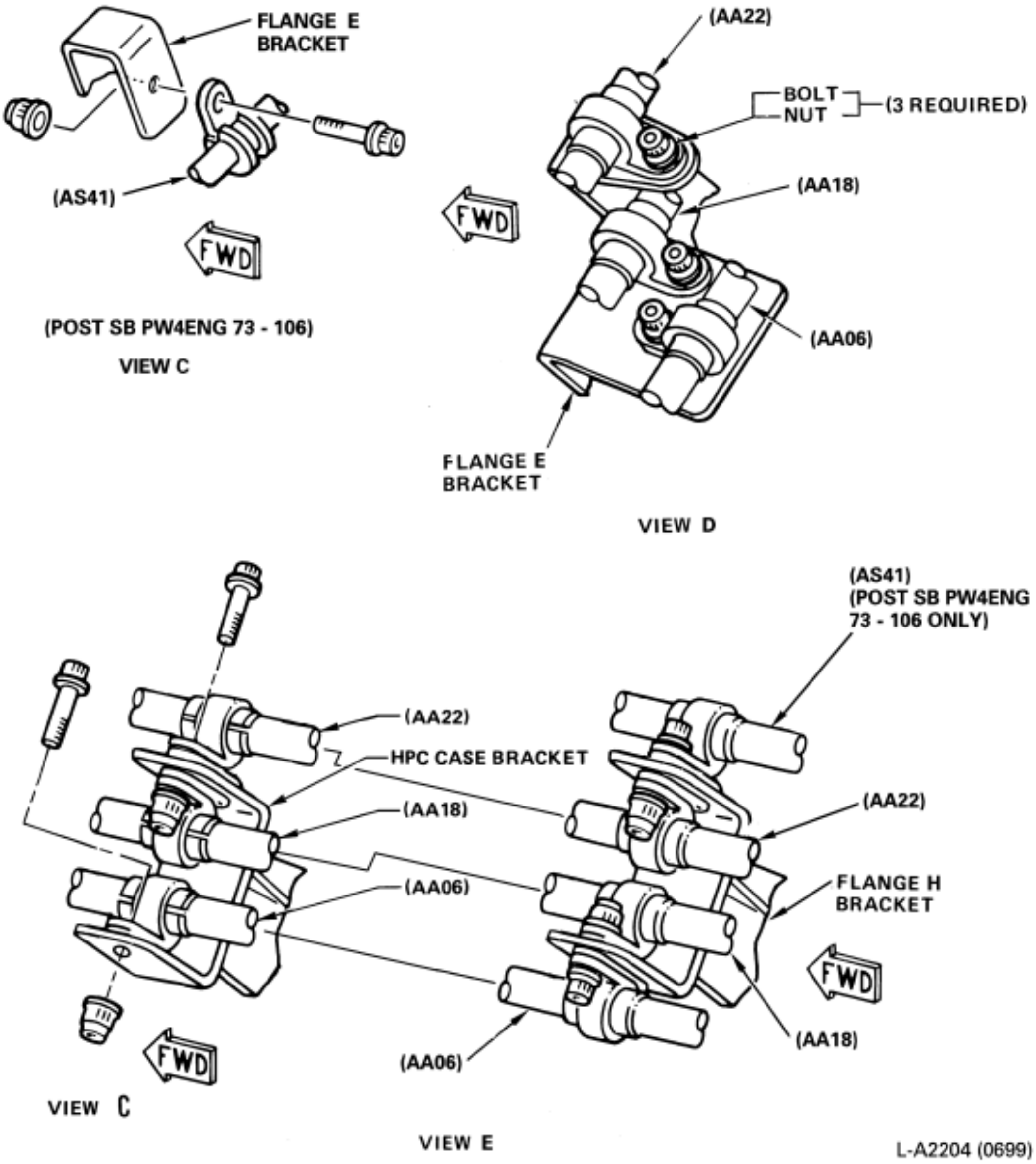
External Plumbing (For Engines With Airbus/McDonnell Douglas Common Parts Configuration)
Figure 301 (Sheet 3)
(Task 72-00-34-020-002)


T
R
(AS29)
(AS04)
(AS20)
S
TOP VIEW
VIEW P-P
GUIDE ASSEMBLY
ON
INTERMEDIATE CASE
SUPPORT ASSEMBLY
CLAMP WELDED
ON TUBE
FWD
(AS04)
VIEW R
L-A7097 (0691)

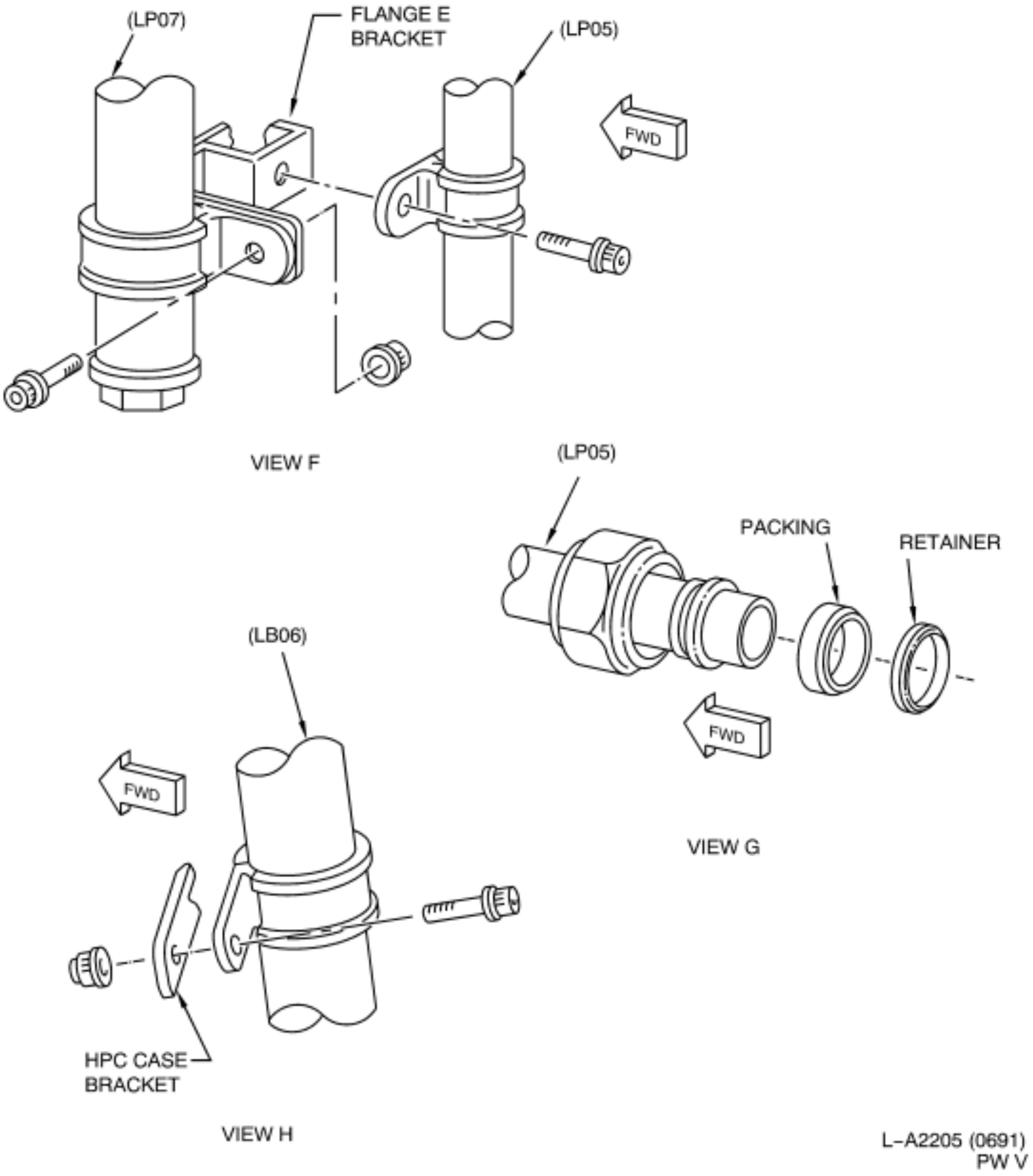
External Plumbing (For Engines With Airbus/McDonnell
Douglas Common Parts Configuration)
Figure 301 (Sheet 4)
(Task 72−00−34−020−002)


BOLT INSTALLED WITH
W1
HARNESS
CLAMP WELDED TO TUBES
(AS20)
FWD
(AS29)
GUIDE ON
INTERMEDIATE CASE
VIEW S
(AS29)
BRACKET ON
FLANGE C
FWD
VIEW T
L-A7098 (0691)

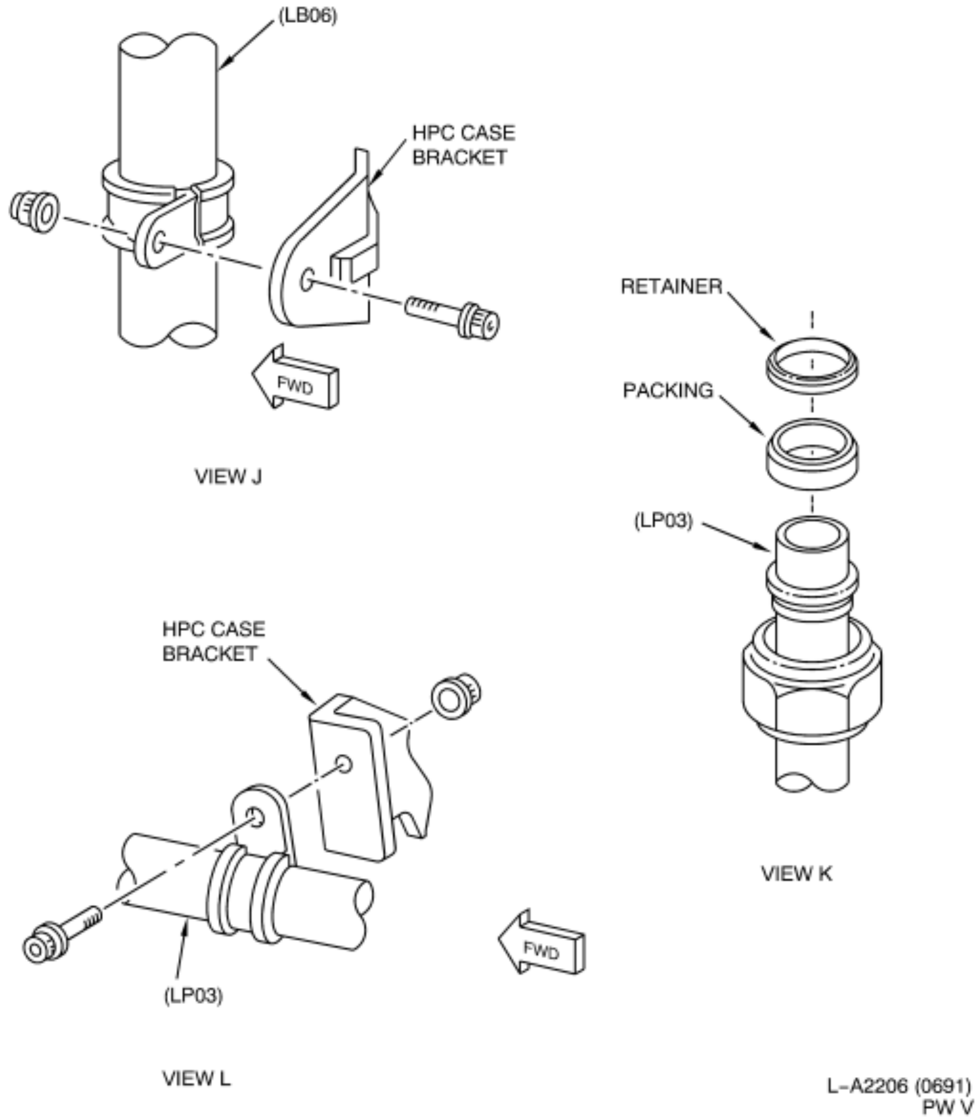
External Plumbing (For Engines With Airbus/McDonnell
Douglas Common Parts Configuration)
Figure 301 (Sheet 5)
(Task 72-00-34-020-002)


FLANGE E
BRACKET
(AS41)
FWD
(POST SB PW4ENG 73 - 106)
VIEW C
(AA22)
BOLT
NUT
(3 REQUIRED)
(AA18)
FWD
(AA06)
FLANGE E
BRACKET
VIEW D
(AS41)
(POST SB PW4ENG
73 - 106 ONLY)
(AA22)
HPC CASE BRACKET
(AA18)
(AA22)
(AA06)
FLANGE H
BRACKET
FWD
(AA18)
(AA06)
FWD
VIEW C
VIEW E
L-A2204 (0699)

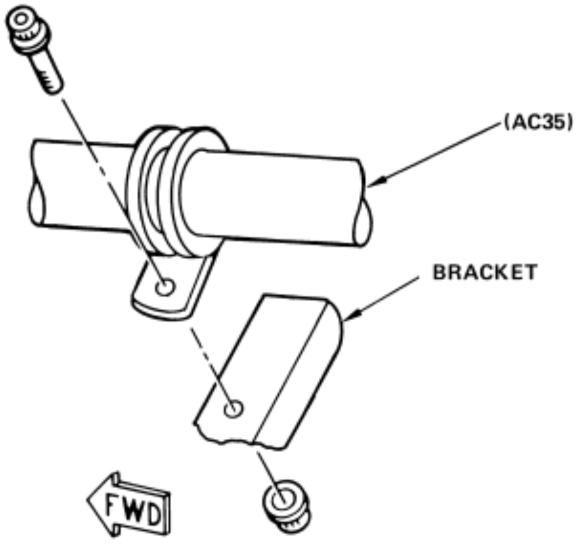
External Plumbing
Figure 301 (Sheet 6)
(Task 72−00−34−020−002)


(LP07)
FLANGE E
BRACKET
(LP05)
FWD
VIEW F
(LP05)
PACKING
RETAINER
FWD
VIEW G
(LB06)
FWD
HPC CASE
BRACKET
VIEW H
L−A2205 (0691)
PW V

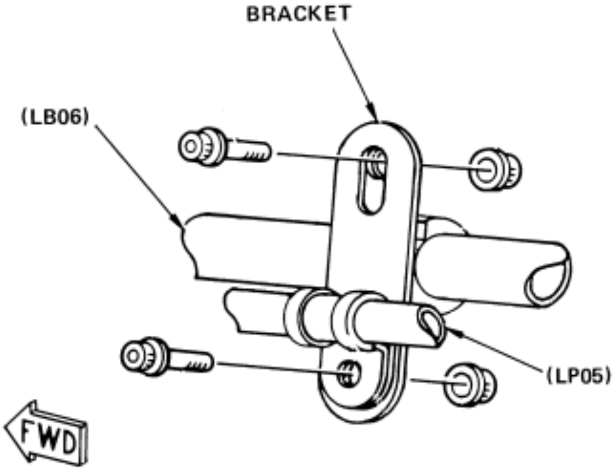
External Plumbing
Figure 301 (Sheet 7)
(Task 72−00−34−020−002)


(LB06)
HPC CASE BRACKET
FWD
VIEW J
RETAINER
PACKING
(LP03)
VIEW K
HPC CASE BRACKET
FWD
(LP03)
VIEW L
L−A2206 (0691)
PW V

External Plumbing
Figure 301 (Sheet 8)
(Task 72−00−34−020−002)


(AC35)
BRACKET
FWD

VIEW M

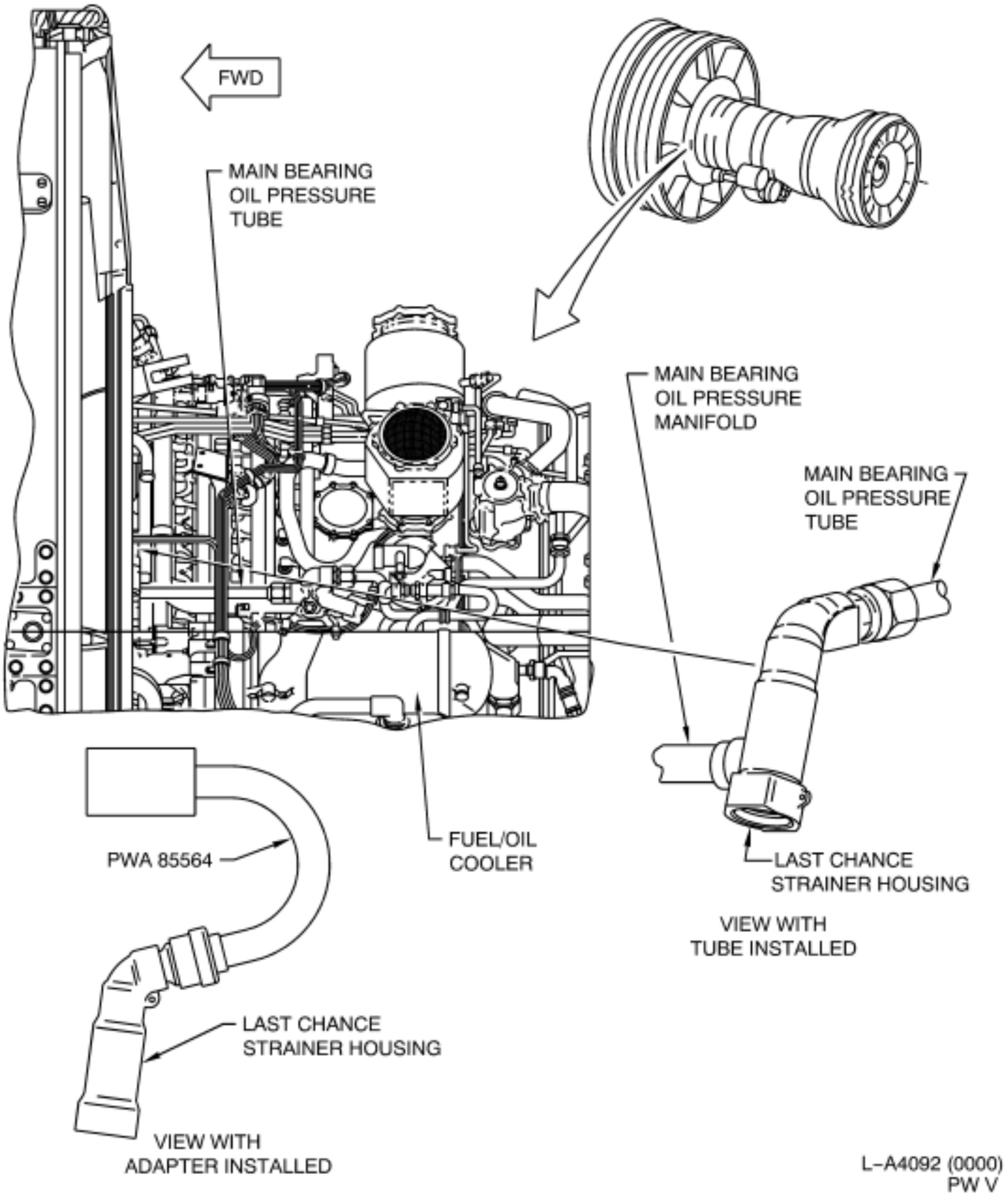

BRACKET
(LB06)
(LP05)
FWD

(POST SB PW4ENG (79 - 33 only)

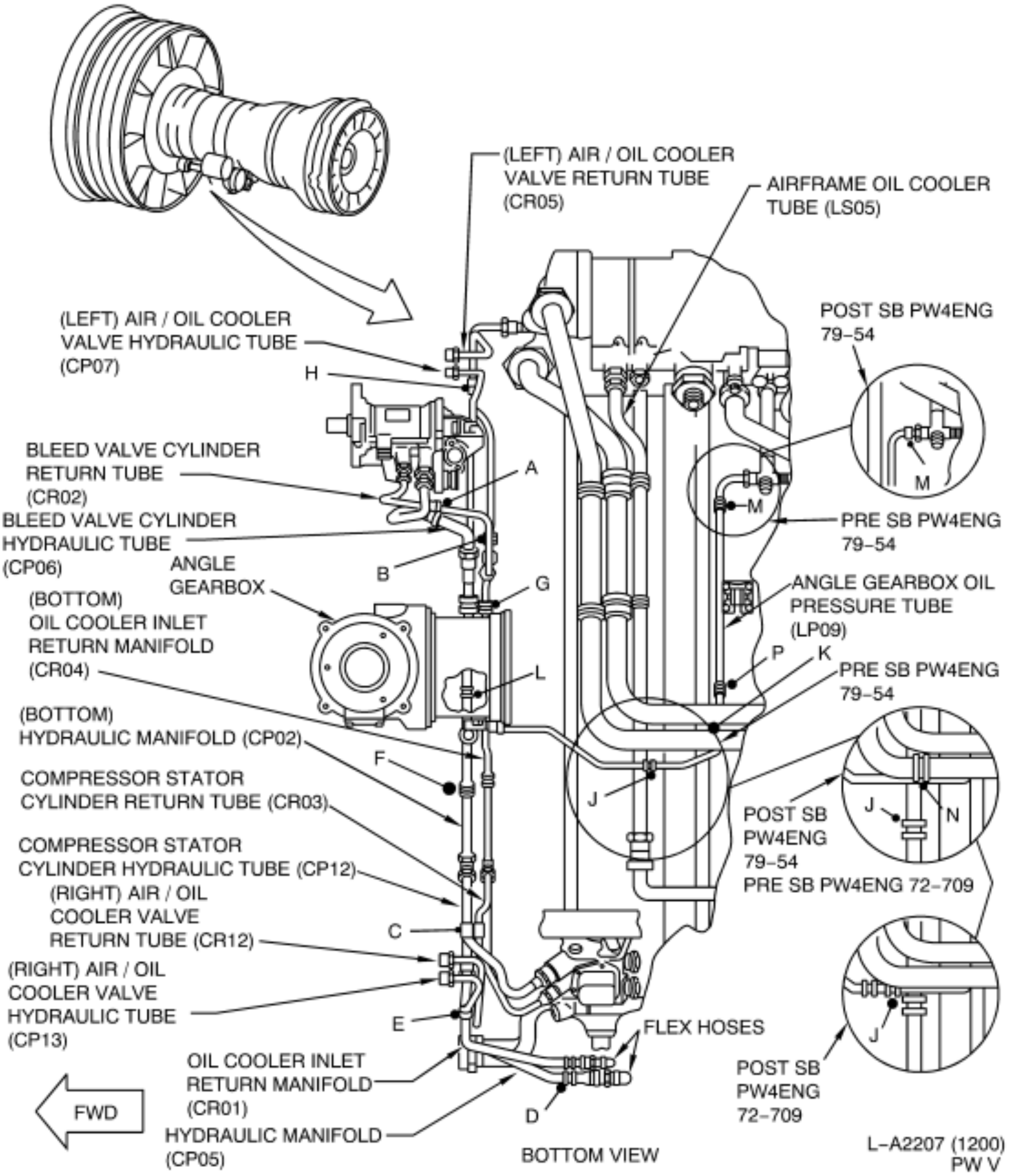
VIEW N

L-A3937 (0691)

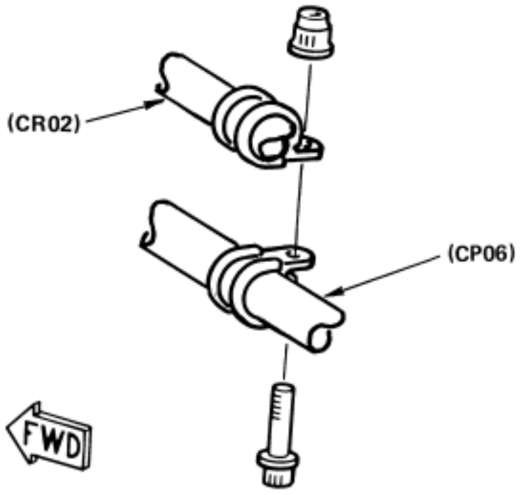
External Plumbing
Figure 301 (Sheet 9)
(Task 72-00-34-020-002)


FWD
MAIN BEARING OIL PRESSURE TUBE
MAIN BEARING OIL PRESSURE MANIFOLD
MAIN BEARING OIL PRESSURE TUBE
PWA 85564
FUEL/OIL COOLER
LAST CHANCE STRAINER HOUSING
VIEW WITH TUBE INSTALLED
LAST CHANCE STRAINER HOUSING
VIEW WITH ADAPTER INSTALLED
L-A4092 (0000)
PW V

Airflow No. 1, 1.5, and 2 Bearing Nozzles
Figure 302
(Task 72-00-34-020-002)

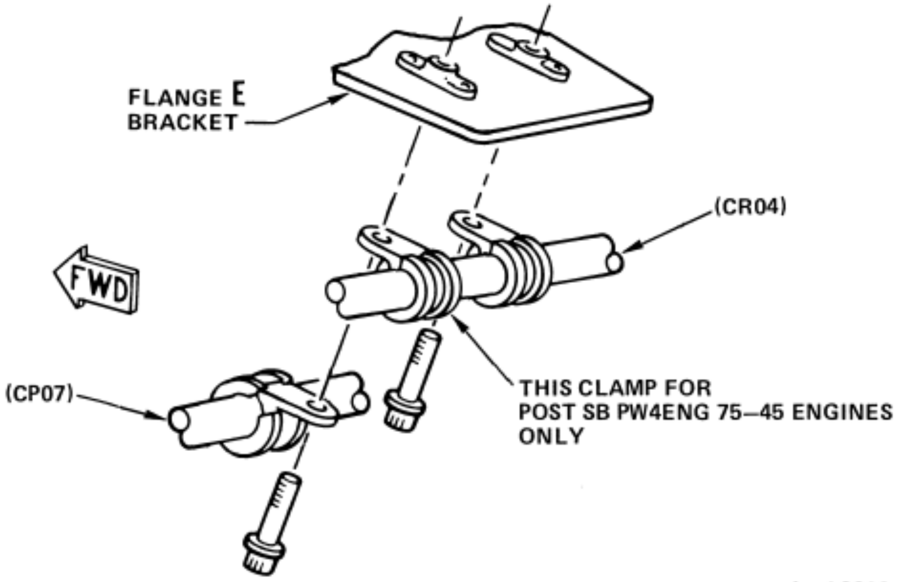

(LEFT) AIR / OIL COOLER VALVE RETURN TUBE (CR05)
AIRFRAME OIL COOLER TUBE (LS05)
POST SB PW4ENG 79-54
(LEFT) AIR / OIL COOLER VALVE HYDRAULIC TUBE (CP07)
H
M
BLEED VALVE CYLINDER RETURN TUBE (CR02)
A
M
PRE SB PW4ENG 79-54
BLEED VALVE CYLINDER HYDRAULIC TUBE (CP06)
ANGLE GEARBOX
B
G
ANGLE GEARBOX OIL PRESSURE TUBE (LP09)
(BOTTOM) OIL COOLER INLET RETURN MANIFOLD (CR04)
P
K
PRE SB PW4ENG 79-54
L
(BOTTOM) HYDRAULIC MANIFOLD (CP02)
F
J
J
N
COMPRESSOR STATOR CYLINDER RETURN TUBE (CR03)
POST SB PW4ENG 79-54
PRE SB PW4ENG 72-709
COMPRESSOR STATOR CYLINDER HYDRAULIC TUBE (CP12)
(RIGHT) AIR / OIL COOLER VALVE RETURN TUBE (CR12)
C
(RIGHT) AIR / OIL COOLER VALVE HYDRAULIC TUBE (CP13)
E
FLEX HOSES
J
POST SB PW4ENG 72-709
FWD
OIL COOLER INLET RETURN MANIFOLD (CR01)
HYDRAULIC MANIFOLD (CP05)
D
BOTTOM VIEW
L-A2207 (1200)
PW V

External Plumbing
Figure 303 (Sheet 1)
(Task 72-00-34-020-002)


(CR02)
(CP06)
FWD

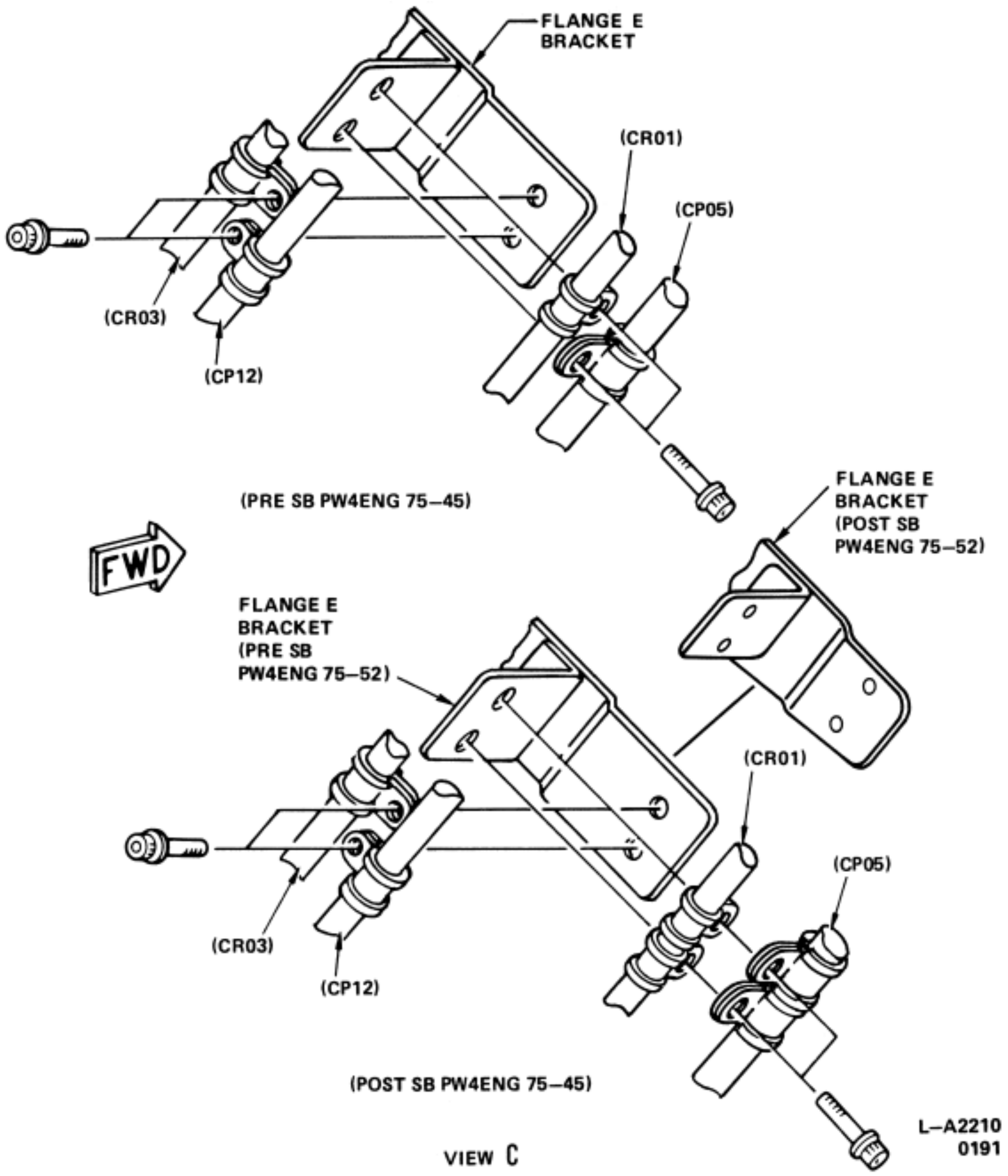
(POST SB PW4ENG 75-45 ONLY)

VIEW A

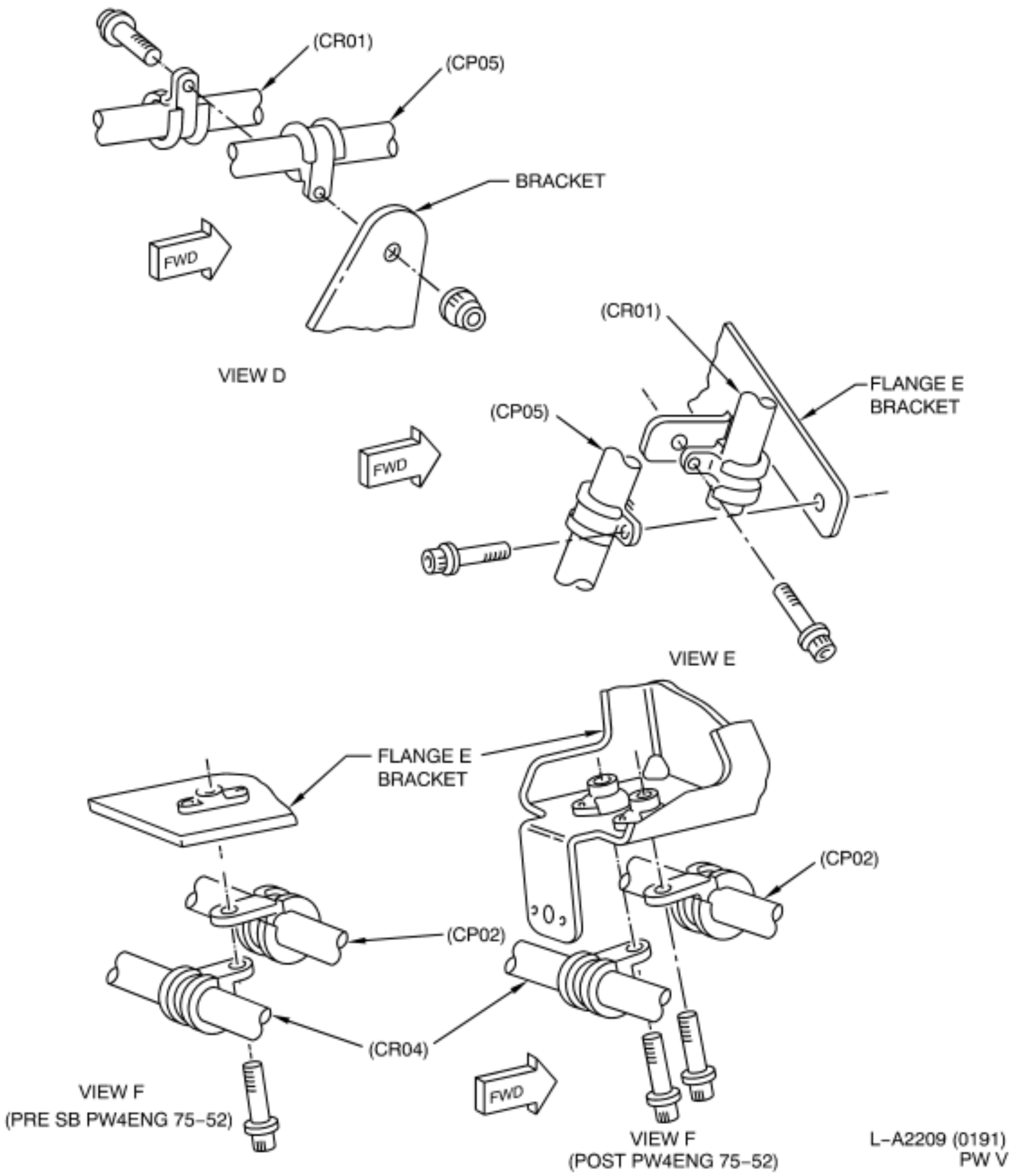

FLANGE E BRACKET
(CR04)
FWD
(CP07)
THIS CLAMP FOR POST SB PW4ENG 75-45 ENGINES ONLY
L-A2208
0390

VIEW B

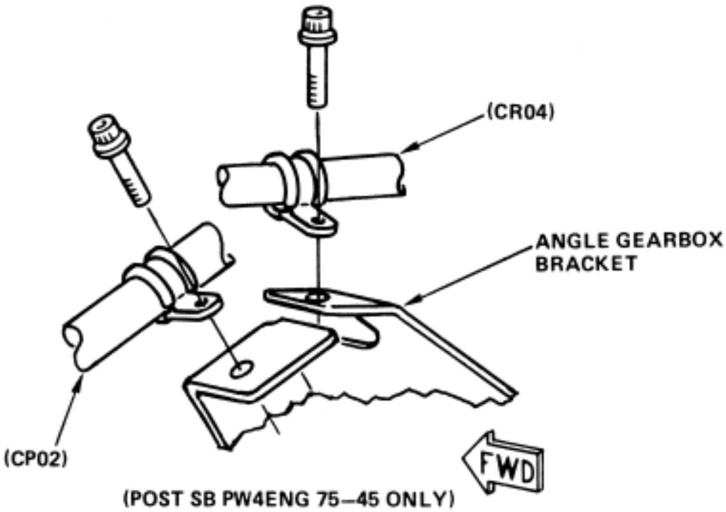
External Plumbing
Figure 303 (Sheet 2)
(Task 72-00-34-020-002)


FLANGE E
BRACKET
(CR01)
(CP05)
(CR03)
(CP12)
(PRE SB PW4ENG 75−45)
FWD
FLANGE E
BRACKET
(POST SB
PW4ENG 75−52)
FLANGE E
BRACKET
(PRE SB
PW4ENG 75−52)
(CR01)
(CP05)
(CR03)
(CP12)
(POST SB PW4ENG 75−45)
VIEW C
L−A2210
0191

External Plumbing
Figure 303 (Sheet 3)
(Task 72−00−34−020−002)

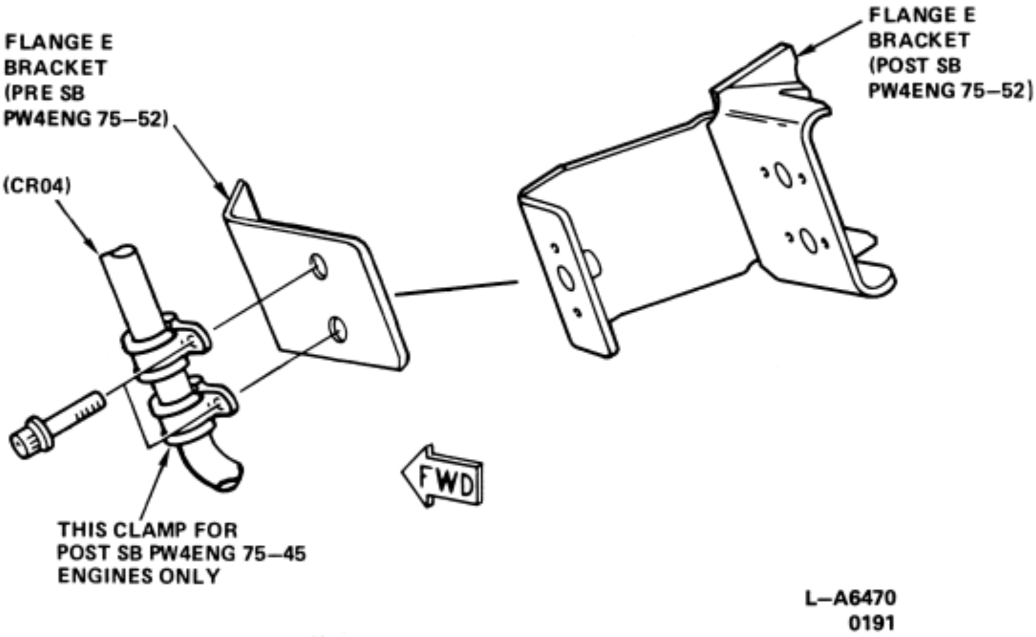

(CR01)
(CP05)
BRACKET
FWD
VIEW D
(CR01)
FLANGE E BRACKET
(CP05)
FWD
VIEW E
FLANGE E BRACKET
(CP02)
(CP02)
(CR04)
VIEW F
(PRE SB PW4ENG 75−52)
FWD
VIEW F
(POST PW4ENG 75−52)
L−A2209 (0191)
PW V

External Plumbing
Figure 303 (Sheet 4)
(Task 72−00−34−020−002)


(CR04)
ANGLE GEARBOX BRACKET
(CP02)
FWD

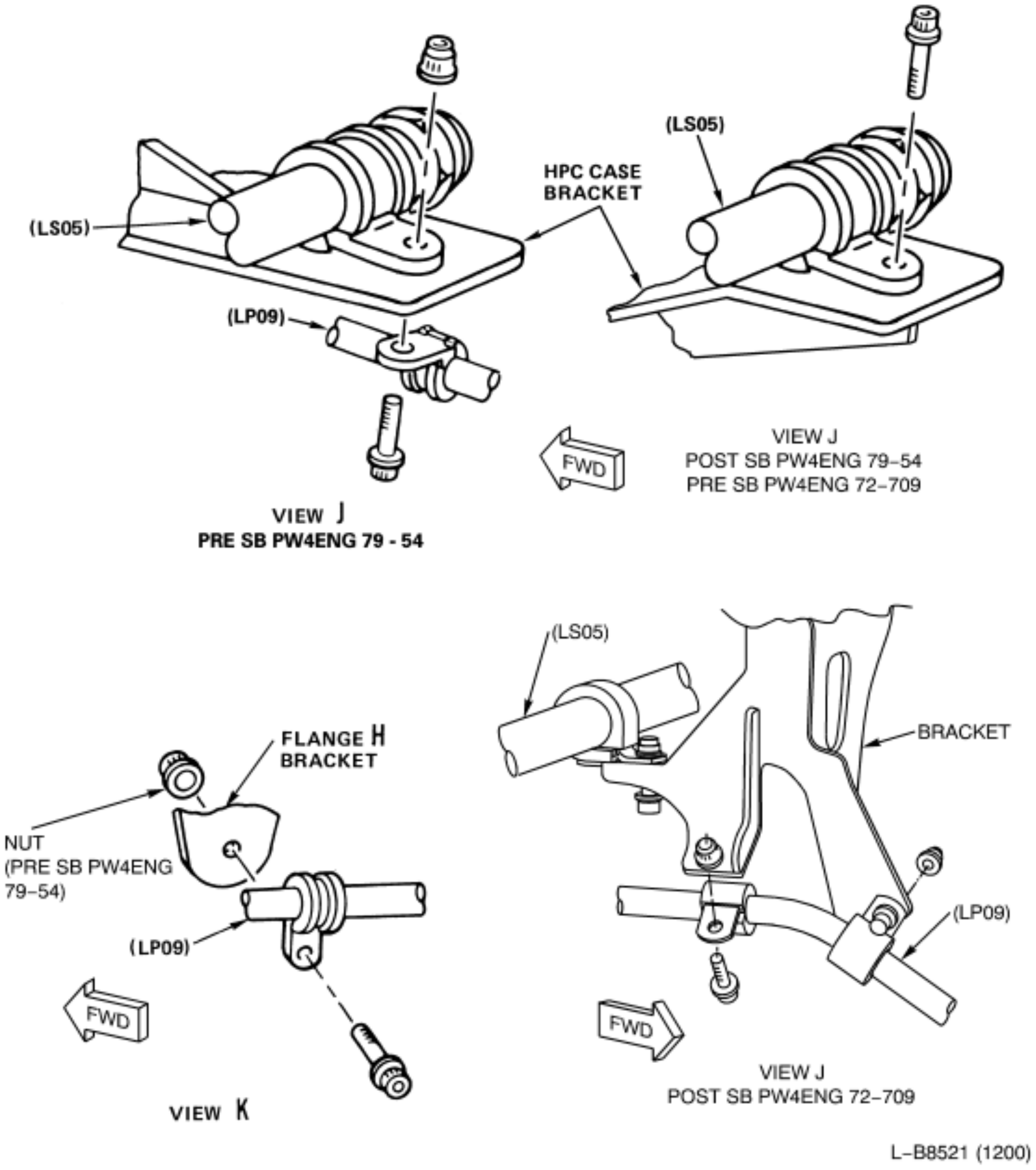
(POST SB PW4ENG 75−45 ONLY)

VIEW G

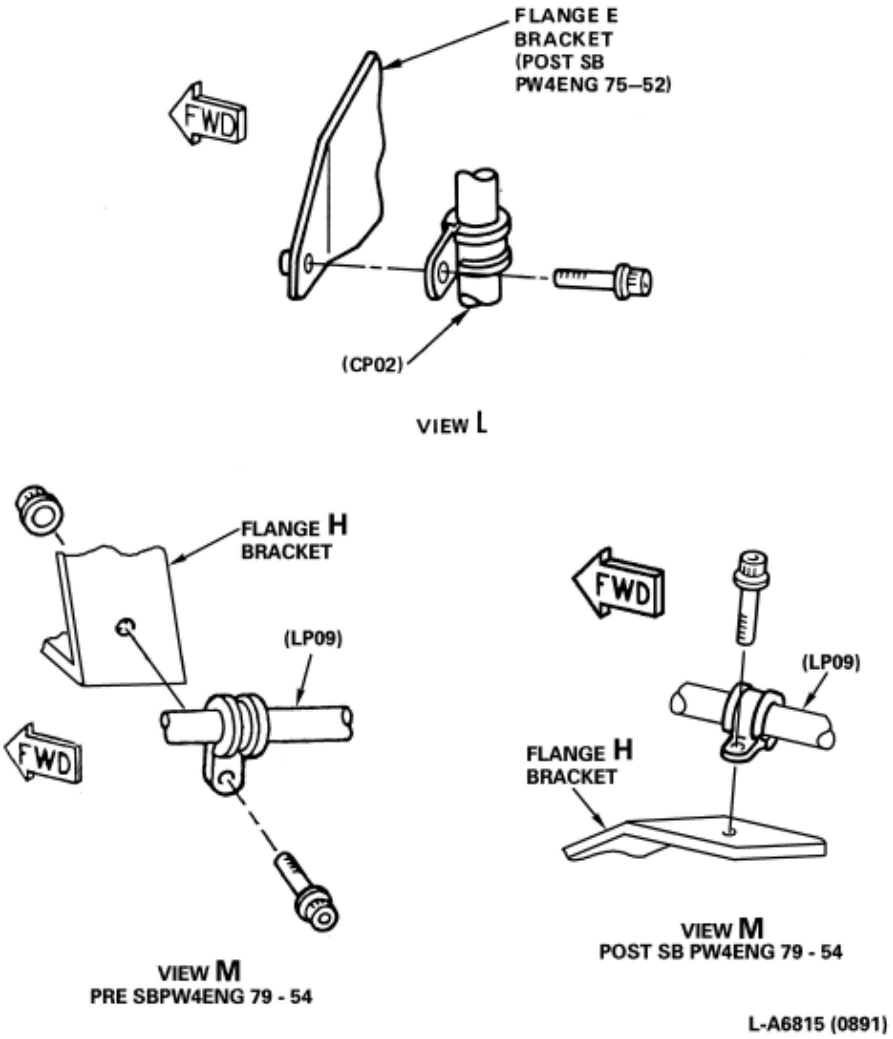

FLANGE E BRACKET (PRE SB PW4ENG 75−52)
(CR04)
FLANGE E BRACKET (POST SB PW4ENG 75−52)
FWD
THIS CLAMP FOR POST SB PW4ENG 75−45 ENGINES ONLY
L−A6470
0191

VIEW H

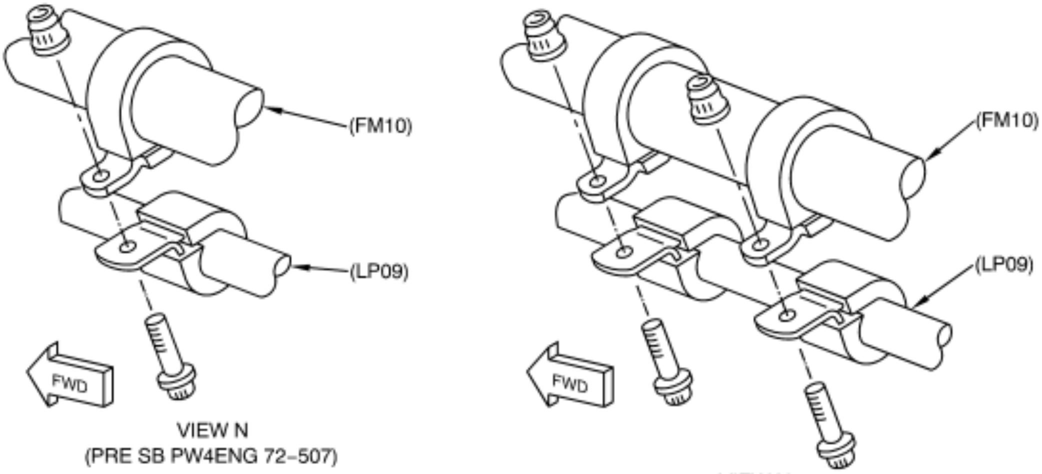
External Plumbing
Figure 303 (Sheet 5)
(Task 72−00−34−020−002)


(LS05)
(LS05)
HPC CASE BRACKET
(LP09)
FWD
VIEW J
POST SB PW4ENG 79−54
PRE SB PW4ENG 72−709
VIEW J
PRE SB PW4ENG 79 - 54
(LS05)
FLANGE H BRACKET
BRACKET
NUT (PRE SB PW4ENG 79−54)
(LP09)
(LP09)
FWD
FWD
VIEW K
VIEW J
POST SB PW4ENG 72−709
L−B8521 (1200)

External Plumbing
Figure 303 (Sheet 6)
(Task 72−00−34−020−002)

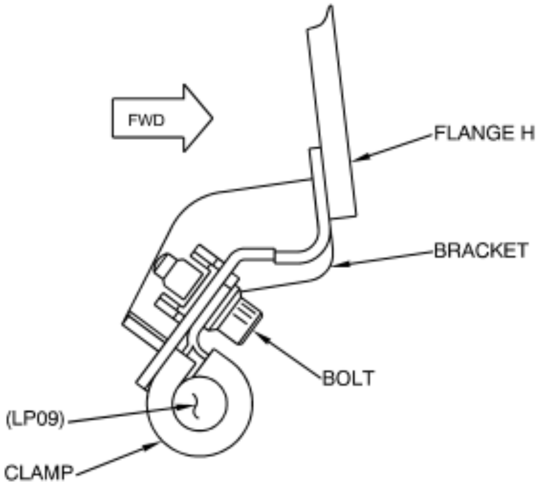

FWD
FLANGE E
BRACKET
(POST SB
PW4ENG 75–52)
(CP02)
VIEW L
FLANGE H
BRACKET
(LP09)
FWD
VIEW M
PRE SBPW4ENG 79 - 54
FWD
(LP09)
FLANGE H
BRACKET
VIEW M
POST SB PW4ENG 79 - 54
L-A6815 (0891)

External Plumbing
Figure 303 (Sheet 7)
(Task 72−00−34−020−002)


(FM10)
(LP09)
FWD
(FM10)
(LP09)
FWD

VIEW N
(PRE SB PW4ENG 72−507)

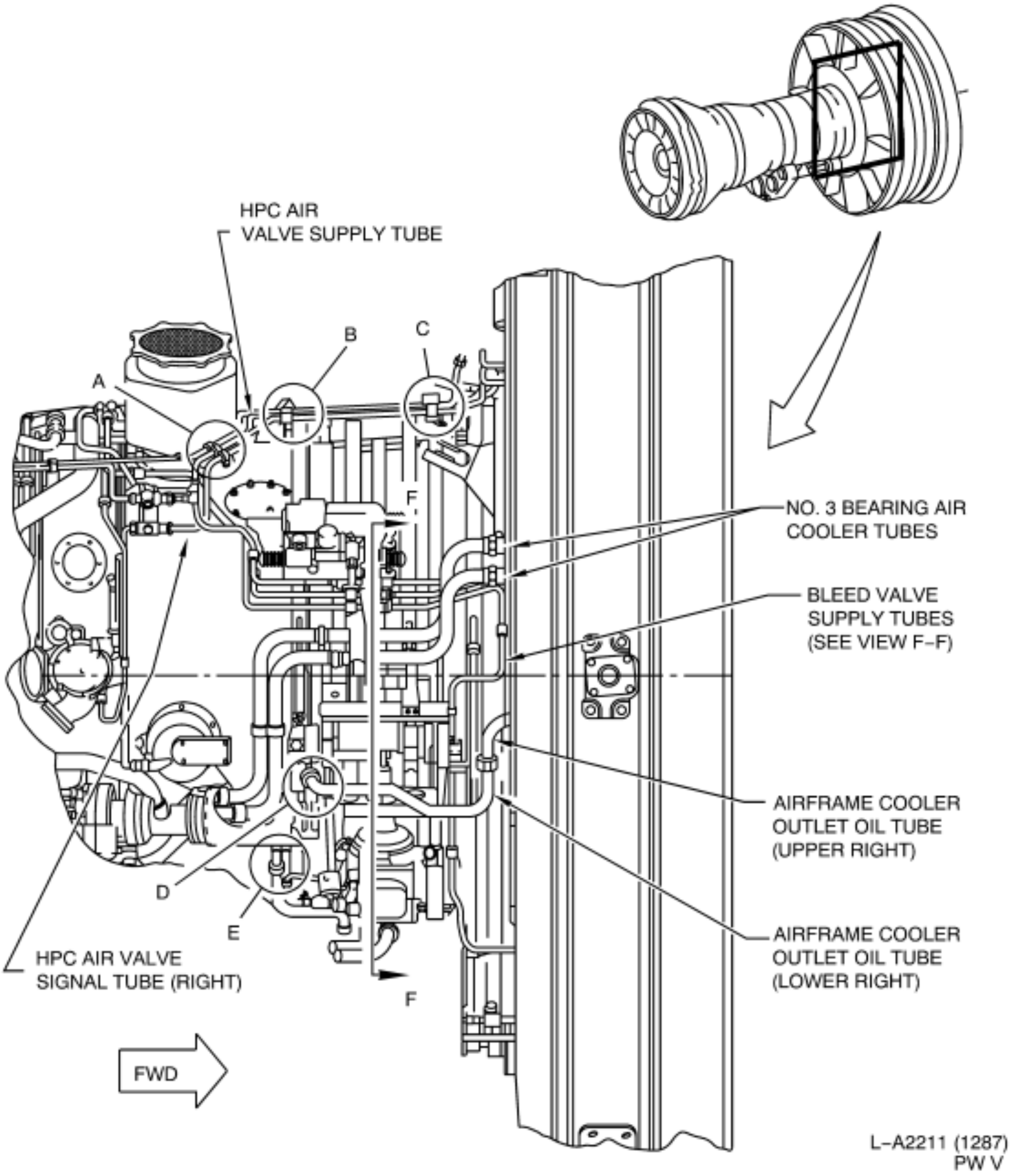
VIEW N
(POST SB PW4ENG 72−507)
(PRE SB PW4ENG 72−709)


FWD
FLANGE H
BRACKET
BOLT
(LP09)
CLAMP

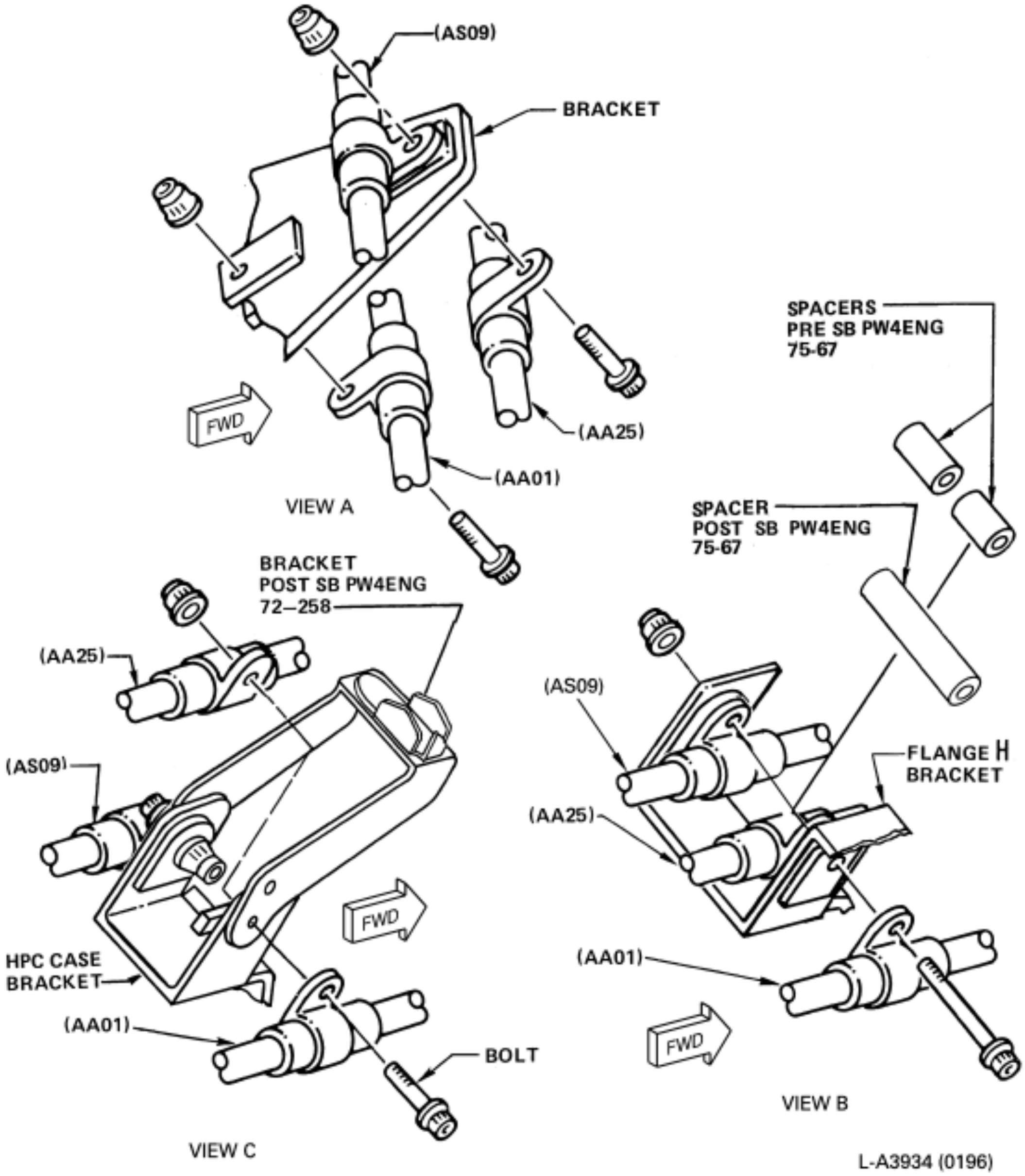
VIEW P
POST SB PW4ENG 72−709

L−B8520 (1200)
PW V

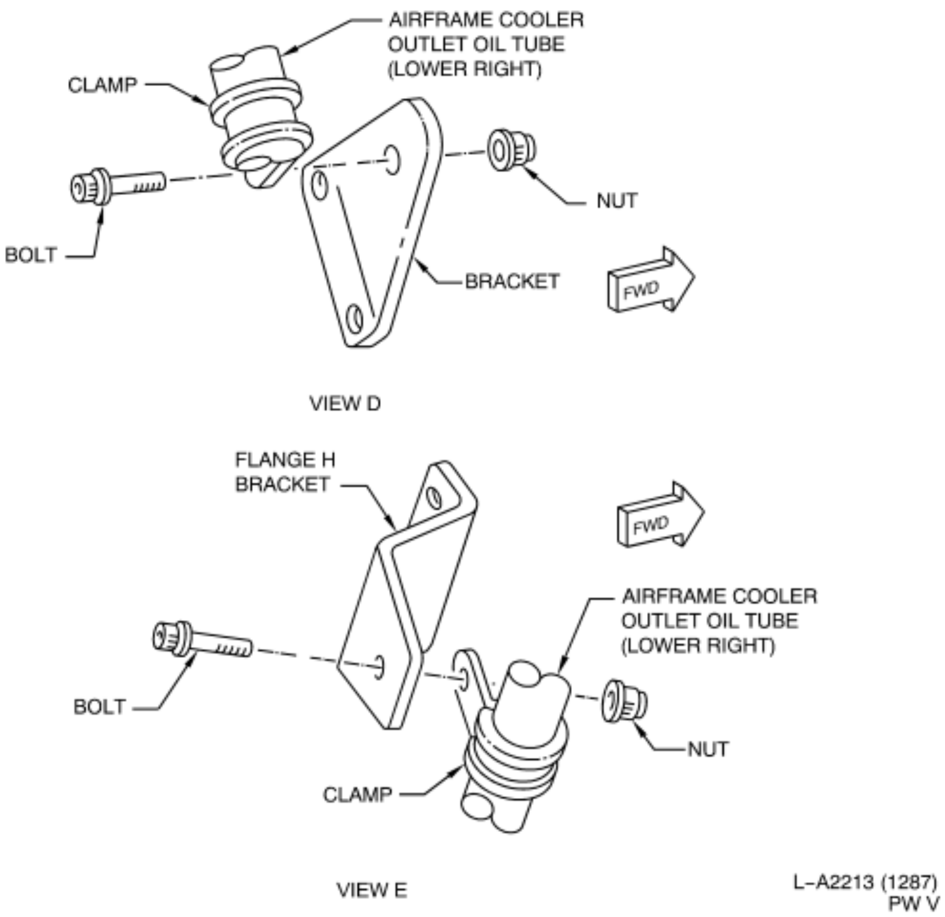
External Plumbing
Figure 303 (Sheet 8)
(Task 72−00−34−020−002)


HPC AIR
VALVE SUPPLY TUBE
A
B
C
F
NO. 3 BEARING AIR
COOLER TUBES
BLEED VALVE
SUPPLY TUBES
(SEE VIEW F-F)
AIRFRAME COOLER
OUTLET OIL TUBE
(UPPER RIGHT)
D
E
AIRFRAME COOLER
OUTLET OIL TUBE
(LOWER RIGHT)
HPC AIR VALVE
SIGNAL TUBE (RIGHT)
F
FWD
L-A2211 (1287)
PW V

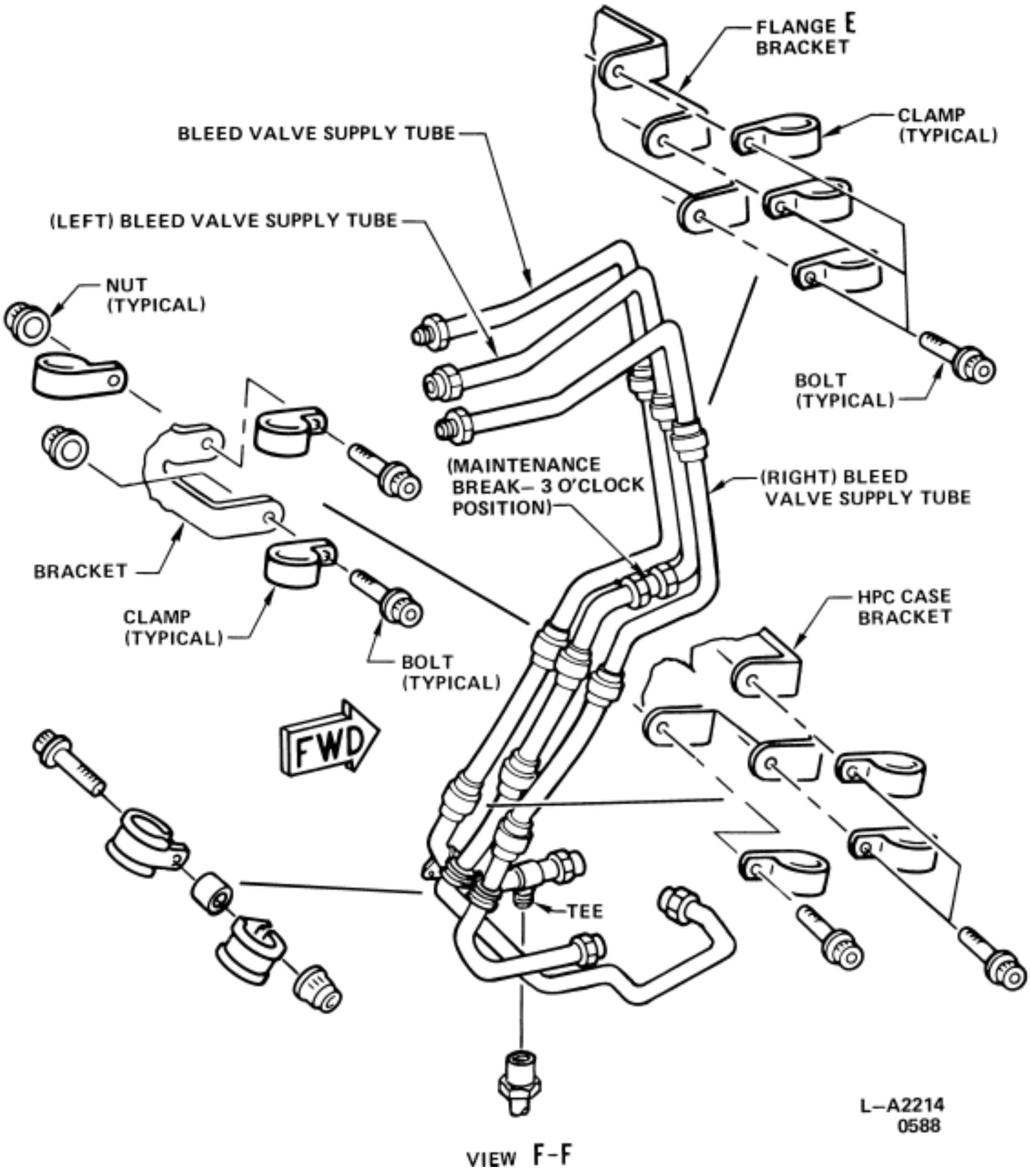
External Plumbing
Figure 304 (Sheet 1)
(Task 72-00-34-020-002)


(AS09)
BRACKET
(AA25)
(AA01)
FWD
VIEW A
SPACERS
PRE SB PW4ENG
75-67
SPACER
POST SB PW4ENG
75-67
BRACKET
POST SB PW4ENG
72–258
(AA25)
(AS09)
HPC CASE
BRACKET
(AA01)
BOLT
FWD
VIEW C
(AS09)
FLANGE H
BRACKET
(AA25)
(AA01)
FWD
VIEW B
L-A3934 (0196)

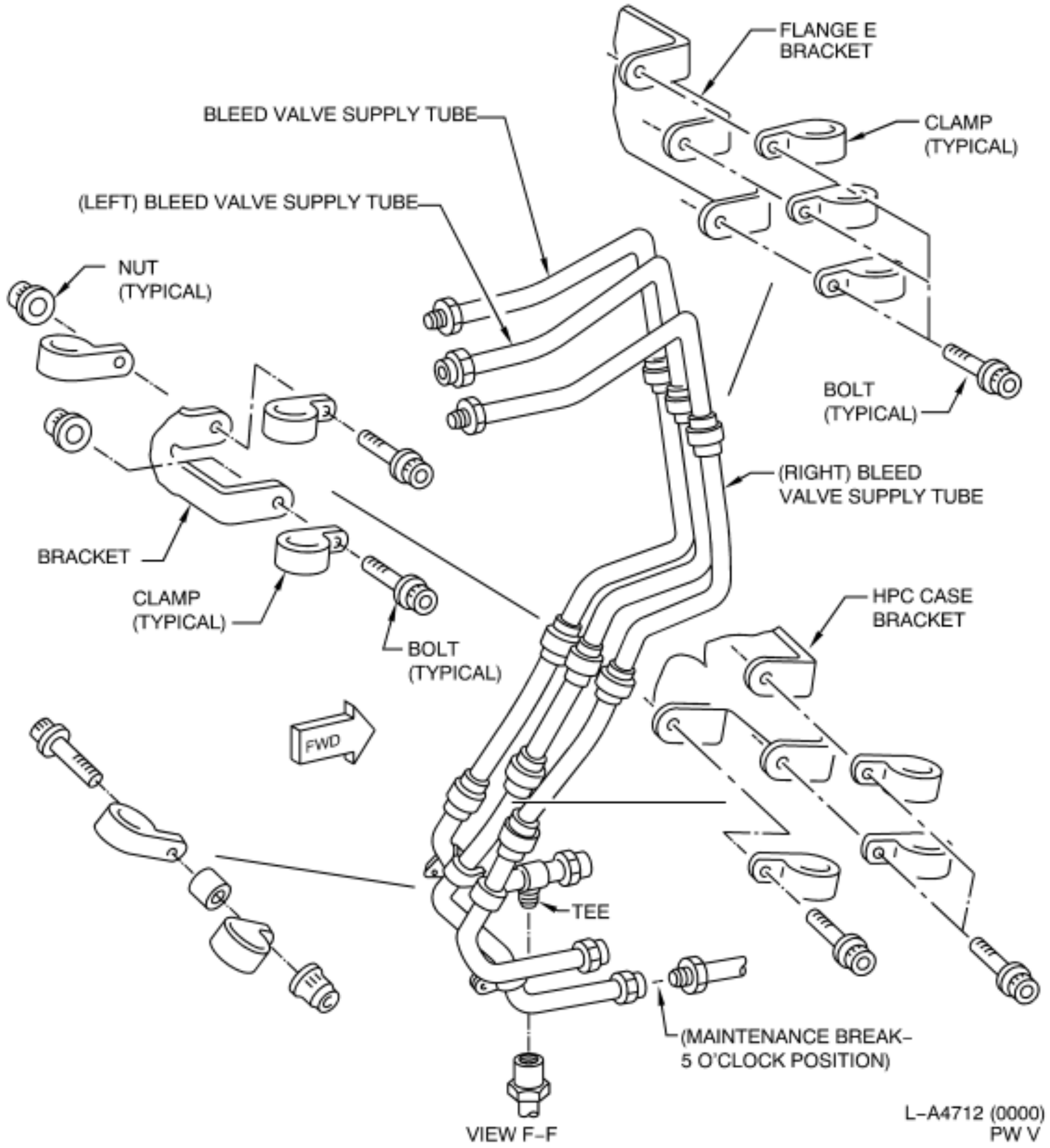
External Plumbing
Figure 304 (Sheet 2)
(Task 72−00−34−020−002)


AIRFRAME COOLER OUTLET OIL TUBE (LOWER RIGHT)
CLAMP
NUT
BOLT
BRACKET
FWD
VIEW D
FLANGE H BRACKET
FWD
AIRFRAME COOLER OUTLET OIL TUBE (LOWER RIGHT)
BOLT
NUT
CLAMP
VIEW E
L−A2213 (1287)
PW V

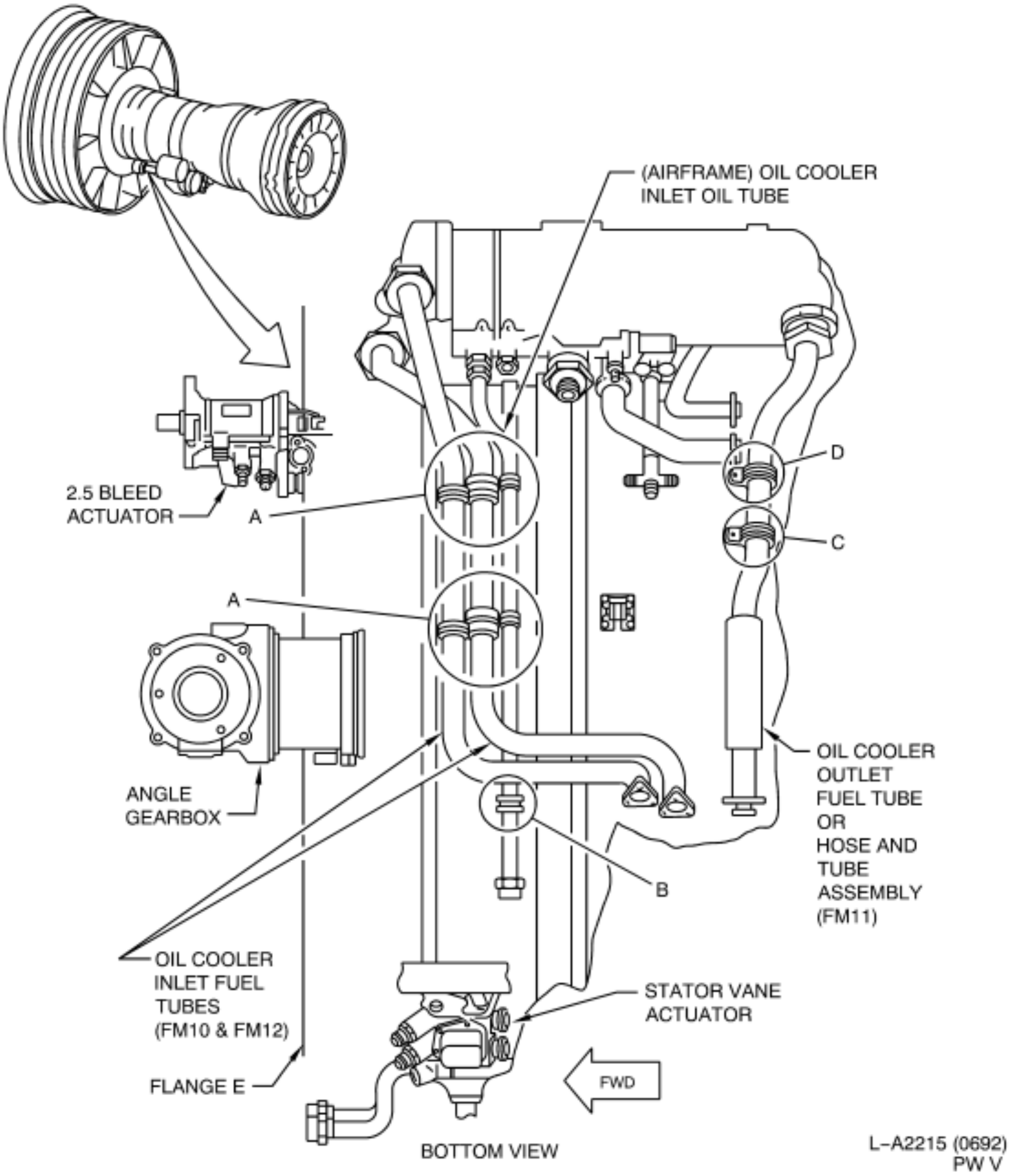
External Plumbing
Figure 304 (Sheet 3)
(Task 72−00−34−020−002)


FLANGE E BRACKET
CLAMP (TYPICAL)
BLEED VALVE SUPPLY TUBE
(LEFT) BLEED VALVE SUPPLY TUBE
NUT (TYPICAL)
BOLT (TYPICAL)
(MAINTENANCE BREAK- 3 O'CLOCK POSITION)
(RIGHT) BLEED VALVE SUPPLY TUBE
BRACKET
CLAMP (TYPICAL)
HPC CASE BRACKET
BOLT (TYPICAL)
FWD
TEE
L-A2214
0588
VIEW F-F

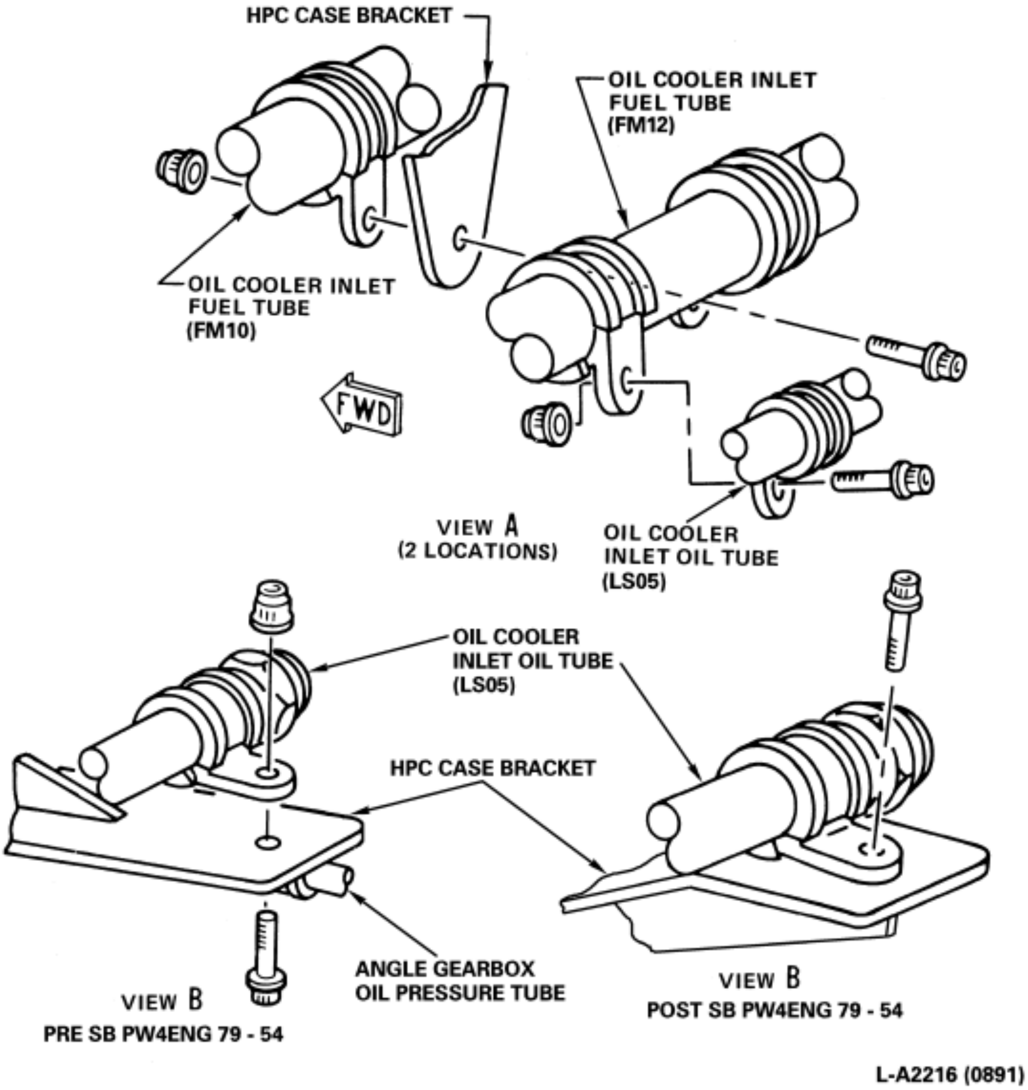
External Plumbing (Pre SB PW4ENG 75-28)
Figure 304 (Sheet 4)
(Task 72-00-34-020-002)


FLANGE E
BRACKET
BLEED VALVE SUPPLY TUBE
CLAMP
(TYPICAL)
(LEFT) BLEED VALVE SUPPLY TUBE
NUT
(TYPICAL)
BOLT
(TYPICAL)
(RIGHT) BLEED
VALVE SUPPLY TUBE
BRACKET
CLAMP
(TYPICAL)
HPC CASE
BRACKET
BOLT
(TYPICAL)
FWD
TEE
(MAINTENANCE BREAK-
5 O'CLOCK POSITION)
VIEW F-F
L-A4712 (0000)
PW V

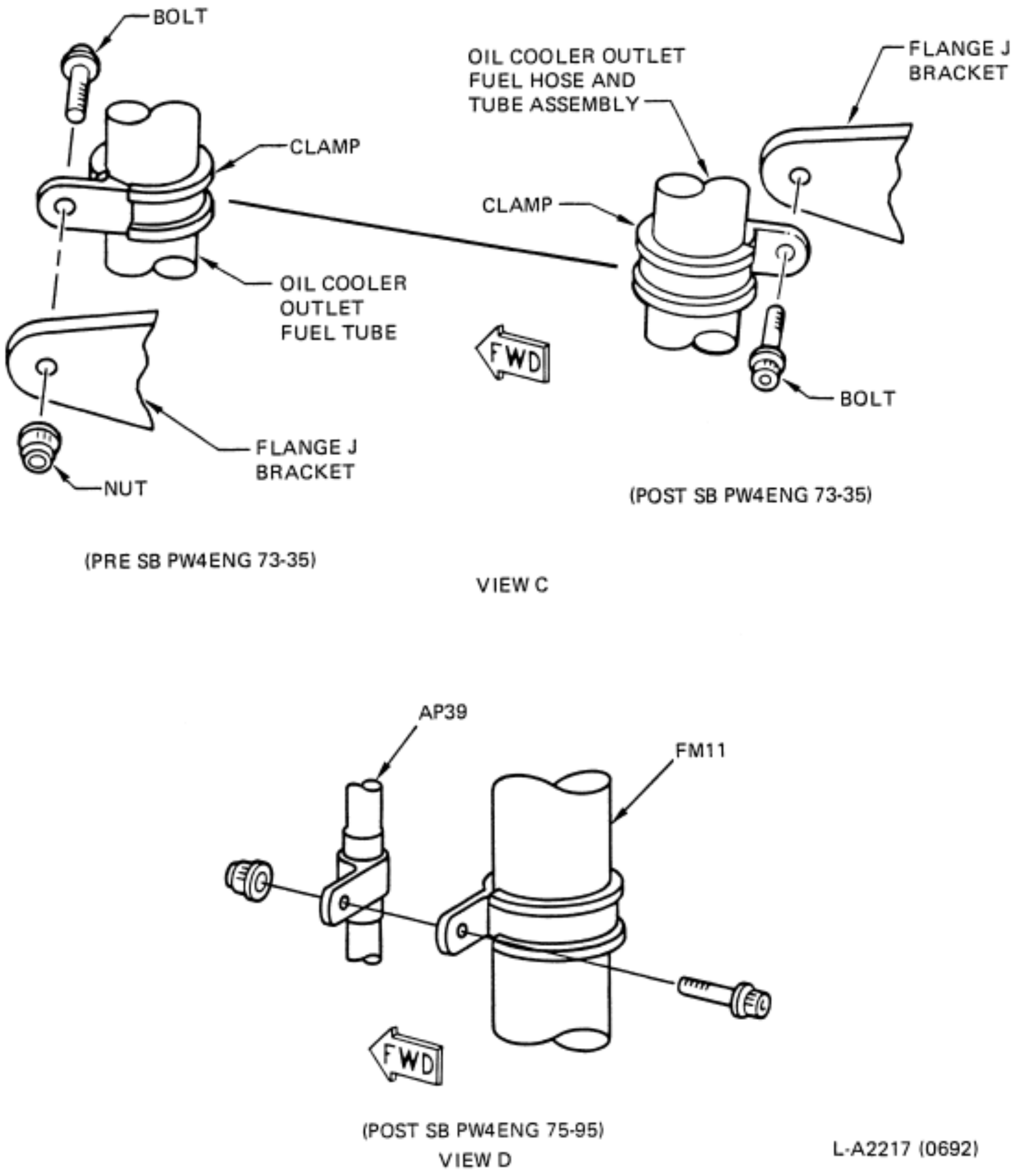
External Plumbing (Post SB PW4ENG 75-28)
Figure 304 (Sheet 5)
(Task 72-00-34-020-002)


(AIRFRAME) OIL COOLER INLET OIL TUBE
2.5 BLEED ACTUATOR
A
A
D
C
ANGLE GEARBOX
OIL COOLER OUTLET FUEL TUBE OR HOSE AND TUBE ASSEMBLY (FM11)
B
OIL COOLER INLET FUEL TUBES (FM10 & FM12)
STATOR VANE ACTUATOR
FLANGE E
FWD
BOTTOM VIEW
L−A2215 (0692)
PW V

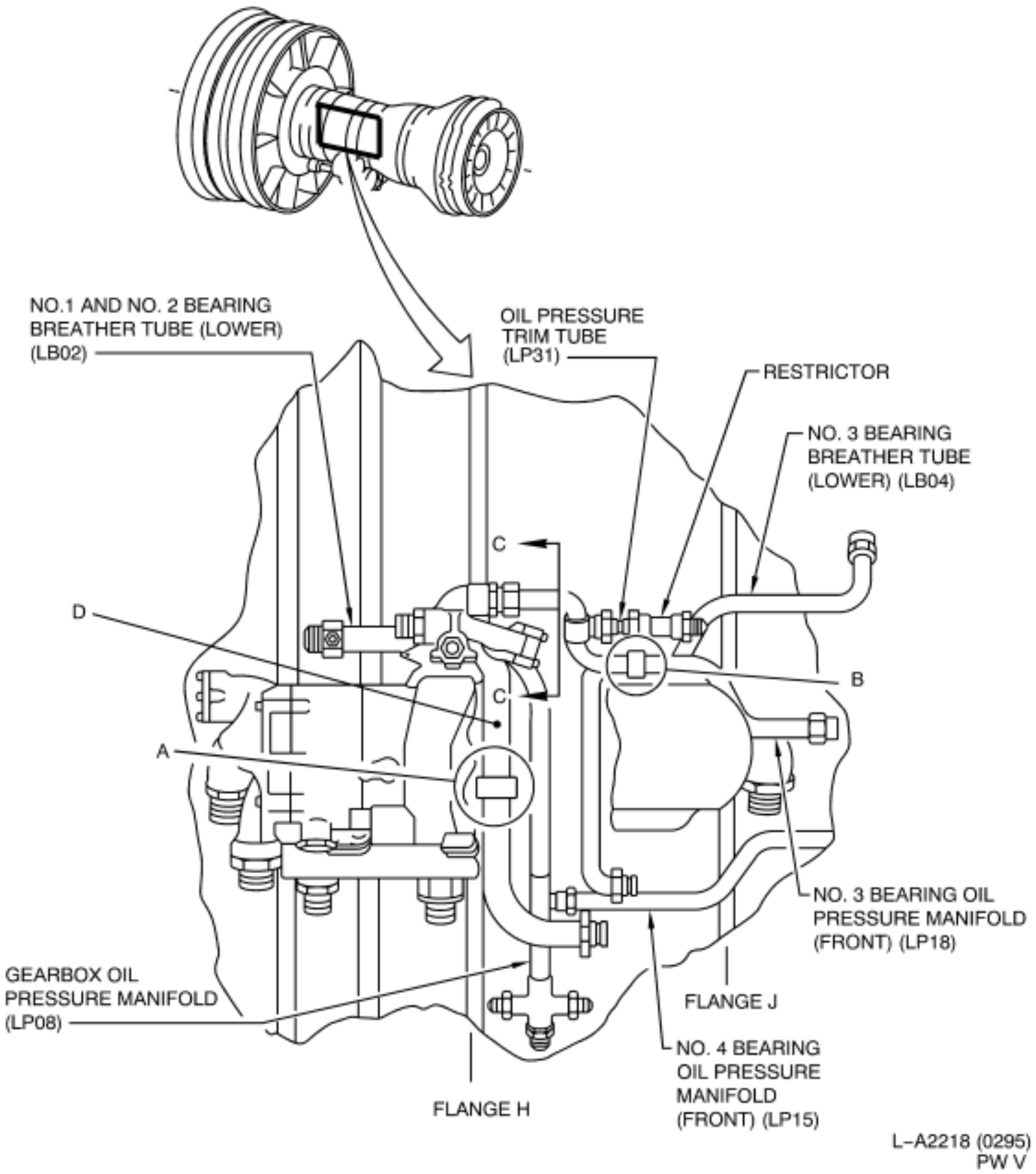
External Plumbing
Figure 305 (Sheet 1)
(Task 72−00−34−020−002)


HPC CASE BRACKET
OIL COOLER INLET FUEL TUBE (FM12)
OIL COOLER INLET FUEL TUBE (FM10)
FWD
VIEW A (2 LOCATIONS)
OIL COOLER INLET OIL TUBE (LS05)
OIL COOLER INLET OIL TUBE (LS05)
HPC CASE BRACKET
ANGLE GEARBOX OIL PRESSURE TUBE
VIEW B PRE SB PW4ENG 79 - 54
VIEW B POST SB PW4ENG 79 - 54
L-A2216 (0891)

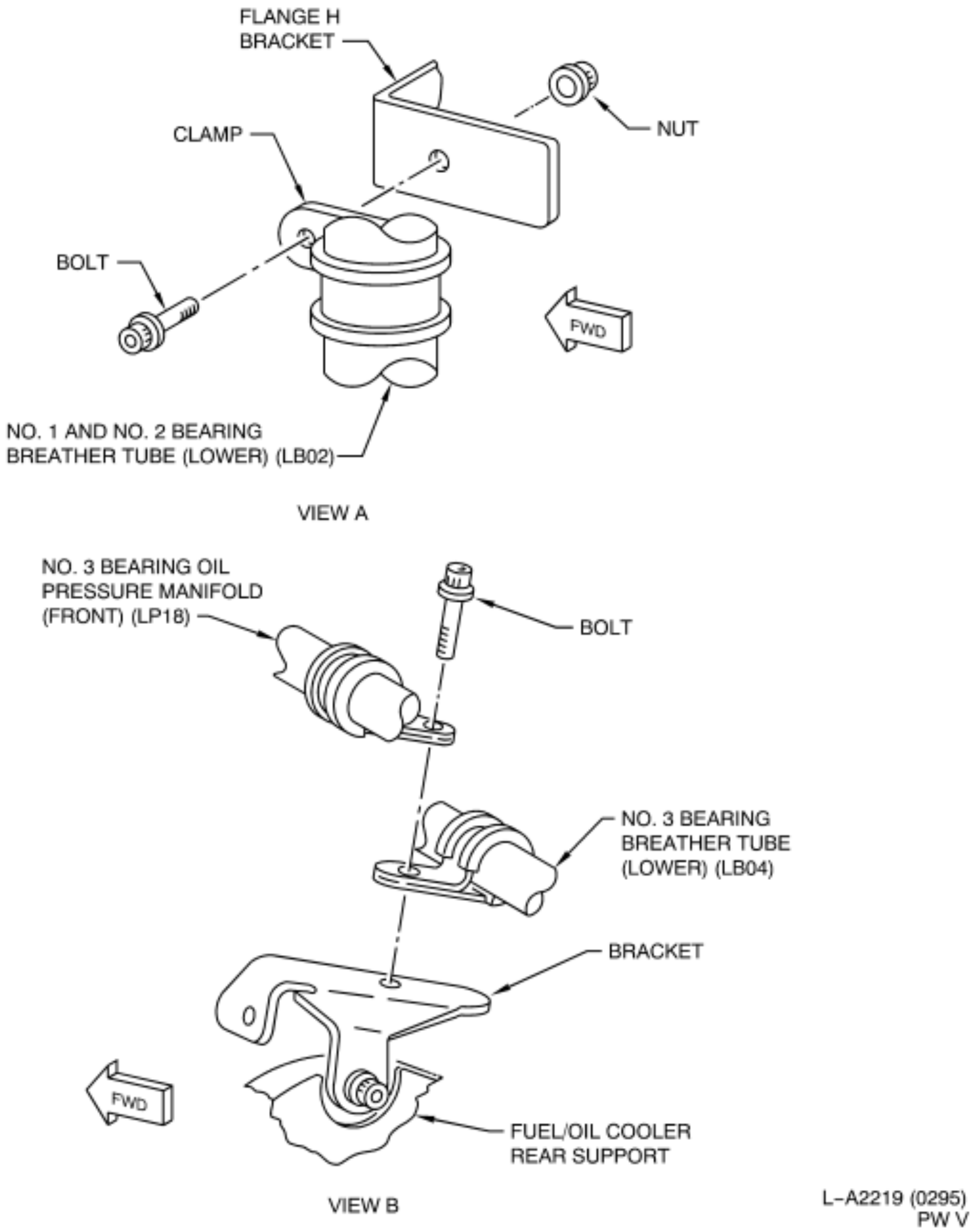
External Plumbing
Figure 305 (Sheet 2)
(Task 72−00−34−020−002)


BOLT
CLAMP
OIL COOLER OUTLET FUEL TUBE
FLANGE J BRACKET
NUT
(PRE SB PW4ENG 73-35)
OIL COOLER OUTLET FUEL HOSE AND TUBE ASSEMBLY
FLANGE J BRACKET
CLAMP
FWD
BOLT
(POST SB PW4ENG 73-35)
VIEW C
AP39
FM11
FWD
(POST SB PW4ENG 75-95)
VIEW D
L-A2217 (0692)

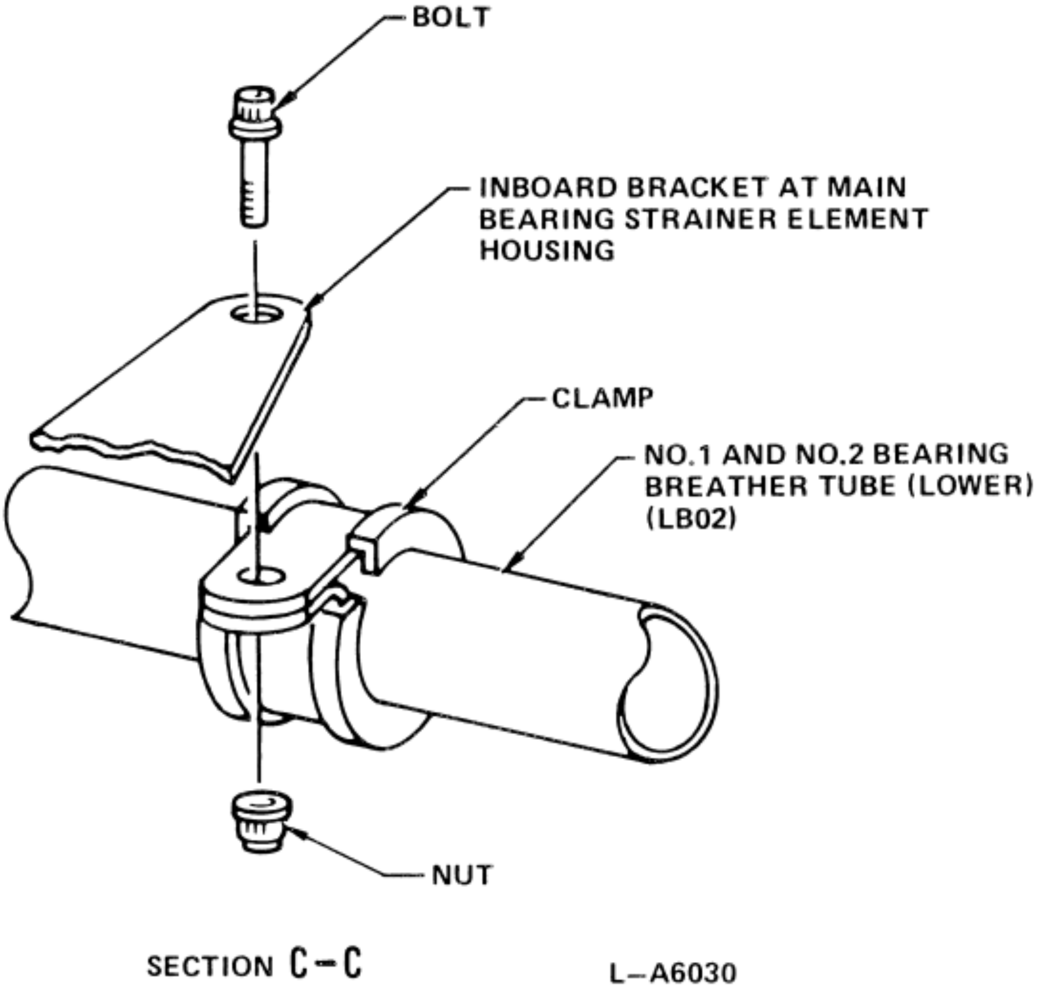
External Plumbing
Figure 305 (Sheet 3)
(Task 72−00−34−020−002)


NO.1 AND NO. 2 BEARING BREATHER TUBE (LOWER) (LB02)
OIL PRESSURE TRIM TUBE (LP31)
RESTRICTOR
NO. 3 BEARING BREATHER TUBE (LOWER) (LB04)
C
D
B
C
A
NO. 3 BEARING OIL PRESSURE MANIFOLD (FRONT) (LP18)
GEARBOX OIL PRESSURE MANIFOLD (LP08)
FLANGE J
NO. 4 BEARING OIL PRESSURE MANIFOLD (FRONT) (LP15)
FLANGE H
L-A2218 (0295)
PW V

External Plumbing
Figure 306 (Sheet 1)
(Task 72-00-34-020-002)

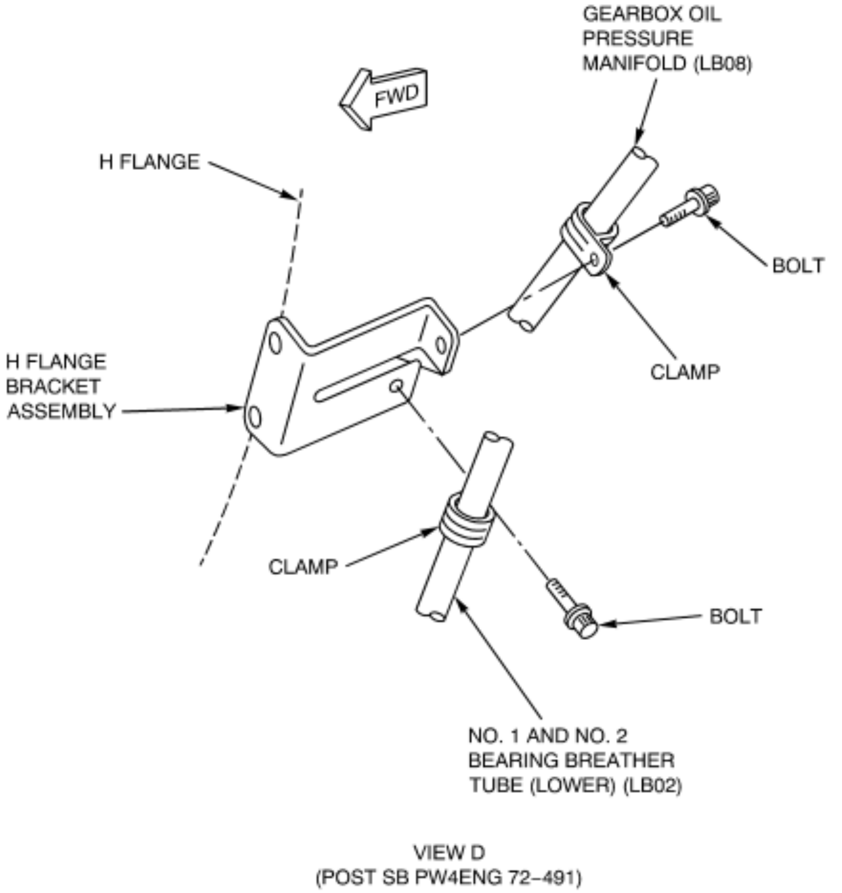

FLANGE H BRACKET
NUT
CLAMP
BOLT
FWD
NO. 1 AND NO. 2 BEARING BREATHER TUBE (LOWER) (LB02)
VIEW A
NO. 3 BEARING OIL PRESSURE MANIFOLD (FRONT) (LP18)
BOLT
NO. 3 BEARING BREATHER TUBE (LOWER) (LB04)
BRACKET
FWD
FUEL/OIL COOLER REAR SUPPORT
VIEW B
L-A2219 (0295)
PW V

External Plumbing
Figure 306 (Sheet 2)
(Task 72−00−34−020−002)


BOLT
INBOARD BRACKET AT MAIN BEARING STRAINER ELEMENT HOUSING
CLAMP
NO.1 AND NO.2 BEARING BREATHER TUBE (LOWER) (LB02)
NUT
SECTION C-C
L-A6030

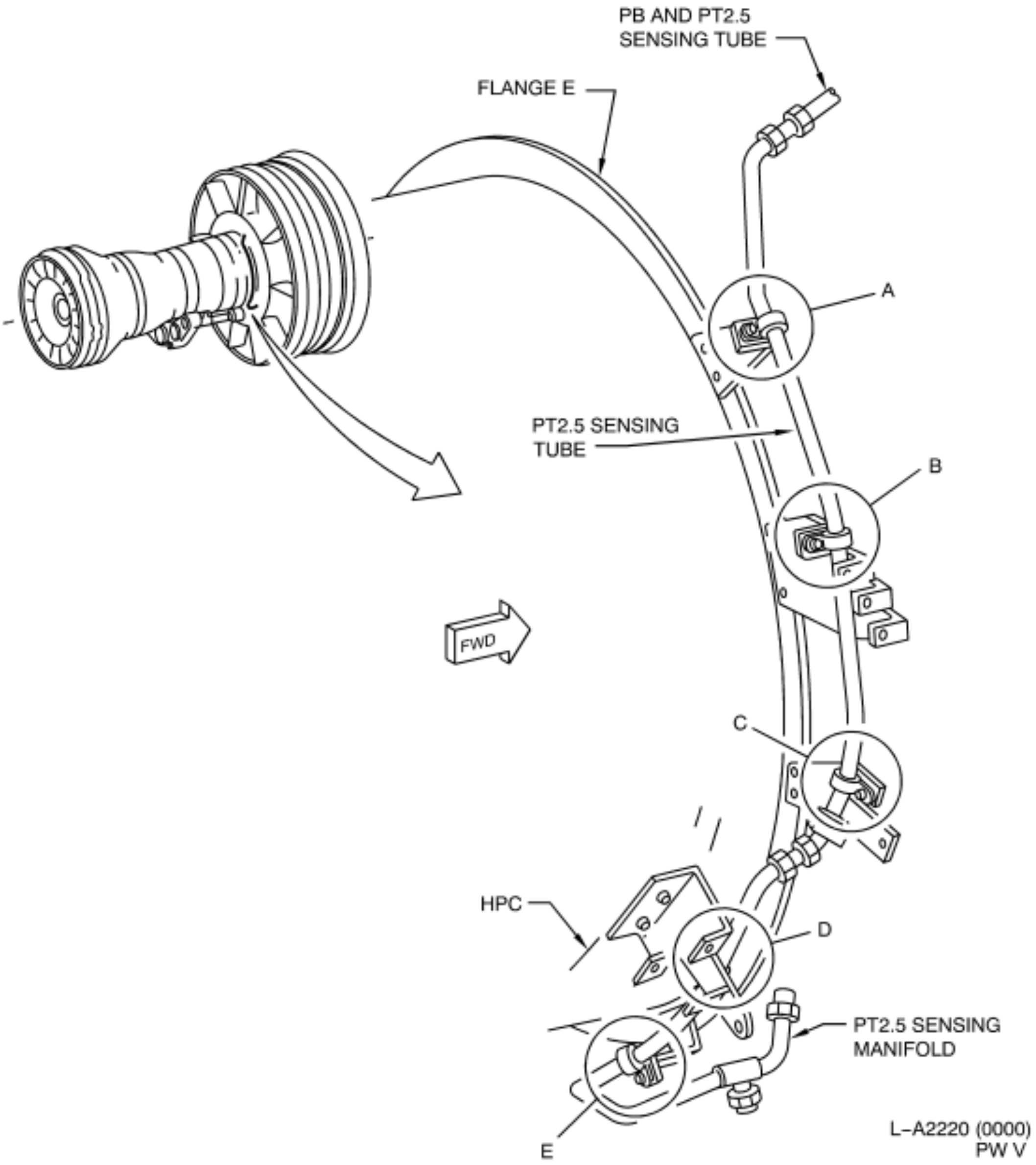
(POST SB PW4ENG 79-33)

External Plumbing
Figure 306 (Sheet 3)
(Task 72-00-34-020-002)

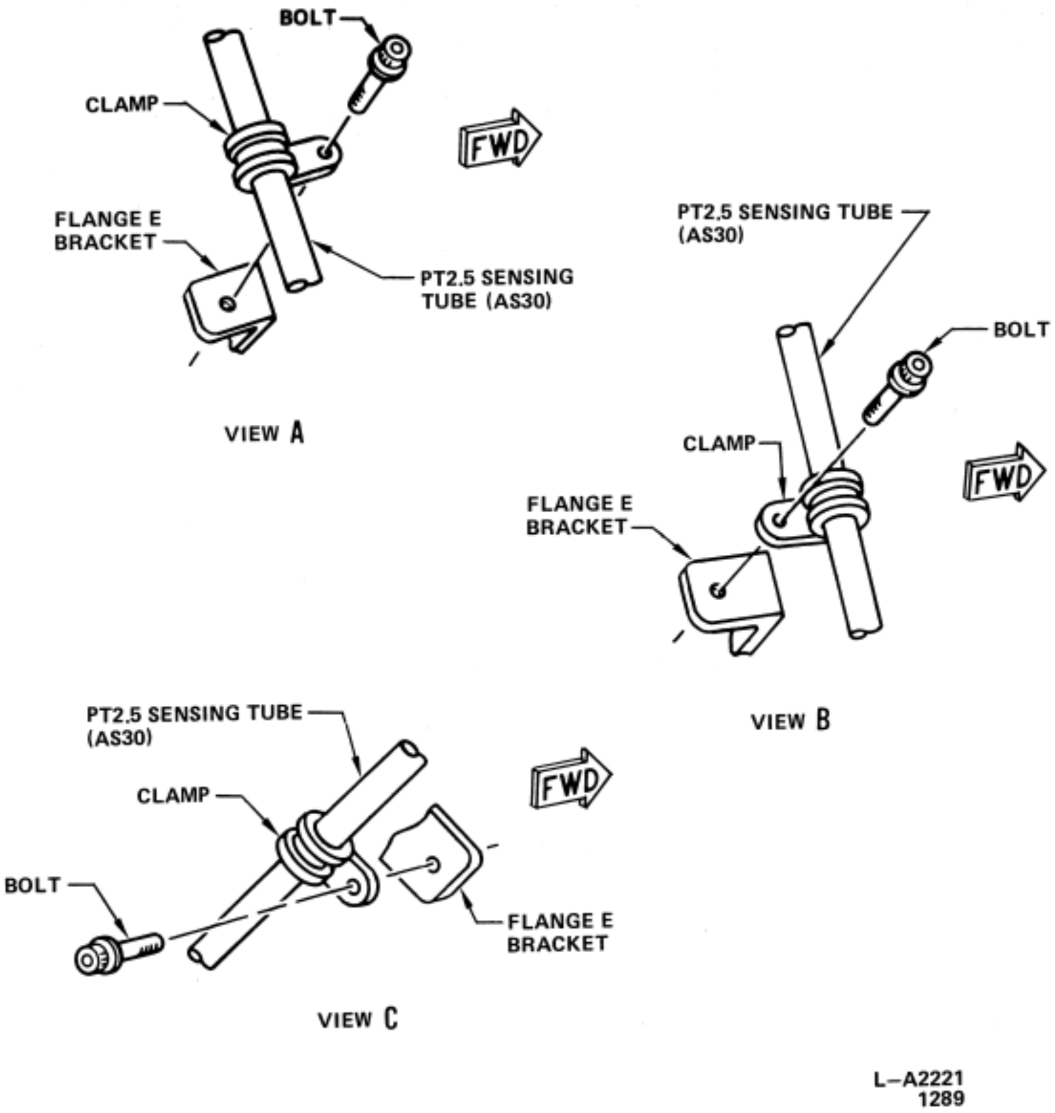

GEARBOX OIL PRESSURE MANIFOLD (LB08)
FWD
H FLANGE
BOLT
H FLANGE BRACKET ASSEMBLY
CLAMP
CLAMP
BOLT
NO. 1 AND NO. 2 BEARING BREATHER TUBE (LOWER) (LB02)
VIEW D
(POST SB PW4ENG 72−491)

L−B0695 (0000)
PW V

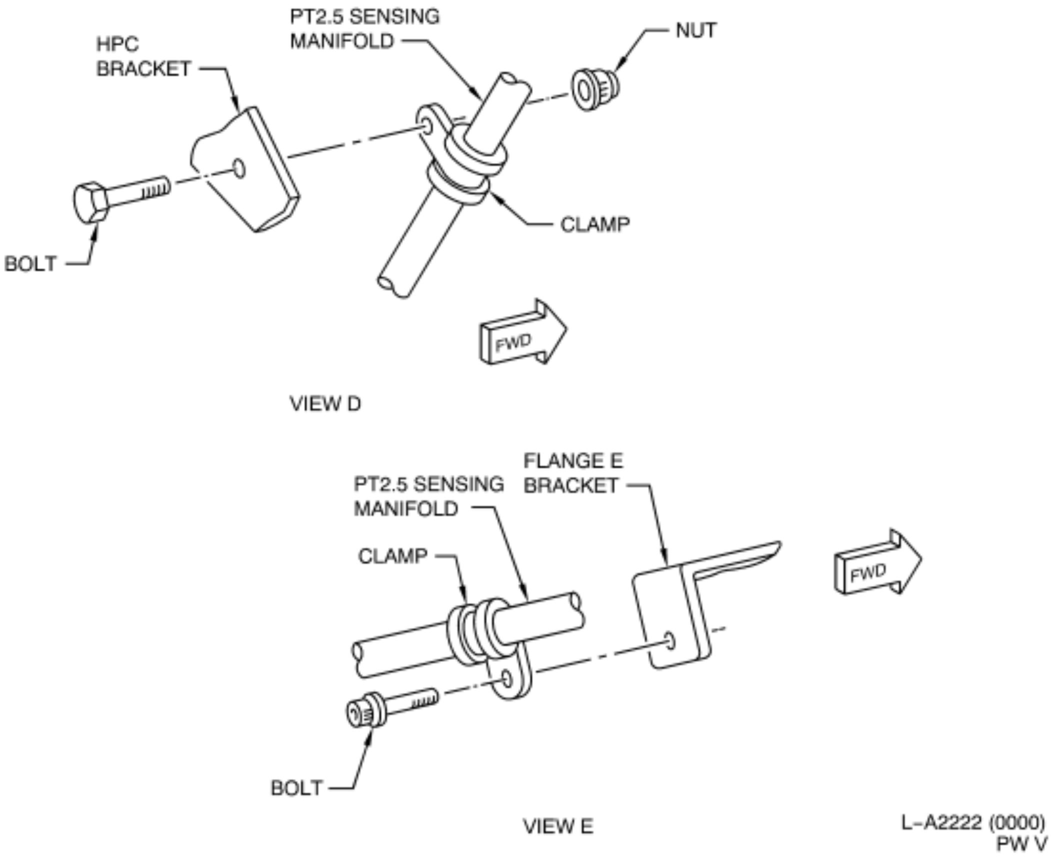
External Plumbing
Figure 306 (Sheet 4)
(Task 72−00−34−020−002)


PB AND PT2.5
SENSING TUBE
FLANGE E
A
PT2.5 SENSING
TUBE
B
FWD
C
HPC
D
PT2.5 SENSING
MANIFOLD
E
L−A2220 (0000)
PW V

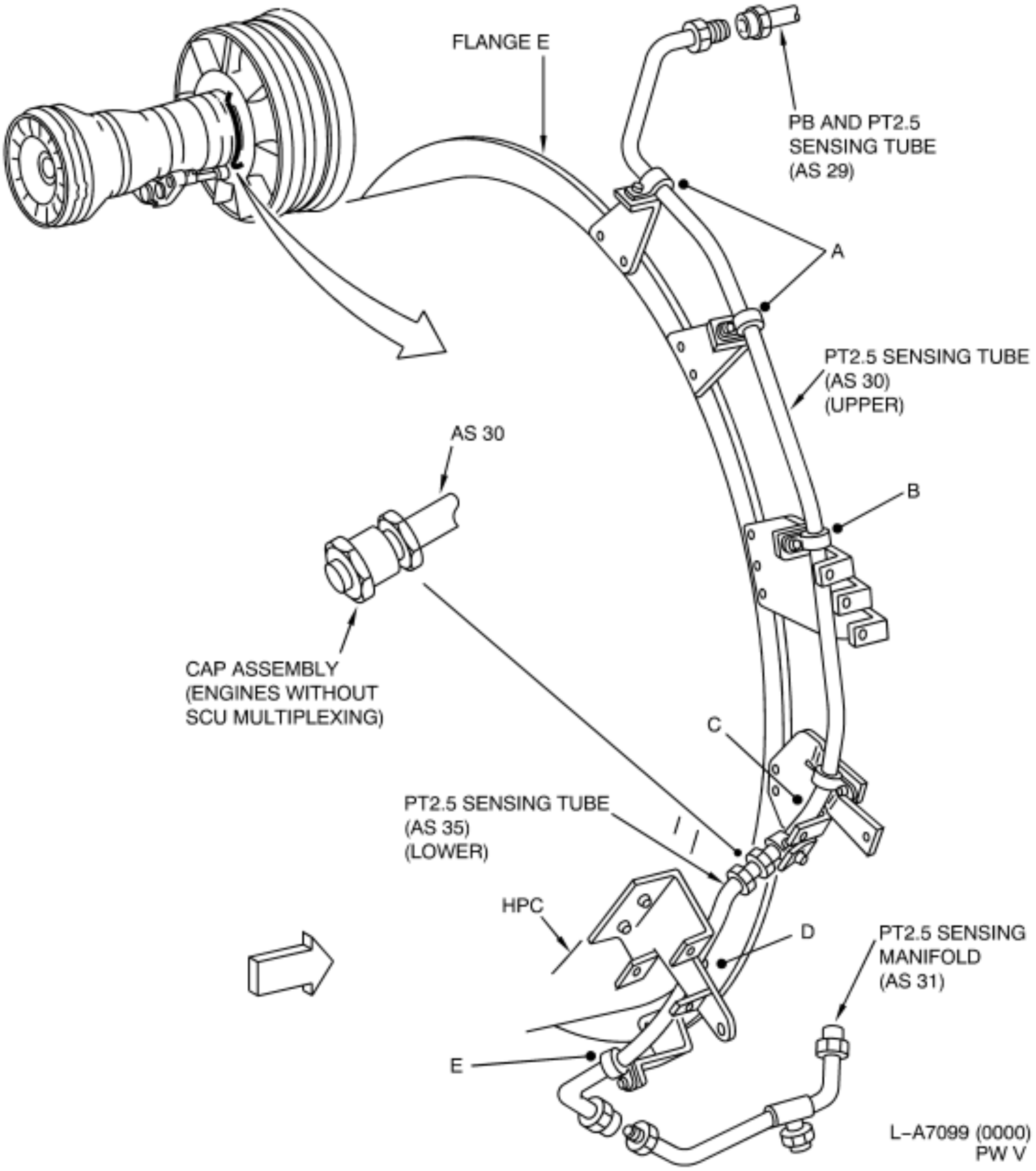
Engine Multiplexer Unit Plumbing
Figure 307 (Sheet 1)
(Task 72−00−34−020−002)


BOLT
CLAMP
FWD
FLANGE E BRACKET
PT2.5 SENSING TUBE (AS30)
VIEW A
PT2.5 SENSING TUBE (AS30)
BOLT
CLAMP
FWD
FLANGE E BRACKET
VIEW B
PT2.5 SENSING TUBE (AS30)
CLAMP
FWD
BOLT
FLANGE E BRACKET
VIEW C
L-A2221
1289

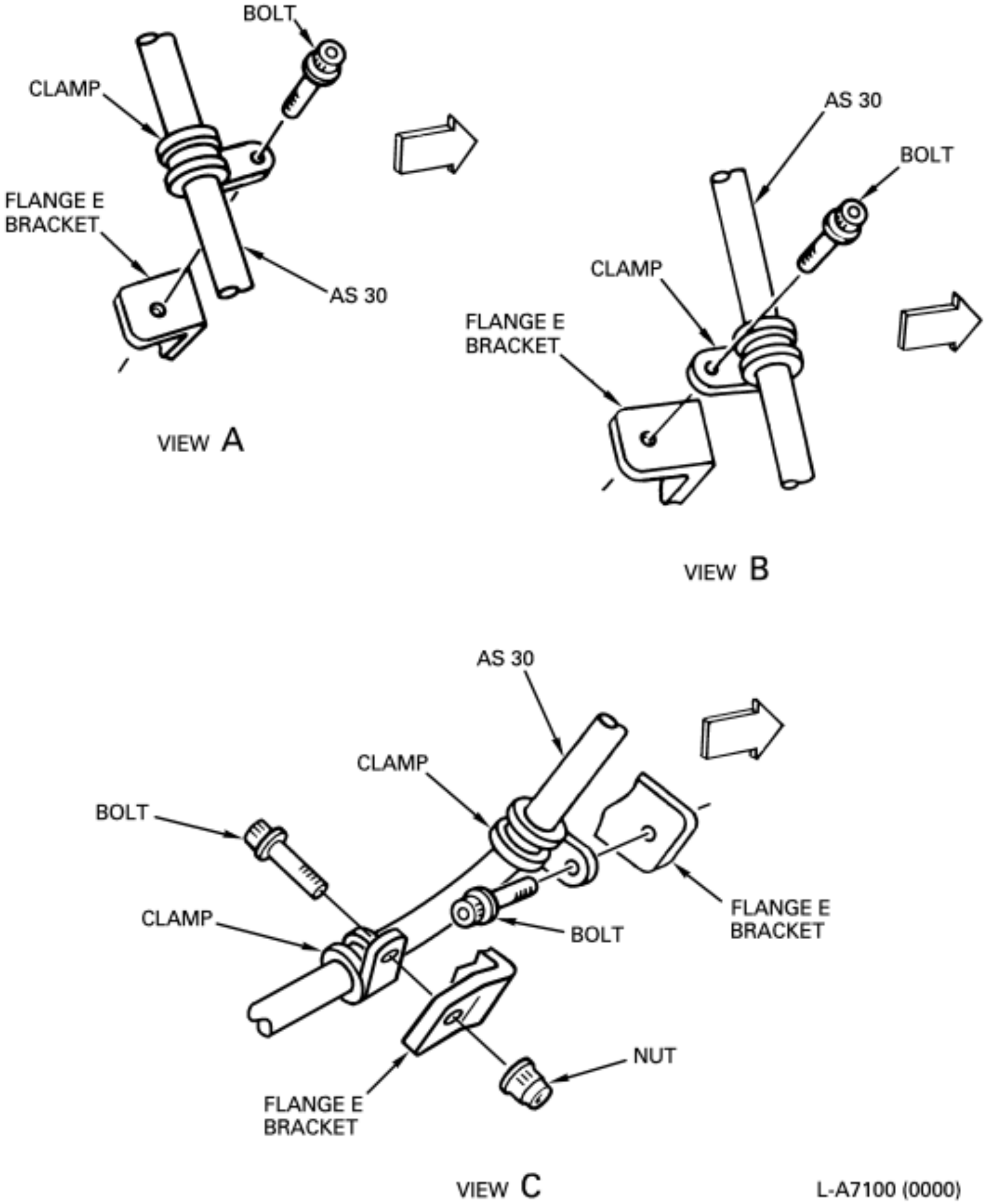
Engine Multiplexer Unit Plumbing
Figure 307 (Sheet 2)
(Task 72-00-34-020-002)


HPC BRACKET
PT2.5 SENSING MANIFOLD
NUT
BOLT
CLAMP
FWD
VIEW D
FLANGE E BRACKET
PT2.5 SENSING MANIFOLD
CLAMP
FWD
BOLT
VIEW E
L−A2222 (0000)
PW V

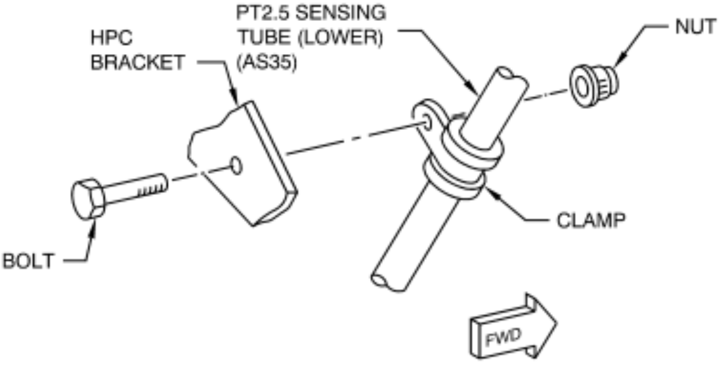
Engine Multiplexer Unit Plumbing
Figure 307 (Sheet 3)
(Task 72−00−34−020−002)


FLANGE E
PB AND PT2.5
SENSING TUBE
(AS 29)
A
PT2.5 SENSING TUBE
(AS 30)
(UPPER)
AS 30
B
CAP ASSEMBLY
(ENGINES WITHOUT
SCU MULTIPLEXING)
C
PT2.5 SENSING TUBE
(AS 35)
(LOWER)
HPC
D
PT2.5 SENSING
MANIFOLD
(AS 31)
E
L−A7099 (0000)
PW V

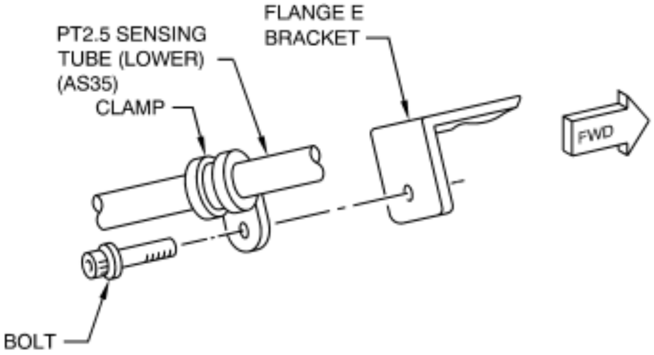
Engine Supplemental Control Unit (SCU) With Multiplexing Plumbing
Figure 308 (Sheet 1)
(Task 72−00−34−020−002)


BOLT
CLAMP
FLANGE E BRACKET
AS 30
VIEW A
AS 30
BOLT
CLAMP
FLANGE E BRACKET
VIEW B
AS 30
CLAMP
BOLT
CLAMP
FLANGE E BRACKET
BOLT
NUT
FLANGE E BRACKET
VIEW C
L-A7100 (0000)

Engine Supplemental Control Unit (SCU) With Multiplexing Plumbing
Figure 308 (Sheet 2)
(Task 72-00-34-020-002)


PT2.5 SENSING
TUBE (LOWER)
(AS35)
HPC
BRACKET
NUT
CLAMP
BOLT
FWD

VIEW D


FLANGE E
BRACKET
PT2.5 SENSING
TUBE (LOWER)
(AS35)
CLAMP
BOLT
FWD

VIEW E

L−A4704 (1289)
PW V

Engine Supplemental Control Unit (SCU) With Multiplexing Plumbing
Figure 308 (Sheet 3)
(Task 72−00−34−020−002)

ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-03

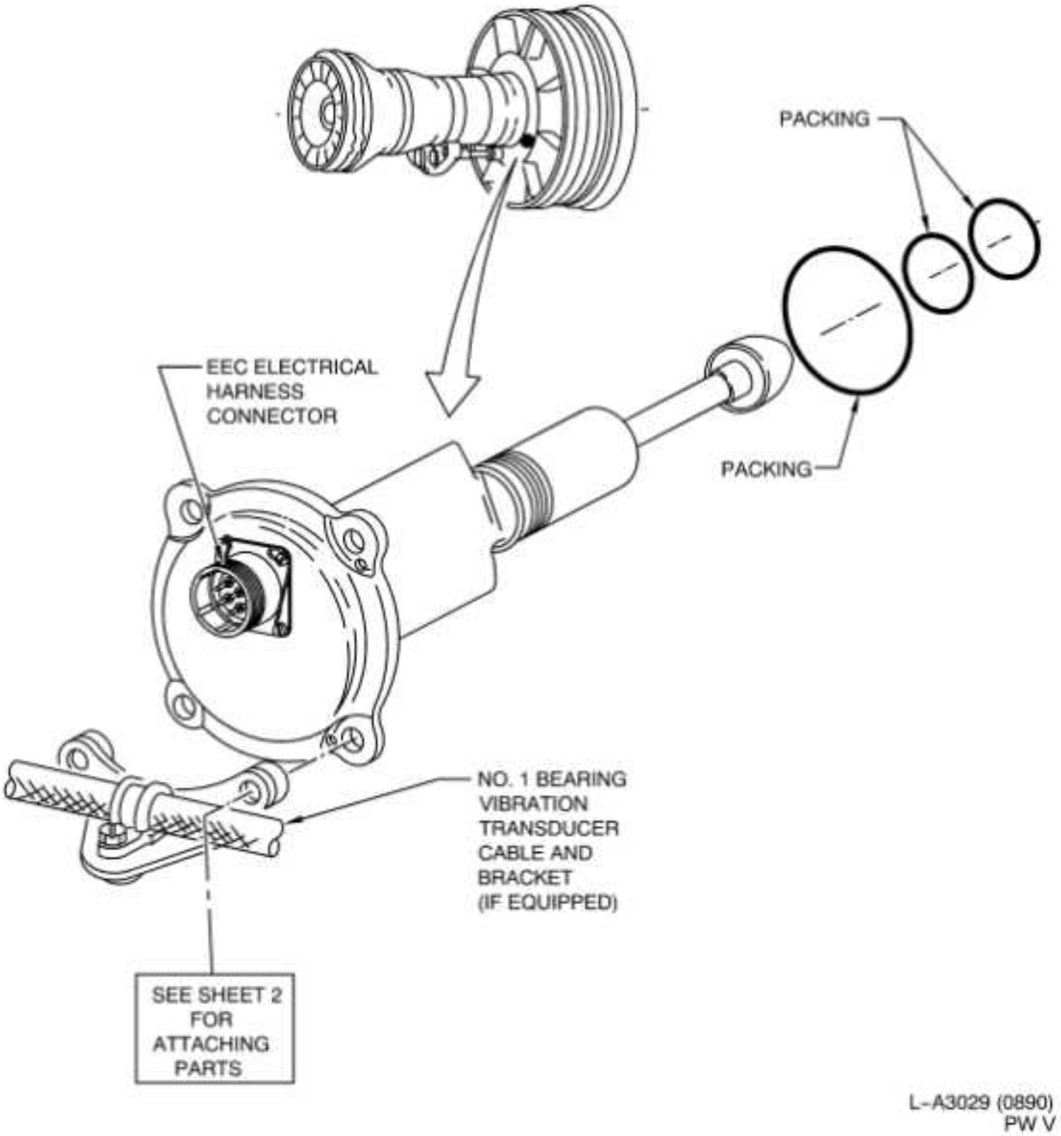
Task 72-00-34-050-001:

1. Remove Electronic Engine Control (EEC) Speed Transducer (N1)
   A. Prerequisites
      (1) Remove the fan exit liner segment (inner rear) that is at 5 o'clock. Refer to 72-00-33, Removal-16 (Task 72-00-33-040-001).
   B. Equipment And Materials Required - None
   C. Procedure
      See Figure 301.
      (1) Disconnect W4P19 harness connector from transducer.
      (2) If required, bend tabs of key washers down. Evenly loosen bolts and nut (if equipped) securing spring loaded transducer flange to intermediate case. Remove bolts, nut (if equipped) washers, and, if applicable, bracket. Discard key washers if used.
      (3) Withdraw speed transducer from case.

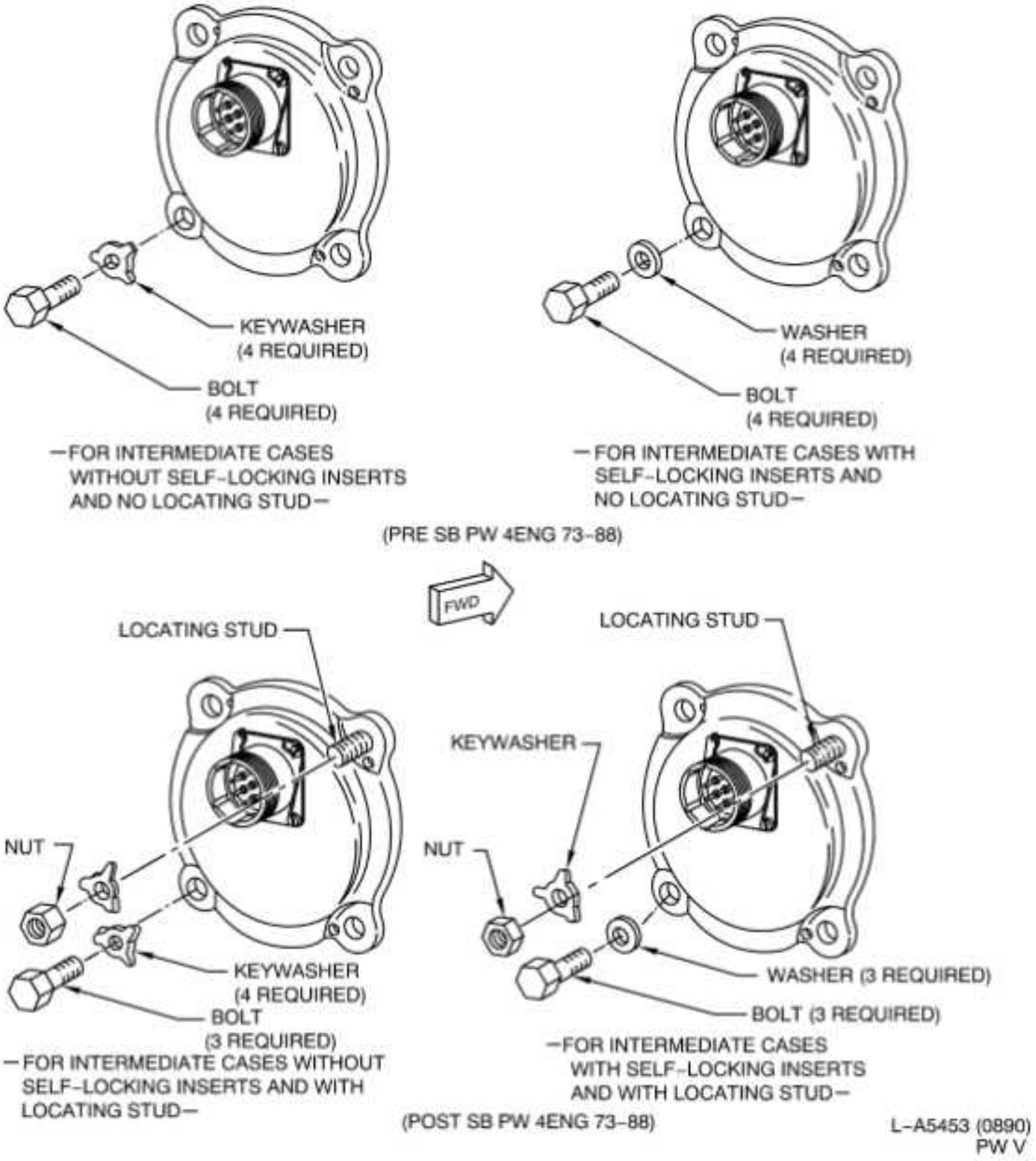
         NOTE: If equipped, use the jackscrew holes in the transducer flange. Do not attempt to rotate transducer until disengaged from inner bracket.

      (4) Remove and discard three packings from transducer.
      (5) Install protective closures.

         NOTE: For additional information concerning detailed maintenance of this component see EEC Speed Transducer (N1) Component Maintenance Manual, 73-21-50 (PW Manual PN 50A449).


PACKING
EEC ELECTRICAL HARNESS CONNECTOR
PACKING
NO. 1 BEARING VIBRATION TRANSDUCER CABLE AND BRACKET (IF EQUIPPED)
SEE SHEET 2 FOR ATTACHING PARTS
L-A3029 (0890)
PW V

EEC Speed Transducer (N1) Removal
Figure 301 (Sheet 1)
(Task 72-00-34-050-001)


KEYWASHER
(4 REQUIRED)
BOLT
(4 REQUIRED)
—FOR INTERMEDIATE CASES WITHOUT SELF-LOCKING INSERTS AND NO LOCATING STUD—
WASHER
(4 REQUIRED)
BOLT
(4 REQUIRED)
—FOR INTERMEDIATE CASES WITH SELF-LOCKING INSERTS AND NO LOCATING STUD—
(PRE SB PW 4ENG 73-88)
FWD
LOCATING STUD
NUT
KEYWASHER
(4 REQUIRED)
BOLT
(3 REQUIRED)
—FOR INTERMEDIATE CASES WITHOUT SELF-LOCKING INSERTS AND WITH LOCATING STUD—
LOCATING STUD
KEYWASHER
NUT
WASHER (3 REQUIRED)
BOLT (3 REQUIRED)
—FOR INTERMEDIATE CASES WITH SELF-LOCKING INSERTS AND WITH LOCATING STUD—
(POST SB PW 4ENG 73-88)
L-A5453 (0890)
PW V

EEC Speed Transducer (N1) Removal
(Attaching Parts)
Figure 301 (Sheet 2)
(Task 72−00−34−050−001)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-34-050-002:

1. Remove No. 1 Bearing Support (Front And Rear) Assembly

NOTE: See Figure 301 for part/assembly removal procedure sequence.

A. Prerequisites

(1) Remove low pressure compressor (LPC). See 72-00-31, Removal-01 Task 72-00-31-020-003.

B. Equipment And Materials Required

Special Tools:
PWA 85367 Adapter, Handling
PWA 85368 Arm, Lifting

C. Procedure
See Figure 302.

R (1) Remove the No. 1 bearing vibration transducer. Refer
R to 72-00-34, Removal-22 (Task 72-00-34-040-001).

R (2) Remove 48 bolts and washers securing support assembly to engine.

R (3) Attach PWA 85368 Arm to PWA 85367 Adapter and using hoist (at third hold from outside of arm) position adapter to front end of No. 1 bearing support assembly.

R (4) Using mallet remove assembly from intermediate case snap and position assembly on bench. Remove hoist, arm and adapter. Remove packing from rear flange and discard.

R (5) If further disassembly is desired continue with following:

(a) Trunnion front and rear support assembly to front end up.

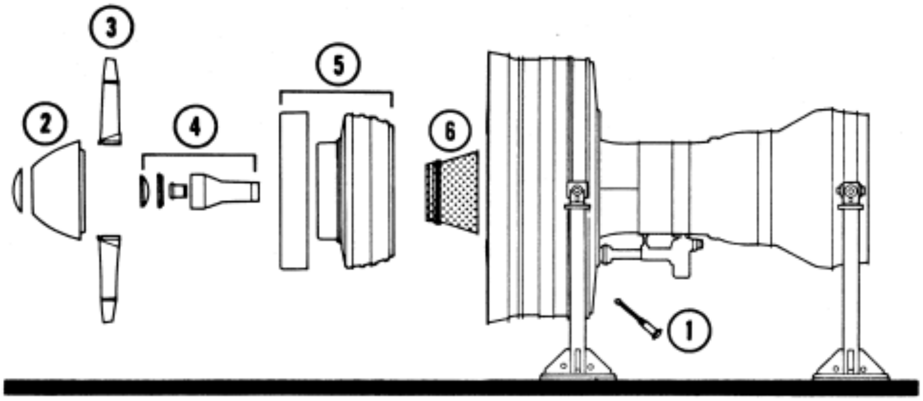
(b) Remove 34 nuts, washers and bolts from bolt circle.

(c) Remove No. 1 bearing (oil) pressure manifold from No. 1 bearing rear support assembly.

1 Remove two bolts and nuts securing manifold to bracket (302/2).

2 Withdraw manifold from bracket (302/1).

(d) Remove front support from rear support. Discard packing from front flange of rear support.

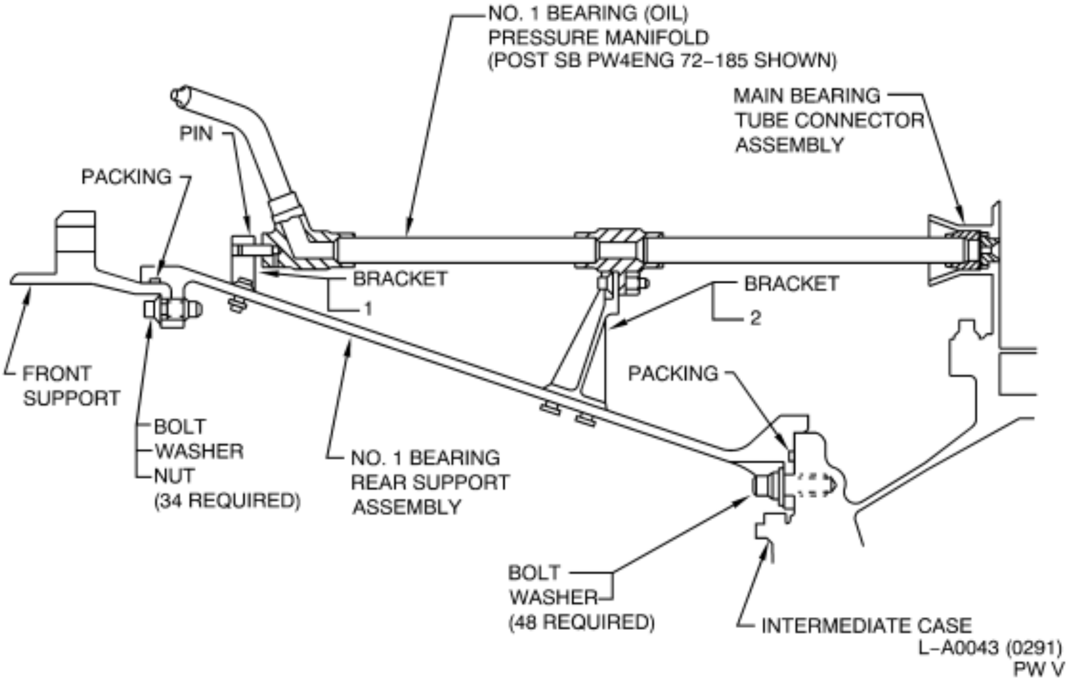


1. REMOVE ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
2. REMOVE COMPRESSOR INLET CONE.
3. REMOVE STAGE 1 LPC BLADE ASSEMBLIES.
4. REMOVE LPC/LPT COUPLING.
5. REMOVE LOW PRESSURE COMPRESSOR (LPC).
6. REMOVE NO. 1 BEARING SUPPORT ASSEMBLY.

L−A0102

Procedure Sequence
Figure 301
(Task 72−00−34−050−002)

R
R


NO. 1 BEARING (OIL)
PRESSURE MANIFOLD
(POST SB PW4ENG 72−185 SHOWN)
MAIN BEARING
TUBE CONNECTOR
ASSEMBLY
PIN
PACKING
BRACKET
1
BRACKET
2
PACKING
FRONT
SUPPORT
BOLT
WASHER
NUT
(34 REQUIRED)
NO. 1 BEARING
REAR SUPPORT
ASSEMBLY
BOLT
WASHER
(48 REQUIRED)
INTERMEDIATE CASE
L−A0043 (0291)
PW V

No. 1 Bearing Support Removal
Figure 302
(Task 72−00−34−050−002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-05

Task 72-00-34-050-003:

1. Remove EEC Fan Case Wiring Harnesses W1 And W2 - Relocated

   NOTE: Removal Of EEC Fan Case Wiring Harnesses W1 And W2 Has Been Relocated To 72-00-33, Removal-06

Task 72-00-34-050-004:

2. Remove EEC Core Engine Wiring Harnesses W3, W4 And W5 - Relocated

   NOTE: Removal Of EEC Core Engine Wiring Harnesses W3, W4, And W5 Has Been Relocated To 72-00-34, Removal-18, Removal-19, And Removal-20 Respectively.

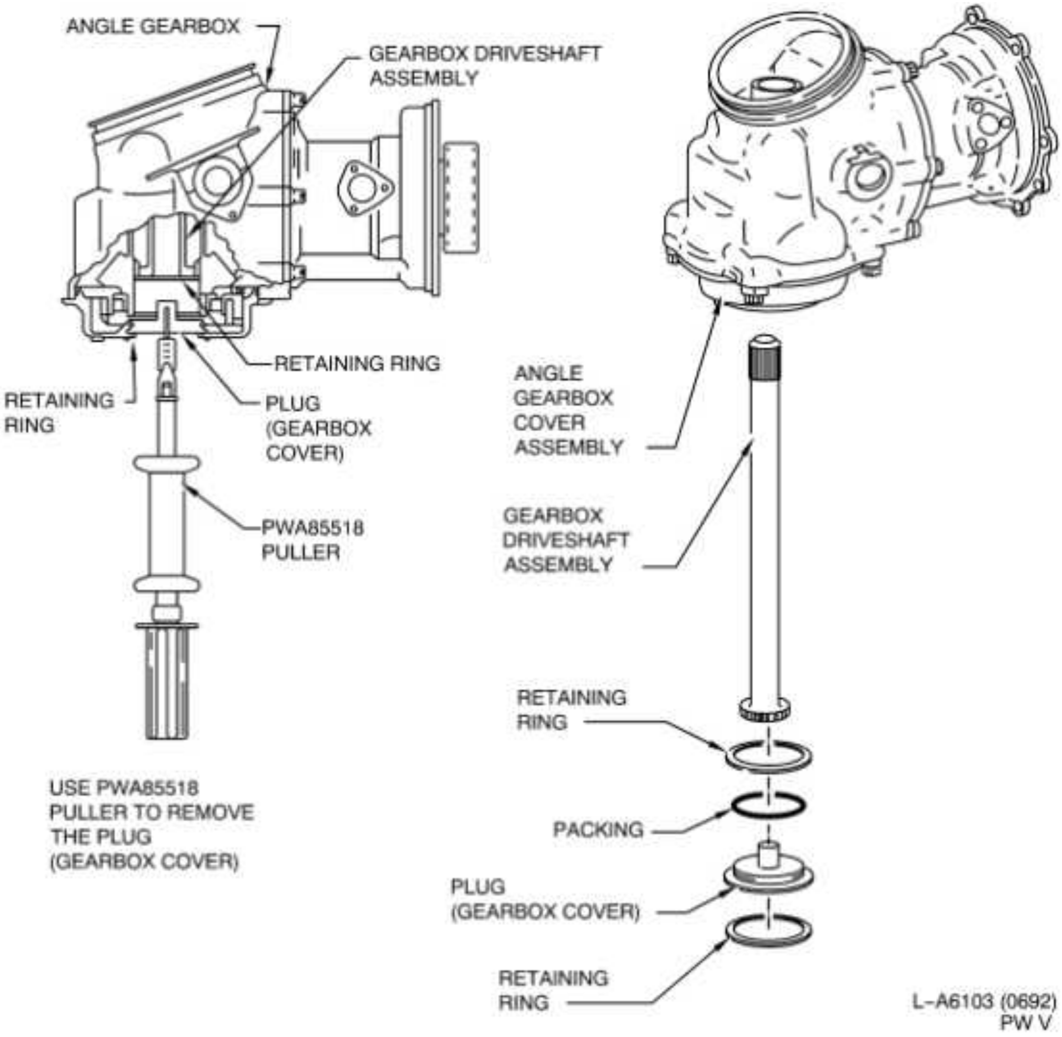
ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-06

Task 72-00-34-030-001:

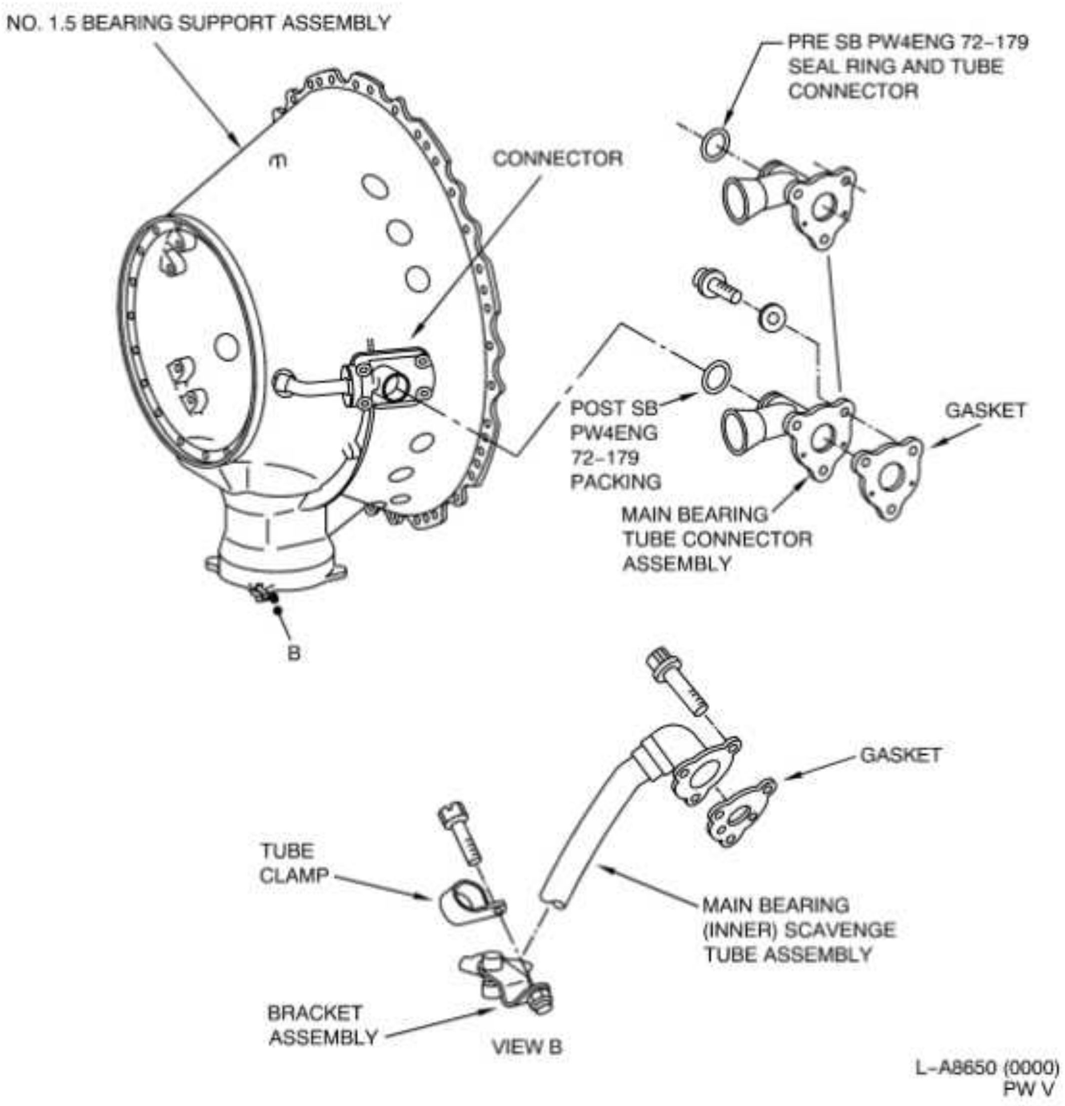
1. Remove No. 1.5 Bearing Support Assembly
   A. Prerequisites
      (1) Remove No. 1 bearing support (front and rear) assembly. See Removal-04 (Task 72-00-34-050-002).
   B. Equipment And Materials Required

      Special Tools:
      PWA 29855-3 Pin (2 Necessary)
      PWA 85366 Adapter, Handling (Optional to PWA 87316)
      PWA 85368 Arm, Lifting
      PWA 85518 Puller
      PWA 87316 Adapter, Handling

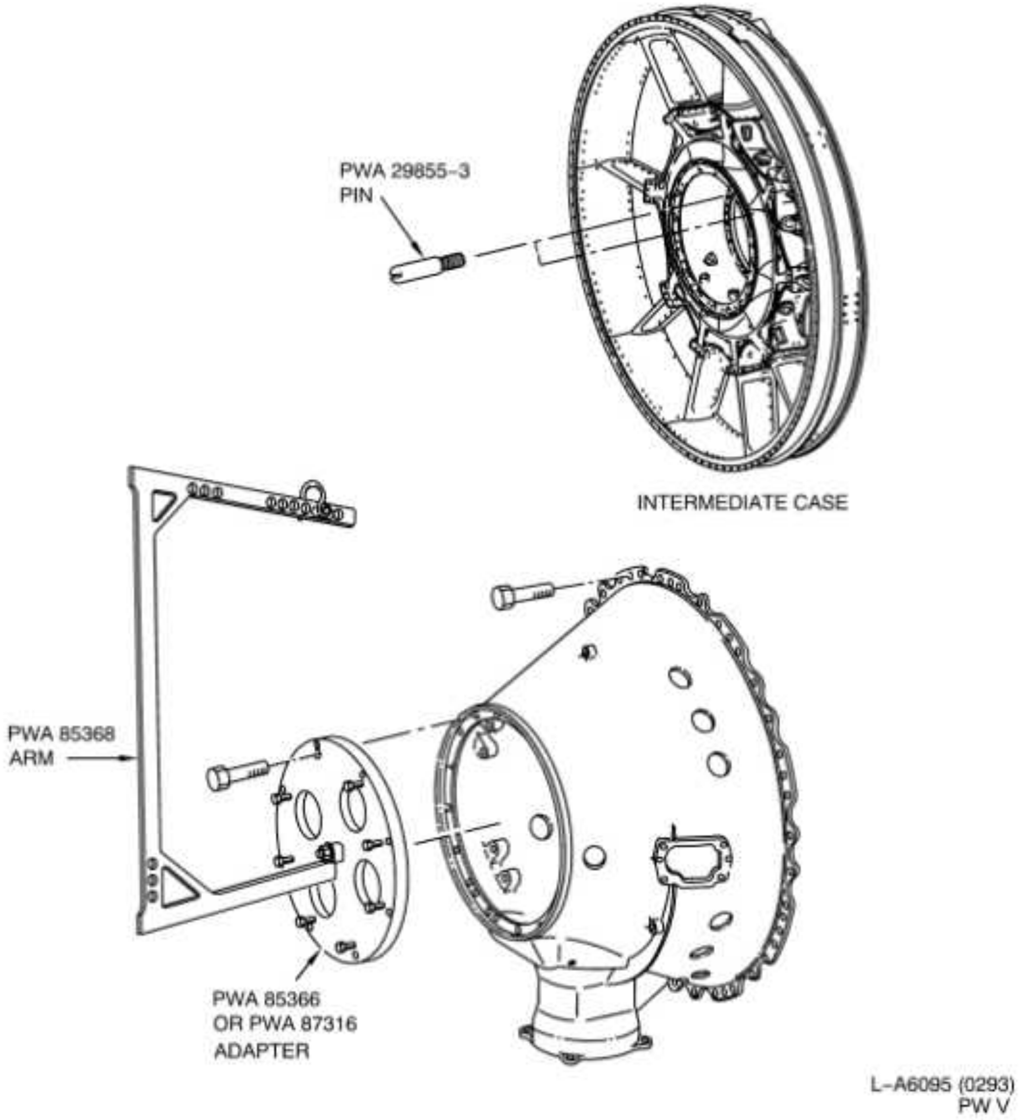
   C. Procedure
      (1) Remove the gearbox driveshaft assembly. See Figure 301.
         (a) Put a container under the angle gearbox to collect oil.
         (b) Remove the retaining ring from the plug (gearbox cover).
         (c) With PWA 85518 Puller, remove the plug (gearbox cover). Discard the packing.
         (d) Remove the retaining ring that is in the angle gearbox.
         (e) Remove the gearbox driveshaft assembly.
      (2) Remove the main bearing (inner) scavenge tube assembly (called tube). See Figure 302.
         (a) Remove the bolt and nut that attach the bracket to the No. 1.5 bearing support assembly.
         (b) Remove the three bolts that attach the tube to intermediate case.
         (c) Remove the tube. Discard the gasket. Remove the clamp from the tube.
      (3) Disconnect the main bearing tube connector from the intermediate case. See Figure 302.
         (a) Remove the three bolts that attach the tube connector to the ID of the intermediate case.
         (b) Push the tube connector into the connector on the support assembly.
         (c) Remove and discard the gasket.
      (4) Remove the No. 1.5 bearing support assembly. See Figure 303.
         (a) Install two PWA 29855-3 Pins in threaded holes in the rear ID of the intermediate case at 2 and 10 o'clock.
         (b) Attach PWA 85366 Adapter to the support assembly:
            1 Attach PWA 85368 Arm to the threaded rod at the center of the adapter.
            2 Attach a hoist to the arm. Lift the tools.


ANGLE GEARBOX
GEARBOX DRIVESHAFT ASSEMBLY
RETAINING RING
RETAINING RING
PLUG (GEARBOX COVER)
PWA85518 PULLER
USE PWA85518 PULLER TO REMOVE THE PLUG (GEARBOX COVER)
ANGLE GEARBOX COVER ASSEMBLY
GEARBOX DRIVESHAFT ASSEMBLY
RETAINING RING
PACKING
PLUG (GEARBOX COVER)
RETAINING RING
L−A6103 (0692)
PW V

Remove The Gearbox Driveshaft Assembly
Figure 301
(Task 72−00−34−030−001)


NO. 1.5 BEARING SUPPORT ASSEMBLY
PRE SB PW4ENG 72-179 SEAL RING AND TUBE CONNECTOR
CONNECTOR
POST SB PW4ENG 72-179 PACKING
GASKET
MAIN BEARING TUBE CONNECTOR ASSEMBLY
B
GASKET
TUBE CLAMP
MAIN BEARING (INNER) SCAVENGE TUBE ASSEMBLY
BRACKET ASSEMBLY
VIEW B
L-A8650 (0000)
PW V

Remove The Main Bearing Tube Connector And (Inner) Scavenge Tube
Figure 302
(Task 72−00−34−030−001)


PWA 29855-3
PIN
INTERMEDIATE CASE
PWA 85368
ARM
PWA 85366
OR PWA 87316
ADAPTER
L-A6095 (0293)
PW V

Remove The No. 1.5 Bearing Support Assembly
Figure 303
(Task 72−00−34−030−001)

3 Attach the adapter to the front flange of the support assembly with the detail screws.

(c) Remove the support assembly:

1 Install 1/4−28 jackscrews in the three threaded holes in the rear flange of the support assembly, at 4, 8, and 12 o'clock.

2 Remove the 33 bolts that attach the rear flange of the support assembly to the intermediate case.

CAUTION: BE CAREFUL OF THE NO. 2 BEARING (OIL) PRESSURE TUBE WHEN YOU REMOVE THE SUPPORT ASSEMBLY.

3 With the jackscrews, slowly remove the support assembly.

4 Put the support assembly on a bench, front end down.

5 Remove the jackscrews.

6 Remove the tools.

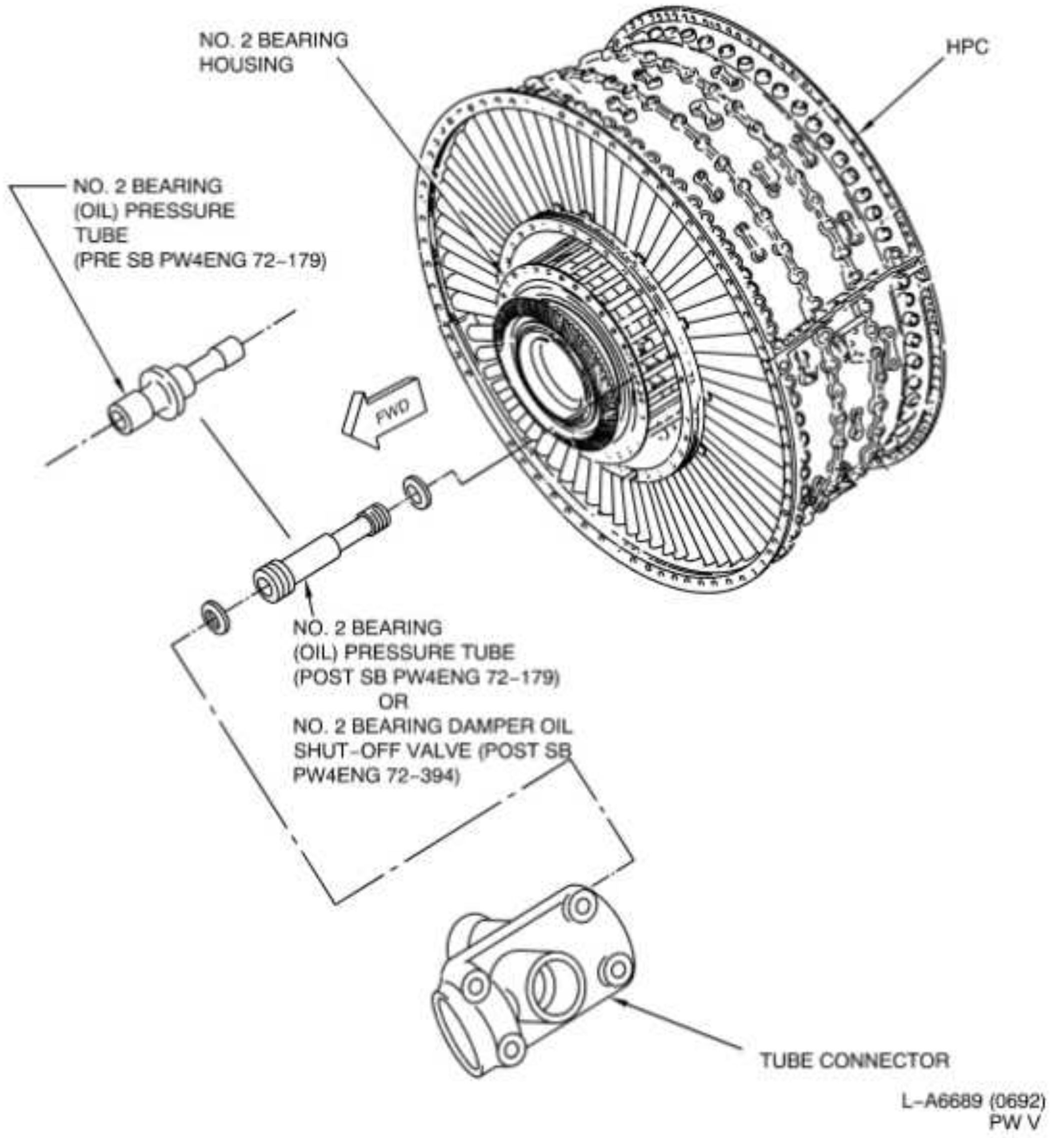
(d) If you will trunnion the intermediate case, install workbolts to replace the 33 bolts you removed.

(5) Remove the No. 2 bearing (oil) pressure tube (Pre SB PW4ENG 72−394) or oil shut−off valve (Post SB PW4ENG 72−394) from the No. 2 bearing housing. If applicable, remove and discard the packings. See Figure 304.

(6) Remove the main bearing tube connector from the support assembly. See Figure 302.

(a) Pull the tube connector out of the connector on the support assembly.

(b) Remove and discard the packing, if applicable.


NO. 2 BEARING HOUSING
HPC
NO. 2 BEARING (OIL) PRESSURE TUBE (PRE SB PW4ENG 72-179)
FWD
NO. 2 BEARING (OIL) PRESSURE TUBE (POST SB PW4ENG 72-179) OR NO. 2 BEARING DAMPER OIL SHUT-OFF VALVE (POST SB PW4ENG 72-394)
TUBE CONNECTOR
L-A6689 (0692)
PW V

Remove The No. 2 Bearing (Oil)
Pressure Tube
Figure 304
(Task 72-00-34-030-001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−07

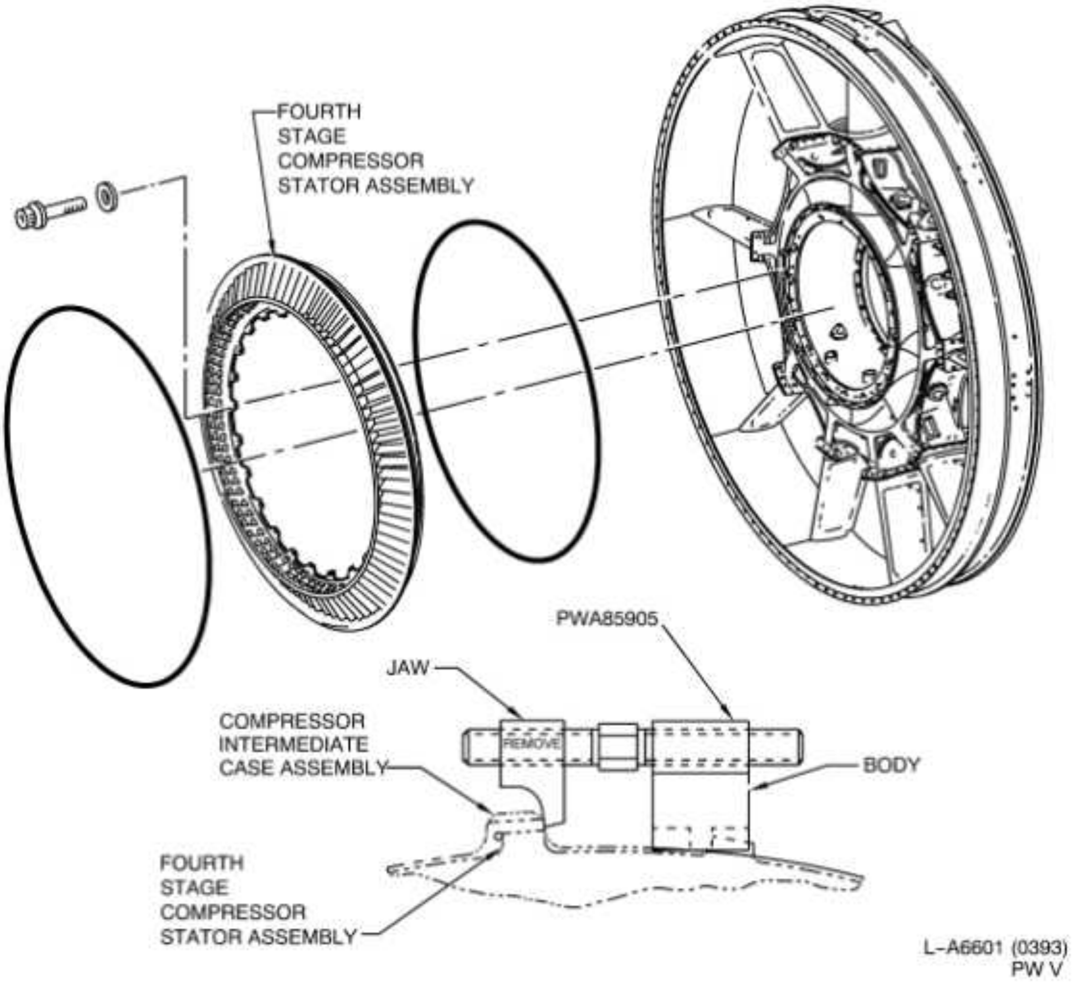
Task 72−00−34−030−002:

1. Remove The 4th Stage Compressor Stator Assembly
   - A. Prerequisites
     - (1) Remove the low pressure compressor (LPC). See 72−00−31, Removal−01 (Task 72−00−31−020−003).
     - (2) Remove the fan exit liner segment (inner rear) that is at 11 or 1 o'clock. Refer to 72−00−33, Removal−16 (Task 72−00−33−040−001).
   - B. Equipment And Materials Required

     Special Tools:
     PWA 85905 Fixture, Assemble/Disassemble

   - C. Procedure
     See Figure 301.

     - (1) Remove the 24 bolts and washers that attach the stator assembly to the intermediate case.
     - (2) Assemble PWA 85905 Fixture.
       - (a) Put the jaw marked "Remove" on the screw.
       - (b) Put the jaw approximately 1.5 inch (38.100 mm) from the body.
       - (c) Have the same quantity of threads at both ends.
       - (d) Engage the fixture in the tabs of the stator assembly and intermediate case at 11 o'clock.
       - (e) While you hold the stator assembly, turn the screw to disengage the tabs of the two assemblies.
       - (f) Remove the stator assembly. Discard the packings.


FOURTH
STAGE
COMPRESSOR
STATOR ASSEMBLY
PWA85905
JAW
REMOVE
COMPRESSOR
INTERMEDIATE
CASE ASSEMBLY
BODY
FOURTH
STAGE
COMPRESSOR
STATOR ASSEMBLY
L−A6601 (0393)
PW V

Remove The 4th Stage Compressor
Stator Assembly
Figure 301
(Task 72−00−34−030−002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-08

Task 72-00-34-050-005:

1. Remove Air/Oil Heat Exchanger And Valve (IDGS)

A. Prerequisites

(1) Remove the fan exit liner segment (inner rear) that is at 4 o'clock. Refer to 72-00-33, Removal-16 (Task 72-00-33-040-001).

B. Equipment And Materials Necessary

Special Tools:

PWA 85853	Adapter, Torque
PWA 102285	Adapter, Torque

C. Procedure
See Figure 301.

NOTE: Items referred to as numbers in parenthesis in text are shown in Figure 301.

(1) Remove two bolts (301/20) and harness bracket (301/21) securing valve cable receptacle to bracket on stator vane actuator support (301/22). Remove receptacle from bracket. Install protective closure.

(2) Remove bolts and nuts securing harness clamps to air/oil cooler valve return tube (301/17).

(3) Remove lockwire and disconnect air/oil cooler valve hydraulic and return tubes (CP13), (CR12) (301/18, 301/17) at heat exchanger adapters.

NOTE: Hold bulkhead adapters with wrench while loosening tube nuts at heat exchanger.

(4) Remove airframe cooler outlet oil tube (LS03) (upper right) (301/30) as follows:

(a) Remove three bolts (301/27) securing tube swivel collar (301/28) to heat exchanger.

(b) Remove lockwire and disconnect tube coupling nut (301/31) from tube coupling. Remove tube from heat exchanger.

(c) Discard packing (301/29). Install protective closures.

(5) (Pre SB PW4ENG 79−60), Remove the four outboard bolts and the four inboard bolts (301/10), and washers (301/9) as follows.

  (a) Remove the four outboard bolts and washers that attach the valve inlet collars to the rear of the intermediate case.

  (b) Use PWA 85853 Torque Adapter to remove the four inboard bolts and washers that attach the valve inlet collars to the rear of the intermediate case.

(6) (Post SB PW4ENG 79−60), Remove the four outboard bolt and washer assemblies and the four inboard bolt and washer assemblies from the valve inlet collars as follows.

  (a) Remove the four outboard bolt and washer assemblies that attach the valve inlet collars to the rear of the intermediate case.

  (b) Use PWA 85853 Torque Adapter to remove the four inboard bolt and washer assemblies that attach the valve inlet collars to the rear of the intermediate case.

  NOTE: The washers are captive (part of) of the washer and bolt assembly.

(7) Remove two bolts (301/11) and washers (301/12) securing bracket (301/24) on forward side of valve to intermediate case.

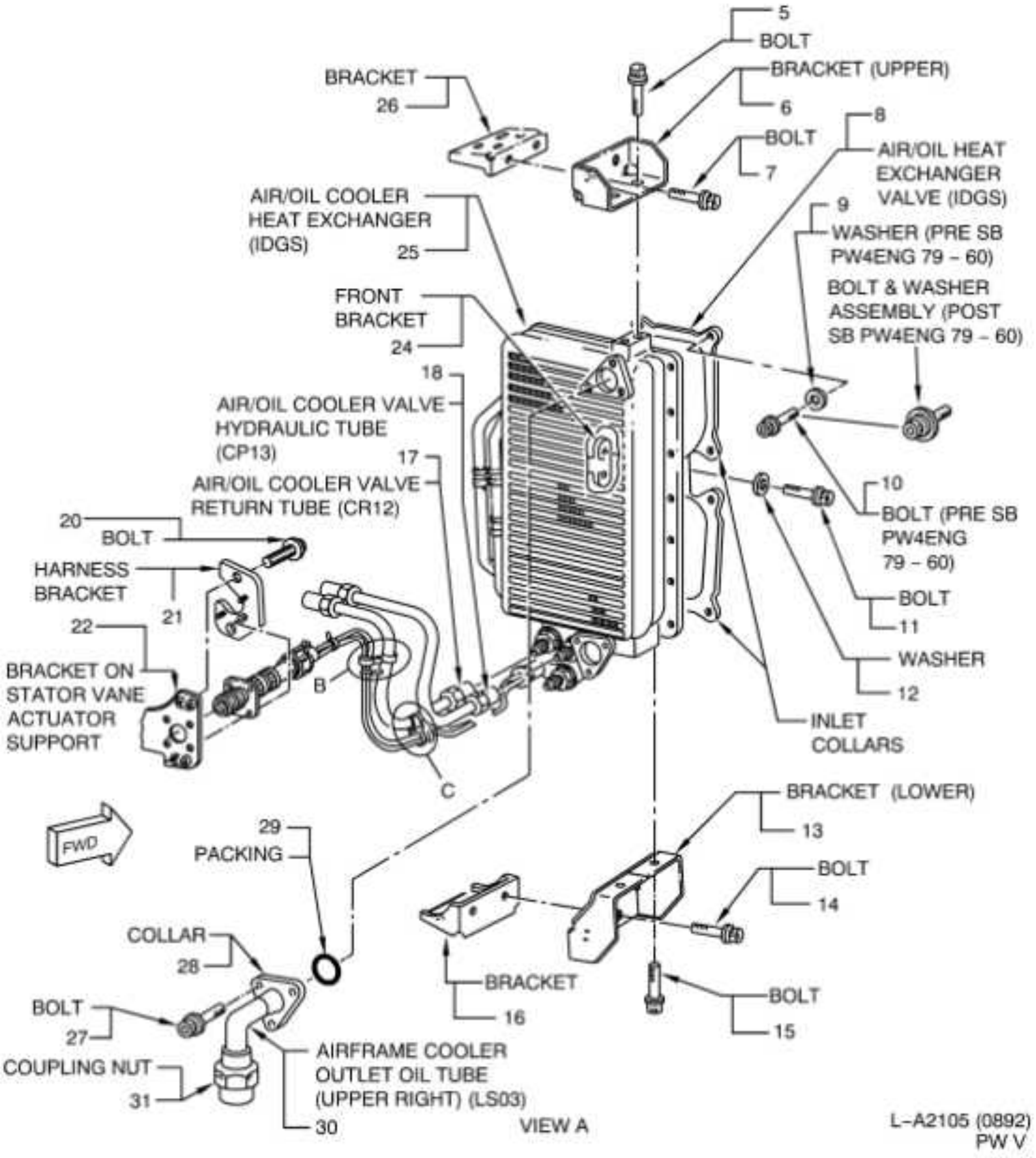
(8) Remove four bolts (301/14, 301/15) using PWA 102285 Torque Adapter securing lower bracket (301/13) to heat exchanger and to bracket (301/16) on intermediate case. Remove bracket (301/13).

CAUTION: DO NOT HANDLE HEAT EXCHANGER VALVE AND HEAT EXCHANGER BY INLET COLLARS. INLET COLLARS ARE NOT INTEGRAL PARTS OF VALVE HOUSING.

(9) Remove four bolts (301/5, 301/7) using PWA 102285 Torque Adapter securing upper bracket (301/6) to heat

exchanger and to bracket (301/26) on intermediate case. Remove heat exchanger and valve from engine.

NOTE: For additional information concerning detailed maintenance of this component see Air/Oil Heat Exchanger Valve (IDGS) Component Maintenance Manual, 75−24−20 (Hamilton Standard) and Air/Oil Heat Exchange (IDGS) Component Maintenance Manual, 24−11−01 (Hughes Treitler).


5
BOLT
BRACKET (UPPER)
6
BRACKET
26
BOLT
7
8
AIR/OIL HEAT EXCHANGER VALVE (IDGS)
AIR/OIL COOLER HEAT EXCHANGER (IDGS)
25
9
WASHER (PRE SB PW4ENG 79 − 60)
BOLT & WASHER ASSEMBLY (POST SB PW4ENG 79 − 60)
FRONT BRACKET
24
18
AIR/OIL COOLER VALVE HYDRAULIC TUBE (CP13)
17
AIR/OIL COOLER VALVE RETURN TUBE (CR12)
10
BOLT (PRE SB PW4ENG 79 − 60)
20
BOLT
HARNESS BRACKET
21
BOLT
11
22
WASHER
12
BRACKET ON STATOR VANE ACTUATOR SUPPORT
B
INLET COLLARS
C
BRACKET (LOWER)
13
FWD
29
PACKING
BOLT
14
COLLAR
28
BRACKET
16
BOLT
15
BOLT
27
COUPLING NUT
31
AIRFRAME COOLER OUTLET OIL TUBE (UPPER RIGHT) (LS03)
30
VIEW A
L−A2105 (0892)
PW V

Air/Oil Heat Exchanger And Valve (IDGS)
Figure 301 (Sheet 1)
(Task 72−00−34−050−005)

ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-09

Task 72-00-34-050-006:

1. Remove Valve From Air/Oil Heat Exchanger (IDGS)

A. Prerequisites

(1) Remove Air/Oil Heat Exchanger And Valve (IDGS). See Removal-08 Task 72-00-34-050-005.

B. Equipment And Materials Necessary

Special Tools

PWA 102285	Adapter, Torque

C. Procedure
See Figure 301, Figure 302, and Figure 303.

NOTE: Items referred to in parenthesis in the text are identified in the figures.

CAUTION: DO NOT LIFT THE HEAT EXCHANGER VALVE AND/OR HEAT EXCHANGER BY THE INLET COLLARS. THE INLET COLLARS ARE NOT AN INTEGRAL PART OF THE VALVE HOUSING.

(1) Place the air/oil heat exchanger and valve on bench.

(2) (Pre SB PW4ENG 79-49) Remove the lockwire and jamnuts which secure the three tubes to the bracket on heat exchanger.

(3) (Post SB PW4ENG 79-49) Remove the lockwire, jamnuts, washers and plate which secure the three tubes to the bracket on the exchanger.

(4) Remove the bolt which secures the tube clamp to the cable shield. Remove the clamp.

(5) Remove the bolts, nuts and washers from the valve and heat exchanger mating flange.

(6) Separate the valve from the heat exchanger.

(7) If a new valve is to be installed, comply with the following:

(a) Disconnect and remove the three tubes from the adapters.

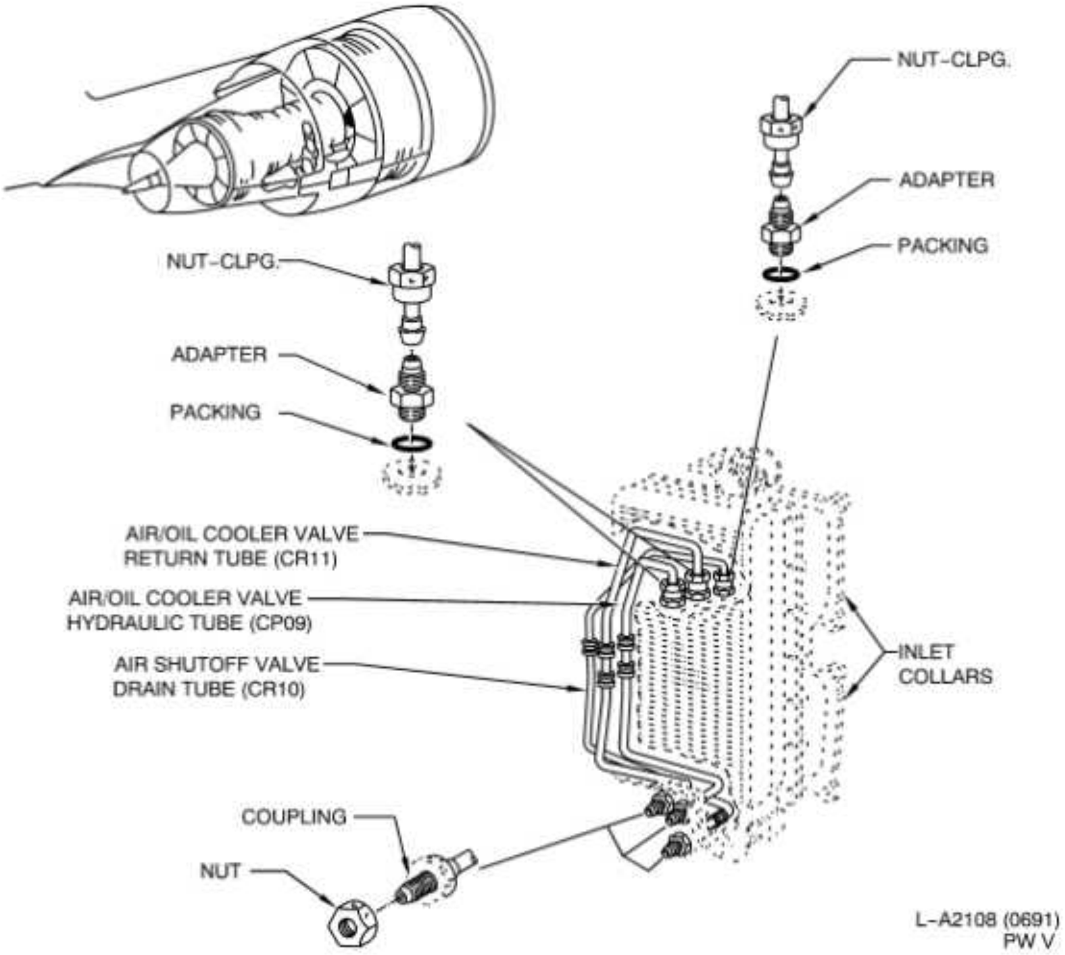
(b) Remove the three adapters from valve ports and discard packings. Install the protective closures.

(c) (Post SB PW4ENG 24−4) Remove the plug from the end of the valve and discard the packing.

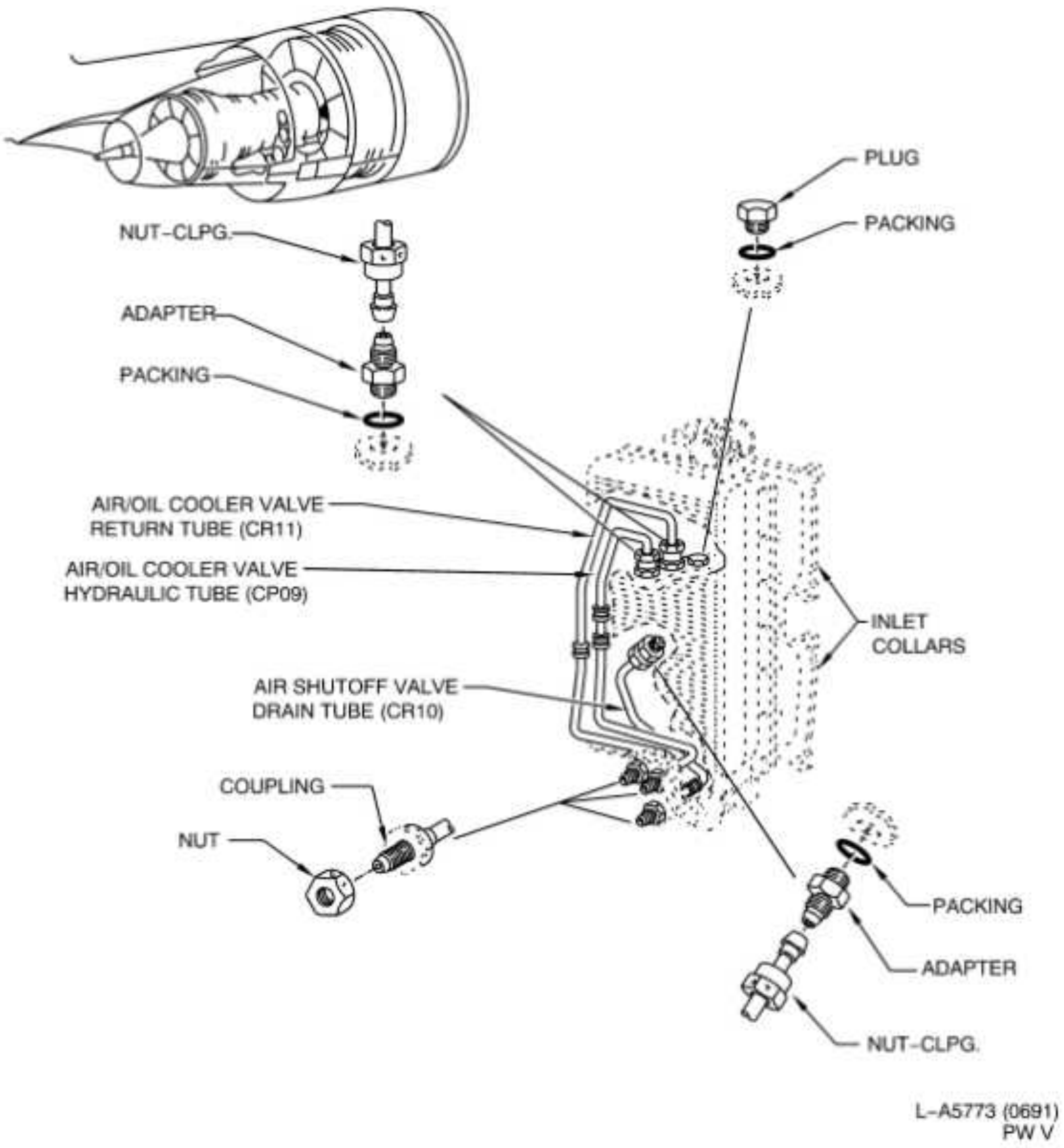
(8) If a new heat exchanger is to be installed, comply with the following:

(a) Remove the bolts, using PWA 102285 Torque Adapter, which secure the lower mount bracket and the upper mount bracket to the heat exchanger. Remove the brackets.

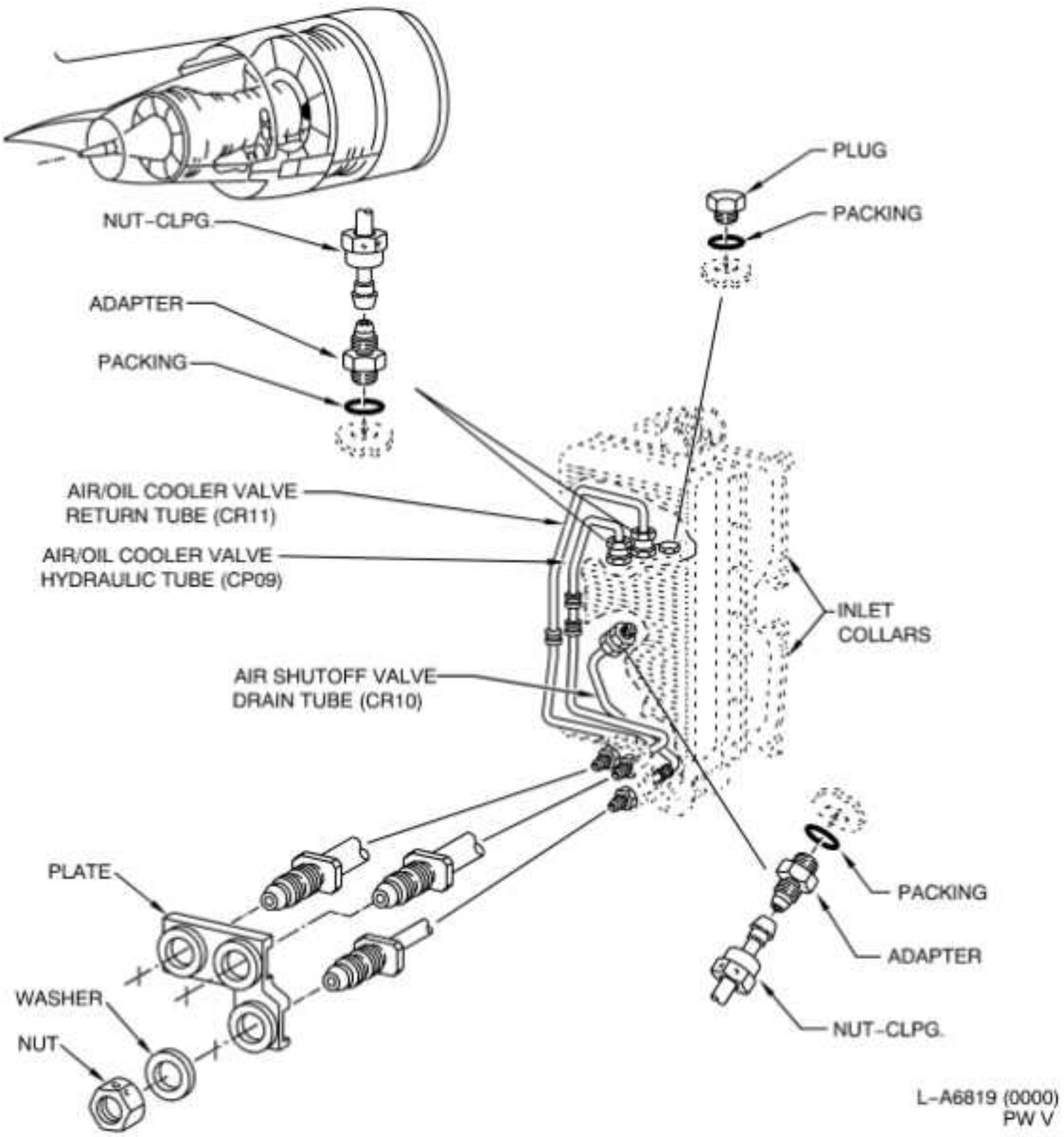
NOTE: For additional information concerning detailed maintainance of this component see Air/Oil Heat Exchanger Valve (IDGS) Component Maintenance Manual, 75−24−20 (Hamilton Standard Division) and Air/Oil Heat Exchanger (IDGS) Component Maintenance Manual, 24−11−01 (Hughes Treitler).


NUT−CLPG.
ADAPTER
PACKING
NUT−CLPG.
ADAPTER
PACKING
AIR/OIL COOLER VALVE RETURN TUBE (CR11)
AIR/OIL COOLER VALVE HYDRAULIC TUBE (CP09)
AIR SHUTOFF VALVE DRAIN TUBE (CR10)
INLET COLLARS
COUPLING
NUT
L−A2108 (0691)
PW V

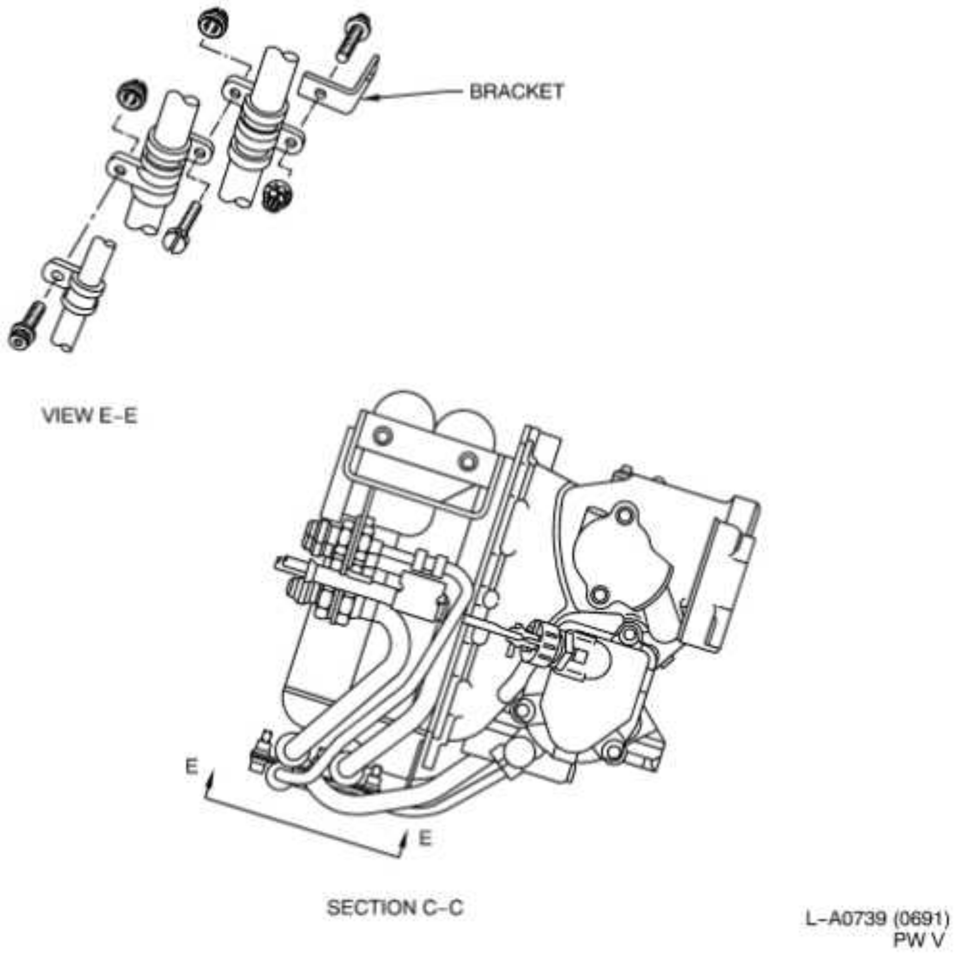
Air/Oil Heat Exchanger And Valve (IDGS) (Pre SB PW4ENG 24−4)
Figure 301 (Sheet 1)
(Task 72−00−34−050−006)


PLUG
PACKING
NUT–CLPG.
ADAPTER
PACKING
AIR/OIL COOLER VALVE RETURN TUBE (CR11)
AIR/OIL COOLER VALVE HYDRAULIC TUBE (CP09)
INLET COLLARS
AIR SHUTOFF VALVE DRAIN TUBE (CR10)
COUPLING
NUT
PACKING
ADAPTER
NUT–CLPG.
L–A5773 (0691)
PW V

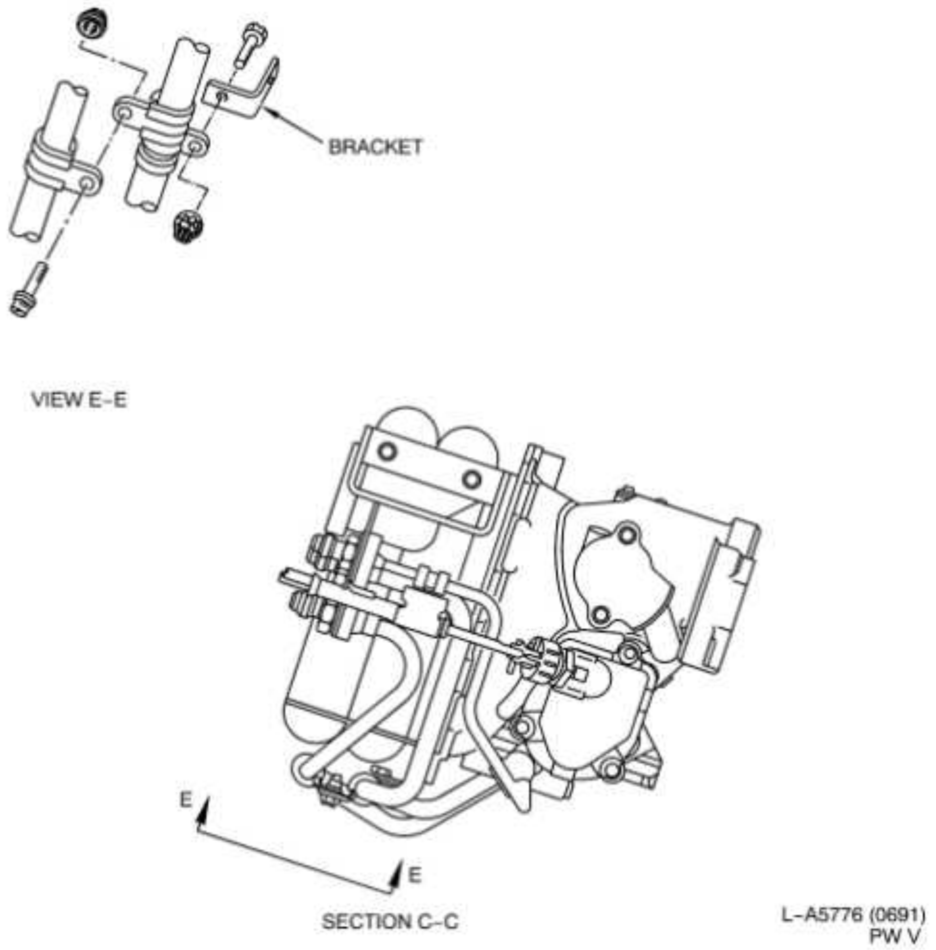
Air/Oil Heat Exchanger And Valve (IDGS) (Post SB PW4ENG 24–4) (Pre SB PW4ENG 79–49)
Figure 301 (Sheet 2)
(Task 72–00–34–050–006)


PLUG
PACKING
NUT-CLPG.
ADAPTER
PACKING
AIR/OIL COOLER VALVE RETURN TUBE (CR11)
AIR/OIL COOLER VALVE HYDRAULIC TUBE (CP09)
INLET COLLARS
AIR SHUTOFF VALVE DRAIN TUBE (CR10)
PLATE
WASHER
NUT
PACKING
ADAPTER
NUT-CLPG.
L-A6819 (0000)
PW V

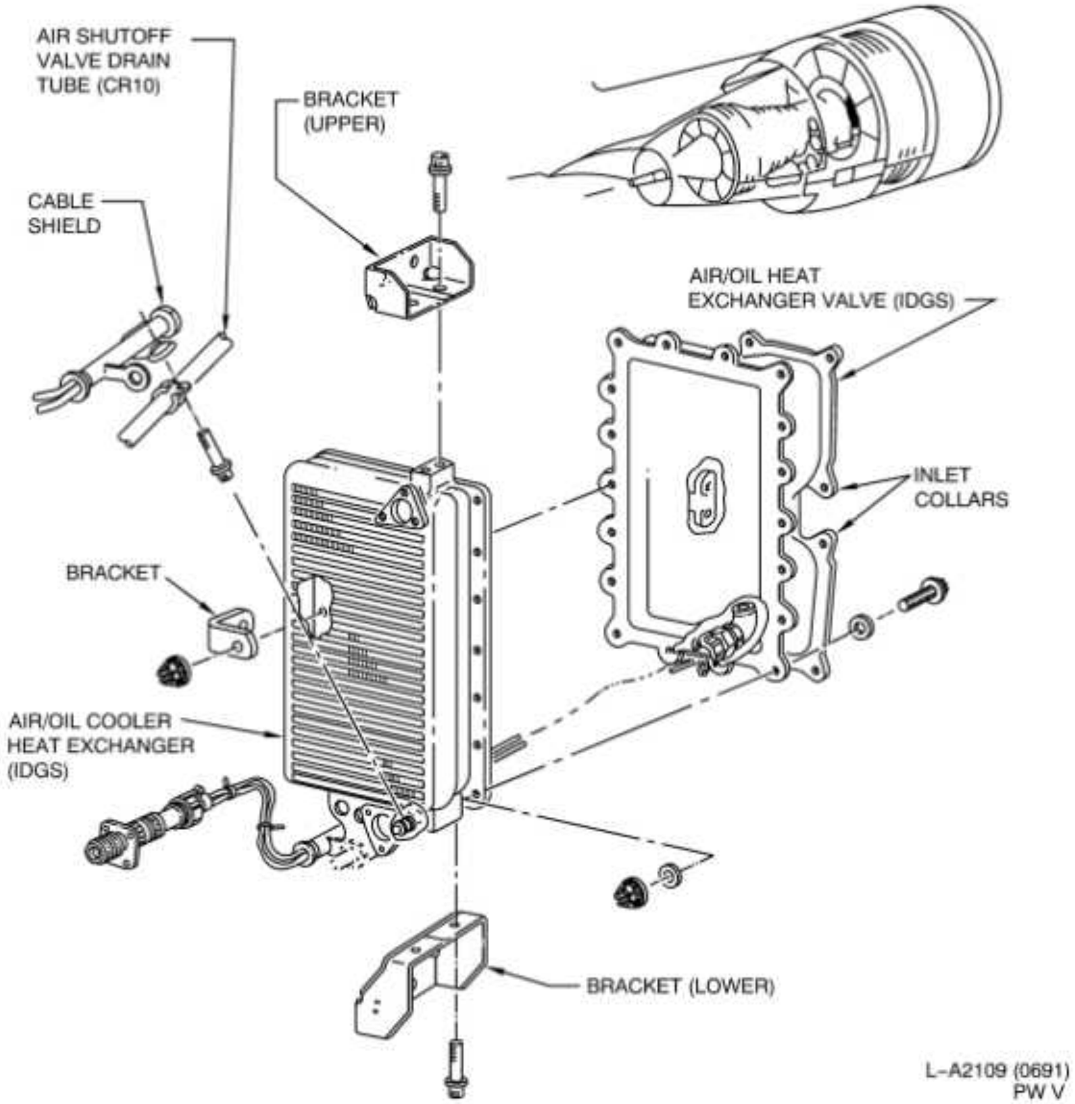
Air/Oil Heat Exchanger And Valve (IDGS) (Post SB PW4ENG 79−49)
Figure 301 (Sheet 3)
(Task 72−00−34−050−006)


BRACKET
VIEW E-E
E
E
SECTION C-C
L-A0739 (0691)
PW V

Air/Oil Heat Exchanger And Valve (IDGS) (Pre SB PW4ENG 79−49)
Figure 302 (Sheet 1)
(Task 72−00−34−050−006)


BRACKET
VIEW E-E
E
E
SECTION C-C
L-A5776 (0691)
PW V

Air/Oil Heat Exchanger And Valve (IDGS) (Post SB PW4ENG 79-49)
Figure 302 (Sheet 2)
(Task 72-00-34-050-006)


AIR SHUTOFF VALVE DRAIN TUBE (CR10)
BRACKET (UPPER)
CABLE SHIELD
AIR/OIL HEAT EXCHANGER VALVE (IDGS)
INLET COLLARS
BRACKET
AIR/OIL COOLER HEAT EXCHANGER (IDGS)
BRACKET (LOWER)
L-A2109 (0691)
PW V

Air/Oil Heat Exchanger And Valve (IDGS)
Figure 303
(Task 72-00-34-050-006)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-34-050-007:

1. Remove Air/Oil Heat Exchanger And Valve (Engine)

A. Prerequisites

(1) Remove the fan exit liner segment (inner rear) that is at 8 o'clock. Refer to 72-00-33, Removal-16 (Task 72-00-33-040-001).

B. Equipment And Materials Necessary

Special Tools:

PWA 85853	Adapter, Torque
PWA 102285	Adapter, Torque

C. Procedure
See Figure 301.

NOTE: Items referred to as numbers in parenthesis in text are identified in Figure 301.

(1) Disconnect the W3P17 harness connector from the air/oil cooler heat exchanger cable connector. Install a protective closure on the harness connector.

(2) Remove two bolts (301/20) and harness bracket securing valve cable receptacle to bracket on HPC case. Remove receptacle from bracket and install protective closure.

(3) Remove lockwire and disconnect air/oil cooler valve hydraulic tube (CP08) (301/18) and air/oil cooler valve hydraulic return tube (CR08) (301/19) from heat exchanger adapters.

NOTE: Hold bulkhead adapters with wrench while loosening tube nuts at heat exchanger.

(4) Remove air cooler inlet oil tube (LP02) (301/29).

(a) Remove bolt, and nut securing W3/W5 harness to bracket clamp to air cooler inlet oil tube.

(b) Remove bolts securing tube flange to air cooler.

(c) Remove three bolts securing other end of tube to oil filter housing. Disengage tube and discard packings. Install protective closures.

R
R

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH
R CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND
R INSTALL A TUBE WITH A FLEX SEGMENT WITH THE
R SAME PRECAUTION USED FOR A TUBE WITHOUT A
R FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A
R TUBE TO HELP WITH THE INSTALLATION OR REMOVAL
R OF THE TUBE OR AN ATTACHED COMPONENT. IF A
R FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE
R A KINK IN THE EXTERNAL WIRE BRAID AND IN THE
R INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND
R LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(5) Disconnect air cooler outlet oil hose and tube (LP03) (301/28).

(a) Remove bolts securing tube flange to air cooler.

(b) Disengage tube and discard packings. Install protective closures.

(6) Remove bolt (301/16) using PWA 102285 Torque Adapter, securing cable conduit to lower bracket (301/11) on intermediate case.

(7) Remove bolt (301/14) using PWA 102285 Torque Adapter, securing rear end of cable conduit to lower bracket (301/11) on intermediate case.

(8) (Pre SB PW4ENG 79−60), Remove the four outboard bolts (301/23) and washers (301/24), and loosen the four inboard bolts (301/23) as follows.

(a) Remove the four outboard bolts (301/23) and washers (301/24) that attach the valve inlet collars to the rear of the intermediate case.

(b) Use PWA 85853 Torque Adapter to loosen the four inboard bolts and washers that attach the valve inlet collars to the rear of the intermediate case. Do not remove the inboard bolts and washers from the intermediate case.

NOTE: The four bolt holes in the valve inlet collars are slotted to make easier the removal of the exchanger and valve.

(9) (Post SB PW4ENG 79-60), Remove the four outboard bolt and washer assemblies, and loosen the four inboard bolt and washer assemblies from the valve inlet collars as follows.

(a) Remove the four outboard bolt and washer assemblies that attach the valve inlet collars to the rear of the intermediate case.

(b) Use PWA 85853 Torque Adapter to loosen the four inboard bolt and washer assemblies that attach the valve inlet collars to the rear of the intermediate case. Do not remove the inboard bolt and washer assemblies from the intermediate case.

NOTE: The washers are captive (part of) of the washer and bolt assembly.

(10) Remove two bolts (301/8) and washers (301/7) securing bracket on forward side of valve to intermediate case.

(11) Remove four bolts (301/15, 301/17) using PWA 102285 Torque Adapter, securing lower bracket (301/9) to heat exchanger and to bracket (301/11) on intermediate case. Remove bracket (301/9).

CAUTION: DO NOT HANDLE HEAT EXCHANGER VALVE AND HEAT EXCHANGER BY INLET COLLARS. INLET COLLARS ARE NOT INTEGRAL PARTS OF THE VALVE HOUSING.

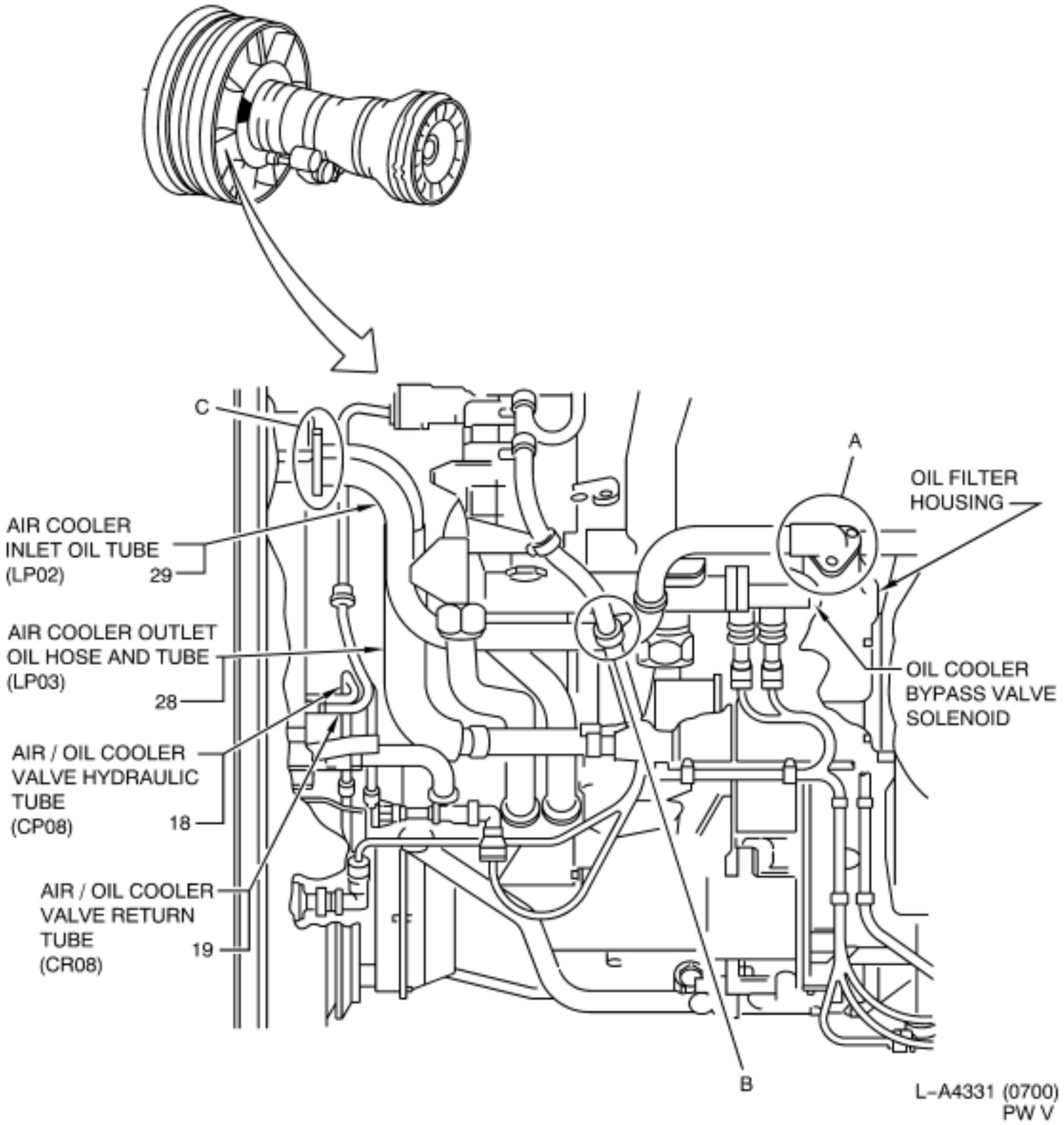
(12) Remove two bolts (301/26) using PWA 102285 Torque Adapter, securing upper bracket (301/25) to bracket (301/5) on intermediate case.

(13) Move heat exchanger and valve outward to disengage inlet collars from inboard bolts. Allow heat exchanger and valve to drop slightly to access bolts (301/27). Remove two bolts (301/27) using PWA 102285 Torque Adapter, and bracket (301/25) from top of heat exchanger and valve.

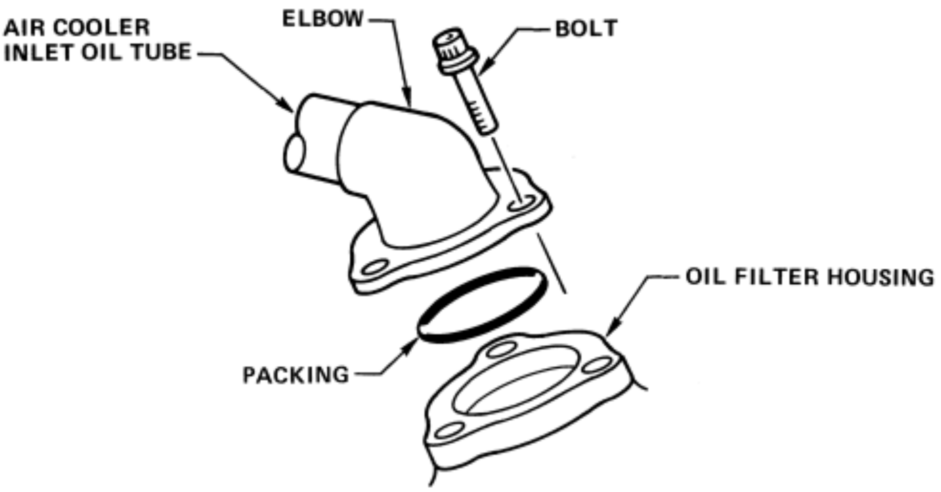
(14) Rotate heat exchanger and valve (top outward) to remove from intermediate case opening while guiding cable and conduit out with heat exchanger and valve.

(15) Install protective closures to remaining openings.

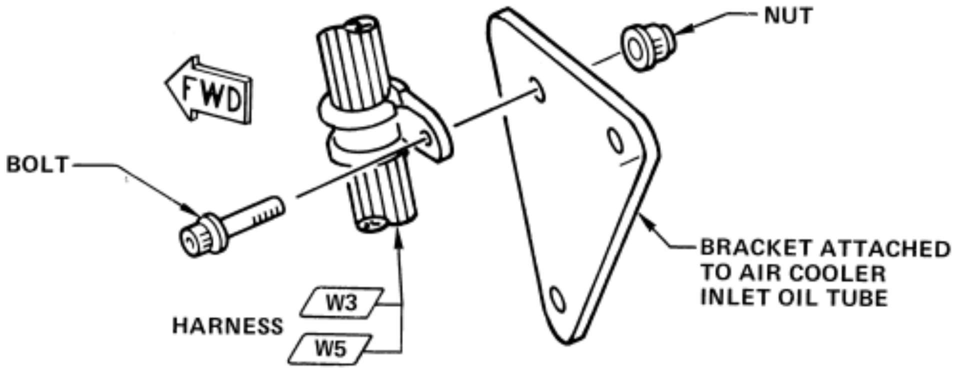
NOTE: For additional information concerning detailed maintenance of this component see Air/Oil Heat Exchanger Valve (Engine) Component Maintenance Manual, 75−24−18 (Hamilton Standard) and Air/Oil Heat Exchanger (Engine) Component Maintenance Manual, 79−21−20 (Hughes Treitler).


C
A
OIL FILTER HOUSING
AIR COOLER INLET OIL TUBE (LP02) 29
AIR COOLER OUTLET OIL HOSE AND TUBE (LP03) 28
AIR / OIL COOLER VALVE HYDRAULIC TUBE (CP08) 18
AIR / OIL COOLER VALVE RETURN TUBE (CR08) 19
OIL COOLER BYPASS VALVE SOLENOID
B
L−A4331 (0700)
PW V

Air/Oil Heat Exchanger And Valve (Engine)
Figure 301 (Sheet 1)
(Task 72−00−34−050−007)


AIR COOLER INLET OIL TUBE
ELBOW
BOLT
OIL FILTER HOUSING
PACKING

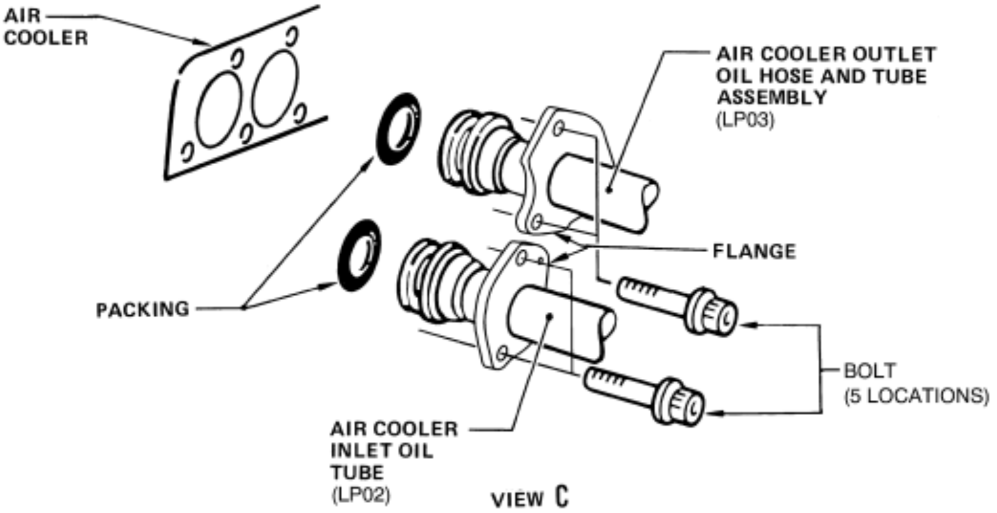
VIEW A


NUT
FWD
BOLT
BRACKET ATTACHED TO AIR COOLER INLET OIL TUBE
W3
HARNESS
W5

VIEW B

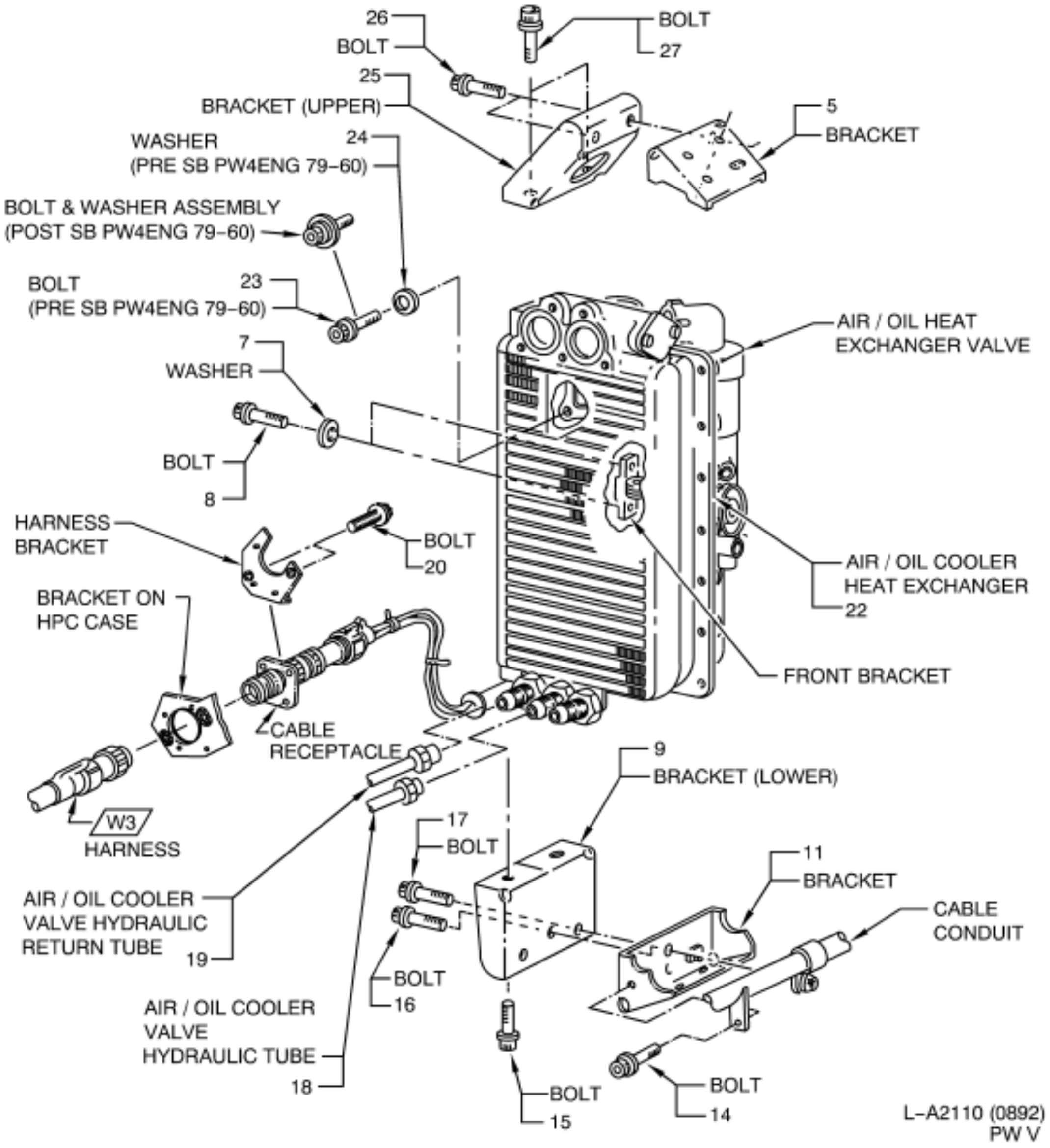
L-A2238
1287

Air/Oil Heat Exchanger And Valve (Engine)
Figure 301 (Sheet 2)
(Task 72-00-34-050-007)


AIR COOLER
AIR COOLER OUTLET OIL HOSE AND TUBE ASSEMBLY (LP03)
FLANGE
PACKING
BOLT (5 LOCATIONS)
AIR COOLER INLET OIL TUBE (LP02)
VIEW C

L−A2241 (0700)

Air/Oil Heat Exchanger And Valve (Engine)
Figure 301 (Sheet 3)
(Task 72−00−34−050−007)


26
BOLT
BOLT
27
25
BRACKET (UPPER)
5
BRACKET
WASHER
(PRE SB PW4ENG 79-60)
24
BOLT & WASHER ASSEMBLY
(POST SB PW4ENG 79-60)
BOLT
(PRE SB PW4ENG 79-60)
23
AIR / OIL HEAT
EXCHANGER VALVE
7
WASHER
BOLT
8
HARNESS
BRACKET
BOLT
20
AIR / OIL COOLER
HEAT EXCHANGER
22
BRACKET ON
HPC CASE
FRONT BRACKET
CABLE
RECEPTACLE
9
BRACKET (LOWER)
W3
HARNESS
17
BOLT
11
BRACKET
CABLE
CONDUIT
AIR / OIL COOLER
VALVE HYDRAULIC
RETURN TUBE
19
BOLT
16
AIR / OIL COOLER
VALVE
HYDRAULIC TUBE
18
BOLT
15
BOLT
14
L-A2110 (0892)
PW V

Air/Oil Heat Exchanger And Valve (Engine)
Figure 301 (Sheet 4)
(Task 72-00-34-050-007)

R
R

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-11

Task 72-00-34-050-008:

1. Remove Valve From Air/Oil Heat Exchanger (Engine)

A. Prerequisites

(1) Remove Air/Oil Heat Exchanger And Valve (Engine). See Removal-10 Task 72-00-34-050-007.

B. Equipment And Materials Necessary

Special Tools

PWA 102285	Adapter, Torque

C. Procedure
See Figure 301, Figure 302, Figure 303.

NOTE: Items referred to in parenthesis in the text are identified in the Figures.

CAUTION: DO NOT HANDLE THE HEAT EXCHANGER VALVE AND/OR HEAT EXCHANGER BY THE INLET COLLARS. THE INLET COLLARS ARE NOT INTEGRAL PARTS OF THE VALVE HOUSING.

(1) Place the air/oil heat exchanger and valve on the bench.

(2) (Pre SB PW4ENG 79-49) Remove the lockwire and jamnuts which secure the three tubes to the flange on the heat exchanger.

(3) (Post SB PW4ENG 79-49), (Pre SB PW4ENG 79-50) Remove the lockwire, jamnuts, washers and plate which secure the three tubes to the flange on the exchanger.

(4) (Post SB PW4ENG 79-50) Remove the lockwire and bolts which secure the three tubes to the exchanger.

(5) Remove the bolts, nuts, washers and if equipped brackets from the valve and heat exchange mating flange. See the figure.

(6) Separate the valve from the heat exchanger.

(7) If a new valve is to be installed, comply with the following:

(a) Disconnect and remove the three tubes from the adapters on the end of the valve.

(b) Remove the bolts, nut, and clamps which secure the (CR09) tube and the (CP08) tube.

(c) (Pre SB PW4ENG 79−49) Remove the nuts which secure the tubes to the exchanger.

(d) (Pre SB PW4ENG 79−50) Remove the nuts, washers and plate which secure the tubes to the exchange.

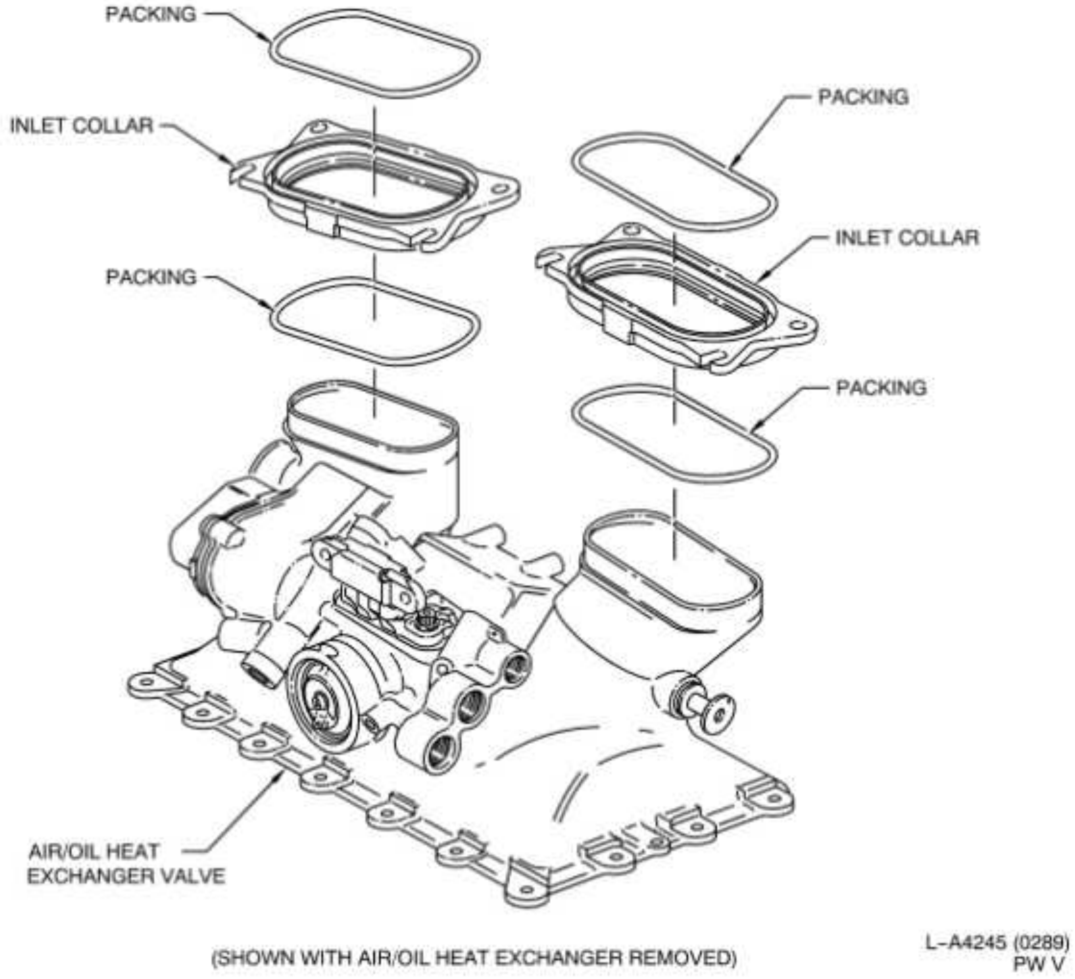
(e) (Post SB PW4ENG 79−50) Remove the bolts that secure the tubes to the exchange.

(f) Remove the three adapters from the valve ports and discard the packings. Install the protective closures.

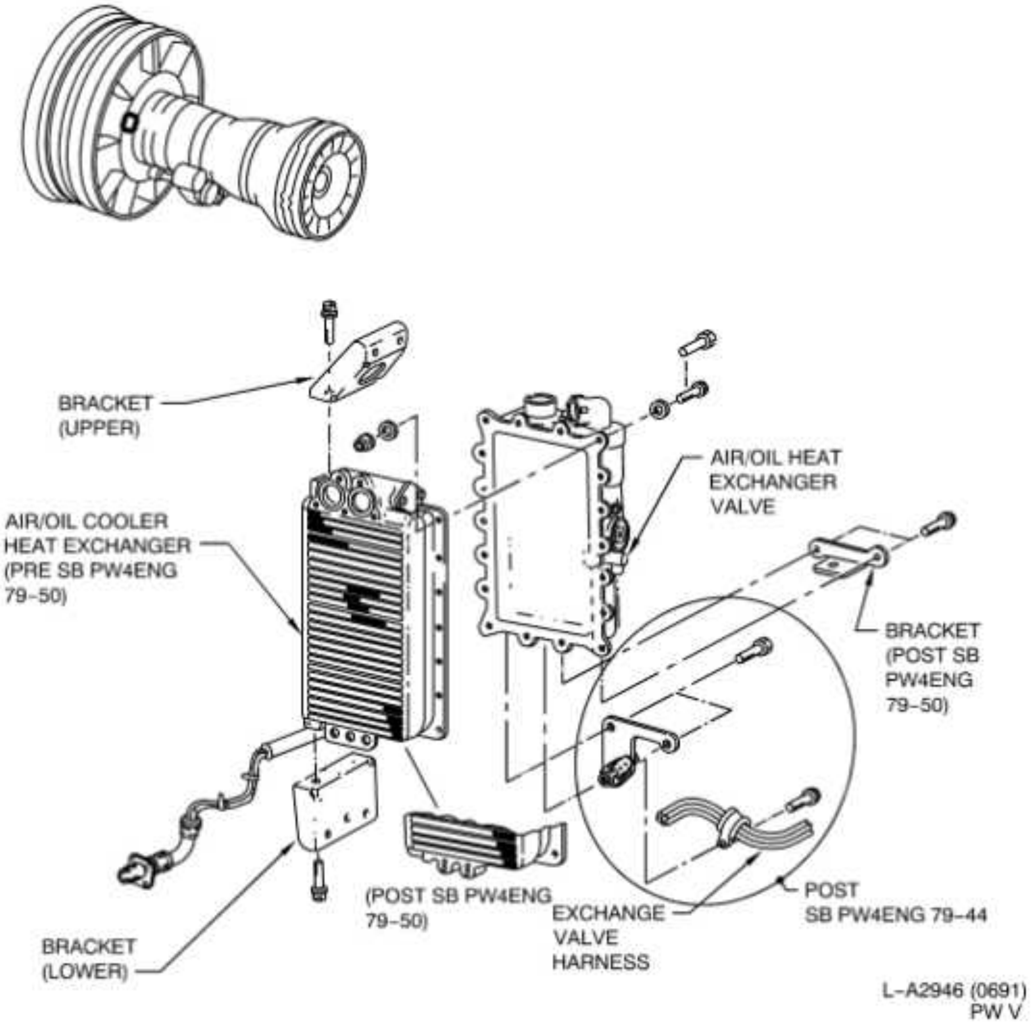
(8) If a new heat exchanger is to be installed, comply with the following:

(a) Remove the bolts, using PWA 102285 Torque Adapter, which secure the lower and upper mount brackets to the heat exchanger. Remove the brackets.

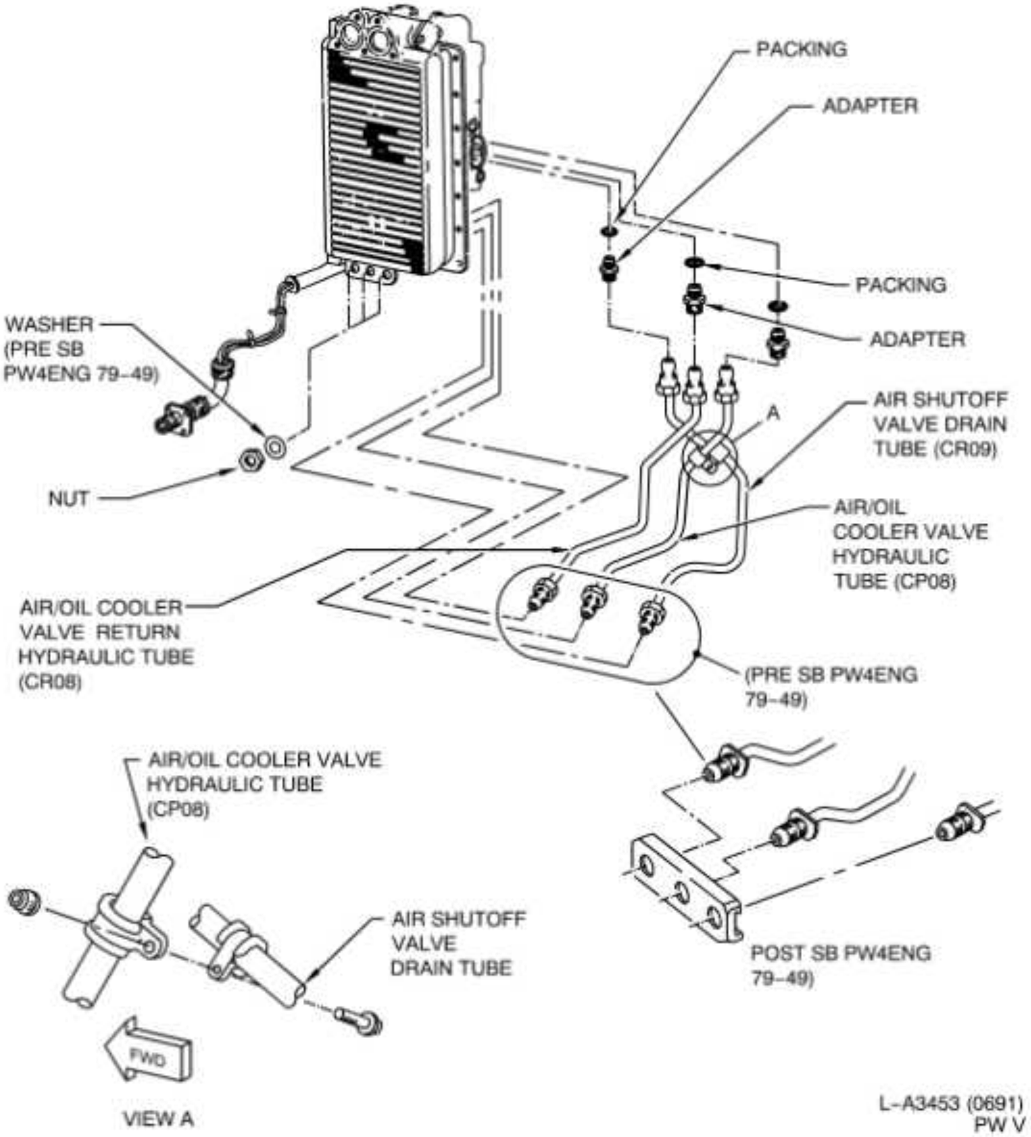
NOTE: For additional information concerning detailed maintainance of this component. See Air/Oil Heat Exchanger Valve (Engine) Component Maintenance Manual, 75−24−18 (Hamilton Standard Division) and Air/Oil Heat Exchanger (Engine) Component Maintenance Manual, 79−21−20 (Hughes Treitler).


PACKING
INLET COLLAR
PACKING
PACKING
INLET COLLAR
PACKING
AIR/OIL HEAT EXCHANGER VALVE
(SHOWN WITH AIR/OIL HEAT EXCHANGER REMOVED)
L-A4245 (0289)
PW V

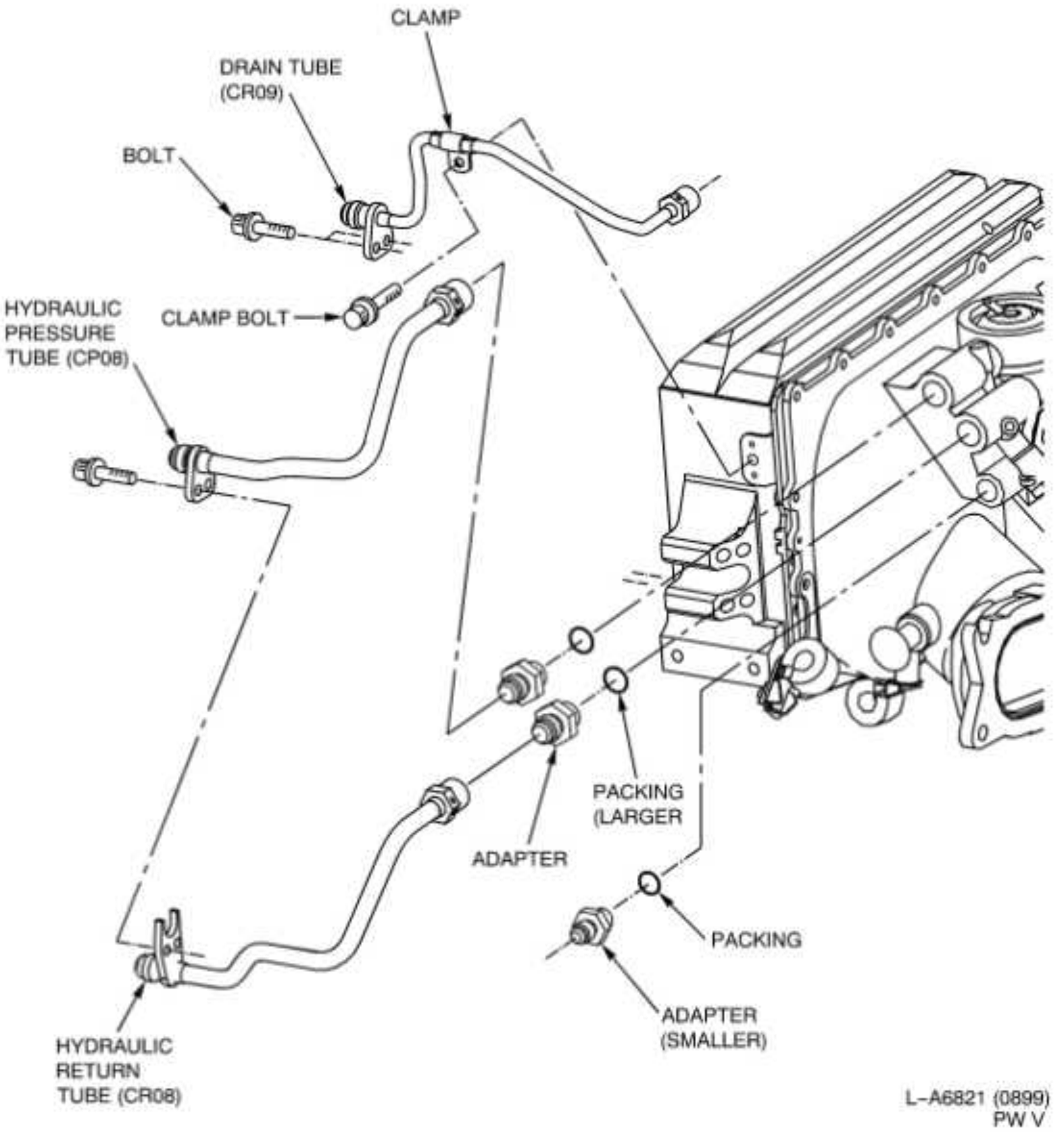
Air/Oil Heat Exchanger Valve Inlet Collars
Figure 301
(Task 72-00-34-050-008)


BRACKET (UPPER)
AIR/OIL HEAT EXCHANGER VALVE
AIR/OIL COOLER HEAT EXCHANGER (PRE SB PW4ENG 79-50)
BRACKET (POST SB PW4ENG 79-50)
(POST SB PW4ENG 79-50)
EXCHANGE VALVE HARNESS
POST SB PW4ENG 79-44
BRACKET (LOWER)
L-A2946 (0691)
PW V

Air/Oil Heat Exchanger And Valve (Engine)
Figure 302
(Task 72-00-34-050-008)


PACKING
ADAPTER
PACKING
ADAPTER
WASHER (PRE SB PW4ENG 79-49)
AIR SHUTOFF VALVE DRAIN TUBE (CR09)
A
NUT
AIR/OIL COOLER VALVE HYDRAULIC TUBE (CP08)
AIR/OIL COOLER VALVE RETURN HYDRAULIC TUBE (CR08)
(PRE SB PW4ENG 79-49)
AIR/OIL COOLER VALVE HYDRAULIC TUBE (CP08)
AIR SHUTOFF VALVE DRAIN TUBE
POST SB PW4ENG 79-49)
FWD
VIEW A
L-A3453 (0691)
PW V

Air/Oil Heat Exchanger And Valve (Engine) (Pre SB PW4ENG 79−50)
Figure 303 (Sheet 1)
(Task 72−00−34−050−008)


CLAMP
DRAIN TUBE
(CR09)
BOLT
HYDRAULIC
PRESSURE
TUBE (CP08)
CLAMP BOLT
PACKING
(LARGER
ADAPTER
PACKING
ADAPTER
(SMALLER)
HYDRAULIC
RETURN
TUBE (CR08)
L−A6821 (0899)
PW V

Air/Oil Heat Exchanger And Valve (Engine) (Post SB PW4ENG 79−50)
Figure 303 (Sheet 2)
(Task 72−00−34−050−008)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-12

Task 72-00-34-050-009:

1. Remove HPC Secondary Flow Control Valve, IDGS Air/Oil Heat Exchanger Valve Override Solenoid

A. Prerequisites

(1) Remove the fan exit liner segment (inner rear) that is at the 1 o'clock position. Refer to 72-00-33, Removal-16 Task 72-00-33-040-001.

B. Equipment And Materials Required - None

C. Procedure
See Figure 301.

(1) Disconnect and remove the W1P10 and W1P11 harness connectors from the solenoid.

(2) Remove the lockwire from the two tube nuts on the rear of the solenoid and disconnect the tubes.

(3) Remove the lockwire from the pressure switch tube nuts. Disconnect and remove the tube. Install protective closures to the tube.

(4) Remove the four bolts that attach the solenoid and the pressure switch bracket to the case. Remove the bracket and solenoid from the engine and install protective closures.

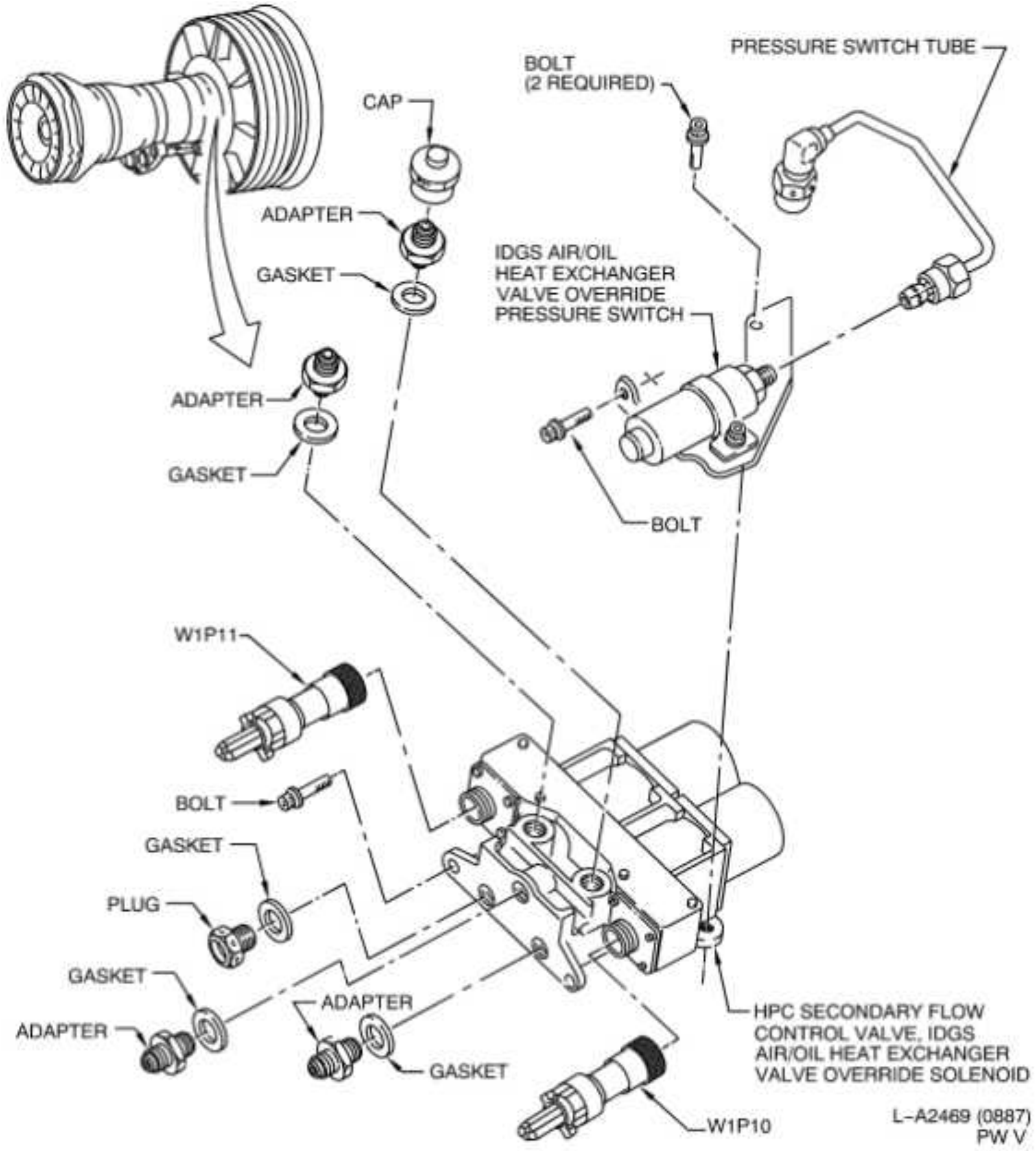
(5) If the solenoid must be replaced, do the following:

(a) Remove the two adapters, one plug, and three gaskets from the rear of the solenoid.

(b) Remove the cap, two adapters, and two gaskets from the top of the solenoid.

(c) Install protective closures to all openings on the solenoid.

NOTE: For additional information concerning detailed maintenance of this component, see Compressor Heating Air/Turbine Vane Cooling Air Valve Solenoid Component Maintenance Manual, 75-33-10 (Midland Ross).


PRESSURE SWITCH TUBE
BOLT
(2 REQUIRED)
CAP
ADAPTER
GASKET
IDGS AIR/OIL
HEAT EXCHANGER
VALVE OVERRIDE
PRESSURE SWITCH
ADAPTER
GASKET
BOLT
W1P11
BOLT
GASKET
PLUG
GASKET
ADAPTER
ADAPTER
GASKET
HPC SECONDARY FLOW
CONTROL VALVE, IDGS
AIR/OIL HEAT EXCHANGER
VALVE OVERRIDE SOLENOID
W1P10
L-A2469 (0887)
PW V

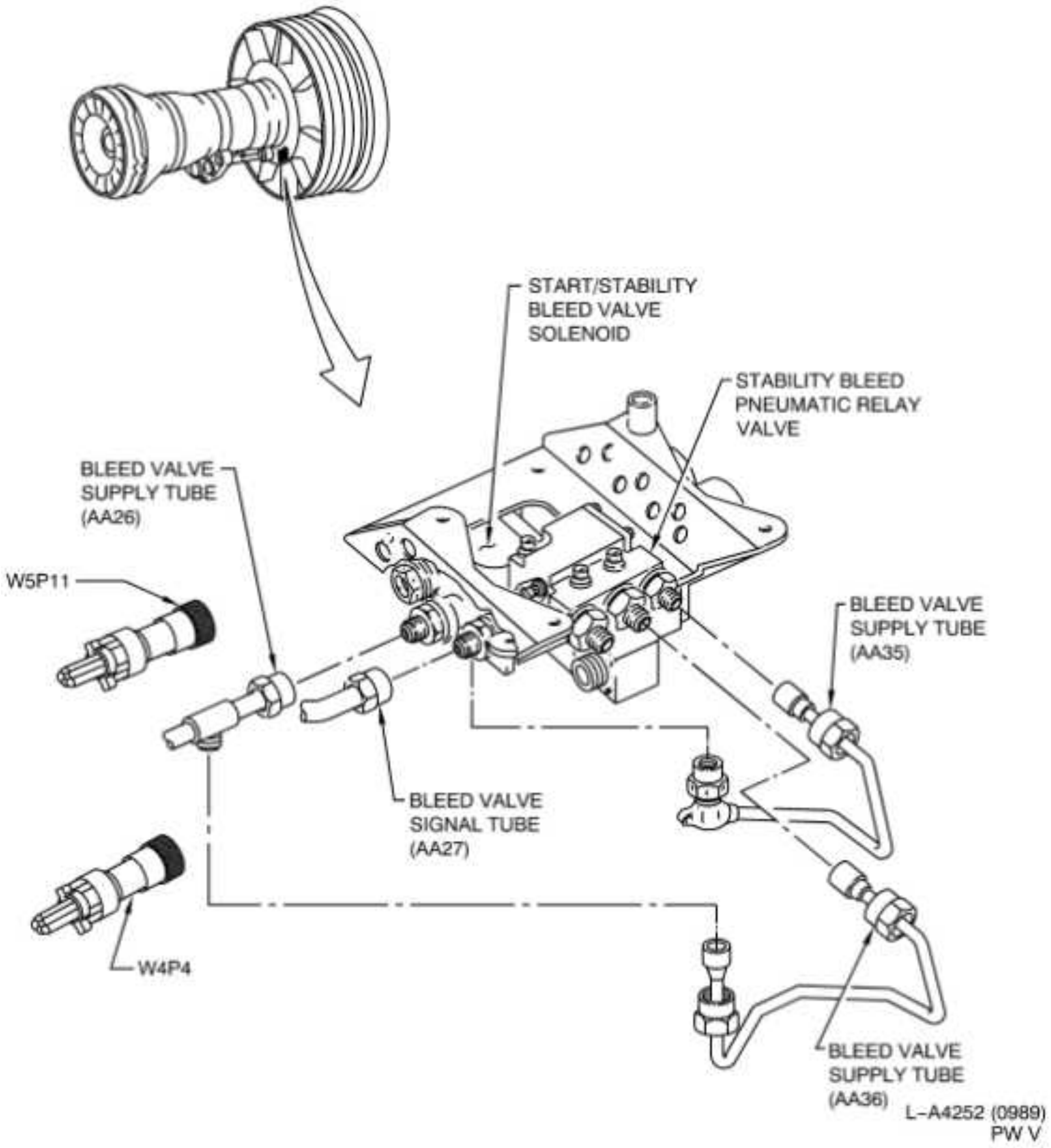
HPC Secondary Flow Control Valve, IDGS Air/Oil
Heat Exchanger Valve Override Solenoid
Figure 301
(Task 72-00-34-050-009)

ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-13

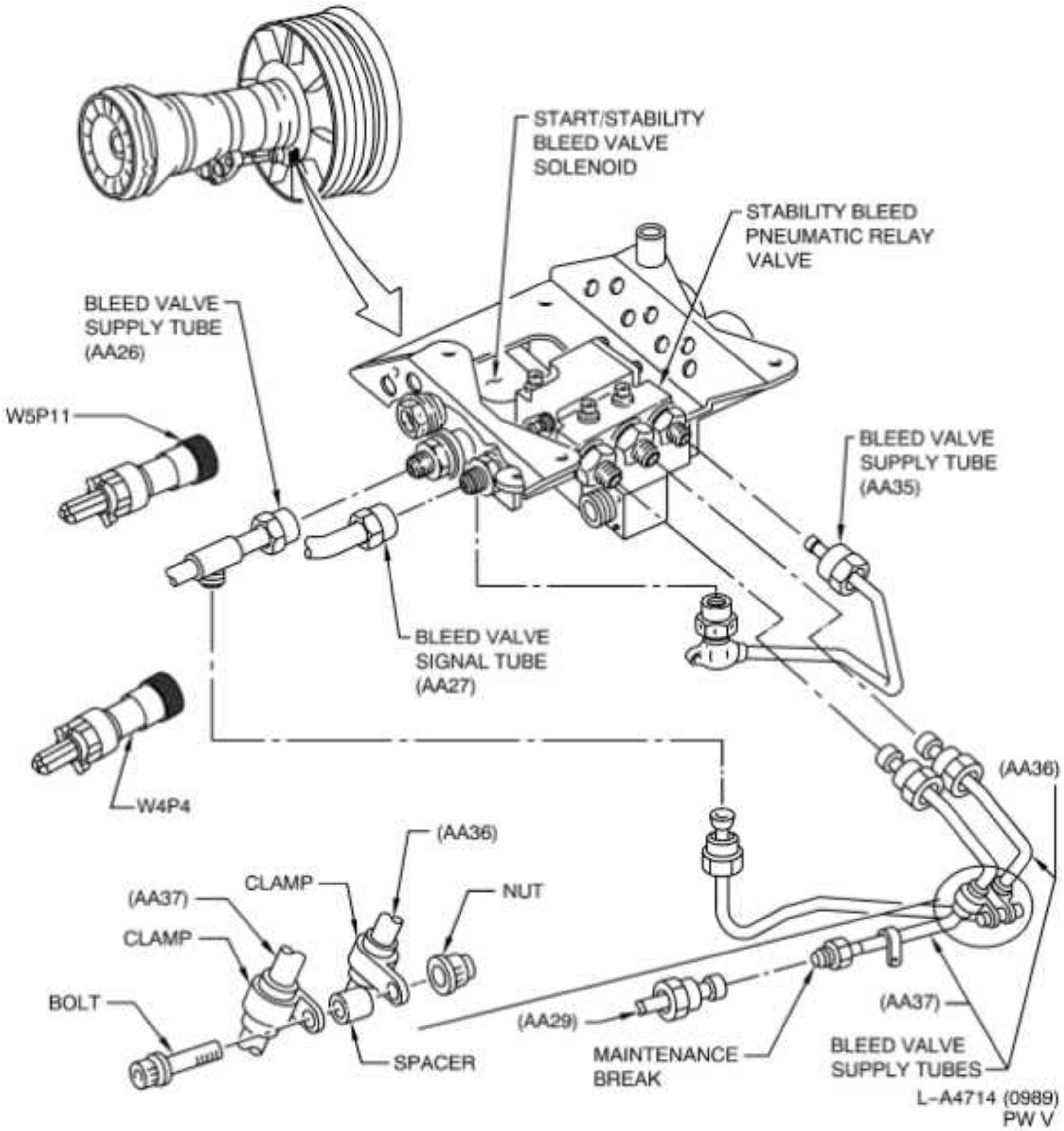
Task 72-00-34-050-010:

1. Remove The Start/Stability Bleed Valve Solenoid
   - A. Prerequisites
     - (1) Remove the fan exit liner segment (inner rear) that is at 5 o'clock. Refer to 72-00-33, Removal-16 (Task 72-00-33-040-001).
   - B. Equipment And Materials Required - None
   - C. Procedure

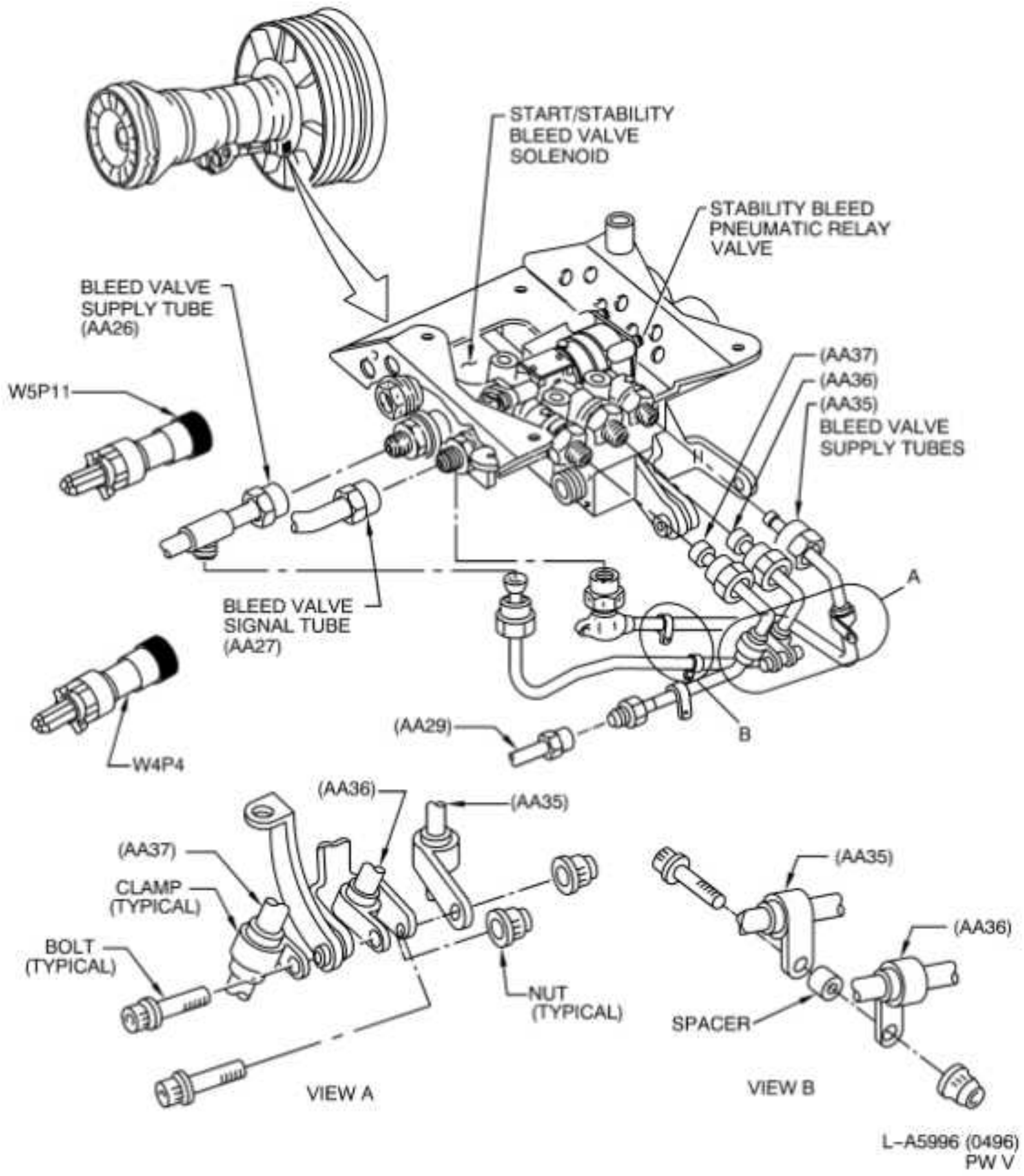
     See Figure 301.
     - (1) Disconnect W4P4 and W5P11 harness connector from solenoid.
     - (2) For (Pre SB PW4ENG 75-28) engines, remove the bleed valve supply tubes as follows. See Figure 301 (Sheet 1).
       - (a) Remove the lockwire. Disconnect the (AA35) and (AA36) tubes at both ends of each tube.
       - (b) Remove the tubes and install the protection covers.
     - (3) For (Post SB PW4ENG 75-28 and Pre SB PW4ENG 75-41) engines, remove the bleed valve supply tubes as follows. See Figure 301 (Sheet 2).
       - (a) Remove the lockwire. Disconnect the (AA35), (AA36), and (AA37) tubes at both ends of each tube.
       - (b) Remove the tubes. Remove the bolt, spacer, nut, and clamps that attach the (AA36) and (AA37) tubes together. Install the protection covers.
     - (4) For (Post SB PW4ENG 75-41) engines, remove the bleed valve supply tubes as follows. See Figure 301 (Sheet 3).
       - (a) Remove the lockwire. Disconnect the (AA35), (AA36), and (AA37) tubes at both ends of each tube.
       - (b) Remove the bolts, nuts, and clamps that attach the tubes to the brackets and to each other.
       - (c) Remove the tubes and install the protection covers.
     - (5) Remove the lockwire and disconnect the (AA26) bleed valve supply tube and the (AA27) bleed valve signal tube from the solenoid.
     - (6) Remove the four bolts that attach the bleed valve bracket assembly to the intermediate case.
     - (7) Remove the four bolts (and bracket, Post SB PW4ENG 75-41 only) that attach the solenoid to the bleed valve bracket. See Figure 301 (Sheet 4). Remove the solenoid and install protection covers.
     - (8) If the solenoid is to be replaced, do as follows.
       - (a) Place valve on bench with adapter cap up facing operator and solenoids to the right.
       - (b) Remove two adapters, one plug, and three gaskets from rear ports of solenoid.
       - (c) Remove cap from adapters and two gaskets from top of solenoid.


START/STABILITY BLEED VALVE SOLENOID
STABILITY BLEED PNEUMATIC RELAY VALVE
BLEED VALVE SUPPLY TUBE (AA26)
W5P11
BLEED VALVE SUPPLY TUBE (AA35)
BLEED VALVE SIGNAL TUBE (AA27)
W4P4
BLEED VALVE SUPPLY TUBE (AA36)
L−A4252 (0989)
PW V

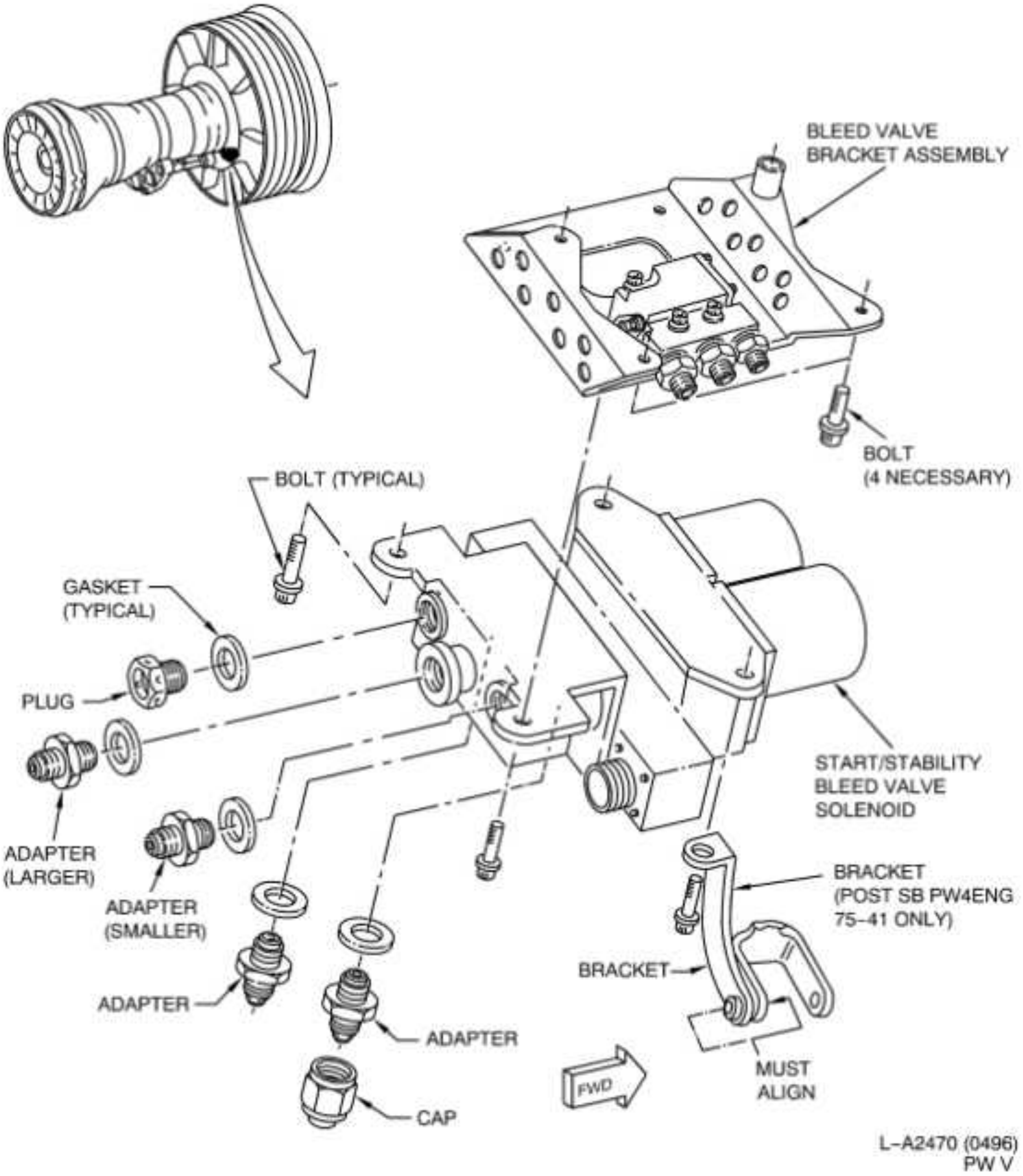
Start/Stability Bleed Valve Solenoid
(Pre SB PW4ENG 75−28)
Figure 301 (Sheet 1)
(Task 72−00−34−050−010)


START/STABILITY BLEED VALVE SOLENOID
STABILITY BLEED PNEUMATIC RELAY VALVE
BLEED VALVE SUPPLY TUBE (AA26)
W5P11
BLEED VALVE SUPPLY TUBE (AA35)
BLEED VALVE SIGNAL TUBE (AA27)
W4P4
(AA36)
(AA36)
NUT
CLAMP
(AA37)
CLAMP
BOLT
SPACER
(AA29)
MAINTENANCE BREAK
(AA37)
BLEED VALVE SUPPLY TUBES
L−A4714 (0989)
PW V

Start/Stability Bleed Valve Solenoid
(Post SB PW4ENG 75−28)
(Pre SB PW4ENG 75−41)
Figure 301 (Sheet 2)
(Task 72−00−34−050−010)


START/STABILITY BLEED VALVE SOLENOID
STABILITY BLEED PNEUMATIC RELAY VALVE
BLEED VALVE SUPPLY TUBE (AA26)
W5P11
(AA37)
(AA36)
(AA35)
BLEED VALVE SUPPLY TUBES
A
BLEED VALVE SIGNAL TUBE (AA27)
W4P4
(AA29)
B
(AA36)
(AA35)
(AA37)
CLAMP (TYPICAL)
BOLT (TYPICAL)
NUT (TYPICAL)
VIEW A
(AA35)
(AA36)
SPACER
VIEW B
L−A5996 (0496)
PW V

Start/Stability Bleed Valve Solenoid
(Post SB PW4ENG 75−41)
Figure 301 (Sheet 3)
(Task 72−00−34−050−010)


BLEED VALVE
BRACKET ASSEMBLY
BOLT
(4 NECESSARY)
BOLT (TYPICAL)
GASKET
(TYPICAL)
PLUG
ADAPTER
(LARGER)
ADAPTER
(SMALLER)
ADAPTER
ADAPTER
CAP
FWD
START/STABILITY
BLEED VALVE
SOLENOID
BRACKET
(POST SB PW4ENG
75−41 ONLY)
BRACKET
MUST
ALIGN
L−A2470 (0496)
PW V

Start/Stability Bleed Valve Solenoid
Figure 301 (Sheet 4)
(Task 72−00−34−050−010)

(d) Install protective closures to all openings on solenoid.

NOTE: For additional information concerning detailed maintenance of this component, see 9th Stage Bleed Solenoid Component Maintenance Manual, 75−31−42 (Midland Ross).

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ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−14

Task 72−00−34−050−011:

1. Remove HPC Secondary Flow Control Valve, Turbine Vane And Blade Cooling Air Valve Solenoid

A. Prerequisites

(1) Remove the fan exit liner segment (inner rear) that is at the 10 o'clock position. Refer to 72−00−33, Removal−16 Task 72−00−33−040−001.

B. Equipment And Materials Required − None

C. Procedure
See Figure 301.

(1) Disconnect and remove the W3P12 harness connector from the solenoid.

(2) Remove the lockwire from the three tube nuts on the rear of the solenoid and disconnect the tubes from the solenoid.

(3) Remove the four bolts that attach the solenoid to the intermediate case. Remove the solenoid from under the bracket and from the engine.

NOTE: Loosen the clamp bolt that attaches the tube to the bracket, if necessary.

(4) If the solenoid must be replaced, do the following:

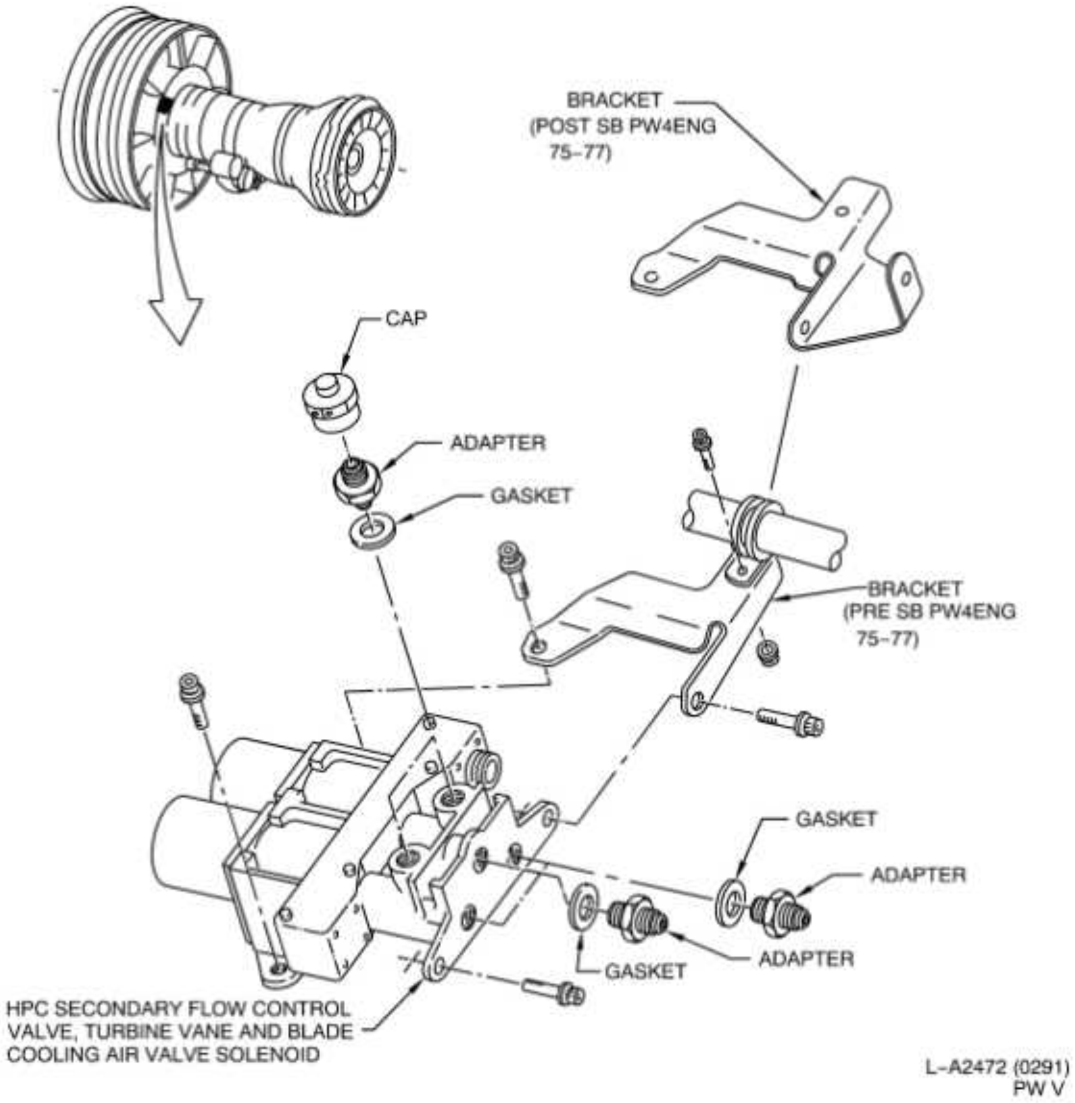
(a) Remove the three adapters and gaskets from the rear of the solenoid.

(b) Remove the lockwire and the two caps from the top of the two adapters.

(c) Remove the two adapters and gaskets from the top of the solenoid.

(d) Install protective closures to all openings.

NOTE: For additional information concerning detailed maintenance of this component, see Compressor Heating Air/Start Bleed Valve Solenoid Component Maintenance Manual, 75−33−12 (Midland Ross).


BRACKET (POST SB PW4ENG 75−77)
CAP
ADAPTER
GASKET
BRACKET (PRE SB PW4ENG 75−77)
GASKET
ADAPTER
ADAPTER
GASKET
HPC SECONDARY FLOW CONTROL VALVE, TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
L−A2472 (0291)
PW V

HPC Secondary Flow Control Valve, Turbine
Vane And Blade Cooling Air Valve Solenoid
Figure 301
(Task 72−00−34−050−011)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-34-050-012:

1. Remove IDGS Air/Oil Heat Exchanger Valve Override Pressure Switch

A. Prerequisites

(1) Remove the fan exit liner segment (inner rear) that is at the 1 o'clock position. Refer to 72-00-33, Removal-16 (Task 72-00-33-040-001).

B. Equipment And Materials Required - None

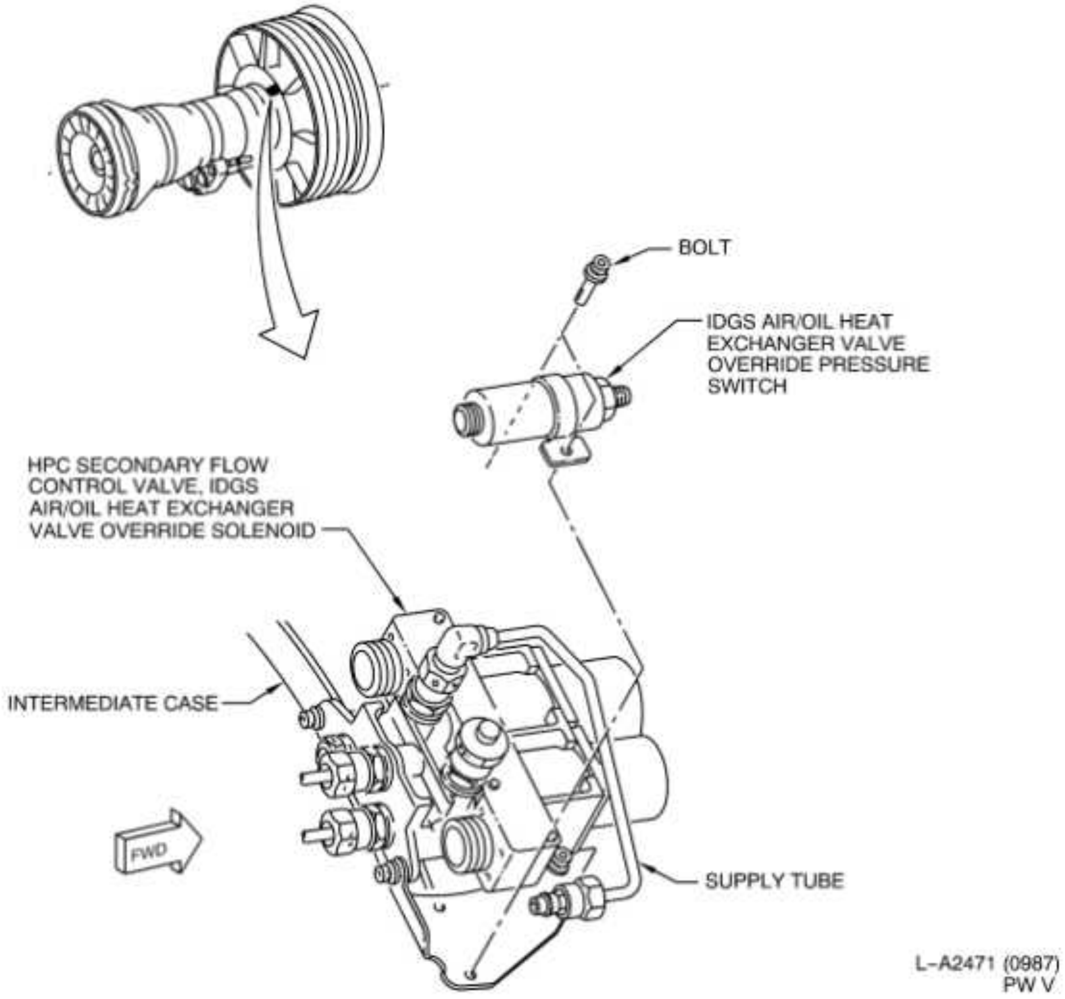
C. Procedure

See Figure 301 or 302.

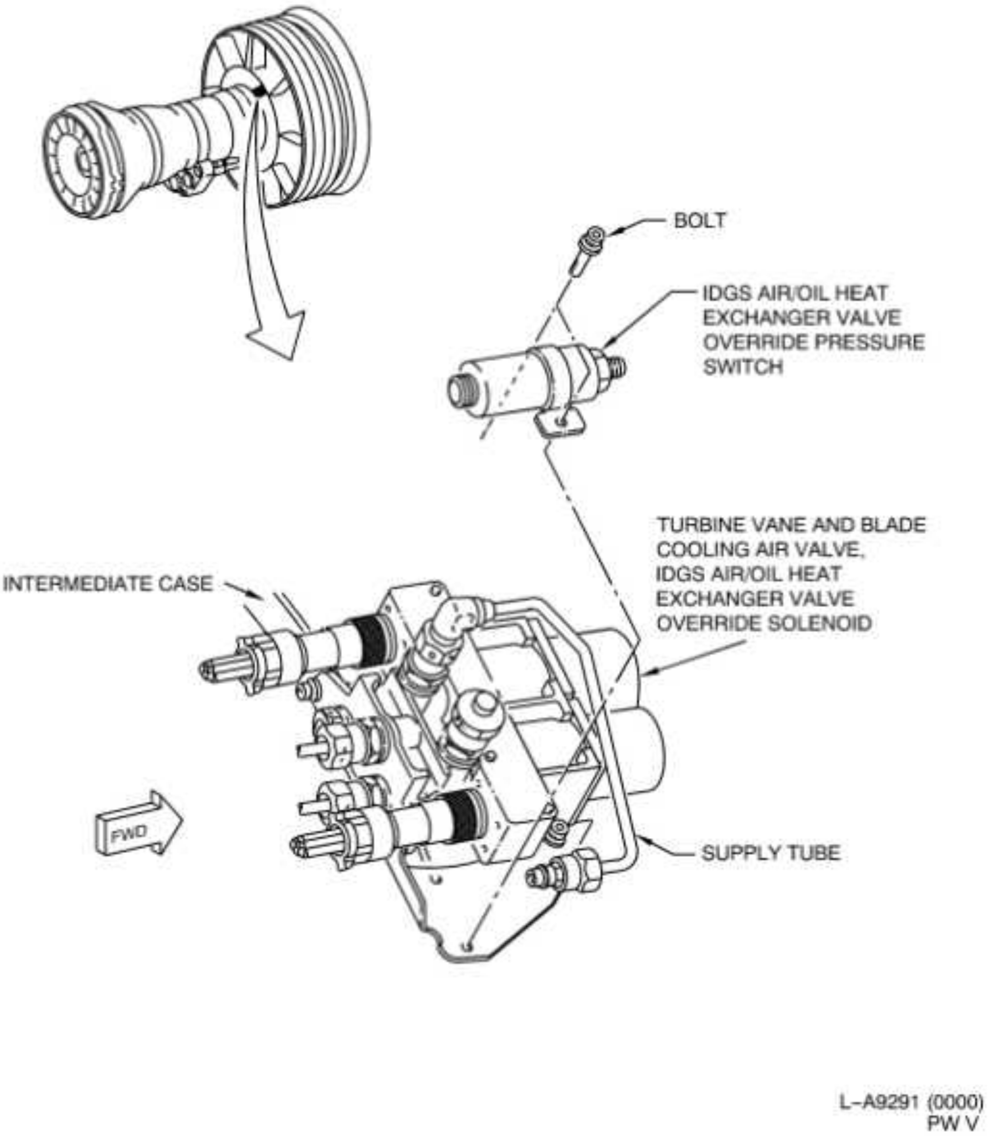
(1) Remove the lockwire and disconnect the pressure switch tube from the front of the override pressure switch.

(2) Remove the two bolts that attach the override pressure switch to the bracket and remove the override pressure switch from the engine.

(3) Install protective closures as necessary.


BOLT
IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE PRESSURE SWITCH
HPC SECONDARY FLOW CONTROL VALVE, IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE SOLENOID
INTERMEDIATE CASE
FWD
SUPPLY TUBE
L−A2471 (0987)
PW V

IDGS Air/Oil Heat Exchanger Valve Override Pressure Switch
Figure 301
(Task 72−00−34−050−012)


BOLT
IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE PRESSURE SWITCH
TURBINE VANE AND BLADE COOLING AIR VALVE, IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE SOLENOID
INTERMEDIATE CASE
FWD
SUPPLY TUBE
L−A9291 (0000)
PW V

IDGS Air/Oil Heat Exchanger Valve Override Pressure Switch
Figure 302
(Task 72−00−34−050−012)

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ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-16

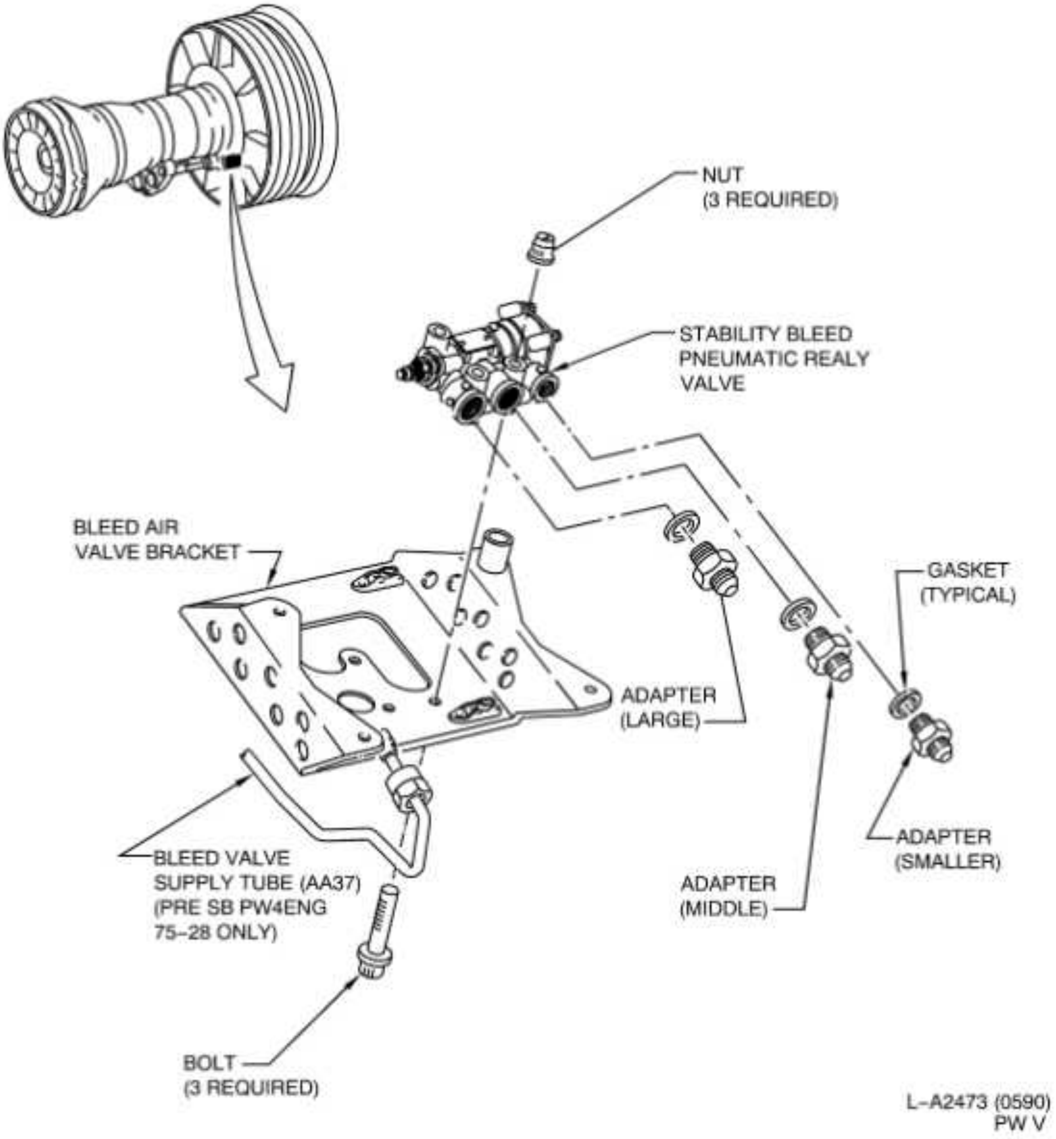
Task 72-00-34-050-013:

1. Remove The Stability Bleed Pneumatic Relay Valve
   - A. Prerequisites
     - (1) Remove the start/stability bleed valve solenoid. See Removal-13 (Task 72-00-34-050-010).
   - B. Equipment And Materials Required - None
   - C. Procedure

     See Figure 301.
     - (1) For engines without the bleed valve supply tube maintenance break (Pre SB PW4ENG 75-28), remove the remaining tube nut from the relay valve at 5 o'clock position on the intermediate case.

     - (2) Remove the three bolts and nuts that attach the relay valve to the bracket in the intermediate case at 5 o'clock position. Remove the relay valve.
     - (3) If the pneumatic relay valve is to be replaced, comply with the following:
       - (a) Remove the three adapters and gaskets from the valve.
       - (b) Install the protection covers to all the openings.

         NOTE: For more data about the maintenance of this component, see the Stability Bleed Pneumatic Relay Valve Component Maintenance Manual, 75-31-43.


NUT
(3 REQUIRED)
STABILITY BLEED
PNEUMATIC REALY
VALVE
BLEED AIR
VALVE BRACKET
GASKET
(TYPICAL)
ADAPTER
(LARGE)
BLEED VALVE
SUPPLY TUBE (AA37)
(PRE SB PW4ENG
75-28 ONLY)
ADAPTER
(SMALLER)
ADAPTER
(MIDDLE)
BOLT
(3 REQUIRED)
L-A2473 (0590)
PW V

Stability Bleed Pneumatic Relay Valve
Figure 301
(Task 72−00−34−050−013)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-17

Task 72-00-34-050-014:

1. Remove EEC Speed Transducer (N1) Multiplexer Input Probe

A. Prerequisites

(1) Remove the fan exit liner segment (inner rear) that is at 5 o'clock. Refer to 72-00-33, Removal-16 (Task 720033040001).

B. Equipment And Materials Required

Special Tools:

PWA 101359 Puller, Mechanical (Pre SB PW4ENG 73-88)

C. Procedure
See Figure 301.

(1) Disconnect cables from connectors on transducer probe.

(2) Remove lockwire and disconnect tube nut from transducer probe.

(3) Remove bolt and clamp securing tube to Flange E bracket at approximately 5 o'clock position.

(4) If required bend key washers down. Evenly loosen bolts and nut (if equipped) securing spring loaded transducer to intermediate case. Remove bolts, and nut (if equipped) and washers. Discard key washers if used.

(5) Reposition bracket (if equipped) and PT2.5 tube to allow removal of transducer from case.

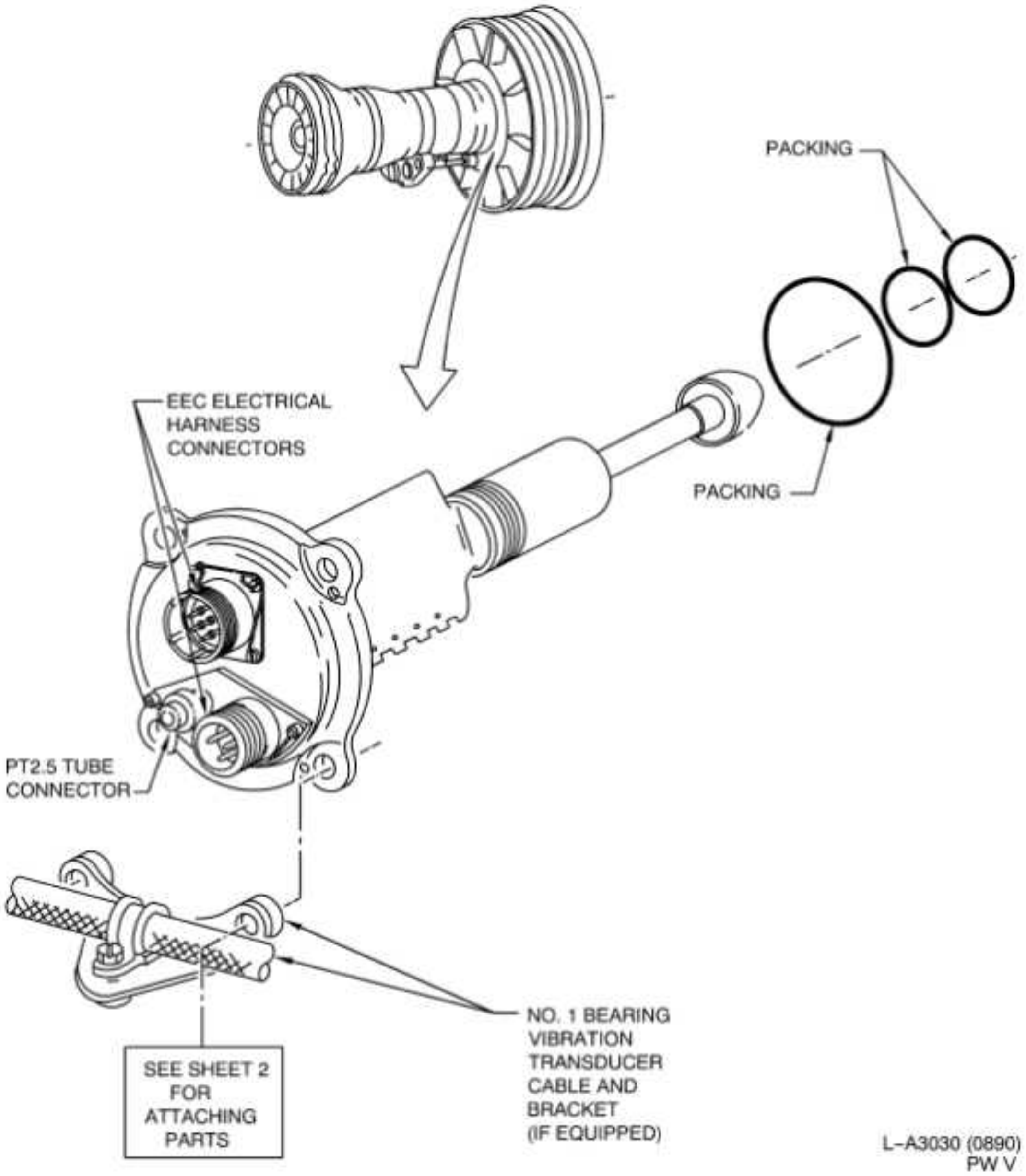
NOTE: Do not attempt to rotate transducer until disengaged from inner bracket.

(6) (Pre SB PW4ENG 73-88) Use PWA 101359 Puller to break the interface between the flange of the transducer probe and the intermediate case.

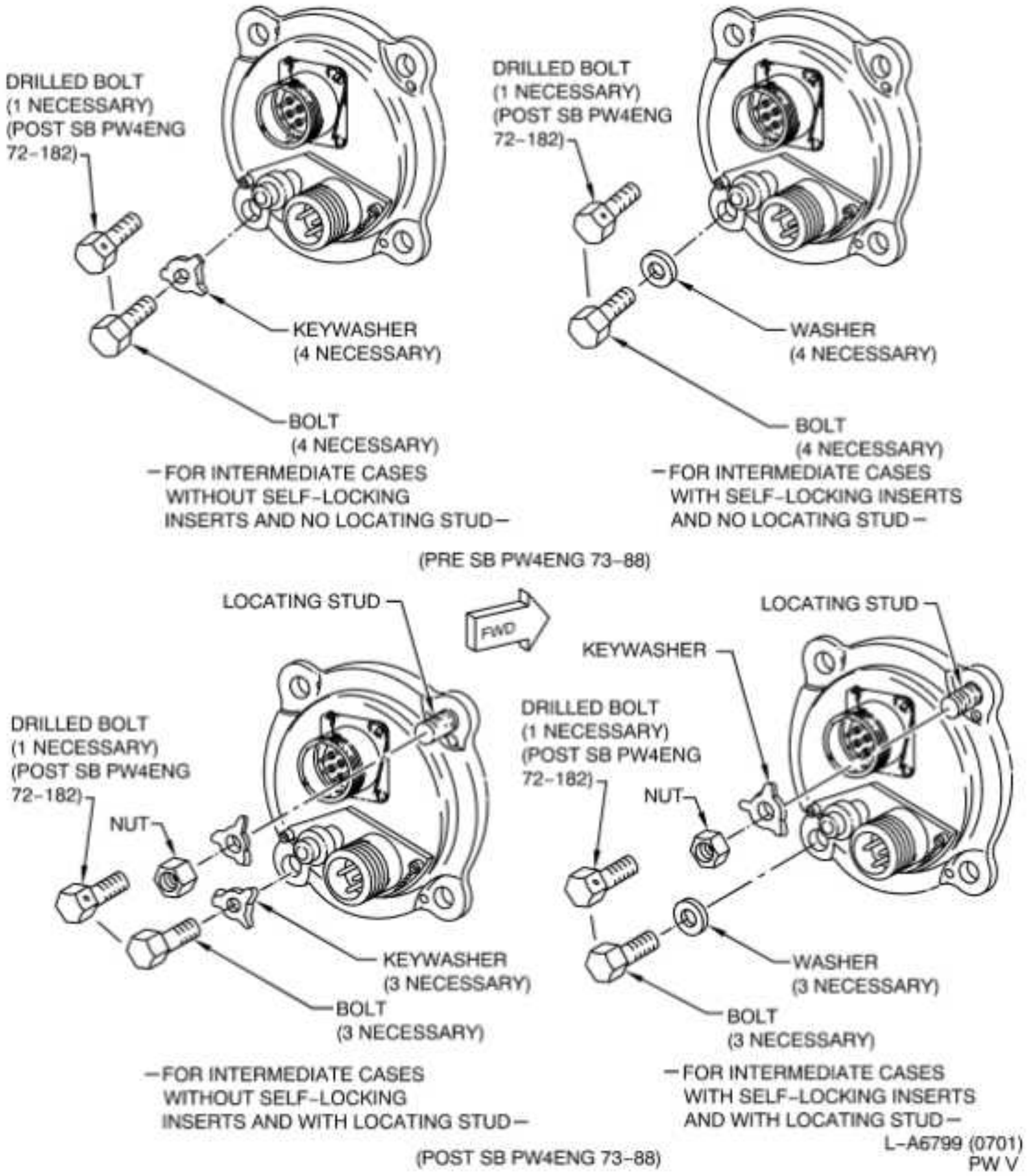
(7) (Post SB PW4ENG 73-88) Use three .190-32 jackscrews in the transducer flange jackscrew holes to break the interface between the flange of the transducer probe and the intermediate case.

(8) Remove the transducer. Remove the packings and discard.

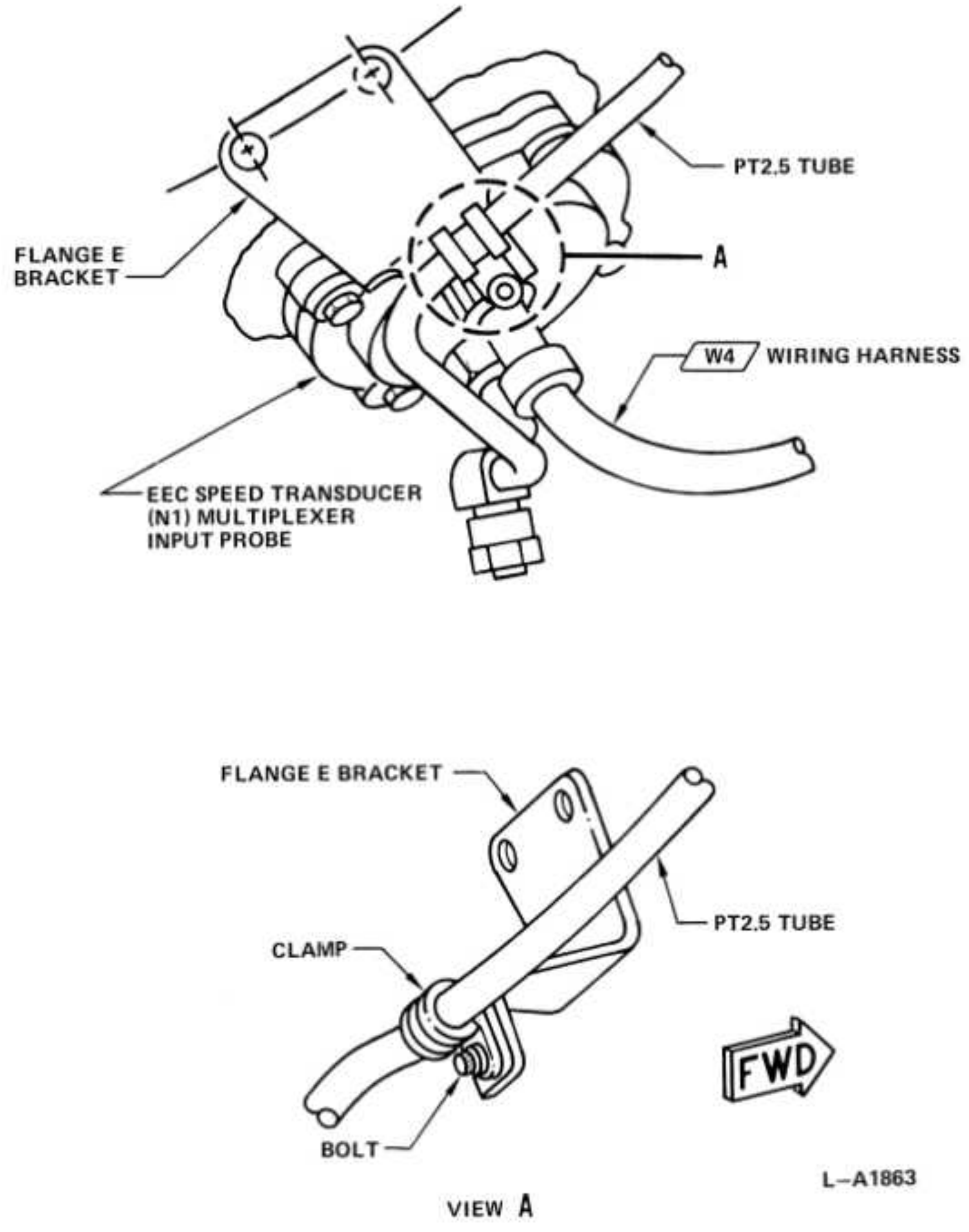
(9) Install protective closures.


PACKING
EEC ELECTRICAL HARNESS CONNECTORS
PACKING
PT2.5 TUBE CONNECTOR
SEE SHEET 2 FOR ATTACHING PARTS
NO. 1 BEARING VIBRATION TRANSDUCER CABLE AND BRACKET (IF EQUIPPED)
L−A3030 (0890)
PW V

EEC Speed Transducer (N1) Multiplexer Input Probe
Figure 301 (Sheet 1)
(Task 72−00−34−050−014)


DRILLED BOLT
(1 NECESSARY)
(POST SB PW4ENG
72-182)
KEYWASHER
(4 NECESSARY)
BOLT
(4 NECESSARY)
—FOR INTERMEDIATE CASES
WITHOUT SELF-LOCKING
INSERTS AND NO LOCATING STUD—
DRILLED BOLT
(1 NECESSARY)
(POST SB PW4ENG
72-182)
WASHER
(4 NECESSARY)
BOLT
(4 NECESSARY)
—FOR INTERMEDIATE CASES
WITH SELF-LOCKING INSERTS
AND NO LOCATING STUD—
(PRE SB PW4ENG 73-88)
LOCATING STUD
FWD
DRILLED BOLT
(1 NECESSARY)
(POST SB PW4ENG
72-182)
NUT
KEYWASHER
(3 NECESSARY)
BOLT
(3 NECESSARY)
—FOR INTERMEDIATE CASES
WITHOUT SELF-LOCKING
INSERTS AND WITH LOCATING STUD—
LOCATING STUD
KEYWASHER
DRILLED BOLT
(1 NECESSARY)
(POST SB PW4ENG
72-182)
NUT
WASHER
(3 NECESSARY)
BOLT
(3 NECESSARY)
—FOR INTERMEDIATE CASES
WITH SELF-LOCKING INSERTS
AND WITH LOCATING STUD—
(POST SB PW4ENG 73-88)
L-A6799 (0701)
PW V

EEC Speed Transducer (N1) Multiplexer Input Probe (Attaching Parts)
Figure 301 (Sheet 2)
(Task 72−00−34−050−014)


PT2.5 TUBE
FLANGE E BRACKET
A
W4 WIRING HARNESS
EEC SPEED TRANSDUCER (N1) MULTIPLEXER INPUT PROBE
FLANGE E BRACKET
PT2.5 TUBE
CLAMP
FWD
BOLT
L−A1863
VIEW A

EEC Speed Transducer (N1) Multiplexer Input Probe
Figure 301 (Sheet 3)
(Task 72−00−34−050−014)

ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-18

Task 72-00-34-050-018:

1. Remove EEC Wiring Harness - W3 (Core Engine)
   A. General
      (1) To remove the EEC wiring harness - W4, see Removal-19 (Task 72-00-34-050-019).
      (2) To remove the EEC wiring harness - W5, see Removal-20 (Task 72-00-34-050-020).
   B. Equipment And Materials Required

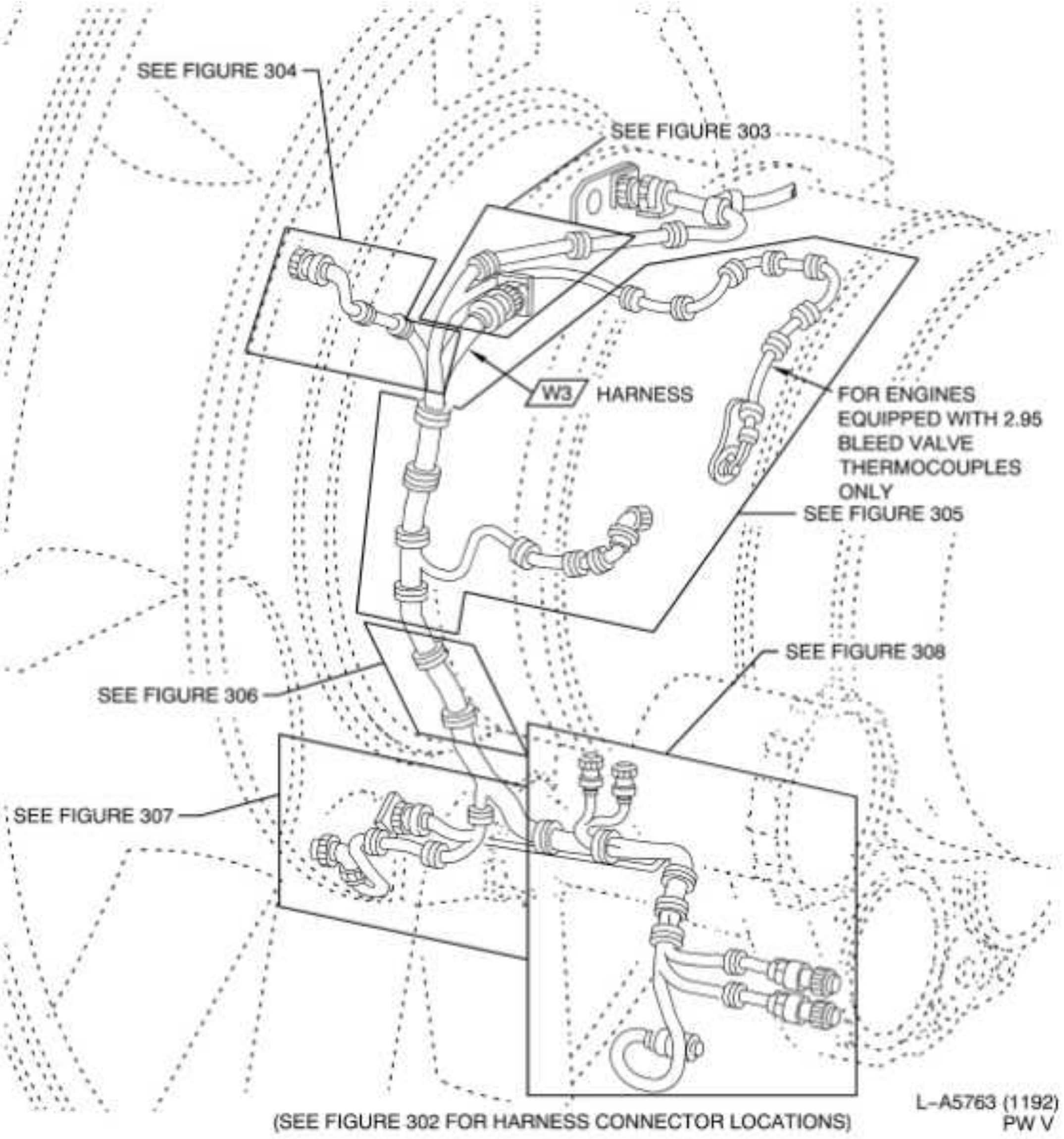
      Special Tools:
      PWA 85749 Torque Adapter, Electronic Harness Connector

   C. Procedure
      See Figures 301 through 308.

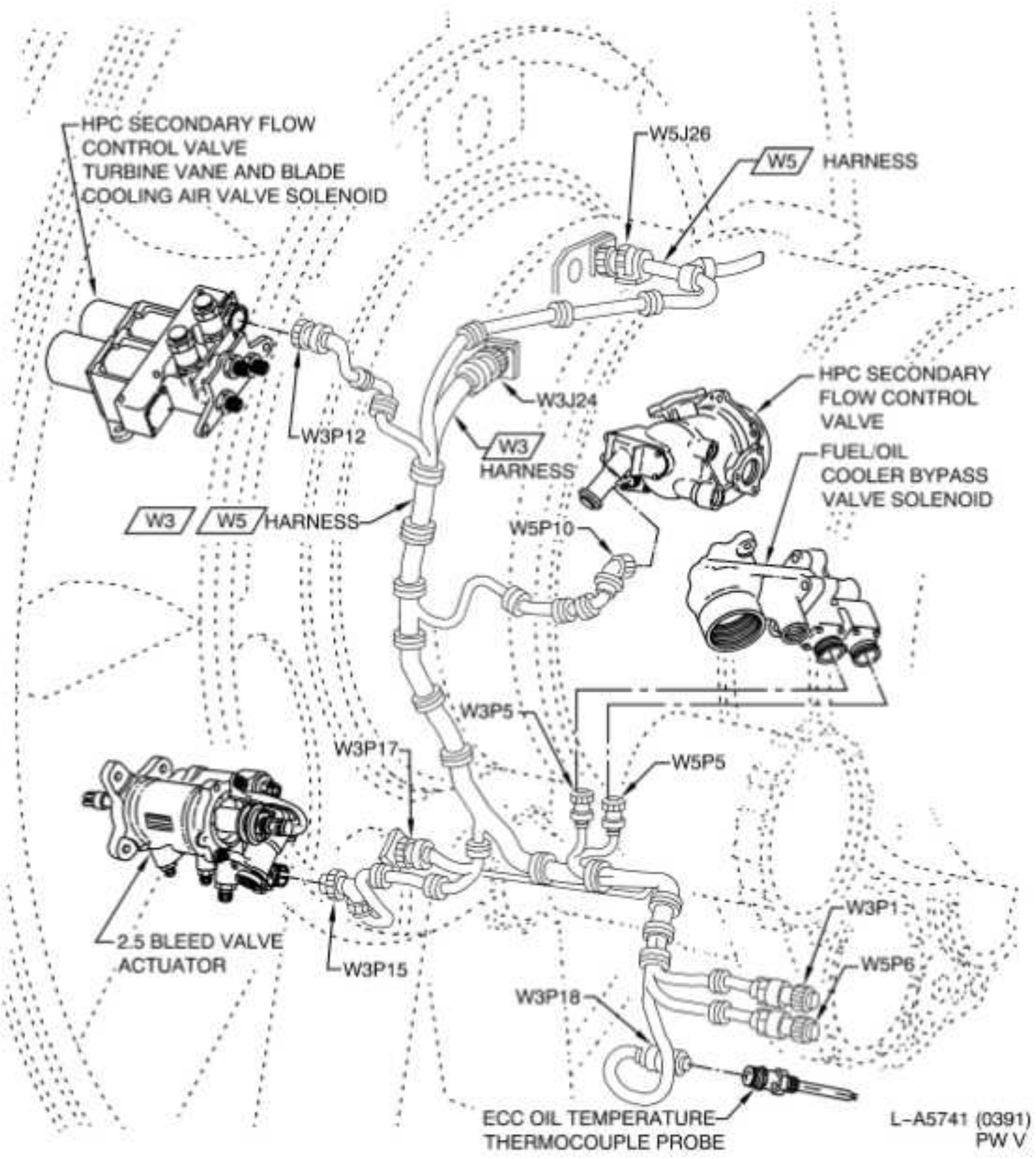
      CAUTION: DO NOT TWIST OR BEND THE HARNESS BADLY DURING THE REMOVAL, OR DAMAGE TO THE HARNESS CAN OCCUR.

      (1) Disconnect the W1P24 harness connector from the W3J24 harness connector located at the 10 o'clock position on the HPC case. Remove the two bolts and harness bracket attaching the W3J24 harness connector flange to the HPC case bracket. Remove the connector from the bracket. Install a protective closure on each harness connector. See Figure 303.
      (2) Disconnect the following harness connectors from the components given below. Install a protective closure on each harness connector and mating receptacle. See Figure 302.

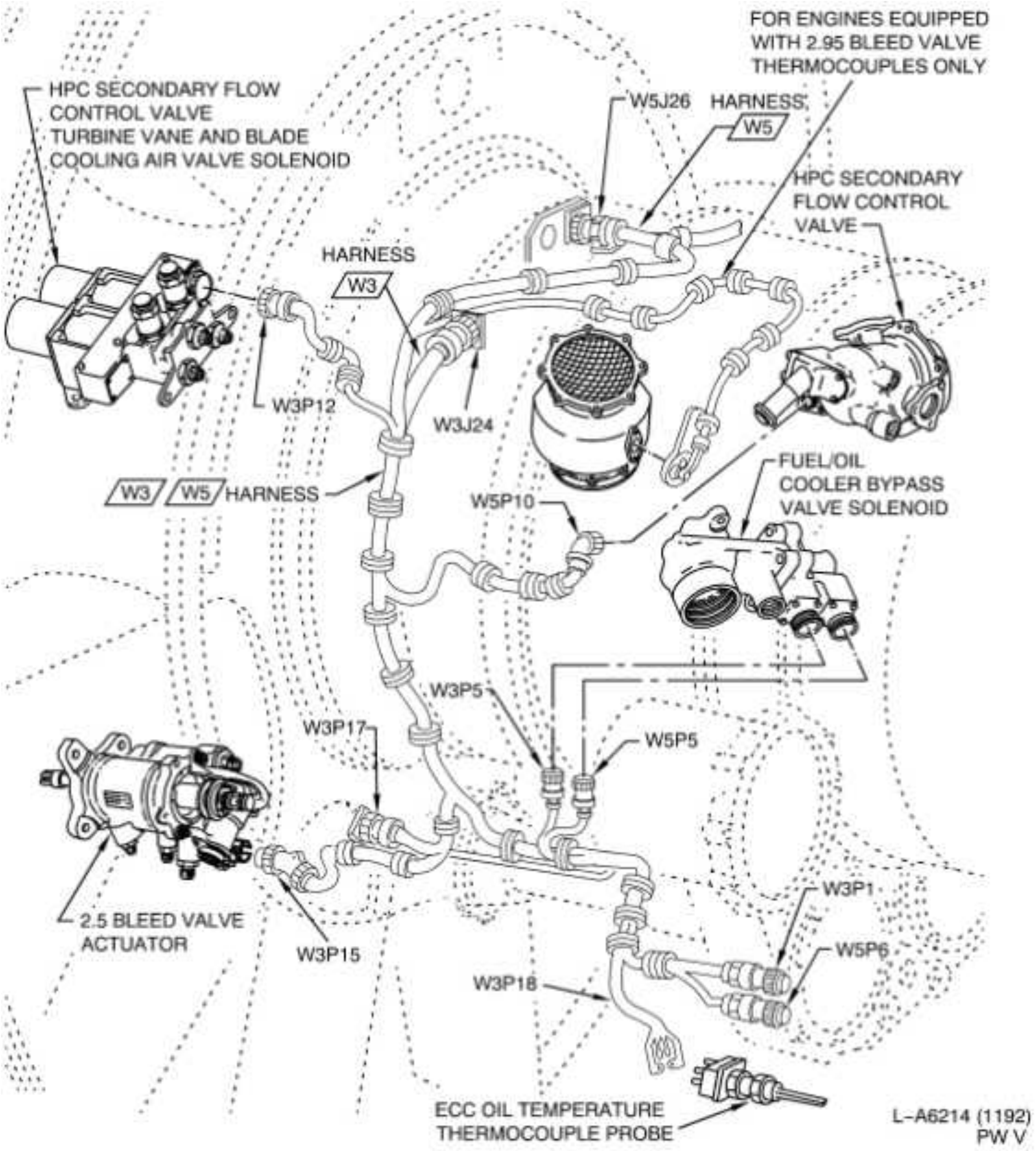
Connector	Component	Location
W3P5	Fuel/Oil Cooler Bypass Valve Solenoid (Front Connector)	8 O'Clock
W3P17	Air/Oil Heat Exchanger And Valve (Engine)	8 O'Clock
W3P15	2.5 Bleed Valve Actuator	Intermediate Case 7:30 O'Clock


SEE FIGURE 304
SEE FIGURE 303
W3
HARNESS
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
SEE FIGURE 305
SEE FIGURE 306
SEE FIGURE 308
SEE FIGURE 307
(SEE FIGURE 302 FOR HARNESS CONNECTOR LOCATIONS)
L−A5763 (1192)
PW V

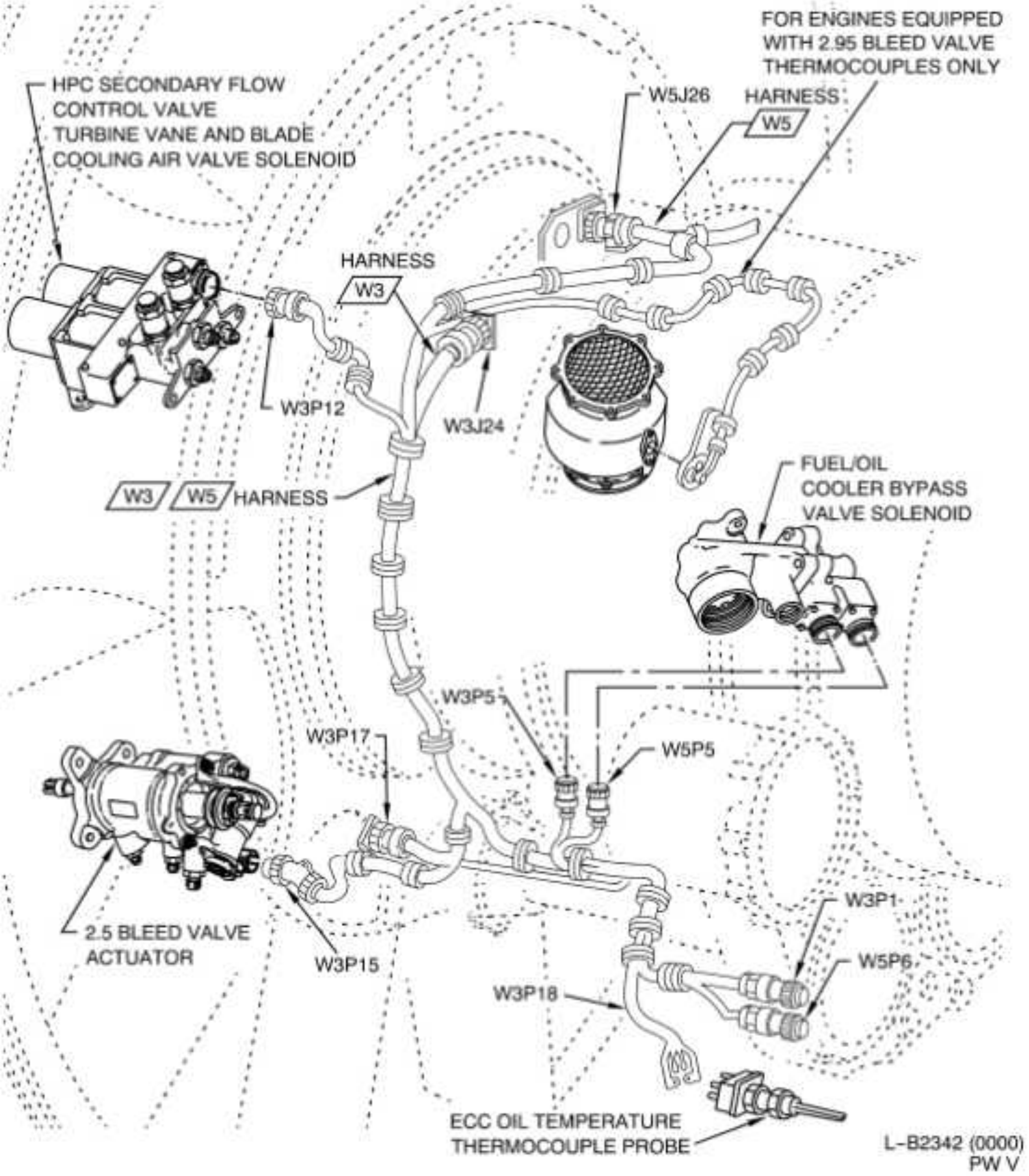
EEC Wiring Harness − W3 (Core Engine)
Figure 301
(Task 72−00−34−050−018)


HPC SECONDARY FLOW CONTROL VALVE
TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
W5J26
W5 HARNESS
W3J24
W3P12
W3 HARNESS
HPC SECONDARY FLOW CONTROL VALVE
FUEL/OIL COOLER BYPASS VALVE SOLENOID
W3 W5 HARNESS
W5P10
W3P5
W3P17
W5P5
2.5 BLEED VALVE ACTUATOR
W3P15
W3P1
W5P6
W3P18
ECC OIL TEMPERATURE THERMOCOUPLE PROBE
L-A5741 (0391)
PW V

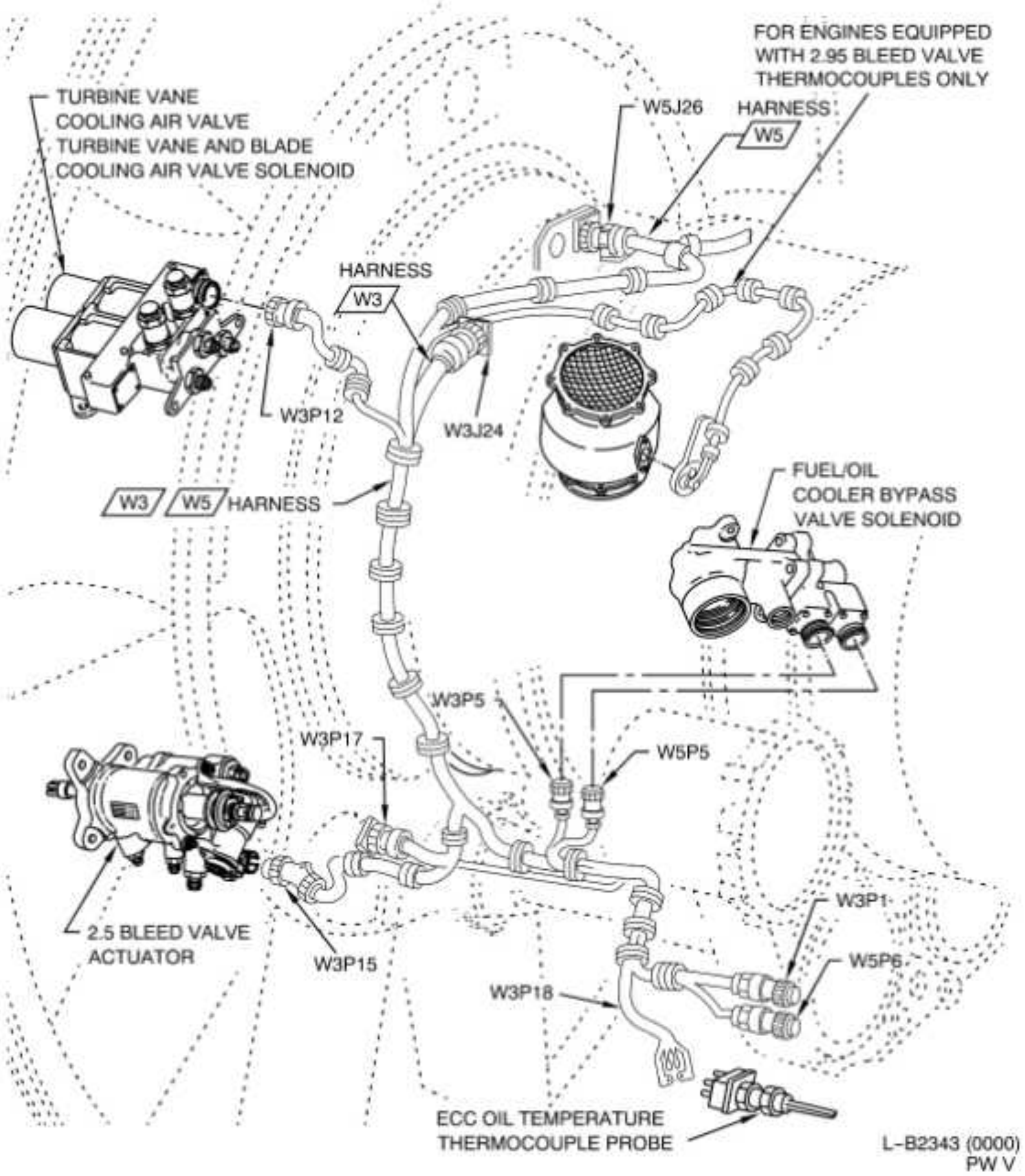
EEC Wiring Harness − W3 (Core Engine)
(Pre SB PW4ENG 73−84)
(Pre SB PW4ENG 75−106)
Figure 302 (Sheet 1)
(Task 72−00−34−050−018)


FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
HPC SECONDARY FLOW CONTROL VALVE
TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
W5J26
HARNESS W5
HPC SECONDARY FLOW CONTROL VALVE
HARNESS W3
W3P12
W3J24
W3 W5 HARNESS
W5P10
FUEL/OIL COOLER BYPASS VALVE SOLENOID
W3P5
W3P17
W5P5
W3P1
W5P6
2.5 BLEED VALVE ACTUATOR
W3P15
W3P18
ECC OIL TEMPERATURE THERMOCOUPLE PROBE
L−A6214 (1192)
PW V

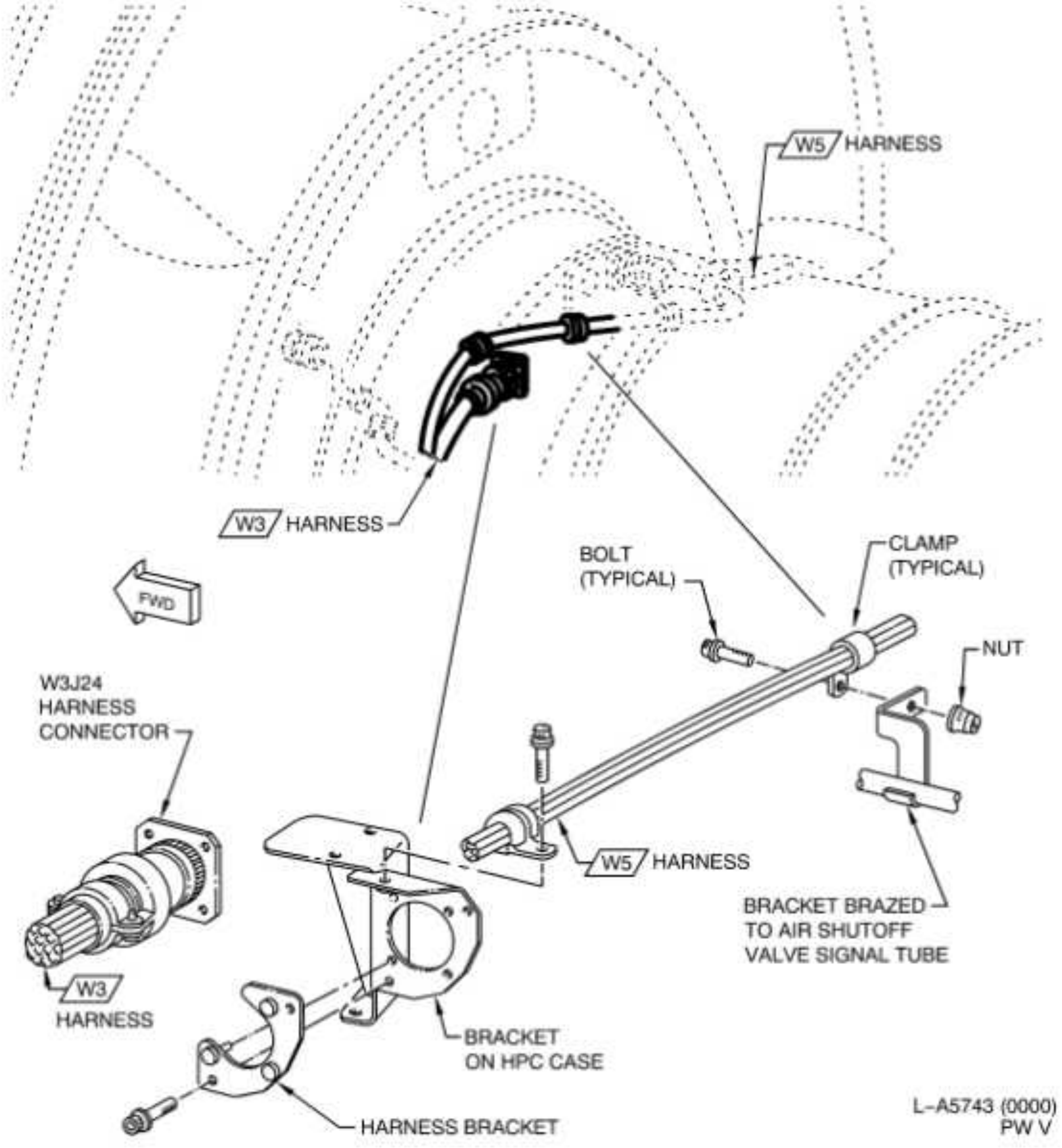
EEC Wiring Harness − W3 (Core Engine)
(Post SB PW4ENG 73−84)
(Pre SB PW4ENG 75−106)
Figure 302 (Sheet 2)
(Task 72−00−34−050−018)


FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
HPC SECONDARY FLOW CONTROL VALVE
TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
W5J26
HARNESS
W5
HARNESS
W3
W3P12
W3J24
W3
W5
HARNESS
FUEL/OIL COOLER BYPASS VALVE SOLENOID
W3P5
W3P17
W5P5
2.5 BLEED VALVE ACTUATOR
W3P15
W3P1
W5P6
W3P18
ECC OIL TEMPERATURE THERMOCOUPLE PROBE
L-B2342 (0000)
PW V

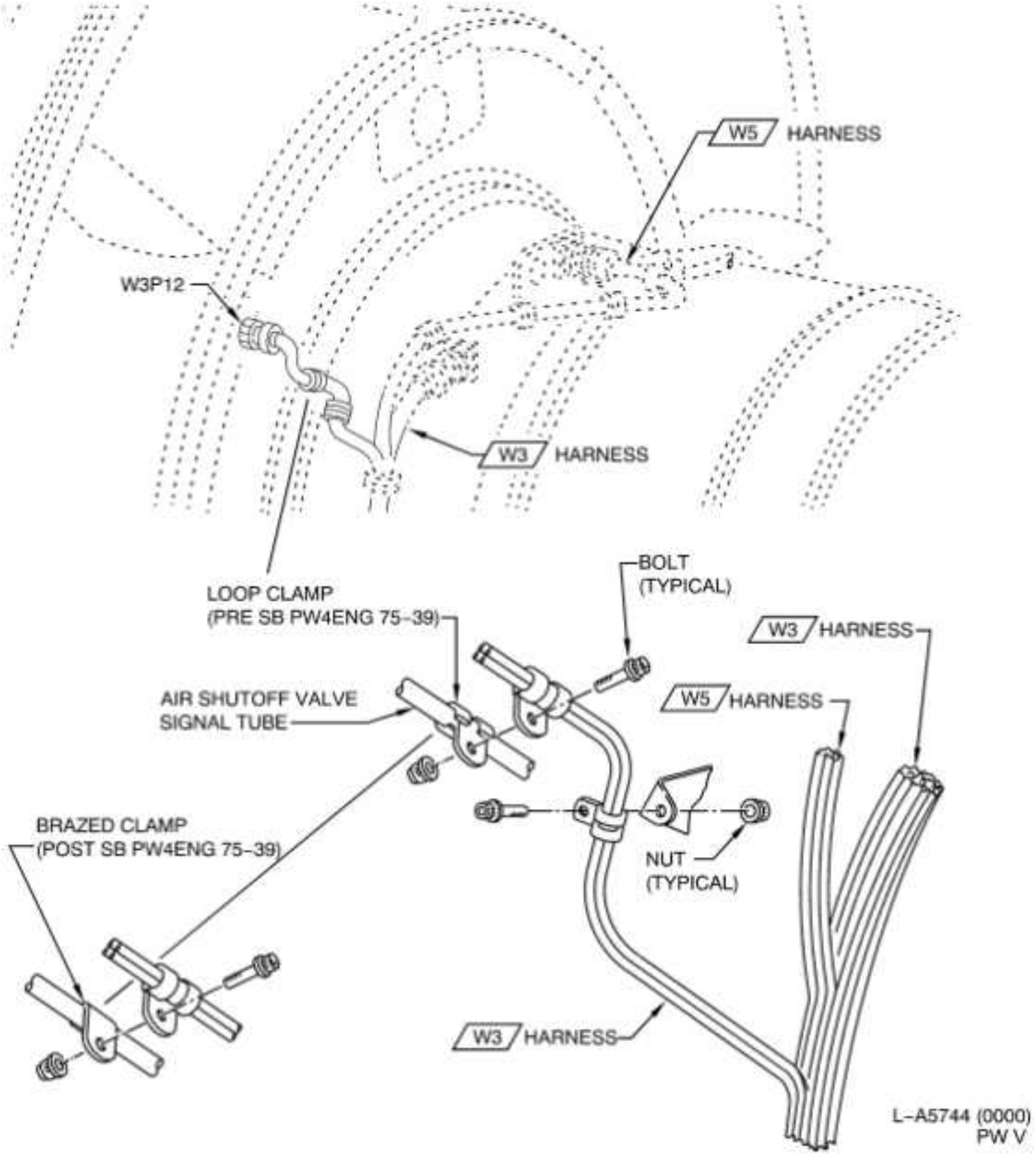
EEC Wiring Harness − W3 (Core Engine)
(Post SB PW4ENG 73−84)
(Post SB PW4ENG 75−106 Or SB PW4ENG 72−572)
(For −3 Engines With CN After Engine Serial Number)
Figure 302 (Sheet 3)
(Task 72−00−34−050−018)


FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
TURBINE VANE COOLING AIR VALVE
TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
W5J26
HARNESS W5
HARNESS W3
W3P12
W3J24
W3 W5 HARNESS
FUEL/OIL COOLER BYPASS VALVE SOLENOID
W3P5
W3P17
W5P5
2.5 BLEED VALVE ACTUATOR
W3P15
W3P1
W5P6
W3P18
ECC OIL TEMPERATURE THERMOCOUPLE PROBE
L-B2343 (0000)
PW V

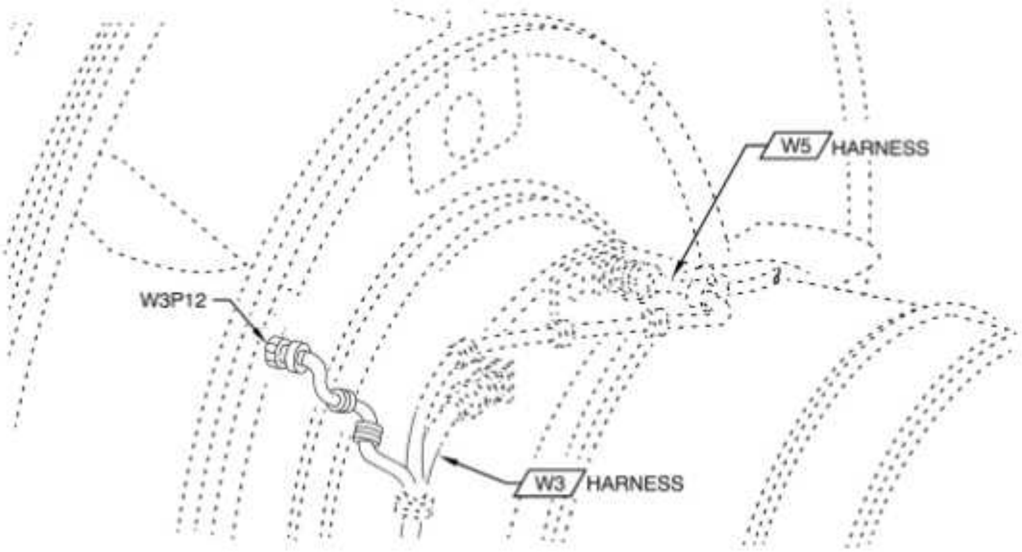
EEC Wiring Harness − W3 (Core Engine)
(For −3 Engines As Built By P&W)
Figure 302 (Sheet 4)
(Task 72−00−34−050−018)

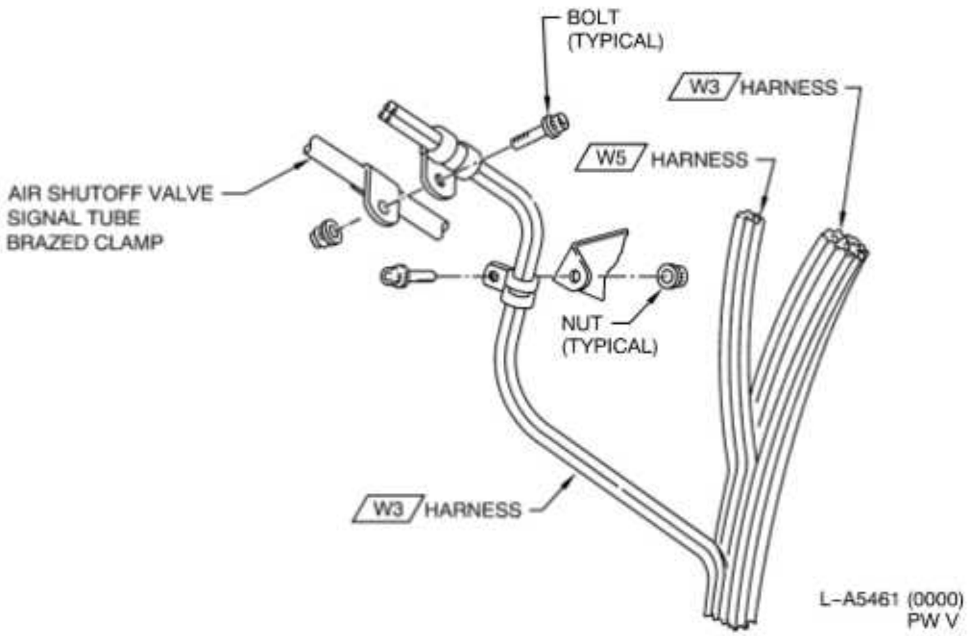

W5 HARNESS
W3 HARNESS
FWD
BOLT (TYPICAL)
CLAMP (TYPICAL)
NUT
W3J24 HARNESS CONNECTOR
W5 HARNESS
BRACKET BRAZED TO AIR SHUTOFF VALVE SIGNAL TUBE
W3 HARNESS
BRACKET ON HPC CASE
HARNESS BRACKET
L−A5743 (0000)
PW V

EEC Wiring Harness − W3 (Core Engine)
Figure 303
(Task 72−00−34−050−018)

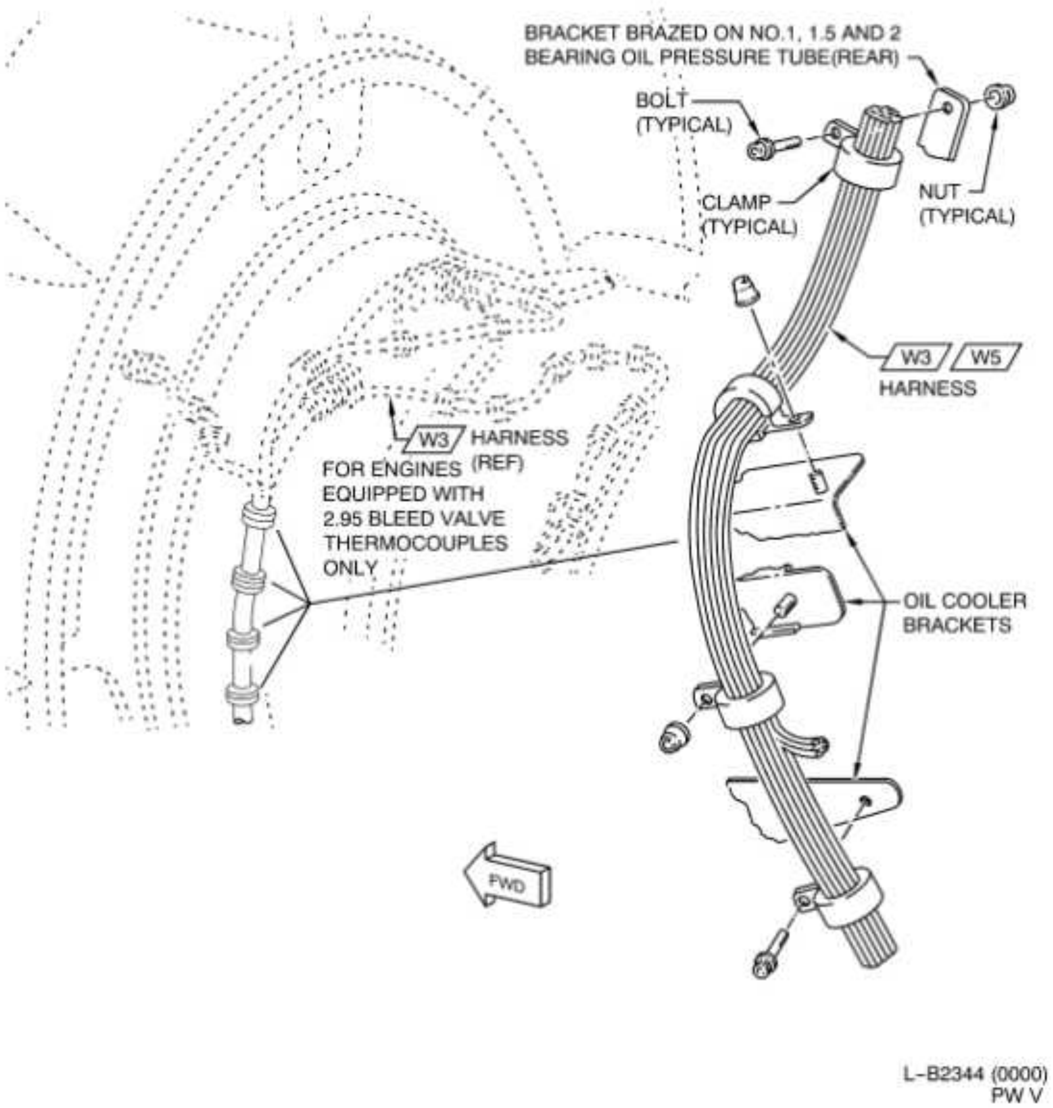

W5 HARNESS
W3P12
W3 HARNESS
LOOP CLAMP
(PRE SB PW4ENG 75-39)
BOLT
(TYPICAL)
W3 HARNESS
AIR SHUTOFF VALVE
SIGNAL TUBE
W5 HARNESS
BRAZED CLAMP
(POST SB PW4ENG 75-39)
NUT
(TYPICAL)
W3 HARNESS
L-A5744 (0000)
PW V

EEC Wiring Harness − W3 (Core Engine)
(For Engines With And Without CN After Engine Serial Number)
Figure 304 (Sheet 1)
(Task 72−00−34−050−018)

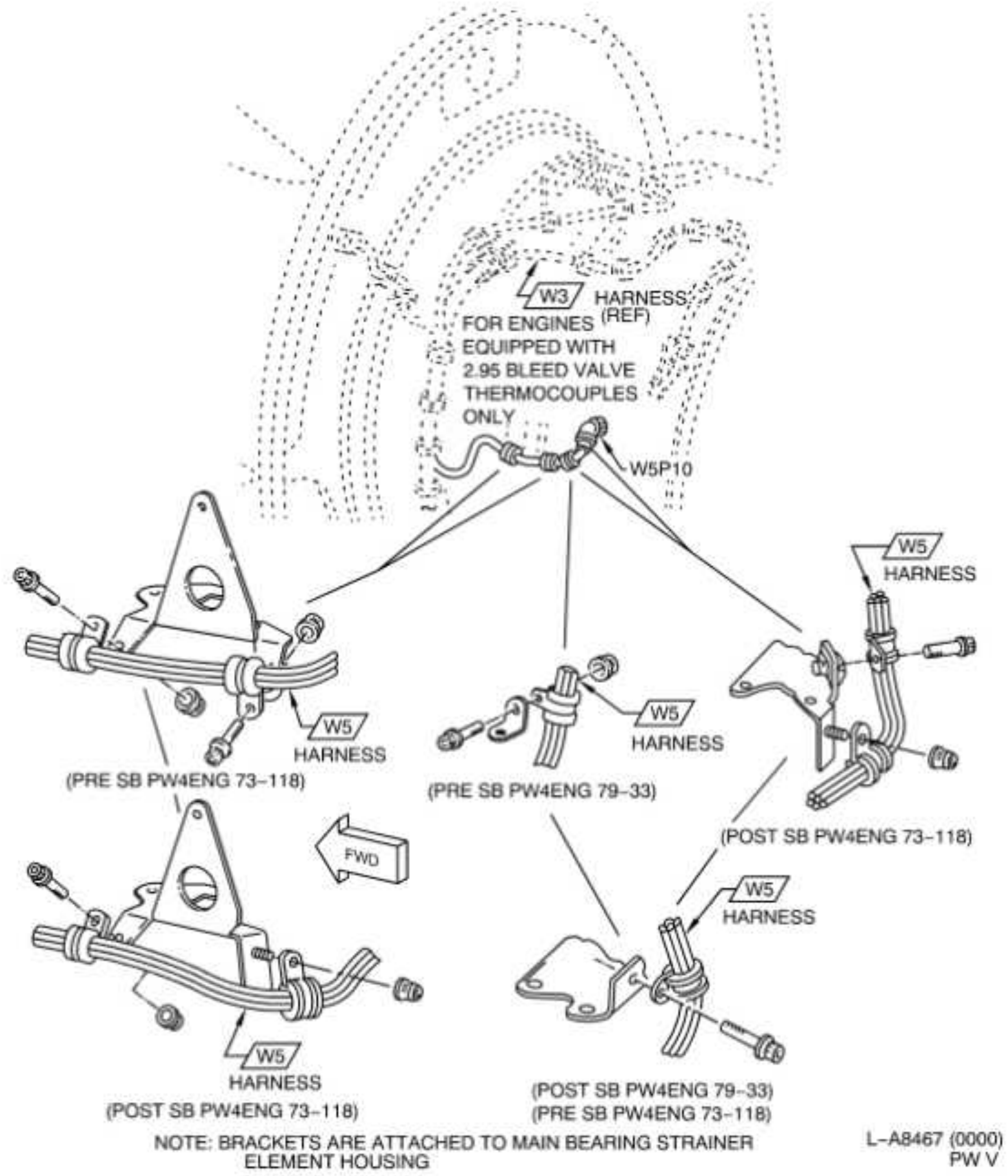

W5 HARNESS
W3P12
W3 HARNESS


BOLT
(TYPICAL)
W3 HARNESS
W5 HARNESS
AIR SHUTOFF VALVE
SIGNAL TUBE
BRAZED CLAMP
NUT
(TYPICAL)
W3 HARNESS
L−A5461 (0000)
PW V

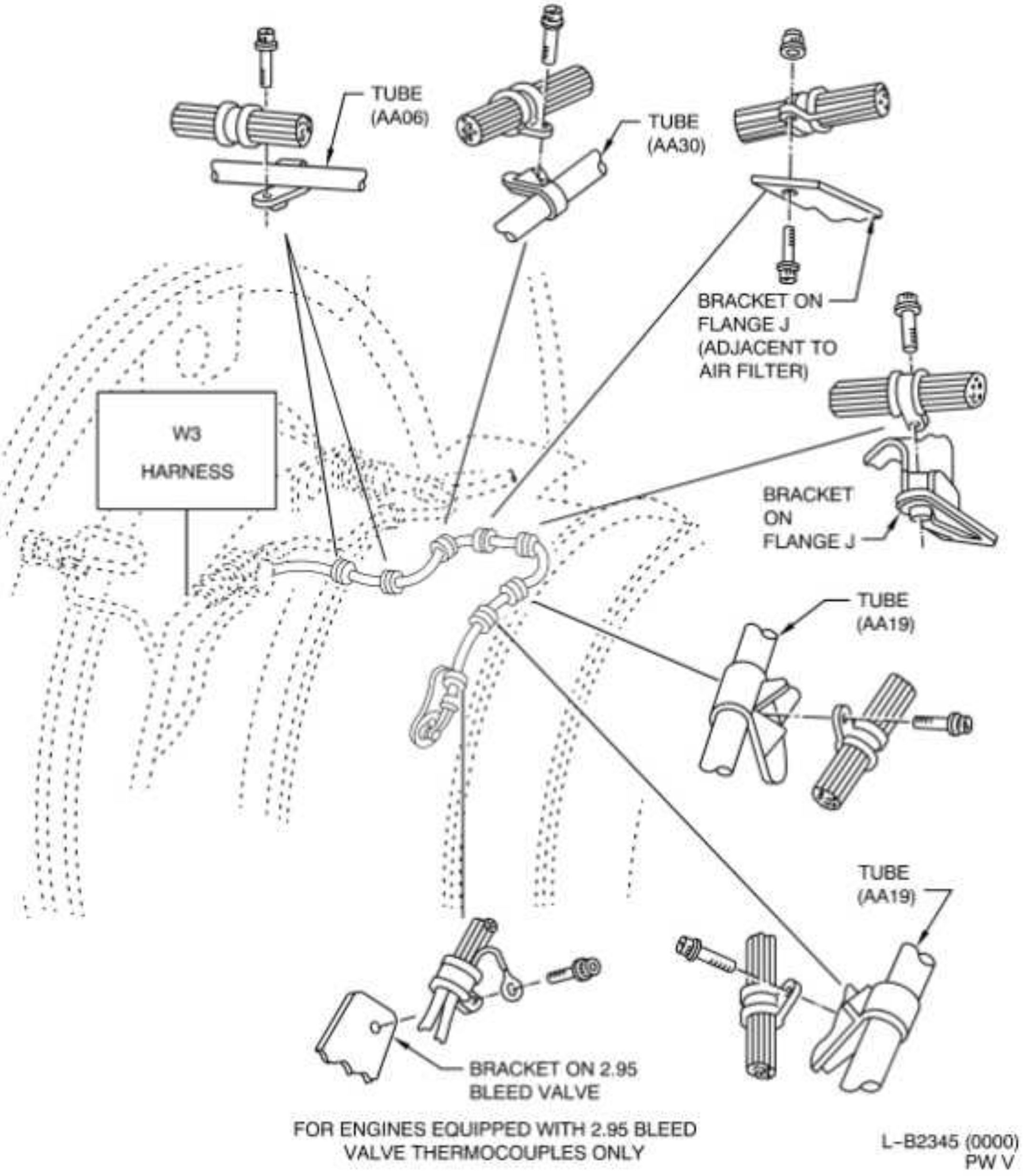
EEC Wiring Harness − W3 (Core Engine)
(For −3 Engines As Built By P&W)
Figure 304 (Sheet 2)
(Task 72−00−34−050−018)


BRACKET BRAZED ON NO.1, 1.5 AND 2
BEARING OIL PRESSURE TUBE(REAR)
BOLT
(TYPICAL)
CLAMP
(TYPICAL)
NUT
(TYPICAL)
W3
W5
HARNESS
W3
HARNESS
(REF)
FOR ENGINES
EQUIPPED WITH
2.95 BLEED VALVE
THERMOCOUPLES
ONLY
OIL COOLER
BRACKETS
FWD
L-B2344 (0000)
PW V

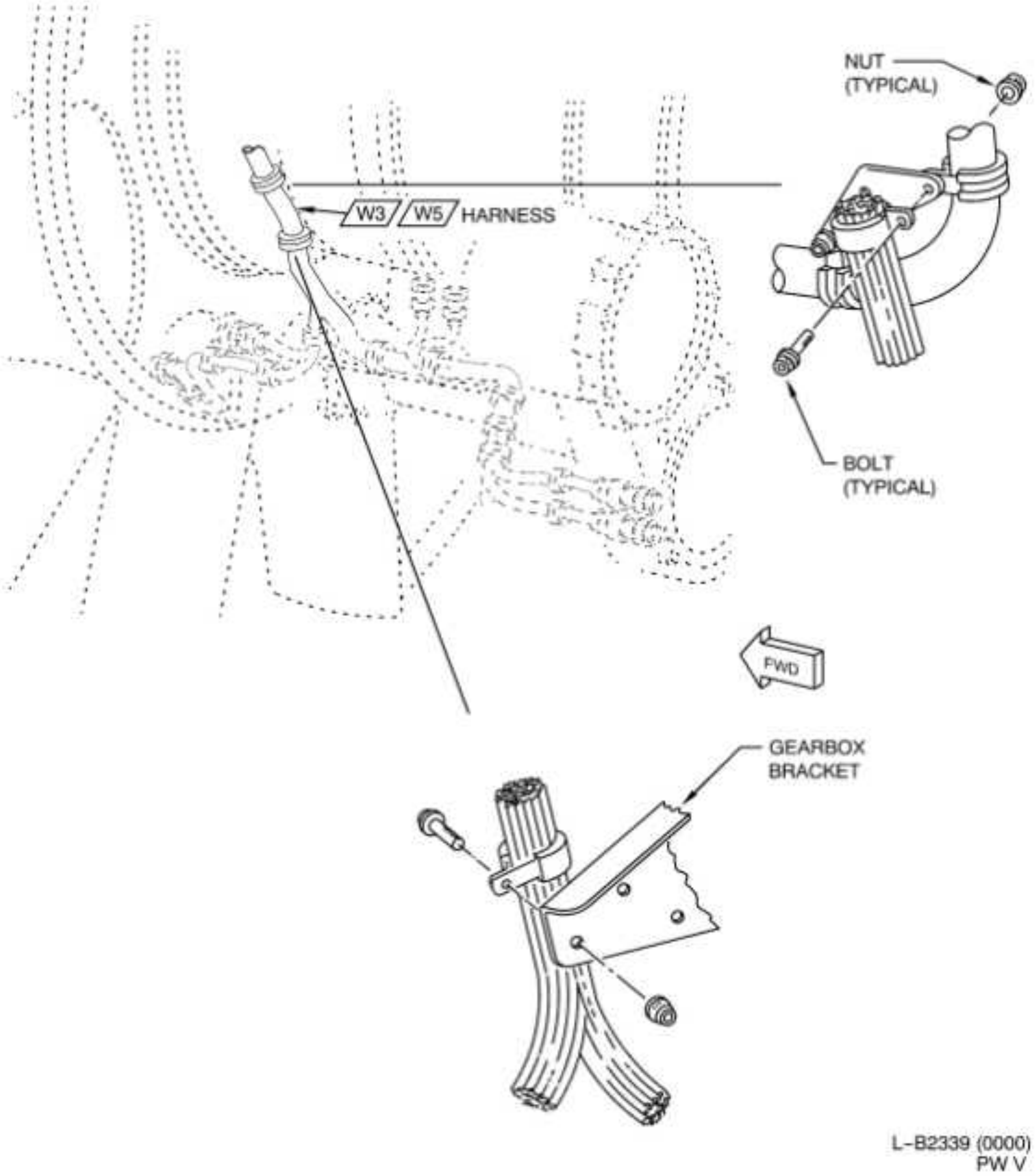
EEC Wiring Harness − W3 (Core Engine)
Figure 305 (Sheet 1)
(Task 72−00−34−050−018)


W3 HARNESS (REF)
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5P10
W5 HARNESS
(PRE SB PW4ENG 73-118)
W5 HARNESS
(PRE SB PW4ENG 79-33)
W5 HARNESS
(POST SB PW4ENG 73-118)
FWD
W5 HARNESS
(POST SB PW4ENG 73-118)
W5 HARNESS
(POST SB PW4ENG 79-33)
(PRE SB PW4ENG 73-118)
NOTE: BRACKETS ARE ATTACHED TO MAIN BEARING STRAINER ELEMENT HOUSING
L-A8467 (0000)
PW V

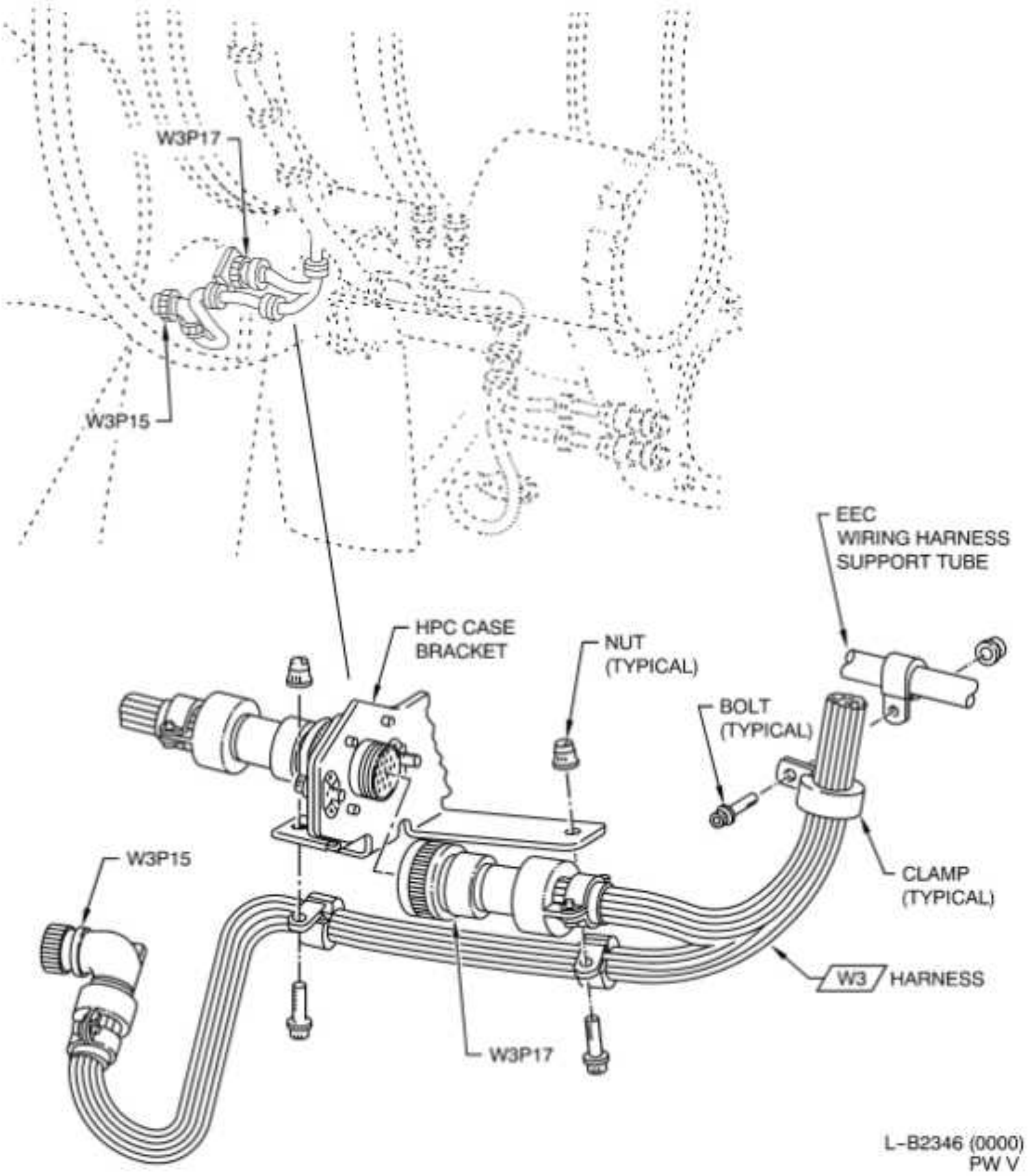
EEC Wiring Harness - W3 (Core Engine)
(Pre SB PW4ENG 75-106)
Figure 305 (Sheet 2)
(Task 72-00-34-050-018)


TUBE
(AA06)
TUBE
(AA30)
BRACKET ON
FLANGE J
(ADJACENT TO
AIR FILTER)
W3
HARNESS
BRACKET
ON
FLANGE J
TUBE
(AA19)
TUBE
(AA19)
BRACKET ON 2.95
BLEED VALVE
FOR ENGINES EQUIPPED WITH 2.95 BLEED
VALVE THERMOCOUPLES ONLY
L-B2345 (0000)
PW V

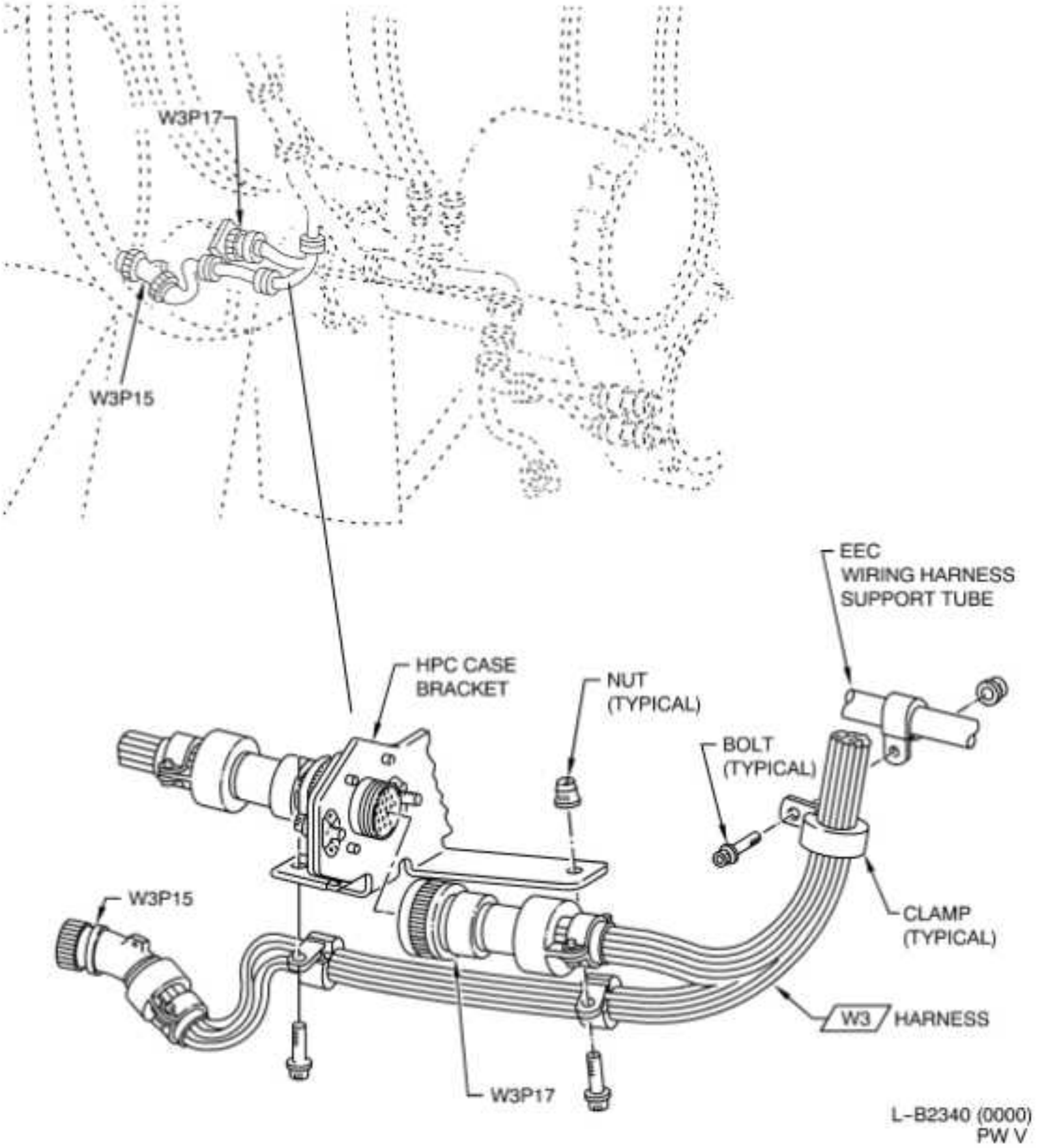
EEC Wiring Harness − W3 (Core Engine)
Figure 305 (Sheet 3)
(Task 72−00−34−050−018)


NUT
(TYPICAL)
W3
W5
HARNESS
BOLT
(TYPICAL)
FWD
GEARBOX
BRACKET
L-B2339 (0000)
PW V

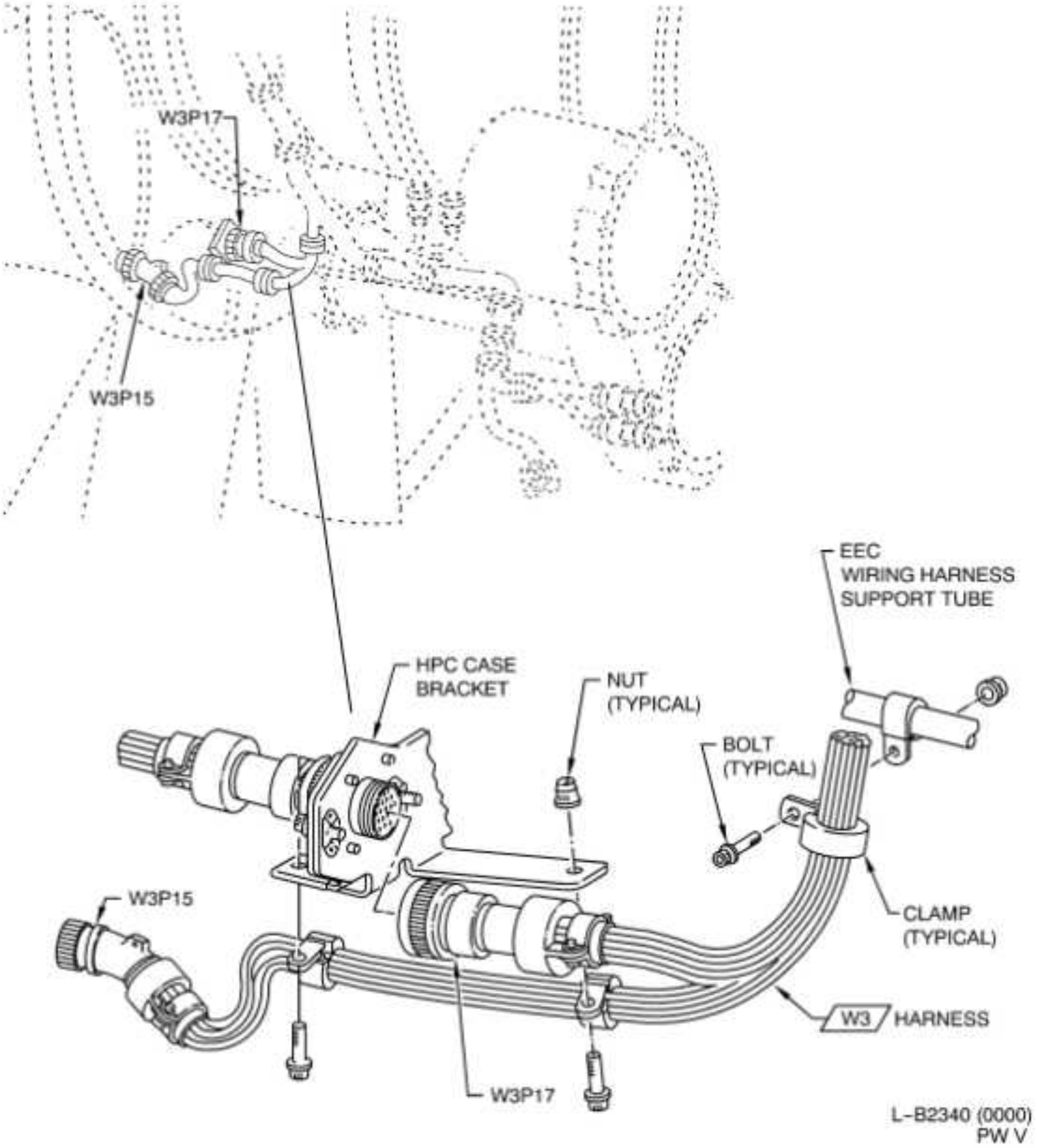
EEC Wiring Harness − W3 (Core Engine)
Figure 306
(Task 72−00−34−050−018)


W3P17
W3P15
EEC
WIRING HARNESS
SUPPORT TUBE
HPC CASE
BRACKET
NUT
(TYPICAL)
BOLT
(TYPICAL)
CLAMP
(TYPICAL)
W3P15
W3 HARNESS
W3P17
L−B2346 (0000)
PW V

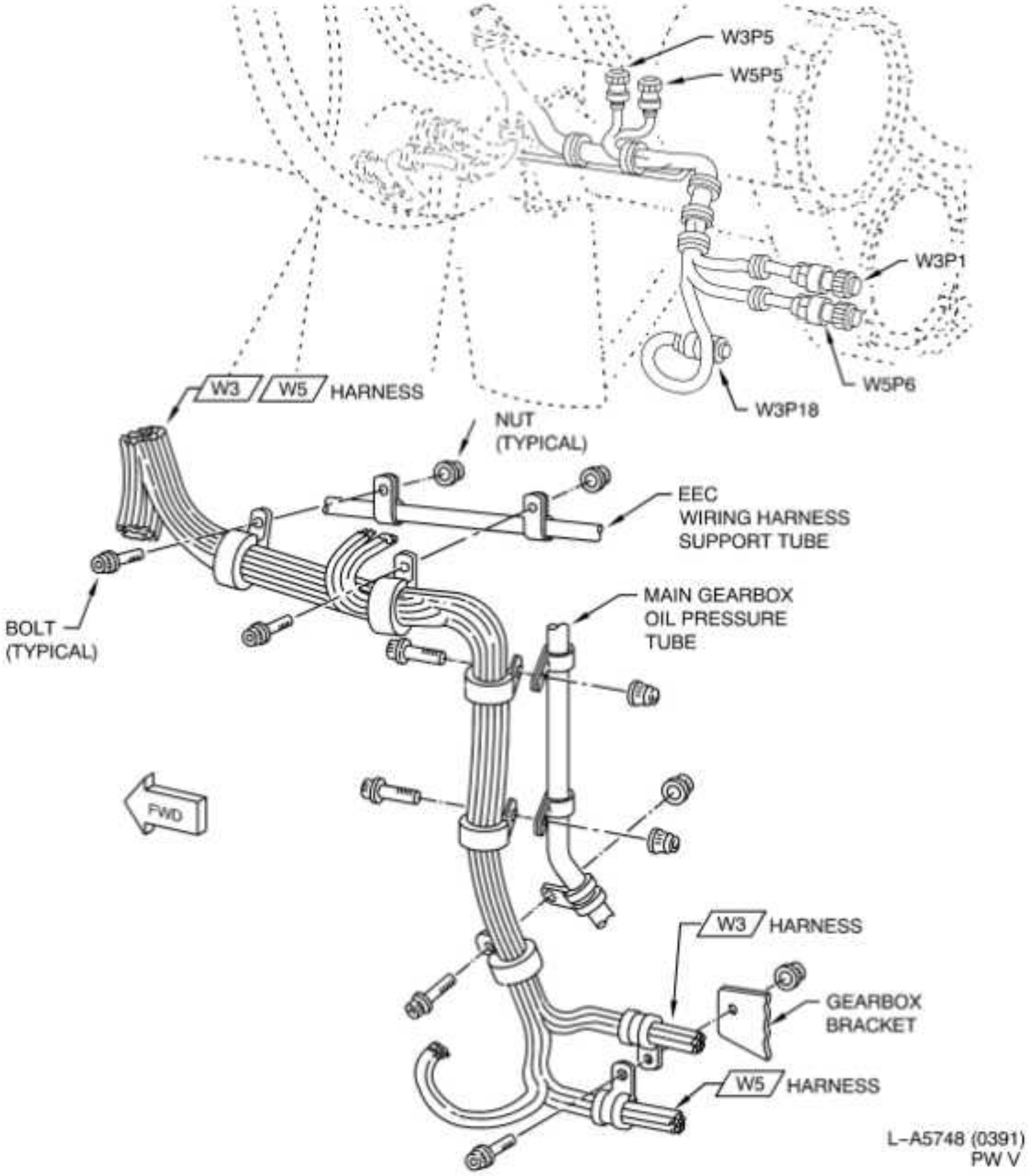
EEC Wiring Harness − W3 (Core Engine)
Support Brackets
(Pre SB PW4ENG 73−84)
Figure 307 (Sheet 1)
(Task 72−00−34−050−018)


W3P17
W3P15
EEC
WIRING HARNESS
SUPPORT TUBE
HPC CASE
BRACKET
NUT
(TYPICAL)
BOLT
(TYPICAL)
W3P15
CLAMP
(TYPICAL)
W3 HARNESS
W3P17
L-B2340 (0000)
PW V

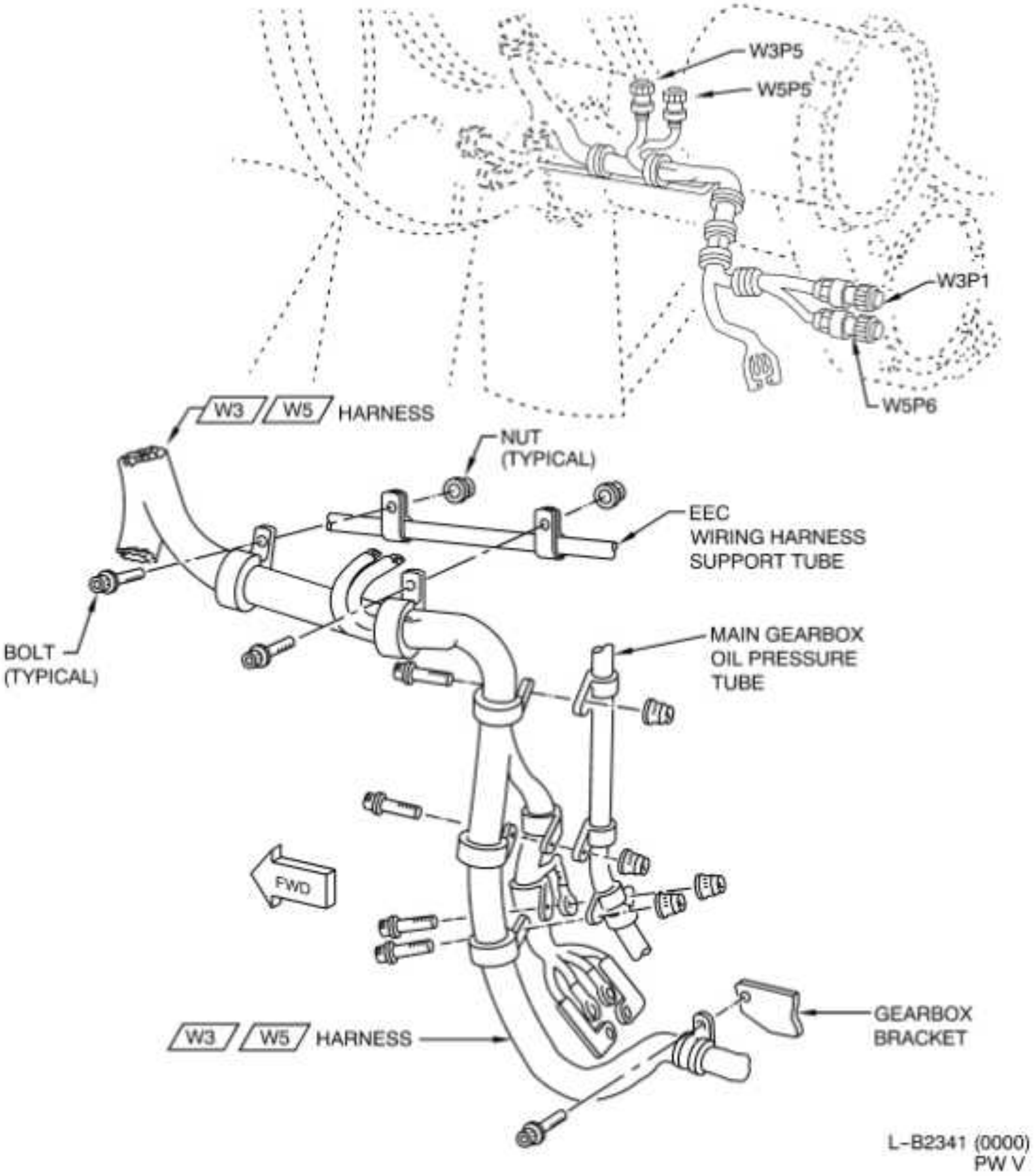
EEC Wiring Harness − W3 (Core Engine)
Support Brackets
(Post SB PW4ENG 73−84)
(For Engines With And Without CN After Engine Serial Number)
Figure 307 (Sheet 2)
(Task 72−00−34−050−018)


W3P17
W3P15
EEC
WIRING HARNESS
SUPPORT TUBE
HPC CASE
BRACKET
NUT
(TYPICAL)
BOLT
(TYPICAL)
W3P15
CLAMP
(TYPICAL)
W3
HARNESS
W3P17
L-B2340 (0000)
PW V

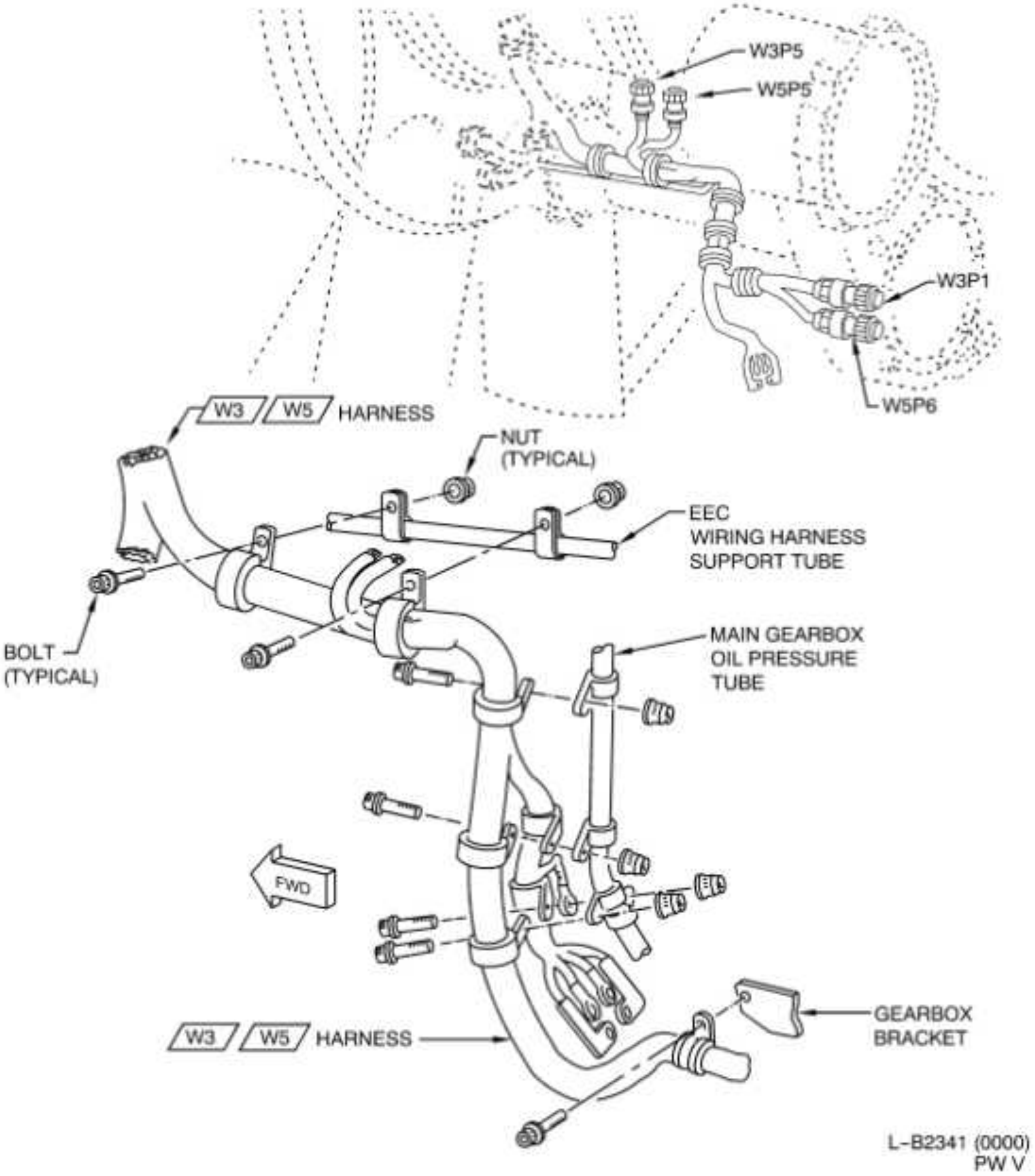
EEC Wiring Harness − W3 (Core Engine)
Support Brackets
(For −3 Engines As Built By P&W)
Figure 307 (Sheet 3)
(Task 72−00−34−050−018)


W3P5
W5P5
W3P1
W5P6
W3P18
W3 W5 HARNESS
NUT (TYPICAL)
EEC WIRING HARNESS SUPPORT TUBE
BOLT (TYPICAL)
MAIN GEARBOX OIL PRESSURE TUBE
FWD
W3 HARNESS
GEARBOX BRACKET
W5 HARNESS
L-A5748 (0391)
PW V

EEC Wiring Harness - W3 (Core Engine)
Support Brackets
(Pre SB PW4ENG 73-84)
Figure 308 (Sheet 1)
(Task 72-00-34-050-018)


W3P5
W5P5
W3P1
W5P6
W3 W5 HARNESS
NUT (TYPICAL)
EEC WIRING HARNESS SUPPORT TUBE
BOLT (TYPICAL)
MAIN GEARBOX OIL PRESSURE TUBE
FWD
W3 W5 HARNESS
GEARBOX BRACKET
L−B2341 (0000)
PW V

EEC Wiring Harness − W3 (Core Engine)
Support Brackets
(Post SB PW4ENG 73−84)
(For Engines With And Without CN After Engine Serial Number)
Figure 308 (Sheet 2)
(Task 72−00−34−050−018)


W3P5
W5P5
W3P1
W5P6
W3 / W5 HARNESS
NUT (TYPICAL)
EEC WIRING HARNESS SUPPORT TUBE
BOLT (TYPICAL)
MAIN GEARBOX OIL PRESSURE TUBE
FWD
W3 / W5 HARNESS
GEARBOX BRACKET
L−B2341 (0000)
PW V

EEC Wiring Harness − W3 (Core Engine)
Support Brackets
(For −3 Engines As Built By P&W)
Figure 308 (Sheet 3)
(Task 72−00−34−050−018)

Connector	Component	Location
W3P12	HPC Secondary Flow Control Valve, Turbine Cooling Air Valve Solenoid	Intermediate Case 10 O'Clock

NOTE: Use a PWA 85749 Electronic Harness Connector Torque Adapter to disconnect the W3P15 and W3P12 harness connectors.

Connector	Component	Location
W3P1	EEC Alternator (Upper Connector)	Bottom of Gearbox 7 O'Clock

NOTE: Use a PWA 85749 Electronic Harness Connector Torque Adapter to disconnect the W3P1 harness connector.

Connector	Component	Location
W3P18	EEC Oil Temperature Thermocouple Probe	Front of Gearbox 7 O'Clock

(3) Remove the bolts, nuts, and clamps that attach the W3 harness to the brackets, support tubes, and thermocouples on the HPC case and the gearbox. See Figures 303 through 308.

(4) Remove the applicable harness ties and carefully remove the W3 harness.

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-19

Task 72-00-34-050-019:

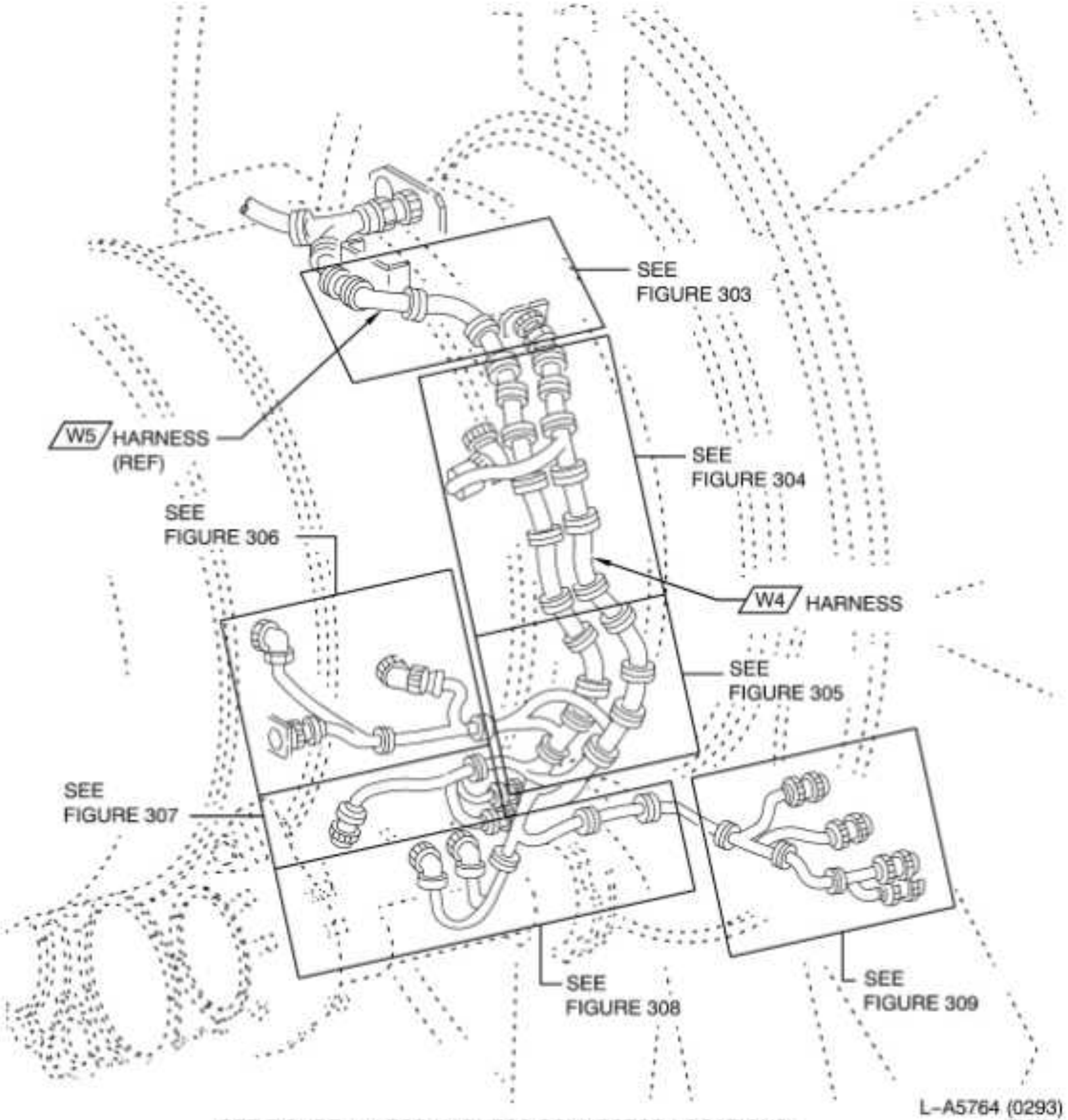
1. Remove EEC Wiring Harness - W4 (Core Engine)
    - A. General
        - (1) To remove the EEC wiring harness - W3, see Removal-18 (Task 72-00-34-050-018).
        - (2) To remove the EEC wiring harness - W5, see Removal-20 (Task 72-00-34-050-020).
    - B. Equipment And Materials Required

      Special Tools:
      PWA 85749 Torque Adapter, Electronic Harness Connector

    - C. Procedure
      See Figures 301 through 309.
        - (1) FOR THESE MODELS: 4152, 4156A, 4158
          (Pre SB PW4ENG 72-572 Or Pre SB PW4ENG 75-106)
            - (a) FOR THESE MODELS: 4152, 4156A, 4158
              Disconnect the W4P10 harness connector from the HPC secondary flow control valve located at the 3:30 o'clock position. Install a protective closure on the harness connector and the mating flow control valve position switch receptacle. See Figure 302 (Sheet 1).
            - (b) FOR THESE MODELS: 4152, 4156A, 4158
              Disconnect the W4P21 harness connector from the turbine vane and blade cooling air valve located at the 3 o'clock position. Install a protective closure on the harness connector and the mating cooling air valve position switch receptacle. See Figure 302 (Sheet 1).

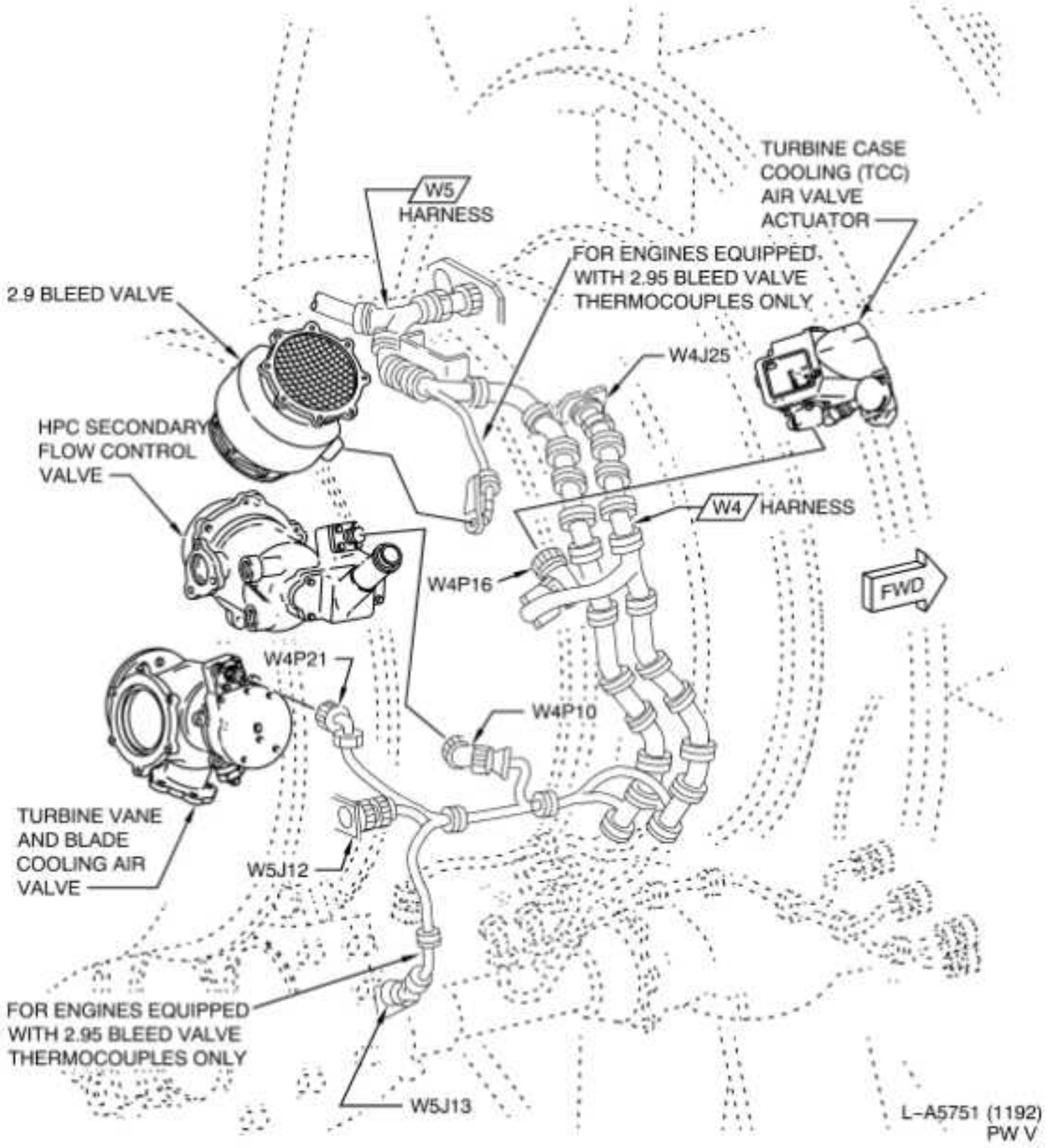
              NOTE: FOR THESE MODELS: 4152, 4156A, 4158
              SB PW4ENG 72-572 Or SB PW4ENG 75-106 removes connectors W4P10 and W4P21 from the W4 wiring harness. See Figure 302 (Sheet 2).

        - (2) Disconnect the following harness connectors from the components given below. Install a protective closure on each harness connector and mating receptacle. See Figure 302.

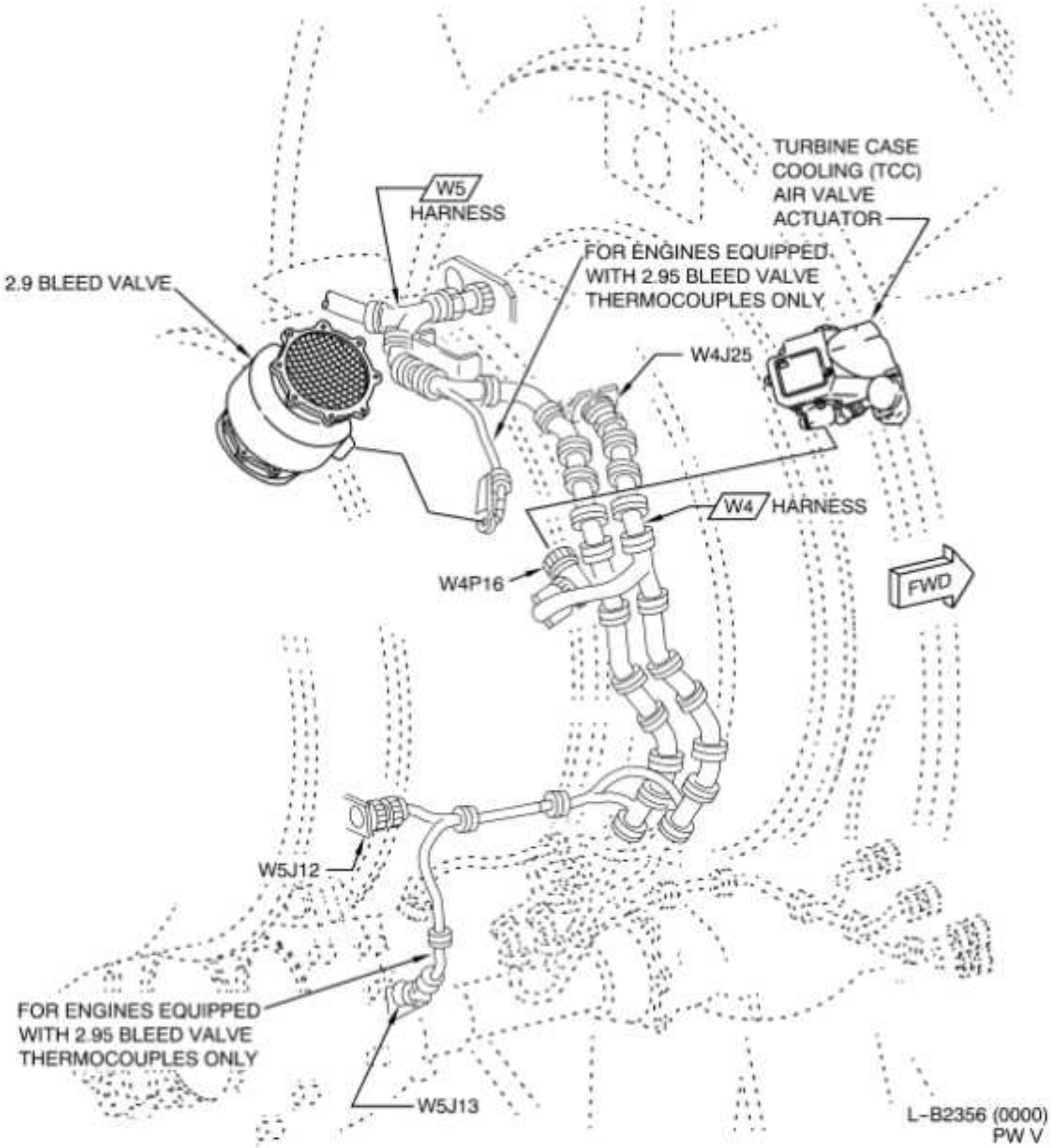

SEE FIGURE 303
W5 HARNESS (REF)
SEE FIGURE 304
SEE FIGURE 306
W4 HARNESS
SEE FIGURE 305
SEE FIGURE 307
SEE FIGURE 308
SEE FIGURE 309
L−A5764 (0293)
PW V

(SEE FIGURE 302 FOR HARNESS CONNECTOR LOCATIONS)

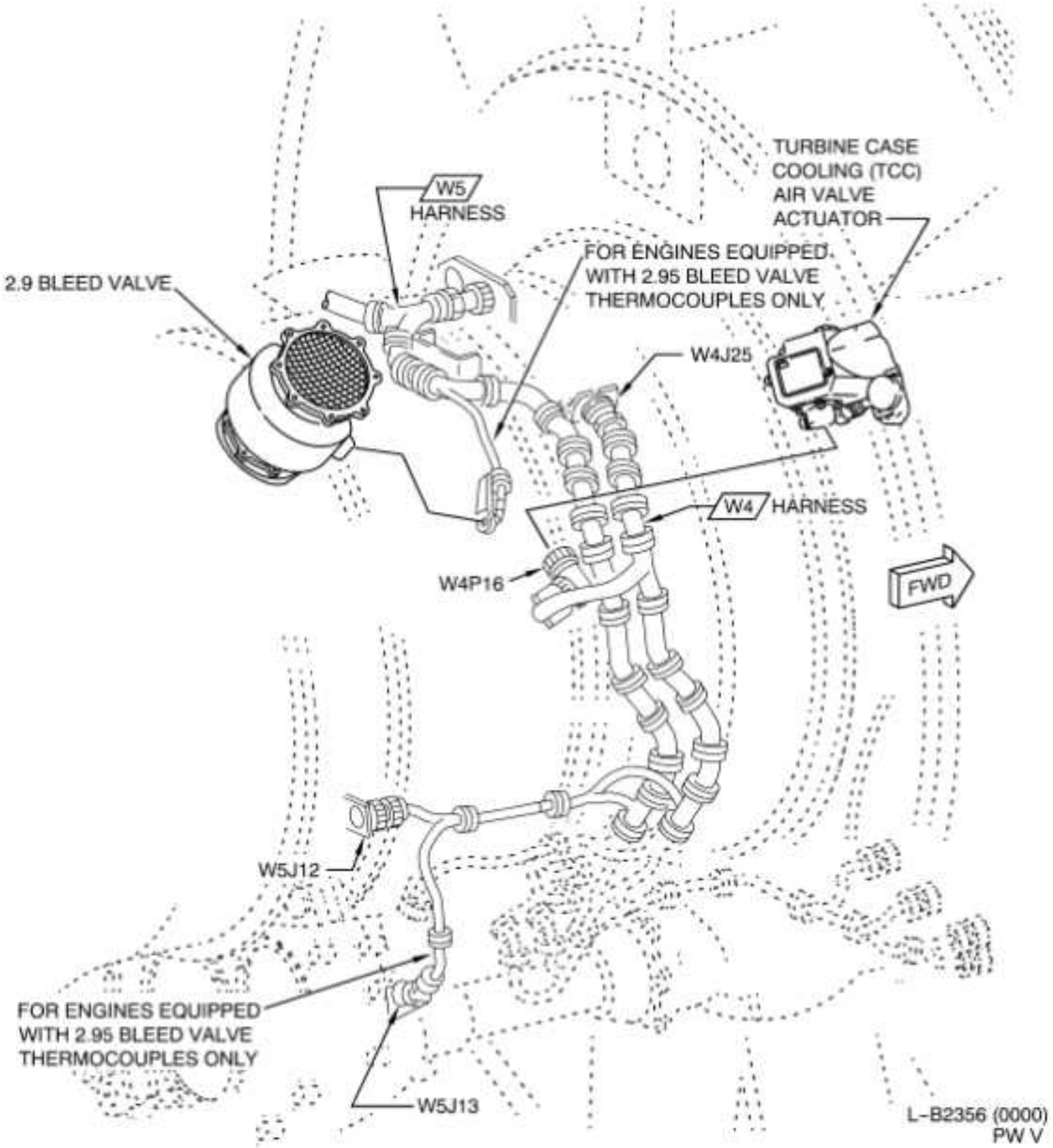
EEC Wiring Harness − W4 (Core Engine)
Figure 301
(Task 72−00−34−050−019)


TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
W5 HARNESS
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
2.9 BLEED VALVE
W4J25
HPC SECONDARY FLOW CONTROL VALVE
W4 HARNESS
W4P16
FWD
W4P21
W4P10
TURBINE VANE AND BLADE COOLING AIR VALVE
W5J12
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5J13
L−A5751 (1192)
PW V

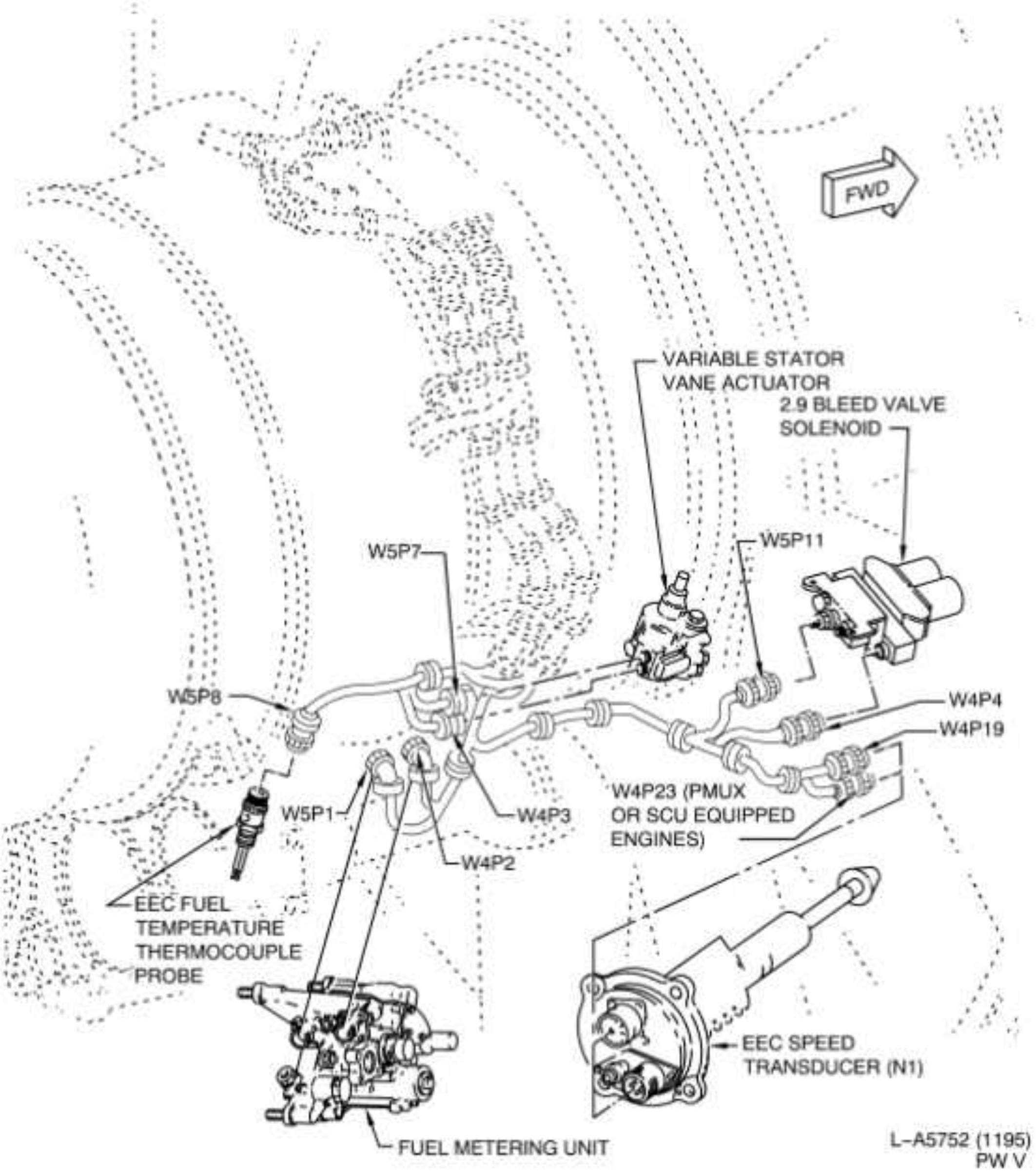
EEC Wiring Harness − W4 (Core Engine)
(Pre SB PW4ENG 75−106)
Figure 302 (Sheet 1)
(Task 72−00−34−450−018)


TURBINE CASE
COOLING (TCC)
AIR VALVE
ACTUATOR
W5
HARNESS
FOR ENGINES EQUIPPED
WITH 2.95 BLEED VALVE
THERMOCOUPLES ONLY
2.9 BLEED VALVE
W4J25
W4
HARNESS
W4P16
FWD
W5J12
FOR ENGINES EQUIPPED
WITH 2.95 BLEED VALVE
THERMOCOUPLES ONLY
W5J13
L-B2356 (0000)
PW V

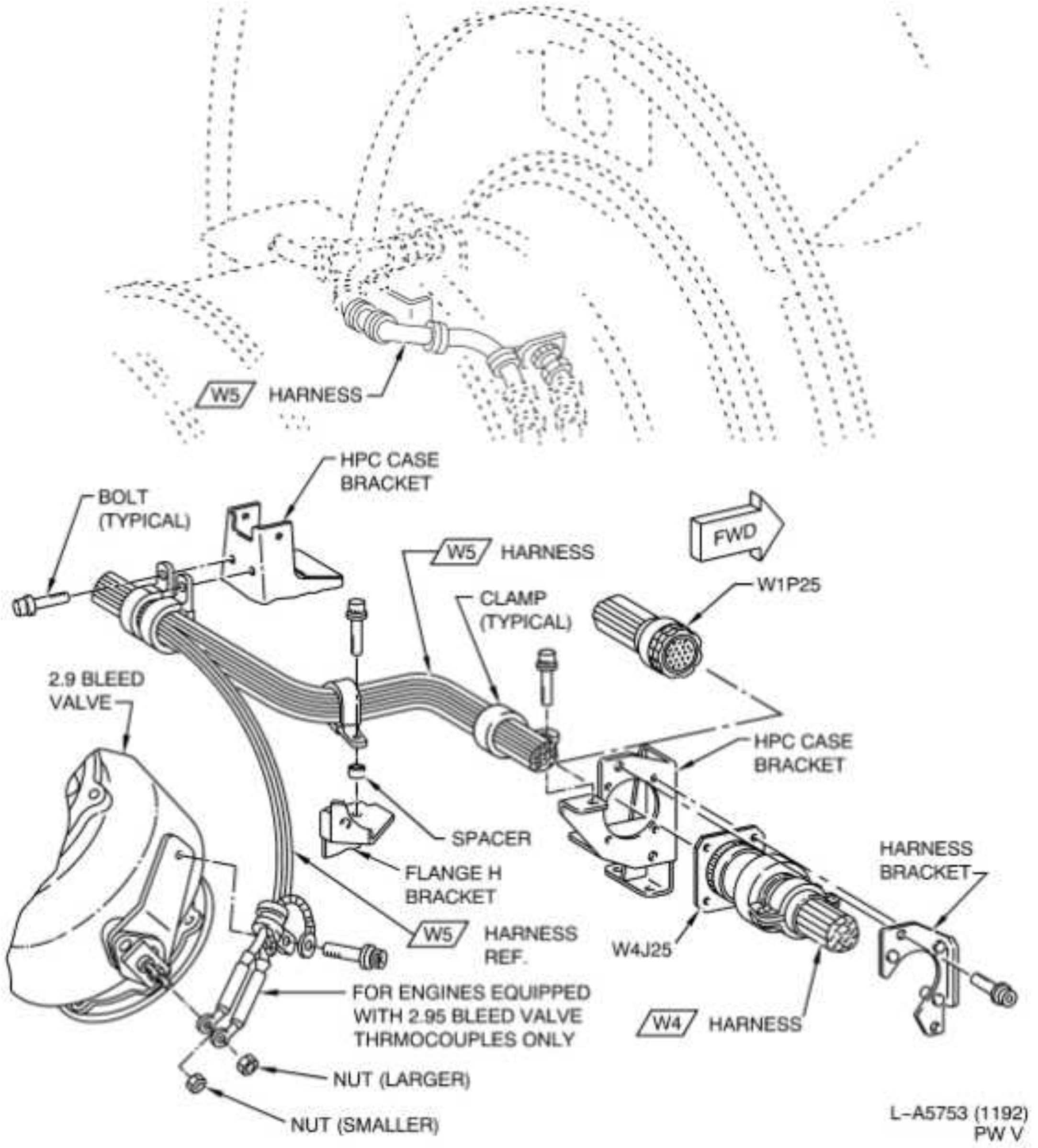
EEC Wiring Harness − W4 (Core Engine)
(Post SB PW4ENG 72−572 Or SB PW4ENG 75−106)
(For −3 Engines With CN After Engine Serial Number)
Figure 302 (Sheet 2)
(Task 72−00−34−450−018)


TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
W5 HARNESS
2.9 BLEED VALVE
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W4J25
W4 HARNESS
W4P16
FWD
W5J12
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5J13
L-B2356 (0000)
PW V

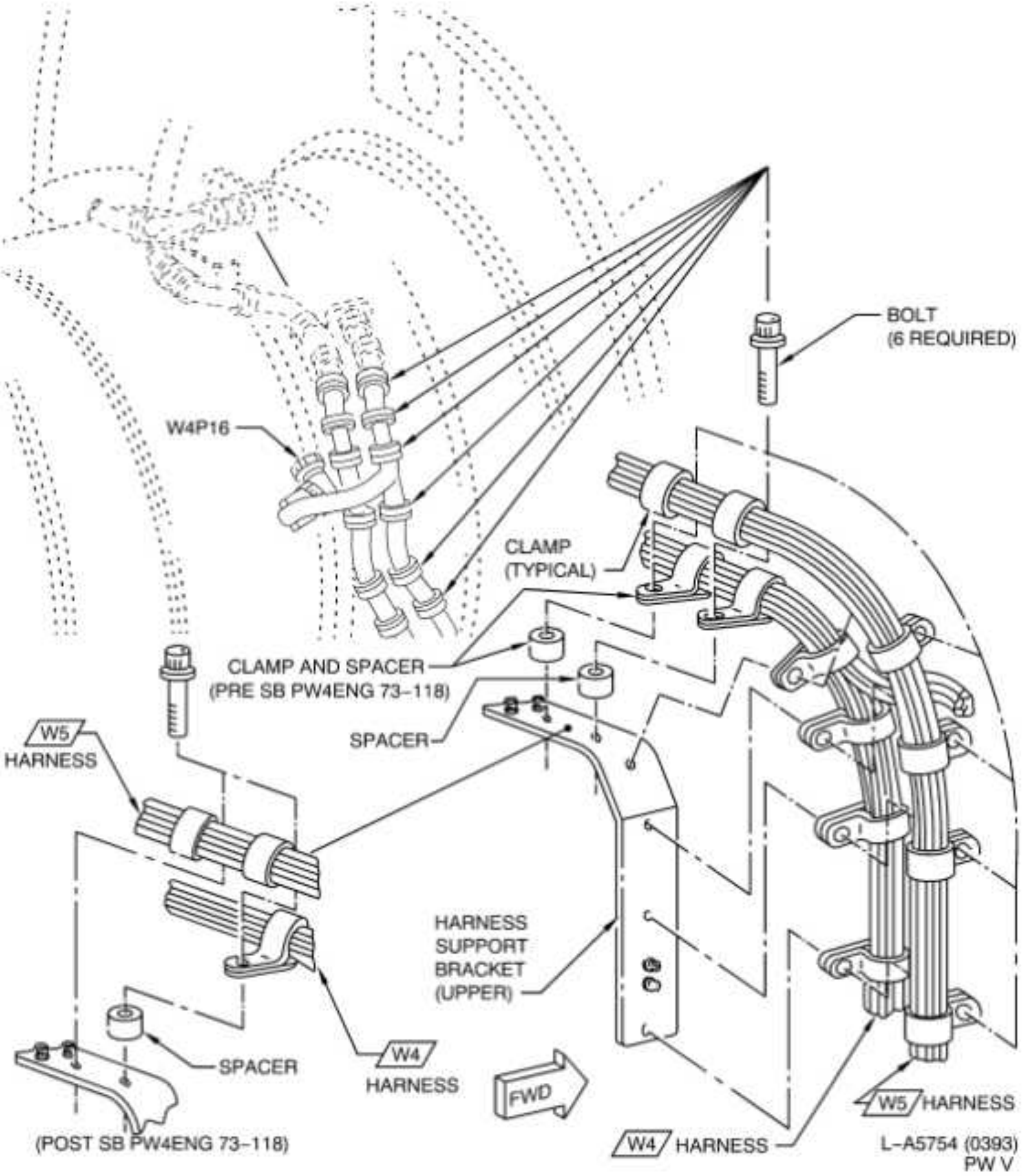
EEC Wiring Harness − W4 (Core Engine)
(For −3 Engines As Built By Pratt & Whitney)
Figure 302 (Sheet 3)
(Task 72−00−34−450−018)


FWD
VARIABLE STATOR VANE ACTUATOR
2.9 BLEED VALVE SOLENOID
W5P11
W5P7
W5P8
W4P4
W4P19
W5P1
W4P3
W4P23 (PMUX OR SCU EQUIPPED ENGINES)
W4P2
EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
EEC SPEED TRANSDUCER (N1)
FUEL METERING UNIT
L−A5752 (1195)
PW V

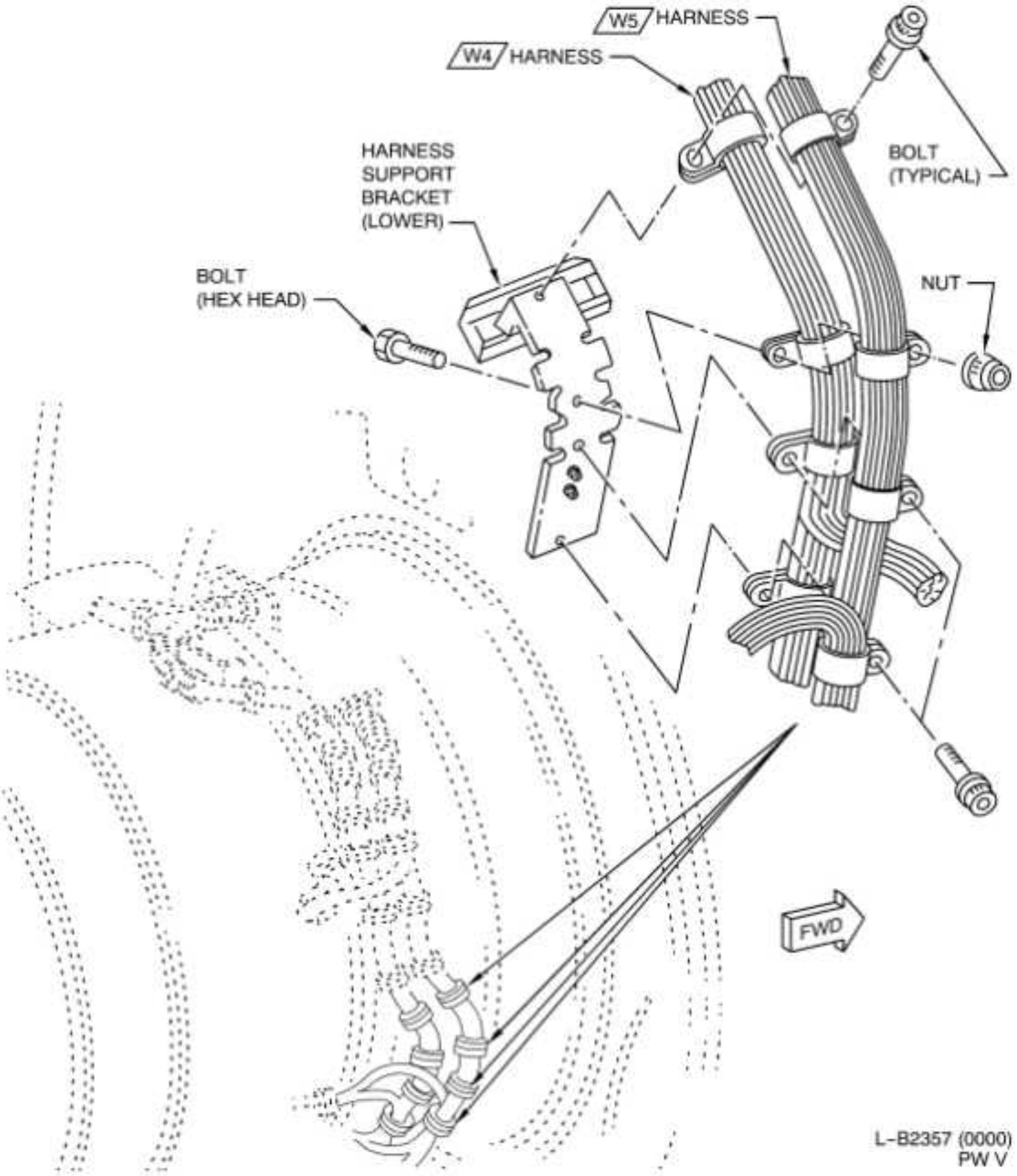
EEC Wiring Harness − W4 (Core Engine)
Figure 302 (Sheet 4)
(Task 72−00−34−450−018)


W5 HARNESS
HPC CASE BRACKET
BOLT (TYPICAL)
FWD
W5 HARNESS
CLAMP (TYPICAL)
W1P25
2.9 BLEED VALVE
HPC CASE BRACKET
SPACER
FLANGE H BRACKET
HARNESS BRACKET
W5 HARNESS REF.
W4J25
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THRMOCOUPLES ONLY
W4 HARNESS
NUT (LARGER)
NUT (SMALLER)
L−A5753 (1192)
PW V

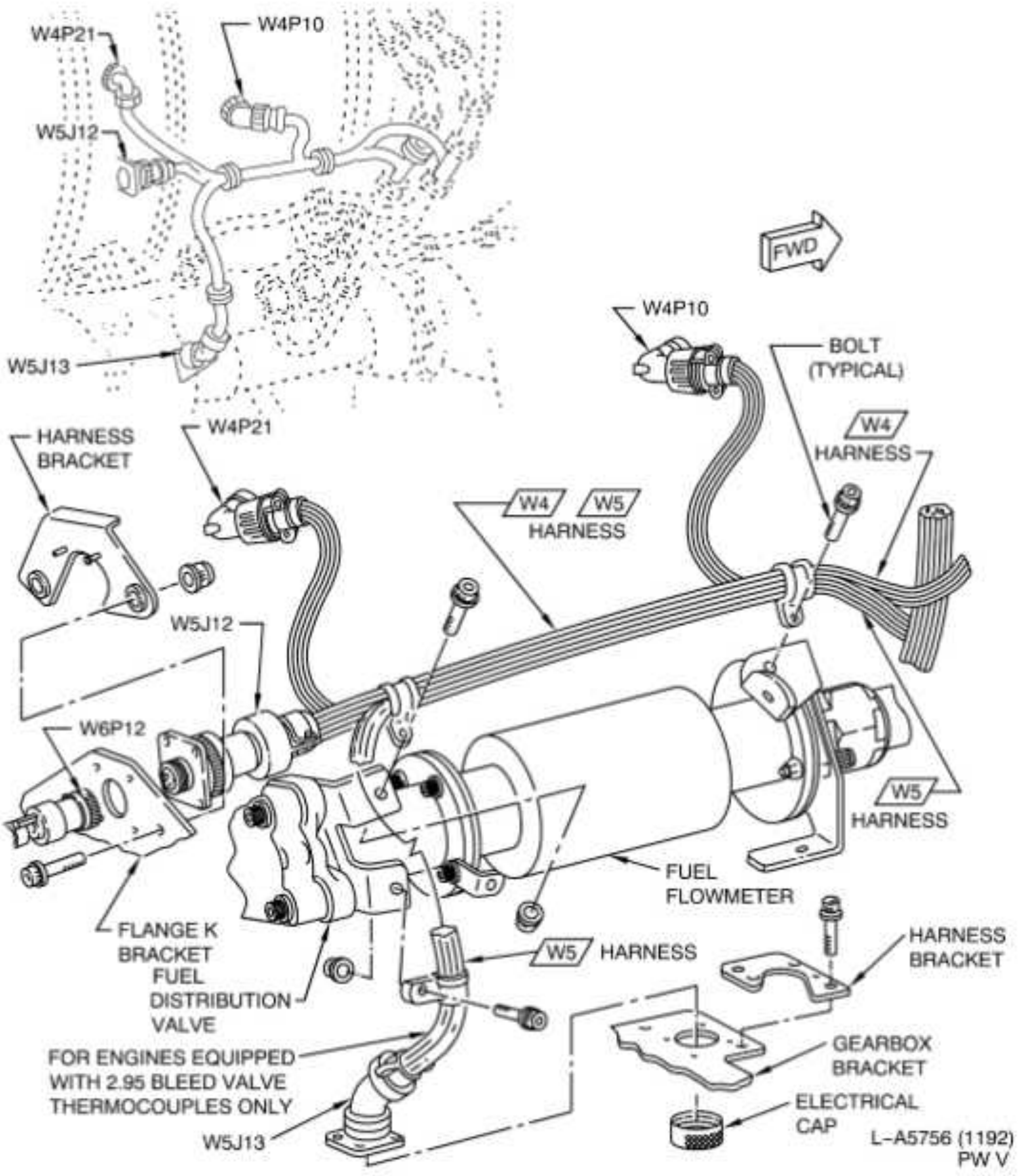
EEC Wiring Harness − W4 (Core Engine)
Figure 303
(Task 72−00−34−450−018)


BOLT
(6 REQUIRED)
W4P16
CLAMP
(TYPICAL)
CLAMP AND SPACER
(PRE SB PW4ENG 73−118)
SPACER
W5
HARNESS
HARNESS
SUPPORT
BRACKET
(UPPER)
SPACER
W4
HARNESS
FWD
(POST SB PW4ENG 73−118)
W4 HARNESS
W5 HARNESS
L−A5754 (0393)
PW V

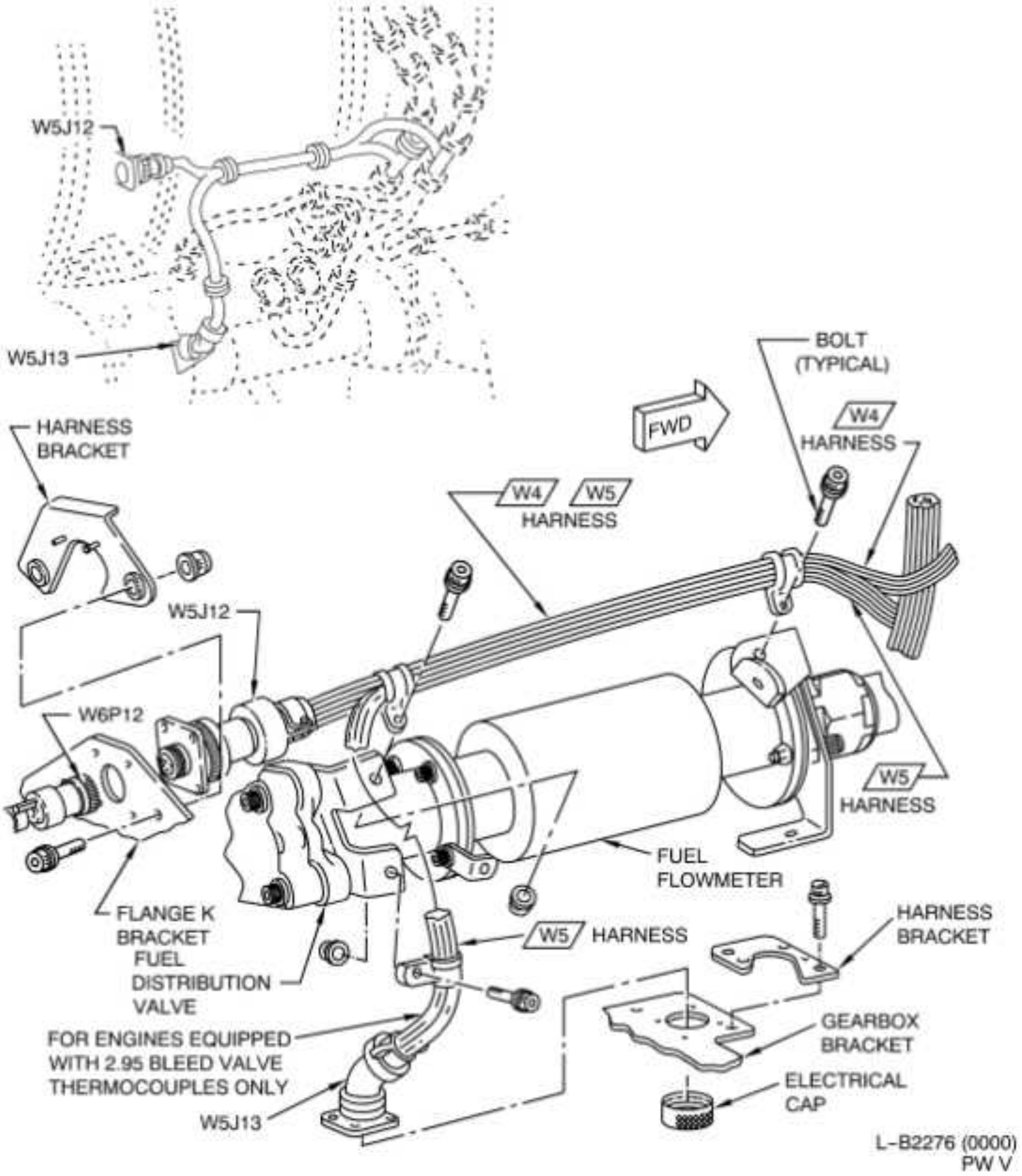
EEC Wiring Harness − W4 (Core Engine)
Figure 304
(Task 72−00−34−450−018)


W5 HARNESS
W4 HARNESS
HARNESS SUPPORT BRACKET (LOWER)
BOLT (TYPICAL)
BOLT (HEX HEAD)
NUT
FWD
L-B2357 (0000)
PW V

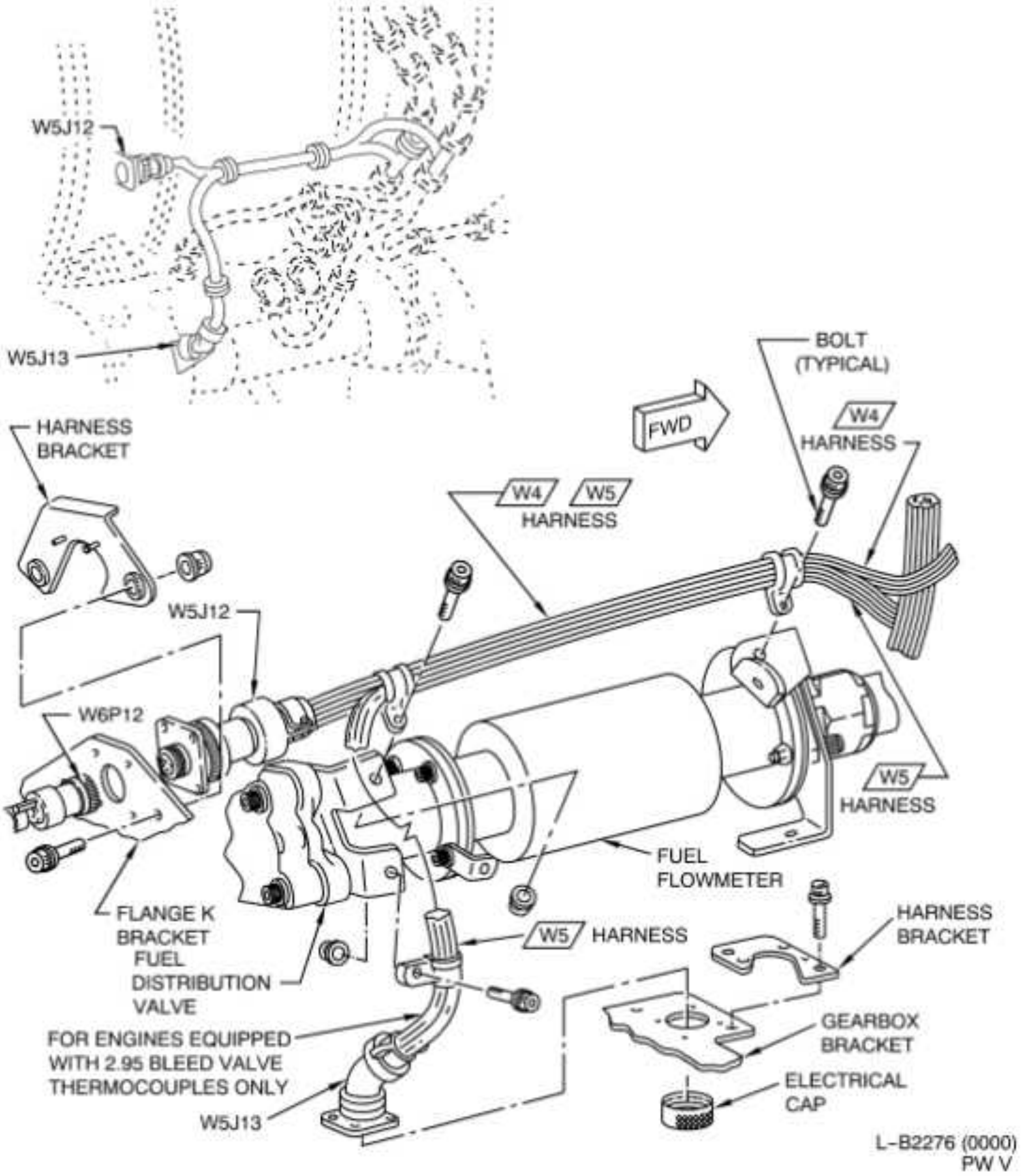
EEC Wiring Harness - W4 (Core Engine)
Figure 305
(Task 72-00-34-450-018)


W4P21
W4P10
W5J12
W5J13
FWD
W4P10
BOLT (TYPICAL)
W4 HARNESS
HARNESS BRACKET
W4P21
W4 W5 HARNESS
W5J12
W6P12
W5 HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
GEARBOX BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5J13
ELECTRICAL CAP
L−A5756 (1192)
PW V

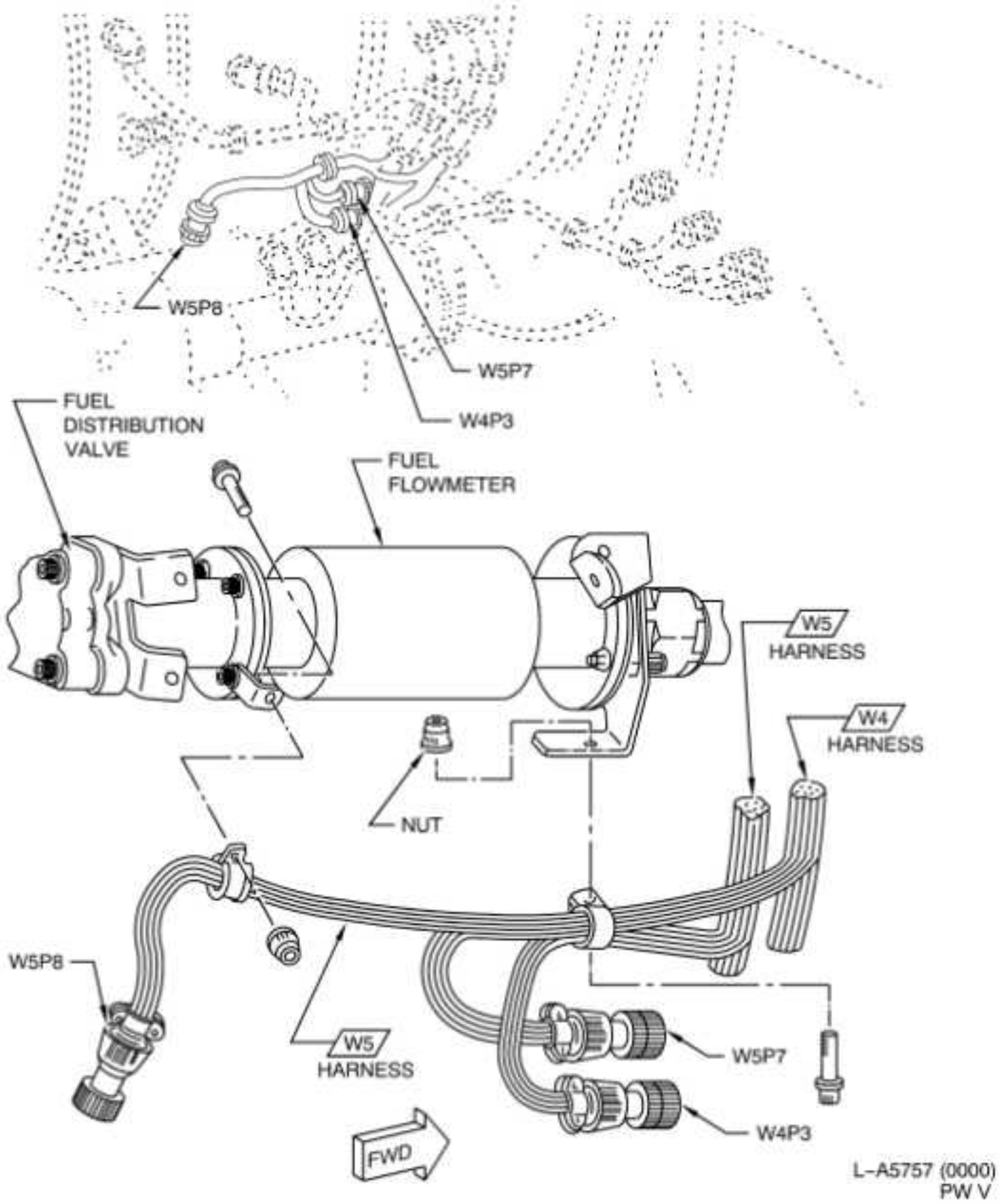
EEC Wiring Harness − W4 (Core Engine)
(Pre SB PW4ENG 75−106)
Figure 306 (Sheet 1)
(Task 72−00−34−450−018)


W5J12
W5J13
BOLT (TYPICAL)
FWD
W4 HARNESS
HARNESS BRACKET
W4 W5 HARNESS
W5J12
W6P12
W5 HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
GEARBOX BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
ELECTRICAL CAP
W5J13
L-B2276 (0000)
PW V

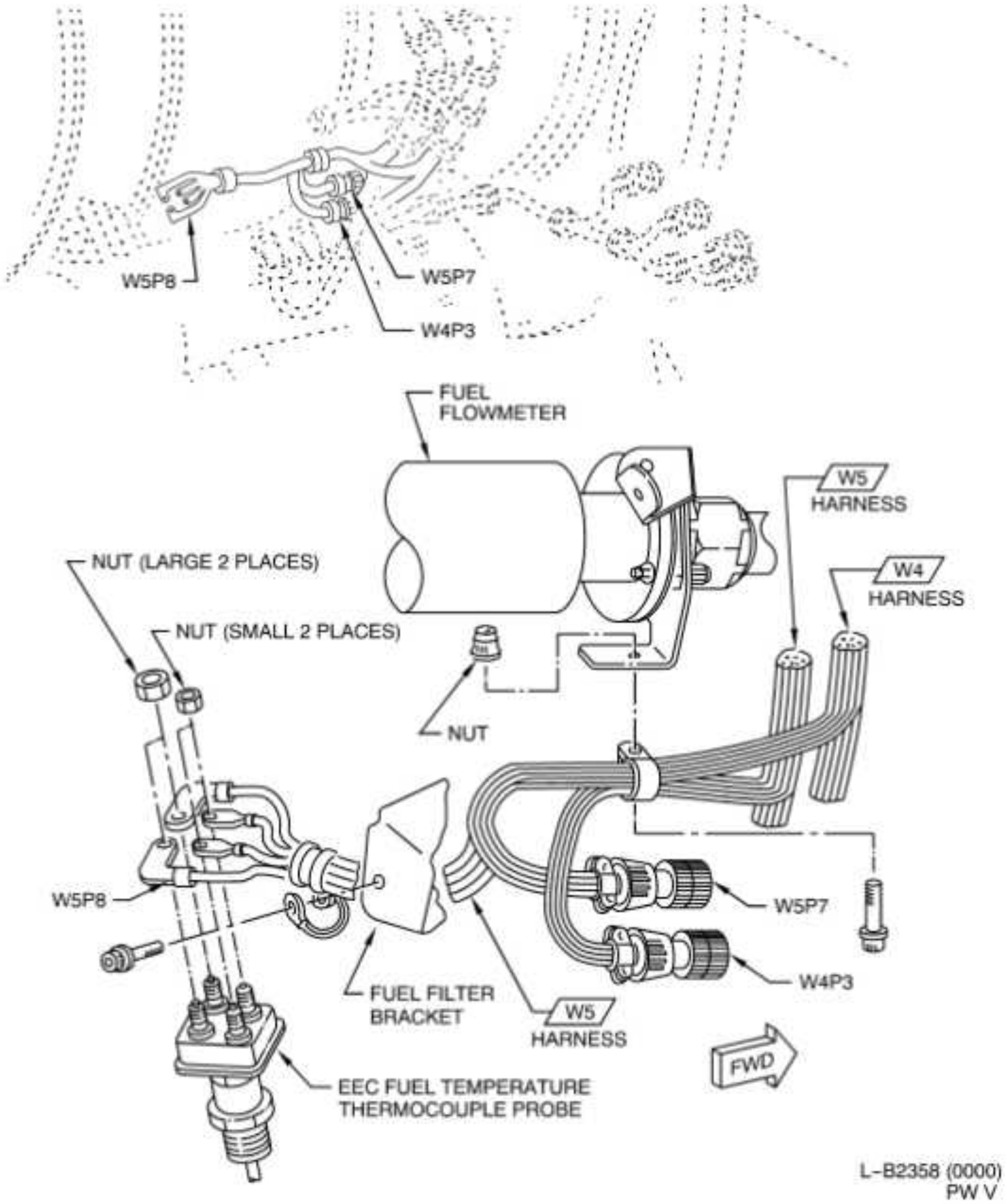
EEC Wiring Harness − W4 (Core Engine)
(Post SB PW4ENG 72−572 Or SB PW4ENG 75−106)
(For −3 Engines With CN After Engine Serial Number)
Figure 306 (Sheet 2)
(Task 72−00−34−450−018)


W5J12
W5J13
BOLT
(TYPICAL)
FWD
W4
HARNESS
HARNESS
BRACKET
W4
W5
HARNESS
W5J12
W6P12
W5
HARNESS
FUEL
FLOWMETER
FLANGE K
BRACKET
FUEL
DISTRIBUTION
VALVE
W5
HARNESS
HARNESS
BRACKET
FOR ENGINES EQUIPPED
WITH 2.95 BLEED VALVE
THERMOCOUPLES ONLY
W5J13
GEARBOX
BRACKET
ELECTRICAL
CAP
L–B2276 (0000)
PW V

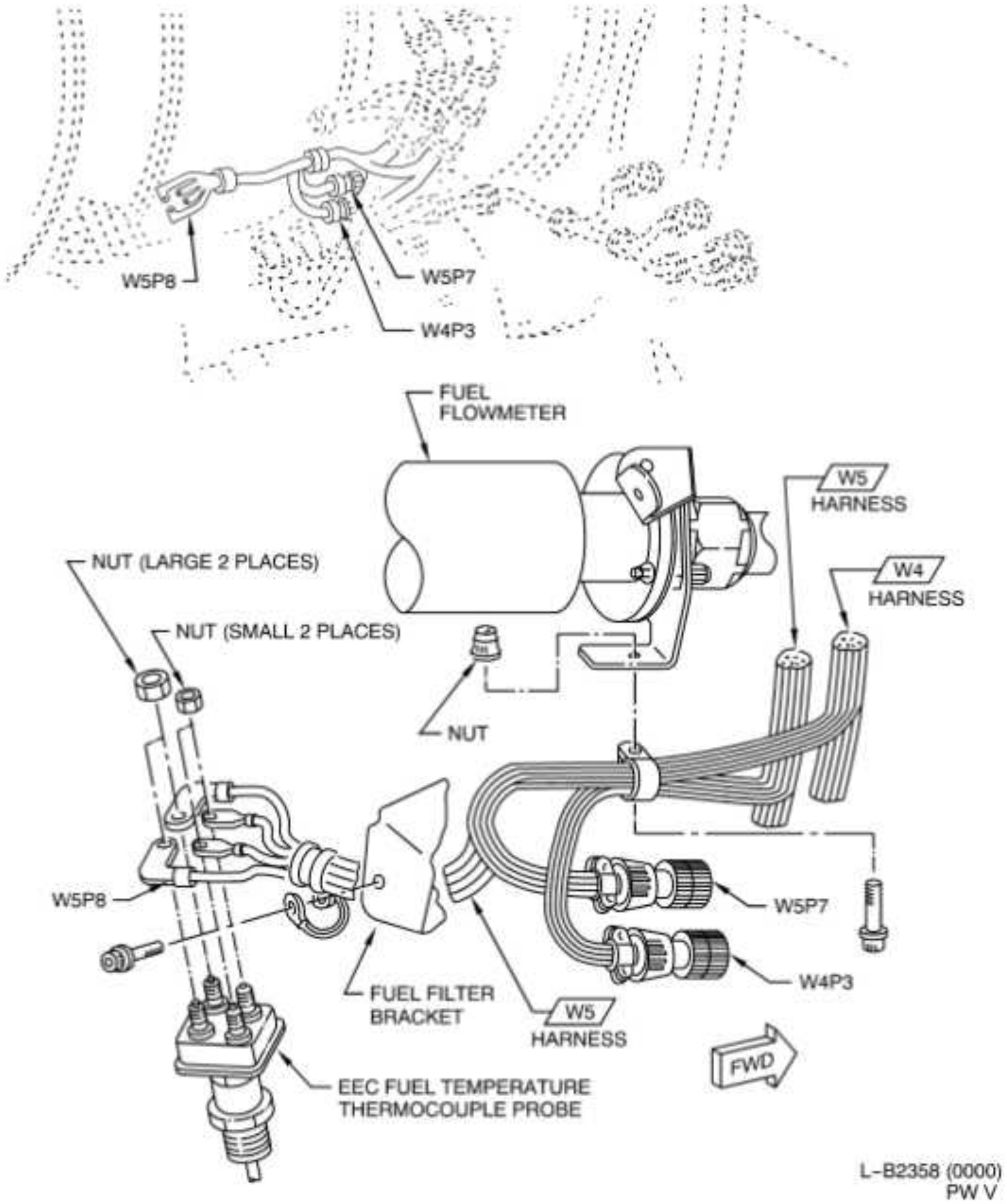
EEC Wiring Harness – W4 (Core Engine)
(For –3 Engines As Built By Pratt & Whitney)
Figure 306 (Sheet 3)
(Task 72–00–34–450–018)


W5P8
W5P7
W4P3
FUEL DISTRIBUTION VALVE
FUEL FLOWMETER
W5 HARNESS
W4 HARNESS
NUT
W5P8
W5 HARNESS
W5P7
W4P3
FWD
L−A5757 (0000)
PW V

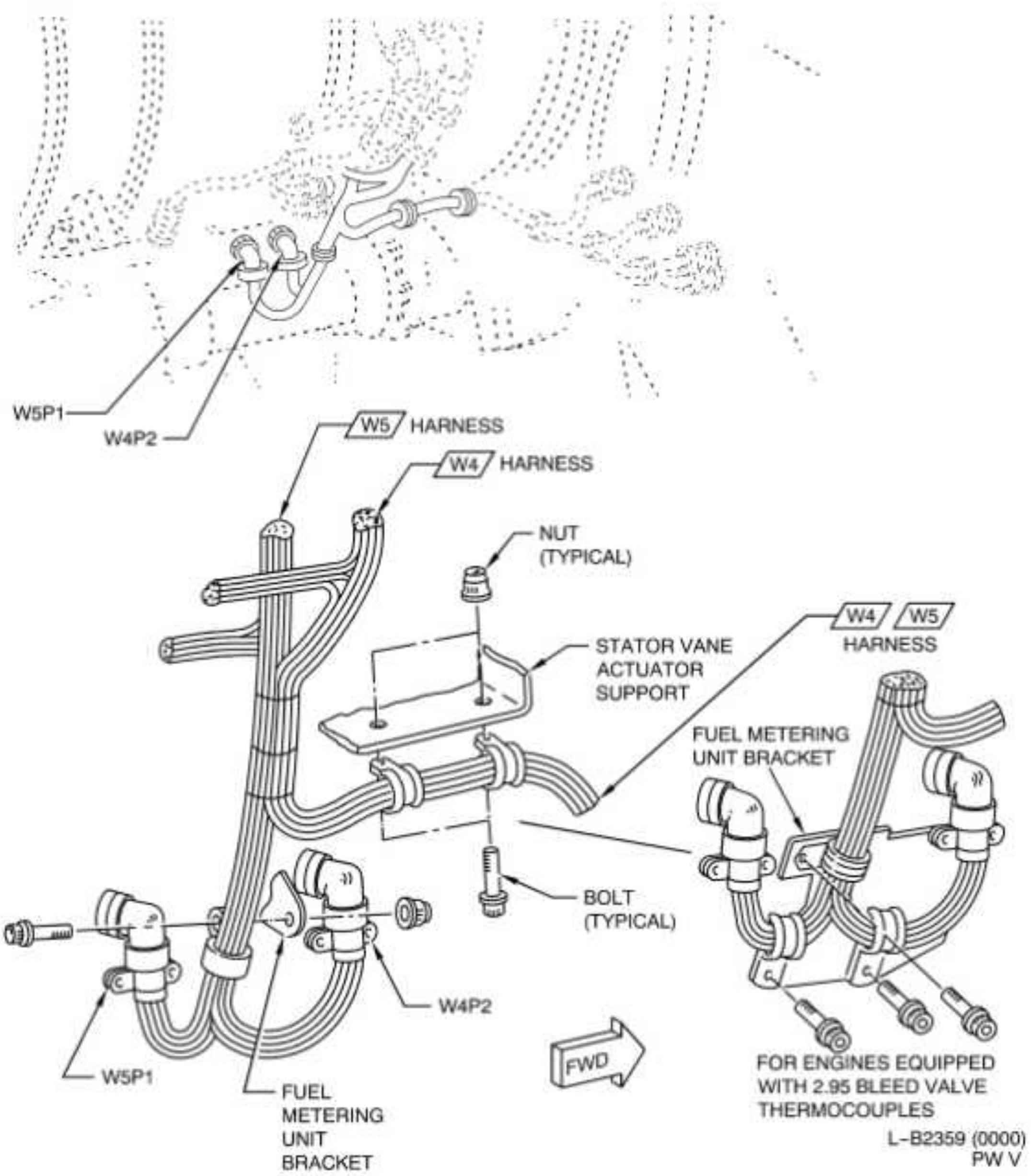
EEC Wiring Harness − W4 (Core Engine)
(Pre SB PW4ENG 73−84)
Figure 307 (Sheet 1)
(Task 72−00−34−450−018)


W5P8
W5P7
W4P3
FUEL FLOWMETER
W5 HARNESS
W4 HARNESS
NUT (LARGE 2 PLACES)
NUT (SMALL 2 PLACES)
NUT
W5P8
W5P7
W4P3
FUEL FILTER BRACKET
W5 HARNESS
EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
FWD
L-B2358 (0000)
PW V

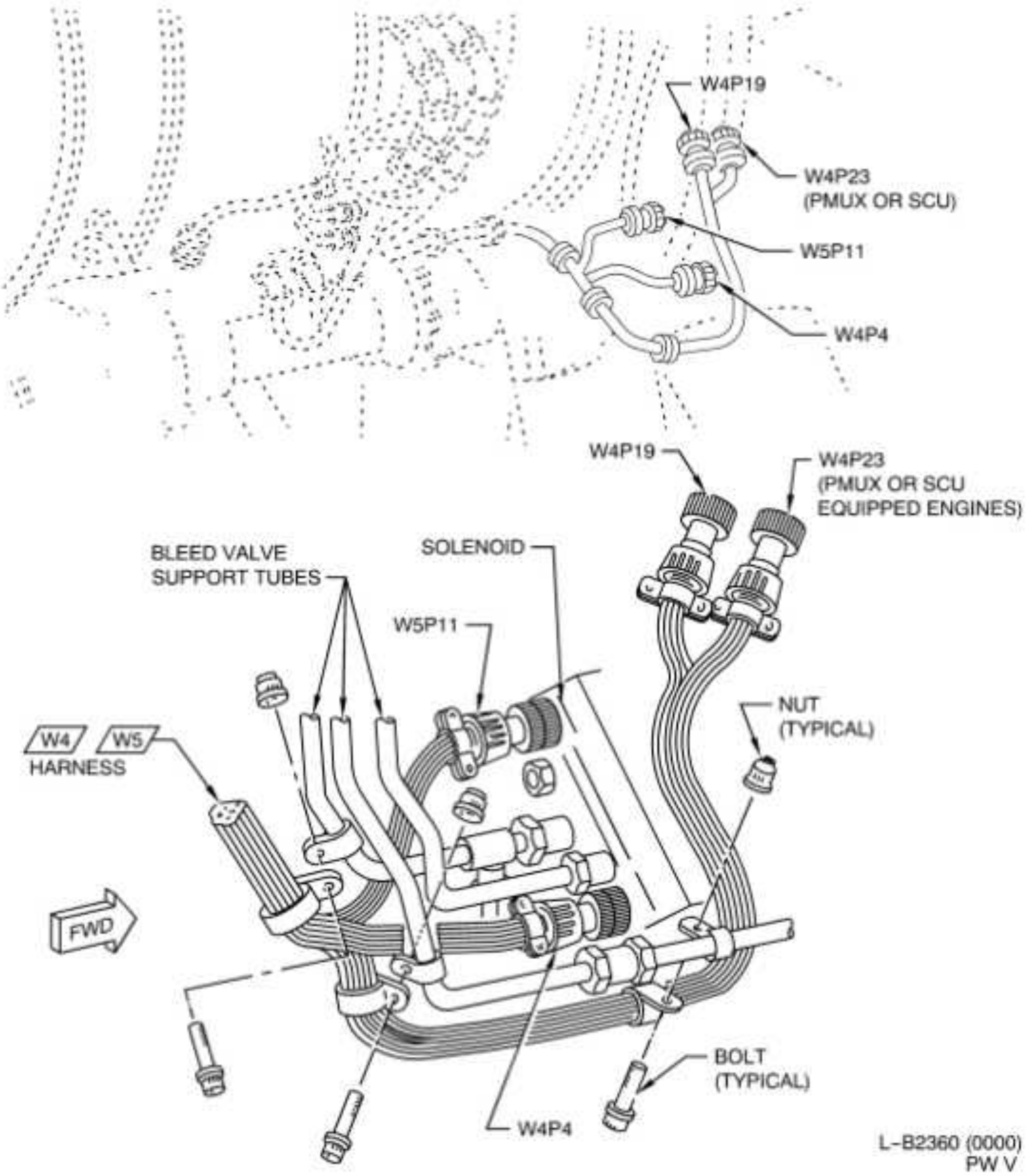
EEC Wiring Harness − W4 (Core Engine)
(Post SB PW4ENG 73−84)
(Post SB PW4ENG 72−572 Or SB PW4ENG 75−106)
(For −3 Engines With And Without CN After Engine Serial Number)
Figure 307 (Sheet 2)
(Task 72−00−34−450−018)


W5P8
W5P7
W4P3
FUEL FLOWMETER
W5 HARNESS
W4 HARNESS
NUT (LARGE 2 PLACES)
NUT (SMALL 2 PLACES)
NUT
W5P8
W5P7
W4P3
FUEL FILTER BRACKET
W5 HARNESS
FWD
EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
L-B2358 (0000)
PW V

EEC Wiring Harness − W4 (Core Engine)
(For −3 Engines As Built By Pratt & Whitney)
Figure 307 (Sheet 3)
(Task 72−00−34−450−018)


W5P1
W4P2
W5 HARNESS
W4 HARNESS
NUT (TYPICAL)
W4 W5 HARNESS
STATOR VANE ACTUATOR SUPPORT
FUEL METERING UNIT BRACKET
BOLT (TYPICAL)
W4P2
W5P1
FUEL METERING UNIT BRACKET
FWD
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES
L-B2359 (0000)
PW V

EEC Wiring Harness − W4 (Core Engine)
Figure 308
(Task 72−00−34−450−018)


W4P19
W4P23
(PMUX OR SCU)
W5P11
W4P4
W4P19
W4P23
(PMUX OR SCU
EQUIPPED ENGINES)
BLEED VALVE
SUPPORT TUBES
SOLENOID
W5P11
W4
W5
HARNESS
NUT
(TYPICAL)
FWD
BOLT
(TYPICAL)
W4P4
L-B2360 (0000)
PW V

EEC Wiring Harness - W4 (Core Engine)
Figure 309
(Task 72-00-34-450-018)

Connector	Component	Location
W4P16	Turbine Case Cooling (TCC) Air Valve Actuator	2 O'Clock
W4P2	Fuel Metering Unit (Forward Connector)	Front Of Fuel Pump 5 O'Clock
W4P3	Variable Stator Vane Actuator (Lower Connector)	4 O'Clock
W4P4	Ninth Stage Start/Stability (2.9) Bleed Valve Solenoid (Outboard Connector)	Intermediate Case 5 O'Clock
W4P19	EEC Speed Transducer (N1)	Intermediate Case 4:30 O'Clock
W4P23	EEC Speed Transducer (N1) (Engines Incorporating PMUX Or SCU)	Intermediate Case 4:30 O'Clock
W1P25	Harness Connector To W4J25 Harness Connector	1 O'Clock

(3) Remove the bolts, nuts, and clamps that attach the W4 harness to the brackets and tubes on the HPC case. See Figures 303 through 309.

(4) Remove the applicable harness ties and carefully remove the W4 harness.

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−20

Task 72−00−34−020−020:

1. Remove The Flange E Brackets And Hardware

A. Equipment And Materials Necessary − None

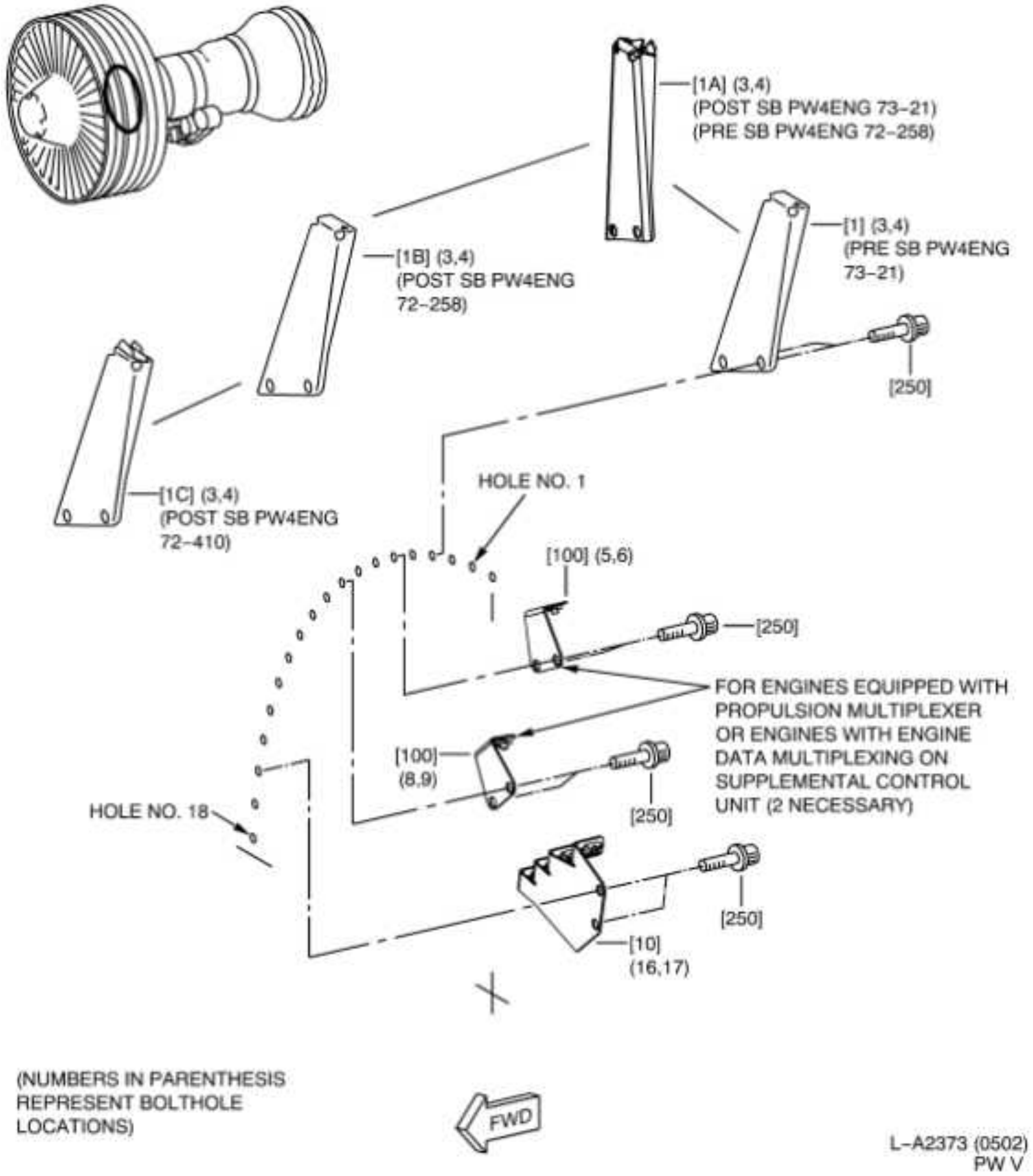
B. Procedure

(1) Remove the Flange E brackets as follows. See Figure 301.

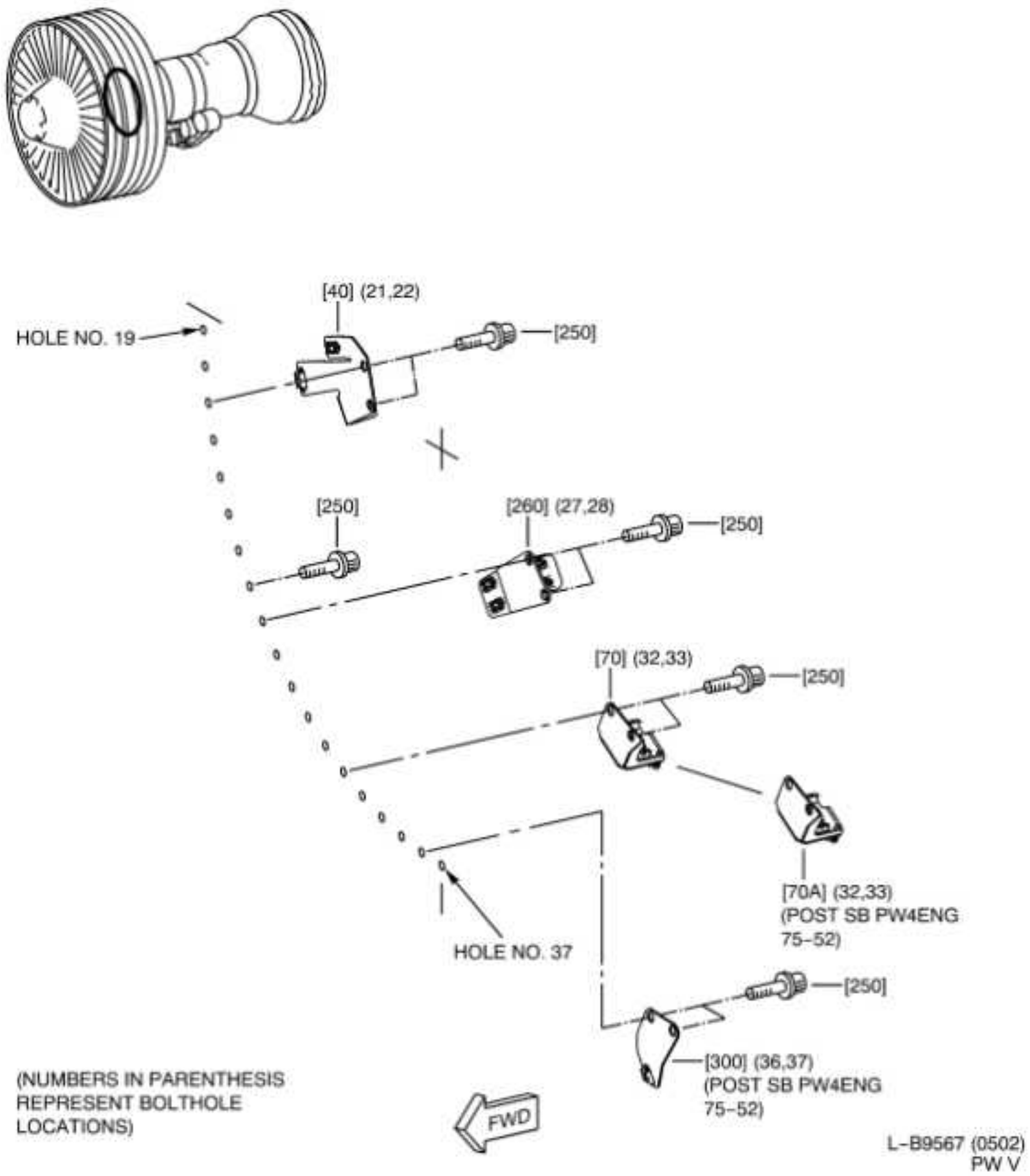
(a) Tag and identify the flange E hardware for the correct bolthole locations.

NOTE: All the part item numbers in the figures are the same as the item numbers in the IPC.

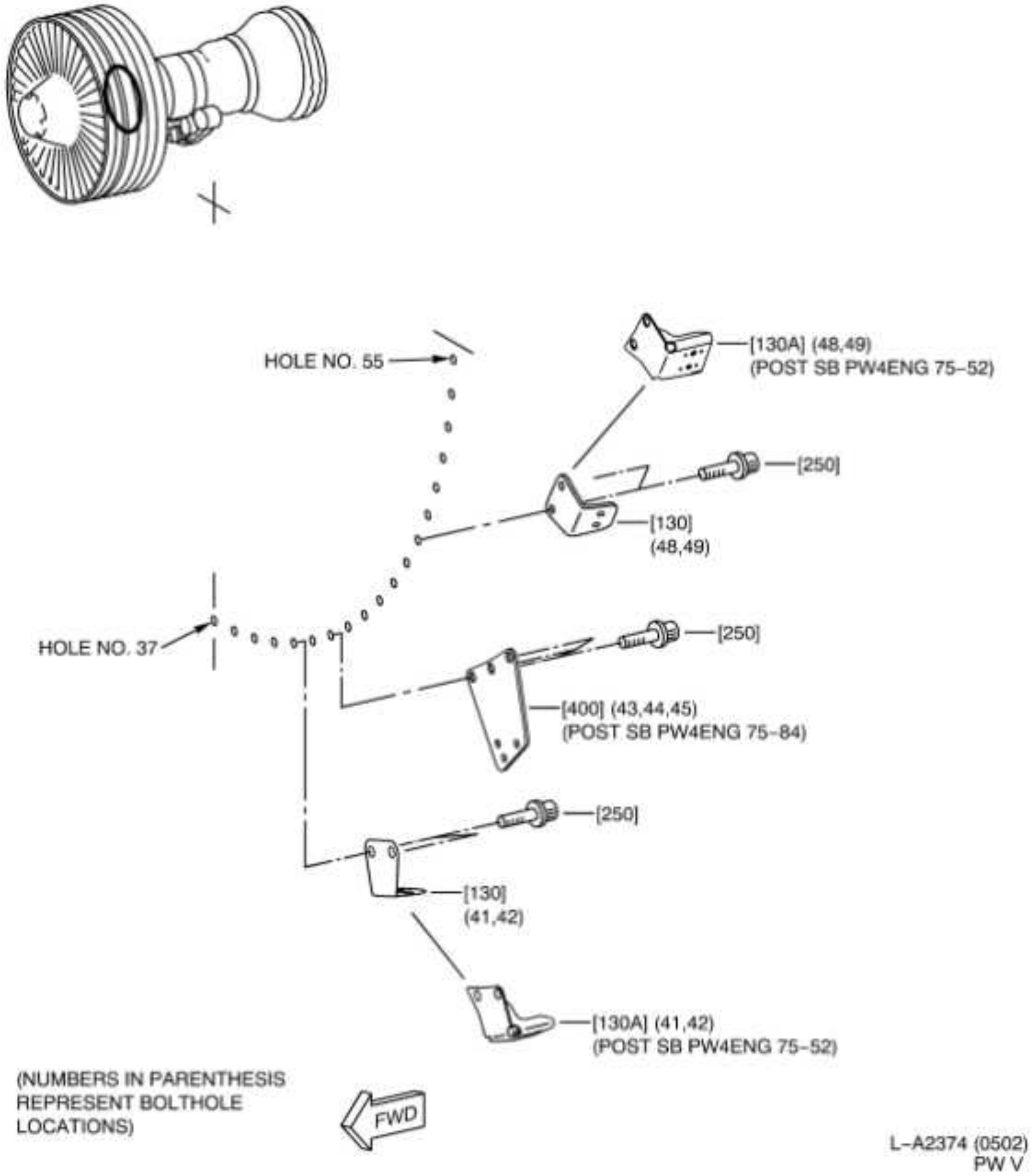
(b) Remove the bolts, which attach the brackets at Flange E.


[1A] (3,4)
(POST SB PW4ENG 73-21)
(PRE SB PW4ENG 72-258)
[1B] (3,4)
(POST SB PW4ENG
72-258)
[1] (3,4)
(PRE SB PW4ENG
73-21)
[250]
[1C] (3,4)
(POST SB PW4ENG
72-410)
HOLE NO. 1
[100] (5,6)
[250]
FOR ENGINES EQUIPPED WITH
PROPULSION MULTIPLEXER
OR ENGINES WITH ENGINE
DATA MULTIPLEXING ON
SUPPLEMENTAL CONTROL
UNIT (2 NECESSARY)
[100]
(8,9)
[250]
HOLE NO. 18
[250]
[10]
(16,17)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-A2373 (0502)
PW V

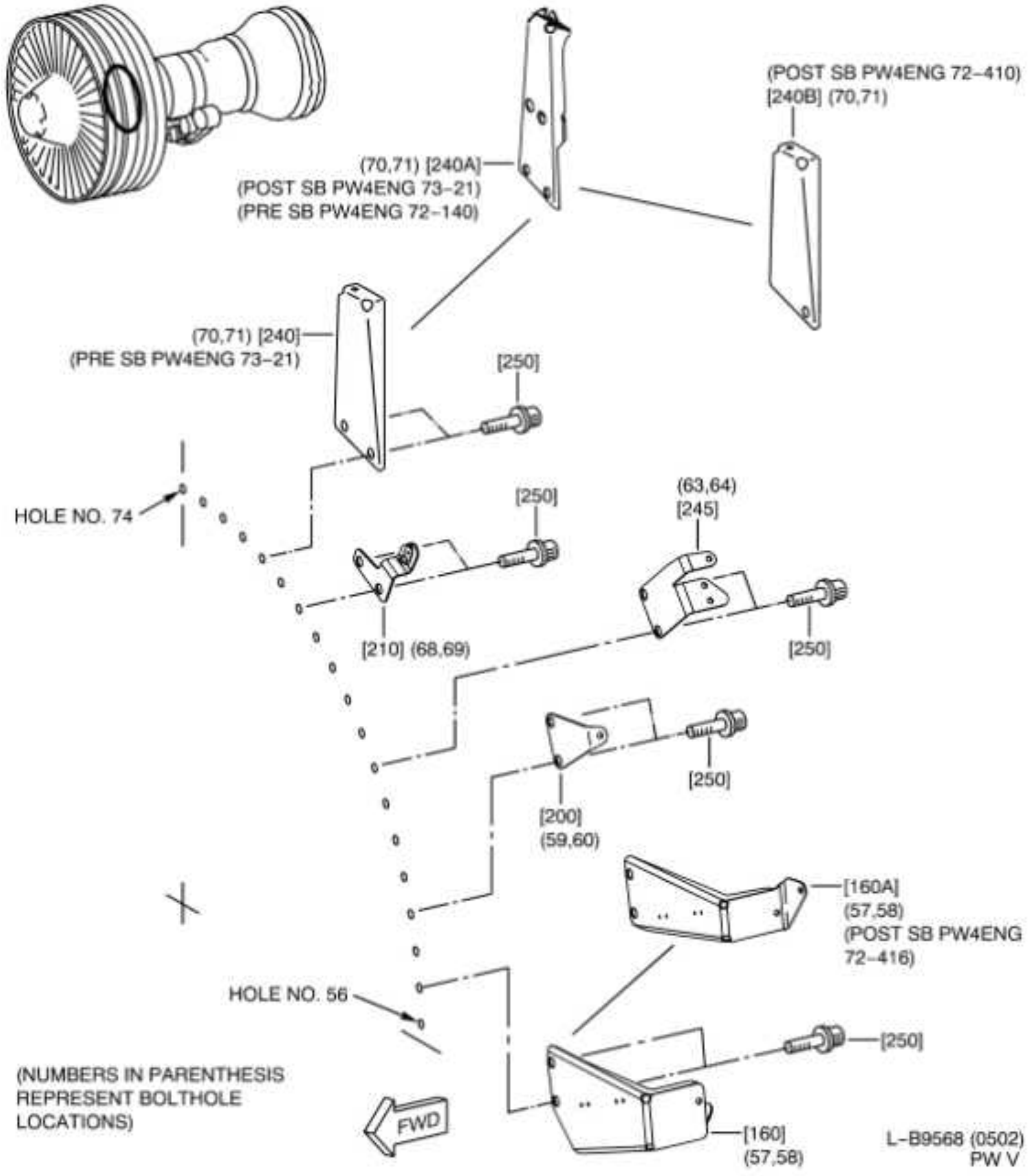
Flange E Bracket Locations
Figure 301 (Sheet 1)
(Task 72-00-34-020-020)


[40] (21,22)
HOLE NO. 19
[250]
[250]
[260] (27,28)
[250]
[70] (32,33)
[250]
[70A] (32,33)
(POST SB PW4ENG
75−52)
HOLE NO. 37
[250]
[300] (36,37)
(POST SB PW4ENG
75−52)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L−B9567 (0502)
PW V

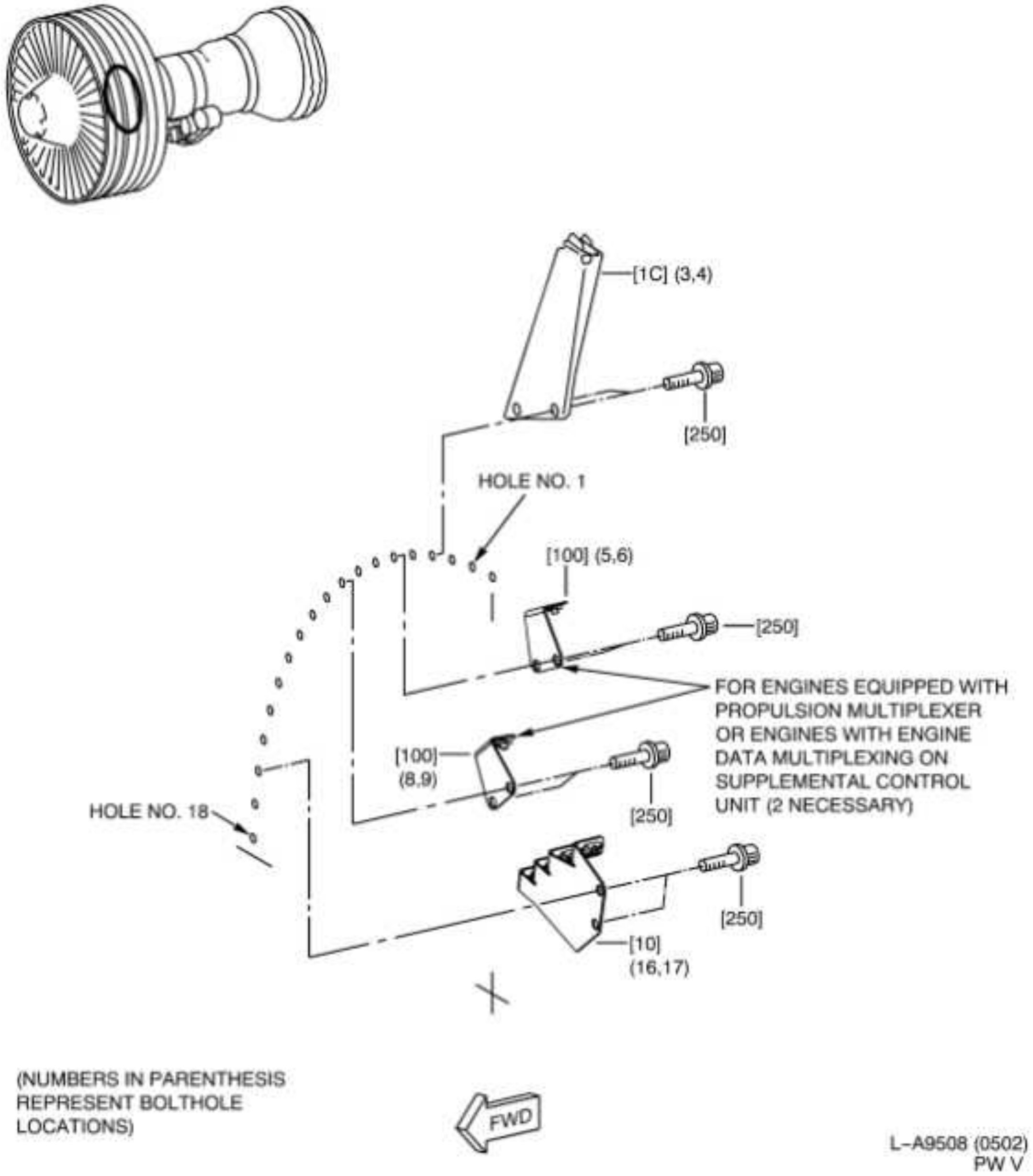
Flange E Bracket Locations
Figure 301 (Sheet 2)
(Task 72−00−34−020−020)


HOLE NO. 55
[130A] (48,49)
(POST SB PW4ENG 75−52)
[250]
[130]
(48,49)
HOLE NO. 37
[250]
[400] (43,44,45)
(POST SB PW4ENG 75−84)
[250]
[130]
(41,42)
[130A] (41,42)
(POST SB PW4ENG 75−52)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L−A2374 (0502)
PW V

Flange E Bracket Locations
Figure 301 (Sheet 3)
(Task 72−00−34−020−020)

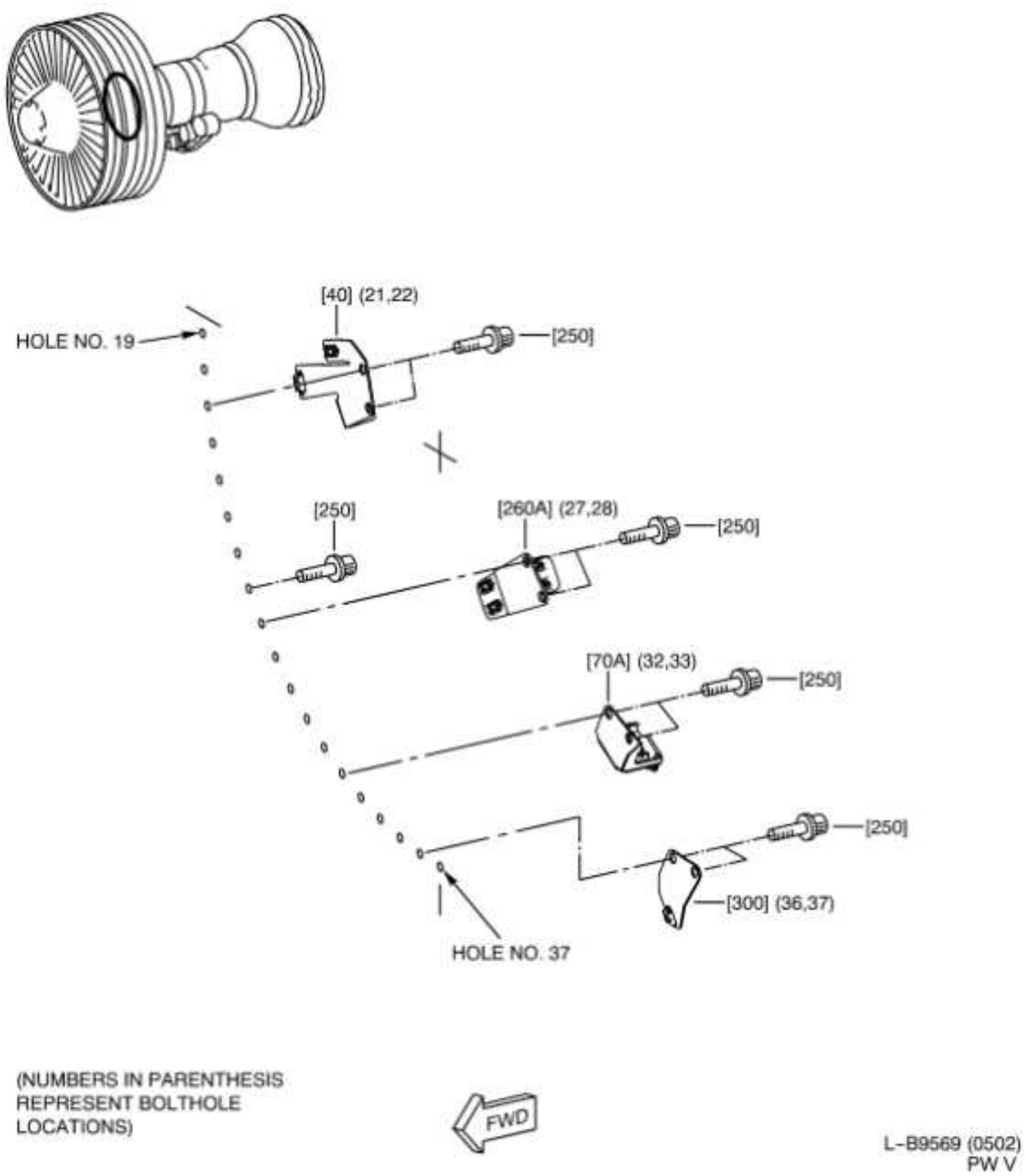

(POST SB PW4ENG 72-410)
[240B] (70,71)
(70,71) [240A]
(POST SB PW4ENG 73-21)
(PRE SB PW4ENG 72-140)
(70,71) [240]
(PRE SB PW4ENG 73-21)
[250]
HOLE NO. 74
[250]
(63,64)
[245]
[210] (68,69)
[250]
[250]
[200]
(59,60)
[160A]
(57,58)
(POST SB PW4ENG 72-416)
HOLE NO. 56
[250]
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
[160]
(57,58)
L-B9568 (0502)
PW V

Flange E Bracket Locations
Figure 301 (Sheet 4)
(Task 72-00-34-020-020)

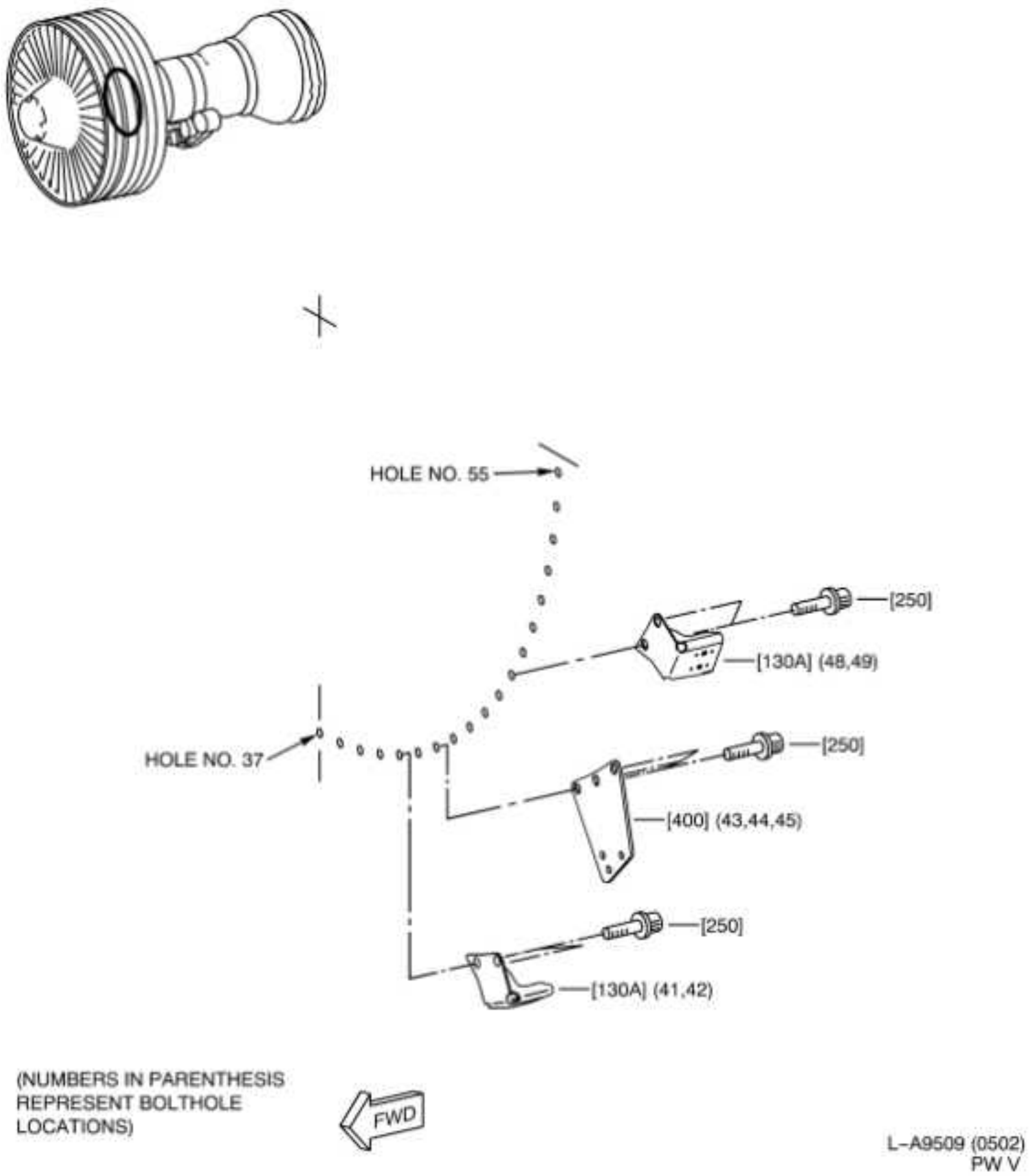

[1C] (3,4)
[250]
HOLE NO. 1
[100] (5,6)
[250]
FOR ENGINES EQUIPPED WITH PROPULSION MULTIPLEXER OR ENGINES WITH ENGINE DATA MULTIPLEXING ON SUPPLEMENTAL CONTROL UNIT (2 NECESSARY)
[100]
(8,9)
[250]
HOLE NO. 18
[250]
[10]
(16,17)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L−A9508 (0502)
PW V

Flange E Bracket Locations (For −3 Engines As Built By P&W)
Figure 301 (Sheet 5)
(Task 72−00−34−020−020)

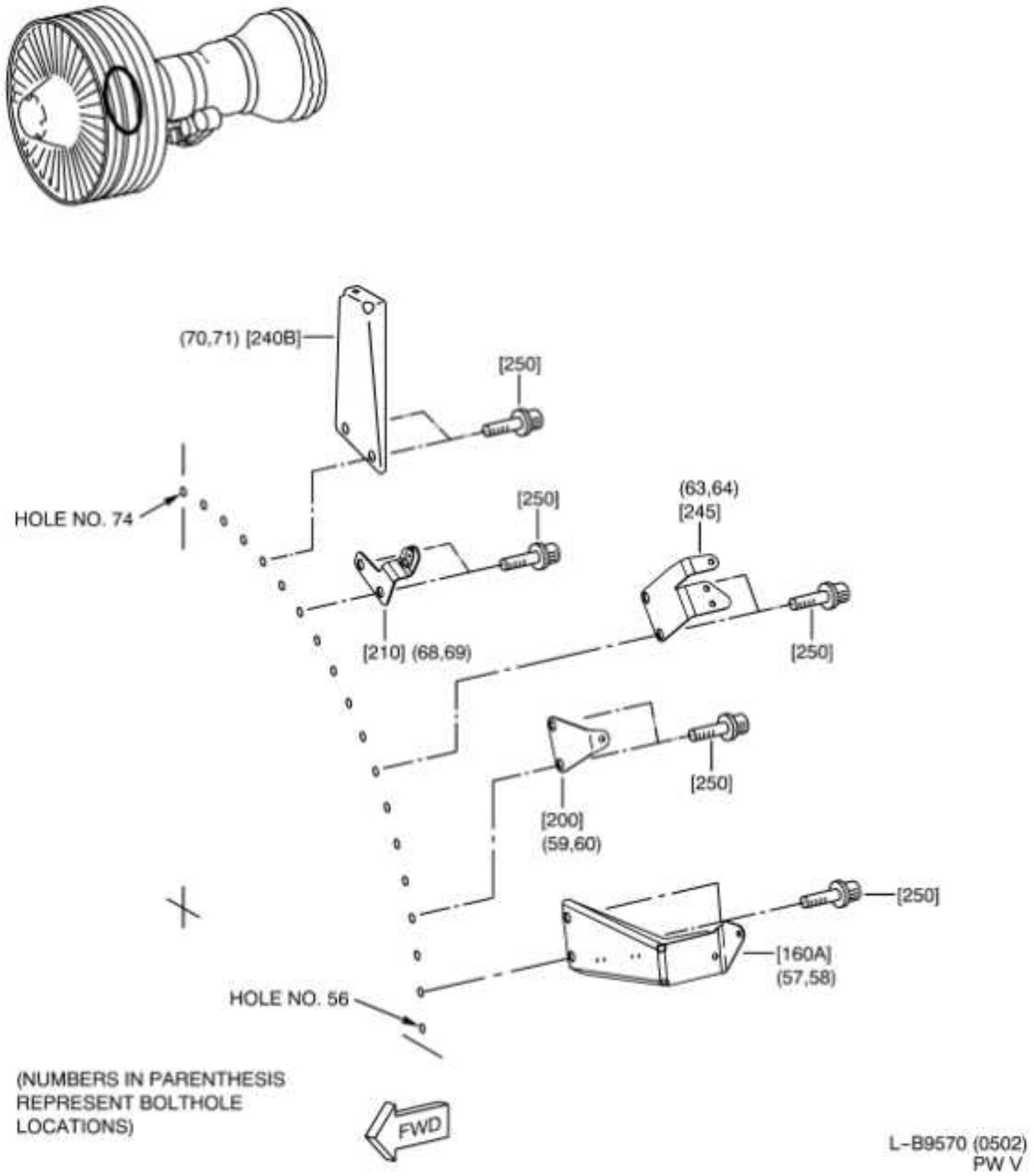
ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-20


[40] (21,22)
HOLE NO. 19
[250]
[250]
[260A] (27,28)
[250]
[70A] (32,33)
[250]
[250]
[300] (36,37)
HOLE NO. 37
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B9569 (0502)
PW V

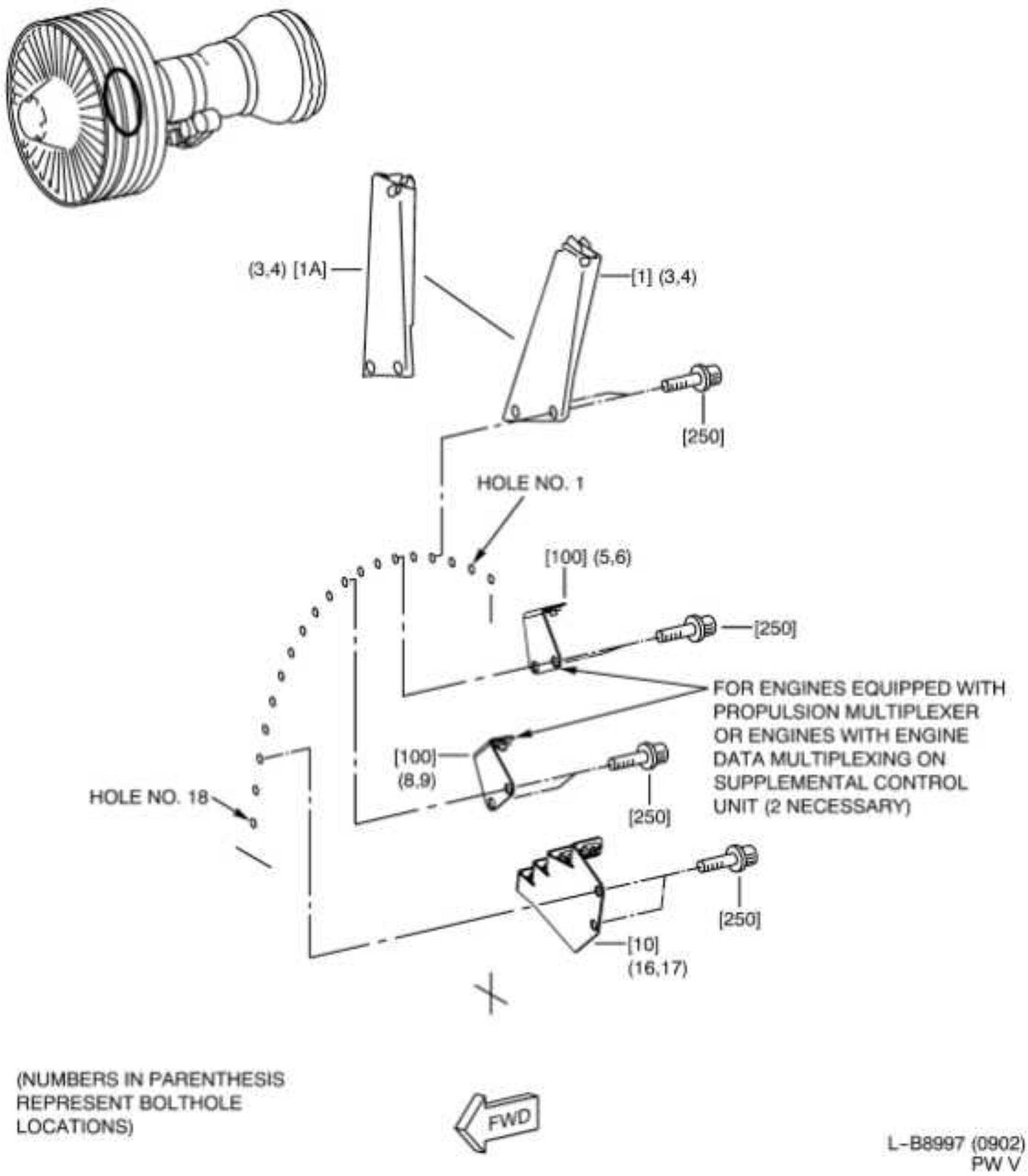
Flange E Bracket Locations (For -3 Engines As Built By P&W)
Figure 301 (Sheet 6)
(Task 72-00-34-020-020)


HOLE NO. 55
[250]
[130A] (48,49)
HOLE NO. 37
[250]
[400] (43,44,45)
[250]
[130A] (41,42)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-A9509 (0502)
PW V

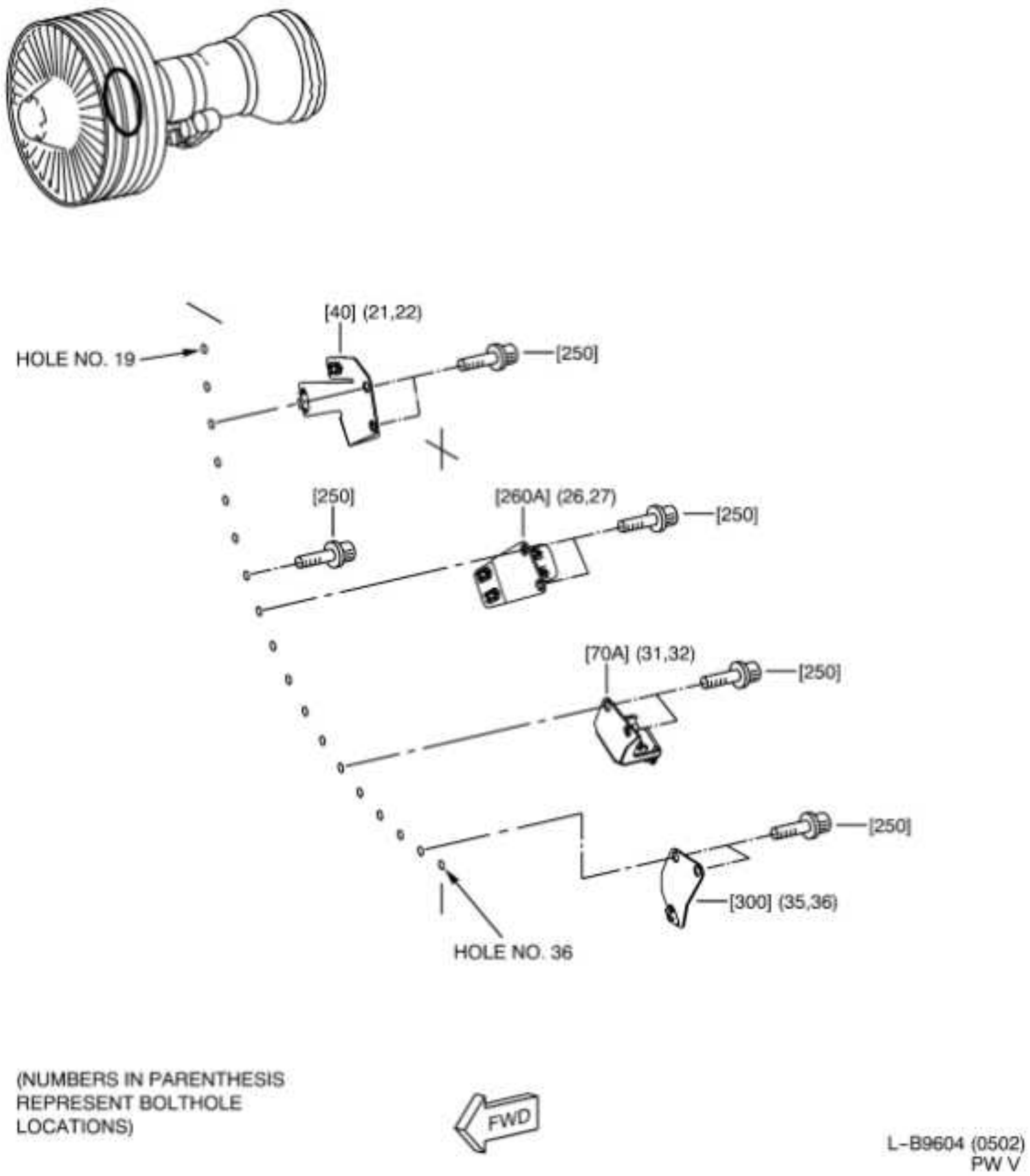
Flange E Bracket Locations (For −3 Engines As Built By P&W)
Figure 301 (Sheet 7)
(Task 72−00−34−020−020)


(70,71) [240B]
[250]
HOLE NO. 74
[250]
(63,64)
[245]
[210] (68,69)
[250]
[250]
[200]
(59,60)
[250]
[160A]
(57,58)
HOLE NO. 56
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B9570 (0502)
PW V

Flange E Bracket Locations (For −3 Engines As Built By P&W)
Figure 301 (Sheet 8)
(Task 72−00−34−020−020)


(3,4) [1A]
[1] (3,4)
[250]
HOLE NO. 1
[100] (5,6)
[250]
FOR ENGINES EQUIPPED WITH PROPULSION MULTIPLEXER OR ENGINES WITH ENGINE DATA MULTIPLEXING ON SUPPLEMENTAL CONTROL UNIT (2 NECESSARY)
[100] (8,9)
[250]
HOLE NO. 18
[250]
[10] (16,17)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B8997 (0902)
PW V

Flange E Bracket Locations (UPS Configuration)
Figure 301 (Sheet 9)
(Task 72−00−34−020−020)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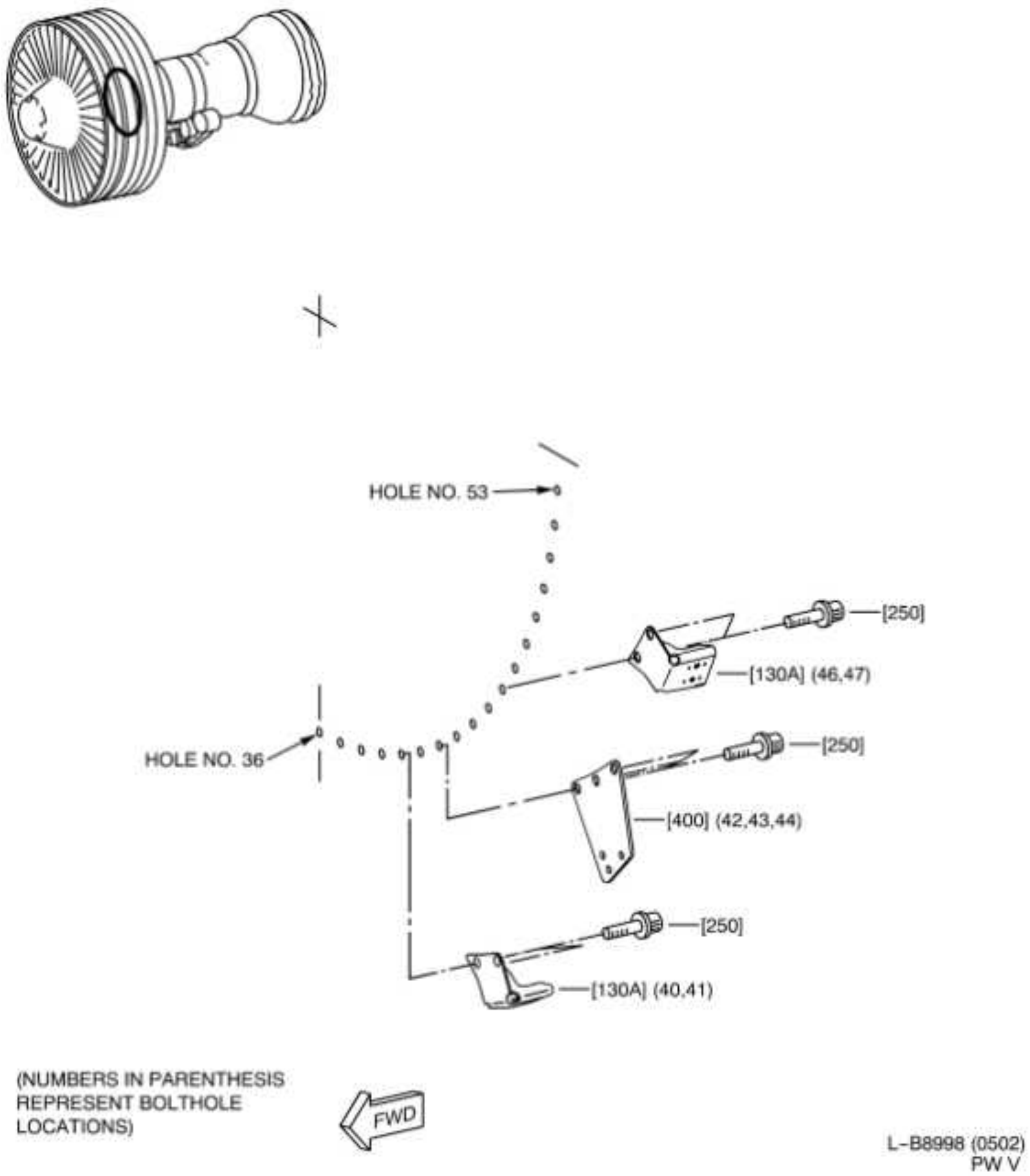
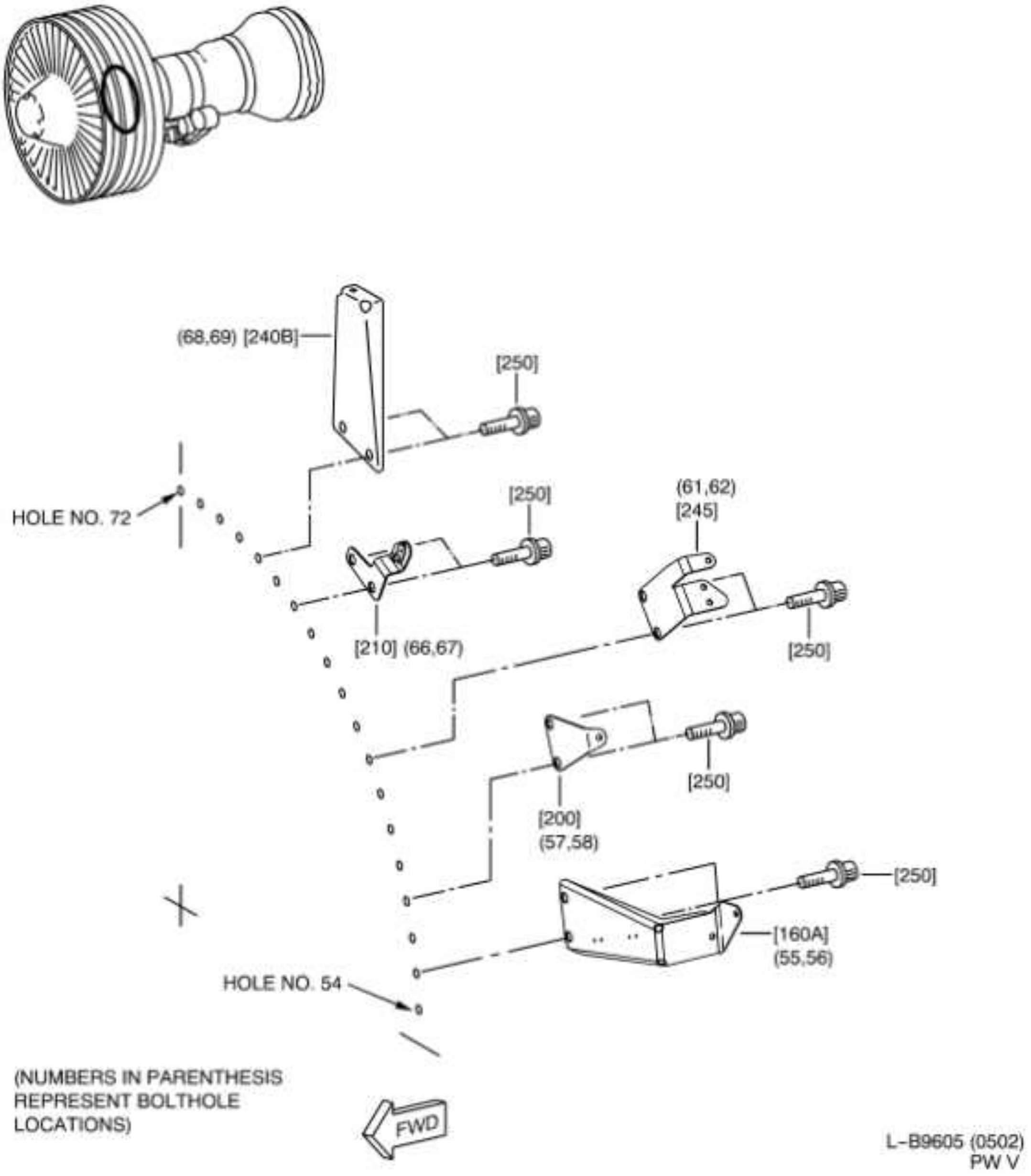
HOLE NO. 19
[250]
[250]
[260A] (26,27)
[250]
[70A] (31,32)
[250]
[250]
[300] (35,36)
HOLE NO. 36
FWD
L-B9604 (0502)
PW V

(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

Flange E Bracket Locations (UPS Configuration)
Figure 301 (Sheet 10)
(Task 72−00−34−020−020)


HOLE NO. 53
[250]
[130A] (46,47)
HOLE NO. 36
[250]
[400] (42,43,44)
[250]
[130A] (40,41)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B8998 (0502)
PW V

Flange E Bracket Locations (UPS Configuration)
Figure 301 (Sheet 11)
(Task 72−00−34−020−020)


(68,69) [240B]
[250]
HOLE NO. 72
[250]
(61,62)
[245]
[210] (66,67)
[250]
[250]
[200]
(57,58)
[250]
[160A]
(55,56)
HOLE NO. 54
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-B9605 (0502)
PW V

Flange E Bracket Locations (UPS Configuration)
Figure 301 (Sheet 12)
(Task 72−00−34−020−020)

Task 72-00-34-020-004:

1. Remove The Fan Unit From The Core Engine

A. Prerequisites

(1) Transfer the engine from the transport stand to pedestals. Refer to 72-00-00, Special Procedures-01 (Task 72-00-00-010-001).

(2) Refer to Table 301 for the other procedures that are prerequisite to this procedure. See Figure 301.

Step	Remove The	Chapter	Removal
1	Magnetic Chip Detector Assemblies In The Oil Tank And Main Gearbox	72-00-61	36 (Task 72-00-61-050-017)
2	Compressor Inlet Cone	72-00-31	02 (Task 72-00-31-020-001)
3a	Electronic Engine Control (EEC) Speed Transducer (N1)	72-00-34	03 (Task 72-00-34-050-001)
or			
3b	EEC Speed Transducer (N1) Multiplexer or SCU Input Speed Probe	72-00-34	17 (Task 72-00-34-050-014)
4	LPC/LPT Coupling*	72-00-32	01 (Task 72-00-32-020-001)

NOTE: *Do not remove the Stage 1 LPC blade assemblies

Other Prerequisite Procedures
Table 301

B. Equipment And Materials Necessary

ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−21

Special Tools:

PWA 25757	Pedestal (4 Necessary)
PWA 25926	Adapters (4 Necessary)
PWA 29855−7	Aligning Pin (2 Necessary)
PWA 76154	Adapter (2 Necessary)
PWA 76155	Sling
PWA 85260	Guide Pin (2 Necessary)
PWA 85390	Adapter, Lifting
PWA 85429	Wrench
PWA 85471	Wrench, Torque
PWA 85537	Fixture, Handling
PWA 85585	Ring, Guide
PWA 85623	Eye, Lifting
PWA 85631	Guide, Piloting
PWA 85749	Adapter, Torque−Electrical Connector
PWA 85785	Adapter, Piloting
PWA 86209	Retainer, Positioning (Optional To PWA 85537)
PWA 86567	Adapter, Lift And Trunnion (2 Necessary)
PWA 86598	Retainer, Positioning (Optional To PWA 86209)
PWA 88204	Guide, Piloting
PWA 101848	Puller, Jackscrew (6 Necessary)

NOTE: Use PWA 86598 or PWA 86209 Retainer as an alternative to PWA 85537 Fixture if you will remove the HPC top front case with the procedure in 72−00−35, Removal−18 (Task 72−00−35−030−001).

C. Disconnect The EEC Wiring Harnesses As Follows: See Figure 302.

(1) Disconnect the W1 EEC wiring harness as follows.

(a) Use the PWA 85749 Torque Adapter and disconnect the W1P11 and the W1P10 harness connectors from the 1 o'clock position solenoid.

(b) Remove the clamp bolts and nuts that attach the harness to the Flange E bracket and to the solenoid muscle tube.

(c) Disconnect the W1P25 harness connector at the HPC case bracket at 1 o'clock position.

(d) Disconnect the W1P24 harness connector at the HPC case bracket at 10 o'clock position.

(e) Disconnect the W1P9 harness connector at the HPC case bracket at 12 o'clock position.

(f) Remove all the clamp bolts and nuts that attach the W1 harness to the HPC case brackets.

(g) Temporarily attach the W1 harness to the 12 o'clock strut with lockwire. Keep the harness clear of Flange E.

(h) Install protection covers.

(2) Disconnect the W2 EEC wiring harness.

(a) Disconnect the W2P26 harness connector at the HPC case bracket at 12 o'clock position.

(b) Remove the bolt that attaches the retaining bracket and the W2J9 receptacle to the HPC case bracket at 12 o'clock position.

(c) Remove all the clamp bolts that attach the W2 harness to the Flange E bracket and the No. 1, 1.5, and 2 bearing tubes.

(d) Temporarily attach the W2 harness to the 12 o'clock strut with lockwire. Keep the harness clear of Flange E.

(e) Install protection covers.

(3) Remove the two bolts that attach the IDG−heat−exchanger valve harness and retaining bracket to the HPC case bracket. Remove the retaining bracket and disconnect the harness receptacle. Install a protection cover. Remove the two clamp bolts that attach the IDG harness to the hydraulic tube.

(4) Use the PWA 85749 Torque Adapter and disconnect the W4P4 and the W5P11 harness connectors from the 5 o'clock position solenoid. Install protection covers.

(5) Remove the clamp bolt that attaches the W4 harness (to the EEC speed transducer) to the bleed valve supply tube at 5 o'clock position.

(6) Disconnect the W3P15 harness connector from the 2.5 bleed valve actuator at 7 o'clock position. Install protection covers.

(7) Disconnect the W3P17 connector from the (engine) air/oil heat exchanger harness receptacle at 7:30 o'clock position. Remove the two bolts that attach the retaining bracket and receptacle from the HPC case bracket. Install a protection cover on the receptacle.

(8) If removal of the HPC top front case is required per 72−00−35, Removal−18 (Task 72−00−35−030−001), after the engine is split, disassemble the W3, W4, and W5 harnesses from the HPC top front case as follows. See Figure 303.

(a) Remove the bolts, nuts, and spacers that attach the harness clamps to the HPC top front case brackets from 9 o'clock position to 3 o'clock position.

(b) Remove the bolts, nuts, and spacers that attach the harness clamps to the two bracket assemblies above and over the stator vane actuator support.

(c) Remove the bolts and brackets that attach the W4J25 connector, the W5J26 connector, and the W3J24 connector to the HPC case brackets at 1, 12 and 10 o'clock position respectively.

(d) Remove the bolts and nuts that attach the harness clamps to the fuel/oil cooler brackets and to the bracket assembly above the cooler.

(e) Disconnect the W4P16 connector from the TCC air valve actuator.

(f) Disconnect the W5P7 connector and the W4P3 connector from the stator vane actuator.

(g) Remove the bolts and nuts that attach the harness to the bottom of the stator vane actuator support.

(h) Remove the harness bracket assemblies from over the TCC air valve actuator and from over the stator vane actuator support assembly.

(i) Move the harnesses rearward of Flange H and install protection covers to all connectors and receptacles.

D. Disconnect The Tubes As Follows
See Figure 304.

(1) Remove the lockwire and disconnect the EEC PB sensing tubes (AS09/20) at 12:30 o'clock position. See Figure 304 (Sheet 1).

(2) For engines with PMUX or SCU, remove lockwire and disconnect the PT2.5 sensing tubes (AS29/30) at 12:30 o'clock position. See Figure 304 (Sheet 1).

(3) Remove lockwire and disconnect the HPC air valve supply and signal tubes (AA01/25) from the solenoid adapters at 1 o'clock position. See Figure 304 (Sheet 1).

(4) Remove lockwire and disconnect the two No. 3 bearing air cooler tubes (LP33/34) from the cooler at 2:30 o'clock position.

(5) Disconnect and remove the tubes from the IDG heat exchanger at 4 o'clock position as follows. See Figure 304 (Sheet 2).

  (a) Remove the lockwire and disconnect the airframe (IDG) cooler outlet oil tube nut. Remove the three bolts that attach the tube to the heat exchanger. Remove the tube and discard the packing. Install the protection covers to the tube ends and port.

  (b) Remove the lockwire and remove the (IDG) air/oil cooler valve hydraulic pressure and return tubes from the heat exchanger and the manifolds. Install the protective covers to the tubes, manifold tees, and the adapters.

(6) Remove the lockwire and disconnect the compressor stator cylinder hydraulic pressure (CP12) and return tube (CR03) from the manifolds and cylinder as follows. See Figure 304 (Sheet 3).

  (a) Remove the clamp bolts that attach the tubes to the Flange E bracket.

  (b) Remove the tubes and install the protective covers to the tubes, manifold tees, and adapters.

(7) Remove the hydraulic pressure (CP05) and oil cooler inlet return (CR01) manifolds as follows. See Figure 304 (Sheet 3).

(a) Remove the lockwire and disconnect the two hose nuts from the manifolds at 3 o'clock position.

(b) Remove the lockwire and disconnect the two manifolds at the lower tee connections at 5 o'clock position.

(c) Remove the clamp bolts and nut that attach the manifolds to the engine brackets. Remove the manifolds and install the protective covers to the hoses and to the manifold ends.

(8) Remove the fuel distribution valve supply tube (FM09) as follows. See Figure 304 (Sheet 4).

(a) Remove the lockwire and disconnect each end.

(b) Remove the clamp bolts and nuts that attach the tube to the engine.

(c) Remove the tube and discard the packings.

(d) Install the protective cover.

(9) Remove the three bleed valve supply tubes (AA26/27/29) as follows. See Figure 304 (Sheet 5).

(a) Remove the lockwire and disconnect the three tube connections at 2:30 o'clock position.

(b) Remove the lockwire and disconnect the two tube connections to the 5 o'clock position solenoid. Remove the lockwire and disconnect the tube connection at the maintenance break adjacent to the solenoid. Remove the lockwire and disconnect the tube nut from the tee adjacent to the solenoid.

(c) Remove the clamp bolts that attach the tubes to the engine brackets, to each other, and to the harness clamps.

(d) Remove the tubes from the engine. Install the protective covers to all the tube ends and the solenoid adapters.

(10) Remove the upper PT2.5 sensing tube assembly (AS30) as follows. See Figure 304 (Sheets 6, 7 and 8).

(a) For engines not equipped with the supplemental control unit (SCU) with multiplexing, remove the lockwire from the cap assembly. Remove the cap assembly from the tube.

(b) For engines equipped with the supplemental control unit (SCU) with multiplexing, remove the lockwire and disconnect the lower tube nut from the tube coupling tube (AS30) at approximately the 4 o'clock position rearward of Flange E.

(c) Remove the bolts, clamps and a nut that attach the (AS30) tube to brackets on Flange E at the 1, 1:30, 2:30, and 3:30 o'clock positions.

(d) Remove the tube from the engine and install protection covers.

(11) For engines equipped with the supplemental control unit (SCU) with multiplexing, remove the lower PT2.5 sensing tube assembly (AS35) as follows.

(a) Remove the bolts and clamps that attach the (AS35) tube to brackets on Flange E at the 4:30 and 5:00 o'clock positions.

(b) Remove the tube from the engine and install protection covers.

NOTE: The lower manifold (AS31) was previously removed with the EEC speed transducer (N1) multiplexer input probe.

(12) Remove the lockwire and disconnect the angle gearbox oil pressure tube (LP09) from the angle gearbox at 6 o'clock position. See Figure 304 (Sheet 9).

(13) Remove the two bolts that attach the angle gearbox oil scavenge tube (LR01) to the angle gearbox at 6 o'clock position. Loosen the clamp bolts as necessary to disengage the tube from the angle gearbox boss. Remove the packing. Install protective covers.

(14) Remove lockwire and disconnect the (2.5) bleed valve cylinder hydraulic pressure (CP02) and return (CR02) tubes from the cylinder and manifolds. See Figure 304 (Sheet 10). Remove the tubes. Install protective covers to the tubes, adapters, and manifold tees.

(15) Remove the two bolts and disconnect the cooling air manifold (AC34) from the fan case boss at 7 o'clock position. Remove the clamp bolt and tube.

(16) Remove the lockwire and disconnect the No. 1, 1.5 and 2 bearing oil scavenge tube (LR02) at 7:30 o'clock position. See Figure 304 (Sheet 11).

(17) Remove lockwire and disconnect each end of the (left) air/oil cooler hydraulic pressure (CP08) and return (CR08), tubes from the air/oil heat exchanger adapters at 8 o'clock position and manifolds. Remove the clamp bolt that attaches the pressure tube to the Flange E bracket. Remove the two tubes and install the protective closures.

(18) Remove the six bolts that attach the air/oil cooler inlet oil tube (LP02) to the main oil filter housing and the air/oil heat exchanger. See Figure 304 (Sheet 12). Remove the clamp bolt that attaches the tube to the HPC case bracket. Move the tube rearward and temporarily attach with lockwire. Discard the packings. Install the protection covers.

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH
R CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND
R INSTALL A TUBE WITH A FLEX SEGMENT WITH THE
R SAME PRECAUTION USED FOR A TUBE WITHOUT A
R FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A
R TUBE TO HELP WITH THE INSTALLATION OR REMOVAL
R OF THE TUBE OR AN ATTACHED COMPONENT. IF A
R FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE
R A KINK IN THE EXTERNAL WIRE BRAID AND IN THE
R INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND
R LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(19) Remove the two bolts that attach the air/oil cooler outlet hose and tube assembly (LP03) to the air/oil heat exchanger. Remove the lockwire and disconnect the tube nut from the fuel oil cooler bypass valve adapter. Remove the clamp bolts that attach the tube to the engine. Remove the tube and discard the packings. Install the protection covers.

ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-21

(20) Remove lockwire and disconnect the main bearing oil pressure tube (LP05) from the strainer housing at 9 o'clock position and the strainer housing at top of the fuel/oil cooler. See Figure 304 (Sheet 13). Remove the clamp bolts and remove the tube. Discard the packing and retainer. Remove the bolt and clamp that attaches the strainer housing to the Flange E bracket. Install protective covers.

(21) Remove lockwire and disconnect the two signal tubes (AA06/18) and the supply tube (AA22) from the solenoid adapters at 10 o'clock position.

(22) Remove lockwire and disconnect the main bearing breather tube (LB06) at 11:30 o'clock position. See Figure 304 (Sheet 14).

(23) Remove lockwire and disconnect the EEC PT4.95 tube (AS04) at 11:30 o'clock position.

(24) If removal of the HPC top front case is required per 72-00-35, Removal-18 (Task 72-00-35-030-001), after the engine is split, remove the (TCC) air valve actuator at 2 o'clock position as follows. See Figure 305.

  (a) Remove the nut and bolt that attach the cable rod end to the (HPC) TCC air shutoff valve idler arm.

  (b) Remove the lockwire and disconnect the cable coupling nut from the actuator.

  (c) Remove the bolt and ground strap from the actuator.

  (d) Remove the four bolts (and nuts, if equipped) that attach the actuator clamps to the bracket.

  (e) Lift the actuator and disengage the cable end from the actuator. Remove the actuator.

  NOTE: Do not remove the hoses from the actuator.

(25) If removal of the HPC top front case is necessary per 72-00-35, Removal-18 (Task 72-00-35-030-001), after the engine is split, remove the stator vane actuator and support assembly as follows. See Figure 306.

(a) Remove the bolts that attach the fuel flowmeter support bracket to the support assembly. Remove the bracket.

(b) Remove the cotter pins, nuts, washers, and bolts that attach the four rod ends to the synchronizing rings. Disengage the rod ends. Install lockwire to the rod end bearings to attach them to the rod ends.

(c) Remove the cotter pins, nuts, bolts, studs, spacers, and shims that attach the support assembly to the HPC cases and brackets.

(d) Remove the stator vane actuator and support assembly.

E. Separate The Fan Unit From The Core Engine

(1) Disconnect the gearbox driveshaft and the gearbox−drive−shaft−(front)−housing (called front housing) from the angle gearbox as follows. See Figure 307.

(a) Remove the four bolts that attach the brackets on the gearbox−driveshaft−(front)−housing (called front housing) to the HPC.

CAUTION: DO NOT USE A TOOL SUCH AS A SCREWDRIVER TO MOVE THE FRONT HOUSING AWAY FROM THE ANGLE GEARBOX. SUCH TOOLS CAN DAMAGE THE PARTS.

(b) Remove the bolts, nuts, and washers that attach the front housing and brackets to the angle gearbox.

(c) Carefully pull the front housing to the rear.

(d) Remove the retaining ring from the gearbox driveshaft.

(e) Carefully pull the gearbox driveshaft to the rear.

(f) Discard the packing at the front of the front housing.

(2) Install PWA 85585 Guide Ring on the No. 1.5 bearing support assembly as follows. See Figure 308.

(a) Install PWA 85585 Guide Ring to the No. 1.5 bearing support assembly.

(b) Attach the ring with the detail screws.

(3) Install either PWA 88204 Guide to the front of the LPT shaft. Tighten by hand.

CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE−UNIT BY THE GUIDE THAT YOU INSTALL ON THE FRONT OF THE CORE−UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE GUIDE. TOO MUCH STRESS ON THE GUIDE CAN CAUSE DAMAGE TO THE PLAIN ROUND NUT.

(4) Install PWA 85631 Guide as follows.

(a) With the PWA 88204 Guide to support the front of the LPT shaft, install the Guide (PWA 85631) in the plain round nut. Be sure the threads engage correctly.

(b) Use PWA 85471 Wrench and tighten the Guide (PWA 85631) until seated.

NOTE: If equipped, the four grooves on the PWA 85631 Guide, Change B) must be fully rearward of the PWA 85585 Guide Ring front surface. If the grooves are not fully rearward of the ring, the threads of the guide are not fully engaged.

(5) Move the legs of PWA 85785 Adapter to their outermost position. Install PWA 85785 Adapter over the previously installed guide until seated against the fan hub. Turn the legs outward and engage the rear of the hub. Tighten the detail wing nuts to hold the legs in position.

(6) Install two PWA 86567 Adapters on the fan case at 3 and 9 o'clock. See Figure 309.

(7) Attach PWA 85623 Eye to the intermediate case at 12 o'clock.

(8) Install PWA 85390 Lifting Adapter on the 8th stage bleed pads as follows.

(a) Remove the tool's two adapters. To remove the adapters, remove the pins.

R
R

(b) Attach the adapters to the 8th stage bleed pads with the detail screws.

(c) With a hoist, lift the arms of the tool.

(d) Attach the arms to the adapters with the pins.

(9) Support the engine with hoists at:

(a) The front of the fan unit. Use, in addition to a hoist and PWA 86567 Adapters, PWA 76155 Sling and two PWA 76154 Adapters.

(b) The rear of the fan unit: PWA 85623 Eye.

(c) The middle of the core engine: PWA 85390 Adapter.

(10) Remove the pedestals.

(11) Remove the 33 bolts in the rear flange of the No. 1.5-bearing-support-assembly. See Figure 310.

NOTE: If removal of the HPC top front case is necessary per 72-00-35, Removal-18 (Task 72-00-35-030-001), use the PWA 86598 Retainer or PWA 86209 Retainer as an alternative to PWA 85537 Fixture. This retainer will permit removal of the top case.

CAUTION: FOR RETAINING BOLTS USE WORKBOLTS WITH DRILLED HEADS WITH A 0.500 INCH (12.700 mm) MAXIMUM SHANK AND THREAD LENGTH. (PN MS9218-05 OR PN MS9218-06 IS RECOMMENDED).

(12) Install four retaining bolts in the holes indicated in Figure 310. Tighten by hand. Tag the bolts "To Be Removed".

(13) Install four jacking bolts in the rear flange of the No. 1.5 bearing support assembly. Tighten by hand. See Figure 310. Tag the bolts "Jacking Bolts".

(14) Remove the Flange E hardware as follows. Refer to 72-00-34, Removal-20 (Task 72-00-34-020-020).

(15) Install two PWA 85260 Guide Pins at approximately 3 and 9 o'clock positions on Flange E. Install two PWA 29855-7 Aligning Pins at approximately 6 and 12 o'clock positions on Flange E. See Figure 311 and Figure 312.

(a) For engines with the 2.5 bleed actuator support bracket (Post SB PW4ENG 75-84), remove the three bolts and nuts that attach the support bracket to a bracket on Flange E.

(16) Install six PWA 101848 Jackscrew Plates as follows. See Figure 312.

(a) Remove the two detail screws from one of the plates.

(b) Put the plate in the space between the intermediate case and the bosses of the HPC-inlet-synchronizing-ring-assemblies. Align the screw holes in the plate with the inserts in the intermediate case.

(c) Attach the plate to the intermediate case with the two screws.

(d) Install the five other jackscrew plates in the same way. Make sure that the distances between the plates are equal.

CAUTION: BE SURE THAT THE HOISTS HAVE THE CORRECT EQUAL TENSION TO PERMIT THE SEPARATION OF THE FAN UNIT FROM THE CORE ENGINE. TOO MUCH OR TOO LESS TENSION ON ANY OF THE HOISTS CAN CAUSE DAMAGE TO THE ENGINE.

CAUTION: USE A FLASHLIGHT AND BE SURE THAT ALL 33 SUPPORT BOLTS AND ALL 74 FLANGE E BOLTS ARE REMOVED. COUNT THE BOLTS. BE SURE ALL EXTERNAL PARTS ARE DISCONNECTED AND ARE CLEAR FOR SEPARATION.

(17) Move the fan unit away from the core engine.

(a) Use the jackscrews in the No. 1.5 bearing support assembly and the jackscrew plates.

(18) For engines that have incorporated SB PW4ENG 72-48, discard the packing on the intermediate case at Flange E. Remove the transfer tube (and packings, if equipped).

(19) Remove the four bolts that are in the No. 1.5 bearing support assembly with the tag "Jacking Bolts".

R
R

(20) Remove the two PWA 85260 Guide Pins and the two PWA 29855−7 Aligning Pins from Flange E.

CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE−UNIT BY THE PWA 85631 GUIDE THAT IS INSTALLED ON THE FRONT OF THE CORE−UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE GUIDE. TOO MUCH STRESS ON THE GUIDE CAN CAUSE DAMAGE TO THE PLAIN ROUND NUT.

(21) Remove the PWA 88204 Guide from the front of the core−unit. Install the flat washer and the turbine shaft nut to the front of the LPT shaft. Tighten the nut with PWA 85429 Wrench until it is seated against the washer. See Figure 313.

(22) Install PWA 85537 Fixture (optional to the installation of PWA 86598 or PWA 86209 Retainer) on the HPC. See Figure 314.

(a) The No. 2−bearing−support−assembly has a locating pin at 6:00 o'clock. Put the locating pin in one of the holes of the tool's inner bolt circle.

(b) Attach the tool to the HPC with the detail screws, washers, and nuts.

(c) Attach the tool to the No. 2−bearing−support−assembly with the detail screws.

(23) Install PWA 86598 Retainer or PWA 86209 Retainer (optional to PWA 85537 Fixture) on the HPC. Use the detail bolts and nuts. See Figure 314.

CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE−UNIT BY THE GUIDE THAT IS INSTALLED ON THE FRONT OF THE CORE−UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE GUIDE. TOO MUCH STRESS ON THE GUIDE CAN CAUSE DAMAGE TO THE PLAIN ROUND NUT.

(24) Attach pedestals to PWA 85537 Fixture or PWA 86598 Retainer or PWA 86209 Retainer.

(25) Remove the gearbox driveshaft and front housing from the gearbox driveshaft housing (called rear housing) as follows. See Figure 315.

(a) Carefully pull the gearbox driveshaft out of the front housing.

(b) Carefully pull the front housing out of the rear housing. Discard the packing.

(c) Put them on pallets. Install protective covers.

(26) Remove PWA 101848 Jackscrew Plates.

NOTE: Do not remove PWA 85390 Adapter from the core−unit.

(27) Remove the PWA 85785 Adapter from the front fan hub.

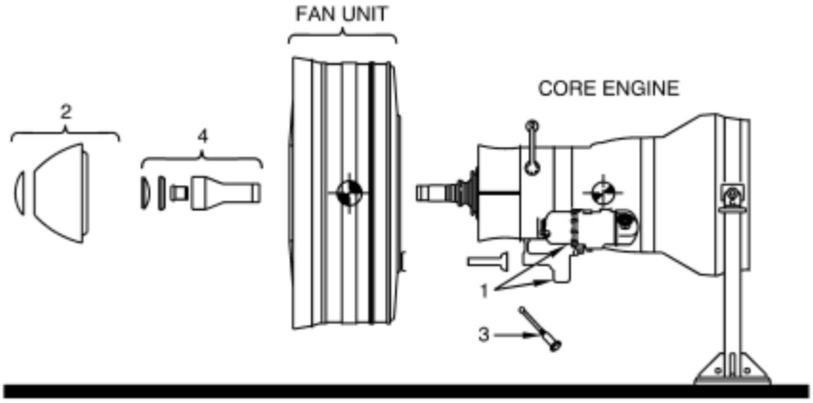
(28) To trunnion the fan unit to rear end down, refer to 72−00−00, Special Procedures−21 (Task 72−00−00−020−004). If you do not trunnion the fan unit, do as follows:

(a) Attach PWA 25926 Adapters to four PWA 25757 Pedestals. Put the PWA 86567 Adapters that are on the fan case and the brackets that are on the intermediate case in the adapters on the pedestals.

(b) Remove the PWA 76154 Adapters, sling, eye, and hoists from the fan unit.

F. Postrequisites

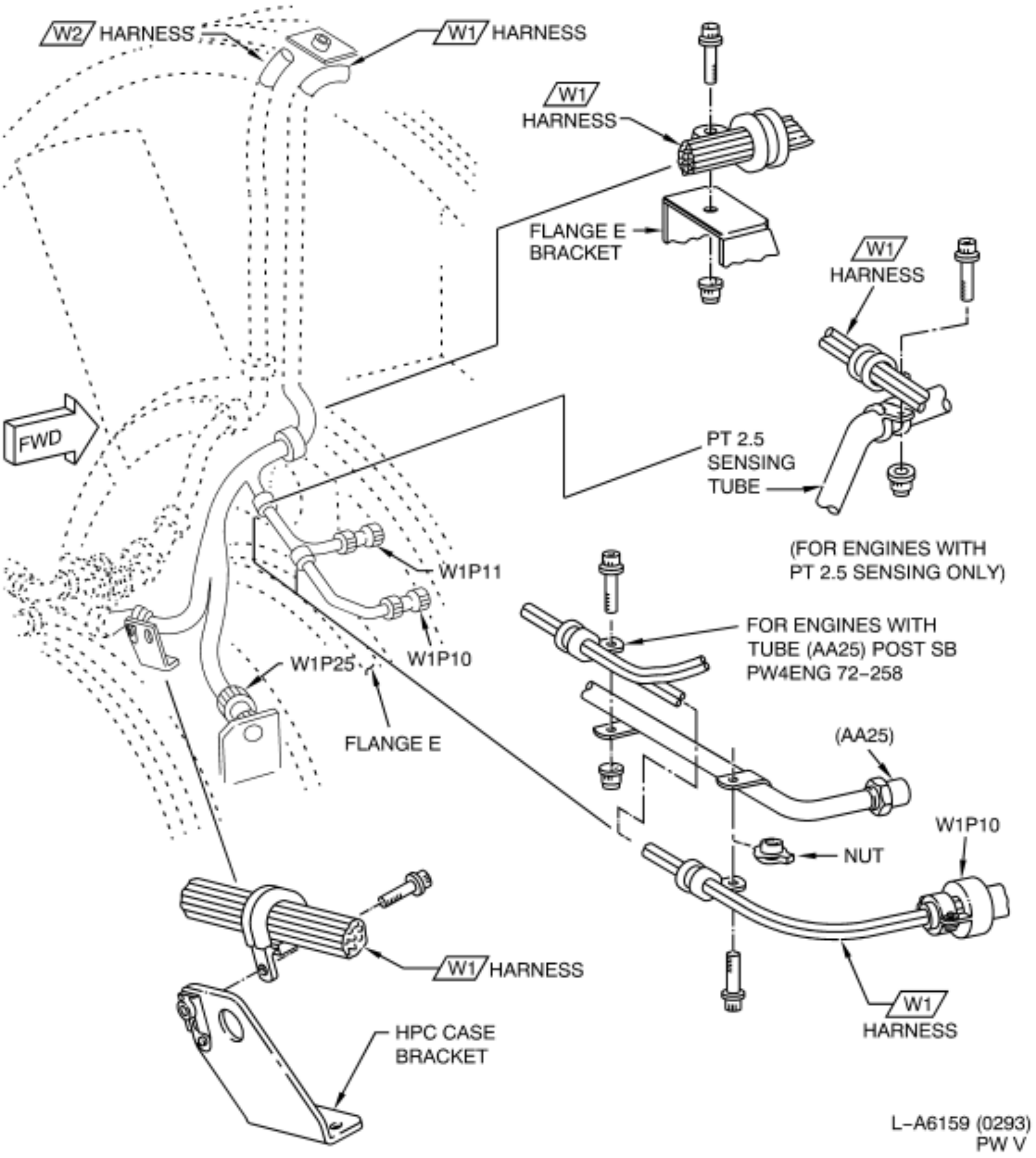
(1) If necessary, remove the HPC top front case. See 72−00−35, Removal−18 (Task 72−00−35−030−001).



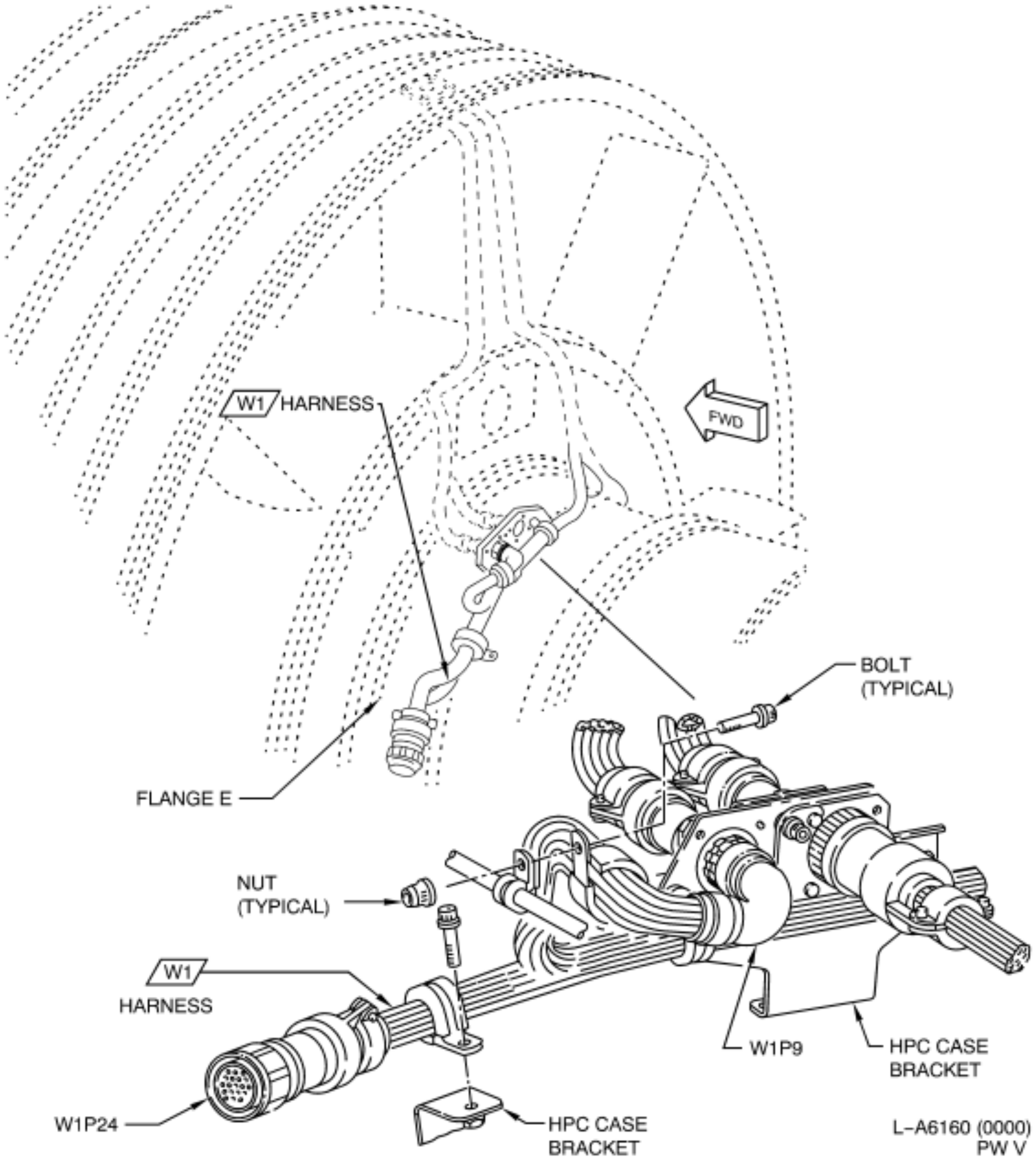
1. MAGNETIC PLUG ASSEMBLIES IN THE OIL TANK AND MAIN GEARBOX
2. COMPRESSOR INLET CONE
3. NI SPEED TRANSDUCER
4. LPC/LPT COUPLING

L−A5069 (0289)
PW V

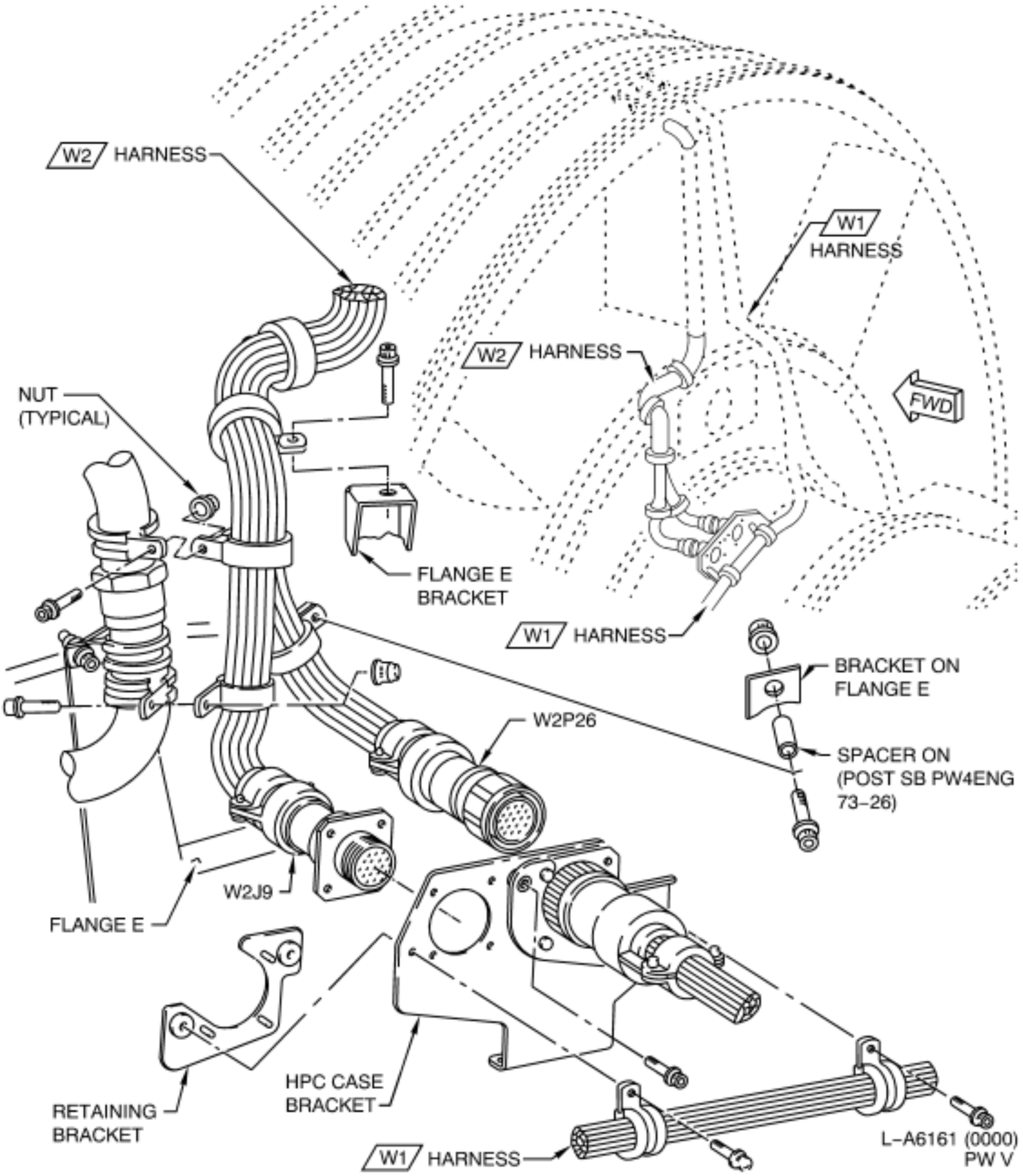
Procedure Sequence
Figure 301
(Task 72−00−34−020−004)


W2 HARNESS
W1 HARNESS
W1 HARNESS
FLANGE E BRACKET
W1 HARNESS
FWD
PT 2.5 SENSING TUBE
(FOR ENGINES WITH PT 2.5 SENSING ONLY)
W1P11
FOR ENGINES WITH TUBE (AA25) POST SB PW4ENG 72-258
W1P25
W1P10
FLANGE E
(AA25)
W1P10
NUT
W1 HARNESS
W1 HARNESS
HPC CASE BRACKET
L-A6159 (0293)
PW V

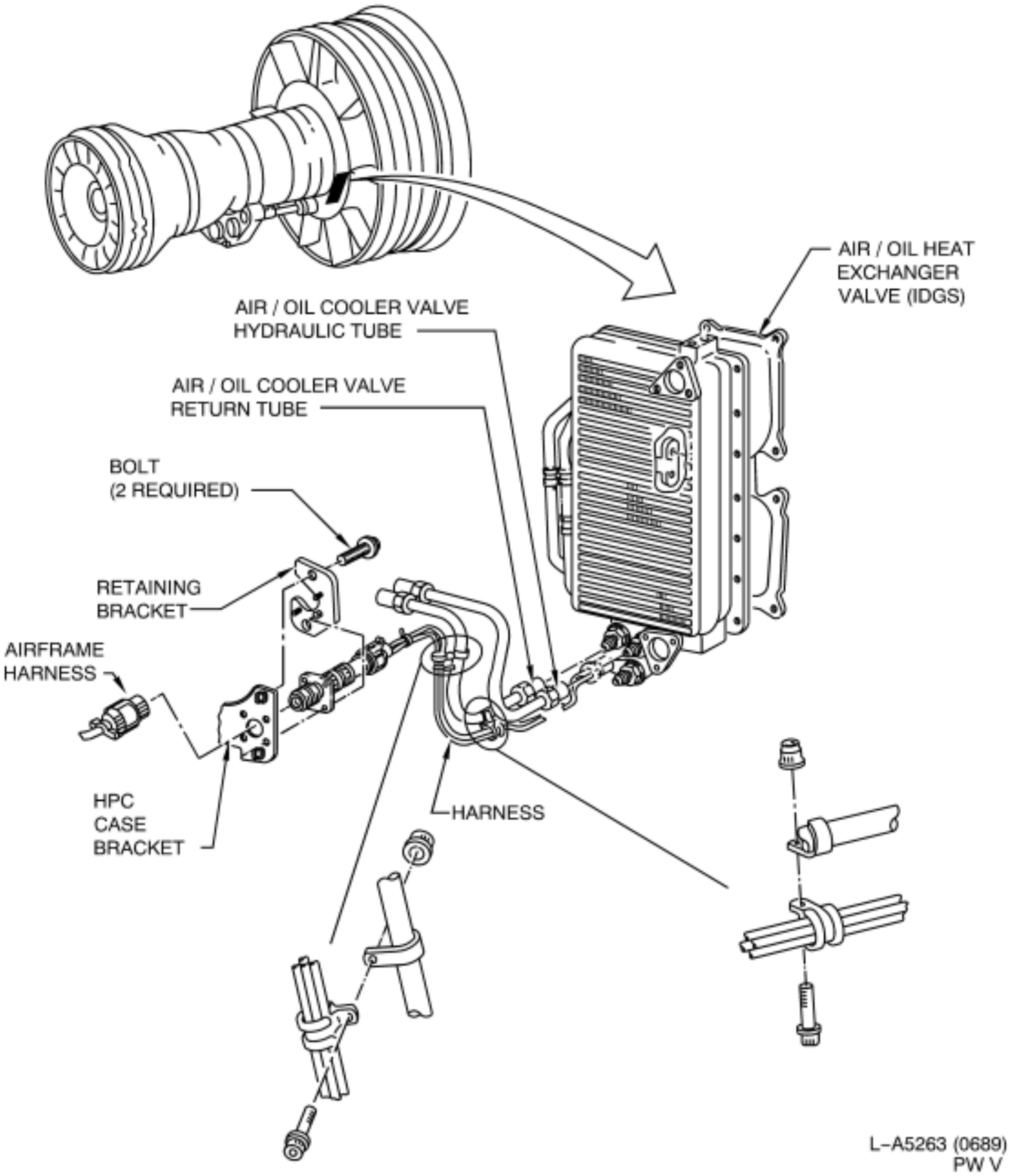
EEC Wiring Harness Removal
Figure 302 (Sheet 1)
(Task 72−00−34−020−004)


W1 HARNESS
FWD
BOLT (TYPICAL)
FLANGE E
NUT (TYPICAL)
W1 HARNESS
W1P9
HPC CASE BRACKET
W1P24
HPC CASE BRACKET
L-A6160 (0000)
PW V

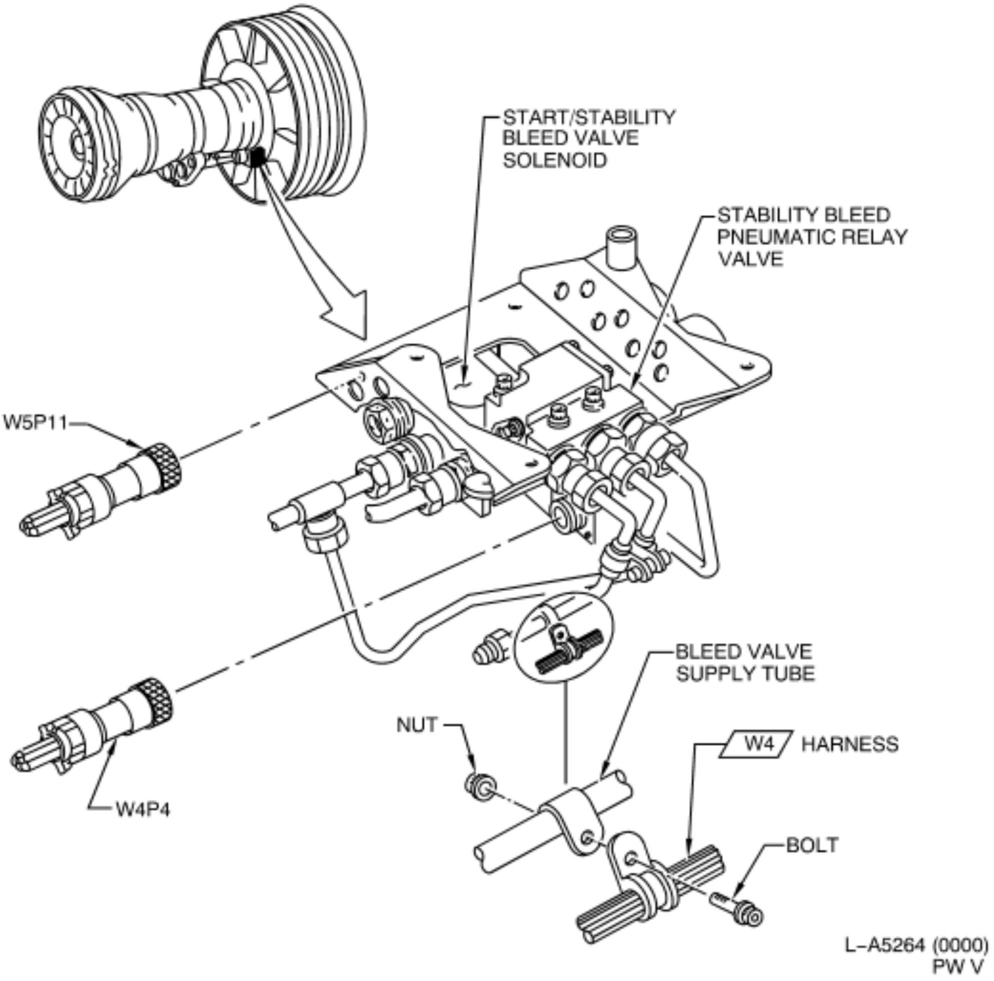
EEC Wiring Harness Removal
Figure 302 (Sheet 2)
(Task 72-00-34-020-004)


W2 HARNESS
W1 HARNESS
W2 HARNESS
NUT (TYPICAL)
FWD
FLANGE E BRACKET
W1 HARNESS
BRACKET ON FLANGE E
W2P26
SPACER ON (POST SB PW4ENG 73−26)
W2J9
FLANGE E
RETAINING BRACKET
HPC CASE BRACKET
W1 HARNESS
L−A6161 (0000)
PW V

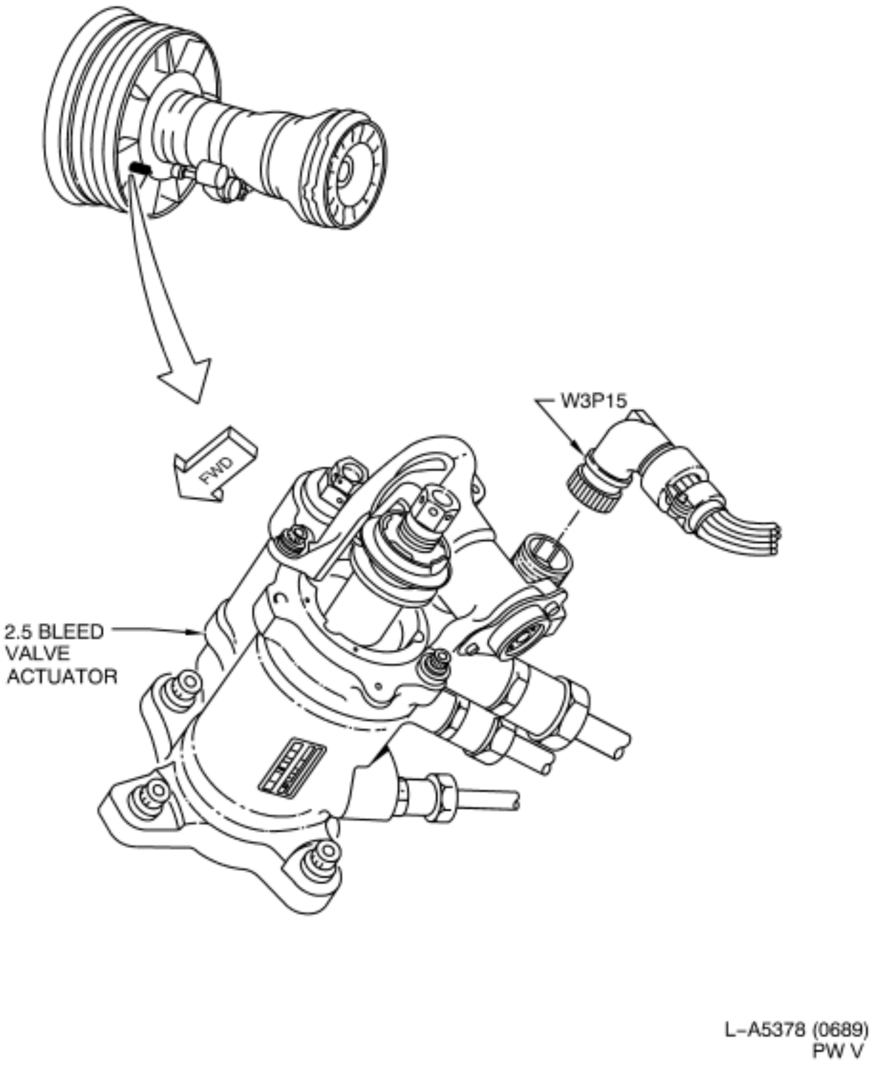
EEC Wiring Harness Removal
Figure 302 (Sheet 3)
(Task 72−00−34−020−004)


AIR / OIL HEAT EXCHANGER VALVE (IDGS)
AIR / OIL COOLER VALVE HYDRAULIC TUBE
AIR / OIL COOLER VALVE RETURN TUBE
BOLT (2 REQUIRED)
RETAINING BRACKET
AIRFRAME HARNESS
HPC CASE BRACKET
HARNESS
L-A5263 (0689)
PW V

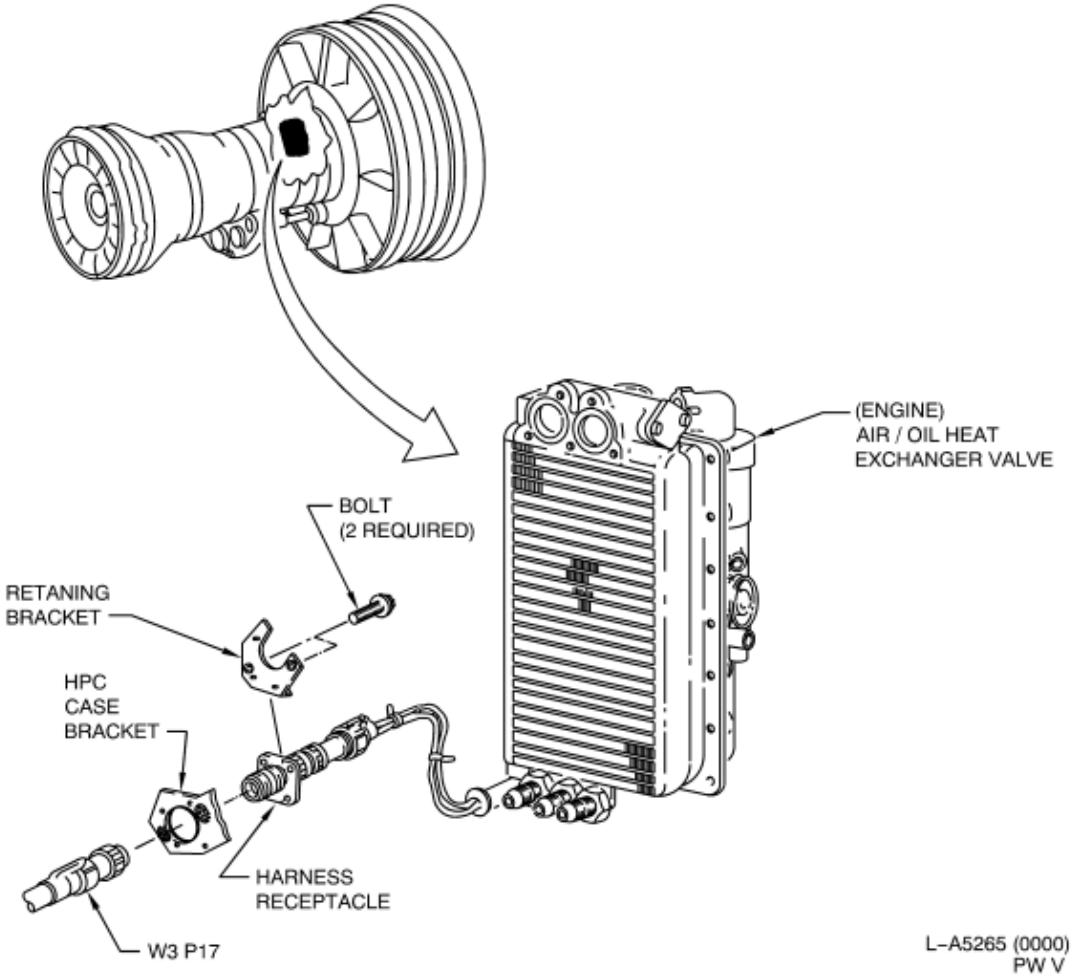
Heat Exchanger Wiring Harness Removal
Figure 302 (Sheet 4)
(Task 72-00-34-020-004)


START/STABILITY BLEED VALVE SOLENOID
STABILITY BLEED PNEUMATIC RELAY VALVE
W5P11
BLEED VALVE SUPPLY TUBE
NUT
W4
HARNESS
BOLT
W4P4
L−A5264 (0000)
PW V

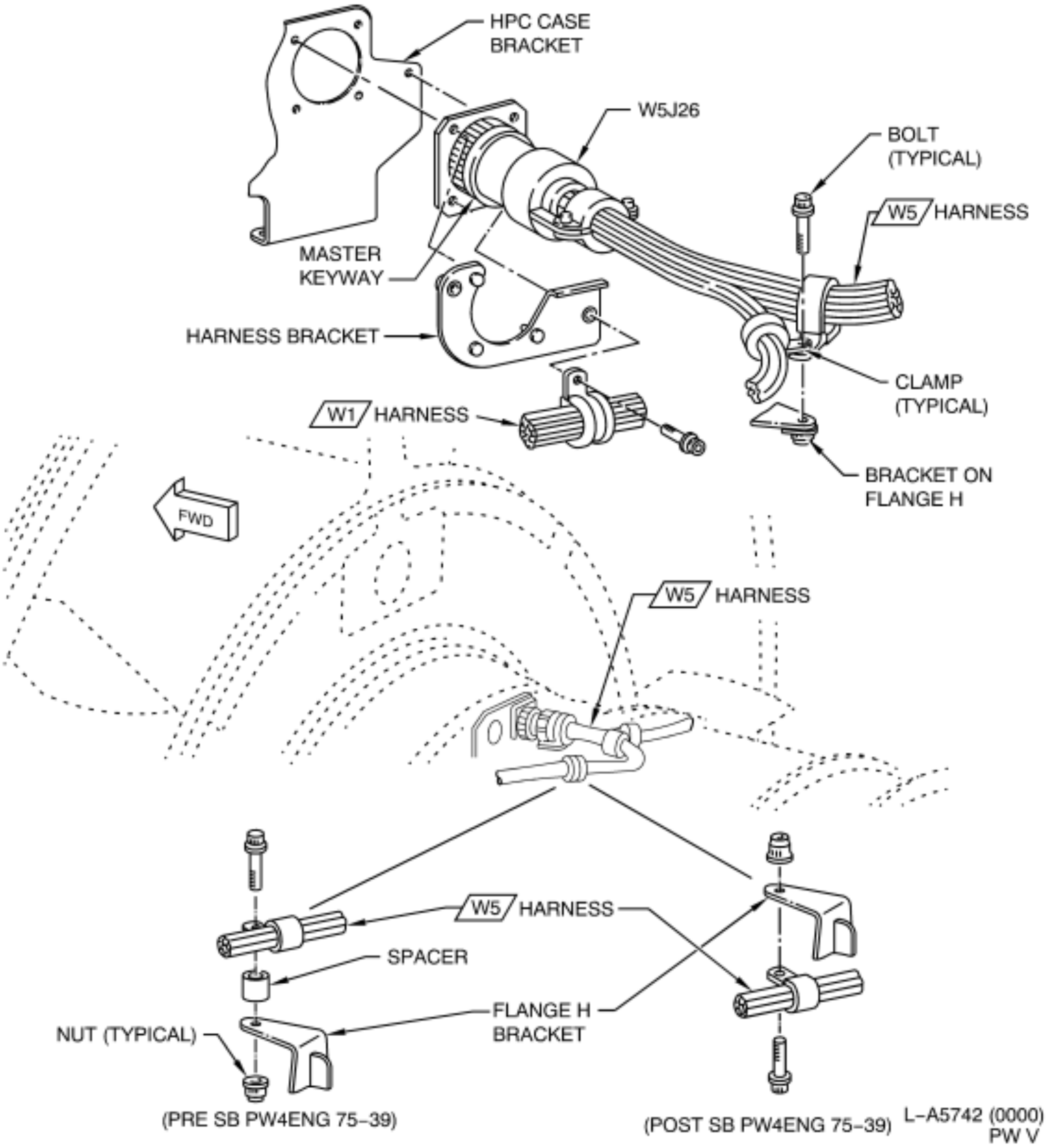
EEC Wiring Harness Removal
Figure 302 (Sheet 5)
(Task 72−00−34−020−004)


W3P15
FWD
2.5 BLEED VALVE ACTUATOR
L−A5378 (0689)
PW V

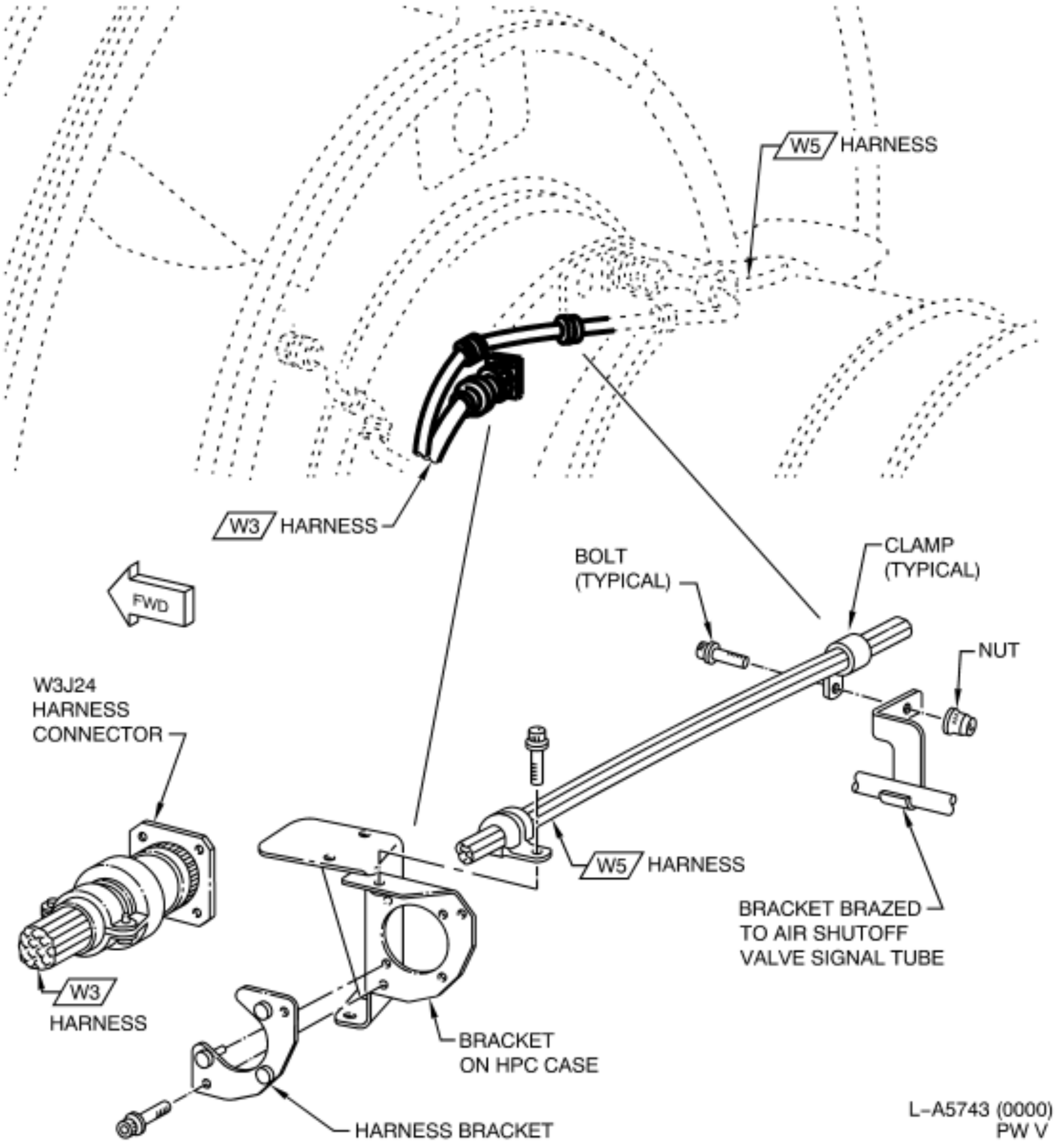
EEC Wiring Harness Removal
Figure 302 (Sheet 6)
(Task 72−00−34−020−004)


(ENGINE)
AIR / OIL HEAT
EXCHANGER VALVE
BOLT
(2 REQUIRED)
RETANING
BRACKET
HPC
CASE
BRACKET
HARNESS
RECEPTACLE
W3 P17
L−A5265 (0000)
PW V

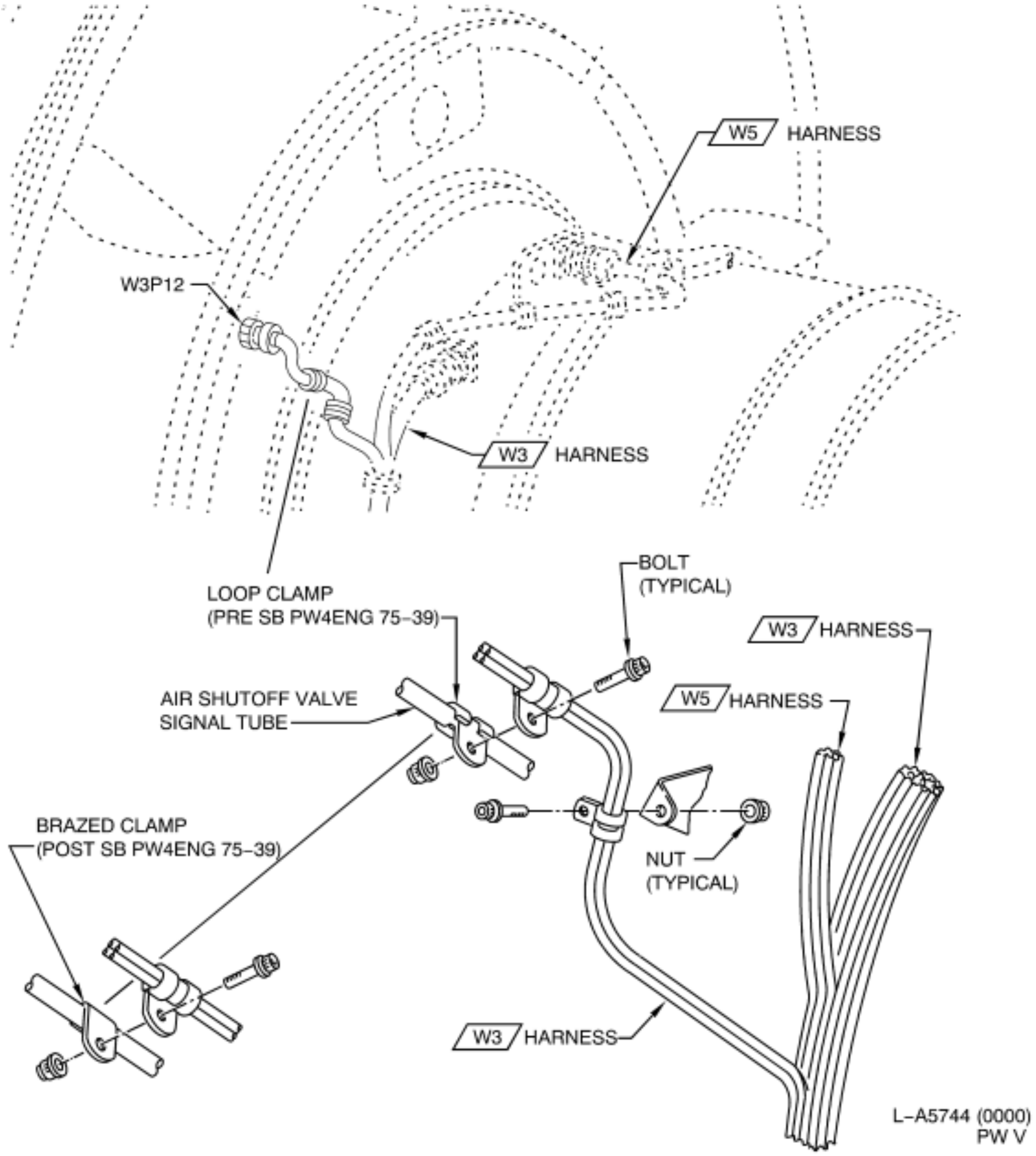
Heat Exchanger Wiring Harness Removal
Figure 302 (Sheet 7)
(Task 72−00−34−020−004)


HPC CASE BRACKET
W5J26
BOLT (TYPICAL)
W5 HARNESS
MASTER KEYWAY
HARNESS BRACKET
CLAMP (TYPICAL)
W1 HARNESS
BRACKET ON FLANGE H
FWD
W5 HARNESS
W5 HARNESS
SPACER
FLANGE H BRACKET
NUT (TYPICAL)
(PRE SB PW4ENG 75-39)
(POST SB PW4ENG 75-39)
L-A5742 (0000)
PW V

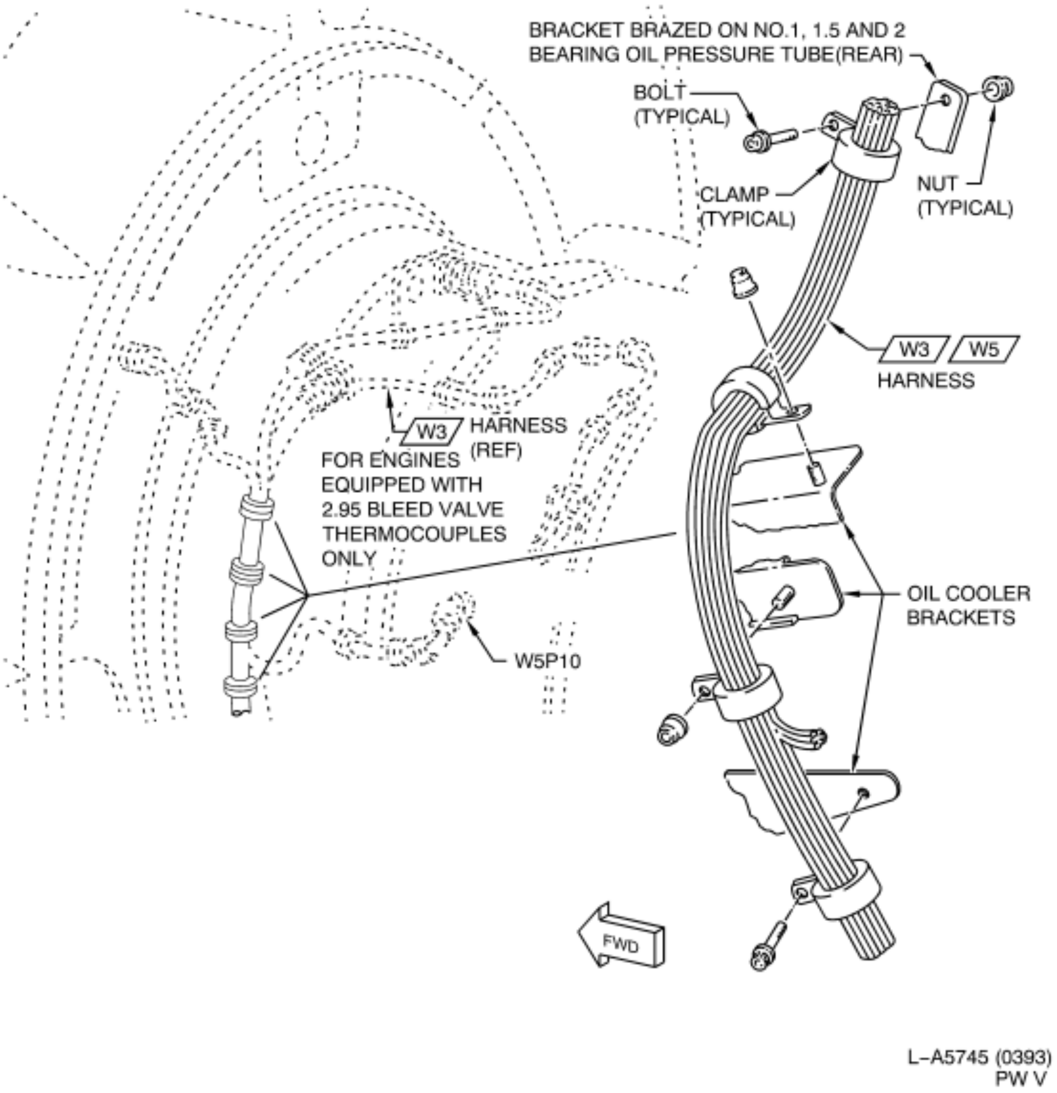
EEC Wiring Harness Removal (Required
Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 1)
(Task 72-00-34-020-004)


W5 HARNESS
W3 HARNESS
BOLT (TYPICAL)
CLAMP (TYPICAL)
FWD
NUT
W3J24 HARNESS CONNECTOR
W5 HARNESS
BRACKET BRAZED TO AIR SHUTOFF VALVE SIGNAL TUBE
W3 HARNESS
BRACKET ON HPC CASE
HARNESS BRACKET
L-A5743 (0000)
PW V

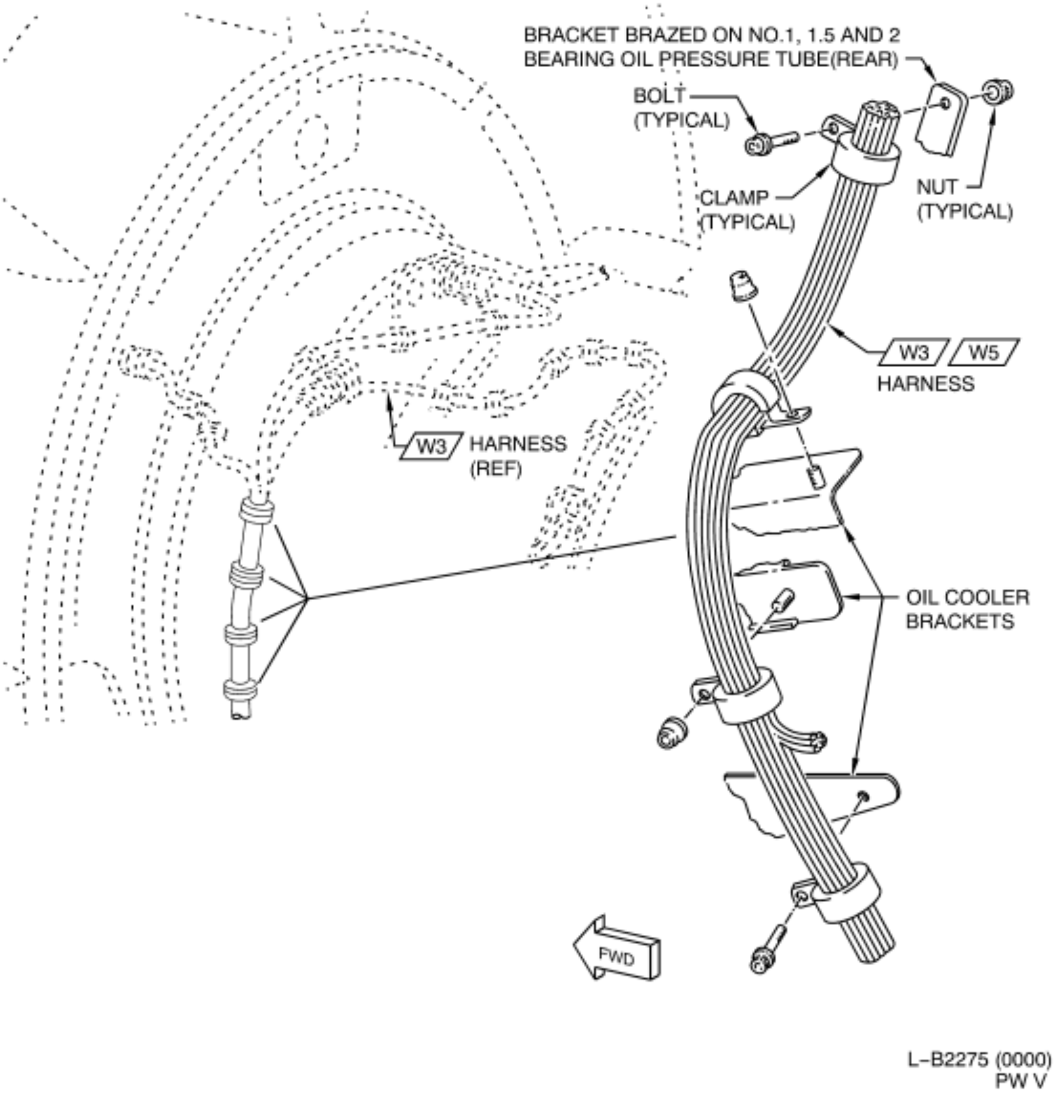
EEC Wiring Harness Removal (Necessary
Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 2)
(Task 72-00-34-020-004)


W5 HARNESS
W3P12
W3 HARNESS
LOOP CLAMP
(PRE SB PW4ENG 75−39)
BOLT
(TYPICAL)
W3 HARNESS
AIR SHUTOFF VALVE
SIGNAL TUBE
W5 HARNESS
BRAZED CLAMP
(POST SB PW4ENG 75−39)
NUT
(TYPICAL)
W3 HARNESS
L−A5744 (0000)
PW V

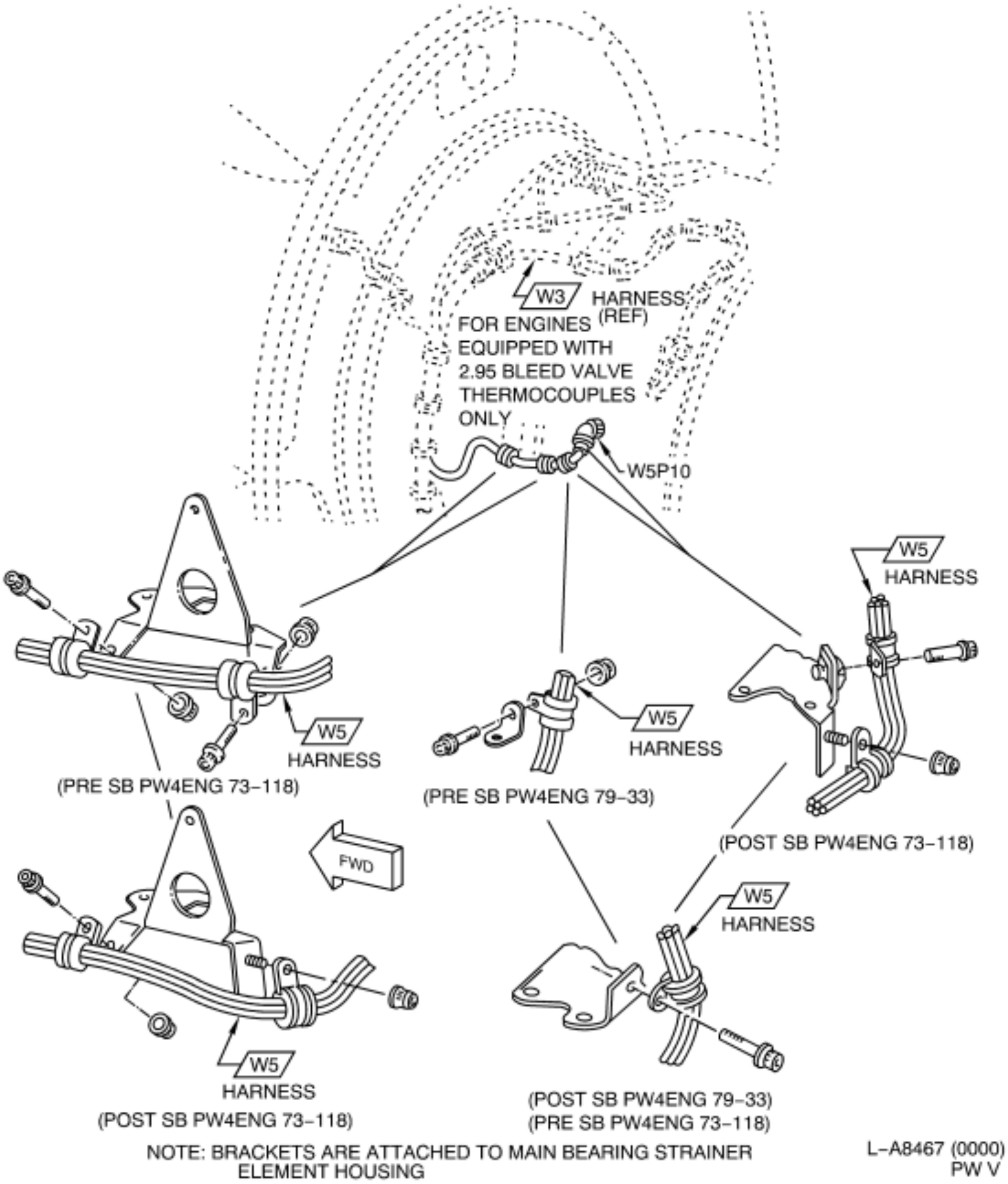
EEC Wiring Harness Removal (Necessary
Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 3)
(Task 72−00−34−020−004)


BRACKET BRAZED ON NO.1, 1.5 AND 2
BEARING OIL PRESSURE TUBE(REAR)
BOLT
(TYPICAL)
CLAMP
(TYPICAL)
NUT
(TYPICAL)
W3
W5
HARNESS
W3
HARNESS
(REF)
FOR ENGINES
EQUIPPED WITH
2.95 BLEED VALVE
THERMOCOUPLES
ONLY
OIL COOLER
BRACKETS
W5P10
FWD
L−A5745 (0393)
PW V

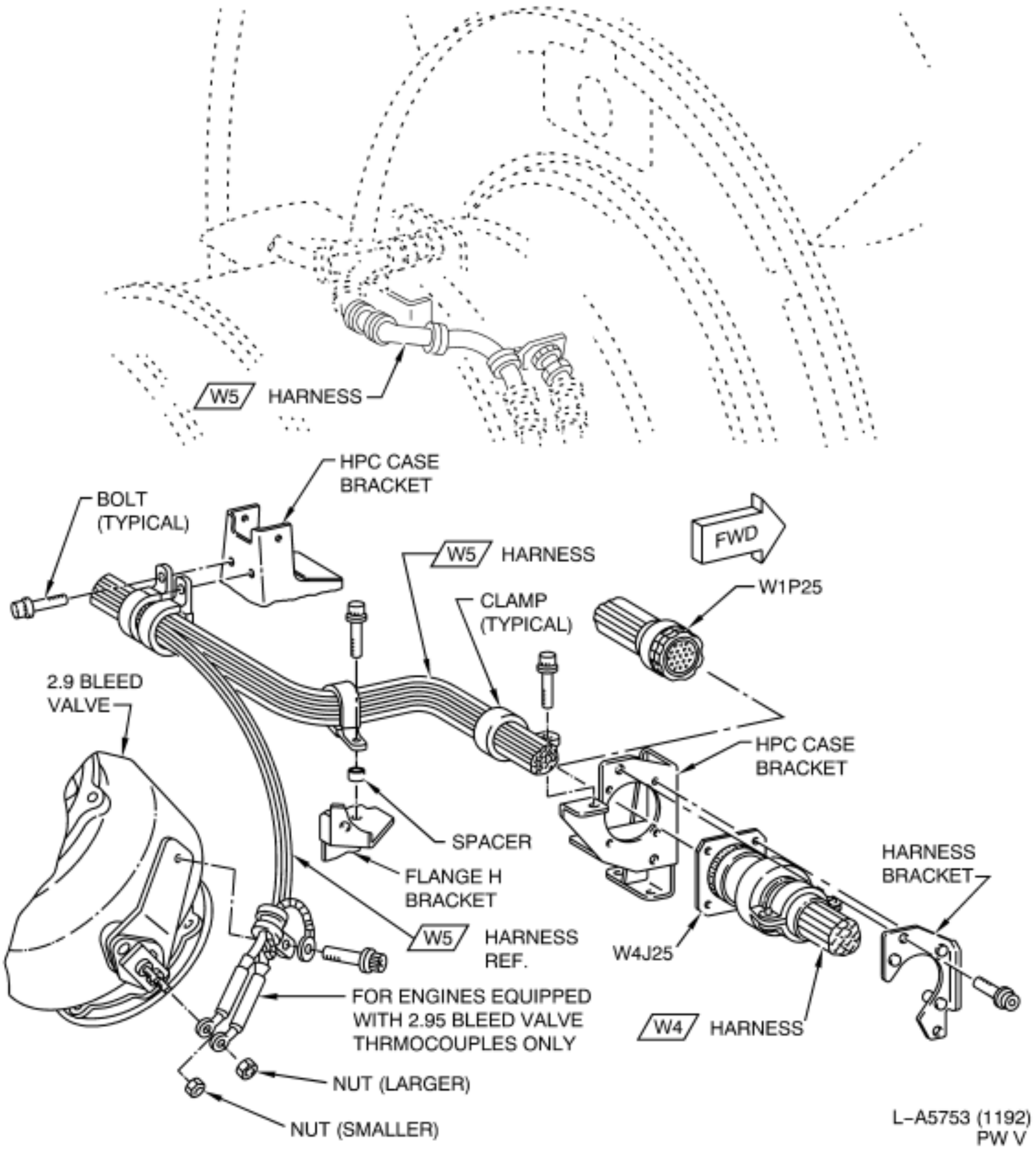
EEC Wiring Harness Removal (Pre SB PW4ENG 75−106)
(Necessary Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 4)
(Task 72−00−34−020−004)


BRACKET BRAZED ON NO.1, 1.5 AND 2
BEARING OIL PRESSURE TUBE(REAR)
BOLT
(TYPICAL)
CLAMP
(TYPICAL)
NUT
(TYPICAL)
W3
W5
HARNESS
W3
HARNESS
(REF)
OIL COOLER
BRACKETS
FWD
L-B2275 (0000)
PW V

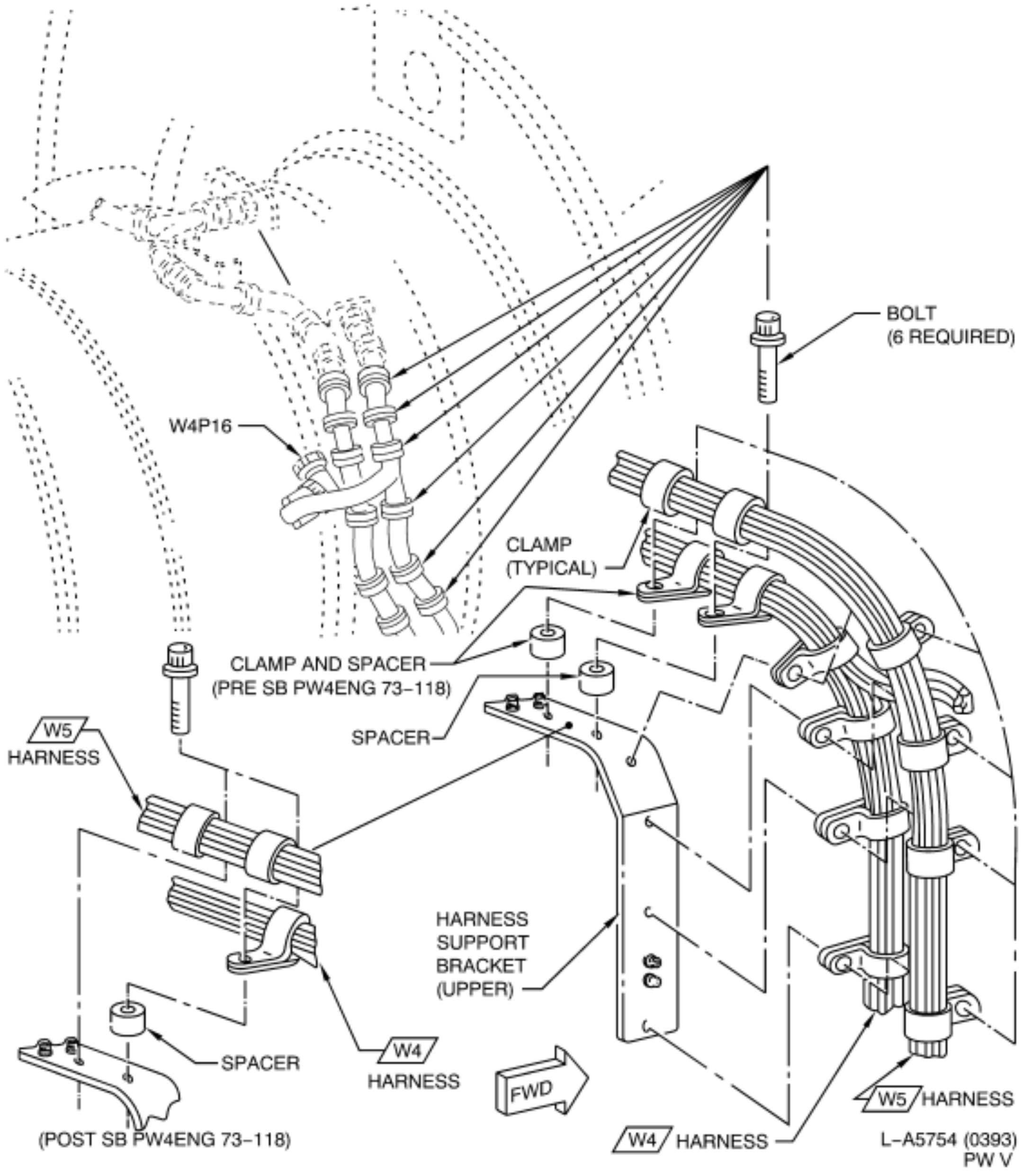
EEC Wiring Harness Removal (Post SB PW4ENG 75-106 Or SB PW4ENG 72-572) (Necessary Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 5)
(Task 72-00-34-020-004)


W3 HARNESS (REF)
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5P10
W5 HARNESS
W5 HARNESS
(PRE SB PW4ENG 73-118)
W5 HARNESS
(PRE SB PW4ENG 79-33)
(POST SB PW4ENG 73-118)
FWD
W5 HARNESS
W5 HARNESS
(POST SB PW4ENG 73-118)
(POST SB PW4ENG 79-33)
(PRE SB PW4ENG 73-118)
NOTE: BRACKETS ARE ATTACHED TO MAIN BEARING STRAINER ELEMENT HOUSING
L-A8467 (0000)
PW V

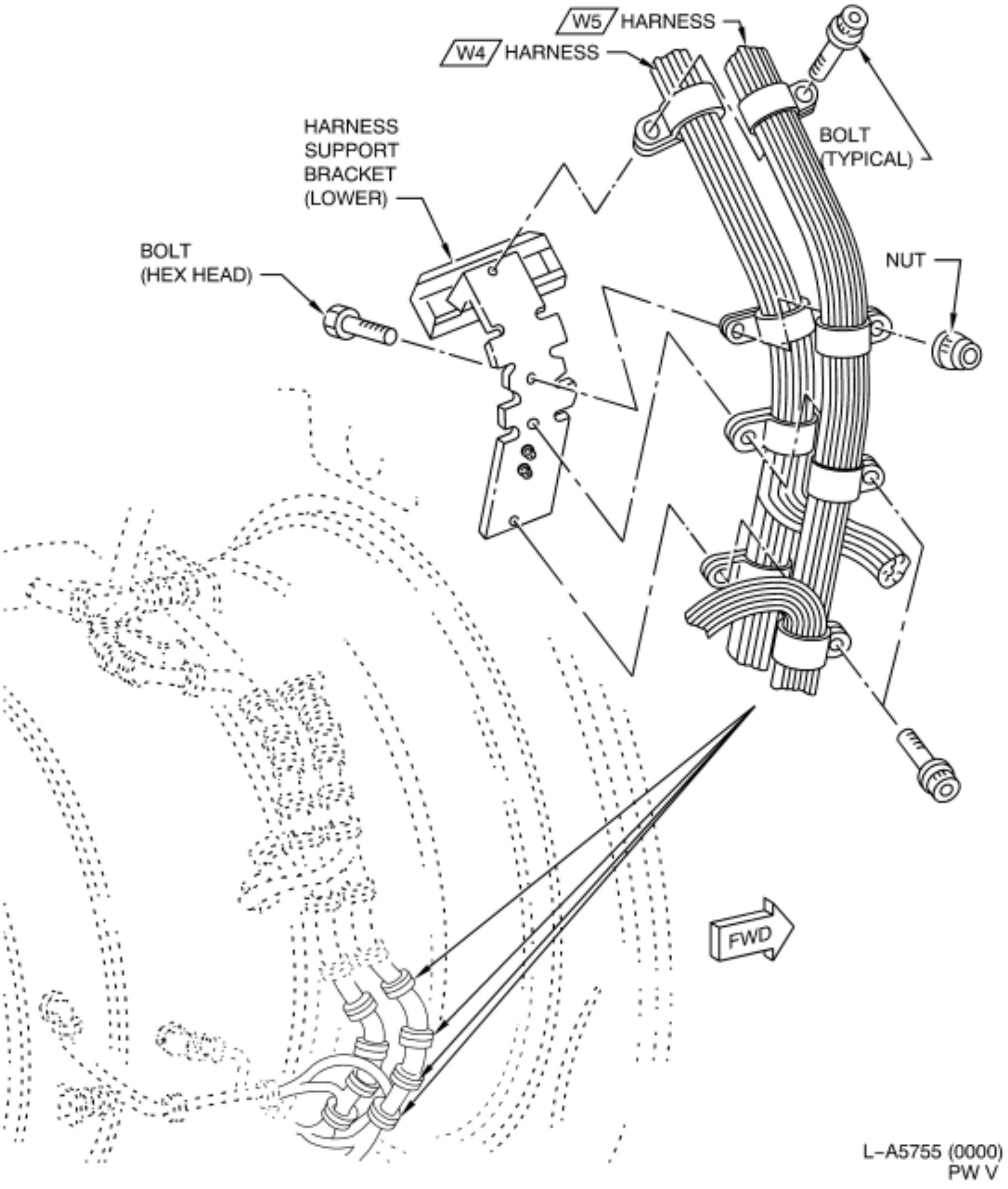
EEC Wiring Harness Removal (Pre SB PW4ENG 75-106 Only)
(Necessary Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 6)
(Task 72-00-34-020-004)


W5 HARNESS
HPC CASE BRACKET
BOLT (TYPICAL)
W5 HARNESS
FWD
CLAMP (TYPICAL)
W1P25
2.9 BLEED VALVE
HPC CASE BRACKET
SPACER
FLANGE H BRACKET
HARNESS BRACKET
W5 HARNESS REF.
W4J25
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THRMOCOUPLES ONLY
W4 HARNESS
NUT (LARGER)
NUT (SMALLER)
L-A5753 (1192)
PW V

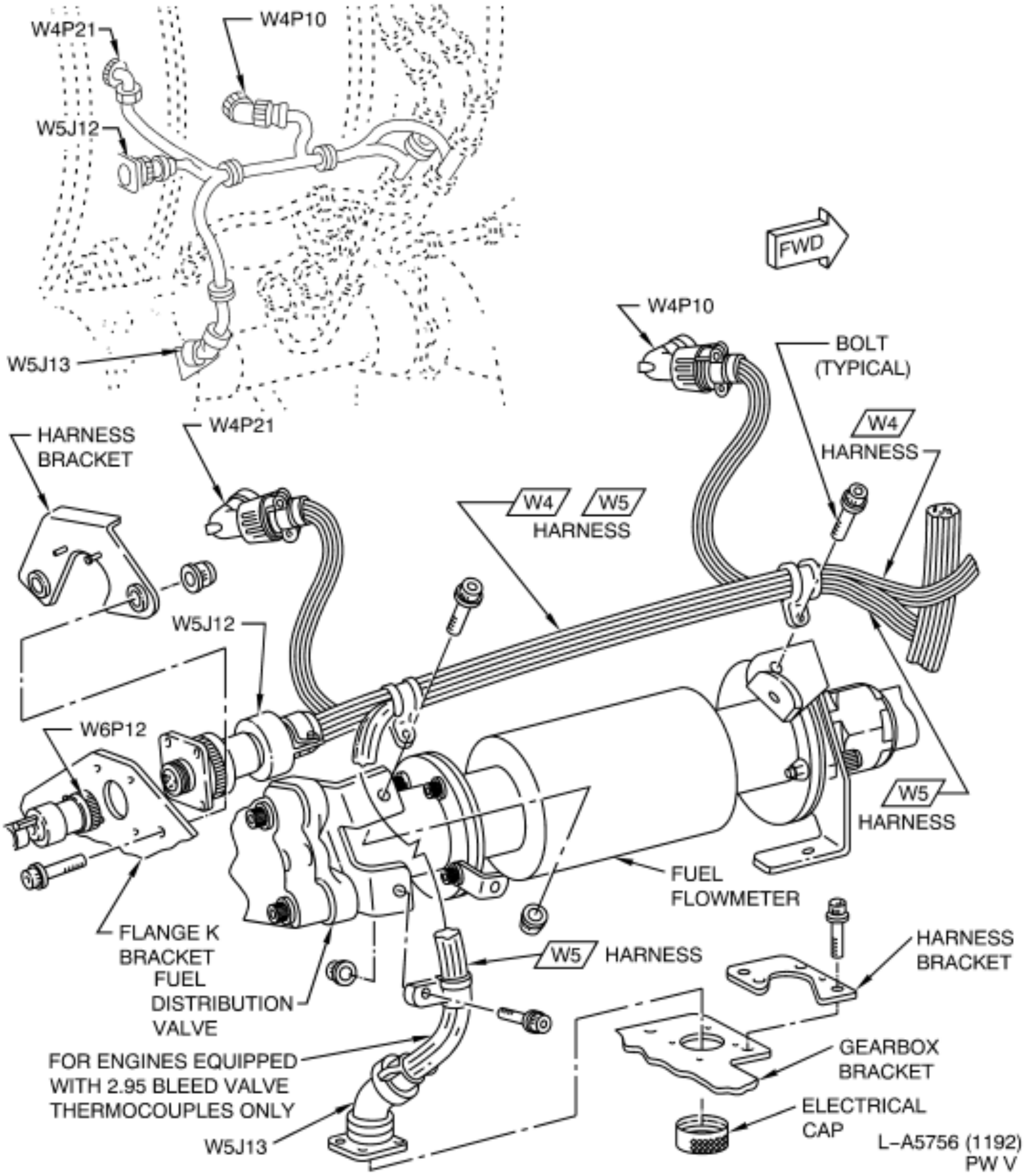
EEC Wiring Harness Removal (Necessary
Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 7)
(Task 72-00-34-020-004)


BOLT
(6 REQUIRED)
W4P16
CLAMP
(TYPICAL)
CLAMP AND SPACER
(PRE SB PW4ENG 73-118)
SPACER
W5
HARNESS
HARNESS
SUPPORT
BRACKET
(UPPER)
SPACER
W4
HARNESS
FWD
(POST SB PW4ENG 73-118)
W4 HARNESS
W5 HARNESS
L-A5754 (0393)
PW V

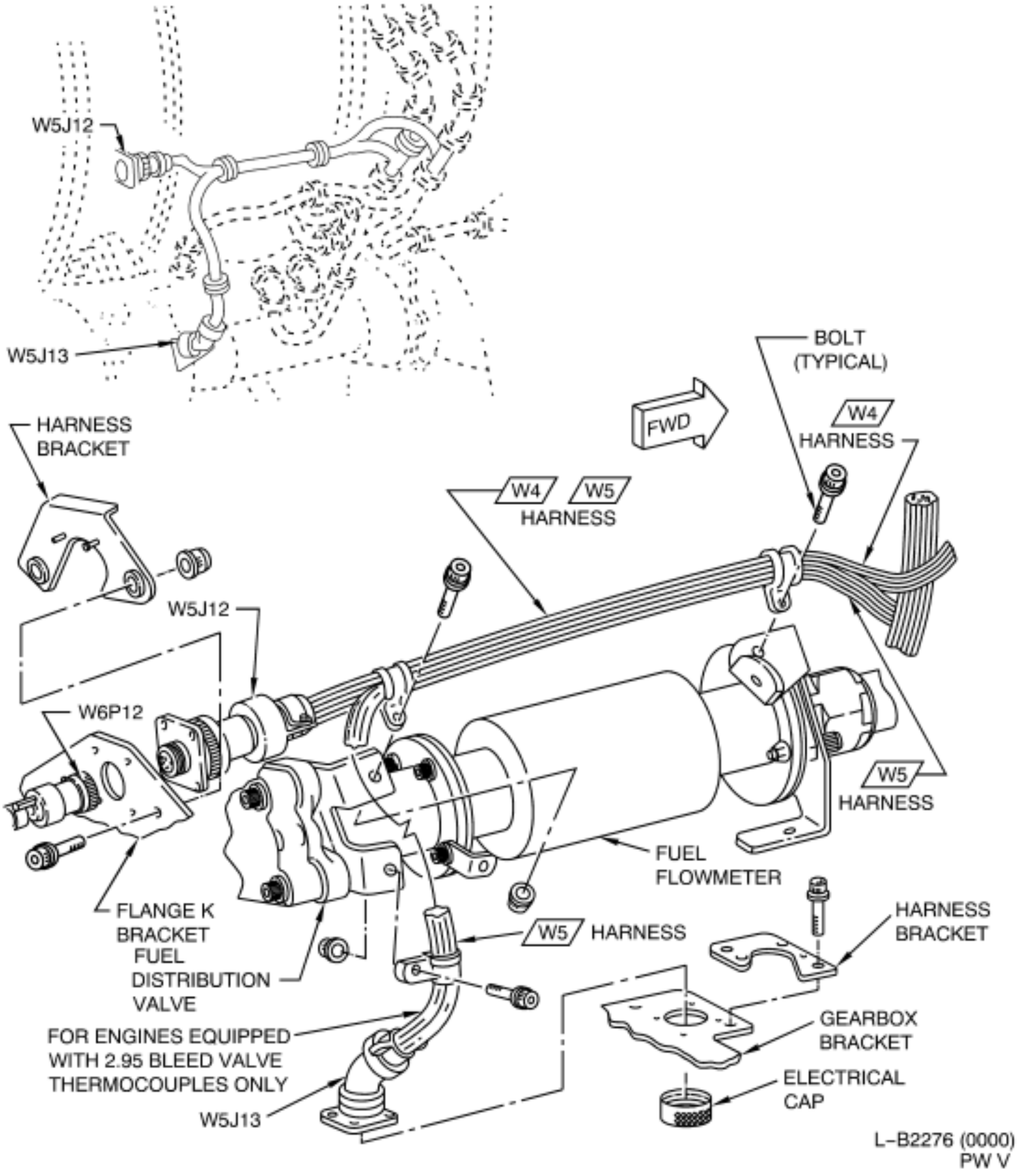
EEC Wiring Harness Removal (Necessary
Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 8)
(Task 72-00-34-020-004)


W5 HARNESS
W4 HARNESS
HARNESS SUPPORT BRACKET (LOWER)
BOLT (TYPICAL)
BOLT (HEX HEAD)
NUT
FWD
L−A5755 (0000)
PW V

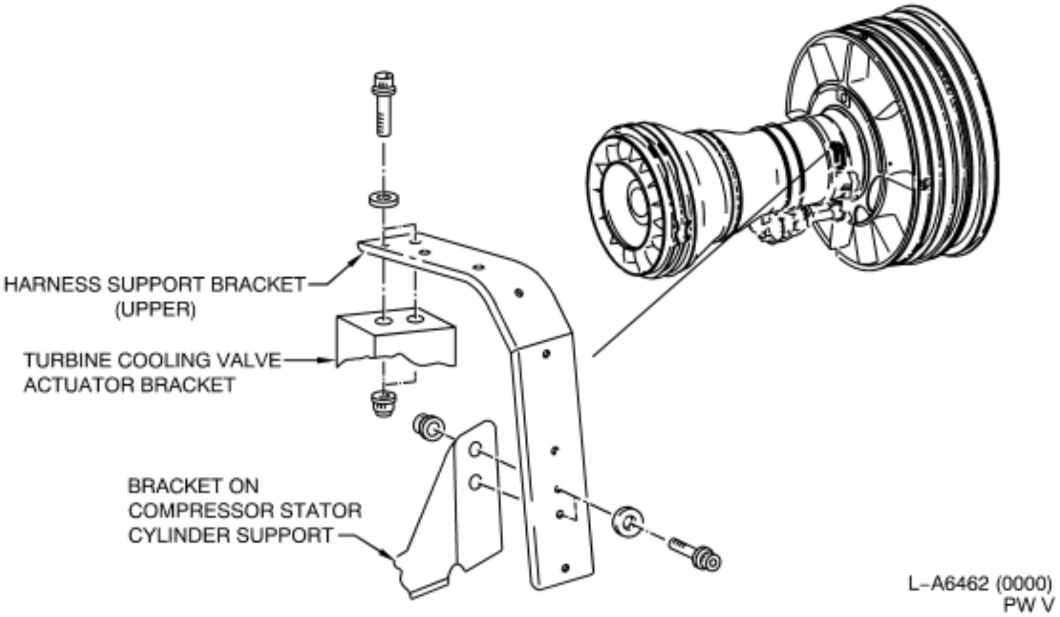
EEC Wiring Harness Removal (Necessary
Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 9)
(Task 72−00−34−020−004)


W4P21
W4P10
W5J12
W5J13
FWD
W4P10
BOLT (TYPICAL)
W4 HARNESS
HARNESS BRACKET
W4P21
W4 W5 HARNESS
W5J12
W6P12
W5 HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
GEARBOX BRACKET
ELECTRICAL CAP
W5J13
L−A5756 (1192)
PW V

EEC Wiring Harness Removal (Pre SB PW4ENG 75−106)
(Necessary Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 10)
(Task 72−00−34−020−004)

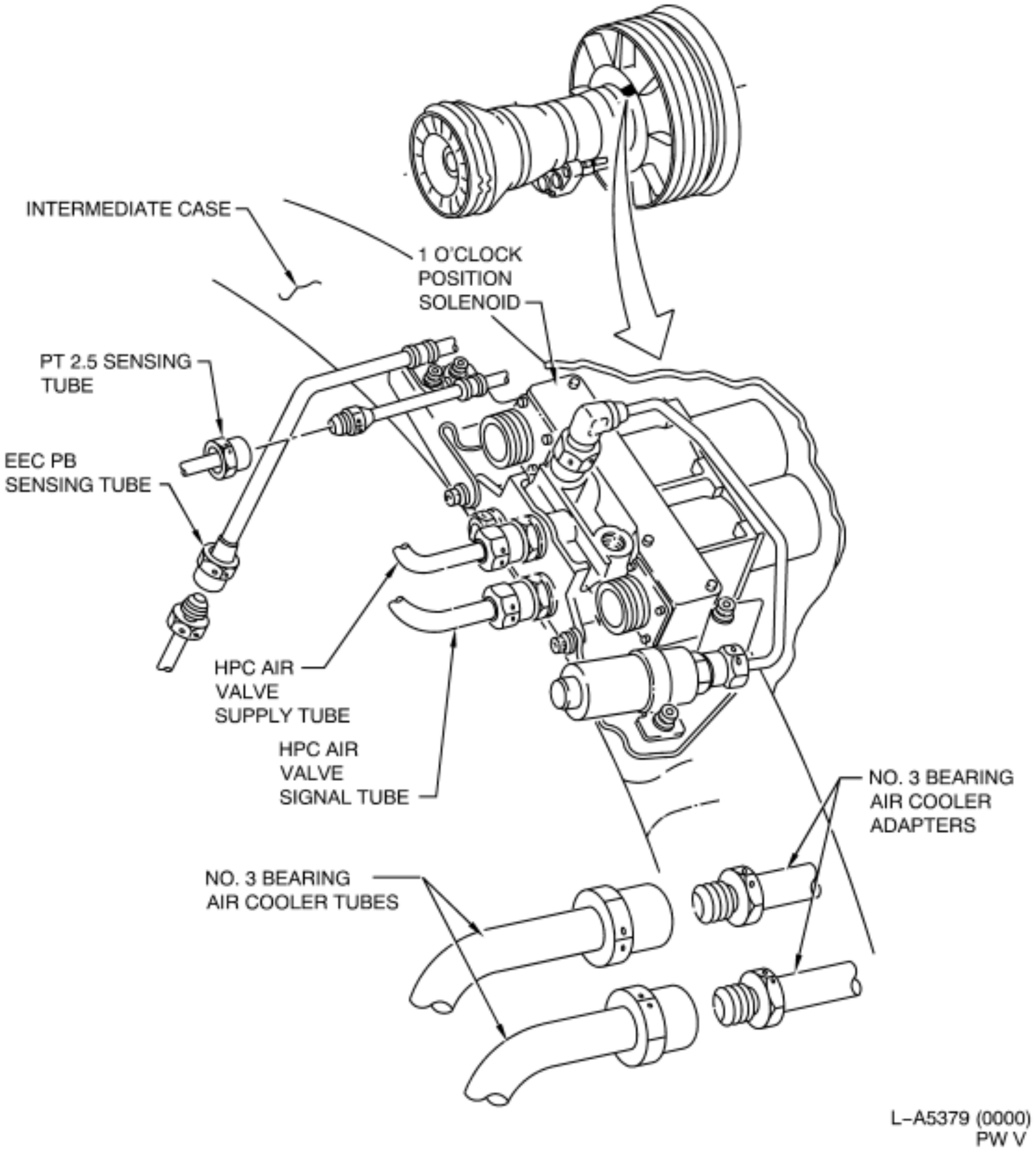

W5J12
W5J13
BOLT (TYPICAL)
FWD
W4 HARNESS
HARNESS BRACKET
W4 W5 HARNESS
W5J12
W6P12
W5 HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
GEARBOX BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5J13
ELECTRICAL CAP
L−B2276 (0000)
PW V

EEC Wiring Harness Removal (Post SB PW4ENG 75−106 Or SB PW4ENG 72−572) (Necessary Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 11)
(Task 72−00−34−020−004)

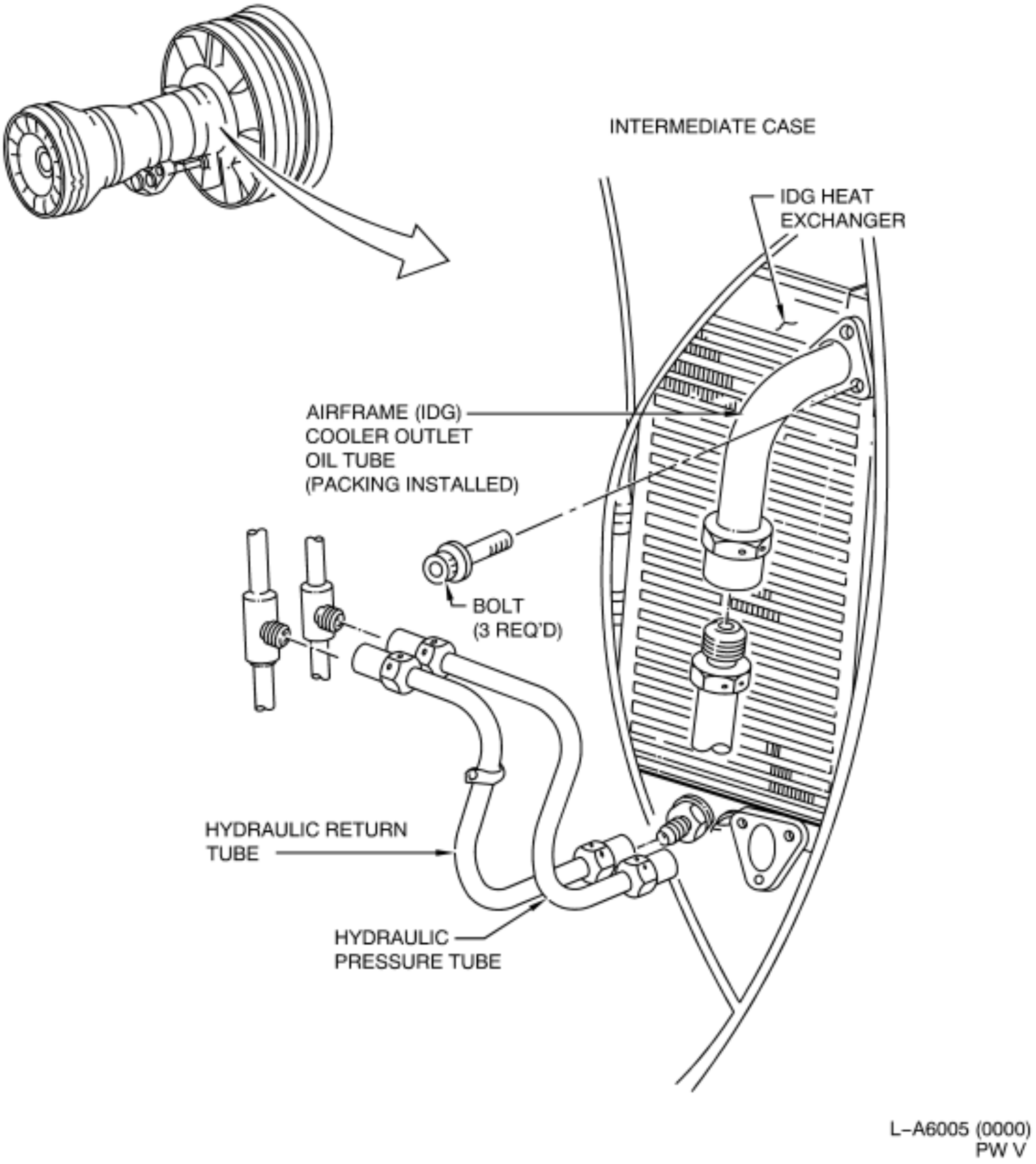

HARNESS SUPPORT BRACKET (UPPER)
TURBINE COOLING VALVE ACTUATOR BRACKET
BRACKET ON COMPRESSOR STATOR CYLINDER SUPPORT
L-A6462 (0000)
PW V

EEC Wiring Harness Removal (Necessary
Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 12)
(Task 72-00-34-020-004)

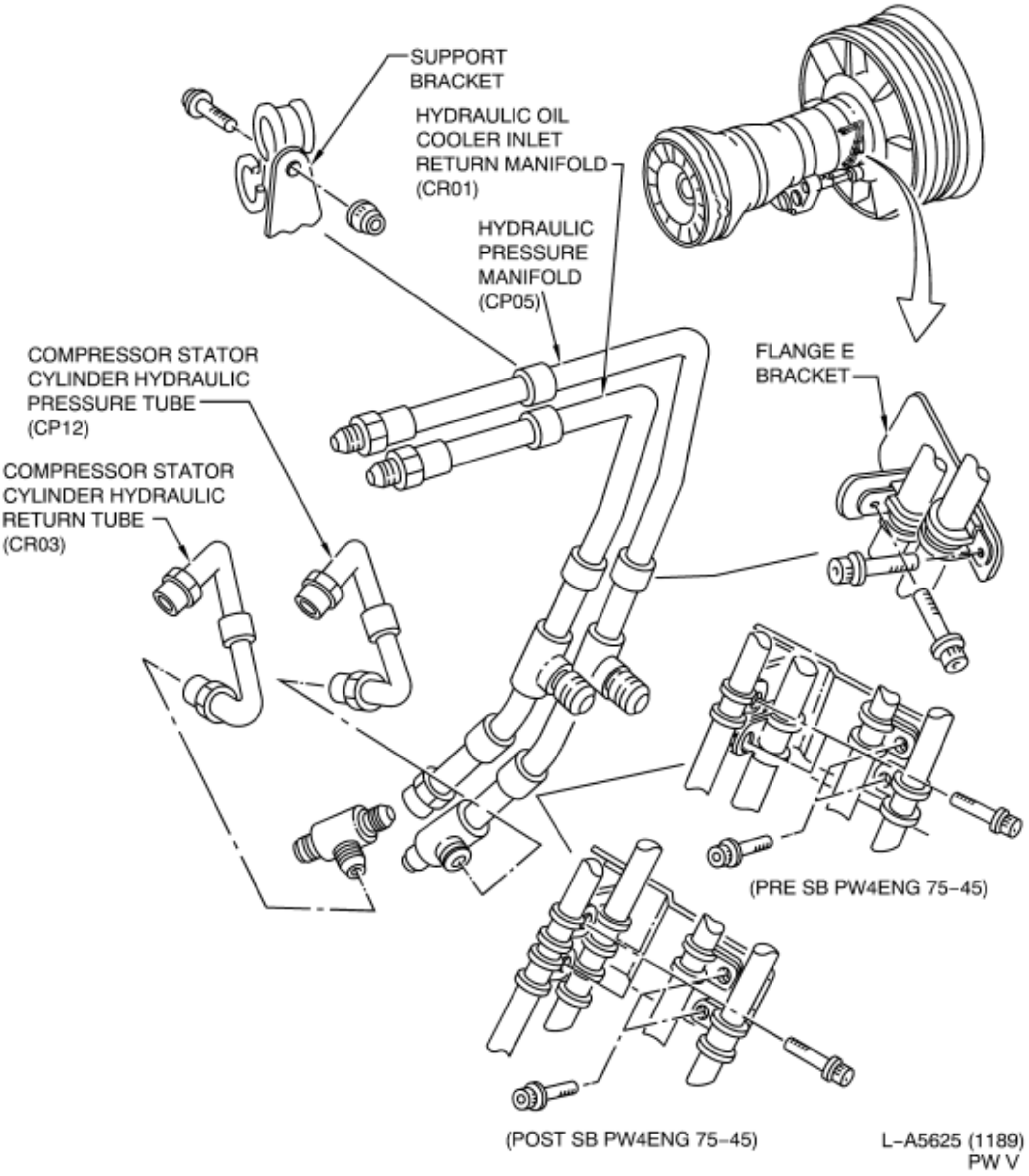
ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−21


INTERMEDIATE CASE
1 O'CLOCK POSITION SOLENOID
PT 2.5 SENSING TUBE
EEC PB SENSING TUBE
HPC AIR VALVE SUPPLY TUBE
HPC AIR VALVE SIGNAL TUBE
NO. 3 BEARING AIR COOLER ADAPTERS
NO. 3 BEARING AIR COOLER TUBES
L−A5379 (0000)
PW V

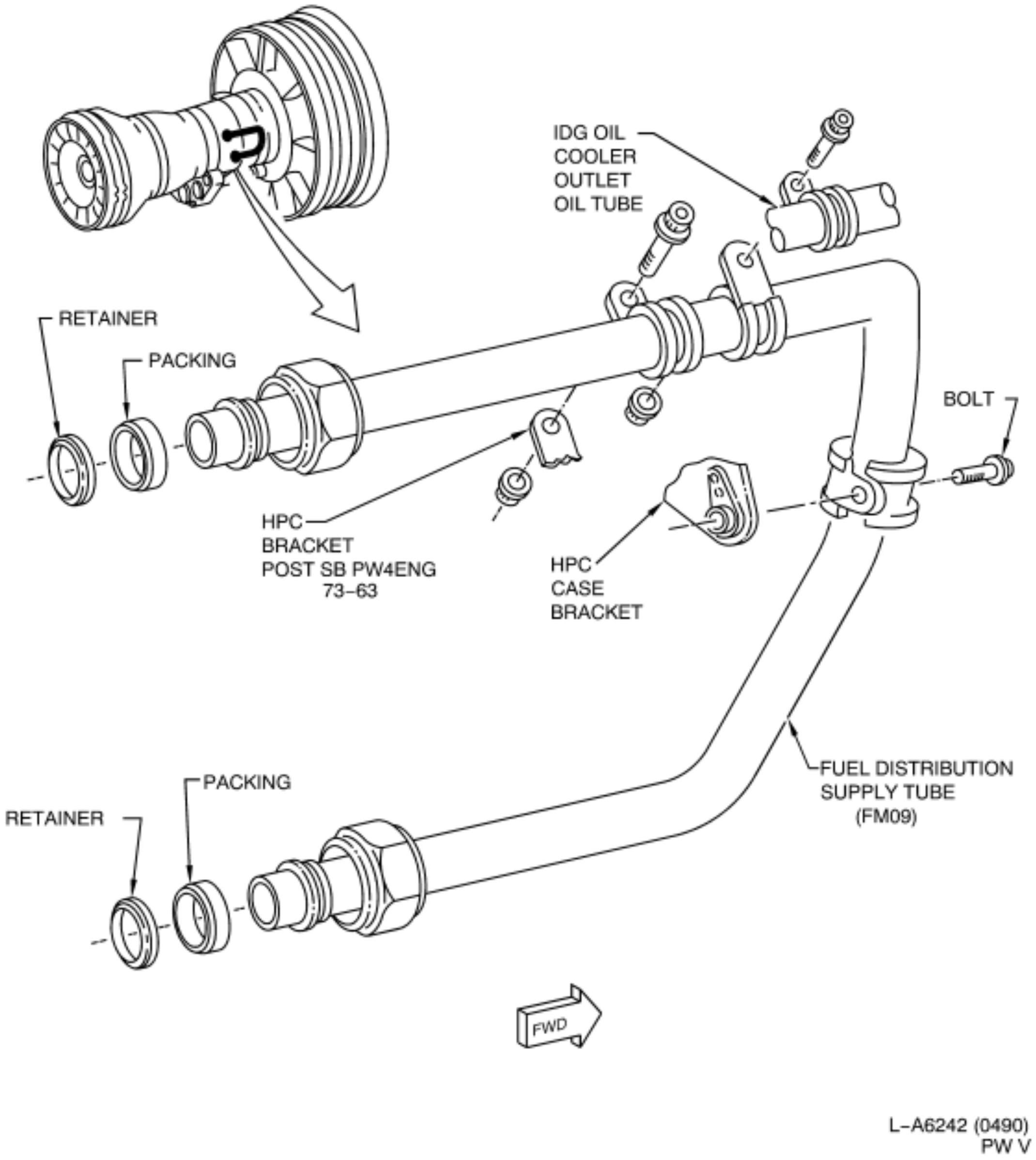
Engine Tube Disconnects And Removals
Figure 304 (Sheet 1)
(Task 72−00−34−020−004)


INTERMEDIATE CASE
IDG HEAT EXCHANGER
AIRFRAME (IDG) COOLER OUTLET OIL TUBE (PACKING INSTALLED)
BOLT (3 REQ'D)
HYDRAULIC RETURN TUBE
HYDRAULIC PRESSURE TUBE
L−A6005 (0000)
PW V

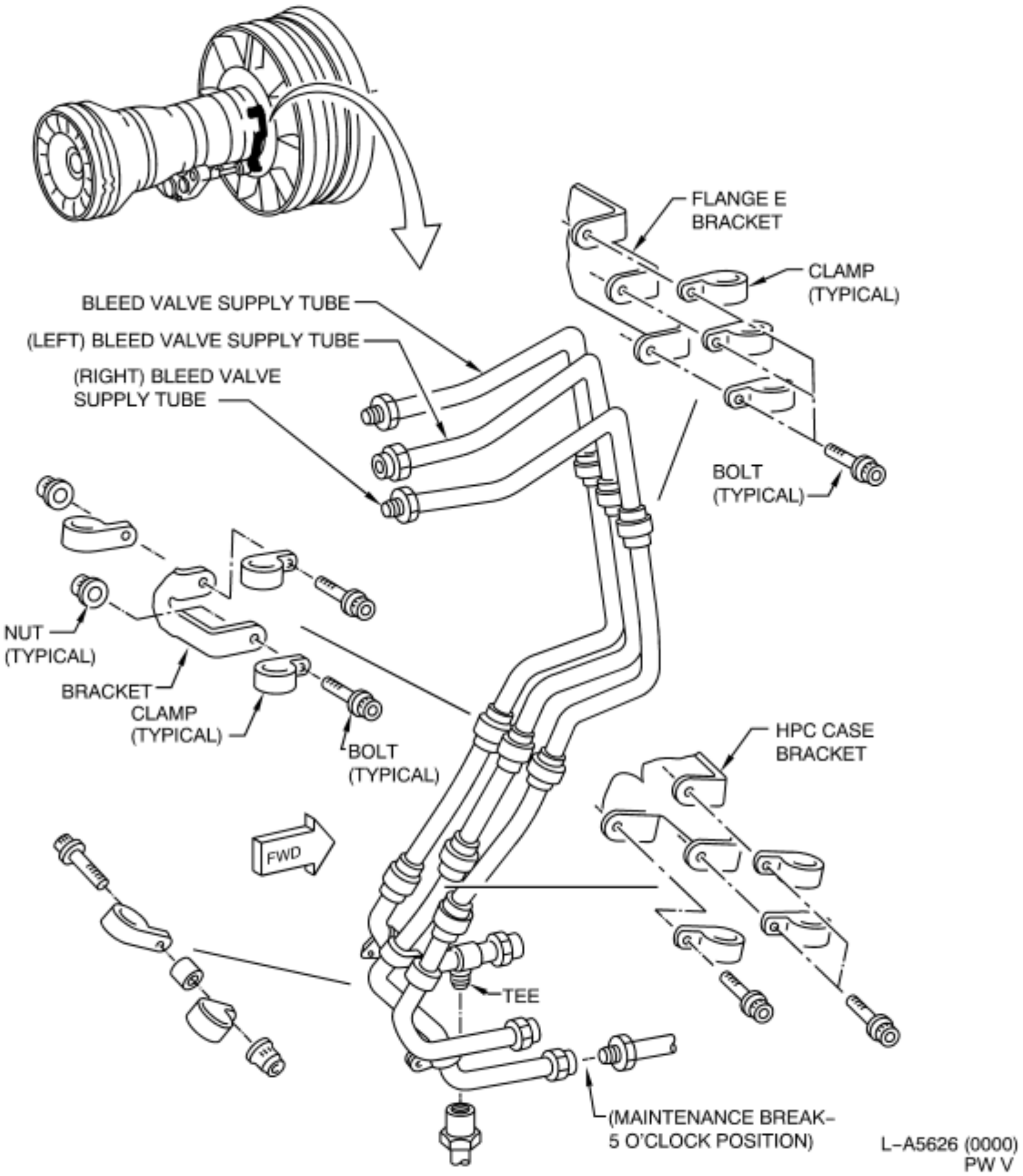
Engine Tube Disconnects And Removals
Figure 304 (Sheet 2)
(Task 72−00−34−020−004)


SUPPORT BRACKET
HYDRAULIC OIL COOLER INLET RETURN MANIFOLD (CR01)
HYDRAULIC PRESSURE MANIFOLD (CP05)
COMPRESSOR STATOR CYLINDER HYDRAULIC PRESSURE TUBE (CP12)
COMPRESSOR STATOR CYLINDER HYDRAULIC RETURN TUBE (CR03)
FLANGE E BRACKET
(PRE SB PW4ENG 75−45)
(POST SB PW4ENG 75−45)
L−A5625 (1189)
PW V

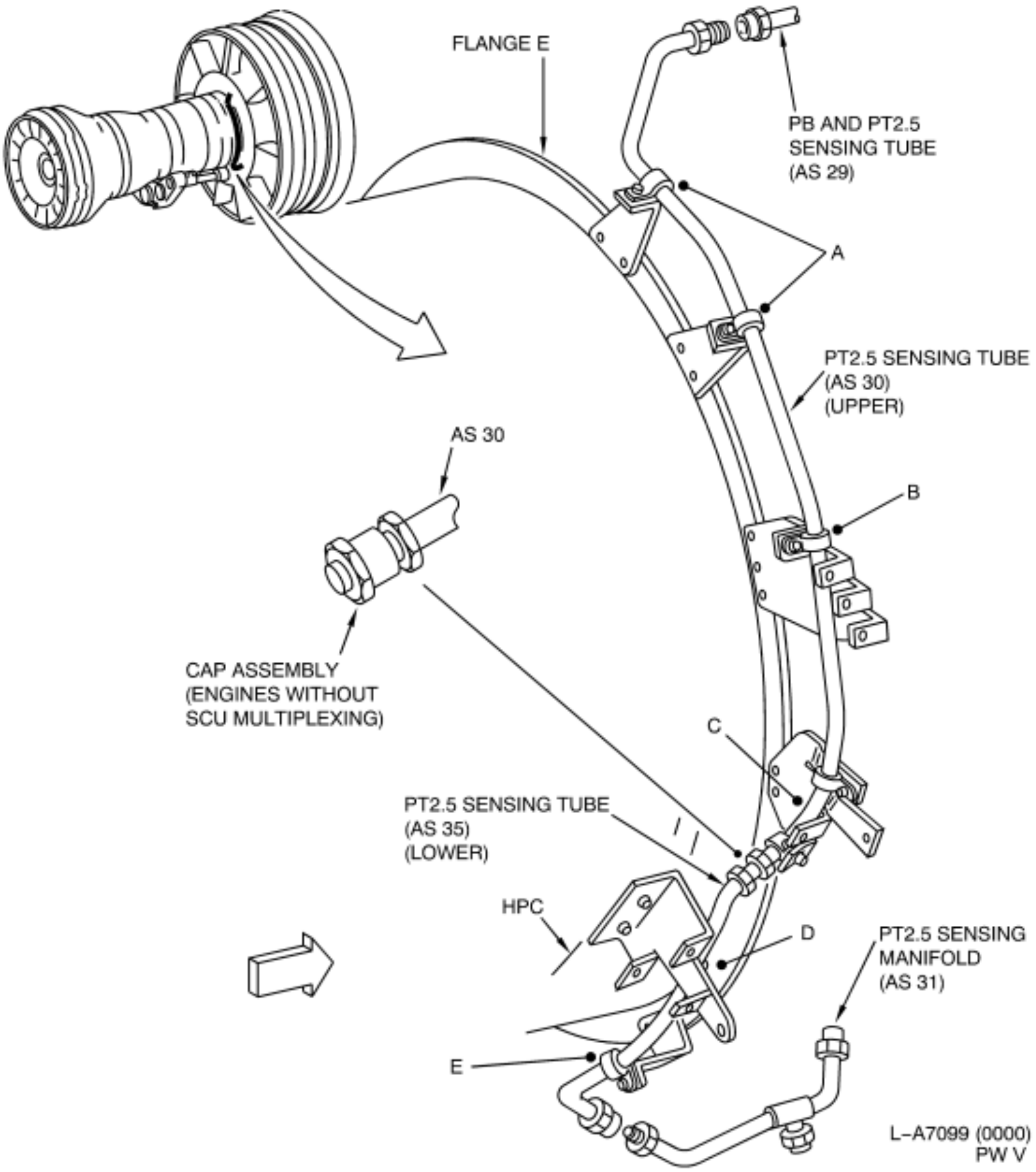
Engine Tube Disconnects And Removals
Figure 304 (Sheet 3)
(Task 72−00−34−020−004)


IDG OIL
COOLER
OUTLET
OIL TUBE
RETAINER
PACKING
BOLT
HPC
BRACKET
POST SB PW4ENG
73-63
HPC
CASE
BRACKET
PACKING
RETAINER
FUEL DISTRIBUTION
SUPPLY TUBE
(FM09)
FWD
L-A6242 (0490)
PW V

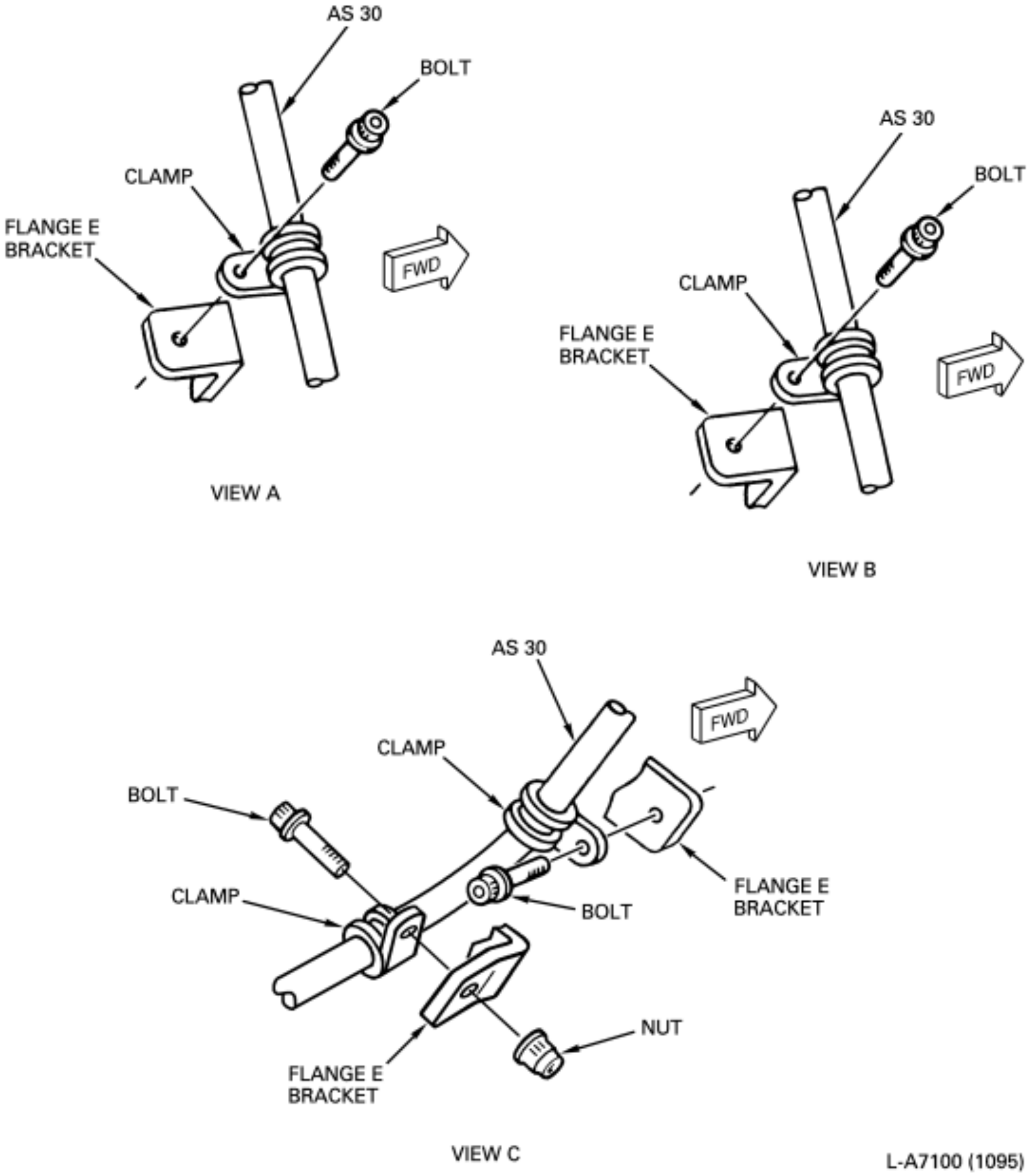
Engine Tube Disconnects And Removals
Figure 304 (Sheet 4)
(Task 72-00-34-020-004)


FLANGE E BRACKET
CLAMP (TYPICAL)
BLEED VALVE SUPPLY TUBE
(LEFT) BLEED VALVE SUPPLY TUBE
(RIGHT) BLEED VALVE SUPPLY TUBE
BOLT (TYPICAL)
NUT (TYPICAL)
BRACKET
CLAMP (TYPICAL)
BOLT (TYPICAL)
HPC CASE BRACKET
FWD
TEE
(MAINTENANCE BREAK- 5 O'CLOCK POSITION)
L-A5626 (0000)
PW V

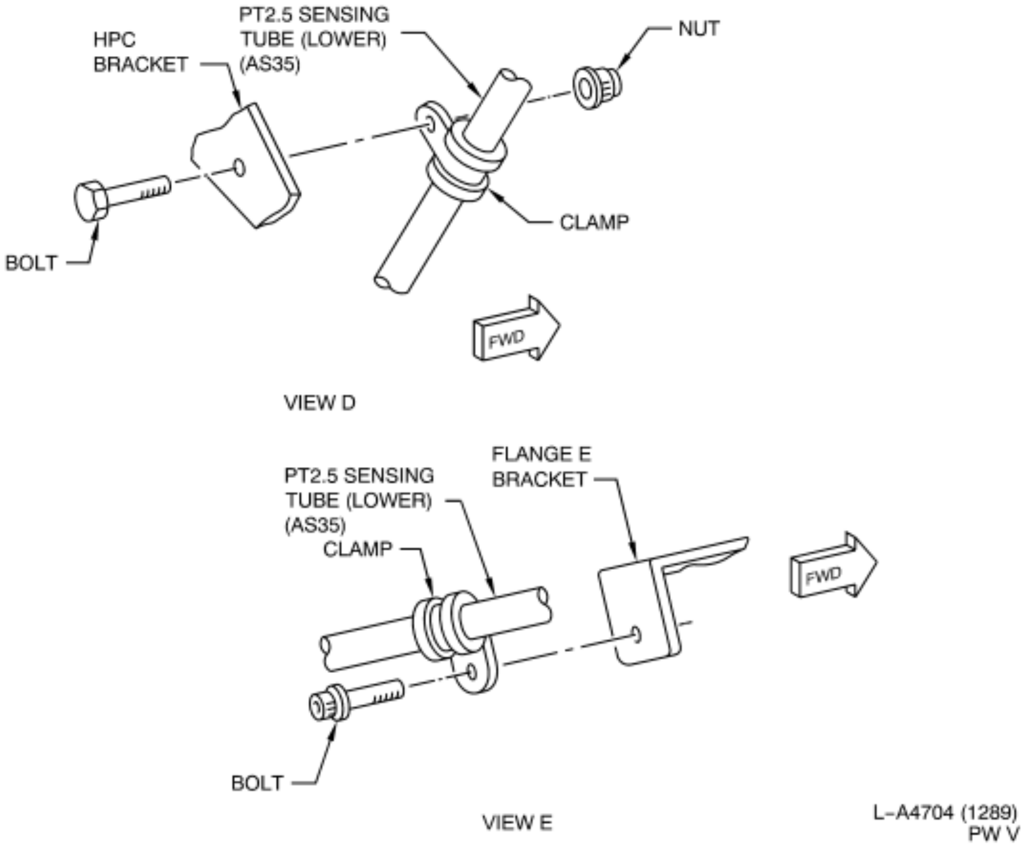
Engine Tube Disconnects And Removals
Figure 304 (Sheet 5)
(Task 72-00-34-020-004)


FLANGE E
PB AND PT2.5 SENSING TUBE (AS 29)
A
PT2.5 SENSING TUBE (AS 30) (UPPER)
AS 30
B
CAP ASSEMBLY (ENGINES WITHOUT SCU MULTIPLEXING)
C
PT2.5 SENSING TUBE (AS 35) (LOWER)
HPC
D
PT2.5 SENSING MANIFOLD (AS 31)
E
L−A7099 (0000)
PW V

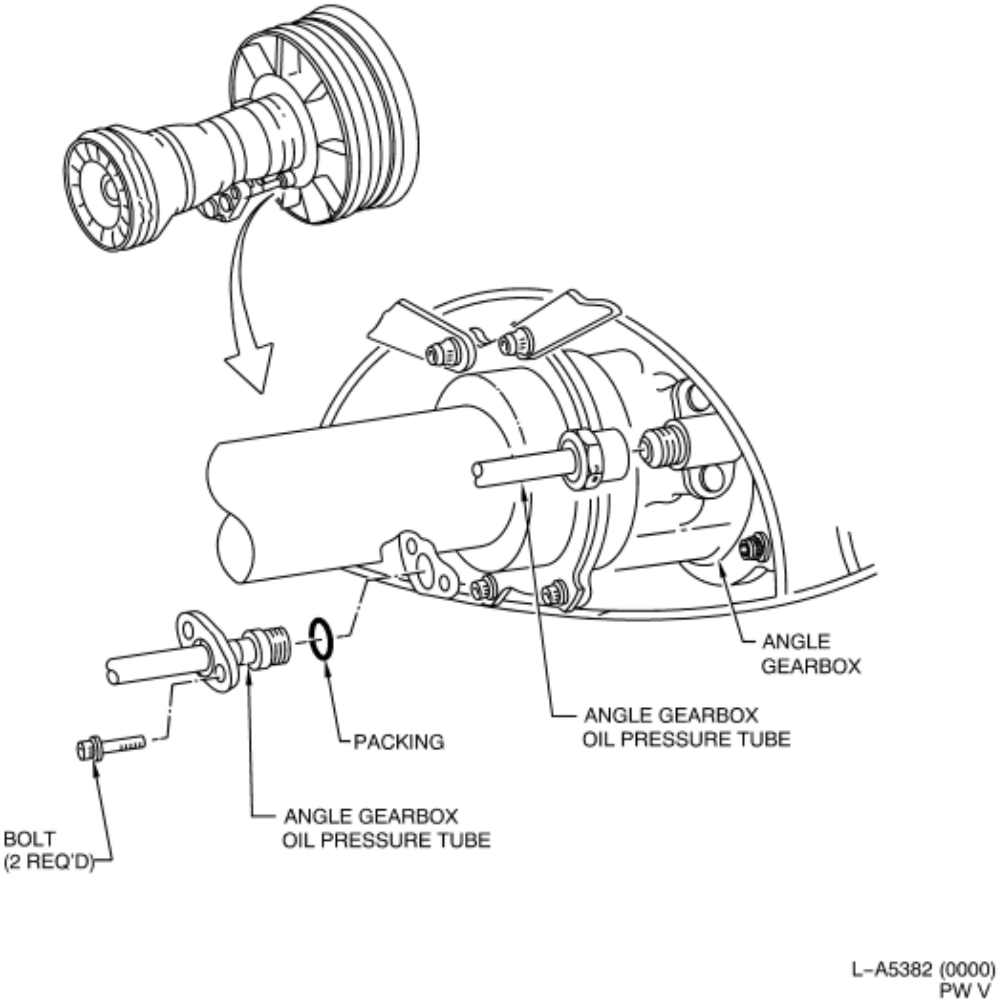
Engine Tube Disconnects And Removals
Figure 304 (Sheet 6)
(Task 72−00−34−020−004)


AS 30
BOLT
CLAMP
FLANGE E BRACKET
FWD
VIEW A
AS 30
BOLT
CLAMP
FLANGE E BRACKET
FWD
VIEW B
AS 30
FWD
CLAMP
BOLT
FLANGE E BRACKET
CLAMP
BOLT
NUT
FLANGE E BRACKET
VIEW C
L-A7100 (1095)

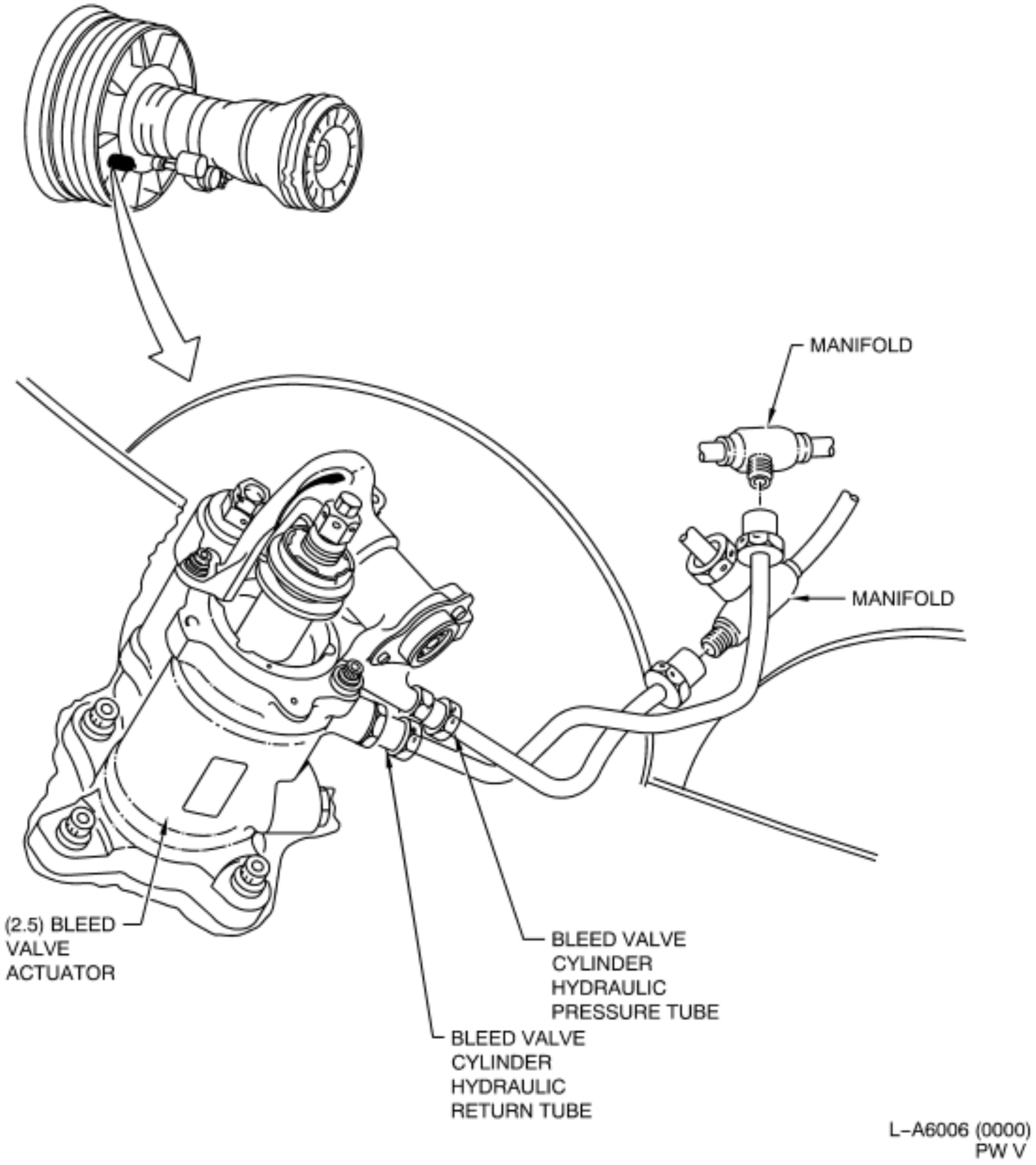
Engine Tube Disconnects And Removals
Figure 304 (Sheet 7)
(Task 72−00−34−020−004)


HPC
BRACKET
PT2.5 SENSING
TUBE (LOWER)
(AS35)
NUT
CLAMP
BOLT
FWD
VIEW D
FLANGE E
BRACKET
PT2.5 SENSING
TUBE (LOWER)
(AS35)
CLAMP
FWD
BOLT
VIEW E
L−A4704 (1289)
PW V

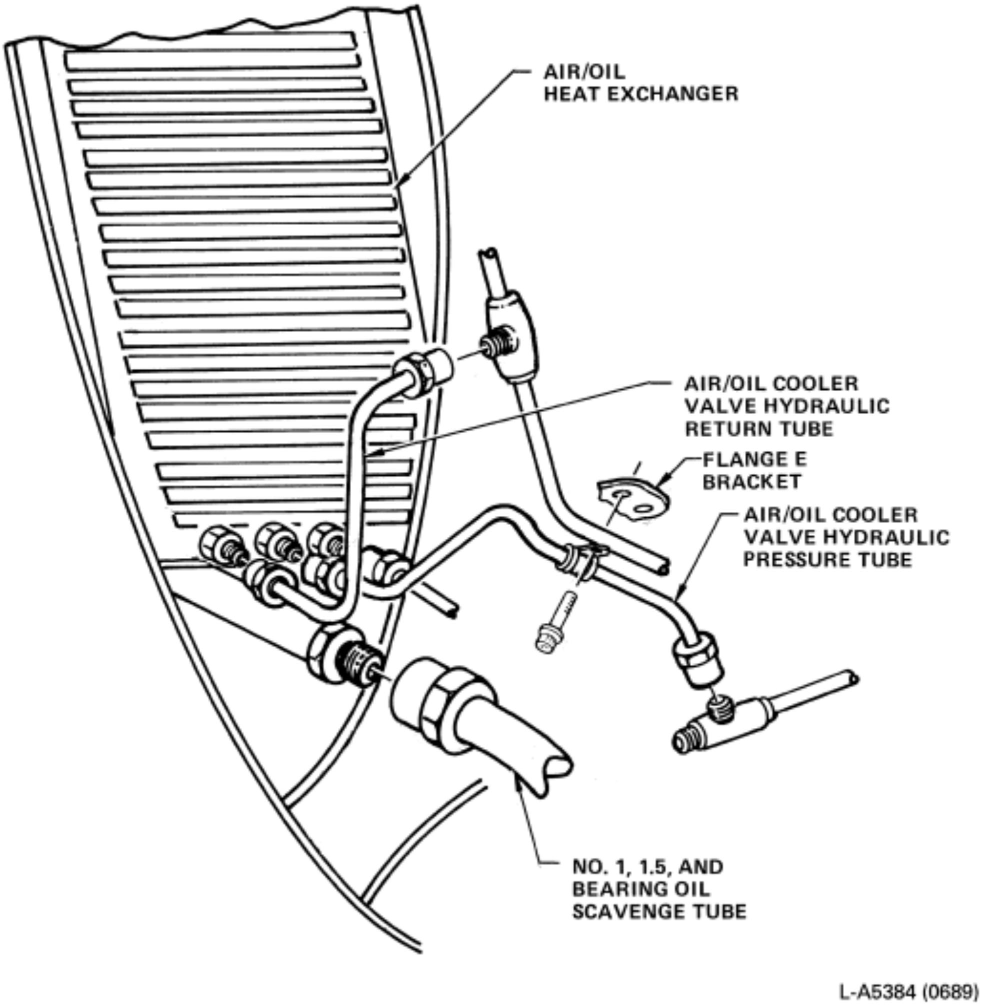
Engine Tube Disconnects And Removals
Figure 304 (Sheet 8)
(Task 72−00−34−020−004)


ANGLE
GEARBOX
ANGLE GEARBOX
OIL PRESSURE TUBE
PACKING
BOLT
(2 REQ'D)
ANGLE GEARBOX
OIL PRESSURE TUBE
L−A5382 (0000)
PW V

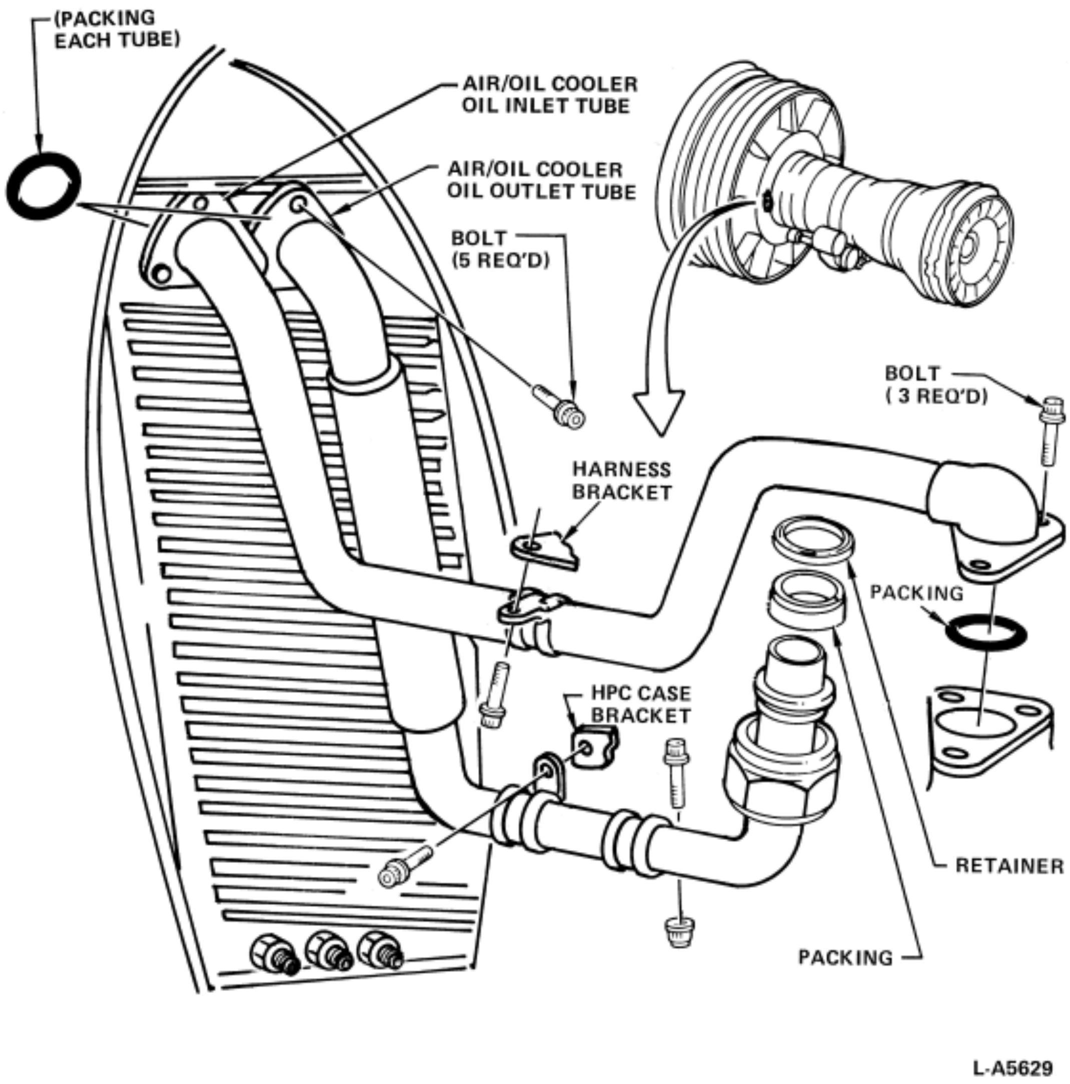
Engine Tube Disconnects And Removals
Figure 304 (Sheet 9)
(Task 72−00−34−020−004)


MANIFOLD
MANIFOLD
(2.5) BLEED VALVE ACTUATOR
BLEED VALVE CYLINDER HYDRAULIC PRESSURE TUBE
BLEED VALVE CYLINDER HYDRAULIC RETURN TUBE
L−A6006 (0000)
PW V

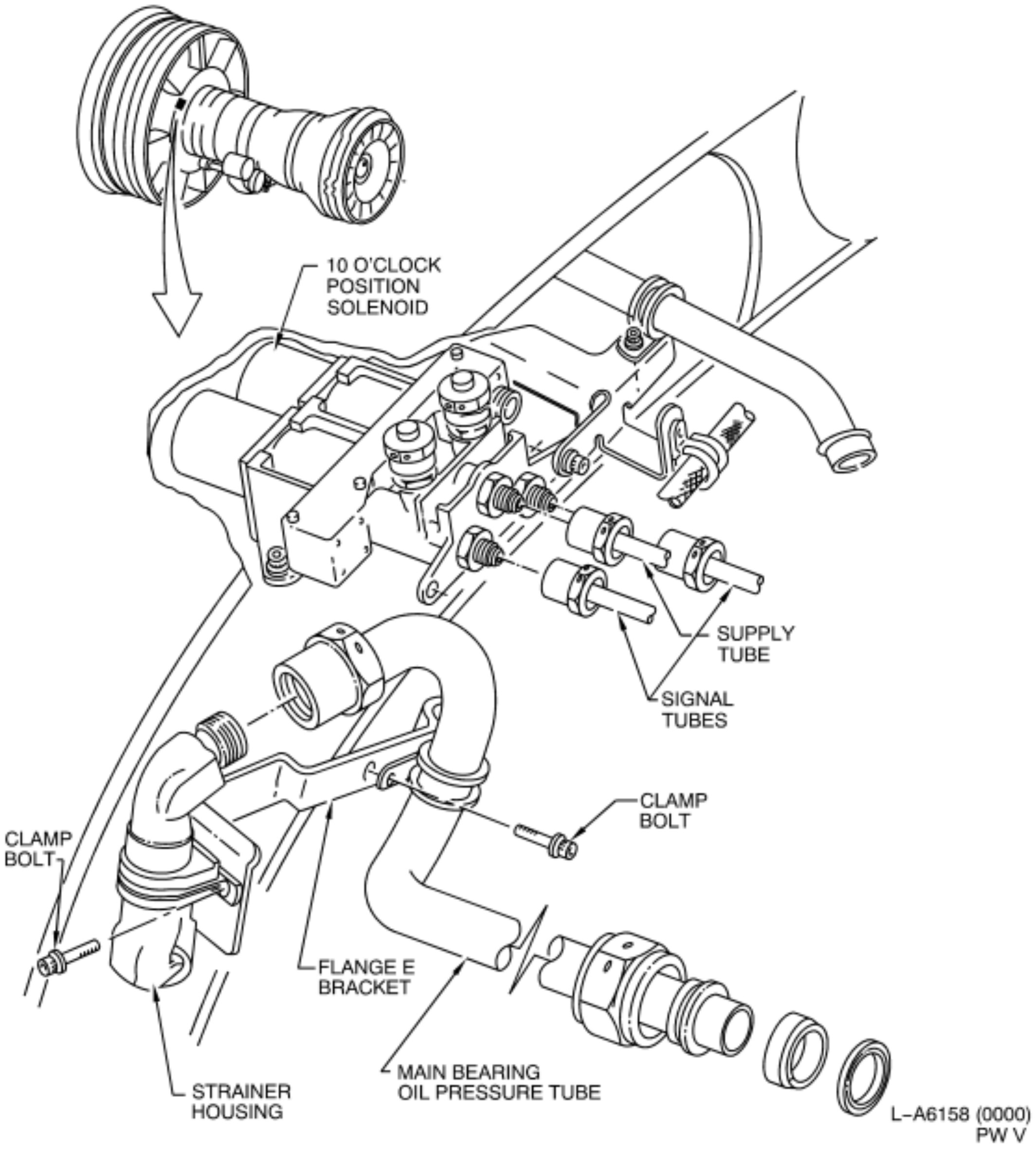
Engine Tube Disconnects And Removals
Figure 304 (Sheet 10)
(Task 72−00−34−020−004)


AIR/OIL HEAT EXCHANGER
AIR/OIL COOLER VALVE HYDRAULIC RETURN TUBE
FLANGE E BRACKET
AIR/OIL COOLER VALVE HYDRAULIC PRESSURE TUBE
NO. 1, 1.5, AND BEARING OIL SCAVENGE TUBE
L-A5384 (0689)

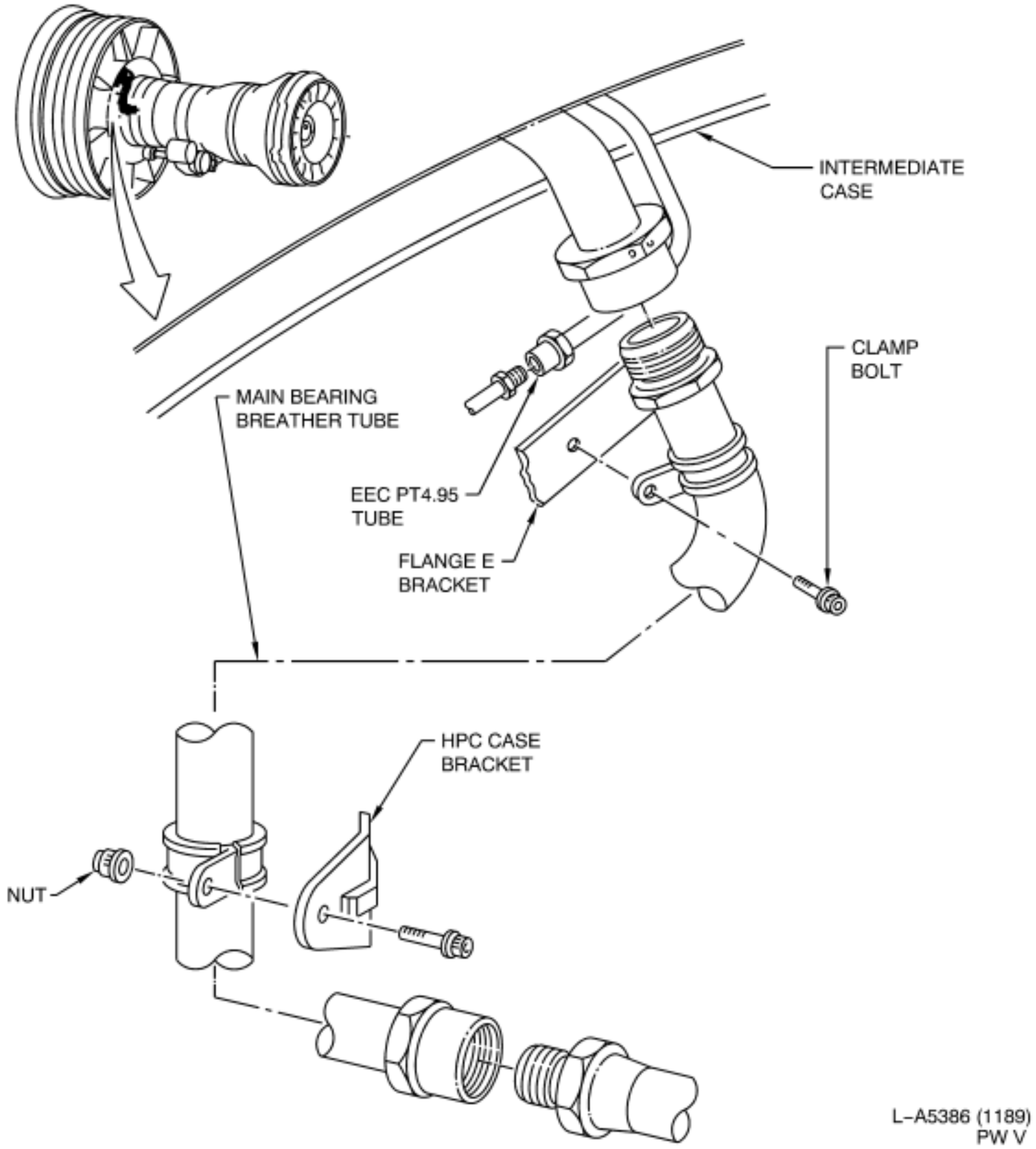
Engine Tube Disconnects And Removals
Figure 304 (Sheet 11)
(Task 72−00−34−020−004)


(PACKING EACH TUBE)
AIR/OIL COOLER OIL INLET TUBE
AIR/OIL COOLER OIL OUTLET TUBE
BOLT (5 REQ'D)
BOLT (3 REQ'D)
HARNESS BRACKET
PACKING
HPC CASE BRACKET
RETAINER
PACKING
L-A5629

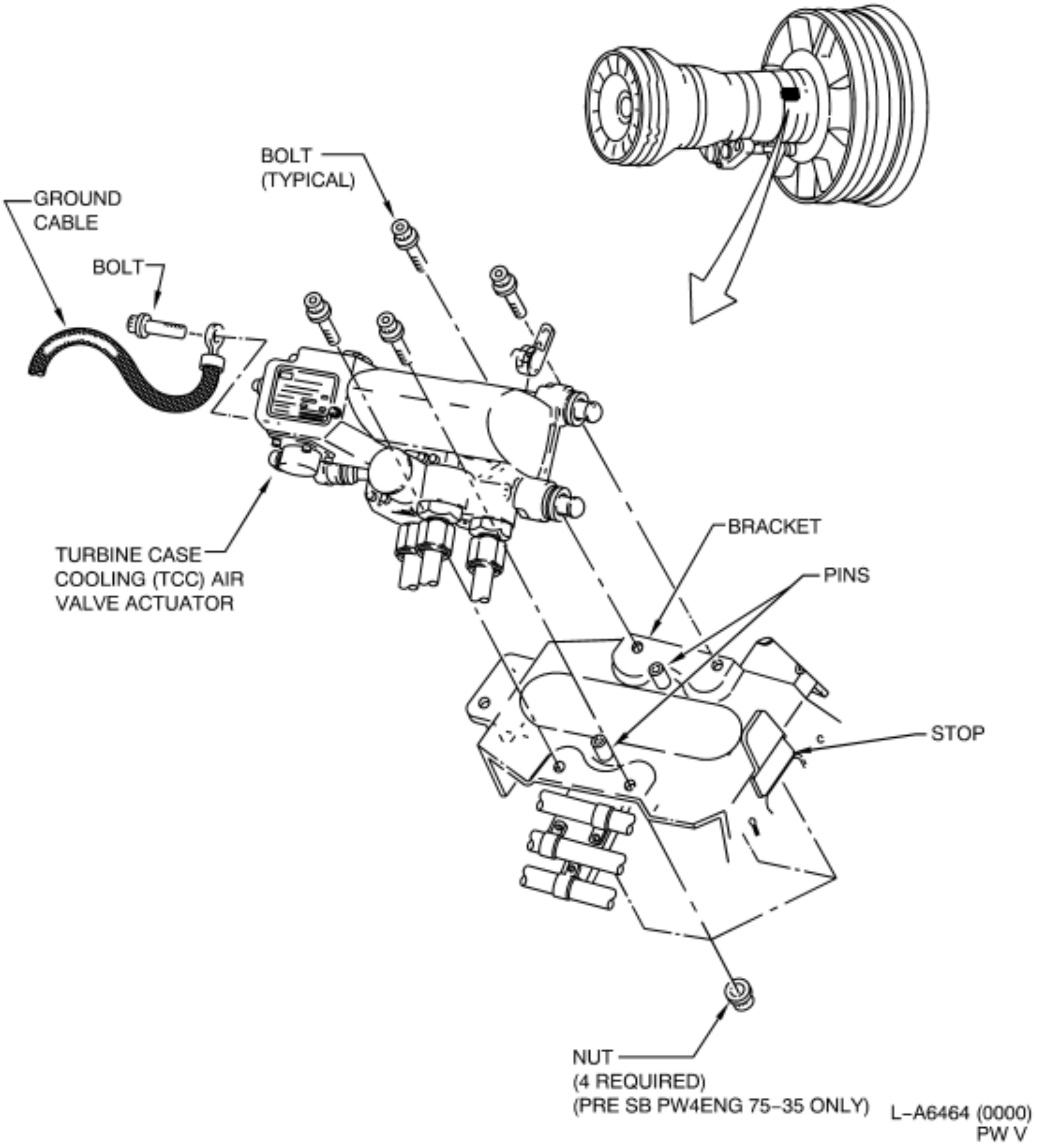
Engine Tube Disconnects And Removals
Figure 304 (Sheet 12)
(Task 72−00−34−020−004)


10 O'CLOCK POSITION SOLENOID
SUPPLY TUBE
SIGNAL TUBES
CLAMP BOLT
CLAMP BOLT
FLANGE E BRACKET
STRAINER HOUSING
MAIN BEARING OIL PRESSURE TUBE
L−A6158 (0000)
PW V

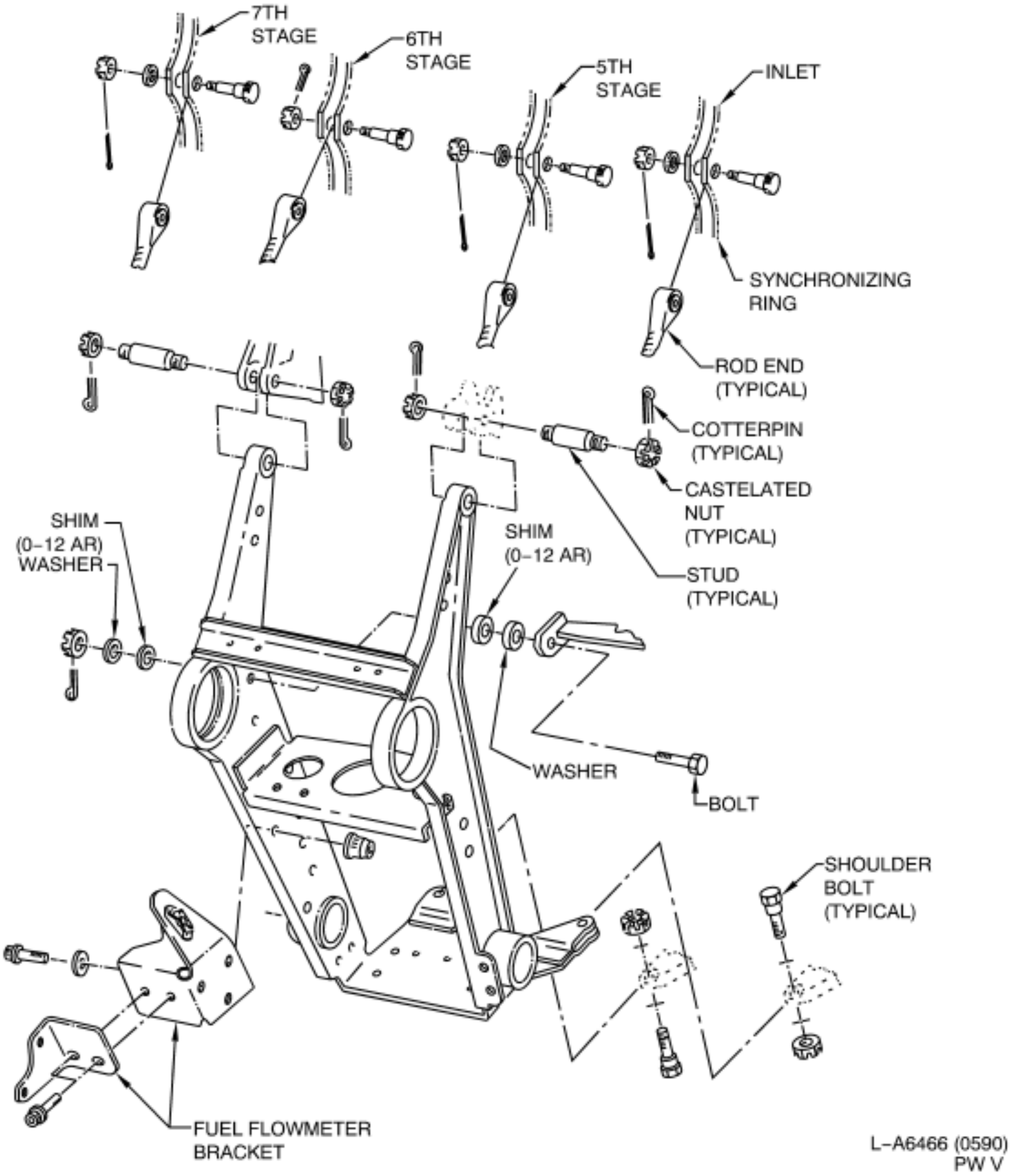
Engine Tube Disconnects And Removals
Figure 304 (Sheet 13)
(Task 72−00−34−020−004)


INTERMEDIATE CASE
CLAMP BOLT
MAIN BEARING BREATHER TUBE
EEC PT4.95 TUBE
FLANGE E BRACKET
HPC CASE BRACKET
NUT
L−A5386 (1189)
PW V

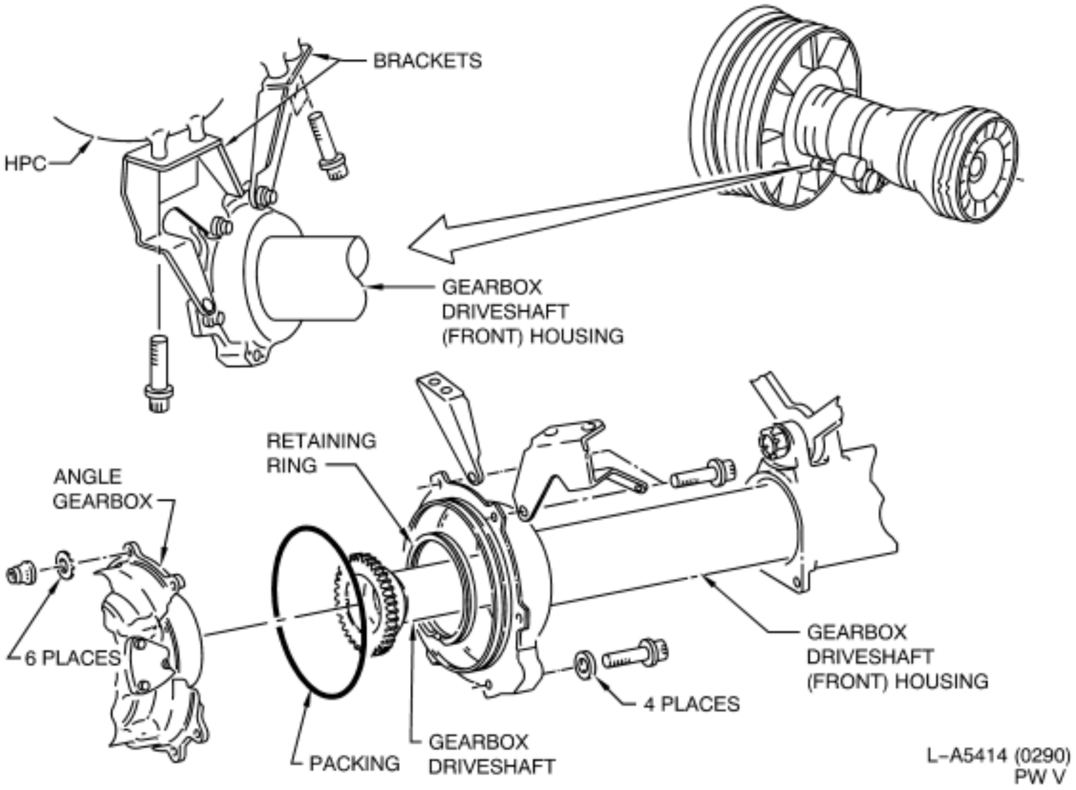
Engine Tube Disconnects And Removals
Figure 304 (Sheet 14)
(Task 72−00−34−020−004)


BOLT
(TYPICAL)
GROUND
CABLE
BOLT
TURBINE CASE
COOLING (TCC) AIR
VALVE ACTUATOR
BRACKET
PINS
STOP
NUT
(4 REQUIRED)
(PRE SB PW4ENG 75−35 ONLY)
L−A6464 (0000)
PW V

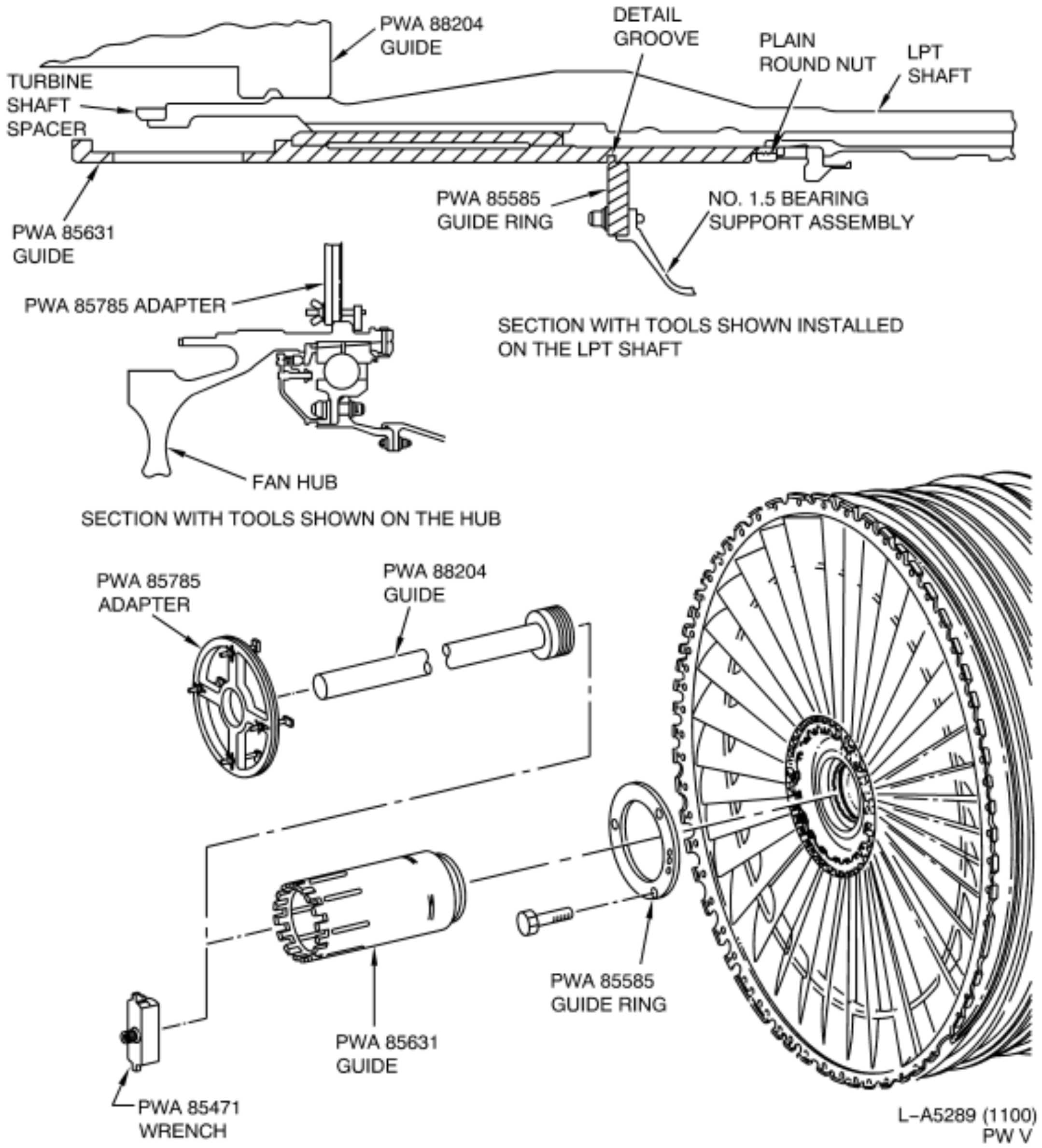
Turbine Case Cooling (TCC) Air Valve Actuator Removal
(Required Only For Removal Of HPC Top Front Case)
Figure 305
(Task 72−00−34−020−004)


7TH STAGE
6TH STAGE
5TH STAGE
INLET
SYNCHRONIZING RING
ROD END (TYPICAL)
COTTERPIN (TYPICAL)
CASTELATED NUT (TYPICAL)
STUD (TYPICAL)
SHIM (0−12 AR)
WASHER
SHIM (0−12 AR)
WASHER
BOLT
SHOULDER BOLT (TYPICAL)
FUEL FLOWMETER BRACKET
L−A6466 (0590)
PW V

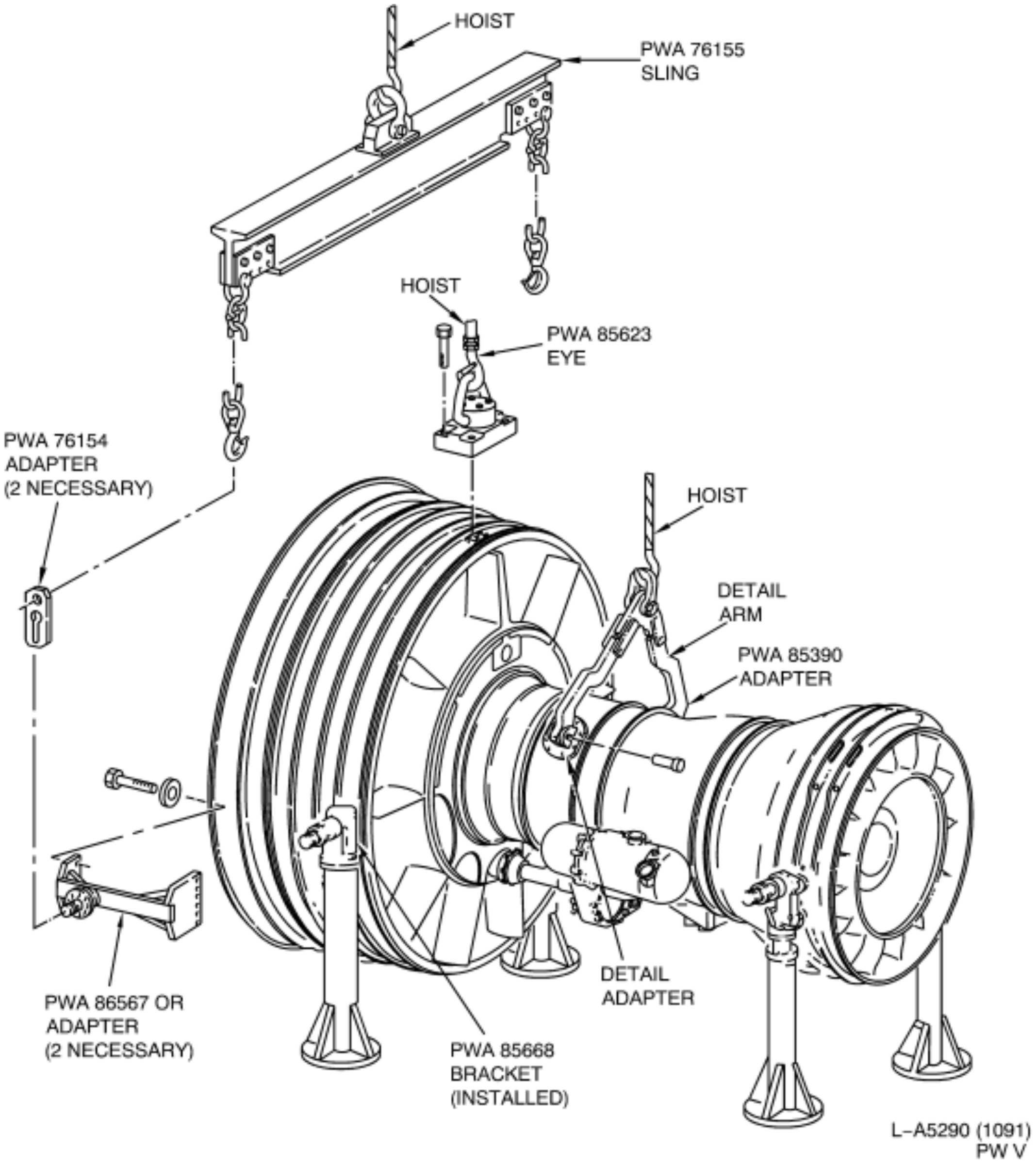
Stator Vane Actuator And Support Assembly
(Required Only For Removal Of HPC Top Front Case)
Figure 306
(Task 72−00−34−020−004)


BRACKETS
HPC
GEARBOX DRIVESHAFT (FRONT) HOUSING
RETAINING RING
ANGLE GEARBOX
6 PLACES
PACKING
GEARBOX DRIVESHAFT
GEARBOX DRIVESHAFT (FRONT) HOUSING
4 PLACES
L−A5414 (0290)
PW V

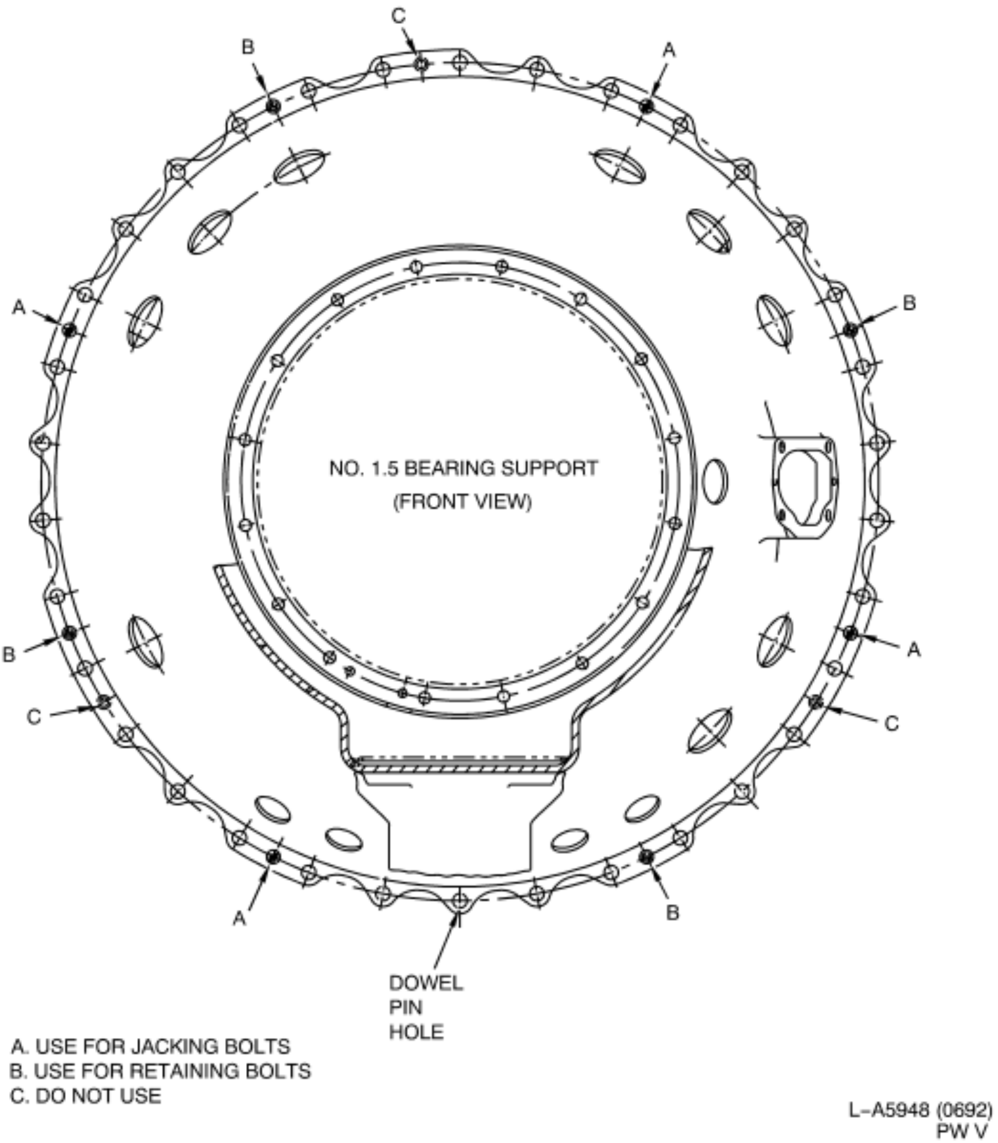
Removal Of The Gearbox Driveshaft
Figure 307
(Task 72−00−34−020−004)


PWA 88204
GUIDE
DETAIL
GROOVE
PLAIN
ROUND NUT
LPT
SHAFT
TURBINE
SHAFT
SPACER
PWA 85631
GUIDE
PWA 85585
GUIDE RING
NO. 1.5 BEARING
SUPPORT ASSEMBLY
PWA 85785 ADAPTER
SECTION WITH TOOLS SHOWN INSTALLED
ON THE LPT SHAFT
FAN HUB
SECTION WITH TOOLS SHOWN ON THE HUB
PWA 85785
ADAPTER
PWA 88204
GUIDE
PWA 85585
GUIDE RING
PWA 85631
GUIDE
PWA 85471
WRENCH
L−A5289 (1100)
PW V

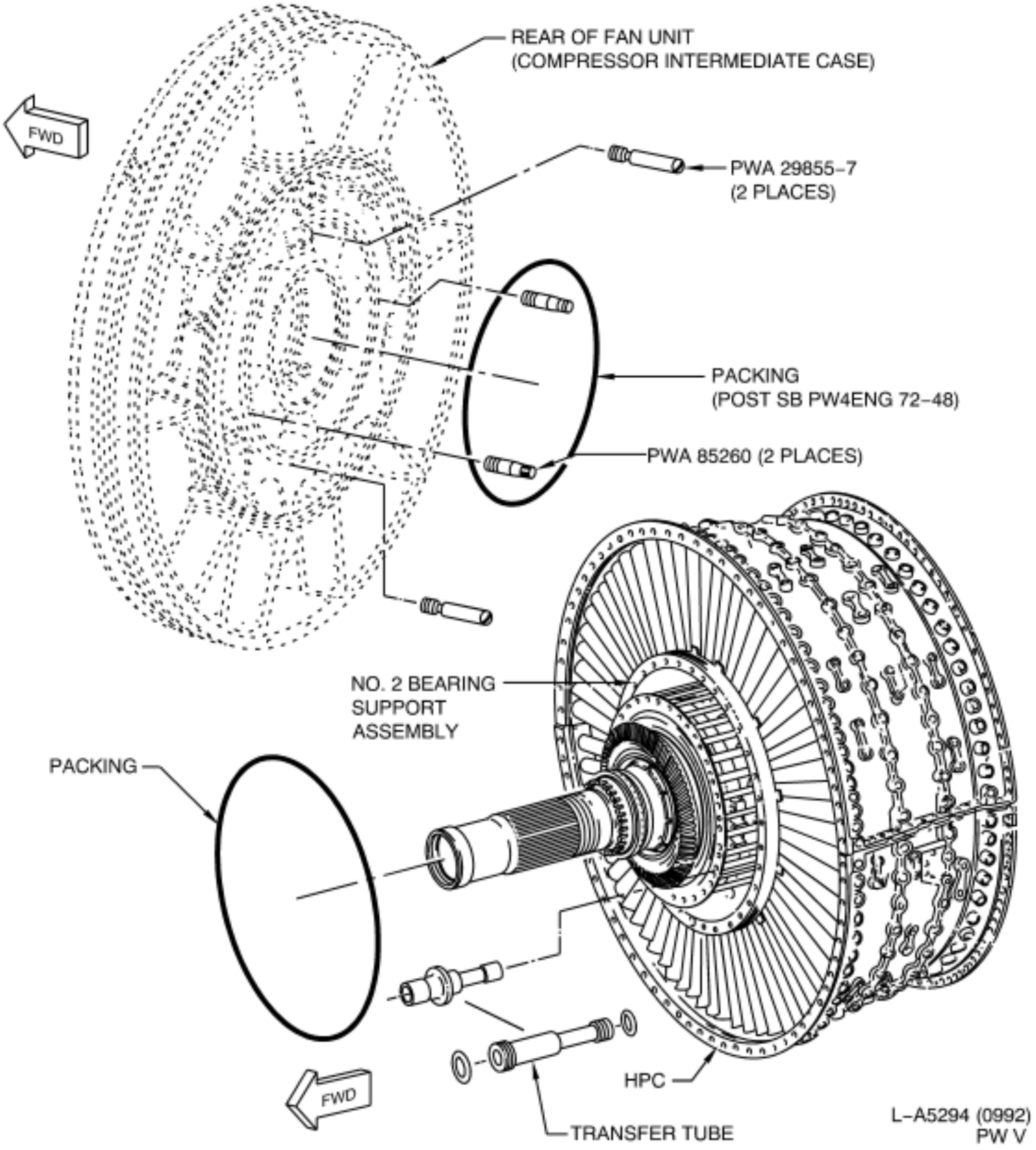
Installation Of Tools On The LPT Shaft
Figure 308
(Task 72−00−34−020−004)


HOIST
PWA 76155
SLING
HOIST
PWA 85623
EYE
PWA 76154
ADAPTER
(2 NECESSARY)
HOIST
DETAIL
ARM
PWA 85390
ADAPTER
DETAIL
ADAPTER
PWA 86567 OR
ADAPTER
(2 NECESSARY)
PWA 85668
BRACKET
(INSTALLED)
L−A5290 (1091)
PW V

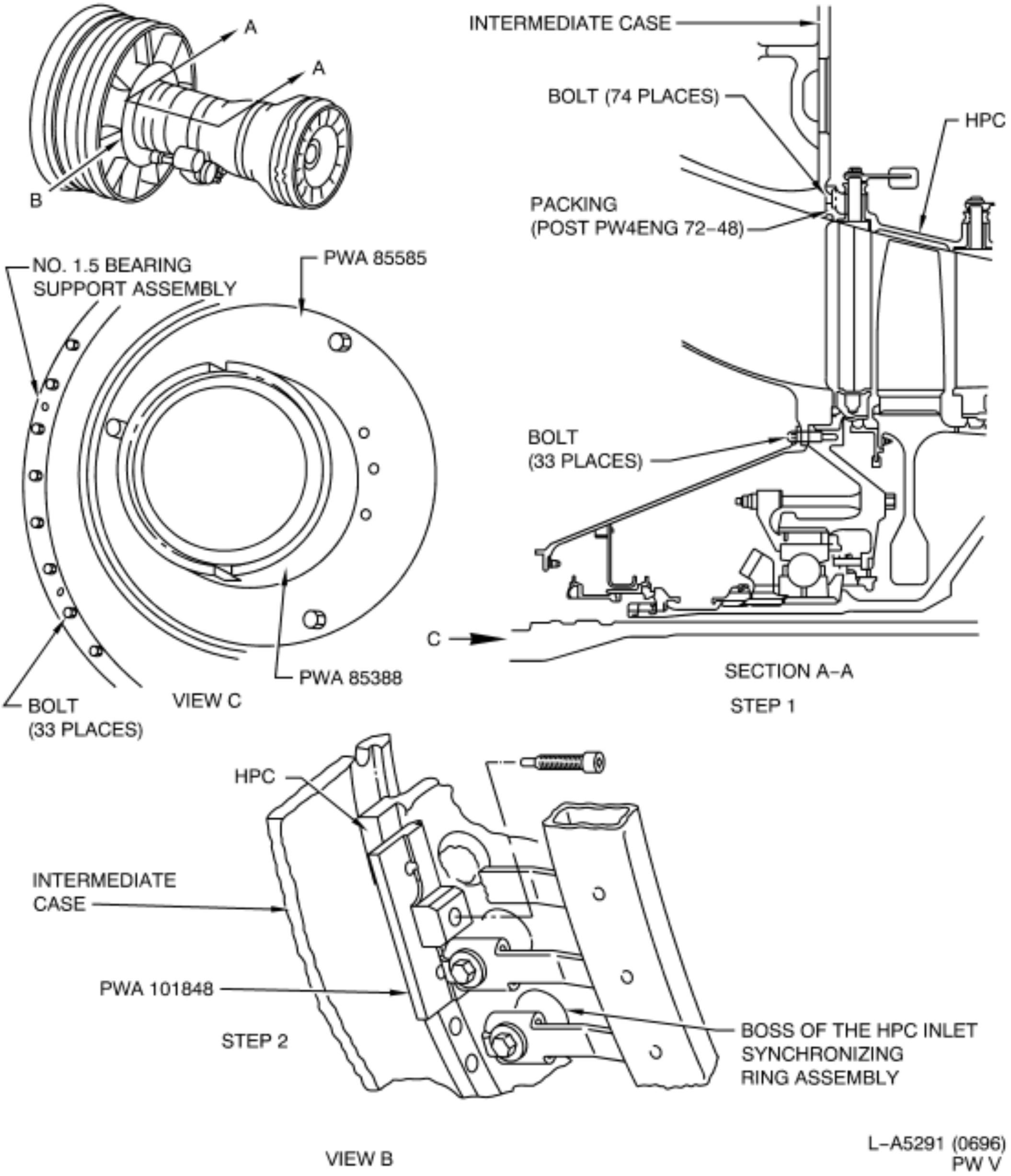
Installation Of The Lifting Tools
Figure 309
(Task 72−00−34−020−004)


C
B
A
A
B
NO. 1.5 BEARING SUPPORT
(FRONT VIEW)
B
A
C
C
A
B
DOWEL
PIN
HOLE
A. USE FOR JACKING BOLTS
B. USE FOR RETAINING BOLTS
C. DO NOT USE
L−A5948 (0692)
PW V

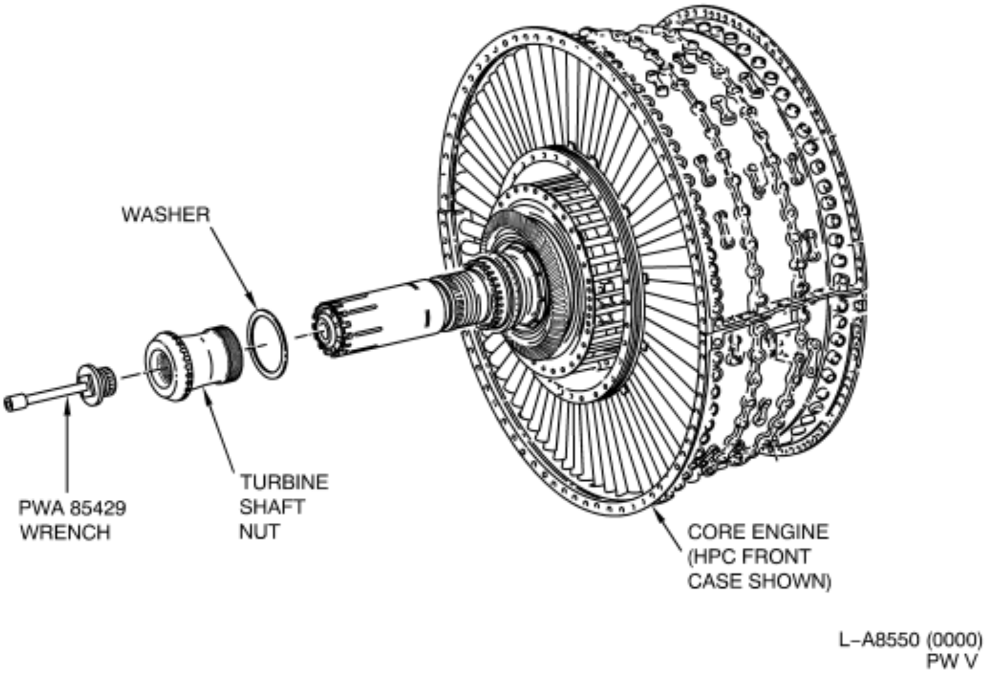
No. 1.5 Bearing Support Bolt Locations
Figure 310
(Task 72−00−34−020−004)


FWD
REAR OF FAN UNIT
(COMPRESSOR INTERMEDIATE CASE)
PWA 29855−7
(2 PLACES)
PACKING
(POST SB PW4ENG 72−48)
PWA 85260 (2 PLACES)
NO. 2 BEARING
SUPPORT
ASSEMBLY
PACKING
FWD
HPC
TRANSFER TUBE
L−A5294 (0992)
PW V

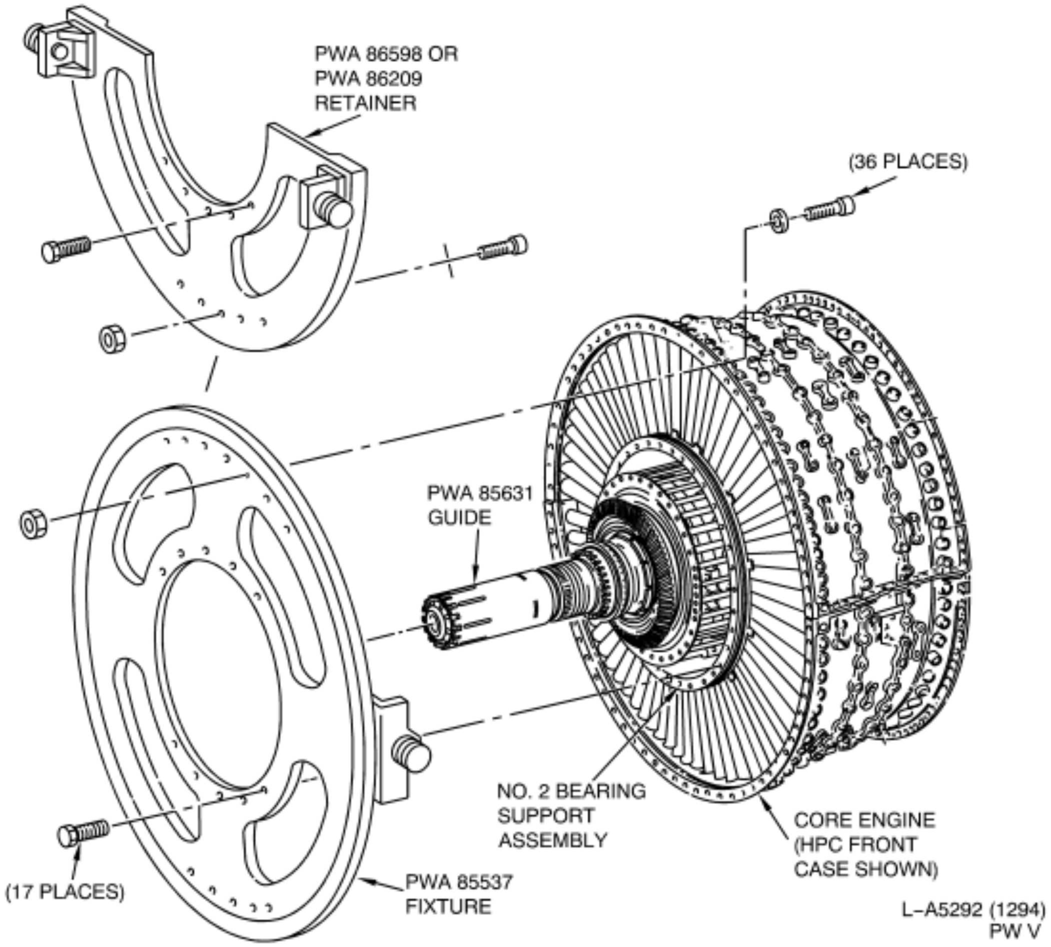
Installation Of Separation Tools
Figure 311
(Task 72−00−34−020−004)


A
A
B
INTERMEDIATE CASE
BOLT (74 PLACES)
HPC
PACKING
(POST PW4ENG 72−48)
NO. 1.5 BEARING
SUPPORT ASSEMBLY
PWA 85585
BOLT
(33 PLACES)
C
PWA 85388
BOLT
(33 PLACES)
VIEW C
SECTION A−A
STEP 1
HPC
INTERMEDIATE
CASE
PWA 101848
STEP 2
BOSS OF THE HPC INLET
SYNCHRONIZING
RING ASSEMBLY
VIEW B
L−A5291 (0696)
PW V

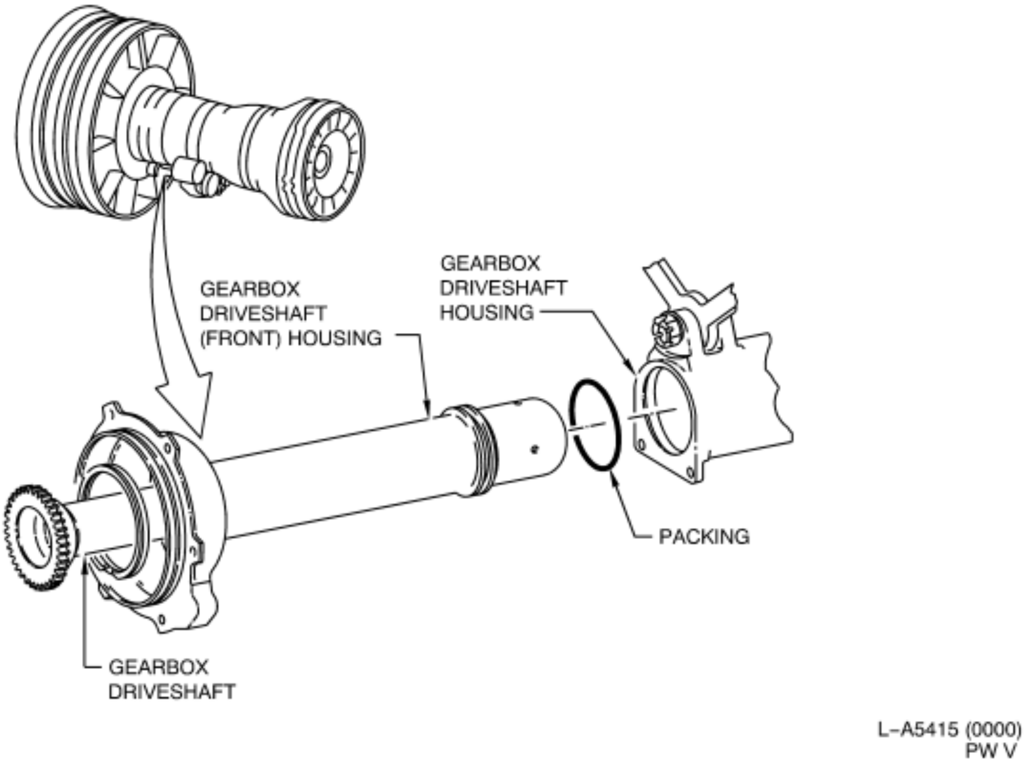
Installation Of Separation Tools
Figure 312
(Task 72−00−34−020−004)


WASHER
PWA 85429 WRENCH
TURBINE SHAFT NUT
CORE ENGINE (HPC FRONT CASE SHOWN)
L−A8550 (0000)
PW V

Installation Of The Turbine Shaft Nut
Figure 313
(Task 72−00−34−020−004)


PWA 86598 OR
PWA 86209
RETAINER
(36 PLACES)
PWA 85631
GUIDE
NO. 2 BEARING
SUPPORT
ASSEMBLY
CORE ENGINE
(HPC FRONT
CASE SHOWN)
(17 PLACES)
PWA 85537
FIXTURE
L−A5292 (1294)
PW V

Installation Of HPC Support Tools
Figure 314
(Task 72−00−34−020−004)


GEARBOX
DRIVESHAFT
(FRONT) HOUSING
GEARBOX
DRIVESHAFT
HOUSING
PACKING
GEARBOX
DRIVESHAFT
L-A5415 (0000)
PW V

Removal Of The Gearbox Driveshaft And Front Housing
Figure 315
(Task 72-00-34-020-004)

Task 72−00−34−020−006:

1. Remove The Fan Unit From The Core Engine

A. Prerequisites

(1) Transfer the engine from the transport stand to pedestals. Refer to 72−00−00, Special Procedures−01 (Task 72−00−00−010−001).

(2) Refer to Table 301 for the other procedures that are prerequisite to this procedure. See Figure 301.

Step	Remove The	Chapter	Removal
1	Magnetic Chip Detector Assemblies In The Oil Tank And Main Gearbox	72−00−61	36 (Task 72−00−61−050−017)
2	Compressor Inlet Cone	72−00−31	02 (Task 72−00−31−020−001)
3a	Electronic Engine Control (EEC) Speed Transducer (N1)	72−00−34	03 (Task 72−00−34−050−001)
or			
3b	EEC Speed Transducer (N1) Multiplexer or SCU Input Speed Probe	72−00−34	17 (Task 72−00−34−050−014)
4	LPC/LPT Coupling*	72−00−32	01 (Task 72−00−32−020−001)

NOTE: *Do not remove the Stage 1 LPC blade assemblies

Other Prerequisite Procedures
Table 301

B. Equipment And Materials Necessary

ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-21

Special Tools:

PWA 25757	Pedestal (4 Necessary)
PWA 25926	Adapters (4 Necessary)
PWA 29855-7	Aligning Pin (2 Necessary)
PWA 76154	Adapter (2 Necessary)
PWA 76155	Sling
PWA 85260	Guide Pin (2 Necessary)
PWA 85390	Adapter, Lifting
PWA 85429	Wrench
PWA 85471	Wrench, Torque
PWA 85537	Fixture, Handling (For Compressors With A Symmetric Case)
PWA 85585	Ring, Guide
PWA 85623	Eye, Lifting
PWA 85631	Guide, Piloting
PWA 85749	Adapter, Torque-Electrical Connector
PWA 85785	Adapter, Piloting
PWA 86209	Retainer, Positioning (Optional To PWA 85537)
PWA 86567	Adapter, Lift And Trunnion (2 Necessary)
PWA 86598	Retainer, Positioning (Optional To PWA 86209)
PWA 88204	Guide, Piloting
PWA 88560	Fixture, Handling (For Compressors With An Asymmetric Case)
PWA 101848	Puller, Jackscrew (6 Necessary)

NOTE: Use PWA 86598 or PWA 86209 Retainer as an alternative to PWA 85537 Fixture if you will remove the HPC top front case with the procedure in 72-00-35, Removal-18 Task 72-00-35-030-001.

C. Disconnect The EEC Wiring Harnesses As Follows: See Figure 302.

(1) Disconnect the W1 EEC wiring harness as follows.

(a) Use the PWA 85749 Torque Adapter and disconnect the W1P11 and the W1P10 harness connectors from the 1 o'clock position solenoid.

(b) Remove the clamp bolts and nuts that attach the harness to the Flange E bracket and to the solenoid muscle tube.

(c) Disconnect the W1P25 harness connector at the HPC case bracket at 1 o'clock position.

(d) Disconnect the W1P24 harness connector at the HPC case bracket at 10 o'clock position.

(e) Disconnect the W1P9 harness connector at the HPC case bracket at 11 o'clock position.

(f) Remove all the clamp bolts and nuts that attach the W1 harness to the HPC case brackets.

(g) Temporarily attach the W1 harness to the 12 o'clock strut with lockwire. Keep the harness clear of Flange E.

(h) Install protection covers.

(2) Disconnect the W2 EEC wiring harness.

(a) Disconnect the W2P26 harness connector at the HPC case bracket at 12 o'clock position.

(b) Remove the bolt that attaches the retaining bracket and the W2J9 receptacle to the HPC case bracket at 11 o'clock position.

(c) Remove all the clamp bolts that attach the W2 harness to the Flange E bracket and the No. 1, 1.5, and 2 bearing tubes.

(d) Temporarily attach the W2 harness to the 12 o'clock strut with lockwire. Keep the harness clear of Flange E.

(e) Install protection covers.

(3) Remove the two bolts that attach the IDG−heat−exchangervalve harness and retaining bracket to the HPC case bracket. Remove the retaining bracket and disconnect the harness receptacle. Install a protection cover. Remove the two clamp bolts that attach the IDG harness to the hydraulic tube.

(4) Use the Torque Adapter (PWA 85749) and disconnect the W4P4 and the W5P11 harness connectors from the 5 o'clock position solenoid. Install protection covers.

(5) Remove the clamp bolt that attaches the W4 harness (to the EEC speed transducer) to the bleed valve supply tube at 5 o'clock position.

(6) Disconnect the W3P15 harness connector from the 2.5 bleed valve actuator at 7 o'clock position. Install protection covers.

(7) Disconnect the W3P17 connector from the (engine) air/oil heat exchanger harness receptacle at 7:30 o'clock position. Remove the two bolts that attach the retaining bracket and receptacle from the HPC case bracket. Install a protection cover on the receptacle.

(8) If removal of the HPC top front case is necessary by 72−00−35, Removal−18 (Task 72−00−35−030−001), after the engine is split, disassemble the W3, W4, and W5 harnesses from the HPC top front case as follows. See Figure 303.

  (a) Remove the bolts, nuts, and spacers that attach the harness clamps to the HPC top front case brackets from 9 o'clock position to 3 o'clock position.

  (b) Remove the bolts, nuts, and spacers that attach the harness clamps to the two bracket assemblies above and over the stator vane actuator support.

  (c) Remove the bolts and brackets that attach the W4J25 connector, the W5J26 connector, and the W3J24 connector to the HPC case brackets at 1, 12 and 10 o'clock position respectively.

  (d) Remove the bolts and nuts that attach the harness clamps to the fuel/oil cooler brackets and to the bracket assembly above the cooler.

  (e) Disconnect the W4P16 connector from the TCC air valve actuator.

  (f) Disconnect the W5P7 connector and the W4P3 connector from the stator vane actuator.

  (g) Remove the bolts and nuts that attach the harness to the bottom of the stator vane actuator support.

  (h) Remove the harness bracket assemblies from over the TCC air valve actuator and from over the stator vane actuator support assembly.

(i) Move the harnesses rearward of Flange H and install protection covers to all connectors and receptacles.

D. Disconnect The Tubes As Follows
See Figure 304.

(1) Remove the lockwire and disconnect the EEC PB sensing tubes (AS09/20) at 12:30 o'clock position. See Figure 304 (Sheet 1).

(2) For engines with PMUX or SCU, remove lockwire and disconnect the PT2.5 sensing tubes (AS29/30) at 12:30 o'clock position. See Figure 304 (Sheet 1).

(3) Remove lockwire and disconnect the HPC air valve supply and signal tubes (AA01/25) from the solenoid adapters at 1 o'clock position. See Figure 304 (Sheet 1).

(4) Remove lockwire and disconnect the two No. 3 bearing air cooler tubes (LP33/34) from the cooler at 2:30 o'clock position.

(5) Disconnect and remove the tubes from the IDG heat exchanger at 4 o'clock position as follows. See Figure 304 (Sheet 2).

(a) Remove the lockwire and disconnect the airframe (IDG) cooler outlet oil tube nut. Remove the three bolts that attach the tube to the heat exchanger. Remove the tube and discard the packing. Install the protection covers to the tube ends and port.

(b) Remove the lockwire and remove the (IDG) air/oil cooler valve hydraulic pressure and return tubes from the heat exchanger and the manifolds. Install the protective covers to the tubes, manifold tees, and the adapters.

(6) Remove the lockwire and disconnect the compressor stator cylinder hydraulic pressure (CP12) and return tube (CR03) from the manifolds and cylinder as follows. See Figure 304 (Sheet 3).

(a) Remove the clamp bolts that attach the tubes to the Flange E bracket.

(b) Remove the tubes and install the protective covers to the tubes, manifold tees, and adapters.

(7) Remove the hydraulic pressure (CP05) and oil cooler inlet return (CR01) manifolds as follows. See Figure 304 (Sheet 3).

(a) Remove the lockwire and disconnect the two hose nuts from the manifolds at 3 o'clock position.

(b) Remove the lockwire and disconnect the two manifolds at the lower tee connections at 5 o'clock position.

(c) Remove the clamp bolts and nut that attach the manifolds to the engine brackets. Remove the manifolds and install the protective covers to the hoses and to the manifold ends.

(8) Remove the fuel distribution valve supply tube (FM09) as follows. See Figure 304 (Sheet 4).

(a) Remove the lockwire and disconnect each end.

(b) Remove the clamp bolts and nuts that attach the tube to the engine.

(c) Remove the tube and discard the packings.

(d) Install the protective cover.

(9) Remove the three bleed valve supply tubes (AA26/27/29) as follows. See Figure 304 (Sheet 5).

(a) Remove the lockwire and disconnect the three tube connections at 2:30 o'clock position.

(b) Remove the lockwire and disconnect the two tube connections to the 5 o'clock position solenoid. Remove the lockwire and disconnect the tube connection at the maintenance break adjacent to the solenoid. Remove the lockwire and disconnect the tube nut from the tee adjacent to the solenoid.

(c) Remove the clamp bolts that attach the tubes to the engine brackets, to each other, and to the harness clamps.

(d) Remove the tubes from the engine. Install the protective covers to all the tube ends and the solenoid adapters.

(10) Remove the upper PT2.5 sensing tube assembly (AS30) as follows. See Figure 304 (Sheet 6), Figure 304 (Sheet 7) and Figure 304 (Sheet 8).

(a) For engines not equipped with the supplemental control unit (SCU) with multiplexing, remove the lockwire from the cap assembly. Remove the cap assembly from the tube.

(b) For engines equipped with the supplemental control unit (SCU) with multiplexing, remove the lockwire and disconnect the lower tube nut from the tube coupling tube (AS30) at approximately the 4 o'clock position rearward of Flange E.

(c) Remove the bolts, clamps and a nut that attach the (AS30) tube to brackets on Flange E at the 1, 1:30, 2:30, and 3:30 o'clock positions.

(d) Remove the tube from the engine and install protection covers.

(11) For engines equipped with the supplemental control unit (SCU) with multiplexing, remove the lower PT2.5 sensing tube assembly (AS35) as follows.

(a) Remove the bolts and clamps that attach the (AS35) tube to brackets on Flange E at the 4:30 and 5:00 o'clock positions.

(b) Remove the tube from the engine and install protection covers.

NOTE: The lower manifold (AS31) was previously removed with the EEC speed transducer (N1) multiplexer input probe.

(12) Remove the lockwire and disconnect the angle gearbox oil pressure tube (LP09) from the angle gearbox at 6 o'clock position. See Figure 304 (Sheet 9).

(13) Remove the two bolts that attach the angle gearbox oil scavenge tube (LR01) to the angle gearbox at 6 o'clock position. Loosen the clamp bolts as necessary to disengage the tube from the angle gearbox boss. Remove the packing. Install protective covers.

(14) Remove lockwire and disconnect the (2.5) bleed valve cylinder hydraulic pressure (CP02) and return (CR02) tubes from the cylinder and manifolds. See Figure 304 (Sheet 10). Remove the tubes. Install protective covers to the tubes, adapters, and manifold tees.

(15) Remove the two bolts and disconnect the cooling air manifold (AC34) from the fan case boss at 7 o'clock position. Remove the clamp bolt and tube.

(16) Remove the lockwire and disconnect the No. 1, 1.5 and 2 bearing oil scavenge tube (LR02) at 7:30 o'clock position. See Figure 304 (Sheet 11).

(17) Remove lockwire and disconnect each end of the (left) air/oil cooler hydraulic pressure (CP08) and return (CR08), tubes from the air/oil heat exchanger adapters at 8 o'clock position and manifolds. Remove the clamp bolt that attaches the pressure tube to the Flange E bracket. Remove the two tubes and install the protective closures.

(18) Remove the six bolts that attach the air/oil cooler inlet oil tube (LP02) to the main oil filter housing and the air/oil heat exchanger. See Figure 304 (Sheet 12). Remove the clamp bolt that attaches the tube to the HPC case bracket. Move the tube rearward and temporarily attach with lockwire. Discard the packings. Install the protection covers.

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH
R CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND
R INSTALL A TUBE WITH A FLEX SEGMENT WITH THE
R SAME PRECAUTION USED FOR A TUBE WITHOUT A
R FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A
R TUBE TO HELP WITH THE INSTALLATION OR REMOVAL
R OF THE TUBE OR AN ATTACHED COMPONENT. IF A
R FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE
R A KINK IN THE EXTERNAL WIRE BRAID AND IN THE

R INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND
R LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(19) Remove the two bolts that attach the air/oil cooler outlet hose and tube assembly (LP03) to the air/oil heat exchanger. Remove the lockwire and disconnect the tube nut from the fuel oil cooler bypass valve adapter. Remove the clamp bolts that attach the tube to the engine. Remove the tube and discard the packings. Install the protection covers.

(20) Remove lockwire and disconnect the main bearing oil pressure tube (LP05) from the strainer housing at 9 o'clock position and the strainer housing at top of the fuel/oil cooler. See Figure 304 (Sheet 13). Remove the clamp bolts and remove the tube. Discard the packing and retainer. Remove the bolt and clamp that attaches the strainer housing to the Flange E bracket. Install protective covers.

(21) Remove lockwire and disconnect the two signal tubes (AA06/18) and the supply tube (AA22) from the solenoid adapters at 10 o'clock position.

(22) Remove lockwire and disconnect the main bearing breather tube (LB06) at 11:30 o'clock position. See Figure 304 (Sheet 14).

(23) Remove lockwire and disconnect the EEC PT4.95 tube (AS04) at 11:30 o'clock position.

(24) If removal of the HPC top front case is necessary by 72−00−35, Removal−18 (Task 72−00−35−030−001), after the engine is split, remove the (TCC) air valve actuator at 2 o'clock position as follows. See Figure 305.

(a) Remove the nut and bolt that attach the cable rod end to the (HPC) TCC air shutoff valve idler arm.

(b) Remove the lockwire and disconnect the cable coupling nut from the actuator.

(c) Remove the bolt and ground strap from the actuator.

(d) Remove the four bolts (and nuts, if equipped) that attach the actuator clamps to the bracket.

(e) Lift the actuator and disengage the cable end from the actuator. Remove the actuator.

NOTE: Do not remove the hoses from the actuator.

(25) If removal of the HPC top front case is necessary by 72−00−35, Removal−18 (Task 72−00−35−030−001), after the engine is split, remove the stator vane actuator and support assembly as follows. See Figure 306.

(a) Remove the bolts that attach the fuel flowmeter support bracket to the support assembly. Remove the bracket.

(b) Remove the cotter pins, nuts, washers, and bolts that attach the four rod ends to the synchronizing rings. Disengage the rod ends. Install lockwire to the rod end bearings to attach them to the rod ends.

(c) Remove the cotter pins, nuts, bolts, studs, spacers, and shims that attach the support assembly to the HPC cases and brackets.

(d) Remove the stator vane actuator and support assembly.

E. Separate The Fan Unit From The Core Engine

(1) Disconnect the gearbox driveshaft and the gearboxdriveshaft(front)housing (called front housing) from the angle gearbox as follows. See Figure 307.

(a) Remove the four bolts that attach the brackets on the gearbox−driveshaft−(front)−housing (called front housing) to the HPC.

CAUTION: DO NOT USE A TOOL SUCH AS A SCREWDRIVER TO MOVE THE FRONT HOUSING AWAY FROM THE ANGLE GEARBOX. SUCH TOOLS CAN DAMAGE THE PARTS.

(b) Remove the bolts, nuts, and washers that attach the front housing and brackets to the angle gearbox.

(c) Carefully pull the front housing to the rear.

(d) Remove the retaining ring from the gearbox driveshaft.

(e) Carefully pull the gearbox driveshaft to the rear.

(f) Discard the packing at the front of the front housing.

(2) Install PWA 85585 Guide Ring on the No. 1.5 bearing support assembly as follows. See Figure 308.

(a) Install Guide Ring (PWA 85585) to the No. 1.5 bearing support assembly.

(b) Attach the ring with the detail screws.

(3) Install the PWA 88204 Guide to the front of the LPT shaft. Tighten by hand.

CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE−UNIT BY THE GUIDE THAT YOU INSTALL ON THE FRONT OF THE CORE−UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE GUIDE. TOO MUCH STRESS ON THE GUIDE CAN CAUSE DAMAGE TO THE PLAIN ROUND NUT.

(4) Install PWA 85631 Guide as follows.

(a) With the Guide (PWA 88204) to support the front of the LPT shaft, install the Guide (PWA 85631) in the plain round nut. Be sure the threads engage correctly.

(b) Use PWA 85471 Wrench and tighten the Guide (PWA 85631) until seated.

NOTE: If equipped, the four grooves on the Guide (PWA 85631), (Change B) must be fully rearward of the Guide Ring (PWA 85585) front surface. If the grooves are not fully rearward of the ring, the threads of the guide are not fully engaged.

(5) Move the legs of PWA 85785 Adapter to their outermost position. Install PWA 85785 Adapter over the previously installed guide until seated against the fan hub. Turn the legs outward and engage the rear of the hub. Tighten the detail wing nuts to hold the legs in position.

ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−21

(6) Install two PWA 86567 Adapters on the fan case at 3 and 9 o'clock. See Figure 309.

(7) Attach PWA 85623 Eye to the intermediate case at 12 o'clock.

(8) Install PWA 85390 Lifting Adapter on the 8th stage bleed pads as follows.

(a) Remove the tool's two adapters. To remove the adapters, remove the pins.

(b) Attach the adapters to the 8th stage bleed pads with the detail screws.

(c) With a hoist, lift the arms of the tool.

(d) Attach the arms to the adapters with the pins.

(9) Support the engine with hoists at:

(a) The front of the fan unit. Use, in addition to a hoist and Adapters (PWA 86567), PWA 76155 Sling and two PWA 76154 Adapters.

(b) The rear of the fan unit: Eye (PWA 85623).

(c) The middle of the core engine: Adapter (PWA 85390).

(10) Remove the pedestals.

(11) Remove the 33 bolts in the rear flange of the No. 1.5 bearing−support−assembly. See Figure 310.

NOTE: If removal of the HPC top front case is necessary per 72−00−35, Removal−18 (Task 72−00−35−030−001), use the Retainer (PWA 86598) or (PWA 86209) as an alternative to Fixture (PWA 85537). This retainer will permit removal of the top case.

R
R

ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−21

CAUTION: FOR RETAINING BOLTS USE WORKBOLTS WITH DRILLED HEADS WITH A 0.500 INCH (12.700 mm) MAXIMUM SHANK AND THREAD LENGTH. (PN MS9218−05 OR PN MS9218−06 IS RECOMMENDED).

(12) Install four retaining bolts in the holes indicated in Figure 310. Tighten by hand. Tag the bolts "To Be Removed".

(13) Install four jacking bolts in the rear flange of the No. 1.5 bearing support assembly. Tighten by hand. See Figure 310. Tag the bolts "Jacking Bolts".

(14) Remove the bolts that attach the HPC to the intermediate case at Flange E. Install two PWA 85260 Guide Pins at approximately 3 and 9 o'clock positions on Flange E. Install two PWA 29855−7 Aligning Pins at approximately 6 and 12 o'clock positions on Flange E. See Figures 311 and 312.

NOTE: Flange E has two configurations, the UPS configuration has 72 bolts and the other configuration has 74 bolts.

(a) For engines with the 2.5 bleed actuator support bracket (Post SB PW4ENG 75−84), remove the three bolts and nuts that attach the support bracket to a bracket on Flange E.

(15) Install six PWA 101848 Jackscrew Plates as follows. See Figure 312.

(a) Remove the two detail screws from one of the plates.

(b) Put the plate in the space between the intermediate case and the bosses of the HPC−inlet−synchronizing ring assemblies. Align the screw holes in the plate with the inserts in the intermediate case.

(c) Attach the plate to the intermediate case with the two screws.

(d) Install the five other jackscrew plates in the same way. Make sure that the distances between the plates are equal.

R
R

CAUTION: BE SURE THAT THE HOISTS HAVE THE CORRECT EQUAL TENSION TO PERMIT THE SEPARATION OF THE FANUNIT FROM THE CORE ENGINE. TOO MUCH OR TOO LESS TENSION ON ANY OF THE HOISTS CAN CAUSE DAMAGE TO THE ENGINE.

CAUTION: USE A FLASHLIGHT AND BE SURE THAT ALL 33 SUPPORT BOLTS AND ALL THE FLANGE E BOLTS ARE REMOVED. COUNT THE BOLTS. THERE SHOULD BE 72 BOLTS FOR THE UPS CONFIGURATION AND 74 BOLTS FOR THE OTHER CONFIGURATION. BE SURE ALL EXTERNAL PARTS ARE DISCONNECTED AND ARE CLEAR FOR SEPARATION.

(16) Move the fan unit away from the core engine.

(a) Use the jackscrews in the No. 1.5 bearing support assembly and the jackscrew plates.

(17) For engines that have incorporated SB PW4ENG 72-48, discard the packing on the intermediate case at Flange E. Remove the transfer tube (and packings, if equipped).

(18) Remove the four bolts that are in the No. 1.5 bearing support assembly with the tag "Jacking Bolts".

(19) Remove the two Guide Pins (PWA 85260) and the two Aligning Pins (PWA 29855-7) from Flange E.

CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE-UNIT BY THE GUIDE (PWA 85631) THAT IS INSTALLED ON THE FRONT OF THE CORE-UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE GUIDE. TOO MUCH STRESS ON THE GUIDE CAN CAUSE DAMAGE TO THE PLAIN ROUND NUT.

(20) Remove the Guide (PWA 88204) from the front of the core-unit. Install the flat washer and the turbine shaft nut to the front of the LPT shaft. Tighten the nut with PWA 85429 Wrench until it is seated against the washer. See Figure 313.

(21) Install the, PWA 85537 Fixture (for compressors with the symmetric case), or the PWA 88560 Fixture (for compressors with the asymmetric case) (optional to the installation of Retainer (PWA 86598) or (PWA 86209) on the HPC. See Figure 314.

R
R

(a) The No. 2-bearing-support-assembly has a locating pin at 6:00 o'clock. Put the locating pin in one of the holes of the tool's inner bolt circle.

(b) Attach the tool to the HPC with the detail screws, washers, and nuts.

(c) Attach the tool to the No.2-bearing-support assembly with the detail screws.

(22) Install Retainer (PWA 86598) or (PWA 86209) (optional to Fixture (PWA 85537 or PWA 88560) on the HPC. Use the detail bolts and nuts. See Figure 314.

CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE-UNIT BY THE GUIDE THAT IS INSTALLED ON THE FRONT OF THE CORE-UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE GUIDE. TOO MUCH STRESS ON THE GUIDE CAN CAUSE DAMAGE TO THE PLAIN ROUND NUT.

(23) Attach pedestals to Fixture (PWA 85537) or Retainer (PWA 86598) or (PWA 86209).

(24) Remove the gearbox driveshaft and front housing from the gearbox driveshaft housing (called rear housing) as follows. See Figure 315.

(a) Carefully pull the gearbox driveshaft out of the front housing.

(b) Carefully pull the front housing out of the rear housing. Discard the packing.

(c) Put them on pallets. Install protective covers.

(25) Remove Jackscrew Plates (PWA 101848).

NOTE: Do not remove Adapter (PWA 85390) from the core-unit.

(26) Remove the Adapter (PWA 85785) from the front fan hub.

(27) To trunnion the fan unit to rear end down, refer to 72-00-00, Special Procedures-21 (Task 72-00-00-020-004). If you do not trunnion the fan unit, do as follows:

R
R

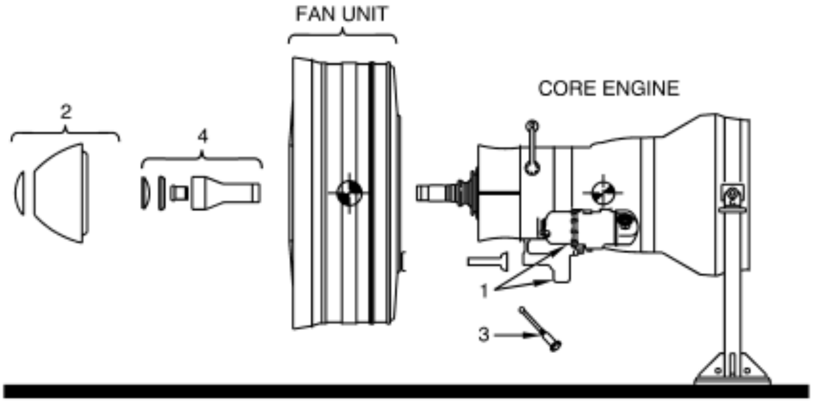
(a) Attach PWA 25926 Adapters to four PWA 25757 Pedestals. Put the Adapters (PWA 86567) that are on the fan case and the brackets that are on the intermediate case in the adapters on the pedestals.

(b) Remove the Adapters (PWA 76154), sling, eye, and hoists from the fan unit.

F. Postrequisites

(1) If necessary, remove the HPC top front case. See 72−00−35, Removal−18 (Task 72−00−35−030−001).

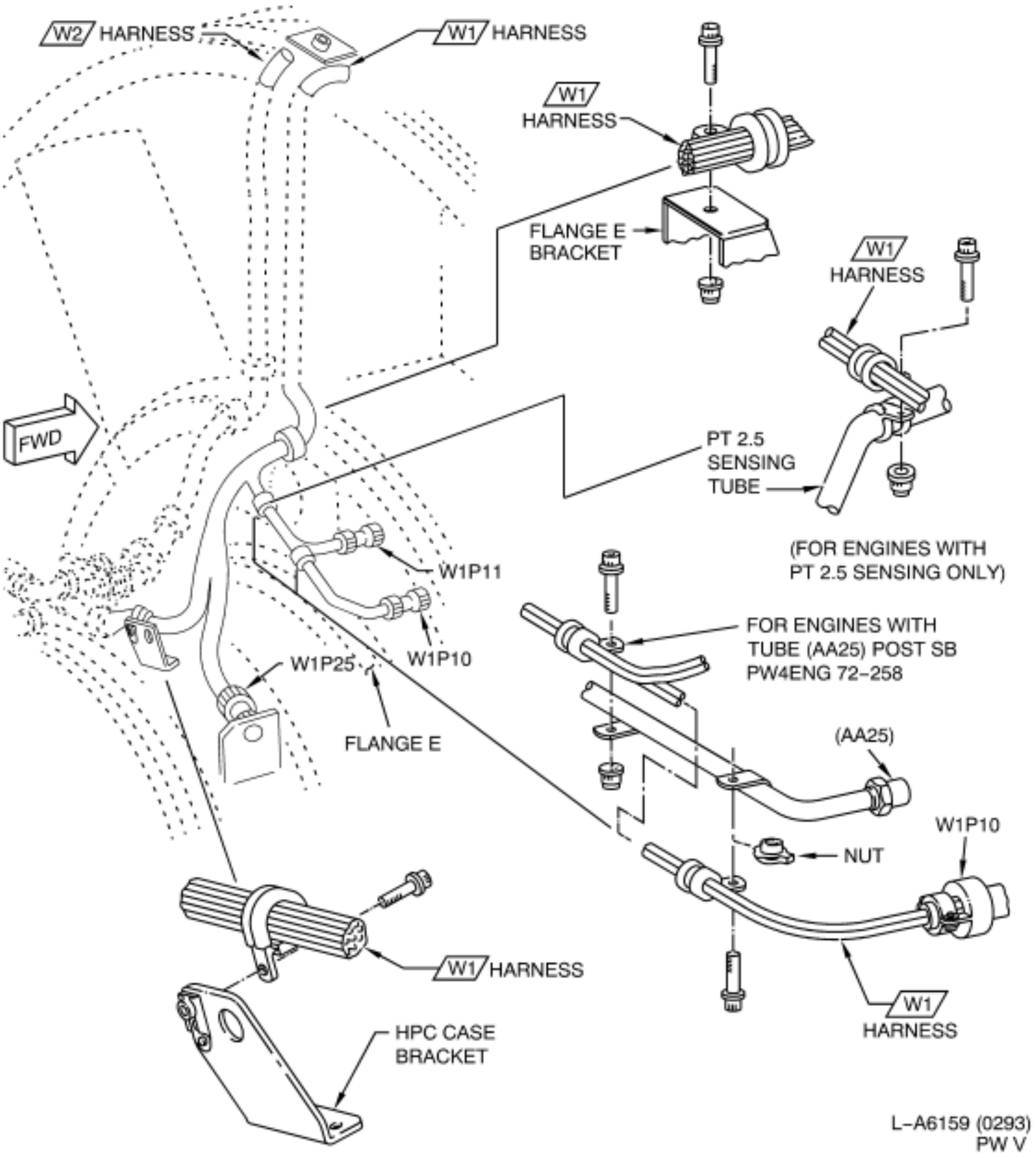
ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−21



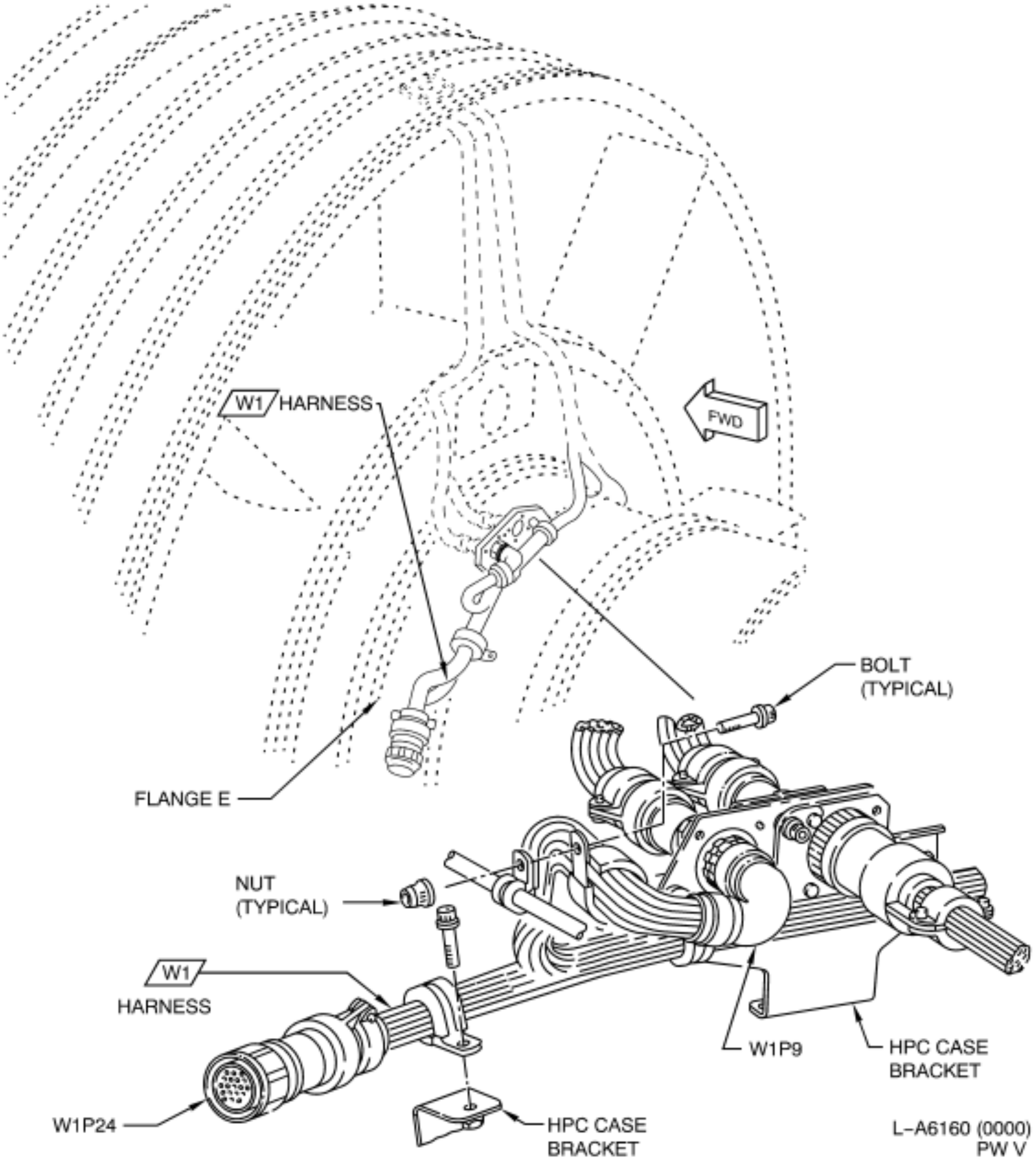
1. MAGNETIC PLUG ASSEMBLIES IN THE OIL TANK AND MAIN GEARBOX
2. COMPRESSOR INLET CONE
3. NI SPEED TRANSDUCER
4. LPC/LPT COUPLING

L−A5069 (0289)
PW V

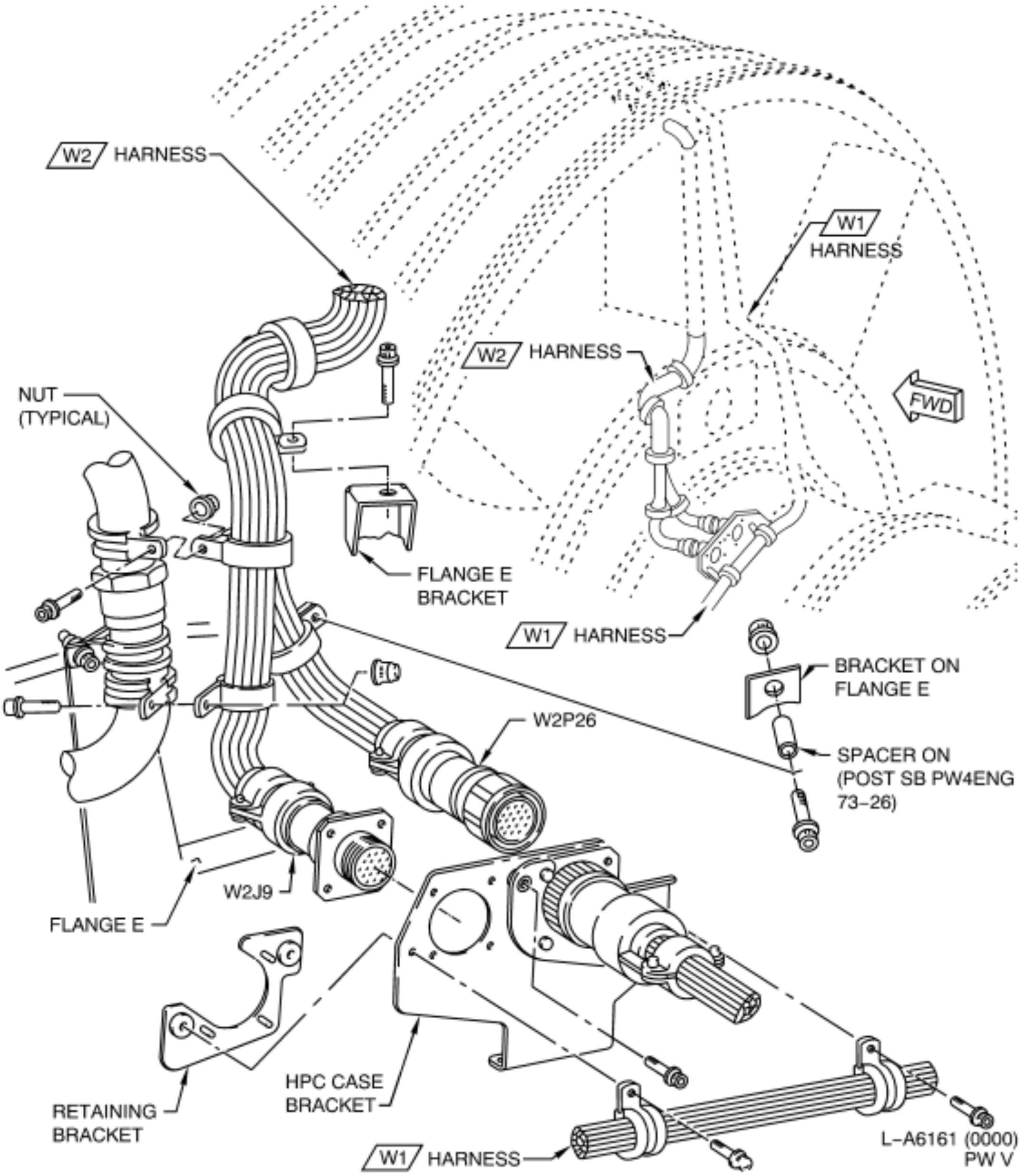
Procedure Sequence
Figure 301
(Task 72−00−34−020−006)


W2 HARNESS
W1 HARNESS
W1 HARNESS
FLANGE E BRACKET
W1 HARNESS
FWD
PT 2.5 SENSING TUBE
(FOR ENGINES WITH PT 2.5 SENSING ONLY)
W1P11
W1P10
W1P25
FOR ENGINES WITH TUBE (AA25) POST SB PW4ENG 72-258
FLANGE E
(AA25)
W1P10
NUT
W1 HARNESS
W1 HARNESS
HPC CASE BRACKET
L-A6159 (0293)
PW V

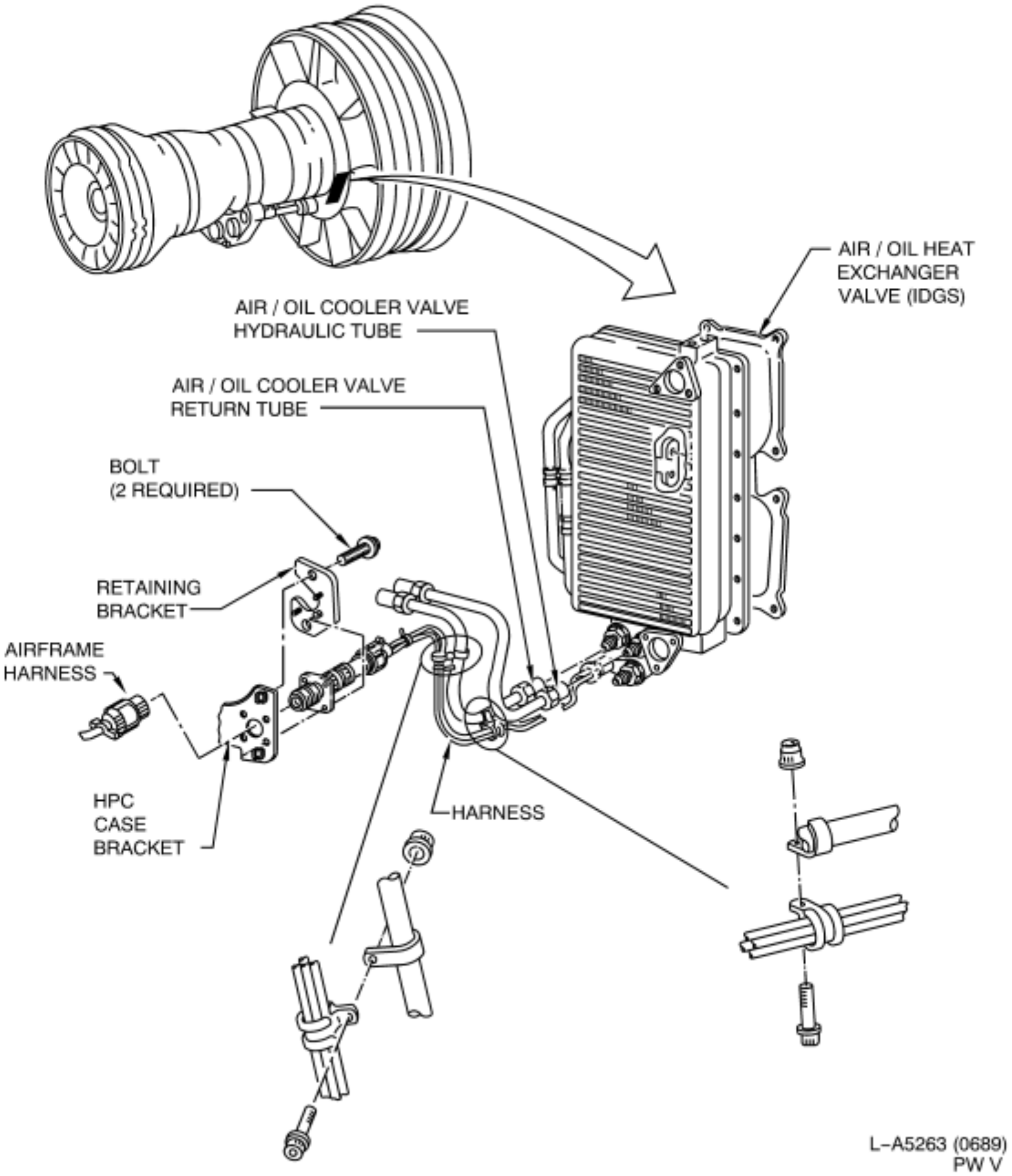
EEC Wiring Harness Removal
Figure 302 (Sheet 1)
(Task 72-00-34-020-006)


W1 HARNESS
FWD
BOLT (TYPICAL)
FLANGE E
NUT (TYPICAL)
W1
HARNESS
W1P9
HPC CASE BRACKET
W1P24
HPC CASE BRACKET
L−A6160 (0000)
PW V

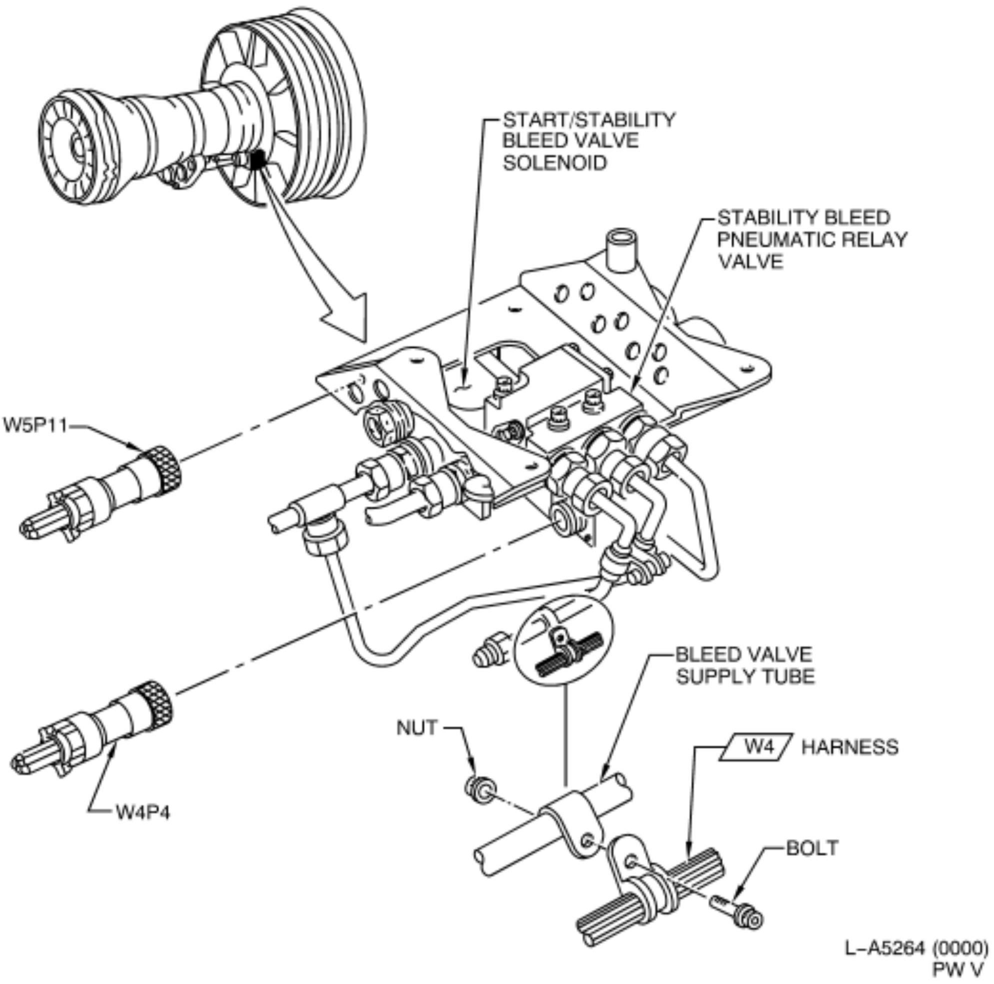
EEC Wiring Harness Removal
Figure 302 (Sheet 2)
(Task 72−00−34−020−006)


W2 HARNESS
W1 HARNESS
W2 HARNESS
FWD
NUT (TYPICAL)
FLANGE E BRACKET
W1 HARNESS
BRACKET ON FLANGE E
W2P26
SPACER ON (POST SB PW4ENG 73-26)
W2J9
FLANGE E
RETAINING BRACKET
HPC CASE BRACKET
W1 HARNESS
L-A6161 (0000) PW V

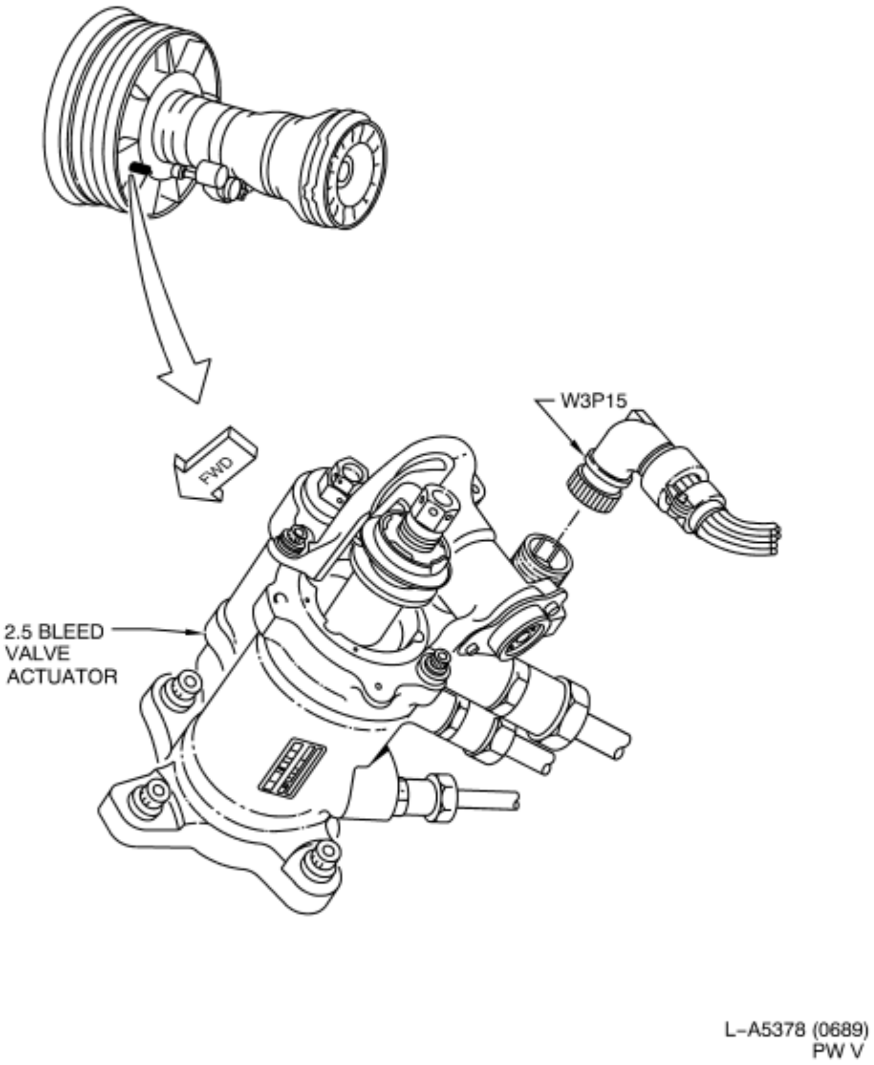
EEC Wiring Harness Removal
Figure 302 (Sheet 3)
(Task 72-00-34-020-006)


AIR / OIL HEAT EXCHANGER VALVE (IDGS)
AIR / OIL COOLER VALVE HYDRAULIC TUBE
AIR / OIL COOLER VALVE RETURN TUBE
BOLT (2 REQUIRED)
RETAINING BRACKET
AIRFRAME HARNESS
HPC CASE BRACKET
HARNESS
L−A5263 (0689)
PW V

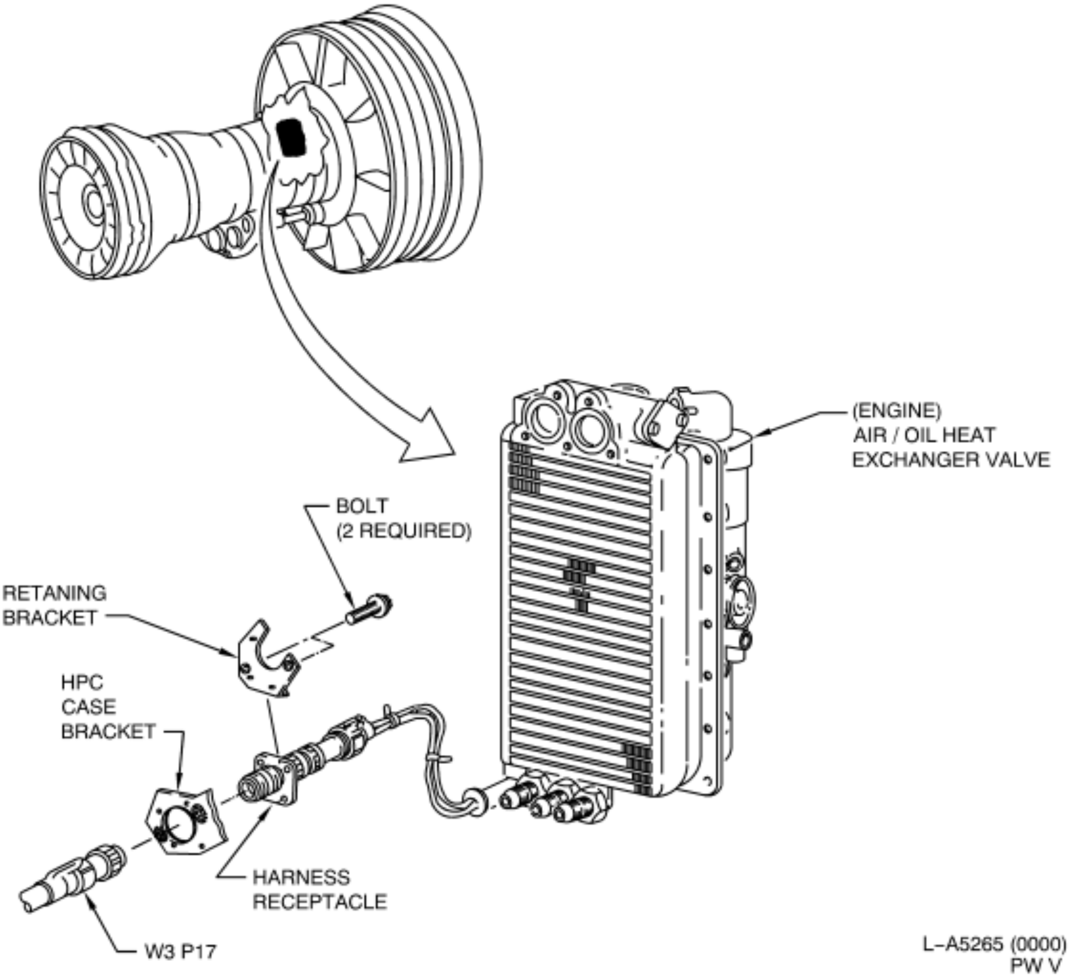
Heat Exchanger Wiring Harness Removal
Figure 302 (Sheet 4)
(Task 72−00−34−020−006)


START/STABILITY BLEED VALVE SOLENOID
STABILITY BLEED PNEUMATIC RELAY VALVE
W5P11
BLEED VALVE SUPPLY TUBE
NUT
W4
HARNESS
BOLT
W4P4
L−A5264 (0000)
PW V

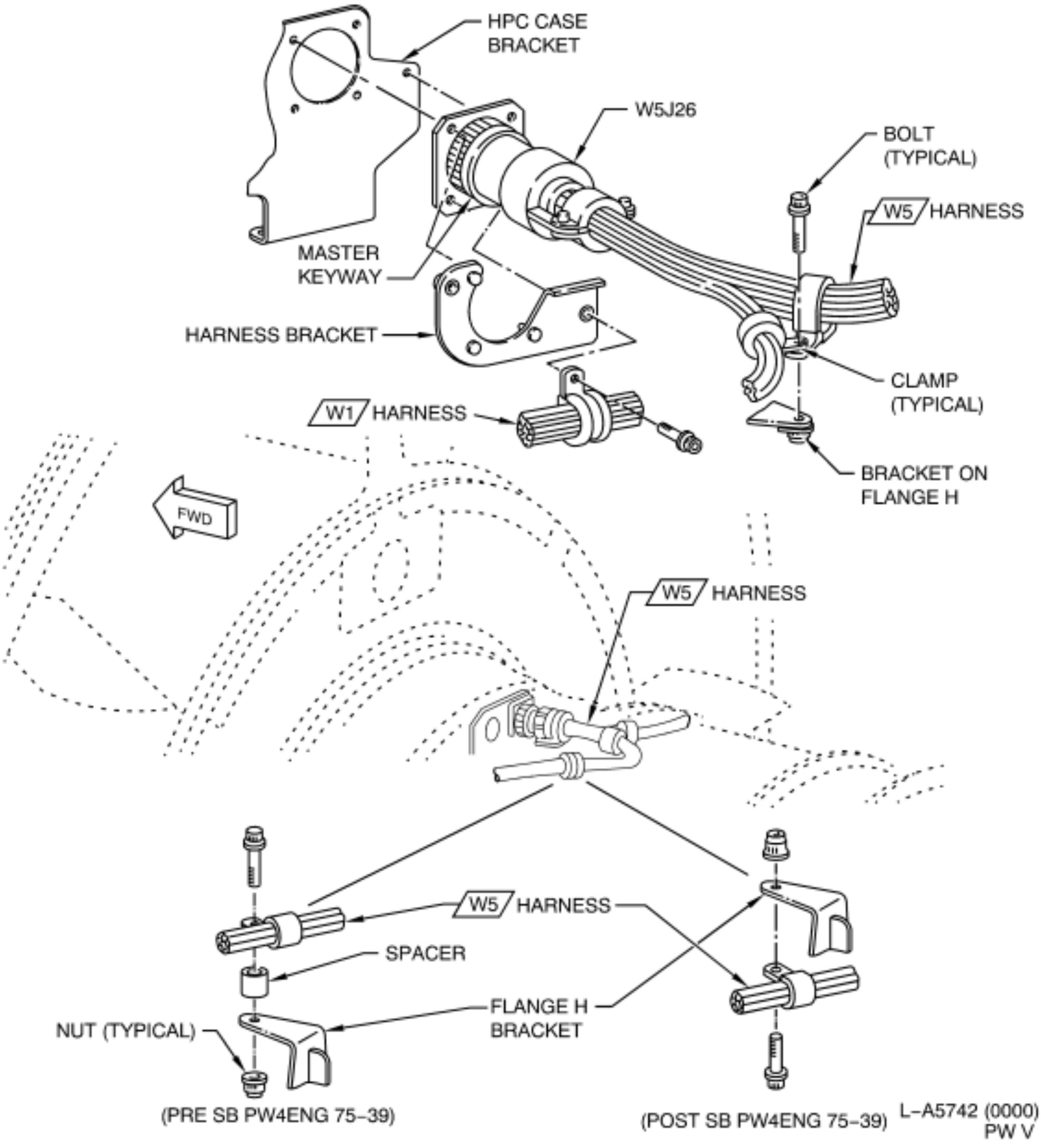
EEC Wiring Harness Removal
Figure 302 (Sheet 5)
(Task 72−00−34−020−006)


W3P15
FWD
2.5 BLEED
VALVE
ACTUATOR
L−A5378 (0689)
PW V

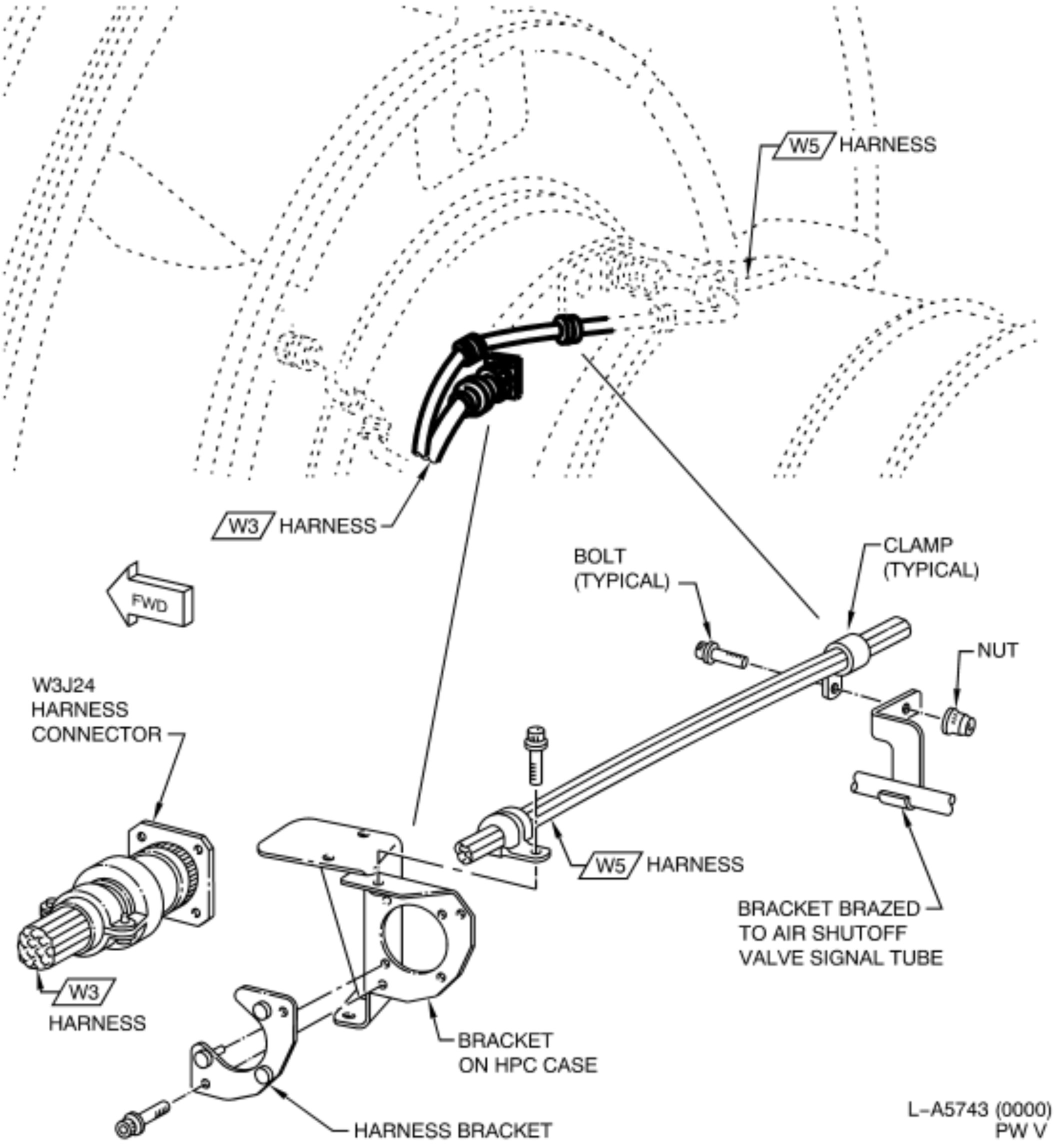
EEC Wiring Harness Removal
Figure 302 (Sheet 6)
(Task 72−00−34−020−006)


(ENGINE)
AIR / OIL HEAT
EXCHANGER VALVE
BOLT
(2 REQUIRED)
RETANING
BRACKET
HPC
CASE
BRACKET
HARNESS
RECEPTACLE
W3 P17
L−A5265 (0000)
PW V

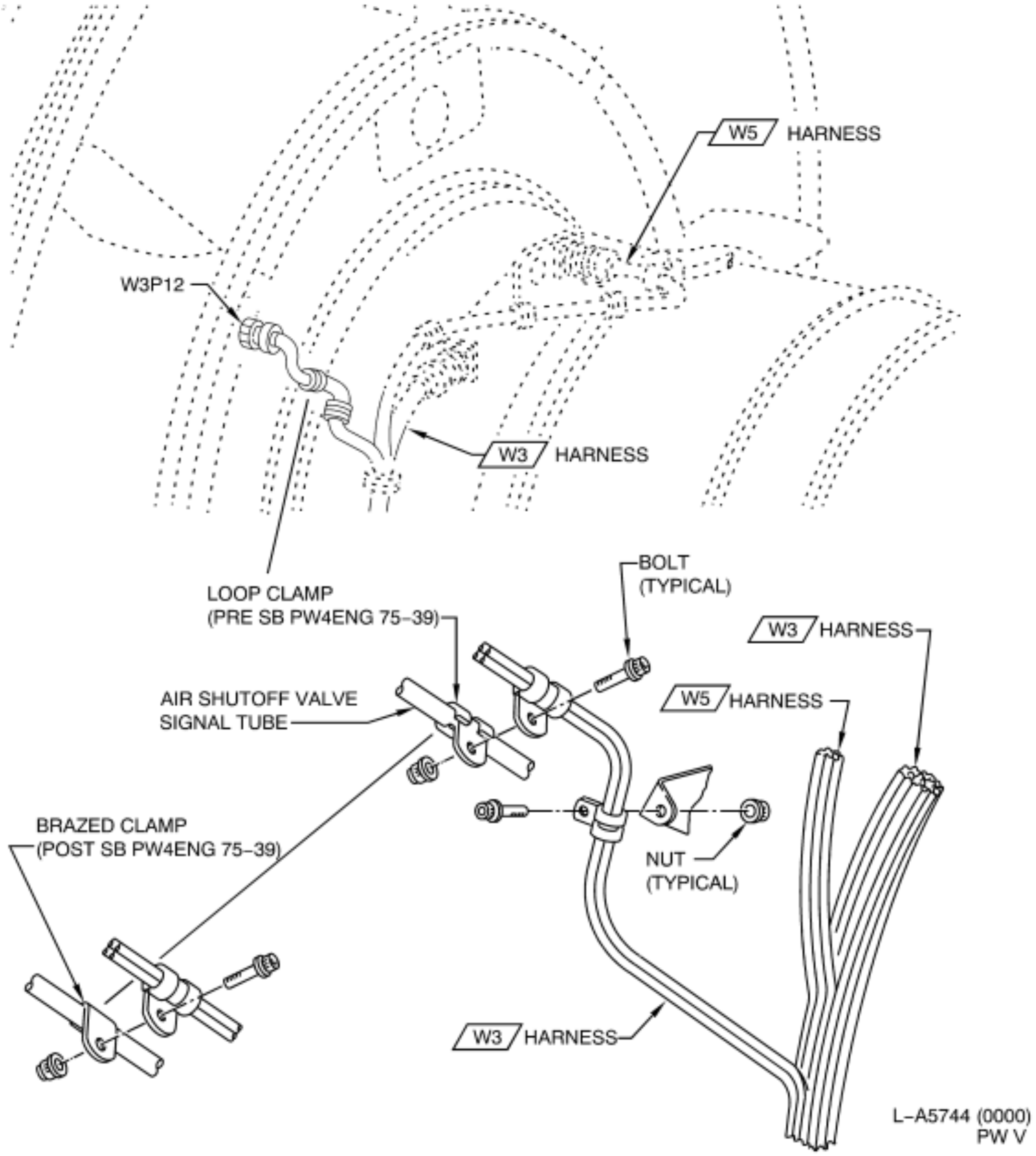
Heat Exchanger Wiring Harness Removal
Figure 302 (Sheet 7)
(Task 72−00−34−020−006)


HPC CASE BRACKET
W5J26
BOLT (TYPICAL)
W5 HARNESS
MASTER KEYWAY
HARNESS BRACKET
CLAMP (TYPICAL)
W1 HARNESS
BRACKET ON FLANGE H
FWD
W5 HARNESS
W5 HARNESS
SPACER
FLANGE H BRACKET
NUT (TYPICAL)
(PRE SB PW4ENG 75-39)
(POST SB PW4ENG 75-39)
L-A5742 (0000)
PW V

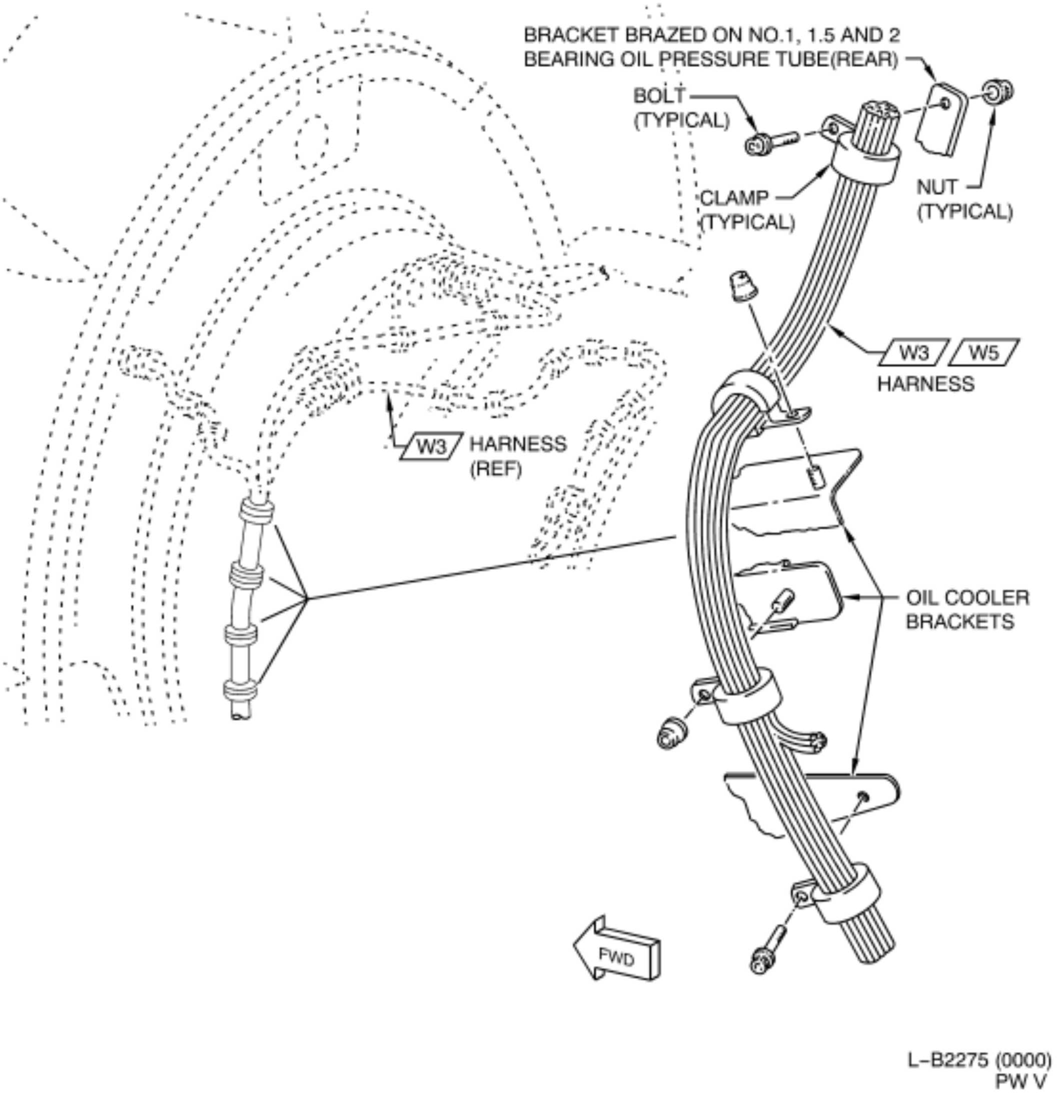
EEC Wiring Harness Removal (Necessary
Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 1)
(Task 72-00-34-020-006)


W5 HARNESS
W3 HARNESS
BOLT (TYPICAL)
CLAMP (TYPICAL)
NUT
FWD
W3J24 HARNESS CONNECTOR
W5 HARNESS
BRACKET BRAZED TO AIR SHUTOFF VALVE SIGNAL TUBE
W3 HARNESS
BRACKET ON HPC CASE
HARNESS BRACKET
L-A5743 (0000)
PW V

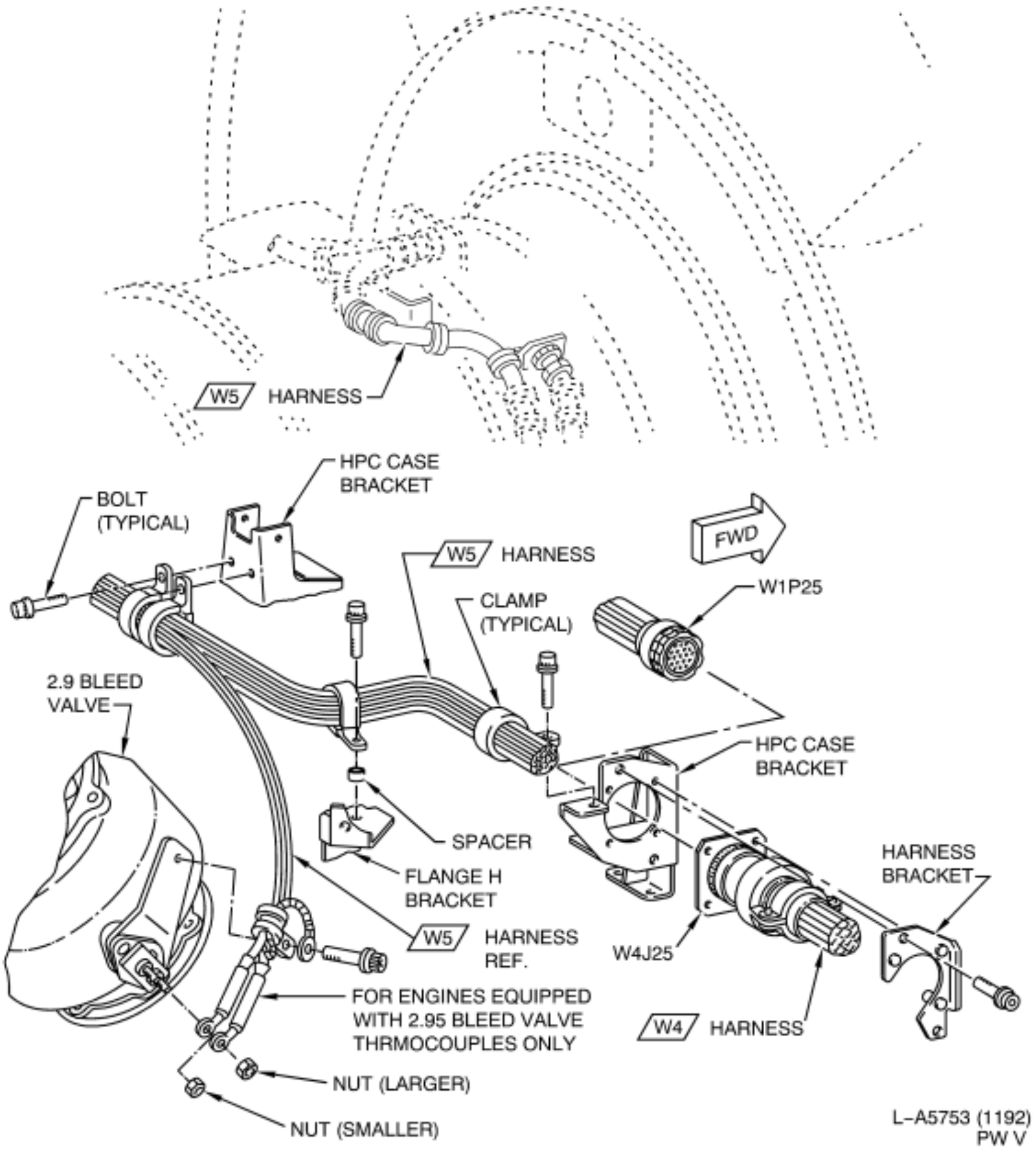
EEC Wiring Harness Removal (Necessary
Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 2)
(Task 72-00-34-020-006)


W5 HARNESS
W3P12
W3 HARNESS
LOOP CLAMP
(PRE SB PW4ENG 75−39)
BOLT
(TYPICAL)
W3 HARNESS
AIR SHUTOFF VALVE
SIGNAL TUBE
W5 HARNESS
BRAZED CLAMP
(POST SB PW4ENG 75−39)
NUT
(TYPICAL)
W3 HARNESS
L−A5744 (0000)
PW V

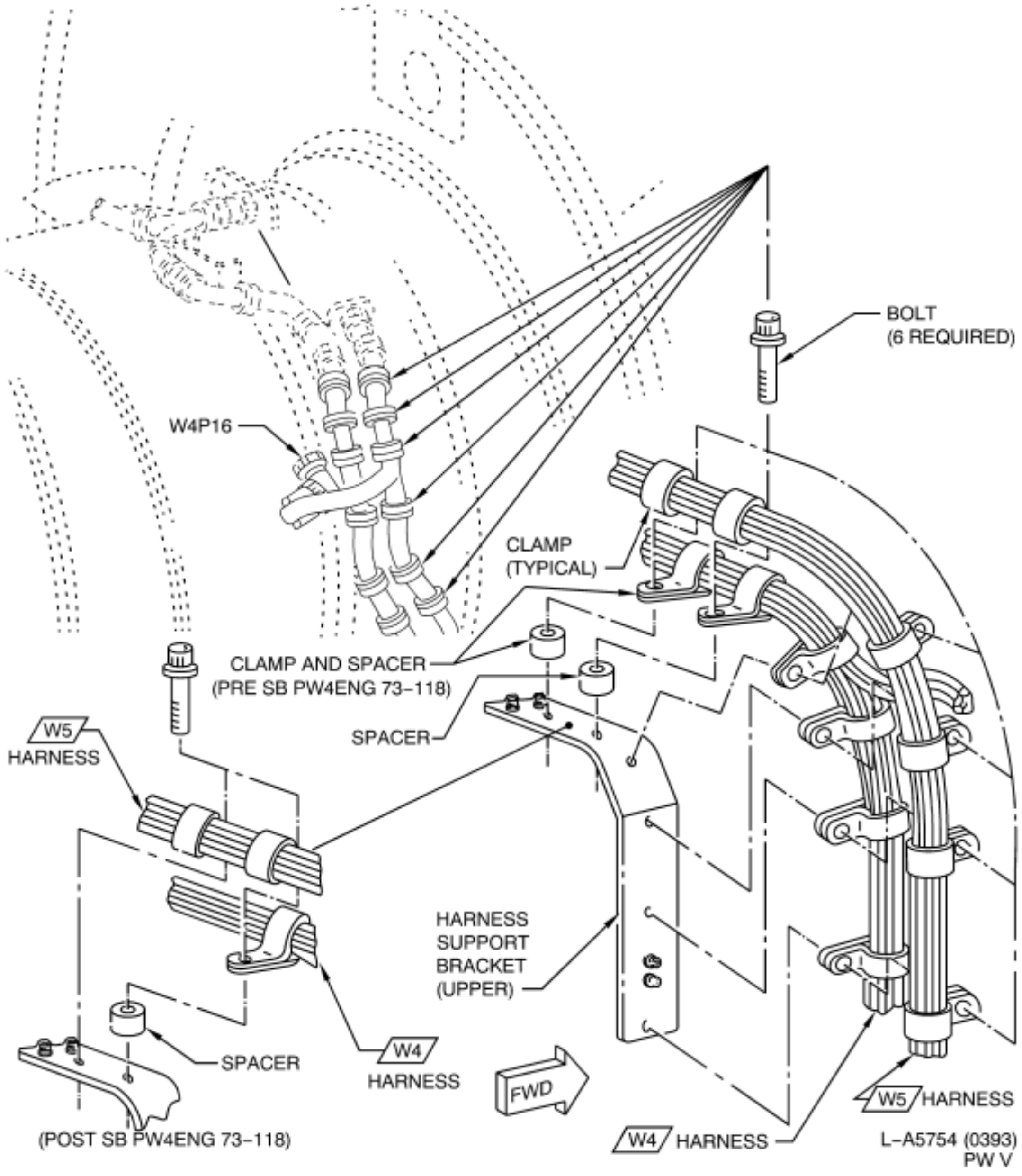
EEC Wiring Harness Removal (Necessary
Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 3)
(Task 72−00−34−020−006)


BRACKET BRAZED ON NO.1, 1.5 AND 2
BEARING OIL PRESSURE TUBE(REAR)
BOLT
(TYPICAL)
CLAMP
(TYPICAL)
NUT
(TYPICAL)
W3
W5
HARNESS
W3
HARNESS
(REF)
OIL COOLER
BRACKETS
FWD
L−B2275 (0000)
PW V

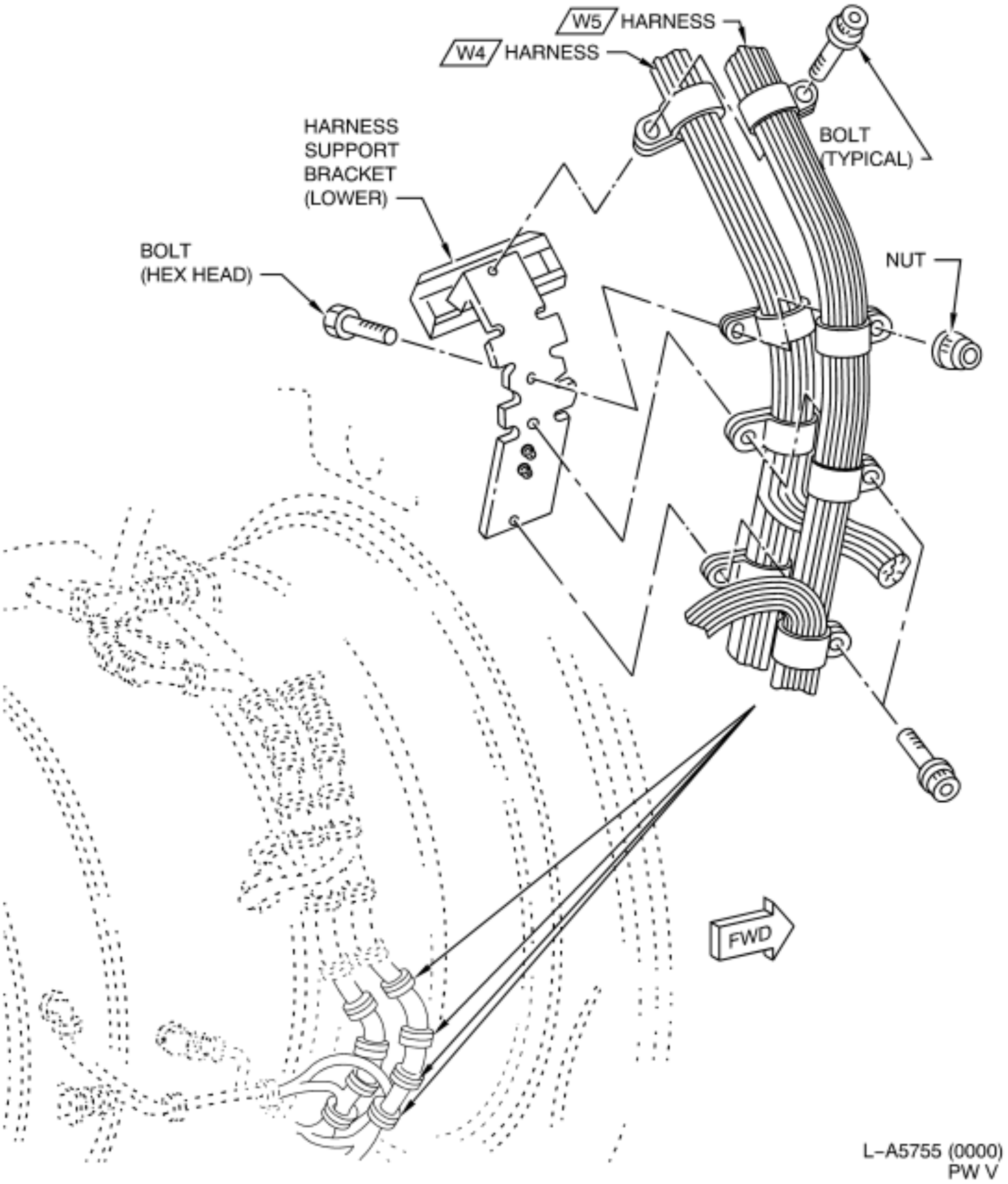
EEC Wiring Harness Removal (Necessary
Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 4)
(Task 72−00−34−020−006)


W5 HARNESS
HPC CASE BRACKET
BOLT (TYPICAL)
W5 HARNESS
FWD
CLAMP (TYPICAL)
W1P25
2.9 BLEED VALVE
HPC CASE BRACKET
SPACER
FLANGE H BRACKET
HARNESS BRACKET
W5 HARNESS REF.
W4J25
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THRMOCOUPLES ONLY
W4 HARNESS
NUT (LARGER)
NUT (SMALLER)
L−A5753 (1192)
PW V

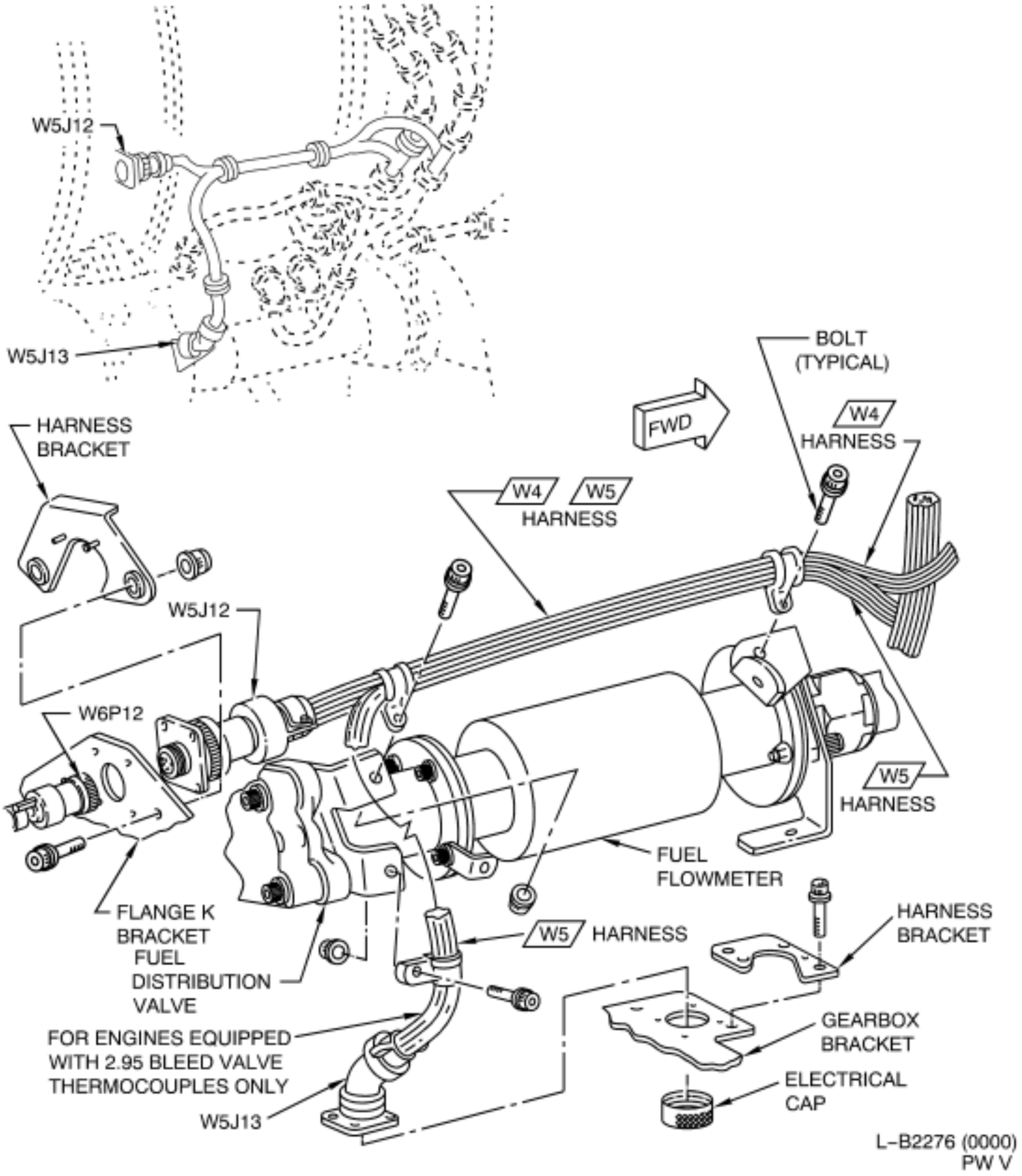
EEC Wiring Harness Removal (Necessary
Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 5)
(Task 72−00−34−020−006)


BOLT
(6 REQUIRED)
W4P16
CLAMP
(TYPICAL)
CLAMP AND SPACER
(PRE SB PW4ENG 73-118)
SPACER
W5
HARNESS
HARNESS
SUPPORT
BRACKET
(UPPER)
SPACER
W4
HARNESS
FWD
(POST SB PW4ENG 73-118)
W4 HARNESS
W5 HARNESS
L-A5754 (0393)
PW V

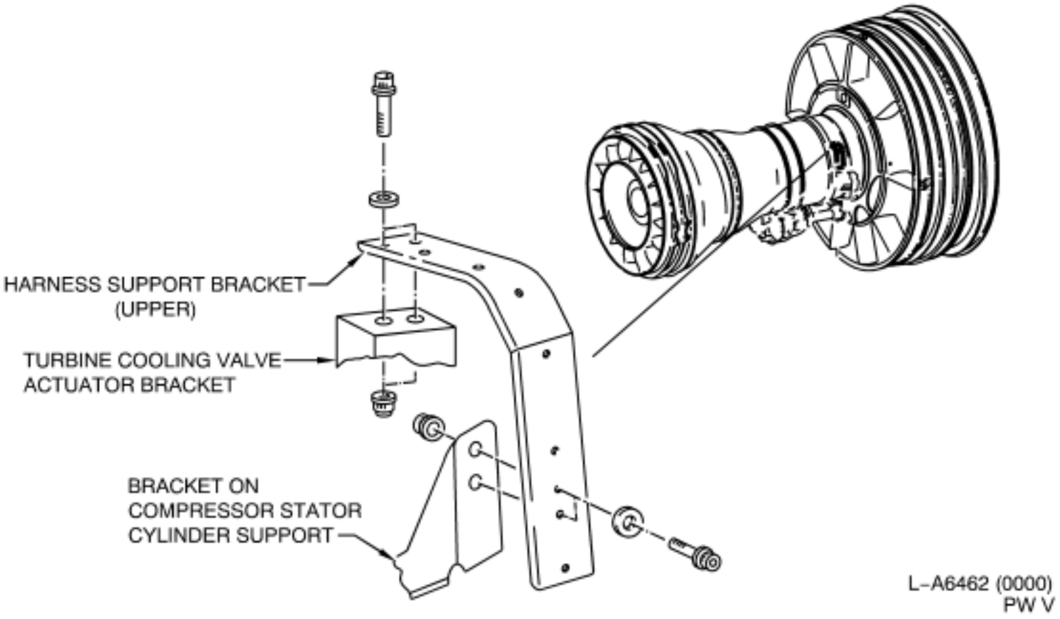
EEC Wiring Harness Removal (Necessary
Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 6)
(Task 72-00-34-020-006)


W5 HARNESS
W4 HARNESS
HARNESS SUPPORT BRACKET (LOWER)
BOLT (TYPICAL)
BOLT (HEX HEAD)
NUT
FWD
L−A5755 (0000)
PW V

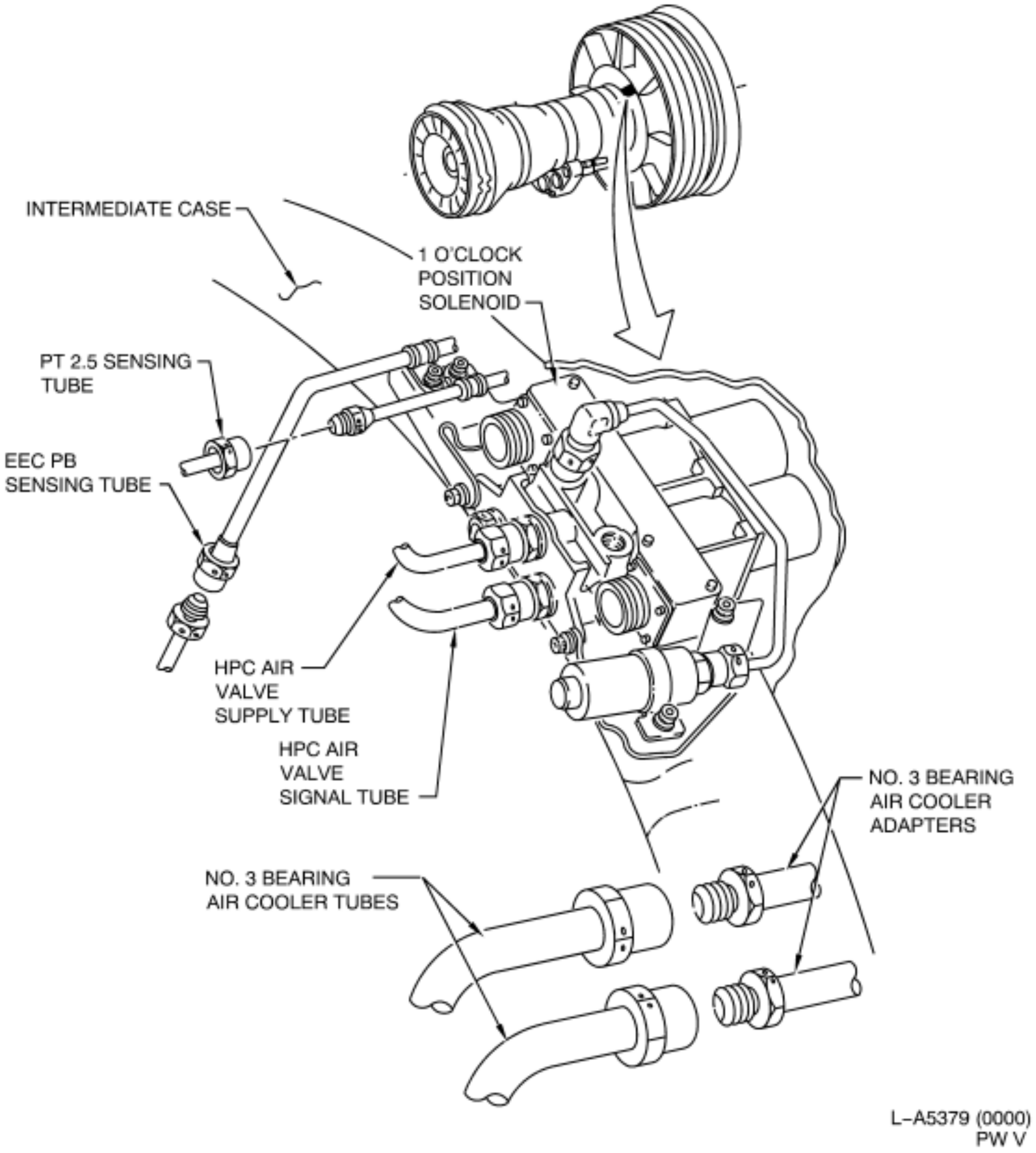
EEC Wiring Harness Removal (Necessary
Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 7)
(Task 72−00−34−020−006)


W5J12
W5J13
HARNESS BRACKET
BOLT (TYPICAL)
FWD
W4
HARNESS
W4 W5
HARNESS
W5J12
W6P12
W5
HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
GEARBOX BRACKET
ELECTRICAL CAP
W5J13
L−B2276 (0000)
PW V

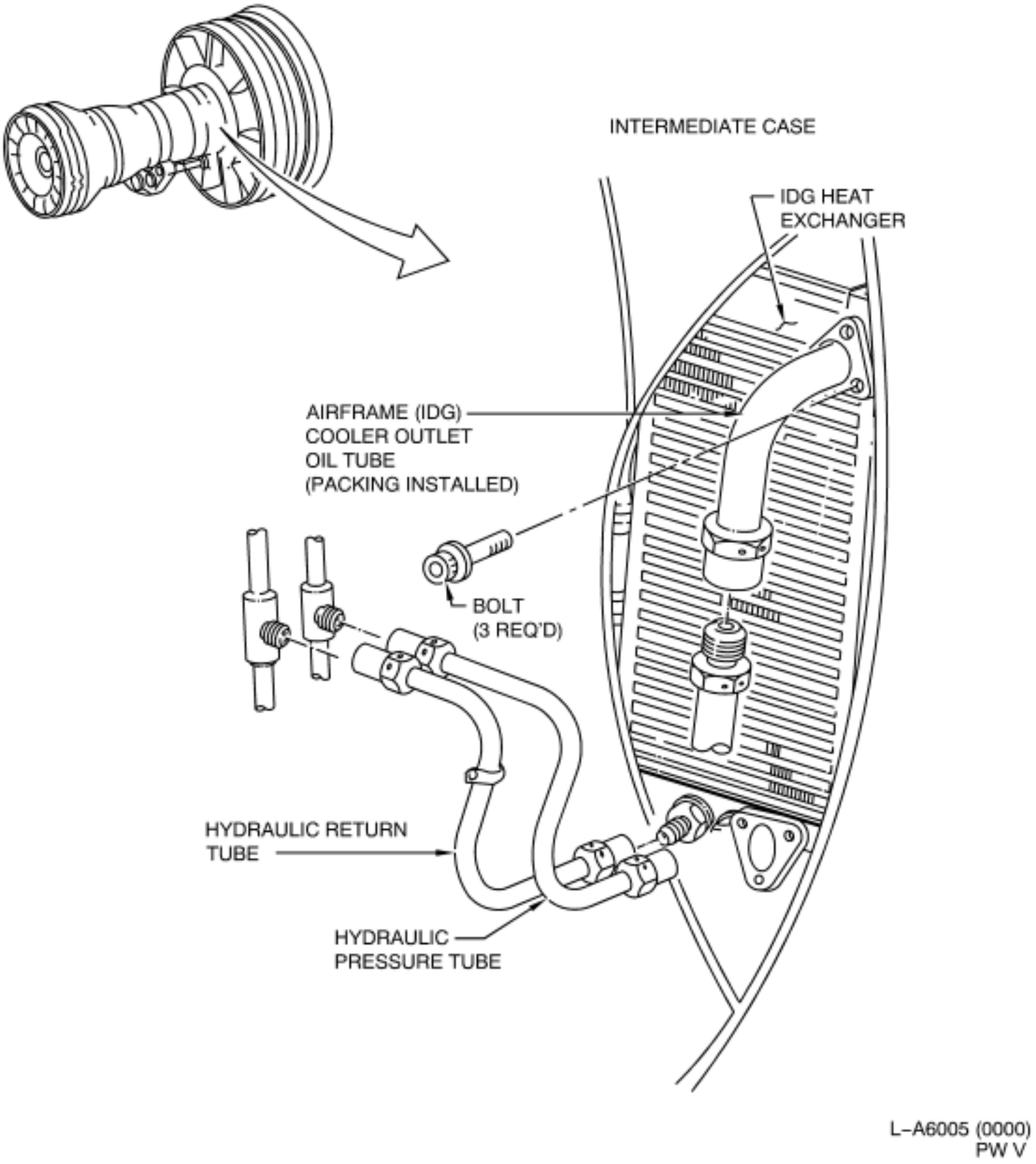
EEC Wiring Harness Removal (Necessary Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 8)
(Task 72−00−34−020−006)


HARNESS SUPPORT BRACKET (UPPER)
TURBINE COOLING VALVE ACTUATOR BRACKET
BRACKET ON COMPRESSOR STATOR CYLINDER SUPPORT
L−A6462 (0000)
PW V

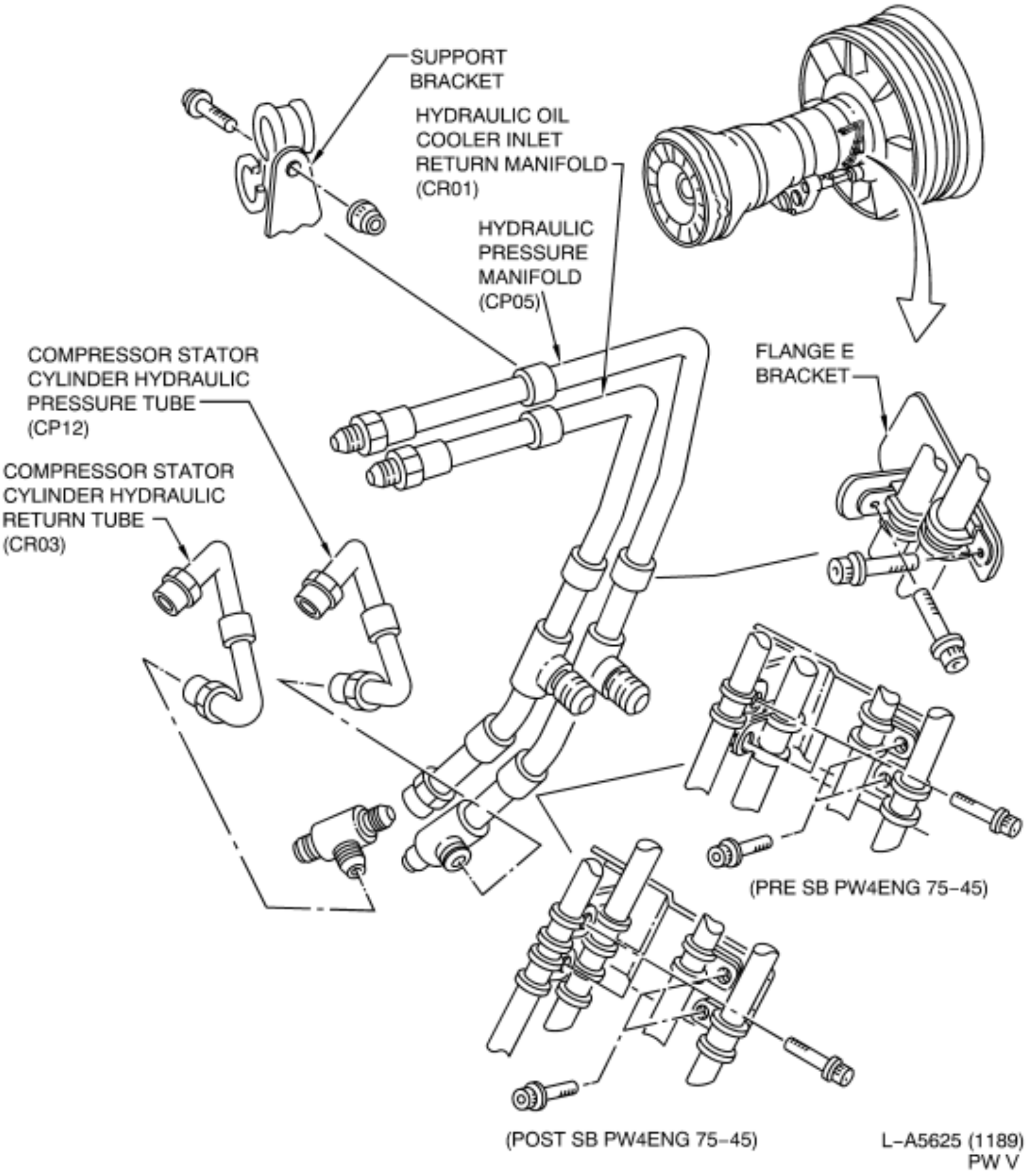
EEC Wiring Harness Removal (Necessary
Only For Removal Of HPC Top Front Case)
Figure 303 (Sheet 9)
(Task 72−00−34−020−006)


INTERMEDIATE CASE
1 O'CLOCK POSITION SOLENOID
PT 2.5 SENSING TUBE
EEC PB SENSING TUBE
HPC AIR VALVE SUPPLY TUBE
HPC AIR VALVE SIGNAL TUBE
NO. 3 BEARING AIR COOLER ADAPTERS
NO. 3 BEARING AIR COOLER TUBES
L−A5379 (0000)
PW V

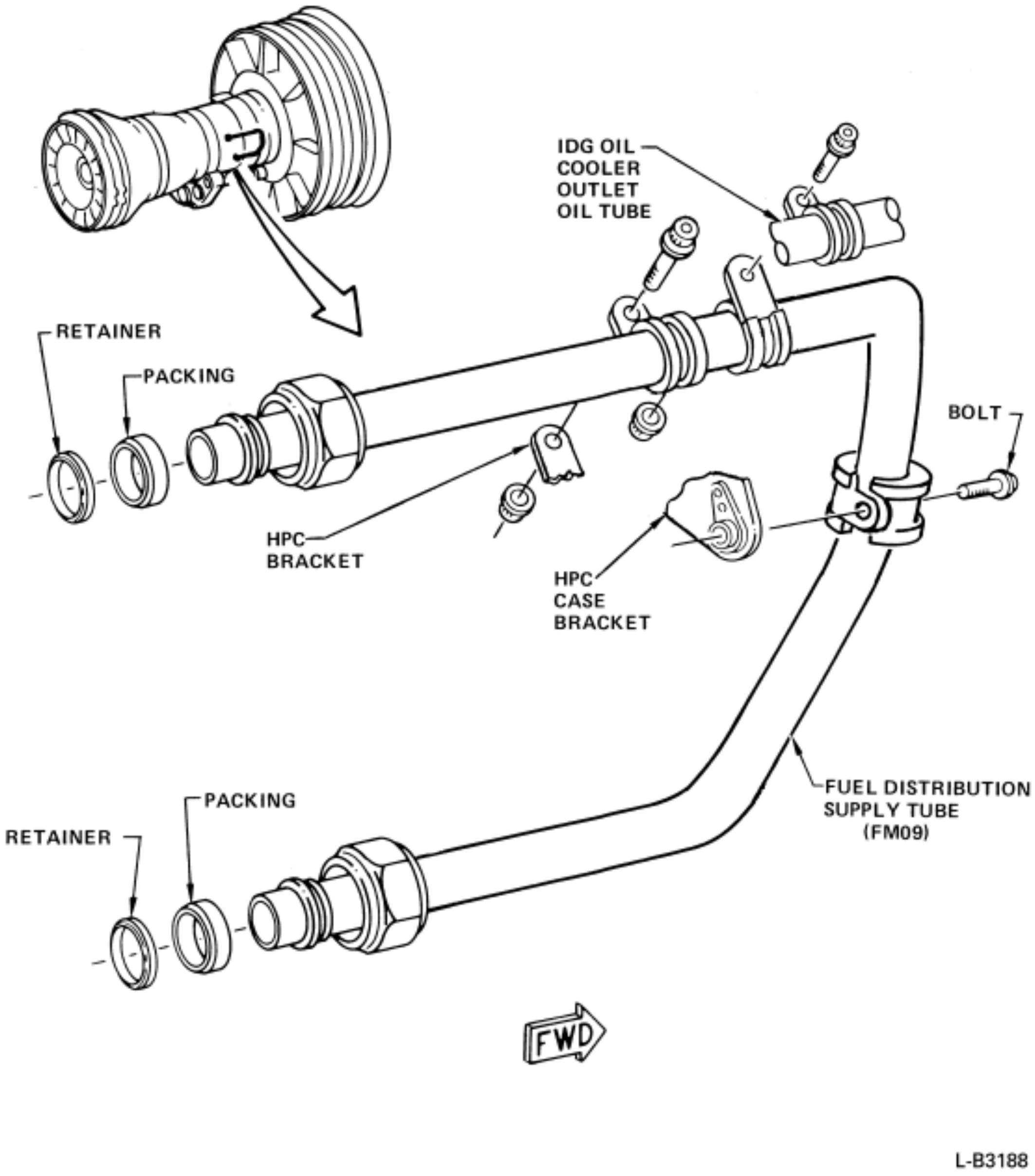
Engine Tube Disconnects And Removals
Figure 304 (Sheet 1)
(Task 72−00−34−020−006)


INTERMEDIATE CASE
IDG HEAT EXCHANGER
AIRFRAME (IDG) COOLER OUTLET OIL TUBE (PACKING INSTALLED)
BOLT (3 REQ'D)
HYDRAULIC RETURN TUBE
HYDRAULIC PRESSURE TUBE
L-A6005 (0000)
PW V

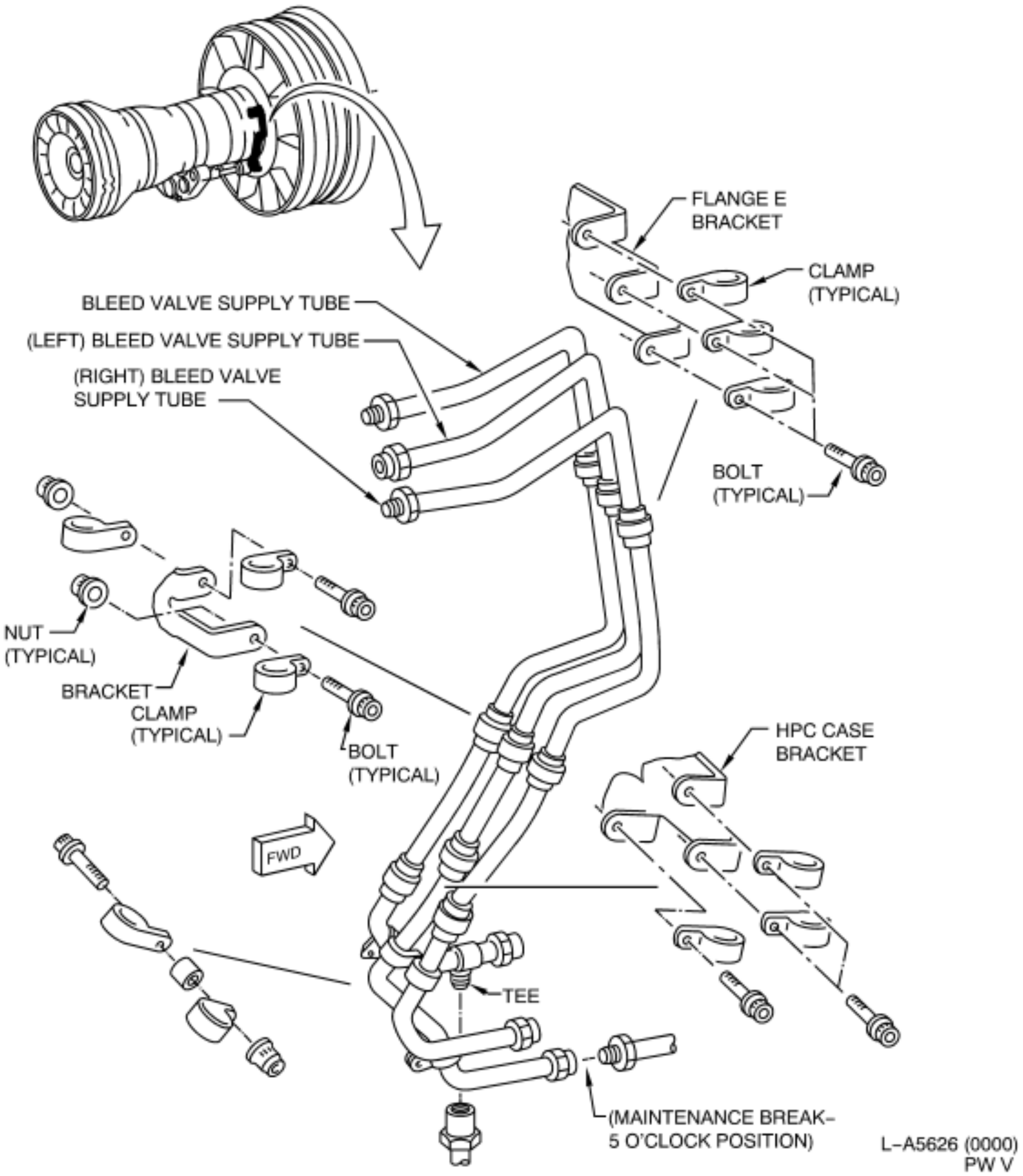
Engine Tube Disconnects And Removals
Figure 304 (Sheet 2)
(Task 72-00-34-020-006)


SUPPORT BRACKET
HYDRAULIC OIL COOLER INLET RETURN MANIFOLD (CR01)
HYDRAULIC PRESSURE MANIFOLD (CP05)
COMPRESSOR STATOR CYLINDER HYDRAULIC PRESSURE TUBE (CP12)
COMPRESSOR STATOR CYLINDER HYDRAULIC RETURN TUBE (CR03)
FLANGE E BRACKET
(PRE SB PW4ENG 75−45)
(POST SB PW4ENG 75−45)
L−A5625 (1189)
PW V

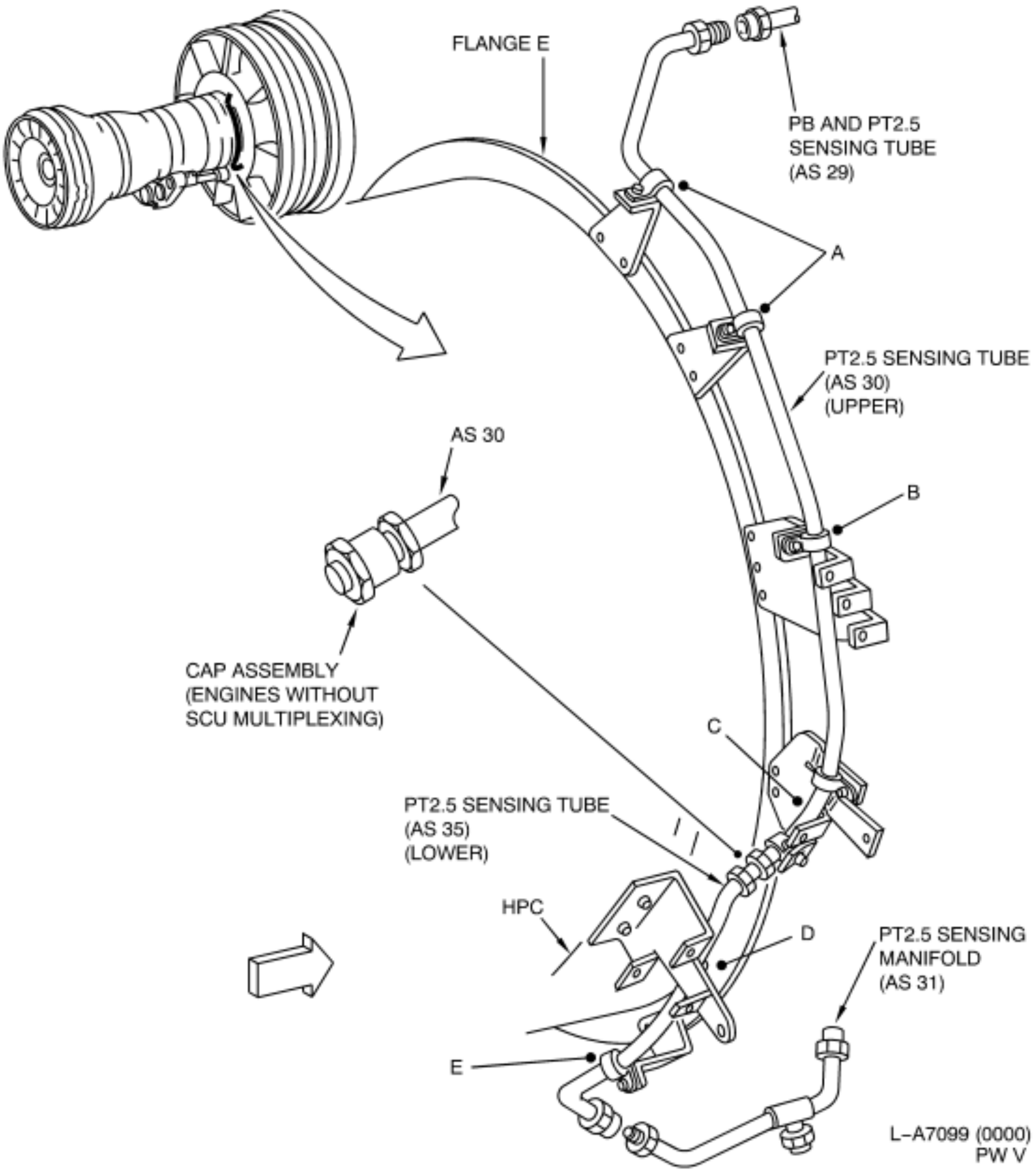
Engine Tube Disconnects And Removals
Figure 304 (Sheet 3)
(Task 72−00−34−020−006)


IDG OIL COOLER OUTLET OIL TUBE
RETAINER
PACKING
BOLT
HPC BRACKET
HPC CASE BRACKET
FUEL DISTRIBUTION SUPPLY TUBE (FM09)
PACKING
RETAINER
FWD
L-B3188

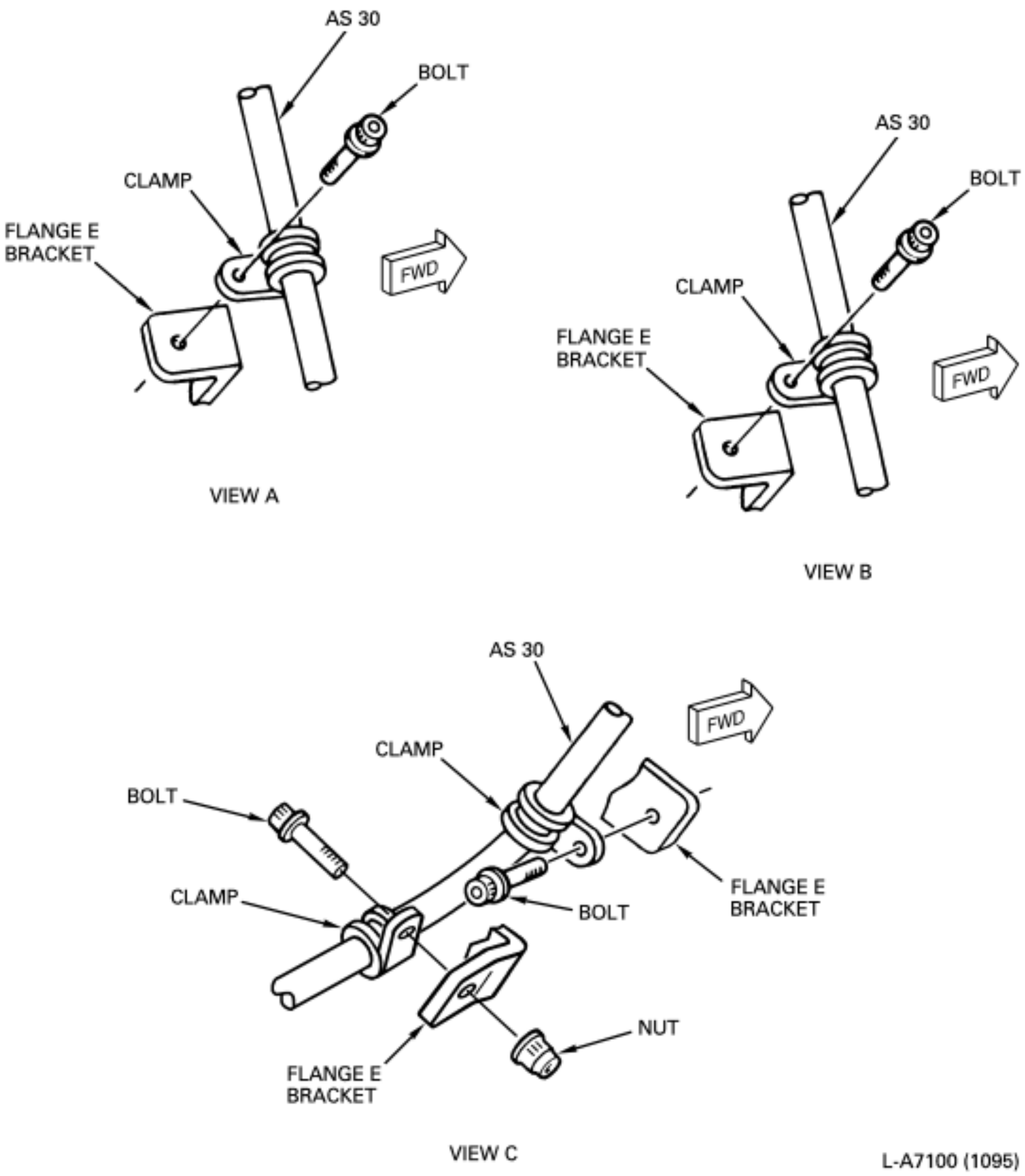
Engine Tube Disconnects And Removals
Figure 304 (Sheet 4)
(Task 72-00-34-020-006)


FLANGE E
BRACKET
CLAMP
(TYPICAL)
BLEED VALVE SUPPLY TUBE
(LEFT) BLEED VALVE SUPPLY TUBE
(RIGHT) BLEED VALVE
SUPPLY TUBE
BOLT
(TYPICAL)
NUT
(TYPICAL)
BRACKET
CLAMP
(TYPICAL)
BOLT
(TYPICAL)
HPC CASE
BRACKET
FWD
TEE
(MAINTENANCE BREAK-
5 O'CLOCK POSITION)
L-A5626 (0000)
PW V

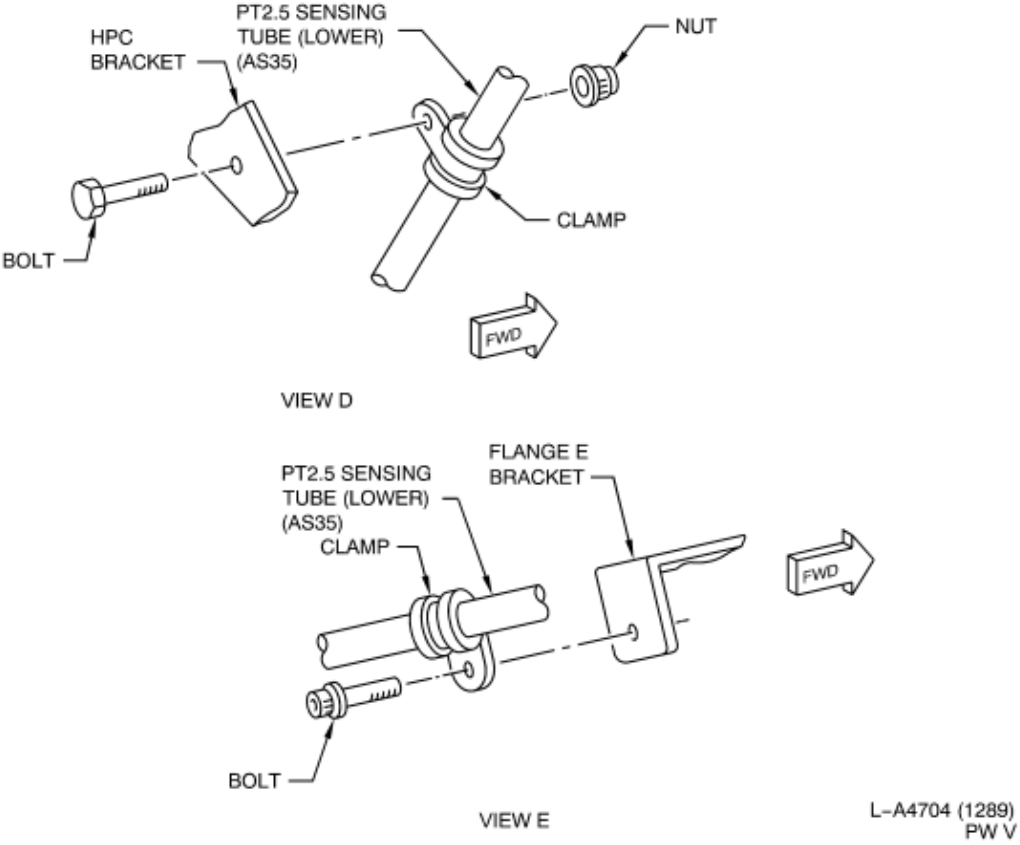
Engine Tube Disconnects And Removals
Figure 304 (Sheet 5)
(Task 72-00-34-020-006)


FLANGE E
PB AND PT2.5
SENSING TUBE
(AS 29)
A
PT2.5 SENSING TUBE
(AS 30)
(UPPER)
AS 30
B
CAP ASSEMBLY
(ENGINES WITHOUT
SCU MULTIPLEXING)
C
PT2.5 SENSING TUBE
(AS 35)
(LOWER)
HPC
D
PT2.5 SENSING
MANIFOLD
(AS 31)
E
L−A7099 (0000)
PW V

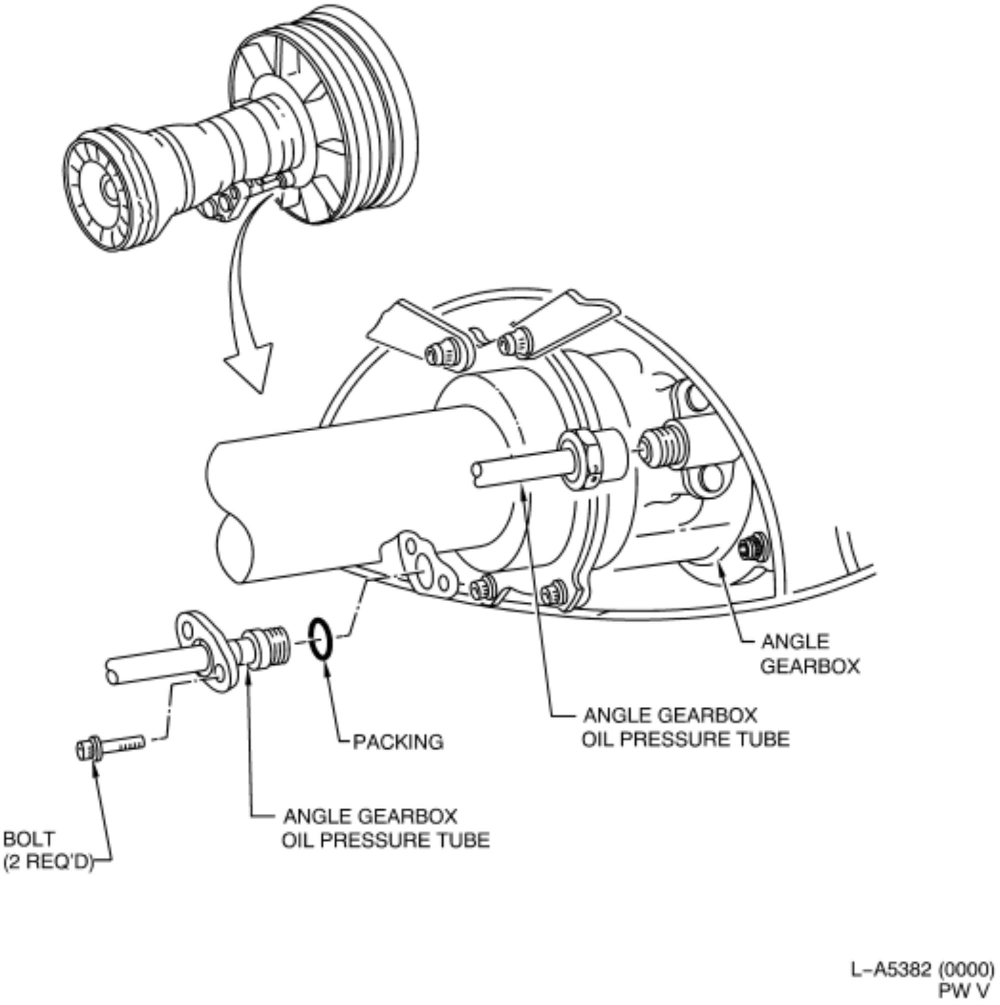
Engine Tube Disconnects And Removals
Figure 304 (Sheet 6)
(Task 72−00−34−020−006)


AS 30
BOLT
CLAMP
FLANGE E BRACKET
FWD
VIEW A
AS 30
BOLT
CLAMP
FLANGE E BRACKET
FWD
VIEW B
AS 30
FWD
CLAMP
BOLT
CLAMP
FLANGE E BRACKET
BOLT
NUT
FLANGE E BRACKET
VIEW C
L-A7100 (1095)

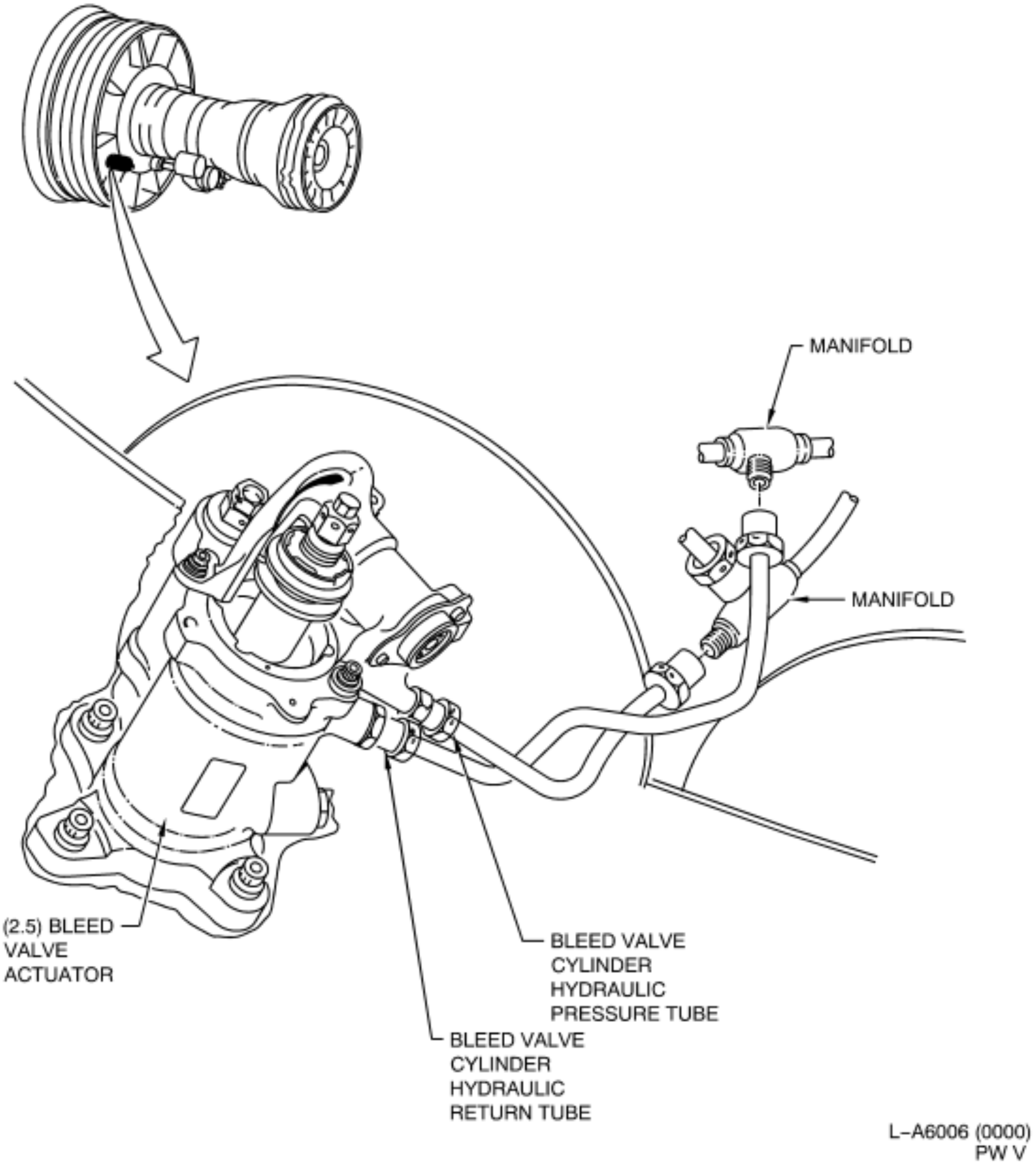
Engine Tube Disconnects And Removals
Figure 304 (Sheet 7)
(Task 72−00−34−020−006)


PT2.5 SENSING
TUBE (LOWER)
(AS35)
HPC
BRACKET
NUT
CLAMP
BOLT
FWD
VIEW D
FLANGE E
BRACKET
PT2.5 SENSING
TUBE (LOWER)
(AS35)
CLAMP
FWD
BOLT
VIEW E
L−A4704 (1289)
PW V

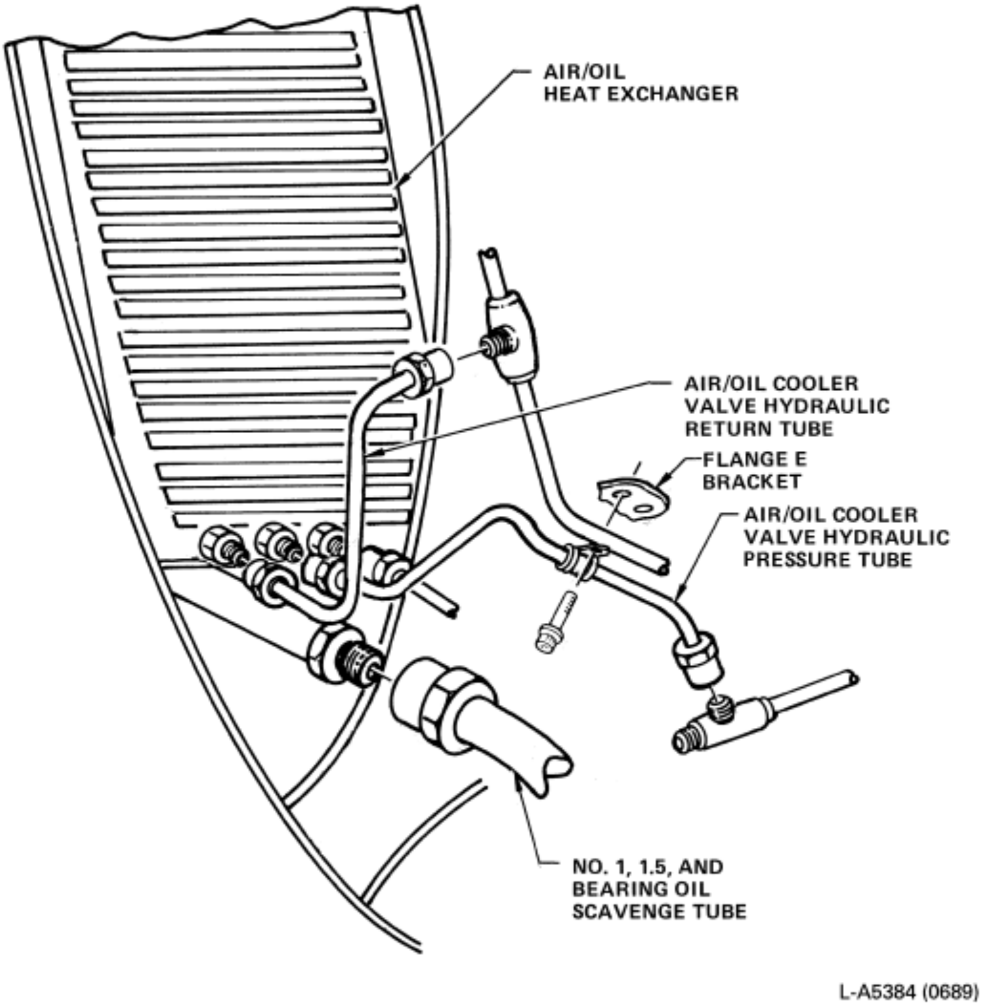
Engine Tube Disconnects And Removals
Figure 304 (Sheet 8)
(Task 72−00−34−020−006)


ANGLE GEARBOX
ANGLE GEARBOX OIL PRESSURE TUBE
PACKING
BOLT (2 REQ'D)
ANGLE GEARBOX OIL PRESSURE TUBE
L−A5382 (0000)
PW V

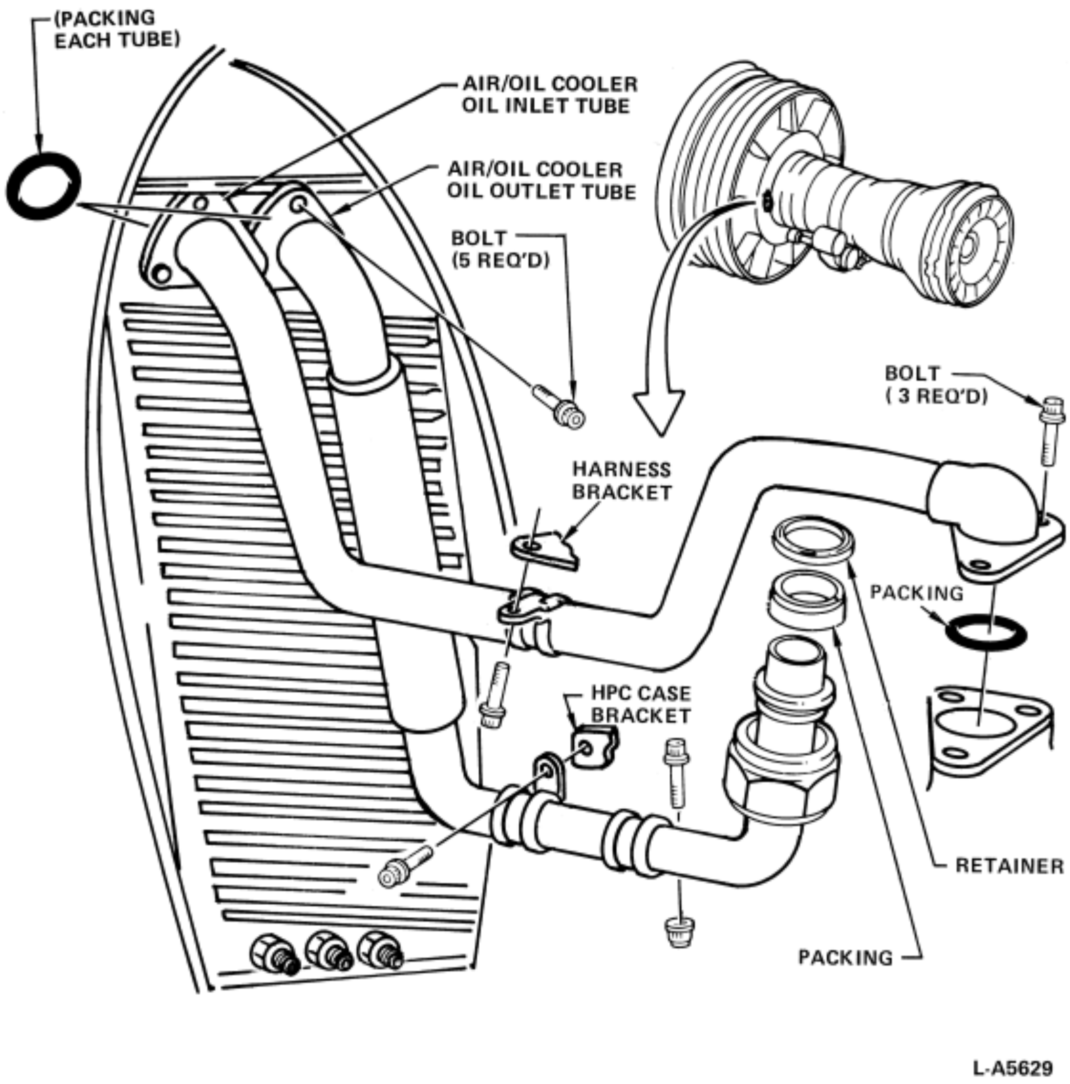
Engine Tube Disconnects And Removals
Figure 304 (Sheet 9)
(Task 72−00−34−020−006)


MANIFOLD
MANIFOLD
(2.5) BLEED VALVE ACTUATOR
BLEED VALVE CYLINDER HYDRAULIC PRESSURE TUBE
BLEED VALVE CYLINDER HYDRAULIC RETURN TUBE
L−A6006 (0000)
PW V

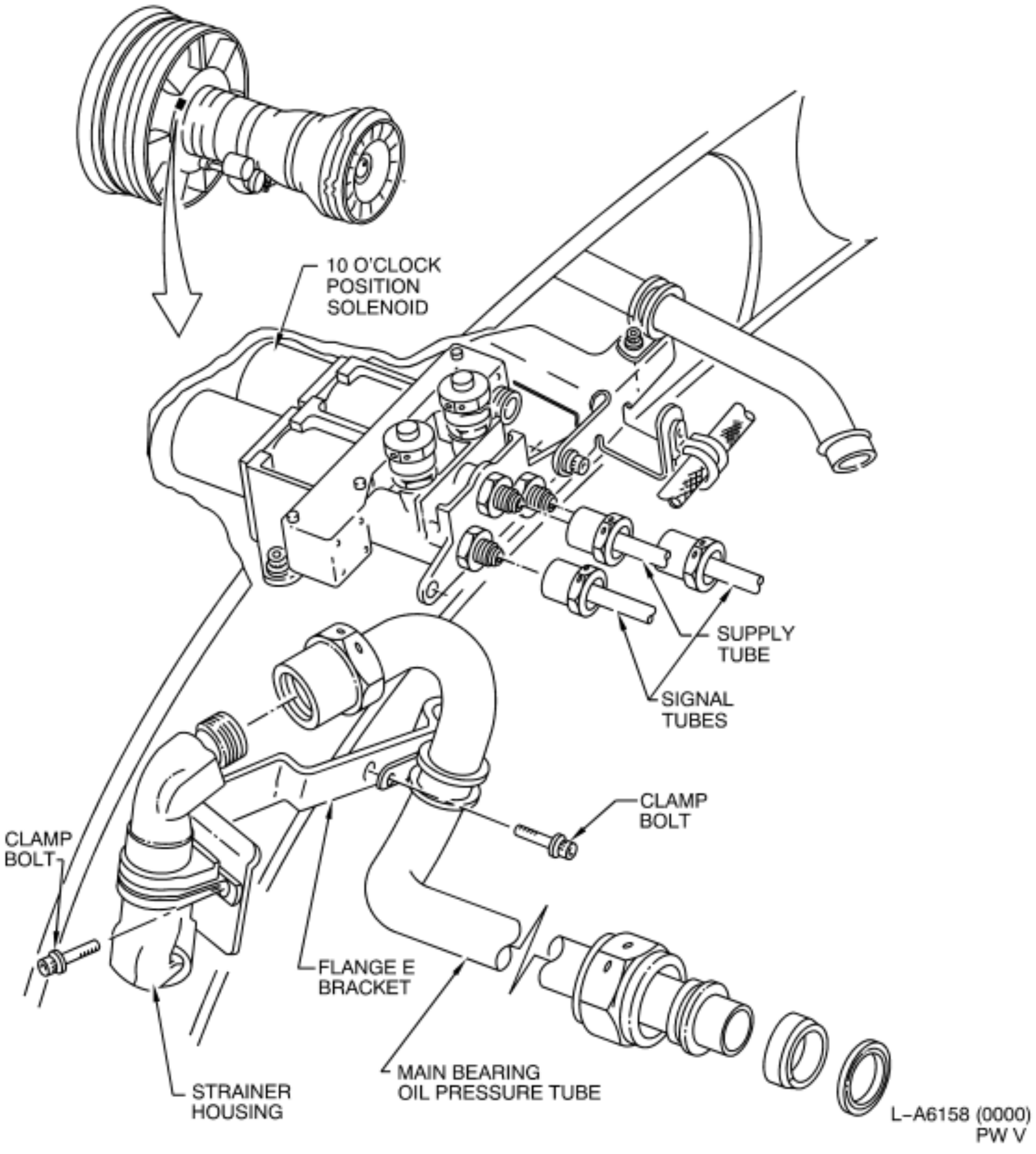
Engine Tube Disconnects And Removals
Figure 304 (Sheet 10)
(Task 72−00−34−020−006)


AIR/OIL HEAT EXCHANGER
AIR/OIL COOLER VALVE HYDRAULIC RETURN TUBE
FLANGE E BRACKET
AIR/OIL COOLER VALVE HYDRAULIC PRESSURE TUBE
NO. 1, 1.5, AND BEARING OIL SCAVENGE TUBE
L-A5384 (0689)

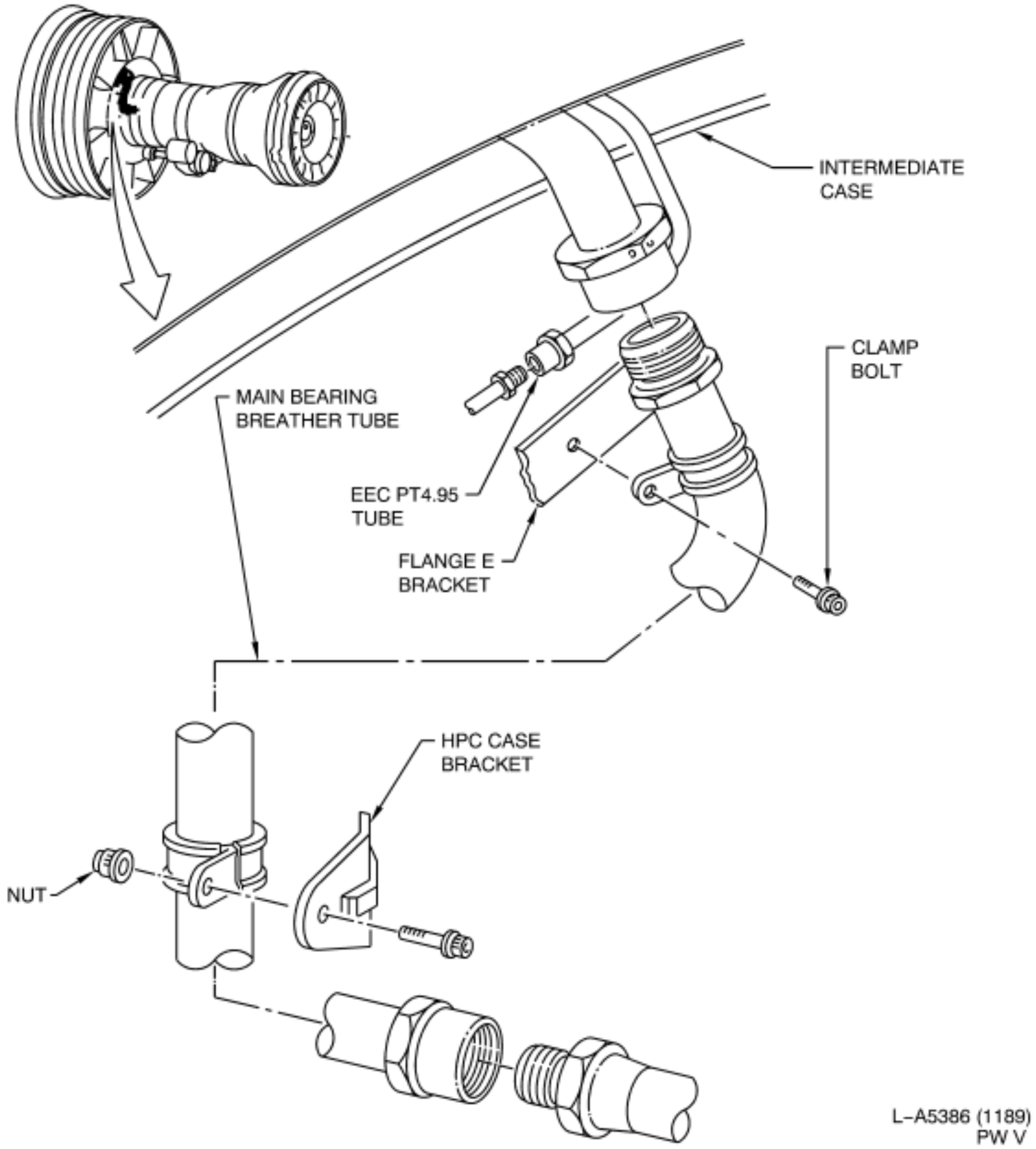
Engine Tube Disconnects And Removals
Figure 304 (Sheet 11)
(Task 72−00−34−020−006)


(PACKING EACH TUBE)
AIR/OIL COOLER OIL INLET TUBE
AIR/OIL COOLER OIL OUTLET TUBE
BOLT (5 REQ'D)
BOLT (3 REQ'D)
HARNESS BRACKET
PACKING
HPC CASE BRACKET
RETAINER
PACKING
L-A5629

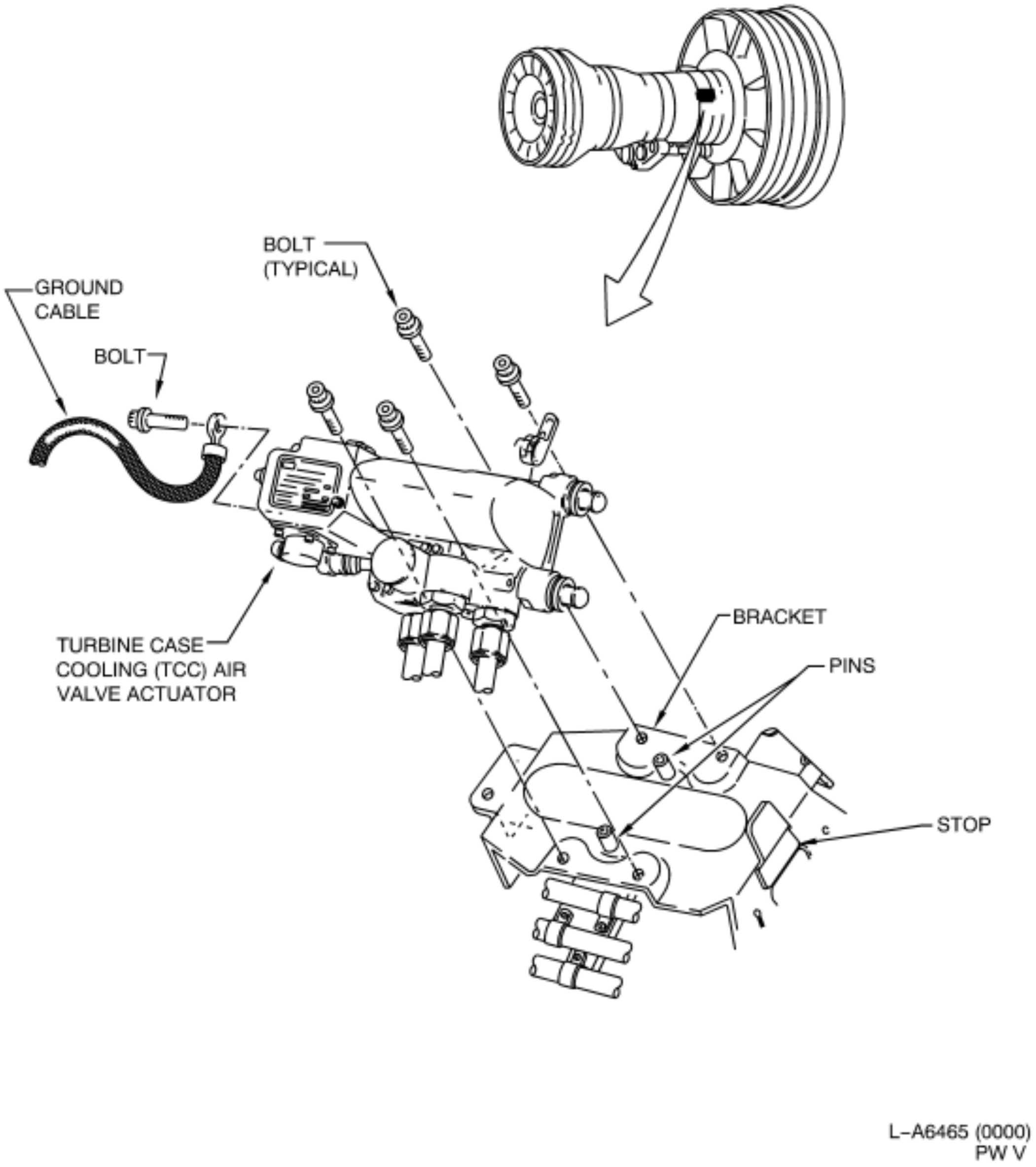
Engine Tube Disconnects And Removals
Figure 304 (Sheet 12)
(Task 72−00−34−020−006)


10 O'CLOCK POSITION SOLENOID
SUPPLY TUBE
SIGNAL TUBES
CLAMP BOLT
CLAMP BOLT
FLANGE E BRACKET
STRAINER HOUSING
MAIN BEARING OIL PRESSURE TUBE
L-A6158 (0000)
PW V

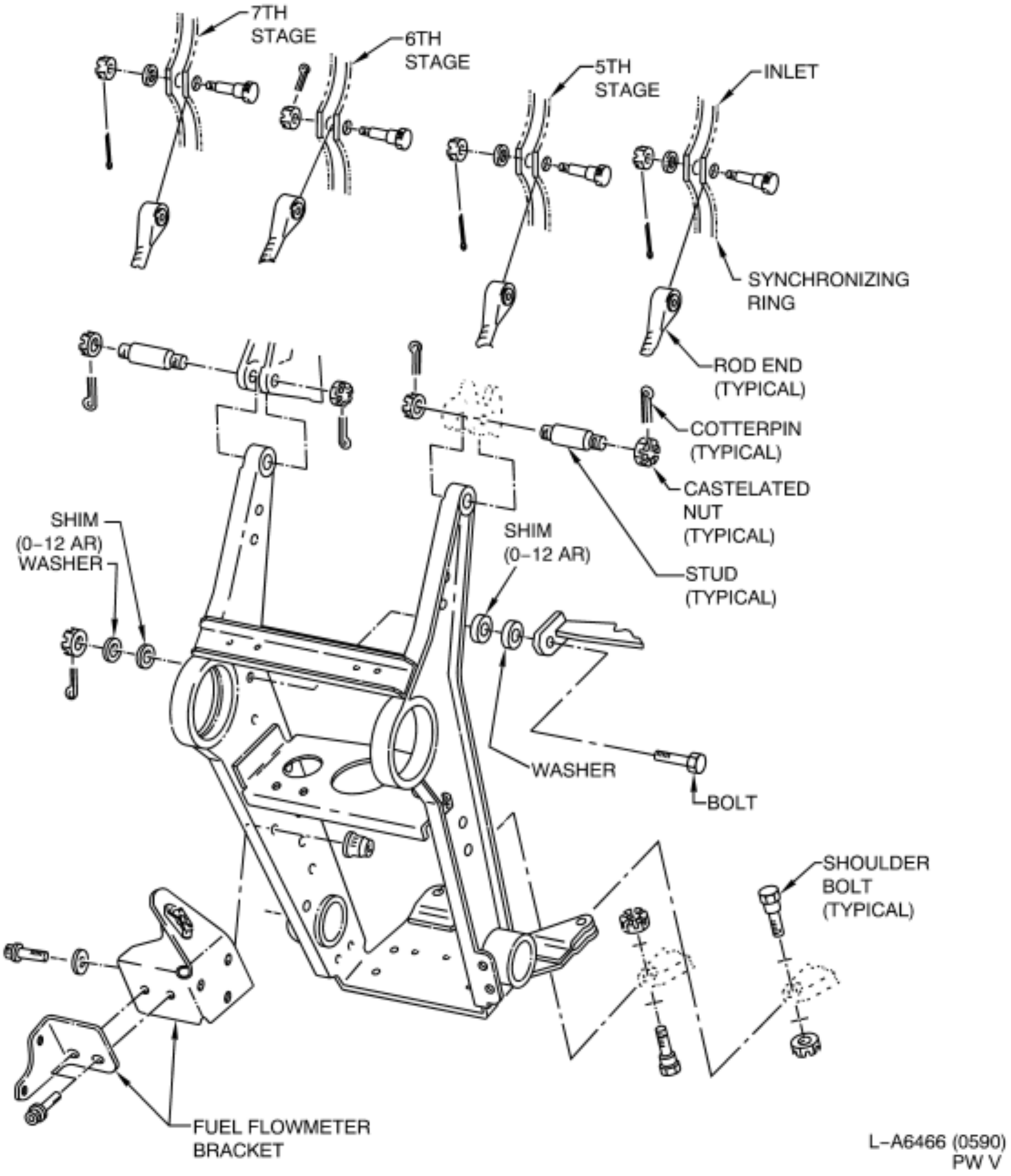
Engine Tube Disconnects And Removals
Figure 304 (Sheet 13)
(Task 72-00-34-020-006)


INTERMEDIATE CASE
CLAMP BOLT
MAIN BEARING BREATHER TUBE
EEC PT4.95 TUBE
FLANGE E BRACKET
HPC CASE BRACKET
NUT
L-A5386 (1189)
PW V

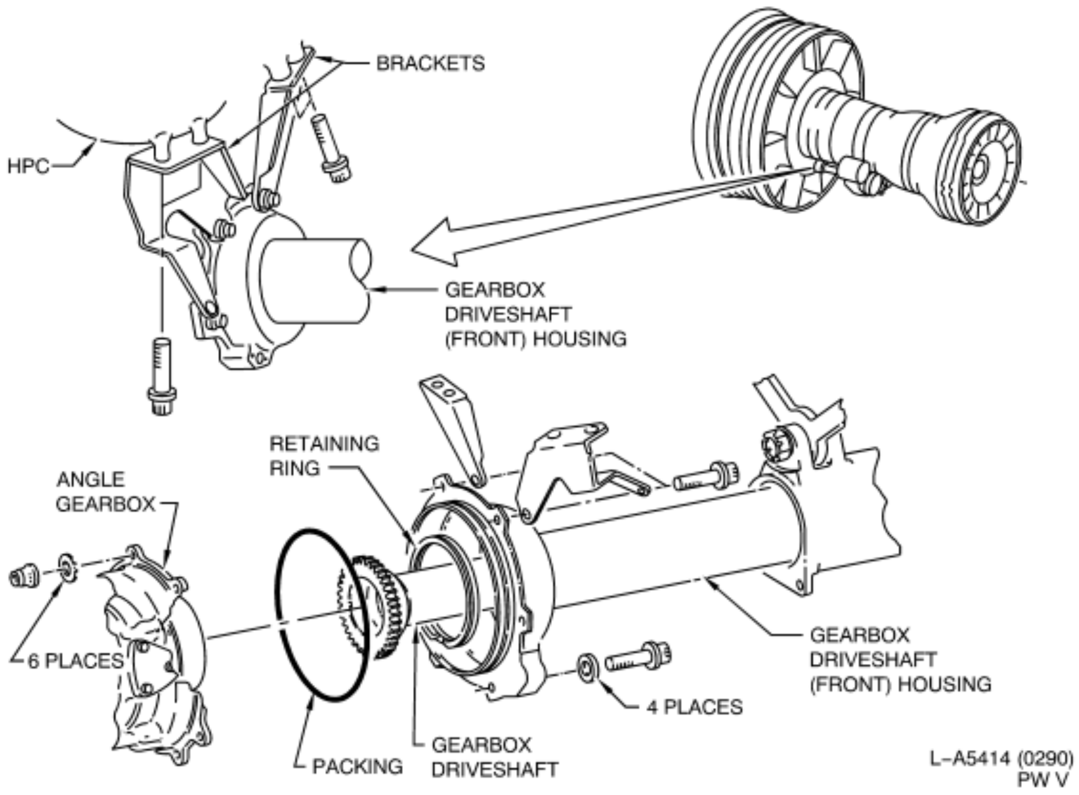
Engine Tube Disconnects And Removals
Figure 304 (Sheet 14)
(Task 72-00-34-020-006)


BOLT
(TYPICAL)
GROUND
CABLE
BOLT
TURBINE CASE
COOLING (TCC) AIR
VALVE ACTUATOR
BRACKET
PINS
STOP
L−A6465 (0000)
PW V

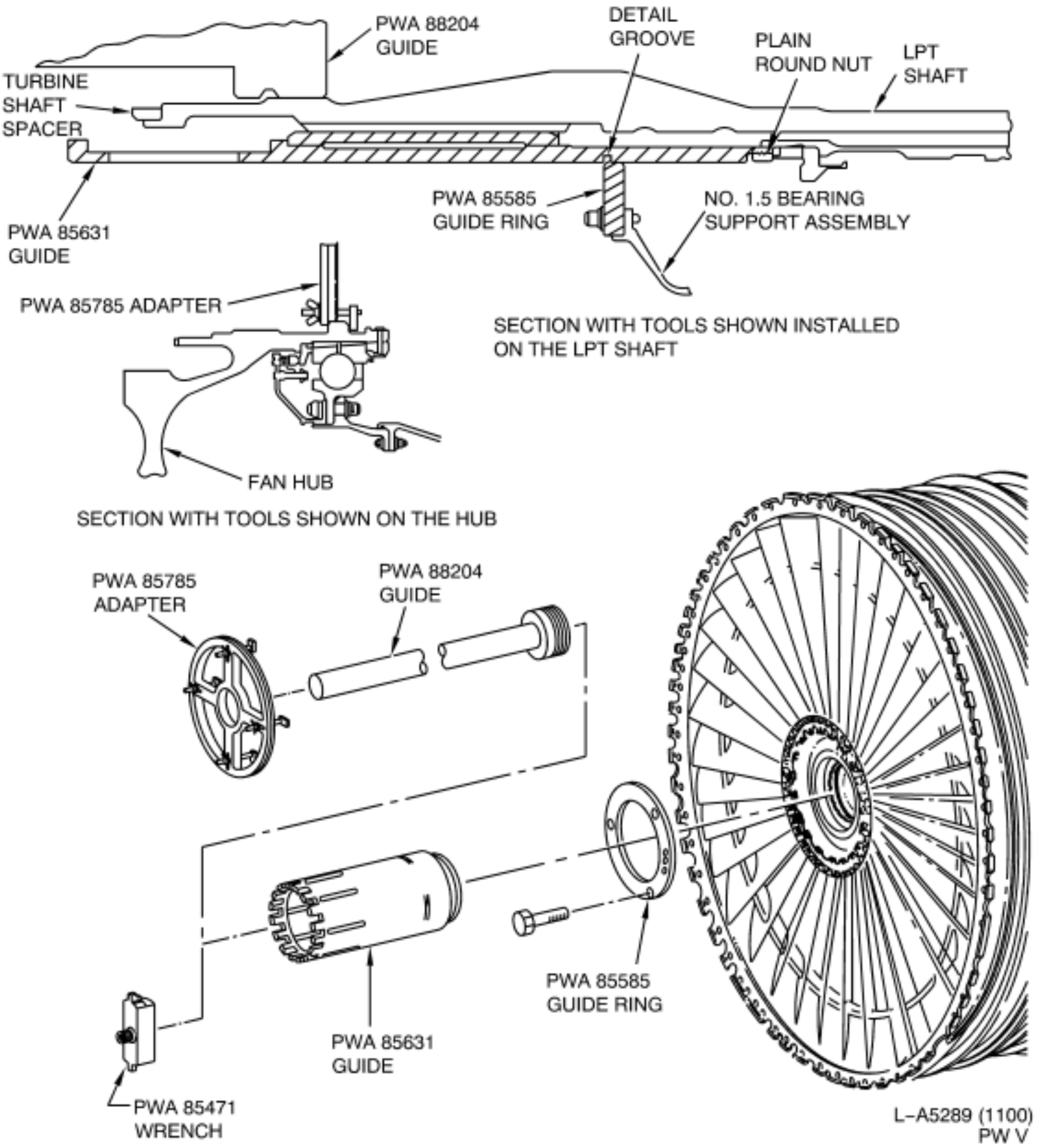
Turbine Case Cooling (TCC) Air Valve Actuator Removal
(Necessary Only For Removal Of HPC Top Front Case)
Figure 305
(Task 72−00−34−020−006)


7TH STAGE
6TH STAGE
5TH STAGE
INLET
SYNCHRONIZING RING
ROD END (TYPICAL)
COTTERPIN (TYPICAL)
CASTELATED NUT (TYPICAL)
STUD (TYPICAL)
SHIM (0-12 AR)
SHIM
(0-12 AR)
WASHER
WASHER
BOLT
SHOULDER BOLT (TYPICAL)
FUEL FLOWMETER BRACKET
L-A6466 (0590)
PW V

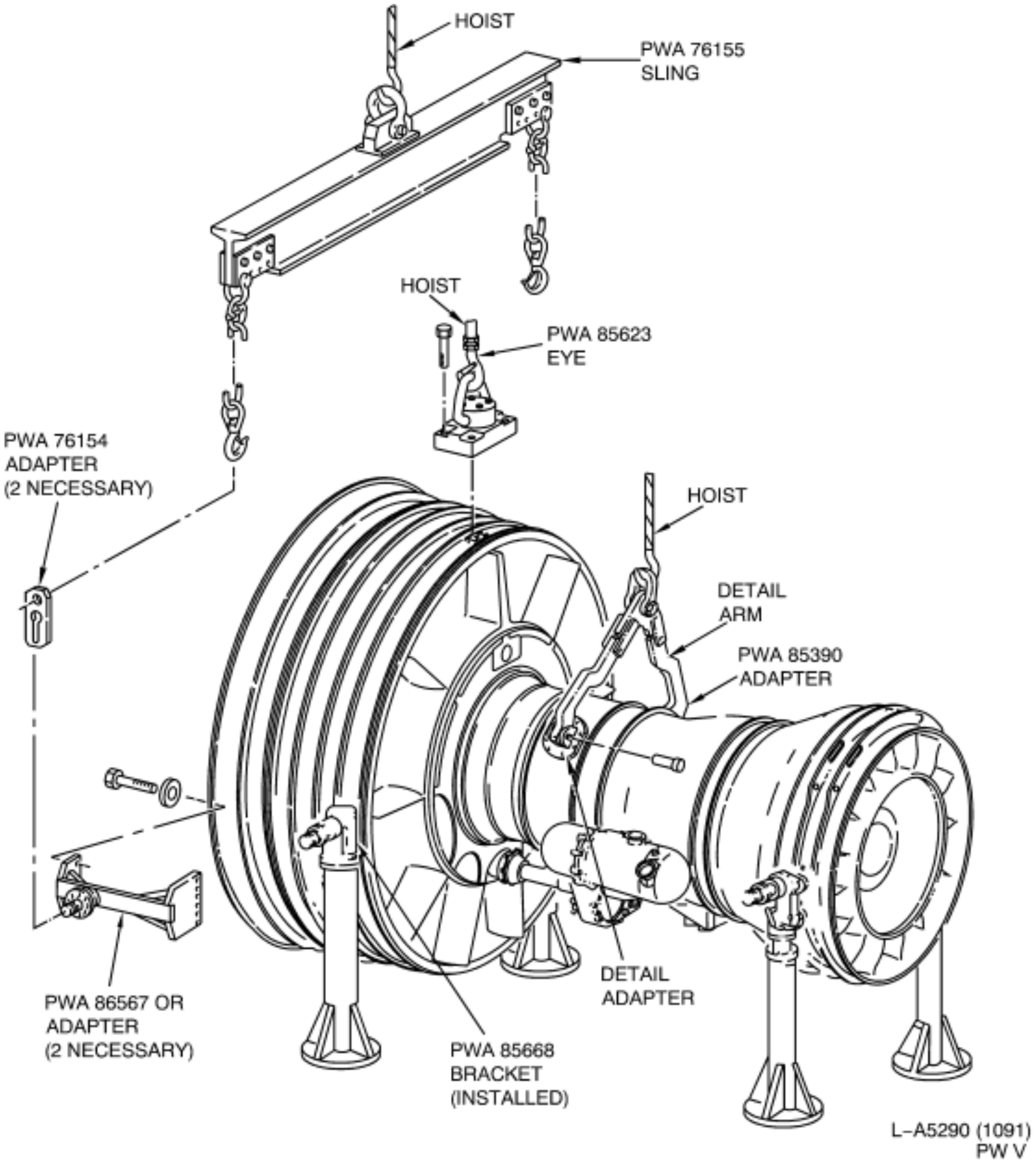
Stator Vane Actuator And Support Assembly
(Necessary Only For Removal Of HPC Top Front Case)
Figure 306
(Task 72-00-34-020-006)


BRACKETS
HPC
GEARBOX
DRIVESHAFT
(FRONT) HOUSING
RETAINING
RING
ANGLE
GEARBOX
6 PLACES
PACKING
GEARBOX
DRIVESHAFT
GEARBOX
DRIVESHAFT
(FRONT) HOUSING
4 PLACES
L−A5414 (0290)
PW V

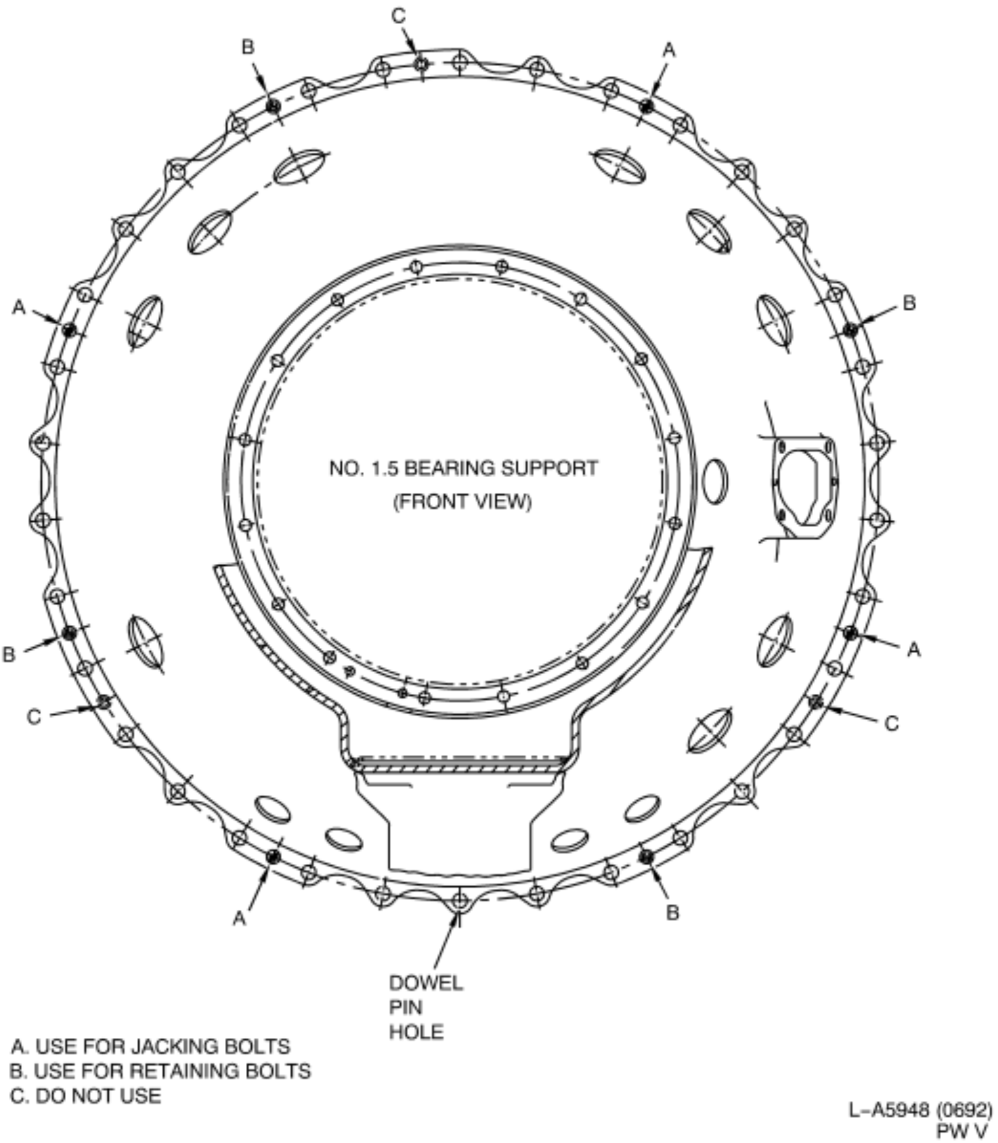
Removal Of The Gearbox Driveshaft
Figure 307
(Task 72−00−34−020−006)


PWA 88204
GUIDE
DETAIL
GROOVE
PLAIN
ROUND NUT
LPT
SHAFT
TURBINE
SHAFT
SPACER
PWA 85631
GUIDE
PWA 85585
GUIDE RING
NO. 1.5 BEARING
SUPPORT ASSEMBLY
SECTION WITH TOOLS SHOWN INSTALLED
ON THE LPT SHAFT
PWA 85785 ADAPTER
FAN HUB
SECTION WITH TOOLS SHOWN ON THE HUB
PWA 85785
ADAPTER
PWA 88204
GUIDE
PWA 85585
GUIDE RING
PWA 85631
GUIDE
PWA 85471
WRENCH
L−A5289 (1100)
PW V

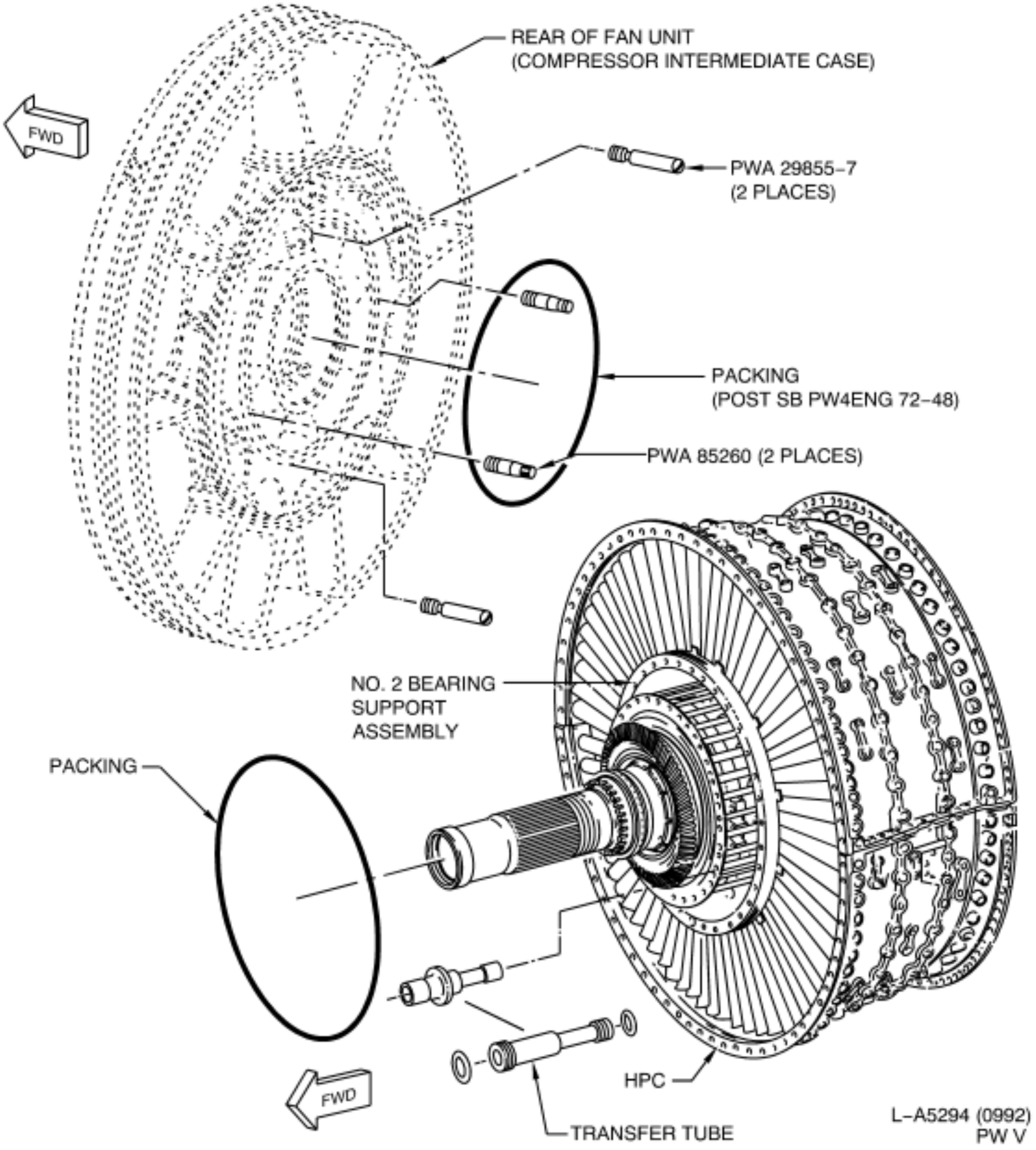
Installation Of Tools On The LPT Shaft
Figure 308
(Task 72−00−34−020−006)


HOIST
PWA 76155
SLING
HOIST
PWA 85623
EYE
PWA 76154
ADAPTER
(2 NECESSARY)
HOIST
DETAIL
ARM
PWA 85390
ADAPTER
DETAIL
ADAPTER
PWA 86567 OR
ADAPTER
(2 NECESSARY)
PWA 85668
BRACKET
(INSTALLED)
L−A5290 (1091)
PW V

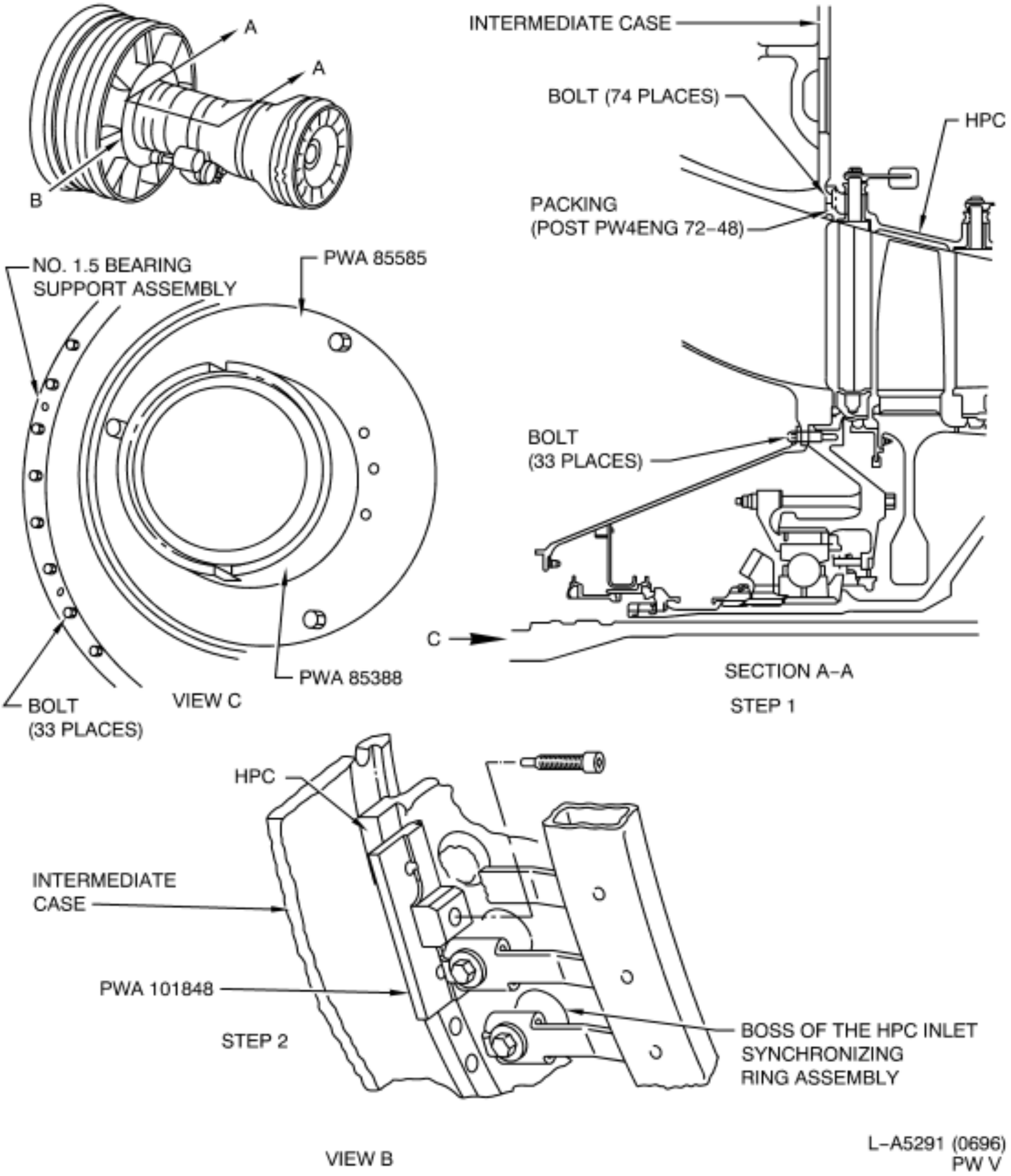
Installation Of The Lifting Tools
Figure 309
(Task 72−00−34−020−006)


C
B
A
A
B
NO. 1.5 BEARING SUPPORT
(FRONT VIEW)
B
A
C
C
A
B
DOWEL
PIN
HOLE
A. USE FOR JACKING BOLTS
B. USE FOR RETAINING BOLTS
C. DO NOT USE
L−A5948 (0692)
PW V

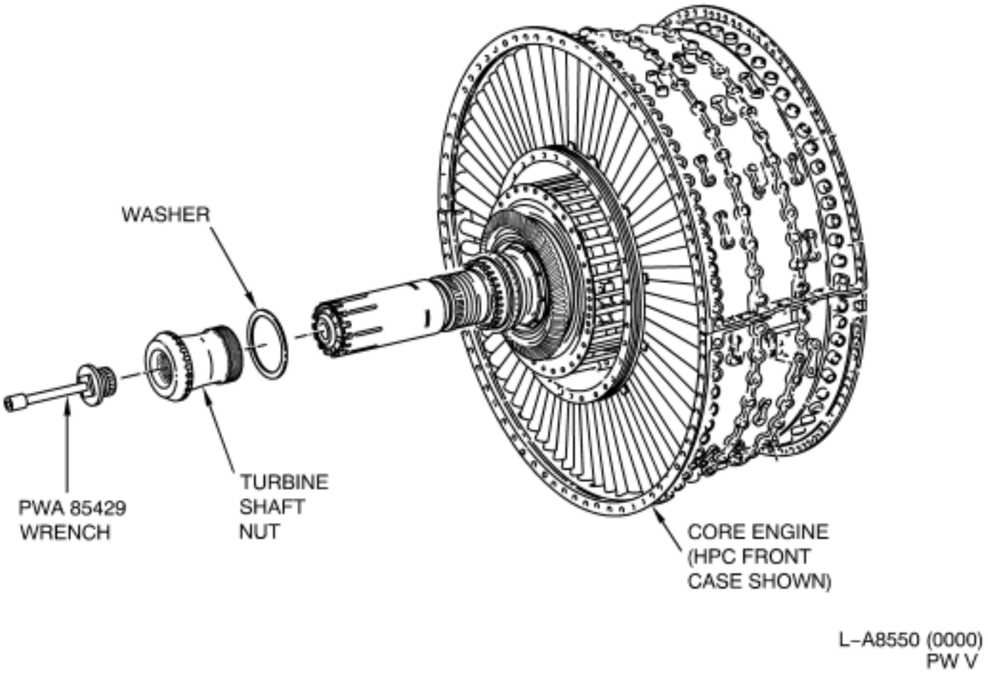
No. 1.5 Bearing Support Bolt Locations
Figure 310
(Task 72−00−34−020−006)


REAR OF FAN UNIT
(COMPRESSOR INTERMEDIATE CASE)
FWD
PWA 29855-7
(2 PLACES)
PACKING
(POST SB PW4ENG 72-48)
PWA 85260 (2 PLACES)
NO. 2 BEARING
SUPPORT
ASSEMBLY
PACKING
HPC
FWD
TRANSFER TUBE
L-A5294 (0992)
PW V

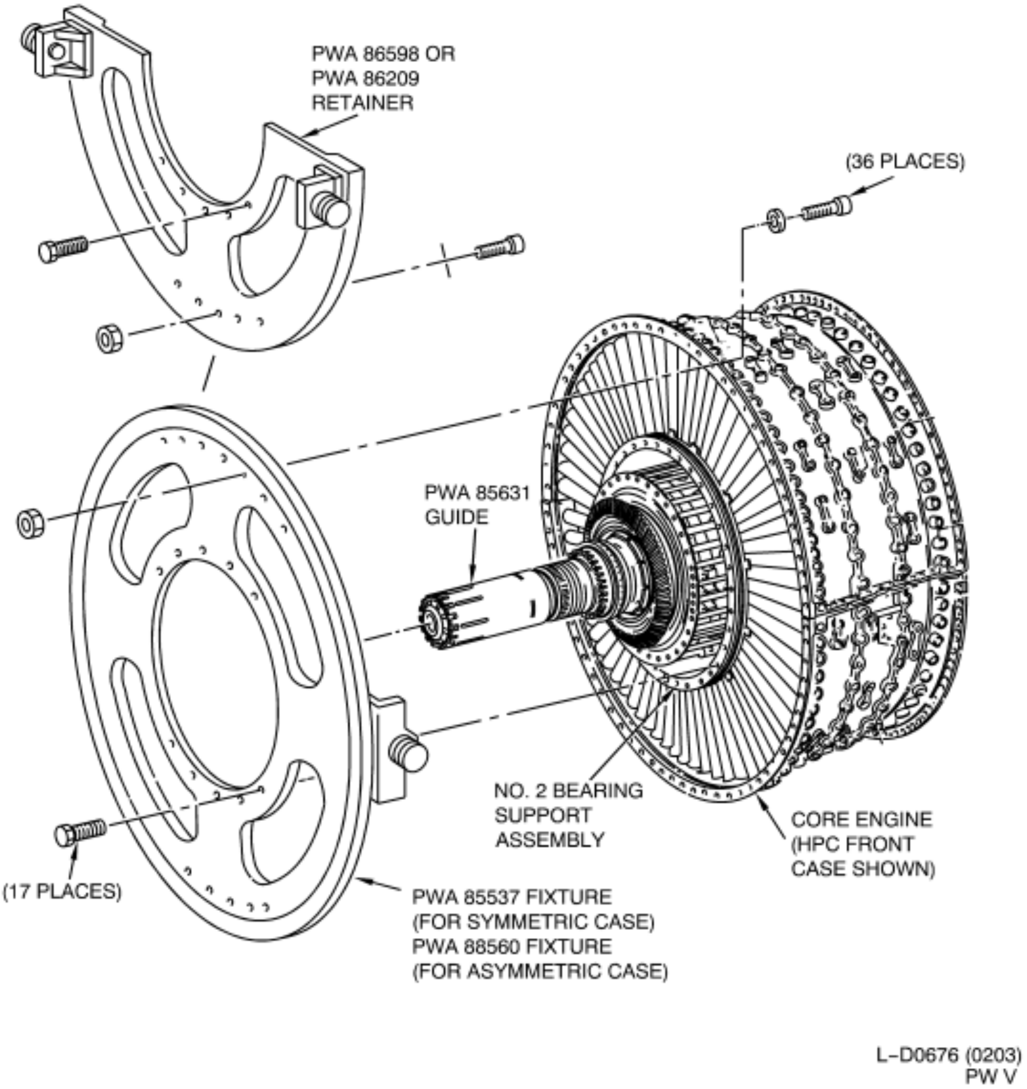
Installation Of Separation Tools
Figure 311
(Task 72-00-34-020-006)


A
A
B
INTERMEDIATE CASE
BOLT (74 PLACES)
HPC
PACKING
(POST PW4ENG 72-48)
NO. 1.5 BEARING
SUPPORT ASSEMBLY
PWA 85585
BOLT
(33 PLACES)
C
PWA 85388
BOLT
(33 PLACES)
VIEW C
SECTION A-A
STEP 1
HPC
INTERMEDIATE
CASE
PWA 101848
STEP 2
BOSS OF THE HPC INLET
SYNCHRONIZING
RING ASSEMBLY
VIEW B
L-A5291 (0696)
PW V

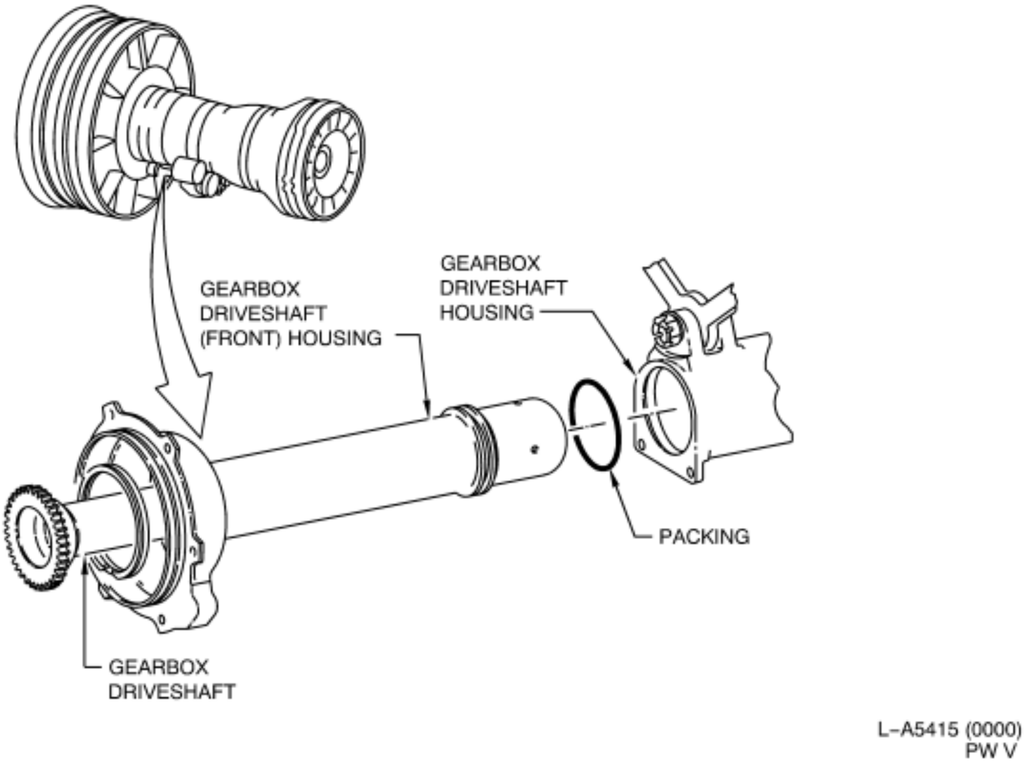
Installation Of Separation Tools
Figure 312
(Task 72-00-34-020-006)


WASHER
PWA 85429
WRENCH
TURBINE
SHAFT
NUT
CORE ENGINE
(HPC FRONT
CASE SHOWN)
L−A8550 (0000)
PW V

Installation Of The Turbine Shaft Nut
Figure 313
(Task 72−00−34−020−006)


PWA 86598 OR
PWA 86209
RETAINER
(36 PLACES)
PWA 85631
GUIDE
NO. 2 BEARING
SUPPORT
ASSEMBLY
CORE ENGINE
(HPC FRONT
CASE SHOWN)
(17 PLACES)
PWA 85537 FIXTURE
(FOR SYMMETRIC CASE)
PWA 88560 FIXTURE
(FOR ASYMMETRIC CASE)
L-D0676 (0203)
PW V

Installation Of HPC Support Tools
Figure 314
(Task 72-00-34-020-006)


GEARBOX DRIVESHAFT (FRONT) HOUSING
GEARBOX DRIVESHAFT HOUSING
PACKING
GEARBOX DRIVESHAFT
L−A5415 (0000)
PW V

Removal Of The Gearbox Driveshaft And Front Housing
Figure 315
(Task 72−00−34−020−006)

Previous Pageblock   Return to Previous Menu   Next Pageblock

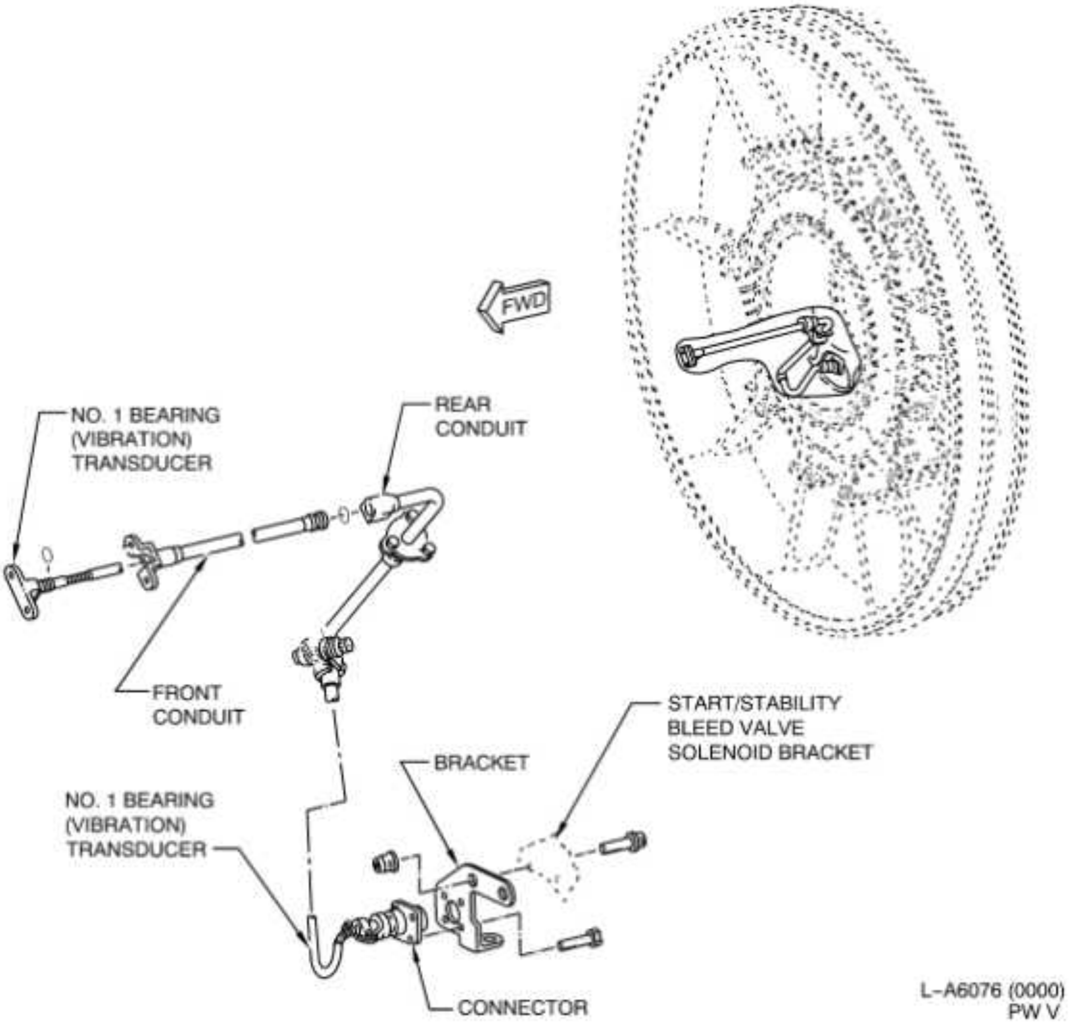
ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-22

Task 72-00-34-040-001:

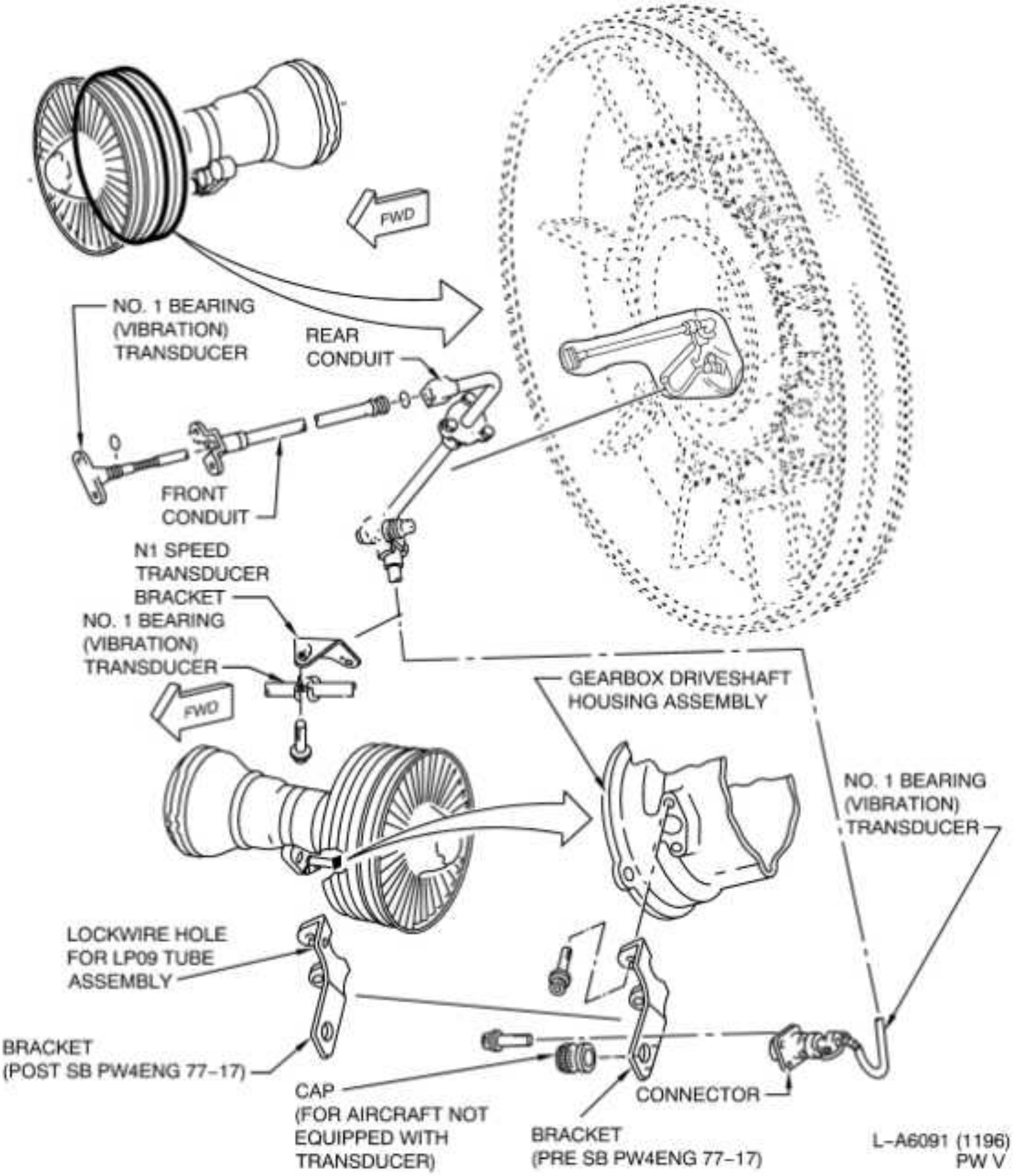
1. Remove The No. 1 Bearing Vibration Transducer
   A. Prerequisites
      (1) Remove the No. 1 bearing support (front and rear) assembly. Refer to Removal-04 (Task 72-00-34-050-002).
   B. Equipment And Materials Required - None
   C. Procedure
      See Figures 301 through 303.
      (1) (Pre SB PW4ENG 77-13) Remove the transducer as follows:
         (a) Remove the two bolts and nuts that attach the transducer bracket to the start/stability-bleed-valve-solenoid bracket.
         (b) Remove the lockwire from the screws that attach the connector to its bracket. Remove the screws. Remove the connector from the bracket.
         (c) Disassemble and remove the connector from the cable Cover the transducer wires and pins with a sheet of plastic. Safety the plastic sheet with tape.

            NOTE: The tape and plastic must be installed around the pins and wire to make the cable move easily through the conduit. There must be sufficient plastic to prevent contamination of the wires and pins from the tape.

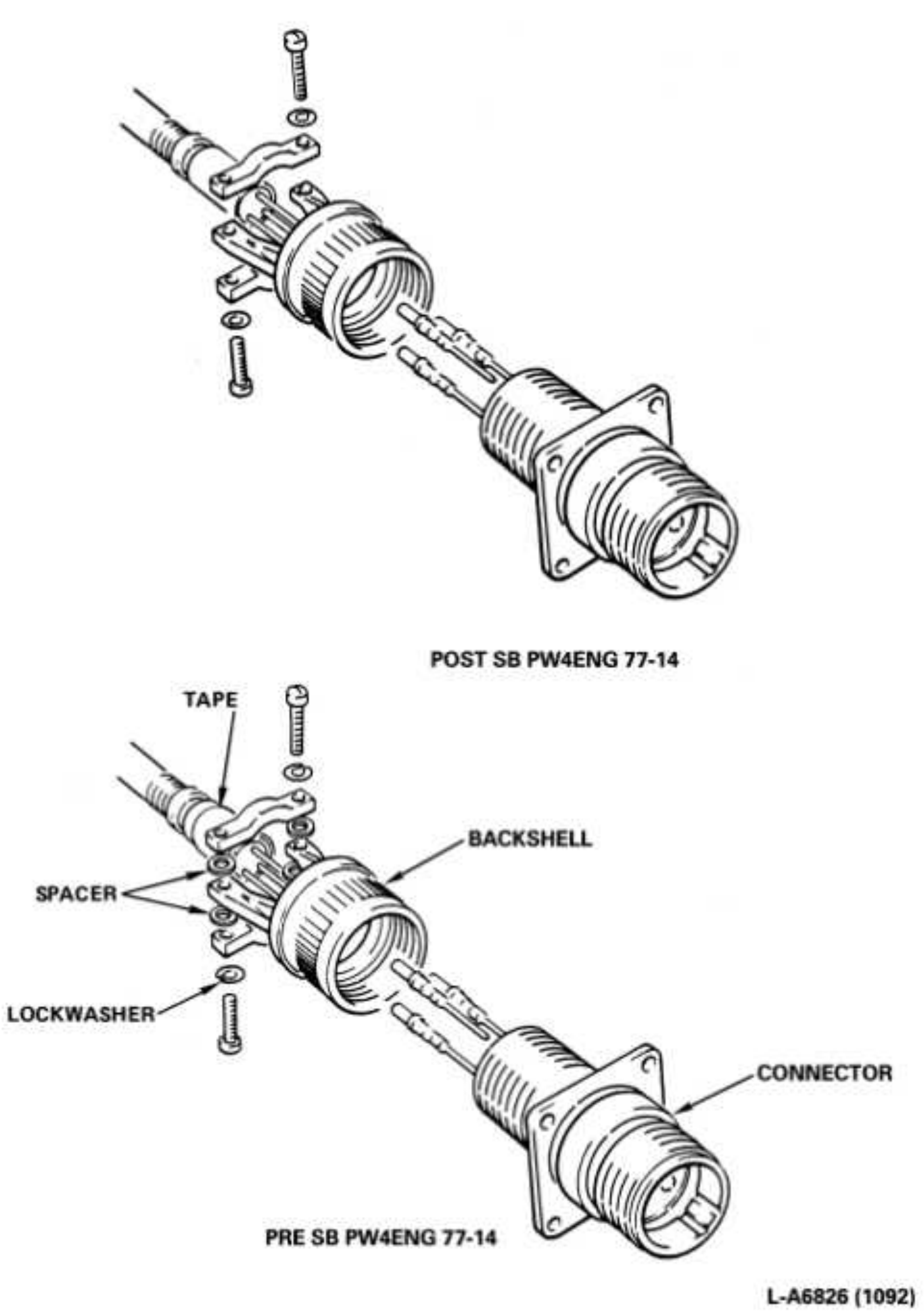
         (d) Pull the transducer out of the conduits. Discard the packing on the transducer.
         (e) Pull the front conduit out of the rear conduit. Discard the packing on the front conduit.
         (f) Keep the connector with the cable.
      (2) (Post SB PW4ENG 77-13) Remove the transducer as follows:
         (a) For aircraft that are not electrically equipped with the transducer, but the engines are equipped with the transducer, remove the electrical cap from the connector.
         (b) (Pre SB PW4ENG 77-17) Remove the two bolts that attach the transducer bracket to the boss on the gearbox driveshaft housing assembly.
         (c) (Post SB PW4ENG 77-17) Remove the (LP09) tube nut lockwire from the transducer bracket and remove the two bolts that attach the transducer bracket to the boss on the gearbox driveshaft housing assembly.
         (d) Remove the lockwire from the screws that attach the connector to its bracket. Remove the screws. Remove the connector from the bracket.


FWD
NO. 1 BEARING (VIBRATION) TRANSDUCER
REAR CONDUIT
FRONT CONDUIT
START/STABILITY BLEED VALVE SOLENOID BRACKET
BRACKET
NO. 1 BEARING (VIBRATION) TRANSDUCER
CONNECTOR
L-A6076 (0000)
PW V

No. 1 Bearing Vibration Transducer
(Pre SB PW4ENG 77-13)
Figure 301
(Task 72-00-34-040-001)


FWD
NO. 1 BEARING (VIBRATION) TRANSDUCER
REAR CONDUIT
FRONT CONDUIT
N1 SPEED TRANSDUCER BRACKET
NO. 1 BEARING (VIBRATION) TRANSDUCER
FWD
GEARBOX DRIVESHAFT HOUSING ASSEMBLY
NO. 1 BEARING (VIBRATION) TRANSDUCER
LOCKWIRE HOLE FOR LP09 TUBE ASSEMBLY
BRACKET (POST SB PW4ENG 77−17)
CAP (FOR AIRCRAFT NOT EQUIPPED WITH TRANSDUCER)
CONNECTOR
BRACKET (PRE SB PW4ENG 77−17)
L−A6091 (1196)
PW V

No. 1 Bearing Vibration Transducer
(Post SB PW4ENG 77−13)
Figure 302
(Task 72−00−34−040−001)


POST SB PW4ENG 77-14
TAPE
BACKSHELL
SPACER
LOCKWASHER
CONNECTOR
PRE SB PW4ENG 77-14
L-A6826 (1092)

No. 1 Bearing Vibration Transducer Backshell
Figure 303
(Task 72−00−34−040−001)

(e) Disassemble and remove the connector from the cable Cover the transducer wires and pins with a sheet of plastic. Safety the plastic sheet with tape.

NOTE: The tape and plastic must be installed around the pins and wire to make the cable move easily through the conduit. There must be sufficient plastic to prevent contamination of the wires and pins from the tape.

(f) Remove the bolt that attaches the transducer clamp to the bracket on the N1 speed transducer at 4:30 o'clock. Remove the clamp from the transducer cable.
(g) Pull the transducer out of the conduits. Discard the packing on the transducer.
(h) Pull the front conduit out of the rear conduit. Discard the packing on the front conduit.
(i) Keep the connector with the cable.

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ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-23

Task 72-00-34-050-020:

1. Remove EEC Wiring Harness - W5 (Core Engine)

A. General

(1) To remove the EEC wiring harness - W3, see Removal-18 (Task 72-00-34-050-018).

(2) To remove the EEC wiring harness - W4, see Removal-19 (Task 72-00-34-050-019).

B. Equipment And Materials Necessary

Special Tools:

PWA 85749	Torque Adapter, Electronic Harness Connector

C. Procedure

See Figure 301, Figure 302, Figure 303, Figure 304, Figure 305, Figure 306, Figure 307, Figure 308, Figure 309, Figure 310, Figure 311, Figure 312, Figure 313, Figure 314, Figure 315, Figure 316, Figure 317 and Figure 318.

CAUTION: DO NOT TWIST OR BEND THE HARNESS BADLY DURING THE REMOVAL, OR DAMAGE TO THE HARNESS CAN OCCUR.

(1) Disconnect the W2P26 harness connector from the W5J26 harness connector located at the 11:30 o'clock position on the HPC case. Remove the two bolts and the harness bracket attaching the W5J26 harness connector flange to the HPC case bracket. Remove the connector from the bracket. Install a protective closure on each harness connector. See Figure 302 and Figure 303.

(2) (Pre SB PW4ENG 73-163) Disconnect the W6P12 harness connector from the W5J12 harness connector located on Flange K at the 3:30 o'clock position. Remove the two (2) bolts and harness bracket attaching the W5J12 harness connector flange to the Flange K bracket. Remove the connector from the bracket. Install a protective closure on each harness connector. See Figure 309 and Figure 314.

(3) (Post SB PW4ENG 73-163) Disconnect the W6P12 harness connector from the W5J12 harness connector located on the TCA tube flange bracket at the 3:30 o'clock position as follows:

(a) (Post SB PW4ENG 73−192) Loosen clamp that attaches the cooling hose to the cooling shield around the W5J12 connector. Remove cooling hose from the cooling shield.

NOTE: Pre SB PW4ENG 73−192 engines do not have W5/W6 wiring harness connector cooling.

(b) (Post SB PW4ENG 73−192) Loosen and remove the clamp attaching the two halves of the cooling shield around the W5J12 connector. Remove the shields and clamp from the connector.

(c) If necessary, remove or loosen bolt and clamp attaching wiring harness to the loop clamp bracket.

(d) Disconnect the W6P12 harness connector from the W5J12 harness connector.

(e) Remove the three (3) bolts and the loop clamp bracket that attach the W5J12 harness connector to the TCA tube flange bracket. Remove the connector from the bracket. Install a protective closure on each harness connector. See Figure 309 and Figure 314.

(4) For engines equipped with 2.95 bleed valve thermocouples only: Disconnect the W7P13 harness connector from the W5J13 harness connector located on a bracket on the right side of the main gearbox. Remove the two bolts and the harness bracket that attaches the W5J13 harness connector flange to the main gearbox bracket. Remove the connector from the bracket. Install a protection cover on each harness connector. See Figure 314.

(5) (Pre SB PW4ENG 72−572 or SB PW4ENG 75−106) Disconnect the W5P10 harness connector from the HPC secondary flow control valve located at the 9:30 o'clock position. Install a protective closure on the harness connector and the mating flow control valve position switch receptacle. See Figure 302 (Sheet 1).

NOTE: SB PW4ENG 72−572 or SB PW4ENG 75−106 removes connector W5P10 from the W5 wiring harness. See Figure 302 (Sheet 3).

(6) Disconnect the following harness connectors from the components given below. Install a protective closure on each harness connector and mating receptacle. See Figure 302 and Figure 310.

Connector	Component	Location
W5P5	Fuel/Oil Cooler Bypass Valve Solenoid (Rear Connector)	8 O'clock
W5P6	EEC Alternator (Lower Connector)	Bottom of Gearbox 7 O'clock

NOTE: Use a PWA 85749 Electronic Harness Connector Torque Adapter to disconnect the W5P6 harness connector.

Connector	Component	Location
W5P7	Variable Stator Vane Actuator (Top Connector)	4 O'clock
W5P11	Ninth Stage Start/Stability (2.9) Bleed Valve Solenoid (Inboard Connector)	Intermediate Case 5 O'clock

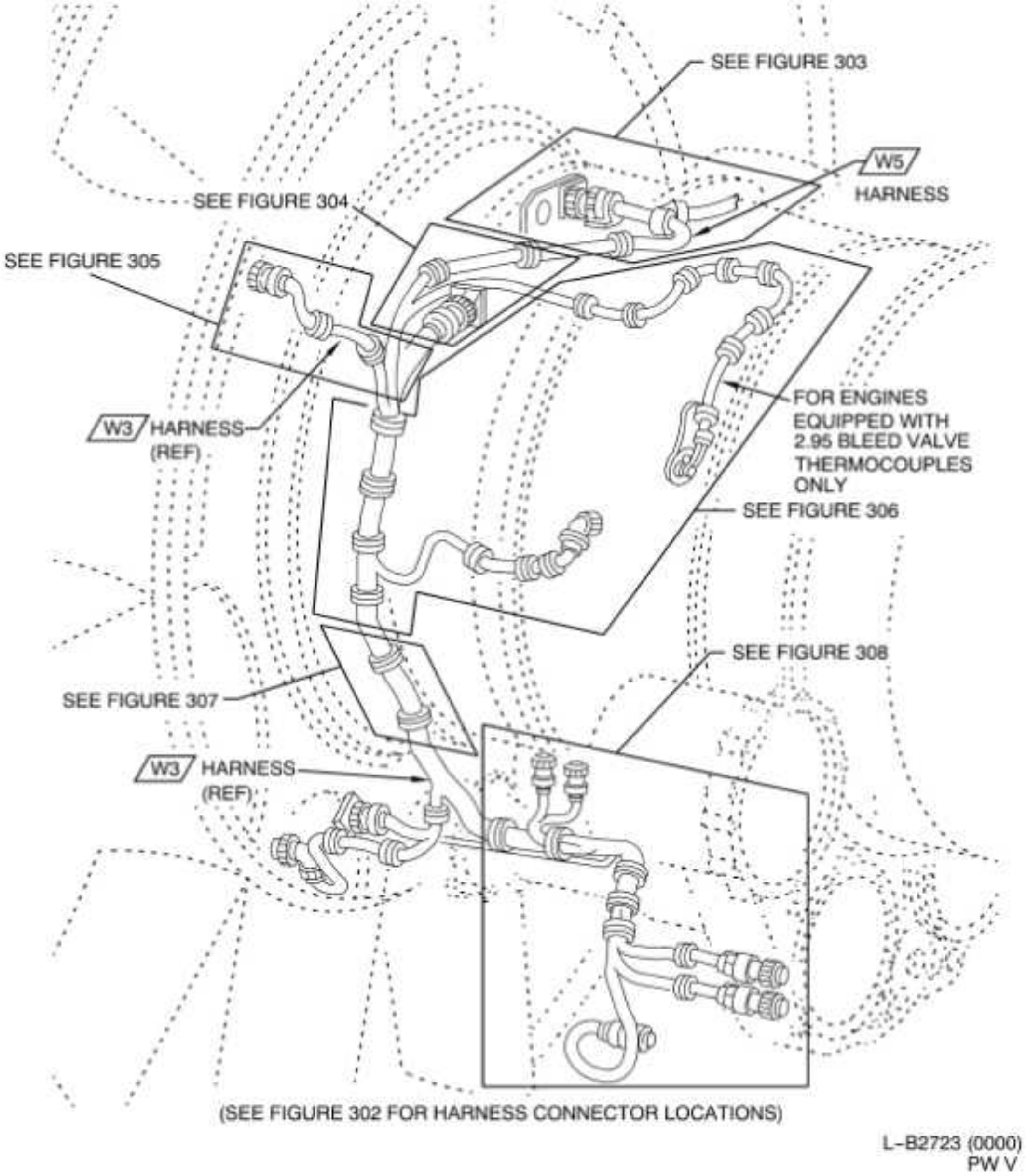
NOTE: Use a PWA 85749 Electronic Harness Connector Torque Adapter to disconnect the W5P11 harness connector.

Connector	Component	Location
W5P1	Fuel Metering Unit (Rear Connector)	Front Of Fuel Pump 5 O'clock
W5P8	EEC Fuel	Fuel Pump Housing 4:30 O'clock

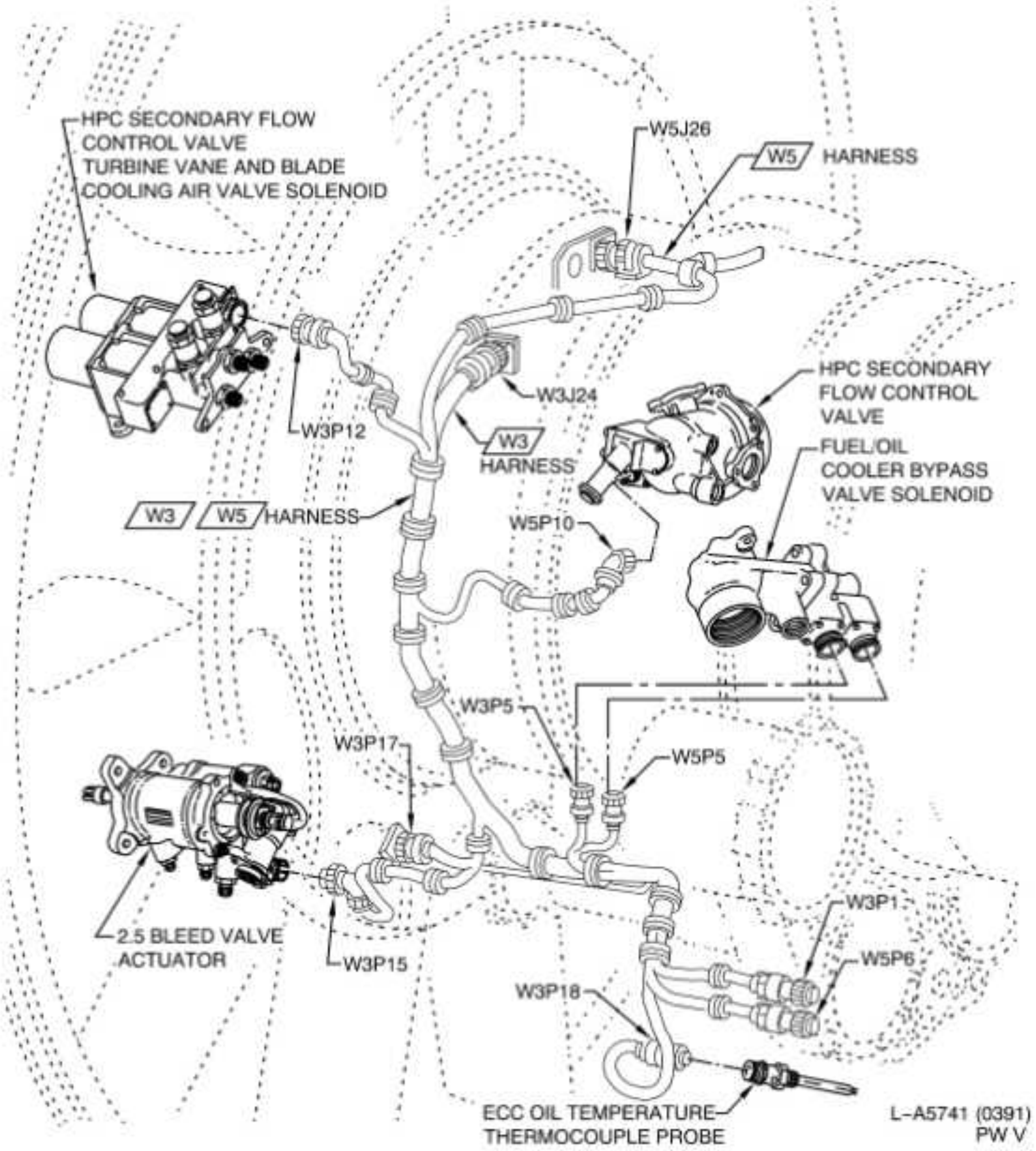
(7) Remove the bolts, nuts, and clamps that attach the W5 harness to the brackets and tubes on the HPC case and the gearbox. See Figure 303, Figure 304, Figure 305, Figure 306, Figure 307, Figure 308 and Figure 311, Figure 312, Figure 313, Figure 314, Figure 315, Figure 316 and, Figure 317.

(8) Remove the applicable harness ties and carefully remove the W5 harness.

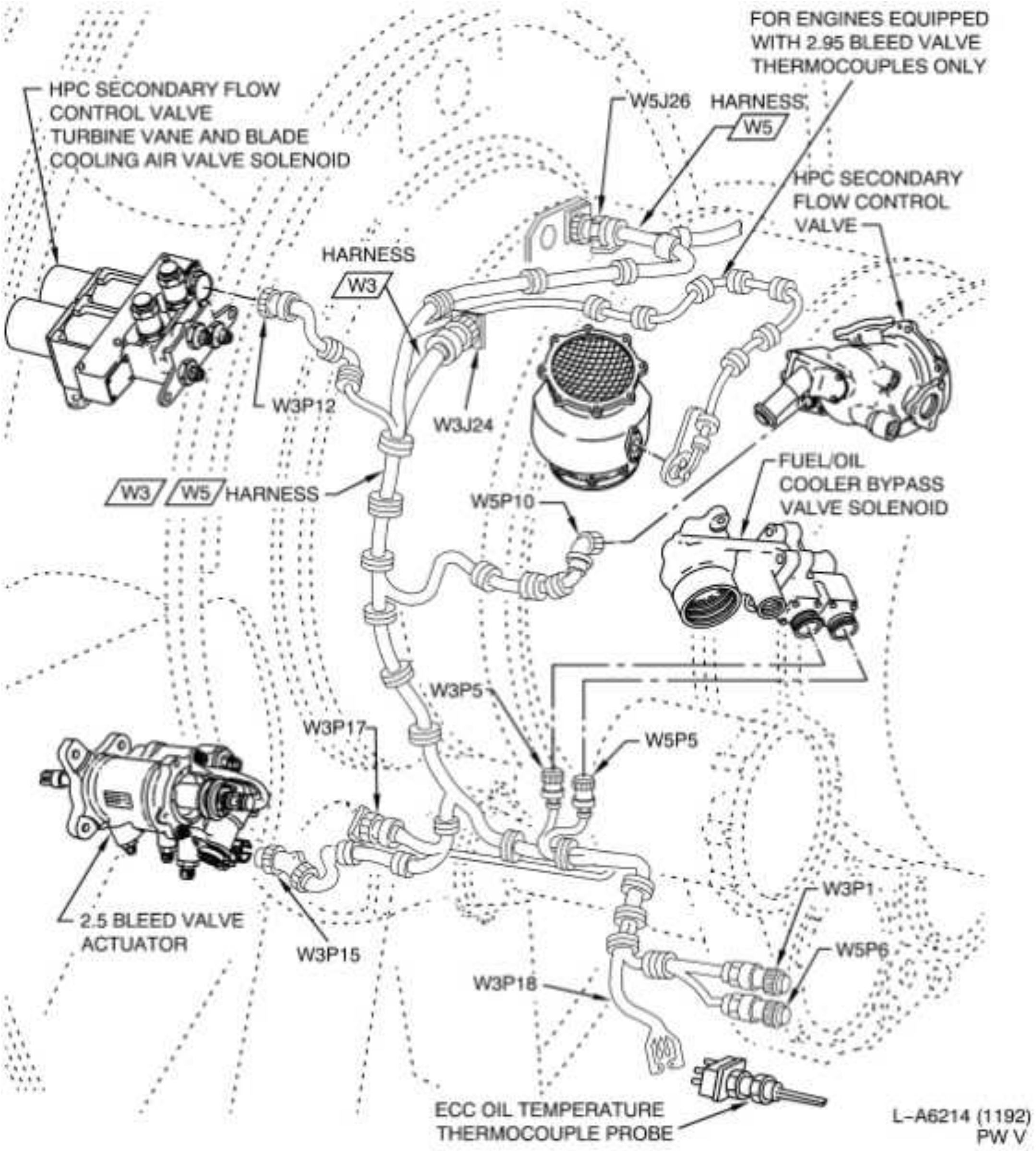
(9) If engine disassembly is necessary, remove the bolts, nuts, and washers that attach the top and lower harness support brackets (318/1, 318/5) to the right side of the HPC case. Remove the brackets. See Figure 318.


SEE FIGURE 303
W5
HARNESS
SEE FIGURE 304
SEE FIGURE 305
W3 HARNESS (REF)
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
SEE FIGURE 306
SEE FIGURE 308
SEE FIGURE 307
W3 HARNESS (REF)
(SEE FIGURE 302 FOR HARNESS CONNECTOR LOCATIONS)
L-B2723 (0000)
PW V

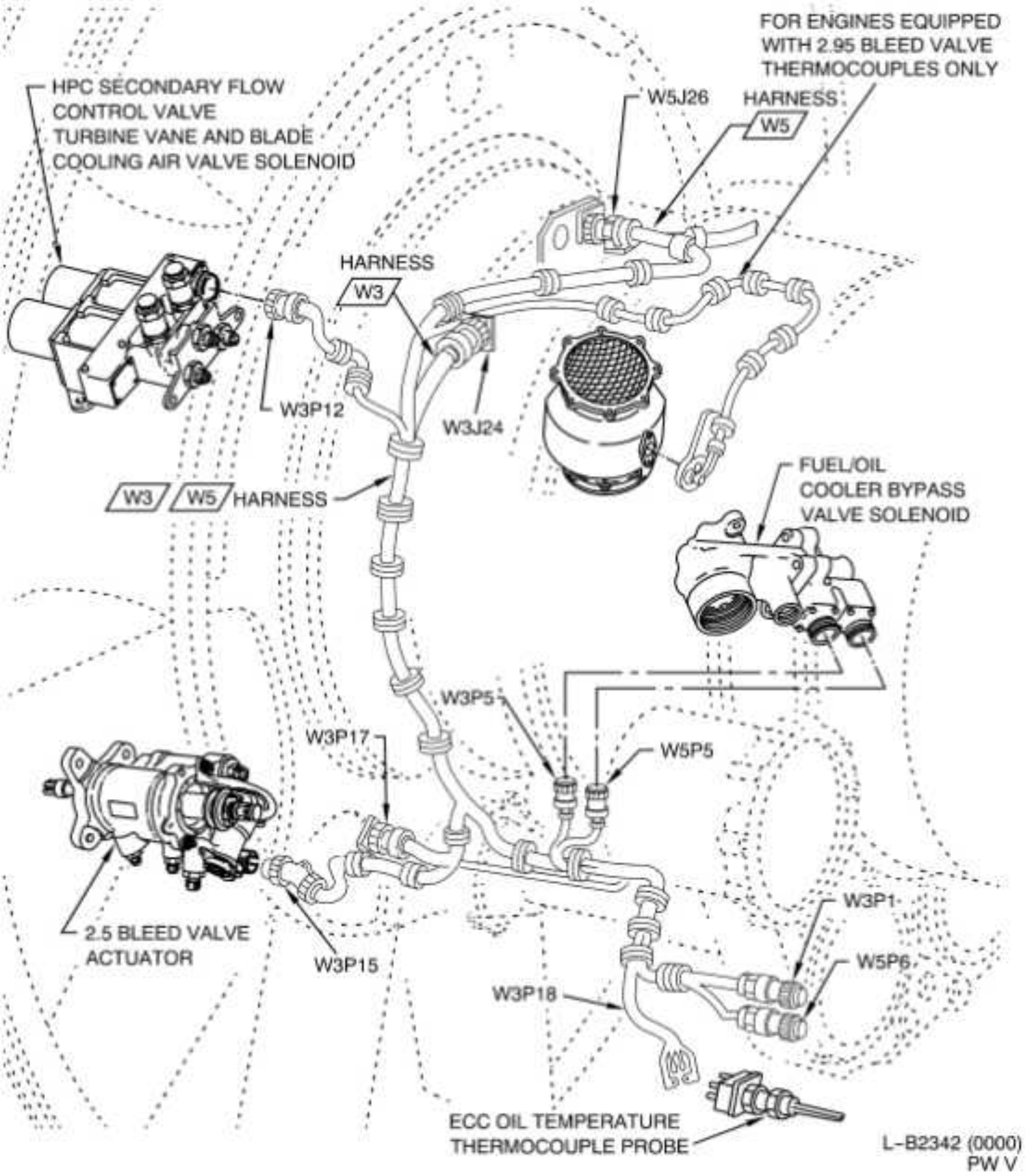
EEC Wiring Harness − W5 (Core Engine)
Figure 301
(Task 72−00−34−050−020)


HPC SECONDARY FLOW CONTROL VALVE
TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
W5J26
W5 HARNESS
HPC SECONDARY FLOW CONTROL VALVE
W3J24
W3P12
W3 HARNESS
FUEL/OIL COOLER BYPASS VALVE SOLENOID
W3 W5 HARNESS
W5P10
W3P5
W3P17
W5P5
2.5 BLEED VALVE ACTUATOR
W3P15
W3P1
W5P6
W3P18
ECC OIL TEMPERATURE THERMOCOUPLE PROBE
L−A5741 (0391)
PW V

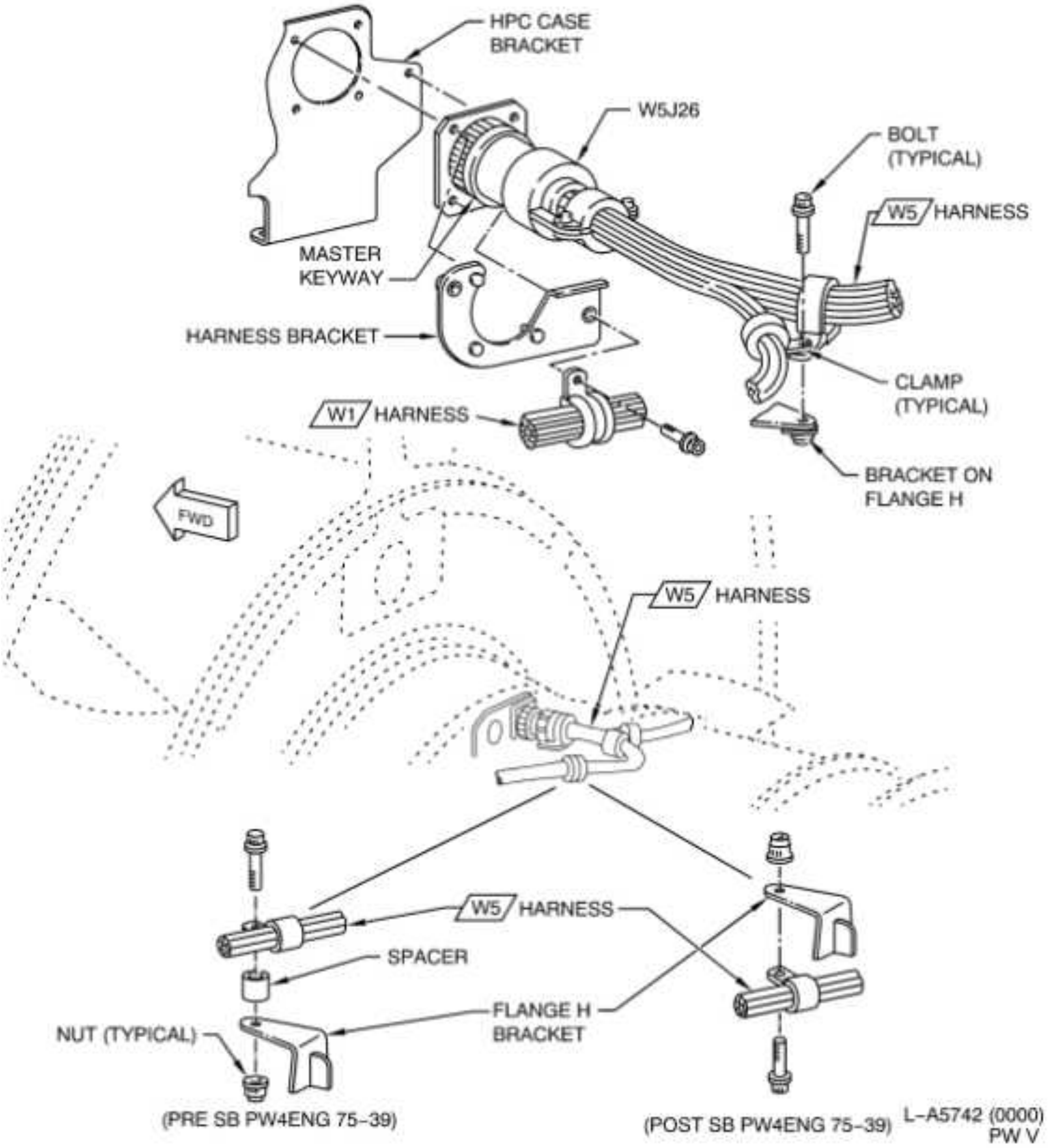
EEC Wiring Harness − W5 (Core Engine)
(Pre SB PW4ENG 73−84 Or SB PW4ENG 75−106)
Figure 302 (Sheet 1)
(Task 72−00−34−050−020)


FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
HPC SECONDARY FLOW CONTROL VALVE
TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
W5J26
HARNESS
W5
HPC SECONDARY FLOW CONTROL VALVE
HARNESS
W3
W3P12
W3J24
W3
W5
HARNESS
W5P10
FUEL/OIL COOLER BYPASS VALVE SOLENOID
W3P5
W3P17
W5P5
2.5 BLEED VALVE ACTUATOR
W3P15
W3P1
W5P6
W3P18
ECC OIL TEMPERATURE THERMOCOUPLE PROBE
L−A6214 (1192)
PW V

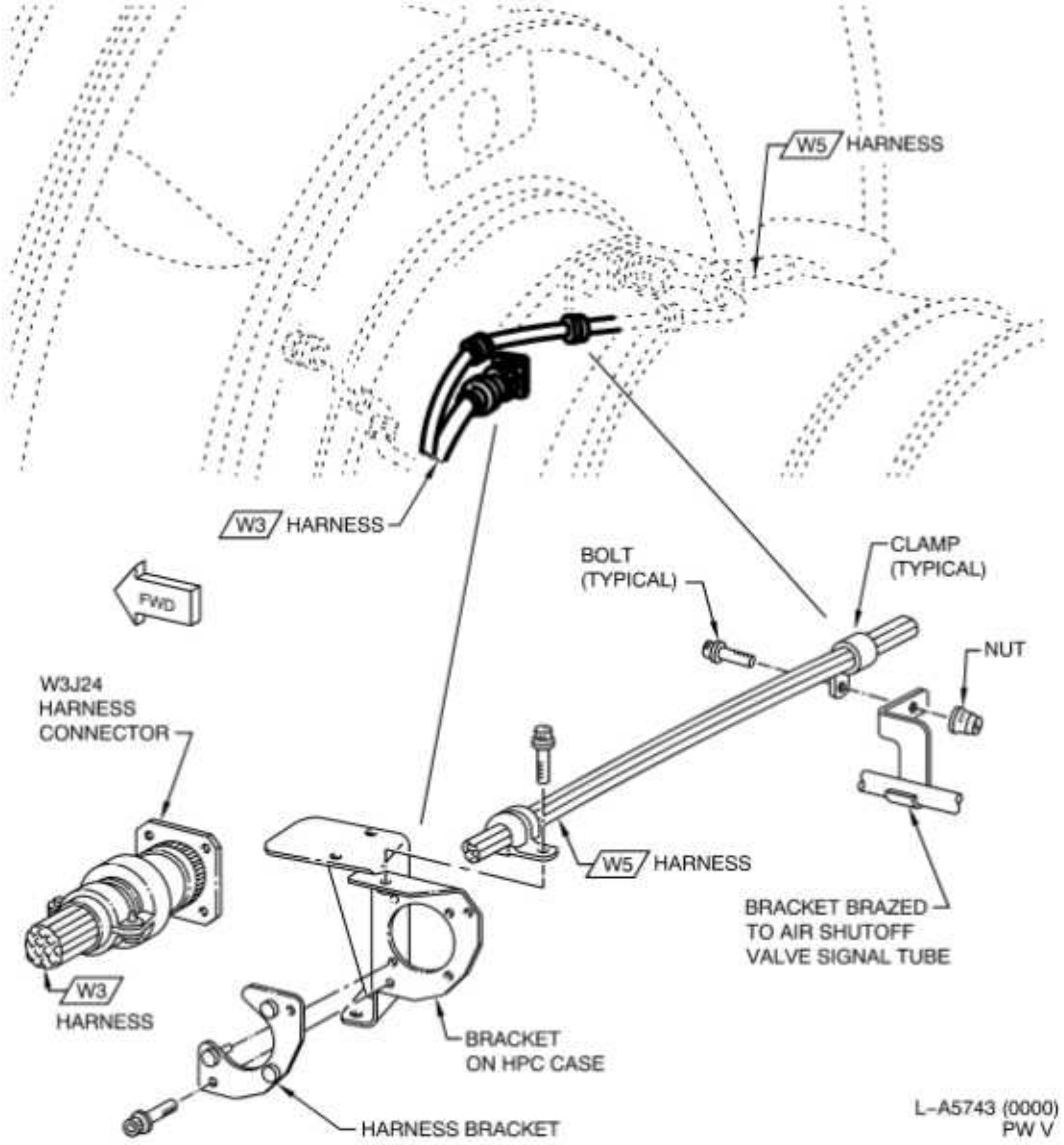
EEC Wiring Harness − W5 (Core Engine)
(Post SB PW4ENG 73−84) (Pre SB PW4ENG 75−106)
Figure 302 (Sheet 2)
(Task 72−00−34−050−020)


FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
HPC SECONDARY FLOW CONTROL VALVE
TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
W5J26
HARNESS
W5
HARNESS
W3
W3P12
W3J24
W3
W5
HARNESS
FUEL/OIL COOLER BYPASS VALVE SOLENOID
W3P5
W3P17
W5P5
W3P1
W5P6
2.5 BLEED VALVE ACTUATOR
W3P15
W3P18
ECC OIL TEMPERATURE THERMOCOUPLE PROBE
L-B2342 (0000)
PW V

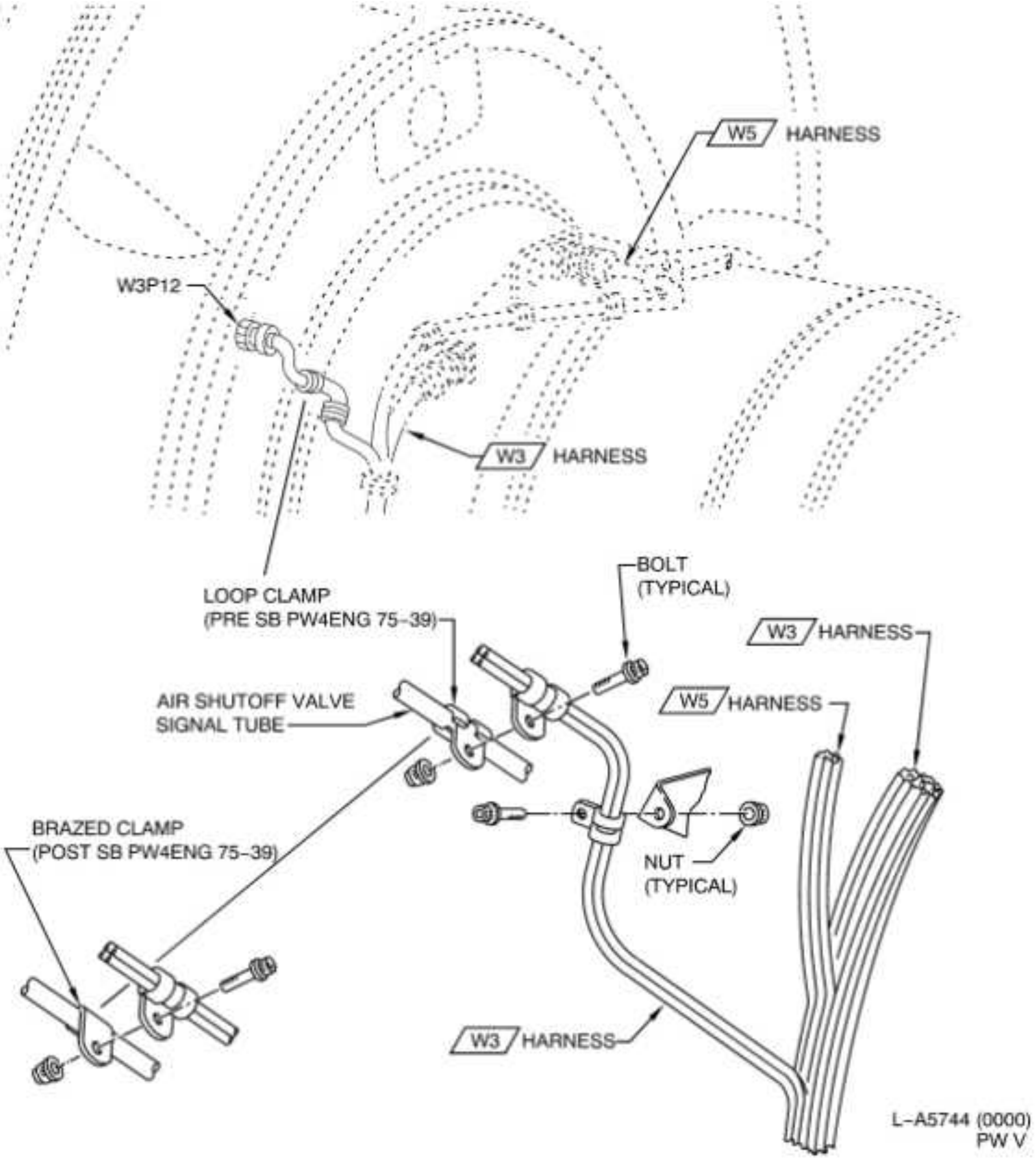
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−84, SB PW4ENG 72−572 Or SB PW4ENG 75−106) (For −3 Engines with CN After Engine Serial Number)
Figure 302 (Sheet 3)
(Task 72−00−34−050−020)


HPC CASE BRACKET
W5J26
BOLT (TYPICAL)
W5 HARNESS
MASTER KEYWAY
HARNESS BRACKET
CLAMP (TYPICAL)
W1 HARNESS
BRACKET ON FLANGE H
FWD
W5 HARNESS
W5 HARNESS
SPACER
FLANGE H BRACKET
NUT (TYPICAL)
(PRE SB PW4ENG 75-39)
(POST SB PW4ENG 75-39)
L-A5742 (0000)
PW V

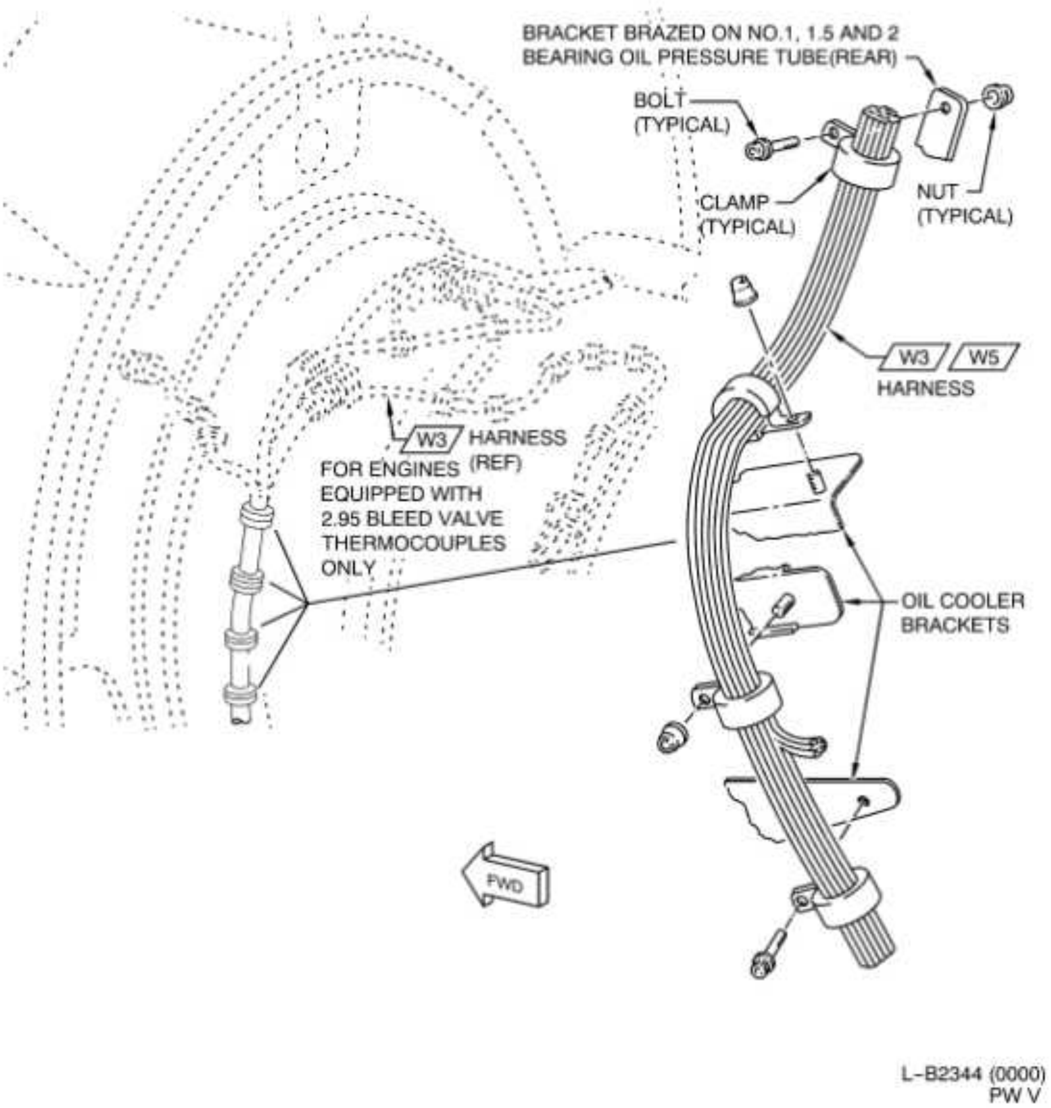
EEC Wiring Harness − W5 (Core Engine)
Figure 303
(Task 72−00−34−050−020)


W5 HARNESS
W3 HARNESS
FWD
BOLT (TYPICAL)
CLAMP (TYPICAL)
NUT
W3J24 HARNESS CONNECTOR
W5 HARNESS
BRACKET BRAZED TO AIR SHUTOFF VALVE SIGNAL TUBE
W3 HARNESS
BRACKET ON HPC CASE
HARNESS BRACKET
L-A5743 (0000)
PW V

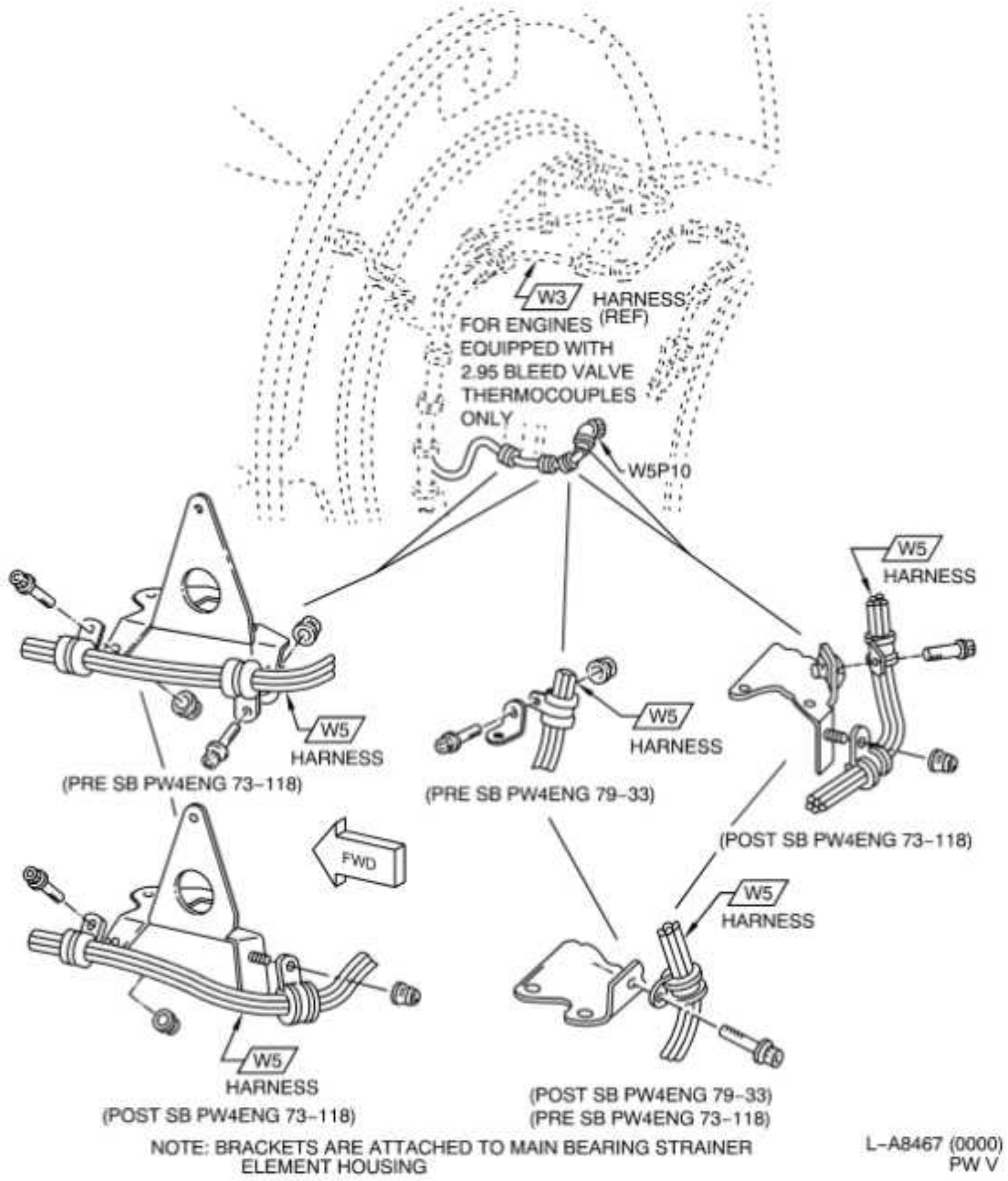
EEC Wiring Harness - W5 (Core Engine)
Figure 304
(Task 72-00-34-050-020)


W5 HARNESS
W3P12
W3 HARNESS
LOOP CLAMP
(PRE SB PW4ENG 75-39)
BOLT
(TYPICAL)
W3 HARNESS
AIR SHUTOFF VALVE
SIGNAL TUBE
W5 HARNESS
BRAZED CLAMP
(POST SB PW4ENG 75-39)
NUT
(TYPICAL)
W3 HARNESS
L-A5744 (0000)
PW V

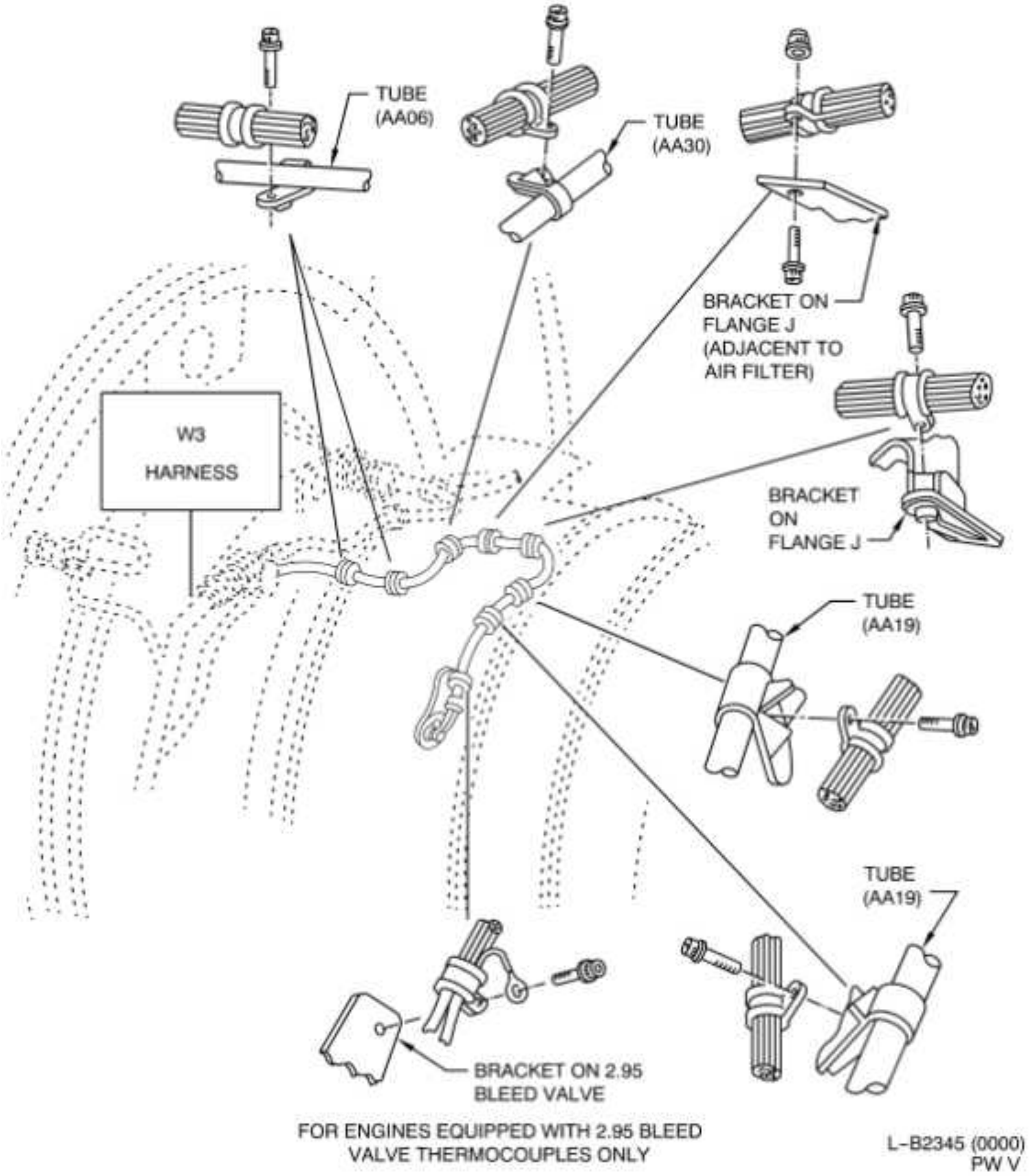
EEC Wiring Harness − W5 (Core Engine)
Figure 305
(Task 72−00−34−050−020)


BRACKET BRAZED ON NO.1, 1.5 AND 2
BEARING OIL PRESSURE TUBE(REAR)
BOLT
(TYPICAL)
CLAMP
(TYPICAL)
NUT
(TYPICAL)
W3 / W5
HARNESS
W3 HARNESS
(REF)
FOR ENGINES
EQUIPPED WITH
2.95 BLEED VALVE
THERMOCOUPLES
ONLY
OIL COOLER
BRACKETS
FWD
L-B2344 (0000)
PW V

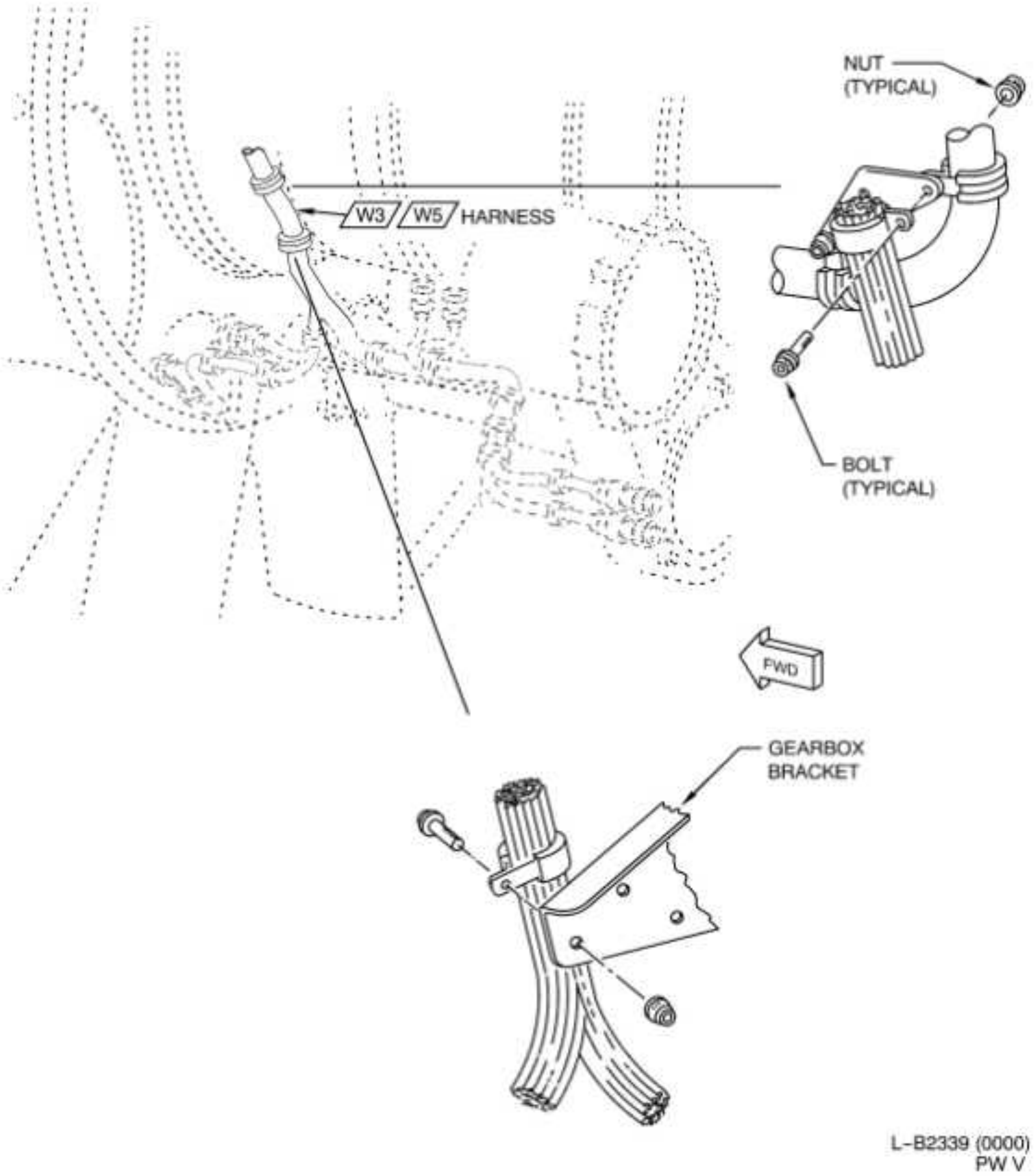
EEC Wiring Harness − W5 (Core Engine)
Figure 306 (Sheet 1)
(Task 72−00−34−050−020)


W3 HARNESS (REF)
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5P10
W5 HARNESS
W5 HARNESS
(PRE SB PW4ENG 73-118)
W5 HARNESS
(PRE SB PW4ENG 79-33)
(POST SB PW4ENG 73-118)
FWD
W5 HARNESS
W5 HARNESS
(POST SB PW4ENG 73-118)
(POST SB PW4ENG 79-33)
(PRE SB PW4ENG 73-118)
NOTE: BRACKETS ARE ATTACHED TO MAIN BEARING STRAINER ELEMENT HOUSING
L-A8467 (0000)
PW V

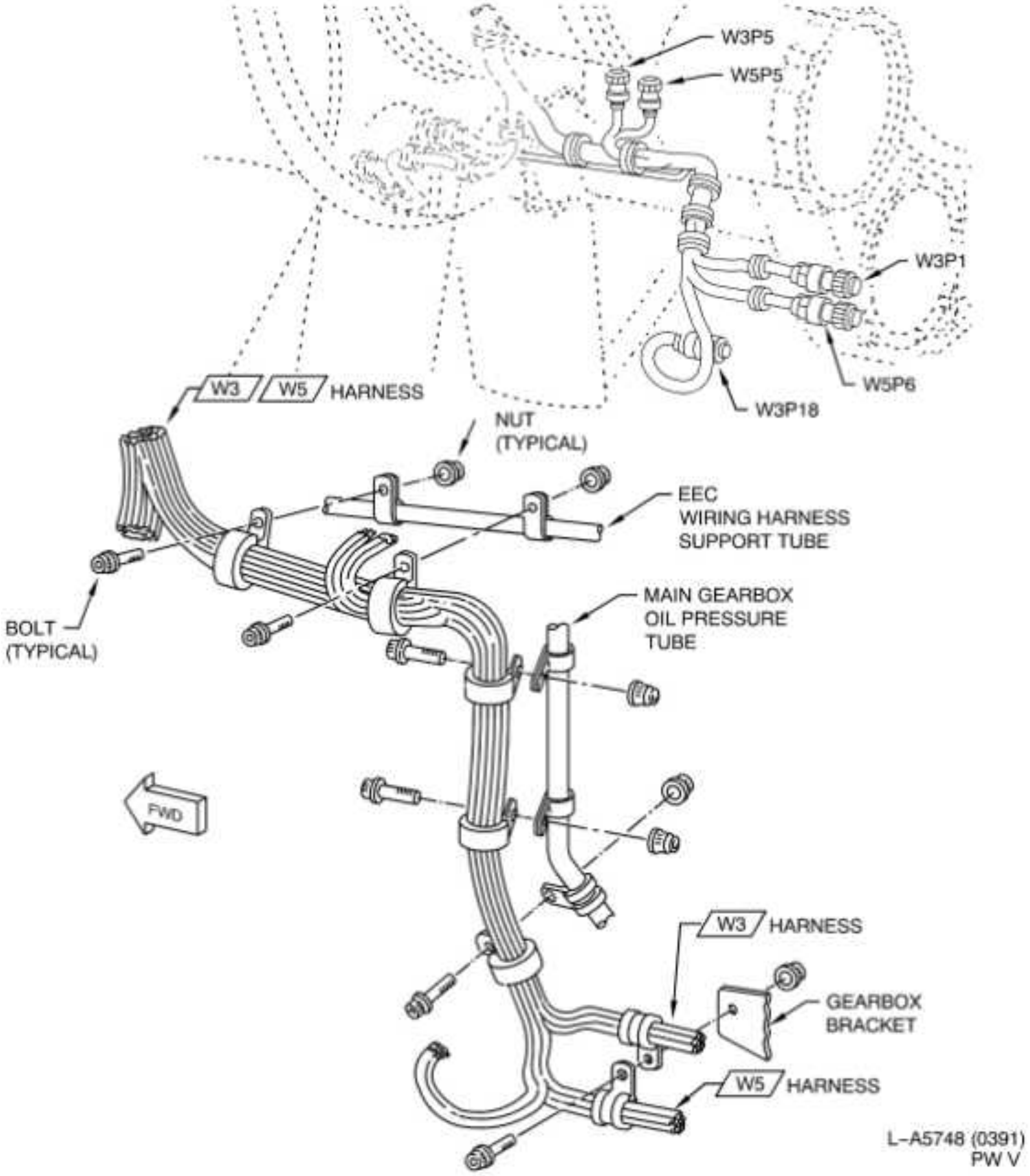
EEC Wiring Harness − W5 (Core Engine) (Pre SB PW4ENG 75−106)
Figure 306 (Sheet 2)
(Task 72−00−34−050−020)


TUBE (AA06)
TUBE (AA30)
BRACKET ON FLANGE J (ADJACENT TO AIR FILTER)
W3 HARNESS
BRACKET ON FLANGE J
TUBE (AA19)
TUBE (AA19)
BRACKET ON 2.95 BLEED VALVE
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
L-B2345 (0000)
PW V

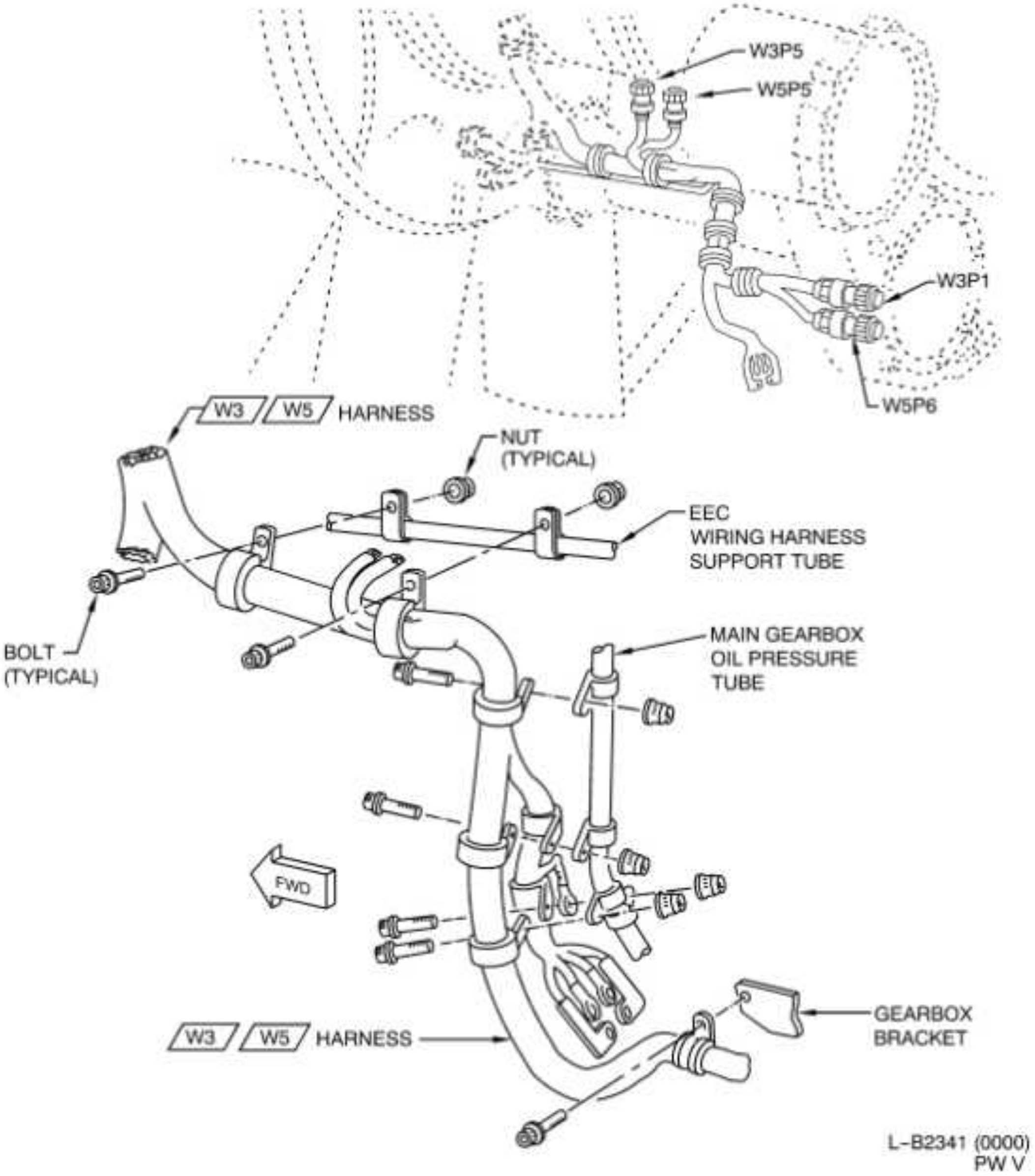
EEC Wiring Harness − W5 (Core Engine)
Figure 306 (Sheet 3)
(Task 72−00−34−050−020)


NUT
(TYPICAL)
W3
W5
HARNESS
BOLT
(TYPICAL)
FWD
GEARBOX
BRACKET
L-B2339 (0000)
PW V

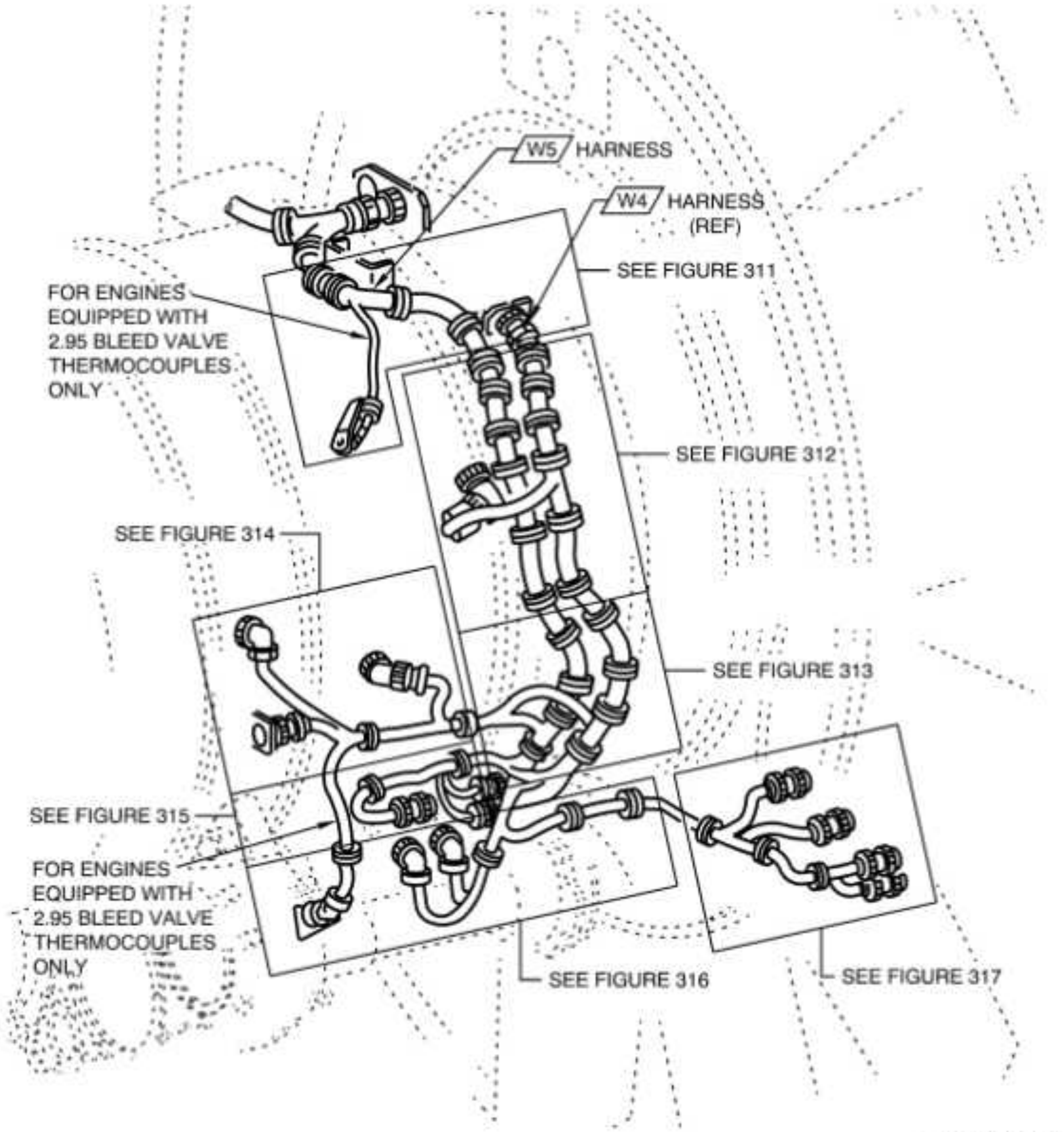
EEC Wiring Harness − W5 (Core Engine)
Figure 307
(Task 72−00−34−050−020)


W3P5
W5P5
W3P1
W5P6
W3P18
W3 / W5 HARNESS
NUT (TYPICAL)
EEC WIRING HARNESS SUPPORT TUBE
BOLT (TYPICAL)
MAIN GEARBOX OIL PRESSURE TUBE
FWD
W3 HARNESS
GEARBOX BRACKET
W5 HARNESS
L-A5748 (0391)
PW V

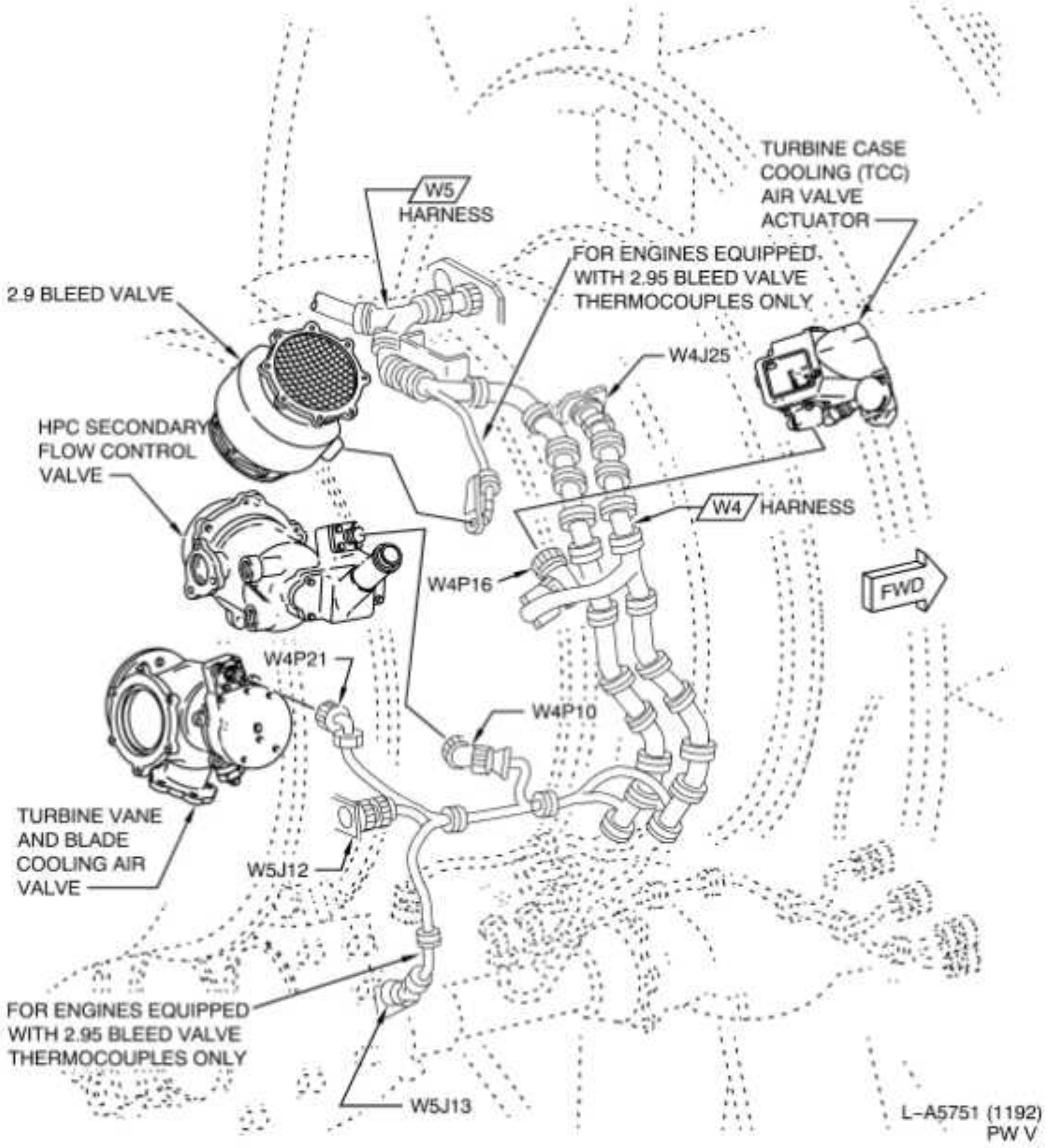
EEC Wiring Harness − W5 (Core Engine) (Pre SB PW4ENG 73−84)
Figure 308 (Sheet 1)
(Task 72−00−34−050−020)


W3P5
W5P5
W3P1
W5P6
W3 / W5 HARNESS
NUT (TYPICAL)
EEC WIRING HARNESS SUPPORT TUBE
BOLT (TYPICAL)
MAIN GEARBOX OIL PRESSURE TUBE
FWD
W3 / W5 HARNESS
GEARBOX BRACKET
L-B2341 (0000)
PW V

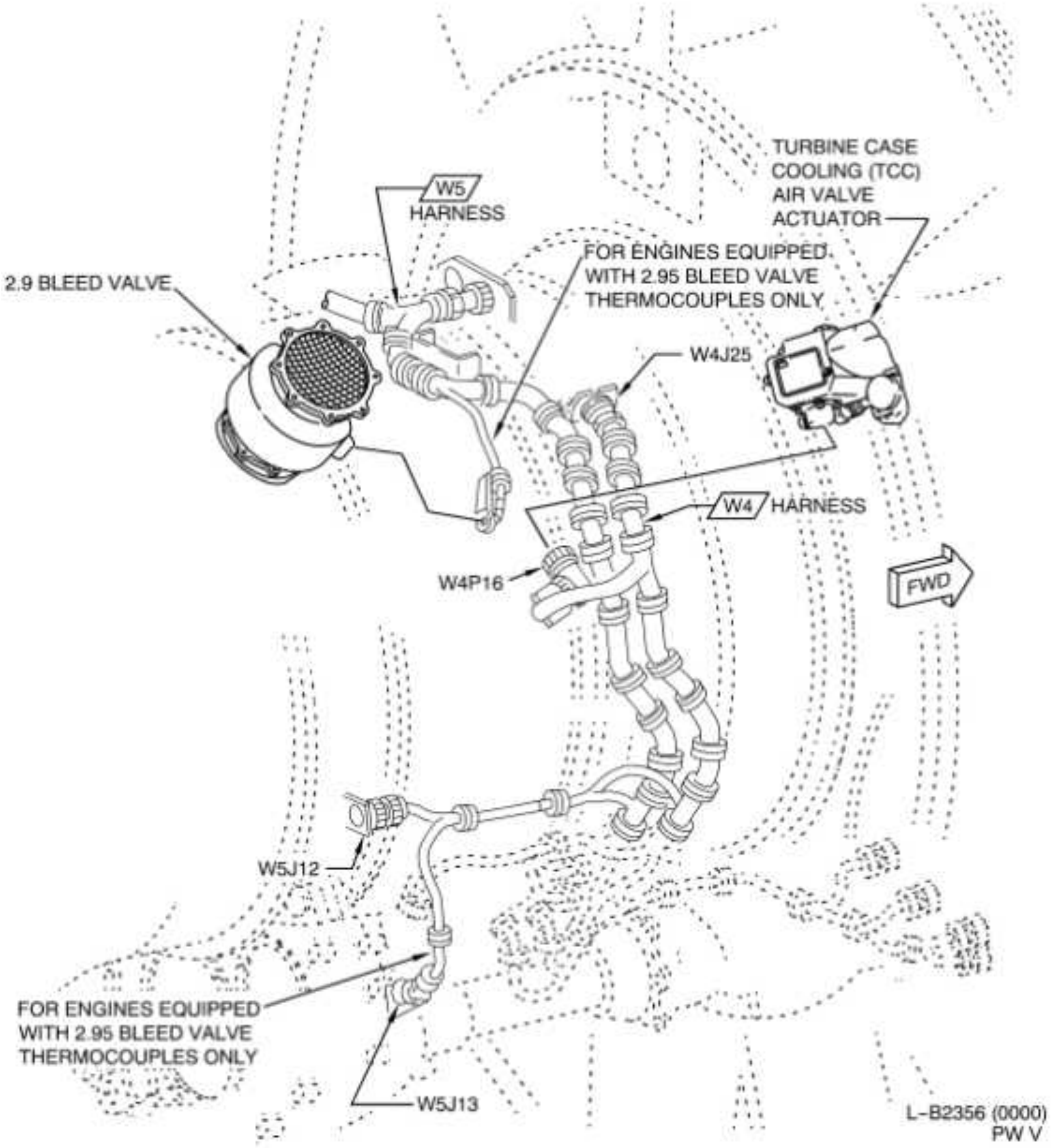
EEC Wiring Harness - W5 (Core Engine) (Post SB PW4ENG 73-84) (For -3 Engines With CN After Engine Serial Number)
Figure 308 (Sheet 2)
(Task 72-00-34-050-020)


W5 HARNESS
W4 HARNESS (REF)
SEE FIGURE 311
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
SEE FIGURE 312
SEE FIGURE 314
SEE FIGURE 313
SEE FIGURE 315
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
SEE FIGURE 316
SEE FIGURE 317
L-B2722 (0000)
PW V

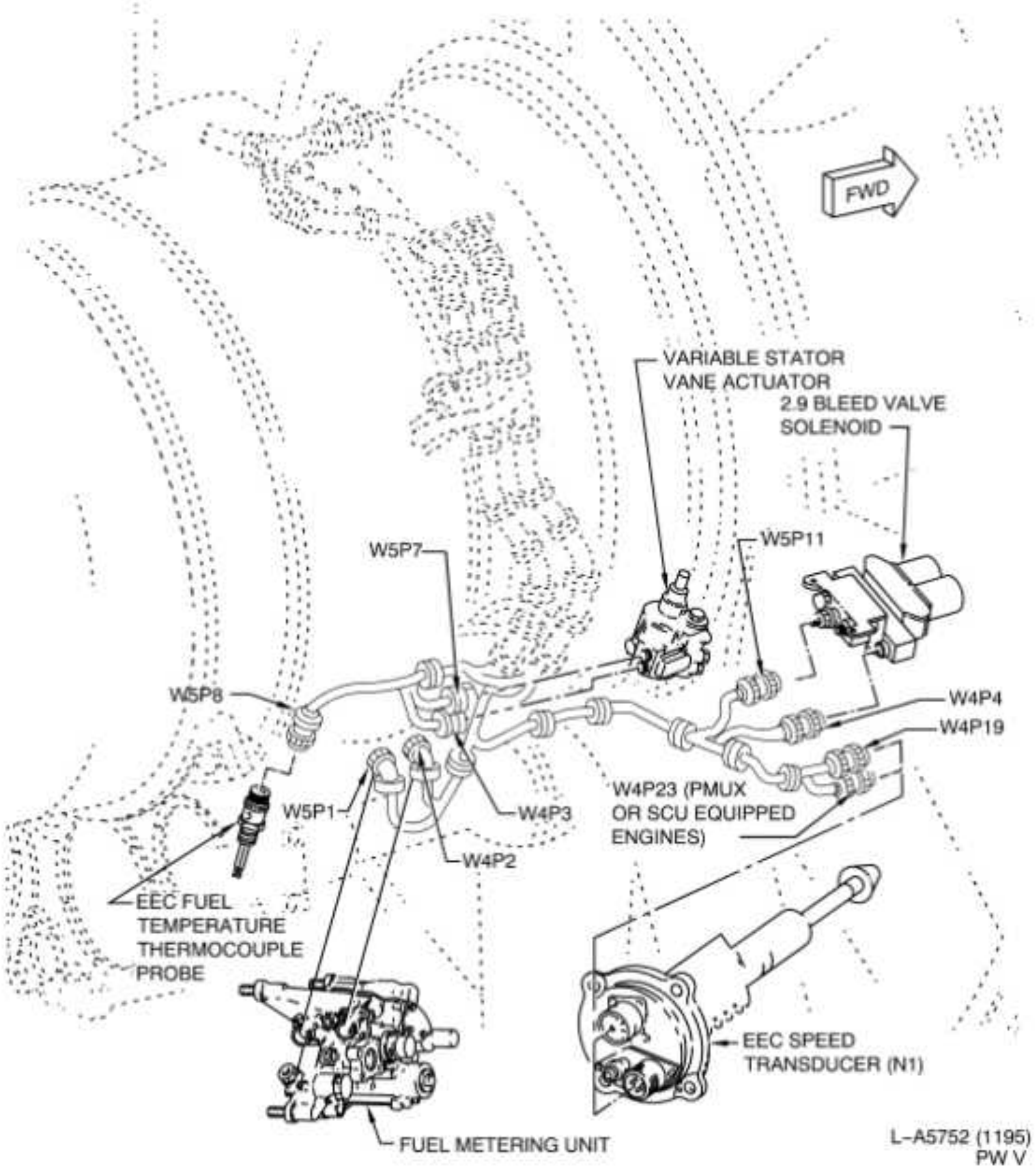
EEC Wiring Harness − W5 (Core Engine)
Figure 309
(Task 72−00−34−050−020)


TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
W5 HARNESS
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
2.9 BLEED VALVE
W4J25
HPC SECONDARY FLOW CONTROL VALVE
W4 HARNESS
W4P16
FWD
W4P21
W4P10
TURBINE VANE AND BLADE COOLING AIR VALVE
W5J12
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5J13
L−A5751 (1192)
PW V

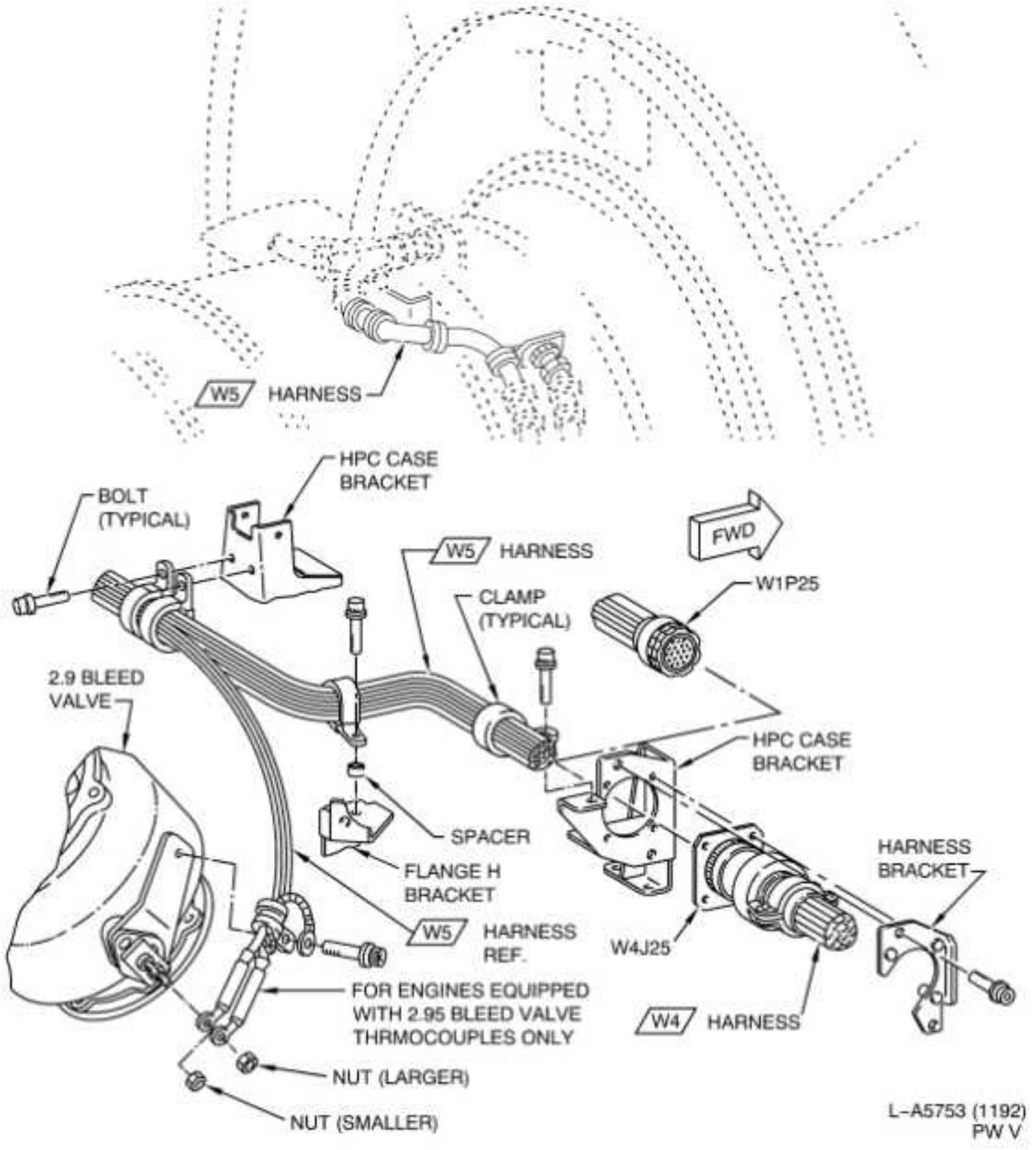
EEC Wiring Harness − W5 (Core Engine) (Pre SB PW4ENG 75−106)
Figure 310 (Sheet 1)
(Task 72−00−34−050−020)


TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
W5 HARNESS
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
2.9 BLEED VALVE
W4J25
W4 HARNESS
W4P16
FWD
W5J12
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5J13
L−B2356 (0000)
PW V

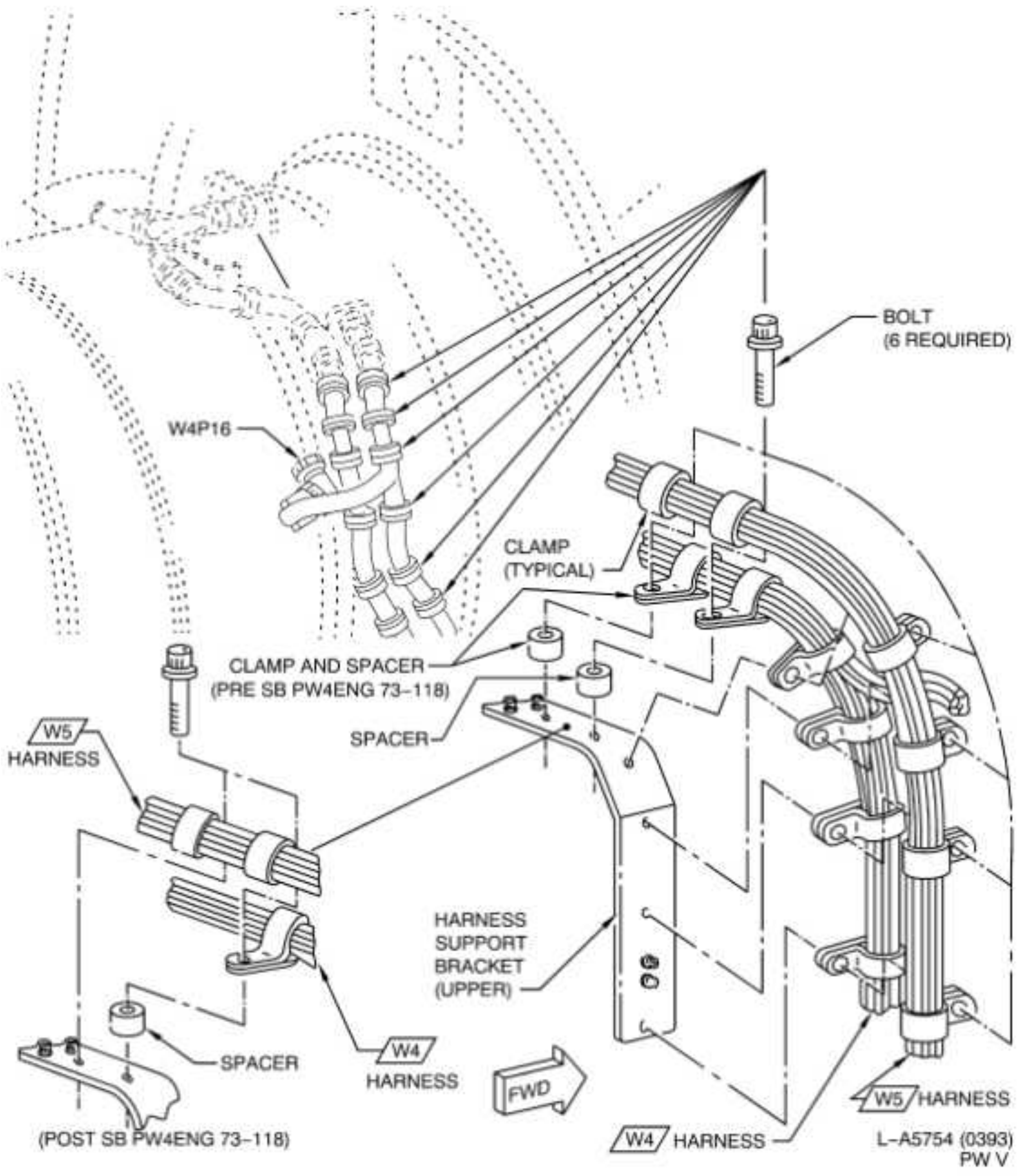
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 72−572 Or SB PW4ENG 75−106) (For −3 Engines With CN After Engine Serial Number)
Figure 310 (Sheet 2)
(Task 72−00−34−050−020)


FWD
VARIABLE STATOR VANE ACTUATOR
2.9 BLEED VALVE SOLENOID
W5P11
W5P7
W5P8
W4P4
W4P19
W5P1
W4P3
W4P23 (PMUX OR SCU EQUIPPED ENGINES)
W4P2
EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
EEC SPEED TRANSDUCER (N1)
FUEL METERING UNIT
L-A5752 (1195)
PW V

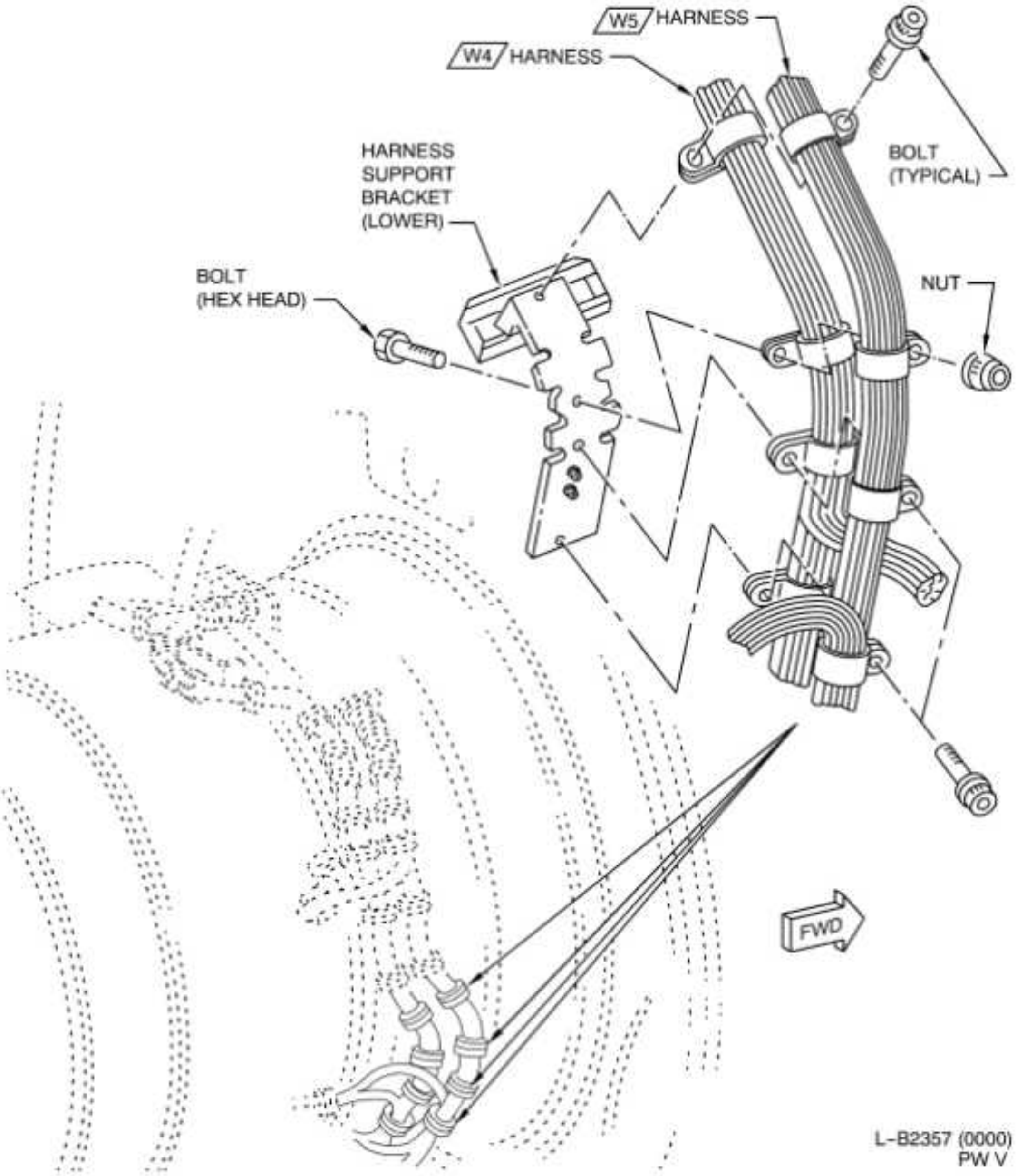
EEC Wiring Harness − W5 (Core Engine)
Figure 310 (Sheet 3)
(Task 72−00−34−050−020)


W5 HARNESS
BOLT (TYPICAL)
HPC CASE BRACKET
W5 HARNESS
FWD
W1P25
CLAMP (TYPICAL)
2.9 BLEED VALVE
HPC CASE BRACKET
SPACER
FLANGE H BRACKET
HARNESS BRACKET
W5 HARNESS REF.
W4J25
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THRMOCOUPLES ONLY
W4 HARNESS
NUT (LARGER)
NUT (SMALLER)
L−A5753 (1192)
PW V

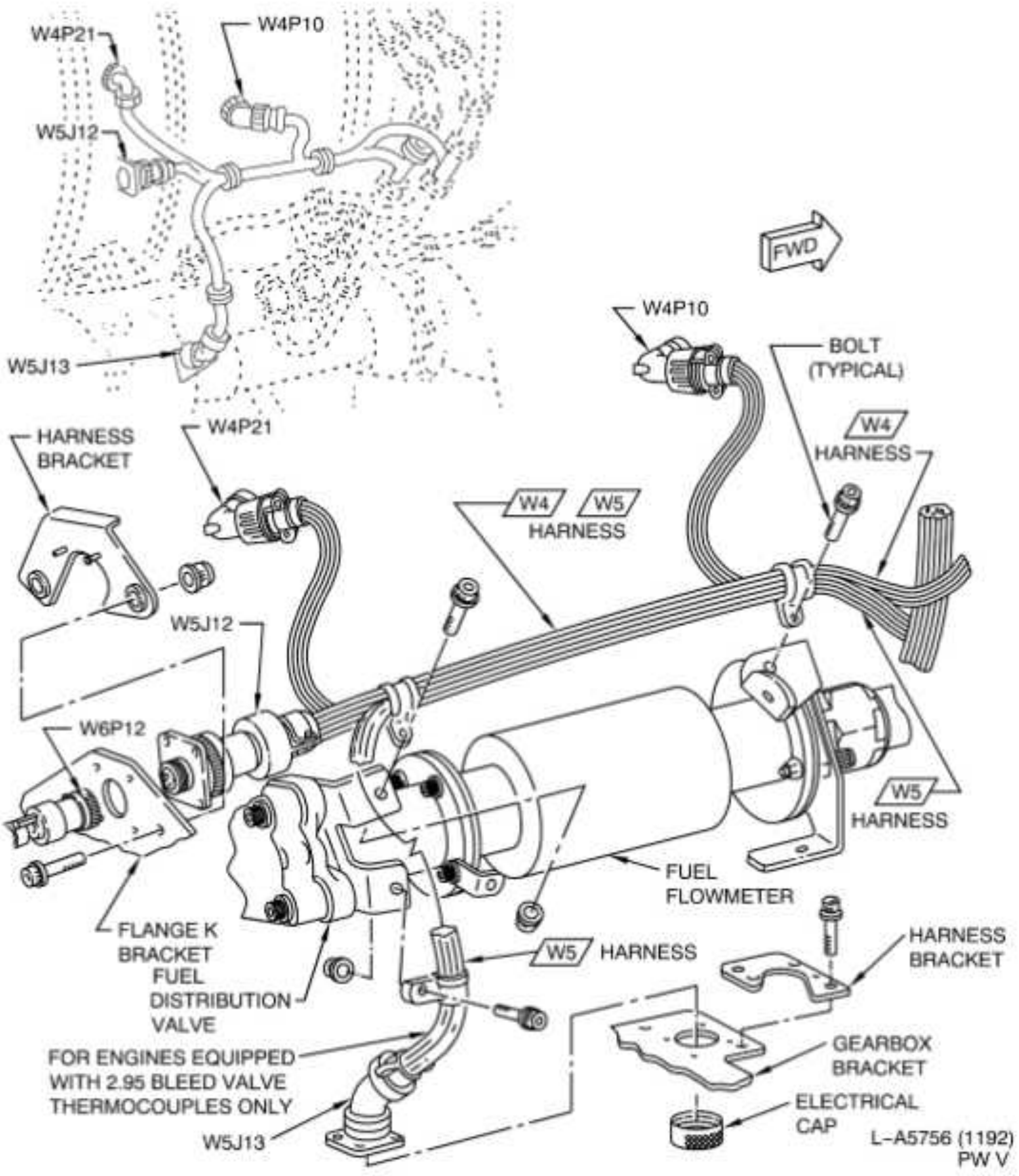
EEC Wiring Harness − W5 (Core Engine)
Figure 311
(Task 72−00−34−050−020)


BOLT
(6 REQUIRED)
W4P16
CLAMP
(TYPICAL)
CLAMP AND SPACER
(PRE SB PW4ENG 73-118)
SPACER
W5
HARNESS
HARNESS
SUPPORT
BRACKET
(UPPER)
SPACER
W4
HARNESS
FWD
(POST SB PW4ENG 73-118)
W4 HARNESS
W5 HARNESS
L-A5754 (0393)
PW V

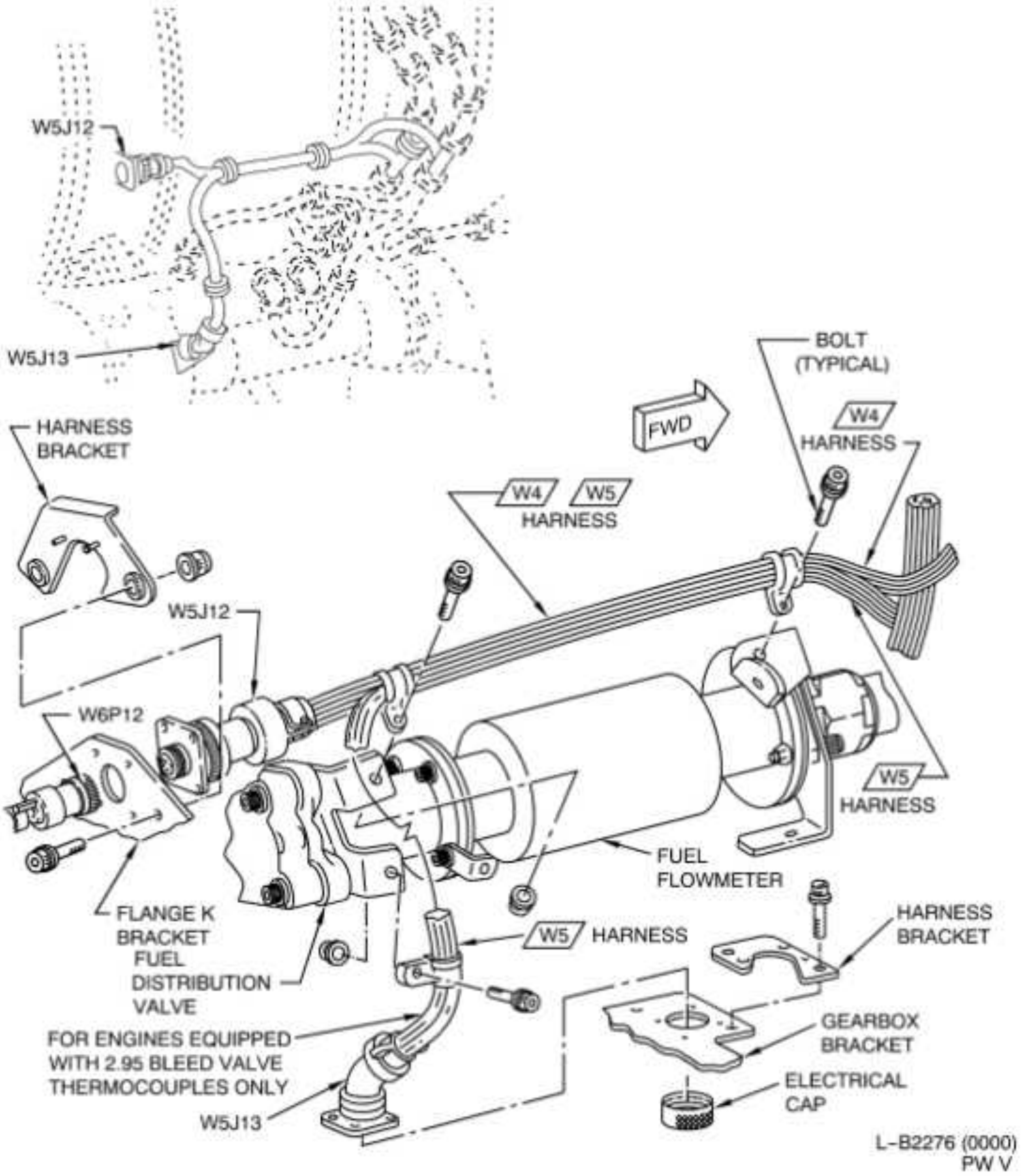
EEC Wiring Harness − W5 (Core Engine)
Figure 312
(Task 72−00−34−050−020)


W5 HARNESS
W4 HARNESS
HARNESS SUPPORT BRACKET (LOWER)
BOLT (TYPICAL)
BOLT (HEX HEAD)
NUT
FWD
L-B2357 (0000)
PW V

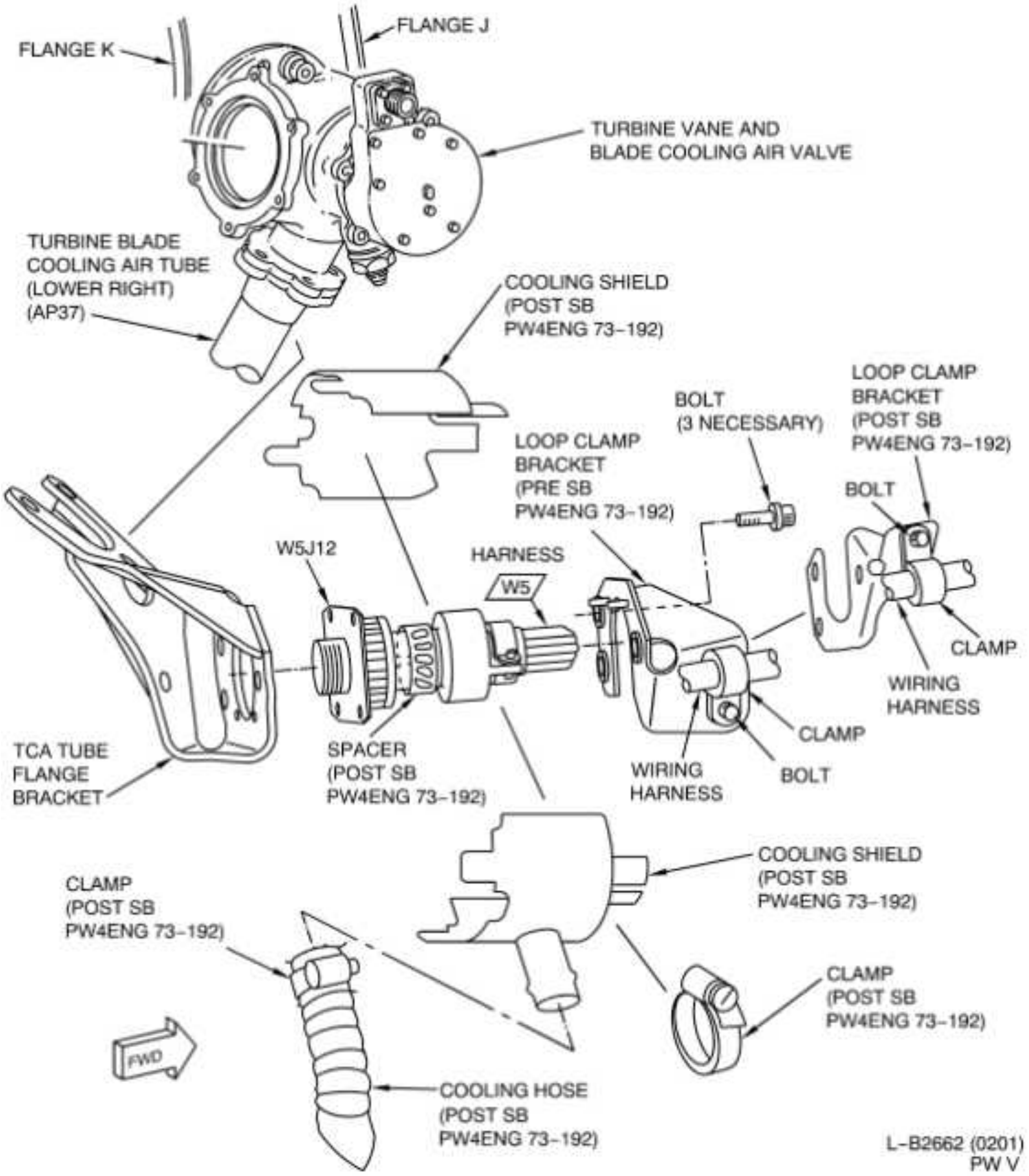
EEC Wiring Harness − W5 (Core Engine)
Figure 313
(Task 72−00−34−050−020)


W4P21
W4P10
W5J12
W5J13
FWD
W4P10
BOLT (TYPICAL)
W4 HARNESS
HARNESS BRACKET
W4P21
W4 W5 HARNESS
W5J12
W6P12
W5 HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
GEARBOX BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
ELECTRICAL CAP
W5J13
L-A5756 (1192)
PW V

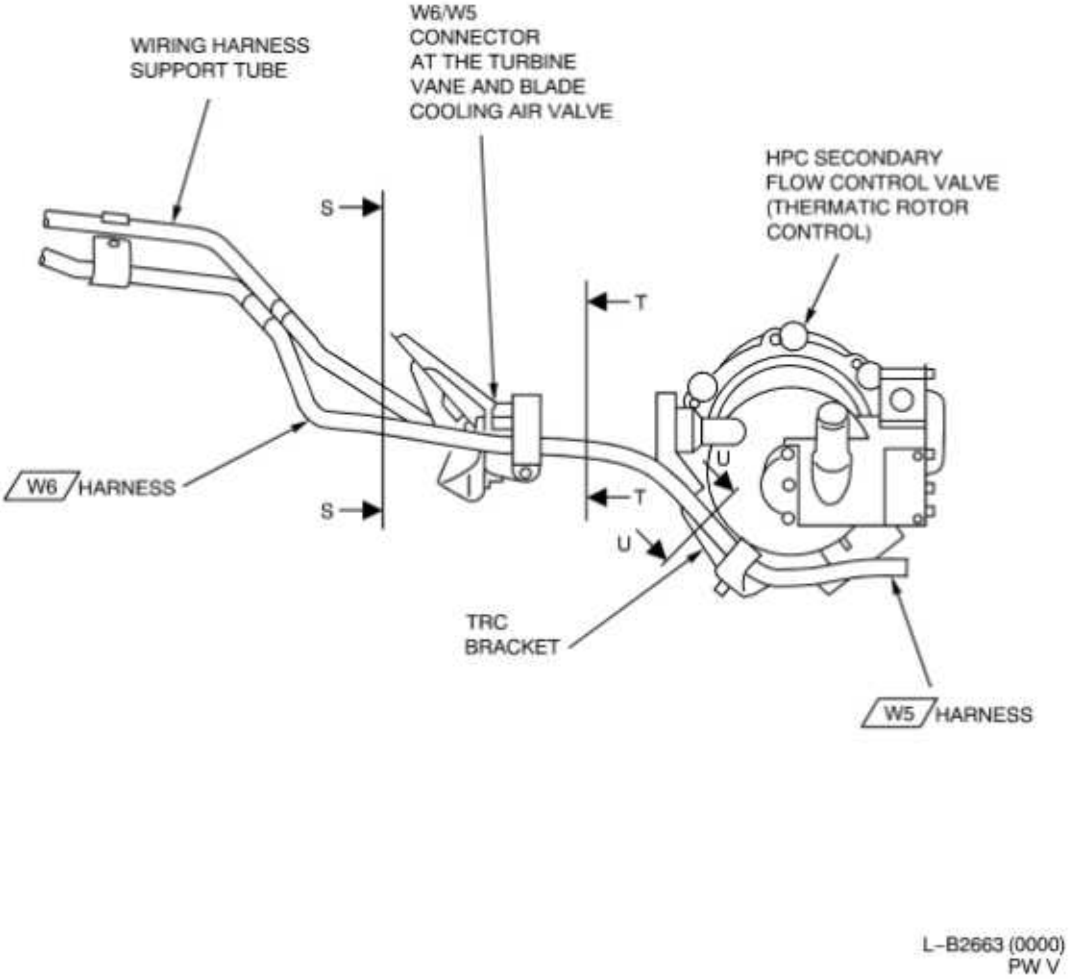
EEC Wiring Harness - W5 (Core Engine) (Pre SB PW4ENG 75-106 Or SB PW4ENG 73-163)
Figure 314 (Sheet 1)
(Task 72-00-34-050-020)


W5J12
W5J13
BOLT (TYPICAL)
FWD
W4 HARNESS
HARNESS BRACKET
W4 W5 HARNESS
W5J12
W6P12
W5 HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
GEARBOX BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
ELECTRICAL CAP
W5J13
L−B2276 (0000)
PW V

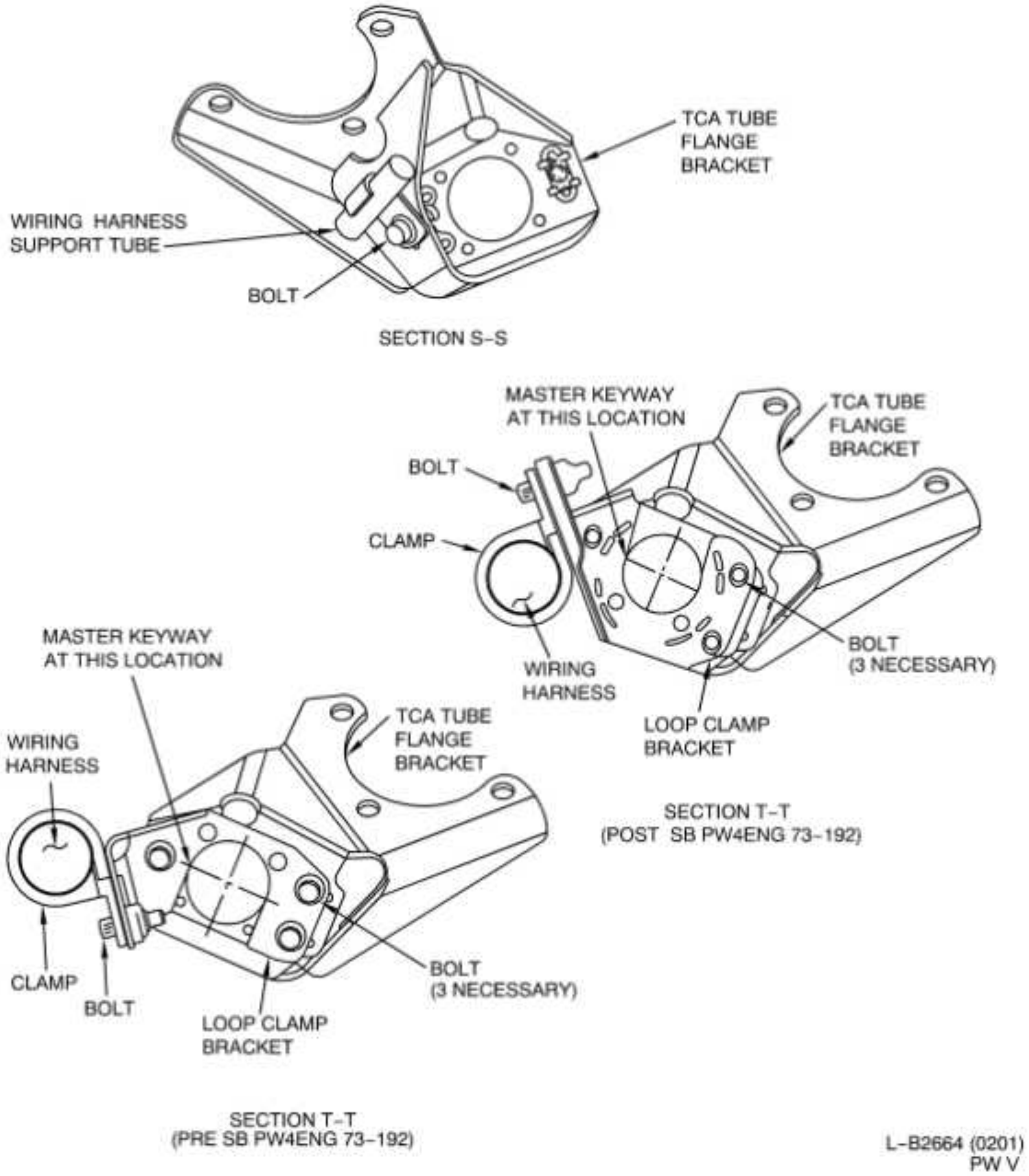
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 72−572 Or SB PW4ENG 75−106) (Pre SB PW4ENG 73−163) (For −3 Engines With CN After Engine Serial Number)
Figure 314 (Sheet 2)
(Task 72−00−34−050−020)


FLANGE K
FLANGE J
TURBINE VANE AND BLADE COOLING AIR VALVE
TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT) (AP37)
COOLING SHIELD (POST SB PW4ENG 73-192)
LOOP CLAMP BRACKET (POST SB PW4ENG 73-192)
BOLT (3 NECESSARY)
LOOP CLAMP BRACKET (PRE SB PW4ENG 73-192)
BOLT
W5J12
HARNESS
W5
CLAMP
WIRING HARNESS
CLAMP
TCA TUBE FLANGE BRACKET
SPACER (POST SB PW4ENG 73-192)
WIRING HARNESS
BOLT
COOLING SHIELD (POST SB PW4ENG 73-192)
CLAMP (POST SB PW4ENG 73-192)
CLAMP (POST SB PW4ENG 73-192)
FWD
COOLING HOSE (POST SB PW4ENG 73-192)
L-B2662 (0201)
PW V

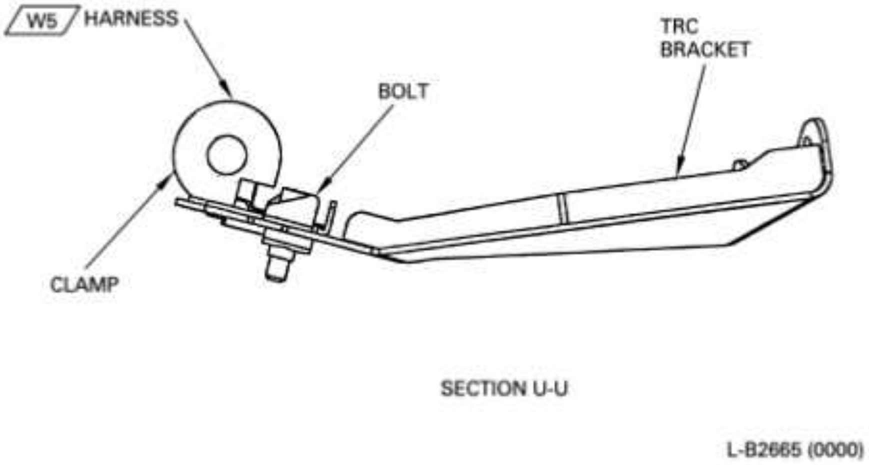
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 314 (Sheet 3)
(Task 72−00−34−050−020)


WIRING HARNESS SUPPORT TUBE
W6/W5 CONNECTOR AT THE TURBINE VANE AND BLADE COOLING AIR VALVE
HPC SECONDARY FLOW CONTROL VALVE (THERMATIC ROTOR CONTROL)
S
S
T
T
U
U
W6 HARNESS
TRC BRACKET
W5 HARNESS
L−B2663 (0000)
PW V

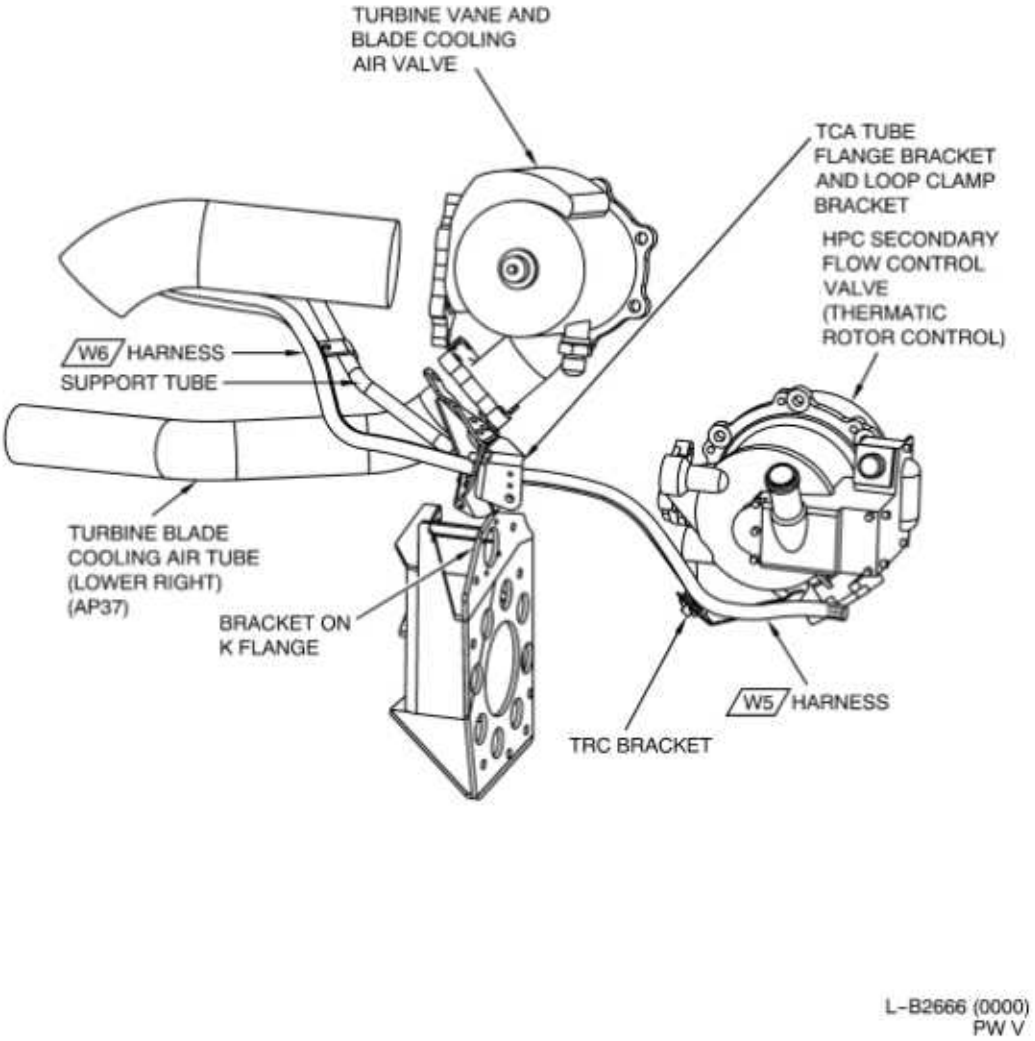
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 314 (Sheet 4)
(Task 72−00−34−050−020)


TCA TUBE FLANGE BRACKET
WIRING HARNESS SUPPORT TUBE
BOLT
SECTION S–S
MASTER KEYWAY AT THIS LOCATION
TCA TUBE FLANGE BRACKET
BOLT
CLAMP
WIRING HARNESS
BOLT (3 NECESSARY)
LOOP CLAMP BRACKET
SECTION T–T (POST SB PW4ENG 73–192)
MASTER KEYWAY AT THIS LOCATION
WIRING HARNESS
TCA TUBE FLANGE BRACKET
CLAMP
BOLT
LOOP CLAMP BRACKET
BOLT (3 NECESSARY)
SECTION T–T (PRE SB PW4ENG 73–192)
L–B2664 (0201)
PW V

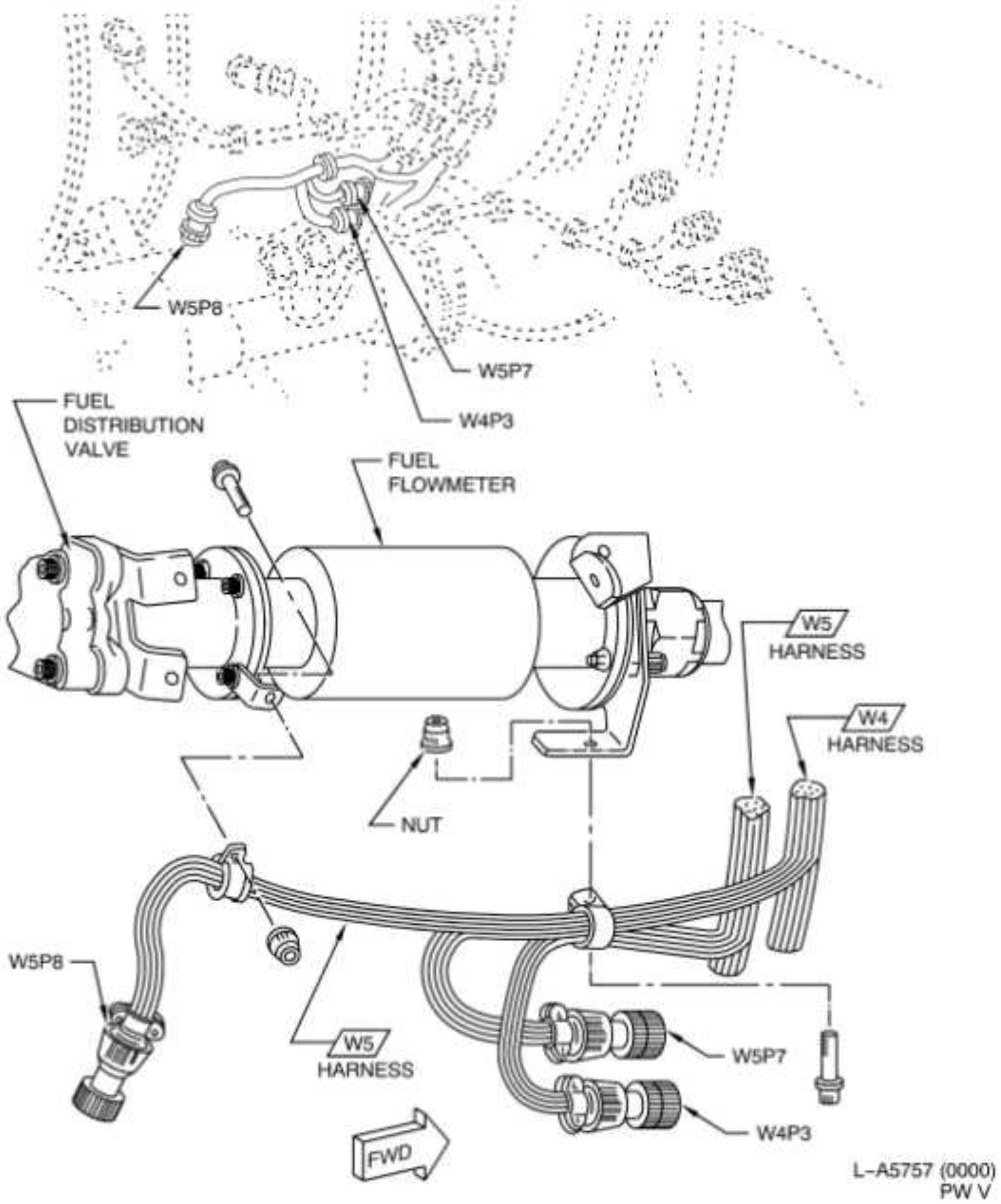
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 314 (Sheet 5)
(Task 72−00−34−050−020)


W5
HARNESS
TRC
BRACKET
BOLT
CLAMP
SECTION U-U
L-B2665 (0000)

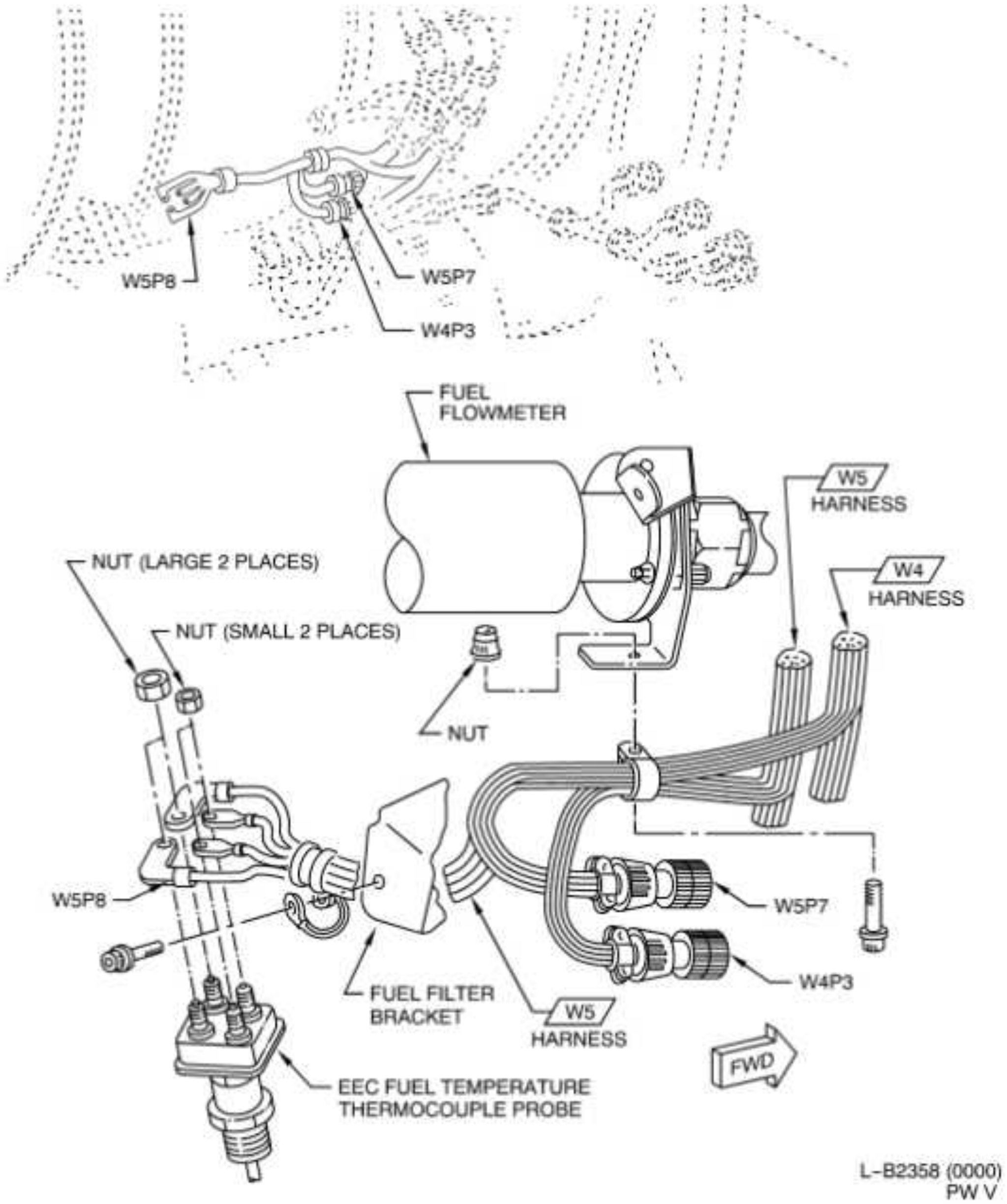
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 314 (Sheet 6)
(Task 72−00−34−050−020)


TURBINE VANE AND BLADE COOLING AIR VALVE
TCA TUBE FLANGE BRACKET AND LOOP CLAMP BRACKET
HPC SECONDARY FLOW CONTROL VALVE (THERMATIC ROTOR CONTROL)
W6 HARNESS
SUPPORT TUBE
TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT) (AP37)
BRACKET ON K FLANGE
W5 HARNESS
TRC BRACKET
L-B2666 (0000)
PW V

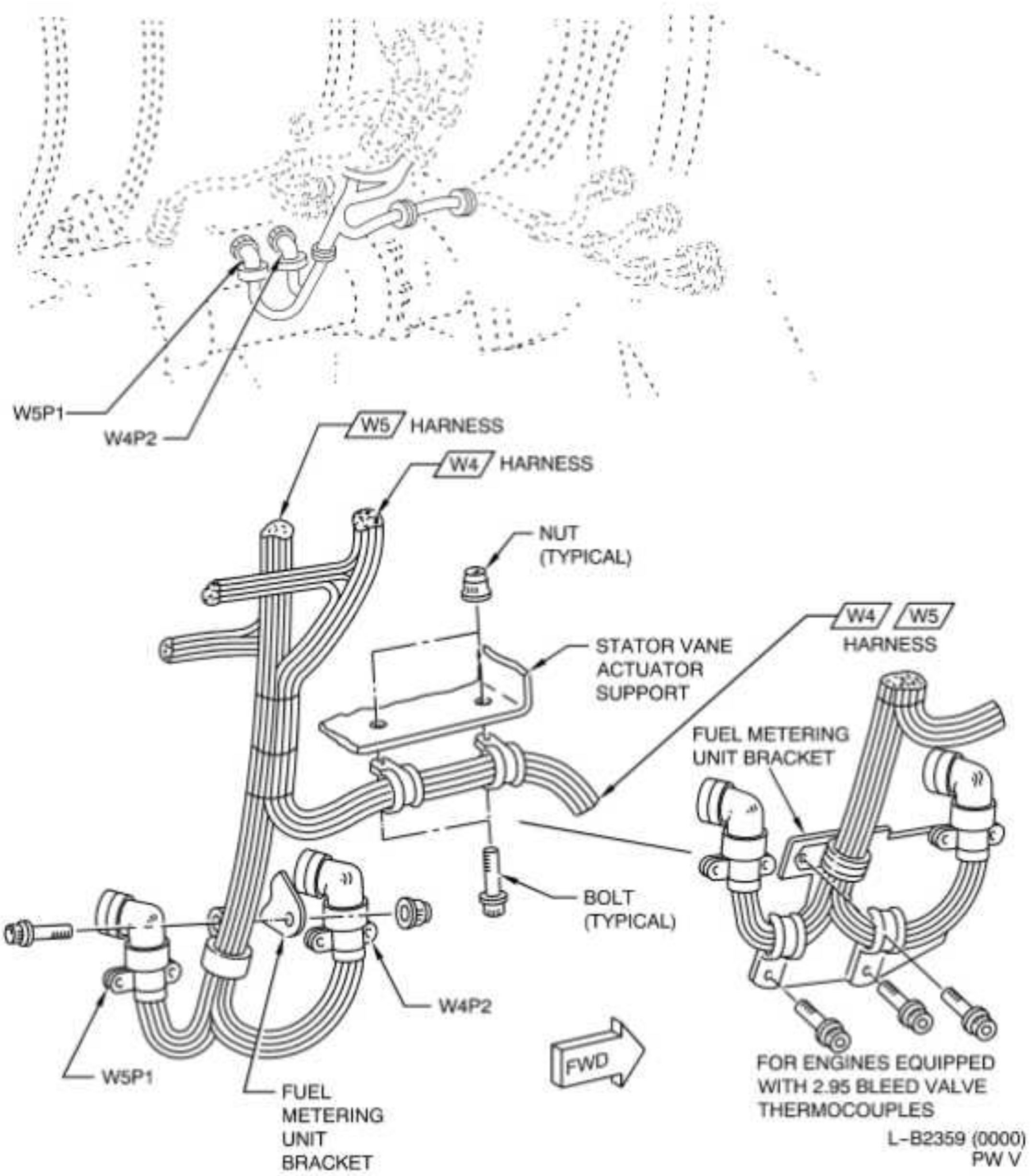
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 314 (Sheet 7)
(Task 72−00−34−050−020)


W5P8
W5P7
W4P3
FUEL DISTRIBUTION VALVE
FUEL FLOWMETER
W5 HARNESS
W4 HARNESS
NUT
W5P8
W5 HARNESS
W5P7
W4P3
FWD
L-A5757 (0000)
PW V

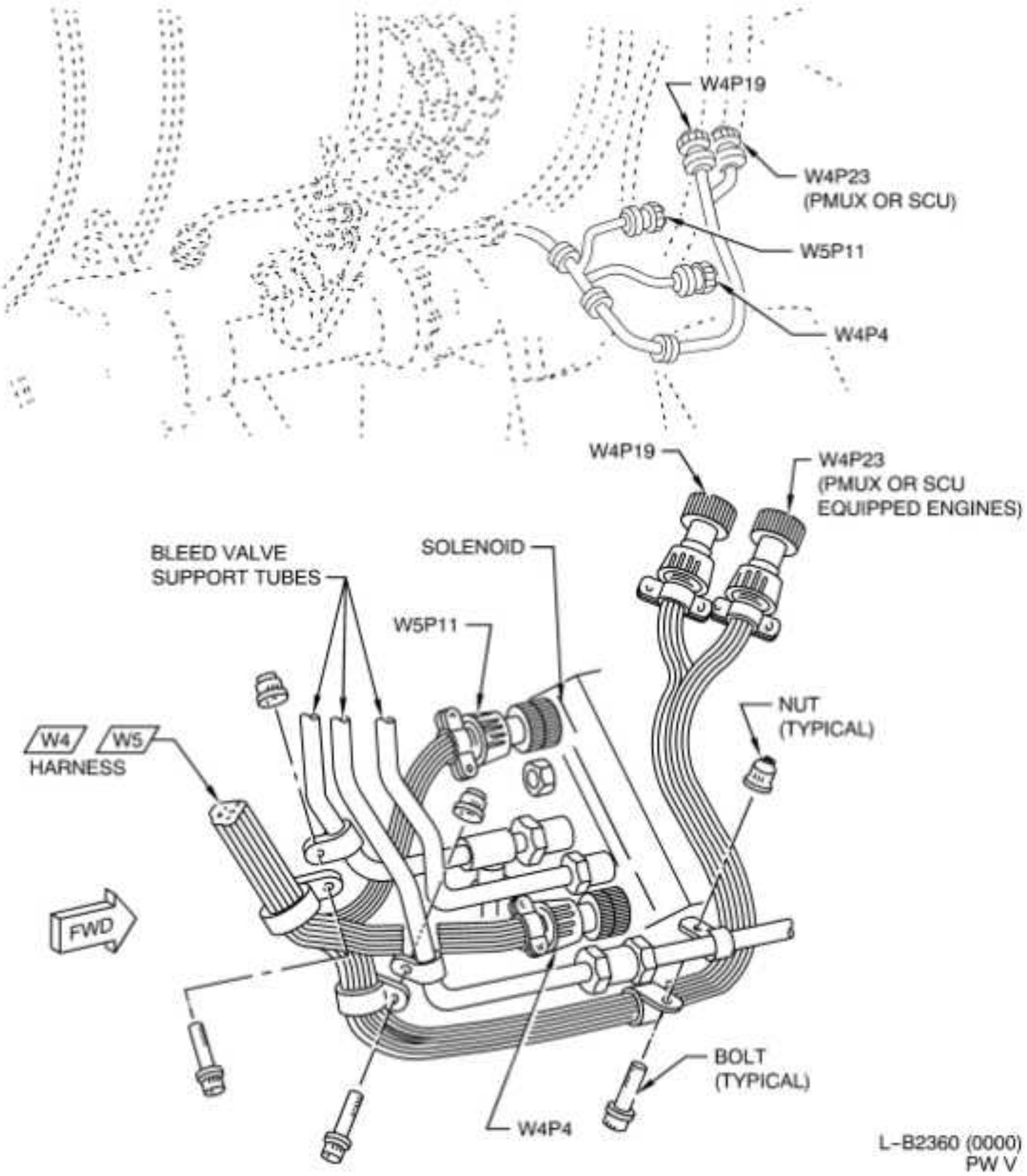
EEC Wiring Harness - W5 (Core Engine) (Pre SB PW4ENG 73-84)
Figure 315 (Sheet 1)
(Task 72-00-34-050-020)


W5P8
W5P7
W4P3
FUEL FLOWMETER
W5 HARNESS
W4 HARNESS
NUT (LARGE 2 PLACES)
NUT (SMALL 2 PLACES)
NUT
W5P8
W5P7
W4P3
FUEL FILTER BRACKET
W5 HARNESS
FWD
EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
L-B2358 (0000)
PW V

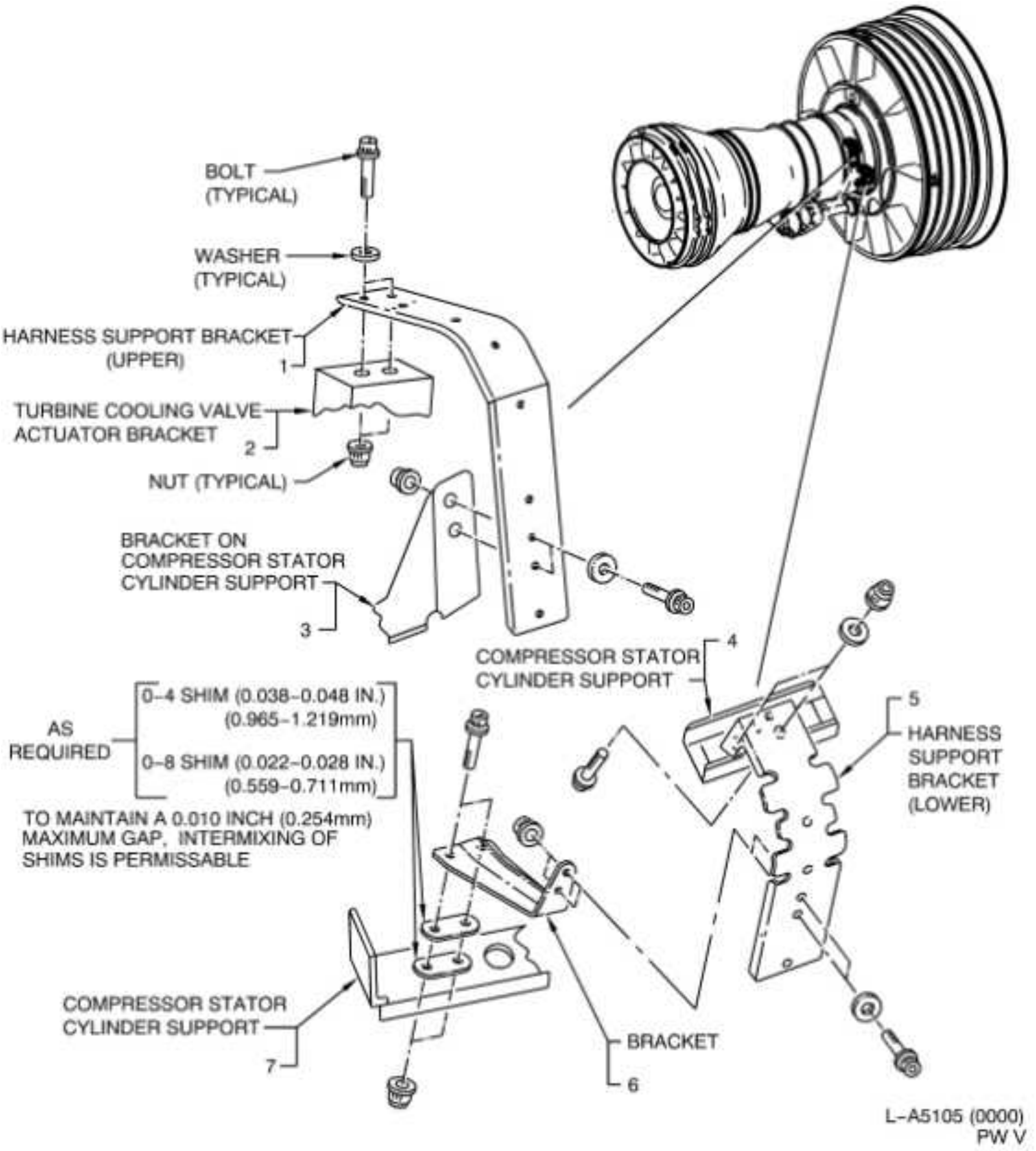
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−84, SB PW4ENG 72−572 Or SB PW4ENG 75−106) (For −3 Engines With CN After Engine Serial Number)
Figure 315 (Sheet 2)
(Task 72−00−34−050−020)


W5P1
W4P2
W5 HARNESS
W4 HARNESS
NUT (TYPICAL)
STATOR VANE ACTUATOR SUPPORT
W4 W5 HARNESS
FUEL METERING UNIT BRACKET
BOLT (TYPICAL)
W4P2
W5P1
FUEL METERING UNIT BRACKET
FWD
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES
L-B2359 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine)
Figure 316
(Task 72−00−34−050−020)


W4P19
W4P23
(PMUX OR SCU)
W5P11
W4P4
W4P19
W4P23
(PMUX OR SCU
EQUIPPED ENGINES)
BLEED VALVE
SUPPORT TUBES
SOLENOID
W5P11
W4
W5
HARNESS
NUT
(TYPICAL)
FWD
BOLT
(TYPICAL)
W4P4
L-B2360 (0000)
PW V

EEC Wiring Harness - W5 (Core Engine)
Figure 317
(Task 72-00-34-050-020)


BOLT (TYPICAL)
WASHER (TYPICAL)
HARNESS SUPPORT BRACKET (UPPER)
1
TURBINE COOLING VALVE ACTUATOR BRACKET
2
NUT (TYPICAL)
BRACKET ON COMPRESSOR STATOR CYLINDER SUPPORT
3
COMPRESSOR STATOR CYLINDER SUPPORT
4
5
HARNESS SUPPORT BRACKET (LOWER)
AS REQUIRED
0−4 SHIM (0.038−0.048 IN.) (0.965−1.219mm)
0−8 SHIM (0.022−0.028 IN.) (0.559−0.711mm)
TO MAINTAIN A 0.010 INCH (0.254mm) MAXIMUM GAP, INTERMIXING OF SHIMS IS PERMISSABLE
COMPRESSOR STATOR CYLINDER SUPPORT
7
BRACKET
6
L−A5105 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine) Support Brackets
Figure 318
(Task 72−00−34−050−020)

ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−23

Task 72−00−34−050−024:

1. Remove EEC Wiring Harness − W5 (Core Engine)

A. General

(1) To remove the EEC wiring harness − W3, see 72−00−34, Removal−18 (Task 72−00−34−050−018).

(2) To remove the EEC wiring harness − W4, see 72−00−34, Removal−19 (Task 72−00−34−050−019).

B. Equipment And Materials Required

Special Tools:

PWA 85749	Torque Adapter, Electronic Harness Connector

C. Procedure

See Figure 301, Figure 302, Figure 303, Figure 304, Figure 305, Figure 306, Figure 307, Figure 308, Figure 309, Figure 310, Figure 311, Figure 312, Figure 313, Figure 314, Figure 315, Figure 316, Figure 317 and, Figure 318.

CAUTION: DO NOT TWIST OR BEND THE HARNESS BADLY DURING THE REMOVAL, OR DAMAGE TO THE HARNESS CAN OCCUR.

NOTE: Items referred to as numbers in parenthesis in text are identified in Figure 317.

(1) Disconnect the W2P26 harness connector from the W5J26 harness connector located at the 11:30 o'clock position on the HPC case. Remove the two bolts and the harness bracket attaching the W5J26 harness connector flange to the HPC case bracket. Remove the connector from the bracket. Install a protective closure on each harness connector. See Figure 302 and Figure 303.

(2) (Pre SB PW4ENG 73−163) Disconnect the W6P12 harness connector from the W5J12 harness connector located on Flange K at the 3:30 o'clock position. Remove the two (2) bolts and harness bracket attaching the W5J12 harness connector flange to the Flange K bracket. Remove the connector from the bracket. Install a protective closure on each harness connector. See Figure 302 and Figure 303.

(3) (Post SB PW4ENG 73−163) Disconnect the W6P12 harness connector from the W5J12 harness connector located on the TCA tube flange bracket at the 3:30 o'clock position as follows. See Figure 309 and Figure 314 (Sheet 2):

(a) (Post SB PW4ENG 73−192) Loosen clamp that attaches the cooling hose to the cooling shield around the W5J12 connector. Remove cooling hose from the cooling shield.

NOTE: Pre SB PW4ENG 73−192 engines do not have W5/W6 wiring harness connector cooling.

(b) (Post SB PW4ENG 73−192) Loosen and remove the clamp attaching the two halves of the cooling shield around the W5J12 connector. Remove the shields and clamp from the connector.

(c) If necessary, remove or loosen bolt and clamp attaching wiring harness to the loop clamp bracket.

(d) Disconnect the W6P12 harness connector from the W5J12 harness connector.

(e) Remove the three (3) bolts and the loop clamp bracket that attach the W5J12 harness connector to the TCA tube flange bracket. Remove the connector from the bracket. Install a protective closure on each harness connector.

(4) For engines equipped with 2.95 Bleed Valve Thermocouple only: Disconnect the W7P13 harness connector from the W5J13 harness connector located on a bracket on the right side of the main gearbox. Remove the two bolts and the harness bracket that attaches the W5J13 harness connector flange to the main gearbox bracket. Remove the connector from the bracket. Install a protection cover on each harness connector. See Figure 314.

(5) Disconnect the following harness connectors from the components given below. Install a protective closure on each harness connector and mating receptacle. See Figure 302 and Figure 310.

Connector	Component	Location
W5P5	Fuel/Oil Cooler Bypass Valve Solenoid (Rear Connector)	8 O'clock
W5P6	EEC Alternator (Lower Connector)	Bottom of Gearbox 7 O'clock

NOTE: Use a PWA 85749 Electronic Harness Connector Torque Adapter to disconnect the W5P6 harness connector.

Connector	Component	Location
W5P7	Variable Stator Vane Actuator (Top Connector)	4 O'clock
W5P11	Ninth Stage Start/Stability (2.9) Bleed Valve Solenoid (Inboard Connector)	Intermediate Case 5 O'clock

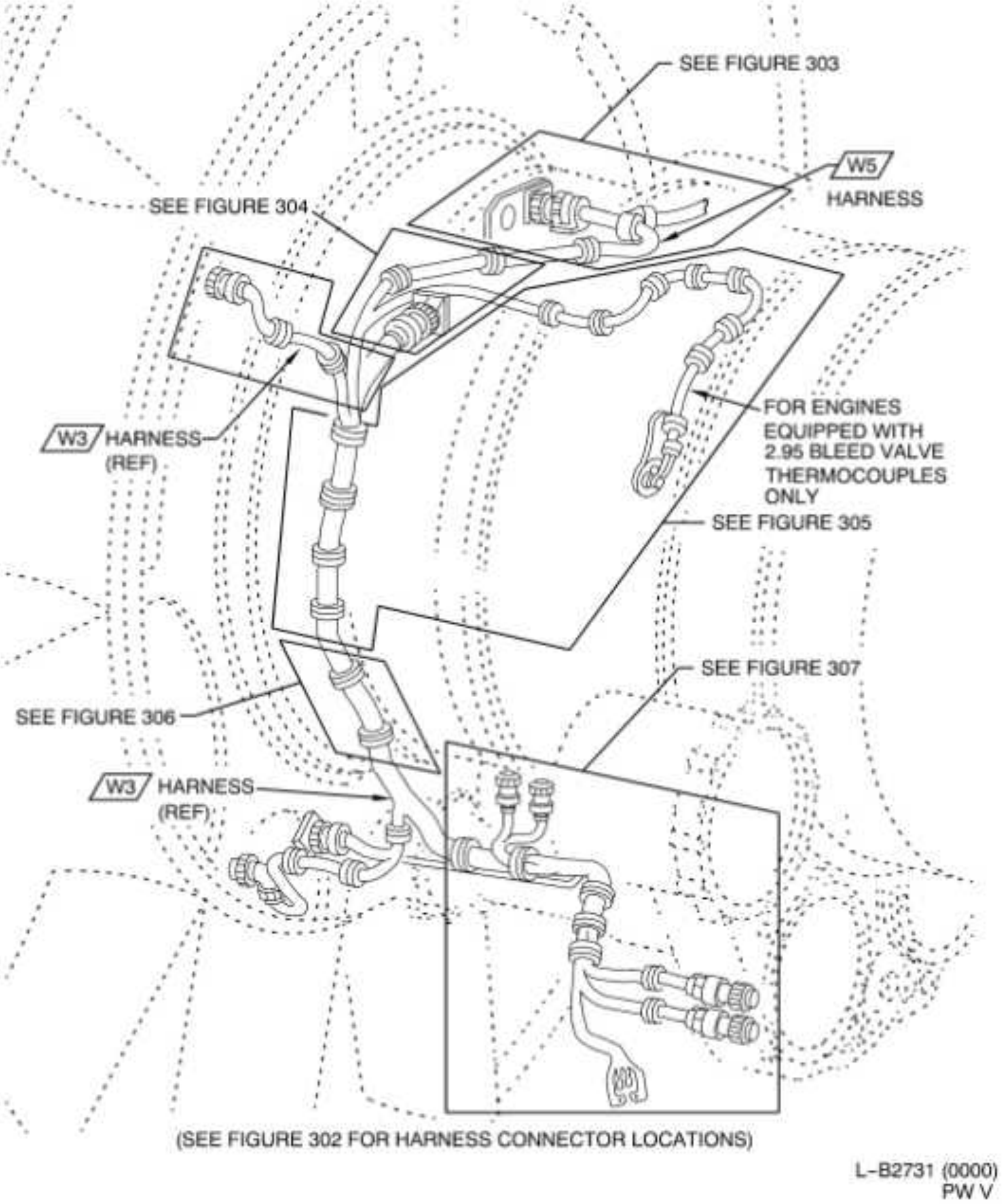
NOTE: Use a PWA 85749 Electronic Harness Connector Torque Adapter to disconnect the W5P11 harness connector.

Connector	Component	Location
W5P1	Fuel Metering Unit (Rear Connector)	Front Of Fuel Pump 5 O'clock
W5P8	EEC Fuel	Fuel Pump Housing 4:30 O'clock

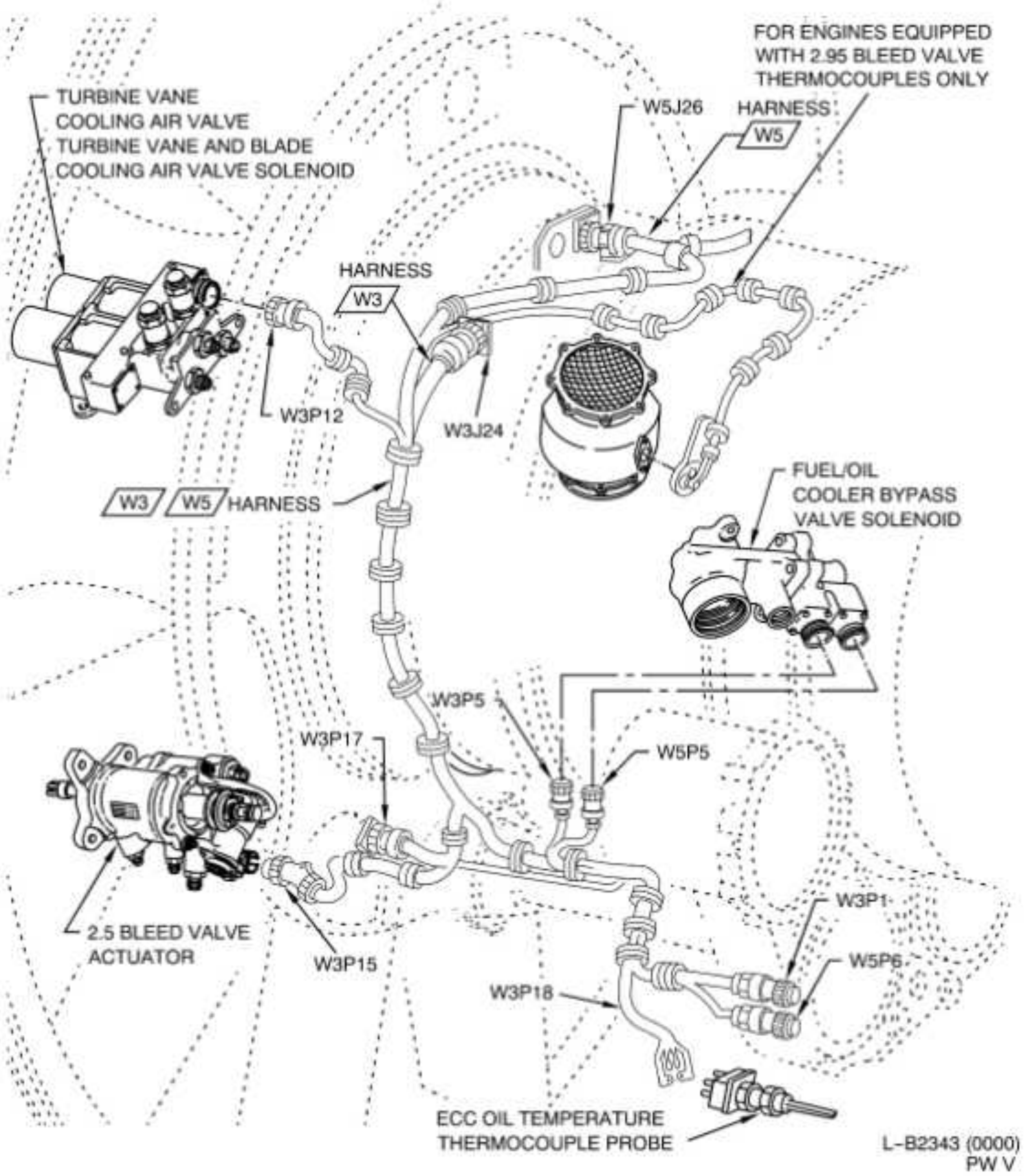
(6) Remove the bolts, nuts, and clamps that attach the W5 harness to the brackets and tubes on the HPC case and the gearbox. See Figure 303, Figure 304, Figure 305, Figure 306, Figure 307, Figure 308 and Figure 311 Figure 312, Figure 313, Figure 314, Figure 315, Figure 316 and, Figure 317.

(7) Remove the applicable harness ties and carefully remove the W5 harness.

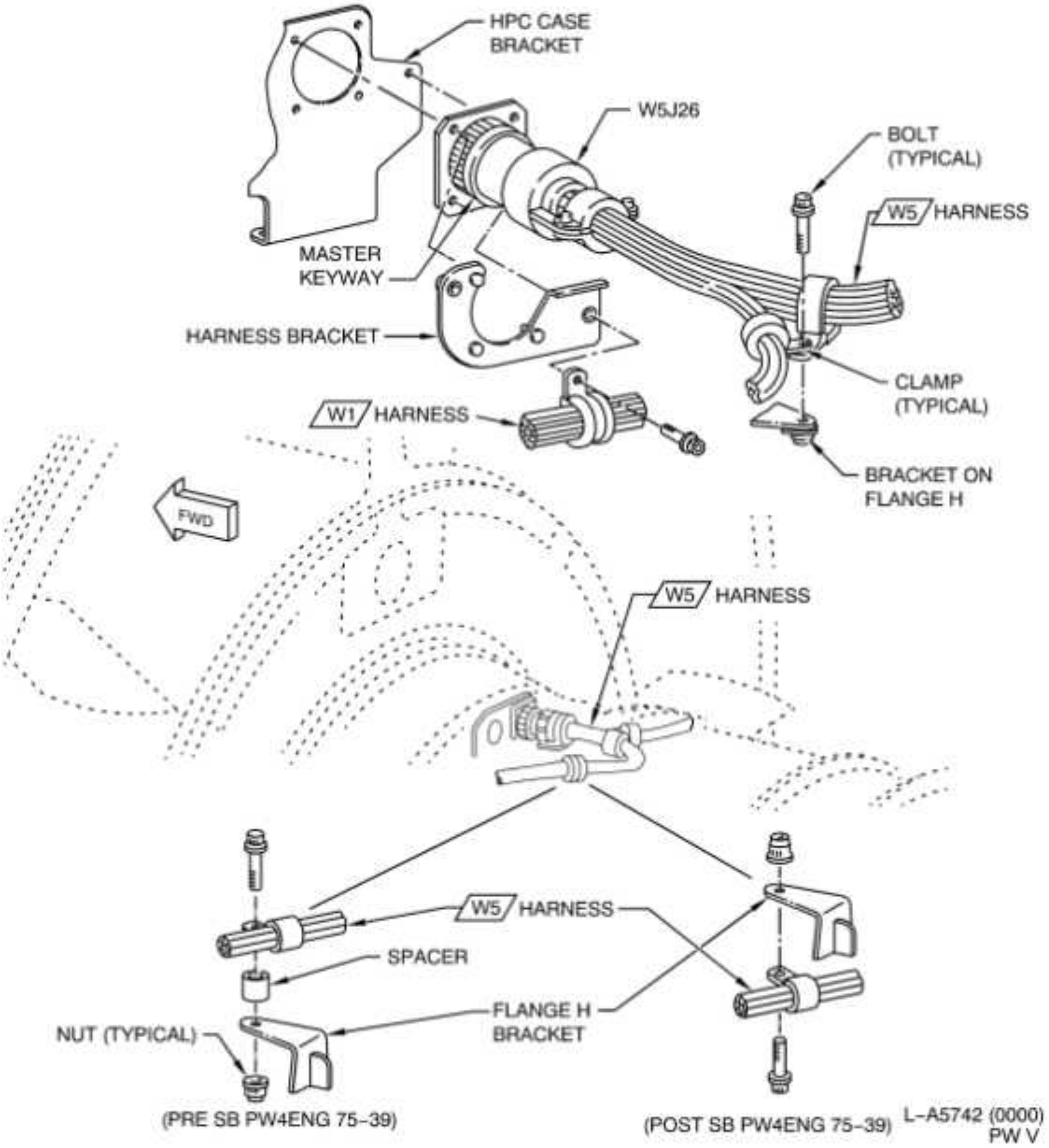
(8) If engine disassembly is required, remove the bolts, nuts, and washers that attach the top and lower harness support brackets (318/1, 318/5) to the right side of the HPC case. Remove the brackets. See Figure 318.


SEE FIGURE 303
W5
HARNESS
SEE FIGURE 304
W3 HARNESS (REF)
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
SEE FIGURE 305
SEE FIGURE 307
SEE FIGURE 306
W3 HARNESS (REF)
(SEE FIGURE 302 FOR HARNESS CONNECTOR LOCATIONS)
L-B2731 (0000)
PW V

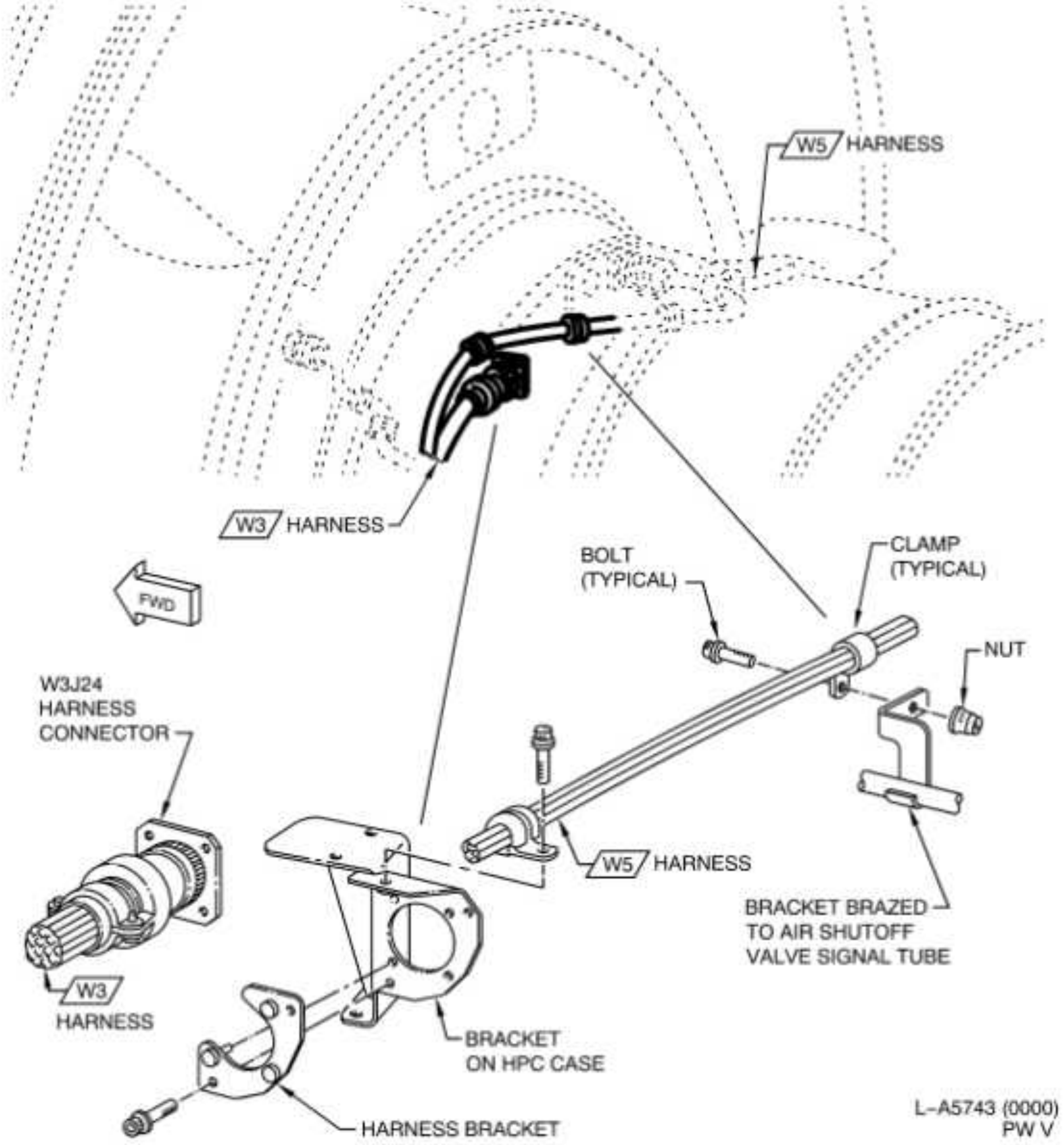
EEC Wiring Harness − W5 (Core Engine)
Figure 301
(Task 72−00−34−050−024)


FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
TURBINE VANE COOLING AIR VALVE
TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
W5J26
HARNESS
W5
HARNESS
W3
W3P12
W3J24
W3
W5
HARNESS
FUEL/OIL COOLER BYPASS VALVE SOLENOID
W3P5
W3P17
W5P5
2.5 BLEED VALVE ACTUATOR
W3P15
W3P1
W5P6
W3P18
ECC OIL TEMPERATURE THERMOCOUPLE PROBE
L-B2343 (0000)
PW V

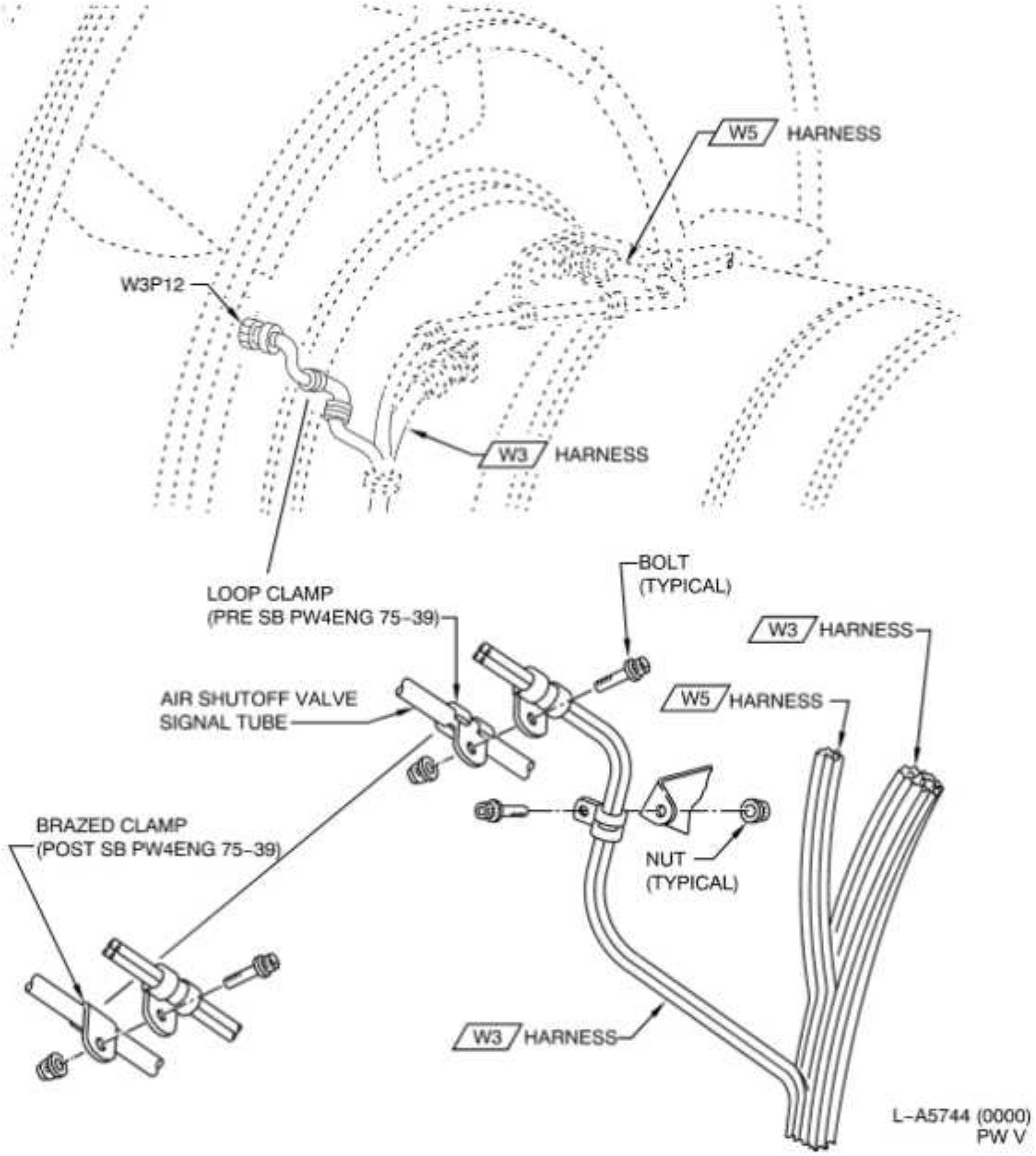
EEC Wiring Harness − W5 (Core Engine)
Figure 302
(Task 72−00−34−050−024)


HPC CASE BRACKET
W5J26
BOLT (TYPICAL)
W5 HARNESS
MASTER KEYWAY
HARNESS BRACKET
CLAMP (TYPICAL)
W1 HARNESS
BRACKET ON FLANGE H
FWD
W5 HARNESS
W5 HARNESS
SPACER
FLANGE H BRACKET
NUT (TYPICAL)
(PRE SB PW4ENG 75-39)
(POST SB PW4ENG 75-39)
L-A5742 (0000)
PW V

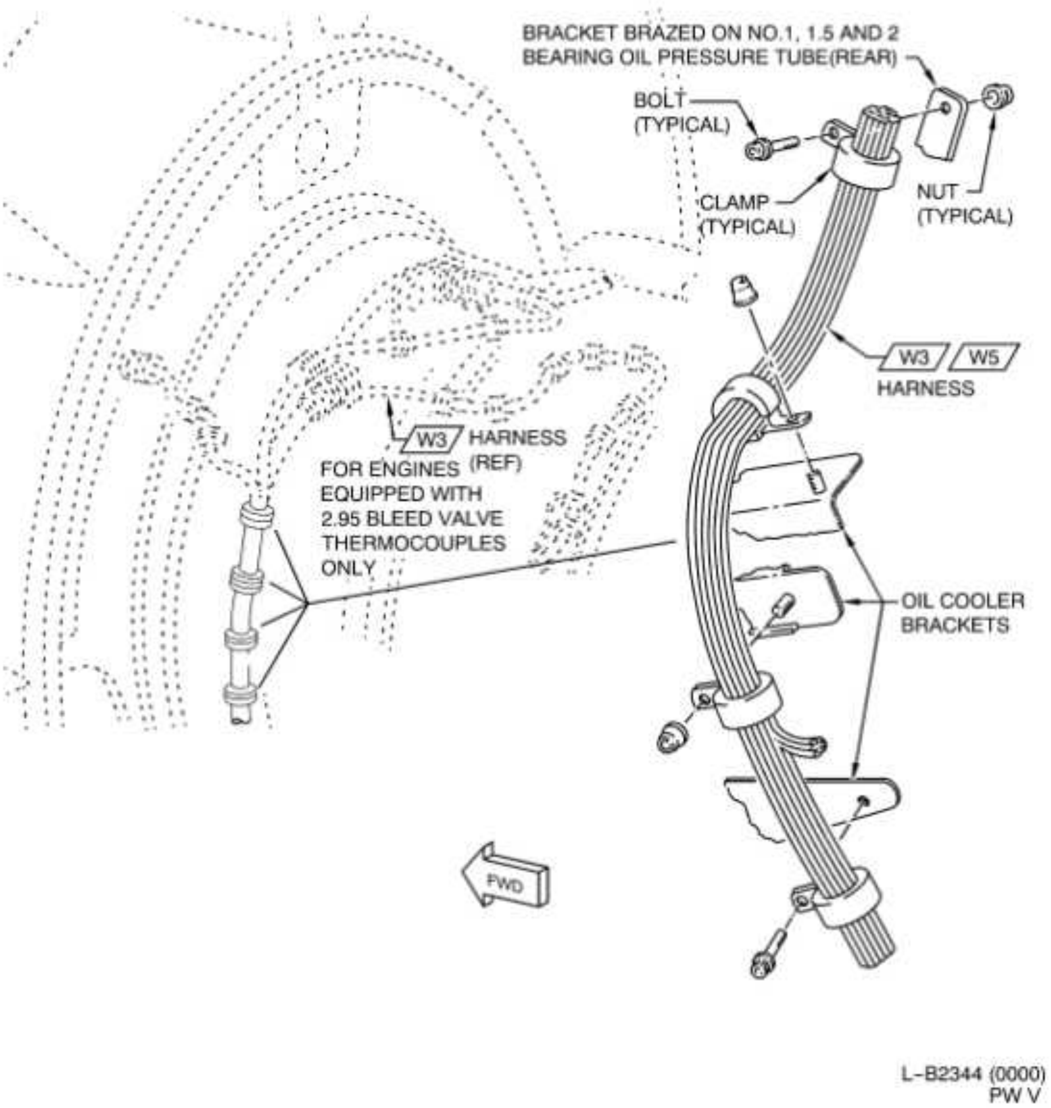
EEC Wiring Harness – W5 (Core Engine)
Figure 303
(Task 72–00–34–050–024)


W5 HARNESS
W3 HARNESS
FWD
BOLT (TYPICAL)
CLAMP (TYPICAL)
NUT
W3J24 HARNESS CONNECTOR
W5 HARNESS
BRACKET BRAZED TO AIR SHUTOFF VALVE SIGNAL TUBE
W3 HARNESS
BRACKET ON HPC CASE
HARNESS BRACKET
L−A5743 (0000)
PW V

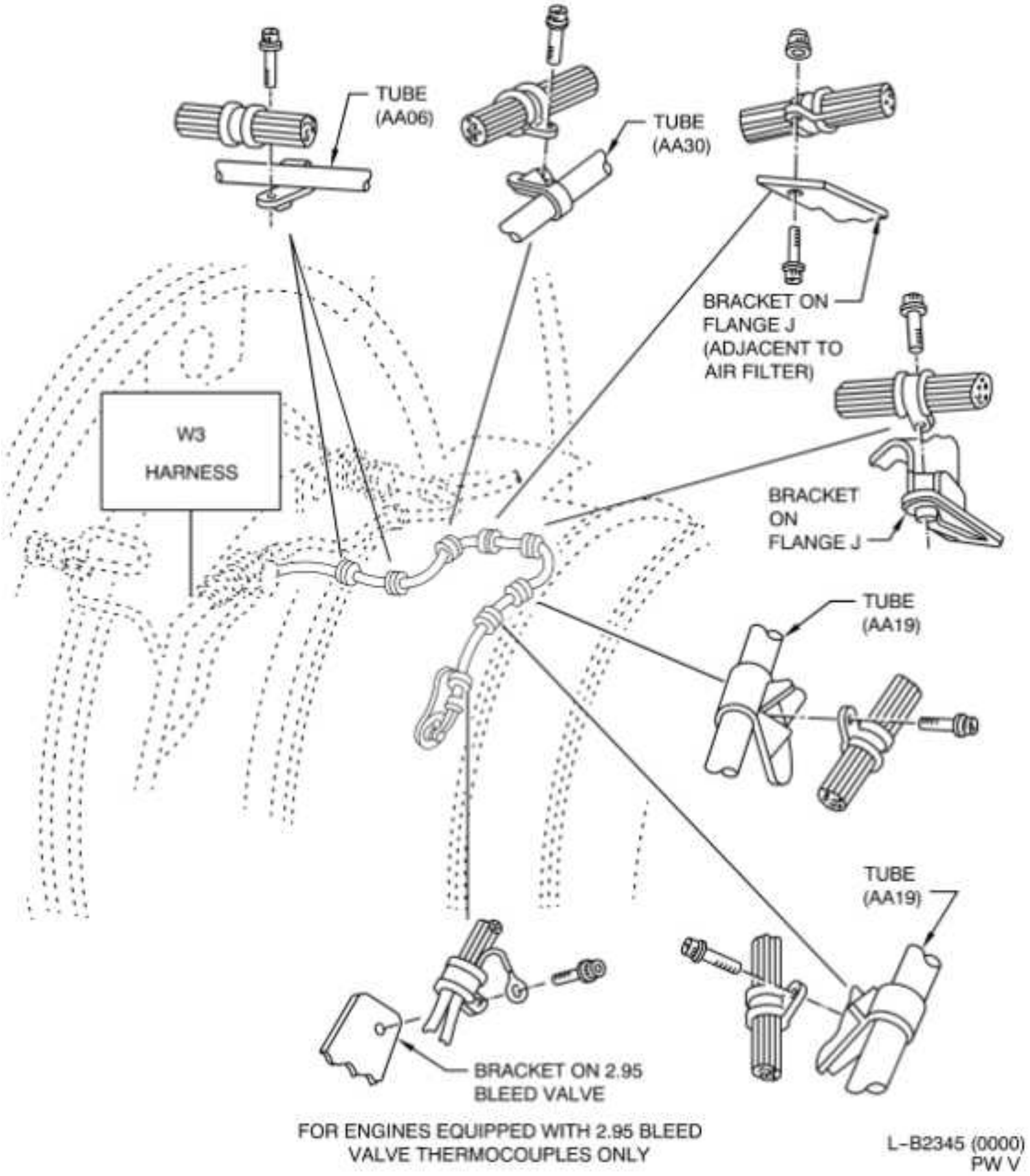
EEC Wiring Harness − W5 (Core Engine)
Figure 304
(Task 72−00−34−050−024)


W5 HARNESS
W3P12
W3 HARNESS
LOOP CLAMP
(PRE SB PW4ENG 75-39)
BOLT
(TYPICAL)
W3 HARNESS
AIR SHUTOFF VALVE
SIGNAL TUBE
W5 HARNESS
BRAZED CLAMP
(POST SB PW4ENG 75-39)
NUT
(TYPICAL)
W3 HARNESS
L-A5744 (0000)
PW V

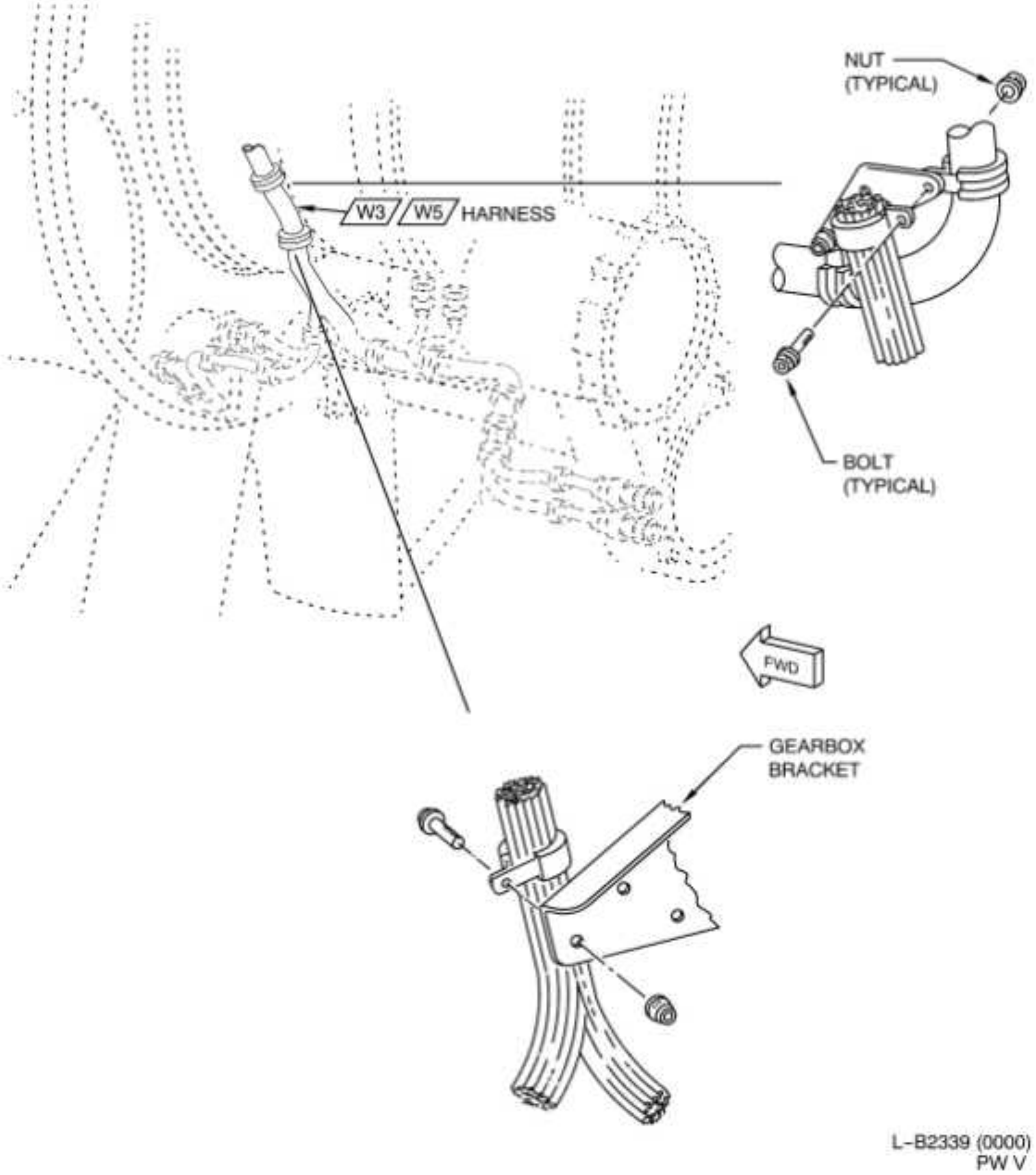
EEC Wiring Harness - W5 (Core Engine)
Figure 305
(Task 72-00-34-050-024)


BRACKET BRAZED ON NO.1, 1.5 AND 2
BEARING OIL PRESSURE TUBE(REAR)
BOLT
(TYPICAL)
CLAMP
(TYPICAL)
NUT
(TYPICAL)
W3 / W5
HARNESS
W3 HARNESS
(REF)
FOR ENGINES
EQUIPPED WITH
2.95 BLEED VALVE
THERMOCOUPLES
ONLY
OIL COOLER
BRACKETS
FWD
L-B2344 (0000)
PW V

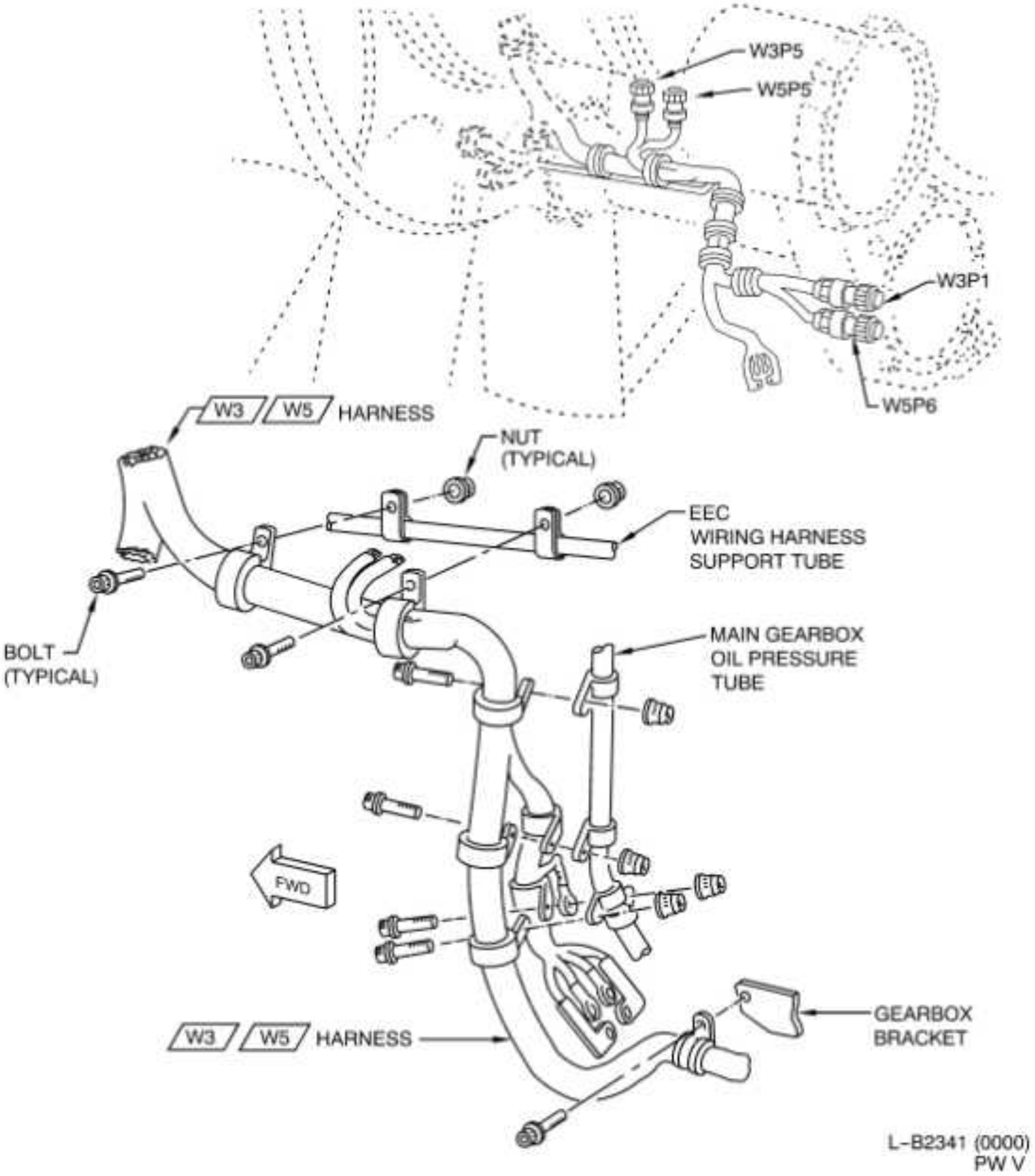
EEC Wiring Harness − W5 (Core Engine)
Figure 306 (Sheet 1)
(Task 72−00−34−050−024)


TUBE (AA06)
TUBE (AA30)
BRACKET ON FLANGE J (ADJACENT TO AIR FILTER)
W3 HARNESS
BRACKET ON FLANGE J
TUBE (AA19)
TUBE (AA19)
BRACKET ON 2.95 BLEED VALVE
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
L-B2345 (0000) PW V

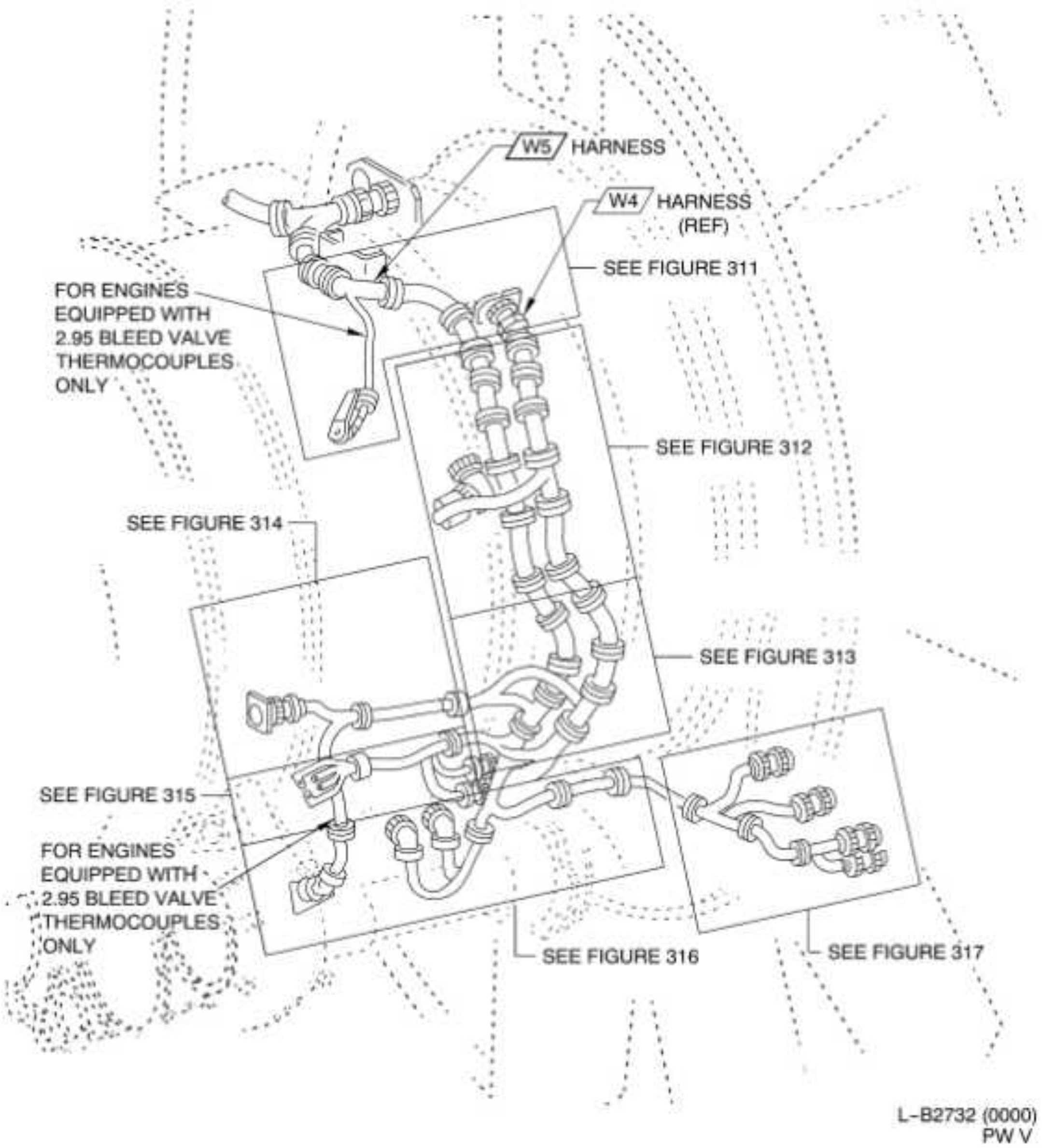
EEC Wiring Harness − W5 (Core Engine)
Figure 306 (Sheet 2)
(Task 72−00−34−050−024)


NUT
(TYPICAL)
W3
W5
HARNESS
BOLT
(TYPICAL)
FWD
GEARBOX
BRACKET
L-B2339 (0000)
PW V

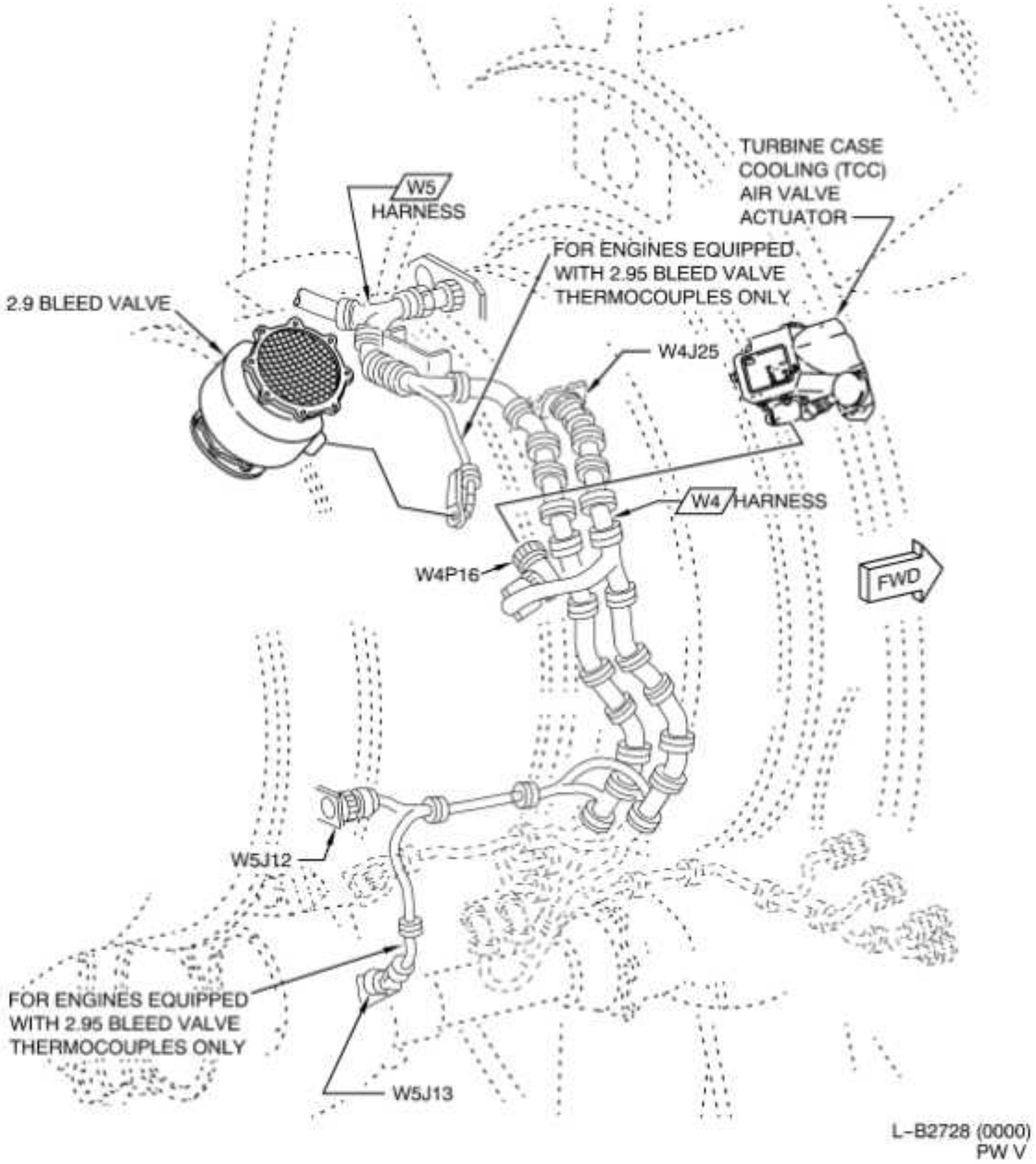
EEC Wiring Harness − W5 (Core Engine)
Figure 307
(Task 72−00−34−050−024)


W3P5
W5P5
W3P1
W5P6
W3 / W5 HARNESS
NUT (TYPICAL)
EEC WIRING HARNESS SUPPORT TUBE
BOLT (TYPICAL)
MAIN GEARBOX OIL PRESSURE TUBE
FWD
W3 / W5 HARNESS
GEARBOX BRACKET
L-B2341 (0000)
PW V

EEC Wiring Harness - W5 (Core Engine)
Figure 308
(Task 72-00-34-050-024)

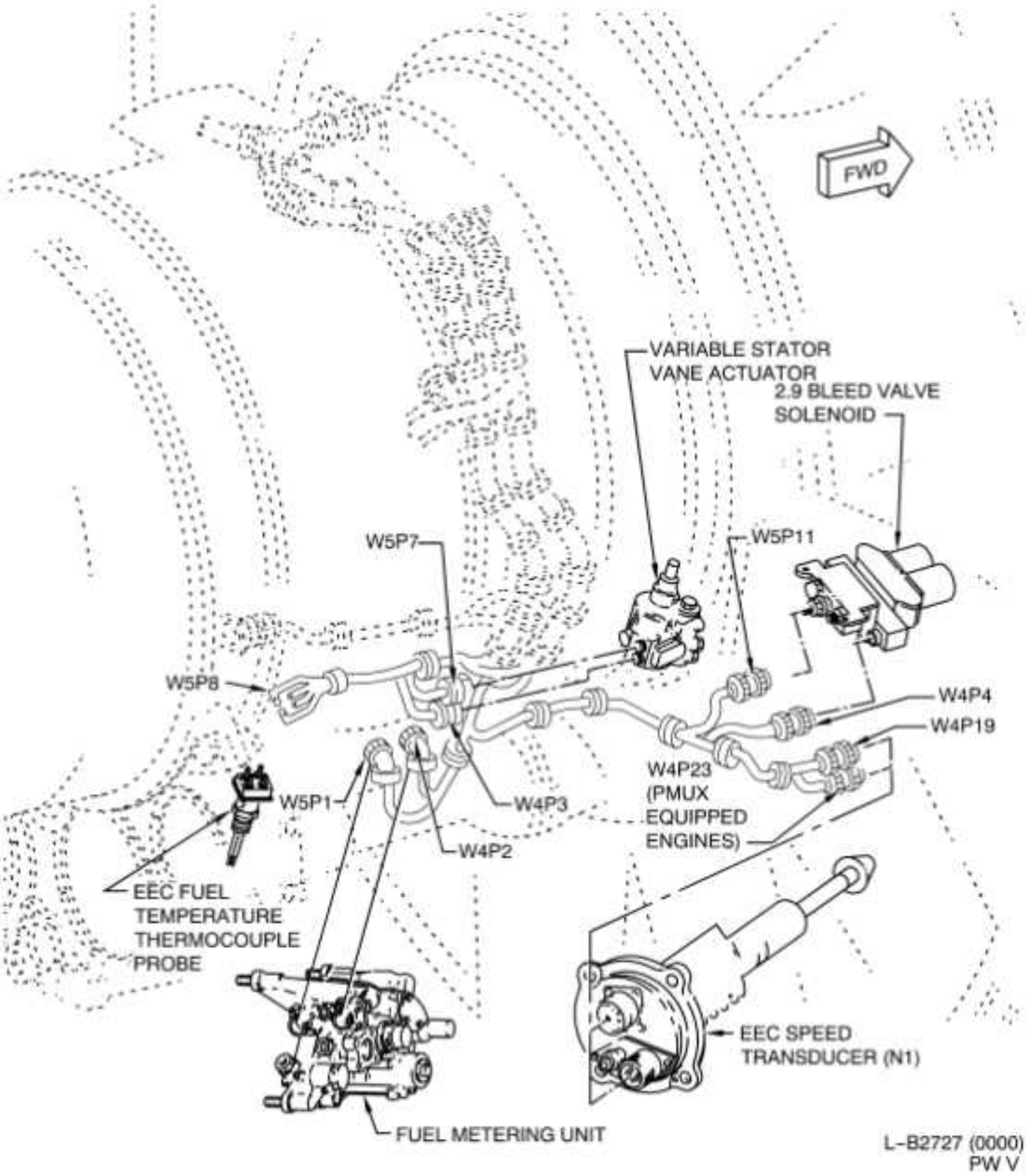

W5 HARNESS
W4 HARNESS (REF)
SEE FIGURE 311
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
SEE FIGURE 312
SEE FIGURE 314
SEE FIGURE 313
SEE FIGURE 315
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
SEE FIGURE 316
SEE FIGURE 317
L−B2732 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine)
Figure 309
(Task 72−00−34−050−024)

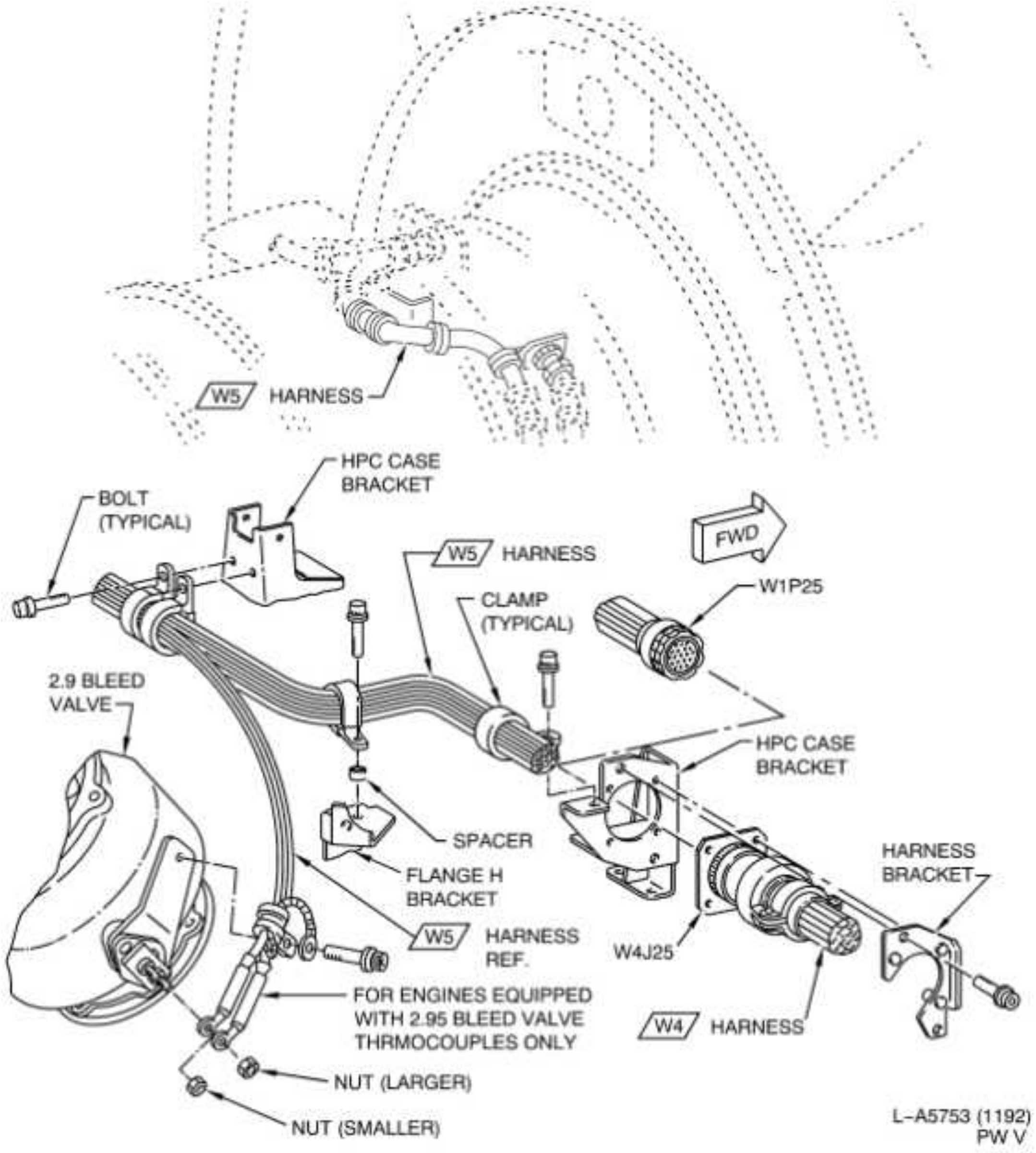

TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
W5 HARNESS
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
2.9 BLEED VALVE
W4J25
W4 HARNESS
W4P16
FWD
W5J12
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5J13
L-B2728 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine)
Figure 310 (Sheet 1)
(Task 72−00−34−050−024)

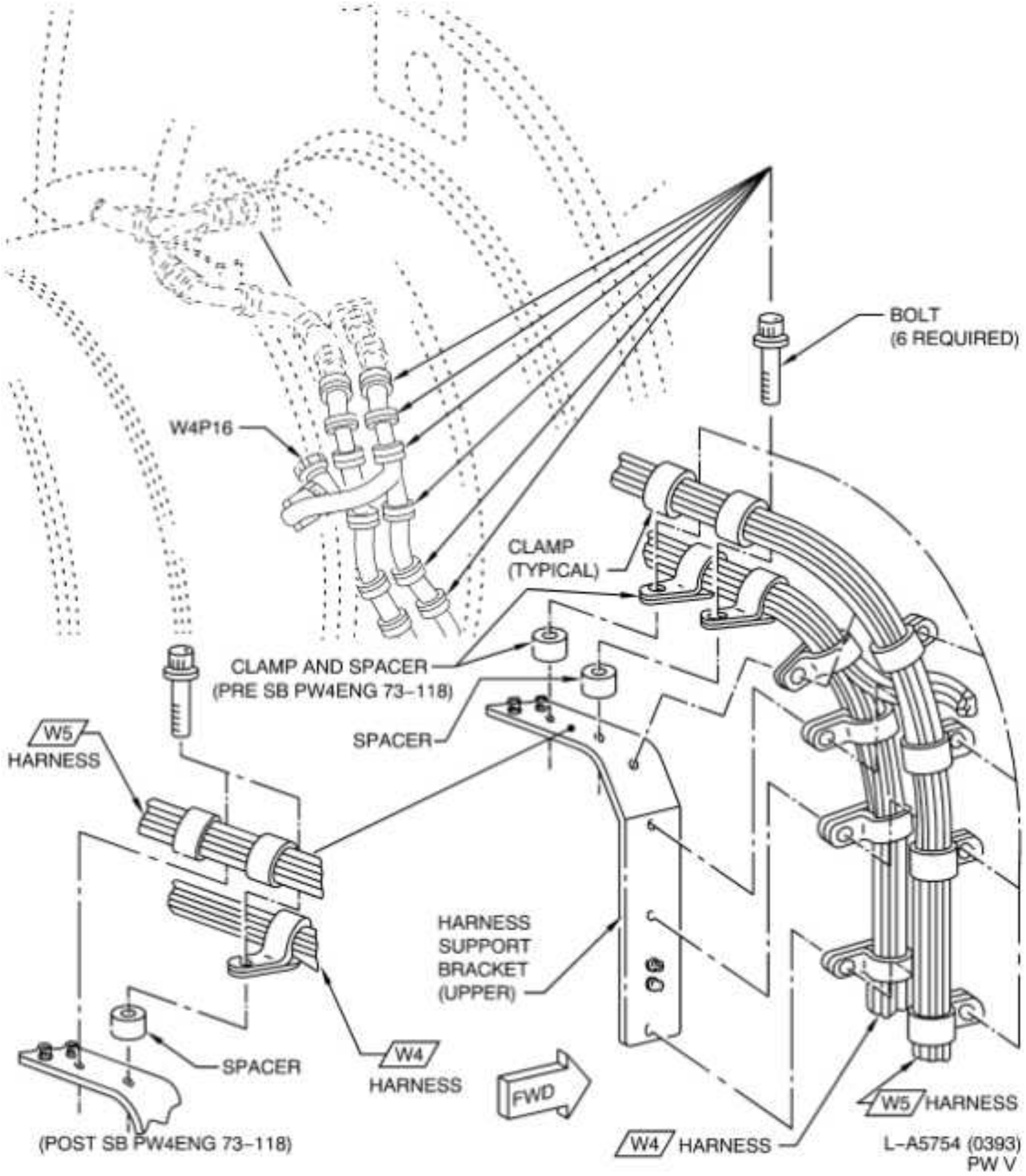
ENGINE GENERAL − INTERMEDIATE CASE − REMOVAL−23


FWD
VARIABLE STATOR VANE ACTUATOR
2.9 BLEED VALVE SOLENOID
W5P7
W5P11
W5P8
W4P4
W4P19
W4P23 (PMUX EQUIPPED ENGINES)
W5P1
W4P3
W4P2
EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
EEC SPEED TRANSDUCER (N1)
FUEL METERING UNIT
L-B2727 (0000)
PW V

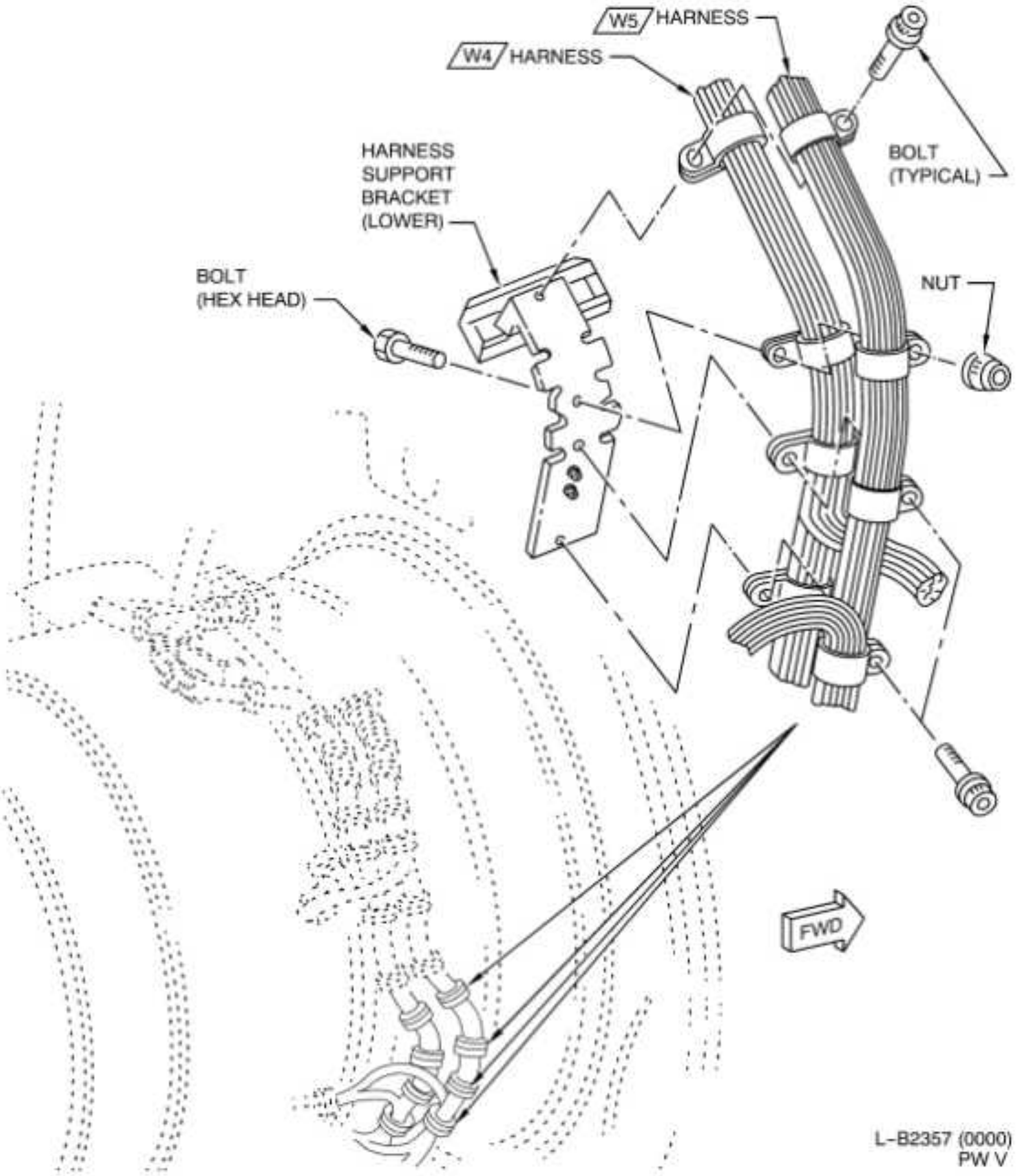
EEC Wiring Harness − W5 (Core Engine)
Figure 310 (Sheet 2)
(Task 72−00−34−050−024)


W5 HARNESS
HPC CASE BRACKET
BOLT (TYPICAL)
W5 HARNESS
FWD
CLAMP (TYPICAL)
W1P25
2.9 BLEED VALVE
HPC CASE BRACKET
SPACER
FLANGE H BRACKET
HARNESS BRACKET
W5 HARNESS REF.
W4J25
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THRMOCOUPLES ONLY
W4 HARNESS
NUT (LARGER)
NUT (SMALLER)
L−A5753 (1192)
PW V

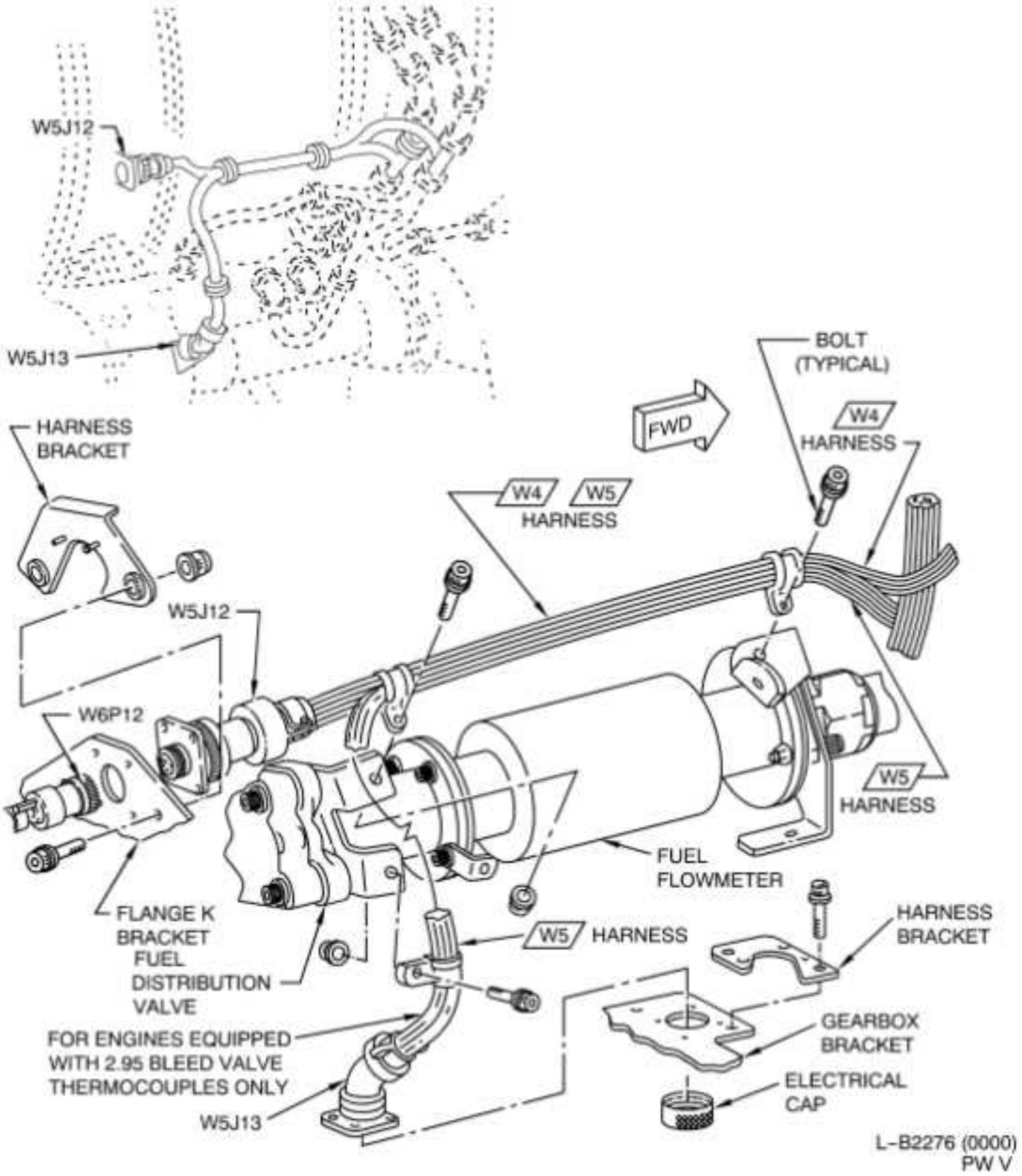
EEC Wiring Harness − W5 (Core Engine)
Figure 311
(Task 72−00−34−050−024)


BOLT
(6 REQUIRED)
W4P16
CLAMP
(TYPICAL)
CLAMP AND SPACER
(PRE SB PW4ENG 73−118)
SPACER
W5
HARNESS
HARNESS
SUPPORT
BRACKET
(UPPER)
SPACER
W4
HARNESS
FWD
(POST SB PW4ENG 73−118)
W4 HARNESS
W5 HARNESS
L−A5754 (0393)
PW V

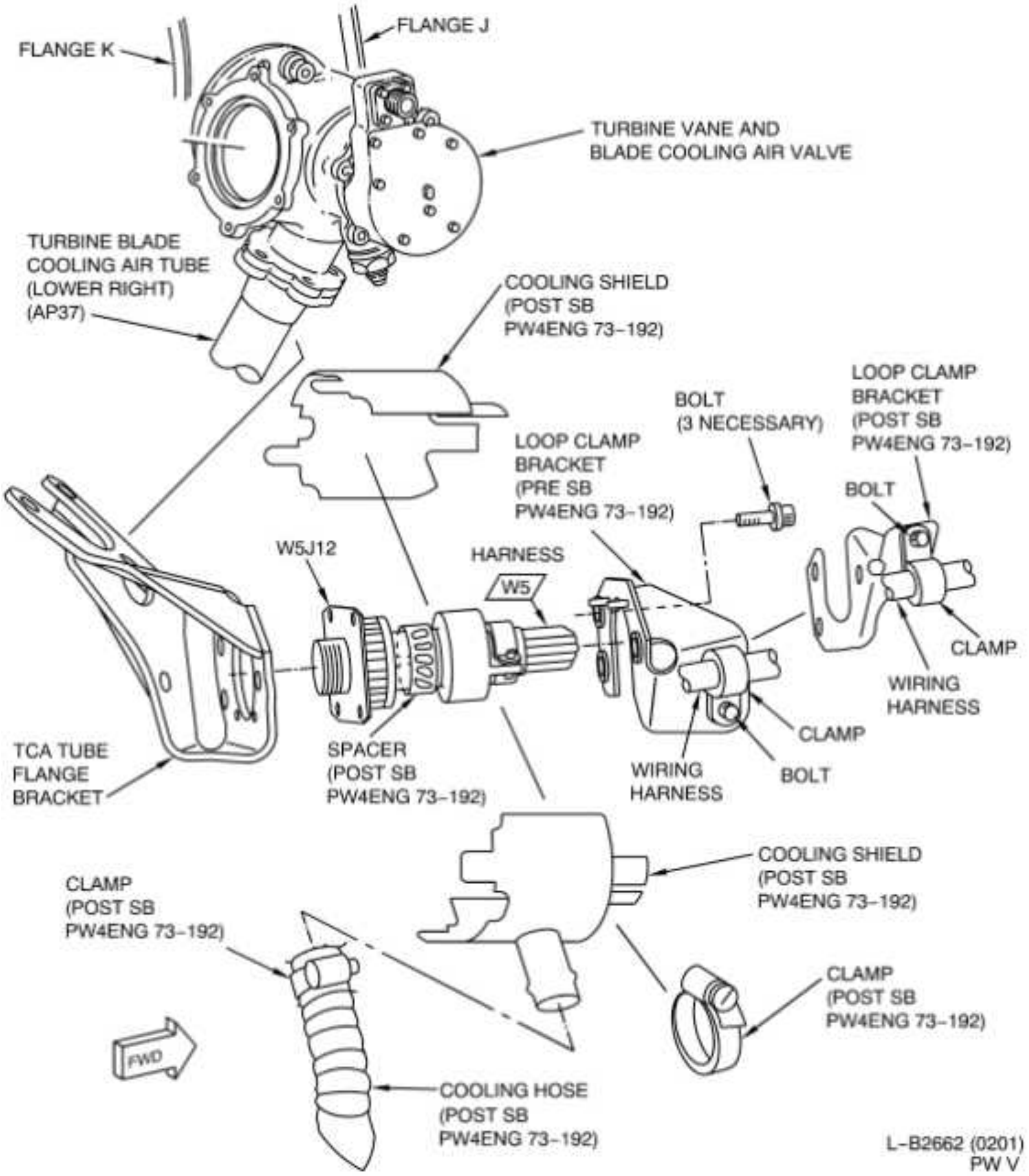
EEC Wiring Harness − W5 (Core Engine)
Figure 312
(Task 72−00−34−050−024)


W5 HARNESS
W4 HARNESS
HARNESS SUPPORT BRACKET (LOWER)
BOLT (TYPICAL)
BOLT (HEX HEAD)
NUT
FWD
L-B2357 (0000)
PW V

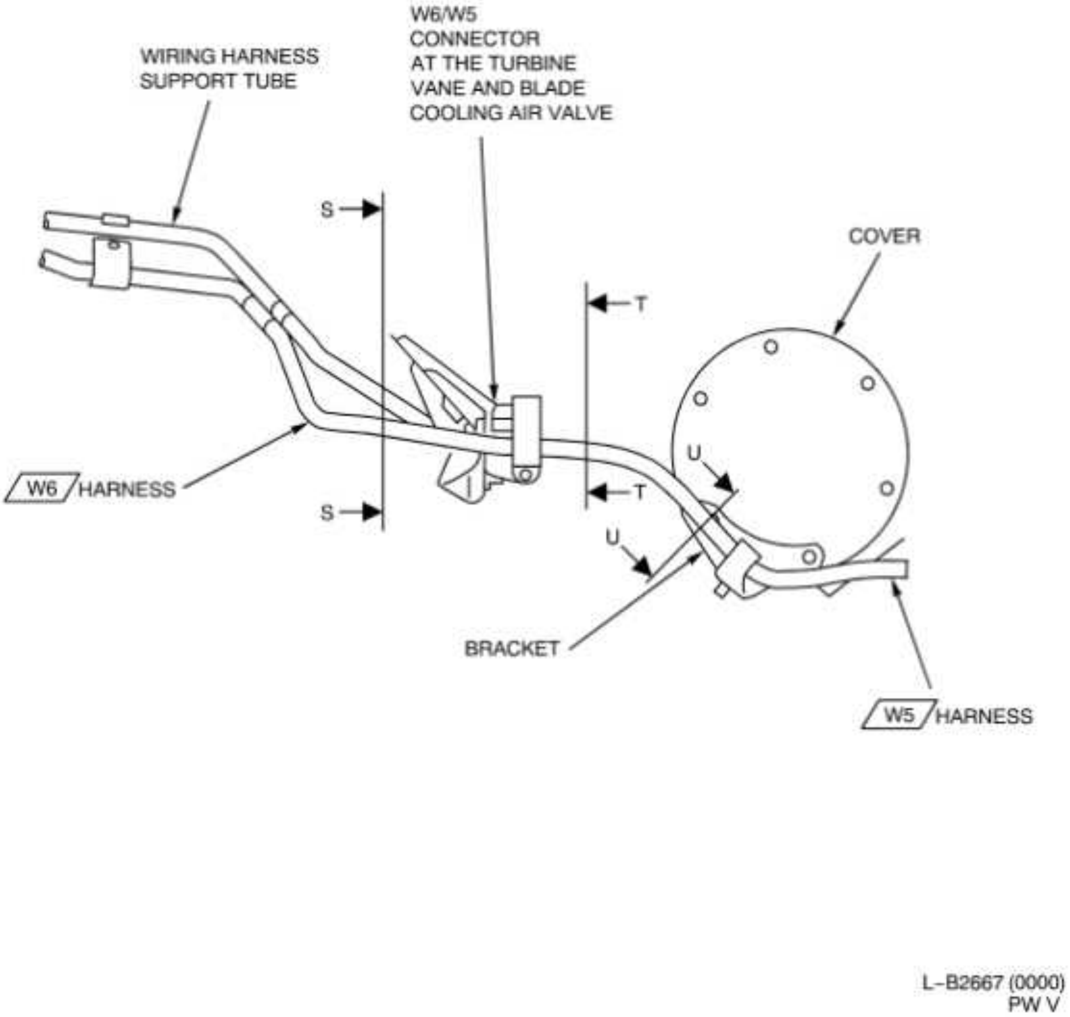
EEC Wiring Harness − W5 (Core Engine)
Figure 313
(Task 72−00−34−050−024)


W5J12
W5J13
BOLT (TYPICAL)
FWD
W4 HARNESS
HARNESS BRACKET
W4 W5 HARNESS
W5J12
W6P12
W5 HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
GEARBOX BRACKET
ELECTRICAL CAP
W5J13
L-B2276 (0000)
PW V

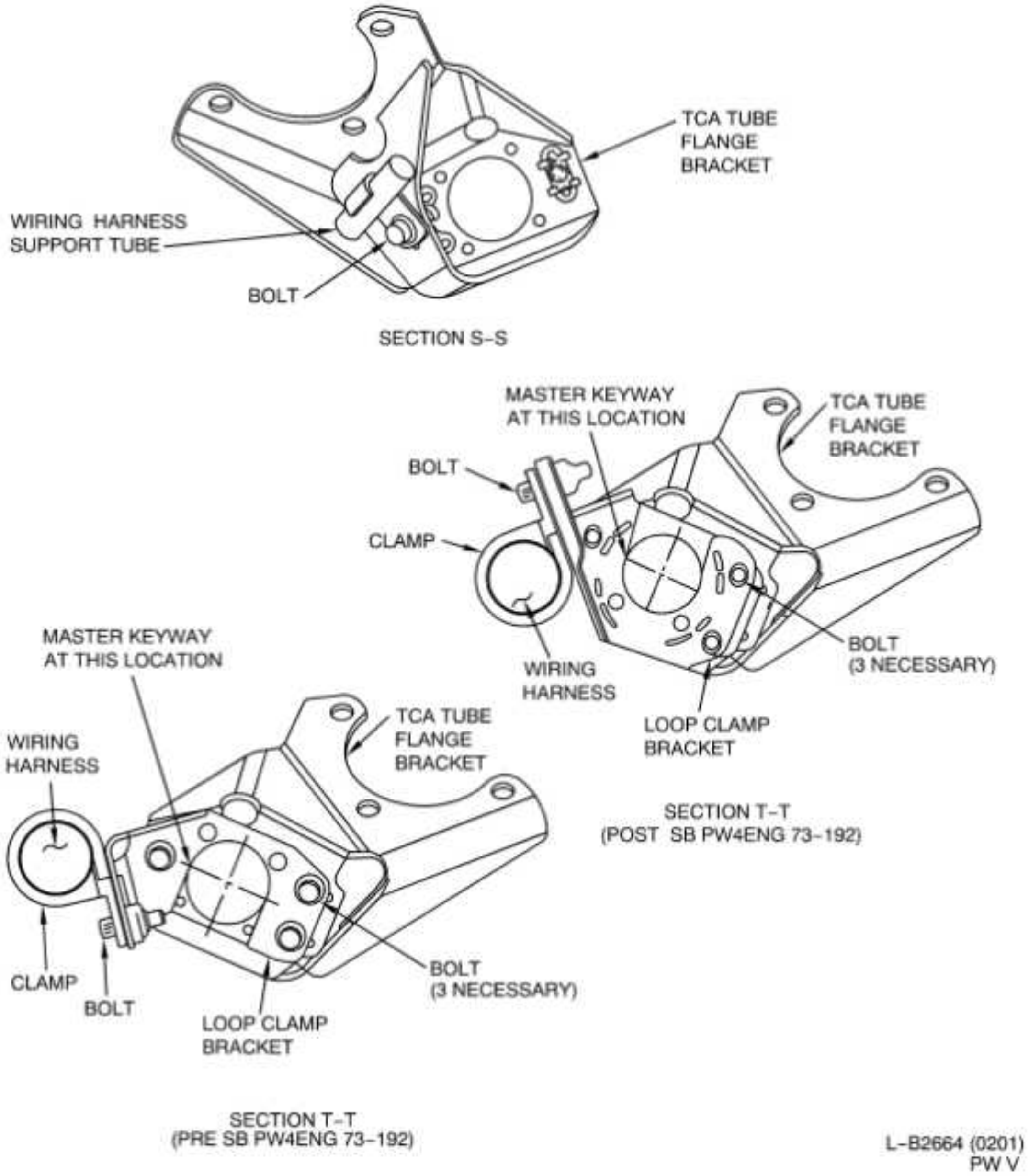
EEC Wiring Harness − W5 (Core Engine) (Pre SB PW4ENG 73−163)
Figure 314 (Sheet 1)
(Task 72−00−34−050−024)


FLANGE K
FLANGE J
TURBINE VANE AND BLADE COOLING AIR VALVE
TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT) (AP37)
COOLING SHIELD (POST SB PW4ENG 73−192)
LOOP CLAMP BRACKET (POST SB PW4ENG 73−192)
BOLT (3 NECESSARY)
LOOP CLAMP BRACKET (PRE SB PW4ENG 73−192)
BOLT
W5J12
HARNESS
W5
CLAMP
WIRING HARNESS
CLAMP
TCA TUBE FLANGE BRACKET
SPACER (POST SB PW4ENG 73−192)
WIRING HARNESS
BOLT
COOLING SHIELD (POST SB PW4ENG 73−192)
CLAMP (POST SB PW4ENG 73−192)
CLAMP (POST SB PW4ENG 73−192)
FWD
COOLING HOSE (POST SB PW4ENG 73−192)
L−B2662 (0201)
PW V

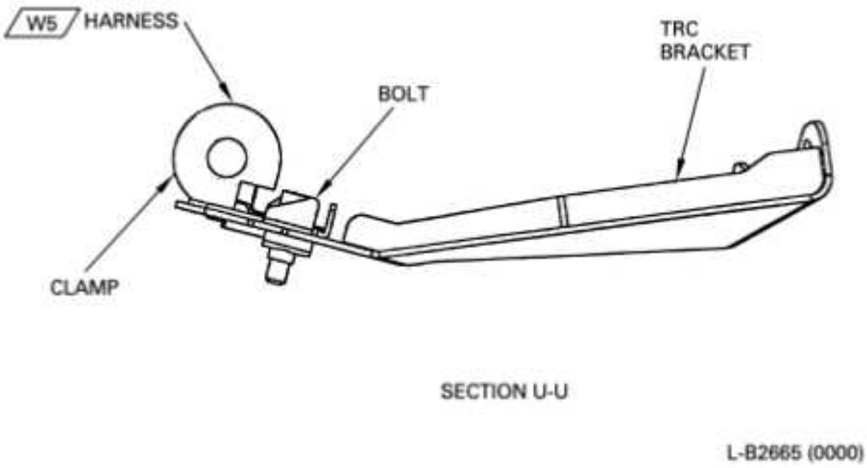
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 314 (Sheet 2)
(Task 72−00−34−050−024)


W6/W5
CONNECTOR
AT THE TURBINE
VANE AND BLADE
COOLING AIR VALVE
WIRING HARNESS
SUPPORT TUBE
S
S
T
T
COVER
U
U
W6 HARNESS
BRACKET
W5 HARNESS
L−B2667 (0000)
PW V

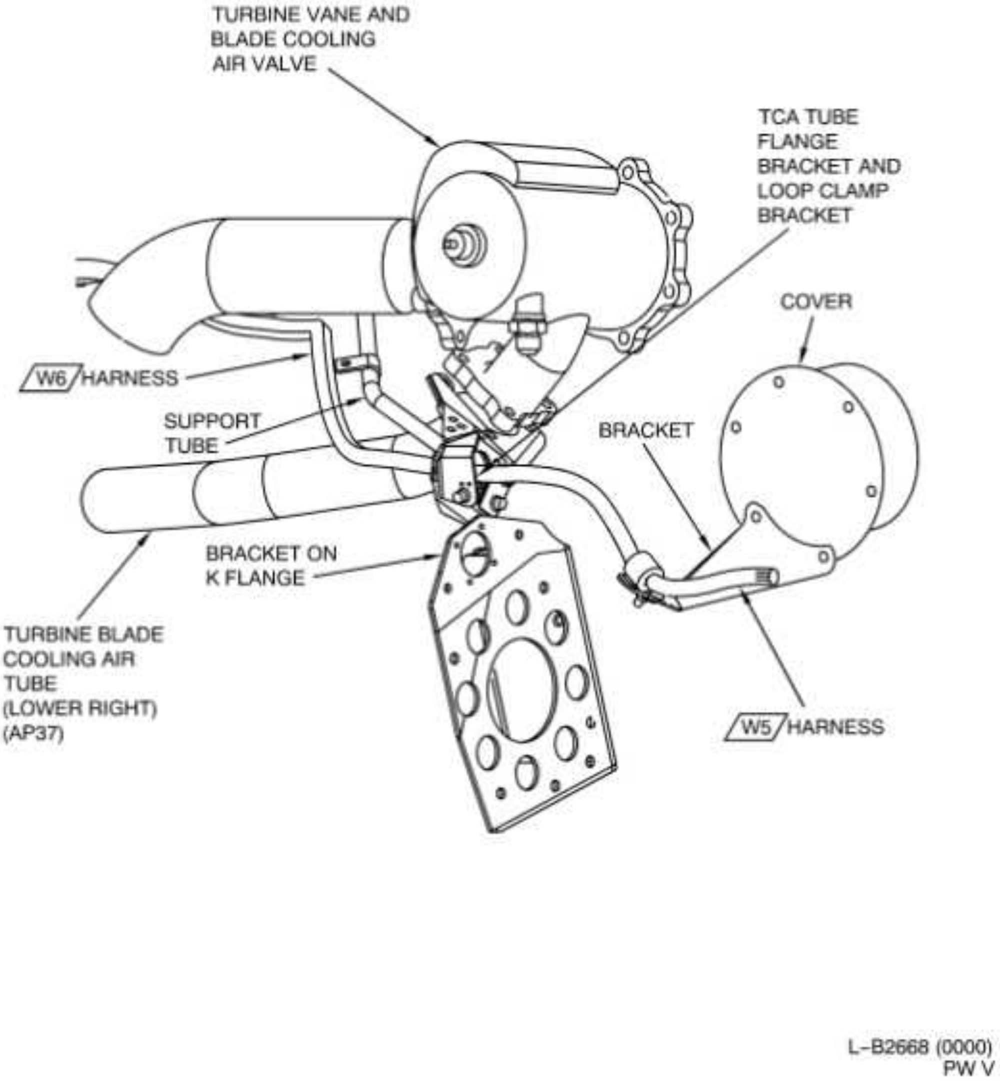
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 314 (Sheet 3)
(Task 72−00−34−050−024)


TCA TUBE FLANGE BRACKET
WIRING HARNESS SUPPORT TUBE
BOLT
SECTION S-S
MASTER KEYWAY AT THIS LOCATION
TCA TUBE FLANGE BRACKET
BOLT
CLAMP
WIRING HARNESS
LOOP CLAMP BRACKET
BOLT (3 NECESSARY)
SECTION T-T (POST SB PW4ENG 73-192)
MASTER KEYWAY AT THIS LOCATION
WIRING HARNESS
TCA TUBE FLANGE BRACKET
CLAMP
BOLT
LOOP CLAMP BRACKET
BOLT (3 NECESSARY)
SECTION T-T (PRE SB PW4ENG 73-192)
L-B2664 (0201)
PW V

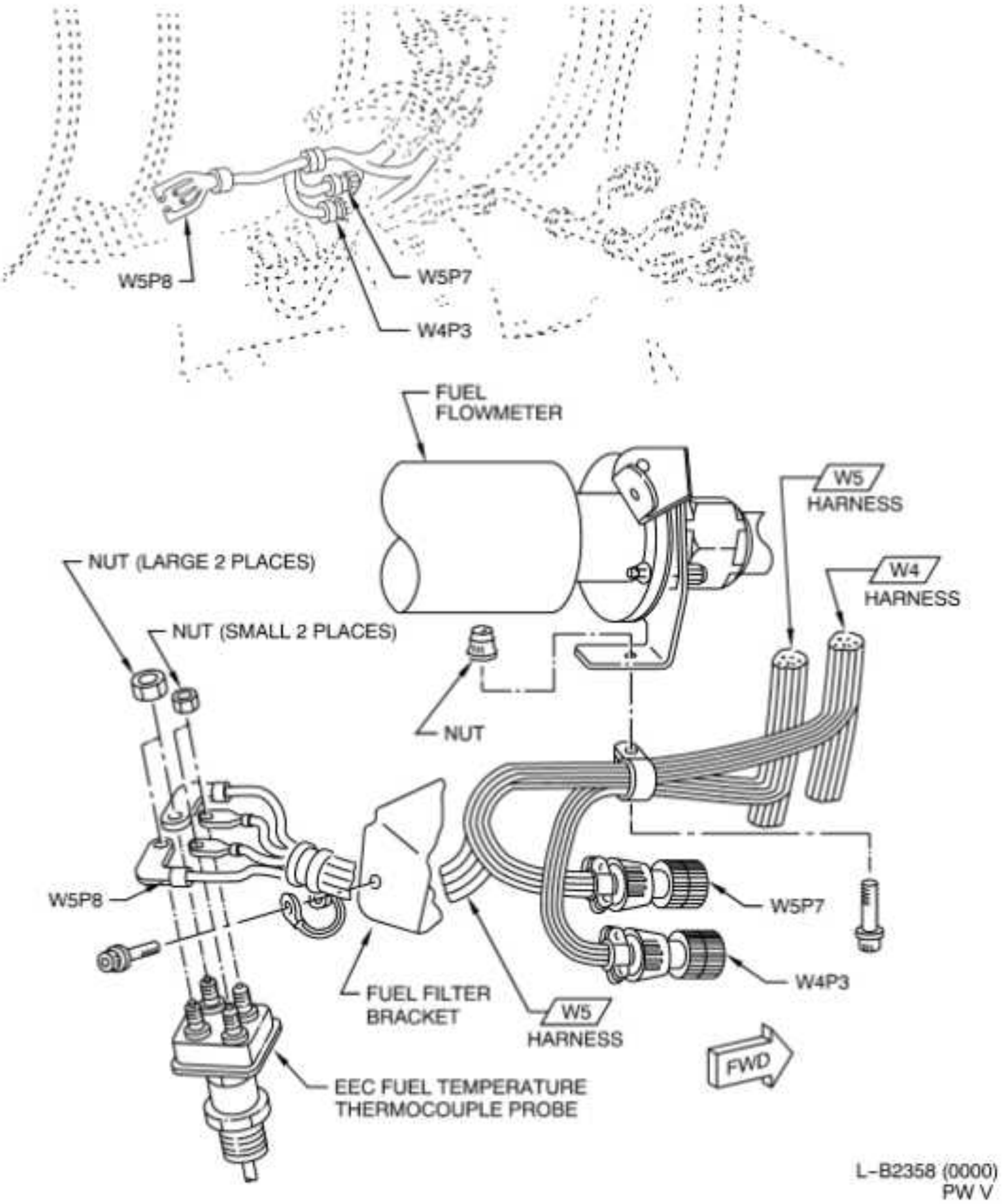
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 314 (Sheet 4)
(Task 72−00−34−050−024)


W5
HARNESS
TRC BRACKET
BOLT
CLAMP
SECTION U-U
L-B2665 (0000)

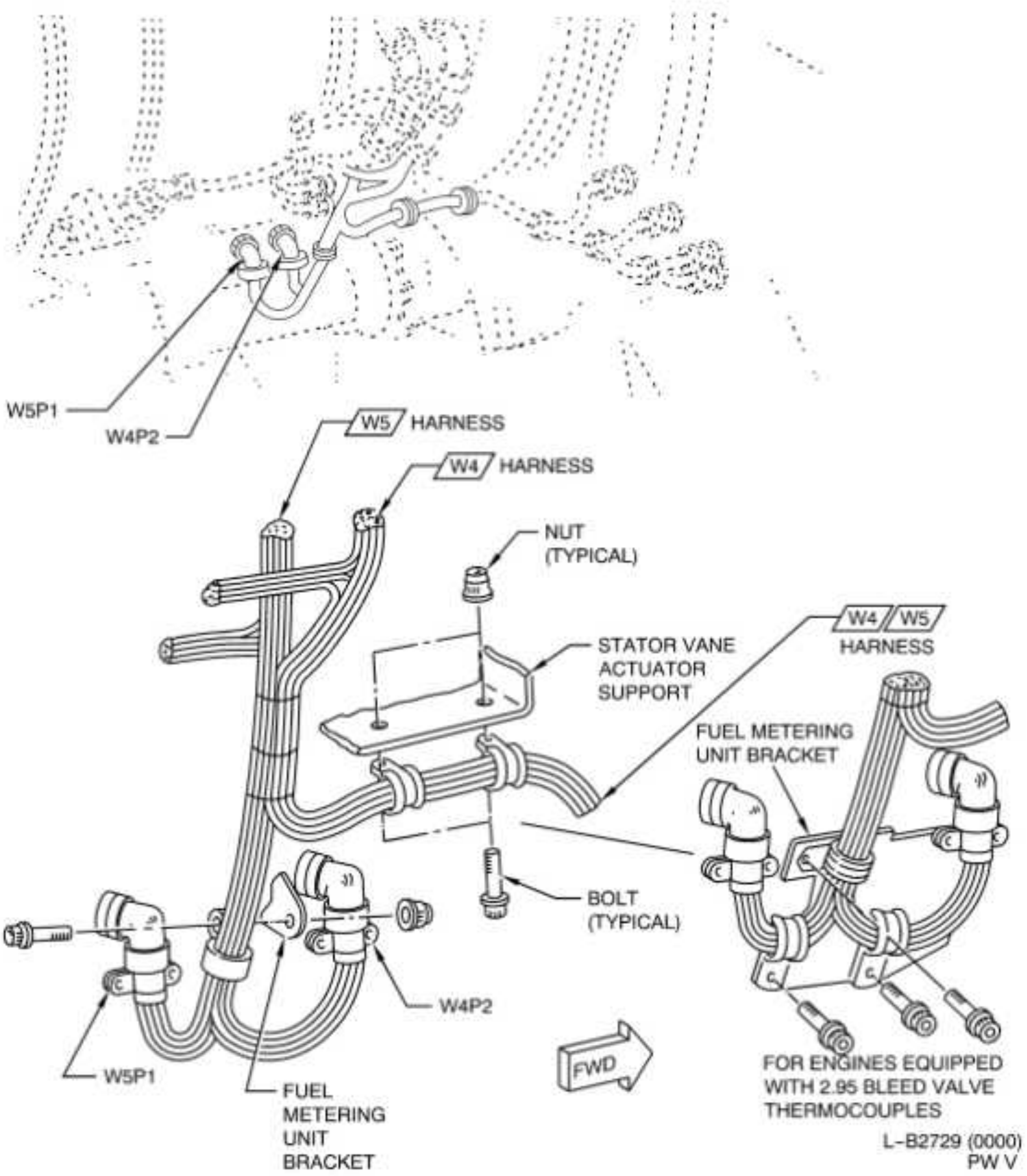
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 314 (Sheet 5)
(Task 72−00−34−050−024)


TURBINE VANE AND BLADE COOLING AIR VALVE
TCA TUBE FLANGE BRACKET AND LOOP CLAMP BRACKET
COVER
W6 HARNESS
SUPPORT TUBE
BRACKET
BRACKET ON K FLANGE
TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT) (AP37)
W5 HARNESS
L−B2668 (0000)
PW V

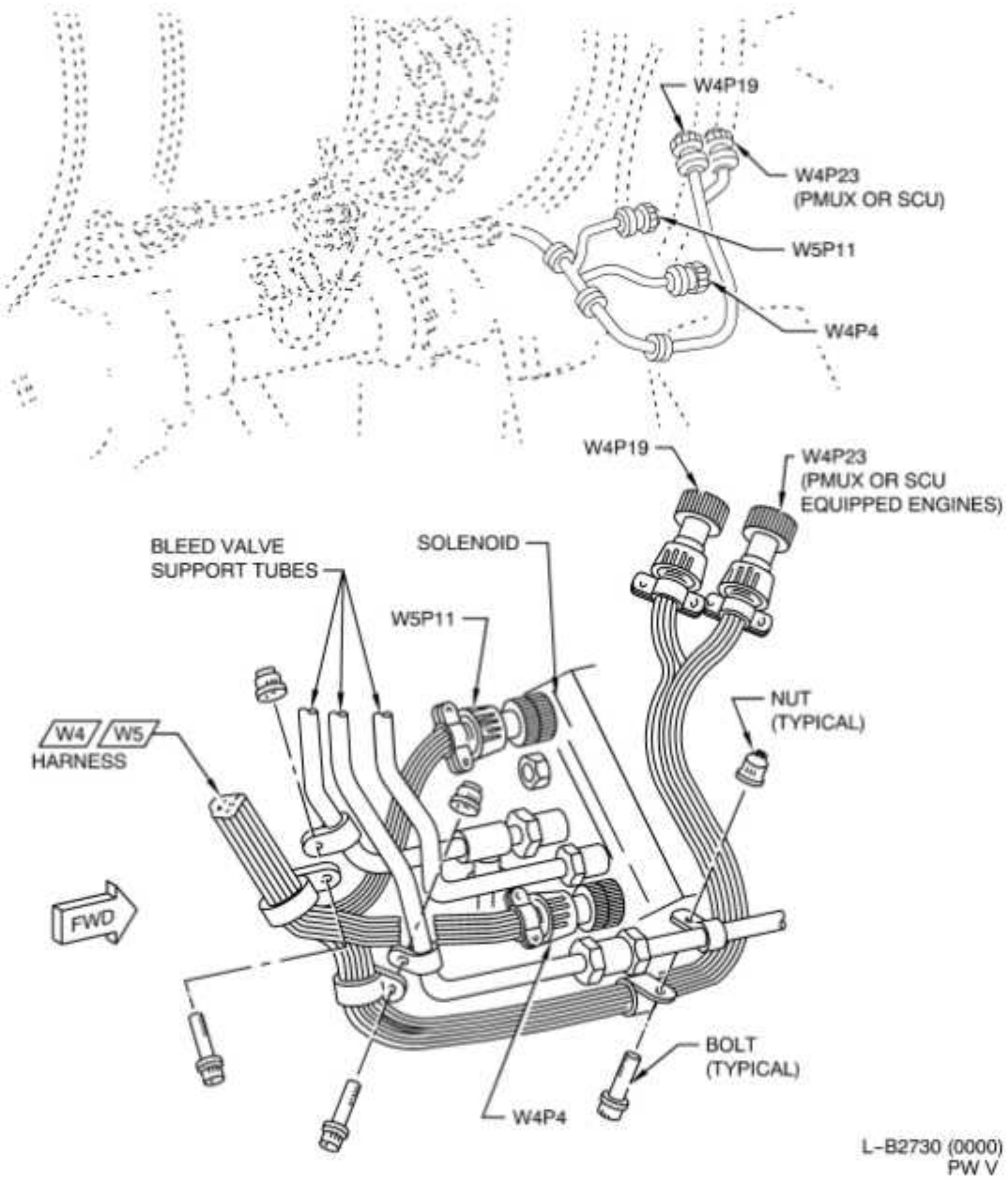
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 314 (Sheet 6)
(Task 72−00−34−050−024)


W5P8
W5P7
W4P3
FUEL FLOWMETER
W5 HARNESS
W4 HARNESS
NUT (LARGE 2 PLACES)
NUT (SMALL 2 PLACES)
NUT
W5P8
W5P7
W4P3
FUEL FILTER BRACKET
W5 HARNESS
EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
FWD
L-B2358 (0000)
PW V

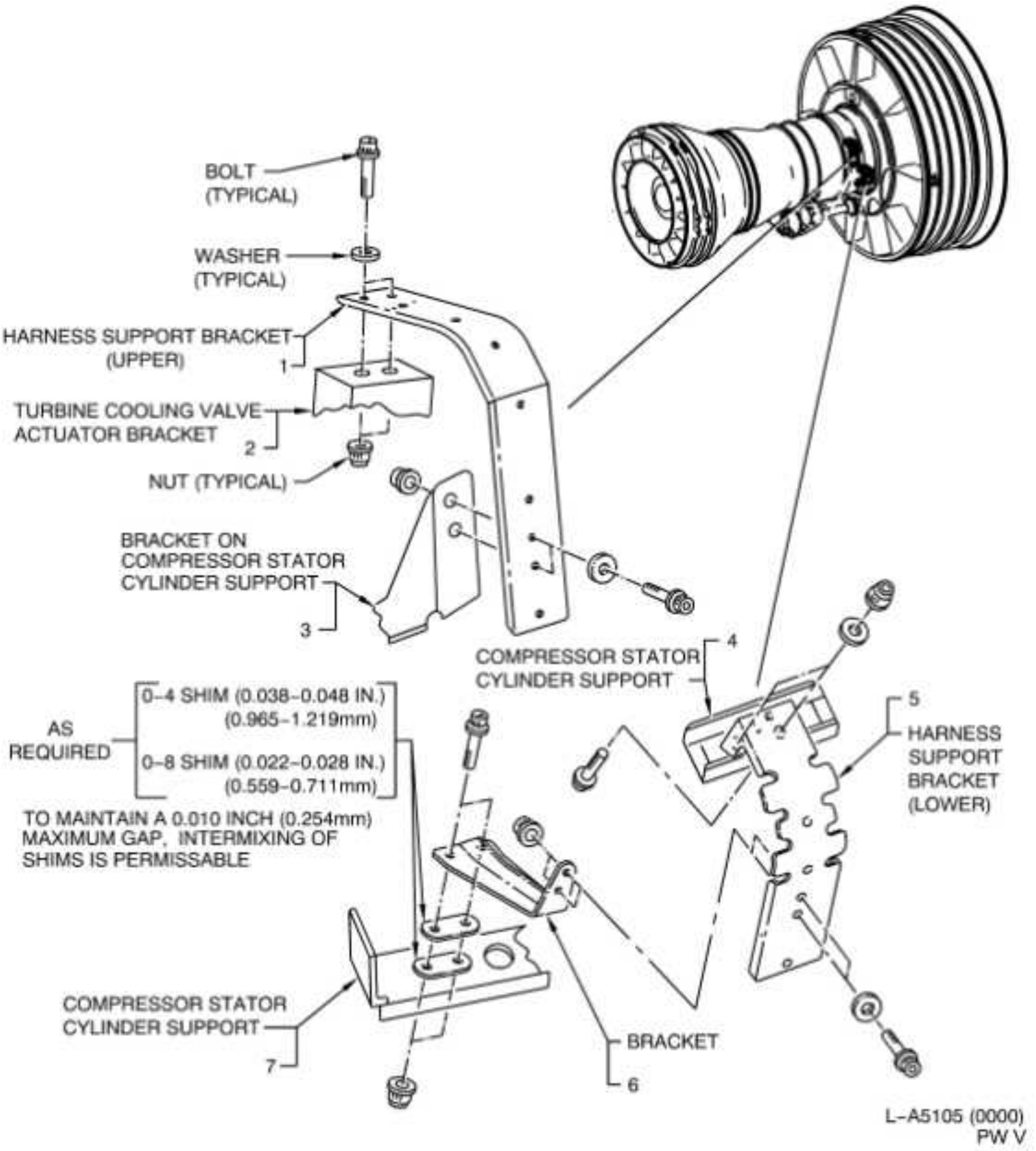
EEC Wiring Harness − W5 (Core Engine)
Figure 315
(Task 72−00−34−050−024)


W5P1
W4P2
W5 HARNESS
W4 HARNESS
NUT (TYPICAL)
STATOR VANE ACTUATOR SUPPORT
W4 W5 HARNESS
FUEL METERING UNIT BRACKET
BOLT (TYPICAL)
W4P2
W5P1
FUEL METERING UNIT BRACKET
FWD
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES
L-B2729 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine)
Figure 316
(Task 72−00−34−050−024)


W4P19
W4P23
(PMUX OR SCU)
W5P11
W4P4
W4P19
W4P23
(PMUX OR SCU
EQUIPPED ENGINES)
BLEED VALVE
SUPPORT TUBES
SOLENOID
W5P11
W4 W5
HARNESS
NUT
(TYPICAL)
FWD
BOLT
(TYPICAL)
W4P4
L-B2730 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine)
Figure 317
(Task 72−00−34−050−024)


BOLT (TYPICAL)
WASHER (TYPICAL)
HARNESS SUPPORT BRACKET (UPPER)
1
TURBINE COOLING VALVE ACTUATOR BRACKET
2
NUT (TYPICAL)
BRACKET ON COMPRESSOR STATOR CYLINDER SUPPORT
3
COMPRESSOR STATOR CYLINDER SUPPORT
4
5
HARNESS SUPPORT BRACKET (LOWER)
AS REQUIRED
0−4 SHIM (0.038−0.048 IN.) (0.965−1.219mm)
0−8 SHIM (0.022−0.028 IN.) (0.559−0.711mm)
TO MAINTAIN A 0.010 INCH (0.254mm) MAXIMUM GAP, INTERMIXING OF SHIMS IS PERMISSABLE
COMPRESSOR STATOR CYLINDER SUPPORT
7
BRACKET
6
L−A5105 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine) Support Brackets
Figure 318
(Task 72−00−34−050−024)

Previous Pageblock   Return to Previous Menu   Next Pageblock

ENGINE GENERAL - INTERMEDIATE CASE - REMOVAL-24

Task 72-00-34-050-022:

1. Remove Turbine Vane And Blade Cooling Air Valve, IDGS Air/Oil Heat Exchanger Valve Override Solenoid

A. Prerequisite

(1) Remove the fan exit liner segment (inner rear) at the 1 o'clock position. Refer to 72-00-33, Removal-16 (Task 72-00-33-040-001).

B. Equipment And Materials - None

C. Procedure

See Figure 301.

(1) Disconnect the W1P10 and W1P11 harness connectors from the solenoid.

(2) Remove the lockwire from the two tube nuts on the rear of the solenoid and disconnect the tubes.

(3) Remove lockwire from the pressure switch tube nuts. Disconnect and remove the tube. Install protection covers on the tube.

(4) Remove the four bolts that attach the solenoid, pressure switch bracket, and loop clamp bracket. Remove the pressure switch bracket. Remove the solenoid from under the loop clamp bracket and install protection covers.

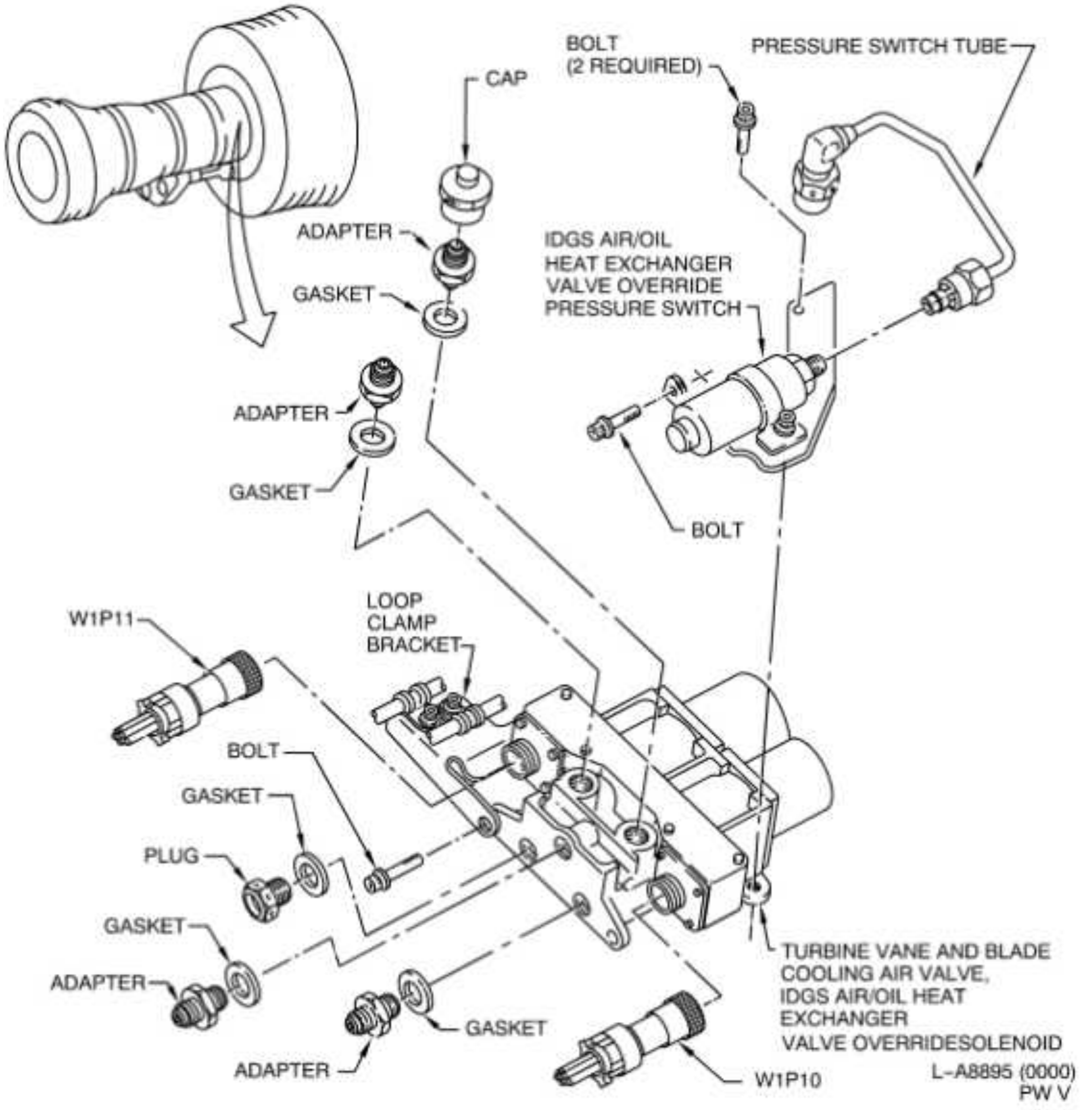
(5) If the solenoid must be replaced do the following:

(a) Remove the two adapters and one plug from the rear of the solenoid.

(b) Remove lockwire and remove the cap from the adapter on top of the solenoid. Remove the two adapters from the top of solenoid.

(c) Install protection covers to all openings on the solenoid.

NOTE: For additional information concerning detailed maintenance of this component, see Compressor Heating Air/Turbine Vane Cooling Air Valve Solenoid Component Maintenance Manual, 75-33-12 (Midland Ross).


BOLT (2 REQUIRED)
PRESSURE SWITCH TUBE
CAP
ADAPTER
GASKET
IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE PRESSURE SWITCH
ADAPTER
GASKET
BOLT
W1P11
LOOP CLAMP BRACKET
BOLT
GASKET
PLUG
GASKET
ADAPTER
GASKET
ADAPTER
TURBINE VANE AND BLADE COOLING AIR VALVE, IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDESOLENOID
W1P10
L−A8895 (0000)
PW V

Turbine Vane And Blade Cooling Air Valve, IDGS
Air/Oil Heat Exchanger Valve Override Solenoid
Figure 301
(Task 72−00−34−050−022)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-34-050-023:

1. Remove Turbine Vane Cooling Air Valve, Turbine Vane And Blade Cooling Air Valve Solenoid

A. Prerequisites

(1) Remove the fan exit liner segment (inner rear) that is at the 10 o'clock position. Refer to 72-00-33, Removal-16 (Task 72-00-33-040-001).

B. Equipment And Materials - None

C. Procedure

See Figure 301.

(1) Disconnect W3P12 harness connector from the solenoid. Install protection covers on the harness and solenoid connectors.

(2) Remove lockwire from the three tube nuts on the rear of solenoid and disconnect the tube nuts from the solenoid.

(3) Remove four bolts that attach the solenoid and bracket to the case. Remove the solenoid from under the bracket and from the engine.

NOTE: If necessary, loosen the clamp bolt that attaches the tube to the bracket to gain clearance for solenoid removal.

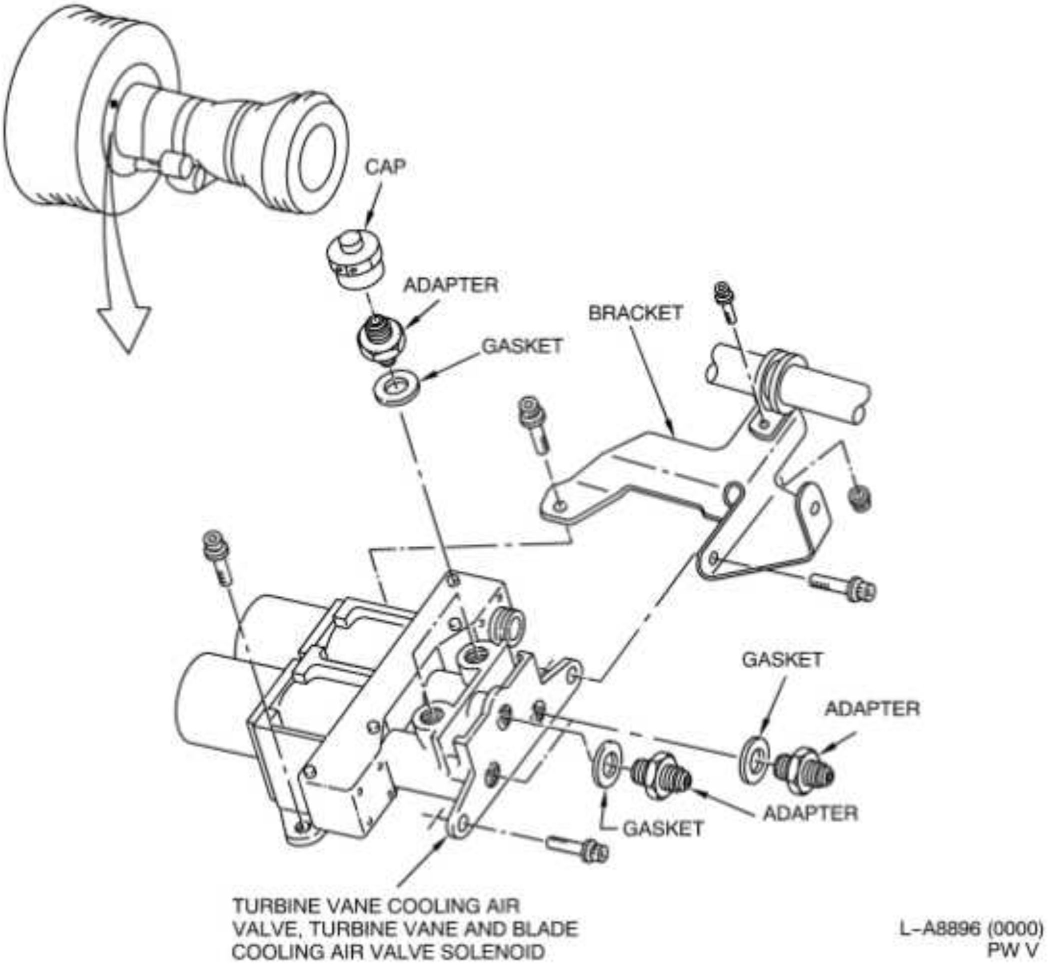
(4) If the solenoid must be replaced, do the following:

(a) Remove the three adapters and gaskets from the rear of the solenoid.

(b) Remove lockwire and remove the two caps from the adapters on top of the valve. Remove the two adapters and gaskets from the top of the solenoid.

(c) Install protection covers to all openings on the valve solenoid.

NOTE: For additional information concerning detailed maintenance of this component, see Compressor Heating Air/Start Bleed Valve Solenoid Component Maintenance Manual, 75-33-10 (Midland Ross).


CAP
ADAPTER
GASKET
BRACKET
GASKET
ADAPTER
ADAPTER
GASKET
TURBINE VANE COOLING AIR
VALVE, TURBINE VANE AND BLADE
COOLING AIR VALVE SOLENOID
L−A8896 (0000)
PW V

Turbine Vane Cooling Air Valve, Turbine Vane
And Blade Cooling Air Valve Solenoid
Figure 301
(Task 72−00−34−050−023)

ENGINE GENERAL - INTERMEDIATE CASE - INSTALLATION-01

Task 72-00-34-420-001:

1. Install The Intermediate Case

NOTE: See Figure 401 for Part/Assembly Installation Procedure Sequence.

A. Prerequisites

(1) See Inspection/Check-01 (Task 72-00-34-990-001) for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:

PWA 27424	Pin, Aligning (3 Necessary)
PWA 28657	Sling
PWA 29855-7	Pin, Aligning (2 Necessary)
PWA 76156	Adapter, Lift And Trunnion
PWA 85064	Fixture, Handling
PWA 85246	Plug, Holding
PWA 85260	Pin, Aligning (2 Necessary)
PWA 87001	Driver, Hand
PWA 88709	Plug, Holding

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P06-002	Petrolatum, White (PMC 9609)
P06-021	Compound, Antigalling (PWA 550)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Insert, Helical Coil	AR	72-34-00/5/40
Packing	1	72-35-00/11/165
Packing	1	72-34-00/16/1

C. Procedure
See Figure 402.

(1) Install tools.

(a) Thread PWA 85246 Plug onto HPC rear hub at center of diffuser case.

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3 (Pre SB PW4ENG 72−562) Thread the PWA 85246 Plug onto the HPC rear hub at the center of the diffuser case.

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3 (Post SB PW4ENG 72−562) Thread the PWA 88709 Plug onto the HPC rear shaft at the center of the diffuser case.

(d) Put two PWA 76156 Adapters on PWA 28657 Sling.

(e) Attach the adapters to trunnion spools of PWA 85064 Fixture.

  1 Loosen knobs in center hub of fixture. With a hoist, install fixture to rear of diffuser case.

  2 Align dowel pin in fixture with hole in case and secure with detail washers and screws. Tighten the detail knobs.

(f) Raise HPC and diffuser and combustion assembly from build stand.

(g) Lubricate packing with Engine Oil P03−001, and install to OD flange of No. 2 bearing support at front of HPC.

(h) For engines that are post SB PW4ENG 72−48, install packing, lubricated with White Petrolatum P06−002, to intermediate case Flange E lip.

NOTE: Engines prior to SB PW4ENG 72−48 do not accept packing at Flange E.

(i) Install PWA 85260 Aligning Pins in intermediate case Flange E at 3 and 9 o'clock locations. Install PWA 29855−7 Pins in the intermediate case at Flange E at 6 and 12 o'clock.

(j) Install three PWA 27424 Aligning Pins, equally spaced, in the 33 hole diameter of the No. 2 bearing support (installed in the HPC).

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−01

(2) Inspect the intermediate case Flange E helical coil inserts. If you find any damaged helical coil inserts, replace the insert(s) as follows:

(a) With pliers, remove the damaged insert. Discard the insert.

(b) Install a new insert on PWA 87001 Driver.

(c) Install the driver through the boltholes in Flange E.

(d) Install a socket and wrench on the driver.

(e) Install the insert in the Flange E. The top coil must be 1 − 1.5 pitch below the surface.

(3) Attach the engine to the intermediate case as follows.

(a) Lower HPC and diffuser and combustion assembly to intermediate case.

(b) Install 8 to 10 workbolts in the 33 bolt circle of the No. 2 bearing support. Remove the alignment pins.

(c) Install 8 to 10 workbolts, with Antigalling Compound P06−021 applied on the threads, in Flange E. Remove the alignment pins.

(d) Tighten the workbolts at Flange E and the No. 2 bearing support at the same time.

1 Tighten and torque the No. 2 bearing support workbolts to 180 − 200 lb−in. (20.337 − 22.597 N.m).

2 Tighten and torque the Flange E workbolts to 225 − 250 lb−in. (25.422 − 28.246 N.m).

(e) Install the Flange E hardware as follows. Refer to 72−00−34 Installation−20 (Task 72−00−34−420−020).

NOTE: Flange E has two configurations, the UPS configuration has 72 bolts and the other configuration has 74 bolts.

(f) Tighten and torque Flange E bolts to 225 - 250 lb-in. (25.422 - 28.246 N.m).

(g) If you trunnion the engine, leave the workbolts installed in the No. 2 bearing support. If not, remove the workbolts.

(h) Remove the hoist, sling, and adapters from diffuser and combustion fixture.

D. Postrequisites

(1) Trunnion The Intermediate Case Through Diffuser And Combustor From Front End Down To Horizontal Position. Refer to 72-00-00, Special Procedures-10 (Task 72-00-00-420-002-A00).

(2) Install The No. 1.5 Bearing Support Assembly On The Intermediate Case. Refer to 72-00-34, Installation-06 (Task 72-00-34-430-001).

(3) Connect/Install External Parts To Complete Installation Of Intermediate Case. Refer to 72-00-34, Installation-02 (Task 72-00-34-420-002).

(4) Install The No. 3 Bearing Rear (Carbon) Seal Assembly And Rear Seal Seat. Refer to 72-00-41, Installation-03 (Task 72-00-41-420-003).

(5) Install The Turbine Nozzle. Refer to 72-00-51, Installation-01 (Task 72-00-51-420-001).

(6) Install The High Pressure Turbine (HPT). Refer to 72-00-52, Installation-01 (Task 72-00-52-420-001).

(7) Install The No. 1 Bearing Vibration Transducer, if applicable. Refer to 72-00-34, Installation-22 (Task 72-00-34-440-001).

(8) Install The No. 1 Bearing Support (Front And Rear) Assembly. Refer to 72-00-34, Installation-04 (Task 72-00-34-450-002).

(9) Install The Fan Case. Refer to 72-00-33, Installation-01 (Task 72-00-33-420-001).

(10) Install The Low Pressure Turbine (LPT) With Shaft. Refer to 72-00-53, Installation-01 (Task 72-00-53-420-001).

(11) Install The Turbine Exhaust Case. Refer to 72−00−54, Installation−01 (Task 72-00-54-020-001).

(12) Install The Low Pressure Compressor (LPC). Refer to 72−00−31, Installation−01 (Task 72-00-31-420-003).

(13) Install The LPC/LPT Coupling. Refer to 72−00−32, Installation−01 (Task 72-00-32-420-001).

(14) Install All Stage 1 LPC Blade Assemblies. Refer to 72−00−31, Installation−04 (Task 72-00-31-420-002-002).

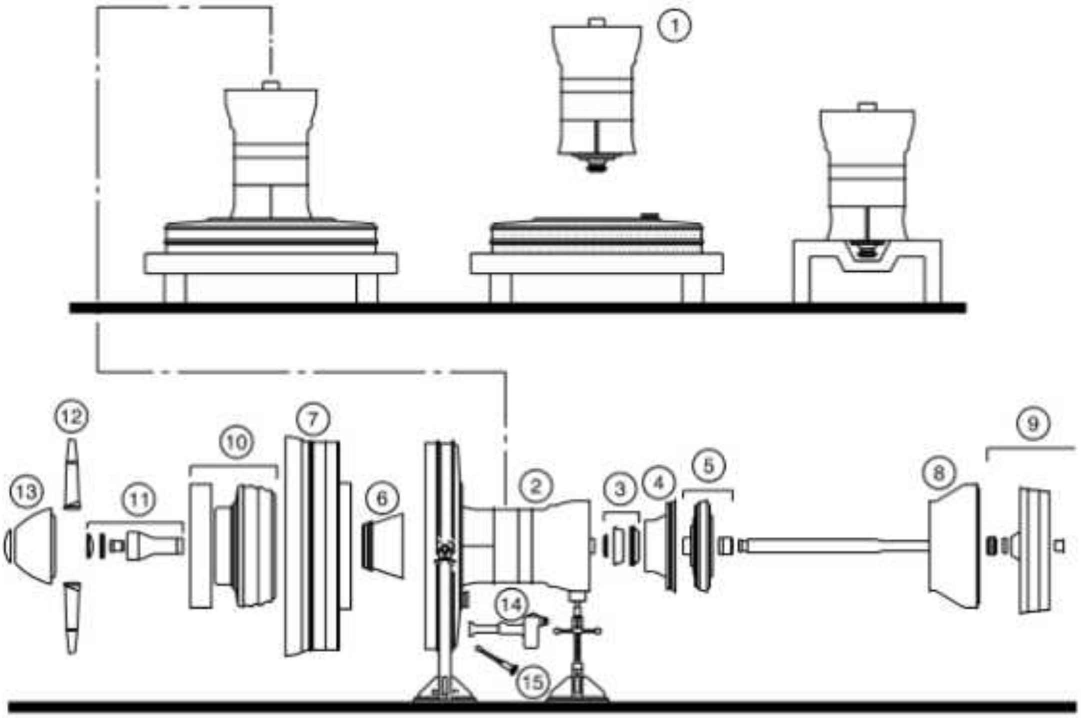
(15) Install The Compressor Inlet Cone. Refer to 72−00−31, Installation−02 (Task 72-00-31-420-001).

(16) Install The Main Gearbox. Refer to 72−00−61, Installation−01 (Task 72-00-61-420-001).

(17) For engines not equipped with engine multiplexer unit (PMUX) or the supplemental control unit, Install Electronic Engine Control (EEC) Speed Transducer (N1). Refer to 72−00−34, Installation−03 (Task 72-00-34-450-001).

(18) For engines equipped with engine multiplexer unit (PMUX) or the supplemental control unit, Install Electronic Engine Control (EEC) Speed Transducer (N1) Multiplexer Input Probe. Refer to 72−00−34, Installation−17 (Task 72-00-34-450-013).

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−01

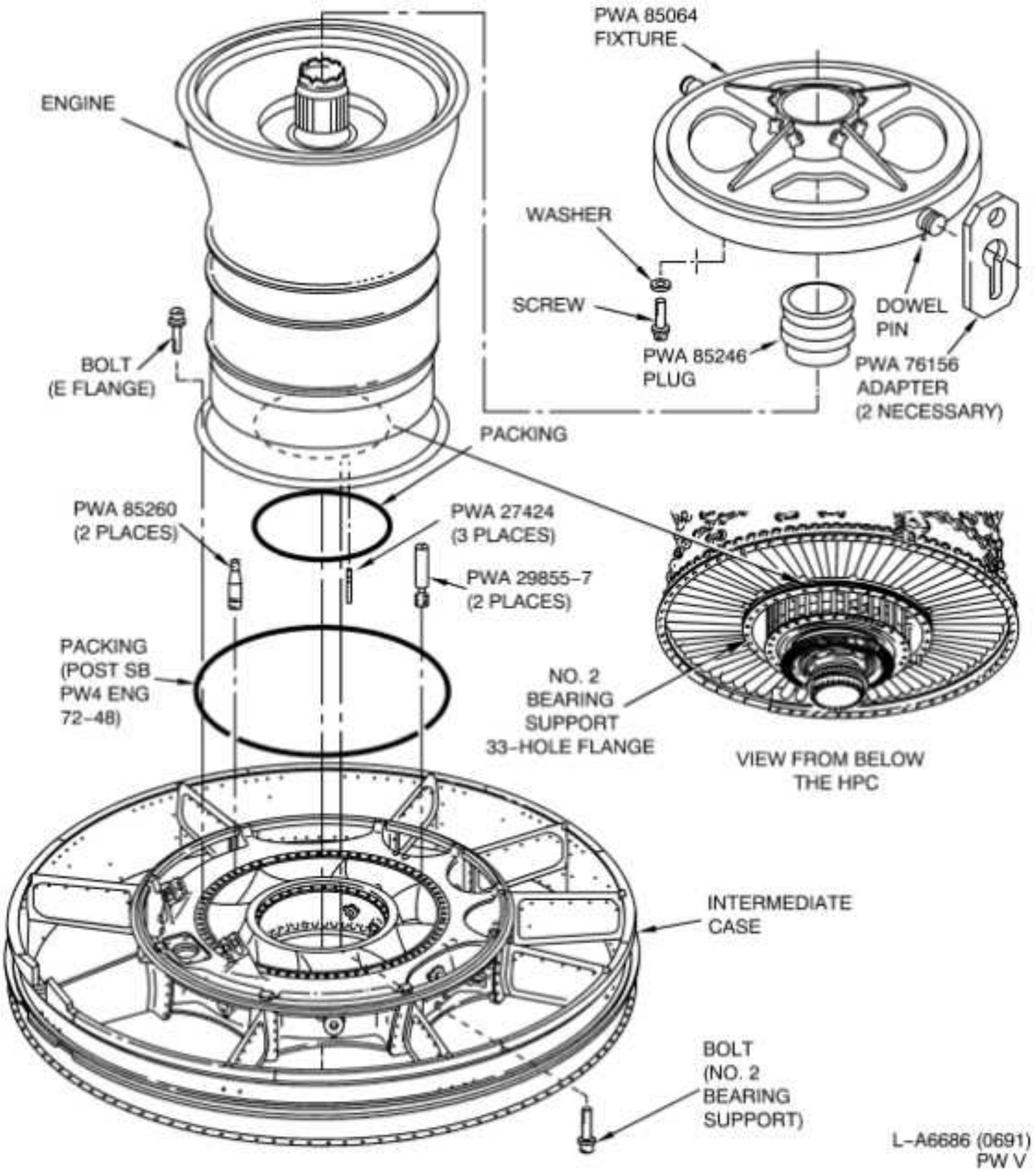


1. INSTALL DIFFUSER AND HIGH PRESSURE COMPRESSOR TO INTERMEDIATE CASE.
2. TRUNNION INTERMEDIATE THROUGH DIFFUSER CASE TO HORIZONTAL.
3. INSTALL NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL PLATE.
4. INSTALL TURBINE NOZZLE.
5. INSTALL HIGH PRESSURE TURBINE (HPT).
6. INSTALL NO. 1 BEARING SUPPORT ASSEMBLY.
7. INSTALL FAN CASE.
8. INSTALL LOW PRESSURE TURBINE (LPT).
9. INSTALL TURBINE EXHAUST CASE.
10. INSTALL LOW PRESSURE COMPRESSOR (LPC).
11. INSTALL LPC/LPT COUPLING.
12. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
13. INSTALL COMPRESSOR INLET CONE.
14. INSTALL MAIN GEARBOX.
15. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).

L−A0105 (0187)
PW V

Procedure Sequence
Figure 401
(Task 72−00−34−420−001)

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−01


PWA 85064
FIXTURE
ENGINE
WASHER
SCREW
DOWEL
PIN
BOLT
(E FLANGE)
PWA 85246
PLUG
PWA 76156
ADAPTER
(2 NECESSARY)
PACKING
PWA 85260
(2 PLACES)
PWA 27424
(3 PLACES)
PWA 29855−7
(2 PLACES)
PACKING
(POST SB
PW4 ENG
72−48)
NO. 2
BEARING
SUPPORT
33−HOLE FLANGE
VIEW FROM BELOW
THE HPC
INTERMEDIATE
CASE
BOLT
(NO. 2
BEARING
SUPPORT)
L−A6686 (0691)
PW V

Intermediate Case Installation
Figure 402
(Task 72−00−34−420−001)

Task 72-00-34-420-002:

1. Install External Plumbing After Intermediate Case Installation

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
R	P05-292	Ferrule, Safety Cable (Optional)
	P06-021	Antigalling Compound (PWA 550-3)
R	P06-054	Antiseize Paste (PWA 36246)
	P18-003	Primer, Zinc Chromate (AMS 3110)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	79-23-00/1/1
Key Washer	4	79-23-00/1/50
Packing	1	24-11-00/2/1
Packing	1	24-11-00/2/70
Packing	1	73-12-00/3/1
Packing	2	73-12-00/3/150
Packing	1	79-21-00/8/1
Packing	1	79-21-00/8/120
Packing	1	79-21-00/9/110
Packing	1	79-21-00/11/1
Packing	1	79-21-00/11/80
Packing	1	79-21-00/11/150
Retainer	1	24-11-00/2/10
Retainer	1	73-12-00/3/10
Retainer	2	73-12-00/3/160
Retainer	1	79-21-00/8/130
Retainer	1	79-21-00/9/120
Retainer	1	79-21-00/11/10

B. Procedure

See Figure 401.

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−02

CAUTION: DO NOT USE LUBRICANTS ON PMUX SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF PMUX CAN RESULT.

(1) For engines equipped with engine propulsion multiplexer unit (PMUX), install (lower) PT2.5 sensing manifold assembly (AS31) as follows.

  (a) Remove protective closures.

  (b) Install manifold to Flange E bracket and HPC case bracket at approximately 5 and 4:30 o'clock positions. Secure with clamps, bolts, threads lubricated with Engine Oil P03−001, and nut handtight only.

  (c) If cap at tee end of manifold has been removed or loosened, torque cap to 135 − 150 lb−in. (15.253 − 16.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

  CAUTION: DO NOT USE LUBRICANTS ON PMUX SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF PMUX CAN RESULT.

(2) For engines equipped with engine propulsion multiplexer unit (PMUX), install (upper) PT2.5 sensing tube assembly (AS30) as follows.

  (a) Remove protective closures.

  (b) Install tube to previously installed manifold handtight only.

  (c) Install clamps and bolts securing tube to three Flange E brackets between 1 and 4 o'clock postions. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

  (d) Torque manifold nut to tube coupling at approximately 4 o'clock position to 135 − 150 lb−in. (15.253 − 16.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

    NOTE: Lower manifold nut and clamp bolts shall be torqued with probe installation.

CAUTION: DO NOT USE LUBRICANTS ON THE SUPPLEMENTAL CONTROL UNIT (SCU) SENSING TUBES, ADAPTERS, OR PACKINGS. LUBRICANTS CAN CAUSE CONTAMINATION OF THE SCU.

(3) For engines equipped with the supplemental control unit (SCU) with multiplexing, install the PT2.5 sensing tube assembly (AS35) as follows.

(a) Remove the protection covers.

(b) Attach the (AS35) tube to brackets on Flange E at the 4:30 and 5:00 o'clock positions with clamps and bolts, threads lubricated with Engine Oil P03−001 and tighten by hand.

(4) Install the upper PT2.5 sensing tube assembly (AS30) as follows.

(a) Remove the protection covers.

(b) For engines equipped with the supplemental control unit (SCU) with multiplexing, install the (AS30) tube to the (AS35) tube assembly and tighten the tube nut by hand.

(c) Install clamps to the (AS30) tube and attach the clamps to brackets on Flange E with four bolts and a nut. Lubricate the threads with Engine Oil P03−001. Torque the bolts and a nut to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) For engines not equipped with the supplemental control unit (SCU) with multiplexing, install a cap assembly to the lower end of the (AS30) tube. Torque the cap assembly 135 − 150 lb−in. (15.253 − 16.948 N.m). Safety the cap assembly with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(5) For engines equipped with the supplemental control unit (SCU) with multiplexing, do as follows.

(a) Torque the bolts that attach the (AS35) tube to brackets on Flange E to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(b) Torque the tube nut tube (AS35) to the tube coupling tube (AS30) to 135 − 150 lb−in. (15.253 − 16.948 N.m). Safety the tube nut with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

NOTE: The manifold (AS31) is installed and torqued with the probe installation.

(6) If HPC was disassembled comply with the following. See Figure 402.

(a) Install gearbox oil pressure manifold assembly (LP08) as follows.

1 Remove protective closures. Lubricate manifold nut threads with Antigalling Compound P06−021. See Figure 402 (Sheet 6). Install tube to inboard adapter at top of fuel/oil cooler handtight only.

2 (Post SB PW4ENG 72−491) Position tube and attach to Flange H bracket assembly at approximately 9 o'clock position, with clamp and bolt, lubricated with Engine Oil P03−001. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

3 Lubricate threads on manifold tee with Antigalling Compound P06−021 and attach No. 4 bearing oil pressure tube nut. Torque tube nut to manifold tee to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

4 Position spray shield to inboard side of connection and secure with hose clamp.

5 (Reference 2151) Torque hose clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

6 Torque manifold nut to fuel/oil cooler adapter to 675 − 750 lb−in. (76.265 − 84.739 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(b) Install (lower) No. 3 bearing oil breather tube assembly (LB04) as follows.

1 Remove protective closures and lubricate tube nut threads with Antigalling Compound P06-021. See Figure 402 (Sheet 5). Install tube between fuel/oil cooler and HPC case. Connect tube nut to tube coupling rearward of Flange K at approximately 10 o'clock position.

2 Install clamp and bolt, threads lubricated with Engine Oil P03-001, to bracket attached to rear support of fuel/oil cooler at approximately 9 o'clock position handtight only.

3 Identify tube nut as being "not torqued" with tag. Tube nut to be torqued in 72-00-61 Installation-02 (after installation of main gearbox).

(c) Install the (front) No. 3 bearing oil pressure manifold assembly (LP18) as follows.

1 (Pre SB PW4ENG 79-52), Remove the protection covers and lubricate the manifold nut
R threads with Antiseize Paste P06-054. Wipe
R off unwanted paste. Install the packing, lubricated with Engine Oil P03-001, and the retainer to the manifold.

2 (Post SB PW4ENG 79-52), Remove protection covers and lubricate the back of the manifold ferrules and the manifold nut threads with Antigallant Compound P06-021. See Figure 402 (Sheet 4). Lubricate the the packing with Engine Oil P03-001 and install the packing and retainer to the manifold.

3 (Pre SB PW4ENG 79-52), Install the manifold to the rear of the strainer housing on the fuel/oil cooler and to the No. 3 bearing oil strainer housing on Flange K. Tighten by hand only.

4 (Post SB PW4ENG 79-52), Install the manifold to the rear of the strainer housing on the fuel cooler and to the adapter on the No. 3 bearing pressure tube (LP19) on Flange K at the 9 o'clock position.

5 Install the clamp and bolt, lubricated with Engine Oil P03−001, that attach the manifold and the (LB04) tube (above) to the bracket attached to the rear of the cooler. Tighten by hand.

CAUTION: DO NOT TORQUE THE MANIFOLD NUTS OR THE CLAMP BOLTS AT THIS TIME. YOU MUST COMPLETE THE INSTALLATION OF THIS MANIFOLD AFTER YOU INSTALL OTHER TUBES AFTER THE GEARBOX INSTALLATION. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

6 Do not torque the manifold nuts or clamps bolts at this time. Install a tag on the manifold "not torqued".

(d) Install the oil pressure trim tube assembly (LP31) and the oil metering nipple (restrictor) as follows.

1 Remove the protection covers and lubricate the tube nut threads with Antigalling Compound P06−021.

2 Install the trim tube (LP31) to the oil manifold tee (LP18) above the cooler. Tighten by hand only.

3 Remove the protection covers and install the oil metering nipple (restrictor) to the trim tube (LP31). Tighten by hand only.

CAUTION: DO NOT TORQUE THE TRIM TUBE (LP31) OR THE NIPPLE (RESTRICTOR) AT THIS TIME. YOU MUST COMPLETE THE INSTALLATION OF THIS TUBE AND NIPPLE (RESTRICTOR) AFTER YOU INSTALL OTHER TUBES AFTER THE GEARBOX INSTALLATION. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

4 Do not torque the tube nuts or nipple at this time. Install a tag on the tube and nipple "not torqued".

NOTE: You will complete the installation of the above manifold (LP18), tube (LP31), and nipple in 72-00-61, Installation-02 Task 72-00-61-420-002. See the installation of the oil trim pressure tube (LP32).

(e) Install (lower) No. 1, 1.5 and 2 bearing breather oil tube assembly (LB02) as follows.

1 Position tube and secure to Flange H bracket, at approximately 9 o'clock position, with clamp, bolt, threads lubricated with Engine Oil P03-001, and nut handtight only.

2 Identify clamp bolt as being "not torqued" with tag. Clamp bolt to be torqued in 72-00-61 Installation-02 (after installation of main gearbox).

3 Install a clamp to the No. 1, 1.5 and 2 bearing breather tube (lower) (LB02) and put to the inboard oil cooler bracket. Attach the clamp to the bracket with a bolt, threads lubricated with Engine Oil P03-001 and a nut tightened by hand (Post SB PW4ENG 79-33).

4 Identify the bolt in the clamp on the inboard oil cooler bracket as "not torqued" with a tag. The bolt will be torqued in 72-00-61, Installation-02 (after the installation of the main gearbox) (Post SB PW4ENG 79-33).

5 Installation of tube to be completed in 72-00-61 Installation-02.

(f) Install oil cooler outlet fuel tube assembly (FM11) (Pre SB PW4ENG 73-35) as follows. See Figure 403.

1 Remove protective closures and lubricate tube nut threads with Engine Oil P03-001. Install packing, lubricated with Engine Oil P03-001, and retainer to cooler end of tube. Install tube to rear adapter on fuel/oil cooler at approximately 8:30 o'clock position handtight only.

2 Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to Flange J bracket at approximately 7 o'clock position. Torque clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

3 Torque tube nut to fuel/oil cooler rear adapter to 100 - 110 lb-in. (11.298 - 12.428 N.m), loosen tube nut, then retorque to same limit. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(g) Install flexible oil cooler outlet fuel hose and tube assembly (FM11) (Post SB PW4ENG 73-35) as follows.

1 Remove the protective closures.

a Inspect the primed surface for nicks, scratches or areas of missing coating. If any, apply wet Zinc Chromate Primer P18-003 to those exposed areas. Allow to air dry a minimum of 10 minutes before assembly to the fuel pump.

2 Lubricate tube nut threads with Engine Oil P03-001. Install packing, lubricated with Engine Oil P03-001, and retainer to cooler end of tube. Install tube to rear adapter on fuel/oil cooler at approximately 8:30 o'clock position handtight only.

3 Install clamp and bolt, threads lubricated with Engine Oil P03-001, securing tube to Flange J bracket at approximately 7 o'clock position. Torque clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

4 (Reference 2170) Torque the tube nut to the fuel/oil cooler rear adapter to 150 - 160 lb-in. (16.948 - 18.078 N.m). Torque the tube nut again to 150 - 160 lb-in. (16.948 - 18.078 N.m) until the torque is kept. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(h) Install oil cooler inlet fuel tube assemblies (FM10) and (FM12) as follows.

1 Remove protective closures and lubricate tube nut threads at cooler end with Engine Oil P03−001. Install packings lubricated with Engine Oil P03−001 and retainers to cooler end of tubes. Install tubes to forward adapters on fuel/oil cooler at approximately 8:30 o'clock position handtight only.

2 Install clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts securing tubes to HPC case brackets at two locations. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

3 (Reference 2170) Torque the tube nuts at the cooler ends to 150 − 160 lb−in. (16.948 − 18.078 N.m). Torque the tube nuts again to 150 − 160 lb−in. (16.948 − 18.078 N.m) until the torque is kept. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292. Fuel pump ends of tubes to be torqued in 72−00−61 Installation−05.

(i) Install (airframe) oil cooler inlet oil tube assembly (LS05) as follows.

1 Remove protective closures and lubricate tube nut threads with Antigalling Compound P06−021. Install packing, lubricated with Engine Oil P03−001, and retainer to cooler end of tube. Install tube to forward adapter on oil cooler bypass valve handtight only.

2 Install clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts securing tube to previously installed tube and HPC case bracket. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

3 Torque tube nut to oil cooler bypass valve adapter to 140 − 160 lb−in. (15.818 − 18.078 N.m), loosen tube nut, then retorque to same limits. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(7) Connect No. 3 bearing air cooler tube assemblies (AP33) and (AP34) as follows. See Figure 404.

R R (a) Lubricate tube nut threads with Antiseize Paste P06-054. Wipe off unwanted paste. Install tube nuts to adapters and torque to 825 - 900 lb-in. (93.212 - 106.686 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(8) Install bleed valve supply tube assemblies (AA26), (AA27), and (AA29) as follows. See Figure 404 (Sheets 4 and 5).

R R (a) Remove protective closures and lubricate all tube nut and coupling threads with Antiseize Paste P06-054. Wipe off unwanted paste. Install inboard tube (AA26), to upper tube nut (AA24), beneath turbine cooling air valve actuator at approximately 2 o'clock position and to air valve solenoid at 5 o'clock position in intermediate case handtight only. Connect tube nut (AA36) to lower tube tee (AA26).

(b) For engines with maintenance break at 3 o'clock position (Pre SB PW4ENG 75-28), install upper middle tube (AA29), to middle tube coupling (AA30), beneath turbine cooling air valve actuator at approximately 2 o'clock position handtight only. Install lower middle tube (AA37) to tube coupling of previously installed tube (AA29) and to pneumatic relay valve at approximately 5 o'clock position handtight only.

(c) For engine equipped with maintenance break at 5 o'clock position (Post SB PW4ENG 75-28), install middle tube to middle tube coupling (AA29) beneath turbine cooling air valve actuator at 2 o'clock position handtight only. Install lower end of tube (AA29) to tube coupling (AA37) rearward of solenoid at 5 o'clock position handtight only.

(d) Install outboard tube (AA27), to lower tube nut (AA28), beneath turbine cooling air valve actuator at approximately 2 o'clock position and to air valve solenoid at 5 o'clock position in intermediate case handtight only.

(e) Install clamps, bolts, threads lubricated with Engine Oil P03-001, nuts and spacer securing tubes to brackets and each other.

(f) Torque all clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(g) Torque three tube nuts (AA24), (AA30), and (AA28) beneath turbine cooling air valve actuator at approximately 2 o'clock position to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(h) For engine equipped with maintenance break at 3 o'clock position (Pre SB PW4ENG 75-28), torque middle tube nut (AA29) at 3 o'clock position to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(i) Torque tube nut (AA36) attached to inboard tube tee (AA26) at approximately 5 o'clock position to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(j) Torque inboard tube nut (AA26) to adapter on air valve solenoid at 5 o'clock position to 225 - 250 lb-in. (25.422 - 28.246 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(k) For engines equipped with maintenance break at 3 o'clock position (Pre SB PW4ENG 75-28), torque lower middle tube nut (AA37) to adapter on pneumatic relay valve at 5 o'clock position to 225 - 250 lb-in. (25.422 - 28.246 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(l) For engines equipped with maintenance break at 5 o'clock position (Post SB PW4ENG 75-28), torque lower middle tube nut (AA29) to tube coupling (AA37) at 5 o'clock position to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(m) Torque outboard tube (AA27) to adapter on air valve solenoid at approximately 5 o'clock position to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(9) Install (lower right) airframe cooler outlet oil tube assembly (LS06) and (upper right) airframe cooler outlet tube assembly (LS03) as follows.

(a) Remove protective closures and lubricate (lower
right) tube nut and coupling threads with
R Antiseize Paste P06−054. Wipe off unwanted paste.

(b) Position (lower right) tube to bracket attached to rear of stator vane lever support and to Flange H bracket at approximately 4:30 o'clock position. Connect tube nut to tube coupling at 5:00 o'clock position handtight only.

(c) Install clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts securing tube to bracket attached to rear of stator vane lever support and to Flange H bracket at approximately 4:30 o'clock position. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Remove protective closures and install packing
lubricated with Engine Oil P03−001 to groove at
flanged end of (upper right) tube. Lubricate tube
R nut threads with Antiseize Paste P06−054. Wipe
R off unwanted paste.

(e) Install (upper right) tube to air/oil cooler and to (lower right) tube coupling. Install three bolts, threads lubricated with Engine Oil P03−001.

(f) Torque bolts securing flanged end of tube to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(g) Torque two tube nuts to 675 − 750 lb−in. (76.265 − 84.739 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 at approximately 5 and 3 o'clock positions.

(10) Install (right) HPC air valve signal tube assembly (AA01) and (right) HPC air valve supply tube assembly (AA25) as follows.

(a) Remove protective closures and lubricate tube nuts
R with Antiseize Paste P06−054. Wipe off unwanted
R paste.

(b) Install supply tube (AA25) to tee forward of upper air filter at approximately 2 o'clock position and to adapter on air valve solenoid at approximately 1 o'clock position in intermediate case handtight only.

(c) Install signal tube (AA01) to lower air filter at approximately 2 o'clock position and to adapter on air valve solenoid at approximately 1 o'clock position in intermeidate case handtight only.

(d) Install clamps, bolts, threads lubricated with Engine Oil P03−001, spacer, and nuts securing tubes to HPC case bracket and to Flange H bracket at approximately 12:30 o'clock position handtight only.

(e) Install clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts securing tubes to bracket attached to bleed valve flange at approximately 1:30 o'clock position handtight only.

(f) Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(g) Torque rear connections of both tubes to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(h) Torque the larger front connection (supply) (AA25) to 225 − 250 lb−in. (25.422 − 28.246 N.m).

(i) Torque the smaller front connection (signal) (AA01) to 170 − 180 lb−in. (19.207 − 20.337 N.m).

(j) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(11) Install angle gearbox oil pressure tube assembly (LP09) as follows. See Figure 405.

(a) Remove protection covers and lubricate tube nut
R threads with Antiseize Paste P06−054. Wipe off
R unwanted paste. Install tube to adapter on right side of angle gearbox and to manifold tee at approximately 7:30 o'clock position handtight only.

(b) Install clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts securing tube to brackets.

(c) (Post SB PW4ENG 72−507) Install two more clamps with a bolt, threads lubricated with Engine Oil P03−001, and a nut, 1.250 − 1.750 inches (31.8 − 44.4 mm) to the rear of the installed clamps. See Figure 405 (Sheet 8).

(d) Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque tube nuts to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(12) Install bottom hydraulic manifold assembly (CP02) and (bottom) oil cooler inlet return manifold assembly (CR04) as follows.

(a) Remove protective closures and lubricate manifold
R nut threads with Antiseize Paste P06−054. Wipe
R off unwanted paste. Install return manifold to adapter on front of fuel/oil cooler at approximately 9 o'clock position handtight only.

(b) Install hydraulic manifold and secure both manifolds to Flange E brackets at approximately 8 and 5 o'clock positions with clamps and bolts, threads lubricated with Engine Oil P03−001. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Torque return manifold nut to fuel/oil cooler to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

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(13) Install (right) hydraulic manifold assembly (CP05) and (right) oil cooler inlet return manifold assembly (CR01) as follows.

(a) Remove protective closures and lubricate manifold
R nut threads with Antiseize Paste P06−054. Wipe
R off unwanted paste. Install both manifolds to
bottom manifolds at approximately 5 o'clock position and to flex hoses at approximately 3 o'clock position handtight only.

(b) Install clamps, bolt, threads lubricated with Engine Oil P03−001, and nut securing manifolds to brackets.

(c) Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Torque nuts (smaller) connecting each end of return manifold to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(e) Torque nuts (larger) connecting each end of hydraulic manifold to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

CAUTION: MAKE SURE YOU CONNECT THE TUBES TO THE CORRECT CONNECTORS OR FAULT MESSAGES WILL BE GENERATED.

(14) Install (right) air/oil cooler valve hydraulic tube assembly (CP13) and (right) air/oil cooler valve return tube assembly (CR12) as follows.

(a) Remove protective closures.

R (b) Lubricate tube nut threads with Antiseize Paste
R P06−054. Wipe off unwanted paste.

(c) Attach both tubes to the adapters on the air/oil heat exchanger at approximately the 4 o'clock position in intermediate case and to the manifold tees.

1 The CR12 tube is installed to the adapter that is furthest from the lower triangular pad on the exchanger. The CP13 tube is installed to the adapter that is closest to the lower triangular pad on the exchanger.

(d) (Reference 256) Torque the two forward tube nuts attached to the heat exchanger tube couplings to 140 − 160 lb−in. (15.818 − 18.078 N.m).

(e) Torque the return tube (CR12) (smaller nut) to the manifold tee to 200 − 225 lb−in. (22.597 − 25.422 N.m).

(f) Torque the pressure tube (CP13) (larger nut) to the manifold tee to 340 − 375 lb−in. (38.415 − 42.369 N.m).

(g) Safety all the tube nuts with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(15) Install compressor stator cylinder hydraulic tube assembly (CP12) and compressor stator cylinder return tube assembly (CR03) as follows.

(a) Remove protective closures.

(b) Lubricate tube nut threads (both tubes) with
R Antiseize Paste P06−054. Wipe off unwanted paste.

(c) Install tubes to adapters on compressor stator cylinder and manifold tees at approximately 5 o'clock position handtight only.

(d) Install clamps and bolts, threads lubricated with Engine Oil P03−001, securing tubes to Flange E bracket. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque return tube nuts (smaller) to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(f) Torque hydraulic tube nuts (larger) to 225 − 250 lb−in. (25.422 − 28.246 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(16) Install (left) air/oil valve cooler hydraulic tube assembly (CP07) and (left) air/oil cooler valve return tube assembly (CR05) as follows.

(a) Remove protective closures.

(b) Lubricate tube nut threads (both tubes) with
R Antiseize Paste P06−054. Wipe off unwanted paste.

(c) Install tubes (longer staighter end) to adapters on (left) air/oil heat exchanger at approximately 8 o'clock position and to manifold tees.

(d) Install clamps and bolts, threads lubricated with Engine Oil P03−001, securing tubes to Flange E bracket. Torque the clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque the two forward tube nuts attached to the heat exchanger tube couplings to 200 − 225 lb−in. (22.597 − 25.422 N.m).

(f) Torque the return tube (CR05) (smaller nut) to the manifold tee to 200 − 225 lb−in. (22.597 − 25.422 N.m).

(g) Torque the pressure tube (CP07) (larger nut) to the manifold tee to 225 − 250 lb−in. (25.422 − 28.246 N.m).

(h) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to all the tube nuts.

(17) Install bleed valve cylinder hydraulic tube assembly (CP06) and bleed valve cylinder return tube assembly (CR02) as follows.

(a) Remove protective closures.

(b) Lubricate return tube nut threads with Engine Oil P03−001 and install to manifold tee and 2.5 bleed valve cylinder adapter at approximately 7 o'clock position in intermediate case.

(c) Torque tube nuts to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(d) Lubricate hydraulic tube nut threads with
R Antiseize Paste P06−054 and install tube to
manifold tee and 2.5 bleed valve cylinder adapter.
R Wipe off unwanted paste.

(e) Install clamps, bolt, threads lubricated with Engine Oil P03−001, and nut securing the two tubes to each other. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(f) Torque hydraulic tube nut to manifold tee to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(g) Torque hydraulic tube nut to bleed cylinder adapter to 225 − 250 lb−in. (25.422 − 28.246 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(18) Install HPC valve cooling air tube assembly (AC35) as follows. See Figure 406.

(a) Remove protective closures.

(b) Install tube to intermediate case at approximately 10 o'clock position and secure with two bolts, threads lubricated with Engine Oil P03−001, handtight only.

(c) Install clamp, bolt, threads lubricated with Engine Oil P03−001, and nut securing tube to bracket attached to solenoid. Torque clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Torque two bolts securing front tube flange to intermediate case to 85 − 95 lb−in. (9.604 − 10.734 N.m).

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE

INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(19) Install air/oil cooler outlet oil hose and tube assembly (LP03) as follows.

(a) Remove protective closures.

(b) Inspect the primed surface for nicks, scratches or areas of missing coating. If any, apply wet Zinc Chromate Primer P18-003 to those exposed areas. Allow to air dry a minimum of 10 minutes before assembly. Do not apply primer to the packing groove or on the surface adjacent to the packing groove.

(c) Install new packing, lubricated with Engine Oil P03-001, to groove at flanged end of tube.

(d) Install new packing, lubricated with Engine Oil P03-001, and retainer to nut end of tube.

(e) Lubricate tube nut threads with Engine Oil P03-001 and install tube to fuel/oil cooler and air/oil heat exchanger. Secure flanged end of tube to air/oil heat exchanger with three bolts, threads lubricated with Engine Oil P03-001, handtight only.

(f) Secure tube to HPC case bracket at approximately 8 o'clock position with clamp, bolt, threads lubricated with Engine Oil P03-001. Torque clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(g) Torque tube nut to 200 - 220 lb-in. (22.597 - 24.857 N.m). Loosen tube nut, then retorque to same limit. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(h) Front tube flange bolts to be torqued with installation of air/oil cooler inlet oil tube. See 72-00-61 Installation-02.

(20) Install main bearing breather tube assemblies (LB01) and (LB06) as follows.

(a) Remove protective closures.

(b) Install gasket and upper tube (LB01) to intermediate case at approximately 11:30 o'clock position and secure with four bolts, threads lubricated with Engine Oil P03-001, and lockwashers handtight only.

(c) Lubricate the middle tube (LB06) coupling, and coupling nut threads (both end fittings) with R Antiseize Paste P06-054 and install to upper tube (LB01) and the lower tube nut (LB02) above fuel/oil cooler at approximately 9 o'clock R position handtight only. Wipe off unwanted paste.

(d) Secure tube to HPC case brackets at approximately 11:30 and 10 o'clock positions with clamps, bolts, threads lubricated with Engine Oil P03-001. Torque clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque four bolts securing upper tube to intermediate case to 65 - 85 lb-in. (7.344 - 9.604 N.m) and bend tabs on lockwashers against flats of bolts to secure.

(f) Torque lower tube nut to upper tube at approximately 11:30 o'clock position to 1150 - 1300 lb-in. (129.933 - 146.880 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(g) Identify tube nut connecting tube (LB06) to tube (LB02, located above fuel/oil cooler at approximately 9 o'clock position as "Not Torqued", with a "Not Torqued" tag. Tube nut to be torqued after installation of main gearbox. See 72-00-61, Installation-02.

(21) Install main bearing oil pressure manifold assembly (LP07) as follows.

(a) Remove protective closures.

(b) Install new packing to last chance strainer. Lubricate packing and threads with Engine Oil P03-001 and install strainer to strainer housing. Torque to 275 - 300 lb-in. (31.071 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(c) Install packing lubricated with Engine Oil P03-001 to flanged end of manifold. Install manifold to intermediate case at approximately 9 o'clock position with three bolts, threads lubricated with Engine Oil P03-001, handtight only.

(d) Secure manifold to Flange E bracket with clamp, bolt, threads lubricated with Engine Oil P03-001, and nut. Torque clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque three bolts securing front flanged end of tube to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(22) Install main bearing oil pressure tube assembly (LP05) as follows.

(a) Remove protective closures.

(b) Install new packing, lubricated with Engine Oil P03-001, and retainer to rear of tube.

(c) Lubricate tube nut threads at both ends with R Antiseize Paste P06-054. Wipe off unwanted paste. Install tube to last chance strainer housing adjacent to Flange E and to adapter above fuel/oil cooler handtight only.

(d) Install clamp and bolt, threads lubricated with Engine Oil P03-001, securing tube to Flange E bracket. Torque bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Install a bracket, clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts to the main bearing breather tube (LB06) and the main bearing oil pressure tube (LP05). Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m). See View N (Post SB PW4ENG 79-33).

(f) Torque forward tube nut to strainer housing to 675 - 750 lb-in. (76.265 - 84.739 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(g) Torque rear tube nut to 140 − 160 lb−in. (15.818 − 18.078 N.m). Loosen tube nut, then retorque to same limit. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(23) Install HPC air valve and air shutoff valve supply tube assembly (AA22) as follows.

(a) Remove protective closures.

(b) Lubricate tube nut and coupling threads with
R Antiseize Paste P06−054 and install tube to middle
solenoid adapter at approximately 10 o'clock
position in intermediate case and to tube adjacent
R to air filters handtight only. Wipe off unwanted
R paste.

(c) Install clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts securing tube to Flange E bracket, Flange H bracket, and HPC case bracket. Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Torque tube (AA22) to solenoid adapter to 225 − 250 lb−in. (25.422 − 28.246 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(e) Torque tube nut (AA34) to the tube coupling (AA22). to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(24) Install air shutoff valve signal tube assembly (AA18) and HPC air valve signal tube assembly (AA06) as follows.

(a) Remove protective closures.

(b) Lubricate tube nut threads (both tubes) with
R Antiseize Paste P06−054 and install tubes to
solenoid adapters at approximately 10 o'clock
position in intermediate case and to air filters
R attached to Flange J bracket handtight only. Wipe
R off unwanted paste.

(c) Install clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts securing tubes to Flange E bracket, Flange H bracket and HPC case bracket. Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Torque all tube nuts to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

CAUTION: DO NOT USE LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF EEC CAN RESULT.

(25) For engines with the PT4.95 maintenance break at Flange K (Post SB PW4ENG 73−106), install the EEC PT4.95 tube assembly (AS41) as follows.

(a) Remove protection covers.

(b) Install the tube to the PT4.95 tube (AS01) at 11:00 o'clock position adjacent to Flange K. Tighten by hand.

(c) Install the clamps, bolts, lubricated with Engine Oil P03−001, and nuts that attach the tube to the brackets.

(d) Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque the tube nut at the rear of the tube to 270 − 300 lb−in. (30.506 − 33.895 N.m).

(f) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

CAUTION: DO NOT USE LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF EEC CAN RESULT.

(26) For basic engines install EEC PT4.95 tube assembly (AS04) as follows.

(a) Remove protective closures.

(b) Position front grommets to inside of intermediate case strut and install tube to grommets. Attach tube to tube coupling at approximately 11:30 o'clock position below intermediate case strut handtight only.

(c) Install clamp, bolt, threads lubricated with Engine Oil P03−001, and nut securing tube to guide at top of intermediate case. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Torque tube nut to tube coupling below strut to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(27) For engines with the Airbus/McDonnell Douglas common parts configuration, install EEC PT4.95 tube assembly (AS04) as follows.

(a) Remove protection covers.

(b) Position front grommets to inside of intermediate case strut and install tube to grommets. Attach tube to tube coupling at approximately the 11:30 o'clock position below the intermediate case strut hand tight.

(c) Install the (welded) tube clamp to the support assembly that is attached to the guide assembly on the intermediate case. Attach the clamp to the support with a bolt, threads lubricated with Engine Oil P03−001. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View R.

(d) Torque tube nut to tube coupling below strut to 270 − 300 lb−in. (30.506 − 33.895). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

CAUTION: DO NOT USE LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF EEC CAN RESULT.

(28) For engines not equipped with engine propulsion multiplexer unit (PMUX), install EEC PB tube assembly (AS20) as follows.

(a) Remove protective closures.

(b) Install tube to grommets in intermediate case strut and attach tube to tube coupling below strut at approximately 12:30 o'clock position handtight only.

(c) Install clamp, bolt, threads lubricated with Engine Oil P03−001, and nut securing tube to guide at top of intermediate case. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Torque tube nut to tube coupling below strut to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

CAUTION: DO NOT USE LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF EEC CAN RESULT.

(29) For engines equipped with engine propulsion multiplexer unit (PMUX), install EEC PB and PT2.5 sensing tube assembly (AS20/29) as follows.

(a) Remove protective closures.

(b) Install tube to grommets in intermediate case strut and attach two tube nuts to tube couplings below strut at approximately 12:30 o'clock position handtight only.

(c) Install bolt, threads lubricated with Engine Oil P03−001, securing tube to top of intermediate case assembly. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Torque larger tube nut (PB) below strut to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(e) Torque smaller tube nut (PT2.5) below strut to 135 − 150 lb−in. (15.253 − 16.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(30) For engines with the Airbus/McDonnell Douglas common parts configuration, install the EEC PB and PT2.5 sensing tube assembly (AS20/29) as follows.

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−02

(a) Remove protective covers.

(b) Install the tubes to grommets in the intermediate case strut and attach the two tube nuts to tube couplings below the strut at approximately the 12:30 o'clock position and tighten by hand.

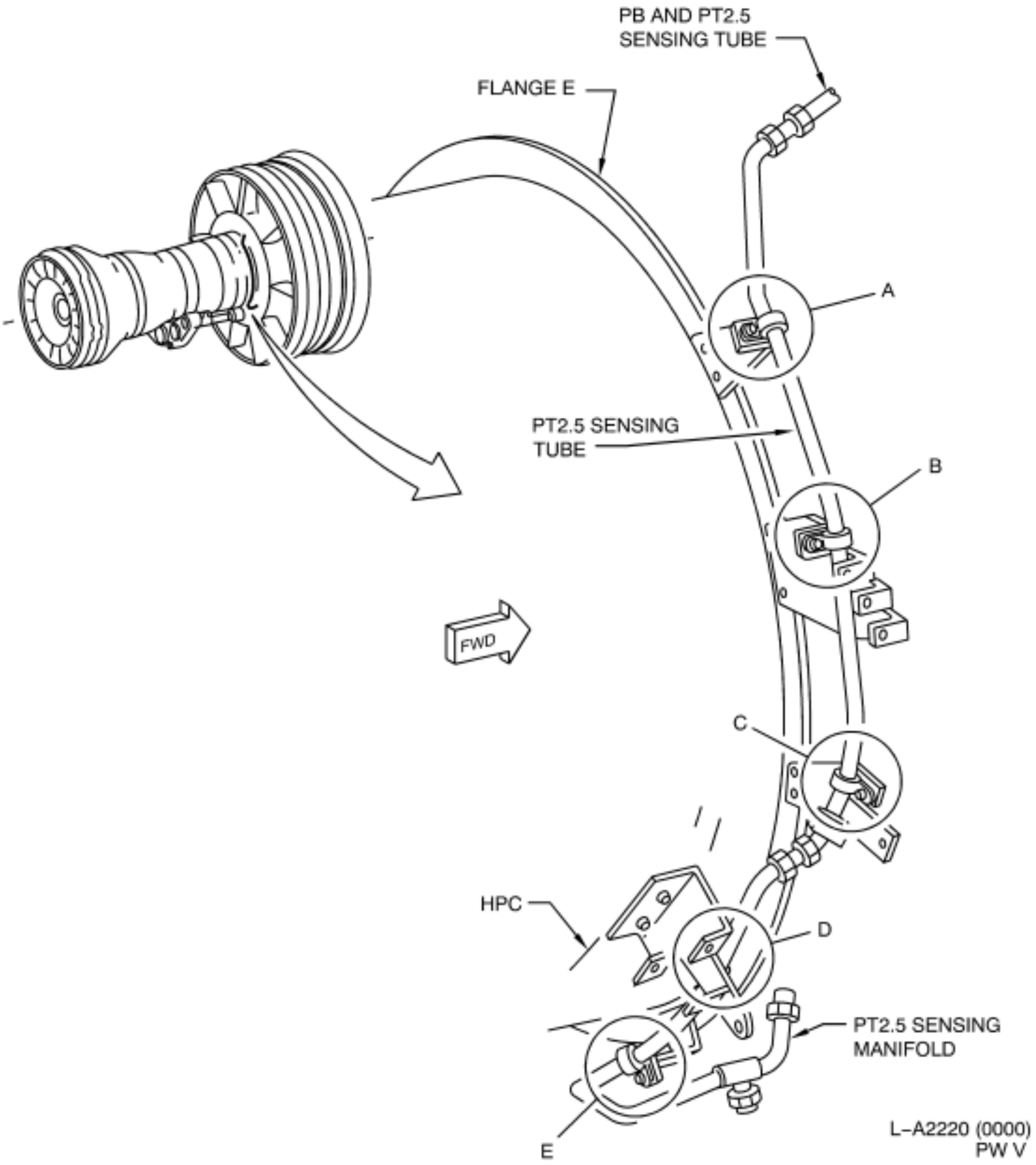
(c) Install two clamps and two bolts, threads lubricated with Engine Oil P03−001, and attach the tubes to a bracket on the solenoid switch at the 12:30 o'clock position below the strut. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Install a clamp to the (AS29) tube and attach to a bracket on Flange C at the 12:30 o'clock position with a bolt, threads lubricated with Engine Oil P03−001 and a nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View T.

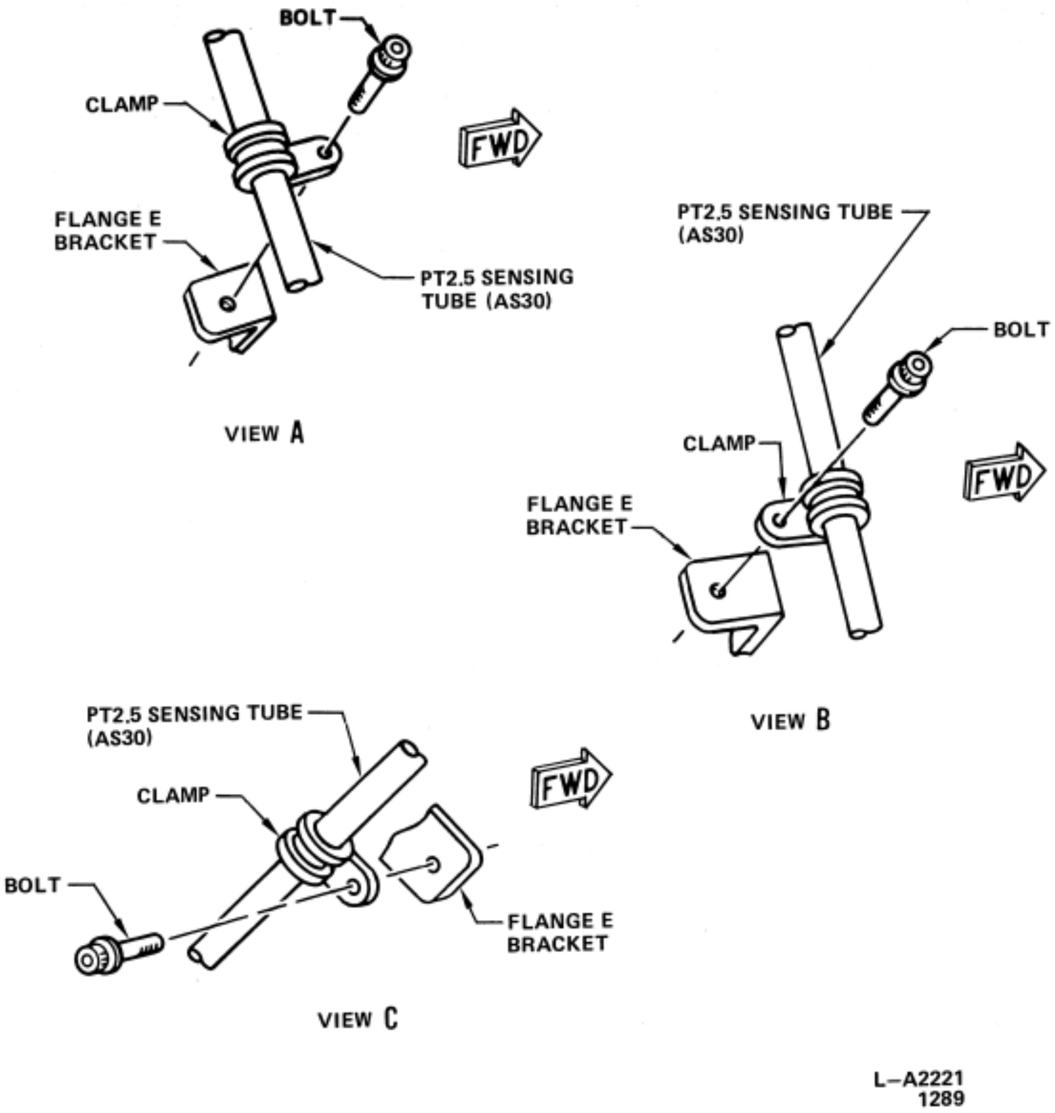
(e) Torque the larger tube nut (PB tube) below the strut to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the tube nut.

(f) Torque the smaller tube nut (PT2.5) below the strut to 135 − 150 lb−in. (15.253 − 16.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the tube nut.

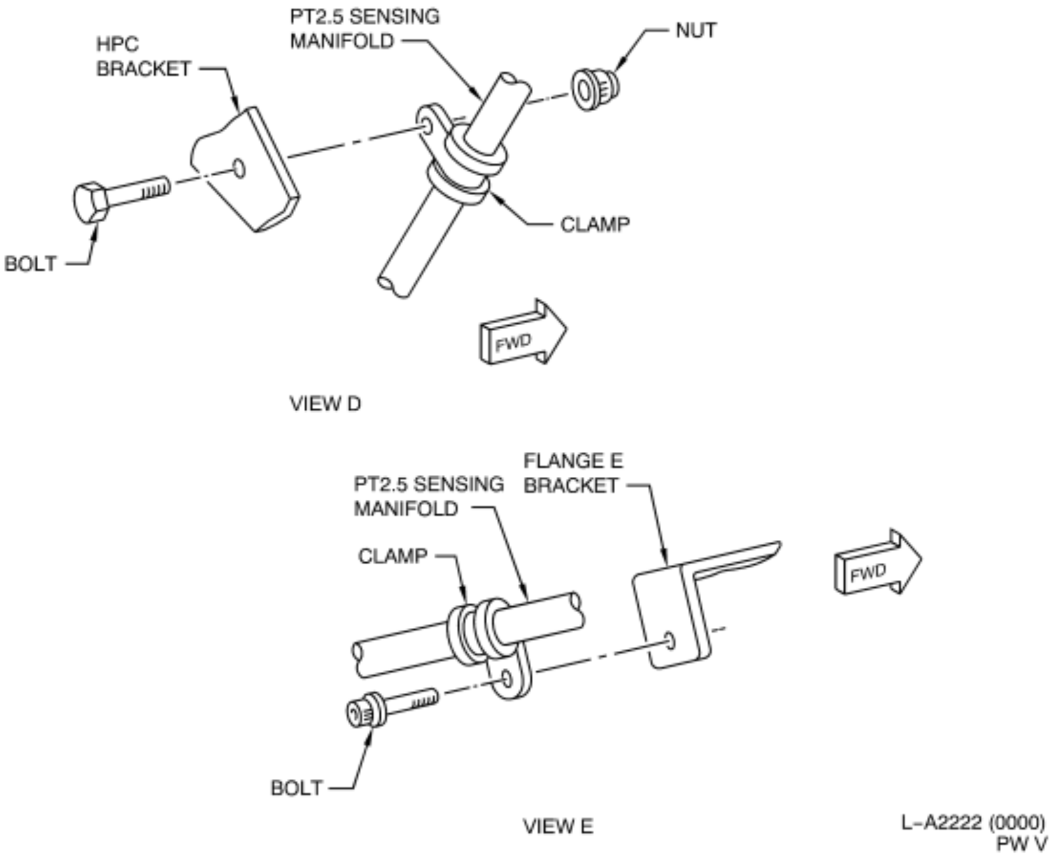
NOTE: The welded tube clamp on tubes (AS20/29) at the 12 o'clock position is attached to the guide on the intermediate case with the installation of the W1 harness. See View S.


PB AND PT2.5
SENSING TUBE
FLANGE E
A
PT2.5 SENSING
TUBE
B
FWD
C
HPC
D
PT2.5 SENSING
MANIFOLD
E
L−A2220 (0000)
PW V

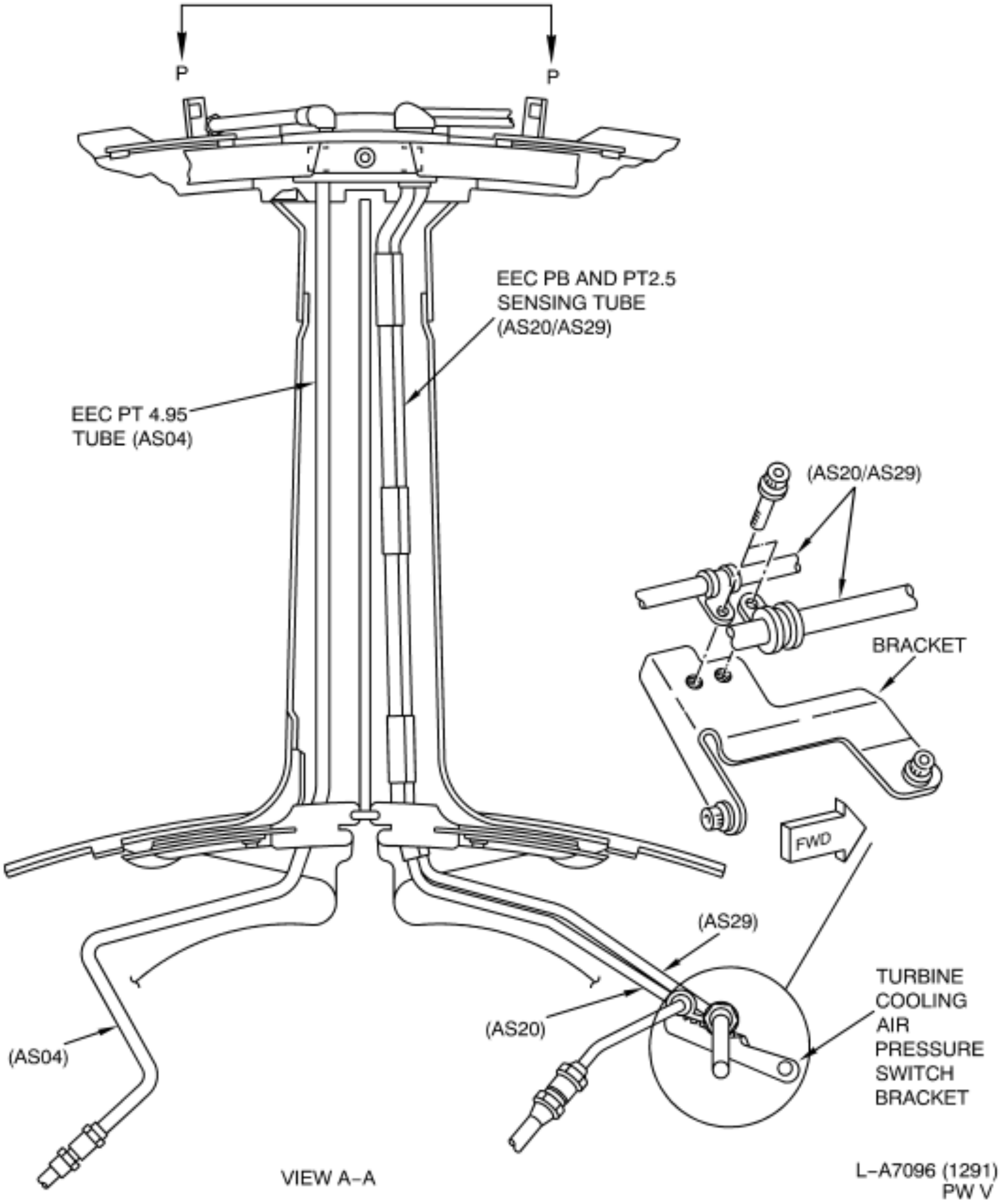
External Plumbing (Engines With Multiplexer Unit)
Figure 401 (Sheet 1)
(Task 72−00−34−420−002)


BOLT
CLAMP
FWD
FLANGE E BRACKET
PT2.5 SENSING TUBE (AS30)
VIEW A
PT2.5 SENSING TUBE (AS30)
BOLT
CLAMP
FWD
FLANGE E BRACKET
VIEW B
PT2.5 SENSING TUBE (AS30)
CLAMP
FWD
BOLT
FLANGE E BRACKET
VIEW C
L-A2221
1289

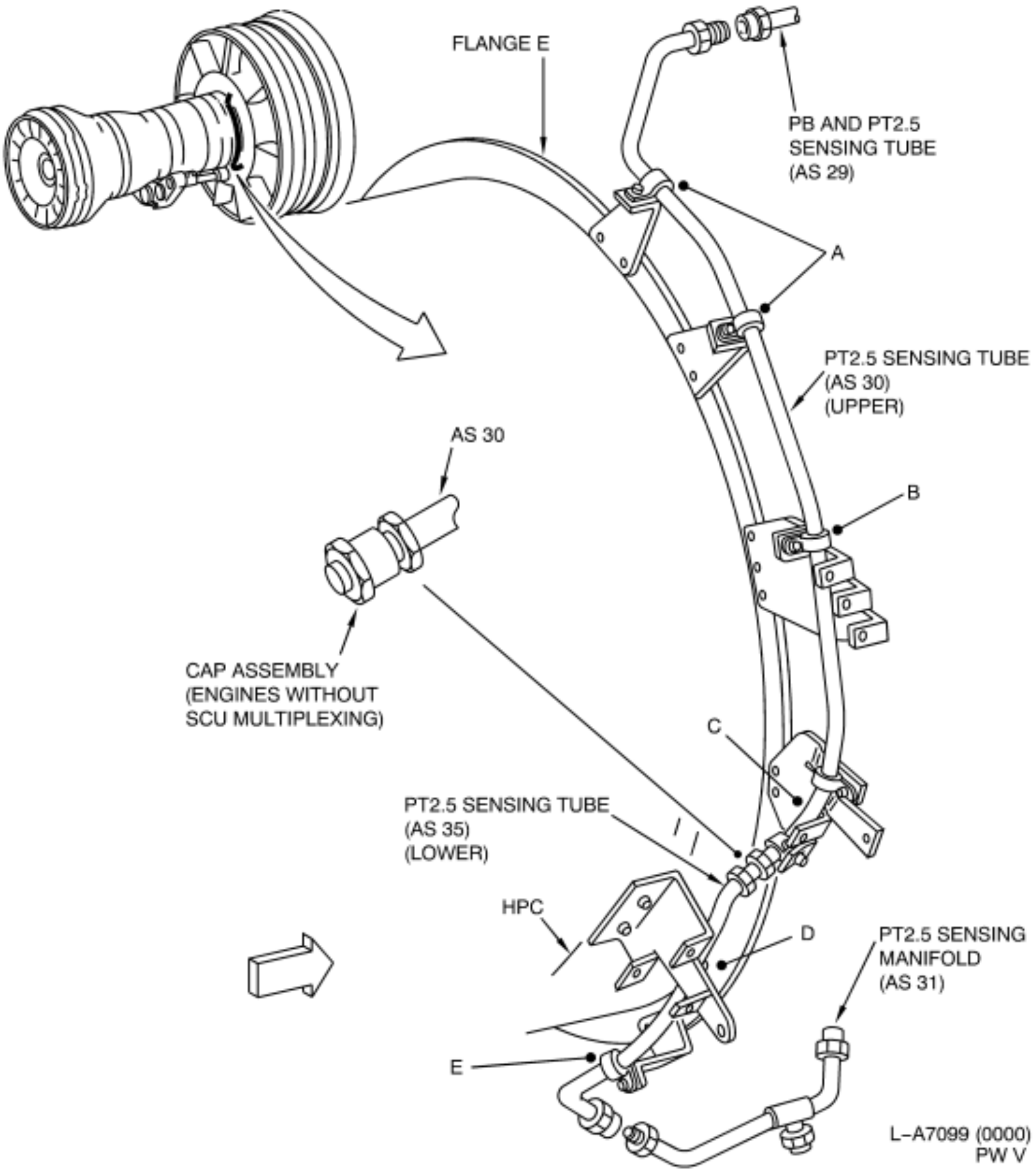
External Plumbing (Engines With Multiplexer Unit)
Figure 401 (Sheet 2)
(Task 72-00-34-420-002)


PT2.5 SENSING MANIFOLD
HPC BRACKET
NUT
BOLT
CLAMP
FWD
VIEW D
FLANGE E BRACKET
PT2.5 SENSING MANIFOLD
CLAMP
FWD
BOLT
VIEW E
L−A2222 (0000)
PW V

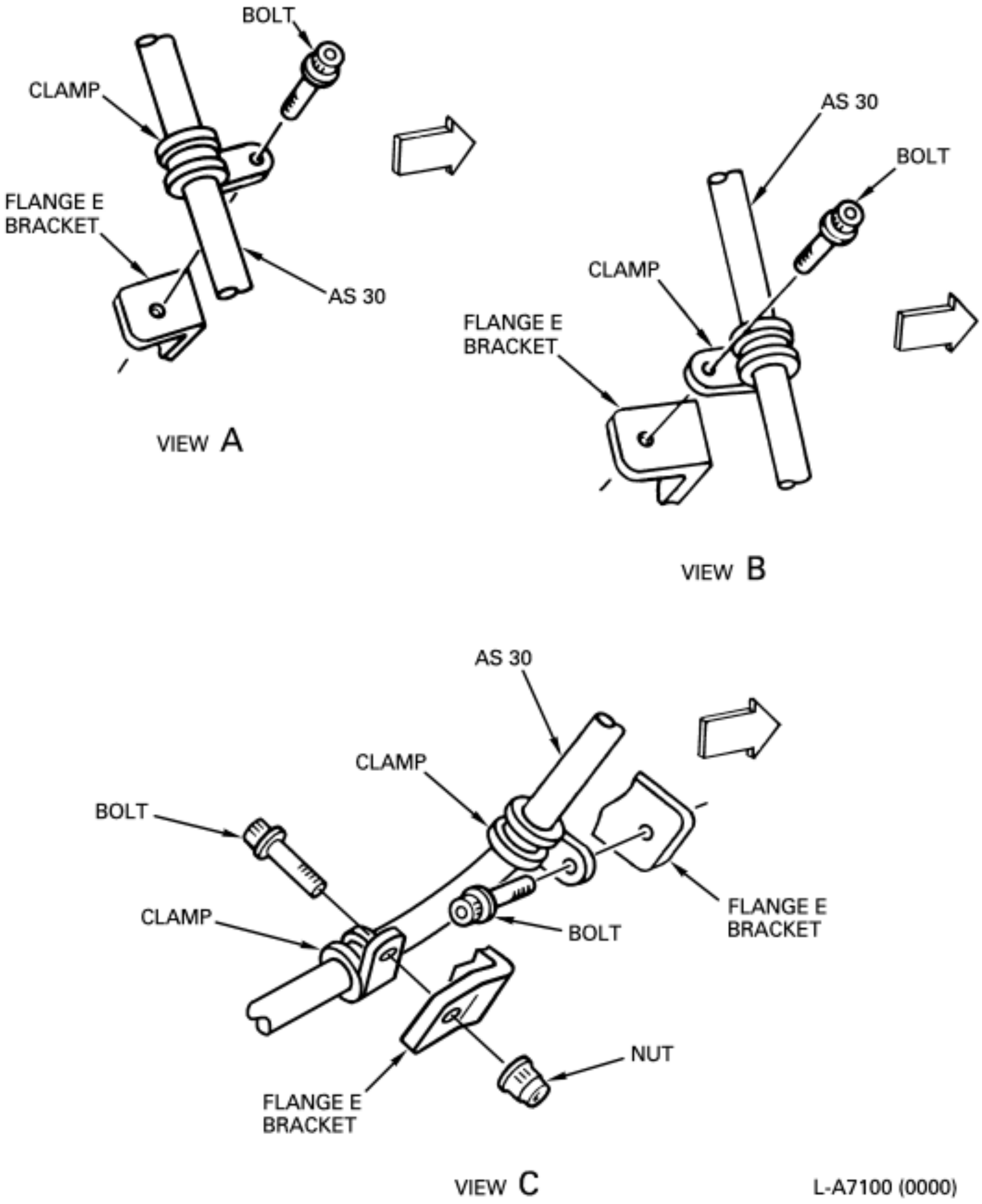
External Plumbing (Engines With Multiplexer Unit)
Figure 401 (Sheet 3)
(Task 72−00−34−420−002)


P
P
EEC PB AND PT2.5
SENSING TUBE
(AS20/AS29)
EEC PT 4.95
TUBE (AS04)
(AS20/AS29)
BRACKET
FWD
(AS29)
(AS20)
(AS04)
TURBINE
COOLING
AIR
PRESSURE
SWITCH
BRACKET
VIEW A−A
L−A7096 (1291)
PW V

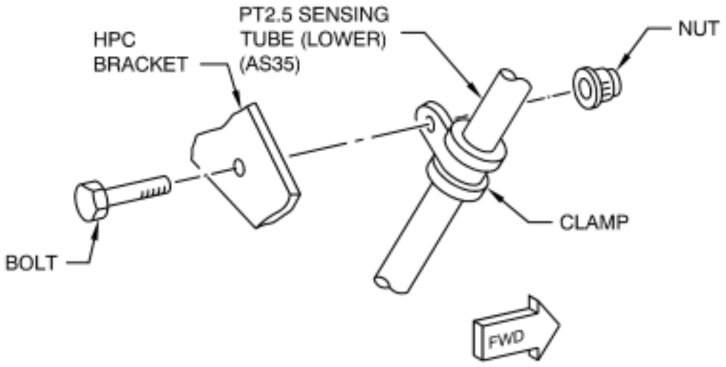
External Plumbing (Engines With SCU With Multiplexing)
Figure 401 (Sheet 4)
(Task 72−00−34−420−002)


FLANGE E
PB AND PT2.5 SENSING TUBE (AS 29)
A
PT2.5 SENSING TUBE (AS 30) (UPPER)
AS 30
B
CAP ASSEMBLY (ENGINES WITHOUT SCU MULTIPLEXING)
C
PT2.5 SENSING TUBE (AS 35) (LOWER)
HPC
D
PT2.5 SENSING MANIFOLD (AS 31)
E
L−A7099 (0000)
PW V

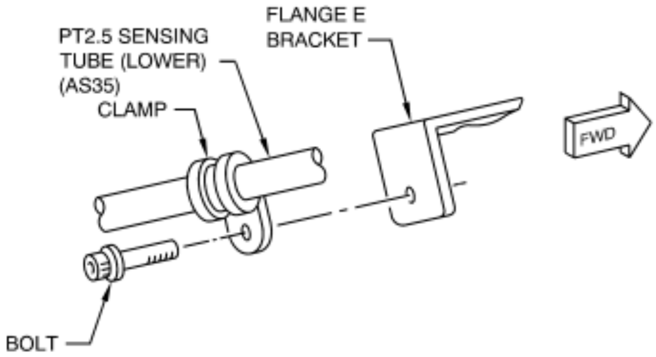
External Plumbing (Engines With SCU With Multiplexing)
Figure 401 (Sheet 5)
(Task 72−00−34−420−002)


BOLT
CLAMP
FLANGE E BRACKET
AS 30
VIEW A
AS 30
BOLT
CLAMP
FLANGE E BRACKET
VIEW B
AS 30
CLAMP
BOLT
CLAMP
BOLT
FLANGE E BRACKET
FLANGE E BRACKET
NUT
VIEW C
L-A7100 (0000)

External Plumbing (Engines With SCU With Multiplexing)
Figure 401 (Sheet 6)
(Task 72−00−34−420−002)


PT2.5 SENSING TUBE (LOWER) (AS35)
NUT
HPC BRACKET
CLAMP
BOLT
FWD

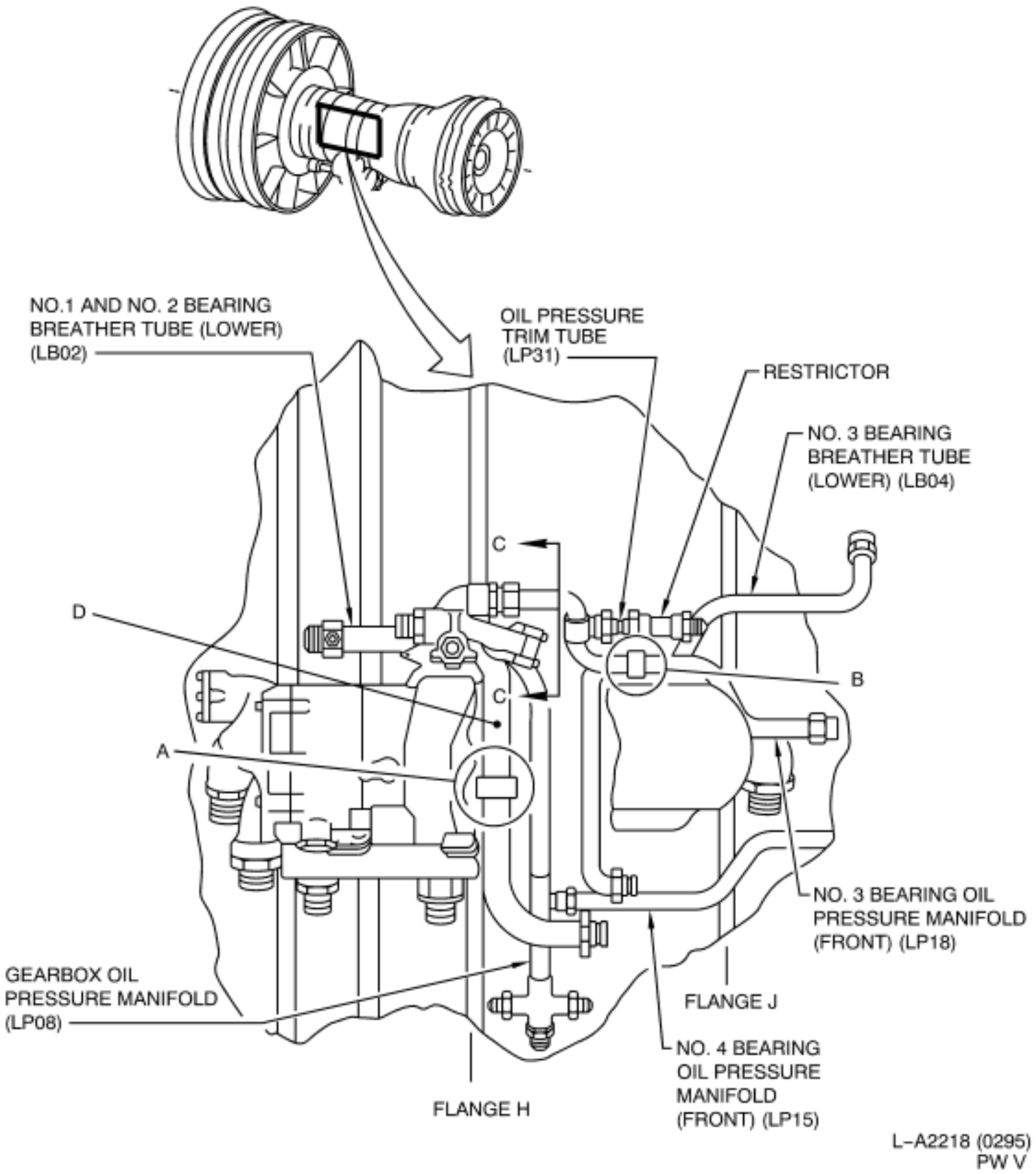
VIEW D


FLANGE E BRACKET
PT2.5 SENSING TUBE (LOWER) (AS35)
CLAMP
FWD
BOLT

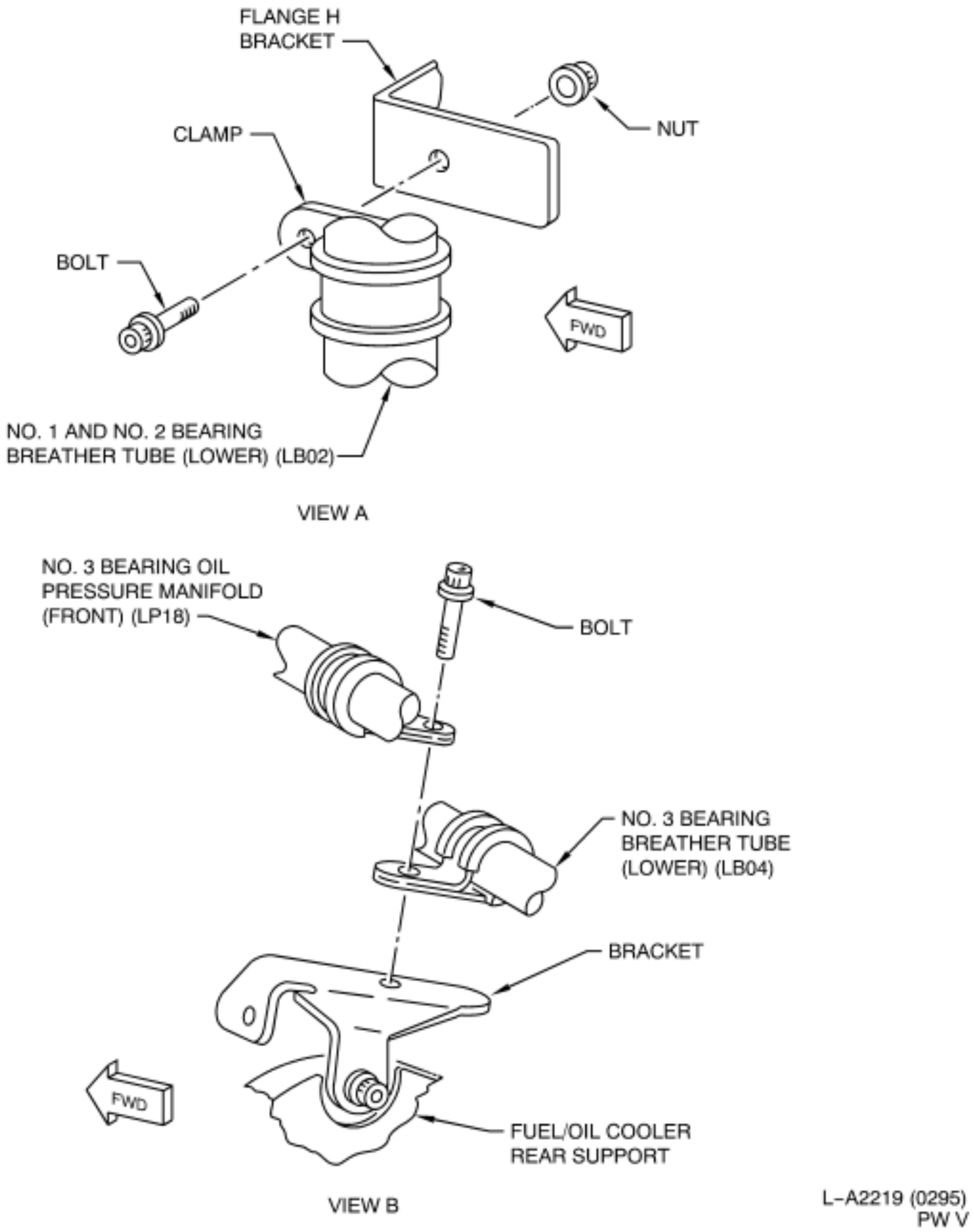
VIEW E

L−A4704 (1289)
PW V

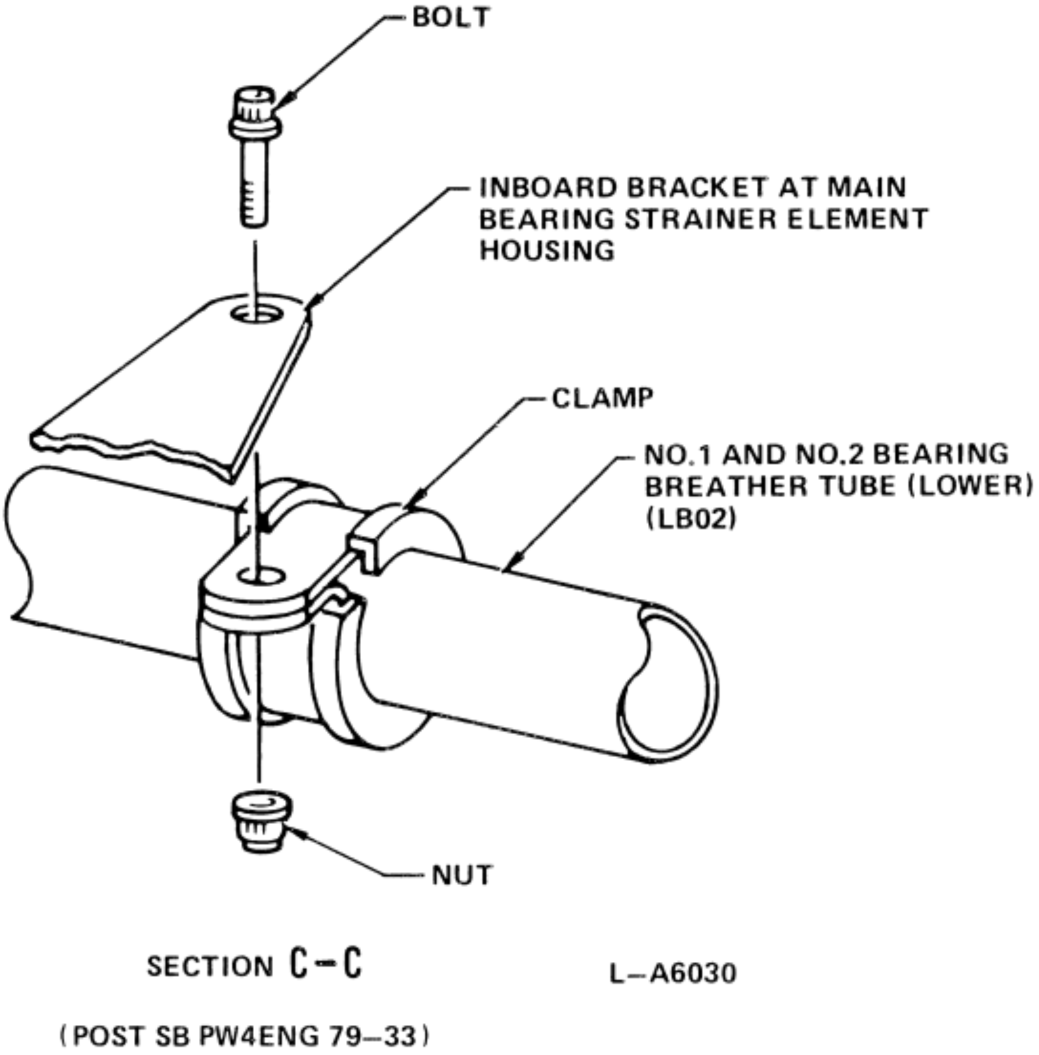
External Plumbing (Engines With SCU With Multiplexing)
Figure 401 (Sheet 7)
(Task 72−00−34−420−002)


NO.1 AND NO. 2 BEARING BREATHER TUBE (LOWER) (LB02)
OIL PRESSURE TRIM TUBE (LP31)
RESTRICTOR
NO. 3 BEARING BREATHER TUBE (LOWER) (LB04)
C
D
B
C
A
NO. 3 BEARING OIL PRESSURE MANIFOLD (FRONT) (LP18)
GEARBOX OIL PRESSURE MANIFOLD (LP08)
FLANGE J
NO. 4 BEARING OIL PRESSURE MANIFOLD (FRONT) (LP15)
FLANGE H
L-A2218 (0295)
PW V

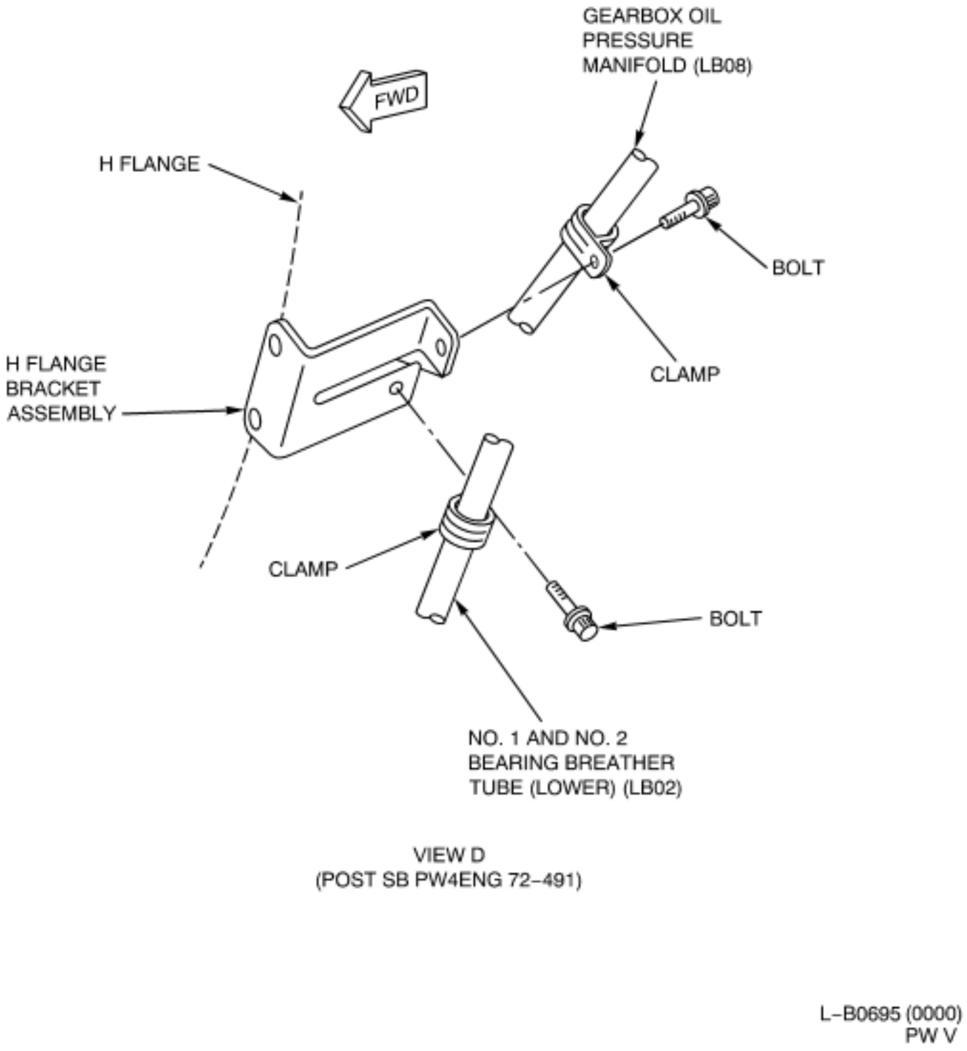
External Plumbing
Figure 402 (Sheet 1)
(Task 72-00-34-420-002)


FLANGE H BRACKET
NUT
CLAMP
BOLT
FWD
NO. 1 AND NO. 2 BEARING BREATHER TUBE (LOWER) (LB02)
VIEW A
NO. 3 BEARING OIL PRESSURE MANIFOLD (FRONT) (LP18)
BOLT
NO. 3 BEARING BREATHER TUBE (LOWER) (LB04)
BRACKET
FWD
FUEL/OIL COOLER REAR SUPPORT
VIEW B
L-A2219 (0295)
PW V

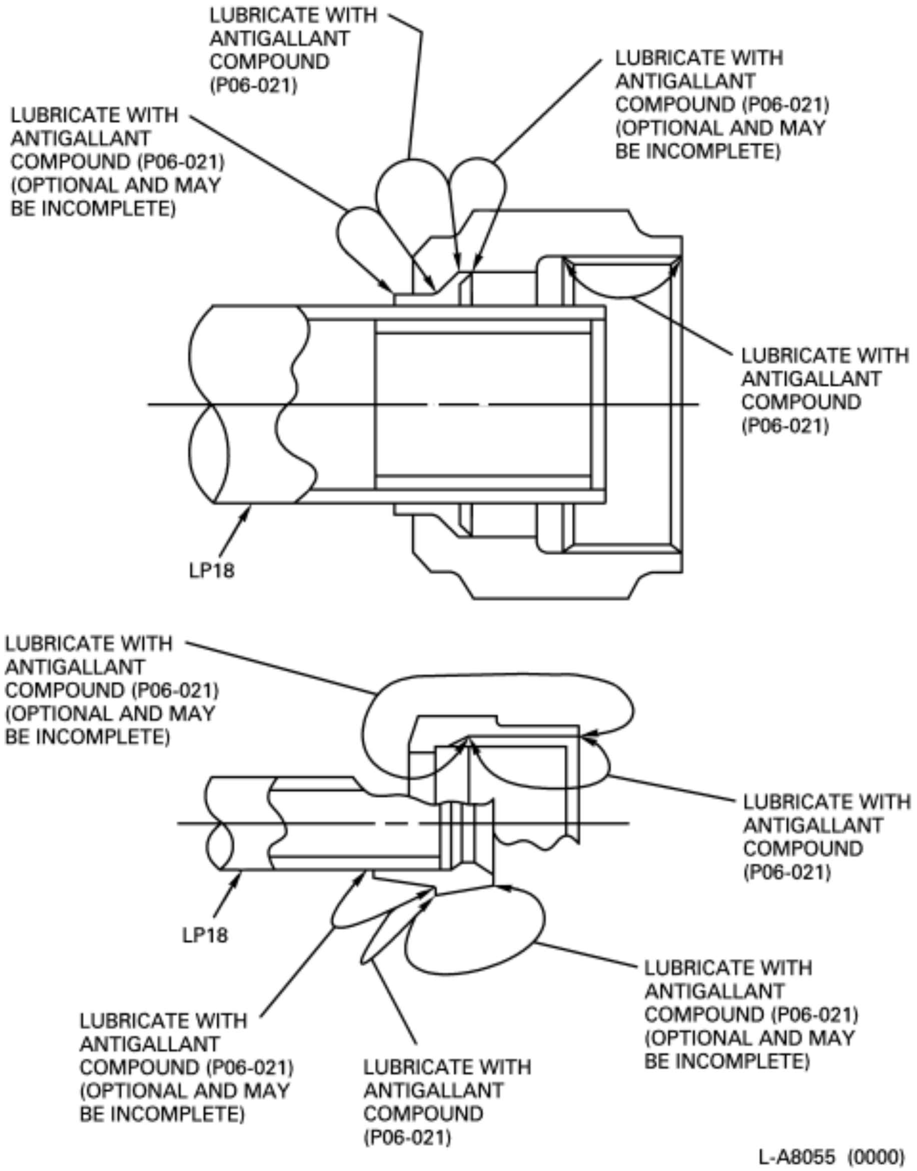
External Plumbing
Figure 402 (Sheet 2)
(Task 72-00-34-420-002)


BOLT
INBOARD BRACKET AT MAIN BEARING STRAINER ELEMENT HOUSING
CLAMP
NO.1 AND NO.2 BEARING BREATHER TUBE (LOWER) (LB02)
NUT
SECTION C-C
L-A6030
(POST SB PW4ENG 79-33)

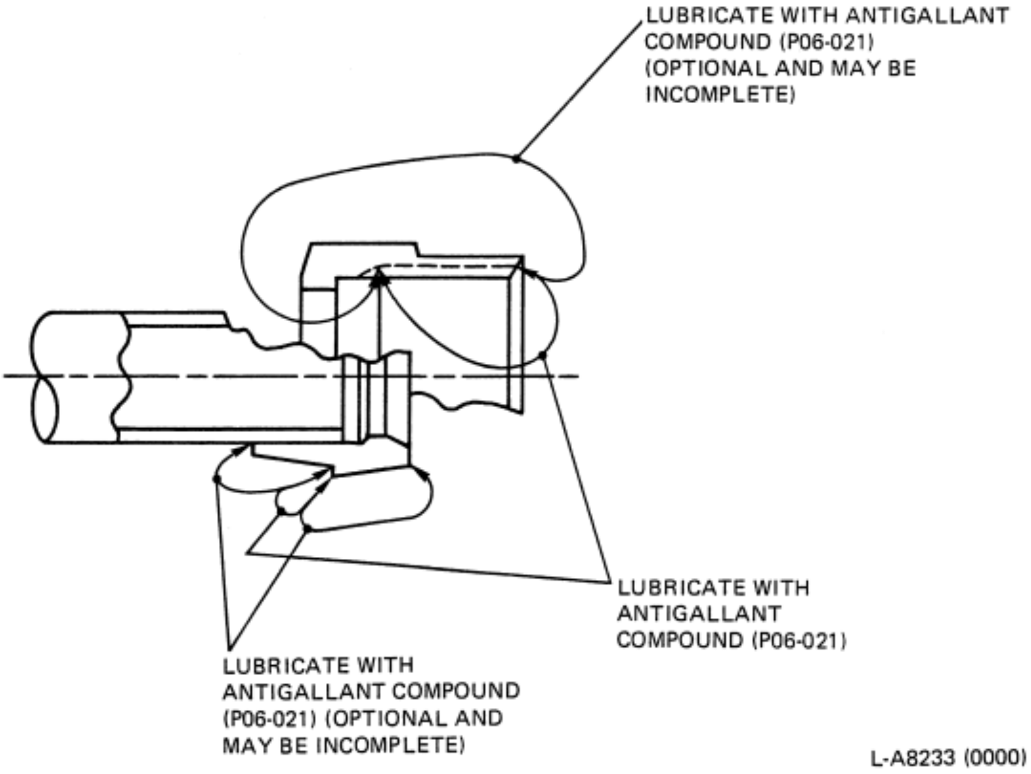
External Plumbing
Figure 402 (Sheet 3)
(Task 72-00-34-420-002)


GEARBOX OIL PRESSURE MANIFOLD (LB08)
FWD
H FLANGE
BOLT
H FLANGE BRACKET ASSEMBLY
CLAMP
CLAMP
BOLT
NO. 1 AND NO. 2 BEARING BREATHER TUBE (LOWER) (LB02)
VIEW D
(POST SB PW4ENG 72-491)
L-B0695 (0000)
PW V

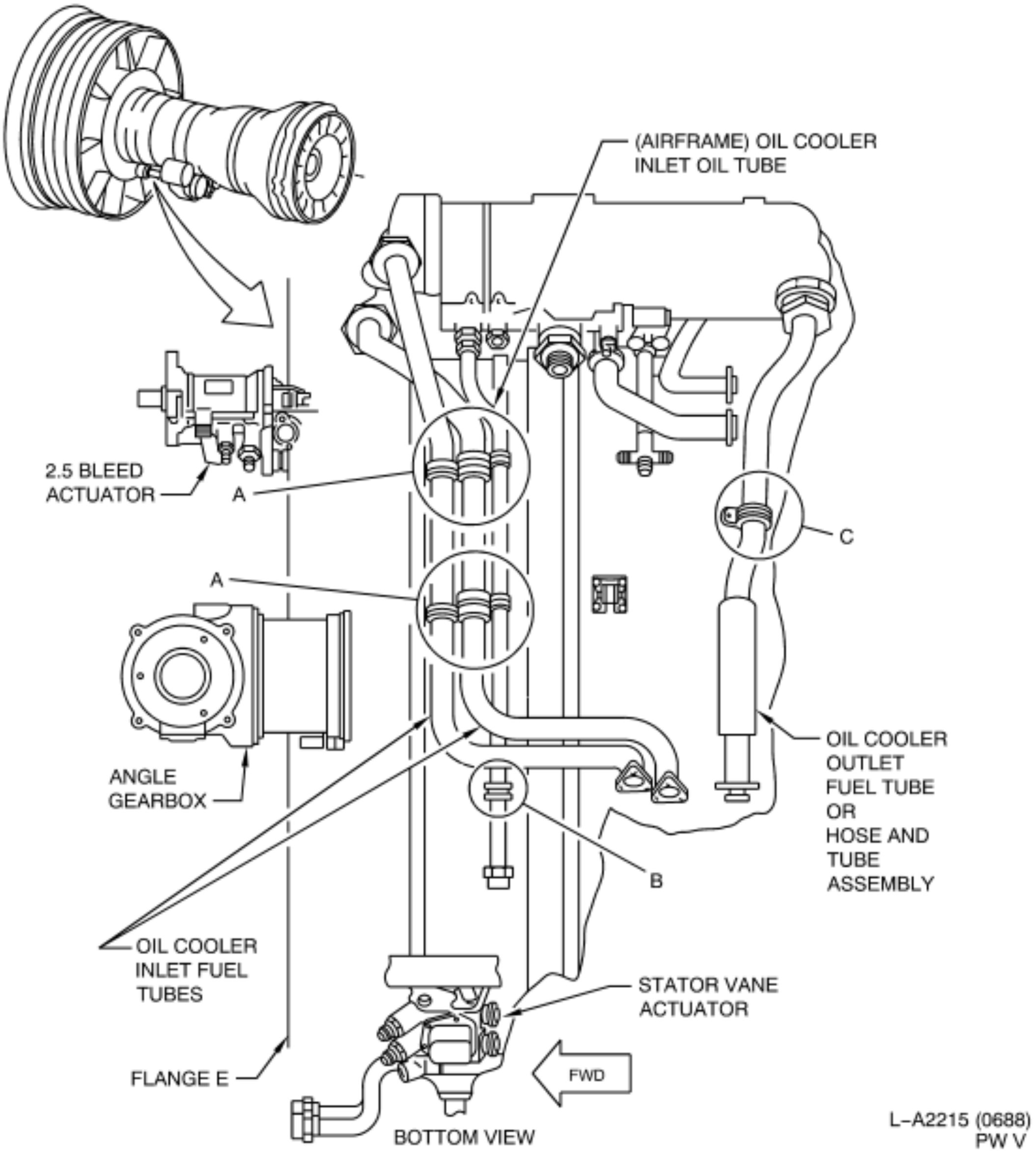
External Plumbing
Figure 402 (Sheet 4)
(Task 72-00-34-420-002)


LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LP18
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LP18
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
L-A8055 (0000)

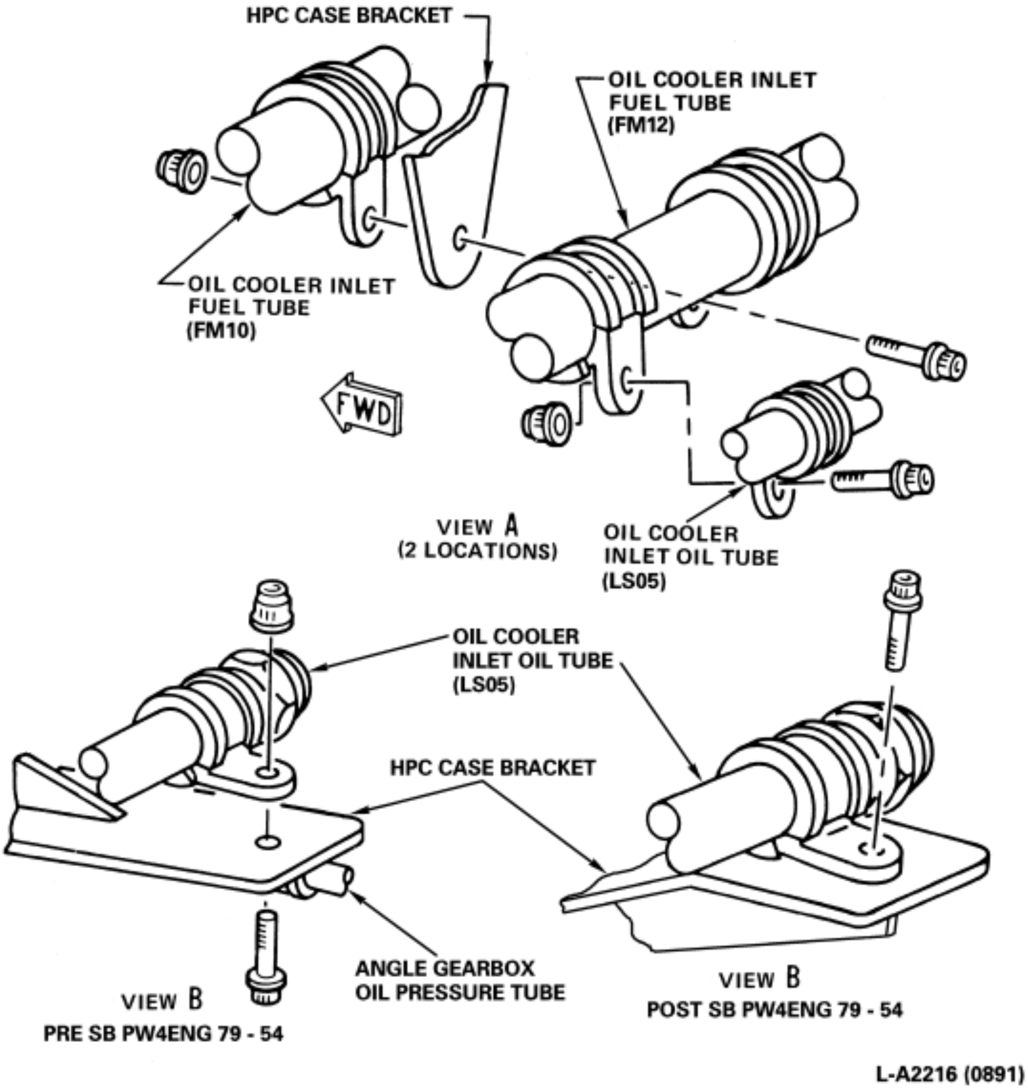
External Plumbing (Post SB PW4ENG 79−52
Lubricate Manifold Ferrules And Nuts)
Figure 402 (Sheet 5)
(Task 72−00−34−420−002)


LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
L-A8233 (0000)

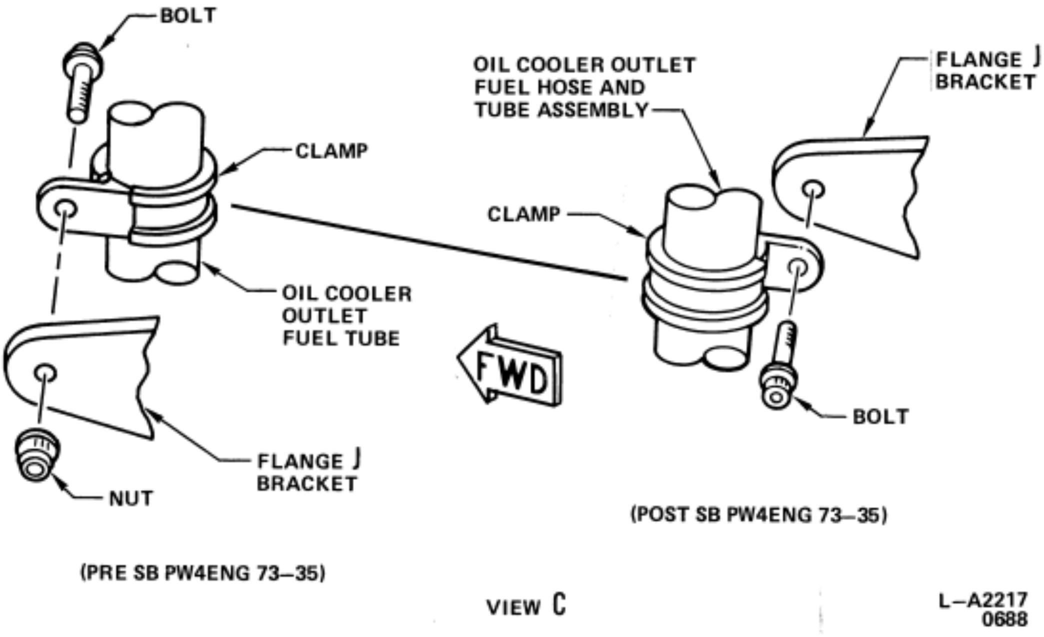
External Plumbing (Application Of Antigallant)
Figure 402 (Sheet 6)
(Task 72−00−34−420−002)


(AIRFRAME) OIL COOLER INLET OIL TUBE
2.5 BLEED ACTUATOR
A
A
C
ANGLE GEARBOX
OIL COOLER OUTLET FUEL TUBE OR HOSE AND TUBE ASSEMBLY
B
OIL COOLER INLET FUEL TUBES
STATOR VANE ACTUATOR
FLANGE E
FWD
BOTTOM VIEW
L−A2215 (0688)
PW V

External Plumbing
Figure 403 (Sheet 1)
(Task 72−00−34−420−002)

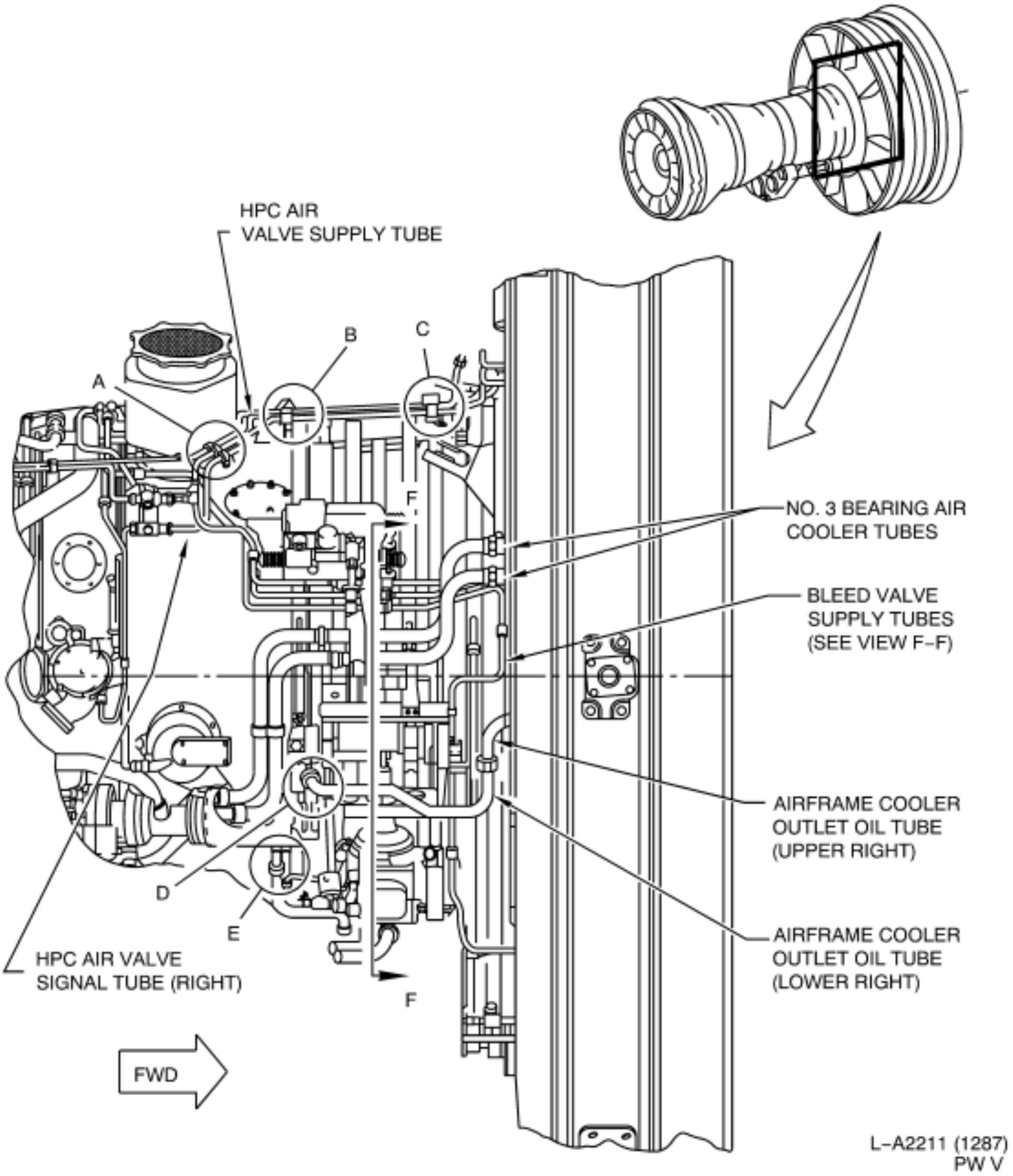

HPC CASE BRACKET
OIL COOLER INLET FUEL TUBE (FM12)
OIL COOLER INLET FUEL TUBE (FM10)
FWD
VIEW A (2 LOCATIONS)
OIL COOLER INLET OIL TUBE (LS05)
OIL COOLER INLET OIL TUBE (LS05)
HPC CASE BRACKET
ANGLE GEARBOX OIL PRESSURE TUBE
VIEW B PRE SB PW4ENG 79 - 54
VIEW B POST SB PW4ENG 79 - 54
L-A2216 (0891)

External Plumbing
Figure 403 (Sheet 2)
(Task 72−00−34−420−002)

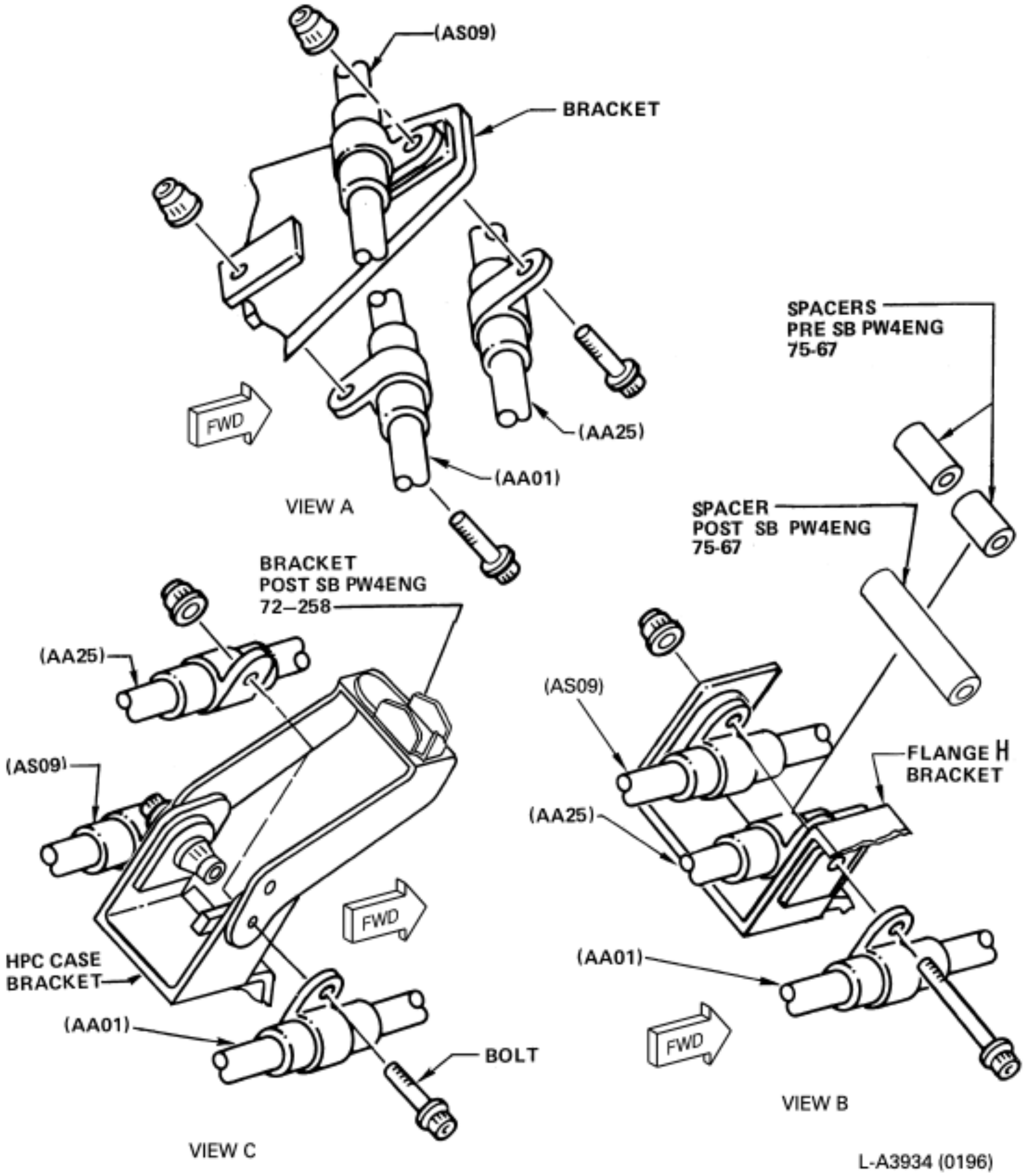

BOLT
CLAMP
OIL COOLER OUTLET FUEL TUBE
FLANGE J BRACKET
NUT
(PRE SB PW4ENG 73-35)
OIL COOLER OUTLET FUEL HOSE AND TUBE ASSEMBLY
FLANGE J BRACKET
CLAMP
FWD
BOLT
(POST SB PW4ENG 73-35)
VIEW C
L-A2217
0688

External Plumbing
Figure 403 (Sheet 3)
(Task 72-00-34-420-002)

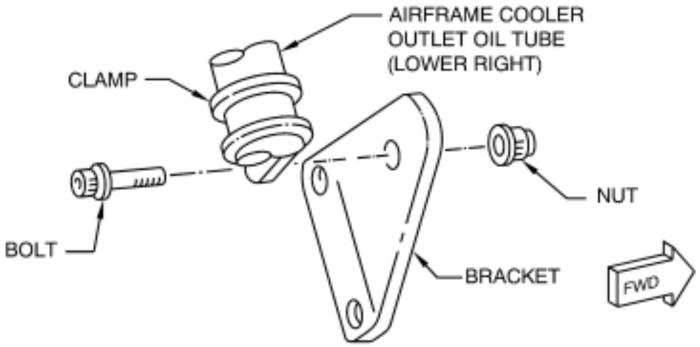
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−02


HPC AIR
VALVE SUPPLY TUBE
A
B
C
F
NO. 3 BEARING AIR
COOLER TUBES
BLEED VALVE
SUPPLY TUBES
(SEE VIEW F−F)
AIRFRAME COOLER
OUTLET OIL TUBE
(UPPER RIGHT)
AIRFRAME COOLER
OUTLET OIL TUBE
(LOWER RIGHT)
D
E
F
HPC AIR VALVE
SIGNAL TUBE (RIGHT)
FWD
L−A2211 (1287)
PW V

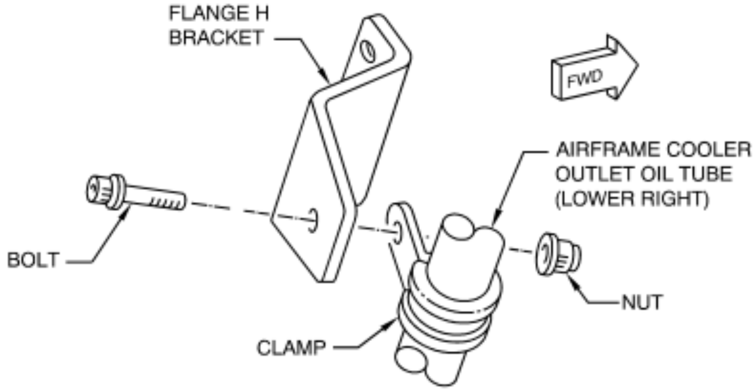
External Plumbing
Figure 404 (Sheet 1)
(Task 72−00−34−420−002)


(AS09)
BRACKET
SPACERS
PRE SB PW4ENG
75-67
FWD
(AA25)
(AA01)
VIEW A
SPACER
POST SB PW4ENG
75-67
BRACKET
POST SB PW4ENG
72–258
(AA25)
(AS09)
(AS09)
FLANGE H
BRACKET
(AA25)
FWD
(AA01)
HPC CASE
BRACKET
(AA01)
BOLT
FWD
VIEW B
VIEW C
L-A3934 (0196)

External Plumbing
Figure 404 (Sheet 2)
(Task 72−00−34−420−002)


AIRFRAME COOLER
OUTLET OIL TUBE
(LOWER RIGHT)
CLAMP
NUT
BOLT
BRACKET
FWD

VIEW D

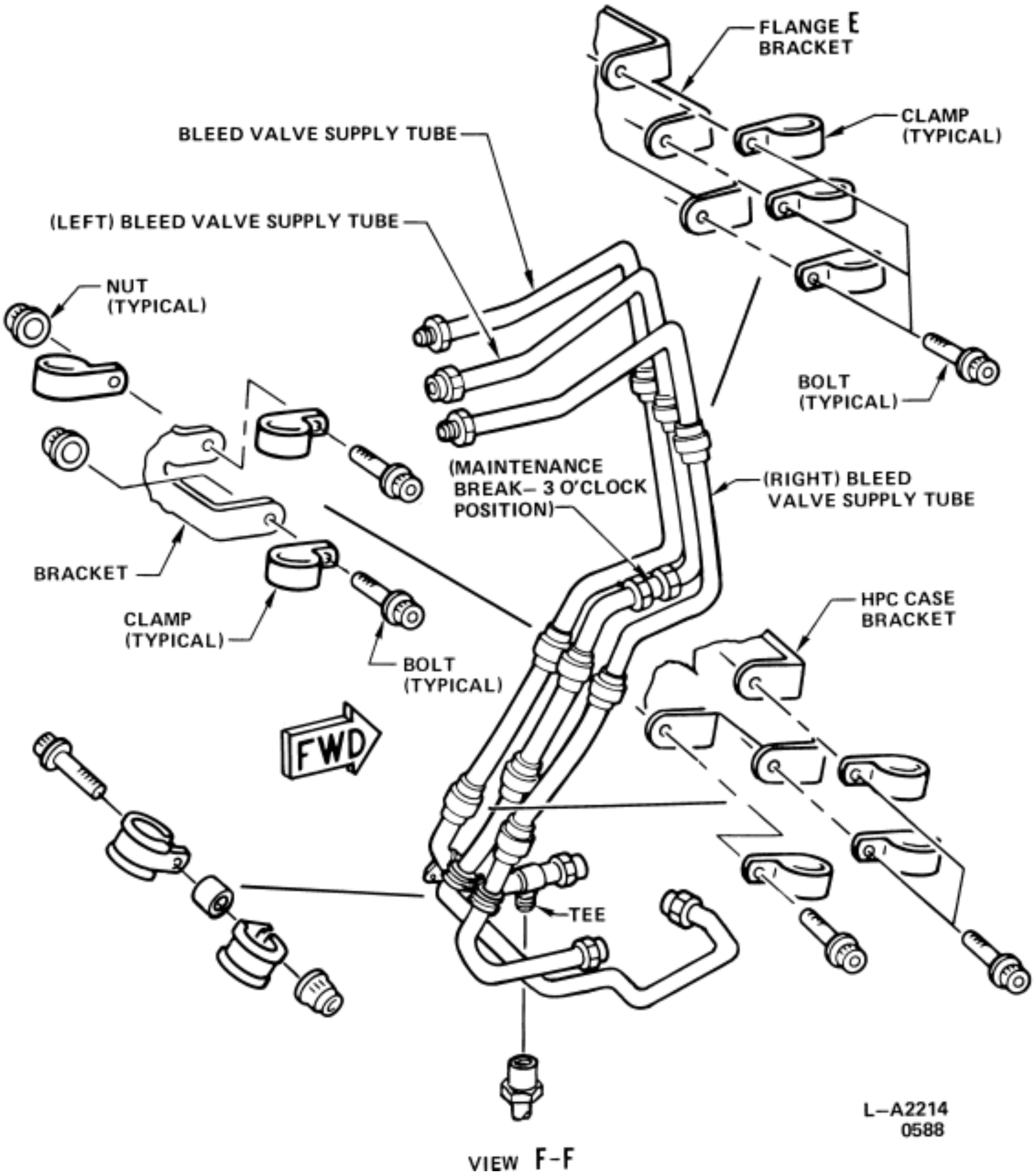

FLANGE H
BRACKET
FWD
AIRFRAME COOLER
OUTLET OIL TUBE
(LOWER RIGHT)
BOLT
NUT
CLAMP

VIEW E

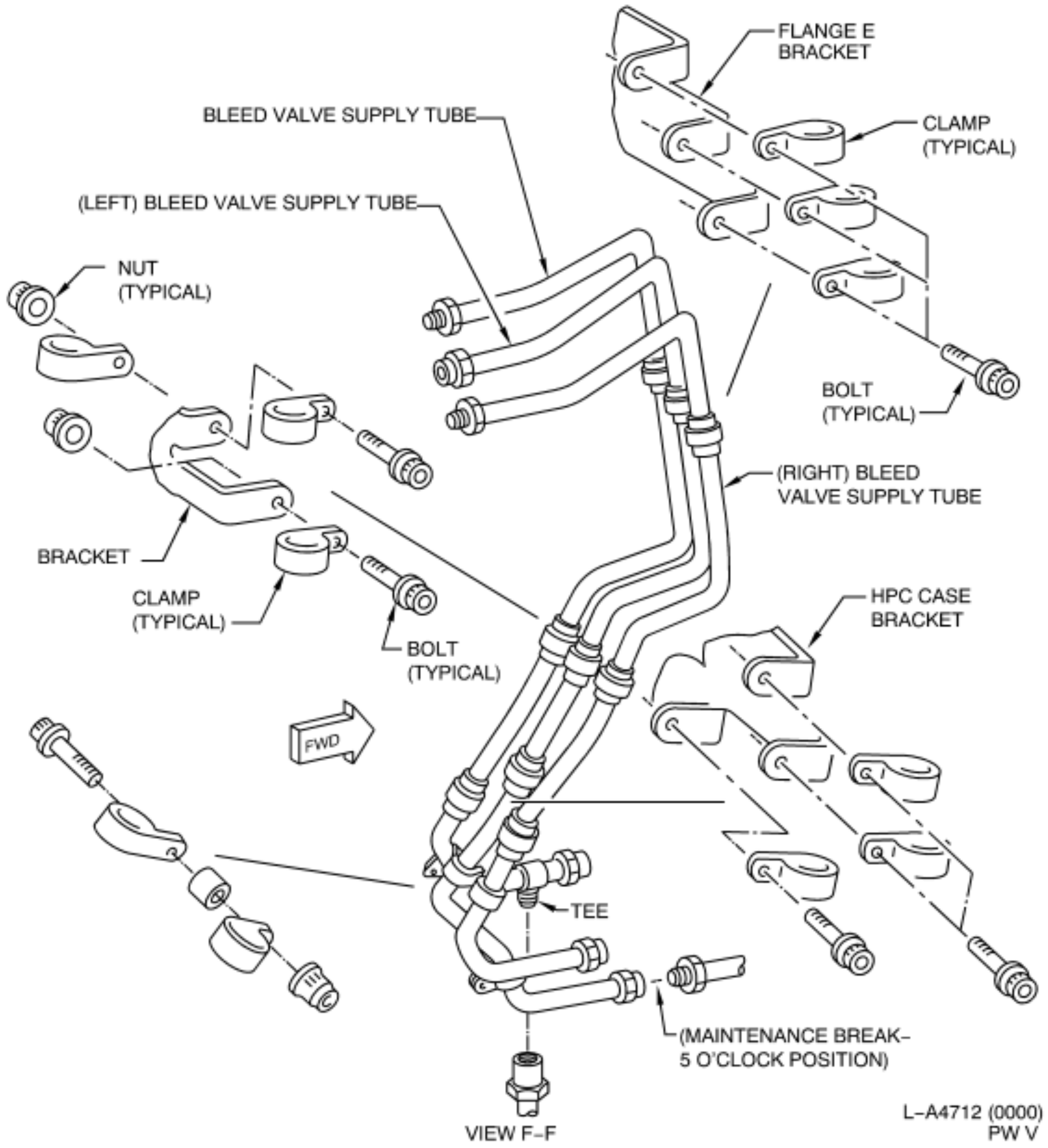
L−A2213 (1287)
PW V

External Plumbing
Figure 404 (Sheet 3)
(Task 72−00−34−420−002)

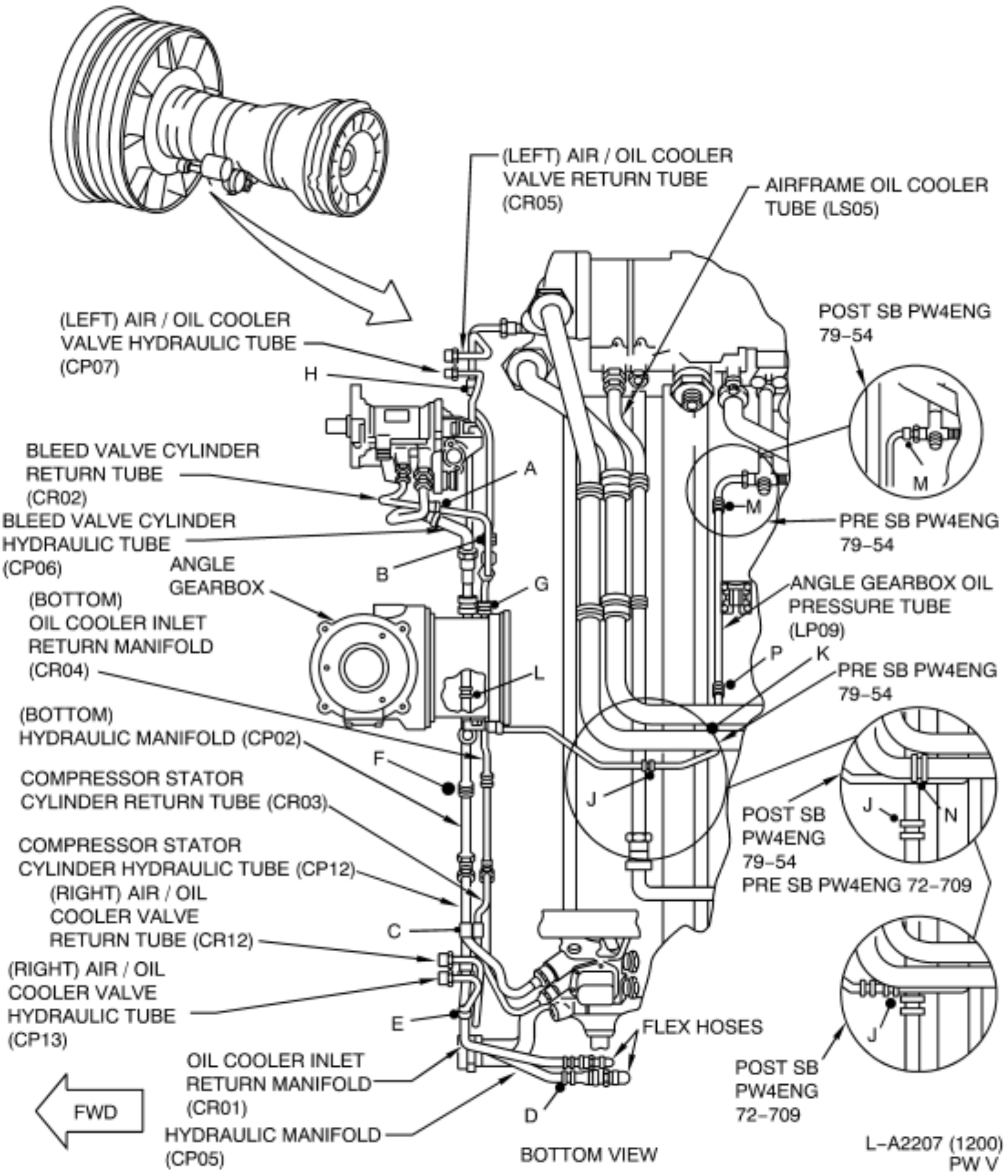
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−02


FLANGE E
BRACKET
CLAMP
(TYPICAL)
BLEED VALVE SUPPLY TUBE
(LEFT) BLEED VALVE SUPPLY TUBE
NUT
(TYPICAL)
BOLT
(TYPICAL)
(MAINTENANCE
BREAK– 3 O'CLOCK
POSITION)
(RIGHT) BLEED
VALVE SUPPLY TUBE
BRACKET
CLAMP
(TYPICAL)
BOLT
(TYPICAL)
HPC CASE
BRACKET
FWD
TEE
L–A2214
0588
VIEW F-F

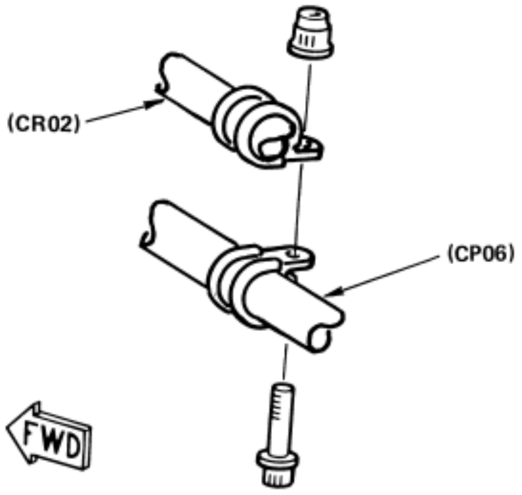
External Plumbing (Pre SB PW4ENG 75−28)
Figure 404 (Sheet 4)
(Task 72−00−34−420−002)


FLANGE E BRACKET
BLEED VALVE SUPPLY TUBE
CLAMP (TYPICAL)
(LEFT) BLEED VALVE SUPPLY TUBE
NUT (TYPICAL)
BOLT (TYPICAL)
(RIGHT) BLEED VALVE SUPPLY TUBE
BRACKET
CLAMP (TYPICAL)
BOLT (TYPICAL)
HPC CASE BRACKET
FWD
TEE
(MAINTENANCE BREAK- 5 O'CLOCK POSITION)
VIEW F-F
L-A4712 (0000)
PW V

External Plumbing (Post SB PW4ENG 75-28)
Figure 404 (Sheet 5)
(Task 72-00-34-420-002)

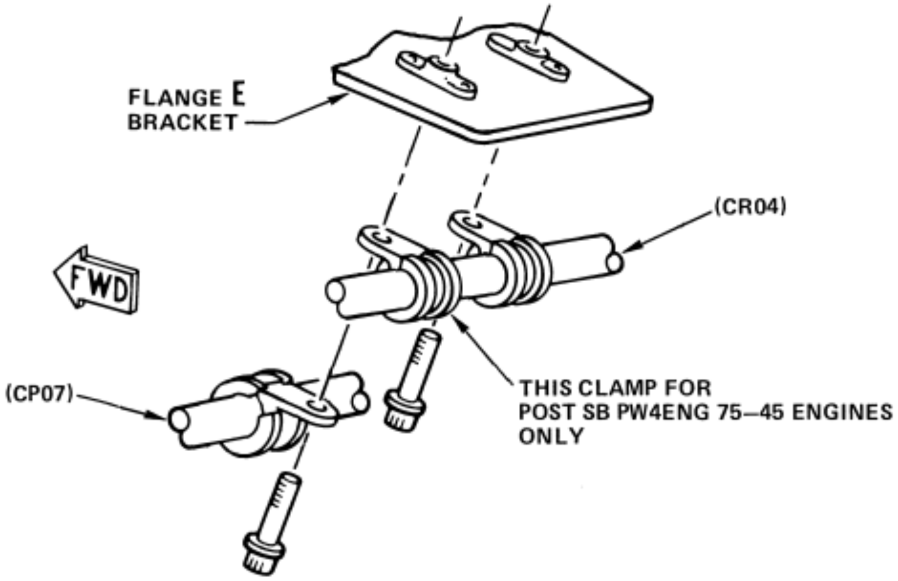

(LEFT) AIR / OIL COOLER VALVE RETURN TUBE (CR05)
AIRFRAME OIL COOLER TUBE (LS05)
(LEFT) AIR / OIL COOLER VALVE HYDRAULIC TUBE (CP07)
H
POST SB PW4ENG 79-54
M
BLEED VALVE CYLINDER RETURN TUBE (CR02)
A
M
PRE SB PW4ENG 79-54
BLEED VALVE CYLINDER HYDRAULIC TUBE (CP06)
ANGLE GEARBOX
B
G
ANGLE GEARBOX OIL PRESSURE TUBE (LP09)
(BOTTOM) OIL COOLER INLET RETURN MANIFOLD (CR04)
P
K
PRE SB PW4ENG 79-54
L
(BOTTOM) HYDRAULIC MANIFOLD (CP02)
F
J
J
N
COMPRESSOR STATOR CYLINDER RETURN TUBE (CR03)
POST SB PW4ENG 79-54 PRE SB PW4ENG 72-709
COMPRESSOR STATOR CYLINDER HYDRAULIC TUBE (CP12)
(RIGHT) AIR / OIL COOLER VALVE RETURN TUBE (CR12)
C
(RIGHT) AIR / OIL COOLER VALVE HYDRAULIC TUBE (CP13)
E
FLEX HOSES
J
POST SB PW4ENG 72-709
OIL COOLER INLET RETURN MANIFOLD (CR01)
FWD
D
HYDRAULIC MANIFOLD (CP05)
BOTTOM VIEW
L-A2207 (1200)
PW V

External Plumbing
Figure 405 (Sheet 1)
(Task 72−00−34−420−002)


(CR02)
(CP06)
FWD

(POST SB PW4ENG 75−45 ONLY)

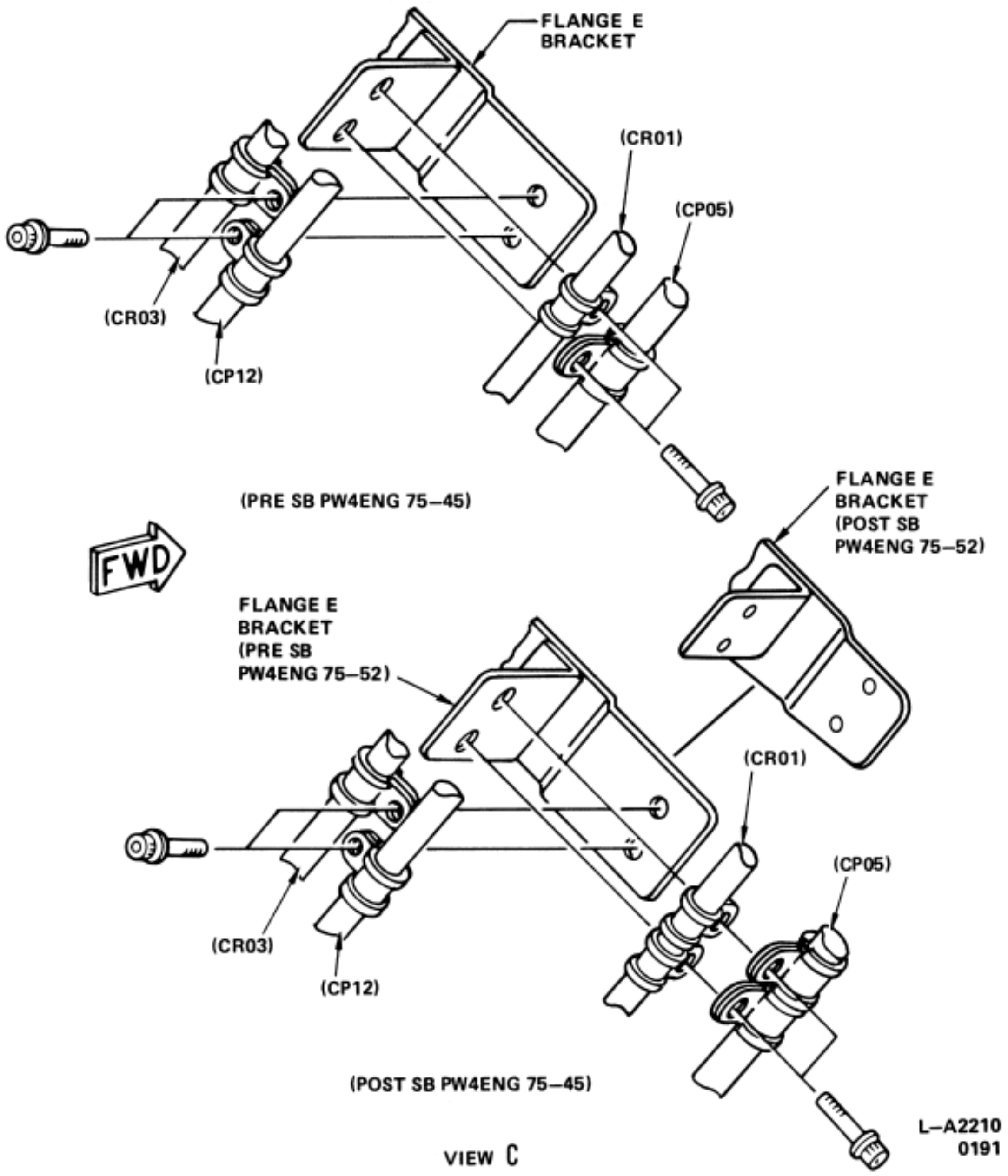
VIEW A


FLANGE E BRACKET
(CR04)
FWD
(CP07)
THIS CLAMP FOR POST SB PW4ENG 75−45 ENGINES ONLY

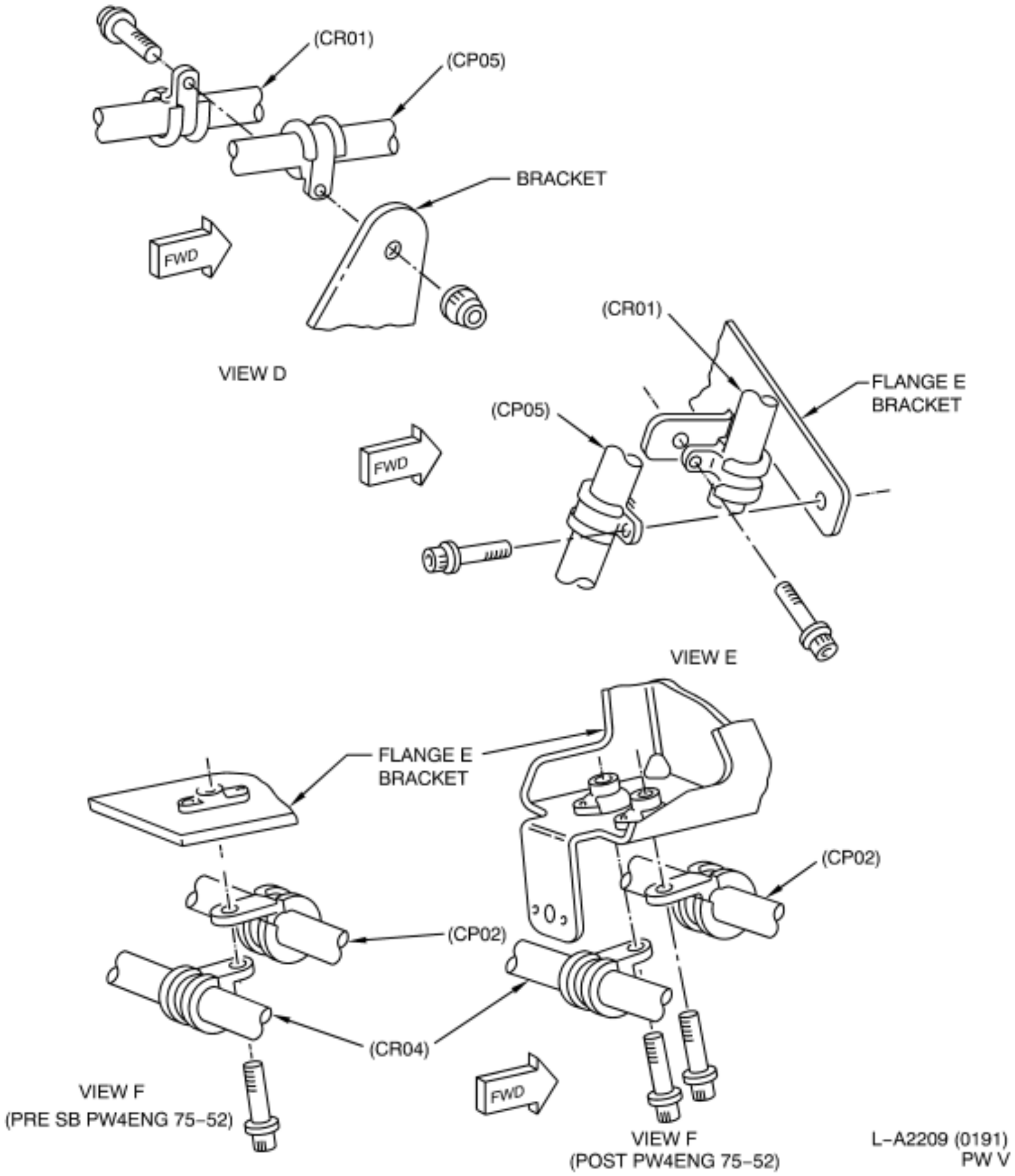
VIEW B

L−A2208
0390

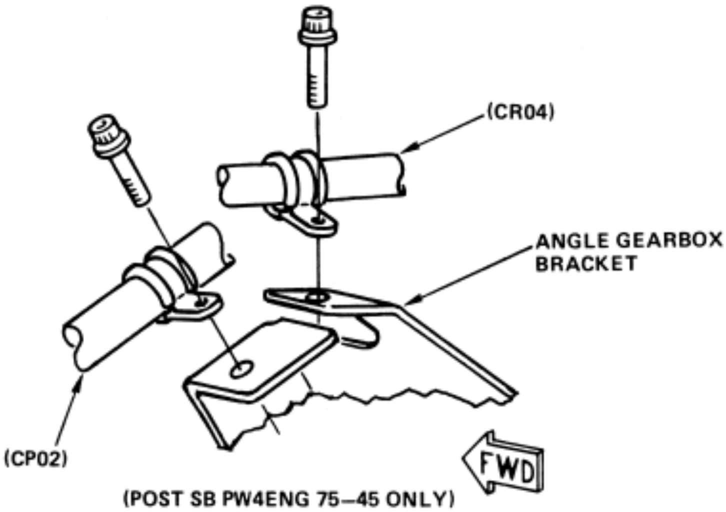
External Plumbing
Figure 405 (Sheet 2)
(Task 72−00−34−420−002)


FLANGE E BRACKET
(CR01)
(CP05)
(CR03)
(CP12)
(PRE SB PW4ENG 75−45)
FWD
FLANGE E BRACKET (POST SB PW4ENG 75−52)
FLANGE E BRACKET (PRE SB PW4ENG 75−52)
(CR01)
(CP05)
(CR03)
(CP12)
(POST SB PW4ENG 75−45)
VIEW C
L−A2210
0191

External Plumbing
Figure 405 (Sheet 3)
(Task 72−00−34−420−002)

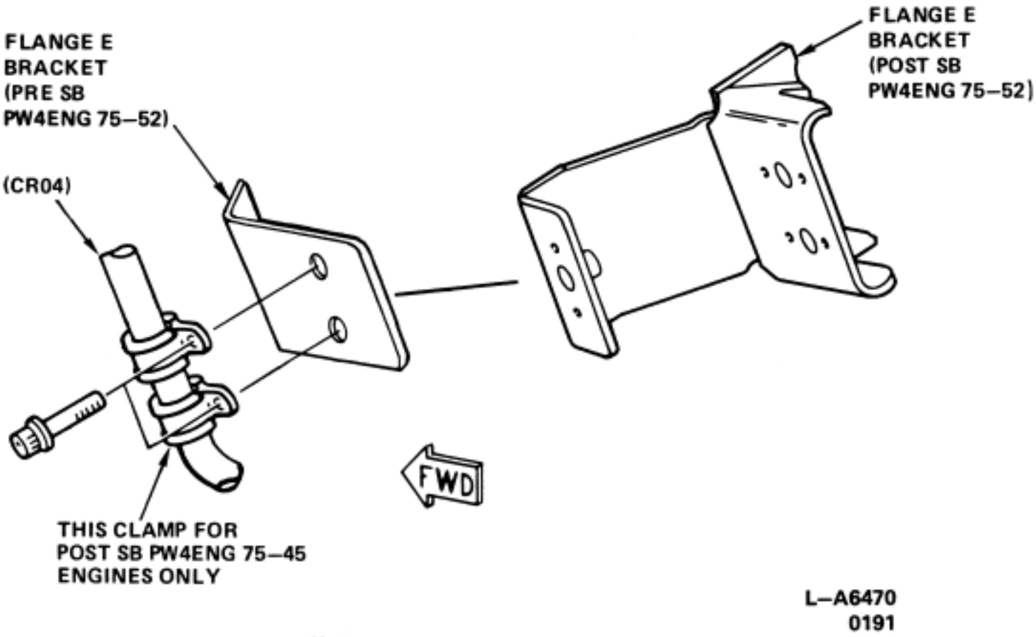

(CR01)
(CP05)
BRACKET
FWD
VIEW D
(CR01)
FLANGE E
BRACKET
(CP05)
FWD
VIEW E
FLANGE E
BRACKET
(CP02)
(CP02)
(CR04)
VIEW F
(PRE SB PW4ENG 75−52)
FWD
VIEW F
(POST PW4ENG 75−52)
L−A2209 (0191)
PW V

External Plumbing
Figure 405 (Sheet 4)
(Task 72−00−34−420−002)


(CR04)
ANGLE GEARBOX BRACKET
(CP02)
FWD

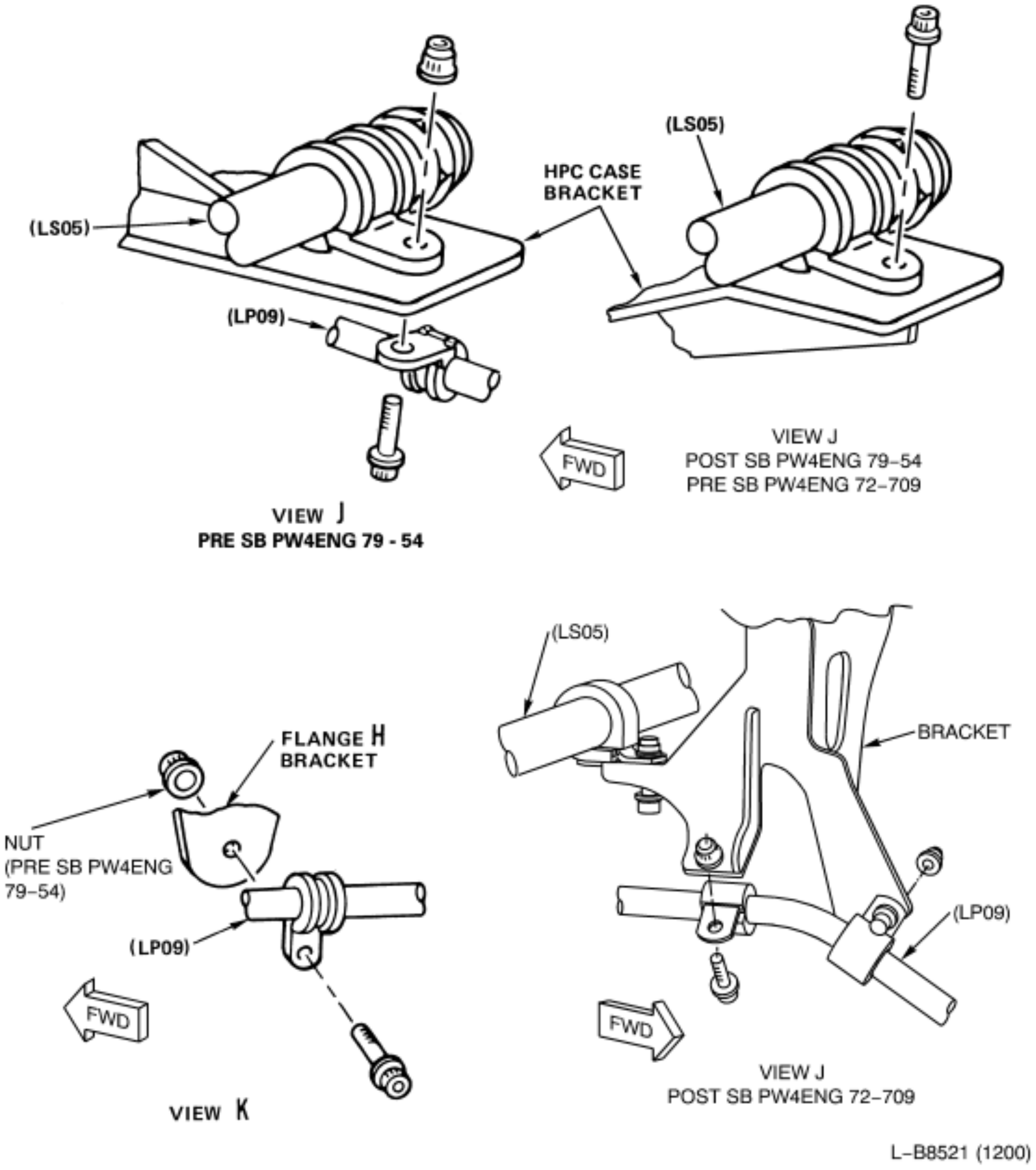
(POST SB PW4ENG 75−45 ONLY)

VIEW G

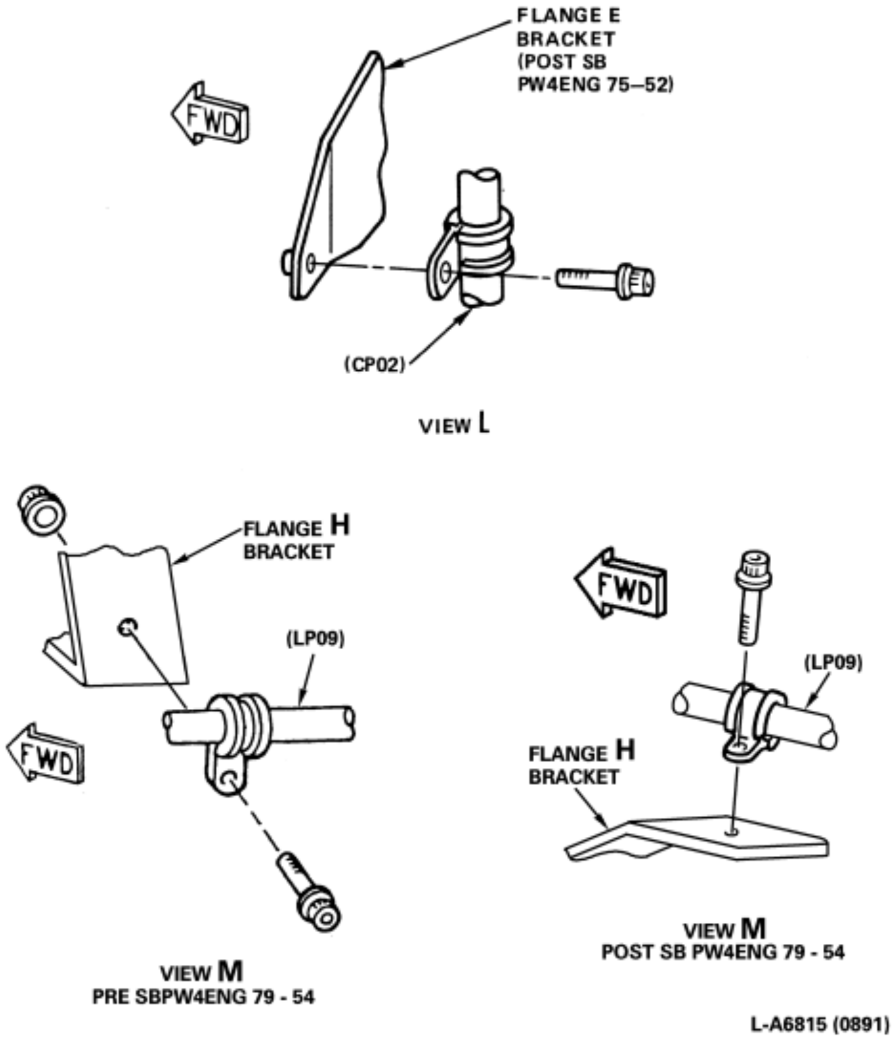

FLANGE E BRACKET (PRE SB PW4ENG 75−52)
(CR04)
FLANGE E BRACKET (POST SB PW4ENG 75−52)
FWD
THIS CLAMP FOR POST SB PW4ENG 75−45 ENGINES ONLY
L−A6470
0191

VIEW H

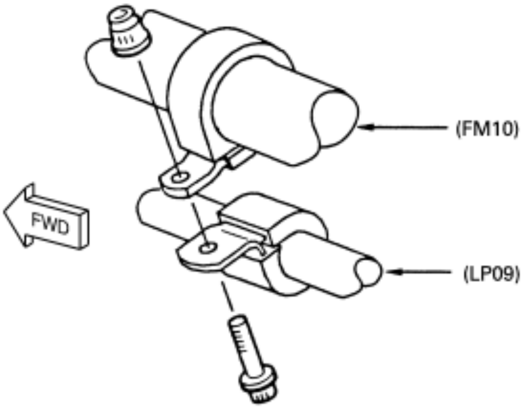
External Plumbing
Figure 405 (Sheet 5)
(Task 72−00−34−420−002)


(LS05)
HPC CASE
BRACKET
(LS05)
(LP09)
FWD
VIEW J
POST SB PW4ENG 79−54
PRE SB PW4ENG 72−709
VIEW J
PRE SB PW4ENG 79 - 54
(LS05)
BRACKET
FLANGE H
BRACKET
NUT
(PRE SB PW4ENG
79−54)
(LP09)
(LP09)
FWD
FWD
VIEW K
VIEW J
POST SB PW4ENG 72−709
L−B8521 (1200)

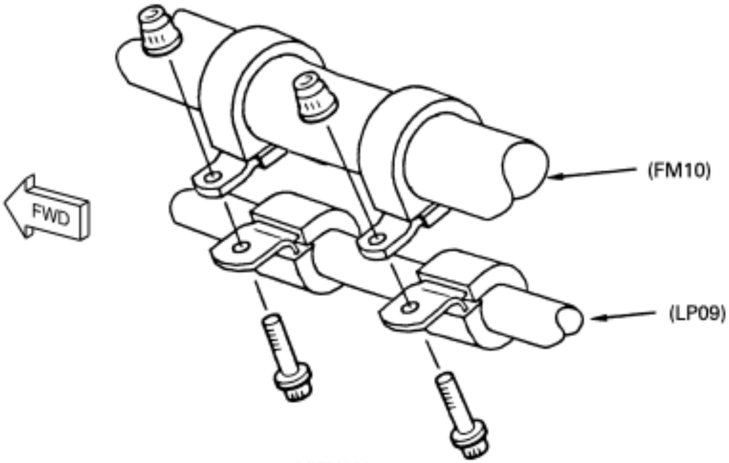
External Plumbing
Figure 405 (Sheet 6)
(Task 72−00−34−420−002)


FLANGE E
BRACKET
(POST SB
PW4ENG 75—52)
FWD
(CP02)
VIEW L
FLANGE H
BRACKET
(LP09)
FWD
VIEW M
PRE SBPW4ENG 79 - 54
FWD
(LP09)
FLANGE H
BRACKET
VIEW M
POST SB PW4ENG 79 - 54
L-A6815 (0891)

External Plumbing
Figure 405 (Sheet 7)
(Task 72−00−34−420−002)



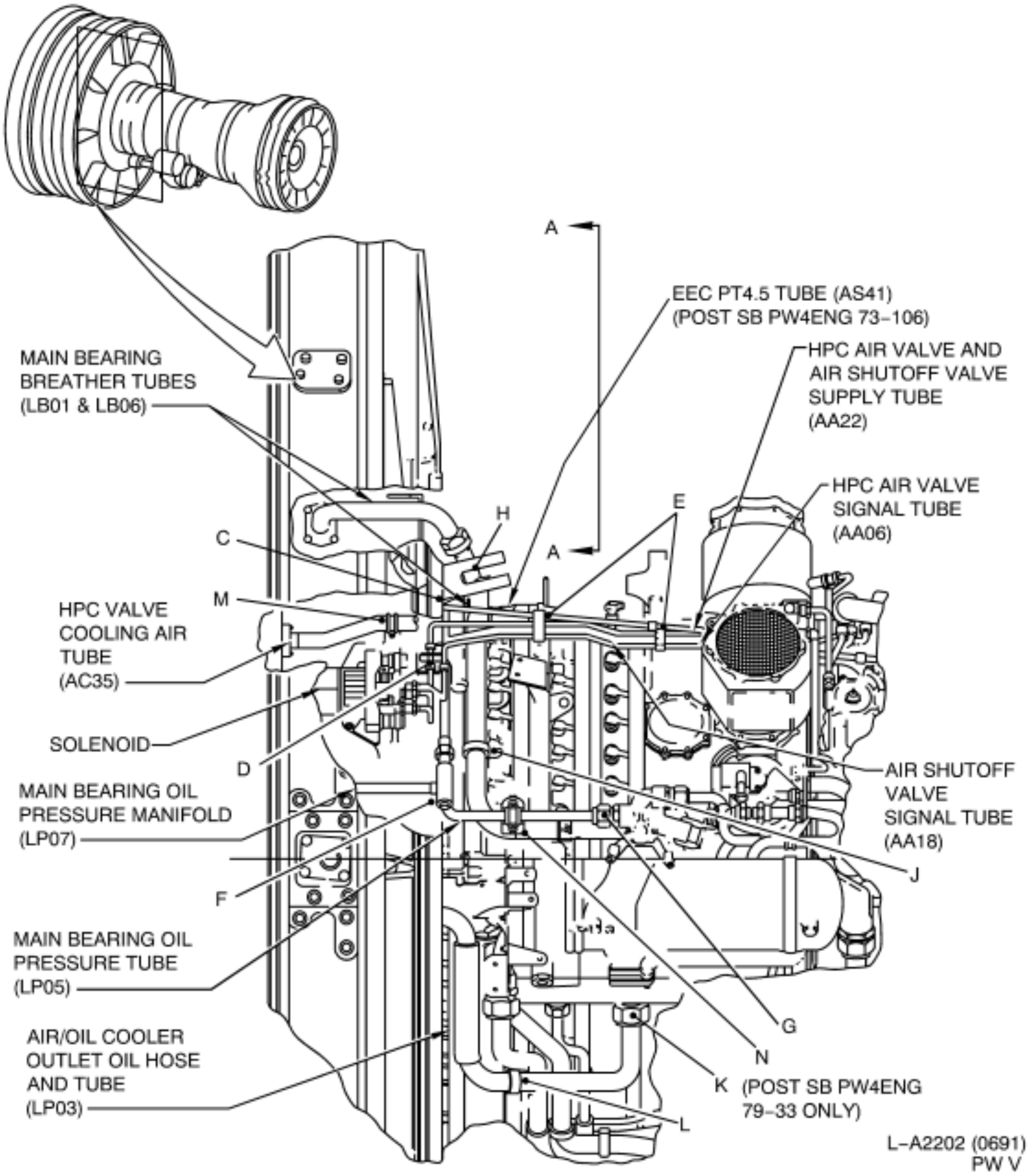
VIEW N
PRE SB PW4ENG 72-507



VIEW N
POST SB PW4ENG 72-507

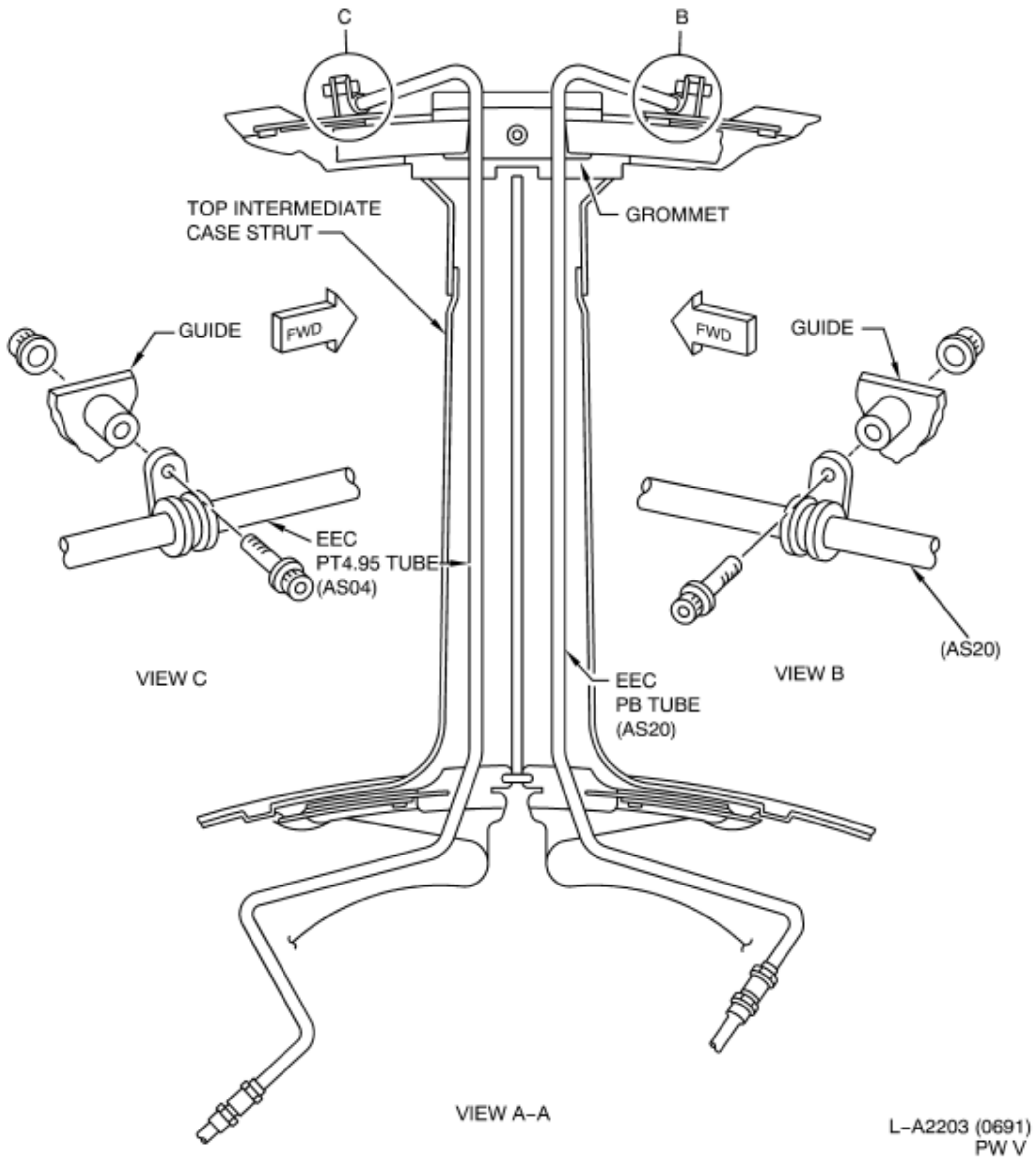
L-A6828 (0195)

External Plumbing
Figure 405 (Sheet 8)
(Task 72−00−34−420−002)

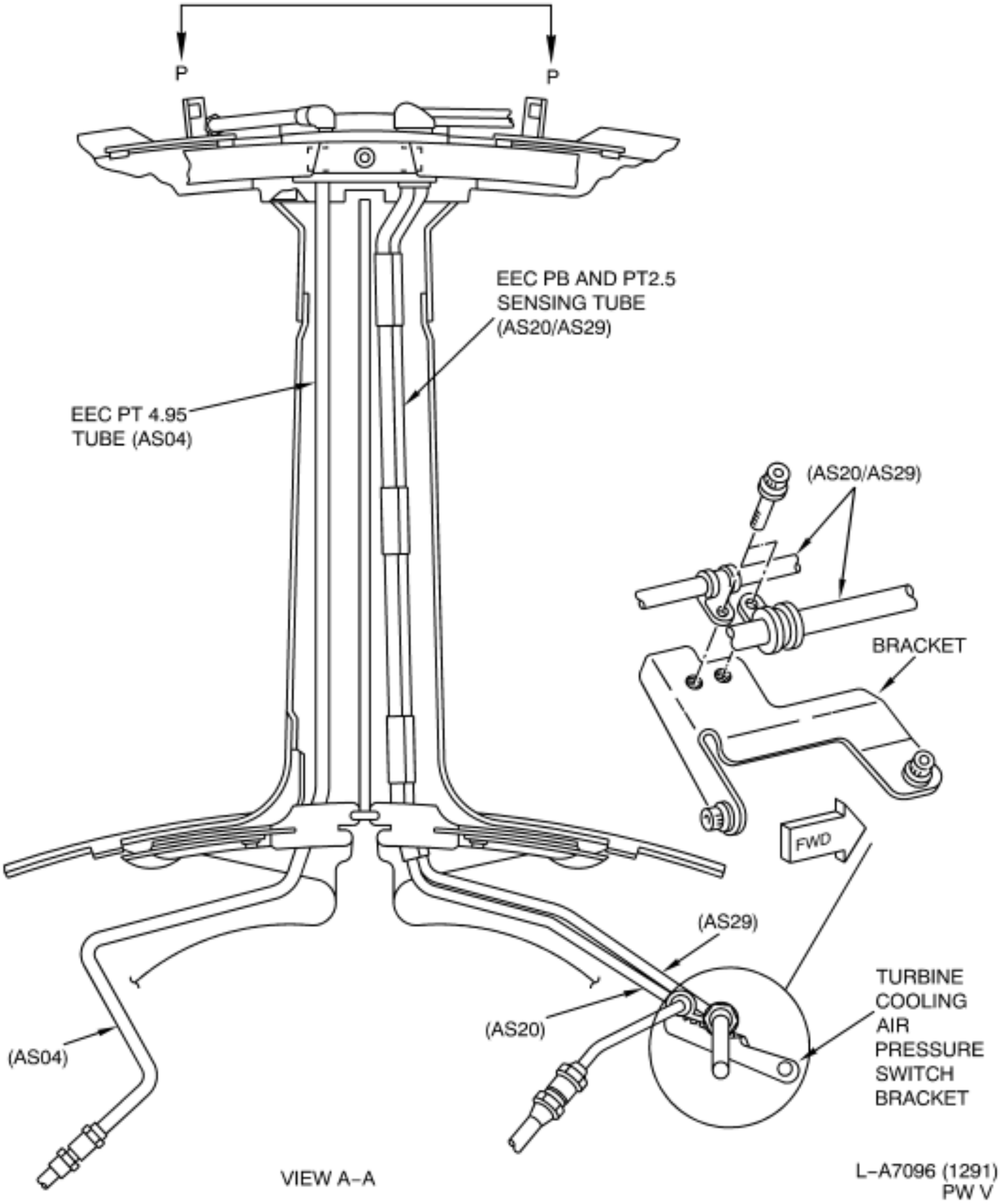

A
EEC PT4.5 TUBE (AS41)
(POST SB PW4ENG 73−106)
HPC AIR VALVE AND
AIR SHUTOFF VALVE
SUPPLY TUBE
(AA22)
MAIN BEARING
BREATHER TUBES
(LB01 & LB06)
HPC AIR VALVE
SIGNAL TUBE
(AA06)
E
H
C
A
M
HPC VALVE
COOLING AIR
TUBE
(AC35)
SOLENOID
D
MAIN BEARING OIL
PRESSURE MANIFOLD
(LP07)
AIR SHUTOFF
VALVE
SIGNAL TUBE
(AA18)
J
F
MAIN BEARING OIL
PRESSURE TUBE
(LP05)
G
AIR/OIL COOLER
OUTLET OIL HOSE
AND TUBE
(LP03)
N
K
(POST SB PW4ENG
79−33 ONLY)
L
L−A2202 (0691)
PW V

External Plumbing
Figure 406 (Sheet 1)
(Task 72−00−34−420−002)

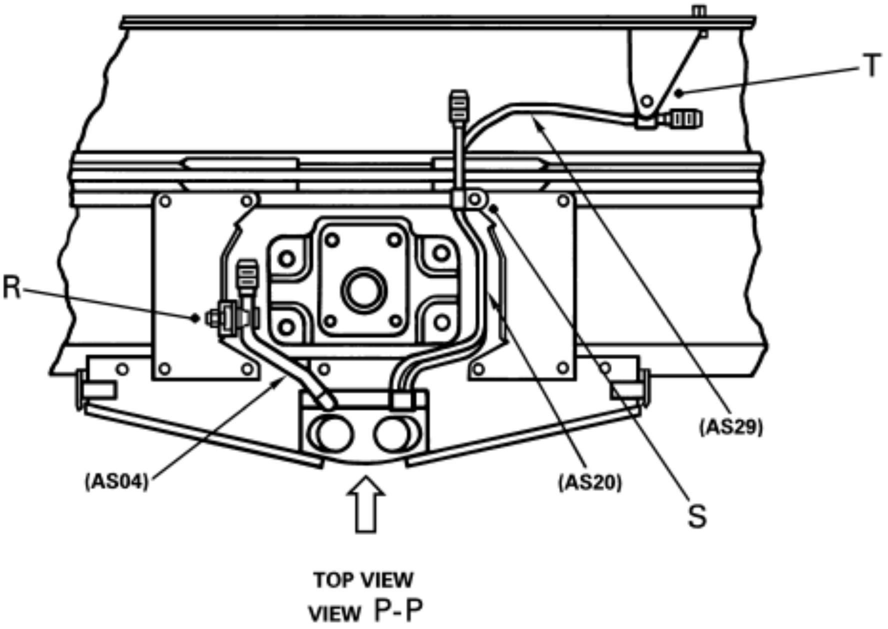
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−02

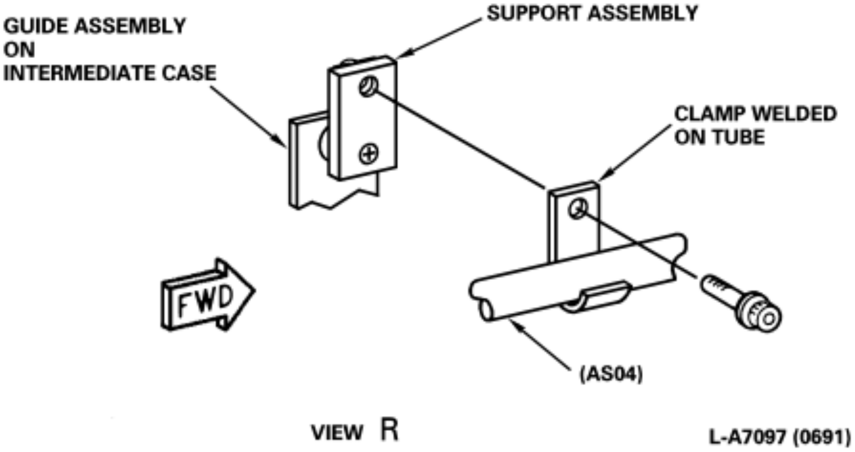

C
B
TOP INTERMEDIATE CASE STRUT
GROMMET
GUIDE
FWD
FWD
GUIDE
EEC PT4.95 TUBE (AS04)
(AS20)
VIEW C
EEC PB TUBE (AS20)
VIEW B
VIEW A−A
L−A2203 (0691)
PW V

External Plumbing
Figure 406 (Sheet 2)
(Task 72−00−34−420−002)

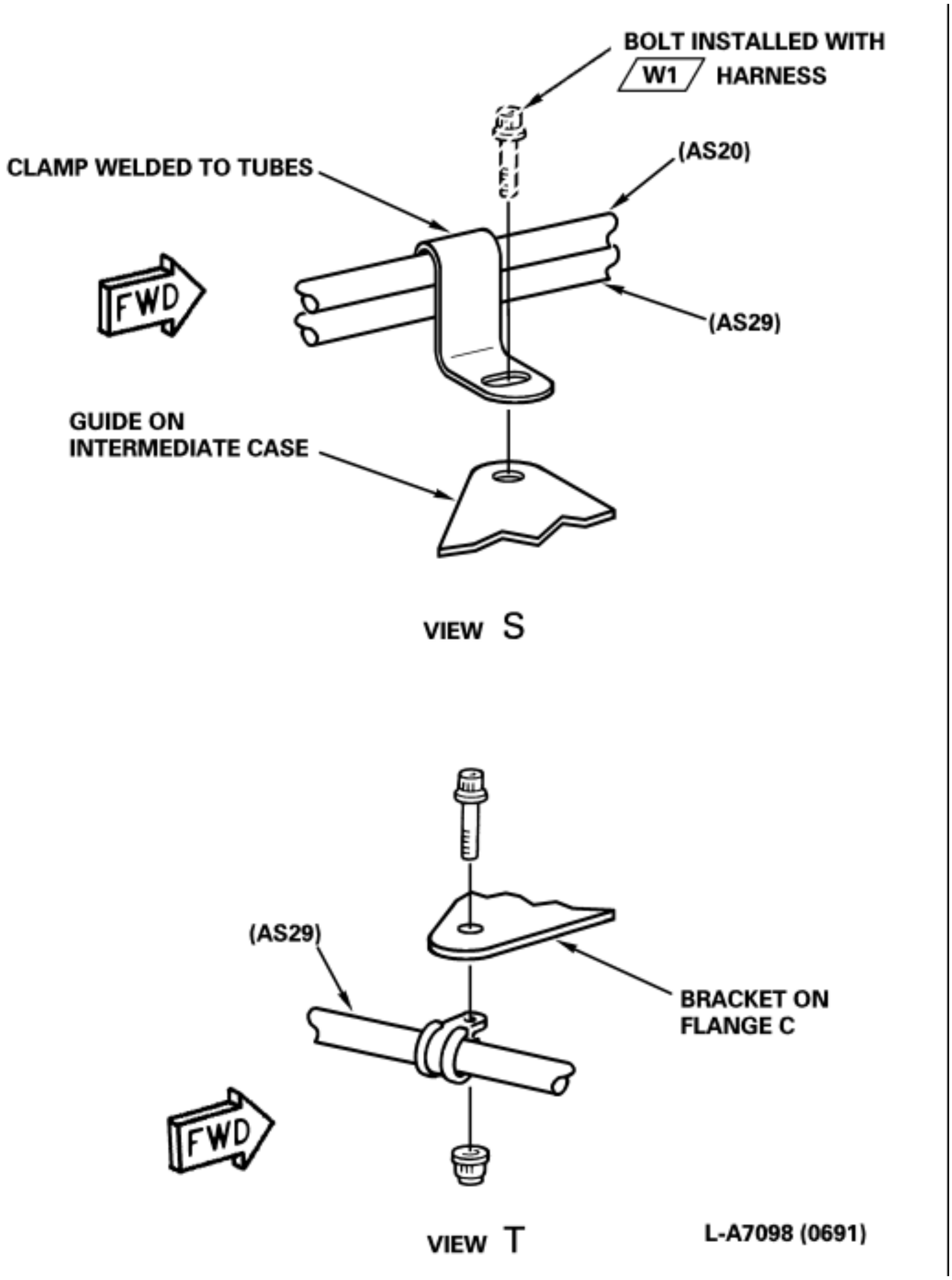

P
P
EEC PB AND PT2.5
SENSING TUBE
(AS20/AS29)
EEC PT 4.95
TUBE (AS04)
(AS20/AS29)
BRACKET
FWD
(AS29)
(AS20)
(AS04)
TURBINE
COOLING
AIR
PRESSURE
SWITCH
BRACKET
VIEW A−A
L−A7096 (1291)
PW V

External Plumbing (For Engines With The
Airbus/McDonnell Douglas Common Parts Configuration)
Figure 406 (Sheet 3)
(Task 72−00−34−420−002)

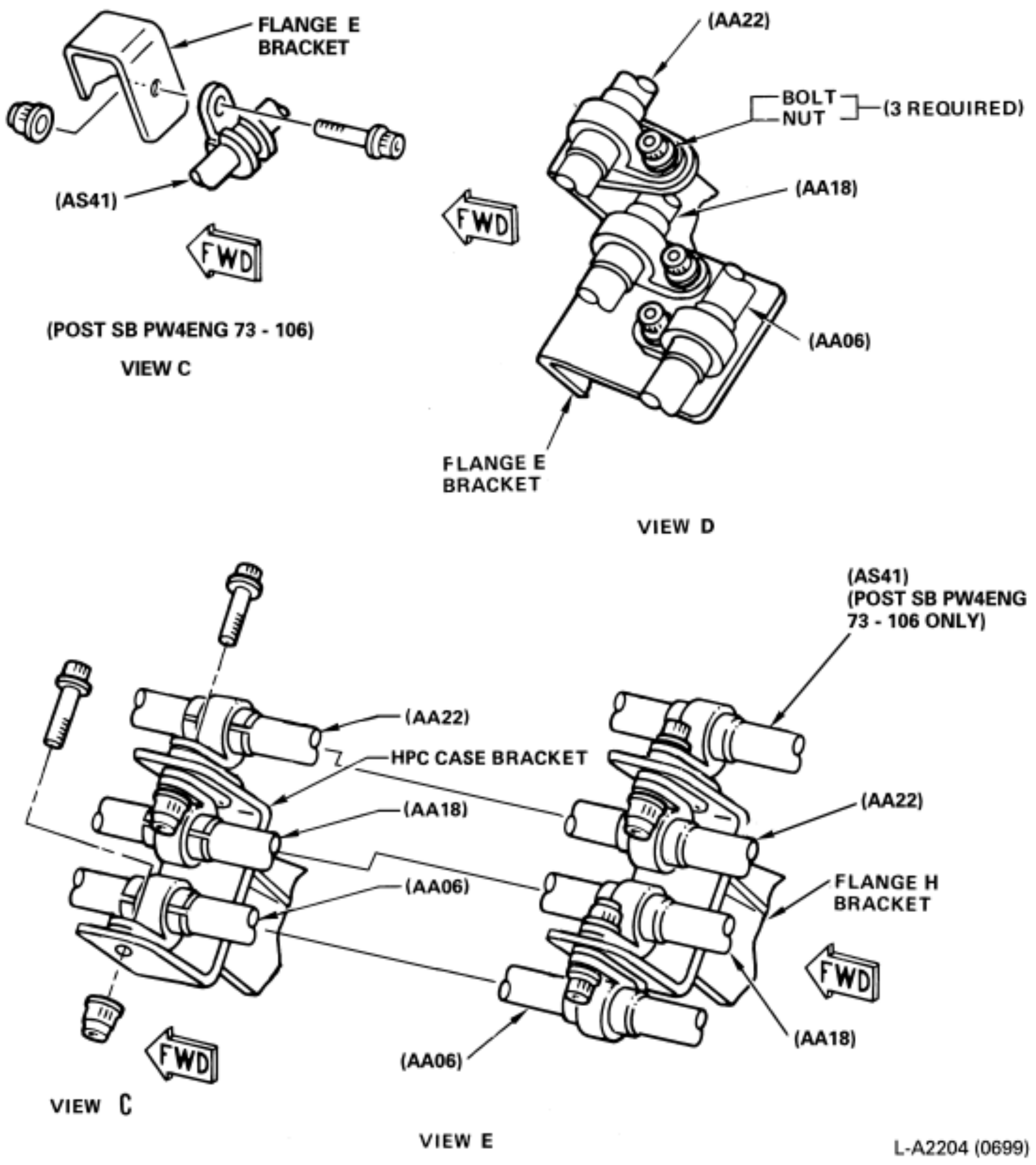

T
R
(AS29)
(AS04)
(AS20)
S
TOP VIEW
VIEW P-P


GUIDE ASSEMBLY
ON
INTERMEDIATE CASE
SUPPORT ASSEMBLY
CLAMP WELDED
ON TUBE
FWD
(AS04)
VIEW R
L-A7097 (0691)

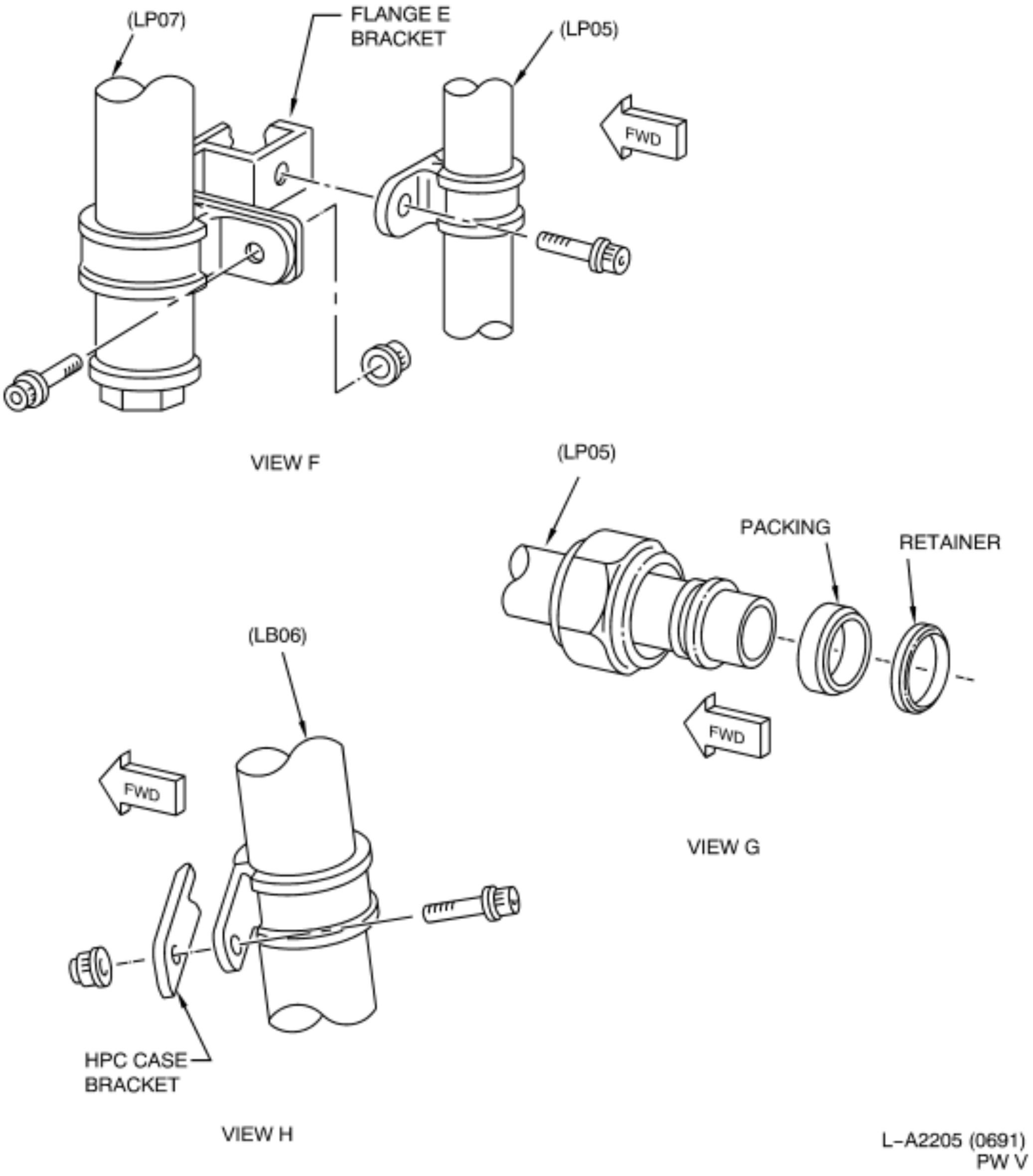
External Plumbing (For Engines With The
Airbus/McDonnell Douglas Common Parts Configuration)
Figure 406 (Sheet 4)
(Task 72−00−34−420−002)


BOLT INSTALLED WITH
W1
HARNESS
CLAMP WELDED TO TUBES
(AS20)
FWD
(AS29)
GUIDE ON
INTERMEDIATE CASE
VIEW S
(AS29)
BRACKET ON
FLANGE C
FWD
VIEW T
L-A7098 (0691)

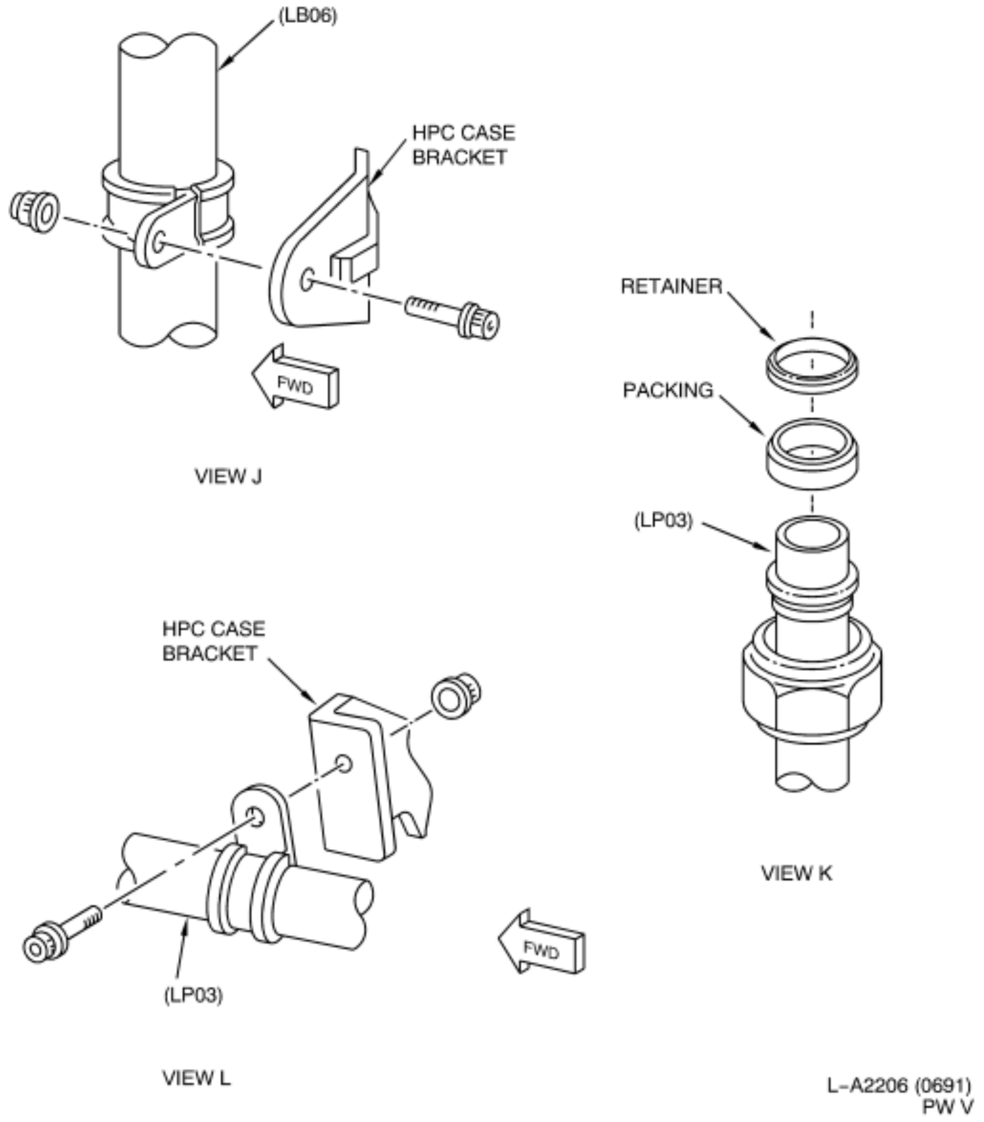
External Plumbing (For Engines With The
Airbus/McDonnell Douglas Common Parts Configuration)
Figure 406 (Sheet 5)
(Task 72−00−34−420−002)


FLANGE E
BRACKET
(AS41)
FWD
(POST SB PW4ENG 73 - 106)
VIEW C
(AA22)
BOLT
NUT
(3 REQUIRED)
(AA18)
FWD
(AA06)
FLANGE E
BRACKET
VIEW D
(AS41)
(POST SB PW4ENG
73 - 106 ONLY)
(AA22)
HPC CASE BRACKET
(AA18)
(AA06)
(AA22)
FLANGE H
BRACKET
FWD
(AA18)
(AA06)
FWD
VIEW C
VIEW E
L-A2204 (0699)

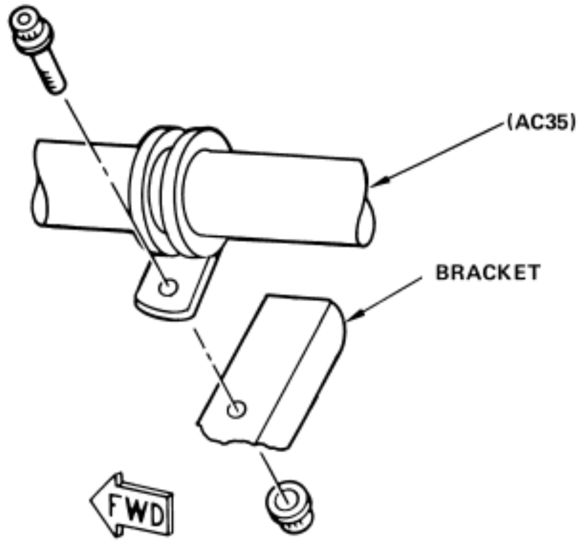
External Plumbing
Figure 406 (Sheet 6)
(Task 72−00−34−420−002)


(LP07)
FLANGE E BRACKET
(LP05)
FWD
VIEW F
(LP05)
PACKING
RETAINER
FWD
VIEW G
(LB06)
FWD
HPC CASE BRACKET
VIEW H
L−A2205 (0691)
PW V

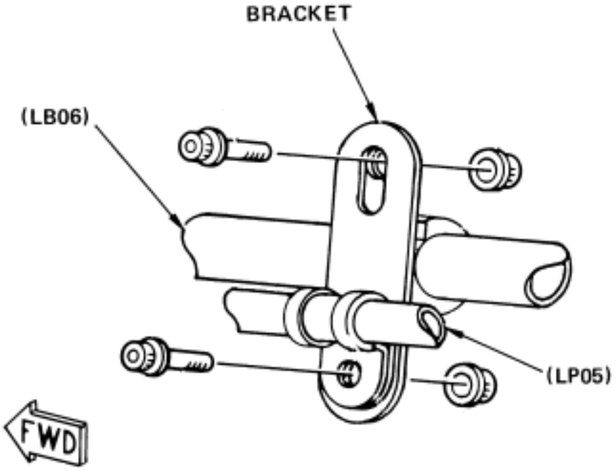
External Plumbing
Figure 406 (Sheet 7)
(Task 72−00−34−420−002)


(LB06)
HPC CASE BRACKET
FWD
VIEW J
RETAINER
PACKING
(LP03)
VIEW K
HPC CASE BRACKET
FWD
(LP03)
VIEW L
L−A2206 (0691)
PW V

External Plumbing
Figure 406 (Sheet 8)
(Task 72−00−34−420−002)


(AC35)
BRACKET
FWD

VIEW M


BRACKET
(LB06)
(LP05)
FWD

(POST SB PW4ENG (79 - 33 only)

VIEW N

L-A3937 (0691)

External Plumbing
Figure 406 (Sheet 9)
(Task 72−00−34−420−002)

ENGINE GENERAL - INTERMEDIATE CASE - INSTALLATION-03

Task 72-00-34-450-001:

1. Install Electronic Engine Control (EEC) Speed Transducer (N1)

A. Equipment And Materials Required

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-395	Beeswax
P05-396	Paraffin Wax Blend
P06-002	Petrolatum, White (PMC 9609)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	4	73-23-00/1/40
Key Washer	1	73-23-00/1/75
Packing	2	73-23-00/1/1
Packing	1	73-23-00/1/10

B. Procedure
See Figure 401.

(1) Remove protective closures.

(2) Examine and adjust, if necessary, the gap between the end of the transducer and the rotor as follows.

(a) Apply Beeswax P05-395 or Paraffin Wax Blend P05-396, approximately 0.070 inch (1.778 mm) to flat surface on the small end of the transducer.

(b) Install a Class 1 shim on the lower shoulder of transducer end.

NOTE: Do not install the three packings on the transducer at this time.

CAUTION: INSTALL THE TRANSDUCER WITH THE ELECTRICAL CONNECTOR REARWARD. DO NOT ROTATE THE TRANSDUCER DURING INSTALLATION OR DAMAGE TO THE TRANSDUCER OR ENGINE CAN RESULT.

(c) Temporarily install the spring−loaded speed transducer into the opening in the intermediate case at approximately 5 o'clock position with the electrical connector rearward.

(d) Lubricate the bolts and nut (if equipped with the locating stud, Post SB PW4ENG 73−88) with Engine Oil P03−001. Temporarily install the washers, bolts, and nut (if equipped). Tighten evenly and engage the transducer to the case completely. Torque the bolts and nut (if equipped) to 85 lb−in. (9.604 N.m). Be sure you engage the transducer to the case completely.

(e) Slowly turn the fan rotor approximately 15 degrees counterclockwise as viewed from the front of the engine.

(f) Loosen the bolts and nut (if equipped) and remove the transducer from the engine.

(g) (Reference 775) Carefully cut a section of wax away from the end of the transducer and the measure thickness of the wax remaining in the area of the deepest impression. If the result is between 0.020 − 0.050 inch (0.508 − 1.270 mm), the proper shim is installed.

(h) If the result is smaller than 0.020 inch (0.508 mm), replace the Class 1 shim with a Class 2 shim.

(i) If the result is greater than 0.050 inch (1.270 mm), remove the Class 1 shim.

(j) Remove all the wax from the end of transducer.

(3) Install two new packings, lubricated with Engine Oil P03−001, to the grooves in the shaft of the transducer. Install one new packing, lubricated with White Petrolatum P06−002, to the groove in the transducer flange. Be sure the correct shim (if required) is installed on the transducer.

CAUTION: INSTALL THE TRANSDUCER WITH THE ELECTRICAL CONNECTOR REARWARD. DO NOT ROTATE THE TRANSDUCER DURING INSTALLATION OR DAMAGE TO THE TRANSDUCER OR ENGINE CAN RESULT.

(4) Carefully reinstall the transducer in the intermediate case with the electrical connector rearward.

(5) For engines with the No. 1 bearing vibration transducer cable bracket, install the bracket to the forward two holes. Attach the transducer as follows. See Figure 401, (Sheet 2).

CAUTION: YOU MUST USE KEY WASHERS WITH CASES THAT DO NOT HAVE SELF−LOCKING INSERTS IN THE INTERMEDIATE CASE BOSS.

(a) Lubricate the bolts with Engine Oil P03−001.

(b) Install the bolts and washers (key washers for engines without self−locking inserts) that attach the transducer. Tighten evenly by hand.

NOTE: Use the longer bolts at the bracket location if equipped.

(c) For engines with the locating stud, install the key washer and nut, lubricated with Engine Oil P03−001. Tighten by hand.

(d) Torque (as equipped)
- the bolts without the self−locking insert feature to 65 − 85 lb−in. (7.344 − 9.604 N.m).
- the bolts with the self−locking insert feature to 85 − 95 lb−in. (9.604 − 10.734 N.m).
- the nut on the locating stud to 150 − 170 lb−in. (16.948 − 19.207 N.m).

(e) Bend the key washer tabs if used.

(6) If equipped, install the clamp and bolt, lubricated with Engine Oil P03−001, and attach the No. 1 bearing vibration transducer cable to the bracket. Torque the clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(7) Connect the W4P19 harness connector to the transducer harness receptacle as follows.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
− the connector coupling nut is fully tight
− the connector fits tightly against the receptacle (metal to metal).

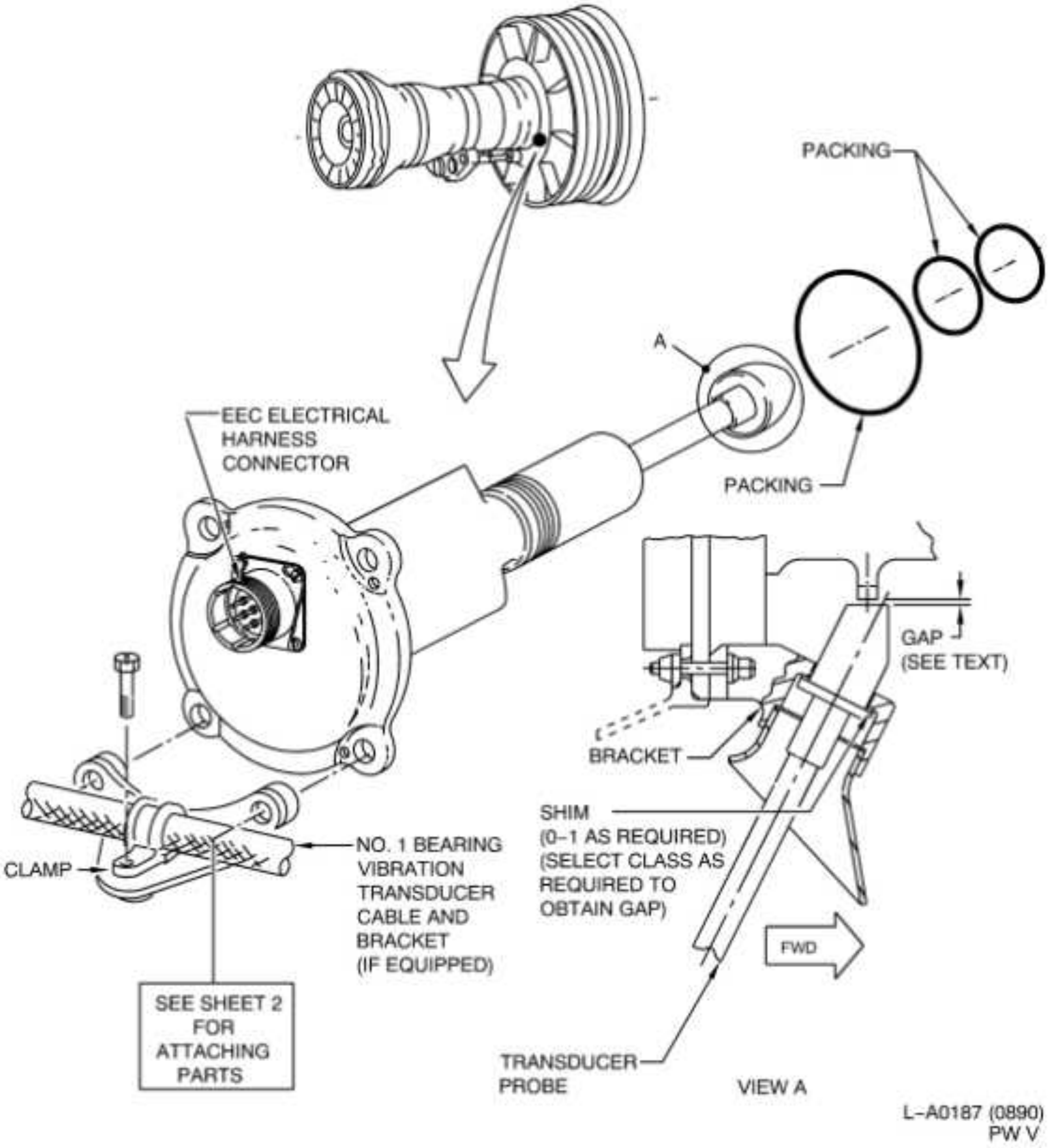
NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

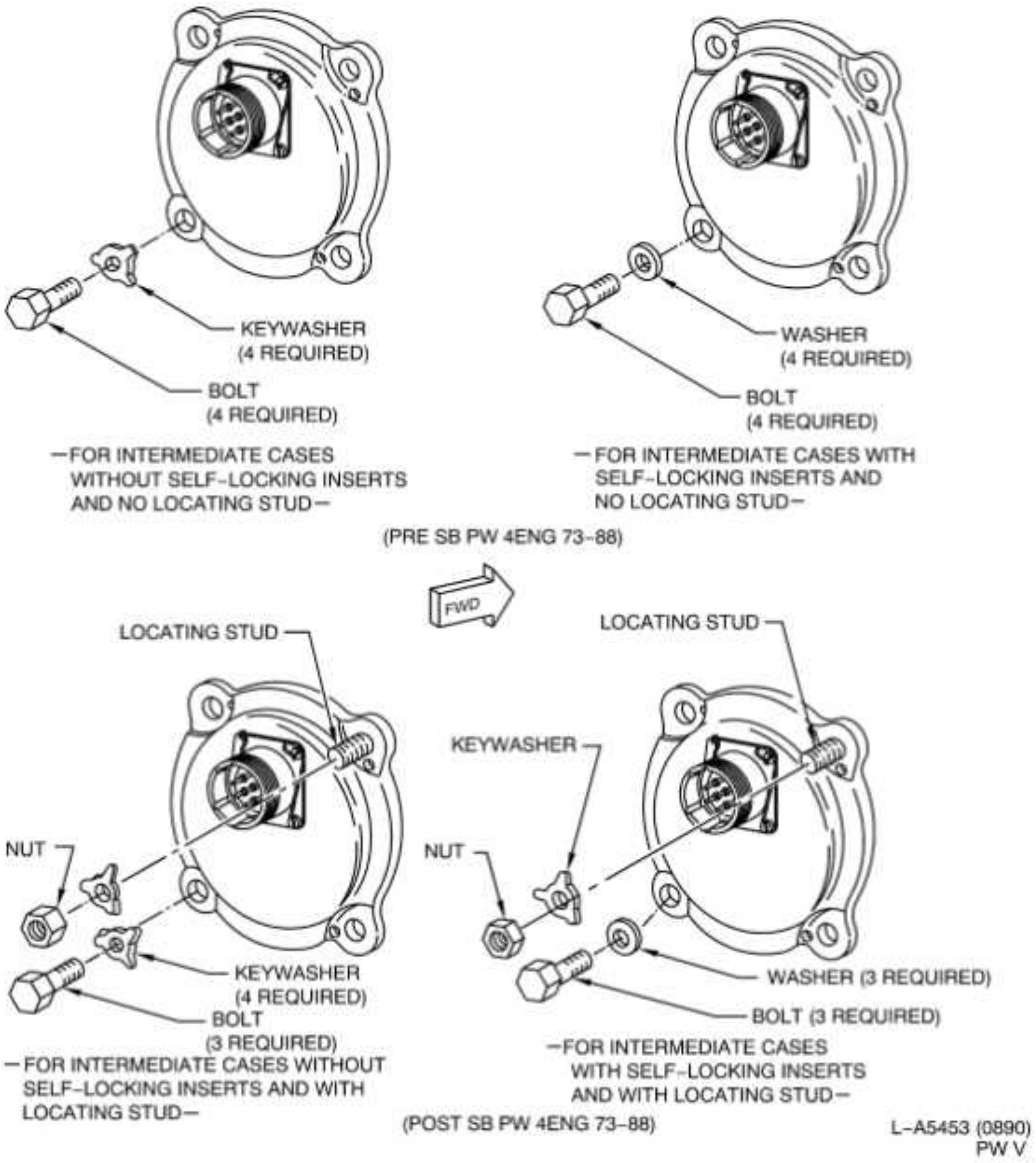
C. Postrequisites

(1) Install the fan exit liner segment (inner rear) that is at 5 o'clock. Refer to 72−00−33, Installation−16 Task 72−00−33−440−001.

(2) Test engine per Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


PACKING
A
PACKING
EEC ELECTRICAL HARNESS CONNECTOR
GAP (SEE TEXT)
BRACKET
SHIM (0−1 AS REQUIRED) (SELECT CLASS AS REQUIRED TO OBTAIN GAP)
CLAMP
NO. 1 BEARING VIBRATION TRANSDUCER CABLE AND BRACKET (IF EQUIPPED)
FWD
SEE SHEET 2 FOR ATTACHING PARTS
TRANSDUCER PROBE
VIEW A
L−A0187 (0890)
PW V

EEC Speed Transducer (N1) Installation
Figure 401 (Sheet 1)
(Task 72−00−34−450−001)


KEYWASHER (4 REQUIRED)
BOLT (4 REQUIRED)
—FOR INTERMEDIATE CASES WITHOUT SELF-LOCKING INSERTS AND NO LOCATING STUD—
WASHER (4 REQUIRED)
BOLT (4 REQUIRED)
—FOR INTERMEDIATE CASES WITH SELF-LOCKING INSERTS AND NO LOCATING STUD—
(PRE SB PW 4ENG 73-88)
FWD
LOCATING STUD
NUT
KEYWASHER (4 REQUIRED)
BOLT (3 REQUIRED)
—FOR INTERMEDIATE CASES WITHOUT SELF-LOCKING INSERTS AND WITH LOCATING STUD—
LOCATING STUD
KEYWASHER
NUT
WASHER (3 REQUIRED)
BOLT (3 REQUIRED)
—FOR INTERMEDIATE CASES WITH SELF-LOCKING INSERTS AND WITH LOCATING STUD—
(POST SB PW 4ENG 73-88)
L-A5453 (0890)
PW V

EEC Speed Transducer (N1) Installation (Attaching Parts)
Figure 401 (Sheet 2)
(Task 72−00−34−450−001)

Task 72−00−34−450−002:

1. Install No. 1 Bearing Support (Front And Rear) Assembly

NOTE: See Figure 401 for part/assembly installation procedure sequence.

A. Prerequisites

(1) See Inspection/Check−01 Task 72−00−34−990−001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:
CTE 5070 Cart, Airflow (Optional To CTE 6070)
CTE 6070 Cart, Airflow
PWA 85367 Adapter, Handling
PWA 85368 Arm, Lifting
PWA 85564 Adapter

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−289	Lockwire (AS3214−02)
P05−291	Cable, Safety (Optional)
P05−292	Ferrule, Safety Cable (Optional)
P06−002	Petrolatum White (PMC 9609)
P06−054	Antiseize Paste (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing (Optional)	1	72−34−00/1/30
Packing	1	72−34−00/1/40
Packing	1	79−21−00/11/1
Retainer	1	79−21−00/11/10

C. Procedure
See Figure 402.

CAUTION: IF NO. 1 BEARING REAR SUPPORT ASSEMBLY PN 50A639 IS USED, THEN NO. 1 BEARING FRONT SUPPORT PN 50A641 MUST BE USED ALSO.

CAUTION: IF NO. 1 BEARING FRONT SUPPORT PN 50A452 IS USED THEN NO. 1 BEARING REAR SUPPORT ASSEMBLY PN 50A566 MUST BE USED ALSO.

CAUTION: NO. 1 BEARING FRONT SUPPORT PN 50A641 MAY BE USED WITH NO. 1 BEARING REAR SUPPORT ASSEMBLY PN 50A566.

(1) Install front support, bolt flange down, in oven that does not exceed 300°F (148.9°C).

(2) Install packing, lubricated with Petrolatum White P06−002, to groove in front flange of rear support.

(3) Remove front support from oven using protective gloves, and position over rear support. Align offset hole at approximately 1:00 o'clock and push to seat on rear support.

(4) Carefully install 34 bolts, threads lubricated with Engine Oil P03−001, washers, and nuts. Torque nuts to 180 − 200 lb−in. (20.337 − 22.597 N.m). Allow parts to cool to touch and recheck torque.

(5) Install No. 1 bearing (oil) pressure manifold in No. 1 bearing rear support assembly.

  (a) Install in the bracket (402/1) the pin that is at end of the manifold.

  (b) Lubricate threads of two bolts with Engine Oil P03−001. Secure flange of manifold to bracket (402/2) with two bolts and two nuts. Torque to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(6) Install suitable aligning pins to engine bolt flange.

(7) Trunnion support assembly to front end down and install packing, lubricated with Engine Oil P03−001, to groove in rear flange of rear support.

(8) Attach PWA 85368 Arm to PWA 85367 Adapter and, using hoist, raise support to front of engine.

(9) Install support to engine, aligning pressure manifold with pressure tube connector and with offset hole at approximately 11 o'clock in intermediate case. Install 46 bolts, threads lubricated with Engine Oil P03-001, and washers to secure support assembly. Remove alignment pins. Install remaining bolts and washers.

(10) Tighten and torque bolts to 290 - 325 lb-in. (32.766 - 36.720 N.m).

(11) Remove hoist, arm, and adapter from support.

(12) Airflow check No. 1, 1.5, and 2 bearing oil nozzles. See Figure 403.

  (a) Remove main bearing oil pressure tube assembly (LP05).

    1 Remove lockwire and disconnect tube from adapter on last chance strainer housing at approximately 9:30 o'clock position at Flange E.

    2 Remove lockwire and disconnect tube nut from fuel/oil cooler adapter at approximately 9 o'clock position.

    3 Remove bolt and clamp securing tube to Flange E bracket and remove tube from engine.

    4 Remove and discard retainer and packing. Install protective closures on fuel/oil cooler adapter.

  (b) Perform airflow check.

    1 Install PWA 85564 Adapter in the last chance strainer housing.

    2 Secure air supply hose from CTE 6070 or CTE 5070 Airflow Cart to larger threaded hole of adapter. Secure the pressure sensing line of the airflow cart to smaller threaded hole in adapter.

3 Airflow check nozzles at 10 psig (68.9 kPa). The airflow value at this check must be within ± 2.0 lb/hr (0.91 kg/hr) of the base airflow value.

NOTE: If this module has the same oil nozzles as before, use the base airflow value that you got before you disassembled the module. Refer to 72−00−34, Removal−02
R (Task 72−00−34−020−002).

NOTE: If this module does not have the same oil nozzles as before, use the base airflow value that you got after you did the oil flow. Refer to 72−34−00, Testing−02 Task 72−34−00−720−001.

NOTE: The airflow value that is for test equipment and reference only is 40 − 57 lb/hr (18.14 − 25.85 kg/hr).

4 Remove the adapter and cart.

(c) Reinstall main bearing oil pressure tube assembly (LP05).

1 Remove protective closure.

2 Install new packing, lubricated with Engine Oil P03−001, and retainer to rear of tube.

3 Lubricate tube nut threads at both ends with Antiseize Paste P06−054. Wipe off unwanted paste. Install tube to last chance strainer housing adjacent to Flange E and to adapter above fuel/oil cooler handtight only.

4 Install clamp and bolt, threads lubricated with Engine Oil P03−001, securing tube to Flange E bracket. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

5 Torque forward tube nut to strainer housing to 675 − 750 lb−in. (76.265 − 84.739 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

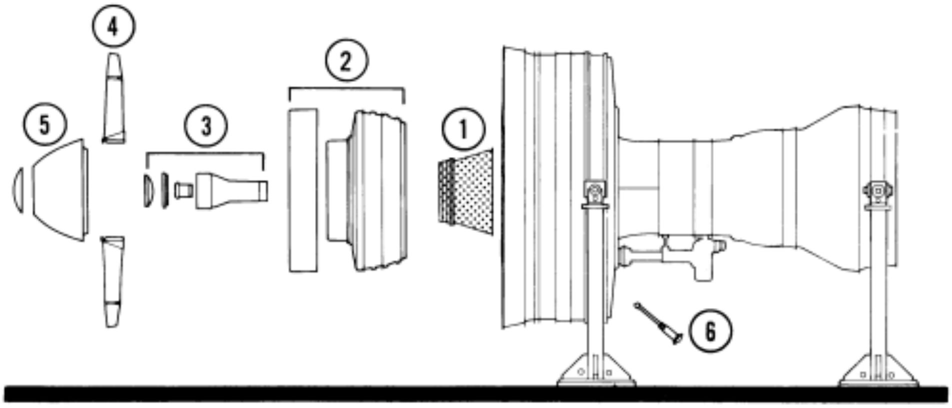
6 Torque rear tube nut to 140 - 160 lb-in. (15.818 - 18.087 N.m). Loosen tube nut, then retorque to required limit. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(13) Install the No. 1 bearing vibration transducer. Refer to 72-00-34, Installation-22 (Task 72-00-34-440-001).

D. Postrequisites

(1) Install low pressure compressor (LPC). See 72-00-31, Installation-01 Task 72-00-31-420-003.

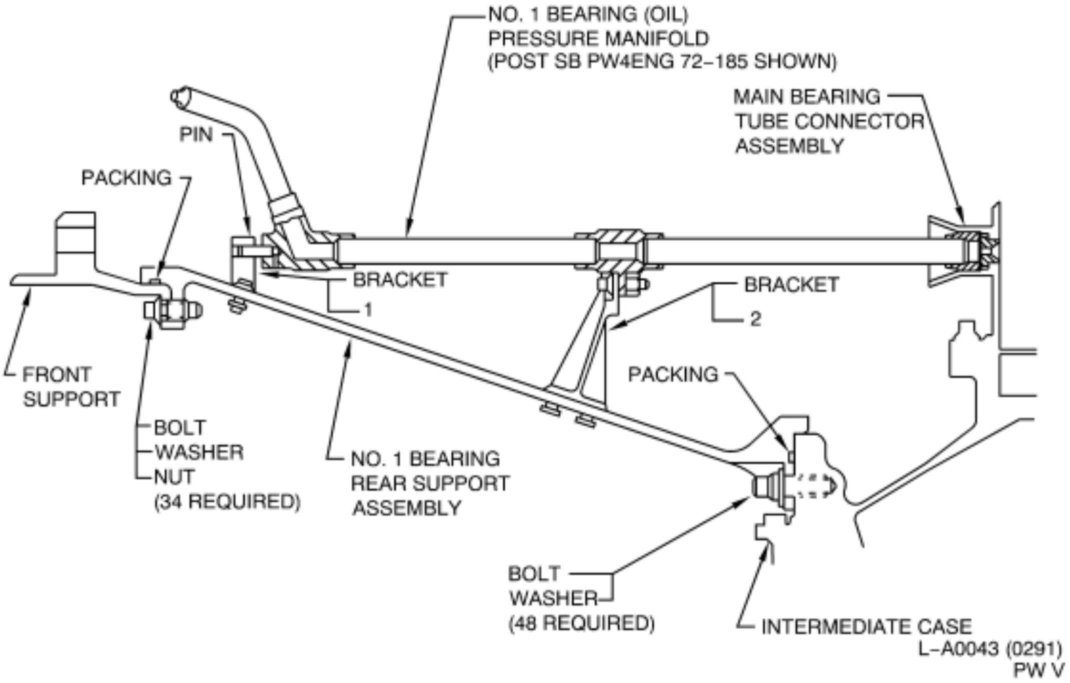
(2) Test engine per Test Reference Table. See 71-00-00, Testing-00 Task 71-00-00-990-003.



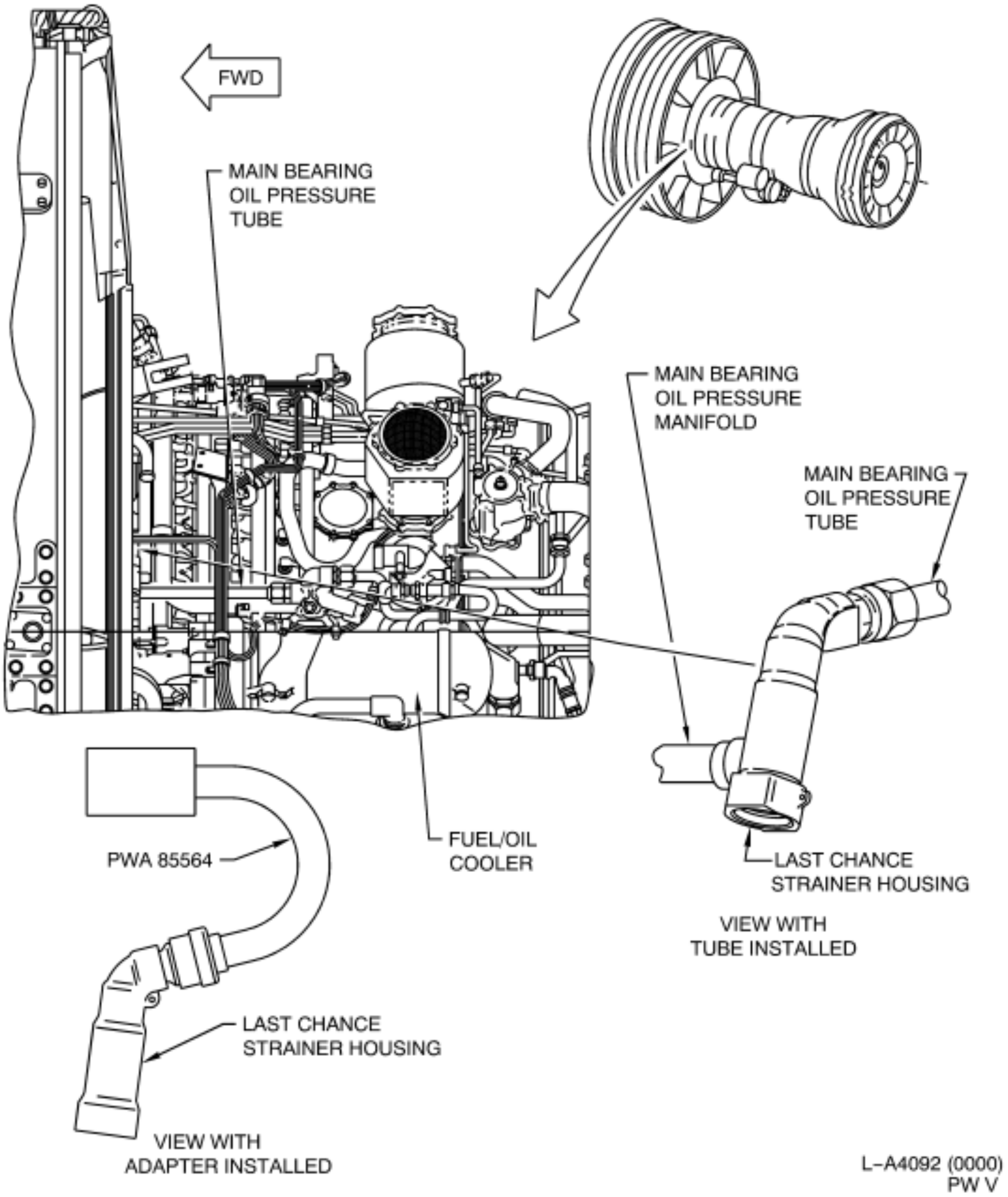
1. INSTALL NO. 1 BEARING SUPPORT ASSEMBLY.
2. INSTALL LOW PRESSURE COMPRESSOR (LPC).
3. INSTALL LPC/LPT COUPLING.
4. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
5. INSTALL COMPRESSOR INLET CONE.
6. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).

L−A0103

Procedure Sequence
Figure 401
(Task 72−00−34−450−002)


NO. 1 BEARING (OIL)
PRESSURE MANIFOLD
(POST SB PW4ENG 72−185 SHOWN)
MAIN BEARING
TUBE CONNECTOR
ASSEMBLY
PIN
PACKING
BRACKET
1
BRACKET
2
FRONT
SUPPORT
PACKING
BOLT
WASHER
NUT
(34 REQUIRED)
NO. 1 BEARING
REAR SUPPORT
ASSEMBLY
BOLT
WASHER
(48 REQUIRED)
INTERMEDIATE CASE
L−A0043 (0291)
PW V

No. 1 Bearing Support Installation
Figure 402
(Task 72−00−34−450−002)


FWD
MAIN BEARING OIL PRESSURE TUBE
MAIN BEARING OIL PRESSURE MANIFOLD
MAIN BEARING OIL PRESSURE TUBE
FUEL/OIL COOLER
PWA 85564
LAST CHANCE STRAINER HOUSING
VIEW WITH TUBE INSTALLED
LAST CHANCE STRAINER HOUSING
VIEW WITH ADAPTER INSTALLED
L-A4092 (0000)
PW V

Airflow No. 1, 1.5 And 2 Bearing Nozzles
Figure 403
(Task 72-00-34-450-002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INTERMEDIATE CASE - INSTALLATION-05

Task 72-00-34-990-002:

1. Install EEC Fan Case Wiring Harnesses W1 And W2 - Relocated

Installation Of EEC Fan Case Wiring Harnesses W1 And W2, Has Been Relocated To 72-00-33, Installation-06.

Task 72-00-34-450-003:

2. Install EEC Core Engine Wiring Harnesses W3, W4 And W5 - Relocated

Installation Of EEC Core Engine Wiring Harnesses W3, W4, And W5, Has Been Relocated To 72-00-34, Installation-18, Installation-19 And Installation-20 Respectively.

Task 72-00-34-430-001:

1. Install No. 1.5 Bearing Support Assembly
   A. Equipment And Materials Required

      Special Tools:
      PWA 29855-3 Pin (2 Necessary)
      PWA 85366 Adapter, Handling (Optional to PWA 87316)
      PWA 85368 Arm, Lifting
      PWA 87316 Adapter, Handling
      PWA 87514 Gage, Plug

      Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

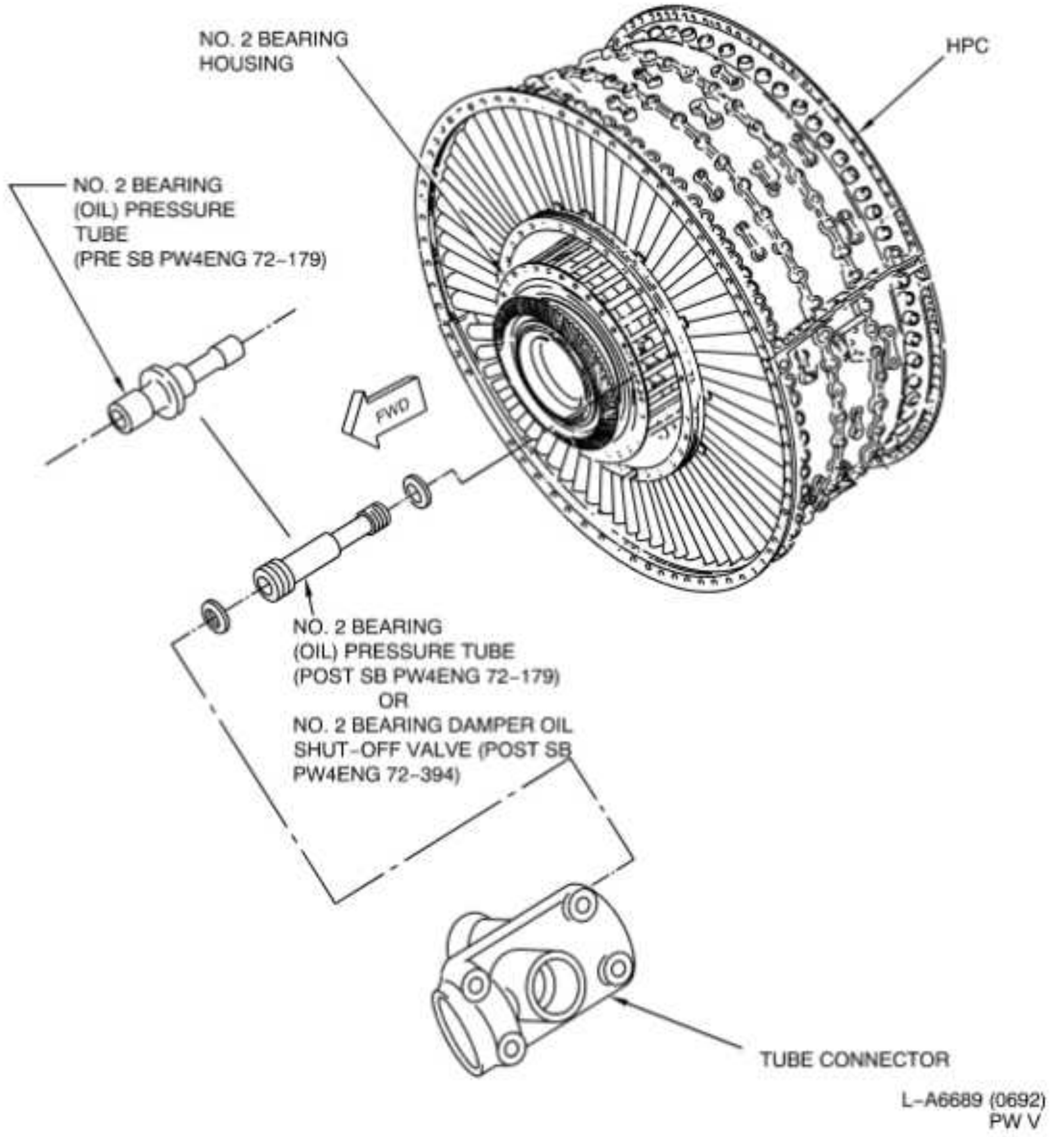
      Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Gasket	1	72-34-00	11	90
Gasket	1	72-34-00	17	80
Packing	1	72-34-00	17	90A
Packing	1	72-34-00	17	235
Packing	1	72-34-00	17	245
Packing	1	72-62-00	3	130

   B. Procedure
      (1) If there are workbolts in the intermediate case at Flange E, remove them.

         CAUTION: BE SURE TO USE THE CORRECT PART NUMBER PRESSURE TUBE. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 72-179.

      (2) Install the No. 2 bearing (oil) pressure tube (Pre SB PW4ENG 72-394) or oil shut-off valve (Post SB PW4ENG 72-394) in the No. 2 bearing housing. See Figure 401.
         (a) For engines that are Pre SB PW4ENG 72-179, install the tube.
         (b) For engines that are Post SB PW4ENG 72-179:
            1 Apply Engine Oil (P03-001) to two packings.
            2 Install the packings on the tube/valve.
            3 Install the tube/valve.


NO. 2 BEARING HOUSING
HPC
NO. 2 BEARING (OIL) PRESSURE TUBE (PRE SB PW4ENG 72-179)
FWD
NO. 2 BEARING (OIL) PRESSURE TUBE (POST SB PW4ENG 72-179) OR NO. 2 BEARING DAMPER OIL SHUT-OFF VALVE (POST SB PW4ENG 72-394)
TUBE CONNECTOR
L-A6689 (0692)
PW V

Installation Of The No. 2 Bearing
(Oil) Pressure Tube
Figure 401
(Task 72−00−34−430−001)

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER TUBE CONNECTOR. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 72−179.

(3) Install the main bearing tube connector assembly (called (tube connector) on the No. 1.5 bearing support assembly (called support) as follows. See Figure 402.
  (a) (Pre SB PW4ENG 72−179) If not installed, install a seal ring, lubricated with Engine Oil (P03−001), on the tube connector.
  (b) (Post SB PW4ENG 72−179) Install a packing, lubricated with Engine Oil (P03−001), on the tube connector.
  (c) Install the tube connector in the connector that is installed on the support. Push the tube connector into the connector that is on the support.

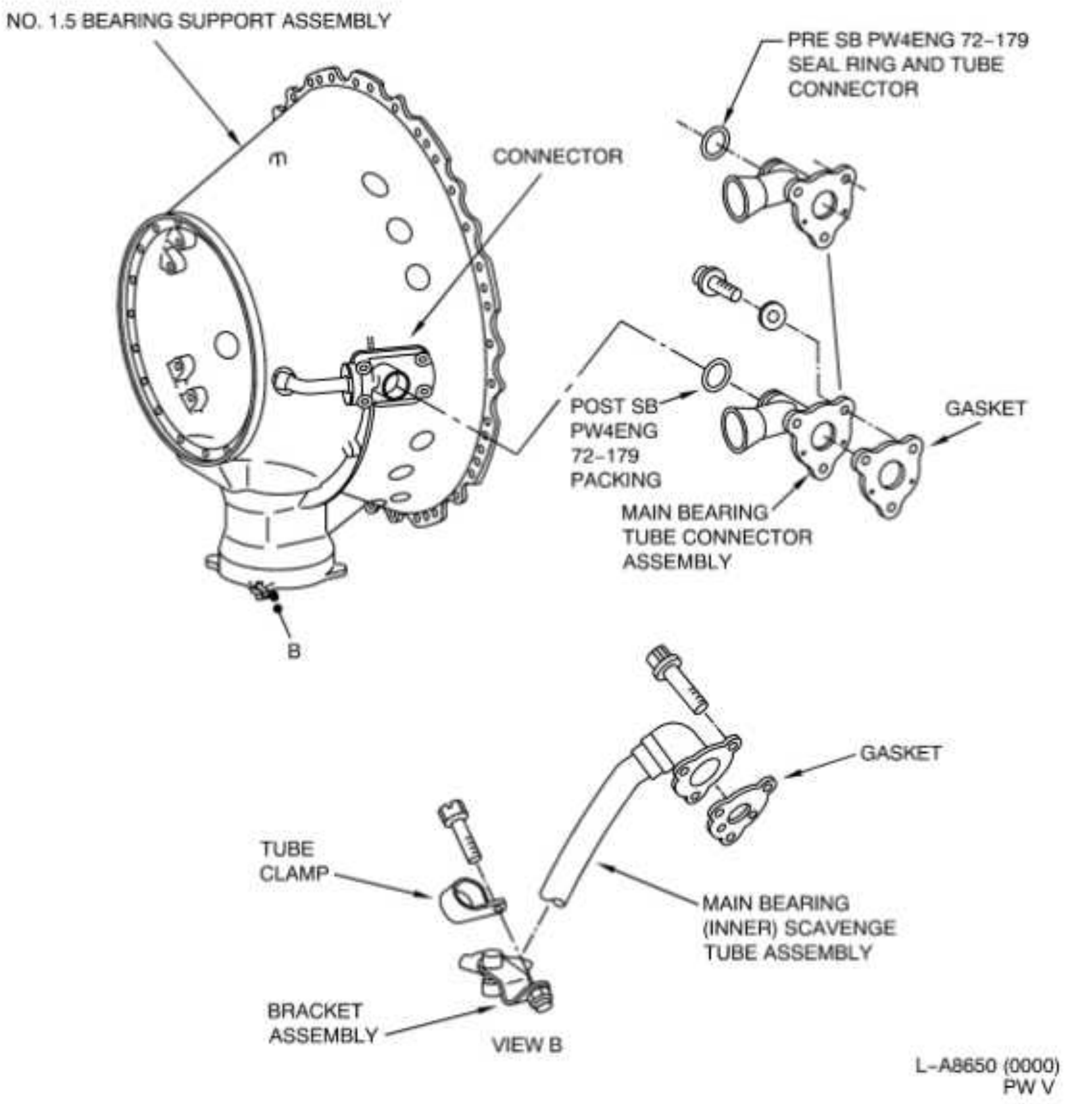
(4) Install the No. 1.5 bearing support assembly in the intermediate case assembly. See Figure 403.
  (a) Install PWA 29855−3 Pins in the threaded holes in rear ID of the intermediate case at 2 and 10 o'clock.
  (b) Attach PWA 85366 Adapter to the front flange of the support assembly with four hex head bolts.
  (c) Attach PWA 85368 Arm to the threaded rod at the center of the adapter.
  (d) Attach a hoist to the arm and raise the support assembly.

  CAUTION: BE CAREFUL NOT TO HIT THE NO. 2 BEARING (OIL) PRESSURE TUBE WHEN YOU INSTALL THE SUPPORT ASSEMBLY.

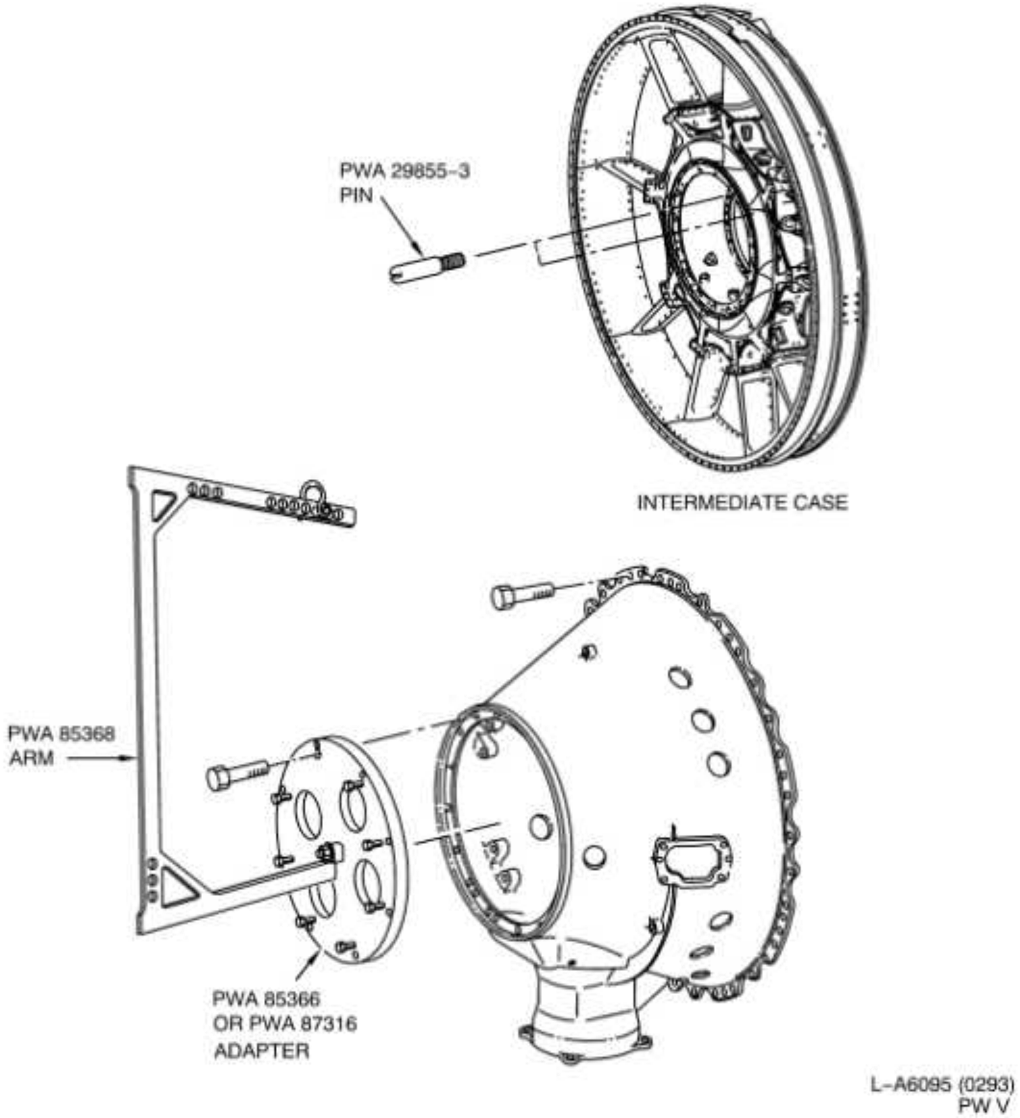
  (e) Apply Engine Oil (P03−001) to the threads of 33 bolts. Attach the support assembly with the bolts.
  (f) Torque the bolts to 180 − 200 lb−in. (20.337 − 22.597 N.m).
  (g) Remove the arm, adapter, and pins.

(5) Attach the tube connector to the tube flange on the intermediate case. See Figure 402.

  (a) Lubricate with Engine Oil (P03−001) the threads of three bolts.
  (b) Put a gasket on the tube flange.
  (c) Move the tube connector to mate with the gasket and tube assembly.


NO. 1.5 BEARING SUPPORT ASSEMBLY
PRE SB PW4ENG 72-179
SEAL RING AND TUBE
CONNECTOR
CONNECTOR
POST SB
PW4ENG
72-179
PACKING
GASKET
MAIN BEARING
TUBE CONNECTOR
ASSEMBLY
B
GASKET
TUBE
CLAMP
MAIN BEARING
(INNER) SCAVENGE
TUBE ASSEMBLY
BRACKET
ASSEMBLY
VIEW B
L-A8650 (0000)
PW V

Install The Main Bearing Tube Connector And (Inner) Scavenge Tube
Figure 402
(Task 72−00−34−430−001)

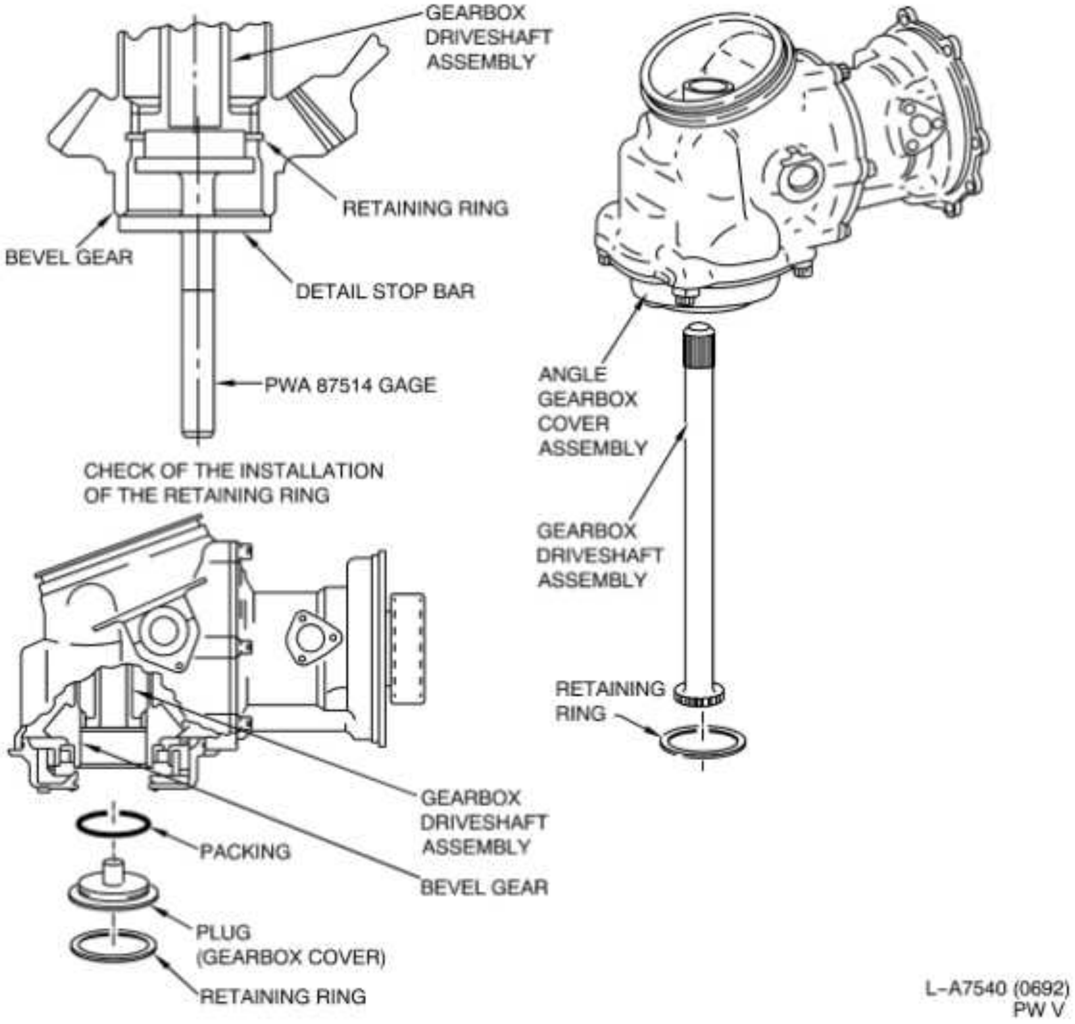

PWA 29855−3
PIN
INTERMEDIATE CASE
PWA 85368
ARM
PWA 85366
OR PWA 87316
ADAPTER
L−A6095 (0293)
PW V

Install The No. 1.5 Bearing Support Assembly
Figure 403
(Task 72−00−34−430−001)

    - (d) Attach the tube connector and gasket to the tube assembly with three washers and the three bolts. Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).
- (6) Install the main bearing (inner) scavenge tube assembly. See Figure 402.
    - (a) Apply Engine Oil (P03-001) to the threads of three bolts.
    - (b) Put the gasket on the tube flange at 7:30 o'clock.
    - (c) Attach the tube assembly to the intermediate case with the three bolts. Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).
    - (d) Put a clamp on the tube assembly.
    - (e) Apply Engine Oil (P03-001) to the threads of one screw.
    - (f) Attach the clamp to the bracket with the screw. Torque the screw to 36 - 40 lb-in. (4.067 - 4.519 N.m).
    - (g) Apply Engine Oil (P03-001) to the threads of a bolt. Attach the bracket to the support assembly with the bolt and a nut. Torque the bolt to 85 - 95 lb-in. (9.604 - 10.734 N.m).
- (7) Install angle gearbox parts. See Figure 404.
    - (a) Apply Engine Oil (P03-001) to the splines of the gearbox driveshaft. Install the gearbox driveshaft. Mate the splines. Install the retaining ring.
    - (b) Do a check of the installation of the gearbox driveshaft retaining ring as follows.
        - 1 Install PWA 87514 Gage in the bore of the bevel gear.
        - 2 If the retaining ring is correctly installed, the detail stop bar will touch the bottom of the bevel gear.
    - (c) Install the plug (gearbox cover).
        - 1 Apply Engine Oil (P03-001) to a packing.
        - 2 Install the packing on the plug (gearbox cover).
        - 3 Install the plug (gearbox cover) in the angle gearbox.
        - 4 Install the retaining ring.

C. Postrequisites

- (1) Install the No. 1 bearing support assembly. See Installation-04 (Task 72-00-34-450-002).


GEARBOX DRIVESHAFT ASSEMBLY
RETAINING RING
BEVEL GEAR
DETAIL STOP BAR
PWA 87514 GAGE
CHECK OF THE INSTALLATION OF THE RETAINING RING
ANGLE GEARBOX COVER ASSEMBLY
GEARBOX DRIVESHAFT ASSEMBLY
RETAINING RING
GEARBOX DRIVESHAFT ASSEMBLY
PACKING
BEVEL GEAR
PLUG (GEARBOX COVER)
RETAINING RING
L−A7540 (0692)
PW V

Install Angle Gearbox Parts
Figure 404
(Task 72−00−34−430−001)

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−07

Task 72−00−34−430−002:

1. Install The 4th Stage Compressor Stator Assembly

A. Equipment And Materials Required

Special Tools:

PWA 85905 Fixture Assemble/Disassemble

Consumable Materials:

	Item No.	Designation
	P03−001	Oil, Engine (PWA 521B)
R R	P06−053	Lubricant, Sealing Ring (PWA 36500)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72−34−00/12/40
Packing	1	72−34−00/12/140

B. Procedure
See Figure 401.

R R (1) Apply Engine Oil P03−001 or Sealing Ring Lubricant P06−053 to the stator assembly packings.

(2) Put the packings in the grooves on the front and rear OD of the stator assembly.

(3) Assemble PWA 85905 Fixture.

(a) Put the jaw marked "install" on the tool 1.5 inch (38.100 mm) from the body.

(b) Make the quantity of threads the same at both ends of the screw.

(4) Put the stator assembly against the intermediate case. The dowel pin in the rear of the stator assembly will engage the offset hole at 12 o'clock. Rotate the stator assembly to partially engage the tabs of the intermediate case.

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−07

(5) At 11 o'clock, engage the fixture in the tabs of the stator assembly and the intermediate case. Turn the screw of the fixture to fully engage the tabs of the stator assembly and intermediate case.

(6) Apply Engine Oil P03−001 to the threads of 24 bolts.

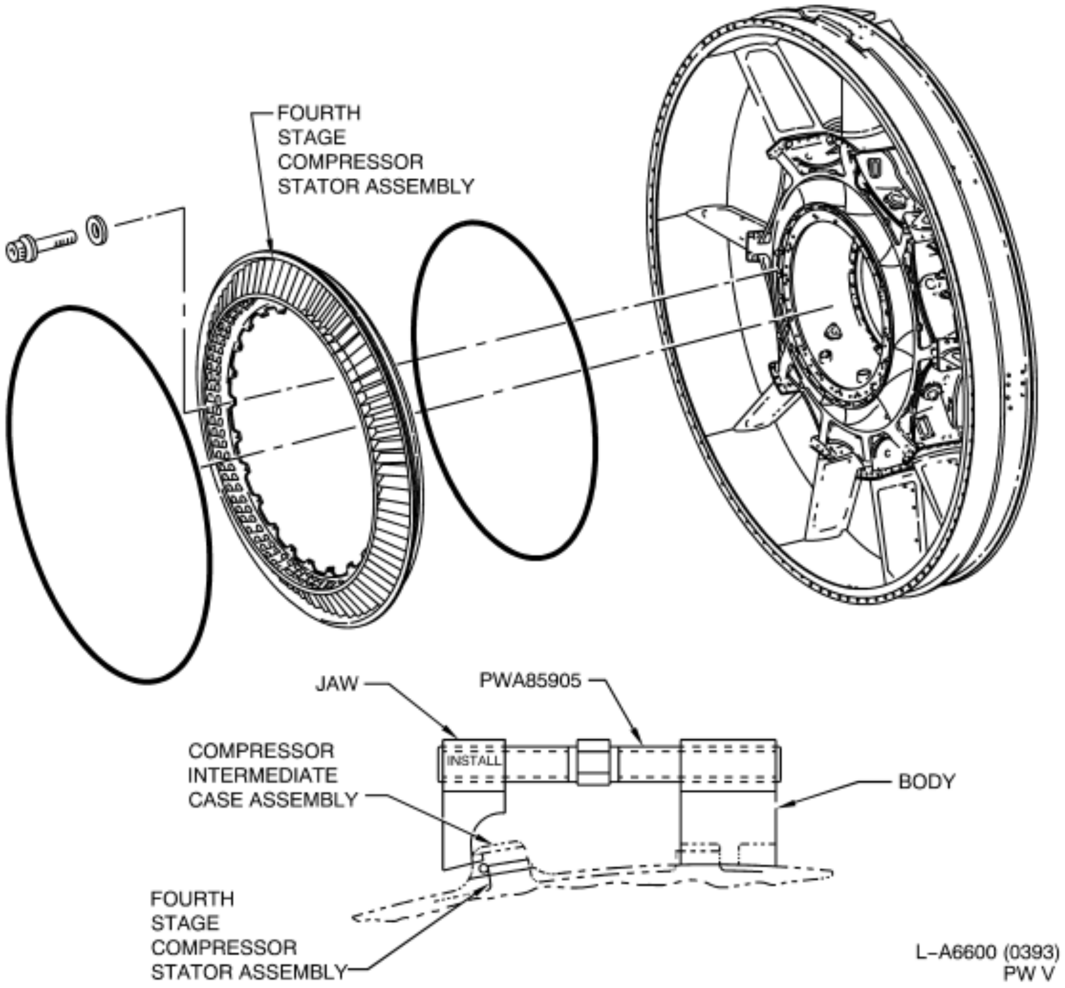
(7) Attach the stator assembly to the intermediate case with washers and the 24 bolts. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(8) Remove the fixture.

C. Postrequisites

(1) Install the fan exit liner segment (inner rear) that is at 11 or 1 o'clock. Refer to 72−00−33, Installation−16 Task 72−00−33−440−001.

(2) Install low pressure compressor (LPC). See 72−00−31, Installation−01 Task 72−00−31−420−003.


FOURTH STAGE COMPRESSOR STATOR ASSEMBLY
JAW
PWA85905
INSTALL
COMPRESSOR INTERMEDIATE CASE ASSEMBLY
BODY
FOURTH STAGE COMPRESSOR STATOR ASSEMBLY
L-A6600 (0393)
PW V

Install The 4th Stage Compressor Stator Assembly
Figure 401
(Task 72-00-34-430-002)

Task 72−00−34−450−004:

1. Install Air/Oil Heat Exchanger And Valve (IDGS)

A. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 85853	Adapter, Torque
PWA 87505	Positioner
PWA 102285	Adapter, Torque

Consumable Materials:

	Item No.	Designation
	P03−001	Oil, Engine (PWA 521B)
	P05−289	Lockwire (AS3214−02)
	P05−291	Cable, Safety (Optional)
	P05−292	Ferrule, Safety Cable (Optional)
	P05−395	Beeswax
	P05−396	Paraffin Wax Blend
	P06−002	Petrolatum, White (PMC 9609)
R	P06−054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	24−11−00/1/6
Packing	1	24−11−00/2/70

B. Procedure

See Figure 401 (Sheet 1), Figure 401 (Sheet 2) and Figure 401 (Sheet 3).

NOTE: Items referred to as numbers in parenthesis in text are identified in Figure 401.

CAUTION: DO NOT HANDLE HEAT EXCHANGER VALVE AND HEAT EXCHANGER BY INLET COLLARS. INLET COLLARS ARE NOT INTEGRAL PARTS OF THE VALVE HOUSING.

(1) Remove protective closures.

(2) (Pre SB PW4ENG 79−60), Make sure the four inboard bolts (401/10) and washers (401/9) are installed loosely to the rear of the intermediate case as follows.

(a) Make sure the four bolts (401/10), threads lubricated with Engine Oil P03−001, and washers (401/9) are installed loosely in the four inboard bolt holes. Make sure the washers are sealed to the boltheads with Beeswax P05−395 or Paraffin Wax Blend P05−396.

(3) (Post SB PW4ENG 79−60), Make sure the four inboard bolt and washer assemblies are loosely installed in the rear of the intermediate case.

(4) Set the height of the bolts/bolt and washer assemblies with a PWA 87505 Positioner .

(5) Install and position air/oil heat exchanger (401/22) and valve in intermediate case, aligning inboard slotted holes in valve ducts with four bolts installed in intermediate case.

CAUTION: BE CERTAIN TO USE SHORTER BOLTS (SAME AS REMOVED) TO SECURE BRACKETS (UPPER AND LOWER TO AIR/OIL HEAT EXCHANGER AND VALVE OR DAMAGE TO UNIT MAY RESULT.

(6) Secure upper bracket (401/6) to heat exchanger and to bracket (401/26) on intermediate case with four bolts (401/5, 401/7), threads lubricated with Engine Oil P03−001, handtight only.

(7) Secure lower bracket (401/13) to heat exchanger and to bracket (401/16) attached to intermediate case with four bolts (401/14, 401/15), threads lubricated with Engine Oil P03−001, handtight only.

(8) Secure bracket (401/24) on forward side of valve to intermediate case with two bolts (401/11), threads lubricated with Engine Oil P03−001, and washers (401/12), handtight only.

(9) (Pre SB PW4ENG 79−60), Attach the valve inlet collars to the rear of the intermediate case as follows.

R
R

(a) Install four outboard bolts (401/10), threads lubricated with Engine Oil P03−001, and washers (401/9) in the outboard holes. Tighten by hand the four inboard bolts that were installed before and the four outboard bolts.

(10) (Post SB PW4ENG 79−60), Attach the valve inlet collars to the rear of the intermediate case as follows.

(a) Install four bolt and washer assemblies, threads lubricated with Engine Oil P03−001, in the outboard bolts holes. Tighten by hand the four inboard bolt and washer assemblies that were installed before and four outboard bolt and washer assemblies.

CAUTION: WITH THE PWA 85853TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING (SEE STANDARD PRACTICES MANUAL, 70−00−00). TOO MUCH TORQUE CAN DAMAGE THE THREADED PARTS.

(11) Torque previously installed bolts (401/5, 401/7, 401/14 and 401/15) bolts with PWA 102285 Torque Adapter to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(12) Torque previously installed bolt (401/10 and 401/11) and washer assemblies with PWA 85853 Torque Adapter to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(13) Install airframe cooler outlet oil tube (upper right) (LS03) (401/30) as follows:

(a) Remove protective closures.

(b) Install packing (401/29) lubricated with Engine Oil P03−001, into groove on collar end of tube.

(c) Install tube, securing swivel collar (401/28) to heat exchanger with three bolts (401/27), threads lubricated with Engine Oil P03−001. Tighten bolts handtight.

(d) Lubricate tube coupling nut (401/31) threads with
R Antiseize Paste P06−054 and connect tube nut to
R the tube coupling. Wipe off unwanted paste.
Tighten nut handtight.

(e) Torque three previously installed bolts (401/27), securing tube swivel collar to heat exchanger, to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Torque tube coupling nut (401/31) to 675 − 750 lb−in. (76.265 − 84.739 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 the nut.

CAUTION: MAKE SURE YOU CONNECT THE TUBE TO THE CORRECT CONNECTOR OR FAULT MESSAGES WILL BE GENERATED.

(14) Connect air/oil cooler valve return tube (CR12) (401/17).

R R (a) Lubricate tube nut threads with Antiseize Paste P06−054. Wipe off unwanted paste. Install the CR12 tube to the adapter that is furthest from the lower triangular pad on the exchanger.

(b) (Reference 256) Torque tube nut to 140 − 160 lb−in. (15.818 − 18.078 N.m.). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

NOTE: Hold bulkhead adapter with wrench while tightening tube nut at heat exchanger.

CAUTION: MAKE SURE YOU CONNECT THE TUBE TO THE CORRECT CONNECTOR OR FAULT MESSAGES WILL BE GENERATED.

(15) Connect air/oil cooler valve hydraulic tube (CP13) (401/18).

R R (a) Lubricate tube nut threads with Antiseize Paste P06−054. Wipe off unwanted paste. Install the CP13 tube to the adapter that is closest to the lower triangular pad on the exchanger. Connect tube nut to heat exchanger adapter.

(b) (Reference 256) Torque tube nut to 140 − 160 lb−in. (15.818 − 18.078 N.m.). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

NOTE: Hold bulkhead adapter with wrench while tightening tube nut at heat exchanger.

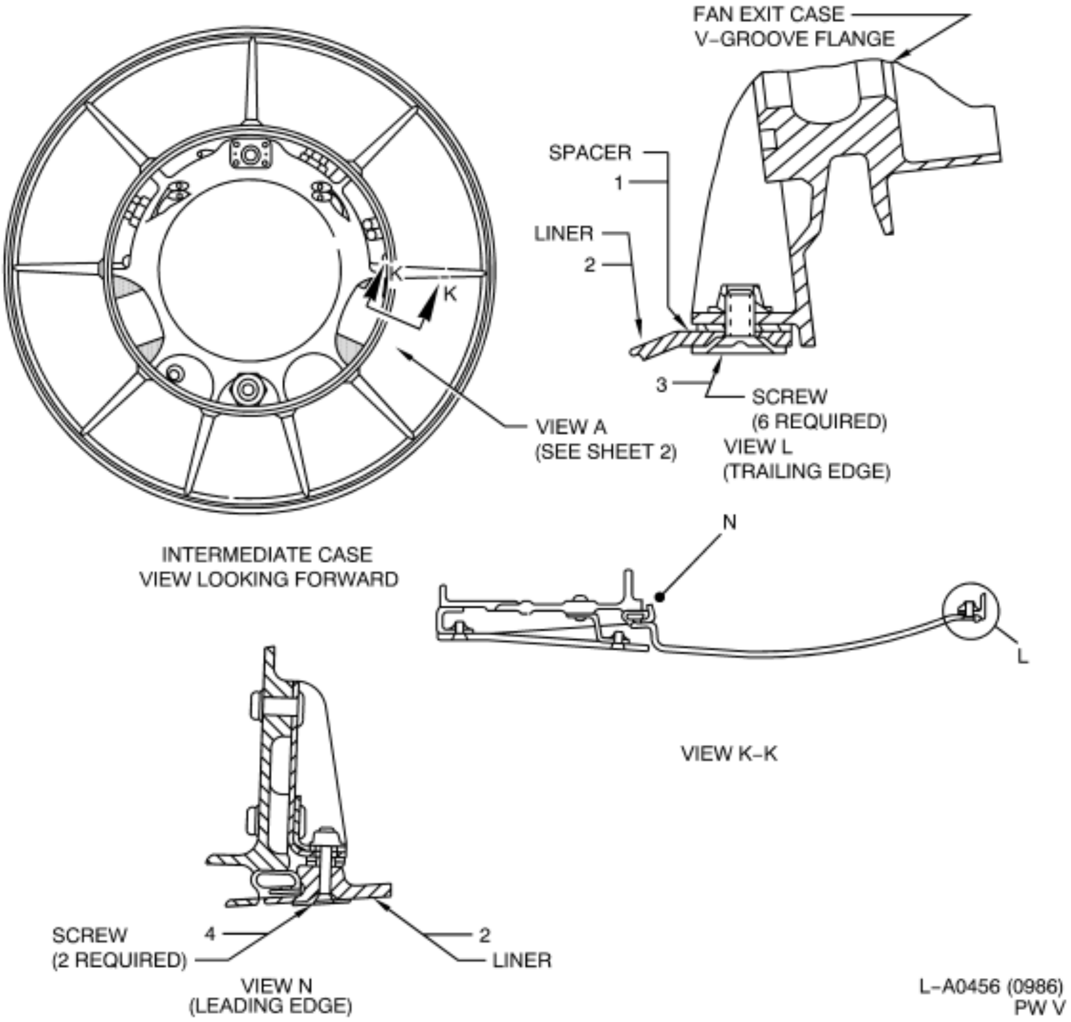
(16) Remove protective closure. Install valve cable receptacle to bracket on stator vane actuator support (401/22), aligning holes in receptacle flange with holes in bracket. Secure connector with two bolts (401/20) threads lubricated with Engine Oil P03−001 and harness bracket (401/21). Torque bolts (401/20) to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(17) Install clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts securing harness to air/oil cooler valve return tube (401/17). Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

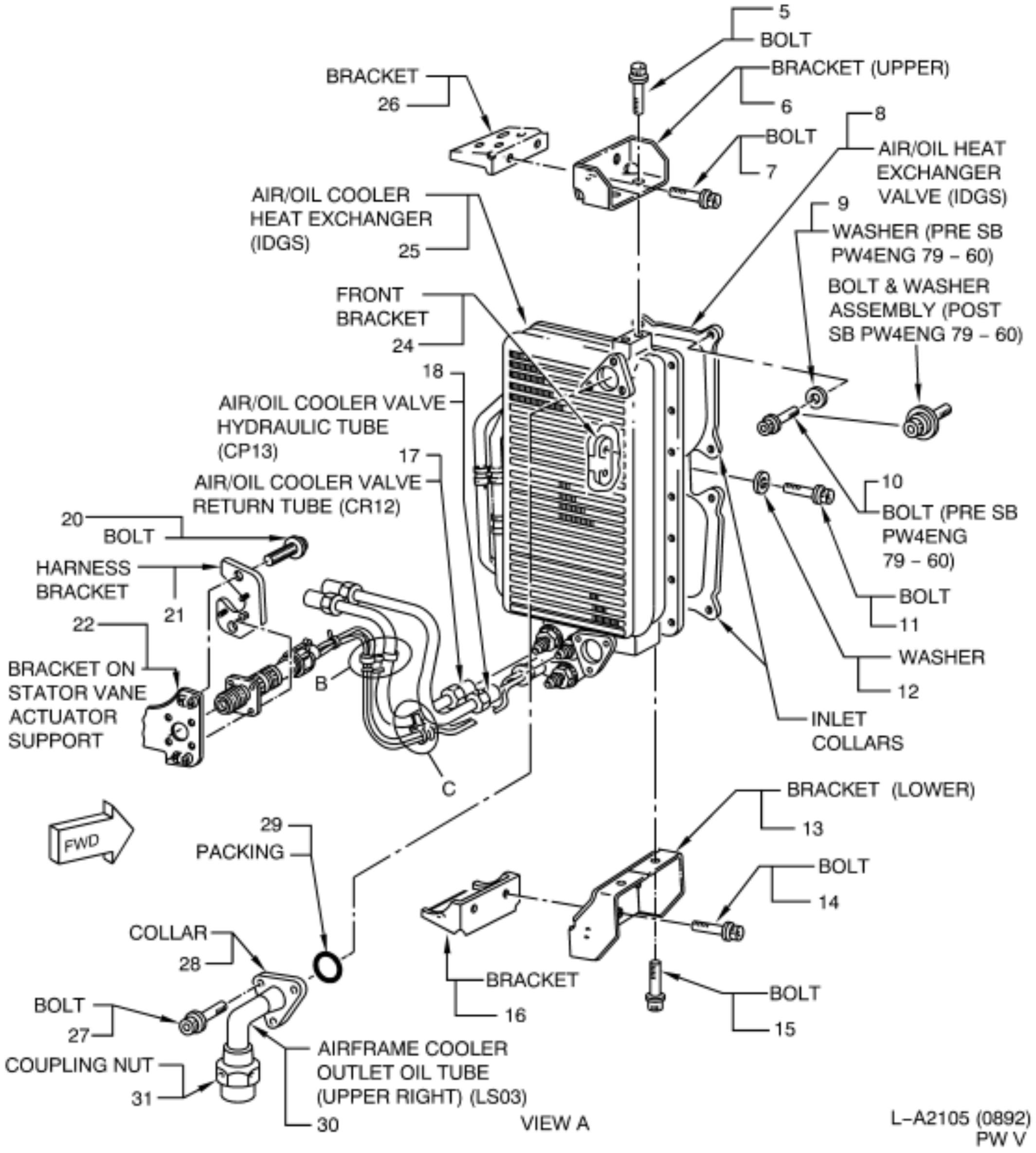
C. Postrequisites

(1) Install the fan exit liner segment (inner rear) that is at 4 o'clock. Refer to 72−00−33, Installation−16 Task 72−00−33−440−001.

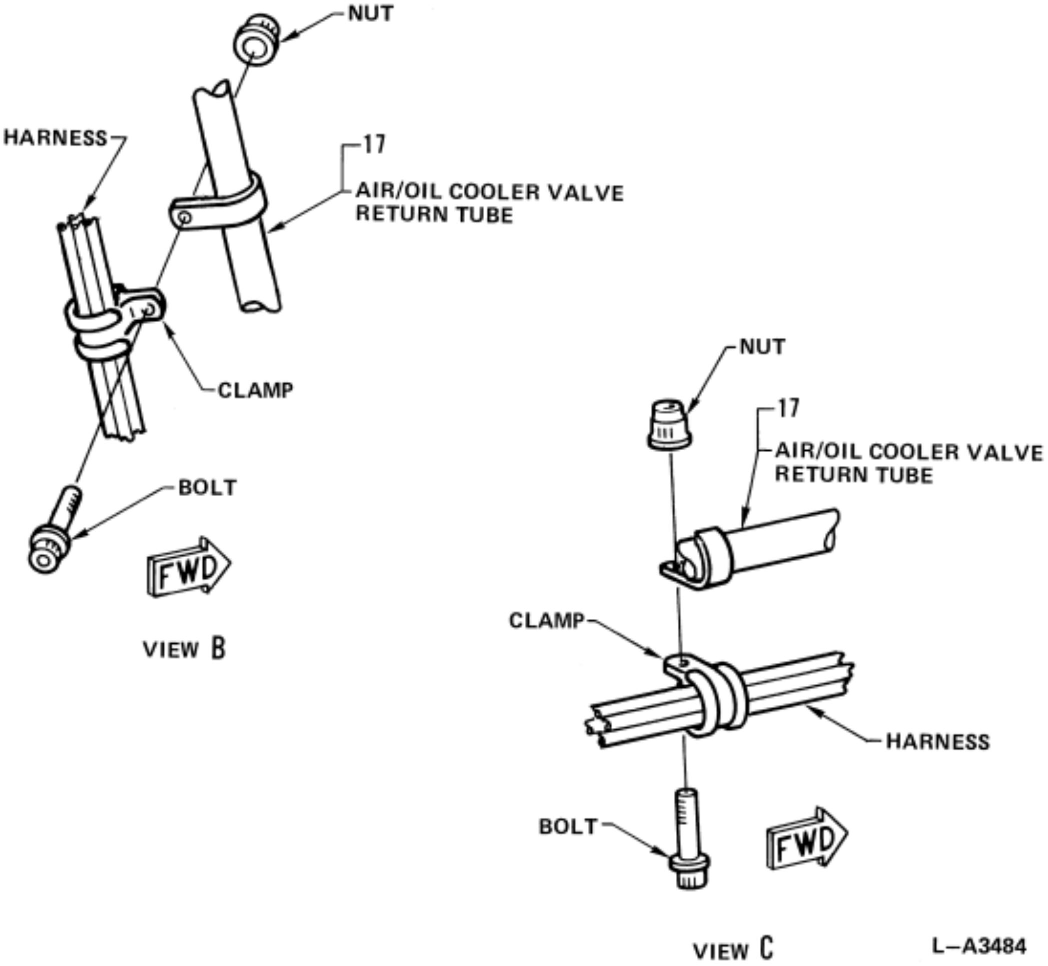
(2) Test engine by Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


FAN EXIT CASE
V-GROOVE FLANGE
SPACER
1
LINER
2
K
K
3
SCREW
(6 REQUIRED)
VIEW A
(SEE SHEET 2)
VIEW L
(TRAILING EDGE)
N
INTERMEDIATE CASE
VIEW LOOKING FORWARD
L
VIEW K-K
SCREW
(2 REQUIRED)
4
2
LINER
VIEW N
(LEADING EDGE)
L-A0456 (0986)
PW V

Air/Oil Heat Exchanger And Valve (IDGS)
Figure 401 (Sheet 1)
(Task 72-00-34-450-004)


5
BOLT
BRACKET (UPPER)
6
BRACKET
26
8
BOLT
7
AIR/OIL HEAT EXCHANGER VALVE (IDGS)
AIR/OIL COOLER HEAT EXCHANGER (IDGS)
25
9
WASHER (PRE SB PW4ENG 79 – 60)
BOLT & WASHER ASSEMBLY (POST SB PW4ENG 79 – 60)
FRONT BRACKET
24
18
AIR/OIL COOLER VALVE HYDRAULIC TUBE (CP13)
17
AIR/OIL COOLER VALVE RETURN TUBE (CR12)
10
BOLT (PRE SB PW4ENG 79 – 60)
20
BOLT
HARNESS BRACKET
21
BOLT
11
22
BRACKET ON STATOR VANE ACTUATOR SUPPORT
B
WASHER
12
INLET COLLARS
C
BRACKET (LOWER)
13
FWD
29
PACKING
BOLT
14
COLLAR
28
BRACKET
16
BOLT
15
BOLT
27
COUPLING NUT
31
AIRFRAME COOLER OUTLET OIL TUBE (UPPER RIGHT) (LS03)
30
VIEW A
L-A2105 (0892)
PW V

Air/Oil Heat Exchanger And Valve (IDGS)
Figure 401 (Sheet 2)
(Task 72-00-34-450-004)


NUT
HARNESS
17
AIR/OIL COOLER VALVE RETURN TUBE
CLAMP
BOLT
FWD
VIEW B
NUT
17
AIR/OIL COOLER VALVE RETURN TUBE
CLAMP
HARNESS
BOLT
FWD
VIEW C
L-A3484

Air/Oil Heat Exchanger And Valve (IDGS)
Figure 401 (Sheet 3)
(Task 72-00-34-450-004)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-34-450-005:

1. Install Valve To Air/Oil Heat Exchanger (IDGS)

A. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 102285	Adapter, Torque

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
R	P05-292	Ferrule, Safety Cable (Optional)
R	P06-053	Lubricant, Sealing Ring (PWA 36500)
	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing (Pre SB PW4ENG 24-4)	1	24-11-00/1/190
Packing	2	24-11-00/1/210
Packing, MS9966-04	2	(Post SB PW4ENG 24-4)

B. Procedure
See Figures 401, 402 and 403.

NOTE: Items referred to parenthesis in the text are identified in the figures.

CAUTION: DO NOT LIFT THE HEAT EXCHANGER VALVE AND/OR HEAT EXCHANGER BY THE INLET COLLARS. THE INLET COLLARS ARE NOT AN INTEGRAL PART OF THE VALVE HOUSING.

(1) Place the air/oil heat exchanger valve on the bench with the two four hole ducts downward and the three end ports facing the operator.

(2) Place the air/oil heat exchanger on the valve with the three hole tube bracket toward the operator.

(3) Secure heat exchanger and drain tube bracket to the valve with bolts, threads lubricated with Engine Oil P03-001, washers (under bolt heads and nuts) and nuts. Omit a washer at the bracket location. Torque the nuts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(4) If a new valve is to be installed, comply with the following:

(a) For Pre SB PW4ENG 24-4: Install a packing, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 on the smaller adapter. Lubricate the adapter threads with Engine Oil P03-001 and install the adapter in the smaller port of the three ports at the end of the valve. Torque the adapter to 65 - 75 lb-in. (7.344 - 8.474 N.m).

(b) For Post SB PW4ENG 24-4: Lubricate a packing with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 and install it on the smaller adapter. Lubricate the adapter threads with Engine Oil P03-001. Locate the angled port (SO OVERBOARD DRAIN) at the end of the valve and install the adapter into the port. Torque the adapter to 65 - 75 lb-in. (7.344 - 8.474 N.m).

NOTE: The end of the valve with the angled port is opposite the three port end of valve.

(c) For Post SB PW4ENG 24-4: Lubricate the packing with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 and install on the plug. Lubricate the plug thread with Engine Oil P03-001 and install the plug in the smaller port of the three ports at the end of the valve. Torque the plug to 65 - 75 lb-in. (7.344 - 8.474 N.m).

(d) Install the packings lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053, on the two larger adapters. Lubricate the adapter threads with Engine Oil P03-001 and install the adapters in two remaining ports. Torque the adapters to 110 - 120 lb-in. (12.428 - 13.558 N.m).

(e) Install the air shut off valve drain tube (CR10) as follows.

1 (Pre SB PW4ENG 79-49) Lubricate the threads of the smaller adapter with Antiseize Paste P06-054, and attach the tube to the adapter and to the hole in tube flange on the heat exchanger. Wipe off unwanted paste. Secure the coupling on the tube to the heat exchanger with a jamnut, threads lubricated with Engine Oil P03-001.

2 (Post SB PW4ENG 79-49) Lubricate the threads of the smaller adapter with Antiseize Paste P06-054, and attach the tube to the adapter and to the hole in tube flange on the heat exchanger with a plate between flats on the tube and the flange. Wipe off unwanted paste. Lubricate the threads on the coupling end of the tube with Engine Oil P03-001 and secure it with a washer and a jamnut.

3 Torque tube nut to 90 - 100 lb-in. (10.169 - 11.298 N.m). Torque the jamnut to 70 - 80 lb-in. (7.909 - 9.039 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 the tube nut and the jamnut.

(f) Install the air/oil cooler valve return tube (CR11) and the air/oil cooler valve hydraulic tube (CP09) as follows.

1 (Pre SB PW4ENG 79-49) Lubricate the threads on the remaining adapters with Antiseize Paste P06-054. Wipe off unwanted paste. Attach the tubes to the remaining adapters, with the couplings on the tubes through the flange on the heat exchanger. Lubricate the threads on the couplings with Engine Oil P03-001 and secure them with jamnuts.

2 (Post SB PW4ENG 79-49) Lubricate the threads on the remaining adapters with Antiseize Paste P06-054. Wipe off unwanted paste. Attach the tubes to the remaining adapters, with the couplings on the tubes through the plate and the flange on the heat exchanger. Lubricate the threads on the couplings with Engine Oil

P03-001 and secure them to the tubes with washers and the jamnuts.

NOTE: (Post SB PW4ENG 24-7) New CP09 and CR11 tubes with revised clamping were introduced to raise the natural frequency of these tubes well above the engine operating range.

NOTE: (Post SB PW4ENG 24-9) Further modified CP09 and CR11 tubes and tube clamping were provided to better align and fit the tubes than those introduced on SB PW4ENG 24-7.

NOTE: (Post SB PW4ENG 24-10) Further modified CR11 tube to correct the SB PW4ENG 24-9 tube data requirements to eliminate the possibility of a tube chafe against the intermediate case centerbody when the IDG air oil cooler is installed.

3 Torque the tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Torque the jamnuts to 70 - 80 lb-in. (7.909 - 9.039 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 the tube nuts and the jamnuts.

NOTE: If the tubes, clamps, bolts and nuts which secure the tubes have been removed, clamp the tubes together as shown in the Figure 403 (Sheets 1 or 9 as applicable).

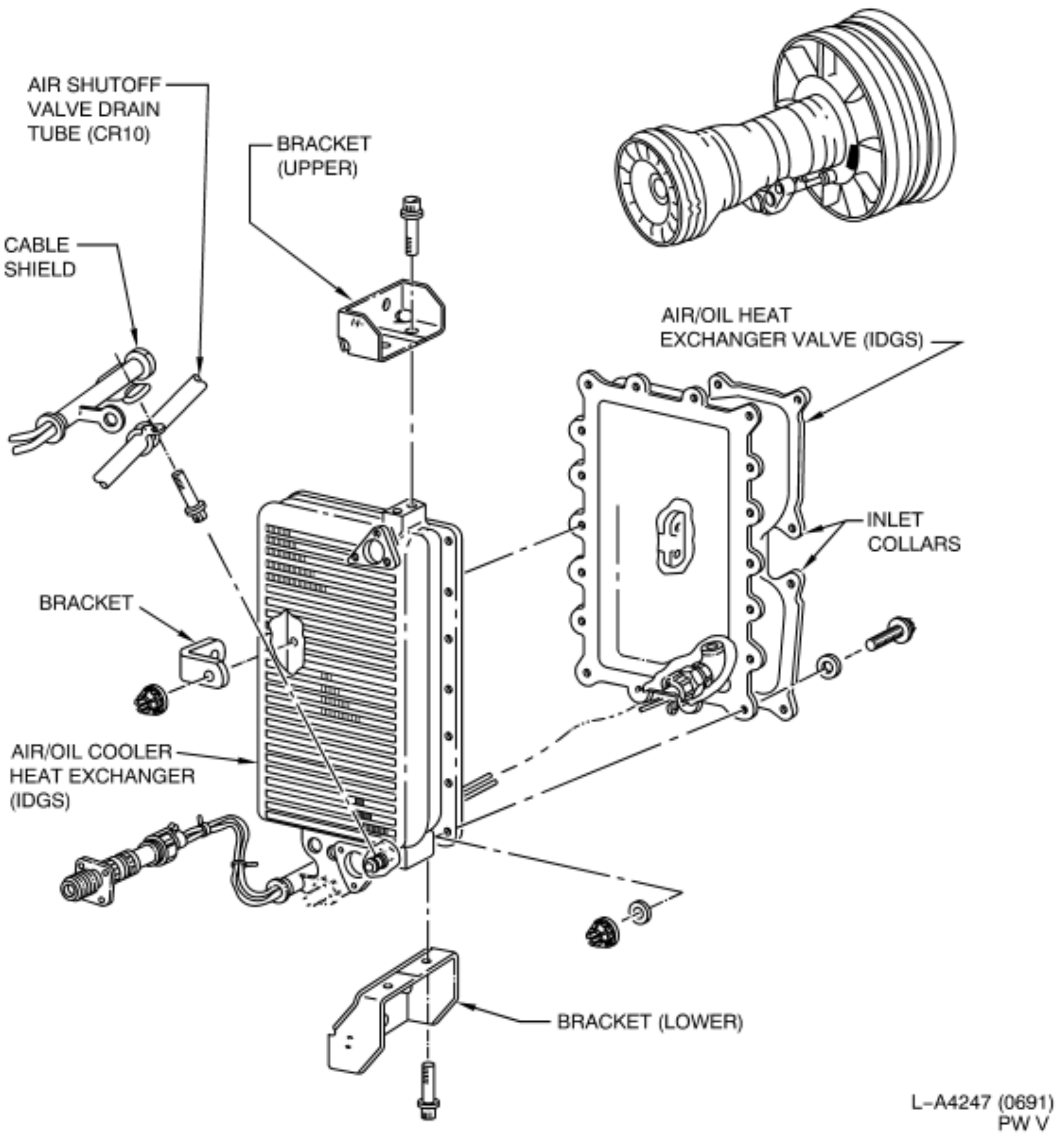
(5) If a new heat exchanger is to be installed, comply with the following:

(a) Install the upper and lower mount brackets to the heat exchanger. Secure the brackets with bolts, threads lubricated with Engine Oil P03-001. Torque the bolts with PWA 102285 Torque Adapter to 85 - 95 lb-in. (9.604 - 10.734 N.m).

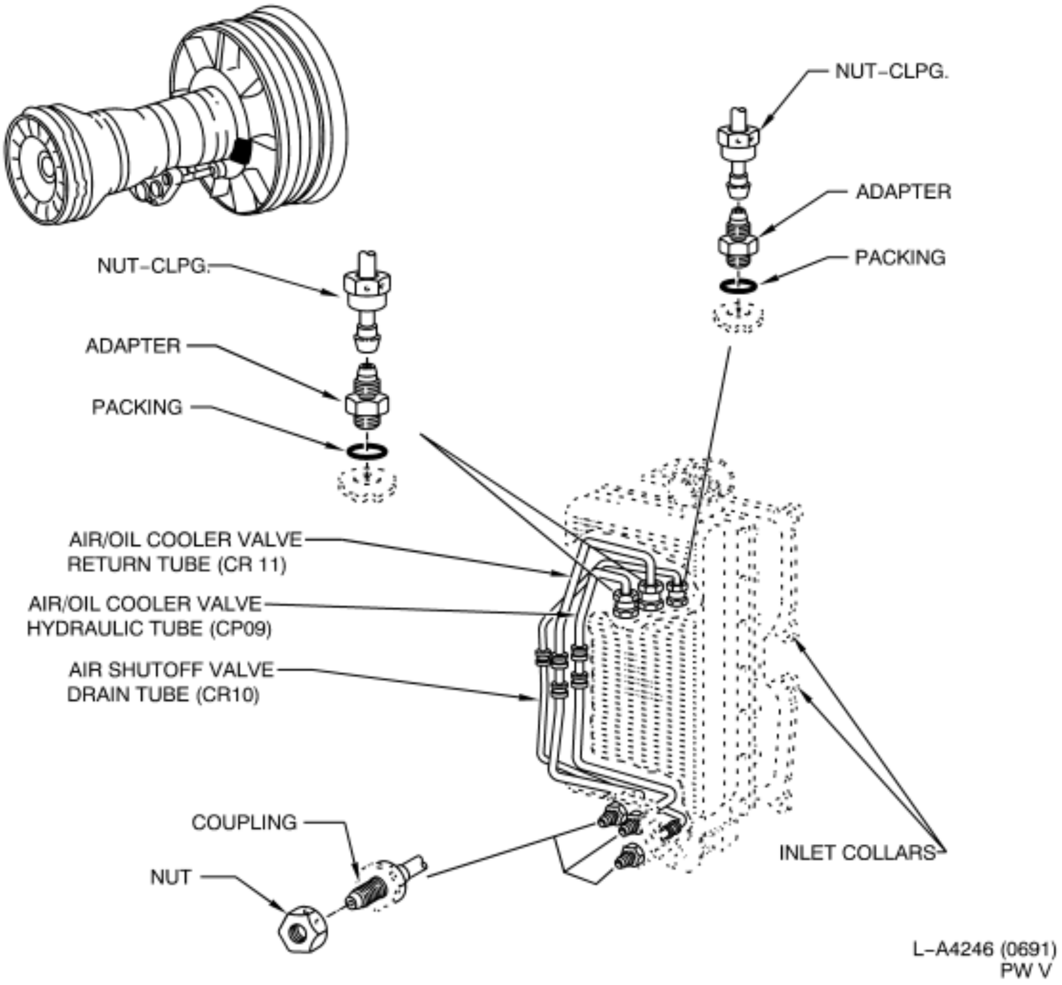
(6) Secure the air shutoff valve drain tube clamp to the cable shield with a bolt, threads lubricated with Engine Oil P03-001. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

C. Postrequisites

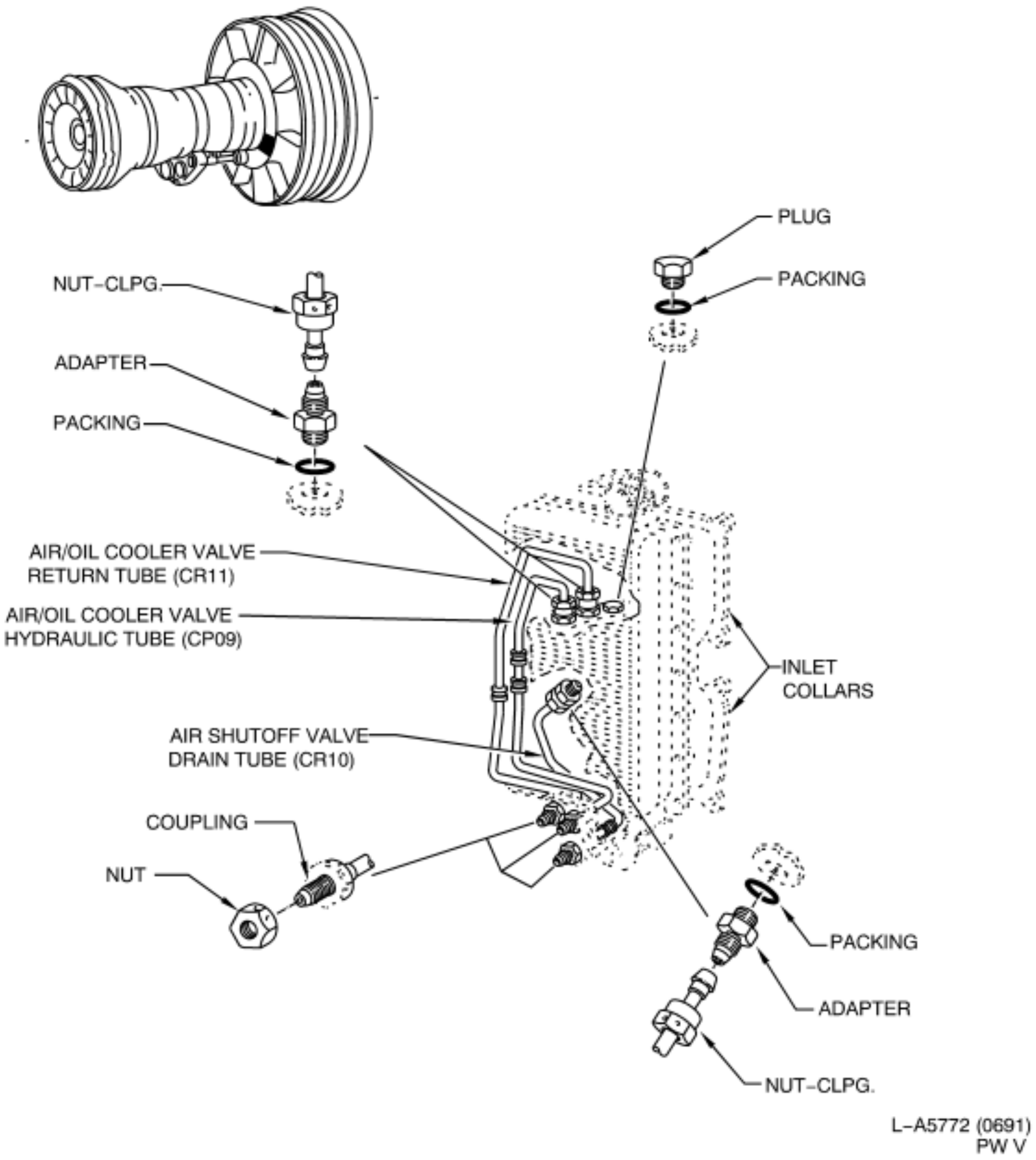
(1) Install Air/Oil Heat Exchanger And Valve (IDGS) to engine per Removal/Installation−01 (Task 72−00−34−450−004).


AIR SHUTOFF VALVE DRAIN TUBE (CR10)
BRACKET (UPPER)
CABLE SHIELD
AIR/OIL HEAT EXCHANGER VALVE (IDGS)
INLET COLLARS
BRACKET
AIR/OIL COOLER HEAT EXCHANGER (IDGS)
BRACKET (LOWER)
L-A4247 (0691)
PW V

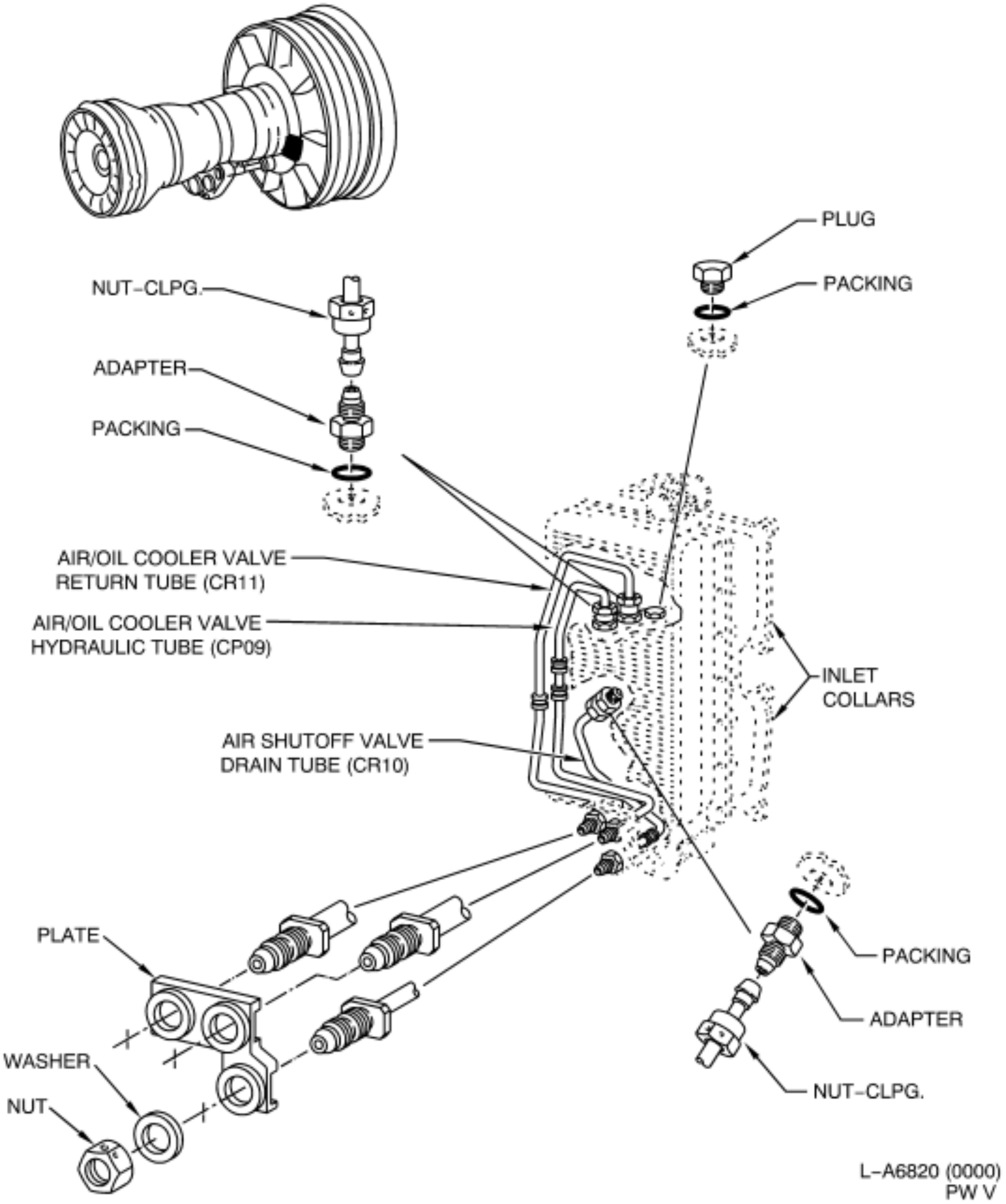
Air/Oil Heat Exchanger And Valve (IDGS)
Figure 401
(Task 72-00-34-450-005)


NUT−CLPG.
ADAPTER
PACKING
NUT−CLPG.
ADAPTER
PACKING
AIR/OIL COOLER VALVE RETURN TUBE (CR 11)
AIR/OIL COOLER VALVE HYDRAULIC TUBE (CP09)
AIR SHUTOFF VALVE DRAIN TUBE (CR10)
COUPLING
NUT
INLET COLLARS
L−A4246 (0691)
PW V

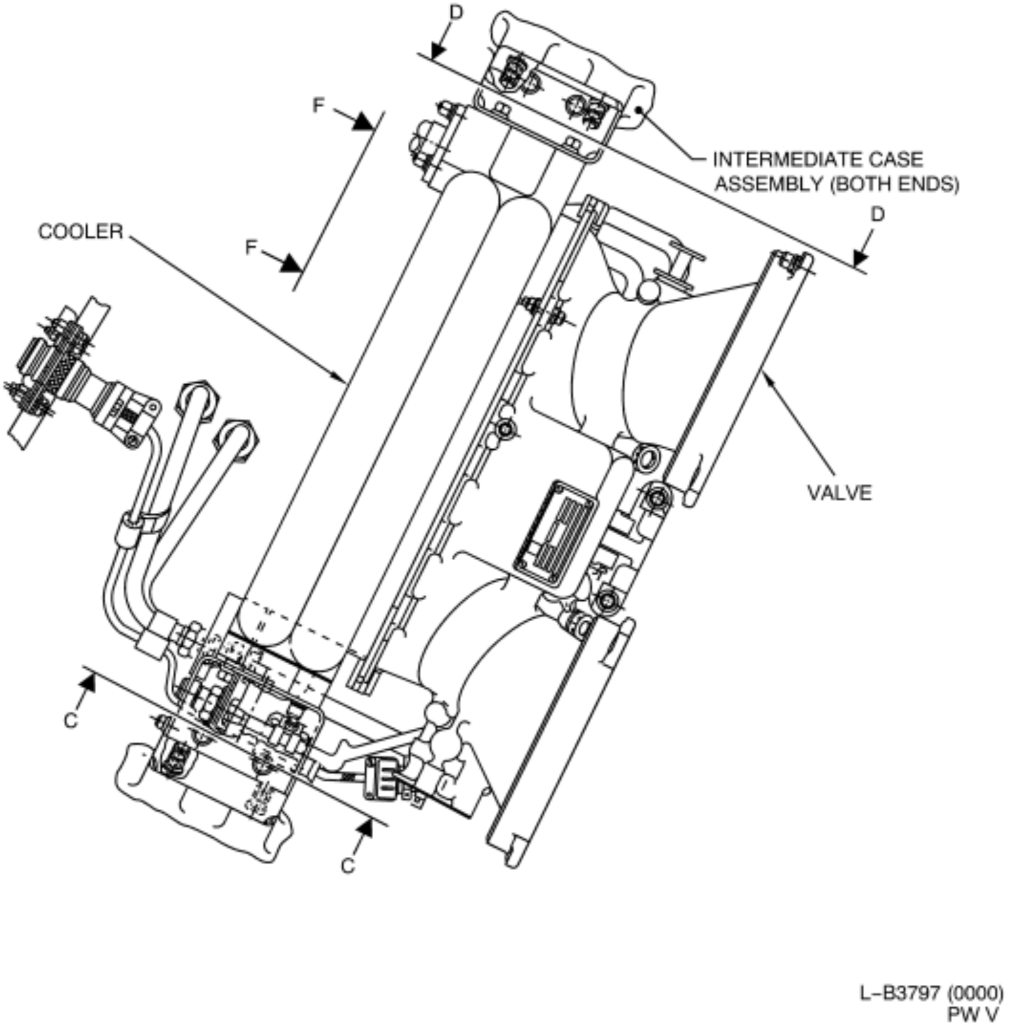
Air/Oil Heat Exchanger And Valve (IDGS) (Pre SB PW4ENG 24−4)
Figure 402 (Sheet 1)
(Task 72−00−34−450−005)


PLUG
PACKING
NUT−CLPG.
ADAPTER
PACKING
AIR/OIL COOLER VALVE RETURN TUBE (CR11)
AIR/OIL COOLER VALVE HYDRAULIC TUBE (CP09)
INLET COLLARS
AIR SHUTOFF VALVE DRAIN TUBE (CR10)
COUPLING
NUT
PACKING
ADAPTER
NUT−CLPG.
L−A5772 (0691)
PW V

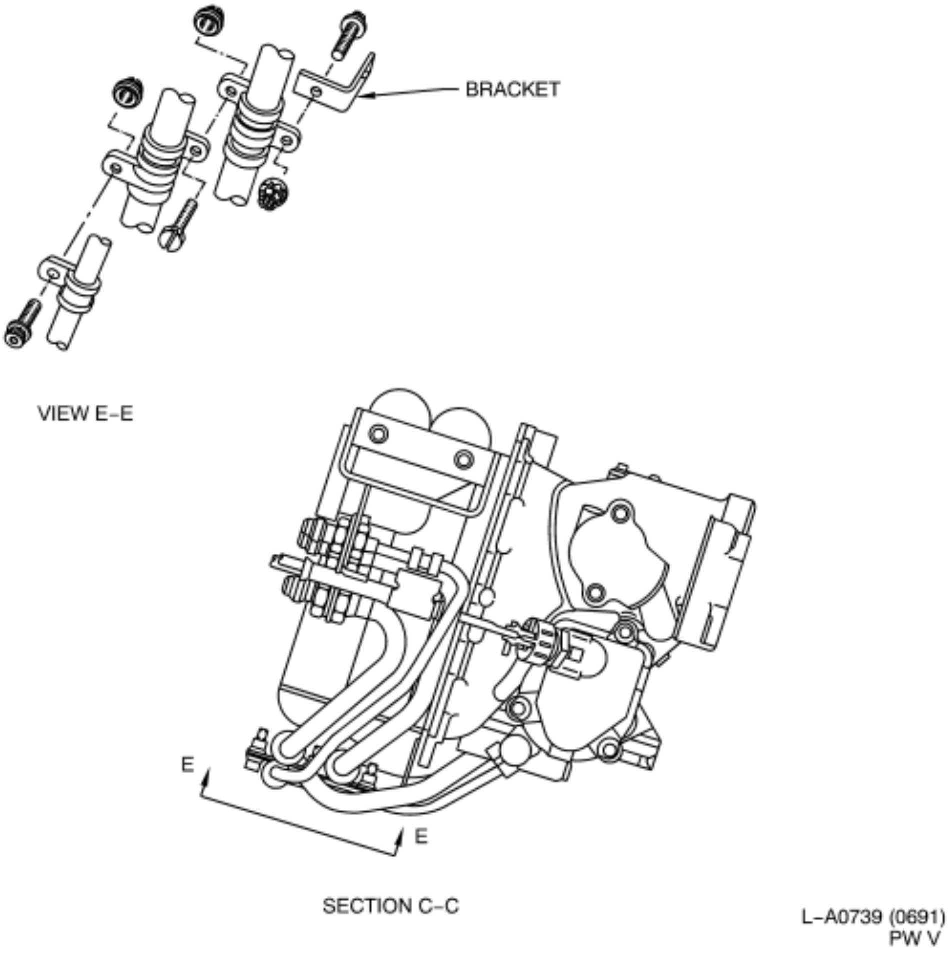
Air/Oil Heat Exchanger And Valve (IDGS) (Post SB PW4ENG 24−4) (Pre SB PW4ENG 79−49)
Figure 402 (Sheet 2)
(Task 72−00−34−450−005)


PLUG
PACKING
NUT-CLPG.
ADAPTER
PACKING
AIR/OIL COOLER VALVE RETURN TUBE (CR11)
AIR/OIL COOLER VALVE HYDRAULIC TUBE (CP09)
INLET COLLARS
AIR SHUTOFF VALVE DRAIN TUBE (CR10)
PLATE
WASHER
NUT
PACKING
ADAPTER
NUT-CLPG.
L-A6820 (0000)
PW V

Air/Oil Heat Exchanger And Valve (IDGS) (Post SB PW4ENG 79-49)
Figure 402 (Sheet 3)
(Task 72-00-34-450-005)


D
F
INTERMEDIATE CASE ASSEMBLY (BOTH ENDS)
D
COOLER
F
VALVE
C
C
L−B3797 (0000)
PW V

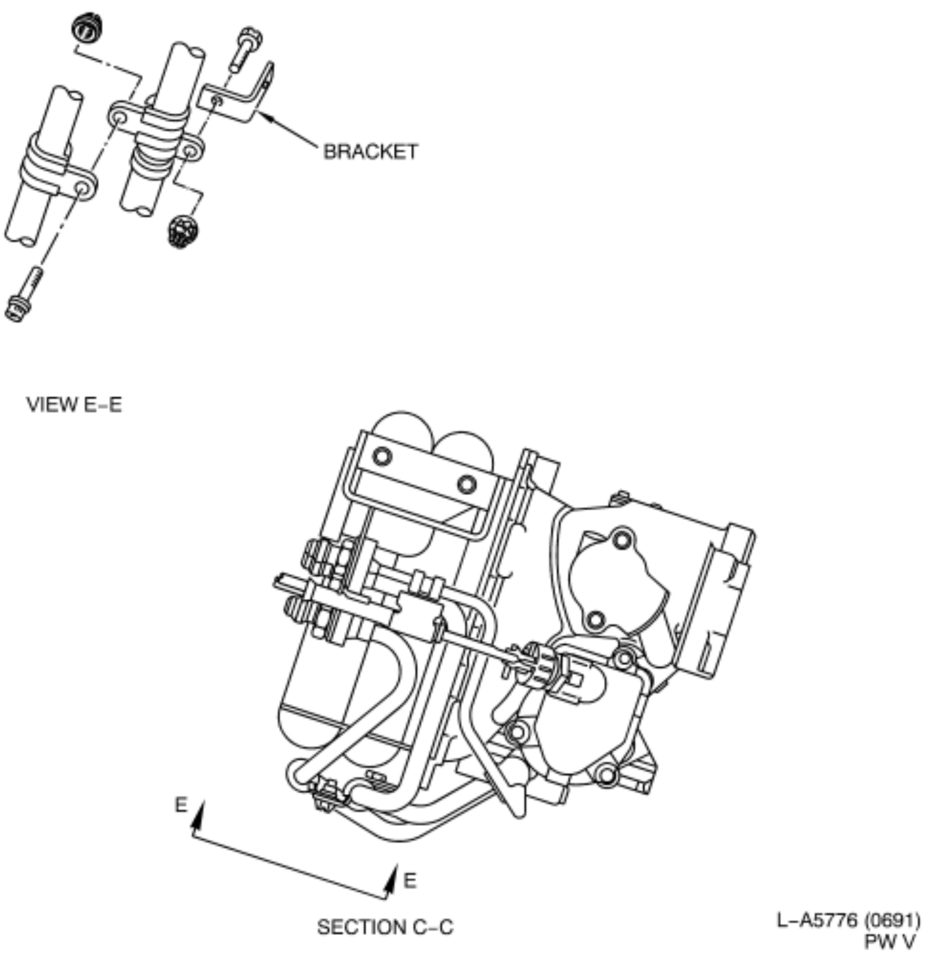
Air/Oil Heat Exchanger And Valve (IDGS)
Figure 403 (Sheet 1)
(Task 72−00−34−450−005)



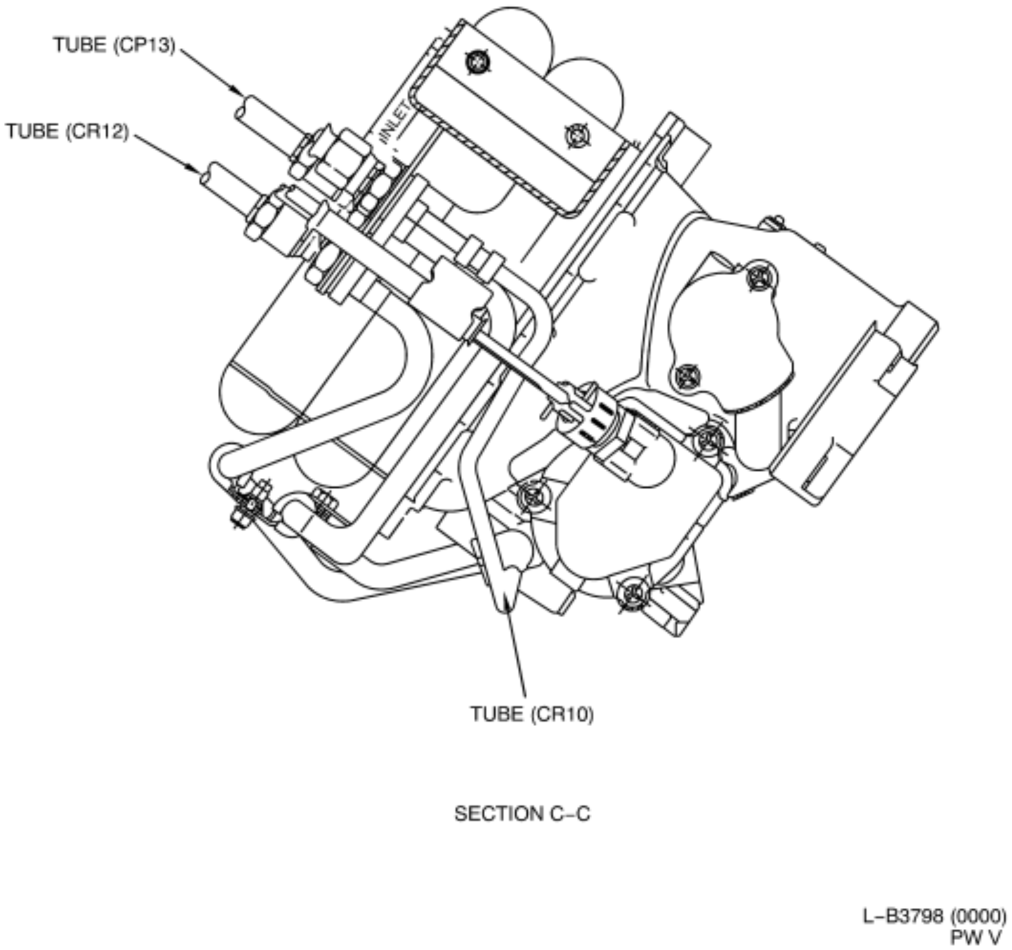
VIEW E−E

SECTION C−C

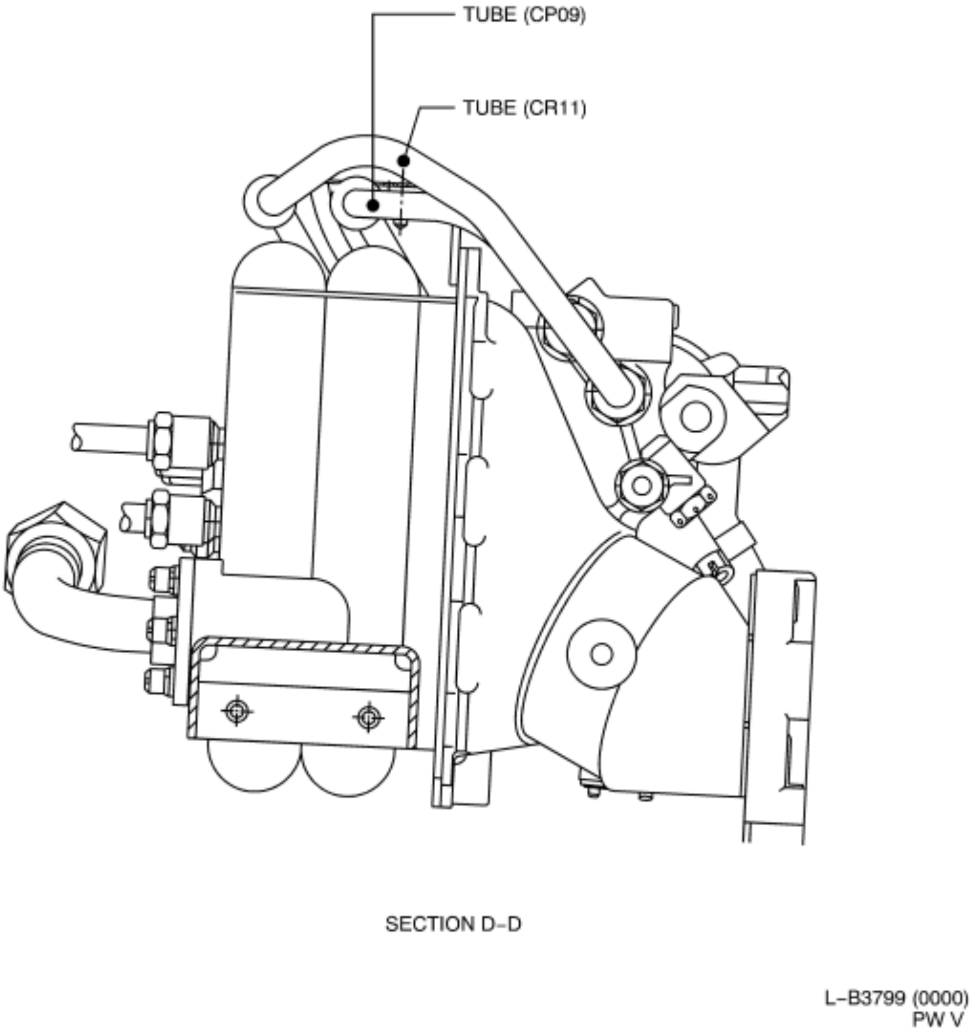
Air/Oil Heat Exchanger And Valve (IDGS) (Pre SB PW4ENG 79−49)
Figure 403 (Sheet 2)
(Task 72−00−34−450−005)


BRACKET
VIEW E−E
E
E
SECTION C−C
L−A5776 (0691)
PW V

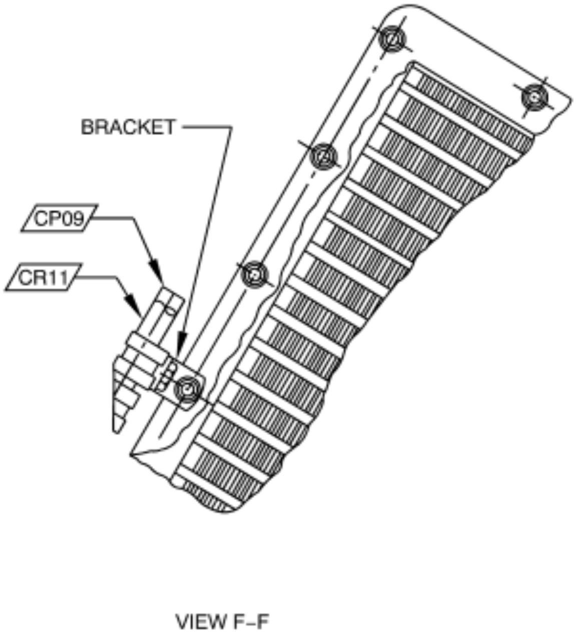
Air/Oil Heat Exchanger And Valve (IDGS) (Post SB PW4ENG 79−49 And Pre SB PW4ENG 24−7)
Figure 403 (Sheet 3)
(Task 72−00−34−450−005)


TUBE (CP13)
TUBE (CR12)
INLET
TUBE (CR10)
SECTION C−C
L−B3798 (0000)
PW V

Air/Oil Heat Exchanger And Valve (IDGS) (Post
SB PW4ENG 79−49 And Pre SB PW4ENG 24−7)
Figure 403 (Sheet 4)
(Task 72−00−34−450−005)

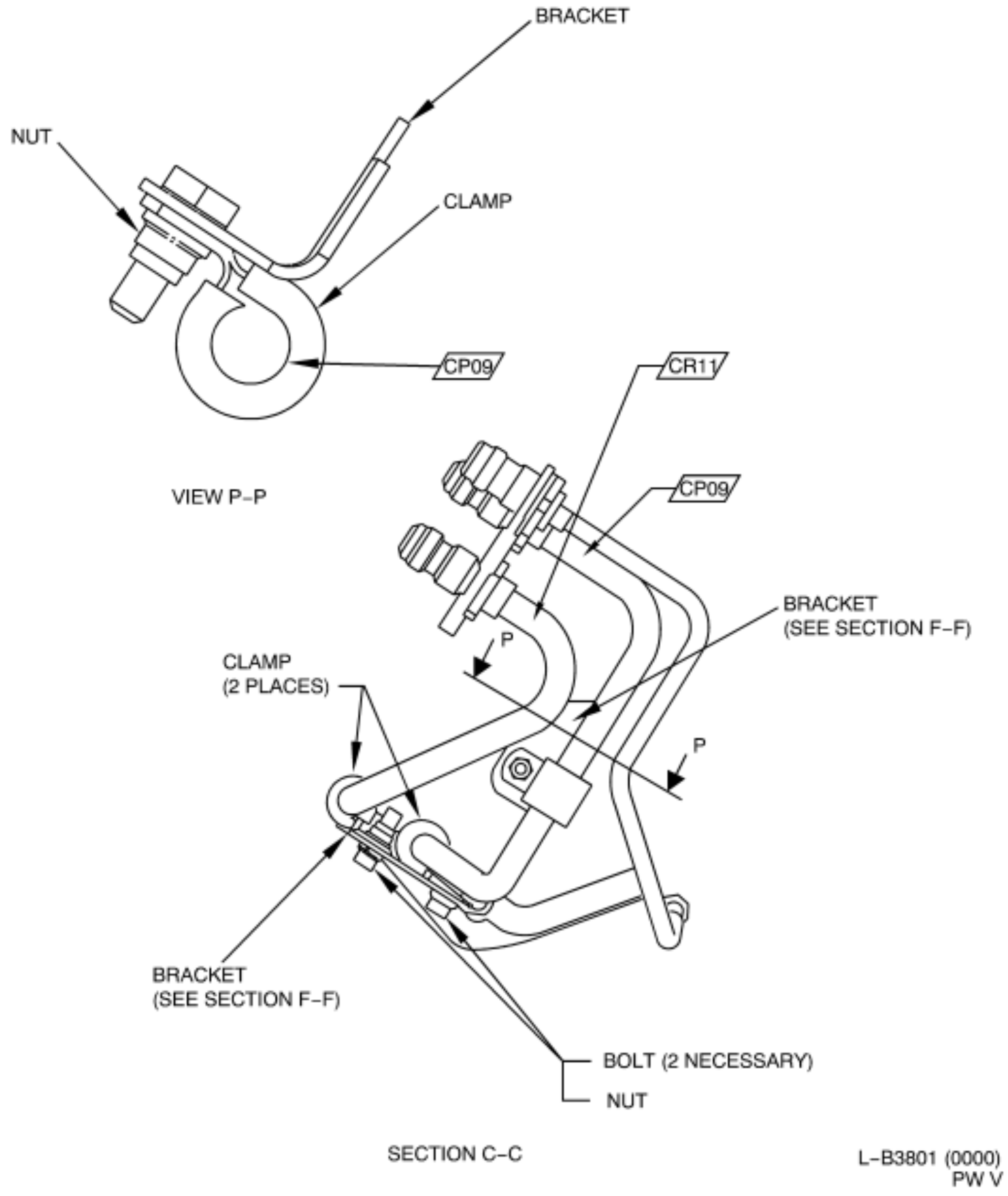

TUBE (CP09)
TUBE (CR11)
SECTION D−D
L−B3799 (0000)
PW V

Air/Oil Heat Exchanger And Valve (IDGS) (Post SB PW4ENG 79−49 And Pre SB PW4ENG 24−7)
Figure 403 (Sheet 5)
(Task 72−00−34−450−005)

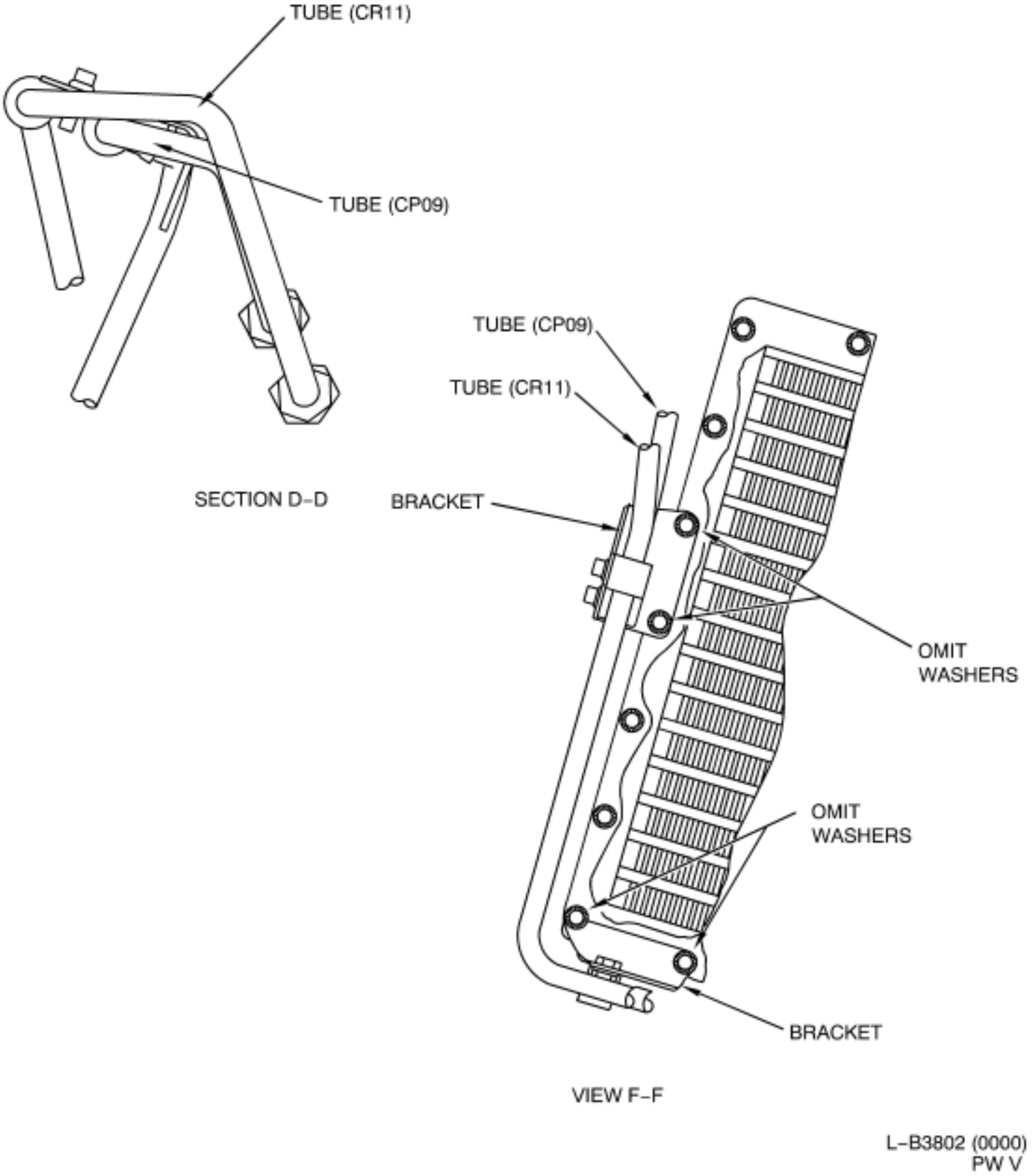


L-B3800 (0000)
PW V

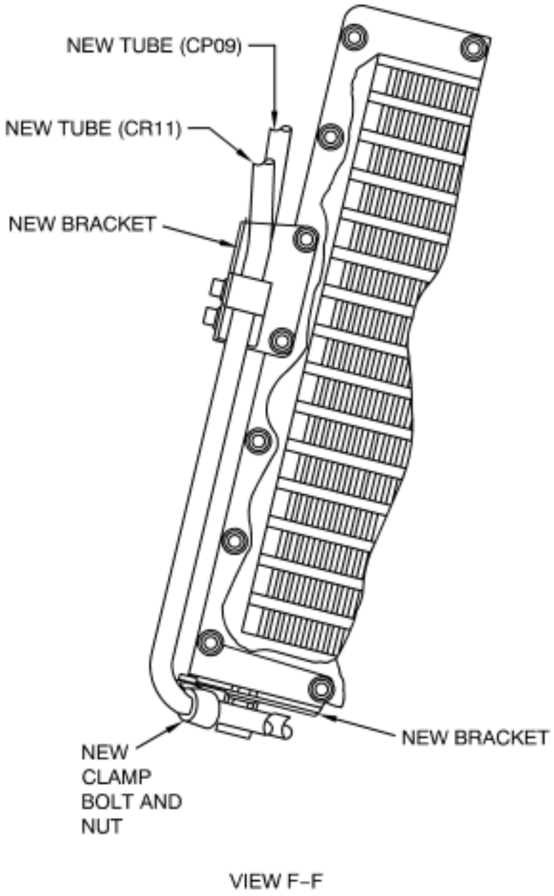
Air/Oil Heat Exchanger And Valve (IDGS) (Post
SB PW4ENG 79-49 And Pre SB PW4ENG 24-7)
Figure 403 (Sheet 6)
(Task 72-00-34-450-005)


BRACKET
NUT
CLAMP
CP09
VIEW P−P
CR11
CP09
BRACKET
(SEE SECTION F−F)
CLAMP
(2 PLACES)
P
P
BRACKET
(SEE SECTION F−F)
BOLT (2 NECESSARY)
NUT
SECTION C−C
L−B3801 (0000)
PW V

Air/Oil Heat Exchanger And Valve (IDGS) (Post
SB PW4ENG 24−7 And Pre SB PW4ENG 24−9)
Figure 403 (Sheet 7)
(Task 72−00−34−450−005)


TUBE (CR11)
TUBE (CP09)
SECTION D-D
TUBE (CP09)
TUBE (CR11)
BRACKET
OMIT
WASHERS
OMIT
WASHERS
BRACKET
VIEW F-F
L-B3802 (0000)
PW V

Air/Oil Heat Exchanger And Valve (IDGS) (Post
SB PW4ENG 24-7 And Pre SB PW4ENG 24-9)
Figure 403 (Sheet 8)
(Task 72-00-34-450-005)


NEW TUBE (CP09)
NEW TUBE (CR11)
NEW BRACKET
NEW CLAMP BOLT AND NUT
NEW BRACKET
VIEW F−F

L−B3803 (0000)
PW V

Air/Oil Heat Exchanger And Valve (IDGS)
(Post SB PW4ENG 24−9 And SB PW4ENG 24−10)
Figure 403 (Sheet 9)
(Task 72−00−34−450−005)

Task 72-00-34-450-006:

1. Install Air/Oil Heat Exchanger And Valve (Engine)

A. Equipment And Materials Necessary

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 85853	Adapter, Torque
PWA 87505	Positioner
PWA 102285	Adapter, Torque

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
	P05-395	Beeswax
	P05-396	Paraffin Wax Blend
R	P06-053	Lubricant, Sealing Ring (PWA 36500)
R	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	2	79-21-00/3/4
Packing	3	79-21-00/8/1

CAUTION: DO NOT HANDLE HEAT EXCHANGER VALVE AND HEAT EXCHANGER BY INLET COLLARS. INLET COLLARS ARE NOT INTEGRAL PARTS OF THE VALVE HOUSING.

B. Procedure

See Figure 401.

NOTE: Items referred to as numbers in parenthesis in text are identified in Figure 401.

(1) (Pre SB PW4ENG 79-60), Make sure the four inboard bolts (401/23) and washers (401/24) are installed loosely to the rear of the intermediate case as follows.

(a) Make sure the four bolts (401/23), threads lubricated with Engine Oil P03-001, and washers (401/24) are installed loosely in the four inboard bolt holes. Make sure the washers are sealed to the boltheads with Beeswax P05-395 or Paraffin Wax Blend P05-396.

(2) (Post SB PW4ENG 79-60), Make sure the four inboard bolt and washers assemblies are loosely installed in the rear of the intermediate case.

(3) Set the height of the bolts/bolt and washer assemblies with a PWA 87505 Positioner.

(4) Remove protective closures.

(5) Ensure detail packings are installed to inlet collars.
R If the packings are not installed, install the new
R packings, lubricated with Engine Oil P03-001 or Sealing
R Ring Lubricant P06-053 to the inlet collars. See
R Figure 401.

(6) Install air/oil heat exchanger (401/22) and valve (bottom end in first) to intermediate case. Rotate top of heat exchanger and valve inward and allow to drop slightly.

CAUTION: BE CERTAIN TO USE SHORTER BOLTS (SAME AS REMOVED) TO SECURE BRACKETS (UPPER AND LOWER) TO AIR/OIL HEAT EXCHANGER AND VALVE OR DAMAGE TO UNIT MAY RESULT.

(7) Secure (upper) bracket (401/25) to heat exchanger and valve with two bolts (401/27), threads lubricated with Engine Oil P03-001. Torque bolts (401/27), with PWA 102285 Torque Adapter to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(8) Raise heat exchanger and valve to engage inlet collars to previously installed inboard bolts (401/23) and washers (401/24) bolt and washer assemblies.

(9) Secure upper bracket (401/25) on heat exchanger to bracket (401/5) on intermediate case with two bolts (401/26), threads lubricated with Engine Oil P03-001. Tighten bolts handtight.

(10) Install previously removed lower bracket (401/9) to heat exchanger. Secure bracket with two bolts (401/15), threads lubricated with Engine Oil P03-001. Torque bolts (401/15), with PWA 102285 Torque Adapter to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(11) Secure lower bracket (401/9) to bracket (401/11) on intermediate case with two bolts (401/17) threads lubricated with Engine Oil P03-001. Tighten bolts handtight.

(12) Secure bracket on forward side of valve to intermediate case with two bolts (401/8), lubricated with Engine Oil P03-001, and washers (401/7). Tighten bolts handtight.

(13) (Pre SB PW4ENG 79-60), Attach the valve inlet collars to the rear of the intermediate case as follows.

- (a) Install four outboard bolts (401/23), threads lubricated with Engine Oil P03-001, and washers (401/24) in the outboard holes. Tighten by hand the four inboard bolts that were installed before and the four outboard bolts.

(14) (Post SB PW4ENG 79-60), Attach the valve inlet collars to the rear of the intermediate case as follows.

- (a) Install four bolt and washer assemblies, threads lubricated with Engine Oil P03-001, in the outboard bolts holes. Tighten by hand the four inboard bolt and washer assemblies that were installed before and four outboard bolt and washer assemblies.

CAUTION: WITH THE PWA 85853 TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING (SEE STANDARD PRACTICES MANUAL, 70-00-00). TOO MUCH TORQUE CAN DAMAGE THE THREADED PARTS.

(15) Torque previously installed bolts (401/17 and 401/26) bolts with PWA 102285 Torque Adapter to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(16) Torque previously installed bolt (401/8 and 401/23) and washer assemblies with PWA 85853 Torque Adapter to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(17) Secure rear end of cable conduit to lower bracket (401/11) on intermediate case with bolts (401/14, 401/16), threads lubricated with Engine Oil P03-001. Torque bolts (401/14, 401/16), with PWA 102285 Torque Adapter to 36 - 40 lb-in. (4.067 - 4.519 N.m).

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(18) Install air cooler outlet oil hose and tube assembly (LP03) (401/28).

(a) Remove protective closures.

(b) Install new packing, lubricated with Engine Oil P03-001, in groove at flanged end.

(c) Secure flange with bolts, threads lubricated with Engine Oil P03-001 handtight only.

(19) Install air cooler inlet oil tube (LP02) (401/29).

(a) Remove protective closures.

(b) Install new packing, lubricated with Engine Oil P03-001, in groove adjacent to flange.

(c) Install new packing, lubricated with Engine Oil P03-001, on elbow end of tube.

(d) Install tube, flange end, to air cooler. Secure flange with bolts, threads lubricated with Engine Oil P03-001.

(e) Secure elbow end of tube to oil filter housing with three bolts, threads lubricated with Engine Oil P03-001.

(f) Torque bolts at each end of tube to 85 - 95 lb-in. (9.604 - 10.734 N.m) including outlet tube flange bolts.

(g) Install bolt, threads lubricated with Engine Oil P03-001, and nut securing W3/W5 harness clamp and bracket installed on tube. Torque bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(20) Install air/oil cooler valve hydraulic return tube (CR05) (401/19).

(a) Lubricate tube nut threads with Antiseize Paste P06-054. Wipe off unwanted paste. Connect tube to heat exchanger (401/22) adapter.

(b) Torque tube nut to 200 - 225 lb-in. (22.597 - 25.422 N.m).

NOTE: Hold bulkhead adapter with wrench while tightening tube nut at heat exchanger.

(c) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 the tube nut.

(21) Install air/oil cooler valve hydraulic tube (CP07) (401/18).

(a) Lubricate tube nut threads with Antiseize Paste P06-054. Wipe off unwanted paste. Connect tube to heat exchanger (401/22) adapter.

(b) Torque tube nut to 200 - 225 lb-in. (22.597 - 25.422 N.m).

NOTE: Hold bulkhead adapter with wrench while tightening tube nut at heat exchanger.

(c) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 the tube nut.

(22) Remove protective closure and install valve cable flanged receptacle to HPC case bracket. Secure with harness bracket and two bolts (401/20), threads lubricated with Engine Oil P03-001. Torque bolts (401/20) to 36 - 40 lb-in. (4.067 - 4.519 N.m).

R
R

(23) Connect the W3P17 harness connector to the heat exchanger and valve harness receptacle as follows.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make
R straight all the bent pins. If necessary, clean
R the connector and receptacle by SPOP 6 (Task
R 70−21−00−110−900). Refer to Section 70−21−00 in
R the Standard Practices Manual, PN 585005.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal). This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

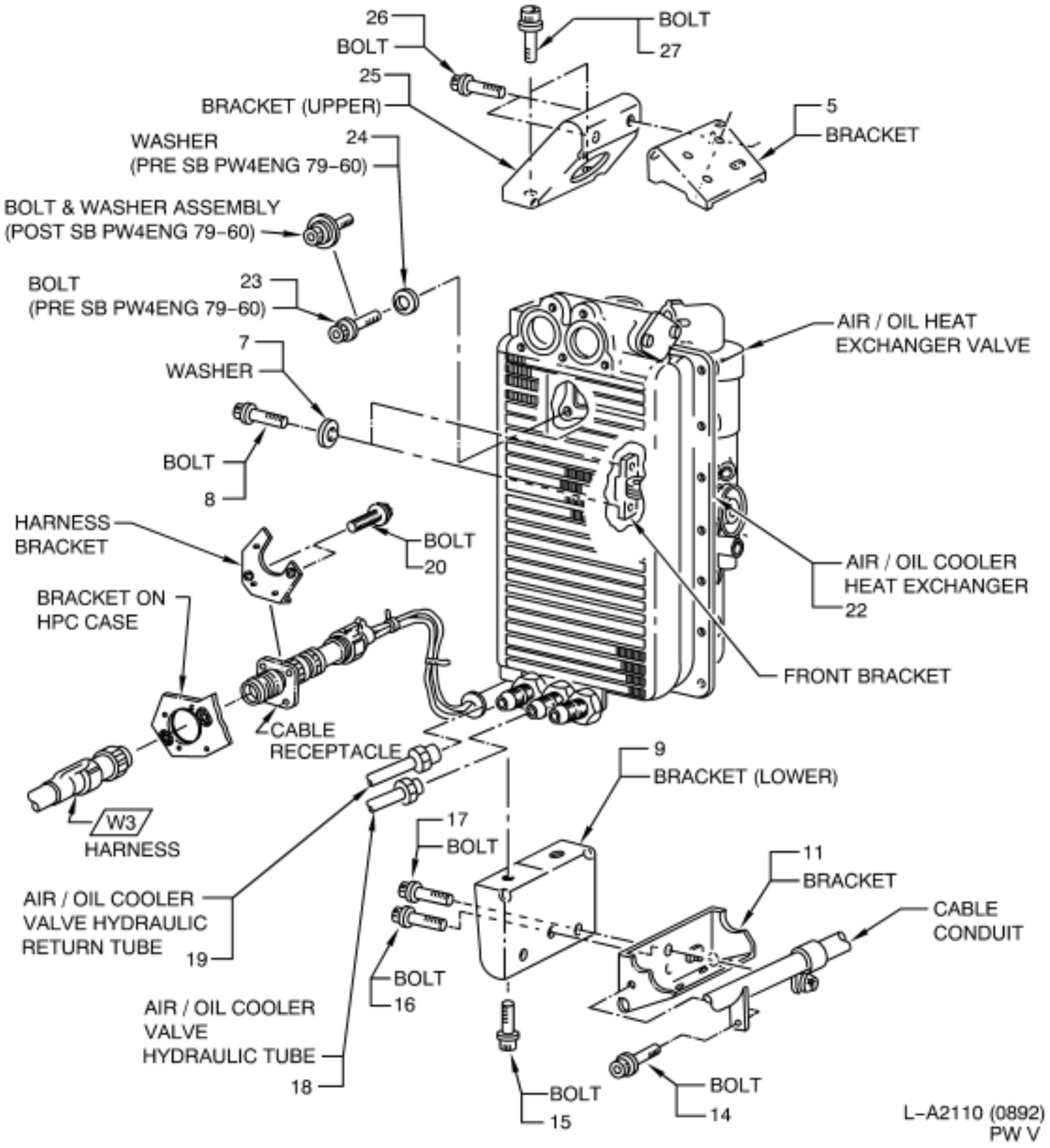
NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

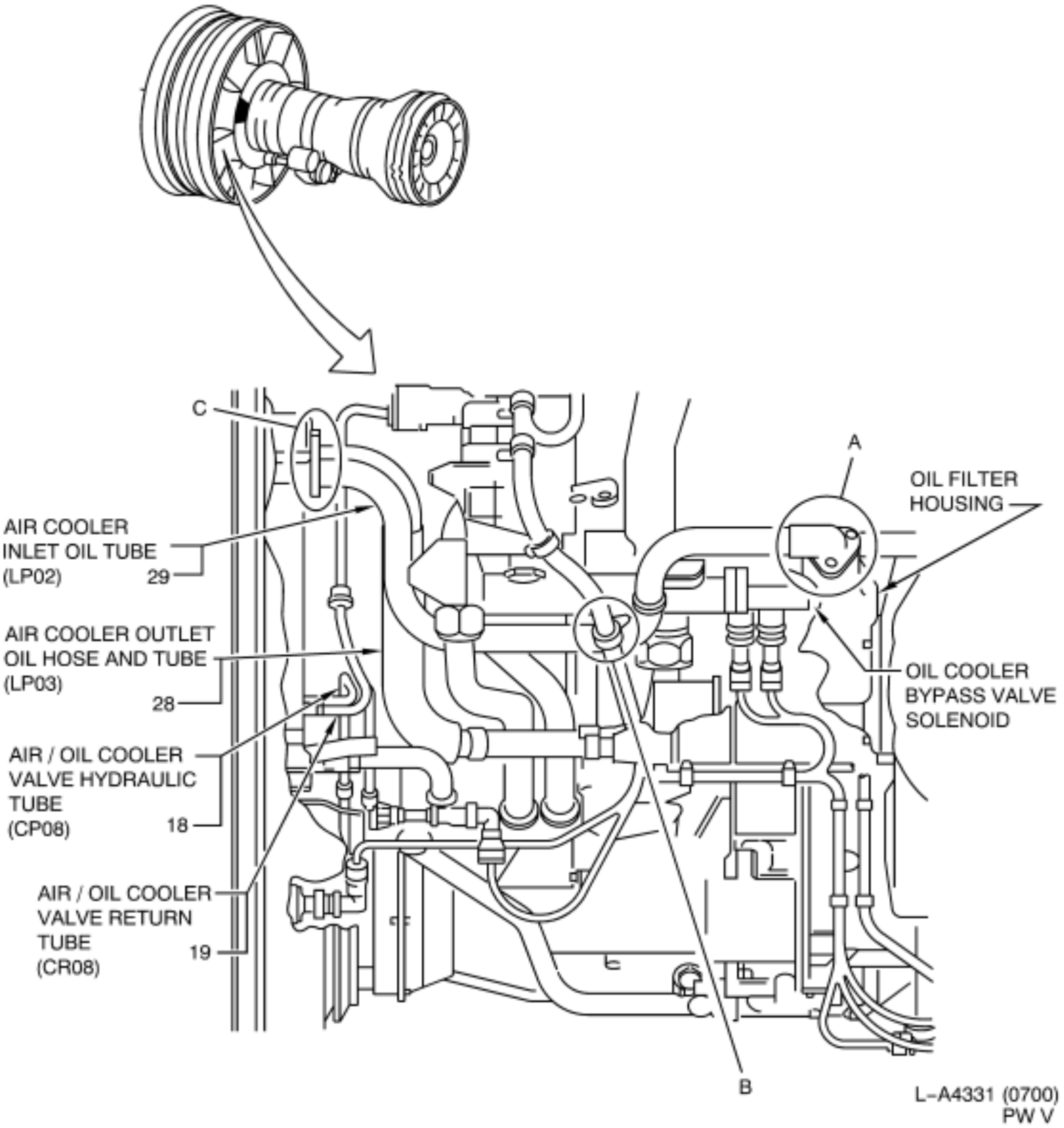
C. Postrequisites

(1) Install the fan exit liner segment (inner rear) that is at 8 o'clock. Refer to 72−00−33, Installation−16 Task 72−00−33−440−001.

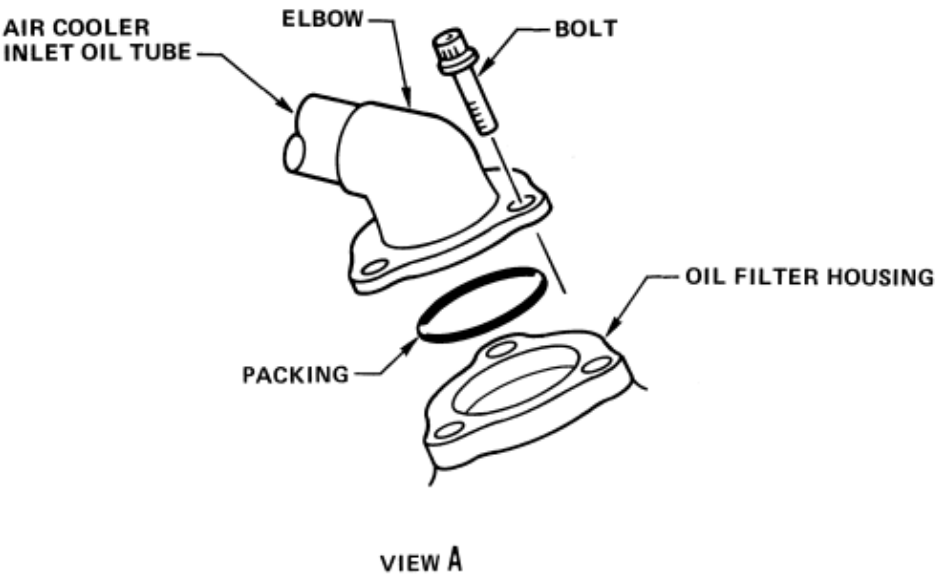
(2) Test engine per Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.

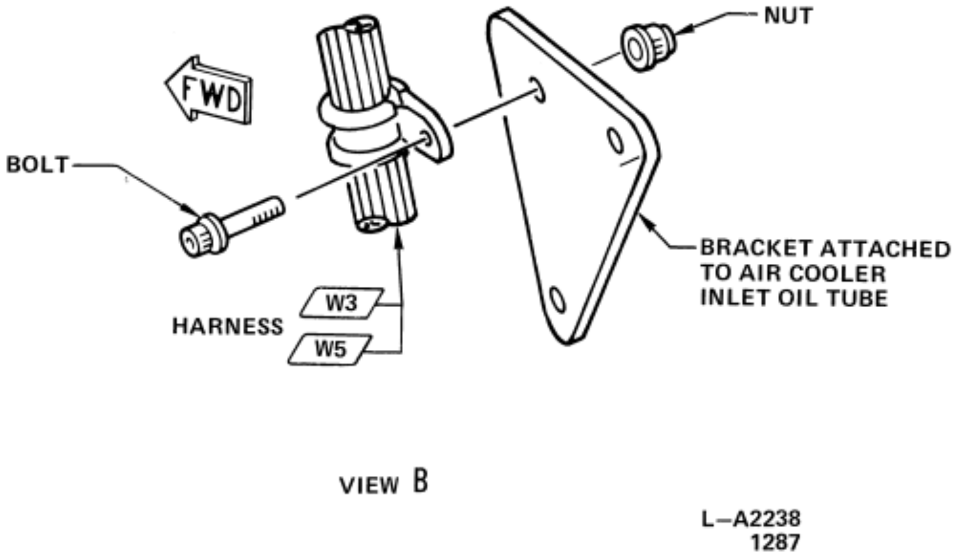

26
BOLT
BOLT
27
25
BRACKET (UPPER)
5
BRACKET
WASHER
(PRE SB PW4ENG 79-60)
24
BOLT & WASHER ASSEMBLY
(POST SB PW4ENG 79-60)
BOLT
(PRE SB PW4ENG 79-60)
23
AIR / OIL HEAT
EXCHANGER VALVE
7
WASHER
BOLT
8
HARNESS
BRACKET
BOLT
20
AIR / OIL COOLER
HEAT EXCHANGER
22
BRACKET ON
HPC CASE
FRONT BRACKET
CABLE
RECEPTACLE
9
BRACKET (LOWER)
W3
HARNESS
17
BOLT
11
BRACKET
CABLE
CONDUIT
AIR / OIL COOLER
VALVE HYDRAULIC
RETURN TUBE
19
BOLT
16
AIR / OIL COOLER
VALVE
HYDRAULIC TUBE
18
BOLT
15
BOLT
14
L-A2110 (0892)
PW V

Air/Oil Heat Exchanger And Valve (Engine)
Figure 401 (Sheet 1)
(Task 72-00-34-450-006)

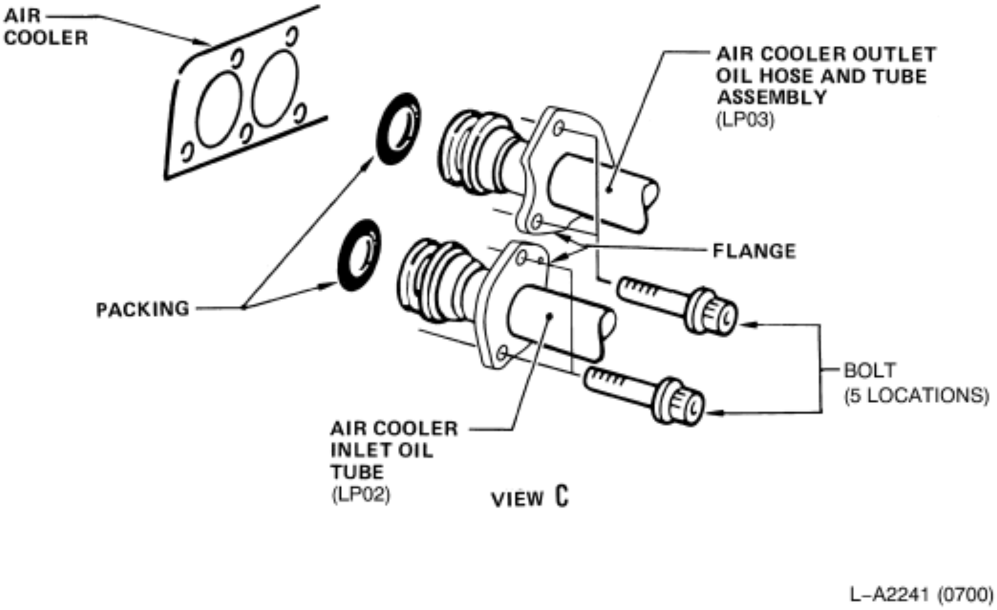

C
A
OIL FILTER HOUSING
AIR COOLER INLET OIL TUBE (LP02)
29
AIR COOLER OUTLET OIL HOSE AND TUBE (LP03)
28
OIL COOLER BYPASS VALVE SOLENOID
AIR / OIL COOLER VALVE HYDRAULIC TUBE (CP08)
18
AIR / OIL COOLER VALVE RETURN TUBE (CR08)
19
B
L–A4331 (0700)
PW V

Air/Oil Heat Exchanger And Valve (Engine)
Figure 401 (Sheet 2)
(Task 72–00–34–450–006)


AIR COOLER INLET OIL TUBE
ELBOW
BOLT
OIL FILTER HOUSING
PACKING
VIEW A


NUT
FWD
BOLT
BRACKET ATTACHED TO AIR COOLER INLET OIL TUBE
HARNESS
W3
W5
VIEW B
L-A2238
1287

Air/Oil Heat Exchanger And Valve (Engine)
Figure 401 (Sheet 3)
(Task 72-00-34-450-006)


AIR COOLER
AIR COOLER OUTLET OIL HOSE AND TUBE ASSEMBLY (LP03)
FLANGE
PACKING
BOLT (5 LOCATIONS)
AIR COOLER INLET OIL TUBE (LP02)
VIEW C
L−A2241 (0700)

Air/Oil Heat Exchanger And Valve (Engine)
Figure 401 (Sheet 4)
(Task 72−00−34−450−006)

Task 72-00-34-450-007:

1. Install Valve To Air/Oil Heat Exchanger (Engine)

A. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 102285	Adapter, Torque

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
R	P05-292	Ferrule, Safety Cable (Optional)
R	P06-053	Lubricant, Sealing Ring (PWA 36500)
	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	79-21-00/3/30
Packing	2	79-21-00/3/50

Lockwire, AS3214-02

B. Procedure
See Figure 401, Figure 402 and Figure 403.

NOTE: Items referred to in parenthesis in the text are identified in the figures.

CAUTION: DO NOT HANDLE THE HEAT EXCHANGER VALVE AND/OR HEAT EXCHANGER BY THE INLET COLLARS. THE INLET COLLARS ARE NOT INTEGRAL PARTS OF THE VALVE HOUSING.

(1) Place the air/oil heat exchanger valve on the bench with the two four hole ducts downward and the three end ports facing the operator.

(2) Place the air/oil heat exchanger on the valve with three hole flange toward the operator.

(3) Secure the heat exchanger to the valve with bolts, threads lubricated with Engine Oil P03-001, washers (under the bolt heads and nuts, omit the four washers at (Post SB PW4ENG 79-44) and (Post SB PW4ENG 79-50) bracket locations) and nuts. Torque the nuts to 36 - 40 lb-in. (4.067 - 4.591 N.m).

(4) (Post SB PW4ENG 79-44) Install a clamp on the wiring harness and secure to the bracket with bolt, threads lubricated with Engine Oil P03-001. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(5) If a new valve was installed, comply with the following:

(a) Install a packing, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 on the smaller adapter. Lubricate the adapter threads with Engine Oil P03-001 and install it to the smaller port in the valve. Torque the adapter to 65 - 75 lb-in. (7.344 - 8.474 N.m).

(b) Install the packings, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 on the two larger adapters. Lubricate the adapter threads with Engine Oil P03-001 and install the adapters in the two remaining ports. Torque the adapters to 110 - 120 lb-in. (12.428 - 13.558 N.m).

(c) Install the air shut off valve drain tube (CR09) as follows.

1 (Pre SB PW4ENG 79-49) Lubricate the threads of the smaller adapter with Antiseize Paste P06-054, and attach the tube to the adapter and to the hole in the tube flange on the heat exchanger. Wipe off unwanted paste. Secure the coupling on the tube to the heat exchanger with a jamnut, threads lubricated with Engine Oil P03-001. Torque the jamnut to 70 - 80 lb-in. (7.909 - 9.039 N.m).

2 (Post SB PW4ENG 79-49), (Pre SB PW4ENG 79-50) Lubricate the threads of the smaller adapter with Antiseize Paste P06-054, and attach the tube to the adapter and to the hole in tube flange on the heat exchanger with a plate between flats on the tube and the flange. Wipe

off unwanted paste. Lubricate the threads on the coupling end of the tube with Engine Oil P03-001 and secure it with a washer and a jamnut. Torque the jamnut to 70 - 80 lb-in. (7.909 - 9.039 N.m).

3 (Post SB PW4ENG 79-50) Lubricate the threads of the smaller adapter with Antiseize Paste P06-054, and attach the tube to the adapter and to the exchanger with two bolts, threads lubricated with Engine Oil P03-001. Wipe off unwanted paste. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

4 Torque tube nut to 90 - 100 lb-in. (10.169 - 11.298 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 the tube nut and if equipped bolts or jamnut.

(d) Install the air/oil cooler valve return tube (CR08) and the air/oil cooler valve hydraulic tube (CP08) as follows.

1 (Pre SB PW4ENG 79-49) Lubricate the threads on the remaining adapters with Antiseize Paste P06-054. Wipe off unwanted paste. Attach the tubes to the remaining adapters, with the couplings on the tubes through the tube flange on the heat exchanger. Lubricate the threads on the couplings with Engine Oil P03-001 and secure them with the jamnuts. Torque the jamnuts to 70 - 80 lb-in. (7.909 - 9.039 N.m).

2 (Post SB PW4ENG 79-49), (Pre SB PW4ENG 79-50) Lubricate the threads on the remaining adapters with Antiseize Paste P06-054. Wipe off unwanted paste. Attach the tubes to the remaining adapters, with the couplings on the tubes through the plate and the tube flange on the heat exchanger. Lubricate the threads on the couplings with Engine Oil P03-001 and secure to the tubes with washers and the jamnuts. Torque the jamnuts to 70 - 80 lb-in. (7.909 - 9.039 N.m).

3 (Post SB PW4ENG 79−50) Lubricate the threads on the remaining adapters with Antiseize Paste P06−054. Wipe off unwanted paste. Attach the tubes to the remaining adapters and to the exchanger with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

4 Torque the tube nuts to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 the tube nuts and if equipped bolts or jamnuts.

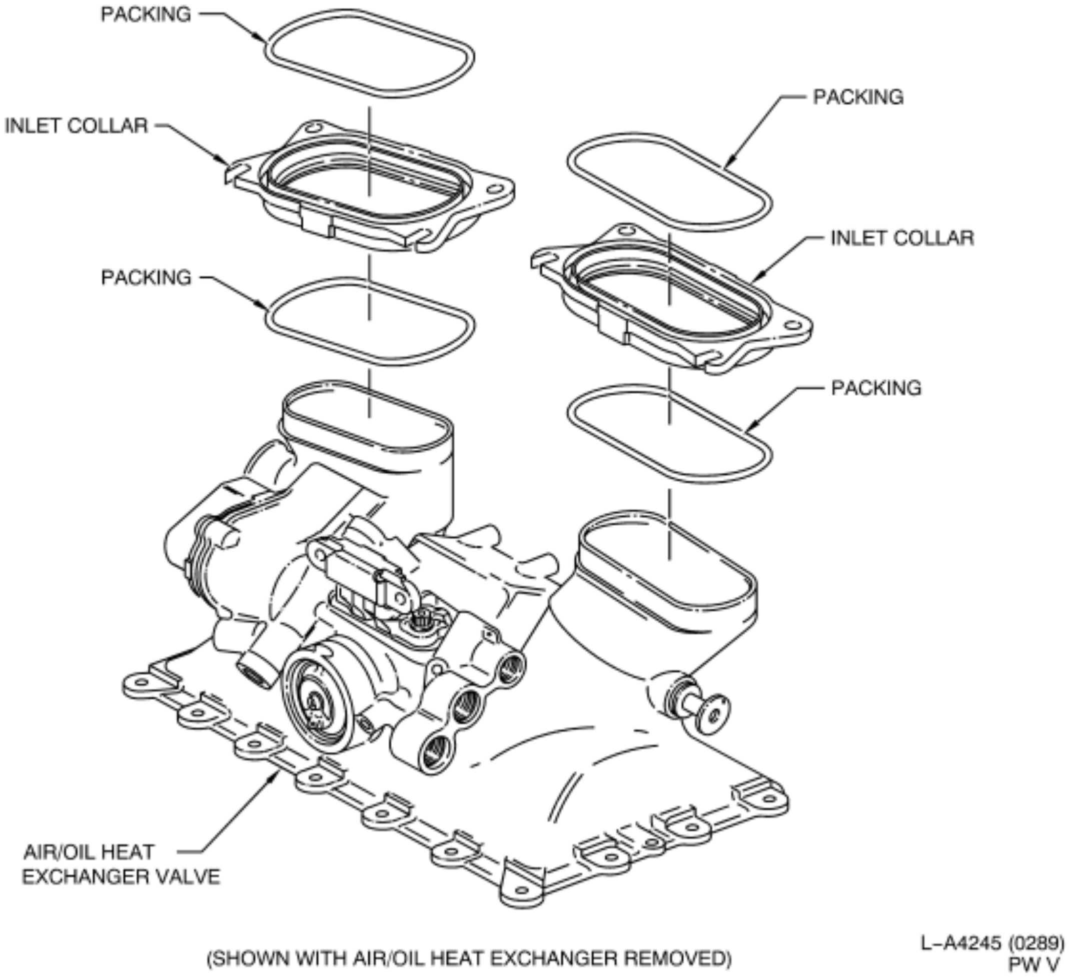
(e) Install the clamps, bolt(s), threads lubricated with Engine Oil P03−001, and nut(s) which secure the tubes (CP08) and (CR08). Torque the bolt(s) to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(6) If a new heat exchanger was installed, comply with the following:

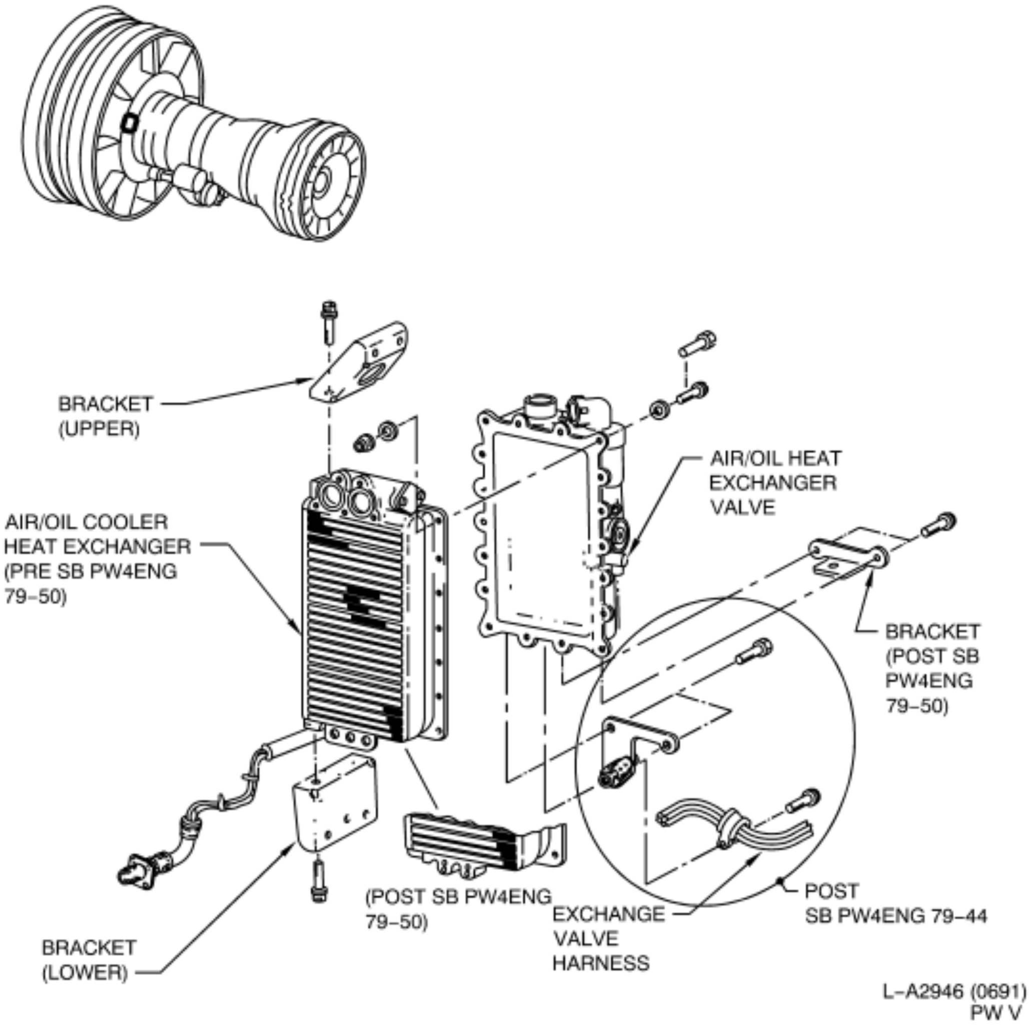
(a) Install the upper and lower mount brackets on the heat exchanger. Secure the brackets with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts with PWA 102285 Torque Adapter to 85 − 95 lb−in. (9.604 − 10.734 N.m).

C. Postrequisites

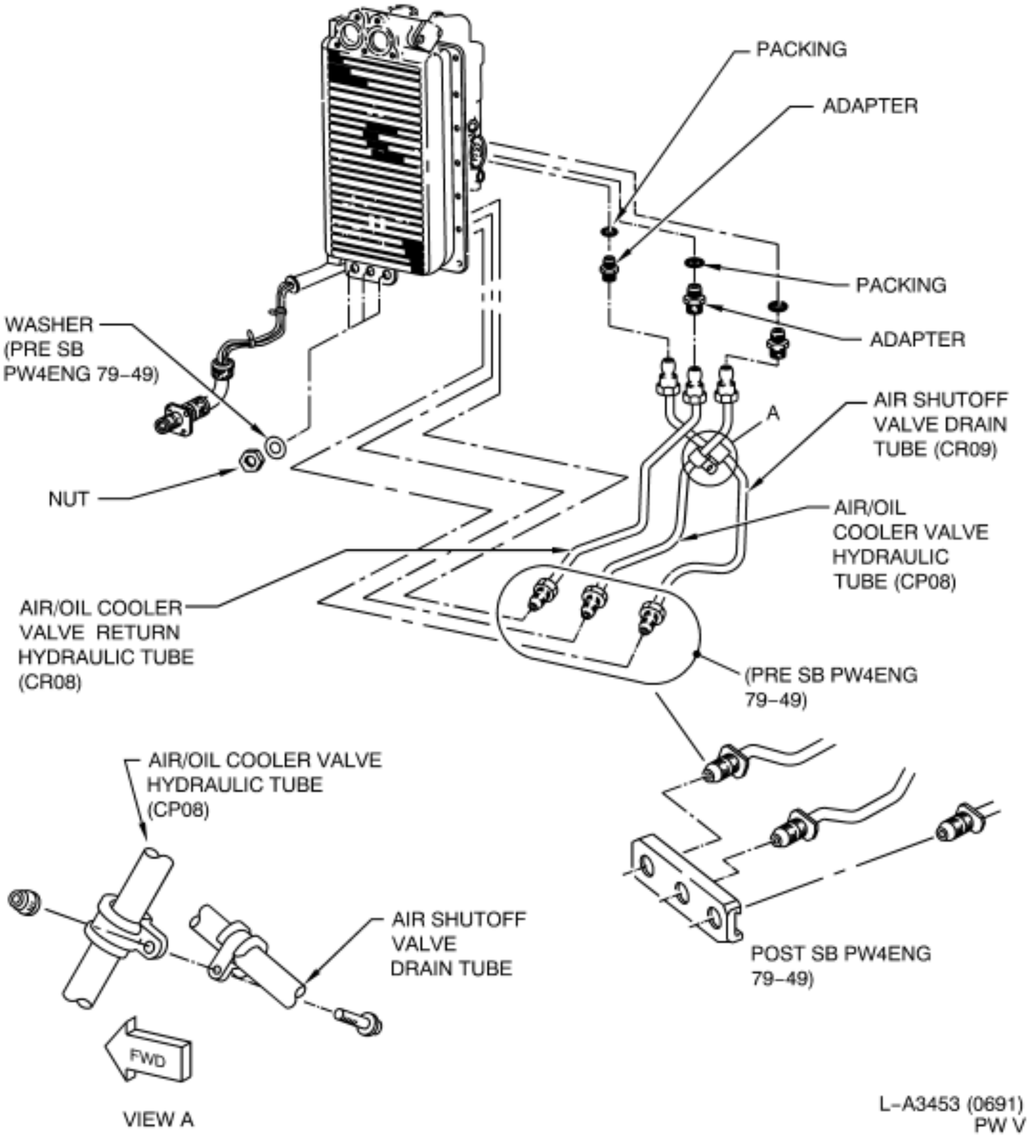
(1) Install Air/Oil Heat Exchanger And Valve (Engine) to engine per Removal/Installation−10 Task 72−00−34−450−006.


PACKING
INLET COLLAR
PACKING
PACKING
INLET COLLAR
PACKING
AIR/OIL HEAT EXCHANGER VALVE
(SHOWN WITH AIR/OIL HEAT EXCHANGER REMOVED)
L-A4245 (0289)
PW V

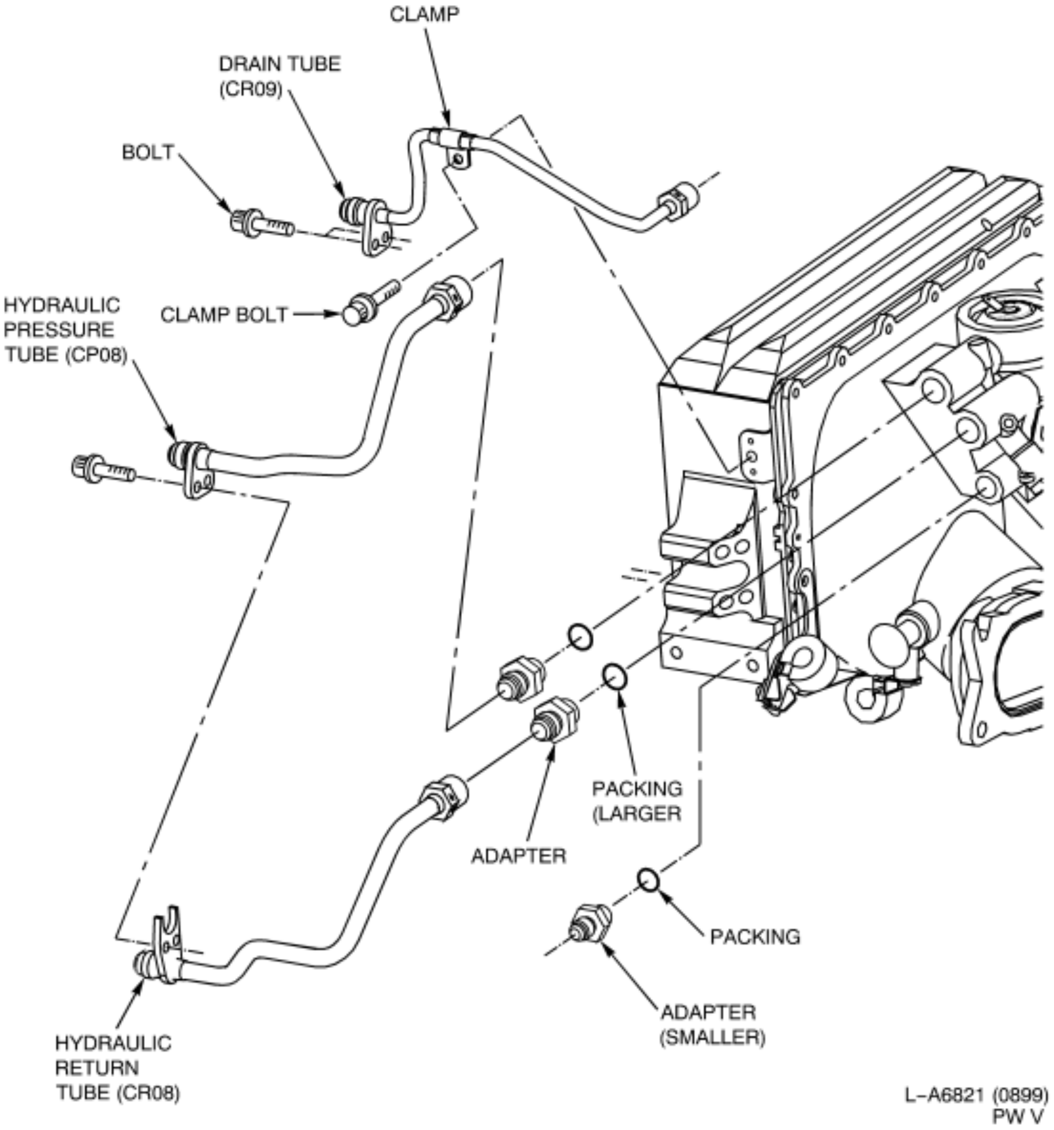
Air/Oil Heat Exchanger Valve Inlet Collars
Figure 401
(Task 72-00-34-450-007)


BRACKET (UPPER)
AIR/OIL COOLER HEAT EXCHANGER (PRE SB PW4ENG 79-50)
AIR/OIL HEAT EXCHANGER VALVE
BRACKET (POST SB PW4ENG 79-50)
(POST SB PW4ENG 79-50)
EXCHANGE VALVE HARNESS
POST SB PW4ENG 79-44
BRACKET (LOWER)
L-A2946 (0691)
PW V

Air/Oil Heat Exchanger And Valve (Engine)
Figure 402
(Task 72-00-34-450-007)


PACKING
ADAPTER
PACKING
ADAPTER
WASHER (PRE SB PW4ENG 79−49)
NUT
AIR SHUTOFF VALVE DRAIN TUBE (CR09)
A
AIR/OIL COOLER VALVE HYDRAULIC TUBE (CP08)
AIR/OIL COOLER VALVE RETURN HYDRAULIC TUBE (CR08)
(PRE SB PW4ENG 79−49)
AIR/OIL COOLER VALVE HYDRAULIC TUBE (CP08)
AIR SHUTOFF VALVE DRAIN TUBE
POST SB PW4ENG 79−49)
FWD
VIEW A
L−A3453 (0691)
PW V

Air/Oil Heat Exchanger And Valve (Engine) (Pre SB PW4ENG 79−50)
Figure 403 (Sheet 1)
(Task 72−00−34−450−007)


CLAMP
DRAIN TUBE (CR09)
BOLT
HYDRAULIC PRESSURE TUBE (CP08)
CLAMP BOLT
PACKING (LARGER
ADAPTER
PACKING
ADAPTER (SMALLER)
HYDRAULIC RETURN TUBE (CR08)
L−A6821 (0899)
PW V

Air/Oil Heat Exchanger And Valve (Engine) (Post SB PW4ENG 79−50)
Figure 403 (Sheet 2)
(Task 72−00−34−450−007)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-34-450-008:

1. Install HPC Secondary Flow Control Valve, IDGS Air/Oil Heat Exchanger Valve Override Solenoid

A. Equipment And Materials Required

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
R P06-054	Paste, Antiseize (PWA 36246)
P11-014	Alcohol, Isopropyl (PMC 9094)

B. Procedure
See Figure 401.

(1) If new solenoid must be installed, do the following:

(a) Remove the protective closures from all openings on the solenoid.

(b) Install two adapters, threads lubricated with Engine Oil P03-001, and two gaskets to two ports on top of solenoid. Torque adapters to 65 - 75 lb-in. (7.344 - 8.747 N.m).

(c) Install cap, threads lubricated with Engine Oil P03-001, to right adapter. Torque cap to 90 - 100 lb-in. (10.169 - 11.298 N.m).

(d) Install two adapters, threads lubricated with Engine Oil P03-001, and two gaskets, larger adapter to center port and smaller adapter to right port, on rear of solenoid. Torque larger adapter to 150 - 170 lb-in. (16.948 - 19.207 N.m). Torque smaller adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m).

(e) Install plug, threads lubricated with Engine Oil P03−001, to left port on rear of solenoid. Torque plug to 110 − 120 lb−in. (12.428 − 13.558 N.m).

(2) FOR THESE MODELS: 4152, 4156A, 4158
Install the solenoid to the intermediate case, at approximately the 1 o'clock position, with two adapters and one plug rearward. Install the switch and bracket assembly to the solenoid and attach with four bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(3) Connect the bleed valve supply tube (AA25) to the solenoid as follows:

(a) Lubricate the threads of the center rear adapter
R with Antiseize Paste P06−054. Wipe off unwanted
R paste.

(b) Install the supply tube nut to the center adapter on the rear of the solenoid.

(c) Torque the tube nut to 225 − 250 lb−in. (25.422 − 28.246 N.m).

(4) Connect the HPC drum air valve signal tube (AA01) to the solenoid as follows:

(a) Lubricate the lower rear adapter on the solenoid with PWA 36246 Antiseize Paste by SPOP 169. (Task 70−41−03−380−049). Refer to section 70−41−03 in the Standard Practices Manual, PN 585005.

(b) Remove excess lubricant.

(c) Install the air solenoid signal tube nut to the adapter.

(d) (Reference 2171) Torque the tube nut to 170 − 180 lb−in. (19.207 − 20.337 N.m).

(e) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the tubes (AA01), (AA25), and plug.

(5) Install pressure switch tube assembly (AA32) as follows.

(a) Lubricate threads at elbow end of tube with Engine Oil P03−001 and threads at straight end of tube
R with Antiseize Paste P06−054. Wipe off unwanted
R paste. Install tube.

(b) Torque elbow end to solenoid adapter to 90 − 100 lb−in. (10.169 − 11.298 N.m). Torque straight end to pressure switch to 65 − 75 lb−in (7.344 − 8.474 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to both ends of the tube and cap.

(6) Connect the W1P10 and the W1P11 harness connectors to the solenoid harness receptacles as follows. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Isopropyl Alcohol P11−014 and let air dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal). This procedure

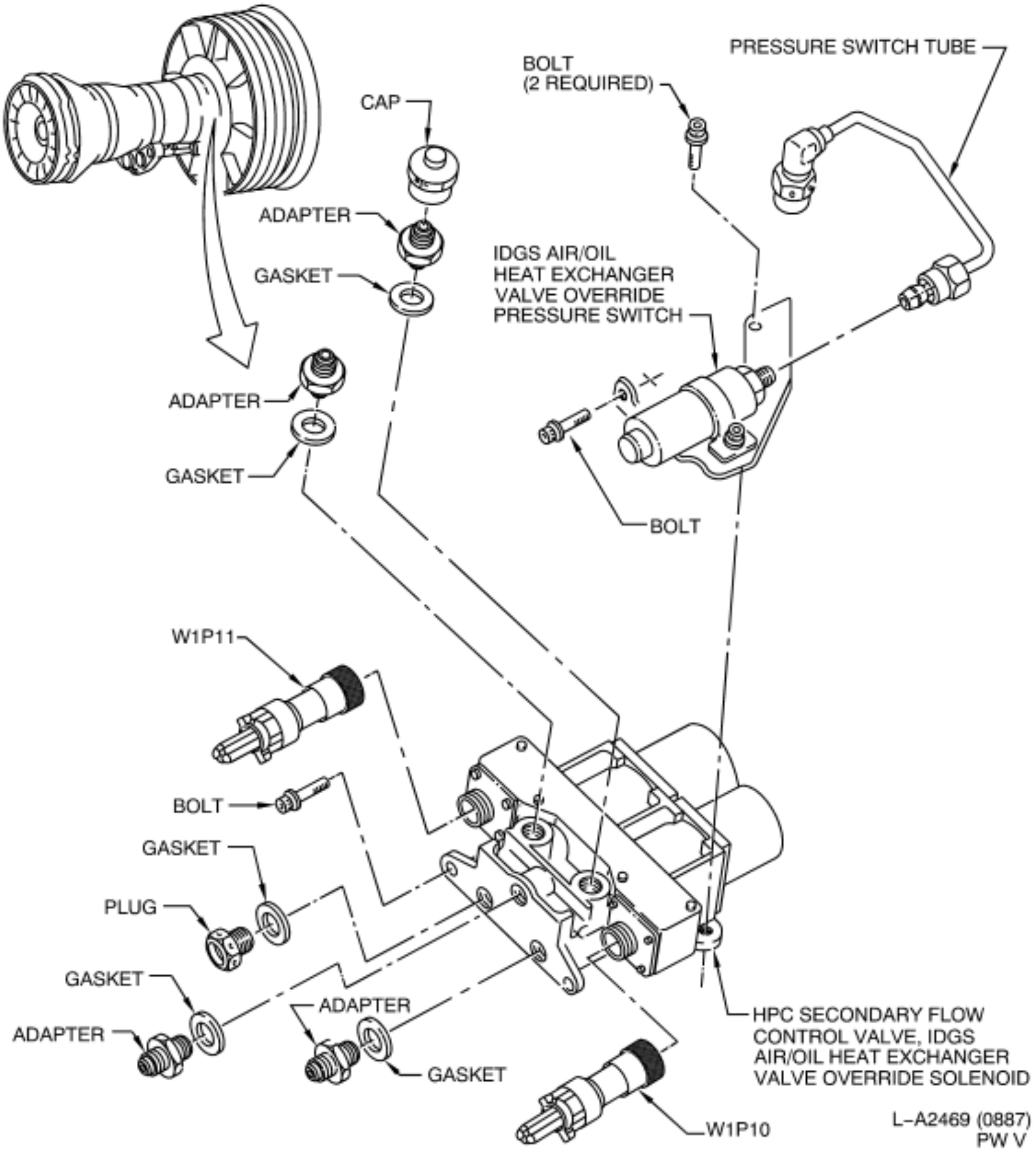
will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

C. Postrequisites

(1) Install the fan exit liner segment (inner rear) that is at the 1 o'clock position. Refer to 72−00−33, Installation−16 (Task 72−00−33−440−001).


PRESSURE SWITCH TUBE
BOLT
(2 REQUIRED)
CAP
ADAPTER
GASKET
IDGS AIR/OIL
HEAT EXCHANGER
VALVE OVERRIDE
PRESSURE SWITCH
ADAPTER
GASKET
BOLT
W1P11
BOLT
GASKET
PLUG
GASKET
ADAPTER
ADAPTER
GASKET
HPC SECONDARY FLOW
CONTROL VALVE, IDGS
AIR/OIL HEAT EXCHANGER
VALVE OVERRIDE SOLENOID
W1P10
L-A2469 (0887)
PW V

HPC Secondary Flow Control Valve, IDGS Air/Oil
Heat Exchanger Valve Override Solenoid
Figure 401
(Task 72-00-34-450-008)

Task 72-00-34-450-009:

1. Install Start/Stability Bleed Valve Solenoid

A. Equipment And Materials Necessary

Standard Tools:
Glenair TG-70 Strap Wrench Or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 Or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
R P06-054	Paste, Antiseize (PWA 36246)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

B. Procedure
See Figure 401.

CAUTION: BE SURE AND USE THE CORRECT PART NUMBER SOLENOID FOR REPLACEMENT. INTERCHANGEABILITY WITH THE W4 WIRING HARNESS CONNECTOR IS EFFECTED. REFER TO SB PW4ENG 73-70 FOR SELECTION.

(1) If new solenoid is being installed comply with the following:

(a) Place valve on bench with two threaded ports up facing operation and solenoids to the right.

(b) Remove protective closures from all openings on solenoid.

(c) Install two adapters, threads lubricated with Engine Oil P03-001, and two gaskets to two ports on top of solenoid. Torque adapters to 65 - 75 lb-in. (7.344 - 8.474 N.m).

(d) Install cap, threads lubricated with Engine Oil P03-001, to adapter furthest from operator. Torque cap to 90 - 100 lb-in. (10.169 - 11.298 N.m).

(e) Install two adapter, threads lubricated with Engine Oil P03−001, larger adapter in center port and smaller adapter to furthest port, and gaskets. Torque larger adapter to 150 − 170 lb−in. (16.948 − 19.207 N.m). Torque smaller adapter to 110 − 120 lb−in. (12.428 − 13.558 N.m).

(f) Install plug, threads lubricated with Engine Oil P03−001, and gasket to remaining rear port. Torque plug to 110 − 120 lb−in. (12.428 − 13.558 N.m).

(2) Install the bleed valve bracket assembly to the intermediate case at approximately the 5 o'clock position. Install four bolts, threads lubricated with Engine Oil P03−001, through the bracket and into the intermediate case. Tighten and torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(3) Position solenoid to bracket on intermediate case at approximately 5 o'clock position, with electrical connectors facing rearward. Secure with four bolts, threads lubricated with Engine Oil P03−001, and bracket (Post SB PW4ENG 75−41 only). Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

NOTE: For (Post SB PW4ENG 75−41) engines, align the bracket boltholes per Figure 401 (Sheet 1). Loosen and torque the bolts again if necessary.

(4) Lubricate threads of solenoid rear center adapter with
R Antiseize Paste P06−054. Wipe off unwanted paste. Install (AA27) bleed valve supply tube assembly to adapter. Torque tube nut to 225 − 250 lb−in. (25.422 − 28.246 N.m).

(5) Lubricate threads of remaining solenoid rear adapter
R with Antiseize Paste P06−054. Wipe off unwanted paste. Install (AA26) bleed valve signal tube assembly to adapter. Torque tube nut to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the two rear tubes and plug.

(6) Install the (AA35), (AA36), and (AA37) bleed valve supply tubes as follows.

(a) Lubricate the elbow threads of the (AA35) tube with Engine Oil P03−001. Lubricate the remaining (AA35), (AA36), and (AA37) tube nut threads with Antiseize Paste P06−054. Wipe off unwanted paste. R

(b) Install the (AA35), (AA36), and (AA37) tubes per figure and tighten by hand.

(c) Install the clamp arrangements per figure with the bolts lubricated with Engine Oil P03−001. Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Torque the elbow end of the (AA35) tube to 90 − 100 lb−in. (10.169 − 11.298 N.m). Torque the opposite end of the (AA35) tube to 65 − 75 lb−in. (7.344 − 8.474 N.m).

(e) Torque the (AA36) tube at both ends to 200 − 225 lb−in. (22.597 − 25.422 N.m).

(f) Torque the (AA37) tube to the relay valve to 225 − 250 lb−in. (25.422 − 28.246 N.m). Torque the opposite end of the (AA37) tube to 200 − 225 lb−in. (22.597 − 25.422 N.m).

(g) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to all the tubes.

(7) Connect the W4P4 and the W5P11 harness connectors to the solenoid harness receptacles as follows. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

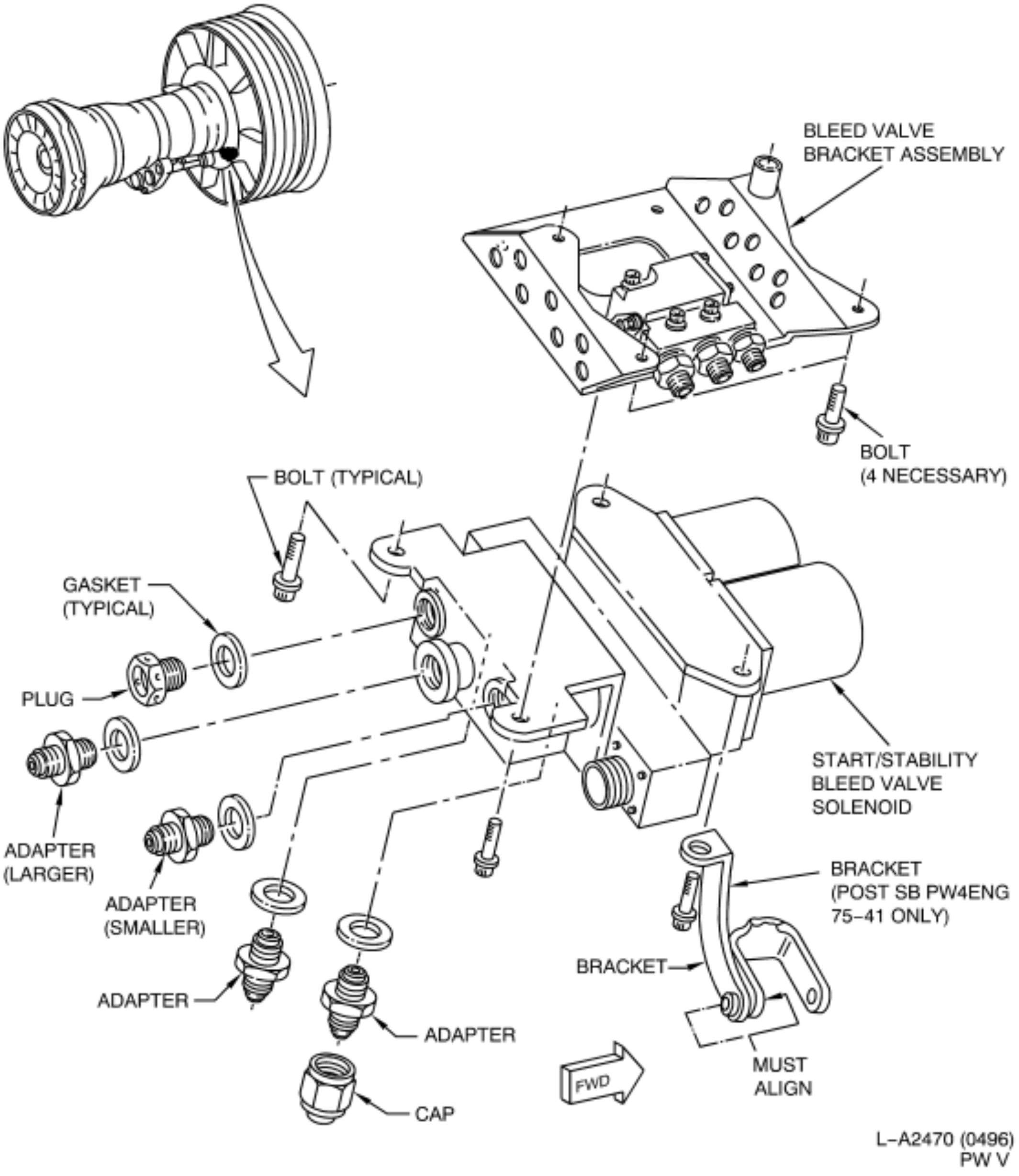
(c) Use the Glenair TG-70 strap wrench or the Glenair TG-69 soft-jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

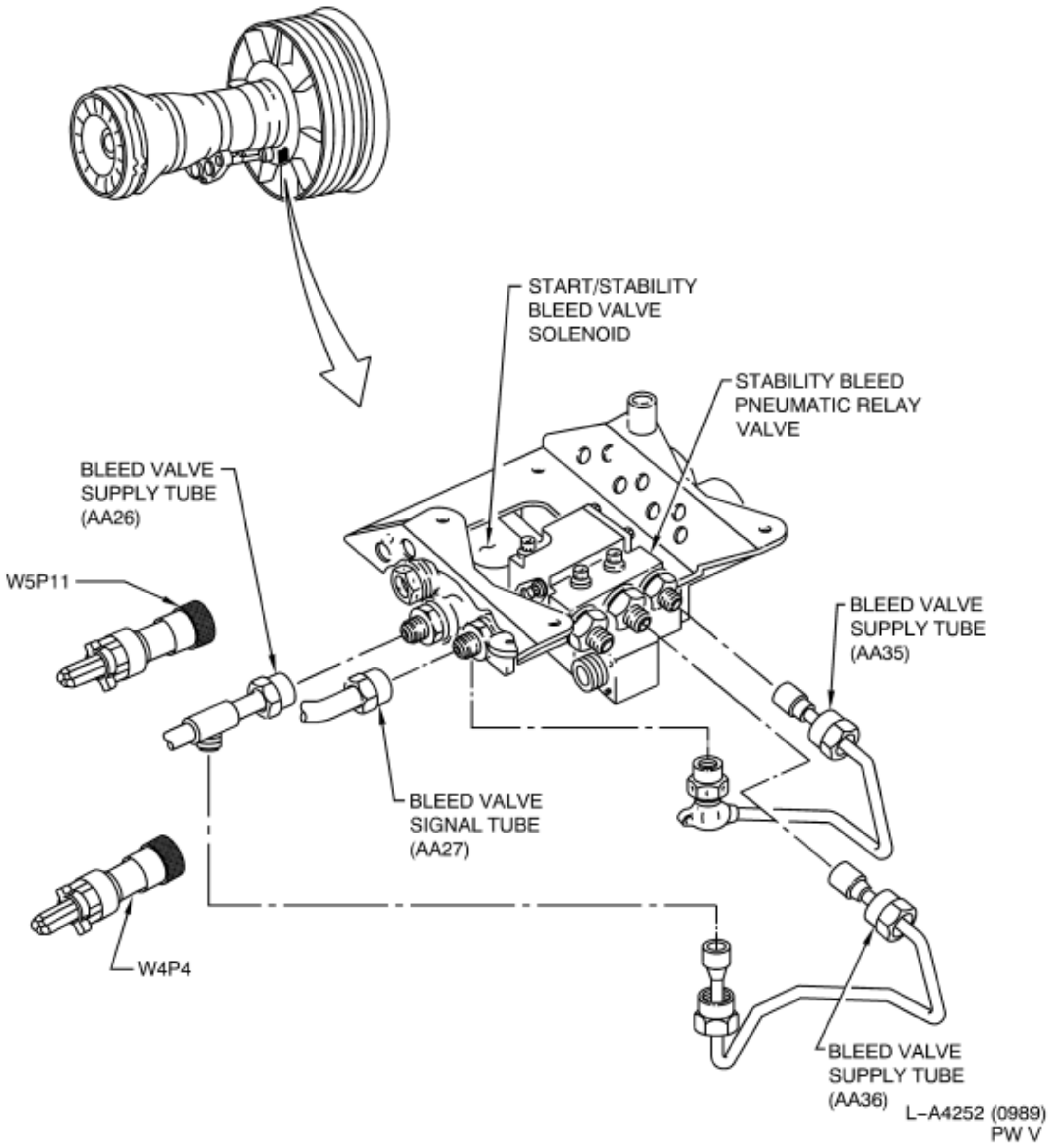
NOTE: See the instructions given with the strap wrench for correct use.

C. Postrequisites

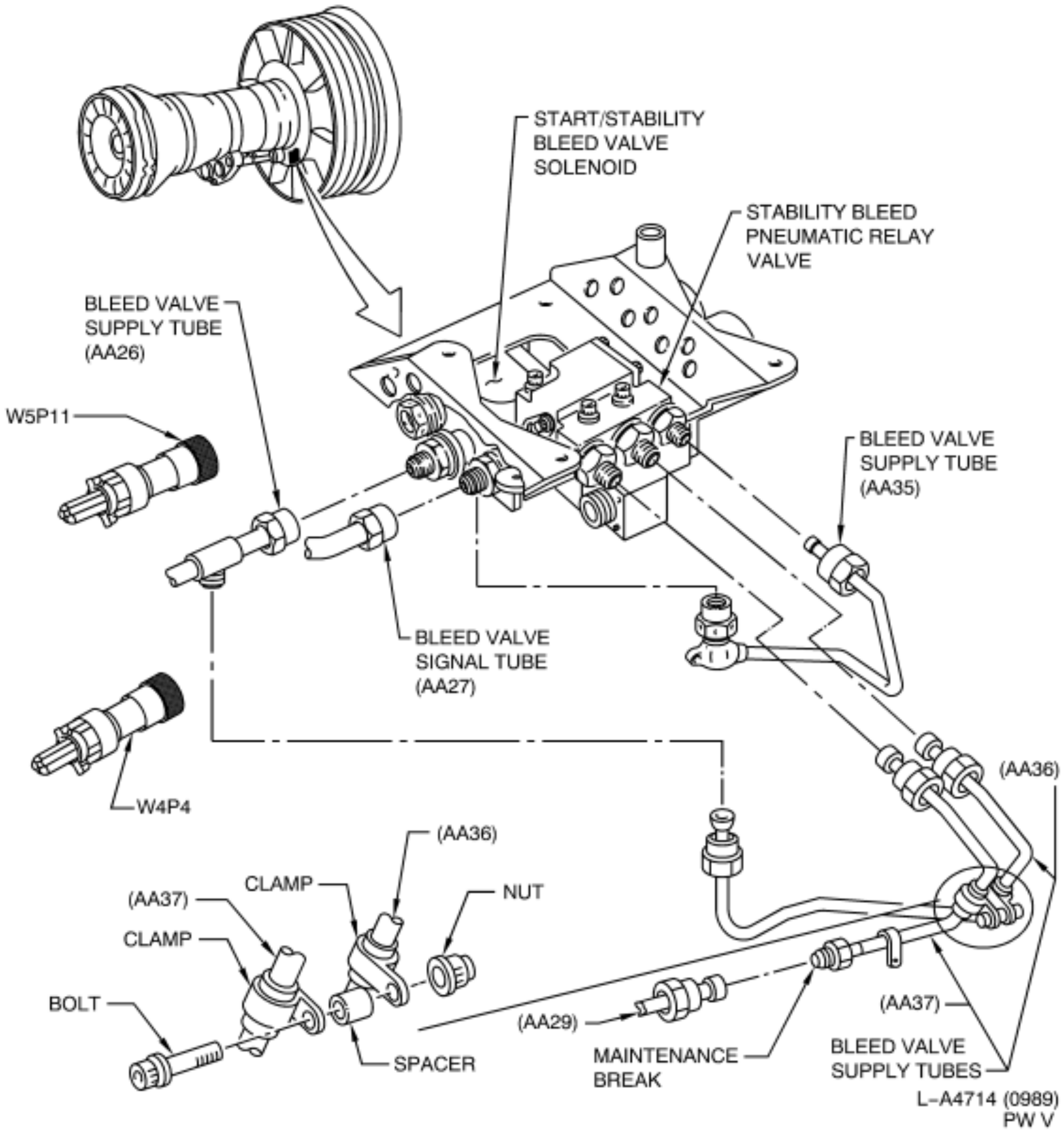
(1) Install the fan exit liner segment (inner rear) that is at 5 o'clock. Refer to 72-00-33, Installation-16 (Task 72-00-33-440-001).


BLEED VALVE
BRACKET ASSEMBLY
BOLT
(4 NECESSARY)
BOLT (TYPICAL)
GASKET
(TYPICAL)
PLUG
ADAPTER
(LARGER)
ADAPTER
(SMALLER)
START/STABILITY
BLEED VALVE
SOLENOID
BRACKET
(POST SB PW4ENG
75−41 ONLY)
BRACKET
ADAPTER
ADAPTER
CAP
FWD
MUST
ALIGN
L−A2470 (0496)
PW V

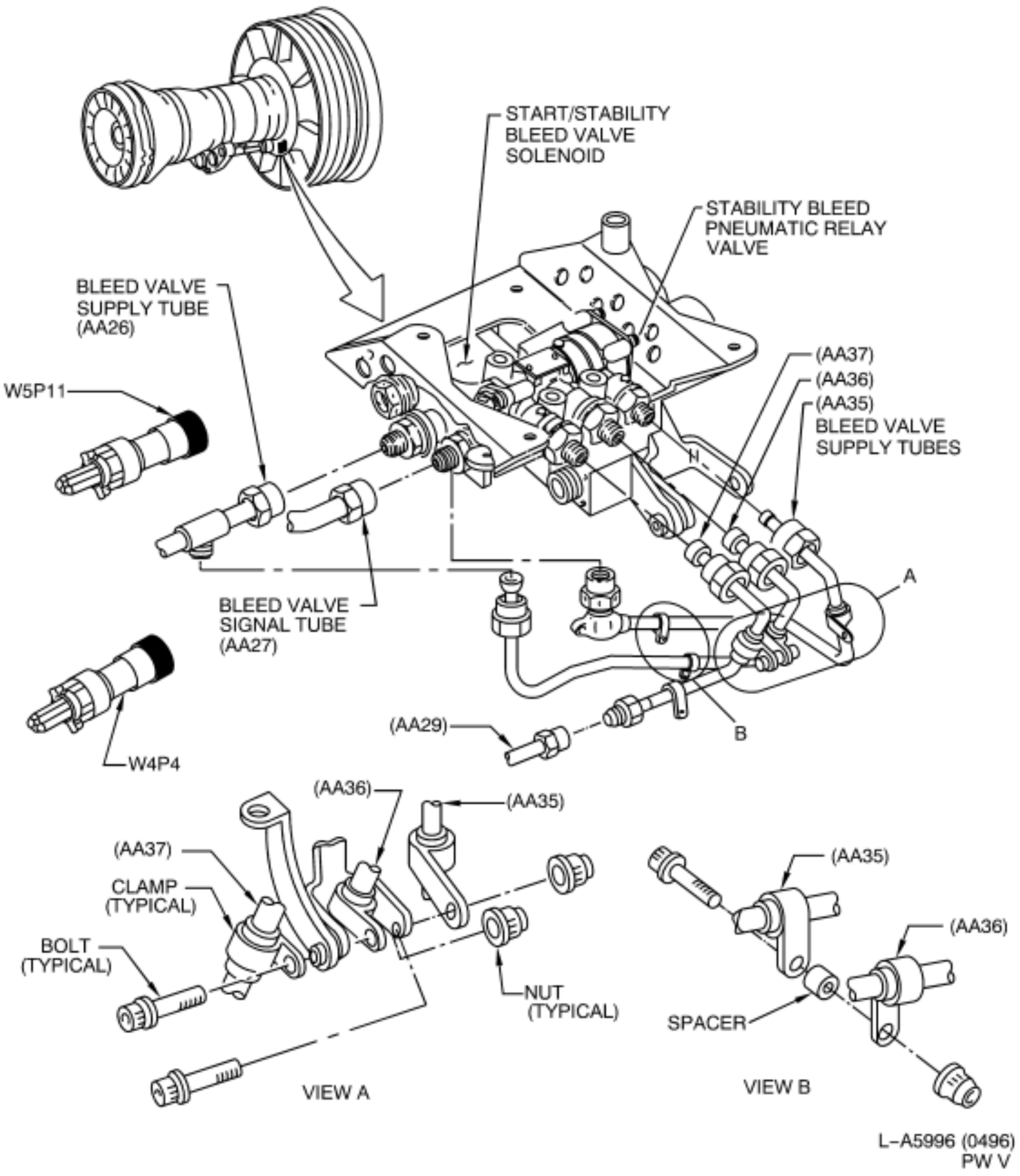
Start/Stability Bleed Valve Solenoid
Figure 401 (Sheet 1)
(Task 72−00−34−450−009)


START/STABILITY BLEED VALVE SOLENOID
STABILITY BLEED PNEUMATIC RELAY VALVE
BLEED VALVE SUPPLY TUBE (AA26)
W5P11
BLEED VALVE SUPPLY TUBE (AA35)
BLEED VALVE SIGNAL TUBE (AA27)
W4P4
BLEED VALVE SUPPLY TUBE (AA36)
L-A4252 (0989)
PW V

Start/Stability Bleed Valve Solenoid (Pre SB PW4ENG 75-28)
Figure 401 (Sheet 2)
(Task 72-00-34-450-009)


START/STABILITY
BLEED VALVE
SOLENOID
STABILITY BLEED
PNEUMATIC RELAY
VALVE
BLEED VALVE
SUPPLY TUBE
(AA26)
W5P11
BLEED VALVE
SUPPLY TUBE
(AA35)
BLEED VALVE
SIGNAL TUBE
(AA27)
W4P4
(AA36)
(AA36)
(AA37)
CLAMP
NUT
CLAMP
BOLT
SPACER
(AA29)
MAINTENANCE
BREAK
(AA37)
BLEED VALVE
SUPPLY TUBES
L-A4714 (0989)
PW V

Start/Stability Bleed Valve Solenoid (Post
SB PW4ENG 75-28) (Pre SB PW4ENG 75-41)
Figure 401 (Sheet 3)
(Task 72-00-34-450-009)


START/STABILITY
BLEED VALVE
SOLENOID
STABILITY BLEED
PNEUMATIC RELAY
VALVE
BLEED VALVE
SUPPLY TUBE
(AA26)
W5P11
(AA37)
(AA36)
(AA35)
BLEED VALVE
SUPPLY TUBES
A
BLEED VALVE
SIGNAL TUBE
(AA27)
W4P4
(AA29)
B
(AA36)
(AA35)
(AA37)
CLAMP
(TYPICAL)
BOLT
(TYPICAL)
NUT
(TYPICAL)
VIEW A
(AA35)
(AA36)
SPACER
VIEW B
L-A5996 (0496)
PW V

Start/Stability Bleed Valve Solenoid (Post SB PW4ENG 75-41)
Figure 401 (Sheet 4)
(Task 72-00-34-450-009)

Task 72-00-34-450-010:

1. Install HPC Secondary Flow Control Valve, Turbine Vane And Blade Cooling Air Valve Solenoid

A. Equipment And Materials Required

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
R	P06-054	Paste, Antiseize (PWA 36246)
	P11-014	Alcohol, Isopropyl (PMC 9094)

B. Procedure
See Figure 401.

(1) If a new solenoid must be installed, do the following:

(a) Remove the protective closures from all openings on the solenoid.

(b) Install two adapters, threads lubricated with Engine Oil P03-001, and gaskets to two ports on top of solenoid. Torque adapter to 65 - 75 lb-in. (7.344 - 8.474 N.m).

(c) Install two caps, threads lubricated with Engine Oil P03-001, to above adapters. Torque the caps to 90 - 100 lb-in. (10.169 - 11.298 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to the caps.

(d) Install three adapters, threads lubricated with Engine Oil P03-001, and gaskets, larger adapter in center, to rear ports of solenoid. Torque center larger adapter to 150 - 170 lb-in. (16.948 - 19.207 N.m). Torque two remaining adapters to 110 - 120 lb-in. (12.428 - 13.558 N.m).

(2) Install the solenoid to the intermediate case and under the bracket leg, at approximately the 10 o'clock position, with the three adapters rearward. Attach with four bolts, threads lubricated with Engine Oil P03−001, and torque to 85 − 95 lb−in. (9.604 − 10.734 N.m). If the clamp bolt on the bracket was loosened for removal of the solenoid, tighten and torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

R (3) Lubricate center rear adapter threads with Antiseize
R Paste P06−054 and install supply tube assembly. Wipe
R off unwanted paste. Torque tube nut to 225 − 250 lb−in. (25.422 − 28.246 N.m).

(4) Lubricate remaining two rear adapter threads with Engine Oil P03−001 and install signal tube assemblies. Torque tube nuts to 270 − 300 lb−in. (30.506 − 33.895 N.m).

(5) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to all the tubes.

(6) FOR THESE MODELS: 4152, 4156A, 4158
Connect the W3P12 harness connector to the solenoid harness receptacle as follows.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Isopropyl Alcohol P11−014 and let air dry.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: FOR THESE MODELS: 4152, 4156A, 4158
USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

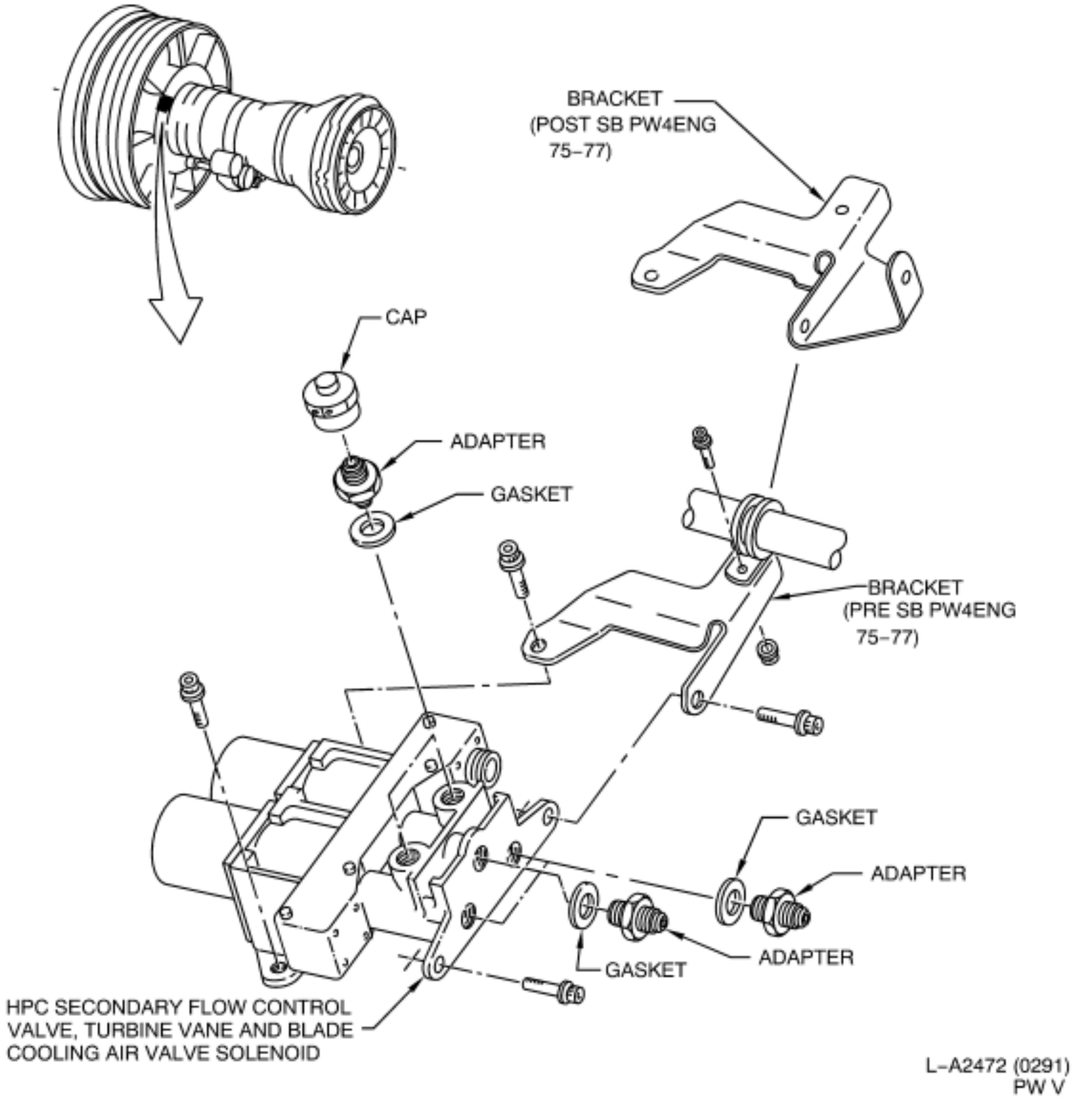
(c) FOR THESE MODELS: 4152, 4156A, 4158
Use the Glenair TG-70 strap wrench or the Glenair TG-69 soft-jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal). This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
See the instructions given with the strap wrench for correct use.

C. Postrequisites

(1) Install the fan exit liner segment (inner rear) that is at the 10 o'clock position. Refer to 72-00-33, Installation-16 Task 72-00-33-440-001.


BRACKET
(POST SB PW4ENG
75−77)
CAP
ADAPTER
GASKET
BRACKET
(PRE SB PW4ENG
75−77)
GASKET
ADAPTER
ADAPTER
GASKET
HPC SECONDARY FLOW CONTROL
VALVE, TURBINE VANE AND BLADE
COOLING AIR VALVE SOLENOID
L−A2472 (0291)
PW V

HPC Secondary Flow Control Valve, Turbine
Vane And Blade Cooling Air Valve Solenoid
Figure 401
(Task 72−00−34−450−010)

ENGINE GENERAL - INTERMEDIATE CASE - INSTALLATION-15

Task 72-00-34-450-011:

1. Install IDGS Air/Oil Heat Exchanger Valve Override Pressure Switch

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
R P06-054	Paste, Antiseize (PWA 36246)

B. Procedure
See Figure 401 or Figure 402.

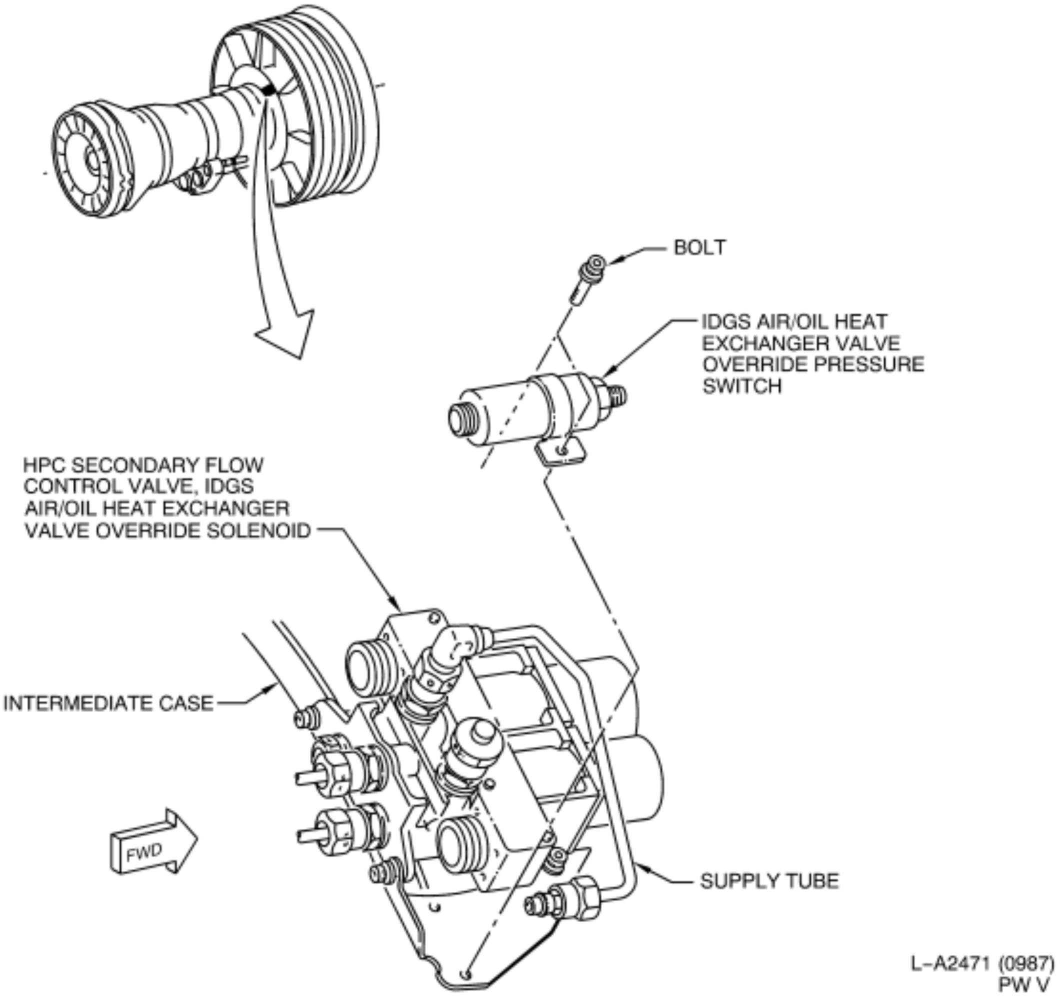
(1) Remove the protective closures.

(2) Install the override pressure switch to the bracket, at approximately the 1 o'clock position on the intermediate case, with the electrical connector rearward. Attach the override pressure switch to the bracket with two bolts, threads lubricated with Engine Oil P03-001. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

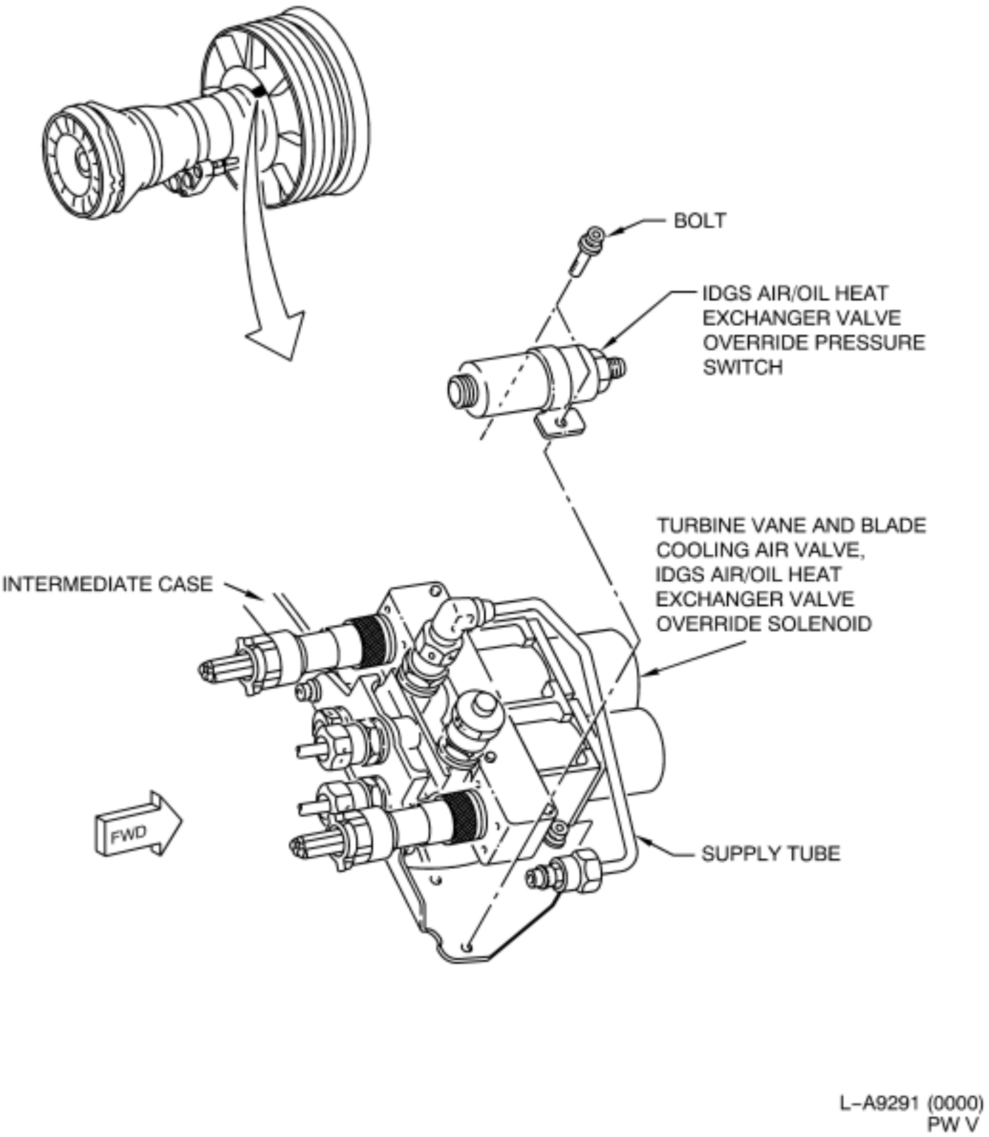
R (3) Lubricate the adapter threads with Antiseize Paste
R P06-054 and install the tube nut. Remove unwanted
R paste. Torque the tube nut to 65 - 75 lb-in. (7.344 - 8.474 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to the tube nut.

C. Postrequisite

(1) Install the fan exit liner segment (inner rear) that is at approximately the 1 o,clock position. Refer to 72-00-33, Installation-16 Task 72-00-33-440-001.


BOLT
IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE PRESSURE SWITCH
HPC SECONDARY FLOW CONTROL VALVE, IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE SOLENOID
INTERMEDIATE CASE
FWD
SUPPLY TUBE
L−A2471 (0987)
PW V

IDGS Air/Oil Heat Exchanger Valve Override Pressure Switch
Figure 401
(Task 72−00−34−450−011)


BOLT
IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE PRESSURE SWITCH
TURBINE VANE AND BLADE COOLING AIR VALVE, IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE SOLENOID
INTERMEDIATE CASE
FWD
SUPPLY TUBE
L−A9291 (0000)
PW V

IDGS Air/Oil Heat Exchanger Valve Override Pressure Switch
Figure 402
(Task 72−00−34−450−011)

Task 72-00-34-450-012:

1. Install The Stability Bleed Pneumatic Relay Valve

A. Equipment And Materials Required

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
R	P06-054	Paste, Antiseize (PWA 36246)

B. Procedure

See Figure 401.

(1) If a new replacement relay valve is being installed, do as follows.

(a) Remove the protection covers from the valve.

(b) Install the three adapters, lubricated with Engine Oil P03-001, and gaskets to the ports on the valve.

(c) Torque the largest adapter to 150 - 170 lb-in. (16.948) - 19.207 N.m). Torque the middle adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m). Torque the smallest adapter to 65 - 75 lb-in. (7.344 - 8.474 N.m).

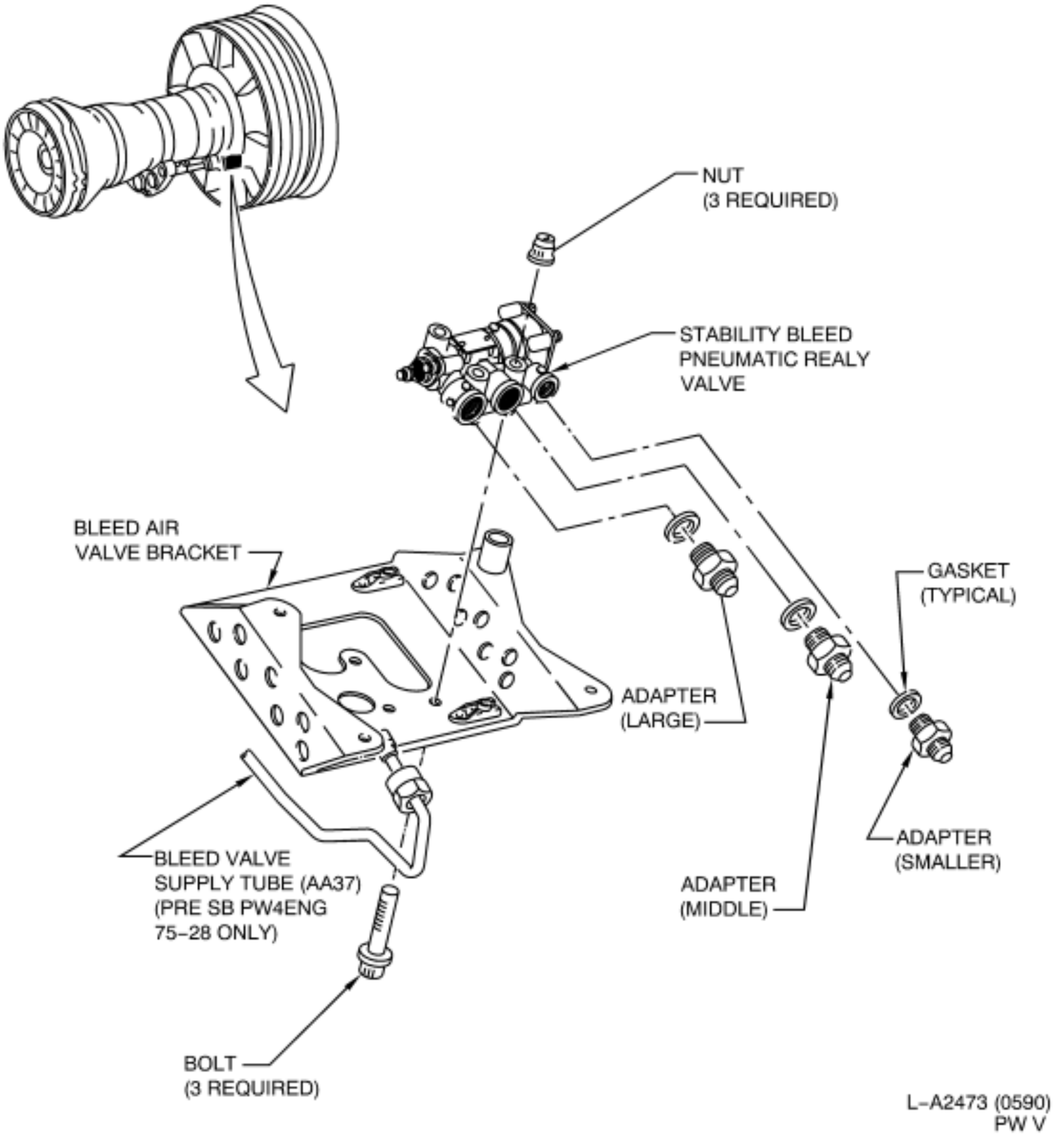
(2) Position the relay valve to the bracket. Attach the valve with three bolts, lubricated with Engine Oil P03-001, and nuts. Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(3) For engines without the bleed valve supply tube maintenance break (Pre SB PW4ENG 75-28), install the bleed valve supply tube to the largest adapter,
R lubricated with Antiseize Paste P06-054. Wipe off
R unwanted paste. Torque the tube nut to 225 - 250 lb-in. (25.422 - 28.246 N.m).

NOTE: Install the lockwire when you install the start/stability bleed valve solenoid.

C. Postrequisites

(1) Install the start/stability bleed valve solenoid. See Installation-13 Task 72-00-34-450-009.


NUT
(3 REQUIRED)
STABILITY BLEED
PNEUMATIC REALY
VALVE
BLEED AIR
VALVE BRACKET
GASKET
(TYPICAL)
ADAPTER
(LARGE)
ADAPTER
(SMALLER)
ADAPTER
(MIDDLE)
BLEED VALVE
SUPPLY TUBE (AA37)
(PRE SB PW4ENG
75-28 ONLY)
BOLT
(3 REQUIRED)
L-A2473 (0590)
PW V

Stability Bleed Pneumatic Relay Valve
Figure 401
(Task 72-00-34-450-012)

R
R

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INTERMEDIATE CASE - INSTALLATION-17

Task 72-00-34-450-013:

1. Install EEC Speed Transducer (N1) Multiplexer Input Probe

A. Equipment And Materials Required

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P05-395	Beeswax
P05-396	Paraffin Wax Blend
P06-002	Petrolatum White (PMC 9609)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	4	73-23-00/1/30
Packing	2	73-23-00/1/1
Packing	1	73-23-00/1/10

B. Procedure
See Figure 401.

(1) Remove protective closures.

(2) Examine and adjust, if necessary, the gap between the end of the transducer and the rotor as follows.

(a) Apply Beeswax P05-395 or Paraffin Wax Blend P05-396, approximately 0.070 inch (1.778 mm) thick, to the flat surface on the small end of the transducer probe.

(b) Install a Class 1 shim on the lower shoulder of the transducer end.

NOTE: Do not install the three packings on the transducer at this time.

CAUTION: INSTALL THE TRANSDUCER WITH THE LARGER ELECTRICAL CONNECTOR REARWARD. DO NOT TURN THE TRANSDUCER DURING INSTALLATION OR DAMAGE TO THE TRANSDUCER OR ENGINE CAN RESULT.

(c) Temporarily install the spring−loaded speed transducer probe into the opening in the intermediate case at approximately 5 o'clock position with the larger electrical connector rearward.

(d) Lubricate the bolts and nut (if equipped with the locating stud, Post SB PW4ENG 73−88) with Engine Oil P03−001. Temporarily install the washers, bolts, and nut (if equipped). Tighten evenly and engage the transducer to the case completely. Torque the bolts and nut (if equipped) to 85 lb−in. (9.604 N.m). Be sure you engage the transducer to the case completely.

(e) Slowly turn the fan rotor approximately 15 degrees counterclockwise as viewed from the front of the engine.

(f) Loosen the bolts and nut (if equipped) and remove the transducer probe from the engine.

(g) (Reference 775) Carefully cut a section of wax away from the end of the transducer and measure the thickness of wax remaining in the area of deepest impression. If the result is between 0.020 − 0.050 inch (0.508 − 1.270 mm), the proper shim is installed.

(h) If the result is smaller than 0.020 inch (0.508 mm), replace the Class 1 shim with a Class 2 shim.

(i) If the result is greater than 0.050 inch (1.270 mm), remove the Class 1 shim.

(j) Remove all wax from the end of the transducer probe.

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−17

(3) Install two new packings, lubricated with Engine Oil P03−001, to the grooves in the shaft of the transducer. Install one new packing, lubricated with White Petrolatum P06−002, to the groove in the transducer flange. Be sure the correct shim (if required) is installed on the transducer.

CAUTION: INSTALL THE TRANSDUCER WITH THE LARGER ELECTRICAL CONNECTOR REARWARD. DO NOT TURN THE TRANSDUCER DURING INSTALLATION OR DAMAGE TO THE TRANSDUCER OR ENGINE CAN RESULT.

(4) Carefully reinstall the transducer probe in the intermediate case with the larger electrical connector rearward.

(5) For engines with the No. 1 bearing vibration transducer cable bracket, install the bracket to the forward two holes. Attach the transducer as follows. See Figure 401, (Sheet 2).

CAUTION: YOU MUST USE KEY WASHERS WITH CASES THAT DO NOT HAVE SELF−LOCKING INSERTS IN THE INTERMEDIATE BOSS.

(a) Lubricate the bolts with Engine Oil P03−001.

(b) Install the bolts and washers (key washers for engines without self−locking inserts) that attach the transducer. Tighten evenly by hand.

NOTE: Use the longer bolts at the bracket location if equipped.

NOTE: (Post SB PW4ENG 72−182) Install the drilled bolt into the mounting hole next to the PT2.5 connection on the transducer.

(c) For engines with the locating stud, install the key washer and nut, lubricated with Engine Oil P03−001. Tighten by hand.

(d) Torque (as equipped)
- the bolts without the self−locking insert feature to 65 − 85 lb−in. (7.344 − 9.604 N.m).
- the bolts with the self−locking insert feature to 85 − 95 lb−in. (9.604 − 10.734 N.m).
- the nut on the locating stud to 150 − 170 lb−in. (16.948 − 19.207 N.m).

(e) Bend the key washer tabs if used.

(6) If equipped, install the clamp and bolt, lubricated with Engine Oil P03−001, and attach the No. 1 bearing vibration transducer cable to the bracket. Torque the clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

CAUTION: DO NOT USE LUBRICANTS ON PMUX SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF PMUX CAN RESULT.

(7) Connect the PT2.5 tube (AS31) to the transducer handtight only.

(8) Install the clamp and bolt, lubricated with Engine Oil P03−001, that attach the tube to the Flange E bracket at approximately 5 o'clock position. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(9) Torque the tube nut to 135 − 150 lb−in. (15.253 − 16.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

NOTE: (Post SB PW4G 72−182) Safety the transducer tube nut to the drilled transducer mount bolt.

(10) Connect the W4P19 and the W4P23 harness connectors to the transducer harness receptacles as follows. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−17

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:

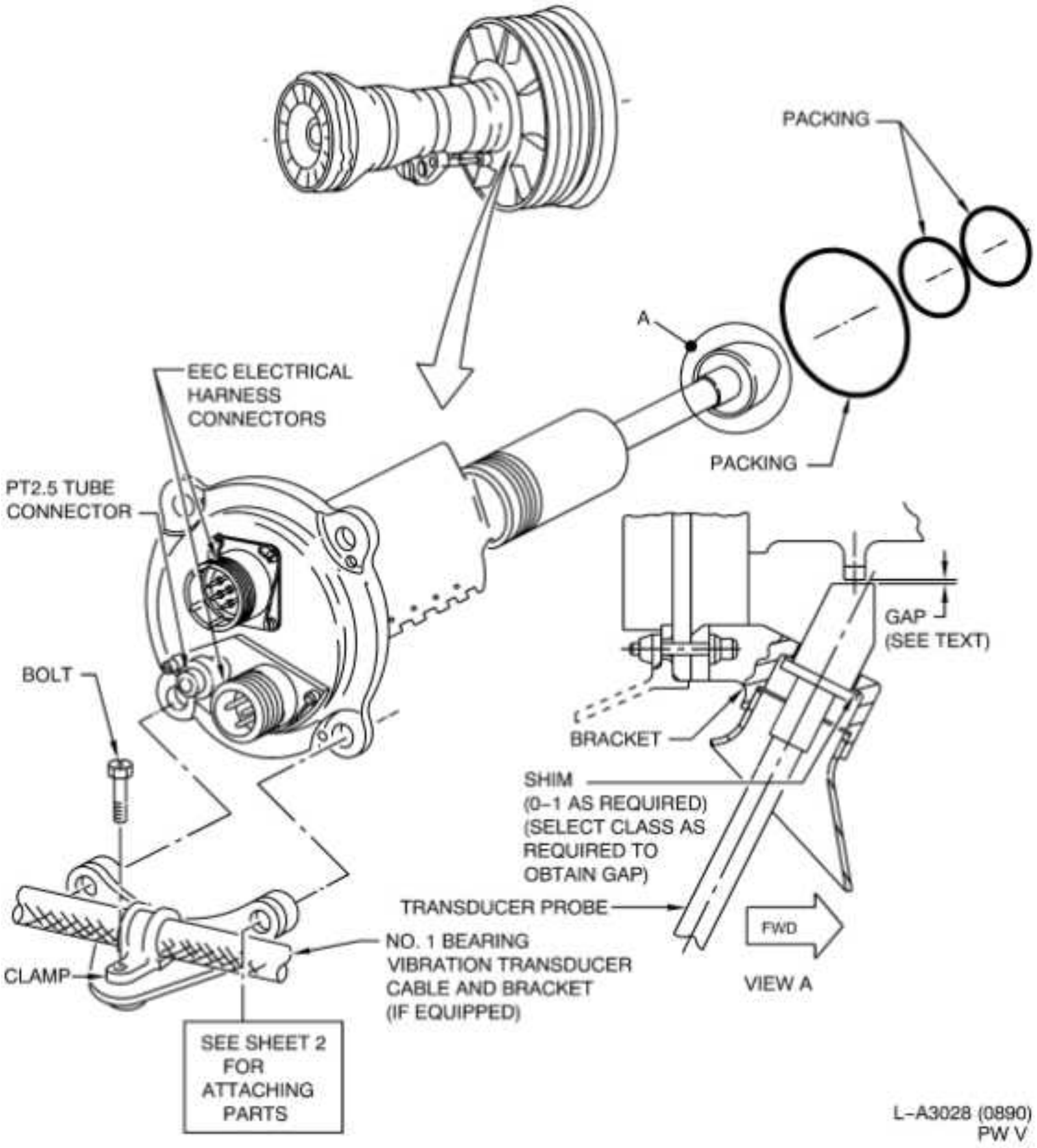
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal). This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

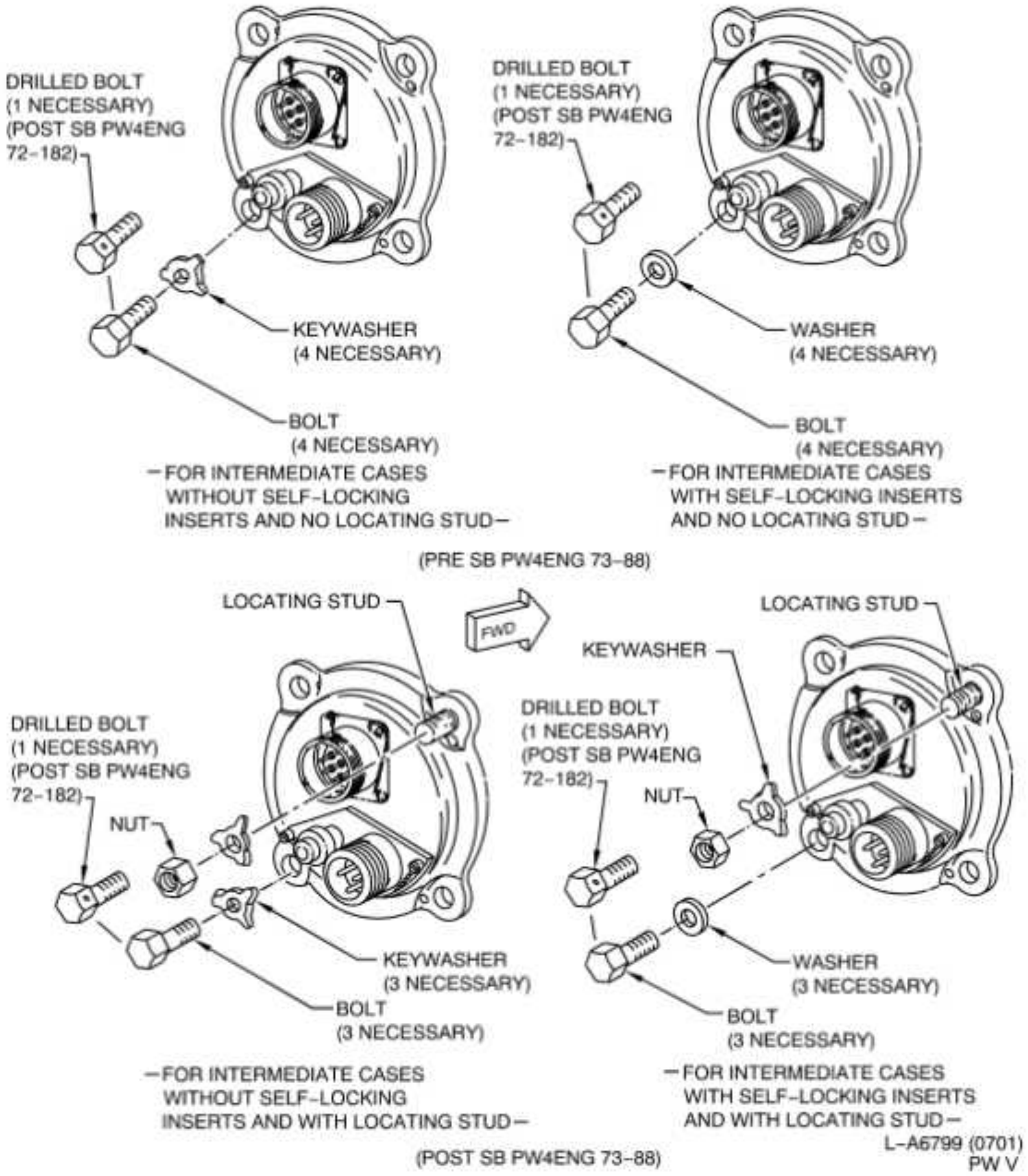
NOTE: See the instructions given with the strap wrench for correct use.

C. Postrequisites

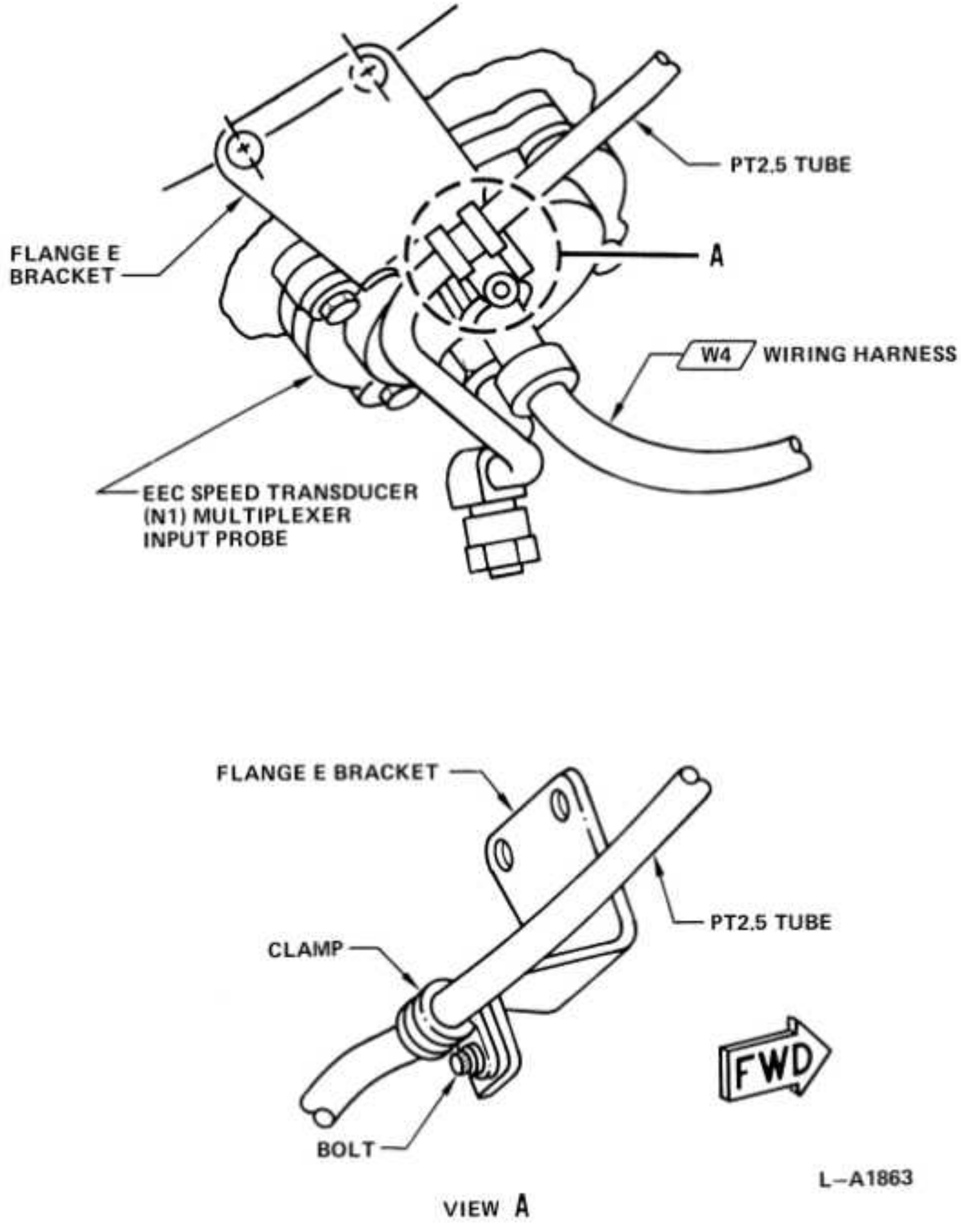
(1) Install the fan exit liner segment (inner rear) that is at 5 o'clock. Refer to 72−00−33, Installation−16 Task 72−00−33−440−001.


PACKING
A
EEC ELECTRICAL HARNESS CONNECTORS
PACKING
PT2.5 TUBE CONNECTOR
GAP (SEE TEXT)
BOLT
BRACKET
SHIM (0−1 AS REQUIRED) (SELECT CLASS AS REQUIRED TO OBTAIN GAP)
TRANSDUCER PROBE
FWD
CLAMP
NO. 1 BEARING VIBRATION TRANSDUCER CABLE AND BRACKET (IF EQUIPPED)
VIEW A
SEE SHEET 2 FOR ATTACHING PARTS
L−A3028 (0890)
PW V

EEC Speed Transducer (N1) Multiplexer Input Probe
Figure 401 (Sheet 1)
(Task 72−00−34−450−013)


DRILLED BOLT (1 NECESSARY) (POST SB PW4ENG 72-182)
KEYWASHER (4 NECESSARY)
BOLT (4 NECESSARY)
—FOR INTERMEDIATE CASES WITHOUT SELF-LOCKING INSERTS AND NO LOCATING STUD—
DRILLED BOLT (1 NECESSARY) (POST SB PW4ENG 72-182)
WASHER (4 NECESSARY)
BOLT (4 NECESSARY)
—FOR INTERMEDIATE CASES WITH SELF-LOCKING INSERTS AND NO LOCATING STUD—
(PRE SB PW4ENG 73-88)
LOCATING STUD
FWD
DRILLED BOLT (1 NECESSARY) (POST SB PW4ENG 72-182)
NUT
KEYWASHER (3 NECESSARY)
BOLT (3 NECESSARY)
—FOR INTERMEDIATE CASES WITHOUT SELF-LOCKING INSERTS AND WITH LOCATING STUD—
LOCATING STUD
KEYWASHER
DRILLED BOLT (1 NECESSARY) (POST SB PW4ENG 72-182)
NUT
WASHER (3 NECESSARY)
BOLT (3 NECESSARY)
—FOR INTERMEDIATE CASES WITH SELF-LOCKING INSERTS AND WITH LOCATING STUD—
(POST SB PW4ENG 73-88)
L-A6799 (0701)
PW V

EEC Speed Transducer (N1) Multiplexer Input Probe (Attaching Parts)
Figure 401 (Sheet 2)
(Task 72−00−34−450−013)


PT2.5 TUBE
FLANGE E BRACKET
A
W4
WIRING HARNESS
EEC SPEED TRANSDUCER (N1) MULTIPLEXER INPUT PROBE
FLANGE E BRACKET
PT2.5 TUBE
CLAMP
FWD
BOLT
L−A1863
VIEW A

EEC Speed Transducer (N1) Multiplexer Input Probe
Figure 401 (Sheet 3)
(Task 72−00−34−450−013)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INTERMEDIATE CASE - INSTALLATION-18

Task 72-00-34-450-017:

1. Install EEC Wiring Harness - W3 (Core Engine)

A. General

(1) To install the EEC wiring harness - W4, see 72-00-34, Installation-19 (Task 72-00-34-450-018).

(2) To install the EEC wiring harness - W5, see 72-00-34, Installation-20 (Task 72-00-34-450-019).

B. Equipment And Materials Necessary

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

Part Name	Quantity	Parts Catalog Reference Section/Figure/Item
Tape - Lacing And Tying, PN 1B1773		

C. Procedure
See Figure 401, Figure 402, Figure 403, Figure 404, Figure 405, Figure 406, Figure 407, Figure 408 and Figure 409.

CAUTION: SEE 72-00-00, INSTALLATION-00 FOR THE GENERAL INSTALLATION REQUIREMENTS FOR THE ELECTRICAL HARNESSES, LEADS AND CABLES.

CAUTION: DO NOT TWIST OR BEND THE HARNESS BADLY DURING THE INSTALLATION, OR DAMAGE TO THE HARNESS CAN OCCUR.

(1) Install the W3 harness on the left side of the engine as follows.

(a) Remove the protective closure. Install the W3J24 connector flange to the HPC case bracket located at the 10 o'clock position. Install the harness bracket that attaches the connector flange to the bracket. Align the bolt holes and install the bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 403.

(2) Connect the W3 harness connectors (given below) to the mating harness receptacles as follows. See Figure 402. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

Connector	Component	Location
W1P24	Harness Connector To W3J24 Harness Connector	10:00 O'Clock
W3P12	HPC Secondary Flow Control Valve, Turbine Cooling Air Valve Solenoid	Intermediate Case 10:00 O'Clock
W3P17	Air/Oil Heat Exchanger And Valve (Engine)	8:00 O'Clock
W3P15	2.5 Bleed Valve Actuator	Intermediate Case 7:30 O'Clock
W3P5	Fuel/Oil Cooler Bypass Valve Solenoid (Forward Connector)	8:00 O'Clock
W3P1	EEC Alternator (Upper Connector)	Bottom Of Gearbox 7 O'Clock
W3P18	EEC Oil Temperature Thermocouple Probe	Front Of Gearbox 7 O'Clock

(3) (Pre SB PW4ENG 73−84), Connect the W3P18 connector of the harness to the EEC oil temperature thermocouple probe as follows.

(4) (Post SB PW4ENG 73−84), For a thermocouple probe with a studded terminal type receptacle and for engines equipped with 2.95 bleed valve thermocouple install the wiring harness as follows.

(a) Install the wiring harness terminals to the thermocouple studs and install loosely the nuts to the thermocouple studs.

(b) Install the clamp, ground strap, and bolt loosely to the bracket on the housing.

CAUTION: TO PREVENT DAMAGE TO THE WIRING HARNESS, MAKE SURE THE THERMOCOUPLE STUD BOX DOES NOT TURN WHEN THE COUPLING NUT IS TORQUED.

(c) If necessary to align the thermocouple stud box, remove the lockwire from the thermocouple coupling nut to the adapter and loosen the coupling nut.

(d) Align the thermocouple stud box with the wiring harness connector.

(e) (Reference 2167) Hold the thermocouple stud box and torque the thermocouple probe coupling nut to 95 − 100 lb−in. (10.734 − 11.298 N.m). Do not let the thermocouple studs turn.

CAUTION: DO NOT ALIGN THE THERMOCOUPLE STUD BOX AFTER THE COUPLING NUT IS TORQUED. HOLD THE THERMOCOUPLE STUD BOX AND LOOSEN THE COUPLING NUT AND ALIGN THE THERMOCOUPLE STUD BOX AGAIN.

(f) Make sure the thermocouple stud box is aligned. Do not put too much force on the terminals of the wiring harness.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(g) (Reference 2273) Torque the alumel nuts (larger terminal studs) to 18 − 22 lb−in. (2.034 − 2.486 N.m).

(h) (Reference 2273) Torque the chromel nuts (smaller terminal studs) to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(i) Install lockwire from the coupling nut to the adapter.

(j) Torque the bolt that attachs the clamp and ground strap to the bracket on the housing to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(5) Adjust the W3 harness for any necessary clearances as required. Install the clamps at all clamp points. Refer to the figures. Attach the clamps loosely to the engine with bolts and/or nuts, threads lubricated with Engine Oil P03−001.

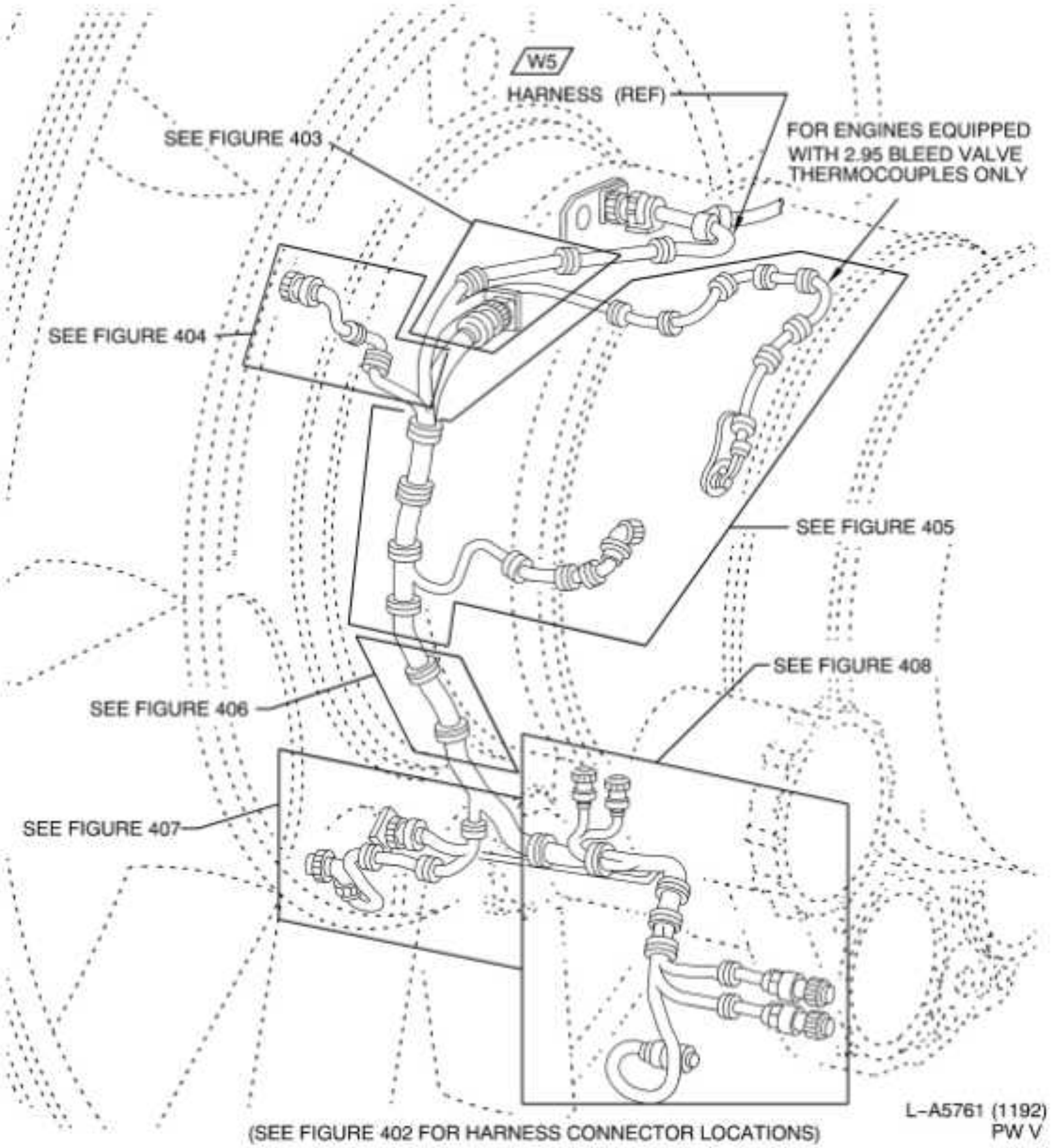
NOTE: Use different clamp sizes on the harnesses to prevent harness movement when tightened. See the Illustrated Parts Catalog for selection of the clamp sizes and part numbers.

(6) Make sure that the harnesses are not tight to the point where sharp bends are caused, and that the harnesses do not touch any engine parts or plumbing. Provide a drip loop on the leads where the wires run downward into the connector.

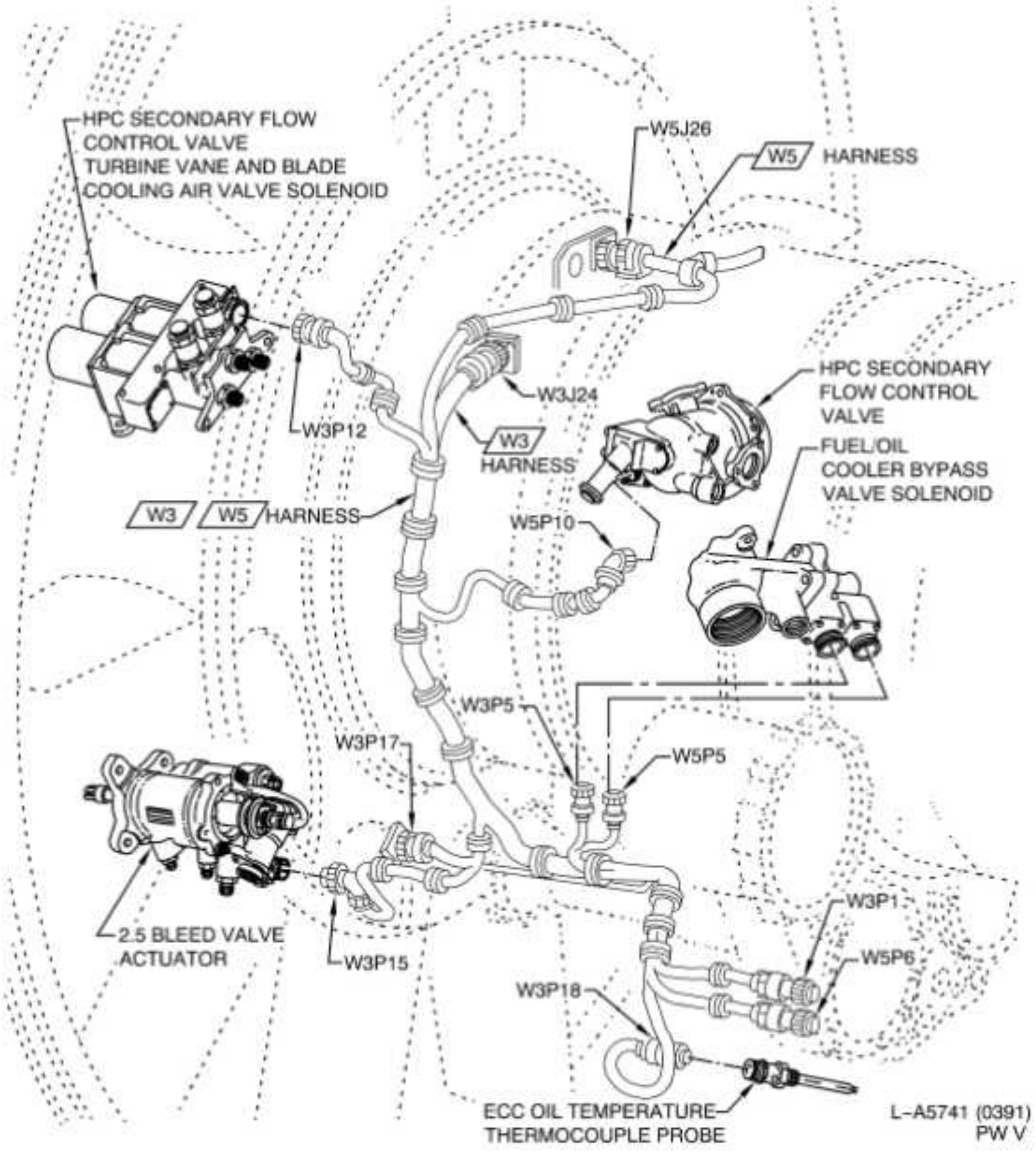
(7) Tighten all the previously installed clamp nuts and/or bolts to a torque of 36 − 40 lb−in. (4.067 − 4.519 N.m).

(8) Tie the harnesses as shown in Figure 409.

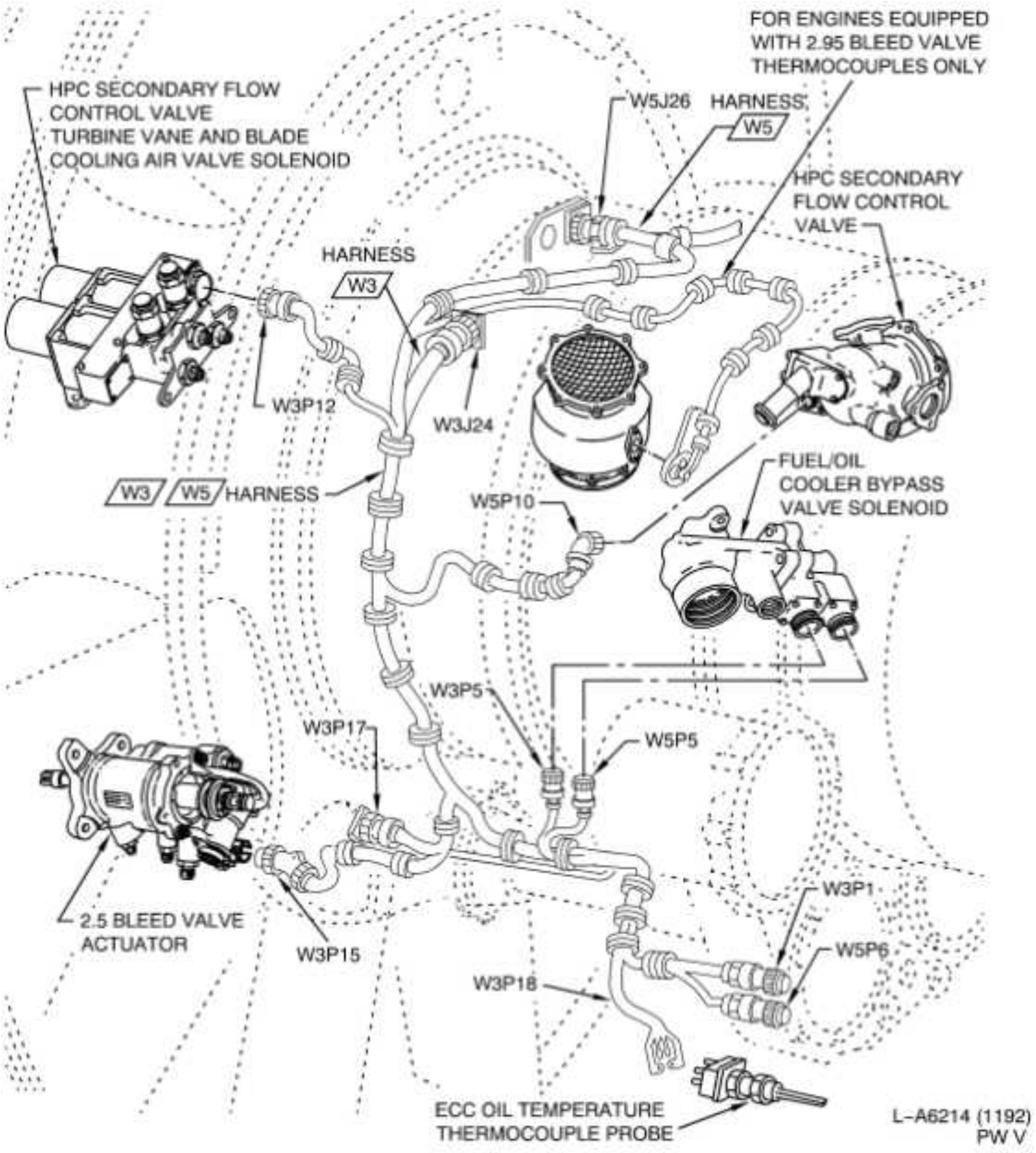
NOTE: Ties must be made with a clove hitch with an extra loop, followed by a square knot, as shown in Figure 409. The clove hitch and square knot must be tightened satisfactorily in place. The harnesses must not be stressed or damaged by overtightening the ties. Where the harness bundles are more than 1.500 inches (38.100 mm) in diameter, the lacing tape must be doubled. Cut the ends of the lacing tape to a length of 0.250 − 0.500 inch (6.350 − 12.700 mm).


W5
HARNESS (REF)
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
SEE FIGURE 403
SEE FIGURE 404
SEE FIGURE 405
SEE FIGURE 406
SEE FIGURE 407
SEE FIGURE 408
(SEE FIGURE 402 FOR HARNESS CONNECTOR LOCATIONS)
L−A5761 (1192)
PW V

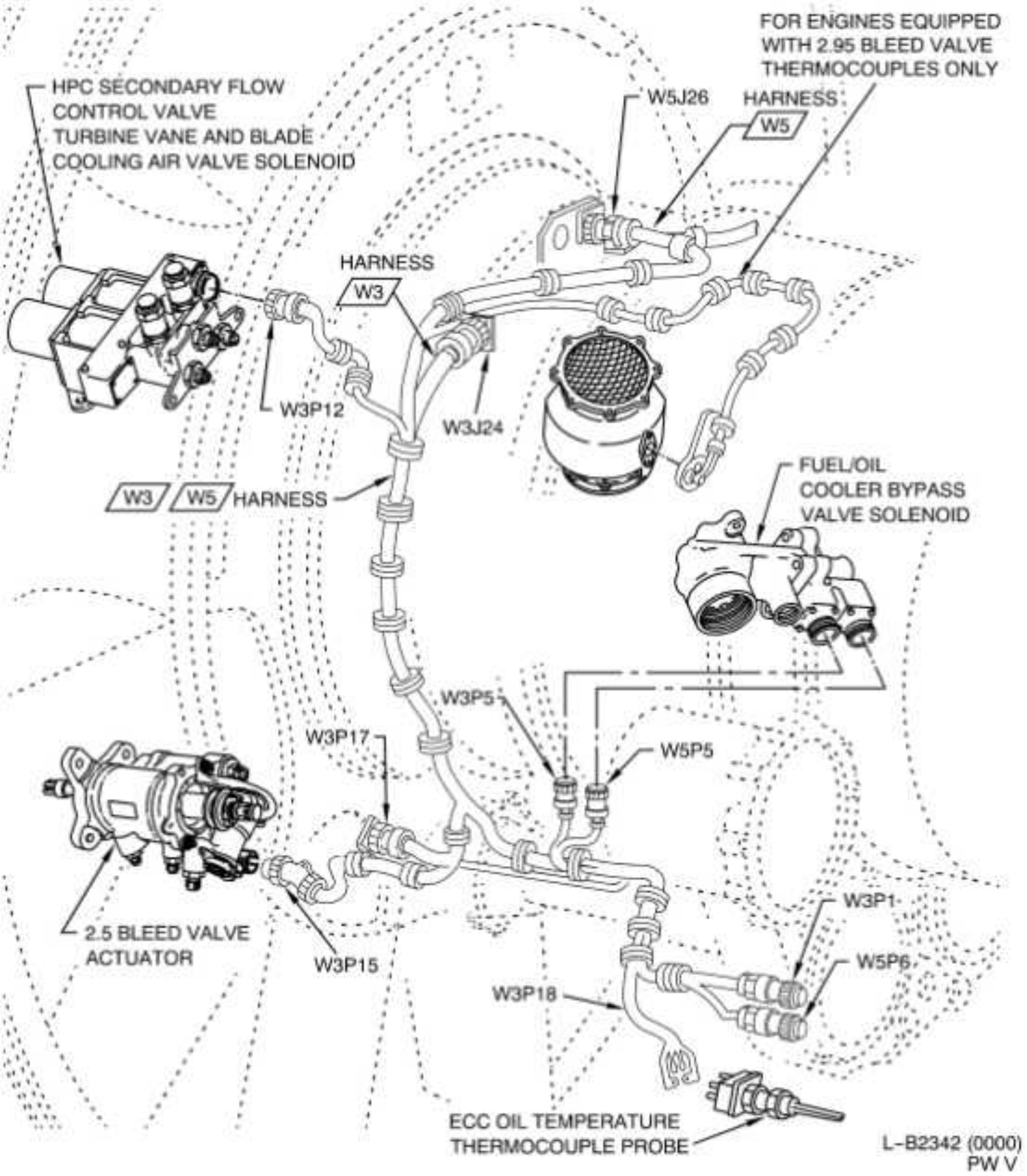
EEC Wiring Harness − W3 (Core Engine)
Figure 401
(Task 72−00−34−450−017)


HPC SECONDARY FLOW CONTROL VALVE TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
W5J26
W5 HARNESS
W3J24
W3P12
W3 HARNESS
HPC SECONDARY FLOW CONTROL VALVE
FUEL/OIL COOLER BYPASS VALVE SOLENOID
W3 W5 HARNESS
W5P10
W3P5
W3P17
W5P5
2.5 BLEED VALVE ACTUATOR
W3P15
W3P1
W5P6
W3P18
ECC OIL TEMPERATURE THERMOCOUPLE PROBE
L-A5741 (0391)
PW V

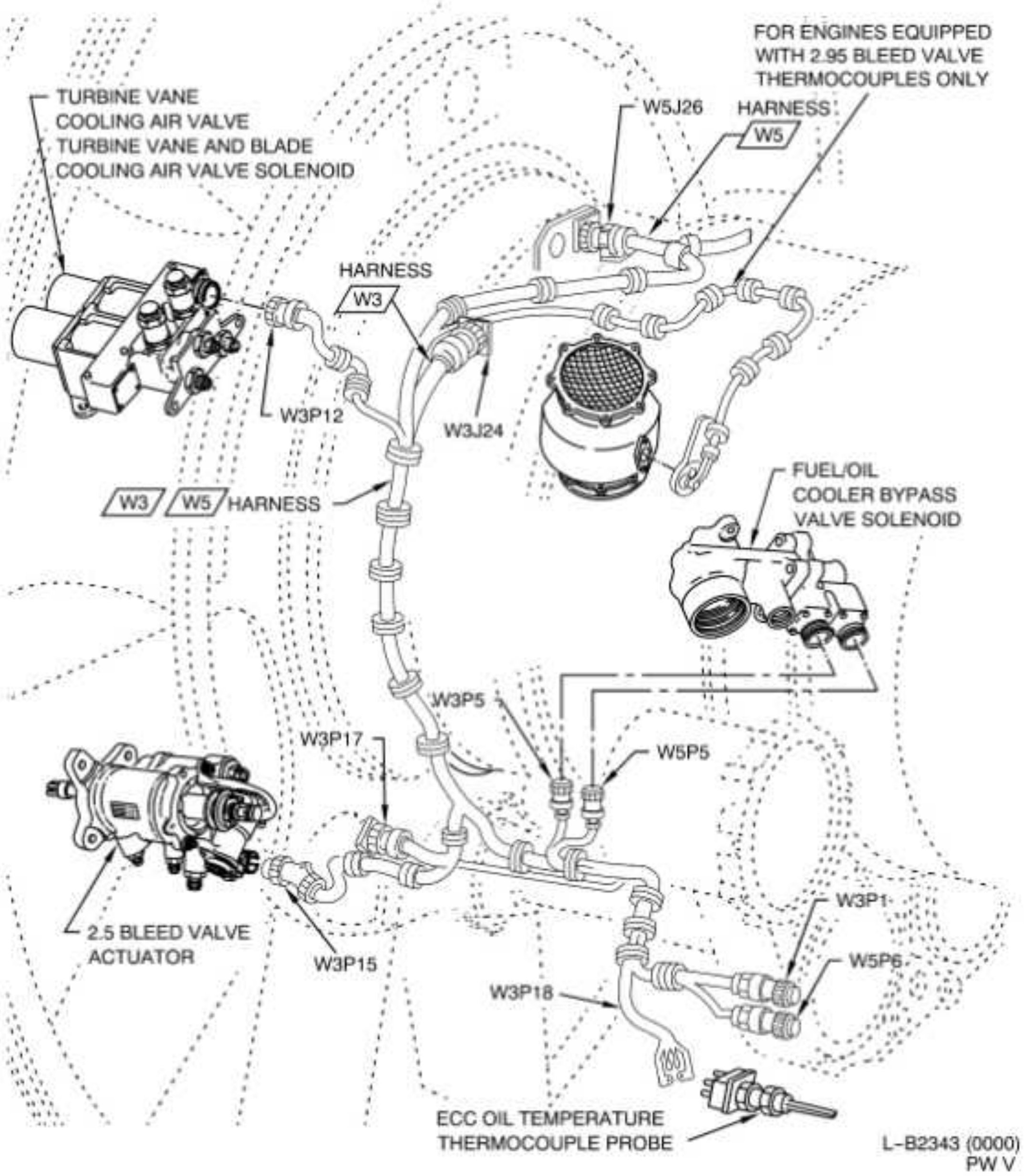
EEC Wiring Harness − W3 (Core Engine) (Pre SB PW4ENG 73−84 And SB PW4ENG 75−106)
Figure 402 (Sheet 1)
(Task 72−00−34−450−017)


FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
HPC SECONDARY FLOW CONTROL VALVE
TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
W5J26
HARNESS
W5
HPC SECONDARY FLOW CONTROL VALVE
HARNESS
W3
W3P12
W3J24
W3
W5
HARNESS
FUEL/OIL COOLER BYPASS VALVE SOLENOID
W5P10
W3P5
W3P17
W5P5
W3P1
2.5 BLEED VALVE ACTUATOR
W3P15
W5P6
W3P18
ECC OIL TEMPERATURE THERMOCOUPLE PROBE
L−A6214 (1192)
PW V

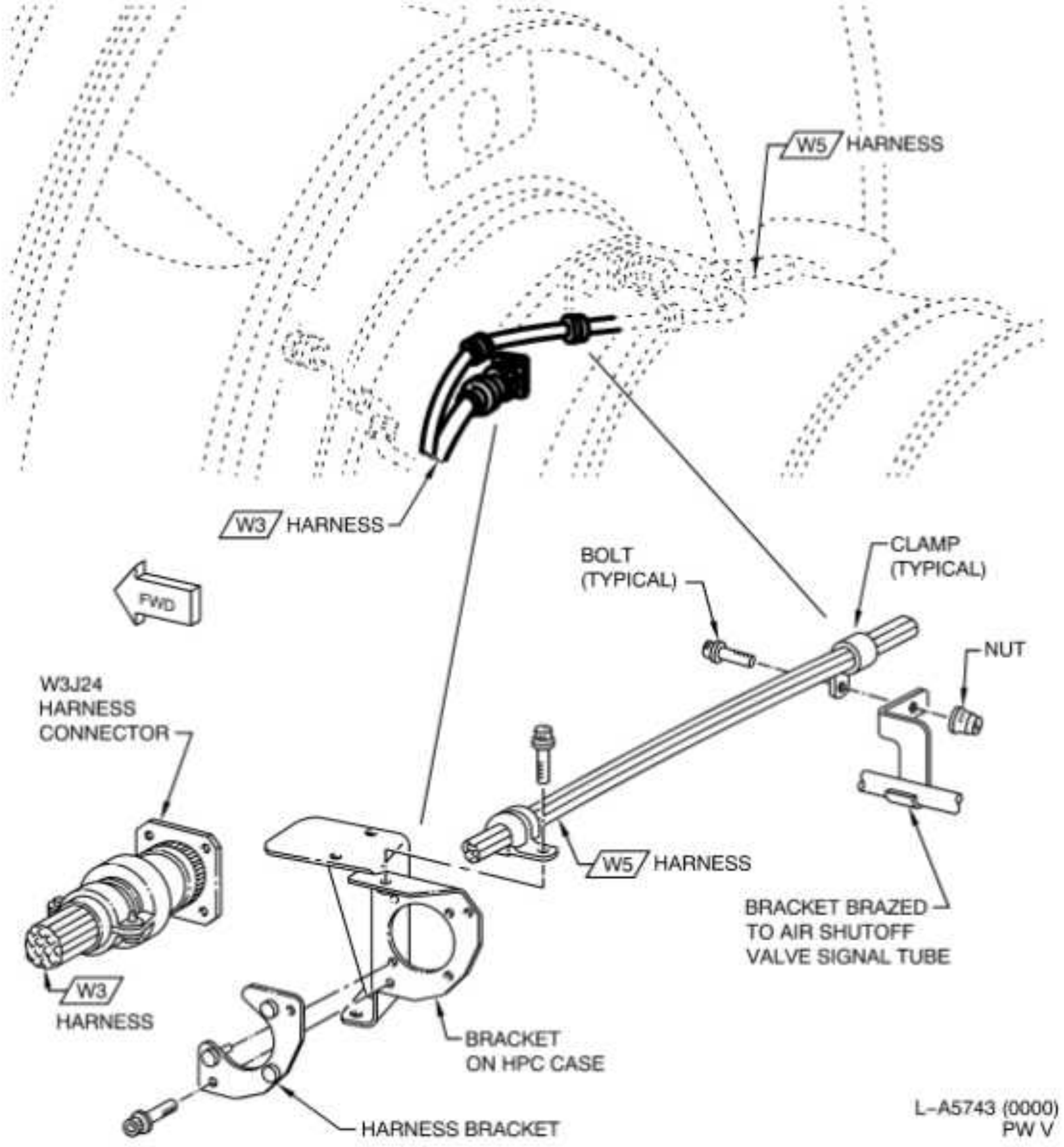
EEC Wiring Harness − W3 (Core Engine)
(Post SB PW4ENG 73−84) (Pre SB PW4ENG 75−106)
Figure 402 (Sheet 2)
(Task 72−00−34−450−017)


HPC SECONDARY FLOW
CONTROL VALVE
TURBINE VANE AND BLADE
COOLING AIR VALVE SOLENOID
HARNESS
W3
W3P12
W3J24
W5J26
HARNESS
W5
FOR ENGINES EQUIPPED
WITH 2.95 BLEED VALVE
THERMOCOUPLES ONLY
W3
W5
HARNESS
FUEL/OIL
COOLER BYPASS
VALVE SOLENOID
W3P5
W3P17
W5P5
2.5 BLEED VALVE
ACTUATOR
W3P15
W3P1
W5P6
W3P18
ECC OIL TEMPERATURE
THERMOCOUPLE PROBE
L-B2342 (0000)
PW V

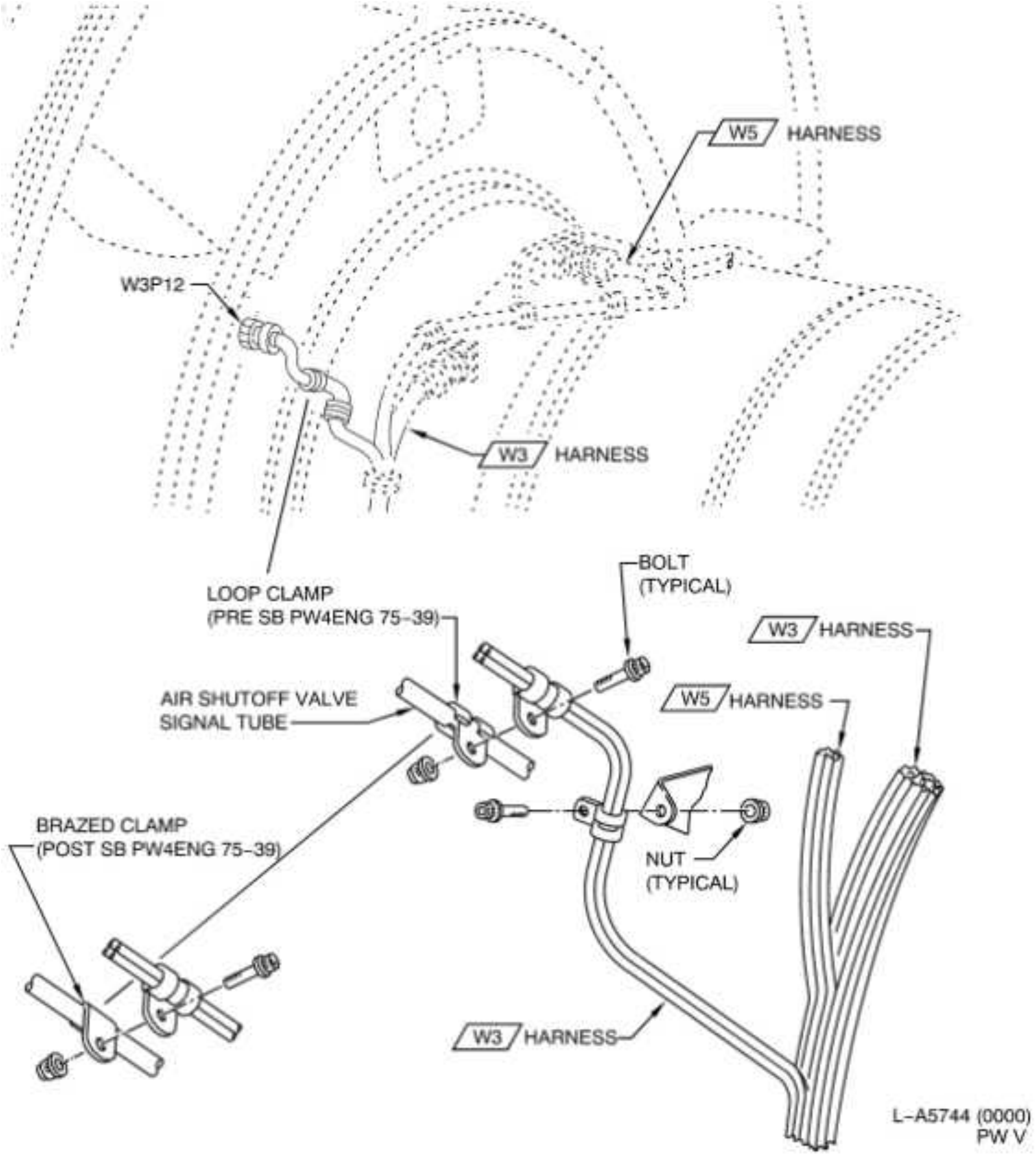
EEC Wiring Harness − W3 (Core Engine) (Post SB PW4ENG 73−84, SB PW4ENG 75−106 or SB PW4ENG 72−572)
(For −3 Engines With CN After Engine Serial Number)
Figure 402 (Sheet 3)
(Task 72−00−34−450−017)


FOR ENGINES EQUIPPED
WITH 2.95 BLEED VALVE
THERMOCOUPLES ONLY
TURBINE VANE
COOLING AIR VALVE
TURBINE VANE AND BLADE
COOLING AIR VALVE SOLENOID
W5J26
HARNESS
W5
HARNESS
W3
W3P12
W3J24
W3
W5
HARNESS
FUEL/OIL
COOLER BYPASS
VALVE SOLENOID
W3P5
W3P17
W5P5
W3P1
2.5 BLEED VALVE
ACTUATOR
W5P6
W3P15
W3P18
ECC OIL TEMPERATURE
THERMOCOUPLE PROBE
L-B2343 (0000)
PW V

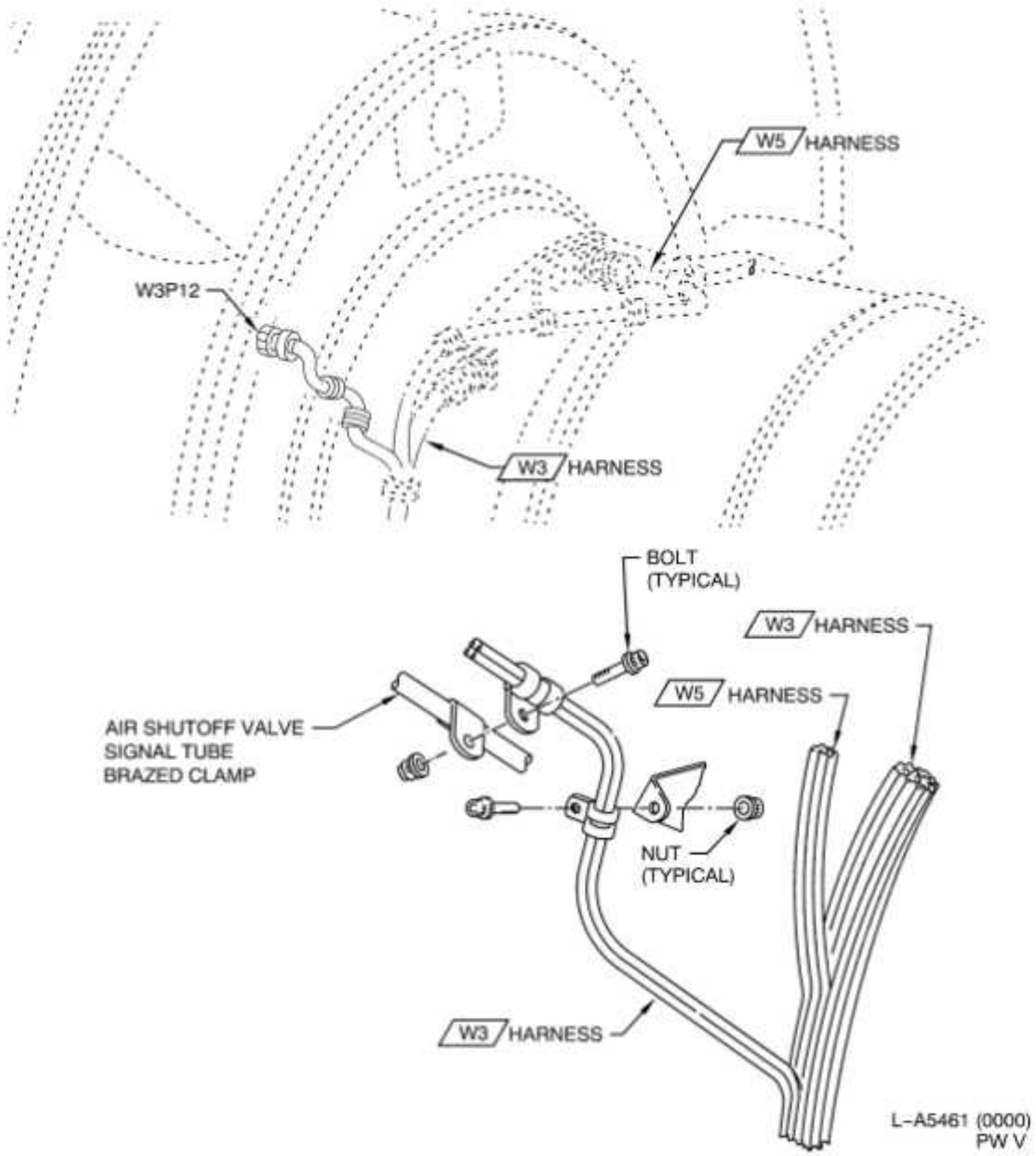
EEC Wiring Harness − W3 (Core Engine)
(For −3 Engines As Built By P&W)
Figure 402 (Sheet 4)
(Task 72−00−34−450−017)


W5 HARNESS
W3 HARNESS
BOLT (TYPICAL)
CLAMP (TYPICAL)
NUT
FWD
W3J24 HARNESS CONNECTOR
W5 HARNESS
BRACKET BRAZED TO AIR SHUTOFF VALVE SIGNAL TUBE
W3 HARNESS
BRACKET ON HPC CASE
HARNESS BRACKET
L−A5743 (0000)
PW V

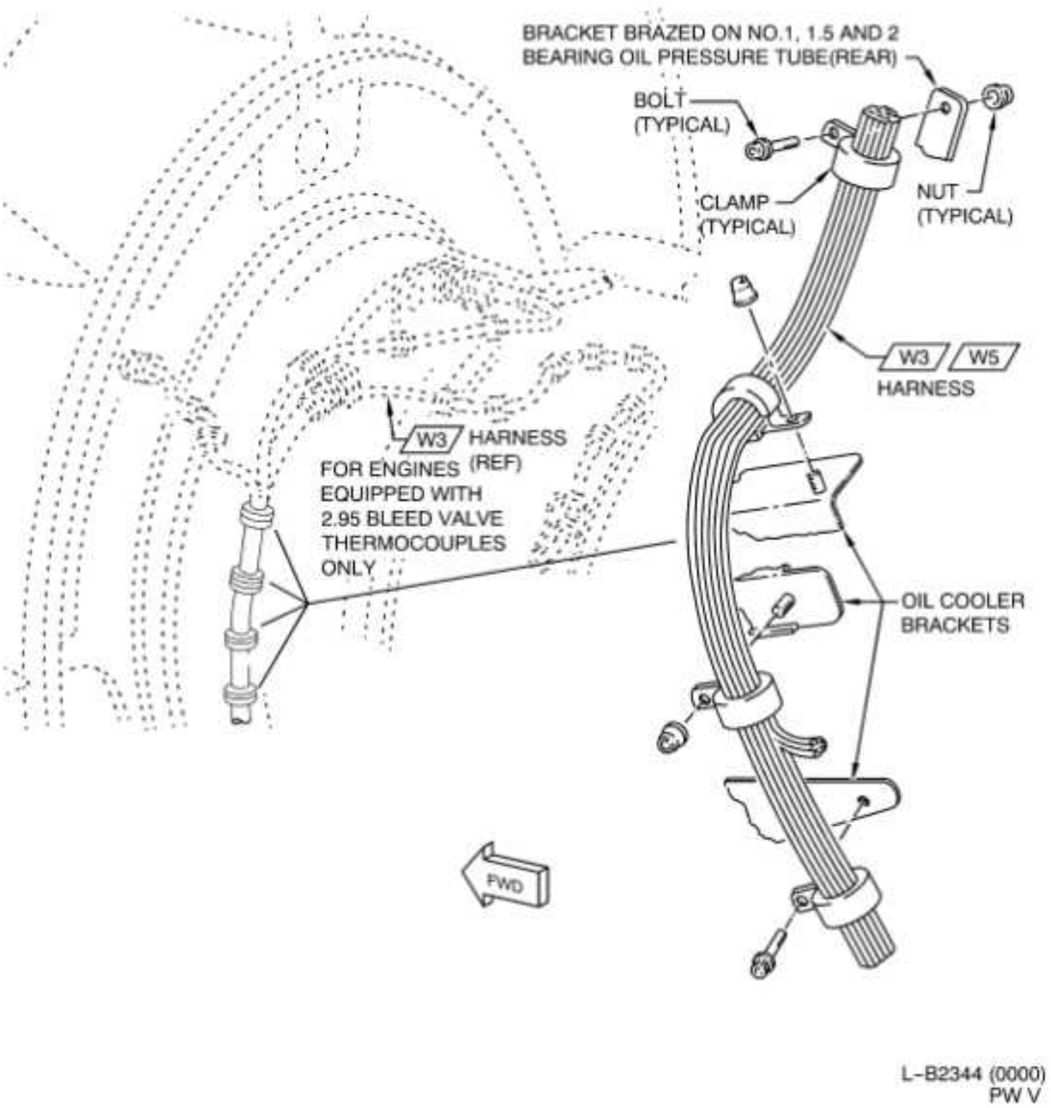
EEC Wiring Harness − W3 (Core Engine)
Figure 403
(Task 72−00−34−450−017)


W5 HARNESS
W3P12
W3 HARNESS
LOOP CLAMP
(PRE SB PW4ENG 75-39)
BOLT
(TYPICAL)
W3 HARNESS
AIR SHUTOFF VALVE
SIGNAL TUBE
W5 HARNESS
BRAZED CLAMP
(POST SB PW4ENG 75-39)
NUT
(TYPICAL)
W3 HARNESS
L-A5744 (0000)
PW V

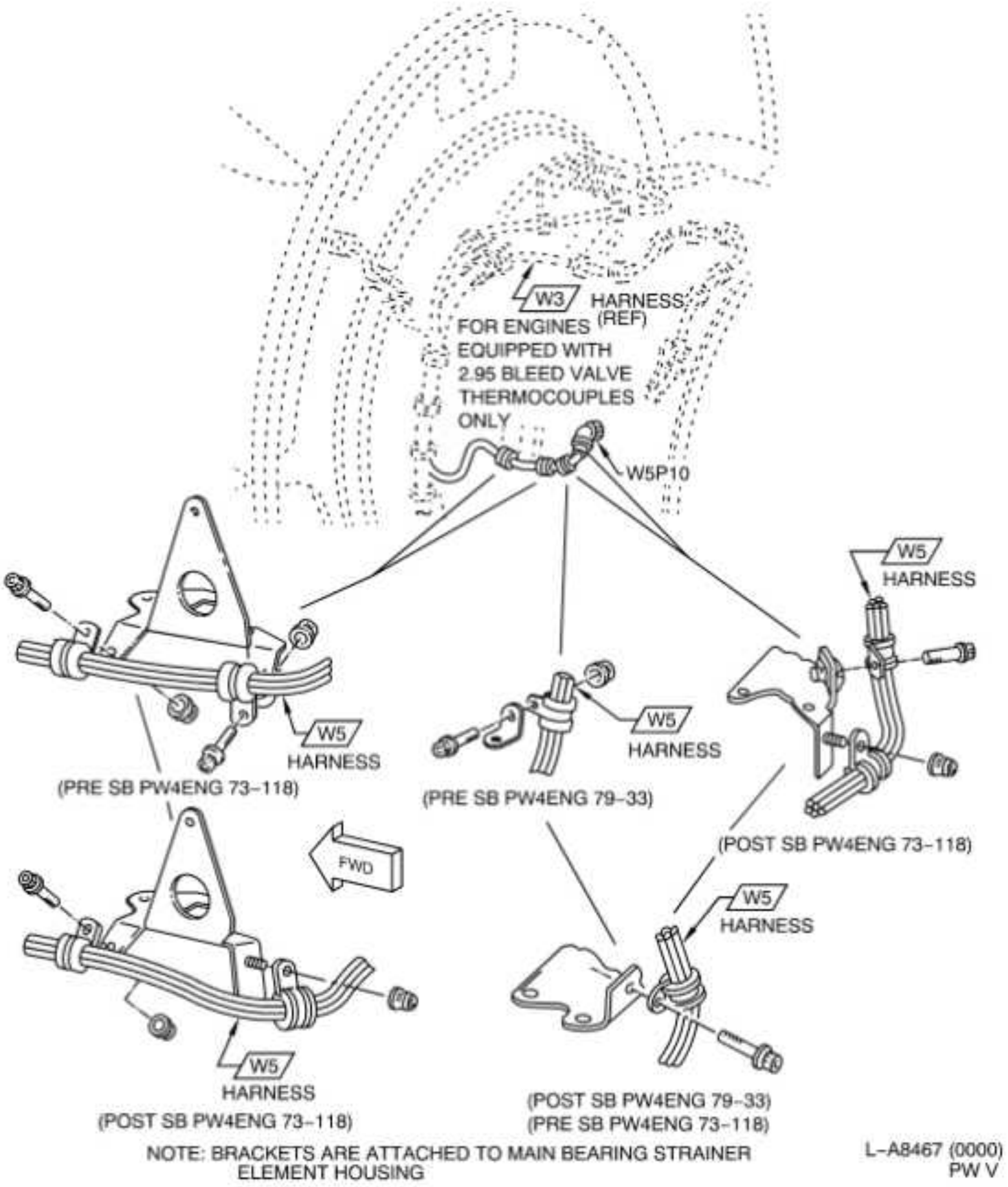
EEC Wiring Harness − W3 (Core Engine) (For Engines
With And Without CN After Engine Serial Number)
Figure 404 (Sheet 1)
(Task 72−00−34−450−017)


W5 HARNESS
W3P12
W3 HARNESS
BOLT (TYPICAL)
W3 HARNESS
W5 HARNESS
AIR SHUTOFF VALVE SIGNAL TUBE BRAZED CLAMP
NUT (TYPICAL)
W3 HARNESS
L−A5461 (0000)
PW V

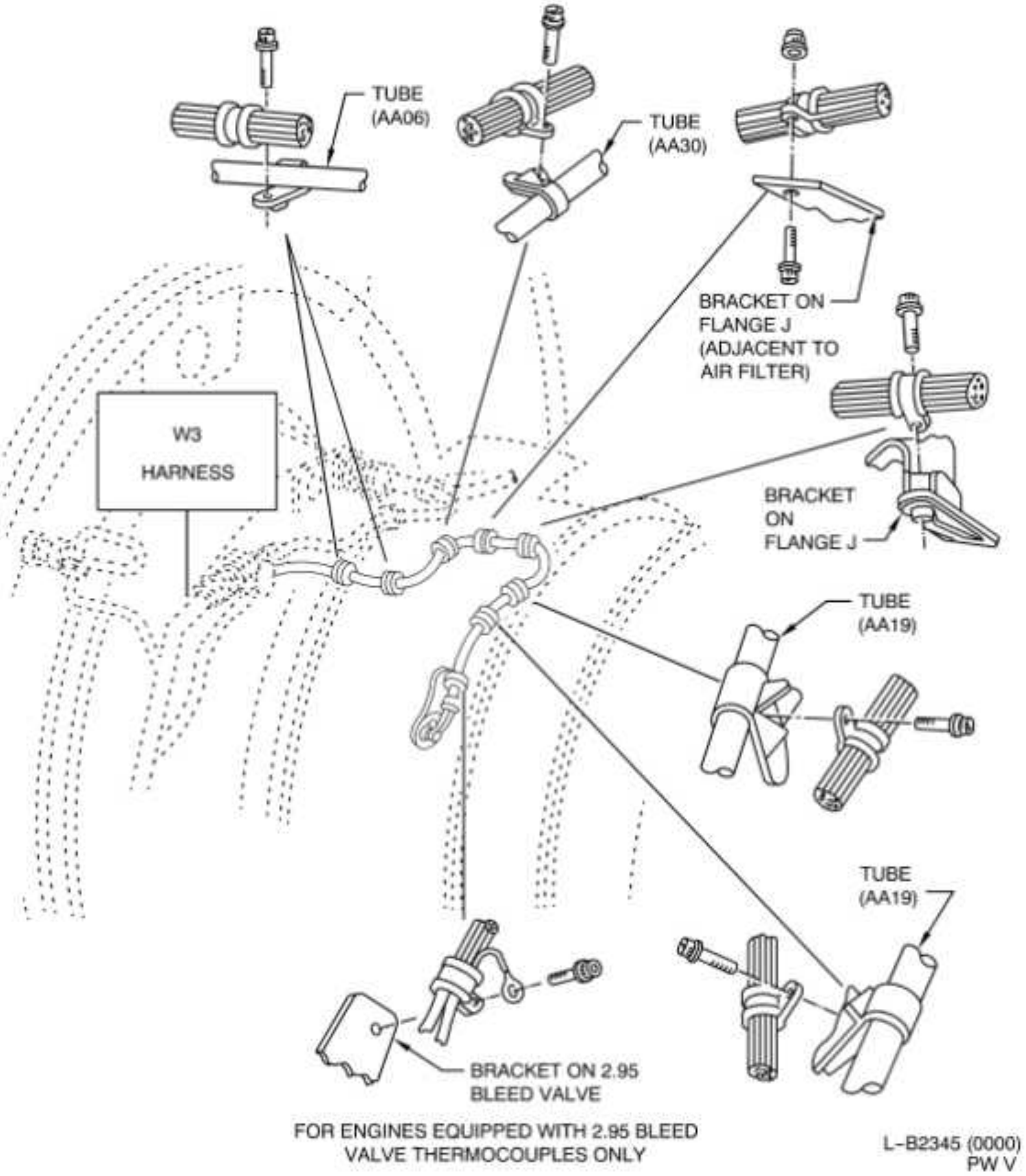
EEC Wiring Harness − W3 (Core Engine)
(For −3 Engines As Built By P&W)
Figure 404 (Sheet 2)
(Task 72−00−34−450−017)


BRACKET BRAZED ON NO.1, 1.5 AND 2
BEARING OIL PRESSURE TUBE(REAR)
BOLT
(TYPICAL)
CLAMP
(TYPICAL)
NUT
(TYPICAL)
W3
W5
HARNESS
W3
HARNESS
(REF)
FOR ENGINES
EQUIPPED WITH
2.95 BLEED VALVE
THERMOCOUPLES
ONLY
OIL COOLER
BRACKETS
FWD
L-B2344 (0000)
PW V

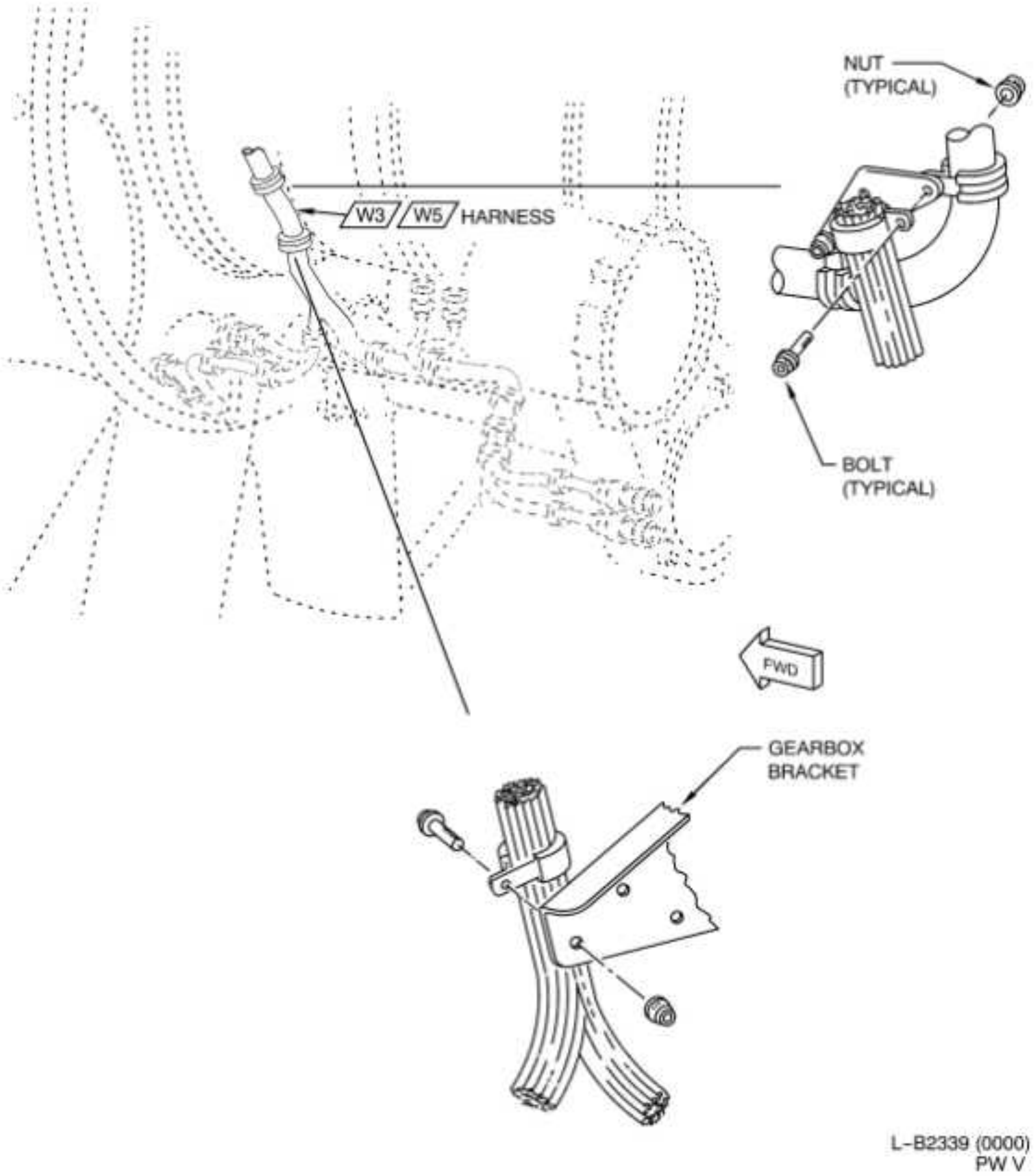
EEC Wiring Harness − W3 (Core Engine)
Figure 405 (Sheet 1)
(Task 72−00−34−450−017)


W3 HARNESS (REF)
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5P10
W5 HARNESS
W5 HARNESS
(PRE SB PW4ENG 73-118)
W5 HARNESS
(PRE SB PW4ENG 79-33)
(POST SB PW4ENG 73-118)
FWD
W5 HARNESS
W5 HARNESS
(POST SB PW4ENG 73-118)
(POST SB PW4ENG 79-33)
(PRE SB PW4ENG 73-118)
NOTE: BRACKETS ARE ATTACHED TO MAIN BEARING STRAINER ELEMENT HOUSING
L-A8467 (0000)
PW V

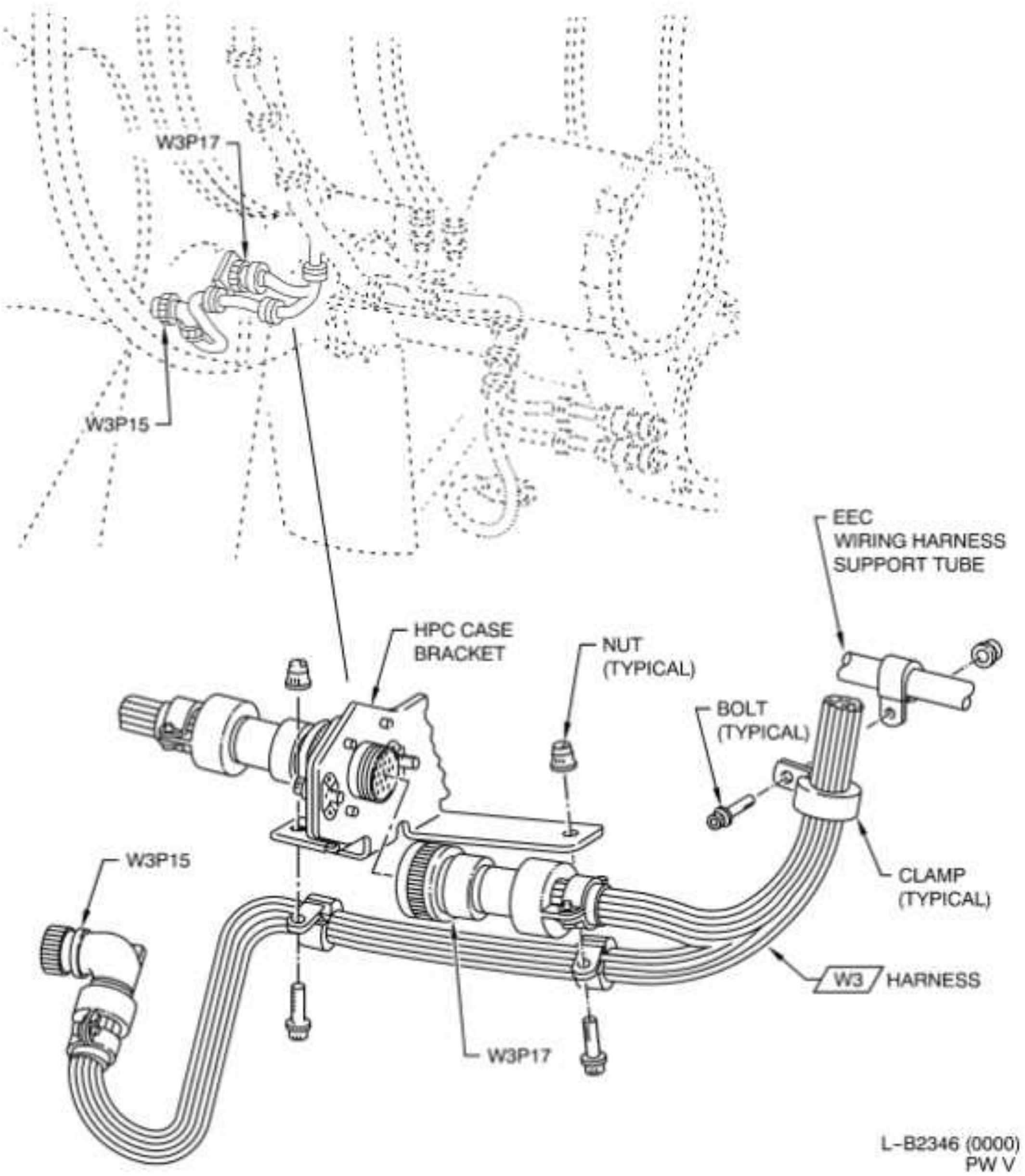
EEC Wiring Harness − W3 (Core Engine) (Pre SB PW4ENG 75−106)
Figure 405 (Sheet 2)
(Task 72−00−34−450−017)


TUBE (AA06)
TUBE (AA30)
BRACKET ON FLANGE J (ADJACENT TO AIR FILTER)
W3 HARNESS
BRACKET ON FLANGE J
TUBE (AA19)
TUBE (AA19)
BRACKET ON 2.95 BLEED VALVE
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
L-B2345 (0000)
PW V

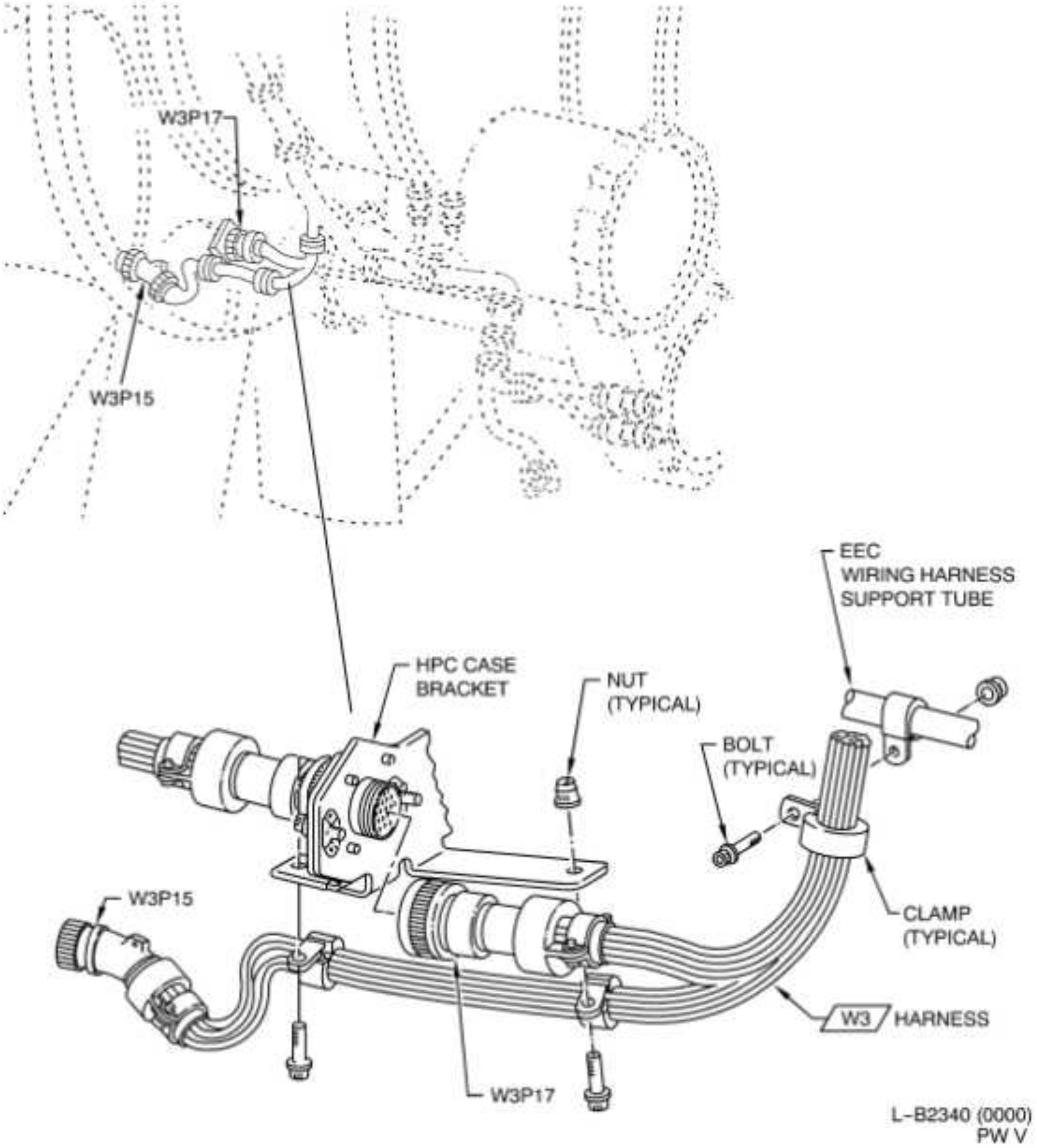
EEC Wiring Harness − W3 (Core Engine)
Figure 405 (Sheet 3)
(Task 72−00−34−450−017)


NUT
(TYPICAL)
W3
W5
HARNESS
BOLT
(TYPICAL)
FWD
GEARBOX
BRACKET
L−B2339 (0000)
PW V

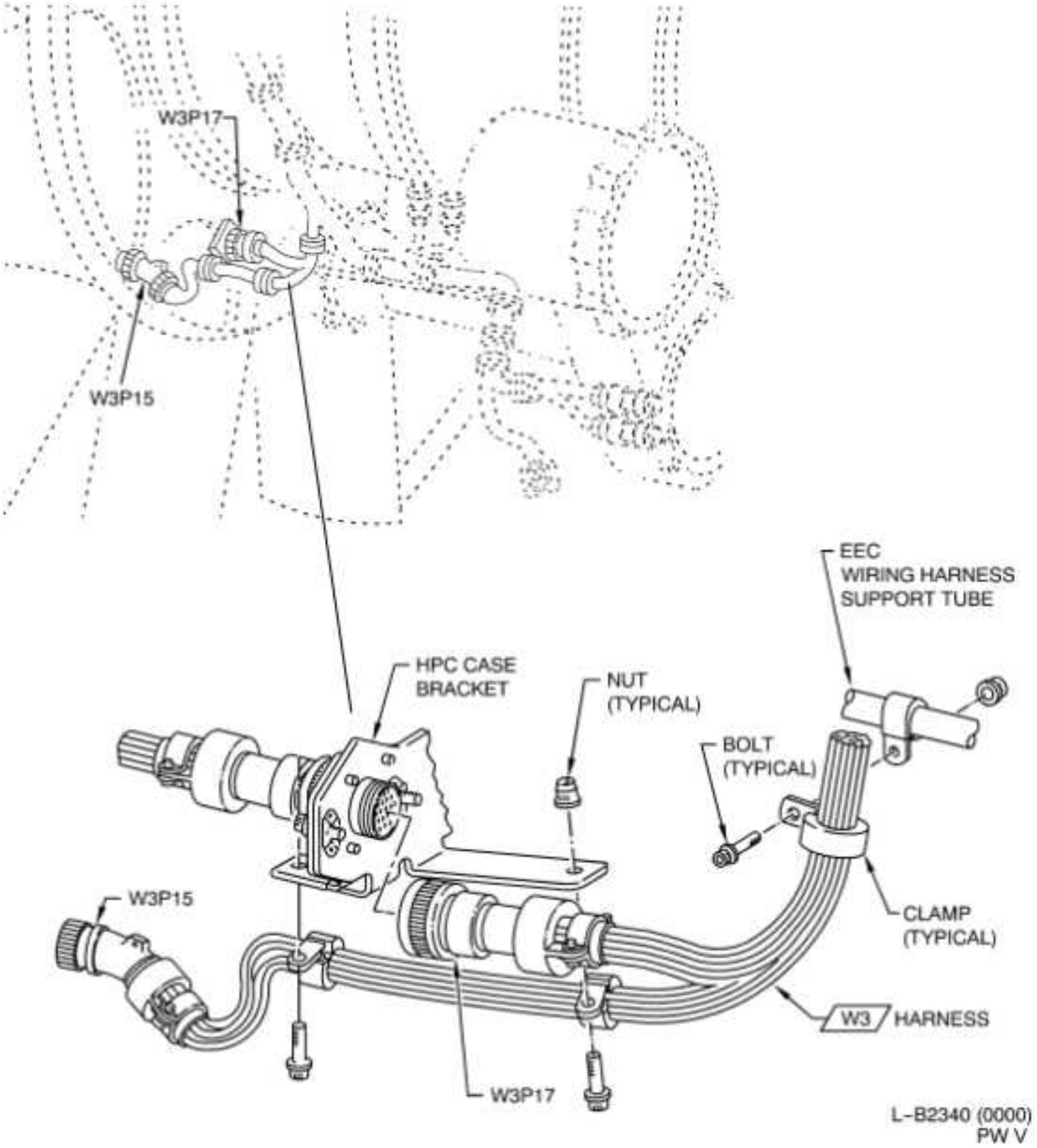
EEC Wiring Harness − W3 (Core Engine)
Figure 406
(Task 72−00−34−450−017)


W3P17
W3P15
EEC
WIRING HARNESS
SUPPORT TUBE
HPC CASE
BRACKET
NUT
(TYPICAL)
BOLT
(TYPICAL)
CLAMP
(TYPICAL)
W3P15
W3 HARNESS
W3P17
L-B2346 (0000)
PW V

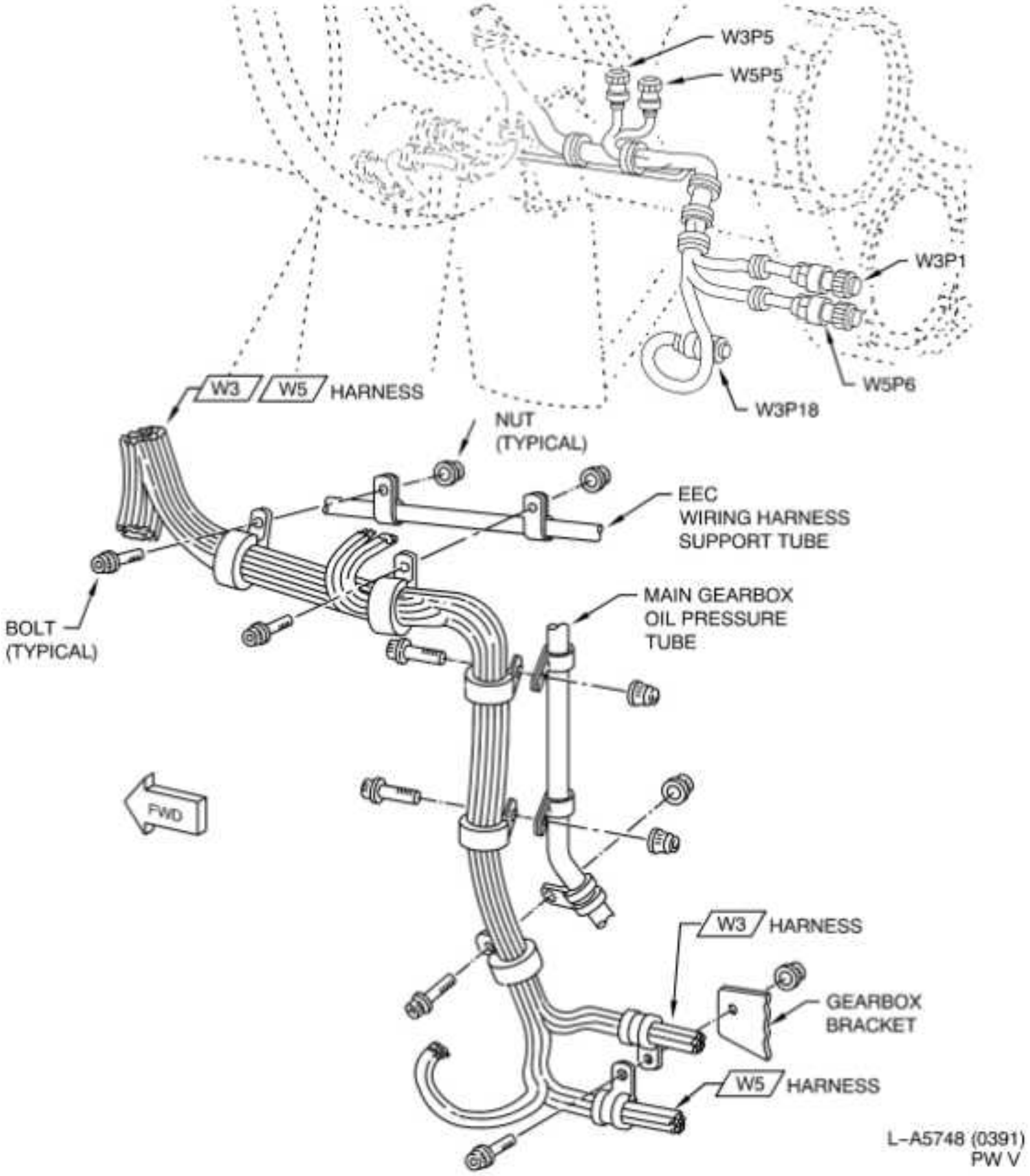
EEC Wiring Harness − W3 (Core Engine)
Support Brackets (Pre SB PW4ENG 73−84)
Figure 407 (Sheet 1)
(Task 72−00−34−450−017)


W3P17
W3P15
EEC
WIRING HARNESS
SUPPORT TUBE
HPC CASE
BRACKET
NUT
(TYPICAL)
BOLT
(TYPICAL)
W3P15
CLAMP
(TYPICAL)
W3 HARNESS
W3P17
L-B2340 (0000)
PW V

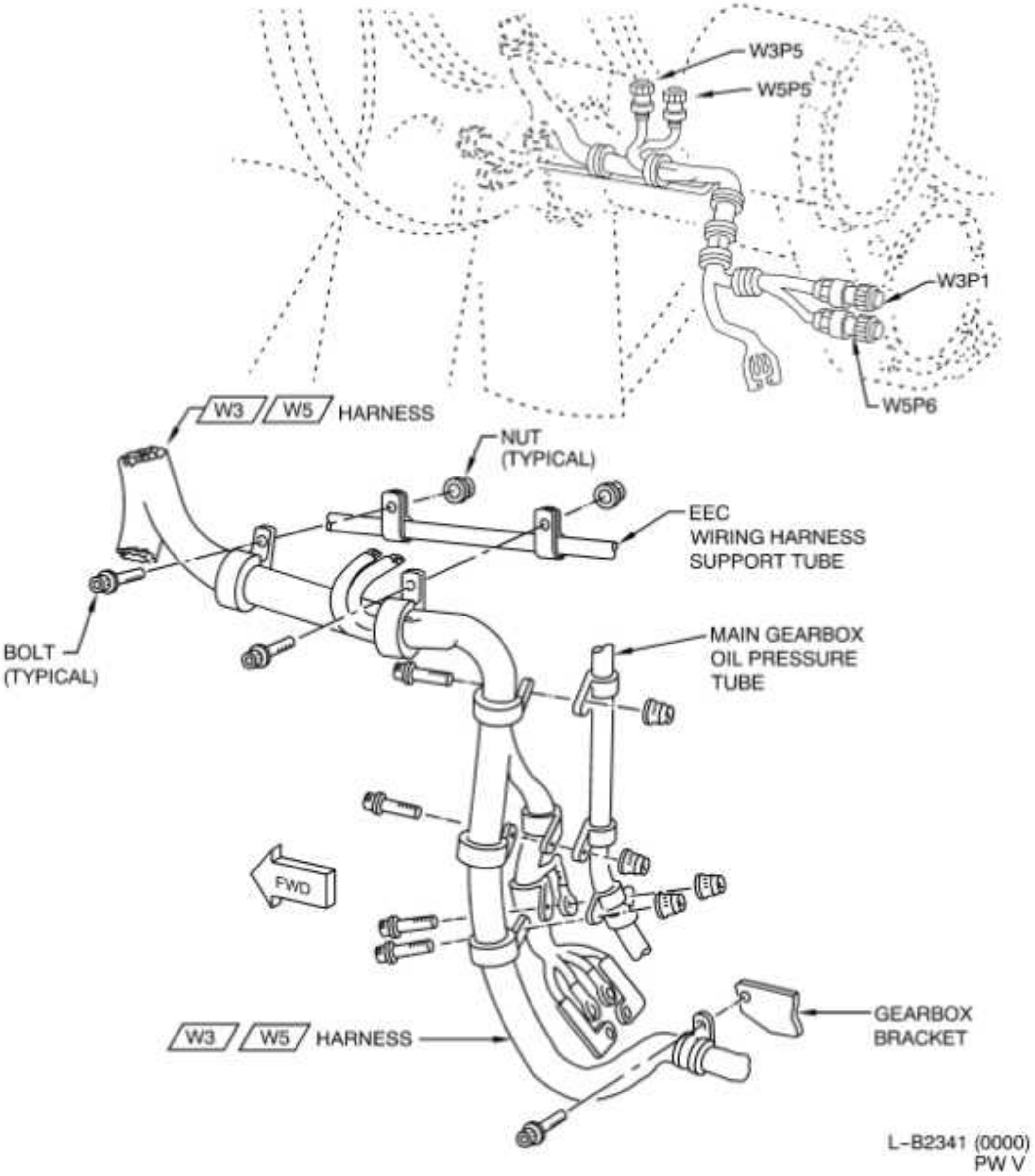
EEC Wiring Harness − W3 (Core Engine) Support
Brackets (Post SB PW4ENG 73−84) (For Engines
With And Without CN After Engine Serial Number)
Figure 407 (Sheet 2)
(Task 72−00−34−450−017)


W3P17
W3P15
EEC
WIRING HARNESS
SUPPORT TUBE
HPC CASE
BRACKET
NUT
(TYPICAL)
BOLT
(TYPICAL)
W3P15
CLAMP
(TYPICAL)
W3 HARNESS
W3P17
L-B2340 (0000)
PW V

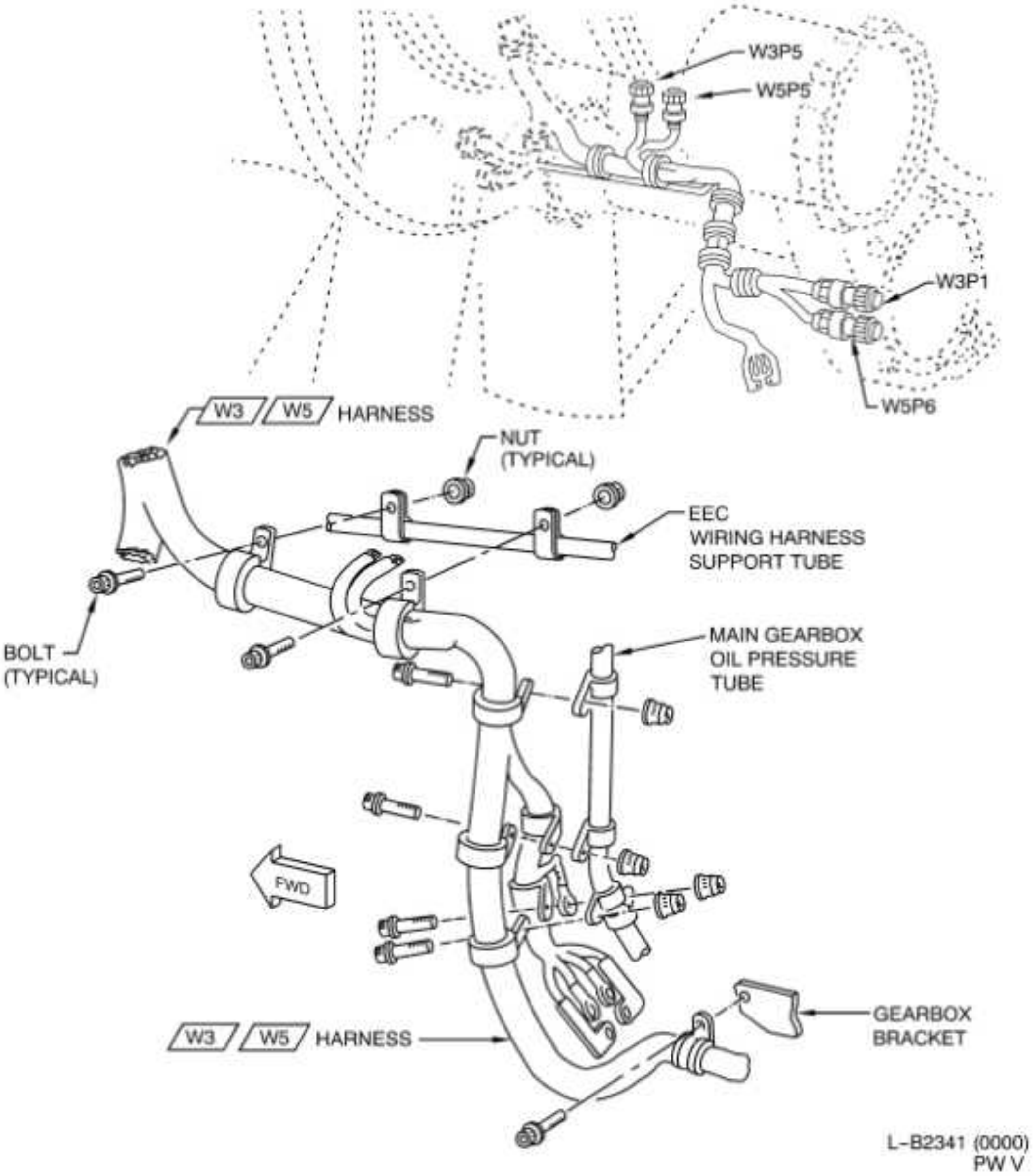
EEC Wiring Harness − W3 (Core Engine) Support
Brackets (For −3 Engines As Built By P&W)
Figure 407 (Sheet 3)
(Task 72−00−34−450−017)


W3P5
W5P5
W3P1
W5P6
W3P18
W3 / W5 HARNESS
NUT (TYPICAL)
EEC WIRING HARNESS SUPPORT TUBE
BOLT (TYPICAL)
MAIN GEARBOX OIL PRESSURE TUBE
FWD
W3 HARNESS
GEARBOX BRACKET
W5 HARNESS
L−A5748 (0391)
PW V

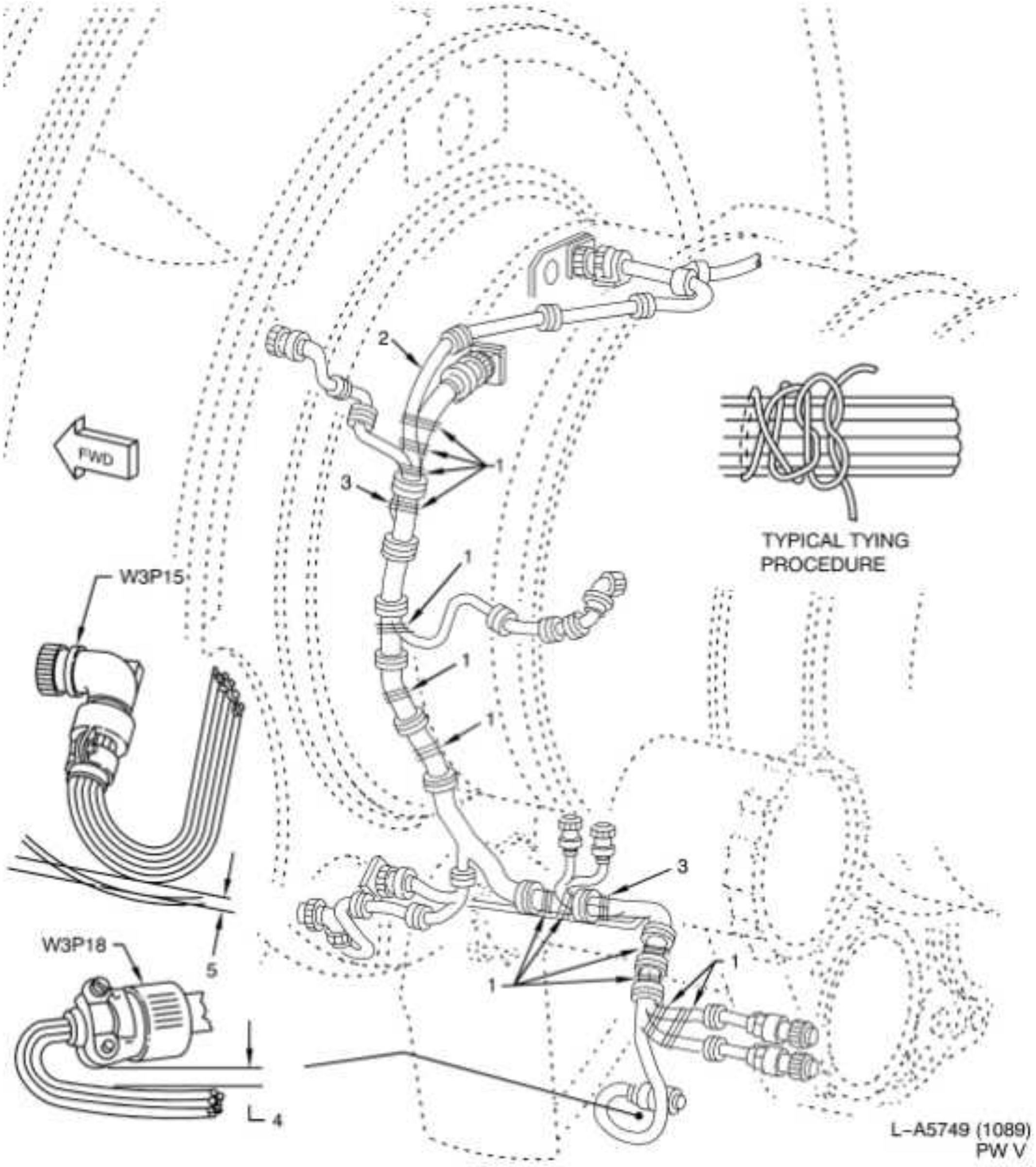
EEC Wiring Harness − W3 (Core Engine)
Support Brackets (Pre SB PW4ENG 73−84)
Figure 408 (Sheet 1)
(Task 72−00−34−450−017)


W3P5
W5P5
W3P1
W5P6
W3 / W5 HARNESS
NUT (TYPICAL)
EEC WIRING HARNESS SUPPORT TUBE
BOLT (TYPICAL)
MAIN GEARBOX OIL PRESSURE TUBE
FWD
W3 / W5 HARNESS
GEARBOX BRACKET
L−B2341 (0000)
PW V

EEC Wiring Harness − W3 (Core Engine) Support
Brackets (Post SB PW4ENG 73−84) (For Engines
With And Without CN After Engine Serial Number)
Figure 408 (Sheet 2)
(Task 72−00−34−450−017)


W3P5
W5P5
W3P1
W5P6
W3 / W5 HARNESS
NUT (TYPICAL)
EEC WIRING HARNESS SUPPORT TUBE
BOLT (TYPICAL)
MAIN GEARBOX OIL PRESSURE TUBE
FWD
W3 / W5 HARNESS
GEARBOX BRACKET
L-B2341 (0000)
PW V

EEC Wiring Harness − W3 (Core Engine) Support
Brackets (For −3 Engines As Built By P&W)
Figure 408 (Sheet 3)
(Task 72−00−34−450−017)

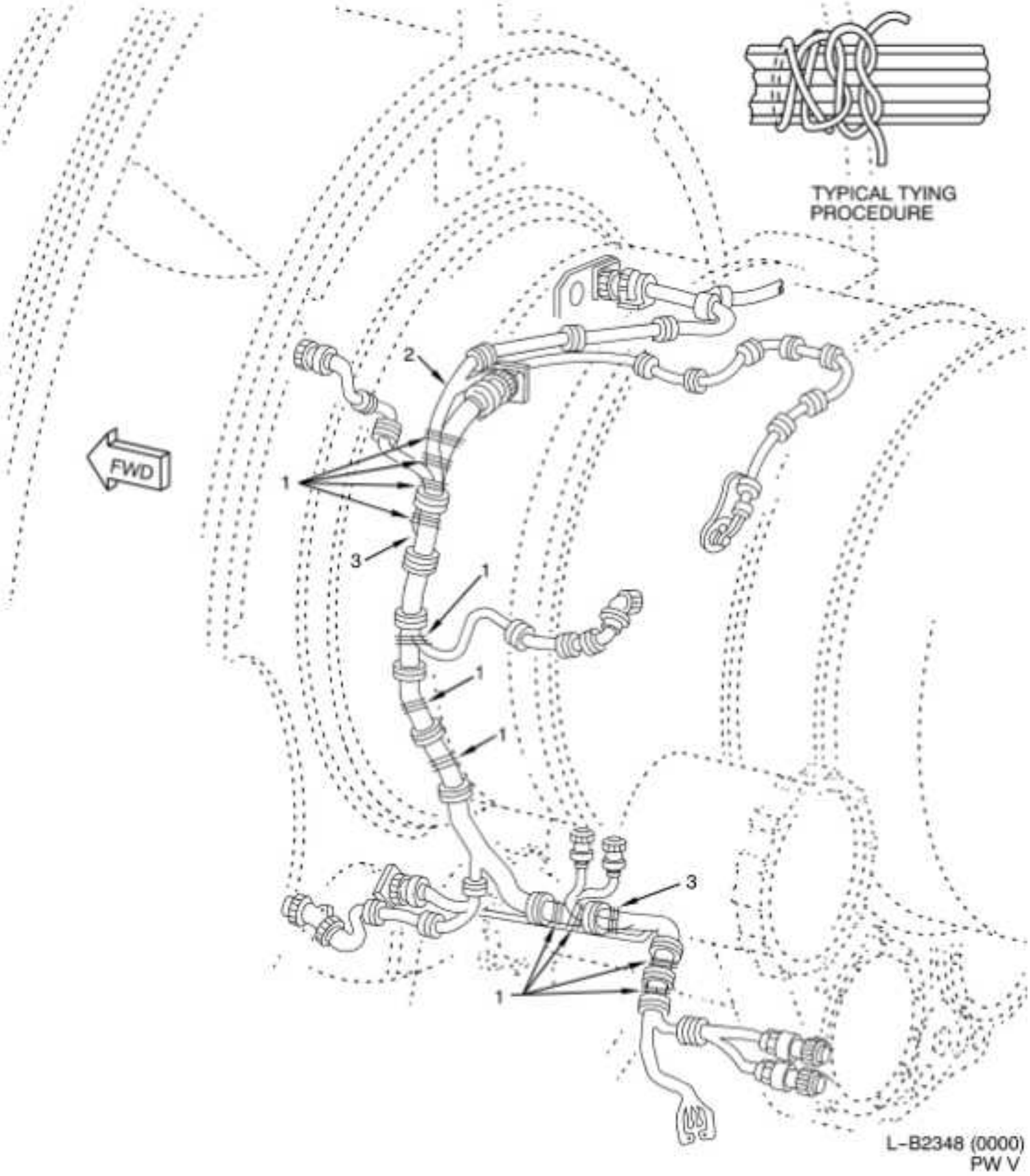

2
1
3
FWD
TYPICAL TYING PROCEDURE
W3P15
1
1
1
3
W3P18
5
1
1
4
L−A5749 (1089)
PW V

EEC Wiring Harness − W3 (Core Engine) (Pre SB PW4ENG 73−84)
Figure 409 (Sheet 1)
(Task 72−00−34−450−017)

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−18

1. Tie
2. The Harness Must Be Put Forward In This Location.
3. Make A Loop In The Harness And Put The Loop Through The Clamp. Tie The Loop And The Harness Together.
4. 0.375 Inch (9.525 mm) Minimum Clearance Required Between The W3P18 Connector And The Harness.
5. 0.500 Inch (12.700 mm) Minimum Clearance Required Between The W3 Harness And The Intermediate Case Vee Groove.

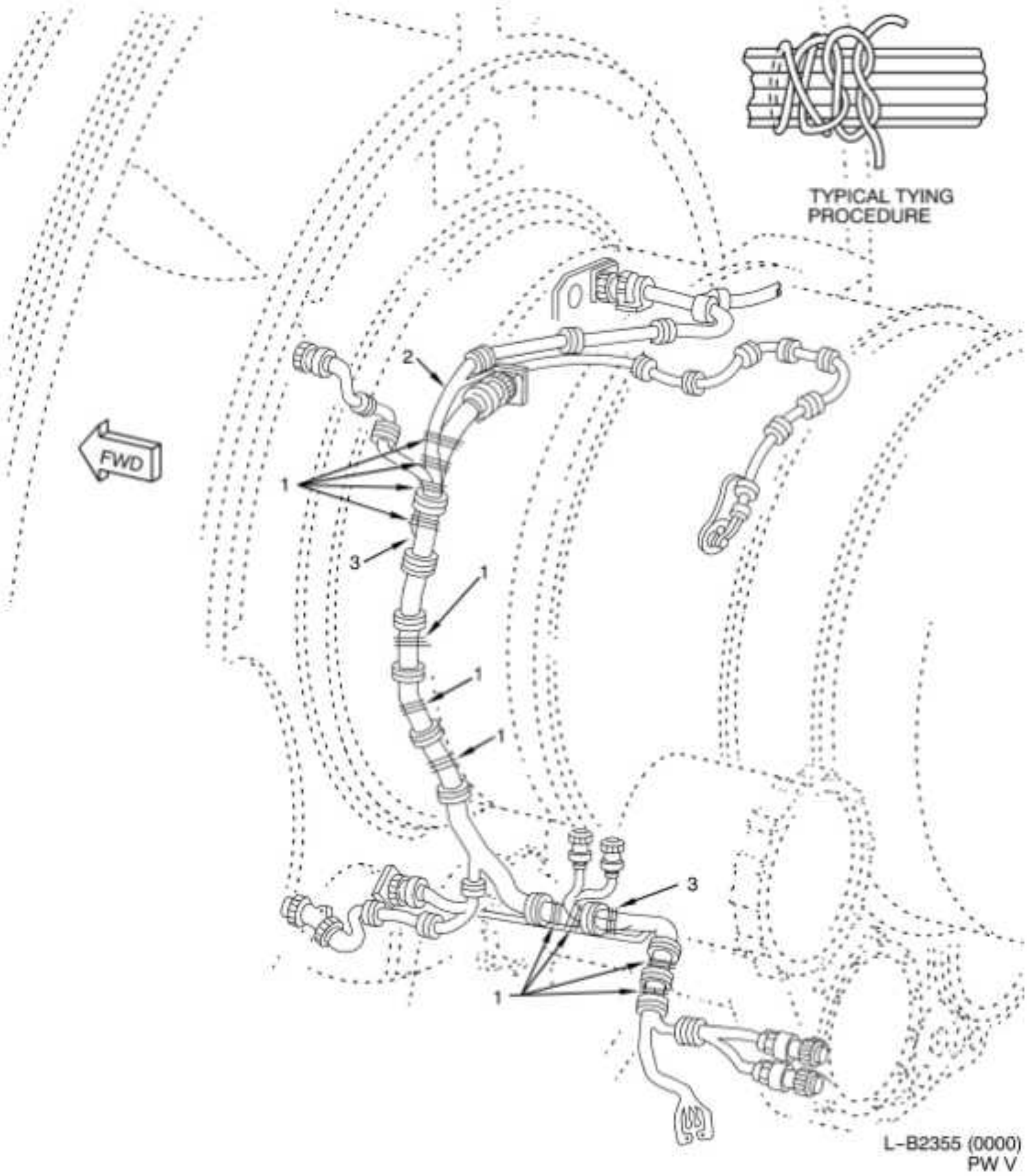
Key to Figure 409 (Sheet 1)


TYPICAL TYING PROCEDURE
FWD
2
1
3
1
1
1
3
1
L-B2348 (0000)
PW V

EEC Wiring Harness − W3 (Core Engine)
(Post SB PW4ENG 73−84) (Pre SB PW4ENG 75−106)
Figure 409 (Sheet 2)
(Task 72−00−34−450−017)

1. Tie
2. The Harness Must Be Put Forward In This Location.
3. Make A Loop In The Harness And Put The Loop Through The Clamp. Tie The Loop And The Harness Together.

Key to Figure 409 (Sheet 2)

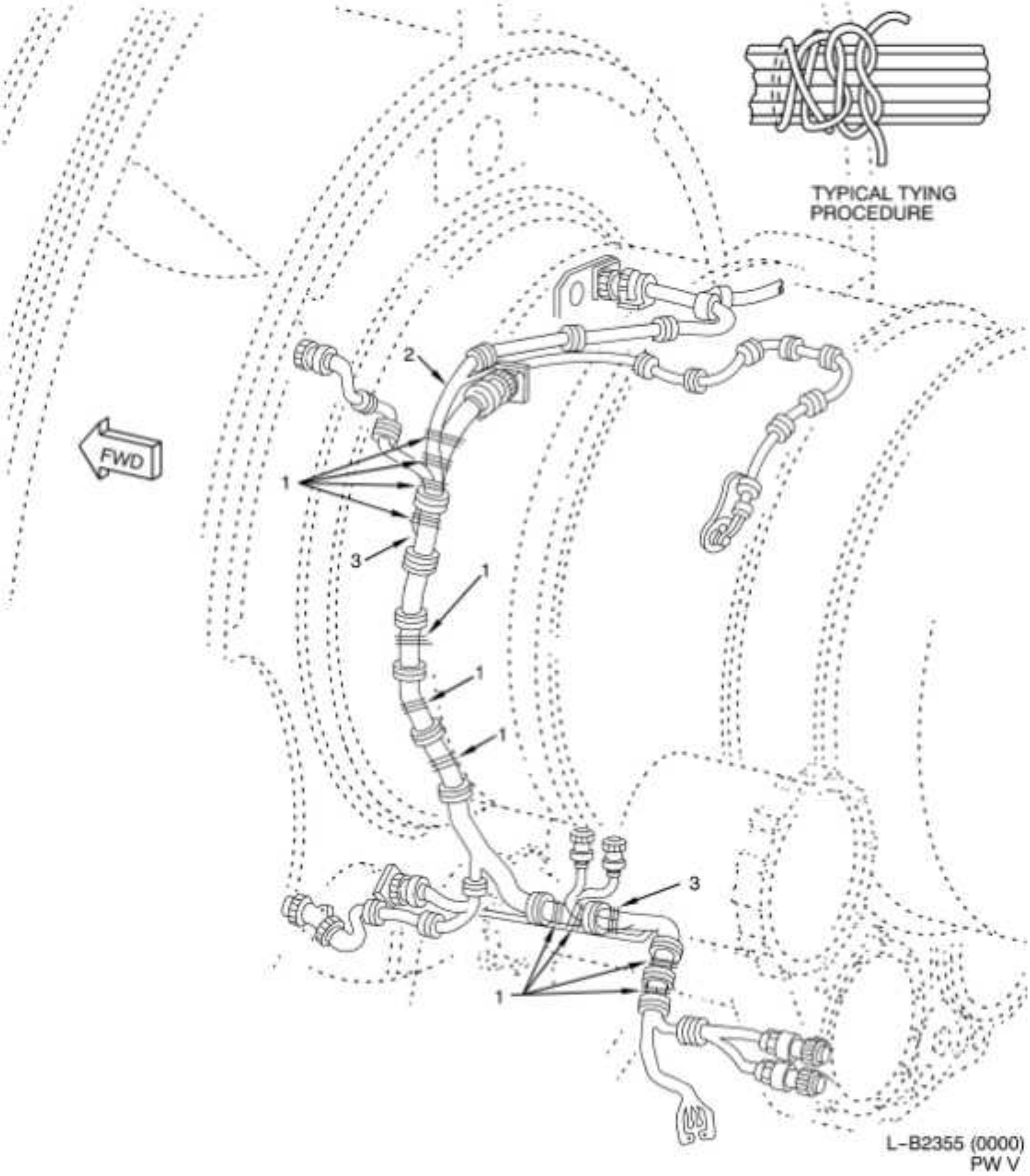

TYPICAL TYING PROCEDURE
FWD
2
1
3
1
1
1
3
1
L−B2355 (0000)
PW V

EEC Wiring Harness − W3 (Core Engine) (Post SB PW4ENG 73−84, SB PW4ENG 75−106 or SB PW4ENG 72−572) (For −3 Engines With CN After Engine Serial Number)
Figure 409 (Sheet 3)
(Task 72−00−34−450−017)

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−18

1. Tie
2. The Harness Must Be Put Forward In This Location.
3. Make A Loop In The Harness And Put The Loop Through The Clamp. Tie The Loop And The Harness Together.

Key to Figure 409 (Sheet 3)


TYPICAL TYING PROCEDURE
FWD
2
1
3
1
1
1
3
1
L-B2355 (0000)
PW V

EEC Wiring Harness − W3 (Core Engine)
(For −3 Engines As Built By P&W)
Figure 409 (Sheet 4)
(Task 72−00−34−450−017)

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−18

1. Tie
2. The Harness Must Be Put Forward In This Location.
3. Make A Loop In The Harness And Put The Loop Through The Clamp. Tie The Loop And The Harness Together.

Key to Figure 409 (Sheet 4)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72−00−34−450−018:

1. Install EEC Wiring Harness − W4 (Core Engine)

A. General

(1) To install the EEC wiring harness − W3, see 72−00−34, Installation−18 Task 72−00−34−450−017.

(2) To install the EEC wiring harness − W5, see 72−00−34, Installation−20 Task 72−00−34−450−019.

B. Equipment And Materials Required

Standard Tools:
Glenair TG−70 Strap Wrench or
Glenair TG−69 Soft Jawed Pliers

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P11−009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Tape − Lacing And Tying, PN 1B1773		
Lockwire, AS3214−01		

C. Procedure
See Figure 401, Figure 402, Figure 403, Figure 404, Figure 405, Figure 406, Figure 407, Figure 408, Figure 409, Figure 410 and Figure 411.

NOTE: Items referred to as numbers in parenthesis in text are identified in Figure 401.

CAUTION: SEE 72−00−00, INSTALLATION−00 FOR THE GENERAL INSTALLATION REQUIREMENTS FOR THE ELECTRICAL HARNESSES, LEADS AND CABLES.

CAUTION: DO NOT TWIST OR BEND THE HARNESS BADLY DURING THE INSTALLATION, OR DAMAGE TO THE HARNESS CAN OCCUR.

CAUTION: BE SURE AND USE THE CORRECT PART NUMBER W4 WIRING HARNESS FOR REPLACEMENT. INTERCHANGEABILITY WITH THE START/STABILITY

BLEED VALVE SOLENOID (5 O'CLOCK POSITION) IS EFFECTED. REFER TO SB PW4ENG 73−70 FOR SELECTION.

(1) If the top and lower harness support brackets (401/1, 401/5) have been previously removed from the right side of the HPC case, install the brackets as follows:

(a) Install the top harness support bracket (401/1) to the turbine cooling valve actuator bracket (401/2) and to the bracket (401/3) on the compressor stator cylinder support. Attach the support bracket (401/1) with bolts, threads lubricated with Engine Oil P03−001, washers (next to the boltheads) and nuts. Torque the bolts and nut to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(b) Install the lower harness support bracket (401/5) to the outer face of the cross brace on the compressor stator cylinder support (401/4). Attach the support bracket (401/5) with bolts, threads lubricated with Engine Oil P03−001, (boltheads inboard), washers (next to nuts) and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Attach bracket (401/6) to the inner face of the lower harness support bracket (401/5) with bolts, threads lubricated with Engine Oil P03−001, (boltheads outboard), washer (next to boltheads) and nuts handtight.

(d) Put a feeler gage between the end of the bracket (401/6) and the compressor stator cylinder support (401/7) so that the brackets are parallel with each other, and the bolts installed in step (c), are aligned in the bolt holes. Have a second person torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m) while holding the brackets in position along with the feeler gage.

(e) Remove the feeler gage and find the thickness used. Record the thickness. Use a minimum amount of shims. Use shims 0 − 4 (0.038 − 0.048 inch) (0.965 − 1.219 mm) and/or shims 0 − 8 (0.022 − 0.028 inch) (0.559 − 0.711 mm), as required, that will be equal to, or up to 0.010 inch (0.254 mm) less than the thickness recorded.

(f) Install the shims between the brackets. Align the bolt holes and attach the brackets together with bolts, threads lubricated with Engine Oil P03-001, (boltheads up) and nuts. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m). Make sure a maximum gap of 0.010 inch (0.254 mm) is between the shims and the brackets after the bolts are torqued.

(2) Install the W4 harness on the right side of the engine.

(a) Remove the protective closure. Install the W4J25 connector flange to the HPC case bracket located at the 1 o'clock position. Install the harness bracket (cut-out rearward) to attach the connector flange between the two brackets. Align the bolt holes and install the bolts, threads lubricated with Engine Oil P03-001. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m). See Figure 404.

(3) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 72-572 or Pre SB PW4ENG 75-106 or SB PW4ENG 72-756) Connect the W4P10 harness connector to the HPC secondary flow control valve located at the 3:30 o'clock position as follows. See Figure 403.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11-009. Let dry.

CAUTION: FOR THESE MODELS: 4152, 4156A, 4158
USE THE CORRECT ASSEMBLY TORQUE. USE OF THE WRONG TORQUE CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTENING PROTECTION.

(b) FOR THESE MODELS: 4152, 4156A, 4158
(Reference 2154) Tighten and torque the connector to 21 - 26 lb-in. (2.373 - 2.938 N.m). Lockwire the connector nut with AS3214-01 Lockwire.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
SB PW4ENG 72-572 or SB PW4ENG 75-106 or

SB PW4ENG 72-756 removes connector W4P10 from the W4 wiring harness. See Figure 403 (Sheet 2).

(4) FOR THESE MODELS: 4152, 4156A, 4158
(SB PW4ENG 72-572 or Pre SB PW4ENG 75-106 or SB PW4ENG 72-756) Connect the W4P21 harness connector to the turbine vane and blade cooling air valve located at the 3 o'clock position as follows. See Figure 403.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11-009. Let dry.

CAUTION: FOR THESE MODELS: 4152, 4156A, 4158
USE THE CORRECT ASSEMBLY TORQUE. USE OF THE WRONG TORQUE CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTENING PROTECTION.

(b) FOR THESE MODELS: 4152, 4156A, 4158
(Reference 2156) Tighten and torque the connector to 30 - 35 lb-in. (3.390 - 3.954 N.m). Lockwire the connector nut with AS3214-01 Lockwire.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
SB PW4ENG 72-572 or SB PW4ENG 75-106 or SB PW4ENG 72-756 removes connector W4P21 from the W4 wiring harness. See Figure 403 (Sheet 2).

(5) Connect the W4 harness connectors (given below) to the mating harness receptacles as follows. See Figure 403. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11-009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

Connector	Component	Location
W4P16	Turbine Case Cooling (TCC) Air Valve Actuator	2 O'Clock
W4P2	Fuel Metering Unit (Forward Connector)	Front Of Fuel Pump 5 O'Clock
W4P3	Variable Stator Vane Actuator (Lower Connector)	4 O'Clock
W4P4	Ninth Stage	Intermediate Case 5

Connector	Component	Location
(CONTINUED)		
	Start/Stability (2.9) Bleed Valve Solenoid (Outboard Connector)	O'Clock
W4P19	EEC Speed Transducer (N1)	Intermediate Case 4:30 O'Clock
W4P23	EEC Speed Transducer (N1) (Engines Incorporating PMUX or SCU)	Intermediate Case 4:30 O'Clock
W1P25	Harness Connector To W4J25 Harness Connector	1 O'Clock

(6) Adjust the W4 harness for any necessary clearances as required. Install the clamps at all clamp points. Refer to the figures. Attach the clamps loosely to the engine with bolts, spacers and/or nuts, threads lubricated with Engine Oil P03−001.

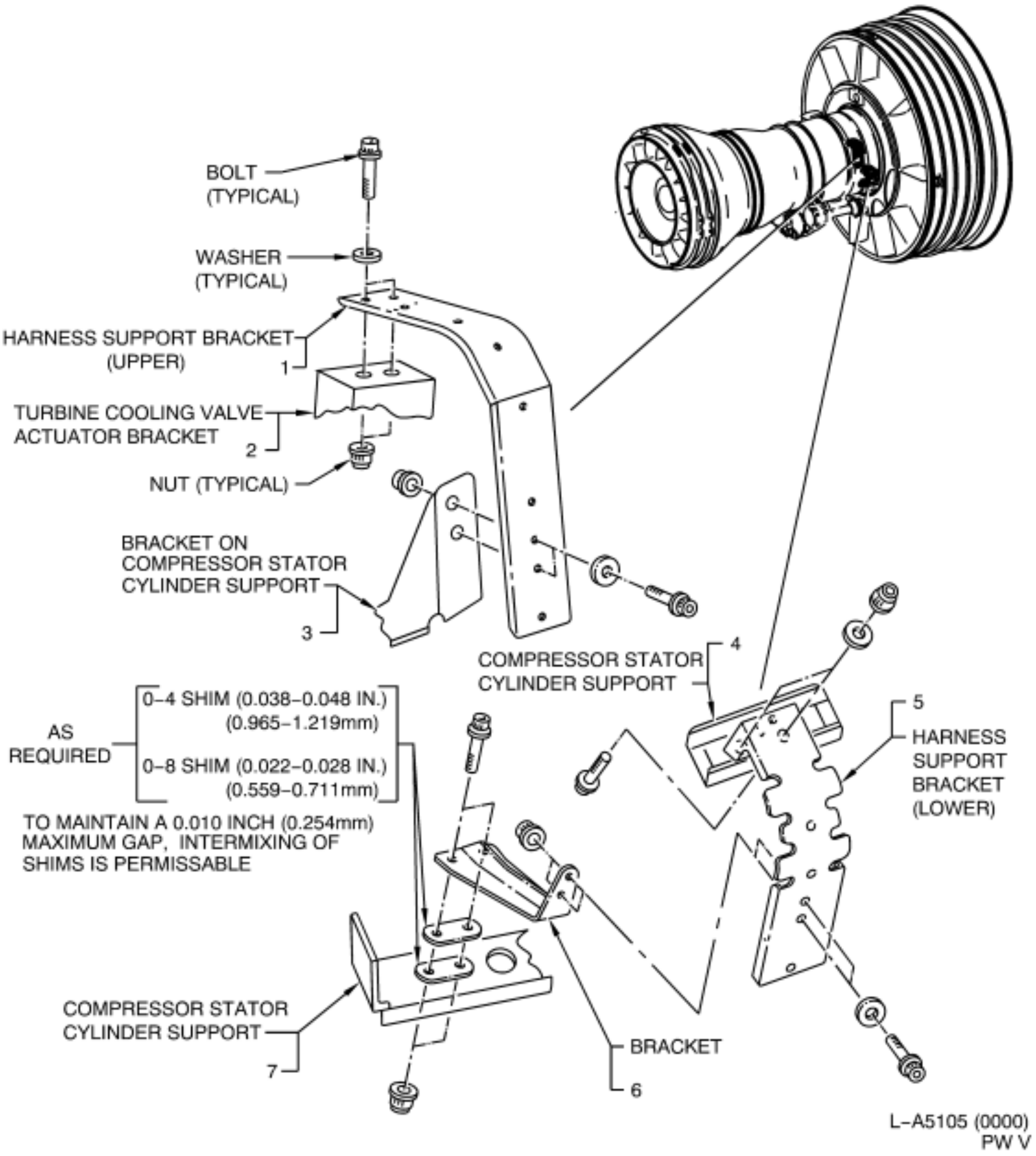
NOTE: Use different clamp sizes on the harnesses to prevent harness movement when tightened. See the Illustrated Parts Catalog for selection of the clamp sizes and part numbers.

(7) Make sure that the harnesses are not tight to the point where sharp bends are caused, and that the harnesses do not touch any engine parts or plumbing. Provide a drip loop on the leads where the wires run downward into the connector.

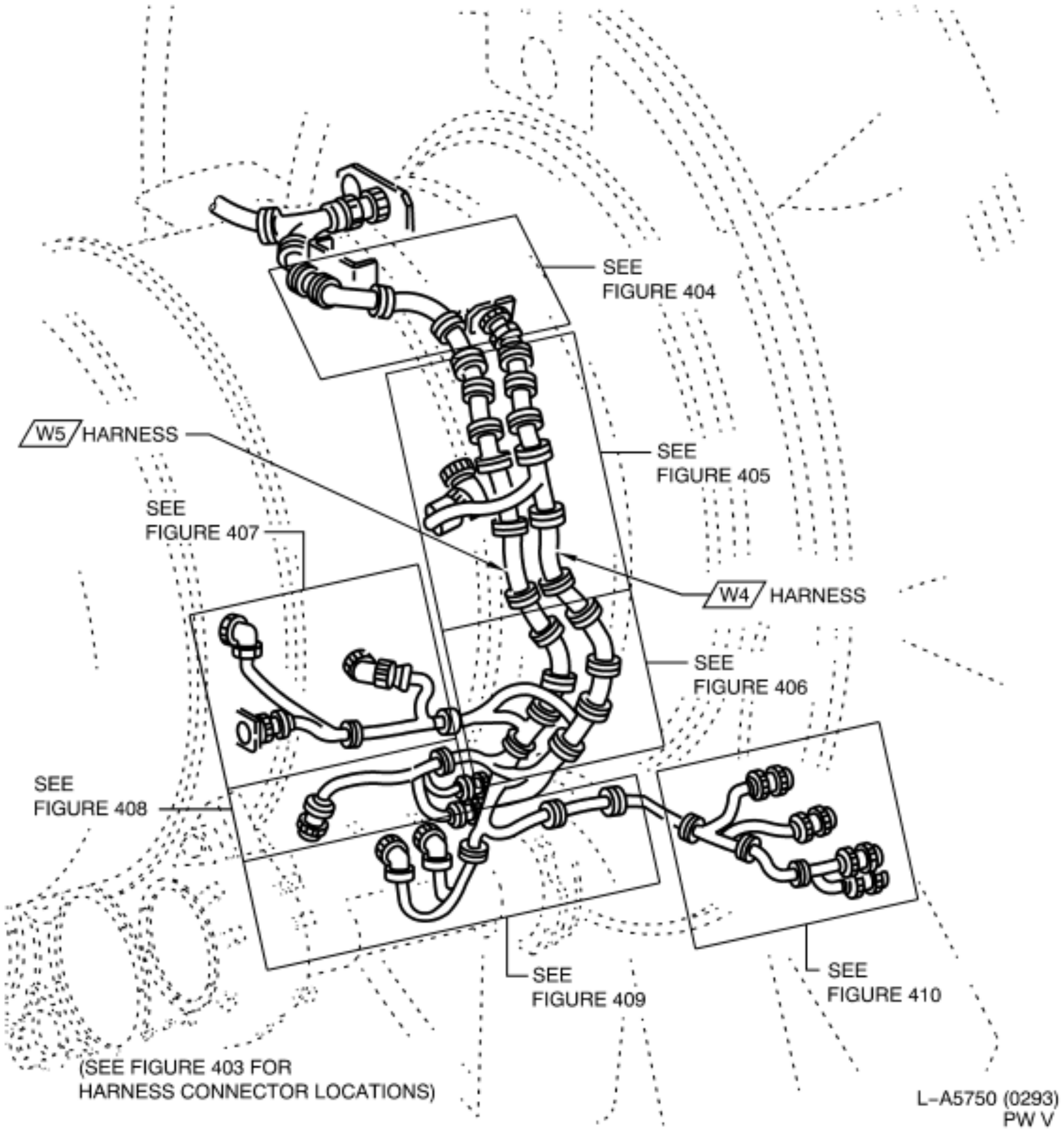
(8) Tighten all the previously installed clamp nuts and/or bolts to a torque of 36 − 40 lb−in. (4.067 − 4.519 N.m).

(9) Tie the harnesses as shown in Figure 411.

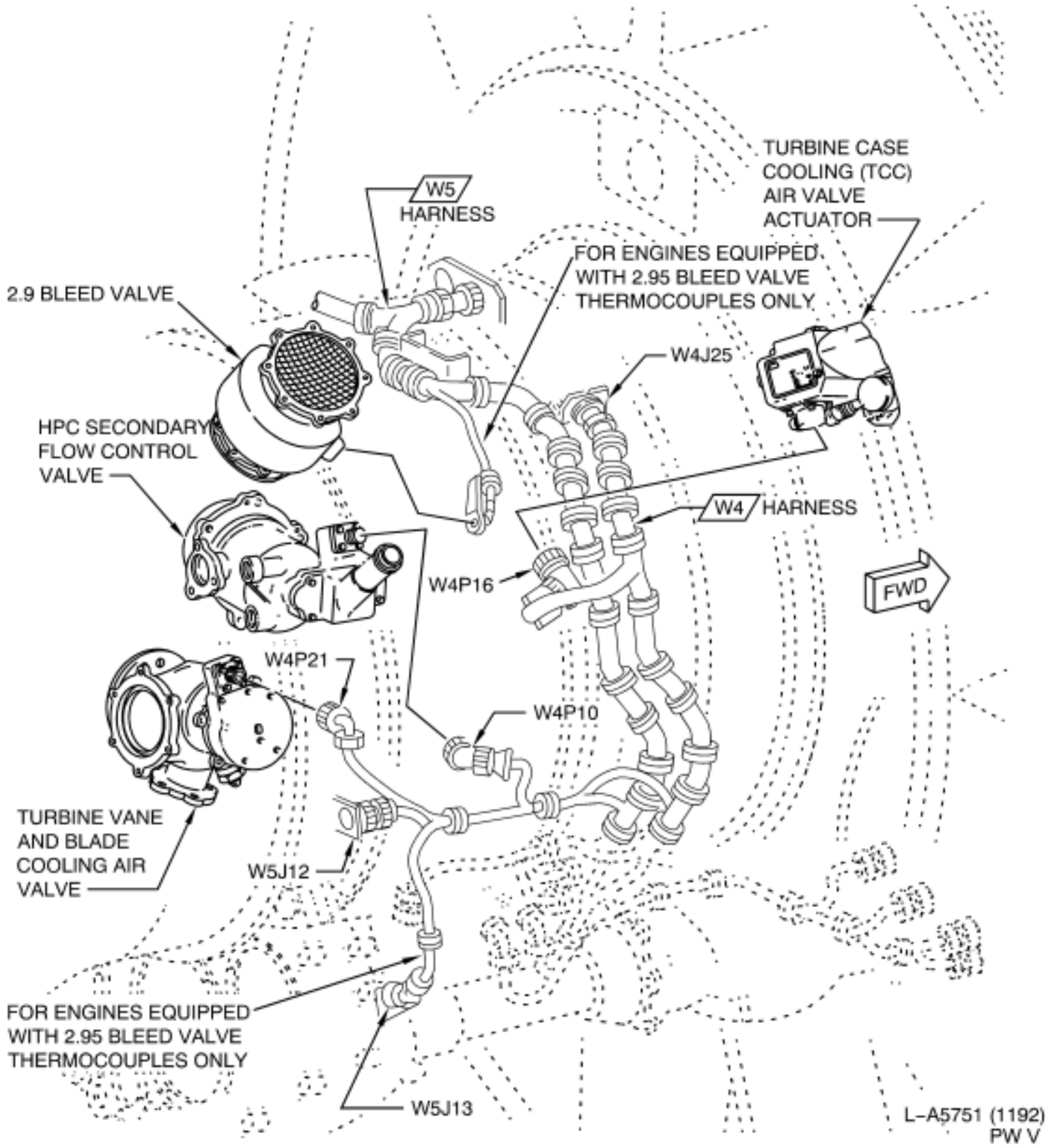
NOTE: Ties must be made with a clove hitch with an extra loop, followed by a square knot, as shown in Figure 411. The clove hitch and square knot must be tightened satisfactorily in place. The harnesses must not be stressed or damaged by overtightening the ties. Where the harness bundles are more than 1.500 inches (38.100 mm) in diameter, the lacing tape must be doubled. Cut the ends of the lacing tape to a length of 0.250 − 0.500 inch (6.350 − 12.700 mm).


BOLT (TYPICAL)
WASHER (TYPICAL)
HARNESS SUPPORT BRACKET (UPPER)
1
TURBINE COOLING VALVE ACTUATOR BRACKET
2
NUT (TYPICAL)
BRACKET ON COMPRESSOR STATOR CYLINDER SUPPORT
3
COMPRESSOR STATOR CYLINDER SUPPORT
4
5
HARNESS SUPPORT BRACKET (LOWER)
AS REQUIRED
0−4 SHIM (0.038−0.048 IN.) (0.965−1.219mm)
0−8 SHIM (0.022−0.028 IN.) (0.559−0.711mm)
TO MAINTAIN A 0.010 INCH (0.254mm) MAXIMUM GAP, INTERMIXING OF SHIMS IS PERMISSABLE
COMPRESSOR STATOR CYLINDER SUPPORT
7
BRACKET
6
L−A5105 (0000)
PW V

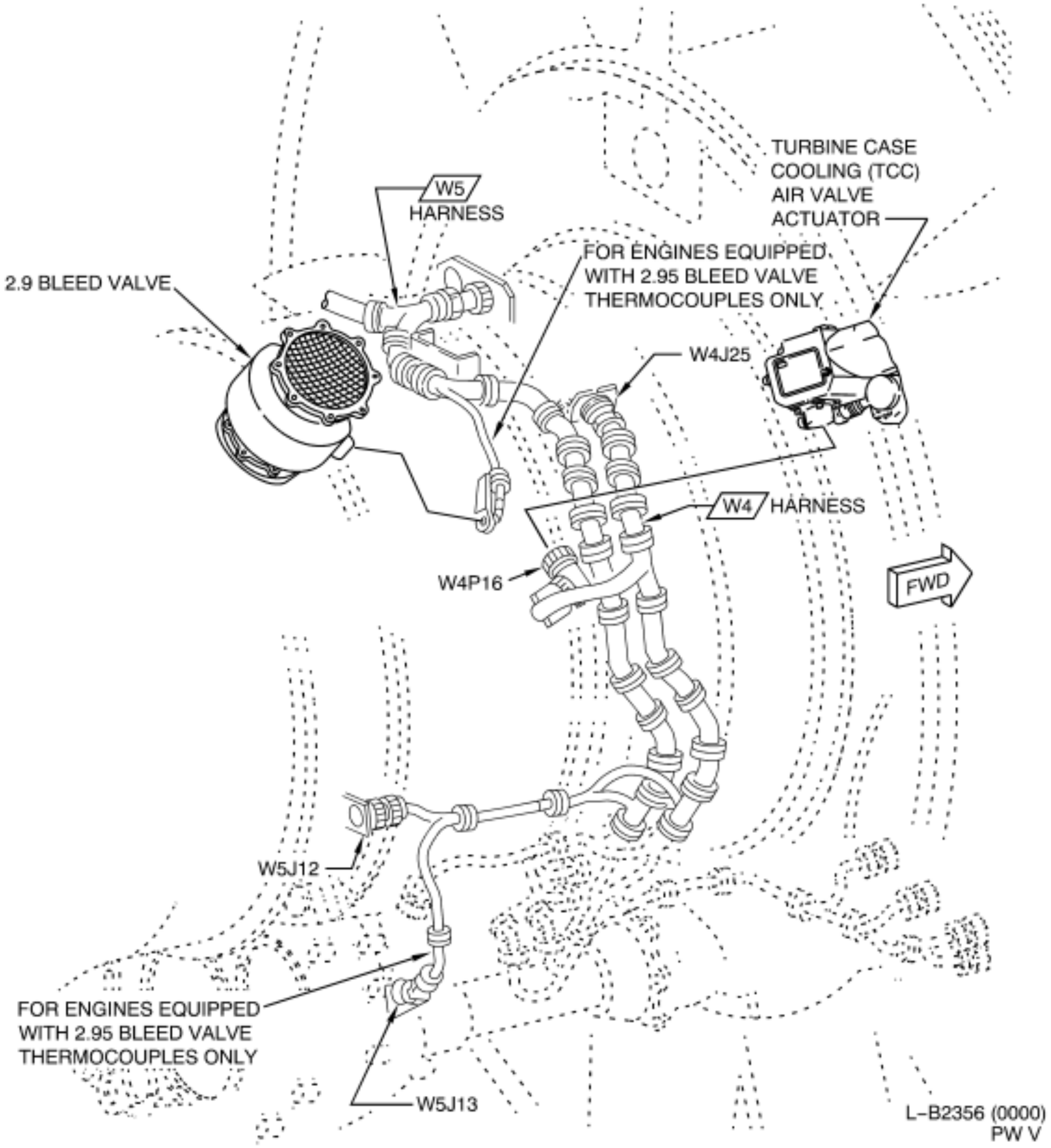
EEC Wiring Harness (Core Engine) Support Brackets
Figure 401
(Task 72−00−34−450−018)


SEE FIGURE 404
W5 HARNESS
SEE FIGURE 405
SEE FIGURE 407
W4 HARNESS
SEE FIGURE 406
SEE FIGURE 408
SEE FIGURE 409
SEE FIGURE 410
(SEE FIGURE 403 FOR HARNESS CONNECTOR LOCATIONS)
L−A5750 (0293)
PW V

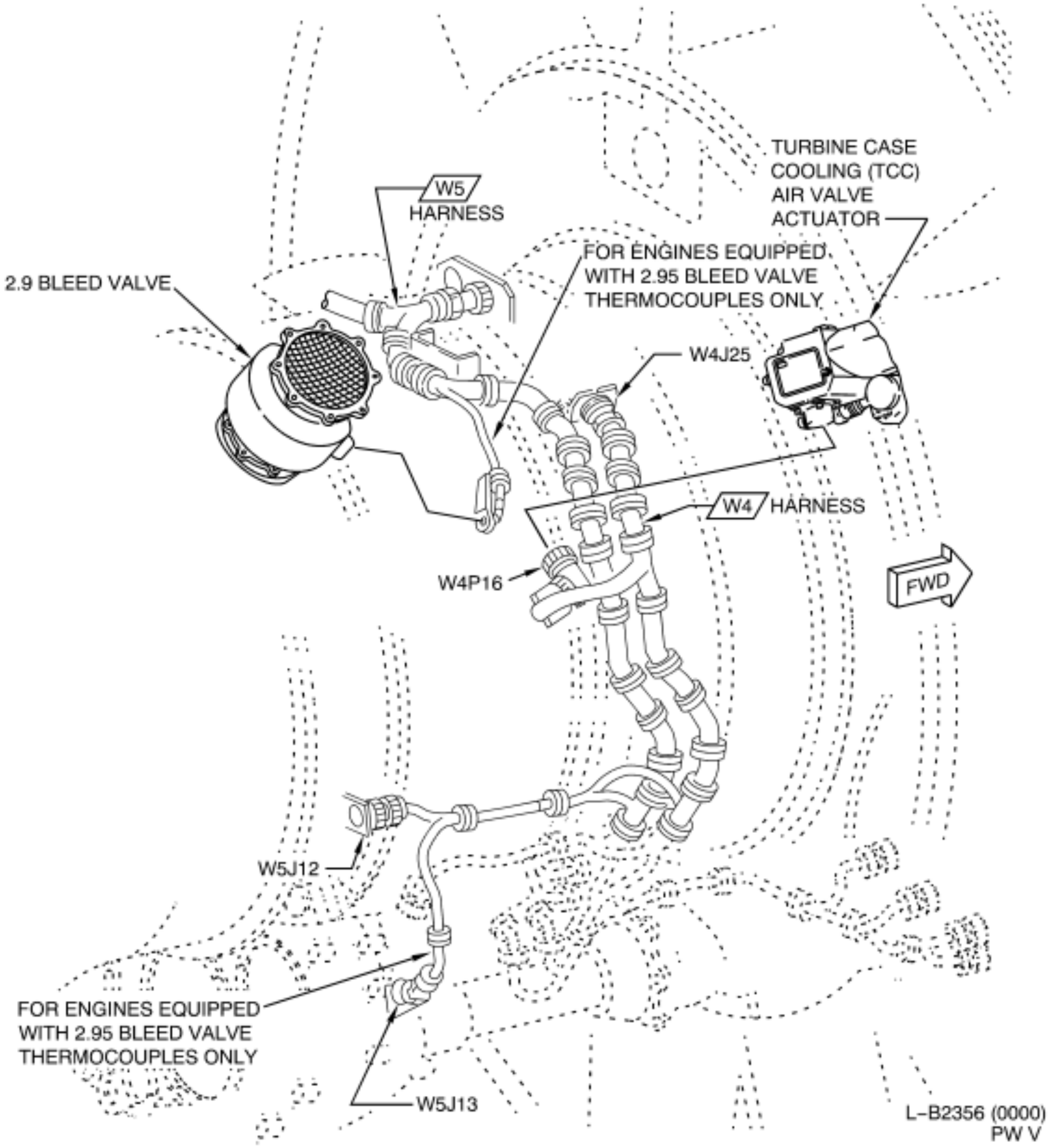
EEC Wiring Harness − W4 (Core Engine)
Figure 402
(Task 72−00−34−450−018)


TURBINE CASE
COOLING (TCC)
AIR VALVE
ACTUATOR
W5
HARNESS
FOR ENGINES EQUIPPED
WITH 2.95 BLEED VALVE
THERMOCOUPLES ONLY
2.9 BLEED VALVE
W4J25
HPC SECONDARY
FLOW CONTROL
VALVE
W4
HARNESS
W4P16
FWD
W4P21
W4P10
TURBINE VANE
AND BLADE
COOLING AIR
VALVE
W5J12
FOR ENGINES EQUIPPED
WITH 2.95 BLEED VALVE
THERMOCOUPLES ONLY
W5J13
L−A5751 (1192)
PW V

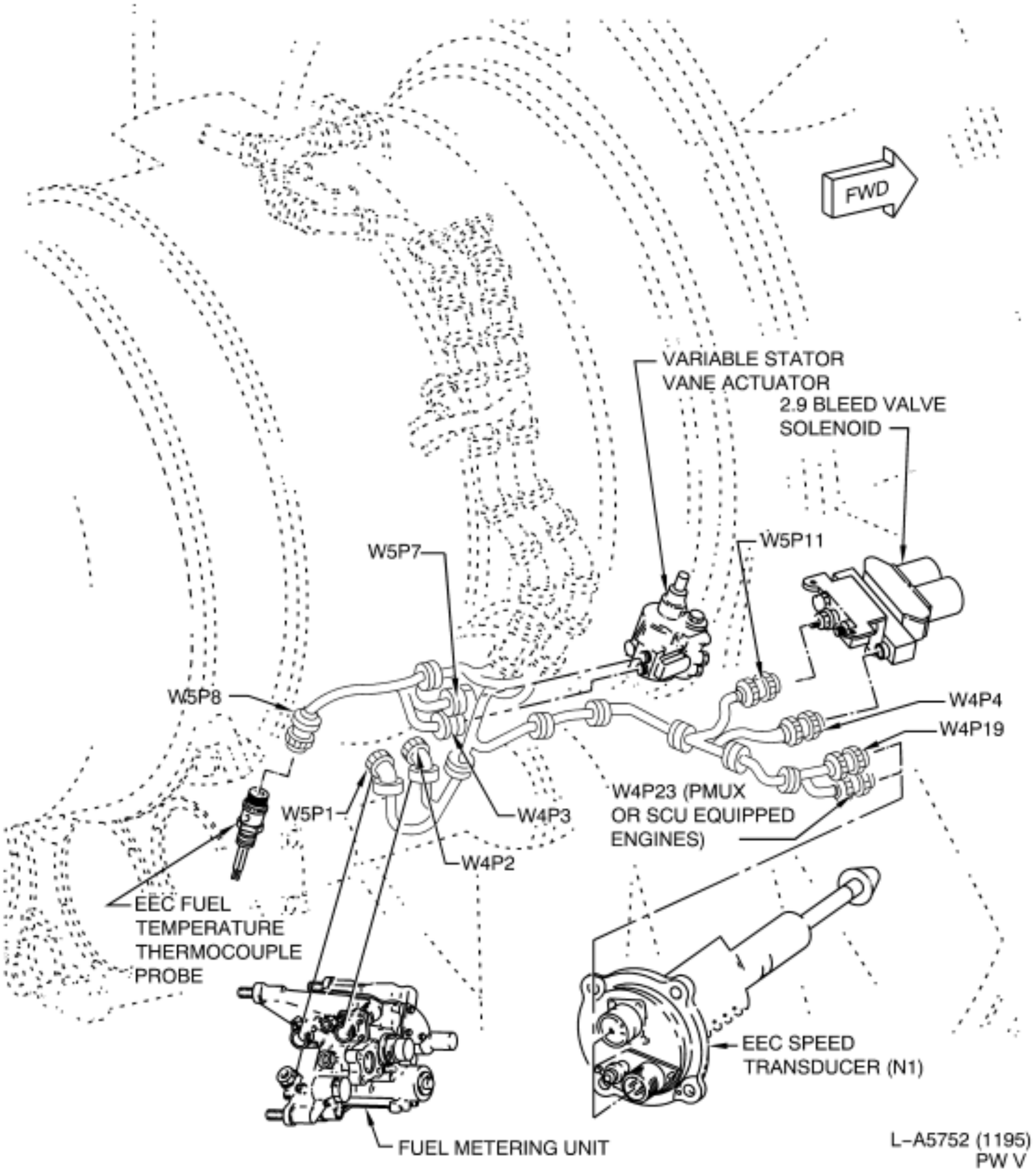
EEC Wiring Harness − W4 (Core Engine) (Pre SB PW4ENG 75−106)
Figure 403 (Sheet 1)
(Task 72−00−34−450−018)


TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
W5 HARNESS
2.9 BLEED VALVE
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W4J25
W4 HARNESS
W4P16
FWD
W5J12
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5J13
L-B2356 (0000)
PW V

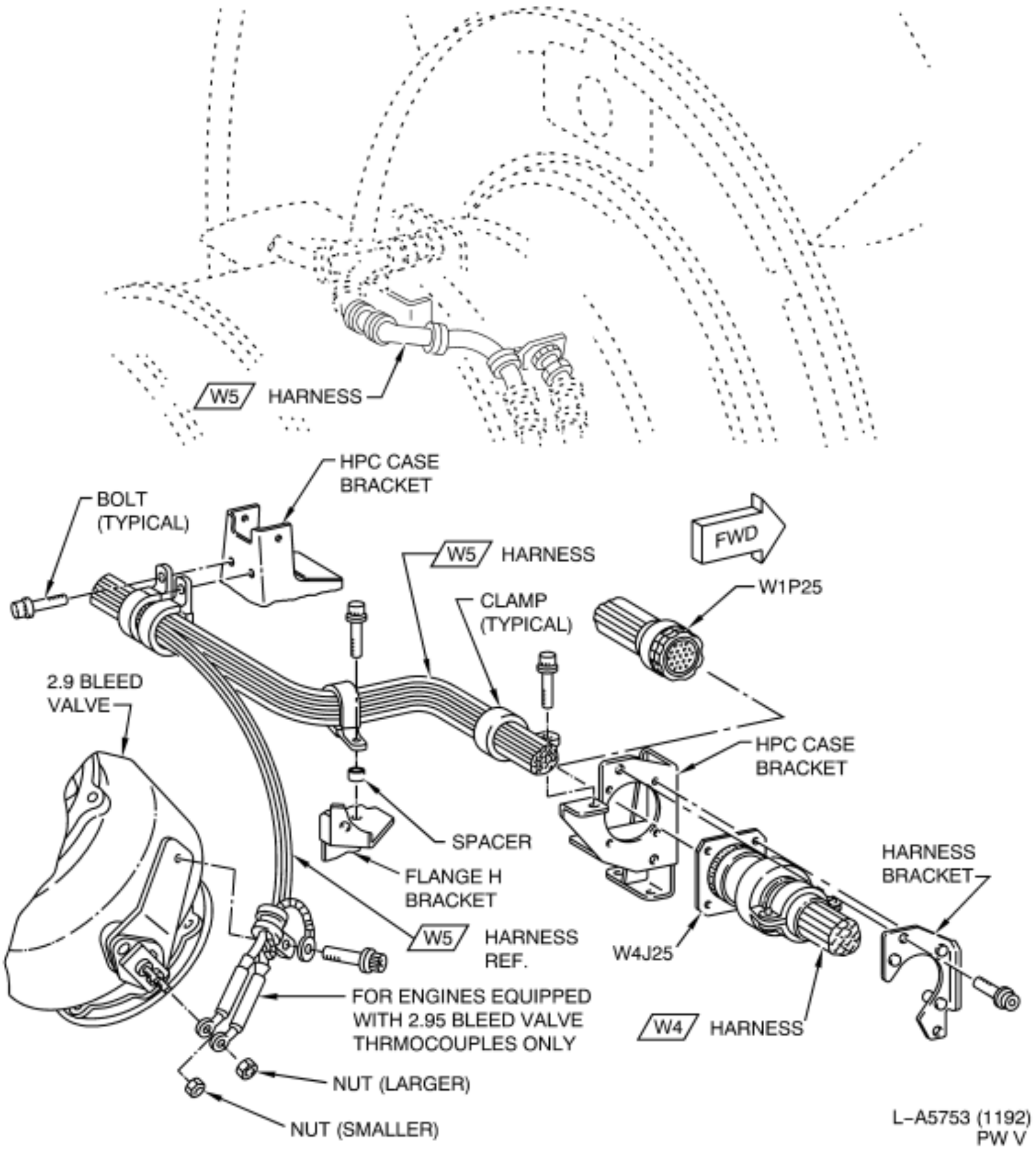
EEC Wiring Harness - W4 (Core Engine) (Post SB PW4ENG 72-572 or SB PW4ENG 75-106 or SB PW4ENG 72-756)
(For -3 Engines With CN After Engine Serial Number)
Figure 403 (Sheet 2)
(Task 72-00-34-450-018)


TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
W5 HARNESS
2.9 BLEED VALVE
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W4J25
W4 HARNESS
W4P16
FWD
W5J12
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5J13
L-B2356 (0000)
PW V

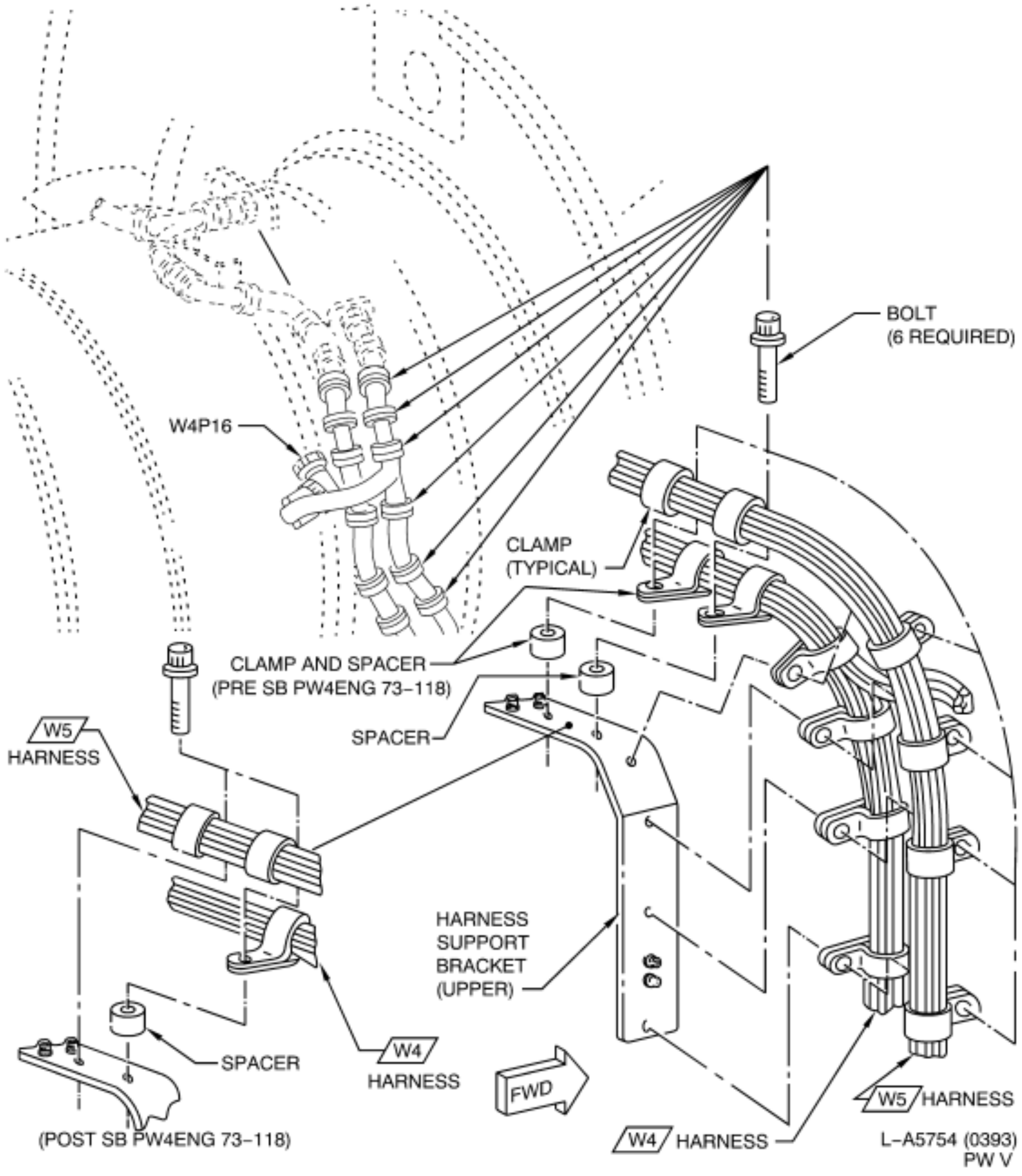
EEC Wiring Harness - W4 (Core Engine) (For -3 Engines As Built By Pratt & Whitney)
Figure 403 (Sheet 3)
(Task 72-00-34-450-018)


FWD
VARIABLE STATOR VANE ACTUATOR
2.9 BLEED VALVE SOLENOID
W5P11
W5P7
W5P8
W4P4
W4P19
W5P1
W4P3
W4P23 (PMUX OR SCU EQUIPPED ENGINES)
W4P2
EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
EEC SPEED TRANSDUCER (N1)
FUEL METERING UNIT
L−A5752 (1195)
PW V

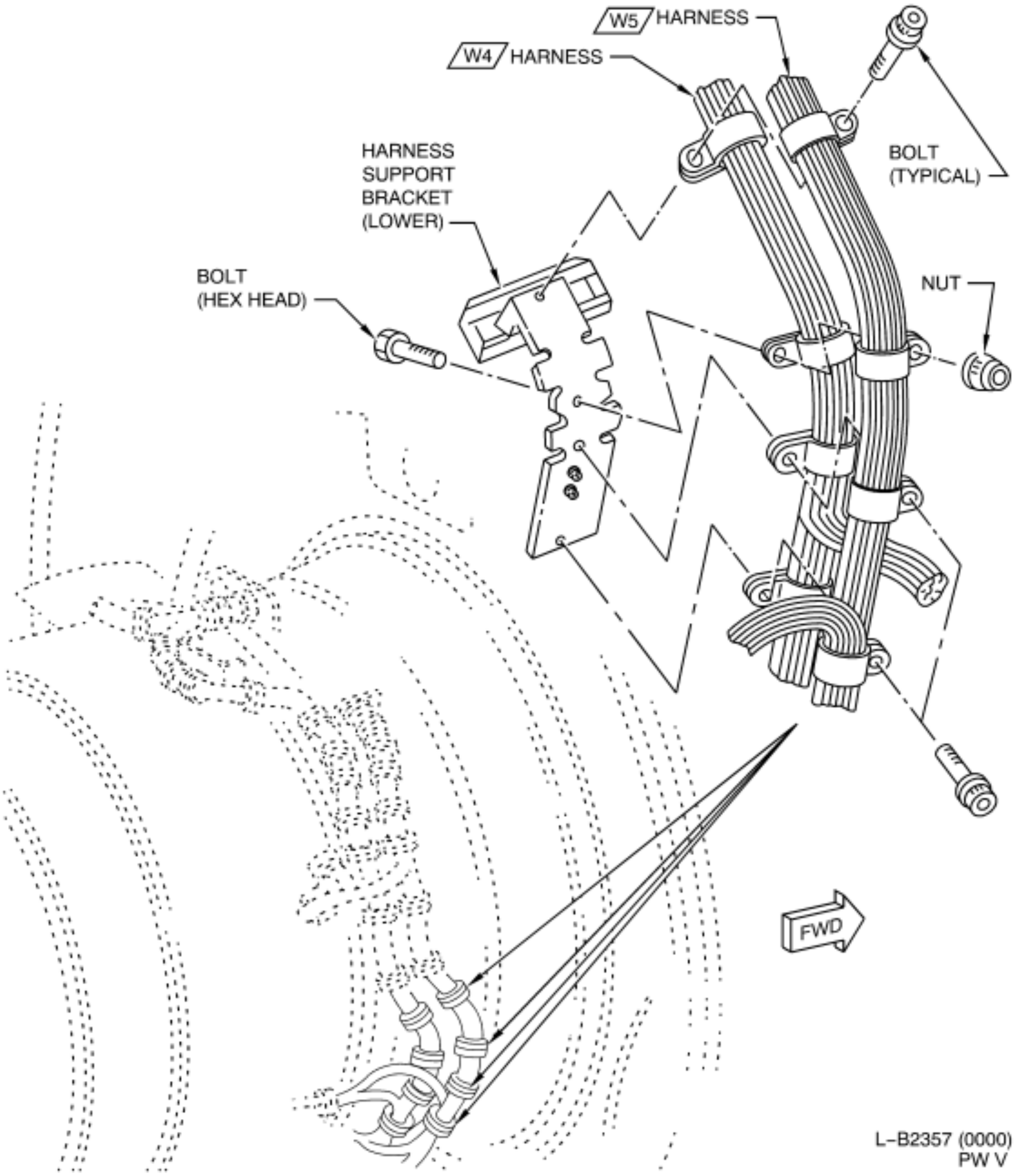
EEC Wiring Harness − W4 (Core Engine)
Figure 403 (Sheet 4)
(Task 72−00−34−450−018)


W5 HARNESS
HPC CASE BRACKET
BOLT (TYPICAL)
W5 HARNESS
FWD
CLAMP (TYPICAL)
W1P25
2.9 BLEED VALVE
HPC CASE BRACKET
SPACER
FLANGE H BRACKET
HARNESS BRACKET
W5 HARNESS REF.
W4J25
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THRMOCOUPLES ONLY
W4 HARNESS
NUT (LARGER)
NUT (SMALLER)
L−A5753 (1192)
PW V

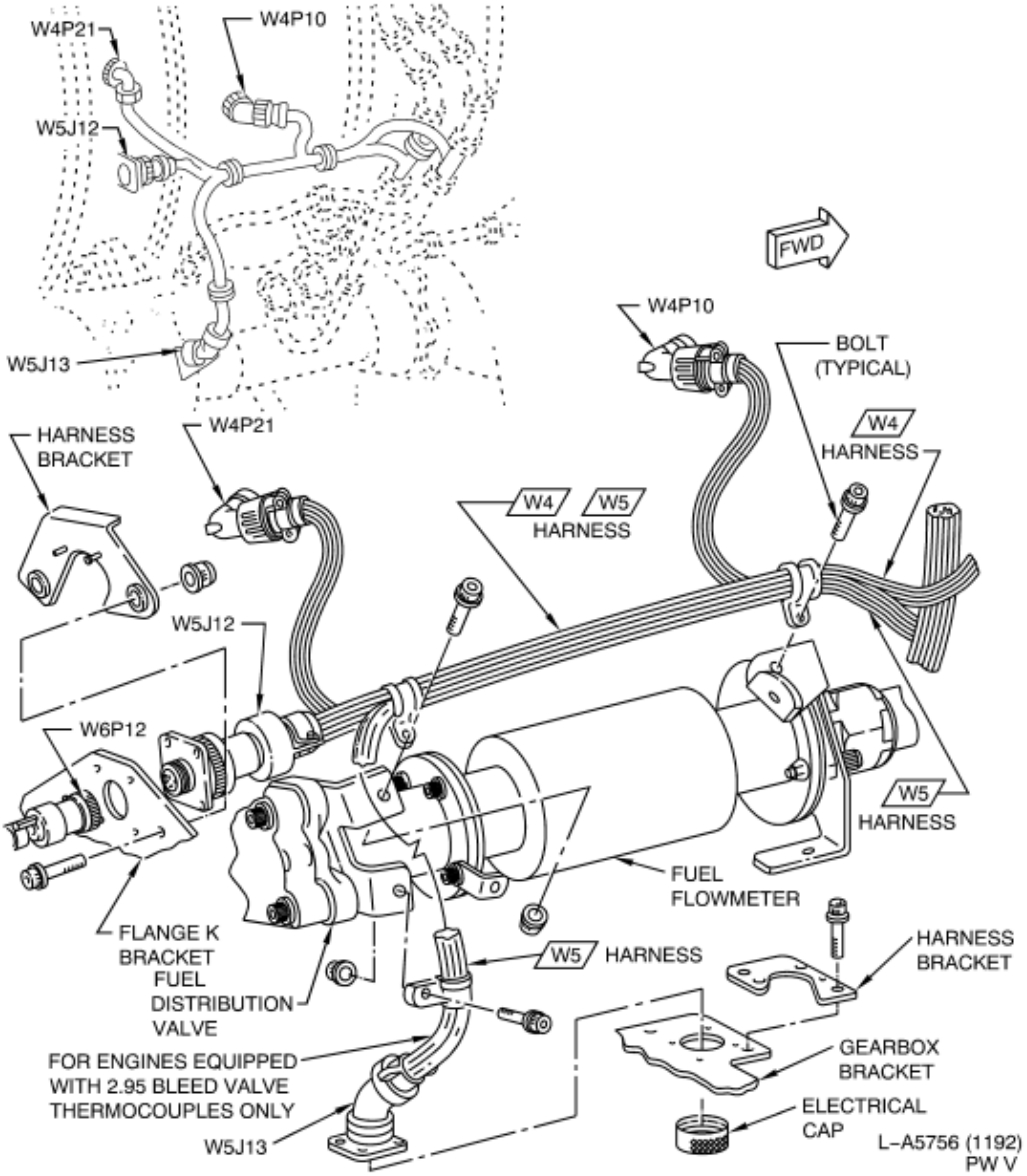
EEC Wiring Harness − W4 (Core Engine)
Figure 404
(Task 72−00−34−450−018)


BOLT
(6 REQUIRED)
W4P16
CLAMP
(TYPICAL)
CLAMP AND SPACER
(PRE SB PW4ENG 73−118)
SPACER
W5
HARNESS
HARNESS
SUPPORT
BRACKET
(UPPER)
SPACER
W4
HARNESS
FWD
(POST SB PW4ENG 73−118)
W5 HARNESS
W4 HARNESS
L−A5754 (0393)
PW V

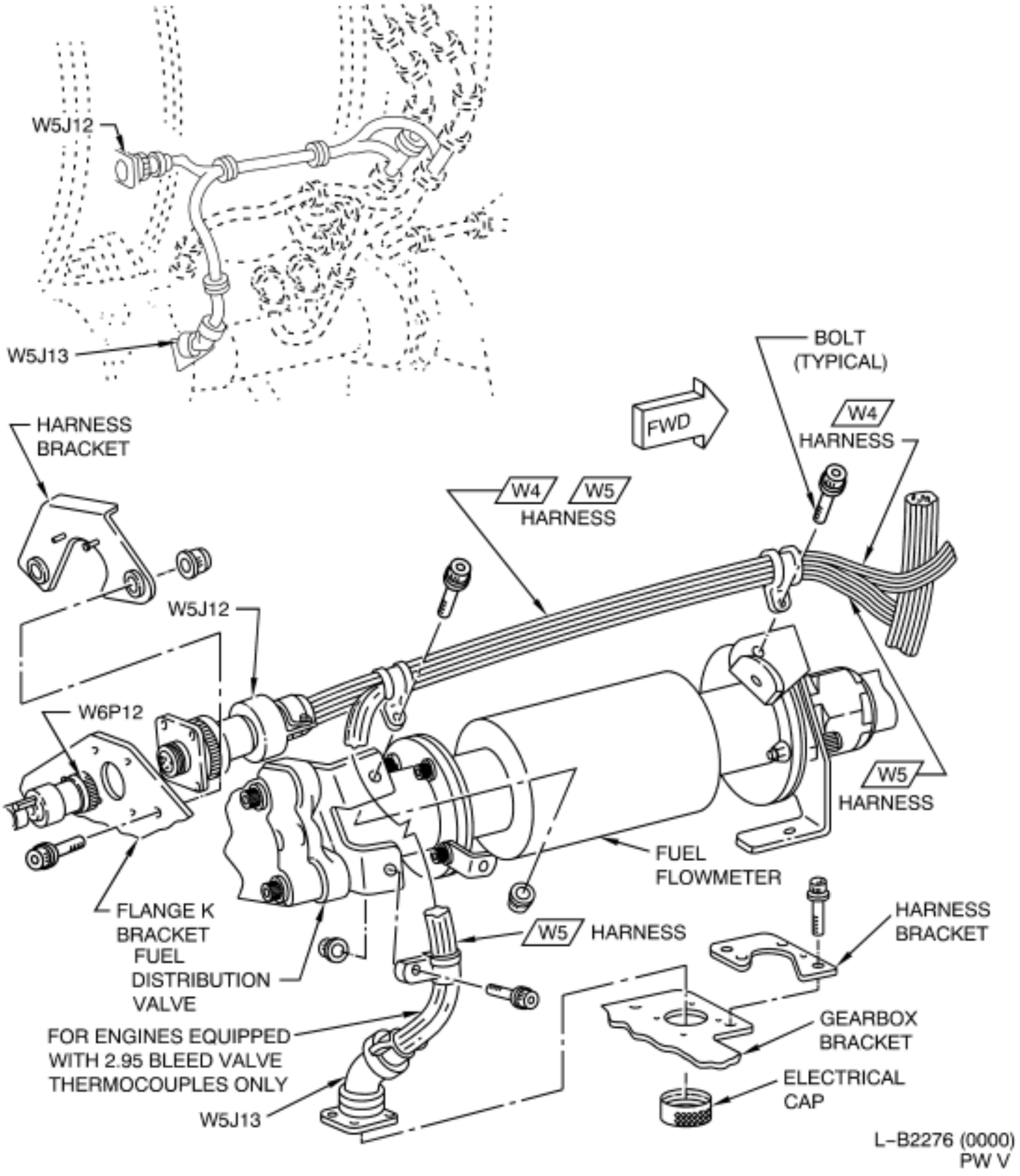
EEC Wiring Harness − W4 (Core Engine)
Figure 405
(Task 72−00−34−450−018)


W5 HARNESS
W4 HARNESS
BOLT (TYPICAL)
HARNESS SUPPORT BRACKET (LOWER)
NUT
BOLT (HEX HEAD)
FWD
L-B2357 (0000)
PW V

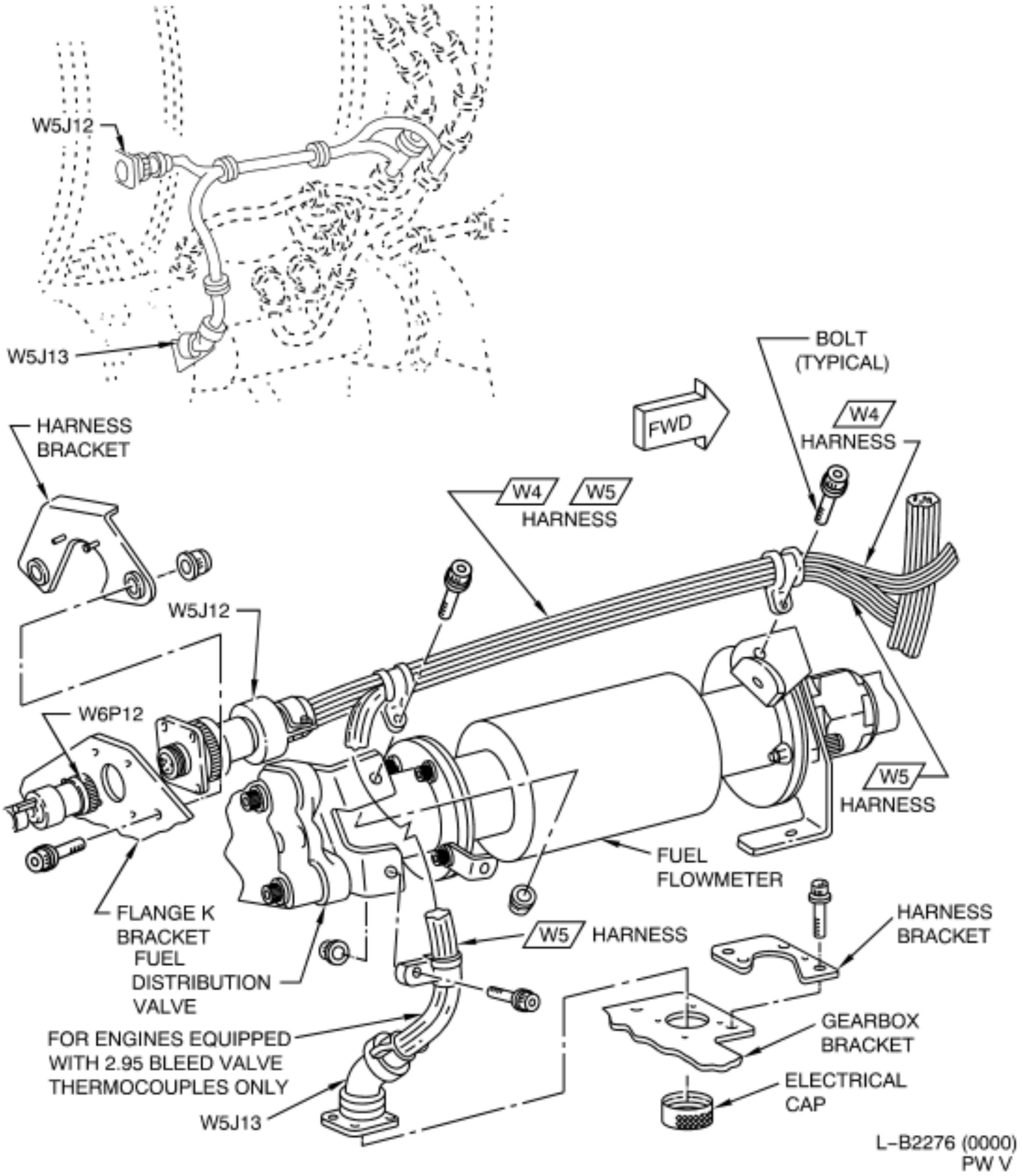
EEC Wiring Harness − W4 (Core Engine)
Figure 406
(Task 72−00−34−450−018)


W4P21
W4P10
W5J12
W5J13
FWD
W4P10
BOLT (TYPICAL)
W4 HARNESS
HARNESS BRACKET
W4P21
W4 W5 HARNESS
W5J12
W6P12
W5 HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
GEARBOX BRACKET
ELECTRICAL CAP
W5J13
L−A5756 (1192)
PW V

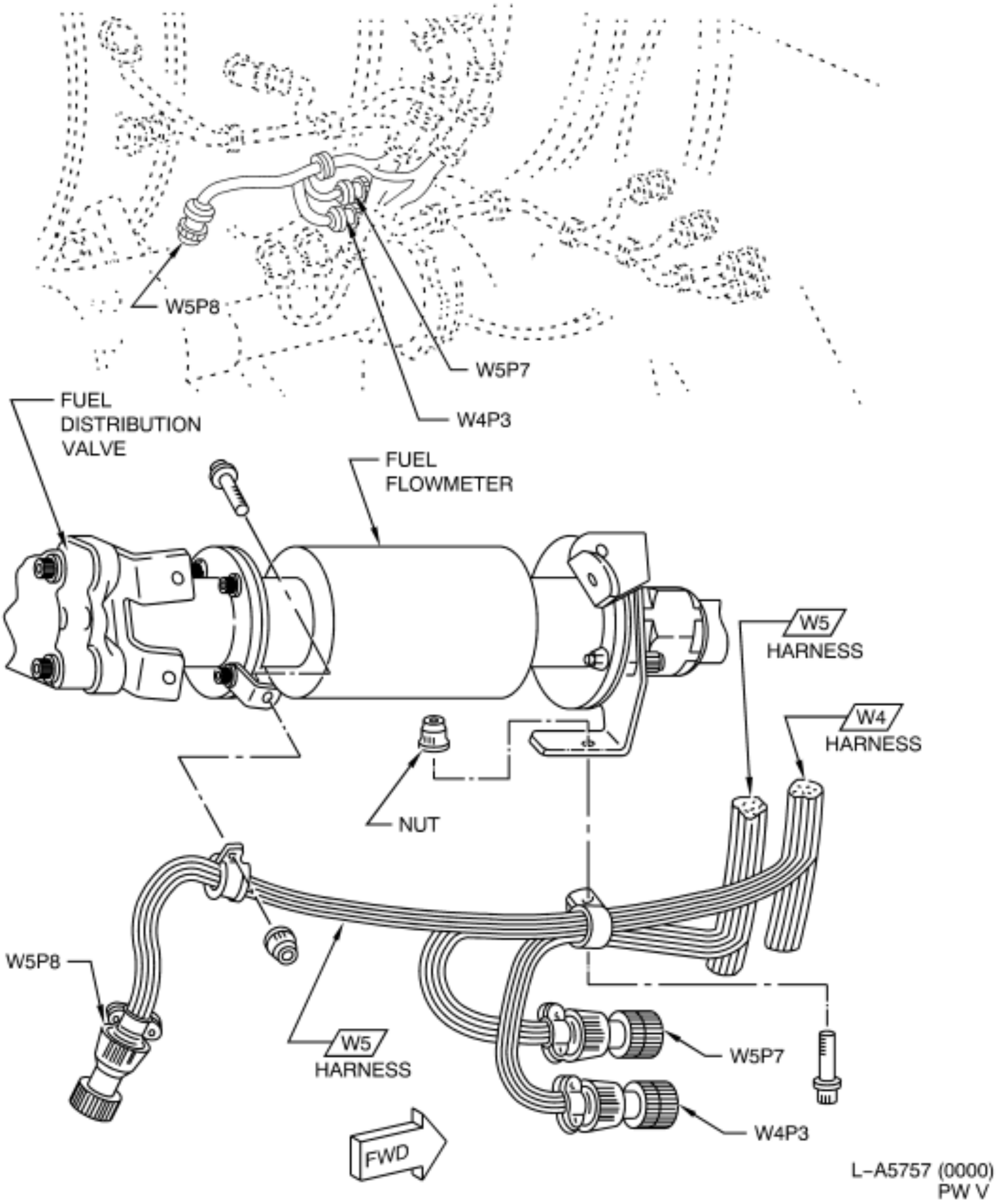
EEC Wiring Harness − W4 (Core Engine) (Pre SB PW4ENG 75−106)
Figure 407 (Sheet 1)
(Task 72−00−34−450−018)


W5J12
W5J13
BOLT (TYPICAL)
FWD
W4 HARNESS
HARNESS BRACKET
W4 W5 HARNESS
W5J12
W6P12
W5 HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
GEARBOX BRACKET
W5J13
ELECTRICAL CAP
L−B2276 (0000)
PW V

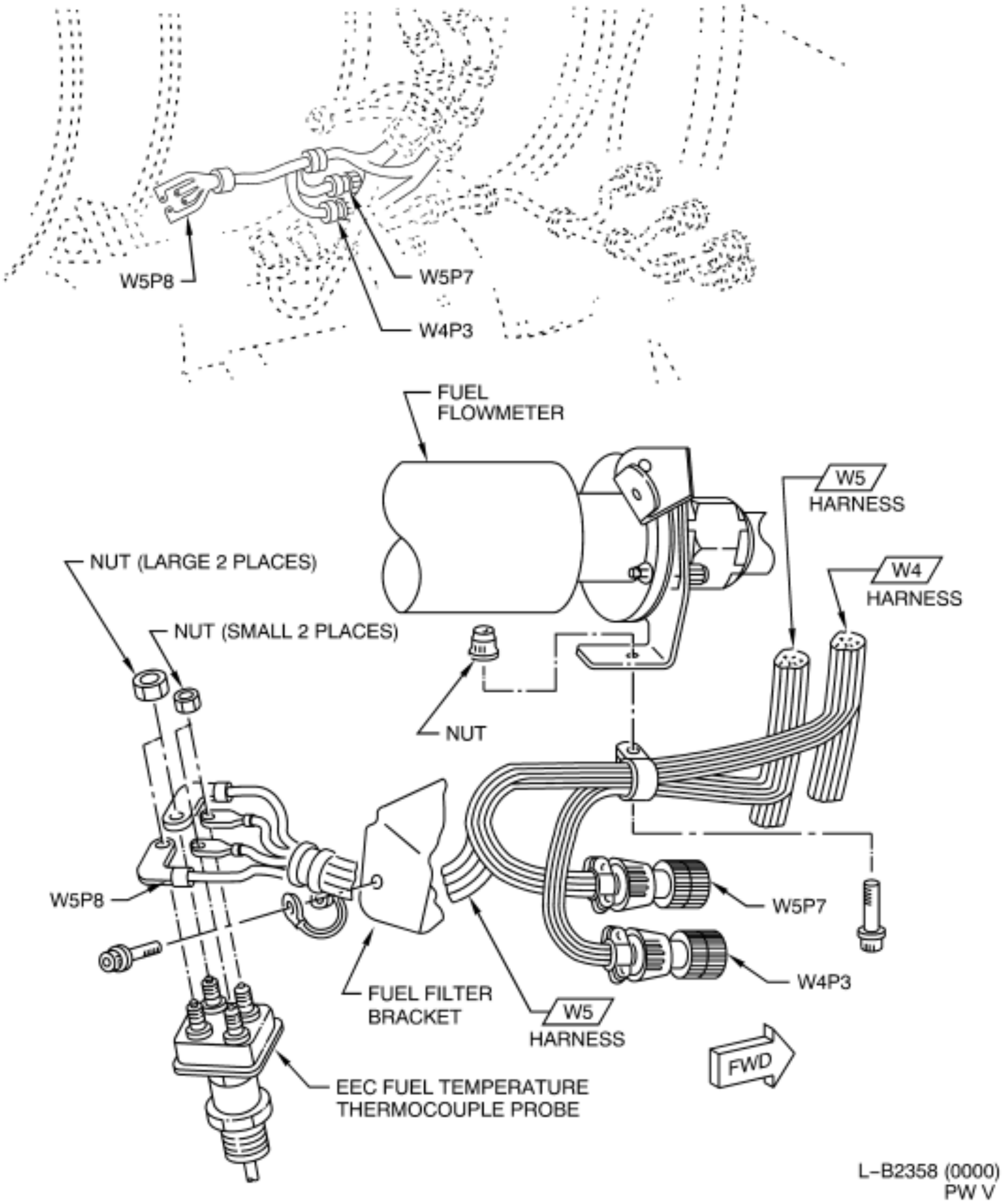
EEC Wiring Harness − W4 (Core Engine) (Post SB PW4ENG 72−572 or SB PW4ENG 75−106 or SB PW4ENG 72−756)
(For −3 Engines With CN After Engine Serial Number)
Figure 407 (Sheet 2)
(Task 72−00−34−450−018)


W5J12
W5J13
BOLT (TYPICAL)
FWD
W4 HARNESS
HARNESS BRACKET
W4 W5 HARNESS
W5J12
W6P12
W5 HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
GEARBOX BRACKET
ELECTRICAL CAP
W5J13
L−B2276 (0000)
PW V

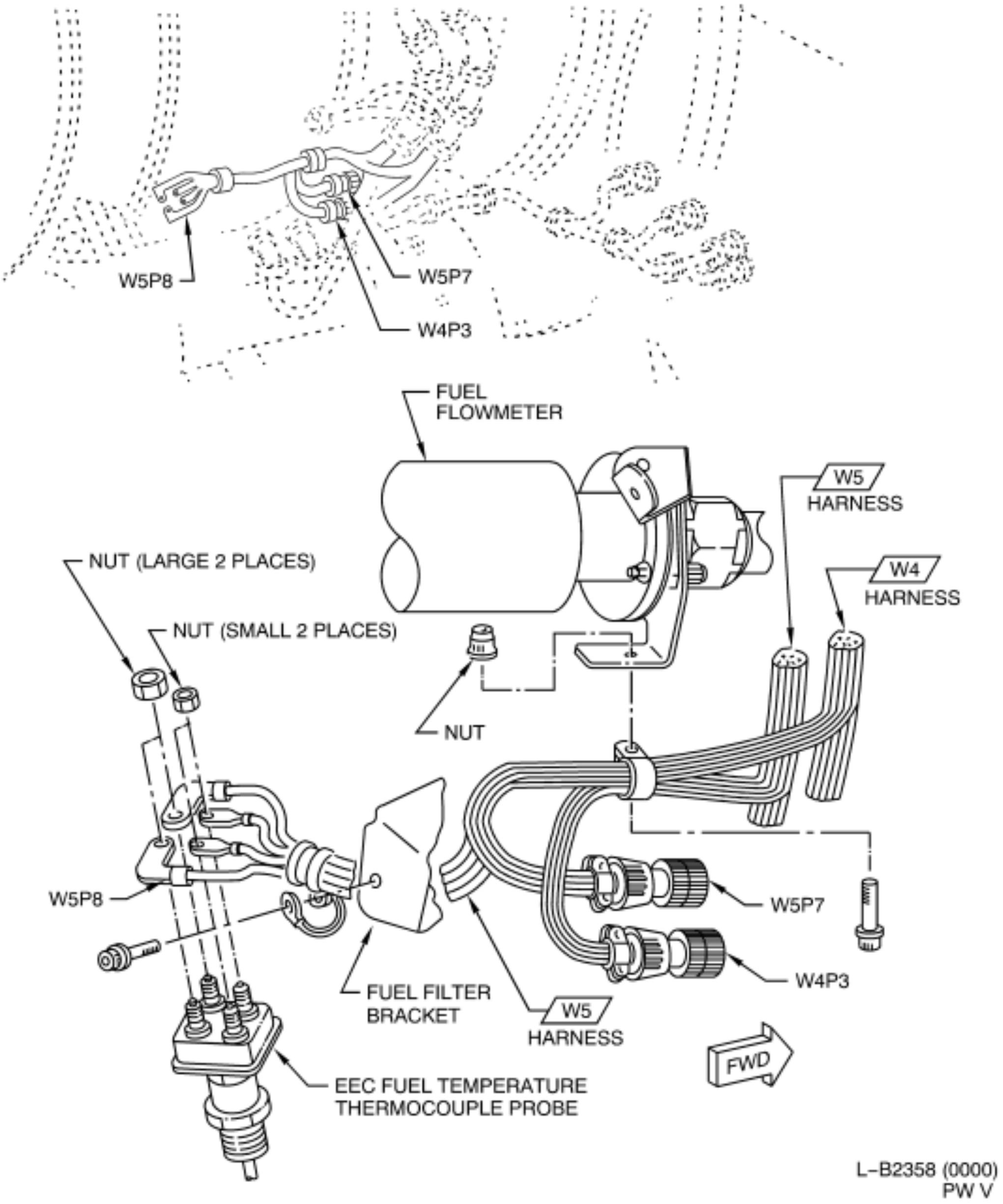
EEC Wiring Harness − W4 (Core Engine) (For −3 Engines As Built By Pratt & Whitney)
Figure 407 (Sheet 3)
(Task 72−00−34−450−018)


W5P8
W5P7
W4P3
FUEL DISTRIBUTION VALVE
FUEL FLOWMETER
W5 HARNESS
W4 HARNESS
NUT
W5P8
W5 HARNESS
W5P7
W4P3
FWD
L-A5757 (0000)
PW V

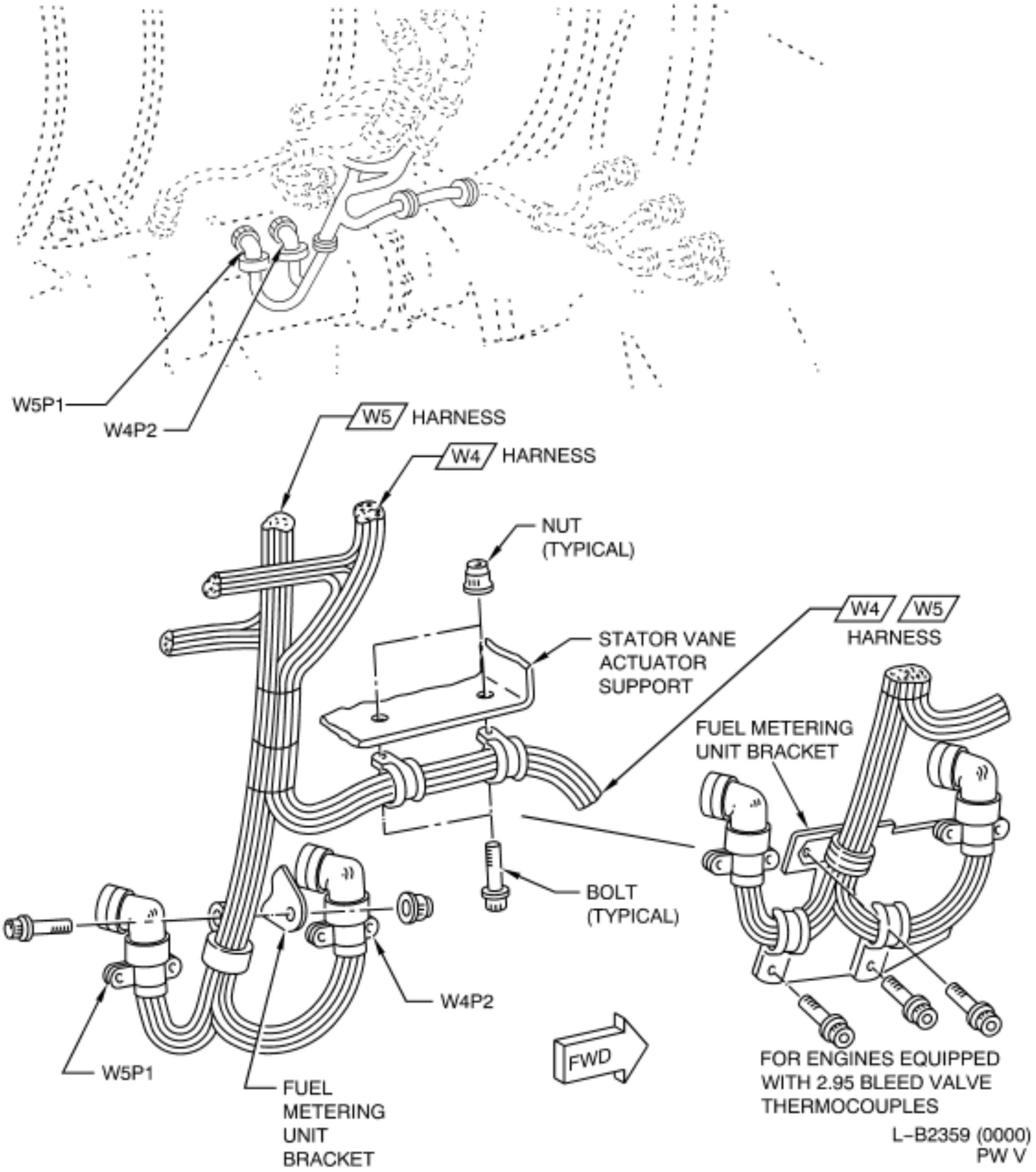
EEC Wiring Harness - W4 (Core Engine) (Pre SB PW4ENG 73-84)
Figure 408 (Sheet 1)
(Task 72-00-34-450-018)


W5P8
W5P7
W4P3
FUEL FLOWMETER
W5 HARNESS
W4 HARNESS
NUT (LARGE 2 PLACES)
NUT (SMALL 2 PLACES)
NUT
W5P8
W5P7
W4P3
FUEL FILTER BRACKET
W5 HARNESS
FWD
EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
L−B2358 (0000)
PW V

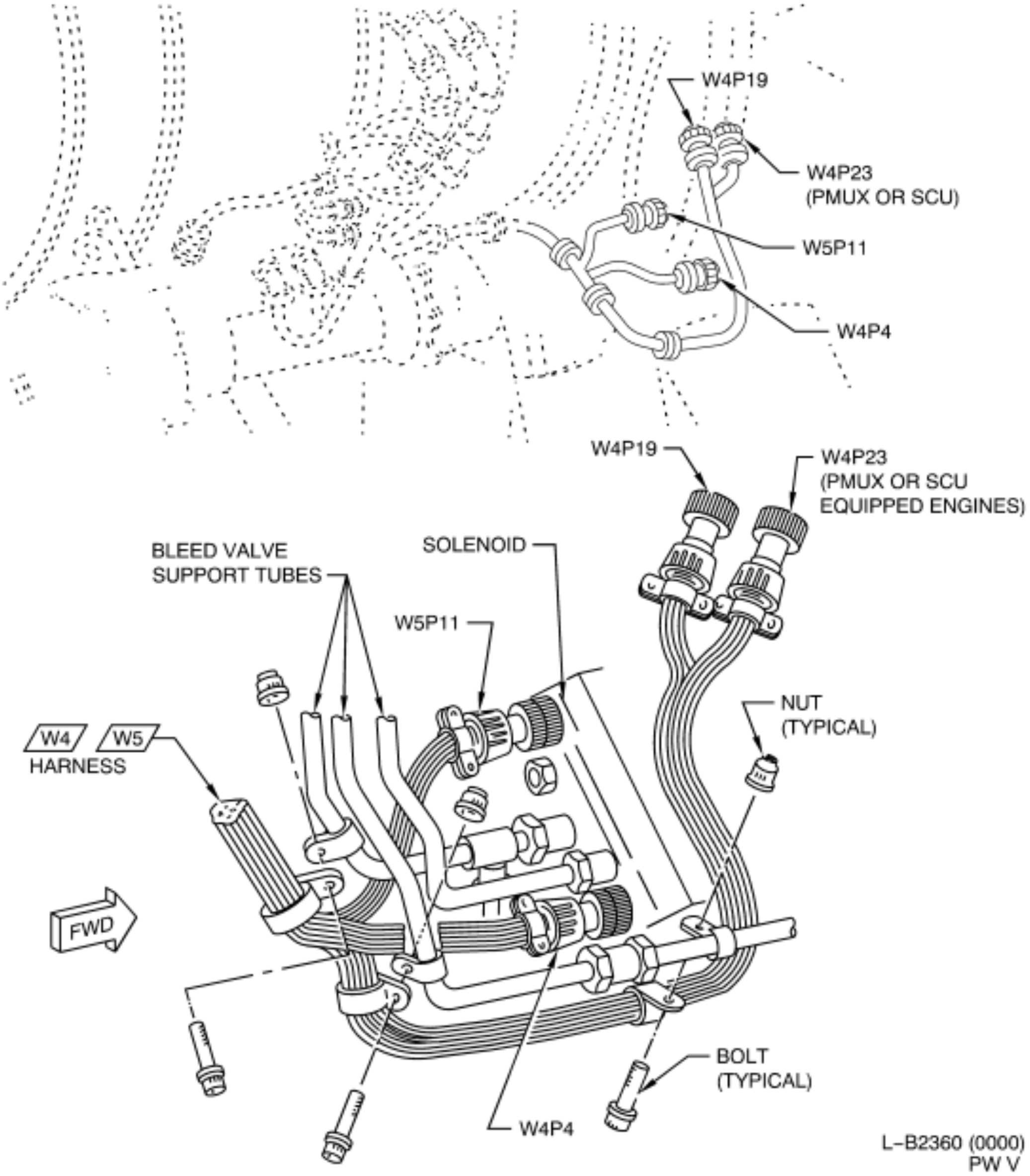
EEC Wiring Harness − W4 (Core Engine) (Post SB PW4ENG 73−84) (Post SB PW4ENG 72−572 or SB PW4ENG 75−106 or SB PW4ENG 72−756) (For −3 Engines With And Without CN After Engine Serial Number)
Figure 408 (Sheet 2)
(Task 72−00−34−450−018)


W5P8
W5P7
W4P3
FUEL FLOWMETER
W5 HARNESS
W4 HARNESS
NUT (LARGE 2 PLACES)
NUT (SMALL 2 PLACES)
NUT
W5P8
W5P7
W4P3
FUEL FILTER BRACKET
W5 HARNESS
FWD
EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
L-B2358 (0000)
PW V

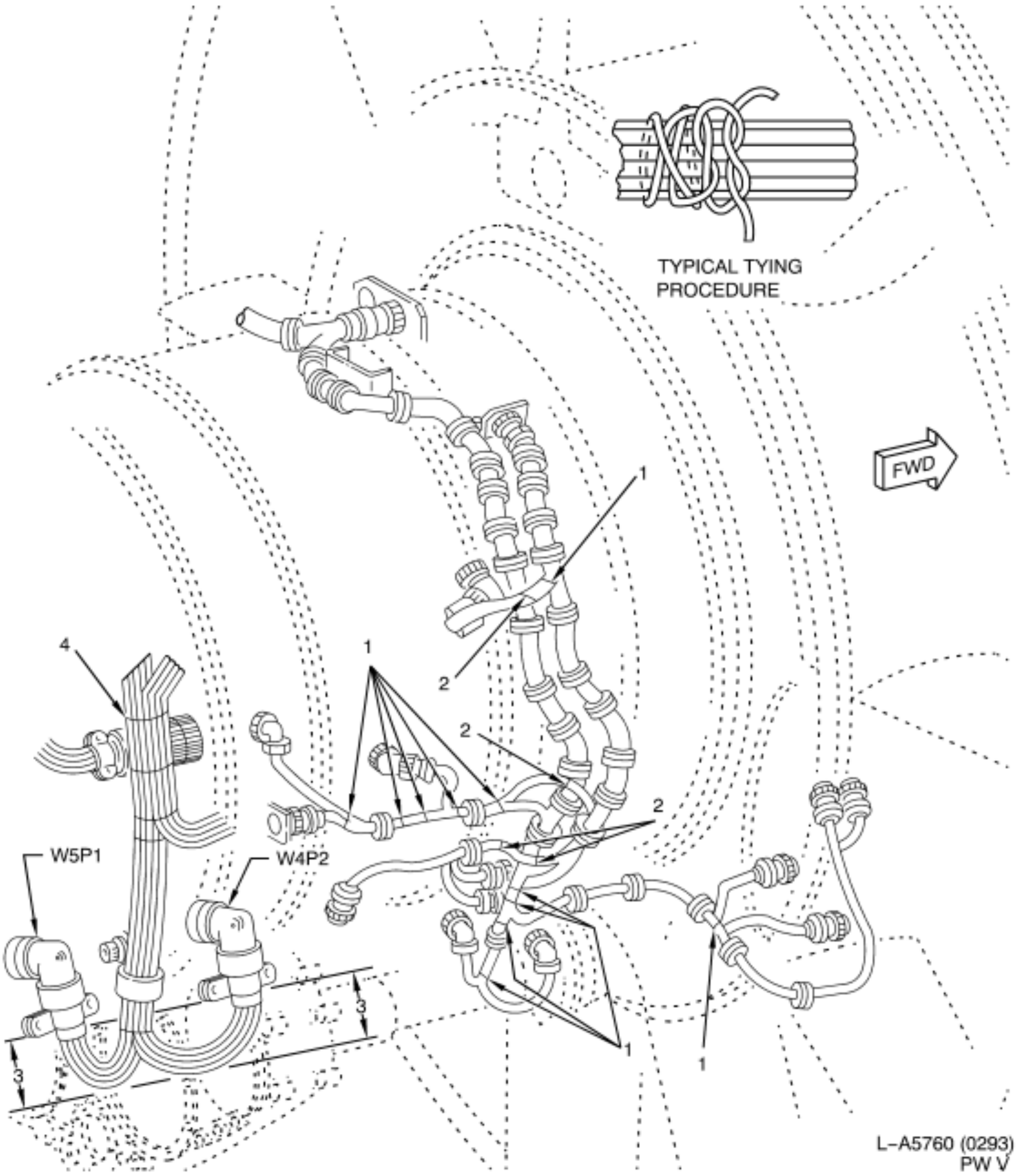
EEC Wiring Harness - W4 (Core Engine) (For
-3 Engines As Built By Pratt & Whitney)
Figure 408 (Sheet 3)
(Task 72-00-34-450-018)


W5P1
W4P2
W5 HARNESS
W4 HARNESS
NUT (TYPICAL)
STATOR VANE ACTUATOR SUPPORT
W4 W5 HARNESS
FUEL METERING UNIT BRACKET
BOLT (TYPICAL)
W4P2
W5P1
FUEL METERING UNIT BRACKET
FWD
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES
L-B2359 (0000)
PW V

EEC Wiring Harness - W4 (Core Engine)
Figure 409
(Task 72-00-34-450-018)


W4P19
W4P23
(PMUX OR SCU)
W5P11
W4P4
W4P19
W4P23
(PMUX OR SCU
EQUIPPED ENGINES)
BLEED VALVE
SUPPORT TUBES
SOLENOID
W5P11
W4
W5
HARNESS
NUT
(TYPICAL)
FWD
BOLT
(TYPICAL)
W4P4
L-B2360 (0000)
PW V

EEC Wiring Harness - W4 (Core Engine)
Figure 410
(Task 72-00-34-450-018)

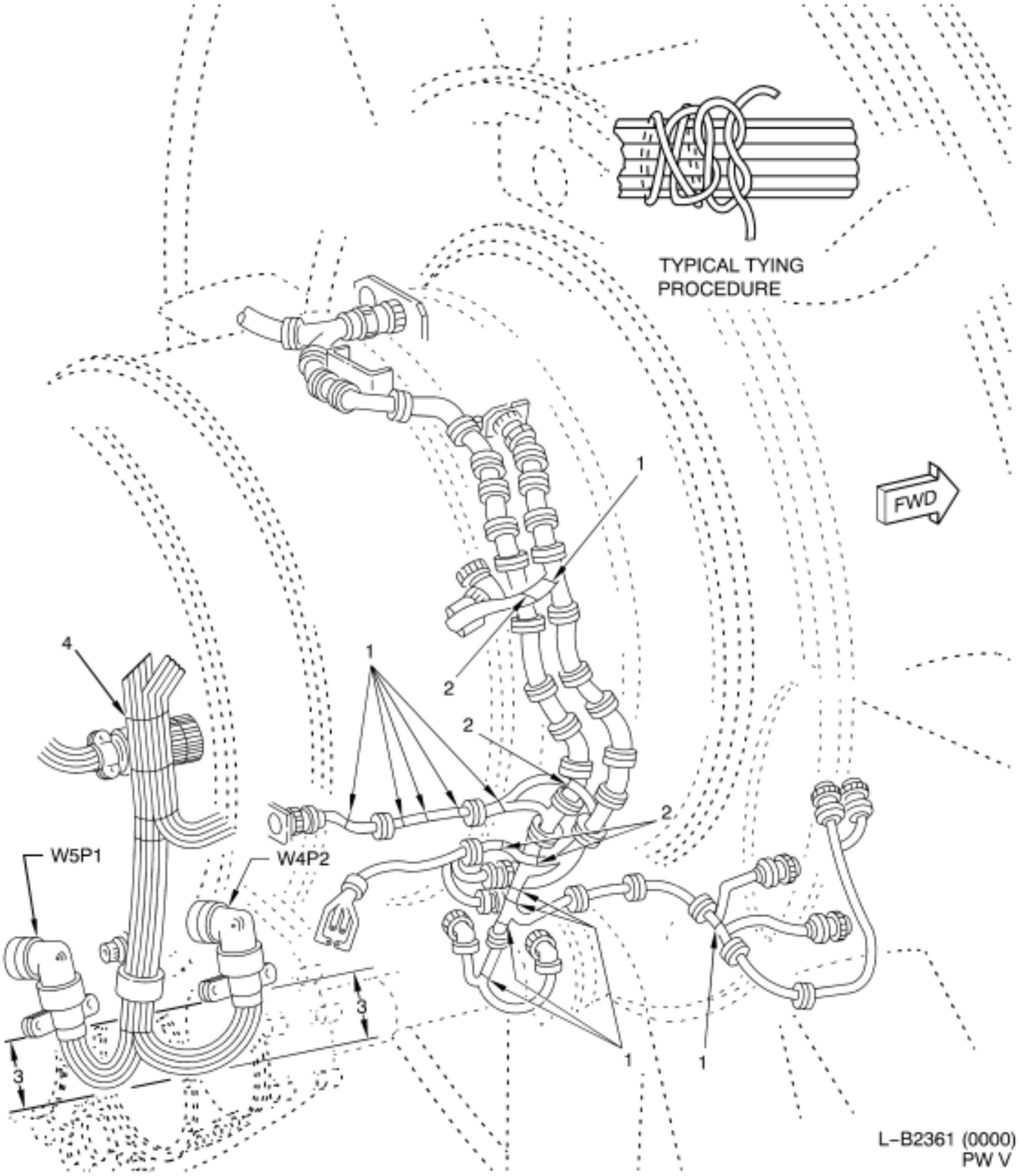

TYPICAL TYING PROCEDURE
FWD
1
1
2
2
4
2
W5P1
W4P2
3
3
1
1
L−A5760 (0293)
PW V

EEC Wiring Harness − W4 (Core Engine) (Pre SB PW4ENG 73−84) (Pre SB PW4ENG 75−106)
Figure 411 (Sheet 1)
(Task 72−00−34−450−018)

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−19

1. Tie
2. Cross Tie
3. 3.000 Inch (76.200 mm) Maximum Clearance Required Between Bottom Of Harness And Connector Clamps.
4. 0.375 Inch (9.525 mm) Minimum Clearance Required Between Harness And W4P3 Connector.

Key to Figure 411 (Sheet 1)


TYPICAL TYING PROCEDURE
FWD
1
2
4
1
2
2
W5P1
W4P2
3
3
1
1
L−B2361 (0000)
PW V

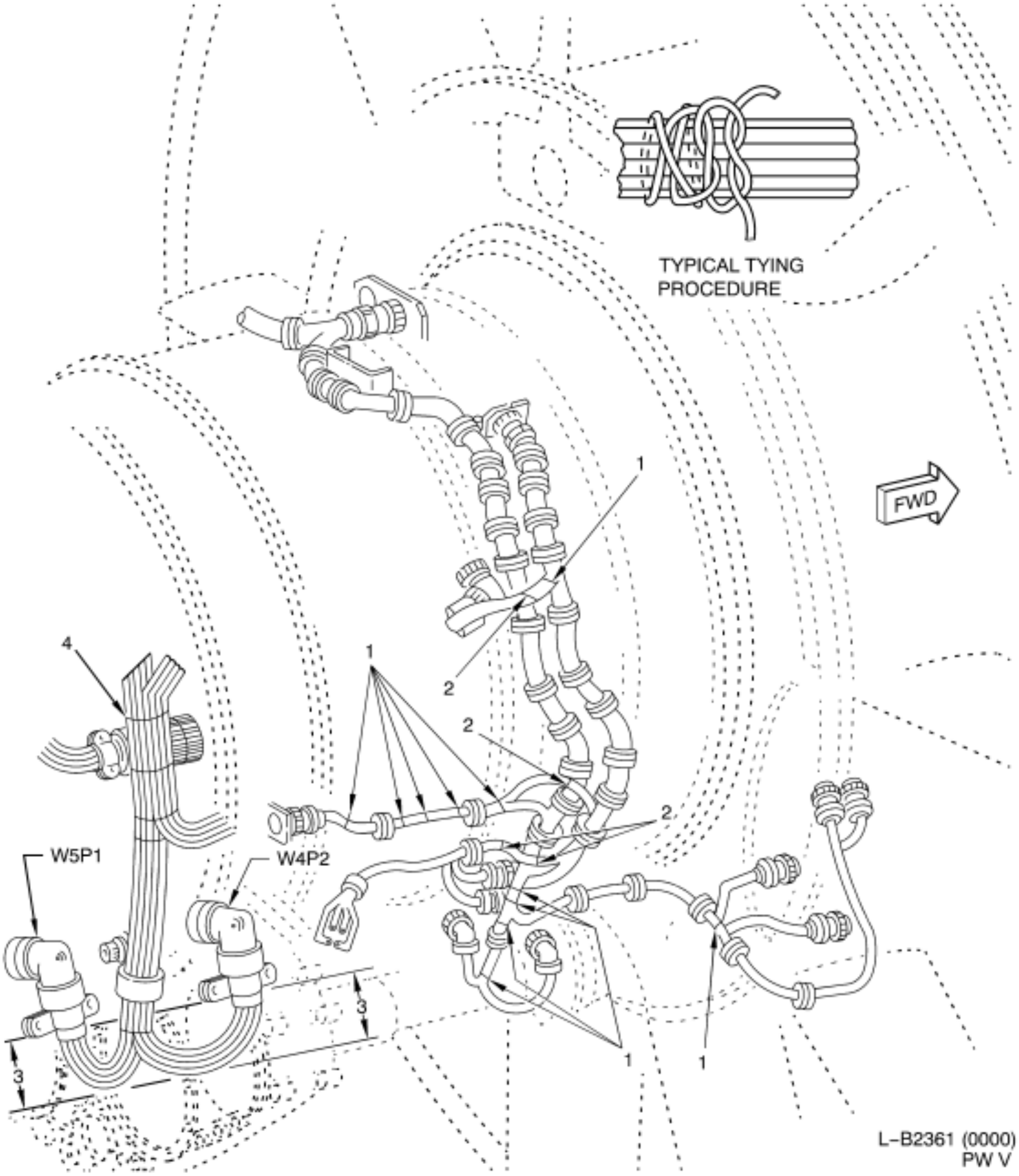
EEC Wiring Harness − W4 (Core Engine) (Post SB PW4ENG 73−84)
(Post SB PW4ENG 72−572 or SB PW4ENG 75−106 or SB PW4ENG 72-756)
(For −3 Engines With CN After Engine Serial Number)
Figure 411 (Sheet 2)
(Task 72−00−34−450−018)

R
R

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−19

R 1. Tie
R 2. Cross Tie
R 3. 3.000 Inch (76.200 mm) Maximum Clearance Required Between Bottom Of Harness And Connector Clamps.
R 4. 0.375 Inch (9.525 mm) Minimum Clearance Required Between Harness And W4P3 Connector.

Key to Figure 411 (Sheet 2)


TYPICAL TYING PROCEDURE
FWD
1
2
4
1
2
2
W5P1
W4P2
3
3
1
1
L−B2361 (0000)
PW V

EEC Wiring Harness − W4 (Core Engine) (For −3 Engines As Built By Pratt & Whitney)
Figure 411 (Sheet 3)
(Task 72−00−34−450−018)

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−19

R 1. Tie
R 2. Cross Tie
R 3. 3.000 Inch (76.200 mm) Maximum Clearance Required Between Bottom
R Of Harness And Connector Clamps.
R 4. 0.375 Inch (9.525 mm) Minimum Clearance Required Between Harness
R And W4P3 Connector.

Key to Figure 411 (Sheet 3)

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−20

Task 72−00−34−420−020:

1. Install The Flange E Brackets And Hardware

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P06−021	Compound, Antigalling (PWA 550)

B. Procedure

(1) Install Flange E hardware as follows. See Figure 401.

(a) Apply Antigalling Compound P06−021 to the threads of 74 Flange E bolts.

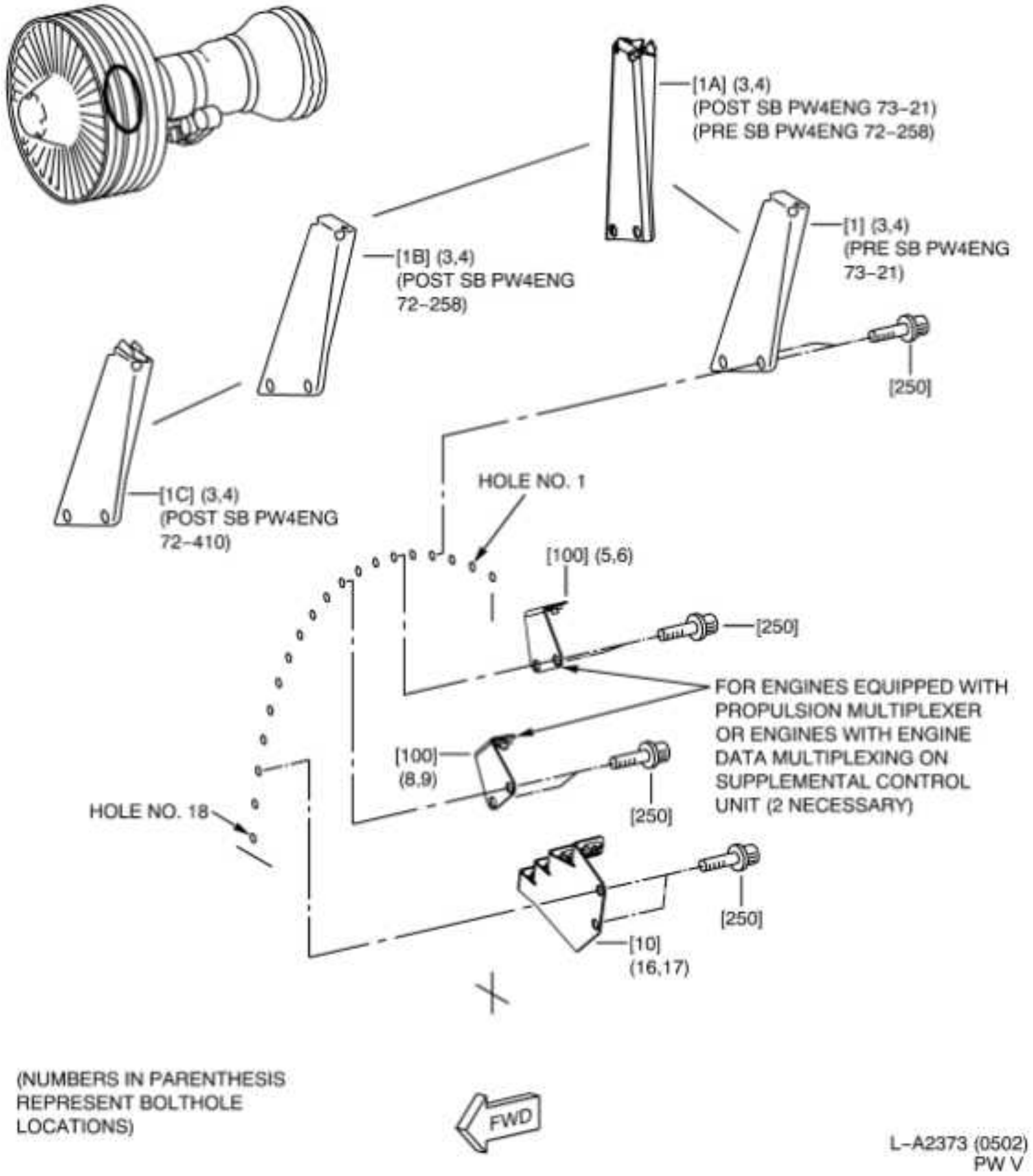
(b) Replace the workbolts and install the brackets and 74 bolts in Flange E.

(c) Remove the alignment pins from Flange E.

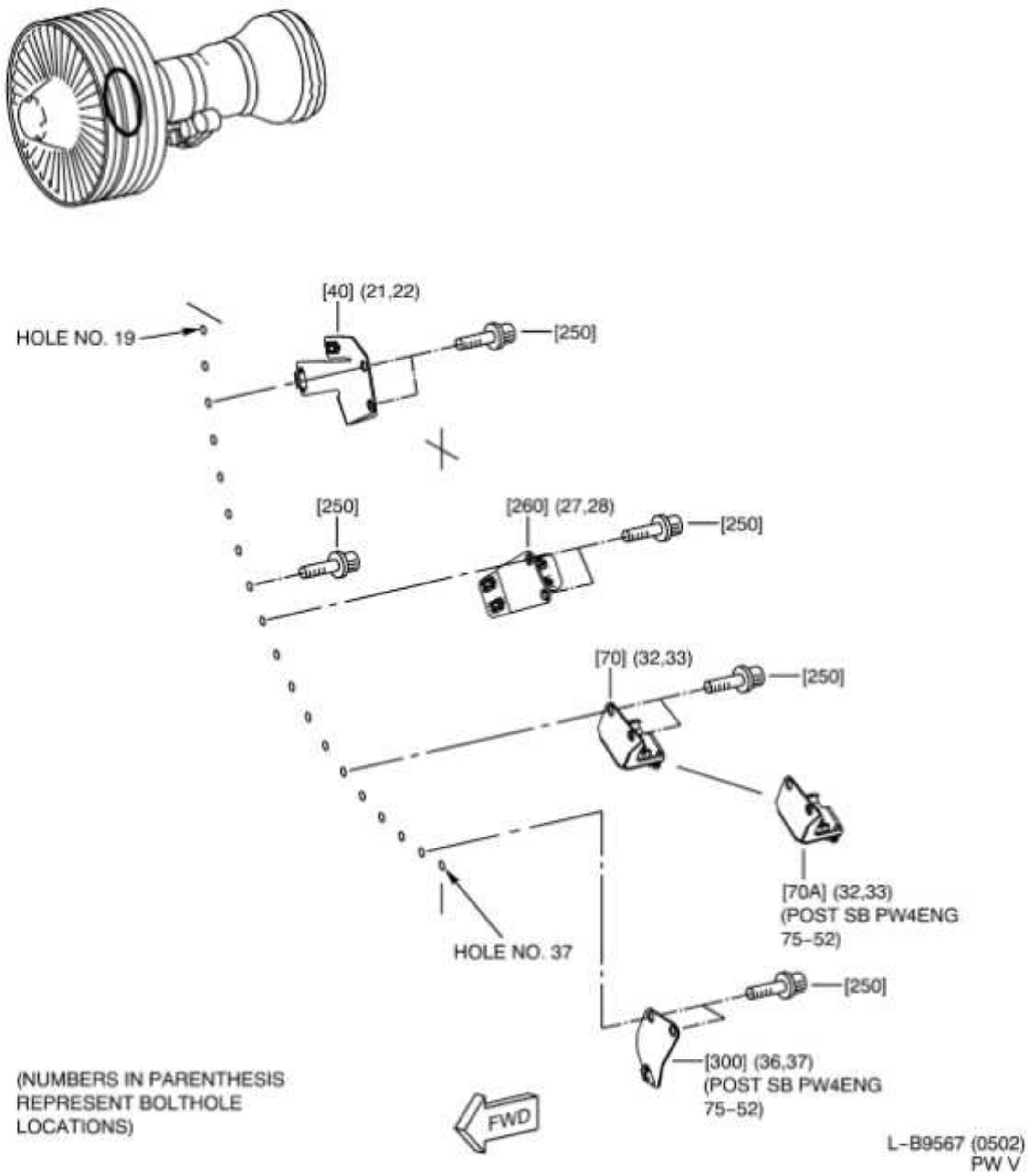
(2) Remove any tags or markings on the brackets or flange.

(3) Examine the assembly for foreign objects, damage, and correct assembly.

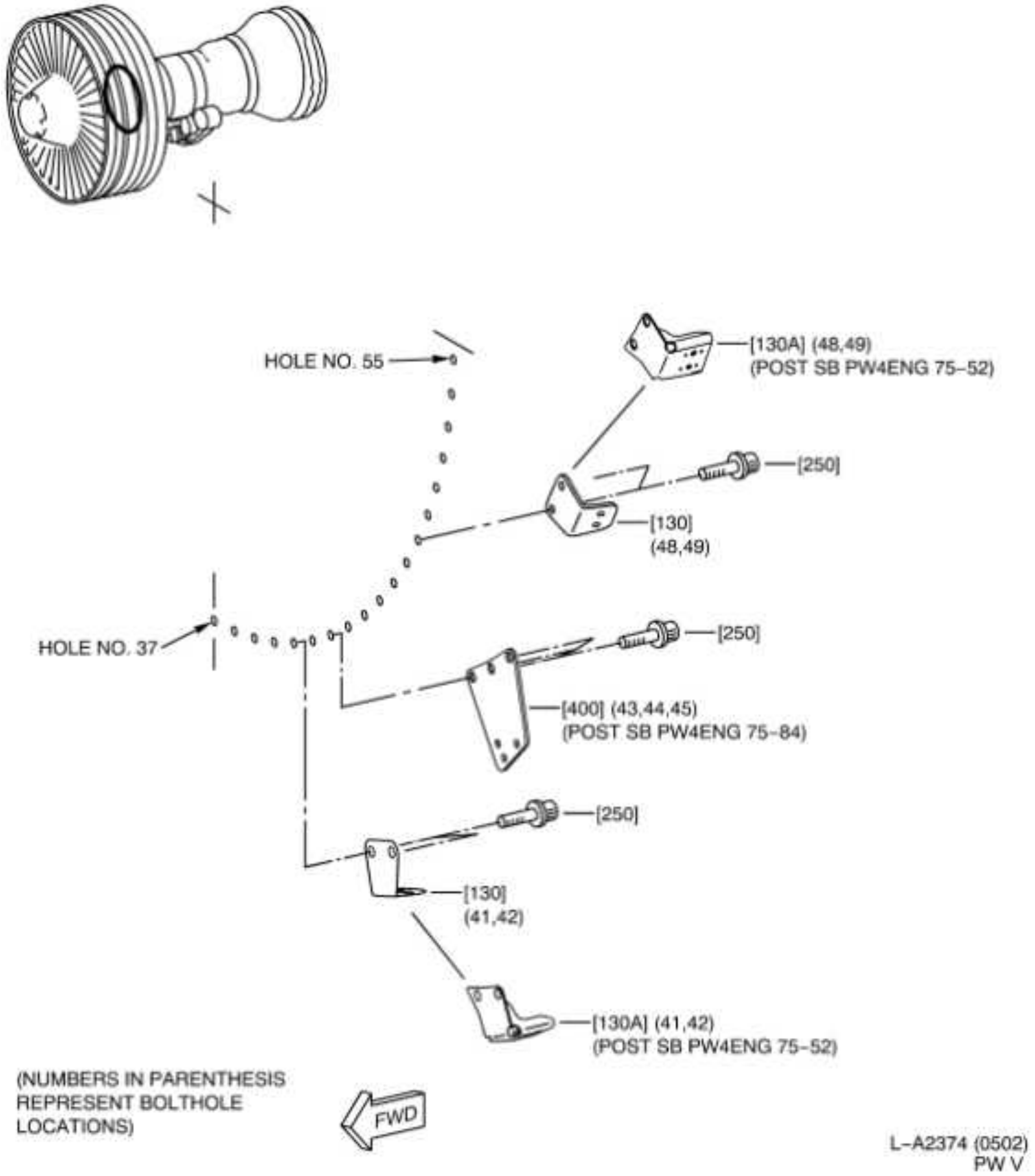
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−20


[1A] (3,4)
(POST SB PW4ENG 73-21)
(PRE SB PW4ENG 72-258)
[1] (3,4)
(PRE SB PW4ENG 73-21)
[1B] (3,4)
(POST SB PW4ENG 72-258)
[250]
[1C] (3,4)
(POST SB PW4ENG 72-410)
HOLE NO. 1
[100] (5,6)
[250]
FOR ENGINES EQUIPPED WITH PROPULSION MULTIPLEXER OR ENGINES WITH ENGINE DATA MULTIPLEXING ON SUPPLEMENTAL CONTROL UNIT (2 NECESSARY)
[100]
(8,9)
[250]
HOLE NO. 18
[250]
[10]
(16,17)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-A2373 (0502)
PW V

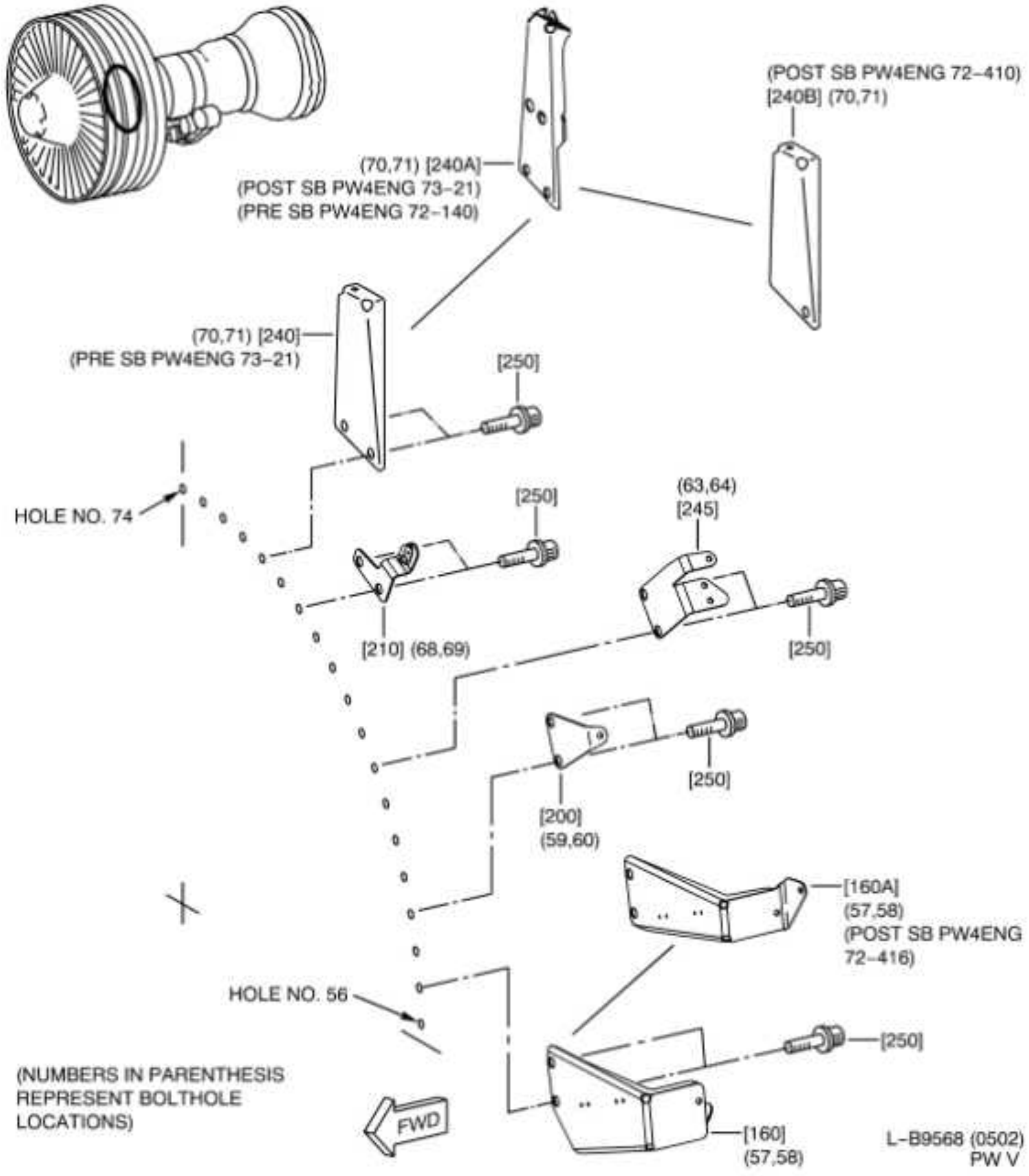
Flange E Bracket Locations
Figure 401 (Sheet 1)
(Task 72−00−34−420−020)


[40] (21,22)
HOLE NO. 19
[250]
[250]
[260] (27,28)
[250]
[70] (32,33)
[250]
[70A] (32,33)
(POST SB PW4ENG
75−52)
HOLE NO. 37
[250]
[300] (36,37)
(POST SB PW4ENG
75−52)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L−B9567 (0502)
PW V

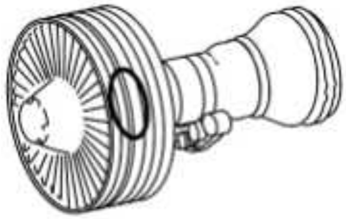
Flange E Bracket Locations
Figure 401 (Sheet 2)
(Task 72−00−34−420−020)

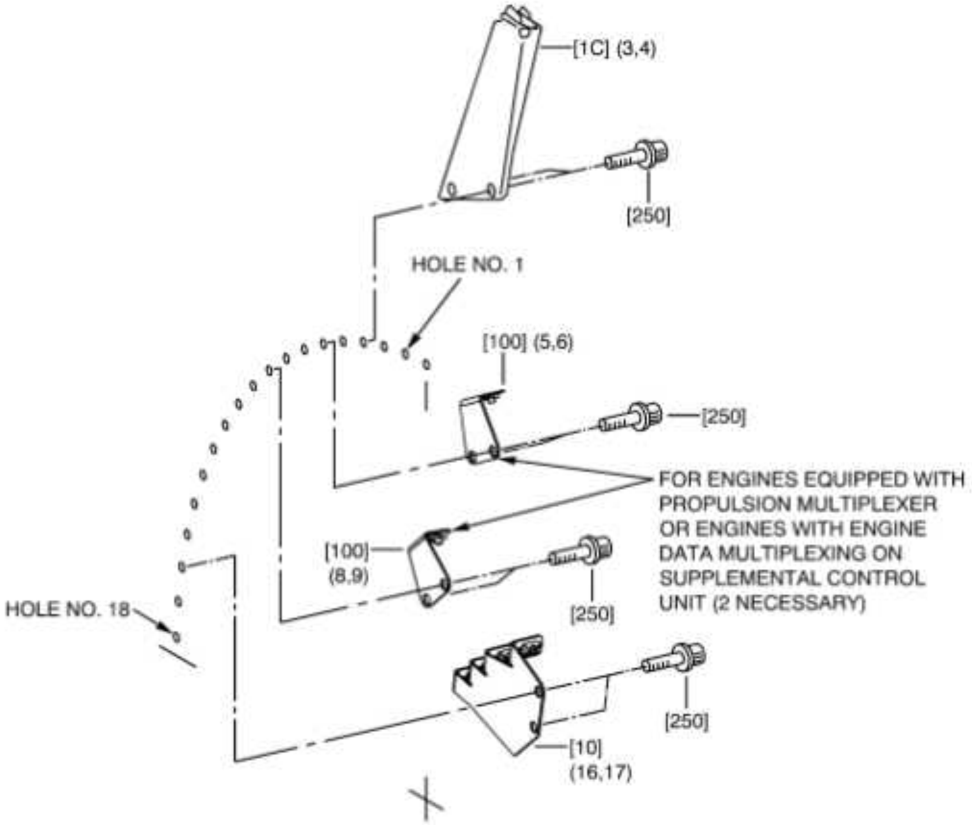

HOLE NO. 55
[130A] (48,49)
(POST SB PW4ENG 75-52)
[250]
[130]
(48,49)
HOLE NO. 37
[250]
[400] (43,44,45)
(POST SB PW4ENG 75-84)
[250]
[130]
(41,42)
[130A] (41,42)
(POST SB PW4ENG 75-52)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-A2374 (0502)
PW V

Flange E Bracket Locations
Figure 401 (Sheet 3)
(Task 72−00−34−420−020)


(POST SB PW4ENG 72-410)
[240B] (70,71)
(70,71) [240A]
(POST SB PW4ENG 73-21)
(PRE SB PW4ENG 72-140)
(70,71) [240]
(PRE SB PW4ENG 73-21)
[250]
HOLE NO. 74
[250]
(63,64)
[245]
[210] (68,69)
[250]
[250]
[200]
(59,60)
[160A]
(57,58)
(POST SB PW4ENG
72-416)
HOLE NO. 56
[250]
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
[160]
(57,58)
L-B9568 (0502)
PW V

Flange E Bracket Locations
Figure 401 (Sheet 4)
(Task 72−00−34−420−020)

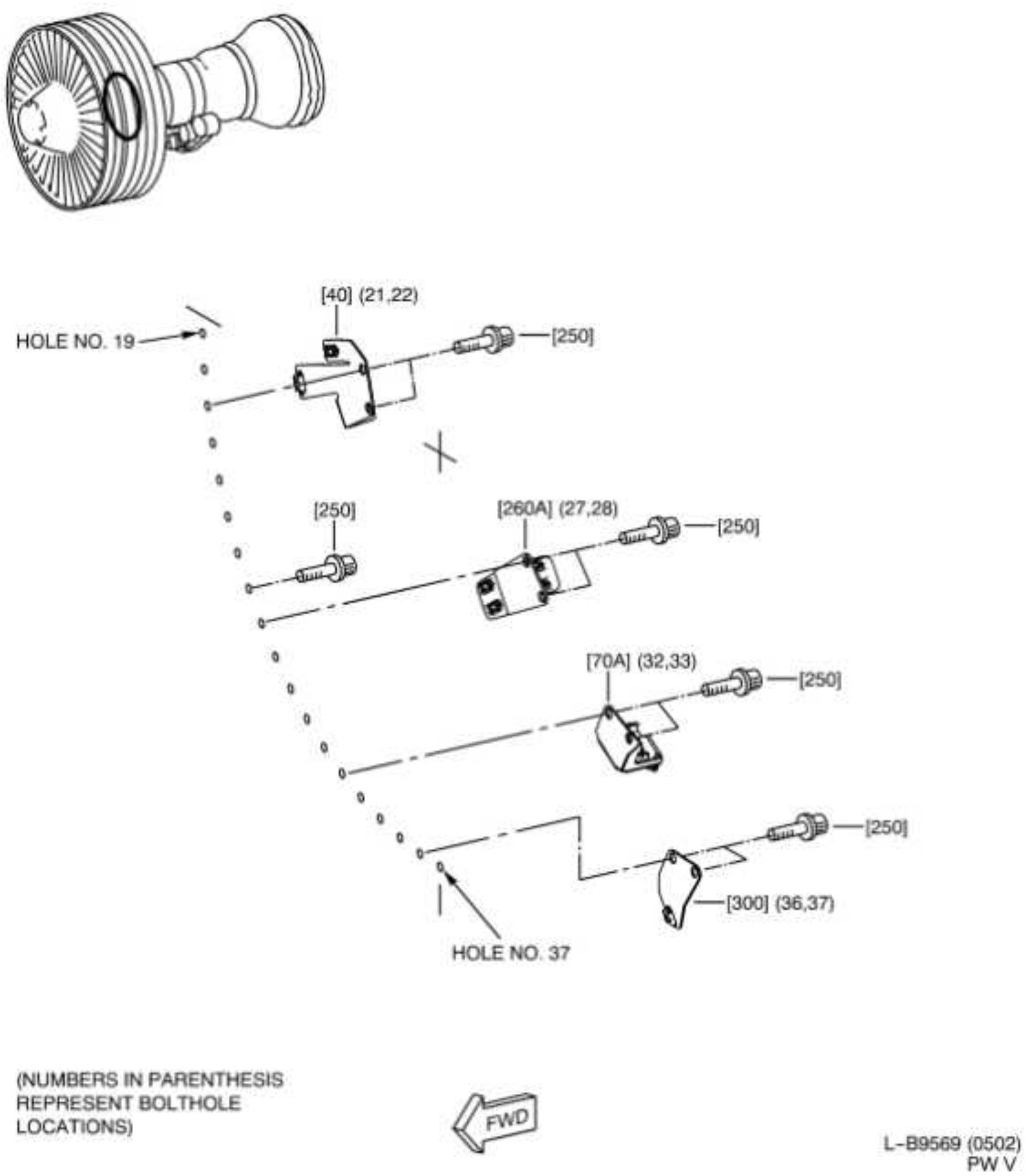



[1C] (3,4)
[250]
HOLE NO. 1
[100] (5,6)
[250]
FOR ENGINES EQUIPPED WITH PROPULSION MULTIPLEXER OR ENGINES WITH ENGINE DATA MULTIPLEXING ON SUPPLEMENTAL CONTROL UNIT (2 NECESSARY)
[100] (8,9)
[250]
HOLE NO. 18
[250]
[10] (16,17)

(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

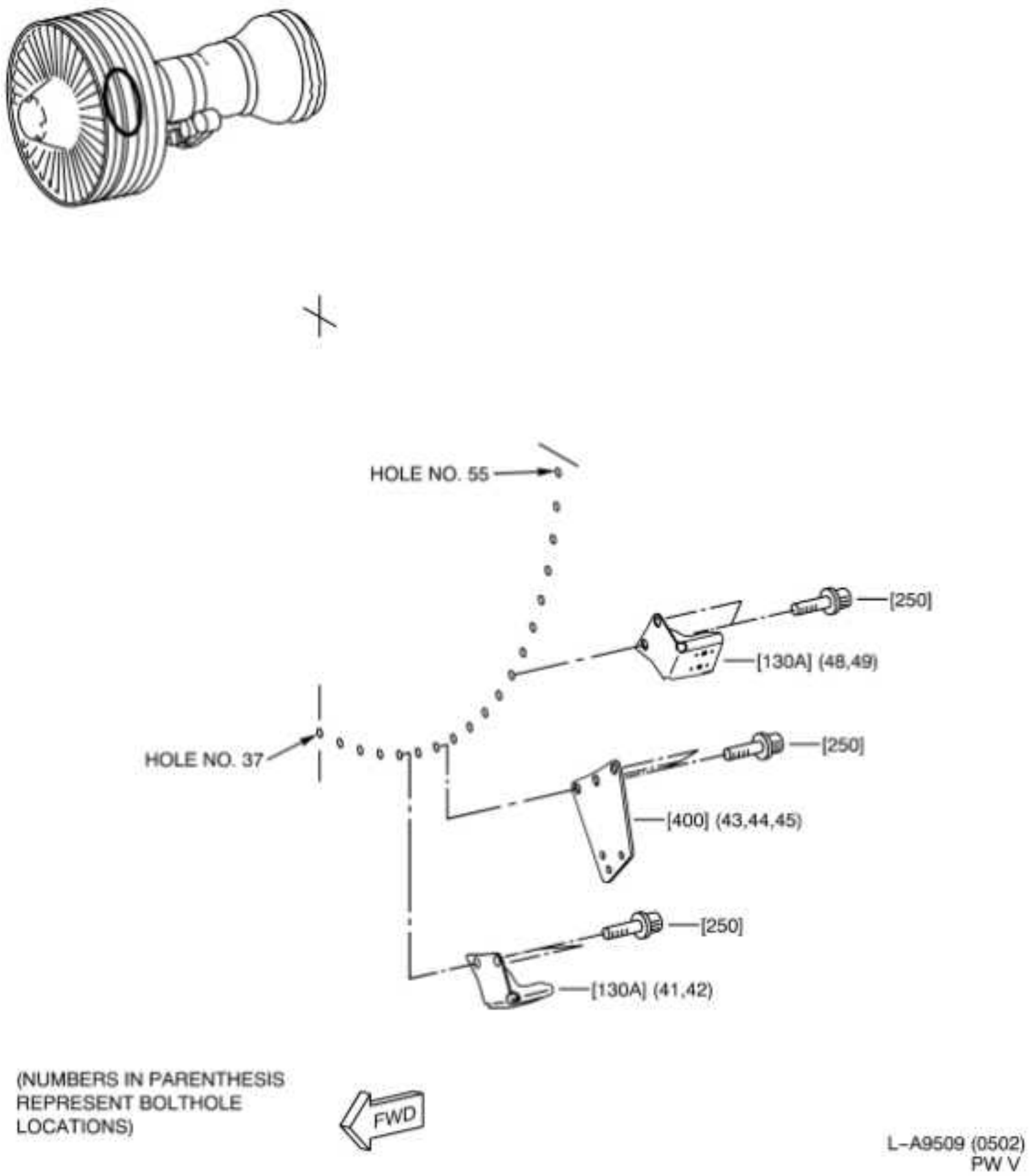
L−A9508 (0502)
PW V

Flange E Bracket Locations (For −3 Engines As Built By P&W)
Figure 401 (Sheet 5)
(Task 72−00−34−420−020)

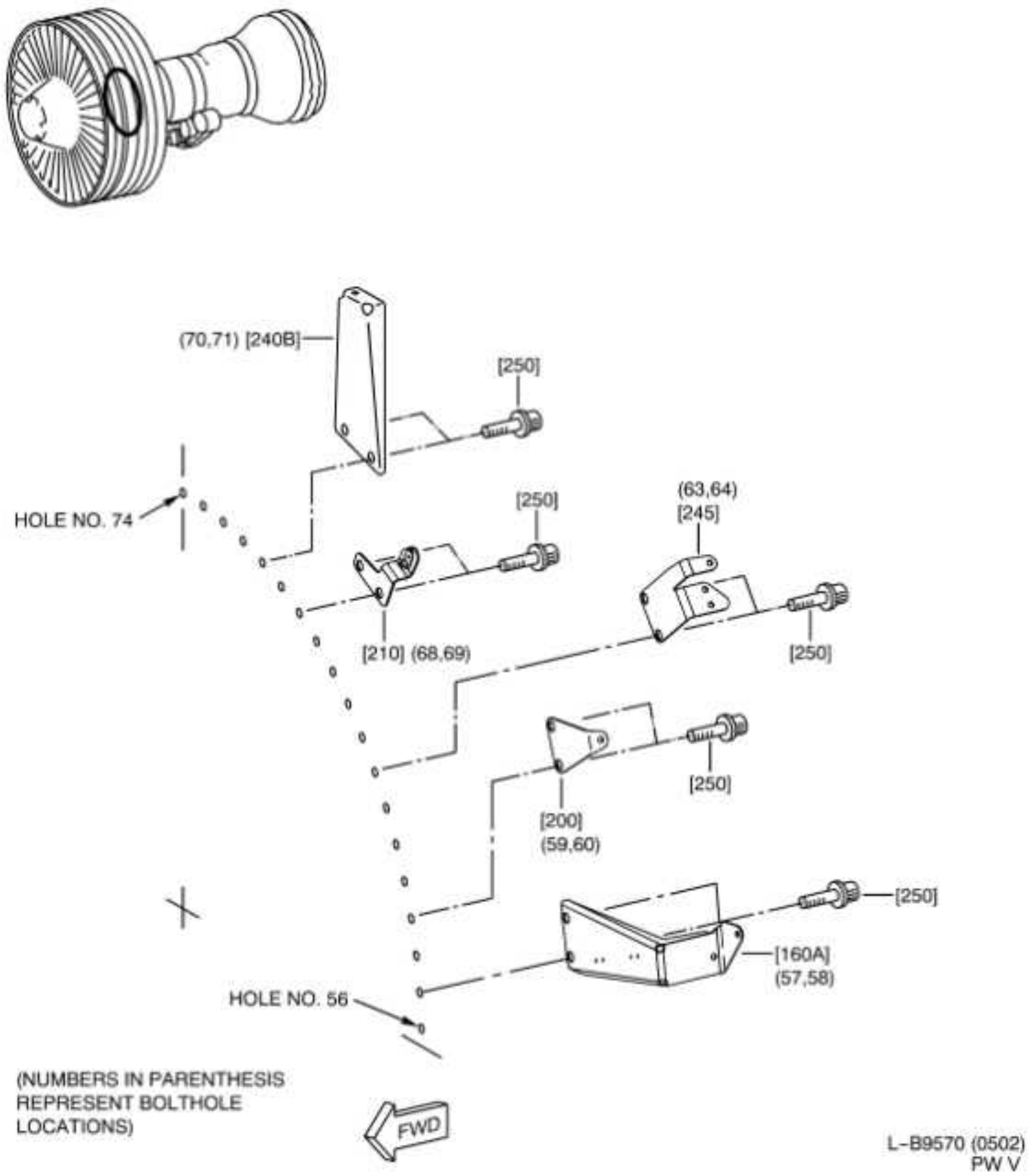

[40] (21,22)
HOLE NO. 19
[250]
[250]
[260A] (27,28)
[250]
[70A] (32,33)
[250]
[250]
[300] (36,37)
HOLE NO. 37
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B9569 (0502)
PW V

Flange E Bracket Locations (For −3 Engines As Built By P&W)
Figure 401 (Sheet 6)
(Task 72−00−34−420−020)

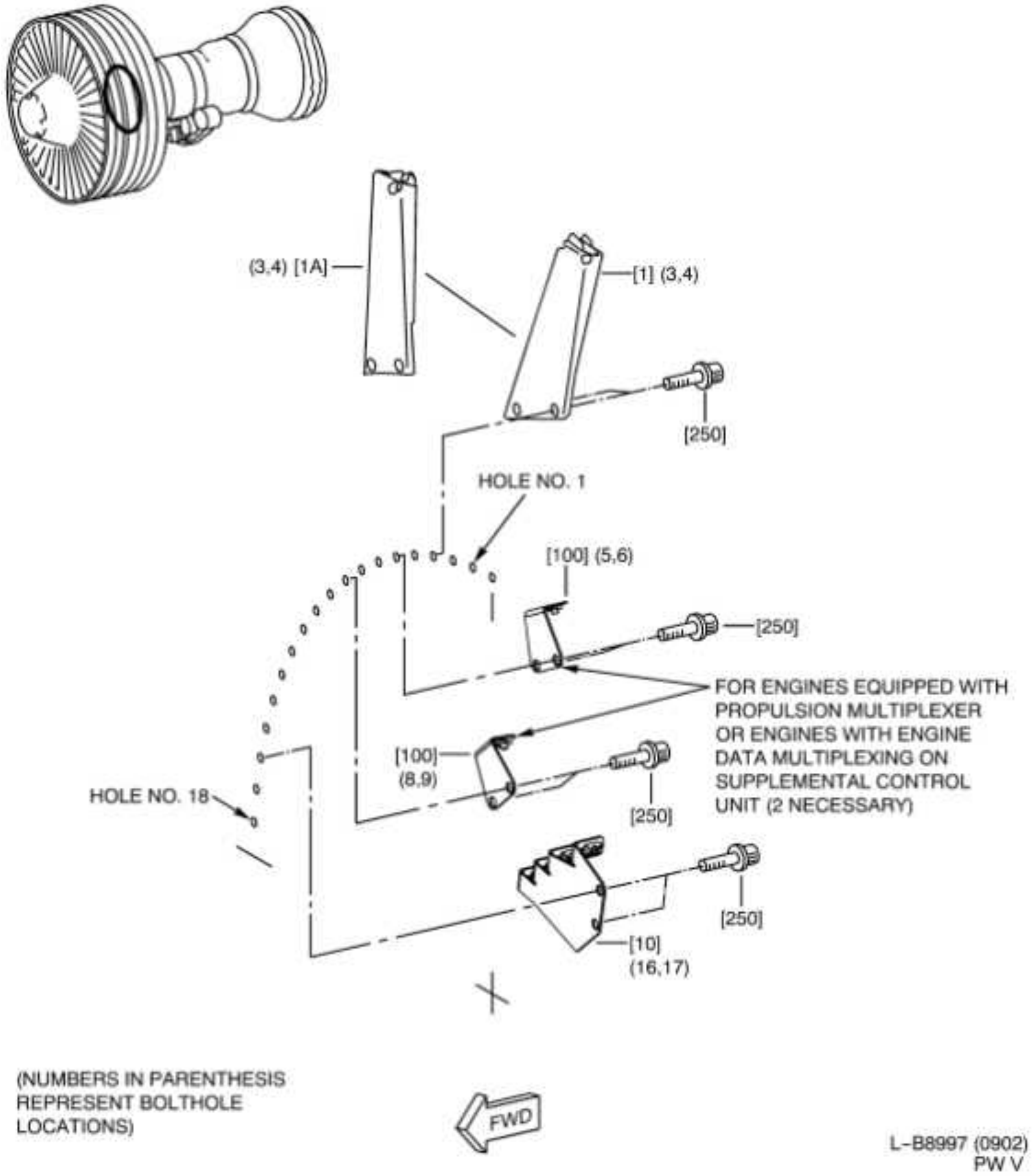
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−20


HOLE NO. 55
HOLE NO. 37
[250]
[130A] (48,49)
[250]
[400] (43,44,45)
[250]
[130A] (41,42)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-A9509 (0502)
PW V

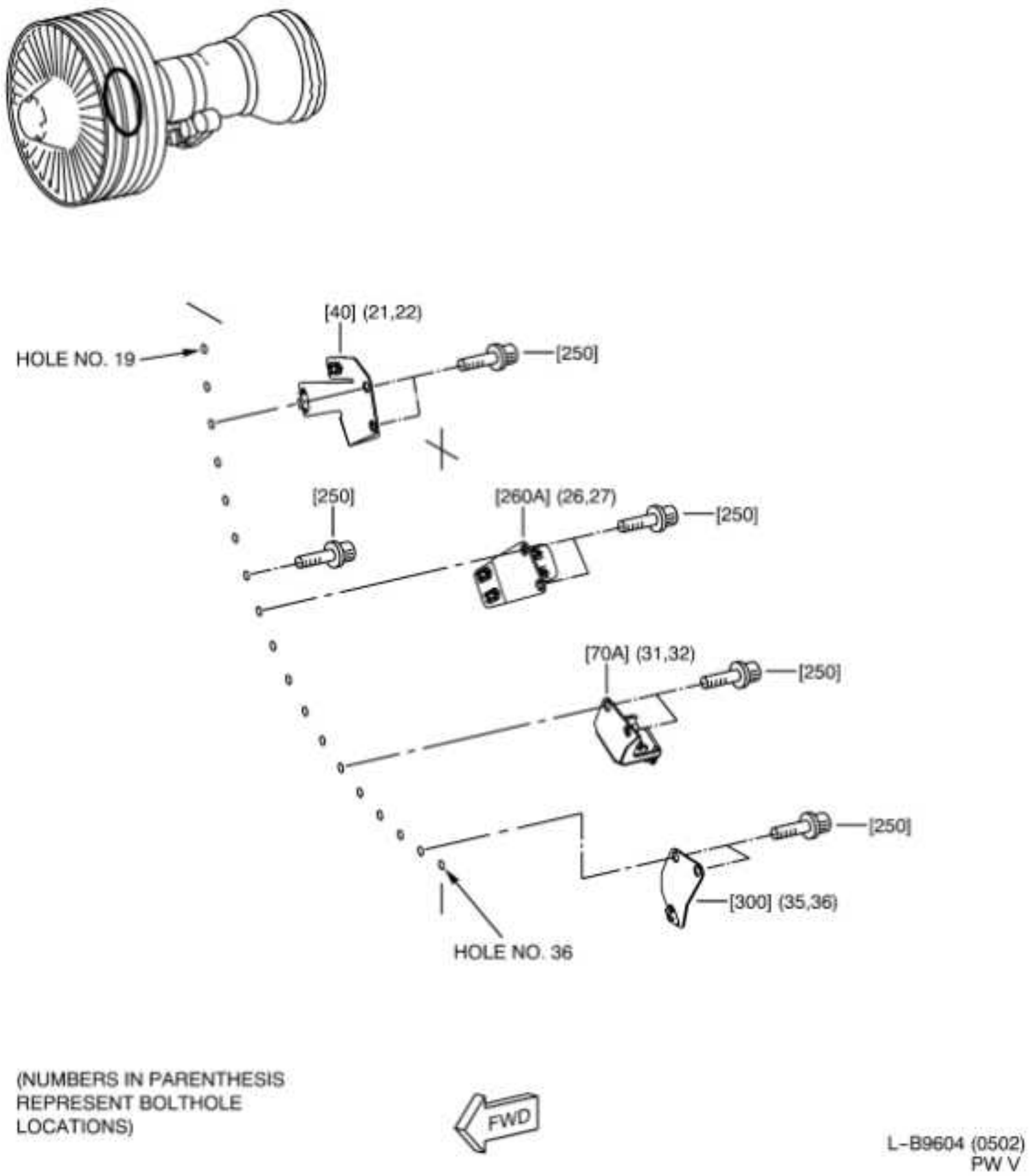
Flange E Bracket Locations (For −3 Engines As Built By P&W)
Figure 401 (Sheet 7)
(Task 72−00−34−420−020)


(70,71) [240B]
[250]
HOLE NO. 74
[250]
(63,64)
[245]
[210] (68,69)
[250]
[250]
[200]
(59,60)
[250]
[160A]
(57,58)
HOLE NO. 56
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B9570 (0502)
PW V

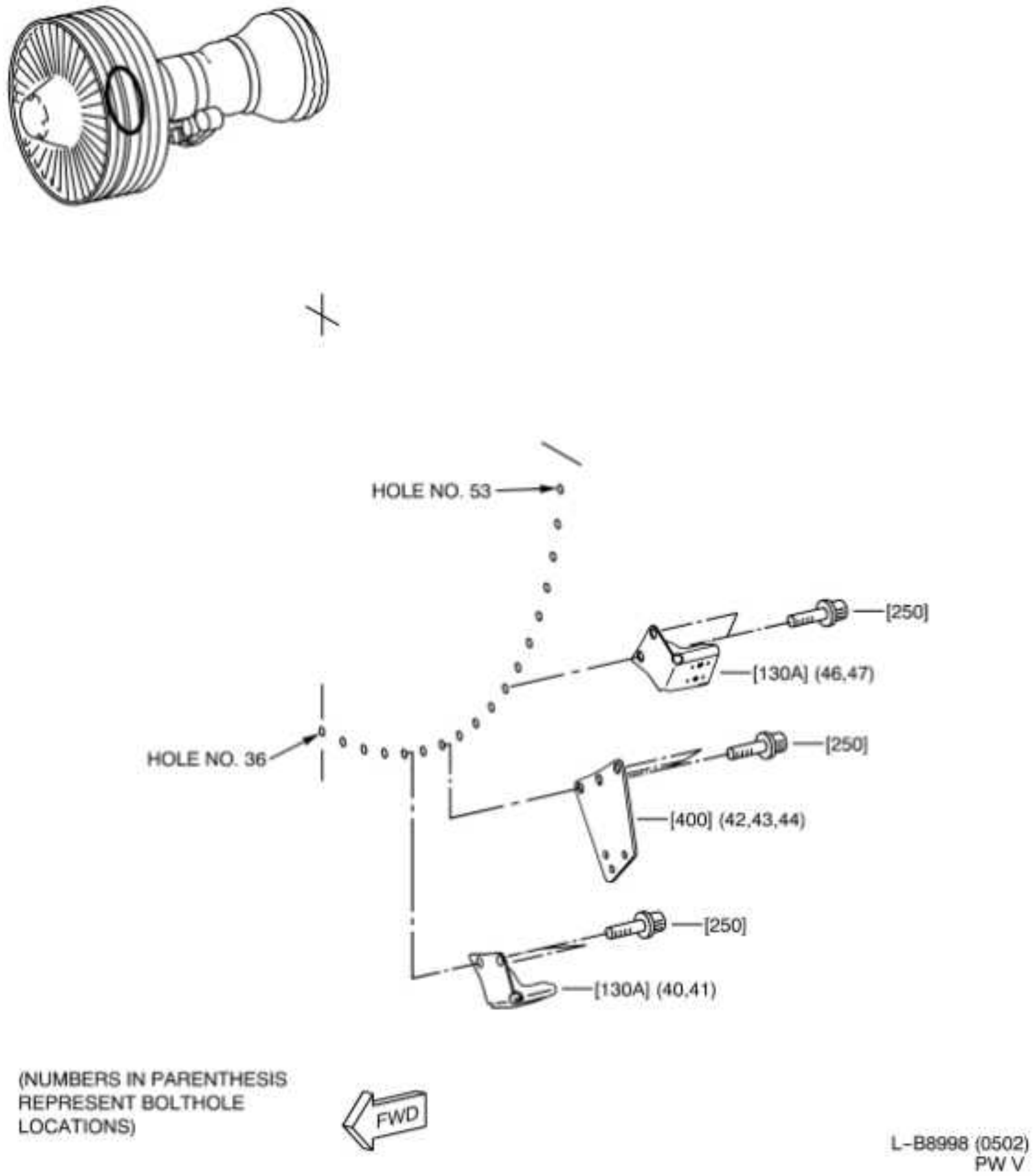
Flange E Bracket Locations (For −3 Engines As Built By P&W)
Figure 401 (Sheet 8)
(Task 72−00−34−420−020)


(3,4) [1A]
[1] (3,4)
[250]
HOLE NO. 1
[100] (5,6)
[250]
FOR ENGINES EQUIPPED WITH PROPULSION MULTIPLEXER OR ENGINES WITH ENGINE DATA MULTIPLEXING ON SUPPLEMENTAL CONTROL UNIT (2 NECESSARY)
[100]
(8,9)
[250]
HOLE NO. 18
[250]
[10]
(16,17)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B8997 (0902)
PW V

Flange E Bracket Locations (UPS Configuration)
Figure 401 (Sheet 9)
(Task 72−00−34−420−020)

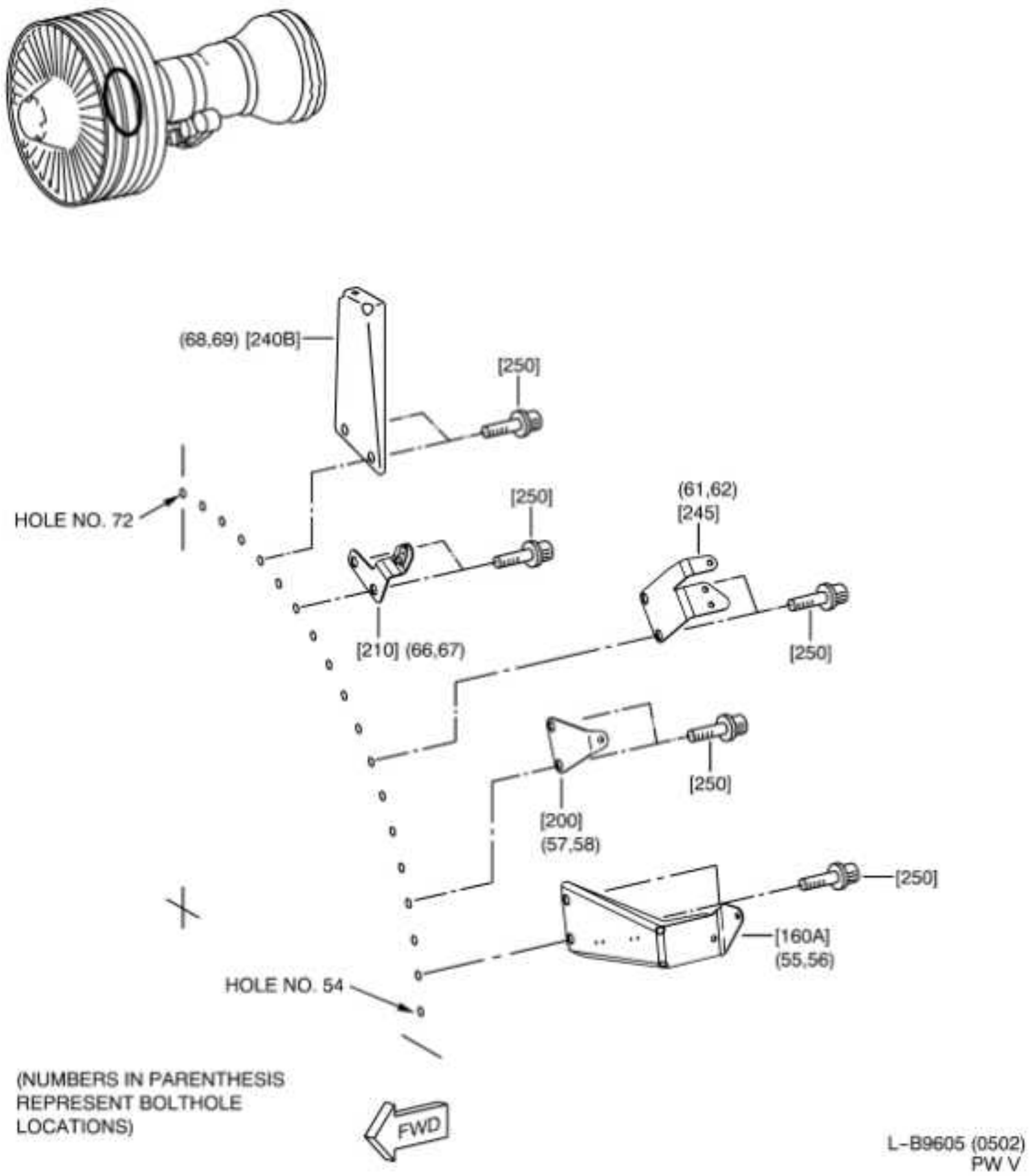

HOLE NO. 19
[40] (21,22)
[250]
[250]
[260A] (26,27)
[250]
[70A] (31,32)
[250]
[250]
[300] (35,36)
HOLE NO. 36
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B9604 (0502)
PW V

Flange E Bracket Locations (UPS Configuration)
Figure 401 (Sheet 10)
(Task 72−00−34−420−020)


HOLE NO. 53
HOLE NO. 36
[250]
[130A] (46,47)
[250]
[400] (42,43,44)
[250]
[130A] (40,41)
FWD
L-B8998 (0502)
PW V

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

Flange E Bracket Locations (UPS Configuration)
Figure 401 (Sheet 11)
(Task 72−00−34−420−020)


(68,69) [240B]
[250]
HOLE NO. 72
[250]
(61,62)
[245]
[210] (66,67)
[250]
[250]
[200]
(57,58)
[250]
[160A]
(55,56)
HOLE NO. 54
FWD
L-B9605 (0502)
PW V

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

Flange E Bracket Locations (UPS Configuration)
Figure 401 (Sheet 12)
(Task 72−00−34−420−020)

Task 72-00-34-420-004:

1. Install The Fan Unit On The Core Engine

A. Prerequisites

(1) If disassembled, install the HPC top front case. See 72-00-35, Installation-18 (Task 72-00-35-430-001).

(2) If applicable, trunnion the fan unit from rear end down to horizontal position. Refer to 72-00-00, Special Procedures-22 (Task 72-00-00-420-004).

B. Equipment And Materials Necessary

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 25757	Pedestal (2 Necessary)
PWA 25926	Adapters (2 Necessary)
PWA 29855-7	Pins, Aligning (2 Necessary)
PWA 76154	Adapter (2 Necessary)
PWA 76155	Sling
PWA 85260	Pins, Aligning (2 Necessary)
PWA 85429	Wrench
PWA 85471	Wrench, Torque
PWA 85537	Fixture, Handling
PWA 85585	Ring, Guide
PWA 85623	Eye, Lifting
PWA 85631	Guide, Piloting
PWA 85768	Puller
PWA 85785	Adapter, Piloting
PWA 86209	Retainer, Positioning (Optional To PWA 85537)
PWA 86598	Retainer, Positioning (Optional To PWA 86209)
PWA 88204	Guide, Piloting

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
R	P06-021	Compound, Antigalling (PWA 550-3)
R	P06-053	Lubricant, Sealing Ring (PWA 36500)
R	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	3	72-35-00/23/300
Packing	1	24-11-00/2/70
Packing	1	72-34-00/16/1
Packing	1	72-35-00/11/165
Packing	1	72-61-00/8/160
Packing	1	72-62-00/6/20
Packing	1	72-62-00/6/30
Packing	3	79-21-00/8/1
Packing	1	79-21-00/8/120
Packing	1	79-21-00/11/1
Packing	1	79-22-00/1/1
Retainer	1	79-21-00/8/130
Retainer	1	79-21-00/11/10
Lockwire, MS9226-06		

C. Procedure - Install The Fan Unit To The Core Engine

(1) If installed, remove the turbine shaft nut and washer from the front of the LPT shaft. Use PWA 85429 Wrench. See Figure 401.

(2) If not installed, install PWA 85585 Guide Ring on the No. 1.5-bearing-support-assembly with detail screws. See Figure 402.

(3) If not installed, install PWA 85785 Adapter to the front of the fan hub as follows.

(a) Move the legs of the adapter to their outermost position.

(b) Engage the rear of the fan hub.

(c) Tighten the wing nuts to hold the legs in position.

(4) If not installed, install the PWA 88204 Guide in the front of the LPT shaft on the core-unit. Tighten by hand. See Figure 403.

CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE-UNIT BY THE PWA 85631 GUIDE YOU INSTALL ON THE FRONT OF THE UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE GUIDE. TOO MUCH STRESS ON THE GUIDE CAN CAUSE DAMAGE TO THE PLAIN ROUND NUT.

(5) If not installed, install PWA 85631 Guide as follows.

(a) Install the guide in the plain round nut. Be sure the threads engage correctly.

(b) Use PWA 85471 Wrench and tighten the guide until seated.

NOTE: If equipped, the four grooves on the PWA 85631 Guide Change B, must be fully rearward of the PWA 85585 Guide Ring front surface. If the grooves are not fully rearward of the ring, the threads of the guide are not fully engaged.

(6) If not installed, attach PWA 85623 Eye to the intermediate case at 12 o'clock with the detail screws. See Figure 404.

(7) Support the engine with hoists at:

(a) The front of the fan unit. Use, in addition to a hoist and PWA 86567 Adapters, PWA 76155 Sling and two PWA 76154 Adapters.

(b) The rear of the fan unit: PWA 85659 Eye.

NOTE: There is already a Hoist and PWA 85390 Adapters that support the center of the core-unit.

(8) If installed, remove PWA 85537 Fixture or PWA 86598 Retainer or PWA 86209 Retainer. See Figure 405.

(9) If installed, remove the pedestals from the fan unit.

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−21

(10) For engines that have incorporated SB PW4ENG 72−48, install a packing on the rear of the intermediate case as follows. See Figure 406.

R (a) Lubricate a packing with Engine Oil P03−001 or
R Sealing Ring Lubricant P06−053.

(b) Install the packing.

R (11) Lubricate a packing with Engine Oil P03−001 or Sealing
R Ring Lubricant P06−053 and install it on the No. 2
R bearing support assembly.

R (12) Install the transfer tube and the new packings,
R lubricated with Engine Oil P03−001 or Sealing Ring
R Lubricant P06−053 to the No. 2 bearing support.

(13) Install PWA 85260 Aligning Pins in the intermediate case. See Figure 406.

(a) Install them at 3 and 9 o'clock positions.

(b) Install them in the Flange E boltholes.

(14) Install PWA 29855−7 Aligning Pins in the intermediate case. See Figure 406.

(a) Install them at 6 and 12 o'clock positions.

(b) Install them in the Flange E boltholes.

(15) Install the gearbox−driveshaft−(front)−housing (called front housing) and the gearbox driveshaft in the gearbox driveshaft housing (called rear housing) as follows. See Figure 407.

(a) Lubricate with Engine Oil P03−001 two packings. Install the packings on the front and rear of the front housing.

(b) Install the front housing in the rear housing. Push the front housing to the rear.

(c) Install the gearbox driveshaft in the rear housing as follows.

1 Make sure that the retaining ring is on the gearbox driveshaft.

2 Mate the gearbox driveshaft splines with the splines of the gearshaft in the main gearbox.

3 Carefully push the gearbox driveshaft to the rear.

(16) Remove the protective caps, plugs, and covers from the openings on the rear of the fan−unit at:

(a) The EEC PB sensing tube nut at 12:30 o'clock position.

(b) The tube adapters of the three solenoids at 1, 5, and 10 o'clock positions.

(c) The No. 3−bearing−air−cooler−adapters at 2:30 o'clock position.

(d) The bleed−valve−supply tube nut and tube coupling at 5 o'clock position.

(e) The angle−gearbox−oil−pressure adapter on the angle gearbox at 6 o'clock position.

(f) The cooling−air−tube adapter at 6:30 o'clock position.

(g) The 1, 1.5, and 2 main−bearing−oil−scavenge−tube coupling at 7:30 o'clock position.

(h) The main−bearing−oil−breather−tube nut at 11:30 o'clock position.

(i) The EEC PT4.95 sensing tube nut at 11:30 o'clock position.

(17) Remove the protective caps, plugs, and covers from the openings on the front of the core−unit at:

(a) The EEC PB sensing tube coupling at 12:30 o'clock position.

(b) The tube nuts that attach to the three solenoids at l, 5, and 10 o'clock positions.

(c) The two No. 3−bearing−air−cooler−tube nuts at 2:30 o'clock position.

(d) The bleed-valve-supply-tube nut and adapter at 5 o'clock position.

(e) The angle-gearbox-pressure-tube nut at 6 o'clock position.

(f) The No. 1, 1.5, and 2 bearing-oil-scavenge-tube nut at 7:30 o'clock position.

(g) The main-bearing-oil-breather-tube coupling at 11:30 o'clock position.

(h) The EEC 4.95 sensing tube coupling at 11:30 o'clock position.

(18) Put the fan unit and the core engine together as follows. See Figure 408.

CAUTION: BE SURE TO ALIGN THE CORE-UNIT AND FAN-UNIT ACCURATELY. DO NOT PERMIT THE PWA 85631 GUIDE ON THE FRONT OF THE CORE-UNIT TO TOUCH THE NO. 2 BEARING CARBON SEAL. DAMAGE TO THE SEAL CAN RESULT.

CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE-UNIT BY THE PWA 85631 GUIDE THAT IS INSTALLED ON THE FRONT OF THE CORE-UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE GUIDE. TOO MUCH STRESS ON THE GUIDE CAN CAUSE DAMAGE TO THE PLAIN ROUND NUT.

(a) Be sure the dowel pin on the front of the No. 2 bearing support is aligned with the dowel pin hole in the No. 1.5 bearing support flange.

(b) Be sure the oil transfer tube will engage the hole in the tube connector in the No. 1.5 bearing support assembly.

(c) Be sure the bevel gear on the LPT shaft is aligned with the bevel gear in the intermediate case. See Figure 407. If not, turn the gear in the HPC as follows.

1 Remove two bolts and washers that attach the manual crank cover to the scavenge pump drive bearing housing assembly. See Figure 409.

2 Remove the cover (manual crank) with PWA 85768 Puller. See Figure 409.

3 To align the bevel gears, turn the gearshaft in the main gearbox with a wrench through the crank pad. See Figure 409.

(d) Carefully align and install the fan−unit to the core−unit until Flange E is almost together. Be sure the distance between the fan−unit and the core−unit at Flange E is approximately the same all around. At the same time, be very careful to correctly engage the bevel gears, oil transfer tube, and dowel pin.

(e) Engage the diameters of the intermediate case and the HPC.

(f) Lubricate with Engine Oil P03−001 33 bolts (No. 1.5 bearing support assembly).

(g) Remove the four workbolts that are in the 33 bolt circle of the No. 1.5 bearing support assembly. Install 33 bolts in the boltholes.

(h) Lubricate with Antigalling Compound P06−021 74 bolts (HPC Flange E).

(i) Install the 74 bolts and, where applicable, brackets in the HPC Flange E.

1 Remove the four aligning pins.

2 For engines with the 2.5 bleed actuator support bracket (Post SB PW4ENG 75−84), attach the support bracket to a bracket on Flange E with three nuts and bolts, threads lubricated with Engine Oil P03−001. Torque the nuts 85 − 95 lb−in. (9.604 − 10.734 N.m).

(j) At the same time, tighten the bolts in the 33 bolt circle and 74 bolt circle.

(k) Torque:

1 Seventy−four bolts to 225 − 250 lb−in. (25.422 − 28.246 N.m).

2 Thirty-three bolts to 180 - 200 lb-in. (20.337 - 22.597 N.m).

(19) If not done, attach PWA 25926 Adapters to two PWA 25757 Pedestals. Put the tool brackets at the sides of the intermediate case in the pedestals.

(20) Remove the eye, hoists, sling, and four PWA 76154 Adapters and PWA 86567 Adapters from the fan unit.

(21) Remove the PWA 85785 Adapter from the front fan hub as follows. See Figure 401.

(a) Loosen the wing nuts.

(b) Turn the tool legs inward.

(c) Remove the adapter.

(22) Remove the PWA 88204 Guide from the LPT shaft. See Figure 403.

(23) Remove PWA 85631 Guide from the LPT shaft. Use PWA 85471 Wrench.

(24) Remove PWA 85585 Guide Ring from the 1.5 bearing support assembly. See Figure 401.

(25) Connect the gearbox driveshaft and the front housing to the angle gearbox as follows. See Figure 407.

(a) Move the retaining ring to the front of the driveshaft.

(b) Carefully push the driveshaft forward to mate with the internal splines in the angle gearbox.

(c) If the splines of the gearbox driveshaft and angle gearbox are not aligned, turn the gearshaft in the main gearbox. Refer to the procedure in a paragraph before this one.

(d) If you removed the manual crank pad cover, install it as follows. See Figure 409.

1 Lubricate with Engine Oil P03-001 a packing.

2 Install the packing on the cover (manual crank).

3 Install the cover in the main gearbox.

4 Lubricate with Antiseize Paste P06−054 two bolts. Wipe off unwanted paste.

5 Install two washers and the two bolts.

6 Torque the bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(e) Install the retaining ring in the internal groove of the angle gearbox.

(f) Attach the front housing to the angle gearbox as follows.

1 Lubricate with Antiseize Paste P06−054 the threads of six nuts. Wipe off unwanted paste.

2 Attach the front housing and brackets to the angle gearbox with two bolts, two washers, and two of the nuts.

3 Attach the front housing to the angle gearbox with four bolts, eight washers, and four nuts.

4 Torque the bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(g) Attach the front housing brackets to the HPC as follows.

1 Lubricate with Engine Oil P03−001 the threads of four bolts.

2 Attach the brackets to the HPC with the four bolts.

3 Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

4 Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(26) If removed, install the stator vane actuator and support assembly as follows.

(a) (Pre SB PW4ENG 72−534) Install the actuator and support assembly to the HPC case brackets and lugs. Install the two upper studs and the four nuts, lubricated with Engine Oil P03−001. Torque the nuts to 65 − 85 lb−in. (7.344 − 9.604 N.m) and install the cotter pins. See Standard Practices Manual, PN 585005, 70−53−00. See Figure 410.

(b) (Post SB PW4ENG 72−534) Install the actuator and support assembly to the HPC case bracket and lugs. Install two expandable studs (called studs) to upper attaching points on support assembly. See Figure 411 (Sheet 1) and Figure 411 (Sheet 2).

NOTE: Installation of the stud to the front attachment lug may require that the 5th stage unison ring be rotated so that the hole in the clevis is in line with the hole in the support assembly and the lug of the front compressor case. This will allow the stud to pass through the hole in the clevis and into the support assembly and the lug on the case.

(c) Lubricate the threads of the nuts with Engine Oil P03−001. Install a washer and a lubricated nut to each end of the studs. Center the studs so that an approximate equal length projects from the front and rear of the front compressor attachment points. Tighten the nuts fingertight.

(d) (Reference 739) Use a 3/32 inch (2.381 mm) hexagonal wrench in the end of the stud to prevent rotation during the torque process. Alternately torque each nut approximately one−half turn until a torque of 55 − 70 lb−in. (6.214 − 7.909 N.m) is obtained and a slot in the nuts is aligned with the cotter pin hole in the studs.

(e) After final torque of the nuts, do an inspection to ensure the following:

1 That a gap exists between the washer and the front compressor attachment points on one or both sides. Replace the stud if the total gap is less than 0.005 inch (0.127 mm). Total gap is the gap at both ends added together, or if only one gap, a gap at either end. See Figure 410 and Figure 411.

2 That the cotter pin holes are located entirely in the slot of the nuts.

3 That the stud end projection is approximately equal at both ends, plus or minus one thread beyond the outboard end of each nut.

(f) Install a cotter pin to secure each nut. Secure four cotter pins. See Standard Practices Manual, PN 585005, 70-53-00.

(g) Install the two lower bolts, lubricated with Engine Oil P03-001, and the two nuts as shown. Torque the nuts to 125 - 170 lb-in. (14.123 - 19.207 N.m). Install the lockwire through each castellated nut and wire hole in bolt threads. Twist the lockwire and wrap around the support and twist again. See Figure 411.

NOTE: The lockwire will prevent the bolts from turning.

(h) (Reference 618) Install the bolt, lubricated with Engine Oil P03-001, through the brace and support with the washer between the brace and support. Install the washer and nut on the bolt. Tighten the nut until a cotter pin slot aligns with the cotter pin hole in the bolt. Hold the head of the bolt against the brace. Measure the clearance from the nut and washer to the bracket. Measure the distance from the brace and washer to the support. Install shims (0-15AR) to get a clearance of 0.008L - 0.008T inch (0.203L - 0.203T mm) on each side of the support. Install and torque the nut 50 - 80 lb-in. (5.649 - 9.039 N.m). Install the cotter pin.

(27) If removed, install the turbine case cooling (TCC) air valve actuator as follows. See Figure 412.

(a) Position and hold actuator clear of pins on bracket on HPC case.

(b) Connect cable end to actuator piston shaft. Position actuator on bracket with pins engaging holes in actuator mount rails.

(c) Secure actuator in place with four bolts, threads lubricated with Engine Oil P03-001, and nuts (if equipped). Torque clamp bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(d) Secure ground strap to threaded hole on rear face of actuator with bolt, threads lubricated with Engine Oil P03-001. Torque bolt to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(28) Lubricate cable coupling nut threads with Engine Oil P03-001, and torque nut to 100 - 125 lb-in. (11.298 - 14.123 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(29) Secure cable rod end bearing to valve idler arm at turbine case cooling (TCC) air shutoff valve (HPT) with bolt, threads lubricated with Engine Oil P03-001, and nut. Torque nut to 36 - 40 lb-in. (4.067 - 4.519 N.m).

D. Procedure - Connect The Tubes
Figure 413 for the right side and Figure 414 for the left side.

(1) Connect the EEC PB sensing tube (AS20) at 12:30 o'clock position as follows. See Figure 413 (Sheet 1).

(a) Do not lubricate the tube threads.

(b) (Reference 2165) Tighten and torque the tube nut to 90 - 110 lb-in. (10.169 - 12.428 N.m).

(c) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(2) Connect the HPC air valve supply (AA25) and signal tube (AA01) to the solenoid adapters at 1 o'clock position as follows.

(a) Apply Antiseize Paste P06-054 to the threads of both solenoid tube adapters. Wipe off unwanted paste.

(b) Tighten and torque the supply tube nut (larger) to 225 - 250 lb-in. (25.422 - 28.246 N.m).

(c) Tighten and torque the signal tube nut (smaller) to 200 - 225 lb-in. (22.597 - 25.422 N.m).

(d) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(3) Connect the No. 3 bearing air cooler tubes (AP33) and (AP34) to the cooler at 2:30 o'clock position as follows.

(a) Apply Antigalling Compound P06-021 to the threads of both air cooler adapters. See Figure 413 (Sheet 2).

(b) Tighten and torque both tube nuts to 825 - 900 lb-in. (93.212 - 106.686 N.m).

(c) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

CAUTION: DO NOT USE LUBRICANTS ON THE SUPPLEMENTAL CONTROL UNIT (SCU) SENSING TUBES, ADAPTERS OR PACKINGS. LUBRICANTS CAN CAUSE CONTAMINATION OF THE SCU.

(4) For engines with the supplemental control unit (SCU) with multiplexing, install the PT2.5 sensing tube assembly (AS35) as follows. See Figure 413 (Sheets 3 through 5).

(a) Remove the protection covers.

(b) Attach the (AS35) tube to brackets on Flange E at the 4:30 and 5:00 o'clock positions with clamps and bolts, threads lubricated with Engine Oil P03-001 and tighten by hand.

(c) Install the upper PT2.5 sensing tube assembly (AS30) as follows.

(d) Remove the protection covers.

(e) For engines equipped with the supplemental control unit (SCU) with multiplexing, install the (AS30) tube to the (AS35) tube assembly and tighten the tube nut by hand.

(f) Install clamps to the (AS30) tube and attach the clamps to brackets on Flange E with four bolts and a nut. Lubricate the threads with Engine Oil P03-001. Torque the bolts and a nut to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(g) (Reference 2165) Torque the upper tube nut to the (AS29) tube coupling at 1 o'clock position to 90 - 110 lb-in. (10.169 - 12.428 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(h) For engines not equipped with the supplemental control unit (SCU) with multiplexing, install a cap assembly to the lower end of the (AS30) tube. Torque the cap assembly 135 - 150 lb-in. (15.2453 - 16.948 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the cap assembly.

(5) For engines not equipped with the supplemental control unit (SCU) with multiplexing, do as follows.

(a) Torque the bolts that attach the (AS35) tube to brackets on Flange E to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(b) Torque the tube nut (AS35) to the tube coupling tube (AS30) to 135 - 150 lb-in. (15.253 - 16.948 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the tube nut.

NOTE: The manifold (AS31) is installed and torqued with the transducer (N1) multiplexer input probe.

(6) Install the three bleed valve supply tubes (AA26), (AA27) and (AA29) as follows. See Figure 413 (Sheets 6 and 7).

(a) Remove the protective covers.

(b) Lubricate all the tube nut and coupling threads with Antiseize Paste P06-054. Wipe off unwanted paste.

(c) Install the inboard tube (AA26) (supply) to the upper tube nut at 2 o'clock position and to the solenoid adapter at 5 o'clock position. Attach the tube nut to the tube tee adjacent to the solenoid.

(d) Install the middle tube (AA27) (left supply) to the tube coupling at 2 o'clock position and to the tube coupling adjacent to the solenoid at 5 o'clock position.

(e) Install the outboard tube (AA29) (right supply) to the tube nut at 2 o'clock position and to the solenoid adapter at 5 o'clock position.

(f) Install the clamp bolts, lubricated with Engine Oil P03-001, spacer, and nut, that attach the tubes to the brackets and to each other. Torque the clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(g) Torque the lower tube nut of the inboard tube to the larger solenoid adapter to 225 - 250 lb-in. (25.422 - 28.246 N.m). Torque all of the remaining tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety all the tube nuts.

(7) Install the fuel distribution valve supply tube (FM09) as follows. See Figure 413 (Sheet 8).

(a) Remove the protective covers.

R (b) Install the two packings PN 227433, lubricated
R with Engine Oil P03-001 or Sealing Ring Lubricant
R P06-053 and retainers PN 354120.

(c) Install the tube to fuel flowmeter and to the fuel metering unit. Tighten by hand.

(d) Install the clamp bolt, lubricated with Engine Oil P03-001, and attach the clamp to the HPC case bracket. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque the tube nuts to 100 − 110 lb−in. (11.298 − 12.428 N.m). Loosen the tube nuts and torque them again to the same limits. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nuts.

(8) Install the hydraulic pressure manifold (CP05) and oil cooler inlet return manifold (CR01) as follows. See Figure 413 (Sheet 9).

(a) Remove the protective covers.

(b) Lubricate all the manifold coupling and tube nut threads with Antiseize Paste P06−054. Wipe off unwanted paste.

(c) Install the two manifolds to the two hoses at 3 o'clock position and to the manifolds at 5 o'clock position.

(d) Install the clamp bolts, lubricated with Engine Oil P03−001, and nut, that attach the manifolds to the engine brackets. Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque the return manifold nuts (smaller) at each end to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nuts.

(f) Torque the pressure manifold nuts (larger) at each end to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nuts.

(9) Install the compressor stator cylinder hydraulic pressure and return tubes (CP12) and (CR03) as follows. See Figure 413 (Sheet 9).

(a) Remove the protective covers.

(b) Lubricate the tube nut threads of both tubes with Antiseize Paste P06−054. Wipe off unwanted paste.

(c) Install the two tubes to the manifold tees and the cylinder adapters.

(d) Install the two clamp bolts, lubricated with Engine Oil P03-001, that attach the tubes to the Flange E bracket. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque the return tube nuts (smaller) to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(f) Torque the pressure tube nuts (larger) to 225 - 250 lb-in. (25.422 - 28.246 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

CAUTION: MAKE SURE YOU CONNECT THE TUBES TO THE CORRECT CONNECTORS OR FAULT MESSAGES WILL BE GENERATED.

(10) Install the (IDG) air/oil cooler valve hydraulic pressure (CP13) and return (CR12) tubes to the IDG heat exchanger at 4 o'clock position as follows. See Figure 413 (Sheet 10).

(a) Remove the protective covers.

(b) Lubricate the (IDG) air/oil cooler valve hydraulic pressure and return tube nut threads with Antiseize Paste P06-054. Wipe off unwanted paste.

(c) Install the two tubes to the manifold tees and heat exchanger adapters.

1 Install the CR12 tube to the adapter that is furthest from the lower triangular pad on the exchanger. Install the CP13 tube to the adapter that is closest to the lower triangular pad on the exchanger. Connect tube nut to heat exchanger adapter.

(d) Torque the two return tube nuts and the one smaller pressure tube nut to 200 - 225 lb-in. (22.597 - 25.422 N.m). Torque the one pressure tube nut (larger) to the manifold tee to 340 - 375 lb-in. (38.415 - 42.369 N.m).

(e) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(11) Install the airframe (IDG) cooler outlet oil tube (LS03) as follows. See Figure 413 (Sheet 10).

(a) Remove the protective covers.

R (b) Install a packing, lubricated with Engine Oil
R P03-001 or Sealing Ring Lubricant P06-053 to the
R packing groove at the flanged end of the tube.

(c) Lubricate the tube nut threads with Antiseize Paste P06-054. Wipe off unwanted paste.

(d) Install the tube with the three bolts, lubricated with Engine Oil P03-001 to the heat exchanger. Tighten the tube nut by hand. Torque the three bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). Torque the tube nut to 675 - 750 lb-in. (76.265 - 84.739 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut and bolts.

(12) Connect the angle gearbox oil pressure tube (LP09) to the angle gearbox at 6 o'clock position as follows. See Figure 413 (Sheet 11).

(a) Apply Antiseize Paste P06-054 to the threads of the mating tube adapter on the angle gearbox. Wipe off unwanted paste.

(b) Tighten and torque the tube nut to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(13) Connect the angle gearbox oil scavenge tube (LR01) to the angle gearbox at 6 o'clock position as follows.

R (a) Remove the protective covers. Install a new
R packing, lubricated with Engine Oil P03-001 or
R Sealing Ring Lubricant P06-053 to the groove at
R the flanged end.

(b) Engage the flanged end into the angle gearbox boss. Install the two bolts, lubricated with Engine Oil P03-001. Tighten and torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(c) Install and torque all the clamp bolts that attach the tube to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(14) Install the 2.5 bleed valve cylinder hydraulic pressure (CP06) and return (CR02) tubes at 7 o'clock position as follows. See Figure 414 (Sheet 1).

(a) Remove protective covers.

(b) Apply Engine Oil P03-001 to the bleed valve cylinder return tube nut threads (smaller diameter tube).

(c) Install the tube. Tighten and torque the tube nuts to 270 - 300 lb-in. (30.506 - 33.895 N.m).

(d) Apply Antiseize Paste P06-054 to the bleed valve cylinder hydraulic pressure tube nut threads (largest diameter tube). Wipe off unwanted paste.

(e) Install the tube. Torque the tube nut attached to the manifold tee to 340 - 375 lb-in. (38.415 - 42.369 N.m). Torque the tube nut attached to the actuator to 225 - 250 lb-in. (25.422 - 28.246 N.m).

(f) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(15) Connect the No. 1, 1.5, and 2 bearing oil scavenge tube (LR02) at the 7:30 o'clock position as follows. See Figure 414 (Sheet 2).

(a) Apply Engine Oil P03-001 to the tubes mating coupling threads.

(b) Tighten and torque the tube nut to 1300 - 1400 lb-in. (146.880 - 158.179 N.m).

(c) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(16) Install the (left) air/oil cooler hydraulic pressure (CP07) and return (CR05) tubes as follows. See Figure 414 (Sheet 2).

(a) Remove the protective covers.

(b) Lubricate the tube nut threads of both tubes with Antiseize Paste P06-054. Wipe off unwanted paste.

(c) Install the tubes to the heat exchanger adapters and the manifold tees. Install the clamp bolt, lubricated with Engine Oil P03-001, that attaches the pressure tube to the Flange E bracket. Torque the clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Torque the one (larger) hydraulic pressure tube nut to the manifold tee to 225 - 250 lb-in. (25.422 - 28.246 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(e) Torque the three remaining (smaller) tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(17) Install the (left) air/oil cooler outlet oil hose and tube assembly (LP03) as follows. See Figure 414 (Sheet 3).

(a) Remove the protective covers.

(b) Apply wet Zinc Chromate Primer P18-003 to the mating surface of the flange end. Do not apply any primer to the raised portion near the packing groove. Let it air dry for 10 minutes before assembly.

R (c) Install a new packing, lubricated with Engine Oil
R P03-001 or Sealing Ring Lubricant P06-053 to the
R packing groove at the flanged end.

R (d) Install a new packing, lubricated with Engine Oil
R P03-001 or Sealing Ring Lubricant P06-053 and
R retainer to the nut end of the tube.

(e) Lubricate the tube nut threads with Antigalling Compound P06-021 and install the tube to the fuel/oil cooler bypass valve and the air/oil heat exchanger.

(f) Attach the flanged end with the two inboard bolts, lubricated with Engine Oil P03-001. Tighten by hand.

(g) Install the clamp bolt, lubricated with Engine Oil P03-001, that attaches the tube to the HPC case bracket. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(h) Torque the tube nut to 200 - 220 lb-in. (22.597 - 24.857 N.m). Loosen the tube nut and torque it again to the same limit. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

NOTE: Torque the bolts at the forward end with the installation of the oil inlet tube.

(18) Install the (left) air/oil cooler inlet oil tube (LP02) as follows. See Figure 414 (Sheet 3).

(a) Remove the protective covers.

R (b) Install the two new packings, lubricated with
R Engine Oil P03-001 or Sealing Ring Lubricant
R P06-053 to the tube ends.

(c) Install the tube to the heat exchanger and the main oil filter housing. Install the six bolts, lubricated with Engine Oil P03-001, that attach the tube.

(d) Install the bolt, lubricated with Engine Oil P03-001, and attaches the harness bracket to the tube. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque the eight bolts that attach the two tube flanges to the heat exchanger and the one tube flange to the main oil filter housing to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(19) Install the main bearing oil pressure tube (LP05) to the last−chance strainer housing at 9 o'clock position as follows. See Figure 414 (Sheet 4).

(a) Remove the protective cover.

R (b) Install a new packing, lubricated with Engine Oil P03−001 or Sealing Ring Lubricant P06−053 and retainer to the tube.

(c) Lubricate the tube nut threads with Antiseize Paste P06−054. Wipe off unwanted paste.

(d) Install the tube to the strainer housing adjacent to Flange E and above the fuel/oil cooler.

(e) Install the two clamp bolts, lubricated with Engine Oil P03−001, that attach the tube and the strainer housing to Flange E. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(f) Torque the forward tube nut to 675 − 750 lb−in (76.265 − 84.739 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nut.

(g) Torque the rear tube nut to 140 − 160 lb−in. (15.818 − 18.078 N.m). Loosen the tube nut and torque it again to the same limits. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nut.

(20) Connect the HPC air valve and air shutoff valve supply (AA22) and the signal tubes (AA06) and (AA18) to the solenoid at 10 o'clock position as follows. See Figure 414 (Sheet 4).

(a) Apply Antiseize Paste P06−054 to the adapter threads on the solenoid. Wipe off unwanted paste.

(b) Tighten and torque the (largest diameter) supply tube nut to 225 − 250 lb−in. (25.422 − 28.246 N.m).

(c) Tighten and torque the two (smaller diameter) signal tubes to 200 − 225 lb−in. (22.597 − 25.422 N.m).

(d) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(21) Connect the main bearing breather tube (LB06) at 11:30 o'clock position as follows. See Figure 414 (Sheet 5).

(a) Apply Antiseize Paste P06-054 to the upper tube coupling threads. Wipe off unwanted paste.

(b) Tighten and torque the tube nut to 1150 - 1300 lb-in. (129.933 - 146.880 N.m).

(c) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(22) Connect the EEC PT4.95 tube (AS04) at 11:30 o'clock position as follows. See Figure 414 (Sheet 5).

(a) Do not lubricate tube threads.

(b) Tighten and torque the tube nut to 270 - 300 lb-in. (30.506 - 33.895 N.m).

(c) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

E. Connect The Wiring Harnesses

CAUTION: SEE 72-00-00, INSTALLATION-00 (TASK 72-00-00-990-008) AND (TASK 72-00-00-990-009) FOR NECESSARY GENERAL INSTALLATION INSTRUCTIONS ABOUT THE WIRING HARNESSES, LEADS, AND CABLES.

CAUTION: DO NOT TWIST OR BEND THE HARNESSES BADLY DURING INSTALLATION OR DAMAGE TO THE HARNESSES CAN RESULT.

(1) If removed, install the W3, W4, and W5 harnesses to the core-unit as follows. See Figure 415.

(a) Install the harness support bracket (upper) to the bracket on the fuel/oil cooler and the HPC case bracket. Attach the support bracket with the bolt and nut, lubricated with Engine Oil P03−001. Torque the bolt and nut to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(b) Connect all the W3, W4, and W5 harness connectors (given below) to the mating harness receptacles as follows. For each connector:

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary,
R carefully make straight all the bent pins. If
R necessary, clean the connector and receptacle
R by SPOP 6 (Task 70−21−00−110−900). Refer to
R Section 70−21−00 in the Standard Practices
R Manual, PN 585005.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- The connector coupling nut is fully tight
- The connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts

are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque. See the instructions given with the strap wrench for correct use.

4 Attach the W4J25 connector, the W5J26 connector, and the W3J24 connector to the HPC case brackets. Install the connector retaining brackets and bolts, lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

5 Connect the W4P16 connector to the TCC air valve actuator.

6 Connect the W5P7 connector and the W4P3 connector to the stator vane actuator.

7 Install the clamp bolts, lubricated with Engine Oil P03−001, and nuts that attach the W3, W4, and W5 harnesses to the engine brackets. See Figure 415. Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(2) Install the W2 harness to the core−unit as follows. See Figure 416

(a) Remove the lockwire that attaches the W2 harness to the 12 o'clock strut. Adjust the harness in position.

(b) Connect the W2P26 harness connector to the harness receptacle on the HPC case bracket at 12 o'clock position as follows.

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary,
R carefully make straight all the bent pins. If
R necessary, clean the connector and receptacle
R by SPOP 6 (Task 70−21−00−110−900). Refer to
R Section 70−21−00 in the Standard Practices
R Manual, PN 585005.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG-70 Strap Wrench or the Glenair TG-69 Soft-Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- The connector coupling nut is fully tight
- The connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque. See the instructions given with the strap wrench for correct use.

(c) Attach the W2J9 harness receptacle to the HPC case bracket at 12 o'clock position. Install the retaining bracket and the two bolts, lubricated with Engine Oil P03-001. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Install the clamp bolts, lubricated with Engine Oil P03-001, and nuts that attach the W2 harness to the Flange E bracket and the No. 1, 1.5 and 2 bearing breather tube. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(3) Install the W1 harness to the core engine as follows. See Figure 416.

(a) Remove the lockwire that attaches the W1 harness to the 12 o'clock strut. Adjust the harness in position.

(b) Connect the W1 harness connectors (given below) to the mating harness receptacles as follows. For each connector:

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary,
R carefully make straight all the bent pins. If
R necessary, clean the connector and receptacle
R by SPOP 6 (Task 70-21-00-110-900). Refer to
R Section 70-21-00 in the Standard Practices
R Manual, PN 585005.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG-70 Strap Wrench or the Glenair TG-69 Soft-Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- The connector coupling nut is fully tight
- The connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts

are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque. See the instructions given with the strap wrench for correct use.

- Connect the W1P25 harness connector to the receptacle on the HPC case bracket at 1 o'clock position and tighten.
- Connect the W1P11 and W1P10 harness connectors to the 1 o'clock position solenoid and tighten. Install the clamp bolts, lubricated with Engine Oil P03-001, and nuts that attach the W1 harness to the solenoid muscle tube and the Flange E bracket. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).
- Connect the W1P24 harness connector to the receptacle on the HPC case bracket at 10 o'clock position and tighten.
- Connect the W1P9 harness connector to the receptacle on the HPC case bracket at 12 o'clock position and tighten.
- Connect the W1P12 harness connector to the solenoid at 10 o'clock position and tighten.

(c) Install the clamp bolts, threads lubricated with Engine Oil P03-001, and nuts that attach the W1 harness to the HPC case brackets. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(4) Install the other harnesses as follows. See Figure 417.

(a) Attach the (IDG)-heat-exchanger harness receptacle to the HPC case bracket at 4 o'clock position. Install the retaining plate and the two bolts, lubricated with Engine Oil P03-001. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m). Install the clamp bolts, lubricated with Engine Oil P03-001, and nuts that attach the harness to the hydraulic tube. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(b) Attach the (engine)−air/oil−heat−exchanger−harness receptacle to the HPC case bracket at 7:30 o'clock position. Install the retaining plate and the two bolts, lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Connect the harness connectors (given below) to the harness receptacles as follows. For each connector:

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary,
R carefully make straight all the bent pins. If
R necessary, clean the connector and receptacle
R by SPOP 6 (Task 70−21−00−110−900). Refer to
R Section 70−21−00 in the Standard Practices
R Manual, PN 585005.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- The connector coupling nut is fully tight
- The connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts

are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

- Connect the W4P4 and W5P11 harness connectors to the solenoid at 5 o'clock position and tighten. Install the clamp bolt, lubricated with Engine Oil P03-001, and nut that attach the W4 harness to the bleed-valve-supply-tube. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).
- Connect the W3P15 harness connector to the 2.5 bleed valve actuator at 7 o'clock position and tighten.
- Connect the W3P17 harness connector to the receptacle on the HPC case bracket at 7:30 o'clock position and tighten.

F. Postrequisites

(1) If the variable stator vane control system was removed or disturbed, rig the system. See 72-00-00, Special Procedures-05 (Task 72-00-00-830-003-A00) or (Task 72-00-00-830-003-B00).

(2) If the turbine case cooling (TCC) air valve actuator was removed or disturbed, rig the actuator. See 72-00-00, Special Procedures-06 (Task 72-00-00-830-004).

(3) Refer to Table 401 for the installation procedures that are postrequisite to this procedure.

Step	Install The	Chapter/ Section	Installation
1	LPC/LPT Coupling	72-00-32	01 (Task 72-00-32 420-001)
2	Compressor Inlet Cone	72-00-31	02 (Task 72-00-31-420-001)

Other Post requisite Procedures
Table 401

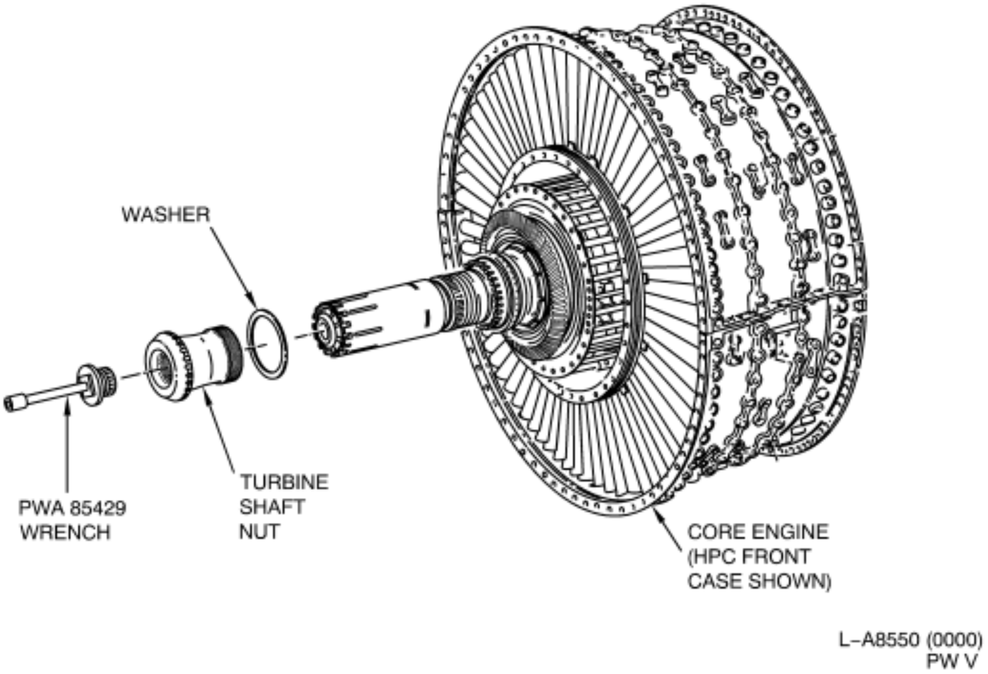
R
R

(CONTINUED)

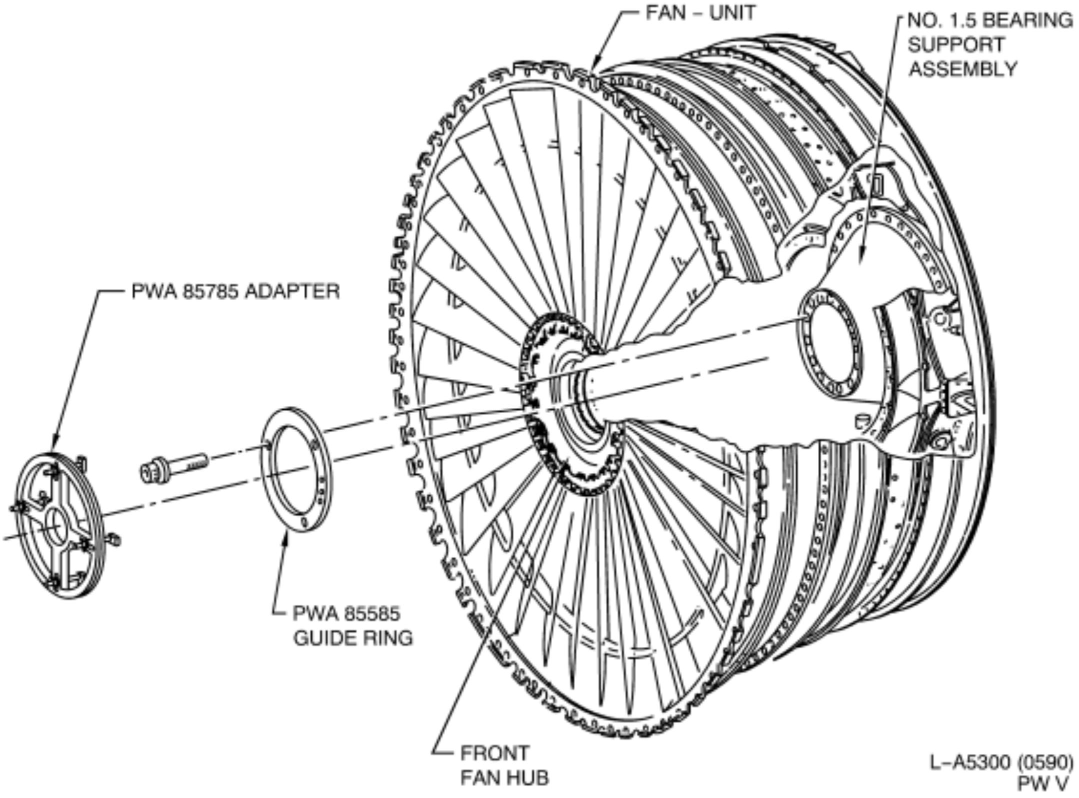
Step	Install The	Chapter/ Section	Installation
3a	Electronic Engine Control (EEC) Speed Transducer (N1)	72-00-34	03 (Task 72-00-34-450-001)
or			
3b	EEC Speed Transducer (N1) Multiplexer Input Speed Probe	72-00-34	17 (Task 72-00-34-450-013)
4	Magnetic Chip Detector Assemblies In The Oil Tank And Main Gearbox	72-00-61	01 (Task 72-00-61-450-017)

Other Post requisite Procedures
Table 401 (Continued)

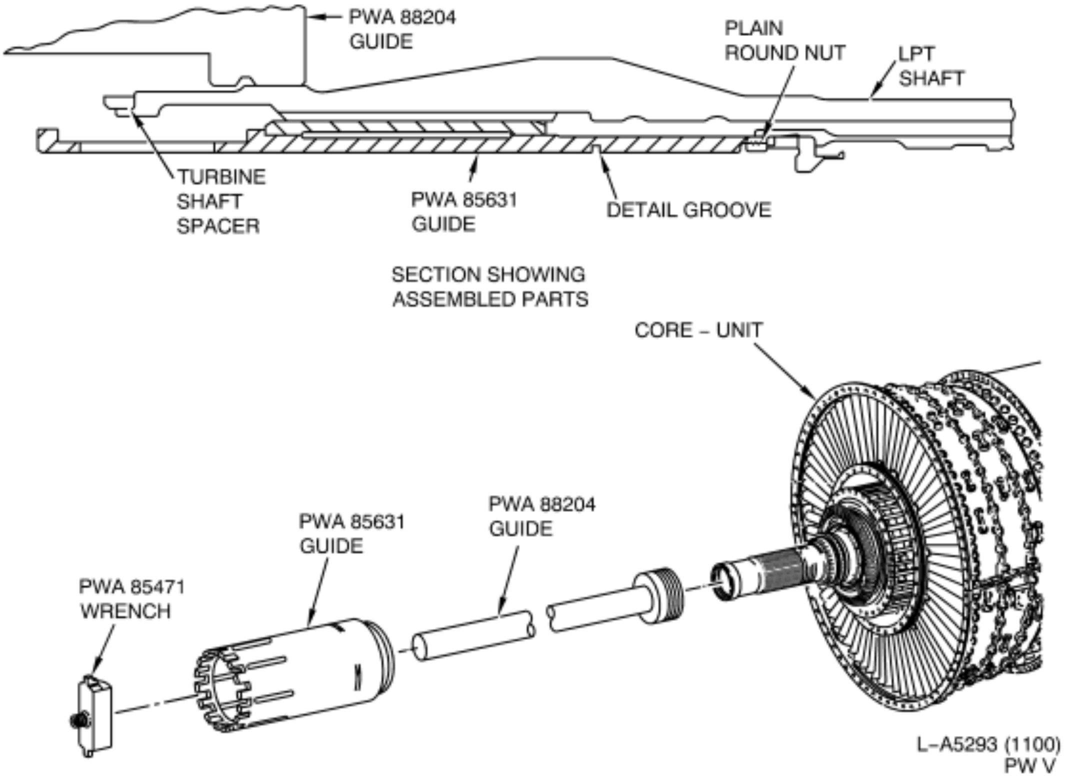
(4) If the quick HPC blade change procedure was used to replace the 5th, 6th, 7th and/or 8th stage blades, test engine per Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).


WASHER
TURBINE SHAFT NUT
PWA 85429 WRENCH
CORE ENGINE (HPC FRONT CASE SHOWN)
L−A8550 (0000)
PW V

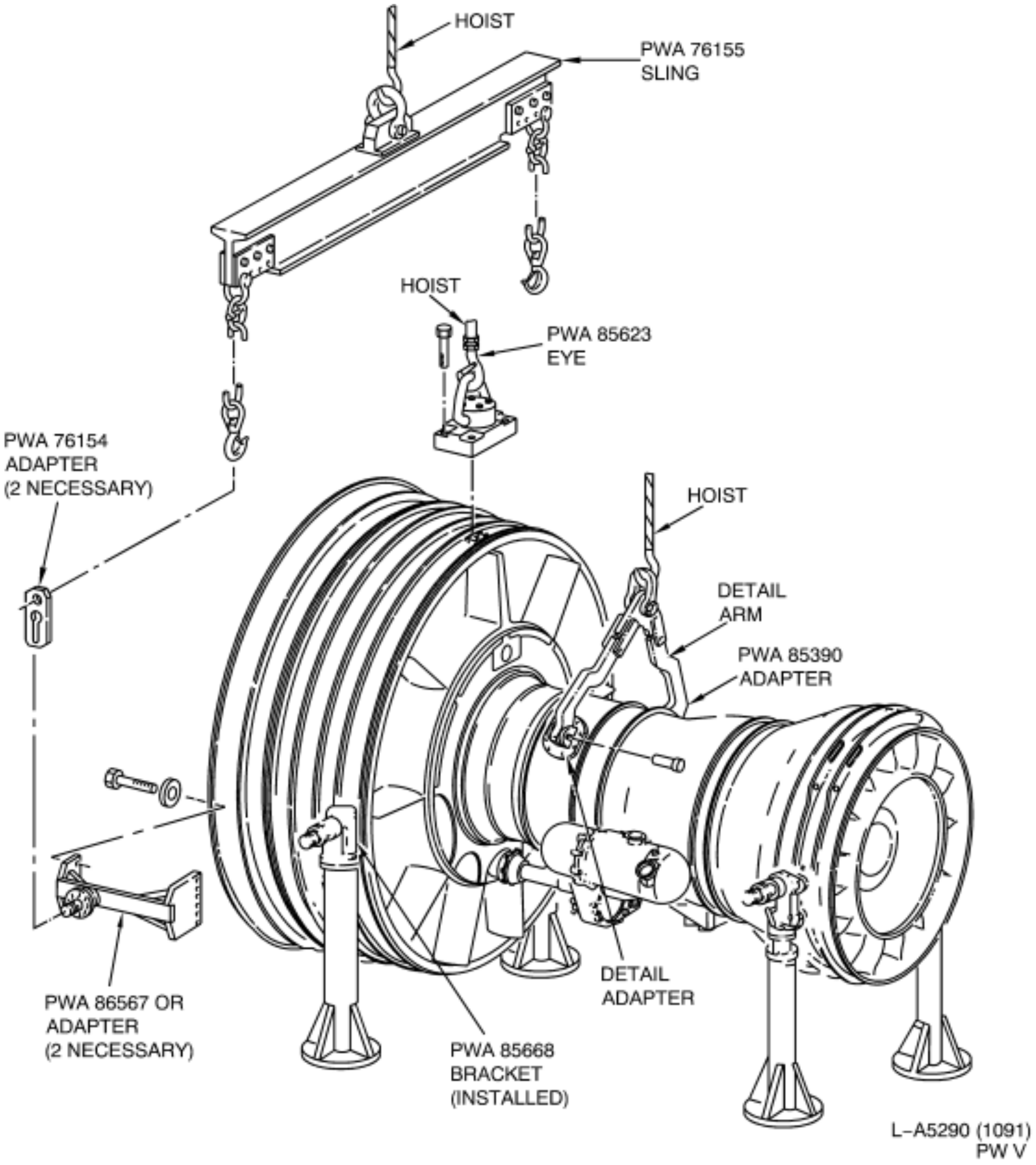
Removal Of The Turbine Shaft Nut
Figure 401
(Task 72−00−34−420−004)


FAN − UNIT
NO. 1.5 BEARING SUPPORT ASSEMBLY
PWA 85785 ADAPTER
PWA 85585 GUIDE RING
FRONT FAN HUB
L−A5300 (0590)
PW V

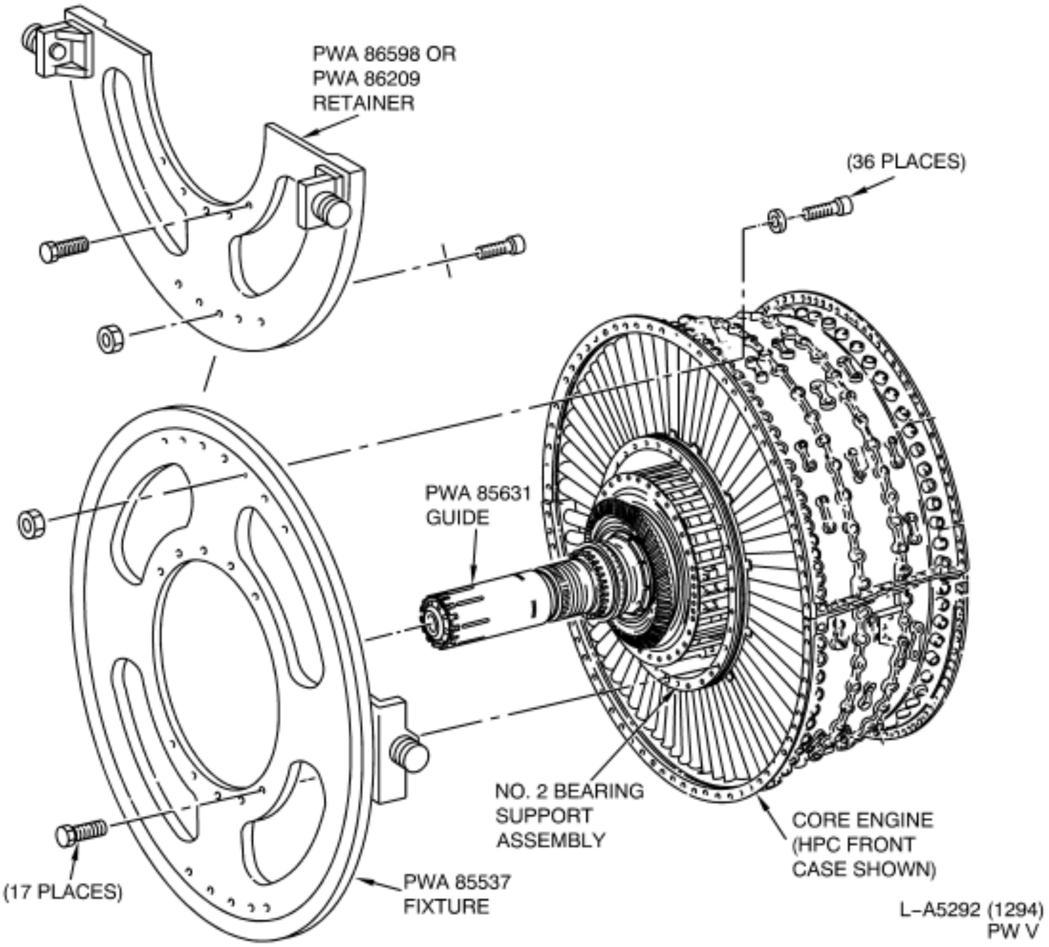
Installation Of PWA 85585
Figure 402
(Task 72−00−34−420−004)


PWA 88204
GUIDE
PLAIN
ROUND NUT
LPT
SHAFT
TURBINE
SHAFT
SPACER
PWA 85631
GUIDE
DETAIL GROOVE
SECTION SHOWING
ASSEMBLED PARTS
CORE − UNIT
PWA 85631
GUIDE
PWA 88204
GUIDE
PWA 85471
WRENCH
L−A5293 (1100)
PW V

Installation Of Tools To The Core−Unit
Figure 403
(Task 72−00−34−420−004)

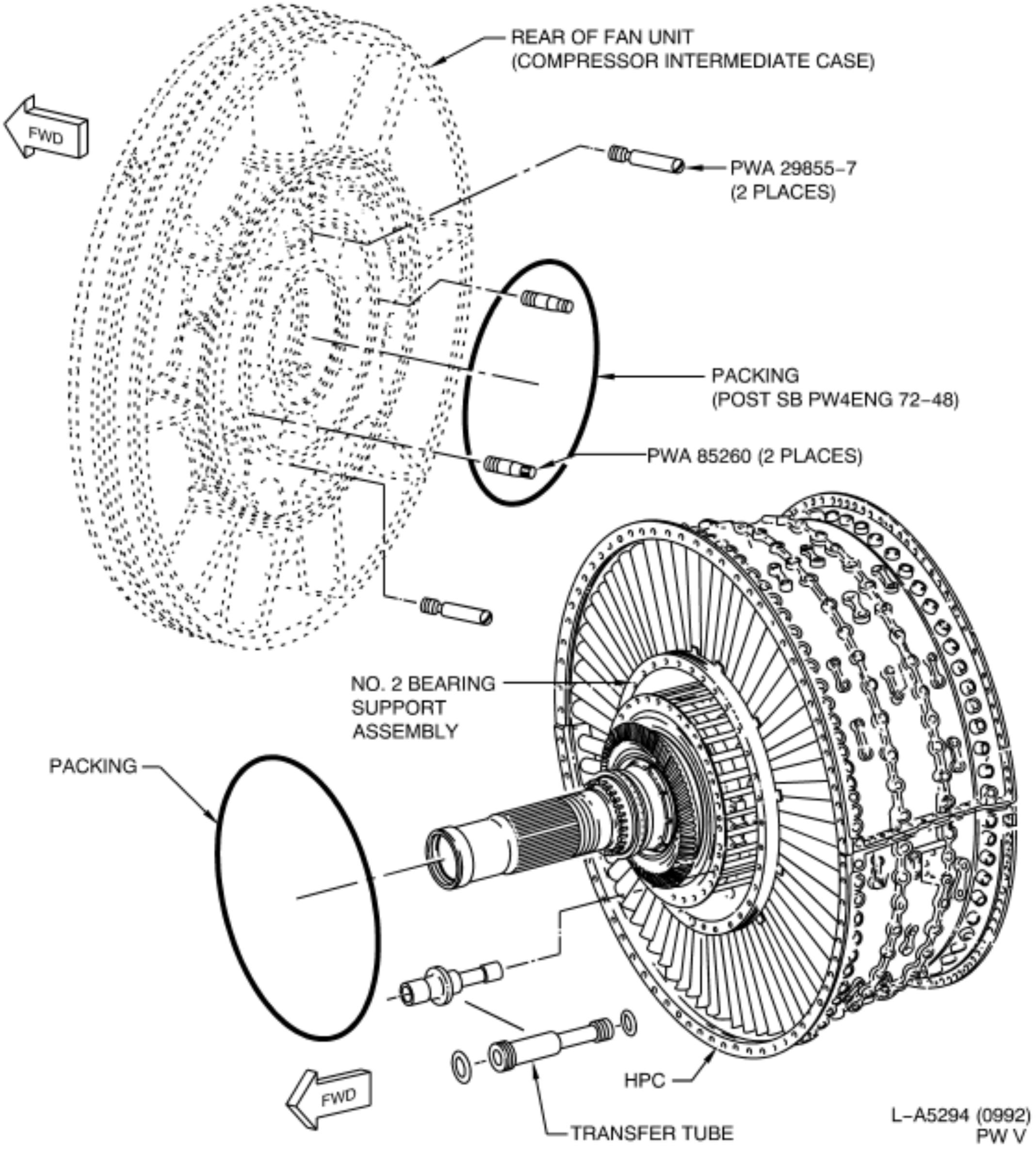

HOIST
PWA 76155
SLING
HOIST
PWA 85623
EYE
PWA 76154
ADAPTER
(2 NECESSARY)
HOIST
DETAIL
ARM
PWA 85390
ADAPTER
DETAIL
ADAPTER
PWA 86567 OR
ADAPTER
(2 NECESSARY)
PWA 85668
BRACKET
(INSTALLED)
L−A5290 (1091)
PW V

Installation Of Lifting Tools
Figure 404
(Task 72−00−34−420−004)

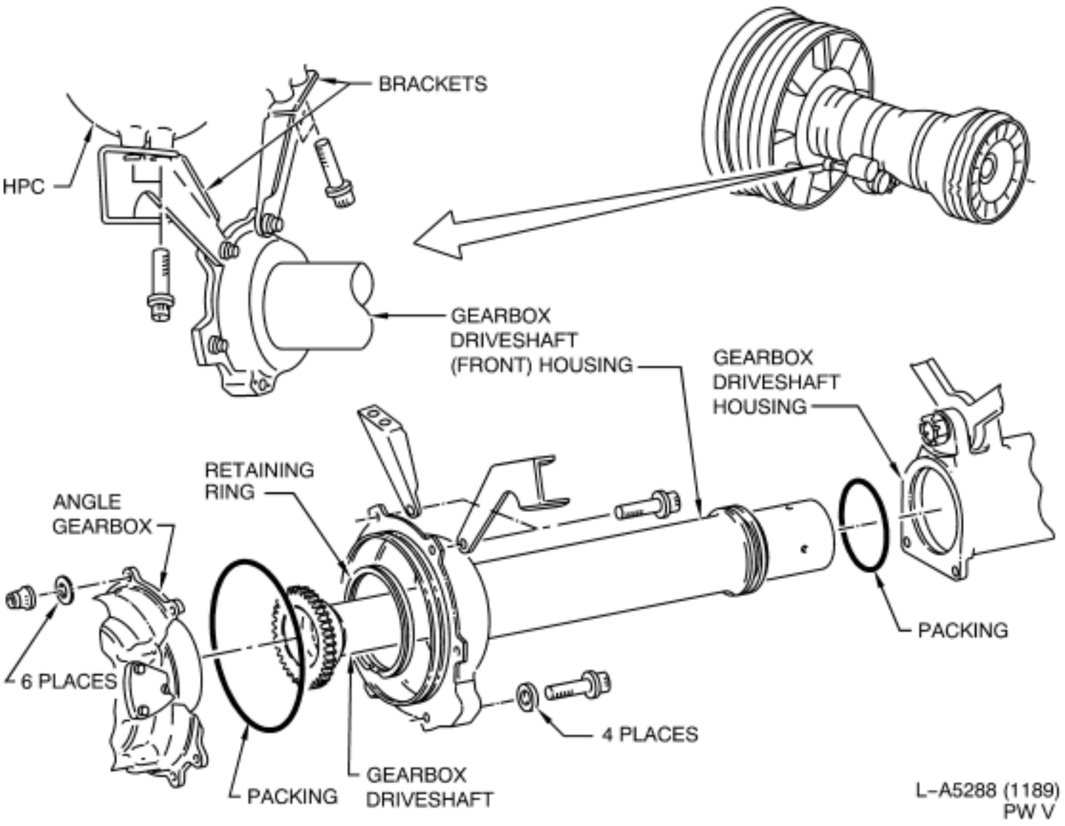

PWA 86598 OR
PWA 86209
RETAINER
(36 PLACES)
PWA 85631
GUIDE
NO. 2 BEARING
SUPPORT
ASSEMBLY
CORE ENGINE
(HPC FRONT
CASE SHOWN)
(17 PLACES)
PWA 85537
FIXTURE
L−A5292 (1294)
PW V

Removal Of The HPC Retainer
Figure 405
(Task 72−00−34−420−004)

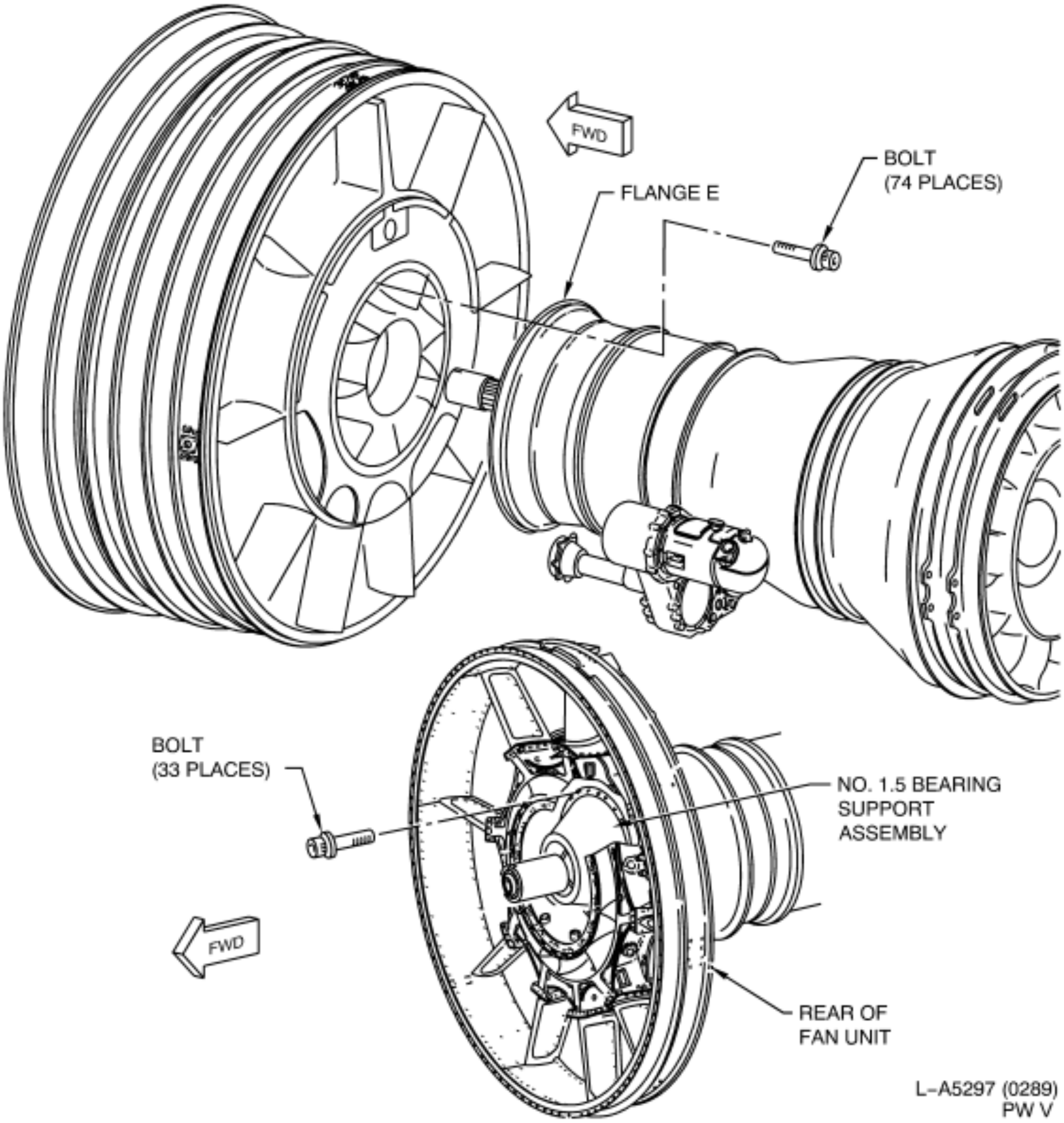
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−21


REAR OF FAN UNIT
(COMPRESSOR INTERMEDIATE CASE)
FWD
PWA 29855-7
(2 PLACES)
PACKING
(POST SB PW4ENG 72-48)
PWA 85260 (2 PLACES)
NO. 2 BEARING
SUPPORT
ASSEMBLY
PACKING
FWD
HPC
TRANSFER TUBE
L-A5294 (0992)
PW V

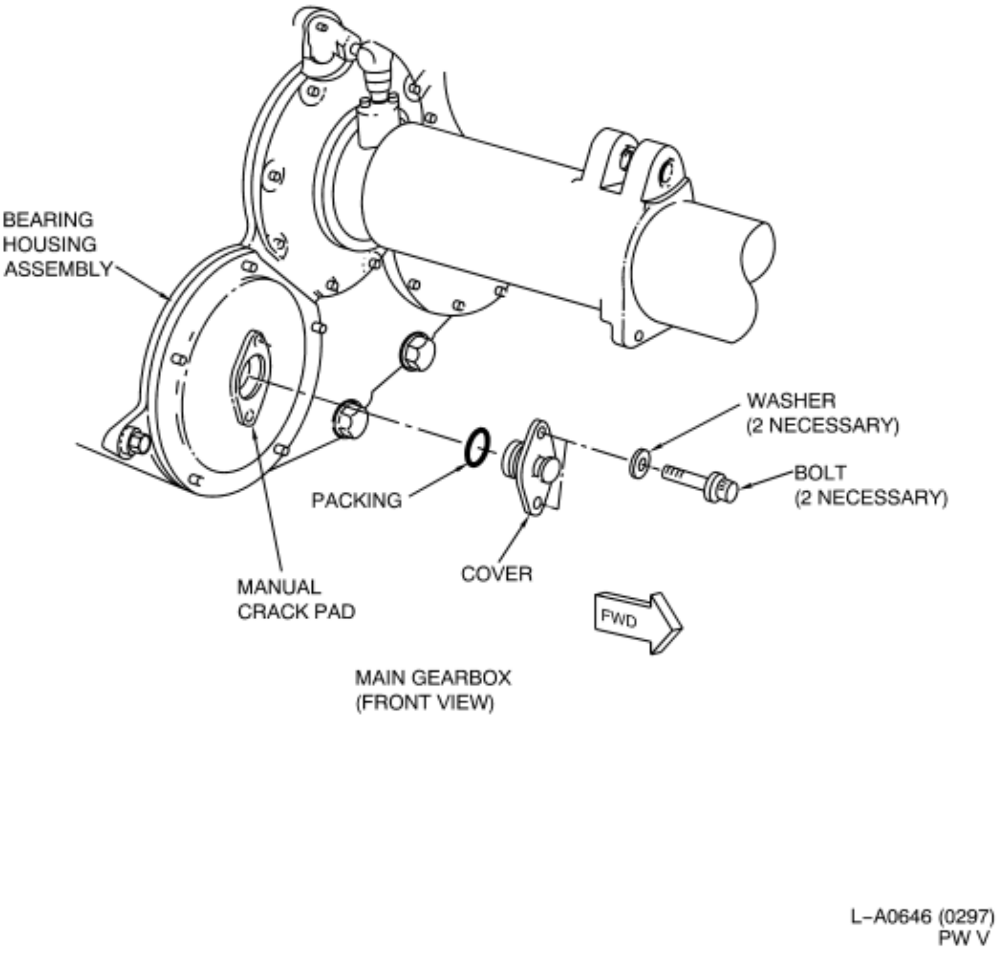
Installation Of The Aligning Pins
Figure 406
(Task 72−00−34−420−004)


BRACKETS
HPC
GEARBOX
DRIVESHAFT
(FRONT) HOUSING
GEARBOX
DRIVESHAFT
HOUSING
RETAINING
RING
ANGLE
GEARBOX
6 PLACES
PACKING
GEARBOX
DRIVESHAFT
4 PLACES
PACKING
L−A5288 (1189)
PW V

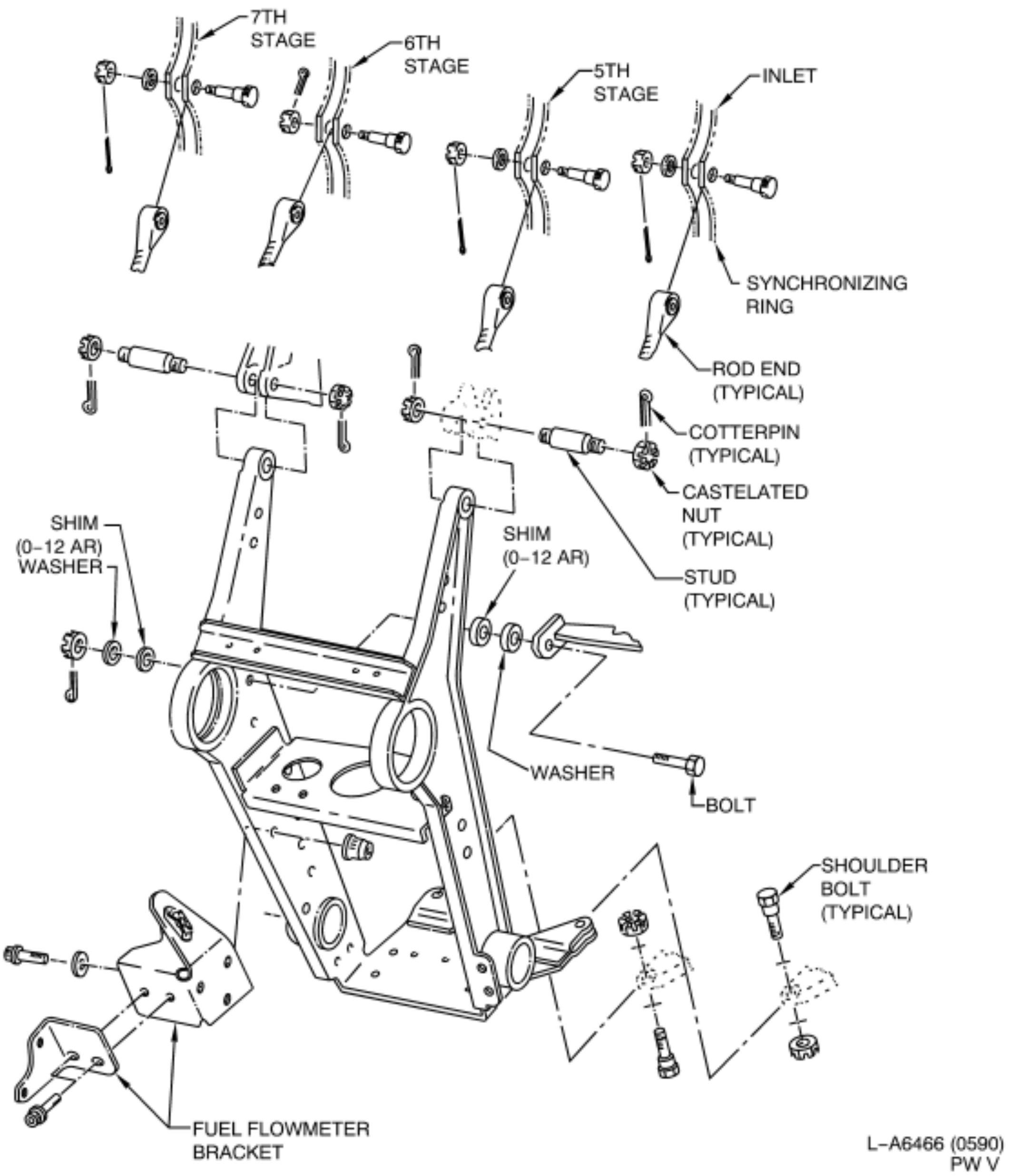
Installation Of The Gearbox Driveshaft
And Front Housing In The Rear Housing
Figure 407
(Task 72−00−34−420−004)


FWD
BOLT
(74 PLACES)
FLANGE E
BOLT
(33 PLACES)
NO. 1.5 BEARING
SUPPORT
ASSEMBLY
FWD
REAR OF
FAN UNIT
L−A5297 (0289)
PW V

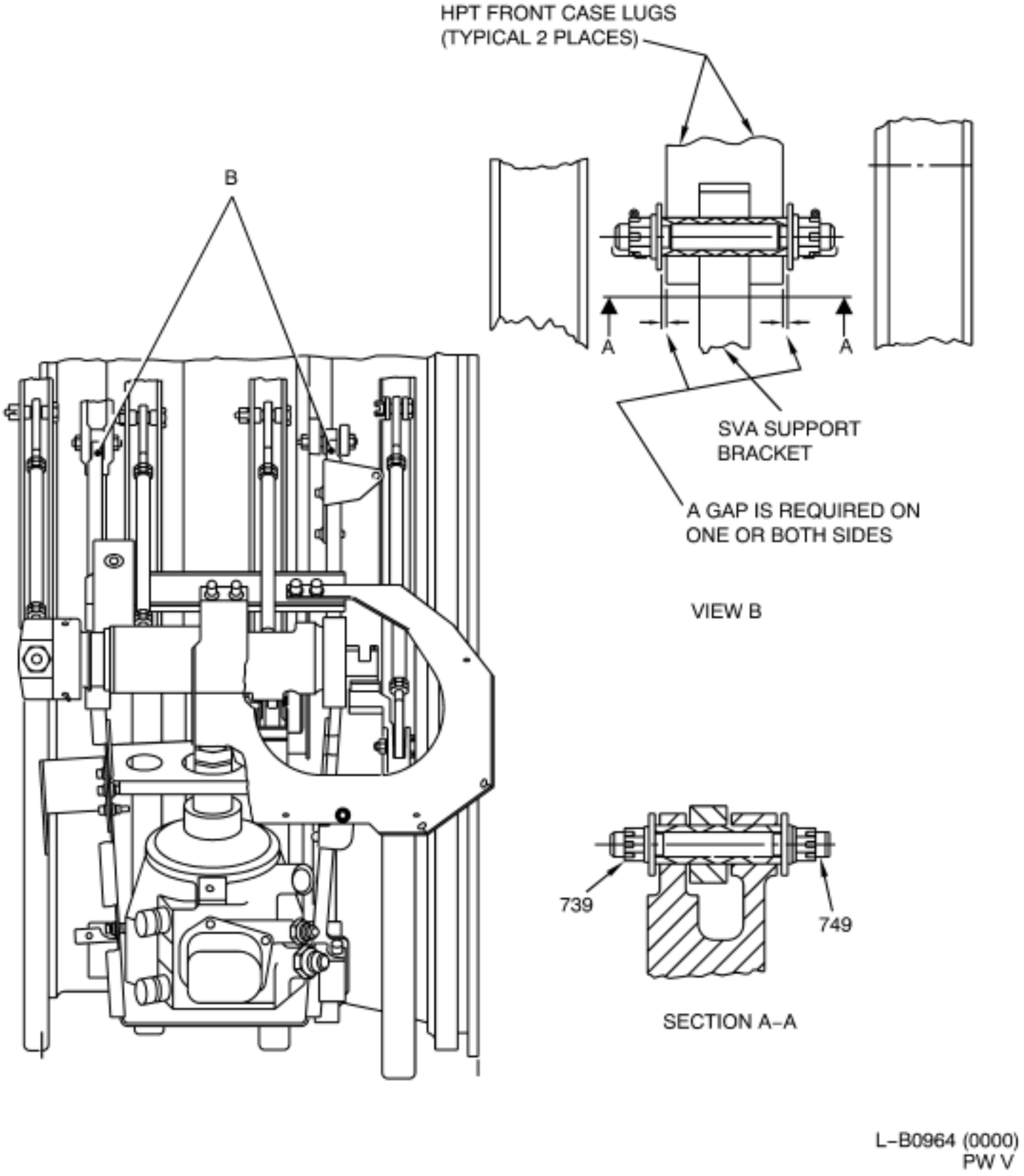
Installation Of Flange E Bolts And No.
1.5 Bearing Support Assembly Bolts
Figure 408
(Task 72−00−34−420−004)


BEARING HOUSING ASSEMBLY
WASHER (2 NECESSARY)
BOLT (2 NECESSARY)
PACKING
COVER
MANUAL CRACK PAD
FWD
MAIN GEARBOX (FRONT VIEW)
L−A0646 (0297)
PW V

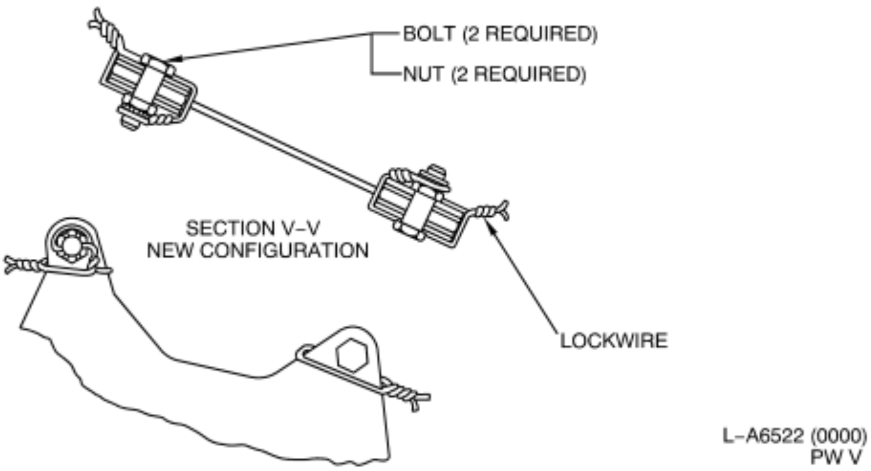
Location Of The Manual Crank Pad Cover
Figure 409
(Task 72−00−34−420−004)


7TH STAGE
6TH STAGE
5TH STAGE
INLET
SYNCHRONIZING RING
ROD END (TYPICAL)
COTTERPIN (TYPICAL)
CASTELATED NUT (TYPICAL)
STUD (TYPICAL)
SHIM
(0−12 AR)
WASHER
SHIM (0−12 AR)
WASHER
BOLT
SHOULDER BOLT (TYPICAL)
FUEL FLOWMETER BRACKET
L−A6466 (0590)
PW V

Stator Vane Actuator And Support Assembly
(If Disassembled) (Pre SB PW4ENG 72−534)
Figure 410
(Task 72−00−34−420−004)

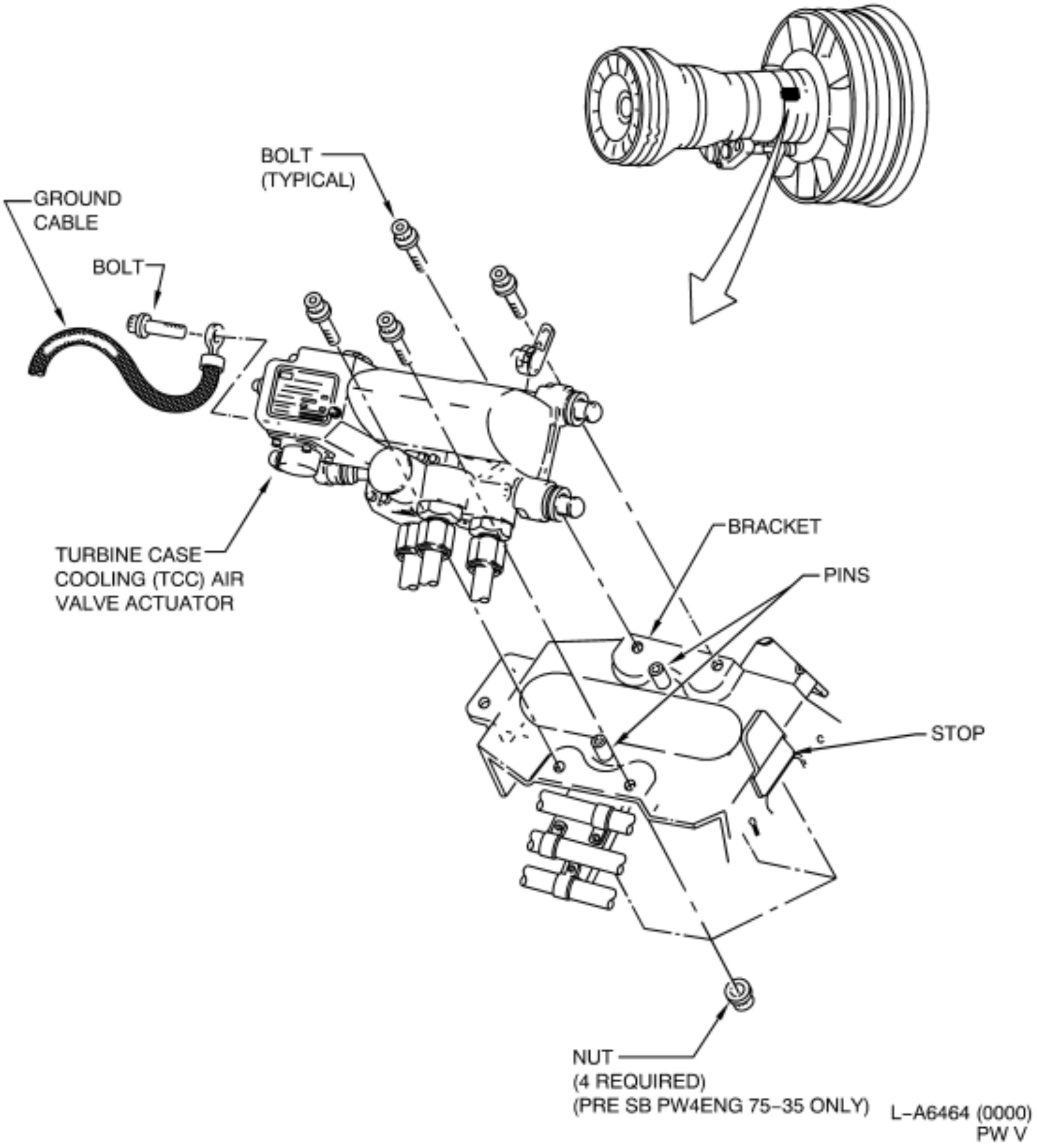

HPT FRONT CASE LUGS
(TYPICAL 2 PLACES)
B
A
A
SVA SUPPORT
BRACKET
A GAP IS REQUIRED ON
ONE OR BOTH SIDES
VIEW B
739
749
SECTION A-A
L-B0964 (0000)
PW V

Stator Vane Actuator And Support Assembly
(If Disassembled) (Post SB PW4ENG 72-534)
Figure 411 (Sheet 1)
(Task 72-00-34-420-004)

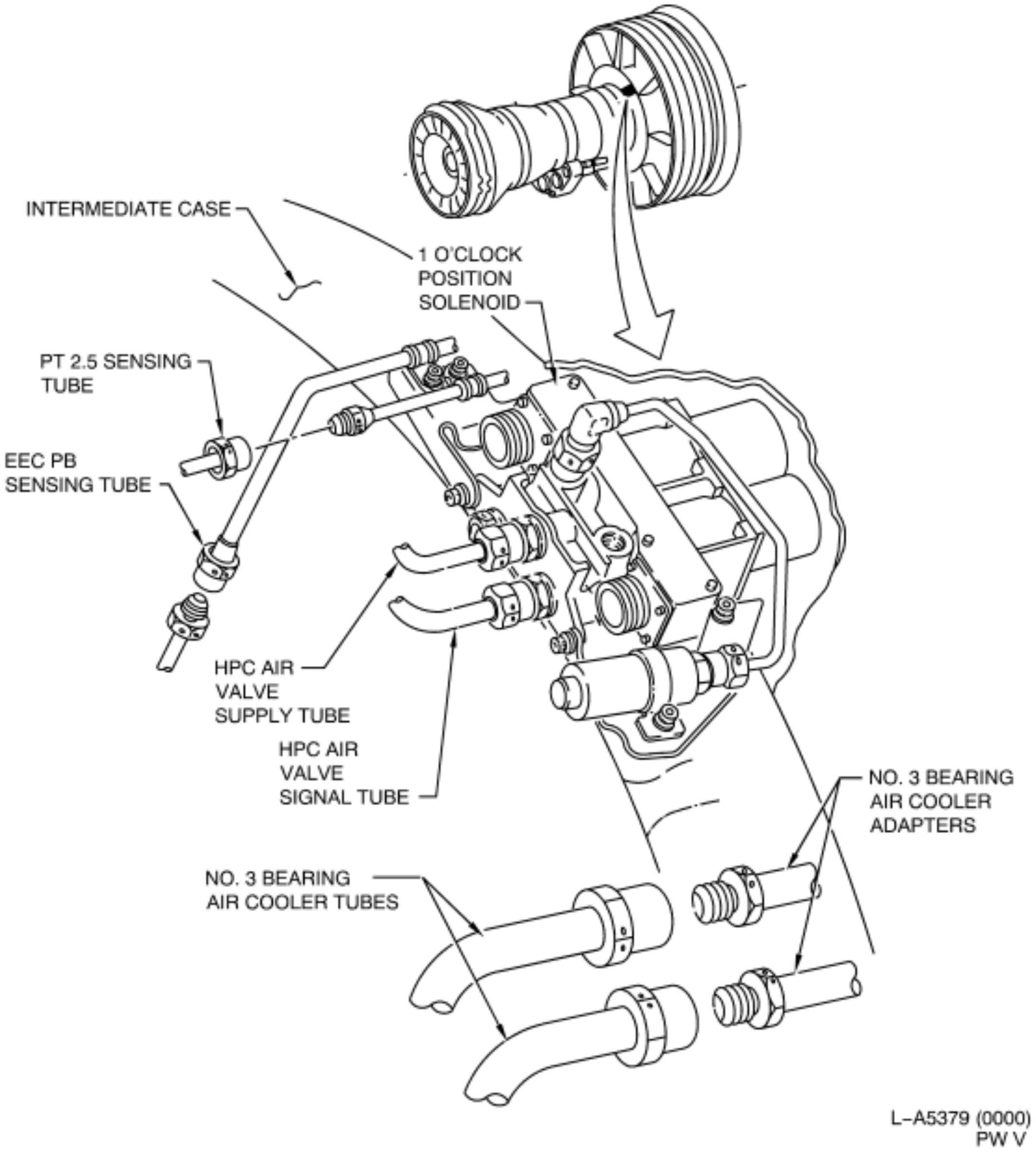

BOLT (2 REQUIRED)
NUT (2 REQUIRED)
SECTION V−V
NEW CONFIGURATION
LOCKWIRE
L−A6522 (0000)
PW V

Stator Vane Actuator And Support Assembly
(Lockwire Installation For Bottom Bolts)
Figure 411 (Sheet 2)
(Task 72−00−34−420−004)

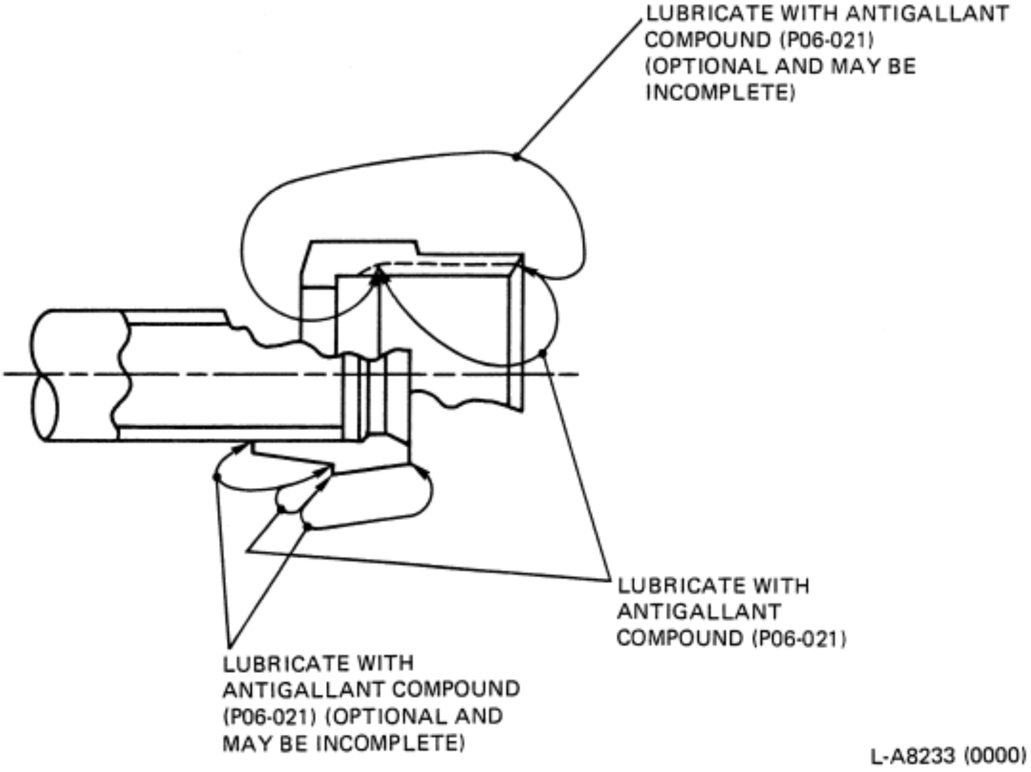
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−21


BOLT
(TYPICAL)
GROUND
CABLE
BOLT
TURBINE CASE
COOLING (TCC) AIR
VALVE ACTUATOR
BRACKET
PINS
STOP
NUT
(4 REQUIRED)
(PRE SB PW4ENG 75−35 ONLY)
L−A6464 (0000)
PW V

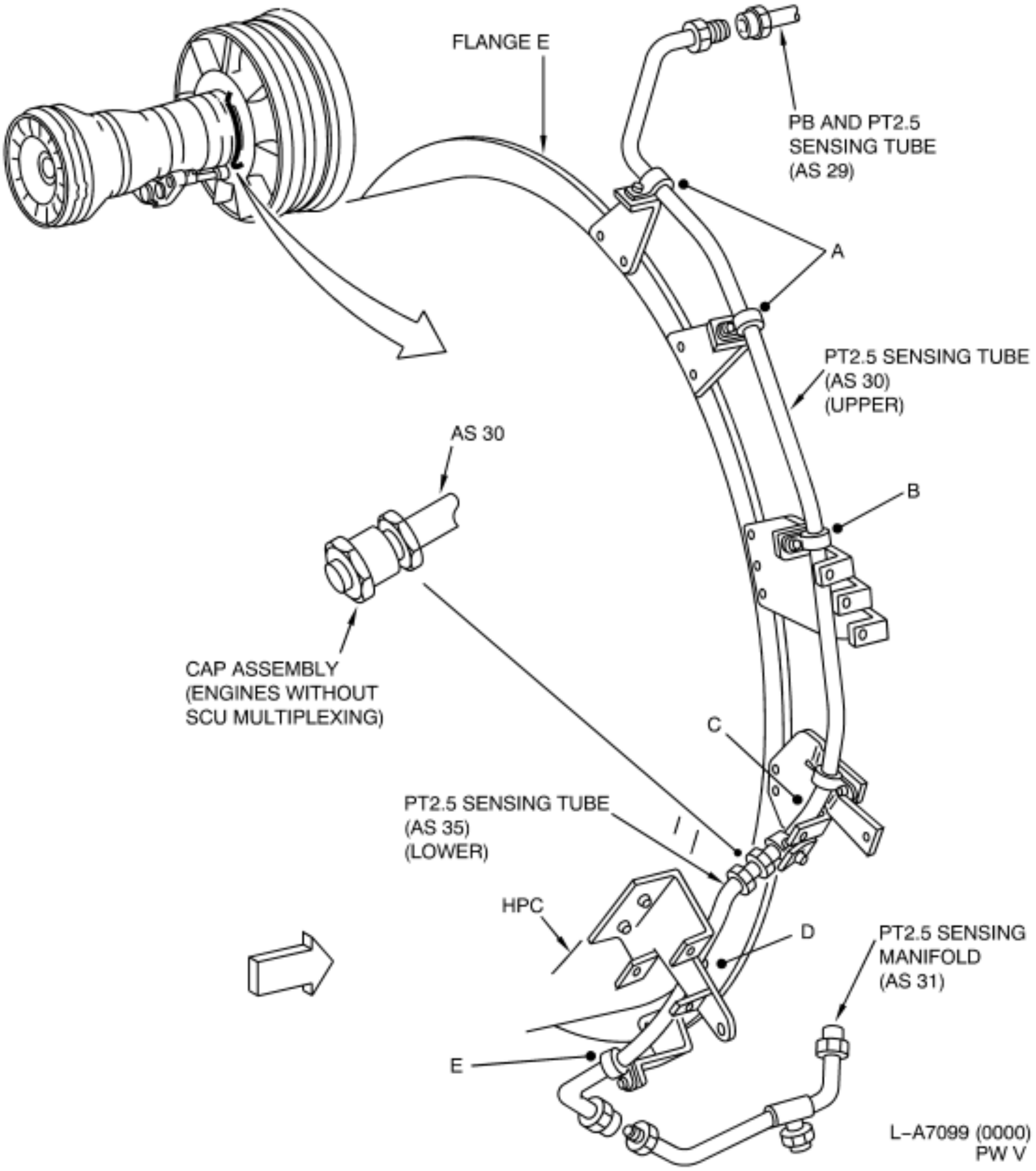
Turbine Case Cooling (TCC) Air Valve Actuator (If Disassembled)
Figure 412
(Task 72−00−34−420−004)


INTERMEDIATE CASE
1 O'CLOCK POSITION SOLENOID
PT 2.5 SENSING TUBE
EEC PB SENSING TUBE
HPC AIR VALVE SUPPLY TUBE
HPC AIR VALVE SIGNAL TUBE
NO. 3 BEARING AIR COOLER ADAPTERS
NO. 3 BEARING AIR COOLER TUBES
L-A5379 (0000)
PW V

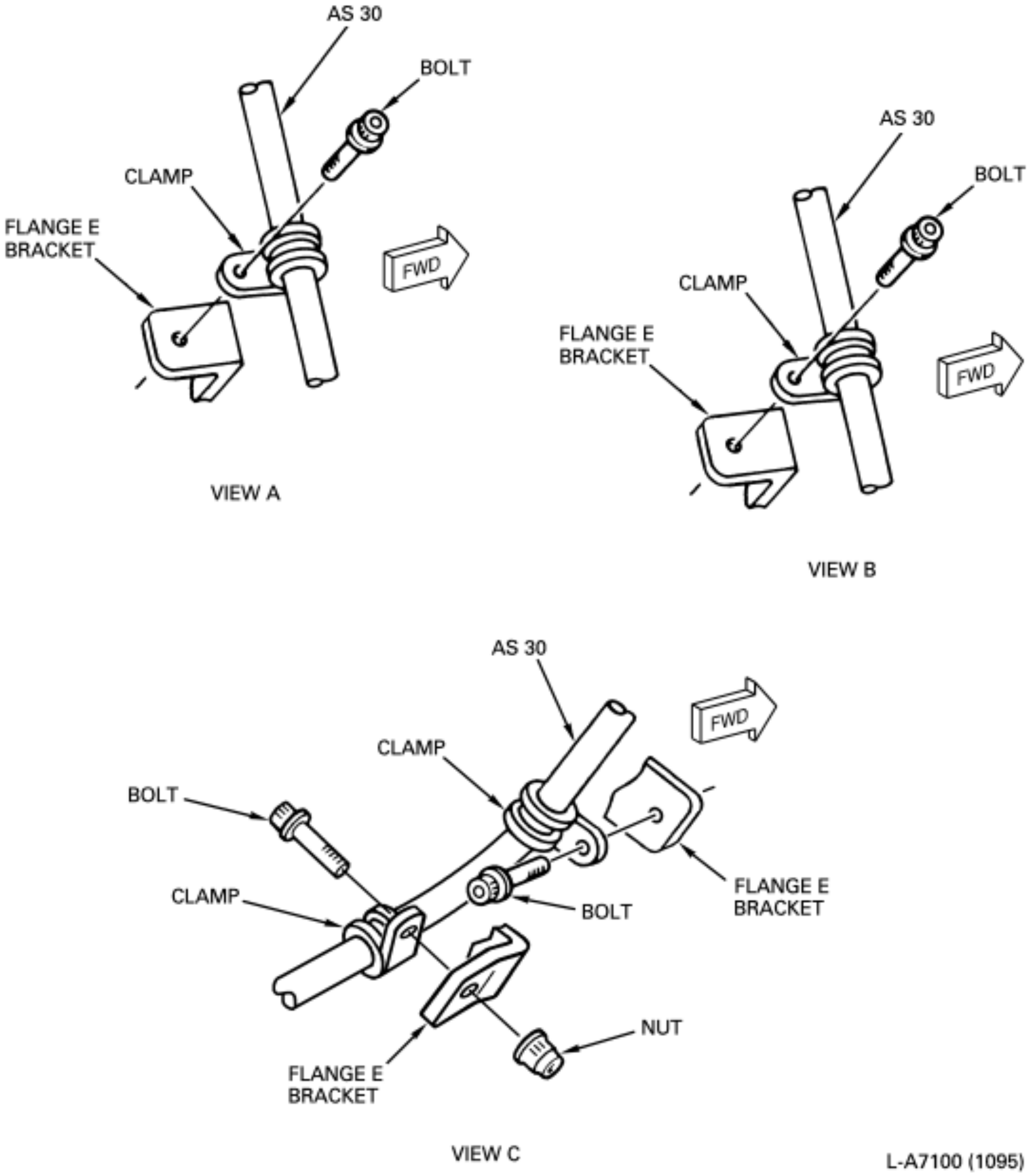
Installation Of The Engine Tubes
Figure 413 (Sheet 1)
(Task 72-00-34-420-004)


LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
L-A8233 (0000)

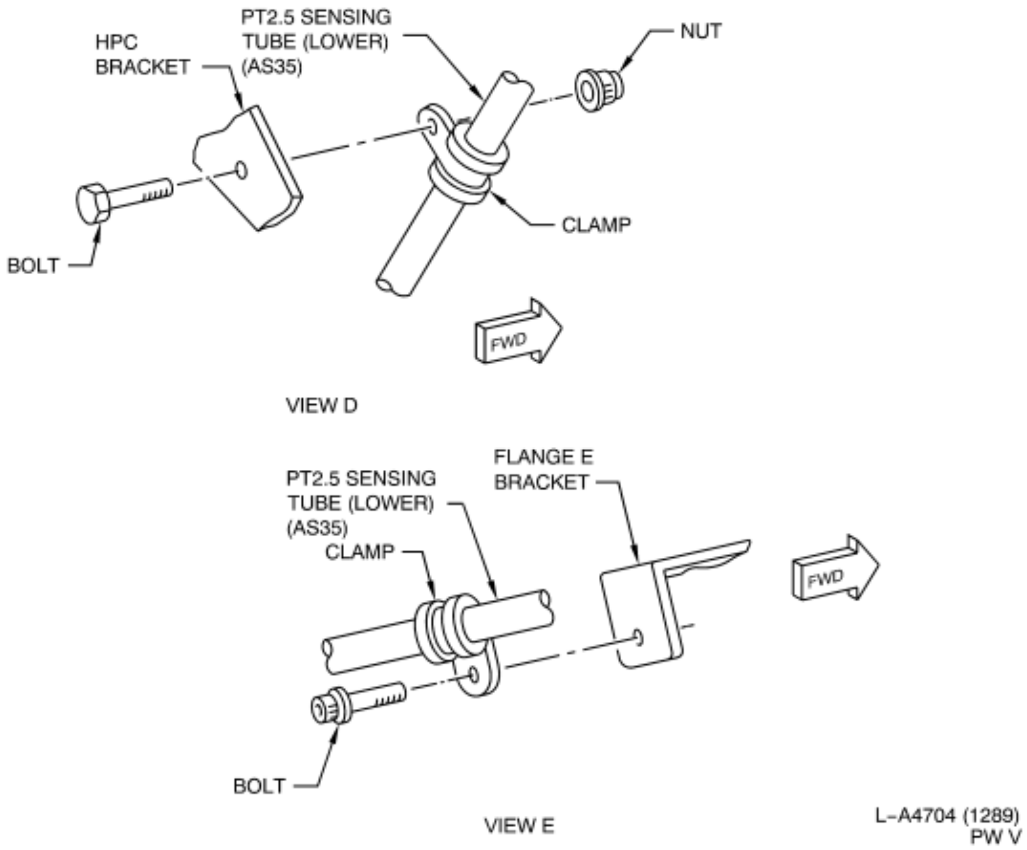
Installation Of The Engine Tubes
Figure 413 (Sheet 2)
(Task 72−00−34−420−004)


FLANGE E
PB AND PT2.5 SENSING TUBE (AS 29)
A
PT2.5 SENSING TUBE (AS 30) (UPPER)
AS 30
B
CAP ASSEMBLY (ENGINES WITHOUT SCU MULTIPLEXING)
C
PT2.5 SENSING TUBE (AS 35) (LOWER)
HPC
D
PT2.5 SENSING MANIFOLD (AS 31)
E
L−A7099 (0000)
PW V

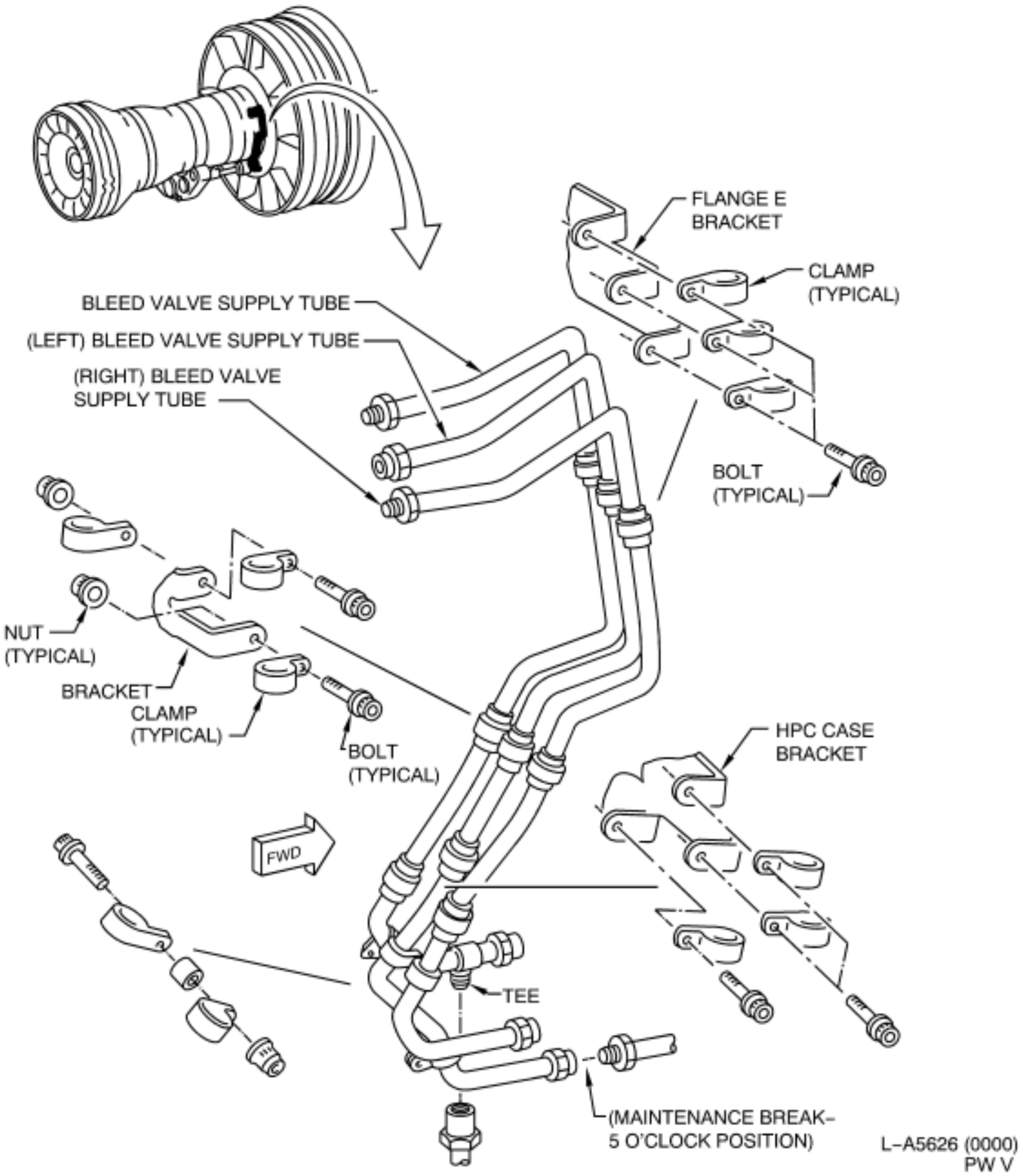
Installation Of The Engine Tubes
Figure 413 (Sheet 3)
(Task 72−00−34−420−004)


AS 30
BOLT
CLAMP
FLANGE E BRACKET
FWD
VIEW A
AS 30
BOLT
CLAMP
FLANGE E BRACKET
FWD
VIEW B
AS 30
FWD
CLAMP
BOLT
CLAMP
BOLT
FLANGE E BRACKET
NUT
FLANGE E BRACKET
VIEW C
L-A7100 (1095)

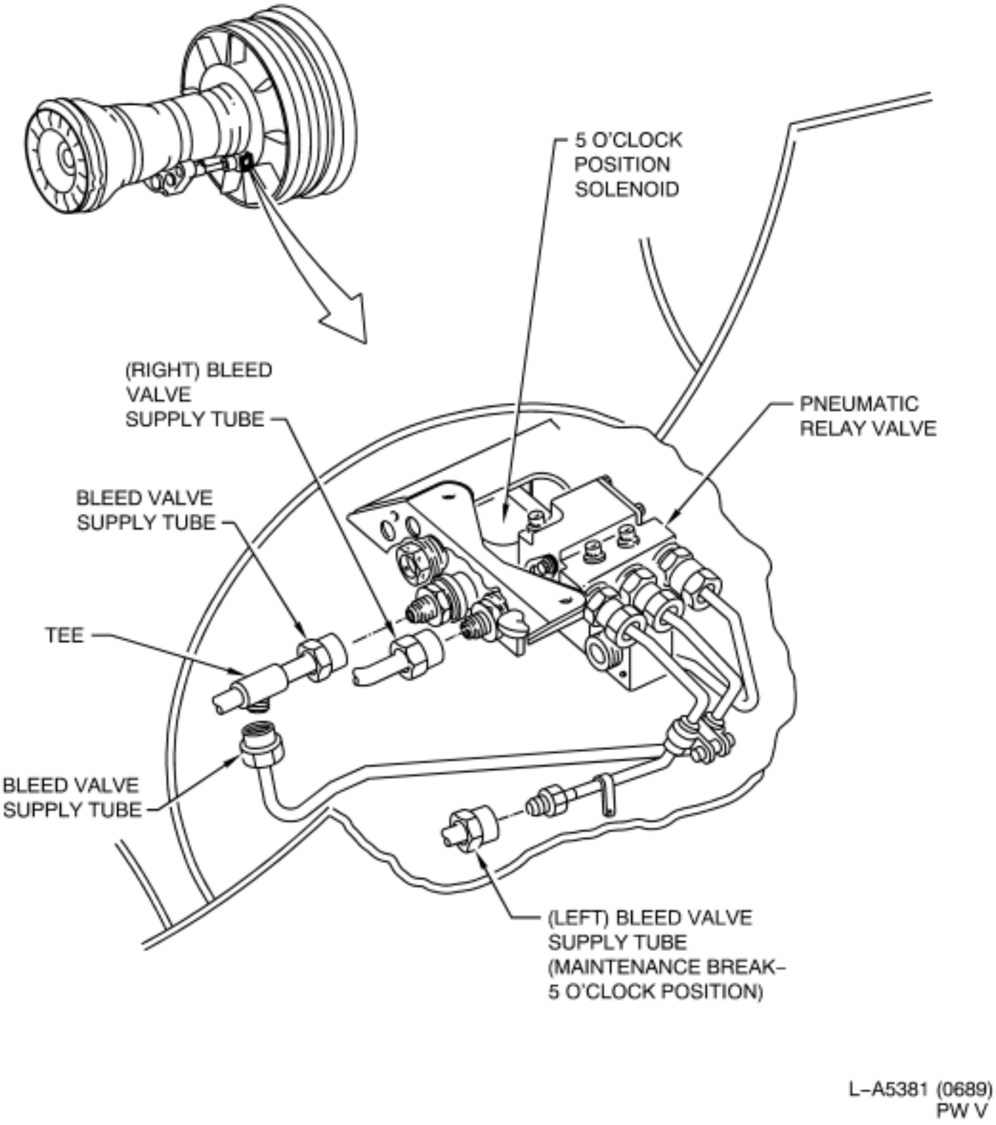
Installation Of The Engine Tubes
Figure 413 (Sheet 4)
(Task 72−00−34−420−004)


HPC
BRACKET
PT2.5 SENSING
TUBE (LOWER)
(AS35)
NUT
CLAMP
BOLT
FWD
VIEW D
FLANGE E
BRACKET
PT2.5 SENSING
TUBE (LOWER)
(AS35)
CLAMP
FWD
BOLT
VIEW E
L−A4704 (1289)
PW V

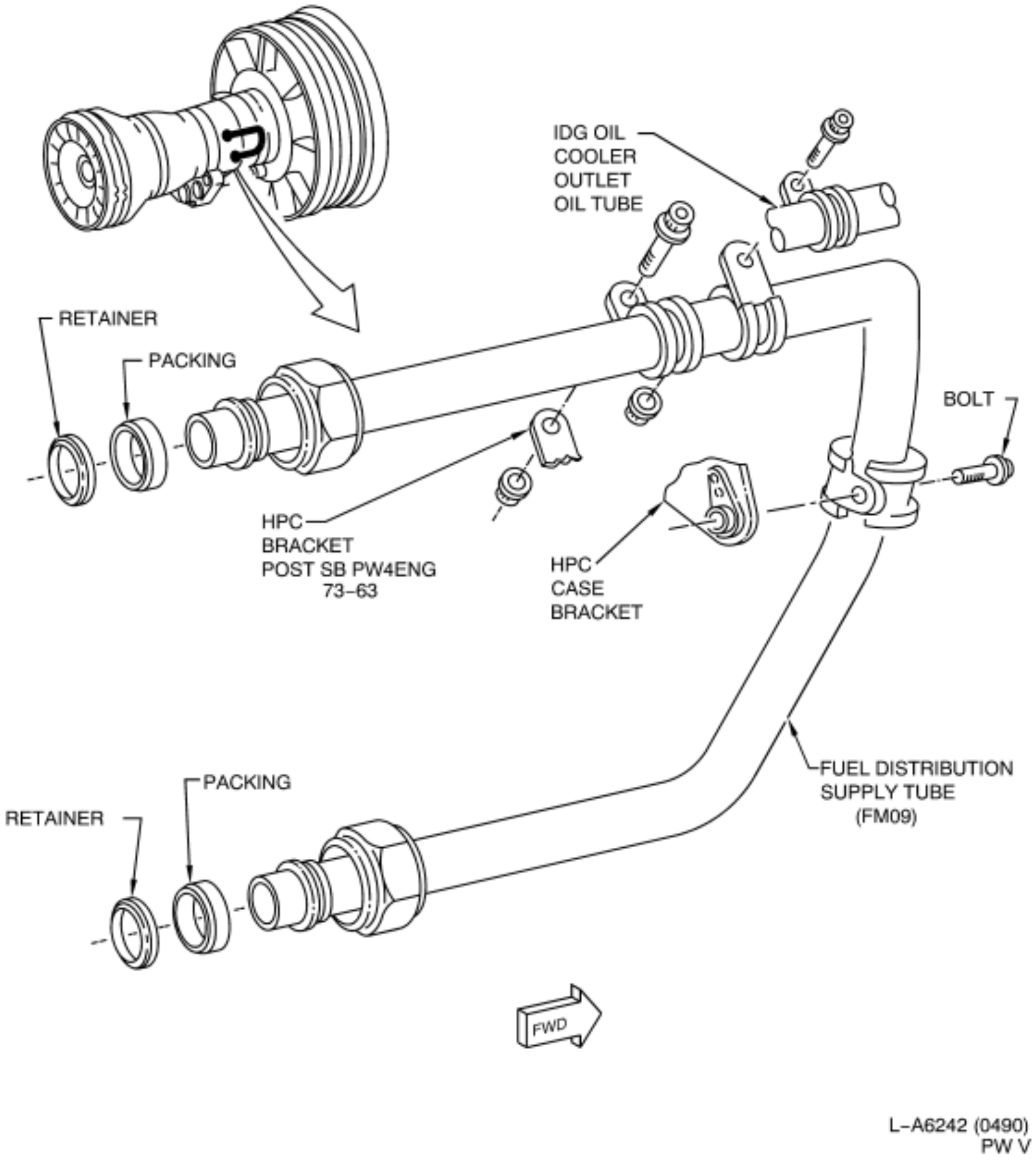
Installation Of The Engine Tubes
Figure 413 (Sheet 5)
(Task 72−00−34−420−004)


FLANGE E
BRACKET
CLAMP
(TYPICAL)
BLEED VALVE SUPPLY TUBE
(LEFT) BLEED VALVE SUPPLY TUBE
(RIGHT) BLEED VALVE
SUPPLY TUBE
BOLT
(TYPICAL)
NUT
(TYPICAL)
BRACKET
CLAMP
(TYPICAL)
BOLT
(TYPICAL)
HPC CASE
BRACKET
FWD
TEE
(MAINTENANCE BREAK-
5 O'CLOCK POSITION)
L-A5626 (0000)
PW V

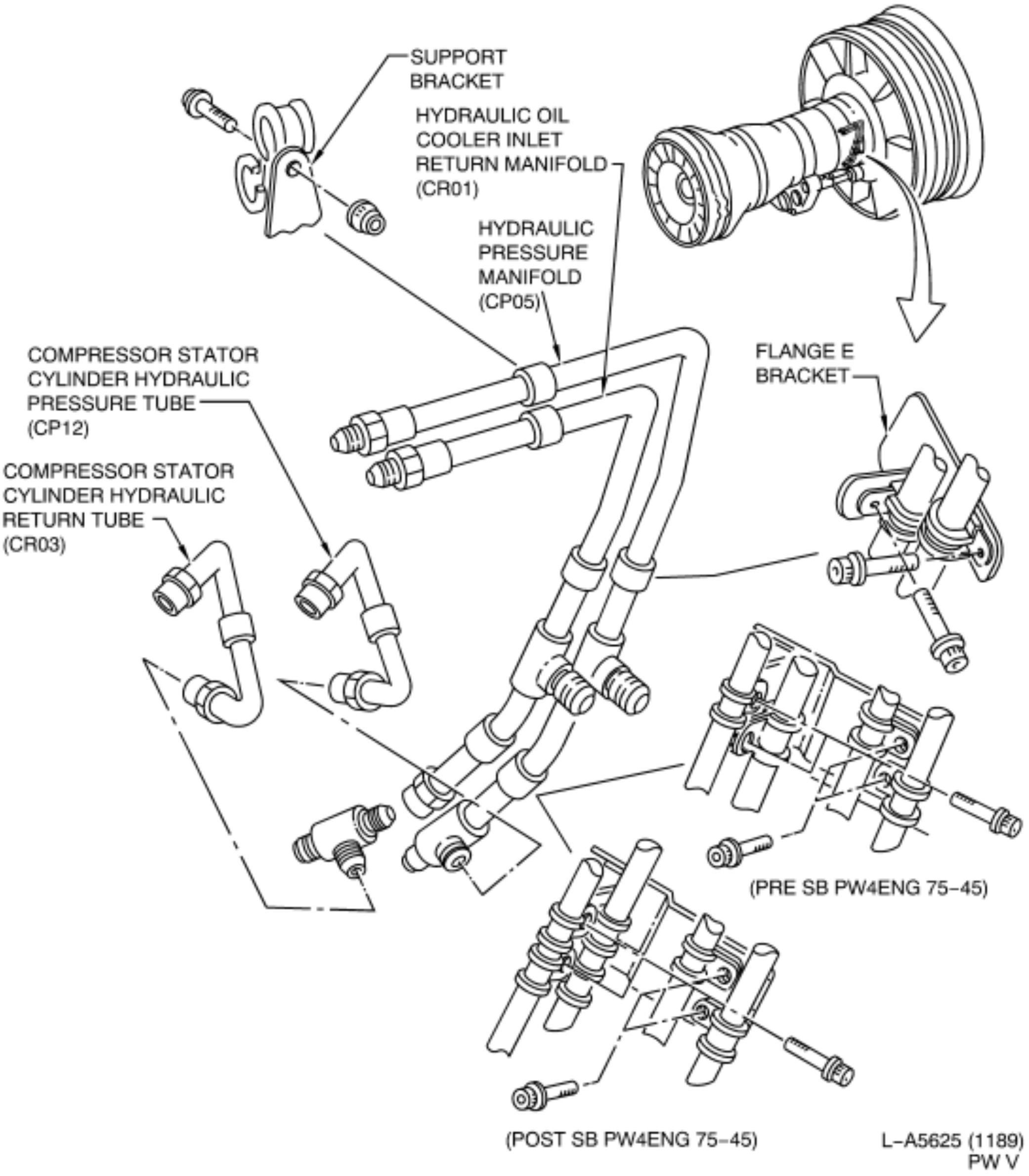
Installation Of The Engine Tubes
Figure 413 (Sheet 6)
(Task 72-00-34-420-004)


5 O'CLOCK POSITION SOLENOID
PNEUMATIC RELAY VALVE
(RIGHT) BLEED VALVE SUPPLY TUBE
BLEED VALVE SUPPLY TUBE
TEE
BLEED VALVE SUPPLY TUBE
(LEFT) BLEED VALVE SUPPLY TUBE (MAINTENANCE BREAK− 5 O'CLOCK POSITION)
L−A5381 (0689)
PW V

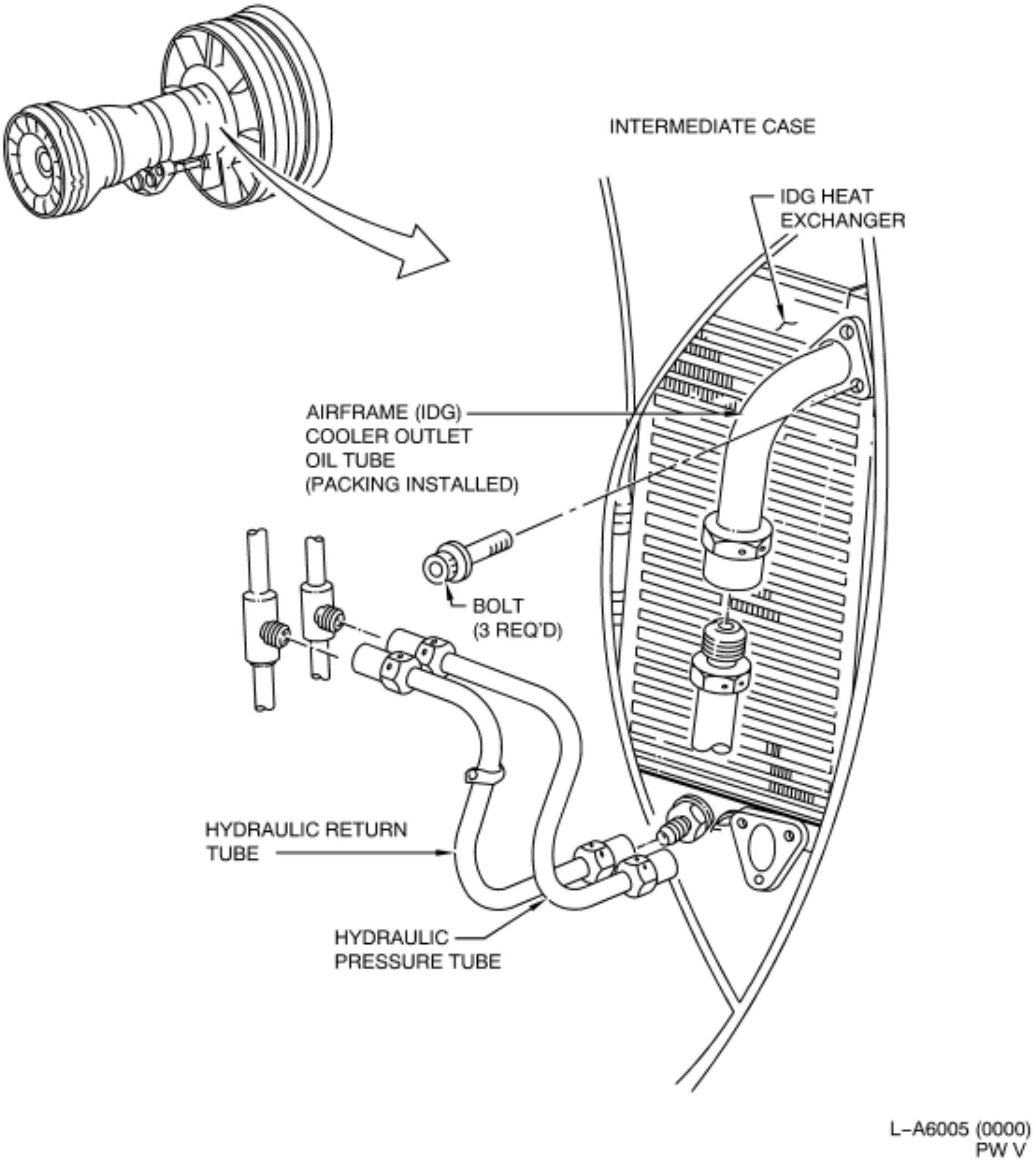
Installation Of The Engine Tubes
Figure 413 (Sheet 7)
(Task 72−00−34−420−004)


IDG OIL
COOLER
OUTLET
OIL TUBE
RETAINER
PACKING
BOLT
HPC
BRACKET
POST SB PW4ENG
73−63
HPC
CASE
BRACKET
PACKING
RETAINER
FUEL DISTRIBUTION
SUPPLY TUBE
(FM09)
FWD
L−A6242 (0490)
PW V

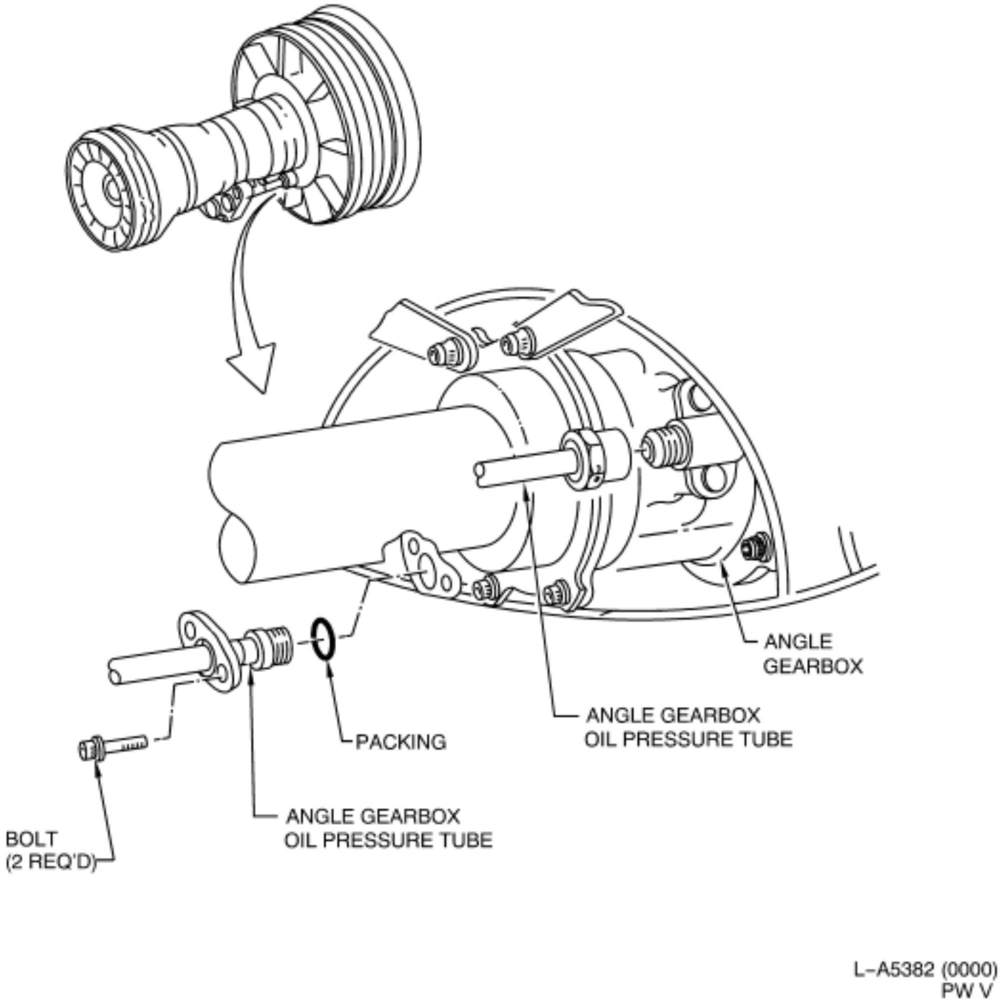
Installation Of The Engine Tubes
Figure 413 (Sheet 8)
(Task 72−00−34−420−004)


SUPPORT BRACKET
HYDRAULIC OIL COOLER INLET RETURN MANIFOLD (CR01)
HYDRAULIC PRESSURE MANIFOLD (CP05)
COMPRESSOR STATOR CYLINDER HYDRAULIC PRESSURE TUBE (CP12)
COMPRESSOR STATOR CYLINDER HYDRAULIC RETURN TUBE (CR03)
FLANGE E BRACKET
(PRE SB PW4ENG 75−45)
(POST SB PW4ENG 75−45)
L−A5625 (1189)
PW V

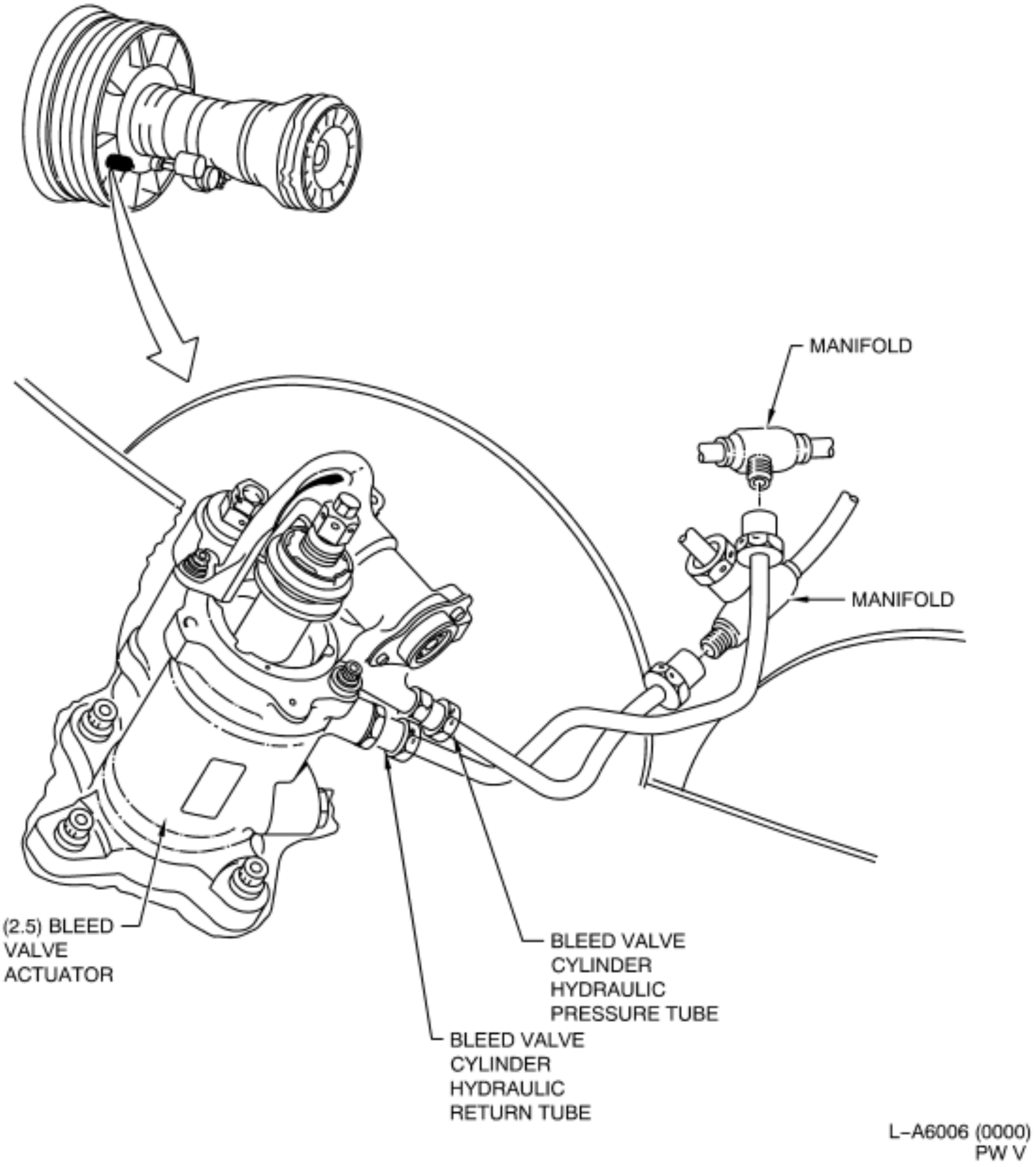
Installation Of The Engine Tubes
Figure 413 (Sheet 9)
(Task 72−00−34−420−004)


INTERMEDIATE CASE
IDG HEAT EXCHANGER
AIRFRAME (IDG) COOLER OUTLET OIL TUBE (PACKING INSTALLED)
BOLT (3 REQ'D)
HYDRAULIC RETURN TUBE
HYDRAULIC PRESSURE TUBE
L−A6005 (0000)
PW V

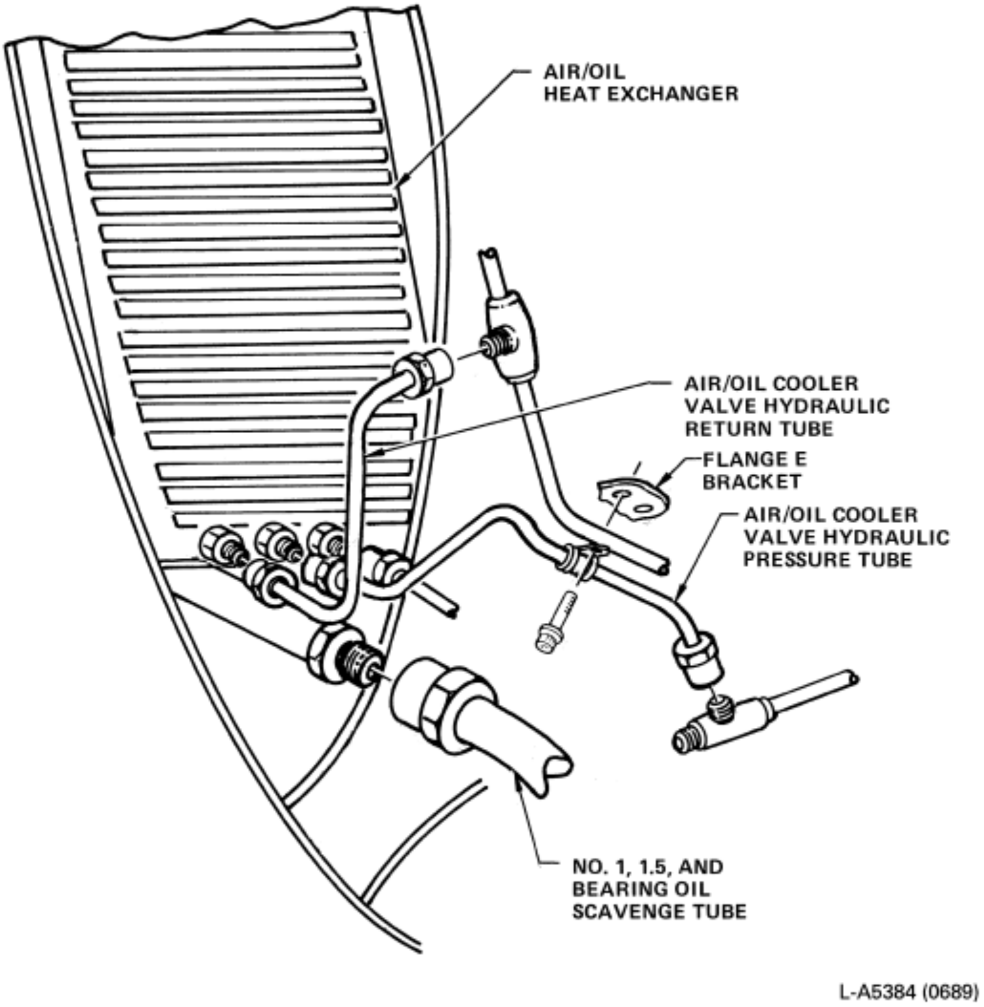
Installation Of The Engine Tubes
Figure 413 (Sheet 10)
(Task 72−00−34−420−004)


ANGLE
GEARBOX
ANGLE GEARBOX
OIL PRESSURE TUBE
PACKING
ANGLE GEARBOX
OIL PRESSURE TUBE
BOLT
(2 REQ'D)
L−A5382 (0000)
PW V

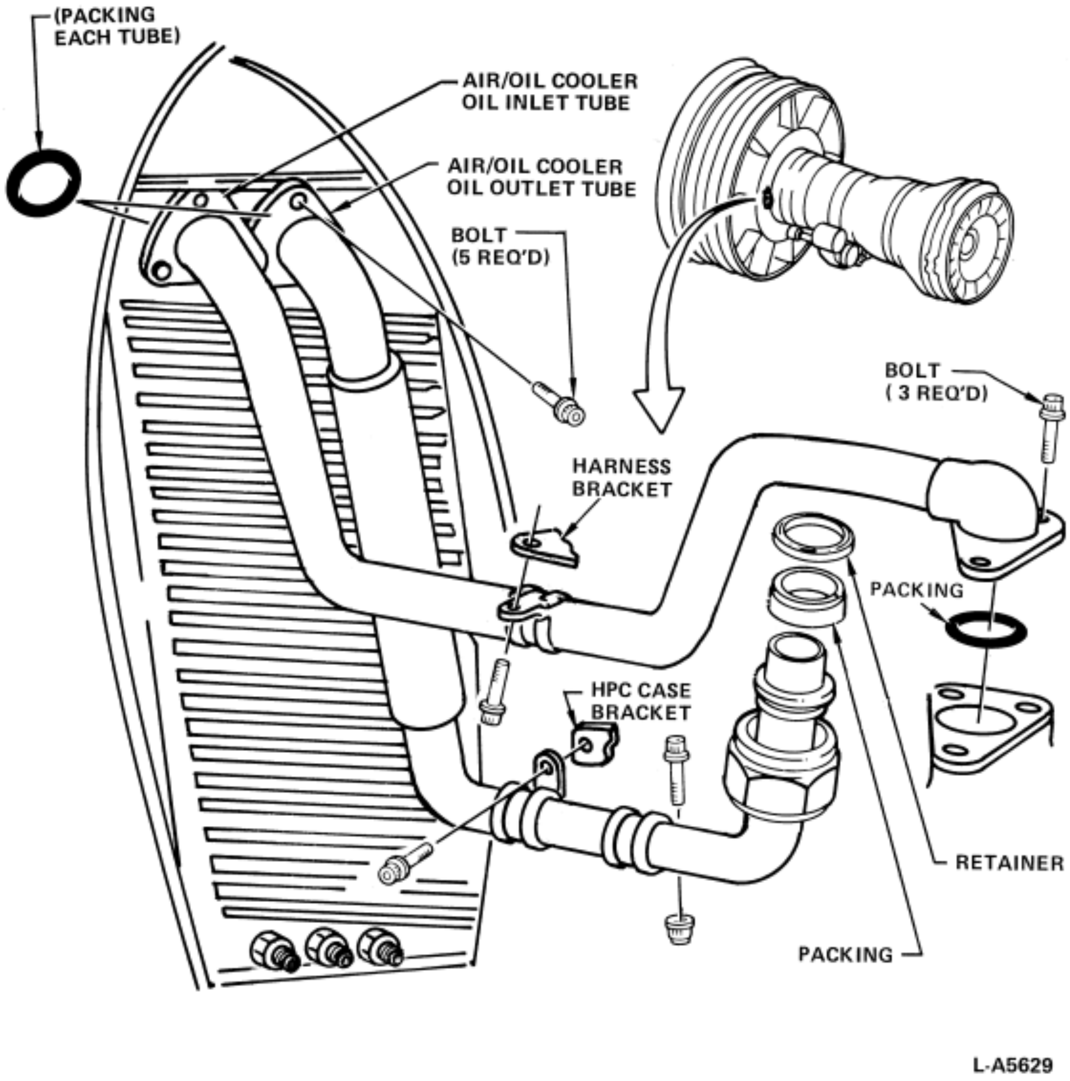
Installation Of The Engine Tubes
Figure 413 (Sheet 11)
(Task 72−00−34−420−004)


MANIFOLD
MANIFOLD
(2.5) BLEED VALVE ACTUATOR
BLEED VALVE CYLINDER HYDRAULIC PRESSURE TUBE
BLEED VALVE CYLINDER HYDRAULIC RETURN TUBE
L−A6006 (0000)
PW V

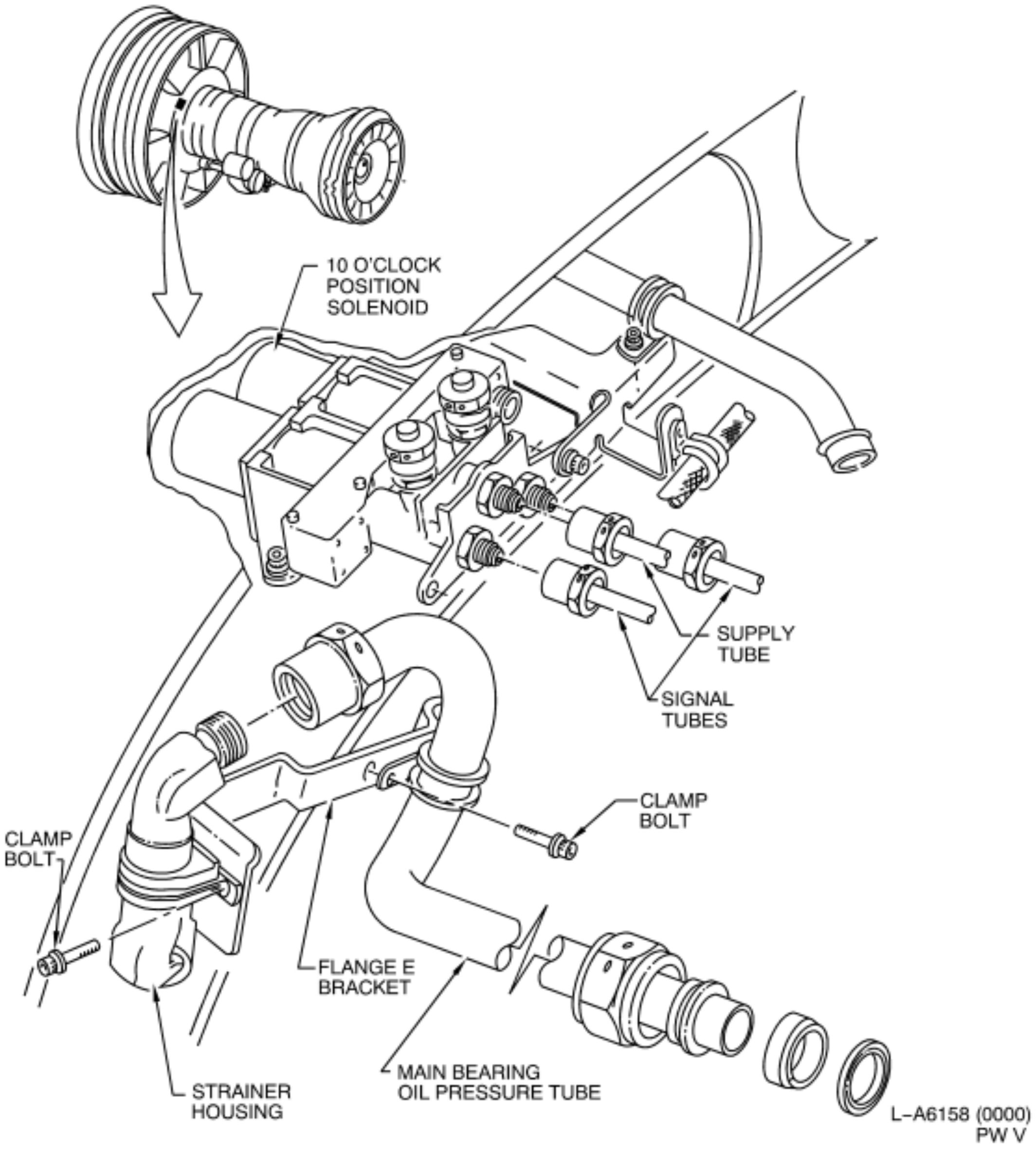
Installation Of The Engine Tubes
Figure 414 (Sheet 1)
(Task 72−00−34−420−004)


AIR/OIL
HEAT EXCHANGER
AIR/OIL COOLER
VALVE HYDRAULIC
RETURN TUBE
FLANGE E
BRACKET
AIR/OIL COOLER
VALVE HYDRAULIC
PRESSURE TUBE
NO. 1, 1.5, AND
BEARING OIL
SCAVENGE TUBE
L-A5384 (0689)

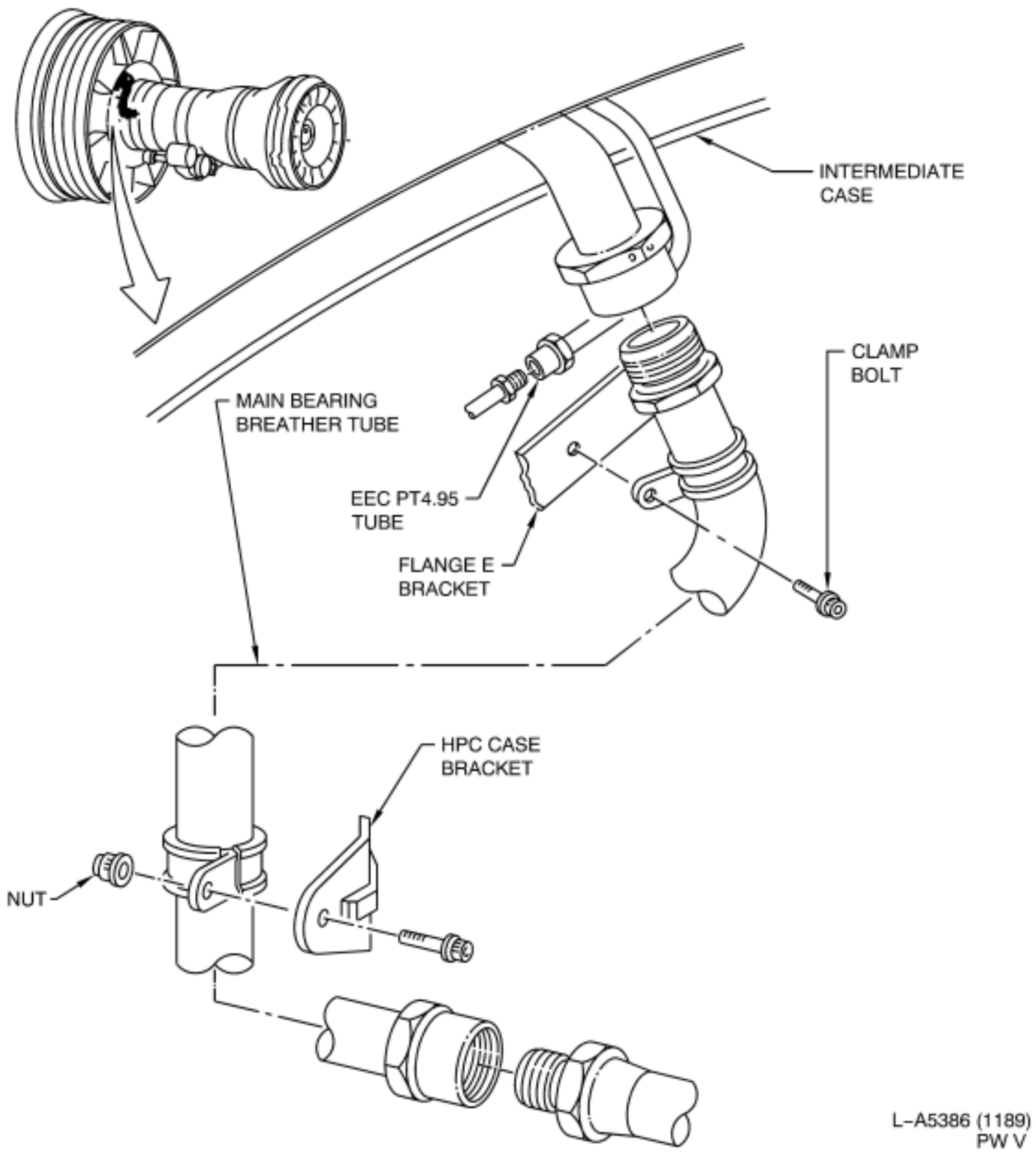
Installation Of The Engine Tubes
Figure 414 (Sheet 2)
(Task 72-00-34-420-004)


(PACKING EACH TUBE)
AIR/OIL COOLER OIL INLET TUBE
AIR/OIL COOLER OIL OUTLET TUBE
BOLT (5 REQ'D)
BOLT (3 REQ'D)
HARNESS BRACKET
PACKING
HPC CASE BRACKET
RETAINER
PACKING
L-A5629

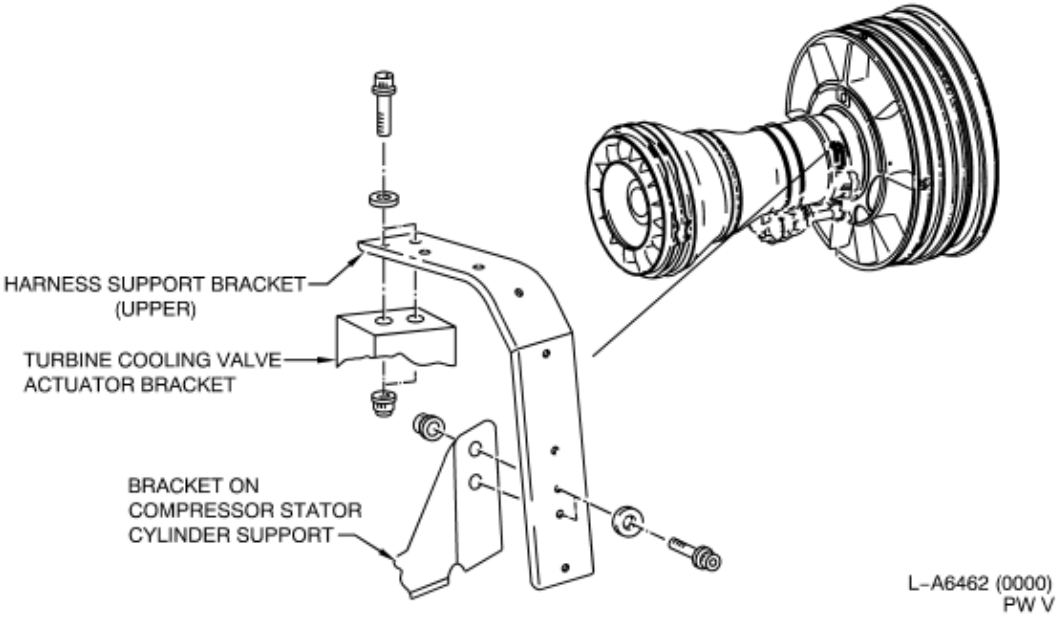
Installation of Engine Tubes
Figure 414 (Sheet 3)
(Task 72−00−34−420−004)


10 O'CLOCK POSITION SOLENOID
SUPPLY TUBE
SIGNAL TUBES
CLAMP BOLT
CLAMP BOLT
FLANGE E BRACKET
STRAINER HOUSING
MAIN BEARING OIL PRESSURE TUBE
L−A6158 (0000)
PW V

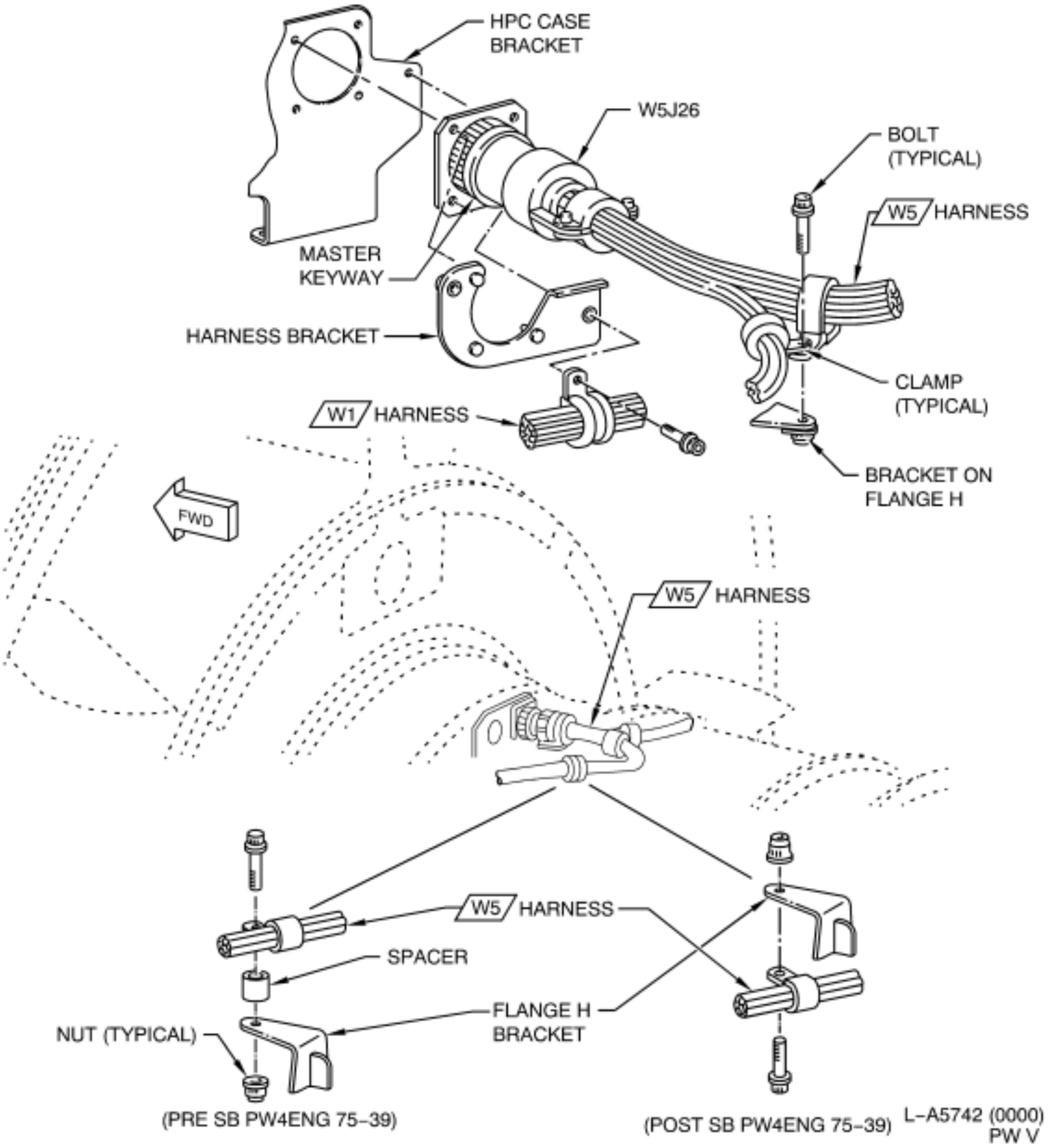
Installation Of Engine Tubes
Figure 414 (Sheet 4)
(Task 72−00−34−420−004)


INTERMEDIATE CASE
CLAMP BOLT
MAIN BEARING BREATHER TUBE
EEC PT4.95 TUBE
FLANGE E BRACKET
HPC CASE BRACKET
NUT
L−A5386 (1189)
PW V

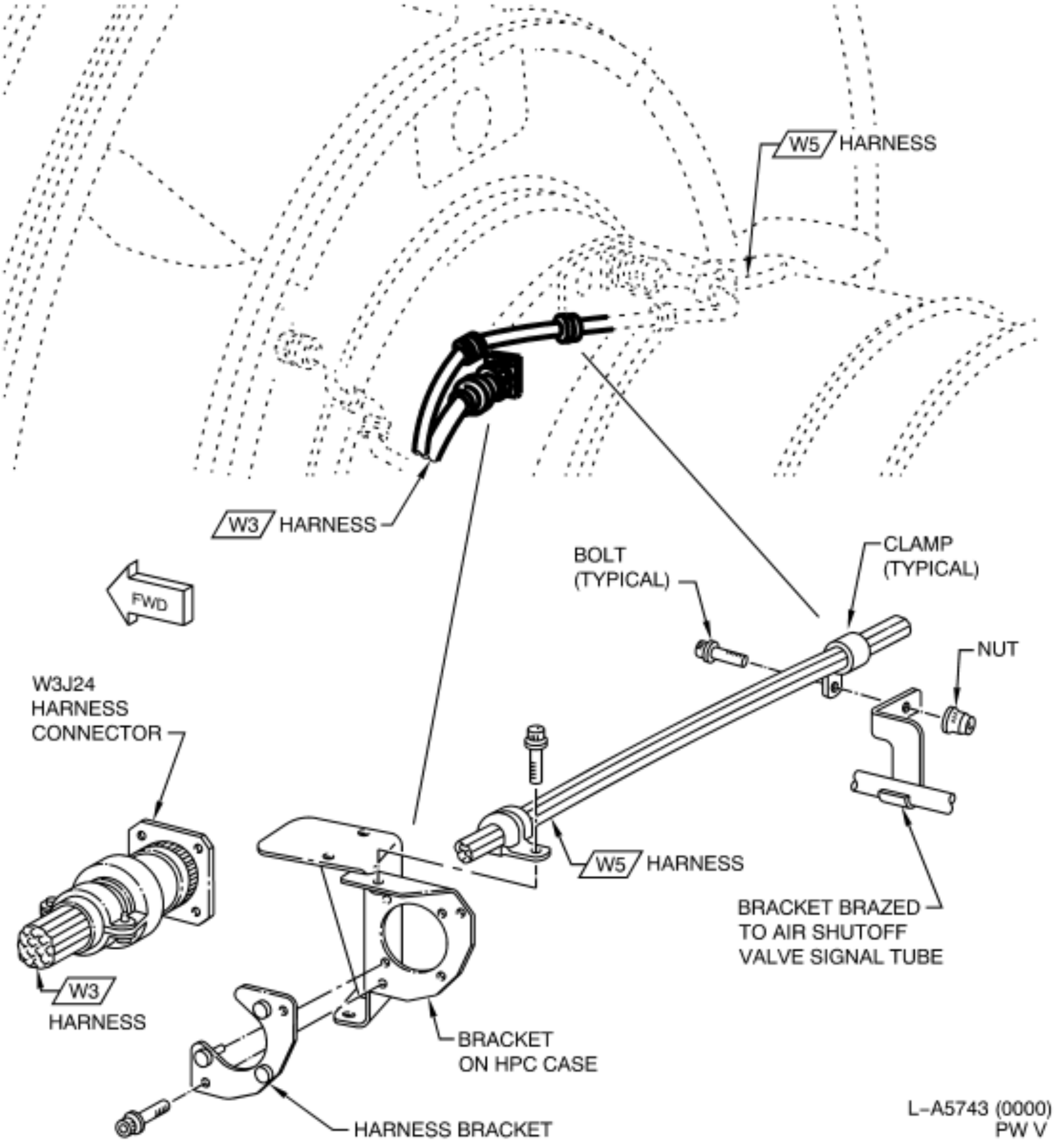
Installation Of Engine Tubes
Figure 414 (Sheet 5)
(Task 72−00−34−420−004)


HARNESS SUPPORT BRACKET (UPPER)
TURBINE COOLING VALVE ACTUATOR BRACKET
BRACKET ON COMPRESSOR STATOR CYLINDER SUPPORT
L-A6462 (0000)
PW V

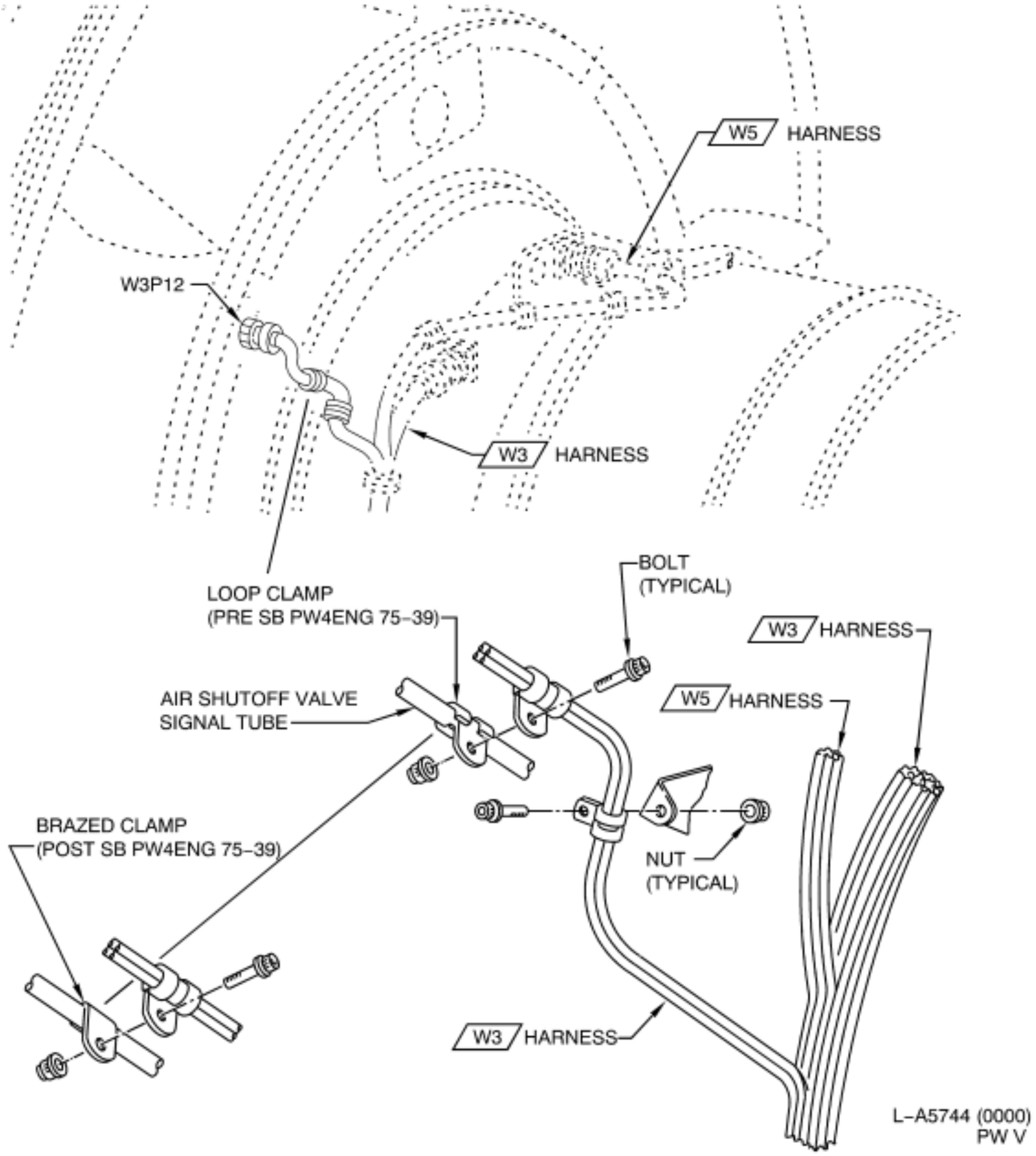
Harness Support Bracket
Figure 415 (Sheet 1)
(Task 72-00-34-420-004)


HPC CASE BRACKET
W5J26
BOLT (TYPICAL)
W5 HARNESS
MASTER KEYWAY
HARNESS BRACKET
CLAMP (TYPICAL)
W1 HARNESS
BRACKET ON FLANGE H
FWD
W5 HARNESS
W5 HARNESS
SPACER
FLANGE H BRACKET
NUT (TYPICAL)
(PRE SB PW4ENG 75−39)
(POST SB PW4ENG 75−39)
L−A5742 (0000)
PW V

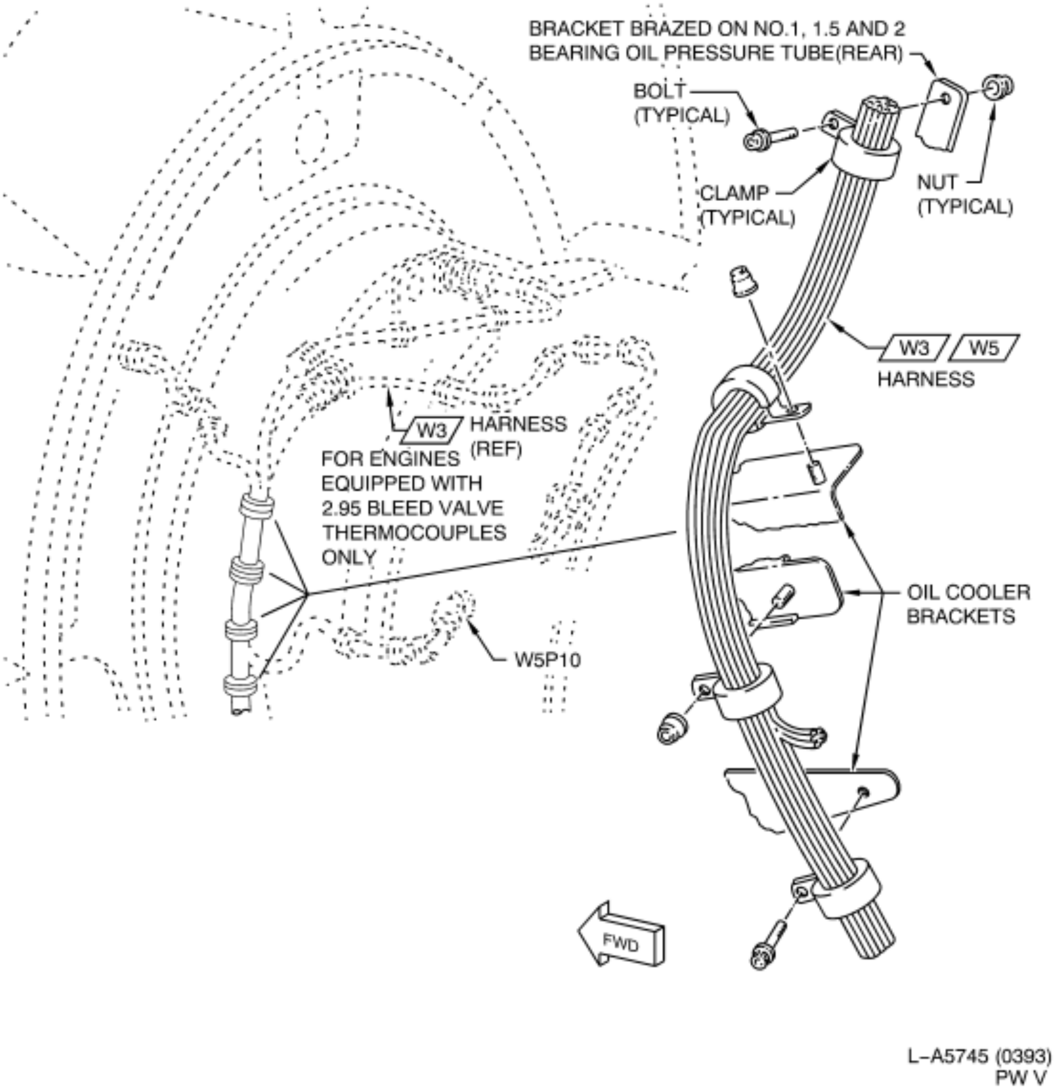
EEC Wiring Harness − Installation
Figure 415 (Sheet 2)
(Task 72−00−34−420−004)


W5 HARNESS
W3 HARNESS
FWD
BOLT (TYPICAL)
CLAMP (TYPICAL)
NUT
W3J24 HARNESS CONNECTOR
W5 HARNESS
BRACKET BRAZED TO AIR SHUTOFF VALVE SIGNAL TUBE
W3 HARNESS
BRACKET ON HPC CASE
HARNESS BRACKET
L-A5743 (0000)
PW V

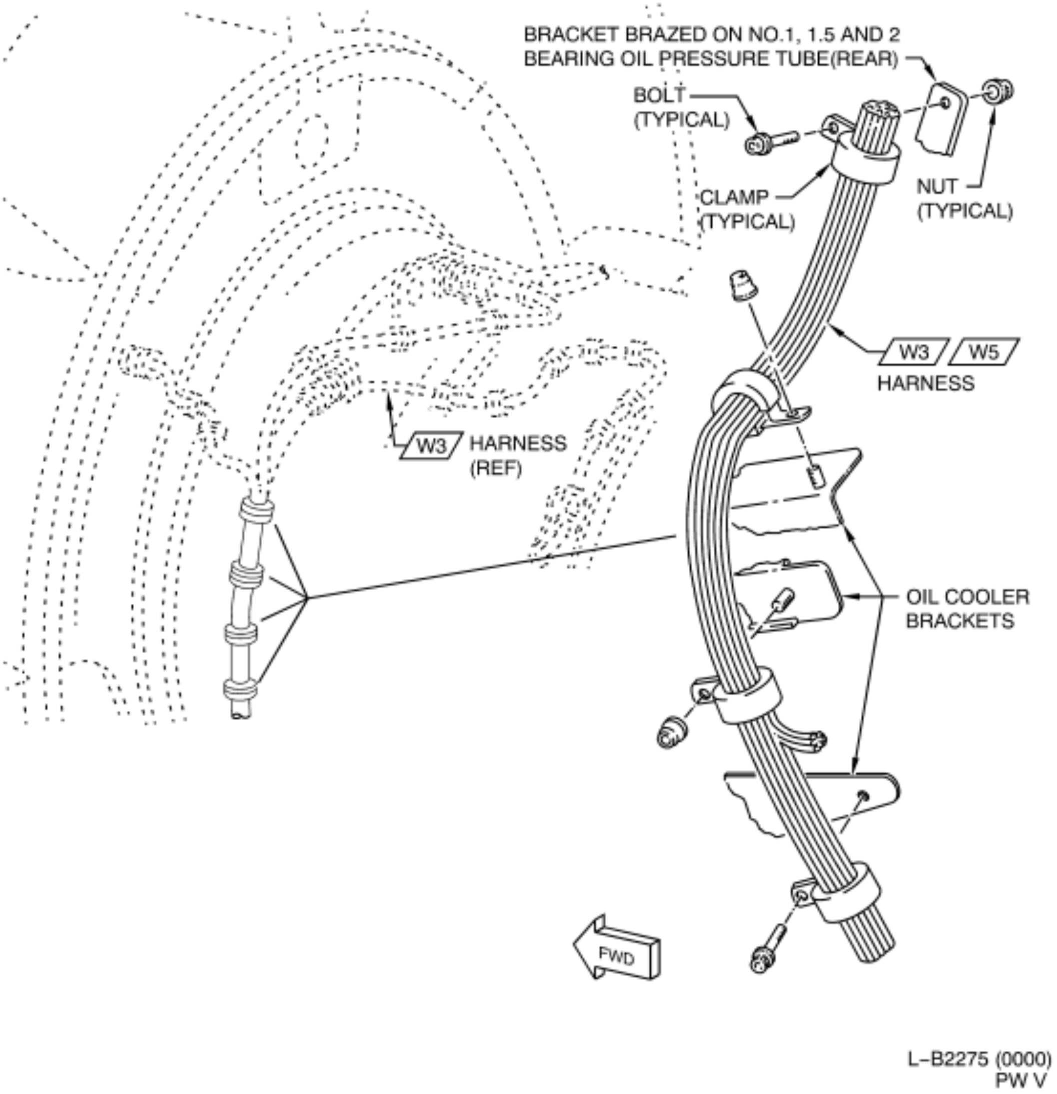
EEC Wiring Harness - Installation
Figure 415 (Sheet 3)
(Task 72-00-34-420-004)


W5 HARNESS
W3P12
W3 HARNESS
LOOP CLAMP
(PRE SB PW4ENG 75−39)
BOLT
(TYPICAL)
W3 HARNESS
AIR SHUTOFF VALVE
SIGNAL TUBE
W5 HARNESS
BRAZED CLAMP
(POST SB PW4ENG 75−39)
NUT
(TYPICAL)
W3 HARNESS
L−A5744 (0000)
PW V

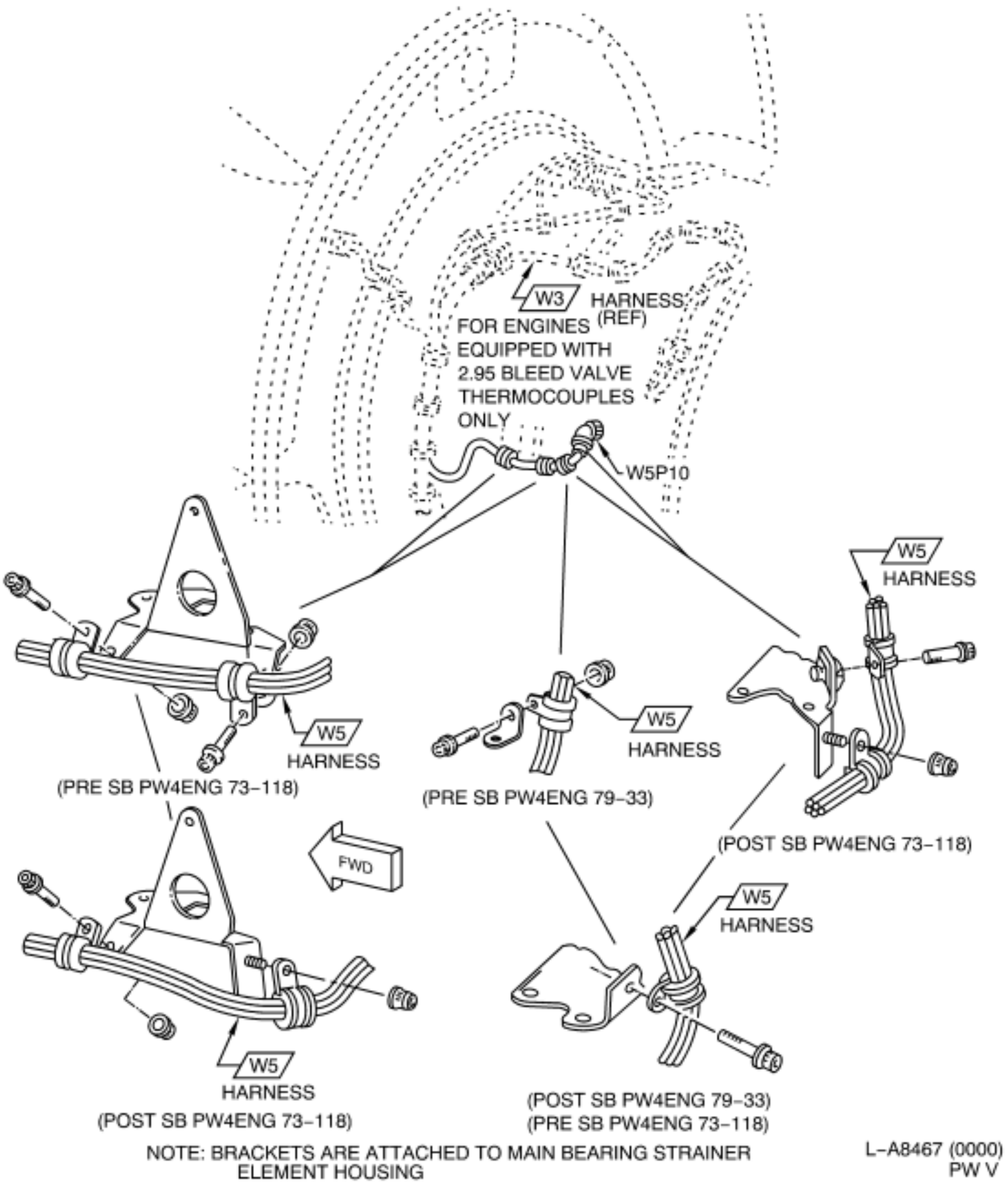
EEC Wiring Harness − Installation
Figure 415 (Sheet 4)
(Task 72−00−34−420−004)


BRACKET BRAZED ON NO.1, 1.5 AND 2 BEARING OIL PRESSURE TUBE(REAR)
BOLT (TYPICAL)
CLAMP (TYPICAL)
NUT (TYPICAL)
W3 W5 HARNESS
W3 HARNESS (REF)
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
OIL COOLER BRACKETS
W5P10
FWD
L−A5745 (0393)
PW V

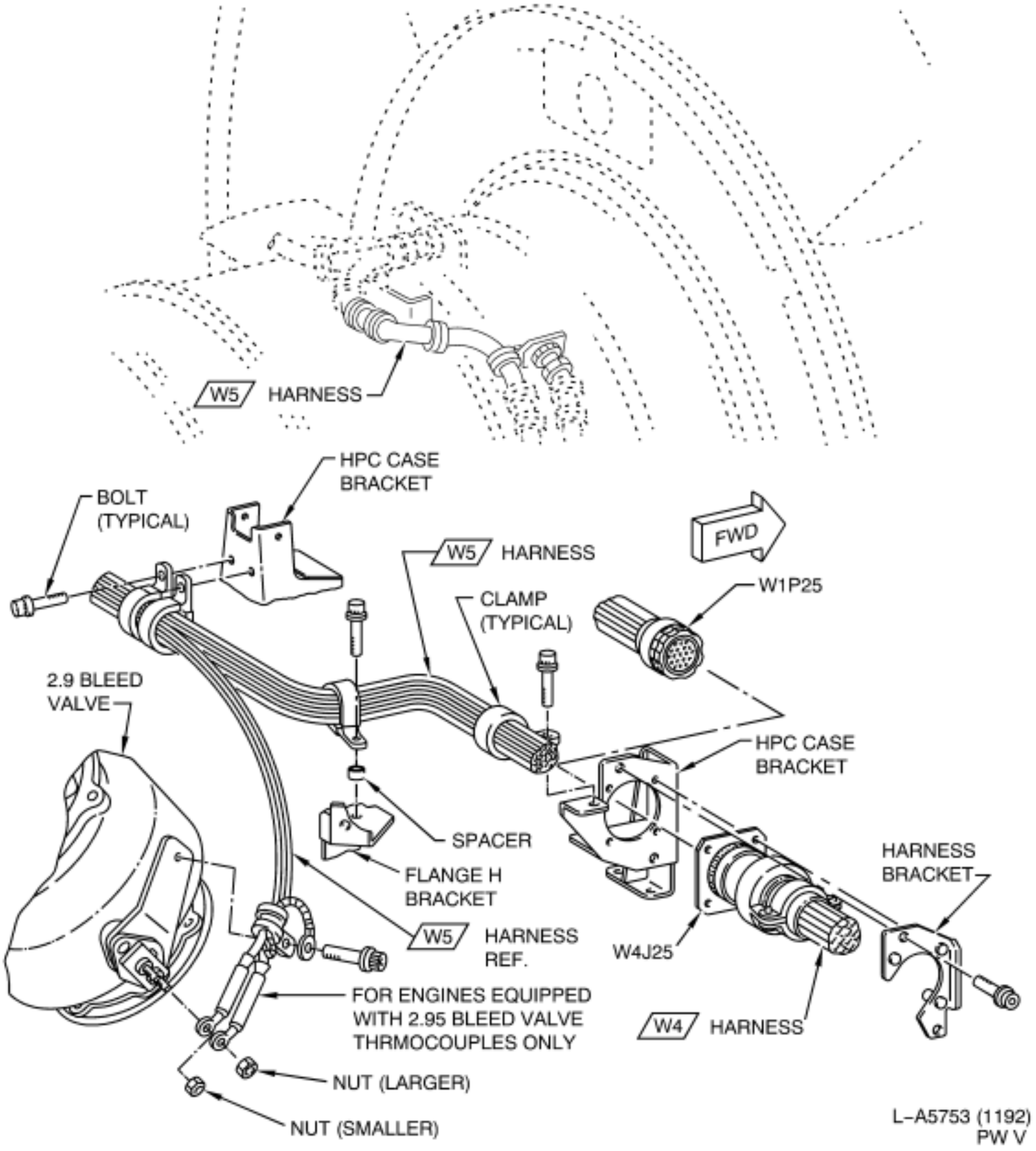
EEC Wiring Harness − Installation (Pre SB PW4ENG 75−106)
Figure 415 (Sheet 5)
(Task 72−00−34−420−004)


BRACKET BRAZED ON NO.1, 1.5 AND 2
BEARING OIL PRESSURE TUBE(REAR)
BOLT
(TYPICAL)
CLAMP
(TYPICAL)
NUT
(TYPICAL)
W3 W5
HARNESS
W3 HARNESS
(REF)
OIL COOLER
BRACKETS
FWD
L−B2275 (0000)
PW V

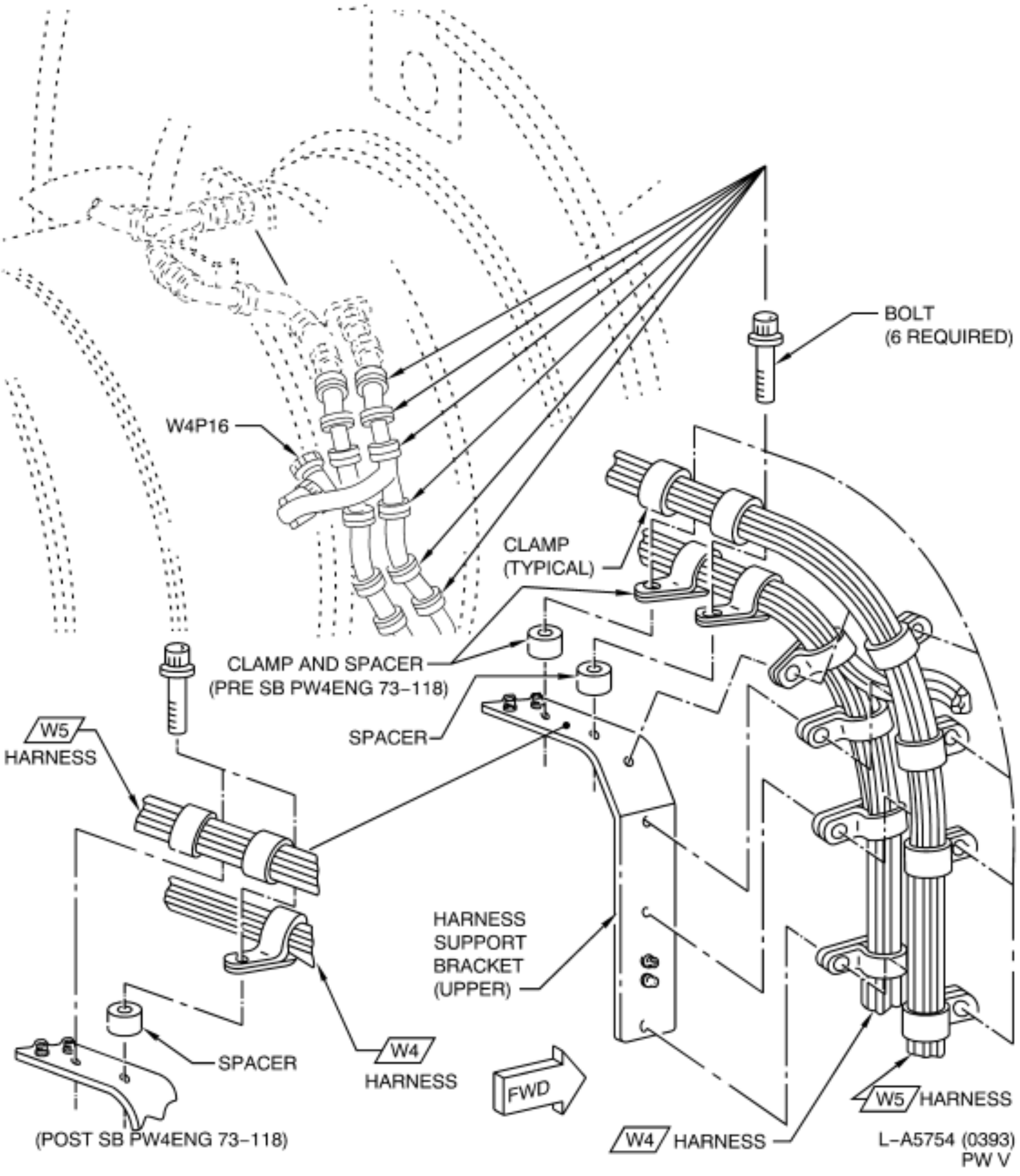
EEC Wiring Harness − Installation (Post SB PW4ENG 75−106 or SB PW4ENG 72−572)
Figure 415 (Sheet 6)
(Task 72−00−34−420−004)


W3 HARNESS (REF)
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5P10
W5 HARNESS
W5 HARNESS
W5 HARNESS
(PRE SB PW4ENG 73-118)
(PRE SB PW4ENG 79-33)
(POST SB PW4ENG 73-118)
FWD
W5 HARNESS
W5 HARNESS
(POST SB PW4ENG 73-118)
(POST SB PW4ENG 79-33)
(PRE SB PW4ENG 73-118)
NOTE: BRACKETS ARE ATTACHED TO MAIN BEARING STRAINER ELEMENT HOUSING
L-A8467 (0000)
PW V

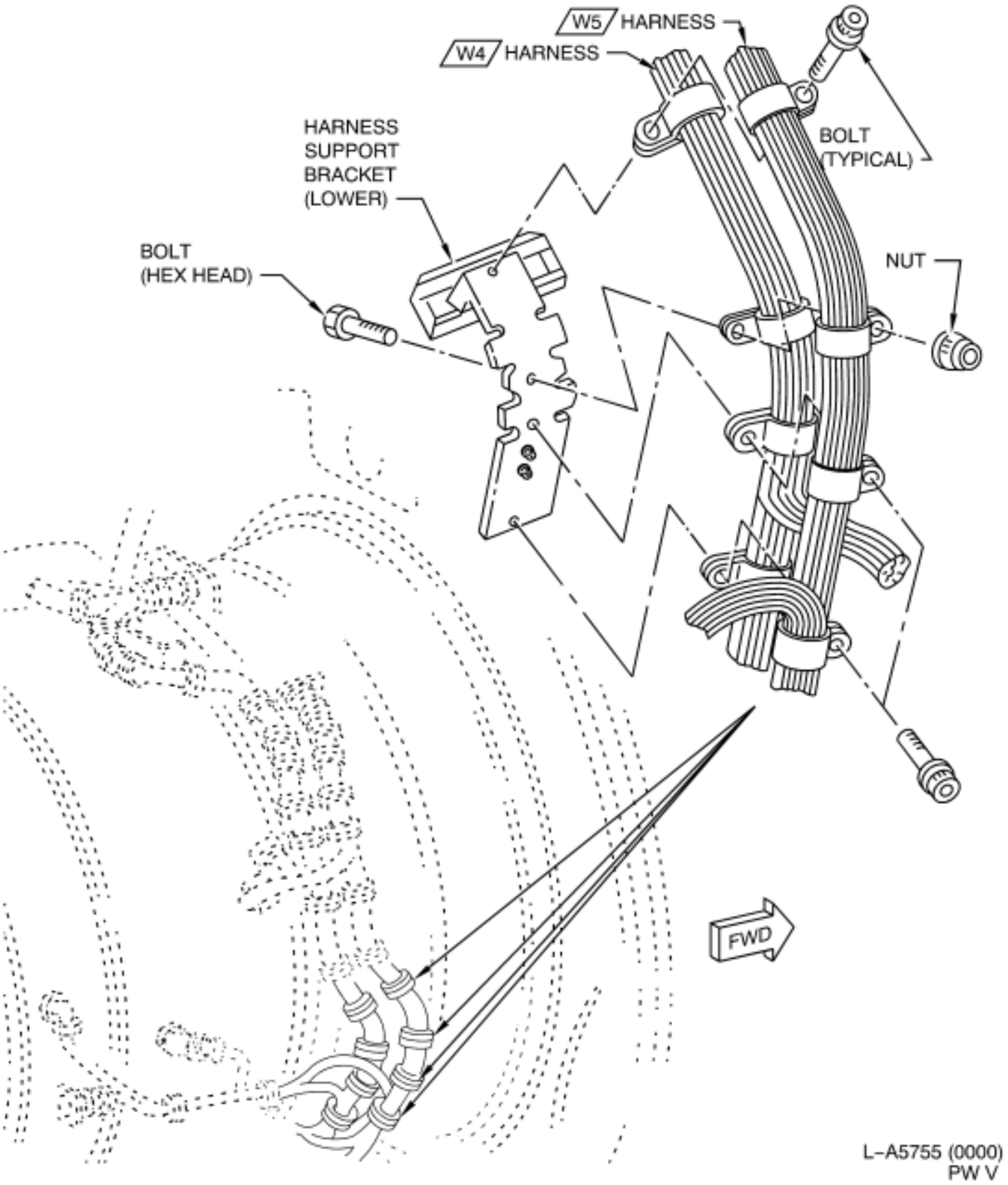
EEC Wiring Harness - Installation (Pre SB PW4ENG 75-106)
Figure 415 (Sheet 7)
(Task 72-00-34-420-004)


W5
HARNESS
HPC CASE BRACKET
BOLT (TYPICAL)
W5
HARNESS
FWD
CLAMP (TYPICAL)
W1P25
2.9 BLEED VALVE
HPC CASE BRACKET
SPACER
FLANGE H BRACKET
HARNESS BRACKET
W5
HARNESS REF.
W4J25
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THRMOCOUPLES ONLY
W4
HARNESS
NUT (LARGER)
NUT (SMALLER)
L-A5753 (1192)
PW V

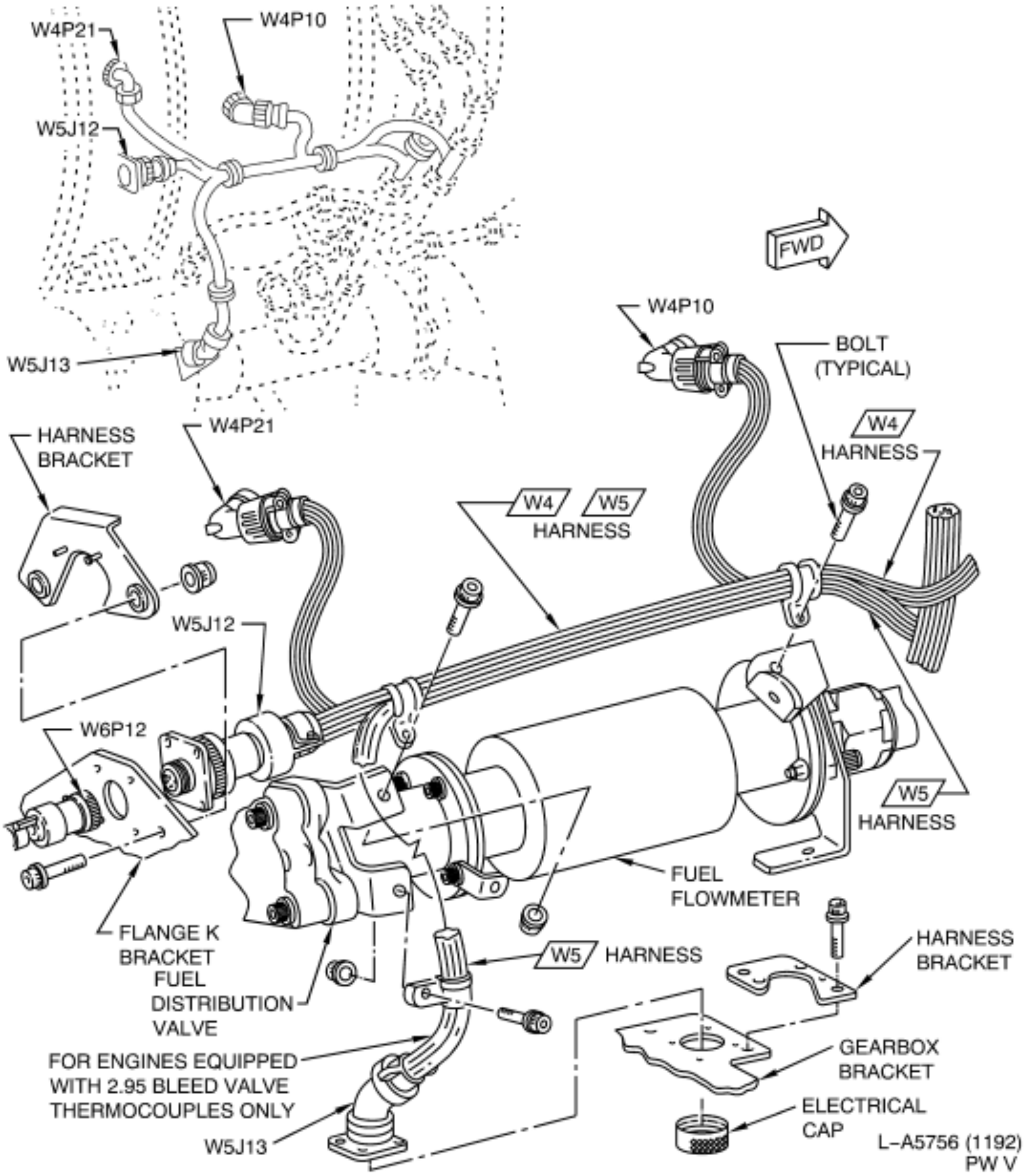
EEC Wiring Harness - Installation
Figure 415 (Sheet 8)
(Task 72-00-34-420-004)


BOLT
(6 REQUIRED)
W4P16
CLAMP
(TYPICAL)
CLAMP AND SPACER
(PRE SB PW4ENG 73-118)
SPACER
W5
HARNESS
HARNESS
SUPPORT
BRACKET
(UPPER)
SPACER
W4
HARNESS
FWD
W5 HARNESS
W4 HARNESS
(POST SB PW4ENG 73-118)
L-A5754 (0393)
PW V

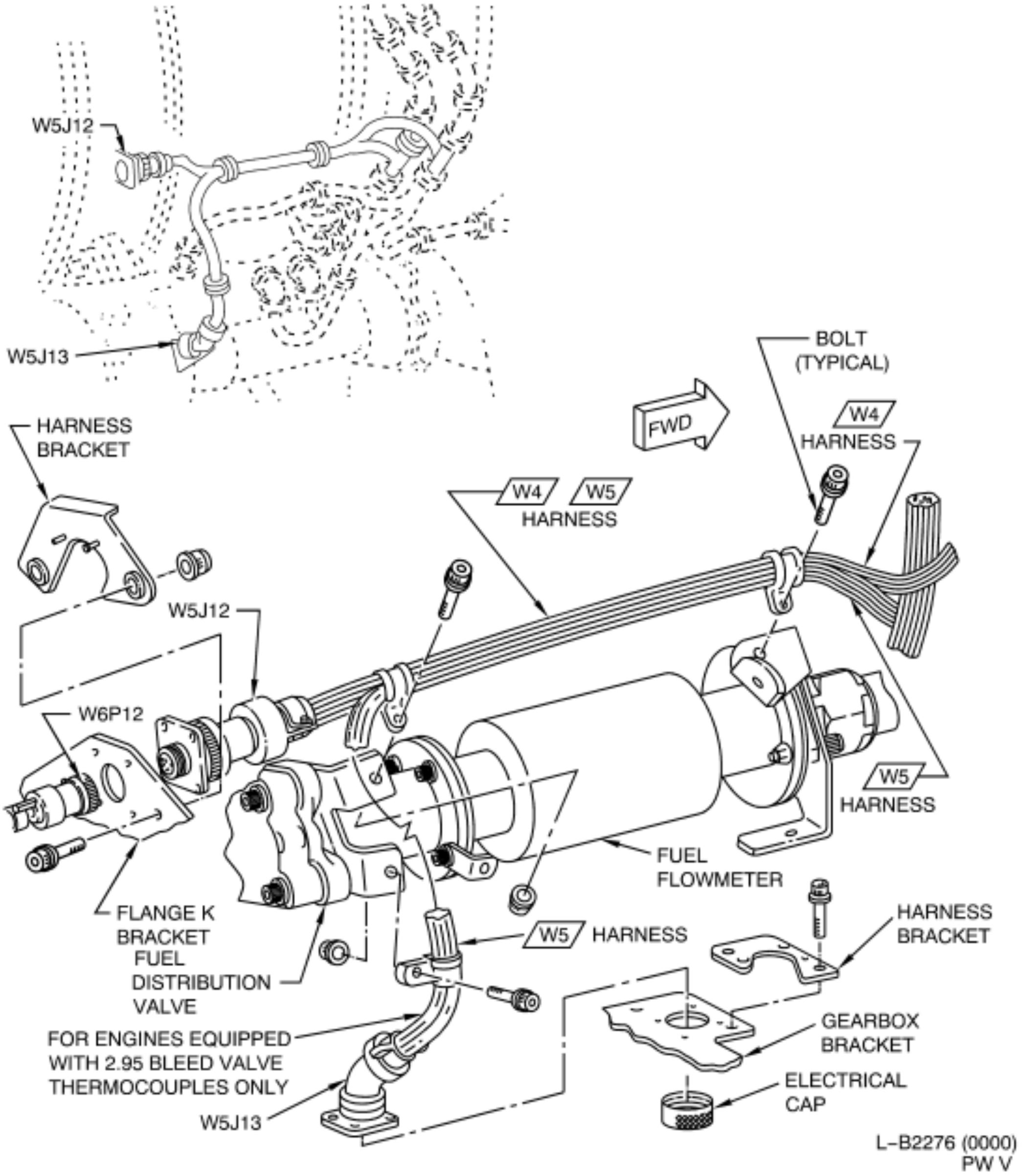
EEC Wiring Harness - Installation
Figure 415 (Sheet 9)
(Task 72-00-34-420-004)


W5 HARNESS
W4 HARNESS
HARNESS SUPPORT BRACKET (LOWER)
BOLT (TYPICAL)
BOLT (HEX HEAD)
NUT
FWD
L-A5755 (0000)
PW V

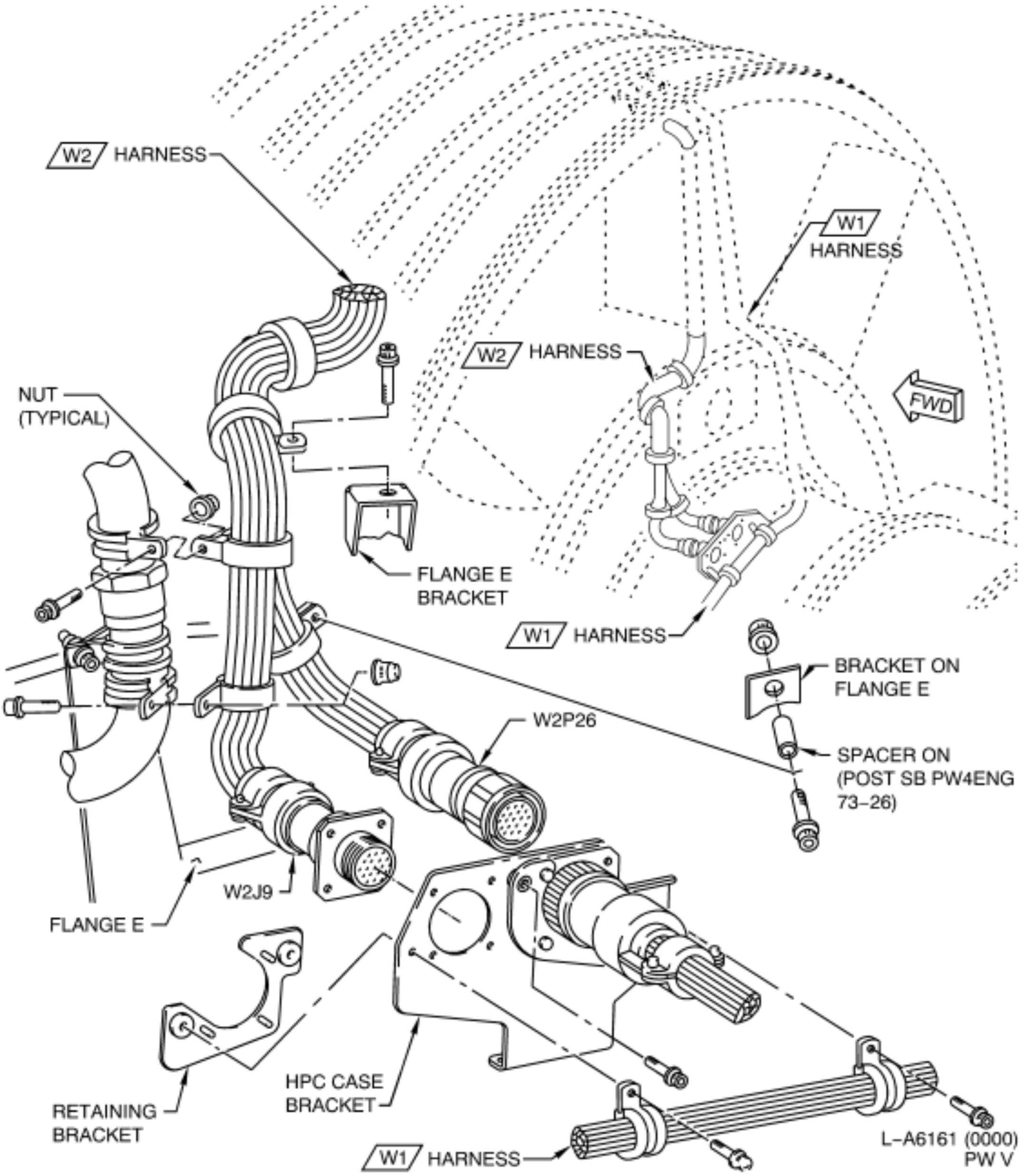
EEC Wiring Harness - Installation
Figure 415 (Sheet 10)
(Task 72-00-34-420-004)


W4P21
W4P10
W5J12
W5J13
FWD
W4P10
BOLT (TYPICAL)
W4 HARNESS
HARNESS BRACKET
W4P21
W4 W5 HARNESS
W5J12
W6P12
W5 HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
GEARBOX BRACKET
ELECTRICAL CAP
W5J13
L-A5756 (1192)
PW V

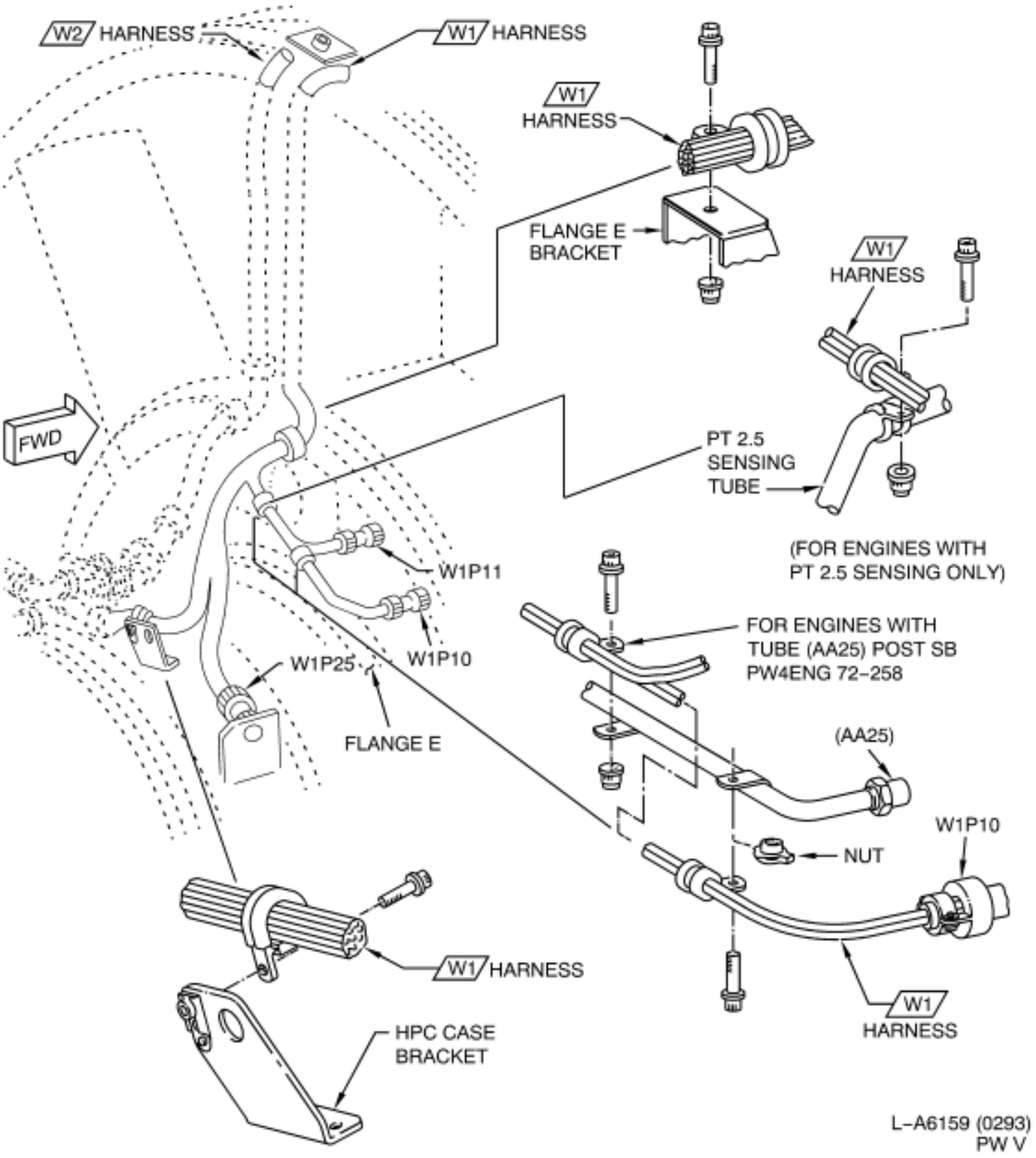
EEC Wiring Harness - Installation (Pre SB PW4ENG 75-106)
Figure 415 (Sheet 11)
(Task 72-00-34-420-004)


W5J12
W5J13
BOLT (TYPICAL)
FWD
W4 HARNESS
HARNESS BRACKET
W4 W5 HARNESS
W5J12
W6P12
W5 HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
GEARBOX BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
ELECTRICAL CAP
W5J13
L−B2276 (0000)
PW V

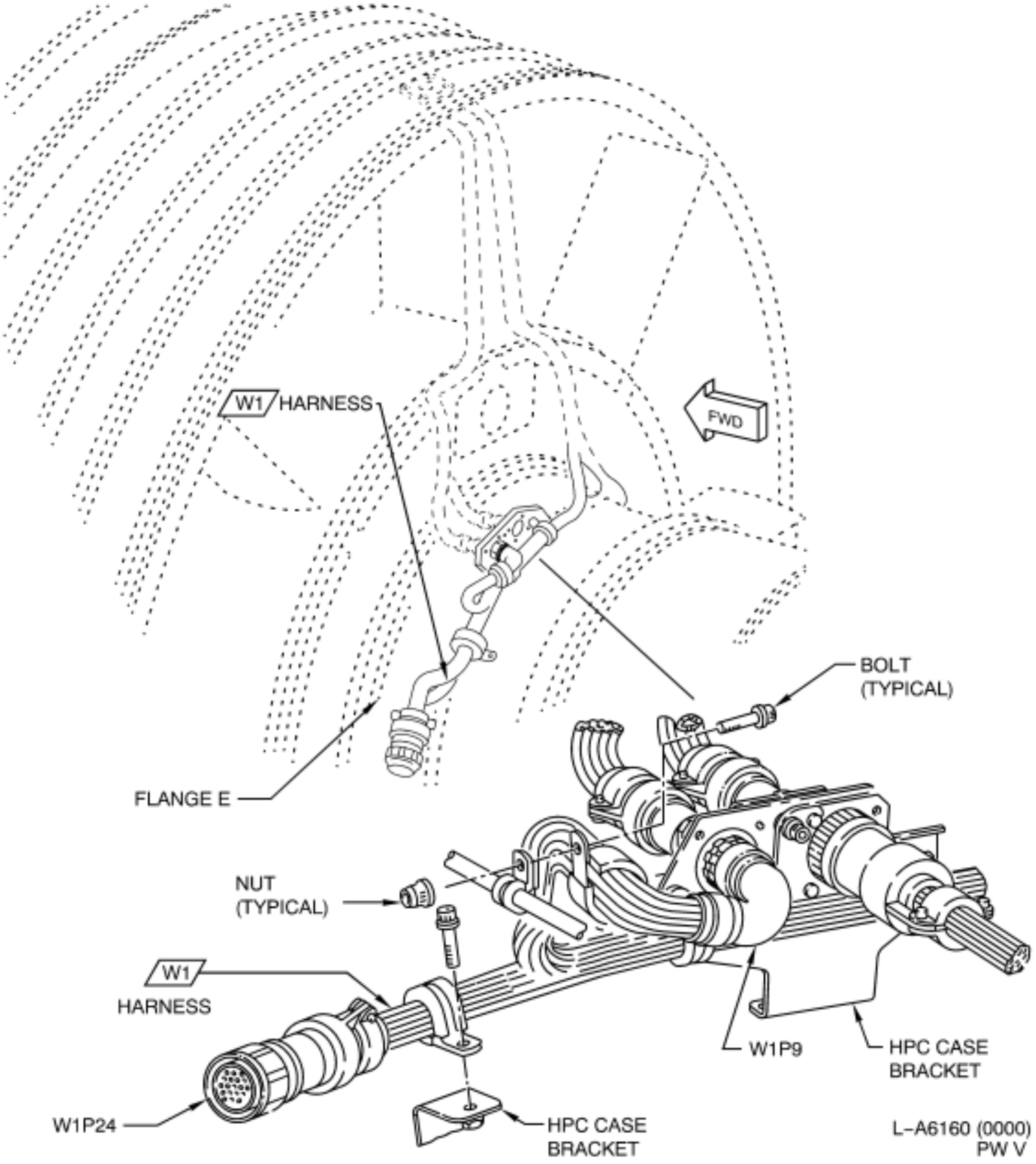
EEC Wiring Harness − Installation (Post
SB PW4ENG 75−106 or SB PW4ENG 72−572)
Figure 415 (Sheet 12)
(Task 72−00−34−420−004)


W2 HARNESS
W1 HARNESS
W2 HARNESS
FWD
NUT (TYPICAL)
FLANGE E BRACKET
W1 HARNESS
BRACKET ON FLANGE E
W2P26
SPACER ON (POST SB PW4ENG 73−26)
W2J9
FLANGE E
RETAINING BRACKET
HPC CASE BRACKET
W1 HARNESS
L−A6161 (0000) PW V

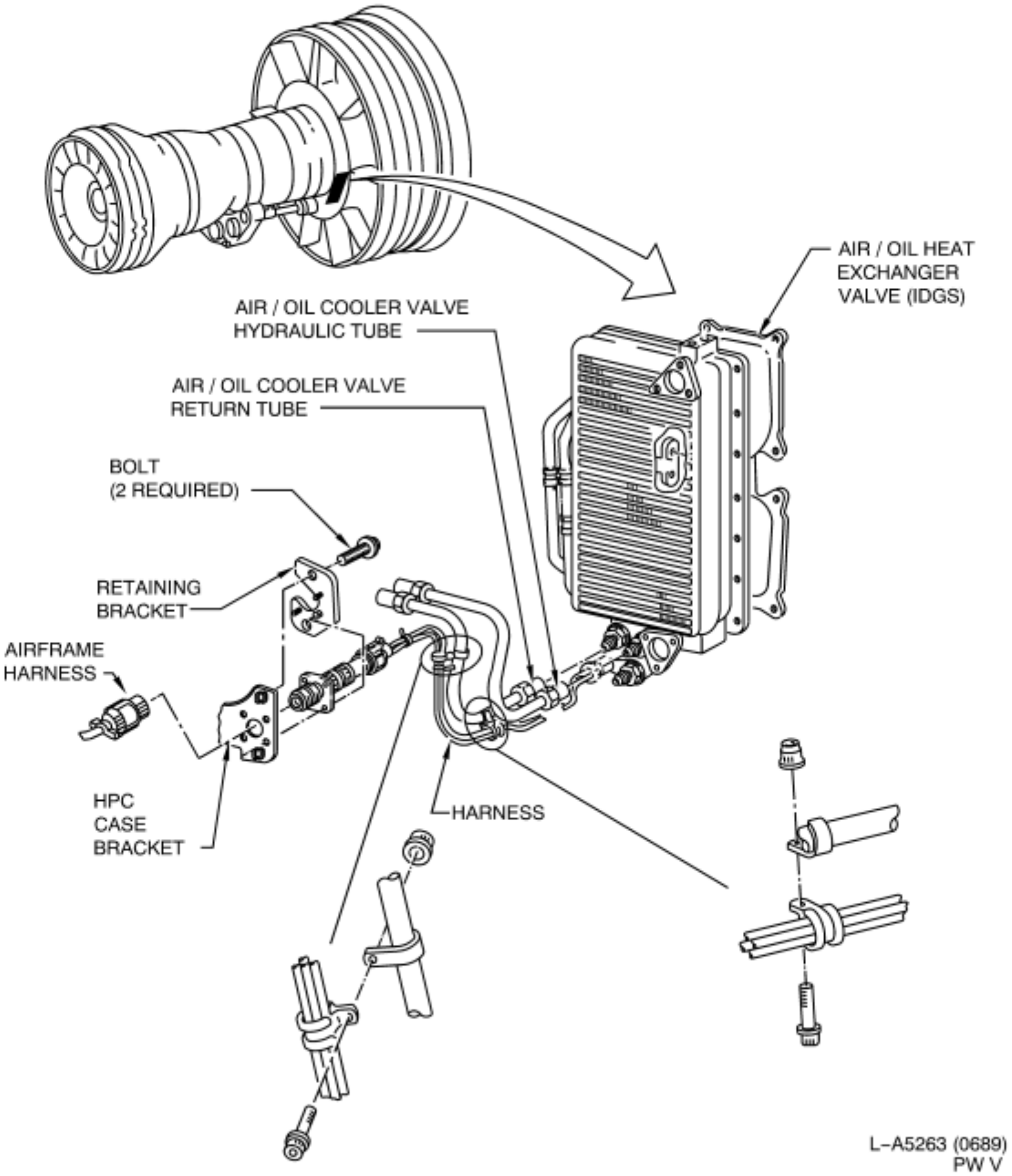
EEC Wiring Harness − Installation
Figure 416 (Sheet 1)
(Task 72−00−34−420−004)


W2 HARNESS
W1 HARNESS
W1 HARNESS
FLANGE E BRACKET
W1 HARNESS
FWD
PT 2.5 SENSING TUBE
(FOR ENGINES WITH PT 2.5 SENSING ONLY)
W1P11
W1P10
W1P25
FOR ENGINES WITH TUBE (AA25) POST SB PW4ENG 72-258
(AA25)
FLANGE E
W1P10
NUT
W1 HARNESS
W1 HARNESS
HPC CASE BRACKET
L-A6159 (0293)
PW V

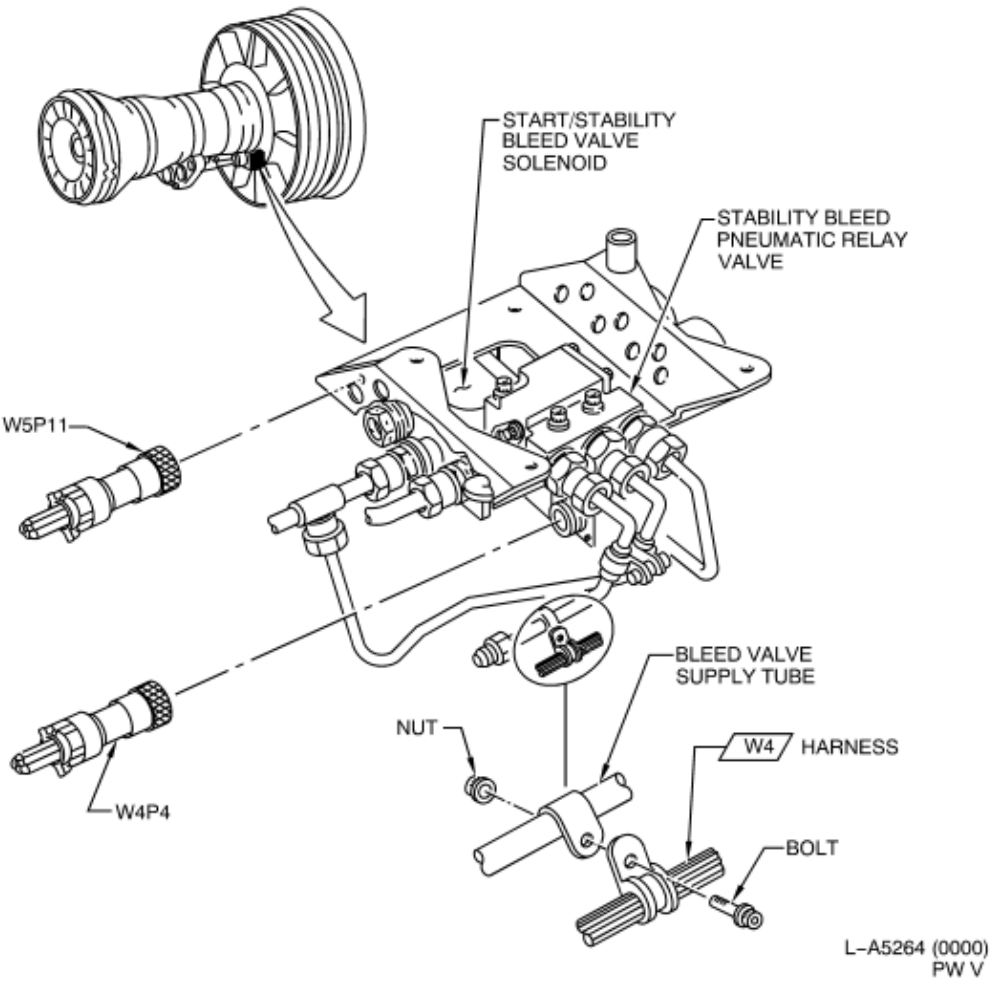
EEC Wiring Harness − Installation
Figure 416 (Sheet 2)
(Task 72−00−34−420−004)


W1 HARNESS
FWD
BOLT (TYPICAL)
FLANGE E
NUT (TYPICAL)
W1
HARNESS
W1P9
HPC CASE BRACKET
W1P24
HPC CASE BRACKET
L−A6160 (0000)
PW V

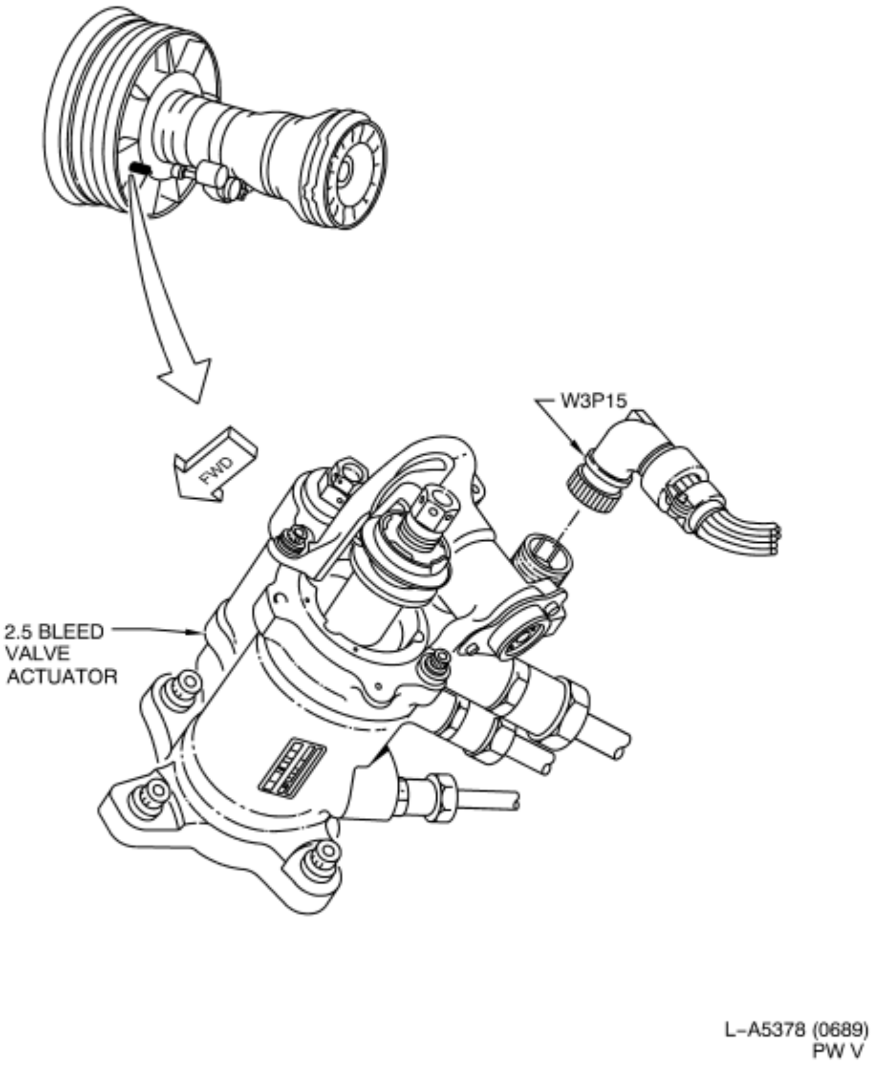
EEC Wiring Harness − Installation
Figure 416 (Sheet 3)
(Task 72−00−34−420−004)


AIR / OIL HEAT EXCHANGER VALVE (IDGS)
AIR / OIL COOLER VALVE HYDRAULIC TUBE
AIR / OIL COOLER VALVE RETURN TUBE
BOLT (2 REQUIRED)
RETAINING BRACKET
AIRFRAME HARNESS
HPC CASE BRACKET
HARNESS
L−A5263 (0689)
PW V

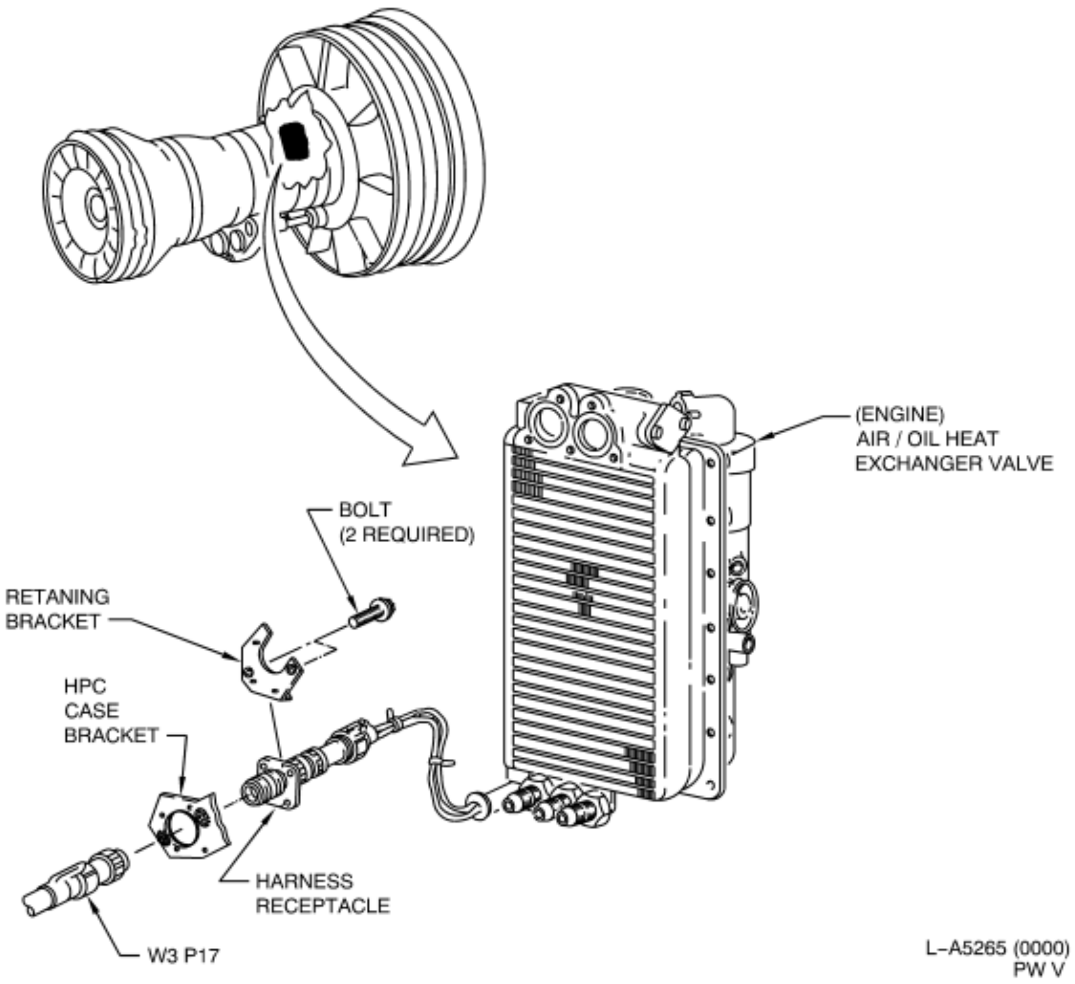
Wiring Harness − Installation
Figure 417 (Sheet 1)
(Task 72−00−34−420−004)


START/STABILITY BLEED VALVE SOLENOID
STABILITY BLEED PNEUMATIC RELAY VALVE
W5P11
BLEED VALVE SUPPLY TUBE
NUT
W4
HARNESS
W4P4
BOLT
L-A5264 (0000)
PW V

Wiring Harness - Installation
Figure 417 (Sheet 2)
(Task 72-00-34-420-004)


W3P15
FWD
2.5 BLEED VALVE ACTUATOR
L−A5378 (0689)
PW V

Wiring Harness − Installation
Figure 417 (Sheet 3)
(Task 72−00−34−420−004)


(ENGINE)
AIR / OIL HEAT
EXCHANGER VALVE
BOLT
(2 REQUIRED)
RETANING
BRACKET
HPC
CASE
BRACKET
HARNESS
RECEPTACLE
W3 P17
L−A5265 (0000)
PW V

Wiring Harness − Installation
Figure 417 (Sheet 4)
(Task 72−00−34−420−004)

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−21

Task 72−00−34−420−006:

1. Install The Fan Unit On The Core Engine

A. Prerequisites

(1) If disassembled, install the HPC top front case. See 72−00−35, Installation−18 (Task 72−00−35−430−001).

(2) If applicable, trunnion the fan unit from rear end down to horizontal position. Refer to 72−00−00, Special Procedures−22 (Task 72−00−00−420−004).

B. Equipment And Materials Necesary

Standard Tools:
Glenair TG−70 Strap Wrench or
Glenair TG−69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 25757	Pedestal (2 Necessary)
PWA 25926	Adapters (2 Necessary)
PWA 29855−7	Pins, Aligning (2 Necessary)
PWA 76154	Adapter (2 Necessary)
PWA 76155	Sling
PWA 85260	Pins, Aligning (2 Necessary)
PWA 85429	Wrench
PWA 85471	Wrench, Torque
PWA 85537	Fixture, Handling
PWA 85585	Ring, Guide
PWA 85623	Eye, Lifting
PWA 85631	Guide, Piloting
PWA 85768	Puller
PWA 85785	Adapter, Piloting
PWA 86209	Retainer, Positioning (Optional To PWA 85537)
PWA 86598	Retainer, Positioning (Optional To PWA 86209)
PWA 88204	Guide, Piloting

R
R

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
R	P06-021	Compound, Antigalling (PWA 550-3)
R	P06-053	Lubricant, Sealing Ring (PWA 36500)
R	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	3	72-35-00/23/300
Packing	1	24-11-00/2/70
Packing	1	72-34-00/16/1
Packing	1	72-35-00/11/165
Packing	1	72-61-00/8/160
Packing	1	72-62-00/6/20
Packing	1	72-62-00/6/30
Packing	3	79-21-00/8/1
Packing	1	79-21-00/8/120
Packing	1	79-21-00/11/1
Packing	1	79-22-00/1/1
Retainer	1	79-21-00/8/130
Retainer	1	79-21-00/11/10
Lockwire, MS9226-06		

C. Procedure - Install The Fan Unit To The Core Engine

(1) If installed, remove the turbine shaft nut and washer from the front of the LPT shaft. Use PWA 85429 Wrench. See Figure 401.

(2) If not installed, install PWA 85585 Guide Ring on the No. 1.5-bearing-support-assembly with detail screws. See Figure 402.

(3) If not installed, install PWA 85785 Adapter to the front of the fan hub as follows.

(a) Move the legs of the adapter to their outermost position.

(b) Engage the rear of the fan hub.

(c) Tighten the wing nuts to hold the legs in position.

(4) If not installed, install the PWA 88204 Guide in the front of the LPT shaft on the core-unit. Tighten by hand. See Figure 403.

CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE-UNIT BY THE PWA 85631 GUIDE YOU INSTALL ON THE FRONT OF THE UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE GUIDE. TOO MUCH STRESS ON THE GUIDE CAN CAUSE DAMAGE TO THE PLAIN ROUND NUT.

(5) If not installed, install PWA 85631 Guide as follows.

(a) Install the guide in the plain round nut. Be sure the threads engage correctly.

(b) Use PWA 85471 Wrench and tighten the guide until seated.

NOTE: If equipped, the four grooves on the PWA 85631 Guide Change B, must be fully rearward of the PWA 85585 Guide Ring front surface. If the grooves are not fully rearward of the ring, the threads of the guide are not fully engaged.

(6) If not installed, attach PWA 85623 Eye to the intermediate case at 12 o'clock with the detail screws. See Figure 404.

(7) Support the engine with hoists at:

(a) The front of the fan unit. Use, in addition to a hoist and PWA 86567 Adapters, PWA 76155 Sling and two PWA 76154 Adapters.

(b) The rear of the fan unit: PWA 85659 Eye.

NOTE: There is already a Hoist and PWA 85390 Adapters that support the center of the core-unit.

(8) If installed, remove PWA 85537 Fixture or PWA 86598 Retainer or PWA 86209 Retainer. See Figure 405.

(9) If installed, remove the pedestals from the fan unit.

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R

(10) For engines that have incorporated SB PW4ENG 72-48, install a packing on the rear of the intermediate case as follows. See Figure 406.

R (a) Lubricate a packing with Engine Oil P03-001 or Sealing Ring Lubricant P06-053.

(b) Install the packing.

R (11) Lubricate a packing with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 and install it on the No. 2 bearing support assembly.

R (12) Install the transfer tube and the new packings, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the No. 2 bearing support.

(13) Install PWA 85260 Aligning Pins in the intermediate case. See Figure 406.

(a) Install them at 3 and 9 o'clock positions.

(b) Install them in the Flange E boltholes.

(14) Install PWA 29855-7 Aligning Pins in the intermediate case. See Figure 406.

(a) Install them at 6 and 12 o'clock positions.

(b) Install them in the Flange E boltholes.

(15) Install the gearbox-driveshaft-(front)-housing (called front housing) and the gearbox driveshaft in the gearbox driveshaft housing (called rear housing) as follows. See Figure 407.

R (a) Lubricate the two packings with Engine Oil P03-001 or Sealing Ring Lubricant P06-053. Install the packings on the front and rear of the front housing.

(b) Install the front housing in the rear housing. Push the front housing to the rear.

(c) Install the gearbox driveshaft in the rear housing as follows.

1 Make sure that the retaining ring is on the gearbox driveshaft.

2 Mate the gearbox driveshaft splines with the splines of the gearshaft in the main gearbox.

3 Carefully push the gearbox driveshaft to the rear.

(16) Remove the protective caps, plugs, and covers from the openings on the rear of the fan−unit at:

(a) The EEC PB sensing tube nut at 12:30 o'clock position.

(b) The tube adapters of the three solenoids at 1, 5, and 10 o'clock positions.

(c) The No. 3−bearing−air−cooler−adapters at 2:30 o'clock position.

(d) The bleed−valve−supply tube nut and tube coupling at 5 o'clock position.

(e) The angle−gearbox−oil−pressure adapter on the angle gearbox at 6 o'clock position.

(f) The cooling−air−tube adapter at 6:30 o'clock position.

(g) The 1, 1.5, and 2 main−bearing−oil−scavenge−tube coupling at 7:30 o'clock position.

(h) The main−bearing−oil−breather−tube nut at 11:30 o'clock position.

(i) The EEC PT4.95 sensing tube nut at 11:30 o'clock position.

(17) Remove the protective caps, plugs, and covers from the openings on the front of the core−unit at:

(a) The EEC PB sensing tube coupling at 12:30 o'clock position.

(b) The tube nuts that attach to the three solenoids at l, 5, and 10 o'clock positions.

(c) The two No. 3−bearing−air−cooler−tube nuts at 2:30 o'clock position.

(d) The bleed-valve-supply-tube nut and adapter at 5 o'clock position.

(e) The angle-gearbox-pressure-tube nut at 6 o'clock position.

(f) The No. 1, 1.5, and 2 bearing-oil-scavenge-tube nut at 7:30 o'clock position.

(g) The main-bearing-oil-breather-tube coupling at 11:30 o'clock position.

(h) The EEC 4.95 sensing tube coupling at 11:30 o'clock position.

(18) Put the fan unit and the core engine together as follows. See Figure 408.

CAUTION: BE SURE TO ALIGN THE CORE-UNIT AND FAN-UNIT ACCURATELY. DO NOT PERMIT THE PWA 85631 GUIDE ON THE FRONT OF THE CORE-UNIT TO TOUCH THE NO. 2 BEARING CARBON SEAL. DAMAGE TO THE SEAL CAN RESULT.

CAUTION: DO NOT SUPPORT THE FRONT OF THE CORE-UNIT BY THE PWA 85631 GUIDE THAT IS INSTALLED ON THE FRONT OF THE CORE-UNIT. DO NOT PUT ANY FORCE OR STRESS ON THE GUIDE. TOO MUCH STRESS ON THE GUIDE CAN CAUSE DAMAGE TO THE PLAIN ROUND NUT.

(a) Be sure the dowel pin on the front of the No. 2 bearing support is aligned with the dowel pin hole in the No. 1.5 bearing support flange.

(b) Be sure the oil transfer tube will engage the hole in the tube connector in the No. 1.5 bearing support assembly.

(c) Be sure the bevel gear on the LPT shaft is aligned with the bevel gear in the intermediate case. See Figure 407. If not, turn the gear in the HPC as follows.

1 Remove two bolts and washers that attach the manual crank cover to the scavenge pump drive bearing housing assembly. See Figure 409.

2 Remove the cover (manual crank) with PWA 85768 Puller. See Figure 409.

3 To align the bevel gears, turn the gearshaft in the main gearbox with a wrench through the crank pad. See Figure 409.

(d) Carefully align and install the fan-unit to the core-unit until Flange E is almost together. Be sure the distance between the fan-unit and the core-unit at Flange E is approximately the same all around. At the same time, be very careful to correctly engage the bevel gears, oil transfer tube, and dowel pin.

(e) Engage the diameters of the intermediate case and the HPC.

(f) Lubricate with Engine Oil P03-001 33 bolts (No. 1.5 bearing support assembly).

(g) Remove the four workbolts that are in the 33 bolt circle of the No. 1.5 bearing support assembly. Install 33 bolts in the boltholes.

(h) Install the Flange E hardware as follows. Refer to 72-00-34, Installation-20 (Task 72-00-34-420-020)..

NOTE: Flange E has two configurations, the UPS configuration has 72 bolts and the other configuration has 74 bolts.

1 For engines with the 2.5 bleed actuator support bracket (Post SB PW4ENG 75-84), attach the support bracket to a bracket on Flange E with three nuts and bolts, threads lubricated with Engine Oil P03-001. Torque the nuts 85 - 95 lb-in. (9.604 - 10.734 N.m).

(i) At the same time, tighten the bolts in the 33 bolt No. 1.5 bearing support assembly and Flange E.

(j) Torque:

1 Flange E bolts to 225 - 250 lb-in. (25.422 - 28.246 N.m).

2 No. 1.5 bearing support assembly bolts to 180 - 200 lb-in. (20.337 - 22.597 N.m).

(19) If not done, attach PWA 25926 Adapters to two PWA 25757 Pedestals. Put the tool brackets at the sides of the intermediate case in the pedestals.

(20) Remove the eye, hoists, sling, and four PWA 76154 Adapters and PWA 86567 Adapters from the fan unit.

(21) Remove the PWA 85785 Adapter from the front fan hub as follows. See Figure 401.

(a) Loosen the wing nuts.

(b) Turn the tool legs inward.

(c) Remove the adapter.

(22) Remove the PWA 88204 Guide from the LPT shaft. See Figure 403.

(23) Remove PWA 85631 Guide from the LPT shaft. Use PWA 85471 Wrench.

(24) Remove PWA 85585 Guide Ring from the 1.5 bearing support assembly. See Figure 401.

(25) Connect the gearbox driveshaft and the front housing to the angle gearbox as follows. See Figure 407.

(a) Move the retaining ring to the front of the driveshaft.

(b) Carefully push the driveshaft forward to mate with the internal splines in the angle gearbox.

(c) If the splines of the gearbox driveshaft and angle gearbox are not aligned, turn the gearshaft in the main gearbox. Refer to the procedure in a paragraph before this one.

(d) If you removed the manual crank pad cover, install it as follows. See Figure 409.

1 Lubricate with Engine Oil P03-001 a packing.

2 Install the packing on the cover (manual crank).

3 Install the cover in the main gearbox.

4 Lubricate with Antiseize Paste P06-054 two bolts. Wipe off unwanted paste.

5 Install two washers and the two bolts.

6 Torque the bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(e) Install the retaining ring in the internal groove of the angle gearbox.

(f) Attach the front housing to the angle gearbox as follows.

1 Lubricate with Antiseize Paste P06-054 the threads of six nuts. Wipe off unwanted paste.

2 Attach the front housing and brackets to the angle gearbox with two bolts, two washers, and two of the nuts.

3 Attach the front housing to the angle gearbox with four bolts, eight washers, and four nuts.

4 Torque the bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(g) Attach the front housing brackets to the HPC as follows.

1 Lubricate with Engine Oil P03-001 the threads of four bolts.

2 Attach the brackets to the HPC with the four bolts.

3 Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

4 Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(26) If removed, install the stator vane actuator and support assembly as follows.

(a) (Pre SB PW4ENG 72−534) Install the actuator and support assembly to the HPC case brackets and lugs. Install the two upper studs and the four nuts, lubricated with Engine Oil P03−001. Torque the nuts to 65 − 85 lb−in. (7.344 − 9.604 N.m) and install the cotter pins. See Standard Practices Manual, PN 585005, 70−53−00. See Figure 410.

(b) (Post SB PW4ENG 72−534) Install the actuator and support assembly to the HPC case bracket and lugs. Install two expandable studs (called studs) to upper attaching points on support assembly. See Figure 411 (Sheet 1) and Figure 411 (Sheet 2).

NOTE: Installation of the stud to the front attachment lug may require that the 5th stage unison ring be rotated so that the hole in the clevis is in line with the hole in the support assembly and the lug of the front compressor case. This will allow the stud to pass through the hole in the clevis and into the support assembly and the lug on the case.

(c) Lubricate the threads of the nuts with Engine Oil P03−001. Install a washer and a lubricated nut to each end of the studs. Center the studs so that an approximate equal length projects from the front and rear of the front compressor attachment points. Tighten the nuts fingertight.

(d) (Reference 739) Use a 3/32 inch (2.381 mm) hexagonal wrench in the end of the stud to prevent rotation during the torque process. Alternately torque each nut approximately one−half turn until a torque of 55 − 70 lb−in. (6.214 − 7.909 N.m) is obtained and a slot in the nuts is aligned with the cotter pin hole in the studs.

(e) After final torque of the nuts, do an inspection to ensure the following:

1 That a gap exists between the washer and the front compressor attachment points on one or both sides. Replace the stud if the total gap is less than 0.005 inch (0.127 mm). Total gap is the gap at both ends added together, or if only one gap, a gap at either end. See Figure 410 and Figure 411.

2 That the cotter pin holes are located entirely in the slot of the nuts.

3 That the stud end projection is approximately equal at both ends, plus or minus one thread beyond the outboard end of each nut.

(f) Install a cotter pin to secure each nut. Secure four cotter pins. See Standard Practices Manual, PN 585005, 70−53−00.

(g) Install the two lower bolts, lubricated with Engine Oil P03−001, and the two nuts as shown. Torque the nuts to 125 − 170 lb−in. (14.123 − 19.207 N.m). Install the lockwire through each castellated nut and wire hole in bolt threads. Twist the lockwire and wrap around the support and twist again. See Figure 411.

NOTE: The lockwire will prevent the bolts from turning.

(h) (Reference 618) Install the bolt, lubricated with Engine Oil P03−001, through the brace and support with the washer between the brace and support. Install the washer and nut on the bolt. Tighten the nut until a cotter pin slot aligns with the cotter pin hole in the bolt. Hold the head of the bolt against the brace. Measure the clearance from the nut and washer to the bracket. Measure the distance from the brace and washer to the support. Install shims (0−15AR) to get a clearance of 0.008L − 0.008T inch (0.203L − 0.203T mm) on each side of the support. Install and torque the nut 50 − 80 lb−in. (5.649 − 9.039 N.m). Install the cotter pin.

(27) If removed, install the turbine case cooling (TCC) air valve actuator as follows. See Figure 412.

(a) Position and hold actuator clear of pins on bracket on HPC case.

(b) Connect cable end to actuator piston shaft. Position actuator on bracket with pins engaging holes in actuator mount rails.

(c) Secure actuator in place with four bolts, threads lubricated with Engine Oil P03−001, and nuts (if equipped). Torque clamp bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(d) Secure ground strap to threaded hole on rear face of actuator with bolt, threads lubricated with Engine Oil P03−001. Torque bolt to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(28) Lubricate cable coupling nut threads with Engine Oil P03−001, and torque nut to 100 − 125 lb−in. (11.298 − 14.123 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nut.

(29) Secure cable rod end bearing to valve idler arm at turbine case cooling (TCC) air shutoff valve (HPT) with bolt, threads lubricated with Engine Oil P03−001, and nut. Torque nut to 36 − 40 lb−in. (4.067 − 4.519 N.m).

D. Procedure − Connect The Tubes
Figure 413 for the right side and Figure 414 for the left side.

(1) Connect the EEC PB sensing tube (AS20) at 12:30 o'clock position as follows. See Figure 413 (Sheet 1).

(a) Do not lubricate the tube threads.

(b) (Reference 2165) Tighten and torque the tube nut to 90 − 110 lb−in. (10.169 − 12.428 N.m).

(c) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nut.

(2) Connect the HPC air valve supply (AA25) and signal tube (AA01) to the solenoid adapters at 1 o'clock position as follows.

(a) Apply Antiseize Paste P06−054 to the threads of both solenoid tube adapters. Wipe off unwanted paste.

(b) Tighten and torque the supply tube nut (larger) to 225 − 250 lb−in. (25.422 − 28.246 N.m).

(c) Tighten and torque the signal tube nut (smaller) to 200 − 225 lb−in. (22.597 − 25.422 N.m).

(d) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nut.

(3) Connect the No. 3 bearing air cooler tubes (AP33) and (AP34) to the cooler at 2:30 o'clock position as follows.

(a) Apply Antigalling Compound P06−021 to the threads of both air cooler adapters. See Figure 413 (Sheet 2).

(b) Tighten and torque both tube nuts to 825 − 900 lb−in. (93.212 − 106.686 N.m).

(c) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nuts.

CAUTION: DO NOT USE LUBRICANTS ON THE SUPPLEMENTAL CONTROL UNIT (SCU) SENSING TUBES, ADAPTERS OR PACKINGS. LUBRICANTS CAN CAUSE CONTAMINATION OF THE SCU.

(4) For engines with the supplemental control unit (SCU) with multiplexing, install the PT2.5 sensing tube assembly (AS35) as follows. See Figure 413 (Sheets 3 through 5).

(a) Remove the protection covers.

(b) Attach the (AS35) tube to brackets on Flange E at the 4:30 and 5:00 o'clock positions with clamps and bolts, threads lubricated with Engine Oil P03−001 and tighten by hand.

(c) Install the upper PT2.5 sensing tube assembly (AS30) as follows.

(d) Remove the protection covers.

(e) For engines equipped with the supplemental control unit (SCU) with multiplexing, install the (AS30) tube to the (AS35) tube assembly and tighten the tube nut by hand.

(f) Install clamps to the (AS30) tube and attach the clamps to brackets on Flange E with four bolts and a nut. Lubricate the threads with Engine Oil P03-001. Torque the bolts and a nut to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(g) (Reference 2165) Torque the upper tube nut to the (AS29) tube coupling at 1 o'clock position to 90 - 110 lb-in. (10.169 - 12.428 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(h) For engines not equipped with the supplemental control unit (SCU) with multiplexing, install a cap assembly to the lower end of the (AS30) tube. Torque the cap assembly 135 - 150 lb-in. (15.2453 - 16.948 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the cap assembly.

(5) For engines not equipped with the supplemental control unit (SCU) with multiplexing, do as follows.

(a) Torque the bolts that attach the (AS35) tube to brackets on Flange E to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(b) Torque the tube nut (AS35) to the tube coupling tube (AS30) to 135 - 150 lb-in. (15.253 - 16.948 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the tube nut.

NOTE: The manifold (AS31) is installed and torqued with the transducer (N1) multiplexer input probe.

(6) Install the three bleed valve supply tubes (AA26), (AA27) and (AA29) as follows. See Figure 413 (Sheets 6 and 7).

(a) Remove the protective covers.

(b) Lubricate all the tube nut and coupling threads with Antiseize Paste P06-054. Wipe off unwanted paste.

(c) Install the inboard tube (AA26) (supply) to the upper tube nut at 2 o'clock position and to the solenoid adapter at 5 o'clock position. Attach the tube nut to the tube tee adjacent to the solenoid.

(d) Install the middle tube (AA27) (left supply) to the tube coupling at 2 o'clock position and to the tube coupling adjacent to the solenoid at 5 o'clock position.

(e) Install the outboard tube (AA29) (right supply) to the tube nut at 2 o'clock position and to the solenoid adapter at 5 o'clock position.

(f) Install the clamp bolts, lubricated with Engine Oil P03-001, spacer, and nut, that attach the tubes to the brackets and to each other. Torque the clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(g) Torque the lower tube nut of the inboard tube to the larger solenoid adapter to 225 - 250 lb-in. (25.422 - 28.246 N.m). Torque all of the remaining tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety all the tube nuts.

(7) Install the fuel distribution valve supply tube (FM09) as follows. See Figure 413 (Sheet 8).

(a) Remove the protective covers.

R (b) Install the two packings PN 227433, lubricated
R with Engine Oil P03-001 or Sealing Ring Lubricant
R P06-053 and retainers PN 354120.

(c) Install the tube to fuel flowmeter and to the fuel metering unit. Tighten by hand.

(d) Install the clamp bolt, lubricated with Engine Oil P03-001, and attach the clamp to the HPC case bracket. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque the tube nuts to 100 - 110 lb-in. (11.298 - 12.428 N.m). Loosen the tube nuts and torque them again to the same limits. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(8) Install the hydraulic pressure manifold (CP05) and oil cooler inlet return manifold (CR01) as follows. See Figure 413 (Sheet 9).

(a) Remove the protective covers.

(b) Lubricate all the manifold coupling and tube nut threads with Antiseize Paste P06-054. Wipe off unwanted paste.

(c) Install the two manifolds to the two hoses at 3 o'clock position and to the manifolds at 5 o'clock position.

(d) Install the clamp bolts, lubricated with Engine Oil P03-001, and nut, that attach the manifolds to the engine brackets. Torque the clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque the return manifold nuts (smaller) at each end to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(f) Torque the pressure manifold nuts (larger) at each end to 340 - 375 lb-in. (38.415 - 42.369 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(9) Install the compressor stator cylinder hydraulic pressure and return tubes (CP12) and (CR03) as follows. See Figure 413 (Sheet 9).

(a) Remove the protective covers.

(b) Lubricate the tube nut threads of both tubes with Antiseize Paste P06-054. Wipe off unwanted paste.

(c) Install the two tubes to the manifold tees and the cylinder adapters.

(d) Install the two clamp bolts, lubricated with Engine Oil P03-001, that attach the tubes to the Flange E bracket. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque the return tube nuts (smaller) to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(f) Torque the pressure tube nuts (larger) to 225 - 250 lb-in. (25.422 - 28.246 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

CAUTION: MAKE SURE YOU CONNECT THE TUBES TO THE CORRECT CONNECTORS OR FAULT MESSAGES WILL BE GENERATED.

(10) Install the (IDG) air/oil cooler valve hydraulic pressure (CP13) and return (CR12) tubes to the IDG heat exchanger at 4 o'clock position as follows. See Figure 413 (Sheet 10).

(a) Remove the protective covers.

(b) Lubricate the (IDG) air/oil cooler valve hydraulic pressure and return tube nut threads with Antiseize Paste P06-054. Wipe off unwanted paste.

(c) Install the two tubes to the manifold tees and heat exchanger adapters.

1 Install the CR12 tube to the adapter that is furthest from the lower triangular pad on the exchanger. Install the CP13 tube to the adapter that is closest to the lower triangular pad on the exchanger. Connect tube nut to heat exchanger adapter.

(d) Torque the two return tube nuts and the one smaller pressure tube nut to 200 - 225 lb-in. (22.597 - 25.422 N.m). Torque the one pressure tube nut (larger) to the manifold tee to 340 - 375 lb-in. (38.415 - 42.369 N.m).

(e) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(11) Install the airframe (IDG) cooler outlet oil tube (LS03) as follows. See Figure 413 (Sheet 10).

(a) Remove the protective covers.

R (b) Install a packing, lubricated with Engine Oil
R P03-001 or Sealing Ring Lubricant P06-053 to the
R packing groove at the flanged end of the tube.

(c) Lubricate the tube nut threads with Antiseize Paste P06-054. Wipe off unwanted paste.

(d) Install the tube with the three bolts, lubricated with Engine Oil P03-001 to the heat exchanger. Tighten the tube nut by hand. Torque the three bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). Torque the tube nut to 675 - 750 lb-in. (76.265 - 84.739 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut and bolts.

(12) Connect the angle gearbox oil pressure tube (LP09) to the angle gearbox at 6 o'clock position as follows. See Figure 413 (Sheet 11).

(a) Apply Antiseize Paste P06-054 to the threads of the mating tube adapter on the angle gearbox. Wipe off unwanted paste.

(b) Tighten and torque the tube nut to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(13) Connect the angle gearbox oil scavenge tube (LR01) to the angle gearbox at 6 o'clock position as follows.

(a) Remove protective covers. Install the new packing, lubricated with Engine Oil P03-001, to the groove at the flanged end.

(b) Engage the flanged end into the angle gearbox boss. Install the two bolts, lubricated with Engine Oil P03-001. Tighten and torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(c) Install and torque all the clamp bolts that attach the tube to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(14) Install the 2.5 bleed valve cylinder hydraulic pressure (CP06) and return (CR02) tubes at 7 o'clock position as follows. See Figure 414 (Sheet 1).

(a) Remove protective covers.

(b) Apply Engine Oil P03-001 to the bleed valve cylinder return tube nut threads (smaller diameter tube).

(c) Install the tube. Tighten and torque the tube nuts to 270 - 300 lb-in. (30.506 - 33.895 N.m).

(d) Apply Antiseize Paste P06-054 to the bleed valve cylinder hydraulic pressure tube nut threads (largest diameter tube). Wipe off unwanted paste.

(e) Install the tube. Torque the tube nut attached to the manifold tee to 340 - 375 lb-in. (38.415 - 42.369 N.m). Torque the tube nut attached to the actuator to 225 - 250 lb-in. (25.422 - 28.246 N.m).

(f) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(15) Connect the No. 1, 1.5, and 2 bearing oil scavenge tube (LR02) at the 7:30 o'clock position as follows. See Figure 414 (Sheet 2).

(a) Apply Engine Oil P03-001 to the tubes mating coupling threads.

(b) Tighten and torque the tube nut to 1300 - 1400 lb-in. (146.880 - 158.179 N.m).

(c) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(16) Install the (left) air/oil cooler hydraulic pressure (CP07) and return (CR05) tubes as follows. See Figure 414 (Sheet 2).

(a) Remove the protective covers.

(b) Lubricate the tube nut threads of both tubes with Antiseize Paste P06-054. Wipe off unwanted paste.

(c) Install the tubes to the heat exchanger adapters and the manifold tees. Install the clamp bolt, lubricated with Engine Oil P03-001, that attaches the pressure tube to the Flange E bracket. Torque the clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Torque the one (larger) hydraulic pressure tube nut to the manifold tee to 225 - 250 lb-in. (25.422 - 28.246 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(e) Torque the three remaining (smaller) tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(17) Install the (left) air/oil cooler outlet oil hose and tube assembly (LP03) as follows. See Figure 414 (Sheet 3).

(a) Remove the protective covers.

(b) Apply wet Zinc Chromate Primer P18-003 to the mating surface of the flange end. Do not apply any primer to the raised portion near the packing groove. Let it air dry for 10 minutes before assembly.

R (c) Install a new packing, lubricated with Engine Oil
R P03-001 or Sealing Ring Lubricant P06-053 to the
R packing groove at the flanged end.

R (d) Install a new packing, lubricated with Engine Oil
R P03-001 or Sealing Ring Lubricant P06-053 and
R retainer to the nut end of the tube.

(e) Lubricate the tube nut threads with Antigalling Compound P06-021 and install the tube to the fuel/oil cooler bypass valve and the air/oil heat exchanger.

(f) Attach the flanged end with the two inboard bolts, lubricated with Engine Oil P03-001. Tighten by hand.

(g) Install the clamp bolt, lubricated with Engine Oil P03-001, that attaches the tube to the HPC case bracket. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(h) Torque the tube nut to 200 - 220 lb-in. (22.597 - 24.857 N.m). Loosen the tube nut and torque it again to the same limit. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

NOTE: Torque the bolts at the forward end with the installation of the oil inlet tube.

(18) Install the (left) air/oil cooler inlet oil tube (LP02) as follows. See Figure 414 (Sheet 3).

(a) Remove the protective covers.

R (b) Install the two new packings, lubricated with
R Engine Oil P03-001 or Sealing Ring Lubricant
R P06-053 to the tube ends.

(c) Install the tube to the heat exchanger and the main oil filter housing. Install the six bolts, lubricated with Engine Oil P03-001, that attach the tube.

(d) Install the bolt, lubricated with Engine Oil P03-001, and attaches the harness bracket to the tube. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque the eight bolts that attach the two tube flanges to the heat exchanger and the one tube flange to the main oil filter housing to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(19) Install the main bearing oil pressure tube (LP05) to the last-chance strainer housing at 9 o'clock position as follows. See Figure 414 (Sheet 4).

(a) Remove the protective cover.

R R R (b) Install a new packing, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 and retainer to the tube.

(c) Lubricate the tube nut threads with Antiseize Paste P06-054. Wipe off unwanted paste.

(d) Install the tube to the strainer housing adjacent to Flange E and above the fuel/oil cooler.

(e) Install the two clamp bolts, lubricated with Engine Oil P03-001, that attach the tube and the strainer housing to Flange E. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(f) Torque the forward tube nut to 675 - 750 lb-in (76.265 - 84.739 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(g) Torque the rear tube nut to 140 - 160 lb-in. (15.818 - 18.078 N.m). Loosen the tube nut and torque it again to the same limits. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(20) Connect the HPC air valve and air shutoff valve supply (AA22) and the signal tubes (AA06) and (AA18) to the solenoid at 10 o'clock position as follows. See Figure 414 (Sheet 4).

(a) Apply Antiseize Paste P06-054 to the adapter threads on the solenoid. Wipe off unwanted paste.

(b) Tighten and torque the (largest diameter) supply tube nut to 225 - 250 lb-in. (25.422 - 28.246 N.m).

(c) Tighten and torque the two (smaller diameter) signal tubes to 200 - 225 lb-in. (22.597 - 25.422 N.m).

(d) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(21) Connect the main bearing breather tube (LB06) at 11:30 o'clock position as follows. See Figure 414 (Sheet 5).

(a) Apply Antiseize Paste P06-054 to the upper tube coupling threads. Wipe off unwanted paste.

(b) Tighten and torque the tube nut to 1150 - 1300 lb-in. (129.933 - 146.880 N.m).

(c) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(22) Connect the EEC PT4.95 tube (AS04) at 11:30 o'clock position as follows. See Figure 414 (Sheet 5).

(a) Do not lubricate tube threads.

(b) Tighten and torque the tube nut to 270 - 300 lb-in. (30.506 - 33.895 N.m).

(c) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

E. Connect The Wiring Harnesses

CAUTION: SEE 72-00-00, INSTALLATION-00 (Task 72-00-00-990-008) AND (TASK 72-00-00-990-009) FOR NECESSARY GENERAL INSTALLATION INSTRUCTIONS ABOUT THE WIRING HARNESSES, LEADS, AND CABLES.

CAUTION: DO NOT TWIST OR BEND THE HARNESSES BADLY DURING INSTALLATION OR DAMAGE TO THE HARNESSES CAN RESULT.

(1) If removed, install the W3, W4, and W5 harnesses to the core-unit as follows. See Figure 415.

(a) Install the harness support bracket (upper) to the bracket on the fuel/oil cooler and the HPC case bracket. Attach the support bracket with the bolt and nut, lubricated with Engine Oil P03-001. Torque the bolt and nut to 36 - 40 lb-in. (4.067 - 4.519 N.m).

R
R

(b) Connect all the W3, W4, and W5 harness connectors (given below) to the mating harness receptacles as follows. For each connector:

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary,
R carefully make straight all the bent pins. If
R necessary, clean the connector and receptacle
R by SPOP 6 (Task 70−21−00−110−900). Refer to
R Section 70−21−00 in the Standard Practices
R Manual, PN 585005.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- The connector coupling nut is fully tight
- The connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque. See the instructions given with the strap wrench for correct use.

4 Attach the W4J25 connector, the W5J26 connector, and the W3J24 connector to the HPC case brackets. Install the connector retaining brackets and bolts, lubricated with Engine Oil P03-001. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

5 Connect the W4P16 connector to the TCC air valve actuator.

6 Connect the W5P7 connector and the W4P3 connector to the stator vane actuator.

7 Install the clamp bolts, lubricated with Engine Oil P03-001, and nuts that attach the W3, W4, and W5 harnesses to the engine brackets. See Figure 415. Torque the clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(2) Install the W2 harness to the core-unit as follows. See Figure 416

(a) Remove the lockwire that attaches the W2 harness to the 12 o'clock strut. Adjust the harness in position.

(b) Connect the W2P26 harness connector to the harness receptacle on the HPC case bracket at 12 o'clock position as follows.

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary,
R carefully make straight all the bent pins. If
R necessary, clean the connector and receptacle
R by SPOP 6 (Task 70-21-00-110-900). Refer to
R Section 70-21-00 in the Standard Practices
R Manual, PN 585005.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG-70 Strap Wrench or the Glenair TG-69 Soft-Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:

- The connector coupling nut is fully tight
- The connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque. See the instructions given with the strap wrench for correct use.

(c) Attach the W2J9 harness receptacle to the HPC case bracket at 12 o'clock position. Install the retaining bracket and the two bolts, lubricated with Engine Oil P03-001. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Install the clamp bolts, lubricated with Engine Oil P03-001, and nuts that attach the W2 harness to the Flange E bracket and the No. 1, 1.5 and 2 bearing breather tube. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(3) Install the W1 harness to the core engine as follows. See Figure 416.

(a) Remove the lockwire that attaches the W1 harness to the 12 o'clock strut. Adjust the harness in position.

(b) Connect the W1 harness connectors (given below) to the mating harness receptacles as follows. For each connector:

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary,
R carefully make straight all the bent pins. If
R necessary, clean the connector and receptacle
R by SPOP 6 (Task 70−21−00−110−900). Refer to
R Section 70−21−00 in the Standard Practices
R Manual, PN 585005.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:

- The connector coupling nut is fully tight
- The connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque. See the instructions given with the strap wrench for correct use.

- Connect the W1P25 harness connector to the receptacle on the HPC case bracket at 1 o'clock position and tighten.
- Connect the W1P11 and W1P10 harness

connectors to the 1 o'clock position solenoid and tighten. Install the clamp bolts, lubricated with Engine Oil P03-001, and nuts that attach the W1 harness to the solenoid muscle tube and the Flange E bracket. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

- Connect the W1P24 harness connector to the receptacle on the HPC case bracket at 10 o'clock position and tighten.
- Connect the W1P9 harness connector to the receptacle on the HPC case bracket at 12 o'clock position and tighten.
- Connect the W1P12 harness connector to the solenoid at 10 o'clock position and tighten.

(c) Install the clamp bolts, threads lubricated with Engine Oil P03-001, and nuts that attach the W1 harness to the HPC case brackets. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(4) Install the other harnesses as follows. See Figure 417.

(a) Attach the (IDG)-heat-exchanger harness receptacle to the HPC case bracket at 4 o'clock position. Install the retaining plate and the two bolts, lubricated with Engine Oil P03-001. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m). Install the clamp bolts, lubricated with Engine Oil P03-001, and nuts that attach the harness to the hydraulic tube. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(b) Attach the (engine)-air/oil-heat-exchanger-harness receptacle to the HPC case bracket at 7:30 o'clock position. Install the retaining plate and the two bolts, lubricated with Engine Oil P03-001. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Connect the harness connectors (given below) to the harness receptacles as follows. For each connector:

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary,
R carefully make straight all the bent pins. If
R necessary, clean the connector and receptacle
R by SPOP 6 (Task 70−21−00−110−900). Refer to
R Section 70−21−00 in the Standard Practices
R Manual, PN 585005.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- The connector coupling nut is fully tight
- The connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

- Connect the W4P4 and W5P11 harness connectors to the solenoid at 5 o'clock position and tighten. Install the clamp bolt, lubricated with Engine Oil P03-001, and nut that attach the W4 harness to the bleed-valve-supply-tube. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

- Connect the W3P15 harness connector to the 2.5 bleed valve actuator at 7 o'clock position and tighten.
- Connect the W3P17 harness connector to the receptacle on the HPC case bracket at 7:30 o'clock position and tighten.

F. Postrequisites

(1) If the variable stator vane control system was removed or disturbed, rig the system. See 72-00-00, Special Procedures-05 (Task 72-00-00-830-003-A00) or (Task 72-00-00-830-003-B00).

(2) If the turbine case cooling (TCC) air valve actuator was removed or disturbed, rig the actuator. See 72-00-00, Special Procedures-06 (Task 72-00-00-830-004).

(3) Refer to Table 401 for the installation procedures that are postrequisite to this procedure.

Step	Install The	Chapter/ Section	Installation
1	LPC/LPT Coupling Coupling	72-00-32	01 (Task 72-00-32 -420-001)
2	Compressor Inlet Cone	72-00-31	02 (Task 72-00-31-420-001)
3a	Electronic Engine Control (EEC) Speed Transducer (N1)	72-00-34	03 (Task 72-00-34-450-001)
or			
3b	EEC Speed Transducer (N1)	72-00-34	17 (Task 72-00-34-450-013)

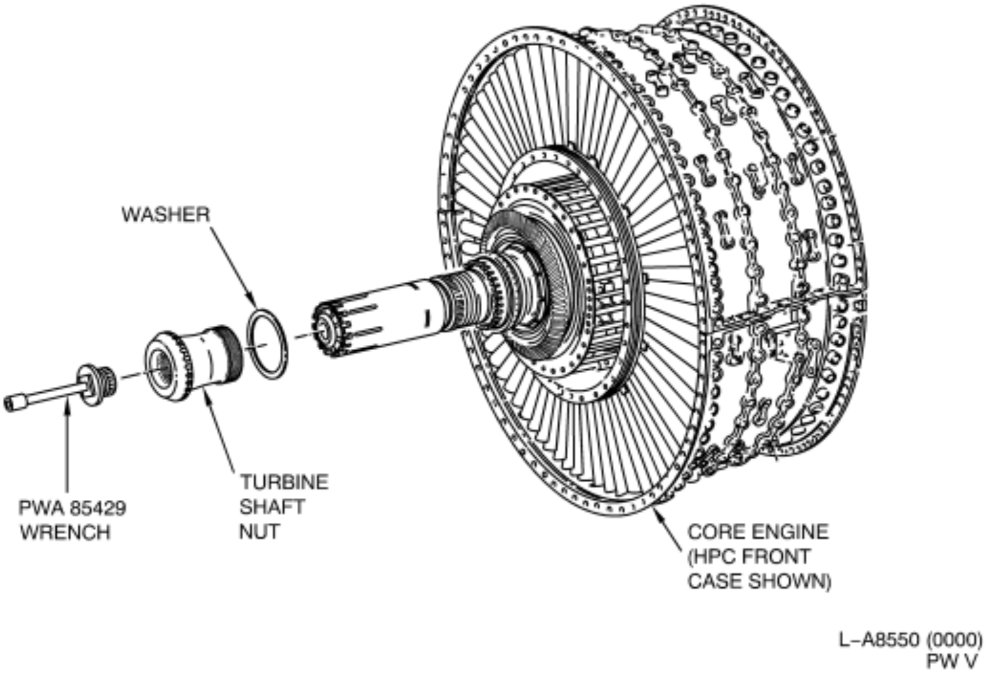
Other Postrequisite Procedures
Table 401

(CONTINUED)

Step	Install The	Chapter/ Section	Installation
	Multiplexer Input Speed Probe		
4	Magnetic Chip Detector Assemblies In The Oil Tank And Main Gearbox	72−00−61	01 (Task 72−00−61−450−017)

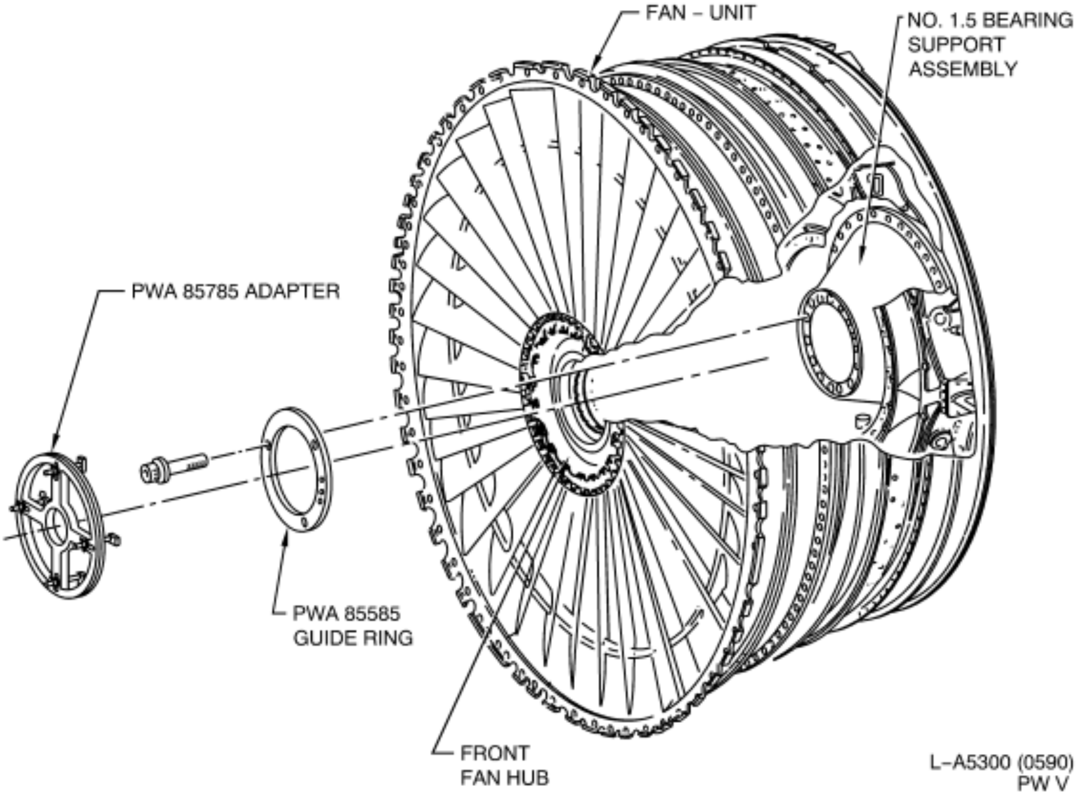
Other Postrequisite Procedures
Table 401 (Continued)

(4) If the quick HPC blade change procedure was used to replace the 5th, 6th, 7th and/or 8th stage blades, test engine per Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).

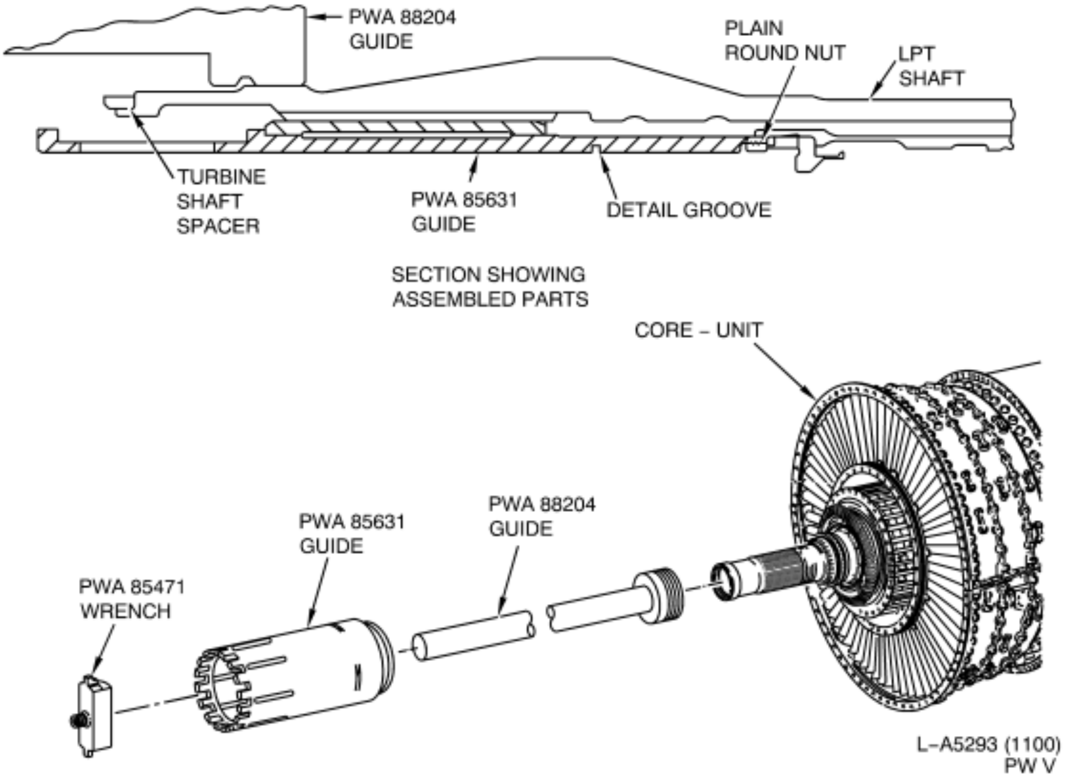

WASHER
TURBINE SHAFT NUT
PWA 85429 WRENCH
CORE ENGINE (HPC FRONT CASE SHOWN)
L−A8550 (0000)
PW V

Removal Of The Turbine Shaft Nut
Figure 401
(Task 72−00−34−420−006)

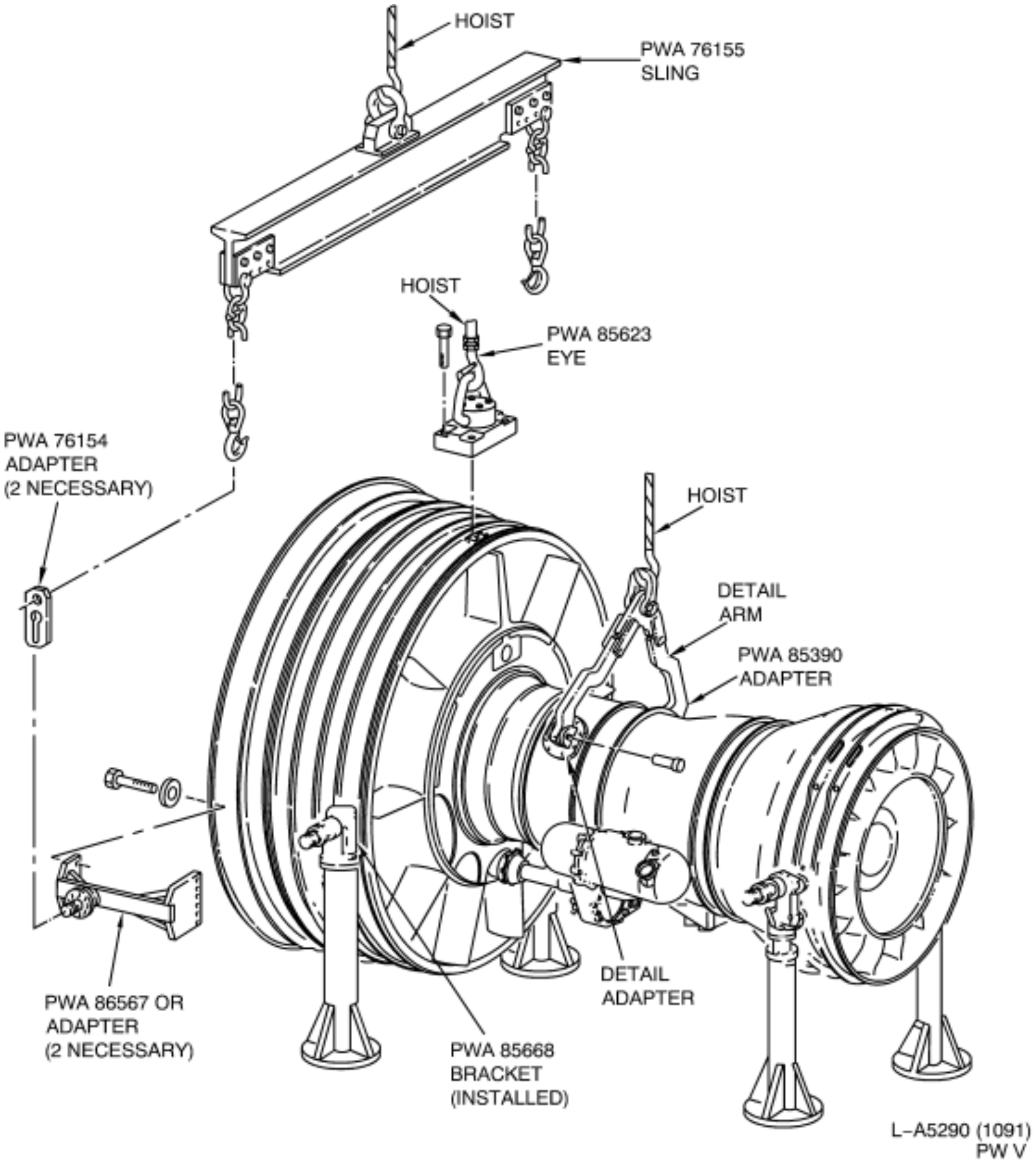
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−21


FAN − UNIT
NO. 1.5 BEARING SUPPORT ASSEMBLY
PWA 85785 ADAPTER
PWA 85585 GUIDE RING
FRONT FAN HUB
L−A5300 (0590)
PW V

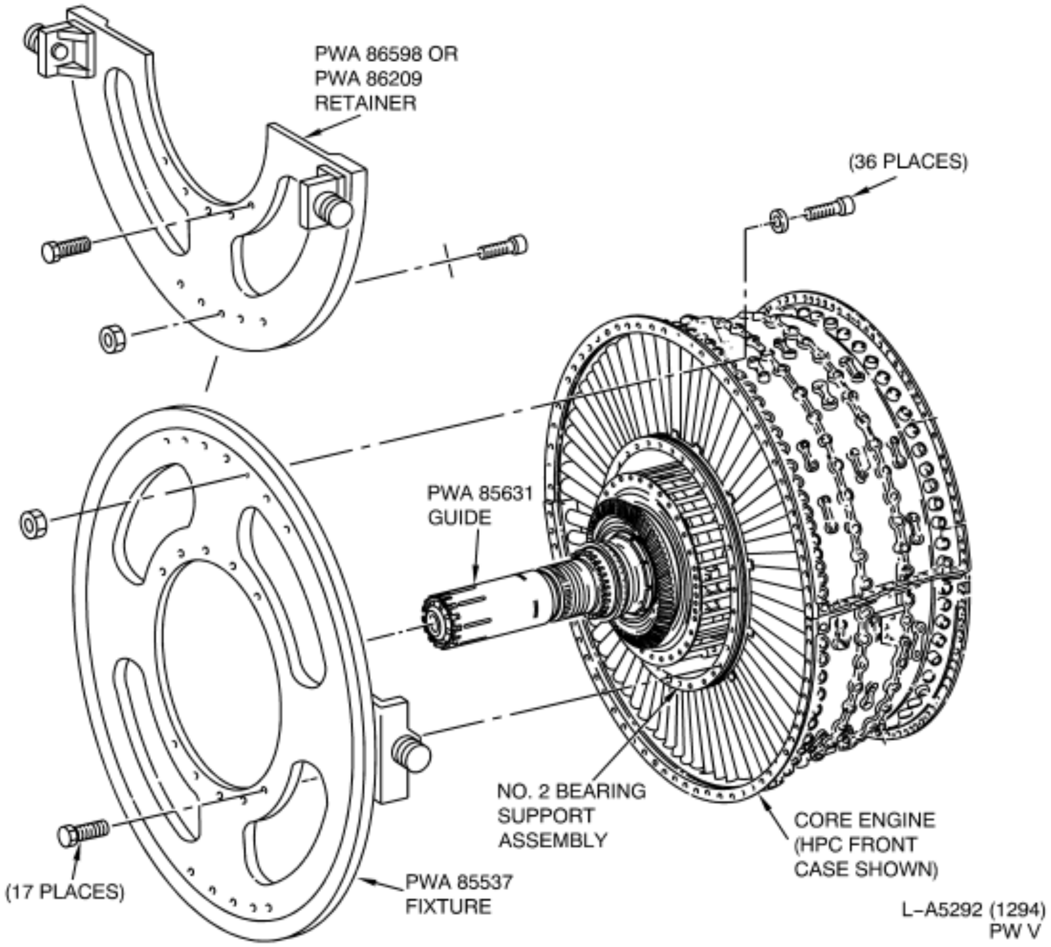
Installation Of PWA 85585
Figure 402
(Task 72−00−34−420−006)


PWA 88204
GUIDE
PLAIN
ROUND NUT
LPT
SHAFT
TURBINE
SHAFT
SPACER
PWA 85631
GUIDE
DETAIL GROOVE
SECTION SHOWING
ASSEMBLED PARTS
CORE − UNIT
PWA 88204
GUIDE
PWA 85631
GUIDE
PWA 85471
WRENCH
L−A5293 (1100)
PW V

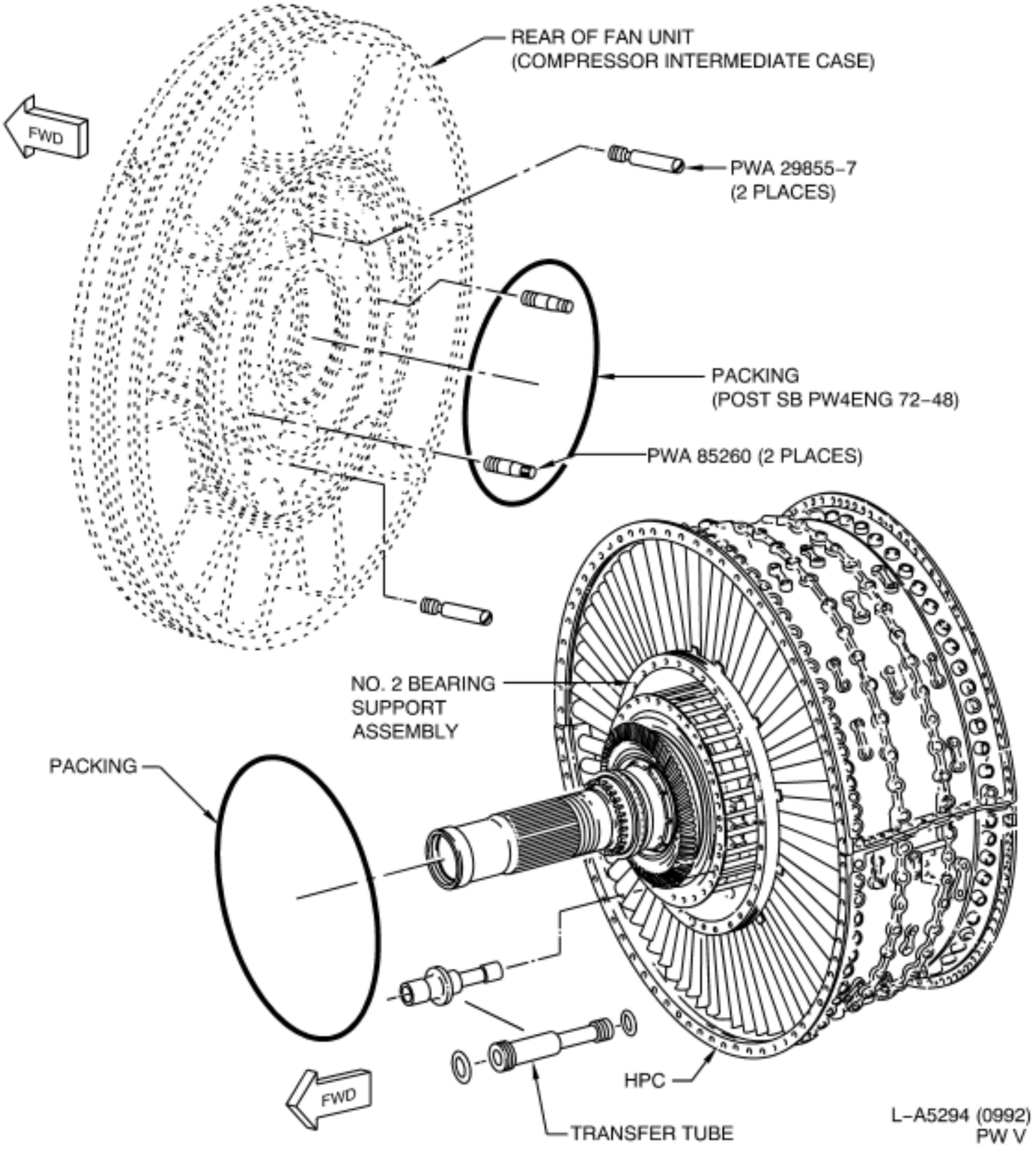
Installation Of Tools To The Core−Unit
Figure 403
(Task 72−00−34−420−006)


HOIST
PWA 76155
SLING
HOIST
PWA 85623
EYE
PWA 76154
ADAPTER
(2 NECESSARY)
HOIST
DETAIL
ARM
PWA 85390
ADAPTER
DETAIL
ADAPTER
PWA 86567 OR
ADAPTER
(2 NECESSARY)
PWA 85668
BRACKET
(INSTALLED)
L−A5290 (1091)
PW V

Installation Of Lifting Tools
Figure 404
(Task 72−00−34−420−006)

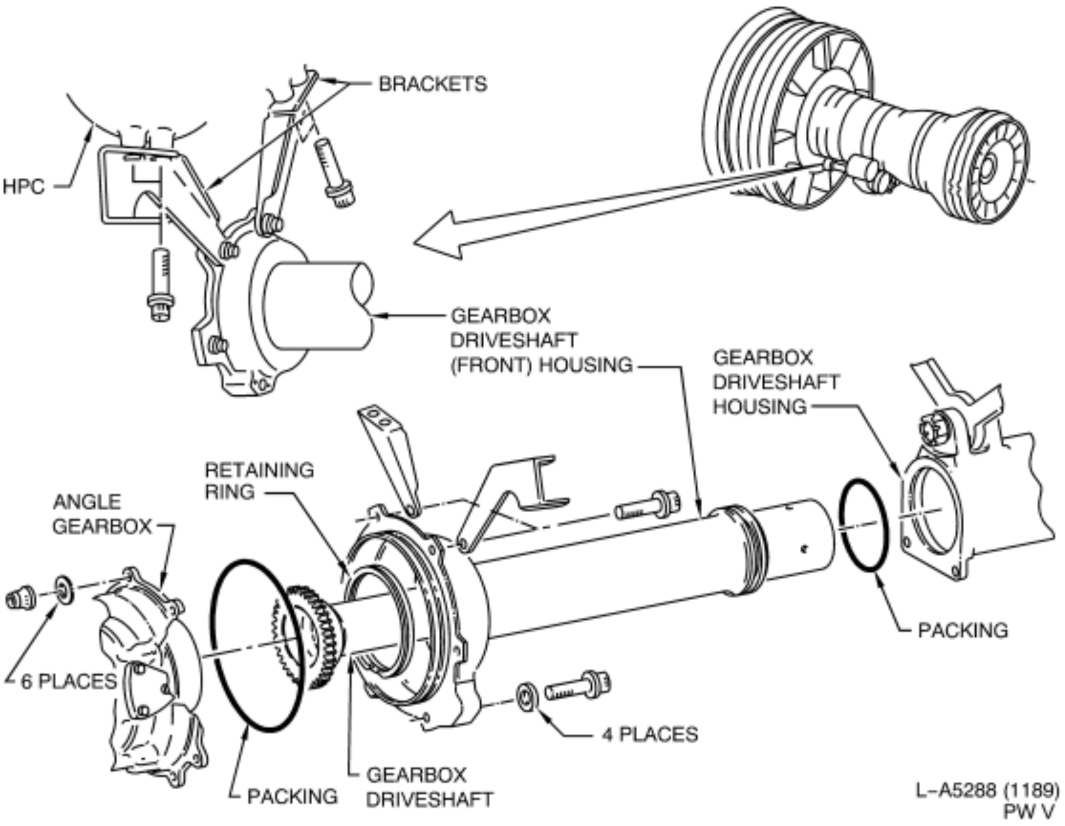

PWA 86598 OR
PWA 86209
RETAINER
(36 PLACES)
PWA 85631
GUIDE
NO. 2 BEARING
SUPPORT
ASSEMBLY
CORE ENGINE
(HPC FRONT
CASE SHOWN)
(17 PLACES)
PWA 85537
FIXTURE
L−A5292 (1294)
PW V

Removal Of The HPC Retainer
Figure 405
(Task 72−00−34−420−006)

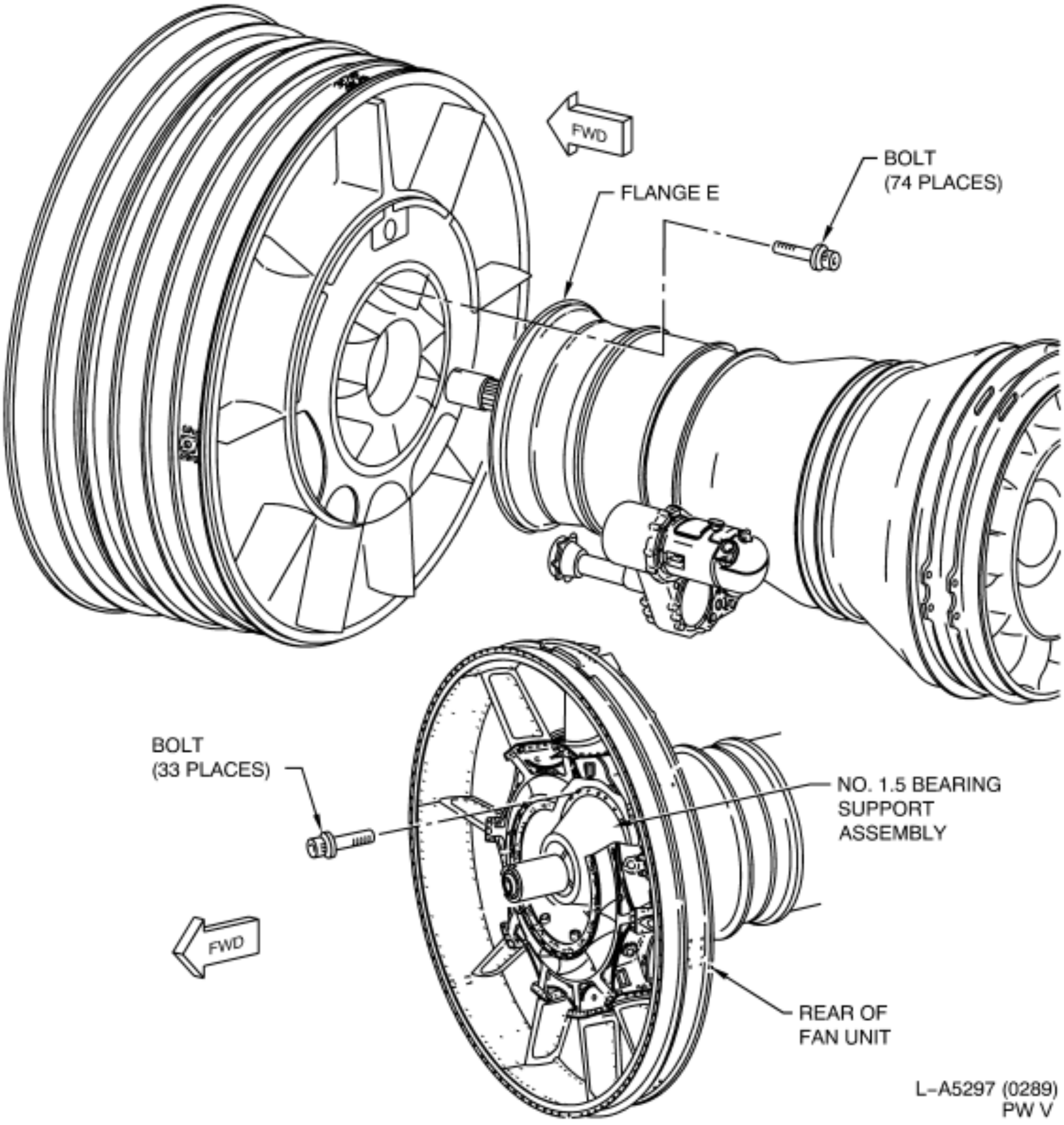

REAR OF FAN UNIT
(COMPRESSOR INTERMEDIATE CASE)
FWD
PWA 29855-7
(2 PLACES)
PACKING
(POST SB PW4ENG 72-48)
PWA 85260 (2 PLACES)
NO. 2 BEARING
SUPPORT
ASSEMBLY
PACKING
HPC
FWD
TRANSFER TUBE
L-A5294 (0992)
PW V

Installation Of The Aligning Pins
Figure 406
(Task 72-00-34-420-006)

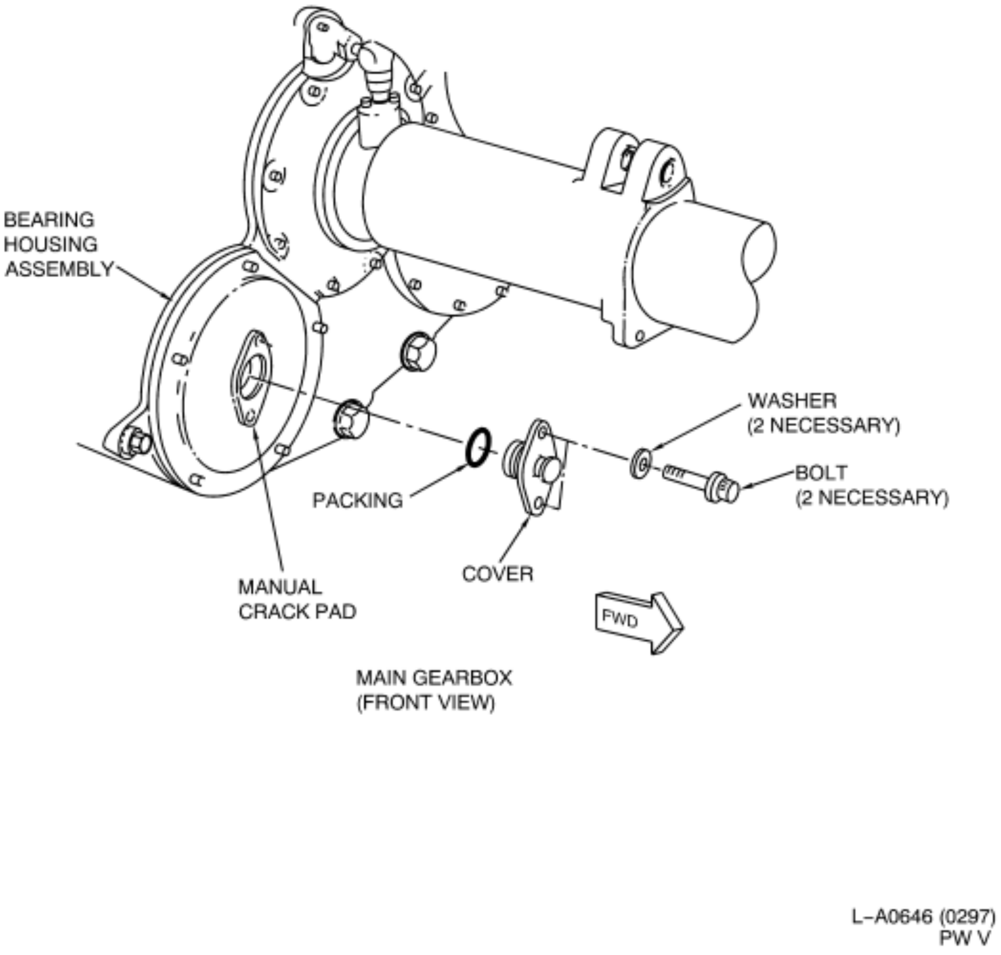
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−21


BRACKETS
HPC
GEARBOX DRIVESHAFT (FRONT) HOUSING
GEARBOX DRIVESHAFT HOUSING
RETAINING RING
ANGLE GEARBOX
PACKING
6 PLACES
4 PLACES
PACKING
GEARBOX DRIVESHAFT
L−A5288 (1189)
PW V

Installation Of The Gearbox Driveshaft
And Front Housing In The Rear Housing
Figure 407
(Task 72−00−34−420−006)

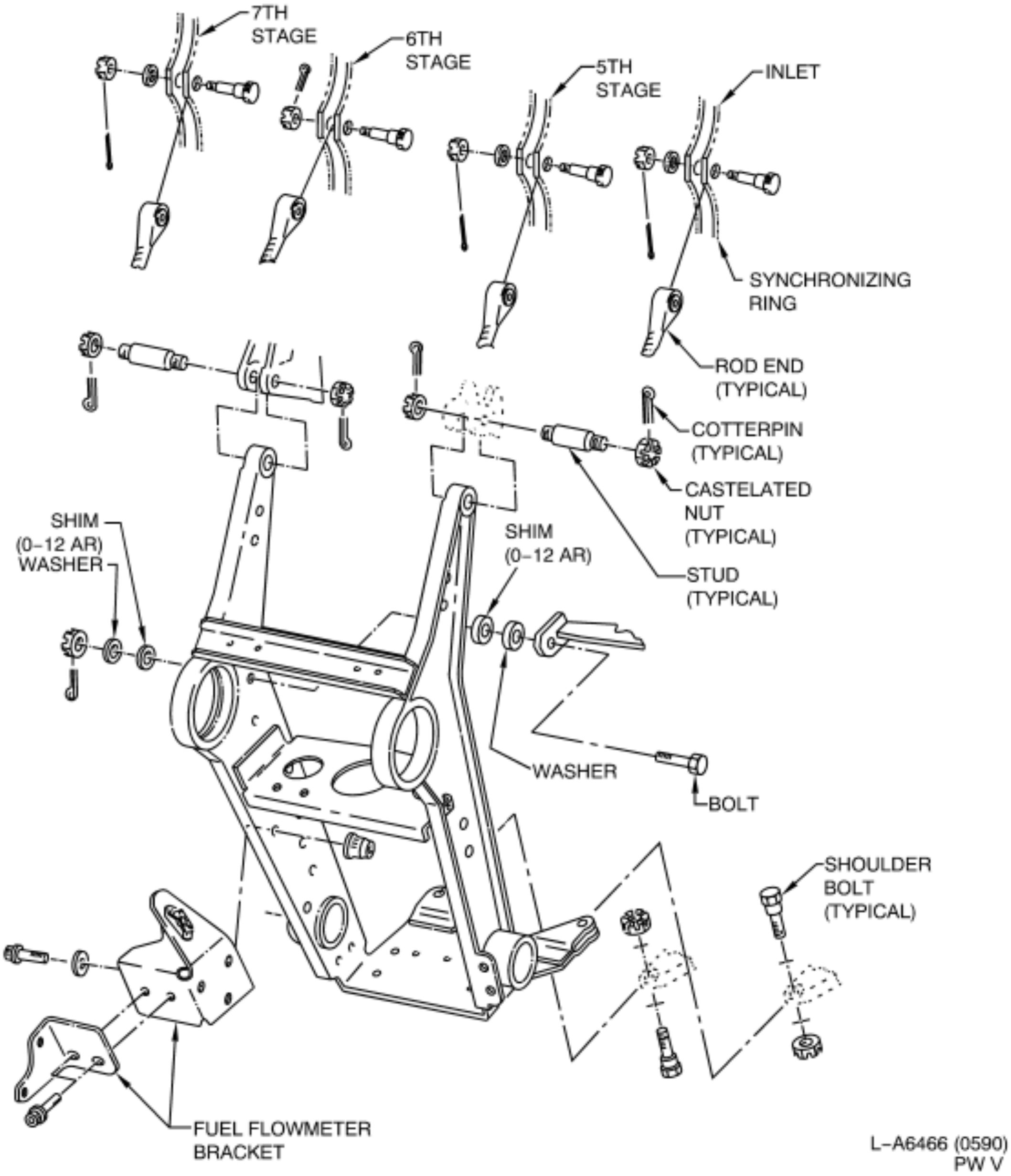

FWD
FLANGE E
BOLT
(74 PLACES)
BOLT
(33 PLACES)
NO. 1.5 BEARING
SUPPORT
ASSEMBLY
FWD
REAR OF
FAN UNIT
L−A5297 (0289)
PW V

Installation Of Flange E Bolts And No.
1.5 Bearing Support Assembly Bolts
Figure 408
(Task 72−00−34−420−006)

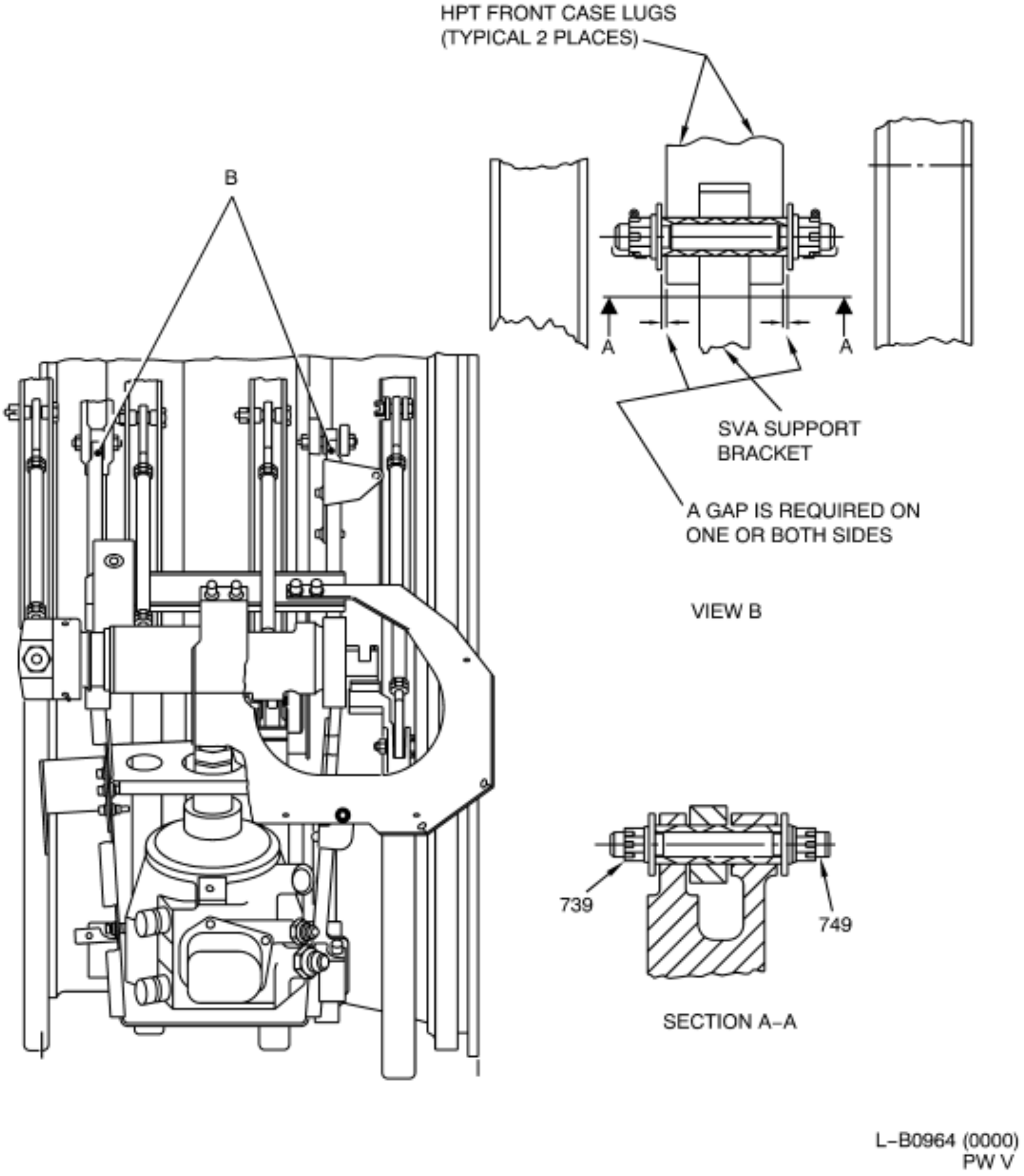

BEARING HOUSING ASSEMBLY
WASHER (2 NECESSARY)
BOLT (2 NECESSARY)
PACKING
COVER
MANUAL CRACK PAD
FWD
MAIN GEARBOX (FRONT VIEW)
L−A0646 (0297)
PW V

Location Of The Manual Crank Pad Cover
Figure 409
(Task 72−00−34−420−006)

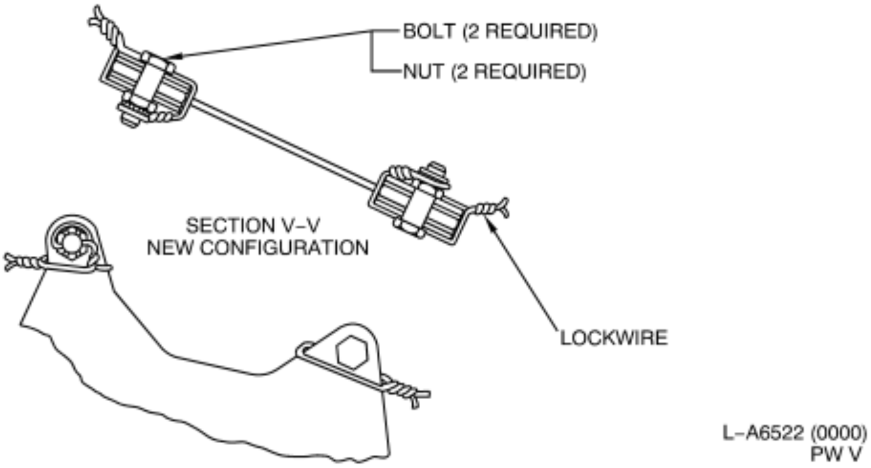
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−21


7TH STAGE
6TH STAGE
5TH STAGE
INLET
SYNCHRONIZING RING
ROD END (TYPICAL)
COTTERPIN (TYPICAL)
CASTELATED NUT (TYPICAL)
STUD (TYPICAL)
SHIM (0−12 AR)
WASHER
SHIM (0−12 AR)
WASHER
BOLT
SHOULDER BOLT (TYPICAL)
FUEL FLOWMETER BRACKET
L−A6466 (0590)
PW V

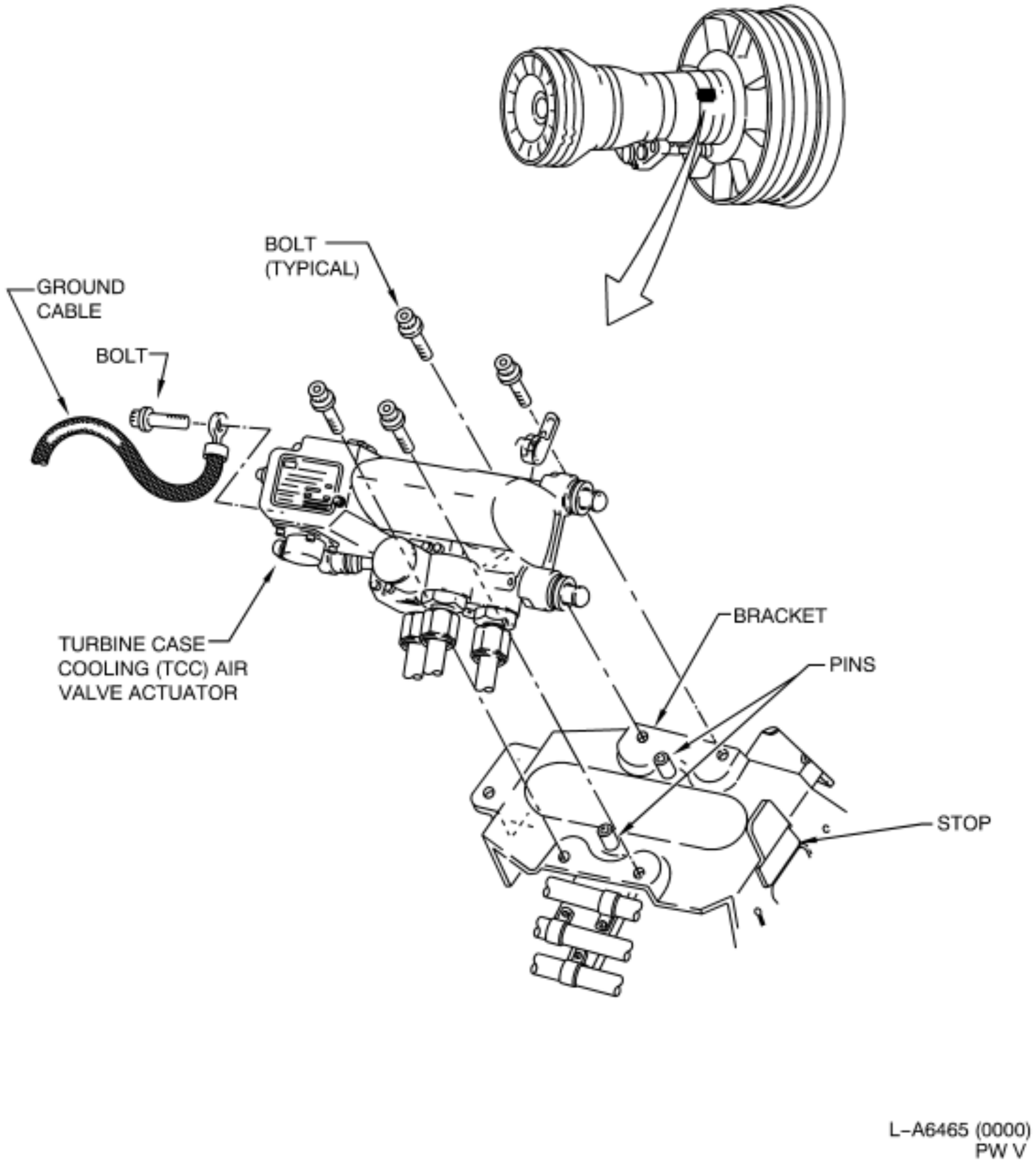
Stator Vane Actuator And Support Assembly
(If Disassembled) (Pre SB PW4ENG 72−534)
Figure 410
(Task 72−00−34−420−006)


HPT FRONT CASE LUGS
(TYPICAL 2 PLACES)
B
A
A
SVA SUPPORT
BRACKET
A GAP IS REQUIRED ON
ONE OR BOTH SIDES
VIEW B
739
749
SECTION A-A
L-B0964 (0000)
PW V

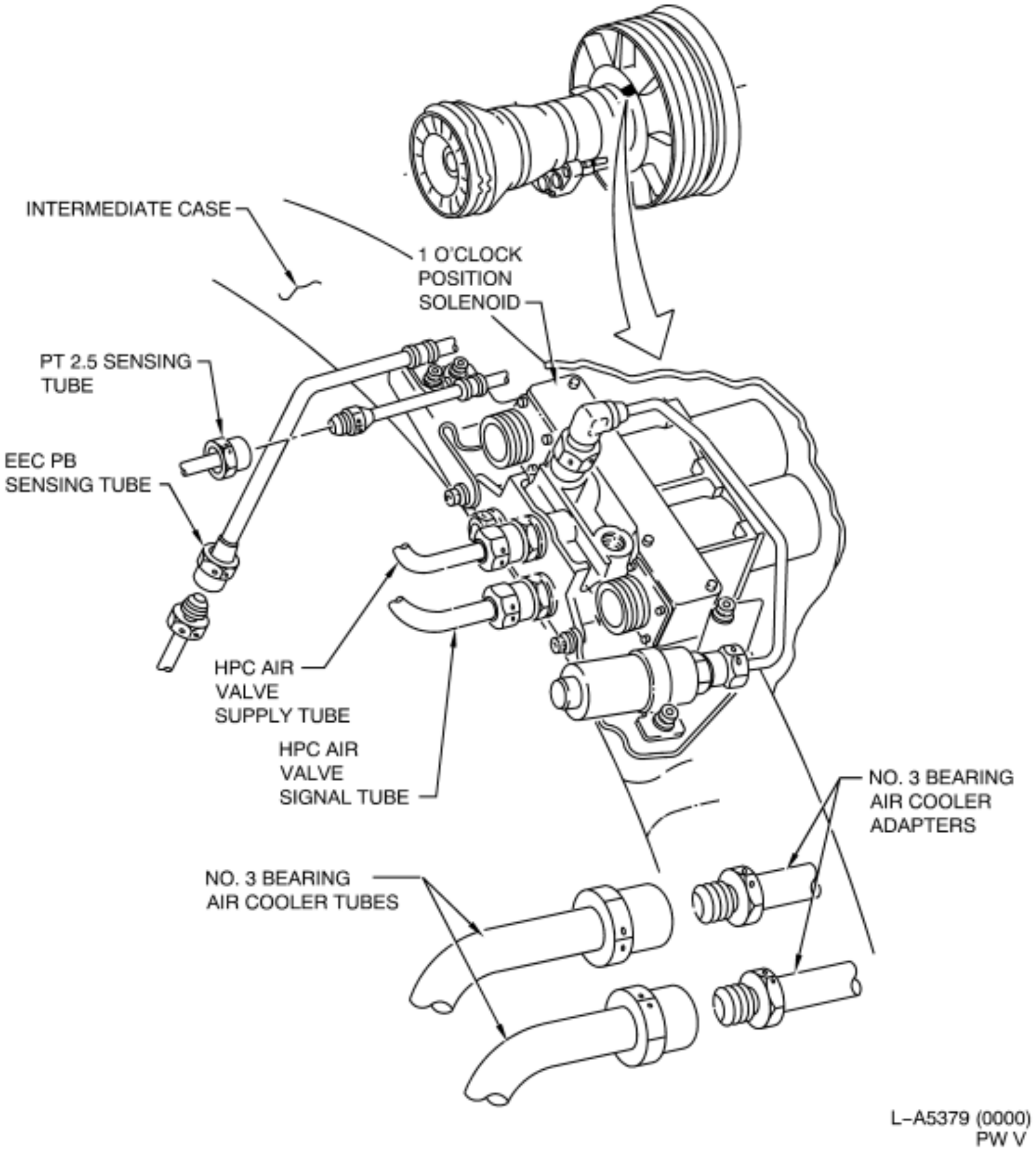
Stator Vane Actuator And Support Assembly
(If Disassembled) (Post SB PW4ENG 72-534)
Figure 411 (Sheet 1)
(Task 72-00-34-420-006)


BOLT (2 REQUIRED)
NUT (2 REQUIRED)
SECTION V−V
NEW CONFIGURATION
LOCKWIRE
L−A6522 (0000)
PW V

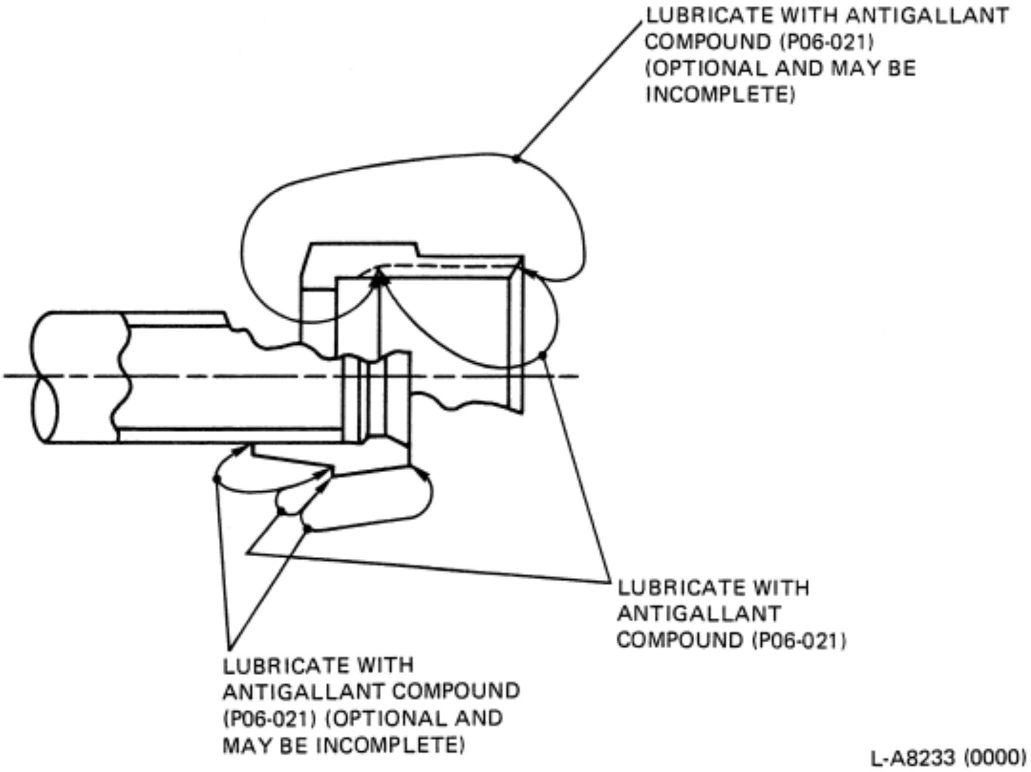
Stator Vane Actuator And Support Assembly
(Lockwire Installation For Bottom Bolts)
Figure 411 (Sheet 2)
(Task 72−00−34−420−006)


BOLT
(TYPICAL)
GROUND
CABLE
BOLT
TURBINE CASE
COOLING (TCC) AIR
VALVE ACTUATOR
BRACKET
PINS
STOP
L−A6465 (0000)
PW V

Turbine Case Cooling (TCC) Air Valve Actuator (If Disassembled)
Figure 412
(Task 72−00−34−420−006)

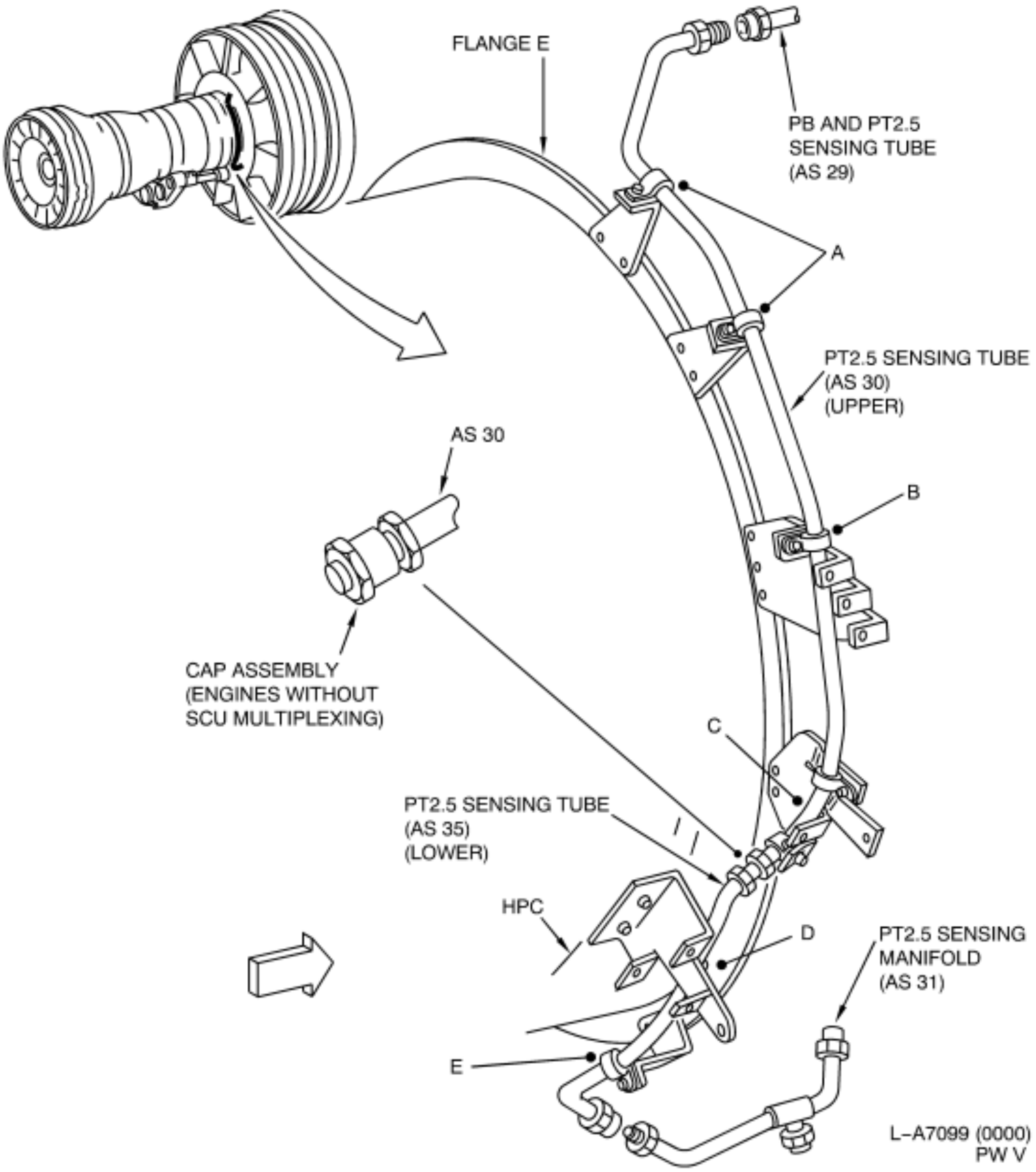

INTERMEDIATE CASE
1 O'CLOCK
POSITION
SOLENOID
PT 2.5 SENSING
TUBE
EEC PB
SENSING TUBE
HPC AIR
VALVE
SUPPLY TUBE
HPC AIR
VALVE
SIGNAL TUBE
NO. 3 BEARING
AIR COOLER
ADAPTERS
NO. 3 BEARING
AIR COOLER TUBES
L−A5379 (0000)
PW V

Installation Of The Engine Tubes
Figure 413 (Sheet 1)
(Task 72−00−34−420−006)

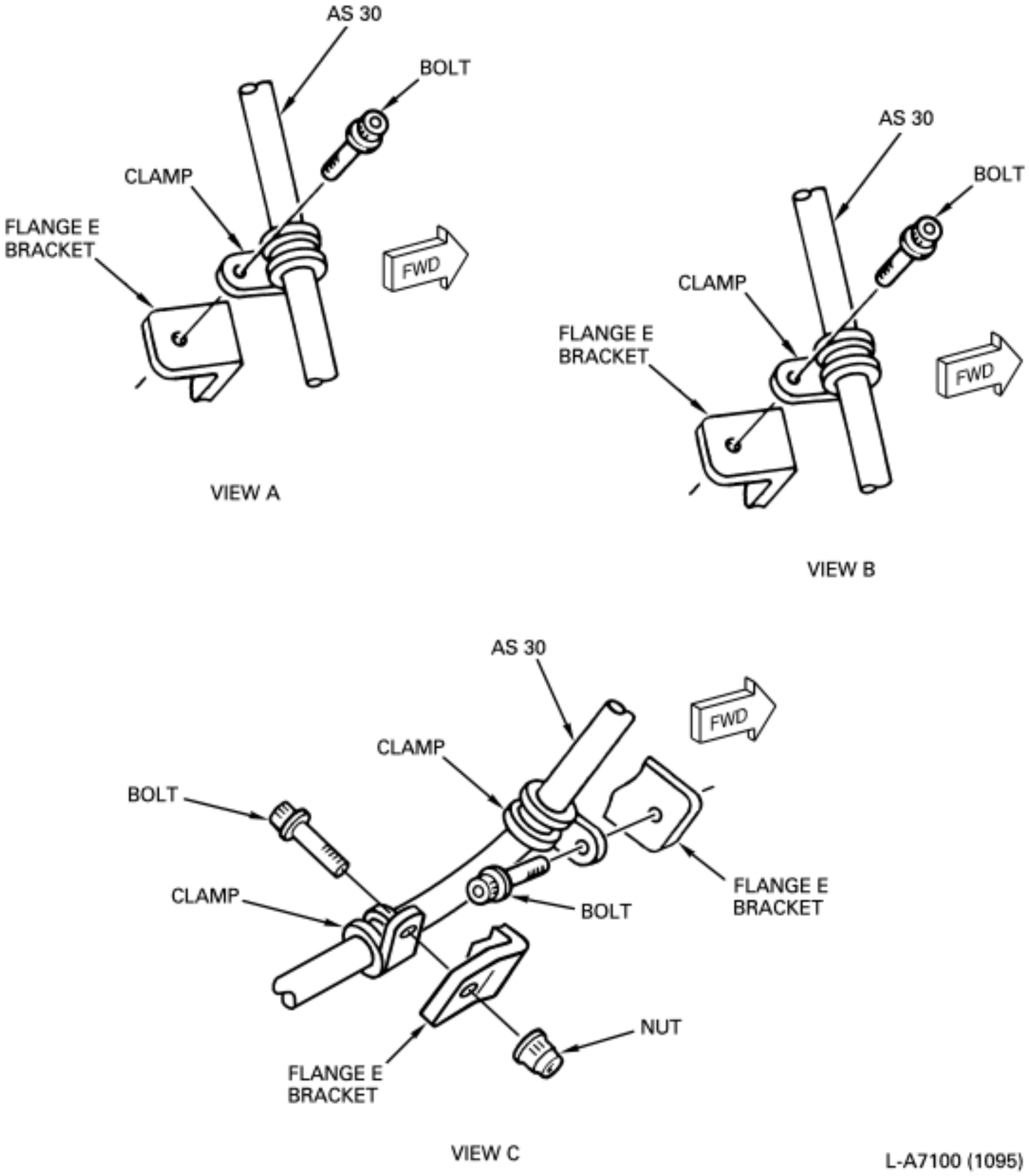

LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
L-A8233 (0000)

Installation Of The Engine Tubes
Figure 413 (Sheet 2)
(Task 72−00−34−420−006)

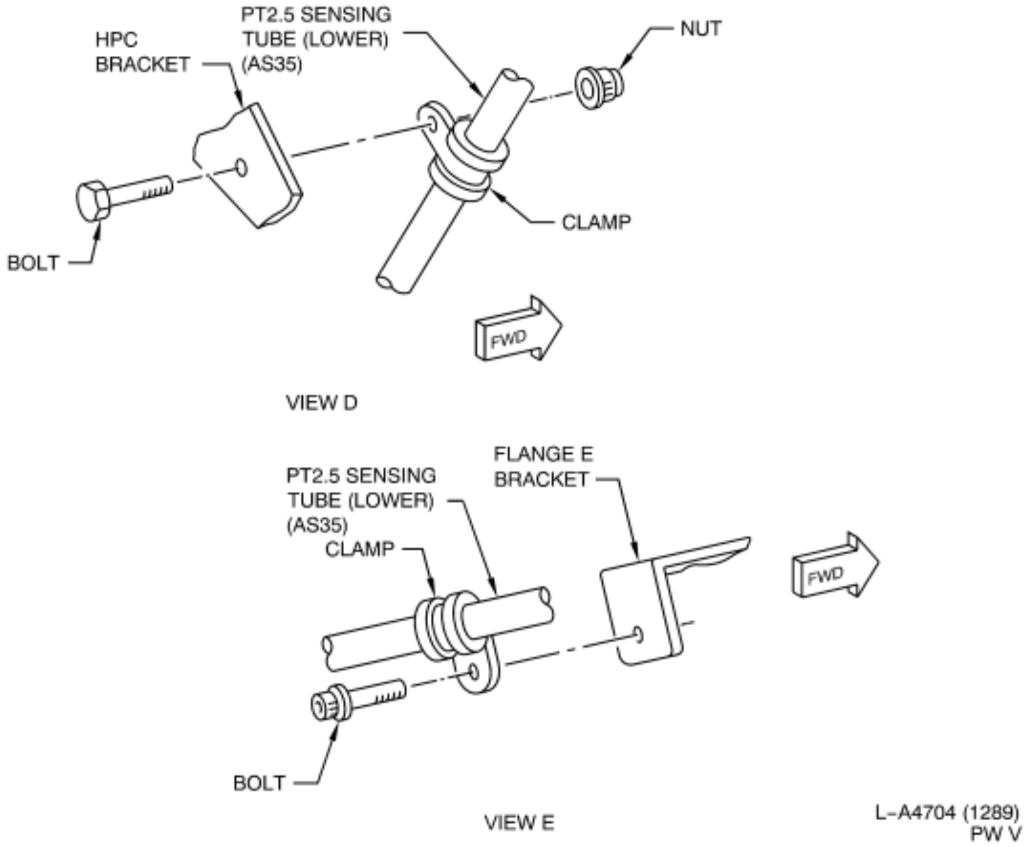
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−21


FLANGE E
PB AND PT2.5 SENSING TUBE (AS 29)
A
PT2.5 SENSING TUBE (AS 30) (UPPER)
AS 30
B
CAP ASSEMBLY (ENGINES WITHOUT SCU MULTIPLEXING)
C
PT2.5 SENSING TUBE (AS 35) (LOWER)
HPC
D
PT2.5 SENSING MANIFOLD (AS 31)
E
L−A7099 (0000)
PW V

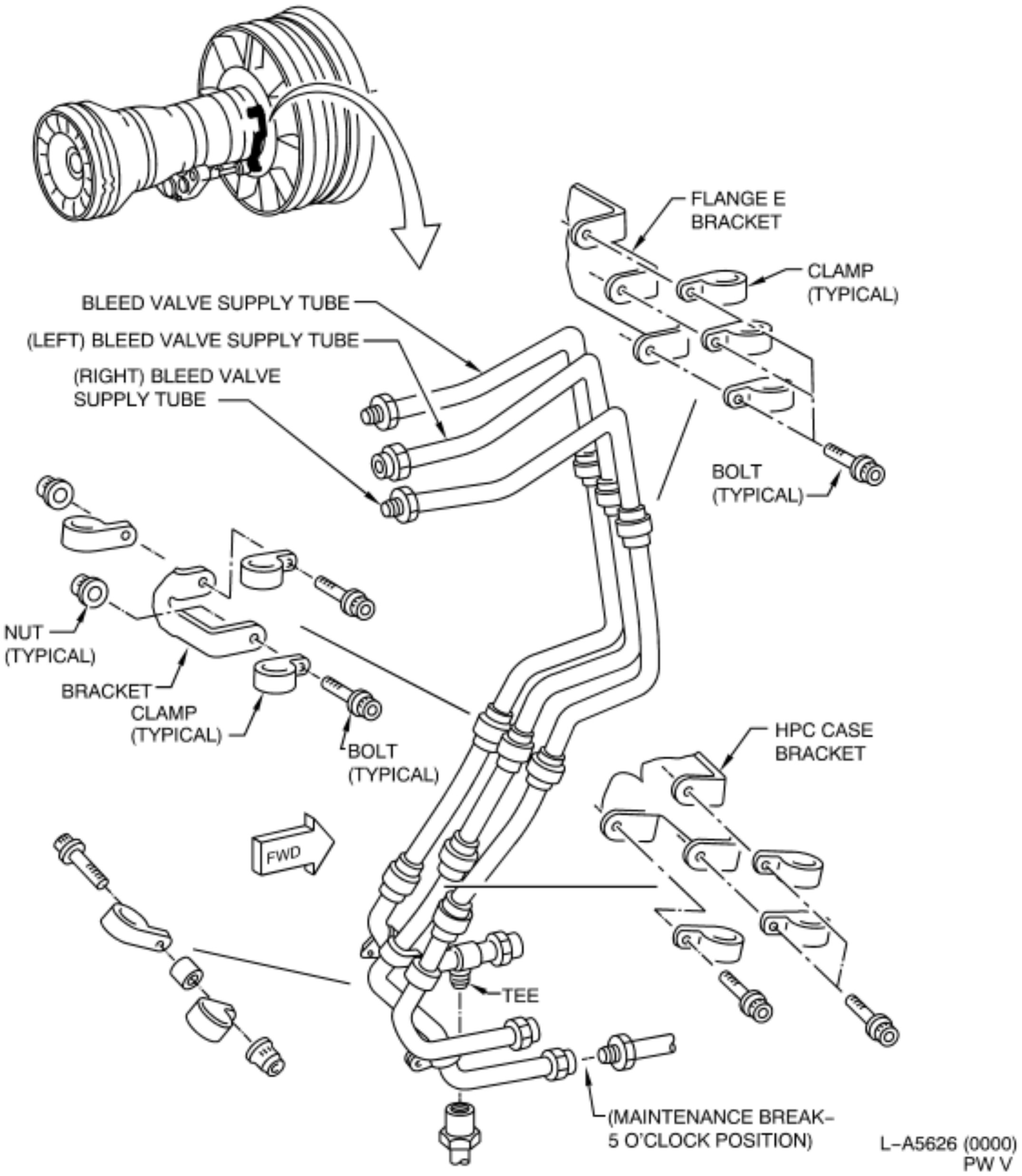
Installation Of The Engine Tubes
Figure 413 (Sheet 3)
(Task 72−00−34−420−006)


AS 30
BOLT
CLAMP
FLANGE E BRACKET
FWD
VIEW A
AS 30
BOLT
CLAMP
FLANGE E BRACKET
FWD
VIEW B
AS 30
FWD
CLAMP
BOLT
CLAMP
BOLT
FLANGE E BRACKET
NUT
FLANGE E BRACKET
VIEW C
L-A7100 (1095)

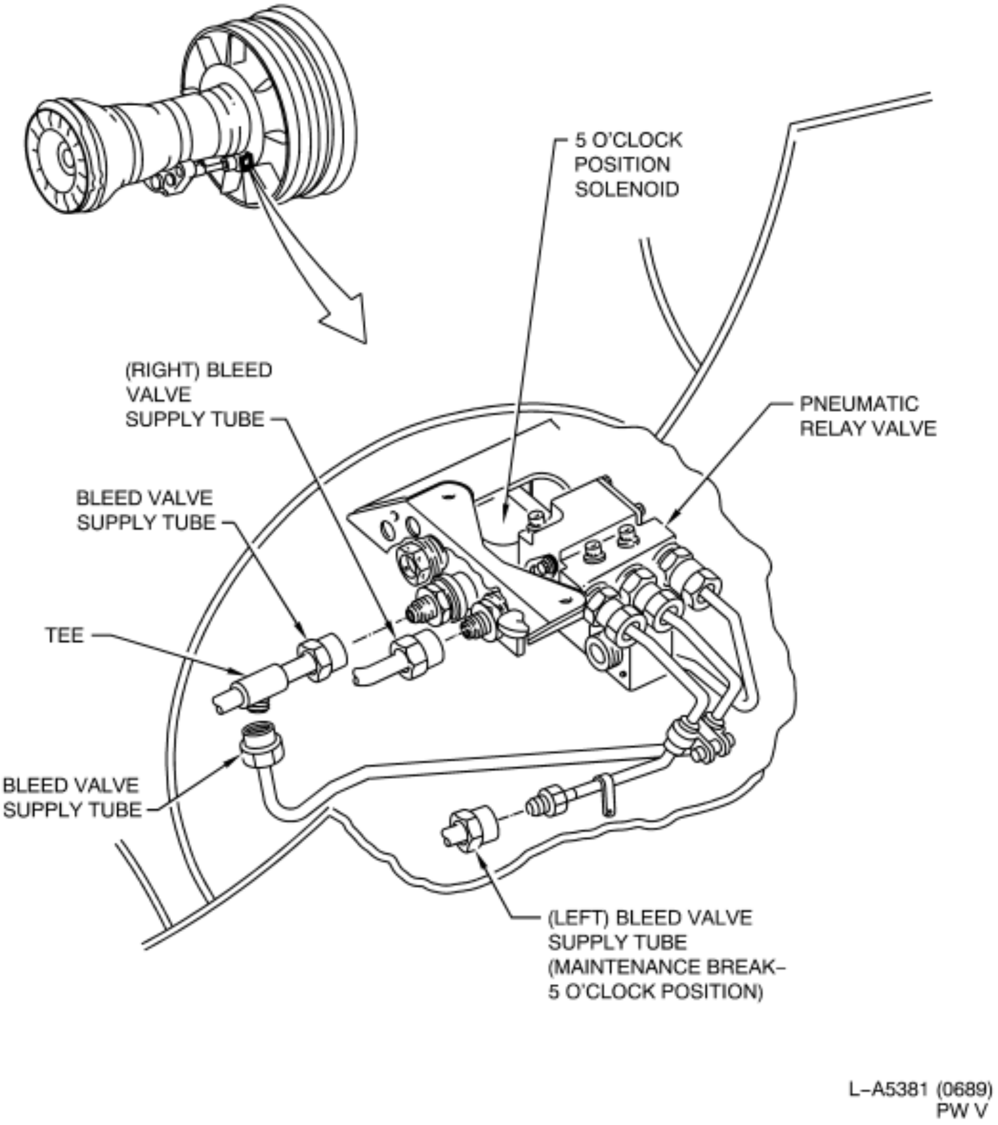
Installation Of The Engine Tubes
Figure 413 (Sheet 4)
(Task 72−00−34−420−006)


PT2.5 SENSING TUBE (LOWER) (AS35)
HPC BRACKET
NUT
CLAMP
BOLT
FWD
VIEW D
FLANGE E BRACKET
PT2.5 SENSING TUBE (LOWER) (AS35)
CLAMP
FWD
BOLT
VIEW E
L−A4704 (1289)
PW V

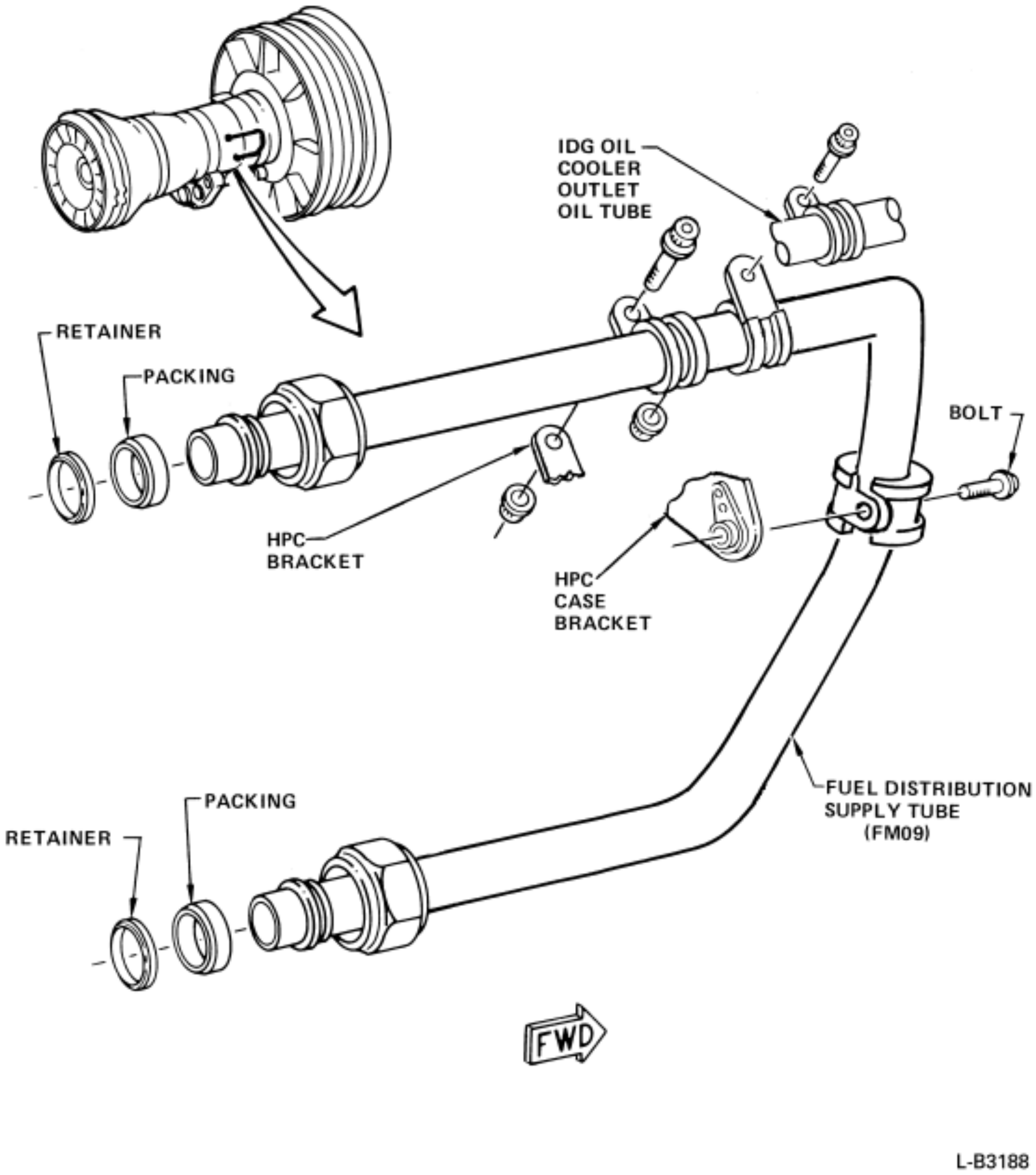
Installation Of The Engine Tubes
Figure 413 (Sheet 5)
(Task 72−00−34−420−006)


FLANGE E BRACKET
CLAMP (TYPICAL)
BLEED VALVE SUPPLY TUBE
(LEFT) BLEED VALVE SUPPLY TUBE
(RIGHT) BLEED VALVE SUPPLY TUBE
BOLT (TYPICAL)
NUT (TYPICAL)
BRACKET
CLAMP (TYPICAL)
BOLT (TYPICAL)
HPC CASE BRACKET
FWD
TEE
(MAINTENANCE BREAK- 5 O'CLOCK POSITION)
L-A5626 (0000)
PW V

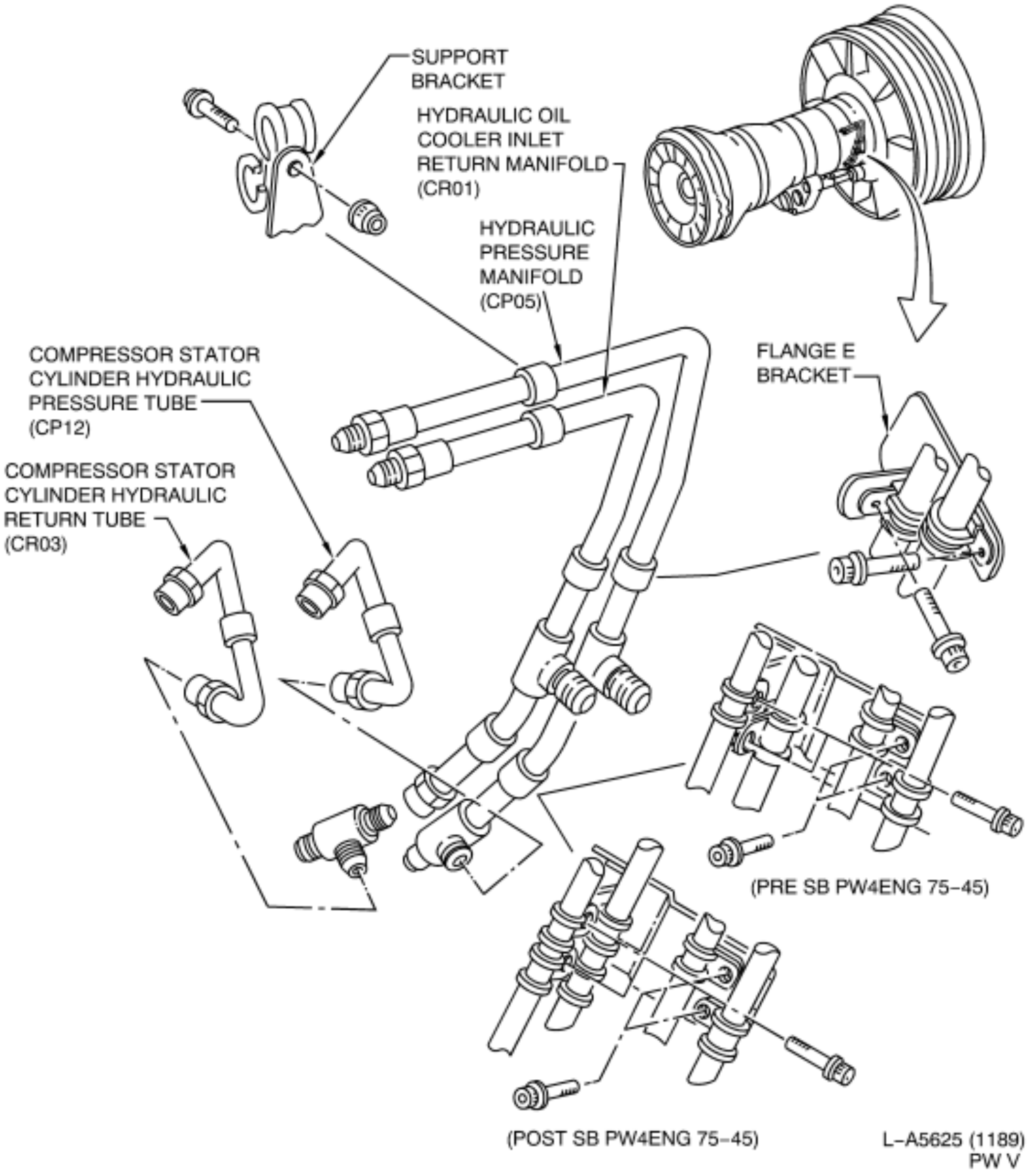
Installation Of The Engine Tubes
Figure 413 (Sheet 6)
(Task 72-00-34-420-006)


5 O'CLOCK POSITION SOLENOID
(RIGHT) BLEED VALVE SUPPLY TUBE
PNEUMATIC RELAY VALVE
BLEED VALVE SUPPLY TUBE
TEE
BLEED VALVE SUPPLY TUBE
(LEFT) BLEED VALVE SUPPLY TUBE (MAINTENANCE BREAK− 5 O'CLOCK POSITION)
L−A5381 (0689)
PW V

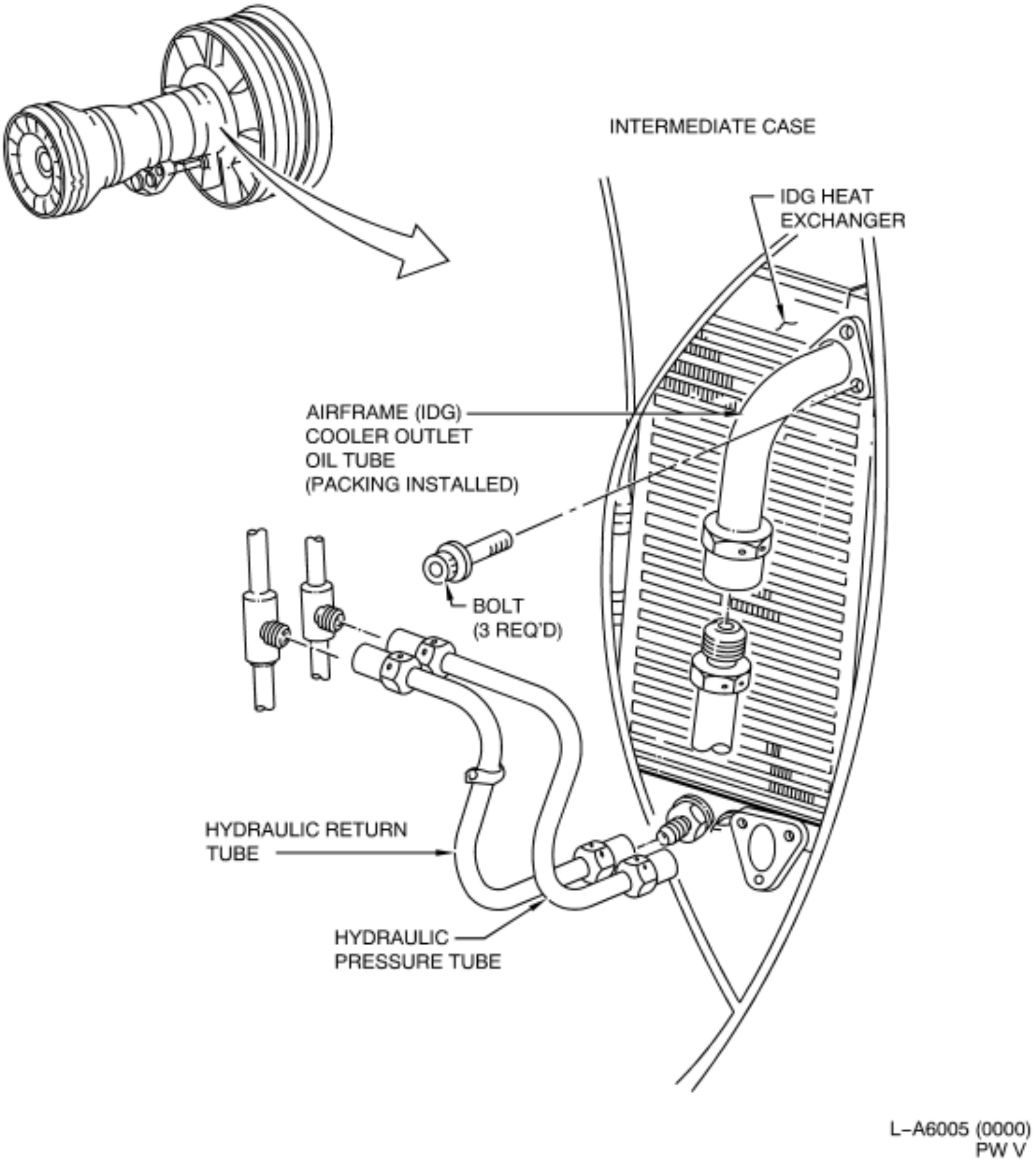
Installation Of The Engine Tubes
Figure 413 (Sheet 7)
(Task 72−00−34−420−006)


IDG OIL
COOLER
OUTLET
OIL TUBE
RETAINER
PACKING
BOLT
HPC
BRACKET
HPC
CASE
BRACKET
PACKING
RETAINER
FUEL DISTRIBUTION
SUPPLY TUBE
(FM09)
FWD
L-B3188

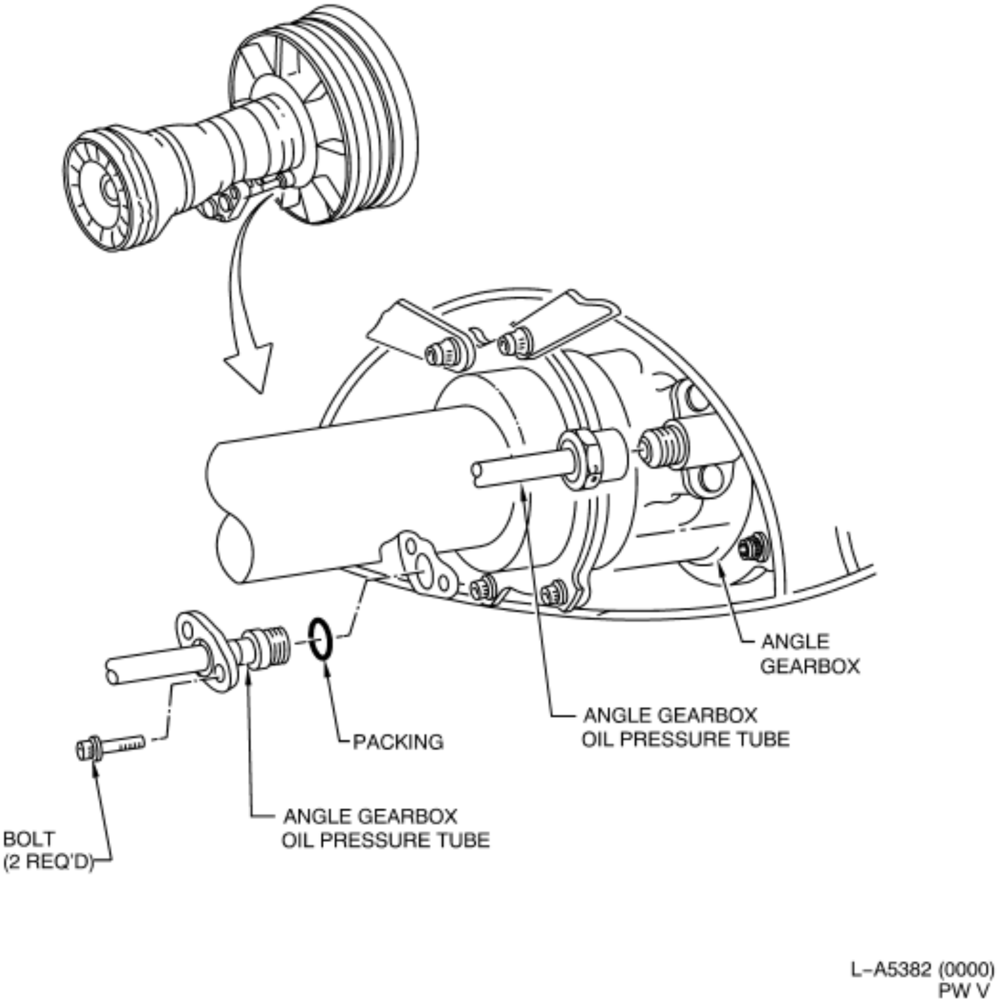
Installation Of The Engine Tubes
Figure 413 (Sheet 8)
(Task 72-00-34-420-006)


SUPPORT BRACKET
HYDRAULIC OIL COOLER INLET RETURN MANIFOLD (CR01)
HYDRAULIC PRESSURE MANIFOLD (CP05)
COMPRESSOR STATOR CYLINDER HYDRAULIC PRESSURE TUBE (CP12)
COMPRESSOR STATOR CYLINDER HYDRAULIC RETURN TUBE (CR03)
FLANGE E BRACKET
(PRE SB PW4ENG 75−45)
(POST SB PW4ENG 75−45)
L−A5625 (1189)
PW V

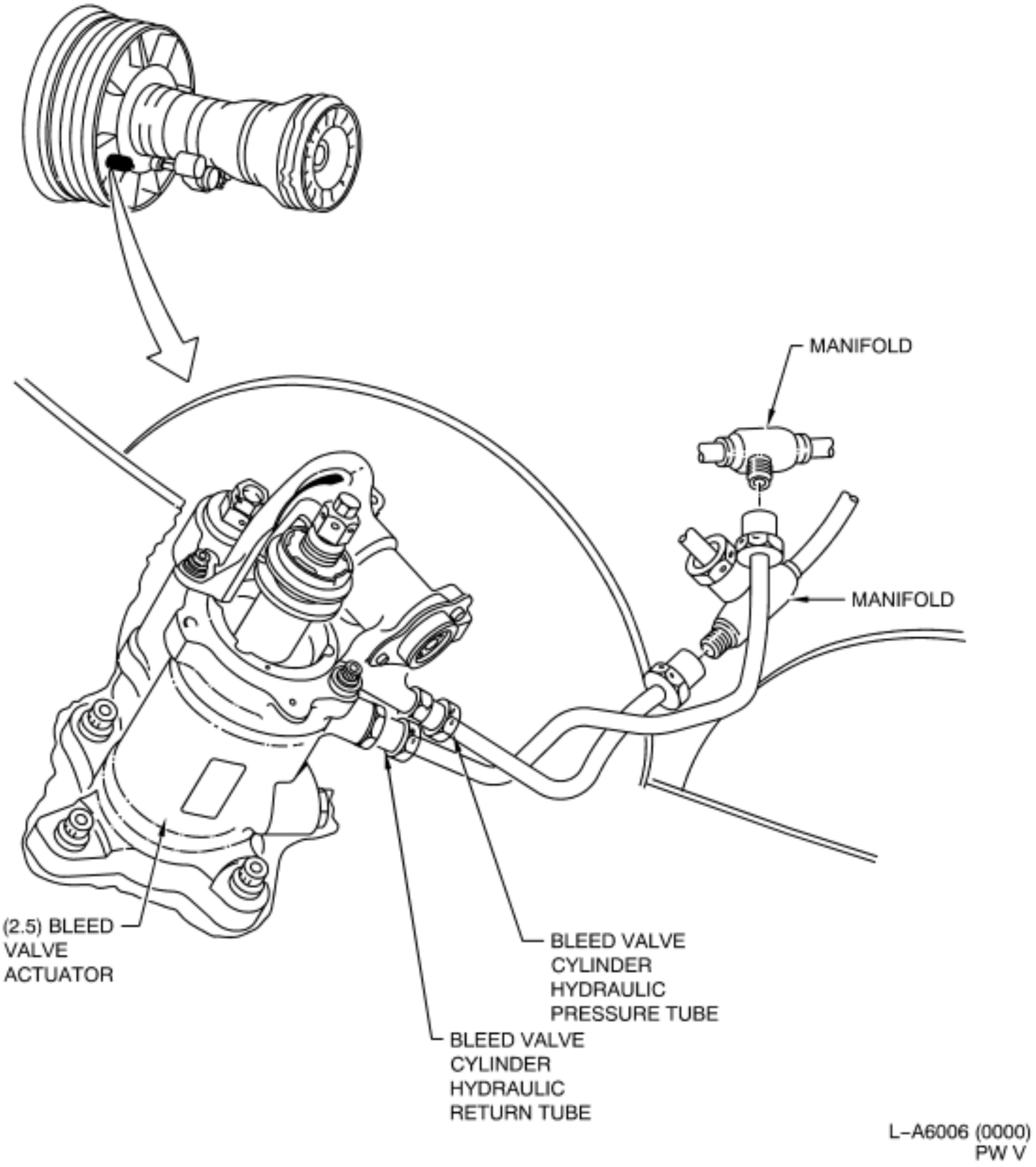
Installation Of The Engine Tubes
Figure 413 (Sheet 9)
(Task 72−00−34−420−006)


INTERMEDIATE CASE
IDG HEAT EXCHANGER
AIRFRAME (IDG) COOLER OUTLET OIL TUBE (PACKING INSTALLED)
BOLT (3 REQ'D)
HYDRAULIC RETURN TUBE
HYDRAULIC PRESSURE TUBE
L−A6005 (0000)
PW V

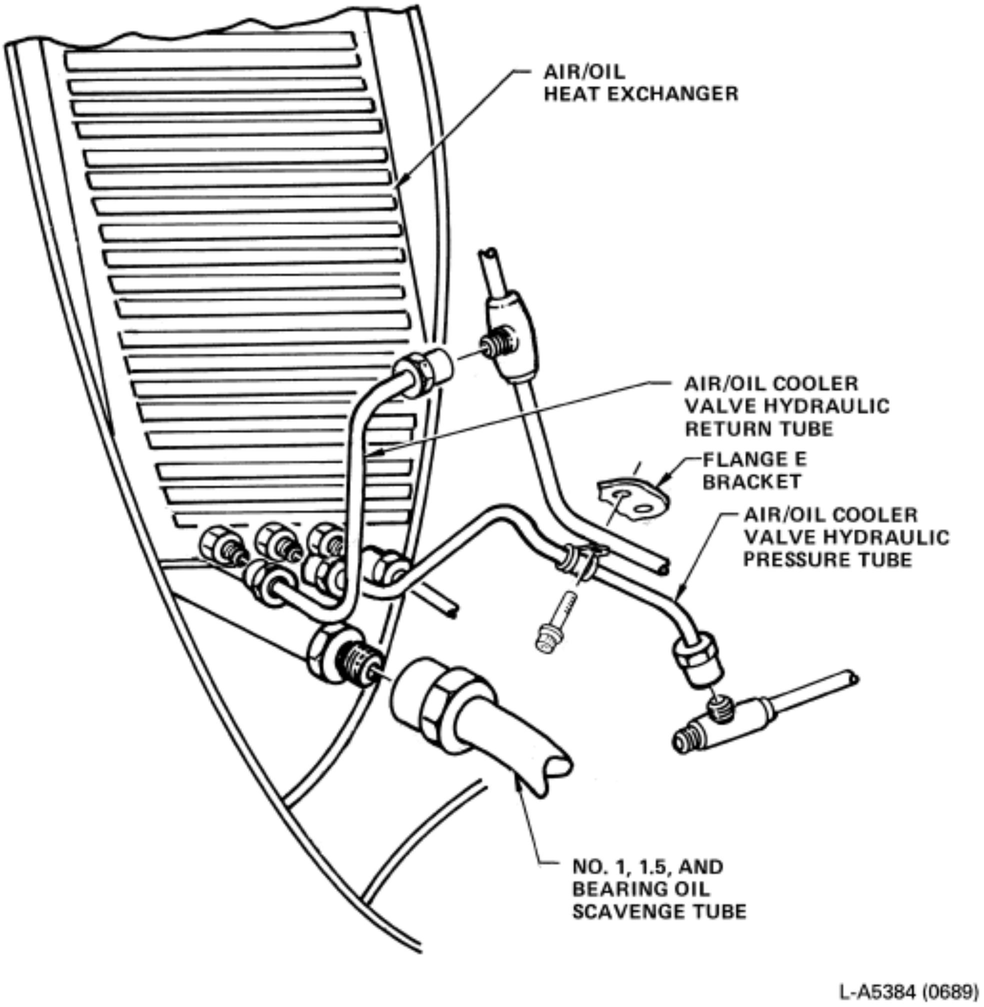
Installation Of The Engine Tubes
Figure 413 (Sheet 10)
(Task 72−00−34−420−006)


ANGLE GEARBOX
ANGLE GEARBOX OIL PRESSURE TUBE
PACKING
BOLT (2 REQ'D)
ANGLE GEARBOX OIL PRESSURE TUBE
L−A5382 (0000)
PW V

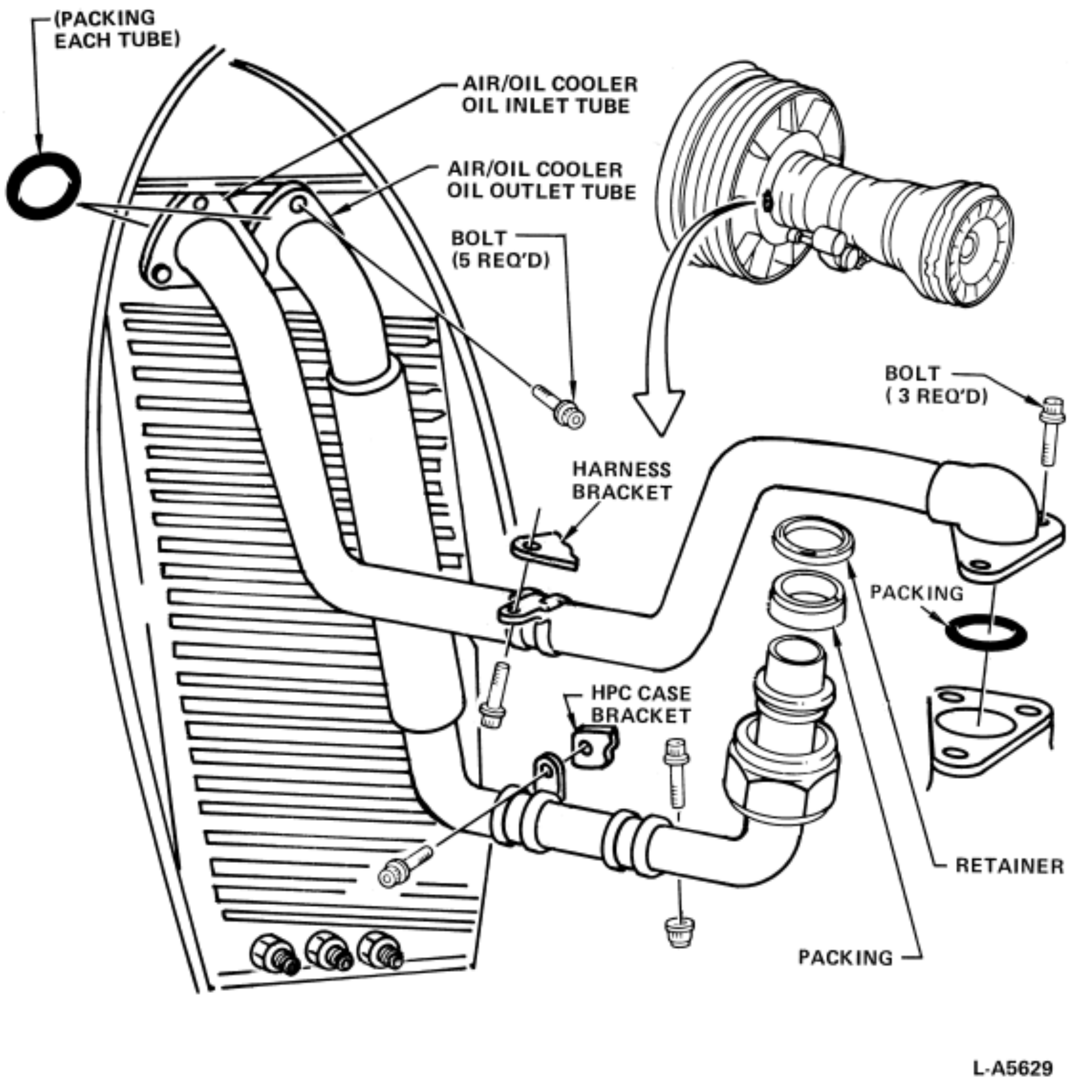
Installation Of The Engine Tubes
Figure 413 (Sheet 11)
(Task 72−00−34−420−006)


MANIFOLD
MANIFOLD
(2.5) BLEED VALVE ACTUATOR
BLEED VALVE CYLINDER HYDRAULIC PRESSURE TUBE
BLEED VALVE CYLINDER HYDRAULIC RETURN TUBE
L−A6006 (0000)
PW V

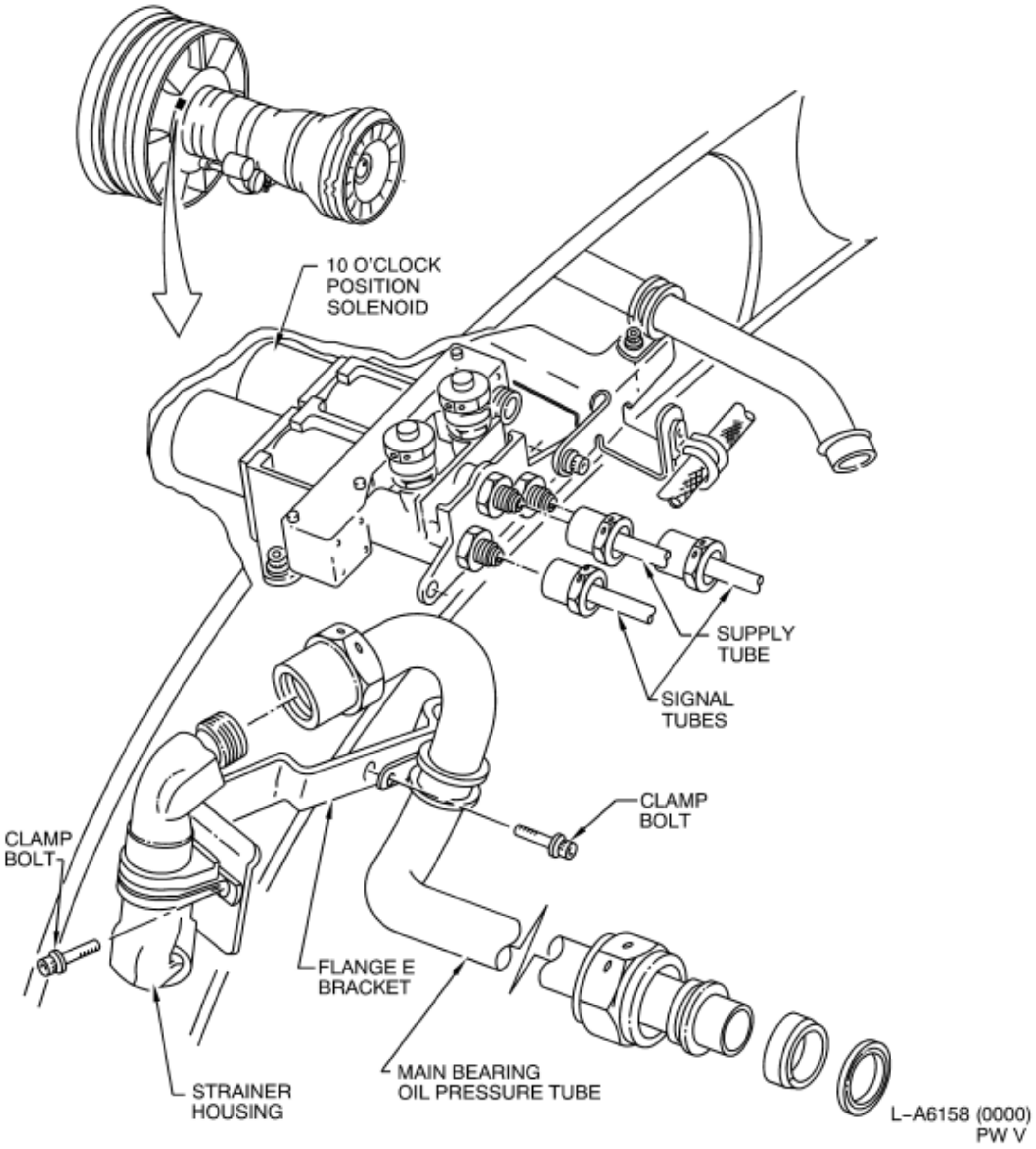
Installation Of The Engine Tubes
Figure 414 (Sheet 1)
(Task 72−00−34−420−006)


AIR/OIL
HEAT EXCHANGER
AIR/OIL COOLER
VALVE HYDRAULIC
RETURN TUBE
FLANGE E
BRACKET
AIR/OIL COOLER
VALVE HYDRAULIC
PRESSURE TUBE
NO. 1, 1.5, AND
BEARING OIL
SCAVENGE TUBE
L-A5384 (0689)

Installation Of The Engine Tubes
Figure 414 (Sheet 2)
(Task 72-00-34-420-006)

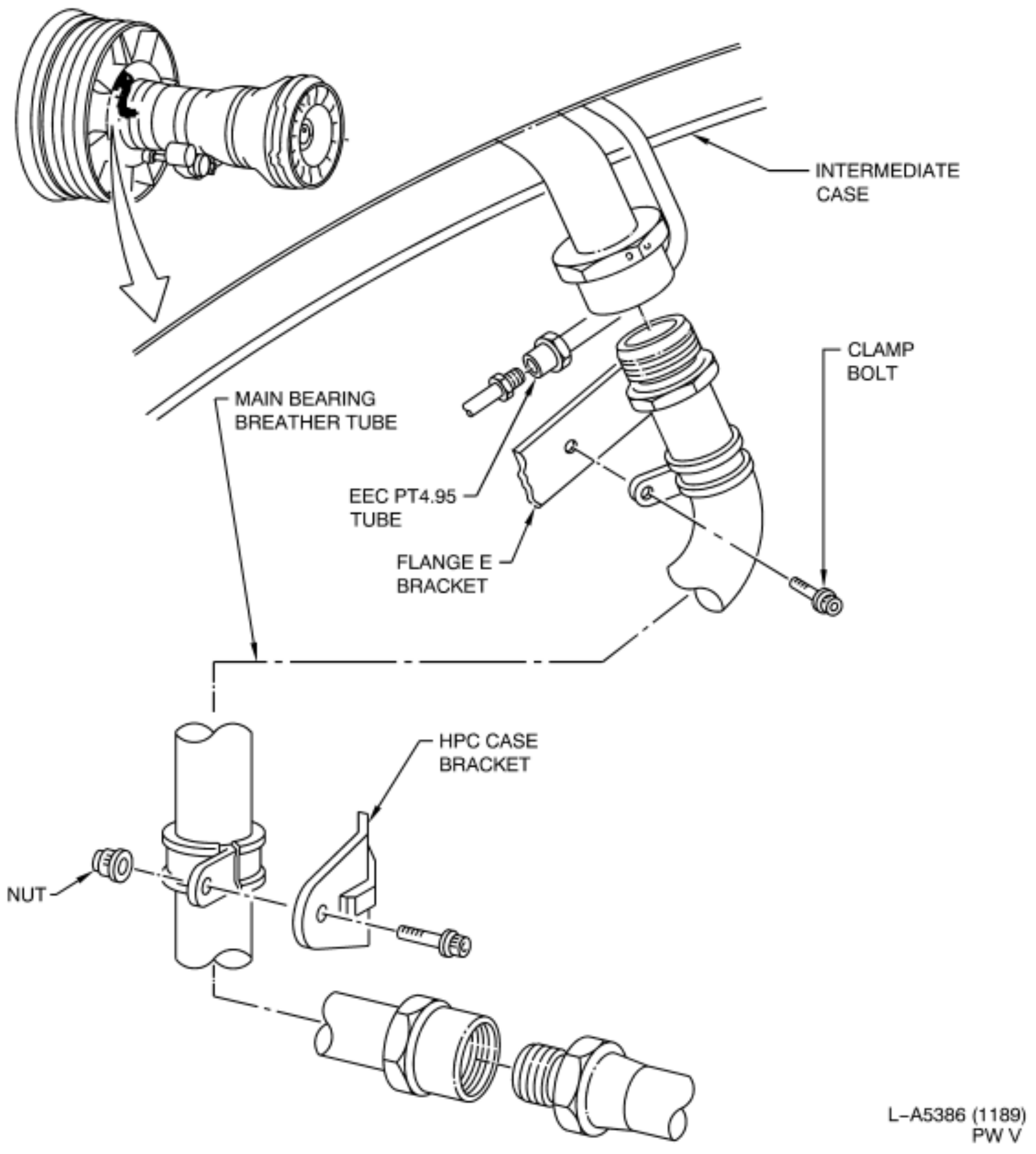

(PACKING
EACH TUBE)
AIR/OIL COOLER
OIL INLET TUBE
AIR/OIL COOLER
OIL OUTLET TUBE
BOLT
(5 REQ'D)
BOLT
(3 REQ'D)
HARNESS
BRACKET
PACKING
HPC CASE
BRACKET
RETAINER
PACKING
L-A5629

Installation of Engine Tubes
Figure 414 (Sheet 3)
(Task 72−00−34−420−006)

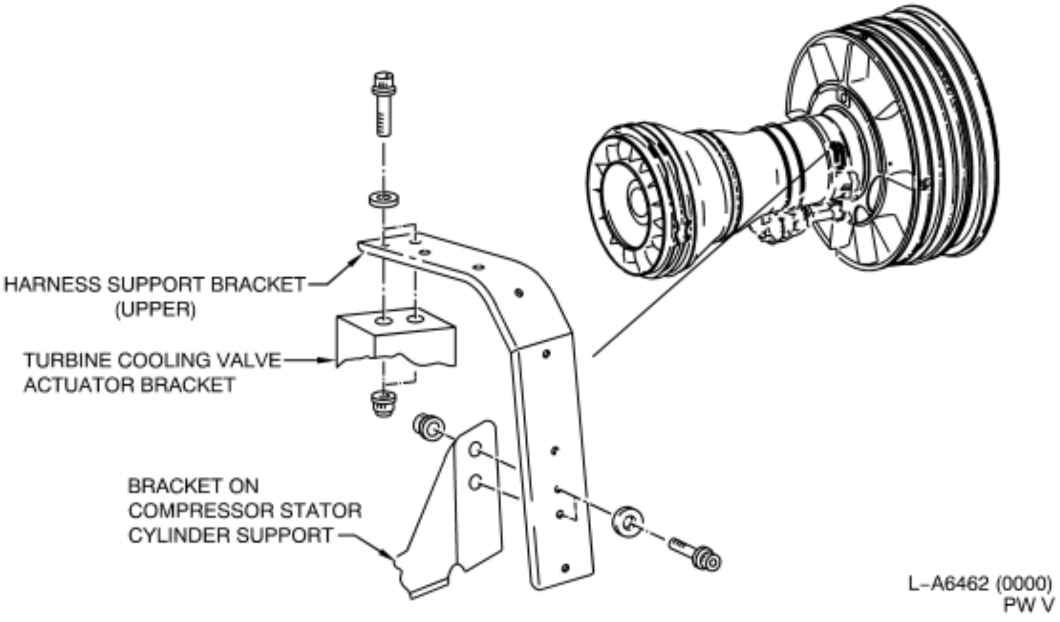

10 O'CLOCK POSITION SOLENOID
SUPPLY TUBE
SIGNAL TUBES
CLAMP BOLT
CLAMP BOLT
FLANGE E BRACKET
STRAINER HOUSING
MAIN BEARING OIL PRESSURE TUBE
L−A6158 (0000)
PW V

Installation Of Engine Tubes
Figure 414 (Sheet 4)
(Task 72−00−34−420−006)

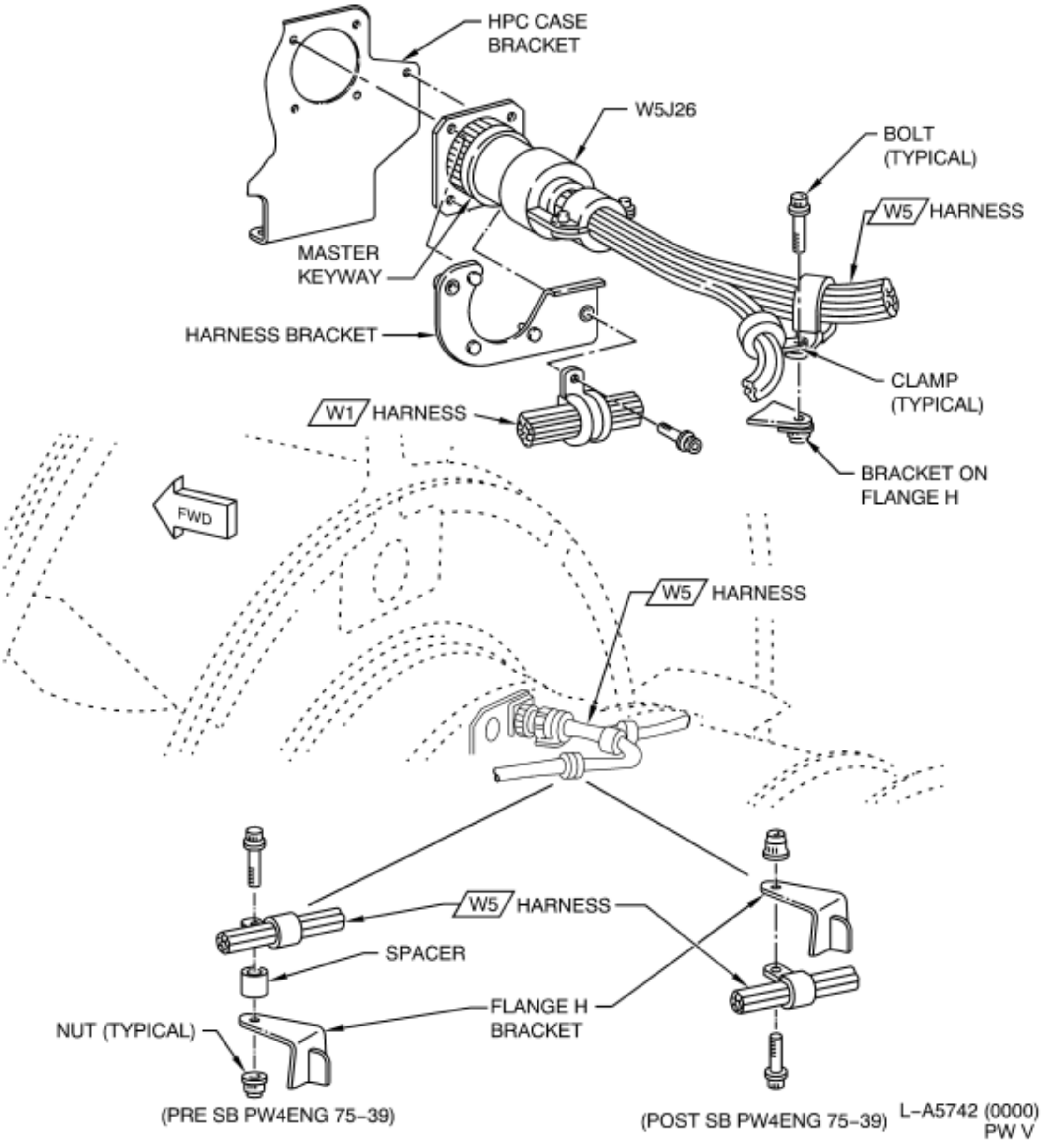
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−21


INTERMEDIATE CASE
CLAMP BOLT
MAIN BEARING BREATHER TUBE
EEC PT4.95 TUBE
FLANGE E BRACKET
HPC CASE BRACKET
NUT
L−A5386 (1189)
PW V

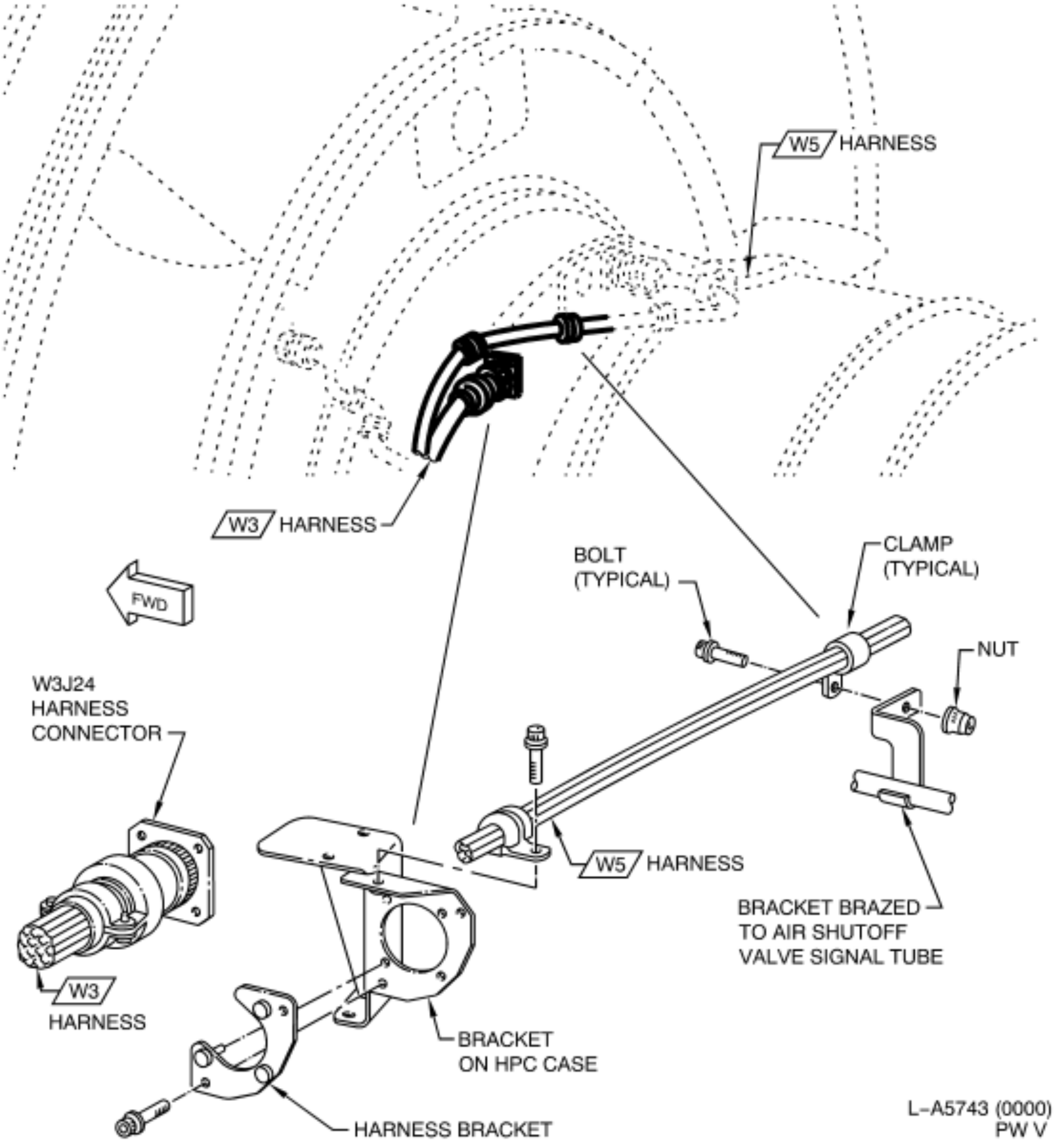
Installation Of Engine Tubes
Figure 414 (Sheet 5)
(Task 72−00−34−420−006)


HARNESS SUPPORT BRACKET (UPPER)
TURBINE COOLING VALVE ACTUATOR BRACKET
BRACKET ON COMPRESSOR STATOR CYLINDER SUPPORT
L−A6462 (0000)
PW V

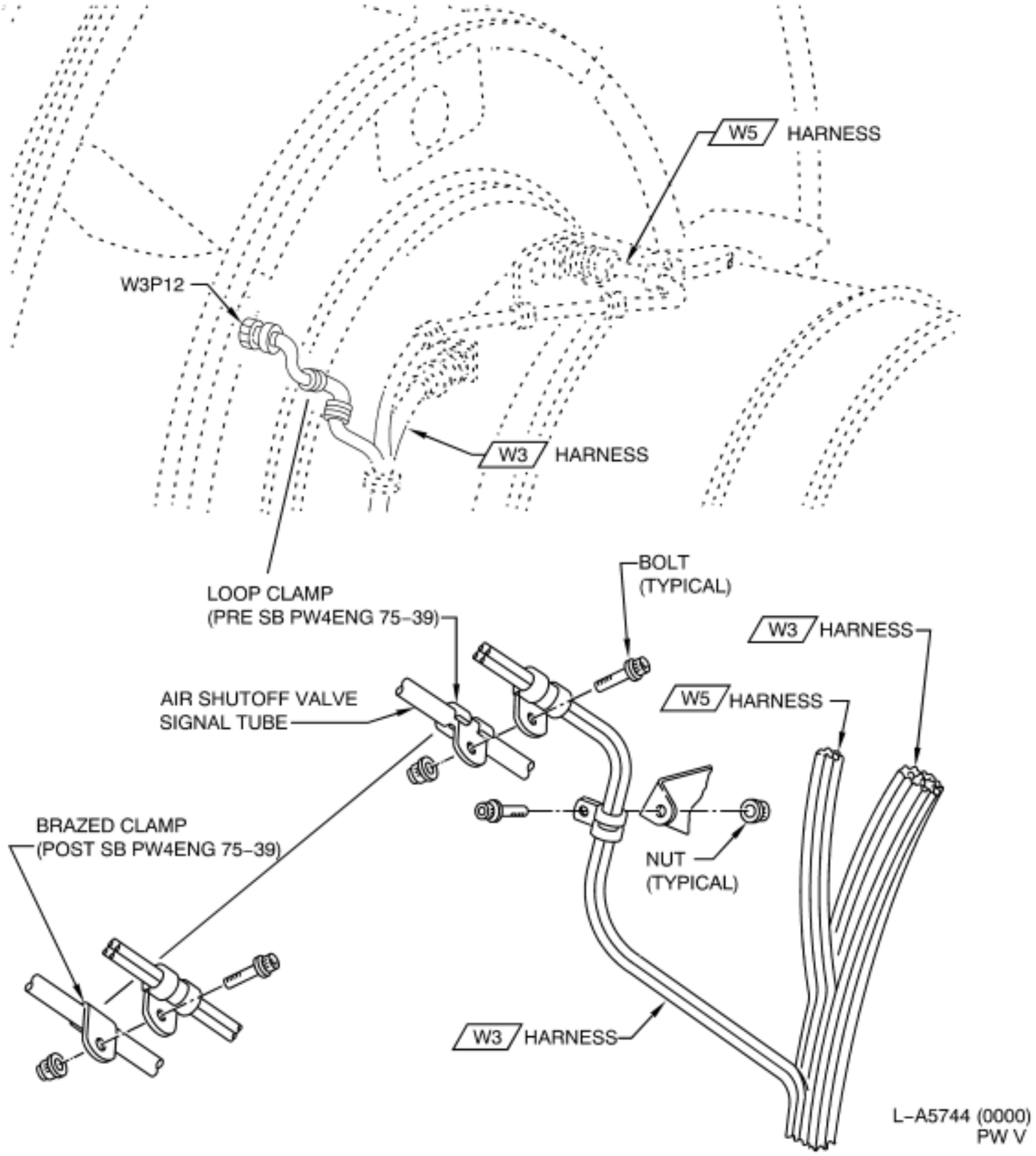
Harness Support Bracket
Figure 415 (Sheet 1)
(Task 72−00−34−420−006)


HPC CASE BRACKET
W5J26
BOLT (TYPICAL)
W5 HARNESS
MASTER KEYWAY
HARNESS BRACKET
CLAMP (TYPICAL)
W1 HARNESS
BRACKET ON FLANGE H
FWD
W5 HARNESS
W5 HARNESS
SPACER
FLANGE H BRACKET
NUT (TYPICAL)
(PRE SB PW4ENG 75-39)
(POST SB PW4ENG 75-39)
L-A5742 (0000)
PW V

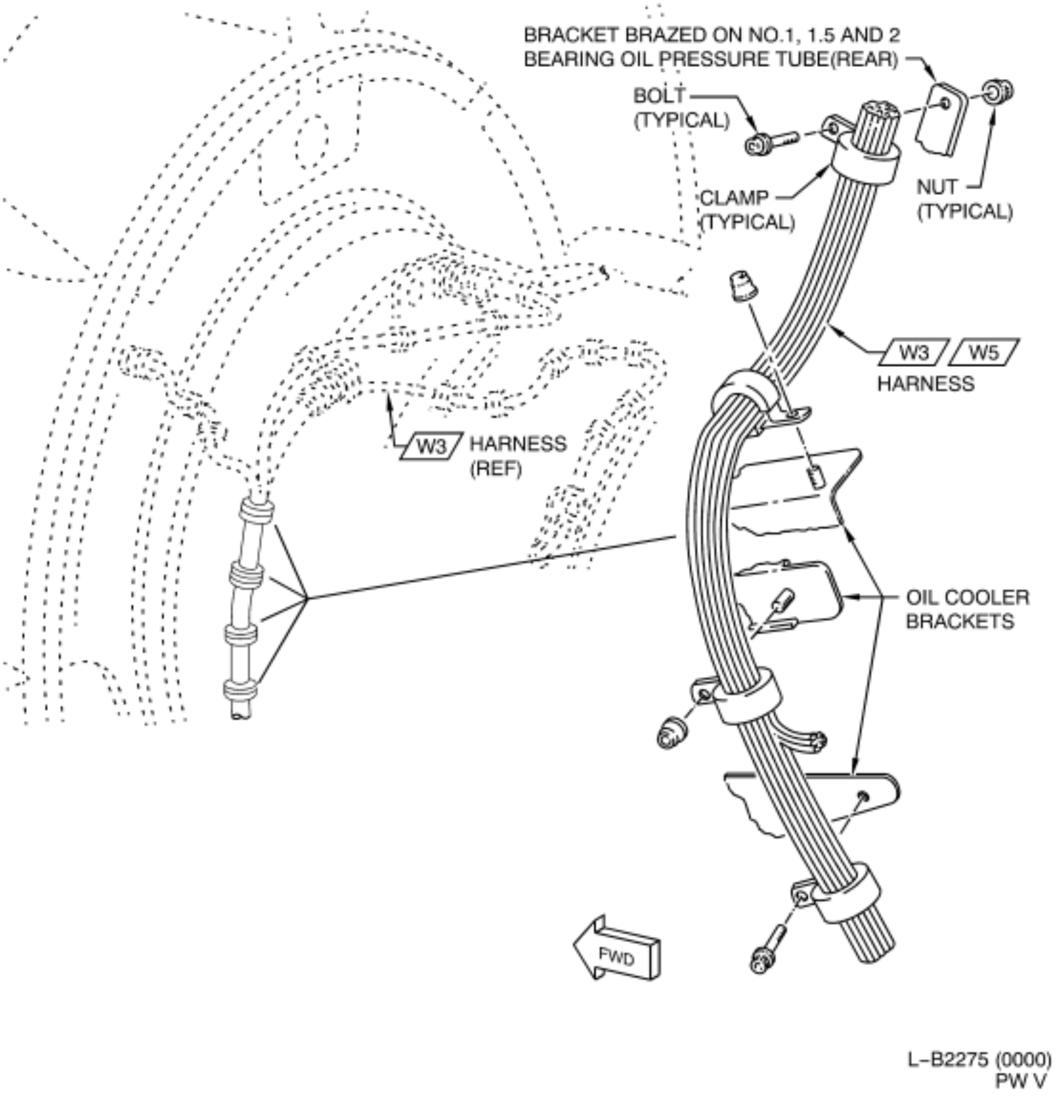
EEC Wiring Harness - Installation
Figure 415 (Sheet 2)
(Task 72-00-34-420-006)


W5 HARNESS
W3 HARNESS
FWD
BOLT (TYPICAL)
CLAMP (TYPICAL)
NUT
W3J24 HARNESS CONNECTOR
W5 HARNESS
BRACKET BRAZED TO AIR SHUTOFF VALVE SIGNAL TUBE
W3 HARNESS
BRACKET ON HPC CASE
HARNESS BRACKET
L-A5743 (0000)
PW V

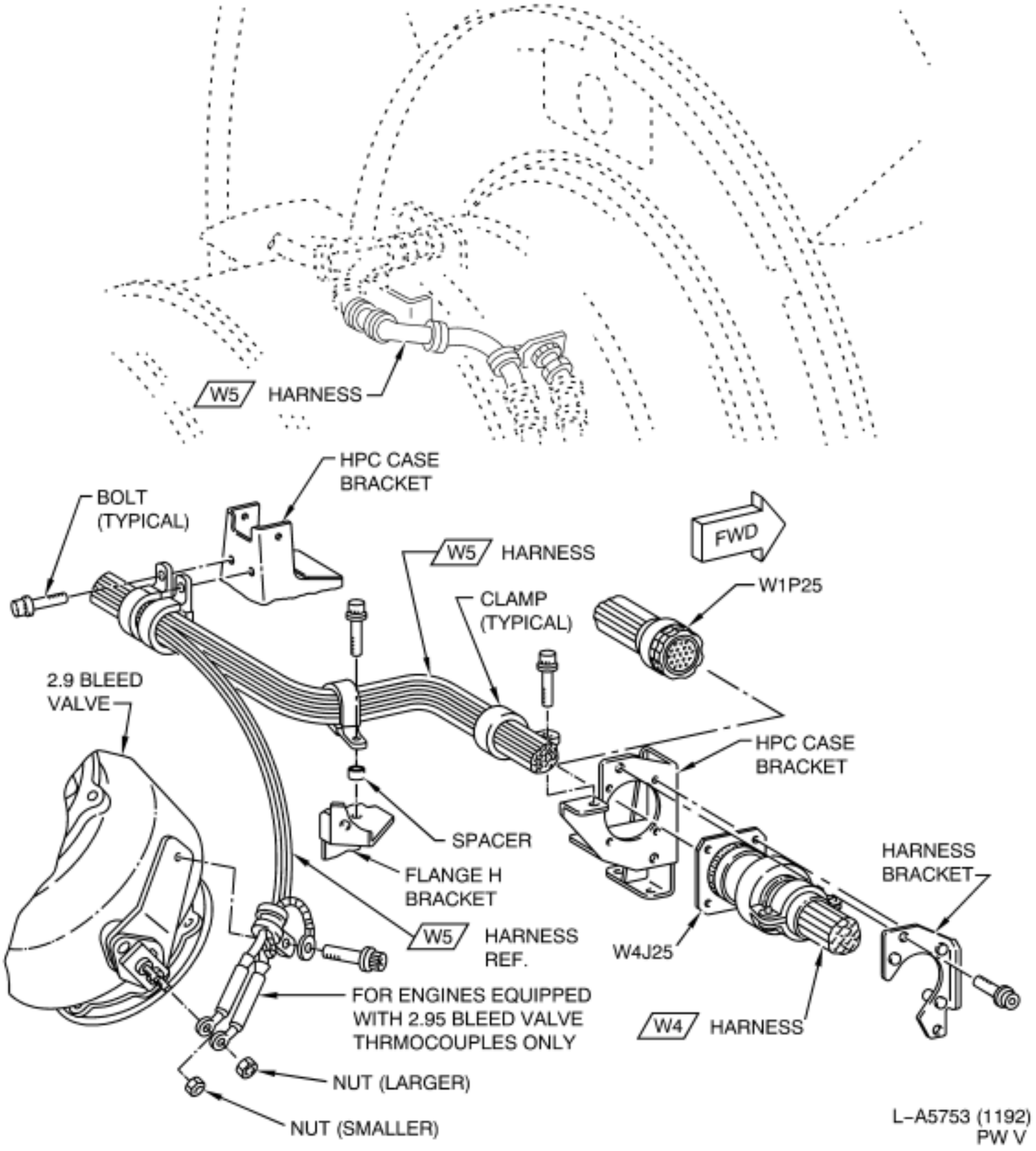
EEC Wiring Harness - Installation
Figure 415 (Sheet 3)
(Task 72-00-34-420-006)


W5 HARNESS
W3P12
W3 HARNESS
LOOP CLAMP
(PRE SB PW4ENG 75−39)
BOLT
(TYPICAL)
W3 HARNESS
AIR SHUTOFF VALVE
SIGNAL TUBE
W5 HARNESS
BRAZED CLAMP
(POST SB PW4ENG 75−39)
NUT
(TYPICAL)
W3 HARNESS
L−A5744 (0000)
PW V

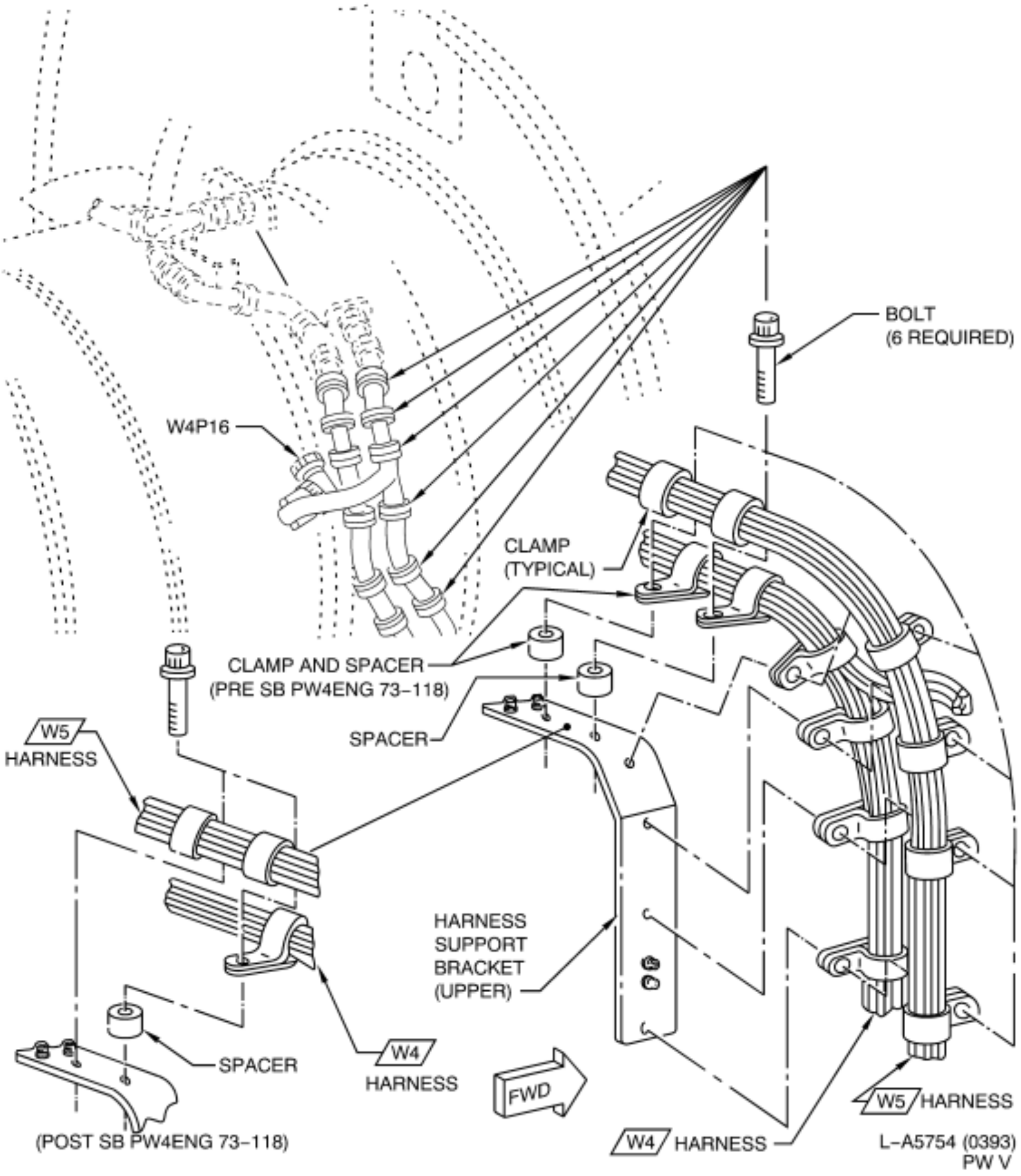
EEC Wiring Harness − Installation
Figure 415 (Sheet 4)
(Task 72−00−34−420−006)


BRACKET BRAZED ON NO.1, 1.5 AND 2 BEARING OIL PRESSURE TUBE(REAR)
BOLT (TYPICAL)
CLAMP (TYPICAL)
NUT (TYPICAL)
W3 W5 HARNESS
W3 HARNESS (REF)
OIL COOLER BRACKETS
FWD
L-B2275 (0000)
PW V

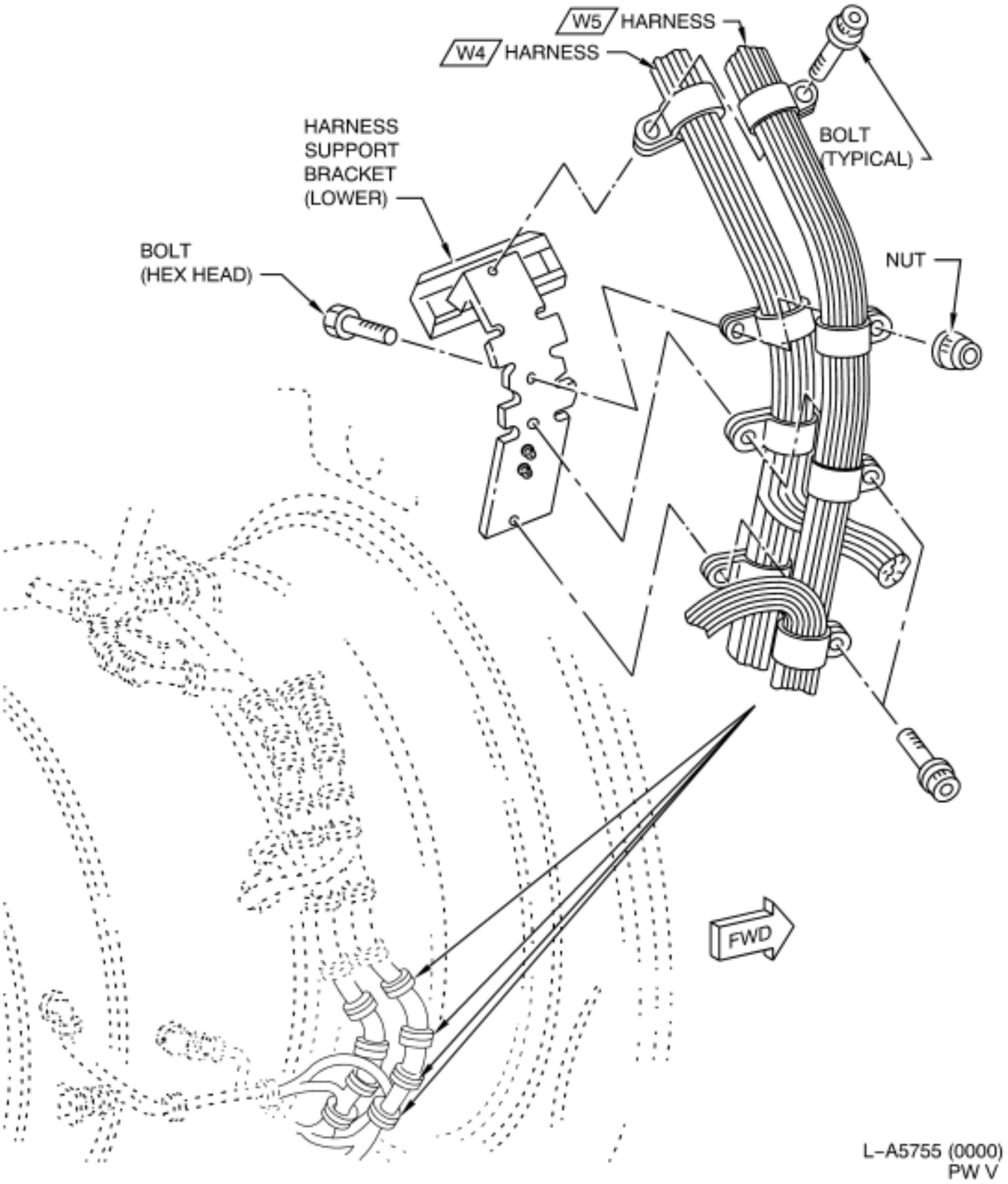
EEC Wiring Harness - Installation
Figure 415 (Sheet 5)
(Task 72-00-34-420-006)


W5 HARNESS
HPC CASE BRACKET
BOLT (TYPICAL)
W5 HARNESS
FWD
CLAMP (TYPICAL)
W1P25
2.9 BLEED VALVE
HPC CASE BRACKET
SPACER
FLANGE H BRACKET
HARNESS BRACKET
W5 HARNESS REF.
W4J25
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W4 HARNESS
NUT (LARGER)
NUT (SMALLER)
L−A5753 (1192)
PW V

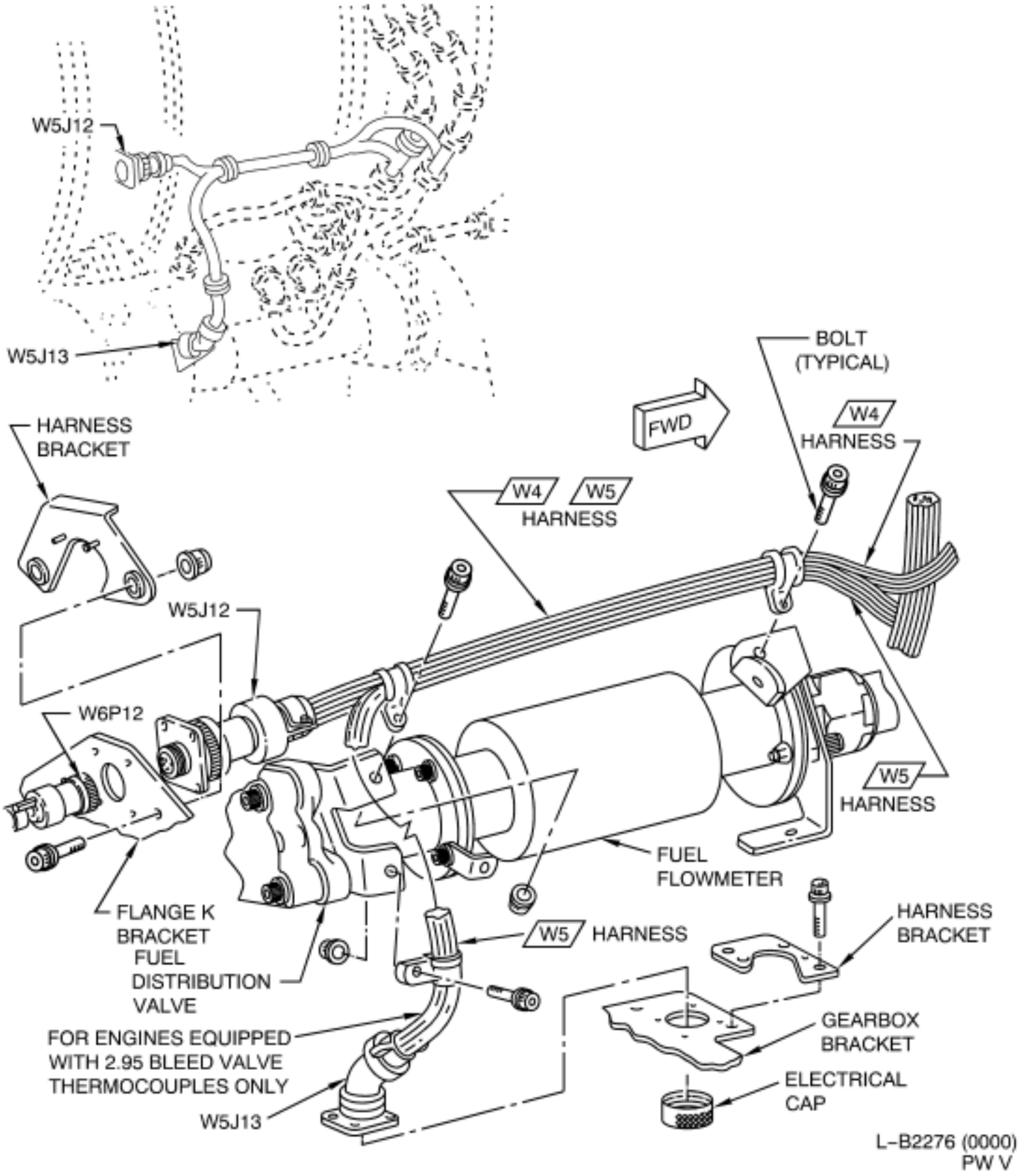
EEC Wiring Harness − Installation
Figure 415 (Sheet 6)
(Task 72−00−34−420−006)


BOLT
(6 REQUIRED)
W4P16
CLAMP
(TYPICAL)
CLAMP AND SPACER
(PRE SB PW4ENG 73−118)
SPACER
W5
HARNESS
HARNESS
SUPPORT
BRACKET
(UPPER)
SPACER
W4
HARNESS
FWD
(POST SB PW4ENG 73−118)
W4 HARNESS
W5 HARNESS
L−A5754 (0393)
PW V

EEC Wiring Harness − Installation
Figure 415 (Sheet 7)
(Task 72−00−34−420−006)

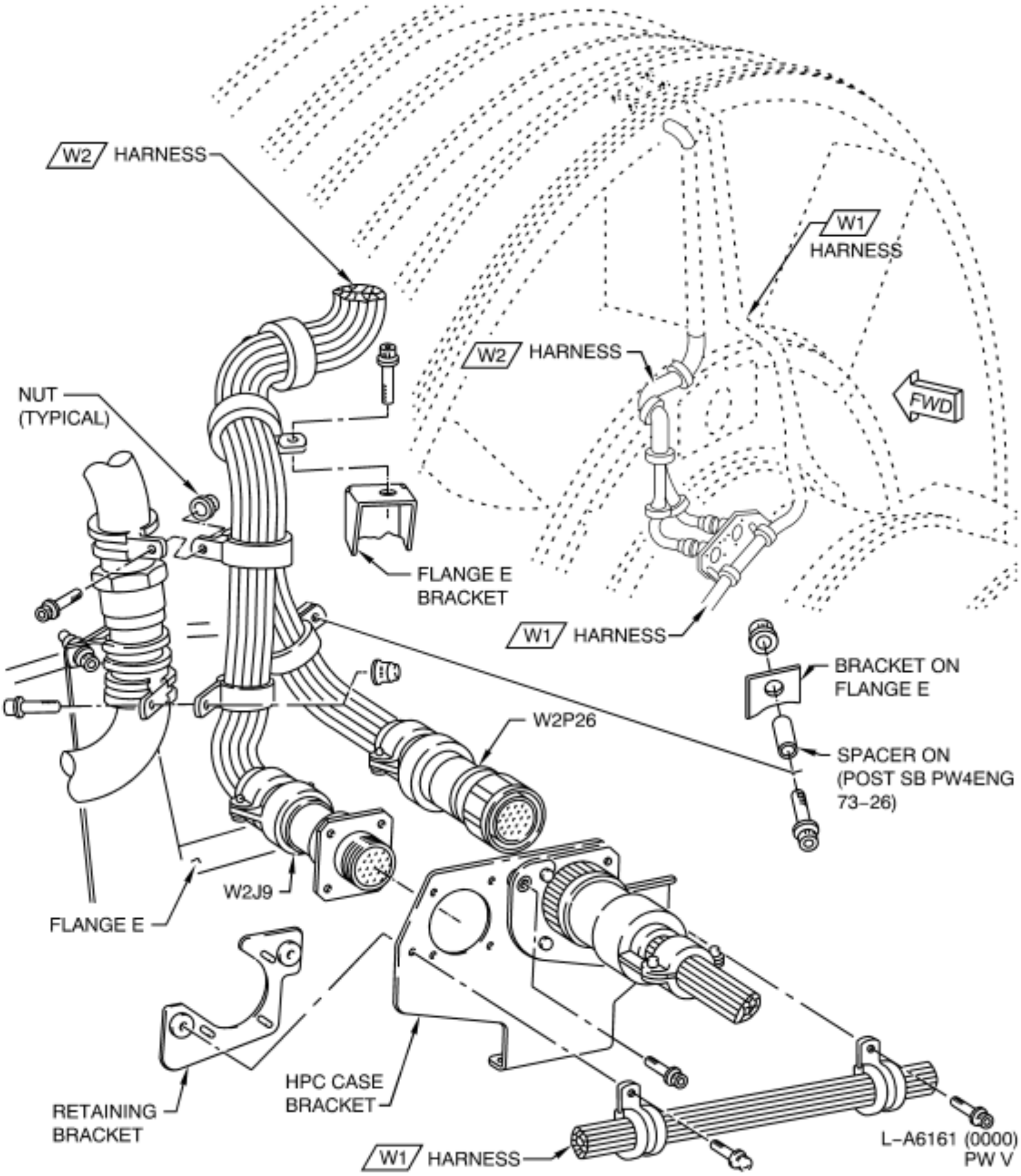

W5 HARNESS
W4 HARNESS
HARNESS SUPPORT BRACKET (LOWER)
BOLT (HEX HEAD)
BOLT (TYPICAL)
NUT
FWD
L−A5755 (0000)
PW V

EEC Wiring Harness − Installation
Figure 415 (Sheet 8)
(Task 72−00−34−420−006)

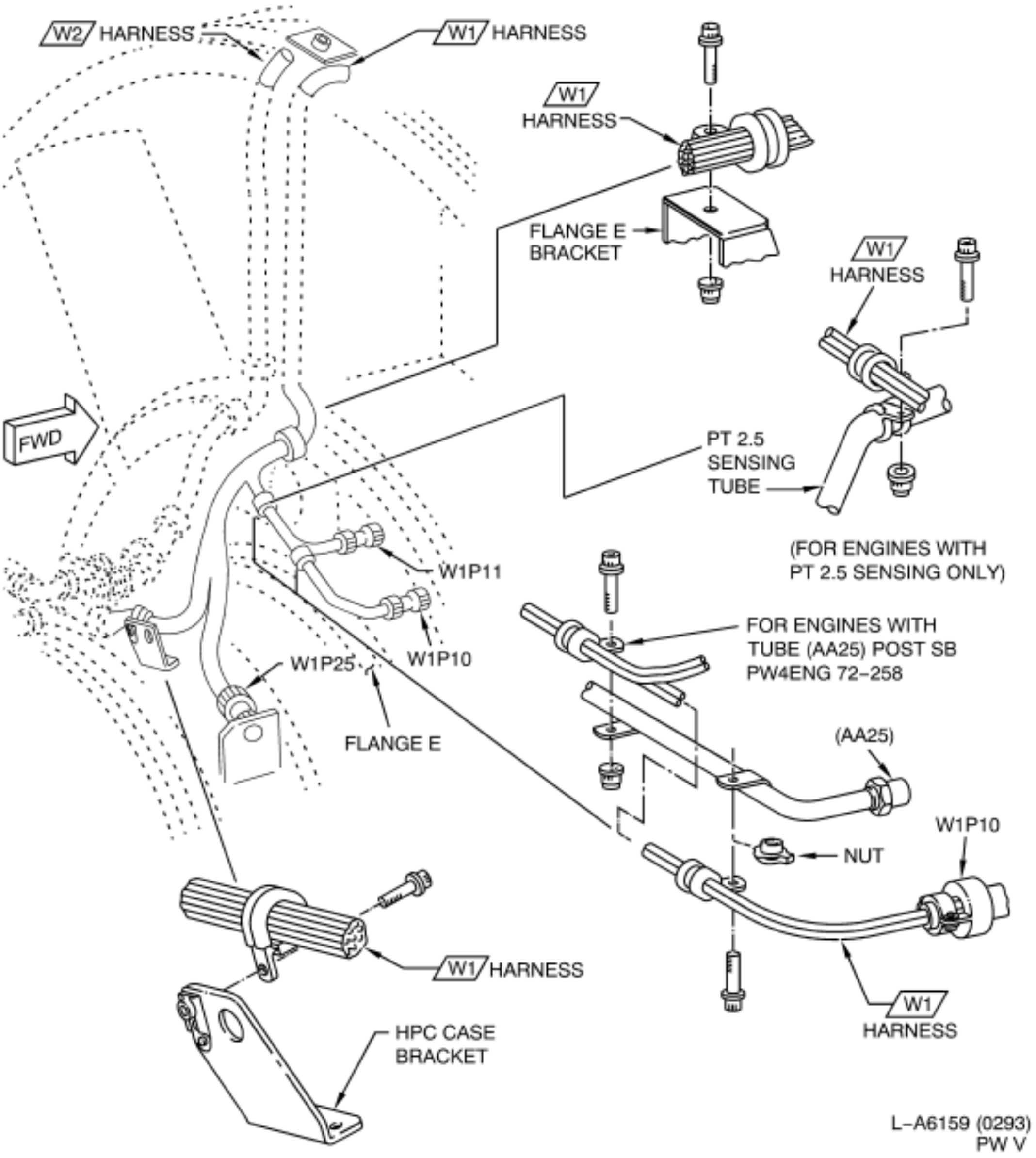

W5J12
W5J13
BOLT (TYPICAL)
FWD
W4 HARNESS
HARNESS BRACKET
W4 W5 HARNESS
W5J12
W6P12
W5 HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
GEARBOX BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
ELECTRICAL CAP
W5J13
L−B2276 (0000)
PW V

EEC Wiring Harness − Installation
Figure 415 (Sheet 9)
(Task 72−00−34−420−006)

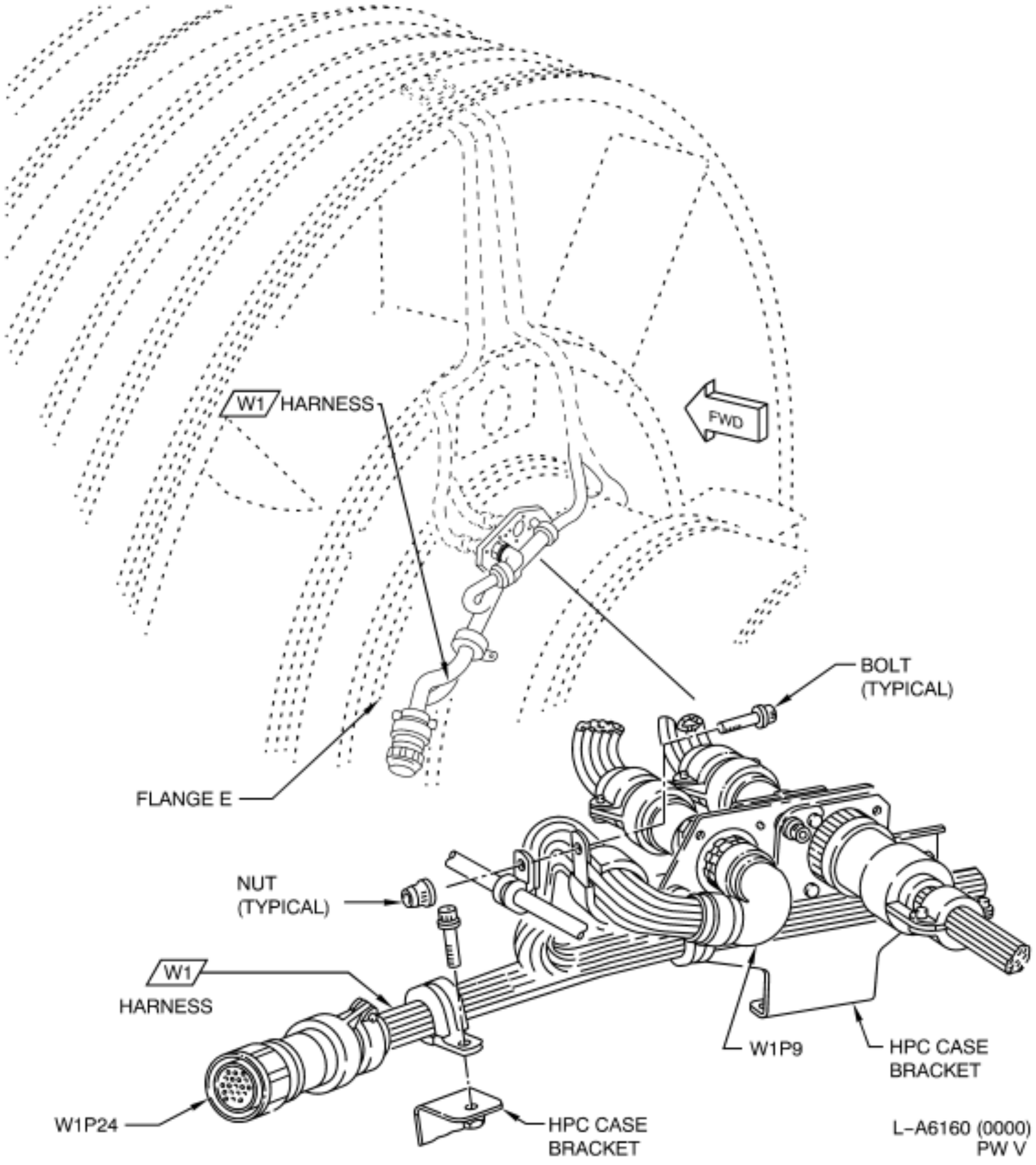
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−21


W2 HARNESS
W1 HARNESS
W2 HARNESS
NUT (TYPICAL)
FWD
FLANGE E BRACKET
W1 HARNESS
BRACKET ON FLANGE E
W2P26
SPACER ON (POST SB PW4ENG 73−26)
W2J9
FLANGE E
RETAINING BRACKET
HPC CASE BRACKET
W1 HARNESS
L−A6161 (0000) PW V

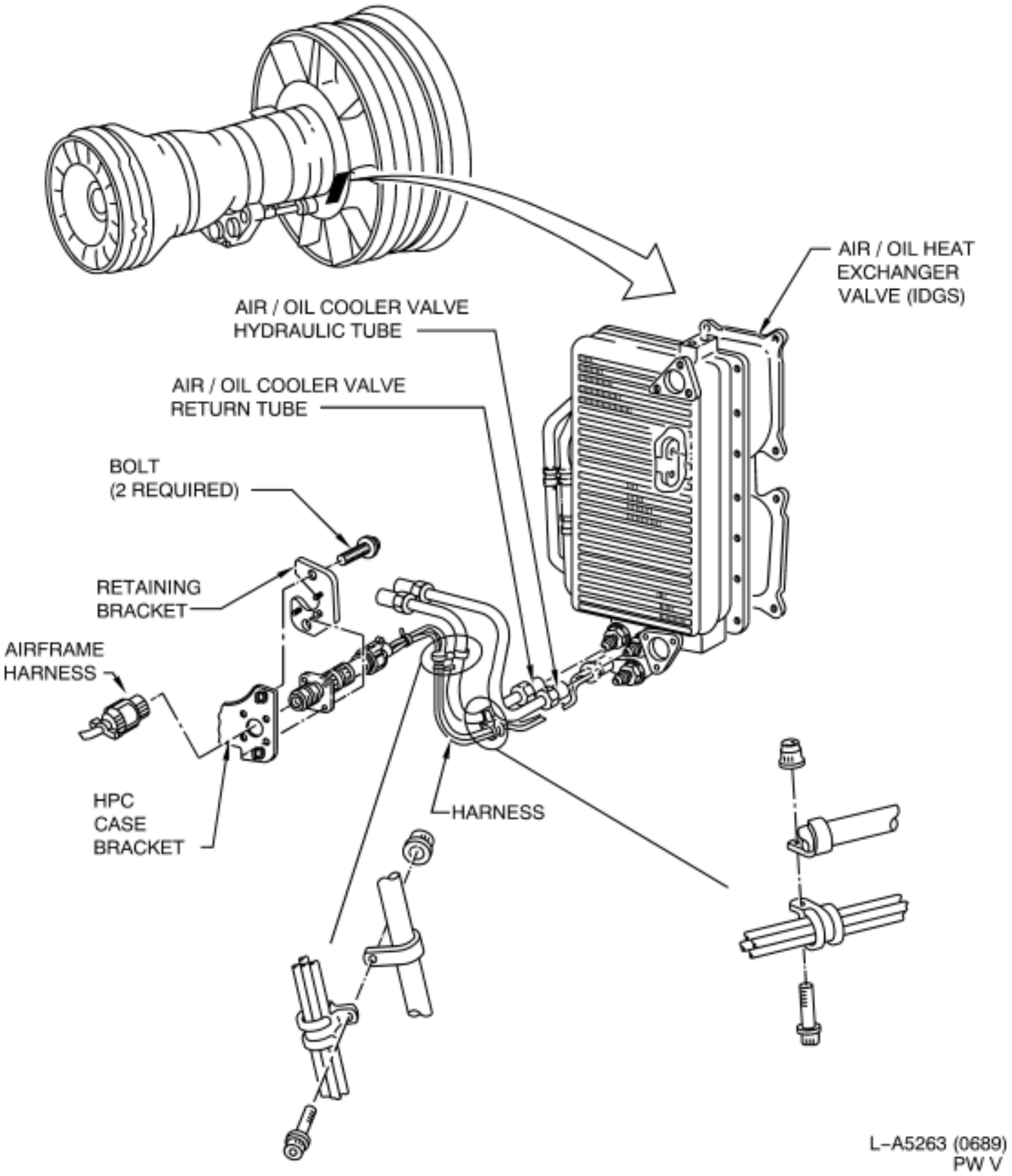
EEC Wiring Harness − Installation
Figure 416 (Sheet 1)
(Task 72−00−34−420−006)


W2 HARNESS
W1 HARNESS
W1 HARNESS
FLANGE E BRACKET
W1 HARNESS
FWD
PT 2.5 SENSING TUBE
(FOR ENGINES WITH PT 2.5 SENSING ONLY)
W1P11
W1P10
FOR ENGINES WITH TUBE (AA25) POST SB PW4ENG 72-258
W1P25
FLANGE E
(AA25)
W1P10
NUT
W1 HARNESS
W1 HARNESS
HPC CASE BRACKET
L-A6159 (0293)
PW V

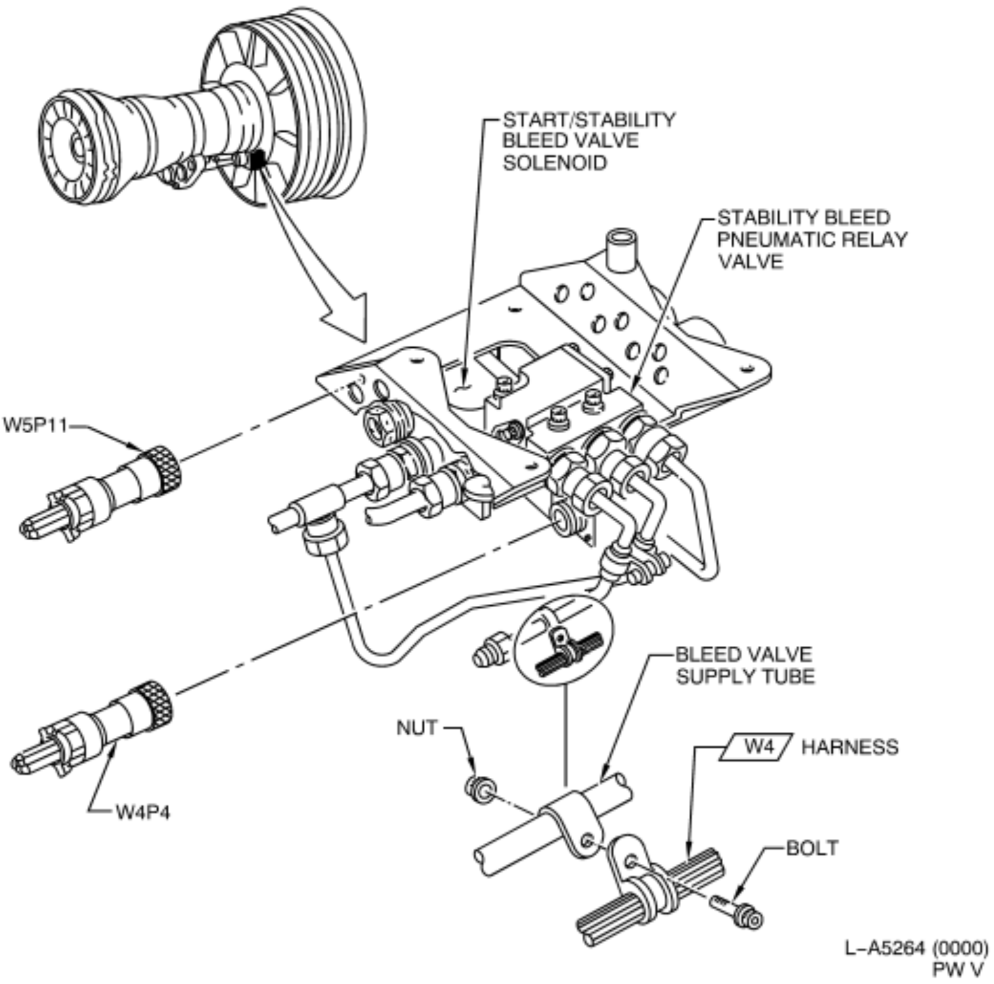
EEC Wiring Harness − Installation
Figure 416 (Sheet 2)
(Task 72−00−34−420−006)


W1 HARNESS
FWD
BOLT (TYPICAL)
FLANGE E
NUT (TYPICAL)
W1
HARNESS
W1P9
HPC CASE BRACKET
W1P24
HPC CASE BRACKET
L−A6160 (0000)
PW V

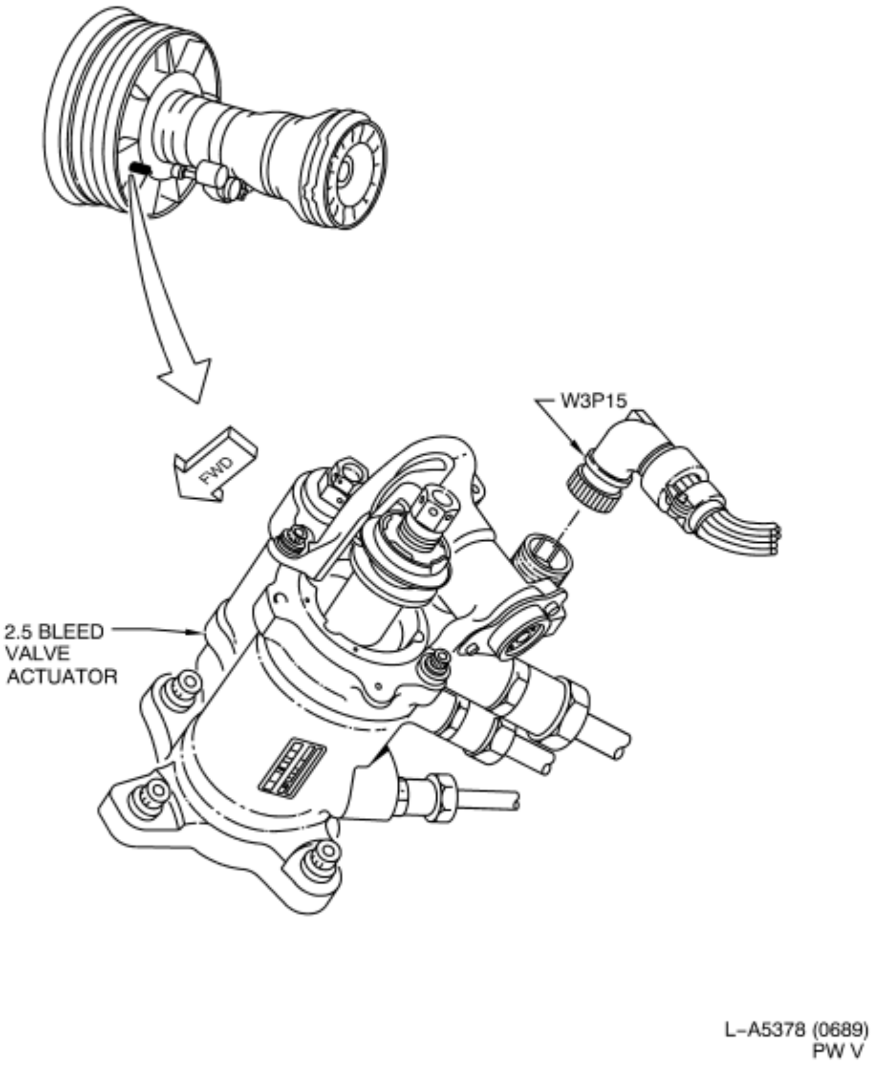
EEC Wiring Harness − Installation
Figure 416 (Sheet 3)
(Task 72−00−34−420−006)


AIR / OIL HEAT EXCHANGER VALVE (IDGS)
AIR / OIL COOLER VALVE HYDRAULIC TUBE
AIR / OIL COOLER VALVE RETURN TUBE
BOLT (2 REQUIRED)
RETAINING BRACKET
AIRFRAME HARNESS
HPC CASE BRACKET
HARNESS
L-A5263 (0689)
PW V

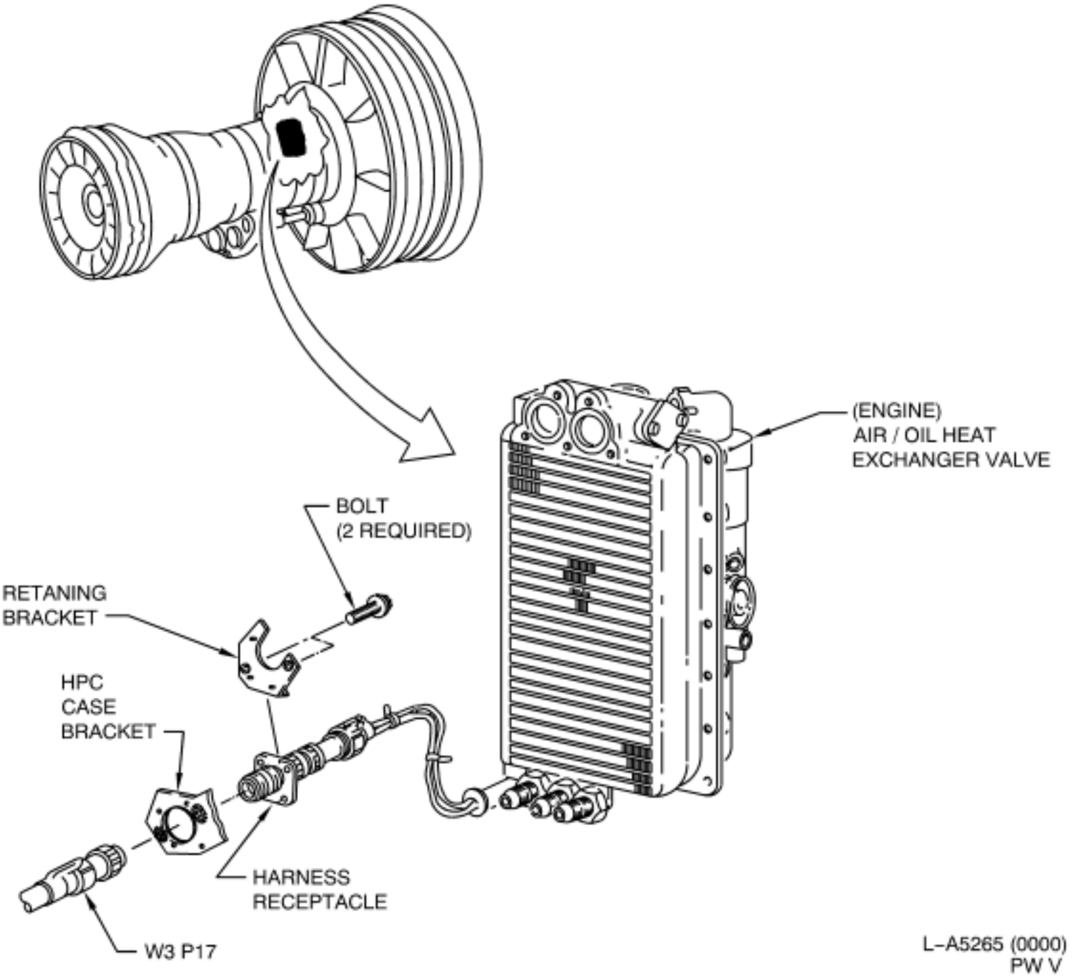
Wiring Harness - Installation
Figure 417 (Sheet 1)
(Task 72-00-34-420-006)


START/STABILITY BLEED VALVE SOLENOID
STABILITY BLEED PNEUMATIC RELAY VALVE
W5P11
BLEED VALVE SUPPLY TUBE
NUT
W4 HARNESS
BOLT
W4P4
L−A5264 (0000)
PW V

Wiring Harness − Installation
Figure 417 (Sheet 2)
(Task 72−00−34−420−006)


W3P15
FWD
2.5 BLEED VALVE ACTUATOR
L−A5378 (0689)
PW V

Wiring Harness − Installation
Figure 417 (Sheet 3)
(Task 72−00−34−420−006)


(ENGINE)
AIR / OIL HEAT
EXCHANGER VALVE
BOLT
(2 REQUIRED)
RETANING
BRACKET
HPC
CASE
BRACKET
HARNESS
RECEPTACLE
W3 P17
L−A5265 (0000)
PW V

Wiring Harness − Installation
Figure 417 (Sheet 4)
(Task 72−00−34−420−006)

ENGINE GENERAL - INTERMEDIATE CASE - INSTALLATION-22

Task 72-00-34-440-001:

1. Install The No. 1 Bearing Vibration Transducer

A. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307
PN MS24256A16 Insertion Tool
Daniels Manufacturing Co. Tool HT210-16 or Equivanlent

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-288	Lockwire (AS3214-01)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	77-32-00/01/050
Packing	1	77-32-00/01/070
TGL Silicone Tape	AR	77-32-00/01/105

B. Procedure
See Figure 401, See Figure 402, and Figure 403.

CAUTION: BE SURE TO USE THE CORRECT PART NUMBERS. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 77-13.

(1) Remove the covers that protect the holes in the intermediate case.

(2) Install the transducer in the conduits as follows.

(a) Apply Engine Oil P03-001 to one packing. Install the packing near the flange of the transducer.

(b) Hold the three pins on the end of the transducer cable together. Wind a piece of plastic sheet around the pins. Safety the plastic sheet with tape.

NOTE: The plastic and tape around the sockets and wire are used so that the cable will not get caught in the conduit when you install it. The cable must be able to move easily through the conduit with the plastic and tape wound around it. The plastic sheet on the wires and pins must also be sufficient to prevent their contamination by the tape.

(c) Apply Engine Oil P03−001 to one packing. Install the packing on the end of the front conduit.

(d) Put the cable end of the transducer into the front conduit, at the flange end of the conduit. Be sure the arrow on the transducer points up. Push the flanges together.

(e) Put the cable end of the transducer into the rear conduit (installed in the intermediate case). Push the cable through the conduit until both conduits are engaged. Be sure the arrow on the forward face of the transducer points toward the centerline of the engine.

(f) Pull the end of the cable through the hole at the rear of the intermediate case.

NOTE: The end of the cable must be inboard of the bracket that attaches the high pressure compressor bleed valve assembly to the intermediate case.

(3) Attach the connector to the bracket as follows.

CAUTION: DO NOT CAUSE DAMAGE TO THE PINS WHEN YOU REMOVE THE TAPE AND PLASTIC

(a) Remove the tape and plastic sheet from the end of the transducer cable.

(b) Install the connector in the bracket. The keyway must be aligned in the bracket as shown in Figure 403.

(c) Attach the connector to the bracket with four screws, lubricated with Engine Oil P03−001. Torque the screws to 4.5 − 6.0 lb−in. (0.508 − 0.678 N.m). Safety the screws with the Lockwire P05−288.

(4) Attach the cable to the connector as follows.

(a) Loosen the screws in the backshell clamp. Install the backshell on the cable but keep it out of the way.

NOTE: Do not tighten the clamp screws at this time.

(b) (Pre SB PW4ENG 77−14) Wrap the end of the cable three times with TGL silicone tape.

(c) Install the wires of the transducer in the connector as follows. Push the pins into the connector with MS24256A16 Insertion Tool until the pin touches the end of the hole.

1 The blue wire goes to No. 1 on the connector.

2 The white wire goes to No. 2 on the connector.

3 The green wire goes to No. 3 on the connector.

(d) Install the backshell on the connector. Torque the coupling ring of the connector to 50 − 55 lb−in. (5.649 − 6.214 N.m).

(e) (Pre SB PW4ENG 77−13) Loosely attach the bracket to the start/stability−bleed−valve−solenoid bracket with two bolts, lubricated with Engine Oil P03−001, and nuts.

(f) (Post SB PW4ENG 77−13) Loosely install the bracket on the gearbox driveshaft housing with two bolts.

(g) Put the clamps of the backshell over the center of the transducer cable ferrule.

(h) (Pre SB PW4ENG 77−14) Install four spacers, one between each screw hole of the clamp and the backshell. Install lock washers under the heads of the screws.

(i) (Post SB PW4ENG 77−14) Attach the backshell to the cable with the clamp and screws, washers under the heads of the screws.

(j) (Reference 1014) With the cable ferrule positioned under the backshell clamps, tighten the backshell clamp screws until the backshell clamps fits finger tight onto ferrule but still allow relative movement.

(k) (Reference 1014) Perform a contact retention test on all 3 pins in the connector. Push test each pin individually using HT210−16 Daniels Mfg. Co. Tool or equivalent. If any of the pins are forced back into the connector, disassemble the cable assembly as necessary to correct the installation of the pin(s). Do not attempt to pull the pins back out into the connector with needle nose pliers. This will cause damage to the pins.

(l) (Reference 1014) Tighten the clamp screws and backshell firmly to secure the cable. Torque the two clamp screws to 4.5 − 6.0 lb−in. (0.508 − 0.678 N.m).

(m) (Post SB PW4ENG 77−14) Safety the backshell and clamp screws with the Lockwire P05−288. Put the wire through the head of one of the screws, then through the backshell, then through the head of the other screw.

(n) (Reference 1014) Check the continuity of the cable assembly as follows:

1 Contact No. 1 to ground should read infinity.

2 Contact No. 2 to ground should read infinity.

3 Contact No. 3 to ground should read zero.

4 If requirements are not met, perform ohmmeter setting again and repeat above continuity checks.

5 If requirements are still not met, disassemble and reassemble the cable as necessary to check the installation as above. Repeat steps (j) through (n) above.

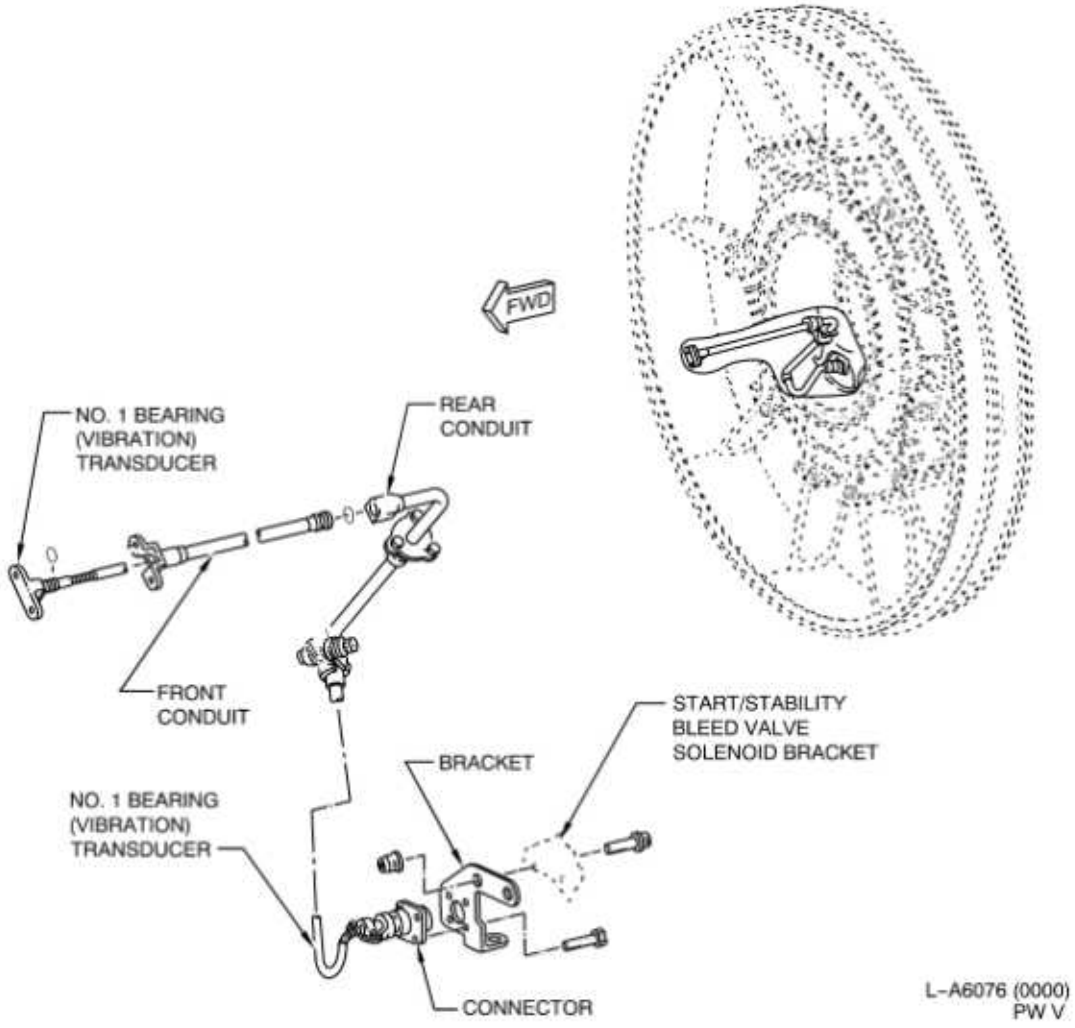
(5) (Pre SB PW4ENG 77−13) Torque the bolts that attach the transducer to the bracket to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(6) (Post SB PW4ENG 77−13) Torque the bolts that attach the bracket to the gearbox driveshaft housing to 62 − 72 lb−in. (7.005 − 8.135 N.m).

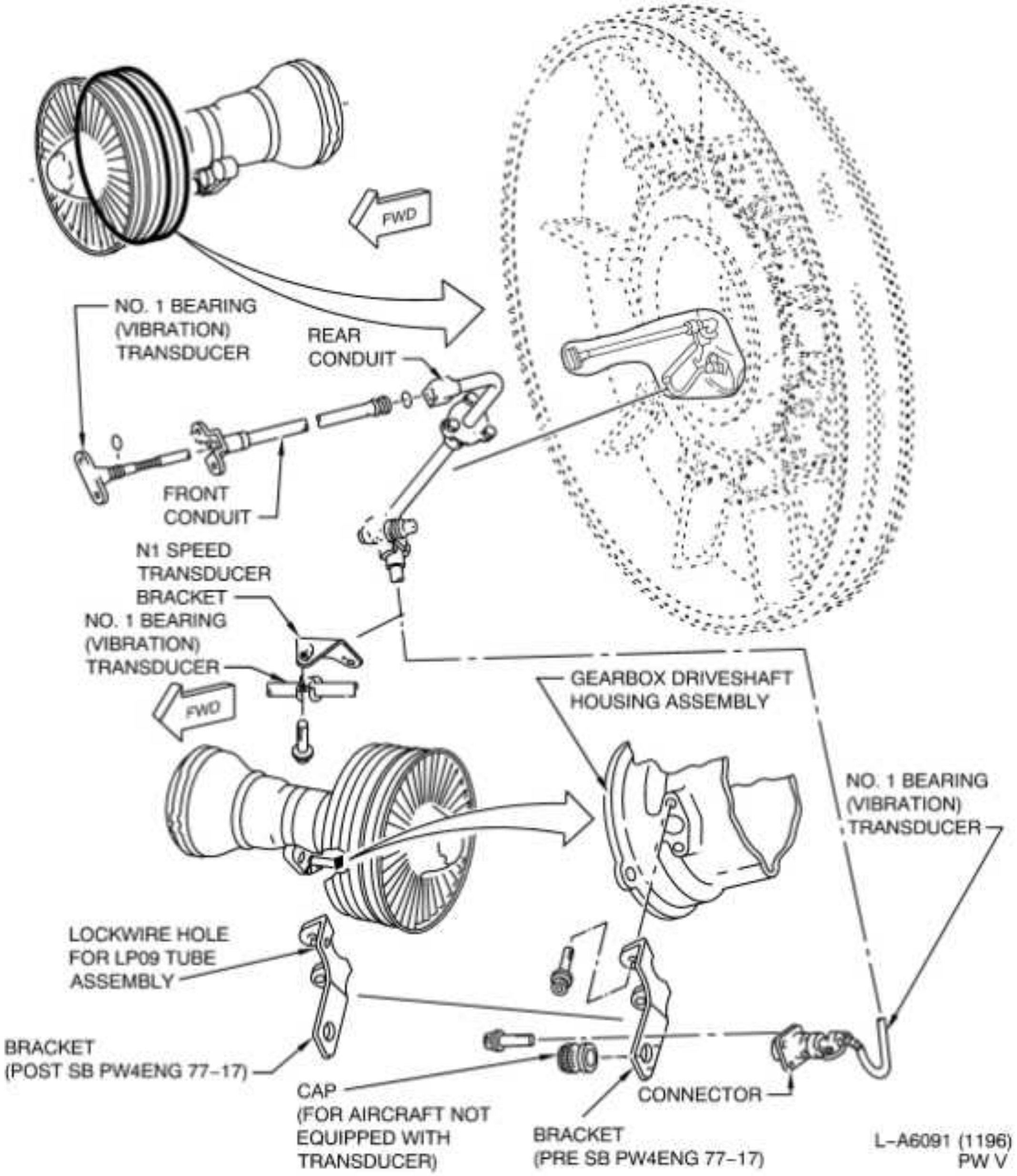
(7) (Post SB PW4ENG 77−17) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the (LP09) tube nut to the transducer bracket mounted on gearbox driveshaft housing assembly.

(8) (Post SB PW4ENG 77−13) Attach the cable to the bracket on the N1 speed transducer with a clamp and clamp bolt, lubricated with Engine Oil P03−001. Torque the clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

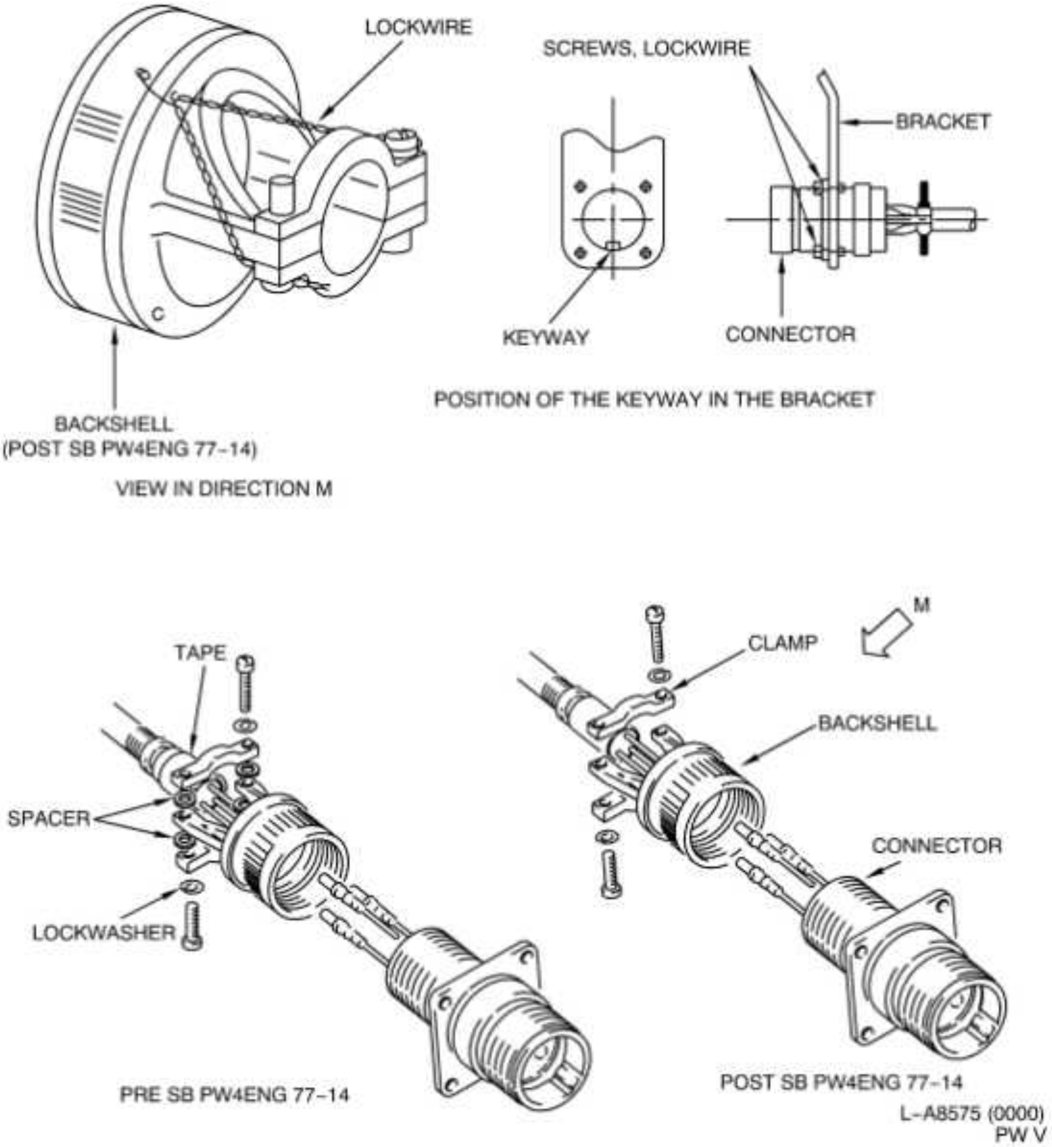
NOTE: For aircraft that are not electrically equipped with the transducer, but the engines are equipped with the transducer, install an electrical cap to the connector. Tighten the cap by hand and install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the cap. This cap must cover the connector during engine use if the aircraft harness does not connect to the transducer receptacle (Post SB PW4ENG 77−11).


FWD
NO. 1 BEARING (VIBRATION) TRANSDUCER
REAR CONDUIT
FRONT CONDUIT
START/STABILITY BLEED VALVE SOLENOID BRACKET
BRACKET
NO. 1 BEARING (VIBRATION) TRANSDUCER
CONNECTOR
L−A6076 (0000)
PW V

No. 1 Bearing Vibration Transducer (Pre SB PW4ENG 77−13)
Figure 401
(Task 72−00−34−440−001)


FWD
NO. 1 BEARING (VIBRATION) TRANSDUCER
REAR CONDUIT
FRONT CONDUIT
N1 SPEED TRANSDUCER BRACKET
NO. 1 BEARING (VIBRATION) TRANSDUCER
FWD
GEARBOX DRIVESHAFT HOUSING ASSEMBLY
NO. 1 BEARING (VIBRATION) TRANSDUCER
LOCKWIRE HOLE FOR LP09 TUBE ASSEMBLY
BRACKET (POST SB PW4ENG 77−17)
CAP (FOR AIRCRAFT NOT EQUIPPED WITH TRANSDUCER)
CONNECTOR
BRACKET (PRE SB PW4ENG 77−17)
L−A6091 (1196)
PW V

No. 1 Bearing Vibration Transducer (Post SB PW4ENG 77−13)
Figure 402
(Task 72−00−34−440−001)


LOCKWIRE
BACKSHELL
(POST SB PW4ENG 77-14)
VIEW IN DIRECTION M
SCREWS, LOCKWIRE
BRACKET
KEYWAY
CONNECTOR
POSITION OF THE KEYWAY IN THE BRACKET
TAPE
SPACER
LOCKWASHER
PRE SB PW4ENG 77-14
M
CLAMP
BACKSHELL
CONNECTOR
POST SB PW4ENG 77-14
L-A8575 (0000)
PW V

No. 1 Bearing Vibration Transducer Backshell
Figure 403
(Task 72−00−34−440−001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INTERMEDIATE CASE - INSTALLATION-23

Task 72-00-34-450-019:

1. Install EEC Wiring Harness - W5 (Core Engine)

A. General

(1) To install the EEC wiring harness - W3, see 72-00-34, Installation-18 (Task 72-00-34-450-017).

(2) To install the EEC wiring harness - W4, see 72-00-34, Installation-19 (Task 72-00-34-450-018).

B. Equipment And Materials Required

Standard Tools:

Glenair TG-70	Strap Wrench or
Glenair TG-69	Soft Jawed Pliers

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Tape - Lacing And Tying, PN 1B1773		
Lockwire, AS3214-01		

C. Procedure

See Figure 401, Figure 402, Figure 403, Figure 404, Figure 405, Figure 406, Figure 407, Figure 408, Figure 409, Figure 410, Figure 411, Figure 412, Figure 413, Figure 414, Figure 415, Figure 416, Figure 417, Figure 418, Figure 419 and, Figure 420.

CAUTION: SEE 72-00-00, INSTALLATION-00 FOR THE GENERAL INSTALLATION REQUIREMENTS FOR THE ELECTRICAL HARNESSES, LEADS AND CABLES.

CAUTION: DO NOT TWIST OR BEND THE HARNESS BADLY DURING THE INSTALLATION, OR DAMAGE TO THE HARNESS CAN OCCUR.

(1) Install the W5 harness on the left and right side of the engine as follows.

(a) Remove the protective closure. Install the W5J26 connector flange to the HPC case bracket located at the 11:30 o'clock position. Attach the connector flange to the bracket temporarily with lockwire. Install the protective closure. See Figure 403.

(b) Place the leg of the harness with the connectors W5P1, W5P7, W5P8, W5P11, and W5J12 (and W5J13 for engines equipped with 2.95 bleed valve thermocouples) over the top of the HPC case and down the right side of the engine.

(c) Remove the lockwire securing the W5J26 connector flange to the HPC case bracket. Install the harness bracket (cut−out up) to attach the connector flange between the two brackets. Align the bolt holes and install the bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(2) (Pre SB PW4ENG 73−163) Remove the protective closures. Install the W5J12 connector flange to the Flange K bracket at the 3:30 o'clock position. Install the harness bracket (angle forward with cut−out inboard) to attach the connector flange between the two brackets. Align the bolt holes and install the bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 415.

(3) (Post SB PW4ENG 73−163) See Figure 415.

(a) Remove the protective closures. Align the W5J12 connector to the TCA tube flange bracket. Position the connector in the bracket so that the master keyway is located at an outboard location at approximately 30 degrees above the horizontal center line. Secure the connector to the TCA tube flange bracket with a loop clamp bracket and three (3) bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(b) Position the W5 harness immediately forward of the W5J12 connector to the TRC bracket. Secure the harness to the TRC bracket with a loop clamp bracket and bolt, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) (Post SB PW4ENG−73−192) Install cooling shields around W5 harness connector as follows:

NOTE: Pre SB PW4ENG 73−192 engines do not have W5/W6 wiring harness connector cooling.

1 Position the cooling shields around the W5 harness connector W5J12 and slide the cooling shield tabs into loop clamp bracket. Make sure the shield with the hose fitting is on the bottom.

2 Install the clamps around the cooling shields. Torque the hose clamps to 10 − 15 lb−in. (1.130 − 1.695 N.m).

3 Install the cooling hose and clamp onto the bottom cooling shield fitting. Torque the hose clamps to 10 − 15 lb−in. (1.130 − 1.695 N.m).

(d) If removed or loosened, install the clamp and bolt attaching the wiring harness to the loop clamp bracket. Lubricate bolt threads with Engine Oil P03−001. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(4) For engines equipped with 2.95 bleed valve thermocouples only: Install the W5J13 connector flange to the bracket on the main gearbox. Install the harness bracket (cutout inboard) to attach the connector flange between the two brackets. Align the bolt holes and install the bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 415.

(5) (Pre SB PW4ENG 72−572 or SB PW4ENG 75−106 or SB PW4ENG 72−756) Connect the W5P10 harness connector to the HPC secondary flow control valve located at the 9:30 o'clock position as follows. See Figure 402 (Sheet 1 or 2).

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

CAUTION: USE THE CORRECT ASSEMBLY TORQUE. USE OF THE WRONG ASSEMBLY TORQUES CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTENING PROTECTION.

(b) (Reference 2154) Tighten and torque the connector to 21 − 26 lb−in. (2.373 − 2.938 N.m). Lockwire the connector nut with AS3214−01 Lockwire.

NOTE: SB PW4ENG 72−572 or SB PW4ENG 75−106 or SB PW4ENG 72−756 removes connector W5P10 from the W5 wiring harness. See Figure 402 (Sheet 3).

(6) Connect the W5 harness connectors (given below) to the mating harness receptacles as follows. See Figure 402 and Figure 411. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND

CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:

− the connector coupling nut is fully tight
− the connector fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

Connector	Component	Location
W5P8	EEC Fuel Temperature Thermocouple	Fuel Pump Housing 4:30 O'clock
W5P1	Fuel Metering Unit (Rear Connector)	Front Of Fuel Pump 5 O'clock
W5P11	Ninth Stage Start/Stability (2.9) Bleed Valve Solenoid (Inboard Connector)	Intermediate Case 5 O'clock
W5P7	Variable Stator Vane Actuator (Top Connector)	4 O'clock
W5P6	EEC Alternator (Lower Connector)	Bottom Of Gearbox 7 O'clock
W5P5	Fuel/Oil Cooler Bypass Valve Solenoid (Rear Connector)	8 O'clock
W2P26	Harness Connector To W5J26 Harness Connector	11:30 O'clock

(CONTINUED)

Connector	Component	Location
W6P12	Harness Connector To W5J12 Harness Connector	3:30 O'clock

(7) (Pre SB PW4ENG 73−84) Connect the W5P8 connector of the harness to the EEC fuel temperature thermocouple probe as follows.

(8) (Post SB PW4ENG 73−84) For a thermocouple probe with a studded terminal type receptacle and for engines equipped with 2.95 bleed valve thermocouple install the wiring harness as follows.

(a) Install the wiring harness terminals to the thermocouple studs and install loosely the nuts to the thermocouple studs.

(b) Install the clamp, ground strap, and bolt loosely to the bracket on the housing.

CAUTION: TO PREVENT DAMAGE TO THE WIRING HARNESS, MAKE SURE THE THERMOCOUPLE STUD BOX DOES NOT TURN WHEN THE COUPLING NUT IS TORQUED.

(c) If necessary to align the thermocouple stud box, remove the lockwire from the thermocouple coupling nut to the adapter and loosen the coupling nut.

(d) Align the thermocouple stud box with the wiring harness connector.

(e) (Reference 2167) Hold the thermocouple stud box and torque the thermocouple probe coupling nut to 95 − 100 lb−in. (10.734 − 11.298 N.m). Do not let the thermocouple studs turn.

CAUTION: DO NOT ALIGN THE THERMOCOUPLE STUD BOX AFTER THE COUPLING NUT IS TORQUED. HOLD THE THERMOCOUPLE STUD BOX AND LOOSEN THE COUPLING NUT AND ALIGN THE THERMOCOUPLE STUD BOX AGAIN.

(f) Make sure the thermocouple stud box is aligned. Do not put too much force on the terminals of the wiring harness.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(g) (Reference 2273) Torque the alumel nuts (larger terminal studs) to 18 - 22 lb-in. (2.034 - 2.486 N.m).

(h) (Reference 2273) Torque the chromel nuts (smaller terminal studs) to 15 - 18 lb-in. (1.695 - 2.034 N.m).

(i) Install lockwire from the coupling nut to the adapter.

(j) Torque the bolt that attaches the clamp and ground strap to the bracket on the housing to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(9) For engines equipped with 2.95 bleed valve thermocouples only: Connect the thermocouple wires (leads) on the W5 harness to the thermocouple studs on the 2.9 bleed valve as follows:

(a) Remove the nuts from the thermocouple studs and attach the thermocouple wires (lead) with the nuts (round collar and inboard). Align the leads so that the wires are parallel to each other.

CAUTION: TOO MUCH TORQUE (MORE THAN THE MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(b) (Reference 2273) Torque the alumel nuts (larger terminal studs) to 18 - 22 lb-in. (2.034 - 2.486 N.m).

(c) (Reference 2273) Torque the chromel nuts (smaller terminal studs) to 15 - 18 lb-in. (1.695 - 2.034 N.m).

(10) Adjust the W5 harness for any necessary clearances as required. Install the clamps at all clamp points. Refer to the figures. Attach the clamps loosely to the engine with bolts and/or nuts, threads lubricated with Engine Oil P03−001.

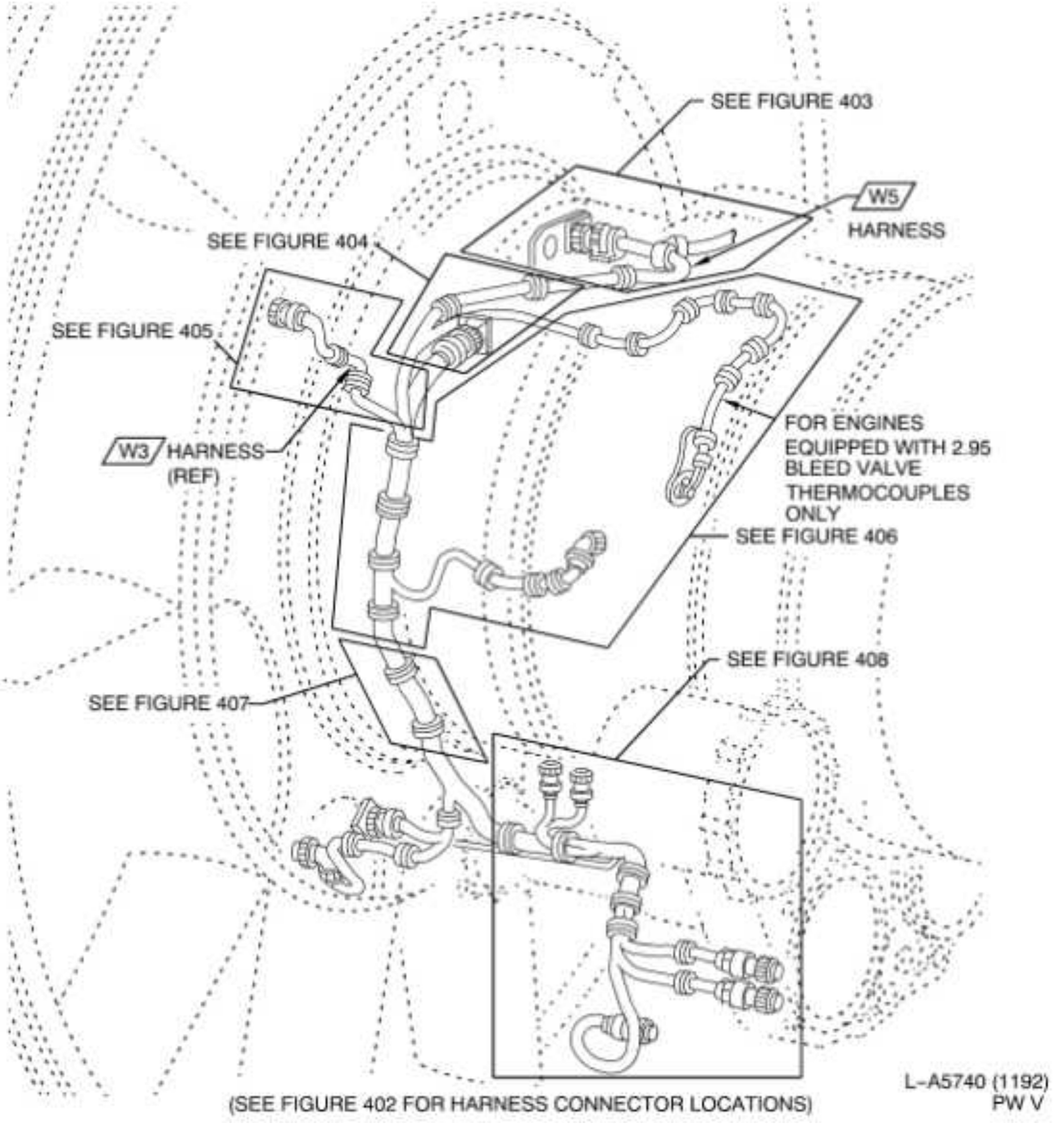
NOTE: Use different clamp sizes on the harnesses to prevent harness movement when tightened. See the Illustrated Parts Catalog for selection of the clamp sizes and part numbers.

(11) Make sure that the harnesses are not tight to the point where sharp bends are caused, and that the harnesses do not touch any engine parts or plumbing. Provide a drip loop on the leads where the wires run downward into the connector.

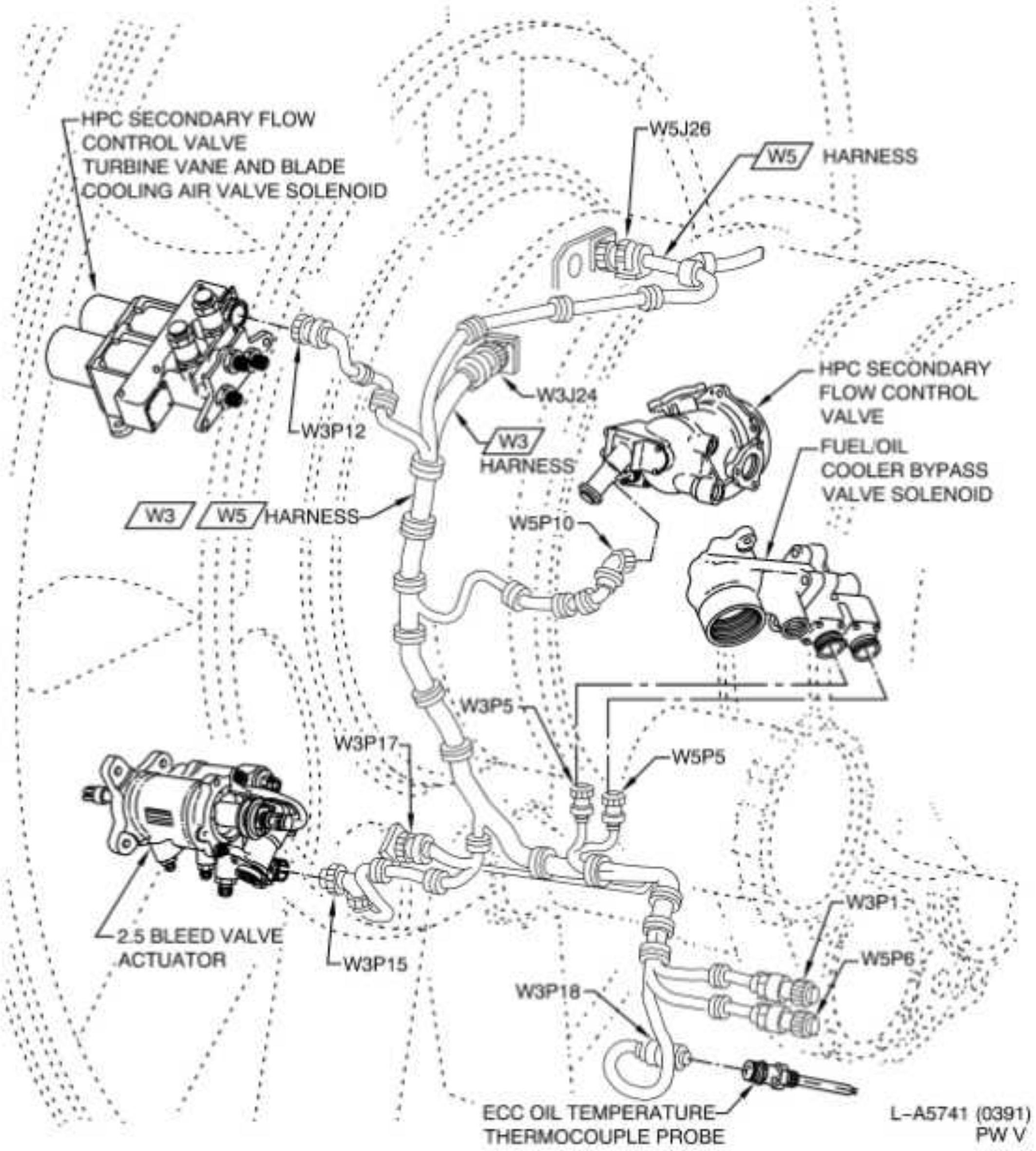
(12) Tighten all the previously installed clamp nuts and/or bolts to a torque of 36 − 40 lb−in. (4.067 − 4.519 N.m).

(13) Tie the harnesses as shown in Figures 409 and 419.

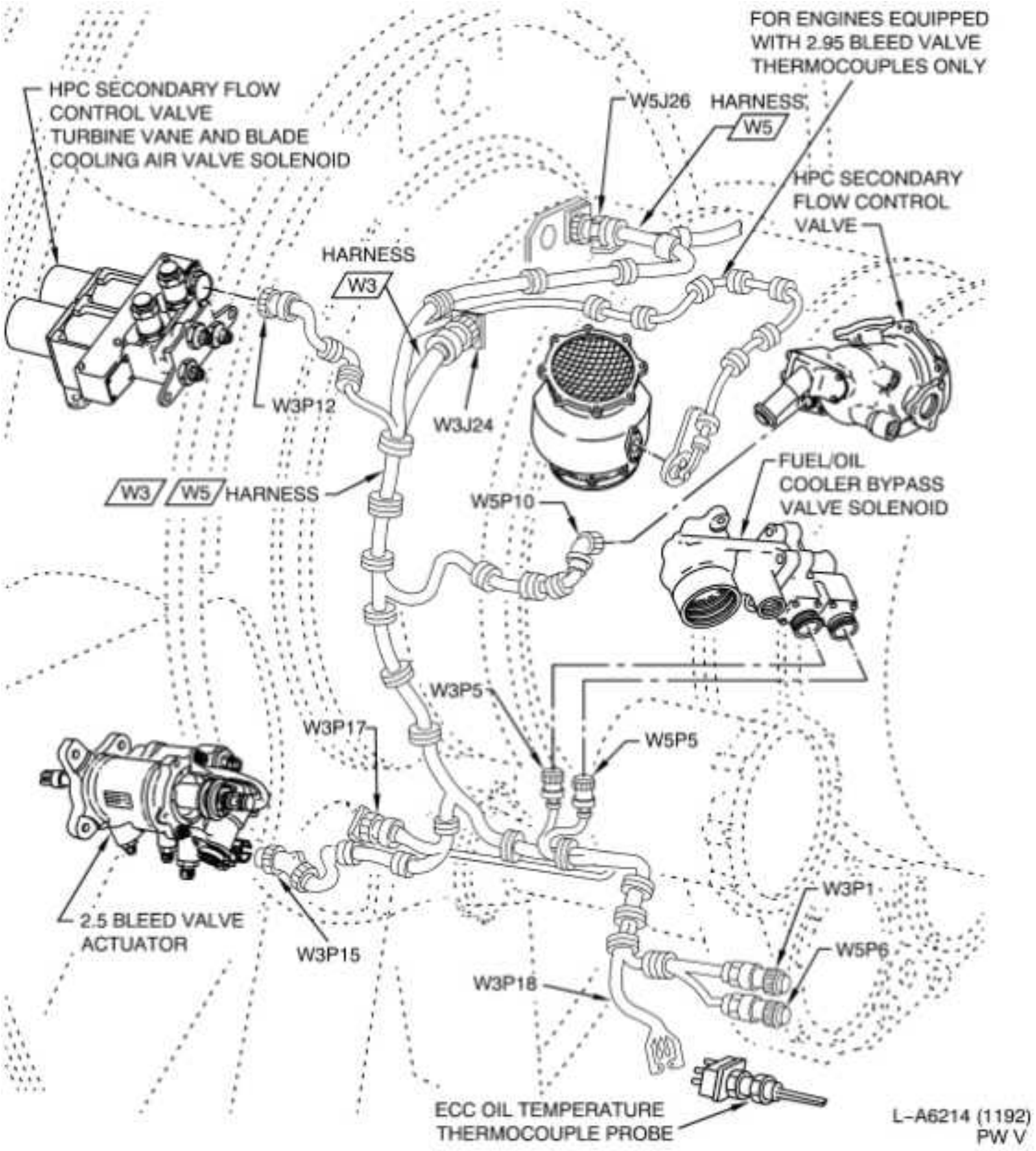
NOTE: Ties must be made with a clove hitch with an extra loop, followed by a square knot, as shown in Figure 409 and 419. The clove hitch and square knot must be tightened satisfactorily in place. The harnesses must not be stressed or damaged by overtightening the ties. Where the harness bundles are more than 1.500 inches (38.100 mm) in diameter, the lacing tape must be doubled. Cut the ends of the lacing tape to a length of 0.250 − 0.500 inch (6.350 − 12.700 mm).


SEE FIGURE 403
W5
HARNESS
SEE FIGURE 404
SEE FIGURE 405
W3 HARNESS (REF)
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
SEE FIGURE 406
SEE FIGURE 408
SEE FIGURE 407
(SEE FIGURE 402 FOR HARNESS CONNECTOR LOCATIONS)
L-A5740 (1192)
PW V

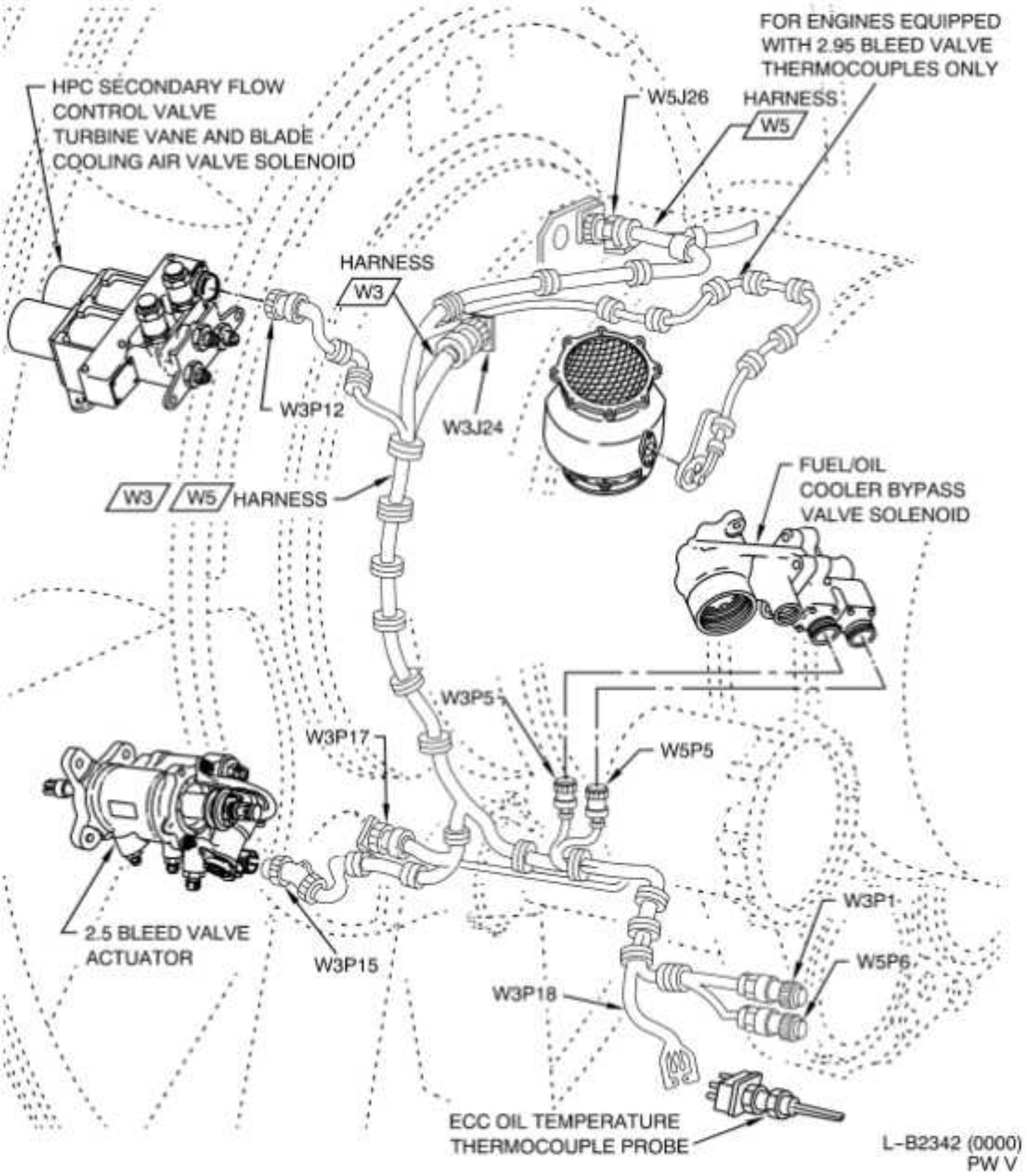
EEC Wiring Harness − W5 (Core Engine)
Figure 401
(Task 72−00−34−450−019)


HPC SECONDARY FLOW CONTROL VALVE TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
W5J26
W5 HARNESS
W3J24
HPC SECONDARY FLOW CONTROL VALVE
W3P12
W3 HARNESS
FUEL/OIL COOLER BYPASS VALVE SOLENOID
W3 W5 HARNESS
W5P10
W3P5
W3P17
W5P5
W3P1
2.5 BLEED VALVE ACTUATOR
W3P15
W5P6
W3P18
ECC OIL TEMPERATURE THERMOCOUPLE PROBE
L−A5741 (0391)
PW V

EEC Wiring Harness − W5 (Core Engine)
(Pre SB PW4ENG 73−84 Or SB PW4ENG 75−106)
Figure 402 (Sheet 1)
(Task 72−00−34−450−019)

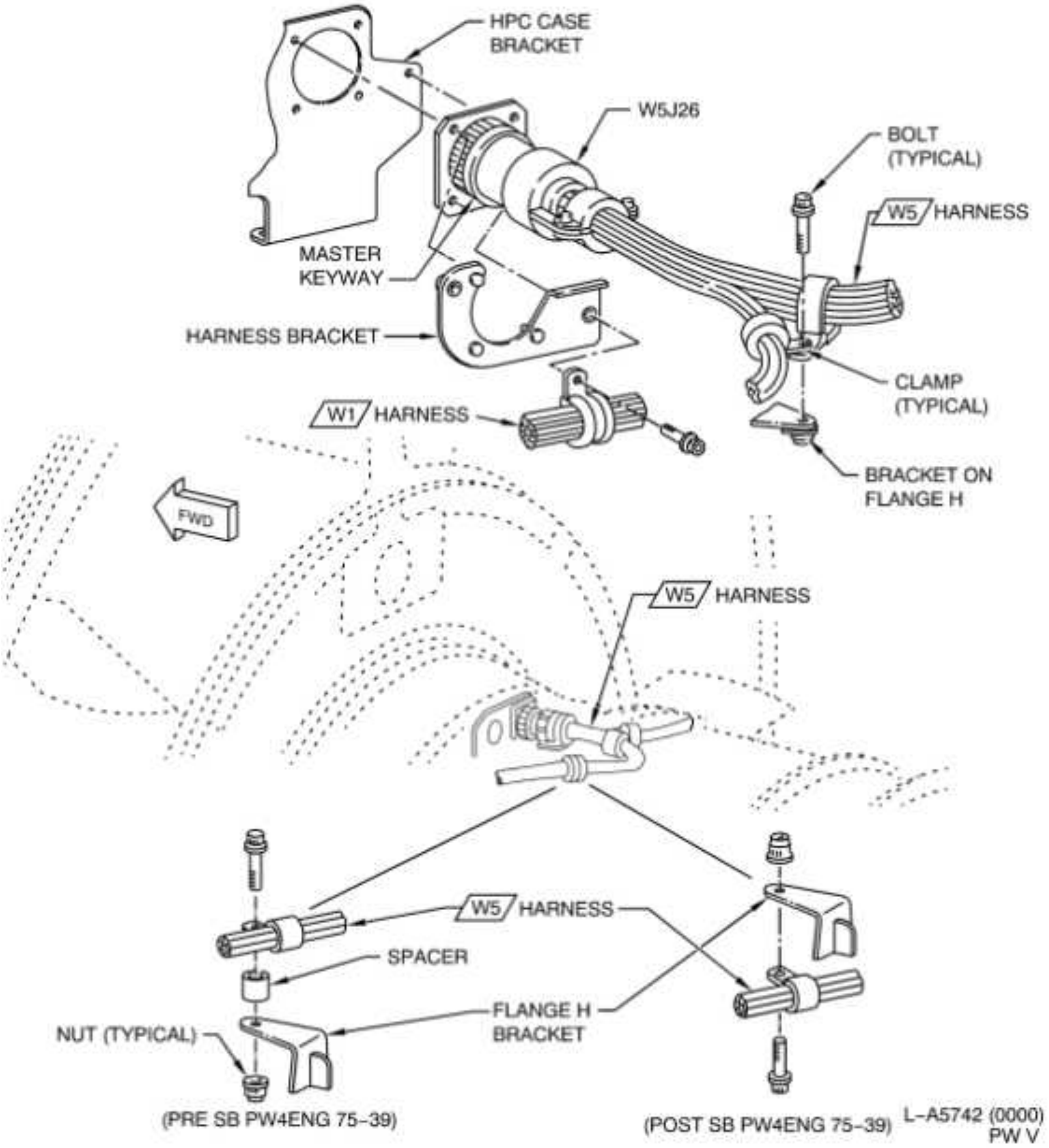

FOR ENGINES EQUIPPED
WITH 2.95 BLEED VALVE
THERMOCOUPLES ONLY
HPC SECONDARY FLOW
CONTROL VALVE
TURBINE VANE AND BLADE
COOLING AIR VALVE SOLENOID
W5J26
HARNESS
W5
HPC SECONDARY
FLOW CONTROL
VALVE
HARNESS
W3
W3P12
W3J24
FUEL/OIL
COOLER BYPASS
VALVE SOLENOID
W3
W5
HARNESS
W5P10
W3P5
W3P17
W5P5
W3P1
W5P6
2.5 BLEED VALVE
ACTUATOR
W3P15
W3P18
ECC OIL TEMPERATURE
THERMOCOUPLE PROBE
L−A6214 (1192)
PW V

EEC Wiring Harness − W5 (Core Engine)
(Post SB PW4ENG 73−84) (Pre SB PW4ENG 75−106)
Figure 402 (Sheet 2)
(Task 72−00−34−450−019)

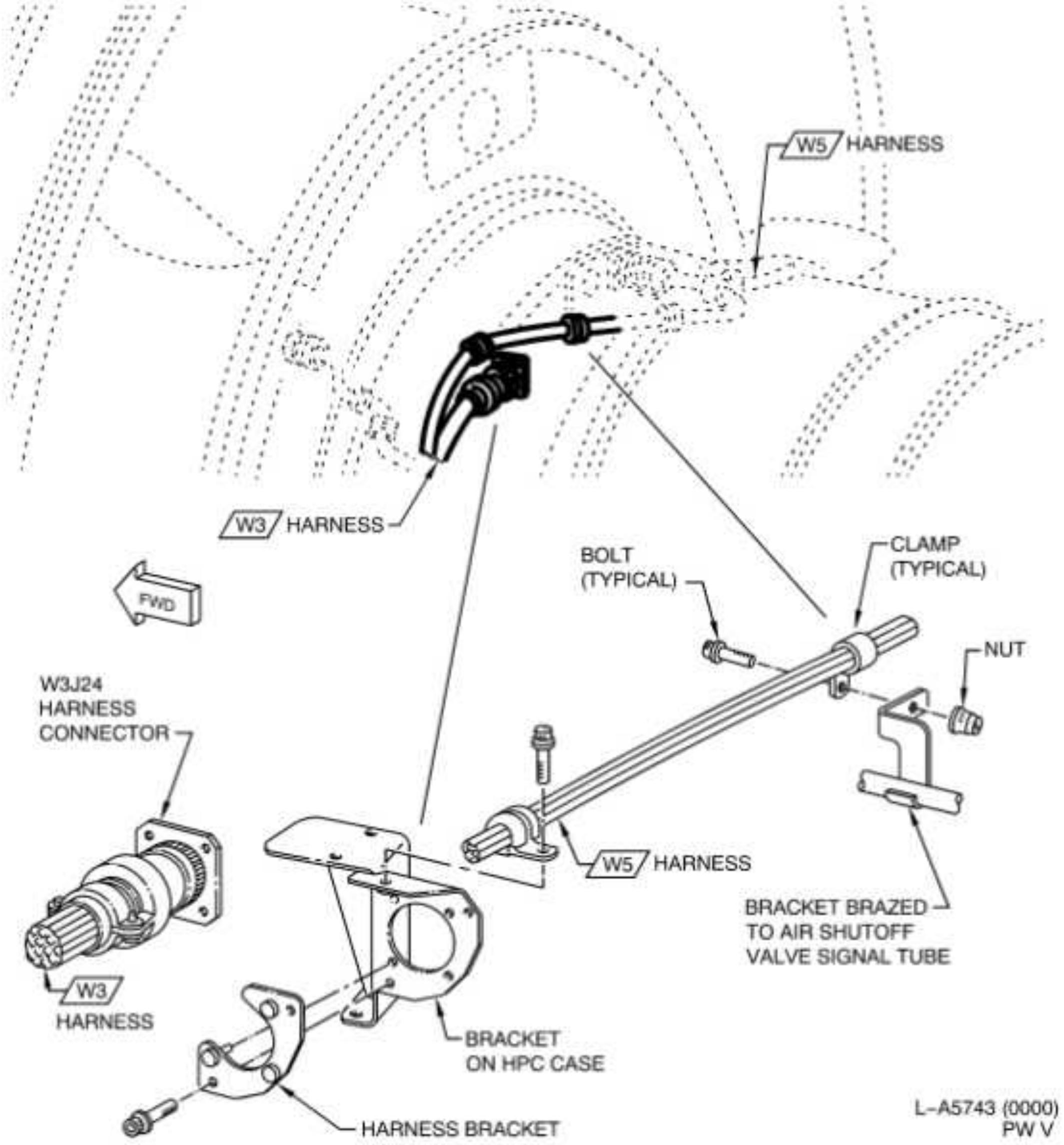

HPC SECONDARY FLOW CONTROL VALVE
TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
W5J26
HARNESS W5
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
HARNESS W3
W3P12
W3J24
W3 W5 HARNESS
FUEL/OIL COOLER BYPASS VALVE SOLENOID
W3P5
W3P17
W5P5
2.5 BLEED VALVE ACTUATOR
W3P15
W3P1
W5P6
W3P18
ECC OIL TEMPERATURE THERMOCOUPLE PROBE
L-B2342 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−84, SB PW4ENG 72−572 Or SB PW4ENG 75−106 Or SB PW4ENG 72−756) (For −3 Engines With CN After Engine Serial Number)
Figure 402 (Sheet 3)
(Task 72−00−34−450−019)

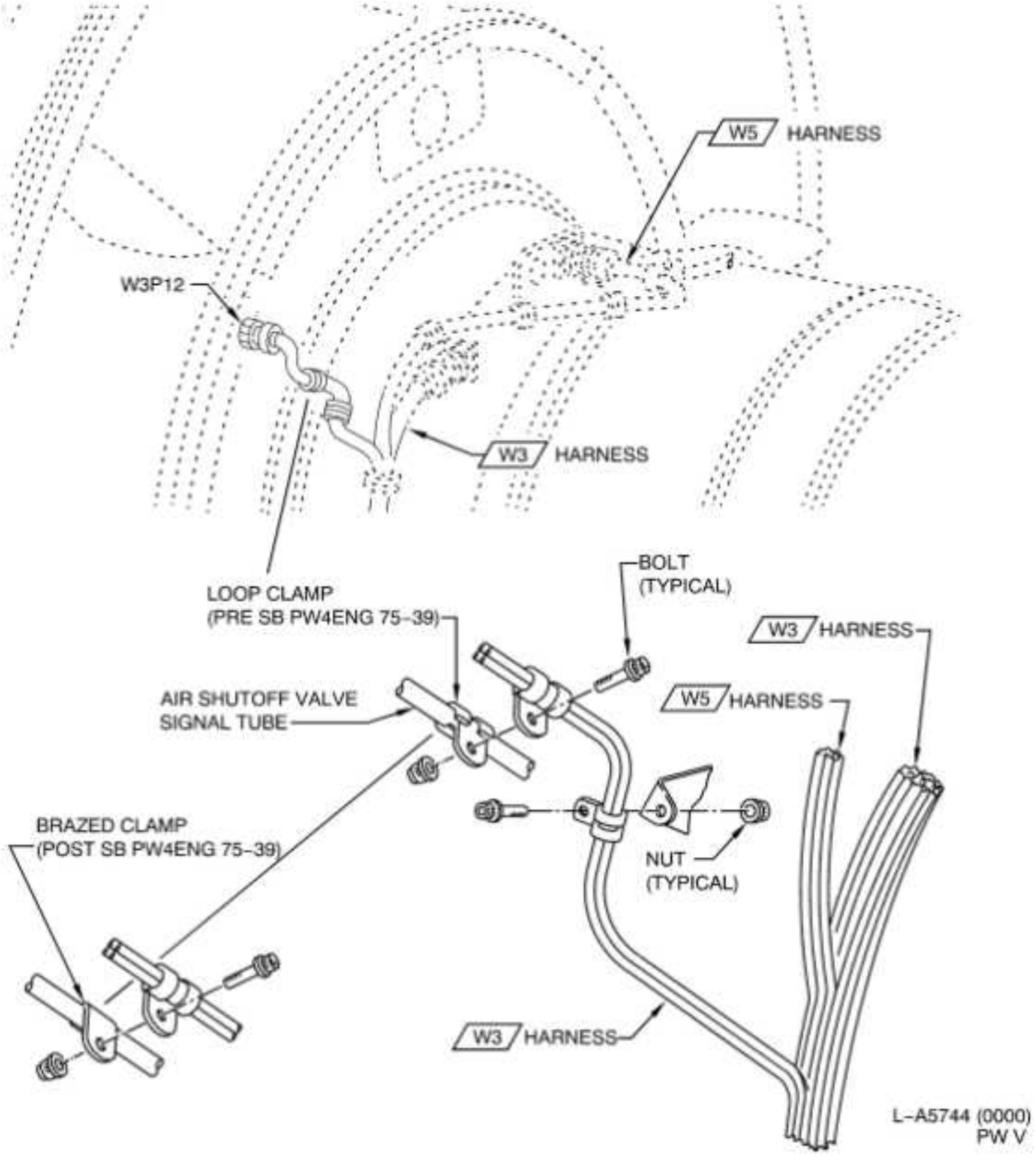
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−23


HPC CASE
BRACKET
W5J26
BOLT
(TYPICAL)
W5 HARNESS
MASTER
KEYWAY
HARNESS BRACKET
CLAMP
(TYPICAL)
W1 HARNESS
BRACKET ON
FLANGE H
FWD
W5 HARNESS
W5 HARNESS
SPACER
NUT (TYPICAL)
FLANGE H
BRACKET
(PRE SB PW4ENG 75-39)
(POST SB PW4ENG 75-39)
L-A5742 (0000)
PW V

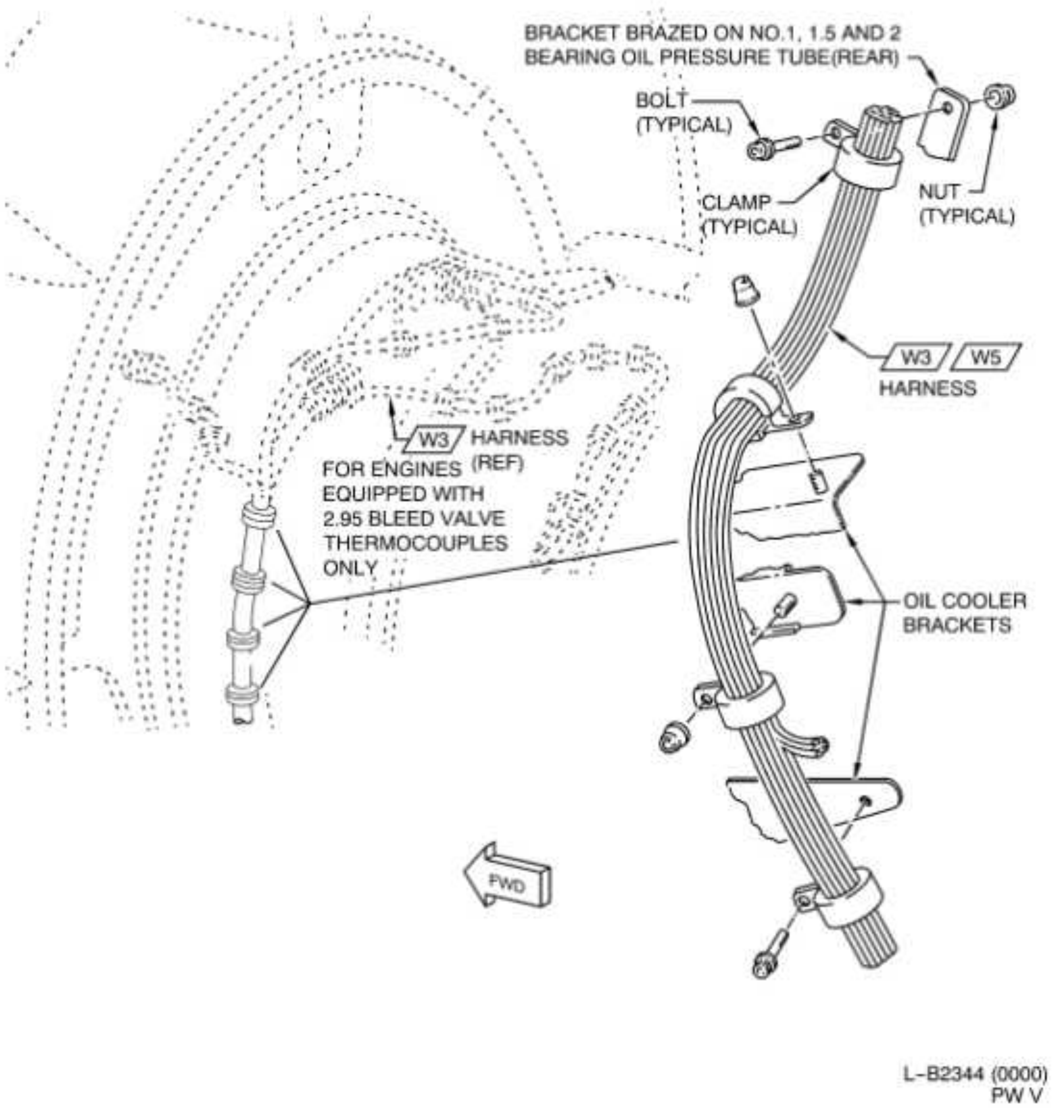
EEC Wiring Harness − W5 (Core Engine)
Figure 403
(Task 72−00−34−450−019)


W5 HARNESS
W3 HARNESS
BOLT (TYPICAL)
CLAMP (TYPICAL)
FWD
NUT
W3J24 HARNESS CONNECTOR
W5 HARNESS
BRACKET BRAZED TO AIR SHUTOFF VALVE SIGNAL TUBE
W3 HARNESS
BRACKET ON HPC CASE
HARNESS BRACKET
L−A5743 (0000)
PW V

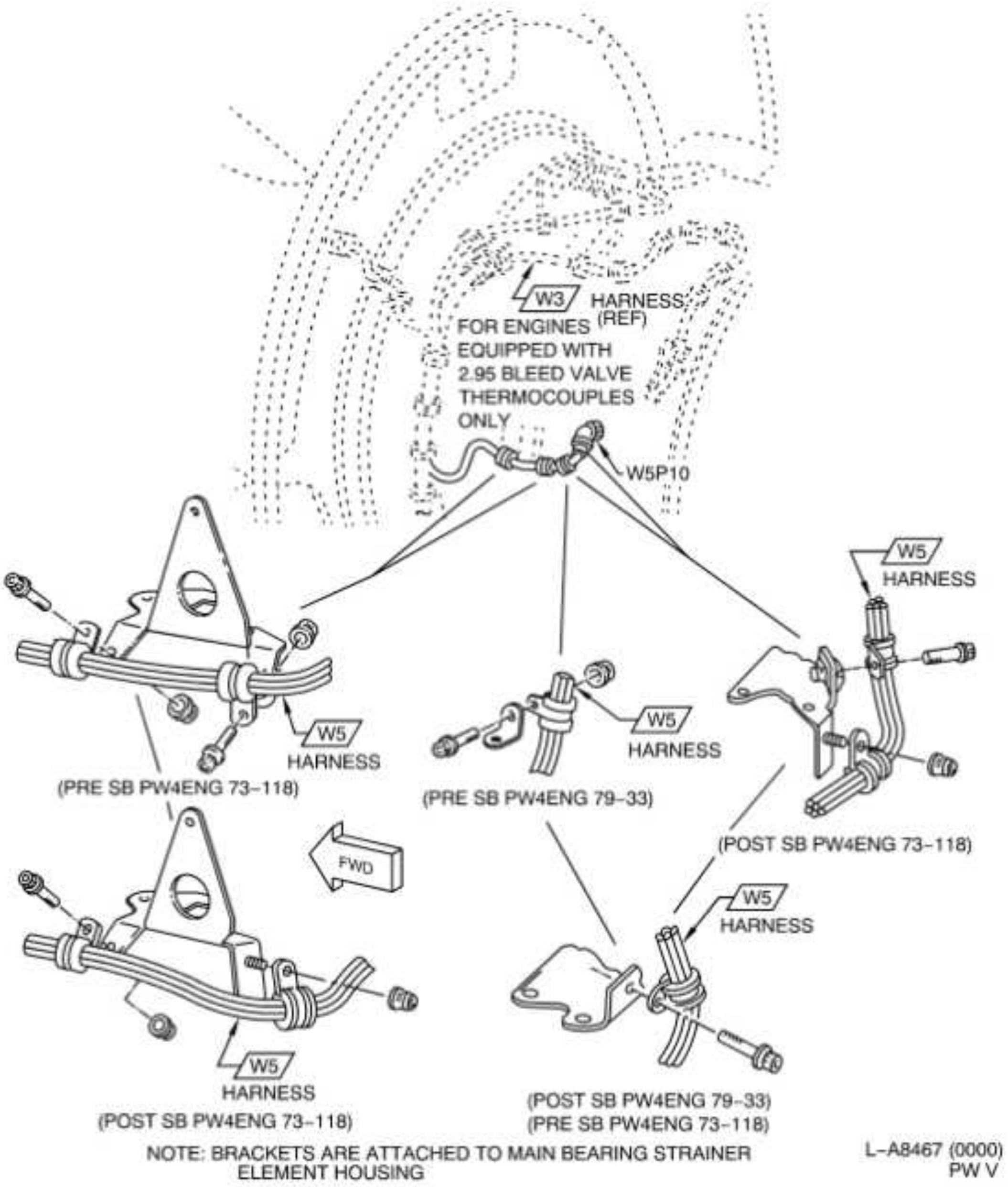
EEC Wiring Harness − W5 (Core Engine)
Figure 404
(Task 72−00−34−450−019)


W5 HARNESS
W3P12
W3 HARNESS
LOOP CLAMP
(PRE SB PW4ENG 75-39)
BOLT
(TYPICAL)
W3 HARNESS
AIR SHUTOFF VALVE
SIGNAL TUBE
W5 HARNESS
BRAZED CLAMP
(POST SB PW4ENG 75-39)
NUT
(TYPICAL)
W3 HARNESS
L-A5744 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine)
Figure 405
(Task 72−00−34−450−019)

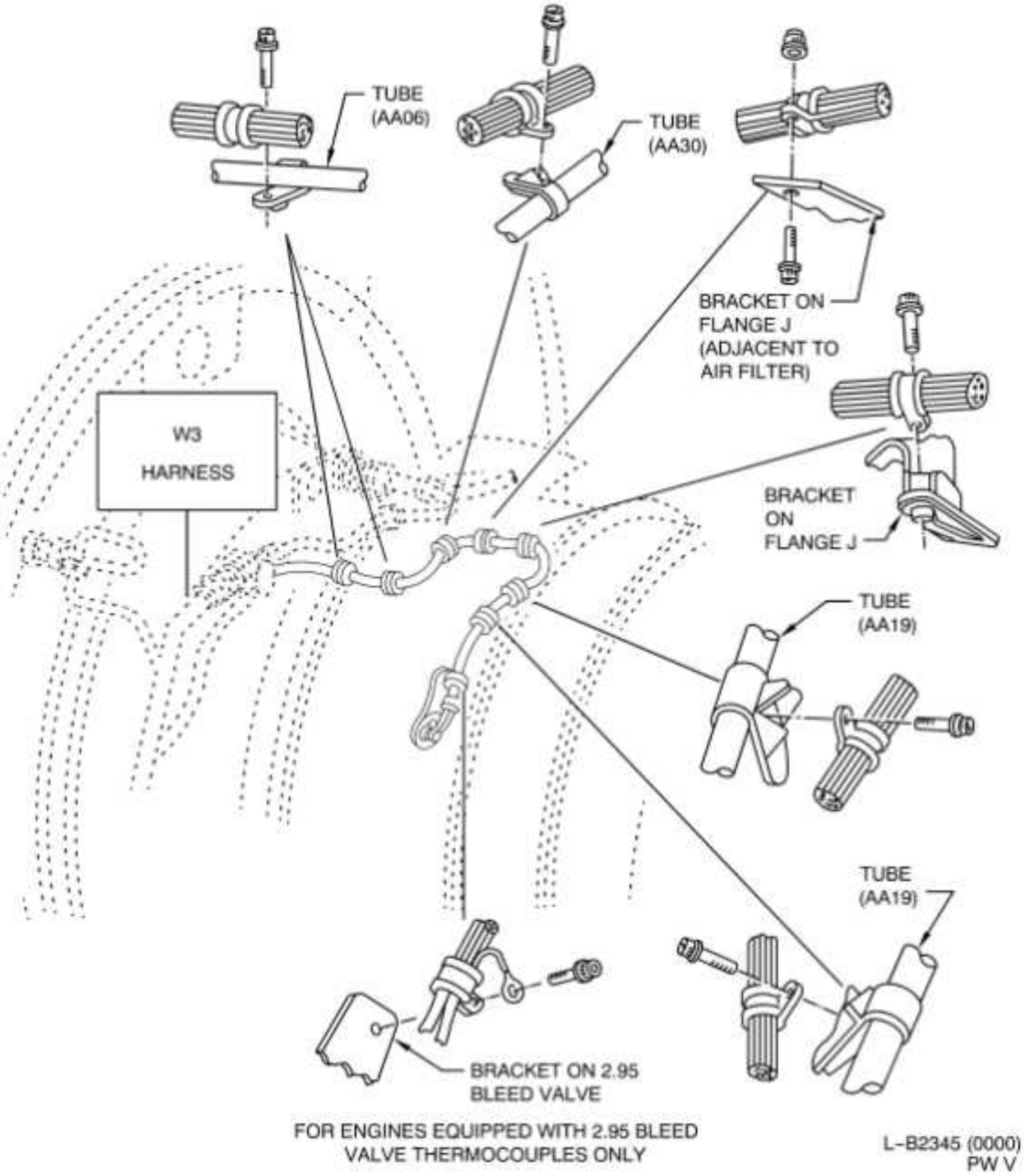

BRACKET BRAZED ON NO.1, 1.5 AND 2
BEARING OIL PRESSURE TUBE(REAR)
BOLT (TYPICAL)
CLAMP (TYPICAL)
NUT (TYPICAL)
W3 / W5 HARNESS
W3 HARNESS (REF)
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
OIL COOLER BRACKETS
FWD
L-B2344 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine)
Figure 406 (Sheet 1)
(Task 72−00−34−450−019)

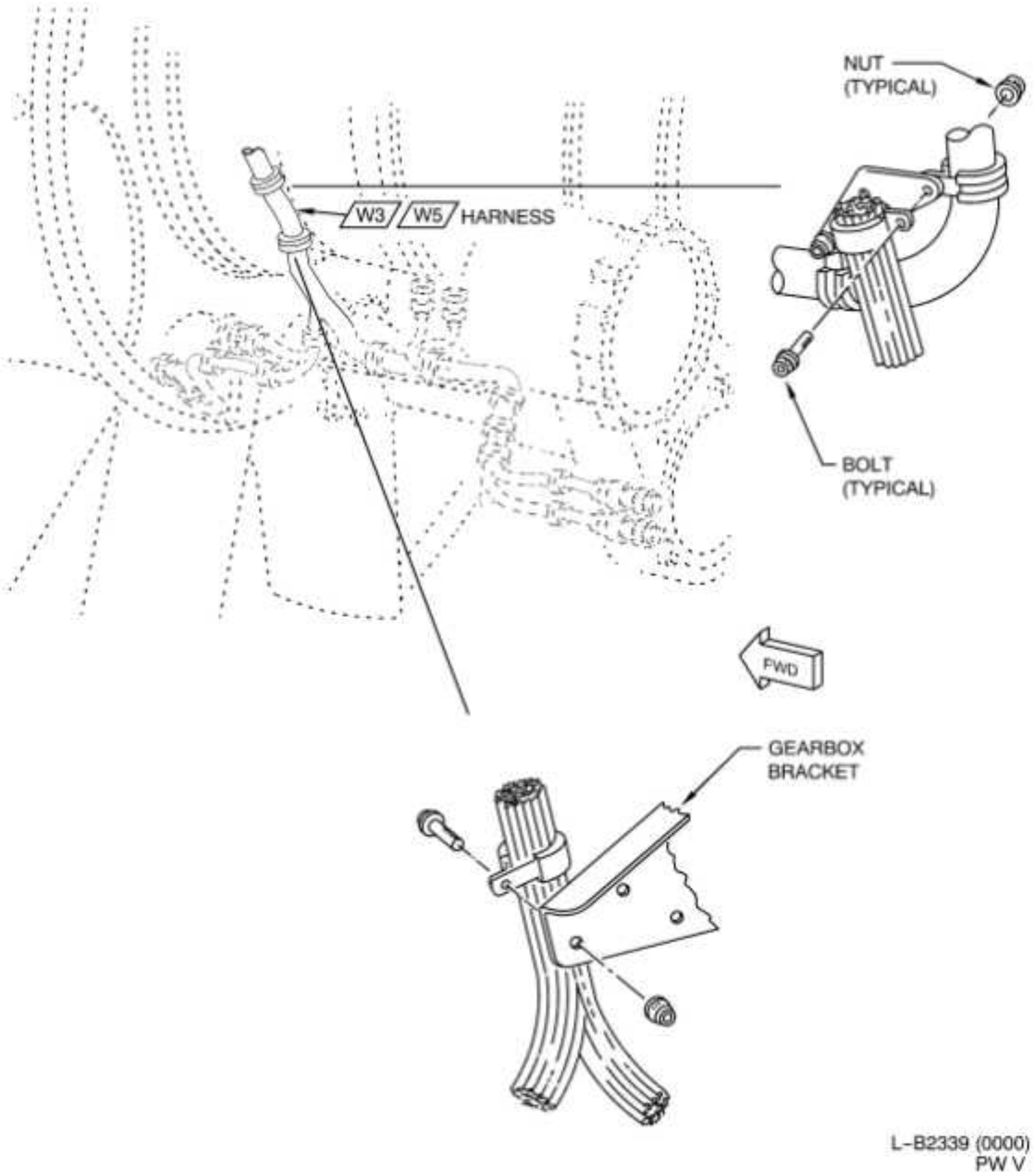

W3 HARNESS (REF)
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5P10
W5 HARNESS
W5 HARNESS
(PRE SB PW4ENG 73-118)
W5 HARNESS
(PRE SB PW4ENG 79-33)
W5 HARNESS
(POST SB PW4ENG 73-118)
FWD
W5 HARNESS
W5 HARNESS
(POST SB PW4ENG 73-118)
(POST SB PW4ENG 79-33)
(PRE SB PW4ENG 73-118)
NOTE: BRACKETS ARE ATTACHED TO MAIN BEARING STRAINER ELEMENT HOUSING
L-A8467 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine) (Pre SB PW4ENG 75−106)
Figure 406 (Sheet 2)
(Task 72−00−34−450−019)

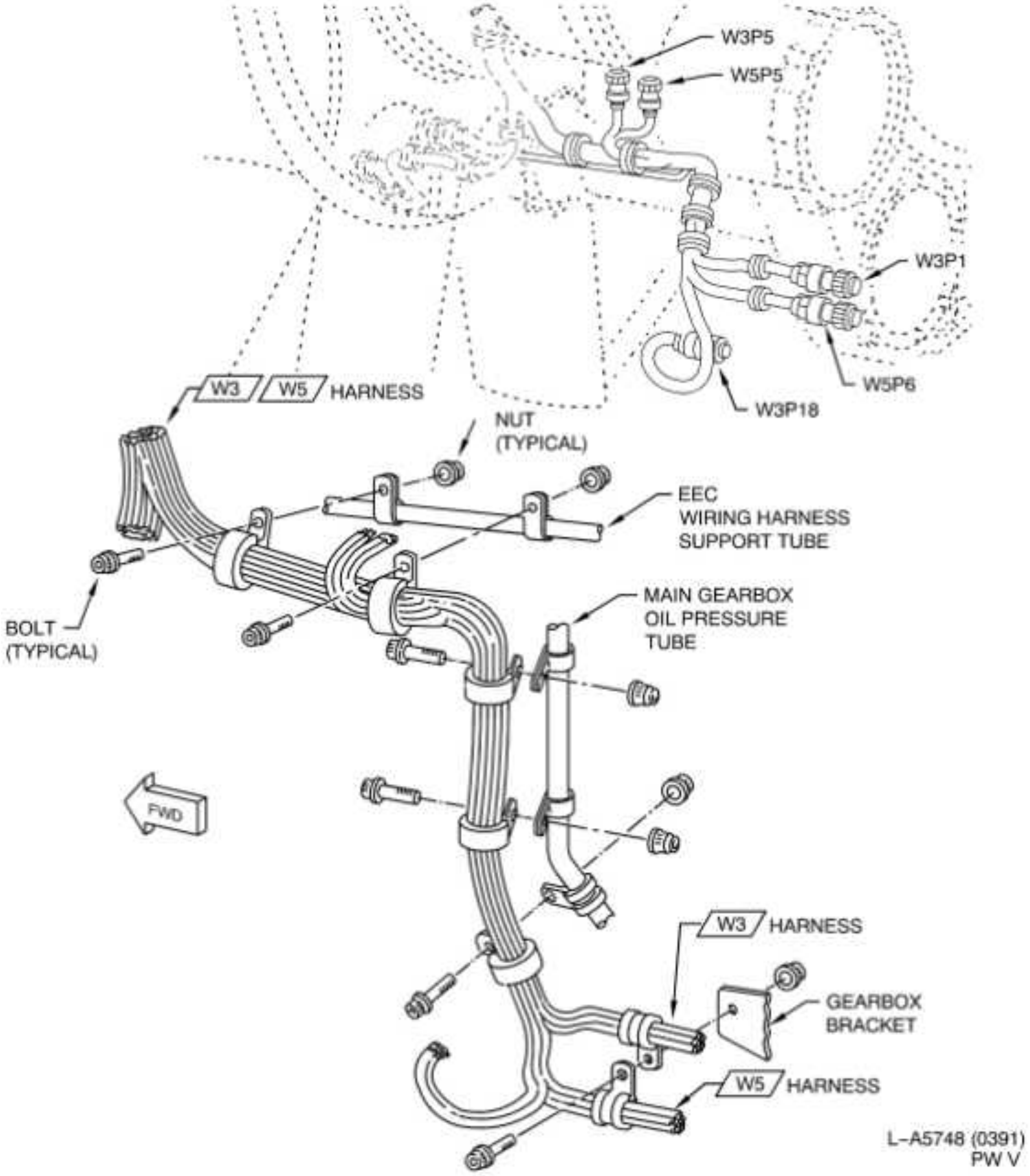
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−23


TUBE (AA06)
TUBE (AA30)
BRACKET ON FLANGE J (ADJACENT TO AIR FILTER)
W3 HARNESS
BRACKET ON FLANGE J
TUBE (AA19)
TUBE (AA19)
BRACKET ON 2.95 BLEED VALVE
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
L-B2345 (0000)
PW V

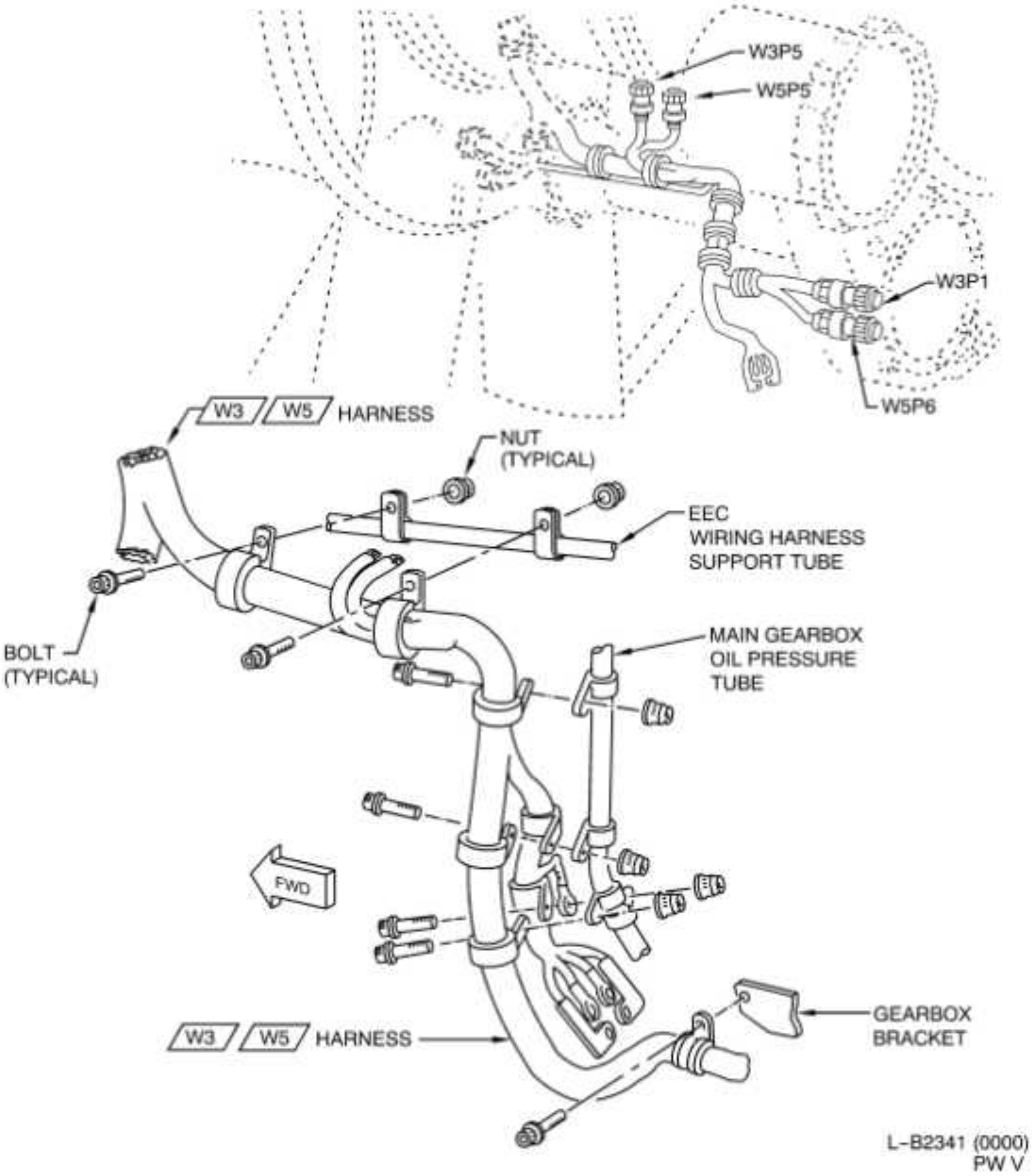
EEC Wiring Harness − W5 (Core Engine)
Figure 406 (Sheet 3)
(Task 72−00−34−450−019)


NUT
(TYPICAL)
W3
W5
HARNESS
BOLT
(TYPICAL)
FWD
GEARBOX
BRACKET
L-B2339 (0000)
PW V

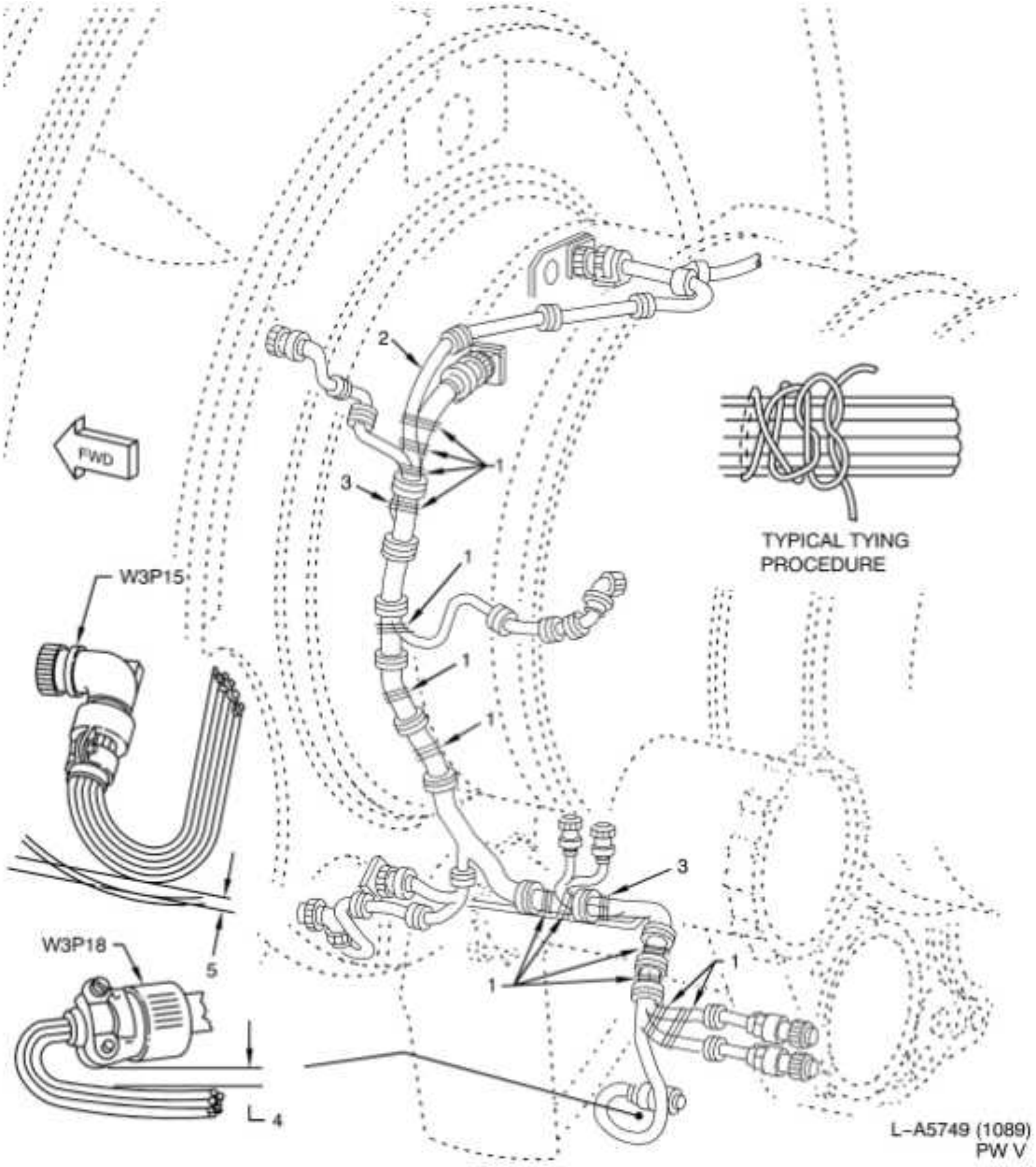
EEC Wiring Harness − W5 (Core Engine)
Figure 407
(Task 72−00−34−450−019)


W3P5
W5P5
W3P1
W5P6
W3P18
W3 / W5 HARNESS
NUT (TYPICAL)
EEC WIRING HARNESS SUPPORT TUBE
BOLT (TYPICAL)
MAIN GEARBOX OIL PRESSURE TUBE
FWD
W3 HARNESS
GEARBOX BRACKET
W5 HARNESS
L−A5748 (0391)
PW V

EEC Wiring Harness − W5 (Core Engine) (Pre SB PW4ENG 73−84)
Figure 408 (Sheet 1)
(Task 72−00−34−450−019)


W3P5
W5P5
W3P1
W5P6
W3 / W5 HARNESS
NUT (TYPICAL)
EEC WIRING HARNESS SUPPORT TUBE
BOLT (TYPICAL)
MAIN GEARBOX OIL PRESSURE TUBE
FWD
W3 / W5 HARNESS
GEARBOX BRACKET
L-B2341 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−84) (For −3 Engines With CN After Engine Serial Number)
Figure 408 (Sheet 2)
(Task 72−00−34−450−019)

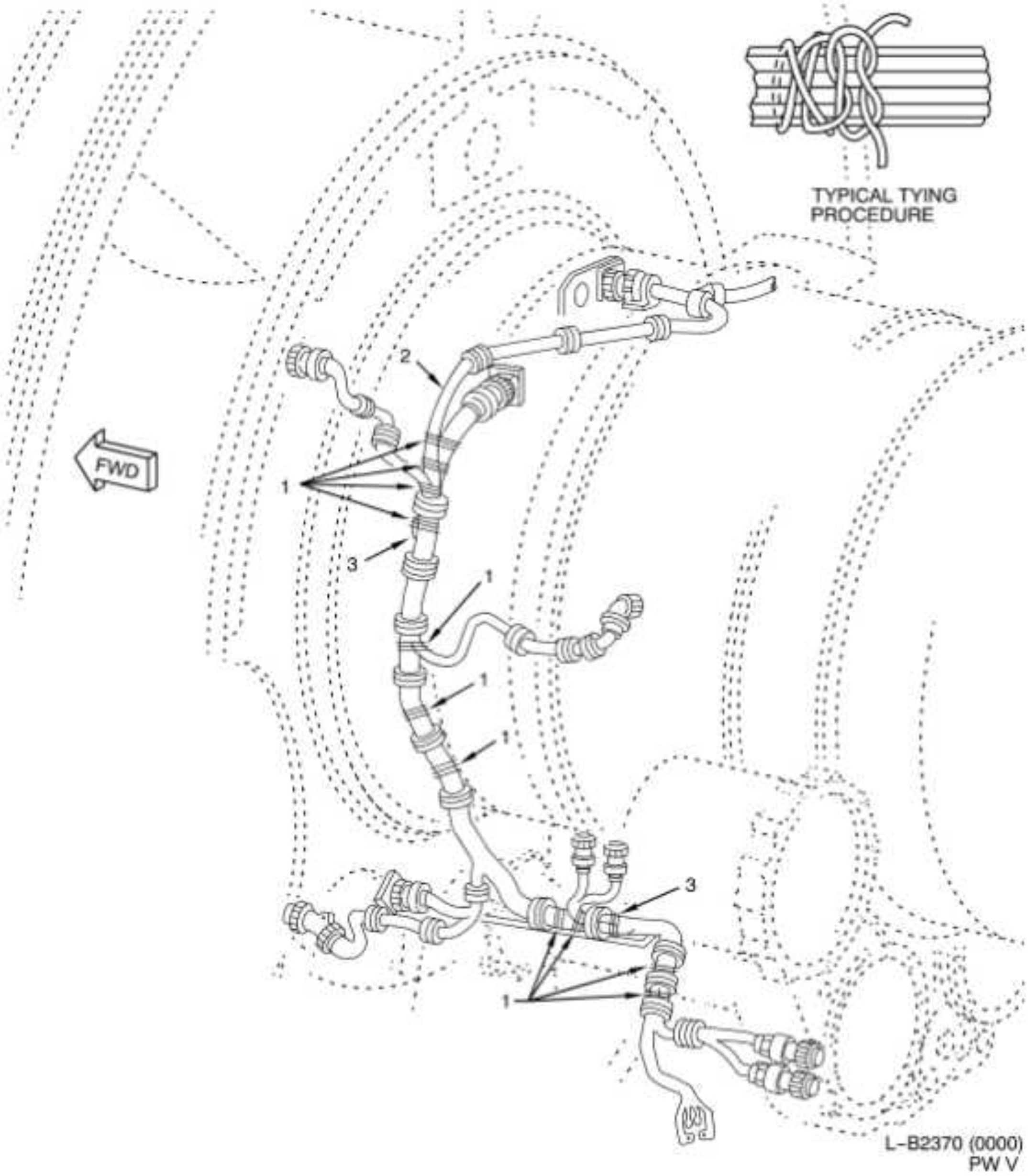

2
1
3
1
1
1
3
1
1
W3P15
5
W3P18
4
FWD
TYPICAL TYING PROCEDURE
L−A5749 (1089)
PW V

EEC Wiring Harness − W5 (Core Engine)
(Pre SB PW4ENG 73−84 Or SB PW4ENG 75−106)
Figure 409 (Sheet 1)
(Task 72−00−34−450−019)

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−23

1. Tie
2. The Harness Must Be Put Forward In This Location.
3. Make A Loop In The Harness And Put The Loop Through The Clamp. Tie The Loop And The Harness Together.
4. 0.375 Inch (9.525 mm) Minimum Clearance Required Between The W3P18 Connector And The Harness.
5. 0.500 Inch (12.700 mm) Minimum Clearance Required Between The W3 Harness And The Intermediate Case Vee Groove.

Key to Figure 409 (Sheet 1)

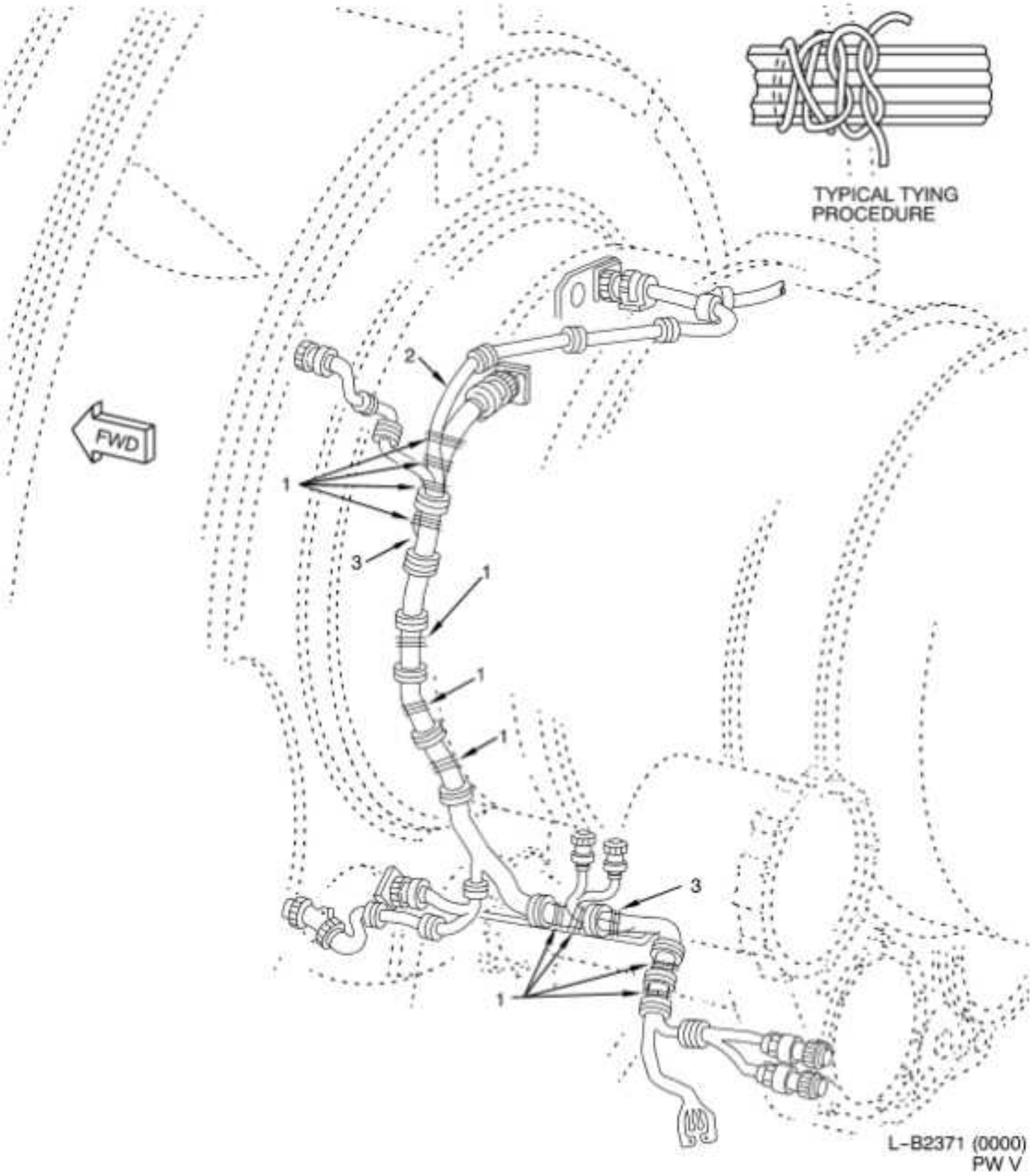

TYPICAL TYING PROCEDURE
FWD
1
2
3
1
3
1
1
1
3
1
L-B2370 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine)
(Post SB PW4ENG 73−84) (Pre SB PW4ENG 75−106)
Figure 409 (Sheet 2)
(Task 72−00−34−450−019)

1. Tie
2. The Harness Must Be Put Forward In This Location.
3. Make A Loop In The Harness And Put The Loop Through The Clamp. Tie The Loop And The Harness Together.

Key to Figure 409 (Sheet 2)

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−23

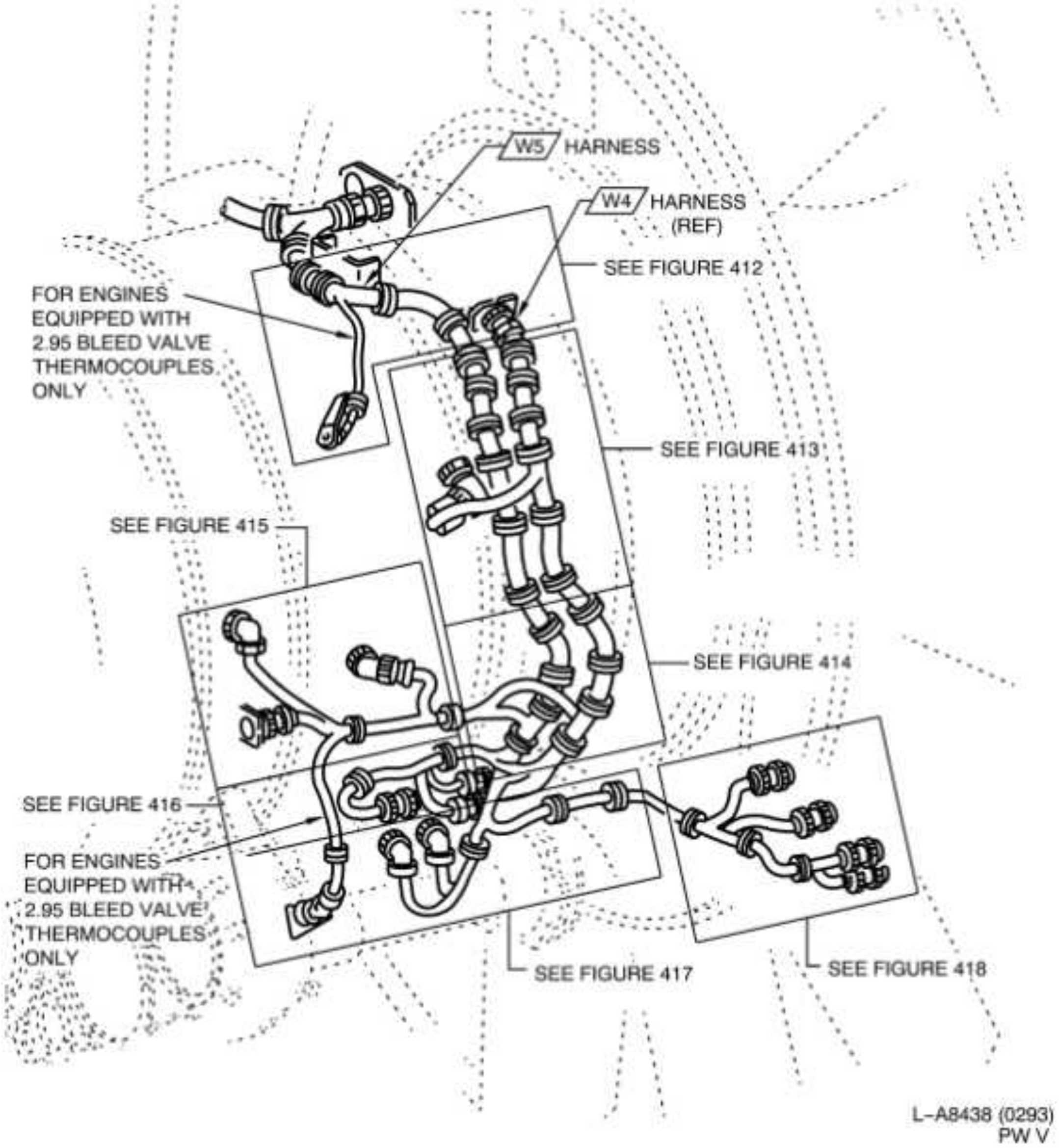

TYPICAL TYING PROCEDURE
FWD
2
1
3
1
1
1
3
1
L−B2371 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 72−572 Or SB PW4ENG 75−106 Or SB PW4ENG 72−756) (For −3 Engines With CN After Engine Serial Number)
Figure 409 (Sheet 3)
(Task 72−00−34−450−019)

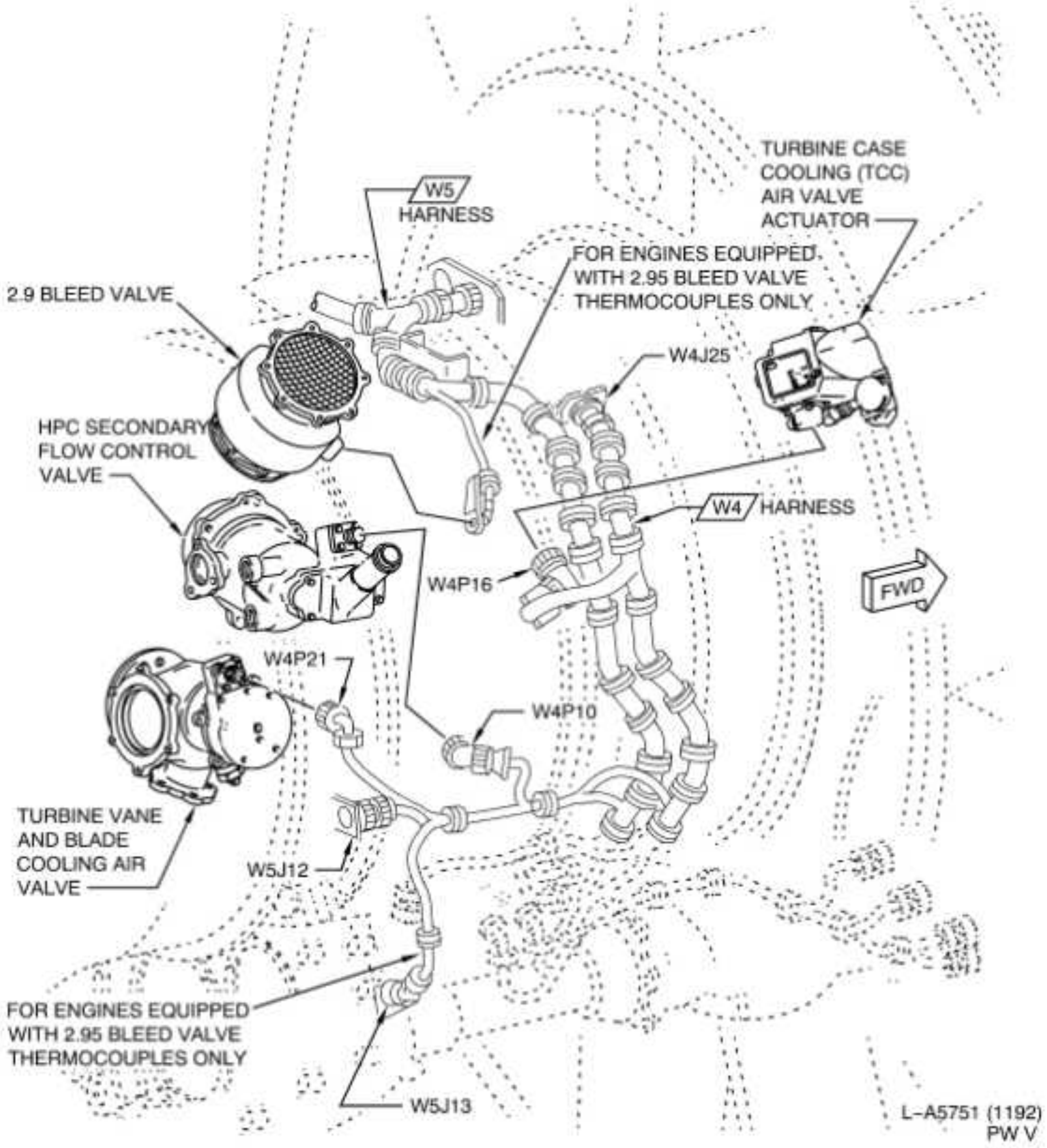
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−23

1. Tie
2. The Harness Must Be Put Forward In This Location.
3. Make A Loop In The Harness And Put The Loop Through The Clamp. Tie The Loop And The Harness Together.

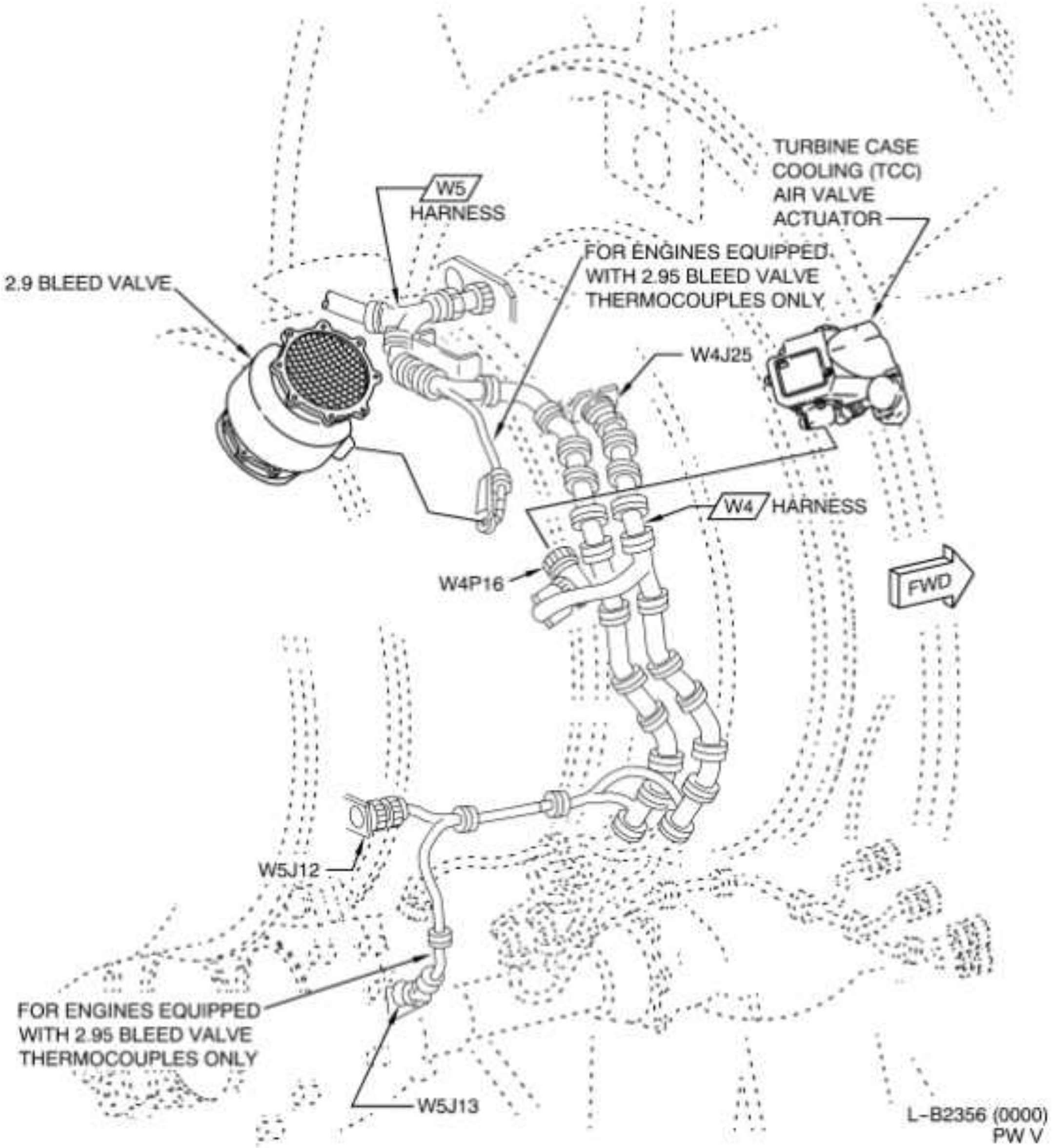
Key to Figure 409 (Sheet 3)


W5 HARNESS
W4 HARNESS (REF)
SEE FIGURE 412
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
SEE FIGURE 413
SEE FIGURE 415
SEE FIGURE 414
SEE FIGURE 416
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
SEE FIGURE 417
SEE FIGURE 418
L−A8438 (0293)
PW V

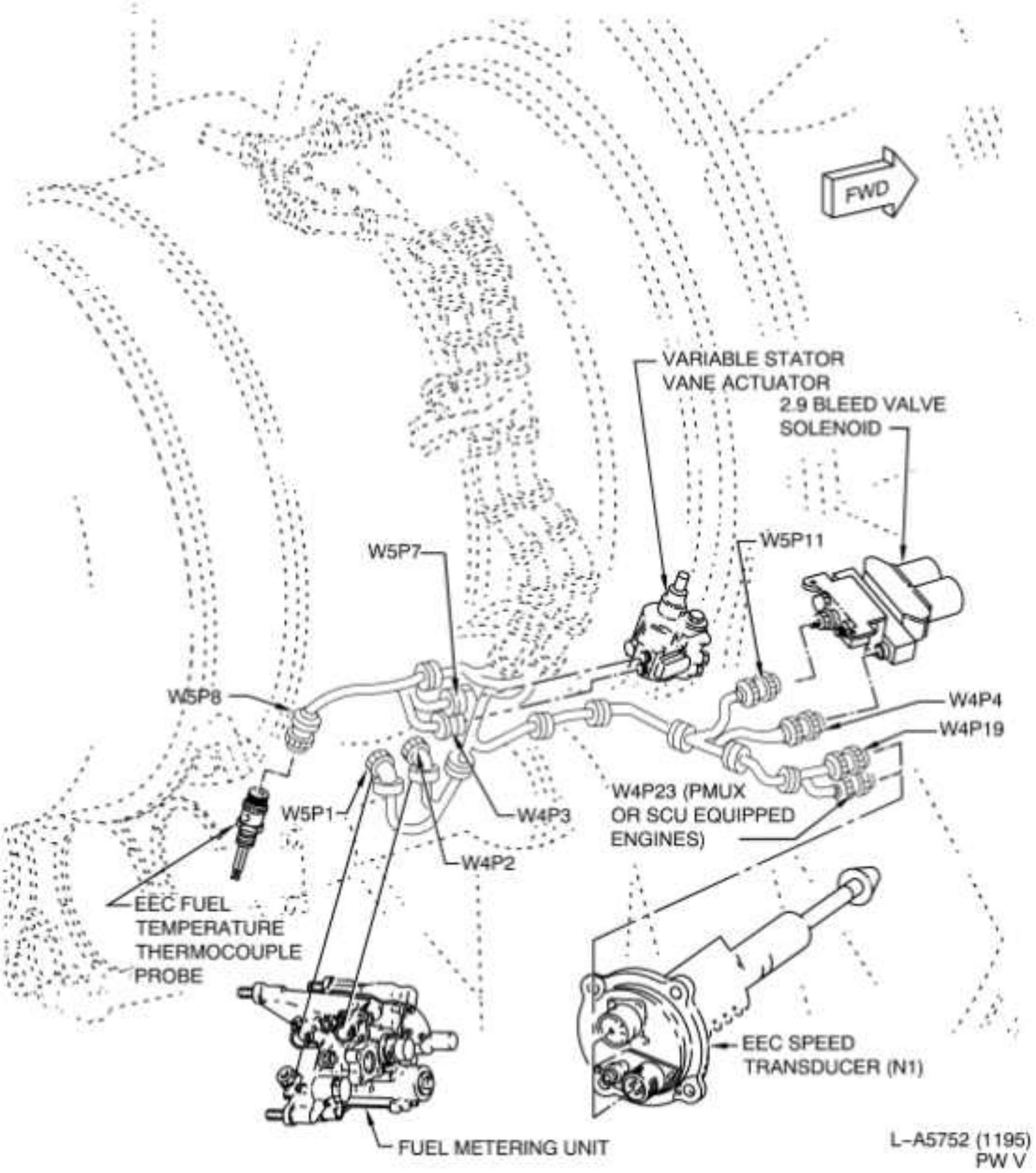
EEC Wiring Harness − W5 (Core Engine)
Figure 410
(Task 72−00−34−450−019)


TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
W5 HARNESS
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
2.9 BLEED VALVE
W4J25
HPC SECONDARY FLOW CONTROL VALVE
W4 HARNESS
W4P16
FWD
W4P21
W4P10
TURBINE VANE AND BLADE COOLING AIR VALVE
W5J12
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5J13
L−A5751 (1192)
PW V

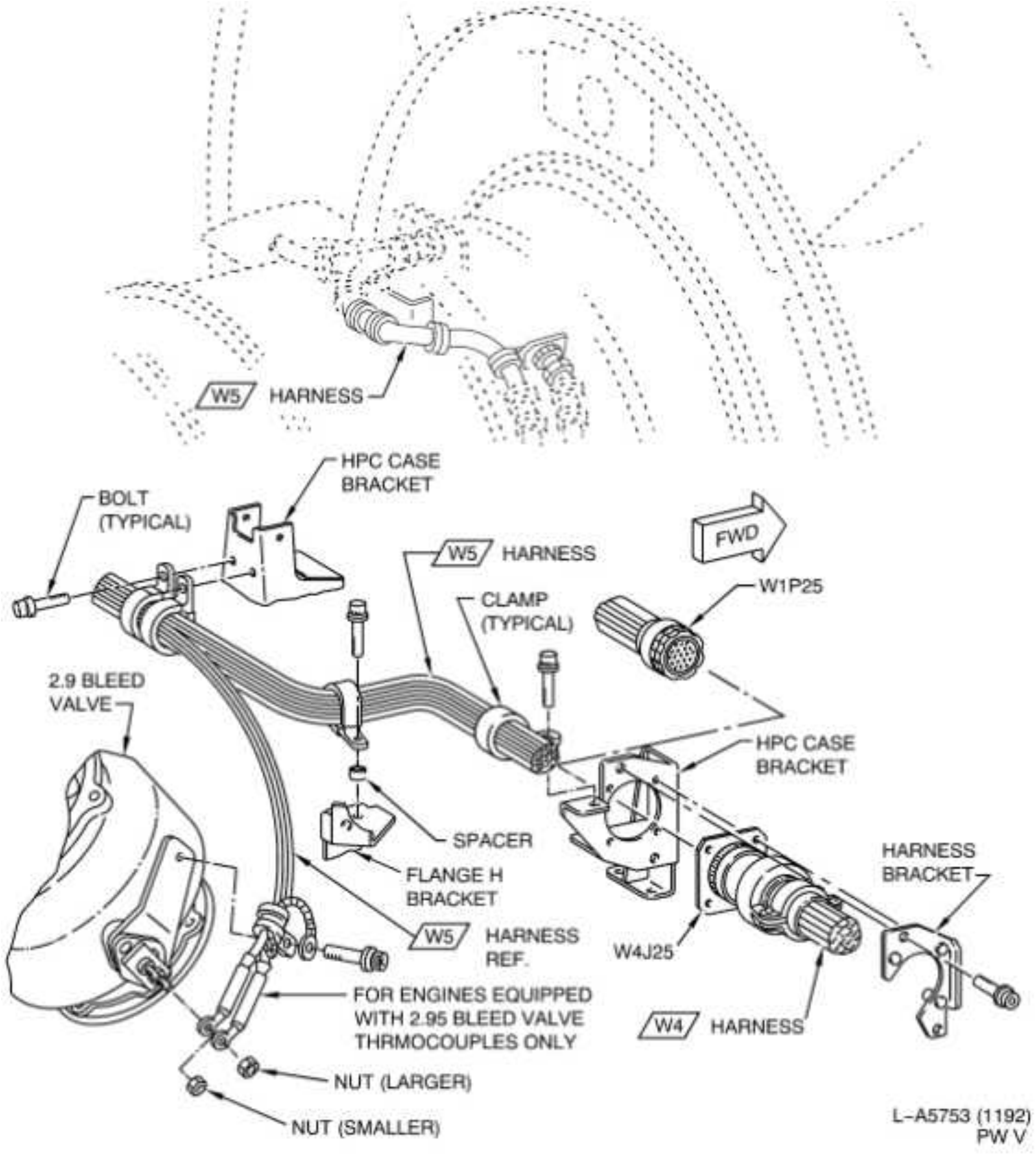
EEC Wiring Harness − W5 (Core Engine) (Pre SB PW4ENG 75−106)
Figure 411 (Sheet 1)
(Task 72−00−34−450−019)


TURBINE CASE
COOLING (TCC)
AIR VALVE
ACTUATOR
W5
HARNESS
2.9 BLEED VALVE
FOR ENGINES EQUIPPED
WITH 2.95 BLEED VALVE
THERMOCOUPLES ONLY
W4J25
W4
HARNESS
W4P16
FWD
W5J12
FOR ENGINES EQUIPPED
WITH 2.95 BLEED VALVE
THERMOCOUPLES ONLY
W5J13
L-B2356 (0000)
PW V

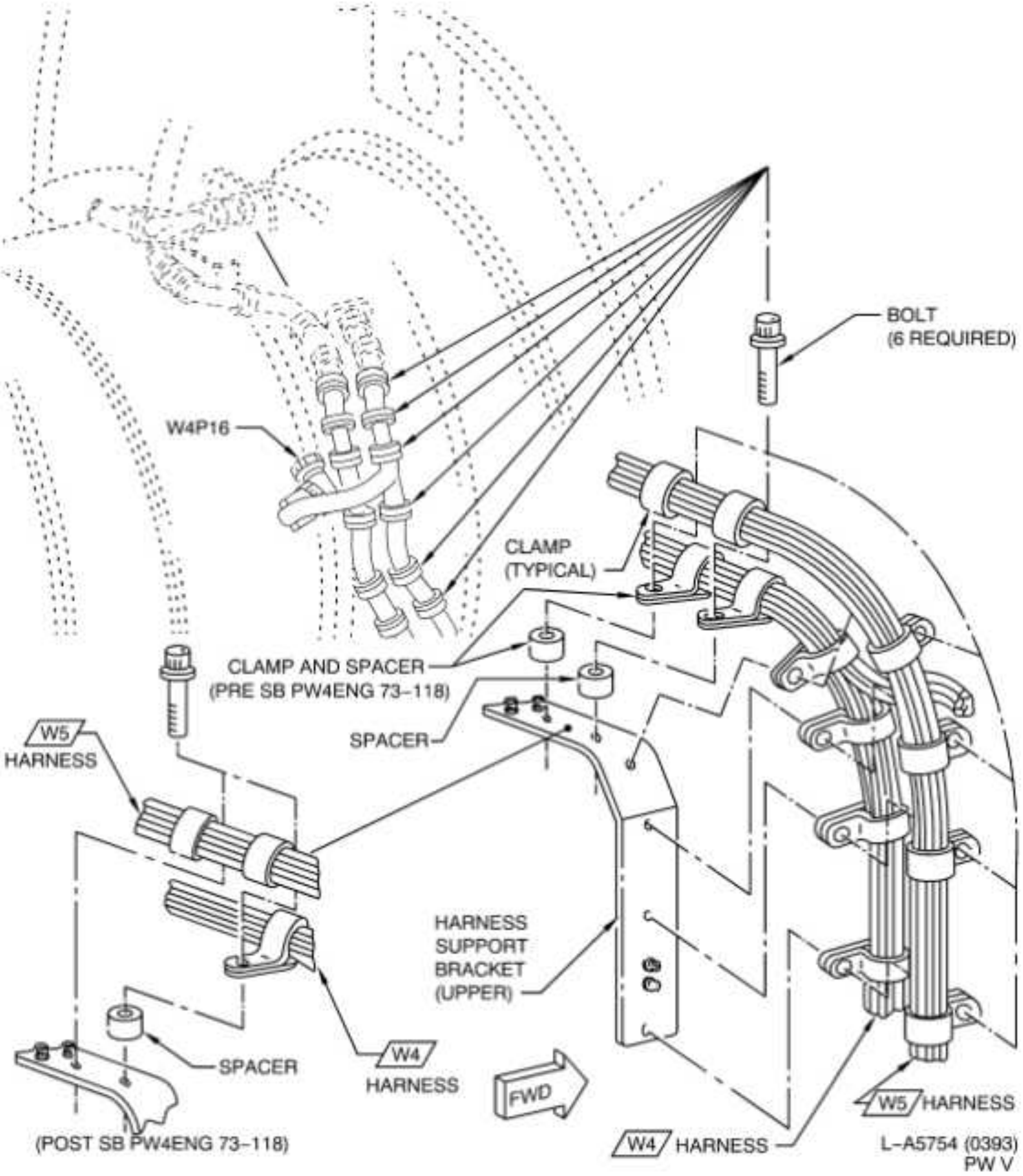
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 72−572 Or SB PW4ENG 75−106 Or SB PW4ENG 72−756) (For −3 Engines With CN After Engine Serial Number)
Figure 411 (Sheet 2)
(Task 72−00−34−450−019)


FWD
VARIABLE STATOR VANE ACTUATOR
2.9 BLEED VALVE SOLENOID
W5P11
W5P7
W5P8
W4P4
W4P19
W5P1
W4P3
W4P23 (PMUX OR SCU EQUIPPED ENGINES)
W4P2
EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
EEC SPEED TRANSDUCER (N1)
FUEL METERING UNIT
L−A5752 (1195)
PW V

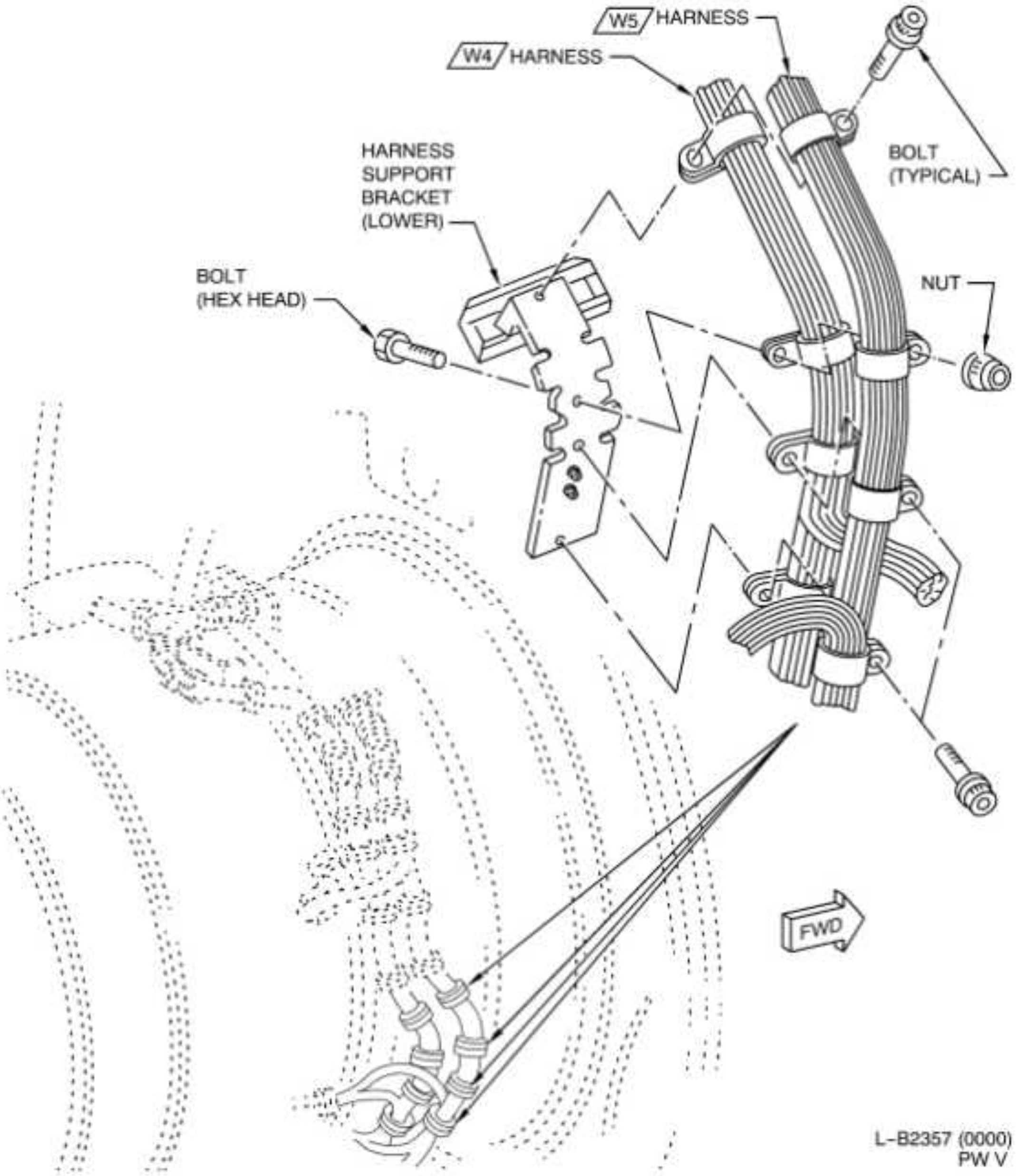
EEC Wiring Harness − W5 (Core Engine)
Figure 411 (Sheet 3)
(Task 72−00−34−450−019)


W5 HARNESS
HPC CASE BRACKET
BOLT (TYPICAL)
W5 HARNESS
FWD
CLAMP (TYPICAL)
W1P25
2.9 BLEED VALVE
HPC CASE BRACKET
SPACER
HARNESS BRACKET
FLANGE H BRACKET
W5 HARNESS REF.
W4J25
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THRMOCOUPLES ONLY
W4 HARNESS
NUT (LARGER)
NUT (SMALLER)
L−A5753 (1192)
PW V

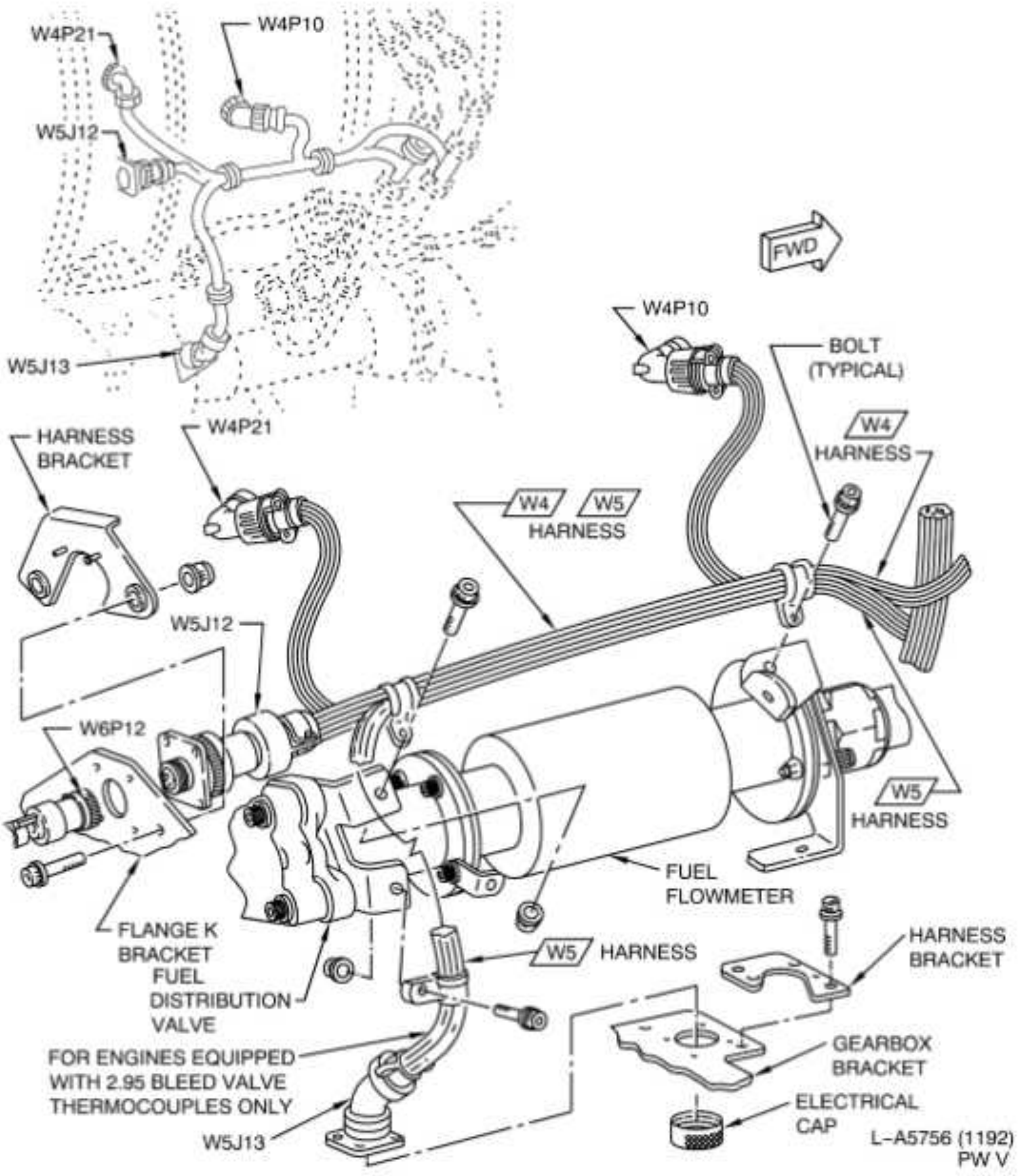
EEC Wiring Harness − W5 (Core Engine)
Figure 412
(Task 72−00−34−450−019)


BOLT
(6 REQUIRED)
W4P16
CLAMP
(TYPICAL)
CLAMP AND SPACER
(PRE SB PW4ENG 73−118)
SPACER
W5
HARNESS
HARNESS
SUPPORT
BRACKET
(UPPER)
SPACER
W4
HARNESS
FWD
(POST SB PW4ENG 73−118)
W4 HARNESS
W5 HARNESS
L−A5754 (0393)
PW V

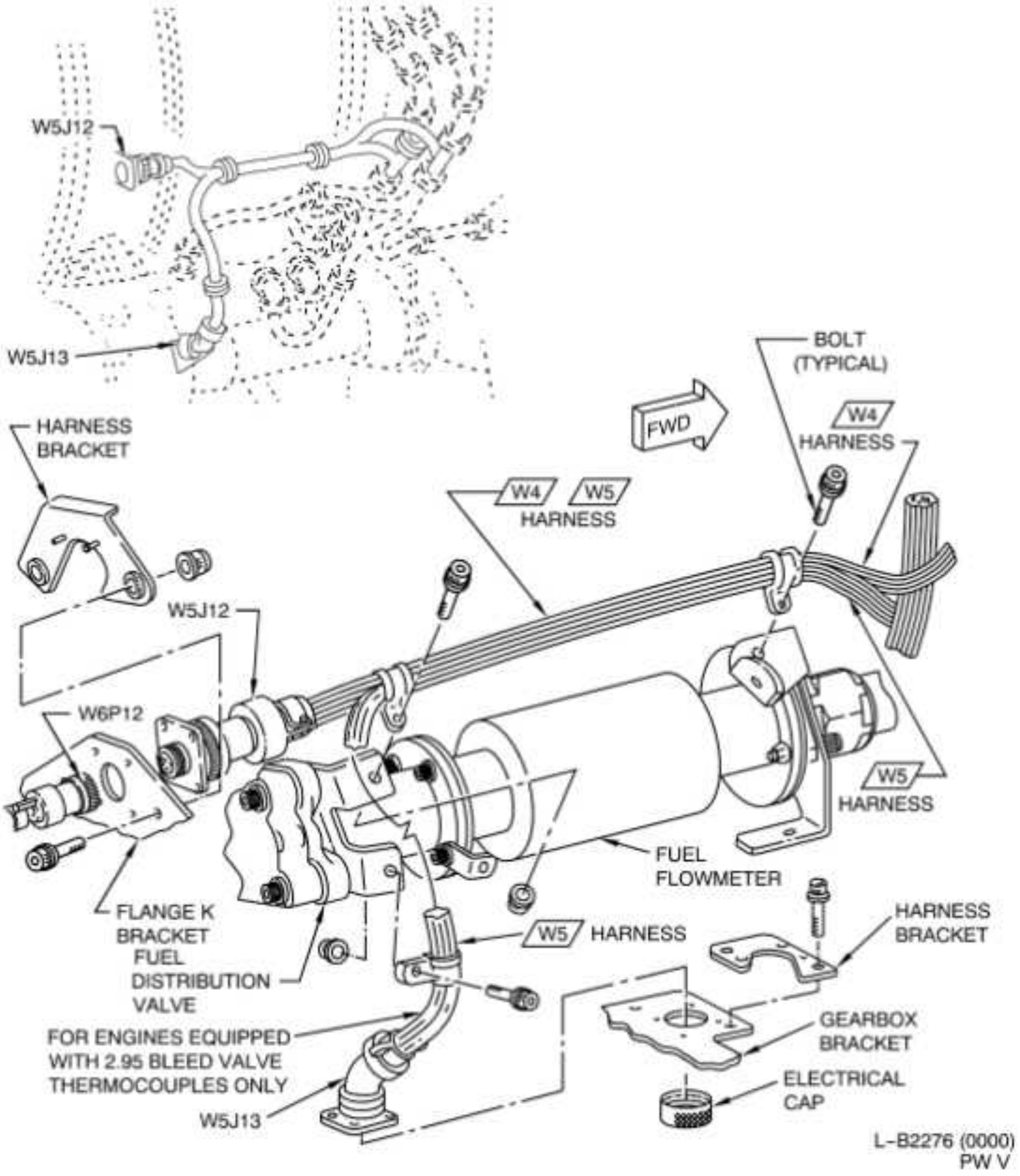
EEC Wiring Harness − W5 (Core Engine)
Figure 413
(Task 72−00−34−450−019)


W5 HARNESS
W4 HARNESS
HARNESS SUPPORT BRACKET (LOWER)
BOLT (TYPICAL)
BOLT (HEX HEAD)
NUT
FWD
L-B2357 (0000)
PW V

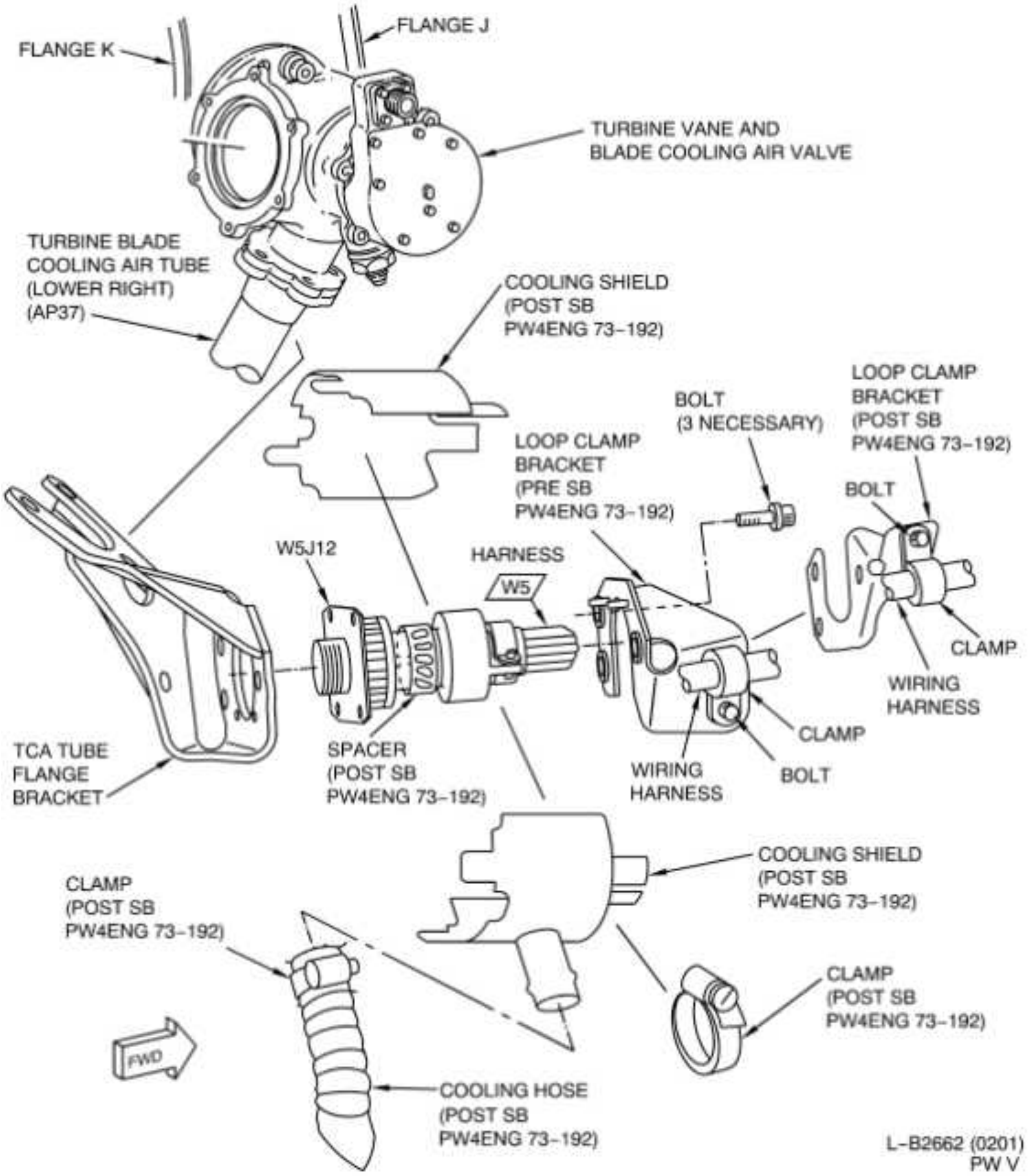
EEC Wiring Harness − W5 (Core Engine)
Figure 414
(Task 72−00−34−450−019)


W4P21
W4P10
W5J12
W5J13
FWD
W4P10
BOLT (TYPICAL)
W4 HARNESS
HARNESS BRACKET
W4P21
W4 W5 HARNESS
W5J12
W6P12
W5 HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
GEARBOX BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
ELECTRICAL CAP
W5J13
L−A5756 (1192)
PW V

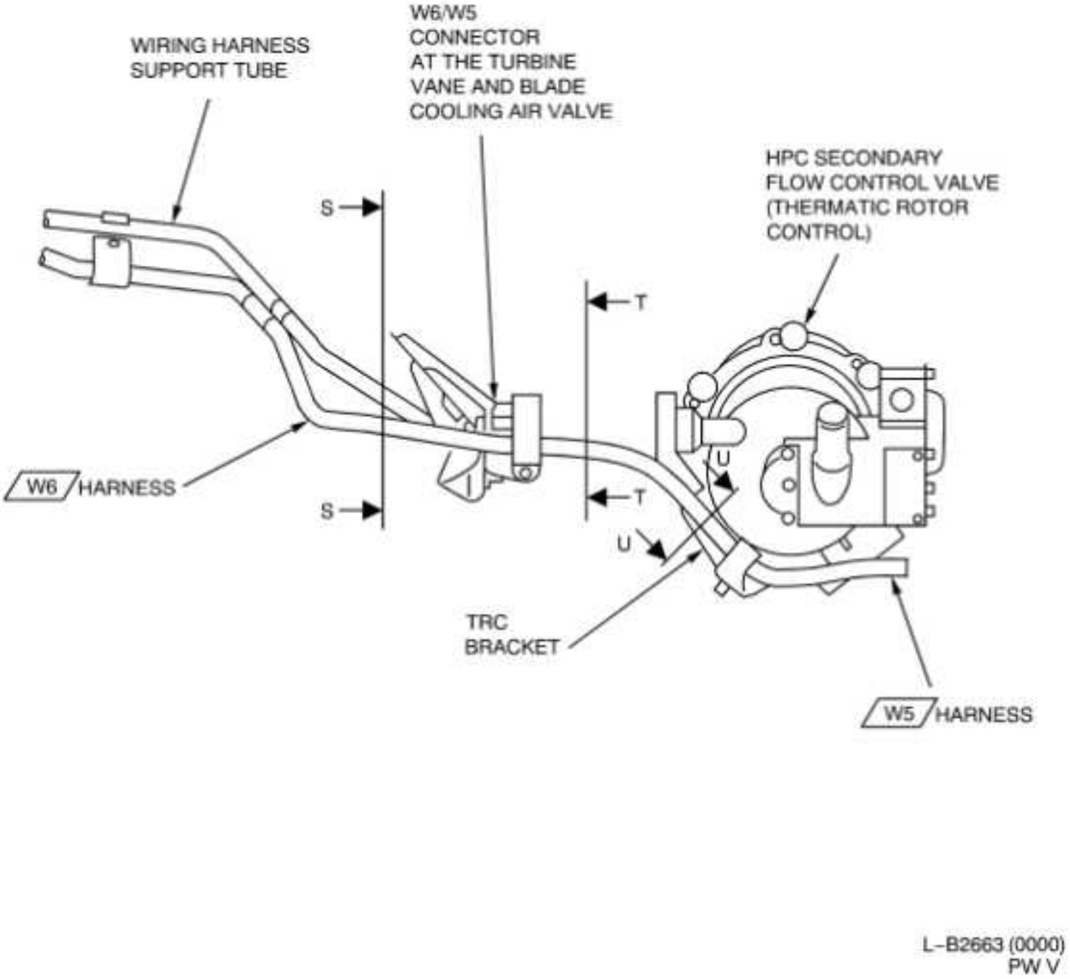
EEC Wiring Harness − W5 (Core Engine) (Pre
SB PW4ENG 75−106 Or SB PW4ENG 73−163)
Figure 415 (Sheet 1)
(Task 72−00−34−450−019)


W5J12
W5J13
HARNESS BRACKET
FWD
BOLT (TYPICAL)
W4 HARNESS
W4 W5 HARNESS
W5J12
W6P12
W5 HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
GEARBOX BRACKET
ELECTRICAL CAP
W5J13
L-B2276 (0000)
PW V

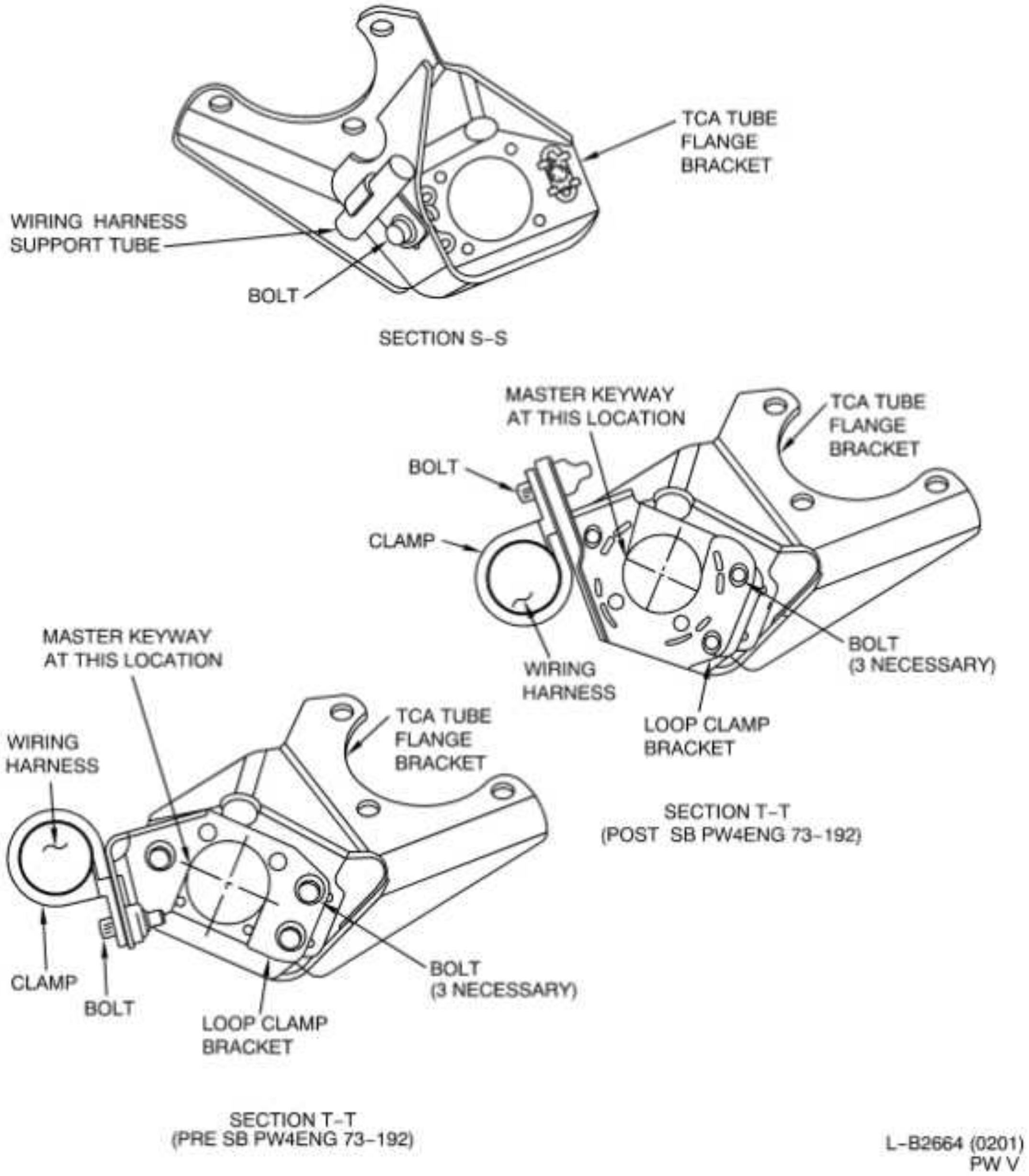
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 72−572 Or SB PW4ENG 75−106 Or SB PW4ENG 72−756) (Pre SB PW4ENG 73−163) (For −3 Engines With CN After Engine Serial Number)
Figure 415 (Sheet 2)
(Task 72−00−34−450−019)


FLANGE K
FLANGE J
TURBINE VANE AND BLADE COOLING AIR VALVE
TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT) (AP37)
COOLING SHIELD (POST SB PW4ENG 73-192)
LOOP CLAMP BRACKET (POST SB PW4ENG 73-192)
BOLT (3 NECESSARY)
LOOP CLAMP BRACKET (PRE SB PW4ENG 73-192)
BOLT
W5J12
HARNESS
W5
CLAMP
WIRING HARNESS
CLAMP
TCA TUBE FLANGE BRACKET
SPACER (POST SB PW4ENG 73-192)
WIRING HARNESS
BOLT
COOLING SHIELD (POST SB PW4ENG 73-192)
CLAMP (POST SB PW4ENG 73-192)
CLAMP (POST SB PW4ENG 73-192)
FWD
COOLING HOSE (POST SB PW4ENG 73-192)
L-B2662 (0201)
PW V

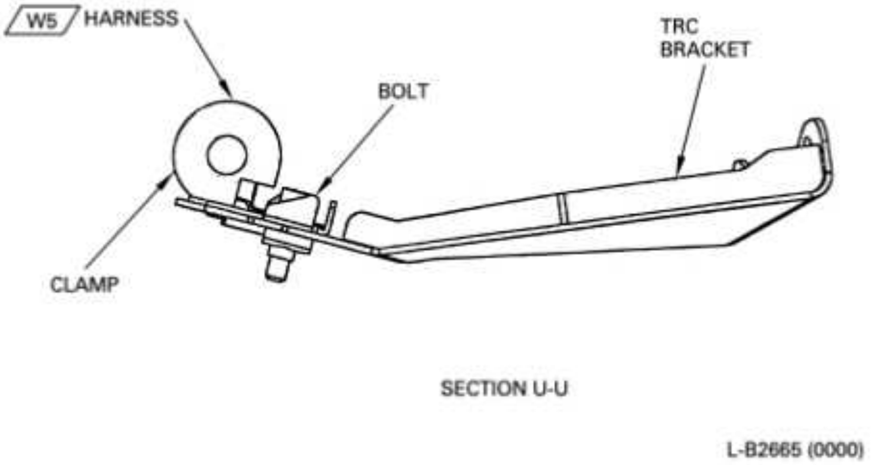
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 415 (Sheet 3)
(Task 72−00−34−450−019)


WIRING HARNESS SUPPORT TUBE
W6/W5 CONNECTOR AT THE TURBINE VANE AND BLADE COOLING AIR VALVE
HPC SECONDARY FLOW CONTROL VALVE (THERMATIC ROTOR CONTROL)
S
S
T
T
U
U
W6 HARNESS
TRC BRACKET
W5 HARNESS
L−B2663 (0000)
PW V

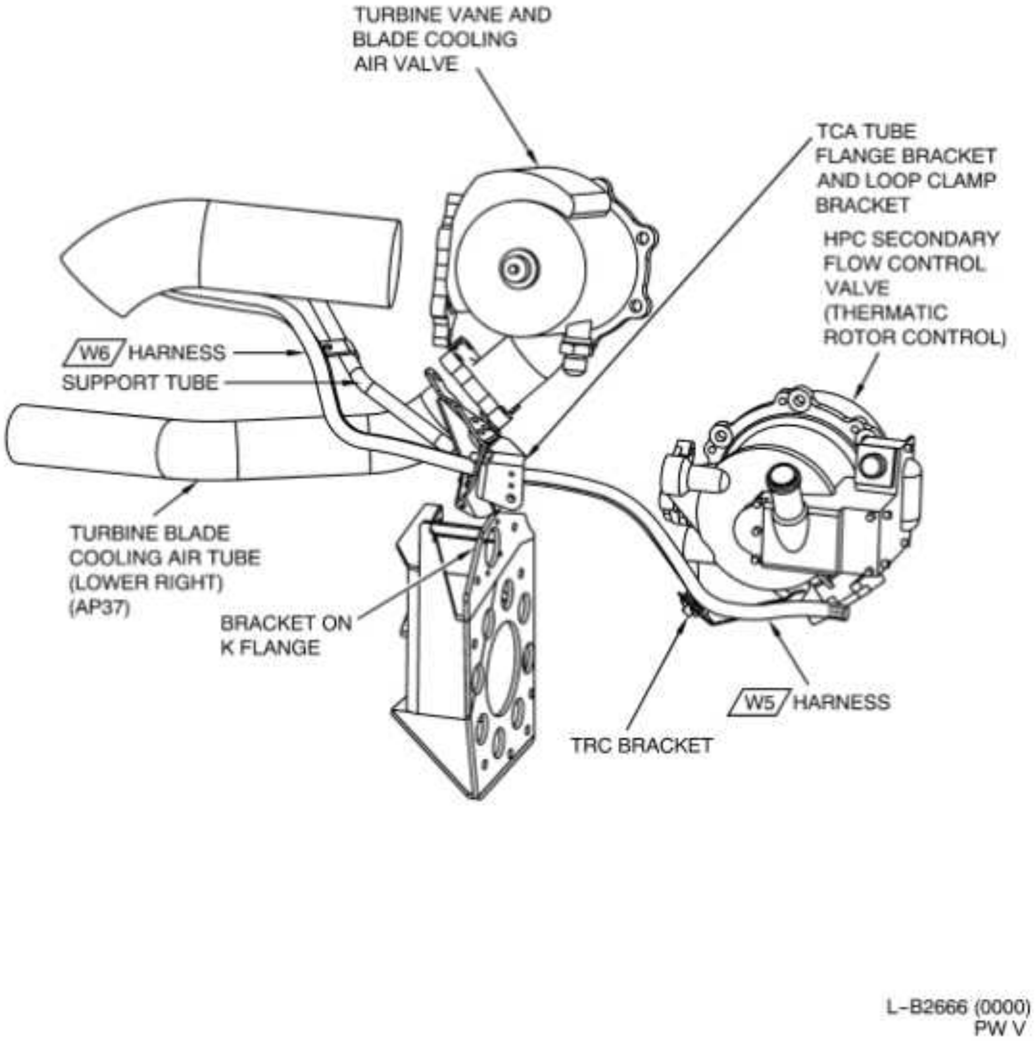
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 415 (Sheet 4)
(Task 72−00−34−450−019)


TCA TUBE FLANGE BRACKET
WIRING HARNESS SUPPORT TUBE
BOLT
SECTION S-S
MASTER KEYWAY AT THIS LOCATION
TCA TUBE FLANGE BRACKET
BOLT
CLAMP
WIRING HARNESS
BOLT (3 NECESSARY)
LOOP CLAMP BRACKET
SECTION T-T (POST SB PW4ENG 73-192)
MASTER KEYWAY AT THIS LOCATION
WIRING HARNESS
TCA TUBE FLANGE BRACKET
CLAMP
BOLT
LOOP CLAMP BRACKET
BOLT (3 NECESSARY)
SECTION T-T (PRE SB PW4ENG 73-192)
L-B2664 (0201)
PW V

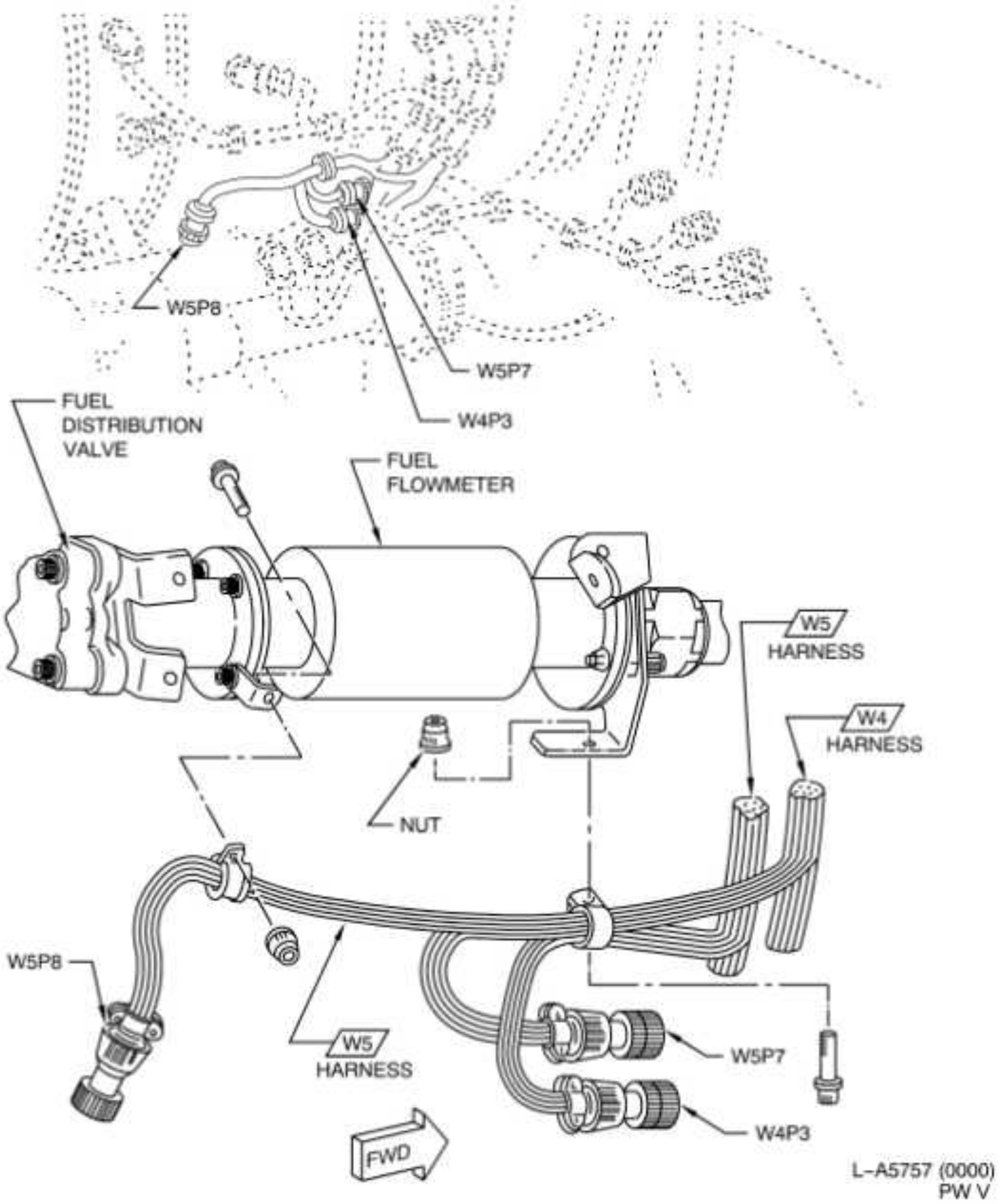
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 415 (Sheet 5)
(Task 72−00−34−450−019)


W5 HARNESS
TRC BRACKET
BOLT
CLAMP
SECTION U-U
L-B2665 (0000)

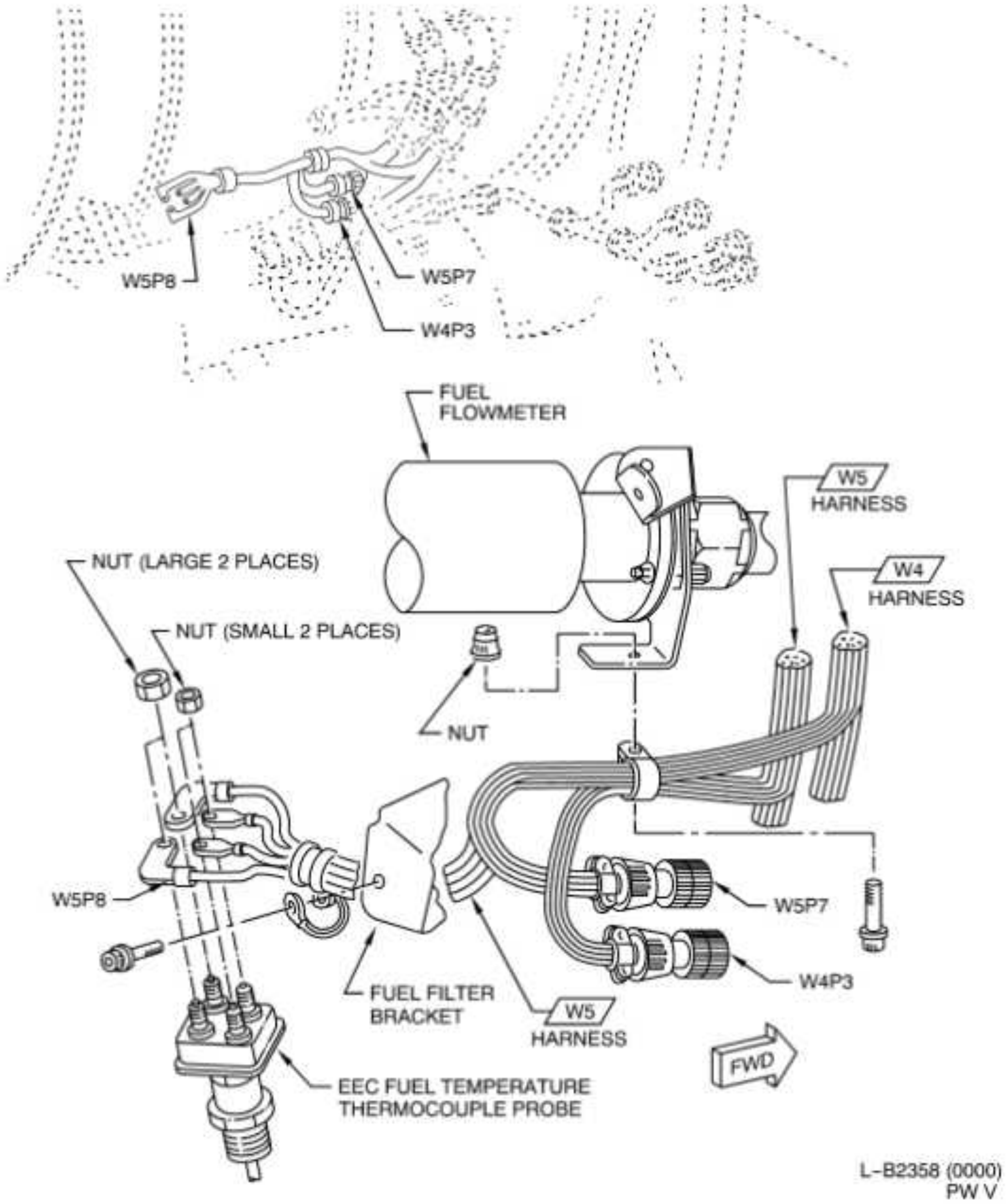
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 415 (Sheet 6)
(Task 72−00−34−450−019)


TURBINE VANE AND BLADE COOLING AIR VALVE
TCA TUBE FLANGE BRACKET AND LOOP CLAMP BRACKET
HPC SECONDARY FLOW CONTROL VALVE (THERMATIC ROTOR CONTROL)
W6 HARNESS
SUPPORT TUBE
TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT) (AP37)
BRACKET ON K FLANGE
W5 HARNESS
TRC BRACKET
L-B2666 (0000)
PW V

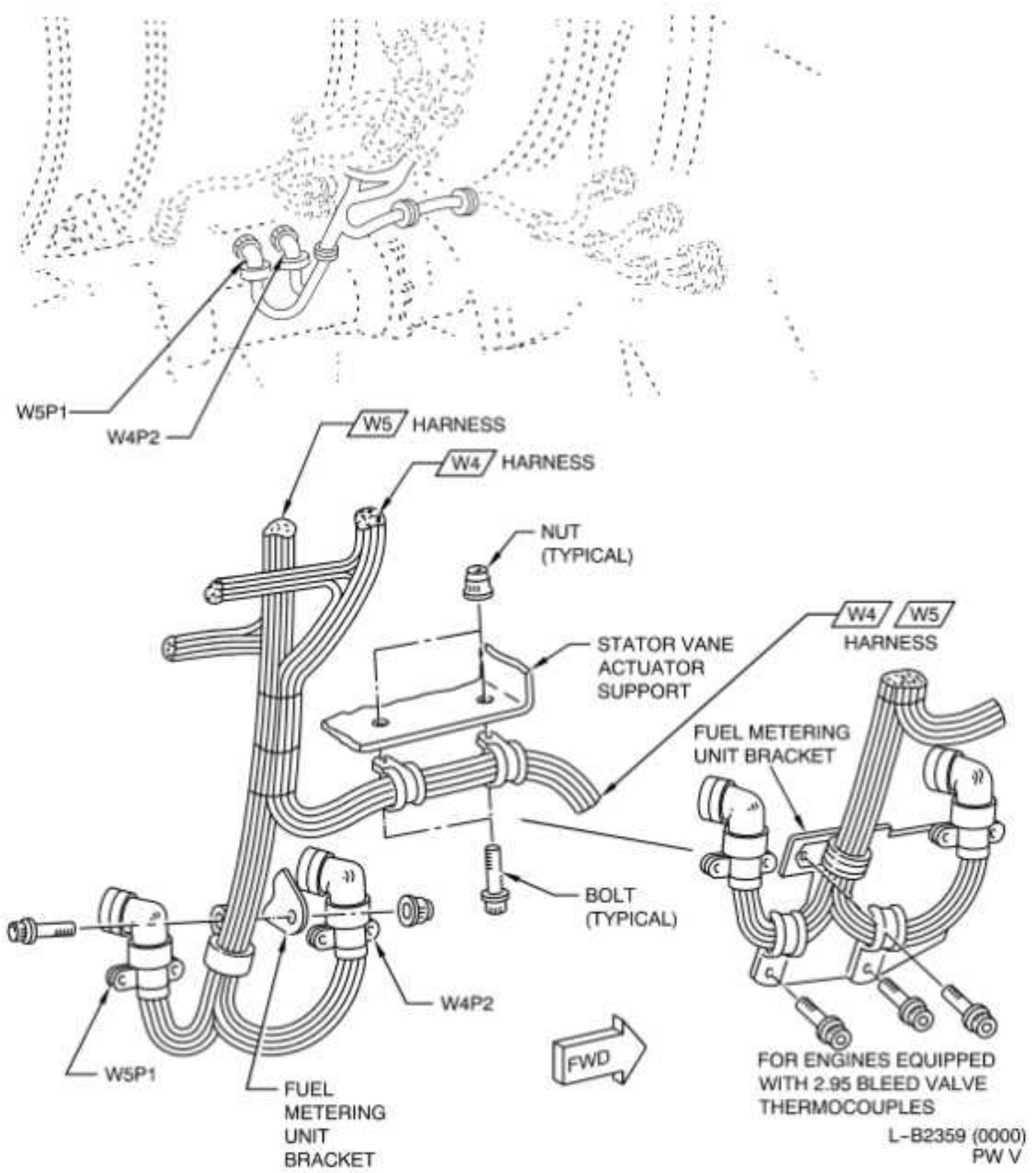
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 415 (Sheet 7)
(Task 72−00−34−450−019)


W5P8
W5P7
W4P3
FUEL DISTRIBUTION VALVE
FUEL FLOWMETER
W5 HARNESS
W4 HARNESS
NUT
W5P8
W5 HARNESS
W5P7
W4P3
FWD
L−A5757 (0000)
PW V

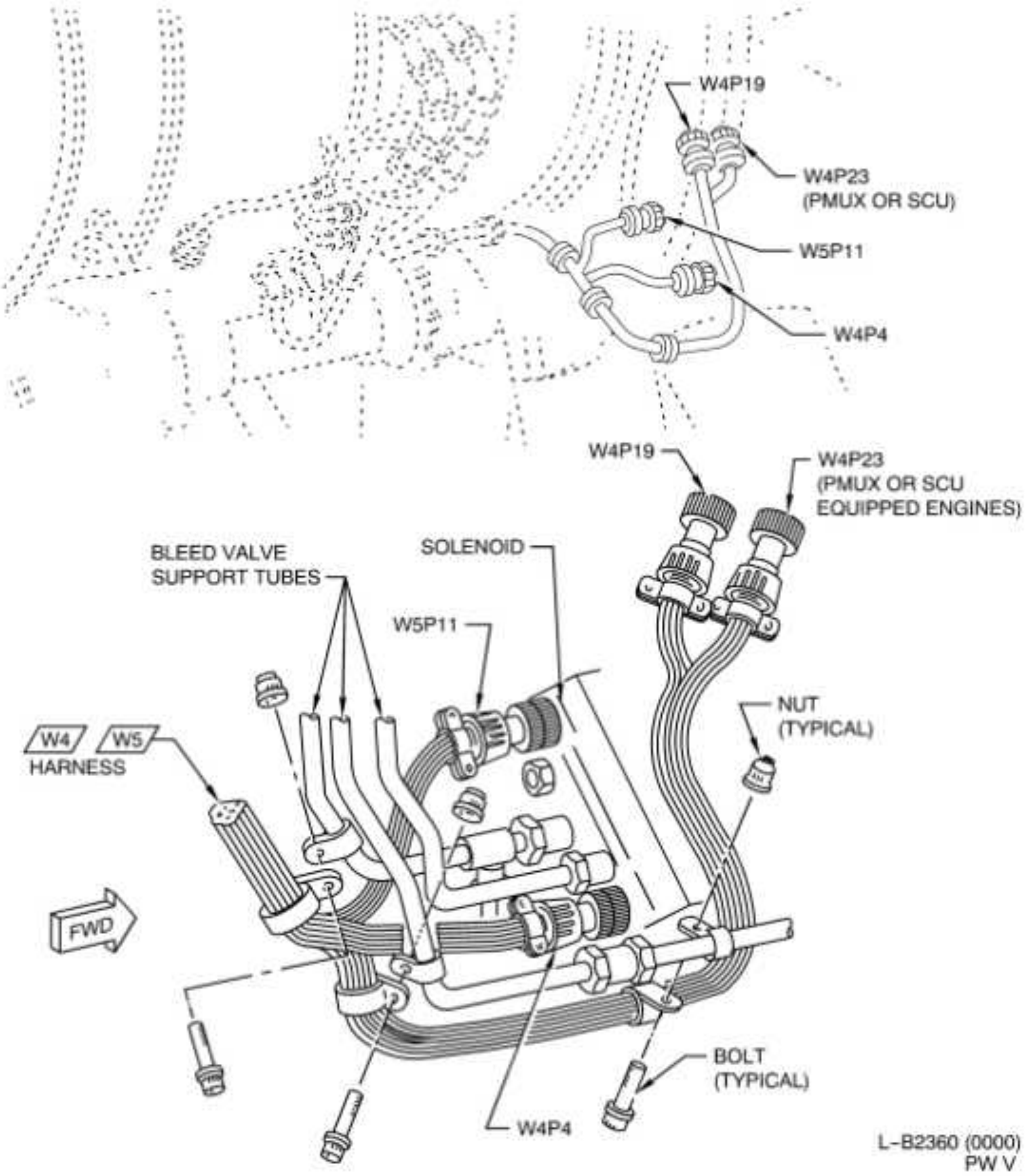
EEC Wiring Harness − W5 (Core Engine) (Pre SB PW4ENG 73−84)
Figure 416 (Sheet 1)
(Task 72−00−34−450−019)


W5P8
W5P7
W4P3
FUEL FLOWMETER
W5 HARNESS
NUT (LARGE 2 PLACES)
W4 HARNESS
NUT (SMALL 2 PLACES)
NUT
W5P8
W5P7
W4P3
FUEL FILTER BRACKET
W5 HARNESS
FWD
EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
L-B2358 (0000)
PW V

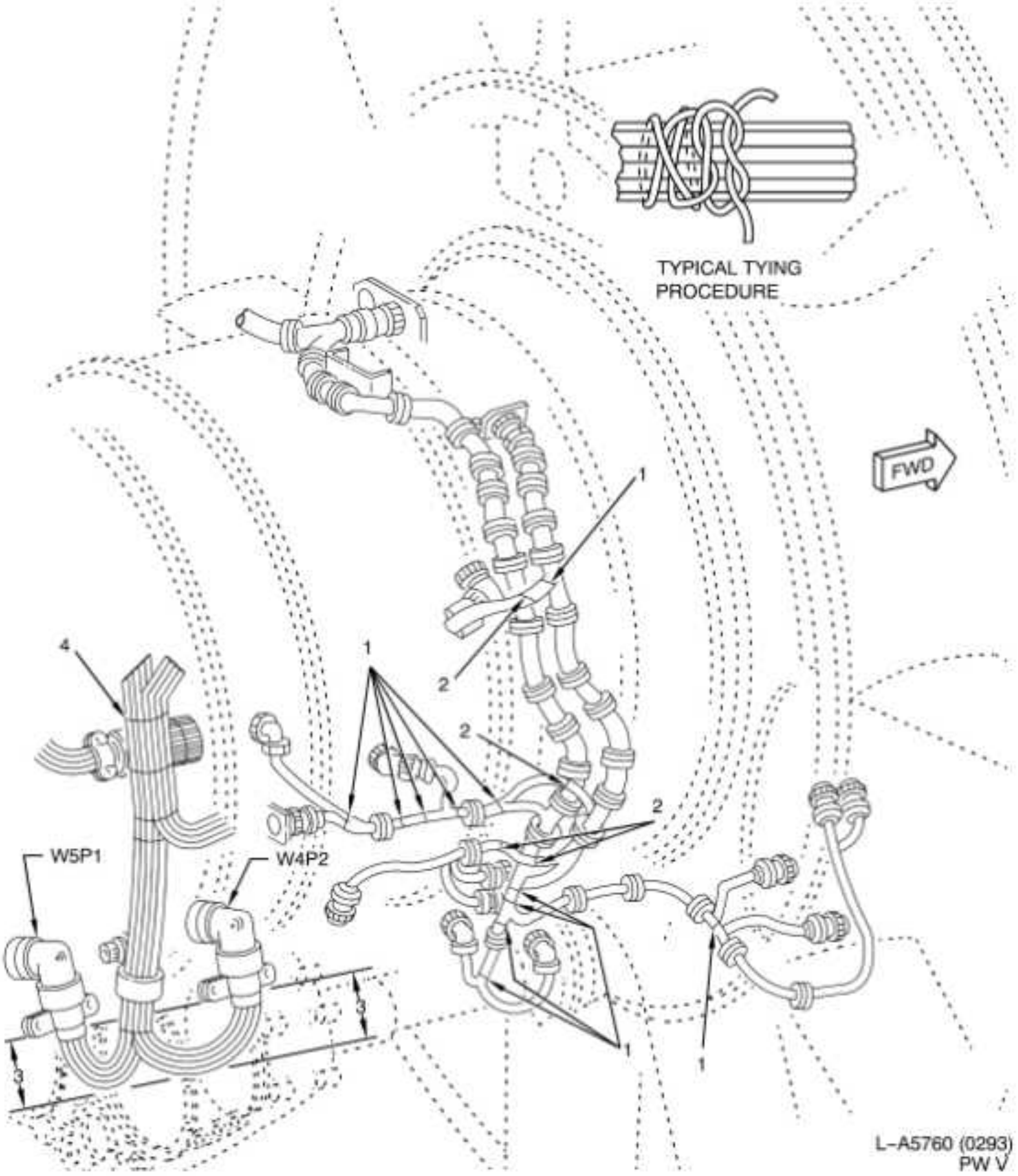
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−84, SB PW4ENG 72−572 Or SB PW4ENG 75−106 Or SB PW4ENG 72−756) (For −3 Engines With CN After Engine Serial Number)
Figure 416 (Sheet 2)
(Task 72−00−34−450−019)


W5P1
W4P2
W5 HARNESS
W4 HARNESS
NUT (TYPICAL)
STATOR VANE ACTUATOR SUPPORT
W4 W5 HARNESS
FUEL METERING UNIT BRACKET
BOLT (TYPICAL)
W4P2
W5P1
FUEL METERING UNIT BRACKET
FWD
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES
L-B2359 (0000)
PW V

EEC Wiring Harness - W5 (Core Engine)
Figure 417
(Task 72-00-34-450-019)


W4P19
W4P23
(PMUX OR SCU)
W5P11
W4P4
W4P19
W4P23
(PMUX OR SCU
EQUIPPED ENGINES)
BLEED VALVE
SUPPORT TUBES
SOLENOID
W5P11
W4
W5
HARNESS
NUT
(TYPICAL)
FWD
BOLT
(TYPICAL)
W4P4
L-B2360 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine)
Figure 418
(Task 72−00−34−450−019)

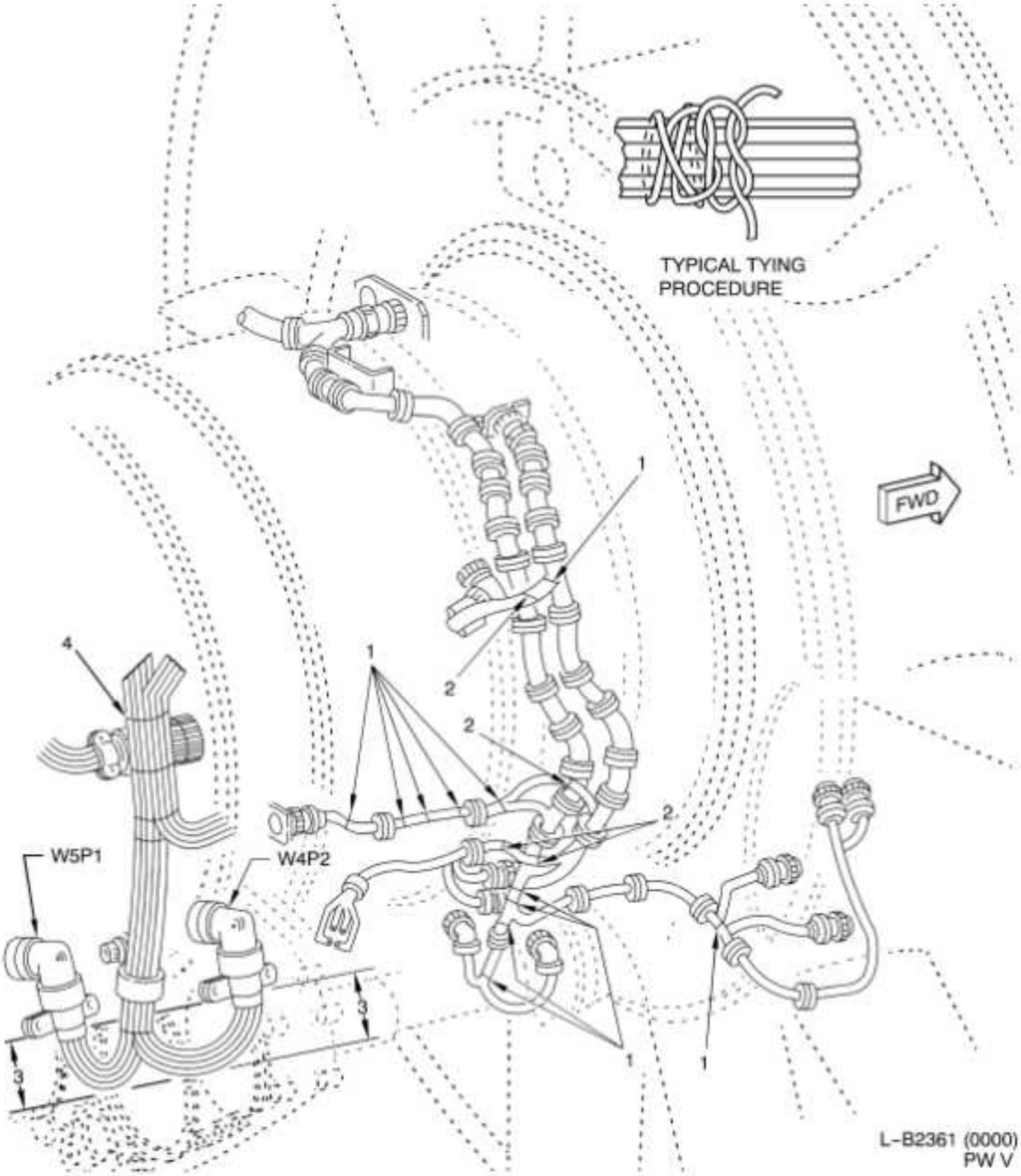

TYPICAL TYING PROCEDURE
FWD
1
2
1
4
2
2
W5P1
W4P2
3
3
1
1
L−A5760 (0293)
PW V

EEC Wiring Harness − W5 (Core Engine) (Pre SB PW4ENG 75−106)
Figure 419 (Sheet 1)
(Task 72−00−34−450−019)

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−23

1. Tie
2. Cross Tie
3. 3.000 Inch (76.200 mm) Maximum Clearance Required Between Bottom Of Harness And Connector Clamps.
4. 0.375 Inch (9.525 mm) Minimum Clearance Required Between Harness And W4P3 Connector.

Key to Figure 419 (Sheet 1)

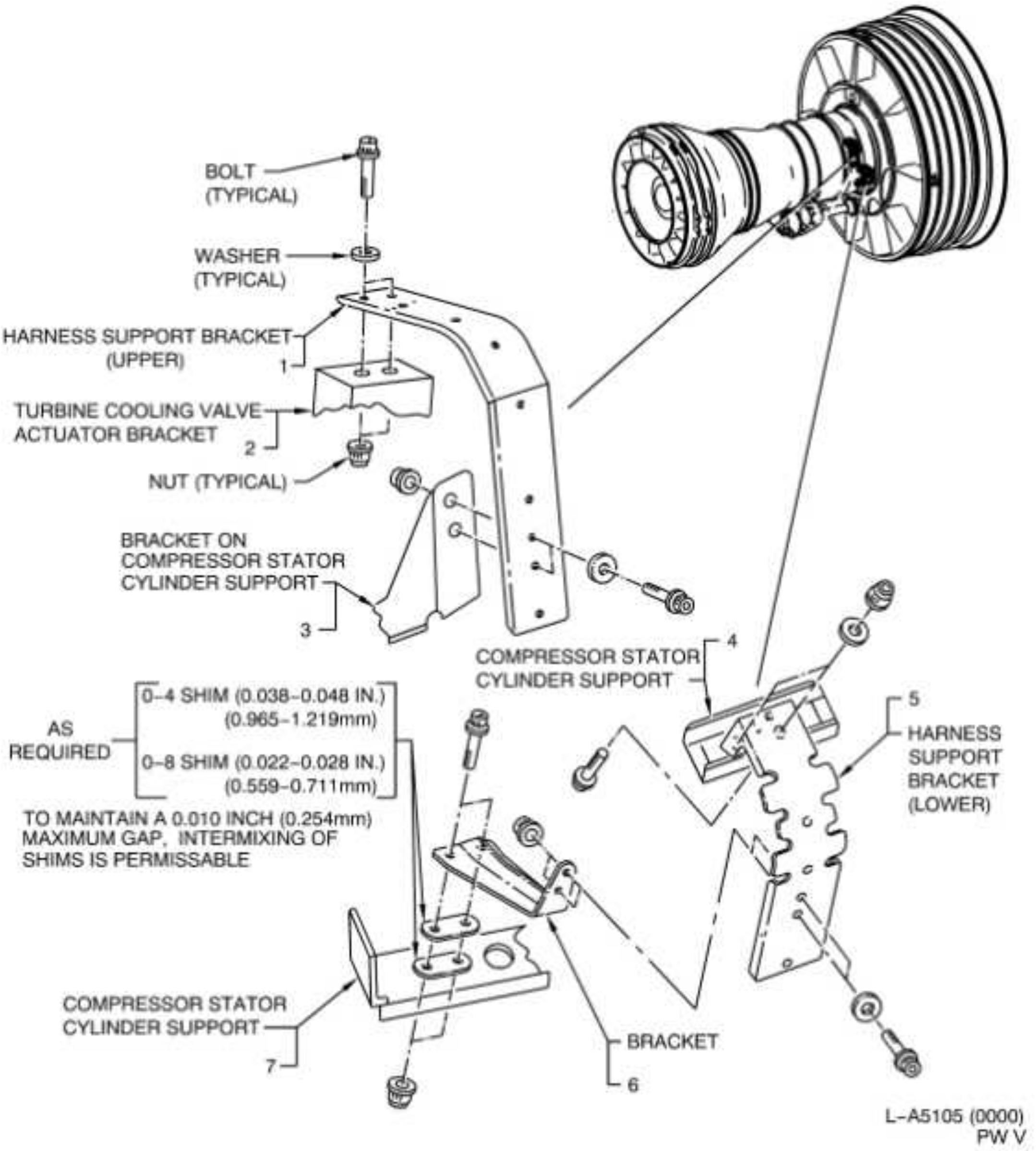

TYPICAL TYING PROCEDURE
FWD
1
1
2
2
4
2
W5P1
W4P2
3
3
1
1
L-B2361 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 72−572 Or SB PW4ENG 75−106 Or SB PW4ENG 72−756)
(For −3 Engines With CN After Engine Serial Number)
Figure 419 (Sheet 2)
(Task 72−00−34−450−019)

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−23

1. Tie
2. Cross Tie
3. 3.000 Inch (76.200 mm) Maximum Clearance Required Between Bottom Of Harness And Connector Clamps.
4. 0.375 Inch (9.525 mm) Minimum Clearance Required Between Harness And W4P3 Connector.

Key to Figure 419 (Sheet 2)


BOLT (TYPICAL)
WASHER (TYPICAL)
HARNESS SUPPORT BRACKET (UPPER)
1
TURBINE COOLING VALVE ACTUATOR BRACKET
2
NUT (TYPICAL)
BRACKET ON COMPRESSOR STATOR CYLINDER SUPPORT
3
COMPRESSOR STATOR CYLINDER SUPPORT
4
5
HARNESS SUPPORT BRACKET (LOWER)
AS REQUIRED
0−4 SHIM (0.038−0.048 IN.) (0.965−1.219mm)
0−8 SHIM (0.022−0.028 IN.) (0.559−0.711mm)
TO MAINTAIN A 0.010 INCH (0.254mm) MAXIMUM GAP, INTERMIXING OF SHIMS IS PERMISSABLE
COMPRESSOR STATOR CYLINDER SUPPORT
7
BRACKET
6
L−A5105 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine) Support Brackets
Figure 420
(Task 72−00−34−450−019)

ENGINE GENERAL - INTERMEDIATE CASE - INSTALLATION-23

Task 72-00-34-450-023:

1. Install EEC Wiring Harness - W5 (Core Engine)

A. General

(1) To install the EEC wiring harness - W3, see 72-00-34, Installation-18 (Task 72-00-34-450-017).

(2) To install the EEC wiring harness - W4, see 72-00-34, Installation-19 (Task 72-00-34-450-018).

B. Equipment And Materials Required

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Tape - Lacing And Tying, PN 1B1773		
Lockwire, AS3214-01		

C. Procedure
See Figure 401, Figure 402, Figure 403, Figure 404, Figure 405, Figure 406, Figure 407, Figure 408, Figure 409, Figure 410, Figure 411, Figure 412, Figure 413, Figure 414, Figure 415, Figure 416, Figure 417, Figure 418, Figure 419 and Figure 420.

CAUTION: SEE 72-00-00, INSTALLATION-00 FOR THE GENERAL INSTALLATION REQUIREMENTS FOR THE ELECTRICAL HARNESSES, LEADS AND CABLES.

CAUTION: DO NOT TWIST OR BEND THE HARNESS BADLY DURING THE INSTALLATION, OR DAMAGE TO THE HARNESS CAN OCCUR.

(1) Install the W5 harness on the left and right side of the engine as follows.

(a) Remove the protective closure. Install the W5J26 connector flange to the HPC case bracket located at the 11:30 o'clock position. Attach the connector flange to the bracket temporarily with lockwire. Install the protective closure. See Figure 403.

(b) Place the leg of the harness with the connectors W5P1, W5P7, W5P8, W5P11, and W5J12 (and W5J13 for engines equipped with 2.95 bleed valve thermocouples) over the top of the HPC case and down the right side of the engine.

(c) Remove the lockwire securing the W5J26 connector flange to the HPC case bracket. Install the harness bracket (cut−out up) to attach the connector flange between the two brackets. Align the bolt holes and install the bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(2) (Pre SB PW4ENG 73−163) Remove the protective closures. Install the W5J12 connector flange to the Flange K bracket at the 3:30 o'clock position. Install the harness bracket (angle forward with cut−out inboard) to attach the connector flange between the two brackets. Align the bolt holes and install the bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 415.

(3) (Post SB PW4ENG 73−163) See Figure 415.

(a) Remove the protective closures. Align the W5J12 connector to the TCA tube flange bracket. Position the connector in the bracket so that the master keyway is located at an outboard location at approximately 30 degrees above the horizontal center line. Secure the connector to the TCA tube flange bracket with a loop clamp bracket and three (3) bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(b) Position the W5 harness immediately forward of the W5J12 connector to the cover bracket. Secure the harness to the cover bracket with a loop clamp bracket and bolt, threads lubricated with Engine Oil P03−001. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) (Post SB PW4ENG 73−192) Install cooling shields around W6 harness connector as follows:

NOTE: Pre SB PW4ENG 73−192 engines do not have W5/W6 wiring harness connector cooling.

1 Position the cooling shields around the W5 harness connector W5J12 and slide the cooling shield tabs into loop clamp bracket. Make sure the shield with the hose fitting is on the bottom.

2 Install the clamps around the cooling shields. Torque the hose clamps to 10 − 15 lb−in. (1.130 − 1.695 N.m).

3 Install the cooling hose and clamp onto the bottom cooling shield fitting. Torque the hose clamps to 10 − 15 lb−in. (1.130 − 1.695 N.m).

(d) If removed or loosened, install the clamp and bolt attaching the wiring harness to the loop clamp bracket. Lubricate bolt threads with Engine Oil P03−001. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(4) For engines equipped with 2.95 bleed valve thermocouples only: Install the W5J13 connector flange to the bracket on the main gearbox. Install the harness bracket (cutout inboard) to attach the connector flange between the two brackets. Align the bolt holes and install the bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 415.

(5) Connect the W5 harness connectors (given below) to the mating harness receptacles as follows. See Figure 402 and Figure 411. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight.
- the connector fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

Connector	Component	Location
W5P8	EEC Fuel Temperature Thermocouple	Fuel Pump Housing 4:30 O'Clock
W5P1	Fuel Metering Unit (Rear Connector)	Front Of Fuel Pump 5 O'Clock

Connector	Component	Location
W5P11	Ninth Stage Start/Stability (2.9) Bleed Valve Solenoid (Inboard Connector)	Intermediate Case 5 O'Clock
W5P7	Variable Stator Vane Actuator (Top Connector)	4 O'Clock
W5P6	EEC Alternator (Lower Connector)	Bottom Of Gearbox 7 O'Clock
W5P5	Fuel/Oil Cooler Bypass Valve Solenoid (Rear Connector)	8 O'Clock
W2P26	Harness Connector To W5J26 Harness Connector	11:30 O'Clock
W6P12	Harness Connector To W5J12 Harness Connector	3:30 O'Clock

(6) For a thermocouple probe with a studded terminal type receptacle and for engines equipped with 2.95 bleed valve thermocouple install the wiring harness as follows.

(a) Install the wiring harness terminals to the thermocouple studs and install loosely the nuts to the thermocouple studs.

(b) Install the clamp, ground strap, and bolt loosely to the bracket on the housing.

CAUTION: TO PREVENT DAMAGE TO THE WIRING HARNESS, MAKE SURE THE THERMOCOUPLE STUD BOX DOES NOT TURN WHEN THE COUPLING NUT IS TORQUED.

(c) If necessary to align the thermocouple stud box, remove the lockwire from the thermocouple coupling nut to the adapter and loosen the coupling nut.

(d) Align the thermocouple stud box with the wiring harness connector.

(e) (Reference 2167) Hold the thermocouple stud box and torque the thermocouple probe coupling nut to 95 − 100 lb−in. (10.734 − 11.298 N.m). Do not let the thermocouple studs turn.

CAUTION: DO NOT ALIGN THE THERMOCOUPLE STUD BOX AFTER THE COUPLING NUT IS TORQUED. HOLD THE THERMOCOUPLE STUD BOX AND LOOSEN THE COUPLING NUT AND ALIGN THE THERMOCOUPLE STUD BOX AGAIN.

(f) Make sure the thermocouple stud box is aligned. Do not put too much force on the terminals of the wiring harness.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(g) (Reference 2273) Torque the alumel nuts (larger terminal studs) to 18 − 22 lb−in. (2.034 − 2.486 N.m).

(h) (Reference 2273) Torque the chromel nuts (smaller terminal studs) to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(i) Install lockwire from the coupling nut to the adapter.

(j) Torque the bolt that attaches the clamp and ground strap to the bracket on the housing to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(7) For engines equipped with 2.95 bleed valve thermocouples only: Connect the thermocouple wires (leads) on the W5 harness to the thermocouple studs on the 2.9 bleed valve as follows:

(a) Remove the nuts from the thermocouple studs and attach the thermocouple wires (lead) with the nuts (round collar and inboard). Align the leads so that the wires are parallel to each other.

CAUTION: TOO MUCH TORQUE (MORE THAN THE MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(b) (Reference 2273) Torque the alumel nuts (larger terminal studs) to 18 − 22 lb−in. (2.034 − 2.486 N.m).

(c) (Reference 2273) Torque the chromel nuts (smaller terminal studs) to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(8) Adjust the W5 harness for any necessary clearances as required. Install the clamps at all clamp points. Refer to the figures. Attach the clamps loosely to the engine with bolts and/or nuts, threads lubricated with Engine Oil P03−001.

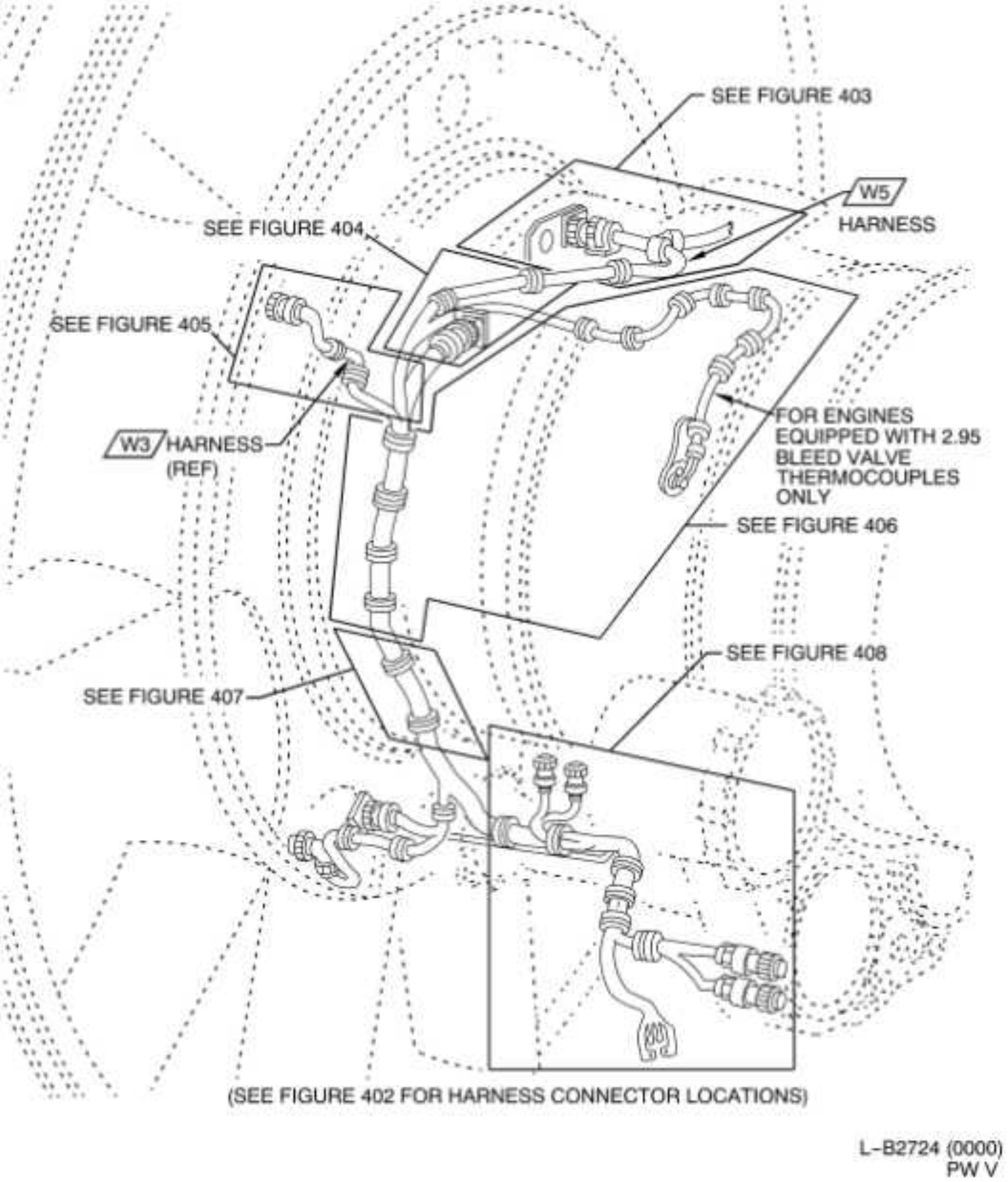
NOTE: Use different clamp sizes on the harnesses to prevent harness movement when tightened. See the Illustrated Parts Catalog for selection of the clamp sizes and part numbers.

(9) Make sure that the harnesses are not tight to the point where sharp bends are caused, and that the harnesses do not touch any engine parts or plumbing. Provide a drip loop on the leads where the wires run downward into the connector.

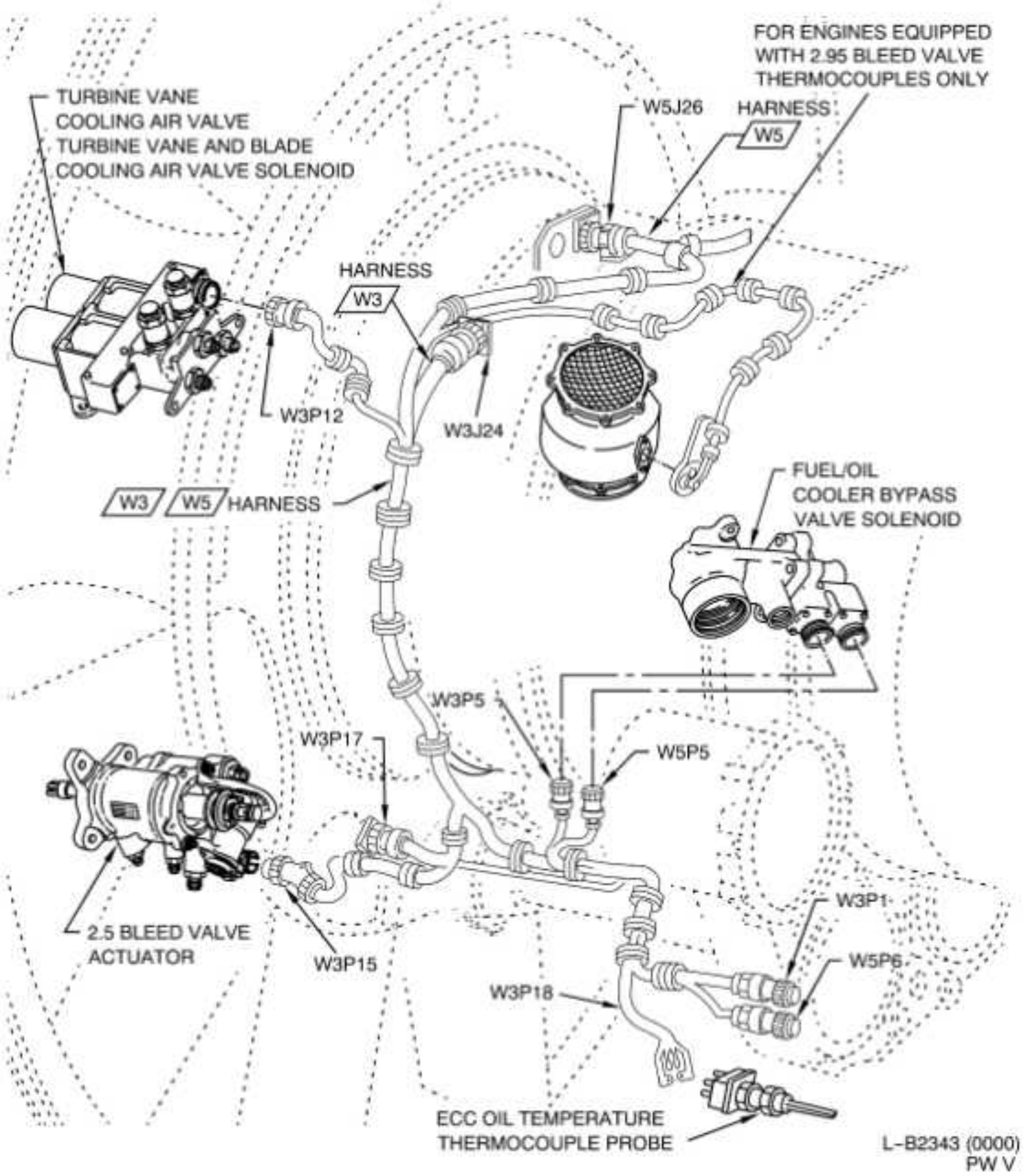
(10) Tighten all the previously installed clamp nuts and/or bolts to a torque of 36 − 40 lb−in. (4.067 − 4.519 N.m).

(11) Tie the harnesses as shown in Figures 409 and 419.

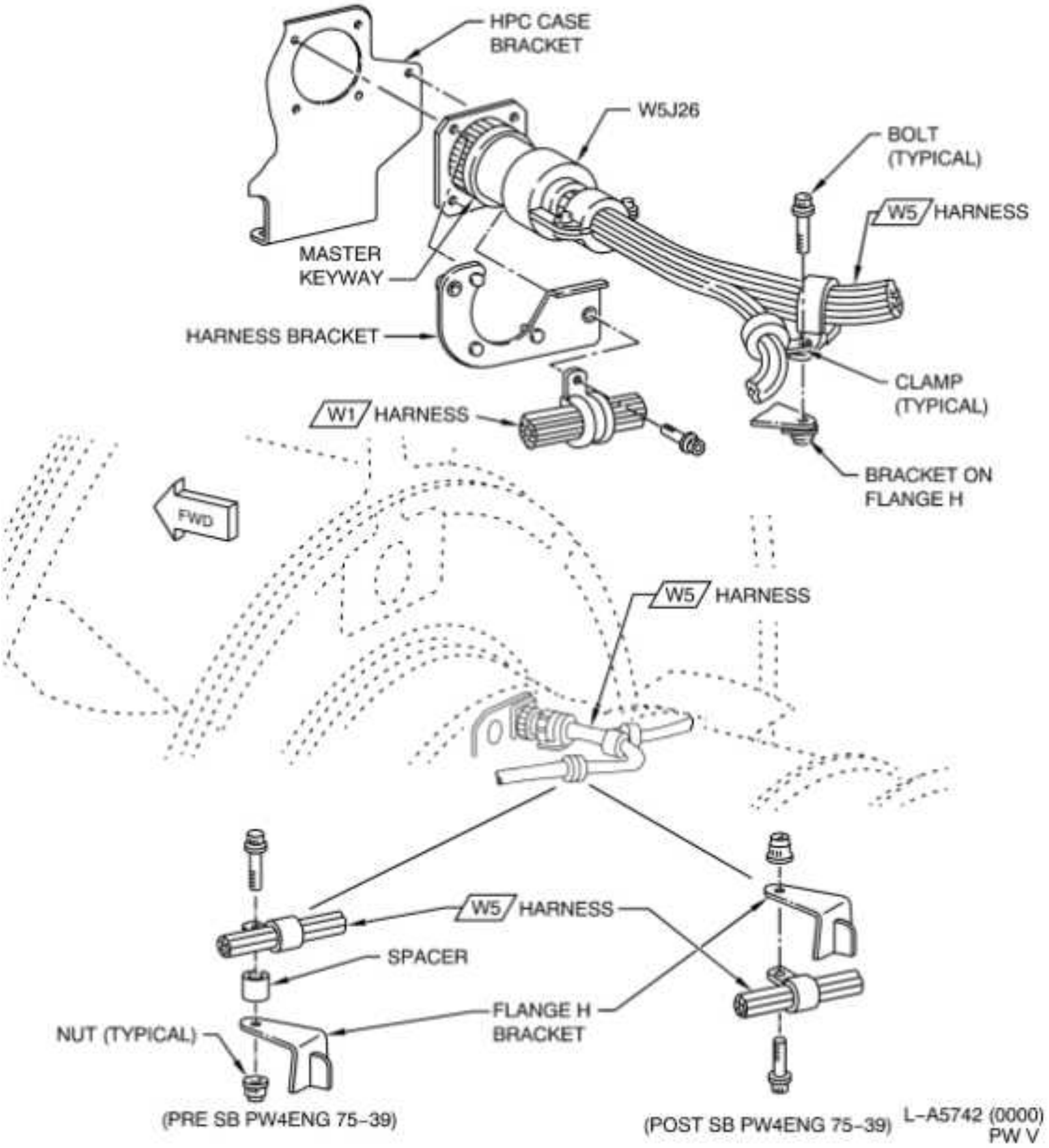
NOTE: Ties must be made with a clove hitch with an extra loop, followed by a square knot, as shown in Figures 409 and 419. The clove hitch and square knot must be tightened satisfactorily in place. The harnesses must not be stressed or damaged by overtightening the ties. Where the harness bundles are more than 1.500 inches (38.100 mm) in diameter, the lacing tape must be doubled. Cut the ends of the lacing tape to a length of 0.250 − 0.500 inch (6.350 − 12.700 mm).


SEE FIGURE 403
W5
HARNESS
SEE FIGURE 404
SEE FIGURE 405
W3
HARNESS
(REF)
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
SEE FIGURE 406
SEE FIGURE 408
SEE FIGURE 407
(SEE FIGURE 402 FOR HARNESS CONNECTOR LOCATIONS)
L−B2724 (0000)
PW V

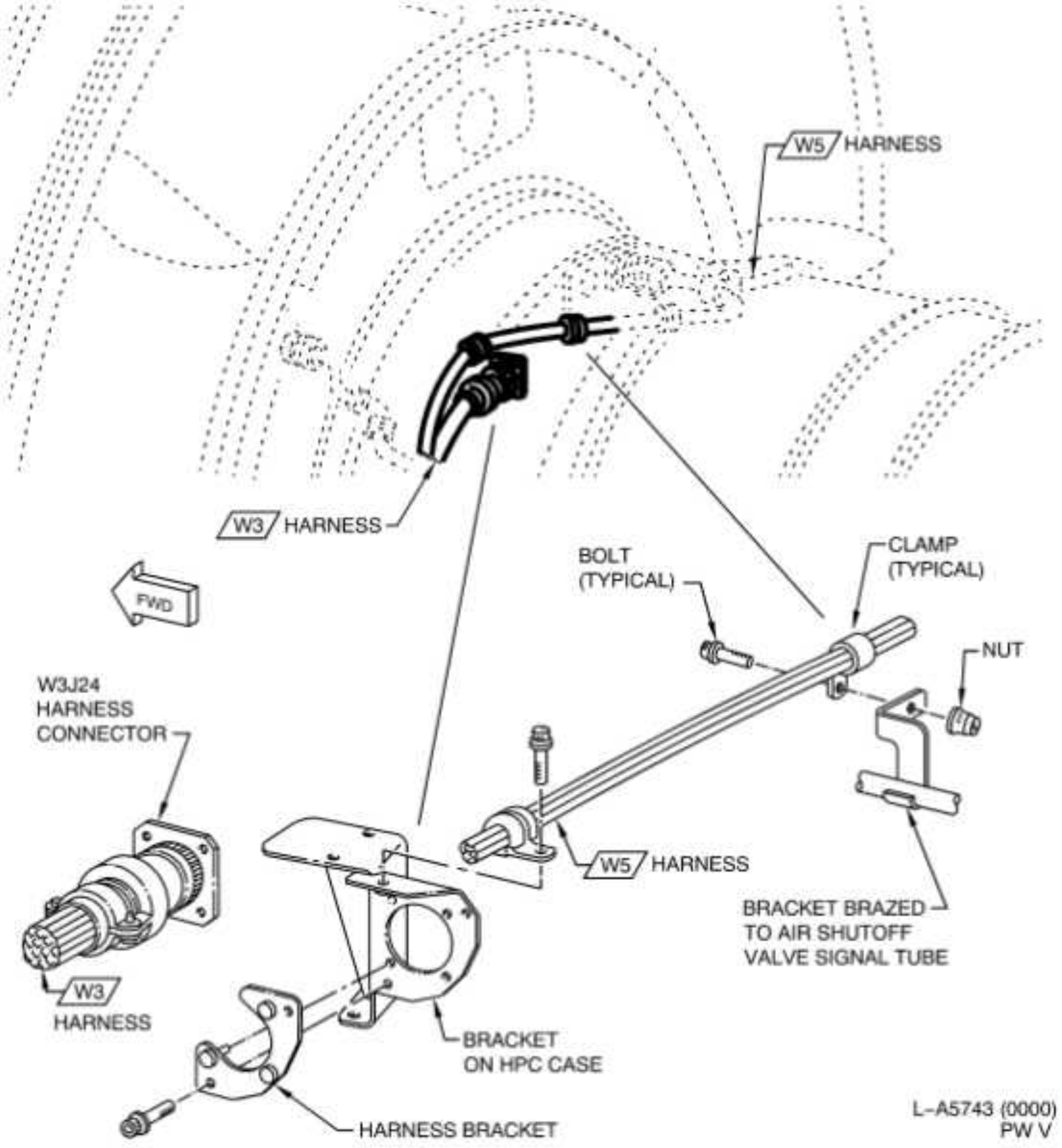
EEC Wiring Harness − W5 (Core Engine)
Figure 401
(Task 72−00−34−450−023)


FOR ENGINES EQUIPPED
WITH 2.95 BLEED VALVE
THERMOCOUPLES ONLY
TURBINE VANE
COOLING AIR VALVE
TURBINE VANE AND BLADE
COOLING AIR VALVE SOLENOID
W5J26
HARNESS
W5
HARNESS
W3
W3P12
W3J24
W3
W5
HARNESS
FUEL/OIL
COOLER BYPASS
VALVE SOLENOID
W3P5
W3P17
W5P5
2.5 BLEED VALVE
ACTUATOR
W3P15
W3P1
W5P6
W3P18
ECC OIL TEMPERATURE
THERMOCOUPLE PROBE
L-B2343 (0000)
PW V

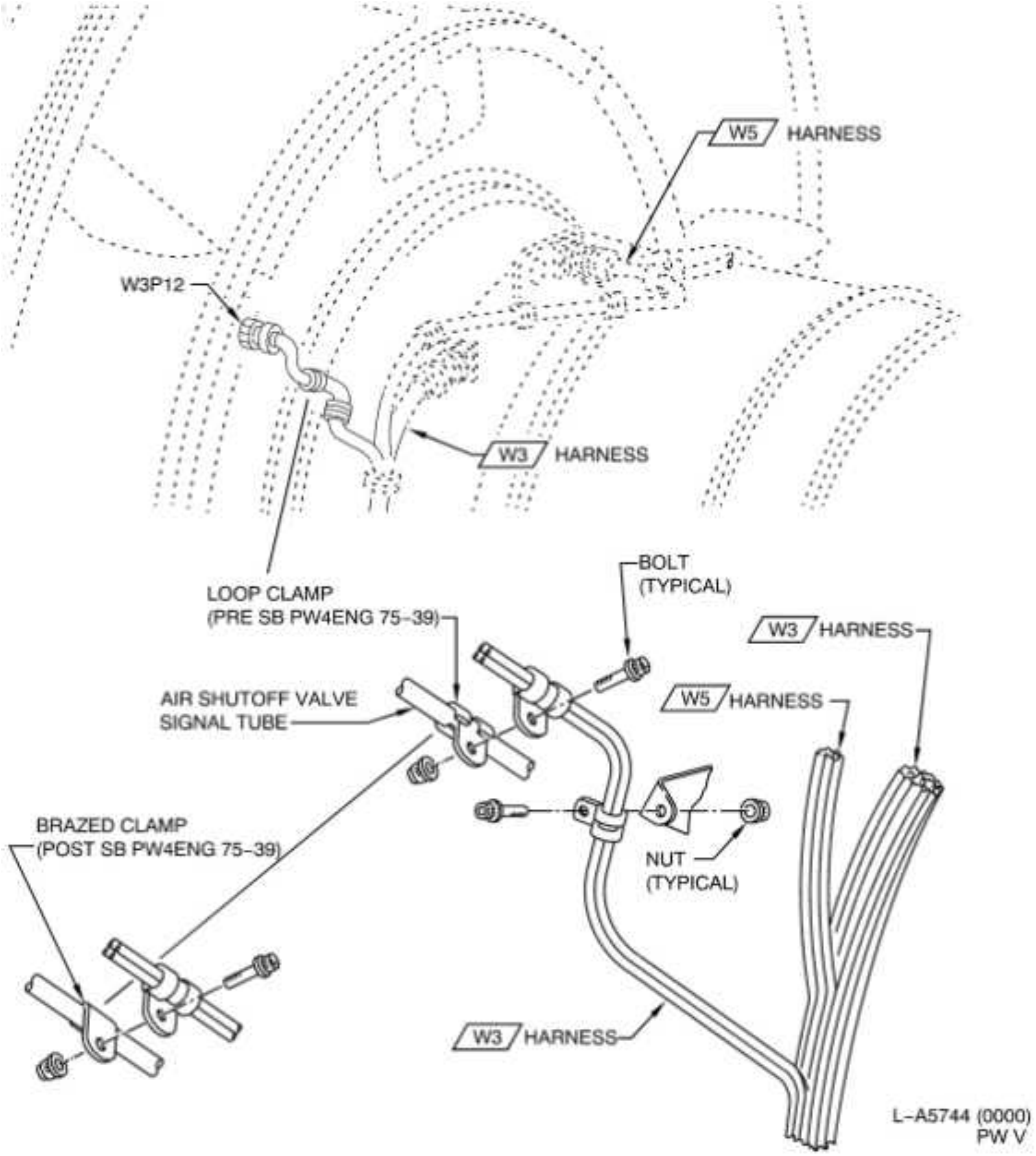
EEC Wiring Harness − W5 (Core Engine)
Figure 402
(Task 72−00−34−450−023)


HPC CASE BRACKET
W5J26
BOLT (TYPICAL)
W5 HARNESS
MASTER KEYWAY
HARNESS BRACKET
CLAMP (TYPICAL)
W1 HARNESS
BRACKET ON FLANGE H
FWD
W5 HARNESS
W5 HARNESS
SPACER
FLANGE H BRACKET
NUT (TYPICAL)
(PRE SB PW4ENG 75-39)
(POST SB PW4ENG 75-39)
L-A5742 (0000)
PW V

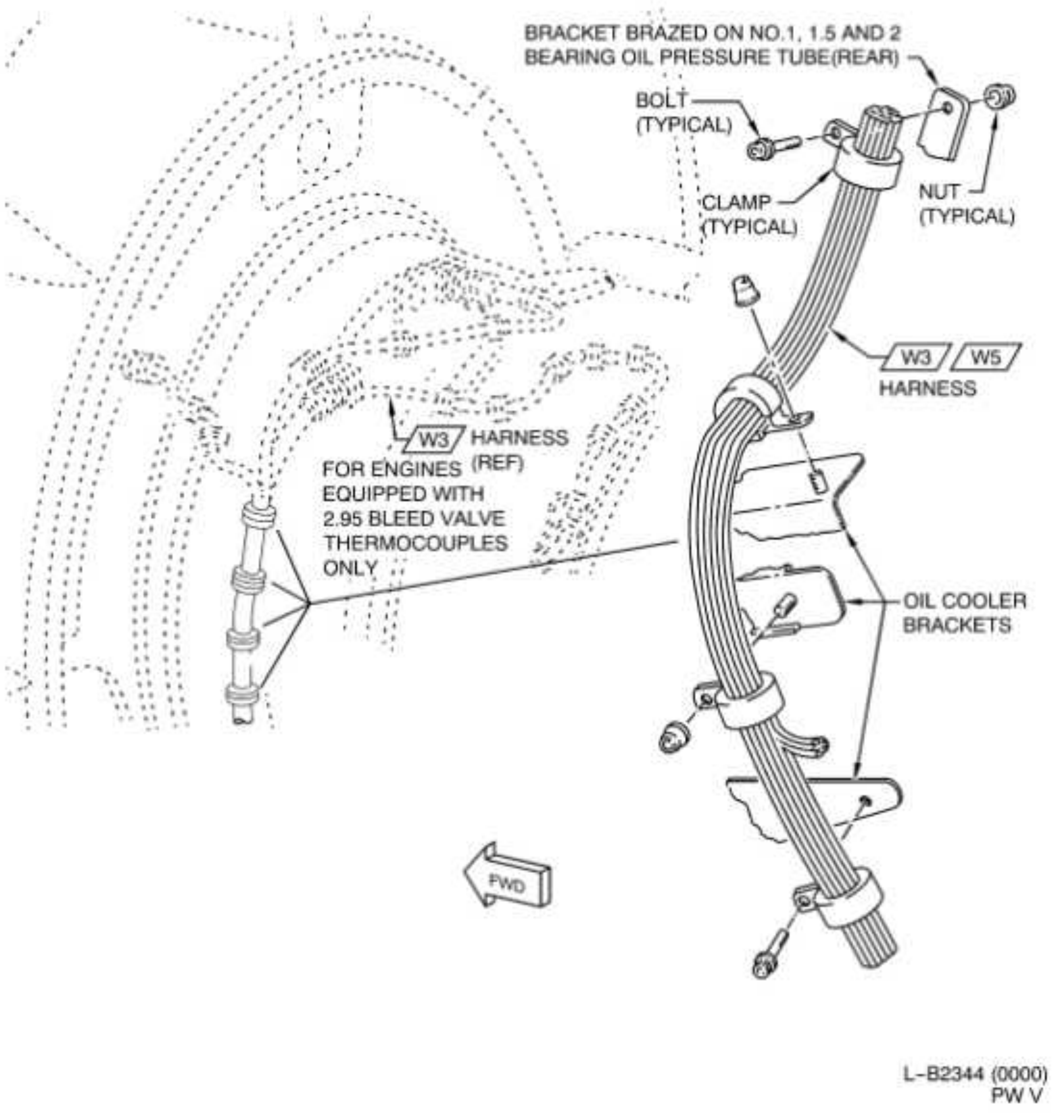
EEC Wiring Harness − W5 (Core Engine)
Figure 403
(Task 72−00−34−450−023)


W5 HARNESS
W3 HARNESS
FWD
BOLT (TYPICAL)
CLAMP (TYPICAL)
NUT
W3J24 HARNESS CONNECTOR
W5 HARNESS
BRACKET BRAZED TO AIR SHUTOFF VALVE SIGNAL TUBE
W3 HARNESS
BRACKET ON HPC CASE
HARNESS BRACKET
L−A5743 (0000)
PW V

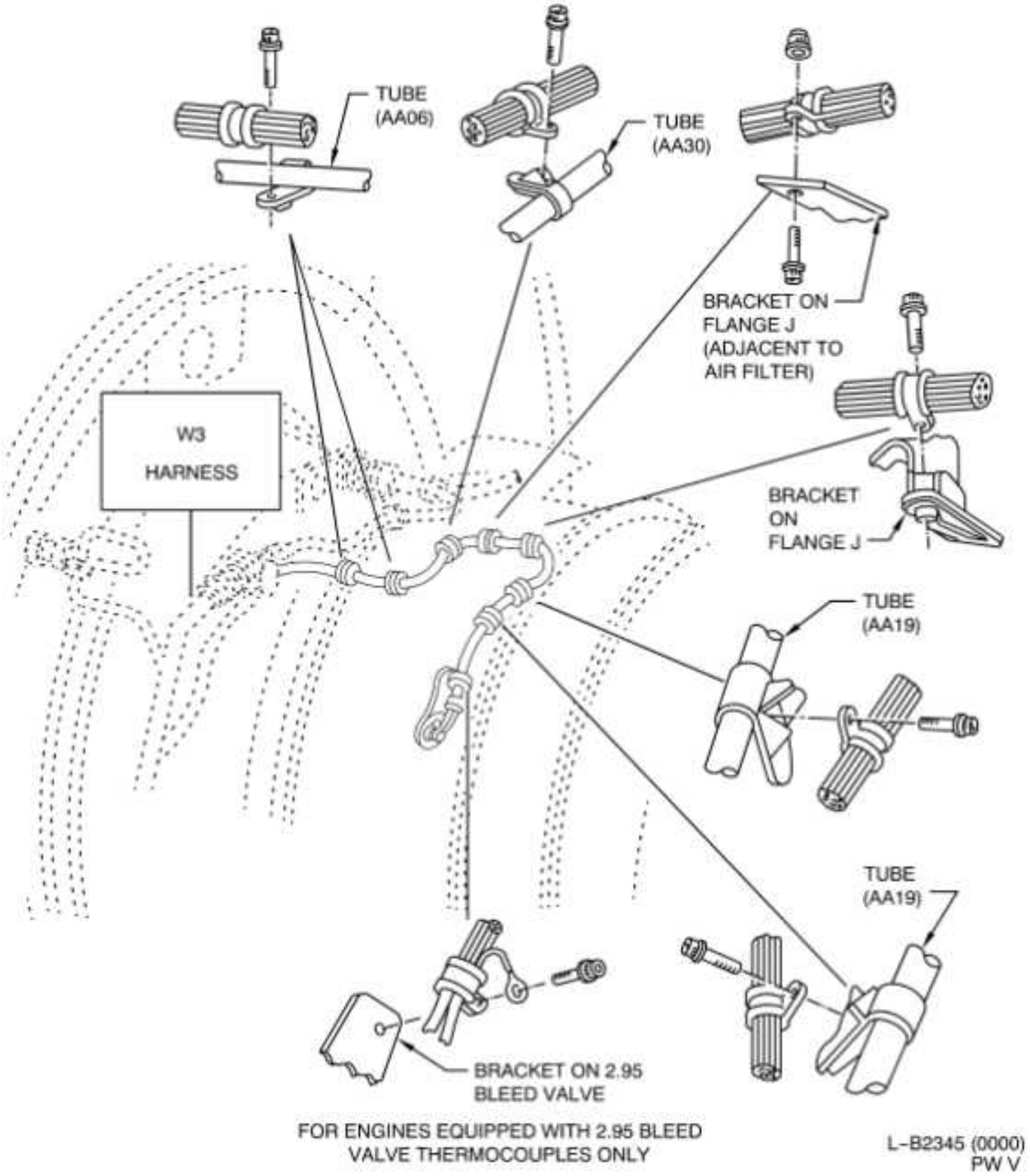
EEC Wiring Harness − W5 (Core Engine)
Figure 404
(Task 72−00−34−450−023)


W5 HARNESS
W3P12
W3 HARNESS
LOOP CLAMP
(PRE SB PW4ENG 75-39)
BOLT
(TYPICAL)
W3 HARNESS
W5 HARNESS
AIR SHUTOFF VALVE
SIGNAL TUBE
BRAZED CLAMP
(POST SB PW4ENG 75-39)
NUT
(TYPICAL)
W3 HARNESS
L-A5744 (0000)
PW V

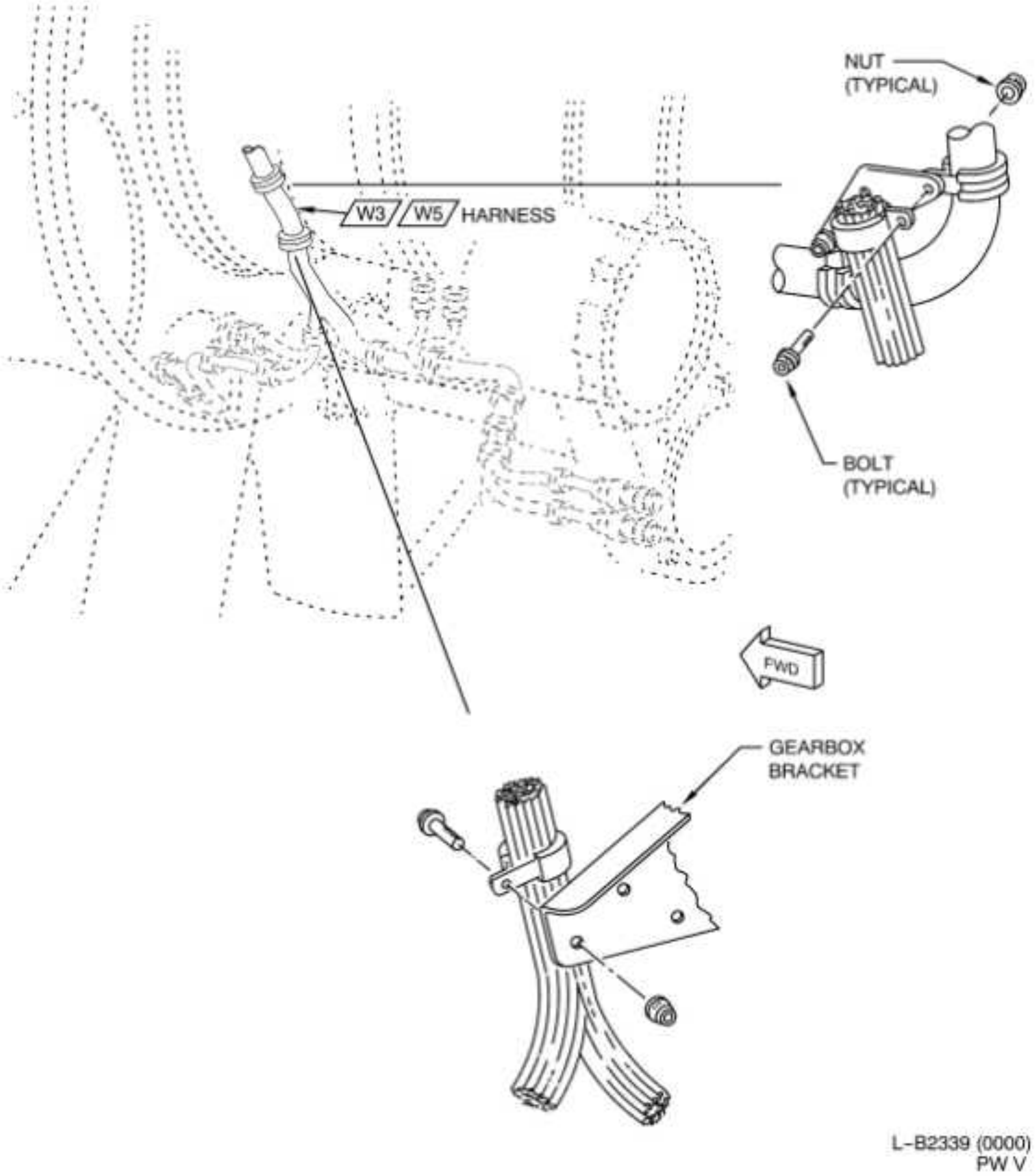
EEC Wiring Harness − W5 (Core Engine)
Figure 405
(Task 72−00−34−450−023)


BRACKET BRAZED ON NO.1, 1.5 AND 2
BEARING OIL PRESSURE TUBE(REAR)
BOLT
(TYPICAL)
CLAMP
(TYPICAL)
NUT
(TYPICAL)
W3 / W5
HARNESS
W3 HARNESS
(REF)
FOR ENGINES
EQUIPPED WITH
2.95 BLEED VALVE
THERMOCOUPLES
ONLY
OIL COOLER
BRACKETS
FWD
L-B2344 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine)
Figure 406 (Sheet 1)
(Task 72−00−34−450−023)

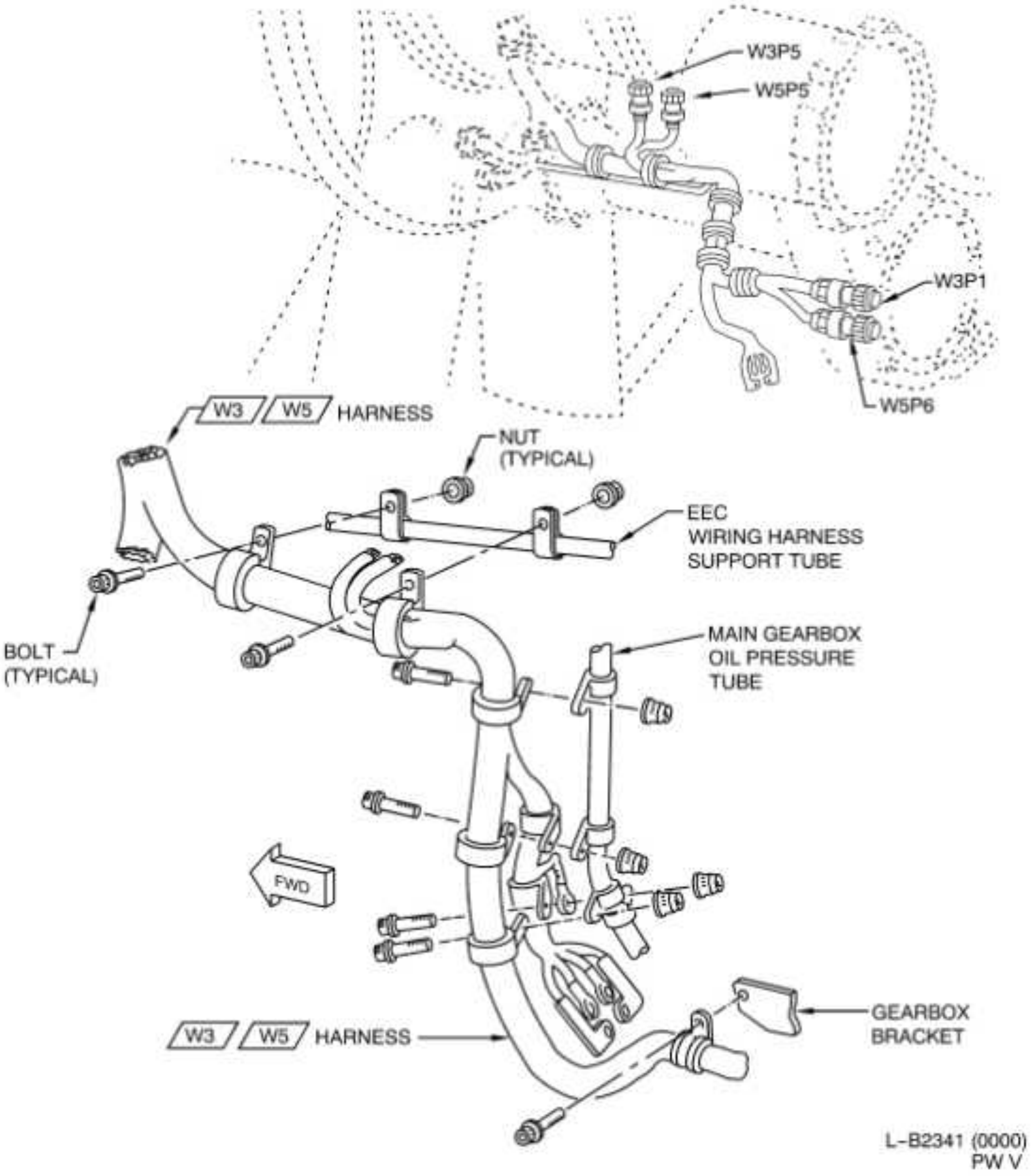

TUBE
(AA06)
TUBE
(AA30)
BRACKET ON
FLANGE J
(ADJACENT TO
AIR FILTER)
W3
HARNESS
BRACKET
ON
FLANGE J
TUBE
(AA19)
TUBE
(AA19)
BRACKET ON 2.95
BLEED VALVE
FOR ENGINES EQUIPPED WITH 2.95 BLEED
VALVE THERMOCOUPLES ONLY
L-B2345 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine)
Figure 406 (Sheet 2)
(Task 72−00−34−450−023)

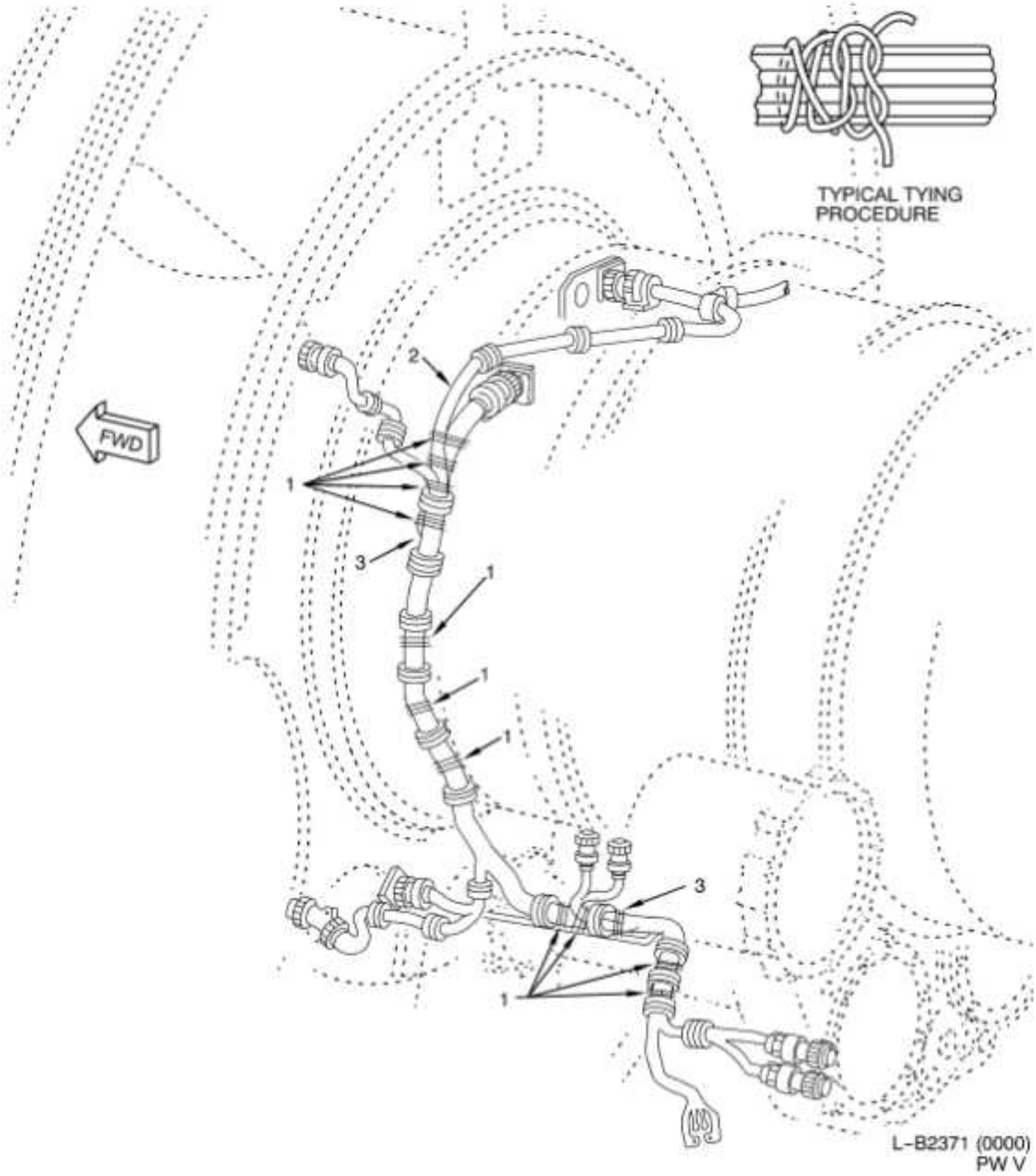

NUT
(TYPICAL)
W3
W5
HARNESS
BOLT
(TYPICAL)
FWD
GEARBOX
BRACKET
L-B2339 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine)
Figure 407
(Task 72−00−34−450−023)

ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−23


W3P5
W5P5
W3P1
W5P6
W3 / W5 HARNESS
NUT (TYPICAL)
EEC WIRING HARNESS SUPPORT TUBE
BOLT (TYPICAL)
MAIN GEARBOX OIL PRESSURE TUBE
FWD
W3 / W5 HARNESS
GEARBOX BRACKET
L-B2341 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine)
Figure 408
(Task 72−00−34−450−023)

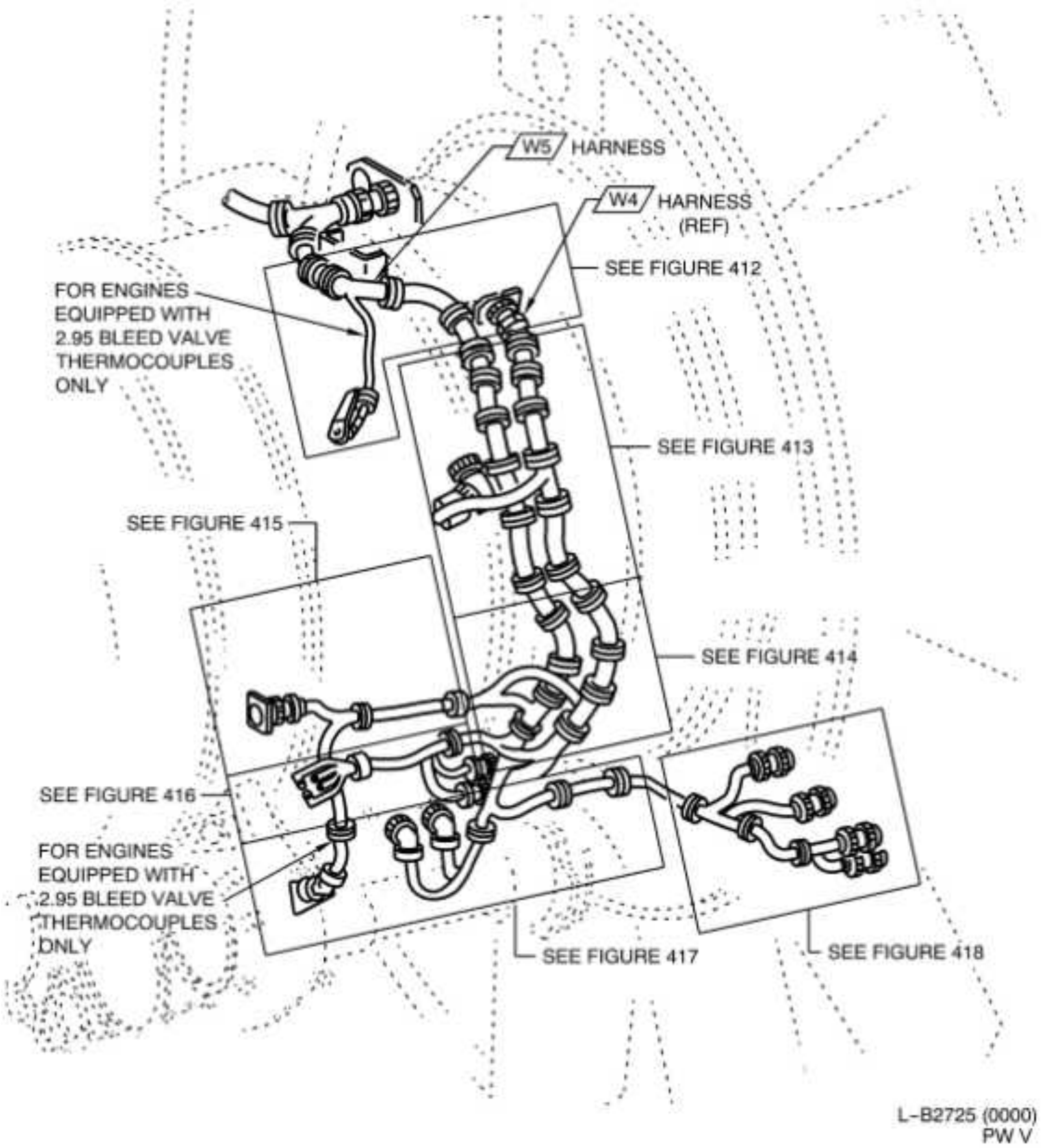

TYPICAL TYING PROCEDURE
FWD
1
2
3
1
1
1
3
1
L-B2371 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine)
Figure 409
(Task 72−00−34−450−023)

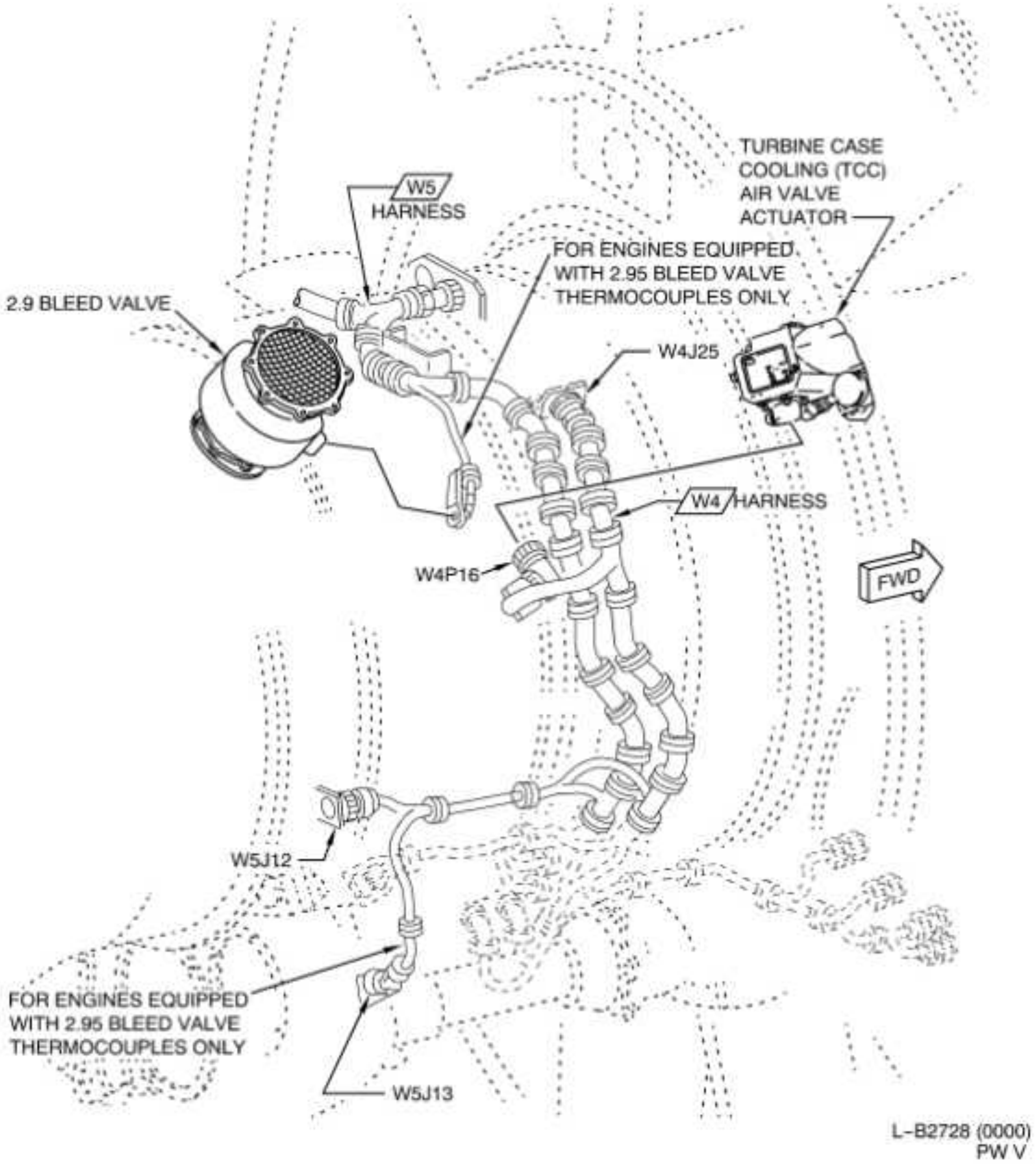
ENGINE GENERAL − INTERMEDIATE CASE − INSTALLATION−23

1. Tie
2. The Harness Must Be Put Forward In This Location
3. Make A Loop In The Harness And Put The Loop Through The Clamp. Tie The Loop And The Harness Together.

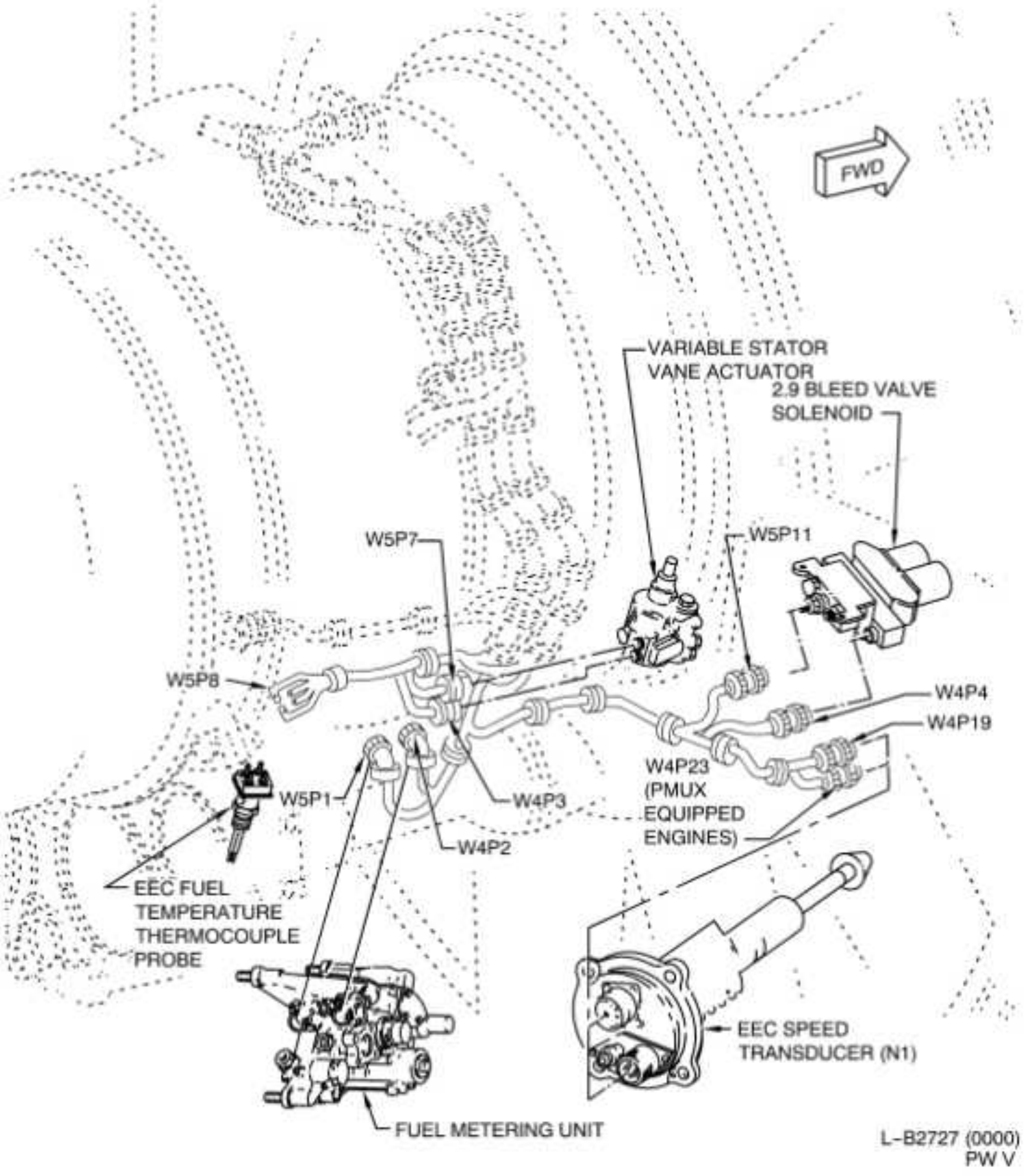
Key to Figure 409


W5 HARNESS
W4 HARNESS (REF)
SEE FIGURE 412
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
SEE FIGURE 413
SEE FIGURE 415
SEE FIGURE 414
SEE FIGURE 416
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
SEE FIGURE 417
SEE FIGURE 418
L-B2725 (0000)
PW V

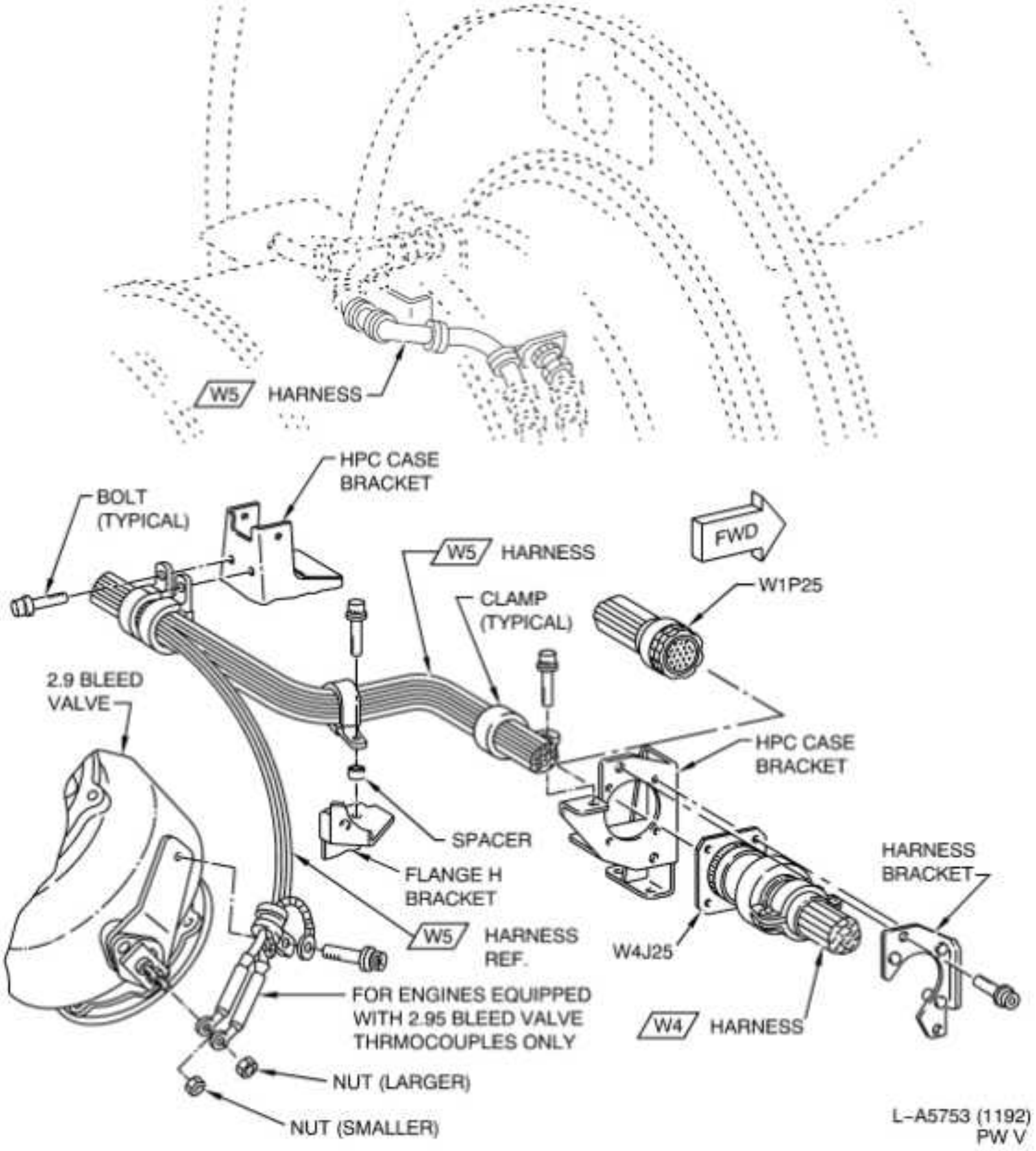
EEC Wiring Harness − W5 (Core Engine)
Figure 410
(Task 72−00−34−450−023)


TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
W5 HARNESS
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
2.9 BLEED VALVE
W4J25
W4 HARNESS
W4P16
FWD
W5J12
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
W5J13
L−B2728 (0000)
PW V

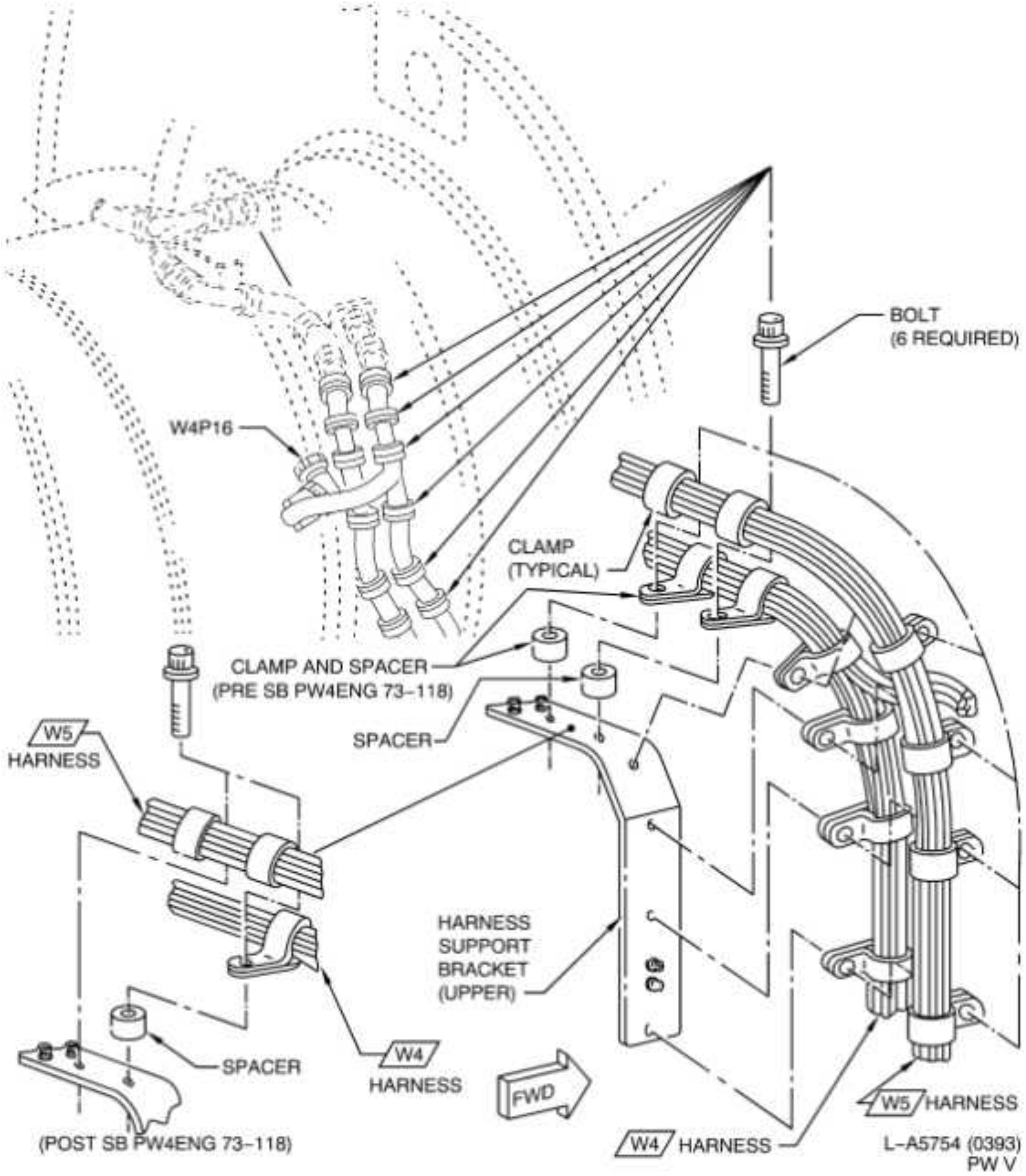
EEC Wiring Harness − W5 (Core Engine)
Figure 411 (Sheet 1)
(Task 72−00−34−450−023)


FWD
VARIABLE STATOR VANE ACTUATOR
2.9 BLEED VALVE SOLENOID
W5P7
W5P11
W5P8
W4P4
W4P19
W4P23 (PMUX EQUIPPED ENGINES)
W5P1
W4P3
W4P2
EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
EEC SPEED TRANSDUCER (N1)
FUEL METERING UNIT
L-B2727 (0000)
PW V

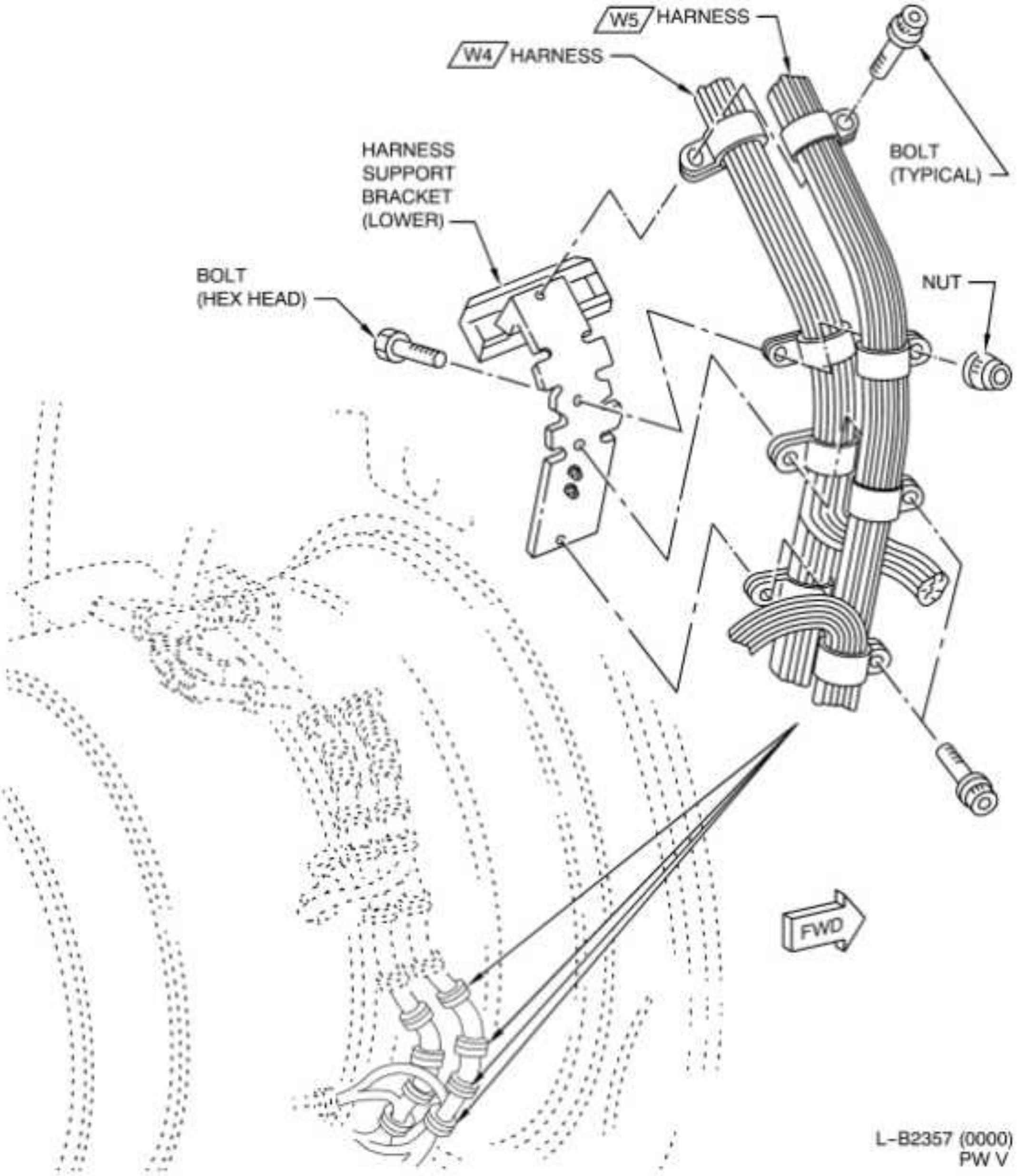
EEC Wiring Harness − W5 (Core Engine)
Figure 411 (Sheet 2)
(Task 72−00−34−450−023)


W5 HARNESS
HPC CASE BRACKET
BOLT (TYPICAL)
W5 HARNESS
FWD
W1P25
CLAMP (TYPICAL)
2.9 BLEED VALVE
HPC CASE BRACKET
SPACER
HARNESS BRACKET
FLANGE H BRACKET
W5 HARNESS REF.
W4J25
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THRMOCOUPLES ONLY
W4 HARNESS
NUT (LARGER)
NUT (SMALLER)
L−A5753 (1192)
PW V

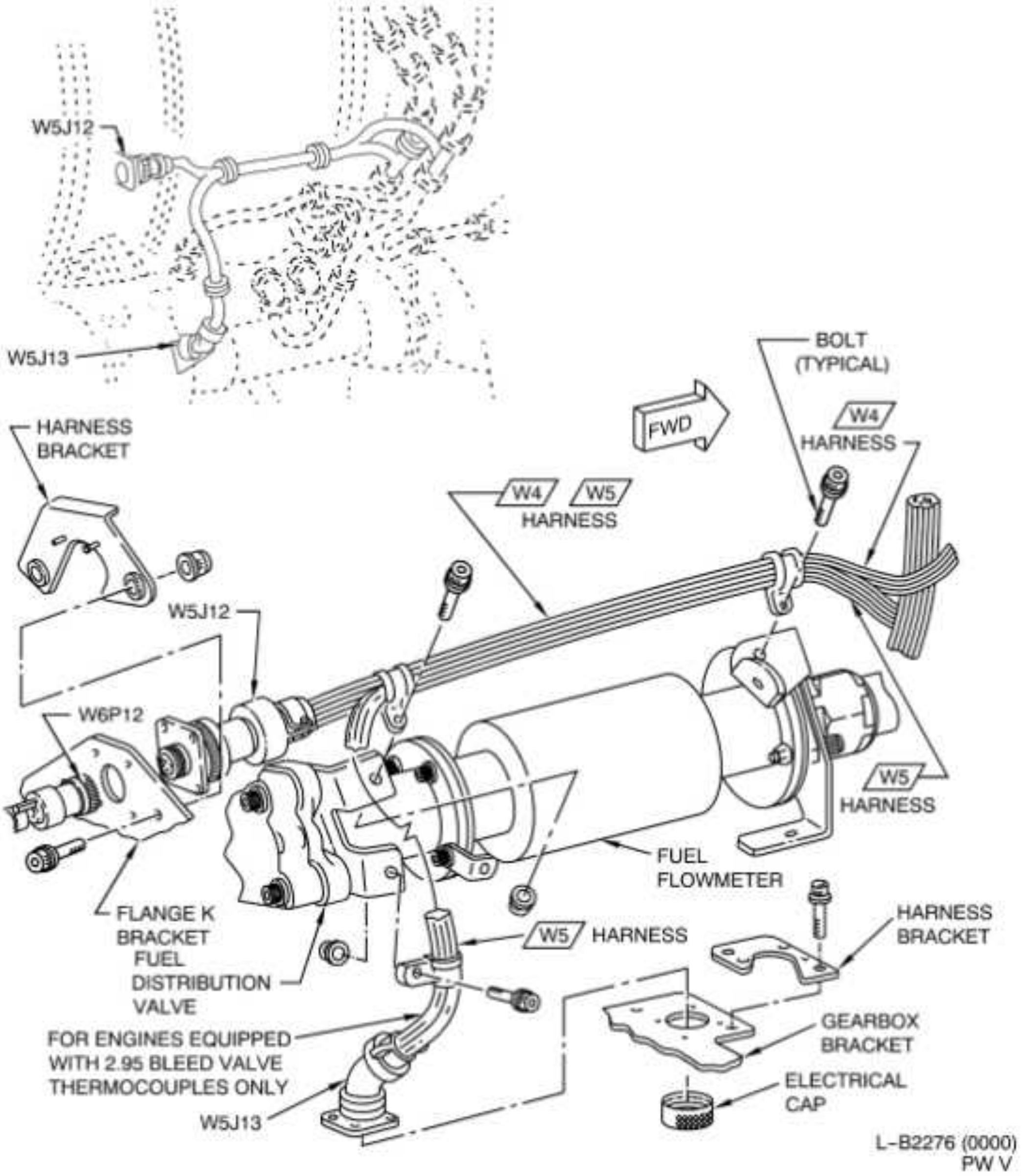
EEC Wiring Harness − W5 (Core Engine)
Figure 412
(Task 72−00−34−450−023)


BOLT
(6 REQUIRED)
W4P16
CLAMP
(TYPICAL)
CLAMP AND SPACER
(PRE SB PW4ENG 73−118)
SPACER
W5
HARNESS
HARNESS
SUPPORT
BRACKET
(UPPER)
SPACER
W4
HARNESS
FWD
(POST SB PW4ENG 73−118)
W5 HARNESS
W4 HARNESS
L−A5754 (0393)
PW V

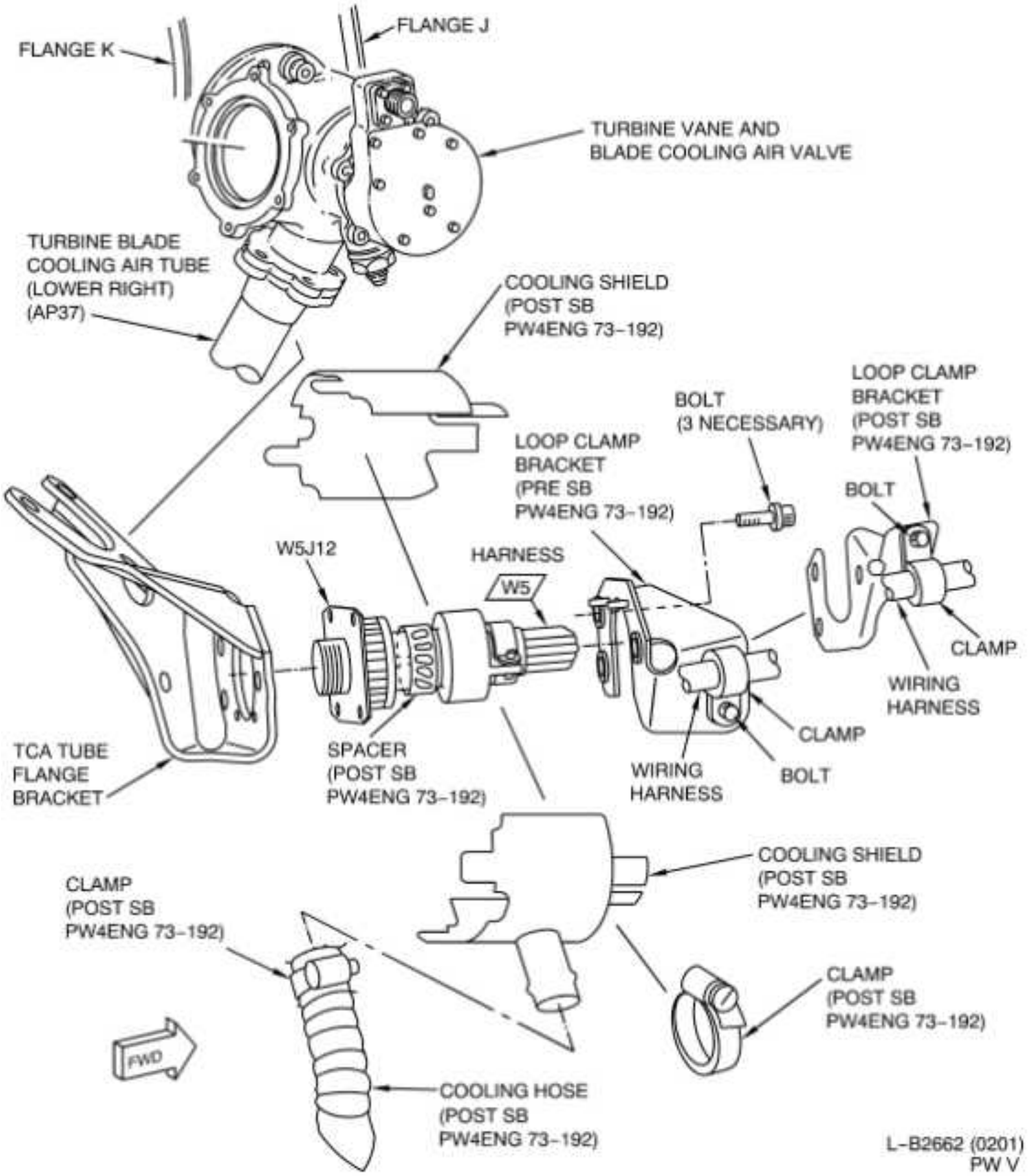
EEC Wiring Harness − W5 (Core Engine)
Figure 413
(Task 72−00−34−450−023)


W5 HARNESS
W4 HARNESS
HARNESS SUPPORT BRACKET (LOWER)
BOLT (TYPICAL)
BOLT (HEX HEAD)
NUT
FWD
L-B2357 (0000)
PW V

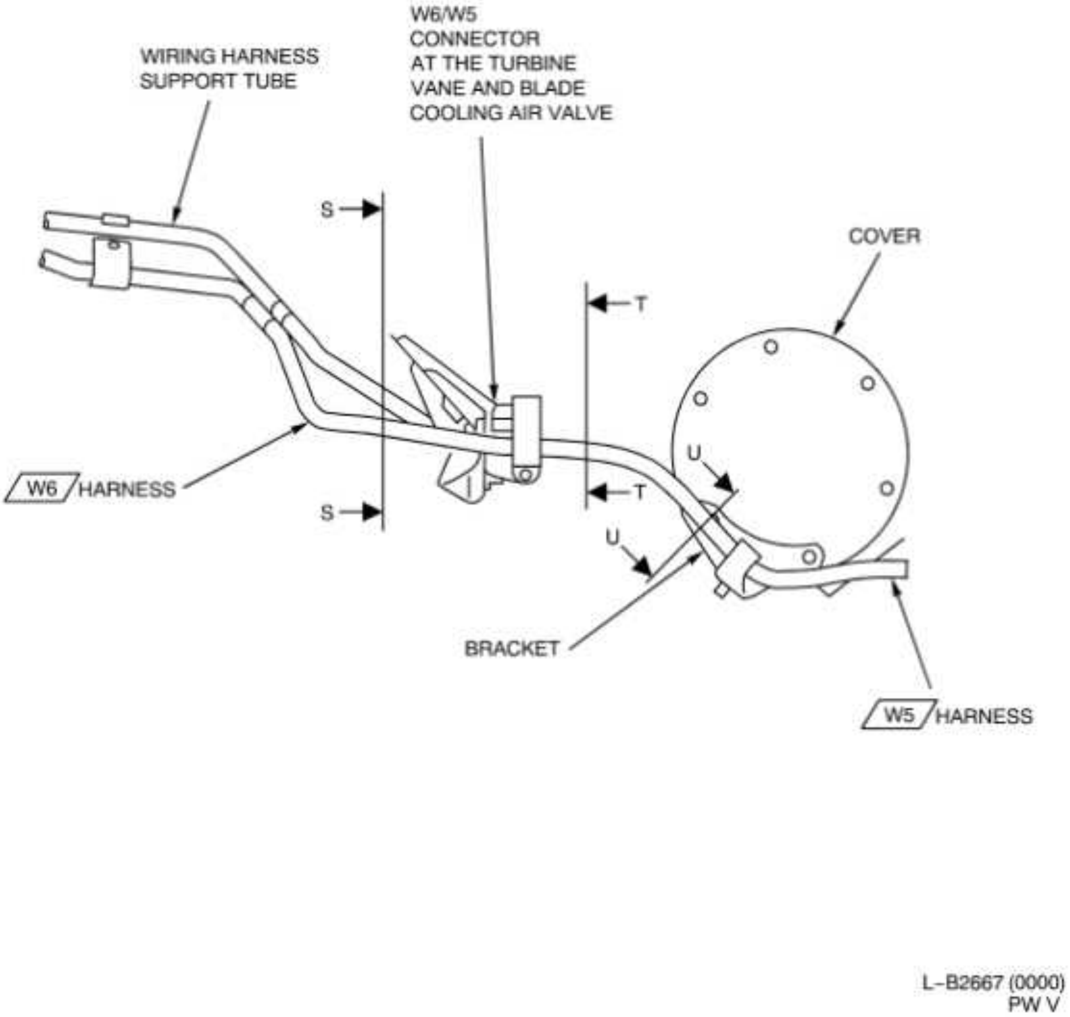
EEC Wiring Harness − W5 (Core Engine)
Figure 414
(Task 72−00−34−450−023)


W5J12
W5J13
BOLT (TYPICAL)
FWD
W4 HARNESS
HARNESS BRACKET
W4 W5 HARNESS
W5J12
W6P12
W5 HARNESS
FUEL FLOWMETER
FLANGE K BRACKET
FUEL DISTRIBUTION VALVE
W5 HARNESS
HARNESS BRACKET
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES ONLY
GEARBOX BRACKET
ELECTRICAL CAP
W5J13
L-B2276 (0000)
PW V

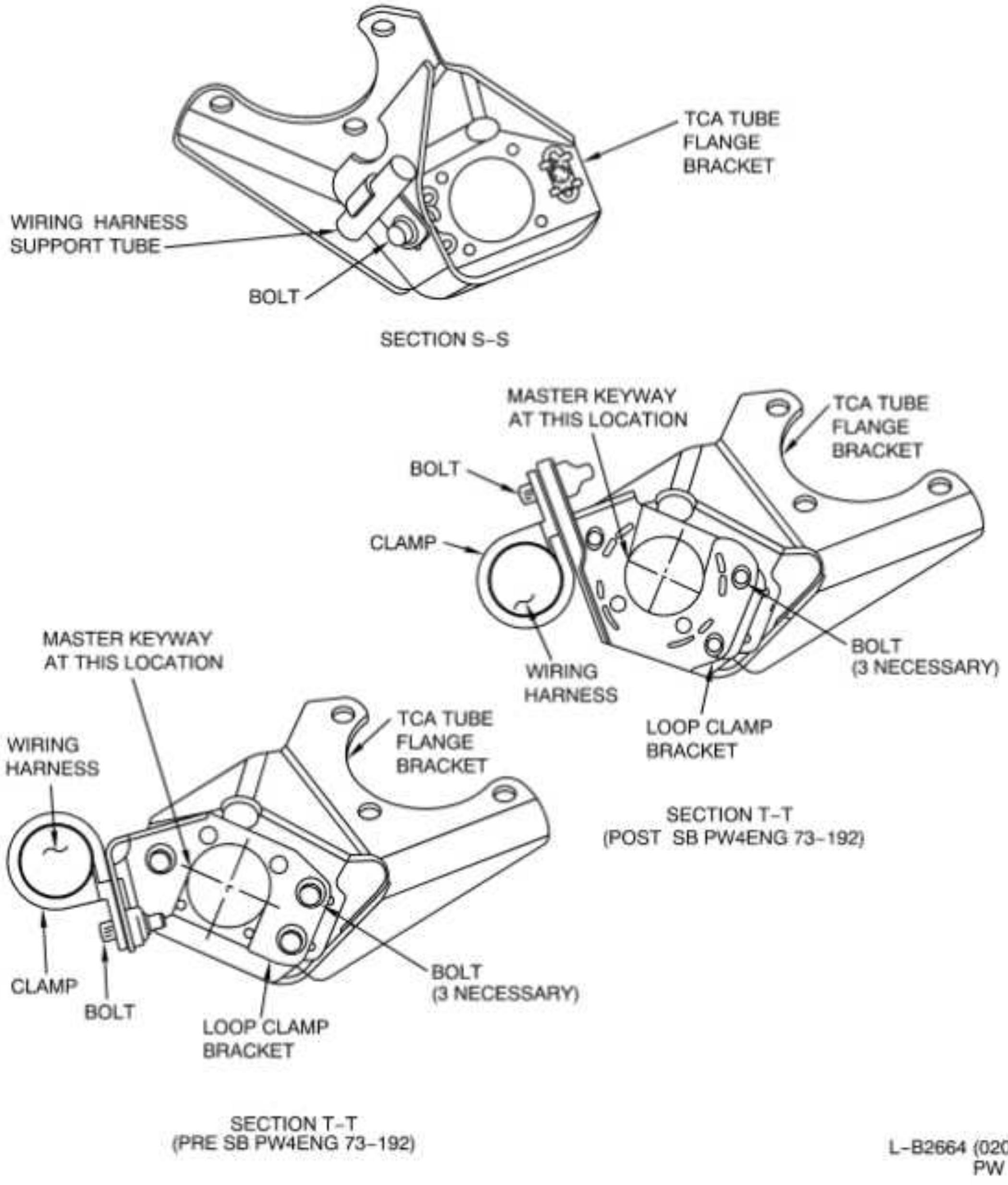
EEC Wiring Harness − W5 (Core Engine) (Pre SB PW4ENG 73−163)
Figure 415 (Sheet 1)
(Task 72−00−34−450−023)


FLANGE K
FLANGE J
TURBINE VANE AND BLADE COOLING AIR VALVE
TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT) (AP37)
COOLING SHIELD (POST SB PW4ENG 73−192)
LOOP CLAMP BRACKET (POST SB PW4ENG 73−192)
BOLT (3 NECESSARY)
LOOP CLAMP BRACKET (PRE SB PW4ENG 73−192)
BOLT
W5J12
HARNESS
W5
CLAMP
WIRING HARNESS
CLAMP
TCA TUBE FLANGE BRACKET
SPACER (POST SB PW4ENG 73−192)
WIRING HARNESS
BOLT
COOLING SHIELD (POST SB PW4ENG 73−192)
CLAMP (POST SB PW4ENG 73−192)
CLAMP (POST SB PW4ENG 73−192)
FWD
COOLING HOSE (POST SB PW4ENG 73−192)
L−B2662 (0201)
PW V

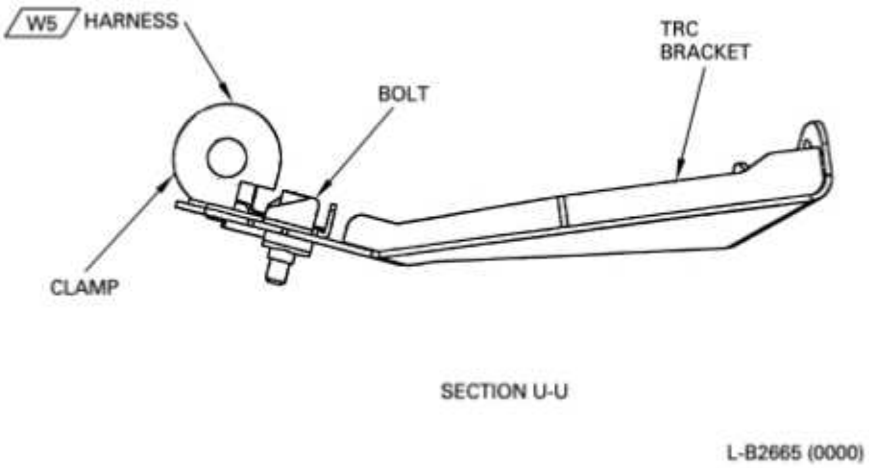
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 415 (Sheet 2)
(Task 72−00−34−450−023)


WIRING HARNESS SUPPORT TUBE
W6/W5 CONNECTOR AT THE TURBINE VANE AND BLADE COOLING AIR VALVE
S
S
T
T
COVER
U
U
W6 HARNESS
BRACKET
W5 HARNESS
L−B2667 (0000)
PW V

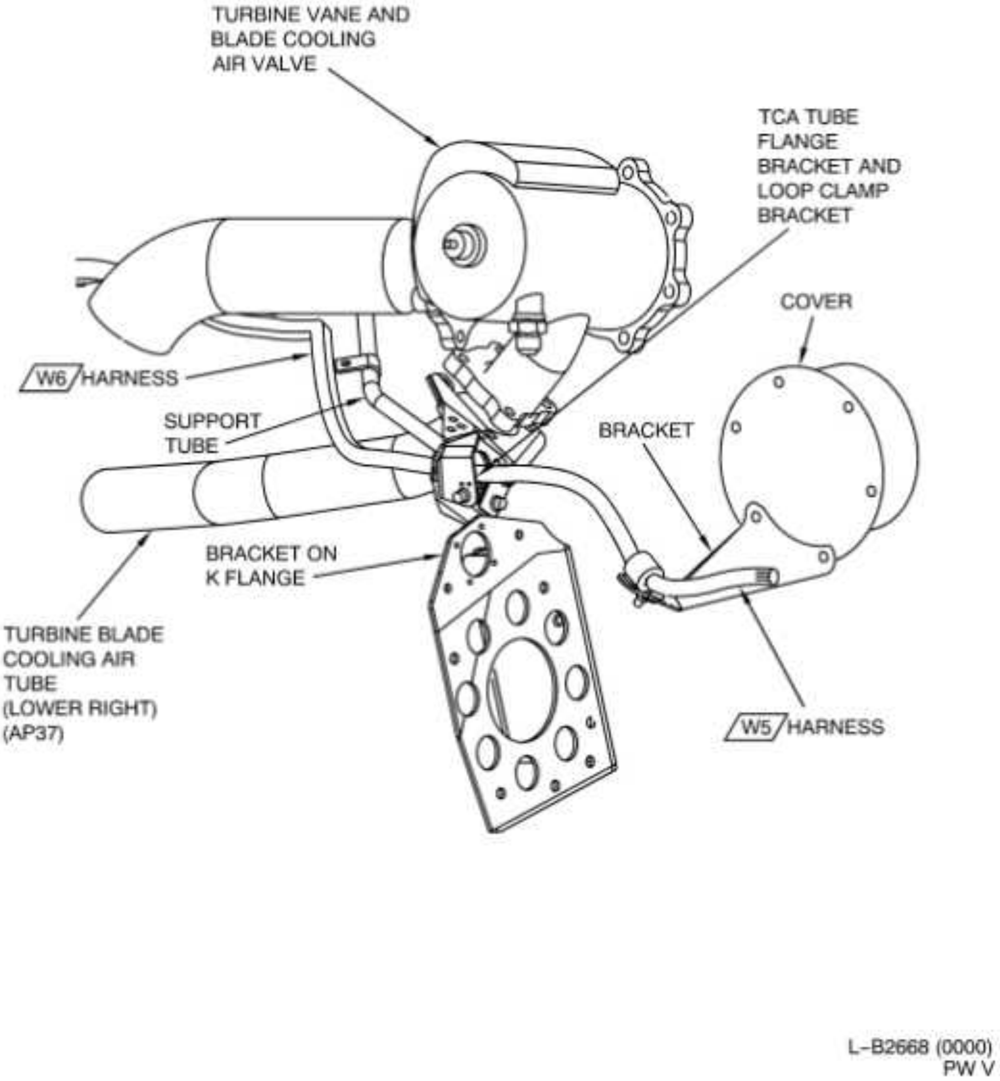
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 415 (Sheet 3)
(Task 72−00−34−450−023)


TCA TUBE FLANGE BRACKET
WIRING HARNESS SUPPORT TUBE
BOLT
SECTION S-S
MASTER KEYWAY AT THIS LOCATION
TCA TUBE FLANGE BRACKET
BOLT
CLAMP
WIRING HARNESS
BOLT (3 NECESSARY)
LOOP CLAMP BRACKET
SECTION T-T (POST SB PW4ENG 73-192)
MASTER KEYWAY AT THIS LOCATION
WIRING HARNESS
TCA TUBE FLANGE BRACKET
CLAMP
BOLT
LOOP CLAMP BRACKET
BOLT (3 NECESSARY)
SECTION T-T (PRE SB PW4ENG 73-192)
L-B2664 (0201)
PW V

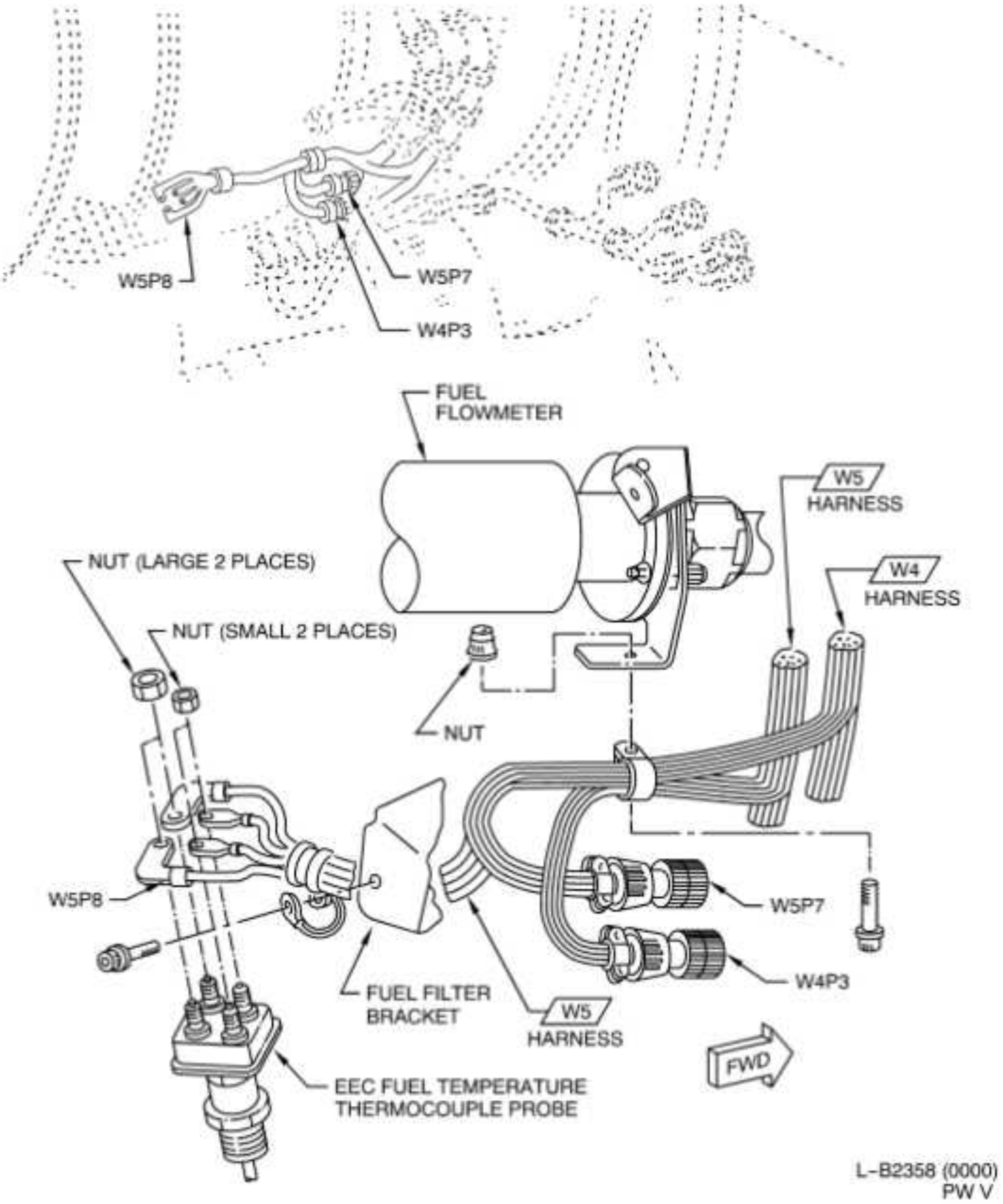
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 415 (Sheet 4)
(Task 72−00−34−450−023)


W5
HARNESS
TRC
BRACKET
BOLT
CLAMP
SECTION U-U
L-B2665 (0000)

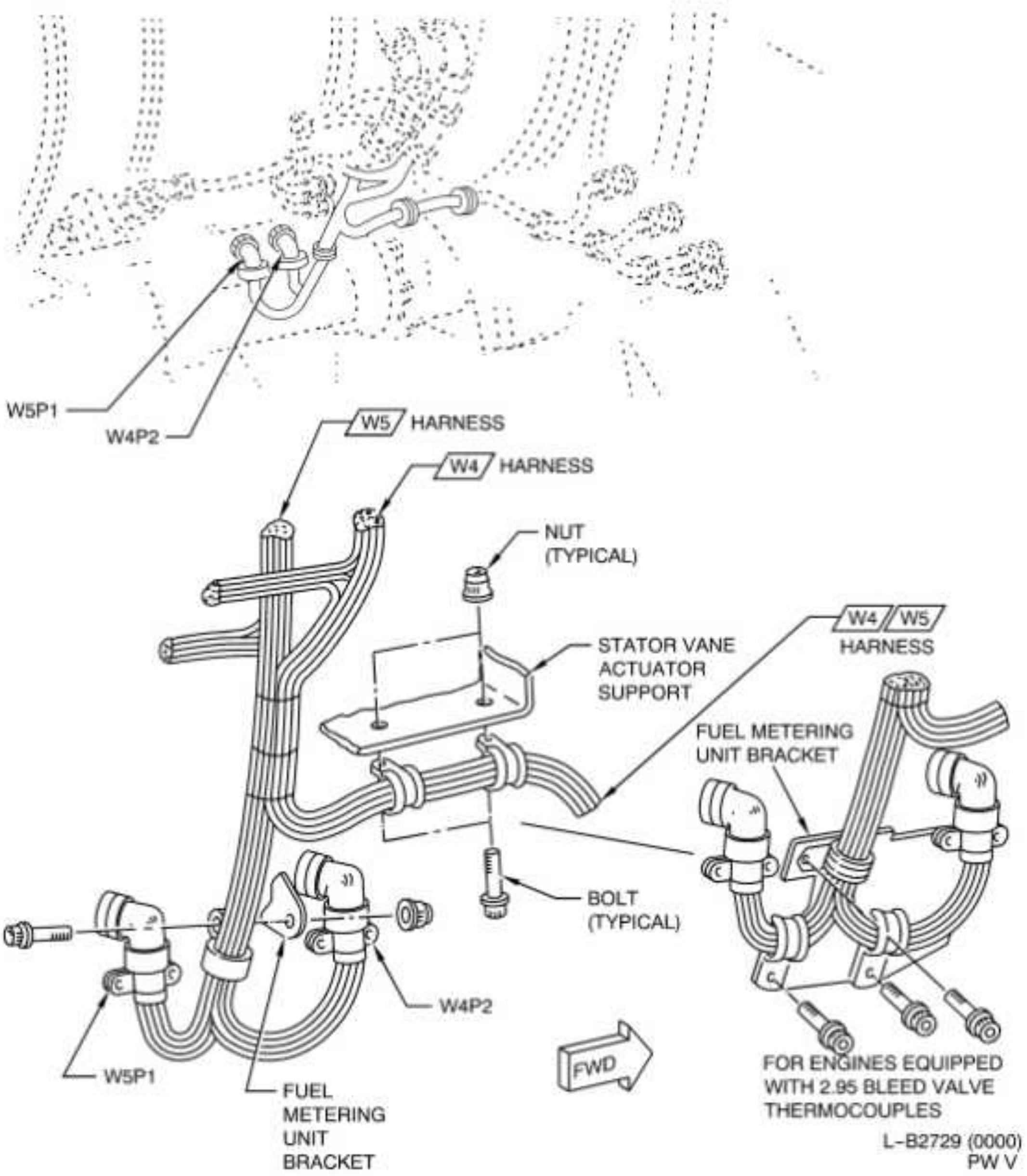
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 415 (Sheet 5)
(Task 72−00−34−450−023)


TURBINE VANE AND BLADE COOLING AIR VALVE
TCA TUBE FLANGE BRACKET AND LOOP CLAMP BRACKET
COVER
W6 HARNESS
SUPPORT TUBE
BRACKET
BRACKET ON K FLANGE
TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT) (AP37)
W5 HARNESS
L-B2668 (0000)
PW V

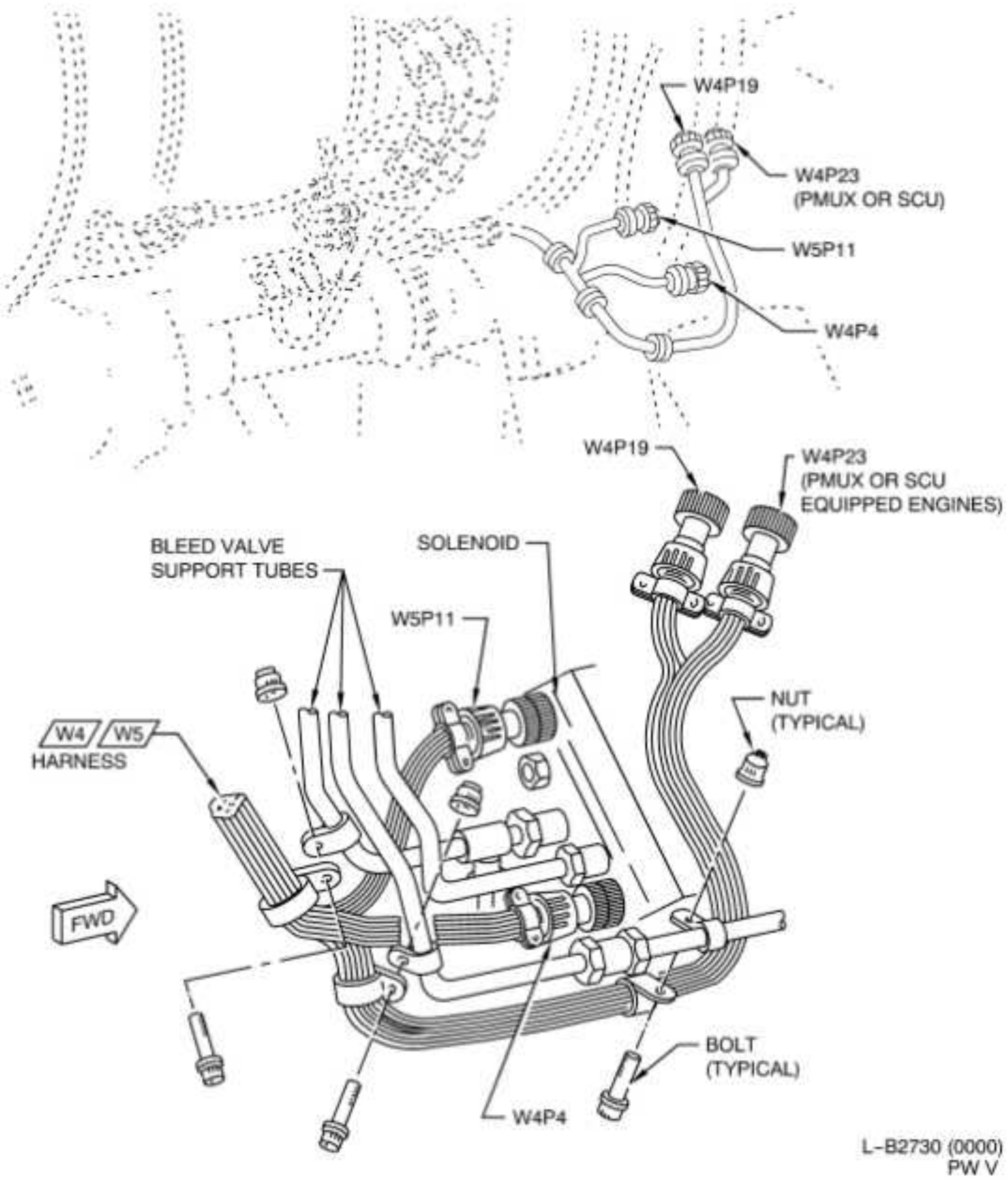
EEC Wiring Harness − W5 (Core Engine) (Post SB PW4ENG 73−163)
Figure 415 (Sheet 6)
(Task 72−00−34−450−023)


W5P8
W5P7
W4P3
FUEL FLOWMETER
W5 HARNESS
NUT (LARGE 2 PLACES)
W4 HARNESS
NUT (SMALL 2 PLACES)
NUT
W5P8
W5P7
W4P3
FUEL FILTER BRACKET
W5 HARNESS
FWD
EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
L-B2358 (0000)
PW V

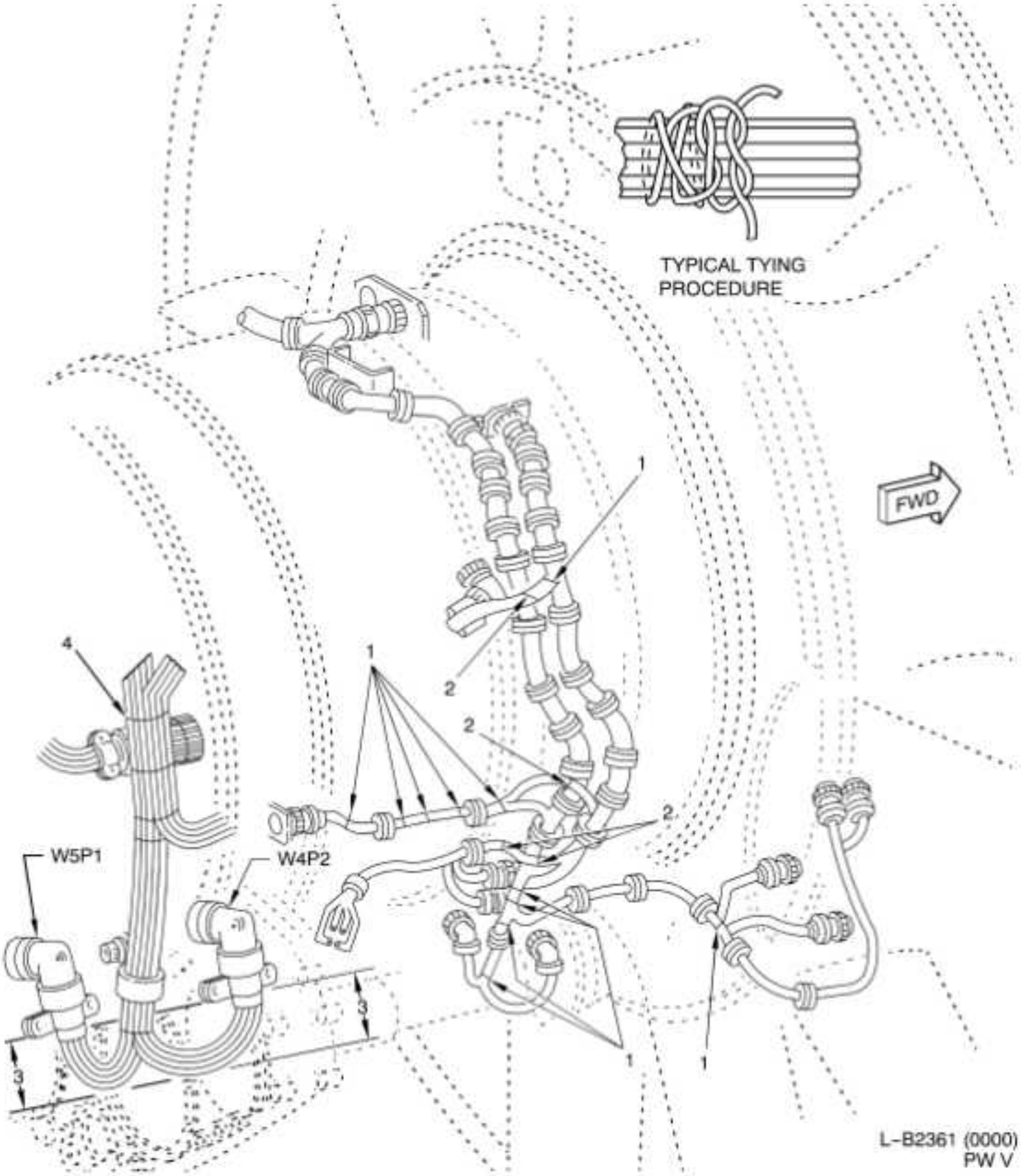
EEC Wiring Harness − W5 (Core Engine)
Figure 416
(Task 72−00−34−450−023)


W5P1
W4P2
W5 HARNESS
W4 HARNESS
NUT (TYPICAL)
STATOR VANE ACTUATOR SUPPORT
W4 W5 HARNESS
FUEL METERING UNIT BRACKET
BOLT (TYPICAL)
W4P2
W5P1
FUEL METERING UNIT BRACKET
FWD
FOR ENGINES EQUIPPED WITH 2.95 BLEED VALVE THERMOCOUPLES
L-B2729 (0000)
PW V

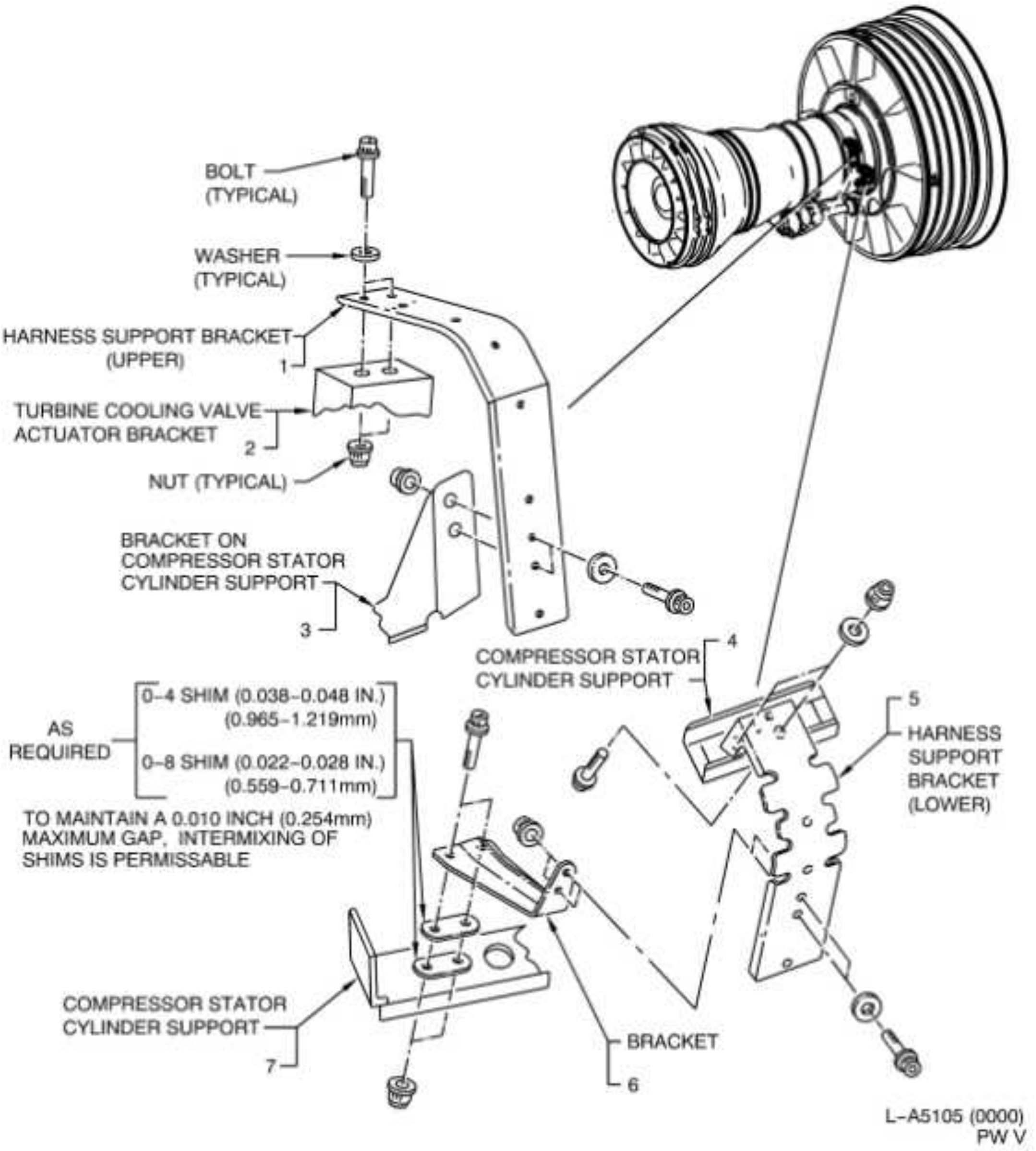
EEC Wiring Harness − W5 (Core Engine)
Figure 417
(Task 72−00−34−450−023)


W4P19
W4P23
(PMUX OR SCU)
W5P11
W4P4
W4P19
W4P23
(PMUX OR SCU
EQUIPPED ENGINES)
BLEED VALVE
SUPPORT TUBES
SOLENOID
W5P11
W4
W5
HARNESS
NUT
(TYPICAL)
FWD
BOLT
(TYPICAL)
W4P4
L-B2730 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine)
Figure 418
(Task 72−00−34−450−023)


TYPICAL TYING PROCEDURE
FWD
1
4
1
2
2
2
W5P1
W4P2
3
3
1
1
L-B2361 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine)
Figure 419
(Task 72−00−34−450−023)


BOLT (TYPICAL)
WASHER (TYPICAL)
HARNESS SUPPORT BRACKET (UPPER)
1
TURBINE COOLING VALVE ACTUATOR BRACKET
2
NUT (TYPICAL)
BRACKET ON COMPRESSOR STATOR CYLINDER SUPPORT
3
COMPRESSOR STATOR CYLINDER SUPPORT
4
HARNESS SUPPORT BRACKET (LOWER)
5
AS REQUIRED
0−4 SHIM (0.038−0.048 IN.) (0.965−1.219mm)
0−8 SHIM (0.022−0.028 IN.) (0.559−0.711mm)
TO MAINTAIN A 0.010 INCH (0.254mm) MAXIMUM GAP, INTERMIXING OF SHIMS IS PERMISSABLE
COMPRESSOR STATOR CYLINDER SUPPORT
7
BRACKET
6
L−A5105 (0000)
PW V

EEC Wiring Harness − W5 (Core Engine) Support Brackets
Figure 420
(Task 72−00−34−450−023)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-34-450-021:

1. Install Turbine Vane And Blade Cooling Air Valve, IDGS Air/Oil Heat Exchanger Valve Override Solenoid

A. Equipment And Materials Necessary

Standard Tools:

Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
R P06-054	Paste, Antiseize (PWA 36246)
P11-014	Alcohol, Isopropyl (PMC 9094)

B. Procedure

See Figure 401.

(1) If a new solenoid must be installed do the following:

(a) Remove the protection covers from all openings on the solenoid.

(b) Install the two adapters with gaskets, threads lubricated with Engine Oil P03-001, to the two openings on top of the solenoid. Torque the adapters to 65 - 75 lb-in. (7.344 - 8.474 N.m).

(c) Install a cap, threads lubricated with Engine Oil P03-001, to the right side adapter. Torque the cap to 90 - 100 lb-in. (10.169 - 11.298 N.m).

(d) Install two adapters, larger adapter in the center port and smaller adapter in the right side port on the rear of the solenoid with gaskets, threads lubricated with Engine Oil P03-001. Torque the larger adapter to 150 - 170 lb-in. (16.948 - 19.207 N.m) and the smaller adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m).

(e) Install plug with a gasket, threads lubricated with Engine Oil P03−001, to the left port on the rear of the solenoid. Torque the plug to 110 − 120 lb−in. (12.428 − 13.558 N.m).

(2) Put the solenoid under the loop clamp bracket at approximately the 1 o'clock position on the intermediate case. Install the solenoid with the two tube adapters pointing rearward and the rear lugs of the solenoid rearward of the lugs on the case. Install the switch and bracket assembly to the solenoid and attach with four bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(3) Connect the bleed valve supply tube (AA25) to the solenoid as follows:

(a) Lubricate the threads of the adapter with
R Antiseize Paste P06−054. Wipe off unwanted paste.

(b) install the supply tube nut to the center adapter on the rear of the solenoid.

(c) Torque the tube nut to 225 − 250 lb−in. (25.422 − 28.246 N.m).

(4) Connect the HPC drum air valve signal tube (AA01) to the solenoid as follows:

(a) Lubricate the lower rear adapter on the solenoid
R with Antiseize Paste P06−054.

R (b) Wipe off unwanted paste.

(c) Install the air solenoid signal tube nut to the adapter.

(d) (Reference 2171) Torque the tube nut to 170 − 180 lb−in. (19.207 − 20.337 N.m)).

(e) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the tubes (AA01), (AA25), and plug.

(5) Install the pressure switch tube assembly as follows:

(a) Lubricate the threads at the elbow end of the tube with Engine Oil P03−001 and threads at the
R straight end of the tube with Antiseize Paste
R P06−054. Wipe off unwanted paste. Install the tube to the engine.

(b) Torque the elbow end to the solenoid adapter to 90 − 100 lb−in. (10.169 − 11.298 N.m). Torque the straight end to the pressure switch to 65 − 75 lb−in. (7.344 − 8.474 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to both ends of the tube and to the cap assembly.

(6) Connect the W1P10 and W1P11 harness connectors to the solenoid. See 70−10−00, Standard Practices Manual.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Isopropyl Alcohol P11−014 and let air dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to make sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).

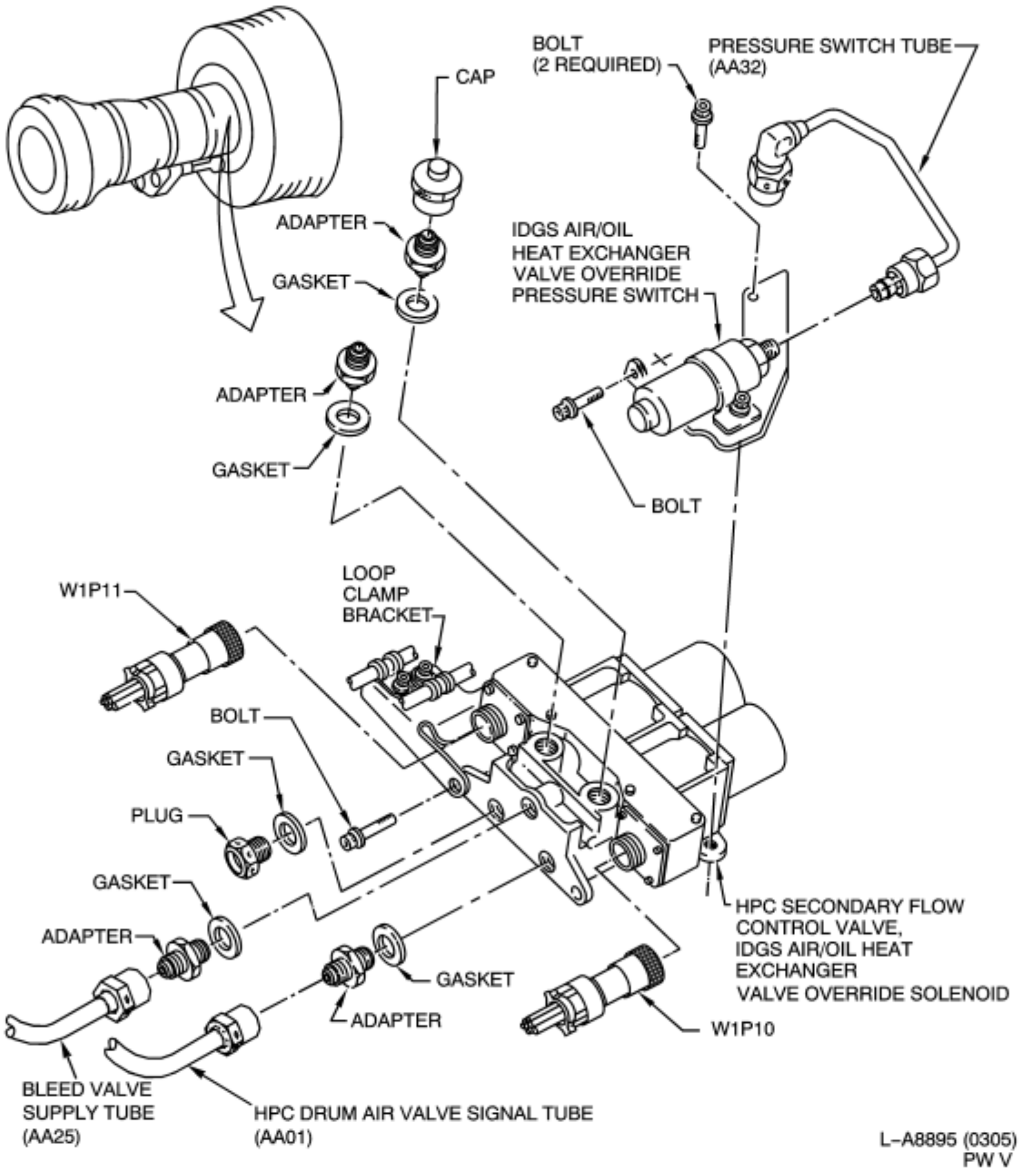
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

C. Postrequisites

(1) Install the fan exit liner segment (inner rear) that is at the 1 o'clock position. Refer to 72-00-33, Installation-16 Task 72-00-33-440-001.


CAP
BOLT
(2 REQUIRED)
PRESSURE SWITCH TUBE
(AA32)
ADAPTER
GASKET
IDGS AIR/OIL
HEAT EXCHANGER
VALVE OVERRIDE
PRESSURE SWITCH
ADAPTER
GASKET
BOLT
LOOP
CLAMP
BRACKET
W1P11
BOLT
GASKET
PLUG
GASKET
ADAPTER
HPC SECONDARY FLOW
CONTROL VALVE,
IDGS AIR/OIL HEAT
EXCHANGER
VALVE OVERRIDE SOLENOID
GASKET
ADAPTER
W1P10
BLEED VALVE
SUPPLY TUBE
(AA25)
HPC DRUM AIR VALVE SIGNAL TUBE
(AA01)
L-A8895 (0305)
PW V

Turbine Vane And Blade Cooling Air Valve, IDGS
Air/Oil Heat Exchanger Valve Override Solenoid
Figure 401
(Task 72-00-34-450-021)

Task 72-00-34-450-022:

1. Install Turbine Vane Cooling Air Valve, Turbine Vane And Blade Cooling Air Valve Solenoid

A. Equipment And Materials Necessary

Standard Tools:
Glenair TG-70 Strap Wrench Or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 Or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
R	P06-054	Paste, Antiseize (PWA 36246)
	P11-014	Alcohol, Isopropyl (PMC 9094)

B. Procedure

See Figure 401.

(1) If a new solenoid must be installed, do the following:

(a) Remove the protection covers from all openings on the solenoid.

(b) Install two adapters with gaskets, threads lubricated with Engine Oil P03-001, to the two openings on the top of the solenoid. Torque the adapters to 65 - 75 lb-in. (7.344 - 8.474 N.m).

(c) Install two caps, threads lubricated with Engine Oil P03-001, to the above adapters. Torque the caps to 90 - 100 lb-in. (10.169 - 11.298 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to the caps.

(d) Install three adapters, larger adapter in center, to three ports on the rear of the solenoid with gaskets, threads lubricated with Engine Oil P03−001. Torque the center adapter to 150 − 170 lb−in. (16.948 − 19.207 N.m) and the two outer adapters to 110 − 120 lb−in. (12.428 − 13.558 N.m).

(2) Position the solenoid to the intermediate case under the bracket, at approximately the 10 o'clock position, with the three adapters pointing rearward and rear lugs on the valve solenoid rearward of the lugs on case with four bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

NOTE: If the clamp bolt was loosened to gain clearance for solenoid removal, tighten and torque the clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

R (3) Lubricate the threads of the adapter with antiseize
R Paste P06−054 and install the supply tube assembly to
R the center adapter on the rear of the solenoid. Wipe
R off excess paste. Torque the tube nut to 225 − 250
lb−in. (25.422 − 28.246 N.m).

(4) Lubricate the upper rear adapter on the valve solenoid with Engine Oil P03−001, and install the signal tube assembly to the adapter. Torque the tube nut to 270 − 300 lb−in. (30.506 − 33.895 N.m).

(5) Lubricate the lower rear adapter on the valve solenoid with Engine Oil P03−001, and install the signal tube assembly to the adapter. Torque the tube nut to 270 − 300 lb−in. (30.506 − 33.895 N.m).

(6) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the tube nuts.

(7) Connect the W3P12 harness connector to the solenoid receptacle as follows.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Isopropyl Alcohol P11−009 and let air dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

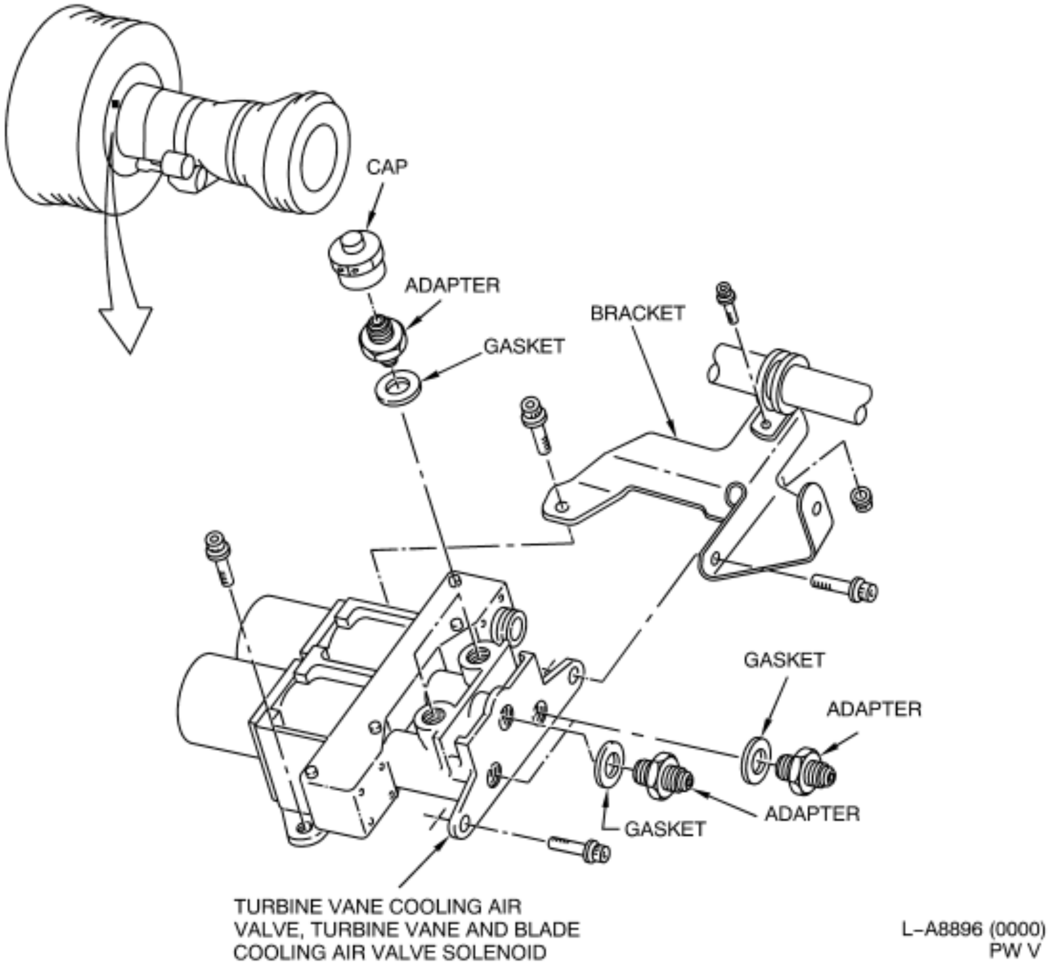
(c) Use the Glenair TG-70 strap wrench or the Glenair TG-69 soft-jawed pliers and tighten the connector coupling nut. Use sufficient force to make sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

C. Postrequisites

(1) Install the fan exit liner segment (inner rear) that is at the 10 o'clock position. Refer to 72-00-33, Installation-16 (Task 72-00-33-440-001).


CAP
ADAPTER
GASKET
BRACKET
GASKET
ADAPTER
ADAPTER
GASKET
TURBINE VANE COOLING AIR VALVE, TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
L-A8896 (0000)
PW V

Turbine Vane Cooling Air Valve, Turbine
Vane And Blade Cooling Air Valve Solenoid
Figure 401
(Task 72-00-34-450-022)

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Task 72-00−34−990−001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (−) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (−) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3.These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
763	A	No. 1 Ball Bearing (72−31−14) No. 1 Bearing Front Support (72−34−82) (See Figure 803)				
		Bearing	17.6605 (448.5767)	17.6613 (448.5970)		
		Support	17.6589 (448.537)	17.6599 (448.561)	.0006T (0.016T)	.0024T (0.060T)
764	B	No. 1 Bearing Rear Support Assembly (72−34−81) No. 1 Bearing Front Support (72−34−82) (See Figure 803)				
		Rear Support	20.279 (515.087)	20.282 (515.162)		
		Front Support	20.274 (514.960)	20.279 (515.086)	.000T (0.000T)	.008T (0.203T)

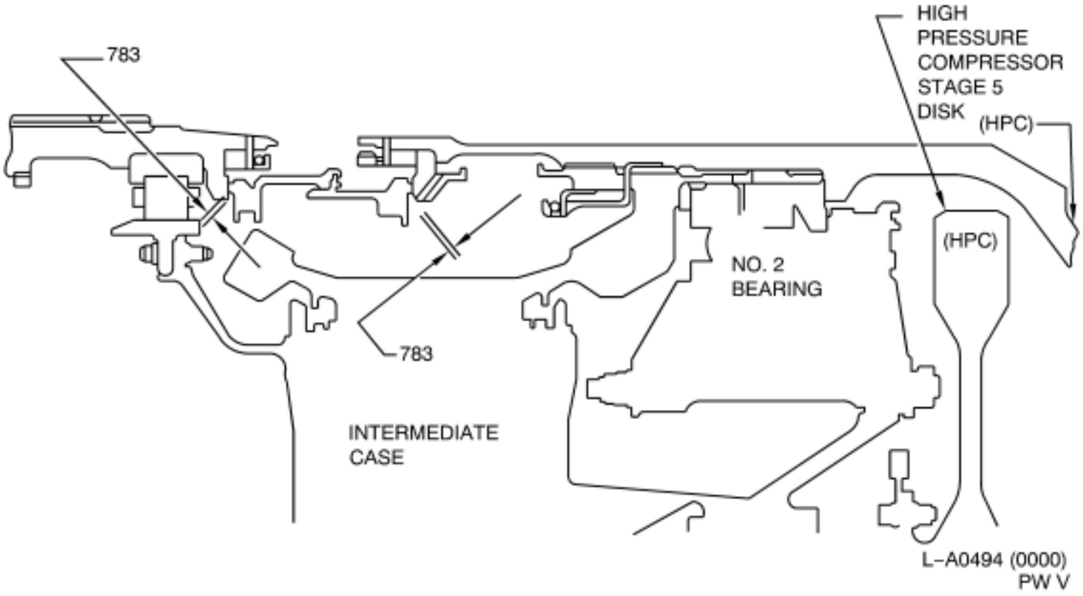
Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
770	B	No. 1 Bearing Rear Support Assembly (72−34−81) Compressor Intermediate Case Assembly (72−34−01) (See Figure 802)				
		Support	26.602 (675.691)	26.606 (675.792)		
		Case	26.598 (675.590)	26.602 (675.690)	.000T (0.000T)	.008T (0.203T)
775	C	Gap, Turbine Shaft Coupling Assembly N1 Speed Sense (See Figure 804)				
		Coupling	7.693 (195.40)	7.706 (195.73)		
		Gap			.020 (0.51)	.050 (1.27)
780	B	Pin, No. 1 Bearing (Oil) Pressure Manifold (72−34−80) No. 1 Bearing Rear Support Assembly (72−34−81) (See Figure 803)				
		Pin	.2485 (6.312)	.2495 (6.337)		
		Support	.250 (6.350)	.251 (6.375)	.0005 (0.013)	.0025 (0.063)
781	B	No. 1 Bearing (Oil) Pressure Manifold Assembly (72−34−80) Main Bearing Tube Connector (72−34−28) (See Figure 803)				
		Manifold	.679 (17.247)	.680 (17.272)		
		Connector	.681 (17.298)	.683 (17.348)	.001 (0.026)	.004 (0.101)
783	A	No. 1.5 Bearing Face Seal Assembly (72−34−38/And) No. 2 Bearing Front Face Seal Assembly (72−34−37) (See Figure 801)				
		Height Of Seal Step			.075* (1.905)*	.105 (2.67)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
785	B	Intermediate Case Assembly (72-34-01) HPC Front Case Assembly (72-35-40) (See Figure 802)				
		Imtd. Case	34.574 (878.180)	34.578 (878.281)		
		HPC Case	34.568 (878.028)	34.572 (878.128)	.002T (0.051T)	.010T (0.254T)
840	B	No. 1 Bearing Front Support (72-34-82) No. 1 Bearing (Carbon) Seal Assembly (72-31-17) (See Figure 803)				
		Support	20.135 (511.429)	20.139 (511.530)		
		Seal	20.131 (511.328)	20.133 (511.378)	.002 (0.051)	.008 (0.203)

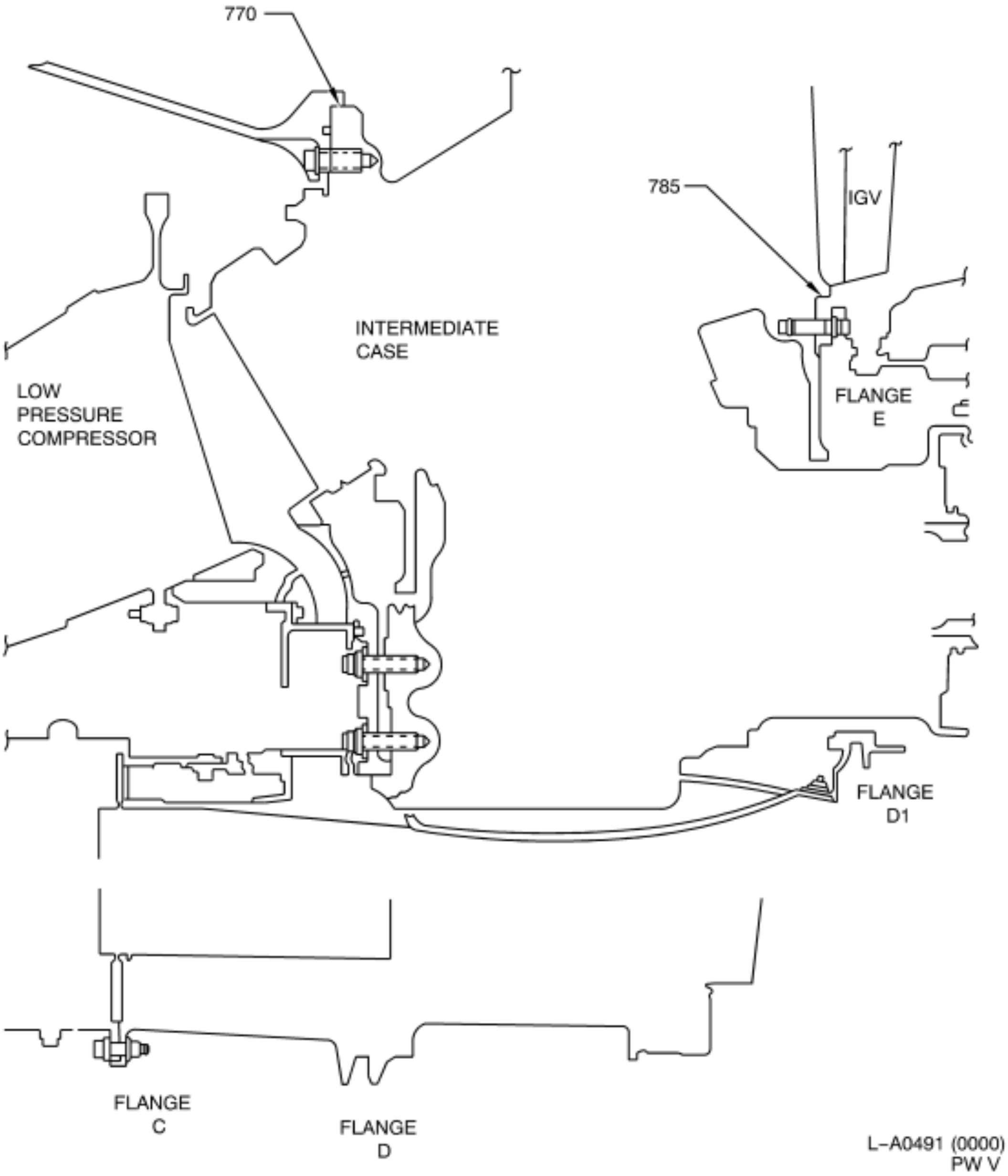
G. Special Torques

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
256	A	'B' Nut (Bulkhead End) IDGS Air/Oil Cooler Return And Pressure See 72-00-34, Installation-02 Task 72-00-34-420-002 See 72-00-34, Installation-08 Task 72-00-34-450-004 See 72-00-34, Installation-10 Task 72-00-34-450-006				
2154	A	Electrical Connector See 72-00-34, Installation-05 Task 72-00-34-450-003 See 72-00-34, Installation-17 Task 72-00-34-450-013				
2155	A	Electrical Connector See 72-00-34, Installation-05 Task 72-00-34-450-003				

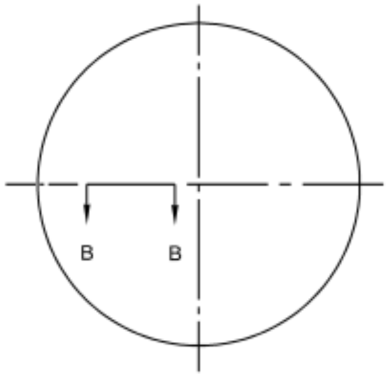
	Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
	2156	A	Electrical Connector See 72-00-34, Installation-03 Task 72-00-34-450-001 See 72-00-34, Installation-05 Task 72-00-34-450-003 See 72-00-34, Installation-12 Task 72-00-34-450-008 See 72-00-34, Installation-13 Task 72-00-34-450-009 See 72-00-34, Installation-14 Task 72-00-34-450-010 See 72-00-34, Installation-17 Task 72-00-34-450-013				
	2157	A	Electrical Connector See 72-00-34, Installation-05 Task 72-00-34-450-003				
	2158	A	Electrical Connector See 72-00-34, Installation-05 Task 72-00-34-450-003 See 72-00-34, Installation-10 Task 72-00-34-450-006				
	2165	A	PB Sense Line Coupling Nuts See 72-00-34, Installation-02 Task 72-00-34-420-002 See 72-00-34, Installation-21 Task 72-00-34-420-003 Cooler Fuel Tube Nuts See 72-00-34, Installation-02 Task 72-00-34-420-002				
R	2171	A	HPC Drum Air Valve Signal Tube (AA01) See 72-00-34, Installation-02 Task 72-00-34-420-002 See 72-00-34, Installation-12 Task 72-00-34-450-008 See 72-00-34, Installation-24 Task 72-00-34-450-021				


783
HIGH PRESSURE COMPRESSOR STAGE 5 DISK (HPC)
(HPC)
NO. 2 BEARING
783
INTERMEDIATE CASE
L−A0494 (0000)
PW V

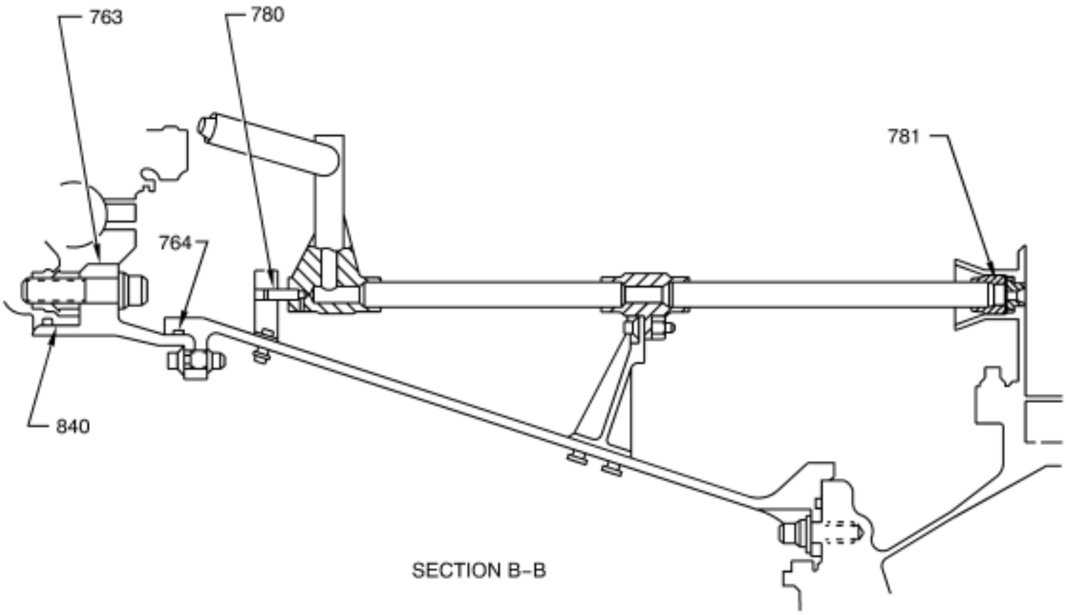
Intermediate Case
Figure 801
(Task 72−00−34−990−001)


770
785
IGV
INTERMEDIATE CASE
LOW PRESSURE COMPRESSOR
FLANGE E
FLANGE D1
FLANGE C
FLANGE D
L−A0491 (0000)
PW V

Intermediate Case
Figure 802
(Task 72−00−34−990−001)



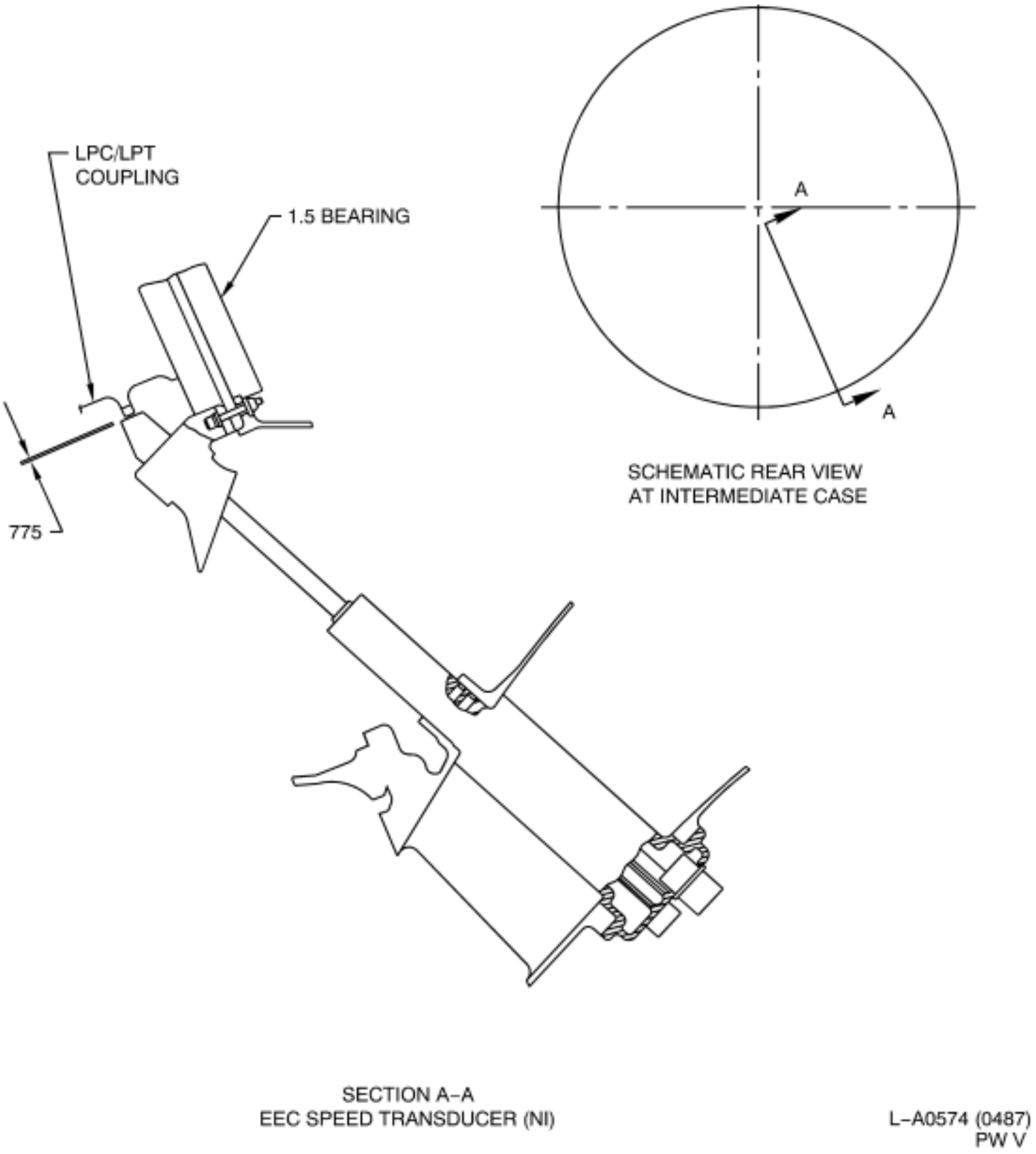
SCHEMATIC REAR VIEW



SECTION B−B

L−A0496 (0000)
PW V

Intermediate Case
Figure 803
(Task 72−00−34−990−001)


LPC/LPT
COUPLING
1.5 BEARING
775
A
A
SCHEMATIC REAR VIEW
AT INTERMEDIATE CASE
SECTION A−A
EEC SPEED TRANSDUCER (NI)
L−A0574 (0487)
PW V

Intermediate Case
Figure 804
(Task 72−00−34−990−001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INTERMEDIATE CASE - INSPECTION/CHECK-10

Task 72-00-34-990-010:

1. Intermediate Case Module Assembly Visual Inspection

A. Equipment And Materials Necessary - None

B. General

NOTE: All applicable Airworthiness Directives (AD's) must be complied with and these directives takes precedence over all inspections or repairs given in this module inspection.

(1) This inspection does not permit time since overhaul to be set to zero.

(2) These procedures give instructions for the visual inspection of the intermediate case module assembly after removal from the engine. Do these procedures before you do the preservation, packing or module installation procedure. This procedure is to find those easy to see types of damage, which can make it necessary to do more disassembly, inspection or repair. For the general visual inspection instructions, refer to Section 70-31-00 in the Standard Practices Manual, PN 585005.

(3) The inspection table in this section is applicable to the intermediate case modules with some, none or all of the components installed. You do not have to disassemble the module assembly to do this inspection. You can choose to apply individual limits to those areas that are visible at all stages of disassembly. If a condition shows that there can be damage that you cannot see, remove a component to fully examine the damaged area. Use the applicable procedures in this manual to remove the component and do an inspection by step (4).

(4) Remove all the components that you find not serviceable at the modular level. Send the applicable components for more inspection and repair at the component level maintenance. Refer to Section 72-34-00 in the PW4000 Series CIR, PN 51A357. Components that you remove from the intermediate case module, will need a Cleaning, Inspection and Repair Manual component level inspection/check.

(5) Unless given differently, non-toleranced areas given in this section are to corners, points of tangency between surfaces or at the points opposite to one of these locations.

C. Procedure

(1) Visually examine the case outer diameter area for surface damage and wear. See Table 801 and Figure 801.

(2) Visually examine the case inner diameter and gaspath area for surface damage and wear. See Table 802 and Figure 802.

(3) Visually examine the case rear surfaces, thrust clevises, front mount, fan exit case flange, HPC inlet guide vane mating surface and No. 2 bearing support mounting flange for damage and wear. See Table 803 and Figure 803.

(4) Visually examine the case rear cover and fairing for damage and wear. See Table 804 and Figure 804.

(5) Visually examine the visible areas of the strut fairings and fan exit liner assemblies for damage and wear. See Table 805 and Figure 805.

(a) Examine Indexes 1 thru 4 which are visible on the case. If the fan exit liners are installed, examine Index 5. If the fan exit liners are removed, continue the inspection with Indexes 6 thru 9 in this table.

(6) If installed, visually examine the stage 4 compressor stator assembly. See Table 806 and Figure 806.

NOTE: The limits given below are those which the stator assembly can continue-in-service. The limits are evaluated from the standpoint of structural integrity and gross performance deficiencies. More airfoil blends or discontinuities in the seal lands will cause a decrease of efficiency and performance. Refurbishment of all the damage is recommended to gain back the performance levels.

NOTE: All corrosion pitting inspection depth limits are applicable after the removal of the damage by the applicable repair.

R ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10

R NOTE: If the damage to the stator vanes are found,
R it is necessary to remove the stage 4 stator
R assembly to do Repair−07. Refer to Section
R 72−34−50 in the PW4000 Series CIR, PN 51A357.

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
1 Hole in the ground handling pads for damage and wear	0.003 inch (0.076 mm) depth maximum	Damage to a maximum of 0.062 inch (1.575 mm) at the 12:00 o'clock ground handling pad can be repaired. Damage at 3:00 and 9:00 o'clock locations more than the permitted limit and damage at 12:00 o'clock and more than 0.062 inch (1.575 mm) must be repaired	
2 Rivets that attach the struts for:			
Looseness and damage	Not permitted	Replace the rivets	Refer to Section 70-43-00 in the Standard Practices Manual, PN 585005.
Nicks, dents and surface damage	0.003 inch (0.076 mm) depth maximum	Replace the rivets	Refer to Section 70-43-00 in the Standard Practices Manual, PN 585005.

Outer Diameter Case Surface Visual Inspection
Table 801

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
3			
Surface of ground handling pads (at 3 and 9 o'clock positions only) for surface damage	0.020 inch (0.508 mm) maximum depth	0.050 inch (1.270 mm) depth maximum. 15 percent maximum of the full ground handling pad surface	Refer to Section 72-34-01, Repair-49 in the PW4000 Series CIR, PN 51A357.
4			
Timing pin for looseness and damage	Not permitted	Replace timing pin	Refer to Section 72-34-01, Repair-39, Repair-41 in the PW4000 Series CIR, PN 51A357.
5			
Fan exit case mount bolt holes and mating flange for:			
Wear and galling	0.300 inch (7.620 mm) diameter maximum	See the repair	Repair mount bolt holes. Refer to Section 72-34-01, Repair-38, Repair-41 in the PW4000 Series CIR, PN 51A357.

Outer Diameter Case Surface Visual Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Cracks	Not permitted	See the repair	Repair cracks. Refer to Section 72-34-01, Repair-38, Repair-41 in the PW4000 Series CIR, PN 51A357.
6 Case outer surface for:			
Cracks originating below or in the area of the strut attach plates.	Not permitted		Remove from service
Bending and distortion	Not permitted	Distortion can be repaired to a maximum of 0.080 inch (2.032 mm) axially and 6.000 inches (152.400 mm) circumferentially	

NOTE: It is necessary to examine the case inner surfaces only if the liner assemblies are removed

Area A Rear lip:			
Surface damage	Not permitted	0.060 inch (1.524 mm) radial depth maximum, 0.120 inch (3.048 mm) axial width maximum and 2.000 inches (50.800 mm) circumferential	Refer to Section 72-34-01, Repair-49 in the PW4000 Series CIR, PN 51A357.

Outer Diameter Case Surface Visual Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)		length maximum. Maximum of three locations for a part	
Area B Rear inner and outer walls: Surface damage and corrosion	0.003 inch (0.076 mm) depth maximum, if a minimum wall thickness in damaged area is kept	0.012 inch (0.305 mm) radial depth maximum and 6.000 inches (152.400 mm) circumferential length maximum with a 1.000 inch (25.400 mm) minimum separation Keep a minimum wall thickness of: 0.203 inch (5.156 mm) for fan case detail PN 50G470. 0.198 inch (5.029 mm) for fan case detail PN 52G068, 52G158. 0.178 inch (4.521 mm) for fan case detail PN 51G544. Or 0.037 inch (0.940 mm)	Refer to Section 72-34-01, Repair-49 in the PW4000 Series CIR, PN 51A357.

Outer Diameter Case Surface Visual Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)		radial depth maximum and 4.000 inches (152.400 mm) circumferential length maximum with a 1.000 inch (25.400 mm) minimum separation	
		Keep a minimum wall thickness of:	
		0.178 inch (4.521 mm) for fan case detail PN 50G470.	
		0.173 inch (4.394 mm) for fan case detail PN 52G068, 52G158.	
		0.153 inch (3.886 mm) for fan case detail PN 51G544.	

NOTE: Blends directly opposite on the inner and outer walls are not permitted. For surface damage in areas adjacent to the handling pads, refer to Area P.

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area C Rear inner and outer walls: Surface damage and corrosion	0.003 inch (0.076 mm) maximum depth if a minimum wall thickness in damaged area is kept.	0.012 inch (0.305 mm) radial depth maximum and 6.000 inches (152.400 mm) circumferential	Refer to Section 72-34-01, Repair-49 in the PW4000 Series CIR, PN 51A357.

Outer Diameter Case Surface Visual Inspection
Table 801 (Continued)

ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)		length maximum with a 1.000 inch (25.400 mm) minimum separation. Keep a minimum wall thickness of 0.108 inch (2.743 mm) Or 0.037 inch (0.940 mm) radial depth maximum and 4.000 inches (101.600 mm) circumferential length maximum with a 1.000 inch (25.400 mm) minimum separation. Keep a minimum wall thickness of 0.083 inch (2.108 mm)	

NOTE: Blends directly opposite on the inner and outer walls are not permitted. For surface damage in areas adjacent to the handling pads, refer to Area P.

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area D Center flange inner wall: Corrosion	Not permitted	Remove superficial corrosion with no measurable depth	Refer to Section 72−34−01, Repair−49 in the PW4000 Series CIR, PN 51A357.

Outer Diameter Case Surface Visual Inspection
Table 801 (Continued)

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Area E Front inner wall: Surface damage and corrosion	Not permitted	0.035 inch (0.889 mm) radial depth maximum	Refer to Section 72−34−01, Repair−49 in the PW4000 Series CIR, PN 51A357.
R	Area F Front inner and outer walls: Individual surface damage at one location	0.003 inch (0.076 mm) depth maximum if a minimum wall thickness in damaged area is kept.	0.045 inch radial depth maximum, 0.160 inch (4.064 mm) axial width maximum and 0.500 inch (12.700 mm) circumferential length maximum	Refer to Section 72−34−01, Repair−49 in the PW4000 Series CIR, PN 51A357.
R			Location of the damage must be minimum 0.500 inch (12.700 mm) away from each fillet radius	
R			Keep a minimum wall thickness of 0.075 inch (1.905 mm)	
R			Blends directly opposite on the inner and outer walls are not permitted	

R NOTE: For surface damage in areas adjacent to the handling pads, refer to Area Q.

R Outer Diameter Case Surface Visual Inspection
R Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
General surface damage	Not permitted	0.015 inch (0.381 mm) radial depth maximum and 6.000 inches (152.400 mm) circumferential length maximum with a 1.000 inch (25.400 mm) minimum separation. Keep a minimum wall thickness of 0.105 inch (2.667 mm) Blends directly opposite on the inner and outer walls are not permitted	Refer to Section 72-34-01, Repair-49 in the PW4000 Series CIR, PN 51A357.

NOTE: For surface damage in areas adjacent to the handling pads, refer to Area Q.

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area G Area rear of the V-groove: Surface damage	Not permitted	0.090 inch (2.286 mm) radial depth maximum, 0.180 inch (4.572 mm) axial width maximum and 0.400 inch (10.160 mm) circumferential length maximum. Maximum of one location	Refer to Section 72-34-01, Repair-49 in the PW4000 Series CIR, PN 51A357.

Outer Diameter Case Surface Visual Inspection
Table 801 (Continued)

R ENGINE GENERAL - INTERMEDIATE CASE - INSPECTION/CHECK-10

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Area H Front flange, inner front and rear faces: Surface damage and corrosion	0.003 inch (0.076 mm) depth maximum	0.050 inch (1.270 mm) axial depth maximum	Refer to Section 72-34-01, Repair-49 in the Standard Practices Manual, PN 585005.
R			Keep a minimum wall thickness of:	
R			0.045 inch (1.143 mm) for fan exit case detail PN 50G470.	
R			0.060 inch (1.524 mm) for fan exit case detail PN 51G544, 52G068 and 52G158.	
R			Blends directly opposite on the inner and rear faces are not permitted	
R	Area I Front flange inner lip: Surface damage	Not permitted	0.050 inch (1.270 mm) depth maximum and 0.175 inch (4.445 mm) circumferential length maximum	Refer to Section 72-34-01, Repair-49 in the PW4000 Series CIR, PN 51A357.

R Outer Diameter Case Surface Visual Inspection
R Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area J Front flange, outer front and rear faces:			
Surface damage	0.003 inch (0.076 mm) depth maximum	0.022 inch (0.559 mm) axial depth maximum	Refer to Section 72-34-01, Repair-49 in the PW4000 Series CIR, PN 51A357.
		Keep a minimum wall thickness of:	
		0.133 inch (3.378 mm) for fan exit case detail PN 50G470.	
		0.145 inch (3.683 mm) for fan exit case detail PN 51G544, 52G068 and 52G158.	
		Blends directly opposite on the outer front and rear faces are not permitted	
		After blending, 50 percent of the hole bearing area for the nut, bolt and washer must stay	

Outer Diameter Case Surface Visual Inspection
Table 801 (Continued)

ENGINE GENERAL - INTERMEDIATE CASE - INSPECTION/CHECK-10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area K Front flange outer lip for: Surface damage	Not permitted	0.060 inch (1.524 mm) radial depth maximum and 0.100 inch (2.540 mm) axial width maximum Or 0.050 inch (1.270 mm) axial depth maximum and 0.400 inch (10.160 mm) circumferential length maximum	Refer to Section 72-34-01, Repair-49 in the PW4000 Series CIR, PN 51A357.
Area L Outer faces of V-groove rails for: Surface damage	0.003 inch (0.076 mm) maximum depth. Smooth raised material.	0.100 inch (2.540 mm) depth maximum, 0.590 inch (14.986 mm) radial depth maximum and 3.750 inches (95.250 mm) circumferential length maximum	Refer to Section 72-34-01, Repair-49 in the PW4000 Series CIR, PN 51A357.

Outer Diameter Case Surface Visual Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area M Top of V-groove rails for:			
Surface damage for clockwise locations 11 to 1 o'clock (viewed from the rear of the engine looking forward)	0.003 inch (0.076 mm) maximum depth. Smooth raised material.	0.250 inch (6.350 mm) radial depth maximum and 6.000 inches (152.400 mm) circumferential length maximum	Refer to Section 72-34-01, Repair-49 in the PW4000 Series CIR, PN 51A357.
Surface damage for clockwise locations 1 to 2 o'clock, 4 to 8 o'clock, 10 to 11 o'clock (viewed from the rear of the engine looking forward)	0.003 inch (0.076 mm) maximum depth. Smooth raised material.	For circumferential lengths to a maximum of 0.999 inch (25.375 mm):	Refer to Section 72-34-01, Repair-49 in the PW4000 Series CIR, PN 51A357.
		0.375 inch (9.525 mm) radial depth maximum	
		For circumferential lengths between 1.000 inch (25.400 mm) and 2.999 inches (76.175 mm):	
		0.090 inch (2.286 mm) radial depth maximum	
		For circumferential lengths between 3.000 inches (76.200 mm) and	

Outer Diameter Case Surface Visual Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			
		6.000 inches (152.400 mm): 0.062 inch (1.575 mm) radial depth maximum	
Area N Inner faces and bottom of the V-groove rails for:			
Surface damage in clockwise locations from 10 - 2 o'clock (seen from the rear of the engine when you look forward)	Permitted to a maximum of 0.025 inch (0.635 mm), with no raised material without repair	Bottom of the V-groove rails: 0.050 inch (1.270 mm) radial depth maximum, 0.250 inch (6.350 mm) axial width maximum and 5.500 inches (139.700 mm) circumferential length maximum with a 1.000 inch (25.400 mm) minimum separation Inner faces of the V-groove rails: 0.035 inch (0.889 mm) radial depth maximum, 0.125 inch (3.175 mm) distance from the bottom of the V-groove, 0.200 inch (5.080 mm) diagonal length	Refer to Section 72-34-01, Repair-49 in the PW4000 Series CIR, PN 51A357.

Outer Diameter Case Surface Visual Inspection
Table 801 (Continued)

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
	(CONTINUED)			
R			maximum and 2.500 inches (63.500 mm) circumferential length maximum with a 1.000 inch (25.400 mm) minimum separation	
R	Surface damage, galling all other locations	Permitted to a maximum of 0.025 inch (0.635 mm), with no raised material, without repair	0.025 inch (0.635 mm) depth maximum. Smooth raised material	Refer to Section 72-34-01, Repair-49 in the PW4000 Series CIR, PN 51A357.
R	Area O Rear flange edge for:			
R	Surface damage at two locations only	Not permitted	0.210 inch (5.334 mm) radial depth maximum, 0.120 inch (3.048 mm) axial width maximum and 3.500 inches (88.900 mm) circumferential length maximum Locations must be 10.000 inches (254.000 mm) minimum distance apart No damage is permitted in 10.000 inches (254.000 mm) maximum	Refer to Section 72-34-01, Repair-49 in the PW4000 Series CIR, PN 51A357.

R Outer Diameter Case Surface Visual Inspection
R Table 801 (Continued)

ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)		circumferential length of the 3 and 9 o'clock centerlines	
General surface damage	Not permitted	0.015 inch (0.381 mm) radial depth maximum and 0.420 inch (10.668 mm) axial width maximum for the full circumference	Refer to Section 72−34−01, Repair−49 in the PW4000 Series CIR, PN 51A357.
Individual surface damage	Not permitted	0.050 inch (1.270 mm) radial depth maximum, 0.400 inch (10.160 mm) axial width maximum and 0.500 inch (12.700 mm) circumferential length Locations must be 2.000 inches (50.800 mm) minimum distance apart	Refer to Section 72−34−01, Repair−49 in the PW4000 Series CIR, PN 51A357.
Area P Rear outer wall in areas adjacent to the handling pads for:			
Surface damage	Not permitted	0.020 inch (0.508 mm) radial depth maximum and 4.000 inches (101.600 mm)	Refer to Section 72−34−01, Repair−49 in the PW4000 Series CIR, PN

Outer Diameter Case Surface Visual Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			
		circumferential length maximum with a 1.000 inch (25.400 mm) minimum separation	51A357.
		Maximum blend area of the surface is 50 percent. Keep the same minimum wall thickness given for Areas B and C	
Area Q Front outer wall in areas adjacent to the handling pads for:			
Surface damage	Not permitted	0.020 inch (0.508 mm) radial depth maximum and 4.000 inches (101.600 mm) circumferential length maximum with a 1.000 inch (25.400 mm) minimum separation	Refer to Section 72-34-01, Repair-49 in the PW4000 Series CIR, PN 51A357.
		Maximum blend area of the surface is 50 percent. Keep the same minimum wall thickness given for Area F	

Outer Diameter Case Surface Visual Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area R			
Fillet radius from 1:30 to 4:30 o'clock and 7:30 to 10:30 o'clock for dents, nicks and scratches	Not permitted	0.008 inch (0.203 mm) depth maximum and 4.000 inches (101.600 mm) length maximum with a 1.000 inch (25.400 mm) minimum separation at a maximum of two locations	Refer to Section 72−34−01, Repair−49 in the PW4000 Series CIR, PN 51A357.

Outer Diameter Case Surface Visual Inspection
Table 801 (Continued)

ENGINE GENERAL - INTERMEDIATE CASE - INSPECTION/CHECK-10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
1 All gaspath wall surfaces for: (Figure 802, Sheet 1)			
Cracks	Not permitted	See the repair	Refer to Section 72-34-01, Repair-31 in the PW4000 Series CIR, PN 51A357.
Nicks, dents, scratches, sharp edges and corrosion pits	0.003 inch (0.076 mm) depth maximum	Damage to a maximum of 0.020 inch (0.508 mm) depth, blend smooth	Manually blend the damage. Refer to Section 70-45-00, in the Standard Practices Manual, PN 585005.
Raised material	Not permitted	Smooth raised material	Manually smooth raised material. Refer to Section 70-45-00, in the Standard Practices Manual, PN 585005.
2 Gaspath struts for: (Figure 802, Sheet 1) thru (Figure 802, Sheet 5)			

Gaspath And Inner Diameter Structure Visual Inspection
Table 802

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Strut leading edge and trailing edge for scratches, nicks, dents and corrosion pits	0.003 inch (0.076 mm) depth maximum	0.100 inch (2.540 mm) depth maximum	Refer to Section 72−34−01, Repair−20 in the PW4000 Series CIR, PN 51A357.
Strut side walls for scratches, nicks, dents and corrosion pits	0.003 inch (0.076 mm) depth maximum	To a maximum of 0.020 inch (0.508 mm) depth	Refer to Section 72−34−01, Repair−20 in the PW4000 Series CIR, PN 51A357.
Holes or deep surface damage in strut side walls	Not permitted	1.500 inches (38.100 mm) by 3.000 inches (76.200 mm) maximum	Refer to Section 72−34−01, Repair−51 in the PW4000 Series CIR, PN 51A357.
3 No. 1 bearing support flange for: (If stage 4 LPC stator is removed) (Figure 802, Sheet 1)			
Cracks	Not permitted	See the repair	Refer to Section 72−34−01, Repair−31 in the PW4000 Series CIR, PN 51A357.

Gaspath And Inner Diameter Structure Visual Inspection
Table 802 (Continued)

R ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Nicks, dents, other surface damage or wear	0.005 inch (0.127 mm) depth maximum. Smooth raised material	Smooth raised material	Refer to Section 72−34−01, Repair−20 in the PW4000 Series CIR, PN 51A357.
R	Helicoil inserts for damage, looseness	Not permitted	Install or replace helicoil insert	Refer to Section 72−34−01, Repair−16 in the PW4000 Series CIR, PN 51A357.
R	4 Stage 4 LPC stator flange for: (If stage 4 LPC stator is removed) (Figure 802, Sheet 1)			
R	Cracks	Not permitted	See the repair	Refer to Section 72−34−01, Repair−31 in the PW4000 Series CIR, PN 51A357.
R	Nicks, dents, other surface damage or wear	0.005 inch (0.127 mm) depth maximum. Smooth raised material	Smooth raised material	Refer to Section 72−34−01, Repair−20 in the PW4000 Series CIR, PN 51A357.

R Gaspath And Inner Diameter Structure Visual Inspection
R Table 802 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Helicoil inserts for damage and looseness	Not permitted	Install or replace helicoil insert	Refer to Section 72-34-01, Repair-31 in the PW4000 Series CIR, PN 51A357.
5 Fan exit case mount pads for: (Figure 802, Sheet 1)			
Cracks	Not permitted	See the repair	Refer to Section 72-34-01, Repair-31 in the PW4000 Series CIR, PN 51A357.
Nicks, dents, other surface damage or wear	0.005 inch (0.127 mm) depth maximum. Smooth raised material	Smooth raised material	Refer to Section 72-34-01, Repair-20 in the PW4000 Series CIR, PN 51A357.
Helicoil inserts for damage and looseness	Not permitted	Install or replace helicoil insert	Refer to Section 72-34-01, Repair-18 in the PW4000 Series CIR, PN 51A357.
6 Not gaspath surface areas (If inner liners are removed) for: (Figure 802, Sheet 1)			

Gaspath And Inner Diameter Structure Visual Inspection
Table 802 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Cracks	Not permitted	See the repair	Refer to Section 72-34-01, Repair-31 in the PW4000 Series CIR, PN 51A357.
Nicks, dents, other surface damage or wear	0.005 inch (0.127 mm) depth maximum. Smooth raised material	Smooth raised material	Refer to Section 72-34-01, Repair-20 in the PW4000 Series CIR, PN 51A357.
If you can access, check the helicoil inserts on the front side of the intermediate case for looseness or damage as follows:			
7 Strut oil tube boss, with helicoil inserts (Figure 802, Sheet 2)	Not permitted	Install or replace helicoil insert	Refer to Section 72-34-01, Repair-19 in the PW4000 Series CIR, PN 51A357.
8 Heat exchanger and air cooler bosses (2:00, 4:00 and 8:00 o'clock locations) Figure 802, Sheet 2)	Not permitted	Install or replace helicoil insert	Refer to Section 72-34-01, Repair-24 in the PW4000 Series CIR, PN 51A357.

Gaspath And Inner Diameter Structure Visual Inspection
Table 802 (Continued)

ENGINE GENERAL - INTERMEDIATE CASE - INSPECTION/CHECK-10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
9 Inner oil tube boss (5:00 o'clock location) Figure 802, Sheet 2)	Not permitted	Install or replace helicoil insert	Refer to Section 72-34-01, Repair-19 in the PW4000 Series CIR, PN 51A357.
10 Boss (5:30 o'clock location) Figure 802, Sheet 2)	Not permitted	Install or replace helicoil insert	Refer to Section 72-34-01, Repair-19 in the PW4000 Series CIR, PN 51A357.
If you can access, check helicoil inserts on the rear side of the intermediate case for looseness or damage as follows:			
11 Solenoid mounts (two locations) (Figure 802, Sheet 3)	Not permitted	Install or replace helicoil insert	Refer to Section 72-34-01, Repair-107 in the PW4000 Series CIR, PN 51A357.

Gaspath And Inner Diameter Structure Visual Inspection
Table 802 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
12 Air/oil cooler inner mounts (Figure 802, Sheet 3)	Not permitted	Install helicoil insert inner mounts or replace helicoil insert	Refer to Section 72-34-01, Repair-107 in the PW4000 Series CIR, PN 51A357.
13 Flange E Figure 802, Sheet 3)	Not permitted	Install or replace helicoil insert	Refer to Section 72-34-01, Repair-19 in the PW4000 Series CIR, PN 51A357.
14 Bleed air valve mount (Figure 802, Sheet 3)	Not permitted	Install or replace helicoil insert	Refer to Section 72-34-01, Repair-107 in the PW4000 Series CIR, PN 51A357.
15 N1 probe outer mount boss for: (Figure 802, Sheet 3)			
Cracks	Not permitted	See the repair	Refer to Section 72-34-01, Repair-31 in the PW4000 Series CIR, PN 51A357.

Gaspath And Inner Diameter Structure Visual Inspection
Table 802 (Continued)

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Surface wear	Not permitted	To a maximum of 0.015 inch (0.381 mm) depth	Refer to Section 72-34-01, Repair-87 in the PW4000 Series CIR, PN 51A357.
R	Loose or damaged helicoil inserts	Not permitted	Install or replace helicoil insert	Refer to Section 72-34-01, Repair-19 in the PW4000 Series CIR, PN 51A357.
R	16 N1 probe mount boss inner diameter for: (Figure 802, Sheet 4)			
R	Cracks	Not permitted	See the repair	Refer to Section 72-34-01, Repair-31 in the PW4000 Series CIR, PN 51A357.
R	Surface wear	To a maximum of 0.003 inch (0.076 mm)	To a maximum of 0.005 inch (0.127 mm) depth	Refer to Section 72-34-01, Repair-20 in the PW4000 Series CIR, PN 51A357.
R	Sharp edges, scratches and other irregular surface conditions.	Not permitted	To a maximum of 0.005 inch (0.127 mm) depth	Refer to Section 72-34-01, Repair-20 in the PW4000 Series CIR, PN 51A357.

R Gaspath And Inner Diameter Structure Visual Inspection
R Table 802 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Loose or damaged helicoil inserts	Not permitted	Install or replace helicoil insert	Refer to Section 72−34−01, Repair−19 in the PW4000 Series CIR, PN 51A357.
17 Front engine mount boss for: (Figure 802, Sheet 3)			
Surface damage	Not permitted	Surface damage can be repaired to a maximum of 0.013 inch (0.330 mm) depth on the rear face and on the inner flange to 0.039 inch (0.991 mm) depth	
18 Missing epoxy primer (Figure 802, Sheet 1)			
No. 1 bearing support mating flange	Not permitted	Replace epoxy primer	Refer to Section 72−34−01, Repair−45 in the PW4000 Series CIR, PN 51A357.
Stage 4 stator mating flange	Not permitted	Replace epoxy primer	Refer to Section 72−34−01, Repair−45 in the PW4000 Series CIR, PN 51A357.

Gaspath And Inner Diameter Structure Visual Inspection
Table 802 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Fan exit inner case mating flange	Not permitted	Replace epoxy primer	Refer to Section 72-34-01, Repair-45 in the PW4000 Series CIR, PN 51A357.
Angle gearbox inner diameter	Not permitted	Replace epoxy primer	Refer to Section 72-34-01, Repair-45 in the PW4000 Series CIR, PN 51A357.
19 Case struts for: (Figure 802, Sheet 1)			
Cracks	Not permitted	See the repair	Refer to Section 72-34-01, Repair-33 in the PW4000 Series CIR, PN 51A357.
20 Intermediate case strut sealant for: (Figure 802, Sheet 1)			
Missing pieces, tears or looseness	Not permitted	Seal must be replaced	Refer to Section 72-34-01, Repair-46 in the PW4000 Series CIR, PN 51A357.

Gaspath And Inner Diameter Structure Visual Inspection
Table 802 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
21 No. 2 bearing support flange (Figure 802, Sheet 3)			
Surface damage	Not permitted	Damage to a maximum of 0.015 inch (0.381 mm) depth can be repaired	Refer to Section 72−34−01, Repair−20 in the PW4000 Series CIR, PN 51A357.

Gaspath And Inner Diameter Structure Visual Inspection
Table 802 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
1 Fan exit case, rear flange (D1), all areas for: (Figure 803, Sheet 1)			
Cracks	Not permitted	See the repair	Refer to Section 72-34-01, Repair-47 in the PW4000 Series CIR, PN 51A357.
Wear or galling	0.003 inch (0.076 mm) depth maximum	To a maximum of 0.025 inch (0.635 mm) depth	Refer to Section 72-34-01, Repair-117 in the PW4000 Series CIR, PN 51A357.
		More than 0.025 inch (0.635 mm) replace the flange	Refer to Section 72-34-01, Repair-95 in the PW4000 Series CIR, PN 51A357.
Fan exit case flange, (D1) Area A, 12:00 o'clock bracket only for:			
Bent or cracked flange	Not permitted	Flange can be repaired to a maximum of 0.030 inch (0.762 mm) depth and to a maximum length of 0.220 inch (5.588 mm).	Refer to Section 72-34-01, Repair-47, Repair-50 in the PW4000 Series CIR, PN 51A357.

Rear Surfaces, Mounts And Flange Visual Inspection
Table 803

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Fan exit case flange, (D1) Area A, full circumference for:			
Bent flange	To a maximum of 0.015 inch (0.381 mm) deflection	To a maximum of 0.250 inch (6.350 mm) depth of blend and 3.000 inches (76.200 mm) length of blend	Refer to Section 72-34-01, Repair-50 in the PW4000 Series CIR, PN 51A357.
		More than 0.250 inch (6.350 mm) or more than 3.000 inches (76.200 mm)	Refer to Section 72-34-01, Repair-95 in the PW4000 Series CIR, PN 51A357.
Fan exit case flange, (D1) Area A, all around for:			
Surface damage and galling	To a maximum of 0.010 inch (0.254 mm) with no sharp edges	0.015 inch (0.381 mm) maximum depth or replace the flange	Refer to Section 72-34-01, Repair-44 in the PW4000 Series CIR, PN 51A357.
		More than 0.015 inch (0.381 mm) depth replace the flange	Refer to Section 72-34-01, Repair-95 in the PW4000 Series CIR, PN 51A357.

Rear Surfaces, Mounts And Flange Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Fan exit case flange, (D1) Area B, 1:00 o'clock position for:			
Surface damage	Not permitted	To a maximum of 0.030 inch (0.762 mm) depth and 0.100 inch (2.540 mm) maximum length	Refer to Section 72−34−01, Repair−50 in the PW4000 Series CIR, PN 51A357.
		More than 0.030 inch (0.762 mm) depth or 0.100 inch (2.540 mm) length replace the flange	Refer to Section 72−34−01, Repair−95 in the PW4000 Series CIR, PN 51A357.
Fan exit case flange, (D1) Area C, all around for:			
Surface damage and galling	Not permitted	To a maximum of 0.015 inch (0.381 mm) depth from the initial surface	Refer to Section 72−34−01, Repair−44 in the PW4000 Series CIR, PN 51A357.
		More than 0.015 inch (0.381 mm) depth replace the flange	Refer to Section 72−34−01, Repair−95 in the PW4000 Series CIR, PN 51A357.

Rear Surfaces, Mounts And Flange Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Raised material or sharp edges	Not permitted	Remove damage and polish	Refer to Section 72-34-01, Repair-44 in the PW4000 Series CIR, PN 51A357.
Areas adjacent to the flange nut plates	Not permitted	Repair damage to a maximum of 0.220 inch (5.588 mm) long by 0.145 inch (3.683 mm) wide by 0.045 inch (1.143 mm) deep maximum	Refer to Section 72-34-01, Repair-44 in the PW4000 Series CIR, PN 51A357.
		More than 0.220 inch (5.588 mm) long or 0.145 inch (3.683 mm) wide or 0.045 inch (1.143 mm) depth, replace the flange	Refer to Section 72-34-01, Repair-95 in the PW4000 Series CIR, PN 51A357.
Flange slot surfaces for damage and wear	Not permitted	To a maximum of 0.205 inch (5.207 mm) long by 0.045 inch (1.143 mm) depth maximum or replace flange	
2 Flange nut plates and flange covers for: (Figure 803, Sheet 1)			

Rear Surfaces, Mounts And Flange Visual Inspection
Table 803 (Continued)

ENGINE GENERAL - INTERMEDIATE CASE - INSPECTION/CHECK-10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Surface or thread damage	Not permitted	Replace nut plates or flange covers	Refer to Section 72-34-01, Repair-48, Repair-96, Repair-97, Repair-98 in the PW4000 Series CIR, PN 51A357.
3 No. 2 bearing support bolt holes for: (Figure 803, Sheet 1)			
Surface damage and wear	0.003 inch (0.076 mm) depth maximum	See the repair	Refer to Section 72-34-01, Repair-42 in the PW4000 Series CIR, PN 51A357.
4 No. 2 bearing support indexing pin hole for: (Figure 803, Sheet 1)			
Cracks, elongation or wear (oversize)	Not permitted	See the repair	Refer to Section 72-34-01, Repair-42 in the PW4000 Series CIR, PN 51A357.

Rear Surfaces, Mounts And Flange Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
5 Angle gearbox mating hole diameter for: (Figure 803, Sheet 1)			
Surface damage and wear	Not permitted		Remove from service
6 Angle gearbox mount pads for: (Figure 803, Sheet 1)			
Cracks	Not permitted	See the repair	Refer to Section 72-34-01, Repair-31 in the PW4000 Series CIR, PN 51A357.
Threads	Not permitted	Install or replace helicoil insert	Refer to Section 72-34-01, Repair-19 in the PW4000 Series CIR, PN 51A357.
7 HPC inlet guide vane mating surface (Flange E) for: (Figure 803, Sheet 1)			

Rear Surfaces, Mounts And Flange Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Cracks	Not permitted	See the repair	Refer to Section 72-34-01, Repair-43 in the PW4000 Series CIR, PN 51A357.
Surface damage	To a maximum of 0.020 inch (0.508 mm) depth, with no sharp edges	Remove the sharp edges and smooth raised material	Refer to Section 72-34-01, Repair-43 in the PW4000 Series CIR, PN 51A357.
8 Thrust clevis mount brackets (two locations) for: (Figure 803, Sheet 1) and Figure 803, Sheet 2)			
Cracks	Not permitted	Not repairable	Remove from service
Wear or galling in the clevis bushings (four locations)	Not permitted	Replace the thrust mount bushings	Refer to Section 72-34-01, Repair-29 in the PW4000 Series CIR, PN 51A357.
Surface damage on the inner surfaces (two locations)	To a maximum of 0.002 inch (0.051 mm) depth	To a maximum of 0.050 inch (1.270 mm) depth	Refer to Section 72-34-01, Repair-32 in the PW4000 Series CIR, PN 51A357.

Rear Surfaces, Mounts And Flange Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area A for: (Figure 803, Sheet 2)			
Cracks	Not permitted	Not repairable	Remove from service
Corrosion and pitting	Not permitted	To a maximum of 1.000 inch (25.400 mm) radius from center of the clevis lug, blend to a maximum of 0.030 inch (0.762 mm) depth and 0.407 inch (10.338 mm) minimum wall thickness	Refer to Section 72−34−01, Repair−123 in the PW4000 Series CIR, PN 51A357.
		More than 1.000 inch (25.400 mm) radius from center of the clevis lug blend to a maximum of 0.050 inch (1.270 mm) depth. 0.387 inch (9.830 mm) minimum wall thickness	Refer to Section 72−34−01, Repair−123 in the PW4000 Series CIR, PN 51A357.
Area B for: (Figure 803, Sheet 2)			
Cracks	Not permitted	Not repairable	Remove from service

Rear Surfaces, Mounts And Flange Visual Inspection
Table 803 (Continued)

R ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Nicks, dents and corrosion pitting	Not permitted	All corrosion must be removed. Pitting is permitted to a maximum of 0.030 inch (0.762 mm) depth with all the raised material removed	Refer to Section 72−34−01, Repair−123 in the PW4000 Series CIR, PN 51A357.
R	Area C for: (Figure 803, Sheet 2)			
R	Nicks, dents and corrosion pitting		All corrosion must be removed. Pitting is permitted to a maximum of 0.030 inch (0.762 mm) depth with all the raised material removed	Refer to Section 72−34−01, Repair−123 in the PW4000 Series CIR, PN 51A357.

R Rear Surfaces, Mounts And Flange Visual Inspection
R Table 803 (Continued)

ENGINE GENERAL - INTERMEDIATE CASE - INSPECTION/CHECK-10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
1 One piece rear cover and support configuration (12:00 o'clock location) for: (Figure 804)			
Cracks	Not permitted	Replace cover	Refer to Section 72-34-01, Repair-100 in the PW4000 Series CIR, PN 51A357.
Gouges	To a maximum of 0.030 inch (0.762 mm) depth, with no raised material and sharp edges.	If more than 0.030 inch (0.762 mm) deep, replace the cover	Refer to Section 72-34-01, Repair-101 in the PW4000 Series CIR, PN 51A357.
2 Two piece rear cover and support configuration (12:00 o'clock location) for: (Figure 804)			
Cover for:			
Cracks	Not permitted	Replace the cover	Refer to Section 72-34-01, Repair-100 in the PW4000 Series CIR, PN 51A357.

Rear Cover And Fairing Visual Inspection
Table 804

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Gouges	To a maximum of 0.020 inch (0.508 mm) depth, with no raised material and raised edges.	Replace the cover	Refer to Section 72-34-01, Repair-101 in the PW4000 Series CIR, PN 51A357.
Dents	To a maximum of 1.500 inches (38.100 mm) long by 0.750 inch (19.050 mm) wide by 0.200 inch (5.080 mm) deep.	Replace cover	Refer to Section 72-34-01, Repair-101 in the PW4000 Series CIR, PN 51A357.
Bent tabs	Bent to a maximum of 20 degrees from the perpendicular.	Replace cover	Refer to Section 72-34-01, Repair-101 in the PW4000 Series CIR, PN 51A357.
Supports for: (Figure 804)			
Crack in a brace	To a maximum of 0.300 inch (7.620 mm) length.	Repair cracks	Refer to Section 72-34-01, Repair-100 in the PW4000 Series CIR, PN 51A357.
Bent brace	Permitted if the brace is tightly attached with rivets.	Replace brace	Refer to Section 72-34-01, Repair-101 in the PW4000 Series CIR, PN 51A357.

Rear Cover And Fairing Visual Inspection
Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Dents	To a maximum of 1.500 inches (38.100 mm) long by 0.750 inch (19.050 mm) wide by 0.200 inch (5.080 mm) radially.	Replace brace	Refer to Section 72-34-01, Repair-101 in the PW4000 Series CIR, PN 51A357.
Gouges	To a maximum of 0.020 inch (0.508 mm) deep.	Replace brace	Refer to Section 72-34-01, Repair-101 in the PW4000 Series CIR, PN 51A357.
3 Rear liner/bracket (visible portions only, all around other than 12:00 o'clock location) for: (Figure 804)			
Loose rivets, deformation or cracks	Not permitted	Replace rear fairing/ bracket	Refer to Section 72-34-01, Repair-27, Repair-122 in the PW4000 Series CIR, PN 51A357.

Rear Cover And Fairing Visual Inspection
Table 804 (Continued)

R ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Wear or galling (at the nacelle interface)	To a maximum of 0.015 inch (0.381 mm) depth by 0.250 inch (6.350 mm) wide by 24.000 inches (609.600 mm) length maximum	If damage is more than serviceable limits, replace bracket	Refer to Section 72−34−01, Repair−27, Repair−122 in the PW4000 Series CIR, PN 51A357.

NOTE: See Table 805 and Figure 805, Index 8 for inspection of the rear fairing/bracket nut plates or rivets, only if liner assemblies are removed.

Rear Cover And Fairing Visual Inspection
Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
1 Strut fairings (16 locations) for: Figure 805)			
Wire mesh fairing configuration:			
Nicks, dents and scratches	To a maximum of 0.010 inch (0.254 mm) depth	To a maximum of 50 percent of the fairing surface and a depth of 0.020 inch (0.508 mm) maximum	Refer to Section 72−34−01, Repair−01, Repair−04, Repair−22, Repair−34 in the PW4000 Series CIR, PN 51A357.
		To a maximum of 50 percent of the fairing surface and more than 0.020 inch (0.508 mm) depth	Refer to Section 72−34−01, Repair−102 in the PW4000 Series CIR, PN 51A357.
Tears, holes and punctures	Not permitted	To a maximum of 50 percent of the fairing surface with a maximum depth of 0.020 inch (0.508 mm)	Refer to Section 72−34−01, Repair−01, Repair−04, Repair−22, Repair−34 in the PW4000 Series CIR, PN 51A357.
		To a maximum of 50 percent of the fairing surface and more than 0.020 inch (0.508 mm)	Refer to Section 72−34−01, Repair−102 in the PW4000 Series CIR, PN

Strut Fairing And Fan Exit Liner Visual Inspection
Table 805

R ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			
		depth	51A357.
Cracks	Not permitted	Cracks that extend to a maximum of 50 percent of the laminate thickness	Refer to Section 72−34−01, Repair−102 in the PW4000 Series CIR, PN 51A357.
		Cracks more than 50 percent of the laminate thickness, replace fairing	Refer to Section 72−34−01, Repair−22, Repair−34 in the PW4000 Series CIR, PN 51A357.
Areas of broken or fuzzy fibers	Not permitted	To a maximum of 50 percent of the fairing surface with a maximum depth of 0.020 inch (0.508 mm)	Refer to Section 72−34−01, Repair−04, Repair−22, Repair−34 in the PW4000 Series CIR, PN 51A357.
		To a maximum of 50 percent of the fairing surface and more than 0.020 inch (0.508 mm) depth	Refer to Section 72−34−01, Repair−102 in the PW4000 Series CIR, PN 51A357.
Surface roughness because of wire mesh distortion (ripples)	Not permitted	To a maximum of 2.000 inches (50.800 mm) by 5.000 inches (127.000 mm) area with a maximum depth of 0.020 inch	Refer to Section 72−34−01, Repair−01, Repair−04 in the PW4000 Series CIR, PN 51A357.

R Strut Fairing And Fan Exit Liner Visual Inspection
R Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			
		(0.508 mm)	
		To a maximum of 50 percent of the fairing surface and more than 0.020 inch (0.508 mm) depth	Refer to Section 72-34-01, Repair-102 in the PW4000 Series CIR, PN 51A357.
Surface erosion	Not permitted	To a maximum of 50 percent of the fairing surface with a maximum depth of 0.020 inch (0.508 mm)	Refer to Section 72-34-01, Repair-04, Repair-22, Repair-34 in the PW4000 Series CIR, PN 51A357.
		To a maximum of 50 percent of the fairing surface and more than 0.020 inch (0.508 mm) depth	Refer to Section 72-34-01, Repair-102 in the PW4000 Series CIR, PN 51A357.
Wire mesh unbonded from laminate, holes or tears	Not permitted	Complete replacement of wire mesh is permitted. You can rebond to a maximum of 9.000 sq-in (5806. sq-mm)	Refer to Section 72-34-01, Repair-102 in the PW4000 Series CIR, PN 51A357.
Viton coated fairing configuration:			

Strut Fairing And Fan Exit Liner Visual Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Viton erosion damage that includes tears, holes and disbonds from the laminate substrate	Not permitted	Full viton replacement is permitted	Refer to Section 72−34−01, Repair−120 in the PW4000 Series CIR, PN 51A357.
Laminate substrate erosion damage including broken fibers, punctures and delamination	Not permitted	To a maximum of 50 percent of the fairing surface	Refer to Section 72−34−01, Repair−120 in the PW4000 Series CIR, PN 51A357.
Delamination in the fairing substrate	Not permitted	To a maximum of 50 percent of the fairing surface	Refer to Section 72−34−01, Repair−120 in the PW4000 Series CIR, PN 51A357.
NOTE: Total area of fairing laminate repairs not more than 50 percent of fairing surface.			
Aluminum fairing material configuration			
Cracks, tears and holes	Not permitted	Replace fairings	Refer to Section 72−34−01, Repair−34 in the PW4000 Series CIR, PN 51A357.

Strut Fairing And Fan Exit Liner Visual Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Nicks and scratches	To a maximum of 0.015 inch (0.381 mm) depth. No raised material or sharp edges.	Blend damage, no raised material is permitted	Refer to Section 72−34−01, Repair−105 in the PW4000 Series CIR, PN 51A357.
		Above 0.015 inch (0.381 mm) depth of damage, replace fairing	Refer to Section 72−34−01, Repair−34 in the PW4000 Series CIR, PN 51A357.
Dents	To a maximum of 0.100 inch (2.540 mm) depth and 0.075 inch (1.905 mm) minimum distance from an edge.	To a maximum of 0.250 inch (6.350 mm) depth maximum with no cracking	Refer to Section 72−34−01, Repair−106 in the PW4000 Series CIR, PN 51A357.
		More than 0.250 inch (6.350 mm) deep, replace the fairing	Refer to Section 72−34−01, Repair−34 in the PW4000 Series CIR, PN 51A357.
2 Fan exit outer liner segment assemblies for: (Figure 805, Sheet 1)			

Strut Fairing And Fan Exit Liner Visual Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Loose or disbonded washers	Not permitted	Replace or rebond washer	Refer to Section 72-34-70, Repair-10 in the PW4000 Series CIR, PN 51A357.
Tears, holes and punctures in the wire mesh indentations	Not permitted	To a maximum of 25 percent of the liner surface and 1.000 inch (25.400 mm) diameter each incident of damage with a 1.000 inch (25.400 mm) separation between each incident of damage or replace liner	Refer to Section 72-34-70, Repair-01, Repair-02, Repair-04 in the PW4000 Series CIR, PN 51A357.
		More than 25 percent of the liner surface or 1.000 inch (25.400 mm) diameter. Full wire mesh replacement is permitted	Refer to Section 72-34-70, Repair-04 in the PW4000 Series CIR, PN 51A357.
Nicks, dents and scratches	To a maximum of 0.020 inch (0.508 mm) depth	To a maximum of 25 percent of the liner surface or replace liner	Refer to Section 72-34-70, Repair-01, Repair-02, Repair-04 in the PW4000 Series CIR, PN 51A357.
			Or

Strut Fairing And Fan Exit Liner Visual Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			Replace by Section 72-34-01, Repair-28 in the PW4000 Series CIR, PN 51A357.
Delamination	Not permitted	2.000 inches (50.800 mm) maximum diameter disbonded area	

NOTE: It is necessary to refer to the applicable Structural Repair Manual (SRM) to find the permitted repaired acoustic treatment area before you do a damage repair. Total area of all repairs cannot be more than 25 percent of surface or liner must be replaced.

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Cracks	Not permitted	Replace liner	Refer to Section 72-34-01, Repair-28 in the PW4000 Series CIR, PN 51A357.
Areas of broken or fuzzy stray fibers	Not permitted	To a maximum of 25 percent of the liner surface maximum and 1.000 inch (25.400 mm) diameter each incident of damage with a 1.000 inch (25.400 mm) separation between damage.	Refer to Section 72-34-70, Repair-02, Repair-04 in the PW4000 Series CIR, PN 51A357.
			Or
			Replace by

Strut Fairing And Fan Exit Liner Visual Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			Section 72−34−01, Repair−28 in the PW4000 Series CIR, PN 51A357.
Delamination in the liner laminate	Not permitted	Replace liner	Refer to Section 72−34−01, Repair−28 in the PW4000 Series CIR, PN 51A357.
Repaired areas	25 percent of liner maximum	Replace liner	Refer to Section 72−34−01, Repair−28 in the PW4000 Series CIR, PN 51A357.
Erosion (exposed broken fibers and punctures) that extend into the liner	Not permitted	To a maximum of 33 percent of the liner surface	Refer to Section 72−34−70, Repair−04 in the PW4000 Series CIR, PN 51A357.
Erosion (dull or rough surface finish, fibers visible)	Not permitted	To a maximum of 25 percent of the liner surface and 1.000 inch (25.400 mm) diameter each incident of damage with a 1.000 inch (25.400 mm) separation between damage	Refer to Section 72−34−70, Repair−02, Repair−04 in the PW4000 Series CIR, PN 51A357.

Strut Fairing And Fan Exit Liner Visual Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			Or Replace by Section 72-34-01, Repair-28 in the PW4000 Series CIR, PN 51A357.
3 Fan exit inner liner segment assemblies and fairing assemblies for: (Figure 805, Sheet 2)			
Missing or loose washers or rivets	Not permitted	Replace washers or rivets	Refer to Section 72-33-80, Repair-02, Repair-03, Repair-09 in the PW4000 Series CIR, PN 51A357.
Surface damage on washers or rivets	0.005 inch (0.127 mm) depth maximum permitted	Replace washers or rivets	Refer to Section 72-33-80, Repair-02, Repair-03, Repair-09 in the PW4000 Series CIR, PN 51A357.

Strut Fairing And Fan Exit Liner Visual Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Nicks, dents, scratches or gouges	To a maximum of 0.010 inch (0.254 mm) depth	To a maximum of 0.020 inch (0.508 mm) depth by 0.500 inch (12.700 mm) length maximum	Refer to Section 72-33-80, Repair-01 in the PW4000 Series CIR, PN 51A357.
Major surface damage	Not permitted	To a maximum of 0.070 inch (1.778 mm) depth by 2.000 inch (50.800 mm) diameter maximum can be repaired. Separation from other major damage 2.000 inches (50.800 mm) minimum and the total area of major damage is 25.000 sq-in (16129. sq-mm) maximum	Refer to Section 72-33-80, Repair-07 in the PW4000 Series CIR, PN 51A357.
Cracks in the potting compound	Permitted. On the outer diameter surface, if the ends of wires are not above the surface.	Not repairable	
Areas of broken wires on the outer diameter surface	Not permitted	To a maximum of 0.020 inch (0.508 mm) depth and a maximum of 0.500 inch (12.700 mm) length	Refer to Section 72-33-80, Repair-01 in the PW4000 Series CIR, PN 51A357.
Punctures or holes	Not permitted	Not repairable	

R Strut Fairing And Fan Exit Liner Visual Inspection
R Table 805 (Continued)

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Erosion at the leading edge (broken wires) on fairing or liner assemblies	Not permitted	To a maximum of 0.020 inch (0.508 mm) depth and a maximum of 0.500 inch (12.700 mm) length	Refer to Section 72−33−80, Repair−01 in the PW4000 Series CIR, PN 51A357.
R	Outer bifurcation fairings, looseness of titanium shield at the leading edge or areas where there is no bond	Not permitted	Rebond titanium shield	Refer to Section 72−33−83, Repair−04 in the PW4000 Series CIR, PN 51A357.
R	Fairing, protective coat for erosion, peeling and missing coat	To a maximum of 1.000 sq−in (645. sq−mm)	To a maximum of 6.250 sq−in (4032. sq−mm)	Refer to Section 72−33−83, Repair−01 in the PW4000 Series CIR, PN 51A357.
R	Wire mesh, perforated aluminum skin and honeycomb core for:			
R	Delamination of wire mesh from skin	Not permitted	No limit. Full wire mesh screen is permitted	Refer to Section 72−33−80, Repair−21 in the PW4000 Series CIR, PN 51A357.

R Strut Fairing And Fan Exit Liner Visual Inspection
R Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Dents, cracks or other erosion damage to perforated skin	Not permitted	No limit. Full perforated skin replacement is permitted	Refer to Section 72-33-80, Repair-21 in the PW4000 Series CIR, PN 51A357.
Crushed or damaged honeycomb core	Not permitted	No limit. Full honeycomb core replacement is permitted	Refer to Section 72-33-80, Repair-21 in the PW4000 Series CIR, PN 51A357.
Surface delamination	Not permitted		Remove from service
Outer diameter surface discoloration	Permitted		
4 Sealant around the liners, brackets, fairings and rivets for: (Figure 805, Sheet 1)			
Loose and constant	Not permitted	Replace sealant	Refer to Section 72-34-01, Repair-36 in the PW4000 Series CIR, PN 51A357.
5 Rivets that attach the fairings for: (Figure 805, Sheet 1)			

Strut Fairing And Fan Exit Liner Visual Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Loose condition, not there	Not permitted	Replace rivets	Refer to Section 70-43-00, in the Standard Practices Manual, PN 585005.
6 Screws that attach the fan exit liner assemblies for: (Figure 805, Sheet 1)			

NOTE: Examine the screws by Index 6 if the fan exit liner assemblies are installed in the module, if not, continue Index 7.

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Loose condition, not there	Not permitted	Replace screws	

NOTE: If the fan exit liner assemblies are removed, examine the areas below or under the liners by Indexes 7 thru 10.

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
7 Fan exit liner segment assembly center brackets for: (Figure 805, Sheet 1)			
Loose condition, deformation and cracks	Not permitted	Replace brackets	Refer to Section 72-34-01, Repair-110 in the PW4000 Series CIR, PN 51A357.

Strut Fairing And Fan Exit Liner Visual Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Loose nut plates	Not permitted	Replace nut plates	Refer to Section 72-34-01, Repair-21 in the PW4000 Series CIR, PN 51A357.

NOTE: It is not necessary to examine the nut plates unless there is damage to the liner or bracket that is not in the limits.

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
8 Fan exit liner segment assembly rear brackets for: (Figure 805, Sheet 1)			
Loose condition, deformation and cracks	Not permitted	Replace brackets	Refer to Section 72-34-01, Repair-114 in the PW4000 Series CIR, PN 51A357.
Loose nut plates	Not permitted	Replace nut plates	Refer to Section 72-34-01, Repair-21 in the PW4000 Series CIR, PN 51A357.

NOTE: It is not necessary to examine the nut plates unless there is damage to the liner or bracket that is not in the limits.

NOTE: See Table 804, Index 3 for inspection of the normally visible rear external portion of the rear fairing/bracket for wear, galling.

Strut Fairing And Fan Exit Liner Visual Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Acoustical baffles (PN 51G969 case only) for: (Figure 805, Sheet 1)			
Missing sealant	Not permitted	Replace sealant	Refer to Section 72-34-01, Repair-40 in the PW4000 Series CIR, PN 51A357.
Loose condition, deformation or cracks	Not permitted	Replace baffles	Refer to Section 72-34-01, Repair-37 in the PW4000 Series CIR, PN 51A357.
10 Fan exit liner segment assembly front brackets for: (Figure 805, Sheet 1)			
Loose condition, deformation and cracks	Not permitted	Replace brackets	Refer to Section 72-34-01, Repair-26 in the PW4000 Series CIR, PN 51A357.
Loose nut plates	Not permitted	Replace nut plates	Refer to Section 72-34-01, Repair-21 in the PW4000 Series CIR, PN 51A357.

Strut Fairing And Fan Exit Liner Visual Inspection
Table 805 (Continued)

R ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair

R NOTE: It is not necessary to examine the nut plates unless
R there is damage to the liner or bracket that is not in the
R limits.

R Strut Fairing And Fan Exit Liner Visual Inspection
R Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Areas in access to the outer shroud for: (Figure 806, Sheet 1)			
Corrosion	Not permitted	See the repair	Refer to Section 72−34−50, Repair−18 in the PW4000 Series CIR, PN 51A357.
Anodized coat missing	Not permitted	See the repair	Refer to Section 72−34−50, Repair−01 in the PW4000 Series CIR, PN 51A357.
Nicks, dents and corrosion pits			
Area A	0.005 inch (0.127 mm) depth maximum, with no raised material or sharp edges	0.010 inch (0.254 mm) depth maximum and 25 percent of total surface area	Refer to Section 72−34−50, Repair−15 in the PW4000 Series CIR, PN 51A357.
		More than 0.010 inch (0.254 mm) depth and to a maximum of 0.060 inch (1.524 mm) depth by 0.150 inch (3.810 mm) diameter in Area D	Refer to Section 72−34−50, Repair−17 in the PW4000 Series CIR, PN 51A357.

Stage 4 Compressor Stator Assembly Visual Inspection
Table 806

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Sealing compound (Figure 806, Sheet 2)			
Eroded and damaged around the complete circumference of the vane on outer shroud outer and inner diameter surfaces	Not permitted	See the repair	Refer to Section 72-34-50, Repair-20 in the PW4000 Series CIR, PN 51A357.
Surface of the stage 4 stator vanes for: (Figure 806, Sheet 3)			
Concave and convex surfaces (other than Area A)			
Pits and corrosion	Not permitted	To a maximum of 12 percent of the total thickness	Refer to Section 72-34-50, Repair-03 in the PW4000 Series CIR, PN 51A357.
		More than 12 percent of the local vane thickness	Replace by Section 72-34-50, Repair-07 in the PW4000 Series CIR, PN 51A357.
Dents with rounded bottoms	Permitted		

Stage 4 Compressor Stator Assembly Visual Inspection
Table 806 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
other dents and nicks	Not permitted	To a maximum of five percent of convex surface and 20 percent of concave surface	Refer to Section 72-34-50, Repair-03 in the PW4000 Series CIR, PN 51A357.
		More than five percent of convex surface or more than 20 percent of the concave surface	Replace by Section 72-34-50, Repair-07 in the PW4000 Series CIR, PN 51A357.
Damage on the side of the vane that is visible on the other side of the vane	Not permitted	Vane replacement	Refer to Section 72-34-50, Repair-07 in the PW4000 Series CIR, PN 51A357.
Area A all around			
Nicks, dents, pits and corrosion	Not permitted	Vane replacement	Refer to Section 72-34-50, Repair-07 in the PW4000 Series CIR, PN 51A357.
Leading and trailing edges (Figure 806, Sheet 3)			
1			
Separation of blends in Area B and Area C			

Stage 4 Compressor Stator Assembly Visual Inspection
Table 806 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Radial distance between blends, to the maximum depth on both edges		1.833 inches (46.558 mm) minimum	
Radial distance between blends, less than maximum depth, on both edges		Less than 1.833 inches (46.558 mm) length separation is permitted if the total blended depth is not more than single blend depth limit	
Quantity of incidents		Two to maximum depth on each edge	
Length of each incident		0.500 inch (12.700 mm) maximum	
Total length of all incidents		0.500 inch (12.700 mm) maximum	
2			
Area B			
Nicks and dents	Not permitted	0.080 inch (2.032 mm) depth maximum for each incident	Refer to Section 72−34−50, Repair−03 in the PW4000 Series CIR, PN 51A357.

Stage 4 Compressor Stator Assembly Visual Inspection
Table 806 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area C Nicks and dents	Not permitted	0.100 inch (2.540 mm) depth maximum for each incident	Refer to Section 72−34−50, Repair−03 in the PW4000 Series CIR, PN 51A357.
Areas in access to the inner shroud for: (Figure 806, Sheet 4)			
Corrosion	Not permitted	To a maximum of 25 percent of the shroud surface area	Refer to Section 72−34−50, Repair−18 in the PW4000 Series CIR, PN 51A357.
Cracks	Not permitted		Remove from service
Raised material sharp edges	Not permitted	Smooth sharp edges and raised material	Manually smooth raised material. Refer to Section 70−45−00, in the Standard Practices Manual, PN 585005.
Anodized coat missing	Not permitted	See the repair	Refer to Section 72−34−50, Repair−01 in the PW4000 Series CIR, PN 51A357.

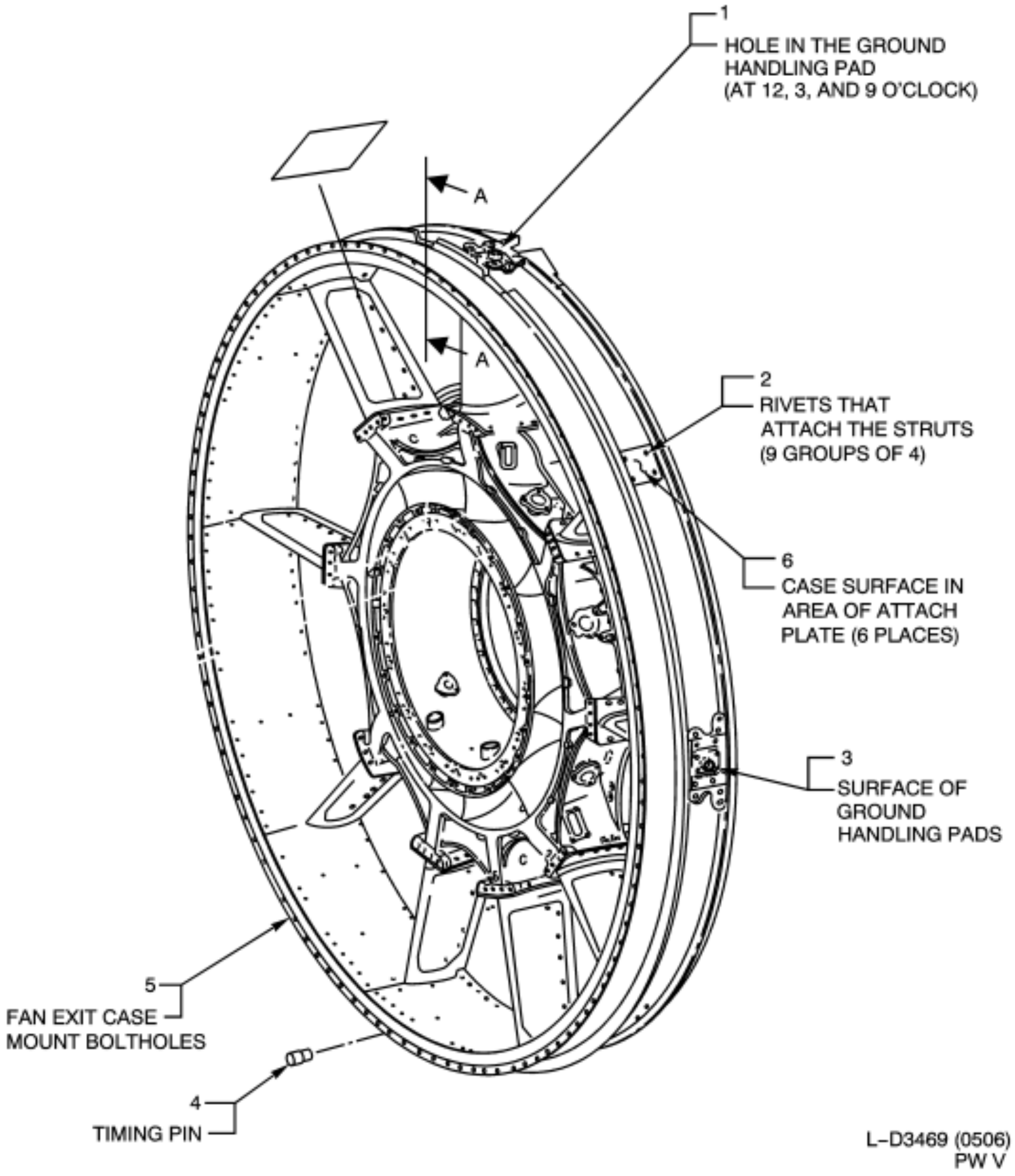
Stage 4 Compressor Stator Assembly Visual Inspection
Table 806 (Continued)

R ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Missing rivets	Not permitted	Replace rivets	Refer to Section 70−43−00, in the Standard Practices Manual, PN 585005.
Inner shroud lug surfaces raised material, nicks, dents, scratches and sharp edges	Not permitted	0.005 inch (0.127 mm) depth maximum	Refer to Section 72−34−50, Repair−08 in the PW4000 Series CIR, PN 51A357.

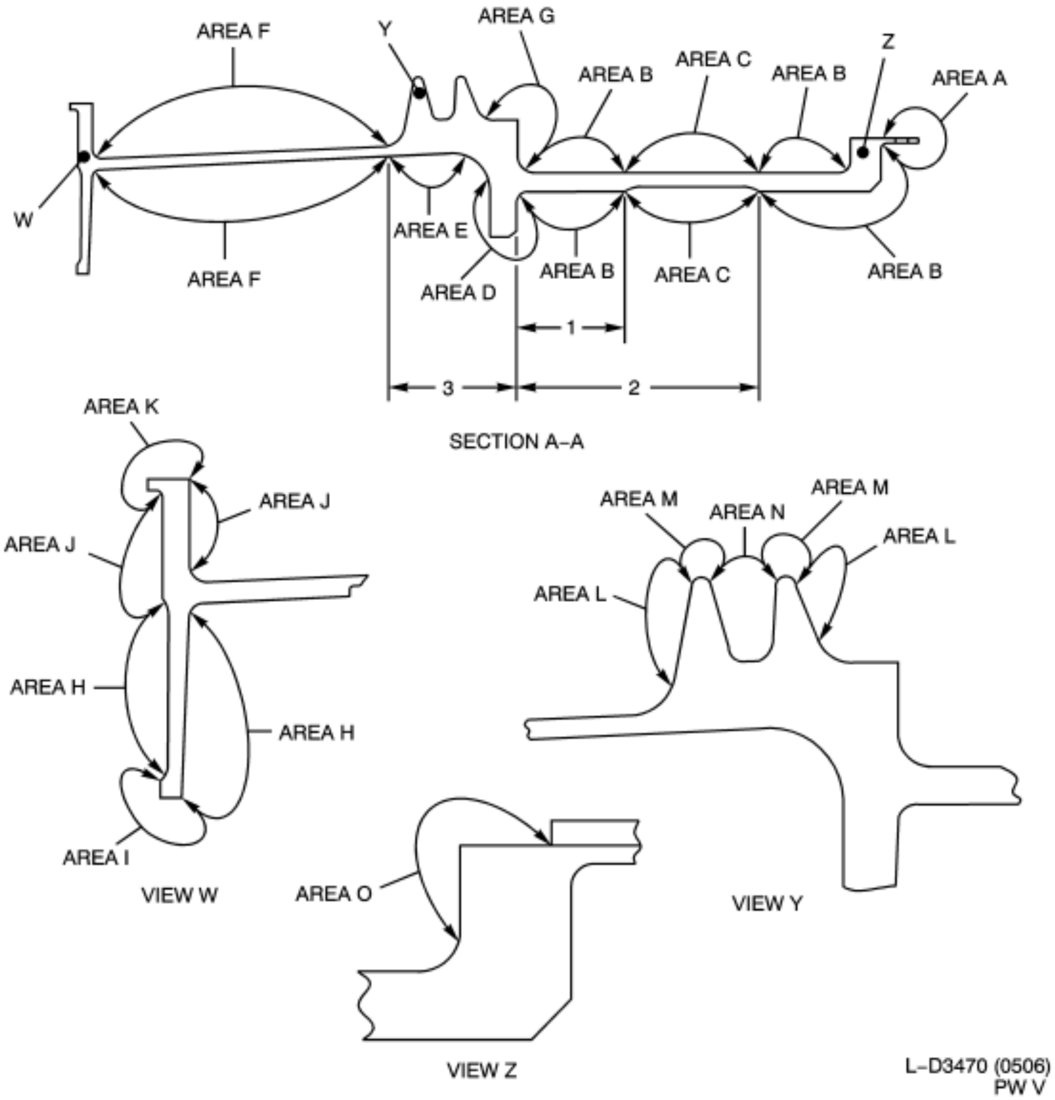
Stage 4 Compressor Stator Assembly Visual Inspection
Table 806 (Continued)

R ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10


1
HOLE IN THE GROUND HANDLING PAD (AT 12, 3, AND 9 O'CLOCK)
A
A
2
RIVETS THAT ATTACH THE STRUTS (9 GROUPS OF 4)
6
CASE SURFACE IN AREA OF ATTACH PLATE (6 PLACES)
3
SURFACE OF GROUND HANDLING PADS
5
FAN EXIT CASE MOUNT BOLTHOLES
4
TIMING PIN
L−D3469 (0506)
PW V

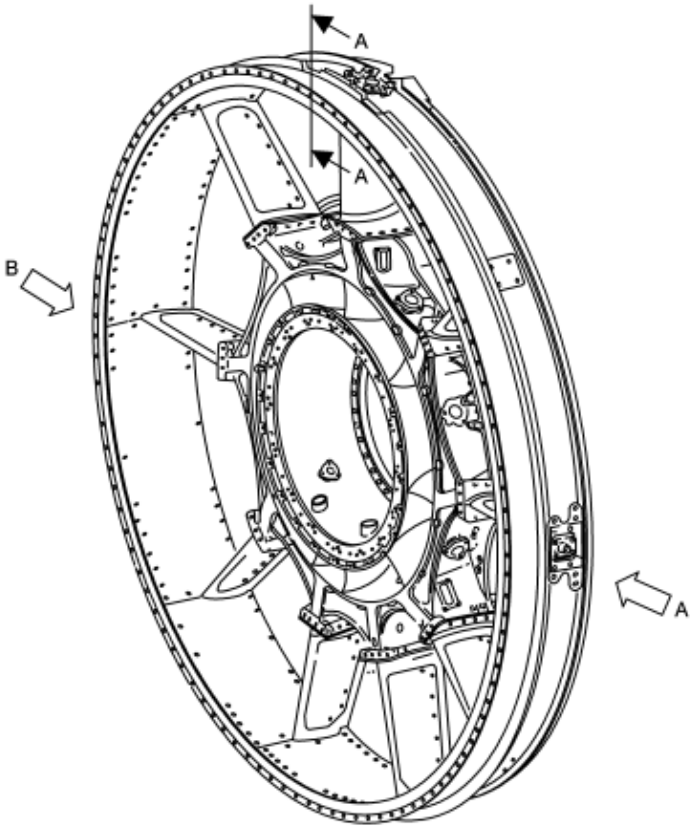
R See Table 801 For Index Definitions

R Outer Diameter Case Surface Visual Inspection Areas
R Figure 801 (Sheet 1)
R (Task 72−00−34−990−010)


AREA F
Y
AREA G
AREA B
AREA C
AREA B
Z
AREA A
W
AREA E
AREA F
AREA D
AREA B
AREA C
AREA B
1
3
2
SECTION A-A
AREA K
AREA J
AREA J
AREA H
AREA H
AREA I
VIEW W
AREA M
AREA N
AREA M
AREA L
AREA L
VIEW Y
AREA O
VIEW Z
L-D3470 (0506)
PW V

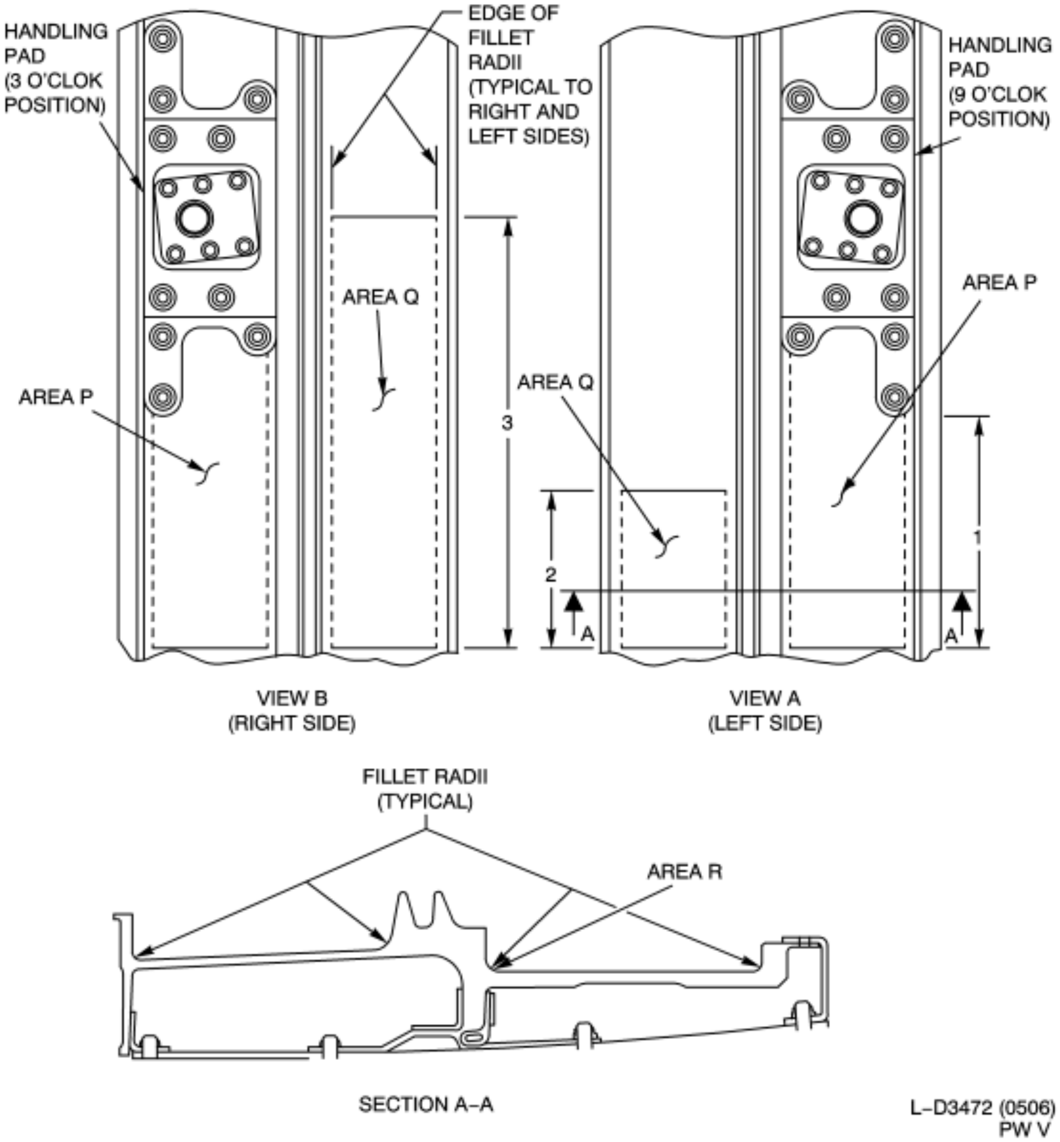
R 1. 1.390 - 1.450 Inches (35.31 - 36.83 mm)
R 2. 3.430 - 3.490 Inches (87.12 - 88.65 mm)
R 3. 1.700 Inches (43.180 mm) Maximum
R See Table 801 For Index Definitions

R Outer Diameter Case Surface Visual Inspection Areas
R Figure 801 (Sheet 2)
R (Task 72-00-34-990-010)



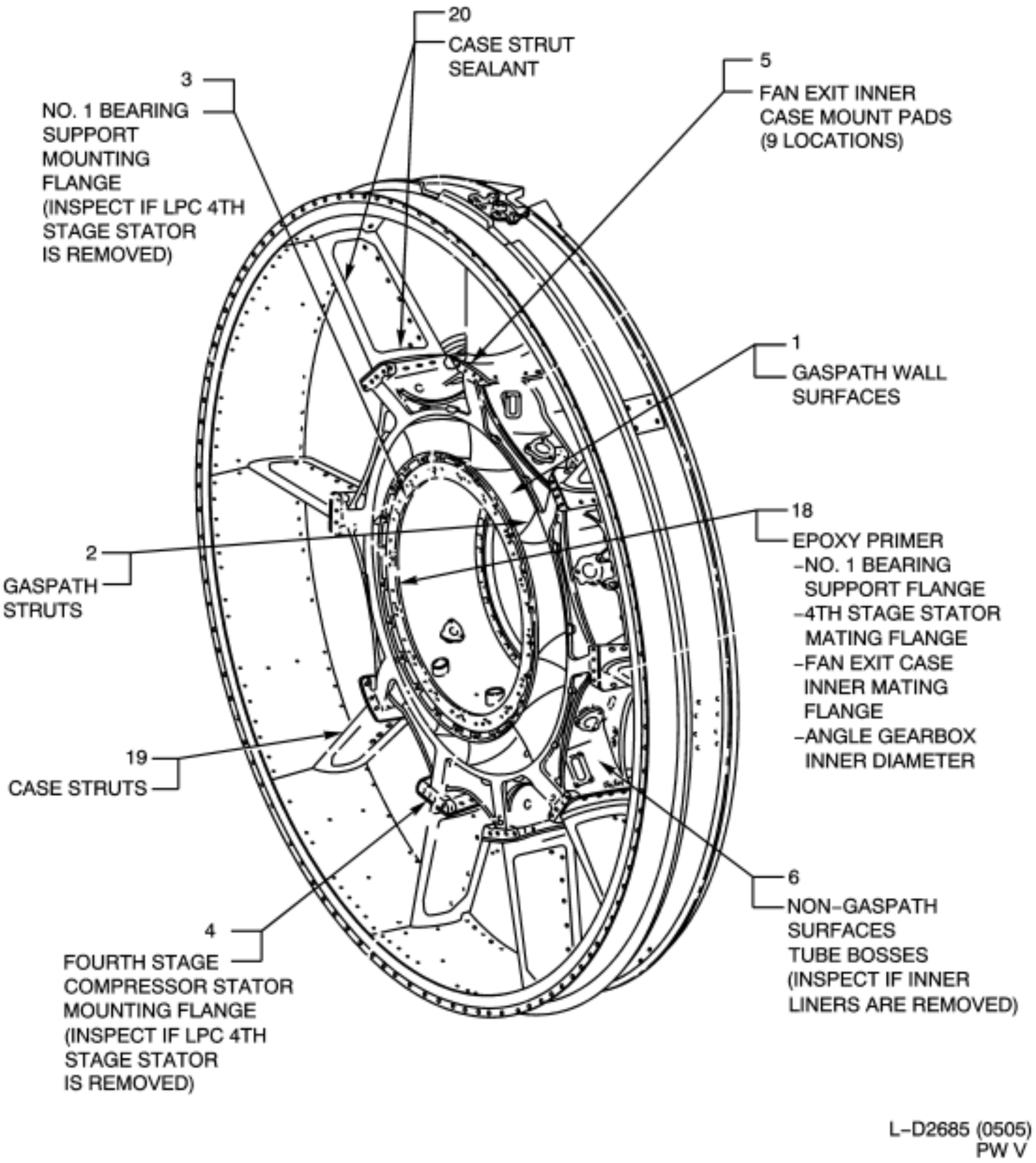
L−D3471 (0506)
PW V

R Outer Diameter Case Surface Visual Inspection Areas
R Figure 801 (Sheet 3)
R (Task 72−00−34−990−010)


HANDLING PAD (3 O'CLOK POSITION)
EDGE OF FILLET RADII (TYPICAL TO RIGHT AND LEFT SIDES)
HANDLING PAD (9 O'CLOK POSITION)
AREA Q
AREA P
AREA Q
AREA P
3
2
1
A
A
VIEW B (RIGHT SIDE)
VIEW A (LEFT SIDE)
FILLET RADII (TYPICAL)
AREA R
SECTION A−A
L−D3472 (0506)
PW V

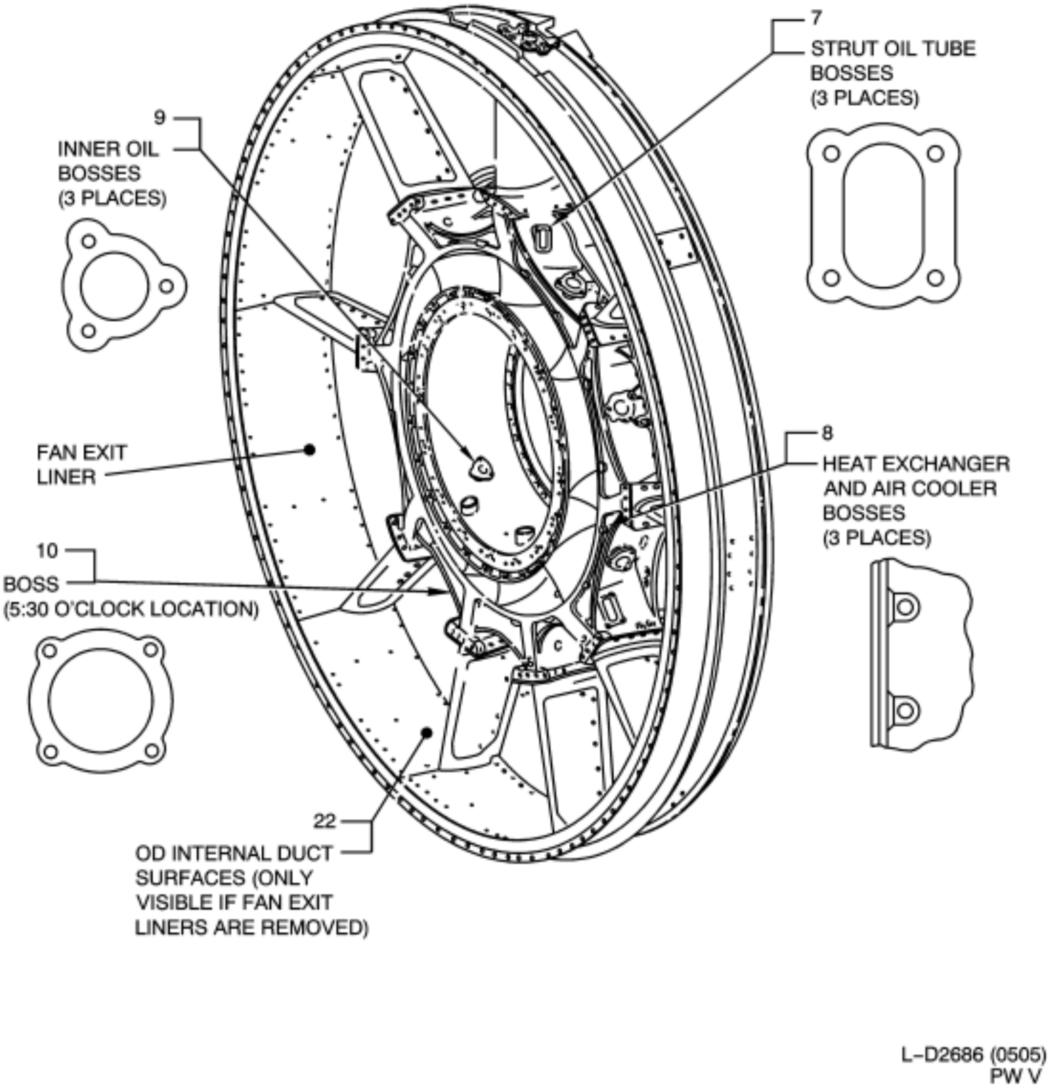
R 1. 9.800 Inches (248.920 mm) Maximum
R 2. 8.000 Inches (203.200 mm) Maximum
R 3. 17.200 Inches (436.880 mm) Maximum

R Outer Diameter Case Surface Visual Inspection Areas
R Figure 801 (Sheet 4)
R (Task 72−00−34−990−010)


20
CASE STRUT SEALANT
3
NO. 1 BEARING SUPPORT MOUNTING FLANGE (INSPECT IF LPC 4TH STAGE STATOR IS REMOVED)
5
FAN EXIT INNER CASE MOUNT PADS (9 LOCATIONS)
1
GASPATH WALL SURFACES
18
EPOXY PRIMER
-NO. 1 BEARING SUPPORT FLANGE
-4TH STAGE STATOR MATING FLANGE
-FAN EXIT CASE INNER MATING FLANGE
-ANGLE GEARBOX INNER DIAMETER
2
GASPATH STRUTS
19
CASE STRUTS
6
NON-GASPATH SURFACES TUBE BOSSES (INSPECT IF INNER LINERS ARE REMOVED)
4
FOURTH STAGE COMPRESSOR STATOR MOUNTING FLANGE (INSPECT IF LPC 4TH STAGE STATOR IS REMOVED)
L-D2685 (0505)
PW V

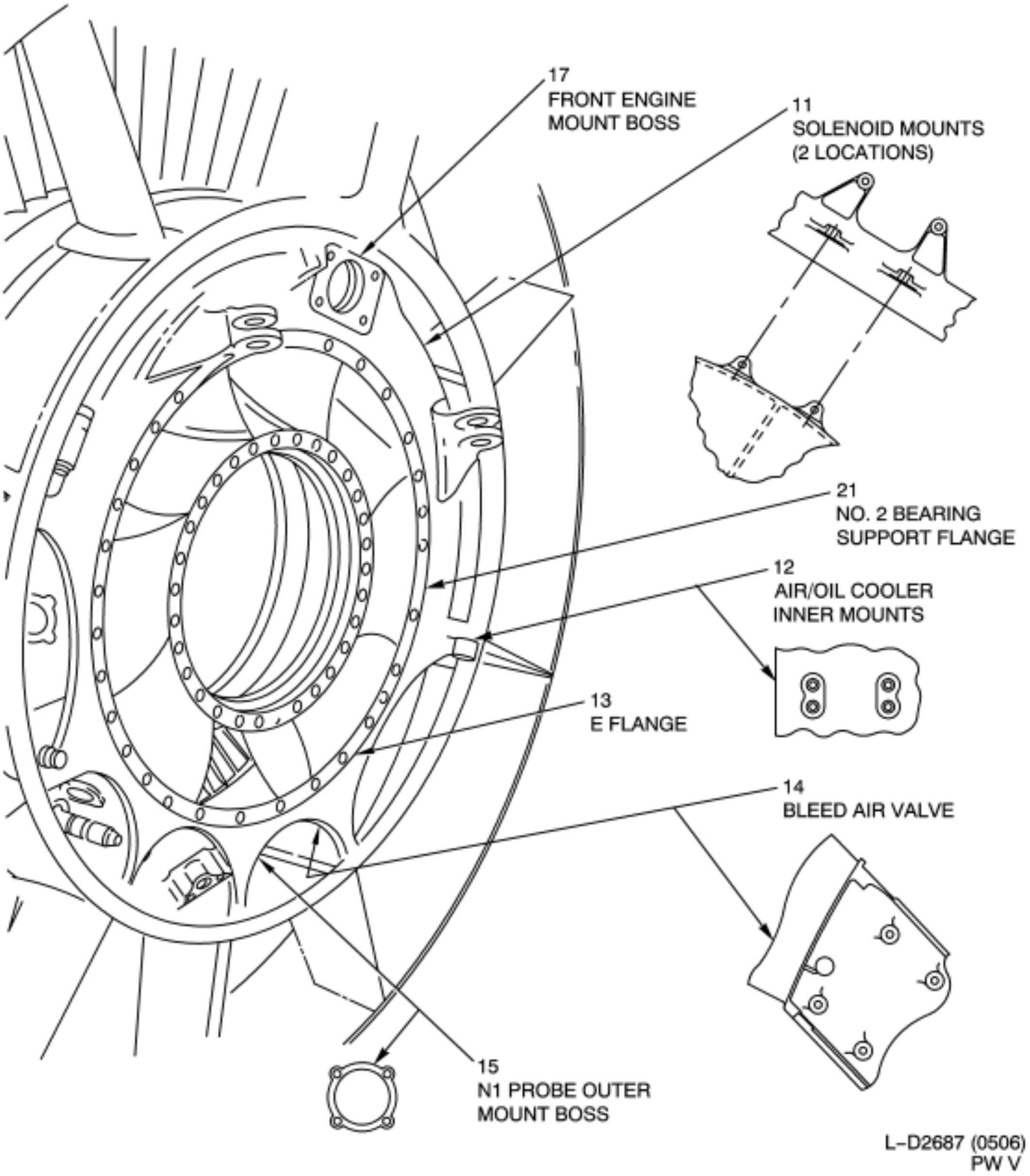
R Gaspath And Inner Diameter Structure Visual Inspection Areas
R Figure 802 (Sheet 1)
R (Task 72−00−34−990−010)

R ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10


7
STRUT OIL TUBE
BOSSES
(3 PLACES)
9
INNER OIL
BOSSES
(3 PLACES)
FAN EXIT
LINER
8
HEAT EXCHANGER
AND AIR COOLER
BOSSES
(3 PLACES)
10
BOSS
(5:30 O'CLOCK LOCATION)
22
OD INTERNAL DUCT
SURFACES (ONLY
VISIBLE IF FAN EXIT
LINERS ARE REMOVED)
L−D2686 (0505)
PW V

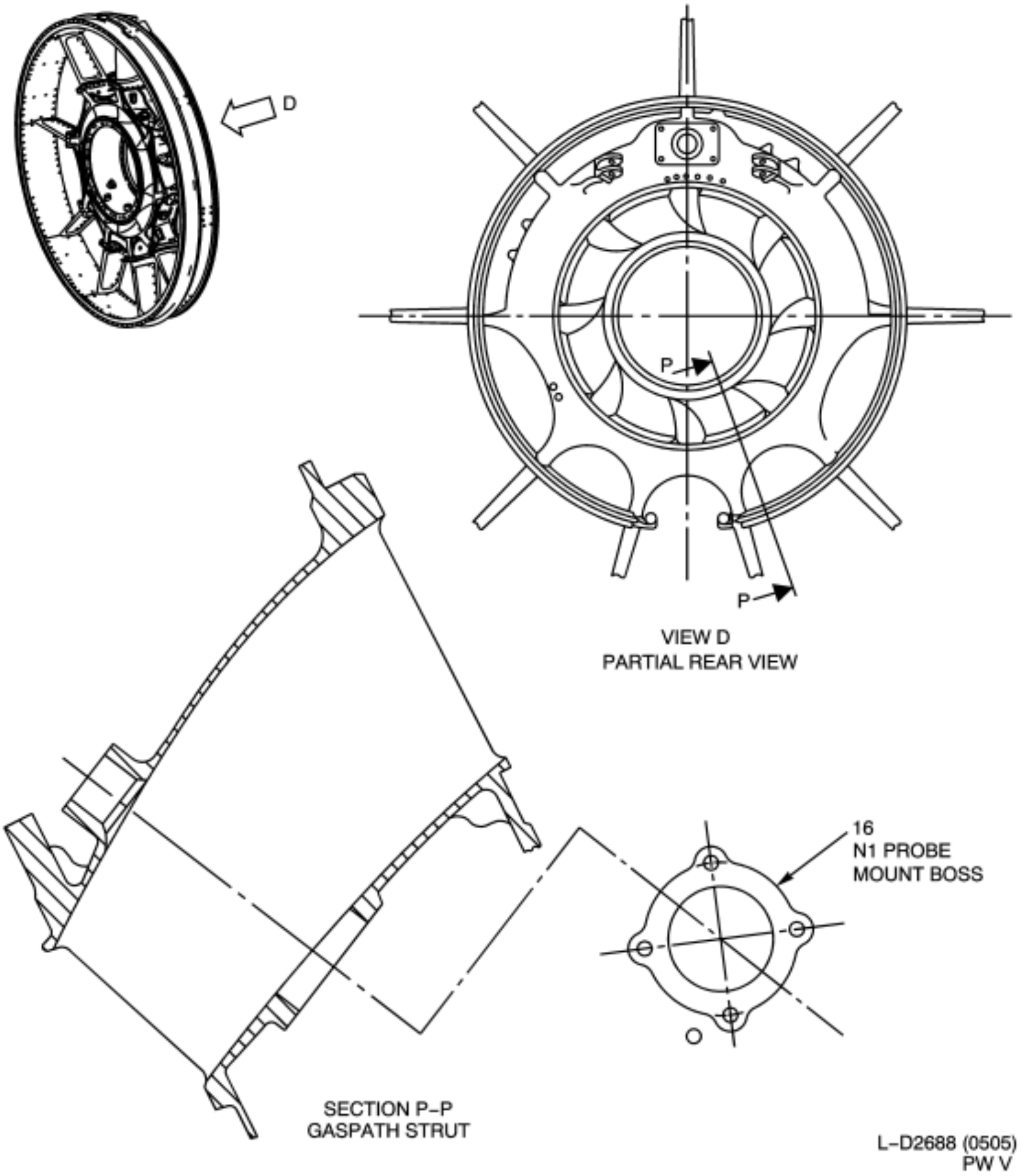
R Gaspath And Inner Diameter Structure Visual Inspection Areas
R Figure 802 (Sheet 2)
R (Task 72−00−34−990−010)

R ENGINE GENERAL - INTERMEDIATE CASE - INSPECTION/CHECK-10

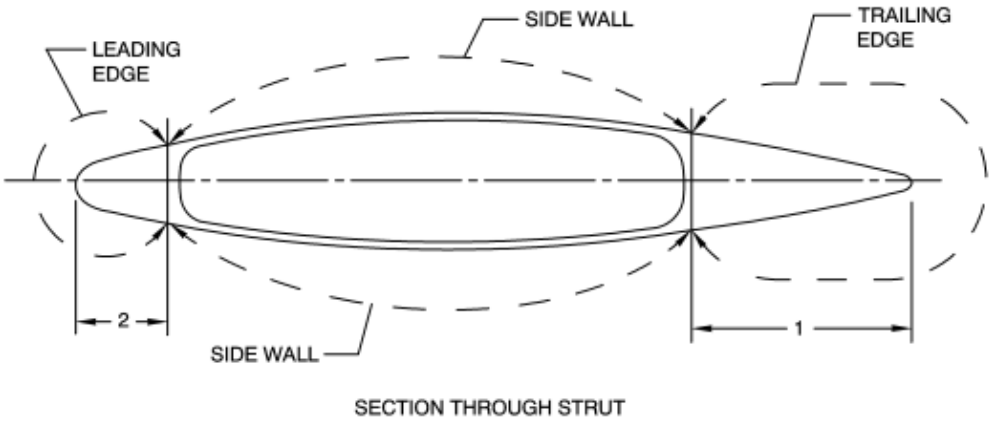

17
FRONT ENGINE
MOUNT BOSS
11
SOLENOID MOUNTS
(2 LOCATIONS)
21
NO. 2 BEARING
SUPPORT FLANGE
12
AIR/OIL COOLER
INNER MOUNTS
13
E FLANGE
14
BLEED AIR VALVE
15
N1 PROBE OUTER
MOUNT BOSS
L-D2687 (0506)
PW V

R Gaspath And Inner Diameter Structure Visual Inspection Areas
R Figure 802 (Sheet 3)
R (Task 72-00-34-990-010)

R ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10


D
P
P
VIEW D
PARTIAL REAR VIEW
16
N1 PROBE
MOUNT BOSS
SECTION P−P
GASPATH STRUT
L−D2688 (0505)
PW V

R Gaspath And Inner Diameter Structure Visual Inspection Areas
R Figure 802 (Sheet 4)
R (Task 72−00−34−990−010)

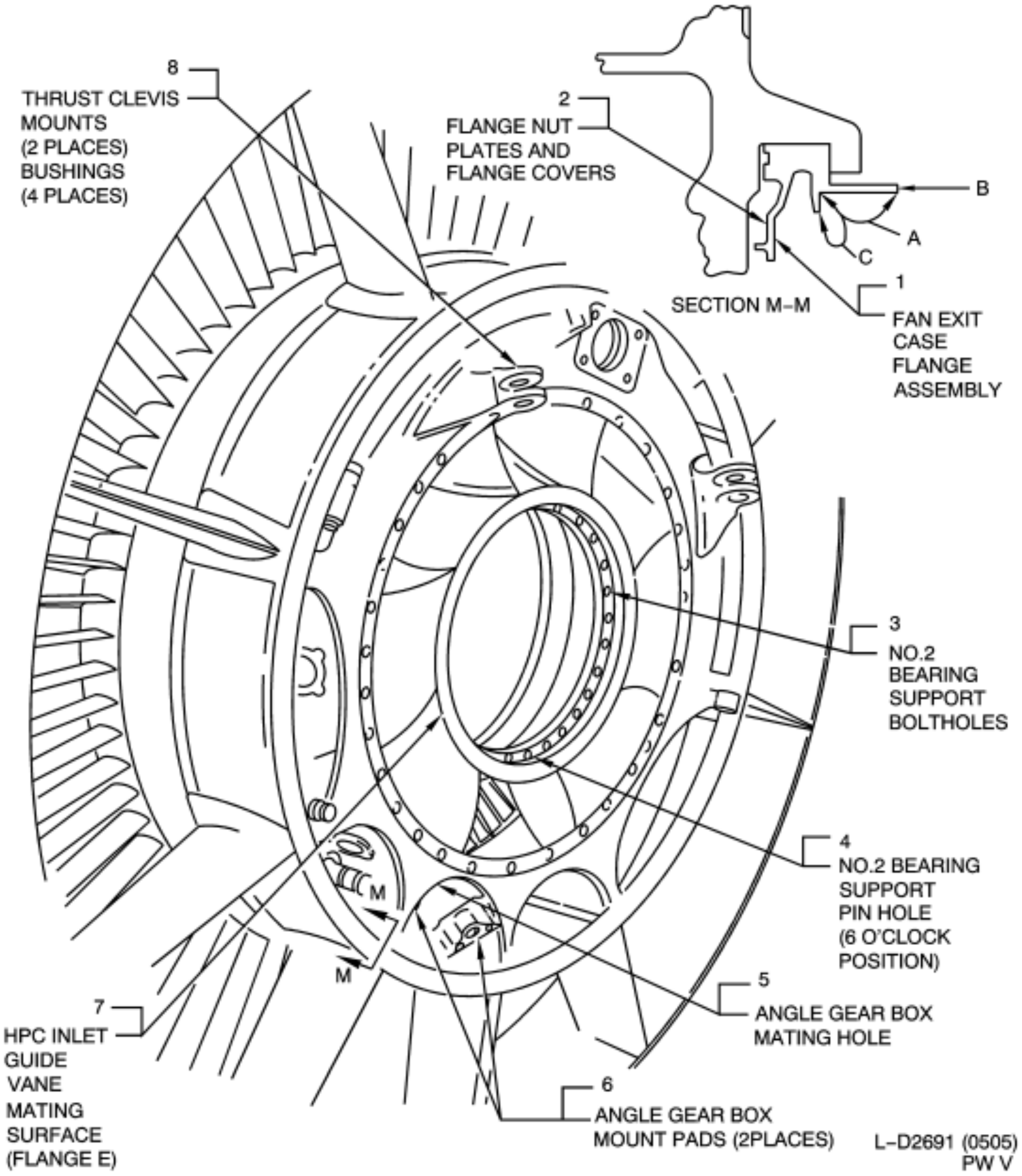

SIDE WALL
TRAILING EDGE
LEADING EDGE
2
1
SIDE WALL
SECTION THROUGH STRUT

L-D3473 (0506)
PW V

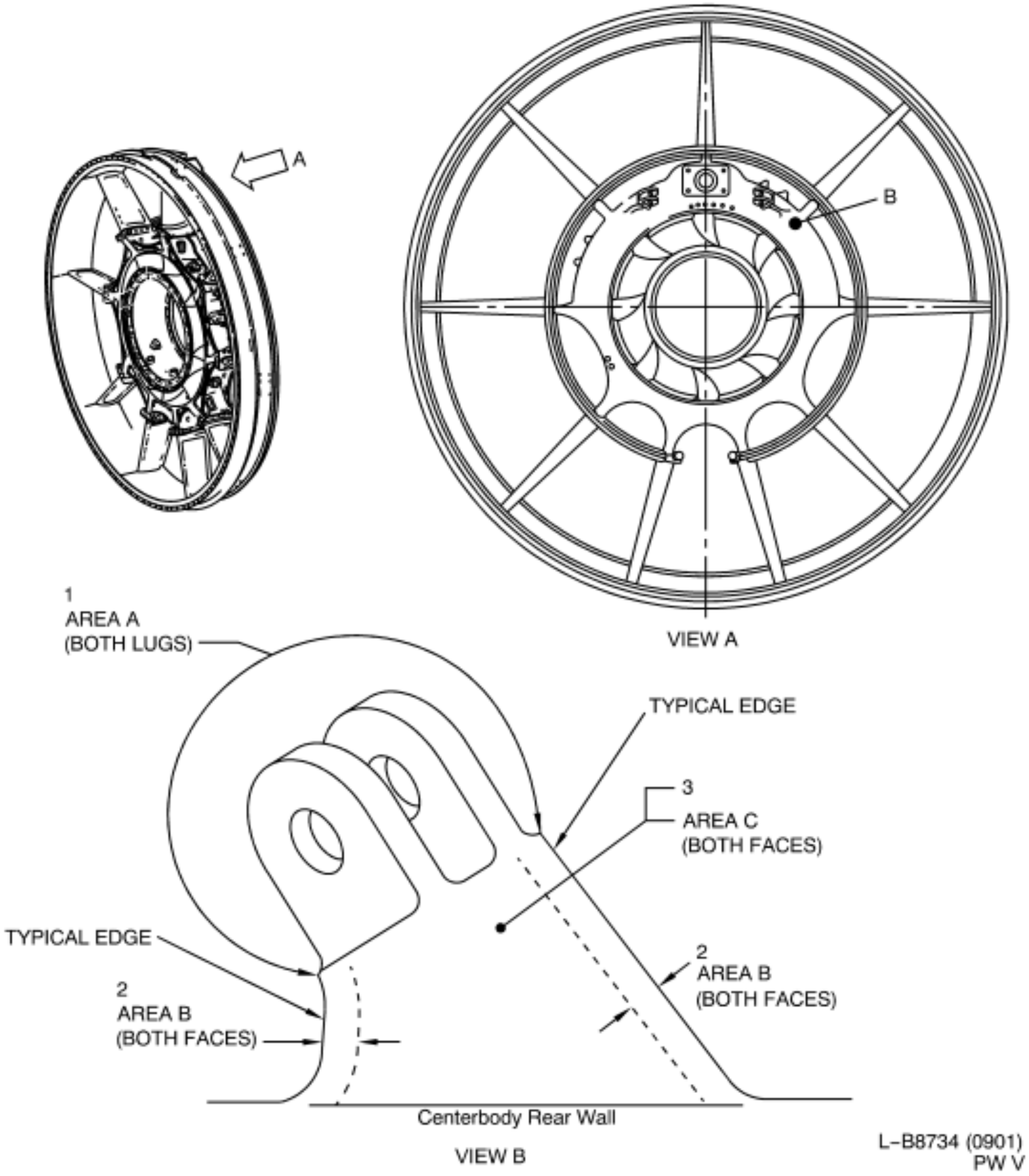
R 1. 1.800 – 1.900 Inches (45.7 – 48.3 mm)
R 2. 1.300 – 1.400 Inches (33.0 – 35.6 mm)
R See Table 802 For Index Definitions

R Gaspath And Inner Diameter Structure Visual Inspection Areas
R Figure 802 (Sheet 5)
R (Task 72-00-34-990-010)

R ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10

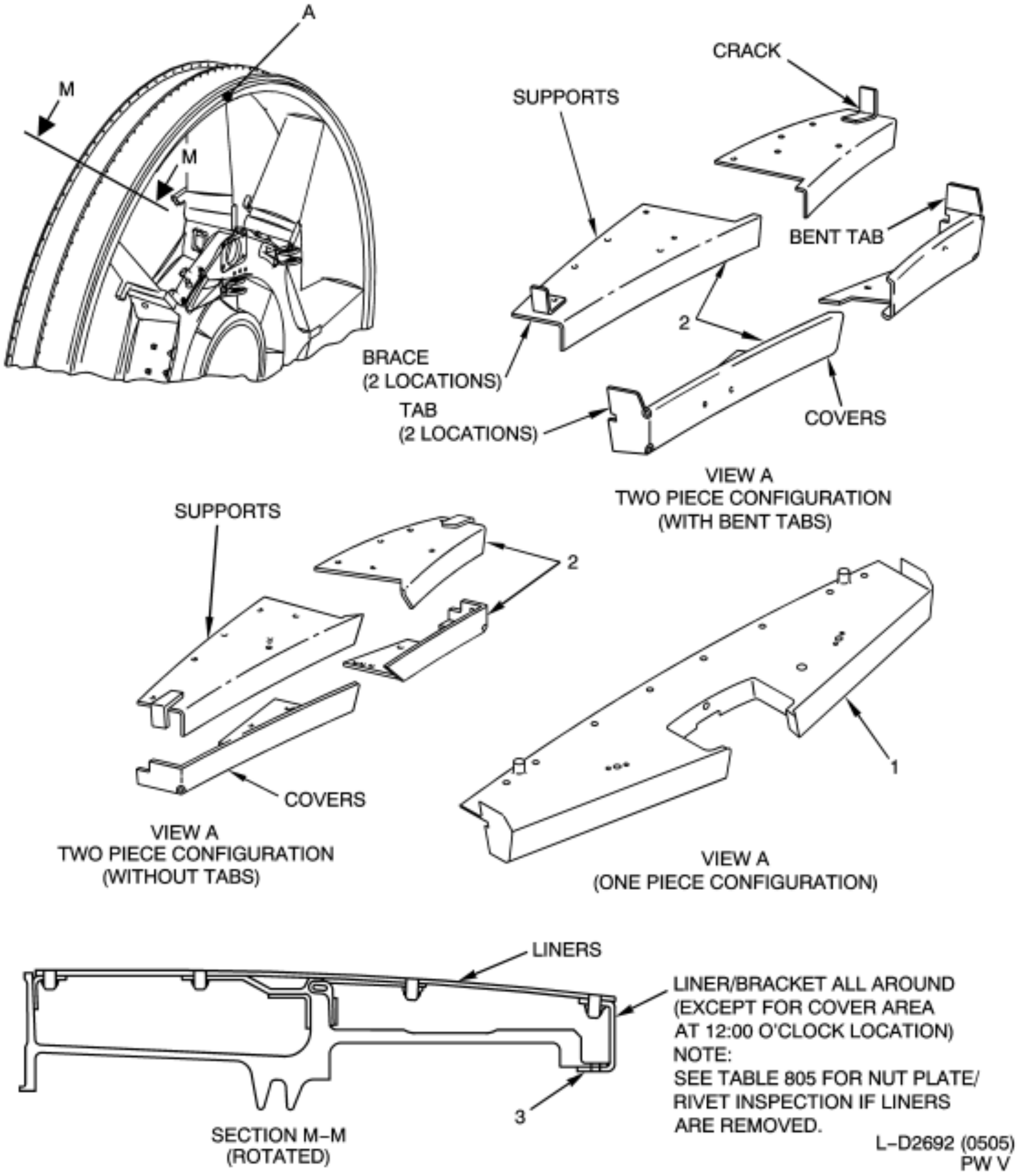

8
THRUST CLEVIS MOUNTS (2 PLACES) BUSHINGS (4 PLACES)
2
FLANGE NUT PLATES AND FLANGE COVERS
B
A
C
1
SECTION M−M
FAN EXIT CASE FLANGE ASSEMBLY
3
NO.2 BEARING SUPPORT BOLTHOLES
4
NO.2 BEARING SUPPORT PIN HOLE (6 O'CLOCK POSITION)
M
M
5
ANGLE GEAR BOX MATING HOLE
7
HPC INLET GUIDE VANE MATING SURFACE (FLANGE E)
6
ANGLE GEAR BOX MOUNT PADS (2PLACES)
L−D2691 (0505)
PW V

R Rear Surfaces, Mounts And Flange Visual Inspection Areas
R Figure 803 (Sheet 1)
R (Task 72−00−34−990−010)

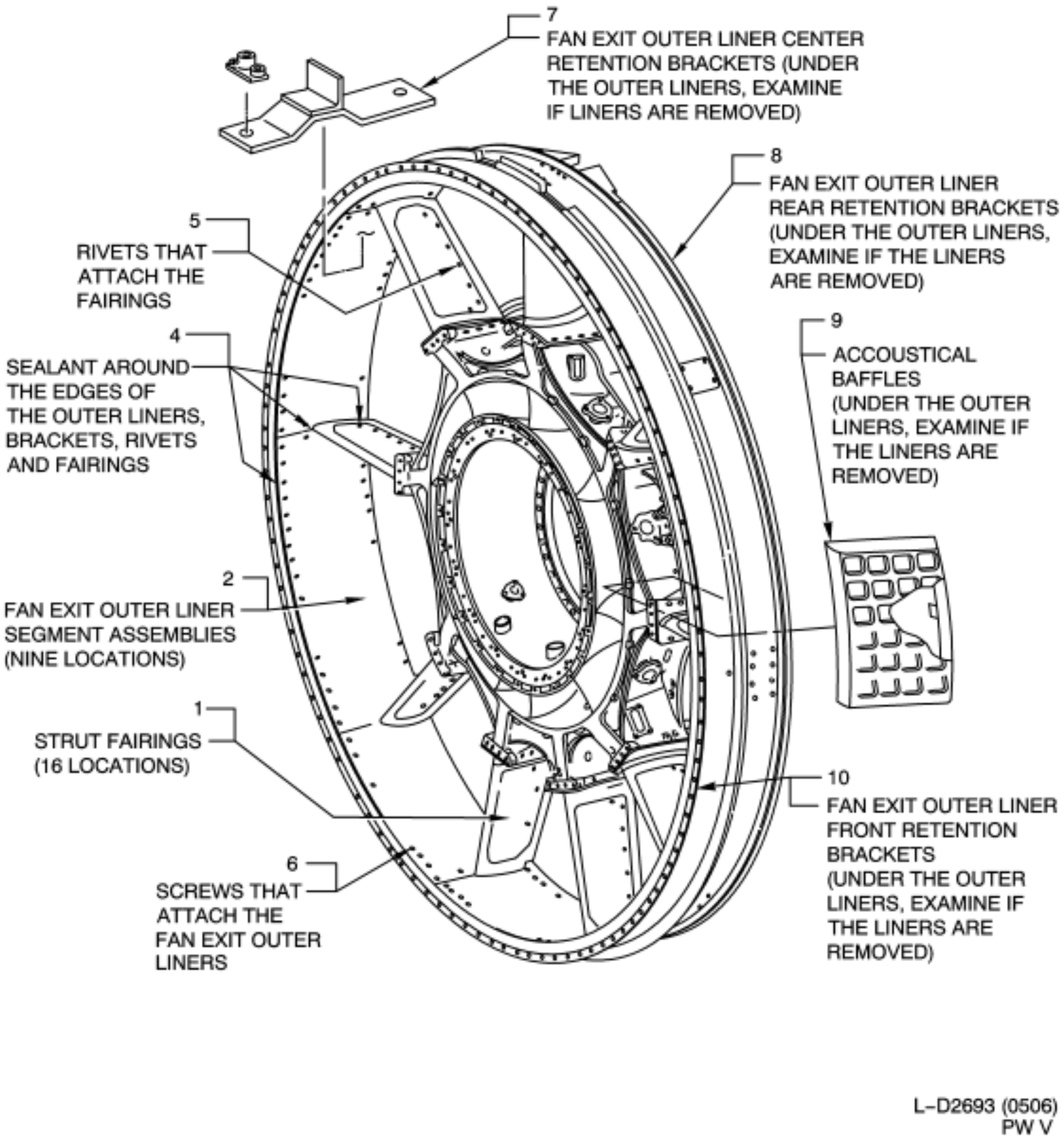

A
B
VIEW A
1
AREA A
(BOTH LUGS)
TYPICAL EDGE
3
AREA C
(BOTH FACES)
TYPICAL EDGE
2
AREA B
(BOTH FACES)
2
AREA B
(BOTH FACES)
Centerbody Rear Wall
VIEW B
L-B8734 (0901)
PW V

R Rear Surfaces, Mounts And Flange Visual Inspection Areas
R Figure 803 (Sheet 2)
R (Task 72-00-34-990-010)

R ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10


A
M
M
CRACK
SUPPORTS
BENT TAB
2
BRACE
(2 LOCATIONS)
TAB
(2 LOCATIONS)
COVERS
VIEW A
TWO PIECE CONFIGURATION
(WITH BENT TABS)
SUPPORTS
2
COVERS
1
VIEW A
TWO PIECE CONFIGURATION
(WITHOUT TABS)
VIEW A
(ONE PIECE CONFIGURATION)
LINERS
LINER/BRACKET ALL AROUND
(EXCEPT FOR COVER AREA
AT 12:00 O'CLOCK LOCATION)
NOTE:
SEE TABLE 805 FOR NUT PLATE/
RIVET INSPECTION IF LINERS
ARE REMOVED.
3
SECTION M−M
(ROTATED)
L−D2692 (0505)
PW V

R Rear Cover And Fairing Visual Inspection Areas
R Figure 804
R (Task 72−00−34−990−010)


7
FAN EXIT OUTER LINER CENTER RETENTION BRACKETS (UNDER THE OUTER LINERS, EXAMINE IF LINERS ARE REMOVED)
8
FAN EXIT OUTER LINER REAR RETENTION BRACKETS (UNDER THE OUTER LINERS, EXAMINE IF THE LINERS ARE REMOVED)
5
RIVETS THAT ATTACH THE FAIRINGS
4
SEALANT AROUND THE EDGES OF THE OUTER LINERS, BRACKETS, RIVETS AND FAIRINGS
9
ACCOUSTICAL BAFFLES (UNDER THE OUTER LINERS, EXAMINE IF THE LINERS ARE REMOVED)
2
FAN EXIT OUTER LINER SEGMENT ASSEMBLIES (NINE LOCATIONS)
1
STRUT FAIRINGS (16 LOCATIONS)
10
FAN EXIT OUTER LINER FRONT RETENTION BRACKETS (UNDER THE OUTER LINERS, EXAMINE IF THE LINERS ARE REMOVED)
6
SCREWS THAT ATTACH THE FAN EXIT OUTER LINERS
L−D2693 (0506)
PW V

R Strut Fairing And Fan Exit Liner Visual Inspection Areas
R Figure 805 (Sheet 1)
R (Task 72−00−34−990−010)

R ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10

R
R
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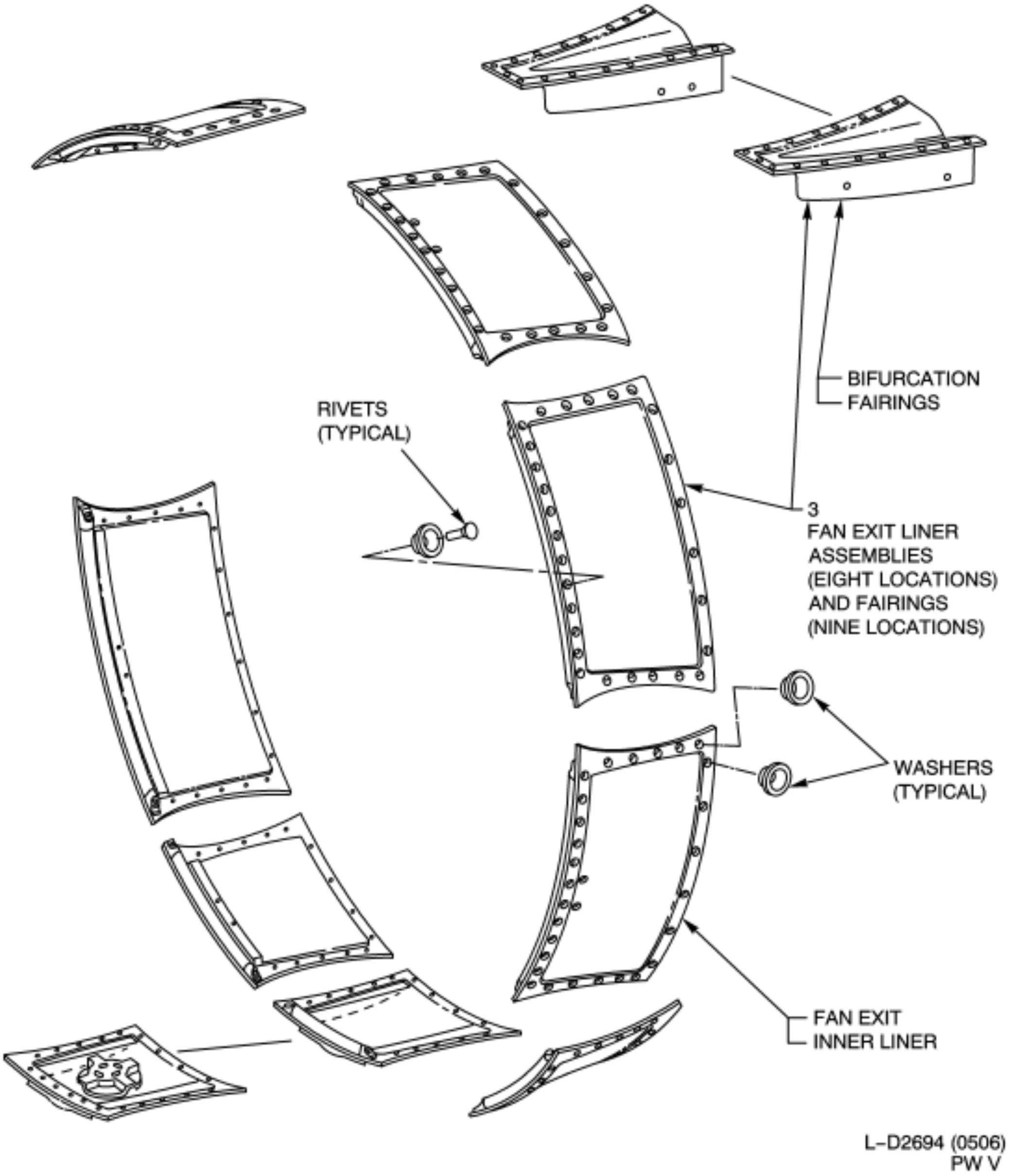
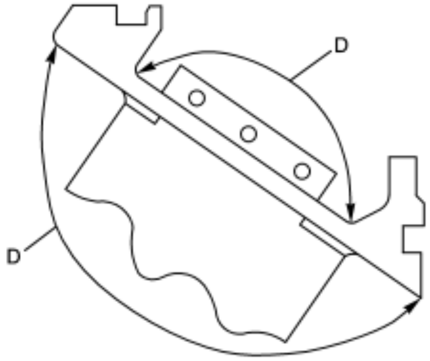
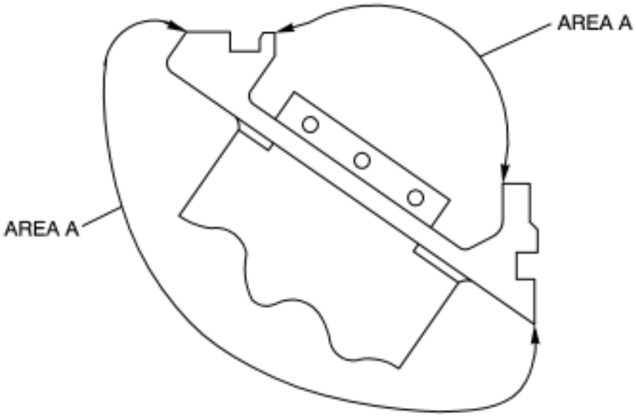
R


BIFURCATION
FAIRINGS
RIVETS
(TYPICAL)
3
FAN EXIT LINER
ASSEMBLIES
(EIGHT LOCATIONS)
AND FAIRINGS
(NINE LOCATIONS)
WASHERS
(TYPICAL)
FAN EXIT
INNER LINER
L−D2694 (0506)
PW V

R Strut Fairing And Fan Exit Liner Visual Inspection Areas
R Figure 805 (Sheet 2)
R (Task 72−00−34−990−010)



VIEW E

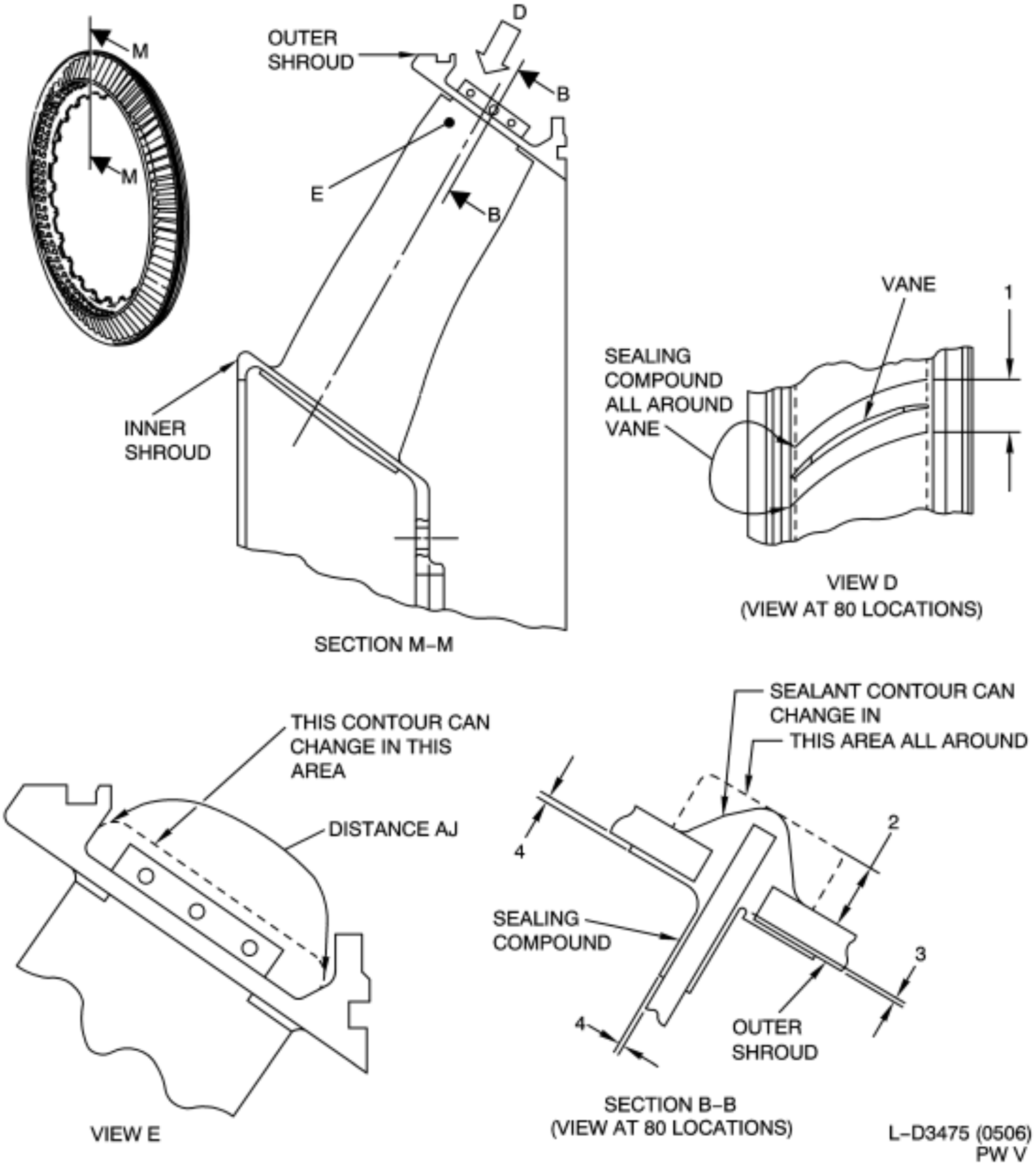


VIEW E

L−D3474 (0506)
PW V

R Stage 4 Compressor Stator Assembly Visual Inspection Areas
R Figure 806 (Sheet 1)
R (Task 72−00−34−990−010)

R ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10

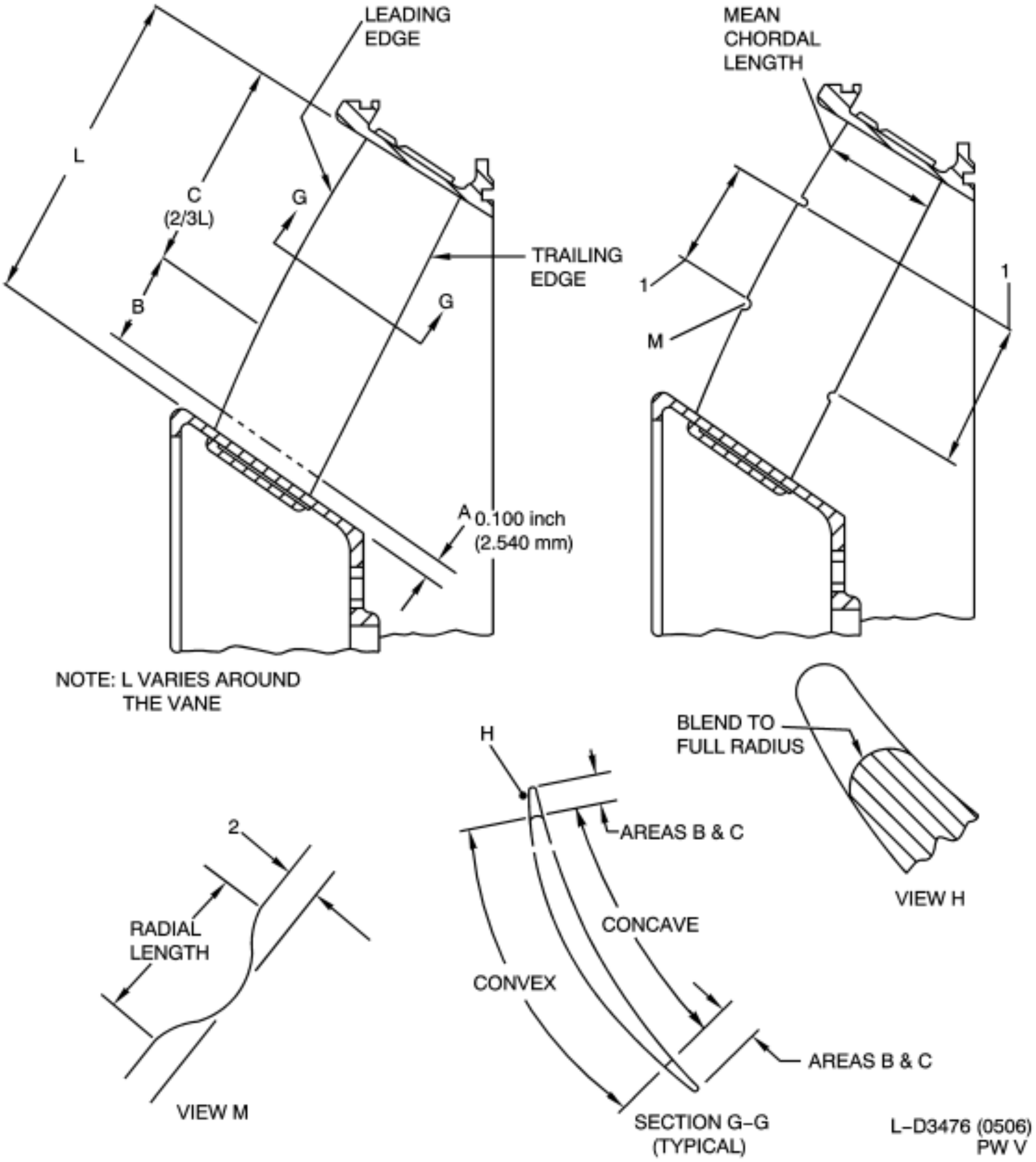

M
M
OUTER SHROUD
D
B
E
B
INNER SHROUD
SECTION M−M
VANE
1
SEALING COMPOUND ALL AROUND VANE
VIEW D
(VIEW AT 80 LOCATIONS)
THIS CONTOUR CAN CHANGE IN THIS AREA
DISTANCE AJ
VIEW E
SEALANT CONTOUR CAN CHANGE IN
THIS AREA ALL AROUND
2
4
SEALING COMPOUND
3
4
OUTER SHROUD
SECTION B−B
(VIEW AT 80 LOCATIONS)
L−D3475 (0506)
PW V

R Stage 4 Compressor Stator Assembly Visual Inspection Areas
R Figure 806 (Sheet 2)
R (Task 72−00−34−990−010)

R ENGINE GENERAL - INTERMEDIATE CASE - INSPECTION/CHECK-10

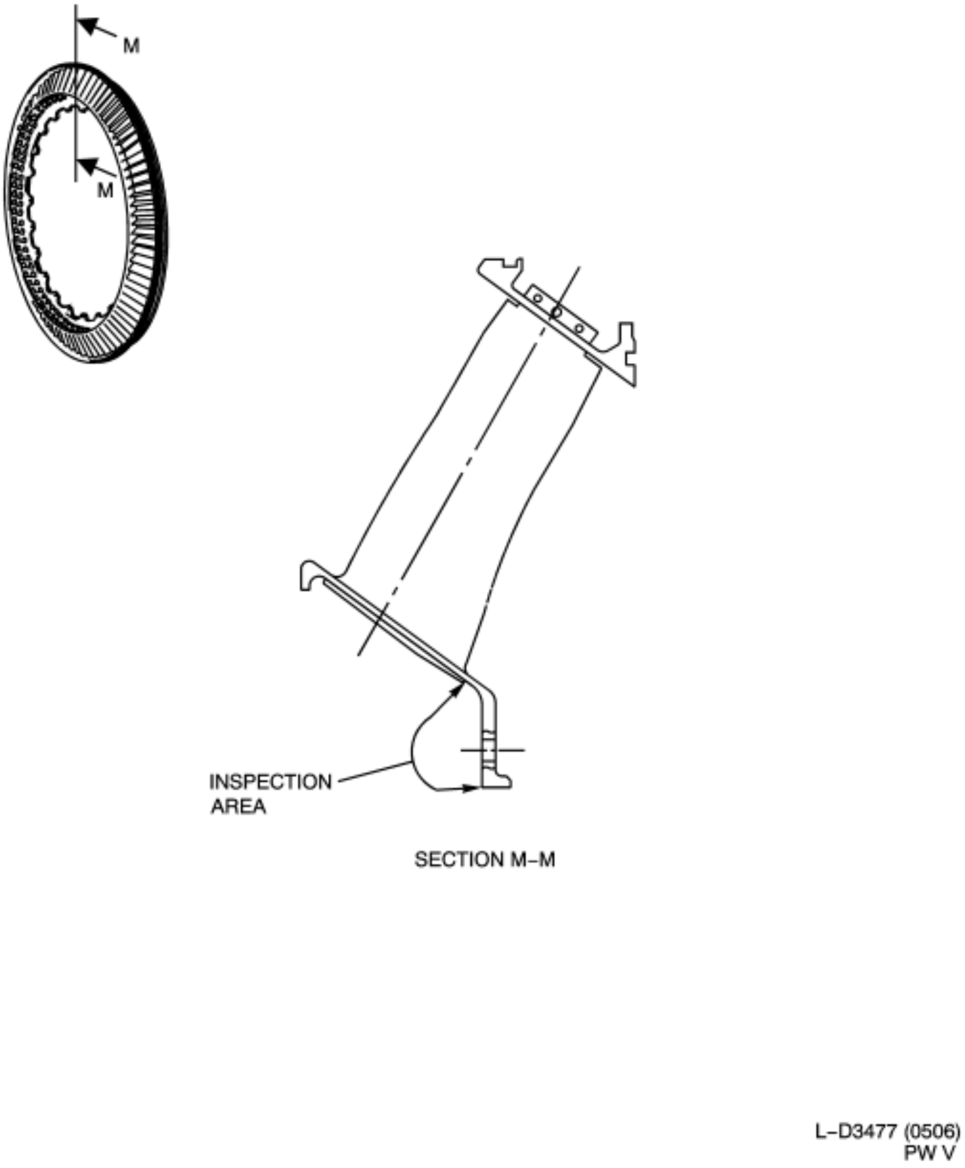
R 1. 0.750 Inch (19.050 mm) Minimum Over Distance AJ
R 2. Sealing Compound Must Cover the Vane Tip.
R 3. 0.050 Inch (1.270 mm) Maximum Undercut All Around
R 4. 0.010 Inch (0.254 mm) Maximum All Around

R Key to Figure 806 (Sheet 2)


LEADING EDGE
MEAN CHORDAL LENGTH
L
C (2/3L)
G
B
TRAILING EDGE
G
1
M
1
A
0.100 inch (2.540 mm)
NOTE: L VARIES AROUND THE VANE
H
BLEND TO FULL RADIUS
AREAS B & C
VIEW H
2
RADIAL LENGTH
CONCAVE
CONVEX
AREAS B & C
VIEW M
SECTION G-G (TYPICAL)
L-D3476 (0506)
PW V

R Stage 4 Compressor Stator Assembly Visual Inspection Areas
R Figure 806 (Sheet 3)
R (Task 72-00-34-990-010)

R ENGINE GENERAL − INTERMEDIATE CASE − INSPECTION/CHECK−10


M
M
INSPECTION
AREA
SECTION M−M
L−D3477 (0506)
PW V

R Stage 4 Compressor Stator Assembly Visual Inspection Areas
R Figure 806 (Sheet 4)
R (Task 72−00−34−990−010)

ENGINE GENERAL - INTERMEDIATE CASE - REPAIR-01

Task 72-00-34-300-001:

1. Install Helical Coil Inserts In The Screw Thread Inserts In The Ground Handling Pad

A. Equipment and Materials

Repair Details:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Insert, Helical Coil	AR	72-34-00	4 or 4A	430

B. Procedure

See Figure 901.

(1) Remove the bolt(s) in the ground handling pad.

(a) Cut off the top of the bolt that is in the screw thread insert in the ground handling pad at 12 o'clock.

(b) Drill through the bolt. Try to remove the bolt with a multi-spline screw extractor.

(c) If you can not remove the bolt with the extractor, drill out the rest of the bolt.

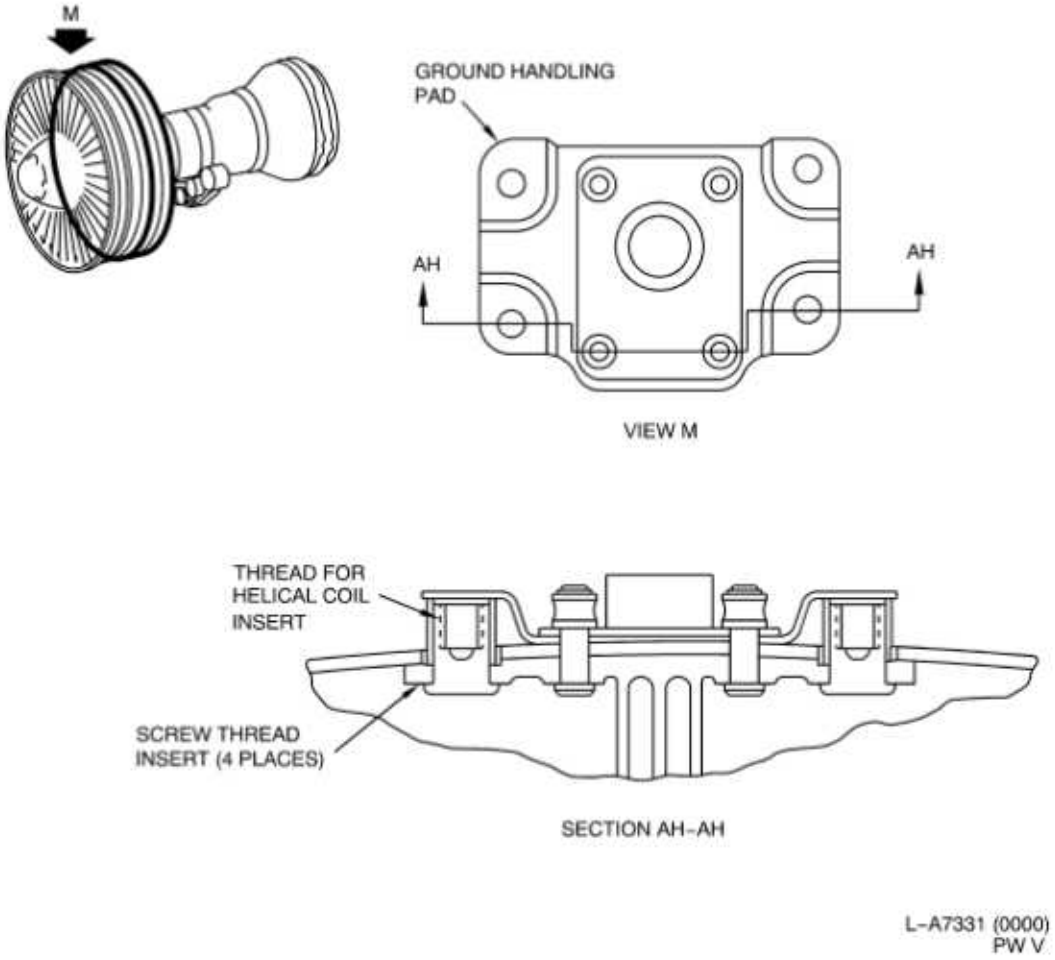
(2) If extraction of the bolt was not possible, install a helicoil insert.

(a) Put new threads in the screw thread insert. The threads must be for a .500-20 x .750 helical coil insert.

(b) Install a helical coil insert in the screw thread insert. Install it 1 - 1.5 pitch below the surface of the screw thread insert.

C. Postrequisites

(1) If the screw thread insert is damaged so badly that installation of the helical coil insert is not possible, remove the fan case and install a new screw thread. insert. Refer to 72-00-33, Removal-01 (Task 72-00-33-020-001) and 72-00-34, Repair-02 (Task 72-00-34-300-002).


M
GROUND HANDLING PAD
AH
AH
VIEW M
THREAD FOR HELICAL COIL INSERT
SCREW THREAD INSERT (4 PLACES)
SECTION AH-AH
L-A7331 (0000)
PW V

Repair Of The Inserts In The Ground Handling Pad
Figure 901
(Task 72−00−34−300−001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INTERMEDIATE CASE - REPAIR-02

Task 72-00-34-300-002:

1. Replace The Screw Thread Inserts In The Ground Handling Pad

A. Prerequisites

(1) Remove the fan case. Refer to 72-00-33 (Task 72-00-33-020-001).

B. Equipment and Materials

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521, Type II)
P09-027	Sealant, Silicone Rubber (PWA 36003-2)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Collar	4	72-34-00/4 or 4A/270
Pin, Rivet	4	72-34-00/4 or 4A/260
Rivet	13	72-34-00/9 or 9A/70
Rivet	4	72-34-00/9 or 9A/210
or		
Rivet	4	72-34-00/9 or 9A/220

Repair Details:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Insert, Screw Thread	AR	72-34-00/4 or 4A/220

C. Procedure
See Figure 901.

Subtask 72-00-34-350-053:

(1) Remove the fan exit liner segment assemblies.

(a) Cut the sealant around the fan exit liner segment assemblies at 1 and 11 o'clock. Remove the screws. Remove the fan exit liner segment assemblies.

(b) Cut the sealant around the fan exit liner segment assemblies on either side of the 12 o'clock strut.

(c) If applicable, remove a screw from each liner segment assembly.

(d) Grind or drill the rivets that attach the fan exit liner segment assemblies to the strut and the case.

(e) Remove the fan exit liner segment assemblies.

(2) Remove the screw thread insert.

CAUTION: DO NOT DAMAGE THE STRUT WHEN YOU GRIND THE FILLET WELDS AROUND THE SCREW THREAD INSERTS.

(a) Grind the fillet weld of the screw thread insert.

(b) Remove the screw thread insert.

NOTE: There is an interference fit between the inserts and the strut.

(c) If necessary, remove the four rivet pins.

(3) Install the new insert.

(a) If the rivet pins were removed, install new ones.

(b) Install the new screw thread insert.

R (c) Weld the new insert. Use PWA 16−22 (Task
R 70−42−01−310−004), but use AMS 5680 welding wire.

(4) Apply a corrosion preventive coating to the strut at 12 o'clock. Refer to the referenced figure. Use SPOP 152
R (Task 70−41−03−380−010).

(5) Install the fan exit liner segment assemblies that attach to the strut.

(a) Align the holes in the fan exit liner segment assemblies and brackets with the mating holes in the case. Attach the fan exit liner segment assemblies to the strut and case with rivets.

(b) (Post SB PW4ENG 72−263) Apply Engine Oil P03−001 to the threads of two screws. Install the screws in the fan exit liner segment assemblies. With a No. 10 Torq−set Drive, torque the screws to 36 − 40 lb−in. (4.067 − 4.059 N.m).

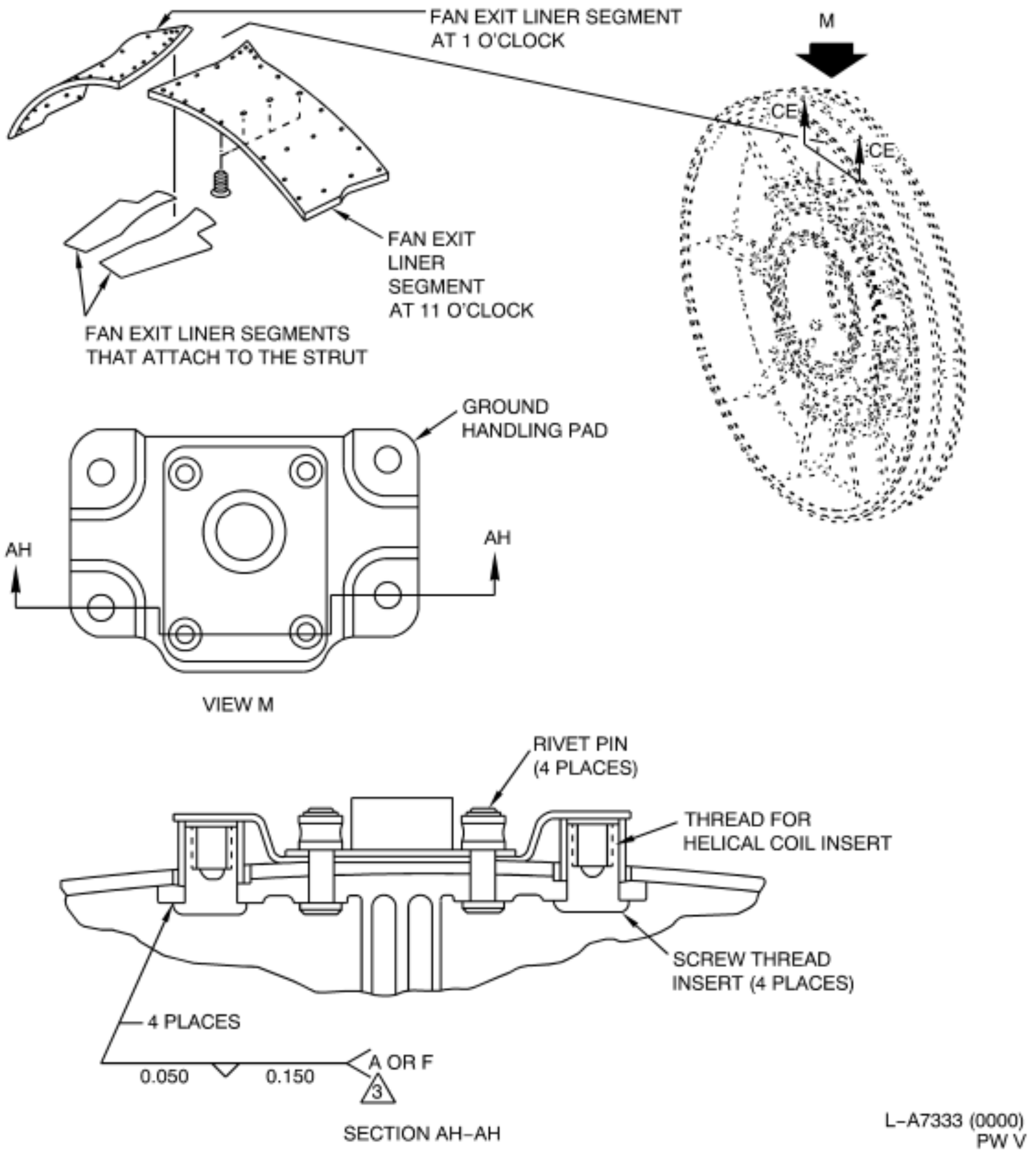
(c) Clean the areas of the strut, case, and liners where there will be sealant. Use PWA 83−A4 (Task 70−48−00−360−001).

(d) Apply Sealant P09−027 to the gap at the edges of the liners. Cure the sealant at room temperature, in air that has a relative humidity of 25 percent, for two hours, minimum.

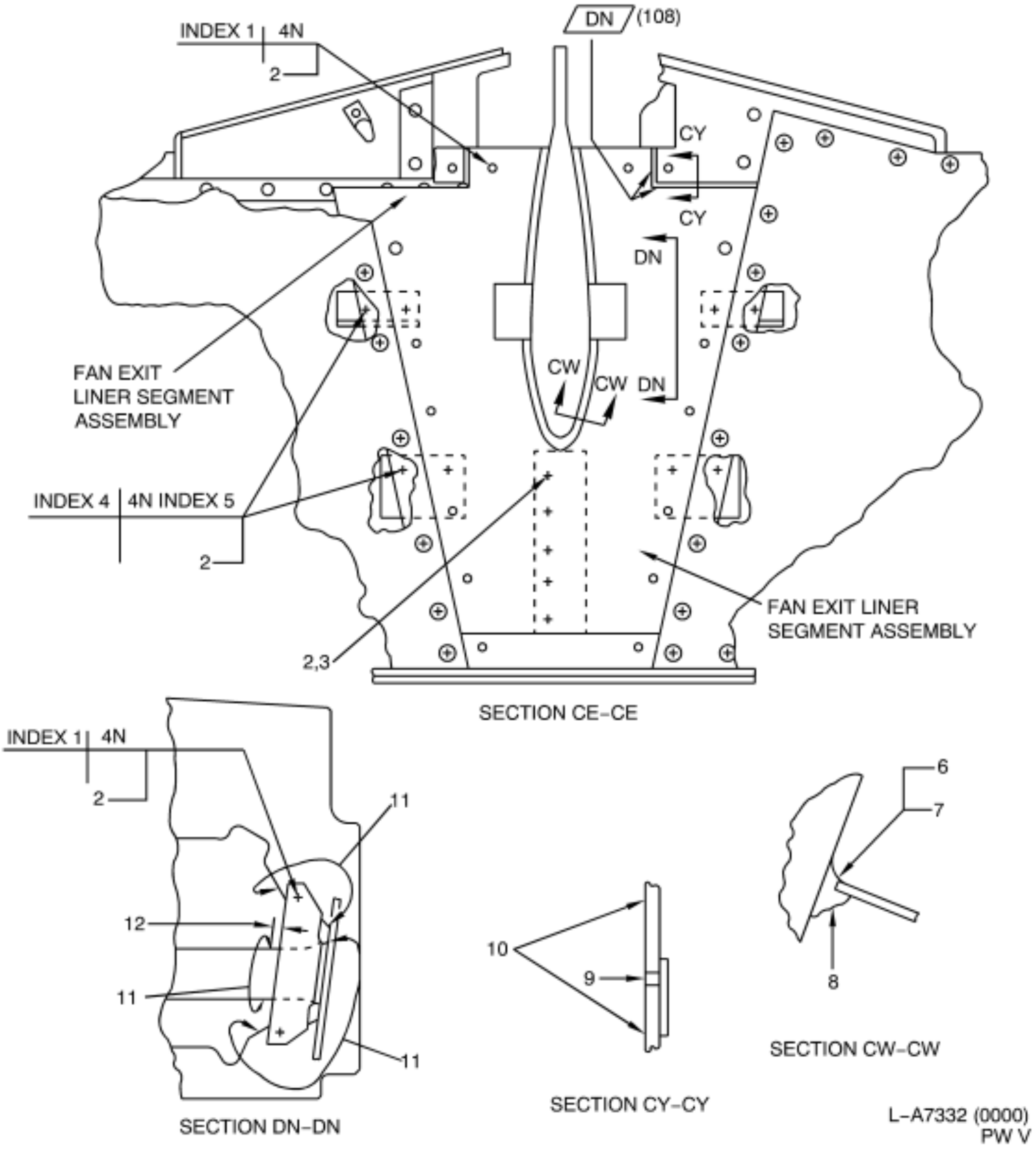
D. Postrequisites

(1) Install the fan exit liner segment assemblies at 1 and 11 o'clock. Refer to 72−34−01, Repair−28 Task 72−34−01−300−028.

(2) Install the fan case. Refer to 72−00−33, Installation−01 Task 72−00−33−420−001.


FAN EXIT LINER SEGMENT
AT 1 O'CLOCK
M
CE
CE
FAN EXIT
LINER
SEGMENT
AT 11 O'CLOCK
FAN EXIT LINER SEGMENTS
THAT ATTACH TO THE STRUT
GROUND
HANDLING PAD
AH
AH
VIEW M
RIVET PIN
(4 PLACES)
THREAD FOR
HELICAL COIL INSERT
SCREW THREAD
INSERT (4 PLACES)
4 PLACES
0.050
0.150
A OR F
3
SECTION AH−AH
L−A7333 (0000)
PW V

Repair Of The Inserts In The Ground Handling Pad
Figure 901 (Sheet 1)
(Task 72−00−34−300−002)


DN (108)
INDEX 1 4N
2
CY
CY
DN
FAN EXIT LINER SEGMENT ASSEMBLY
CW
CW DN
INDEX 4 4N INDEX 5
2
2,3
FAN EXIT LINER SEGMENT ASSEMBLY
SECTION CE-CE
INDEX 1 4N
2
11
12
11
11
SECTION DN-DN
10
9
SECTION CY-CY
6
7
8
SECTION CW-CW
L-A7332 (0000)
PW V

Repair Of The Inserts In The Ground Handling Pad
Figure 901 (Sheet 2)
(Task 72-00-34-300-002)

1. (Pre SB PW4ENG 72−263) Rivet, PN 657334 Or PN 4020971, Two Places
   (Post SB PW4ENG 72−263) Screw, Two Places
2. Within A Diameter Equal To Twice The Manufactured Head Diameter, It Is Permitted For The Maximum Gap Between Faying Surfaces To Be 0.005 Inch (0.127 mm)
3. Rivet PN 658946, Five Places
4. Rivet PN 658946, Eight Places, Four Groups Of Two Rivets
5. Even With, To 0.010 Inch (0.254 mm), Below
6. Fill All Around With Sealant
7. 0.250 − 0.500 Inch (6.4 − 12.7 mm) Modified Radius All Around
8. It Is Not Necessary For This Surface To Be Smooth. No Control Is Necessary.

9 Fill All Around With Sealant For The Full Length Of The Gap At Location DN.

10. The Sealant Must Be Even With, To 0.010 Inch (0.254 mm) Above, These Surfaces, Two Places
11. Apply Corrosion Preventive Coating, Two Places
12. 0.200 Inch (5.080 mm) All Around The Surfaces That Touch Each Other

Key to Figure 901 (Sheet 2)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - INTERMEDIATE CASE - REPAIR-03

Task 72-00-34-300-003:

1. Replace Or Bond An Intermediate Case Strut Seal

NOTE: This repair replaces a damaged seal or bonds a loose seal.

A. Equipment And Materials

Consumable Materials:

Item No.	Designation
P05-133	Mold Release (PWA 36007)
P09-027	Sealant Silicone Rubber (PWA 36003-2)

Repair Details:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Seal	AR	72-34-00	4A	345

B. Procedure

See Figure 901.

Subtask 72-00-34-350-051:

(1) If the seal is damaged, mechanically remove the old seal fully. If part of the seal is loose, but the seal is not damage, do not remove it.

Subtask 72-00-34-360-001-002:

(2) Clean the surfaces of the case. Use PWA 83-A4 (Task 70-48-00-360-001).

Subtask 72-00-34-350-052:

(3) Cut the seal to fit the repair area.

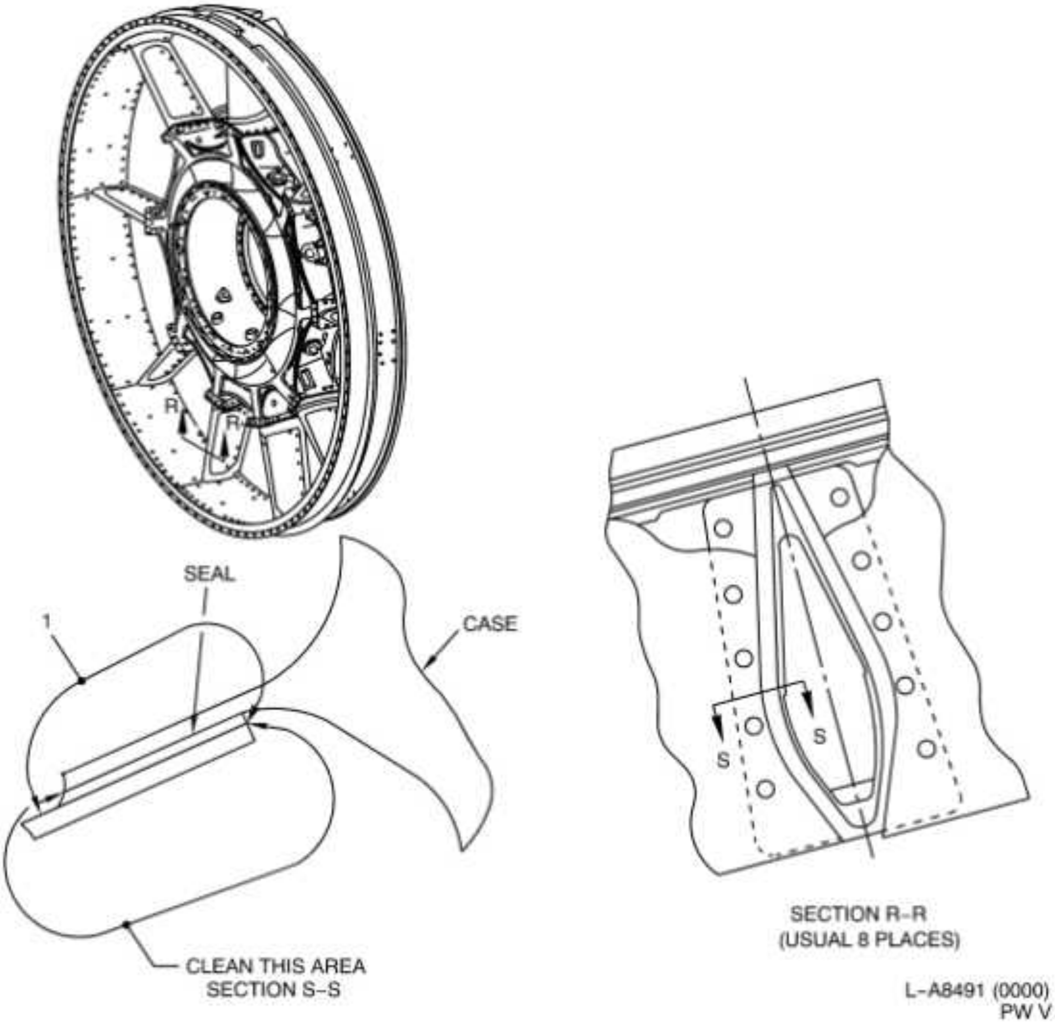
NOTE: Do not do this step if you do not replace the seal.

Subtask 72-00-34-360-001-003:

(4) Clean the bonding surfaces of the seal. Use PWA 83-D1 (Task 70-48-00-360-001).

Subtask 72-00-34-360-051:

(5) Apply a layer of Mold Release (P05-133) to a form.


R
R
SEAL
1
CASE
CLEAN THIS AREA
SECTION S−S
S
S
SECTION R−R
(USUAL 8 PLACES)
L−A8491 (0000)
PW V

1. Apply Mold Release To The Form.

Replace The Intermediate Case Strut Seal
Figure 901
(Task 72−00−34−300−003)

ENGINE GENERAL − INTERMEDIATE CASE − REPAIR−03

(6) Fill the area shown in the figure with Sealant (P09−027). Install the seal and the form.

(7) Cure the sealant in air that is at room temperature and has a relative humidity of 25 percent for two hours before you touch it.

(8) Remove the form.

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72−00−35

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	HIGHLIGHTS
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72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−02 • 72−00−35−020−001−002: Remove The No. 2 Bearing Seal Seat − Horizontal
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−03 • 72−00−35−020−002: Remove External Plumbing From High Pressure Compressor
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−04 • 72−00−35−050−001−A: Remove Fuel/Oil Cooler − For Engines Not Equipped With Front Split Mount Bracket (Pre SB PW4ENG 79−20) • 72−00−35−050−001−B: Remove Fuel/Oil Cooler − For Engines Equipped With Front Split Mount Bracket (Post SB PW4ENG 79−20)
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−05 • 72−00−35−050−002: Remove Turbine Case Cooling (TCC) Air Valve Actuator
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−06 • 72−00−35−050−003: Remove Turbine Vane And Blade Cooling Air Valve Position Switch
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−07 • 72−00−35−050−005: Remove Turbine Vane And Blade Cooling Air Valve (Right)
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−08 • 72−00−35−050−004: Remove Turbine Vane And Blade Cooling Air Valve (Left)
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−09 • 72−00−35−050−006: Remove HPC Secondary Flow Control Valve (Left)
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−10

	- 72−00−35−050−007: (Pre SB PW4ENG 72−756) Remove HPC Secondary Flow Control Valve (Right)
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−11 - 72−00−35−050−008: Remove Fuel/Oil Cooler Bypass Valve
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−12 - 72−00−35−050−009: Remove 9th Stage Start/Stability (2.9) Bleed Valve (Upper Left)
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−13 - 72−00−35−050−010: Remove 9th Stage Start/Stability (2.9) Bleed Valve (Upper Right)
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−14 - 72−00−35−050−011: Remove Engine Fuel/Oil Cooler Bypass Valve Solenoid
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−15 - 72−00−35−050−012: Remove Variable Stator Vane Actuator
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−16 - 72−00−35−050−013: Remove PS3 Air Filters
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−17 - 72−00−35−050−014: Remove The 9th Stage Start/Stability (2.9) Bleed Valve Thermocouple
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−18 - 72−00−35−030−001: Remove The Upper Half Of The HPC Front Case For Access To The 5th Through 8th Stage Blades
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−19 - 72−00−35−030−002: Remove The 5th Through 8th Stage Blades (Quick HPC Blade Change)
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−20 - 72−00−35−050−015: Remove The (2.9) Bleed Valve Screen
72−00−35	TURBINE VANE COOLING AIR VALVE − REMOVAL−21 - 72−00−35−050−016: Remove Turbine Vane Cooling Air Valve
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−01 - 72−00−35−420−001: Install The HPC
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	- 72−00−35−420−001−002: Install The No. 2 Bearing Seal Seat − Horizontal
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−03 - 72−00−35−420−002: Install External Plumbing To High Pressure Compressor
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−04 - 72−00−35−450−001−A: Install Fuel/Oil Cooler − For Engines Not Equipped With Front Split Mount Bracket (Pre SB PW4ENG 79−20) - 72−00−35−450−001−B: Install Fuel/Oil Cooler − For Engines Equipped With Front Split Mount Bracket (Post SB PW4ENG 79−20)
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−05 - 72−00−35−450−002: Install Turbine Case Cooling (TCC) Air Valve Actuator
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−06 - 72−00−35−450−003: Install Turbine Vane And Blade Cooling Air Valve Position Switch
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−07 - 72−00−35−450−004: Install Turbine Vane And Blade Cooling Air Valve (Right)
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−08 - 72−00−35−450−005: Install Turbine Vane And Blade Cooling Air Valve (Left)
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−09 - 72−00−35−450−006: Install HPC Secondary Flow Control Valve (Left)
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−10 - 72−00−35−450−007: (Pre SB PW4ENG 72−756) Install HPC Secondary Flow Control Valve (Right)
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−11 - 72−00−35−450−008: Install Fuel/Oil Cooler Bypass Valve
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−12 - 72−00−35−450−009: Install 9th Stage Start/Stability (2.9) Bleed Valve (Upper Left)
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−13 - 72−00−35−450−010: Install 9th Stage Start/Stability (2.9) Bleed Valve (Upper Right)

72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−14 • 72−00−35−450−011: Install Engine Fuel/Oil Cooler Bypass Valve Solenoid
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−15 • 72−00−35−450−012: Install Variable Stator Vane Actuator
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−16 • 72−00−35−450−013: Install PS3 Air Filters
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−17 • 72−00−35−450−014: Install The 9th Stage Start/Stability (2.9) Bleed Valve Thermocouple
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−18 • 72−00−35−430−001: Install The Upper Half Of The HPC Front Case After Accessing The 5th Through 8th Stage Blades
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−19 • 72−00−35−430−002: Install The 5th Through 8th Stage HPC Blades (Quick HPC Blade Change)
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−20 • 72−00−35−450−015: Install The (2.9) Bleed Valve Screen
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−21 • 72−00−35−450−016: Install Turbine Vane Cooling Air Valve
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−01 • 72−00−35−990−001: Specific Fits And Clearances
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−02 • 72−00−35−210−001: Inspect Variable Stator Vane Control System
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−03 • 72−00−35−210−002: Inspect HPC Secondary Flow Control Valve System
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04 • 72−00−35−210−004: Inspect HPC Rear Drum OD Thrust Balance Seal
72−00−35	ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REPAIR−01

	• 72−00−35−300−001: Blend Repair Of Stage 5, 6 And 7 Rotor Blades For A Fully Built HPC Module − Axial Compressor Rotor Assembly

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ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−01

Task 72−00−35−020−001:

1. Remove The HPC

NOTE: See Figure 301 for part/assembly removal procedure sequence.

A. Prerequisites

(1) Remove The Intermediate Case. Refer to 72−00−34, Removal−01 (Task 72−00−34−020−001).

(2) Remove The Diffuser And Combustor. Refer to 72−00−41, Removal−01 (Task 72−00−41−020−001).

(3) Remove The External Plumbing From The High Pressure Compressor. Refer to Removal−03 (Task 72−00−35−020−002).

B. Equipment And Materials Required

Standard Wrenching Tools:

Hydraulic:

PWA 18872	Wrench, Hydraulic
Or	
PWA 33732	Wrench, Hydraulic
Or	
PWA 87354	Wrench, Hydraulic
Or	
PWA 80070	Wrench System, Hydraulic (Includes Pump, Cart, Wrench)
PWA 29510	Pump, Hand (2 Hose)
Or	
PWA 28814	Pump, Electric (2 Hose)
PWA 28815	Cart, Storage (Optional)
Or	
PWA 28825	Cart, Storage (Optional)
Or	
PWA 75046	Cart, Storage (Optional)

Mechanical:

PWA 45418	Wrench, Mechanical
Or	
PWA 80071	Wrench, Mechanical
Or	
PWA 80187	Wrench, Mechanical
PWA 45419	Multiplier, Pneumatic

Standard Wrenching Tools:

(CONTINUED)

	Or	
	PWA 80651	Multiplier, Pneumatic (Do Not Use With PWA 45418)
	PWA 85375	Plate, Anchor (Do Not Use With PWA 80071)
	Or	
	PWA 88100	Plate, Anchor

Special Tools:

	PWA 3755	Pump, Hydraulic (1 Hose)
	Or	
	PWA 29389	Pump, Hydraulic (1 Hose)
	PWA 76154	Adapter, Sling (4 Necessary)
	PWA 85031	Puller (No. 2 Bearing And Seal Assembly)
	PWA 85530	Wrench, Torque (HPC Rear Hub Nut)
R	PWA 85535	Nut, Retaining (HPC Rear Hub)
	Or	
	PWA 88701	Nut, Retaining (HPC Rear Hub)
	PWA 85536	Adapter, Torque (HPC Rear Hub Nut)
	PWA 85537	Fixture, Handling (HPC Front Case − With Symmetric Case)
	Or	
	PWA 88560	Fixture, Handling (HPC Front Case − With Asymmetric Case)
	PWA 86155	Wrench (No. 2 Bearing Retaining Ring Bolts)
	PWA 88643	Sling (2 Necessary)
	Or	
	PWA 88673	Sling (2 Necessary)
R	PWA 107219	Fixture, Handling (HPC Rear)

Special Tools (Hydraulic Wrenching):

PWA 85510	Wrench (Front Seal Seat Nut)
PWA 85512	Wrench (No. 2 Bearing Nut)
PWA 86002	Retainer (Adapter To HPC Front Hub)
PWA 86596	Adapter, Holding (HPC Front Hub)

Special Tools (Mechanical Wrenching):

PWA 85032	Adapter, Holding (HPC Front Hub)
PWA 85033	Wrench (No. 2 Bearing Nut)
PWA 85034	Wrench (No. 2 Front Seal Seat Nut)
PWA 86002	Retainer (Adapter To HPC Front Hub)

C. Procedure

(1) Lift and turn the HPC (to front end up) as follows. See Figure 302 and Figure 303.

- (a) Put two PWA 76154 Adapters on the PWA 88643 or PWA 88673 Sling.
- (b) Lift the Sling with a hoist.
- (c) Attach the Sling (with the Adapters) to the trunnion spools of the PWA 107219 Fixture. R
- (d) Put the Fixture on the rear of the HPC with a hoist.
- (e) Attach the Fixture to the HPC rear case with the detail screws.
- (f) Remove the Sling and Adapters.
- (g) (Pre SB PW4ENG 72−562) Install the PWA 85535 Nut to the HPC rear hub.
- (h) (Post SB PW4ENG 72−562 − Phase III Engines) Install the PWA 88701 Nut to the HPC rear hub.
- (i) Install the PWA 85530 Wrench to the Nut.
- (j) Install the PWA 85536 Adapter to the HPC rear hub.
- (k) Use standard wrenches to hold the Adapter and tighten the Nut.
- (l) Lift the HPC with the hoist.
- (m) Attach the PWA 85537 Fixture (for HPC symmetric case) or the PWA 88560 Fixture (for HPC asymmetric case) to the front of the HPC as follows.
    - 1 Use the hoist and lift the HPC over the Fixture.
    - 2 Attach the Fixture to the HPC front case flange with 36 detail screws, washers, and nuts.
    - 3 Attach the Fixture to the No. 2 bearing and seal assembly with the 17 detail screws.
- (n) Use the hoist and lift the HPC.

(o) Attach a second hoist with a PWA 88643 Sling or PWA 88673Sling and PWA 76154 Adapters to the front Fixture.

(p) Turn the HPC to front end up and install the HPC in a Stand.

(q) Remove the front Fixture and all hoists, Slings, and Adapters.

(2) Remove the retaining ring [1] and key washer [2] which hold the No. 2 bearing front seal seat [4] and nut [3]. See Figure 304.

(3) For operators that use the mechanical wrenching tools, remove the No. 2 bearing front seal seat nut [3] as follows. See Figure 305.

(a) Engage the PWA 85032 Adapter teeth to the HPC front hub and attach it with the PWA 86002 Retainer as follows.

1 Install the Retainer through the Adapter and engage the inside of the HPC hub with the detail foot.

2 Install the slotted washer.

3 Tighten the detail nut to make the Adapter tight on the HPC hub.

(b) Install the PWA 85034 Wrench teeth to the nut [3].

(c) Use the standard mechanical wrenching tools (from the Standard Wrenching Tools list) to loosen the nut [3].

(d) Remove the Wrenches.

(e) Remove the nut [3]. Discard the nut.

NOTE: When the nut [3] is removed, it must not be re−used. The nut must be replaced with a new nut.

(4) For operators that use the hydraulic wrenching tools, remove the No. 2 bearing front seal seat nut [3] as follows. See Figure 306.

(a) Engage the PWA 86596 Adapter teeth to the HPC front hub and attach it with the PWA 86002 Retainer as follows.

1 Install the Retainer through the Adapter and engage the inside of the HPC hub with the detail foot.

2 Install the slotted washer.

3 Tighten the detail nut to make the Adapter tight on the HPC hub.

(b) Install the PWA 85510 Wrench teeth to the nut [3].

(c) Use the standard hydraulic wrenching tools (from the Standard Wrenching Tools list) to loosen the nut [3].

(d) Remove the Wrenches.

(e) Remove the nut [3]. Discard the nut.

NOTE: When the nut [3] is removed, it must not be re−used. The nut must be replaced with a new nut.

(5) Remove the No. 2 bearing front seal seat [4]. See Figure 307.

(6) Remove the retaining ring [10] and key washer [11] which hold the No. 2 bearing nut [12]. See Figure 307.

(7) For operators that use the mechanical wrenching tools, remove the No. 2 bearing nut [12] as follows. See Figure 308.

(a) Install the PWA 85033 Wrench over the Adapter that is installed to the HPC front hub.

(b) Engage the teeth of the Wrench in the slots of the retaining nut [12].

(c) Use the standard mechanical wrenching tools (from the Standard Wrenching Tools list) to loosen the nut [12].

(d) Remove the tools.

(e) Remove the nut [12] and lock [20].

(8) For operators that use the hydraulic wrenching tools, remove the No. 2 bearing nut [12] as follows. See Figure 309.

(a) Install PWA 85512 or PWA 85033 Wrench over the Adapter that is installed to the HPC front hub.

(b) Engage the teeth of the Wrench in the slots of the retaining nut [12].

(c) Use the standard hydraulic wrenching tools (from the Standard Wrenching Tools list) to loosen the nut [12].

(d) Remove the tools.

(e) Remove the nut [12] and lock [20].

(9) Remove the No. 2 bearing and seal assembly as follows. See Figure 310.

(a) Turn the No. 2 bearing and seal assembly to unlock the tabs on the rear flange from the HPC.

(b) Remove the detail ring from PWA 85031 Puller.

(c) Loosen the detail hand knobs of the Puller.

(d) Put the detail plate in the end of the HPC front hub. Put the detail jaws over the teeth of the gearbox drive bevel gear.

(e) Install the detail ring on the Puller. Tighten the detail hand knobs.

(f) Attach PWA 3755 or PWA 29389 Pump to the Puller.

(g) Loosen the No. 2 bearing and seal assembly.

(h) Remove the tools.

(i) With a hoist and sling, remove the No. 2 bearing and seal assembly.

(j) Put the assembly on a bench.

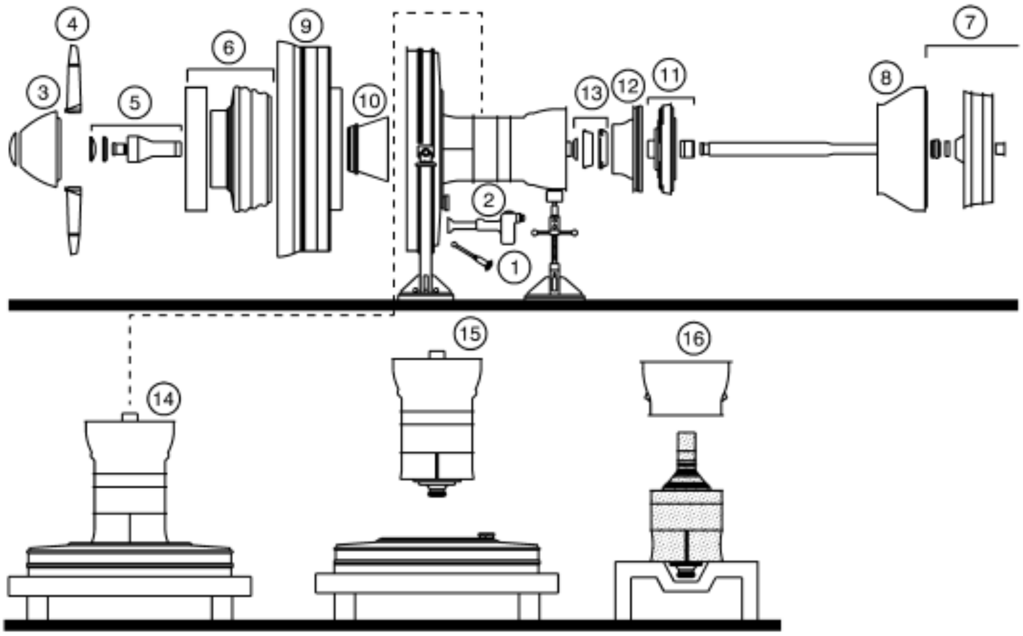
(10) If applicable, remove the 5th stage HPC shroud retaining ring (Post SB PW4ENG 72−204) as follows. See Figure 311.

  (a) Use the PWA 86155 Wrench to remove the bolts that attach the ring to the No. 2 bearing and seal assembly.

  (b) Remove the ring.

(11) Cover the No. 2 bearing and seal assembly and the HPC inlet.

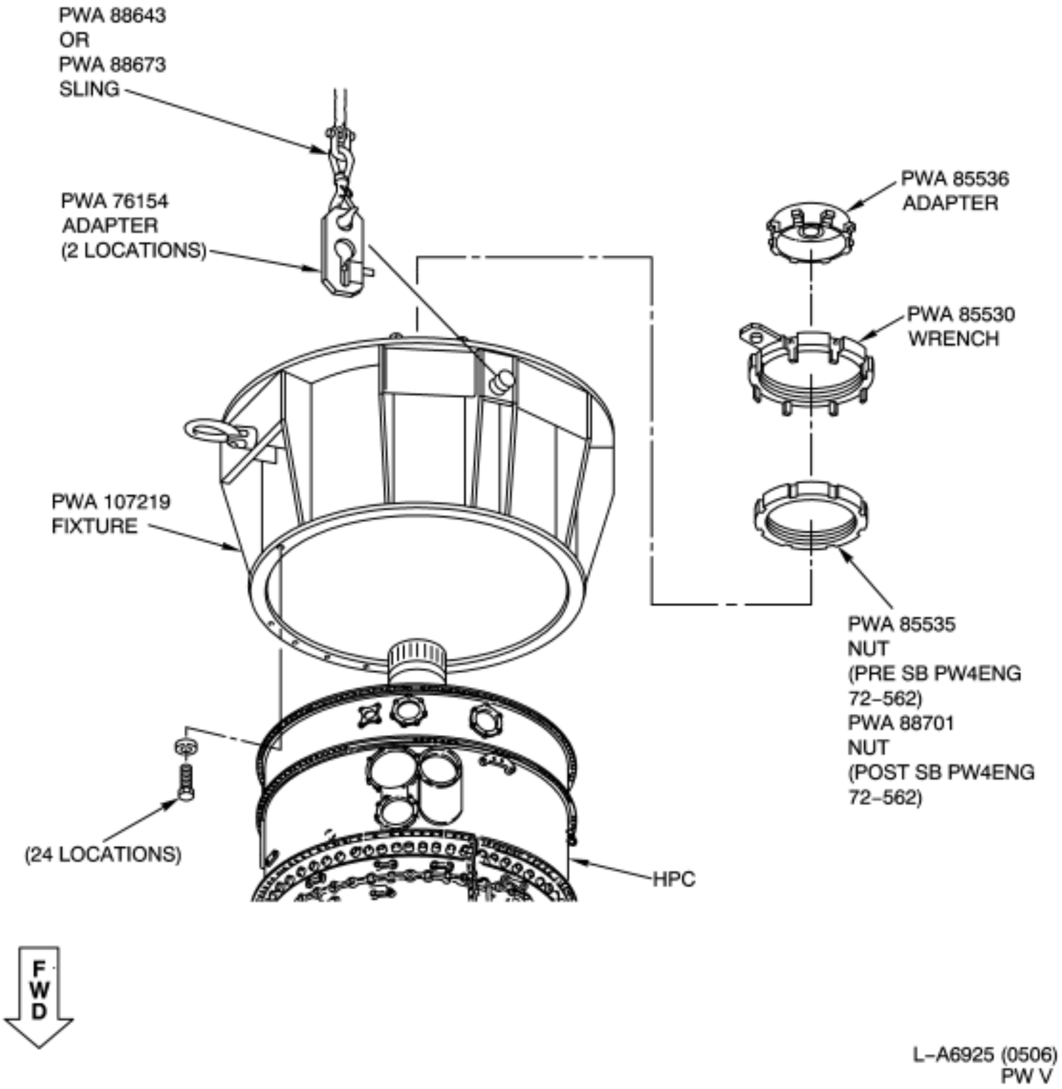
(12) Make sure that you install all the necessary protection covers.



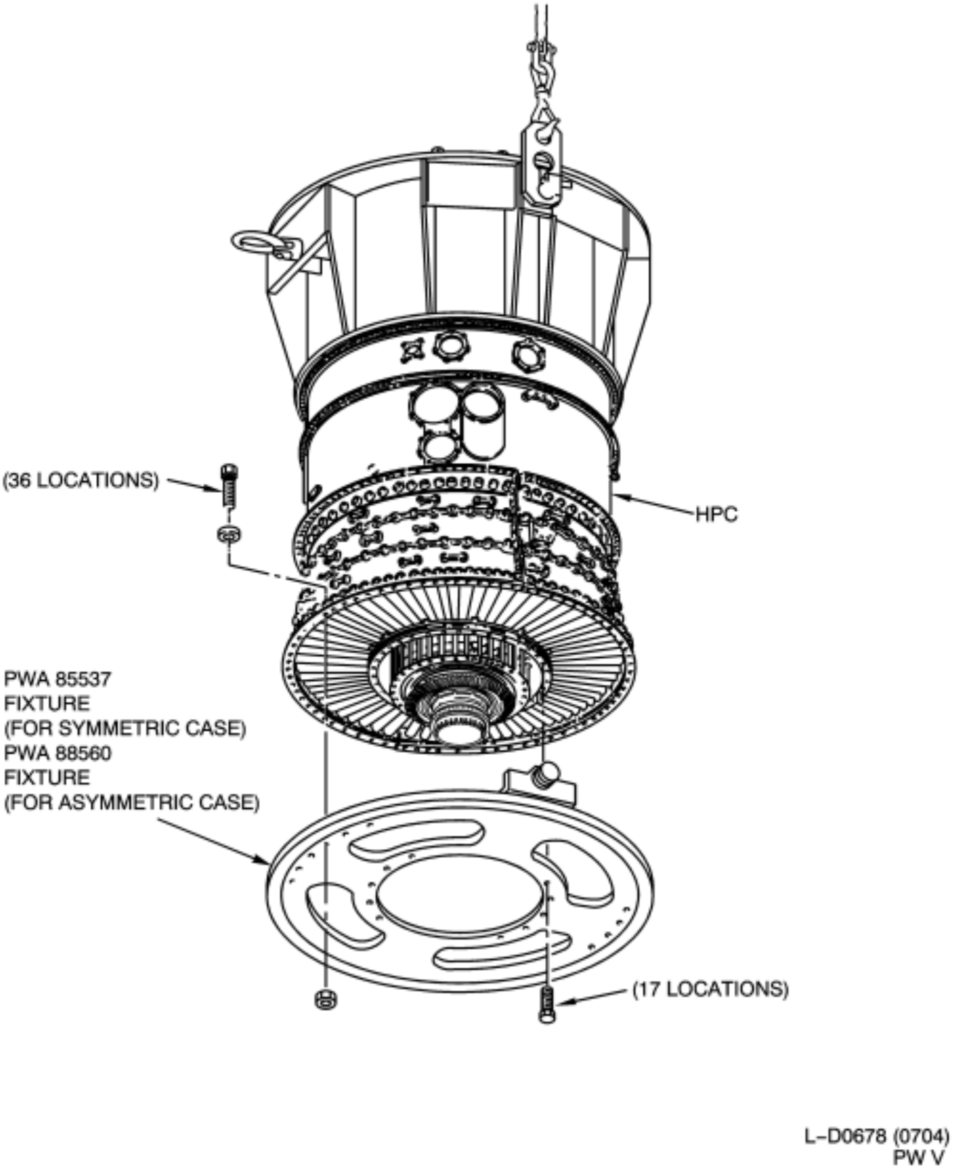
1. REMOVE ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
2. REMOVE MAIN GEARBOX.
3. REMOVE COMPRESSOR INLET CONE.
4. REMOVE STAGE 1 LPC BLADE ASSEMBLIES.
5. REMOVE LPC/LPT COUPLING.
6. REMOVE LOW PRESSURE COMPRESSOR (LPC).
7. REMOVE TURBINE EXHAUST CASE.
8. REMOVE LOW PRESSURE TURBINE (LPT).
9. REMOVE FAN CASE.
10. REMOVE NO. 1 BEARING SUPPORT ASSEMBLY.
11. REMOVE HIGH PRESSURE TURBINE (HPT).
12. REMOVE TURBINE NOZZLE.
13. REMOVE NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL PLATE.
14. TRUNNION INTERMEDIATE THROUGH DIFFUSER CASE TO FRONT END DOWN.
15. REMOVE DIFFUSER AND HIGH PRESSURE COMPRESSOR FROM INTERMEDIATE CASE.
16. REMOVE DIFFUSER AND COMBUSTOR FROM HIGH PRESSURE COMPRESSOR.

L−A0714 (0000)
PW V

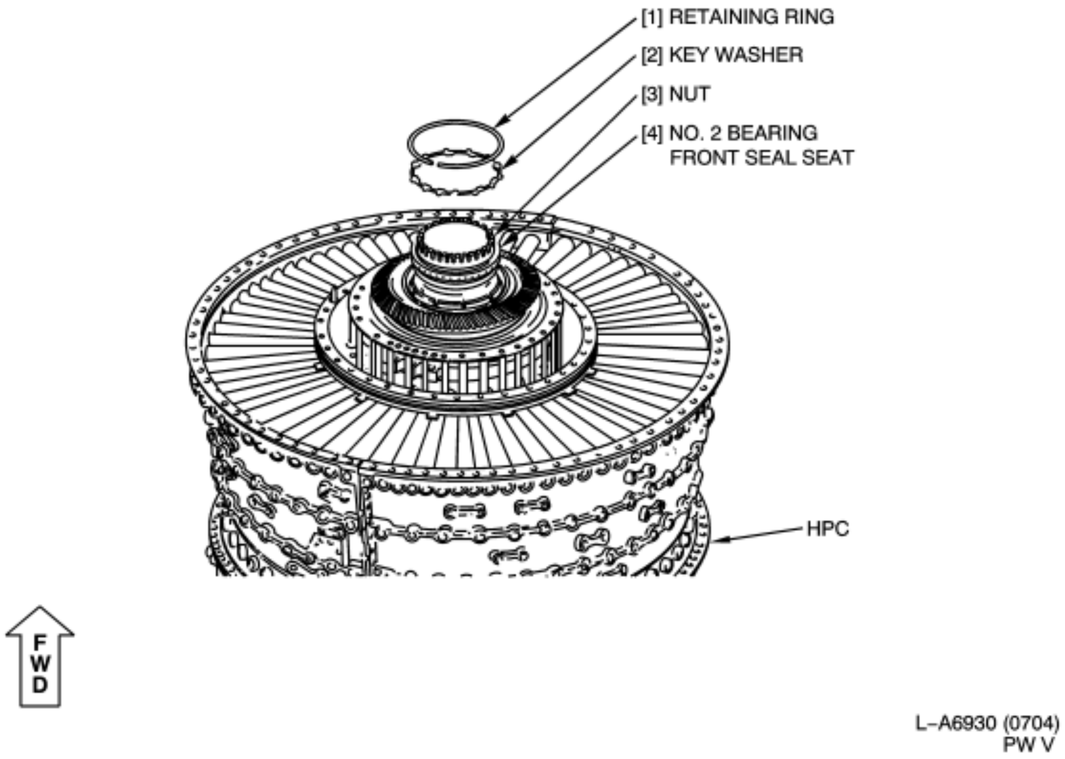
Remove The HPC − (Procedure Sequence)
Figure 301
(Task 72−00−35−020−001)


PWA 88643
OR
PWA 88673
SLING
PWA 76154
ADAPTER
(2 LOCATIONS)
PWA 85536
ADAPTER
PWA 85530
WRENCH
PWA 107219
FIXTURE
PWA 85535
NUT
(PRE SB PW4ENG
72−562)
PWA 88701
NUT
(POST SB PW4ENG
72−562)
(24 LOCATIONS)
HPC
FWD
L−A6925 (0506)
PW V

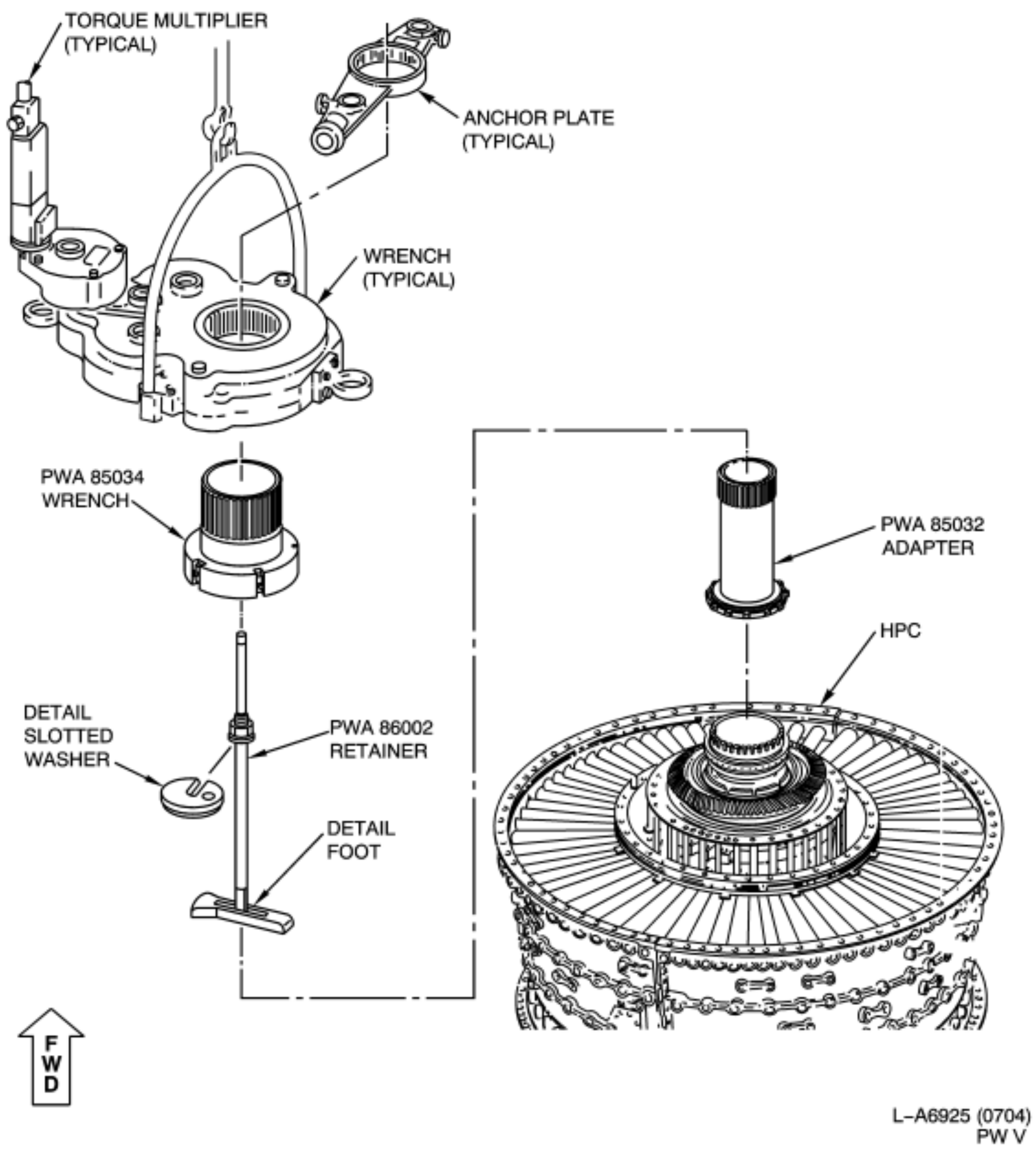
Remove The HPC − (Attach The Rear Fixture)
Figure 302
(Task 72−00−35−020−001)


(36 LOCATIONS)
HPC
PWA 85537
FIXTURE
(FOR SYMMETRIC CASE)
PWA 88560
FIXTURE
(FOR ASYMMETRIC CASE)
(17 LOCATIONS)
L-D0678 (0704)
PW V

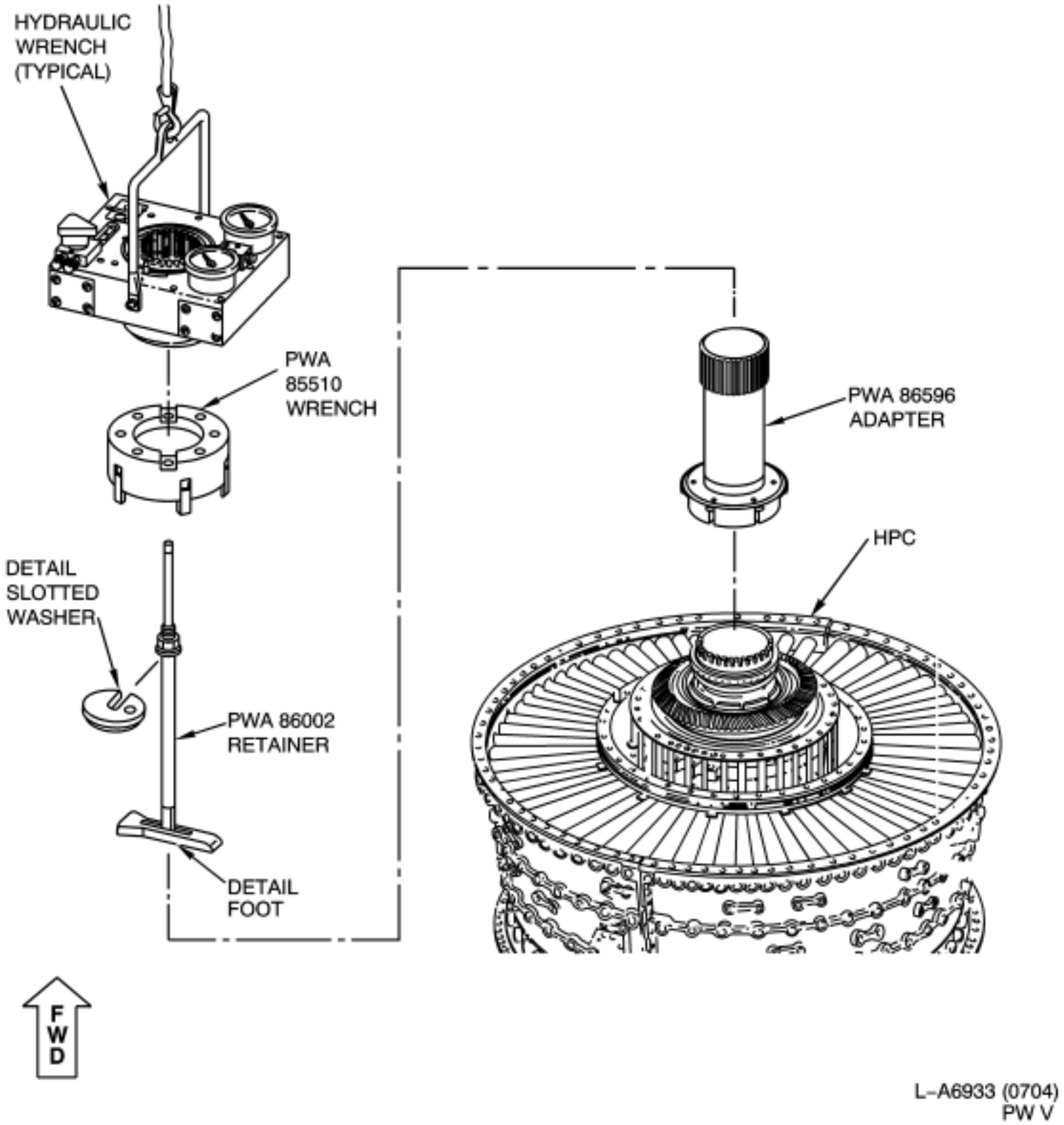
Remove The HPC - (Attach The Front Fixture)
Figure 303
(Task 72-00-35-020-001)


[1] RETAINING RING
[2] KEY WASHER
[3] NUT
[4] NO. 2 BEARING FRONT SEAL SEAT
HPC
FWD
L−A6930 (0704)
PW V

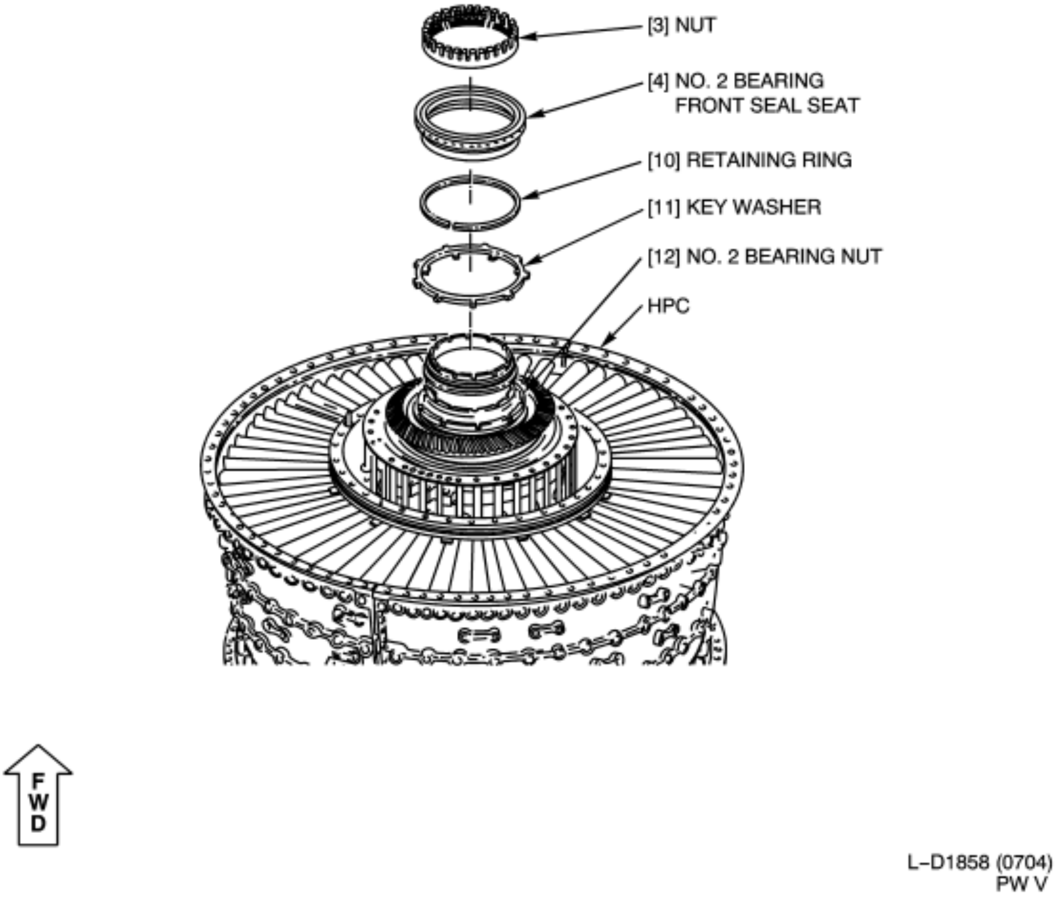
Remove The HPC − (No. 2 Bearing Front Seal Seat
Nut Retaining Ring and Key Washer Removal)
Figure 304
(Task 72−00−35−020−001)


TORQUE MULTIPLIER
(TYPICAL)
ANCHOR PLATE
(TYPICAL)
WRENCH
(TYPICAL)
PWA 85034
WRENCH
PWA 85032
ADAPTER
HPC
DETAIL
SLOTTED
WASHER
PWA 86002
RETAINER
DETAIL
FOOT
F
W
D
L-A6925 (0704)
PW V

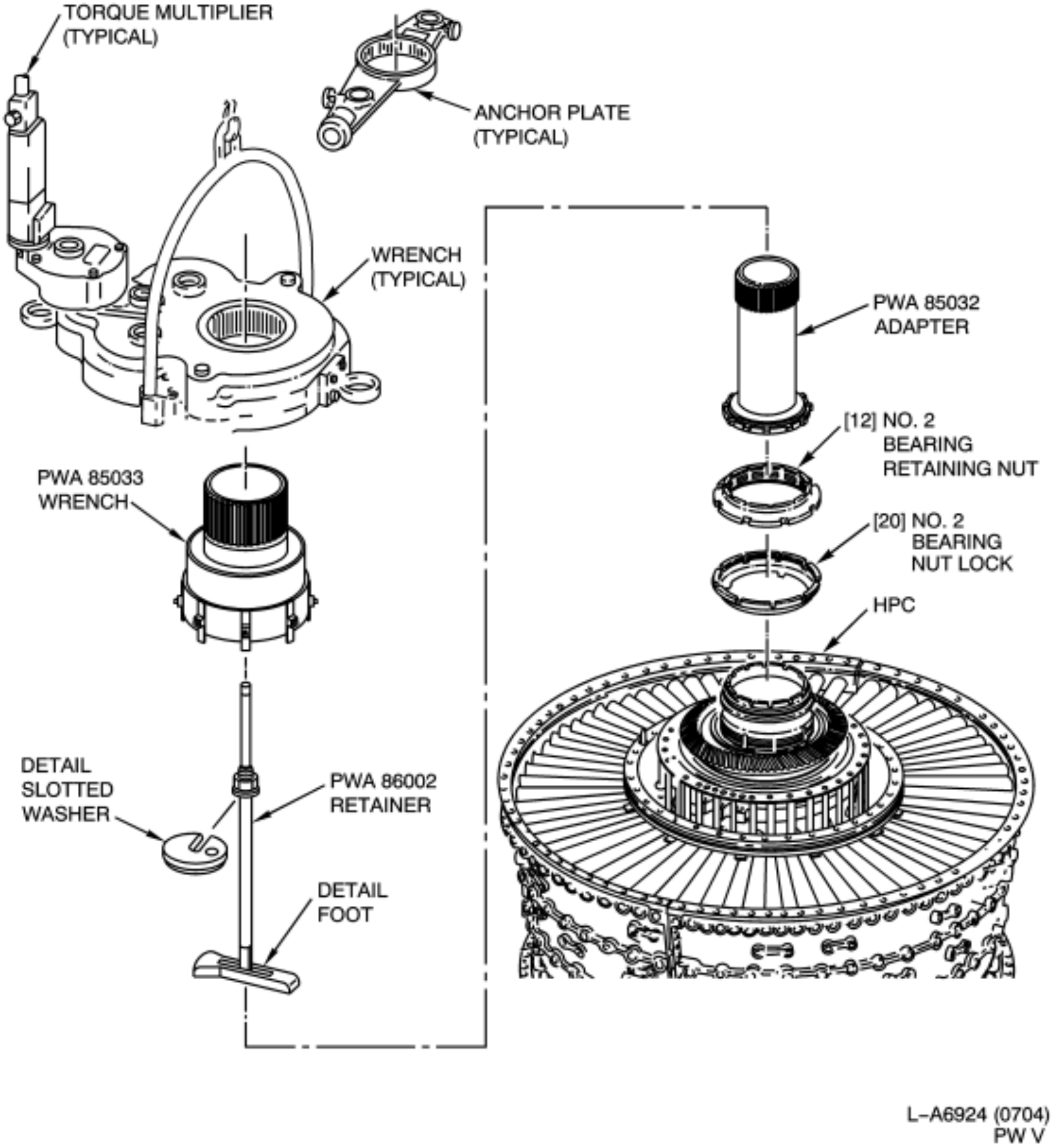
Remove The HPC - (No. 2 Bearing Front
Seal Seat Nut Removal - Mechanical Wrench)
Figure 305
(Task 72-00-35-020-001)


HYDRAULIC WRENCH (TYPICAL)
PWA 85510 WRENCH
DETAIL SLOTTED WASHER
PWA 86002 RETAINER
DETAIL FOOT
PWA 86596 ADAPTER
HPC
FWD
L-A6933 (0704)
PW V

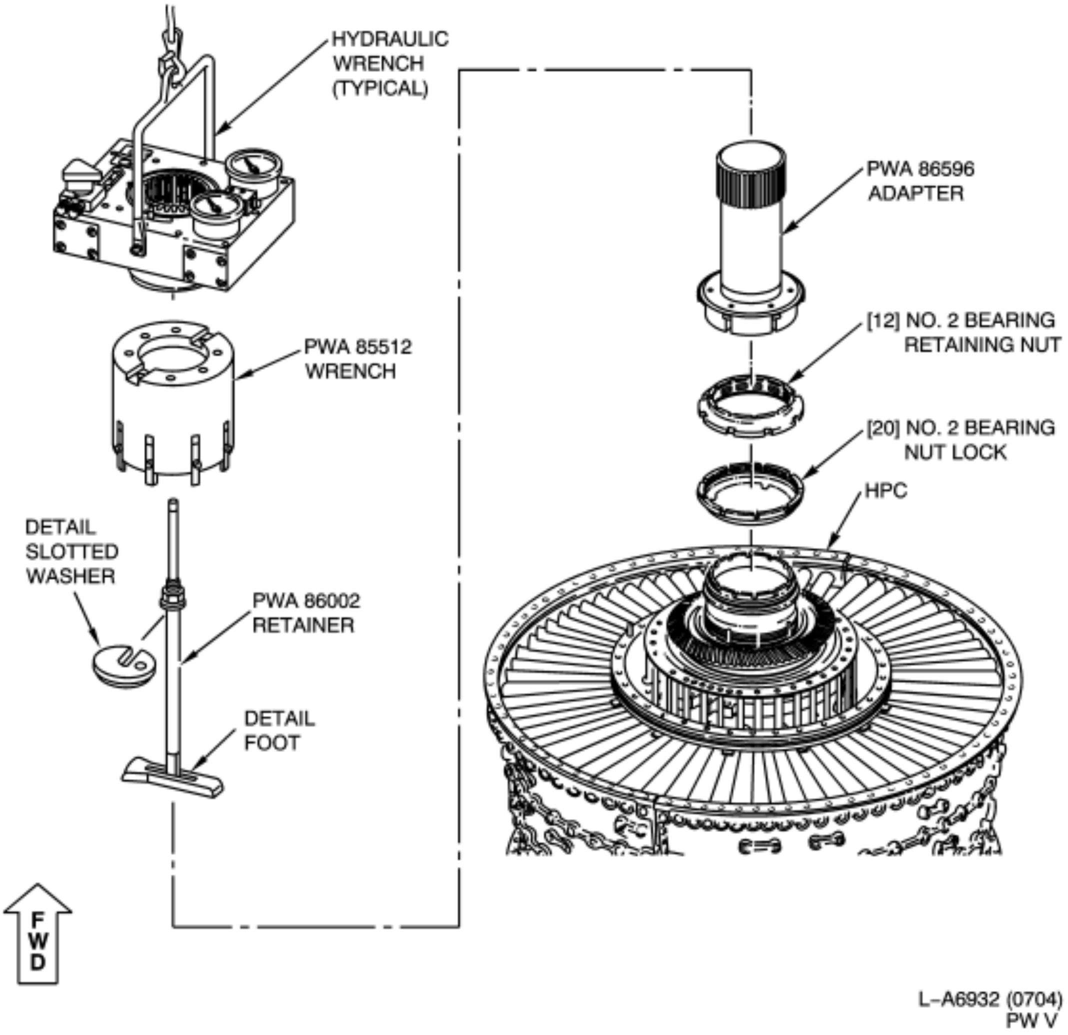
Remove The HPC - (No. 2 Bearing Front
Seal Seat Nut Removal - Hydraulic Wrench)
Figure 306
(Task 72-00-35-020-001)


[3] NUT
[4] NO. 2 BEARING FRONT SEAL SEAT
[10] RETAINING RING
[11] KEY WASHER
[12] NO. 2 BEARING NUT
HPC
FWD
L−D1858 (0704)
PW V

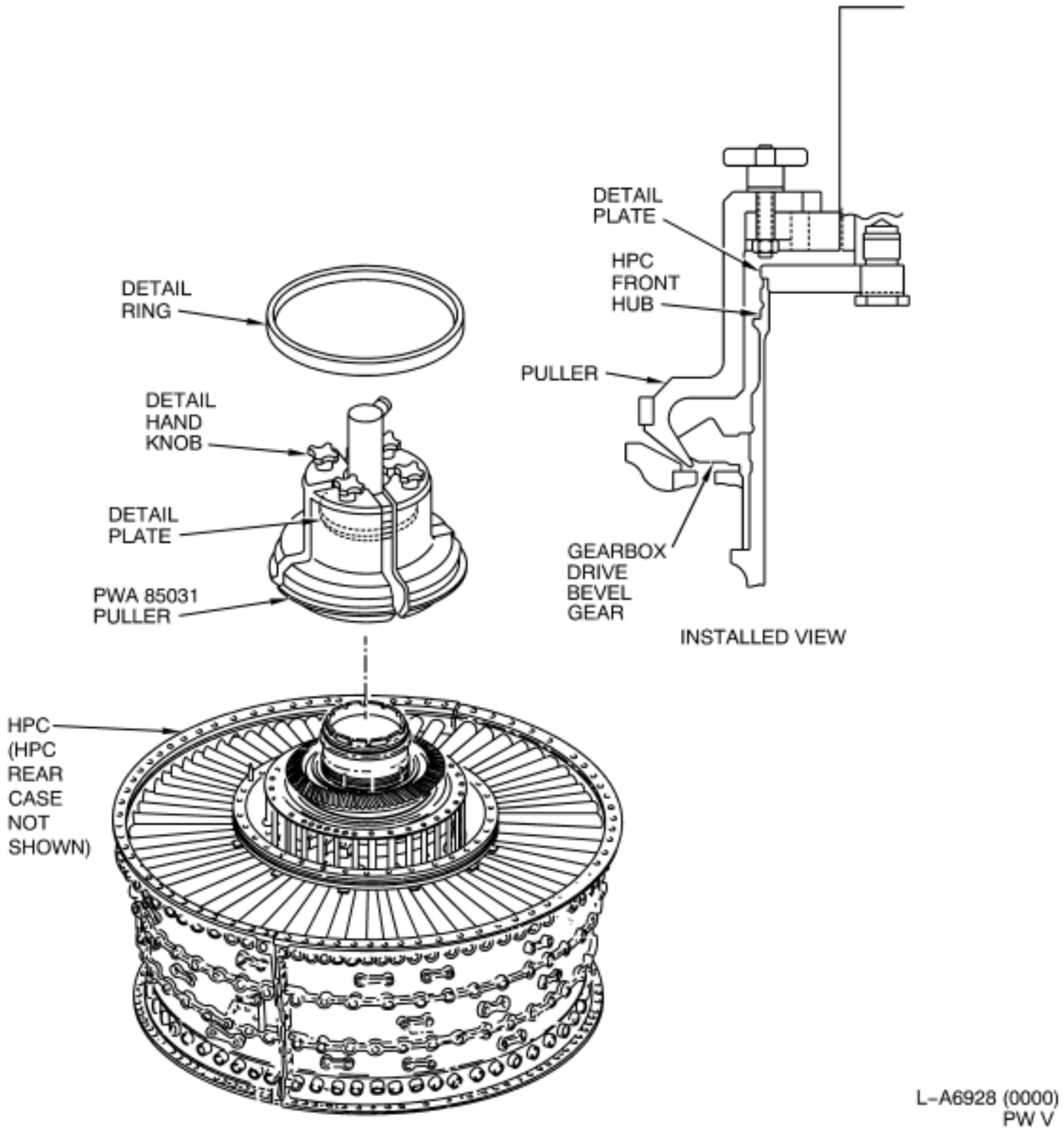
Remove The HPC − (Removal Of The No. 2 Bearing Front Seal Seat And Nut)
Figure 307
(Task 72−00−35−020−001)


TORQUE MULTIPLIER (TYPICAL)
ANCHOR PLATE (TYPICAL)
WRENCH (TYPICAL)
PWA 85032 ADAPTER
[12] NO. 2 BEARING RETAINING NUT
[20] NO. 2 BEARING NUT LOCK
HPC
PWA 85033 WRENCH
DETAIL SLOTTED WASHER
PWA 86002 RETAINER
DETAIL FOOT
L−A6924 (0704)
PW V

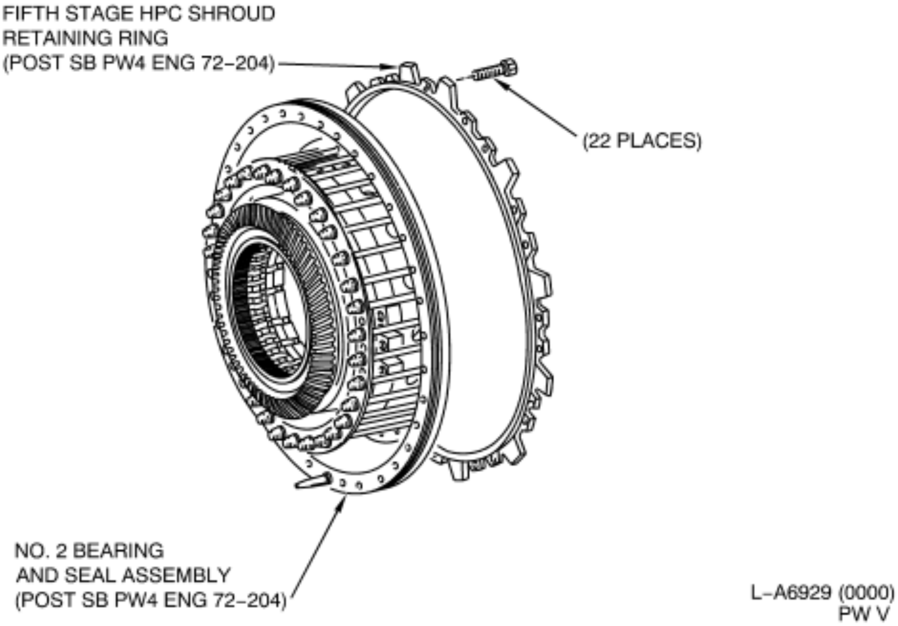
Remove The HPC − (No. 2 Bearing Retaining
Nut Removal − Mechanical Wrench)
Figure 308
(Task 72−00−35−020−001)


HYDRAULIC WRENCH (TYPICAL)
PWA 85512 WRENCH
DETAIL SLOTTED WASHER
PWA 86002 RETAINER
DETAIL FOOT
FWD
PWA 86596 ADAPTER
[12] NO. 2 BEARING RETAINING NUT
[20] NO. 2 BEARING NUT LOCK
HPC
L−A6932 (0704)
PW V

Remove The HPC − (No. 2 Bearing
Retaining Nut Removal − Hydraulic Wrench)
Figure 309
(Task 72−00−35−020−001)


DETAIL PLATE
HPC FRONT HUB
PULLER
GEARBOX DRIVE BEVEL GEAR
INSTALLED VIEW
DETAIL RING
DETAIL HAND KNOB
DETAIL PLATE
PWA 85031 PULLER
HPC (HPC REAR CASE NOT SHOWN)
L-A6928 (0000)
PW V

Remove The HPC - (No. 2 Bearing And Seal Assembly Removal)
Figure 310
(Task 72-00-35-020-001)


FIFTH STAGE HPC SHROUD
RETAINING RING
(POST SB PW4 ENG 72−204)
(22 PLACES)
NO. 2 BEARING
AND SEAL ASSEMBLY
(POST SB PW4 ENG 72−204)
L−A6929 (0000)
PW V

Remove The HPC − (5th Stage HPC Shroud Retaining Ring Removal)
Figure 311
(Task 72−00−35−020−001)

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Task 72-00-35-020-001-002:

1. Remove The No. 2 Bearing Seal Seat - Horizontal

NOTE: See Figure 301 for part/assembly removal procedure sequence.

A. Prerequisites

(1) Remove The EEC Speed Transducer (N1) Multiplexer Input Probe. Refer to 72-00-34, Removal-17 (Task 72-00-34-050-014).

(2) Remove The Compressor Inlet Cone. Refer to 72-00-31, Removal-02 (Task 72-00-31-020-001).

(3) Remove All The Stage 1 LPC (Fan) Blade Assemblies. Refer to 72-00-31, Removal-04 (Task 72-00-31-020-002-002).

(4) Remove The LPC/LPT Coupling. Refer to 72-00-32, Removal-01 (Task 72-00-32-020-001).

(5) Remove The Low Pressure Compressor (LPC). Refer to 72-00-31, Removal-01 (Task 72-00-31-020-003).

(6) Remove The Low Pressure Turbine And Turbine Exhaust Case. Refer to 72-00-53, Removal-08 (Task 72-00-53-020-002).

(7) Remove The No. 1 Bearing Support (Front And Rear) Assembly. Refer to 72-00-34, Removal-04 (Task 72-00-34-050-002).

(8) Remove The No. 1.5 Bearing Support Assembly. Refer to 72-00-34, Removal-06 (Task 72-00-34-030-001).

B. Equipment And Materials Necessary

Standard Wrenching Tools:

Hydraulic:

PWA 18872	Wrench, Hydraulic
Or	
PWA 33732	Wrench, Hydraulic

NOTE: Do not use PWA 87354 or PWA 80070 Hydraulic Wrenches to do this procedure. These

Standard Wrenching Tools:

(CONTINUED)

wrenches are too heavy and apply too much torque for this horizontal application.

PWA 29510	Pump, Hand (2 Hose)
Or	
PWA 28814	Pump, Electric (2 Hose)
PWA 28815	Cart, Storage (Optional)
Or	
PWA 28825	Cart, Storage (Optional)
Or	
PWA 75046	Cart, Storage (Optional)

Mechanical:

PWA 45418	Wrench, Mechanical
Or	
PWA 80187	Wrench, Mechanical

NOTE: Do not use the PWA 80071 Mechanical Wrench to do this procedure. This wrench is too heavy and applies too much torque for this horizontal application.

PWA 45419	Multiplier, Pneumatic
Or	
PWA 80651	Multiplier, Pneumatic (Do Not Use With PWA 45418)
PWA 85375	Plate, Anchor
Or	
PWA 88100	Plate, Anchor

Special Tools:

R	PWA 85368	Arm, Lifting
	PWA 85530	Wrench, Torque (HPC Rear Hub Nut)
R	PWA 106464	Adapter, Lift

Special Tools (Hydraulic Wrenching):

PWA 85510	Wrench (Front Seal Seat Nut)
PWA 86002	Retainer (Adapter To HPC Front Hub)
PWA 86596	Adapter, Holding (HPC Front Hub)

Special Tools:

(CONTINUED)

Special Tools (Mechanical Wrenching):

PWA 85032	Adapter, Holding (HPC Front Hub)
PWA 85034	Wrench (No. 2 Front Seal Seat Nut)
PWA 86002	Retainer (Adapter To HPC Front Hub)

C. Procedure

(1) For operators that use the mechanical wrenching tools, remove the No. 2 bearing front seal seat nut [4] as follows. See Figure 302 (Sheet 1) and Figure 302 (Sheet 2).

(a) Remove the retaining ring [2] and key washer [1] which hold the No. 2 bearing front seal seat nut [4].

(b) Engage the PWA 85032 Adapter teeth to the HPC front hub and attach it with the PWA 86002 Retainer as follows.

1 Install the Retainer through the Adapter and engage the inside of the HPC hub with the detail foot.

2 Install the slotted washer.

3 Tighten the detail nut to make the Adapter tight on the HPC hub.

(c) Install the PWA 85034 Wrench teeth to the nut [4].

R (d) Use the PWA 85368 Lifting Arm with the PWA 106364
R Lift Adapter and the standard mechanical wrenching tools (from the Standard Wrenching Tools list) to loosen the nut [4].

NOTE: You must fabricate an adapter that will attach the wrench to the Handling Fixture. This adapter must safely lift 125 lbs (56.70 kg) minimum.

(e) Remove the tools.

(2) For operators that use the hydraulic wrenching tools, remove the No. 2 bearing front seal seat nut [4] as follows. See Figure 303 (Sheet 1) and Figure 303 (Sheet 2).

(a) Remove the retaining ring [2] and key washer [1] which hold the No. 2 bearing front seal seat nut [4].

(b) Engage the PWA 86596 Adapter teeth to the HPC front hub and attach it with the PWA 86002 Retainer as follows.

1 Install the Retainer through the Adapter and engage the inside of the HPC hub with the detail foot.

2 Install the slotted washer.

3 Tighten the detail nut to make the Adapter tight on the HPC hub.

(c) Install the PWA 85510 Wrench teeth to the nut [4].

R
R (d) Use the PWA 85368 Lifting Arm with the PWA 106364 Lift Adapter and the standard mechanical wrenching tools (from the Standard Wrenching Tools list) to loosen the nut [4].

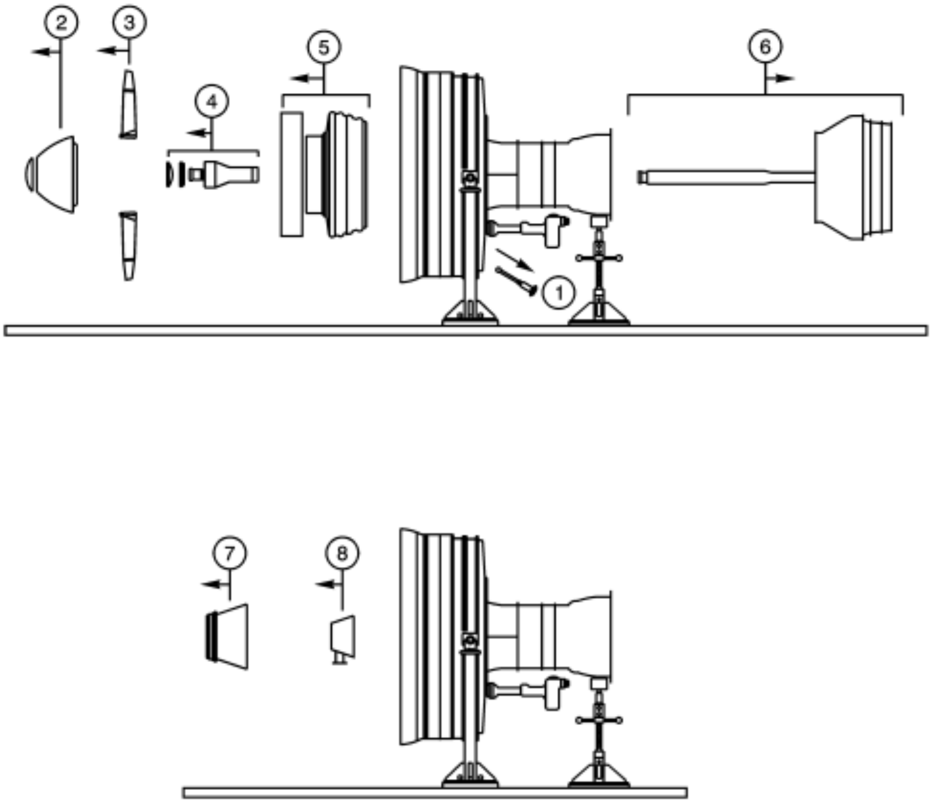
NOTE: You must fabricate an adapter that will attach the wrench to the Handling Fixture. This adapter must safely lift 125 lbs (56.70 kg) minimum.

(e) Remove the tools.

(3) Remove the nut [4] and No. 2 bearing front seal seat [3]. Discard the nut. See Figure 304.

NOTE: When the nut [4] is removed, it must not be re−used. The nut must be replaced with a new nut.

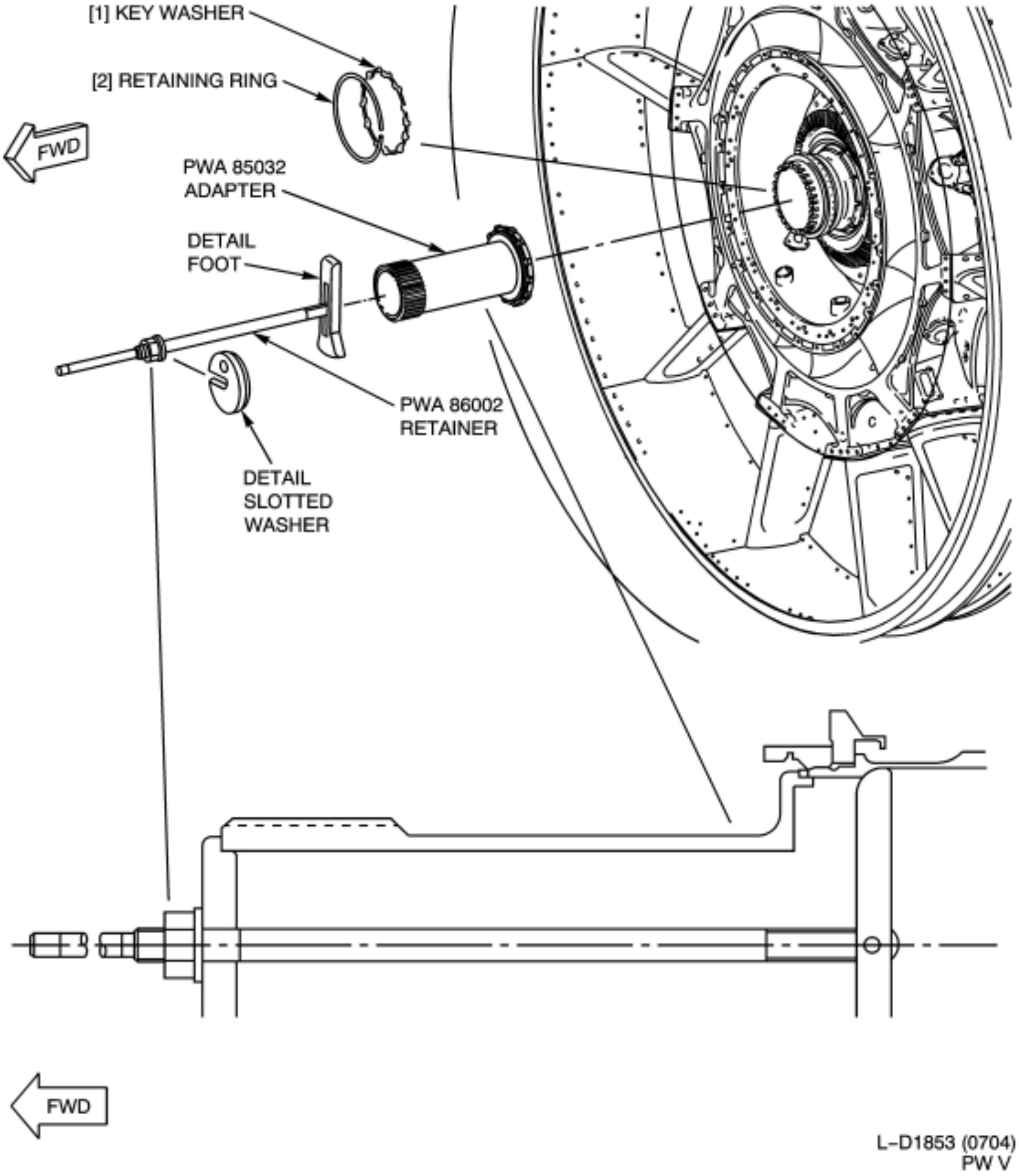
(4) Make sure that you install all the necessary protection covers.



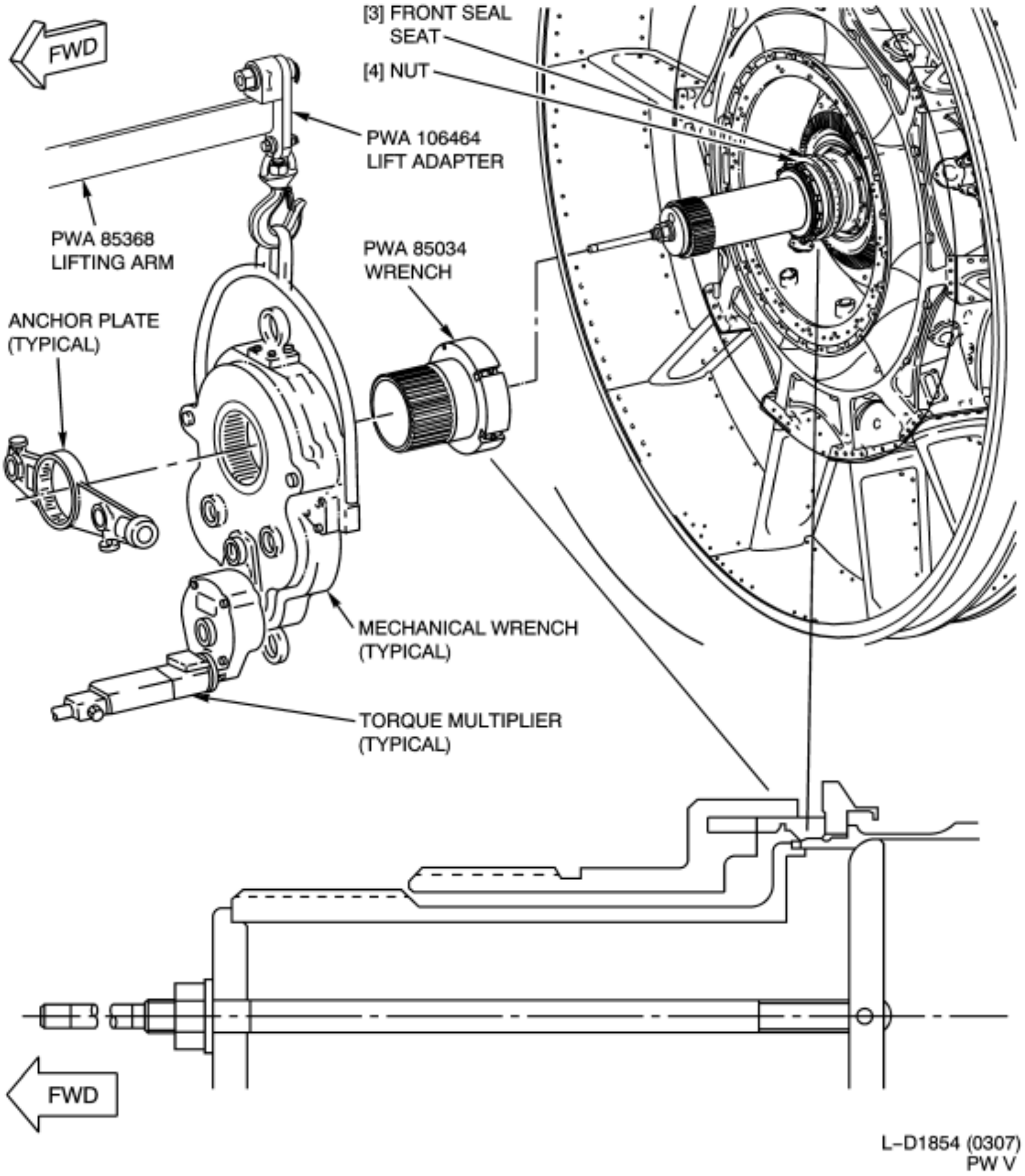
SEE LIST OF
PREREQUISITE TASKS

L−D1851 (0704)
PW V

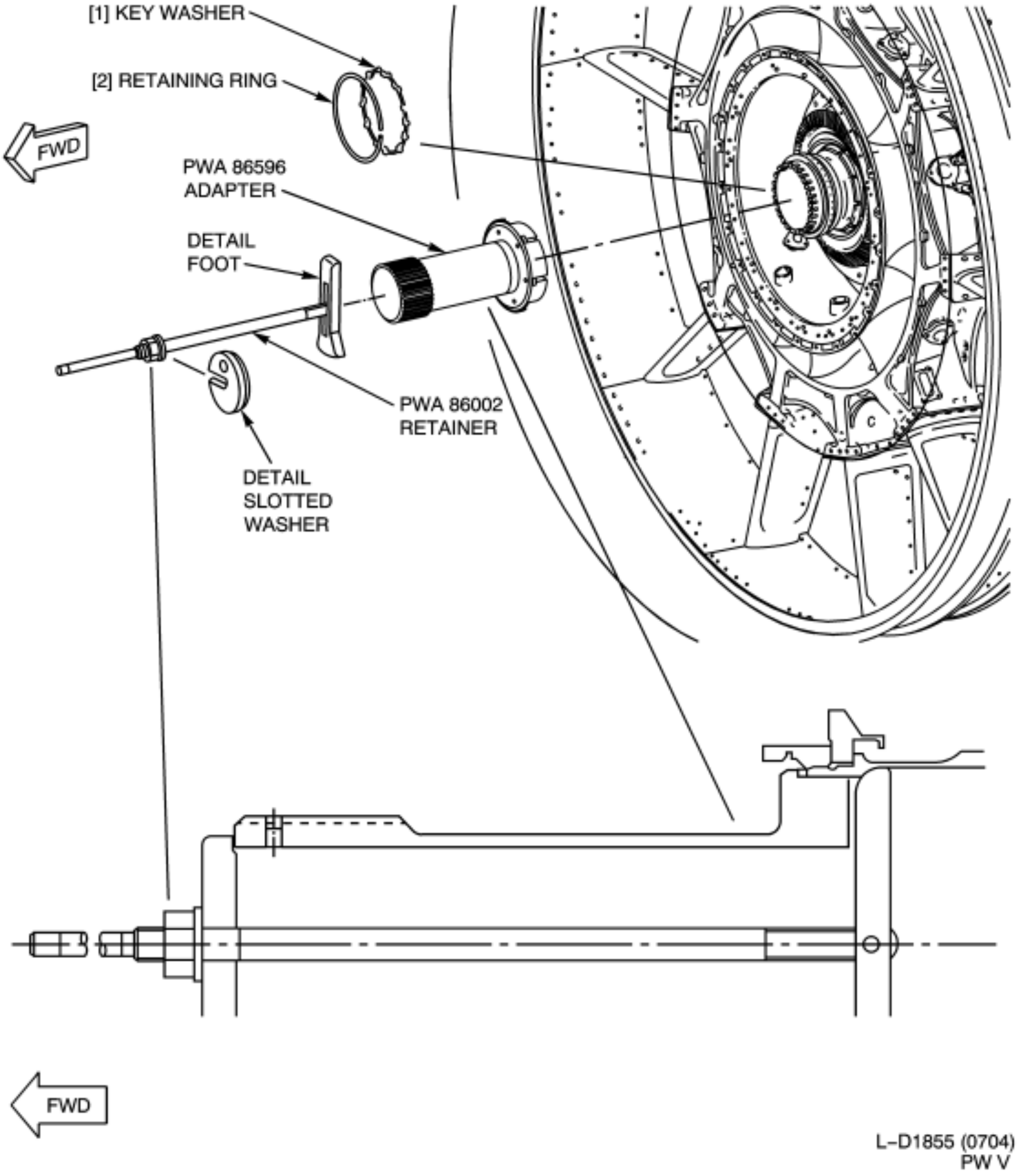
Remove The No. 2 Bearing Seal Seat
− Horizontal − (Prerequisite Tasks)
Figure 301
(Task 72−00−35−020−001−002)


[1] KEY WASHER
[2] RETAINING RING
FWD
PWA 85032
ADAPTER
DETAIL
FOOT
PWA 86002
RETAINER
DETAIL
SLOTTED
WASHER
FWD
L-D1853 (0704)
PW V

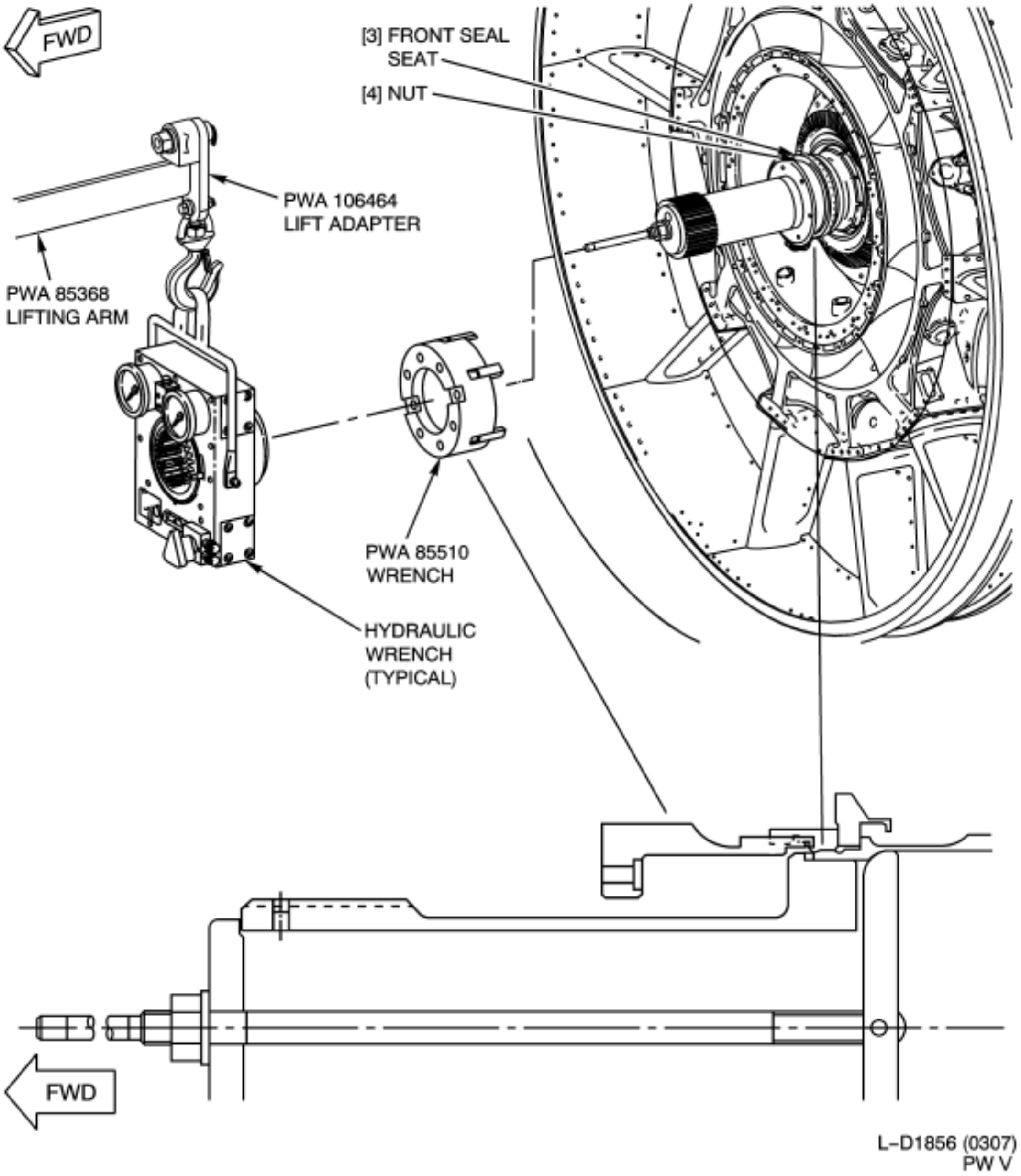
Remove The No. 2 Bearing Seal Seat −
Horizontal − (Mechanical Wrenching Tools)
Figure 302 (Sheet 1)
(Task 72−00−35−020−001−002)


FWD
[3] FRONT SEAL SEAT
[4] NUT
PWA 106464 LIFT ADAPTER
PWA 85368 LIFTING ARM
PWA 85034 WRENCH
ANCHOR PLATE (TYPICAL)
MECHANICAL WRENCH (TYPICAL)
TORQUE MULTIPLIER (TYPICAL)
FWD
L−D1854 (0307)
PW V

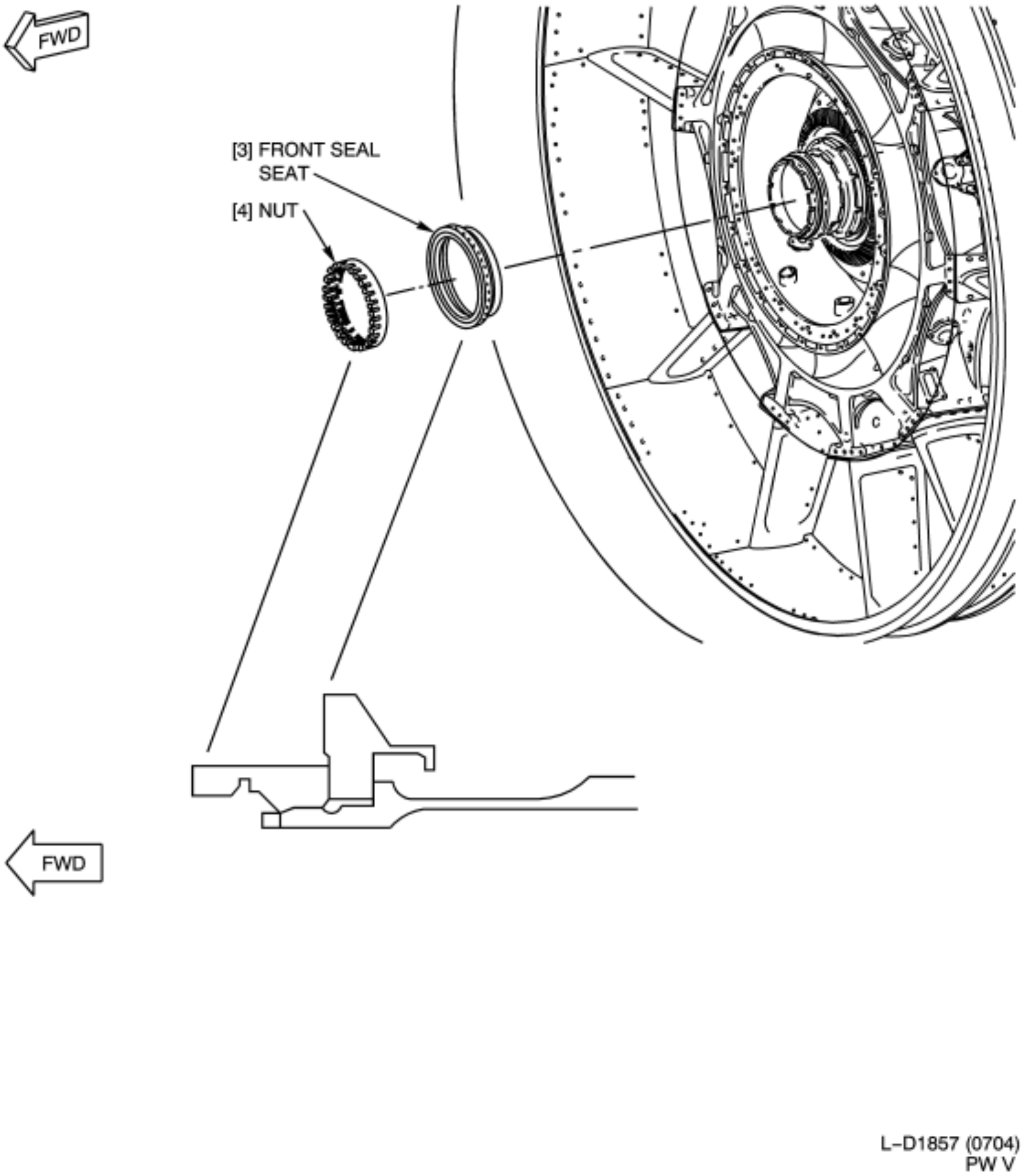
Remove The No. 2 Bearing Seal Seat −
Horizontal − (Mechanical Wrenching Tools)
Figure 302 (Sheet 2)
(Task 72−00−35−020−001−002)


[1] KEY WASHER
[2] RETAINING RING
FWD
PWA 86596
ADAPTER
DETAIL
FOOT
PWA 86002
RETAINER
DETAIL
SLOTTED
WASHER
FWD
L-D1855 (0704)
PW V

Remove The No. 2 Bearing Seal Seat -
Horizontal - (Hydraulic Wrenching Tools)
Figure 303 (Sheet 1)
(Task 72-00-35-020-001-002)


FWD
[3] FRONT SEAL SEAT
[4] NUT
PWA 106464 LIFT ADAPTER
PWA 85368 LIFTING ARM
PWA 85510 WRENCH
HYDRAULIC WRENCH (TYPICAL)
FWD
L−D1856 (0307)
PW V

Remove The No. 2 Bearing Seal Seat −
Horizontal − (Hydraulic Wrenching Tools)
Figure 303 (Sheet 2)
(Task 72−00−35−020−001−002)


FWD
[3] FRONT SEAL SEAT
[4] NUT
FWD
L−D1857 (0704)
PW V

Remove The No. 2 Bearing Seal Seat − Horizontal
Figure 304
(Task 72−00−35−020−001−002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - REMOVAL-03

Task 72-00-35-020-002:

1. Remove External Plumbing From High Pressure Compressor

   A. Equipment And Materials Required - None

   B. Procedure

      See Figures 301 and 302.

      NOTE: FOR THESE MODELS: 4152, 4156A, 4158
      HPC air valve signal tubes were removed and cap assemblies installed on the air filters and the HPC air valves by Alert SB PW4ENG 75-62R2.

      HPC air valve signal tube was (re)installed and the cap assemblies were removed from the air filter and the HPC air valve by SB PW4ENG 75-85 and SB PW4ENG 75-116.

      (1) FOR THESE MODELS: 4152, 4156A, 4158
      (Pre SB PW4ENG 75-102 and SB PW4ENG 75-116) Remove the air shutoff valve signal manifold assembly (left) (AA19) as follows.

         (a) FOR THESE MODELS: 4152, 4156A, 4158
         Remove lockwire and disconnect manifold nuts from rear of upper left air filter at approximately the 11 o'clock position and from air shutoff valve at approximately the 10 o'clock position. Disconnect tube nut from manifold tee and remove tube from engine.

         (b) FOR THESE MODELS: 4152, 4156A, 4158
         Install protective closures.

      (2) FOR THESE MODELS: 4152, 4156A, 4158
      (Post SB PW4ENG 75-102 and SB PW4ENG 75-116) Remove the air shutoff valve signal manifold assembly (left) (AA19) as follows.

         (a) FOR THESE MODELS: 4152, 4156A, 4158
         Remove lockwire and disconnect manifold nuts from rear of upper left air filter at approximately the 11 o'clock position and from air shutoff valve at approximately the 10 o'clock position. Remove the tube from engine.

         (b) FOR THESE MODELS: 4152, 4156A, 4158
         Install protective closures.

(3) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the air shutoff valve signal manifold assembly (left) (AA19) as follows.

  (a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
  Remove lockwire and disconnect manifold nuts from rear of upper left air filter at approximately the 11 o'clock position and from air shutoff valve at approximately the 10 o'clock position. Remove tube from engine.

(4) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 75−85 and SB PW4ENG 75−116) Remove the HPC air valve signal tube assembly (AA16) on the left side of the engine.

  (a) FOR THESE MODELS: 4152, 4156A, 4158
  Remove the lockwire and disconnect the tube nuts from the rear of the lower left air filter at approximately the 11 o'clock position and from the secondary flow control air valve at approximately the 10 o'clock position.

  (b) FOR THESE MODELS: 4152, 4156A, 4158
  Remove the bolt, nut and clamp that attach the tube to a bracket that is attached to the turbine vane and blade cooling air valve.

  (c) FOR THESE MODELS: 4152, 4156A, 4158
  Remove the tube from the engine and install protection covers.

(5) Remove air supply manifold assembly (AA24) as follows.

  (a) Remove the lockwire and disconnect the manifold nut from the front upper right air filter at approximately the 2 o'clock position.

  (b) Remove bolts, nuts, and clamps that attach the manifold to the bracket below and the bracket rear of the turbine cooling air valve actuator at approximately the 2 o'clock position. Remove the tube from engine and install protective closures.

(6) Remove the (right) bleed valve supply tube assembly (AA28) as follows.

(a) Remove the lockwire and disconnect the tube nut from the right side HPC bleed valve at approximately the 1 o'clock position.

(b) Remove bolt, nut, and clamp that attaches the tube to the Flange J bracket at approximately the 1 o'clock position.

(c) Remove bolts, nuts, and clamps that attach the tube to the bracket below and the bracket rear of the turbine cooling air valve actuator at approximately the 2 o'clock position. Remove the tube from engine and install protective closures.

(7) Remove the (left) bleed valve supply tube assembly (AA30) as follows.

(a) Remove the lockwire and disconnect the tube nut from the left side HPC bleed valve at approximately the 11 o'clock position.

(b) Remove bolts, nuts, and clamps that attach the tub to the bracket below and bracket rear of the turbine cooling air valve actuator at approximately the 2 o'clock position.

(c) Remove bolts, nuts, and clamps that attach the tube to the Flange J brackets at approximately the 1, 12 and 11 o'clock positions. Remove the tube from engine and install protective closures.

(8) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 75−116) Remove air shutoff valve signal tube assembly (lower) (AA21) as follows.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove lockwire and disconnect the tube nuts from the turbine cooling air shutoff valve at approximately the 3 o'clock position and from the upper tube coupling rear of Flange J at approximately the 2 o'clock position.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Remove bolt, nut, and clamp that attaches the tube to the bracket attached to flange of shutoff valve at approximately the 3 o'clock position. Remove the tube from engine and install protective closures.

(9) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 75−116) Remove air shutoff valve signal tube assembly (lower) (AA90) as follows.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove lockwire and disconnect the tube nuts from the turbine cooling air shutoff valve at approximately the 3 o'clock position and from the check valve on the lower end of (AA89) tube coupling rear of Flange J at approximately the 2:30 o'clock position.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Remove bolt, nut, and clamp that attaches the tube to the bracket attached to flange of shutoff valve at approximately the 3 o'clock position. Remove the tube from engine and install protective closures.

(10) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the air shutoff valve signal tube assembly (AA77) as follows.

(a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the lockwire and disconnect the tube nuts from the turbine vane and blade cooling air valve at approximately the 3 o'clock position and from the (lower) air filter at approximately the 1 o'clock position on the HPC case.

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the bolt, nut and clamp that attach the tube to the bracket attached to the flange of the turbine vane and blade cooling air valve at approximately the 3 o'clock position. Remove the tube from the engine and install protective covers.

(11) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 75−102 and SB PW4ENG 75−116) Remove the air shutoff valve signal tube assembly (upper) (AA20) as follows.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove bolts, nuts, and clamps that attach the tube to the Flange J brackets at approximately the 2, 12 and 11 o'clock positions. Remove the tube from the engine and install protective closures.

(12) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the turbine vane cooling air valve pressure tube (AA76) as follows.

(a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the lockwire and disconnect the tube nuts from the (lower) air filter on the left side of the engine at approximately the 11 o'clock position and from the turbine vane cooling air valve at the 2 o'clock position on the HPC case.

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the bolts, nuts and clamps that attach the tube to the brackets on Flange J at the 10, 11:30 and 1 o'clock positions.

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the tube from the engine and install protective closures.

(13) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 75−85 and Pre SB PW4ENG 75−116) Remove the HPC air valve signal tube assembly (AA15) on the right side of the engine.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove the lockwire and disconnect the tube nuts from the rear of the lower right air filter at approximately the 2 o'clock and from the HPC secondary flow control valve at approximately the 3:30 o'clock position forward of Flange J.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Remove the bolt, nut and clamp that attach the tube to a bracket that is attached to the turbine cooling air shutoff valve flange. Remove the tube from the engine and install protection covers.

(14) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 75−116) Remove the HPC air valve signal tube assemblies (AA89) and (AA91) on the right side of the engine.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove the lockwire and disconnect the (AA91) tube nuts from the tee at the lower end of the (AA89) signal tube at approximately the 2:30 o'clock position and from the HPC secondary flow control valve at approximately the 3:30 o'clock position forward of Flange J.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Remove the lockwire and disconnect the (AA89) tube nut from the rear of the lower right air filter at approximately the 2 o'clock poition. Remove the check valve, if necessary, from the tee end of the tube.

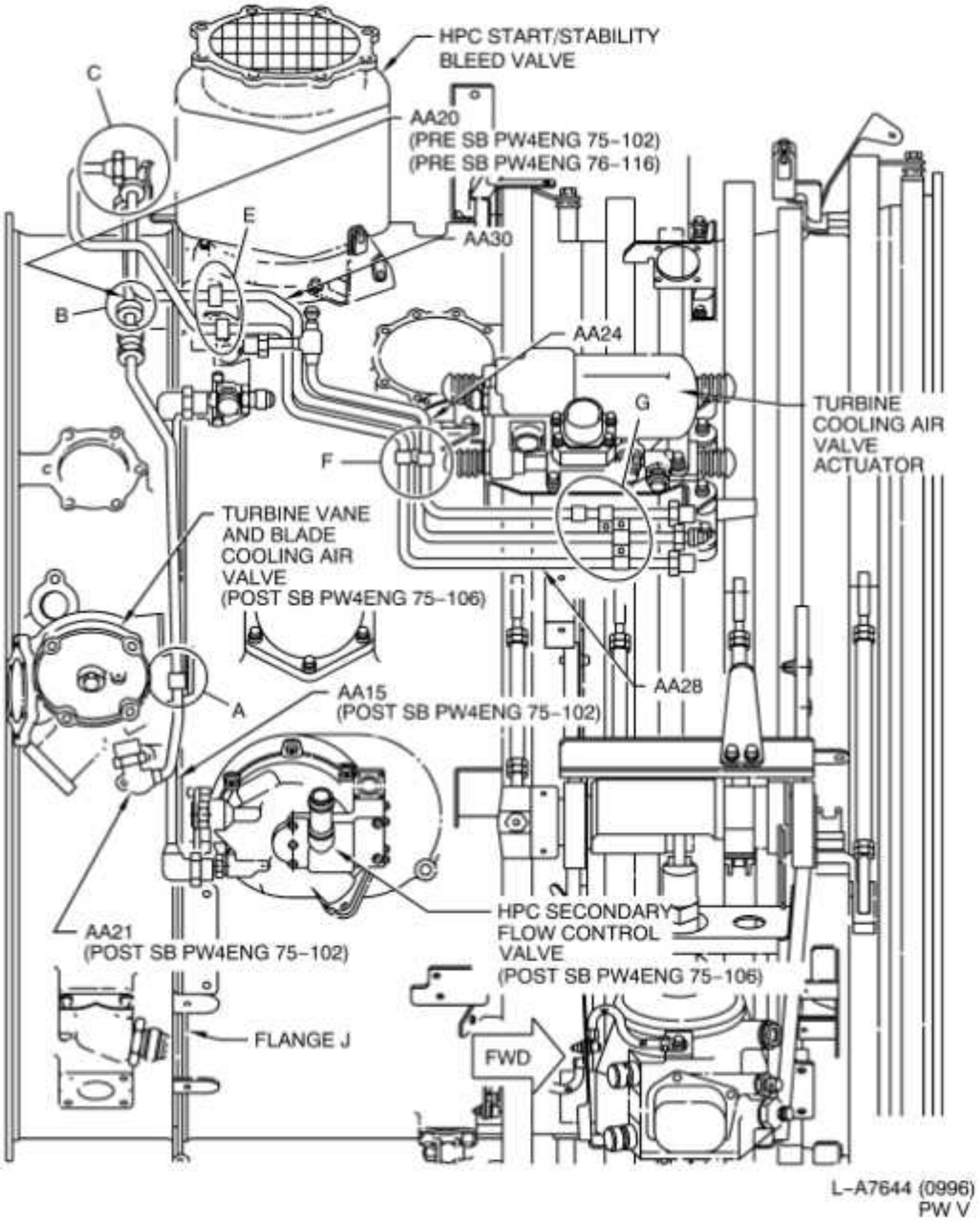
(15) Remove the main bearing strainer element housing assembly as follows.

(a) Remove lockwire, plugs and adapters. Remove packings and discard. Install protective closures.

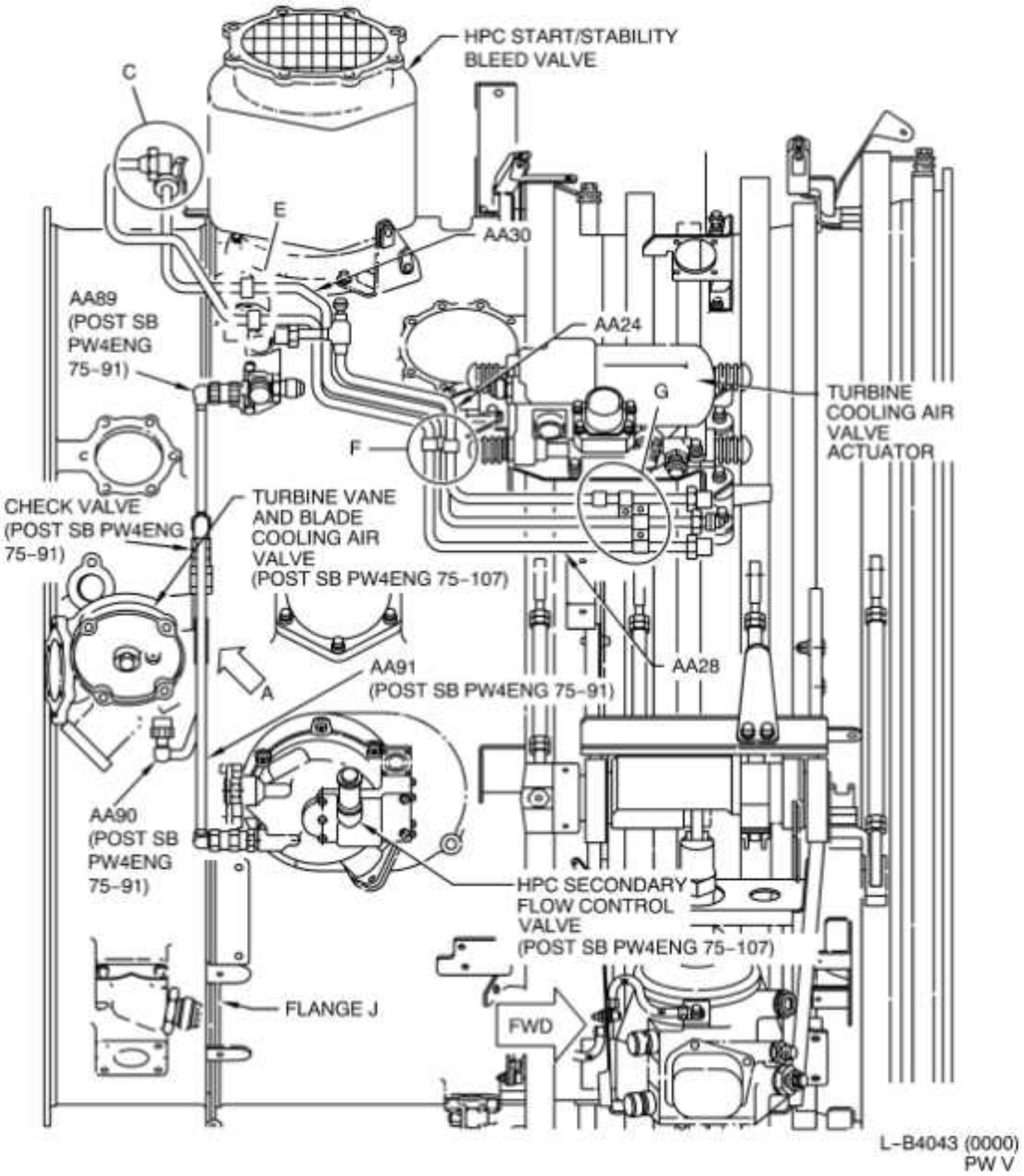
(b) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 79−53) Remove the threaded insert from housing. Remove the packing from the insert and discard the packing. Install a protection cover.

(c) Remove the bolts that attach the strainer element in the housing and remove the element. Remove packing and discard.

(d) Remove bolts, washer, and bracket that attach the housing flange to the top of fuel/oil cooler at approximately the 9 o'clock position and remove the housing. Remove packing and discard.

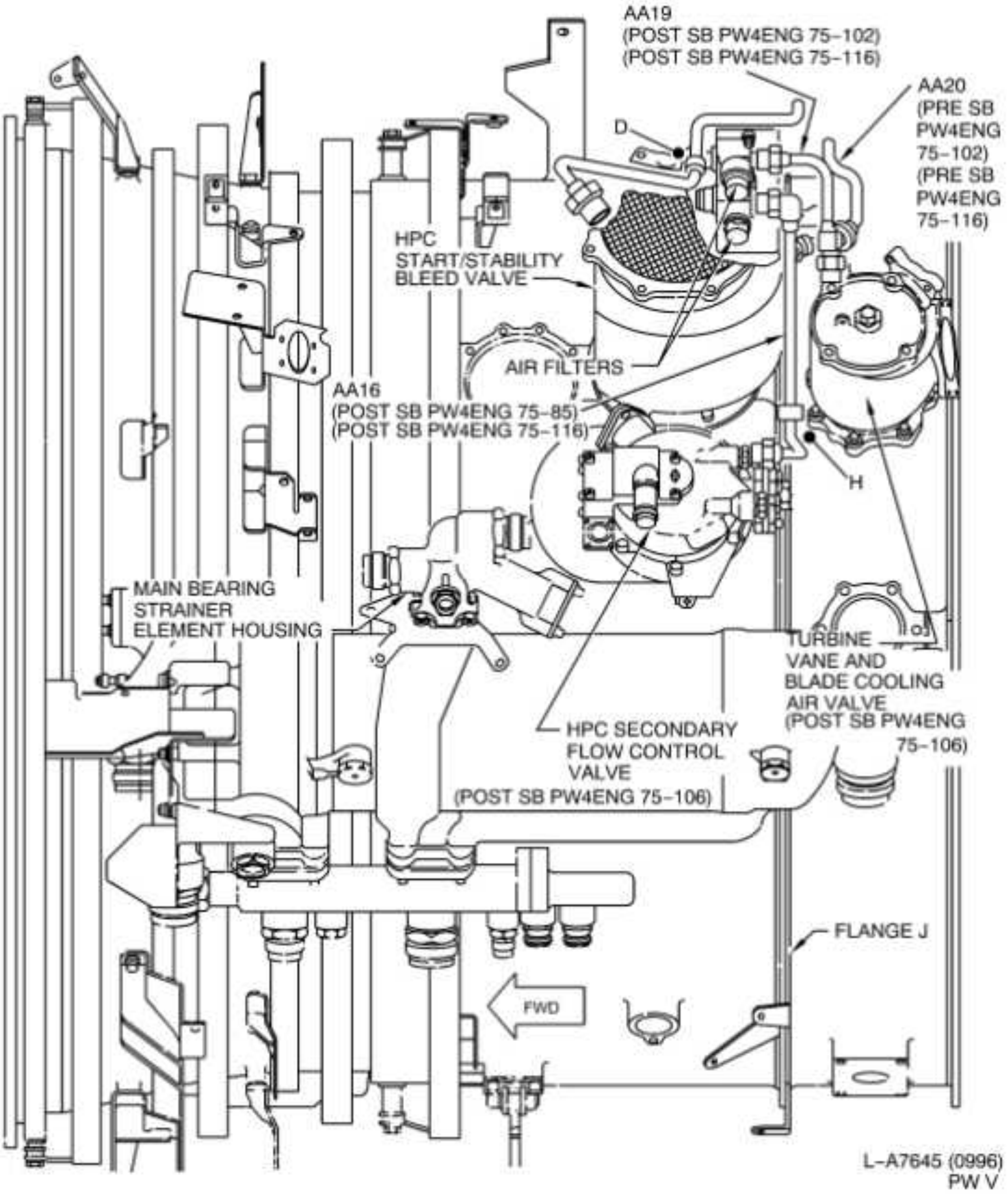

HPC START/STABILITY BLEED VALVE
C
AA20 (PRE SB PW4ENG 75-102) (PRE SB PW4ENG 76-116)
E
AA30
B
AA24
G
TURBINE COOLING AIR VALVE ACTUATOR
F
TURBINE VANE AND BLADE COOLING AIR VALVE (POST SB PW4ENG 75-106)
AA28
A
AA15 (POST SB PW4ENG 75-102)
AA21 (POST SB PW4ENG 75-102)
HPC SECONDARY FLOW CONTROL VALVE (POST SB PW4ENG 75-106)
FLANGE J
FWD
L-A7644 (0996)
PW V

High Pressure Compressor Plumbing
(Pre SB PW4ENG 75−116)
Figure 301 (Sheet 1)
(Task 72−00−35−020−002)

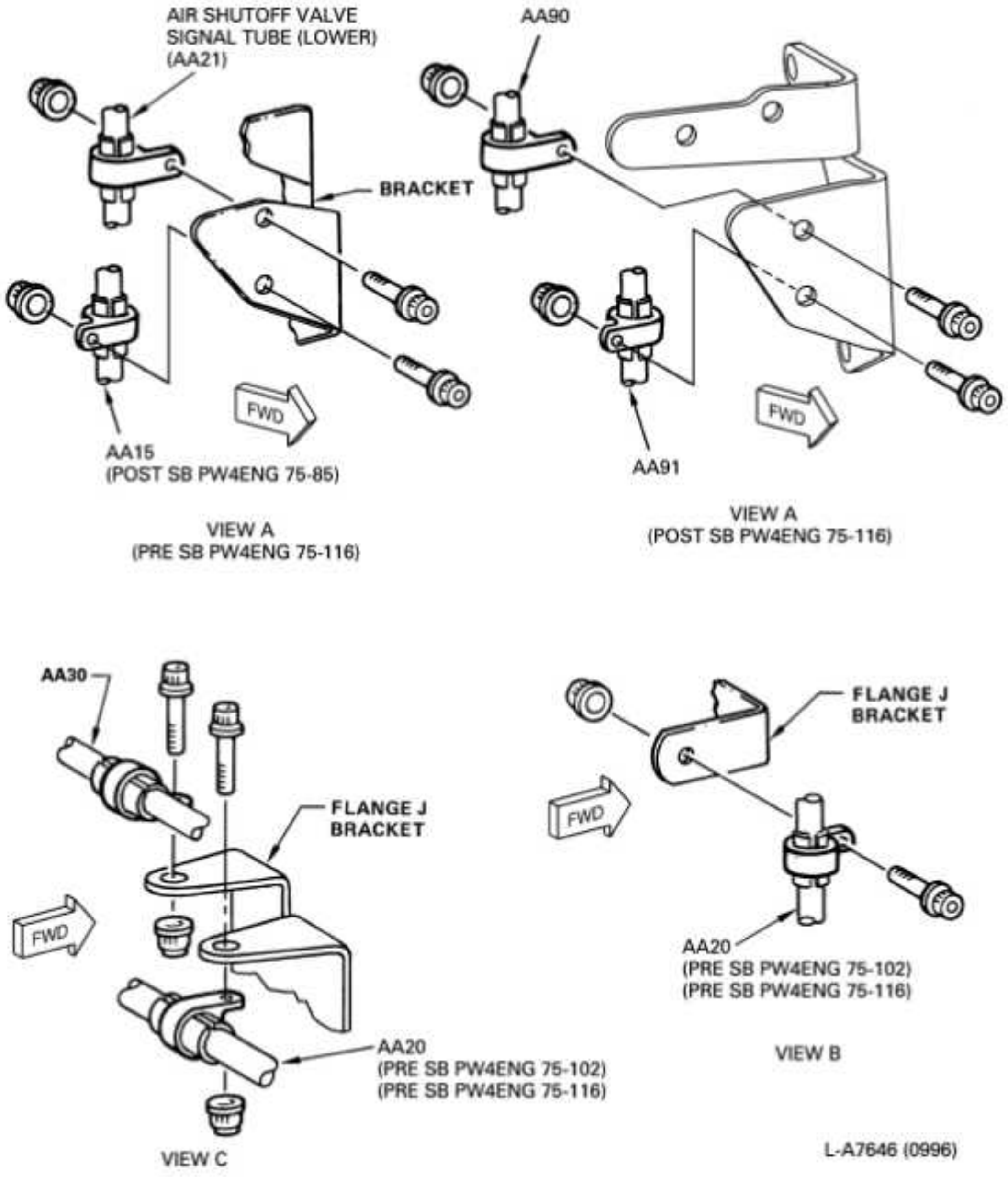

C
HPC START/STABILITY BLEED VALVE
E
AA30
AA89 (POST SB PW4ENG 75-91)
AA24
G
TURBINE COOLING AIR VALVE ACTUATOR
F
CHECK VALVE (POST SB PW4ENG 75-91)
TURBINE VANE AND BLADE COOLING AIR VALVE (POST SB PW4ENG 75-107)
A
AA91 (POST SB PW4ENG 75-91)
AA28
AA90 (POST SB PW4ENG 75-91)
HPC SECONDARY FLOW CONTROL VALVE (POST SB PW4ENG 75-107)
FLANGE J
FWD
L-B4043 (0000)
PW V

High Pressure Compressor Plumbing
(Post SB PW4ENG 75−116)
Figure 301 (Sheet 2)
(Task 72−00−35−020−002)

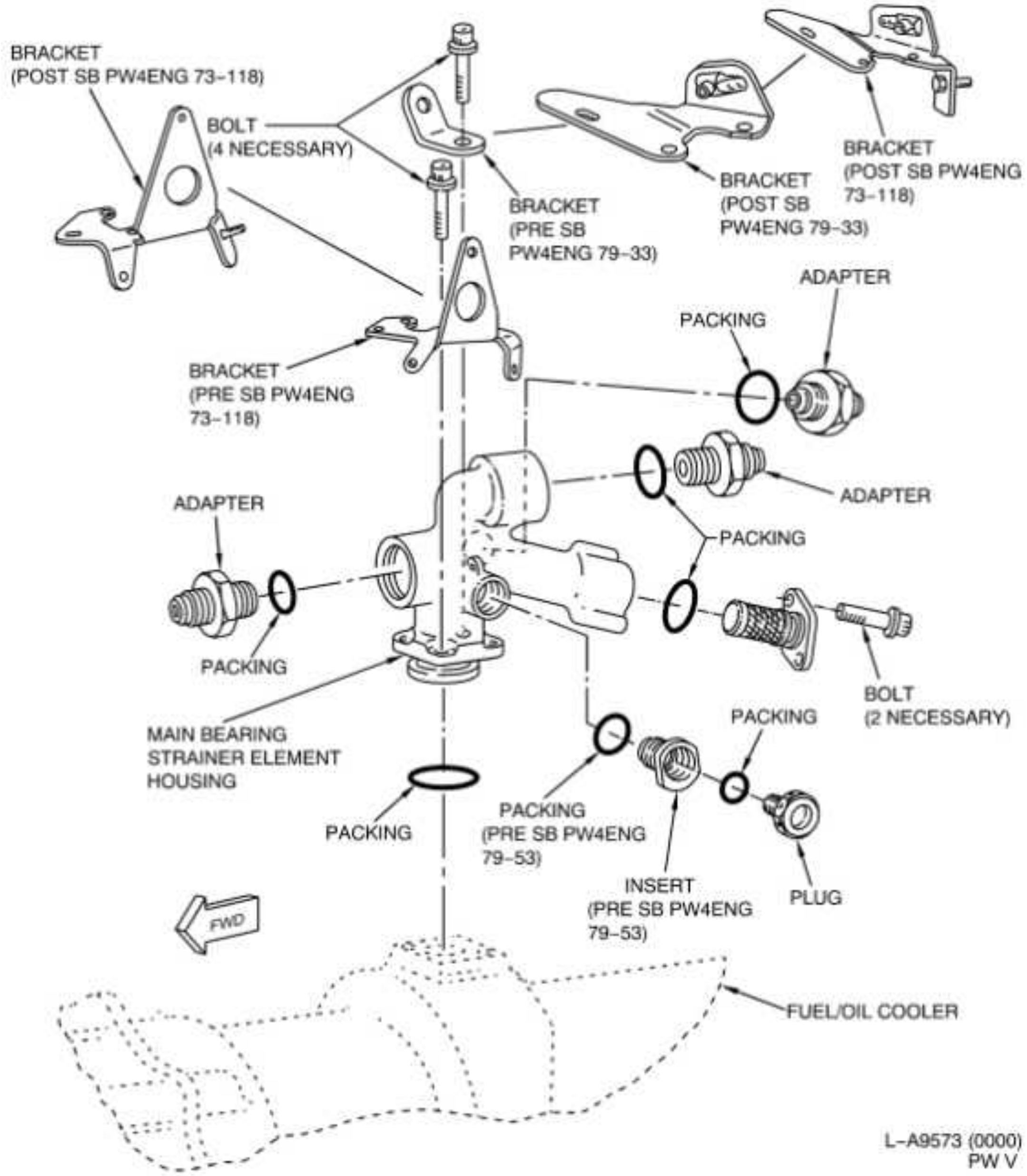
ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−03


AA19
(POST SB PW4ENG 75−102)
(POST SB PW4ENG 75−116)
AA20
(PRE SB PW4ENG 75−102)
(PRE SB PW4ENG 75−116)
D
HPC START/STABILITY BLEED VALVE
AIR FILTERS
AA16
(POST SB PW4ENG 75−85)
(POST SB PW4ENG 75−116)
H
MAIN BEARING STRAINER ELEMENT HOUSING
TURBINE VANE AND BLADE COOLING AIR VALVE
(POST SB PW4ENG 75−106)
HPC SECONDARY FLOW CONTROL VALVE
(POST SB PW4ENG 75−106)
FLANGE J
FWD
L−A7645 (0996)
PW V

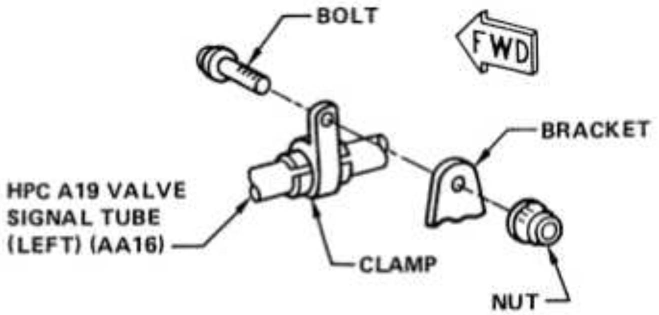
High Pressure Compressor Plumbing
Figure 301 (Sheet 3)
(Task 72−00−35−020−002)


AIR SHUTOFF VALVE
SIGNAL TUBE (LOWER)
(AA21)
AA90
BRACKET
FWD
AA15
(POST SB PW4ENG 75-85)
VIEW A
(PRE SB PW4ENG 75-116)
FWD
AA91
VIEW A
(POST SB PW4ENG 75-116)
AA30
FLANGE J
BRACKET
FWD
AA20
(PRE SB PW4ENG 75-102)
(PRE SB PW4ENG 75-116)
VIEW C
FLANGE J
BRACKET
FWD
AA20
(PRE SB PW4ENG 75-102)
(PRE SB PW4ENG 75-116)
VIEW B
L-A7646 (0996)

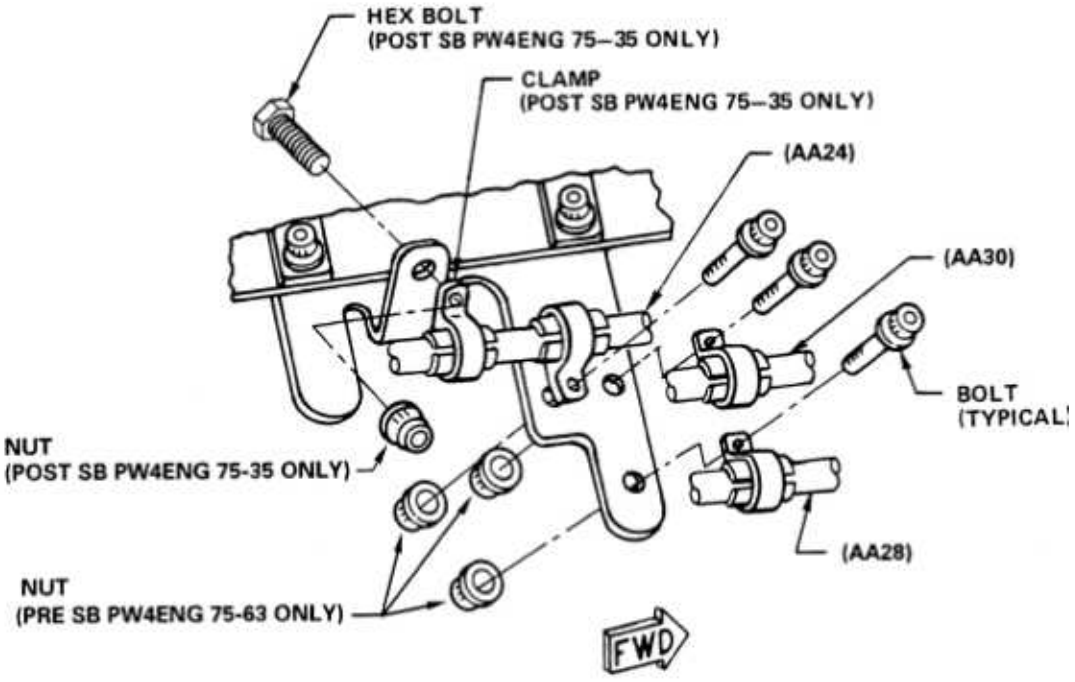
High Pressure Compressor Plumbing
Figure 301 (Sheet 4)
(Task 72–00–35–020–002)


BRACKET (POST SB PW4ENG 73−118)
BOLT (4 NECESSARY)
BRACKET (PRE SB PW4ENG 79−33)
BRACKET (POST SB PW4ENG 79−33)
BRACKET (POST SB PW4ENG 73−118)
ADAPTER
PACKING
BRACKET (PRE SB PW4ENG 73−118)
ADAPTER
PACKING
ADAPTER
PACKING
BOLT (2 NECESSARY)
PACKING
MAIN BEARING STRAINER ELEMENT HOUSING
PACKING
PACKING (PRE SB PW4ENG 79−53)
INSERT (PRE SB PW4ENG 79−53)
PLUG
FWD
FUEL/OIL COOLER
L−A9573 (0000)
PW V

High Pressure Compressor Plumbing
Figure 301 (Sheet 5)
(Task 72−00−35−020−002)


BOLT
FWD
BRACKET
HPC A19 VALVE
SIGNAL TUBE
(LEFT) (AA16)
CLAMP
NUT

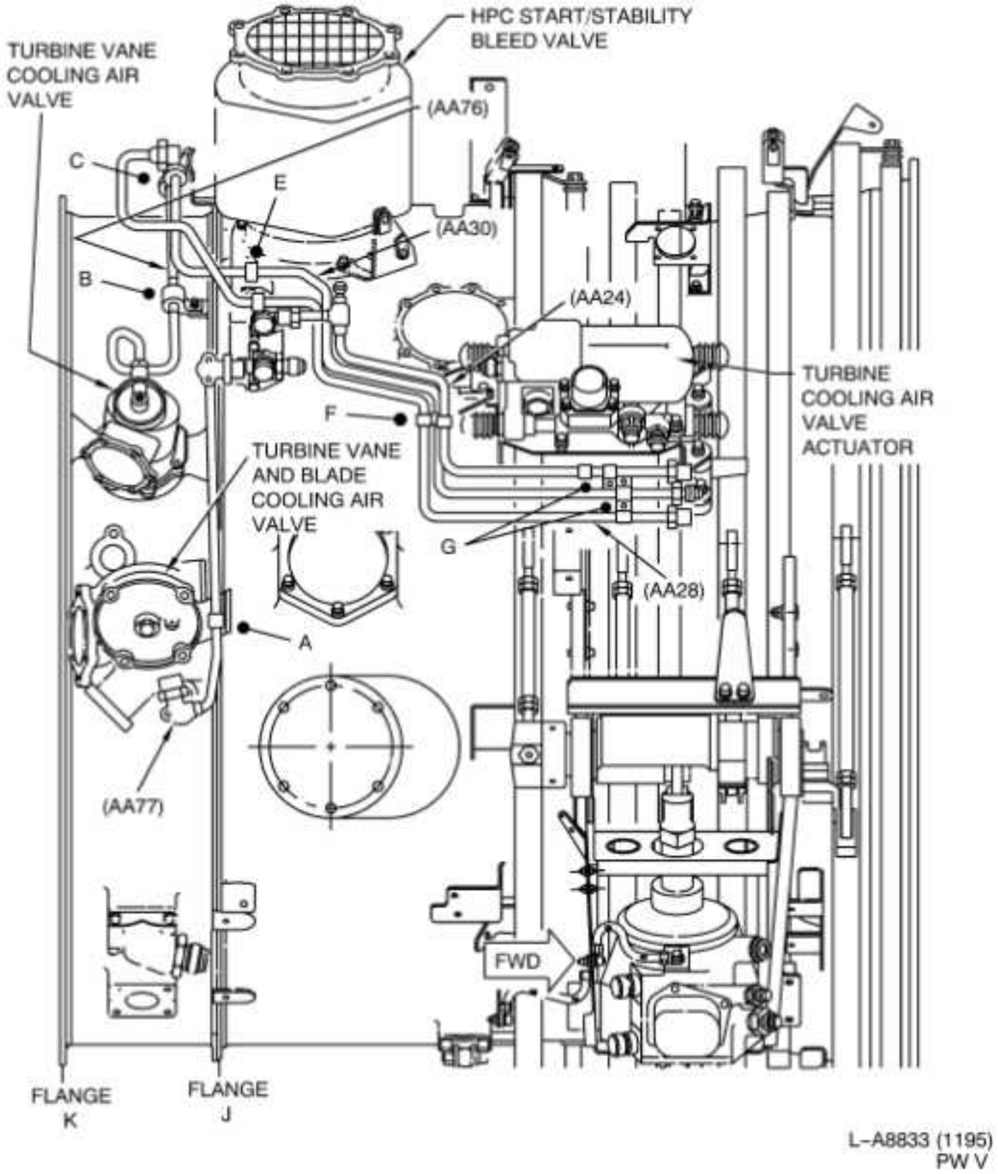
VIEW H
(POST SB PW4ENG 75-85)


HEX BOLT
(POST SB PW4ENG 75−35 ONLY)
CLAMP
(POST SB PW4ENG 75−35 ONLY)
(AA24)
(AA30)
BOLT
(TYPICAL
NUT
(POST SB PW4ENG 75-35 ONLY)
(AA28)
NUT
(PRE SB PW4ENG 75-63 ONLY)
FWD

VIEW G

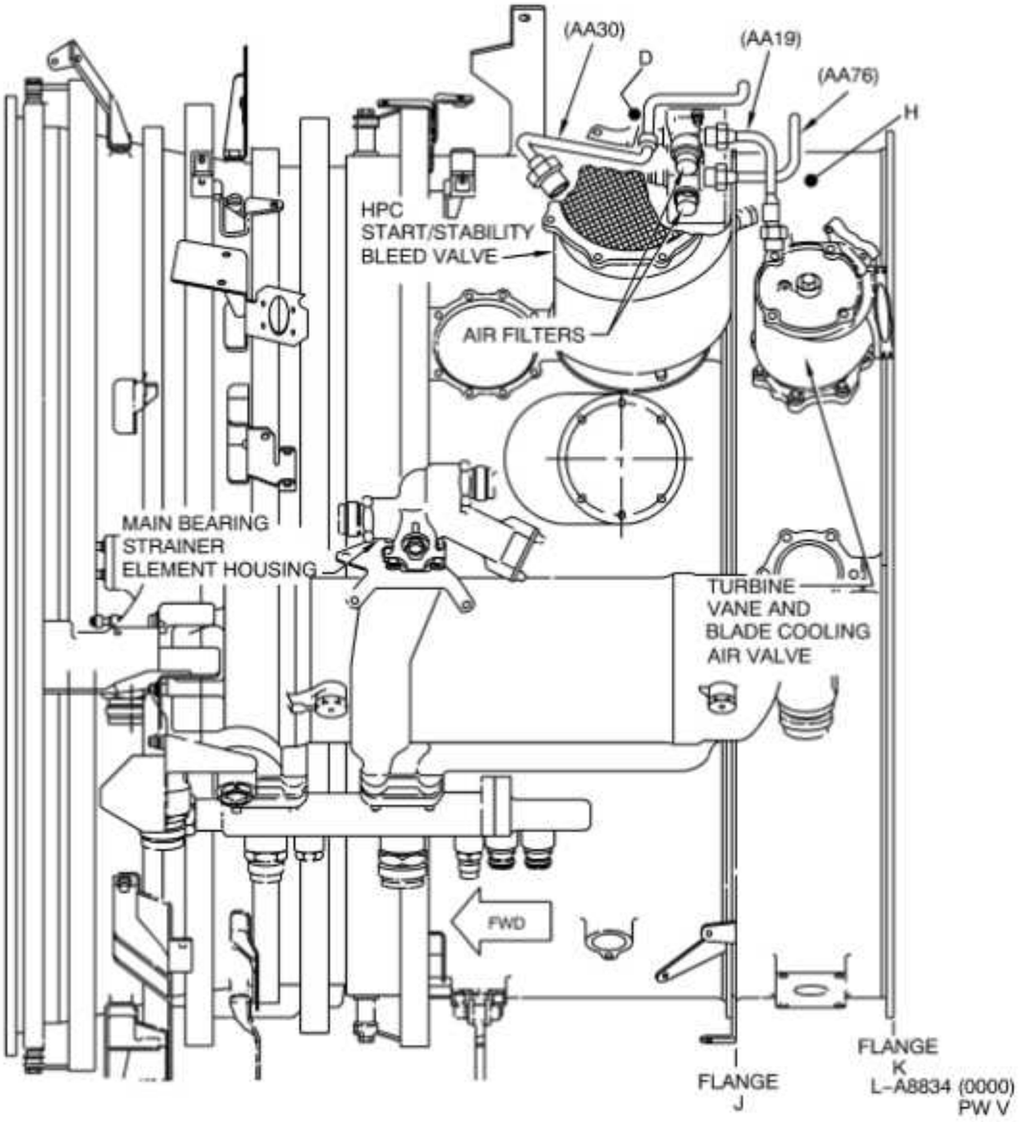
L-A8025

High Pressure Compressor Plumbing
Figure 301 (Sheet 6)
(Task 72−00−35−020−002)

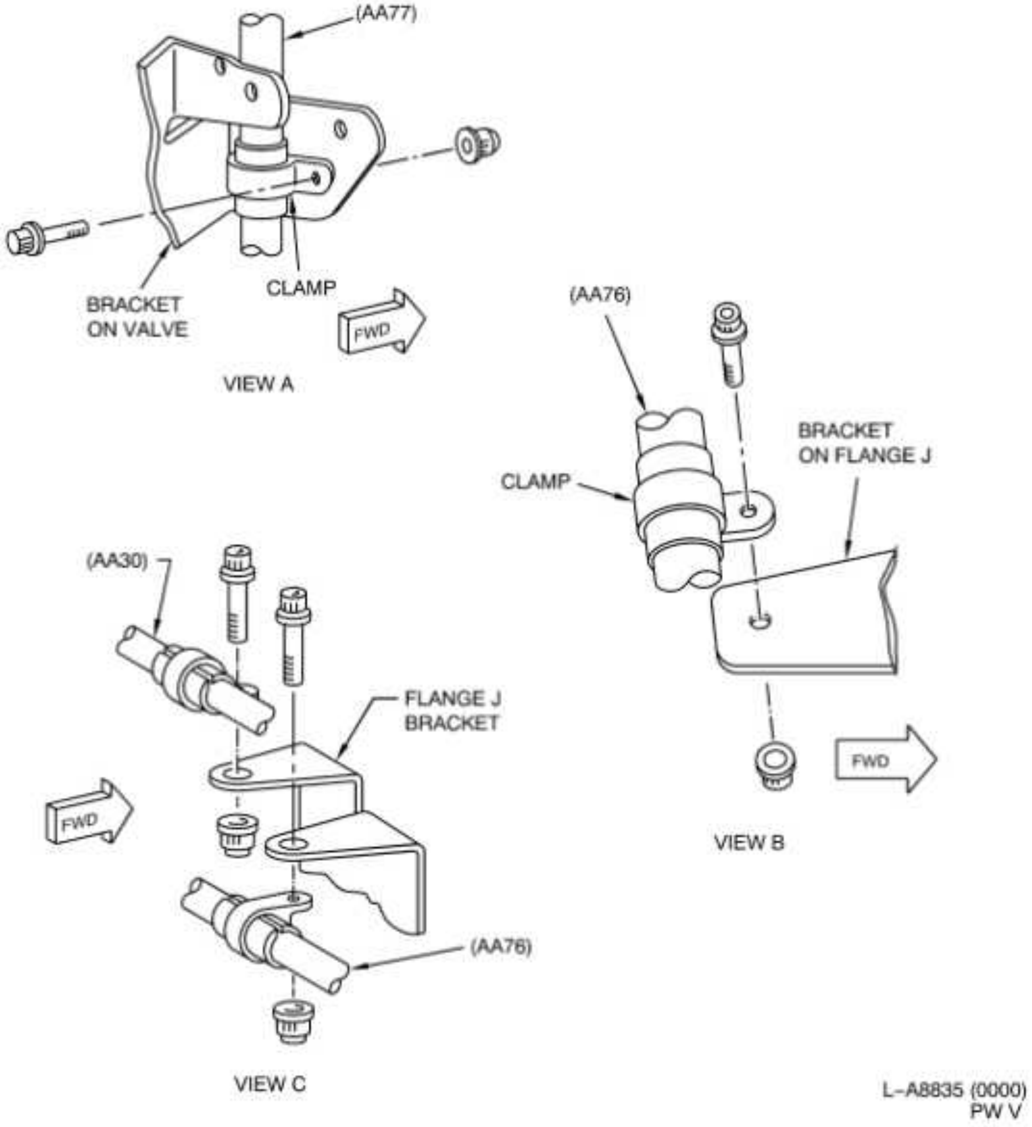

HPC START/STABILITY BLEED VALVE
TURBINE VANE COOLING AIR VALVE
(AA76)
C
E
(AA30)
B
(AA24)
TURBINE COOLING AIR VALVE ACTUATOR
F
TURBINE VANE AND BLADE COOLING AIR VALVE
G
(AA28)
A
(AA77)
FWD
FLANGE K
FLANGE J
L−A8833 (1195)
PW V

High Pressure Compressor Plumbing
Figure 301 (Sheet 7)
(Task 72−00−35−020−002)

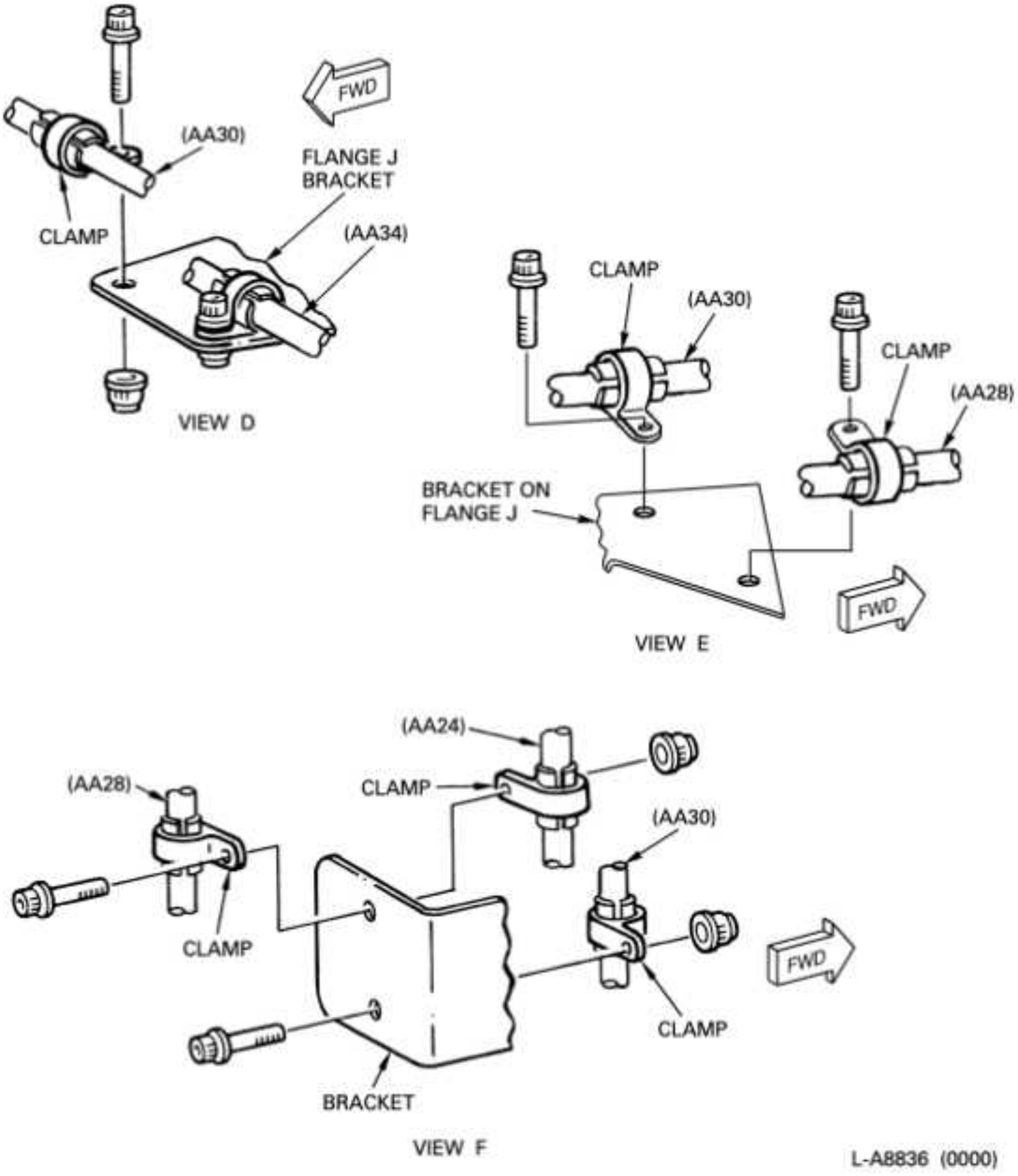
ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−03


(AA30)
D
(AA19)
(AA76)
H
HPC START/STABILITY BLEED VALVE
AIR FILTERS
MAIN BEARING STRAINER ELEMENT HOUSING
TURBINE VANE AND BLADE COOLING AIR VALVE
FWD
FLANGE J
FLANGE K
L−A8834 (0000)
PW V

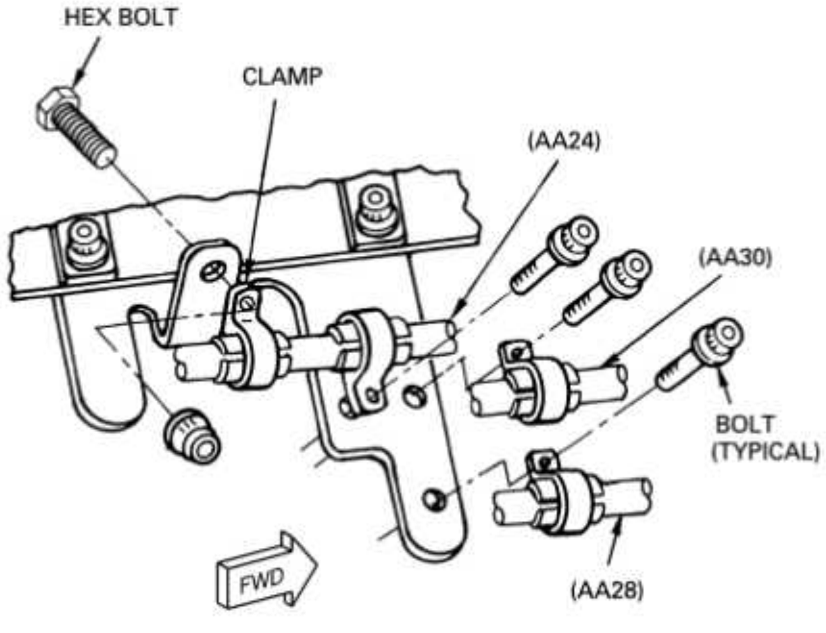
High Pressure Compressor Plumbing
Figure 301 (Sheet 8)
(Task 72−00−35−020−002)


(AA77)
BRACKET ON VALVE
CLAMP
FWD
VIEW A
(AA76)
CLAMP
BRACKET ON FLANGE J
FWD
VIEW B
(AA30)
FLANGE J BRACKET
FWD
(AA76)
VIEW C
L−A8835 (0000)
PW V

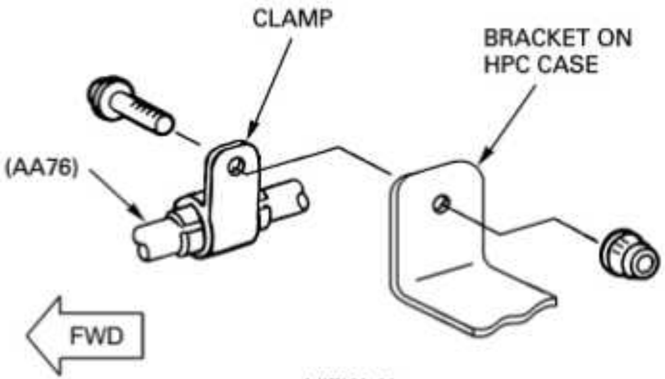
High Pressure Compressor Plumbing
Figure 301 (Sheet 9)
(Task 72−00−35−020−002)


FWD
(AA30)
FLANGE J
BRACKET
CLAMP
(AA34)
VIEW D
CLAMP
(AA30)
CLAMP
(AA28)
BRACKET ON
FLANGE J
FWD
VIEW E
(AA24)
(AA28)
CLAMP
(AA30)
CLAMP
FWD
CLAMP
BRACKET
VIEW F
L-A8836 (0000)

High Pressure Compressor Plumbing
Figure 301 (Sheet 10)
(Task 72−00−35−020−002)


HEX BOLT
CLAMP
(AA24)
(AA30)
BOLT
(TYPICAL)
FWD
(AA28)

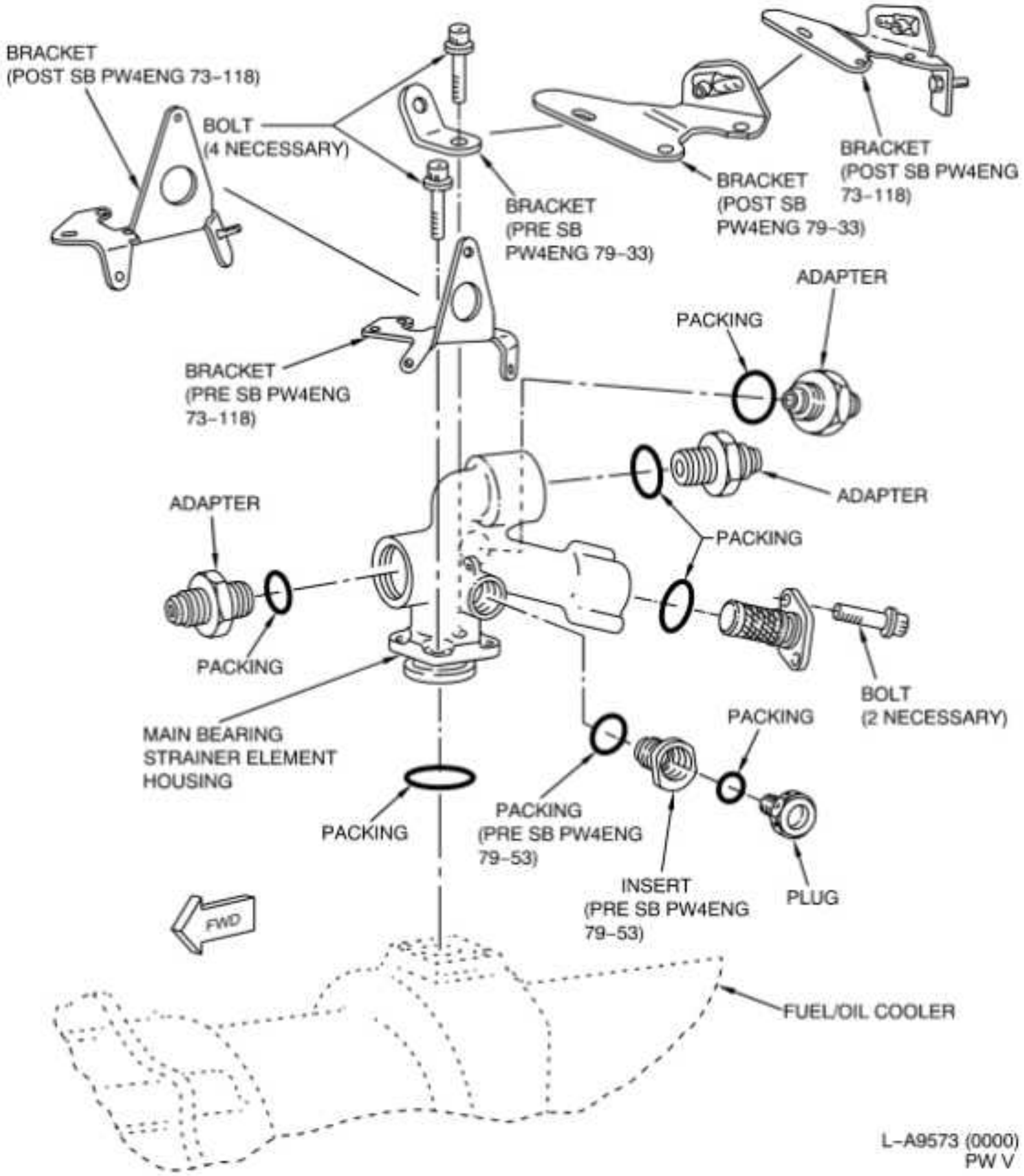
VIEW G


CLAMP
BRACKET ON
HPC CASE
(AA76)
FWD

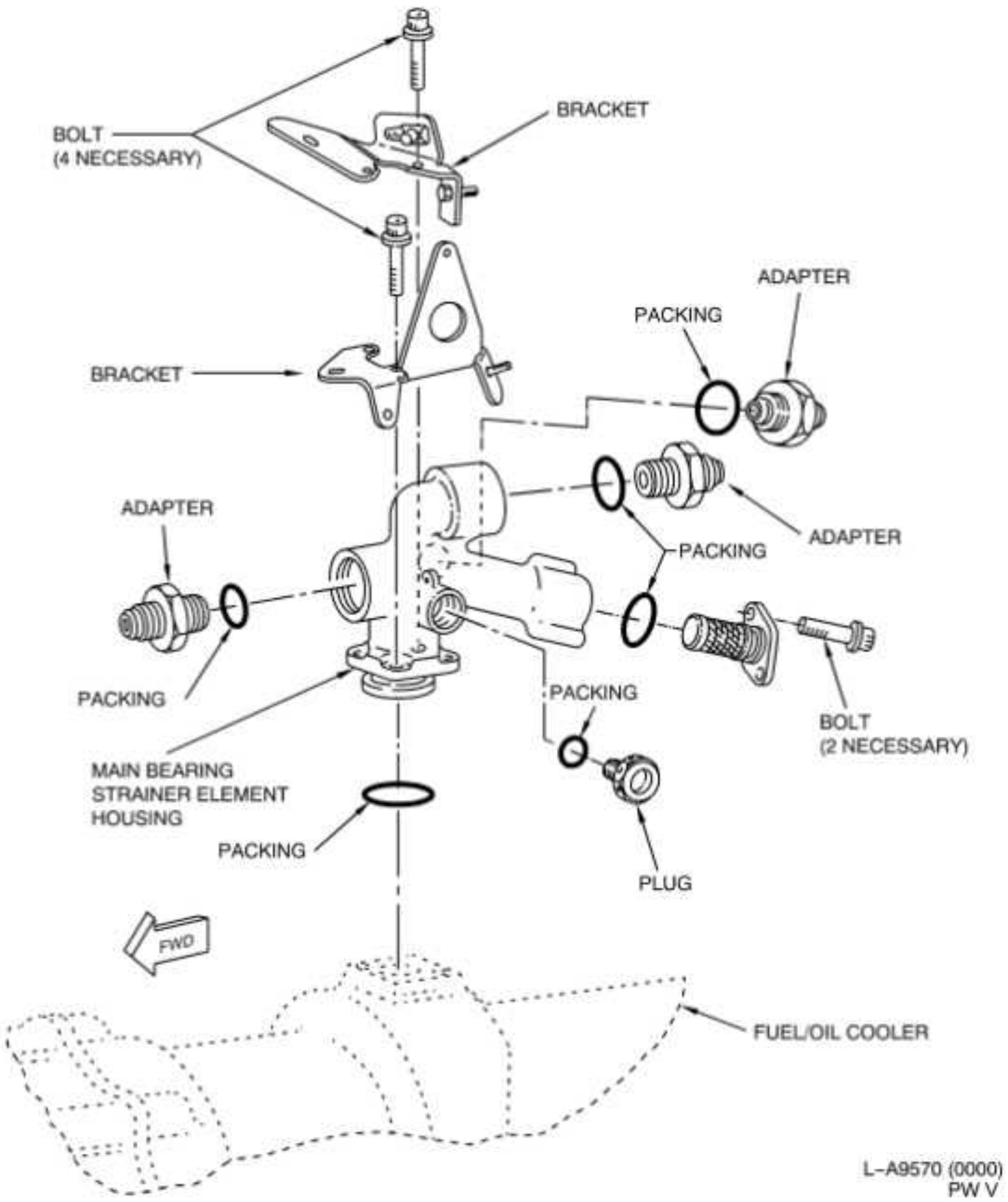
VIEW H

L-A8837 (0000)

High Pressure Compressor Plumbing
Figure 301 (Sheet 11)
(Task 72−00−35−020−002)


BRACKET
(POST SB PW4ENG 73-118)
BOLT
(4 NECESSARY)
BRACKET
(PRE SB
PW4ENG 79-33)
BRACKET
(POST SB
PW4ENG 79-33)
BRACKET
(POST SB PW4ENG
73-118)
ADAPTER
PACKING
BRACKET
(PRE SB PW4ENG
73-118)
ADAPTER
PACKING
ADAPTER
PACKING
MAIN BEARING
STRAINER ELEMENT
HOUSING
BOLT
(2 NECESSARY)
PACKING
PACKING
PACKING
(PRE SB PW4ENG
79-53)
INSERT
(PRE SB PW4ENG
79-53)
PLUG
FWD
FUEL/OIL COOLER
L-A9573 (0000)
PW V

Main Bearing Strainer Housing
Figure 302 (Sheet 1)
(Task 72−00−35−020−002)


BOLT
(4 NECESSARY)
BRACKET
ADAPTER
PACKING
BRACKET
ADAPTER
ADAPTER
PACKING
PACKING
PACKING
BOLT
(2 NECESSARY)
MAIN BEARING
STRAINER ELEMENT
HOUSING
PACKING
PLUG
FWD
FUEL/OIL COOLER
L−A9570 (0000)
PW V

Main Bearing Strainer Housing
Figure 302 (Sheet 2)
(Task 72−00−35−020−002)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-35-050-001-A:

1. Remove Fuel/Oil Cooler - For Engines Not Equipped With Front Split Mount Bracket (Pre SB PW4ENG 79-20)

   A. Equipment And Materials Necessary - None

   B. Procedure
   See Figure 301, Figure 302, Figure 303, Figure 304, and Figure 305.

      (1) Disconnect harnesses from fuel/oil cooler as follows. See Figure 301.

         (a) Disconnect W3P5 and W5P5 harness connectors from oil cooler bypass valve solenoid.

         (b) Remove bolts and nuts securing W3 and W5 harness to brackets at front of cooler and bracket below cooler.

         (c) Install protective closures to connectors.

         (d) Remove four bolts securing loop clamp brackets to fuel/oil cooler. Remove brackets and reinstall bolts handtight.

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH
R CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND
R INSTALL A TUBE WITH A FLEX SEGMENT WITH THE
R SAME PRECAUTION USED FOR A TUBE WITHOUT A
R FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A
R TUBE TO HELP WITH THE INSTALLATION OR REMOVAL
R OF THE TUBE OR AN ATTACHED COMPONENT. IF A
R FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE
R A KINK IN THE EXTERNAL WIRE BRAID AND IN THE
R INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND
R LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

      (2) Disconnect tubes from fuel/oil cooler and fuel/oil cooler bypass valve as follows. See Figure 302.

         NOTE: Be prepared to catch fuel and oil in a container with a minimum capacity of 5 U.S. gallons (19 liters).

         (a) Loosen and remove all clamp bolts and nuts securing the following tubes to HPC case brackets and to each other.

1 Oil cooler inlet fuel tubes (FM10) and (FM12)

2 Oil cooler inlet oil tube (airframe) (LS05).

3 Air cooler outlet oil hose and tube assembly (LP03).

(b) Remove lockwire and disconnect oil cooler inlet return manifold (CR04) from front of fuel/oil cooler.

(c) Remove six bolts securing two oil cooler inlet fuel tubes to fuel pump and fuel bypass valve (FM10) and (FM12). Remove lockwire and disconnect same tubes from fuel/oil cooler. Disengage tubes at both ends. Remove and discard packings and retainers.

(d) Remove lockwire and disconnect left oil cooler inlet oil tube (airframe) (LS05) from right tube at union at approximately 6 o'clock position. Remove lockwire and disconnect tube from fuel/oil cooler bypass valve. Disengage tube. Remove packings and retainer and discard.

(e) Remove lockwire and disconnect air cooler outlet oil hose and tube assembly (LP03) from fuel/oil cooler bypass valve. Disengage hose and tube assembly from fuel/oil cooler bypass valve.

(f) Remove lockwire and disconnect oil cooler bypass valve drain tube (LP20) from fuel/oil cooler bypass valve.

(g) Remove lockwire and disconnect oil cooler outlet fuel tube (FM11) from rear of fuel/oil cooler.

(3) Remove main bearing strainer housing as follows. See Figure 303.

NOTE: Be prepared to catch fuel and oil in a container with a minimum capacity of 5 U.S. gallons (19 liters).

CAUTION: YOU MUST USE THE WRENCHING FLATS ON THE MATING PARTS WHEN YOU LOOSEN OR TIGHTEN ANY OR ALL TUBE NUTS. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

(a) (Post SB PW4ENG 79-52), Remove the bolt, nut and clamp that attach the tube (LP32) to a bracket on the flange of the secondary flow control valve.

(b) Remove the lockwire. Use the wrenching flats to disconnect the tube nuts from the oil tube metering nipple. Loosen the clamp bolts that attach the oil trim pressure tube (LP32). Loosen the three bolts that attach the oil trim pressure tube (LP32) to the main oil filter housing. Remove the metering nipple.

(c) (Pre SB PW4ENG 79-52), Remove the lockwire and disconnect the No. 3 bearing oil pressure manifold (LP18) from the rear of the main bearing strainer housing. Remove the hose clamp, spray shield, and lockwire. Disconnect the manifold from the front of the No. 3 bearing oil strainer housing (LP19). Remove the attaching hardware. Remove the tube.

(d) (Post SB PW4ENG 79-52), Remove the lockwire and disconnect the No. 3 bearing oil pressure manifold (LP18) from the rear of the main bearing strainer housing. Remove the bolt, clamp and spray shield from the rear of the manifold. Disconnect the manifold from the front of the No. 3 bearing pressure tube (LP19). Remove the attaching hardware and remove the tube from the engine.

(e) Remove lockwire and disconnect gearbox oil pressure manifold (LP08) from inboard side of strainer housing.

(f) Disconnect the No. 1, 1.5 and 2 main bearing oil pressure tube (LP05) as follows. See Figure 303.

1 Remove the lockwire and disengage the tube nuts from the front side of the main bearing strainer element housing and from the strainer housing attached to the bracket on Flange E.

2 Loosen the clamp bolt that attaches the tube to the bracket on Flange E.

3 (Post SB PW4ENG 79-33), Remove the bolt and nut that attach the main bearing oil pressure tube (LP05) to a bracket on the main bearing breather tube (LB06). Clamp can stay with tube.

4 Disengage the tube from the strainer housings.

(g) Remove four bolts securing strainer housing to top of fuel/oil cooler. Reposition brackets on strainer housing flange with W5 harness attached and remove strainer housing.

(h) Remove packings from tubes and packing on strainer housing flange and discard.

(i) Install protective closures.

(4) Remove fuel/oil cooler as follows. See Figure 304.

(a) Remove four bolts and three washers securing rear of oil cooler to HPC case bracket. Position loop clamp bracket rearward.

WARNING: TAKE NECESSARY PRECAUTIONS TO AVOID EXCESSIVE CONTACT WITH FUEL AND OIL DRAINAGE DURING REMOVAL OF COOLER.

(b) Raise rear of cooler off tube connections and move rearward to disengage front mount pin. Reposition W3 and W5 harness forward of cooler. Remove cooler from engine forward end first.

(c) Remove all packings and retainers from tubes and discard.

(d) Install protective closures.

(5) If fuel/oil cooler is to be replaced, comply with the following. See Figure 305.

(a) Remove tube adapters and plugs from fuel/oil cooler. Discard packings.

(b) Remove cotter pin, nut, and pin, from fuel/oil cooler front ear.

R
R

(c) Remove fuel/oil cooler bypass valve and adapters if necessary. See Removal−11 (Task 72−00−35−050−008).

(d) Install protective closures.

NOTE: For additional information concerning detailed maintenance of this component, see Fuel/Oil Heat Exchanger Component Maintenance Manual, 79−21−15, (Serck Heat Transfer).

Task 72−00−35−050−001−B:

2. Remove Fuel/Oil Cooler − For Engines Equipped With Front Split Mount Bracket (Post SB PW4ENG 79−20)

A. Equipment And Materials Necessary − None

B. Procedure
See Figure 306, Figure 307, Figure 308, Figure 309 and Figure 310.

(1) Disconnect harnesses from fuel/oil cooler as follows. See Figure 306.

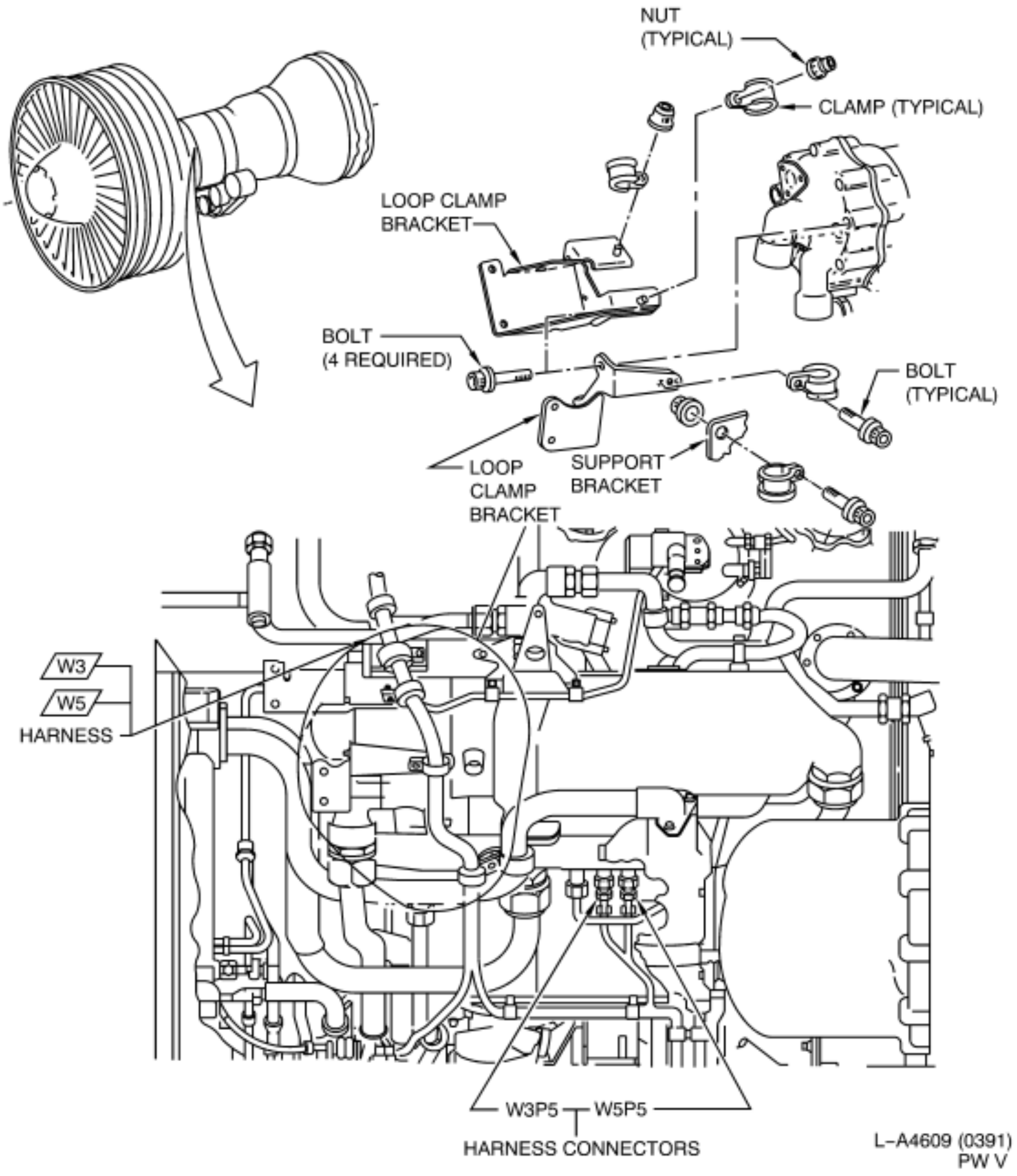
(a) Disconnect W3P5 and W5P5 harness connectors from oil cooler bypass valve solenoid.

(b) Remove bolts and nuts securing W3 and W5 harness to brackets at front of cooler and bracket below cooler.

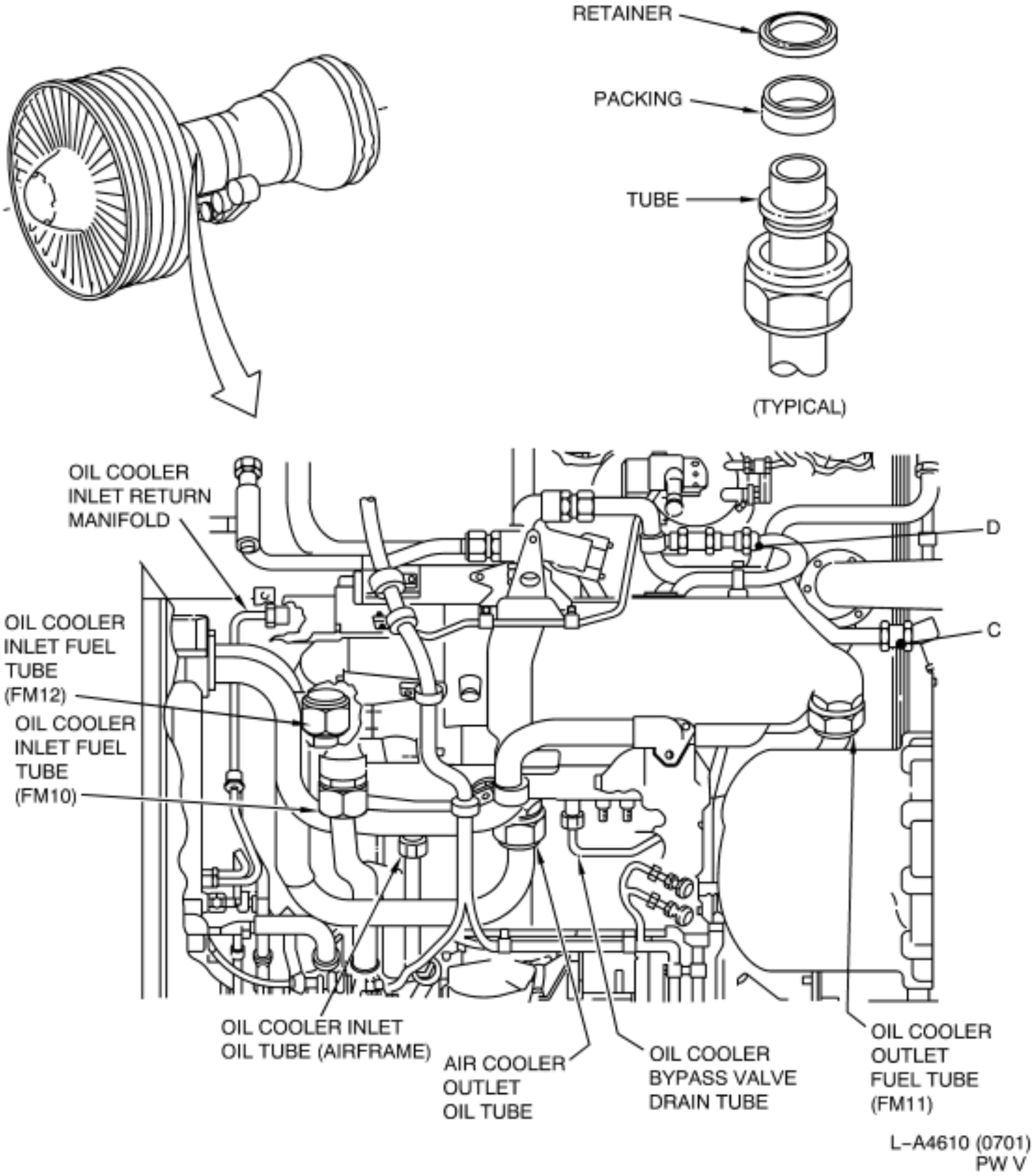
(c) Install protective closures to connectors.

(d) Remove four bolts securing loop clamp brackets to fuel/oil cooler. Remove brackets and reinstall bolts handtight.

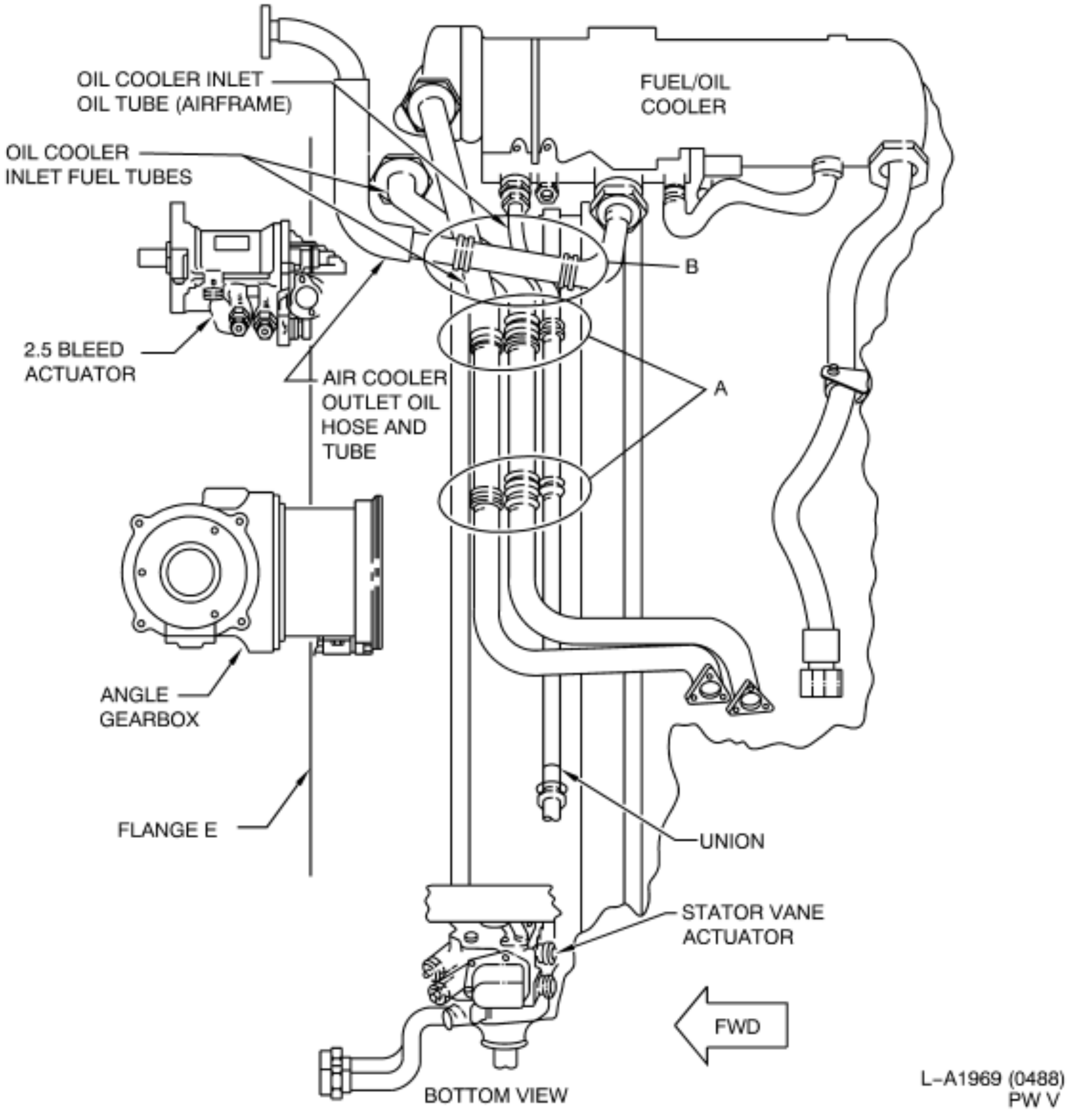
R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH
R CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND
R INSTALL A TUBE WITH A FLEX SEGMENT WITH THE
R SAME PRECAUTION USED FOR A TUBE WITHOUT A
R FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A
R TUBE TO HELP WITH THE INSTALLATION OR REMOVAL
R OF THE TUBE OR AN ATTACHED COMPONENT. IF A
R FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE
R A KINK IN THE EXTERNAL WIRE BRAID AND IN THE


NUT (TYPICAL)
CLAMP (TYPICAL)
LOOP CLAMP BRACKET
BOLT (4 REQUIRED)
BOLT (TYPICAL)
LOOP CLAMP BRACKET
SUPPORT BRACKET
W3
W5
HARNESS
W3P5
W5P5
HARNESS CONNECTORS
L-A4609 (0391)
PW V

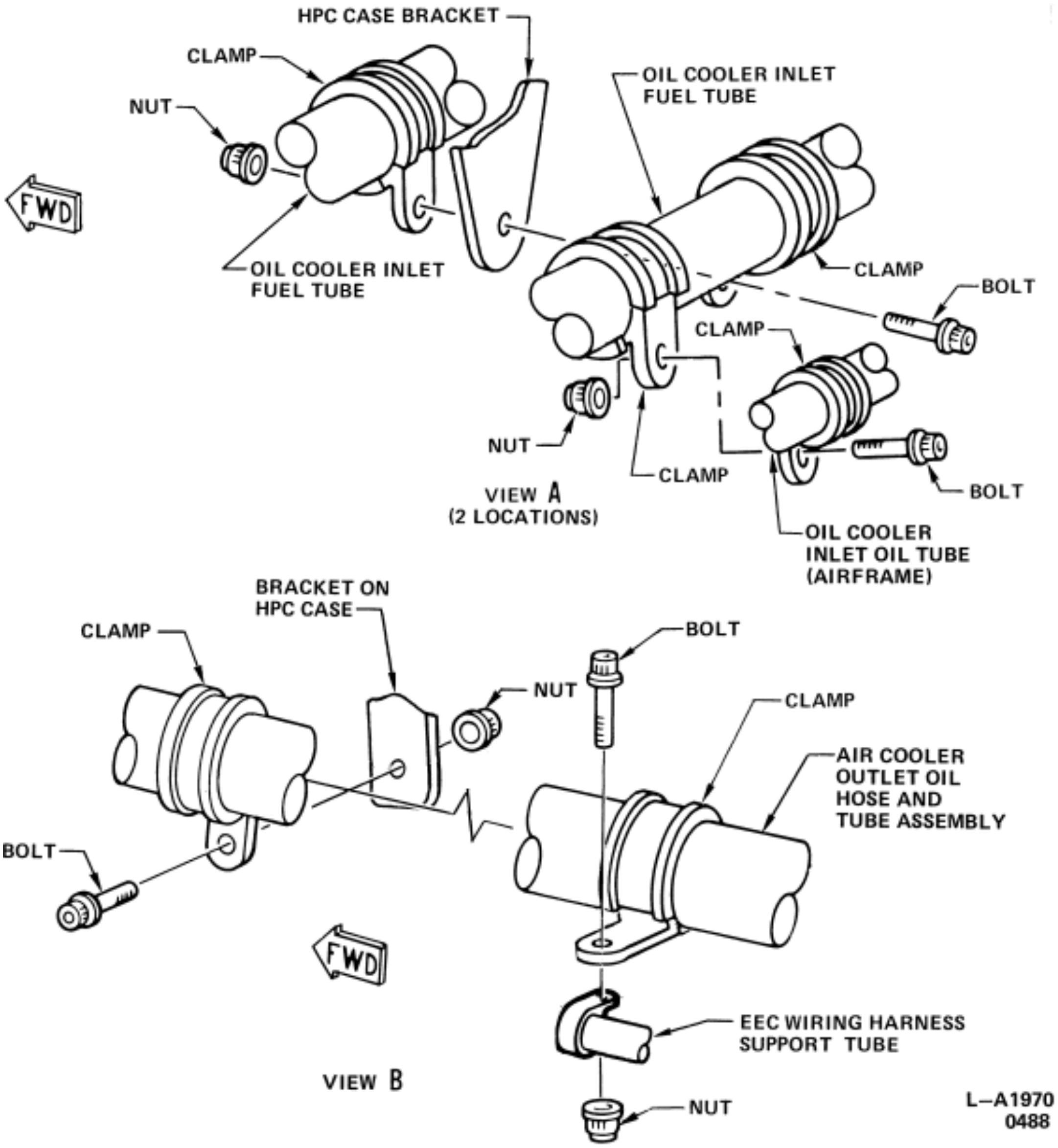
EEC Wiring Harness And Support Brackets
Figure 301
(Task 72-00-35-050-001-A)


RETAINER
PACKING
TUBE
(TYPICAL)
OIL COOLER INLET RETURN MANIFOLD
OIL COOLER INLET FUEL TUBE (FM12)
OIL COOLER INLET FUEL TUBE (FM10)
D
C
OIL COOLER INLET OIL TUBE (AIRFRAME)
AIR COOLER OUTLET OIL TUBE
OIL COOLER BYPASS VALVE DRAIN TUBE
OIL COOLER OUTLET FUEL TUBE (FM11)
L−A4610 (0701)
PW V

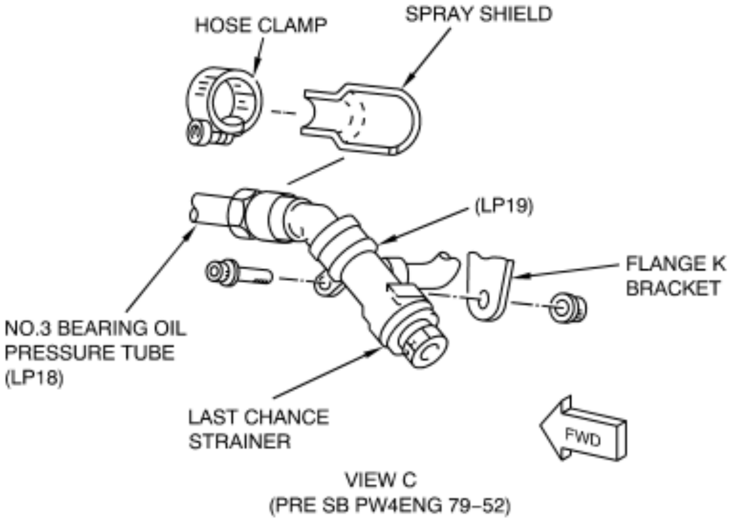
Fuel/Oil Cooler Front And Bottom Tube Connections
Figure 302 (Sheet 1)
(Task 72−00−35−050−001−A)

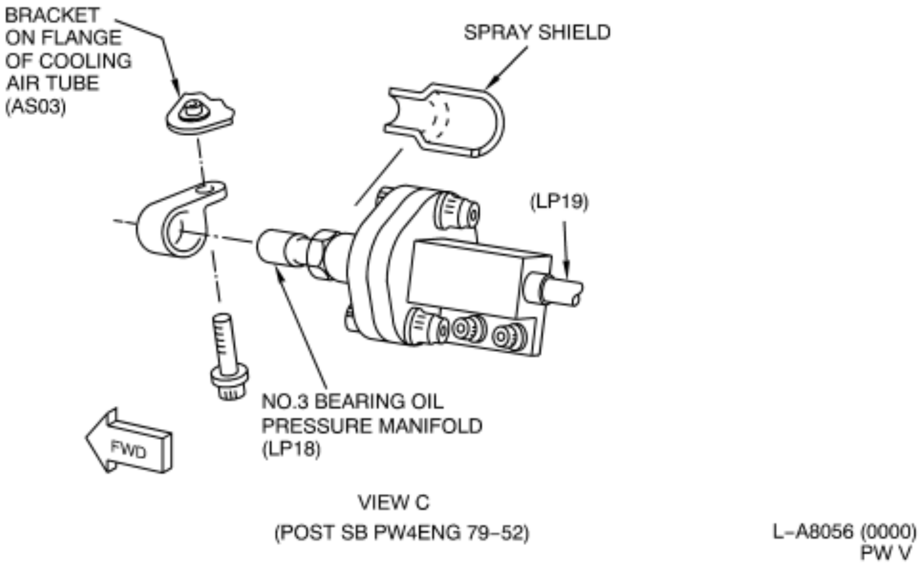

OIL COOLER INLET
OIL TUBE (AIRFRAME)
FUEL/OIL
COOLER
OIL COOLER
INLET FUEL TUBES
B
2.5 BLEED
ACTUATOR
AIR COOLER
OUTLET OIL
HOSE AND
TUBE
A
ANGLE
GEARBOX
FLANGE E
UNION
STATOR VANE
ACTUATOR
FWD
BOTTOM VIEW
L-A1969 (0488)
PW V

Fuel/Oil Cooler Front And Bottom Tube Connections (And Clamps)
Figure 302 (Sheet 2)
(Task 72-00-35-050-001-A)

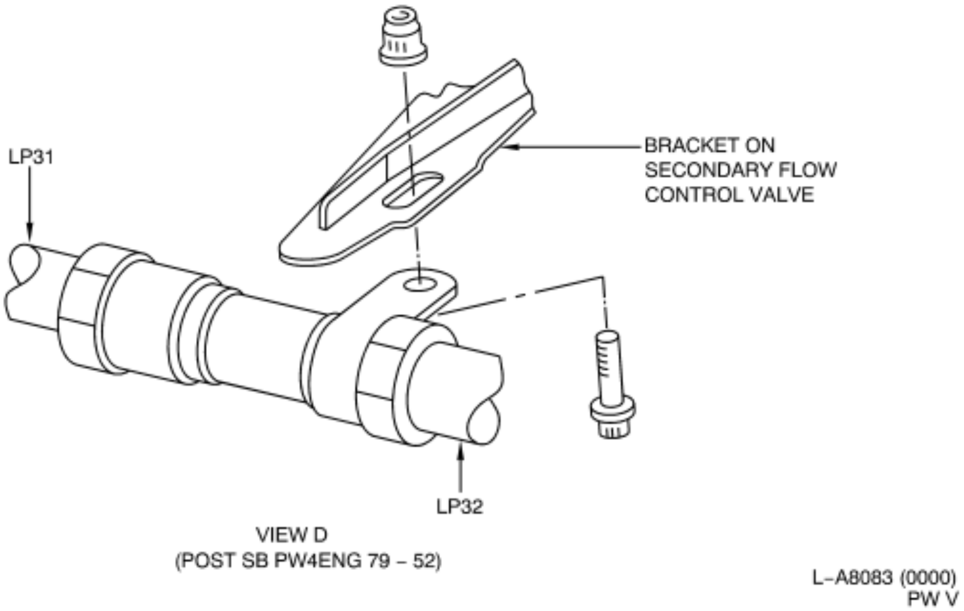

HPC CASE BRACKET
CLAMP
NUT
FWD
OIL COOLER INLET FUEL TUBE
OIL COOLER INLET FUEL TUBE
CLAMP
BOLT
CLAMP
NUT
CLAMP
BOLT
VIEW A
(2 LOCATIONS)
OIL COOLER INLET OIL TUBE (AIRFRAME)
BRACKET ON HPC CASE
CLAMP
BOLT
NUT
CLAMP
AIR COOLER OUTLET OIL HOSE AND TUBE ASSEMBLY
BOLT
FWD
EEC WIRING HARNESS SUPPORT TUBE
VIEW B
NUT
L-A1970
0488

Fuel/Oil Cooler Front And Bottom Tube Connections (And Clamps)
Figure 302 (Sheet 3)
(Task 72-00-35-050-001-A)

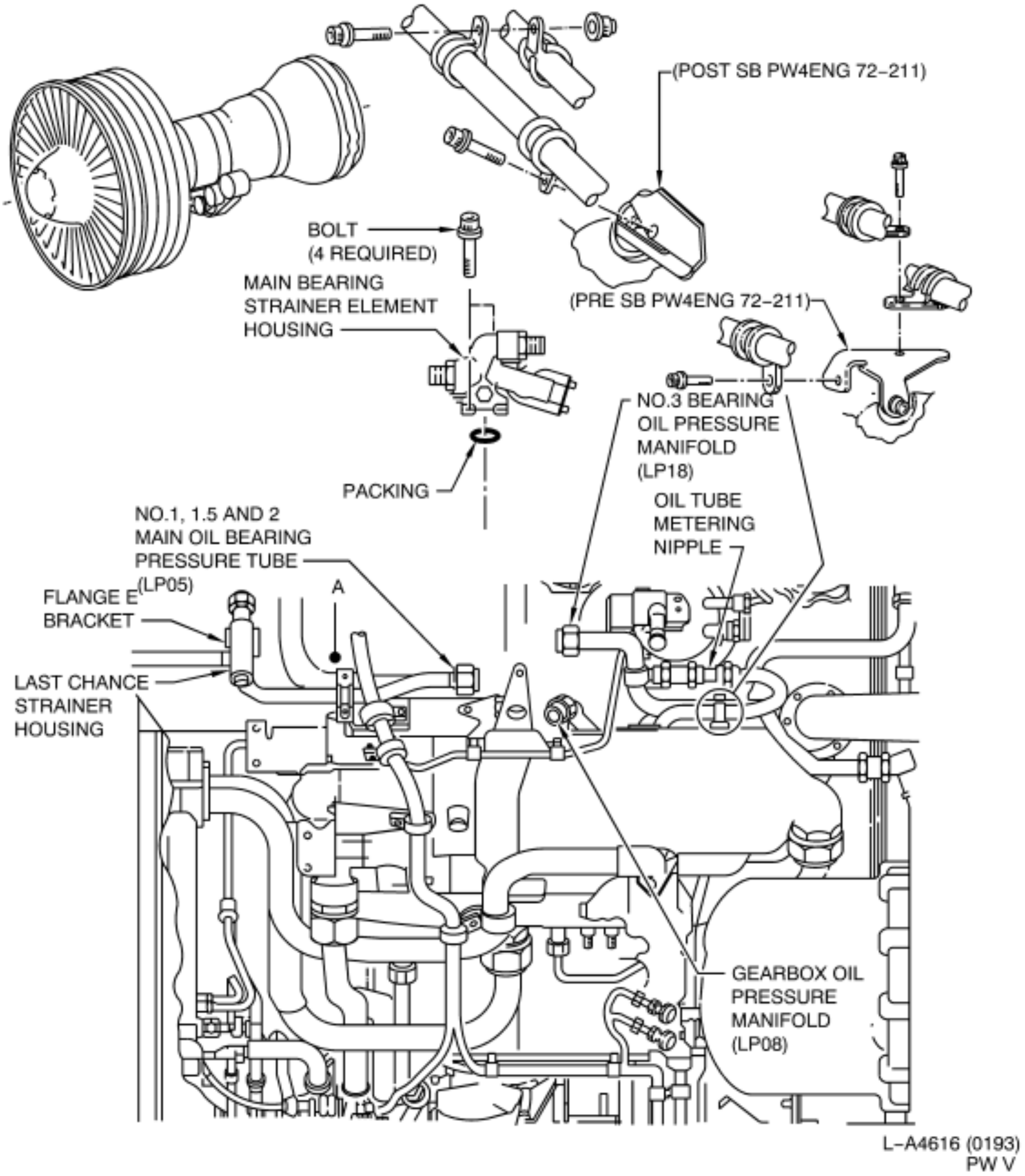

HOSE CLAMP
SPRAY SHIELD
(LP19)
FLANGE K BRACKET
NO.3 BEARING OIL PRESSURE TUBE (LP18)
LAST CHANCE STRAINER
FWD
VIEW C
(PRE SB PW4ENG 79-52)


BRACKET ON FLANGE OF COOLING AIR TUBE (AS03)
SPRAY SHIELD
(LP19)
NO.3 BEARING OIL PRESSURE MANIFOLD (LP18)
FWD
VIEW C
(POST SB PW4ENG 79-52)
L-A8056 (0000)
PW V

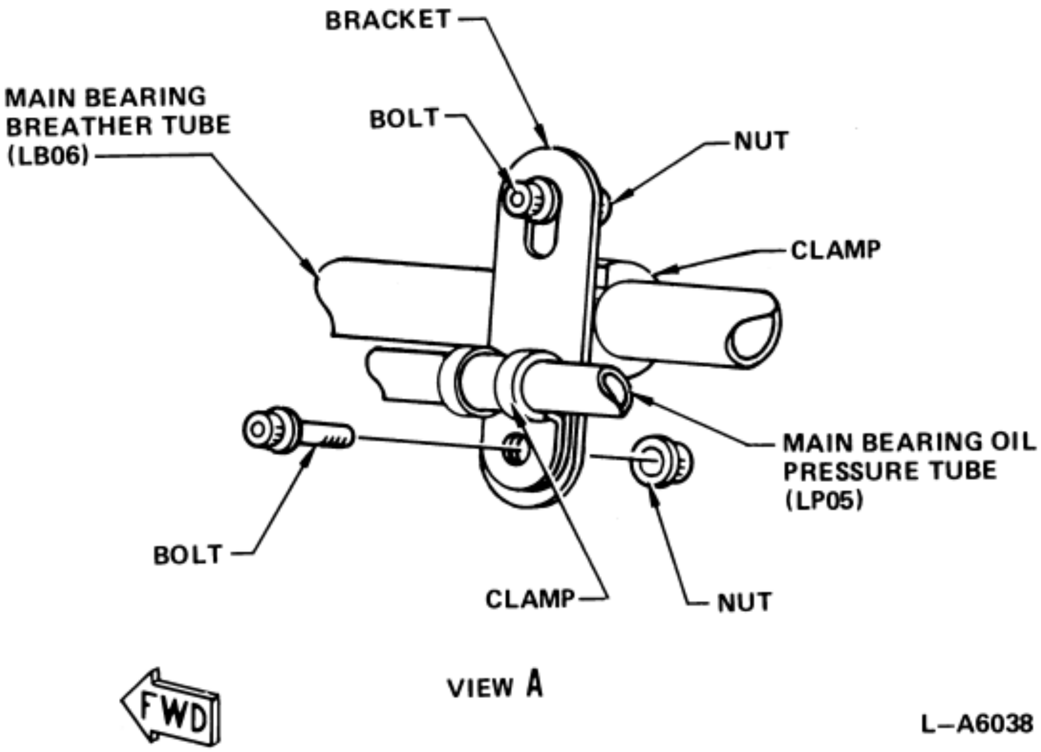
Fuel/Oil Cooler Front And Bottom Tube Connections (And Clamps)
Figure 302 (Sheet 4)
(Task 72-00-35-050-001-A)


BRACKET ON
SECONDARY FLOW
CONTROL VALVE
LP31
LP32
VIEW D
(POST SB PW4ENG 79 – 52)
L–A8083 (0000)
PW V

Fuel/Oil Cooler Front And Bottom Tube Connections (And Clamps)
Figure 302 (Sheet 5)
(Task 72−00−35−050−001−A)

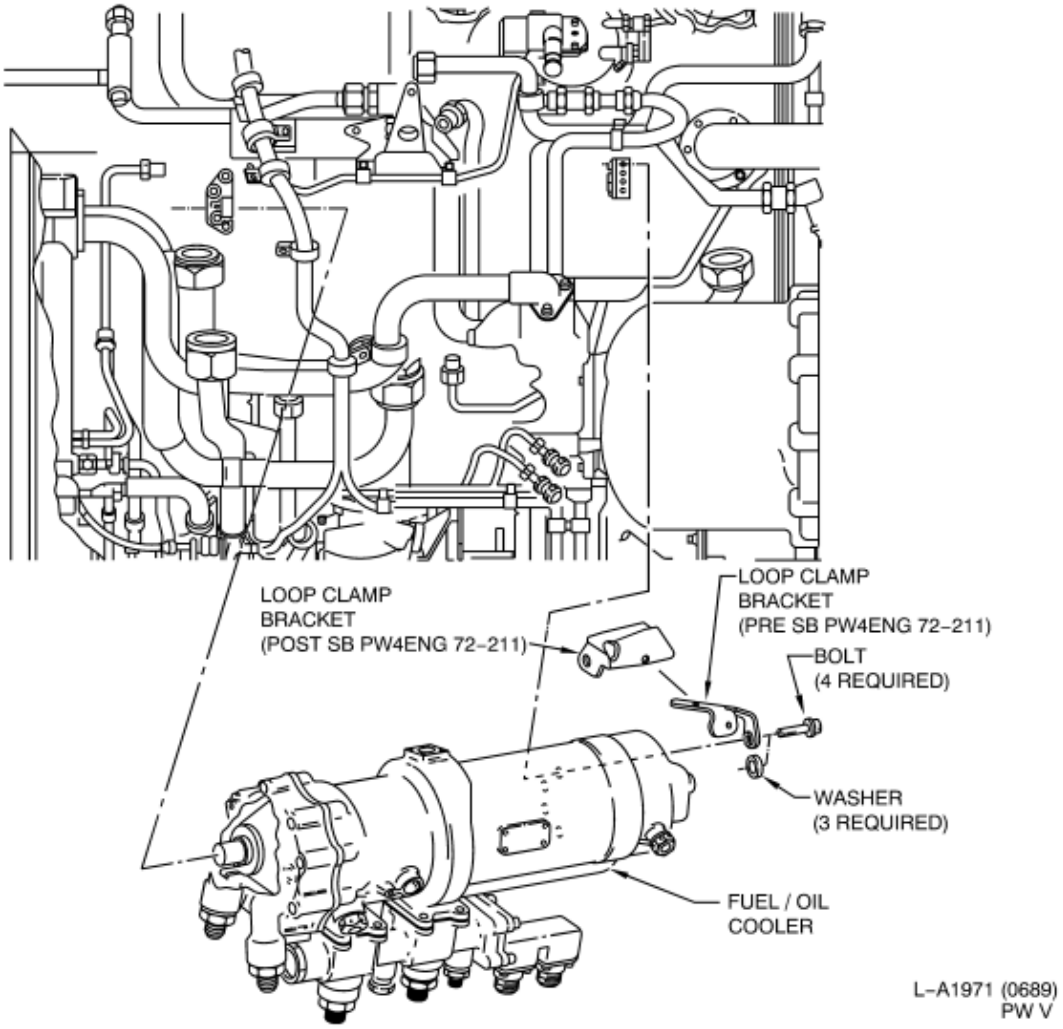

(POST SB PW4ENG 72-211)
BOLT
(4 REQUIRED)
MAIN BEARING
STRAINER ELEMENT
HOUSING
(PRE SB PW4ENG 72-211)
NO.3 BEARING
OIL PRESSURE
MANIFOLD
(LP18)
PACKING
OIL TUBE
METERING
NIPPLE
NO.1, 1.5 AND 2
MAIN OIL BEARING
PRESSURE TUBE
(LP05)
A
FLANGE E
BRACKET
LAST CHANCE
STRAINER
HOUSING
GEARBOX OIL
PRESSURE
MANIFOLD
(LP08)
L-A4616 (0193)
PW V

Main Bearing Strainer Element Housing
Figure 303 (Sheet 1)
(Task 72-00-35-050-001-A)

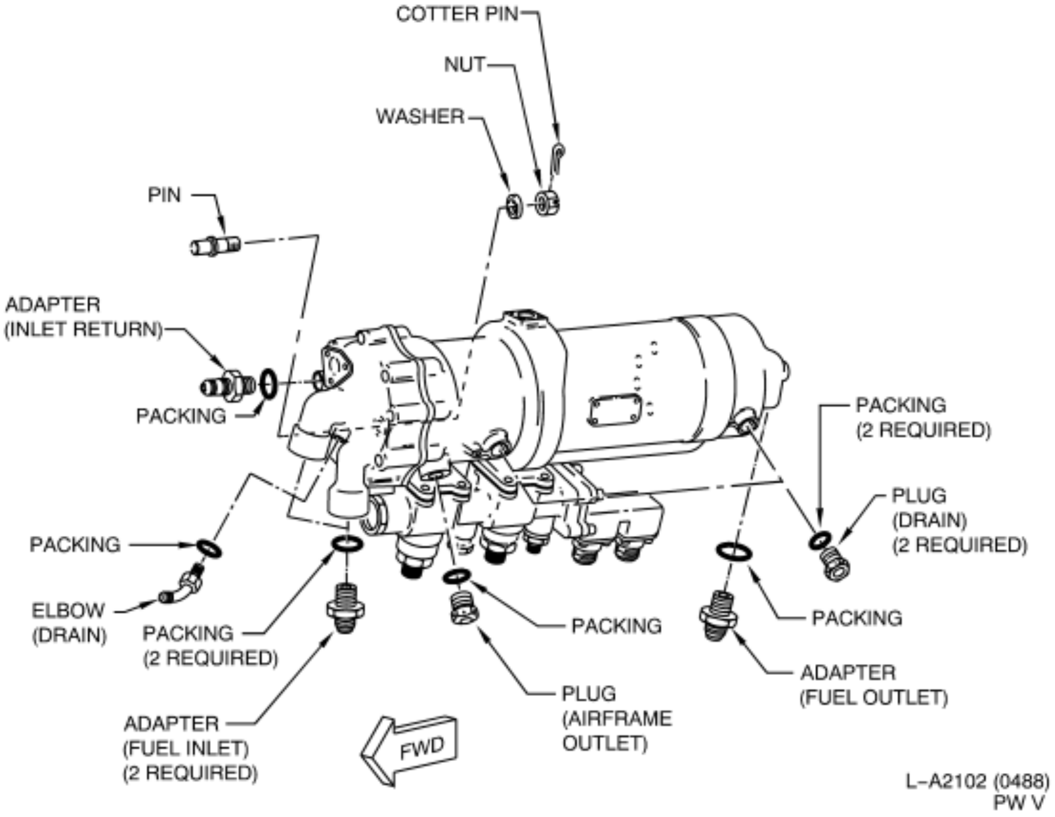

BRACKET
MAIN BEARING BREATHER TUBE (LB06)
BOLT
NUT
CLAMP
MAIN BEARING OIL PRESSURE TUBE (LP05)
BOLT
CLAMP
NUT
FWD
VIEW A
L-A6038

Main Bearing Strainer Element Housing
Figure 303 (Sheet 2)
(Task 72-00-35-050-001-A)

R
R


LOOP CLAMP
BRACKET
(POST SB PW4ENG 72-211)
LOOP CLAMP
BRACKET
(PRE SB PW4ENG 72-211)
BOLT
(4 REQUIRED)
WASHER
(3 REQUIRED)
FUEL / OIL
COOLER
L-A1971 (0689)
PW V

Fuel/Oil Cooler Front And Rear Mounts
Figure 304
(Task 72-00-35-050-001-A)


COTTER PIN
NUT
WASHER
PIN
ADAPTER (INLET RETURN)
PACKING
PACKING (2 REQUIRED)
PLUG (DRAIN) (2 REQUIRED)
PACKING
ELBOW (DRAIN)
PACKING (2 REQUIRED)
PACKING
PACKING
ADAPTER (FUEL OUTLET)
PLUG (AIRFRAME OUTLET)
ADAPTER (FUEL INLET) (2 REQUIRED)
FWD
L−A2102 (0488)
PW V

Fuel/Oil Cooler Assembly
Figure 305
(Task 72−00−35−050−001−A)

R INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND
R LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(2) Disconnect tubes from fuel/oil cooler and fuel/oil cooler bypass valve as follows. See Figure 307.

NOTE: Be prepared to catch fuel and oil in a container with a minimum capacity of 5 U.S. gallons (19 liters).

(a) Remove lockwire and disconnect oil cooler inlet return manifold (CR04) from front of fuel/oil cooler.

(b) Remove lockwire and disconnect two oil cooler inlet fuel tubes (FM10) and (FM12) from bottom of fuel/oil cooler.

(c) Remove lockwire and disconnect oil cooler inlet oil tube (LS05) (airframe) from fuel/oil cooler bypass valve.

(d) Remove lockwire and disconnect air cooler outlet oil hose and tube assembly (LP03) from fuel/oil cooler bypass valve.

(e) Remove lockwire and disconnect oil cooler bypass valve drain tube (LP20) from fuel/oil cooler bypass valve.

(f) Remove lockwire and disconnect oil cooler outlet fuel tube (FM11) from rear of fuel/oil cooler.

(3) Remove main bearing strainer housing as follows. See Figure 308.

NOTE: Be prepared to catch fuel and oil in a container with a minimum capacity of 5 U.S. gallons (19 liters).

CAUTION: YOU MUST USE THE WRENCHING FLATS ON THE MATING PARTS WHEN YOU LOOSEN OR TIGHTEN ANY OR ALL TUBE NUTS. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

(a) (Post SB PW4ENG 79−52), Remove the bolt, nut and clamp that attach the tube (LP32) to a bracket on the flange of the secondary flow control valve.

(b) Remove the lockwire. Use the wrenching flats to disconnect the tube nuts from the oil tube metering nipple. Loosen the clamp bolts that attach the oil trim pressure tube (LP32). Loosen the three bolts that attach the oil trim pressure tube (LP32) to the main oil filter housing. Remove the metering nipple.

(c) (Pre SB PW4ENG 79−52), Remove the lockwire and disconnect the No. 3 bearing oil pressure manifold (LP18) from the rear of the main bearing strainer housing. Remove the hose clamp, spray shield, and lockwire. Disconnect the manifold from the front of the No. 3 bearing oil strainer housing (LP19). Remove the attaching hardware. Remove the tube.

(d) (Post SB PW4ENG 79−52), Remove the lockwire and disconnect the No. 3 bearing oil pressure manifold (LP18) from the rear of the main bearing strainer housing. Remove the bolt, clamp and spray shield from the rear of the manifold. Disconnect the manifold from the front of the No. 3 bearing pressure tube (LP19). Remove the attaching hardware and remove the tube from the engine.

(e) Remove lockwire and disconnect gearbox oil pressure manifold (LP08) from inboard side of strainer housing.

(f) Disconnect the No. 1, 1.5 and 2 main bearing oil pressure tube (LP05) as follows. See Figure 303.

1 Remove the lockwire and disengage the tube nuts from the front side of the main bearing strainer element housing and from the strainer housing attached to the bracket on Flange E.

2 Loosen the clamp bolt that attaches the tube to the bracket on Flange E.

3 (Post SB PW4ENG 79−33), Remove the bolt and nut that attach the main bearing oil pressure tube (LP05) to a bracket on the main bearing breather tube (LB06). Clamp can stay with tube.

4 Disengage the tube from the strainer housings.

(g) Remove four bolts securing strainer housing to top of fuel/oil cooler. Reposition brackets on strainer housing flange with W5 harness attached and remove strainer housing.

(h) Remove packings from tubes and strainer housing flange and discard.

(i) Install protective closures.

(4) Remove fuel/oil cooler as follows. See Figure 309.

(a) Remove two bolts securing front oil cooler bracket to HPC case bracket.

(b) Remove four bolts and three washers securing rear of oil cooler to HPC case bracket. Reposition loop clamp bracket rearward.

WARNING: TAKE NECESSARY PRECAUTIONS TO AVOID EXCESSIVE CONTACT WITH FUEL AND OIL DRAINAGE DURING REMOVAL OF COOLER.

(c) Raise cooler off tube connections and move outward and rearward. Reposition W3 and W5 harness forward of cooler. Remove cooler from engine forward end first.

(d) Remove front oil cooler bracket from pin on cooler.

(e) Remove all packings and retainers from tubes and discard.

(f) Install protective closures.

(5) If fuel/oil cooler is to be replaced, comply with the following. See Figure 310.

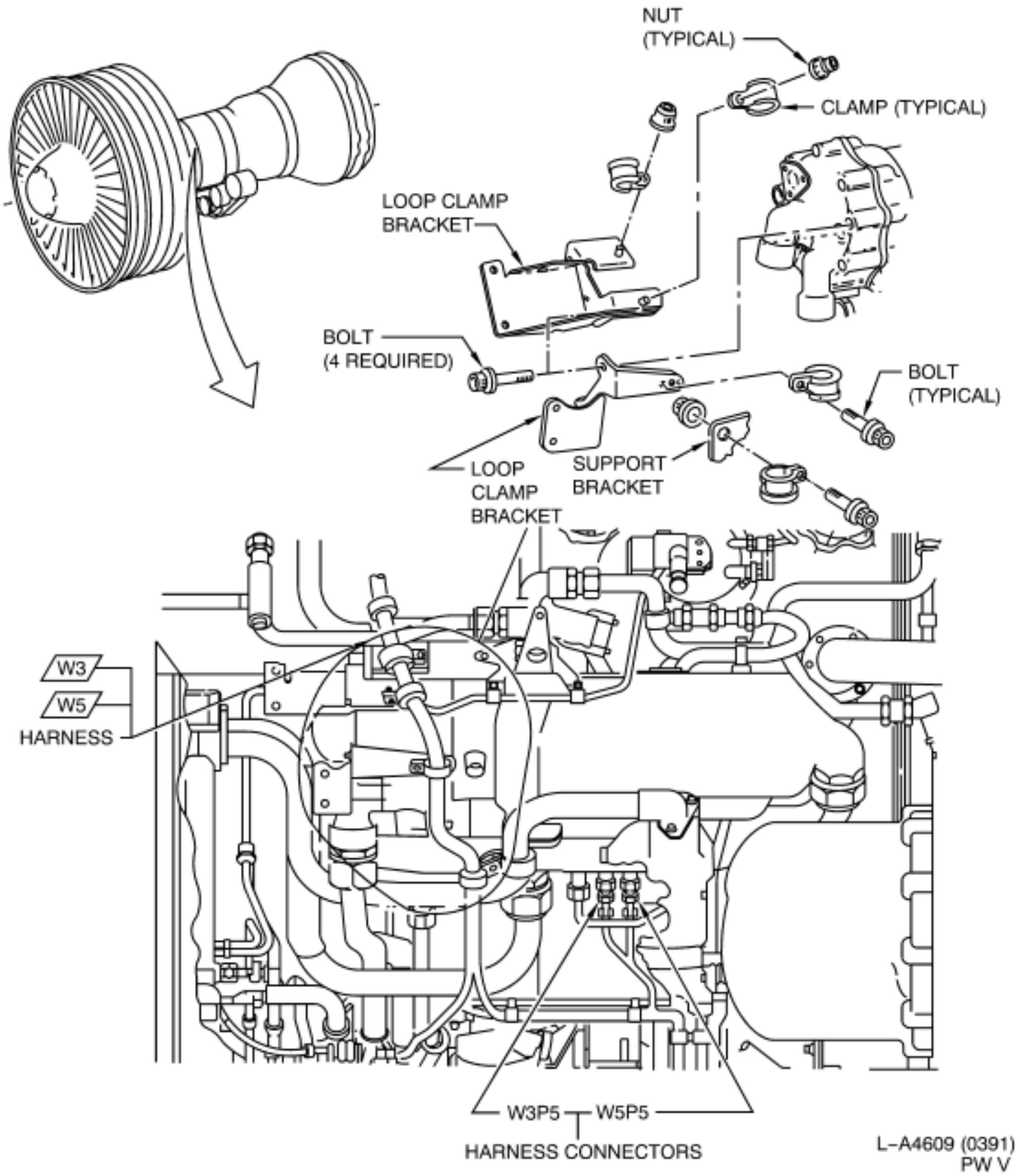
(a) Remove tube adapters and plugs from fuel/oil cooler. Discard packings.

(b) Remove cotter pin, nut, pin, and oil cooler bracket retainer from fuel/oil cooler front ear.

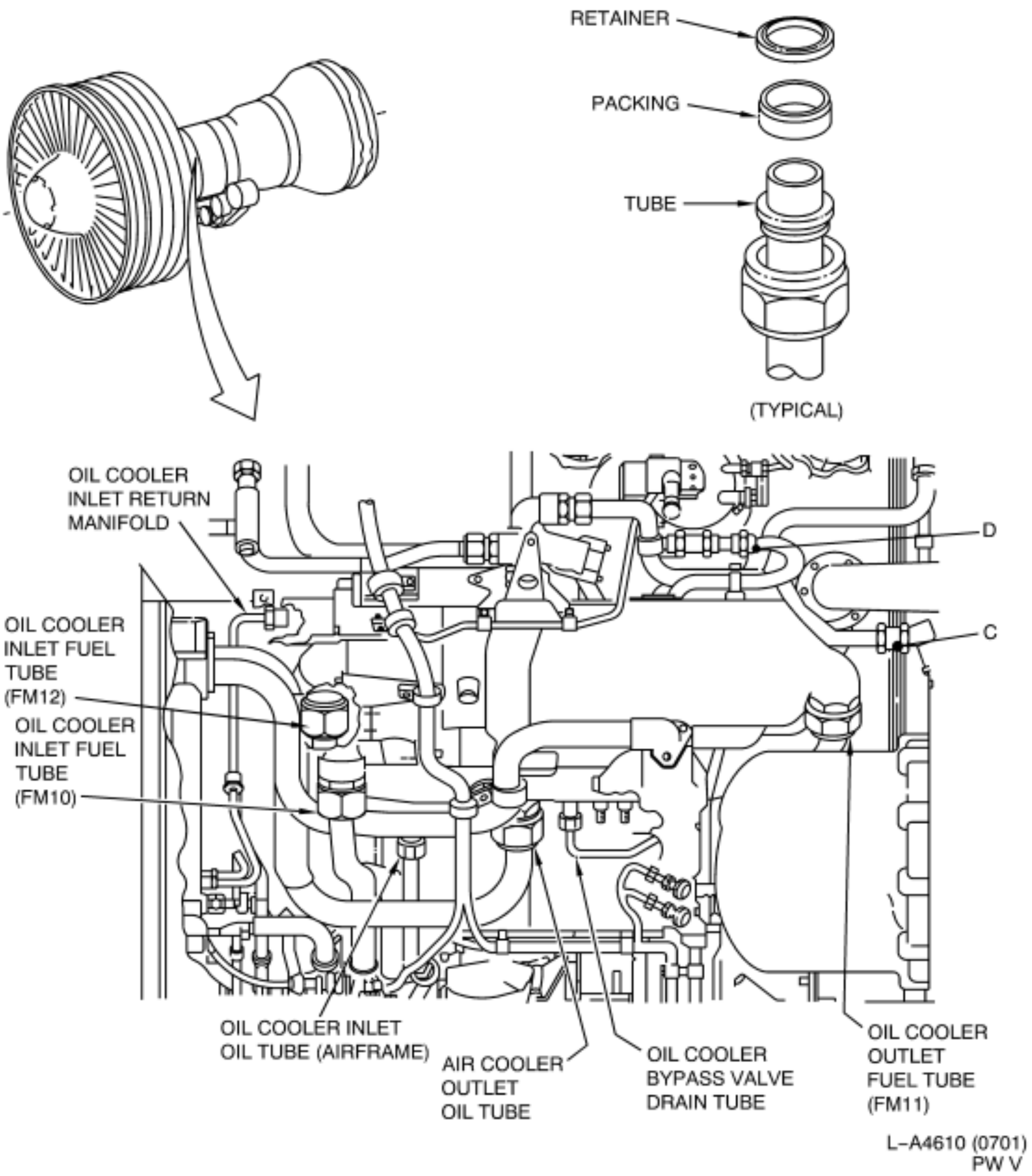
(c) Remove fuel/oil cooler bypass valve and adapters if necessary. See Removal−11 (Task 72−00−35−050−008).

(d) Install protective closures.

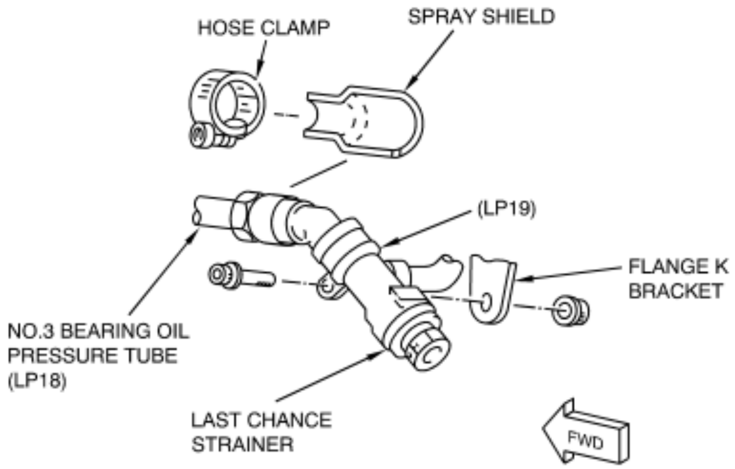
NOTE: For additional information concerning detailed maintenance of this component, see Fuel/Oil Heat Exchanger Component Maintenance Manual, 79−21−15, (Serck Heat Transfer).


NUT
(TYPICAL)
CLAMP (TYPICAL)
LOOP CLAMP
BRACKET
BOLT
(4 REQUIRED)
BOLT
(TYPICAL)
SUPPORT
BRACKET
LOOP
CLAMP
BRACKET
W3
W5
HARNESS
W3P5
W5P5
HARNESS CONNECTORS
L-A4609 (0391)
PW V

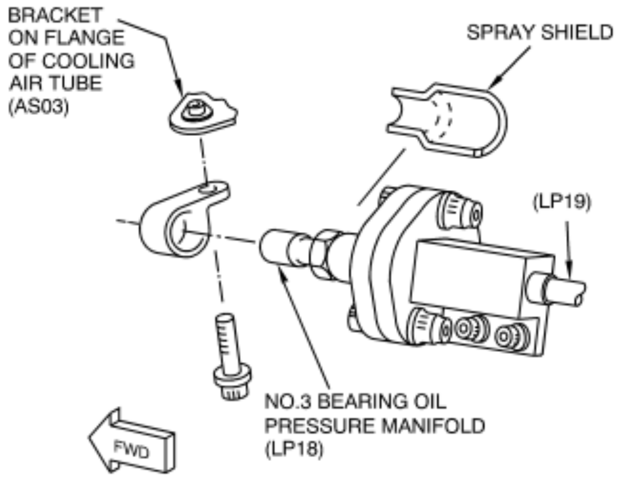
EEC Wiring Harness And Support Brackets
Figure 306
(Task 72-00-35-050-001-B)


RETAINER
PACKING
TUBE
(TYPICAL)
OIL COOLER INLET RETURN MANIFOLD
D
OIL COOLER INLET FUEL TUBE (FM12)
C
OIL COOLER INLET FUEL TUBE (FM10)
OIL COOLER INLET OIL TUBE (AIRFRAME)
AIR COOLER OUTLET OIL TUBE
OIL COOLER BYPASS VALVE DRAIN TUBE
OIL COOLER OUTLET FUEL TUBE (FM11)
L-A4610 (0701)
PW V

Fuel/Oil Cooler Front And Bottom Tube Connections
Figure 307 (Sheet 1)
(Task 72-00-35-050-001-B)


HOSE CLAMP
SPRAY SHIELD
(LP19)
FLANGE K BRACKET
NO.3 BEARING OIL PRESSURE TUBE (LP18)
LAST CHANCE STRAINER
FWD

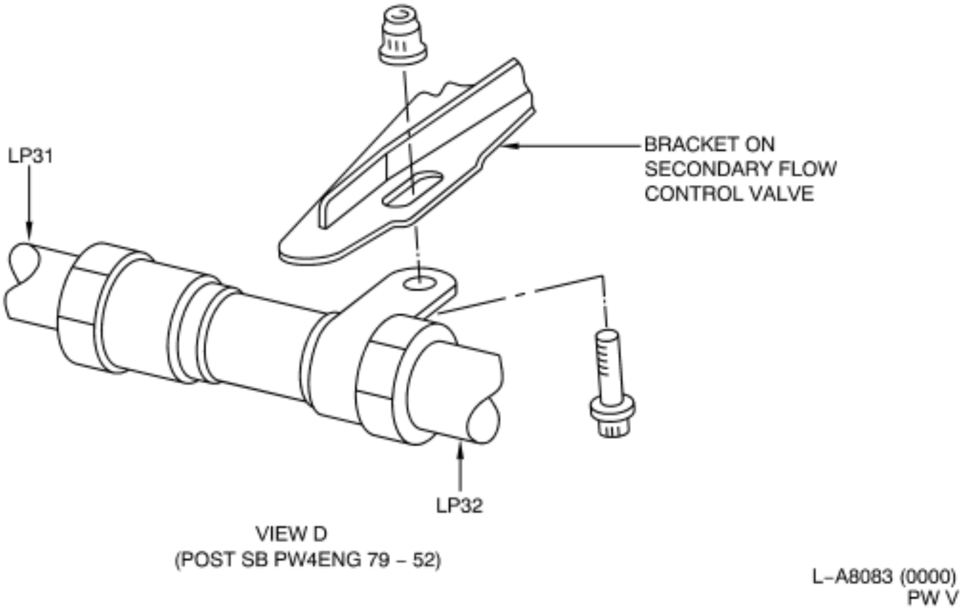
VIEW C
(PRE SB PW4ENG 79-52)


BRACKET ON FLANGE OF COOLING AIR TUBE (AS03)
SPRAY SHIELD
(LP19)
NO.3 BEARING OIL PRESSURE MANIFOLD (LP18)
FWD

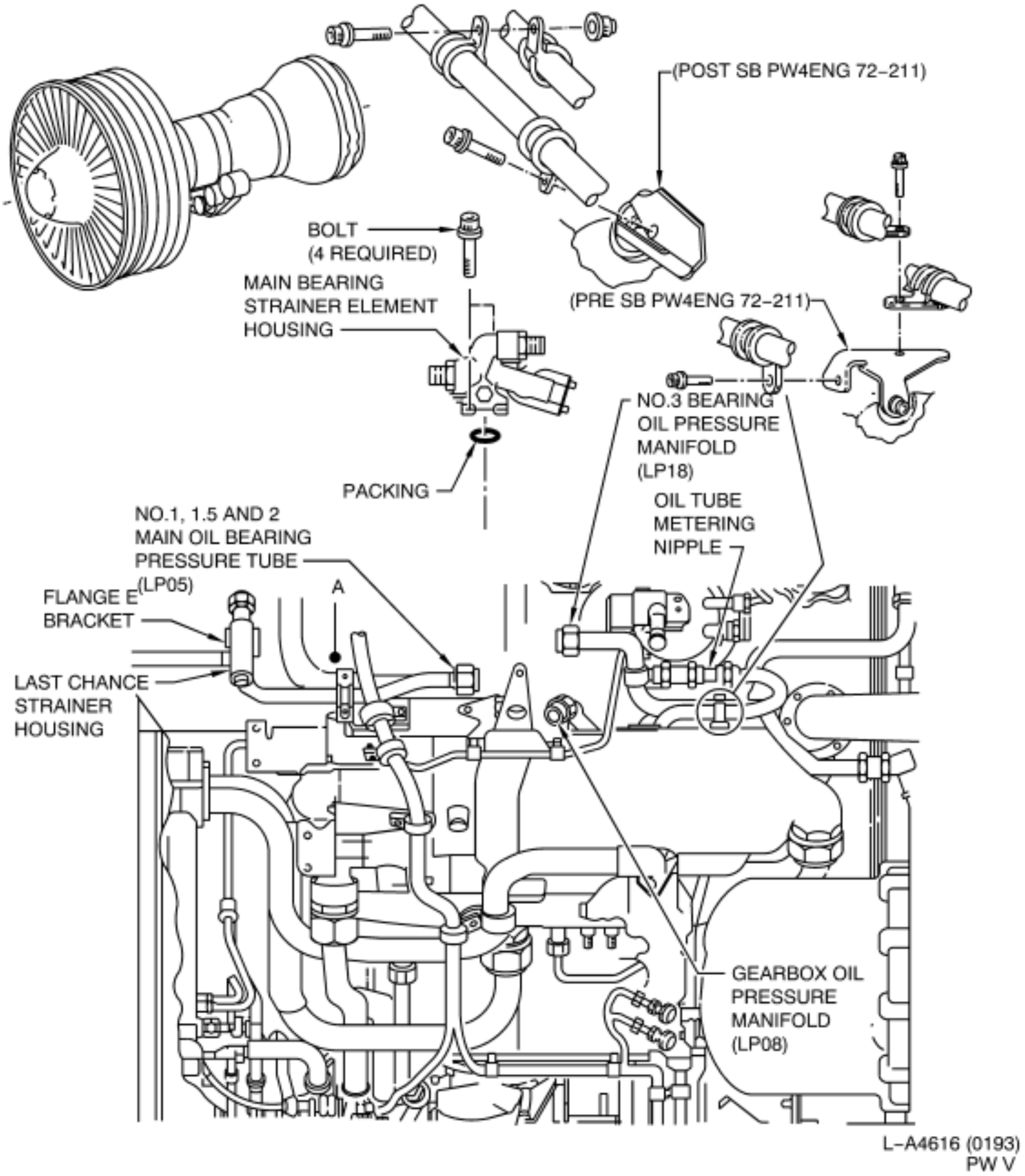
VIEW C
(POST SB PW4ENG 79-52)

L-A8056 (0000)
PW V

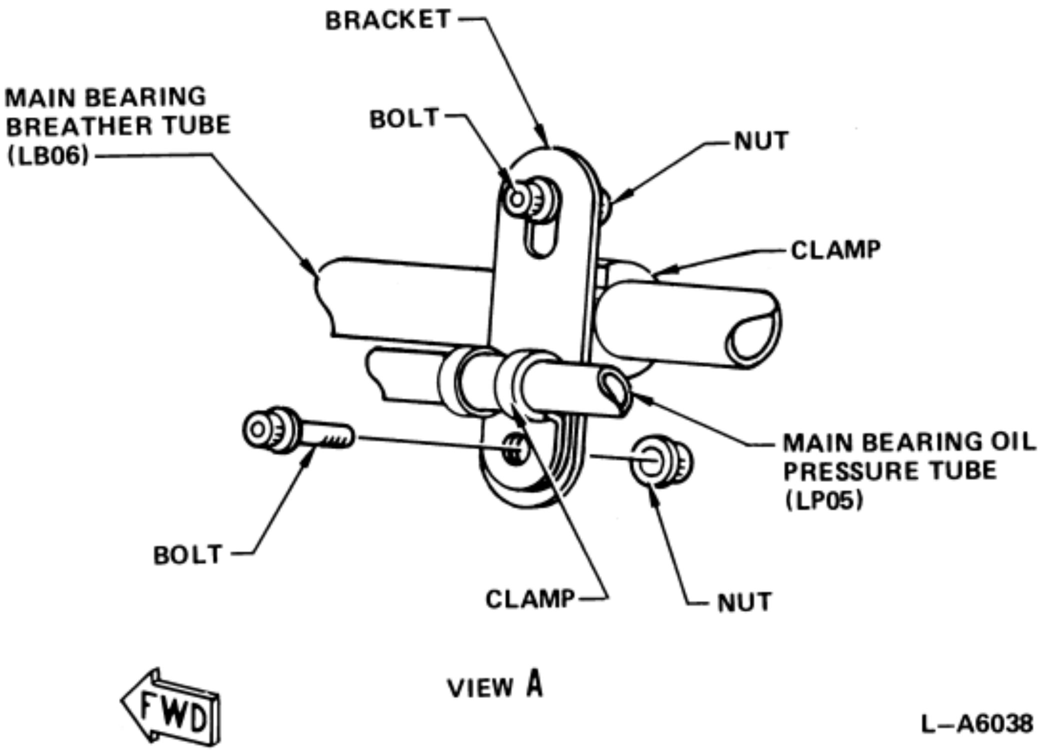
Fuel/Oil Cooler Front And Bottom Tube Connections
Figure 307 (Sheet 2)
(Task 72-00-35-050-001-B)


BRACKET ON SECONDARY FLOW CONTROL VALVE
LP31
LP32
VIEW D
(POST SB PW4ENG 79 – 52)
L–A8083 (0000)
PW V

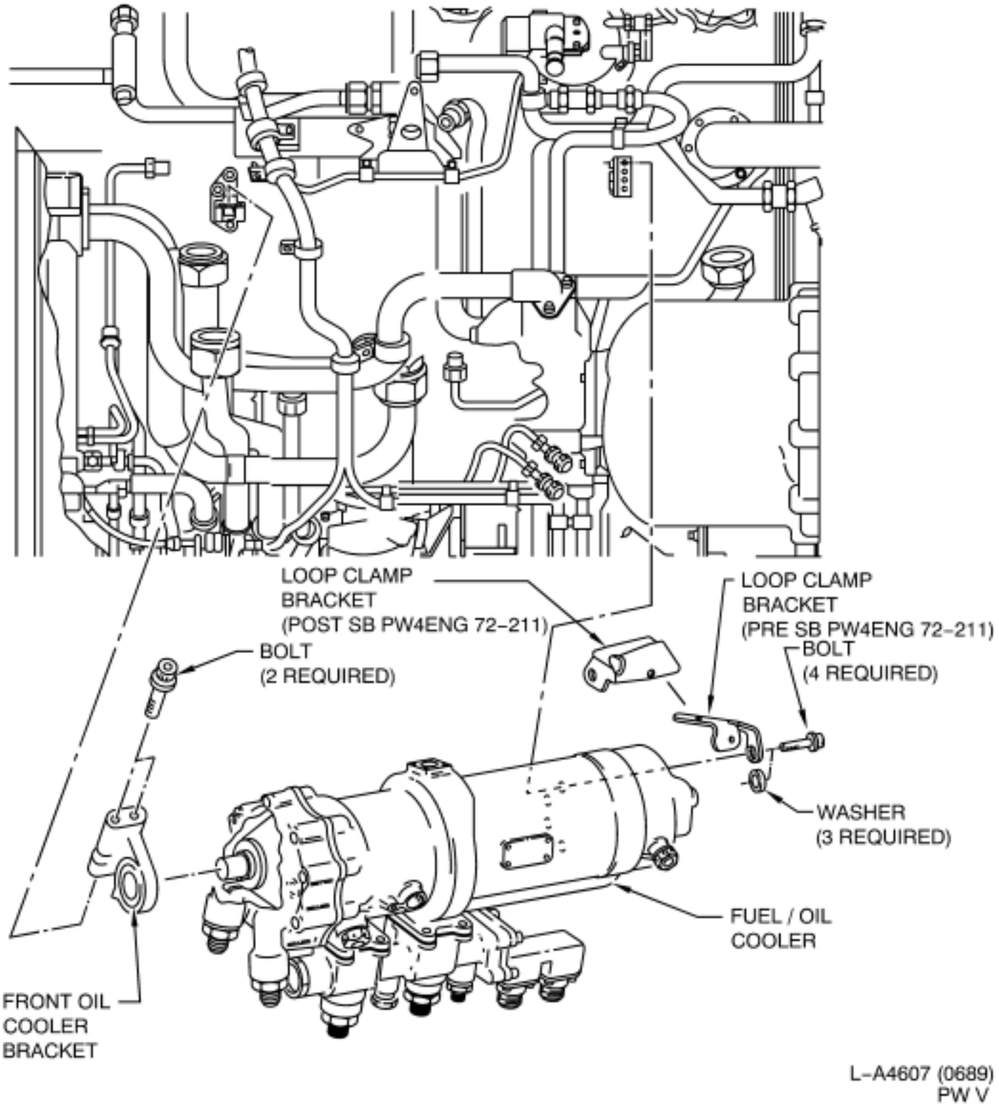
Fuel/Oil Cooler Front And Bottom Tube Connections
Figure 307 (Sheet 3)
(Task 72−00−35−050−001−B)


(POST SB PW4ENG 72-211)
BOLT
(4 REQUIRED)
MAIN BEARING
STRAINER ELEMENT
HOUSING
(PRE SB PW4ENG 72-211)
NO.3 BEARING
OIL PRESSURE
MANIFOLD
(LP18)
PACKING
OIL TUBE
METERING
NIPPLE
NO.1, 1.5 AND 2
MAIN OIL BEARING
PRESSURE TUBE
(LP05)
FLANGE E
BRACKET
A
LAST CHANCE
STRAINER
HOUSING
GEARBOX OIL
PRESSURE
MANIFOLD
(LP08)
L-A4616 (0193)
PW V

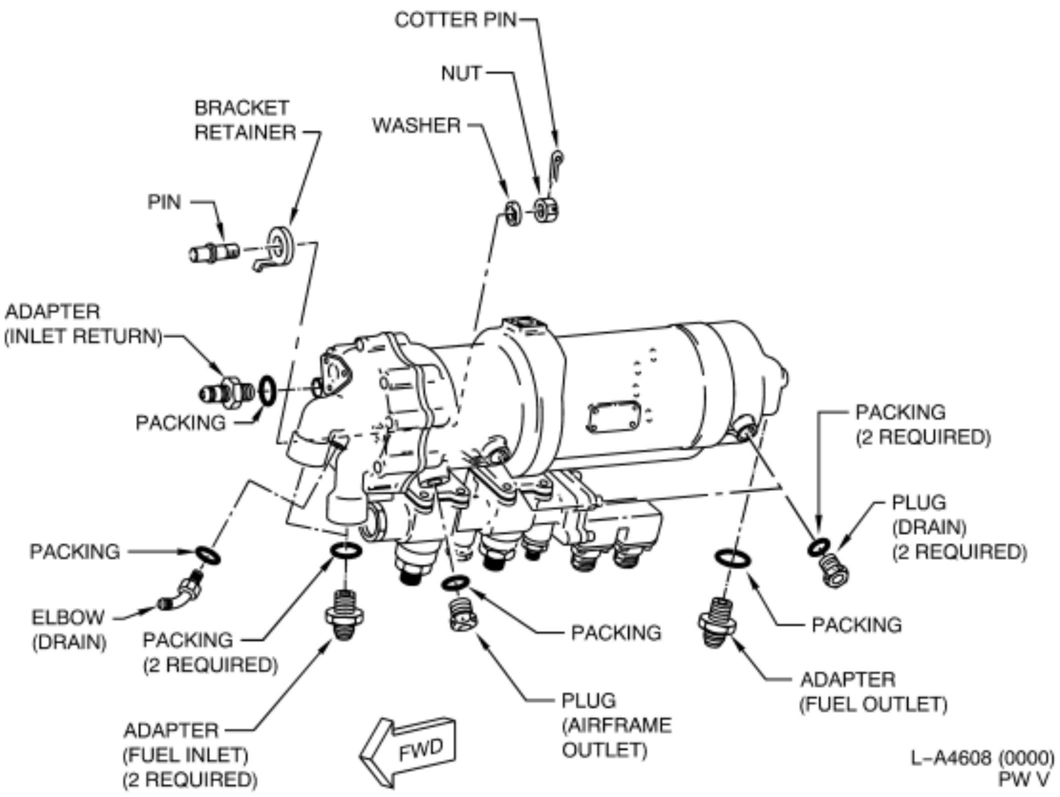
Main Bearing Strainer Element Housing
Figure 308 (Sheet 1)
(Task 72-00-35-050-001-B)


BRACKET
MAIN BEARING BREATHER TUBE (LB06)
BOLT
NUT
CLAMP
MAIN BEARING OIL PRESSURE TUBE (LP05)
BOLT
CLAMP
NUT
FWD
VIEW A
L-A6038

Main Bearing Strainer Element Housing
Figure 308 (Sheet 2)
(Task 72-00-35-050-001-B)


LOOP CLAMP
BRACKET
(POST SB PW4ENG 72-211)
LOOP CLAMP
BRACKET
(PRE SB PW4ENG 72-211)
BOLT
(2 REQUIRED)
BOLT
(4 REQUIRED)
WASHER
(3 REQUIRED)
FUEL / OIL
COOLER
FRONT OIL
COOLER
BRACKET
L-A4607 (0689)
PW V

Fuel/Oil Cooler Front And Rear Mounts
Figure 309
(Task 72−00−35−050−001−B)


COTTER PIN
NUT
BRACKET RETAINER
WASHER
PIN
ADAPTER (INLET RETURN)
PACKING
PACKING (2 REQUIRED)
PLUG (DRAIN) (2 REQUIRED)
PACKING
ELBOW (DRAIN)
PACKING (2 REQUIRED)
PACKING
PACKING
ADAPTER (FUEL OUTLET)
PLUG (AIRFRAME OUTLET)
ADAPTER (FUEL INLET) (2 REQUIRED)
FWD
L−A4608 (0000)
PW V

Fuel/Oil Cooler Assembly
Figure 310
(Task 72−00−35−050−001−B)

ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−05

Task 72−00−35−050−002:

1. Remove Turbine Case Cooling (TCC) Air Valve Actuator

A. Equipment And Materials Necessary − None

B. Procedure
See Figure 301.

R CAUTION: BE CAREFUL WHEN YOU HANDLE, REMOVE OR INSTALL
R ALL TUBES WHICH CONTAIN A FLEX DESIGN
R SEGMENT. REMOVE AND INSTALL A TUBE WITH A
R FLEX SEGMENT WITH THE SAME PRECAUTIONS
R USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO
R NOT BEND THE FLEXHOSE OF A TUBE TO HELP
R WITH THE INSTALLATION OR REMOVAL OF AN
R ATTACHED COMPONENT. IF A FLEX SEGMENT IS
R BENT TOO MUCH, THIS CAN CAUSE A KINK IN
R THE EXTERNAL WIRE BRAID AND IN THE INNER
R POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS
R OR TUBE RUPTURE CAN BE THE RESULT.

(1) Disconnect W4P16 harness connector from connector on actuator. Install protective closures.

(2) Remove nut and bolt securing cable rod end bearing to valve idler arm at turbine case cooling (TCC) air shutoff valve (HPT).

(3) Remove lockwire from cable coupling nut, and disconnect cable coupling nut from actuator.

(4) Remove lockwire and disconnect the pressure and return hoses at forward lower side of actuator.

NOTE: Be prepared to catch fuel in a container with a minimum capacity of 1 U.S. gallon (3.8 liters).

(5) Remove bolt securing ground strap to rear of actuator.

(6) Remove bolts (and nuts if equipped) securing the four hinged clamps on actuator mount rails to bracket on HPC case.

(7) Lift actuator clear of bracket pins and stop. Release cable end from actuator piston shaft and remove actuator from engine.

(8) Install protective closures.

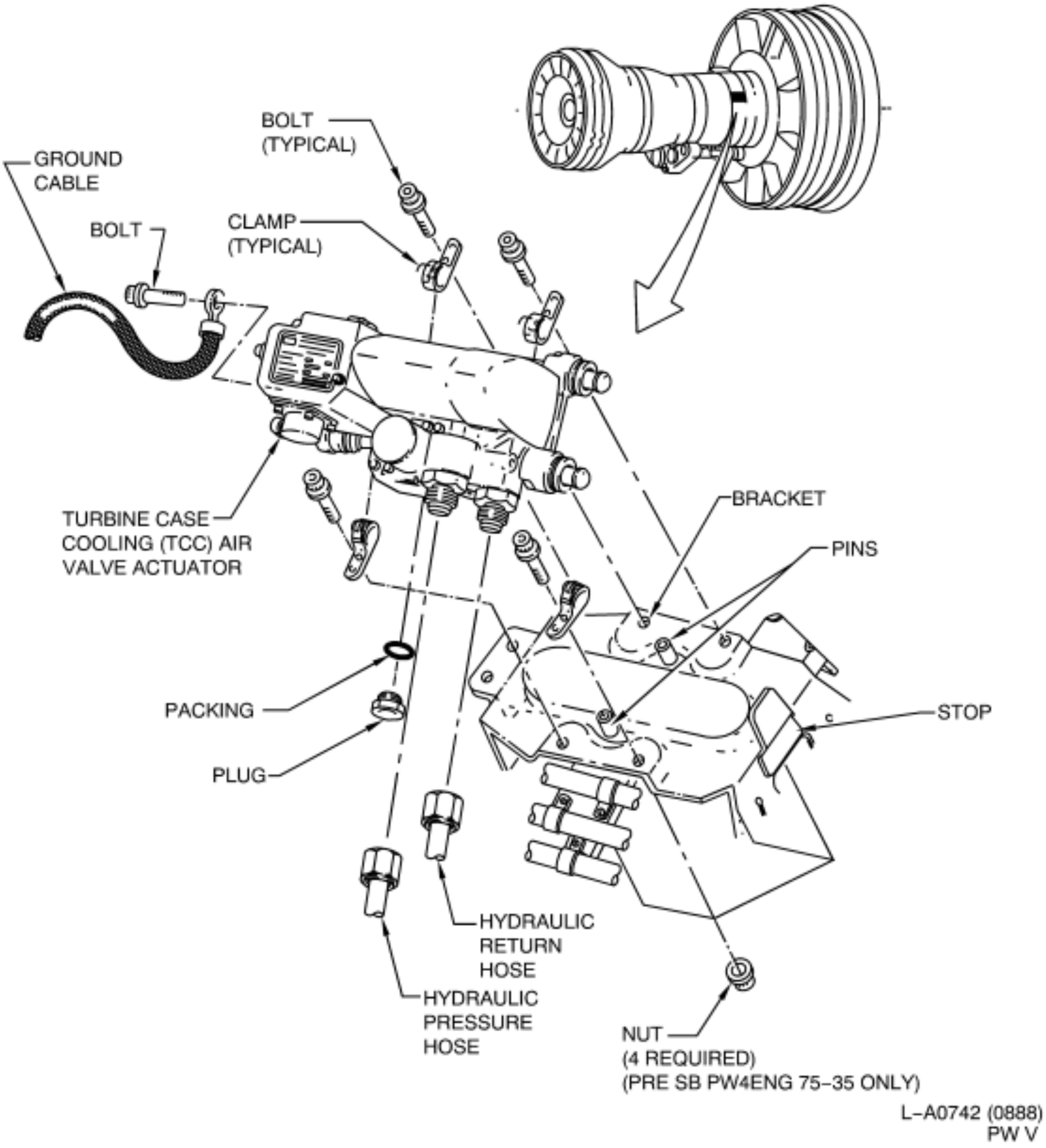
(9) If actuator is to be replaced, comply with the following.

  (a) Remove plug from lower rear port of actuator. Remove packing and discard.

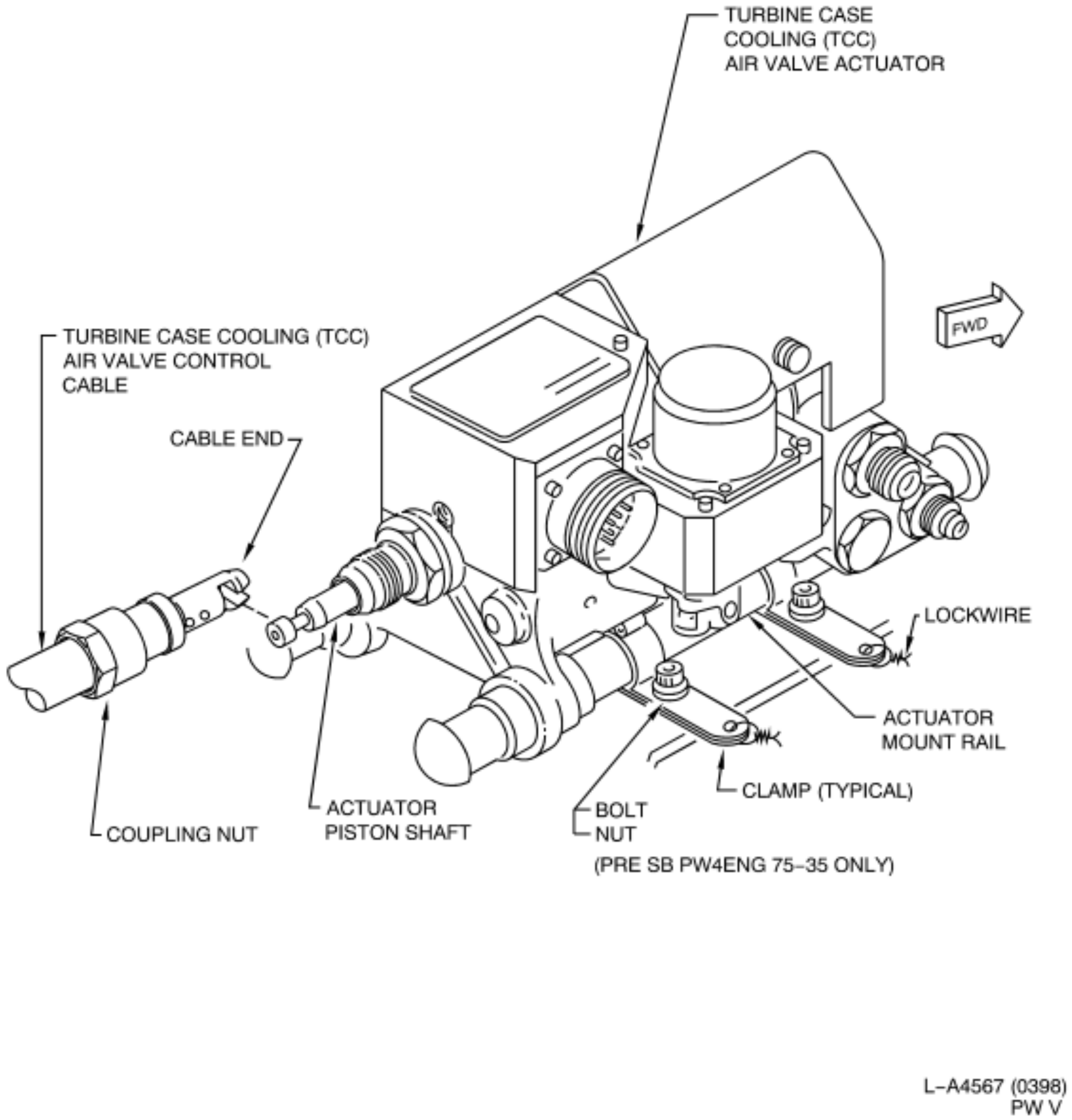
  (b) Remove lockwire and four clamps.

  (c) Install protective closure.

    NOTE: For additional information concerning detailed maintenance of the component, see Turbine Case Cooling (TCC) Air Valve Actuator Component Maintenance Manual, 75−24−14 (Parker Hannifin).


BOLT
(TYPICAL)
GROUND
CABLE
BOLT
CLAMP
(TYPICAL)
TURBINE CASE
COOLING (TCC) AIR
VALVE ACTUATOR
BRACKET
PINS
PACKING
PLUG
STOP
HYDRAULIC
RETURN
HOSE
HYDRAULIC
PRESSURE
HOSE
NUT
(4 REQUIRED)
(PRE SB PW4ENG 75-35 ONLY)
L-A0742 (0888)
PW V

Turbine Case Cooling (TCC) Air Valve Actuator
Figure 301 (Sheet 1)
(Task 72-00-35-050-002)


TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
FWD
TURBINE CASE COOLING (TCC) AIR VALVE CONTROL CABLE
CABLE END
LOCKWIRE
ACTUATOR MOUNT RAIL
CLAMP (TYPICAL)
BOLT
NUT
(PRE SB PW4ENG 75−35 ONLY)
ACTUATOR PISTON SHAFT
COUPLING NUT
L−A4567 (0398)
PW V

Turbine Case Cooling (TCC) Air Valve Actuator
Figure 301 (Sheet 2)
(Task 72−00−35−050−002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−06

Task 72−00−35−050−003:

1. Remove Turbine Vane And Blade Cooling Air Valve Position Switch

   A. Equipment And Materials Required − None

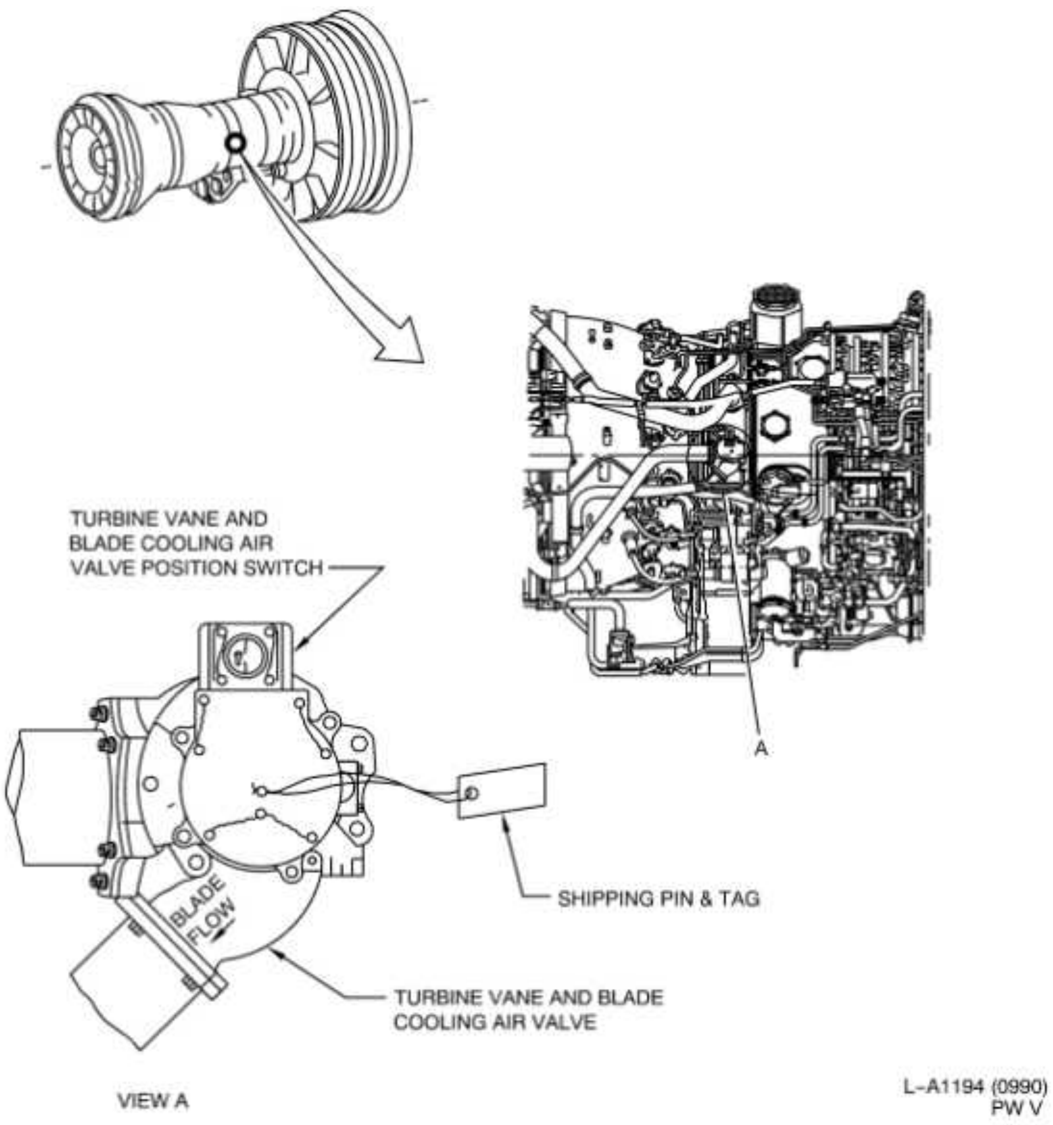
   B. Procedure
   See Figure 301.

      NOTE: This procedure is applicable for engines without SB PW4ENG 72−572 or SB PW4ENG 75−106 only or SB PW4ENG 75−756 or SB PW4ENG 75−759 or SB PW4ENG 75−147 only.

      (1) Disconnect W4P21 harness connector from turbine vane and blade cooling air valve position switch on turbine vane cooling air valve on right side of engine on HPC case at approximately the 3 o'clock position. Install protective closures.

      (2) Remove bolts securing position switch to outer surface of turbine vane and blade cooling air valve and remove position switch from engine.

         NOTE: For additional information concerning detailed maintenance of this component see Turbine Vane And Blade Cooling Air Valve Position Switch Component Maintenance Manual 75−24−11, (Midland Ross).


A
TURBINE VANE AND BLADE COOLING AIR VALVE POSITION SWITCH
SHIPPING PIN & TAG
BLADE FLOW
TURBINE VANE AND BLADE COOLING AIR VALVE
VIEW A
L-A1194 (0990)
PW V

Turbine Vane And Blade Cooling Air Valve Position Switch
Figure 301
(Task 72−00−35−050−003)

ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - REMOVAL-07

Task 72-00-35-050-005:

1. Remove Turbine Vane And Blade Cooling Air Valve (Right)

A. Prerequisite

(1) Remove turbine vane and blade cooling air valve position switch per 72-00-35, Removal-06.

B. Equipment And Materials Necessary - None

C. Procedure
See Figure 301 and Figure 302.

(1) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 75-116) Remove lockwire and disconnect air signal tube (AA21) from valve.

(2) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 75-116) Remove lockwire and disconnect air signal tube (AA90) from valve.

(3) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Remove the lockwire and disconnect the air signal tube (AA77) from the valve.

(4) Loosen and remove bolts securing rear flange of valve to forward flange of turbine vane cooling air tube assembly (AP02).

(5) Remove bolts that attach the bracket and the turbine blade cooling air tube assembly (AP37) front flange to the valve.

(a) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 72-572 or SB PW4ENG 72-537 or Post SB PW4ENG 72-627) Remove and discard the gaskets. Remove the metering plate and install the protective closures.

(b) FOR THESE MODELS: 4152, 4156A, 4158
(Post PW4ENG 72-572 and Pre SB PW4ENG 72-627 or Post SB PW4ENG 72-537 and Pre SB PW4ENG 72-627) Remove and discard the gaskets. Remove the ring spacer and install the protective closures.

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3 (Pre SB PW4ENG 72−537 or Post SB PW4ENG 72−627) Remove and discard the gaskets. Remove the metering plate and install the protective closures.

(d) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3 (Post SB PW4ENG 72−537 and Pre SB PW4ENG 72−627) Remove and discard the gaskets. Remove the ring spacer and install the protective closures.

(e) If valve is to be replaced, remove tube adapter and copper gasket from valve. Discard gasket.

(6) Remove the bolt and nut that attaches the air signal tube to the bracket mounted to the valve flange.

(7) Remove the bolt and nut that attaches the adjustable link to same the bracket.

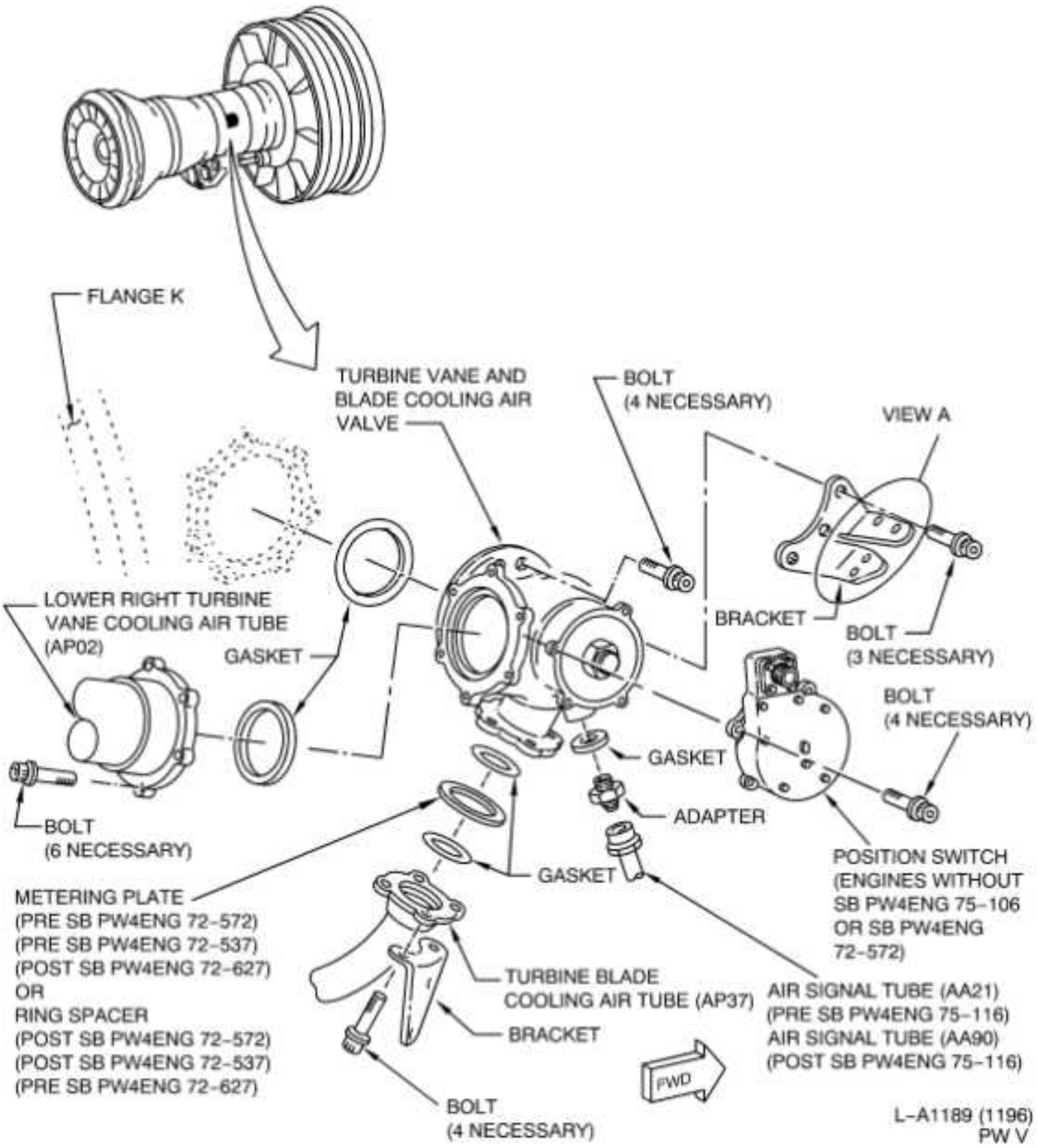
(8) Remove the bolts that attaches the valve flange and the bracket to the HPC case.

NOTE: The use of a standard 5/16 inch, 12 point torque adapter, with a length of approximately 2 9/16 inch (65.088 mm), will make the valve removal easier.

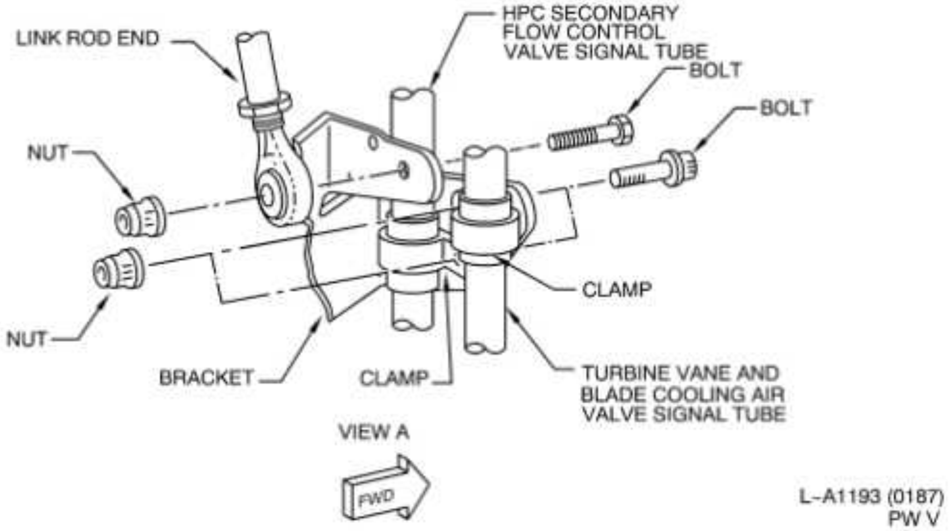
(9) Remove the turbine vane and blade cooling air valve (right) from the engine. Discard the gasket.

(10) Install protective closures to open tubes and valve pad.

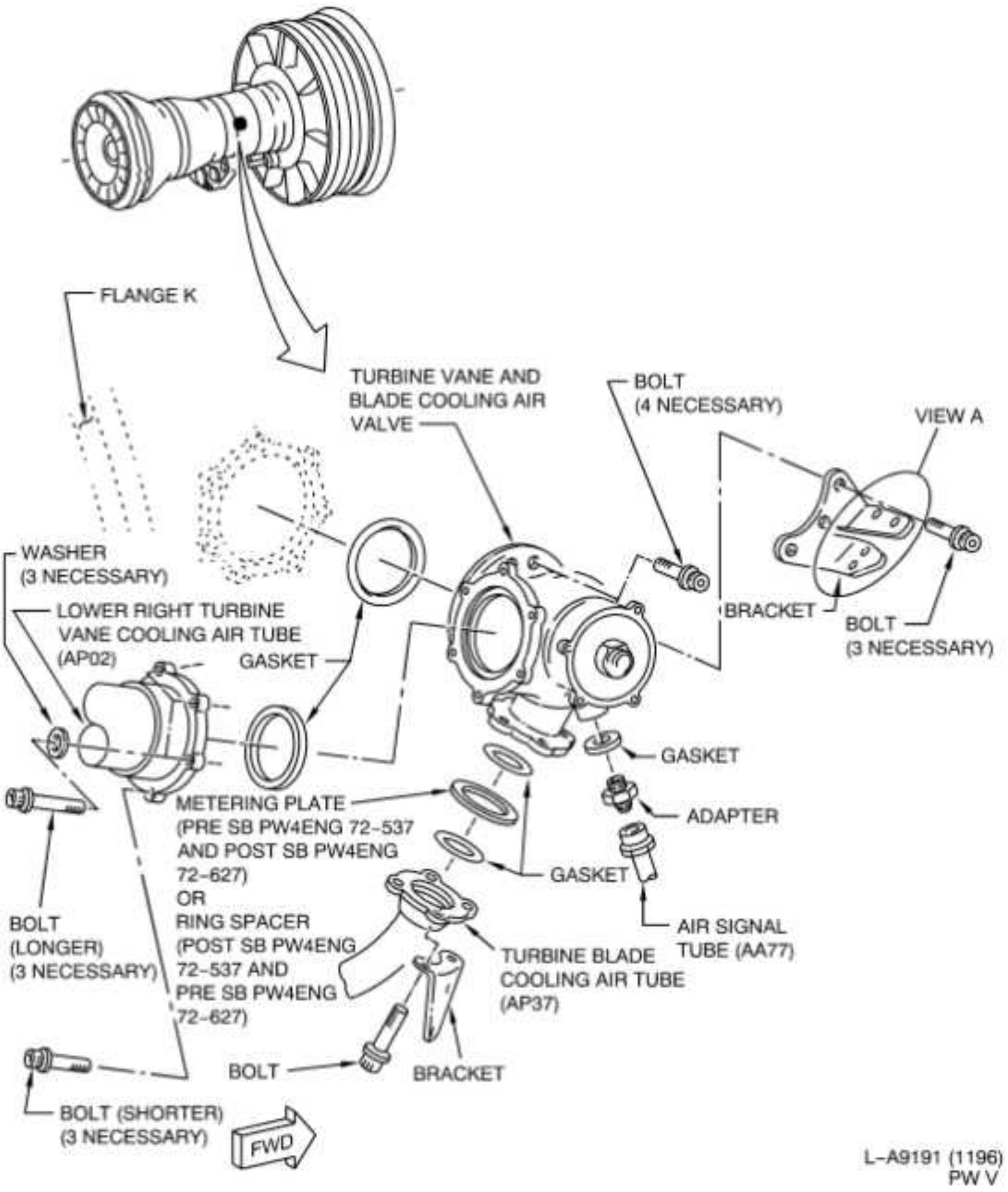
NOTE: For additional information concerning detailed maintenance of this component see Turbine Vane And Blade Cooling Air Valve Component Maintenance Manual, 75−24−12 (Midland Ross).


FLANGE K
TURBINE VANE AND BLADE COOLING AIR VALVE
BOLT (4 NECESSARY)
VIEW A
BRACKET
BOLT (3 NECESSARY)
BOLT (4 NECESSARY)
LOWER RIGHT TURBINE VANE COOLING AIR TUBE (AP02)
GASKET
GASKET
ADAPTER
BOLT (6 NECESSARY)
GASKET
POSITION SWITCH (ENGINES WITHOUT SB PW4ENG 75-106 OR SB PW4ENG 72-572)
METERING PLATE (PRE SB PW4ENG 72-572) (PRE SB PW4ENG 72-537) (POST SB PW4ENG 72-627) OR RING SPACER (POST SB PW4ENG 72-572) (POST SB PW4ENG 72-537) (PRE SB PW4ENG 72-627)
TURBINE BLADE COOLING AIR TUBE (AP37)
AIR SIGNAL TUBE (AA21) (PRE SB PW4ENG 75-116) AIR SIGNAL TUBE (AA90) (POST SB PW4ENG 75-116)
BRACKET
FWD
BOLT (4 NECESSARY)
L-A1189 (1196)
PW V

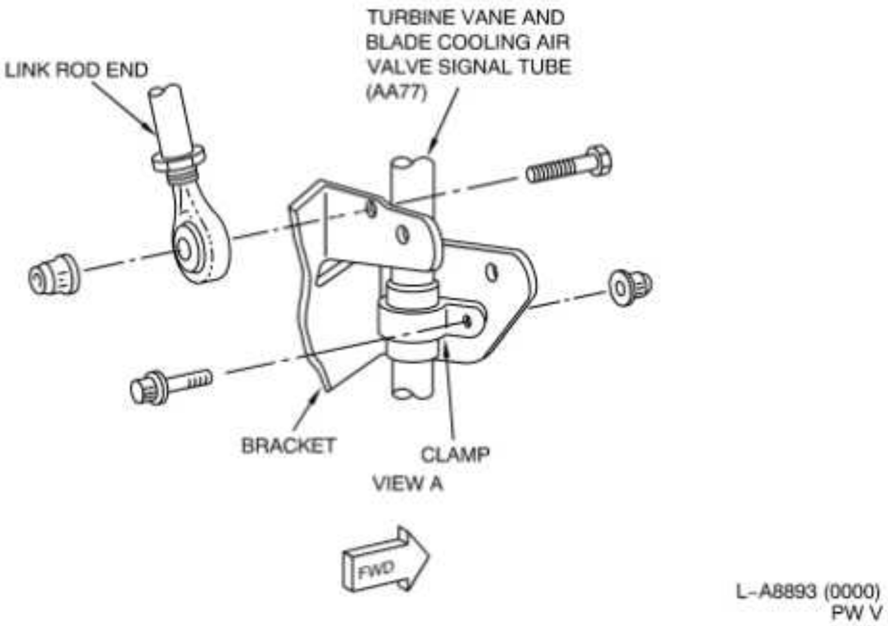
Turbine Vane And Blade Cooling Air Valve (Right)
Figure 301 (Sheet 1)
(Task 72−00−35−050−005)


LINK ROD END
HPC SECONDARY FLOW CONTROL VALVE SIGNAL TUBE
BOLT
BOLT
NUT
CLAMP
NUT
BRACKET
CLAMP
TURBINE VANE AND BLADE COOLING AIR VALVE SIGNAL TUBE
VIEW A
FWD
L-A1193 (0187)
PW V

Bracket Clipping
Figure 301 (Sheet 2)
(Task 72-00-35-050-005)


FLANGE K
TURBINE VANE AND BLADE COOLING AIR VALVE
BOLT (4 NECESSARY)
VIEW A
WASHER (3 NECESSARY)
LOWER RIGHT TURBINE VANE COOLING AIR TUBE (AP02)
GASKET
BRACKET
BOLT (3 NECESSARY)
GASKET
ADAPTER
METERING PLATE (PRE SB PW4ENG 72-537 AND POST SB PW4ENG 72-627) OR RING SPACER (POST SB PW4ENG 72-537 AND PRE SB PW4ENG 72-627)
GASKET
BOLT (LONGER) (3 NECESSARY)
AIR SIGNAL TUBE (AA77)
TURBINE BLADE COOLING AIR TUBE (AP37)
BOLT
BRACKET
BOLT (SHORTER) (3 NECESSARY)
FWD
L-A9191 (1196)
PW V

Turbine Vane And Blade Cooling Air Valve (Right)
Figure 302 (Sheet 1)
(Task 72-00-35-050-005)


TURBINE VANE AND BLADE COOLING AIR VALVE SIGNAL TUBE (AA77)
LINK ROD END
BRACKET
CLAMP
VIEW A
FWD
L−A8893 (0000)
PW V

Bracket Clipping
Figure 302 (Sheet 2)
(Task 72−00−35−050−005)

Previous Pageblock Return to Previous Menu Next Pageblock

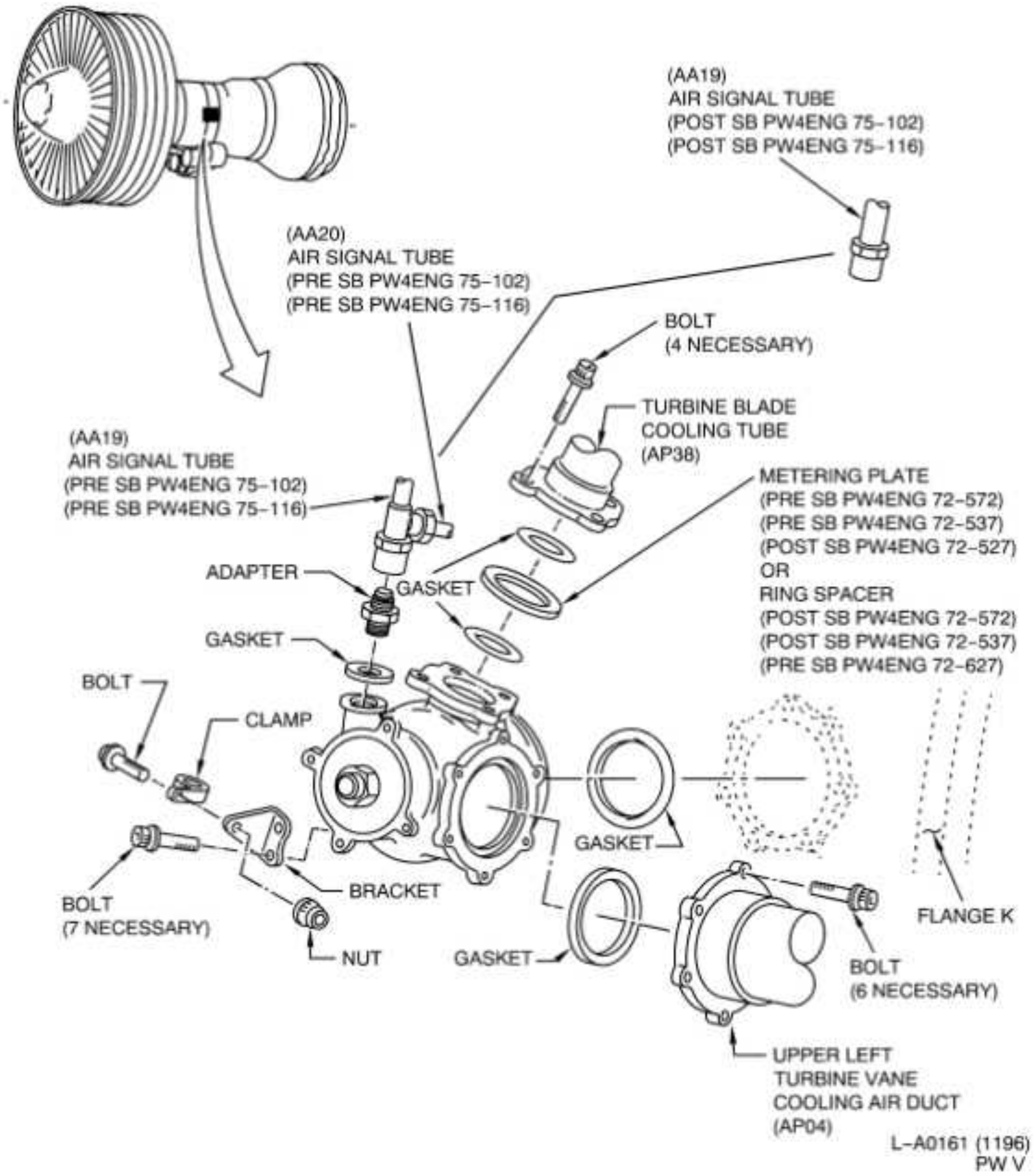
ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - REMOVAL-08

Task 72-00-35-050-004:

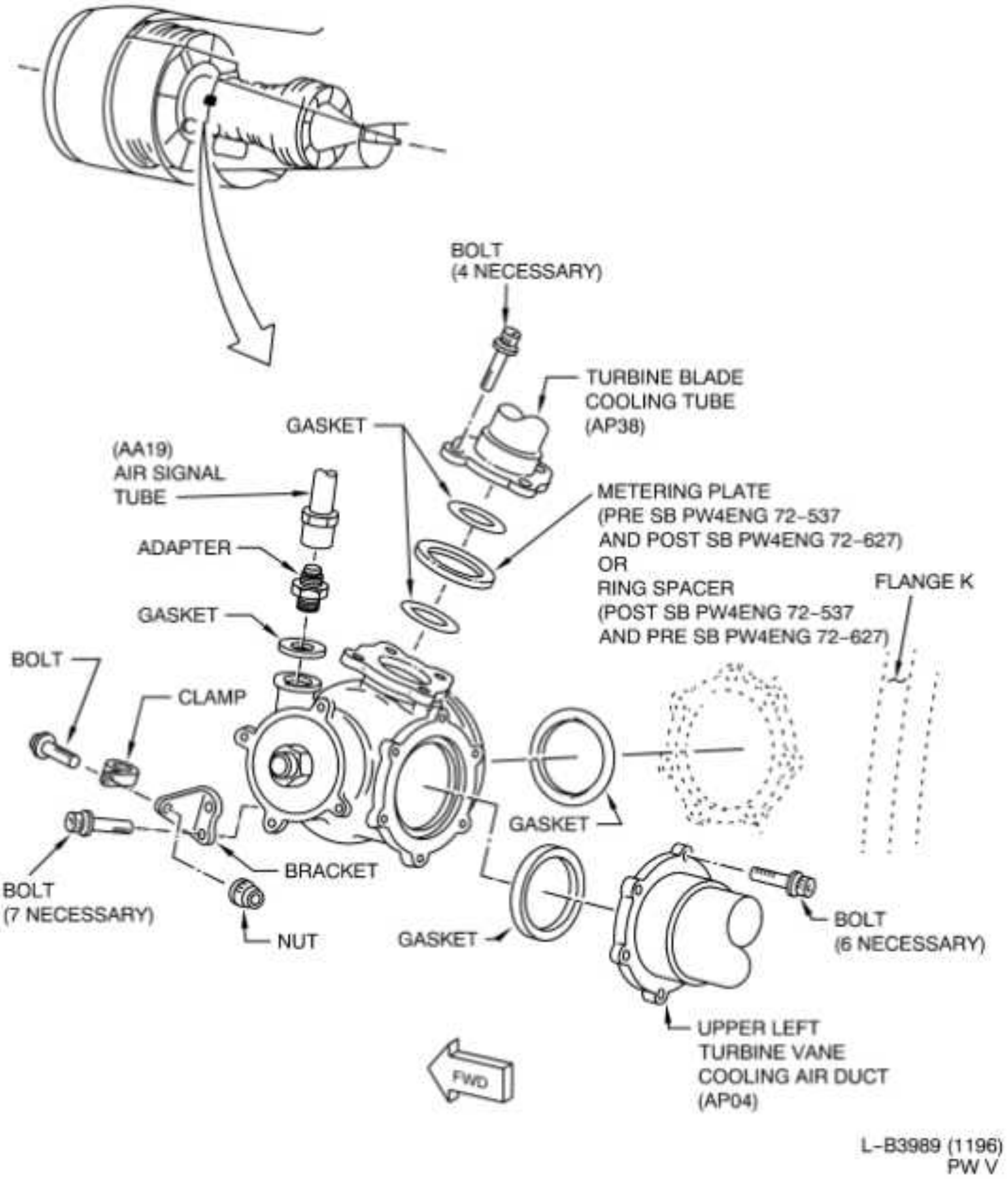
1. Remove Turbine Vane And Blade Cooling Air Valve (Left)
    A. Equipment And Materials Required - None
    B. Procedure
    See Figures 301 and 302.
        (1) Remove lockwire and disconnect air signal tube (AA19) from valve.
        (2) Loosen and remove bolts securing rear flange of valve to forward flange of turbine vane cooling air tube assembly (AP04).
        (3) Remove bolts securing turbine blade cooling air tube assembly (AP38) front flange to valve.
            (a) FOR THESE MODELS: 4152, 4156A, 4158 (Pre SB PW4ENG 72-572 or SB PW4ENG 72-537 or Post SB PW4ENG 72-627) Remove and discard the gaskets. Remove the metering plate and install the protective closures.
            (b) FOR THESE MODELS: 4152, 4156A, 4158 (Post PW4ENG 72-572 and Pre SB PW4ENG 72-627 or Post SB PW4ENG 72-537 and Pre SB PW4ENG 72-627) Remove and discard the gaskets. Remove the ring spacer and install the protective closures.
            (c) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3 (Pre SB PW4ENG 72-537 or Post SB PW4ENG 72-627) Remove and discard the gaskets. Remove the metering plate and install the protective closures.
            (d) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3 (Post SB PW4ENG 72-537 and Pre SB PW4ENG 72-627) Remove and discard the gaskets. Remove the ring spacer and install the protective closures.
        (4) Remove bolt and nut securing tube clamp to bracket attached to valve flange.
        (5) Remove bolts securing valve flange to engine pad.

NOTE: The use of a standard 5/16 inch, 12 point torque adapter, with a length of approximately 2 9/16 inch (65.088 mm), will make the valve removal easier.

        (6) Remove bracket and turbine vane and blade cooling air valve (left) from engine. Discard metal gasket. Install protective closures to open tubes and valve pad.


(AA19)
AIR SIGNAL TUBE
(POST SB PW4ENG 75-102)
(POST SB PW4ENG 75-116)
(AA20)
AIR SIGNAL TUBE
(PRE SB PW4ENG 75-102)
(PRE SB PW4ENG 75-116)
BOLT
(4 NECESSARY)
TURBINE BLADE
COOLING TUBE
(AP38)
(AA19)
AIR SIGNAL TUBE
(PRE SB PW4ENG 75-102)
(PRE SB PW4ENG 75-116)
METERING PLATE
(PRE SB PW4ENG 72-572)
(PRE SB PW4ENG 72-537)
(POST SB PW4ENG 72-527)
OR
RING SPACER
(POST SB PW4ENG 72-572)
(POST SB PW4ENG 72-537)
(PRE SB PW4ENG 72-627)
ADAPTER
GASKET
GASKET
BOLT
CLAMP
GASKET
BRACKET
BOLT
(7 NECESSARY)
NUT
GASKET
FLANGE K
BOLT
(6 NECESSARY)
UPPER LEFT
TURBINE VANE
COOLING AIR DUCT
(AP04)
L-A0161 (1196)
PW V

Turbine Vane And Blade Cooling Air
Valve (Left)
Figure 301
(Task 72-00-35-050-004)


BOLT
(4 NECESSARY)
TURBINE BLADE
COOLING TUBE
(AP38)
GASKET
(AA19)
AIR SIGNAL
TUBE
METERING PLATE
(PRE SB PW4ENG 72-537
AND POST SB PW4ENG 72-627)
OR
RING SPACER
(POST SB PW4ENG 72-537
AND PRE SB PW4ENG 72-627)
ADAPTER
FLANGE K
GASKET
BOLT
CLAMP
GASKET
BOLT
(7 NECESSARY)
BRACKET
NUT
GASKET
BOLT
(6 NECESSARY)
UPPER LEFT
TURBINE VANE
COOLING AIR DUCT
(AP04)
FWD
L-B3989 (1196)
PW V

Turbine Vane And Blade Cooling Air
Valve (Left)
Figure 302
(Task 72-00-35-050-004)

(a) If valve is to be replaced, remove tube adapter and gasket from valve. Install protective closure.

NOTE: For additional information concerning detailed maintenance of this component see Turbine Vane And Blade Cooling Air Valve Component Maintenance Manual, 75-24-12 (Midland Ross).

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ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - REMOVAL-09

Task 72-00-35-050-006:

1. Remove HPC Secondary Flow Control Valve (Left)

   A. Equipment And Materials Required - None

   B. Procedure

   See Figure 301.

   NOTE: This procedure is applicable for engines without SB PW4ENG 72-572 or SB PW4ENG 75-106 only.

   (1) Remove lockwire and disconnect W5P10 harness connector from valve. Install protective closures.

   (2) (Post SB PW4ENG 75-85), Remove the lockwire and disconnect the signal tube (AA16) from the adapter.

   (3) Remove the clamp bolt and nut that attach the tube to the bracket on the rear of the valve (Post SB PW4ENG 72-211).

   (4) Remove six bolts securing valve to HPC case. Remove valve from case. Discard gasket. Install protective closures.

   (5) If valve is to be replaced, comply with the following:

   (a) (Pre SB PW4ENG 75-85), Remove lockwire from the cap assembly and the cap assembly from adapter.

   (b) Remove the adapter and the gasket from the valve. Install protection covers.

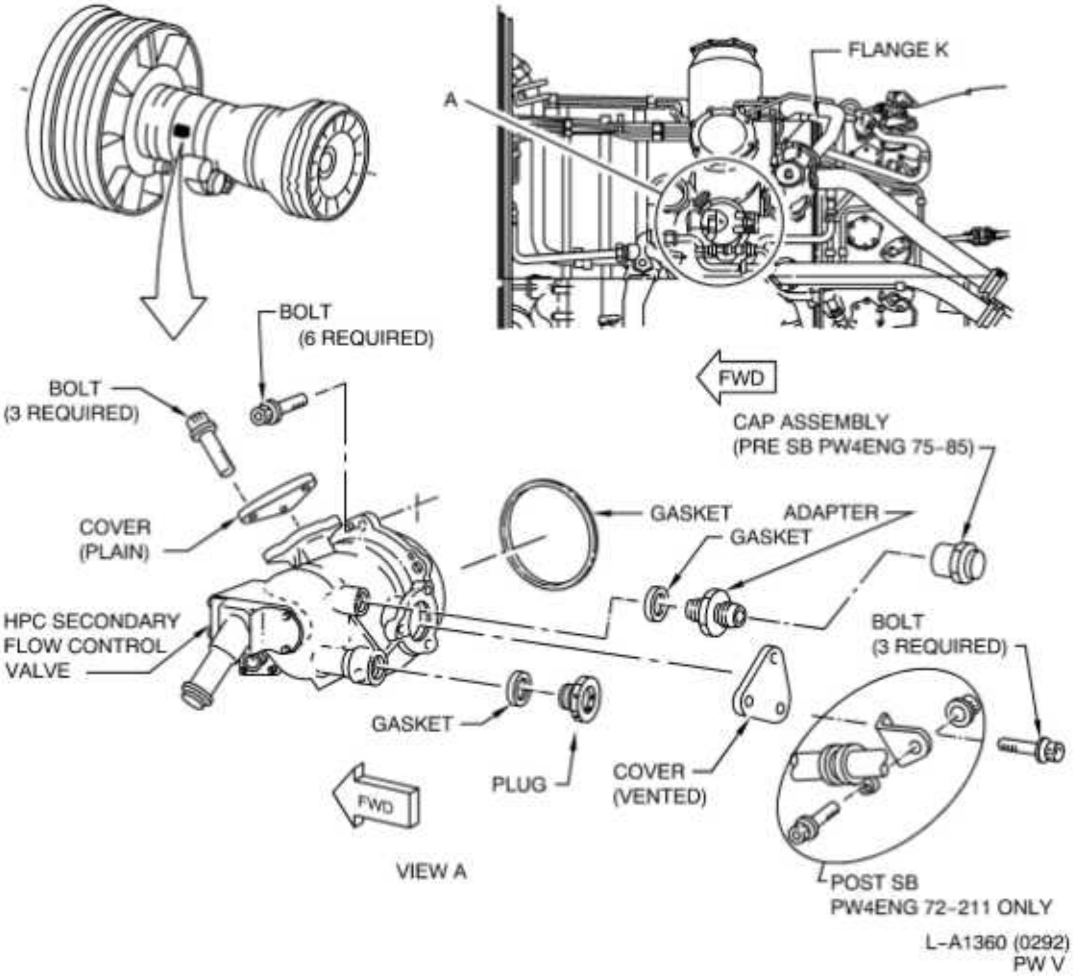
   NOTE: HPC air valve signal tube was removed and cap assemblies installed on the air filter and the HPC air valve by Alert Service Bulletin (PW4ENG 75-62R2).

   HPC air valve signal tube was re-installed and the cap assemblies were removed from the air filter and the HPC air valve by Service Bulletin (PW4ENG 75-85).

   (c) Remove six bolts securing two covers and bracket (Post SB PW4ENG 72-211 only) to valve. Remove covers and install protective closures.

(d) Remove lockwire and remove remaining plug and gasket from valve. Install protective closure.

NOTE: For additional information concerning detailed maintenance of this component, see Compressor Rotor Heating Air Valve Component Maintenance Manual, 75−33−08 (Midland Ross).


FLANGE K
A
BOLT
(6 REQUIRED)
BOLT
(3 REQUIRED)
FWD
CAP ASSEMBLY
(PRE SB PW4ENG 75-85)
COVER
(PLAIN)
GASKET
ADAPTER
GASKET
HPC SECONDARY
FLOW CONTROL
VALVE
BOLT
(3 REQUIRED)
GASKET
PLUG
COVER
(VENTED)
FWD
VIEW A
POST SB
PW4ENG 72-211 ONLY
L-A1360 (0292)
PW V

HPC Secondary Flow Control Valve (Left)
Figure 301
(Task 72-00-35-050-006)

Task 72-00-35-050-007:

R 1. (Pre SB PW4ENG 72-756) Remove HPC Secondary Flow Control Valve (Right)

A. Equipment And Materials Necessary - None

B. Procedure
See Figure 301.

NOTE: This procedure is applicable for engine without SB PW4ENG 75-106 or SB PW4ENG 72-572 only.

(1) Remove lockwire and disconnect W4P10 harness connector from valve. Install protective closures.

(2) (Post SB PW4ENG 75-85 and Pre SB PW4ENG 75-116) Remove the lockwire and disconnect the signal tube (AA15) from the adapter.

(3) (Post SB PW4ENG 75-116) Remove the lockwire and disconnect the signal tube (AA91) from the adapter.

(4) Remove six bolts securing valve and bracket (Post SB PW4ENG 73-163) to HPC case. Remove valve from case. Discard gasket. Install protective closure on HPC case pad on valve mounting flange.

(5) If valve is to replaced, comply with the following:

(a) (Pre SB PW4ENG 75-85), Remove lockwire from the cap assembly and the cap assembly from adapter.

NOTE: The HPC air valve signal tube was removed and cap assemblies were installed on the air filter and the HPC air valve by Alert SB PW4ENG 75-62R2.

NOTE: The HPC air valve signal tube was reinstalled and the cap assemblies were removed from the air filter and the HPC air valve by SB PW4ENG 75-85.

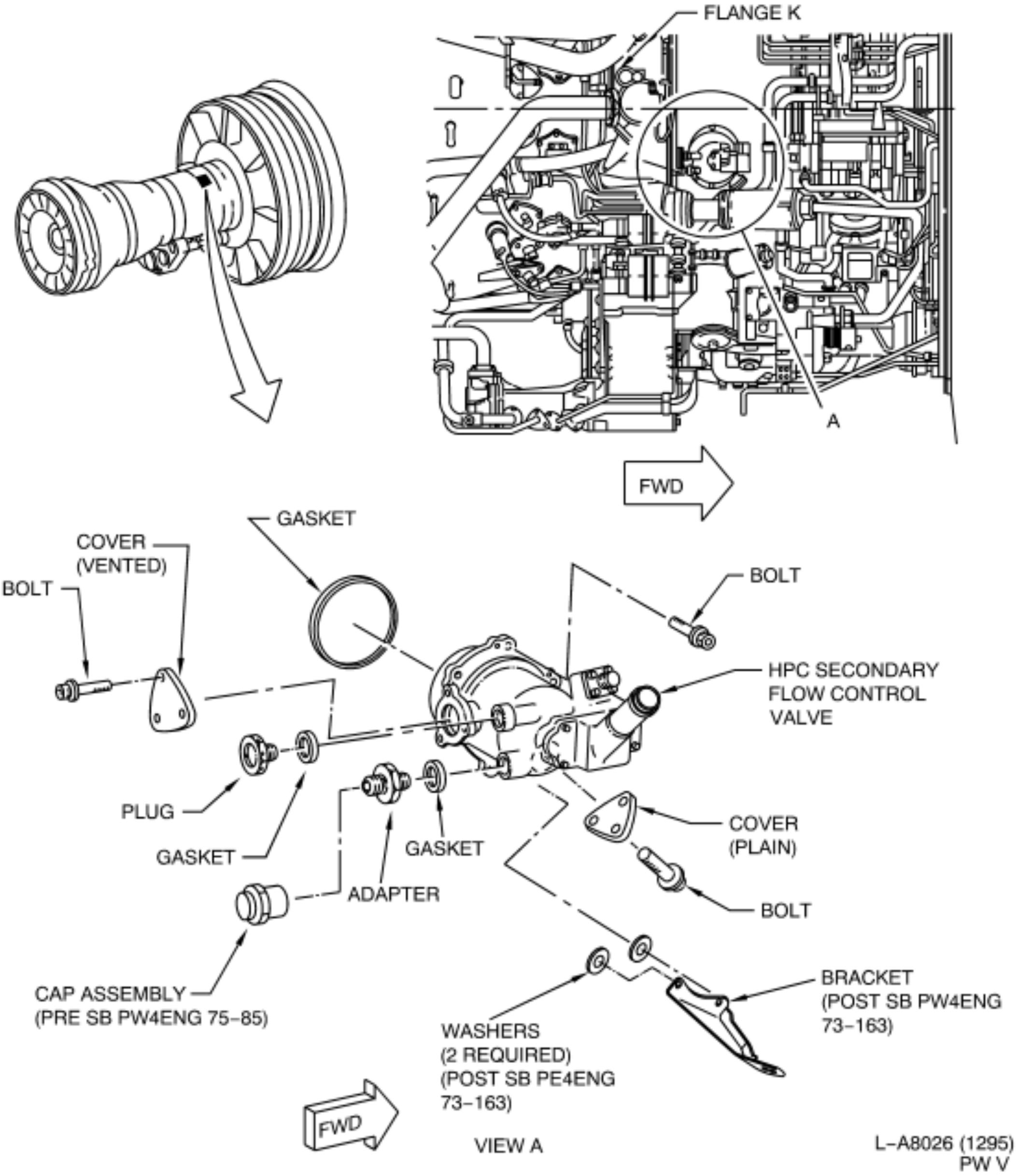
(b) Remove the adapter and the gasket from the valve. Install protection covers.

(c) Remove six bolts securing two covers to valve. Remove covers and install protective closures.

ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−10

(d) Remove lockwire and remove remaining plug and gasket from valve. Install protective closure.

NOTE: For additional information concerning detailed maintenance of this component, see Compressor Rotor Heating Air Valve Component Maintenance Manual, 75−33−08 (Midland Ross).


FLANGE K
A
FWD
GASKET
COVER (VENTED)
BOLT
BOLT
HPC SECONDARY FLOW CONTROL VALVE
PLUG
GASKET
GASKET
ADAPTER
COVER (PLAIN)
BOLT
CAP ASSEMBLY (PRE SB PW4ENG 75-85)
BRACKET (POST SB PW4ENG 73-163)
WASHERS (2 REQUIRED) (POST SB PE4ENG 73-163)
FWD
VIEW A
L-A8026 (1295)
PW V

HPC Secondary Flow Control Valve (Right)
Figure 301
(Task 72-00-35-050-007)

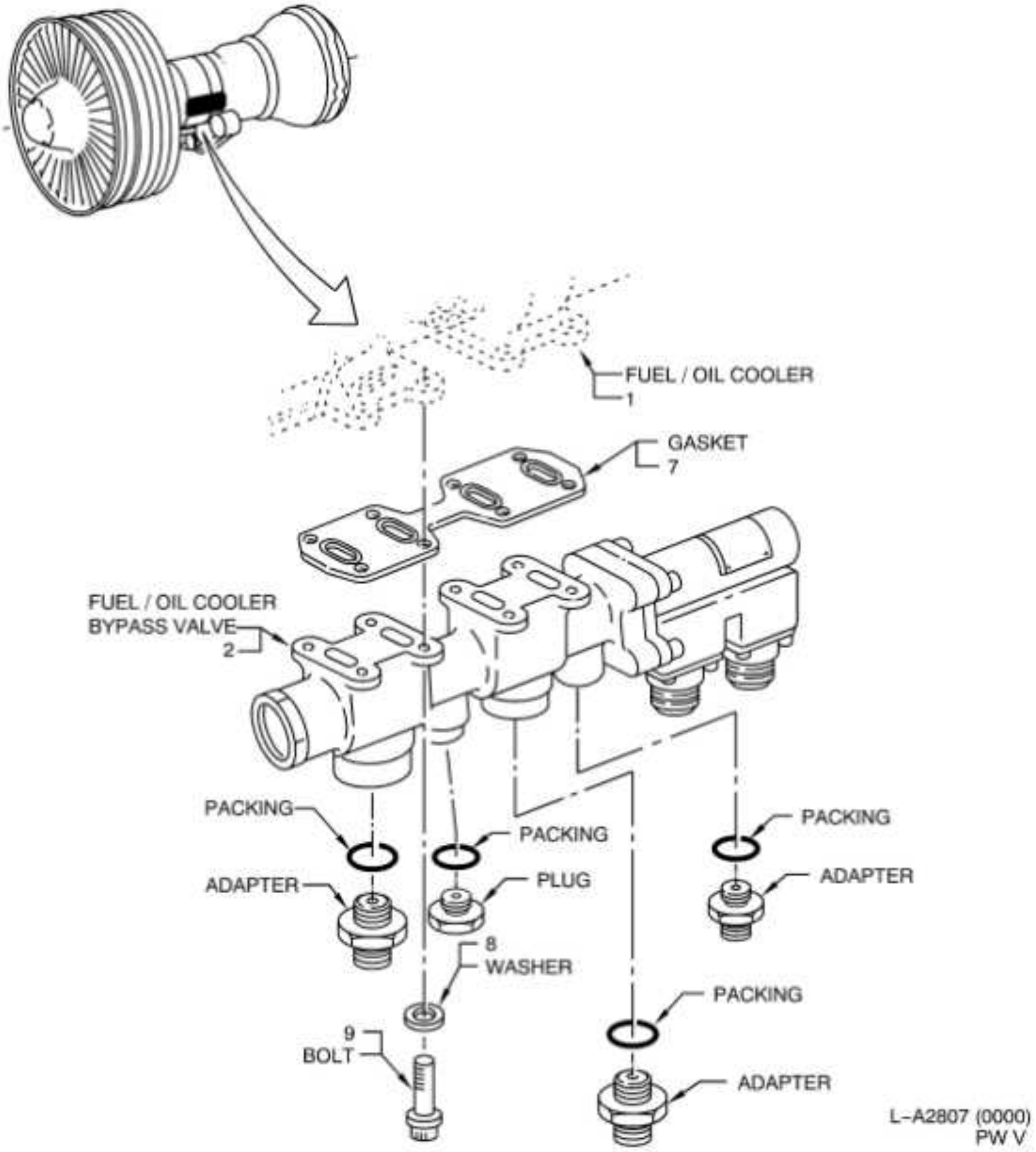
ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - REMOVAL-11

Task 72-00-35-050-008:

1. Remove Fuel/Oil Cooler Bypass Valve
   - A. Prerequisites
     - (1) Remove fuel/oil cooler. See Removal-04 (Task 72-00-35-050-001).
   - B. Equipment And Materials Required - None
   - C. Procedure

     See Figure 301.
     - (1) Remove eight bolts (301/9) and washers (301/8) securing bypass valve (301/2) to fuel/oil cooler (301/1) and remove valve. Discard gasket (301/7).
     - (2) Install protective closures.
     - (3) If bypass valve is to be replaced comply with the following.
       - (a) Remove lockwire, plug, adapters, and packings from bypass valve. Discard packings. Install protective closures.

         NOTE: For additional information concerning detailed maintenance of this component see Fuel/Oil Heat Exchanger Bypass Valve Component Maintenance Manual 79-21-16, (Parker Hannifin).


FUEL / OIL COOLER
1
GASKET
7
FUEL / OIL COOLER
BYPASS VALVE
2
PACKING
PACKING
PACKING
ADAPTER
PLUG
ADAPTER
8
WASHER
PACKING
9
BOLT
ADAPTER
L-A2807 (0000)
PW V

Engine Fuel/Oil Cooler Bypass
Valve Removal
Figure 301
(Task 72-00-35-050-008)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - REMOVAL-12

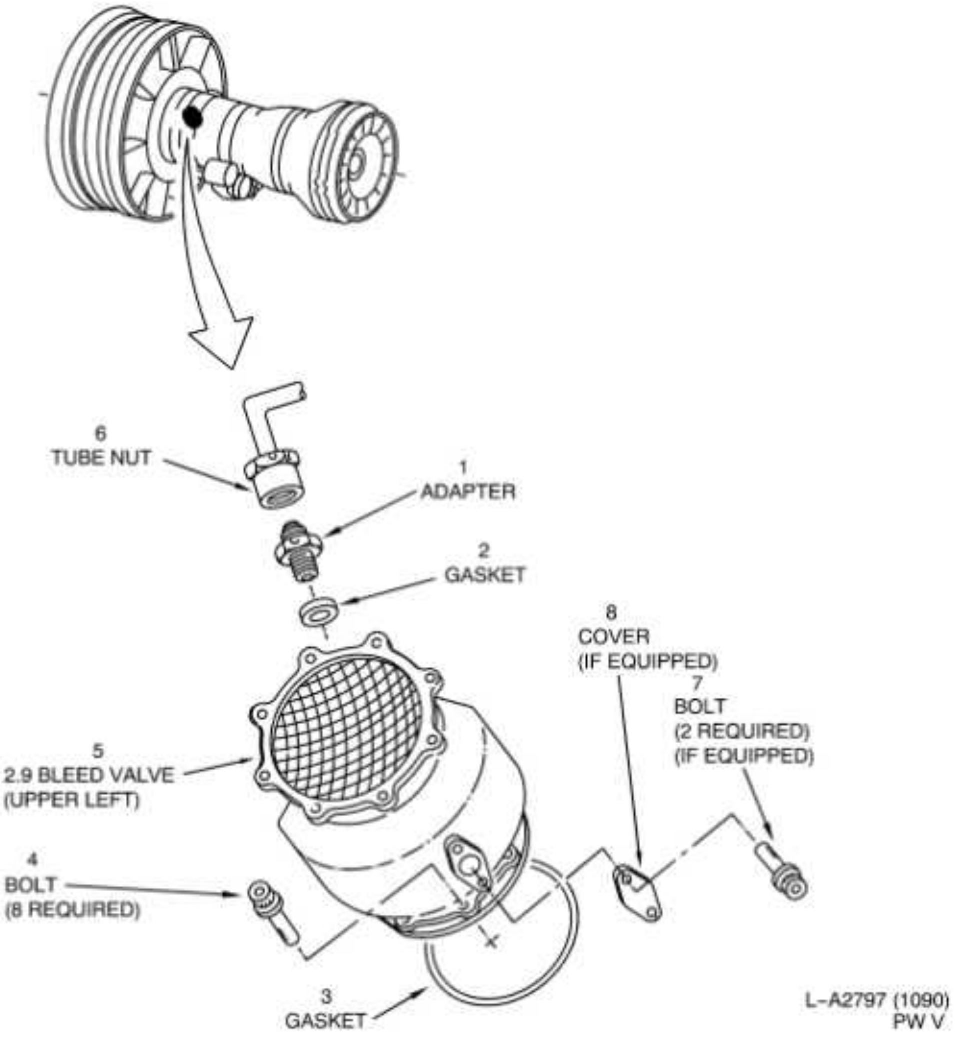
Task 72-00-35-050-009:

1. Remove 9th Stage Start/Stability (2.9) Bleed Valve (Upper Left)
   A. Prerequisites
      (1) For engines with the 2.9 bleed valve thermocouple probe, remove the probe. See 72-00-35, Removal-17 (Task 72-00-35-050-014).
   B. Equipment And Materials Required

      Special Tools:
      PWA 85436 Adapter, Torque

   C. Procedure
      See Figure 301.
      (1) Remove lockwire and disconnect manifold tube nut (AA30) (301/6) from 2.9 bleed valve (301/5), located at 10 o'clock position on left side of HPC case.
      (2) Using PWA 85436 Torque Adapter, remove eight bolts (301/4) securing bleed valve (301/5) to engine, and remove valve.
      (3) Remove gasket (301/3) from boss and discard. Install protective closures.
      (4) Remove adapter (301/1) from bleed valve (301/5) and discard gasket, (301/2). Install protective closures on bleed valve.
      (5) If equipped remove the bolts (301/7) and the cover (301/8) from the boss located on the side of the bleed valve. Install a protection cover on the bleed valve.

      NOTE: For additional information concerning detailed maintenance of this component see 9th Stage Start Bleed Valve Component Maintenance Manual, 75-31-40 (Midland Ross).


6
TUBE NUT
1
ADAPTER
2
GASKET
8
COVER
(IF EQUIPPED)
7
BOLT
(2 REQUIRED)
(IF EQUIPPED)
5
2.9 BLEED VALVE
(UPPER LEFT)
4
BOLT
(8 REQUIRED)
3
GASKET
L−A2797 (1090)
PW V

Ninth Stage Start/Stability (2.9)
Bleed Valve Removal (Upper Left)
Figure 301
(Task 72−00−35−050−009)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - REMOVAL-13

Task 72-00-35-050-010:

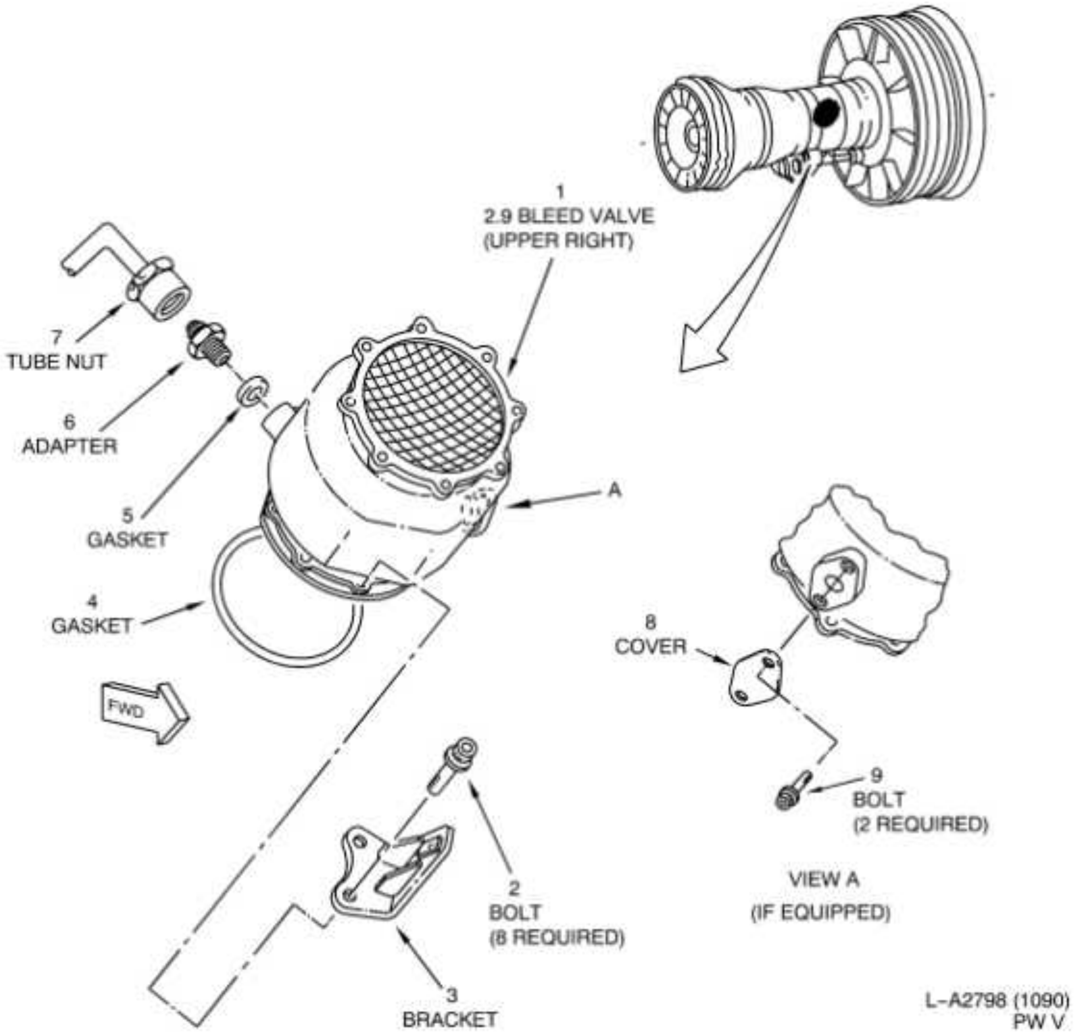
1. Remove 9th Stage Start/Stability (2.9) Bleed Valve (Upper Right)
    - A. Prerequisites
        - (1) For engines with the 2.9 bleed valve thermocouple probe, remove the probe. See 72-00-35, Removal-17 (Task 72-00-35-050-014).
    - B. Equipment And Materials Required

      Special Tools:
      PWA 85436 Adapter, Torque

    - C. Procedure
      See Figure 301.
        - (1) Remove lockwire and disconnect manifold tube nut (AA28) (301/7) from 2.9 bleed valve (301/1), located at 1 o'clock position on right side of HPC case.
        - (2) Using PWA 85436 Torque Adapter, remove eight bolts (301/2) and bracket (301/3), securing bleed valve (301/1) to engine and remove valve.
        - (3) Remove gasket (301/4) from boss and discard. Install protective closures.
        - (4) Remove adapter (301/6) from bleed valve (301/1) and discard gasket, (301/5). Install protective closures on bleed valve.
        - (5) If equipped remove the bolts (301/9) and the cover (301/8) from the boss located on the side of the bleed valve. Install a protection cover on the bleed valve.

          NOTE: For additional information concerning detailed maintenance of this component see 9th Stage Start Bleed Valve Component Maintenance Manual, 75-31-40 (Midland Ross).

ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−13


1
2.9 BLEED VALVE
(UPPER RIGHT)
7
TUBE NUT
6
ADAPTER
5
GASKET
4
GASKET
A
FWD
8
COVER
9
BOLT
(2 REQUIRED)
VIEW A
(IF EQUIPPED)
2
BOLT
(8 REQUIRED)
3
BRACKET
L−A2798 (1090)
PW V

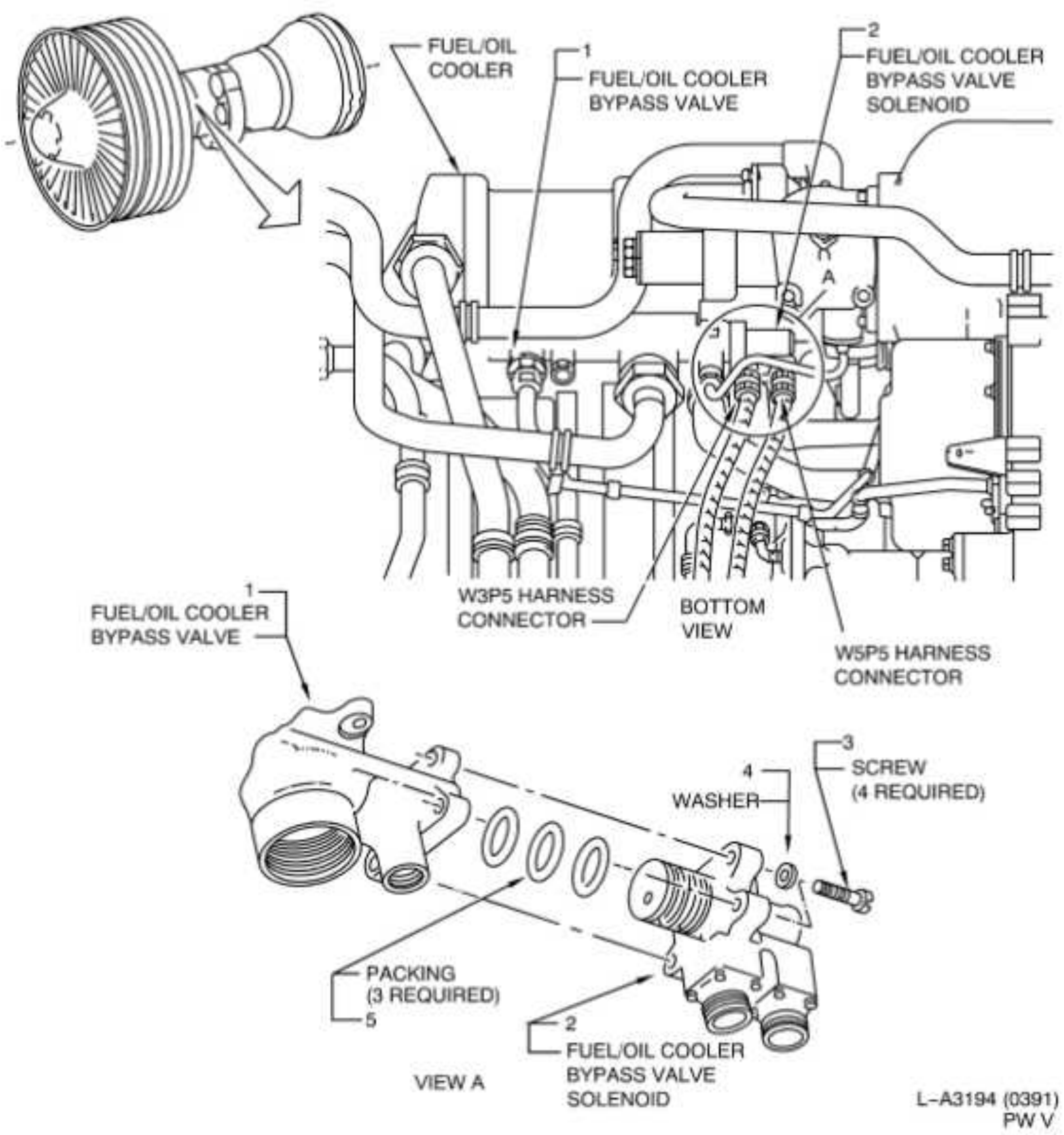
Ninth Stage Start/Stability (2.9)
Bleed Valve Removal (Upper Right)
Figure 301
(Task 72−00−35−050−010)

ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−14

Task 72−00−35−050−011:

1. Remove Engine Fuel/Oil Cooler Bypass Valve Solenoid
   A. Equipment And Materials Required − None
   B. Procedure
      See Figure 301.
      (1) Disconnect W3P5 and W5P5 harness connectors from fuel/oil cooler bypass valve solenoid (301/2). Install protective closures.
      (2) Remove screws (301/3) and washers (301/4) securing solenoid (301/2) to fuel/oil cooler bypass valve (301/1).
      (3) Separate solenoid (301/2) from bypass valve (301/1). Discard packings.

NOTE: For additional information concerning detailed maintenance of the component see Fuel/Oil Heat Exchanger Bypass Valve Component Maintenance Manual, 79−21−16 (Parker Hannifin).


FUEL/OIL COOLER
1
FUEL/OIL COOLER BYPASS VALVE
2
FUEL/OIL COOLER BYPASS VALVE SOLENOID
A
1
FUEL/OIL COOLER BYPASS VALVE
W3P5 HARNESS CONNECTOR
BOTTOM VIEW
W5P5 HARNESS CONNECTOR
4
WASHER
3
SCREW (4 REQUIRED)
PACKING (3 REQUIRED)
5
2
FUEL/OIL COOLER BYPASS VALVE SOLENOID
VIEW A
L−A3194 (0391)
PW V

Fuel/Oil Cooler Bypass Valve
Solenoid Removal
Figure 301
(Task 72−00−35−050−011)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - REMOVAL-15

Task 72-00-35-050-012:

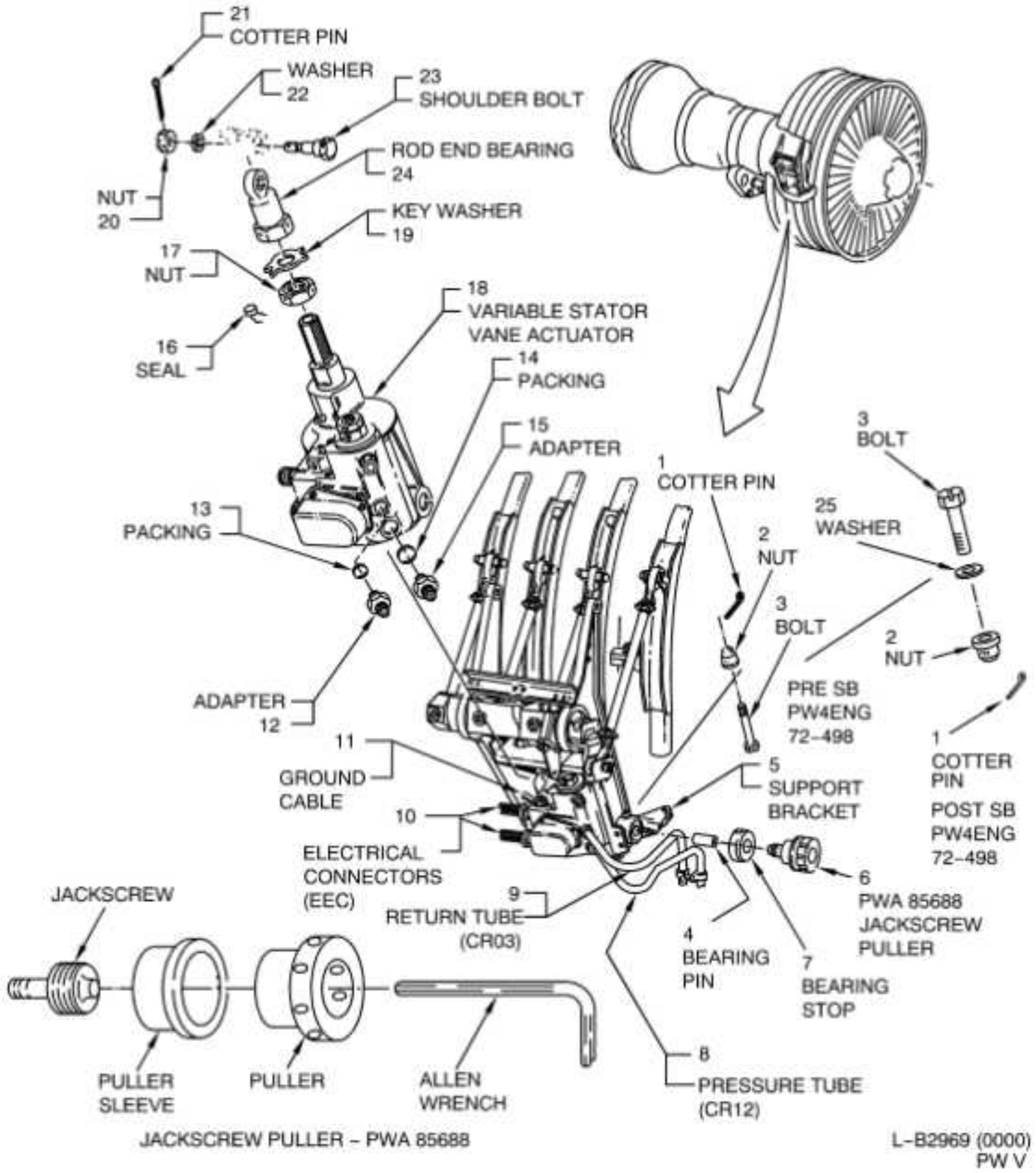
1. Remove Variable Stator Vane Actuator
   A. Equipment And Materials Required

      Special Tools:
      PWA 85688 Puller, Jackscrew

   B. Procedure
      See Figure 301.
      (1) Disconnect W4P3 and W5P7 harness connectors (301/10) from stator vane actuator (301/18). Install protective closures.
      (2) Disconnect ground cable (301/11) attached to actuator (301/18).
      (3) Remove lockwire and disconnect tube nuts securing hydraulic pressure tube (CP12) (301/8) and return tube (CR03) (301/9) to actuator (301/18) and manifold tees.

          NOTE: Be prepared to catch fuel in container with a minimum capacity of 5 U.S. gallons (19 liters).

      (4) Remove cotter pin (301/1), nut (301/2), bolt (301/3), washer (301/25) (SB PW4ENG 72-498) and bearing stop (301/7) from both sides of support bracket (301/5). Discard cotter pins.
      (5) Use the PWA 85688 Jackscrew Puller and remove the bearing pins (301/4) from both sides of the support bracket (301/5) as follows.
          For each side:
          (a) Install the puller jackscrew into the bearing pin (301/4). Tighten the jackscrew by hand.
          (b) Install the puller sleeve over the jackscrew.
          (c) Install the puller into the sleeve and to the jackscrew. Tighten the puller by hand.
          (d) While you hold the jackscrew with an allen wrench, turn the puller with a spanner wrench or a 0.180 inch (4.572 mm) diameter punch. Turn the puller until you remove the bearing pin (301/4).
      (6) Remove cotter pin (301/21), nut (301/20), washer (301/22) and shoulder bolt (301/23) securing actuator rod end bearing (301/24) to bell crank. Discard cotter pin. Remove actuator from engine and install protective closures.
      (7) If actuator (301/18) is to be replaced comply with the following:
          (a) Remove adapters (301/12) and (301/15) from actuator and discard packings (301/13) and (301/14). Install protective closures.


21
COTTER PIN
WASHER
22
23
SHOULDER BOLT
ROD END BEARING
24
NUT
20
KEY WASHER
19
17
NUT
18
VARIABLE STATOR
VANE ACTUATOR
16
SEAL
14
PACKING
15
ADAPTER
1
COTTER PIN
3
BOLT
25
WASHER
2
NUT
13
PACKING
3
BOLT
2
NUT
PRE SB
PW4ENG
72-498
ADAPTER
12
1
COTTER
PIN
11
GROUND
CABLE
5
SUPPORT
BRACKET
POST SB
PW4ENG
72-498
10
ELECTRICAL
CONNECTORS
(EEC)
6
PWA 85688
JACKSCREW
PULLER
JACKSCREW
9
RETURN TUBE
(CR03)
4
BEARING
PIN
7
BEARING
STOP
PULLER
SLEEVE
PULLER
ALLEN
WRENCH
8
PRESSURE TUBE
(CR12)
JACKSCREW PULLER - PWA 85688
L-B2969 (0000)
PW V

Variable Stator Vane Actuator Removal
Figure 301
(Task 72−00−35−050−012)

(8) Cut lockwire and remove seal (301/16), rod end bearing (301/24), key washer (301/19), and nut (301/17) from actuator rod. Discard lockwire, key washer and seal.

NOTE: For additional information concerning detailed maintenance of this component see Stator Vane Actuator Component Maintenance Manual, 75−31−33, (Hamilton Standard).

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ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - REMOVAL-16

Task 72-00-35-050-013:

1. Remove PS3 Air Filters

   A. Equipment And Materials Required - None

   B. Procedure

   See Figures 301, 302 and 303.

   (1) Remove the lockwire and disconnect the tubes from the air filters attached to the Flange J brackets at approximately the 11 and the 1:30 o'clock positions.

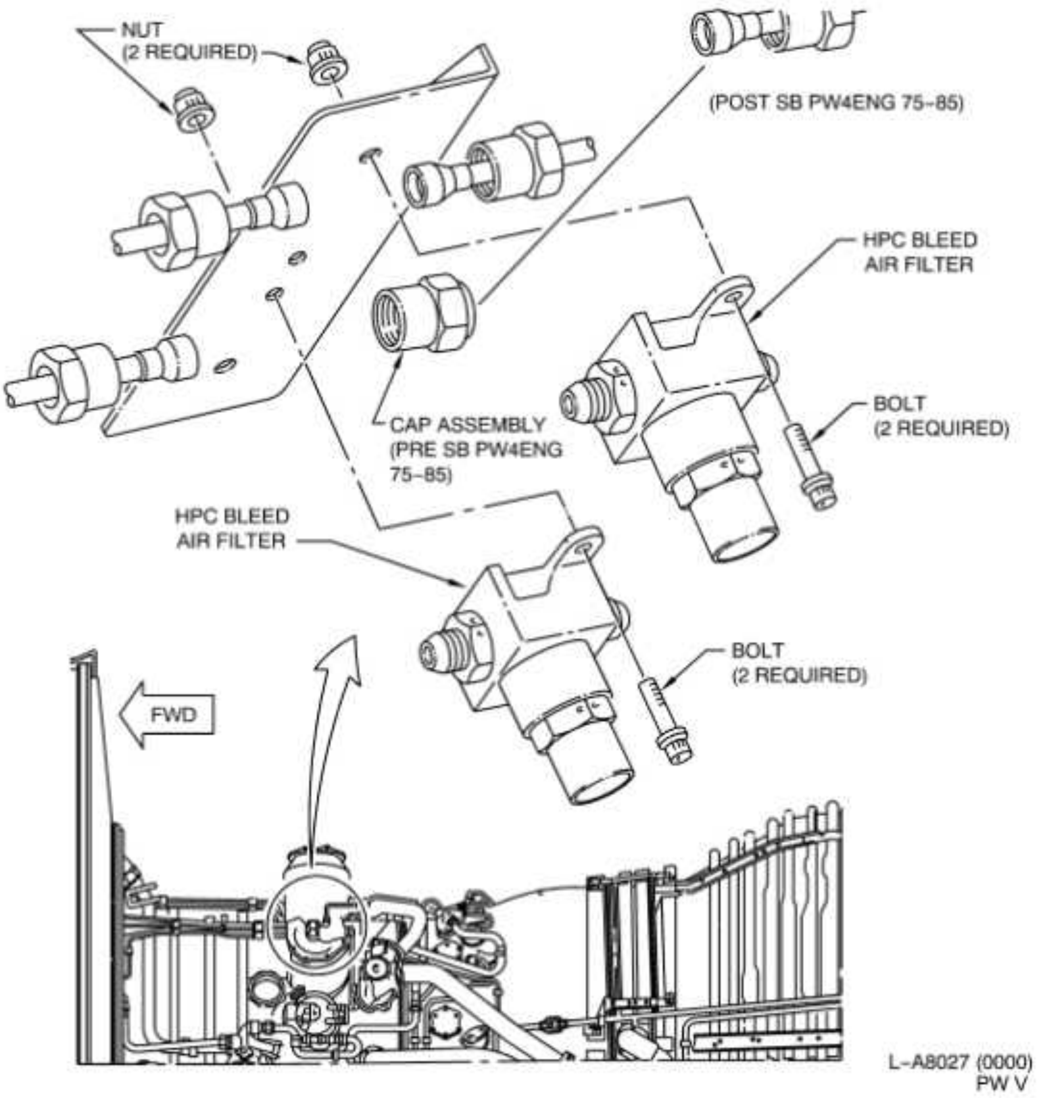
   (2) FOR THESE MODELS: 4152, 4156A, 4158 (Pre SB PW4ENG 75-85), Remove lockwire from the cap assemblies. Remove the cap assemblies from the air filters.

   (3) Remove the bolts and nuts that attach the air filters to brackets the Flange J brackets. Remove the filters.

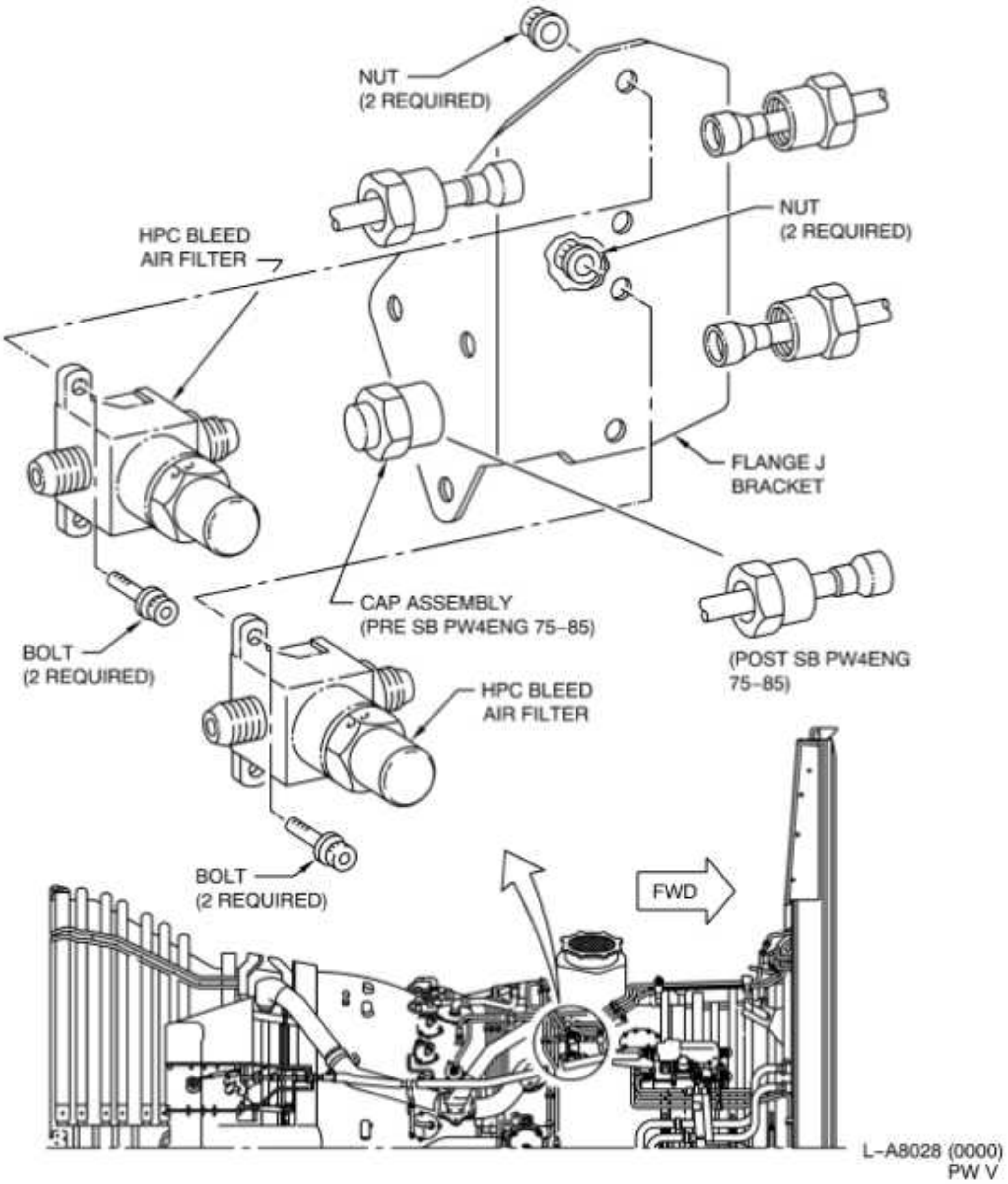
   (4) Install protective closures.

   NOTE: FOR THESE MODELS: 4152, 4156A, 4158
   HPC air valve signal tube was removed and cap assemblies installed on the air filter and the HPC air valve by Alert SB (PW4ENG 75-62R2).

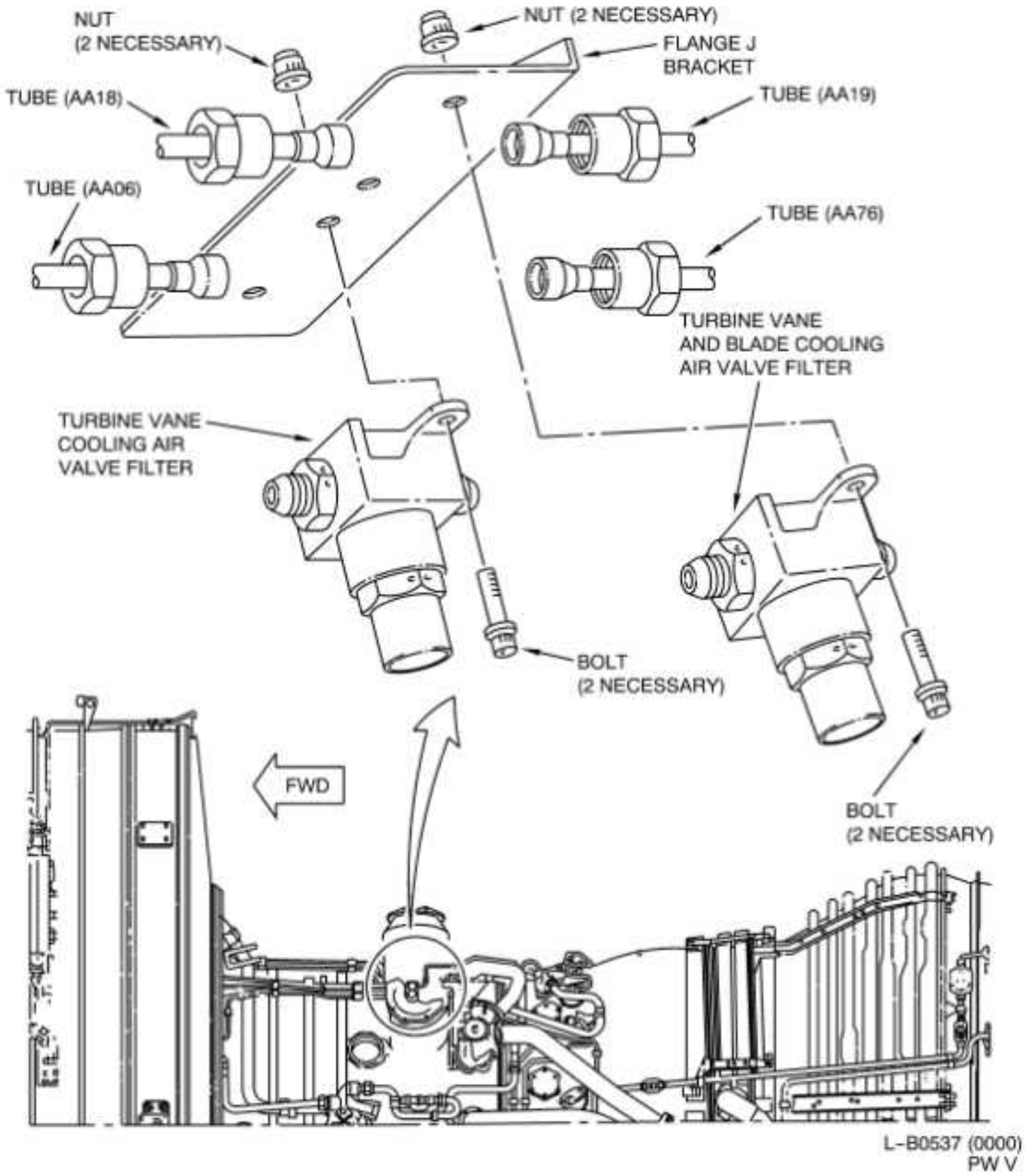
   HPC air valve signal tube was (re)installed and the cap assemblies were removed from the air filter and the HPC air valve by SB (PW4ENG 75-85).


NUT
(2 REQUIRED)
(POST SB PW4ENG 75-85)
HPC BLEED
AIR FILTER
BOLT
(2 REQUIRED)
CAP ASSEMBLY
(PRE SB PW4ENG
75-85)
HPC BLEED
AIR FILTER
BOLT
(2 REQUIRED)
FWD
L-A8027 (0000)
PW V

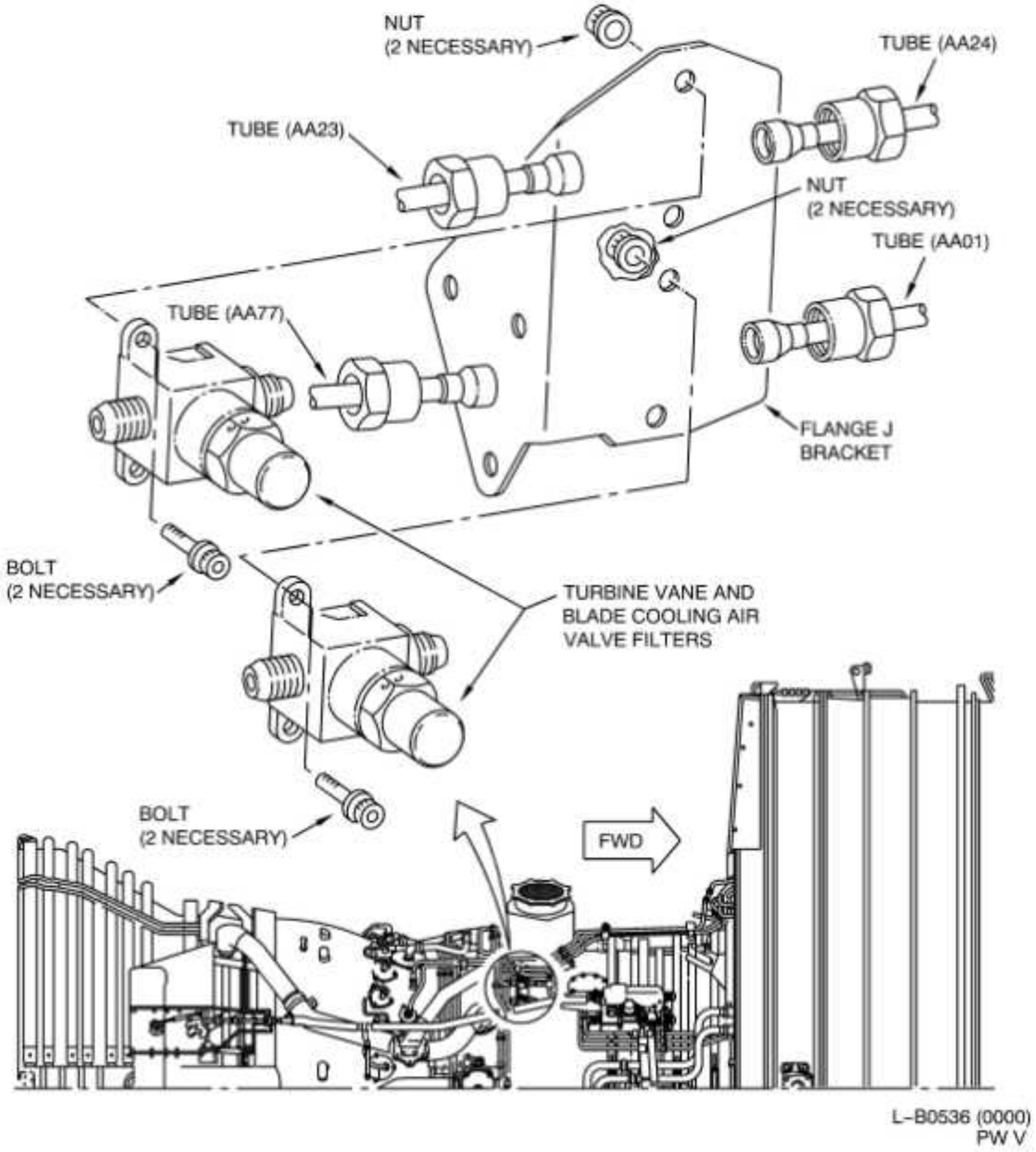
HPC Bleed Air (PS3) Filters (Left)
Figure 301
(Task 72−00−35−050−013)


NUT
(2 REQUIRED)
NUT
(2 REQUIRED)
HPC BLEED
AIR FILTER
FLANGE J
BRACKET
CAP ASSEMBLY
(PRE SB PW4ENG 75−85)
(POST SB PW4ENG
75−85)
BOLT
(2 REQUIRED)
HPC BLEED
AIR FILTER
BOLT
(2 REQUIRED)
FWD
L−A8028 (0000)
PW V

HPC Bleed Air (PS3) Filters (Right)
Figure 302
(Task 72−00−35−050−013)


NUT
(2 NECESSARY)
NUT (2 NECESSARY)
FLANGE J
BRACKET
TUBE (AA18)
TUBE (AA19)
TUBE (AA06)
TUBE (AA76)
TURBINE VANE
AND BLADE COOLING
AIR VALVE FILTER
TURBINE VANE
COOLING AIR
VALVE FILTER
BOLT
(2 NECESSARY)
FWD
BOLT
(2 NECESSARY)
L−B0537 (0000)
PW V

Turbine Vane And Blade Cooling Air (PS3) Filters (Left)
Figure 303 (Sheet 1)
(Task 72−00−35−050−013)


NUT
(2 NECESSARY)
TUBE (AA24)
TUBE (AA23)
NUT
(2 NECESSARY)
TUBE (AA01)
TUBE (AA77)
FLANGE J
BRACKET
BOLT
(2 NECESSARY)
TURBINE VANE AND
BLADE COOLING AIR
VALVE FILTERS
BOLT
(2 NECESSARY)
FWD
L−B0536 (0000)
PW V

Turbine Vane And Blade Cooling Air (PS3) Filters (Right)
Figure 303 (Sheet 2)
(Task 72−00−35−050−013)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-35-050-014:

1. Remove The 9th Stage Start/Stability (2.9) Bleed Valve Thermocouple

A. Equipment And Materials Required - None

B. Procedure

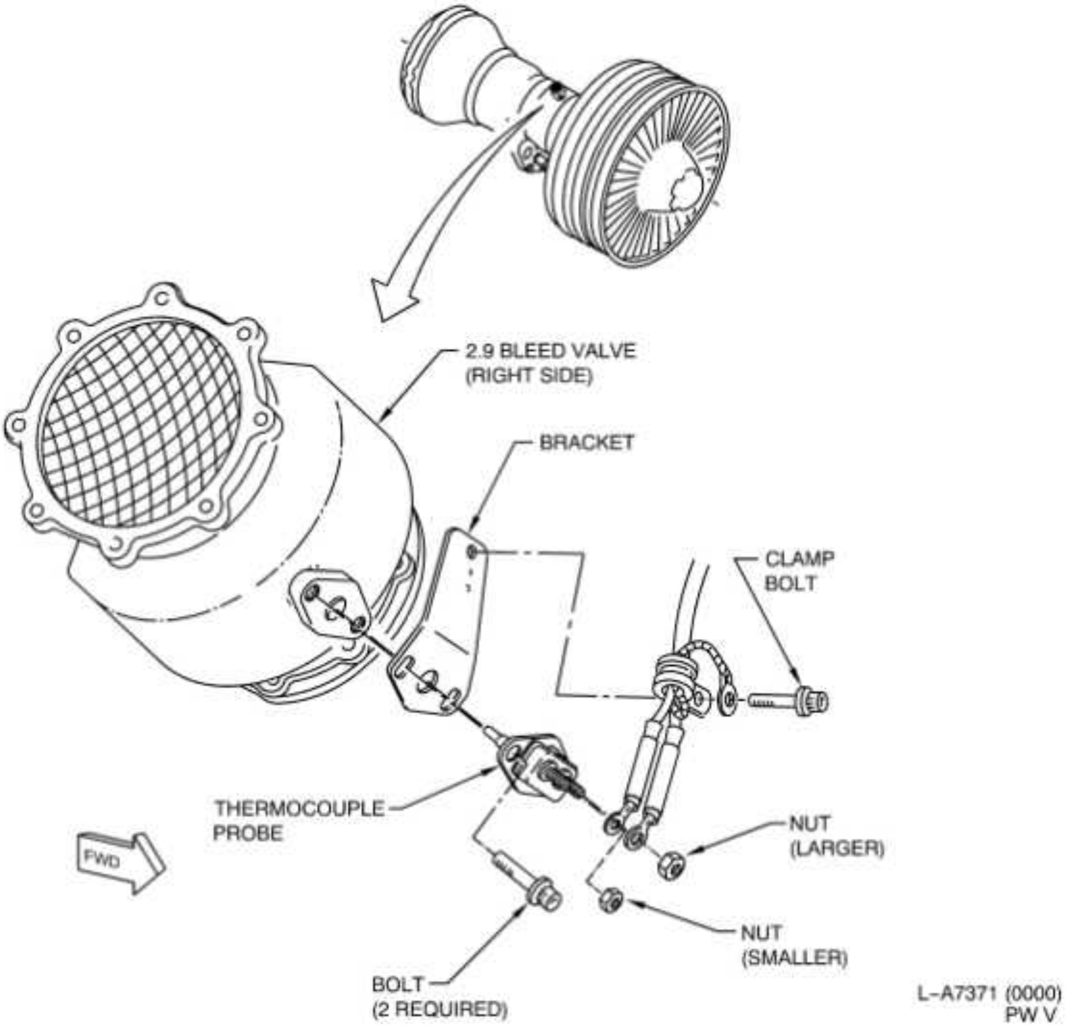
See Figures 301 and 302.

NOTE: Use this procedure for the removal of either the left, the right, or both the thermocouple probes.

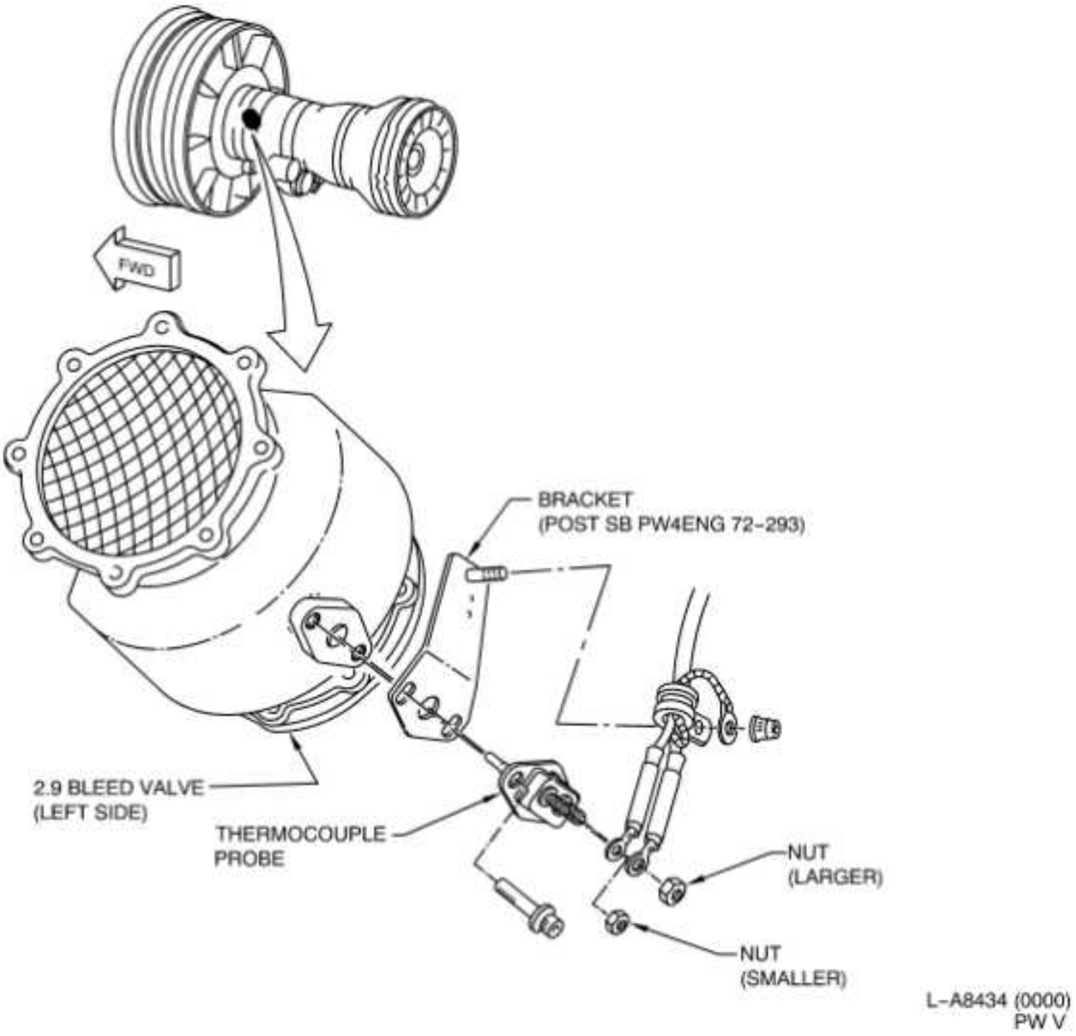
(1) Remove the two nuts and the clamp bolt or nut that attach the harness lead to the thermocouple probe and the bracket.

(2) Remove the two bolts, the bracket, and the thermocouple probe from the bleed valve.

(3) Install protection covers.


2.9 BLEED VALVE
(RIGHT SIDE)
BRACKET
CLAMP
BOLT
THERMOCOUPLE
PROBE
FWD
NUT
(LARGER)
NUT
(SMALLER)
BOLT
(2 REQUIRED)
L-A7371 (0000)
PW V

Ninth Stage Start/Stability (2.9)
Bleed Valve Thermocouple Probe
(Right Side)
Figure 301
(Task 72−00−35−050−014)


FWD
BRACKET
(POST SB PW4ENG 72-293)
2.9 BLEED VALVE
(LEFT SIDE)
THERMOCOUPLE
PROBE
NUT
(LARGER)
NUT
(SMALLER)
L−A8434 (0000)
PW V

Ninth Stage Start/Stability (2.9)
Bleed Valve Thermocouple Probe
(Left Side)
Figure 302
(Task 72−00−35−050−014)

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ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - REMOVAL-18

Task 72-00-35-030-001:

1. Remove The Upper Half Of The HPC Front Case For Access To The 5th Through 8th Stage Blades

A. Prerequisites

(1) Remove the fan-unit from the core-unit. See 72-00-34, Removal-21 Task 72-00-34-020-003.

B. Equipment And Materials Required

Special Tools:

PWA 86564 Sling, HPC Front Split Case

C. Procedure

(1) Remove the tubes from the top left side as follows. See Figure 301.

(a) Remove the lockwire and disconnect the tubes that follow.

1 The HPC air valve and air shutoff valve supply tube (AA22).

2 The air shutoff valve signal tube (AA18).

3 The HPC (left) air valve signal tube (AA06).

4 For engines without the PT4.95 maintenance break at Flange K (Pre SB PW4ENG 73-106), the EEC PT4.95 tube (AS01).

5 For engines with the PT4.95 maintenance break at Flange K (Post SB PW4ENG 73-106), the EEC PT4.95 PT4.95 tube (AS41).

(b) Remove the bolts and nuts that attach the tubes.

(c) Remove the tubes and install the protection covers.

NOTE: For engines without the PT4.95 maintenance break at Flange K (Pre SB PW4ENG 73-106), do not try to remove the (AS01) tube. Move the tube to the rear of Flange H.

(2) Remove the tubes from the top right side as follows: See Figure 302.

(a) Remove the lockwire and disconnect the tubes that follow.

1 The EEC PB tube (AS09).

2 The HPC air valve supply tube (AA25).

3 The HPC air valve signal tube (AA01).

4 The HPC air valve and bleed valve supply manifold (AA24).

5 The (right) bleed valve supply tube (AA28).

6 The (left) bleed valve supply tube (AA30).

(b) Remove the bolts, nuts, and spacers that attach the tubes.

(c) Remove the tubes and install the protection covers.

(3) Disconnect the upper and lower HPC synchronizing rings from each other as follows: See Figure 303.

(a) Remove the bolts and key washers that attach the clevis and plate to each ring.

NOTE: Turn the synchronizing rings as necessary to gain access to the clevis and plate bolts and key washers.

(b) Remove the clevis and plates from each stage.

(4) Remove the twenty two bolts and nuts that attach the top and bottom HPC front cases to each other.

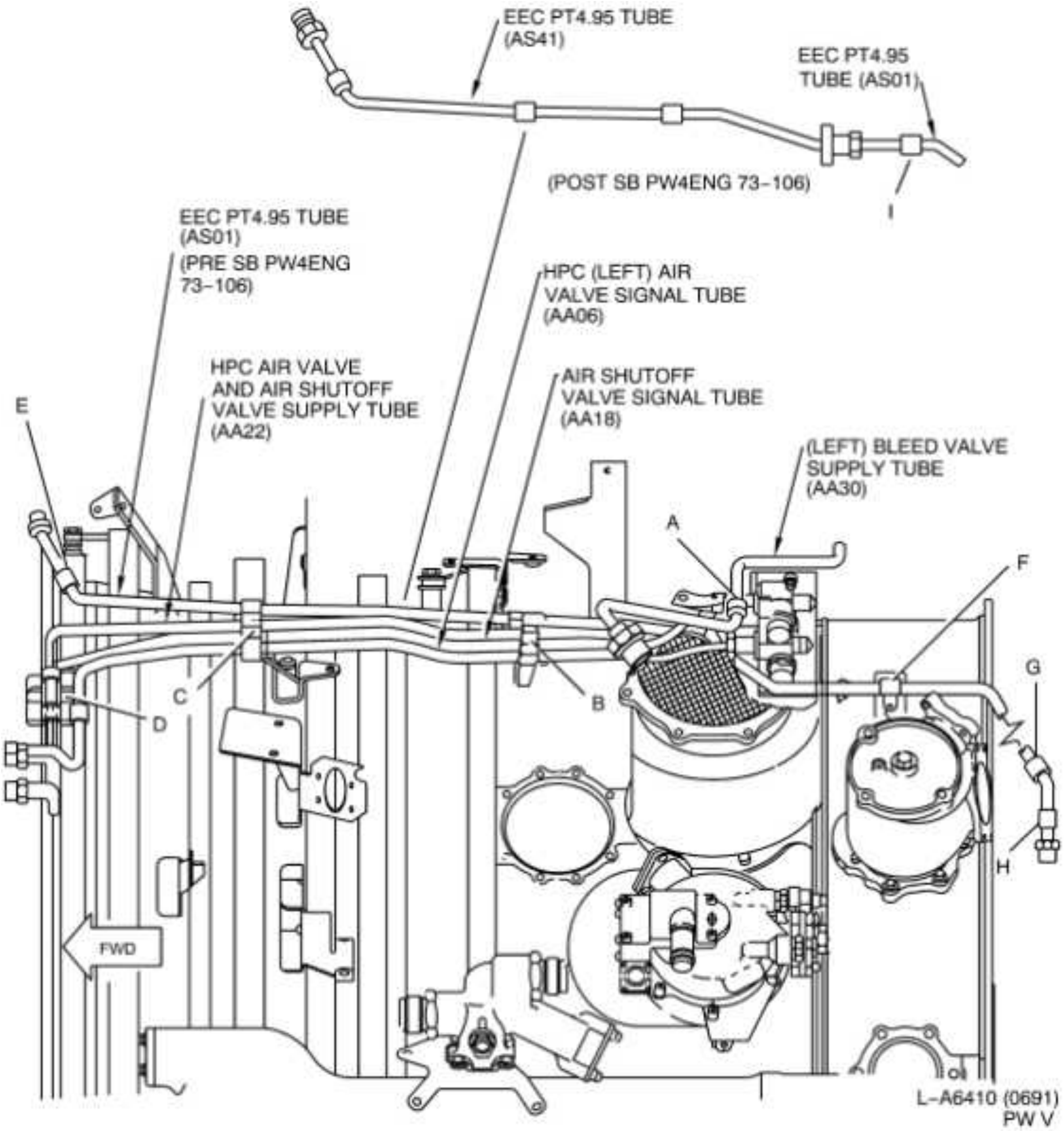
(5) Remove the Flange H hardware as follows (9 - 3 o'clock position). Refer to 72-35-00, Disassembly-21 (Task 72-35-00-030-021).

(6) Attach PWA 86564 Sling to top split case. Use a hoist and carefully raise the top case off of the bottom case. Place case half on storage rack and remove sling.

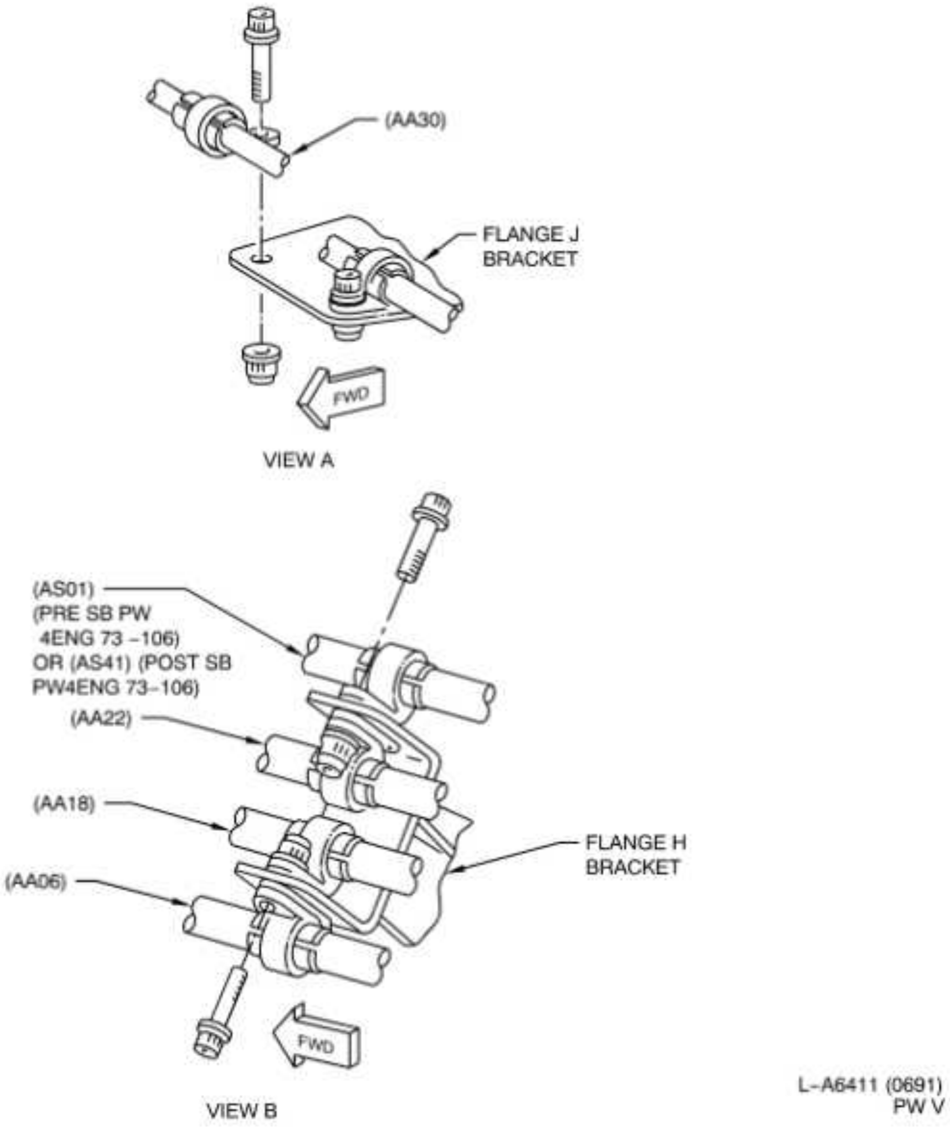
D. Postrequisites

(1) Remove the desired blades. See Removal−19 (Task 72−00−35−030−002).

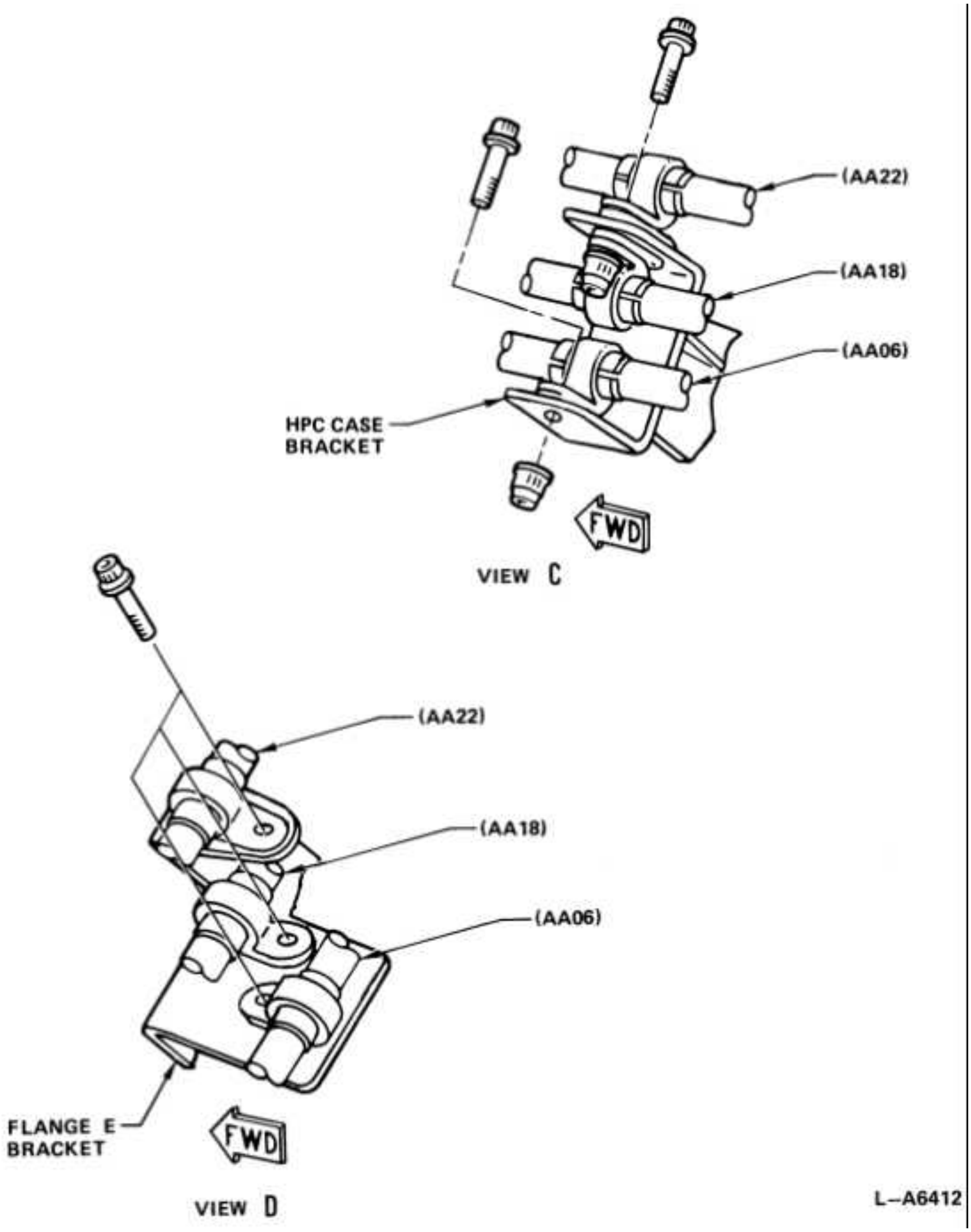
ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−18


EEC PT4.95 TUBE (AS41)
EEC PT4.95 TUBE (AS01)
(POST SB PW4ENG 73−106)
I
EEC PT4.95 TUBE (AS01) (PRE SB PW4ENG 73−106)
HPC (LEFT) AIR VALVE SIGNAL TUBE (AA06)
HPC AIR VALVE AND AIR SHUTOFF VALVE SUPPLY TUBE (AA22)
AIR SHUTOFF VALVE SIGNAL TUBE (AA18)
E
(LEFT) BLEED VALVE SUPPLY TUBE (AA30)
A
F
G
C
D
B
H
FWD
L−A6410 (0691)
PW V

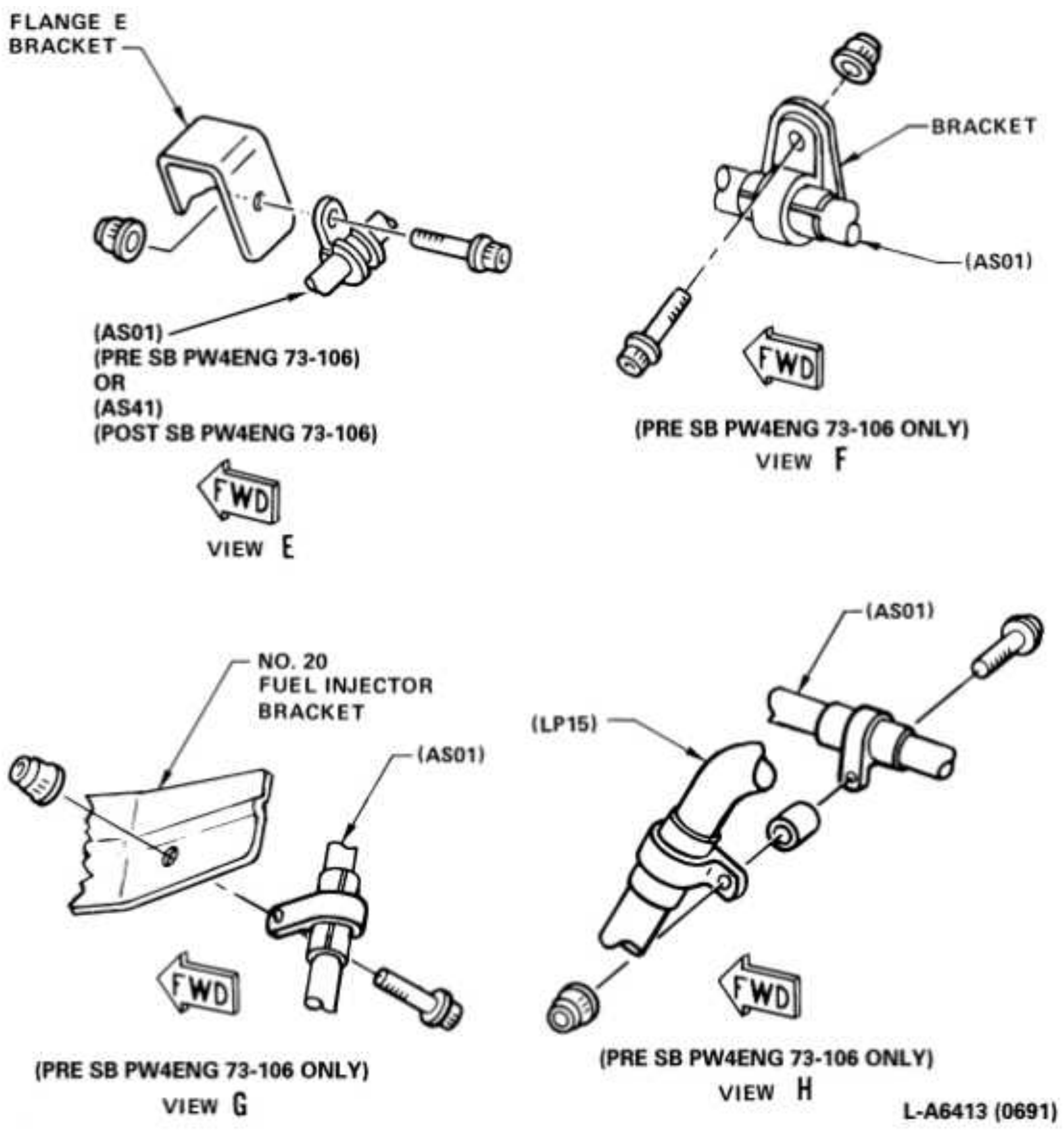
Tube Removal (Left Side)
Figure 301 (Sheet 1)
(Task 72−00−35−030−001)


(AA30)
FLANGE J
BRACKET
FWD
VIEW A
(AS01)
(PRE SB PW
4ENG 73 –106)
OR (AS41) (POST SB
PW4ENG 73–106)
(AA22)
(AA18)
(AA06)
FLANGE H
BRACKET
FWD
VIEW B
L-A6411 (0691)
PW V

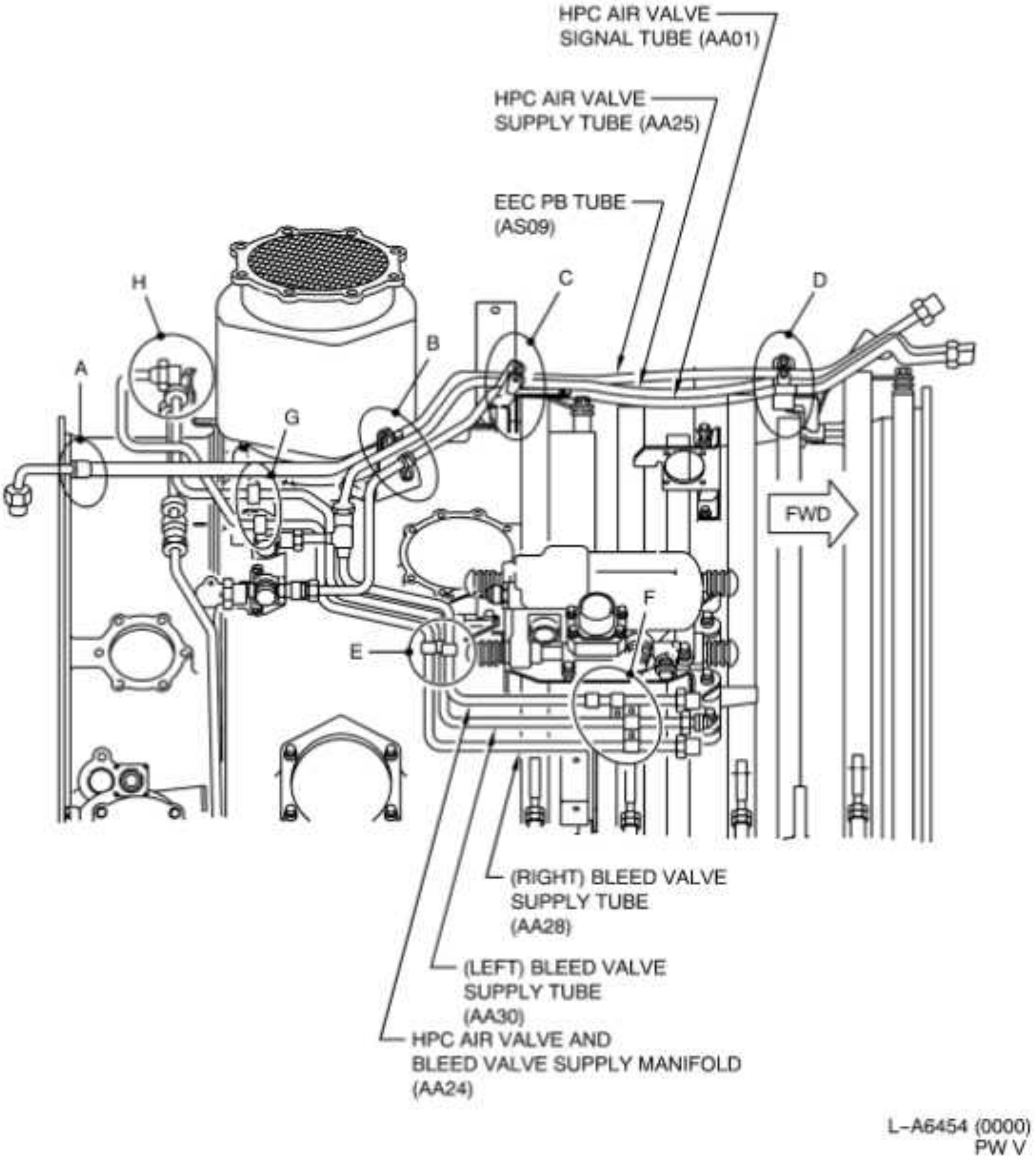
Tube Removal (Left Side)
Figure 301 (Sheet 2)
(Task 72−00−35−030−001)


(AA22)
(AA18)
(AA06)
HPC CASE BRACKET
FWD
VIEW C
(AA22)
(AA18)
(AA06)
FLANGE E BRACKET
FWD
VIEW D
L-A6412

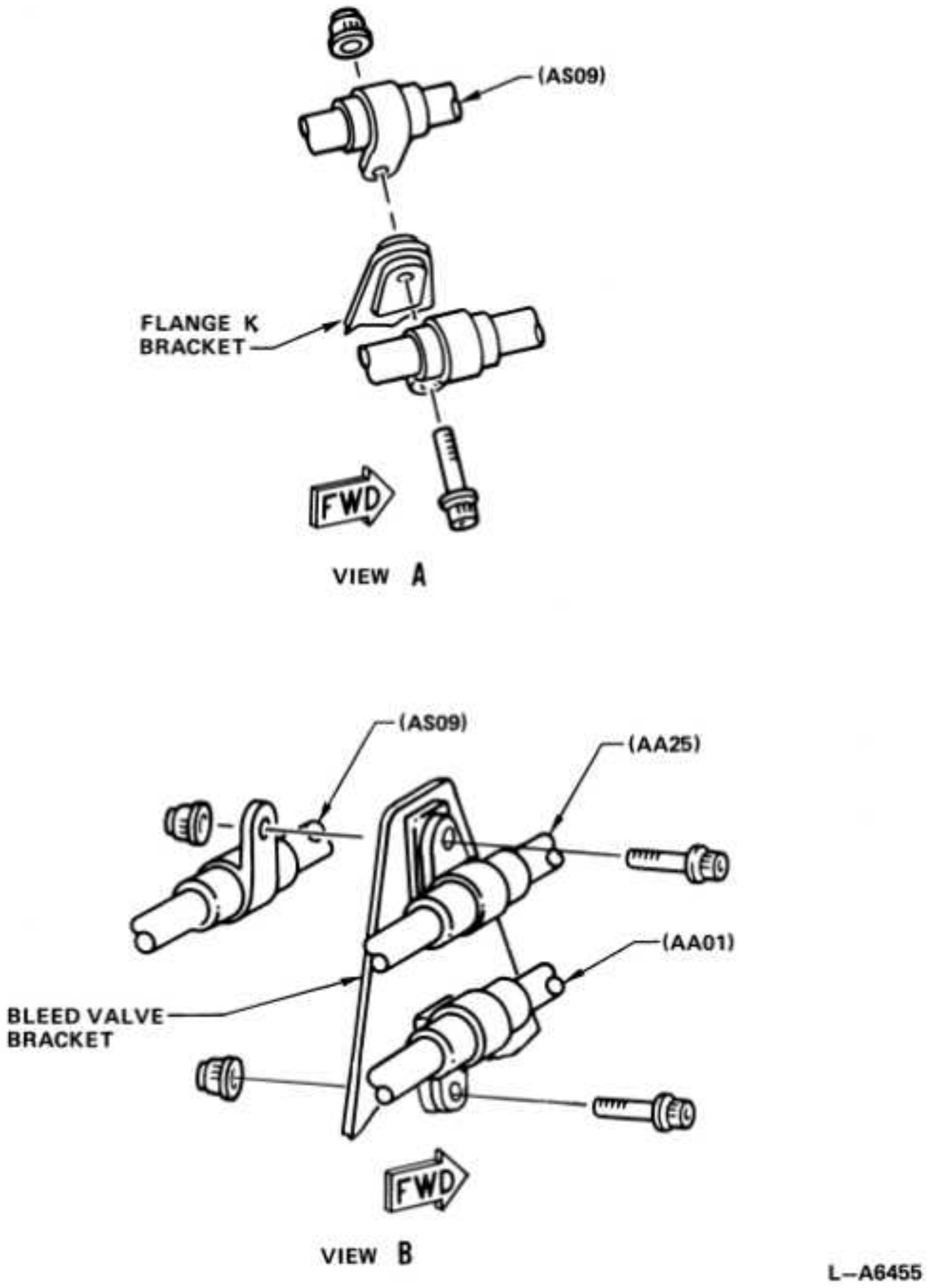
Tube Removal (Left Side)
Figure 301 (Sheet 3)
(Task 72-00-35-030-001)


FLANGE E
BRACKET
(AS01)
(PRE SB PW4ENG 73-106)
OR
(AS41)
(POST SB PW4ENG 73-106)
FWD
VIEW E
BRACKET
(AS01)
FWD
(PRE SB PW4ENG 73-106 ONLY)
VIEW F
NO. 20
FUEL INJECTOR
BRACKET
(AS01)
FWD
(PRE SB PW4ENG 73-106 ONLY)
VIEW G
(AS01)
(LP15)
FWD
(PRE SB PW4ENG 73-106 ONLY)
VIEW H
L-A6413 (0691)

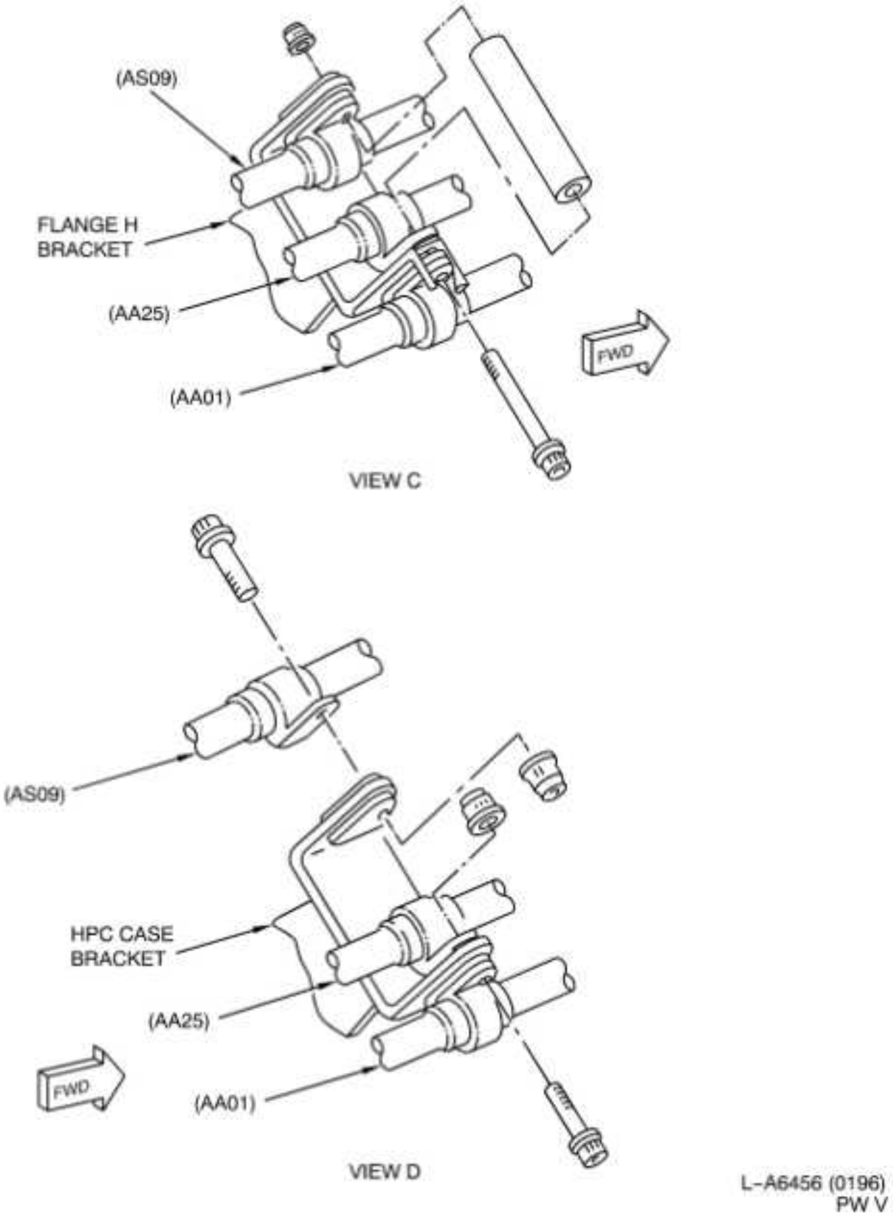
Tube Removal (Left Side)
Figure 301 (Sheet 4)
(Task 72−00−35−030−001)


HPC AIR VALVE SIGNAL TUBE (AA01)
HPC AIR VALVE SUPPLY TUBE (AA25)
EEC PB TUBE (AS09)
H
C
D
A
B
G
FWD
F
E
(RIGHT) BLEED VALVE SUPPLY TUBE (AA28)
(LEFT) BLEED VALVE SUPPLY TUBE (AA30)
HPC AIR VALVE AND BLEED VALVE SUPPLY MANIFOLD (AA24)
L-A6454 (0000)
PW V

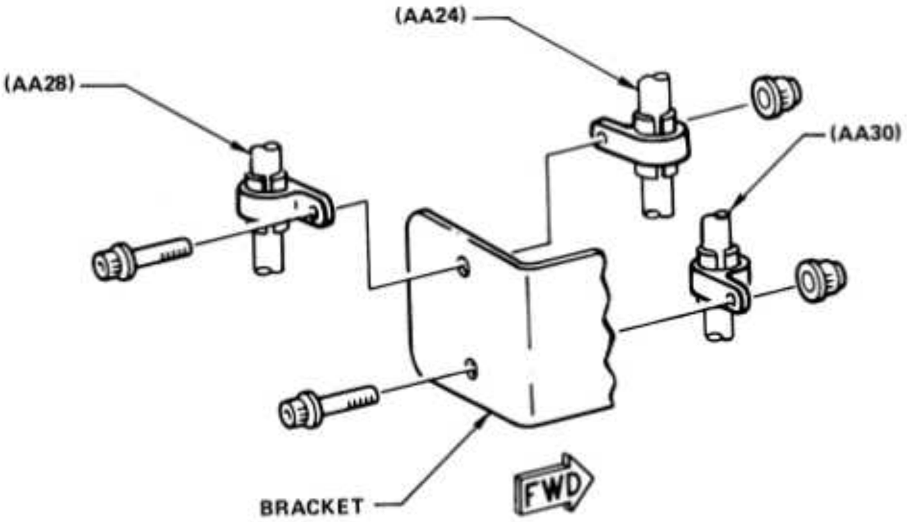
Tube Removal (Right Side)
Figure 302 (Sheet 1)
(Task 72-00-35-030-001)


(AS09)
FLANGE K
BRACKET
FWD
VIEW A
(AS09)
(AA25)
(AA01)
BLEED VALVE
BRACKET
FWD
VIEW B
L-A6455

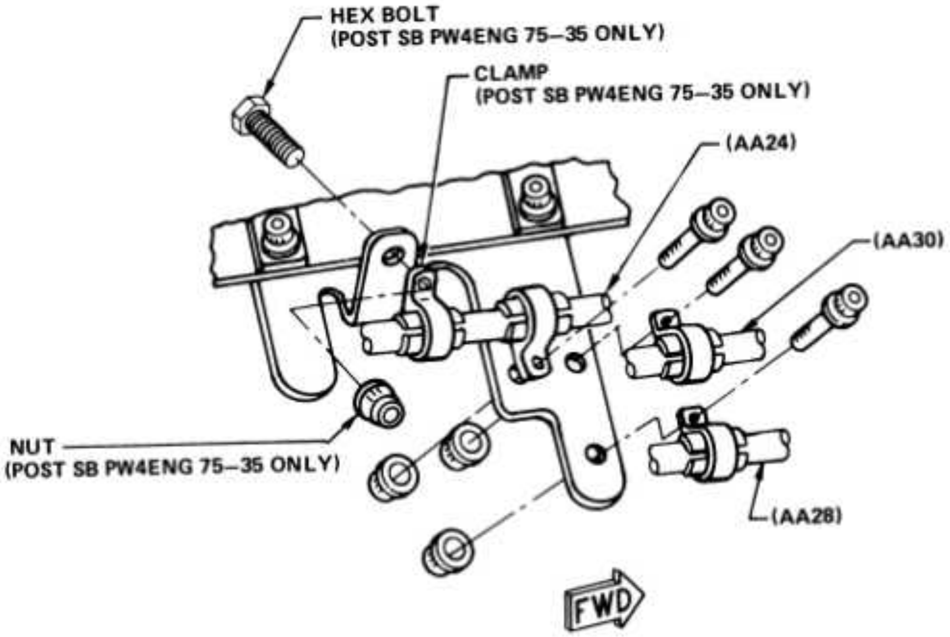
Tube Removal (Right Side)
Figure 302 (Sheet 2)
(Task 72-00-35-030-001)


(AS09)
FLANGE H BRACKET
(AA25)
(AA01)
FWD
VIEW C
(AS09)
HPC CASE BRACKET
(AA25)
FWD
(AA01)
VIEW D
L-A6456 (0196)
PW V

Tube Removal (Right Side)
Figure 302 (Sheet 3)
(Task 72−00−35−030−001)

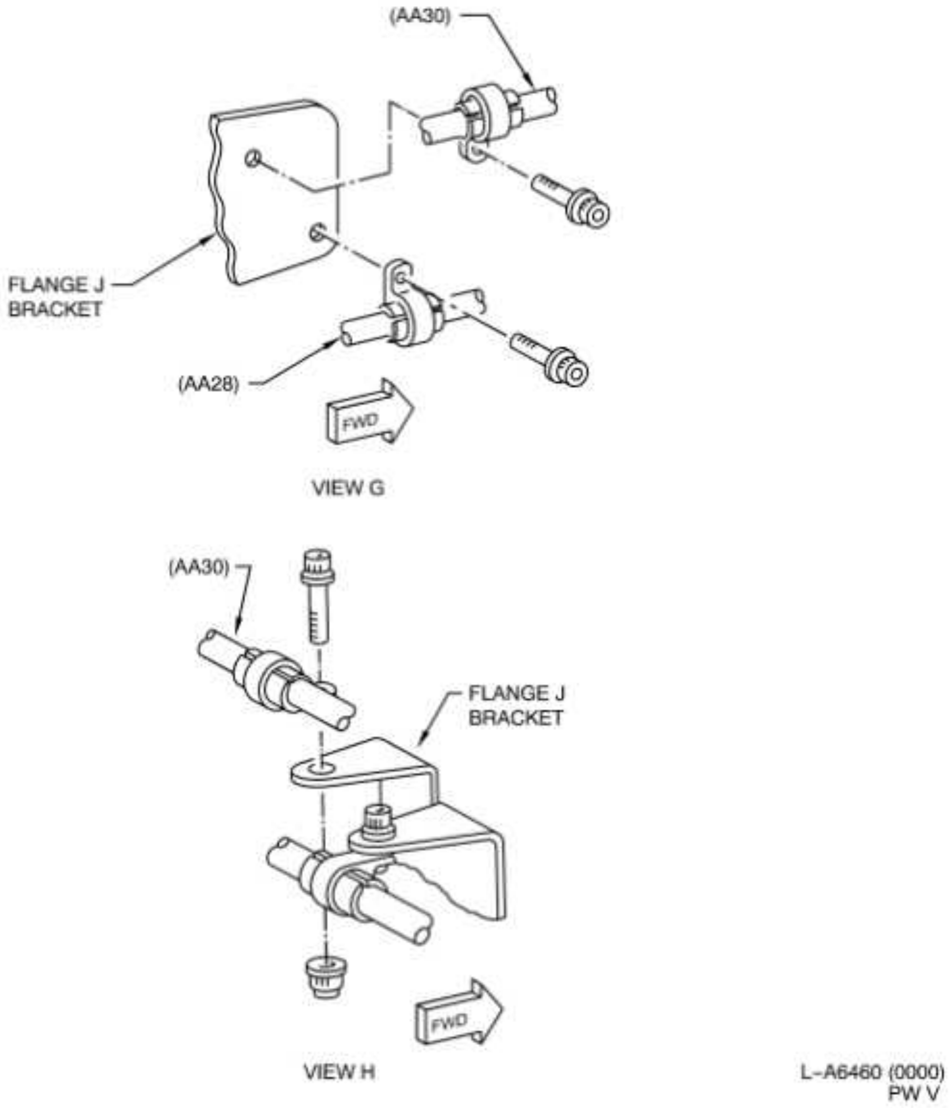

(AA24)
(AA28)
(AA30)
BRACKET
FWD

VIEW E

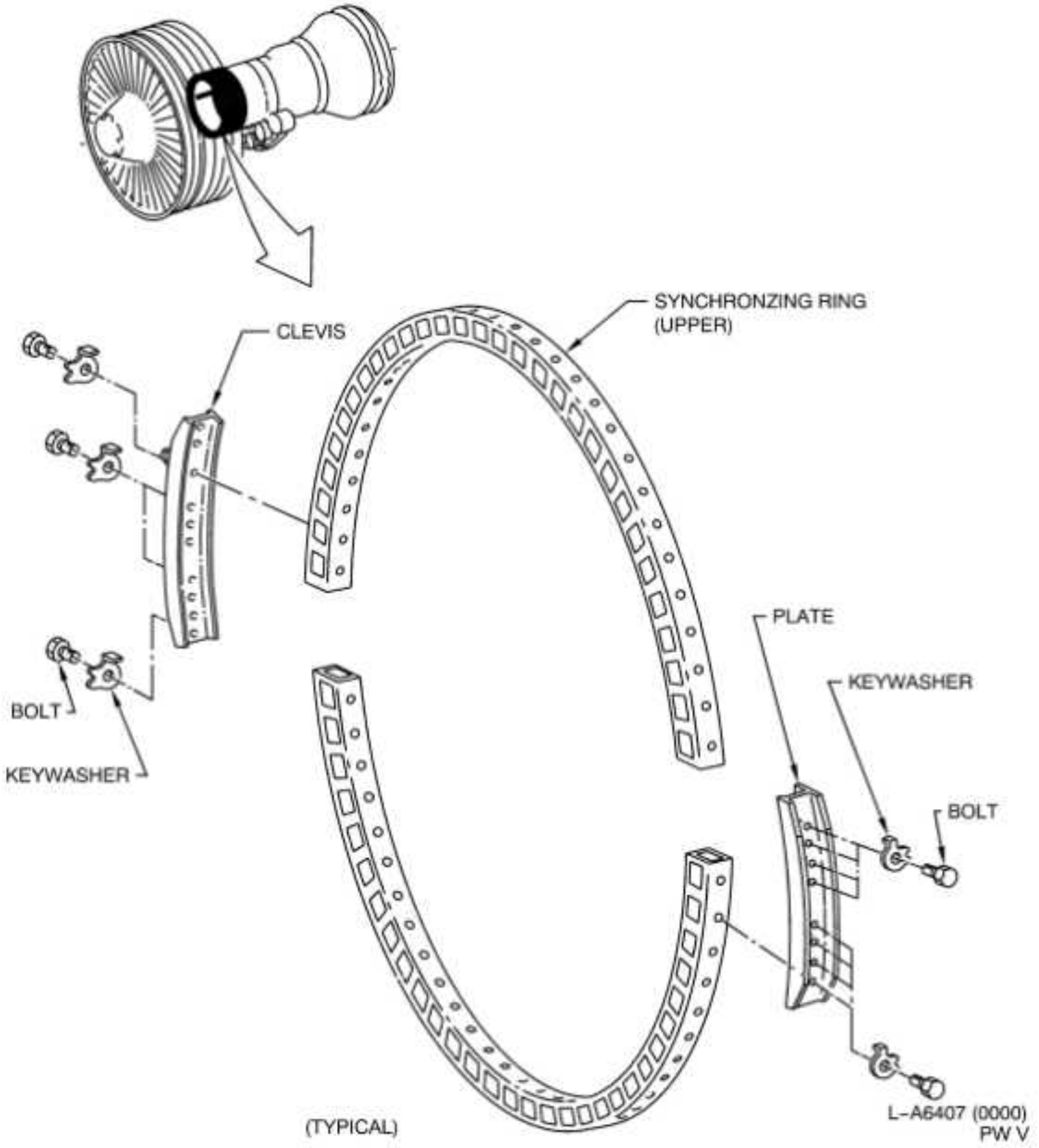

HEX BOLT
(POST SB PW4ENG 75−35 ONLY)
CLAMP
(POST SB PW4ENG 75−35 ONLY)
(AA24)
(AA30)
NUT
(POST SB PW4ENG 75−35 ONLY)
(AA28)
FWD
L−A6458

VIEW F

Tube Removal (Right Side)
Figure 302 (Sheet 4)
(Task 72−00−35−030−001)


(AA30)
FLANGE J
BRACKET
(AA28)
FWD
VIEW G
(AA30)
FLANGE J
BRACKET
FWD
VIEW H
L-A6460 (0000)
PW V

Tube Removal (Left Side)
Figure 302 (Sheet 5)
(Task 72-00-35-030-001)


SYNCHRONZING RING
(UPPER)
CLEVIS
PLATE
KEYWASHER
BOLT
BOLT
KEYWASHER
(TYPICAL)
L−A6407 (0000)
PW V

HPC Synchronizing Ring (Typical)
Figure 303
(Task 72−00−35−030−001)

Task 72-00-35-030-002:

R 1. Remove The 5th Through 8th Stage Blades (Quick HPC Blade Change)

A. Prerequisites

(1) Remove the upper half of the HPC front case for
R access to the 5th thru 8th stage blades. See Section
R 72-00-35, Removal-18 (Task 72-00-35-030-001).

R B. Equipment And Materials Necessary

Special Tools:
PWA 80257 Drift, Tab Bending
PWA 86190 Extractor

C. Procedure

(1) Locally fabricate a suitable protector to cover the opening between the case and rotor stages to prevent foreign material from falling into the engine.

(2) Determine the number of blades that must be replaced. Refer to Table 301.

Blade Replacement Limits	Stage 5	Stage 6	Stage 7	Stage 8
Maximum number of unpaired blades (Original blades must not be eroded, blended, etc.)	0	2	4	4
Maximum number of pairs	6	8	10	10
Maximum number of blades ordered by computer program	40	51	56	53

Blade Replacement Limits
Table 301

(3) Rotate the rotor as required to remove a blade lock at a damaged blade location. Use a PWA 80257 Drift and a mallet to unbend tabs of the lock. Unbend the tabs of the two blade locks in either the clockwise or

counter−clockwise direction from the first blade lock. See Figure 301.

NOTE: To provide sufficient clearance to rotate the blade lock for removal, it is necessary to move two adjacent blade locks in the clockwise or counterclockwise direction from the first.

(4) For 5th stage blade removal only, use a plastic chisel to remove sealant from the blade lock area.

(5) Drift the locks to position the cut−outs in the first lock at the blade locations. Remove the blade lock. Drift the adjacent locks as necessary to remove them from the disk. Discard the blade locks. Use a vacuum to remove loose sealant particles.

CAUTION: ANY PRESSURE OR FORCE REQUIRED TO REMOVE THE BLADES FROM THE DISK MUST BE APPLIED TO ROOT PLATFORM AREA OF THE BLADE AND NOT TO THE LEADING OR TRAILING EDGE OF THE AIRFOIL. THE AIRFOIL SECTION OF BLADES ARE EASILY DAMAGED BY ANY KIND OF FORCE.

R (6) Remove only blades that must be replaced as follows:
R Refer to Table 301.

R (a) In the following step, during blade removal for
R the 5th stage blades, make marks on the 5th stage
R disk to show the location of counterweights, part
R number, and class installed on the 5th stage blade
R roots. Use one of the approved marking methods
R specified in Section 70−11−00 in the Standard
R Practices Manual, PN 585005.

R NOTE: Counterweights must be reinstalled at the
R same location in 72−00−35, Installation−19
R (Task 72−00−35−030−002).

R (b) To remove the 5th thru 7th stage blades, use a drift and mallet at the blade root area to remove blades from the disk.

R (c) To remove the 8th stage blades, use PWA 86190 Extractor and a mallet at the blade root area to remove blades from the disk.

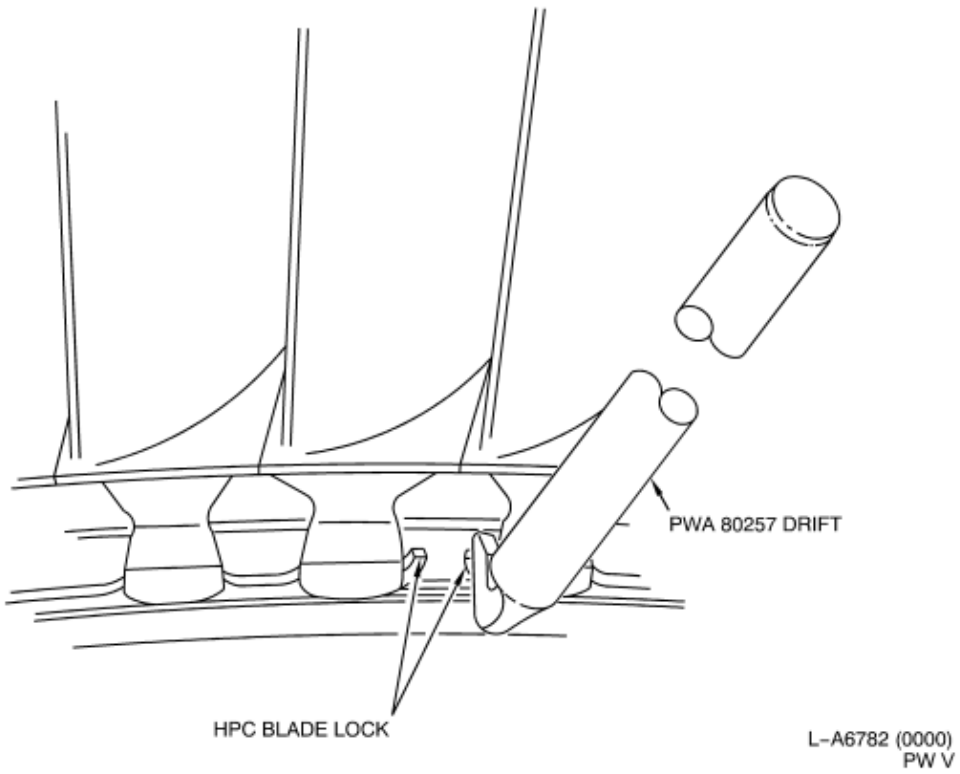
R (d) If the damaged blades exceed the maximum number of pairs limit, then all of the blades in that stage must be replaced.

(7) Use a plastic chisel to remove sealant from the blade roots and blade slots of the rotor as required. Thoroughly vacuum the area to remove sealant particles.

(8) Repeat the above procedure at any other locations that require blade removal.

D. Postrequisites

R (1) Install the desired blades. See Installation-19 (Task
R 72-00-35-430-002).


PWA 80257 DRIFT
HPC BLADE LOCK
L−A6782 (0000)
PW V

R Unbend Blade Locks Typical, Stages 5 Thru 8
Figure 301
(Task 72−00−35−030−002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − REMOVAL−20

Task 72−00−35−050−015:

1. Remove The (2.9) Bleed Valve Screen

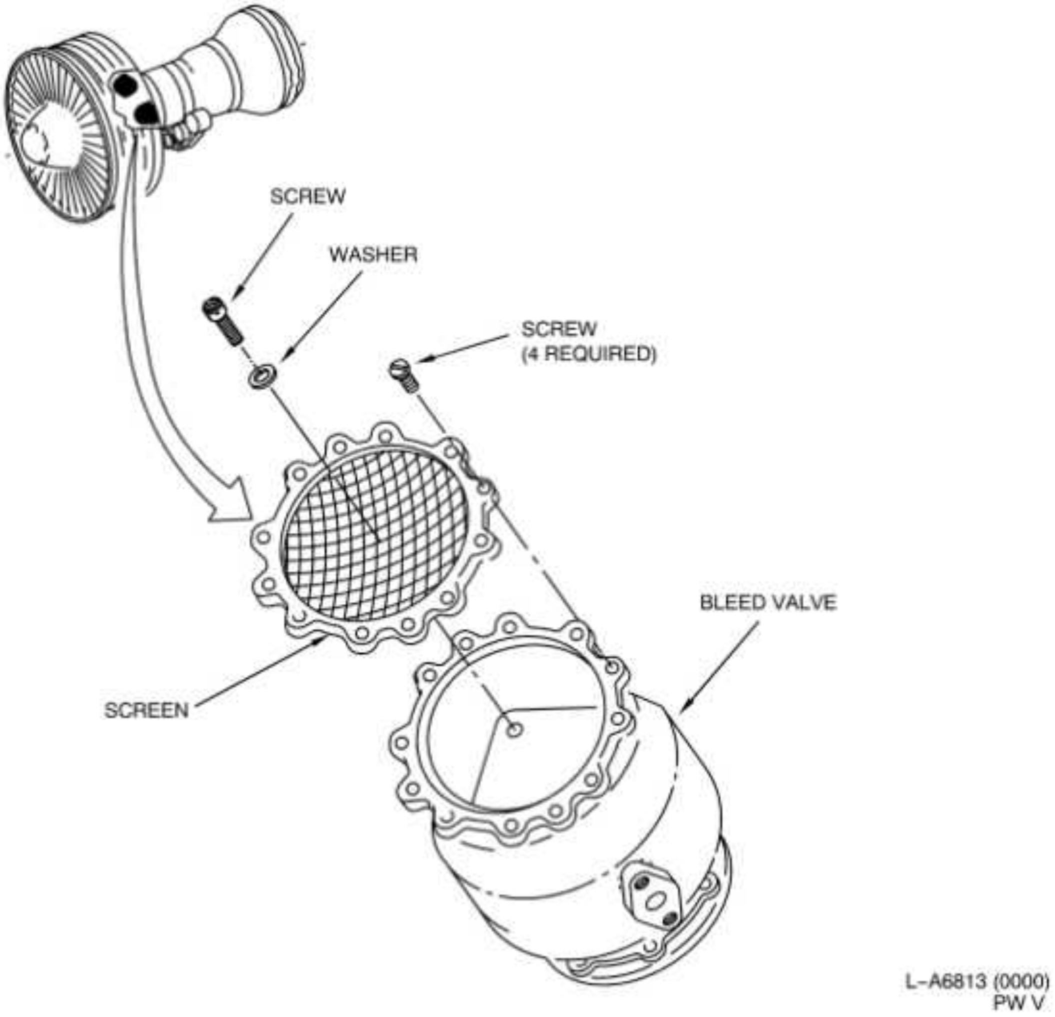
   A. Equipment And Materials Required − None

   B. Procedure

   See Figure 301.

   (1) Remove the screw and washer from the center of the screen and the four screws which secure the screen to the flange of the valve.

   (2) Remove the screen and install a protective cover over the bleed valve port.


SCREW
WASHER
SCREW
(4 REQUIRED)
BLEED VALVE
SCREEN
L−A6813 (0000)
PW V

2.9 Bleed Valve Screen Removal
Figure 301
(Task 72−00−35−050−015)

TURBINE VANE COOLING AIR VALVE - REMOVAL-21

Task 72-00-35-050-016:

1. Remove Turbine Vane Cooling Air Valve

   A. Equipment And Material Required - None

   B. Procedure

   See Figure 301.

   (1) Remove the lockwire and disconnect the tube nut on air signal tube (AA76) from the valve.

   (2) Loosen and remove the bolts that attach the flange of the valve to the flange of the (upper) right turbine vane cooling air duct assembly (AP01).

   (3) Remove the bolt and nut that attach the adjustable link rod end to the bracket that is attached to the valve flange.

   (4) Remove the bolts that attach the valve flange and bracket to the HPC boss.

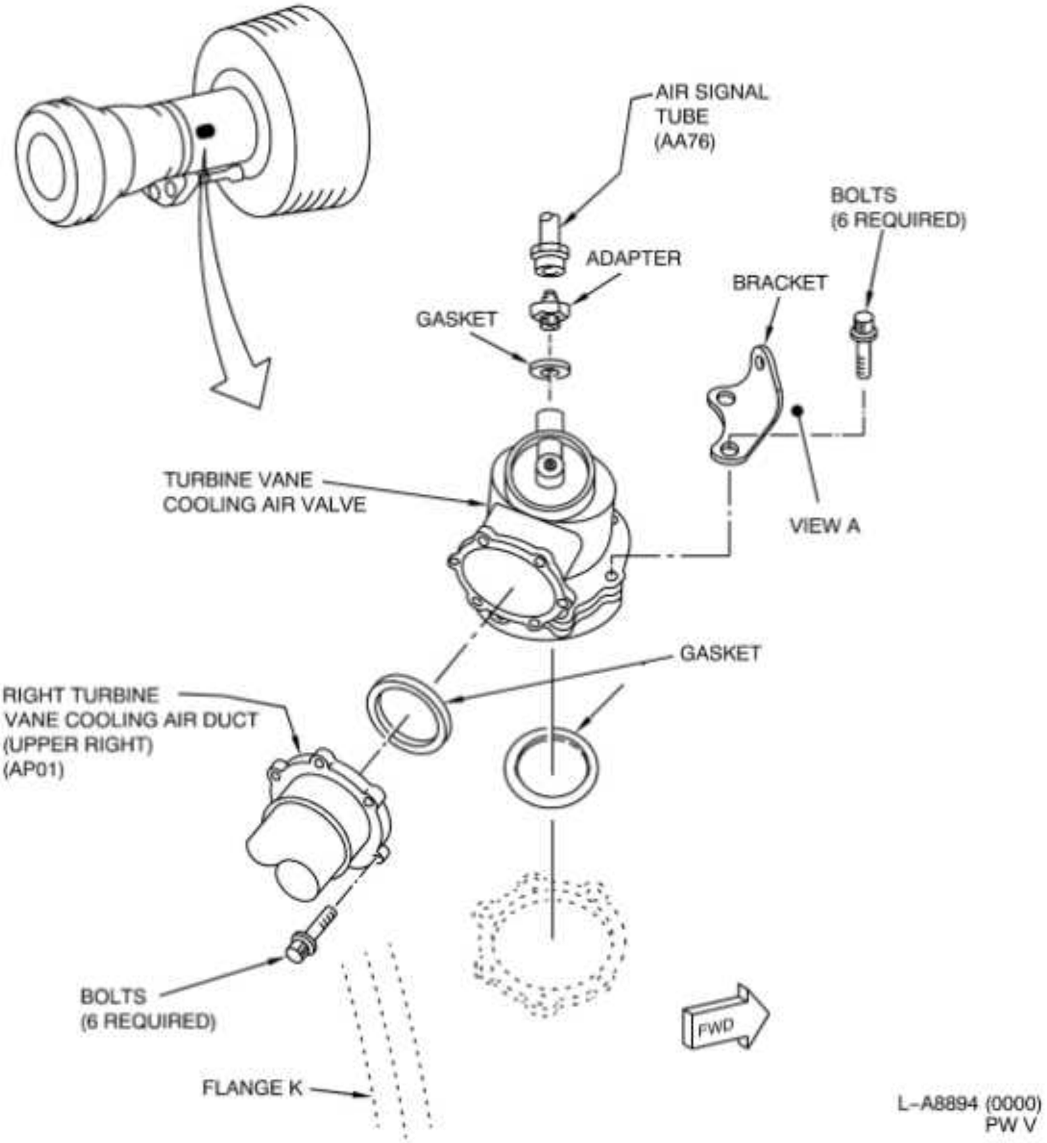
   (5) Remove the turbine vane cooling air valve from the engine. Discard the gaskets.

   (a) If the valve is to be replaced, remove the tube adapter and gasket from the valve.

   (6) Install protection covers to the duct, tube and valve pad.

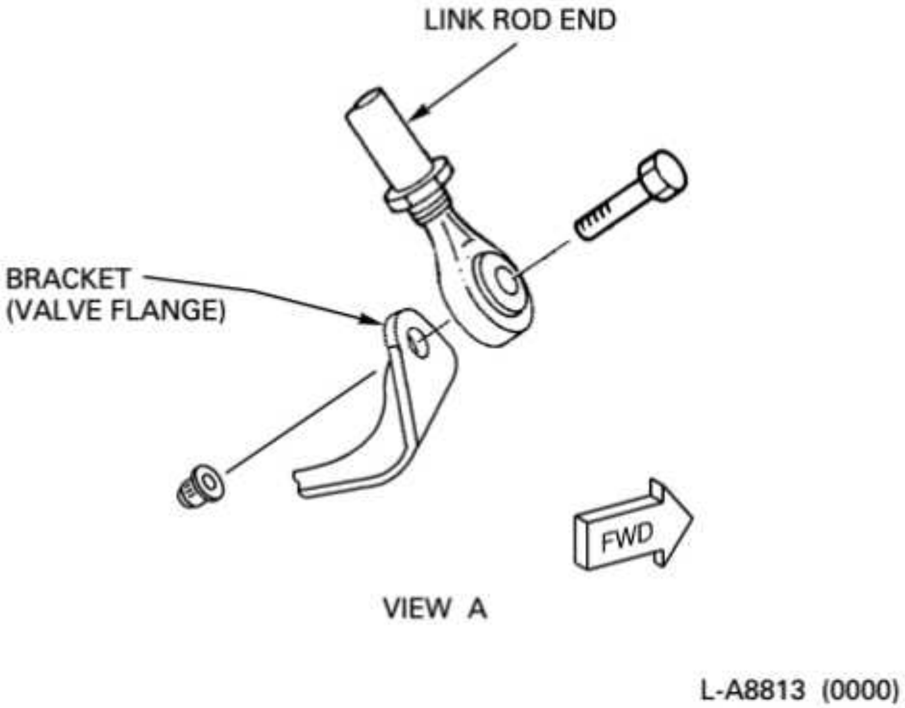
   NOTE: For additional information concerning detailed maintenance of this component see Air Shut Off Valve Component Maintenance Manual, 75-24-29 (Grimes).

TURBINE VANE COOLING AIR VALVE − REMOVAL−21


AIR SIGNAL TUBE (AA76)
BOLTS (6 REQUIRED)
ADAPTER
BRACKET
GASKET
TURBINE VANE COOLING AIR VALVE
VIEW A
GASKET
RIGHT TURBINE VANE COOLING AIR DUCT (UPPER RIGHT) (AP01)
BOLTS (6 REQUIRED)
FWD
FLANGE K
L−A8894 (0000)
PW V

Turbine Vane Cooling Air Valve
Figure 301 (Sheet 1)
(Task 72−00−35−050−016)

TURBINE VANE COOLING AIR VALVE − REMOVAL−21


LINK ROD END
BRACKET (VALVE FLANGE)
FWD
VIEW A
L-A8813 (0000)

Turbine Vane Cooling Air Valve
Figure 301 (Sheet 2)
(Task 72−00−35−050−016)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-35-420-001:

1. Install The HPC

A. Prerequisites

(1) See Inspection/Check-01 (Task 72-00-35-990-001) for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque the retaining nut as follows:

(2) Trunnion the HPC to front end up. Refer to Assemble The High Pressure Compressor (HPC) (Without Ring Case), 72-35-00, Assembly-01 (Task 72-35-00-400-001) or Assemble The High Pressure Compressor (HPC) (With Ring Case), 72-35-00, Assembly-01 (Task 72-35-00-400-007).

B. Equipment And Materials Necessary

Standard Wrenching Tools:
Hydraulic:

PWA 18872	Wrench, Hydraulic
Or	
PWA 33732	Wrench, Hydraulic
Or	
PWA 87354	Wrench, Hydraulic
Or	
PWA 80070	Wrench System, Hydraulic (Includes Pump, Cart, Wrench)
PWA 29510	Pump, Hand (2 Hose)
Or	
PWA 28814	Pump, Electric (2 Hose)
PWA 28815	Cart, Storage (Optional)
Or	
PWA 28825	Cart, Storage (Optional)
Or	
PWA 75046	Cart, Storage (Optional)

Mechanical:

PWA 45418	Wrench, Mechanical
Or	
PWA 80071	Wrench, Mechanical
Or	
PWA 80187	Wrench, Mechanical
PWA 45419	Multiplier, Pneumatic
Or	

Standard Wrenching Tools:

(CONTINUED)

PWA 80651	Multiplier, Pneumatic (Do Not Use With PWA 45418)
PWA 85375	Plate, Anchor (Do Not Use With PWA 80071)
Or	
PWA 88100	Plate, Anchor

Special Tools:

PWA 3755	Pump, Hydraulic (1 Hose)
Or	
PWA 29389	Pump, Hydraulic (1 Hose)
PWA 29606	Control, Heater
PWA 75028	Gage, Hydraulic Pressure
PWA 76154	Adapter, Sling (4 Necessary)
PWA 85030	Pusher, Hydraulic (No. 2 Bearing And Seal Assembly)
PWA 85530	Wrench, Torque (HPC Rear Hub Nut)
PWA 85536	Adapter, Torque (HPC Rear Hub)
PWA 85537	Fixture, Handling (HPC Front Case) (For HPCs With A Symmetric Case)
Or	
PWA 88560	Fixture, Handling (HPC Front Case) (For HPCs With An Asymmetric Case)
PWA 86155	Wrench (No. 2 Bearing Retaining Ring Bolts)
PWA 88643	Sling (2 Necessary)
Or	
PWA 88673	Sling (2 Necessary)
PWA 102072	Gage, Flush Pin
PWA 103114	Fixture, Handling (No. 2 Bearing And Support Assembly)
PWA 103115	Heater (No. 2 Bearing And Seal Assembly)

Special Tools (Hydraulic Wrenching):

PWA 85510	Wrench (Front Seal Seat Nut)
PWA 85512	Wrench (No. 2 Bearing Nut)
PWA 86002	Retainer (Adapter To HPC Front Hub)
PWA 86596	Adapter, Holding (HPC Front Hub)

Special Tools (Mechanical Wrenching):

PWA 85032	Adapter, Holding (HPC Front Hub)
PWA 85033	Wrench (No. 2 Bearing Nut)
PWA 85034	Wrench (No. 2 Front Seal Seat Nut)
PWA 86002	Retainer (Adapter To HPC Front Hub)

Consumable Materials:

Item No.	Designation
P06-001	Lubricant, Dry Film (PMC 9934)
P09-002	Compound, Anaerobic Retaining (PWA 549-8)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Nut	1	72-35-00/1/50

C. Procedure

NOTE: A change to a different HPC module does not require a change in thickness of the classified spacer that has been selected for the No. 2 bearing and seal assembly.

NOTE: Heat is necessary to install the No. 2 bearing and seal assembly on the HPC front hub. An oven or electrical heater is necessary to increase the temperature of the assembly for this procedure.

(1) (Reference 1002) Make a record of Dimensions CC, U, W, and X as follows. See Figure 401 (Sheet 1), Figure 401 (Sheet 2), and Figure 401 (Sheet 3).

(a) If not previously done, measure Dimension CC. Refer to Final Assemble The No. 2 Bearing And Seal Assembly, 72-34-04, Assembly-03 (Task 72-34-04-440-002).

(b) Make a record of Dimension CC on the Worksheet.

(c) Measure the Dimension U on the HPC hub.

(d) Make a record of Dimension U on the Worksheet.

(e) Calculate Dimension T1.

(f) Make a record of calculated Dimension T1 on the Worksheet.

(g) Measure the Dimension W on the nut [1].

(h) Make a record of Dimension W on the Worksheet.

(i) Measure Dimension X on the lock [2].

(j) Make a record of Dimension X on the Worksheet.

(k) Calculate Dimension Y1.

(l) Make a record of calculated Dimension Y1 on the Worksheet.

(2) If you will use an oven to heat the assembly, set the oven temperature now to 300° − 350°F (149° − 177°C).

(3) (Post SB PW4ENG 72−204) If applicable, install the 5th stage HPC shroud retaining ring [12] on the No. 2 bearing and seal assembly as follows. See Figure 402.

(a) Apply Compound P09−002 to the threads of 22 bolts [11].

(b) Align and attach the retaining ring [12] to the assembly with the bolts [11].

(c) Torque the bolts [11] evenly and in small increments to 180 − 200 lb−in. (20.337 − 22.597 N.m).

(4) Install the PWA 103114 Handling Fixture to the No. 2 bearing and seal assembly as follows. See Figure 403.

(a) Turn the assembly to front end up.

(b) Align the dowel pin hole in the Fixture with the dowel pin in the assembly.

(c) Attach the Fixture with the eleven detail bolts.

CAUTION: DO NOT LET THE BEARING INNER RACE TEMPERATURE BE MORE THAN 50°F (28°C) HIGHER THEN THE OUTER RACE TEMPERATURE. THE BEARING OUTER RACE TEMPERATURE CAN BE MORE THAN THE INNER RACE TEMPERATURE.

CAUTION: WHEN YOU HEAT THE ASSEMBLY, THE GEAR MUST BE FREE TO TURN AT ALL TIMES.

(5) (Reference 1002) Heat the No. 2 bearing and seal assembly by one of the methods which follows. See Figure 404 for the PWA 103115 Electrical Heater Method.

(a) Oven Method:

1 Attach a hoist to the Handling Fixture.

2 Put the assembly in the oven.

3 Remove the hoist and sling.

4 Make sure the temperature of the oven is 300° - 350°F (149° - 177°C).

(b) PWA 103115 Electrical Heater Method:

1 Attach a hoist to the Handling Fixture.

2 Put the assembly on a heat resistant surface.

3 Put the Heater on the assembly so that the heat element is inside the bevel gear bore.

4 Connect the PWA 29606 Heater Control to the Heater receptacle and the thermocouple leads.

5 The thermocouple probe must touch the part to be heated.

6 Adjust the Heater Control to a temperature of 300° - 350°F (149° - 177°C).

(6) While the No. 2 bearing and seal assembly heats, prepare the HPC front hub for installation of the assembly as follows. See Figure 405 (Sheet 1).

(a) Insert the shaft and puller plate of the PWA 85030 Hydraulic Pusher into the hub of the HPC and then rotate the plate and install it against the bottom surface of the hub.

(b) Install the Pusher plate and nut at the top of the hub to lock the shaft and plate in position.

(c) Apply a thin layer of Lubricant P06-001 on the hub.

(d) Install either the PWA 3755 or PWA 29389 Hydraulic Pump and PWA 75028 Hydraulic Pressure Gage on the hydraulic cylinder of the Hydraulic Pusher.

CAUTION: YOU MUST PUT A LOAD ON THE BEARING AND SEAL ASSEMBLY IN LESS THAN TWO MINUTES AFTER REMOVAL FROM THE OVEN. IF YOU DO NOT, THE MAY NOT FULLY INSTALL THE ASSEMBLY TO THE HUB.

(7) (Reference 1002) When the No. 2 bearing and seal assembly is at 300° − 350°F (149° − 177°C), install the assembly on the HPC hub as follows. See Figure 405 (Sheet 2) and Figure 405 (Sheet 3).

(a) If the Heater was used, shut off the power and disconnect the Controller from the Heater. Do not remove the Heater from the assembly.

(b) Attach a hoist to the Handling Fixture and move over the HPC.

(c) Align the tabs on the assembly with the slots in the HPC inlet airseal.

(d) Install the assembly on the HPC front hub.

(e) Remove the hoist.

(f) Use protective gloves to carefully remove the Heater.

(g) Install the Pusher detail cover and hydraulic cylinder over the shaft and install the nut.

(h) In less than two minutes after removal from the oven, use the Pusher to put a 5800 psi (39989.6 kPa) load on the assembly for 15 minutes minimum.

(i) After 15 minutes, remove the Pusher, Gage, and Pump.

CAUTION: THE GEAR AND BEARING INNER RACE MUST TURN FREELY AT ALL TIMES. IF NECESSARY, DECREASE THE TEMPERATURE OF THE ID OF THE HPC FRONT HUB WITH CLEAN SHOP AIR.

CAUTION: DO NOT PUT ANYTHING COLD ON THE BEARING. IF YOU PUT SOMETHING COLD ON THE BEARING, YOU WILL MAKE THE OUTER RACE

SMALLER THAN THE INNER RACE, AND THE GEAR WILL NOT TURN.

(j) The gear must turn freely at all times. If necessary, cool the inside of the HPC front hub with clean shop air.

NOTE: If the outer race cools faster than the inner race, it is possible that the gear will not turn.

(k) Turn the No. 2 bearing support assembly to align the pin in the support assembly between the two tabs which are closest together at 6 o'clock position.

CAUTION: WHEN YOU MEASURE THE DIMENSIONS, THE TEMPERATURE OF THE PARTS MUST BE WITHIN 5°F (2.8°C) OF ROOM TEMPERATURE.

(8) (Reference 1002) Make sure that the assembly is fully installed as follows. See Figure 401 (Sheet 1) and Figure 401 (Sheet 4).

(a) Measure Dimension T.

(b) Make a record of the Dimension T on the Worksheet.

(c) The measured Dimension T must not be more than 0.001 inch (0.025 mm) or less than 0.0015 inch (0.038 mm) of the calculated Dimension T1.

(d) If the measurements are not in the limits, you must remove the assembly, do the measurements again, and install the assembly again until the measurements are in the limits.

CAUTION: THE NUT YOU INSTALL MUST BE NEW OR HAVE NEW ANTIGALLANT APPLIED. TO APPLY NEW ANTIGALLANT TO THE NUT, REFER TO 72−35−95, REPAIR−01 (TASK 72−35−95−300−001), PW4000 Series CIR, PN 51A357.

(9) Install the No. 2 bearing nut lock [2] and No. 2 bearing retaining nut [1] to the hub handtight only. See Figure 406.

(a) Make sure that Dimension W and Dimension X are on the Worksheet.

(10) For operators that use the mechanical wrenching tools, install the wrenching tools as follows. See Figure 407.

(a) Engage the PWA 85032 Adapter teeth to the HPC front hub and attach it with the PWA 86002 Retainer as follows.

1 Install the Retainer through the Adapter and engage the inside of the HPC hub with the detail foot.

2 Install the slotted washer.

3 Tighten the detail nut to make the Adapter tight on the HPC hub.

(b) Install the PWA 85033 Wrench over the Adapter and engage the Wrench teeth to the nut [1].

(c) Install the standard mechanical wrenching tools (from the Standard Wrenching Tools list) to torque the nut [1].

(11) For operators that use the hydraulic wrenching tools, install the wrenching tools as follows. See Figure 408.

(a) Engage the PWA 86596 Adapter teeth to the HPC front hub and attach it with the PWA 86002 Retainer as follows.

1 Install the Retainer through the Adapter and engage the inside of the HPC hub with the detail foot.

2 Install the slotted washer.

3 Tighten the detail nut to make the Adapter tight on the HPC hub.

(b) Install the PWA 85512 Wrench over the Adapter and engage the Wrench teeth to the nut [1].

(c) Install the standard hydraulic wrenching tools (from the Standard Wrenching Tools list) to torque the nut [1].

CAUTION: IF YOU REMOVE THE NUT AFTER YOU TORQUE IT, YOU MUST APPLY NEW ANTIGALLANT TO IT. REFER TO 72−35−95, REPAIR−01 (TASK 72−35−95−300−001), PW4000 Series CIR, PN 51A357.

(12) (Reference 974) Torque the No. 2 bearing retaining nut [1] as follows.

(a) Tighten the nut [1] to 4500 − 5500 lb−in. (508.482 − 621.416 N.m).

(b) Turn the nut [1] through an angle of 5 − 10 degrees.

(c) Loosen the nut [1] to zero.

(d) Tighten the nut [1] to 4500 − 5500 lb−in. (508.482 − 621.416 N.m).

(e) Find a common reference point between the nut [1] and its mating part.

(f) Turn the nut [1] through an angle of 5 − 10 degrees.

(g) Loosen the nut [1] to 0 lbf−in.

(h) Tighten the nut [1] to 4500 − 5500 lb−in. (508.482 − 621.416 N.m).

(i) If the reference point of the nut [1] is aligned with the reference point of the mating part, or no more than two degrees beyond it, turn the nut [1] through an angle of 5 − 10 degrees.

(j) If the reference points are not in the limits, do steps (e),(f),(g), and (h) until the reference points are in the limits. Then do step (i).

(k) Remove all the tools except the Adapter and Retainer.

(13) (Reference 1002) Measure and record Dimension Y by one of the methods which follows. See Figure 401 (Sheet 1) and Figure 401 (Sheet 4).

(a) Standard Depth Micrometer Method:

1 Measure Dimension Y with a standard depth micrometer. and record the measurement.

2 Make a record of Dimension Y on the Worksheet.

(b) PWA 102072 Flush Pin Gage Method:

1 Install the Gage on the front face of the HPC front hub.

2 Put the Gage detail flush pin on the nut [1] forward surface.

3 Read and record the measurement, Dimension Y on the digital indicator.

4 Make a record of Dimension Y on the Worksheet.

5 Remove the Gage.

(14) Use the Worksheet to determine if the installation is satisfactory as follows. See Figure 401 (Sheet 1).

(a) Calculate Dimension Y2.

(b) Measured Y must be equal to, or more than, Calculated Y2 by 0.004 inch (0.102 mm).

(c) If the measurements are not in the limits, you must remove the assembly, do the measurements again, install the assembly again until the measurements are in limits.

(15) Install the key washer [29] and retaining ring [28] on the nut [1]. See Figure 409.

(16) Examine the assembly for foreign objects, damage, and correct assembly.

CAUTION: THE No. 2 BEARING RETAINING NUT YOU INSTALL MUST BE NEW.

(17) Install the No. 2 bearing front seal seat [27] with the seal face up and the No. 2 bearing front seal seat nut [26] handtight only. See Figure 409.

(18) (Reference 973) For operators that use the mechanical wrenching tools, install the wrenching tools as follows. See Figure 410.

(a) Install the PWA 85034 Wrench over the Adapter and engage the Wrench teeth to the nut [26].

(b) Install the standard mechanical wrenching tools (from the Standard Wrenching Tools list) to torque the nut [26].

(19) For operators that use the hydraulic wrenching tools, install the wrenching tools as follows. See Figure 411.

(a) Install the PWA 85510 Wrench over the Adapter and engage the Wrench teeth to the nut [26].

(b) Install the standard hydraulic wrenching tools (from the Standard Wrenching Tools list) to torque the nut [26].

CAUTION: IF YOU REMOVE THE NO. 2 BEARING RETAINING NUT AFTER YOU TORQUE IT, YOU MUST THEN INSTALL A NEW NUT.

(20) (Reference 973) Torque the No. 2 bearing face seal nut [26] as follows.

(a) Torque the nut [26] to 800 - 1200 lb-in. (90.388 - 135.582 N.m).

(b) Turn the nut [26] through an angle of 9 - 10 degrees, 12 minutes.

(c) Loosen the nut [26] to 0 lb-in. (0.000 N.m).

(d) Torque the nut [26] to 800 - 1200 lb-in. (90.388 - 135.582 N.m).

(e) Turn the nut [26] through an angle of 9 - 10 degrees, 12 minutes.

(f) Remove the tools.

(21) Install the key washer [38] and retaining ring [37]. See Figure 412.

(22) Examine the assembly for foreign objects, damage, and correct assembly.

(23) Install the PWA 85537 Handling Fixture to the front of the HPC as follows. See Figure 413.

(a) Install the PWA 88643 Sling or PWA 88673 Sling and two PWA 76154 Adapters to a hoist.

(b) Carefully lift and lower the Fixture to the HPC front case.

(c) Attach the Fixture to the HPC front case with the 36 detail screws, washers, and nuts.

(d) Attach the Fixture to the No. 2 bearing and seal assembly with the 17 detail screws.

(24) Trunnion the HPC to front end down as follows.

(a) Use the hoist, Sling, and Adapters to lift the HPC.

(b) Carefully use a second hoist, Sling, and Adapters on the rear Fixture to turn the HPC to front end down.

(c) Install the HPC front end down in the Stand.

(d) Remove the hoist, Sling, and Adapters from the front Fixture.

R (25) Remove the rear PWA 107219 Fixture as follows. See Figure 414.

(a) Use the PWA 85536 Adapter and the PWA 85530 Wrench to remove the PWA 85535 Nut or PWA 88701 Nut from the HPC rear hub.

(b) Remove the 24 detail bolts.

(c) Use the hoist, Sling, and Adapters to remove the rear Fixture.

(26) Examine the assembly for foreign objects, damage, and correct assembly.

(27) Make sure that you install all the necessary protection covers.

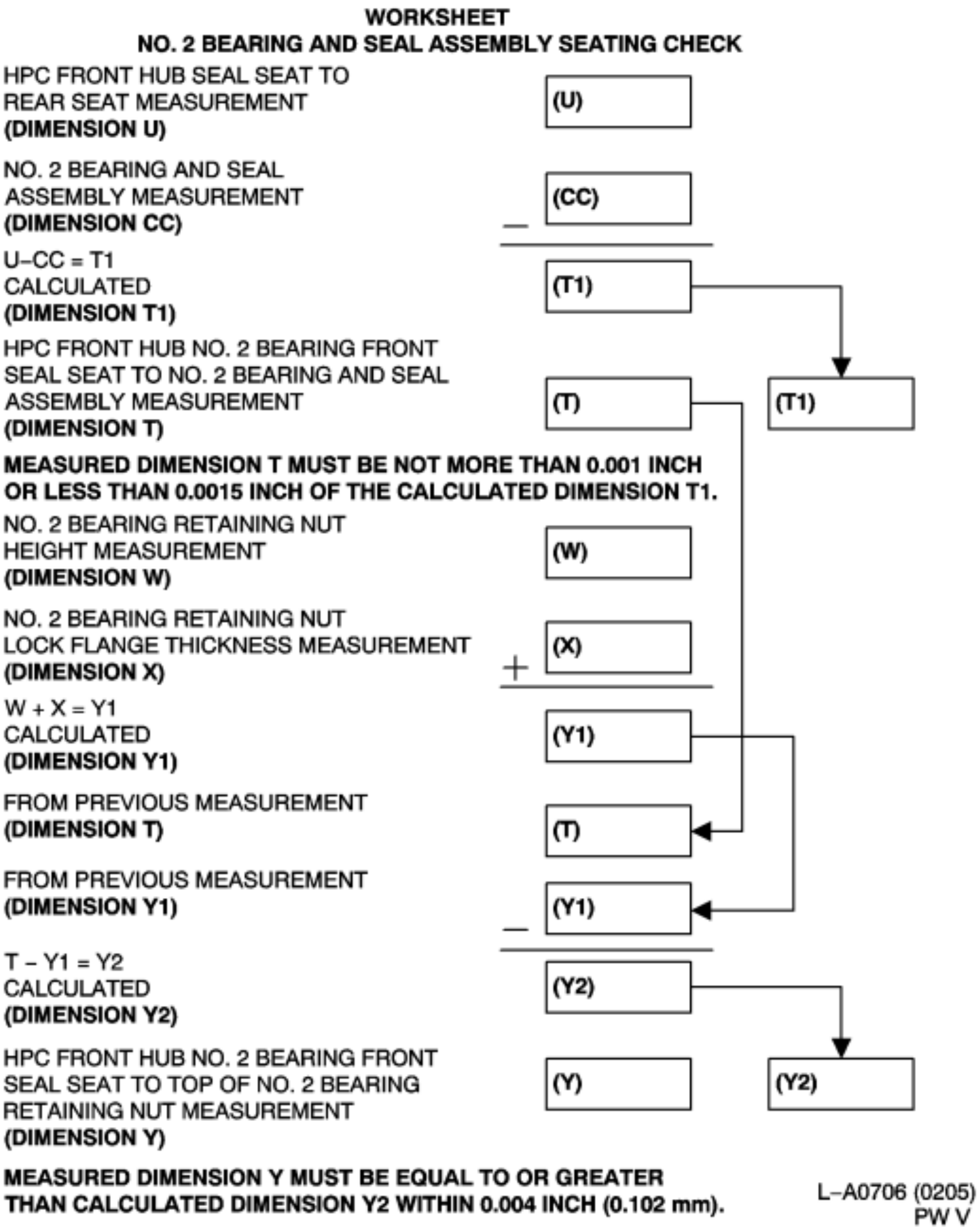
D. Postrequisites

(1) Install The External Plumbing On The High Pressure Compressor. Refer to Installation−03 (Task 72−00−35−420−002).

(2) Install The Diffuser And Combustor. Refer to 72−00−41, Installation−01 (Task 72−00−41−420−001).

(3) Install The Intermediate Case. Refer to 72−00−34, Installation−01 (Task 72−00−34−420−001).

(4) See Figure 415 for more postrequisite tasks.



WORKSHEET
NO. 2 BEARING AND SEAL ASSEMBLY SEATING CHECK

HPC FRONT HUB SEAL SEAT TO REAR SEAT MEASUREMENT **(DIMENSION U)**

NO. 2 BEARING AND SEAL ASSEMBLY MEASUREMENT **(DIMENSION CC)**

U-CC = T1 CALCULATED **(DIMENSION T1)**

HPC FRONT HUB NO. 2 BEARING FRONT SEAL SEAT TO NO. 2 BEARING AND SEAL ASSEMBLY MEASUREMENT **(DIMENSION T)**

MEASURED DIMENSION T MUST BE NOT MORE THAN 0.001 INCH OR LESS THAN 0.0015 INCH OF THE CALCULATED DIMENSION T1.

NO. 2 BEARING RETAINING NUT HEIGHT MEASUREMENT **(DIMENSION W)**

NO. 2 BEARING RETAINING NUT LOCK FLANGE THICKNESS MEASUREMENT **(DIMENSION X)**

W + X = Y1 CALCULATED **(DIMENSION Y1)**

FROM PREVIOUS MEASUREMENT **(DIMENSION T)**

FROM PREVIOUS MEASUREMENT **(DIMENSION Y1)**

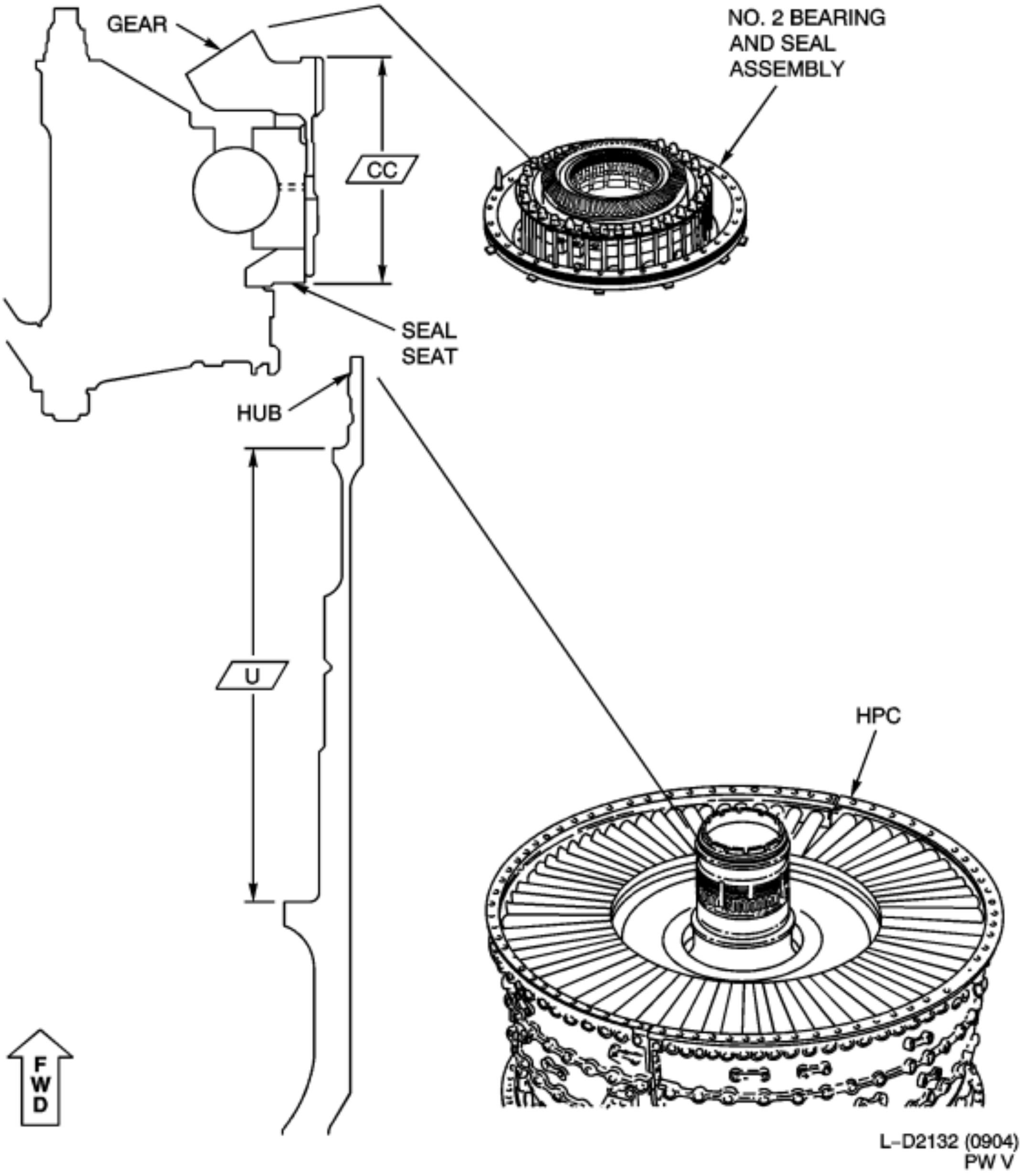
T - Y1 = Y2 CALCULATED **(DIMENSION Y2)**

HPC FRONT HUB NO. 2 BEARING FRONT SEAL SEAT TO TOP OF NO. 2 BEARING RETAINING NUT MEASUREMENT **(DIMENSION Y)**

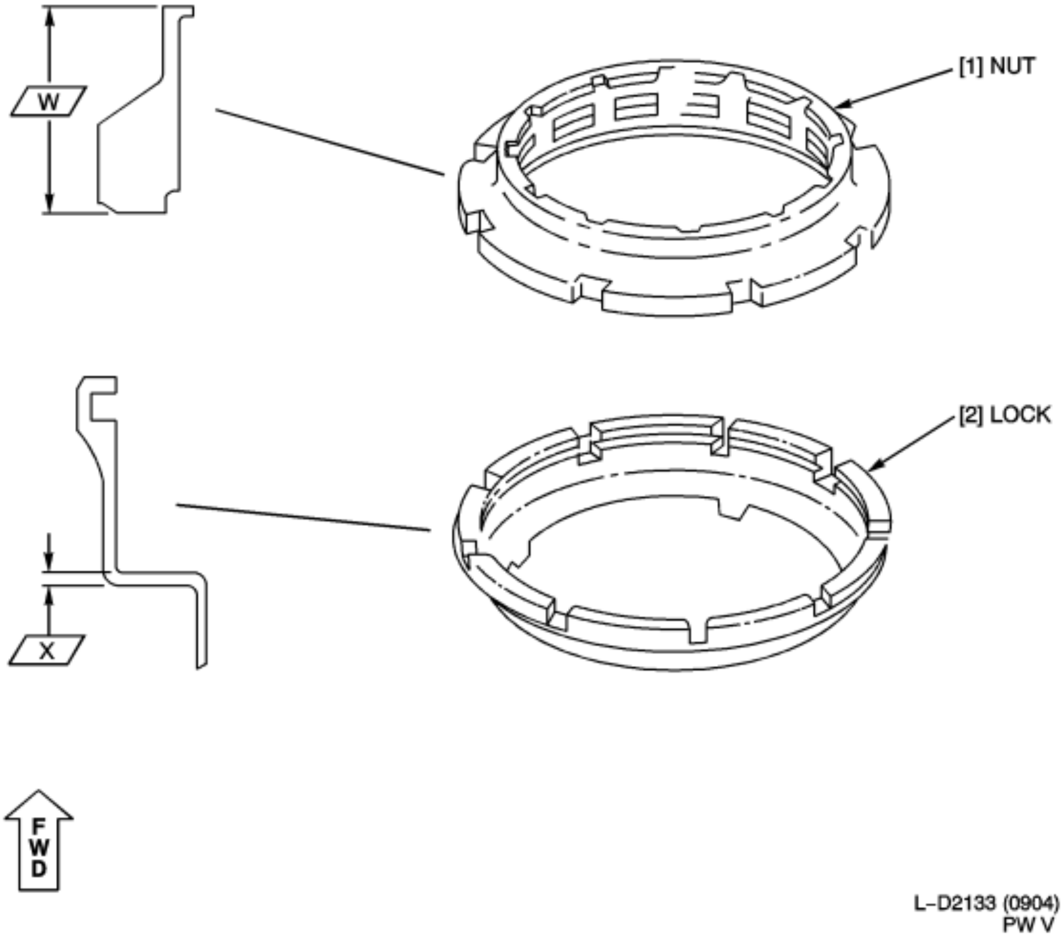
MEASURED DIMENSION Y MUST BE EQUAL TO OR GREATER THAN CALCULATED DIMENSION Y2 WITHIN 0.004 INCH (0.102 mm).

L-A0706 (0205)
PW V

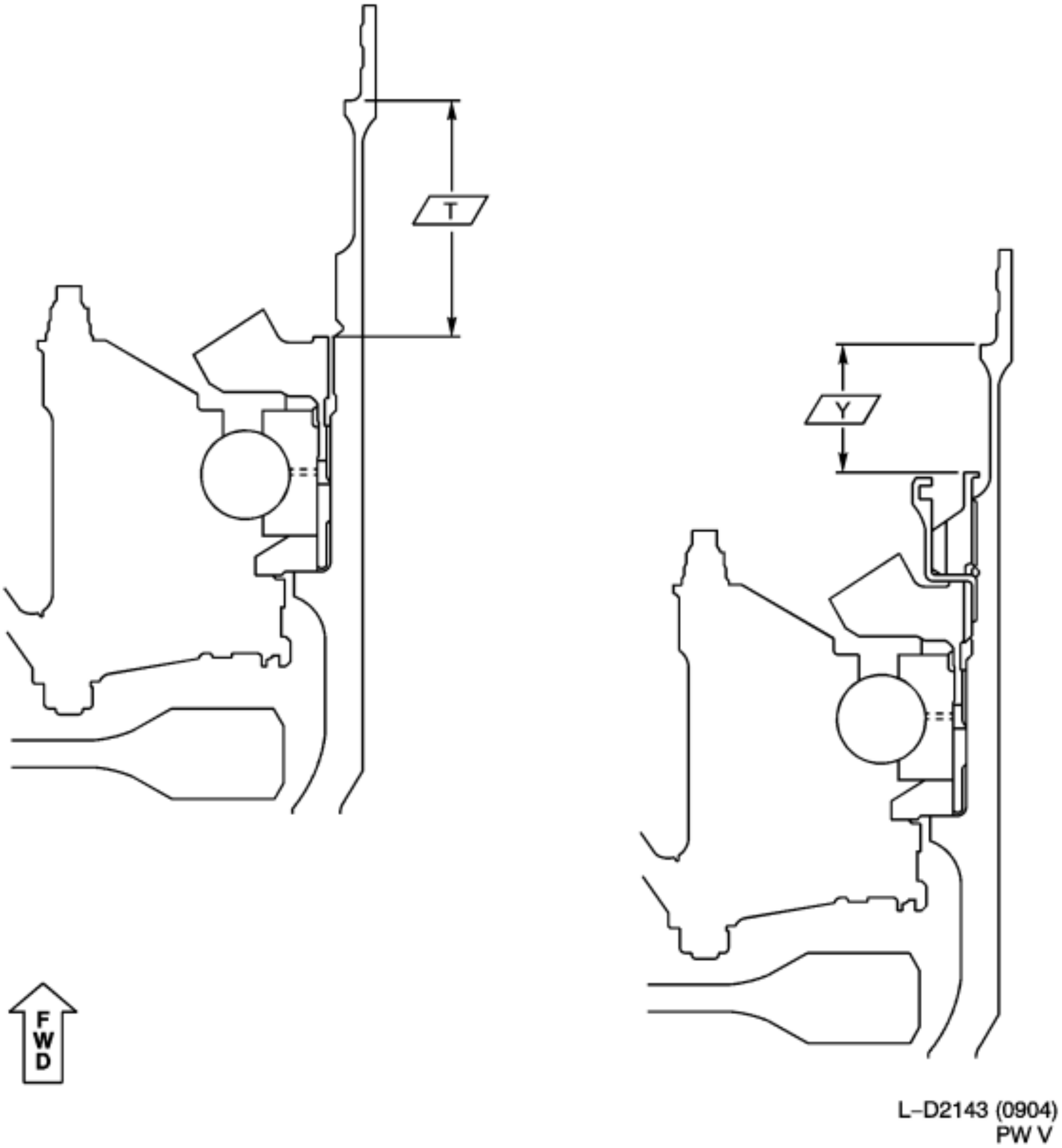
Install The HPC - (Measurements And Calculations - Worksheet)
Figure 401 (Sheet 1)
(Task 72-00-35-420-001)


GEAR
NO. 2 BEARING AND SEAL ASSEMBLY
CC
SEAL SEAT
HUB
U
HPC
FWD
L-D2132 (0904)
PW V

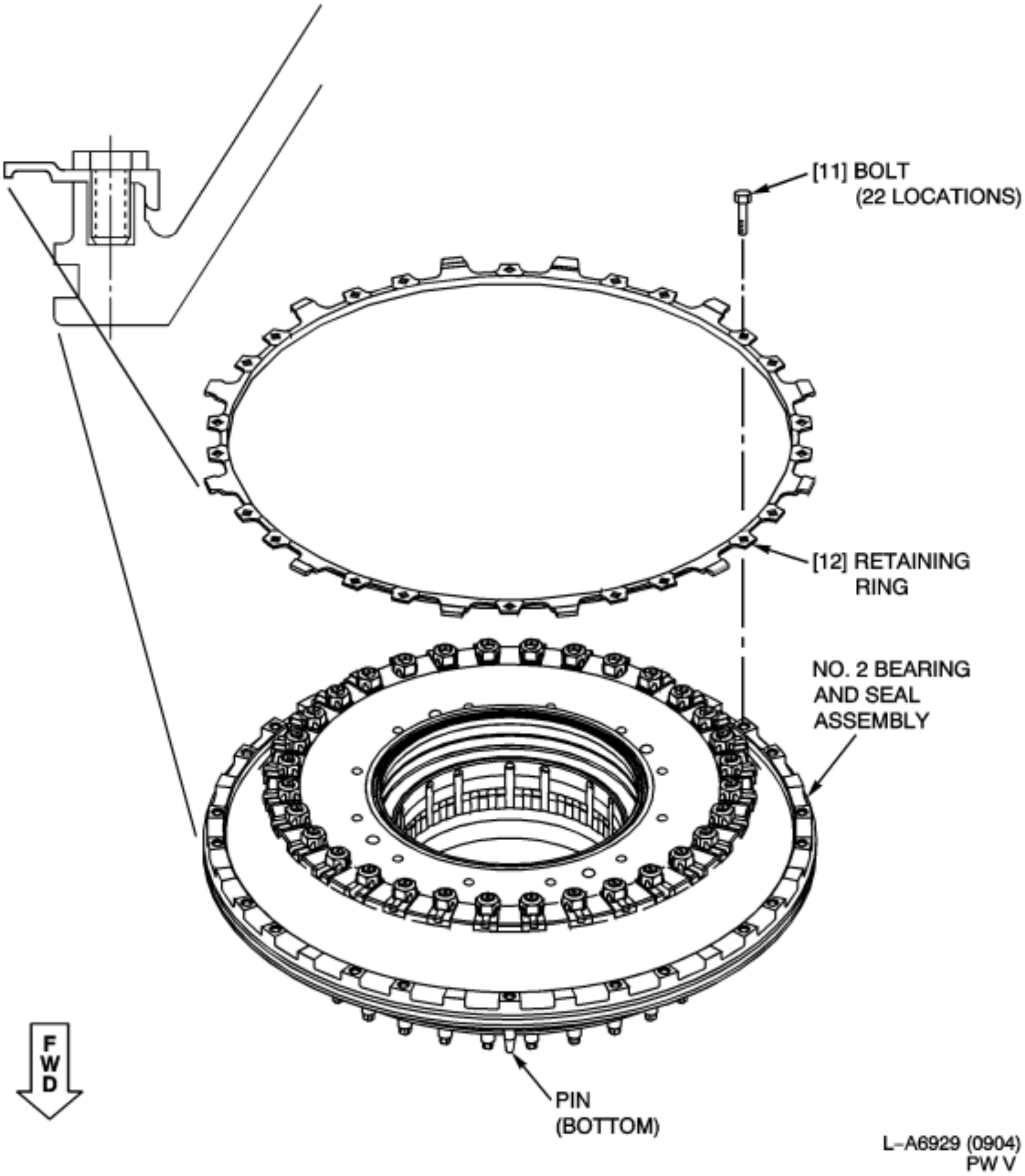
Install The HPC - (Measurements And Calculations)
Figure 401 (Sheet 2)
(Task 72-00-35-420-001)


W
[1] NUT
[2] LOCK
X
FWD
L−D2133 (0904)
PW V

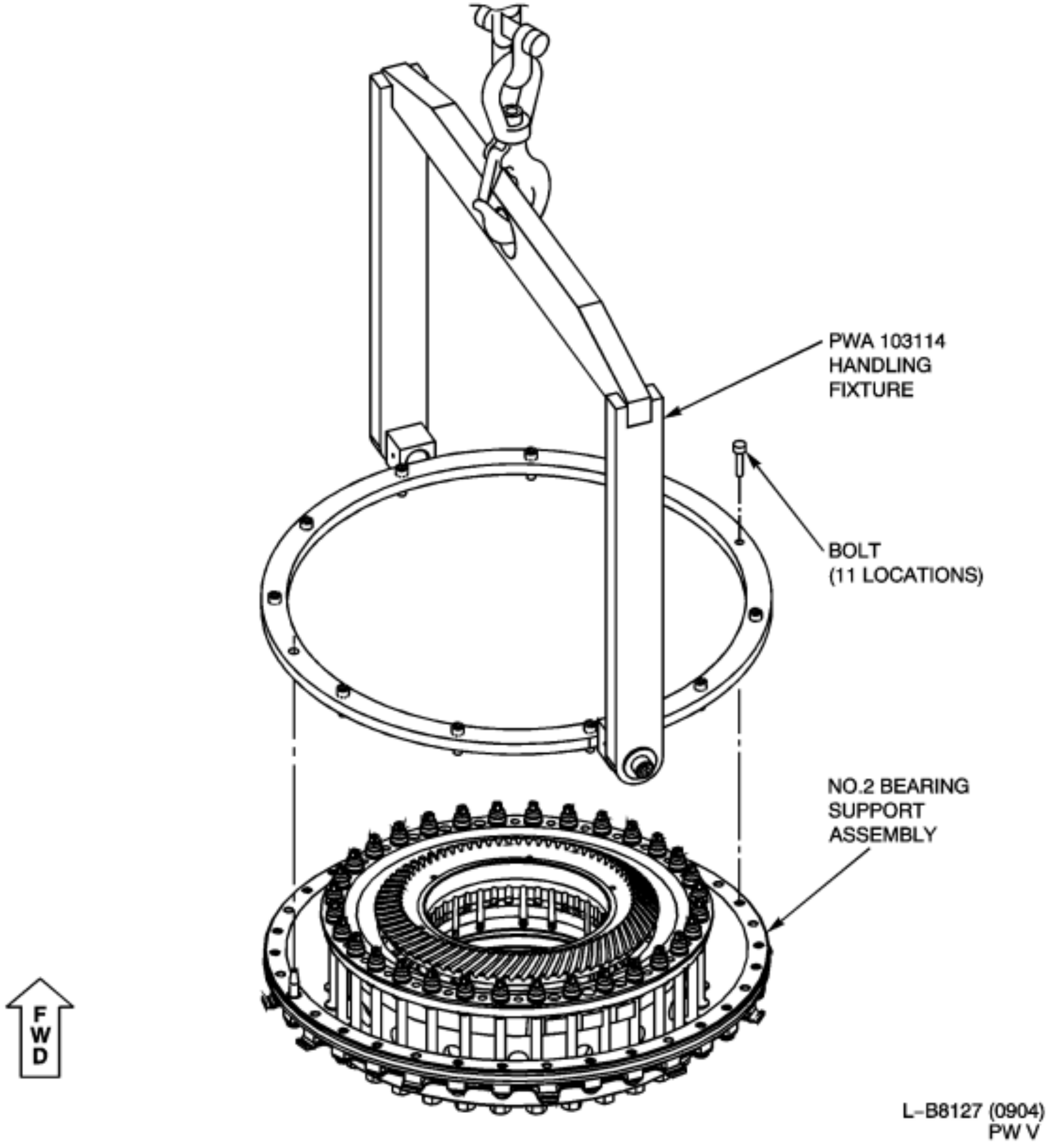
Install The HPC − (Measurements And Calculations)
Figure 401 (Sheet 3)
(Task 72−00−35−420−001)



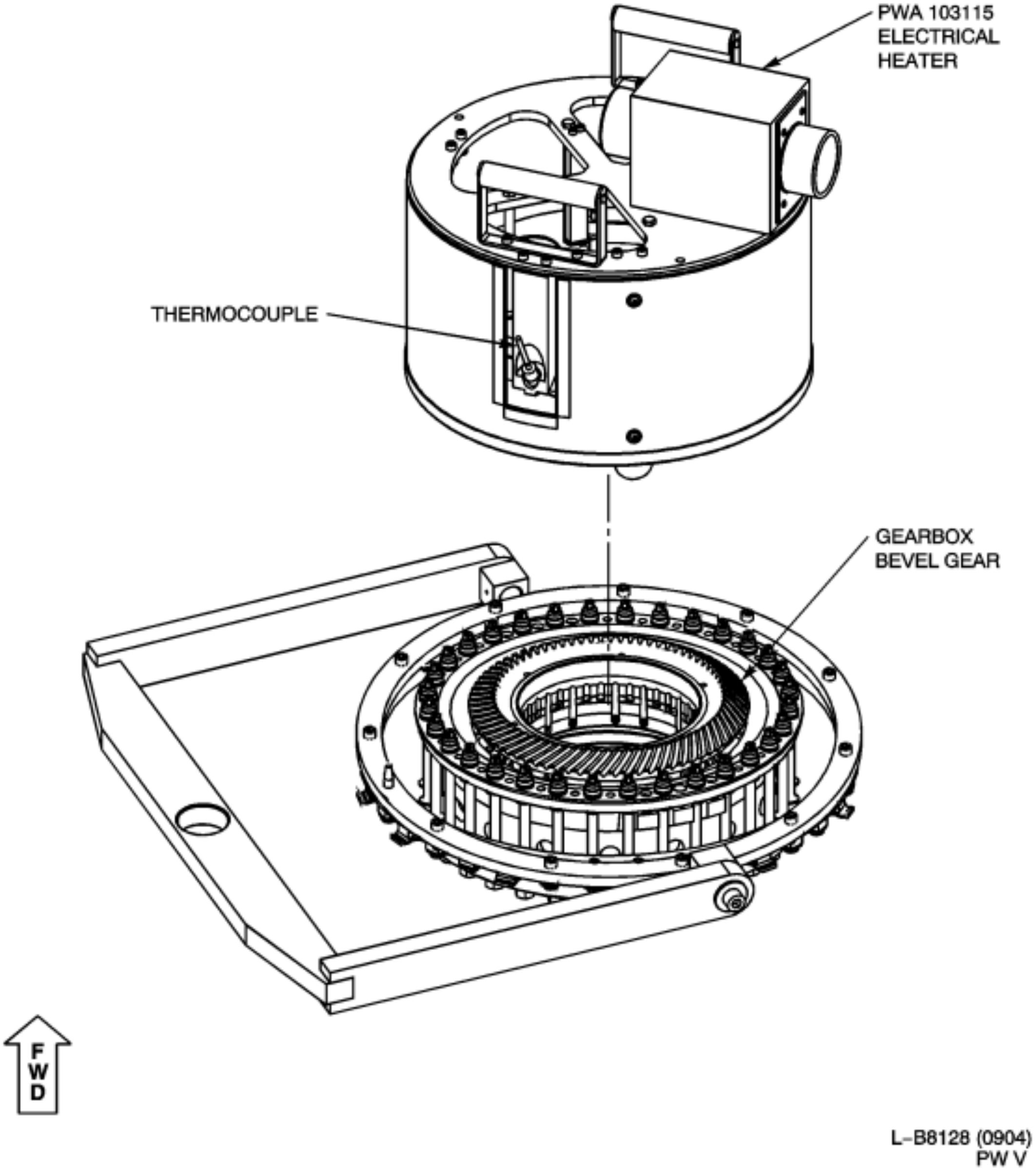
Install The HPC − (Measurements And Calculations)
Figure 401 (Sheet 4)
(Task 72−00−35−420−001)


[11] BOLT
(22 LOCATIONS)
[12] RETAINING
RING
NO. 2 BEARING
AND SEAL
ASSEMBLY
FWD
PIN
(BOTTOM)
L−A6929 (0904)
PW V

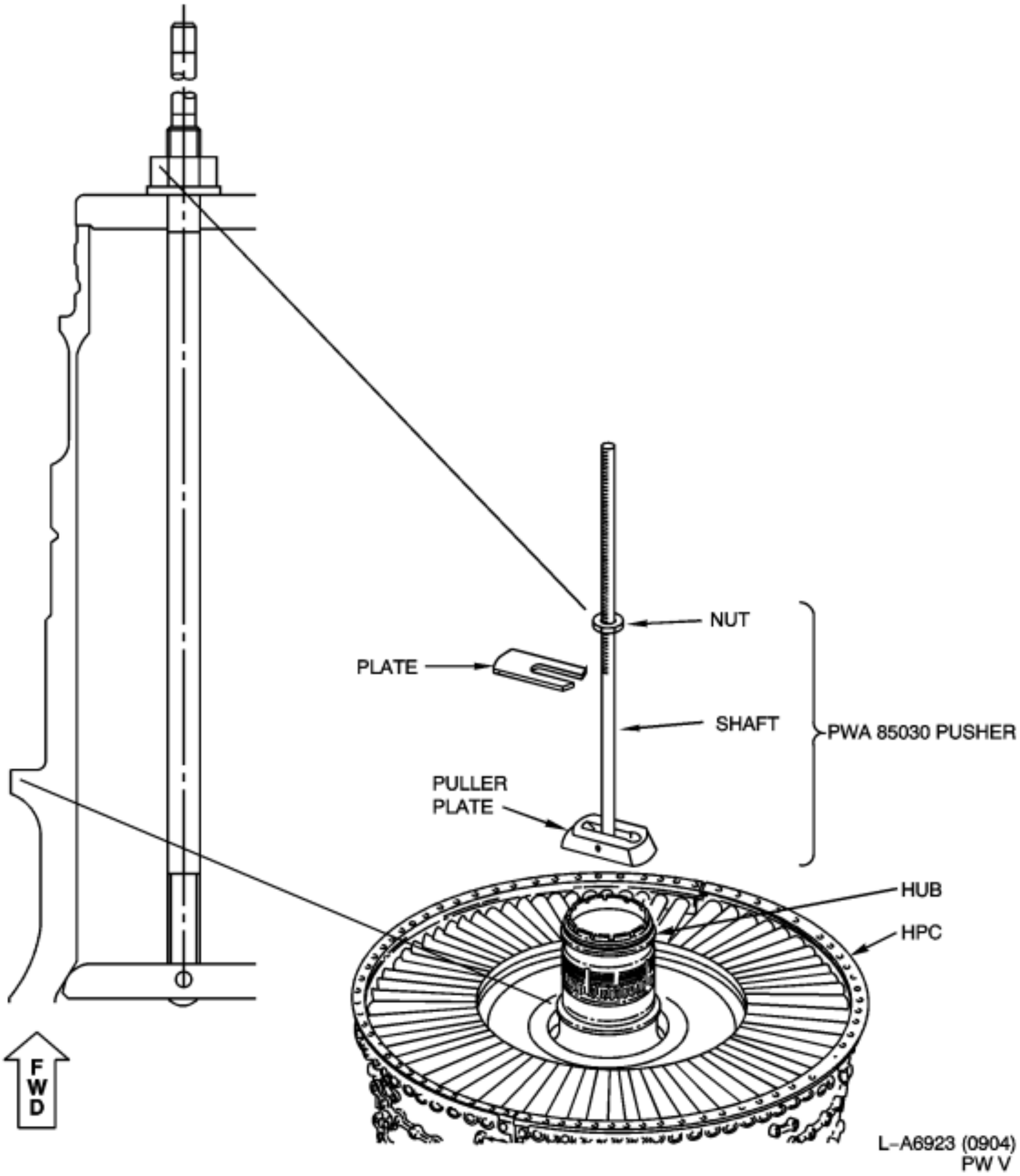
Install The HPC − (5th Stage Shroud Retaining
Ring Installation − Post SB PW4 ENG 72−204)
Figure 402
(Task 72−00−35−420−001)


PWA 103114
HANDLING
FIXTURE
BOLT
(11 LOCATIONS)
NO.2 BEARING
SUPPORT
ASSEMBLY
FWD
L−B8127 (0904)
PW V

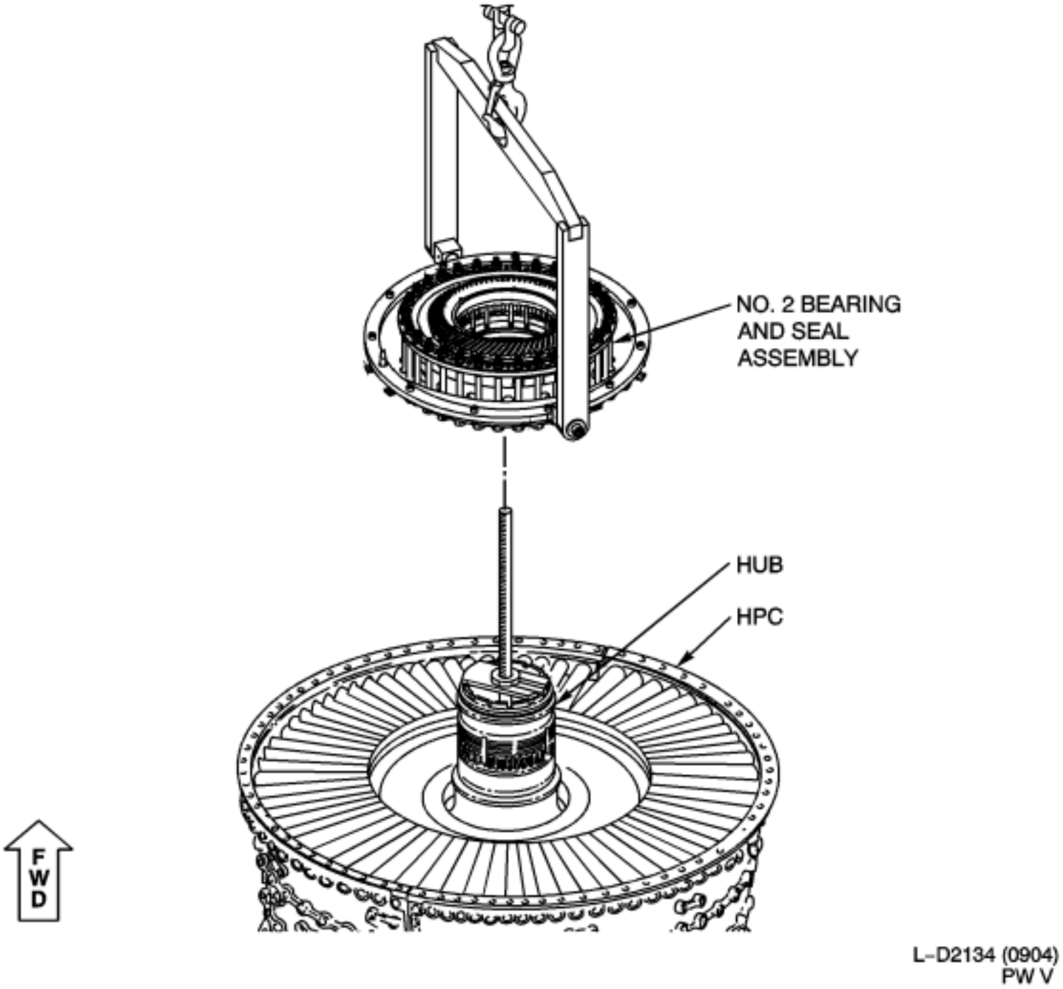
Install The HPC − (PWA 103114 Handling Fixture Installation)
Figure 403
(Task 72−00−35−420−001)


PWA 103115
ELECTRICAL
HEATER
THERMOCOUPLE
GEARBOX
BEVEL GEAR
F
W
D
L−B8128 (0904)
PW V

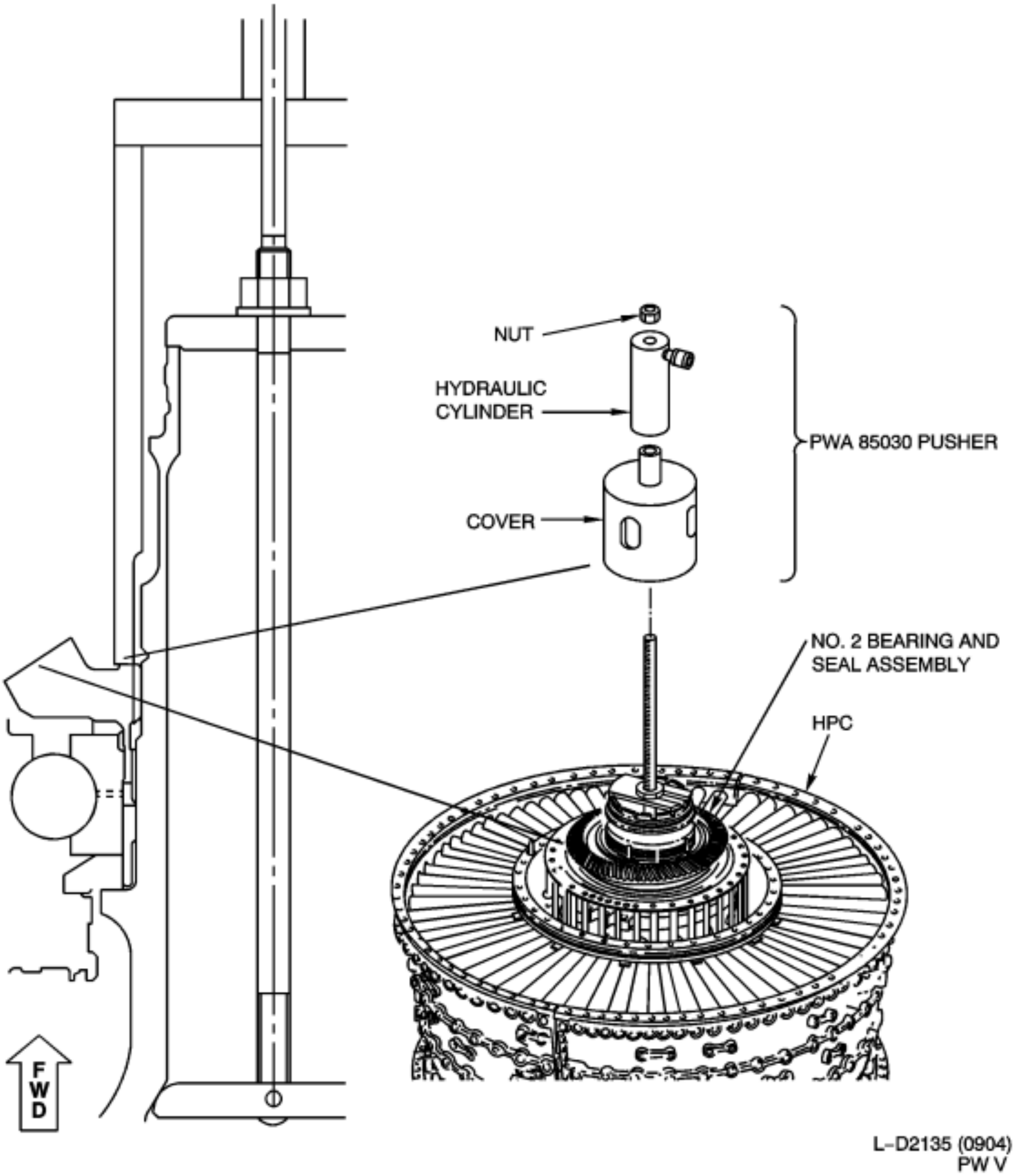
Install The HPC − (PWA 103115 Electrical Heater Installation)
Figure 404
(Task 72−00−35−420−001)


NUT
PLATE
SHAFT
PWA 85030 PUSHER
PULLER PLATE
HUB
HPC
FWD
L-A6923 (0904)
PW V

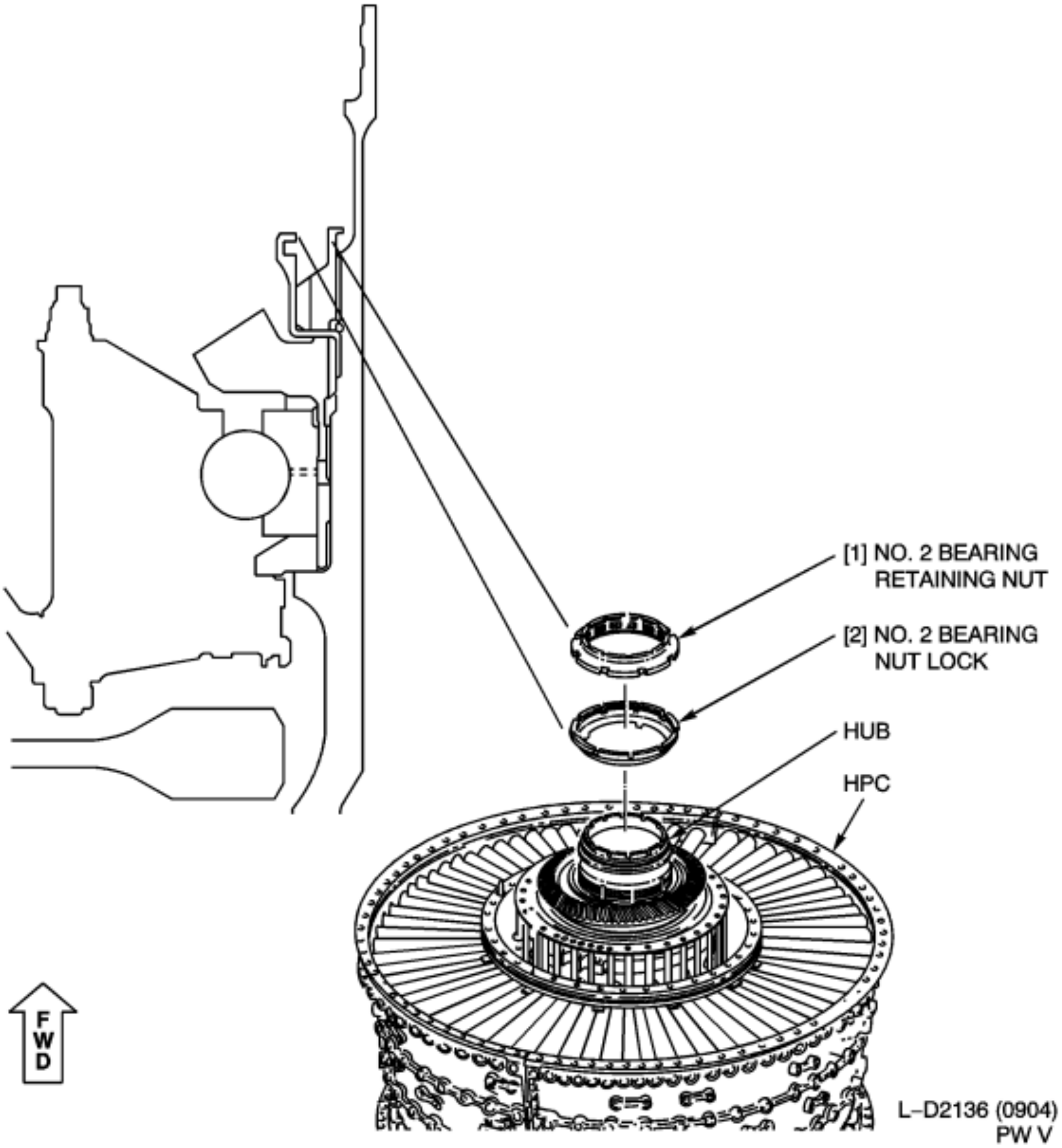
Install The HPC - (No. 2 Bearing And Seal Assembly Installation)
Figure 405 (Sheet 1)
(Task 72-00-35-420-001)


NO. 2 BEARING AND SEAL ASSEMBLY
HUB
HPC
FWD
L−D2134 (0904)
PW V

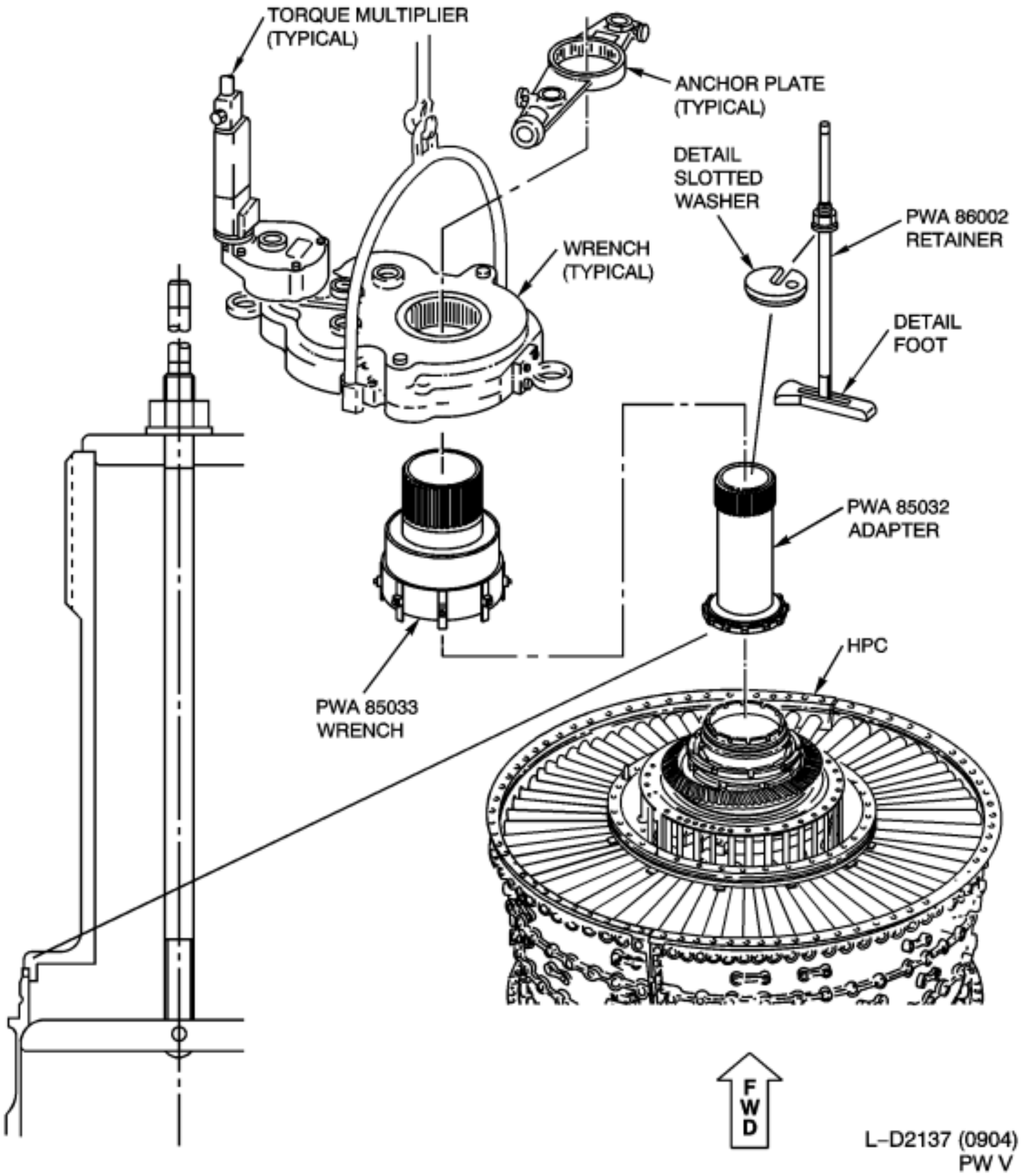
Install The HPC − (No. 2 Bearing And Seal Assembly Installation)
Figure 405 (Sheet 2)
(Task 72−00−35−420−001)


NUT
HYDRAULIC CYLINDER
COVER
PWA 85030 PUSHER
NO. 2 BEARING AND SEAL ASSEMBLY
HPC
FWD
L-D2135 (0904)
PW V

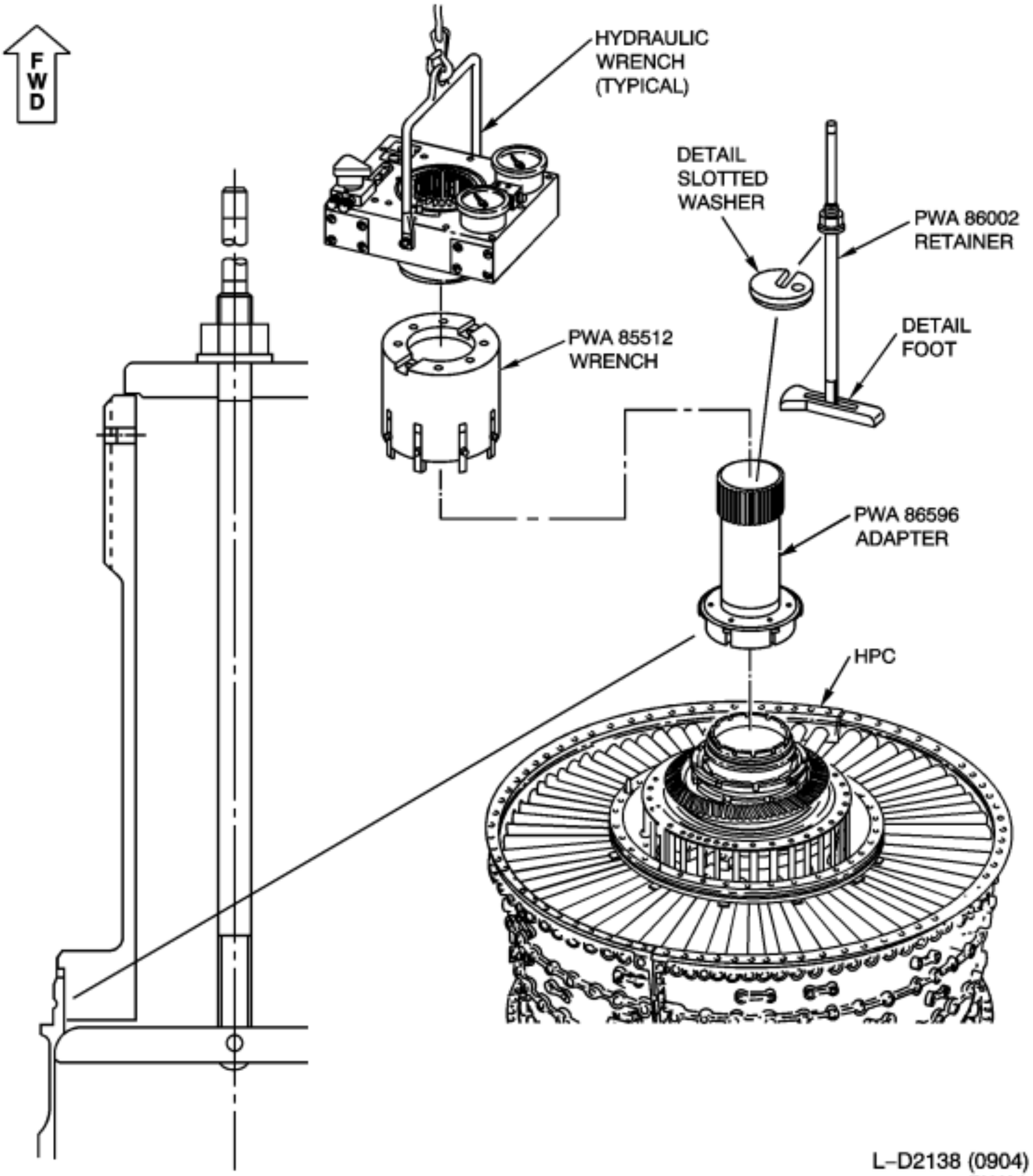
Install The HPC − (No. 2 Bearing And Seal Assembly Installation)
Figure 405 (Sheet 3)
(Task 72−00−35−420−001)


[1] NO. 2 BEARING RETAINING NUT
[2] NO. 2 BEARING NUT LOCK
HUB
HPC
FWD
L−D2136 (0904)
PW V

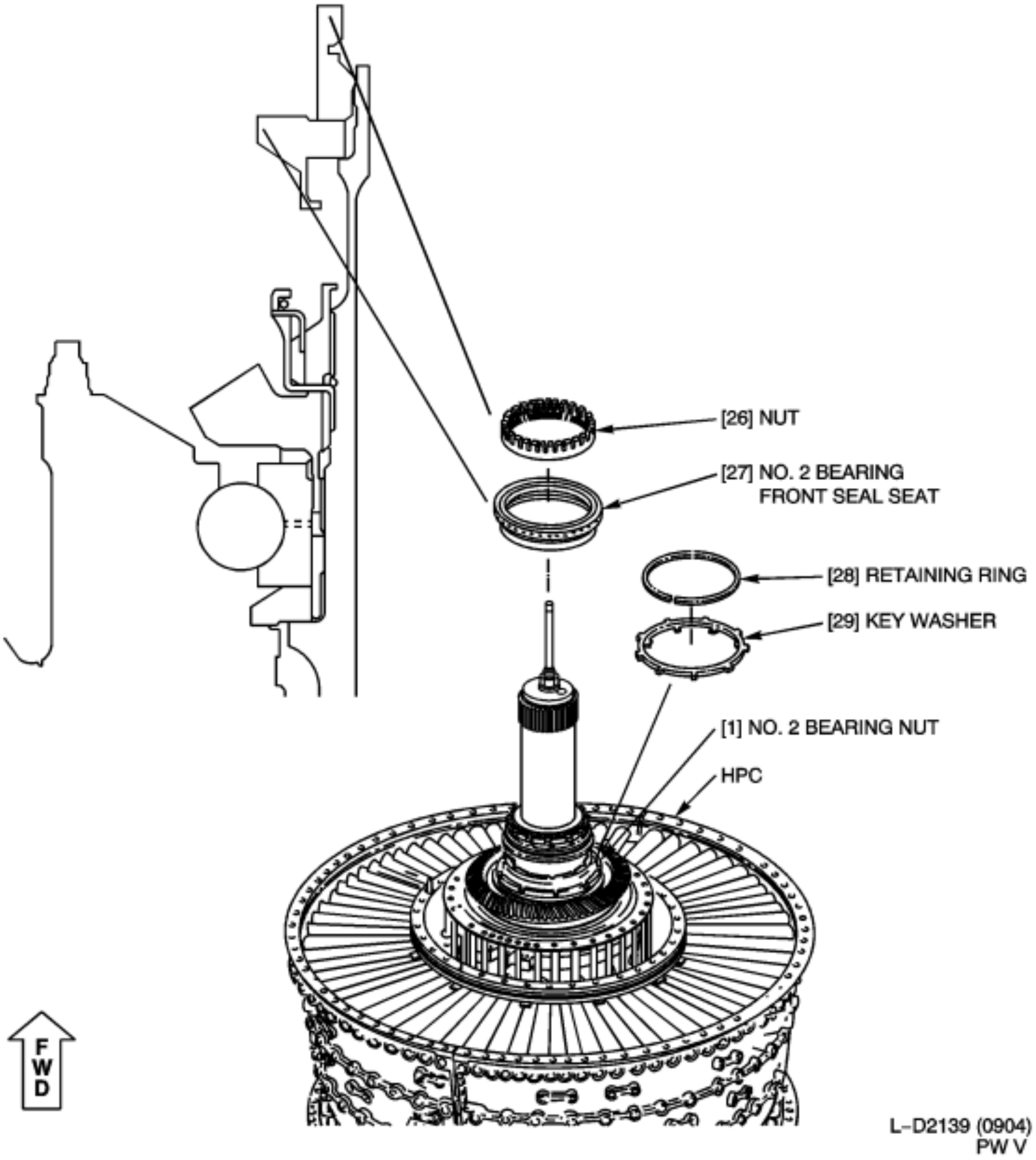
Install The HPC − (No. 2 Bearing Retaining Nut And Lock Installation)
Figure 406
(Task 72−00−35−420−001)


TORQUE MULTIPLIER (TYPICAL)
ANCHOR PLATE (TYPICAL)
DETAIL SLOTTED WASHER
PWA 86002 RETAINER
WRENCH (TYPICAL)
DETAIL FOOT
PWA 85032 ADAPTER
HPC
PWA 85033 WRENCH
FWD
L−D2137 (0904)
PW V

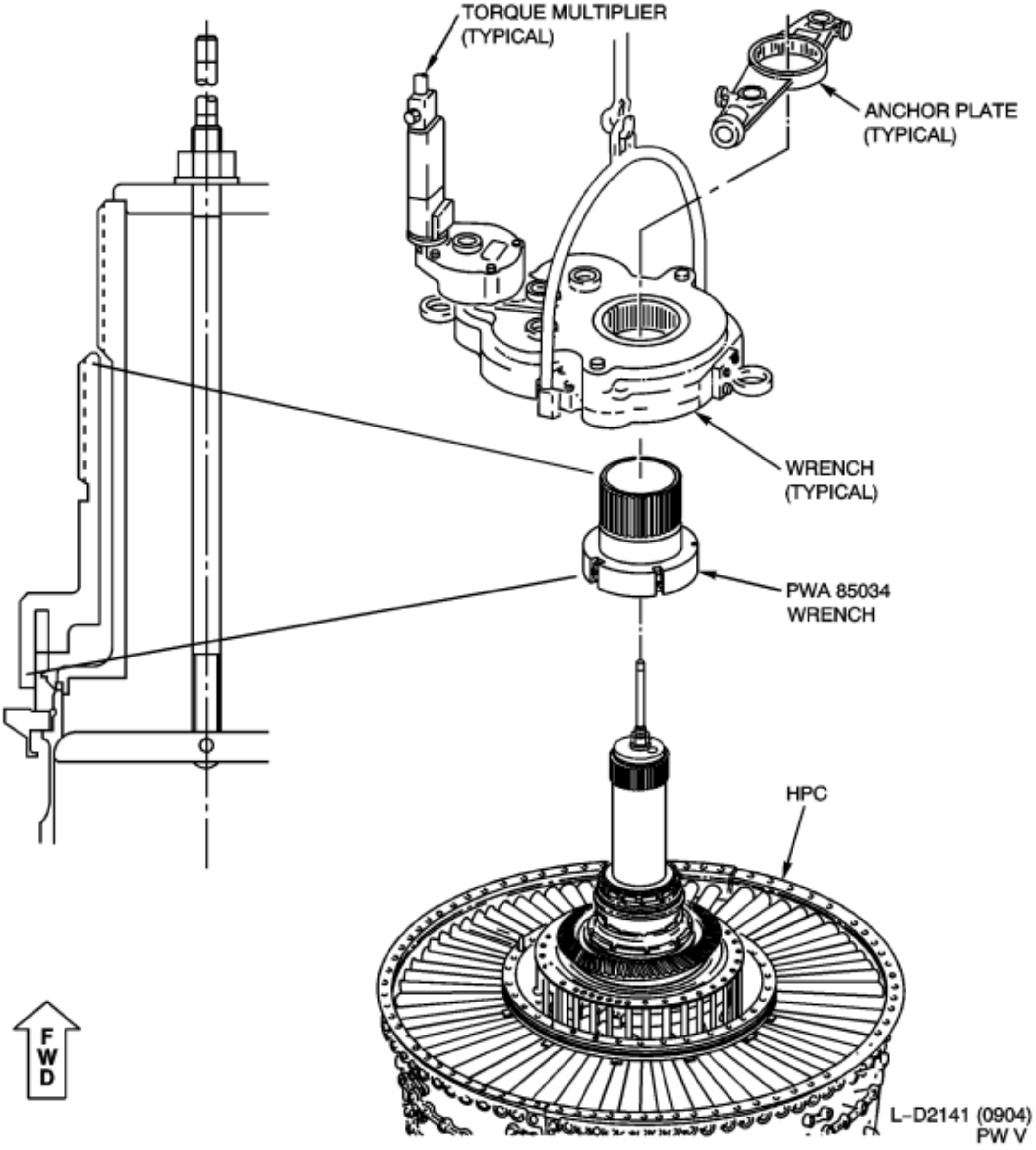
Install The HPC − (No. 2 Bearing Retaining Nut Installation − Mechanical Wrench)
Figure 407
(Task 72−00−35−420−001)


FWD
HYDRAULIC WRENCH (TYPICAL)
DETAIL SLOTTED WASHER
PWA 86002 RETAINER
DETAIL FOOT
PWA 85512 WRENCH
PWA 86596 ADAPTER
HPC
L−D2138 (0904)
PW V

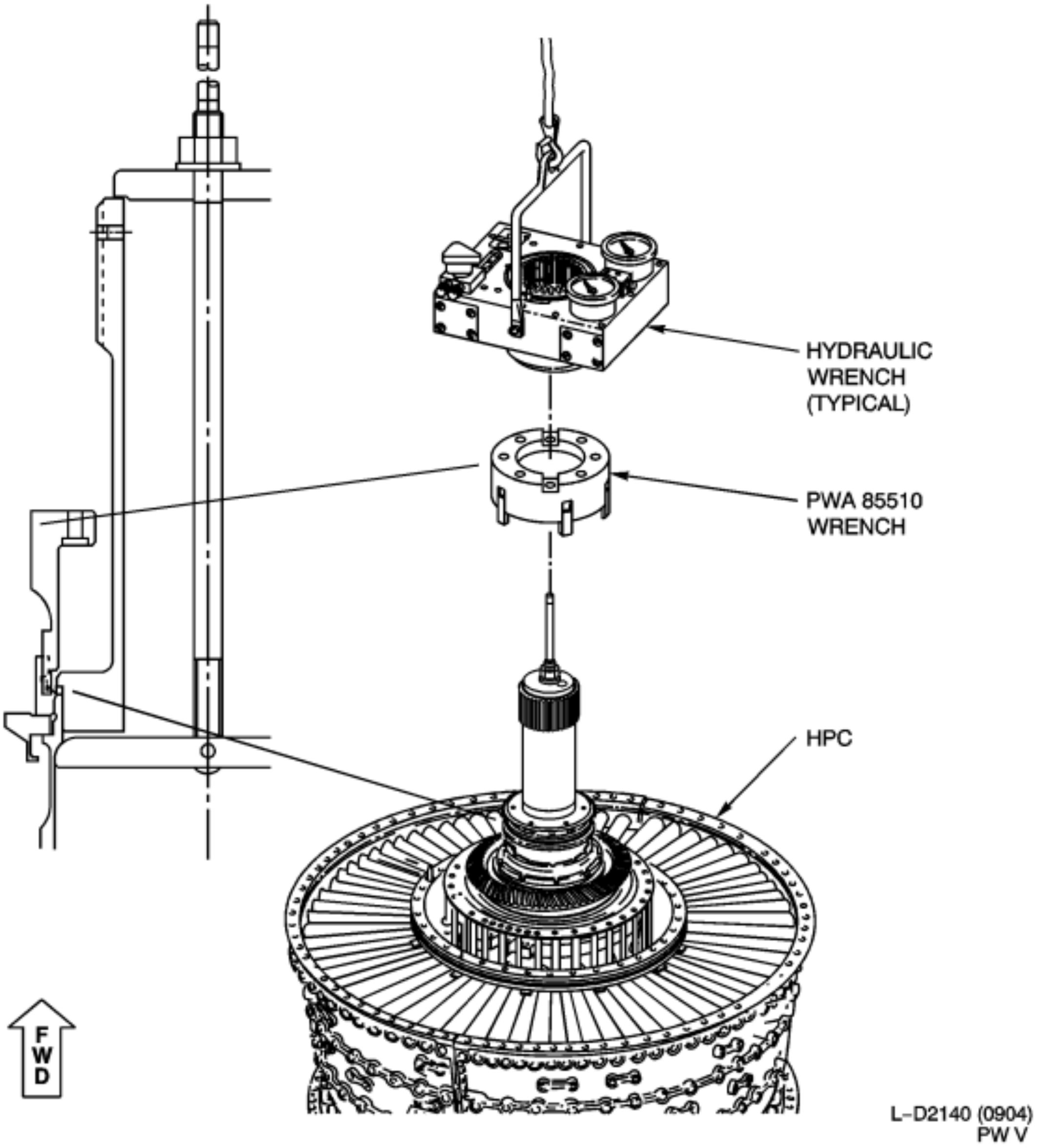
Install The HPC − (No. 2 Bearing Retaining Nut Installation − Hydraulic Wrench)
Figure 408
(Task 72−00−35−420−001)


[26] NUT
[27] NO. 2 BEARING FRONT SEAL SEAT
[28] RETAINING RING
[29] KEY WASHER
[1] NO. 2 BEARING NUT
HPC
FWD
L−D2139 (0904)
PW V

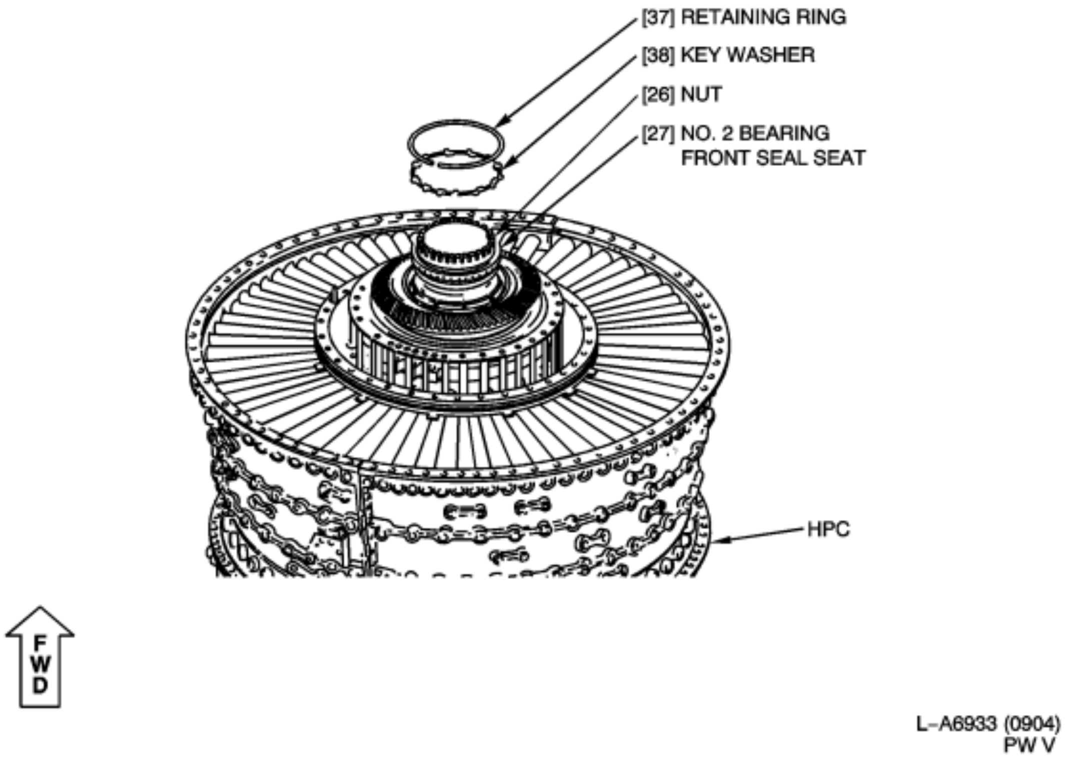
Install The HPC − (No. 2 Bearing Nut Retaining Ring And No. 2 Bearing Front Seal Seat Retaining Nut Installation)
Figure 409
(Task 72−00−35−420−001)


TORQUE MULTIPLIER (TYPICAL)
ANCHOR PLATE (TYPICAL)
WRENCH (TYPICAL)
PWA 85034 WRENCH
HPC
F W D
L−D2141 (0904) PW V

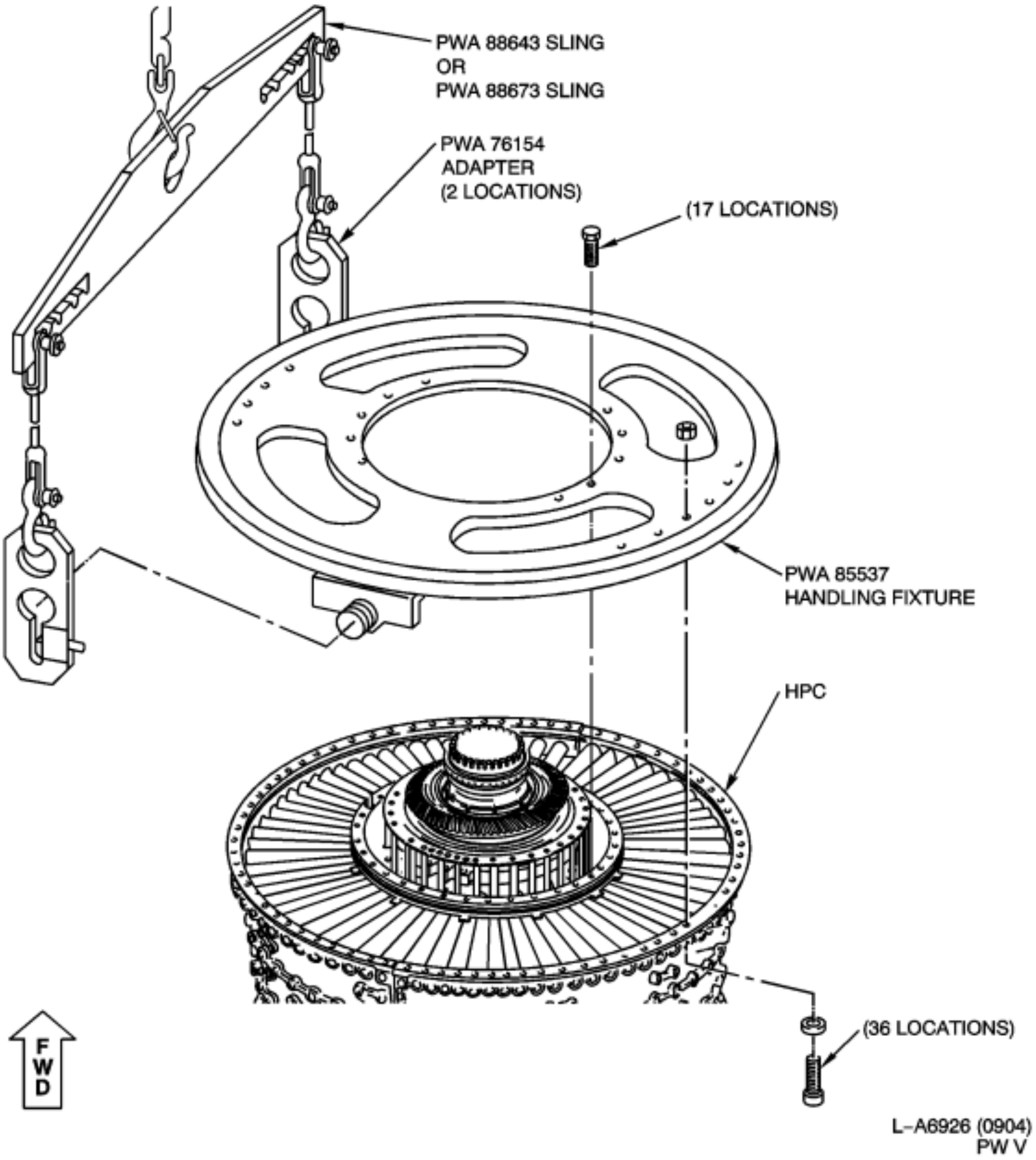
Install The HPC − (No. 2 Bearing Front Seal Seat Retaining Nut Installation − Mechanical Wrench)
Figure 410
(Task 72−00−35−420−001)


HYDRAULIC WRENCH (TYPICAL)
PWA 85510 WRENCH
HPC
FWD
L-D2140 (0904)
PW V

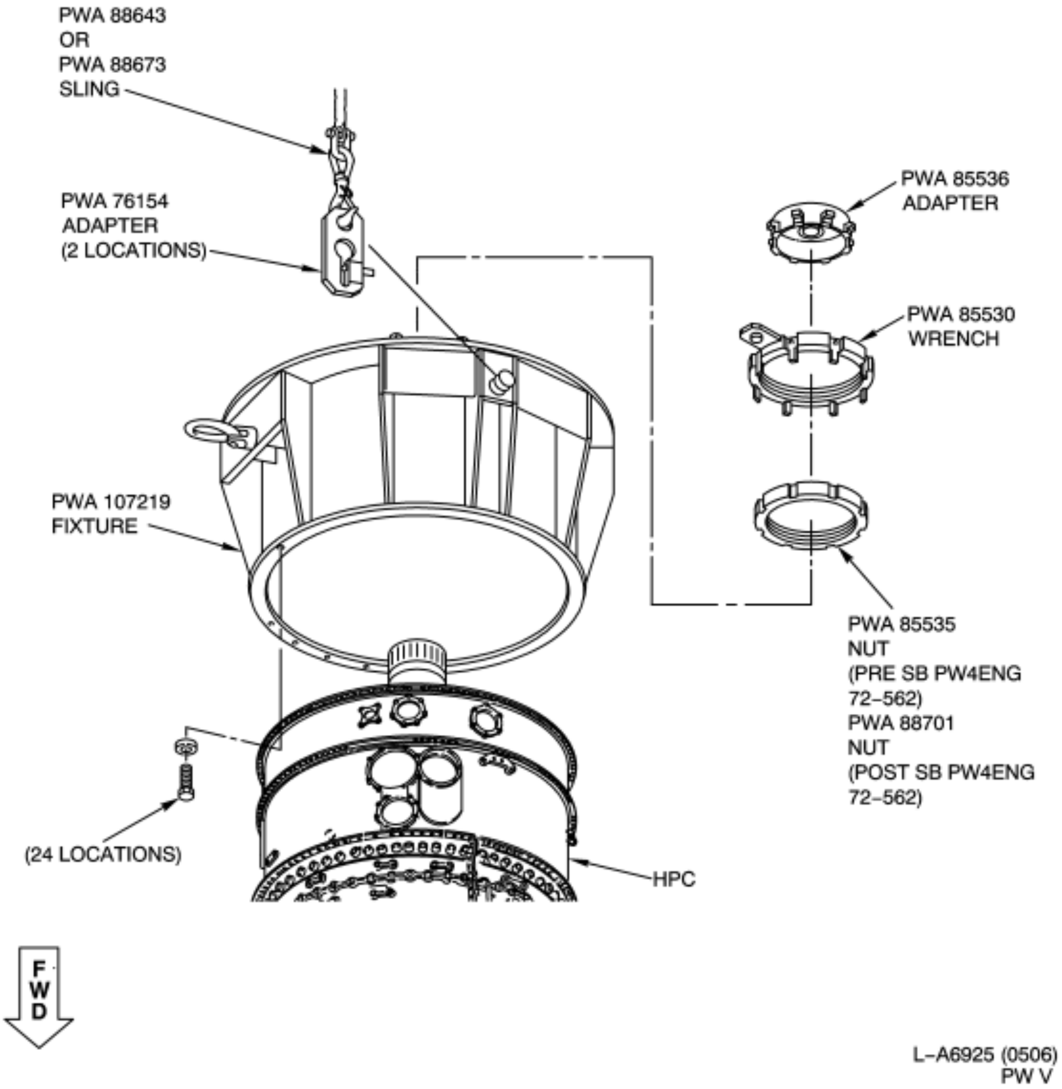
Install The HPC − (No. 2 Bearing Front Seal Seat
Retaining Nut Installation − Hydraulic Wrench)
Figure 411
(Task 72−00−35−420−001)


[37] RETAINING RING
[38] KEY WASHER
[26] NUT
[27] NO. 2 BEARING FRONT SEAL SEAT
HPC
FWD
L−A6933 (0904)
PW V

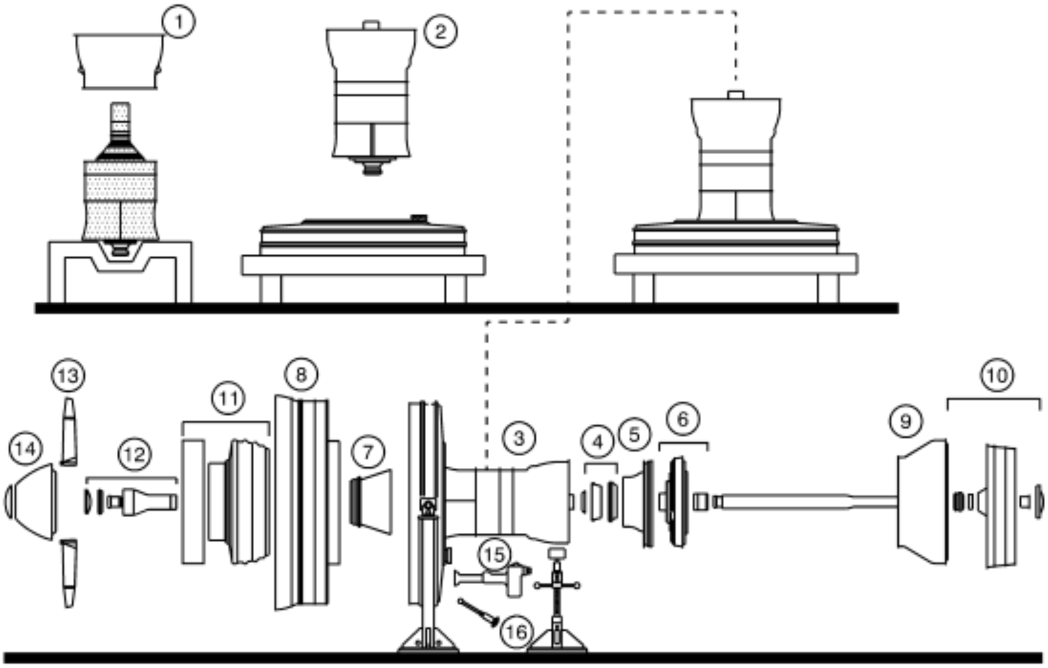
Install The HPC − (No. 2 Bearing Front
Seal Seat Nut Retaining Ring Installation)
Figure 412
(Task 72−00−35−420−001)


PWA 88643 SLING
OR
PWA 88673 SLING
PWA 76154
ADAPTER
(2 LOCATIONS)
(17 LOCATIONS)
PWA 85537
HANDLING FIXTURE
HPC
(36 LOCATIONS)
FWD
L−A6926 (0904)
PW V

Install The HPC − (Front Fixture Installation)
Figure 413
(Task 72−00−35−420−001)


PWA 88643
OR
PWA 88673
SLING
PWA 76154
ADAPTER
(2 LOCATIONS)
PWA 85536
ADAPTER
PWA 85530
WRENCH
PWA 107219
FIXTURE
PWA 85535
NUT
(PRE SB PW4ENG
72−562)
PWA 88701
NUT
(POST SB PW4ENG
72−562)
(24 LOCATIONS)
HPC
FWD
L−A6925 (0506)
PW V

Install The HPC − (Rear Fixture Removal)
Figure 414
(Task 72−00−35−420−001)



1. INSTALL DIFFUSER AND COMBUSTOR TO HIGH PRESSURE COMPRESSOR.
2. INSTALL DIFFUSER AND HIGH PRESSURE COMPRESSOR TO INTERMEDIATE CASE.
3. TRUNNION INTERMEDIATE THROUGH DIFFUSER CASE TO HORIZONTAL.
4. INSTALL NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL PLATE.
5. INSTALL TURBINE NOZZLE.
6. INSTALL HIGH PRESSURE TURBINE (HPT).
7. INSTALL NO. 1 BEARING SUPPORT ASSEMBLY.
8. INSTALL FAN CASE.
9. INSTALL LOW PRESSURE TURBINE (LPT).
10. INSTALL TURBINE EXHAUST CASE.
11. INSTALL LOW PRESSURE COMPRESSOR (LPC).
12. INSTALL LPC/LPT COUPLING.
13. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
14. INSTALL COMPRESSOR INLET CONE.
15. INSTALL MAIN GEARBOX.
16. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).

L−A0715 (0000)
PW V

Install The HPC − (Postrequisites)
Figure 415
(Task 72−00−35−420−001)

Task 72-00-35-420-001-002:

1. Install The No. 2 Bearing Seal Seat - Horizontal

A. Prerequisites

(1) See Inspection/Check-01 (Task 72-00-35-990-001) for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque the retaining nut as follows.

B. Equipment And Materials Necessary

Standard Wrenching Tools:

Hydraulic:

PWA 18872	Wrench, Hydraulic
Or	
PWA 33732	Wrench, Hydraulic

NOTE: Do not use PWA 87354 or PWA 80070 Hydraulic Wrenches to do this procedure. These wrenches are too heavy and apply too much torque for this horizontal application.

PWA 29510	Pump, Hand (2 Hose)
Or	
PWA 28814	Pump, Electric (2 Hose)
PWA 28815	Cart, Storage (Optional)
Or	
PWA 28825	Cart, Storage (Optional)
Or	
PWA 75046	Cart, Storage (Optional)

Mechanical:

PWA 45418	Wrench, Mechanical
Or	
PWA 80187	Wrench, Mechanical

NOTE: Do not use the PWA 80071 Mechanical Wrench to do this procedure. This wrench is too heavy and applies too much torque for this

Standard Wrenching Tools:

(CONTINUED)

horizontal application.

PWA 45419	Multiplier, Pneumatic
Or	
PWA 80651	Multiplier, Pneumatic (Do Not Use With PWA 45418)
PWA 85375	Plate, Anchor
Or	
PWA 88100	Plate, Anchor

Special Tools:

R	PWA 85368	Arm, Lifting
	PWA 85530	Wrench, Torque (HPC Rear Hub Nut)
R	PWA 106464	Adapter, Lift

Special Tools (Hydraulic Wrenching):

PWA 85510	Wrench (Front Seal Seat Nut)
PWA 86002	Retainer (Adapter To HPC Front Hub)
PWA 86596	Adapter, Holding (HPC Front Hub)

Special Tools (Mechanical Wrenching):

PWA 85032	Adapter, Holding (HPC Front Hub)
PWA 85034	Wrench (No. 2 Front Seal Seat Nut)
PWA 86002	Retainer (Adapter To HPC Front Hub)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Nut	1	72−35−00/1/50

C. Procedure

(1) Install the No. 2 bearing front seal seat [3] to the HPC hub with the larger diameter seal surface forward. See Figure 401.

CAUTION: THE NO. 2 BEARING RETAINING NUT [4] YOU INSTALL MUST BE NEW.

CAUTION: IF YOU REMOVE THE NO. 2 BEARING RETAINING NUT AFTER YOU TORQUE IT, YOU MUST THEN INSTALL A NEW NUT.

(2) Install the new nut [4] handtight only.

(3) (Reference 973) For operators that use the mechanical wrenching tools, torque the nut [4] as follows. See Figure 402 (Sheet 1) and Figure 402 (Sheet 2).

(a) Engage the PWA 85032 Adapter teeth to the HPC front hub and attach it with the PWA 86002 Retainer as follows.

1 Install the Retainer through the Adapter and engage the inside of the HPC hub with the detail foot.

2 Install the slotted washer.

3 Tighten the detail nut to make the Adapter tight on the HPC hub.

(b) Install the PWA 85034 Wrench teeth to the nut [4].

R (c) Use the PWA 85368 Lifting Arm with the PWA 106364
R Lift Adapter and the standard mechanical wrenching tools (from the Standard Wrenching Tools list) to torque the nut [4] as follows.

NOTE: You must fabricate an adapter that will attach the wrench to the Handling Fixture. This adapter must safely lift 125 lbs (56.70 kg) minimum.

1 Torque the nut [4] to 800 - 1200 lb-in. (90.388 - 135.582 N.m).

2 Turn the nut [4] through an angle of 9 - 10 degrees, 12 minutes.

3 Loosen the nut [4] to 0 lb-in. (0.000 N.m).

4 Torque the nut [4] to 800 - 1200 lb-in. (90.388 - 135.582 N.m).

5 Turn the nut [4] through an angle of 9 - 10 degrees, 12 minutes.

(d) Remove the tools.

(4) (Reference 973) For operators that use the hydraulic wrenching tools, torque the [4] as follows. See Figure 403 (Sheet 1) and Figure 403 (Sheet 2).

(a) Engage the PWA 86596 Adapter teeth to the HPC front hub and attach it with the PWA 86002 Retainer as follows.

1 Install the Retainer through the Adapter and engage the inside of the HPC hub with the detail foot.

2 Install the slotted washer.

3 Tighten the detail nut to make the Adapter tight on the HPC hub.

(b) Install the PWA 85510 Wrench teeth to the nut [4].

R (c) Use the PWA 85368 Lifting Arm with the PWA 106364
R Lift Adapter and the standard mechanical wrenching tools (from the Standard Wrenching Tools list) to torque the nut [4] as follows.

NOTE: You must fabricate an adapter that will attach the wrench to the Handling Fixture. This adapter must safely lift 125 lbs (56.70 kg) minimum.

1 Torque the nut [4] to 800 - 1200 lb-in. (90.388 - 135.582 N.m).

2 Turn the nut [4] through an angle of 9 - 10 degrees, 12 minutes.

3 Loosen the nut [4] to 0 lb-in. (0.000 N.m).

4 Torque the nut [4] to 800 - 1200 lb-in. (90.388 - 135.582 N.m).

5 Turn the nut [4] through an angle of 9 - 10 degrees, 12 minutes.

(d) Remove the tools.

(5) Install the key washer [1] and retaining ring [2] completely in the nut [4].

(6) Examine the assembly for foreign objects, damage, and correct assembly.

(7) Make sure that you install all the necessary protection covers.

D. Postrequisites

NOTE: See Figure 404.

(1) Install The No. 1.5 Bearing Support Assembly. Refer to 72-00-34, Installation-06 (Task 72-00-34-430-001).

(2) Install The No. 1 Bearing Support (Front And Rear) Assembly. Refer to 72-00-34, Installation-04 (Task 72-00-34-450-002).

(3) Install The Low Pressure Turbine And Turbine Exhaust Case. Refer to 72-00-53, Installation-08 (Task 72-00-53-420-002).

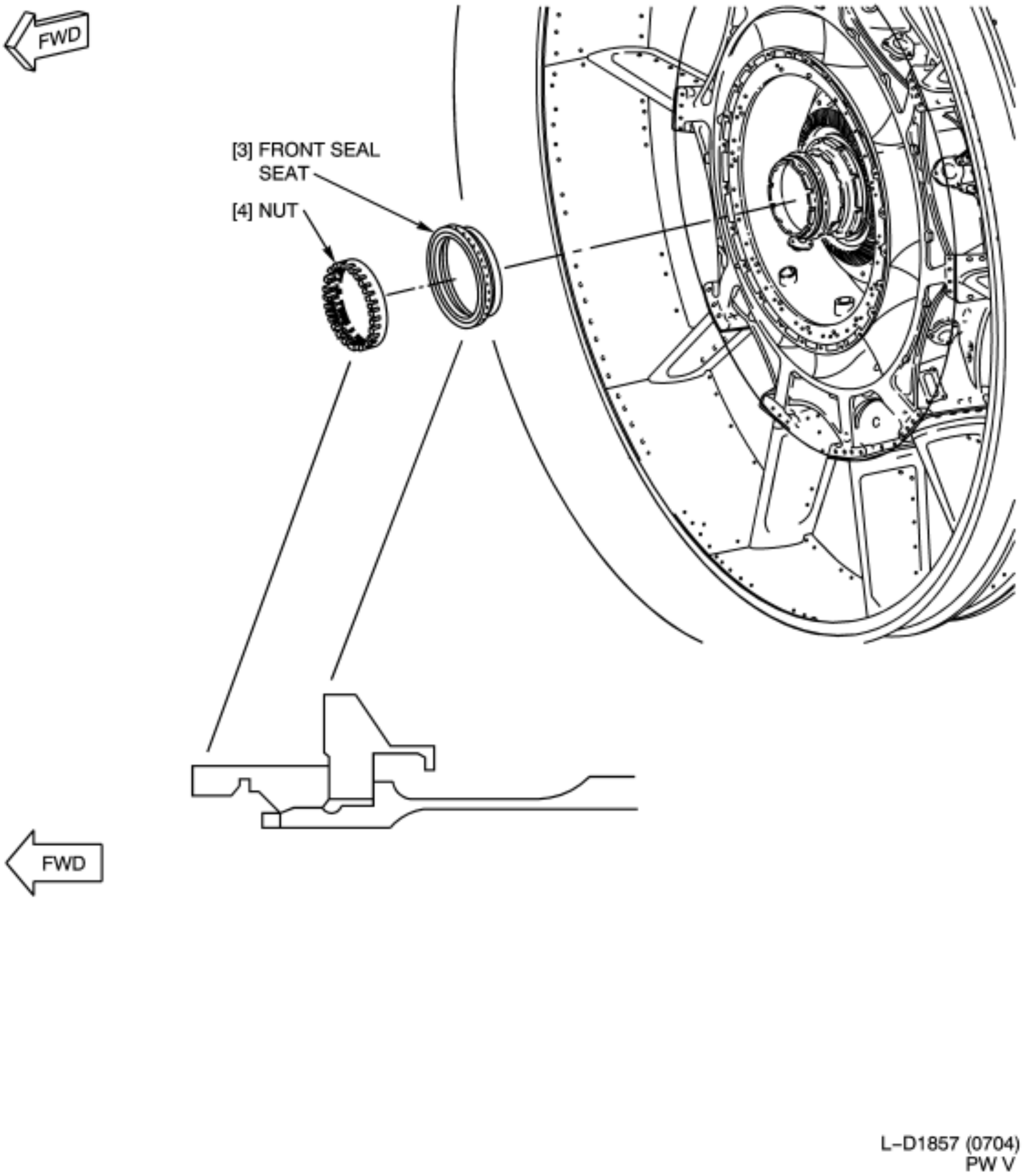
(4) Install The Low Pressure Compressor (LPC). Refer to 72-00-31, Installation-01 (Task 72-00-31-420-003).

(5) Install The LPC/LPT Coupling. Refer to 72-00-32, Installation-06 (Task 72-00-32-420-001).

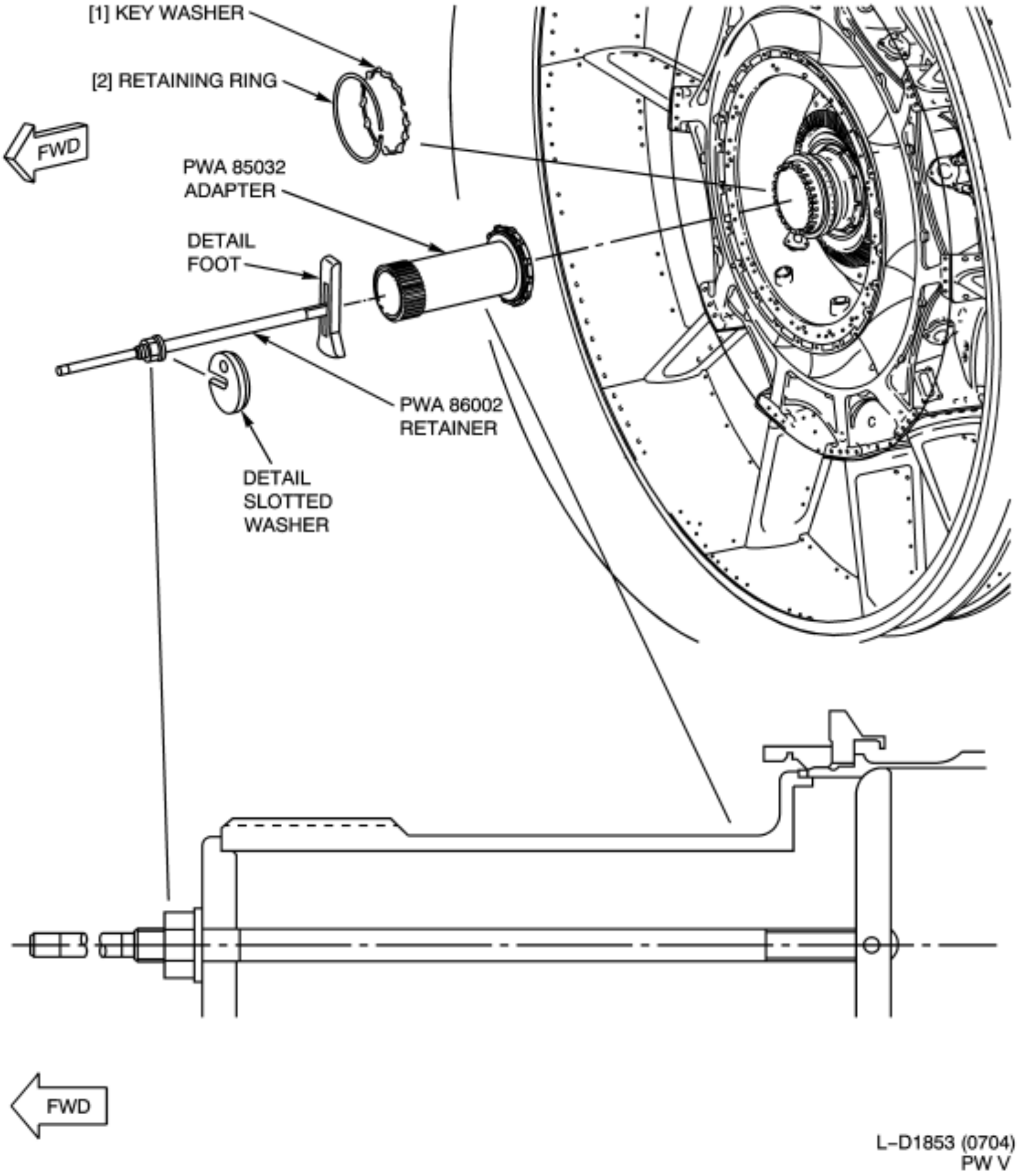
(6) Install All The Stage 1 LPC (Fan) Blade Assemblies. Refer to 72-00-31, Installation-04 (Task 72-00-31-420-002-002).

(7) Install The Compressor Inlet Cone. Refer to 72-00-31, Installation-02 (Task 72-00-31-420-001).

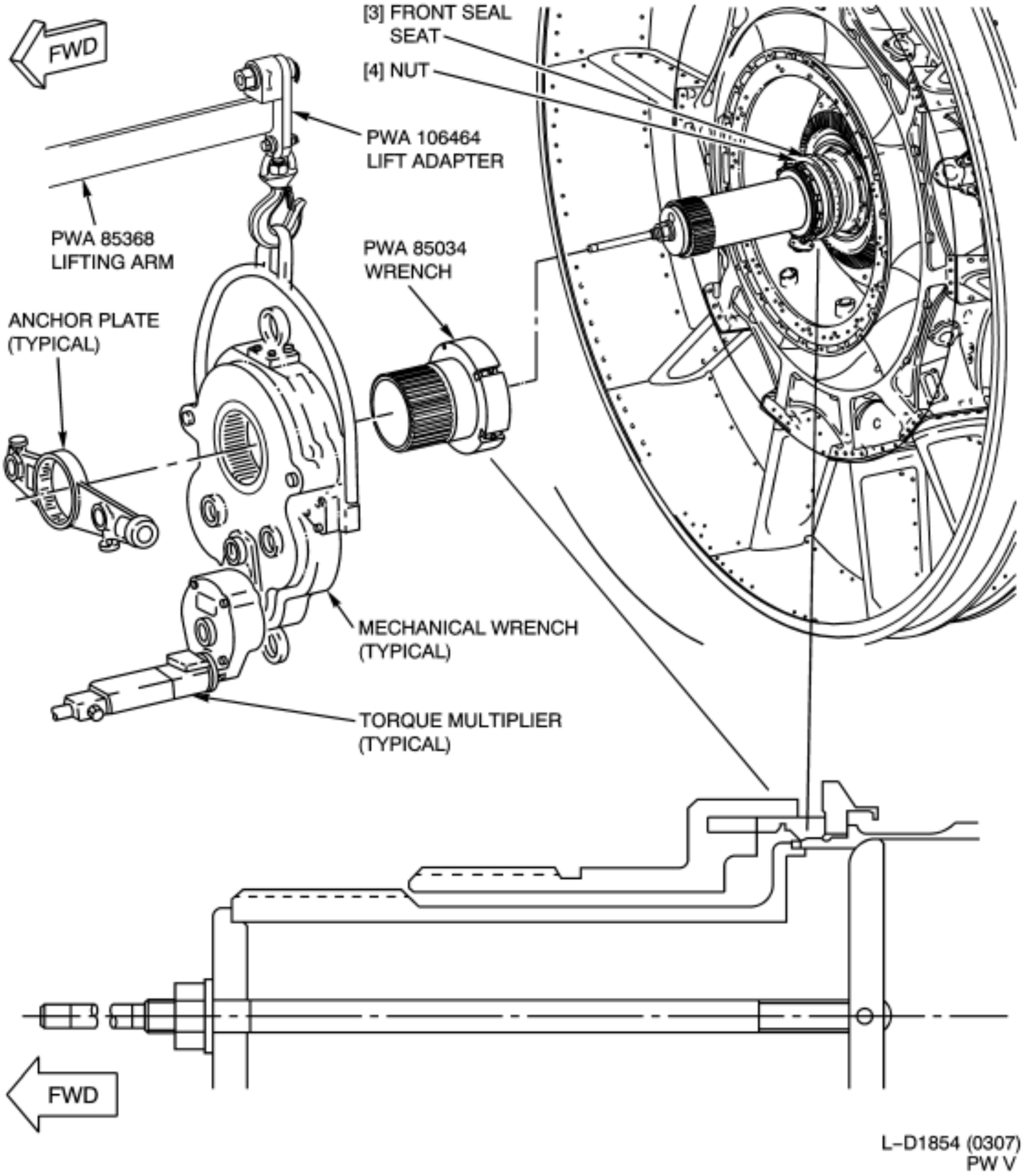
(8) Install The EEC Speed Transducer (N1) Multiplexer Input Probe. Refer to 72-00-34, Installation-03 (Task 72-00-34-450-001).


FWD
[3] FRONT SEAL SEAT
[4] NUT
FWD
L−D1857 (0704)
PW V

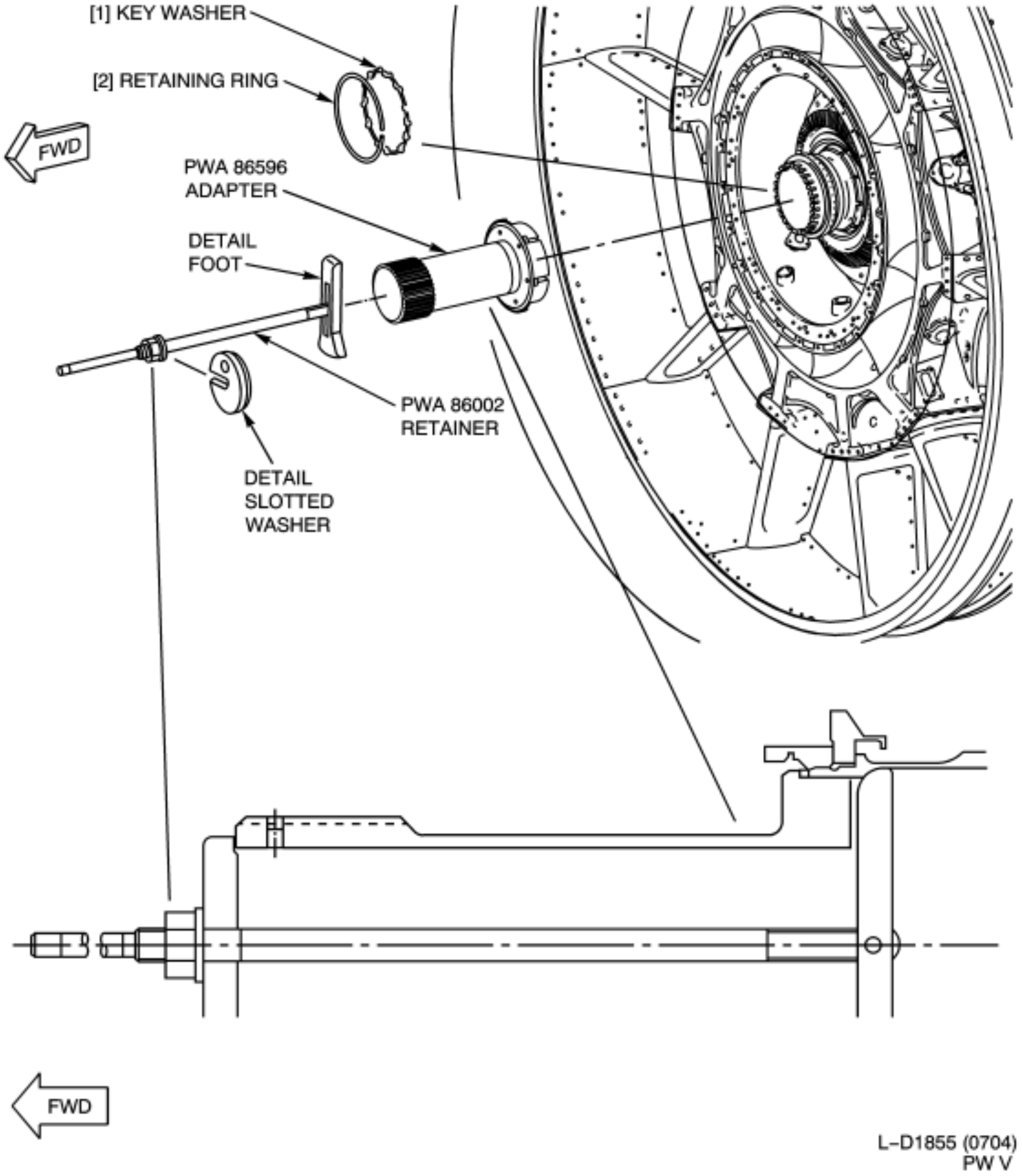
Install The No. 2 Bearing Seal Seat − Horizontal
Figure 401
(Task 72−00−35−420−001−002)


[1] KEY WASHER
[2] RETAINING RING
FWD
PWA 85032
ADAPTER
DETAIL
FOOT
PWA 86002
RETAINER
DETAIL
SLOTTED
WASHER
FWD
L-D1853 (0704)
PW V

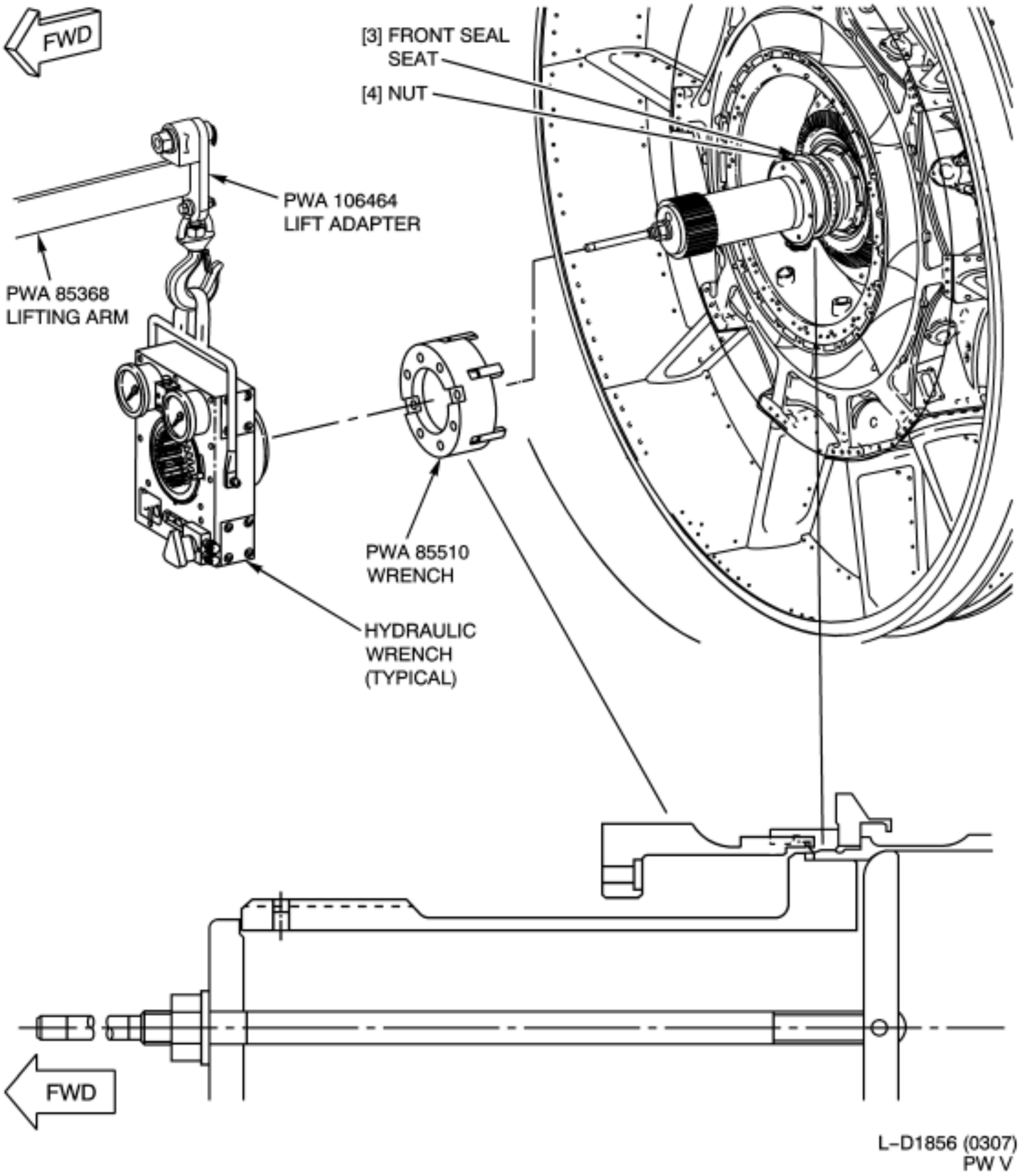
Install The No. 2 Bearing Seal Seat −
Horizontal − (Mechanical Wrenching Tools)
Figure 402 (Sheet 1)
(Task 72−00−35−420−001−002)


FWD
[3] FRONT SEAL SEAT
[4] NUT
PWA 106464 LIFT ADAPTER
PWA 85368 LIFTING ARM
PWA 85034 WRENCH
ANCHOR PLATE (TYPICAL)
MECHANICAL WRENCH (TYPICAL)
TORQUE MULTIPLIER (TYPICAL)
FWD
L−D1854 (0307)
PW V

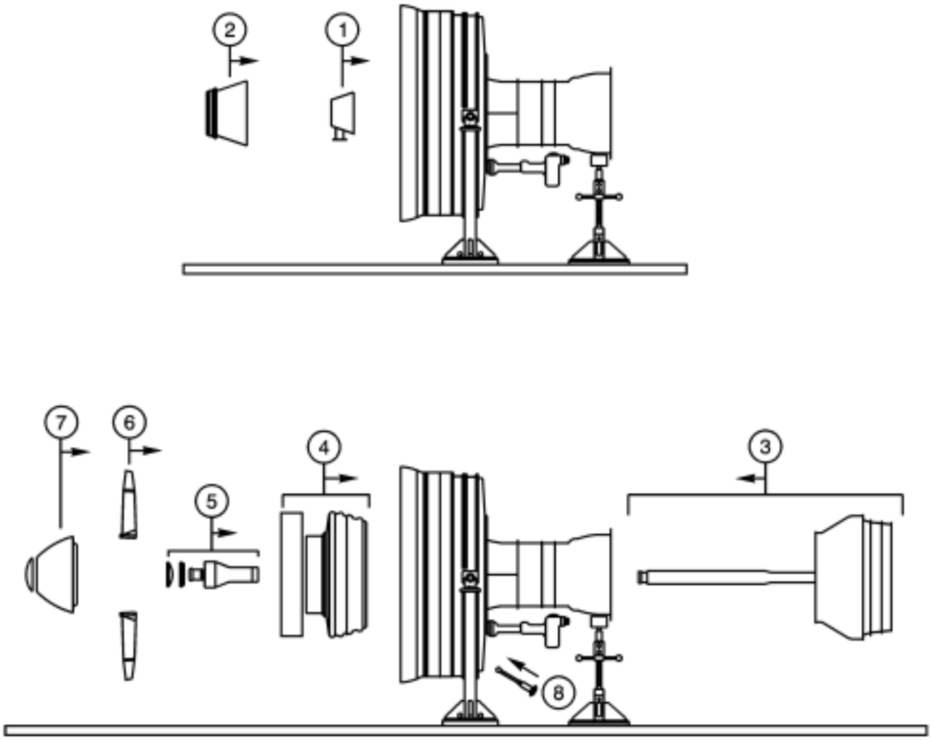
Install The No. 2 Bearing Seal Seat −
Horizontal − (Mechanical Wrenching Tools)
Figure 402 (Sheet 2)
(Task 72−00−35−420−001−002)


[1] KEY WASHER
[2] RETAINING RING
FWD
PWA 86596 ADAPTER
DETAIL FOOT
PWA 86002 RETAINER
DETAIL SLOTTED WASHER
FWD
L-D1855 (0704)
PW V

Install The No. 2 Bearing Seal Seat -
Horizontal - (Hydraulic Wrenching Tools)
Figure 403 (Sheet 1)
(Task 72-00-35-420-001-002)


FWD
[3] FRONT SEAL SEAT
[4] NUT
PWA 106464 LIFT ADAPTER
PWA 85368 LIFTING ARM
PWA 85510 WRENCH
HYDRAULIC WRENCH (TYPICAL)
C
C
FWD
L-D1856 (0307)
PW V

Install The No. 2 Bearing Seal Seat -
Horizontal - (Hydraulic Wrenching Tools)
Figure 403 (Sheet 2)
(Task 72-00-35-420-001-002)



SEE LIST OF
POSTREQUISITE TASKS

L-D1852 (0704)
PW V

Remove The No. 2 Bearing Seal Seat - Horizontal
Figure 404
(Task 72-00-35-420-001-002)

Task 72-00-35-420-002:

1. Install External Plumbing To High Pressure Compressor

A. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
R	P06-021	Compound, Antigalling (PWA 550-3)
R	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOGUE REFERENCE SECTION/FIGURE/ITEM
Packing	1	79-21-00/6/40
Packing	1	79-21-00/6/90
Packing	1	79-21-00/6/120
Packing	2	79-21-00/6/140
Packing	1	79-21-00/6/145
Packing	1	79-21-00/6/160
Packing	1	79-21-00/6/180

B. Procedure
See Figure 401 and Figure 402.

(1) Install the main bearing strainer element housing assembly as follows.

(a) Remove the covers. Install the packing, lubricated with Engine Oil P03-001, to the groove at the flanged end of the housing. Install the housing to the top of the fuel/oil cooler. Attach the housing with four bolts, lubricated with Engine Oil P03-001, and two brackets. Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(b) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 79-51) Install packings, lubricated with Engine Oil P03-001, to smaller side of adapters (401/1, 401/5) and lubricate threads with Engine Oil P03-001. Install adapters to the front and rear ports and torque to 375 - 425 lb-in. (42.369 - 48.019 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the adapters.

(c) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 79-51) Install packing, lubricated with Engine Oil P03-001, to the smaller ID side of adapter (401/1). Install the adapter, threads lubricated with Engine Oil P03-001and packing side inward, to the front port. Torque the adapter to 450 - 550 lb-in. (50.843 - 62.142 N.m). Install a packing, lubricated with Engine Oil P03-001, to the smaller side of the adapter (401/5) and lubricate the threads with Engine Oil P03-001. Install the adapter to the rear port and torque to 275 - 300 lb-in. (31.071 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety both adapters.

(d) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 79-53), Install packings, lubricated with Engine Oil P03-001, to insert (401/2) and plug (401/3). Lubricate threads and install insert (401/2) to outboard port. Torque insert (401/2) to 150 - 170 lb-in. (16.948 - 19.207 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the insert. Install plug (401/3) and torque to 65 - 75 lb-in. (7.344 - 8.474 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the plug.

(e) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 79-53), Install a packing lubricated with Engine Oil P03-001 to the plug (401/3). Install the plug into the main bearing strainer housing and torque to 65 - 75 lb-in. (7.344 - 8.474 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the plug.

(f) FOR THESE MODELS: 4152, 4156A, 4158
Install packing, lubricated with Engine Oil P03-001, to larger side of adapter (401/4). Install adapter (401/4), threads lubricated with Engine Oil P03-001, to inboard port and torque to 450 - 550 lb-in. (50.843 - 62.142 N.m).

(g) FOR THESE MODELS: 4152, 4156A, 4158
Install packing, lubricated with Engine Oil P03-001, to groove in strainer. Install strainer and secure with bolts, threads lubricated with Engine Oil P03-001. Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(h) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install the packing, lubricated with Engine Oil P03-001, to the smaller ID side of adapter (401/4). Install the adapter, threads lubricated with Engine Oil P03-001 and packing side inward, to the front port. Torque the adapter to 450 - 550 lb-in. (50.843 - 62.142 N.m). Install a packing, lubricated with Engine Oil P03-001, to the smaller side of the adapter (401/2) and lubricate the threads with Engine Oil P03-001. Install the adapter to the rear port and torque to 275 - 300 lb-in. (31.071 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety both adapters.

(i) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install a packing lubricated with Engine Oil P03-001 to the plug (401/3). Install the plug into the main bearing strainer housing and torque to 65 - 75 lb-in. (7.344 - 8.474 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the plug.

(j) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install packing, lubricated with Engine Oil P03-001, to the larger side of the adapter (401/1). Install adapter (401/1), threads lubricated with Engine Oil P03-001, to the inboard port and torque to 450 - 550 lb-in. (50.843 - 62.142 N.m).

(k) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install packing, lubricated with Engine Oil P03−001, to the groove in the strainer. Install the strainer and attach with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(2) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 75−85 and Pre SB PW4ENG 75−116) Install the HPC air valve signal tube assembly (AA15) on the right side of the engine. See Figure 402.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove the protection covers and lubricate the tube nut threads with Engine Oil P03−001. Install the tube to the rear of the lower right air filter at approximately the 2 o'clock position and to the HPC secondary flow control valve at approximately the 3:30 o'clock position forward of Flange J.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Install a clamp, bolt, threads lubricated with Engine Oil P03−001, and nut that attach the tube to a bracket that is attached to the turbine cooling air shutoff valve flange. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) FOR THESE MODELS: 4152, 4156A, 4158
Torque the tube nuts to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the tube nuts.

(3) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 75−116) Install the HPC air valve signal tube assemblies (AA89) and (AA91) on the right side of the engine.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove the protection covers.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Install the (AA89) tube to the rear of the lower right air filter at approximately the 2 o'clock position. Install the check valve on the lower end of the tube just above the tube tee.

(c) FOR THESE MODELS: 4152, 4156A, 4158
Install the HPC air valve signal tube assembly (AA91) on the (AA89) tube tee at approximately the 2:30 o'clock position forward of Flange J. Install the lower end of (AA91) tube to the HPC secondary flow control valve at approximately the 3:30 o'clock position forward of Flange J.

(d) FOR THESE MODELS: 4152, 4156A, 4158
Install a clamp, bolt, threads lubricated with Engine Oil P03-001, and nut that attach the tube to a bracket that is attached to the turbine cooling air shutoff valve flange. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) FOR THESE MODELS: 4152, 4156A, 4158
Torque the tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the tube nuts.

(4) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 75-102 and SB PW4ENG 75-116) Install air shutoff valve signal tube assembly (upper) (AA20) as follows.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove the protective closures and lubricate the tube nut threads with Antiseize Paste P06-054.
R Remove the unwanted paste. Position tube to Flange J brackets.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts securing tube to Flange J brackets at approximately 10 o'clock and 12 o'clock positions. Torque clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(5) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 75-116) Install air shutoff valve signal tube assembly (lower) (AA21) as follows.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove protective closures and lubricate tube nut threads at elbow end with Engine Oil P03-001, and at straight end with Antiseize Paste P06-054.
R Remove the unwanted paste. Install the elbow end of tube to turbine cooling air shutoff valve at approximately 3 o'clock position and to previously installed tubes at approximately 2 o'clock position rearward of Flange J handtight only.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to bracket attached to valve flange at approximately 3 o'clock position. Torque clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) FOR THESE MODELS: 4152, 4156A, 4158
Torque tube nut at elbow end of tube to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the tube nut. Torque tube nut at straight end of tube to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the tube nut.

(6) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 75-116) Install air shutoff valve signal tube assembly (lower) (AA90) as follows.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove protective closures and lubricate tube nut threads at elbow end with Engine Oil P03-001, and at straight end with Antiseize Paste P06-054.
R Remove the unwanted paste. Install the elbow end of tube to turbine cooling air shutoff valve at approximately 3 o'clock position. Install the opposite tube end to the check valve installed before on tube (AA89) at approximately the 2 o'clock position rearward of Flange J handtight only.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Install clamp, bolt, threads lubricated with Engine Oil P03−001, and nut securing tube to bracket attached to valve flange at approximately 3 o'clock position. Torque clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) FOR THESE MODELS: 4152, 4156A, 4158
Torque tube nut at elbow end of tube to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292. Torque tube nut at straight end of tube to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(7) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the turbine vane and blade cooling air valve signal tube assembly (AA77) as follows.

(a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the protective covers and lubricate the tube nut threads at the U shaped end of the tube with Engine Oil P03−001, and at the 90 degree elbow end of the tube with Antigalling Compound P06−021. Install the tube nut at the U shaped end of the tube to the turbine vane and blade cooling air valve at approximately the 3 o'clock position and the opposite tube nut to the (lower) air filter at approximately the 1:30 o'clock position.

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Attach the tube to the bracket on the turbine vane and blade cooling air valve flange with a clamp, a bolt, threads lubricated with Engine Oil P03−001, and nut. Torque the clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Torque the tube nut that is attached to the valve to 270 − 300 lb−in. (30.506 − 33.895 N.m). Torque the tube nut that is attached to the air filter to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the tube nuts.

(8) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install the turbine vane cooling air valve pressure tube assembly (AA76) as follows.

(a) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
R Remove the protective covers and lubricate the
R tube nuts with Antiseize Paste P06-054. Remove
R the unwanted paste. Install the tube to the (lower) air filter, on the left side of the engine, at approximately the 11 o'clock position and the opposite end of the tube to the turbine vane cooling air valve at the 2 o'clock position on the HPC case.

(b) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Attach the tube to the brackets on Flange J at the 10, 11:30, and 1 o'clock positions with clamps, bolts, threads lubricated with Engine Oil P03-001 and nuts. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Torque the tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the tube nuts.

(9) Install (left) bleed valve supply tube assembly (AA30) as follows.

R (a) Remove the protective closures and lubricate the
R tube nut threads with Antiseize Paste P06-054.
R Remove the unwanted paste. Install the tube to left HPC bleed valve at approximately 11 o'clock position handtight only.

(b) Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts securing tube to bracket below and bracket rear of turbine cooling air valve actuator at approximately 2 o'clock position handtight only.

(c) Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts securing tube to Flange J brackets at approximately 1, 12 and 11 o'clock positions handtight only.

(d) Torque all clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque tube nut to 200 - 225 lb-in. (22.597 - 23.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the tube nut.

(10) Install (right) bleed valve supply tube assembly (AA28) as follows.

R (a) Remove the protective closures and lubricate the
R tube nut threads with Antiseize Paste P06-054.
R Remove the unwanted paste. Install the tube to
HPC right side bleed valve at approximately 1 o'clock position handtight only.

(b) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to Flange J bracket at approximately 1 o'clock position handtight only.

(c) Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts securing tube to bracket below and bracket rear of turbine cooling air valve actuator at approximately 2 o'clock position handtight only.

(d) Torque all clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque tube nut to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the tube nut.

(11) Install air supply manifold assembly (AA24) as follows.

R (a) Remove the protective closures and lubricate
R the manifold nut threads with Antiseize Paste
R P06-054. Remove the unwanted paste. Install the
manifold to front of upper right air filter at approximately 2 o'clock position handtight only.

(b) Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts securing manifold to bracket below and bracket rear of turbine cooling air valve actuator at approximately 2 o'clock position. Torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Torque manifold nut to filter to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(12) (Reference 736) Tighten and torque the two bolts that attach the clamp bracket and ground cable to the turbine case cooling actuator support bracket to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(13) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 75-102 and SB PW4ENG 75-116) Install air shutoff valve signal manifold assembly (left) (AA19) as follows.

(a) FOR THESE MODELS: 4152, 4156A, 4158
R Remove the protective closures and lubricate the
R manifold nut threads with Antiseize Paste P06-054.
R Remove the unwanted paste. Install the manifold
to rear of upper left air filter at approximately the 11 o'clock position and to the turbine vane cooling air valve at approximately the 10 o'clock position handtight only. Connect tube nut to tee handtight only.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Torque all three manifold nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(14) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 75-102 and SB PW4ENG 75-116) Install air shutoff valve signal manifold assembly (left) (AA19) as follows.

(a) FOR THESE MODELS: 4152, 4156A, 4158
R Remove the protective closures and lubricate the
R manifold nut threads with Antiseize Paste P06-054.
R Remove the unwanted paste. Install the manifold
to rear of upper left air filter at approximately the 11 o'clock position and to the turbine vane cooling air valve at approximately the 10 o'clock position handtight only.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Torque the two manifold nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(15) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install air shutoff valve signal manifold assembly (left) (AA19) as follows.

(a) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
R Remove the protective closures and lubricate the
R manifold nut threads with Antiseize Paste P06-054.
R Remove the unwanted paste. Install the manifold
to rear of upper left air filter at approximately the 11 o'clock position and to the turbine vane cooling air valve at approximately the 10 o'clock position handtight only.

(b) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Torque the two manifold nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(16) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 75-85 and SB PW4ENG 75-116) Install the HPC air valve signal tube assembly (AA16) on the left side of the engine.

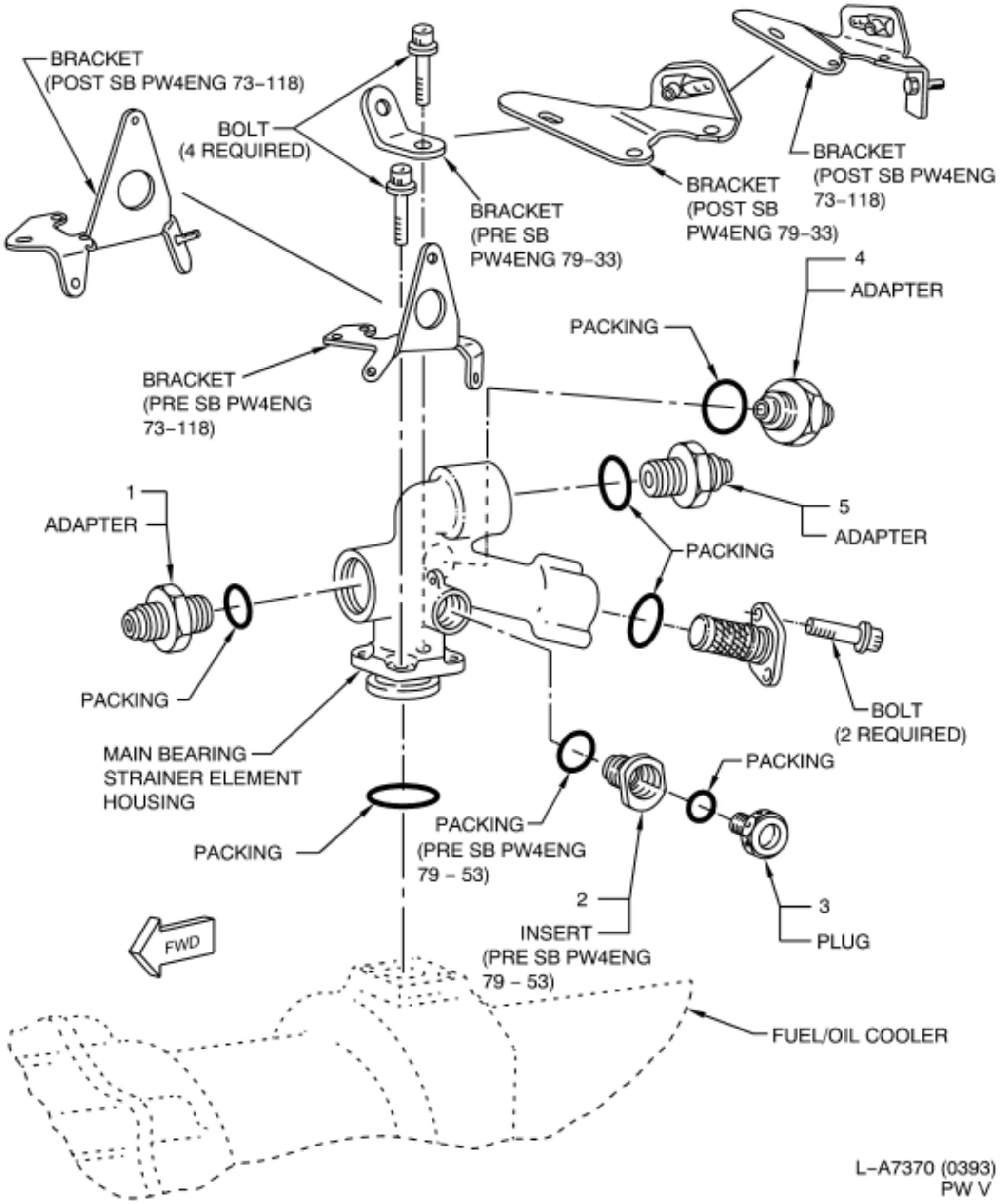
(a) FOR THESE MODELS: 4152, 4156A, 4158
R Remove the protection covers and lubricate the
R tube nut threads with Antiseize Paste P06-054.
R Remove the unwanted paste. Install the tube
to the rear of the lower left air filter at approximately the 11 o'clock position and to the HPC secondary flow control valve approximately at the 10 o'clock position.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Install a clamp, bolt, threads lubricated with Engine Oil P03-001, and nut that attach the tube to a bracket that is attached to the turbine cooling air shutoff valve flange. Torque the nut to 36 - 40 lb-in. (4.067 - 4.519 N.m).

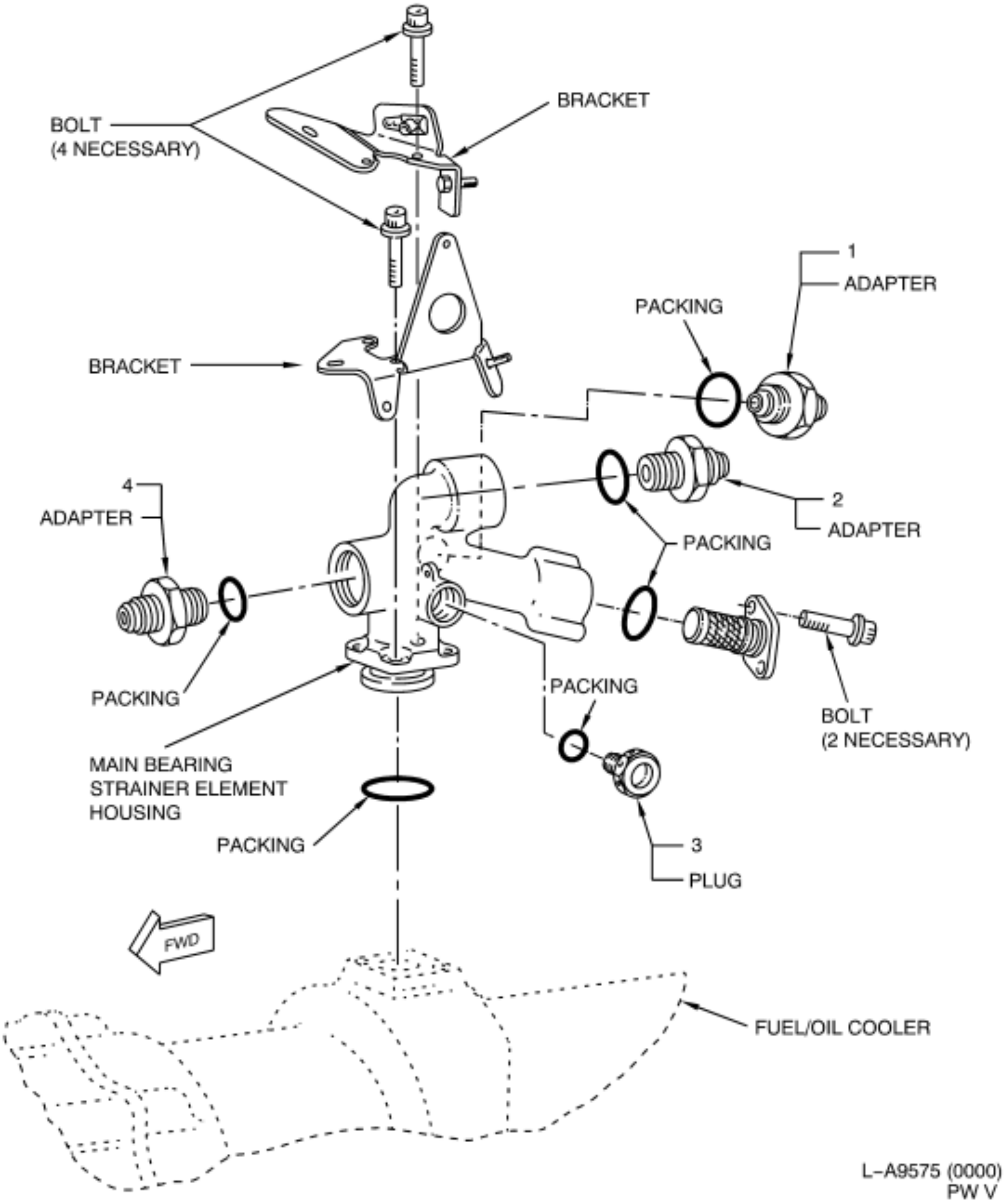
(c) FOR THESE MODELS: 4152, 4156A, 4158
Torque the tube nuts to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the tube nuts.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
HPC air valve signal tube was removed and cap assemblies installed on the air filter and the HPC air valve by Alert SB PW4ENG 75−62R2.

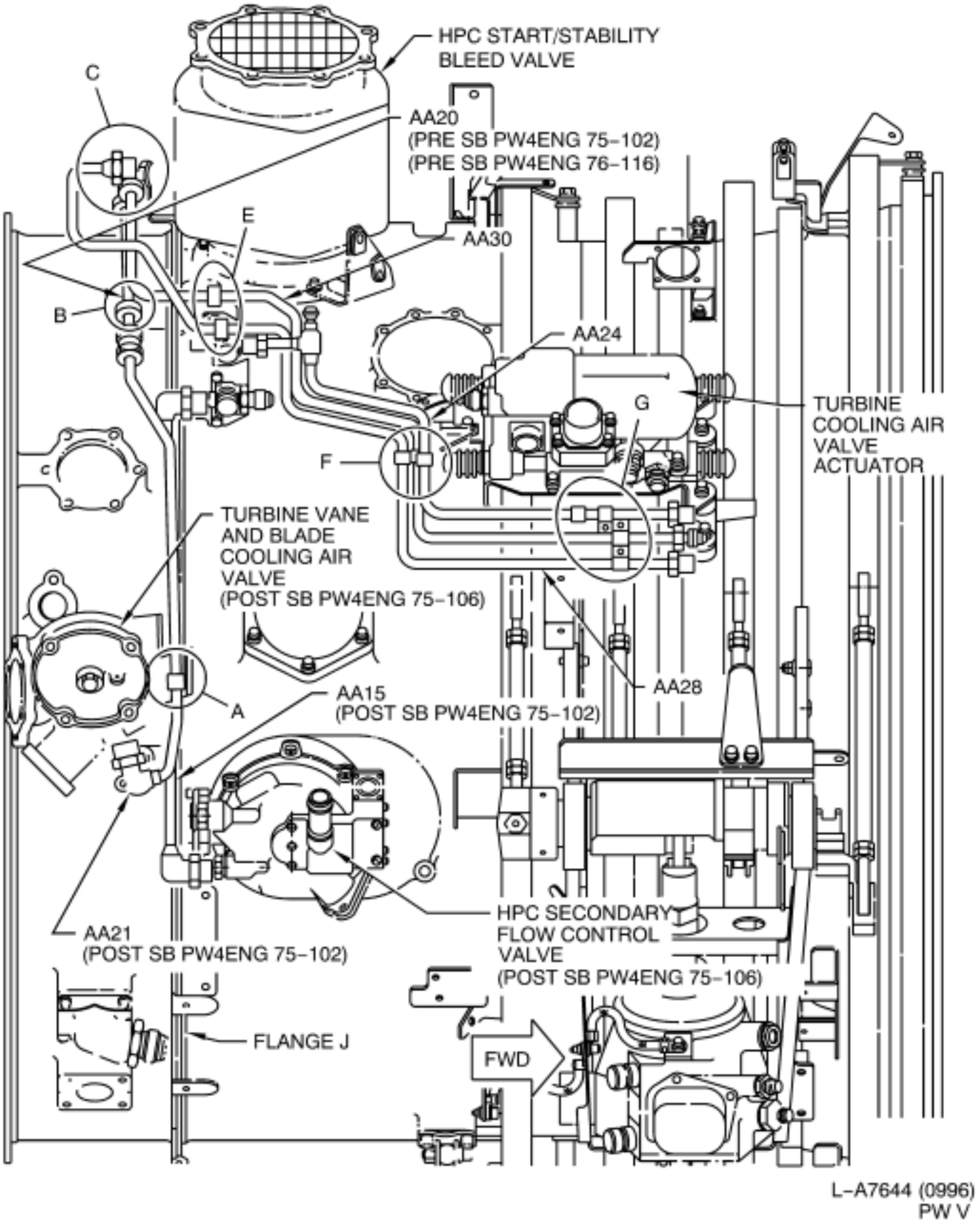
NOTE: FOR THESE MODELS: 4152, 4156A, 4158
HPC air valve signal tube was re−installed and the cap assemblies were removed from the air filter and the HPC air valve by SB PW4ENG 75−85.


BRACKET
(POST SB PW4ENG 73-118)
BOLT
(4 REQUIRED)
BRACKET
(PRE SB
PW4ENG 79-33)
BRACKET
(POST SB
PW4ENG 79-33)
BRACKET
(POST SB PW4ENG
73-118)
4
ADAPTER
PACKING
BRACKET
(PRE SB PW4ENG
73-118)
5
ADAPTER
1
ADAPTER
PACKING
PACKING
BOLT
(2 REQUIRED)
MAIN BEARING
STRAINER ELEMENT
HOUSING
PACKING
PACKING
PACKING
(PRE SB PW4ENG
79 - 53)
2
INSERT
(PRE SB PW4ENG
79 - 53)
3
PLUG
FWD
FUEL/OIL COOLER
L-A7370 (0393)
PW V

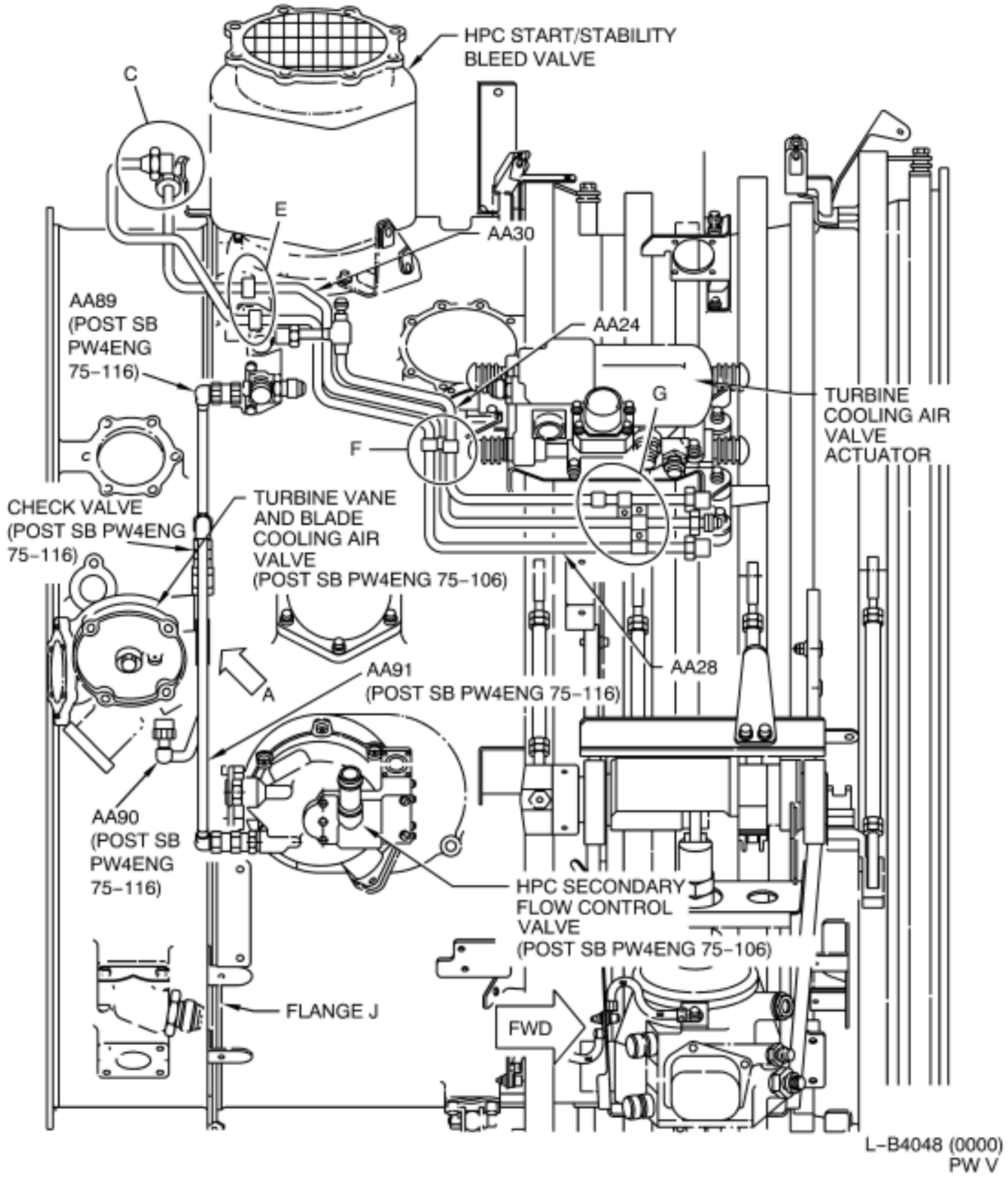
Main Bearing Strainer Housing
Figure 401 (Sheet 1)
(Task 72−00−35−420−002)


BOLT
(4 NECESSARY)
BRACKET
1
ADAPTER
PACKING
BRACKET
4
ADAPTER
2
ADAPTER
PACKING
PACKING
PACKING
BOLT
(2 NECESSARY)
MAIN BEARING
STRAINER ELEMENT
HOUSING
PACKING
3
PLUG
FWD
FUEL/OIL COOLER
L-A9575 (0000)
PW V

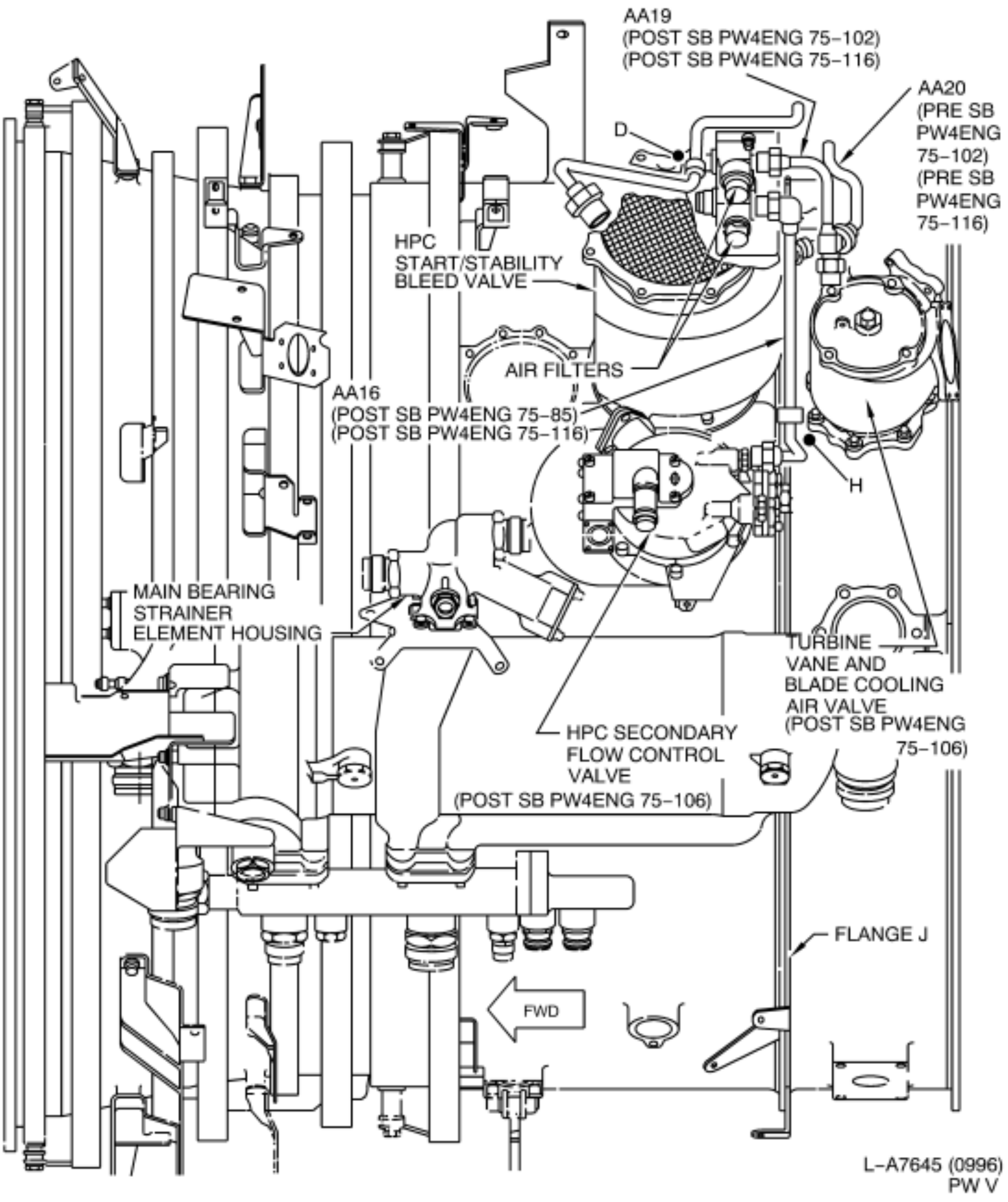
Main Bearing Strainer Housing
Figure 401 (Sheet 2)
(Task 72-00-35-420-002)


HPC START/STABILITY BLEED VALVE
C
AA20 (PRE SB PW4ENG 75-102) (PRE SB PW4ENG 76-116)
E
AA30
B
AA24
G
TURBINE COOLING AIR VALVE ACTUATOR
F
TURBINE VANE AND BLADE COOLING AIR VALVE (POST SB PW4ENG 75-106)
A
AA28
AA15 (POST SB PW4ENG 75-102)
AA21 (POST SB PW4ENG 75-102)
HPC SECONDARY FLOW CONTROL VALVE (POST SB PW4ENG 75-106)
FLANGE J
FWD
L-A7644 (0996)
PW V

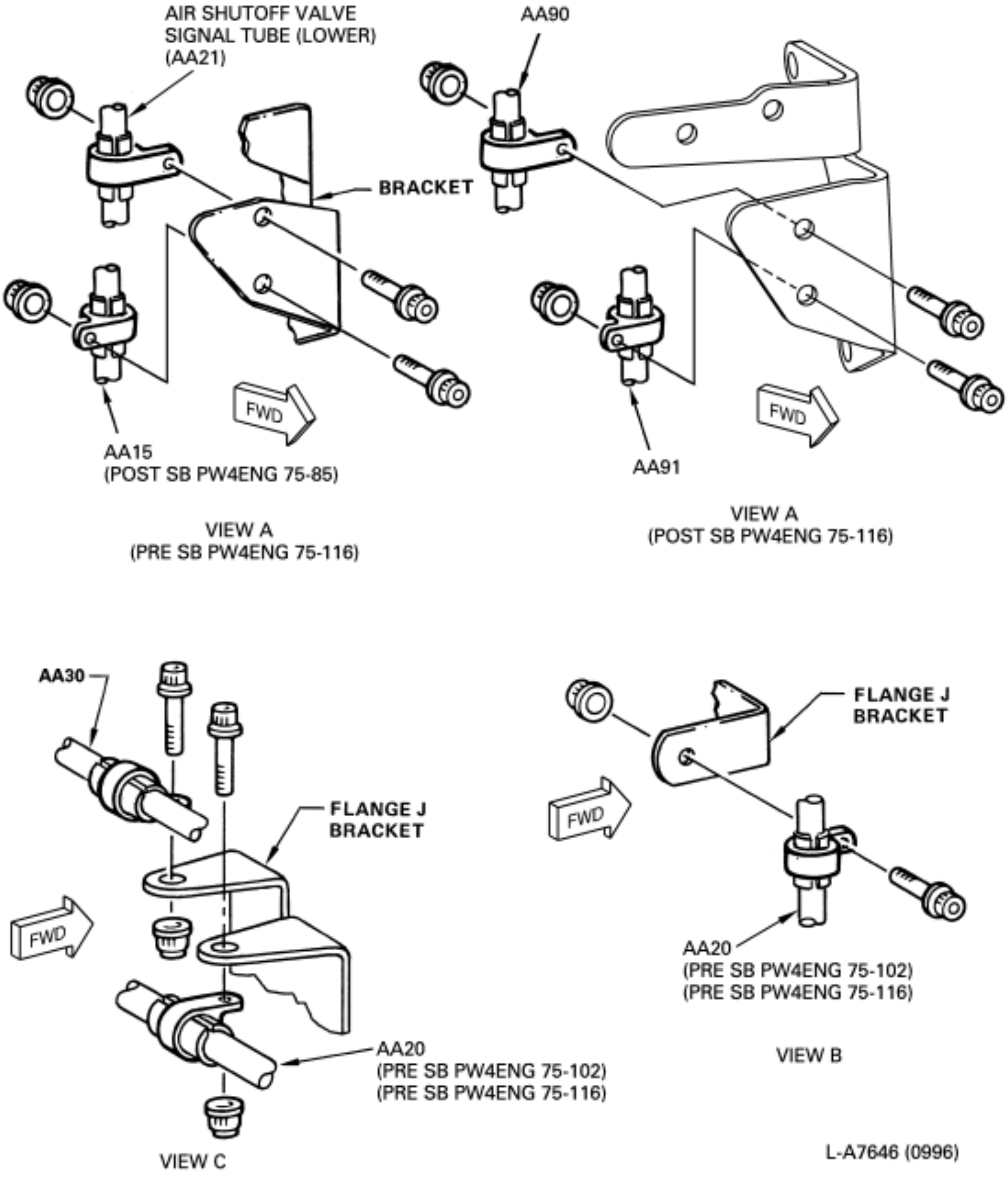
High Pressure Compressor Plumbing (Pre SB PW4ENG 75-116)
Figure 402 (Sheet 1)
(Task 72-00-35-420-002)


HPC START/STABILITY BLEED VALVE
C
E
AA30
AA89 (POST SB PW4ENG 75−116)
AA24
G
TURBINE COOLING AIR VALVE ACTUATOR
F
CHECK VALVE (POST SB PW4ENG 75−116)
TURBINE VANE AND BLADE COOLING AIR VALVE (POST SB PW4ENG 75−106)
A
AA91 (POST SB PW4ENG 75−116)
AA28
AA90 (POST SB PW4ENG 75−116)
HPC SECONDARY FLOW CONTROL VALVE (POST SB PW4ENG 75−106)
FLANGE J
FWD
L−B4048 (0000)
PW V

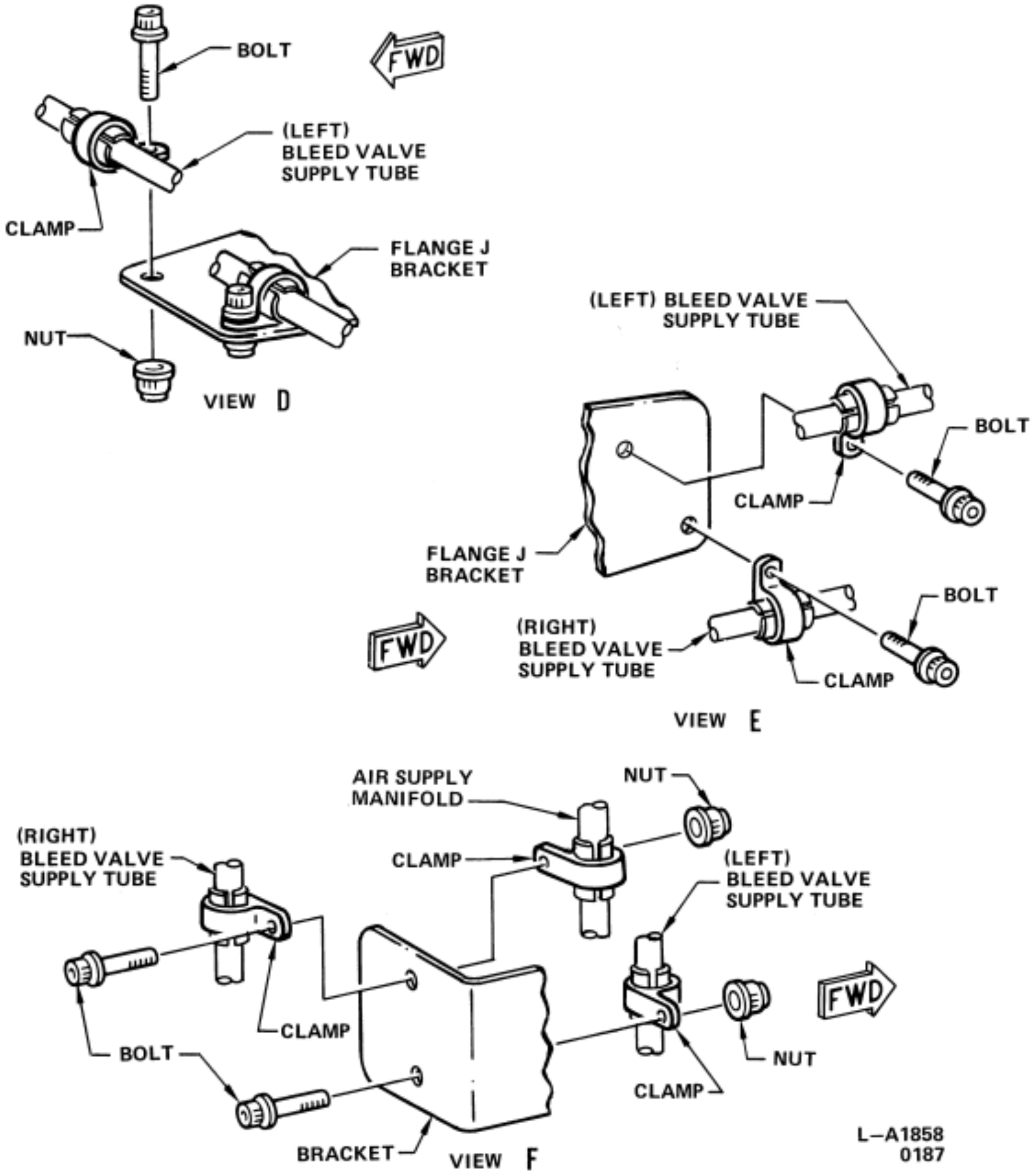
High Pressure Compressor Plumbing (Post SB PW4ENG 75−116)
Figure 402 (Sheet 2)
(Task 72−00−35−420−002)


AA19
(POST SB PW4ENG 75-102)
(POST SB PW4ENG 75-116)
AA20
(PRE SB PW4ENG 75-102)
(PRE SB PW4ENG 75-116)
D
HPC START/STABILITY BLEED VALVE
AIR FILTERS
AA16
(POST SB PW4ENG 75-85)
(POST SB PW4ENG 75-116)
H
MAIN BEARING STRAINER ELEMENT HOUSING
TURBINE VANE AND BLADE COOLING AIR VALVE
(POST SB PW4ENG 75-106)
HPC SECONDARY FLOW CONTROL VALVE
(POST SB PW4ENG 75-106)
FLANGE J
FWD
L-A7645 (0996)
PW V

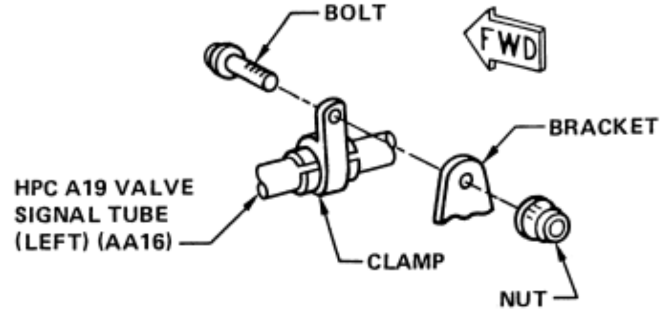
High Pressure Compressor Plumbing
Figure 402 (Sheet 3)
(Task 72-00-35-420-002)


AIR SHUTOFF VALVE
SIGNAL TUBE (LOWER)
(AA21)
BRACKET
FWD
AA15
(POST SB PW4ENG 75-85)
VIEW A
(PRE SB PW4ENG 75-116)
AA90
FWD
AA91
VIEW A
(POST SB PW4ENG 75-116)
AA30
FLANGE J
BRACKET
FWD
AA20
(PRE SB PW4ENG 75-102)
(PRE SB PW4ENG 75-116)
VIEW C
FLANGE J
BRACKET
FWD
AA20
(PRE SB PW4ENG 75-102)
(PRE SB PW4ENG 75-116)
VIEW B
L-A7646 (0996)

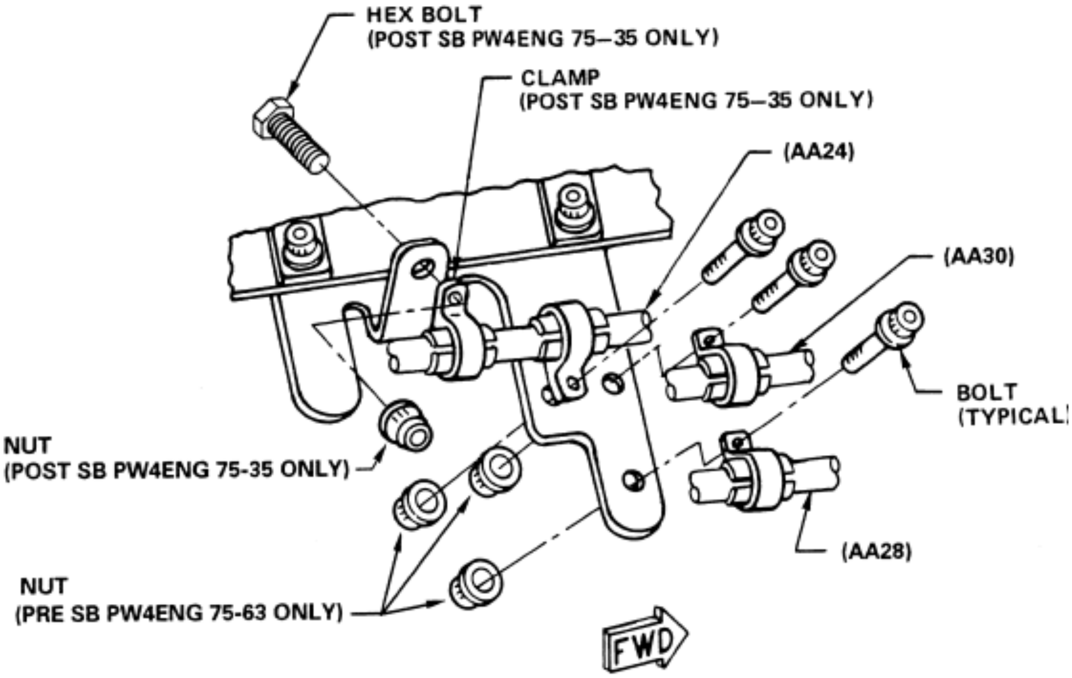
High Pressure Compressor Plumbing
Figure 402 (Sheet 4)
(Task 72−00−35−420−002)


BOLT
FWD
(LEFT) BLEED VALVE SUPPLY TUBE
CLAMP
FLANGE J BRACKET
NUT
VIEW D
(LEFT) BLEED VALVE SUPPLY TUBE
BOLT
CLAMP
FLANGE J BRACKET
BOLT
FWD
(RIGHT) BLEED VALVE SUPPLY TUBE
CLAMP
VIEW E
AIR SUPPLY MANIFOLD
NUT
(RIGHT) BLEED VALVE SUPPLY TUBE
CLAMP
(LEFT) BLEED VALVE SUPPLY TUBE
FWD
CLAMP
BOLT
NUT
CLAMP
BRACKET
VIEW F
L-A1858
0187

High Pressure Compressor Plumbing
Figure 402 (Sheet 5)
(Task 72-00-35-420-002)


BOLT
FWD
BRACKET
HPC A19 VALVE SIGNAL TUBE (LEFT) (AA16)
CLAMP
NUT

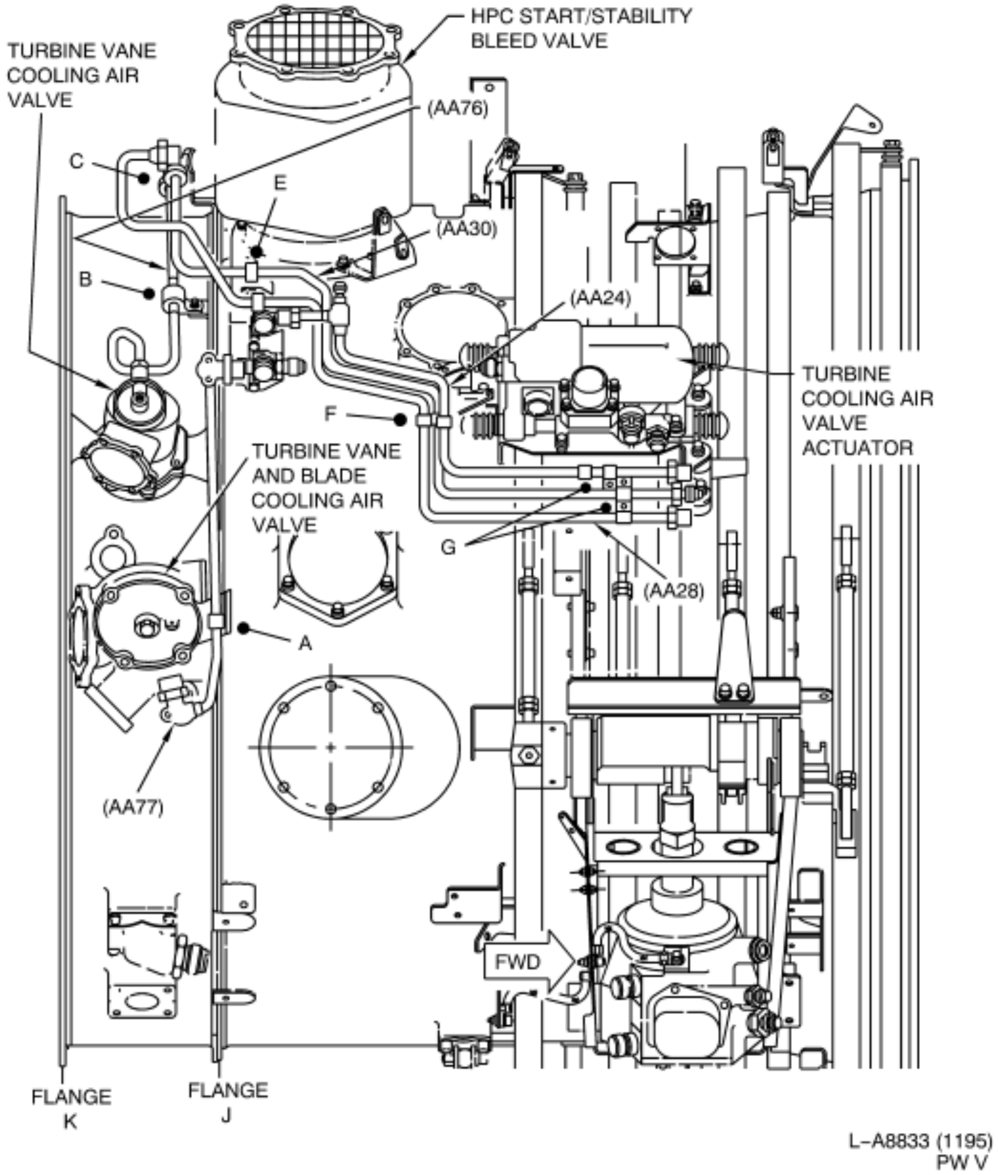
VIEW H
(POST SB PW4ENG 75-85)


HEX BOLT (POST SB PW4ENG 75−35 ONLY)
CLAMP (POST SB PW4ENG 75−35 ONLY)
(AA24)
(AA30)
BOLT (TYPICAL
NUT (POST SB PW4ENG 75-35 ONLY)
(AA28)
NUT (PRE SB PW4ENG 75-63 ONLY)
FWD

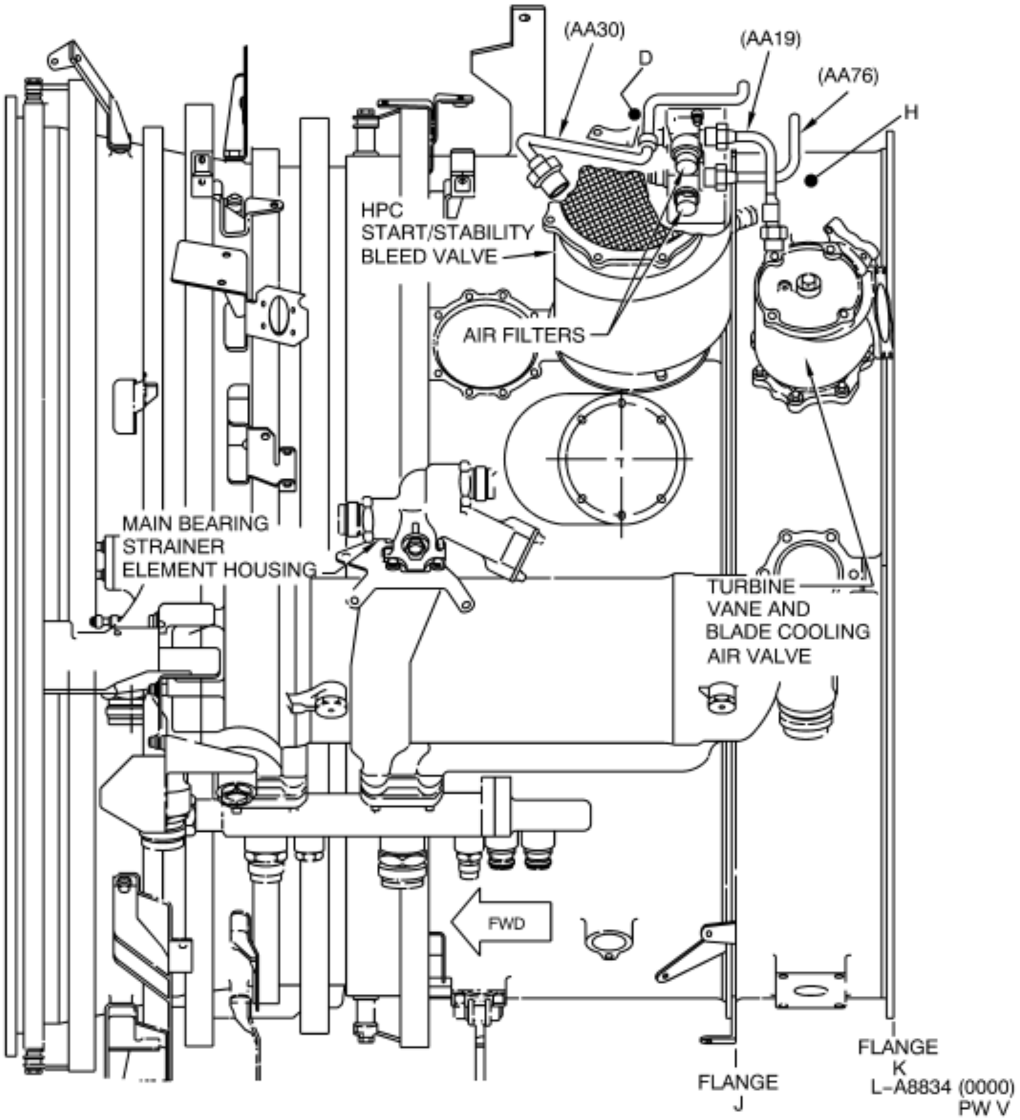
VIEW G

L-A8025

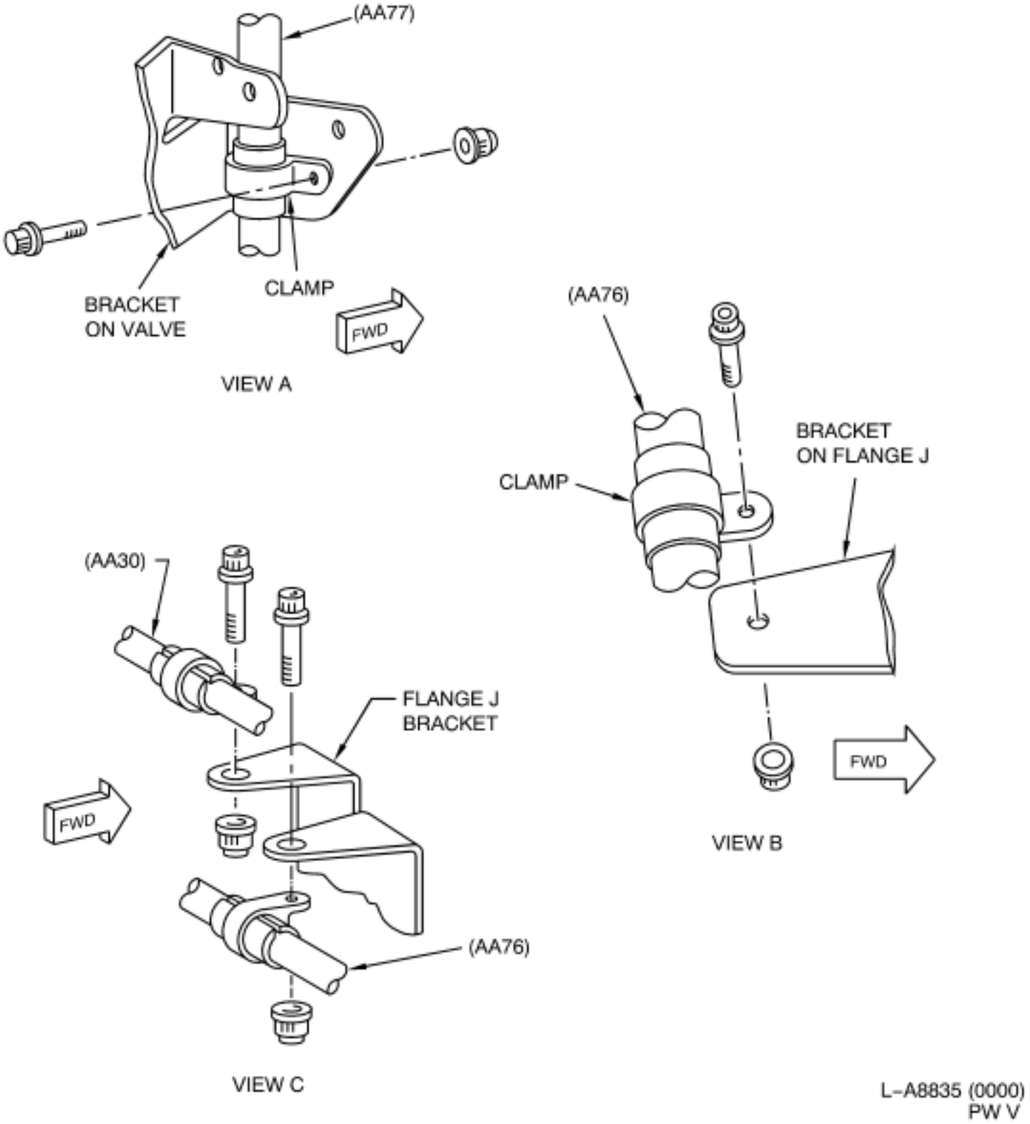
High Pressure Compressor Plumbing
Figure 402 (Sheet 6)
(Task 72−00−35−420−002)


HPC START/STABILITY BLEED VALVE
TURBINE VANE COOLING AIR VALVE
(AA76)
C
E
(AA30)
B
(AA24)
TURBINE COOLING AIR VALVE ACTUATOR
F
TURBINE VANE AND BLADE COOLING AIR VALVE
G
(AA28)
A
(AA77)
FWD
FLANGE K
FLANGE J
L−A8833 (1195)
PW V

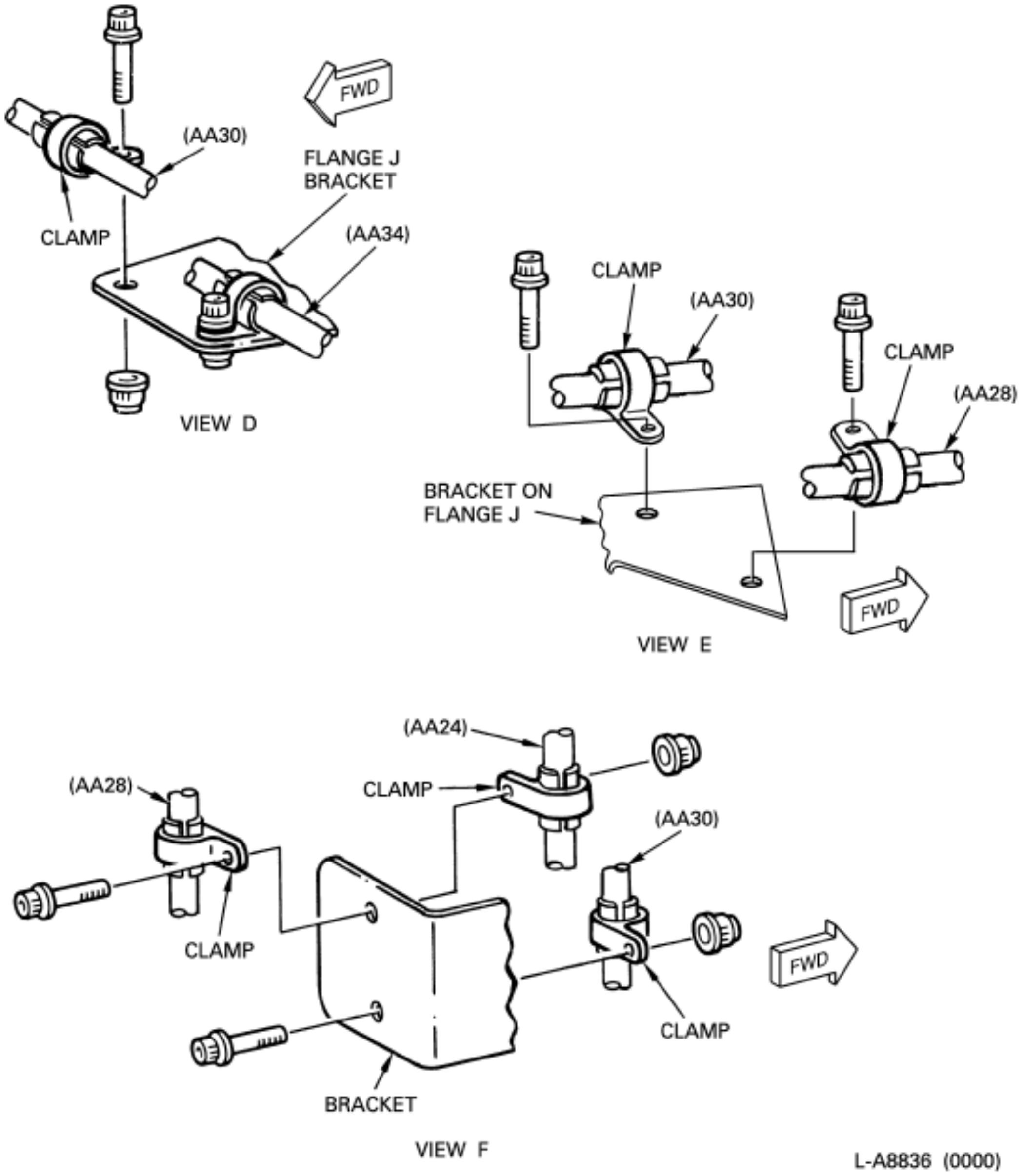
High Pressure Compressor Plumbing
Figure 402 (Sheet 7)
(Task 72−00−35−420−002)


(AA30)
D
(AA19)
(AA76)
H
HPC START/STABILITY BLEED VALVE
AIR FILTERS
MAIN BEARING STRAINER ELEMENT HOUSING
TURBINE VANE AND BLADE COOLING AIR VALVE
FWD
FLANGE J
FLANGE K
L-A8834 (0000)
PW V

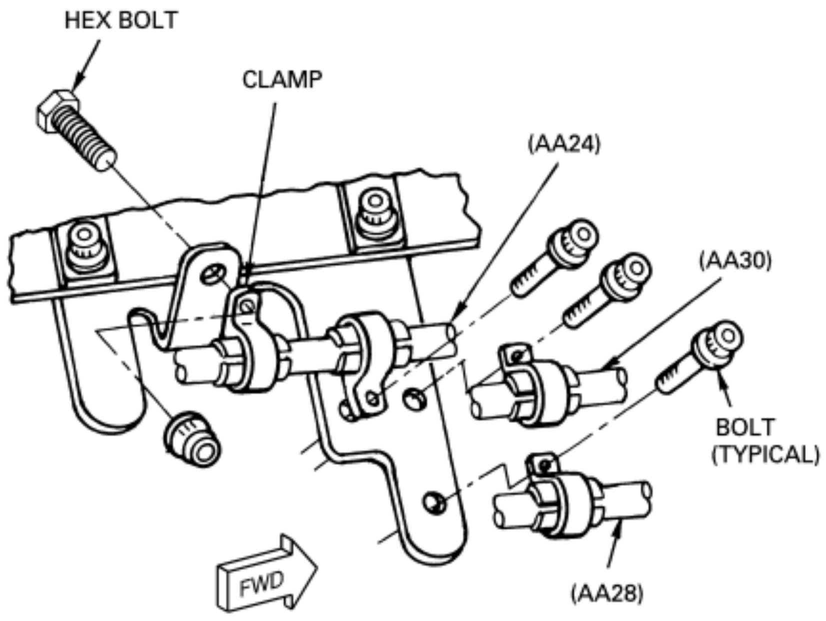
High Pressure Compressor Plumbing
Figure 402 (Sheet 8)
(Task 72-00-35-420-002)


(AA77)
BRACKET ON VALVE
CLAMP
FWD
VIEW A
(AA76)
CLAMP
BRACKET ON FLANGE J
FWD
VIEW B
(AA30)
FLANGE J BRACKET
FWD
(AA76)
VIEW C
L−A8835 (0000)
PW V

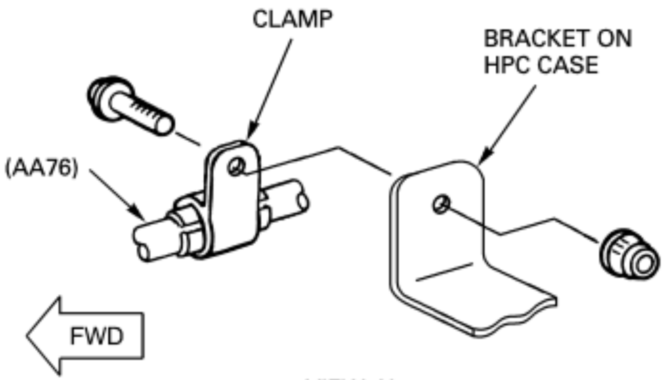
High Pressure Compressor Plumbing
Figure 402 (Sheet 9)
(Task 72−00−35−420−002)


FWD
(AA30)
FLANGE J
BRACKET
CLAMP
(AA34)
VIEW D
CLAMP
(AA30)
CLAMP
(AA28)
BRACKET ON
FLANGE J
FWD
VIEW E
(AA24)
(AA28)
CLAMP
(AA30)
CLAMP
FWD
CLAMP
BRACKET
VIEW F
L-A8836 (0000)

High Pressure Compressor Plumbing
Figure 402 (Sheet 10)
(Task 72−00−35−420−002)


HEX BOLT
CLAMP
(AA24)
(AA30)
BOLT
(TYPICAL)
FWD
(AA28)

VIEW G


CLAMP
BRACKET ON
HPC CASE
(AA76)
FWD

VIEW H

L-A8837 (0000)

High Pressure Compressor Plumbing
Figure 402 (Sheet 11)
(Task 72-00-35-420-002)

Previous Pageblock   Return to Previous Menu   Next Pageblock

Task 72-00-35-450-001-A:

1. Install Fuel/Oil Cooler - For Engines Not Equipped With Front Split Mount Bracket (Pre SB PW4ENG 79-20)

A. Equipment And Materials Necessary

Standard Tools:

Glenair TG-70	Strap Wrench (Optional To Glenair TG-69)
Glenair TG-69	Soft Jawed Pliers (Optional To Glenair TG-70)
Bergen Mechanical Crimper	(Optional) Model M303, M305 Or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
R	P05-292	Ferrule, Safety Cable (Optional)
	P06-021	Compound, Antigalling (PWA 550)
	P06-036	Compound, Antigallant (PWA 36035)
R	P06-054	Paste, Antiseize (PWA 36246)
	P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	1	79-21-00/05/080
Packing	1	79-21-00/11/001
Packing	1	79-21-00/05/190
Packing	1	79-21-00/06/040
Packing	1	79-21-00/09/110
Packing	2	79-21-00/05/010
Packing	3	79-21-00/05/030
Packing	1	79-21-00/08/120
Packing	1	73-12-00/03/001
Packing	1	79-21-00/09/010
Packing	2	79-21-00/05/170
Packing	2	73-12-00/03/150
Packing	2	73-12-00/03/170
Packing	1	24-11-00/02/001
Retainer	1	24-11-00/02/010
Retainer	1	79-21-00/09/120
Retainer	1	79-21-00/11/010

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
(CONTINUED)		
Retainer	1	73−12−00/03/010
Retainer	1	79−21−00/08/130
Retainer	1	79−21−00/09/020
Retainer	2	73−12−00/03/160

B. Procedure
See Figure 401, Figure 402, Figure 403, Figure 404 and Figure 405.

(1) If new replacement fuel/oil cooler is to be installed, comply with the following. See Figure 401.

(a) Remove protective closures.

(b) Install fuel/oil cooler bypass valve. See Installation−11 Task 72−00−35−450−008.

(c) Install pin, threads lubricated with Engine Oil P03−001, to front mounting ear and secure with washer and nut. Torque nut to 550 − 750 lb−in. (62.142 − 84.739 N.m) aligning cotter pin hole. Install cotter pin and secure.

(d) Install adapter (inlet return), threads lubricated with Engine Oil P03−001, and packing, lubricated with Engine Oil P03−001, to fuel/oil cooler port. Torque adapter to 110 − 120 lb−in. (12.428 − 13.558 N.m).

(e) Install elbow and jamnut, threads lubricated with Engine Oil P03−001, and packing, lubricated with Engine Oil P03−001, to fuel/oil cooler port handtight only. (Elbow jamnut to be torqued after alignment of elbow with drain tube).

(f) Install two adapters (fuel inlet) and one adapter (fuel outlet), threads lubricated with Engine Oil P03−001, and packings, lubricated with Engine Oil P03−001, to fuel/oil cooler ports. Torque three adapters to 650 − 750 lb−in. (73.440 − 84.739 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(g) Install two plugs (drain), threads lubricated with Engine Oil P03−001, and packings, lubricated with Engine Oil P03−001, to fuel/oil cooler ports. Torque two plugs to 110 − 120 lb−in. (12.428 − 13.558 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(h) Install plug (airframe outlet), threads lubricated with Engine Oil P03−001, and packing, lubricated with Engine Oil P03−001, to fuel/oil cooler port. Torque plug, to 375 − 425 lb−in. (42.369 − 48.019 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(2) Install fuel/oil cooler as follows. See Figure 404.

(a) Remove protective closures.

(b) Lubricate adapter (inlet return) threads with Engine Oil P03−001. Lubricate remaining adapters on fuel/oil cooler and bypass valve with Antigalling Compound P06−021.

(c) Install packing, lubricated with Engine Oil P03−001, and retainer to each of the following tubes at fuel/oil cooler end:

1 Oil cooler inlet fuel tube (two).

2 Oil cooler inlet oil tube (airframe).

3 Air cooler outlet oil hose and tube assembly.

4 Oil cooler bypass drain tube.

5 Oil cooler outlet fuel tube.

(d) Install two packings, lubricated with Engine Oil P03−001, to lower flanged ends of oil cooler inlet fuel tubes. Ensure W3 and W5 harness is positioned forward and install cooler (rearward end first). See Figure 402. Move cooler forward (inboard of harness and rear of cooler raised off tubes) to engage front mount pin. Ensure all tubes are aligned and lower rear of cooler onto tubes.

(e) Install loop clamp bracket to top bolt hole of rear mount. Secure rear mount with four bolts, threads lubricated with Engine Oil P03−001, and three washers (omit washer at bracket). Torque bolts to 180 − 200 lb−in. (20.337 − 22.597 N.m).

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(3) Torque and secure tubes to fuel/oil cooler and fuel/oil cooler bypass valve adapters as follows. See Figure 404.

(a) (Reference 2170) Torque the oil cooler outlet fuel tube nut (FM11) to 150 − 160 lb−in. (16.948 − 18.078 N.m). Torque the tube nuts again to 150 − 160 lb−in. (16.948 − 18.078 N.m) until the torque is kept.

(b) Torque oil cooler bypass drain tube (LP20) to 65 − 70 lb−in. (7.344 − 7.909 N.m), then loosen and retorque to same value.

(c) Torque oil cooler inlet return manifold (CR04) to 200 − 225 lb−in. (22.597 − 25.422 N.m) at front of cooler.

(d) Connect both ends of oil cooler inlet fuel tubes (two) (FM10) and (FM12) to fuel/oil cooler and to fuel pump and bypass valve. Secure bottom tube flanges with six bolts, threads lubricated with Engine Oil P03−001, handtight only. Install clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts securing tubes to HPC case brackets at two locations. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). Torque six bolts securing tube flanges to fuel pump and fuel bypass valve to 85 − 95 lb−in. (9.604 − 10.734 N.m). (Reference 2170) Torque the tube nuts to the fuel oil cooler to 150 − 160 lb−in. (16.948 −

18.078 N.m). Torque the tube nuts again to 150 − 160 lb−in. (16.948 − 18.078 N.m) until the torque is kept.

(e) Lubricate union at approximately 6 o'clock
R position with Antiseize Paste P06−054 and connect
oil cooler inlet oil tube (LS05) (airframe)
to fuel/oil cooler bypass valve and to union
R handtight only. Wipe off unwanted paste. Secure
tube to previously installed fuel inlet tube at two locations using clamp, bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). Torque tube to union to 675 − 750 lb−in. (76.265 − 84.739 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292. Torque nut to bypass valve to 140 − 160 lb−in. (15.818 − 18.078 N.m), then loosen and retorque to same value.

(f) Connect air cooler outlet oil hose and tube assembly (LP03) to bypass valve handtight only. Secure tube to HPC case bracket and EEC wiring harness support tube using clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). Torque hose and tube assembly nut to bypass valve to 100 − 110 lb−in. (11.298 − 12.428 N.m), then loosen and retorque to same value.

(g) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to all the tubes torqued to the bottom of the fuel/oil cooler and the fuel/oil cooler bypass valve adapters.

NOTE: Forward inboard oil cooler inlet fuel tube to be lockwired to forward outboard wire hole in bypass valve gasket.

(4) Install main bearing strainer housing as follows. See Figure 403.

(a) Remove protective closures.

(b) Lubricate threads of two largest adapters (front and rear of strainer housing) with Antigalling Compound P06−021. Lubricate threads of smaller
R adapter (inboard side of housing) with Antiseize
R Paste P06−054. Wipe off unwanted paste.

(c) Install packing, lubricated with Engine Oil P03−001, and retainer to the No. 1, 1.5 and 2 main bearing oil pressure manifold.

(d) Install packing, lubricated with Engine Oil P03−001, to groove in flange of main bearing strainer housing. Install housing to top of fuel/oil cooler engaging tubes to adapters.

(e) Secure housing to fuel/oil cooler with four bolts, threads lubricated with Engine Oil P03−001, and brackets attached to W5 harness. Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Install the No. 3 bearing oil pressure manifold (LP18) as follows:

CAUTION: DO THIS PROCEDURE EXACTLY AS FOLLOWS OR TUBE FAILURE CAN RESULT. YOU MUST USE THE WRENCHING FLATS ON THE MATING PARTS WHEN YOU LOOSEN OR TIGHTEN ANY OR ALL TUBE NUTS. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

1 Be sure and loosen
- (Pre SB PW4ENG 79−52), the clamp bolt that attaches the No. 3 bearing oil strainer (LP19) to the Flange K bracket
- (Post SB PW4ENG 79−52), the clamp bolts that attaches the ferrule end (contains the oil strainer) of the No. 3 bearing pressure tube (LP19) to the bracket on Flange K
- the three bolts that attach the oil trim pressure tube (LP32) to the main oil filter housing.

2 (Pre SB PW4ENG 79-52), Lubricate the back of the manifold ferrules per Figure 406 (Sheet 1) with Antigallant Compound P06-036. Lubricate the forward tube nut threads with Antigalling Compound P06-021. Lubricate the rear tube nut
R threads with Antiseize Paste P06-054. Wipe off
R unwanted paste. Lubricate the packing with Engine Oil P03-001. Install the packing and retainer to the tube.

3 (Post SB PW4ENG 79-52), Lubricate the back of the manifold ferrules and the manifold nut threads with Antigallant Compound P06-021. See Figure 406 (Sheet 2). Lubricate the packing with Engine Oil P03-001 and install the packing and retainer to the manifold.

4 Install the manifold (LP18) to the strainer housings. Tighten by hand.

5 Lubricate the threads of the oil tube metering nipple (restrictor) with Antigalling Compound P06-021. Lubricate the back of the ferrules on the oil trim pressure tubes (LP31) and (LP32) per Figure 406 (Sheet 1) with Antigallant Compound P06-036. Install the nipple to the two oil trim pressure tubes (LP31) and (LP32). Tighten by hand.

6 Lubricate the clamp bolts with Engine Oil P03-001 and install the attaching hardware for the No. 3 bearing oil pressure manifold and the oil trim pressure tube.

7 (Reference 2016) Be sure that the center of the forward clamp (on the oil trim pressure tube) is 2.500 - 3.000 inch (63.500 - 76.200 mm) from the center of the rear clamp (Post SB PW4ENG 72-211 only).

8 Torque the clamp bolts and tubes exactly as follows:
- the clamp bolt that attaches the back to back clamps (LP18) to (LP32) to 36 - 40 lb-in. (4.067 - 4.519 N.m)
- the clamp bolt(s) that attach the tubes to the oil cooler rear bracket to 36 - 40 lb-in. (4.067 - 4.519 N.m)
- (Pre SB PW4ENG 79-52), the clamp bolt that

attaches the No. 3 bearing oil strainer (LP19) to the Flange K bracket to 36 − 40 lb−in. (4.067 − 4.519 N.m)
- (Post SB PW4ENG 79−52), the bolts that attach the ferrule end of the No. 3 bearing pressure tube (LP19) to the bracket on Flange K to 36 − 40 lb−in. (4.067 − 4.519 N.m)
- the three bolts that attach the oil trim pressure tube (LP32) to the main oil filter housing to 85 − 95 lb−in. (9.604 − 10.734 N.m)
- the front tube nut of the (LP18) manifold to strainer housing to 140 − 160 lb−in. (15.818 − 18.078 N.m), then loosen and torque again to the same value
- the tube nuts (LP31) and (LP32), that attach the oil tube metering nipple (restrictor) to 675 − 750 lb−in. (76.265 − 84.739 N.m)
- (Post SB PW4ENG 79−52), Install a clamp to the tube nut end of the oil trim pressure tube (LP32) and attach the clamp to a bracket on the secondary flow control valve flange with a bolt, lubricated with Engine Oil P03−001 and a nut. Torque the nut to 36 − 40 (4.067 − 4.519 N.m)
- (Pre SB PW4ENG 79−52), the manifold nut (LP18) to the No. 3 bearing oil strainer at Flange K to 675 − 750 lb−in. (76.265 − 84.739 N.m)
- (Post SB PW4ENG 79−52), the manifold nut (LP18) to the adapter in the No. 3 bearing oil pressure tube (LP19) at Flange K to 675 − 750 lb−in. (76.265 − 84.739 N.m).

(g) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 at all necessary locations,

(h) (Pre SB PW4ENG 79−52), Install the spray shield to the inboard side of the rear manifold (LP18) connection.

(i) (Pre SB PW4ENG 79−52), (Reference 2151) Attach the shield with the hose clamp and torque the clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

R
R

(j) (Post SB PW4ENG 79−52), Install the spray shield to the inboard side of the rear manifold (LP18) that is attached to the No. 3 bearing pressure tube (LP19). Attach the spray shield with a clamp and a bolt, threads lubricated with Engine Oil P03−001, to a bracket attached to the flange of the cooling air tube on the high compressor. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(k) Install the No. 1, 1.5 and 2 main bearing oil pressure tube (LP05) as follows.

1 Apply Antigalling Compound P06−021 to the threads of the tube nuts.

2 Install the tube to the strainer housings (packing and retainer at the rearward end installed) and tighten by hand.

3 Torque the clamp bolt that attaches the tube to the bracket on Flange E to 36 − 40 lb−in. (4.067 − 4.519 N.m).

4 (Post SB PW4ENG 79−33), Attach the clamp on the tube to a bracket on the main bearing breather tube (LB06) with a nut and bolt, threads lubricated with Engine Oil P03−001. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 403 (Sheet 2).

5 Torque the forward tube nut to 675 − 750 lb−in. (76.265 − 84.739 N.m). Install lockwire to the tube nut.

6 Torque the rear tube nut to 140 − 160 lb−in. (15.818 − 18.078 N.m), and then loosen to zero torque. Torque the rear tube nut a second time to 140 − 160 lb−in. (15.818 − 18.078 N.m). Install lockwire to the tube nut.

(l) Connect and torque gearbox oil pressure manifold (LP08) to 675 − 750 lb−in. (76.265 − 84.739 N.m) and secure with lockwire.

(5) Attach and connect harnesses to fuel/oil cooler and fuel/oil cooler bypass valve as follows. See Figure 405.

(a) Install two loop clamp brackets.

  1 Remove four bolts and washers from front flange of fuel/oil cooler.

  2 Secure two loop clamp brackets to front flange with four bolts, threads lubricated with Engine Oil P03−001. Omit washers.

  3 Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(b) Connect the W5P5 and the W3P5 harness connectors to the bypass valve solenoid front and rear, respectively, harness receptacles as follows. For each connector:

  1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

  2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

  NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

  CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

  3 Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
  - the connector coupling nut is fully tight
  - the connector fits tightly against the receptacle (metal to metal).

- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque. See the instructions given with the strap wrench for correct use.

(c) Install three bolts and two nuts, threads lubricated with Engine Oil P03-001, securing W3 and W5 harnesses to brackets attached to front of cooler and to bracket below cooler. Torque bolts and nuts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

Task 72-00-35-450-001-B:

2. Install Fuel/Oil Cooler - For Engines Equipped With Front Split Mount Bracket (Post SB PW4ENG 79-20)

A. Equipment And Materials Necessary

Standard Tools:

Glenair TG-70	Strap Wrench (Optional to Glenair TG-69)
Glenair TG-69	Soft Jawed Pliers (Optional to Glenair TG-70)
Bergen Mechanical Crimper	(Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
R	P03-001	Oil, Engine (PWA 521B)
	P06-021	Compound, Antigalling (PWA 550)
	P06-036	Compound, Antigallant (PWA 36035)
R	P06-054	Paste, Antiseize (PWA 36246)
	P11-009	Alcohol, Denatured Ethyl(AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	1	79-21-00/05/080
Packing	1	79-21-00/11/001
Packing	1	79-21-00/05/190
Packing	1	79-21-00/06/040
Packing	1	79-21-00/09/110
Packing	2	79-21-00/05/010
Packing	3	79-21-00/05/030
Packing	1	79-21-00/08/120
Packing	1	73-12-00/03/001
Packing	1	79-21-00/09/010
Packing	2	79-21-00/05/170
Packing	2	73-12-00/03/150
Packing	1	24-11-00/02/001
Retainer	1	24-11-00/02/010
Retainer	1	79-21-00/09/120
Retainer	1	79-21-00/11/010
Retainer	1	73-12-00/03/010
Retainer	1	79-21-00/08/130
Retainer	1	79-21-00/09/020
Retainer	2	73-12-00/03/160

B. Procedure
See Figure 407, Figure 408, Figure 409, Figure 410 and Figure 411.

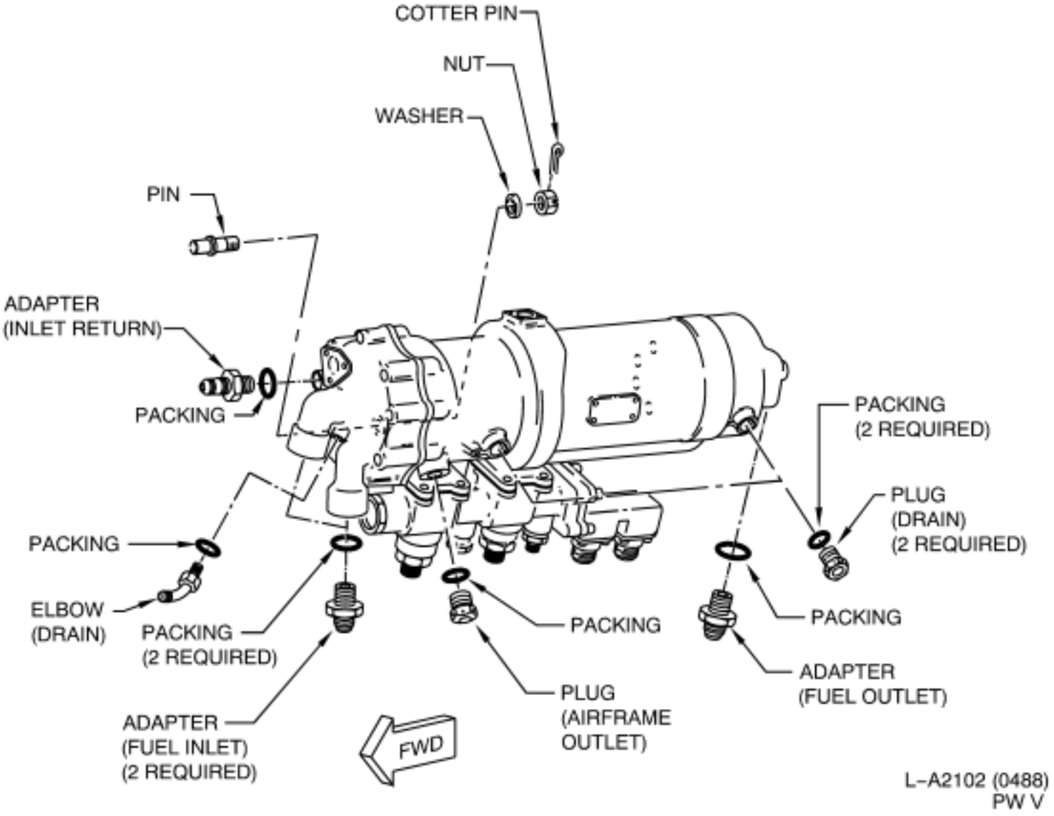
(1) If new replacement fuel/oil cooler is to be installed, comply with the following as follows. See Figure 407.

(a) Remove protective closures.

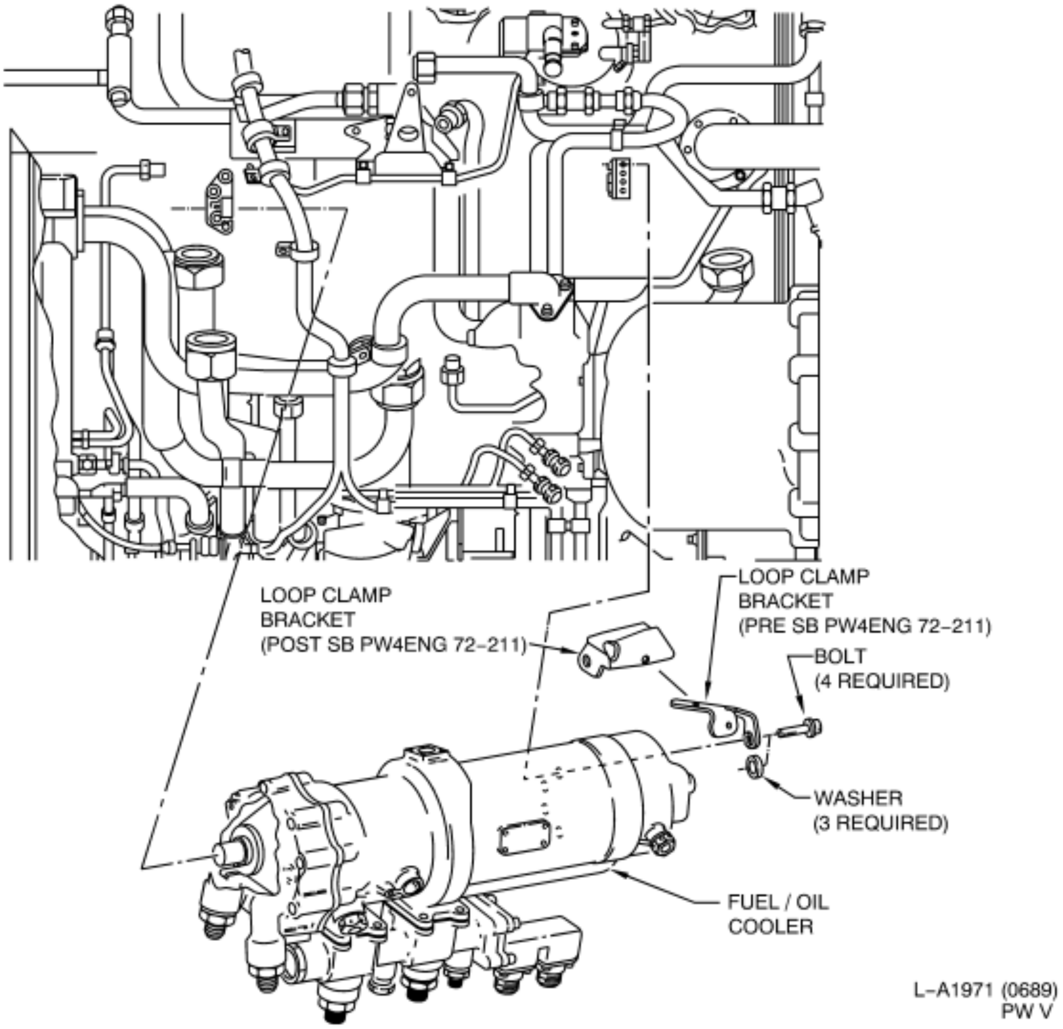
(b) Install fuel/oil cooler bypass valve. See Installation-11 Task 72-00-35-450-008.

(c) Install bracket retainer and pin, threads lubricated with Engine Oil P03-001, to front mounting ear and secure with washer and nut. Torque nut to 550 - 750 lb-in. (62.142 - 84.739 N.m) aligning cotter pin hole. Install cotter pin and secure.

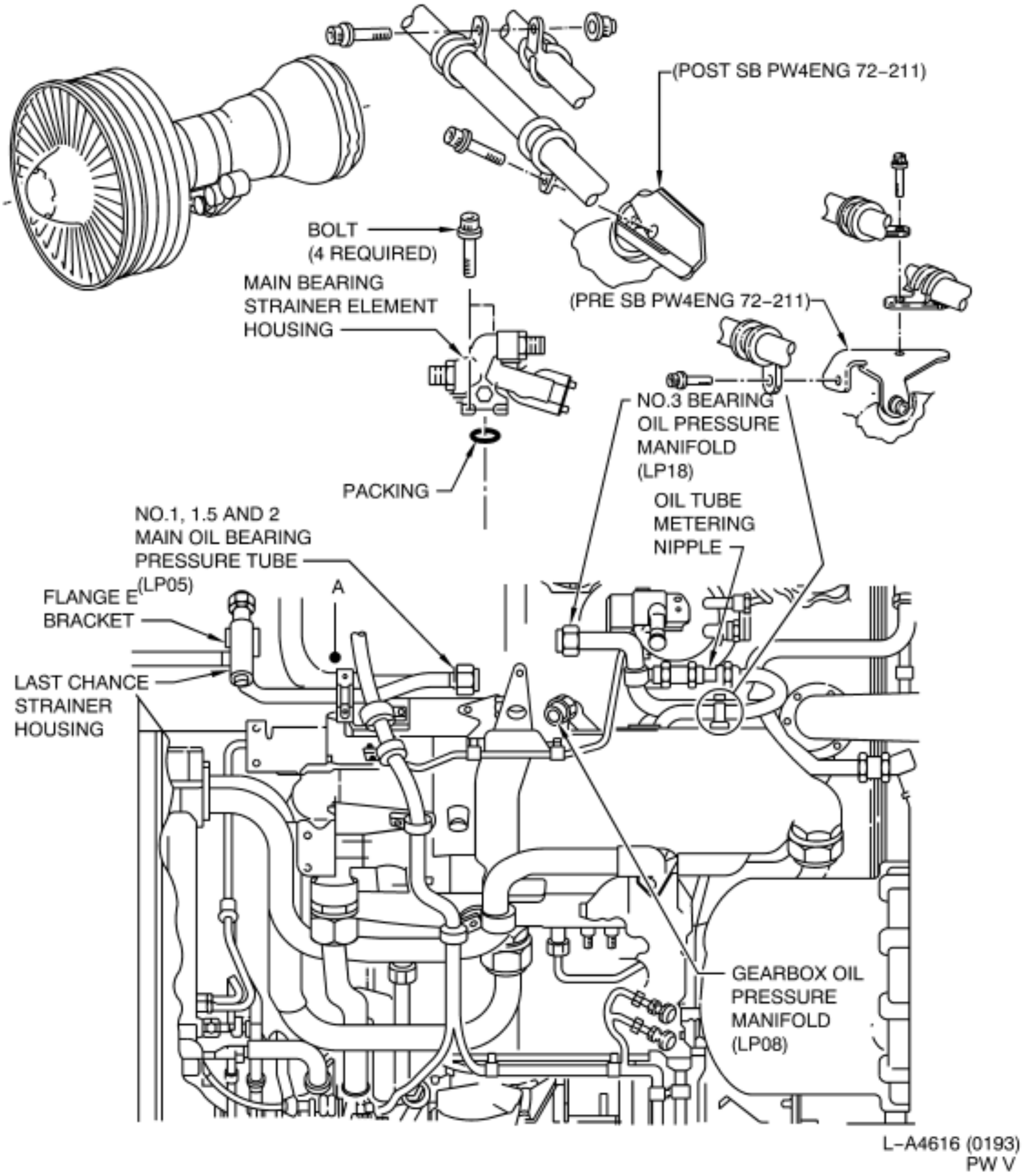
(d) Install adapter (inlet return), threads lubricated with Engine Oil P03-001, and packing, lubricated with Engine Oil P03-001, to fuel/oil cooler port. Torque adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m).


COTTER PIN
NUT
WASHER
PIN
ADAPTER (INLET RETURN)
PACKING
PACKING (2 REQUIRED)
PLUG (DRAIN) (2 REQUIRED)
PACKING
ELBOW (DRAIN)
PACKING (2 REQUIRED)
PACKING
PACKING
ADAPTER (FUEL OUTLET)
PLUG (AIRFRAME OUTLET)
ADAPTER (FUEL INLET) (2 REQUIRED)
FWD
L−A2102 (0488)
PW V

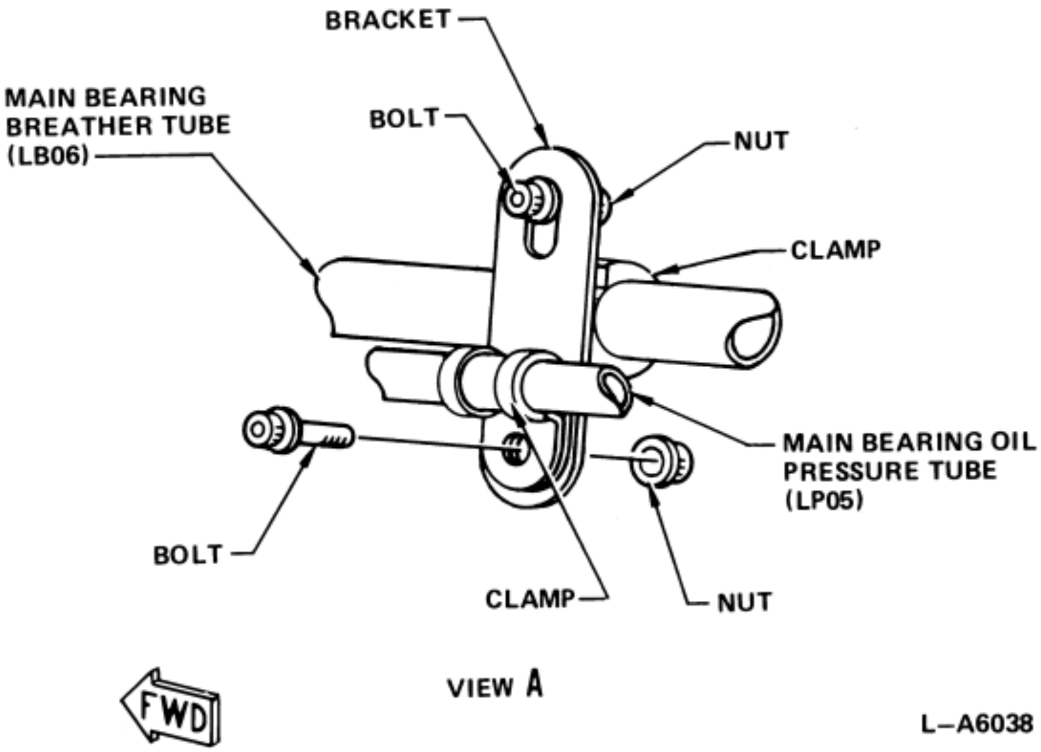
Fuel/Oil Cooler Assembly
Figure 401
(Task 72−00−35−450−001−A)


LOOP CLAMP
BRACKET
(POST SB PW4ENG 72−211)
LOOP CLAMP
BRACKET
(PRE SB PW4ENG 72−211)
BOLT
(4 REQUIRED)
WASHER
(3 REQUIRED)
FUEL / OIL
COOLER
L−A1971 (0689)
PW V

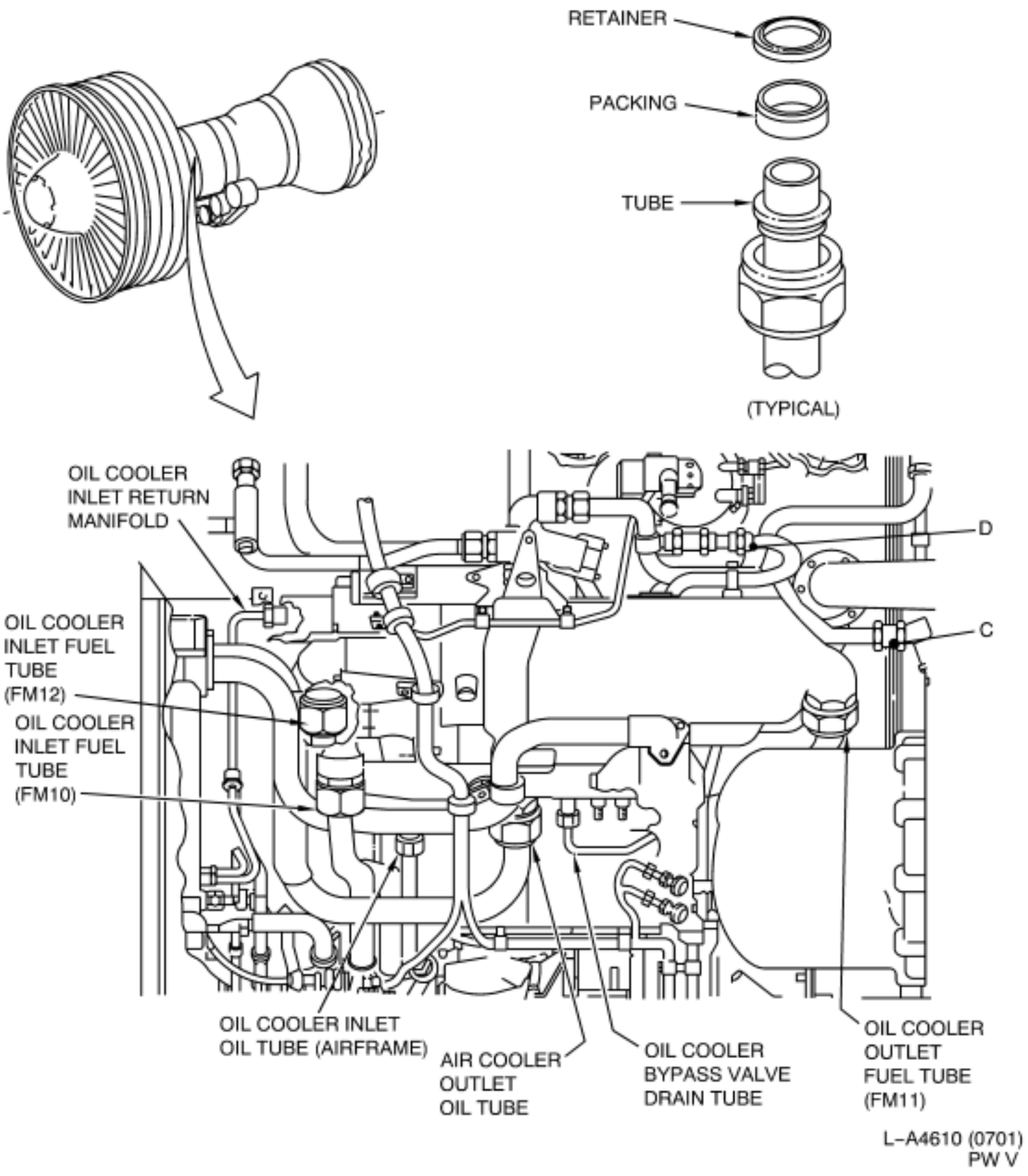
Fuel/Oil Cooler Front And Rear Mounts
Figure 402
(Task 72−00−35−450−001−A)


(POST SB PW4ENG 72-211)
BOLT
(4 REQUIRED)
MAIN BEARING
STRAINER ELEMENT
HOUSING
(PRE SB PW4ENG 72-211)
NO.3 BEARING
OIL PRESSURE
MANIFOLD
(LP18)
PACKING
OIL TUBE
METERING
NIPPLE
NO.1, 1.5 AND 2
MAIN OIL BEARING
PRESSURE TUBE
(LP05)
A
FLANGE E
BRACKET
LAST CHANCE
STRAINER
HOUSING
GEARBOX OIL
PRESSURE
MANIFOLD
(LP08)
L-A4616 (0193)
PW V

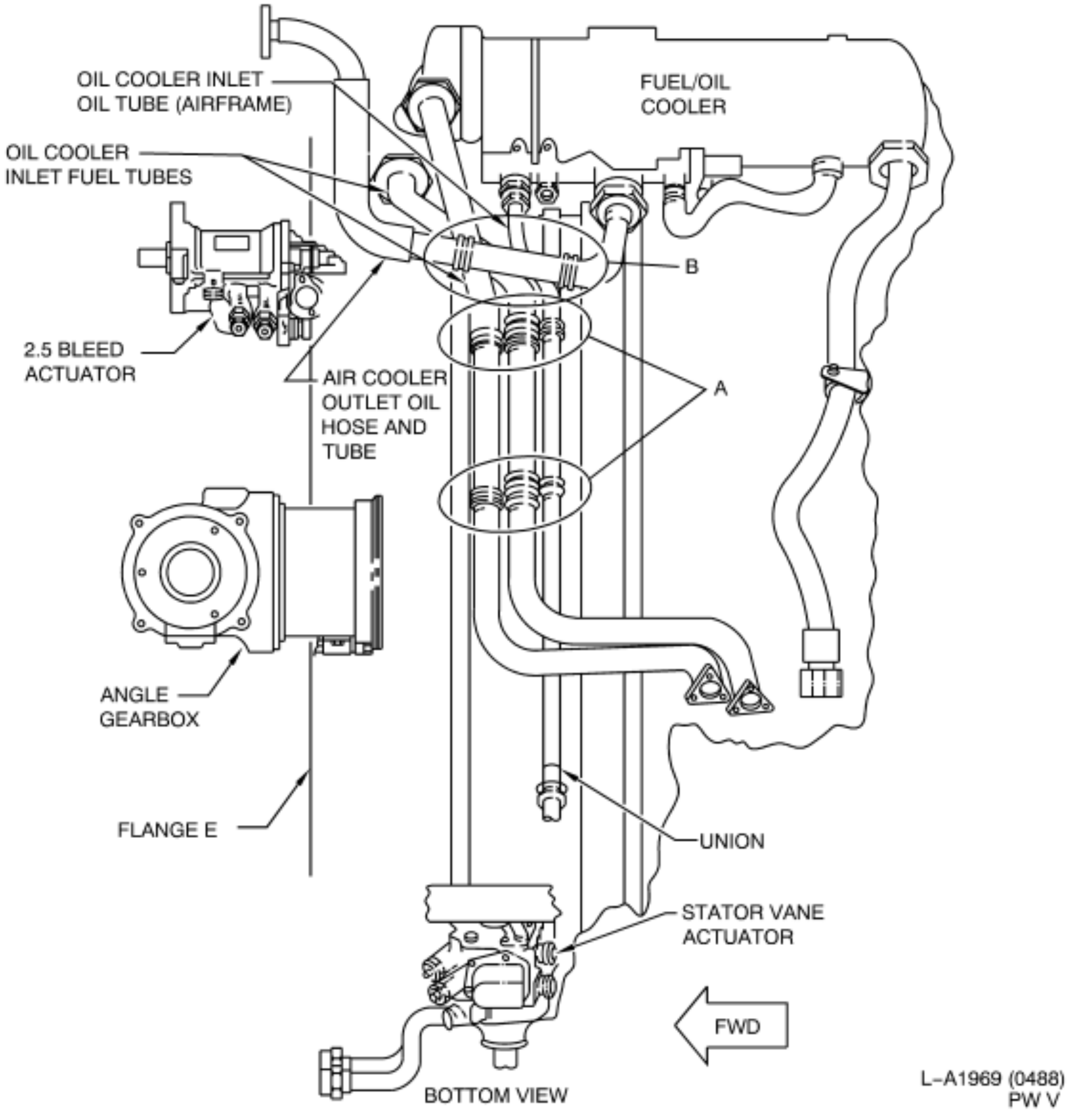
Main Bearing Strainer Element Housing
Figure 403 (Sheet 1)
(Task 72-00-35-450-001-A)


BRACKET
MAIN BEARING BREATHER TUBE (LB06)
BOLT
NUT
CLAMP
MAIN BEARING OIL PRESSURE TUBE (LP05)
BOLT
CLAMP
NUT
FWD
VIEW A
L−A6038

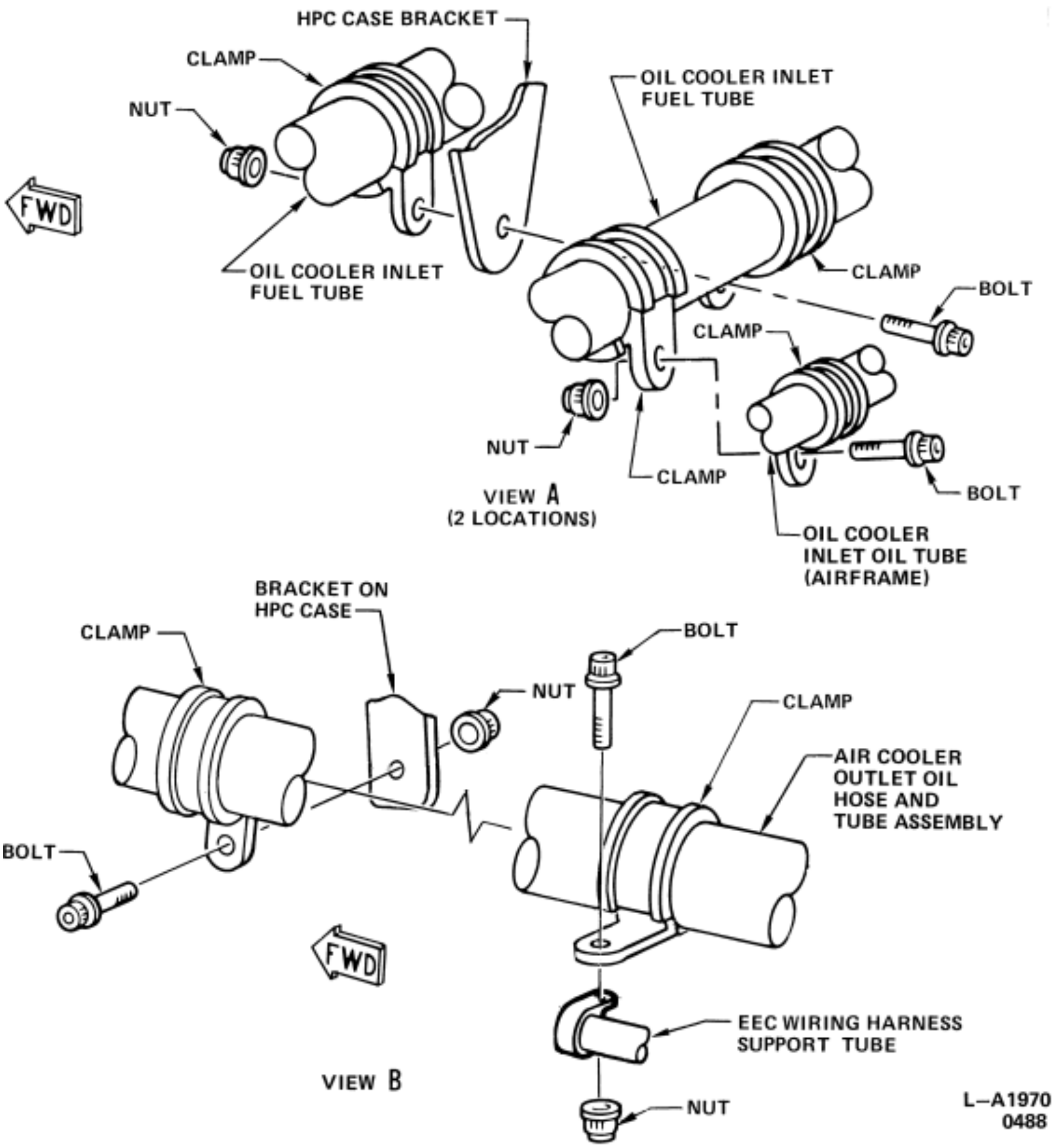
Main Bearing Strainer Element Housing
Figure 403 (Sheet 2)
(Task 72−00−35−450−001−A)


RETAINER
PACKING
TUBE
(TYPICAL)
OIL COOLER INLET RETURN MANIFOLD
D
C
OIL COOLER INLET FUEL TUBE (FM12)
OIL COOLER INLET FUEL TUBE (FM10)
OIL COOLER INLET OIL TUBE (AIRFRAME)
AIR COOLER OUTLET OIL TUBE
OIL COOLER BYPASS VALVE DRAIN TUBE
OIL COOLER OUTLET FUEL TUBE (FM11)
L−A4610 (0701)
PW V

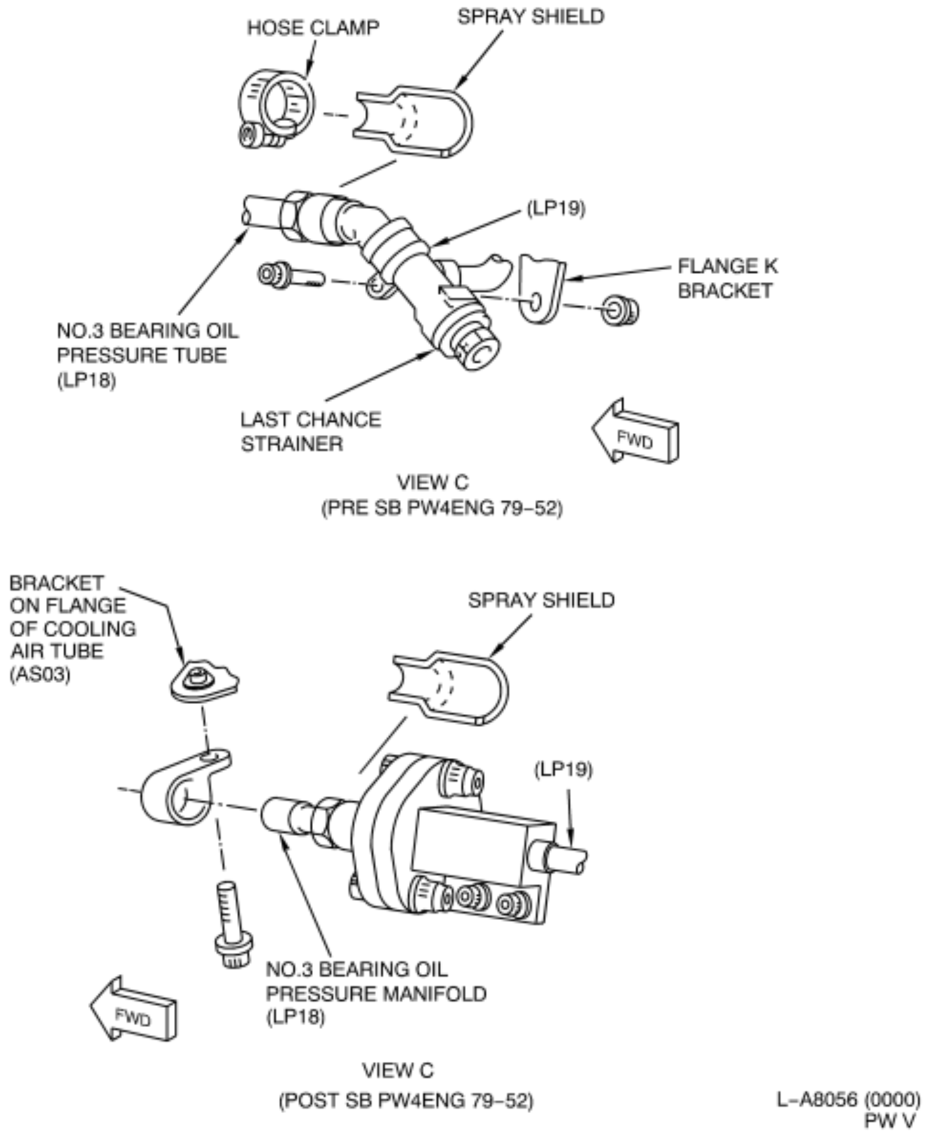
Fuel/Oil Cooler Front And Bottom Tube Connections
Figure 404 (Sheet 1)
(Task 72−00−35−450−001−A)


OIL COOLER INLET
OIL TUBE (AIRFRAME)
FUEL/OIL
COOLER
OIL COOLER
INLET FUEL TUBES
B
2.5 BLEED
ACTUATOR
AIR COOLER
OUTLET OIL
HOSE AND
TUBE
A
ANGLE
GEARBOX
FLANGE E
UNION
STATOR VANE
ACTUATOR
FWD
BOTTOM VIEW
L-A1969 (0488)
PW V

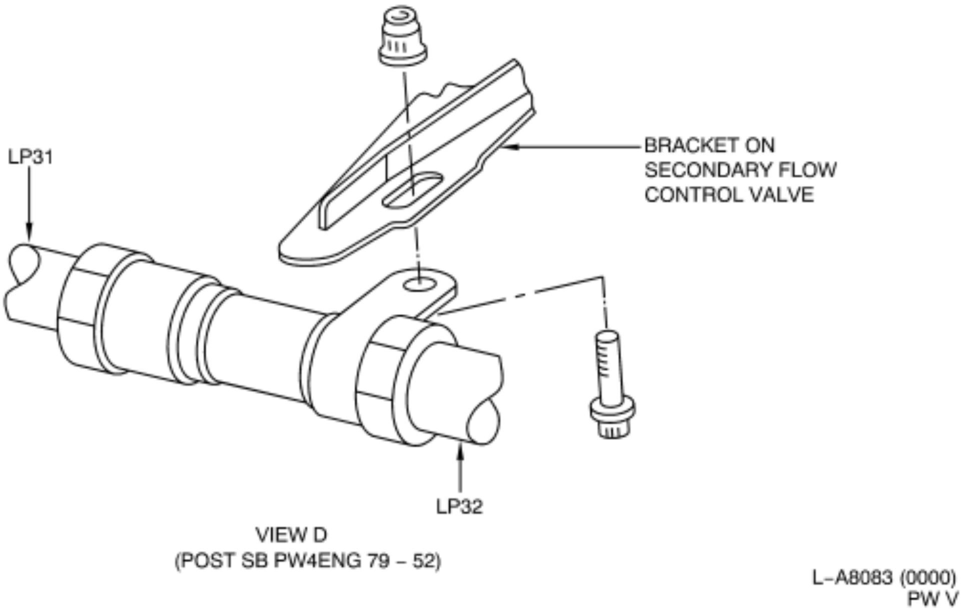
Fuel/Oil Cooler Front And Bottom Tube Connections (And Clamps)
Figure 404 (Sheet 2)
(Task 72-00-35-450-001-A)


HPC CASE BRACKET
CLAMP
NUT
FWD
OIL COOLER INLET FUEL TUBE
OIL COOLER INLET FUEL TUBE
CLAMP
BOLT
CLAMP
NUT
CLAMP
BOLT
VIEW A
(2 LOCATIONS)
OIL COOLER INLET OIL TUBE (AIRFRAME)
BRACKET ON HPC CASE
CLAMP
BOLT
NUT
CLAMP
AIR COOLER OUTLET OIL HOSE AND TUBE ASSEMBLY
BOLT
FWD
EEC WIRING HARNESS SUPPORT TUBE
VIEW B
NUT
L−A1970
0488

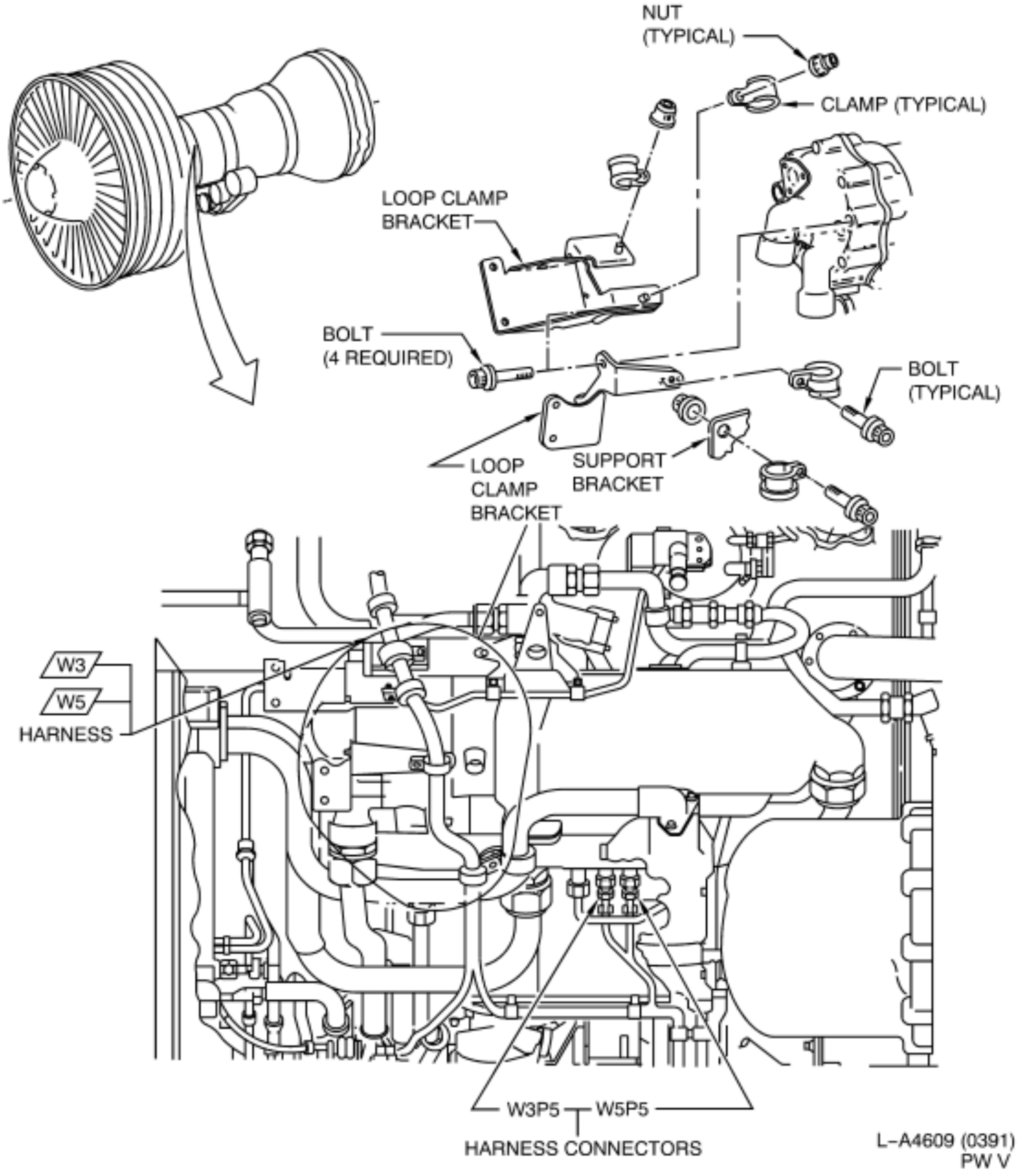
Fuel/Oil Cooler Front And Bottom Tube Connections (And Clamps)
Figure 404 (Sheet 3)
(Task 72−00−35−450−001−A)


HOSE CLAMP
SPRAY SHIELD
(LP19)
FLANGE K BRACKET
NO.3 BEARING OIL PRESSURE TUBE (LP18)
LAST CHANCE STRAINER
FWD
VIEW C
(PRE SB PW4ENG 79−52)
BRACKET ON FLANGE OF COOLING AIR TUBE (AS03)
SPRAY SHIELD
(LP19)
NO.3 BEARING OIL PRESSURE MANIFOLD (LP18)
FWD
VIEW C
(POST SB PW4ENG 79−52)
L−A8056 (0000)
PW V

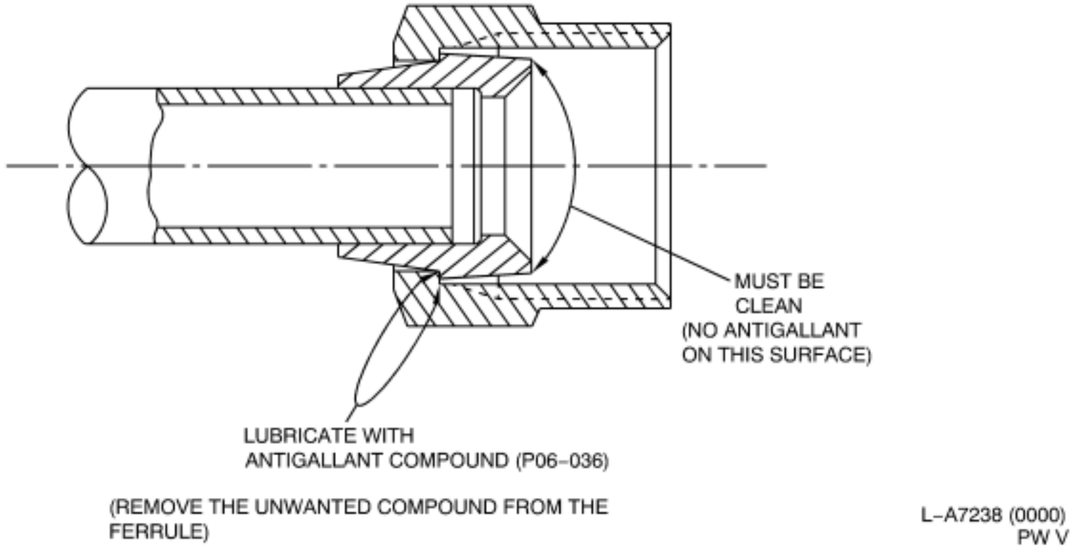
Fuel/Oil Cooler Front And Bottom Tube Connections (And Clamps)
Figure 404 (Sheet 4)
(Task 72−00−35−450−001−A)


BRACKET ON SECONDARY FLOW CONTROL VALVE
LP31
LP32
VIEW D
(POST SB PW4ENG 79 – 52)
L−A8083 (0000)
PW V

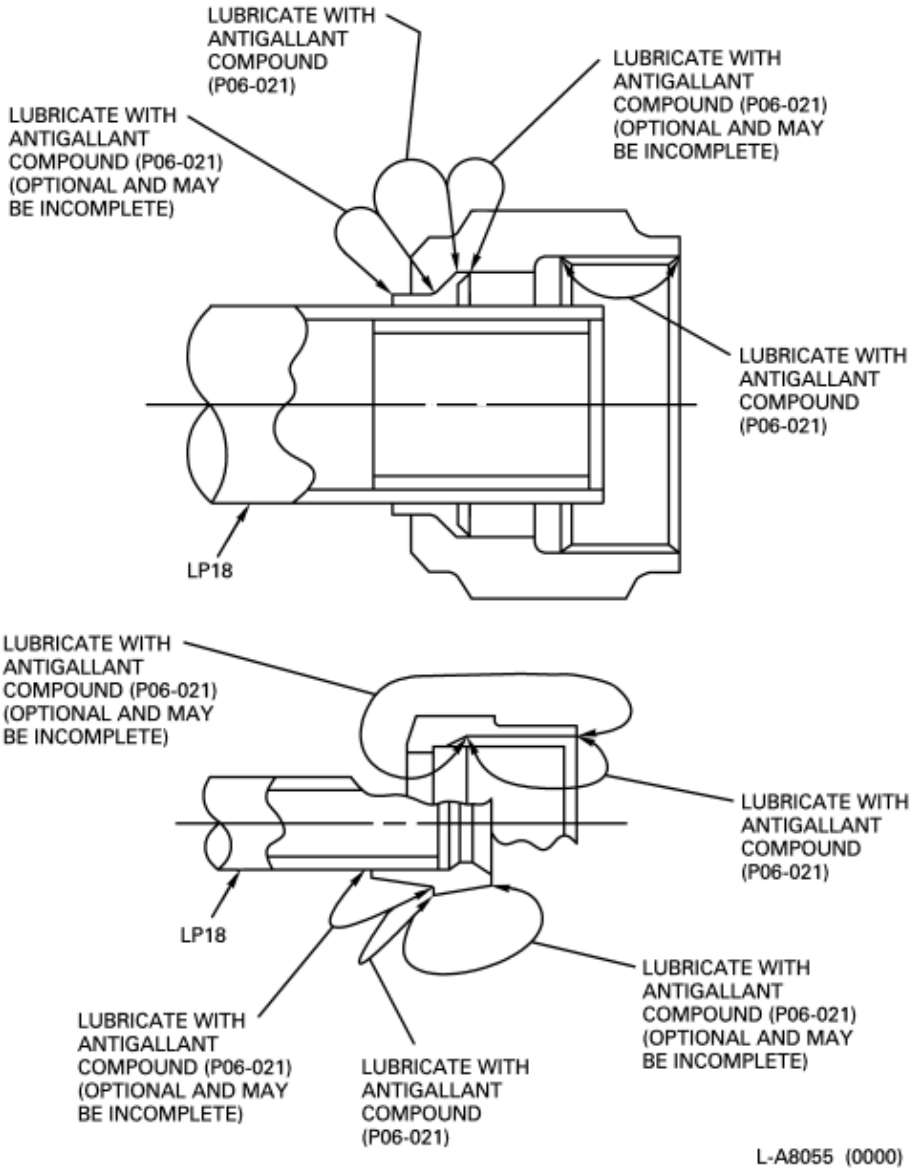
Fuel/Oil Cooler Front And Bottom Tube Connections (And Clamps)
Figure 404 (Sheet 5)
(Task 72−00−35−450−001−A)


NUT
(TYPICAL)
CLAMP (TYPICAL)
LOOP CLAMP
BRACKET
BOLT
(4 REQUIRED)
BOLT
(TYPICAL)
LOOP
CLAMP
BRACKET
SUPPORT
BRACKET
W3
W5
HARNESS
W3P5
W5P5
HARNESS CONNECTORS
L-A4609 (0391)
PW V

EEC Wiring Harness And Support Brackets
Figure 405
(Task 72−00−35−450−001−A)


MUST BE
CLEAN
(NO ANTIGALLANT
ON THIS SURFACE)
LUBRICATE WITH
ANTIGALLANT COMPOUND (P06−036)
(REMOVE THE UNWANTED COMPOUND FROM THE
FERRULE)
L−A7238 (0000)
PW V

Application Of Antigallant To Back Of Tube Ferrules
Figure 406 (Sheet 1)
(Task 72−00−35−450−001−A)


LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LP18
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LP18
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
L-A8055 (0000)

Application Of Antigallant To Back Of
Tube Ferrules (Post SB PW4ENG 79−52)
Figure 406 (Sheet 2)
(Task 72−00−35−450−001−A)

(e) Install elbow and jamnut, threads lubricated with Engine Oil P03−001, and packing, lubricated with Engine Oil P03−001, to fuel/oil cooler port. (Elbow jamnut to be torqued after alignment of elbow with drain tube).

(f) Install two adapters (fuel inlet) and one adapter (fuel outlet), threads lubricated with Engine Oil P03−001, and packings, lubricated with Engine Oil P03−001, to fuel/oil cooler ports. Torque three adapters to 650 − 750 lb−in. (73.440 − 84.739 N.m) and secure with lockwire.

(g) Install two plugs (drain), threads lubricated with Engine Oil P03−001, and packings, lubricated with Engine Oil P03−001, to fuel/oil cooler ports. Torque two plugs to 110 − 120 lb−in. (12.428 − 13.558 N.m) and secure with lockwire.

(h) Install plug (airframe outlet), threads lubricated with Engine Oil P03−001, and packing, lubricated with Engine Oil P03−001, to fuel/oil cooler port. Torque plug, to 375 − 425 lb−in. (42.369 − 48.019 N.m) and secure with lockwire.

(2) Install fuel/oil cooler as follows. See Figure 410.

(a) Remove protective closures.

(b) Lubricate adapter (inlet return) threads with Engine Oil P03−001. Lubricate remaining adapters on fuel/oil cooler and bypass valve with Antigalling Compound P06−021.

(c) Install packing, lubricated with Engine Oil P03−001, and retainer to each of the following tubes:

1 Oil cooler inlet fuel tube (two) (FM10) and (FM12).

2 Oil cooler inlet oil tube (airframe) (LS05).

3 Air cooler outlet oil hose and tube assembly (LP03).

4 Oil cooler bypass drain tube (LP20).

5 Oil cooler outlet fuel tube (FM11).

(d) Install oil cooler front bracket to pin and engage retainer. See Figure 408. Ensure W3 and W5 harness is positioned forward and install cooler (rearward end first). Move cooler forward (inboard of harness) and lower onto tubes and HPC case brackets. Ensure all tubes are aligned and engaged in adapters. Install two bolts, threads
R lubricated with Antiseize Paste P06−054, to front bracket and torque to 125 − 140 lb−in. (14.123 −
R 15.818 N.m). Wipe off unwanted paste.

(e) Slide loop clamp bracket forward to top bolt hole of rear mount. Secure rear mount with four bolts, threads lubricated with Engine Oil P03−001, and three washers (omit washer at bracket). Torque bolts to 180 − 200 lb−in. (20.337 − 22.597 N.m).

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(3) Torque and secure tubes to fuel/oil cooler and fuel/oil cooler bypass valve adapters as follows. See Figure 410.

(a) (Reference 2170) Torque the oil cooler outlet fuel tube nut (FM11) and the oil cooler inlet fuel tubes (FM10) and (FM12) to 150 − 160 lb−in. (16.948 − 18.078 N.m). Torque the tube nuts again to 150 − 160 lb−in. (16.948 − 18.078 N.m) until the torque is kept.

(b) Torque oil cooler bypass drain tube (LP20) to 65 − 70 lb−in. (7.344 − 7.909 N.m), then loosen and retorque to same value.

(c) Torque air cooler outlet oil tube (LP03) to 200 − 220 lb−in. (22.597 − 24.857 N.m), then loosen and retorque to same value.

(d) Torque oil cooler inlet oil tube (airframe) (LS05) to 140 − 160 lb−in. (15.818 − 18.078 N.m), then loosen and retorque to same value.

(e) Torque oil cooler inlet return manifold (CR04) to 200 − 225 lb−in. (22.597 − 25.422 N.m).

(f) Lockwire all tubes torqued to bottom of fuel/oil cooler and fuel/oil cooler bypass valve adapters.

NOTE: Forward inboard oil cooler inlet fuel tube to be lockwired to forward outboard wire hole in bypass valve gasket.

(4) Install main bearing strainer housing as follows. See Figure 409.

(a) Remove protective closures.

(b) Lubricate threads of two largest adapters (front and rear of strainer housing) with Antigalling Compound P06−021. Lubricate threads of smaller
R adapter (inboard side of housing) with Antiseize
R Paste P06−054. Wipe off unwanted paste.

(c) Install packing, lubricated with Engine Oil P03−001, and retainer to the No. 1, 1.5, and 2 main bearing oil pressure manifold.

(d) Install packing, lubricated with Engine Oil P03−001, to groove in flange of main bearing strainer housing. Install housing to top of fuel/oil cooler engaging tubes to adapters.

(e) Secure housing to fuel/oil cooler with four bolts, threads lubricated with Engine Oil P03−001, and brackets attached to W5 harness. Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Install the No. 3 bearing oil pressure manifold (LP18) as follows:

CAUTION: DO THIS PROCEDURE EXACTLY AS FOLLOWS OR TUBE FAILURE CAN RESULT. YOU MUST USE THE WRENCHING FLATS ON THE MATING PARTS WHEN YOU LOOSEN OR TIGHTEN ANY

OR ALL TUBE NUTS. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

1 Be sure and loosen
  - (Pre SB PW4ENG 79-52), the clamp bolt that attaches the No. 3 bearing oil strainer (LP19) to the Flange K bracket
  - (Post SB PW4ENG 79-52), the clamp bolts that attaches the ferrule end (contains the oil strainer) of the No. 3 bearing pressure tube (LP19) to the bracket on Flange K
  - the three bolts that attach the oil trim pressure tube (LP32) to the main oil filter housing.

2 (Pre SB PW4ENG 79-52), Lubricate the back of the manifold ferrules per Figure 412, (Sheet 1) with Antigallant Compound P06-036. Lubricate the forward tube nut threads with Antigalling Compound P06-021. Lubricate the rear tube nut
R threads with Antiseize Paste P06-054. Wipe off
R unwanted paste. Lubricate the packing with Engine Oil P03-001. Install the packing and retainer to the tube.

3 (Post SB PW4ENG 79-52), Lubricate the back of the manifold ferrules and the manifold nut threads with Antigallant Compound P06-021. Lubricate the packing with Engine Oil P03-001 and install the packing and retainer to the manifold. See Figure 412 (Sheet 2).

4 Install the manifold (LP18) to the strainer housings. Tighten by hand.

5 Lubricate the threads of the oil tube metering nipple (restrictor) with Antigalling Compound P06-021. Lubricate the back of the ferrules on the oil trim pressure tubes (LP31) and (LP32) per Figure 412, (Sheet 1) with Antigallant Compound P06-036. Install the nipple to the two oil trim pressure tubes (LP31) and (LP32). Tighten by hand.

6 Lubricate the clamp bolts with Engine Oil P03-001 and install the attaching hardware for the No. 3 bearing oil pressure manifold and the oil trim pressure tube.

7 (Reference 2016) Be sure that the center of the forward clamp (on the oil trim pressure tube) is 2.500 − 3.000 inch (63.500 − 76.200 mm) from the center of the rear clamp (Post SB PW4ENG 72−211 only).

8 Torque the clamp bolts and tubes exactly as follows:

- the clamp bolt that attaches the back to back clamps (LP18) to (LP32) to 36 − 40 lb−in. (4.067 − 4.519 N.m)
- the clamp bolt(s) that attach the tubes to the oil cooler rear bracket to 36 − 40 lb−in. (4.067 − 4.519 N.m)
- (Pre SB PW4ENG 79−52), the clamp bolt that attaches the No. 3 bearing oil strainer (LP19) to the Flange K bracket to 36 − 40 lb−in. (4.067 − 4.519 N.m)
- (Post SB PW4ENG 79−52), the bolts that attach the ferrule end of the No. 3 bearing pressure tube (LP19) to the bracket on Flange K to 36 − 40 lb−in. (4.067 − 4.519 N.m)
- the three bolts that attach the oil trim pressure tube (LP32) to the main oil filter housing to 85 − 95 lb−in. (9.604 − 10.734 N.m)
- the front tube nut of the (LP18) manifold to strainer housing to 140 − 160 lb−in. (15.818 − 18.078 N.m), then loosen and torque again to the same value
- the tube nuts (LP31) and (LP32), that attach the oil tube metering nipple (restrictor) to 675 − 750 lb−in. (76.265 − 84.739 N.m)
- (Post SB PW4ENG 79−52), Install a clamp to the tube nut end of the oil trim pressure tube (LP32) and attach the clamp to a bracket on the secondary flow control valve flange with a bolt, lubricated with Engine Oil P03−001 and a nut. Torque the nut to 36 − 40 (4.067 − 4.519 N.m)
- (Pre SB PW4ENG 79−52), the manifold nut (LP18) to the No. 3 bearing oil strainer at Flange K to 675 − 750 lb−in. (76.265 − 84.739 N.m)
- (Post SB PW4ENG 79−52), the manifold nut (LP18) to the adapter in the No. 3 bearing oil pressure tube (LP19) at Flange K to 675 − 750 lb−in. (76.265 − 84.739 N.m).

(g) Install the lockwire at all necessary locations.

(h) (Pre SB PW4ENG 79−52), Install the spray shield to the inboard side of the rear manifold (LP18) connection.

(i) (Pre SB PW4ENG 79−52), (Reference 2151) Attach the shield with the hose clamp and torque the clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(j) (Post SB PW4ENG 79−52), Install the spray shield to the inboard side of the rear manifold (LP18) that is attached to the No. 3 bearing pressure tube (LP19). Attach the spray shield with a clamp and a bolt, threads lubricated with Engine Oil P03−001, to a bracket attached to the flange of the cooling air tube on the high compressor. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(k) Install the No. 1, 1.5 and 2 main bearing oil pressure tube (LP05) as follows.

  1 Apply Antigalling Compound P06−021 to the threads of the tube nuts.

  2 Install the tube to the strainer housings (packing and retainer at the rearward end installed) and tighten by hand.

  3 Torque the clamp bolt that attaches the tube to the bracket on Flange E to 36 − 40 lb−in. (4.067 − 4.519 N.m).

  4 (Post SB PW4ENG 79−33), Attach the clamp on the tube to a bracket on the main bearing breather tube (LB06) with a nut and bolt, threads lubricated with Engine Oil P03−001. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 403 (Sheet 2).

  5 Torque the forward tube nut to 675 − 750 lb−in. (76.265 − 84.739 N.m). Install lockwire to the tube nut.

6 Torque the rear tube nut to 140 − 160 lb−in. (15.818 − 18.078 N.m), and then loosen to zero torque. Torque the rear tube nut a second time to 140 − 160 lb−in. (15.818 − 18.078 N.m). Install lockwire to the tube nut.

(l) Connect and torque the gearbox oil pressure manifold (LP08) to 675 − 750 lb−in. (76.265 − 84.739 N.m). Install lockwire to the tube nut.

(5) Attach and connect harnesses to fuel/oil cooler and fuel/oil cooler bypass valve as follows. See Figure 411.

(a) Install two loop clamp brackets.

1 Remove four bolts and washers from front flange of fuel/oil cooler.

2 Secure two loop clamp brackets to front flange with four bolts, threads lubricated with Engine Oil P03−001. Omit washers.

3 Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(b) Connect the W5P5 and the W3P5 harness connectors to the bypass valve solenoid front and rear, respectively, harness receptacles as follows. For each connector:

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

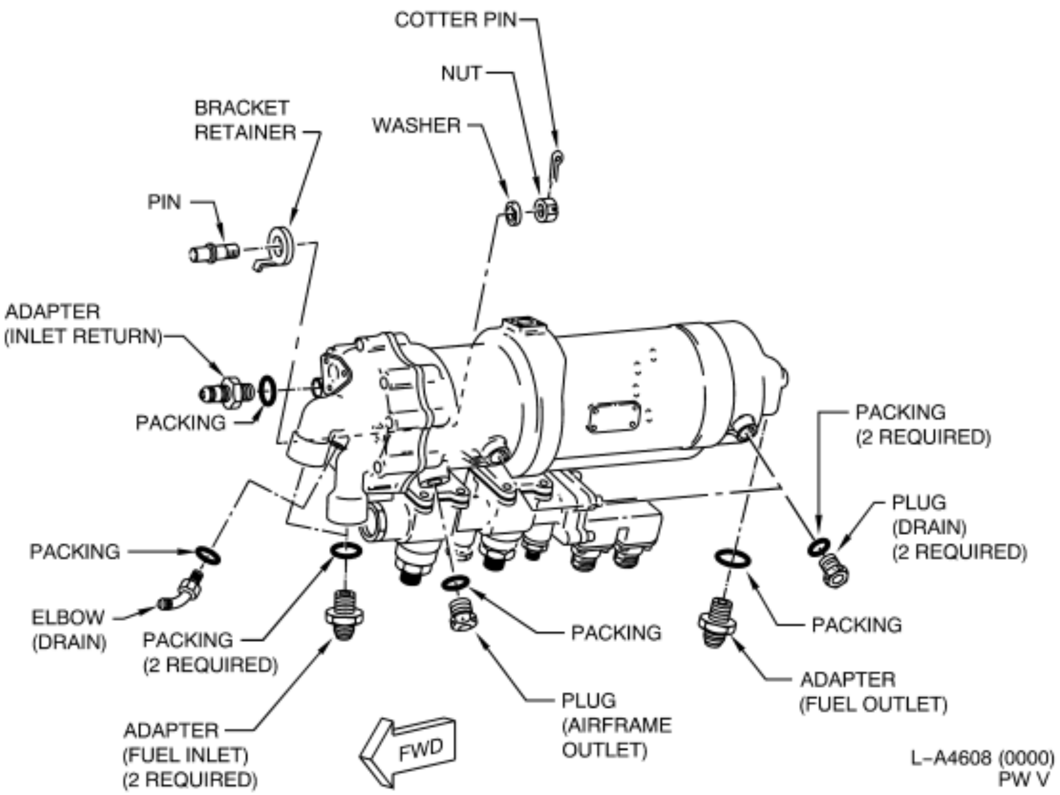
NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

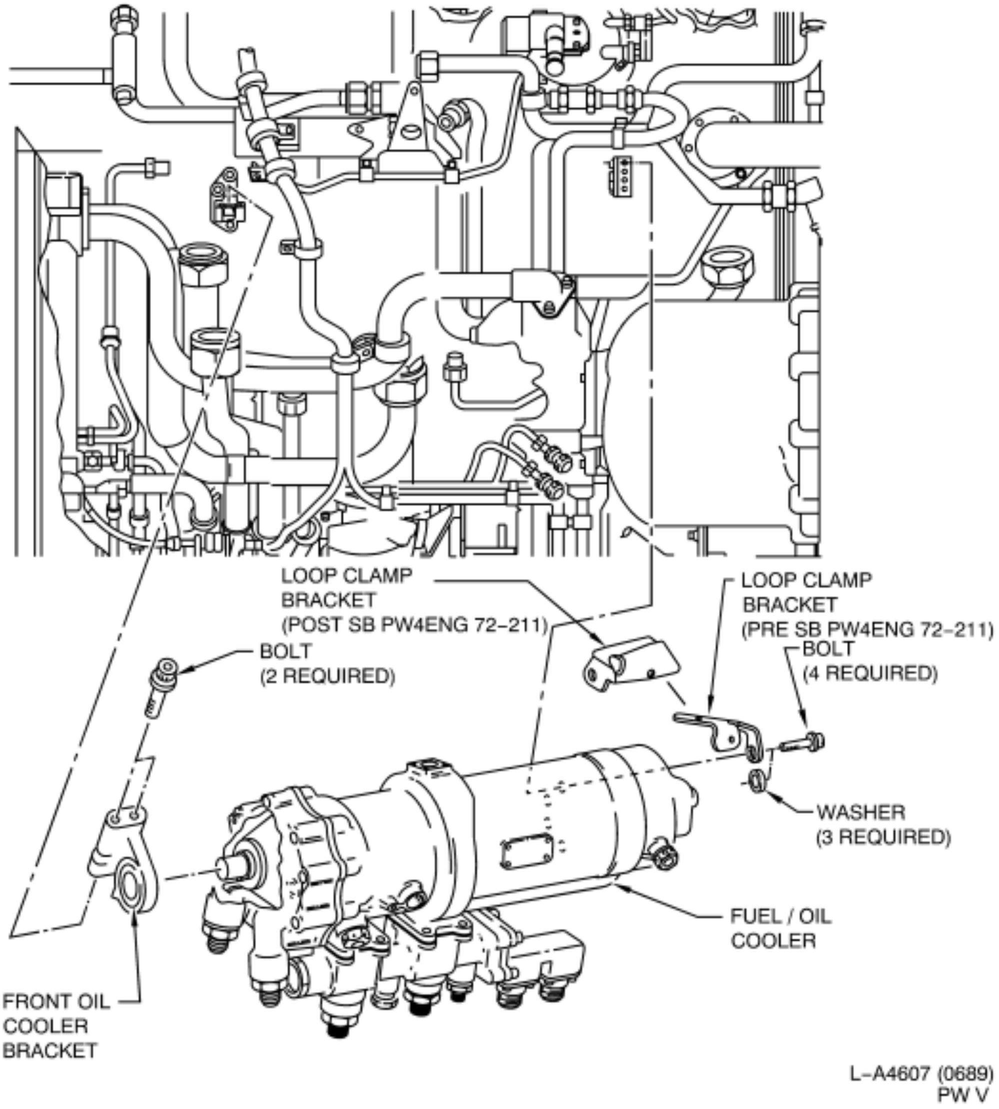
3 Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque. See the instructions given with the strap wrench for correct use.

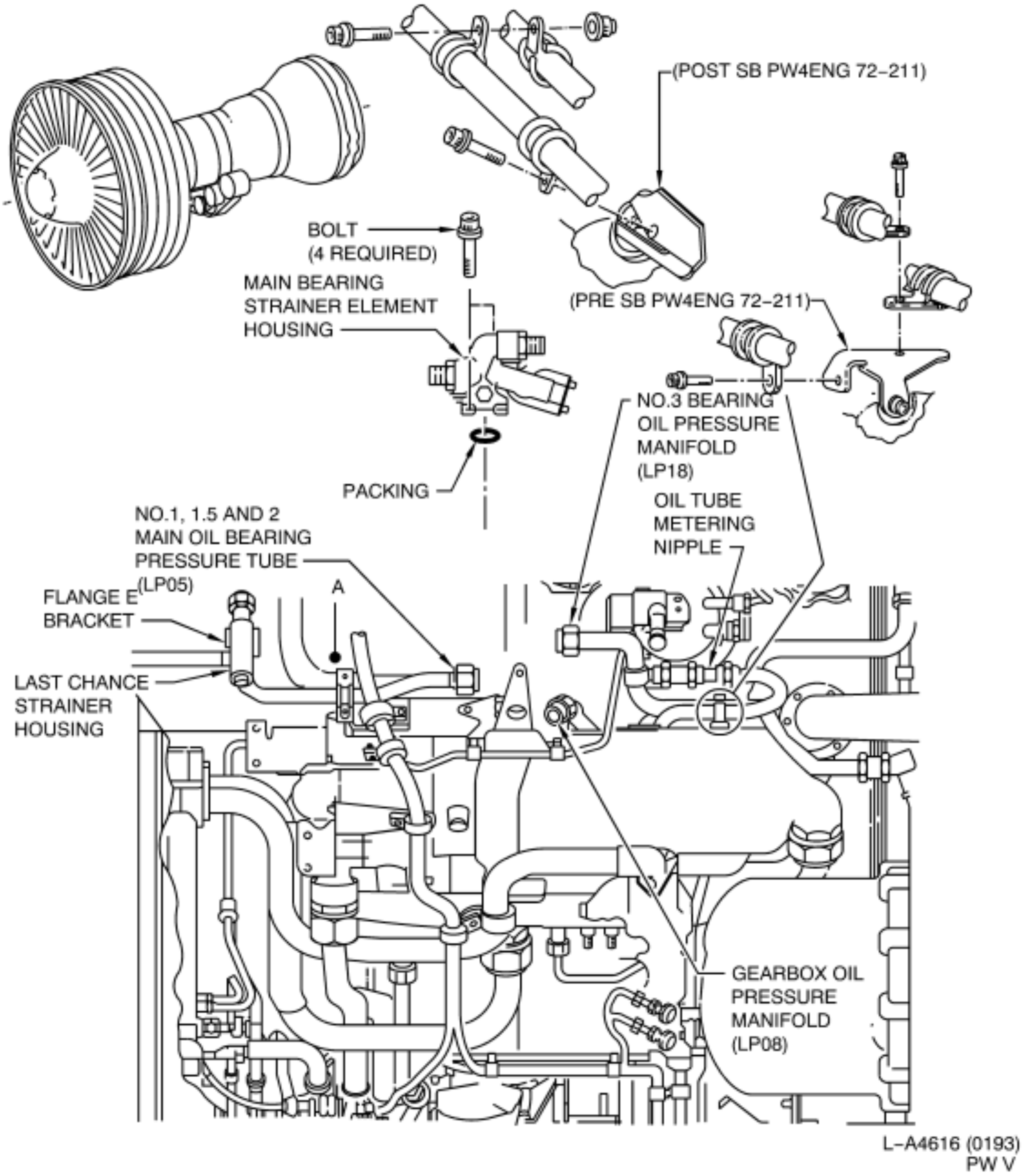
(c) Install three bolts and two nuts, threads lubricated with Engine Oil P03−001, securing W3 and W5 harnesses to brackets attached to front of cooler and to bracket below cooler. Torque bolts and nuts to 36 − 40 lb−in. (4.067 − 4.519 N.m).


COTTER PIN
NUT
BRACKET RETAINER
WASHER
PIN
ADAPTER (INLET RETURN)
PACKING
PACKING (2 REQUIRED)
PLUG (DRAIN) (2 REQUIRED)
PACKING
ELBOW (DRAIN)
PACKING (2 REQUIRED)
PACKING
PACKING
ADAPTER (FUEL OUTLET)
PLUG (AIRFRAME OUTLET)
ADAPTER (FUEL INLET) (2 REQUIRED)
FWD
L-A4608 (0000)
PW V

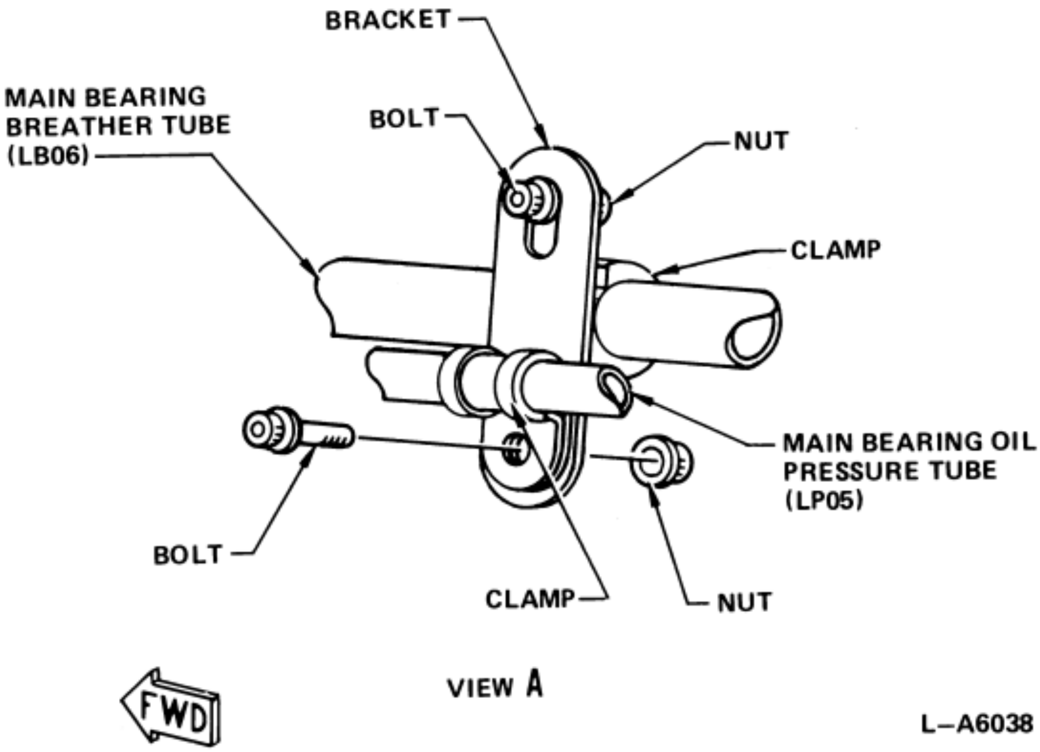
Fuel/Oil Cooler Assembly
Figure 407
(Task 72-00-35-450-001-B)


LOOP CLAMP BRACKET (POST SB PW4ENG 72−211)
LOOP CLAMP BRACKET (PRE SB PW4ENG 72−211)
BOLT (2 REQUIRED)
BOLT (4 REQUIRED)
WASHER (3 REQUIRED)
FUEL / OIL COOLER
FRONT OIL COOLER BRACKET
L−A4607 (0689)
PW V

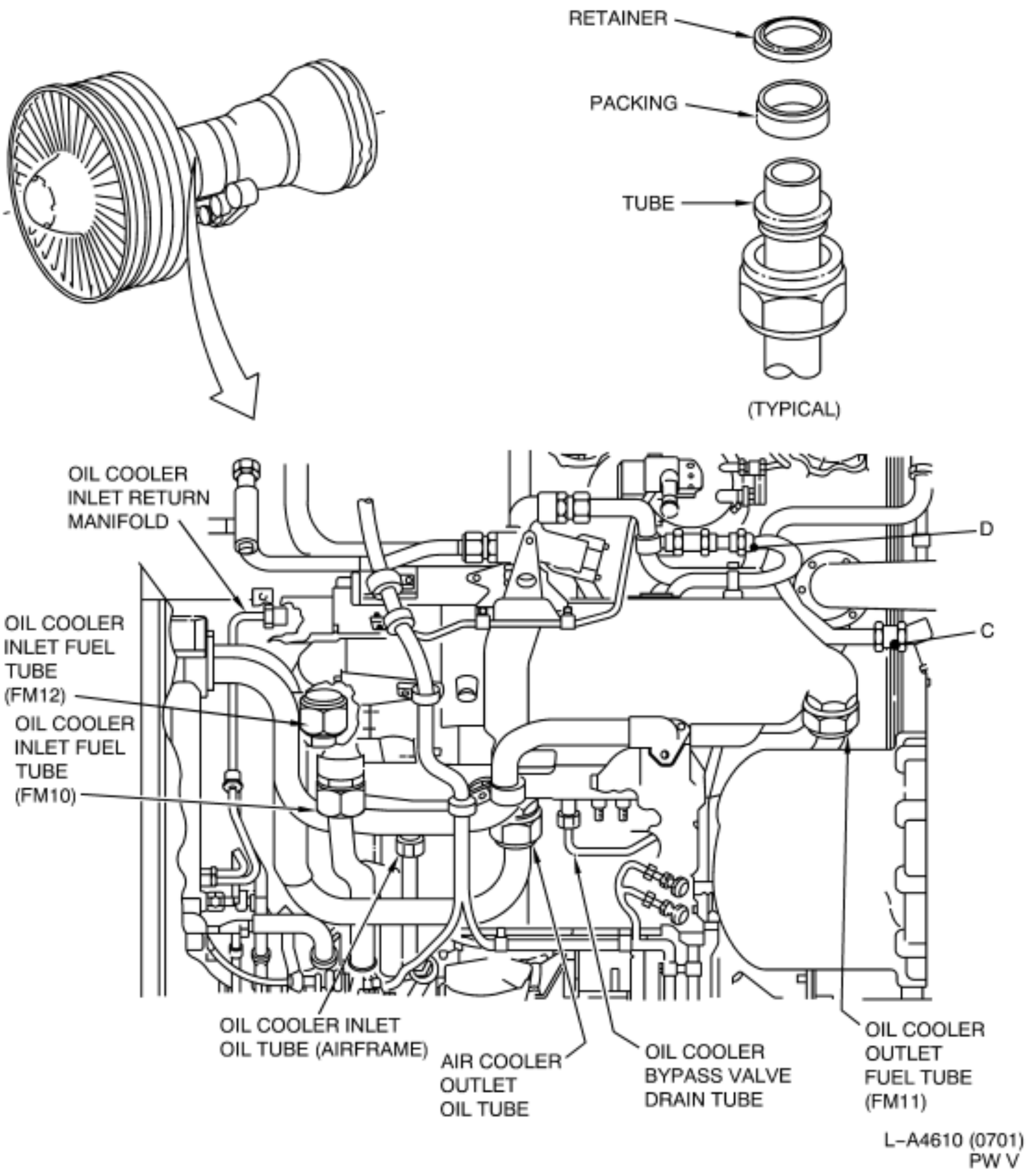
Fuel/Oil Cooler Front And Rear Mounts
Figure 408
(Task 72−00−35−450−001−B)


(POST SB PW4ENG 72−211)
BOLT
(4 REQUIRED)
MAIN BEARING
STRAINER ELEMENT
HOUSING
(PRE SB PW4ENG 72−211)
NO.3 BEARING
OIL PRESSURE
MANIFOLD
(LP18)
PACKING
OIL TUBE
METERING
NIPPLE
NO.1, 1.5 AND 2
MAIN OIL BEARING
PRESSURE TUBE
(LP05)
A
FLANGE E
BRACKET
LAST CHANCE
STRAINER
HOUSING
GEARBOX OIL
PRESSURE
MANIFOLD
(LP08)
L−A4616 (0193)
PW V

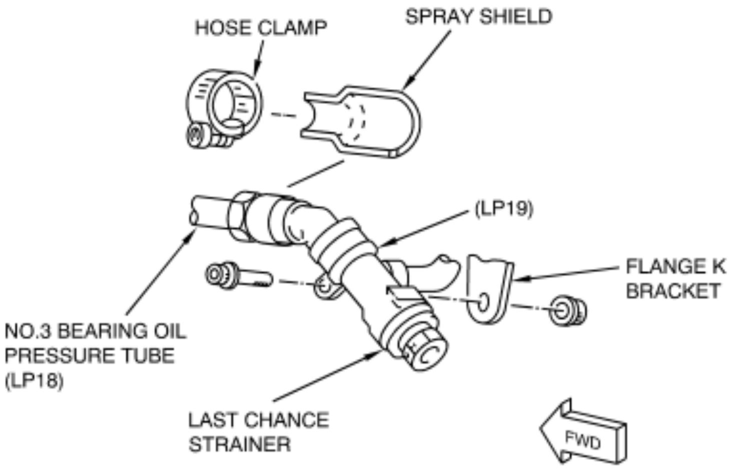
Main Bearing Strainer Element Housing
Figure 409 (Sheet 1)
(Task 72−00−35−450−001−B)


BRACKET
MAIN BEARING BREATHER TUBE (LB06)
BOLT
NUT
CLAMP
MAIN BEARING OIL PRESSURE TUBE (LP05)
BOLT
CLAMP
NUT
FWD
VIEW A
L−A6038

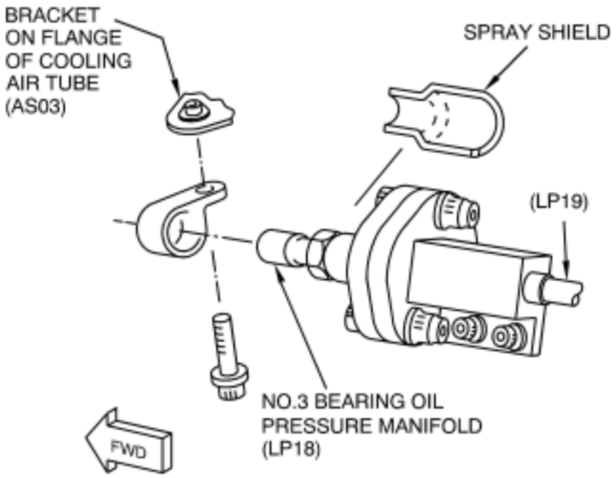
Main Bearing Strainer Element Housing
Figure 409 (Sheet 2)
(Task 72−00−35−450−001−B)


RETAINER
PACKING
TUBE
(TYPICAL)
OIL COOLER INLET RETURN MANIFOLD
OIL COOLER INLET FUEL TUBE (FM12)
OIL COOLER INLET FUEL TUBE (FM10)
D
C
OIL COOLER INLET OIL TUBE (AIRFRAME)
AIR COOLER OUTLET OIL TUBE
OIL COOLER BYPASS VALVE DRAIN TUBE
OIL COOLER OUTLET FUEL TUBE (FM11)
L−A4610 (0701)
PW V

Fuel/Oil Cooler Front And Bottom Tube Connections
Figure 410 (Sheet 1)
(Task 72−00−35−450−001−B)


HOSE CLAMP
SPRAY SHIELD
(LP19)
FLANGE K BRACKET
NO.3 BEARING OIL PRESSURE TUBE (LP18)
LAST CHANCE STRAINER
FWD

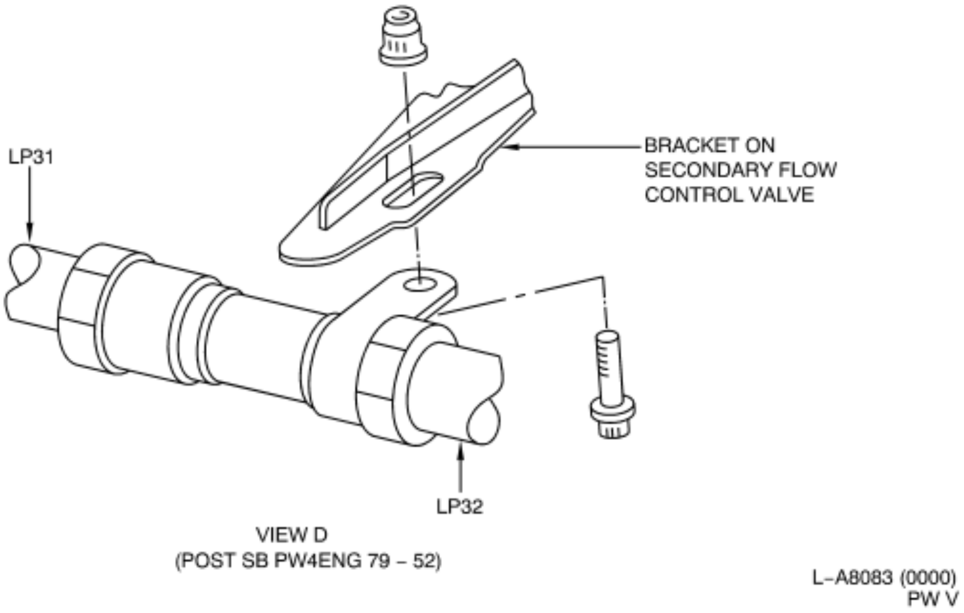
VIEW C
(PRE SB PW4ENG 79-52)


BRACKET ON FLANGE OF COOLING AIR TUBE (AS03)
SPRAY SHIELD
(LP19)
NO.3 BEARING OIL PRESSURE MANIFOLD (LP18)
FWD

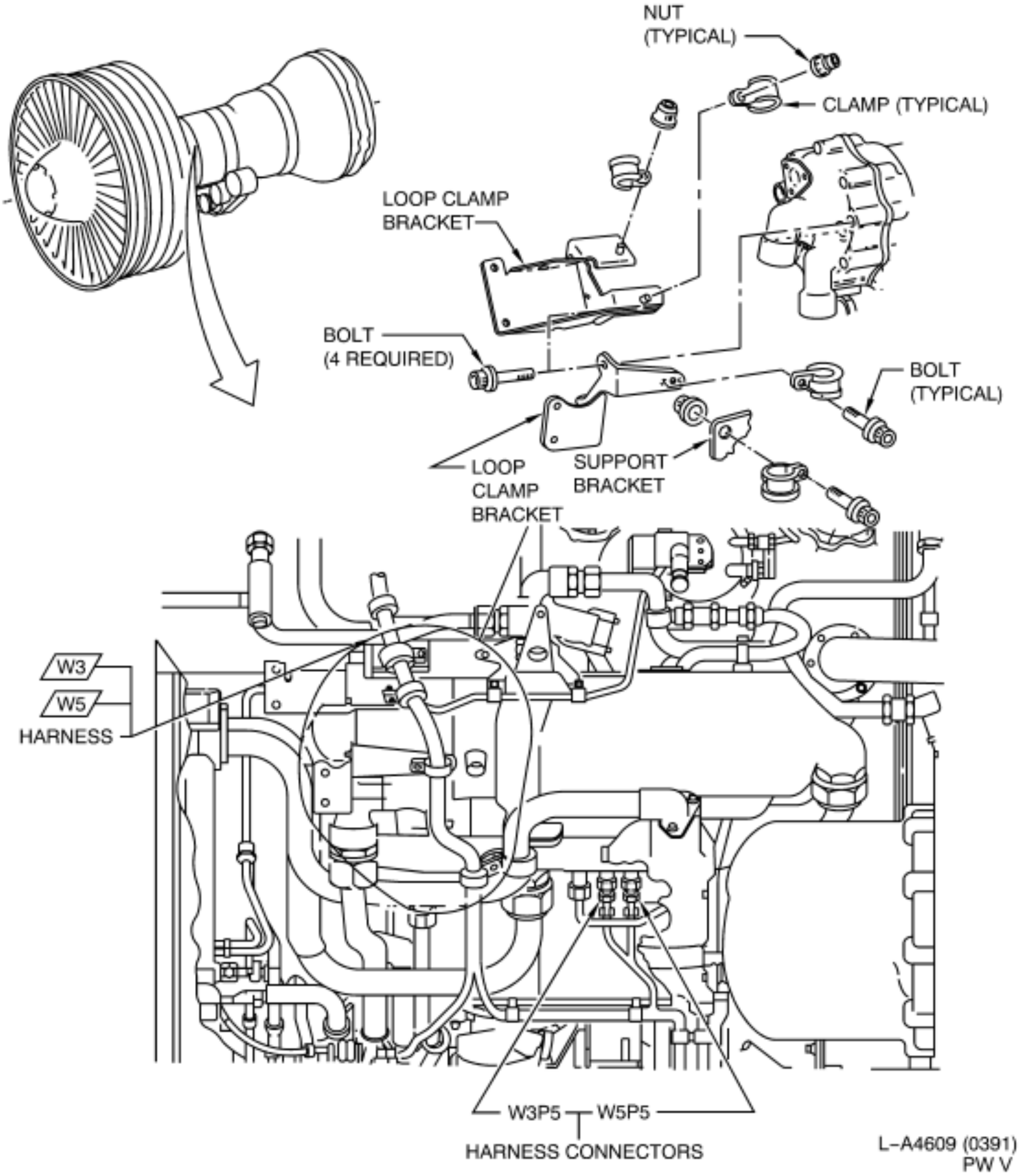
VIEW C
(POST SB PW4ENG 79-52)

L-A8056 (0000)
PW V

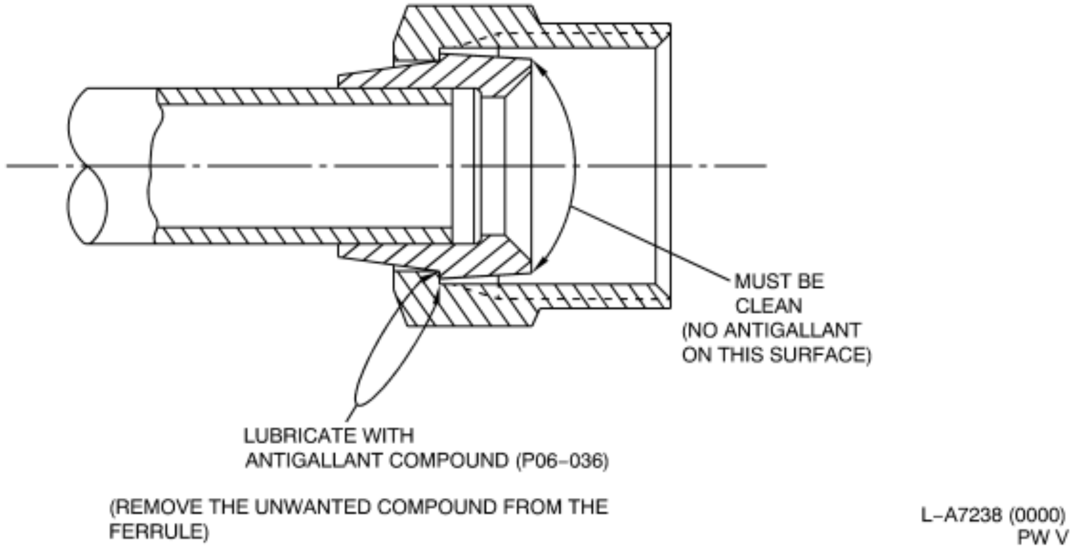
Fuel/Oil Cooler Front And Bottom Tube Connections
Figure 410 (Sheet 2)
(Task 72-00-35-450-001-B)


BRACKET ON
SECONDARY FLOW
CONTROL VALVE
LP31
LP32
VIEW D
(POST SB PW4ENG 79 − 52)
L−A8083 (0000)
PW V

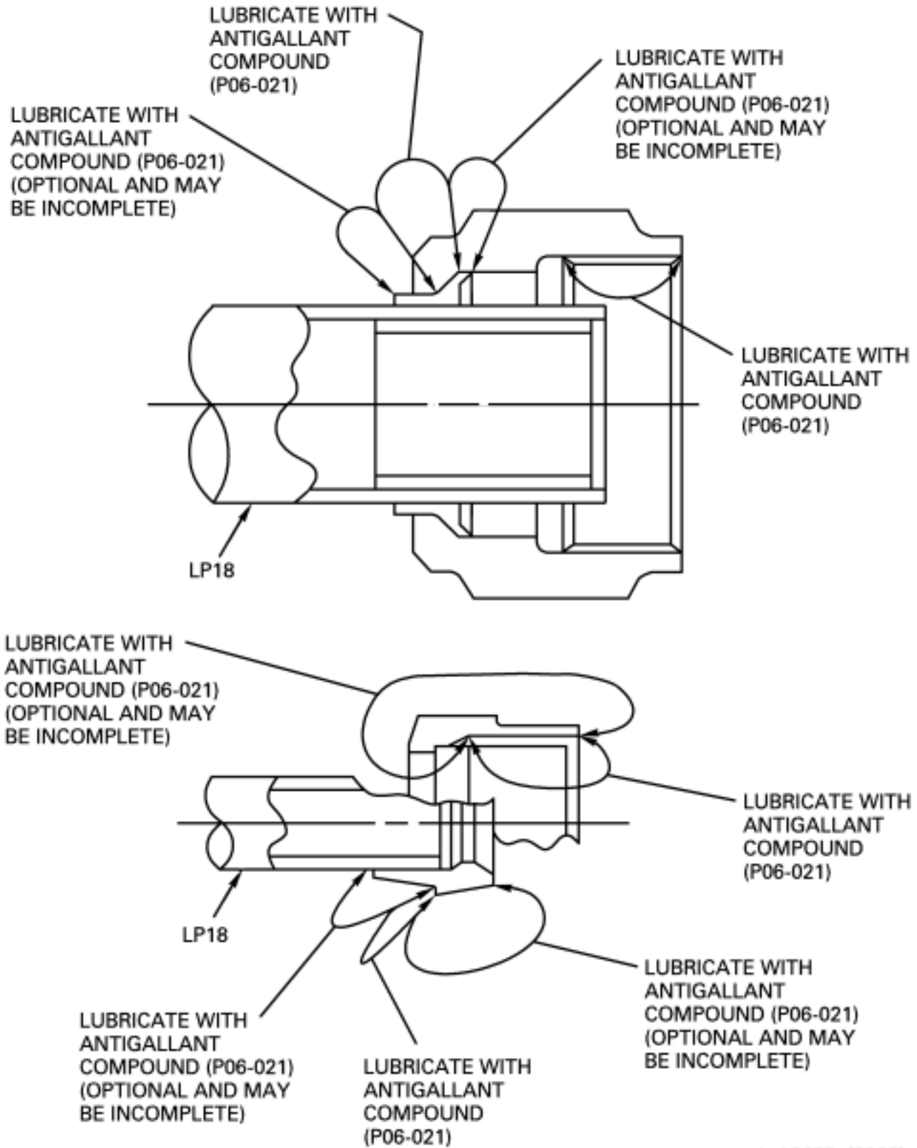
Fuel/Oil Cooler Front And Bottom Tube Connections
Figure 410 (Sheet 3)
(Task 72−00−35−450−001−B)


NUT (TYPICAL)
CLAMP (TYPICAL)
LOOP CLAMP BRACKET
BOLT (4 REQUIRED)
BOLT (TYPICAL)
LOOP CLAMP BRACKET
SUPPORT BRACKET
W3
W5
HARNESS
W3P5
W5P5
HARNESS CONNECTORS
L−A4609 (0391)
PW V

EEC Wiring Harness And Support Brackets
Figure 411
(Task 72−00−35−450−001−B)


MUST BE CLEAN (NO ANTIGALLANT ON THIS SURFACE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06−036)
(REMOVE THE UNWANTED COMPOUND FROM THE FERRULE)
L−A7238 (0000)
PW V

Application Of Antigallant To Back Of Tube Ferrules
Figure 412 (Sheet 1)
(Task 72−00−35−450−001−B)


LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LP18
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LP18
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
L-A8055 (0000)

Application Of Antigallant To Back Of
Tube Ferrules (Post SB PW4ENG 79−52)
Figure 412 (Sheet 2)
(Task 72−00−35−450−001−B)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-35-450-002:

1. Install Turbine Case Cooling (TCC) Air Valve Actuator

A. Equipment And Materials Required

Standard Tools:

Glenair TG−70 Strap Wrench or
Glenair TG−69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−289	Lockwire (AS3214−02)
P05−291	Cable, Safety (Optional)
P05−292	Ferrule, Safety Cable (Optional)
P11−009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	75−24−00/11/130
Packing	1	75−24−00/11/150
Packing	1	75−24−00/11/170

B. Procedure

See Figure 401.

(1) If new actuator is being installed, comply with the following.

  (a) Check to ensure that actuator moves freely on mount rails.

  (b) Remove protective closures.

  (c) Install the new packing (401/1), lubricated with Engine Oil P03−001, to the plug (401/2).

(d) Install the plug (401/1), threads lubricated with Engine Oil P03−001, to the lower rear port of actuator. Torque the plug (401/2) to 90 − 100 lb−in. (10.169 − 11.298 N.m). Safety the plug (401/2) with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(2) If necessary, the hydraulic pressure and the hydraulic return adapters and their packings can be replaced as follows.

(a) Install the new packing (401/3), lubricated with Engine Oil P03−001, to the hydraulic pressure adapter (401/4).

(b) Install the hydraulic pressure adapter (401/4), threads lubricated with Engine Oil P03−001, to the upper (largest) port of the actuator. Tighten the adapter (401/4) to a snug fit.

(c) Install the new packing (401/6), lubricated with Engine Oil P03−001, to the hydraulic return adapter (401/7).

(d) Install the hydraulic return adapter (401/7), threads lubricated with Engine Oil P03−001, to the remaining port (right side) of the actuator. Tighten the adapter (401/7) to a snug fit.

(3) Remove protective closures.

(4) Install two hinged clamps to each mount rail on actuator. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the clamps shut if so equipped.

(5) Position and hold actuator clear of pins on bracket on HPC case.

(6) Connect cable end to actuator piston shaft. Position actuator on bracket with pins engaging holes in actuator mount rails.

NOTE: For the complete assembly of the cable and rod, see 72−00−53, Installation−06 (Task 72−00−53−450−004).

(7) Secure actuator in place with four bolts, threads lubricated with Engine Oil P03−001. For engines not equipped with nut plates (Pre SB PW4ENG 75−35), install four nuts. Torque clamp bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(8) Secure ground strap to threaded hole on rear face of actuator with bolt, threads lubricated with Engine Oil P03−001. Torque bolt to 85 − 95 lb−in. (9.604 − 10.734 N.m).

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(9) Lubricate threads of nuts on return (CR13) and pressure (CP11) hoses with Engine Oil P03−001, and attach hoses to their respective ports on actuator.

CAUTION: TO PREVENT OVER TORQUE OF THE ADAPTER AND POSSIBLE DAMAGE TO THE PACKING, HOLD AND KEEP THE ADAPTER FROM TURNING WHEN YOU TORQUE THE HOSE NUT.

(10) With the correct wrench to hold the adapter (401/4) from turning, torque the largest (pressure) hose nut (401/5) (CP11) to 450 − 500 lb−in. (50.843 − 56.492 N.m). Safety the hose nut (401/5) with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

CAUTION: TO PREVENT OVER TORQUE OF THE ADAPTER AND POSSIBLE DAMAGE TO THE PACKING, HOLD AND KEEP THE ADAPTER FROM TURNING WHEN YOU TORQUE THE HOSE NUT.

(11) With the correct wrench to hold the adapter (401/7) from turning, torque the remaining (return) hose nut (401/8) (CR13) to 270 − 300 lb−in. (30.506 − 33.895 N.m). Safety the hose nut (401/8) with Lockwire

P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(12) Lubricate cable coupling nut threads with Engine Oil P03−001, and torque nut to 100 − 125 lb−in. (11.298 − 14.123 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nut.

(13) Secure cable rod end bearing to valve idler arm at turbine case cooling (TCC) air shutoff valve (HPT) with bolt, threads lubricated with Engine Oil P03−001, and nut. Torque nut to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(14) Connect the W4P16 harness connector to the actuator harness receptacle as follows.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

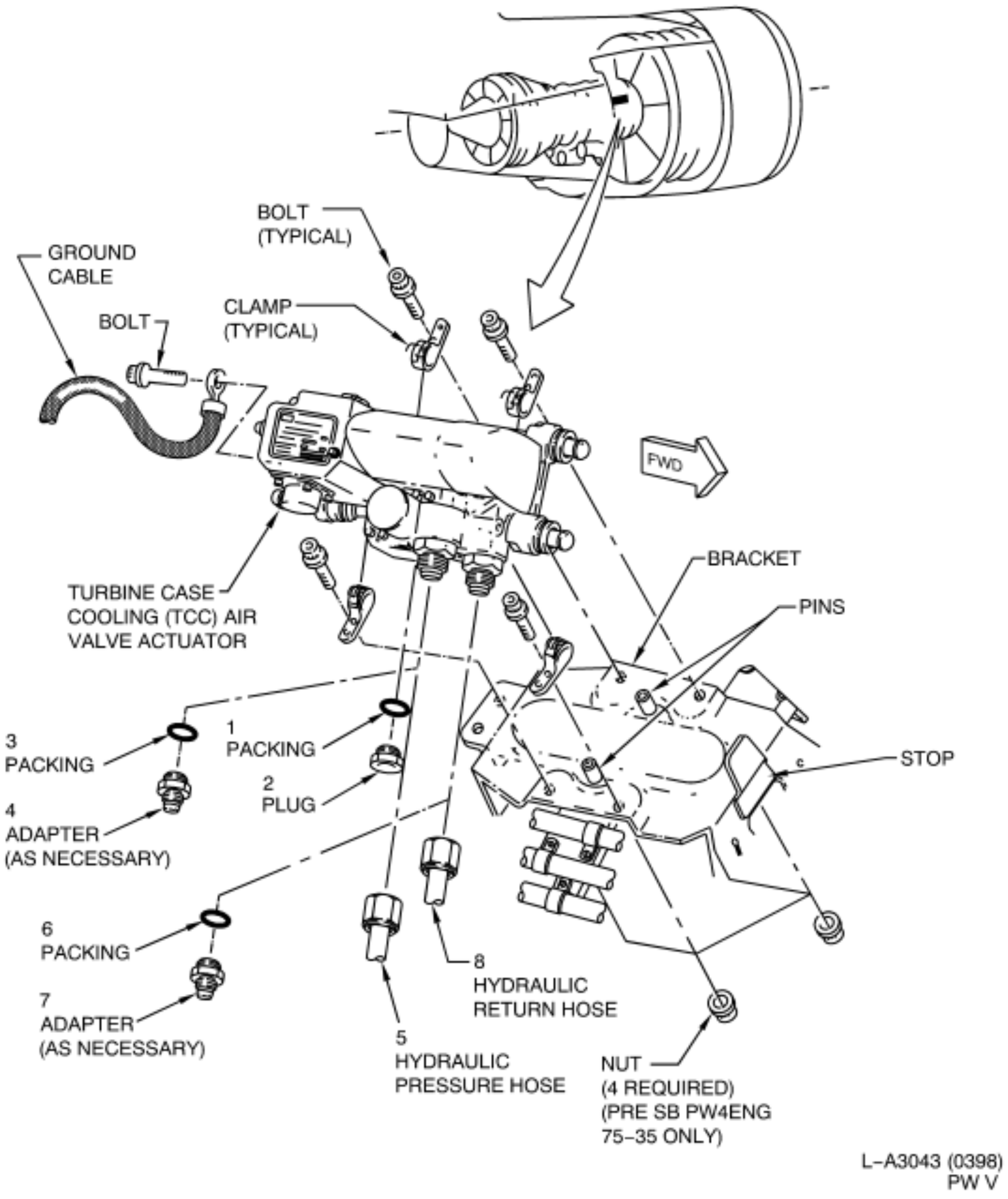
(c) Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
− The connector coupling nut is fully tight
− The connector fits tightly against the receptacle (metal to metal).

- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

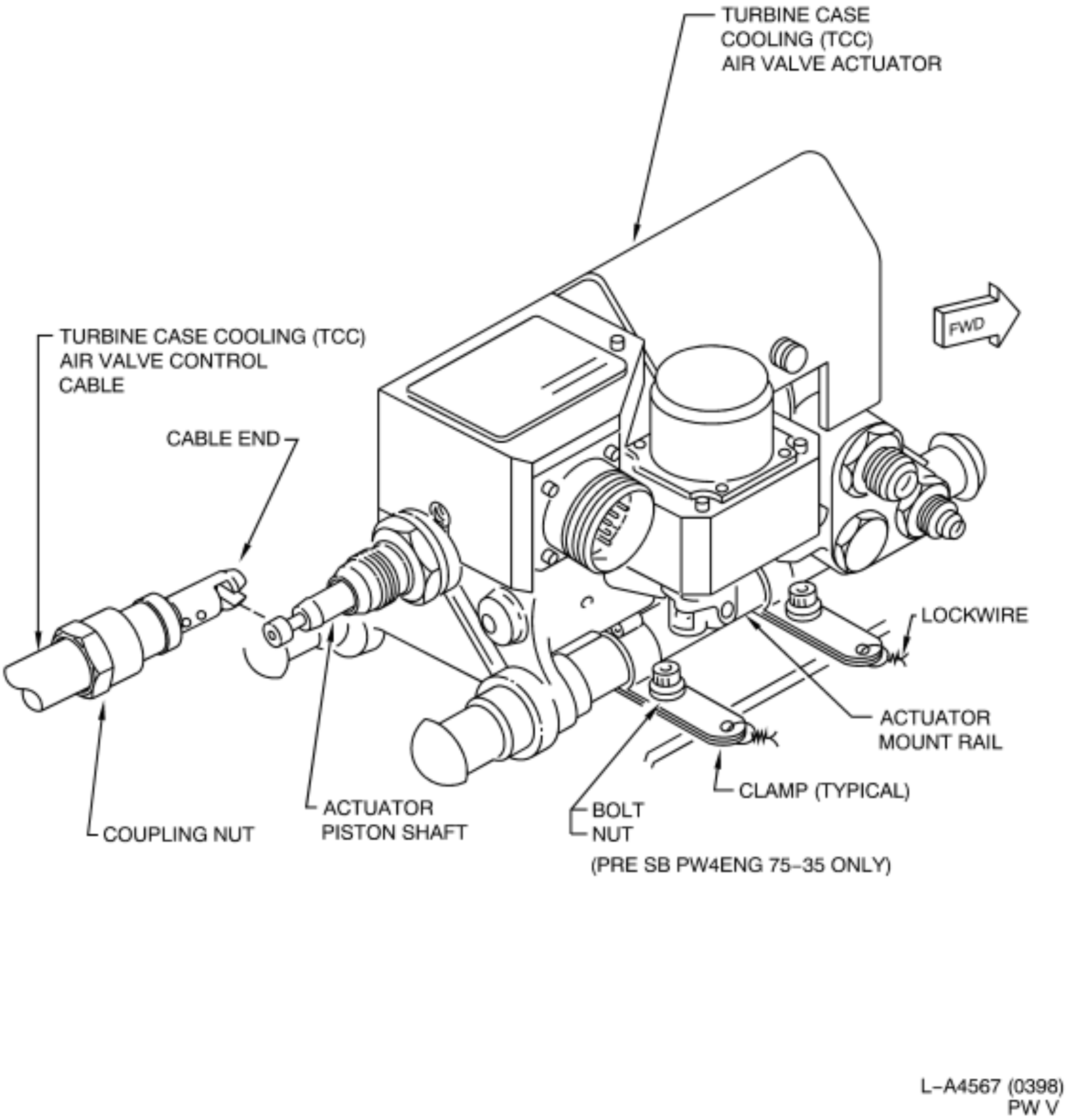
NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque. See the instructions given with the strap wrench for correct use.

C. Postrequisites

(1) Rig automatic turbine rotor clearance control system per 72−00−00, Special Procedures−06 Task 72−00−00−830−004 or Special Procedures−11 Task 72−00−00−830−005 as applicable.


BOLT
(TYPICAL)
GROUND
CABLE
BOLT
CLAMP
(TYPICAL)
FWD
BRACKET
PINS
TURBINE CASE
COOLING (TCC) AIR
VALVE ACTUATOR
3
PACKING
1
PACKING
2
PLUG
4
ADAPTER
(AS NECESSARY)
STOP
6
PACKING
7
ADAPTER
(AS NECESSARY)
8
HYDRAULIC
RETURN HOSE
5
HYDRAULIC
PRESSURE HOSE
NUT
(4 REQUIRED)
(PRE SB PW4ENG
75-35 ONLY)
L-A3043 (0398)
PW V

Turbine Case Cooling (TCC) Air Valve Actuator
Figure 401 (Sheet 1)
(Task 72-00-35-450-002)


TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
FWD
TURBINE CASE COOLING (TCC) AIR VALVE CONTROL CABLE
CABLE END
LOCKWIRE
ACTUATOR MOUNT RAIL
CLAMP (TYPICAL)
BOLT
NUT
(PRE SB PW4ENG 75-35 ONLY)
ACTUATOR PISTON SHAFT
COUPLING NUT
L-A4567 (0398)
PW V

Turbine Case Cooling (TCC) Air Valve Actuator
Figure 401 (Sheet 2)
(Task 72-00-35-450-002)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-35-450-003:

1. Install Turbine Vane And Blade Cooling Air Valve Position Switch

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lockwire, AS3214-01		

B. Procedure

See Figure 401.

NOTE: This procedure is applicable for engines without SB PW4ENG 72-572 or SB PW4ENG 75-106 or SB PW4ENG 75-756 or SB PW4ENG 75-759 or SB PW4ENG 75-147 only.

(1) Position turbine vane and blade cooling air valve position switch to turbine vane and blade cooling air valve aligning bolt holes for proper positioning. See Figure 401.

(2) Secure position switch to valve with bolts, threads lubricated with Engine Oil P03-001. Torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

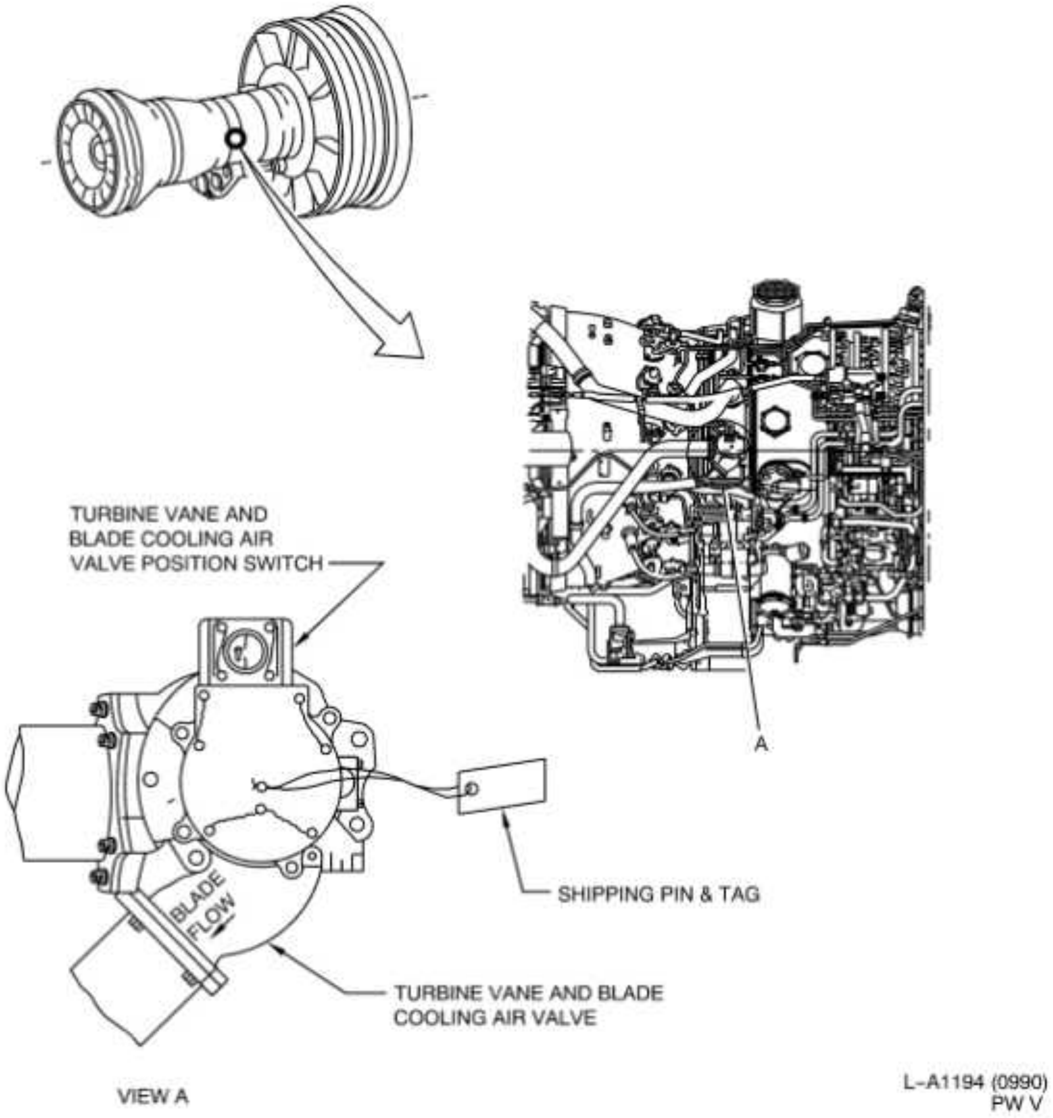
(3) Connect W4P21 the harness connector to the switch as follows.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11-009. Let dry.

CAUTION: USE THE CORRECT ASSEMBLY TORQUE. USE OF THE WRONG TORQUE CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(b) (Reference 2156) Tighten and torque the connector to 30 − 35 lb−in. (3.390 − 3.954 N.m). Install the AS3214−01 Lockwire.

(4) (Reference 760) If necessary, remove the shipping cotter pin and tag from the face of the switch.


TURBINE VANE AND BLADE COOLING AIR VALVE POSITION SWITCH
A
SHIPPING PIN & TAG
BLADE FLOW
TURBINE VANE AND BLADE COOLING AIR VALVE
VIEW A
L-A1194 (0990)
PW V

Turbine Vane And Blade Cooling Air Valve Position Switch
Figure 401
(Task 72−00−35−450−003)

Task 72-00-35-450-004:

1. Install Turbine Vane And Blade Cooling Air Valve (Right)

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 Or M307

Special Tools:

NOTE: Use a 5/16 inch, 12 point standard torque adapter (approximately 2 9/16 inch (65.088 mm) long) to install and torque the valve attaching bolts.

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-059	Wax, Paraffin (PMC 9552)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
R P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	75-24-00/1/1
Gasket	1	75-24-00/2/95
Gasket	2	75-26-00/2/210

B. Procedure
See Figure 401 and Figure 402.

(1) Remove protective closures.

(2) If a new valve must be installed, do the following:

   (a) Install a new copper gasket to the tube adapter.

   (b) Lubricate the adapter threads with Engine Oil P03-001, and install the adapter to the air supply (servo) port of valve.

   (c) Torque the adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m).

(3) Install a new metal gasket to boss on HPC case located on right side of engine at approximately the 3 o'clock position forward of Flange K and attach with Paraffin Wax P05-059.

CAUTION: WITH A STANDARD TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. (SEE THE STANDARD PRACTICES MANUAL). TOO MUCH TORQUE CAN DAMAGE THE THREADED PARTS.

(4) Install the valve and the bracket to the boss and attach with bolts, thread lubricated with Engine Oil P03-001. Use a 5/6 inch, 12 point standard torque adapter (approximately 2 9/16 inch (65.088 mm) long) to tighten and torque bolts to 85 - 95 lb-in. (9.604 - 10.724 N.m), continue to torque the bolts until the torque is kept.

NOTE: If engine has the ring case style compressor, (Post SB PW4ENG 72-756 or SB PW4ENG 72-759), you must install a turbine vane and blade cooling air valve (Post SB PW4ENG 75-147) with the foolproofing pin hole to match the pin on the flange boss, (See Figure 401 (sheet 1) and Figure 402 (Sheet 1).

NOTE: There are seven bolts which attach the valve to the case; Make sure you use the longer bolts for the bracket locations on the valve.

(5) Install bolt, threads lubricated with Engine Oil P03-001, nut, and link rod end to bracket attached to valve flange. Torque bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(6) FOR THESE MODELS: 4152, 4156A, 4158
Install bolts, threads lubricated with Engine Oil P03-001, and nuts to attach the tube clamps to the same bracket. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(7) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install bolt, threads lubricated with Engine Oil P03-001, and nut that attach the tube clamp to the same bracket. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(8) Install a new gasket between the flange of the valve and the turbine vane cooling air tube (AP02) and attach the flanges with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m), continue to torque the bolts until the torque is kept.

(9) Install a gasket to the four hole air shutoff valve flanged end of the cooling air tube (AP37) and a second gasket to the mating flange on the valve and hold in place with Paraffin Wax P05−059.

(a) FOR THESE MODELS: 4152, 4156A, 4158 (Pre SB PW4ENG 72−572 or SB PW4ENG 72−537 or Post SB PW4ENG 72−627) Install the metering plate in the four hole air shutoff valve flanged end of the tube (between the gaskets) and hold in place with Paraffin Wax P05−059. Attach the flange of the tube to the valve with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m), continue to torque the bolts until the torque is kept.

(b) FOR THESE MODELS: 4152, 4156A, 4158 (Post PW4ENG 72−572 and Pre SB PW4ENG 72−627 or Post SB PW4ENG 72−537 and Pre SB PW4ENG 72−627) Install the ring spacer in the four hole air shutoff valve flanged end of the tube (between the gaskets) and hold in place with Paraffin Wax P05−059. Attach the flange of the tube to the valve with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m), continue to torque the bolts until the torque is kept.

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3 (Pre SB PW4ENG 72−537 or Post SB PW4ENG 72−627) Install the metering plate in the four hole air shutoff valve flanged end of the tube (between the gaskets) and hold in place with Paraffin Wax P05−059. Attach the flange of the tube to the valve with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m), continue to torque the bolts until the torque is kept.

(d) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
(Post SB PW4ENG 72−537 and Pre SB PW4ENG 72−627) Install the ring spacer in the four hole air shutoff valve flanged end of the tube (between the gaskets) and hold in place with Paraffin Wax P05−059. Attach the flange of the tube to the valve with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m), continue to torque the bolts until the torque is kept.

(10) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 75−116) Lubricate the threads of the tube adapter with Engine Oil P03−001 and attach the air signal tube (AA21) to the adapter. Torque the tube nut to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

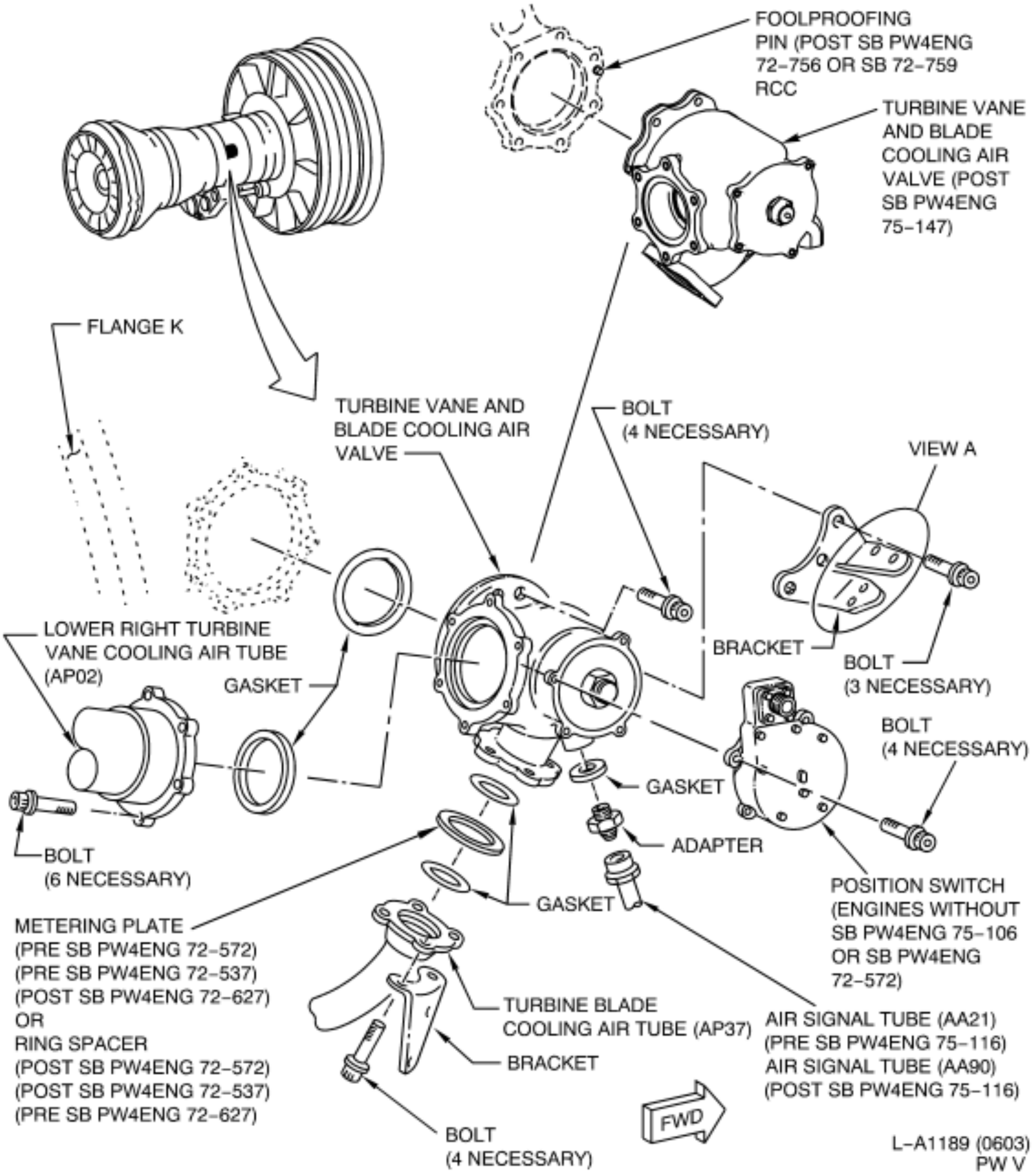
(11) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 75−116) Lubricate the threads of the tube adapter with Engine Oil P03−001 and attach the air signal tube (AA90) to the adapter. Torque the tube nut to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(12) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Lubricate the threads of the tube adapter with Engine Oil P03−001 and attach the air signal tube (AA77) to the adapter. Torque the tube nut to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

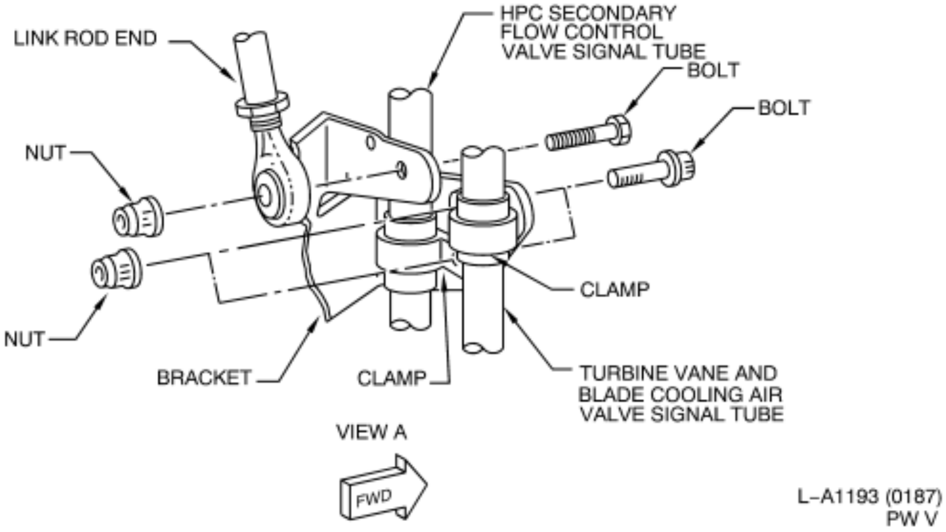
C. Postrequisite

(1) FOR THESE MODELS: 4152, 4156A, 4158
Install turbine vane and blade cooling air valve position switch by 72−00−35, Installation−06.

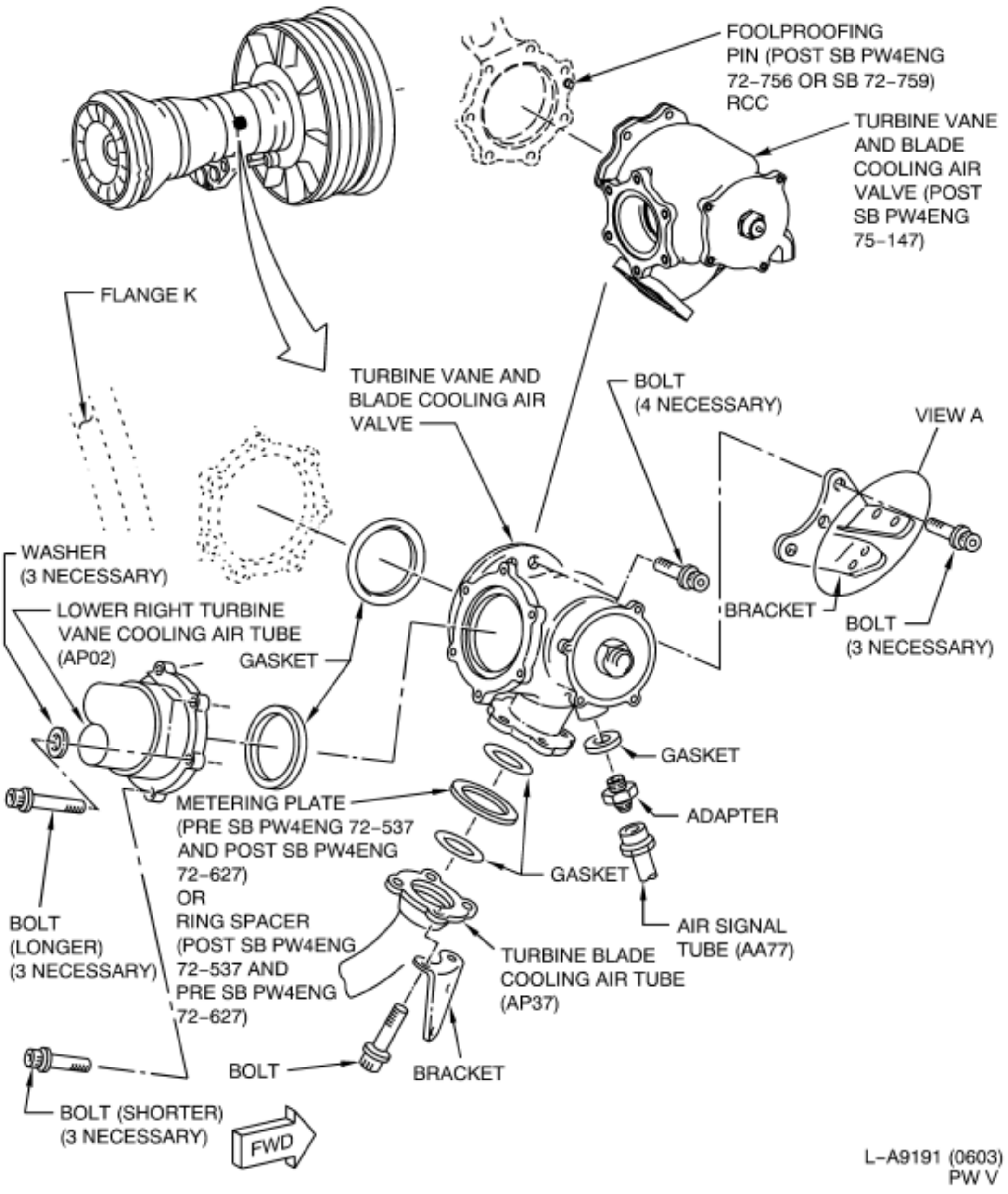
(2) Test engine by Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


FOOLPROOFING PIN (POST SB PW4ENG 72−756 OR SB 72−759 RCC
TURBINE VANE AND BLADE COOLING AIR VALVE (POST SB PW4ENG 75−147)
FLANGE K
TURBINE VANE AND BLADE COOLING AIR VALVE
BOLT (4 NECESSARY)
VIEW A
BRACKET
BOLT (3 NECESSARY)
LOWER RIGHT TURBINE VANE COOLING AIR TUBE (AP02)
GASKET
BOLT (4 NECESSARY)
GASKET
ADAPTER
BOLT (6 NECESSARY)
POSITION SWITCH (ENGINES WITHOUT SB PW4ENG 75−106 OR SB PW4ENG 72−572)
GASKET
METERING PLATE (PRE SB PW4ENG 72−572) (PRE SB PW4ENG 72−537) (POST SB PW4ENG 72−627) OR RING SPACER (POST SB PW4ENG 72−572) (POST SB PW4ENG 72−537) (PRE SB PW4ENG 72−627)
TURBINE BLADE COOLING AIR TUBE (AP37)
AIR SIGNAL TUBE (AA21) (PRE SB PW4ENG 75−116) AIR SIGNAL TUBE (AA90) (POST SB PW4ENG 75−116)
BRACKET
FWD
BOLT (4 NECESSARY)
L−A1189 (0603)
PW V

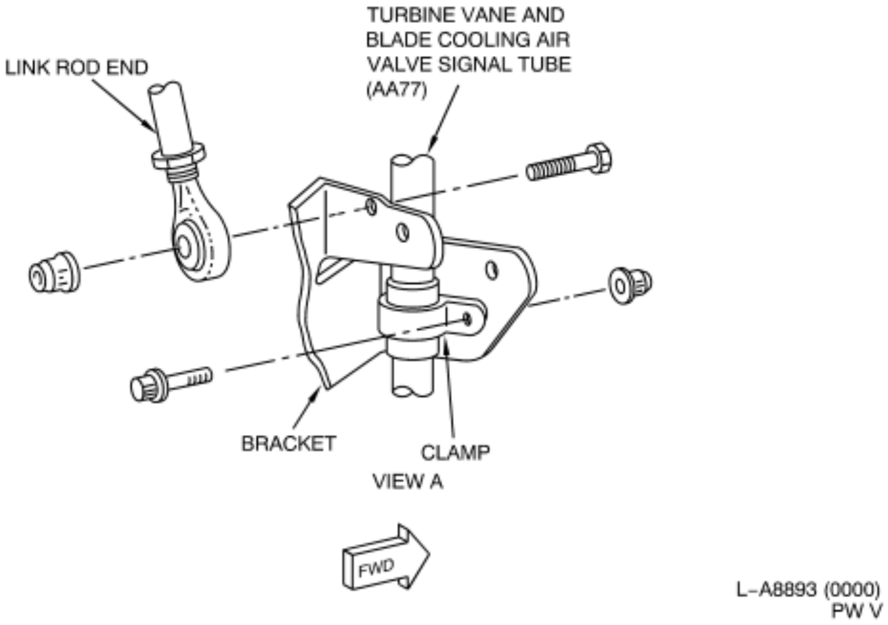
Turbine Vane And Blade Cooling Air Valve (Right)
Figure 401 (Sheet 1)
(Task 72−00−35−450−004)


LINK ROD END
HPC SECONDARY FLOW CONTROL VALVE SIGNAL TUBE
BOLT
BOLT
NUT
NUT
CLAMP
BRACKET
CLAMP
TURBINE VANE AND BLADE COOLING AIR VALVE SIGNAL TUBE
VIEW A
FWD
L−A1193 (0187)
PW V

Bracket Clipping
Figure 401 (Sheet 2)
(Task 72−00−35−450−004)


FOOLPROOFING
PIN (POST SB PW4ENG
72−756 OR SB 72−759)
RCC
TURBINE VANE
AND BLADE
COOLING AIR
VALVE (POST
SB PW4ENG
75−147)
FLANGE K
TURBINE VANE AND
BLADE COOLING AIR
VALVE
BOLT
(4 NECESSARY)
VIEW A
WASHER
(3 NECESSARY)
LOWER RIGHT TURBINE
VANE COOLING AIR TUBE
(AP02)
GASKET
BRACKET
BOLT
(3 NECESSARY)
GASKET
ADAPTER
METERING PLATE
(PRE SB PW4ENG 72−537
AND POST SB PW4ENG
72−627)
OR
RING SPACER
(POST SB PW4ENG
72−537 AND
PRE SB PW4ENG
72−627)
GASKET
AIR SIGNAL
TUBE (AA77)
TURBINE BLADE
COOLING AIR TUBE
(AP37)
BOLT
(LONGER)
(3 NECESSARY)
BOLT
BRACKET
BOLT (SHORTER)
(3 NECESSARY)
FWD
L−A9191 (0603)
PW V

Turbine Vane And Blade Cooling Air Valve (Right)
Figure 402 (Sheet 1)
(Task 72−00−35−450−004)


TURBINE VANE AND BLADE COOLING AIR VALVE SIGNAL TUBE (AA77)
LINK ROD END
BRACKET
CLAMP
VIEW A
FWD
L−A8893 (0000)
PW V

Bracket Clipping
Figure 402 (Sheet 2)
(Task 72−00−35−450−004)

Task 72-00-35-450-005:

1. Install Turbine Vane And Blade Cooling Air Valve (Left)

A. Equipment And Materials Required

Special Tools:

NOTE: Use a 5/16 inch, 12 point standard torque adapter (approximately 2 9/16 inch (65.088 mm) long) to install and torque the valve attaching bolts.

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-059	Wax, Paraffin (PMC 9552)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-021	Compound, Anti-Gallant

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	75-24-00/1/1
Gasket	1	75-24-00/3/125
Gasket	2	75-26-00/1/40

B. Procedure
See Figure 401 and Figure 402.

(1) Remove protective closures.

(2) If new valve is being installed, comply with the following:

(a) With gasket on tube adapter and with threads lubricated with Engine Oil P03-001, install to air supply (servo) port of valve.

(b) Tighten and torque adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m)

(3) Install new metal gasket to pad on HPC case located in upper left side of engine at 10 o'clock position forward of Flange K and secure with Paraffin Wax P05−059.

CAUTION: WITH A STANDARD TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. (SEE THE STANDARD PRACTICES MANUAL). TOO MUCH TORQUE CAN DAMAGE THE THREADED PARTS.

(4) Position valve and bracket to above pad and secure with bolts, thread lubricated with Engine Oil P03−001. Use a 5/6 inch, 12 point standard torque adapter (approximately 2 9/16 inch (65.088 mm) long) to tighten and torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Then without loosening, continue to tighten to required torque until torque is maintained.

NOTE: If engine has the ring case style compressor (Post SB PW4ENG 72−756 or SB PW4ENG 72−759), you must install a turbine vane and blade cooling air valve (Post SB PW4ENG 75−147) with the foolproofing pin hole to match the pin on the flange boss (Figure 401 and Figure 402).

NOTE: There are seven bolts which attach the valve to the case; Make sure you use the longer bolts for the bracket locations on the valve.

(5) Install bolt, threads lubricated with Engine Oil P03−001, and nut securing tube clamp to bracket mounted to flange of valve. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(6) Position new metal gasket between flanges of subject valve and vane cooling air tube (AP04) and secure flanges with bolts, threads lubricated with Engine Oil P03−001. Tighten and torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m), then without loosening, continue to tighten to required torque until torque is maintained.

(7) Install a gasket to the four hole air shutoff valve flanged end of the cooling air tube (AP38) and a second gasket to the mating flange on the valve and hold in place with Paraffin Wax P05−059.

(a) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 72−572 or SB PW4ENG 72−537 or Post SB PW4ENG 72−627) Install the metering plate in the four hole air shutoff valve flanged end of the tube (between the gaskets) and hold in place with Paraffin Wax P05−059. Attach the flange of the tube to the valve with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m), continue to torque the bolts until the torque is kept.

(b) FOR THESE MODELS: 4152, 4156A, 4158
(Post PW4ENG 72−572 and Pre SB PW4ENG 72−627 or Post SB PW4ENG 72−537 and Pre SB PW4ENG 72−627) Install the ring spacer in the four hole air shutoff valve flanged end of the tube (between the gaskets) and hold in place with Paraffin Wax P05−059. Attach the flange of the tube to the valve with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m), continue to torque the bolts until the torque is kept.

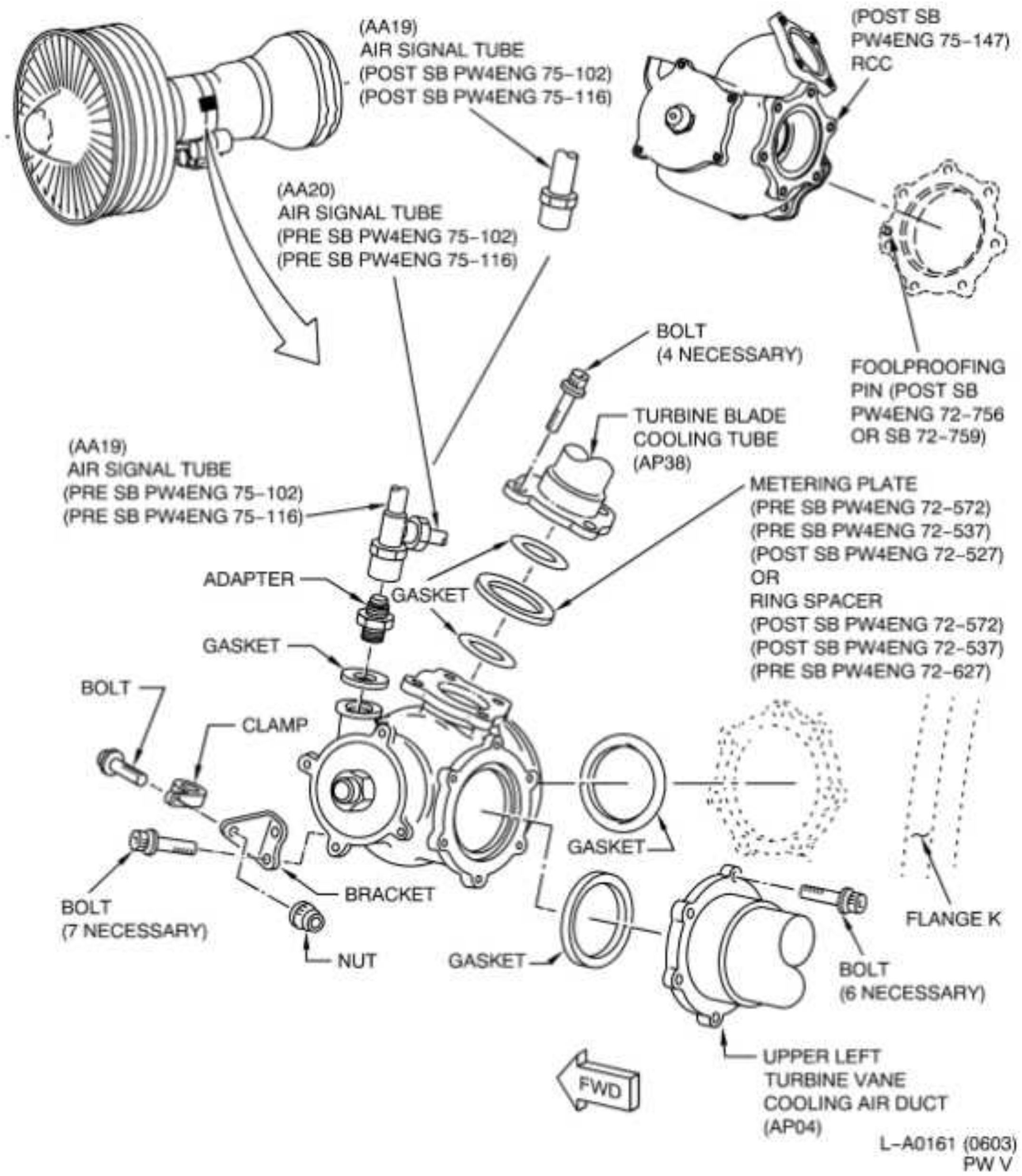
(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
(Pre SB PW4ENG 72−537 or Post SB PW4ENG 72−627) Install the metering plate in the four hole air shutoff valve flanged end of the tube (between the gaskets) and hold in place with Paraffin Wax P05−059. Attach the flange of the tube to the valve with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m), continue to torque the bolts until the torque is kept.

(d) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
(Post SB PW4ENG 72−537 and Pre SB PW4ENG 72−627) Install the ring spacer in the four hole air shutoff valve flanged end of the tube (between the gaskets) and hold in place with Paraffin Wax P05−059. Attach the flange of the tube to the valve with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m), continue to torque the bolts until the torque is kept.

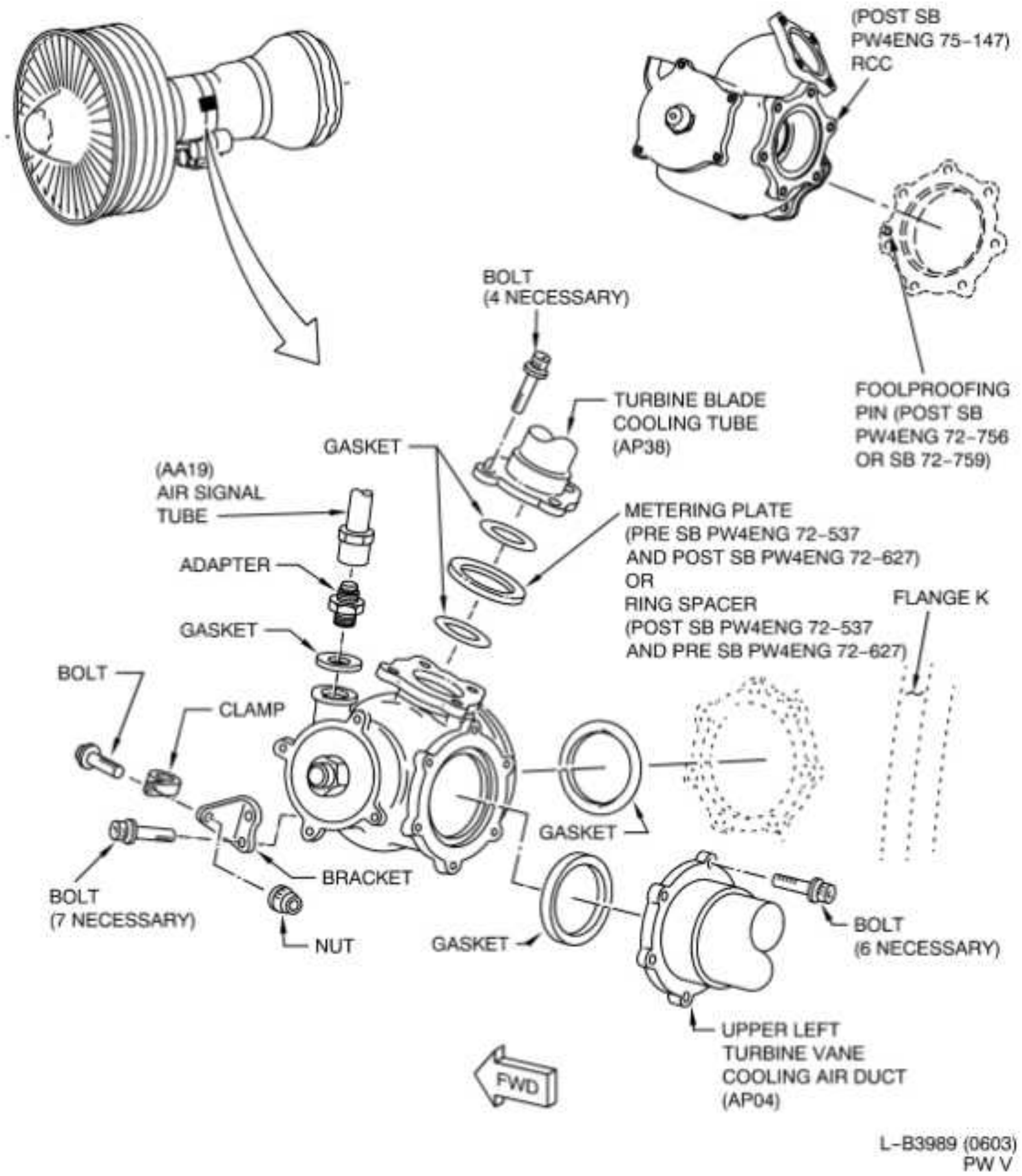
(8) Lubricate outer threads of tube adapter with Anti−Gallant compound P06−021, and secure air signal tube (AA19) nut to "servo" port. Tighten and torque tube nut 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nut.

C. Postrequisite

(1) Test engine per Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).


(AA19)
AIR SIGNAL TUBE
(POST SB PW4ENG 75-102)
(POST SB PW4ENG 75-116)
(POST SB
PW4ENG 75-147)
RCC
(AA20)
AIR SIGNAL TUBE
(PRE SB PW4ENG 75-102)
(PRE SB PW4ENG 75-116)
BOLT
(4 NECESSARY)
FOOLPROOFING
PIN (POST SB
PW4ENG 72-756
OR SB 72-759)
TURBINE BLADE
COOLING TUBE
(AP38)
(AA19)
AIR SIGNAL TUBE
(PRE SB PW4ENG 75-102)
(PRE SB PW4ENG 75-116)
METERING PLATE
(PRE SB PW4ENG 72-572)
(PRE SB PW4ENG 72-537)
(POST SB PW4ENG 72-527)
OR
RING SPACER
(POST SB PW4ENG 72-572)
(POST SB PW4ENG 72-537)
(PRE SB PW4ENG 72-627)
ADAPTER
GASKET
GASKET
BOLT
CLAMP
GASKET
BRACKET
BOLT
(7 NECESSARY)
NUT
GASKET
FLANGE K
BOLT
(6 NECESSARY)
FWD
UPPER LEFT
TURBINE VANE
COOLING AIR DUCT
(AP04)
L-A0161 (0603)
PW V

Turbine Vane And Blade Cooling Air Valve (Left)
Figure 401
(Task 72−00−35−450−005)


(POST SB PW4ENG 75-147) RCC
BOLT (4 NECESSARY)
TURBINE BLADE COOLING TUBE (AP38)
FOOLPROOFING PIN (POST SB PW4ENG 72-756 OR SB 72-759)
GASKET
(AA19) AIR SIGNAL TUBE
METERING PLATE (PRE SB PW4ENG 72-537 AND POST SB PW4ENG 72-627) OR RING SPACER (POST SB PW4ENG 72-537 AND PRE SB PW4ENG 72-627)
ADAPTER
FLANGE K
GASKET
BOLT
CLAMP
GASKET
BRACKET
BOLT (7 NECESSARY)
NUT
GASKET
BOLT (6 NECESSARY)
UPPER LEFT TURBINE VANE COOLING AIR DUCT (AP04)
FWD
L-B3989 (0603)
PW V

Turbine Vane And Blade Cooling Air Valve (Left)
Figure 402
(Task 72−00−35−450−005)

Task 72-00-35-450-006:

1. Install HPC Secondary Flow Control Valve (Left)

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-059	Wax, Paraffin (PMC 9552)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
R	P06-054	Paste, Anti-Seize (PWA 36246)
	P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	75-33-00/1/1
Lockwire, AS3214-01		

B. Procedure
See Figure 401.

NOTE: This procedure is applicable for engines without SB PW4ENG 72-572 or SB PW4ENG 75-106 only.

(1) If new valve is to be installed, comply with the following:

(a) With valve on bench and viewed as in Figure 401, remove protective closures from valve ports. Install gasket on plug. Install plug, threads lubricated with Engine Oil P03-001, into lower outboard port of valve. Torque plug to 110 - 120 lb-in. (12.428 - 13.558 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the plug.

(b) Install three hole cover, with air vent holes (towards valve flange and towards valve port) to rear port. Secure cover and bracket (Post SB PW4ENG 72-211 only) with three bolts, lubricated with Engine Oil P03-001. Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(c) Install plain three hole cover to remaining three hole port. Secure cover with three bolts, threads lubricated with Engine Oil P03-001. Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(d) Install gasket on adapter. Install adapter, threads lubricated with Engine Oil P03-001, into remaining threaded valve port. Torque adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m).

(e) (Pre SB PW4ENG 75-85), Lubricate the threads of the adapter with Engine Oil P03-001. Install a cap assembly onto the adapter and torque the cap assembly to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install lockwire on the cap assembly.

NOTE: HPC air valve signal tube was removed and cap assemblies installed on the air filter and the HPC air valve by Alert SB PW4ENG 75-62R2.

NOTE: HPC air valve signal tube was reinstalled and the cap assemblies were removed from the air filter and the HPC air valve by SB PW4ENG 75-85.

(2) Remove protective closures. Install gasket on HPC case pad. Secure gasket in place with Paraffin Wax P05-059.

(3) Install valve on pad aligning offset hole. Secure valve with six bolts, threads lubricated with Engine Oil P03-001. Tighten bolts to a torque of 85 - 95 lb-in. (9.604 - 10.734 N.m), then retorque to same torque without loosening.

(4) (Post SB PW4ENG 75-85), Install the HPC air valve signal tube assembly (AA16) on the left side of the engine.

R (a) Remove the protective covers and lubricate the tube nut threads with Anti-Seize Paste P06-054.
R Remove the unwanted paste. Install the tube
R to the rear of the lower left air filter at approximately the 11 o'clock position and to the HPC secondary flow control valve approximately at the 10 o'clock position.

(b) Install a clamp, bolt, threads lubricated with Engine Oil P03-001, and nut that attach the tube to a bracket that is attached to the turbine cooling air shutoff valve flange. Torque the nut to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Torque the tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the tube nuts.

(5) Connect the W5P10 harness connector to the valve as follows.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11-009. Let dry.

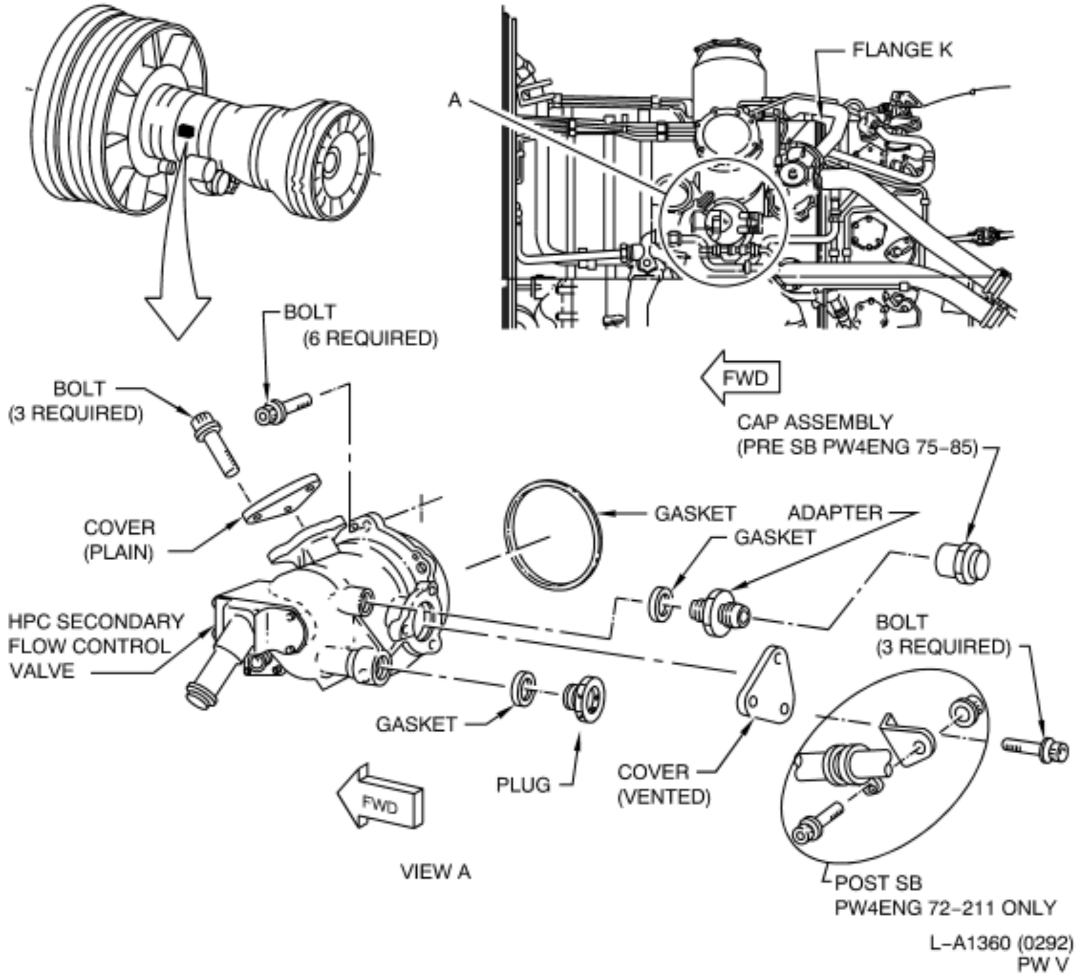
CAUTION: USE THE CORRECT ASSEMBLY TORQUE. USE OF THE WRONG TORQUE CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(b) (Reference 2154) Tighten and torque connector to 21 - 26 lb-in. (2.373 - 2.938 N.m) and secure with AS3214-01 Lockwire.

(6) For engines with the bracket on the rear of the valve, attach the tube clamp with the bolt, lubricated with Engine Oil P03-001, and nut (Post SB PW4ENG 72-211 only). Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

C. Postrequisites

(1) Test engine per Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


FLANGE K
A
BOLT
(6 REQUIRED)
FWD
BOLT
(3 REQUIRED)
CAP ASSEMBLY
(PRE SB PW4ENG 75-85)
COVER
(PLAIN)
GASKET
ADAPTER
GASKET
HPC SECONDARY
FLOW CONTROL
VALVE
BOLT
(3 REQUIRED)
GASKET
PLUG
COVER
(VENTED)
FWD
VIEW A
POST SB
PW4ENG 72-211 ONLY
L-A1360 (0292)
PW V

HPC Secondary Flow Control Valve (Left)
Figure 401
(Task 72−00−35−450−006)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-35-450-007:

R 1. (Pre SB PW4ENG 72-756) Install HPC Secondary Flow Control Valve (Right)

A. Equipment And Materials Necessary

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-059	Wax, Paraffin (PMC 9552)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	75-33-00/1/1

B. Procedure
See Figure 401.

NOTE: This procedure is applicable for engines without SB PW4ENG 75-106 or SB PW4ENG 72-572 only.

(1) If new valve is to be installed, comply with the following:

(a) With valve on bench and viewed as in Figure 401, remove protective closures from valve ports. Install new gasket on plug. Install plug, threads lubricated with Engine Oil P03-001, into upper outboard port of valve. Torque plug to 110 - 120 lb-in. (12.428 - 13.558 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the plug.

(b) Install three hole cover, with air vent holes away from operator and towards valve, to rear port. Secure cover with three bolts, threads lubricated with Engine Oil P03-001. Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(c) Install plain three hole cover to remaining three hole port. Secure cover with three bolts, threads lubricated with Engine Oil P03-001. Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(d) Install gasket on adapter. Install adapter, threads lubricated with Engine Oil P03-001, into remaining threaded valve port. Torque adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m).

(e) (Pre SB PW4ENG 75-85) Lubricate the threads of the adapter with Engine Oil P03-001. Install a cap assembly onto the adapter and torque the cap assembly to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the cap assembly.

NOTE: The HPC air valve signal tube (AA15) was removed and cap assemblies installed on the air filter and the HPC air valve by Alert SB PW4ENG 75-62R2.

NOTE: The HPC air valve signal tube (AA15) was reinstalled and the cap assemblies were removed from the air filter and the HPC air valve by SB PW4ENG 75-85.

(2) Remove protective closures. Install gasket on HPC case pad. Secure gasket in place with Paraffin Wax P05-059.

(3) Install valve on pad aligning offset hole.

(a) (Post SB PW4ENG 73-163) Align the bracket with the 6 and 8 o'clock holes. Install the washers between the bracket and the valve.

(b) Secure valve with six bolts, threads lubricated with Engine Oil P03-001. Tighten bolts to a torque of 85 - 95 lb-in. (9.604 - 10.734 N.m), then retorque to required torque without loosening.

(4) (Post SB PW4ENG 75-85 and Pre SB PW4ENG 75-116) Install the HPC air valve signal tube assembly (AA15) on the right side of the engine.

(a) Remove the protection covers and lubricate the tube nut threads with Engine Oil P03-001. Install the tube to the rear of the lower right air filter at approximately the 2 o'clock position and to the HPC secondary flow control valve at approximately the 3:30 o'clock position forward of Flange J.

(b) Install a clamp, bolt, threads lubricated with Engine Oil P03-001, and nut that attach the tube to a bracket that is attached to the turbine cooling air shutoff valve flange. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Torque the tube nuts to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the tube nuts.

(5) (Post SB PW4ENG 75-116) Install the HPC air valve signal tube assembly (AA91) on the right side of the engine.

(a) Remove the protection covers. Install the tube to the (AA89) tube tee at approximately the 2;30 o'clock position forward of Flange J. Install the lower end of the tube to the HPC secondary flow valve at approximately the 3:30 o'clock position forward of Flange J.

(b) Install a clamp, bolt, threads lubricated with Engine Oil P03-001, and nut that attach the tube to a bracket that is attached to the turbine cooling air shutoff valve flange. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Torque the tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the tube nuts.

(6) Connect W4P10 the harness connector to the valve as follows.

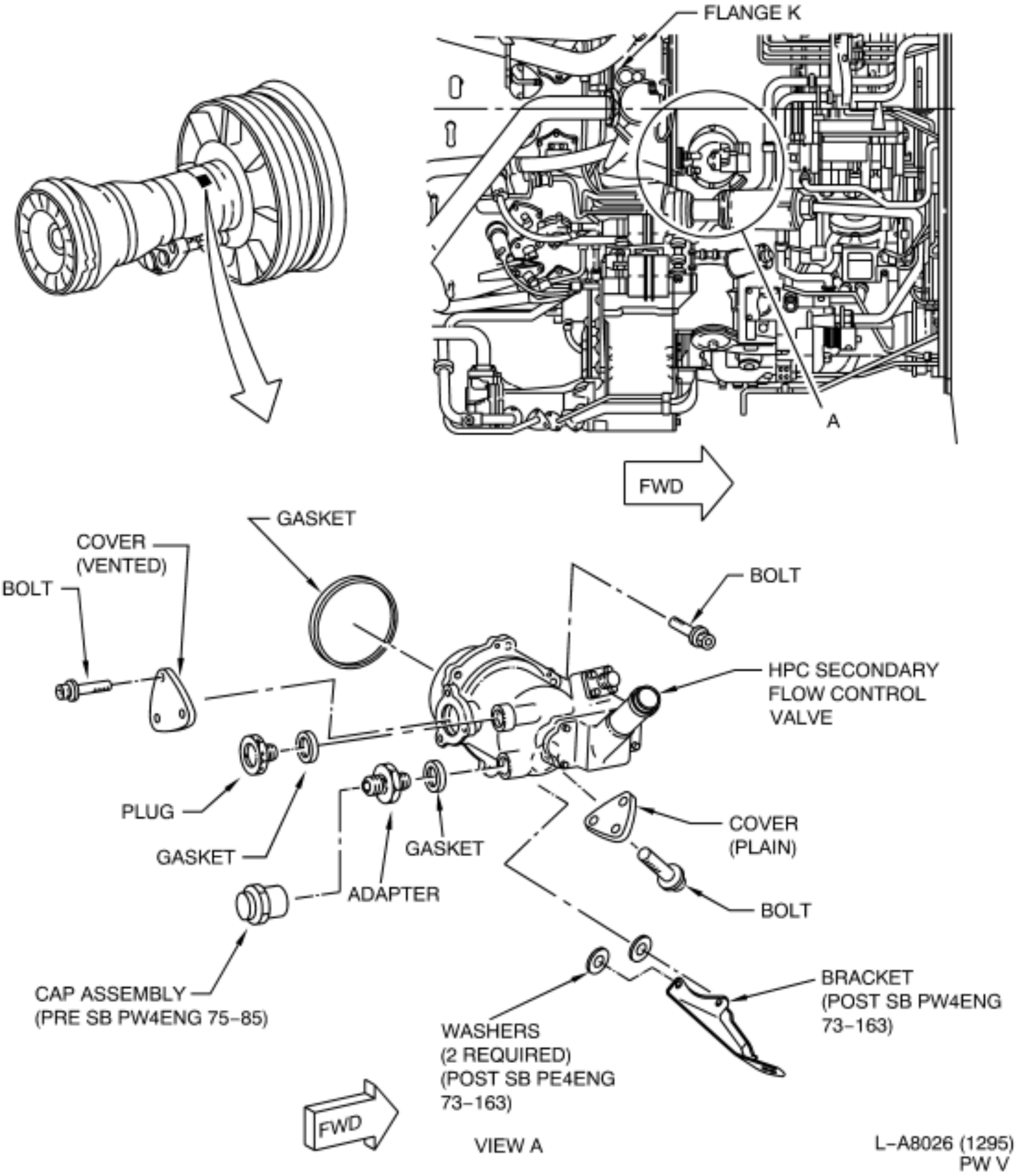
(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

CAUTION: USE THE CORRECT ASSEMBLY TORQUE. USE OF THE WRONG TORQUE CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(b) (Reference 2154) Tighten and torque connector to 21 − 26 lb−in. (2.373 − 2.938 N.m) and secure. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the connector.

C. Postrequisites

(1) Test engine per Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


FLANGE K
A
FWD
GASKET
COVER (VENTED)
BOLT
BOLT
HPC SECONDARY FLOW CONTROL VALVE
PLUG
GASKET
GASKET
ADAPTER
COVER (PLAIN)
BOLT
CAP ASSEMBLY (PRE SB PW4ENG 75-85)
BRACKET (POST SB PW4ENG 73-163)
WASHERS (2 REQUIRED) (POST SB PE4ENG 73-163)
FWD
VIEW A
L-A8026 (1295)
PW V

HPC Secondary Flow Control Valve (Right)
Figure 401
(Task 72-00-35-450-007)

ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - INSTALLATION-11

Task 72-00-35-450-008:

1. Install Fuel/Oil Cooler Bypass Valve

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	79-21-00/6/1
Packing	2	79-21-00/6/200
Packing	1	79-21-00/6/220
Packing	1	79-21-00/6/250

B. Procedure
See Figure 401.

(1) Remove protective closures from fuel/oil cooler bypass valve (401/13).

(2) If new bypass valve assembly is being installed, install adapters and plugs as follows:

(a) Install new packing (401/3), lubricated with Engine Oil P03-001, to adapter (401/4) and install adapter threads lubricated with Engine Oil P03-001, to port (marked RTN). Torque the adapter 110 - 120 lb-in. (12.428 - 13.558 N.m).

(b) Install new packing (401/12) lubricated with Engine Oil P03-001, to adapter (401/11) and install adapter, threads lubricated with Engine Oil P03-001, to the port (marked IDG OIL). Torque the adapter 375 - 425 lb-in. (42.369 - 48.019 N.m).

(c) Install new packing (401/5), lubricated with Engine Oil P03−001, to adapter (401/6) and install adapter, threads lubricated with Engine Oil P03−001, to the valve opening (marked ENG OIL). Torque the adapter to 650 − 750 lb−in. (73.440 − 84.739 N.m).

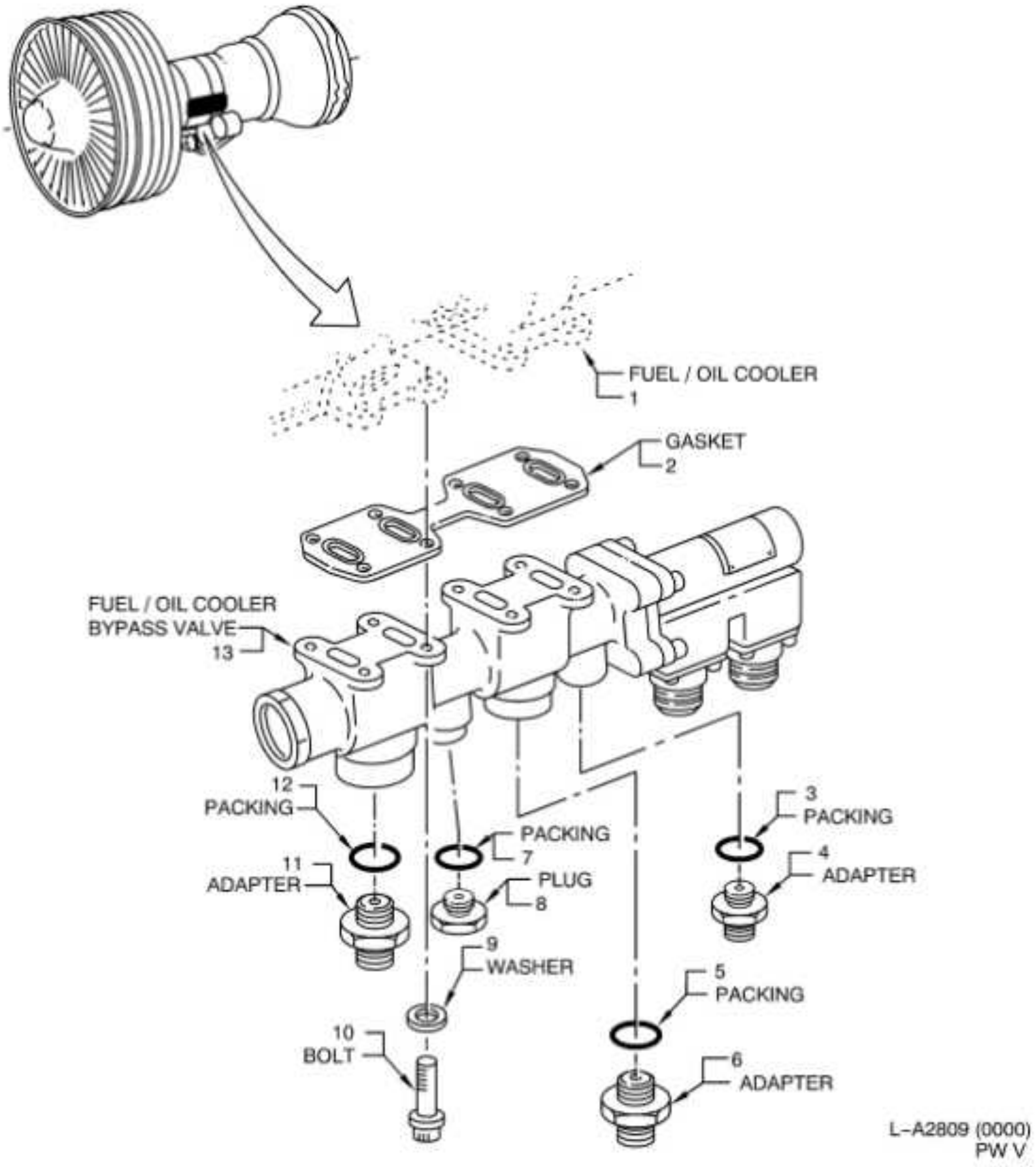
(d) Install new packing (401/7) lubricated with Engine Oil P03−001, to plug (401/8) and install plug, threads lubricated with Engine Oil P03−001, to small port (marked DRN). Torque plug 110 − 120 lb−in. (12.428 − 13.558 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the plug.

(3) Position gasket (401/2) to bypass valve (401/13) and position valve to fuel/oil cooler (401/1) and secure with eight bolts (401/10), threads lubricated with Engine Oil P03−001 and washers (401/9). Torque bolts 85 − 95 lb−in. (9.604 − 10.734 N.m).

C. Postrequisites

(1) Install fuel/oil cooler. See Installation−04 Task 72−00−35−450−001−A00.

(2) Test engine per Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


FUEL / OIL COOLER
1
GASKET
2
FUEL / OIL COOLER
BYPASS VALVE
13
12
PACKING
PACKING
7
3
PACKING
11
ADAPTER
PLUG
8
4
ADAPTER
9
WASHER
5
PACKING
10
BOLT
6
ADAPTER
L-A2809 (0000)
PW V

Fuel/Oil Cooler Bypass Valve Installation
Figure 401
(Task 72−00−35−450−008)

Previous Pageblock   Return to Previous Menu   Next Pageblock

Task 72-00-35-450-009:

1. Install 9th Stage Start/Stability (2.9) Bleed Valve (Upper Left)

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:
PWA 85436 Adapter, Torque

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-021	Compound, Antigalling (PWA 550-3)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Gasket	1	75-35-00	1	1
Gasket	1	75-35-00	1	40

B. Procedure
See Figure 401.

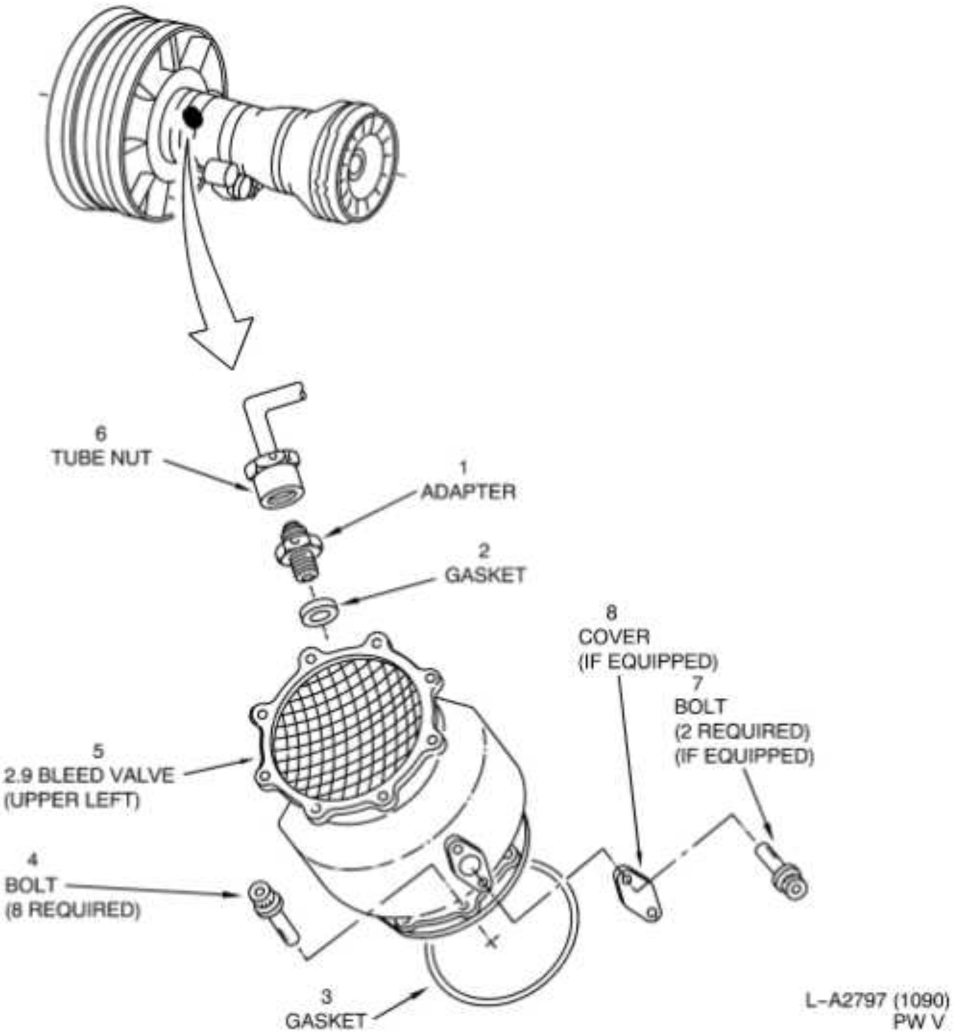
(1) Install gasket (401/2) on adapter (401/1). Lubricate adapter threads with Engine Oil (P03-001).

(2) Remove protective closure and install adapter (401/1) in boss on bleed valve (401/5). Torque adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m).

(3) If equipped remove the protection cover from the boss on the side of the bleed valve. Install the cover (401/8) to the boss and attach the bolts (401/7), threads lubricated with Engine Oil (P03-001). Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(4) Remove protective closure from boss on left side of HPC case at approximately 10 o'clock position and install gasket (401/3) in groove on boss.

CAUTION: WHEN USING PWA 85436 TORQUE ADAPTER THE ACTUAL TORQUE WRENCH READING WILL BE LESS THAN THAT


6
TUBE NUT
1
ADAPTER
2
GASKET
8
COVER
(IF EQUIPPED)
7
BOLT
(2 REQUIRED)
(IF EQUIPPED)
5
2.9 BLEED VALVE
(UPPER LEFT)
4
BOLT
(8 REQUIRED)
3
GASKET
L-A2797 (1090)
PW V

Ninth Stage Start/Stability (2.9)
Bleed Valve Installation
Figure 401
(Task 72-00-35-450-009)

STATED BELOW. SEE STANDARD TORQUES IN STANDARD PRACTICES MANUAL.

(5) Remove protective closure from bleed valve (401/5) and install valve to boss aligning adapter (401/1) with tube nut (401/6). Secure bleed valve with eight bolts (401/4), lubricated with Engine Oil (P03−001). Using PWA 85436 Torque Adapter tighten and torque bolts (401/4) to 85 − 95 lb−in. (9.604 − 10.734 N.m) then restore to required limit without loosening until required torque is maintained.

(6) Connect tube nut (AA30) (401/6) threads lubricated with Antigalling Compound (P06−021), to adapter (401/1) on bleed valve. Torque to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292).

C. Postrequisites

(1) Test engine per Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).

Task 72-00-35-450-010:

1. Install 9th Stage Start/Stability (2.9) Bleed Valve (Upper Right)

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 85436 Adapter, Torque

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Gasket	1	75-35-00	1	1
Gasket	1	75-35-00	1	40

B. Procedure
See Figure 401.

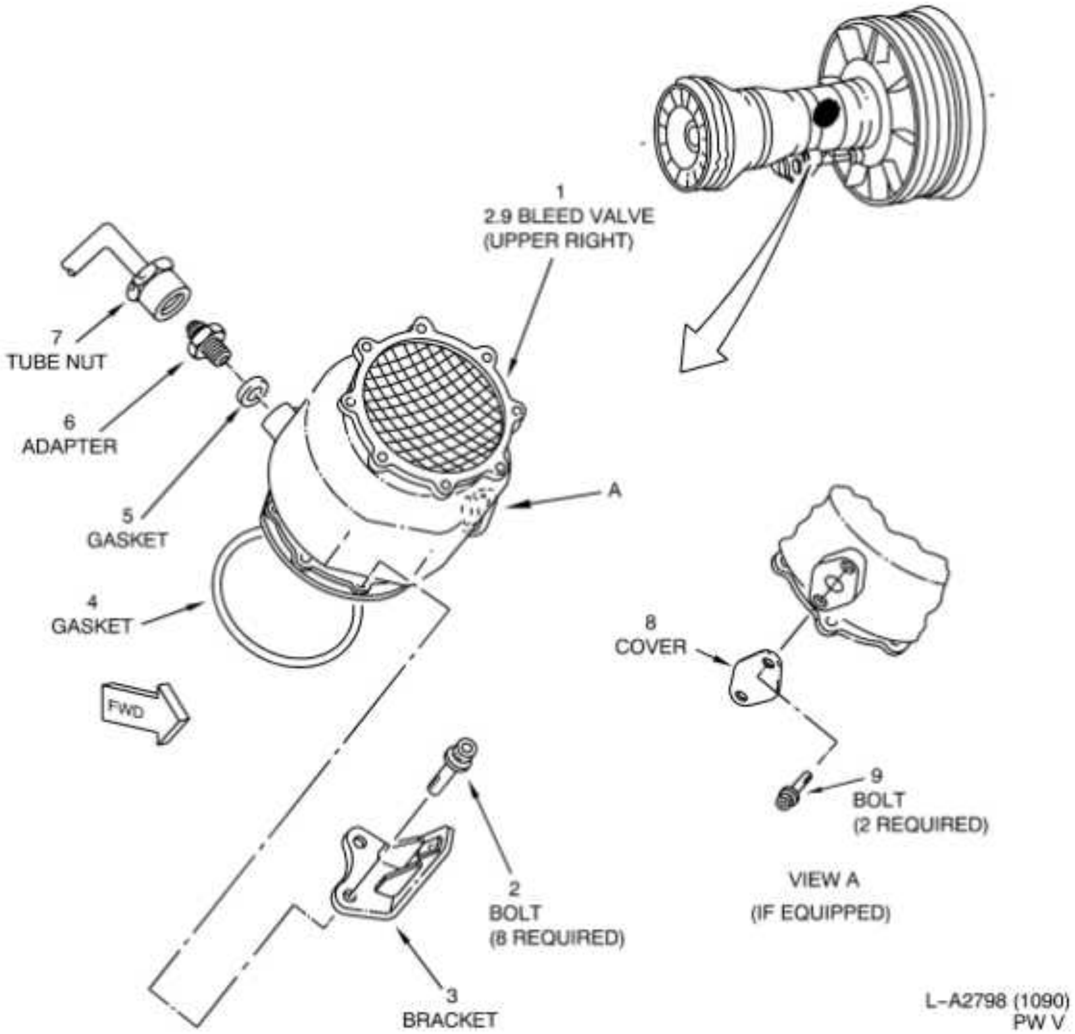
(1) Install gasket (401/5) on adapter (401/6). Lubricate adapter threads with Engine Oil (P03-001).

(2) Remove protective closure and install adapter (401/6) in boss on bleed valve (401/1). Torque adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m).

(3) If equipped remove the protection cover from the boss on the side of the bleed valve. Install the cover (401/8) to the boss and attach the bolts (401/9), threads lubricated with Engine Oil (P03-001). Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(4) Remove protective closure from boss on right side of HPC case at approximately 1 o'clock position and install gasket (401/4) in groove on boss.

CAUTION: WHEN USING PWA 85436 TORQUE ADAPTER THE ACTUAL TORQUE WRENCH READING WILL BE LESS THAN THAT


1
2.9 BLEED VALVE
(UPPER RIGHT)
7
TUBE NUT
6
ADAPTER
5
GASKET
4
GASKET
A
FWD
8
COVER
9
BOLT
(2 REQUIRED)
VIEW A
(IF EQUIPPED)
2
BOLT
(8 REQUIRED)
3
BRACKET
L−A2798 (1090)
PW V

Ninth Stage Start/Stability (2.9)
Bleed Valve Installation (Upper Right)
Figure 401
(Task 75−00−35−450−010)

STATED BELOW. SEE STANDARD TORQUES IN STANDARD PRACTICES MANUAL.

(5) Remove protective closure from bleed valve (401/1) and install valve to boss aligning adapter (401/6) with tube nut (AA28) (401/7). Secure bleed valve with eight bolts (401/2), lubricated with Engine Oil (P03−001) and bracket (401/3). Using PWA 85436 Torque Adapter tighten and torque bolts (401/2) to 85 − 95 lb−in. (9.604 − 10.734 N.m) then restore to required limit without loosening until required torque is maintained.

(6) Connect tube nut (AA28) (401/7) threads lubricated with Engine Oil (P03−001), to adapter (401/6) on bleed valve. Torque to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292).

C. Postrequisites

(1) For engines with the 2.9 bleed valve thermocouple probe, install the probe. See 72−00−35, Installation−17 (Task 72−00−35−450−014).

(2) Test engine per Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).

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Task 72-00-35-450-011:

1. Install Engine Fuel/Oil Cooler Bypass Valve Solenoid

A. Equipment And Materials Necessary

Standard Tools:

Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
R	P06-053	Lubricant, Sealing Ring (PWA 36500)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	3	79-21-00/6/14

B. Procedure

See Figure 401.

R R R (1) Install the three packings (401/5) lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the fuel/oil cooler bypass valve solenoid (401/2).

(2) Install solenoid (401/2) to rear end of bypass valve (401/1), with electrical connectors facing downward, and secure with screws (401/3), threads lubricated with Engine Oil P03-001 and washers (401/4). Torque screws to 60 - 80 lb-in. (6.779 - 9.039 N.m).

(3) Connect the W5P5 and the W3P5 harness connectors to the solenoid front and rear, respectively, harness receptacles as follows. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make
R straight all the bent pins. If necessary, clean
R the connector and receptacle by SPOP 6 (Task
R 70-21-00-110-900). Refer to Section 70-21-00 in
R the Standard Practices Manual, PN 585005.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

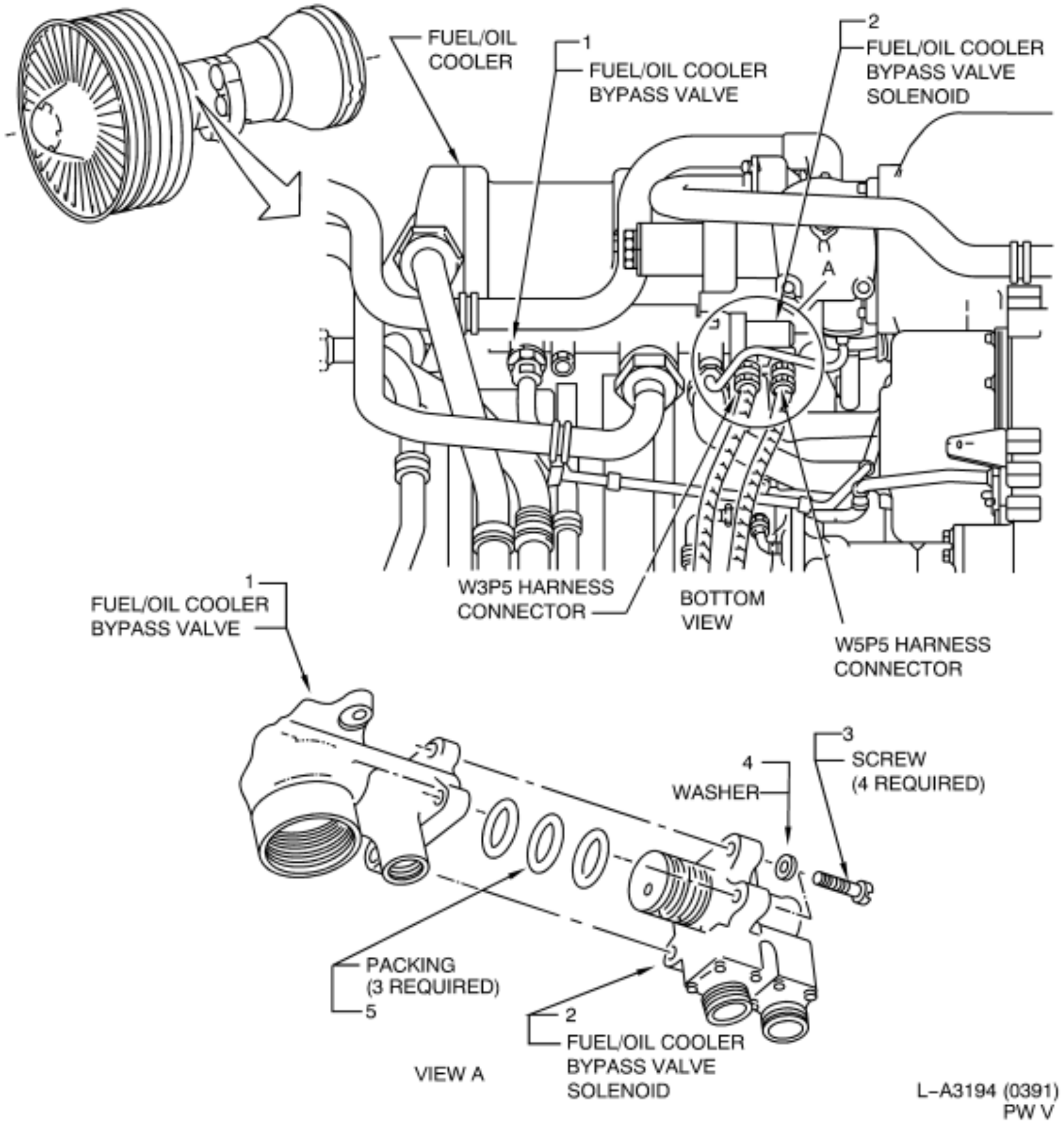
(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal)
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque. See the instructions given with the strap wrench for correct use.

C. Postrequisites

(1) Test engine per Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.

R
R


FUEL/OIL COOLER
1
FUEL/OIL COOLER BYPASS VALVE
2
FUEL/OIL COOLER BYPASS VALVE SOLENOID
A
1
FUEL/OIL COOLER BYPASS VALVE
W3P5 HARNESS CONNECTOR
BOTTOM VIEW
W5P5 HARNESS CONNECTOR
4
WASHER
3
SCREW (4 REQUIRED)
PACKING (3 REQUIRED)
5
2
FUEL/OIL COOLER BYPASS VALVE SOLENOID
VIEW A
L-A3194 (0391)
PW V

Fuel/Oil Cooler Bypass Valve Solenoid Installation
Figure 401
(Task 72-00-35-450-011)

Task 72-00-35-450-012:

1. Install Variable Stator Vane Actuator

A. Equipment And Materials Required

Standard Tools:

Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
R	P05-292	Ferrule, Safety Cable (Optional)
	P06-005	Lubricant (PWA 587)
	P06-037	Compound, Anti-seize (PWA 36053-4)
R	P06-053	Lubricant, Sealing Ring (PWA 36500)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	2	75-31-00/1/100
Key Washer	1	75-31-00/1/120
Packing	1	75-31-00/1/10
Packing	1	75-31-00/1/30

B. Procedure

See Figure 401.

(1) If new actuator (401/18) is being installed comply with the following:

R (a) Install the new packings (401/13) and (401/14),
R lubricated with Engine Oil P03-001 or Sealing Ring
R Lubricant P06-053 on the adapters (401/12) and
R (401/15). Remove the protective closures from actuator ports and install adapters, threads lubricated with Engine Oil P03-001. Torque smaller adapter at return port to 110 - 120 lb-in. (12.428 - 13.558 N.m). Torque larger adapter at pressure port to 150 - 170 lb-in. (16.948 - 19.207 N.m). Install the Lockwire P05-289 or

Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(b) Install nut (401/17), new key washer (401/19) and rod end bearing (401/24) to actuator (401/18). Do not tighten nut or bend keywasher.

(2) Position actuator (401/18) to support bracket (401/5) with rod end bearing (401/24) up through hole in support bracket. Align side mount holes in actuator with openings in support bracket. Apply Lubricant P06-005 or Anti-seize Compound P06-037 to the bearing pins (401/4) and insert pins through support brackets bearings to engage the actuator. Tap to seat. Install bearing stops (401/7) to bracket aligning bolt hole in stop with hole in bracket. Secure stops with bolts (401/3), threads lubricated with Engine Oil P03-001, washers (401/25) (SB PW4ENG 72-498) and nuts (401/2). Torque nuts to 36 - 40 lb-in. (4.067 - 4.519 N.m). Install cotter pins (401/1) and bend to lock. See Standard Practices Manual.

NOTE: With some tolerance conditions, the clearance between the bolt hole in the bearing stop (401/7) and the bolt (401/3) possibly is not sufficient for a satisfactory installation of the bolt. If this occurs, see SB PW4ENG 75-38 for the repair procedure.

(3) Secure rod end bearing (401/24) to compressor stator bellcrank with shoulder bolt (401/23), threads lubricated with Engine Oil P03-001, washer (401/22) and nut (401/20), fingertight only.

(4) Secure ground cable (401/11) to actuator (401/18) with bolt, threads lubricated with Engine Oil P03-001. Torque bolt to 75 - 85 lb-in. (8.474 - 9.604 N.m).

(5) Connect the W4P3 and the W5P7 harness connectors to the actuator harness receptacles as follows. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make
R straight any bent pins. If necessary, clean
R the connector and receptacle by SPOP 6 (Task
R 70-21-00-110-900). Refer to Section 70-21-00 in
R the Standard Practices Manual, PN 585005.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

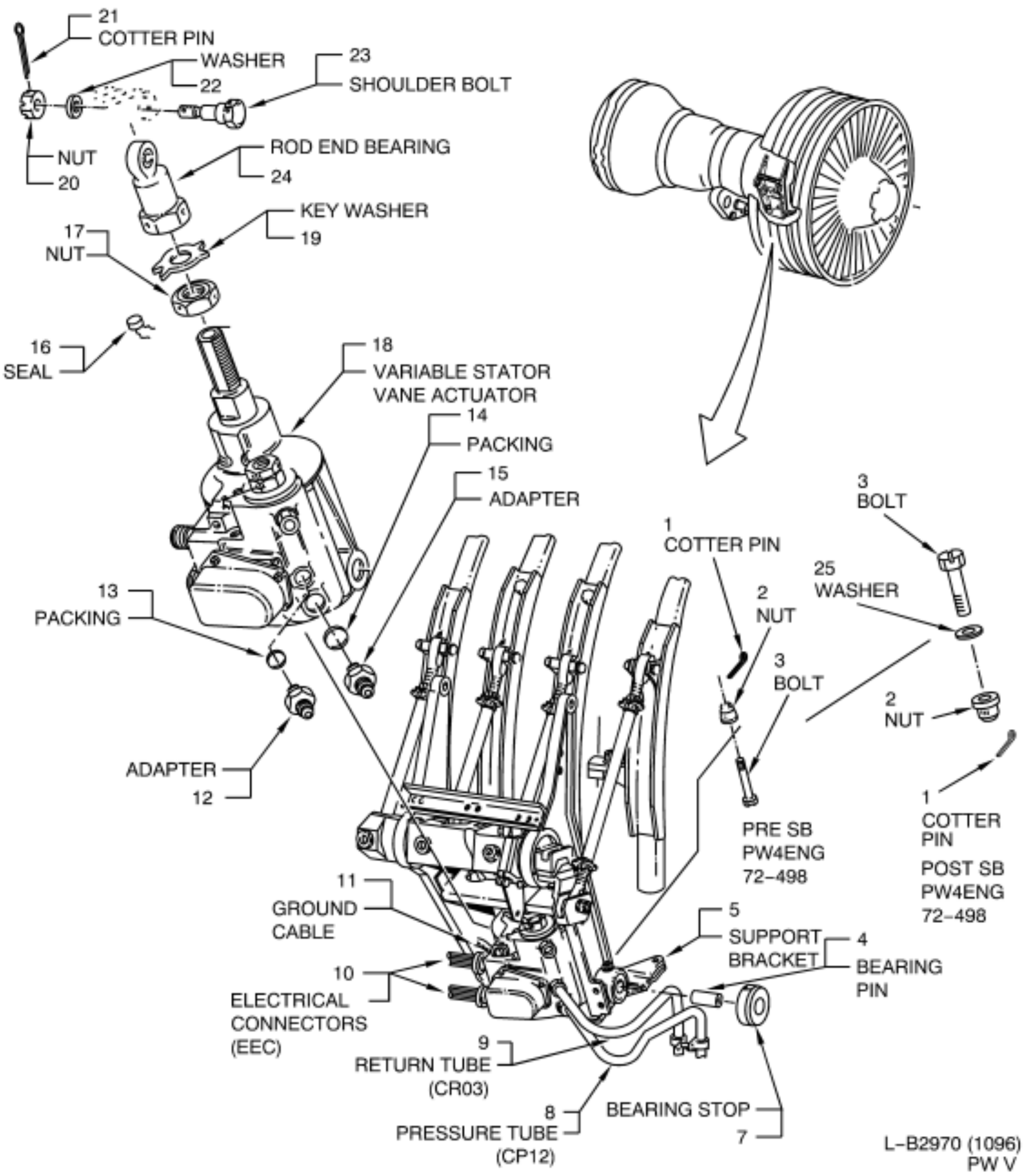
NOTE: See the instructions given with the strap wrench for correct use.

NOTE: Hydraulic pressure and return tubes will be torqued during rigging procedure.

C. Postrequisites

(1) Rig variable stator vane actuator per 72−00−00, Special Procedures−05 Task 72−00−00−830−003.

R
R


21
COTTER PIN
WASHER
22
23
SHOULDER BOLT
NUT
20
ROD END BEARING
24
KEY WASHER
19
17
NUT
16
SEAL
18
VARIABLE STATOR VANE ACTUATOR
14
PACKING
15
ADAPTER
3
BOLT
1
COTTER PIN
25
WASHER
2
NUT
3
BOLT
2
NUT
13
PACKING
1
COTTER PIN
ADAPTER
12
PRE SB PW4ENG 72-498
POST SB PW4ENG 72-498
11
GROUND CABLE
5
SUPPORT BRACKET
4
BEARING PIN
10
ELECTRICAL CONNECTORS (EEC)
9
RETURN TUBE (CR03)
8
PRESSURE TUBE (CP12)
BEARING STOP
7
L-B2970 (1096)
PW V

Variable Stator Vane Actuator Installation
Figure 401
(Task 72-00-35-450-012)

Task 72-00-35-450-013:

1. Install PS3 Air Filters

A. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 Or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
R	P05-292	Ferrule, Safety Cable (Optional)
	P06-021	Compound, Antigalling (PWA 550-3)
R	P06-054	Paste, Antiseize (PWA 36246)

B. Procedure
See Figure 401, Figure 402 and Figure 403.

(1) Remove protective closures.

(2) Position the air filters to holes in the Flange J brackets at approximately the 11 and 1:30 o'clock positions. Attach with bolts, threads lubricated with Engine Oil P03-001, and nuts. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(3) FOR THESE MODELS: 4152, 4156A, 4158
R Install tube nuts, threads lubricated with Antiseize
R Paste P06-054, to filters. Wipe off unwanted paste. Torque tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 from the forward tube nuts to the forward hex adapters. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 from the rear tube nuts to the filter covers.

(4) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install tubes (AA06), (AA76), (AA18) and (AA19) to the filters at approximately the 11 o'clock position with tube nut threads lubricated with Antigalling Compound P06-021. Torque the tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292

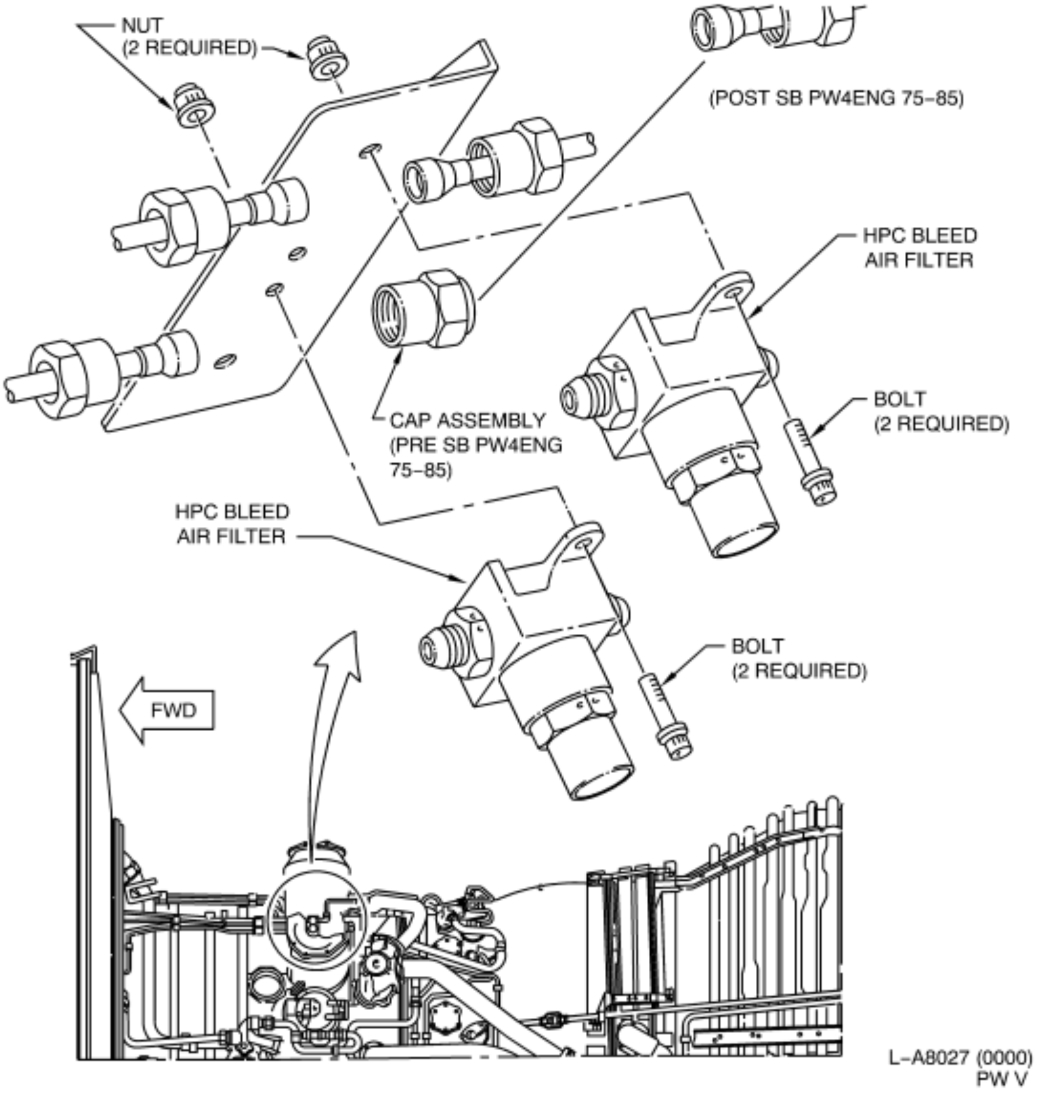
from the forward tubes to the forward hex adapters. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 from the rear tubes to the filter covers. See Figure 403 (Sheet 1).

(5) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install tubes (AA77), (AA01), (AA23) and (AA24) to the filters at approximately the 1:30 o'clock position with tube nut threads lubricated with Antigalling Compound P06−021. Torque the tube nuts to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 from the forward tubes to the forward hex adapters. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 from the rear tubes to the filter covers. See Figure 403 (Sheet 2).

(6) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 75−85), Install the cap assembles, threads lubricated with Engine Oil P03−001, to the filters. Torque the cap assemblies to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the cap assemblies.

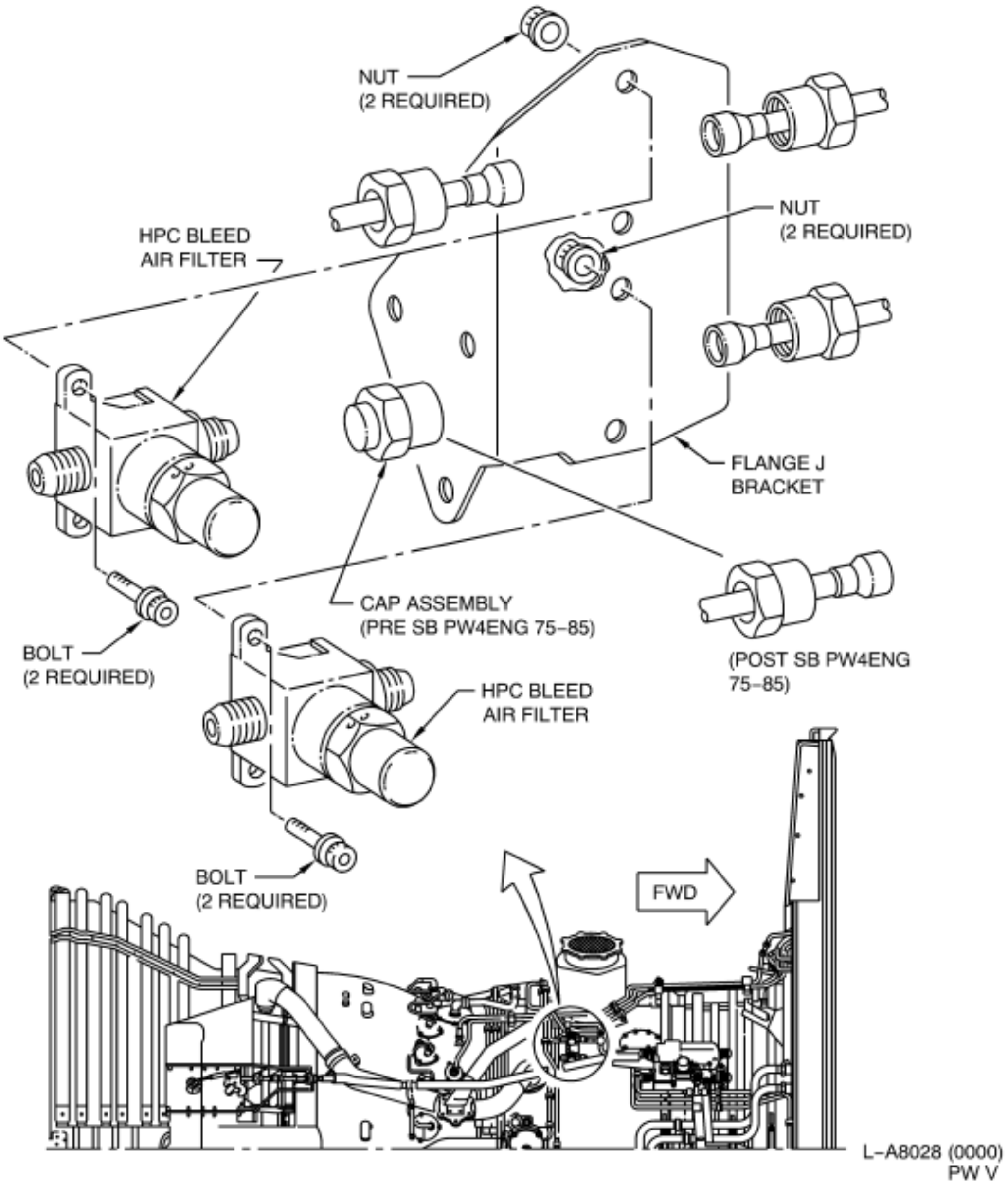
NOTE: FOR THESE MODELS: 4152, 4156A, 4158
HPC air valve signal tube was removed and cap assemblies installed on the air filter and the HPC air valve by Alert SB (PW4ENG 75−62R2).

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
HPC air valve signal tube was re−installed and the cap assemblies were removed from the air filter and the HPC air valve by SB (PW4ENG 75−85).

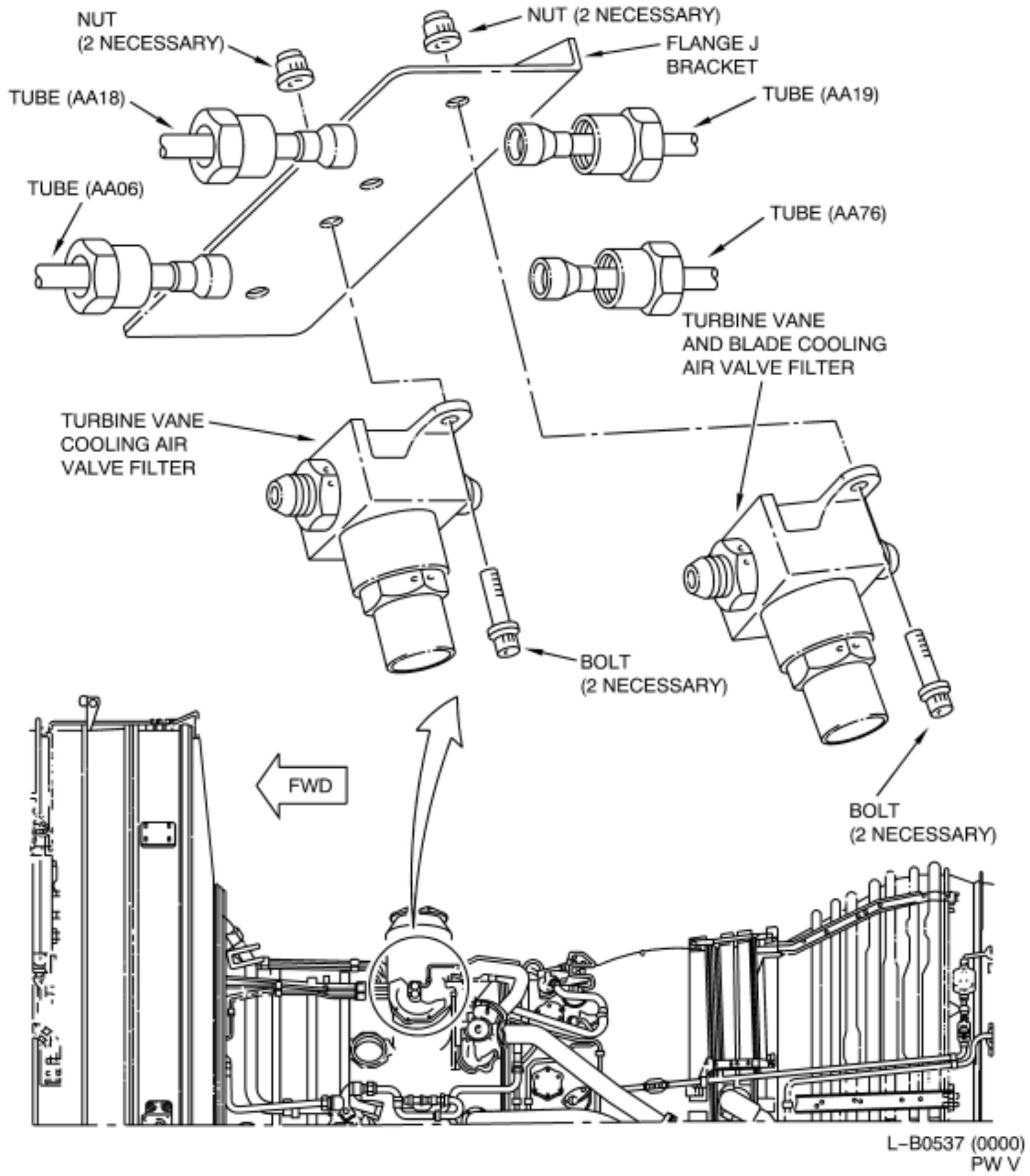

NUT
(2 REQUIRED)
(POST SB PW4ENG 75−85)
HPC BLEED
AIR FILTER
BOLT
(2 REQUIRED)
CAP ASSEMBLY
(PRE SB PW4ENG
75−85)
HPC BLEED
AIR FILTER
BOLT
(2 REQUIRED)
FWD
L−A8027 (0000)
PW V

HPC Bleed Air (PS3) Filters (Left)
Figure 401
(Task 72−00−35−450−013)

R

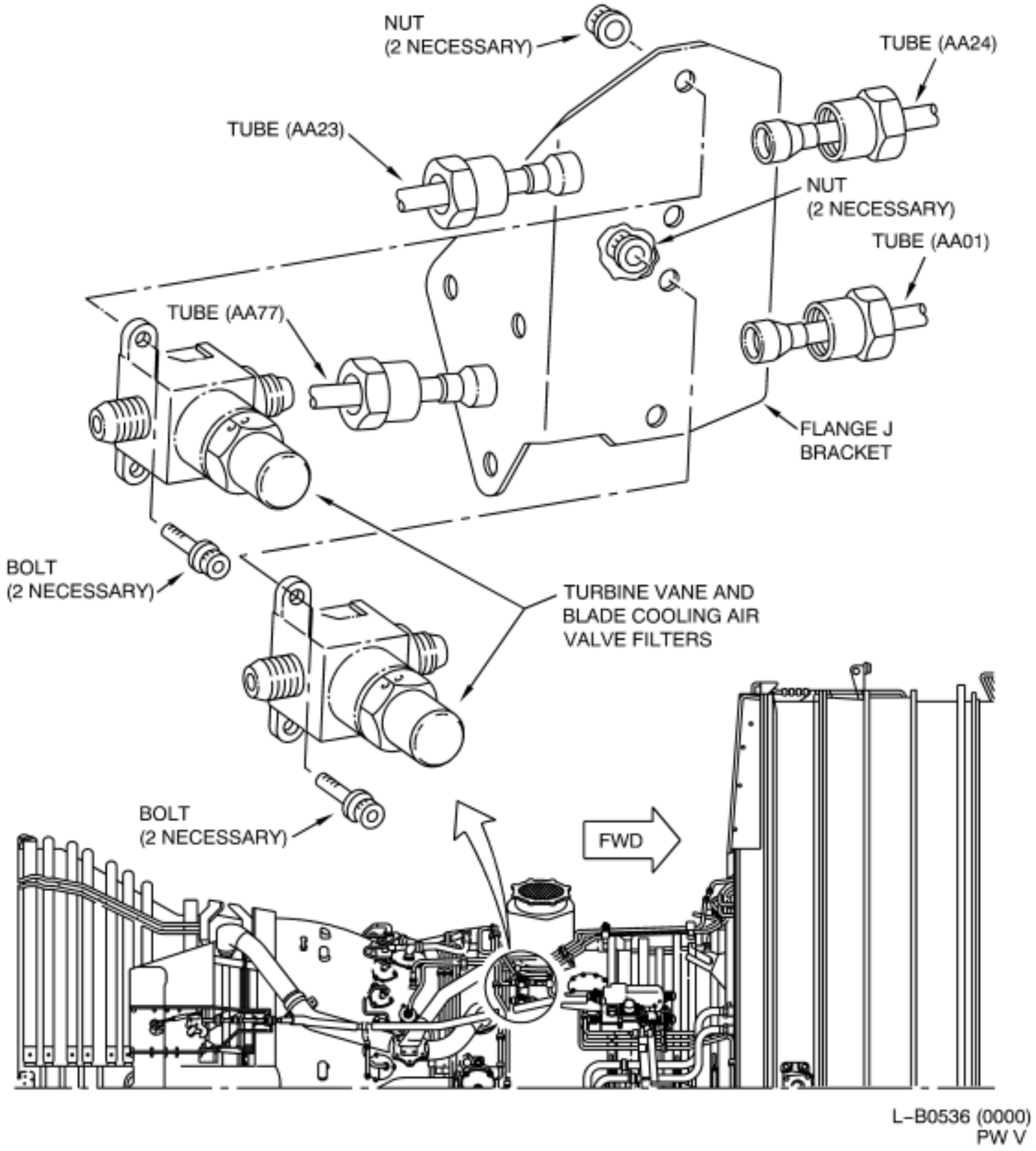

NUT
(2 REQUIRED)
NUT
(2 REQUIRED)
HPC BLEED
AIR FILTER
FLANGE J
BRACKET
CAP ASSEMBLY
(PRE SB PW4ENG 75-85)
BOLT
(2 REQUIRED)
(POST SB PW4ENG
75-85)
HPC BLEED
AIR FILTER
BOLT
(2 REQUIRED)
FWD
L-A8028 (0000)
PW V

HPC Bleed Air (PS3) Filters (Right)
Figure 402
(Task 72-00-35-450-013)


NUT
(2 NECESSARY)
NUT (2 NECESSARY)
FLANGE J
BRACKET
TUBE (AA18)
TUBE (AA19)
TUBE (AA06)
TUBE (AA76)
TURBINE VANE
AND BLADE COOLING
AIR VALVE FILTER
TURBINE VANE
COOLING AIR
VALVE FILTER
BOLT
(2 NECESSARY)
FWD
BOLT
(2 NECESSARY)
L-B0537 (0000)
PW V

Turbine Vane And Blade Cooling Air (PS3) Filters (Left)
Figure 403 (Sheet 1)
(Task 72-00-35-450-013)

R
R


NUT
(2 NECESSARY)
TUBE (AA24)
TUBE (AA23)
NUT
(2 NECESSARY)
TUBE (AA01)
TUBE (AA77)
FLANGE J
BRACKET
BOLT
(2 NECESSARY)
TURBINE VANE AND
BLADE COOLING AIR
VALVE FILTERS
BOLT
(2 NECESSARY)
FWD
L-B0536 (0000)
PW V

Turbine Vane And Blade Cooling Air (PS3) Filters (Right)
Figure 403 (Sheet 2)
(Task 72-00-35-450-013)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-35-450-014:

1. Install The 9th Stage Start/Stability (2.9) Bleed Valve Thermocouple

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

B. Procedure
See Figure 401 and Figure 402.

NOTE: Use this procedure for the installation of either the left, right, or both of the thermocouple probes.

(1) Remove the protection covers.

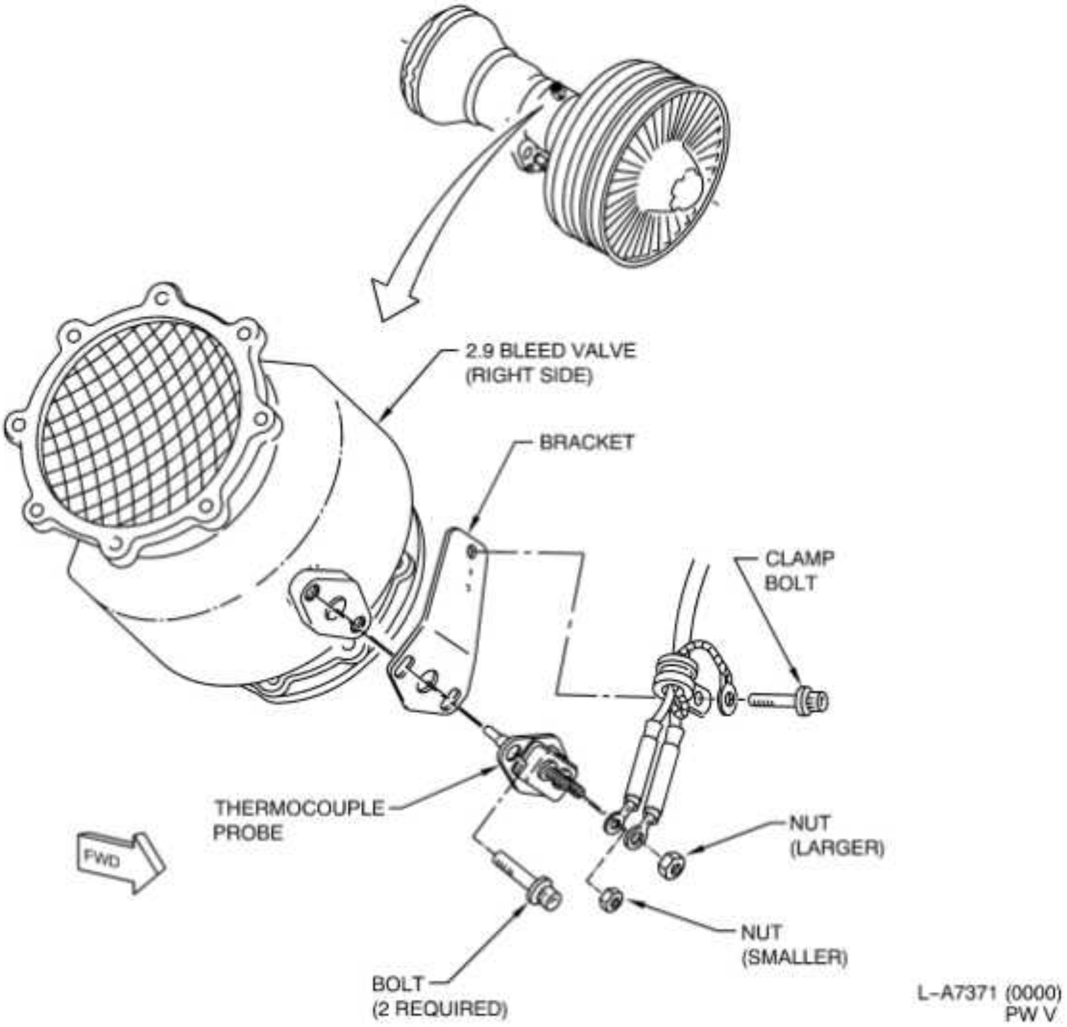
(2) Install the thermocouple probe and bracket to the port in the bleed valve as shown in the figure. Attach the bracket and probe with the two bolts, lubricated with Engine Oil P03-001. Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(3) Install the harness to the thermocouple probe with the two nuts. Tighten by hand.

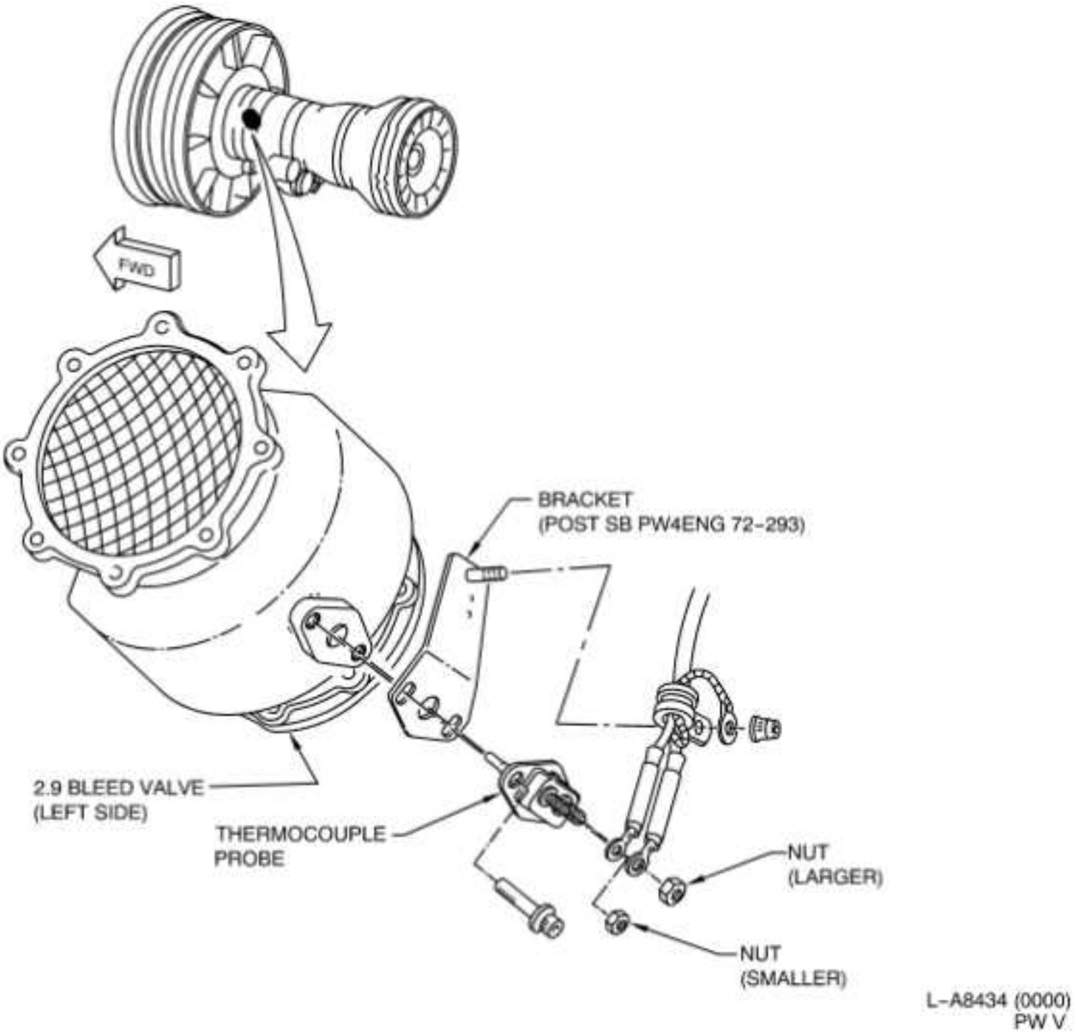
(4) Lubricate the welded bolt on the bracket with Engine Oil P03-001. Install the small ground cable and clamp and attach them to the bolt with a clamp nut. Torque the clamp nut to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(5) (Reference 2273) Torque the nut on the larger stud of probe to 18 - 22 lb-in. (2.034 - 2.486 N.m).

(6) (Reference 2273) Torque the nut on the smaller stud on probe to 15 - 18 lb-in. (1.695 - 2.034 N.m).


2.9 BLEED VALVE
(RIGHT SIDE)
BRACKET
CLAMP
BOLT
THERMOCOUPLE
PROBE
FWD
NUT
(LARGER)
NUT
(SMALLER)
BOLT
(2 REQUIRED)
L-A7371 (0000)
PW V

Ninth Stage Start/Stability (2.9) Bleed
Valve Thermocouple Probe (Right Side)
Figure 401
(Task 72−00−35−450−014)


FWD
BRACKET
(POST SB PW4ENG 72-293)
2.9 BLEED VALVE
(LEFT SIDE)
THERMOCOUPLE
PROBE
NUT
(LARGER)
NUT
(SMALLER)
L-A8434 (0000)
PW V

Ninth Stage Start/Stability (2.9) Bleed
Valve Thermocouple Probe (Left Side)
Figure 402
(Task 72−00−35−450−014)

Task 72-00-35-430-001:

1. Install The Upper Half Of The HPC Front Case After Accessing The 5th Through 8th Stage Blades

A. Prerequisites

(1) If removed, install the 5th through 8th stage blades. See Installation-19 Task 72-00-35-430-002.

B. Equipment And Materials Necessary

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 86564	Sling - HPC Front Split Case

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
	P05-395	Beeswax
	P05-396	Paraffin Wax Blend
R	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	8	72-35-00/12/280
Key Washer	8	72-35-00/13/280
Key Washer	8	72-35-00/14/280
Key Washer	8	72-35-00/15/280
Packing	A/R	72-35-00/11/170

C. Procedure

(1) Install the top HPC front case as follows:

(a) Install new packing material into the groove on the rear flange of the top HPC front case. Hold in place with small amounts of Beeswax P05-395 or Paraffin Wax Blend P05-396. The ends of the packing material must be even or below the case split line.

(b) Install PWA 86564 Sling to top half of HPC front case. Attach hoist and carefully install the case to the HPC. Remove sling.

(c) (Reference 1553) Attach the top case as follows:

1 Install the 22 bolts, lubricated with Engine Oil P03-001, and 22 nuts that attach the top case to the lower case.

NOTE: Tighten the bolts by hand.

2 Install the Flange H hardware as follows: Refer to 72-35-00 Assembly-21 (Task 72-35-00-430-021).

NOTE: Tighten the bolts by hand.

3 Tighten and torque the horizontal flanges to 565 - 595 lb-in. (63.836 - 67.226 N.m). Tighten these bolts in order per Figure 401.

(d) Tighten and torque the Flange H bolts to 180 - 200 lb-in. (20.337 - 22.597 N.m).

CAUTION: FIFTH AND SIXTH STAGE SYNCHRONIZING RING CLEVISES AND 7TH STAGE SYNCHRONIZING RING MUST BE USED IN SETS FOR SIX STATOR VANE SCHEDULE OR (19 STATOR VANE SCHEDULE (SB PW4ENG 72-197)

(2) Connect the upper and lower HPC synchronizing rings to each other as follows: See Figure 402.

(a) Install the clevis and plate to each stage.

NOTE: Do not intermix synchronizing plates and synchronizing rings. Make sure the correct synchronizing plate is used with the correct synchronizing ring.

(b) Attach each plate and clevis with to each stage with eight key washers and eight bolts, lubricated with Engine Oil P03−001.

NOTE: Turn the synchronizing rings as necessary to gain access to the clevis and plate bolts and key washers.

(c) Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Bend the key washer tubes to secure the bolts.

(3) Install the tubes to the top right side of the engine as follows. See Figure 403.

(a) Install the (left) bleed valve supply tube (AA30) as follows.

1 Remove the protection covers.

R R 2 Lubricate the tube threads with Antiseize Paste P06−054. Wipe off unwanted paste.

3 Install the tube and tighten by hand.

4 Install the clamps, bolts, lubricated with Engine Oil P03−001, and nuts. Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

5 Torque the rear tube nut to 200 − 225 lb−in. (22.597 − 23.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(b) Install the (right) bleed valve supply tube (AA28) as follows.

1 Remove the protection cover.

R R 2 Lubricate the tube threads with Antiseize Paste P06−054. Wipe off unwanted paste.

3 Install the tube and tighten by hand.

4 Install the clamps, bolts, lubricated with Engine Oil P03−001, and nuts. Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

5 Torque the rear tube nut to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(c) Install the HPC air valve and bleed valve supply manifold (AA24) as follows.

1 Remove the protection covers.

R R 2 Lubricate the tube threads with Antiseize Paste P06−054. Wipe off unwanted paste.

3 Install the tube and tighten by hand.

4 Install the clamps, bolts, lubricated with Engine Oil P03−001, and nuts. Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

5 Torque the rear tube nut to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(d) Install the HPC air valve signal tube (AA01) as follows.

1 Remove the protection covers.

R R 2 Lubricate the tube threads with Antiseize Paste P06−054. Wipe off unwanted paste.

3 Install the tube and tighten by hand.

4 Install the clamps, bolts, lubricated with Engine Oil P03−001, and nuts. Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

5 Torque the rear tube nut to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(e) Install the HPC air valve supply tube (AA25) as follows.

1 Remove the protection covers.

R 2 Lubricate the tube threads with Antiseize Paste
R P06−054. Wipe off unwanted paste.

3 Install the tube, forward end to nipple on TVBC solenoid and aft end to AA34.

4 Install the clamps, bolts, lubricated with Engine Oil P03−001, and nuts. Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

5 Torque the rear tube nut to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

CAUTION: DO NOT LUBRICATE EEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF EEC CAN RESULT.

(f) Install the EEC PB tube (AS09) as follows.

1 Remove protection covers.

2 Install the tube and tighten by hand.

3 Install the clamps, bolts, lubricated with Engine Oil P03−001, and nuts. Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

4 Torque the rear tube nut to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(4) Install the tubes to the top left side of the engine as follows. See Figure 404.

CAUTION: DO NOT LUBRICATE EEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF EEC CAN RESULT.

(a) For engines without the PT4.95 maintenance break at Flange K (Pre SB PW4ENG 73−106), install the EEC PT4.95 tube (AS01) as follows.

1 Remove the protection covers.

2 Install the tube and tighten by hand.

3 Install the clamps, bolts, lubricated with Engine Oil P03−001, spacer, and nuts. Torque the clamps bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

4 Torque the rear tube nut to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(b) For engines with the PT4.95 maintenance break at Flange K (Post SB PW4ENG 73−106), install the EEC PT4.95 tube (AS41) as foll

1 Remove the protection covers.

2 Install the tube and tighten by hand.

3 Install the clamps, bolts, lubricated with Engine Oil P03−001, and nuts. Torque the clamps bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

4 Torque the rear tube nut to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(c) Install the HPC (left) air valve signal tube (AA06) as follows.

1 Remove the protection covers.

R 2 Lubricate the tube threads with Antiseize Paste
R P06−054. Wipe off unwanted paste.

3 Install the tube and tighten by hand.

4 Install the clamps, bolts, lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

5 Torque the forward tube nut, attaching the solenoid adapter, and the rear tube nut to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(d) Install the air shutoff valve signal tube (AA18) as follows.

1 Remove protection covers.

R 2 Lubricate the tube nut threads with Antiseize
R Paste P06-054. Wipe off unwanted paste.

3 Install the tube and tighten by hand.

4 Install the clamps, bolts, lubricated with Engine Oil P03-001, spacer, and nuts. Torque the clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

5 Torque the forward tube nut, attaching to the solenoid adapter, the rear tube nut attaching to the air filter to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(e) Install the HPC air valve and air shutoff valve supply tube (AA22) as follows.

1 Remove the protection covers.

R 2 Lubricate the tube threads with Antiseize Paste
R P06-054. Wipe off unwanted paste.

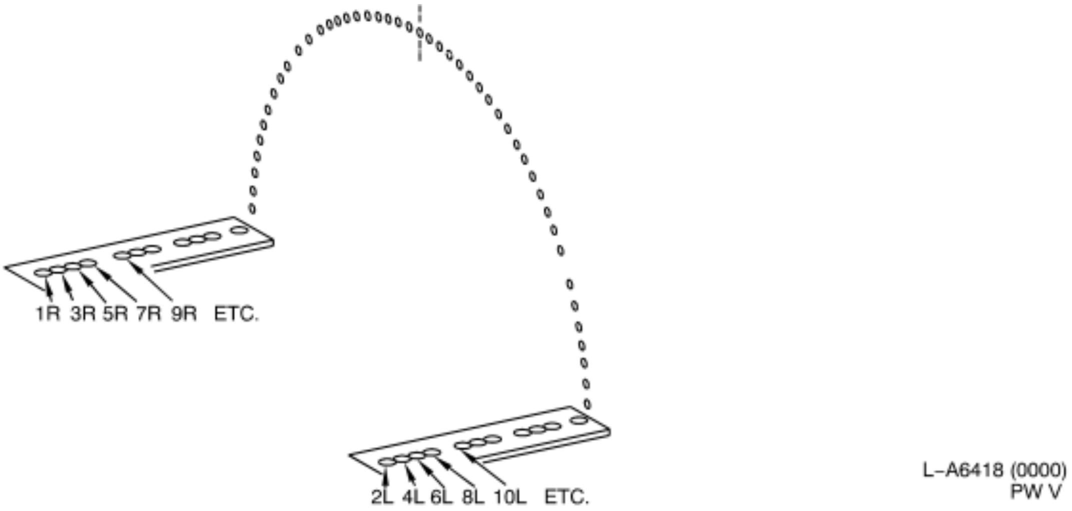
3 Install the tube and tighten by hand.

4 Install the clamps, bolts, lubricated with Engine Oil P03-001, spacer, and nuts. Torque the clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

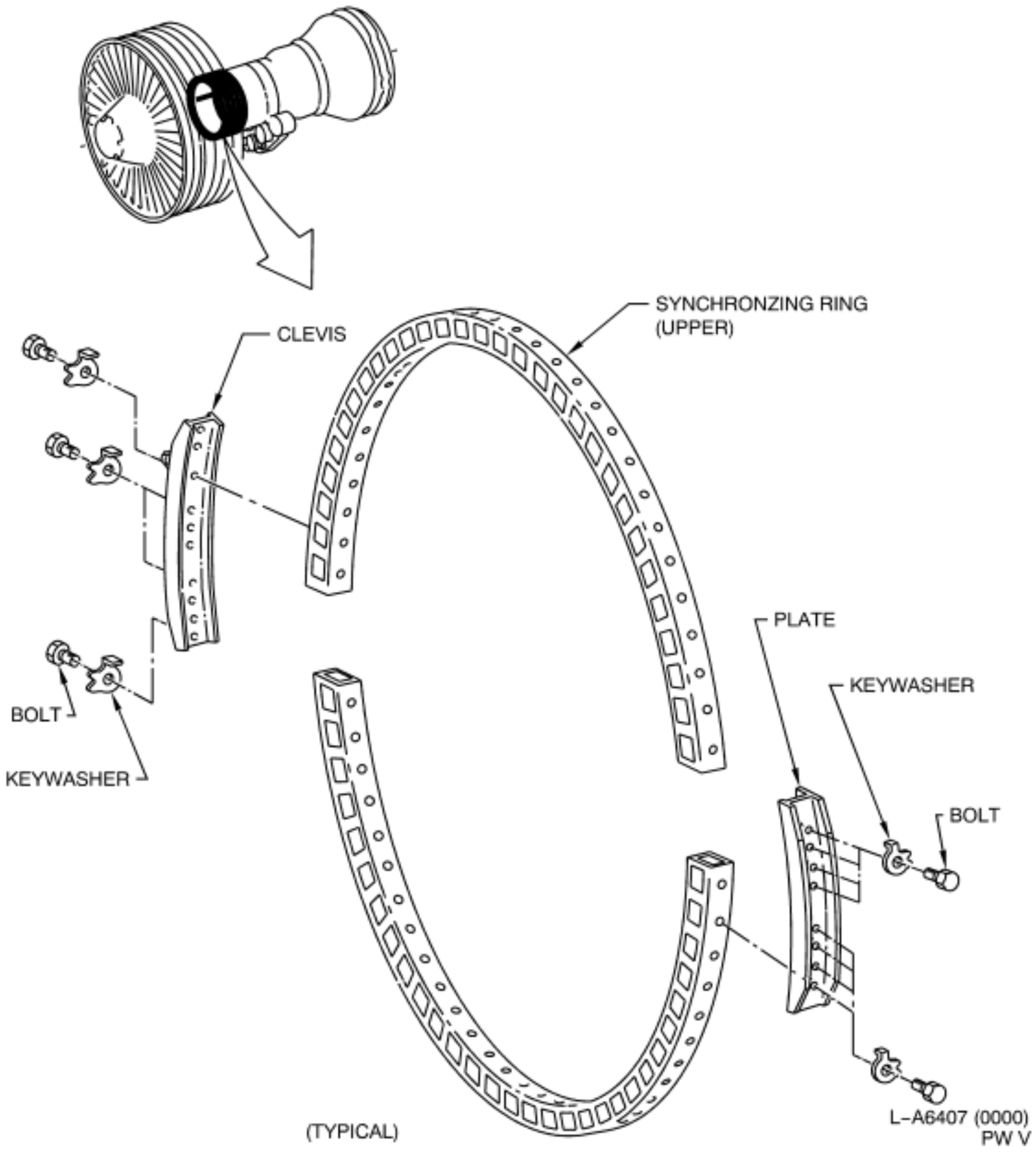
5 Torque the rear tube nut to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

D. Postrequisites

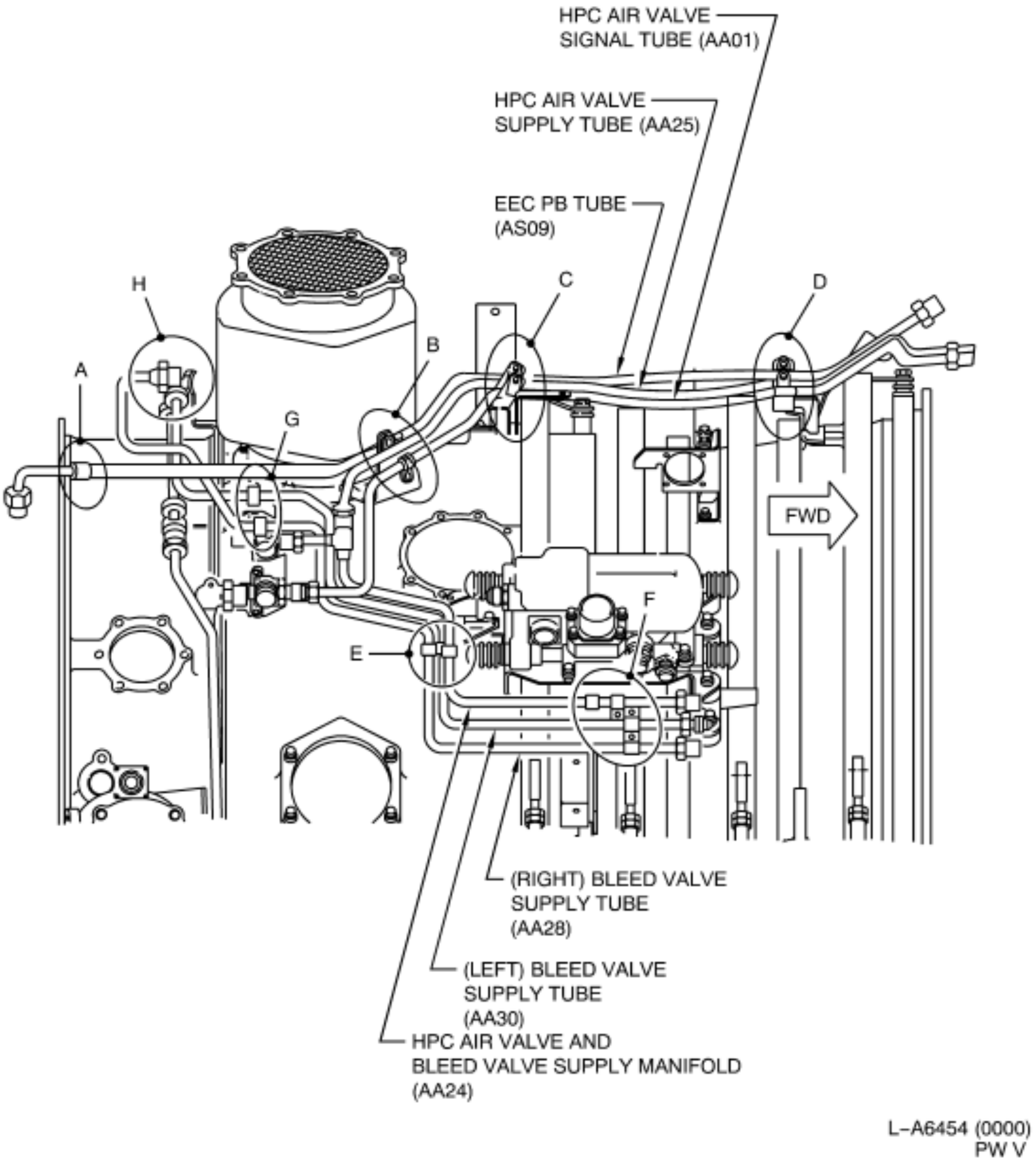
(1) Install the fan-unit to the core engine. See 72-00-34, Installation-21 (Task 72-00-34-420-004).


1R 3R 5R 7R 9R ETC.
2L 4L 6L 8L 10L ETC.
L−A6418 (0000)
PW V

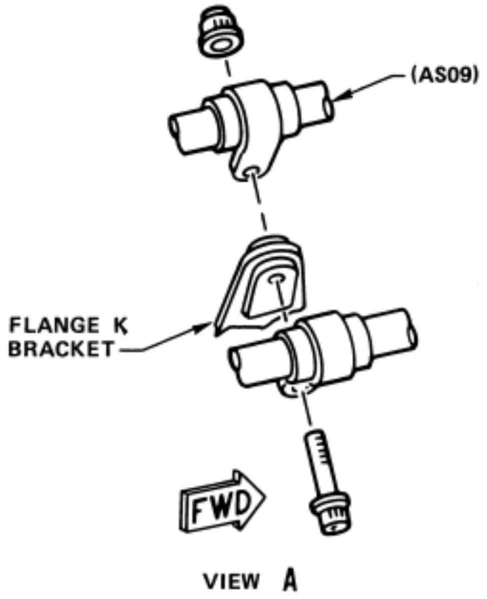
Top HPC Front Case Installation (Horizontal Flange Torque Sequence)
Figure 401
(Task 72−00−35−430−001)

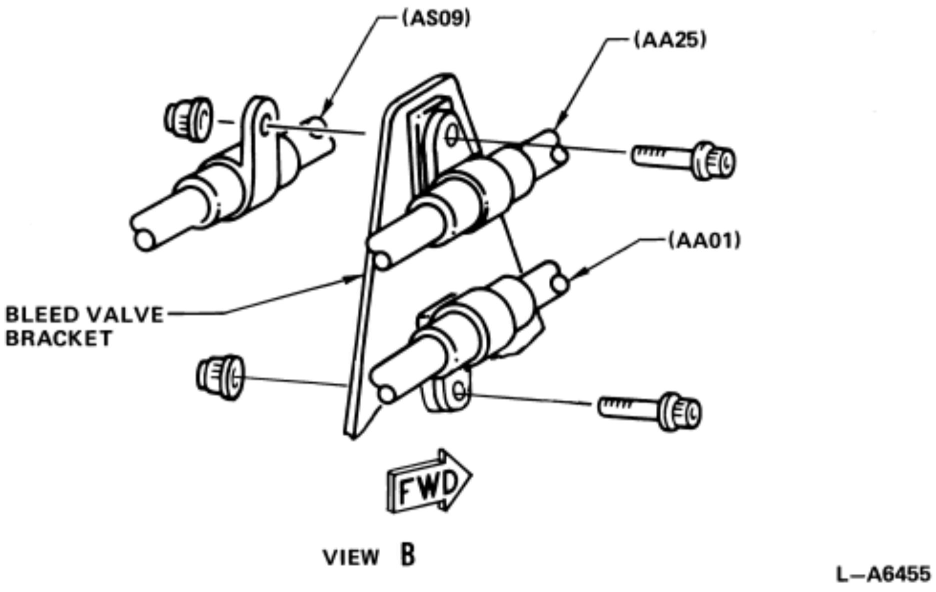

SYNCHRONZING RING
(UPPER)
CLEVIS
PLATE
KEYWASHER
BOLT
BOLT
KEYWASHER
(TYPICAL)
L-A6407 (0000)
PW V

HPC Synchronizing Ring (Typical)
Figure 402
(Task 72-00-35-430-001)

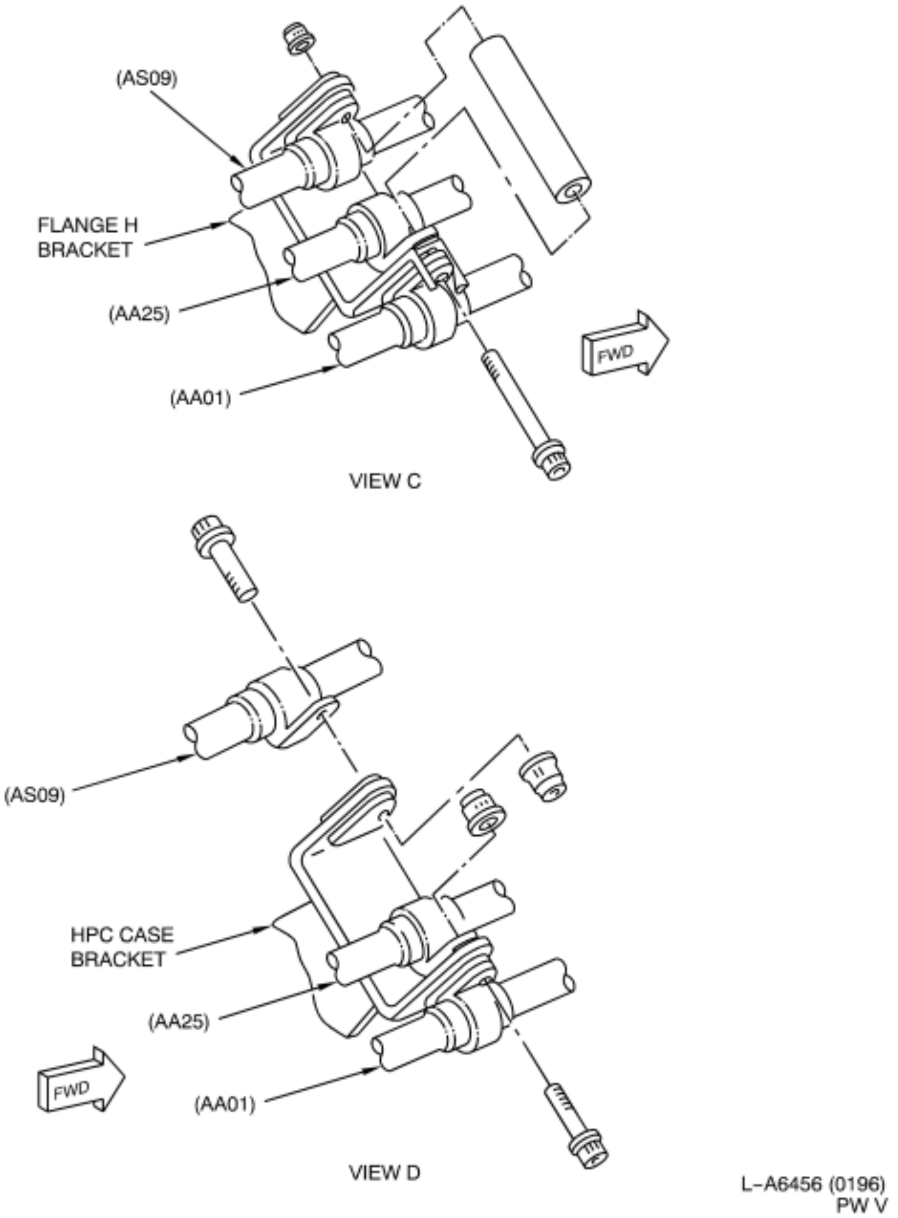

HPC AIR VALVE
SIGNAL TUBE (AA01)
HPC AIR VALVE
SUPPLY TUBE (AA25)
EEC PB TUBE
(AS09)
H
C
D
A
B
G
FWD
F
E
(RIGHT) BLEED VALVE
SUPPLY TUBE
(AA28)
(LEFT) BLEED VALVE
SUPPLY TUBE
(AA30)
HPC AIR VALVE AND
BLEED VALVE SUPPLY MANIFOLD
(AA24)
L-A6454 (0000)
PW V

Tube Installation (Right Side)
Figure 403 (Sheet 1)
(Task 72-00-35-430-001)

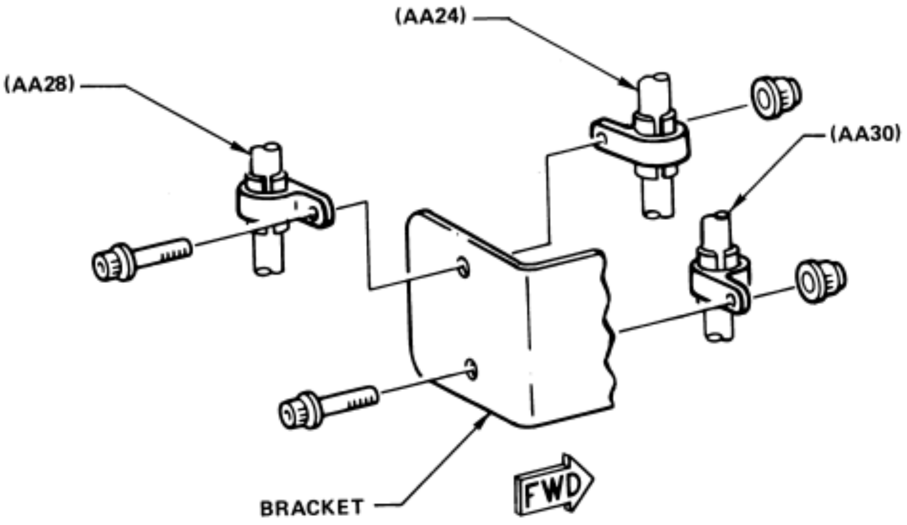

(AS09)
FLANGE K
BRACKET
FWD
VIEW A


(AS09)
(AA25)
(AA01)
BLEED VALVE
BRACKET
FWD
VIEW B
L−A6455

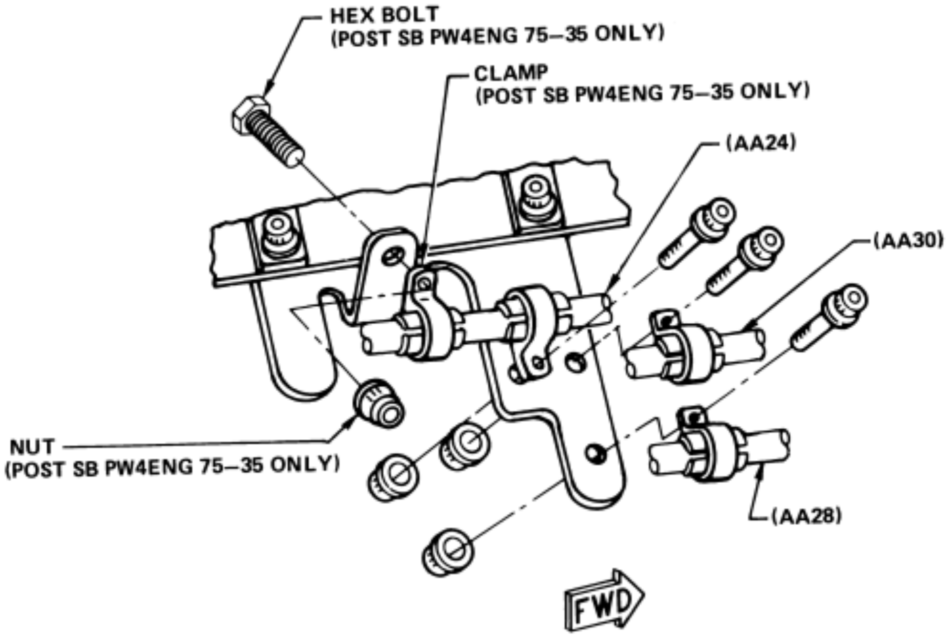
Tube Installation (Right Side)
Figure 403 (Sheet 2)
(Task 72−00−35−430−001)


(AS09)
FLANGE H BRACKET
(AA25)
(AA01)
FWD
VIEW C
(AS09)
HPC CASE BRACKET
(AA25)
FWD
(AA01)
VIEW D
L-A6456 (0196)
PW V

Tube Installation (Right Side)
Figure 403 (Sheet 3)
(Task 72-00-35-430-001)


(AA24)
(AA28)
(AA30)
BRACKET
FWD

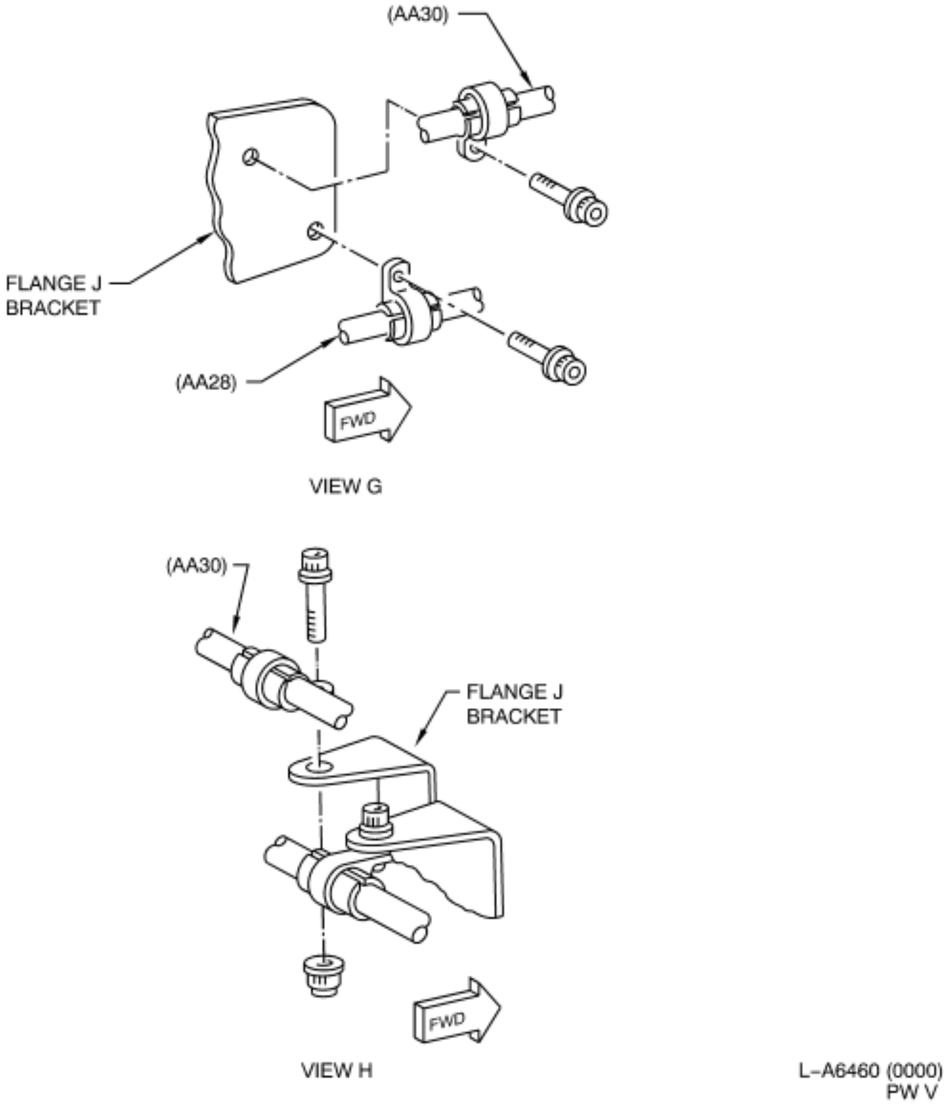
VIEW E


HEX BOLT
(POST SB PW4ENG 75-35 ONLY)
CLAMP
(POST SB PW4ENG 75-35 ONLY)
(AA24)
(AA30)
NUT
(POST SB PW4ENG 75-35 ONLY)
(AA28)
FWD

VIEW F

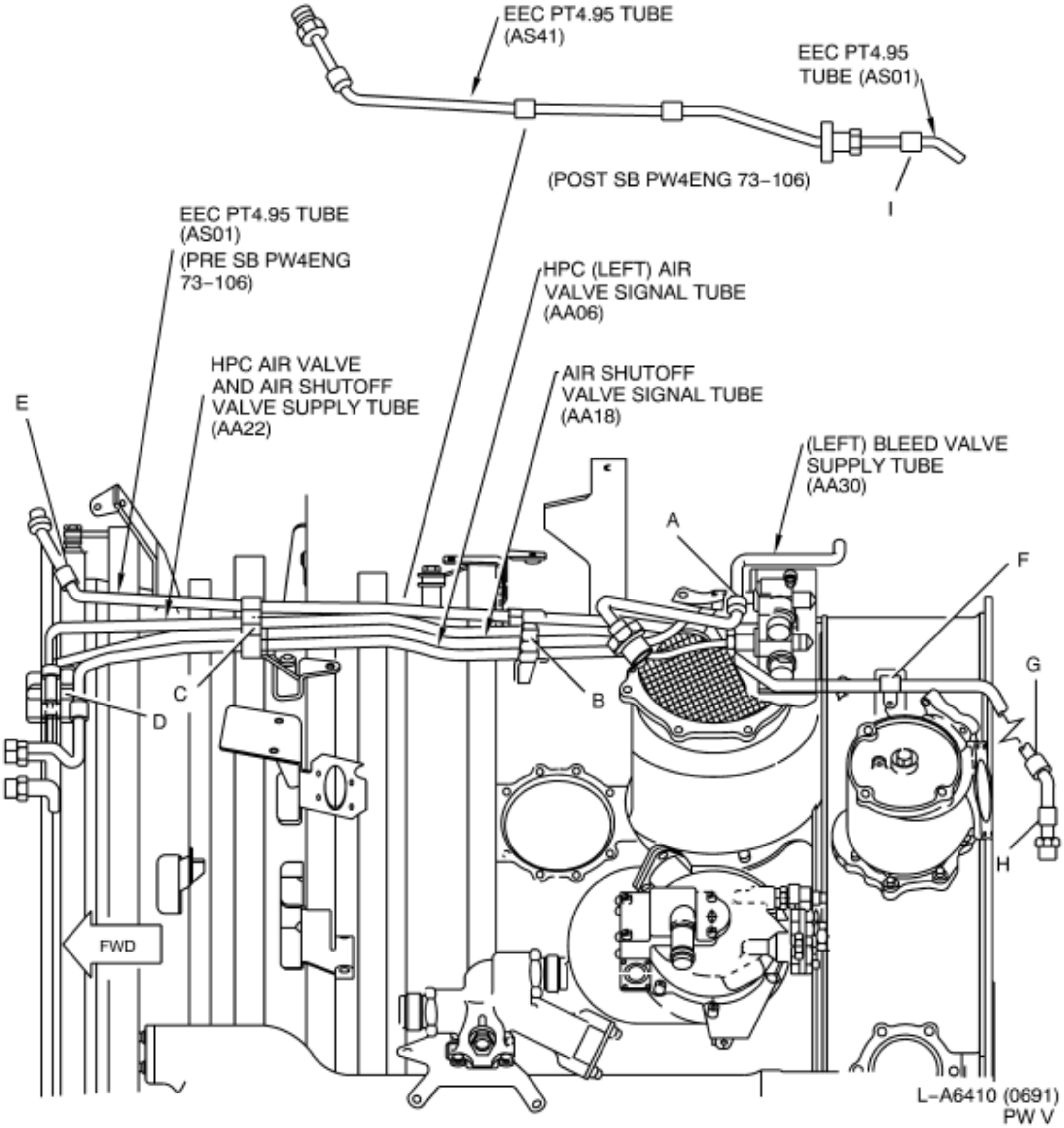
L-A6458

Tube Installation (Right Side)
Figure 403 (Sheet 4)
(Task 72-00-35-430-001)

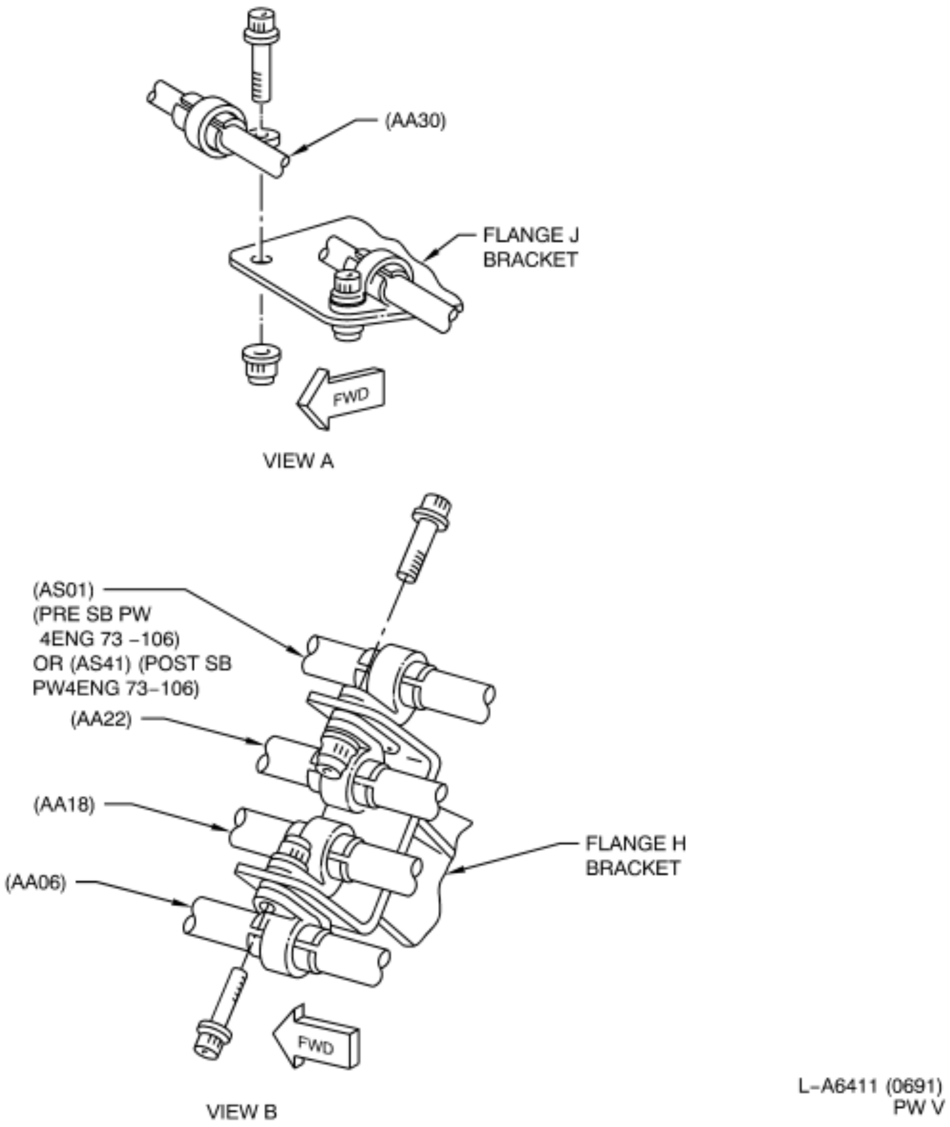

(AA30)
FLANGE J
BRACKET
(AA28)
FWD
VIEW G
(AA30)
FLANGE J
BRACKET
FWD
VIEW H
L−A6460 (0000)
PW V

Tube Installation (Right Side)
Figure 403 (Sheet 5)
(Task 72−00−35−430−001)

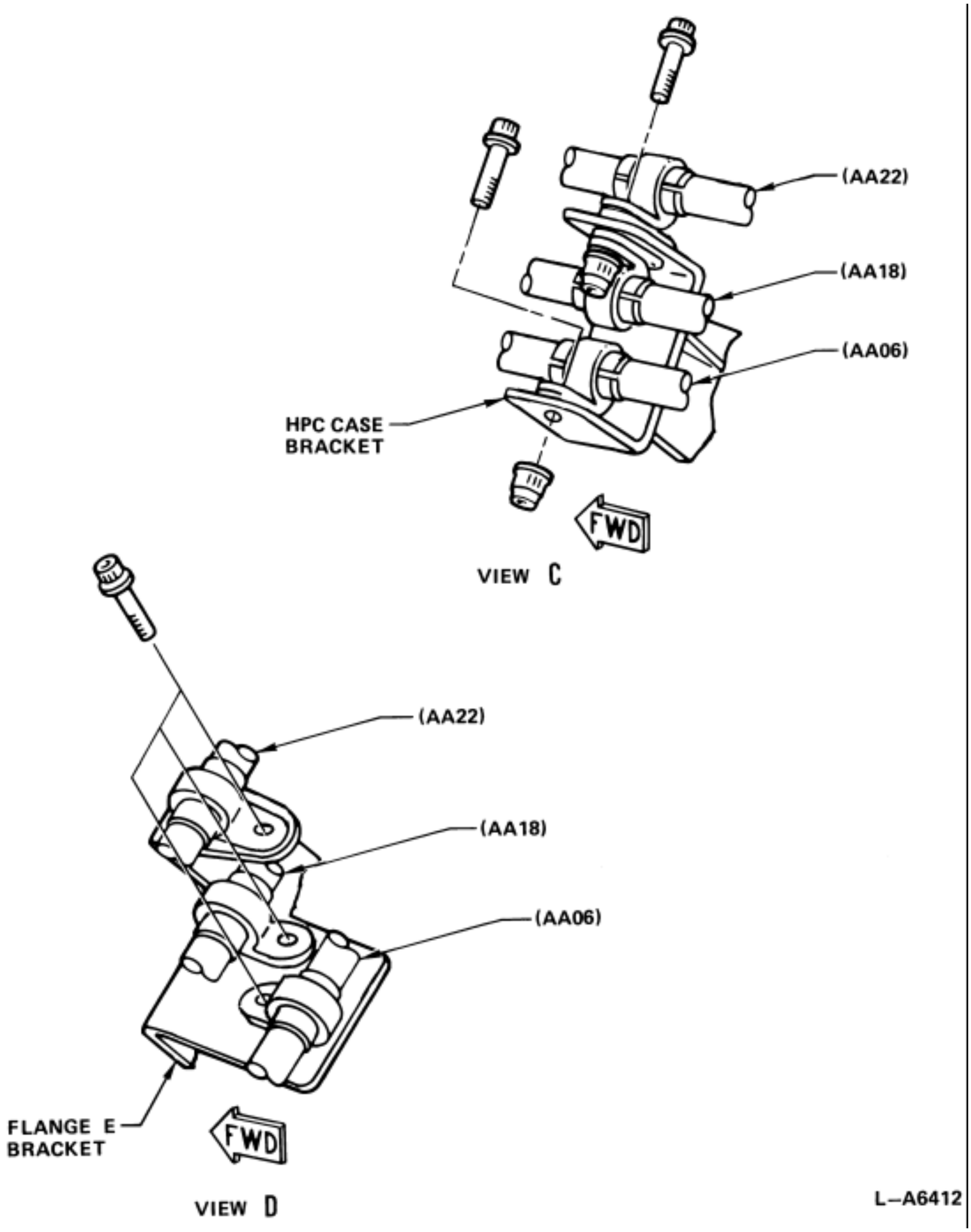
ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSTALLATION−18


EEC PT4.95 TUBE
(AS41)
EEC PT4.95
TUBE (AS01)
(POST SB PW4ENG 73−106)
I
EEC PT4.95 TUBE
(AS01)
(PRE SB PW4ENG
73−106)
HPC (LEFT) AIR
VALVE SIGNAL TUBE
(AA06)
HPC AIR VALVE
AND AIR SHUTOFF
VALVE SUPPLY TUBE
(AA22)
AIR SHUTOFF
VALVE SIGNAL TUBE
(AA18)
(LEFT) BLEED VALVE
SUPPLY TUBE
(AA30)
E
A
F
G
C
D
B
H
FWD
L−A6410 (0691)
PW V

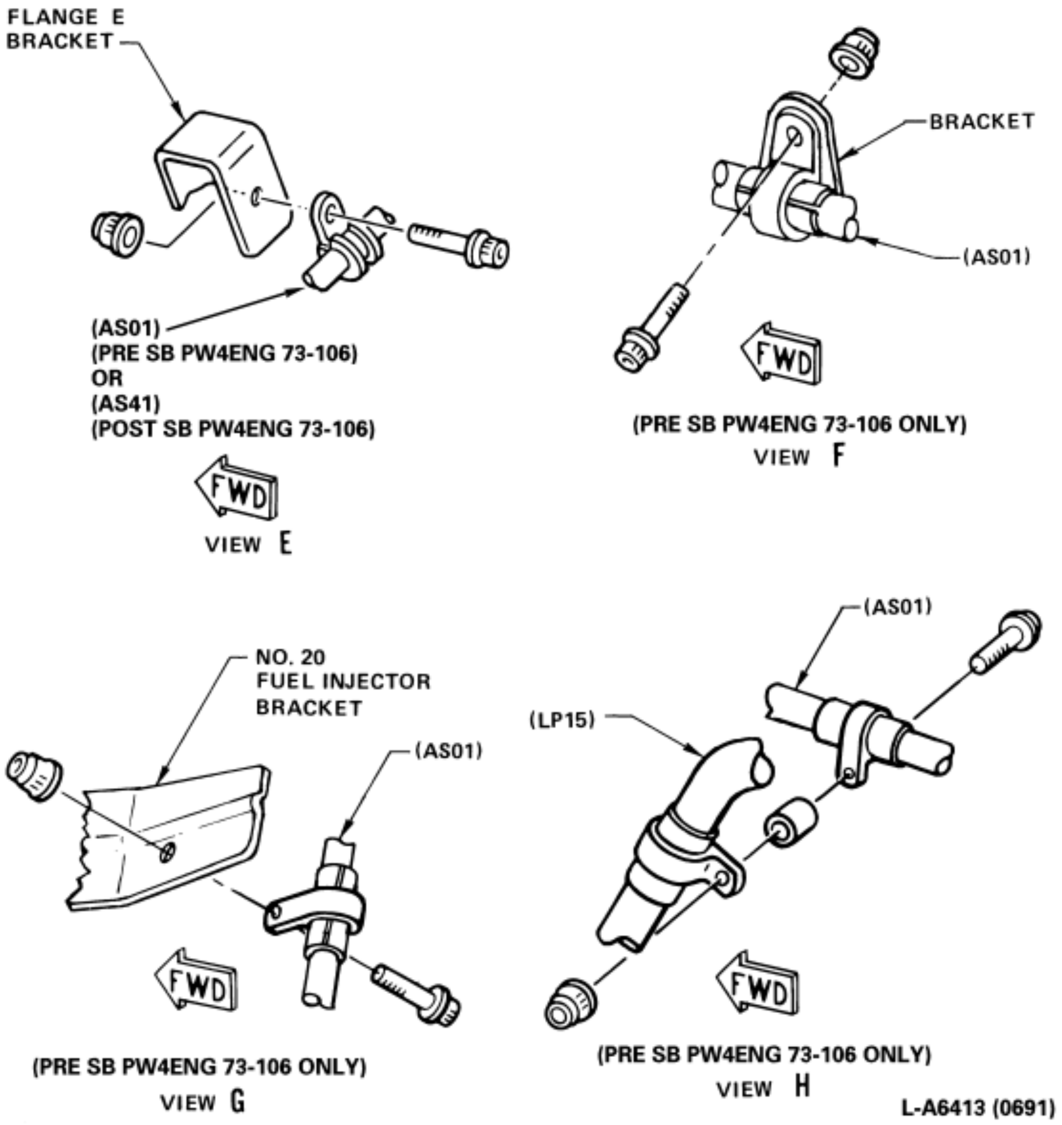
Tube Installation (Left Side)
Figure 404 (Sheet 1)
(Task 72−00−35−430−001)


(AA30)
FLANGE J BRACKET
FWD
VIEW A
(AS01) (PRE SB PW 4ENG 73 -106) OR (AS41) (POST SB PW4ENG 73-106)
(AA22)
(AA18)
(AA06)
FLANGE H BRACKET
FWD
VIEW B
L-A6411 (0691)
PW V

Tube Installation (Left Side)
Figure 404 (Sheet 2)
(Task 72-00-35-430-001)


(AA22)
(AA18)
(AA06)
HPC CASE BRACKET
FWD
VIEW C
(AA22)
(AA18)
(AA06)
FLANGE E BRACKET
FWD
VIEW D
L−A6412

Tube Installation (Left Side)
Figure 404 (Sheet 3)
(Task 72−00−35−430−001)


FLANGE E
BRACKET
(AS01)
(PRE SB PW4ENG 73-106)
OR
(AS41)
(POST SB PW4ENG 73-106)
FWD
VIEW E
BRACKET
(AS01)
FWD
(PRE SB PW4ENG 73-106 ONLY)
VIEW F
NO. 20
FUEL INJECTOR
BRACKET
(AS01)
FWD
(PRE SB PW4ENG 73-106 ONLY)
VIEW G
(AS01)
(LP15)
FWD
(PRE SB PW4ENG 73-106 ONLY)
VIEW H
L-A6413 (0691)

Tube Installation (Left Side)
Figure 404 (Sheet 4)
(Task 72−00−35−430−001)

Task 72-00-35-430-002:

1. Install The 5th Through 8th Stage HPC Blades (Quick HPC Blade Change)

A. Prerequisites

(1) Remove damaged 5th through 8th stage HPC blades. Refer to Removal−19 Task 72−00−35−030−002.

B. Equipment And Materials Required

Standard Tools:

Computer Program "BLADIS"

NOTE: The computer program (for the personal computer) is available from: Schenck Trebel Co., 535 Acorn St.,Deerpark, NY 11729

Special Tools:

PWA 78012	Bender, Pneumatic (Optional To PWA 100012 Change Letter A and PWA 102146)
PWA 78013	Bender, Pneumatic (Optional To PWA 100013)(Replaced By PWA 100014 Change Letter A)
PWA 78014	Bender, Pneumatic (Replaced By PWA 100013 Change Letter B)
PWA 86518	Bender, Mechanical (Optional To PWA 78012)
PWA 86519	Bender, Mechanical (Optional To PWA 78013)
PWA 86520	Bender, Mechanical (Optional To PWA 78014)
PWA 87123	Bender, Mechanical (Optional To PWA 86520)
PWA 87128	Bender, Mechanical (Optional To PWA 86518)
PWA 87129	Bender, Mechanical (Optional To PWA 86519)
PWA 100012	Bender Change Letter A, Pneumatic (Prebend) (With PWA 102146, Optional to PWA 78012)
PWA 100013	Bender Change Letter B, Pneumatic (Initial Bend) (Replaces PWA 78014 And Options)
PWA 100014	Bender Change Letter A, Pneumatic (Initial Bend) (Replaces PWA 78013 And Options)
PWA 100096	Bender, Pneumatic (Final Bend)
PWA 102146	Bender, Pneumatic (Final Bend) (With PWA 100012 Change Letter A, Optional to PWA 78012)
PWA 102171	Bender, Pneumatic (Final Bend)

Consumable Materials:

Item No.	Designation
P05-045	Pen, Marker
P09-014	Sealant, Silicone Rubber (PWA 36003)
P09-015	Sealing Compound (PWA 544)

C. Procedure

(1) Ensure that the protector is secured to prevent foreign material from falling into the engine.

CAUTION: SIXTH THROUGH EIGHTH STAGE BLADES THAT DO NOT HAVE EROSION OR MATERIAL REMOVAL BY BLENDING CAN BE REPLACED AS SINGLE (UNPAIRED) BLADES OF THE SAME PART NUMBER AS SPECIFIED IN TABLE 401. BLADES THAT ARE ERODED OR WERE PREVIOUSLY BLENDED MUST BE REPLACED IN BLADE PAIRS AS SPECIFIED IN TABLE 401.

(2) Obtain the blades to be replaced. Refer to Table 401 for the blade replacement guidelines. If the following blade replacement guidelines do not apply, then replace blades in order by computer program.

Blade Replacement Guidelines	Stage 5	Stage 6	Stage 7	Stage 8
Maximum number of unpaired blades (Original blades must not be eroded, blended, etc.)	0	2	4	4
or				
Maximum number of pairs of blades	6	8	10	10

Blade Replacement Limits
Table 401

(3) Mass weigh blades. Blade weight pairs must be within 0.025 oz. (709. mg). Temporarily mark the blade weight with a Marker P05-045 or equivalent.

(4) If a complete set of blades must be installed, pan weigh the blades to within 0.025 oz. (709. mg). Temporally mark the blade weight with a Marker P05-045 or equivalent. Use the computer program "Bladis" to determine the blade installation sequence to produce a net vector sum of 0.1 oz-in. (72. g.mm) or less.

(5) Wipe blade areas to be sealed by SPOP 208 Wipe Method (Task 70-21-00-110-040).

(6) For the 5th stage blades, you must reinstall the correct counterweights to the blades that will be installed at the counterweight locations identified in 72-00-35, Removal-19 (Task 72-00-35-030-002) as follows:

(a) Apply Silicone Rubber Sealant P09-014 to the counterweight as shown in Figure 401.

(b) Place counterweight with sealant to the bottom of the blade root.

(7) Immediately before installing each 5th or 6th stage blade, apply Silicone Rubber Sealant P09-014 to the blade root as shown in Figure 402. Coat blades thickly enough to fill in voids between blade root and disk/drum slot when blade is in the installed position. Also, apply sealant to the wire lock groove of blades and of disk/drum at blade locations. See Figure 402.

(8) Assemble each 5th or 6th stage blade into the disk as follows:

(a) For the 5th stage blades, use the reference marks on the disk to locate where to install the blades with the counterweights.

(b) When a blade is assembled into the disk/drum, hold the blade radially outward against the disk slot bearing surface, while the blade is moved to the installed position.

(c) Remove excess sealant from around the blade root area and fill in any voids.

NOTE: If disassembly is required and the sealant coating is damaged, it must be repaired before reassembly.

R (9) Retain the 5th stage blades by inserting the wire locks into the wire lock grooves in a clockwise direction when viewed from the front. Be sure the lock under the blade is coated with sealant to make sure lock will not roll over after sealant cure. Use the PWA 78012 Pneumatic Bender or the PWA 86518 Mechanical Bender or PWA 87128 Mechanical Bender to crimp the wire locks for blades. These bending tools have separate jaws for initial and final bends. After making the initial bend, replace the initial bend jaw with the final bend jaw and compress handles until blade lock is fully bent. As an option to the PWA 78012 Pneumatic Bender with separate jaws for initial and final bends, the PWA 100012 Pneumatic Bending Tool Change Letter A is used for the prebend of the blade lock and the PWA 102146 Pneumatic Bending Tool is used for the final bend of the blade lock. No tangential motion of the lock is allowed in the installed position. Measure the bend dimension with a dial caliper. See Figure 403. R

R (10) Retain the 6th stage blades by inserting the wire locks into the wire lock grooves in a clockwise direction when viewed from the front. Be sure the lock under the blade is coated with sealant to make sure lock will not roll over after sealant cure. Bend the blade locks. Use a PWA 78013 Bender or a PWA 100014 Pneumatic Bender Change Letter A for the initial bend and a PWA 100096 Pneumatic Bender for the final bend to crimp the locks. No tangential motion of the lock is allowed in the installed position. Measure the bend dimension with a dial caliper. See Figure 403. R

NOTE: If you use the PWA 78013 Bender, you must use the pre bend and final bend jaws.

R (11) Allow sealant to cure at room temperature and 20 percent minimum humidity for eight hours prior to the balance operation. Total curing time before engine test is 24 hours minimum.

R (12) For 7th and 8th stage blades that are replaced, apply R Sealing Compound P09-015 to the areas shown in Figure R 404, after cleaning those areas as specified in step (5). If sealant is not applied immediately after cleaning, exercise extreme care to protect prepared surfaces against contamination with oil, grease or other foreign materials.

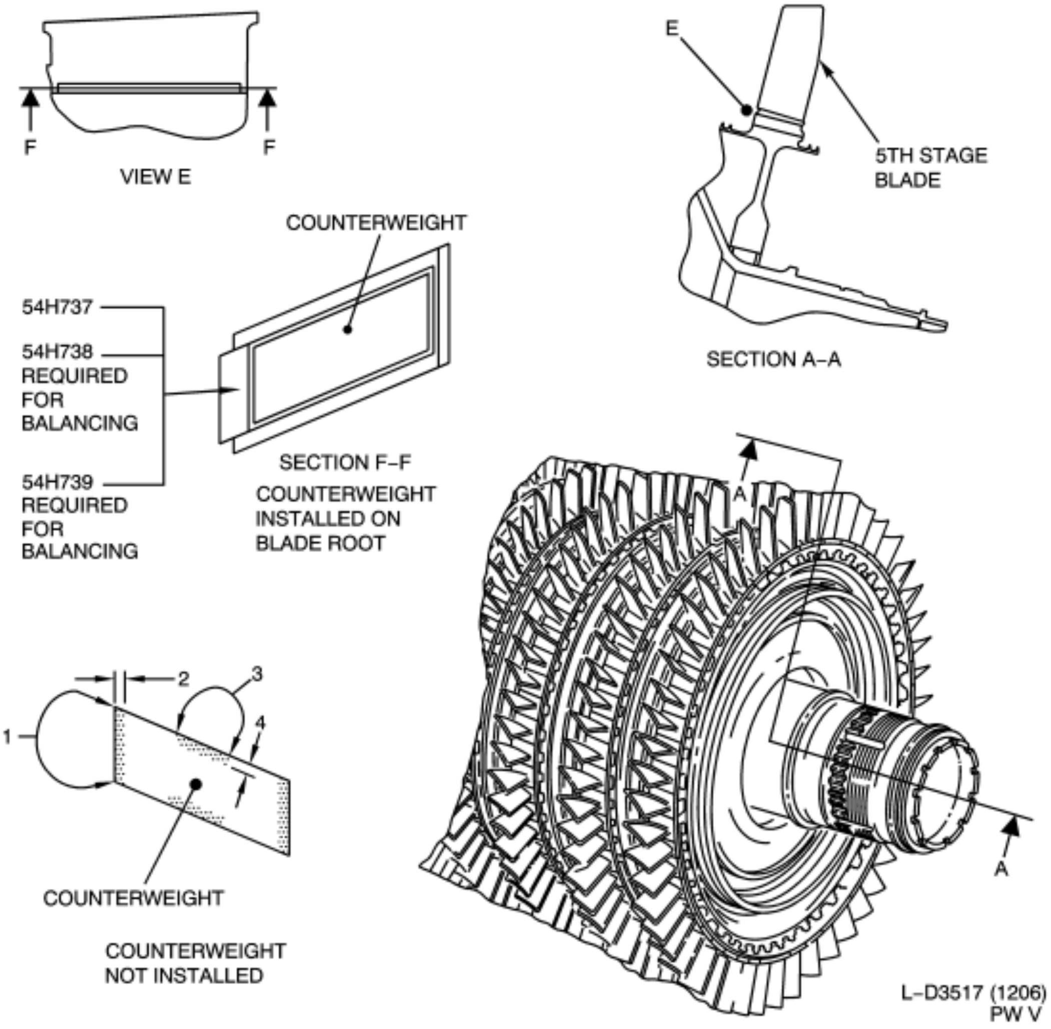
R (13) Assemble blades into drum as described in step (7).

R (14) Retain 7th and 8th stage blades by inserting the wire locks into the wire lock grooves in a clockwise direction when viewed from the front. Bend the blade locks. Use a PWA 78014 Bender or a PWA 100013 Pneumatic Bender Change Letter B for the initial bend and a PWA 102171 Pneumatic Bender for the final bend to crimp the locks. No tangential motion of the lock is allowed in the installed position. Measure the bend dimension with a dial caliper. See Figure 403. R

NOTE: If you use the PWA 78014 Bender, you must use the pre bend and final bend jaws.

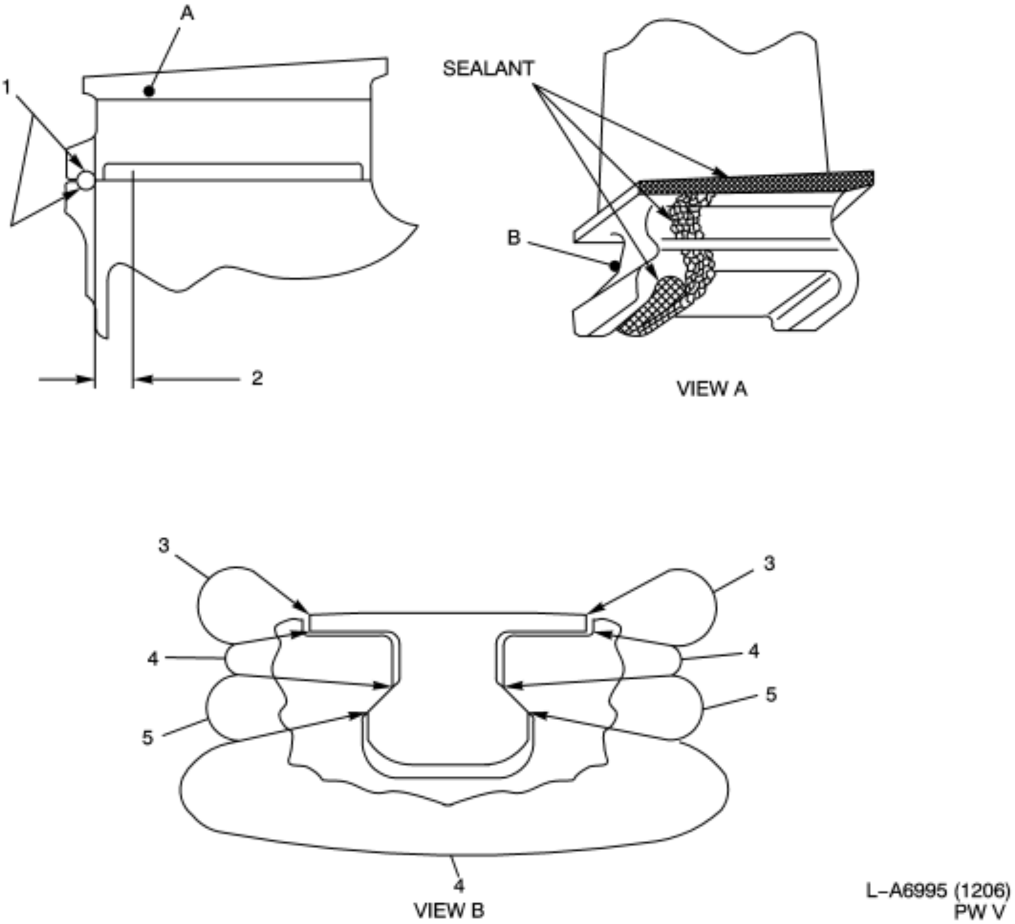
D. Postrequisites

(1) Install the upper half of the HPC front case after accessing the 5th through 8th stage blades. Refer to Installation-18 Task 72-00-35-430-001.


F
F
VIEW E
E
5TH STAGE BLADE
SECTION A-A
COUNTERWEIGHT
54H737
54H738 REQUIRED FOR BALANCING
54H739 REQUIRED FOR BALANCING
SECTION F-F
COUNTERWEIGHT INSTALLED ON BLADE ROOT
A
A
1
2
3
4
COUNTERWEIGHT
COUNTERWEIGHT NOT INSTALLED
L-D3517 (1206)
PW V

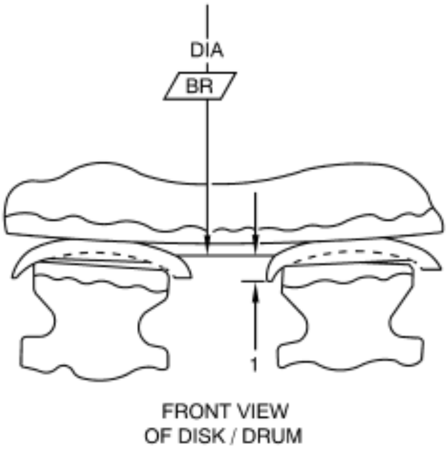
R 1. Apply Sealant Here, Both Edges.
R 2. 0.200 Inch (5.080 mm) Maximum, Forward And Aft Edges.
R 3. Apply Sealant Here, Both Sides In Center 1/3 Of Each Side.
R 4. 0.150 Inch (3.810 mm) Maximum, Both Sides.

R 5th Stage Blade Counterweight Installation
R Figure 401
R (Task 72-00-35-430-002)



1. Sealant Application Areas: 5th Stage = 40 Places; 6th Stage = 51 Places.
2. 0.200 − 0.400 Inch (5.1 − 10.2 mm)
3. Apply Sealant (P09−014) In Areas Shown For Entire Length Of Blade Platform.
4. Apply Sealant (P09−014) In Areas Shown For Distance Index 2.
5. No Sealant To Be Applied In This Area But Traces Are Permissible After Assembly Of Blade To Disk.

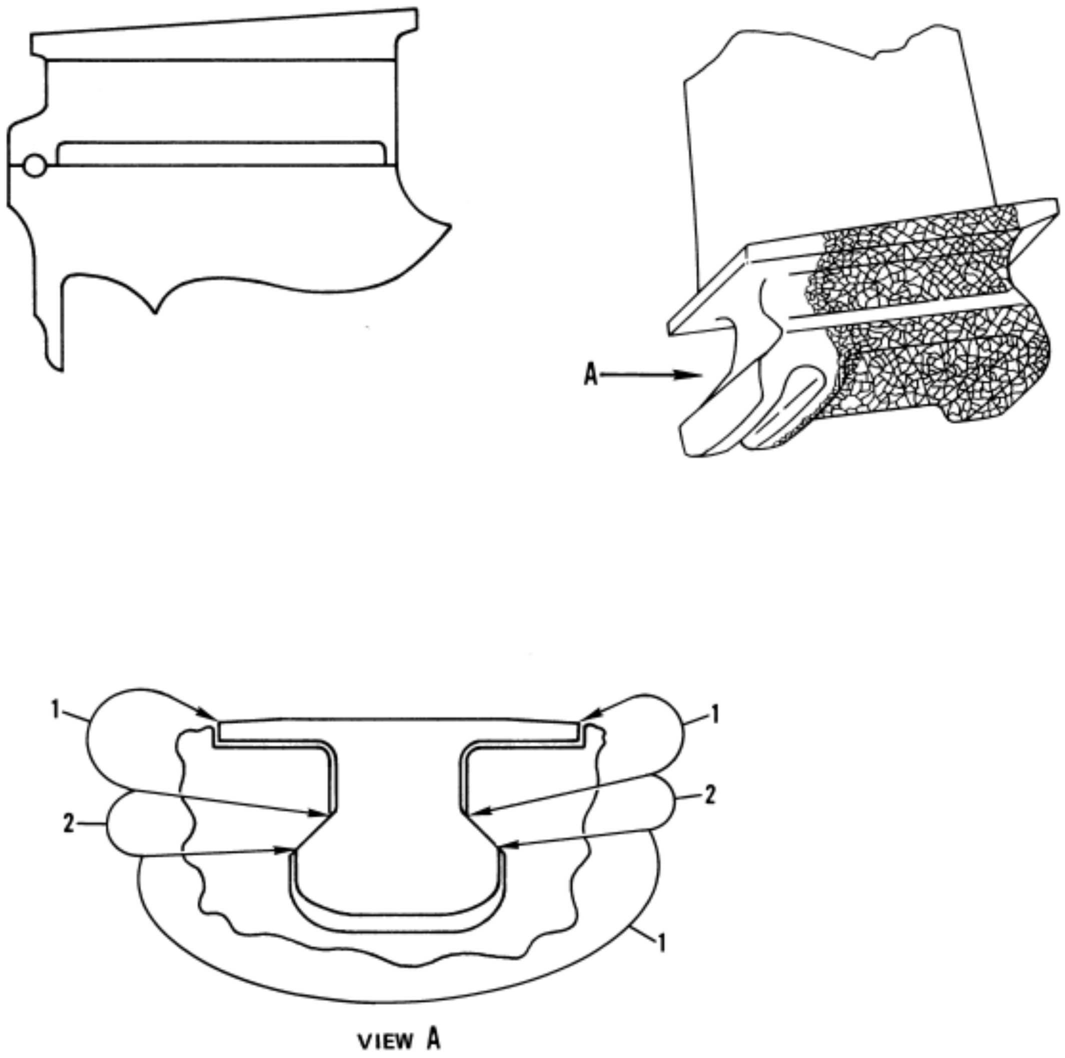
Sealant Application
R Figure 402
(Task 72−00−35−430−002)



L−A7780 (0000)
PW V

1. 0.190 Inch (4.826 mm) Minimum (For 5th Stage) 0.150 Inch (3.810 mm) Minimum (For 6th, 7th And 8th Stages)

Blade Lock Installation
R Figure 403
(Task 72−00−35−430−002)



L-A7000

1. Apply Sealant (P09−015) In Areas Shown For Entire Length Of Blade Root.
2. No Sealant To Be Applied In This Area But Traces Are Permissible After Assembly Of Blade To Disk.

Sealant Application
R Figure 404
(Task 72−00−35−430−002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - INSTALLATION-20

Task 72-00-35-450-015:

1. Install The (2.9) Bleed Valve Screen

   A. Equipment And Materials Required - None

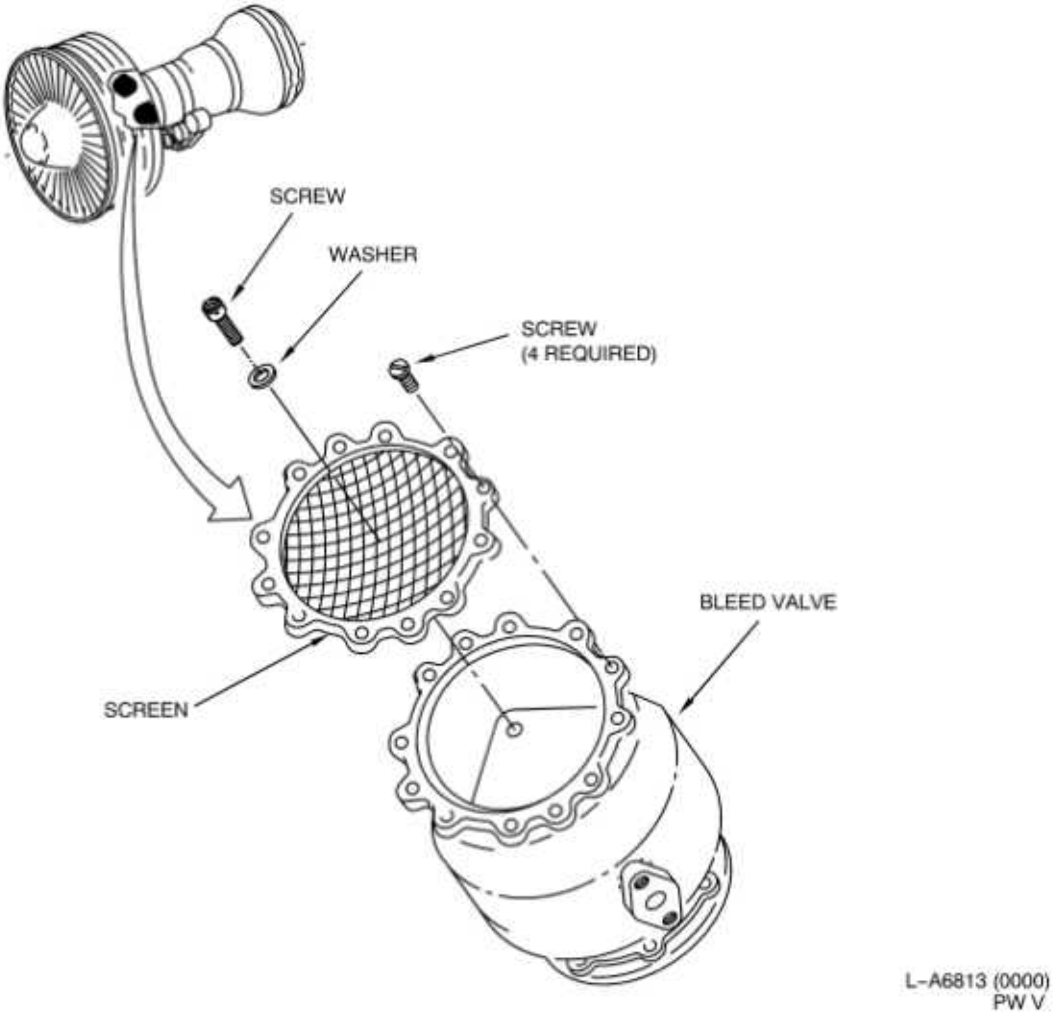
   B. Procedure

      See Figure 401.

      (1) Remove the protective cover from the bleed valve port.

      (2) Position the screen on the bleed valve housing and secure it at the flange with four screws. Torque the screws to 32 - 36 lb-in. (3.616 - 4.007 N.m).

      (3) Attach the screen to the bleed valve housing through the opening in the center of the screen mesh with a screw an washer. Torque the screw to 25 - 30 lb-in. (2.825 - 3.390 N.m).


SCREW
WASHER
SCREW
(4 REQUIRED)
BLEED VALVE
SCREEN
L−A6813 (0000)
PW V

2.9 Bleed Valve Screen Installation
Figure 401
(Task 72−00−35−450−015)

Task 72-00-35-450-016:

1. Install Turbine Vane Cooling Air Valve

A. Equipment And Materials Necessary

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
	P05-059	Wax, Paraffin (PMC 9552)
R	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket, ST2402-030 or ST2412-030	1	
Gasket, ST1112-029 or ST1122-029	1	
Gasket, 512640	1	

B. Procedure
See Figure 401.

(1) Remove protection covers.

(2) If a new valve is being installed, do the following.

(a) Install a gasket to the tube adapter.

(b) Lubricate the threads of the adapter with Engine Oil P03-001, and install the adapter in the air supply port of the valve.

(c) Torque the adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m).

(3) Install a new gasket to the boss on the HPC case located on the right side of the engine at approximately the 2:30 o'clock position. Attach the gasket to the case with Paraffin Wax P05-059.

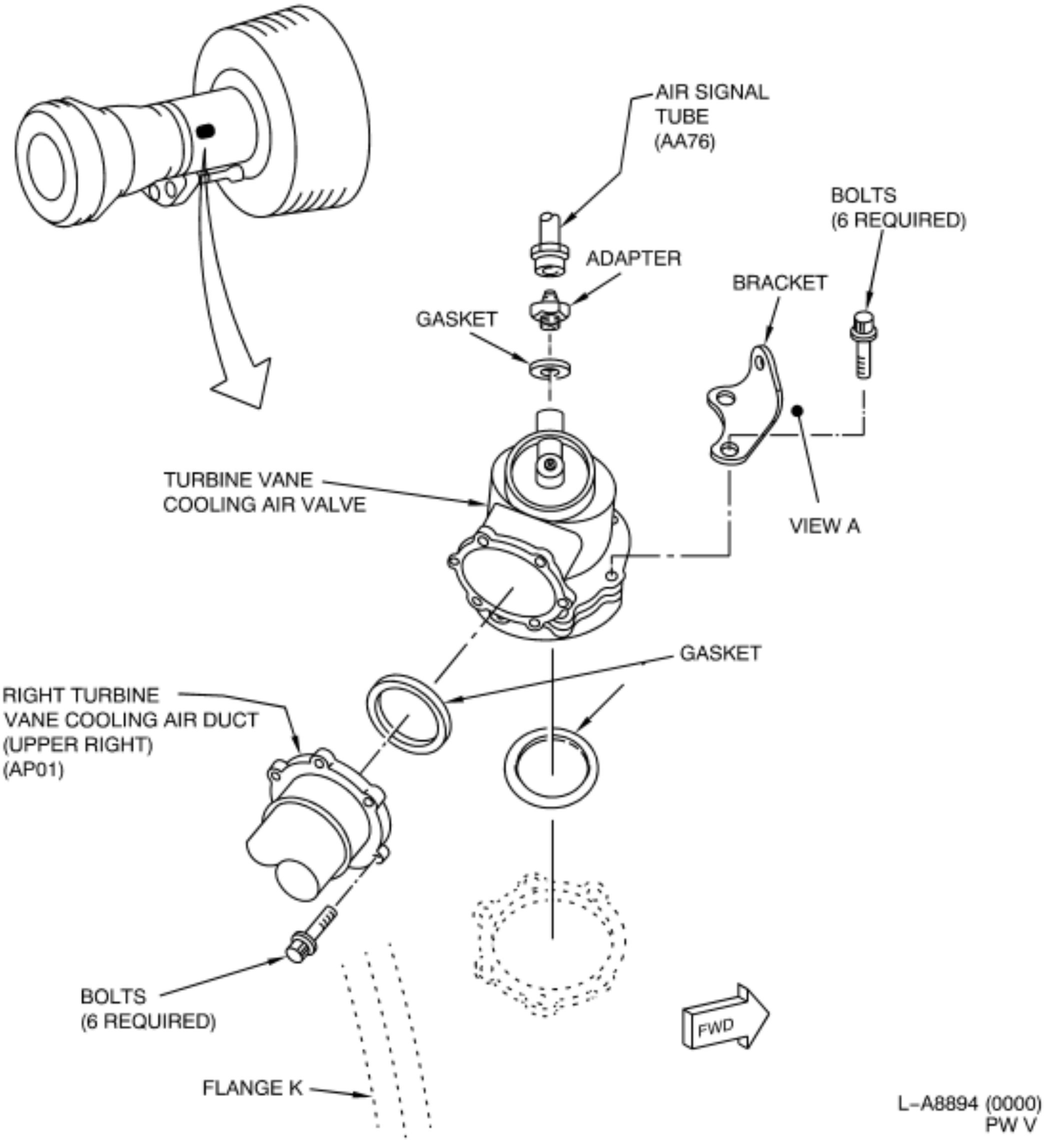
(4) Install a new gasket to the flange of the (upper) right turbine vane cooling air duct (AP01). Attach the gasket with Paraffin Wax P05-059.

(5) Install the valve with a bracket to the boss and attach with bolts, threads lubricated with Engine Oil P03-001 Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). Without loosening the bolts, torque the bolts again until the 85 - 95 lb-in. (9.604 - 10.734 N.m) is keep.

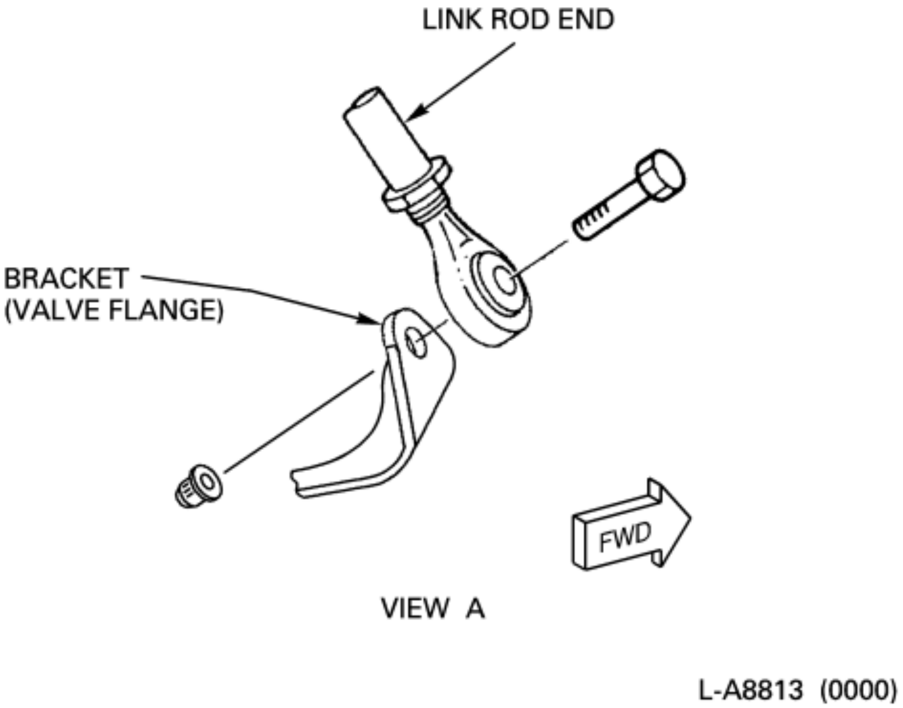
(6) Attach the flange of the (upper right) turbine vane cooling air duct (AP01) to the flange of the valve with bolts, threads lubricated with Engine Oil P03-001. Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). Without loosening the bolts, torque the bolts again until the 85 - 95 lb-in. (9.604 - 10.734 N.m) is keep.

(7) Install the link rod end to the bracket that is mounted to valve flange. Attach the rod end to the bracket with a bolt, threads lubricated with Engine Oil P03-001 and a nut. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

R
R
R
(8) Lubricate the threads of the tube adapter with Antiseize Paste P06-054. Remove the unwanted paste and attach the air signal tube (AA76) to the adapter. Torque the tube nut to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to the tube nut.


AIR SIGNAL TUBE (AA76)
BOLTS (6 REQUIRED)
ADAPTER
BRACKET
GASKET
TURBINE VANE COOLING AIR VALVE
VIEW A
GASKET
RIGHT TURBINE VANE COOLING AIR DUCT (UPPER RIGHT) (AP01)
BOLTS (6 REQUIRED)
FWD
FLANGE K
L-A8894 (0000)
PW V

Turbine Vane Cooling Air Valve
Figure 401 (Sheet 1)
(Task 72-00-35-450-016)


LINK ROD END
BRACKET
(VALVE FLANGE)
FWD
VIEW A
L-A8813 (0000)

Turbine Vane Cooling Air Valve
Figure 401 (Sheet 2)
(Task 72−00−35−450−016)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-01

Task 72-00-35-990-001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131)	(-)	0.512 (13.005)	=	.005 (0.126)
0.527 (13.385)	(-)	0.508 (12.903)	=	.019 (0.482)

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
782 (1)	B	HPC Front Hub (72-35-05) (PN 50H470 Prior To Change Letter J/ PN 51H572 Prior To Change Letter E) No. 2 Bearing Front Seal Seat (72-35-90) (See Figure 801, Sheet 2)				
		Hub	6.550 (166.370)	6.551 (166.395)		
		Seat	6.552 (166.421)	6.554 (166.471)	.001 (0.026)	.004 (0.101)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
782 (2)	B	HPC Front Hub (72−35−05) (PN 50H470 Change Letter J And Subsequent/ PN 51H572 Change Letter E And Subsequent) No. 2 Bearing Front Seal Seat (72−35−90) (See Figure 801, Sheet 2)				
		Hub	6.549 (166.345)	6.551 (166.395)		
		Seat	6.552 (166.421)	6.554 (166.471)	.001 (0.026)	.005 (0.127)
784	A	HPC Front Hub (72−35−05) Gearbox Drive Bevel Gear (72−34−12) (See Figure 801, Sheet 2)				
		Hub	7.305 (185.547)	7.306 (185.572)		
		Gear	7.301 (185.446)	7.302 (185.470)	.003T (0.077T)	.005T (0.127T)

G. Spline Data

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
952	B	1. Gearbox Drive Bevel Gear (72−34−12) Internal Spline (See Figure 801, Sheet 2)				
		A. Effective Space Width	.0491 (1.247)	−−−		
		B. Actual Space Width	−−−	.0555 (1.410)		
		2. HPC Front Hub (72−35−05) External Spline (See Figure 801, Sheet 2)				
		A. Effective Tooth Thickness	−−−	.0476 (1.209)		

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
(CONTINUED)						
		B. Actual Tooth Thickness	.0412 (1.046)	---		
		3. Fit			.0015 (0.038)	---

H. Special Torques

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
736	A	Bolt And Nut Torquing Procedure, Turbine Case Cooling Air Valve Actuator Ground Cable See 72-00-35, Installation-03 (Task 72-00-35-420-002)				
973	A	No. 2 Bearing Front Seal Seat Retaining Nut (See Figure 801, Sheet 2) See 72-00-35, Installation-01 (Task 72-00-35-420-001)				
974	A	No. 2 Bearing Retaining Nut (See Figure 801, Sheet 2) See 72-00-35, Installation-01 (Task 72-00-35-420-001)				
2154	A	Electrical Connector See 72-00-35, Installation-04 (Task 72-00-35-450-001-A00) And (Task 72-00-35-450-001-B00) See 72-00-35, Installation-09 (Task 72-00-35-450-006) See 72-00-35, Installation-10 (Task 72-00-35-450-007)				

Ref. No.	IFR	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
2155	A	Electrical Connector See 72-00-35, Installation-04 (Task 72-00-35-450-001-A00) And (Task 72-00-35-450-001-B00) See 72-00-35, Installation-11 (Task 72-00-35-450-008)				
2156	A	Electrical Connector See 72-00-35, Installation-06 (Task 72-00-35-450-003)				
2157	A	Electrical Connector See 72-00-35, Installation-15 (Task 72-00-35-450-012)				
2158	A	Electrical Connector See 72-00-35, Installation-05 (Task 72-00-35-450-002)				
2273	A	Terminal Box Nut (Alumel) Terminal Box Nut (Chromel) See 72-00-35, Installation-17 (Task 72-00-35-450-014)				

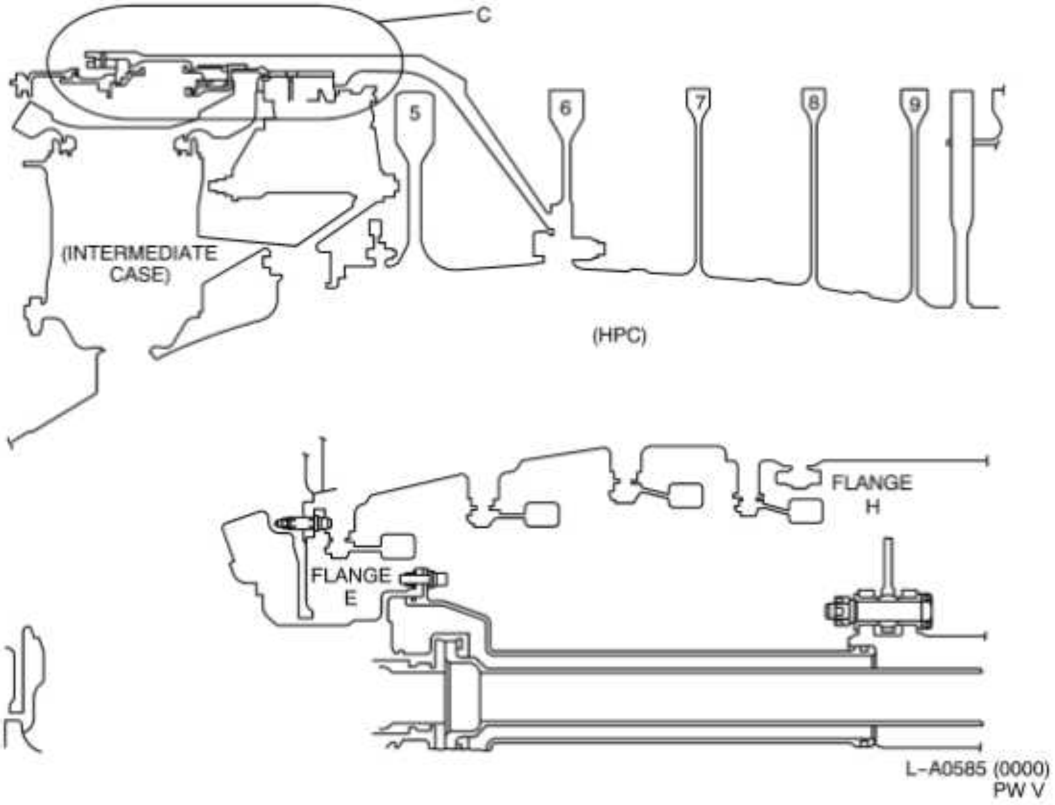
I. Special Assembly Procedures

Ref. No.	IFR	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
760	A	Turbine Vane And Blade Cooling Air Valve Position Switch - Installation See 72-00-35, Installation-06 (Task 72-00-35-450-003)				
1002	A	Bottoming Procedure, For Installing Gearbox Drive Bevel Gear, Spacers, And No. 2 Bearing On HPC Front Hub (See Figure 801, Sheet 2) See 72-00-35, Installation-01 (Task 72-00-35-420-001)				

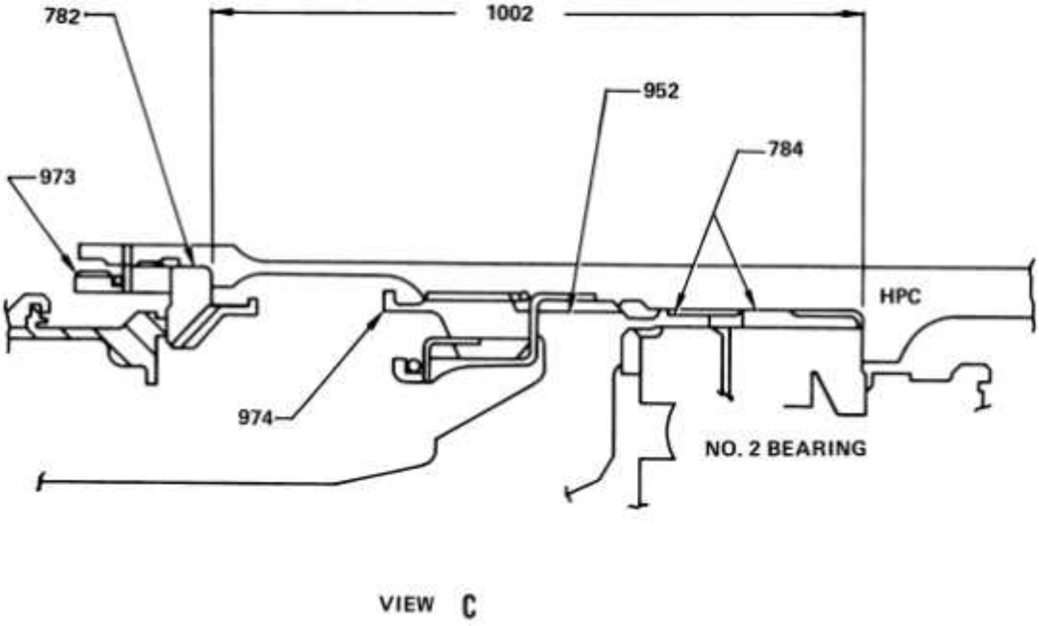
ENGINE GENERAL - HIGH PRESSURE
COMPRESSOR (HPC) - INSPECTION/CHECK-01

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
2016	A	Procedure For Installing The Oil Trim Pressure Tube Clamping See 72-00-35, Installation-04 (Task 72-00-35-450-001-A00) And (Task 72-00-35-450-001-B00)				
2170	A	Torque Procedure, Fuel/Oil Cooler Fuel Tube Nuts See 72-00-35, Installation-04 (Task 72-00-35-450-001-A00) And (Task 72-00-35-450-001-B00)				

ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−01


C
5
6
7
8
9
(INTERMEDIATE CASE)
(HPC)
FLANGE E
FLANGE H
L-A0585 (0000)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 1)
(Task 72−00−35−990−001)


782
1002
952
784
973
HPC
974
NO. 2 BEARING
VIEW C

L-A0601

High Pressure Compressor (HPC)
Figure 801 (Sheet 2)
(Task 72-00-35-990-001)

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ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-02

Task 72-00-35-210-001:

1. Inspect Variable Stator Vane Control System
   - A. Equipment And Materials Required - None
   - B. Procedure
     - (1) Inspect variable stator vane actuator for leakage. Any leakage requires replacement of actuator. See Removal-15 (Task 72-00-35-050-012) and Installation-15 (Task 72-00-35-450-012).
     - (2) Inspect actuation linkage for damage and/or looseness.
       - (a) Any damage requires replacement of part(s).
       - (b) No end play is permitted in spherical rod end bearing and if present, part(s) must be replaced.
     - (3) Inspect stator vane arms and retaining pins for proper attachment or to locate loose or detached vane arms in Stages IGV, 5, 6 or 7. See 72-00-35, Inspection/Check-03 (Task 72-00-35-210-002) for inspection procedure.
     - (4) If any part(s) are replaced per this inspection procedure, cycle stator vane control system several times with 250 - 350 psig (1723.7 - 2413.2 kPa) hydraulic pressure applied to ensure freedom of movement and no binding.

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ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−03

Task 72−00−35−210−002:

1. Inspect HPC Secondary Flow Control Valve System
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figures 801 and 802.
     - (1) Inspect HPC secondary flow control valve and HPC secondary flow control valve, turbine vane and blade cooling air valve solenoid for physical condition and security.
     - (2) Check HPC secondary flow control valve visual position indicator pin.

       NOTE: Valves are spring−loaded open when deactivated.

       - (a) An extended pin indicates valve is fully open (normal condition).
       - (b) If pin is not fully extended, valve may be partially or fully closed. Replace valve.
     - (3) Inspect plumbing and brackets for physical condition and security.
       - (a) Cracked or crimped tubes are not acceptable and must be replaced.
       - (b) Minor surface damage is acceptable provided the function of the system is not compromised.
     - (4) Inspect electrical harnesses for chafing and/or loose connectors. Replace as required.
     - (5) Visually inspect the HPC variable stator vane system for Stages IGV, 5, 6 and 7. See Figure 803 (Sheets 1 and 2).
       - (a) Inspect the HPC synchronizing unison ring rivet pin assemblies for lateral or radial looseness of pin heads that can result in interference/binding with the vespel runner pads. If pin looseness is found, replace unison ring assembly.

         NOTE: If the inspection results confirm that no rivet pins are loose, the following inspection step need not be performed.

       - (b) Inspect the vespel runner pads at 20 locations on the upper half of the HPC front case assembly. Look for possible chipping or grooving caused by interference with loose unison ring assembly rivet pins. If damaged runner pads are found, perform a detail borescope inspection for HPC rotor blade Stages 5, 6 and 7, prior to engine operation. Refer to 72−00−00, Inspection/Check−01. Remove/ replace damaged runner pads.

(c) Inspect variable vane actuation linkage for damage or looseness. No wear or end play is permitted in the spherical rod end bearings in the connecting rods between lever sets and VSV synchronizing rings. If damage or looseness is present, the damaged or worn part(s) must be replaced.

(d) Inspect variable vane arms to locate loose or detached vane arms in Stages IGV, 5, 6 and 7. Any loose vane arms require that the synchronizing ring for the stage be replaced. However, any detached vane arms that are found require disassembly of the HPC and inspection of rotor disks, blades and vanes as specified below. Vane arm detachment is defined as a loss of rivet pin attachment to the synchronizing ring, incorrect assembly to the vane trunnion or detachment from the vane trunnion. If distress/crack indication is found in any vanes or blades, replace all the vanes or blades in the subject stage. See Figure 804.

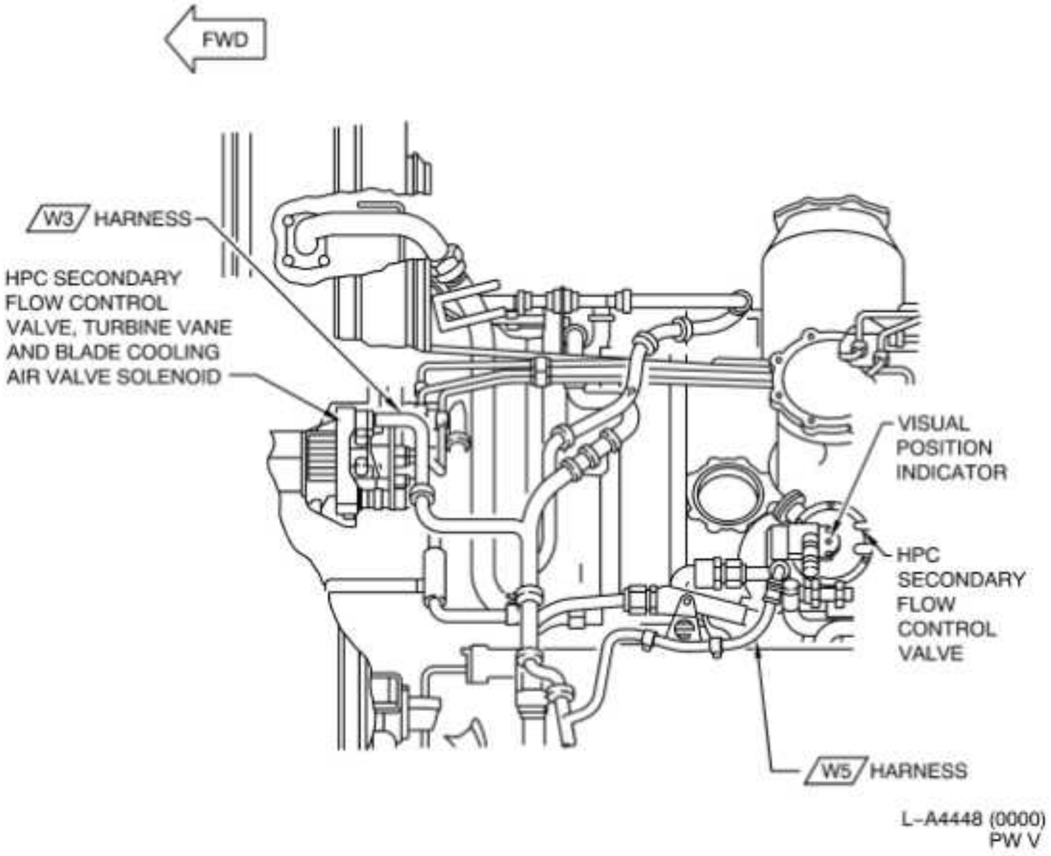
1 A detached inlet guide vane (IGV) arm requires that rotor disks, blades and vanes in Stages IGV, 5th and 6th be completely inspected for crack indication

2 A detached 5th stage vane arm requires that rotor disks, blades and vanes in Stages 5th, 6th and 7th be completely inspected for crack indication.

3 A detached 6th stage vane arm requires that rotor disks, blades and vanes in Stages 6th, 7th and 8th be completely inspected for crack indication.

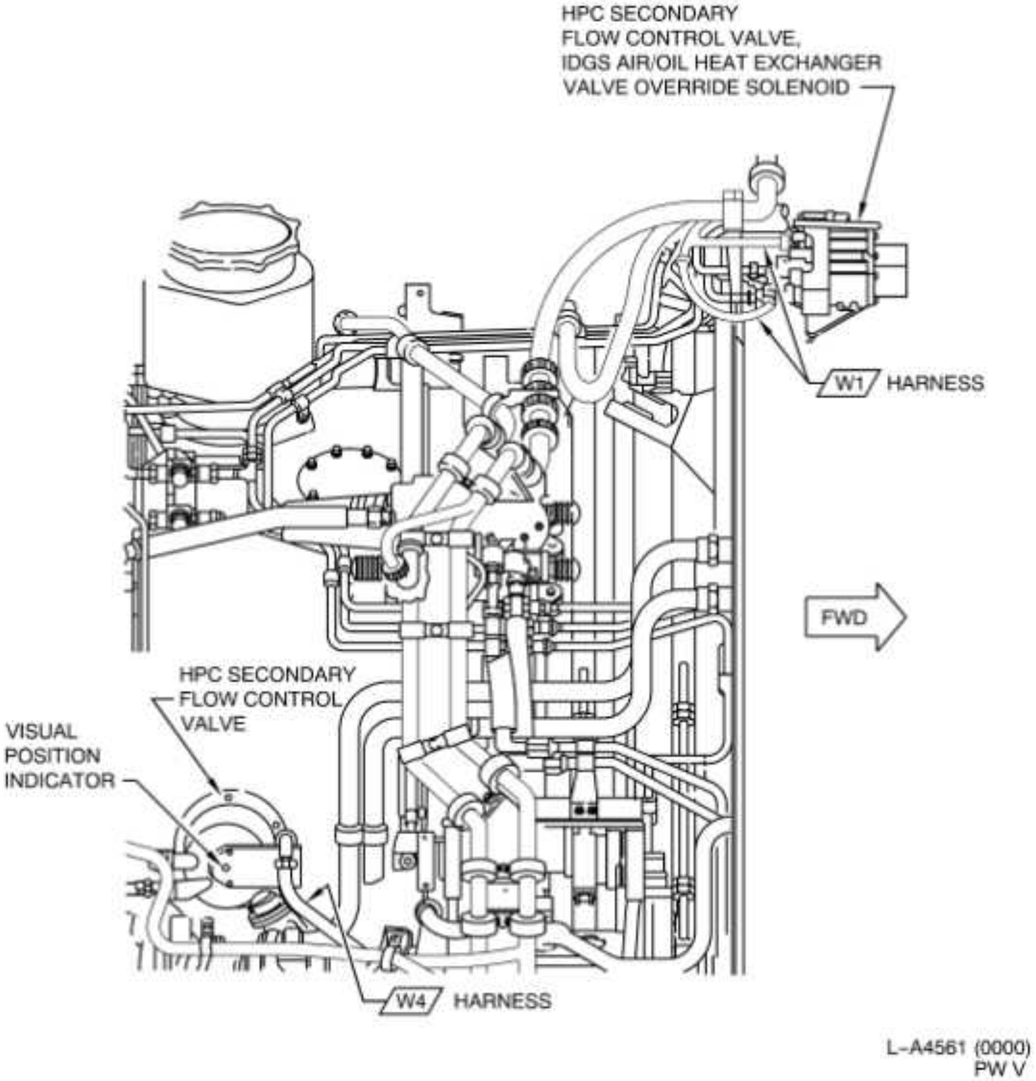
4 A detached 7th stage vane arm requires that rotor disks, blades and vanes in Stages 7th, 8th and 9th be completely inspected for crack indication.

ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−03

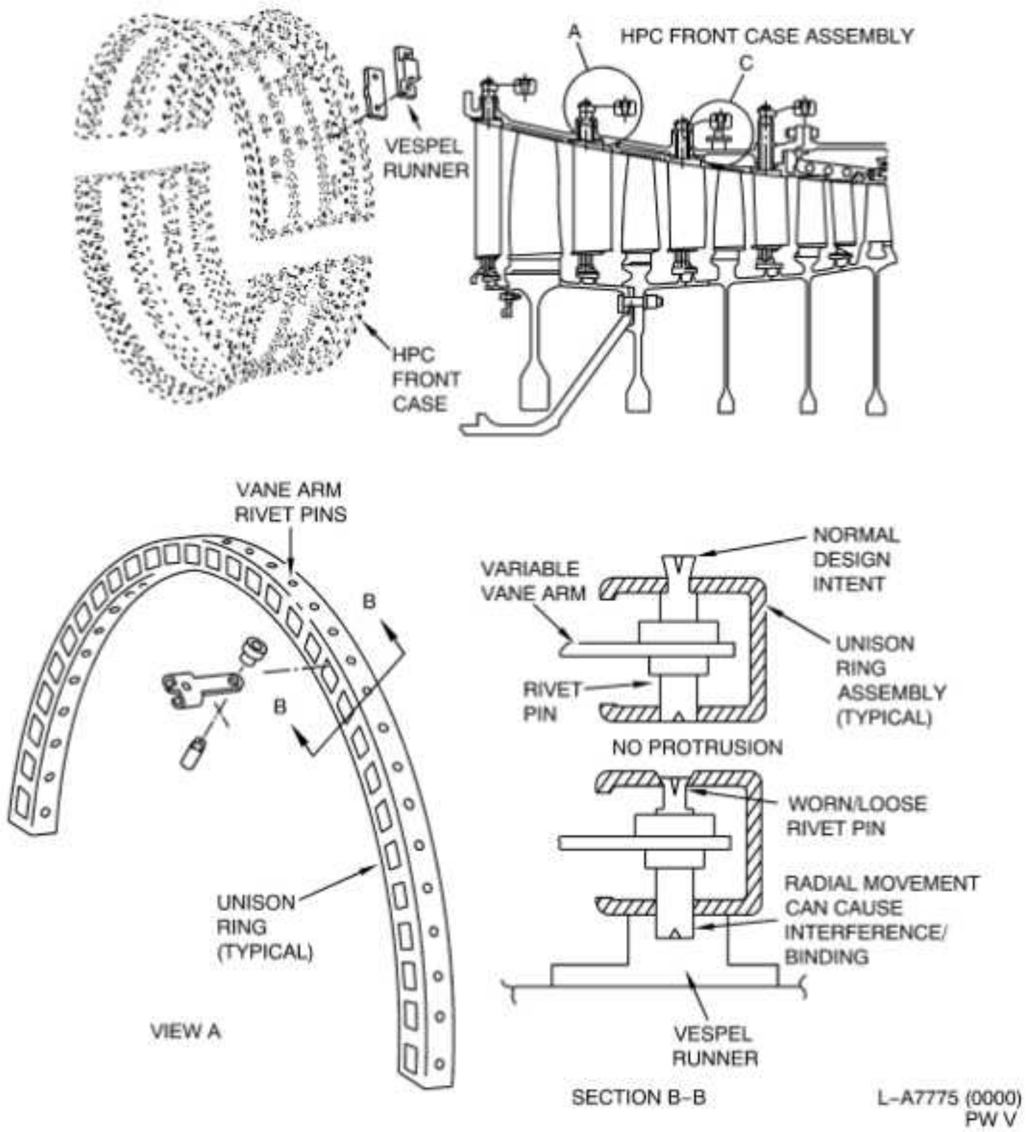

FWD
W3 HARNESS
HPC SECONDARY FLOW CONTROL VALVE, TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
VISUAL POSITION INDICATOR
HPC SECONDARY FLOW CONTROL VALVE
W5 HARNESS
L-A4448 (0000)
PW V

HPC Secondary Flow Control Valve
Figure 801
(Task 72−00−35−210−002)

ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−03

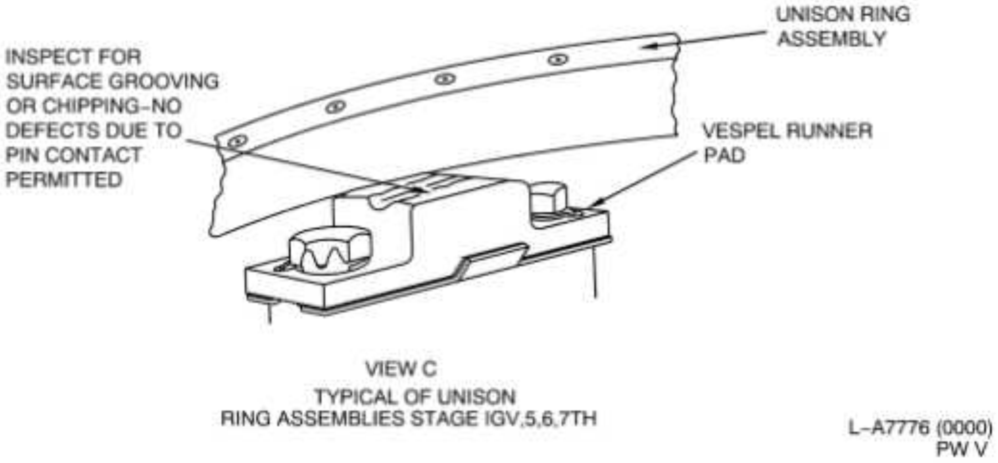

HPC SECONDARY
FLOW CONTROL VALVE,
IDGS AIR/OIL HEAT EXCHANGER
VALVE OVERRIDE SOLENOID
W1 HARNESS
FWD
HPC SECONDARY
FLOW CONTROL
VALVE
VISUAL
POSITION
INDICATOR
W4 HARNESS
L-A4561 (0000)
PW V

HPC Secondary Flow Control Valve
Figure 802
(Task 72−00−35−210−002)


A
HPC FRONT CASE ASSEMBLY
C
VESPEL RUNNER
HPC FRONT CASE
VANE ARM RIVET PINS
B
B
UNISON RING (TYPICAL)
VIEW A
VARIABLE VANE ARM
NORMAL DESIGN INTENT
UNISON RING ASSEMBLY (TYPICAL)
RIVET PIN
NO PROTRUSION
WORN/LOOSE RIVET PIN
RADIAL MOVEMENT CAN CAUSE INTERFERENCE/ BINDING
VESPEL RUNNER
SECTION B-B
L-A7775 (0000)
PW V

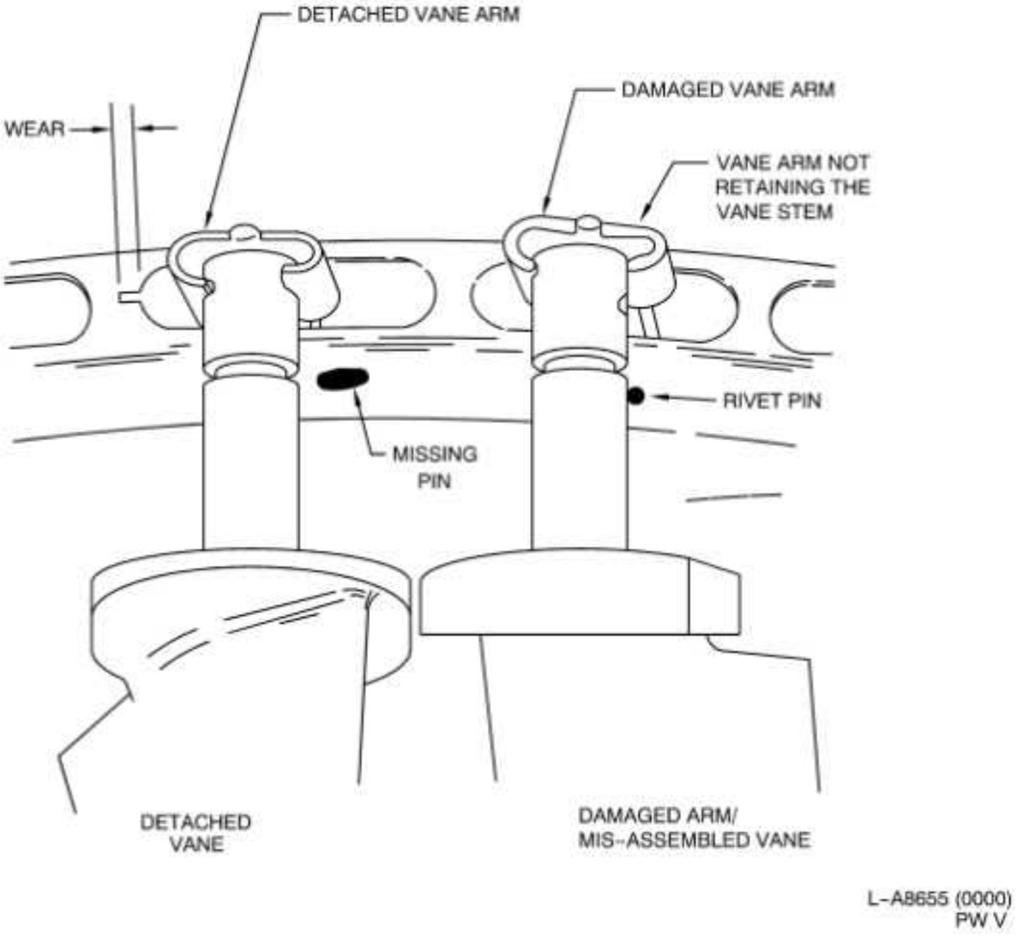
Inspect HPC Unison Ring Rivet
Pin Assemblies
Figure 803 (Sheet 1)
(Task 72−00−35−210−002)

ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−03


UNISON RING ASSEMBLY
INSPECT FOR SURFACE GROOVING OR CHIPPING-NO DEFECTS DUE TO PIN CONTACT PERMITTED
VESPEL RUNNER PAD
VIEW C
TYPICAL OF UNISON RING ASSEMBLIES STAGE IGV,5,6,7TH
L−A7776 (0000)
PW V

Inspect HPC Unison Ring Runner Pads
Figure 803 (Sheet 2)
(Task 72−00−35−210−002)

ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−03


DETACHED VANE ARM
DAMAGED VANE ARM
WEAR
VANE ARM NOT RETAINING THE VANE STEM
RIVET PIN
MISSING PIN
DETACHED VANE
DAMAGED ARM/ MIS-ASSEMBLED VANE
L-A8655 (0000)
PW V

Inspect HPC Variable Vane Arms
Figure 804
(Task 72−00−35−210−002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-04

Task 72-00-35-210-004:

1. Inspect HPC Rear Drum OD Thrust Balance Seal

A. Equipment And Materials Required - None

B. Procedure

See Figure 801 and Table 801.

(1) Fluorescent penetrant inspect the HPC rear drum OD thrust balance seal knife edge for cracks per SPOP 70, high sensitivity (Task 70-33-00-230-004).

NOTE: Coating removal from the knife edges is not required prior to the FPI. See a sample photo of simulated FPI indication on the coated knife edge.

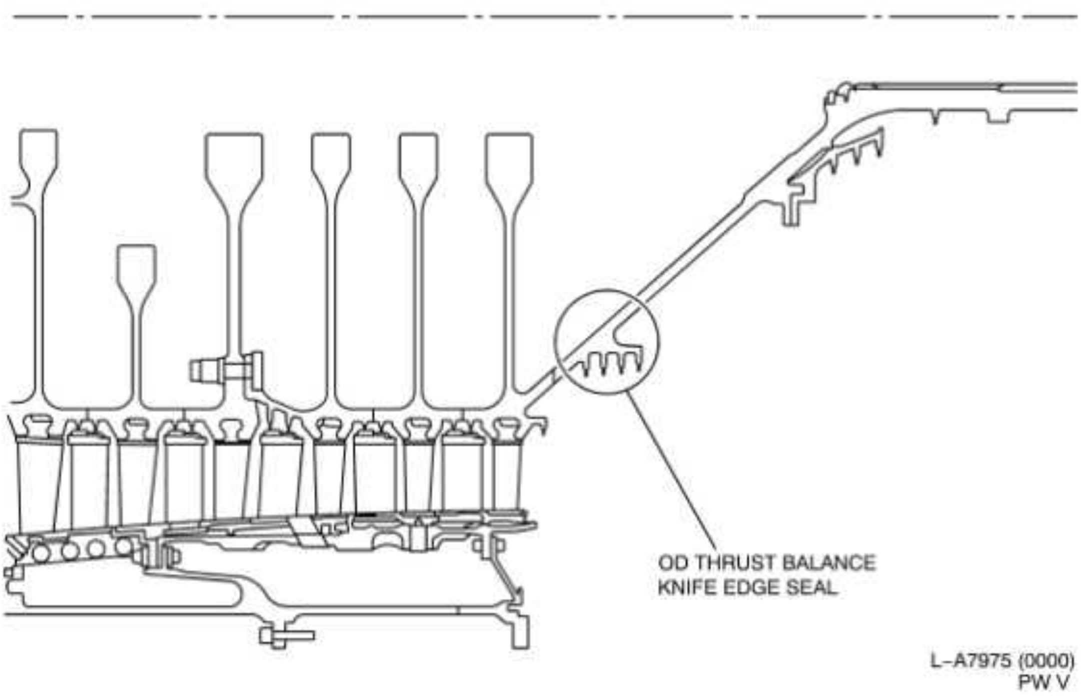
(2) Visually inspect the HPC rear drum OD thrust balance seal knife edges for surface damage and cracks. Use a fluorescent (white) light and a 3X - 8X magnifying glass.

(3) If a crack is detected by either FPI and/or visual inspection, do the following.

(a) Remove the HPC rear drum from the HPC module.

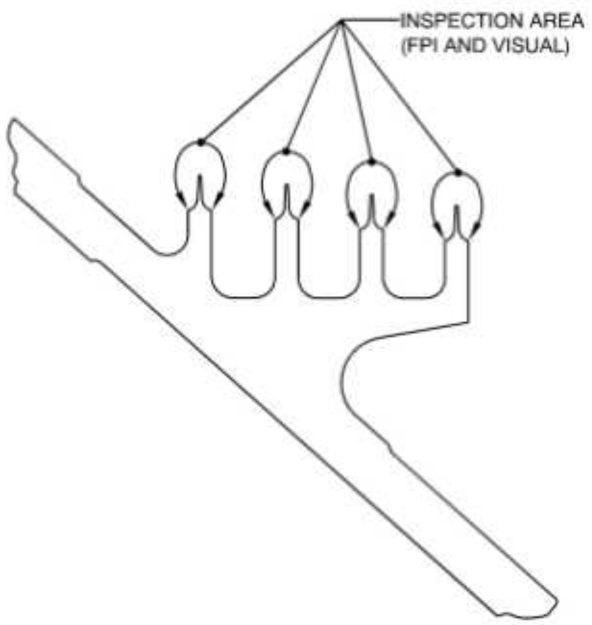
(b) Inspect the HPC rear drum OD thrust balance seal per 72-35-08, Inspection/Check-02 (Task 72-35-08-200-002) and 72-35-08, Inspection/Check-03 (Task 72-35-08-200-003).

ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) −
INSPECTION/CHECK−04


OD THRUST BALANCE
KNIFE EDGE SEAL
L−A7975 (0000)
PW V

HPC Rear Drum OD Thrust Balance Seal Inspection
Figure 801 (Sheet 1)
(Task 72−00−35−210−004)

ENGINE GENERAL − HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04


INSPECTION AREA
(FPI AND VISUAL)

L−A8038 (0000)
PW V

HPC Rear Drum OD Thrust Balance Seal Inspection
Figure 801 (Sheet 2)
(Task 72−00−35−210−004)

ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-04

Inspect	Serviceable Limits	Repairable Limits	Repair
Cracks	No cracks permitted		
Coating chipping	Chipping which does not expose base coat is acceptable. Chipping to base coat for a total added length of 25% of knife edge circumference. No single chip to base coat can be more than 45 degrees along the circumference.		

NOTE: Metal transfer on knife edges from honeycomb seal land may be seen. The matal transfer is acceptable. Verify whether it is metal transfer or a coating chipping.

HPC Rear Drum OD thrust Balance Seal Inspection
Table 801

ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC) - REPAIR-01

Task 72-00-35-300-001:

1. Blend Repair Of Stage 5, 6 And 7 Rotor Blades For A Fully Built HPC Module - Axial Compressor Rotor Assembly

R NOTE: This Repair Is Relocated To 72-00-00, Repair-02.

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72−00−41

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	HIGHLIGHTS
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72−00−41	ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−05 • 72−00−41−050−002: Remove Exciter−To−Igniter Plug Cable, (Lower Plug−Lower Box)
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72−00−41	ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−07 • 72−00−41−050−004: Remove Igniter Plug
72−00−41	ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−08 • 72−00−41−050−005: Remove Igniter Plug, Igniter Plug Boss And Exciter−To−Igniter Cable
72−00−41	ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−09 • 72−00−41−020−004: Remove No. 3 Bearing Rear Seal Assembly And Rear Seal Seat (Vertical)
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	- 72−00−41−060−001: Remove Fuel Distribution Valve Strainer
72−00−41	ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−11 - 72−00−41−020−011: Remove Combustion Chamber (Outer) (Horizontal)
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72−00−41	ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−16 - 72−00−41−040−000: Remove Diffuser And Combustor − Unassigned
72−00−41	ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−17 - 72−00−41−040−001: Remove No. 3 Bearing (Vertical)
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72−00−41	ENGINE GENERAL − DIFFUSER AND COMBUSTOR − CLEANING−04 • 72−00−41−110−001: Clean Fuel Distribution Valve Strainer (Ultrasonic)
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72−00−41	ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSPECTION/CHECK−03 • 72−00−41−210−003: Inspect Igniter Plug
72−00−41	ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSPECTION/CHECK−04 • 72−00−41−210−004: Inspect Exciter−To−Igniter Plug Cable

72−00−41	ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSPECTION/CHECK−05 • 72−00−41−210−005: Inspect Fuel Distribution Valve Strainer
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72−00−41	ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSPECTION/CHECK−07 • 72−00−41−720−001: No. 3 Bearing Compartment Vacuum Check
72−00−41	ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSPECTION/CHECK−08 • 72−00−41−210−008: Visually Inspect Diffuser And Combustion Areas
72−00−41	ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSPECTION/CHECK−10 • 72−00−41−210−010: Visually Examine The Diffuser And Combustor Module Assembly − Engine General − Diffuser And Combustor

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-01

Task 72-00-41-020-001:

1. Remove Diffuser And Combustor (Vertical)

NOTE: See Figure 301 for part/assembly removal procedure sequence.

A. Prerequisites

(1) Remove The Electronic Engine Control (EEC) Speed Transducer (N1). Refer to 72-00-34, Removal-03 Task 72-00-34-050-001).

(2) Remove The Main Gearbox. Refer to 72-00-61, Removal-01 (Task 72-00-61-020-001).

(3) Remove The Compressor Inlet Cone. Refer to 72-00-31, Removal-02 (Task 72-00-31-020-001).

(4) Remove The 1st Stage LPC Blade Assemblies. Refer to 72-00-31, Removal-04 (Task 72-00-31-020-002-002).

(5) Remove The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed). Refer to 72-00-32, Removal-01 (Task 72-00-32-020-001).

(6) Remove The Low Pressure Compressor. Refer to 72-00-31, Removal-01 (Task 72-00-31-020-003).

(7) Remove The Turbine Exhaust Case. Refer to 72-00-54, Removal-01 (Task 72-00-54-020-001).

(8) Remove The Low Pressure Turbine With Shaft. Refer to 72-00-53, Removal-01 (Task 72-00-53-020-001).

(9) Remove The Fan Case. Refer to 72-00-33, Removal-01 (Task 72-00-33-020-001).

(10) Remove The No. 1 Bearing Support Assembly. Refer to 72-00-34, Removal-04 (Task 72-00-34-050-002).

(11) Remove The High Pressure Turbine. Refer to 72-00-52, Removal-01 (Task 72-00-52-020-001).

(12) Remove The Turbine Nozzle. Refer to 72-00-51, Removal-01 (Task 72-00-51-020-001).

(13) Remove The No. 3 Bearing Rear Seal Assembly. Refer to 72-00-41, Removal-03 (Task 72-00-41-020-003).

(14) Trunnion The Intermediate Case Through Diffuser And Combustor From Horizontal To Front End Down Position. Refer to 72−00−00, Special Procedures−09 (Task 72−00−00−020−002−A).

(15) Disconnect/Remove The External Parts To Gain Access To Diffuser And Combustor. Refer to 72−00−41, Removal−02 (Task 72−00−41−020−002).

B. Equipment And Materials Required

Standard Tools:

0.250−28 Jackscrews (Four Required)

Special Tools:

PWA 28657	Sling
PWA 29389	Pump, Hydraulic
PWA 76154	Adapters (Two Required)
PWA 80187	Multiplier, Torque
PWA 85056	Cover, Protector (Optional To PWA 85802)
PWA 85067	Fixture
PWA 85068	Fixture
PWA 85069	Puller, Jackscrew
PWA 85071	Puller, Hydraulic
PWA 85159	Protector
PWA 85168	Protector
PWA 85308	Guide (Optional To PWA 85701)
PWA 85428	Protector, Plastic
PWA 85701	Guide
PWA 85751	Bracket, Handling (Two Required)
PWA 85802	Cover, Protector
PWA 85797	Wrench (Optional To PWA 86491)
PWA 85983	Adapter, Stabilizer (Two Required Twin Overhead Rail System Only)
PWA 86489	Puller, Jackscrew
PWA 86491	Driver, Torque
PWA 102743	Adapter, Torque
PWA 102744	Adapter, Holder

C. Procedure

(1) Position PWA 85168 Protector (302/8), (303/8), smaller end first, into diffuser case. Push protector down to seat in case.

(2) Remove PWA 85159 Thread Protector (302/2), (303/2) from rear of HPC rear hub. See Figure 302 and Figure 303.

(3) Remove No. 3 bearing inner race and rollers (302/3), (303/3) using PWA 85071 Puller(302/1), (303/1).

(a) Retract hydraulic cylinder ram as required. Remove jaw retaining ring of puller.

(b) Position puller over HPC rear hub (302/9), (303/9) and engage jaws with puller groove in No. 3 bearing inner race. Position retaining ring over jaws and seat on flange of jaws. Secure retaining ring using knurled screw.

(c) Connect PWA 29389 Hydraulic Pump to hydraulic cylinder.

(d) Actuate hydraulic pump to separate inner race from tight fit on hub.

(e) Remove hydraulic pump. Remove retaining ring securing jaws. Remove puller from engine.

CAUTION: HANDLE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN LINT FREE GLOVES TO PREVENT BEARING DAMAGE.

CAUTION: DETAIL PARTS OF BEARINGS MUST BE KEPT IN THEIR ORIGINAL ASSEMBLIES. PROTECT BEARINGS BY STORING IN A SUITABLE CONTAINER.

(f) Remove bearing inner race and rolls from HPC rear hub and place in suitable labeled container.

CAUTION: WHEN YOU REMOVE THE NO. 3 BEARING OUTER RACE, YOU MUST EXAMINE THE NO. 3 BEARING HOUSING FOR SIGNS OF WEAR ON THE HOUSING SHOULDER AND JOURNAL SURFACES. SEE PW4000 SERIES CIR, PN 51A357.

(4) Remove No. 3 bearing outer race (303/11) - For engines when it is necessary to remove outer race from diffuser and combustor when it is installed on the high pressure compressor. See Figure 303.

NOTE: See 72-41-00, Removal-01 Task 72-41-00-030-004 for the removal of the No. 3 bearing outer race from the diffuser and combustor when it is not installed on the engine.

NOTE: See 72-41-00, Disassembly-03 Task 72-41-00-030-003-001 or 72-41-00, Dissasembly-04 Task 72-41-00-030-003-002 for removal of outer race from the No. 3 bearing duct and housing after the duct and housing has been removed from the diffuser and combustor.

(a) Remove PWA 85168 Protector (303/8).

(b) Install six workbolts, lubricated with Engine Oil P03-001, into bearing housing channel nuts equally around housing. Torque workbolts to 290 - 325 lb-in. (32.766 - 36.720 N.m).

NOTE: The workbolts are a quality standard bolt with .375-24 by 1.000 inch (25.400 mm) thread length.

(c) Install PWA 85168 Protector (303/8).

(d) Remove rivet (303/13) from retaining nut (303/12) in housing and discard rivet.

(e) With PWA 86491 Driver or PWA 85797 Wrench (303/15), loosen and remove the retaining nut (303/12) from housing.

NOTE: If you use PWA 86491Driver, you must attach the driver to the bearing housing with the four detail cap screws.

(f) Mechanical Wrench Method (Optional) - See Figure 303, Sheet 2. With PWA 102743 Torque Adapter (303/16), PWA 102744 Holder Adapter (303/17), and PWA 80187 Torque Multiplier (303/18), loosen and remove the retaining nut (303/12) from the housing.

CAUTION: HANDLE NO. 3 BEARING OUTER RACE WITH CLEAN GLOVES TO PREVENT BEARING DAMAGE.

(g) With PWA 86489 Puller (303/10) remove the No. 3 bearing outer race (303/11) from housing as follows.

1 Turn the large hex head cap screw clockwise, the full length of its travel.

2 Turn the three hand knobs counterclockwise, the full length of their travel.

3 Put the puller into position until it touches the bearing housing. Also, the jaws must align with the scallops in the bearing housing.

4 Carefully and equally, turn the hand knobs clockwise until the jaws fully engage the scallops of the bearing housing.

5 Turn the large hex head cap screw counterclockwise until the outer race is loose.

6 Remove the puller. Remove the bearing outer race.

(h) Remove PWA 85168 Protector (303/8) and the six workbolts (303/14) from the bearing housing.

(i) Install PWA 85168 Protector (303/8), smaller end first, into diffuser case. Push protector down to seat in case.

(5) Remove No. 3 bearing seal spacer (302/5), (303/5) with PWA 85068 Fixture (302/4), (303/4).

NOTE: If the No. 3 bearing outer race has not been removed by the above procedure, install PWA 85802 Protector Cover or PWA 85056 Protector Cover (302/10) over outer race.

(a) Loosen screws and wing nuts securing jaws.

(b) Position puller over HPC rear hub. Slide jaws behind rear flange of seal spacer. Tighten screws and wing nuts to secure jaws.

(c) Pull fixture by hand to remove spacer.

(d) If spacer cannot be removed by hand, install PWA 85069 Puller to upper flange of fixture per following step.

(e) Retract center jackscrew of PWA 85069 Puller and position puller to upper flange of PWA 85068 Fixture. Secure puller to fixture with detail screws. Using standard wrench, tighten center jackscrew to seat center puck in HPC rear hub. Continue tightening jackscrew to remove seal spacer from tight fit on hub. Remove screws securing puller to fixture. Remove puller.

(f) Loosen screws and wing nuts securing jaws to ring detail of PWA 85068 Fixture. Remove fixture.

(g) Remove seal spacer from HPC rear hub.

(6) Remove No. 3 bearing front seal seat (302/7), (303/7) with PWA 85067 Fixture (302/6), (303/6).

(a) Loosen screws and hand knobs securing jaws to fixture.

(b) Position fixture over HPC rear hub with fixture locating on seal seat. Slide jaws outward to engage pulling flange of seat. Tighten upper screws to secure jaws. Tighten hand knobs to fully engage jaws in pulling groove of seal seat.

(c) Pull fixture by hand to remove seal seat.

(d) If seal seat cannot be removed by hand, install PWA 85069 Puller to upper flange of fixture per following step.

(e) Retract center jackscrew of PWA 85069 Puller and position puller to upper flange of PWA 85067 Fixture. Secure puller to fixture with detail screws. Using standard wrench tighten center jackscrew to seat center puck in HPC rear hub. Continue tightening jackscrew to remove seal seat from tight fit on hub. Remove screws securing puller to fixture. Remove puller.

(f) Loosen screws and hand knobs securing jaws to ring detail of fixture. Remove fixture.

(g) Remove seal seat from HPC rear hub.

(7) Remove the Flange K hardware as follows. Refer to 72−00−41 Removal−20 (Task 72−00−41−020−020).

(8) For PWA 85701 Guide, retract two setscrews or side of guide. Position PWA 85308 Guide or PWA 85701 Guide, larger diameter end first, over HPC rear hub. Seat on seal plate shoulder of hub. For PWA 85701 Guide, handtighten two setscrews on side of guide. See Figure 304.

(9) Install two PWA 85751 Handling Brackets to diffuser case.

NOTE: If you have a twin overhead rail system you must use PWA 85983 Stabilizer Adapters with PWA 85751 Brackets.

(a) Loosen and remove the clamp bolts that attach the fuel tubes to the Flange K bracket for PWA 85751 Bracket tool installation clearance.

(b) Using hoist, position longer front flange of brackets to rear of front flange of diffuser case at 3 and 9 o'clock locations, locating four pins in front flange of bracket into four boltholes in diffuser case front flange. Position shorter rear flange of bracket to front of diffuser case rear flange and secure with detail nuts and bolts.

(c) Position double spool bracket in rear most two holes as marked on bracket.

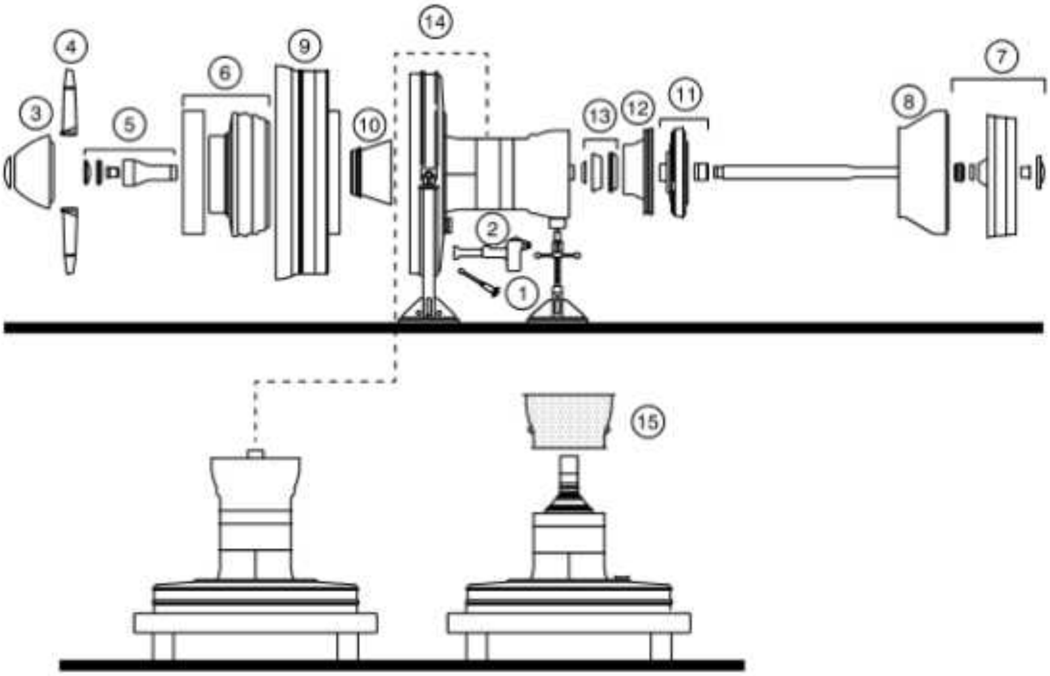
(10) Using hoist, connect PWA 28657 Sling with two PWA 76154 Adapters to outer trunnion spools of brackets. Load hoist, and using 0.250−28 Jackscrews at Flange K, separate diffuser and combustor from engine.

(11) Hoist diffuser case assembly upward to clear engine.

(12) Remove gasket from rear flange of HPC rear case if equipped (Post SB PW4ENG 72−48).

(13) Lower diffuser case assembly onto pallet front end down. Remove PWA 85751 Brackets from case. For PWA 85701 Guide, retract two setscrews on side of guide. Remove PWA 85701 Guide or PWA 85308 Guide from HPC rear hub.

(14) Install PWA 85428 Protector over No. 3 bearing rear seal knife−edge on HPC rear hub. Reinstall PWA 85159 Protector over threads and splines of HPC rear hub.

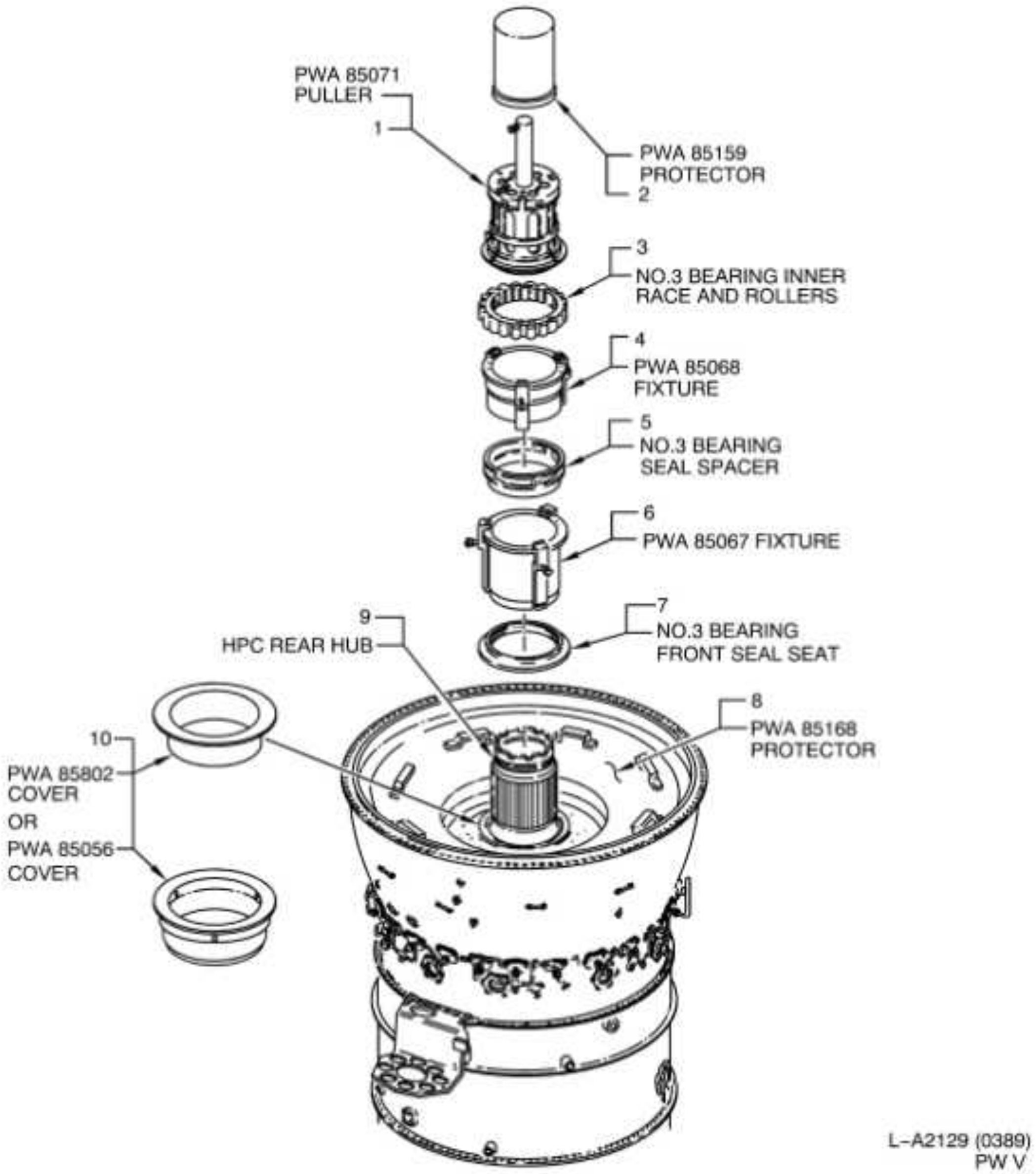


1. REMOVE ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
2. REMOVE MAIN GEARBOX.
3. REMOVE COMPRESSOR INLET CONE.
4. REMOVE STAGE 1 LPC BLADE ASSEMBLIES.
5. REMOVE LPC/LPT COUPLING.
6. REMOVE LOW PRESSURE COMPRESSOR (LPC).
7. REMOVE TURBINE EXHAUST CASE.
8. REMOVE LOW PRESSURE TURBINE (LPT).
9. REMOVE FAN CASE.
10. REMOVE NO. 1 BEARING SUPPORT ASSEMBLY.
11. REMOVE HIGH PRESSURE TURBINE (HPT).
12. REMOVE TURBINE NOZZLE.
13. REMOVE NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL SEAT.
14. TRUNNION INTERMEDIATE THROUGH DIFFUSER CASE TO FRONT END DOWN.
15. REMOVE DIFFUSER AND COMBUSTOR.

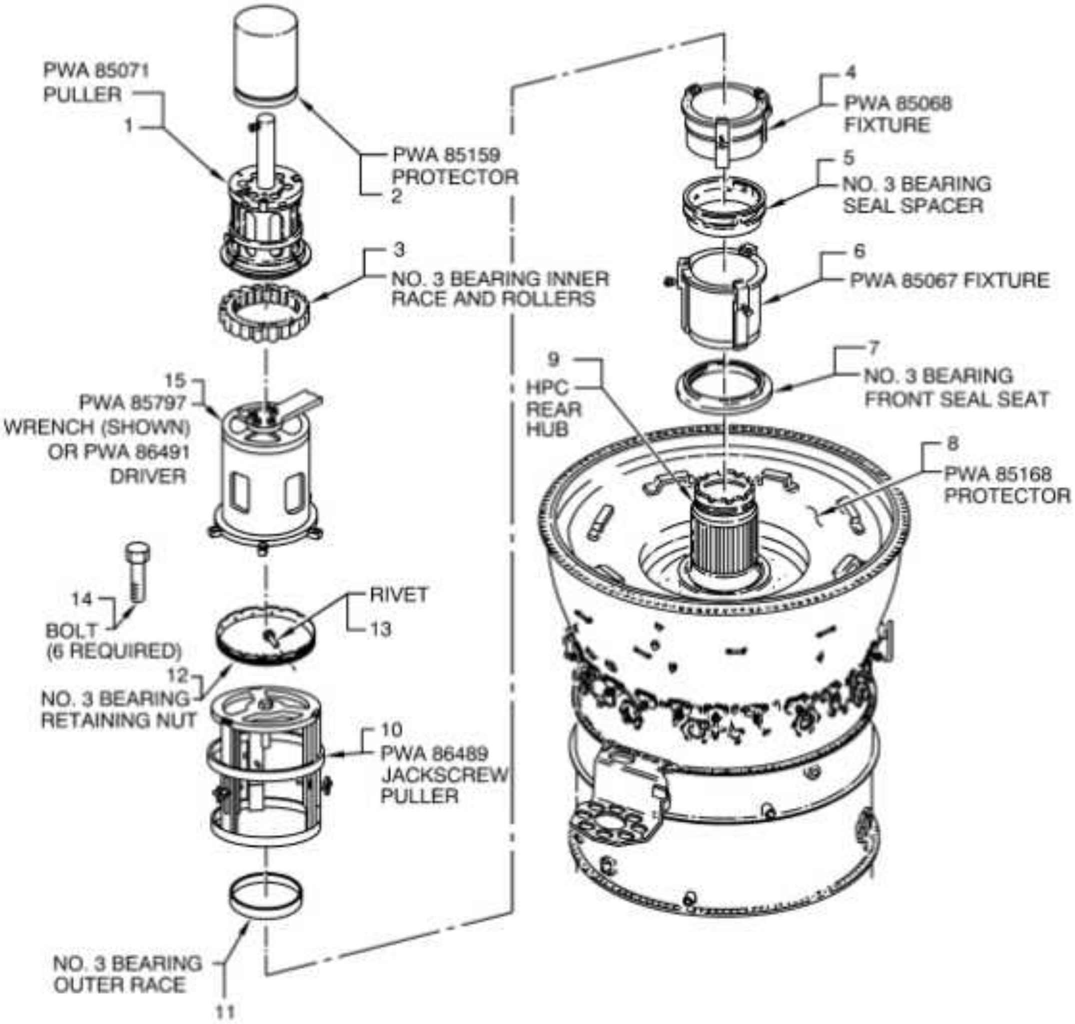
L−A0256 (0000)
PW V

Procedure Sequence
Figure 301
(Task 72−00−41−020−001)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−01


PWA 85071
PULLER
1
PWA 85159
PROTECTOR
2
3
NO.3 BEARING INNER
RACE AND ROLLERS
4
PWA 85068
FIXTURE
5
NO.3 BEARING
SEAL SPACER
6
PWA 85067 FIXTURE
9
HPC REAR HUB
7
NO.3 BEARING
FRONT SEAL SEAT
8
PWA 85168
PROTECTOR
10
PWA 85802
COVER
OR
PWA 85056
COVER
L−A2129 (0389)
PW V

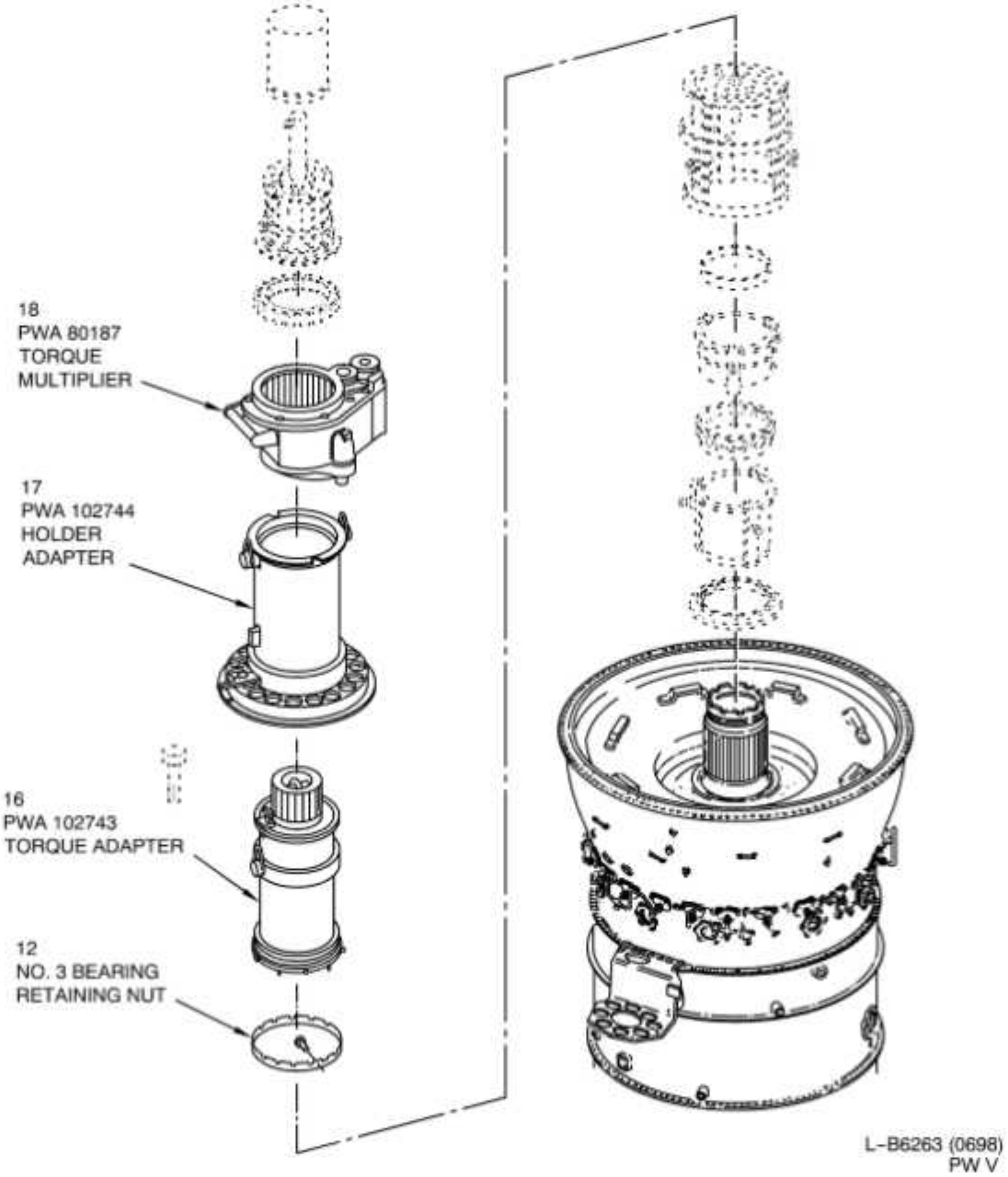
Diffuser And Combustor Removal − Not
Requiring No. 3 Bearing Outer Race Removal
Figure 302
(Task 72−00−41−020−001)


PWA 85071
PULLER
1
PWA 85159
PROTECTOR
2
3
NO. 3 BEARING INNER
RACE AND ROLLERS
15
PWA 85797
WRENCH (SHOWN)
OR PWA 86491
DRIVER
14
BOLT
(6 REQUIRED)
RIVET
13
12
NO. 3 BEARING
RETAINING NUT
10
PWA 86489
JACKSCREW
PULLER
NO. 3 BEARING
OUTER RACE
11
4
PWA 85068
FIXTURE
5
NO. 3 BEARING
SEAL SPACER
6
PWA 85067 FIXTURE
9
HPC
REAR
HUB
7
NO. 3 BEARING
FRONT SEAL SEAT
8
PWA 85168
PROTECTOR

L−A5800 (1093)
PW V

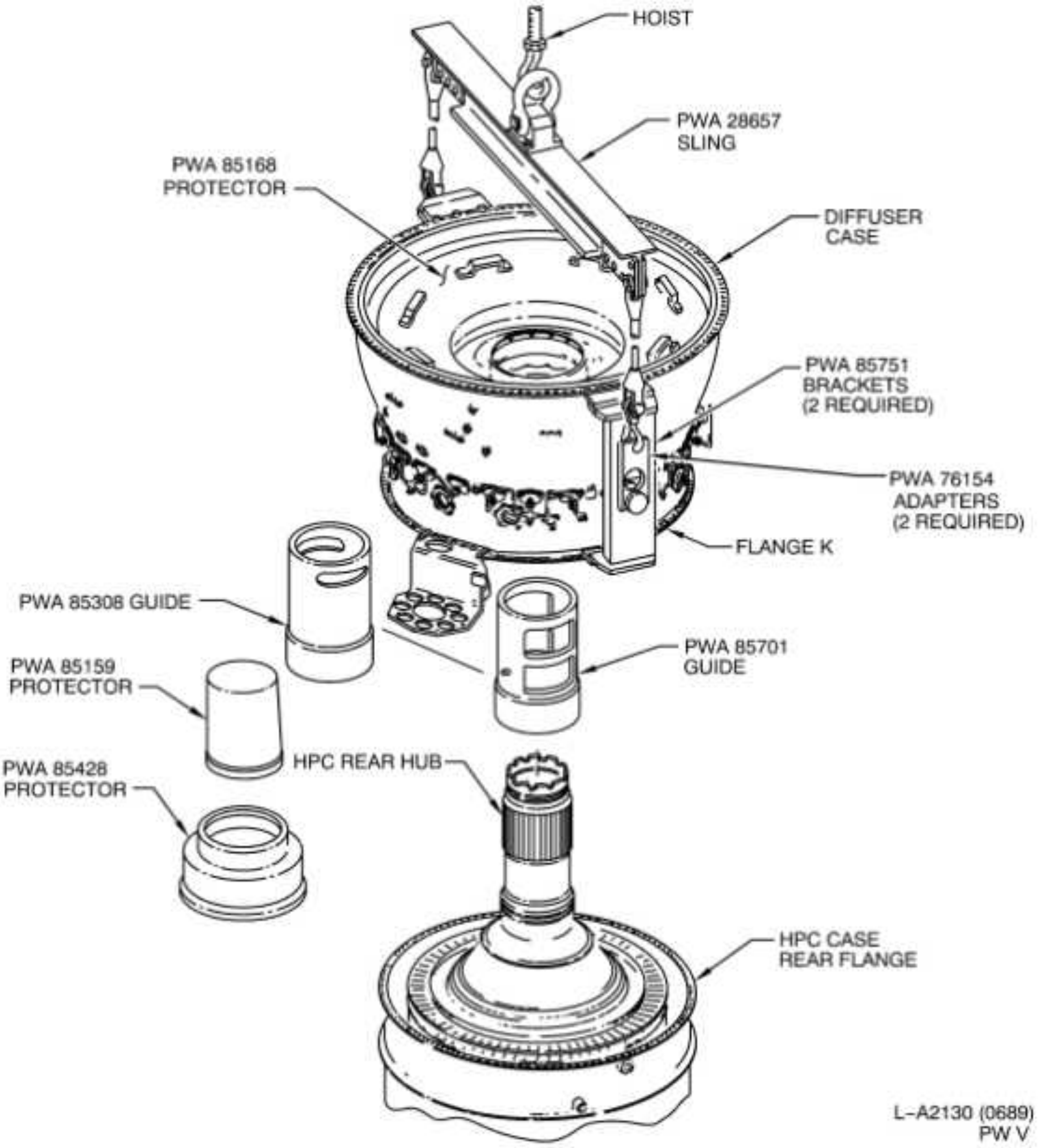
Diffuser And Combustor Removal − Requiring
No. 3 Bearing Outer Race Removal
Figure 303 (Sheet 1)
(Task 72−00−41−020−001)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−01


18
PWA 80187
TORQUE
MULTIPLIER
17
PWA 102744
HOLDER
ADAPTER
16
PWA 102743
TORQUE ADAPTER
12
NO. 3 BEARING
RETAINING NUT
L-B6263 (0698)
PW V

Diffuser And Combustor Removal − Requiring
No. 3 Bearing Outer Race Removal
Figure 303 (Sheet 2)
(Task 72−00−41−020−001)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−01


HOIST
PWA 28657 SLING
PWA 85168 PROTECTOR
DIFFUSER CASE
PWA 85751 BRACKETS (2 REQUIRED)
PWA 76154 ADAPTERS (2 REQUIRED)
FLANGE K
PWA 85308 GUIDE
PWA 85701 GUIDE
PWA 85159 PROTECTOR
HPC REAR HUB
PWA 85428 PROTECTOR
HPC CASE REAR FLANGE
L−A2130 (0689)
PW V

Diffuser And Combustor
Figure 304
(Task 72−00−41−020−001)

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-01

Task 72-00-41-020-005:

1. Remove Diffuser And Combustor (Vertical)

NOTE: See Figure 301 for part/assembly removal procedure sequence.

A. Prerequisites

(1) Remove The Electronic Engine Control (EEC) Speed Transducer (N1). Refer to 72-00-34, Removal-03 (Task 72-00-34-050-001).

(2) Remove The Main Gearbox. Refer to 72-00-61, Removal-01 (Task 72-00-61-020-001).

(3) Remove The Compressor Inlet Cone. Refer to 72-00-31, Removal-02 (Task 72-00-31-020-001).

(4) Remove The 1st Stage LPC Blade Assemblies. Refer to 72-00-31, Removal-04 (Task 72-00-31-020-002-002).

(5) Remove The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed). Refer to 72-00-32, Removal-01 (Task 72-00-32-020-001).

(6) Remove The Low Pressure Compressor. Refer to 72-00-31, Removal-01 (Task 72-00-31-020-003).

(7) Remove The Turbine Exhaust Case. Refer to 72-00-54, Removal-01 (Task 72-00-54-020-001).

(8) Remove The Low Pressure Turbine With Shaft. Refer to 72-00-53, Removal-01 (Task 72-00-53-020-001).

(9) Remove The Fan Case. Refer to 72-00-33, Removal-01 (Task 72-00-33-020-001).

(10) Remove The No. 1 Bearing Support Assembly. Refer to 72-00-34, Removal-04 (Task 72-00-34-050-002).

(11) Remove The High Pressure Turbine. Refer to 72-00-52, Removal-01 (Task 72-00-52-020-001).

(12) Remove The Turbine Nozzle. Refer to 72-00-51, Removal-01 (Task 72-00-51-020-001).

(13) Remove The No. 3 Bearing Rear Seal Assembly. Refer to 72-00-41, Removal-03 (Task 72-00-41-020-003).

(14) Trunnion The Intermediate Case Through Diffuser And The Combustor From Horizontal To The Front End Down Position. Refer to 72−00−00, Special Procedures−09 (Task 72−00−00−020−002−A00).

(15) Disconnect/Remove The External Parts To Get Access To The Diffuser And Combustor. Refer to 72−00−41, Removal−02 (Task 72−00−41−020−006).

B. Equipment And Materials Required

Standard Tools:
0.250−28 Jackscrews (Four Necessary)

Special Tools:

PWA 28657	Sling
PWA 29389	Pump, Hydraulic
PWA 76154	Adapters (Two Necessary)
PWA 80187	Multiplier, Torque
PWA 85056	Cover, Protector (Optional To PWA 85802)
PWA 85067	Fixture
PWA 85068	Fixture
PWA 85069	Puller, Jackscrew
PWA 85071	Puller, Hydraulic
PWA 85159	Protector
PWA 85168	Protector
PWA 85308	Guide (Optional To PWA 85701)
PWA 85428	Protector, Plastic
PWA 85701	Guide
PWA 85751	Bracket, Handling (Two Necessary)
PWA 85802	Cover, Protector
PWA 85797	Wrench (Optional To PWA 86491)
PWA 85983	Adapter, Stabilizer (Two Necessary Twin Overhead Rail System Only)
PWA 86489	Puller, Jackscrew
PWA 86491	Driver, Torque
PWA 102743	Adapter, Torque
PWA 102744	Adapter, Holder

C. Procedure

(1) Install the PWA 85168 Protector (302/8), (303/8), smaller end first, into the diffuser case. Push the protector down to seat in the case.

(2) Remove the PWA 85159 Thread Protector (302/2), (303/2) from the rear of the HPC rear hub. See Figure 302 and Figure 303.

(3) Remove the No. 3 bearing inner race and rollers (302/3), (303/3), use PWA 85071 Puller (302/1), (303/1).

(a) Retract the hydraulic cylinder ram as necessary. Remove the jaw retaining ring of the puller.

(b) Install the puller over the HPC rear hub (302/9), (303/9) and engage the jaws with the puller groove in the No. 3 bearing inner race. Install the retaining ring over the jaws to engage against the flange of the jaws. Attach the retaining ring with the knurled screw.

(c) Attach the PWA 29389 Hydraulic Pump to the hydraulic cylinder.

(d) Operate the hydraulic pump to disengage the inner race from the tight fit on the hub.

(e) Remove the hydraulic pump. Remove the retaining ring from the jaws. Remove the puller from the engine.

CAUTION: YOU MUST WEAR CLEAN LINT FREE GLOVES WHEN YOU TOUCH THE NO. 3 BEARING INNER RACE AND ROLLERS TO PREVENT BEARING DAMAGE.

CAUTION: DETAIL PARTS OF THE BEARINGS MUST BE KEPT IN THEIR ORIGINAL ASSEMBLIES. PROTECT THE BEARINGS BY STORAGE IN AN APPLICABLE CONTAINER.

(f) Remove the bearing inner race and rollers from the HPC rear hub and put in an applicable labeled container.

CAUTION: WHEN YOU REMOVE THE NO. 3 BEARING OUTER RACE, YOU MUST EXAMINE THE NO. 3 BEARING HOUSING FOR SIGNS OF WEAR ON THE HOUSING SHOULDER AND

JOURNAL SURFACES. SEE PW4000 SERIES CIR, PN 51A357.

(4) Remove the No. 3 bearing outer race (303/11) − For engines when it is necessary to remove the outer race from the diffuser and combustor when it is installed on the high pressure compressor. See Figure 303.

NOTE: See 72−41−00, Removal−01 Task 72−41−00−030−004 for the removal of the No. 3 bearing outer race from the diffuser and combustor when it is not installed on the engine.

NOTE: See 72−41−00, Disassembly−03 Task 72−41−00−030−003−001 or Dissasembly−04 Task 72−41−00−030−003−002 for removal of the outer race from the No. 3 bearing duct and housing after the duct and housing has been removed from the diffuser and combustor.

(a) Remove the PWA 85168 Protector (303/8).

(b) Install six workbolts, lubricated with Engine Oil P03−001, into the bearing housing channel nuts equally around the housing. Torque the workbolts to 290 − 325 lb−in. (32.766 − 36.720 N.m).

NOTE: The workbolts are a quality standard bolt with .375−24 by 1.000 inch (25.400 mm) thread length.

(c) Install the PWA 85168 Protector (303/8).

(d) Remove the rivet (303/13) from the retaining nut (303/12) in the housing and discard the rivet.

(e) With PWA 86491 Driver or PWA 85797 Wrench (303/15), loosen and remove the retaining nut (303/12) from housing.

NOTE: If you use PWA 86491 Driver, you must attach the driver to the bearing housing with the four detail cap screws.

(f) Mechanical Wrench Method (Optional) − See Figure 303, Sheet 2. With PWA 102743 Torque Adapter (303/16), PWA 102744 Holder Adapter (303/17) and PWA 80187 Torque Multiplier (303/18), loosen and remove the retaining nut (303/12) from the housing.

CAUTION: YOU MUST WEAR CLEAN LINT FREE GLOVES WHEN YOU TOUCH THE NO. 3 BEARING OUTER RACE TO PREVENT BEARING DAMAGE.

(g) With the PWA 86489 Puller (303/10) remove the No. 3 bearing outer race (303/11) from the housing as follows.

1 Turn the large hex head cap screw clockwise, the full length of its travel.

2 Turn the three hand knobs counterclockwise, the full length of their travel.

3 Put the puller into position until it touches the bearing housing. Also, the jaws must align with the scallops in the bearing housing.

4 Carefully and equally, turn the hand knobs clockwise until the jaws fully engage the scallops of the bearing housing.

5 Turn the large hex head cap screw counterclockwise until the outer race is loose.

6 Remove the puller. Remove the bearing outer race.

(h) Remove the PWA 85168 Protector (303/8) and the six workbolts (303/14) from the bearing housing.

(i) Install the PWA 85168 Protector (303/8), smaller end first, into diffuser case. Push protector down to engage in the case.

(5) Remove the No. 3 bearing seal spacer (302/5), (303/5) with PWA 85068 Fixture (302/4), (303/4).

NOTE: If the No. 3 bearing outer race has not been removed by the above procedure, install PWA 85802 Protector Cover or PWA 85056 Protector Cover (302/10) over the outer race.

(a) Loosen the screws and wing nuts that attach the jaws.

(b) Install the puller over the HPC rear hub. Move the jaws behind the rear flange of the seal spacer. Tighten the screws and wing nuts to attach the jaws.

(c) Pull the fixture by hand to remove the spacer.

(d) If the spacer cannot be removed by hand, install the PWA 85069 Puller to the upper flange of the fixture by the steps that follow.

1 Retract the center jackscrew of the PWA 85069 Puller and install the puller to the upper flange of the PWA 85068 Fixture. Attach the puller to the fixture with detail screws. Use a standard wrench and tighten the center jackscrew to engage the center puck in the HPC rear hub. Continue to tighten the jackscrew to remove the seal spacer from the tight fit on the hub. Remove the screws that attach the puller to the fixture. Remove the puller.

2 Loosen the screws and wing nuts that attach the jaws to the ring detail of the PWA 85068 Fixture. Remove the fixture.

3 Remove the seal spacer from the HPC rear hub.

(6) Remove the No. 3 bearing front seal seat (302/7), (303/7) with the PWA 85067 Fixture (302/6), (303/6).

(a) Loosen the screws and hand knobs that attach the jaws to the fixture.

(b) Install the fixture over the HPC rear hub with the fixture installed on the seal seat. Slide the jaws outward to engage the pulling flange of the seat. Tighten the upper screws to engage the jaws. Tighten the hand knobs to fully engage the jaws in the pulling groove of the seal seat.

(c) Pull the fixture by hand to remove the seal seat.

(d) If the seal seat cannot be removed by hand, install the PWA 85069 Puller to the upper flange of the fixture by the steps that follow:

1 Retract the center jackscrew of the PWA 85069 Puller and install the puller to the upper flange of the PWA 85067 Fixture. Attach the puller to the fixture with detail screws. Use a standard wrench and tighten the center jackscrew to engage the center puck in the HPC rear hub. Continue to tighten the jackscrew to remove the seal seat from the tight fit on the hub. Remove the screws that attach the puller to the fixture. Remove the puller.

2 Loosen the screws and hand knobs that attach the jaws to the ring detail of the fixture. Remove the fixture.

3 Remove the seal seat from the HPC rear hub.

(7) Remove the Flange K hardware as follows: Refer to 72-00-41, Removal-20 (Task 72-00-41-020-020).

(8) For PWA 85701 Guide, retract the two setscrews on the side of the guide. Install the PWA 85308 Guide or PWA 85701 Guide, larger diameter end first, over the HPC rear hub. Engage against seal plate shoulder of the hub. For PWA 85701 Guide, hand tighten the two setscrews on side of guide. See Figure 304.

(9) Install two PWA 85751 Handling Brackets to the diffuser case.

NOTE: If you have a twin overhead rail system you must use PWA 85983 Stabilizer Adapters with PWA 85751 Brackets.

(a) Loosen and remove the clamp bolts that attach the fuel tubes to the Flange K bracket for PWA 85751 Bracket tool installation clearance.

(b) Use a hoist and install the longer front flange of the brackets to the rear of the front flange of the diffuser case at the 3 and 9 o'clock locations, install four pins in the front flange of the bracket into the four boltholes in the diffuser case front flange. Put the shorter rear flange of the bracket to the front of the diffuser case rear flange and attach with detail nuts and bolts.

(c) Install the double spool bracket in the rear most two holes as marked on the bracket.

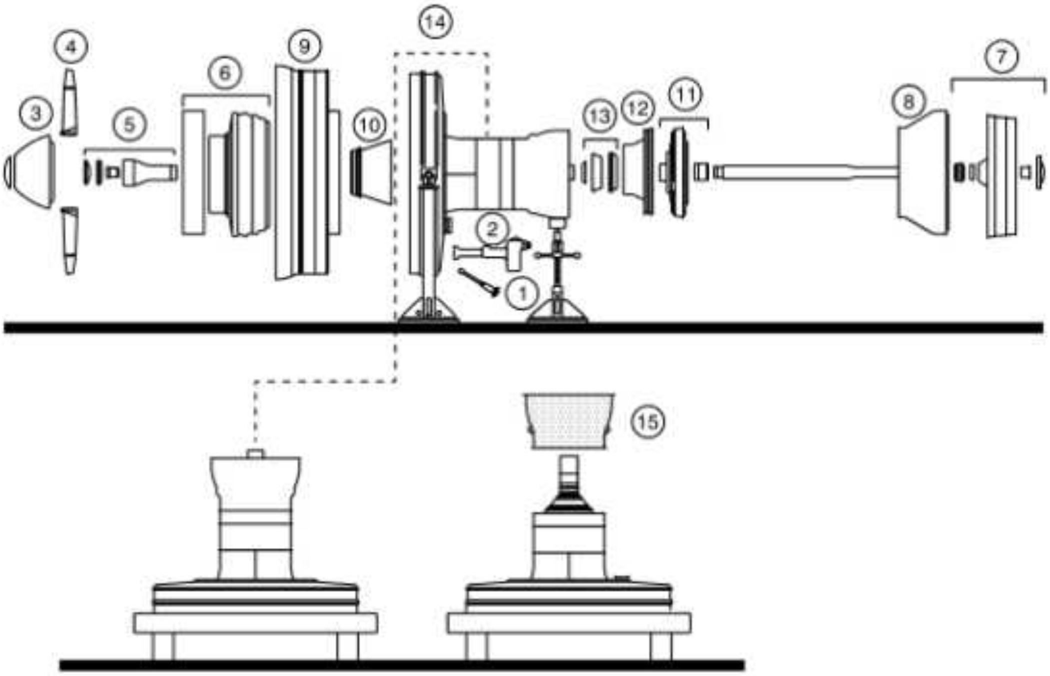
(10) Use a hoist and connect the PWA 28657 Sling with two PWA 76154 Adapters to the outer trunnion spools of the brackets. Load the hoist, and use a 0.250−28 Jackscrews at Flange K to separate the diffuser and combustor from the engine.

(11) Hoist the diffuser case assembly upward to clear the engine.

(12) Remove the gasket from the rear flange of the HPC rear case.

(13) Lower the diffuser case assembly onto a pallet front end down. Remove the PWA 85751 Brackets from the case. For PWA 85701 Guide, retract two setscrews on the side of the guide. Remove PWA 85701 Guide or PWA 85308 Guide from the HPC rear hub.

(14) Install the PWA 85428 Protector over the No. 3 bearing rear seal knife−edge on the HPC rear hub. Install the PWA 85159 Protector over the threads and splines of the HPC rear hub.

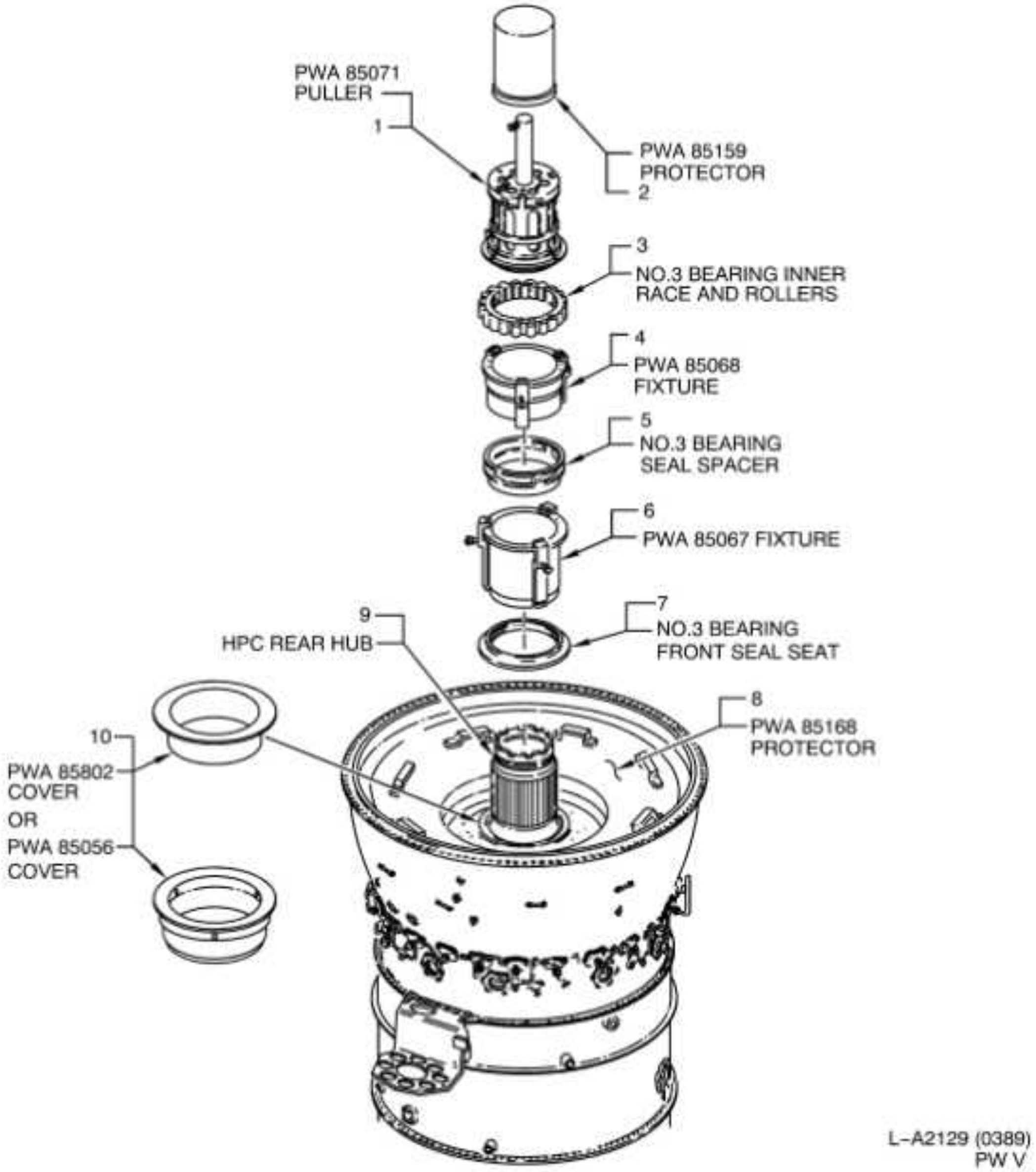


1. REMOVE ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
2. REMOVE MAIN GEARBOX.
3. REMOVE COMPRESSOR INLET CONE.
4. REMOVE STAGE 1 LPC BLADE ASSEMBLIES.
5. REMOVE LPC/LPT COUPLING.
6. REMOVE LOW PRESSURE COMPRESSOR (LPC).
7. REMOVE TURBINE EXHAUST CASE.
8. REMOVE LOW PRESSURE TURBINE (LPT).
9. REMOVE FAN CASE.
10. REMOVE NO. 1 BEARING SUPPORT ASSEMBLY.
11. REMOVE HIGH PRESSURE TURBINE (HPT).
12. REMOVE TURBINE NOZZLE.
13. REMOVE NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL SEAT.
14. TRUNNION INTERMEDIATE THROUGH DIFFUSER CASE TO FRONT END DOWN.
15. REMOVE DIFFUSER AND COMBUSTOR.

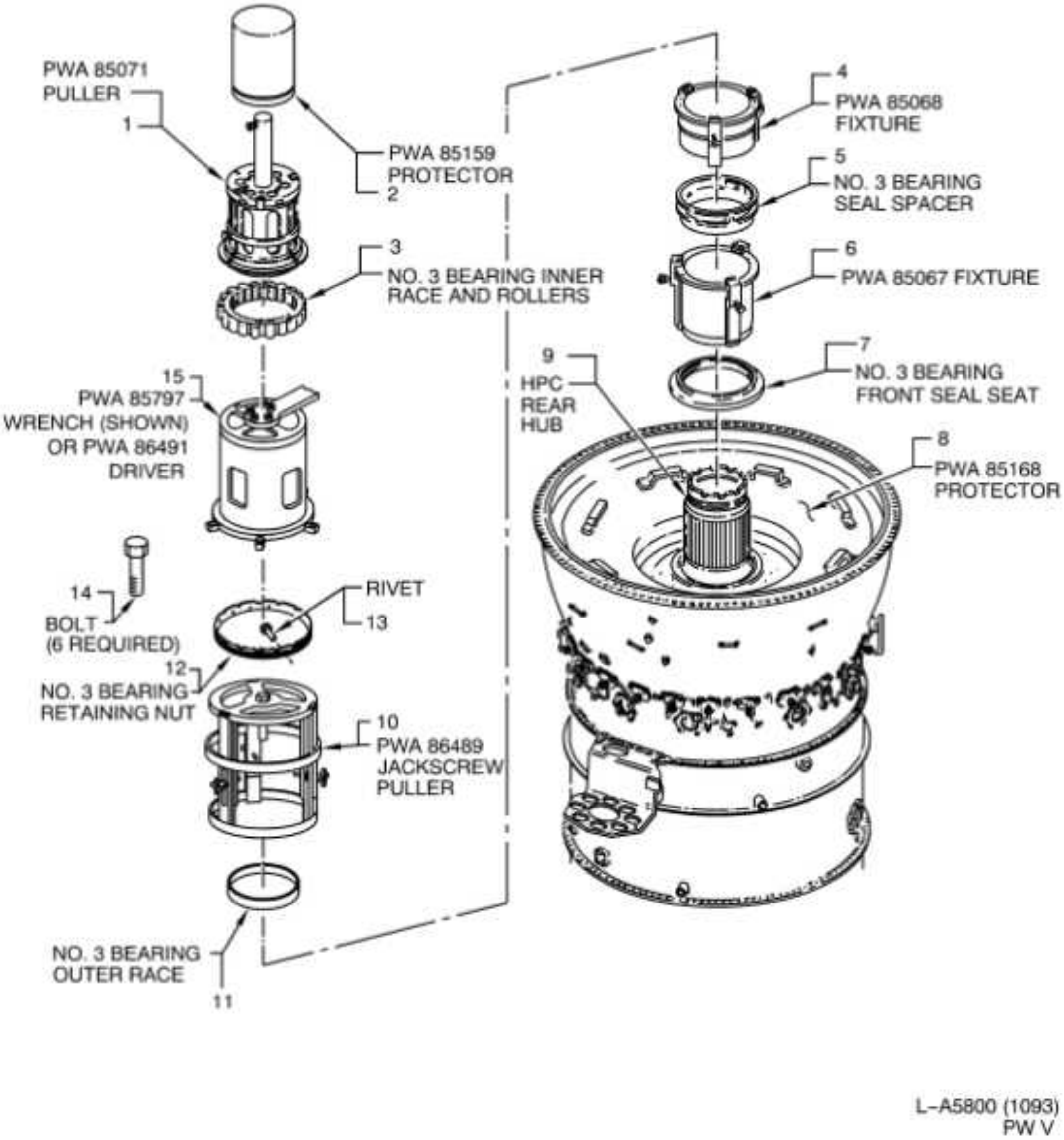
L−A0256 (0000)
PW V

Procedure Sequence
Figure 301
(Task 72−00−41−020−005)

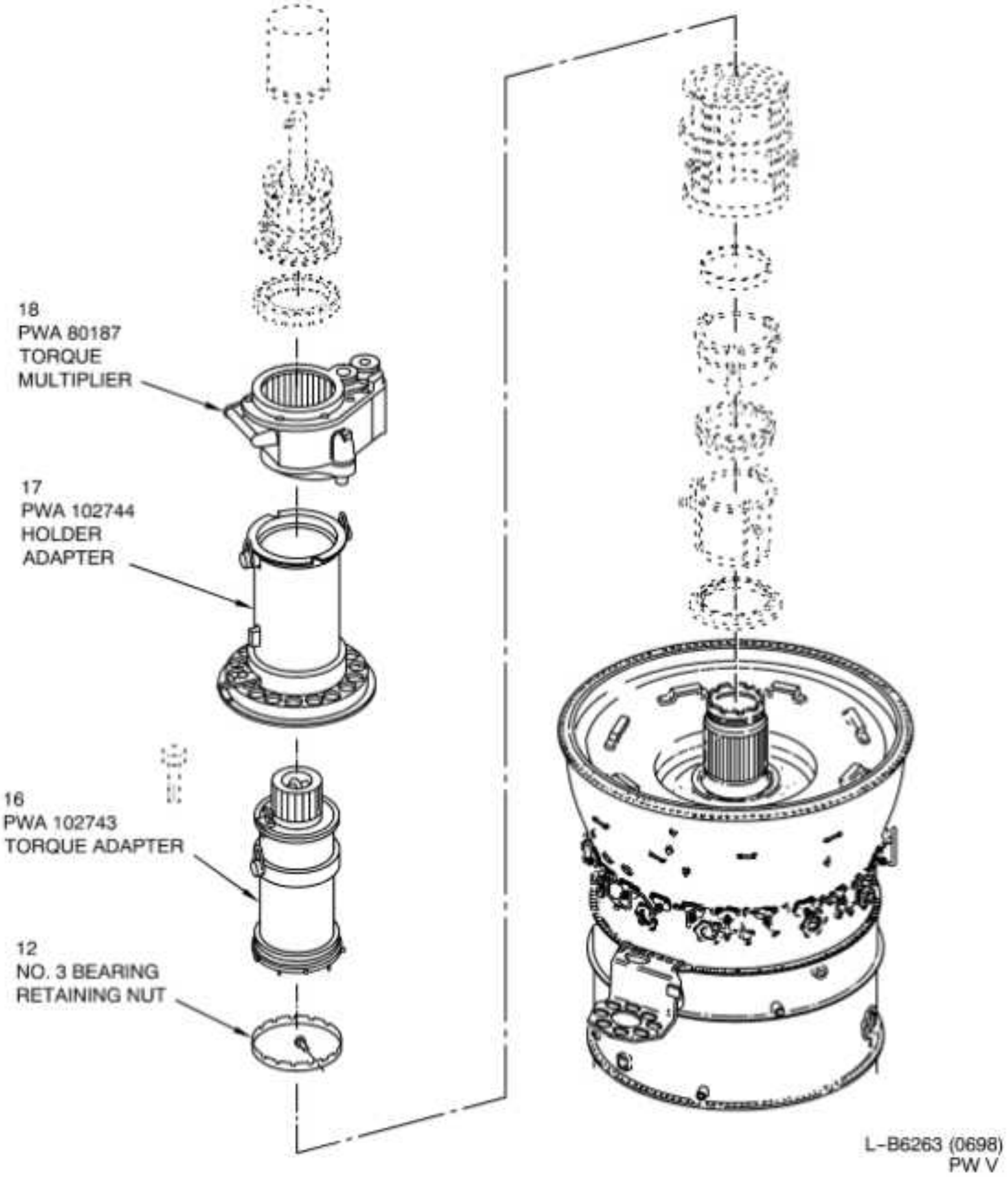
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−01


PWA 85071
PULLER
1
PWA 85159
PROTECTOR
2
3
NO.3 BEARING INNER
RACE AND ROLLERS
4
PWA 85068
FIXTURE
5
NO.3 BEARING
SEAL SPACER
6
PWA 85067 FIXTURE
9
HPC REAR HUB
7
NO.3 BEARING
FRONT SEAL SEAT
8
PWA 85168
PROTECTOR
10
PWA 85802
COVER
OR
PWA 85056
COVER
L−A2129 (0389)
PW V

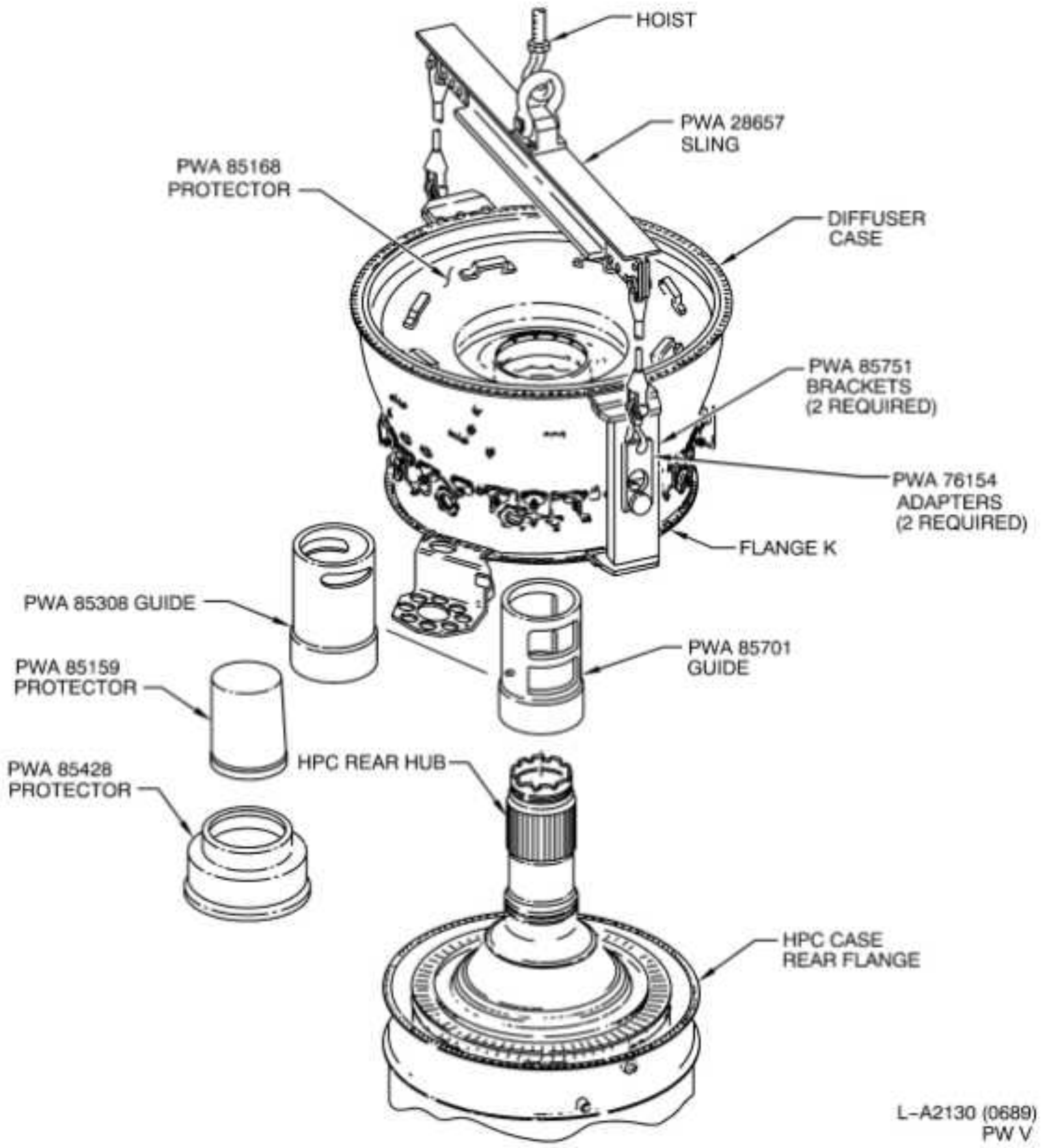
Diffuser And Combustor Removal (Engines Where The
No. 3 Bearing Outer Race Removal Is Not Necessary)
Figure 302
(Task 72−00−41−020−005)


PWA 85071
PULLER
1
PWA 85159
PROTECTOR
2
3
NO. 3 BEARING INNER
RACE AND ROLLERS
15
PWA 85797
WRENCH (SHOWN)
OR PWA 86491
DRIVER
14
BOLT
(6 REQUIRED)
RIVET
13
12
NO. 3 BEARING
RETAINING NUT
10
PWA 86489
JACKSCREW
PULLER
NO. 3 BEARING
OUTER RACE
11
4
PWA 85068
FIXTURE
5
NO. 3 BEARING
SEAL SPACER
6
PWA 85067 FIXTURE
9
HPC
REAR
HUB
7
NO. 3 BEARING
FRONT SEAL SEAT
8
PWA 85168
PROTECTOR
L−A5800 (1093)
PW V

Diffuser And Combustor Removal (Engines Where The
No. 3 Bearing Outer Race Removal Is Necessary)
Figure 303 (Sheet 1)
(Task 72−00−41−020−005)


18
PWA 80187
TORQUE
MULTIPLIER
17
PWA 102744
HOLDER
ADAPTER
16
PWA 102743
TORQUE ADAPTER
12
NO. 3 BEARING
RETAINING NUT
L-B6263 (0698)
PW V

Diffuser And Combustor Removal (Engines Where The No. 3 Bearing Outer Race Removal Is Necessary)
Figure 303 (Sheet 2)
(Task 72−00−41−020−005)


HOIST
PWA 28657 SLING
PWA 85168 PROTECTOR
DIFFUSER CASE
PWA 85751 BRACKETS (2 REQUIRED)
PWA 76154 ADAPTERS (2 REQUIRED)
FLANGE K
PWA 85308 GUIDE
PWA 85701 GUIDE
PWA 85159 PROTECTOR
HPC REAR HUB
PWA 85428 PROTECTOR
HPC CASE REAR FLANGE
L−A2130 (0689)
PW V

Diffuser And Combustor
Figure 304
(Task 72−00−41−020−005)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-41-020-002:

1. Remove External Plumbing Prior To Diffuser And Combustor Removal

A. Equipment And Materials Required - None

B. Procedure
See Figure 301, Figure 302, Figure 303, Figure 304, Figure 305, Figure 306 and Figure 307.

(1) If not previously accomplished, remove four bolts and bracket (Pre SB PW4ENG 73-163 only) securing fuel flowmeter and support to fuel distribution valve. Remove flowmeter and support. Discard packing.

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(2) Remove pressure (CP11) and return (CR13) flex hoses as follows.

(a) Disconnect two hose nuts from turbine case cooling air valve actuator and from manifold couplings. Remove hoses.

(b) Install protective closures.

(3) Remove diffuser seal air vent tube assemblies (AP21) and (AP17) as follows.

(a) Remove the bolt and nut that attach two clamps to the bracket on the tube flange at approximately 3 o'clock position on diffuser case.

(b) Remove the lockwire and the bolts that attach the tube (AP21) and bracket to the diffuser case at approximately 3 o'clock position.

(c) Remove the four bolts that attach the (AP21) tube to the lower (AP17) tube. Remove the bracket from he flange of the tube (AP21) (Post SB PW4ENG 75-95).

(d) Remove the bolt, nut, and clamp that attach the tubes to the brackets.

CAUTION: WHEN YOU REMOVE THE (AP21) RIGHT SIDE TUBE LOCK FROM THE INTERNAL DIFFUSER SEAL AIR VENT TUBE ASSEMBLY, YOU MUST BE CAREFUL THAT THE AIR VENT TUBE DOES NOT FALL INTO THE DIFFUSER CASE. AS A PRECAUTION, ATTACH A TEMPORARY SAFETY WIRE AROUND THE INTERNAL DIFFUSER SEAL AIR VENT TUBE ASSEMBLY SO IT WILL NOT FALL INTO THE DIFFUSER CASE. IF THE AIR VENT TUBE FALLS INTO THE DIFFUSER CASE IT IS POSSIBLE THAT MORE ENGINE DISASSEMBLY WILL BE NECESSARY TO GET ACCESS TO REMOVE THE TUBE.

(e) Remove the tube. Remove the locks and gaskets. Discard the gaskets.

(f) (Pre SB PW4ENG 72-514) Remove the tube. Remove the locks and gaskets. Discard the gaskets.

(g) (Post SB PW4ENG 72-514 and Pre SB PW4ENG 72-572) Remove the tube. Remove the metering plug, locks and gaskets. Discard the gaskets.

(h) (Post SB PW4ENG 72-572) Remove the tube. Remove the locks and gaskets. Discard the gaskets.

(i) Remove the four bolts that attach the (lower) tube to the diffuser case (AP17). Remove the tube, gaskets, and deflector. Discard the gaskets. Install covers.

(4) Remove No. 3 bearing cooler air tube assemblies (AP33) and (AP34) as follows. See Figure 302.

(a) Remove bolts, nuts, and gearbox heat shields to gain access to elbow connections located on HPC rear case at approximately 5 o'clock position.

(b) (Post SB PW4ENG 75-95 and Pre SB PW4ENG 75-144) Remove lockwire from the tube nut and disconnect the No. 3 bearing breather valve air supply tube assembly (AP39) from the air tube (AP34).

(c) Remove lockwire and disconnect No. 3 bearing cooler air tube nuts from cooler at approximately the 2 o'clock position in fan case. Remove lockwire and disconnect tube nuts on rearward ends of tubes from HPC case and diffuser case elbows.

(d) Remove bolts, nuts, and clamps securing tubes to bracket attached to Flange J at approximately 4:30 o'clock position.

(e) Remove bolt, nut, and clamps securing tubes to Flange H bracket at approximately 3 o'clock position.

(f) Remove bolts, nuts, and clamps securing heat shield to tubes at approximately 2:30 o'clock position forward of Flange H. Remove heat shield from engine.

(g) Remove bolts, and clamps securing tubes to HPC bracket at approximately 2:30 o'clock position. Remove tubes from engine and install protective closures.

(5) Remove HPC air and bleed valve supply tube assembly (AA23) as follows. See Figure 303.

(a) Remove lockwire and disconnect tube nut from upper HPC bleed air filter at approximately 2 o'clock position forward of Flange J.

(b) Remove lockwire and disconnect tube nut from diffuser case adapter at approximately 2 o'clock position.

(c) Remove bolt, nut, and clamps securing tubes to Flange K bracket at approximately the 1 o'clock position. Remove tube from engine and install protective closures.

(6) (Pre SB PW4ENG 72-567) Remove EEC PB tube assembly (AS09) as follows. (See Figure 303 (Sheets 1, 4 and 5).

R
R

(a) Remove lockwire and disconnect tube from diffuser case adapter at approximately 1 o'clock position.

(b) Remove lockwire and disconnect tube nut from tube coupling rearward of Flange E at approximately 12:30 o'clock position.

(c) Remove bolts, nuts, spacer, and clamps securing tube to Flange H bracket and HPC bracket at approximately 12:30 o'clock position.

(d) Remove bolt, nut, and clamp securing tube to bracket attached to HPC bleed valve flange at approximately 1:30 o'clock position.

(e) Remove the tube from the engine and install protective closures.

(7) (Post SB PW4ENG 72−567) Remove EEC PB tube assembly (AS09) as follows. See Figure 303 (Sheets 2 through 5).

(a) Remove the lockwire and disconnect the tube from the diffuser case at approximately the 3 o'clock position.

(b) Remove lockwire and disconnect tube nut from tube coupling rearward of Flange E at approximately 12:30 o'clock position.

(c) Remove bolts, nuts and clamps securing tube to Flange H bracket and HPC bracket at approximately 12:30 o'clock position.

(d) Remove bolt, nut and clamp securing tube to bracket attached to HPC bleed valve flange at approximately 1:30 o'clock position.

(e) Remove the bolt, nut and clamp that attach the tube to a bracket on Flange K at approximately the 1:30 o'clock position.

(f) Remove the bolt and clamp that attach the tube to a bracket on the diffuser case cover at approximately the 1:30 o'clock position.

(g) Remove the bolt and clamp that attach the tube to a bracket on Flange K at approximately the 2:30 o'clock position.

(h) Remove the tube from the engine and install protective closures.

(8) Remove bleed and HPC air valve supply tube assembly (AA34) as follows. See Figure 304.

(a) Remove lockwire and disconnect tube nut from adapter on diffuser case at approximately 12:30 o'clock position.

(b) Remove lockwire and disconnect tube nut from tube coupling adjacent to air filters at approximately 11 o'clock position.

(c) Remove bolt, nut, and clamp securing tube to Flange J bracket.

(d) Remove bolt, nut, and clamp securing tube to Flange K bracket at approximately 12 o'clock position. Remove tube from engine and install protective closures.

(9) Remove No. 3 bearing breather tube assembly (upper) (LB03) as follows.

(a) Remove lockwire and disconnect tube elbow from diffuser case internal tube nut at approximately 1 o'clock position.

(b) Remove bolt and clamp securing tube to bracket at approximately 11 o'clock position.

(c) Remove bolts, nuts, and clamps securing tube to Flange K brackets at approximately 10, 12 and 1 o'clock positions. Remove tube from engine and install protective closures.

(10) Remove No. 3 bearing oil vent tube assembly (front) (LD01) as follows.

(a) Remove lockwire and disconnect tube nut from diffuser case coupling at approximately 8 o'clock position.

(b) Remove bolt, nut, and clamp securing tube to diffuser case bracket at approximately 9 o'clock position. Remove tube from engine and install protective closures.

(11) Remove turbine blade cooling tube assembly (upper) (AP38) as follows. See Figure 305.

(a) Remove bolts securing tube to turbine cooling air shutoff valve on HPC at approximately 10 o'clock position.

(b) Remove lockwire and bolts securing tube to diffuser case pad at approximately 2 o'clock position.

(c) Remove bolt, nut, and clamp securing tube to Flange K bracket at approximately 11 o'clock position.

(d) (Pre SB PW4ENG 72-572 or SB PW4ENG 72-537 or Post SB PW4ENG 72-627) Remove the tube from the engine. Remove and discard the gaskets. Remove the metering plate and tube locks. Install the protective closures.

(e) (Post SB PW4ENG 72-572 and Pre SB PW4ENG 72-627 or Post SB PW4ENG 72-537 and Pre SB PW4ENG 72-627) Remove the tube from the engine. Remove and discard the gaskets. Remove the ring spacer and tube locks. Install the protective closures.

NOTE: Do not discard metal gaskets.

(12) (Pre SB PW4ENG 72-567) Remove the diffuser seal air vent tube assembly (left) (AP22) as follows. See Figure 305 (Sheets 1 through 5).

(a) Remove lockwire and disconnect tube nut from diffuser case internal tube at approximately 11 o'clock position.

(b) Remove bolts, nuts, and clamps securing PT4.95 tube and air shutoff valve signal tube to bracket attached to forward end of tube. Remove lockwire, bolts, and bracket securing tube elbow to HPC rear case.

(c) Remove bolt, nut, and clamp securing tube to fuel injector bracket. Remove tube from engine and remove deflector from HPC case. Remove and discard gaskets. Install protective closures.

NOTE: Do not discard metal gaskets.

(13) (Post SB PW4ENG 72-567) Remove the diffuser seal air vent tube assembly (left) (AP22) as follows. See Figure 305 (Sheets 6 through 11).

(a) Remove the lockwire and bolts that attach the tube to the diffuser case pad at approximately the 11 o'clock position.

(b) Remove the lockwire and bolts that attach the tube assembly (AP22) and bracket to the diffuser case pad at approximately the 11:30 o'clock position.

(c) Remove bolts, nuts and clamps that attach the PT4.95 tube (AS01) and the turbine vane cooling air valve signal tube (AA76) to the bracket attached to the flanged end of the tube (AP22). Remove the bracket from the engine.

CAUTION: WHEN YOU REMOVE THE (AP22) LEFT SIDE TUBE LOCK FROM THE INTERNAL DIFFUSER SEAL AIR VENT TUBE ASSEMBLY, YOU MUST BE CAREFUL THAT THE AIR VENT TUBE DOES NOT FALL INTO THE DIFFUSER CASE. AS A PRECAUTION, ATTACH A TEMPORARY SAFETY WIRE AROUND THE INTERNAL DIFFUSER SEAL AIR VENT TUBE ASSEMBLY SO IT WILL NOT FALL INTO THE DIFFUSER CASE. IF THE AIR VENT TUBE FALLS INTO THE DIFFUSER CASE IT IS POSSIBLE THAT MORE ENGINE DISASSEMBLY WILL BE NECESSARY TO GET ACCESS TO REMOVE THE TUBE.

(d) Remove the bolt, nut and clamp that attach the tube to a fuel injector bracket. Remove the tube from the engine. Remove the deflector from the recessed area of the diffuser case pad. Remove and discard the gaskets from the tube flanged end and from the diffuser case pad. Remove the tube locks and gaskets from the diffuser case pad and install protective covers.

NOTE: Do not discard metal gasket.

(14) (Pre SB PW4ENG 79-52) Remove the No. 3 bearing oil pressure tube assembly (LP19) as follows. See Figure 306.

CAUTION: YOU MUST USE THE WRENCHING FLATS ON THE STRAINER HOUSING WHEN YOU LOOSEN OR TIGHTEN THE STRAINER. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

(a) Remove the lockwire. While you hold the strainer housing with a wrench, loosen and remove the strainer from the housing. Remove the packing and discard.

(b) Remove hose clamp securing spray shield to No. 3 bearing oil pressure manifold at approximately 9 o'clock position. Remove spray shield from engine. Remove lockwire and disconnect manifold nut from tube strainer housing.

(c) Remove lockwire and disconnect tube nut from diffuser case internal tube at approximately 10 o'clock position.

(d) Remove bolts, nuts, and clamps securing tube to Flange K bracket. Remove tube from engine and install protective closures.

(15) (Post SB PW4ENG 79−52) (Pre/Post SB PW4ENG 72−491) Remove the No. 3 bearing oil pressure tube assembly (LP19) as follows. See Figure 306.

(a) Remove the bolt from the clamp that attaches the No. 3 bearing oil pressure manifold (LP18) and spray shield to a bracket attached to flange of cooling air tube (AS03) on the high compressor at approximately the 9 o'clock position. Remove the bolt and spray shield.

(b) Remove the lockwire and disconnect the manifold nut from the tube adapter.

(c) Remove the bolts that attach the ferrule end of the tube (LP19) to a bracket assembly on Flange K. Remove the bolt, nut and clamp that attach the tube to a bracket on Flange K at approximately the 9:30 o'clock position.

(d) Remove the lockwire from the bolts that attach the adapter and a strainer into the ferrule end of the tube. Remove the bolts and nuts from the adapter. Remove the adapter and strainer from the tube. Remove the packing from the adapter and discard.

(e) Remove the lockwire and disconnect the tube nut from the diffuser case internal tube at approximately the 10 o'clock position. Remove the tube from the engine and install protection covers.

(16) (Pre SB PW4ENG 72-491) Remove No. 4 bearing oil pressure assembly (front) (LP15) as follows.

(a) Remove hose clamp and spray shield from tube connection at tee forward of Flange J at approximately 8 o'clock position.

(b) Remove lockwire and disconnect tube nut from tee.

(c) Remove bolt, nut, and clamp securing tube to bracket attached to cooling air tube flange at approximately 9 o'clock position.

(d) Remove bolt, nut, and clamp securing tube to fuel injector bracket at approximately 9 o'clock position.

(e) Remove bolt, spacer, nut, and clamp securing tube to EEC PT4.95 tube at approximately 9:30 o'clock position. Remove tube from engine and install protective closures. If equipped remove the clamp and clip-on wear sleeves from PT4.95 tube (AS01).

(17) (Post SB PW4ENG 72-491) Remove No. 4 bearing oil pressure tube assembly (front) (LP15) as follows.

(a) Remove hose clamps and spray shields from tube connection at tee forward of Flange J at approximately 8 o'clock position and the tee fitting at the deoiler idler bearing pressure line (LP35) connection.

(b) Remove lockwire and disconnect tube nuts from tees.

(c) Remove bolt, nut, and clamp securing tube to bracket attached to cooling air tube flange at approximately 9 o'clock position.

(d) Remove bolt, nut, and clamp securing tube to fuel injector bracket at approximately 9 o'clock position.

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−02

(e) Remove bolt and clamp that holds the tube to Flange K bracket assembly at approximately 9 o'clock position.

(f) Remove bolt, spacer, nut, and clamp securing tube to EEC PT4.95 tube at approximately 9:30 o'clock position. Remove tubes from engine and install protective closures. If equipped remove the clamp and clip−on wear sleeves from PT4.95 tube (AS01).

(18) Remove EEC PT4.95 tube assembly (AS01) as follows.

(a) Remove lockwire and disconnect tube nut from tube coupling at forward end of tube.

(b) Remove bolts, nuts, and clamps securing tube to engine.

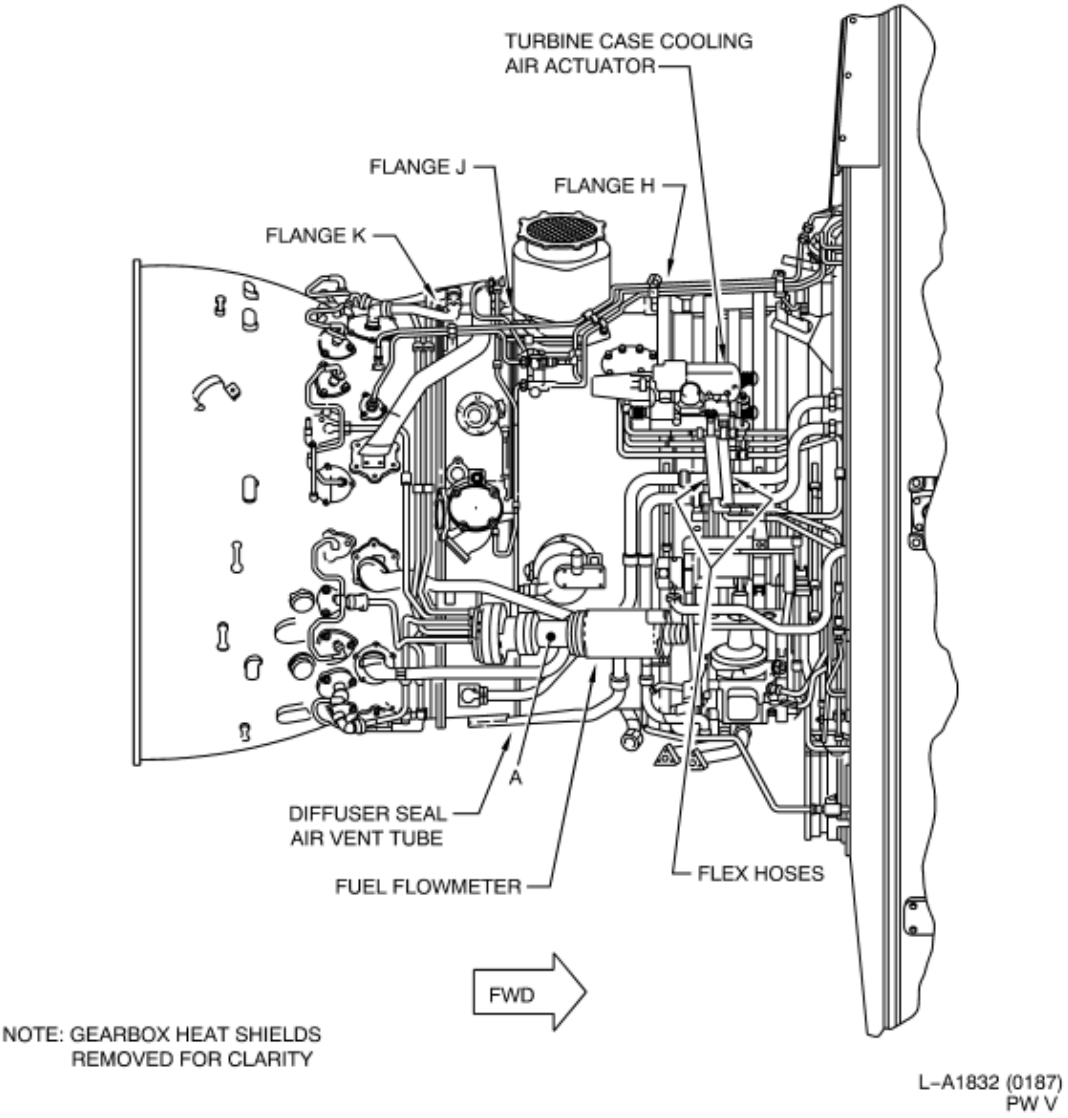
(c) Remove tube from engine and install protective closures.

(19) Remove the gearbox heat shields as follows. See Figure 307.

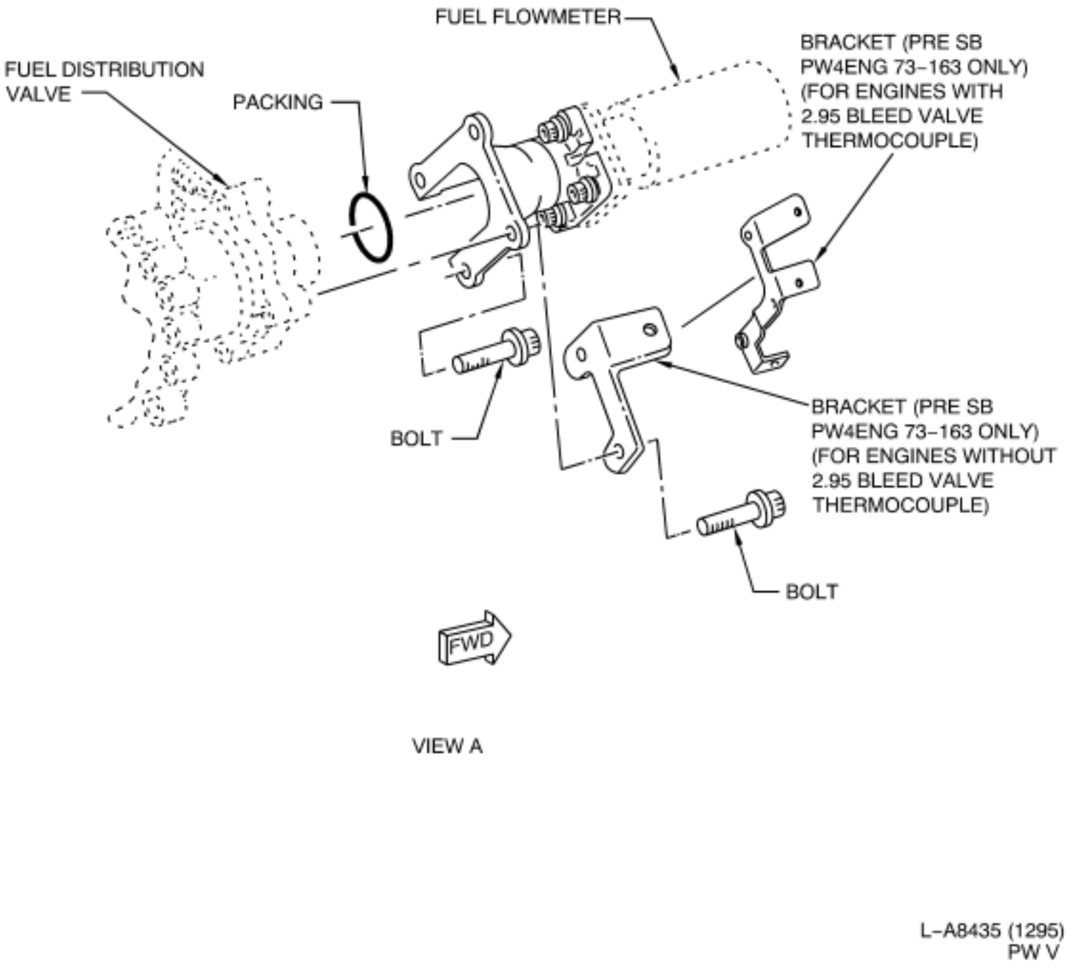
(a) Remove the bolts and nuts that attach the heat shields to the Flanges J and K brackets and to each other.

(b) Remove the heat shields.

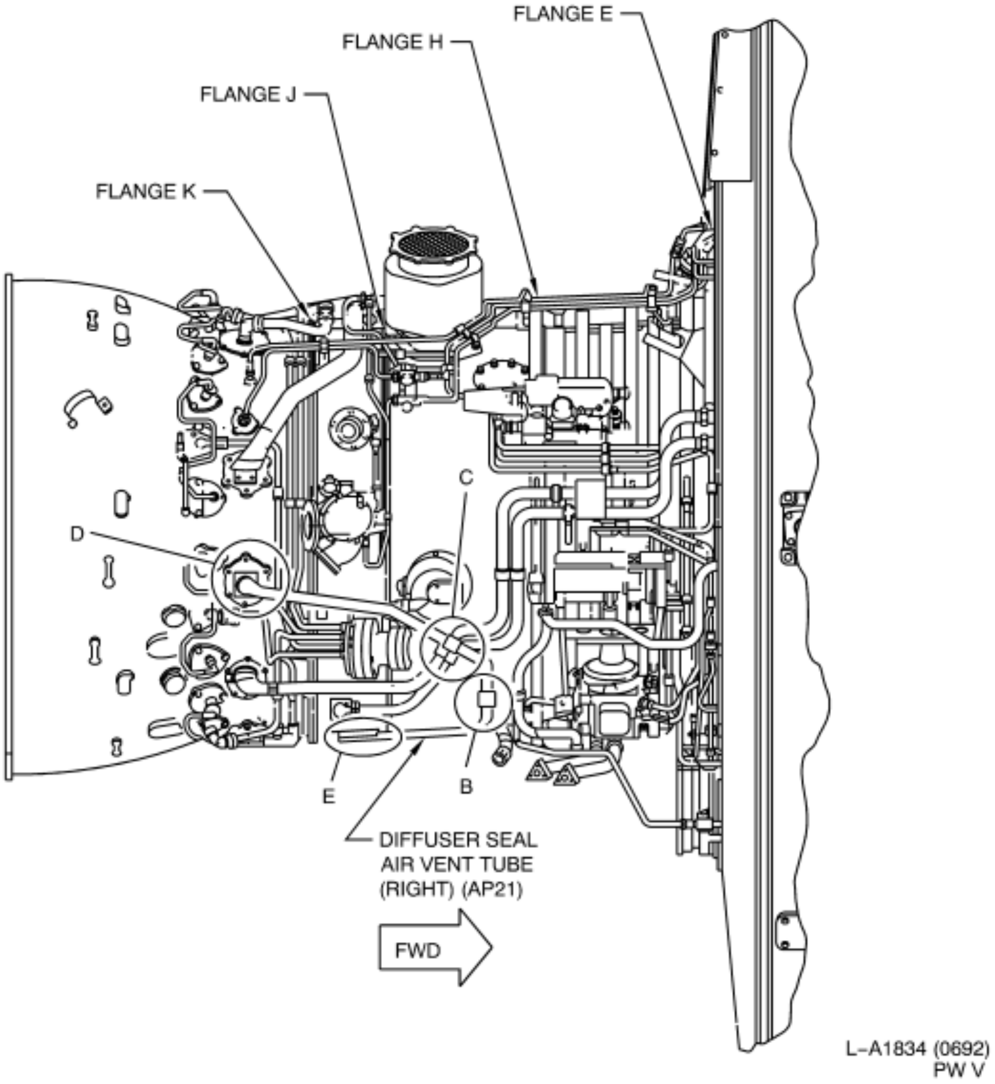
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−02


TURBINE CASE COOLING AIR ACTUATOR
FLANGE J
FLANGE H
FLANGE K
A
DIFFUSER SEAL AIR VENT TUBE
FUEL FLOWMETER
FLEX HOSES
FWD
NOTE: GEARBOX HEAT SHIELDS REMOVED FOR CLARITY
L−A1832 (0187)
PW V

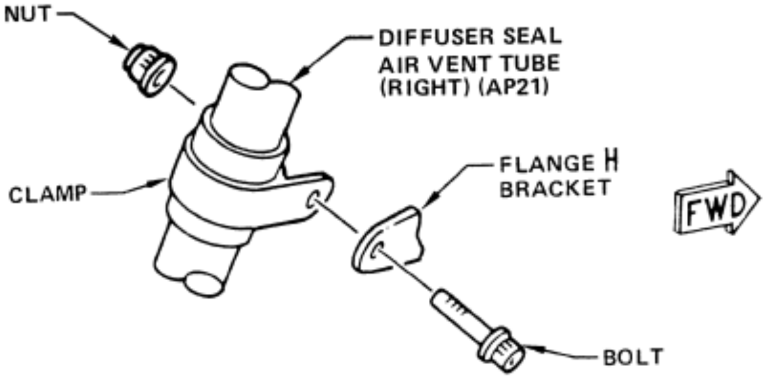
External Plumbing Removal
Figure 301 (Sheet 1)
(Task 72−00−41−020−002)


FUEL FLOWMETER
BRACKET (PRE SB PW4ENG 73−163 ONLY) (FOR ENGINES WITH 2.95 BLEED VALVE THERMOCOUPLE)
FUEL DISTRIBUTION VALVE
PACKING
BOLT
BRACKET (PRE SB PW4ENG 73−163 ONLY) (FOR ENGINES WITHOUT 2.95 BLEED VALVE THERMOCOUPLE)
BOLT
FWD
VIEW A
L−A8435 (1295)
PW V

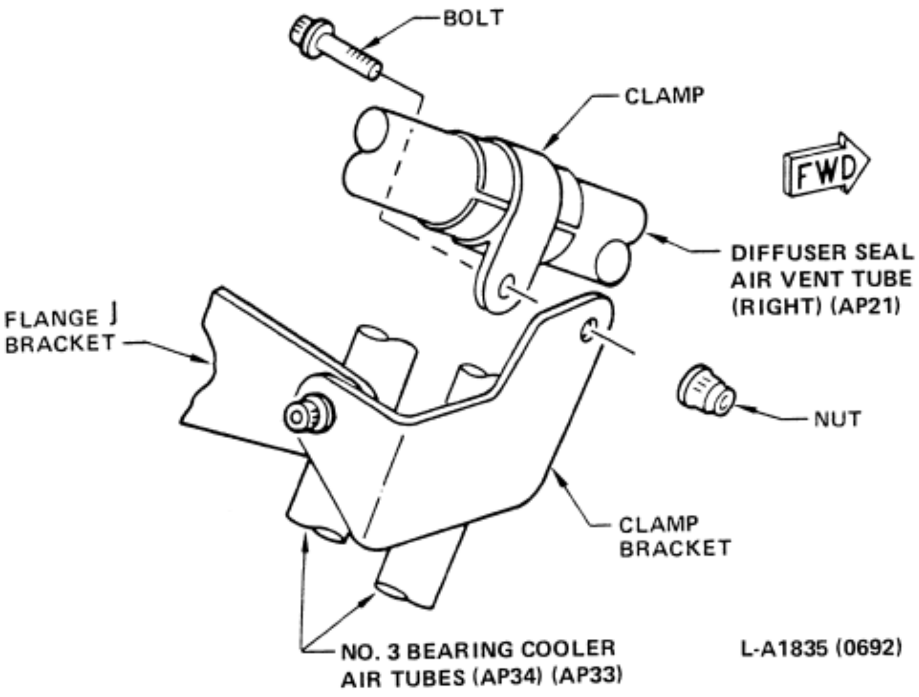
External Plumbing Removal
Figure 301 (Sheet 2)
(Task 72−00−41−020−002)


FLANGE E
FLANGE H
FLANGE J
FLANGE K
C
D
E
B
DIFFUSER SEAL AIR VENT TUBE (RIGHT) (AP21)
FWD
L-A1834 (0692)
PW V

External Plumbing Removal
Figure 301 (Sheet 3)
(Task 72-00-41-020-002)

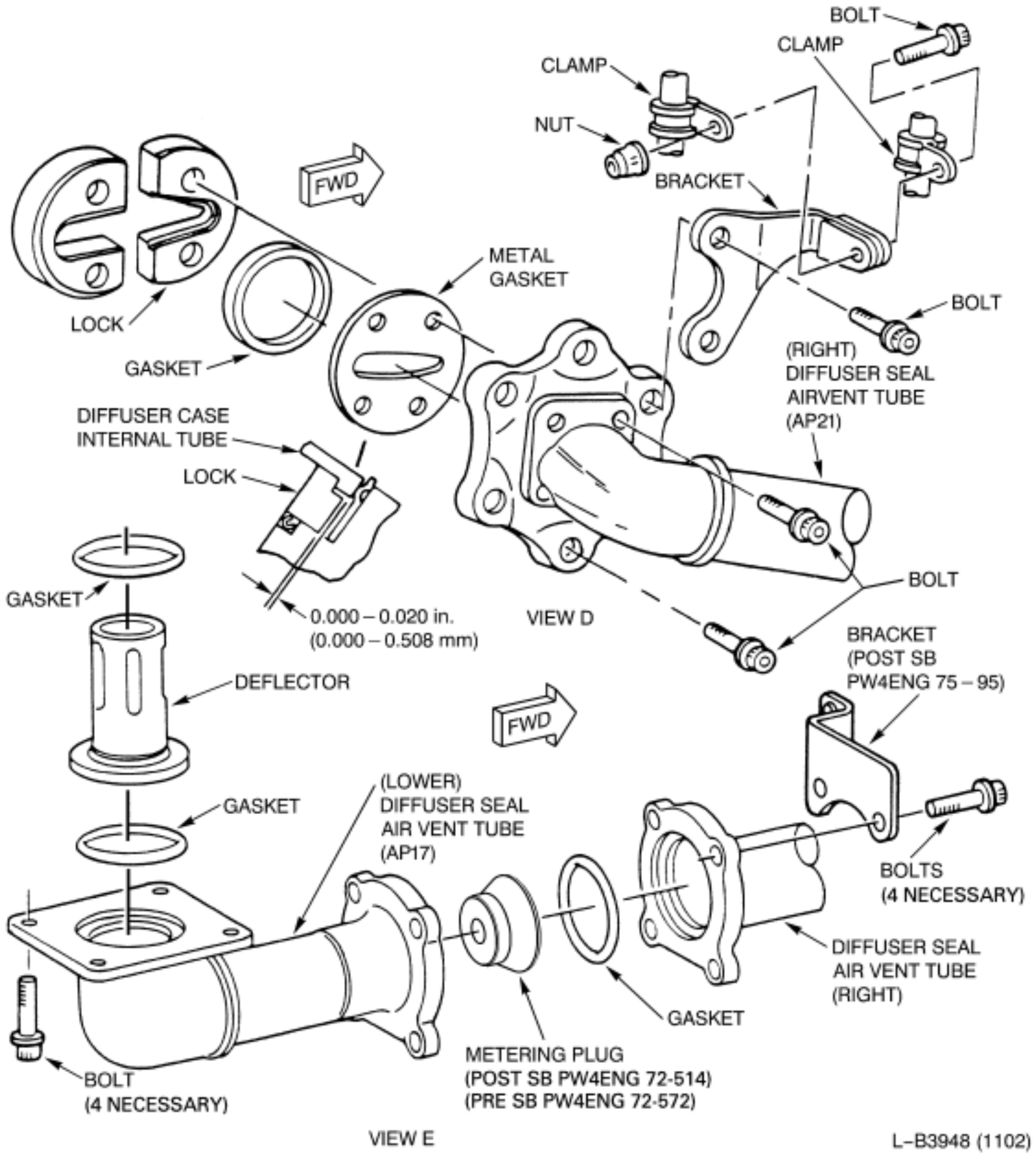

NUT
DIFFUSER SEAL AIR VENT TUBE (RIGHT) (AP21)
CLAMP
FLANGE H BRACKET
FWD
BOLT

VIEW B

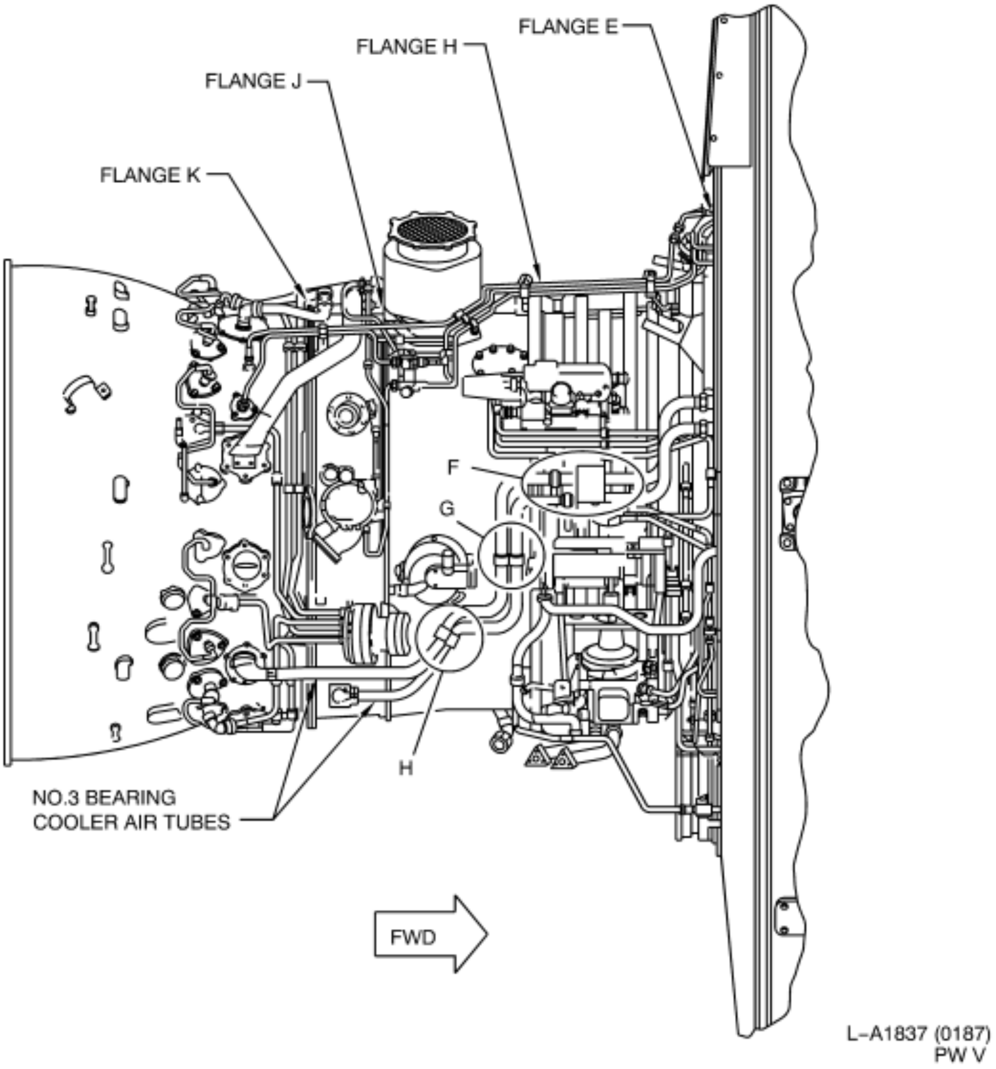

BOLT
CLAMP
FWD
DIFFUSER SEAL AIR VENT TUBE (RIGHT) (AP21)
FLANGE J BRACKET
NUT
CLAMP BRACKET
NO. 3 BEARING COOLER AIR TUBES (AP34) (AP33)
L-A1835 (0692)

VIEW C

External Plumbing Removal
Figure 301 (Sheet 4)
(Task 72−00−41−020−002)

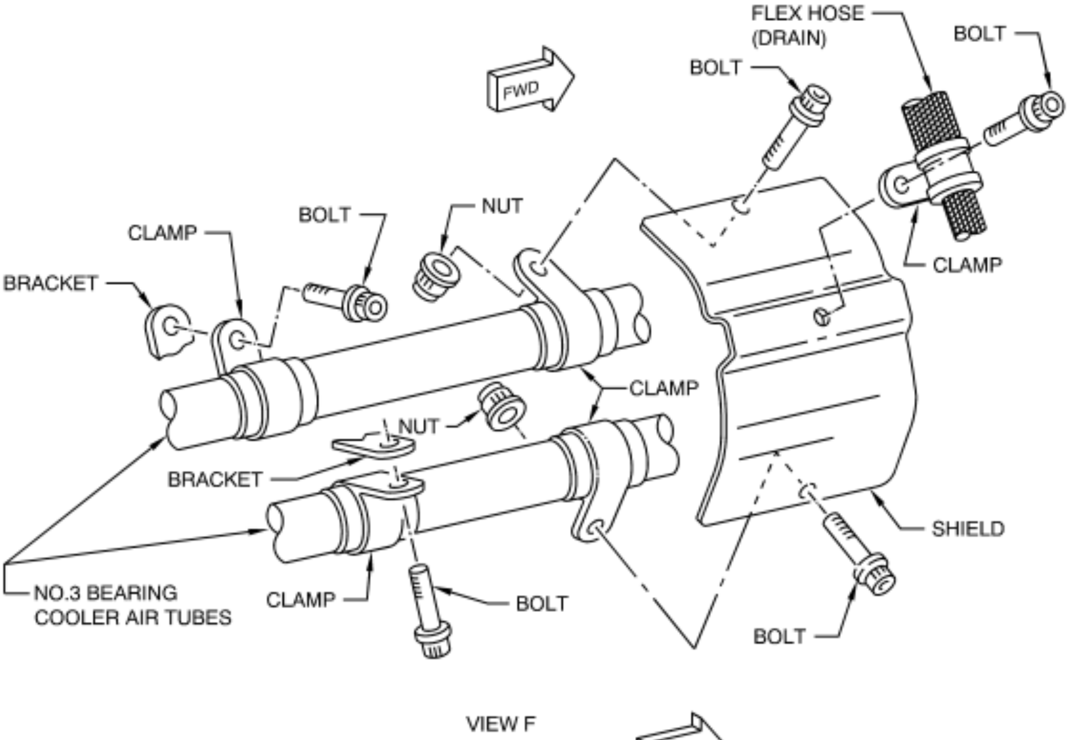

BOLT
CLAMP
CLAMP
NUT
BRACKET
FWD
METAL GASKET
LOCK
GASKET
BOLT
(RIGHT) DIFFUSER SEAL AIRVENT TUBE (AP21)
DIFFUSER CASE INTERNAL TUBE
LOCK
GASKET
0.000 – 0.020 in. (0.000 – 0.508 mm)
VIEW D
BOLT
BRACKET (POST SB PW4ENG 75 – 95)
DEFLECTOR
FWD
GASKET
(LOWER) DIFFUSER SEAL AIR VENT TUBE (AP17)
BOLTS (4 NECESSARY)
DIFFUSER SEAL AIR VENT TUBE (RIGHT)
GASKET
METERING PLUG (POST SB PW4ENG 72-514) (PRE SB PW4ENG 72-572)
BOLT (4 NECESSARY)
VIEW E
L-B3948 (1102)

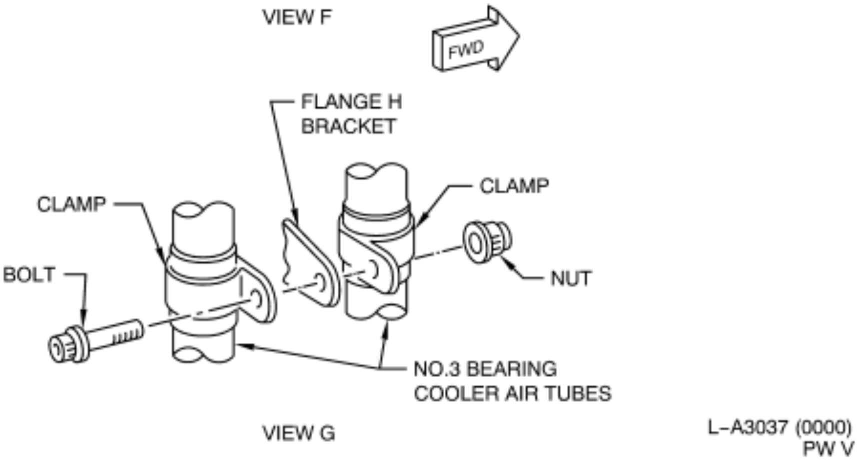
External Plumbing Removal
Figure 301 (Sheet 5)
(Task 72-00-41-020-002)


FLANGE E
FLANGE H
FLANGE J
FLANGE K
F
G
H
NO.3 BEARING COOLER AIR TUBES
FWD
L−A1837 (0187)
PW V

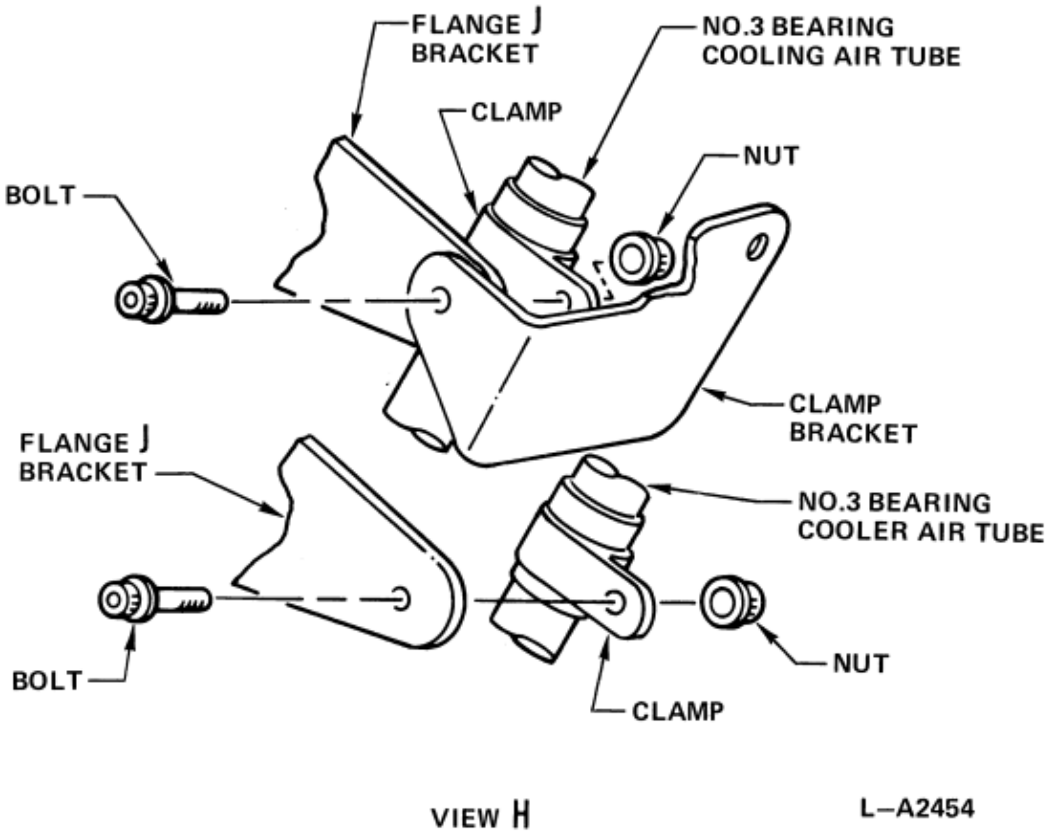
External Plumbing Removal
Figure 302 (Sheet 1)
(Task 72−00−41−020−002)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−02

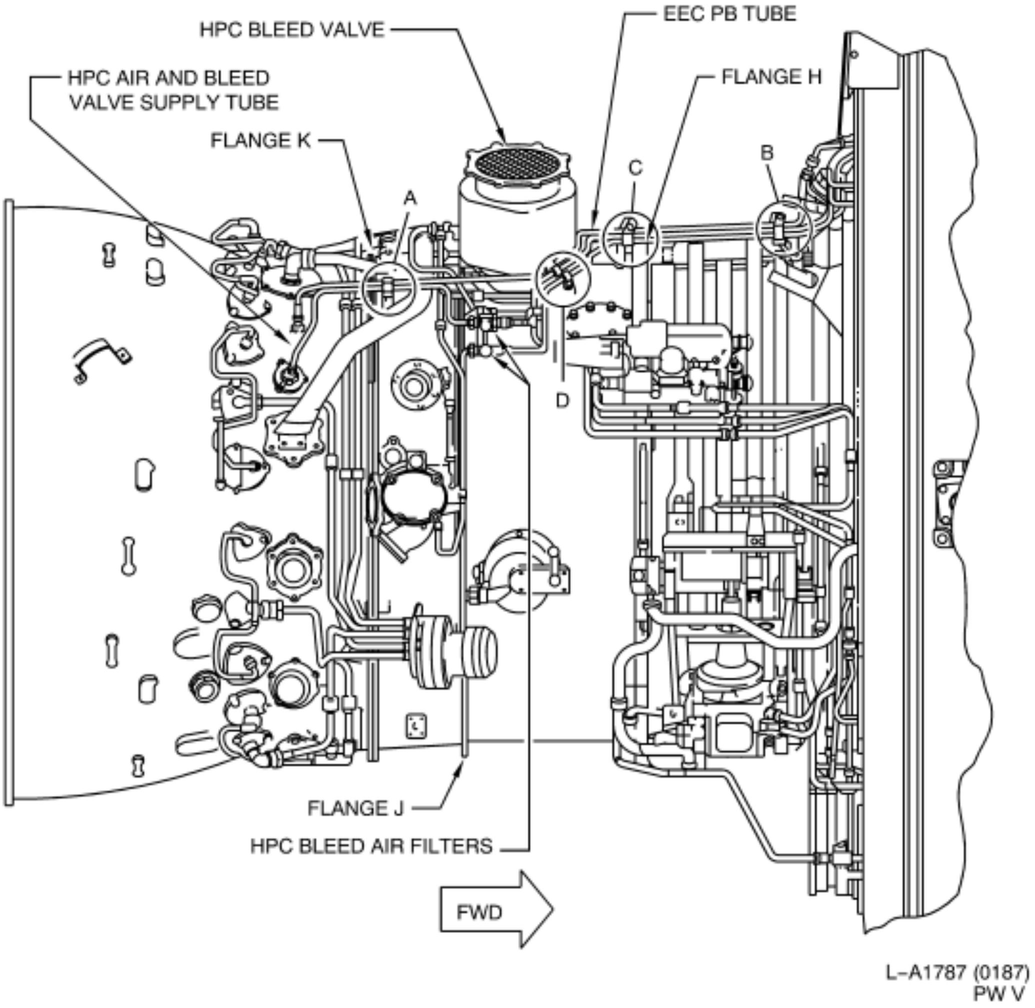

FWD
FLEX HOSE
(DRAIN)
BOLT
BOLT
CLAMP
BOLT
NUT
BRACKET
CLAMP
CLAMP
NUT
BRACKET
SHIELD
NO.3 BEARING
COOLER AIR TUBES
CLAMP
BOLT
BOLT
VIEW F


FWD
FLANGE H
BRACKET
CLAMP
CLAMP
BOLT
NUT
NO.3 BEARING
COOLER AIR TUBES
VIEW G
L−A3037 (0000)
PW V

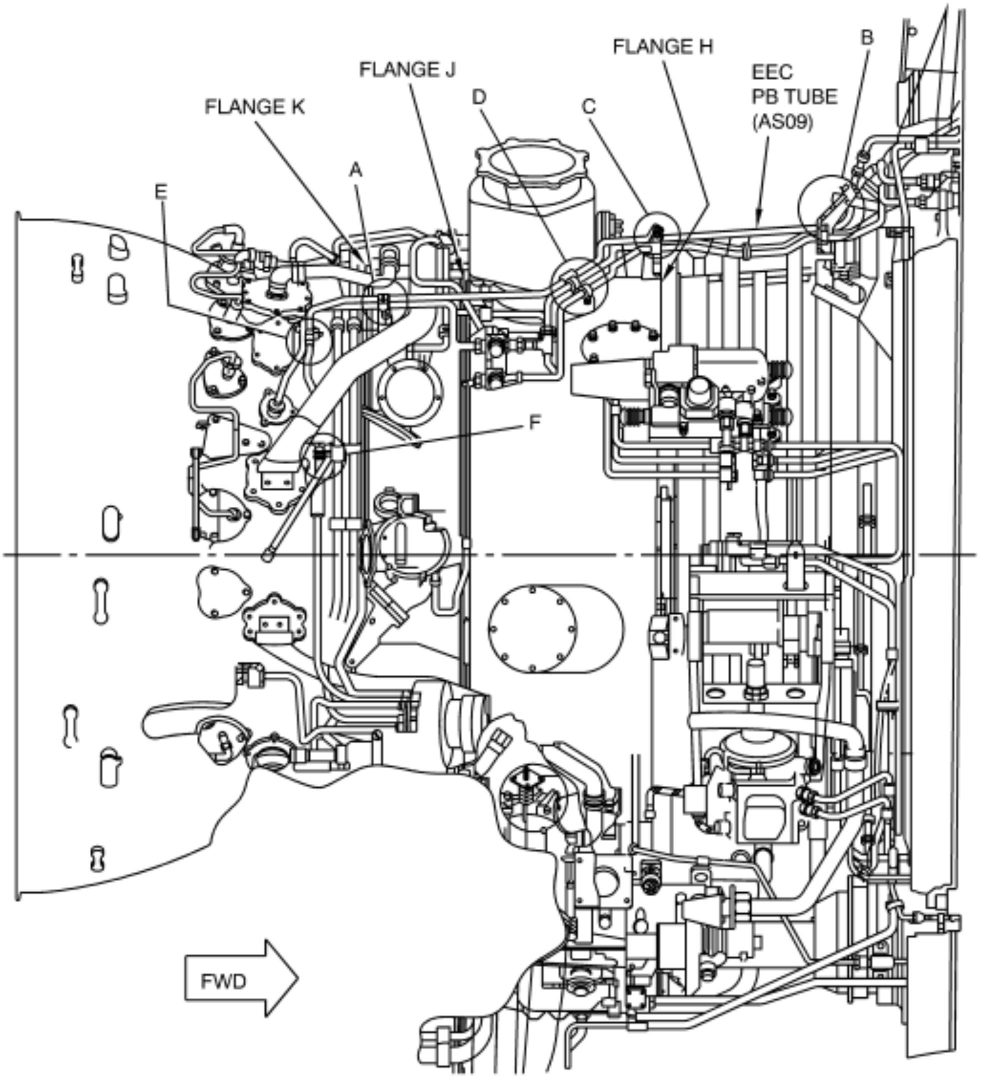
External Plumbing Removal
Figure 302 (Sheet 2)
(Task 72−00−41−020−002)


FLANGE J
BRACKET
NO.3 BEARING
COOLING AIR TUBE
CLAMP
NUT
BOLT
CLAMP
BRACKET
FLANGE J
BRACKET
NO.3 BEARING
COOLER AIR TUBE
NUT
BOLT
CLAMP
VIEW H
L-A2454

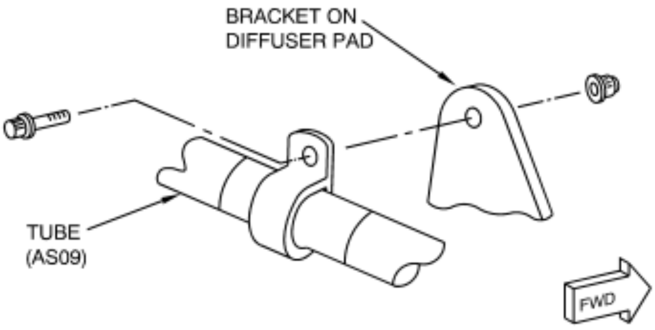
External Plumbing Removal
Figure 302 (Sheet 3)
(Task 72-00-41-020-002)


HPC BLEED VALVE
EEC PB TUBE
FLANGE H
HPC AIR AND BLEED VALVE SUPPLY TUBE
FLANGE K
A
B
C
D
FLANGE J
HPC BLEED AIR FILTERS
FWD
L−A1787 (0187)
PW V

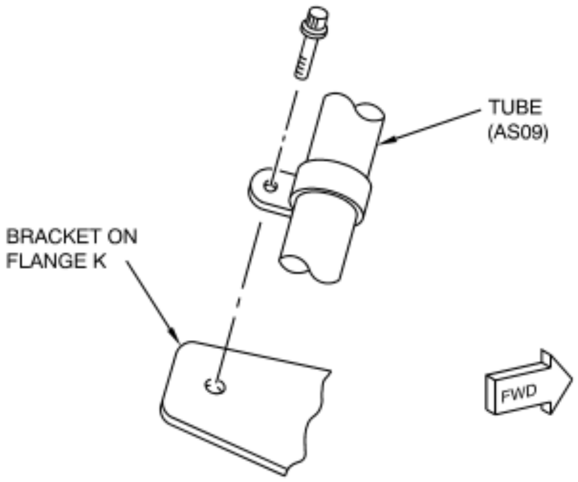
External Plumbing Removal (Pre SB PW4ENG 72−567)
Figure 303 (Sheet 1)
(Task 72−00−41−020−002)


FLANGE H
B
FLANGE J
EEC
PB TUBE
(AS09)
D
C
FLANGE K
A
E
F
FWD
L-A8783 (0994)
PW V

External Plumbing Removal (Post SB PW4ENG 72-567)
Figure 303 (Sheet 2)
(Task 72-00-41-020-002)


BRACKET ON
DIFFUSER PAD
TUBE
(AS09)
FWD

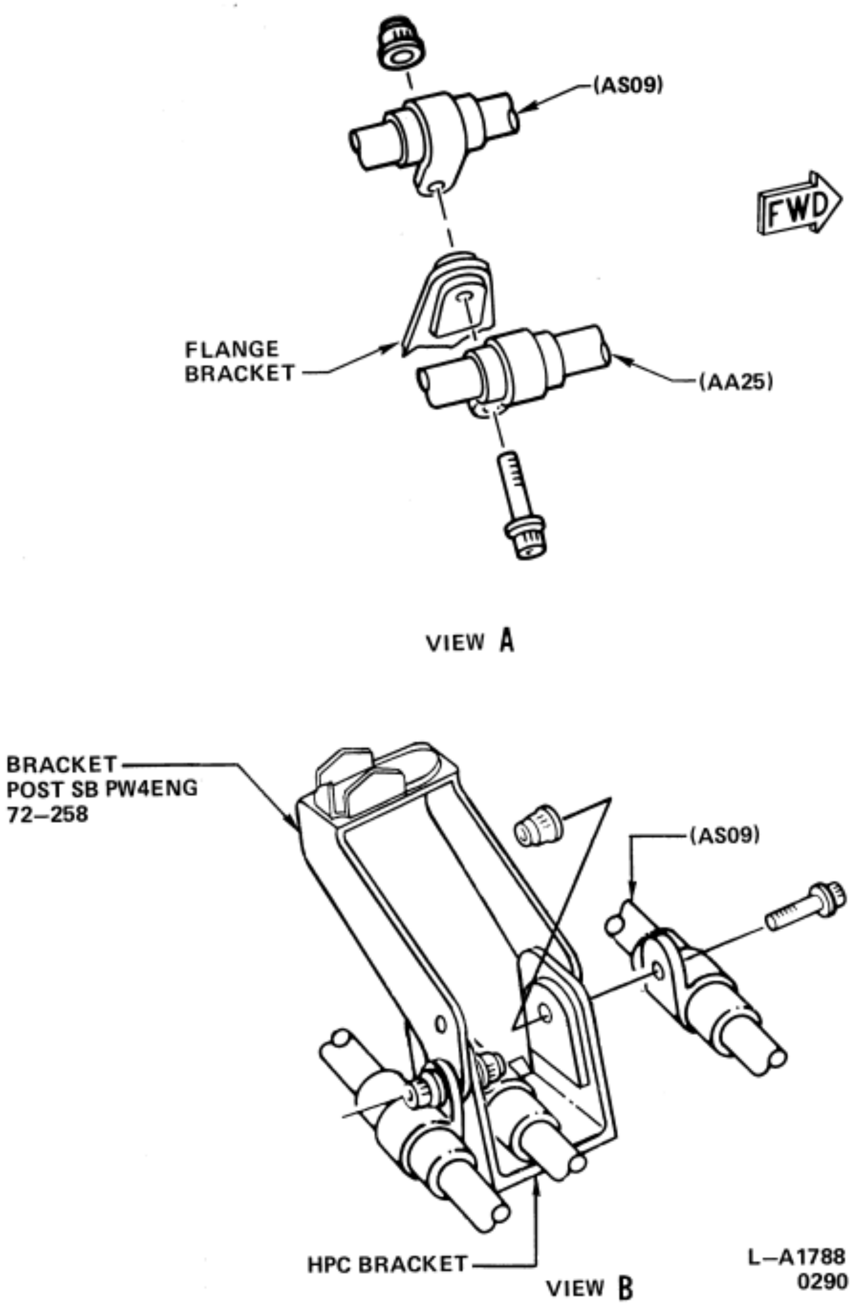
VIEW E


TUBE
(AS09)
BRACKET ON
FLANGE K
FWD

VIEW F

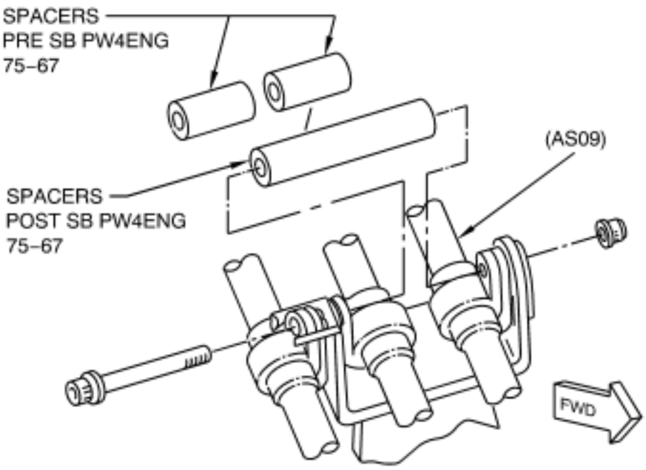
L−A8784 (0000)
PW V

External Plumbing Removal (Post SB PW4ENG 72−567)
Figure 303 (Sheet 3)
(Task 72−00−41−020−002)

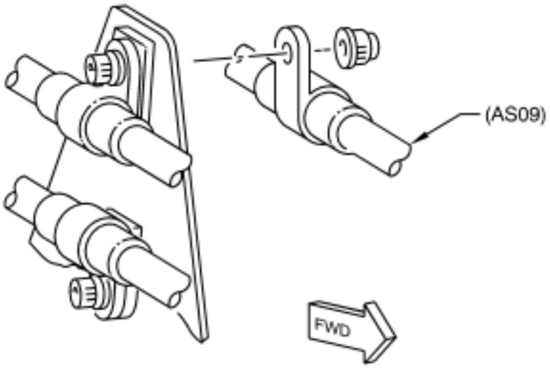

(AS09)
FWD
FLANGE BRACKET
(AA25)
VIEW A
BRACKET POST SB PW4ENG 72-258
(AS09)
HPC BRACKET
VIEW B
L-A1788
0290

External Plumbing Removal
Figure 303 (Sheet 4)
(Task 72-00-41-020-002)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−02


SPACERS
PRE SB PW4ENG
75−67
SPACERS
POST SB PW4ENG
75−67
(AS09)
FWD

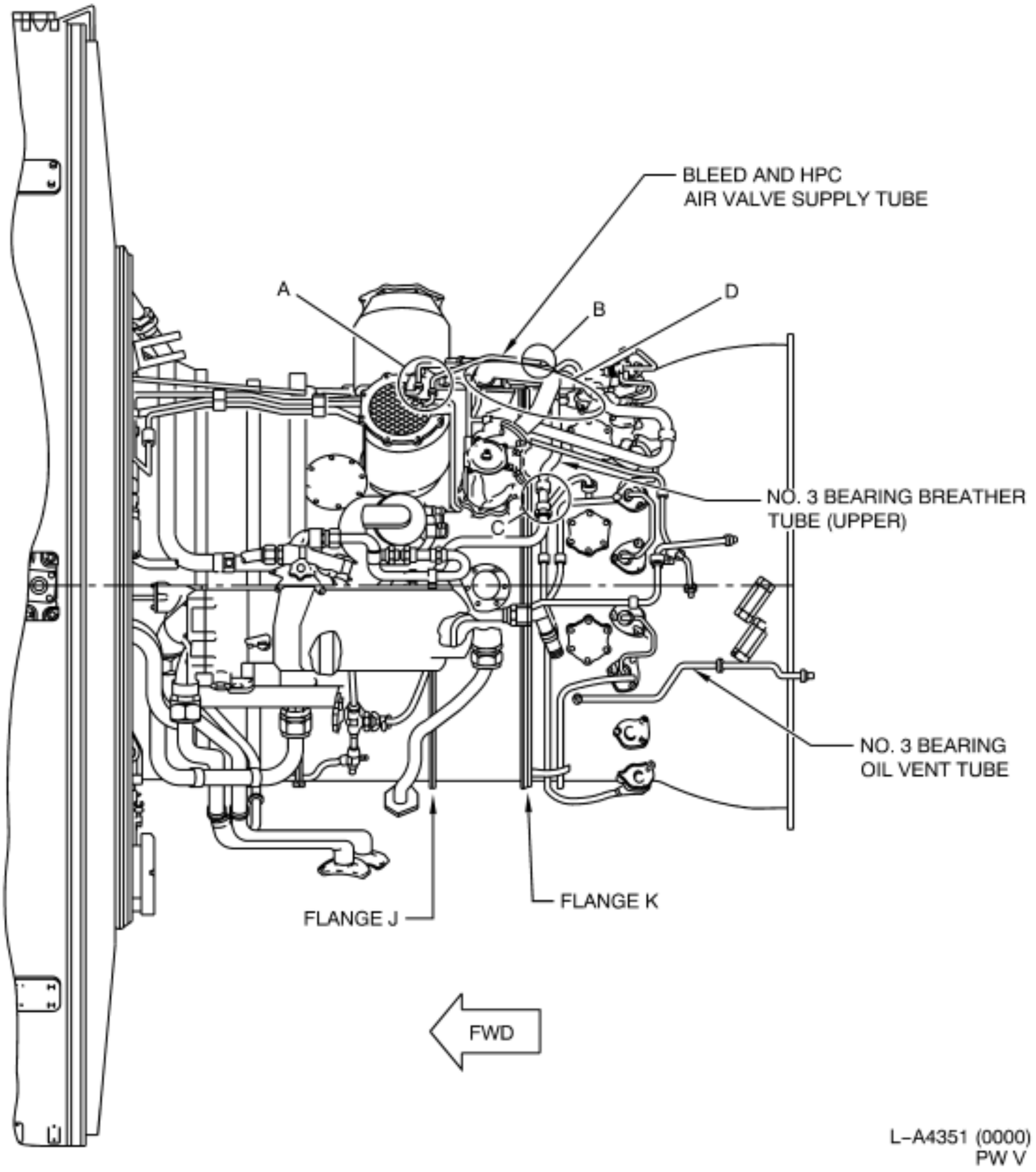
VIEW C



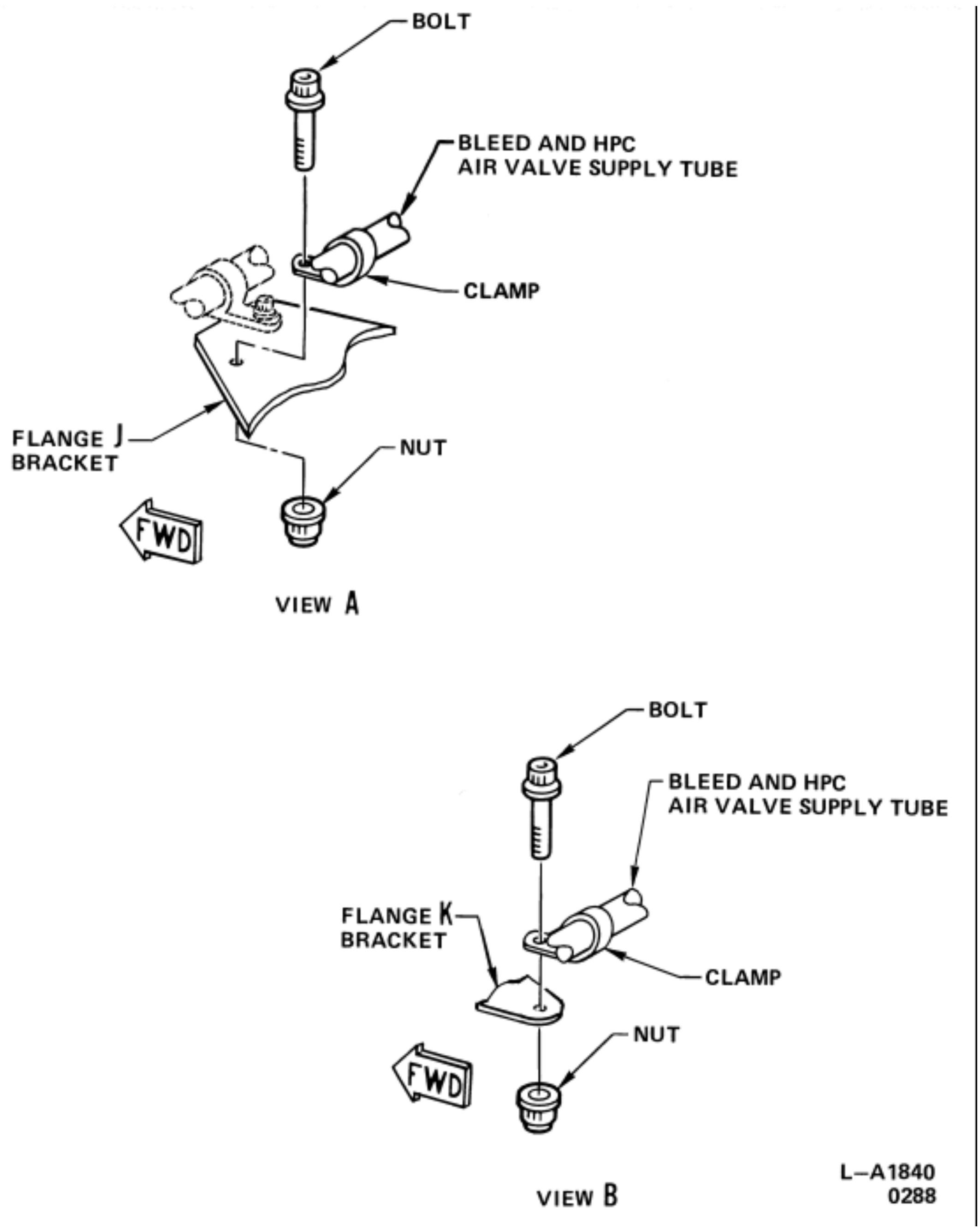
VIEW D

L−A3933 (0196)
PW V

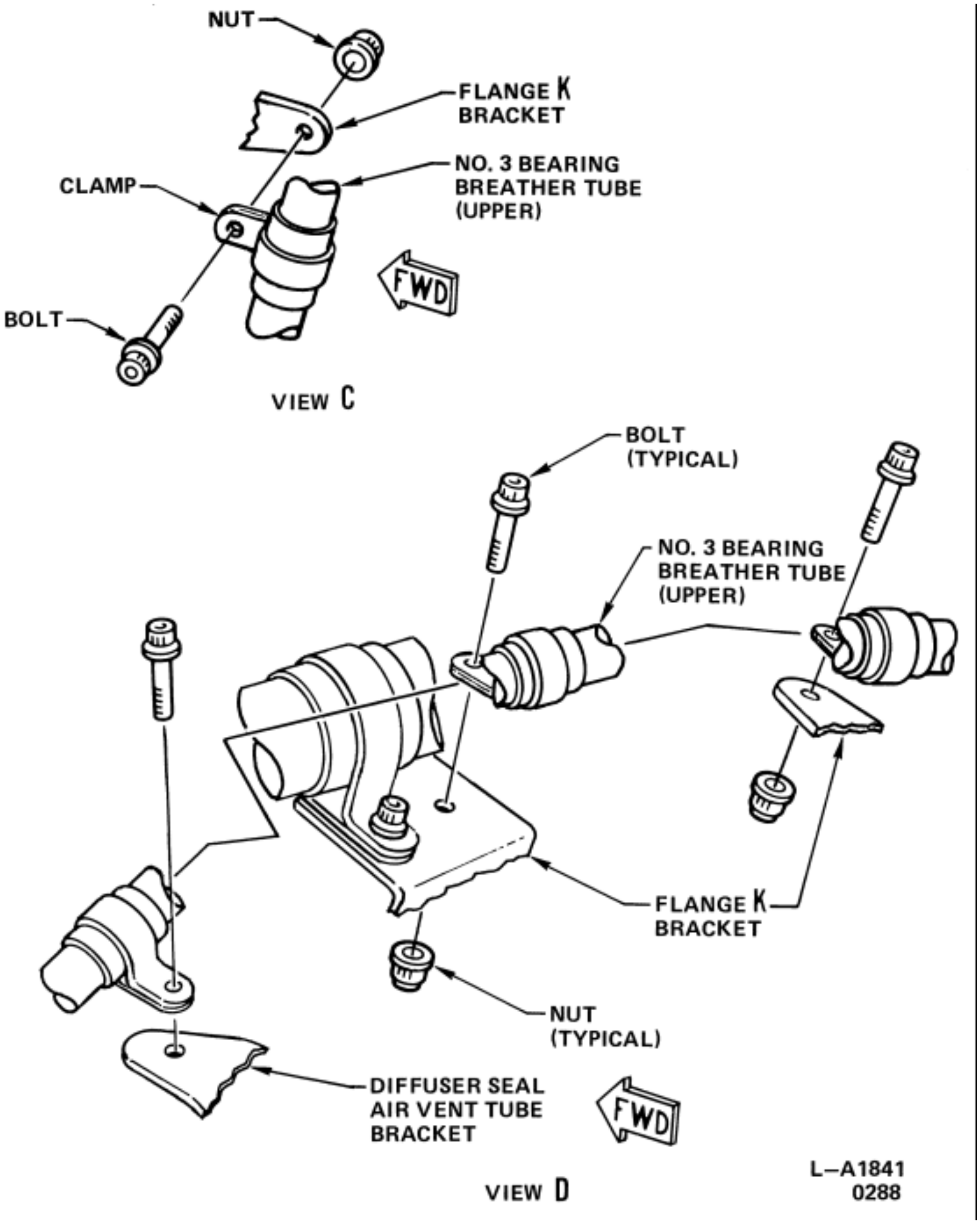
External Plumbing Removal
Figure 303 (Sheet 5)
(Task 72−00−41−020−002)


BLEED AND HPC
AIR VALVE SUPPLY TUBE
A
B
D
C
NO. 3 BEARING BREATHER
TUBE (UPPER)
NO. 3 BEARING
OIL VENT TUBE
FLANGE J
FLANGE K
FWD
L−A4351 (0000)
PW V

External Plumbing Removal
Figure 304 (Sheet 1)
(Task 72−00−41−020−002)

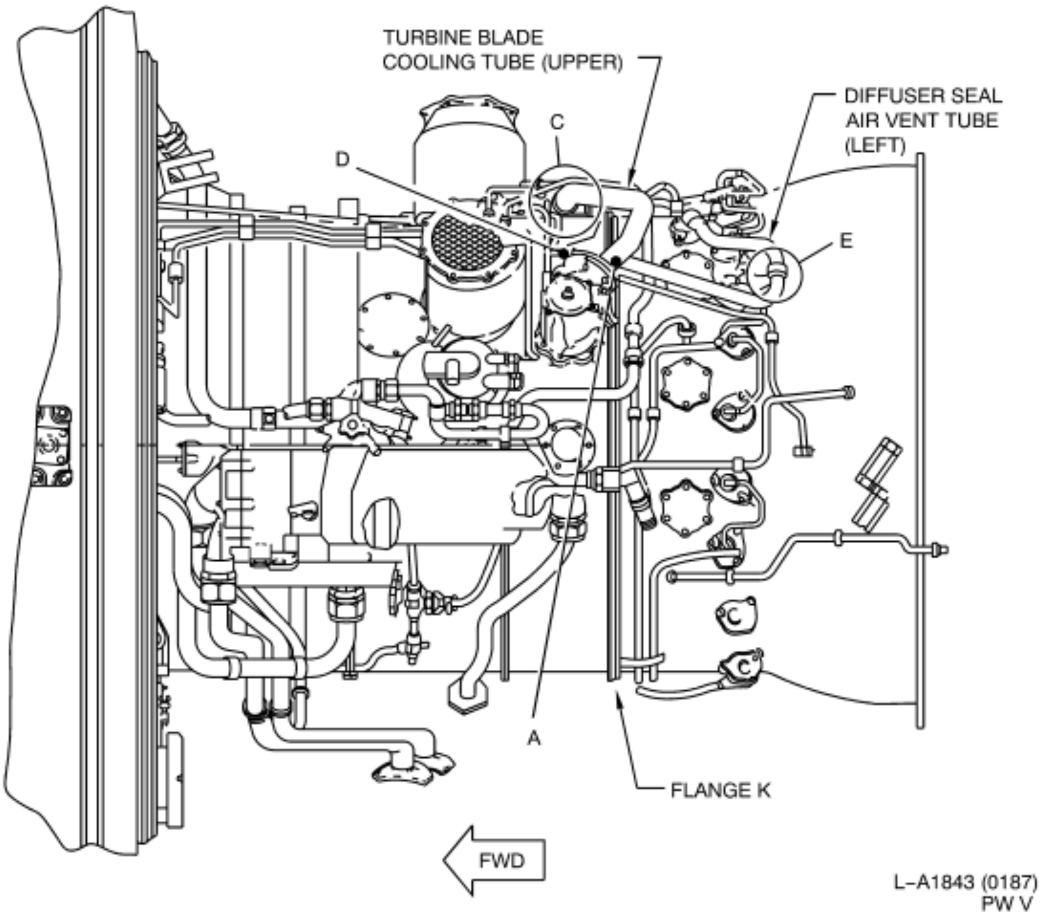

BOLT
BLEED AND HPC
AIR VALVE SUPPLY TUBE
CLAMP
FLANGE J
BRACKET
NUT
FWD
VIEW A
BOLT
BLEED AND HPC
AIR VALVE SUPPLY TUBE
FLANGE K
BRACKET
CLAMP
NUT
FWD
VIEW B
L-A1840
0288

External Plumbing Removal
Figure 304 (Sheet 2)
(Task 72-00-41-020-002)


NUT
FLANGE K
BRACKET
NO. 3 BEARING
BREATHER TUBE
(UPPER)
CLAMP
FWD
BOLT
VIEW C
BOLT
(TYPICAL)
NO. 3 BEARING
BREATHER TUBE
(UPPER)
FLANGE K
BRACKET
NUT
(TYPICAL)
DIFFUSER SEAL
AIR VENT TUBE
BRACKET
FWD
L-A1841
0288
VIEW D

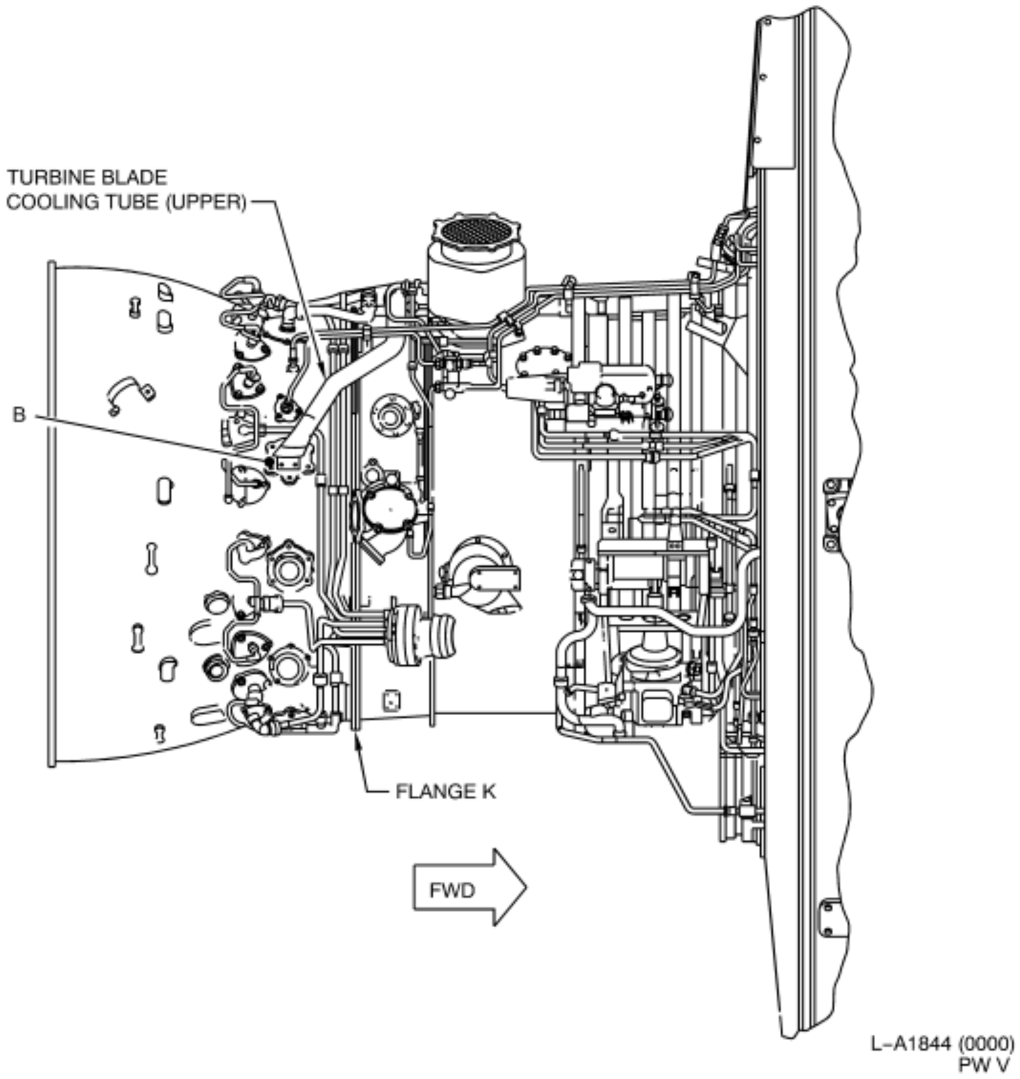
External Plumbing Removal
Figure 304 (Sheet 3)
(Task 72-00-41-020-002)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−02

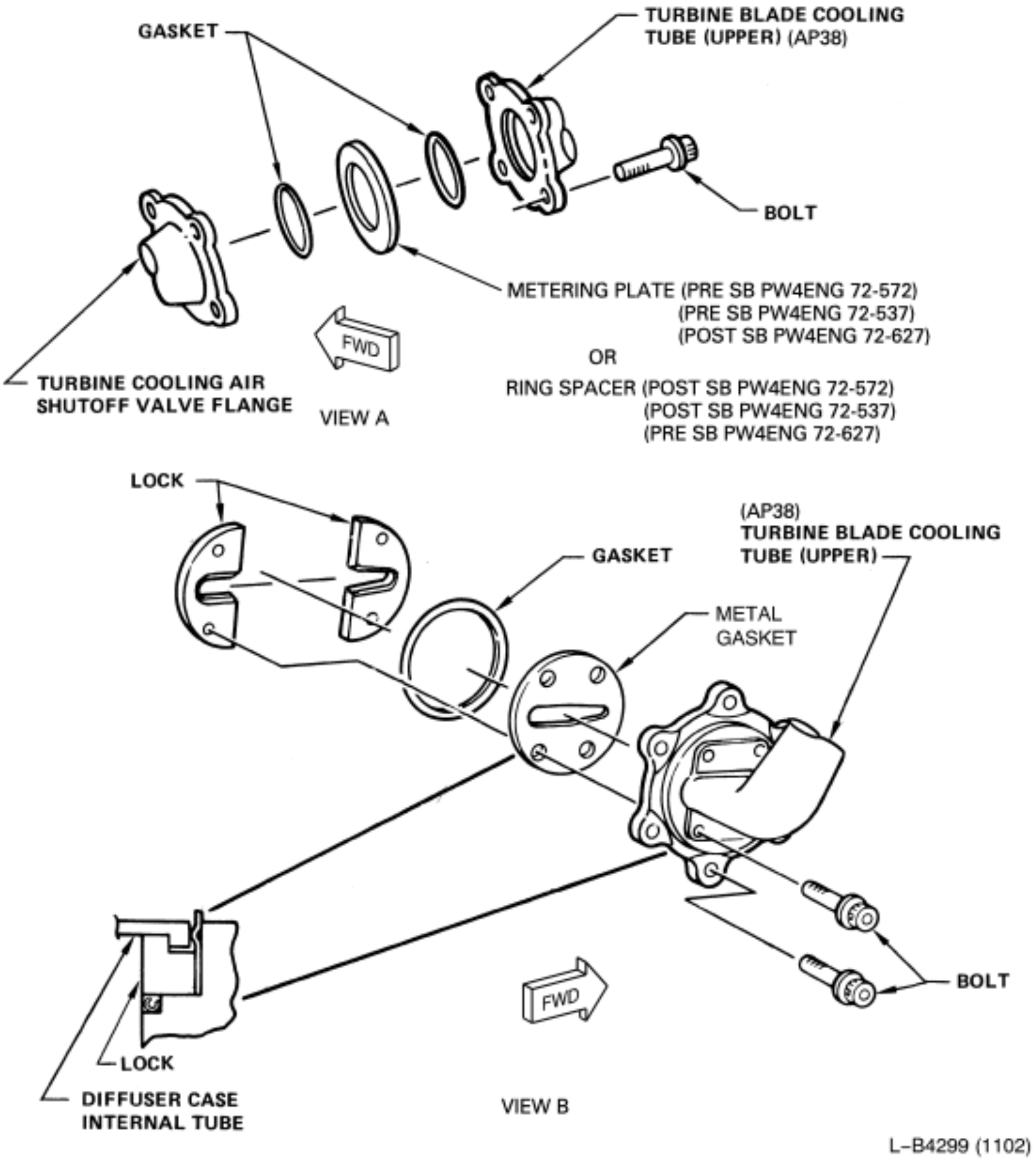

TURBINE BLADE COOLING TUBE (UPPER)
DIFFUSER SEAL AIR VENT TUBE (LEFT)
C
D
E
A
FLANGE K
FWD
L−A1843 (0187)
PW V

External Plumbing Removal (Pre SB PW4ENG 72−567)
Figure 305 (Sheet 1)
(Task 72−00−41−020−002)

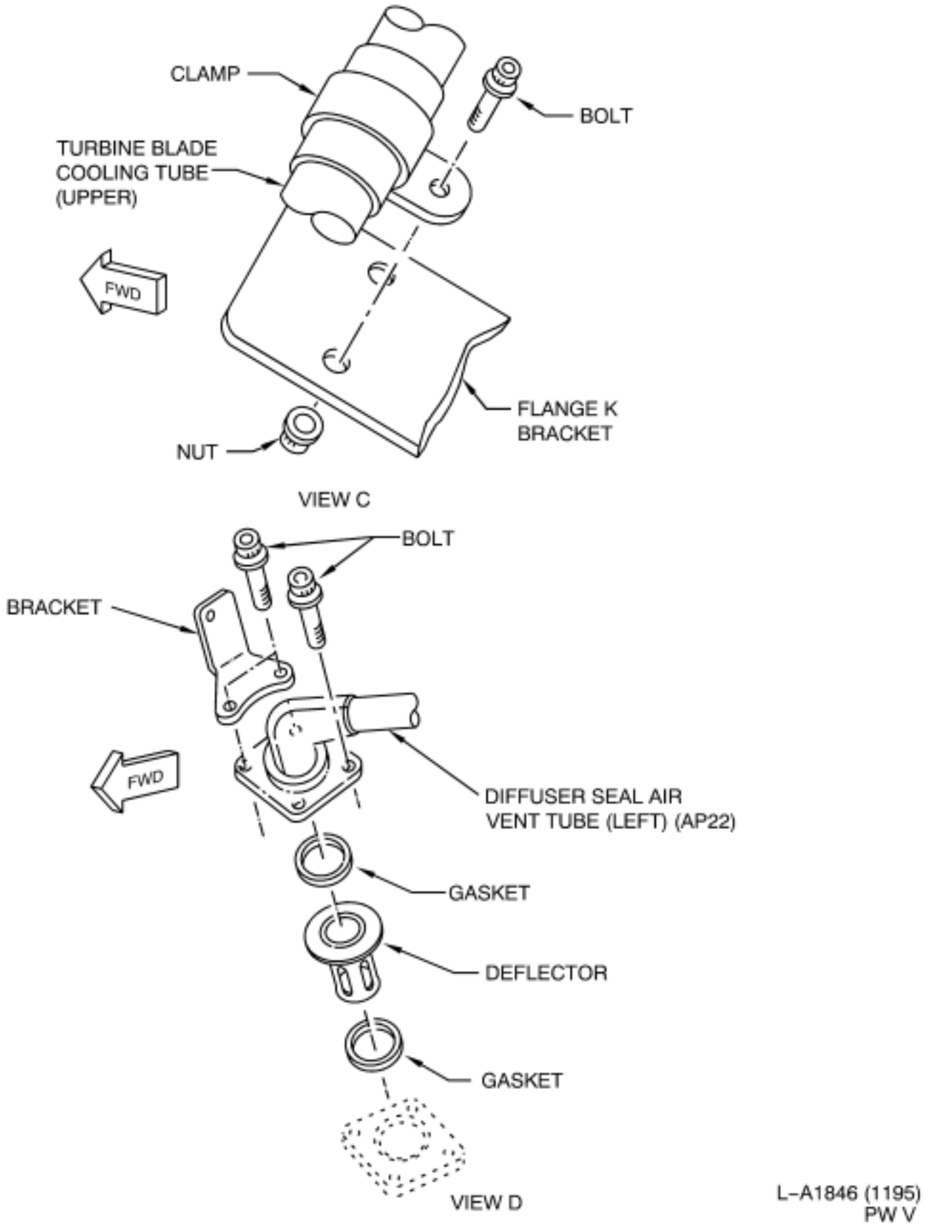
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−02


TURBINE BLADE COOLING TUBE (UPPER)
B
FLANGE K
FWD
L−A1844 (0000)
PW V

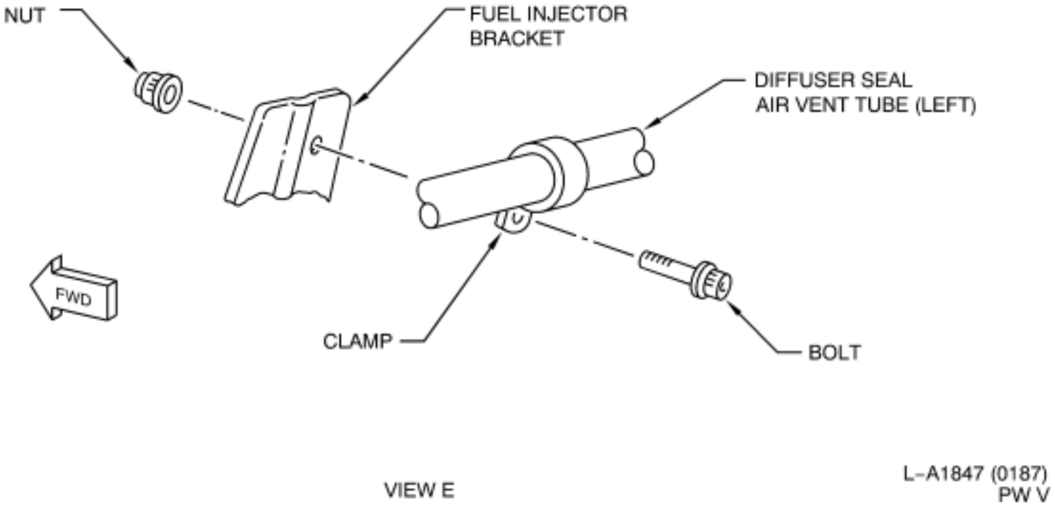
External Plumbing Removal (Pre SB PW4ENG 72−567)
Figure 305 (Sheet 2)
(Task 72−00−41−020−002)


GASKET
TURBINE BLADE COOLING TUBE (UPPER) (AP38)
BOLT
METERING PLATE (PRE SB PW4ENG 72-572)
(PRE SB PW4ENG 72-537)
(POST SB PW4ENG 72-627)
OR
RING SPACER (POST SB PW4ENG 72-572)
(POST SB PW4ENG 72-537)
(PRE SB PW4ENG 72-627)
FWD
TURBINE COOLING AIR SHUTOFF VALVE FLANGE
VIEW A
LOCK
GASKET
(AP38) TURBINE BLADE COOLING TUBE (UPPER)
METAL GASKET
BOLT
FWD
LOCK
DIFFUSER CASE INTERNAL TUBE
VIEW B
L-B4299 (1102)

External Plumbing Removal (Pre SB PW4ENG 72-567)
Figure 305 (Sheet 3)
(Task 72-00-41-020-002)

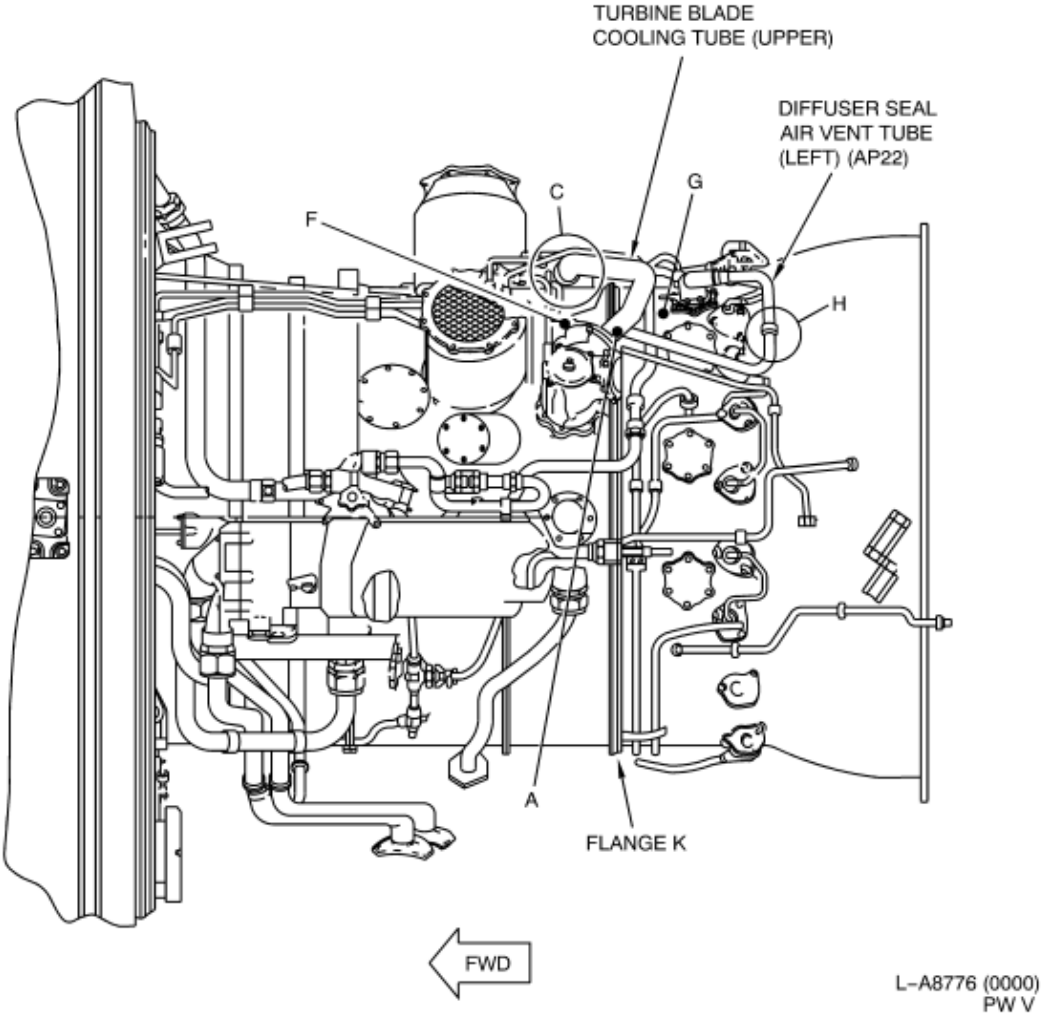

CLAMP
BOLT
TURBINE BLADE COOLING TUBE (UPPER)
FWD
FLANGE K BRACKET
NUT
VIEW C
BOLT
BRACKET
FWD
DIFFUSER SEAL AIR VENT TUBE (LEFT) (AP22)
GASKET
DEFLECTOR
GASKET
VIEW D
L-A1846 (1195)
PW V

External Plumbing Removal (Pre SB PW4ENG 72-567)
Figure 305 (Sheet 4)
(Task 72-00-41-020-002)

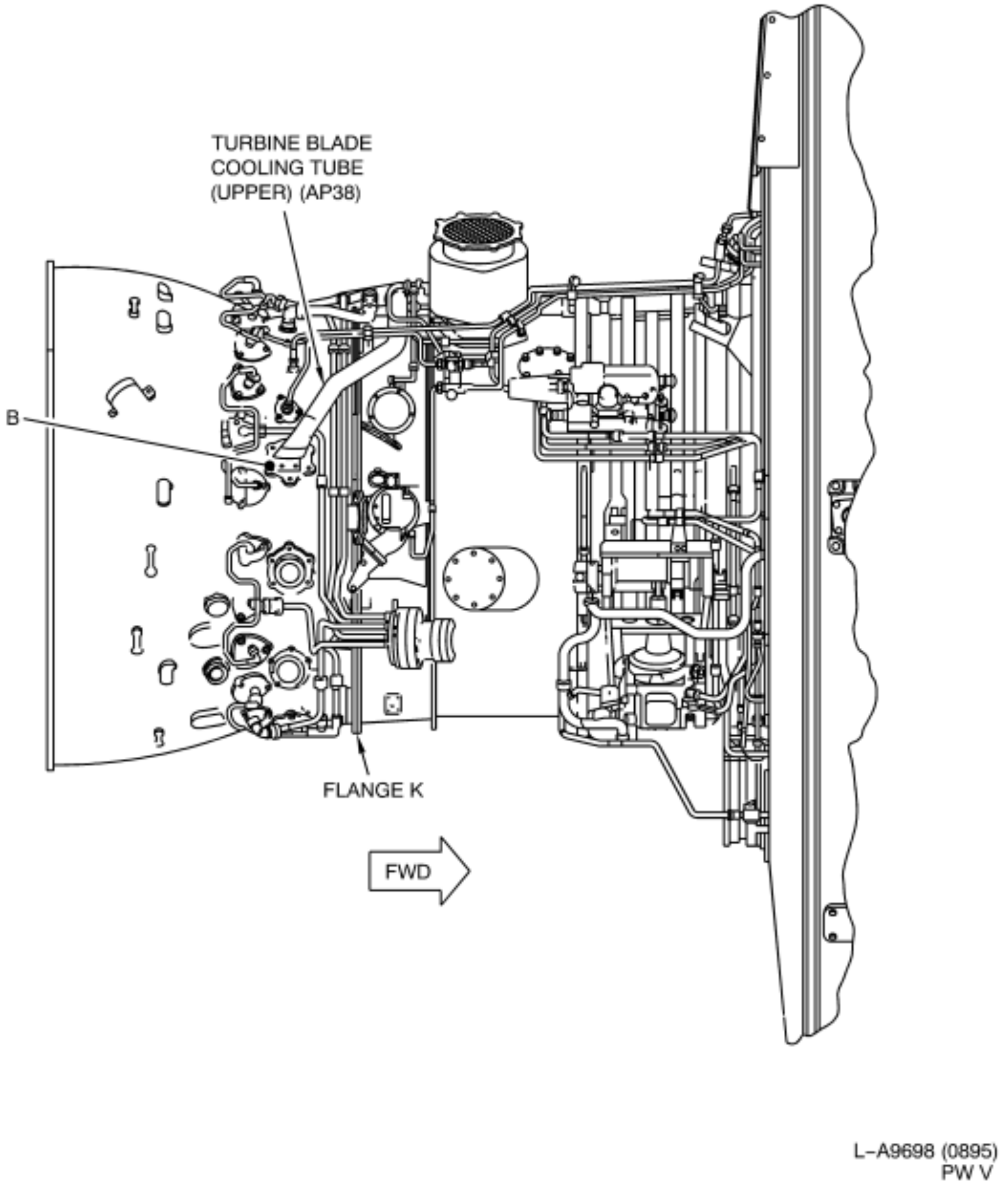

NUT
FUEL INJECTOR BRACKET
DIFFUSER SEAL AIR VENT TUBE (LEFT)
FWD
CLAMP
BOLT
VIEW E
L−A1847 (0187)
PW V

External Plumbing Removal (Pre SB PW4ENG 72−567)
Figure 305 (Sheet 5)
(Task 72−00−41−020−002)

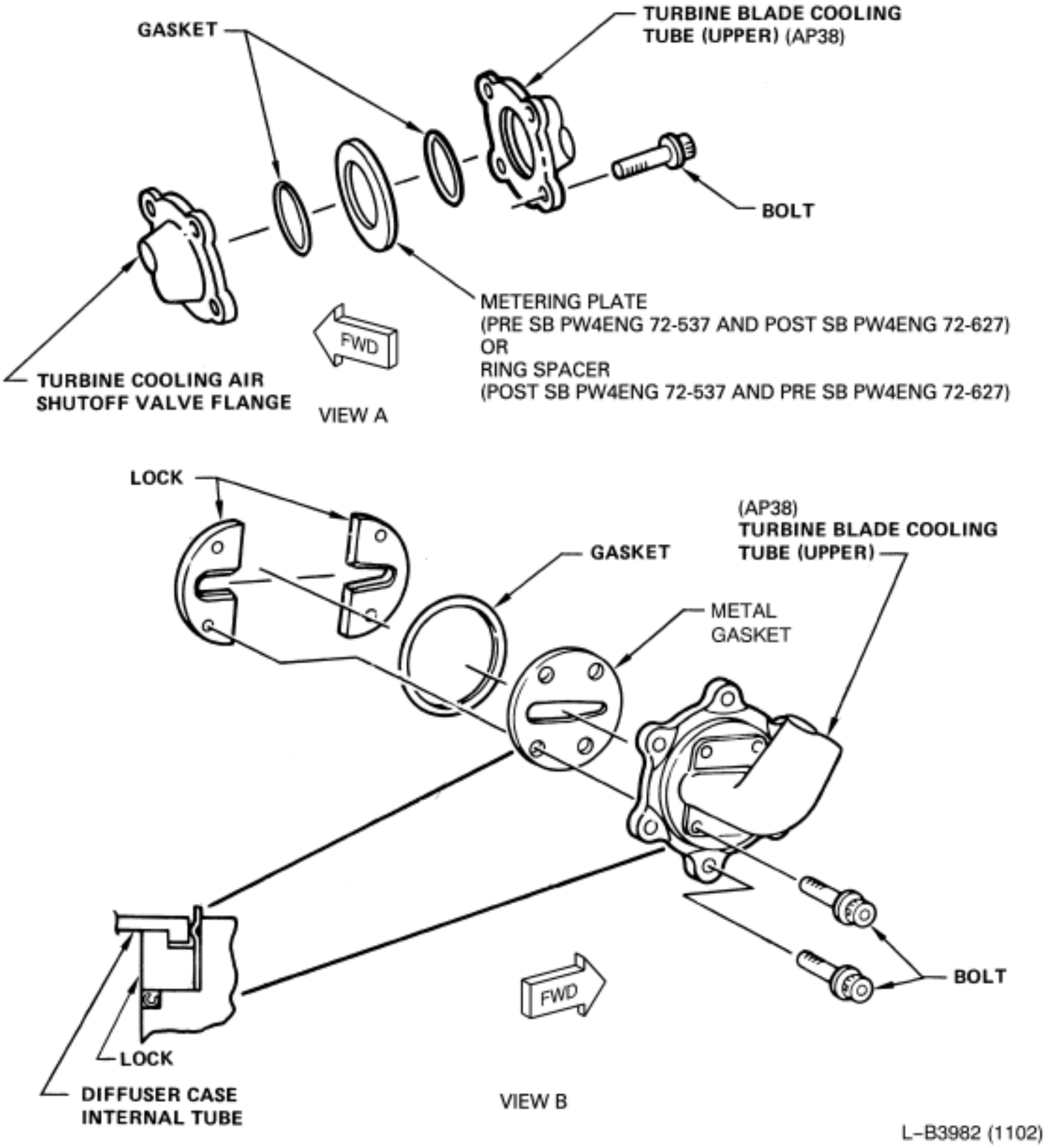
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−02


TURBINE BLADE
COOLING TUBE (UPPER)
DIFFUSER SEAL
AIR VENT TUBE
(LEFT) (AP22)
G
C
F
H
C
C
A
FLANGE K
FWD
L−A8776 (0000)
PW V

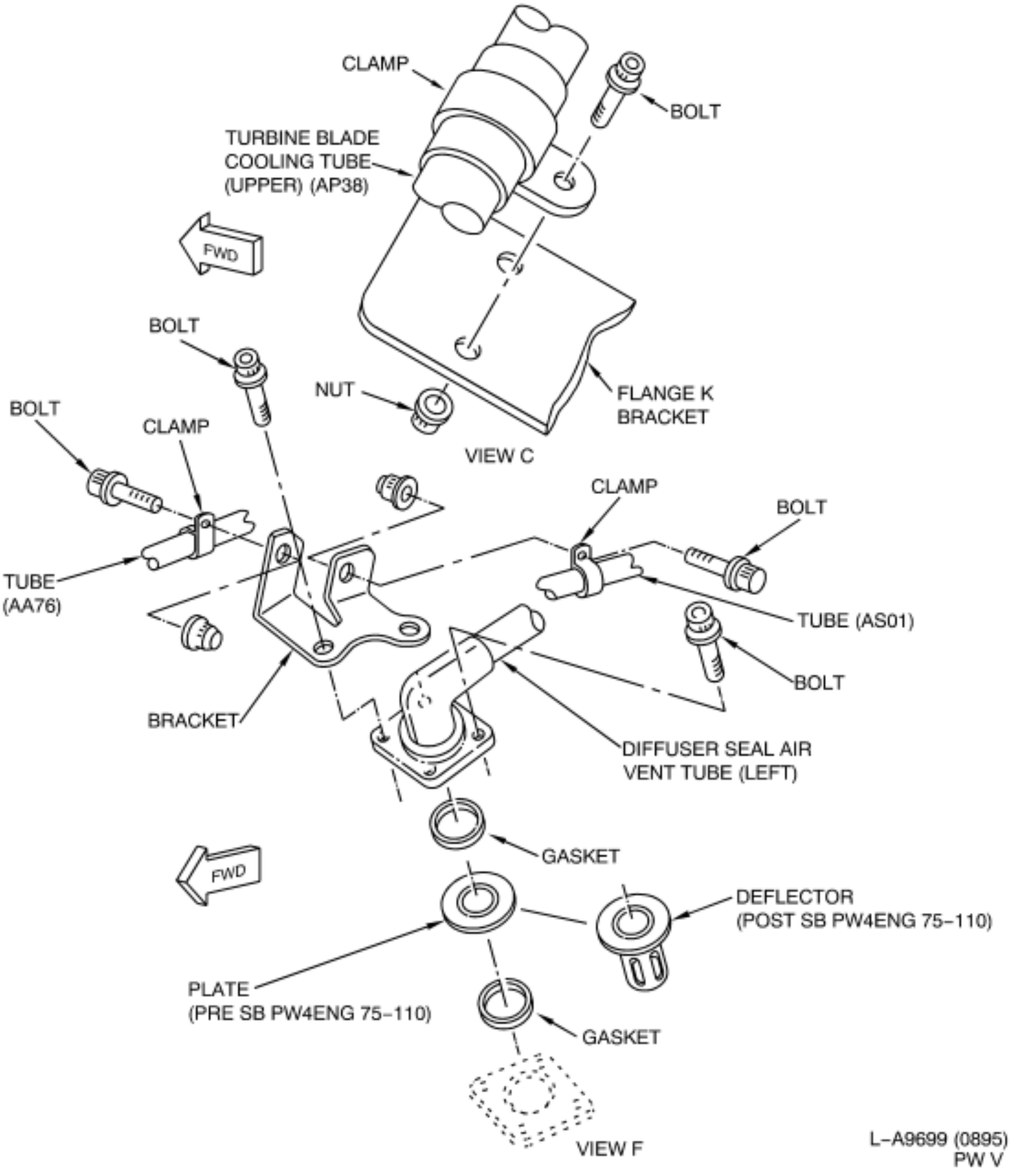
External Plumbing Removal (Post SB PW4ENG 72−567)
Figure 305 (Sheet 6)
(Task 72−00−41−020−002)


TURBINE BLADE COOLING TUBE (UPPER) (AP38)
B
FLANGE K
FWD
L−A9698 (0895)
PW V

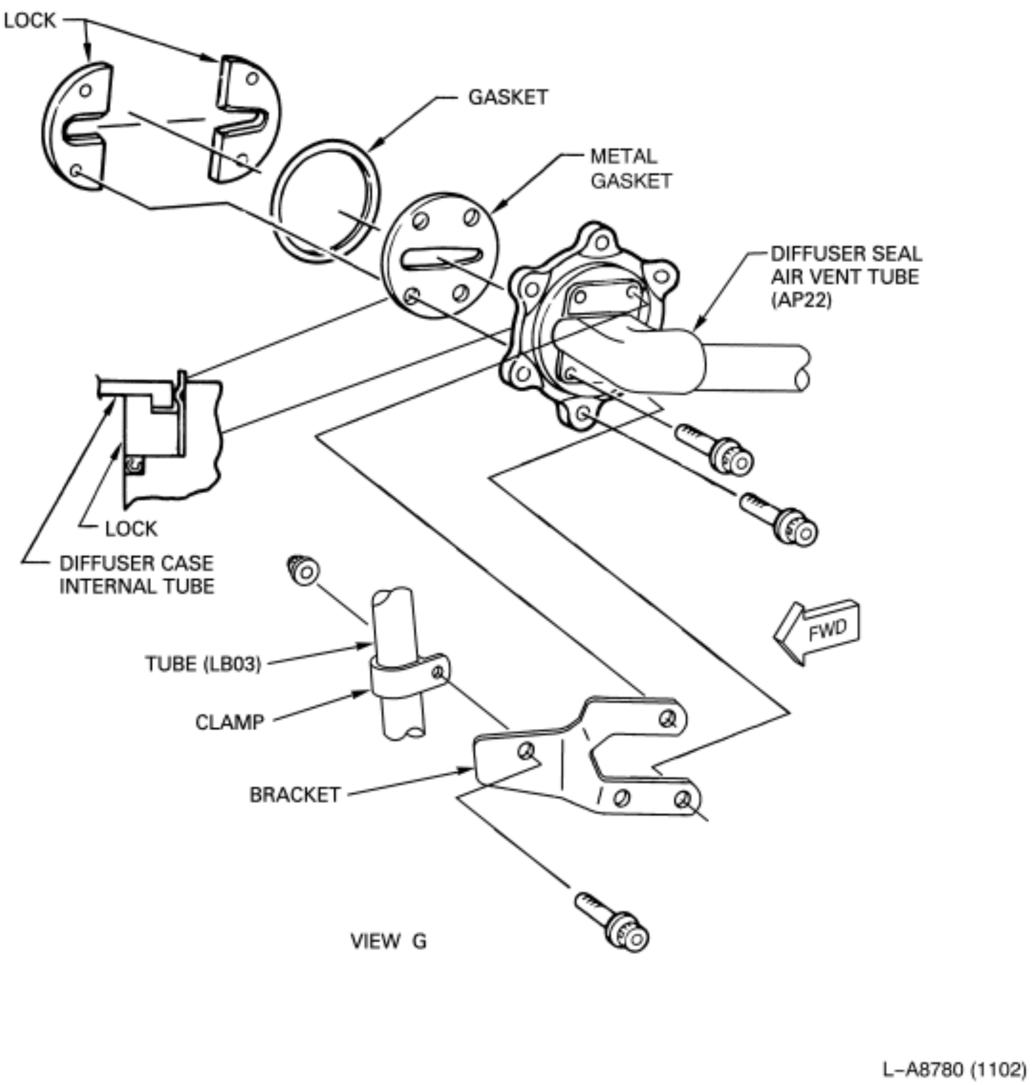
External Plumbing Removal (Post SB PW4ENG 72−567)
Figure 305 (Sheet 7)
(Task 72−00−41−020−002)


GASKET
TURBINE BLADE COOLING TUBE (UPPER) (AP38)
BOLT
METERING PLATE (PRE SB PW4ENG 72-537 AND POST SB PW4ENG 72-627)
OR
RING SPACER (POST SB PW4ENG 72-537 AND PRE SB PW4ENG 72-627)
FWD
TURBINE COOLING AIR SHUTOFF VALVE FLANGE
VIEW A
LOCK
GASKET
(AP38) TURBINE BLADE COOLING TUBE (UPPER)
METAL GASKET
BOLT
FWD
LOCK
DIFFUSER CASE INTERNAL TUBE
VIEW B
L-B3982 (1102)

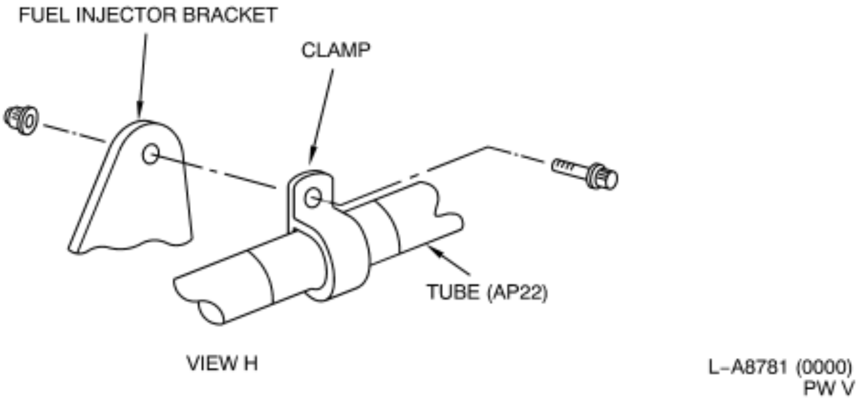
External Plumbing Removal (Post SB PW4ENG 72-567)
Figure 305 (Sheet 8)
(Task 72-00-41-020-002)


CLAMP
BOLT
TURBINE BLADE COOLING TUBE (UPPER) (AP38)
FWD
BOLT
NUT
FLANGE K BRACKET
BOLT
CLAMP
VIEW C
CLAMP
BOLT
TUBE (AA76)
TUBE (AS01)
BOLT
BRACKET
DIFFUSER SEAL AIR VENT TUBE (LEFT)
GASKET
FWD
DEFLECTOR (POST SB PW4ENG 75−110)
PLATE (PRE SB PW4ENG 75−110)
GASKET
VIEW F
L−A9699 (0895)
PW V

External Plumbing Removal (Post SB PW4ENG 72−567)
Figure 305 (Sheet 9)
(Task 72−00−41−020−002)

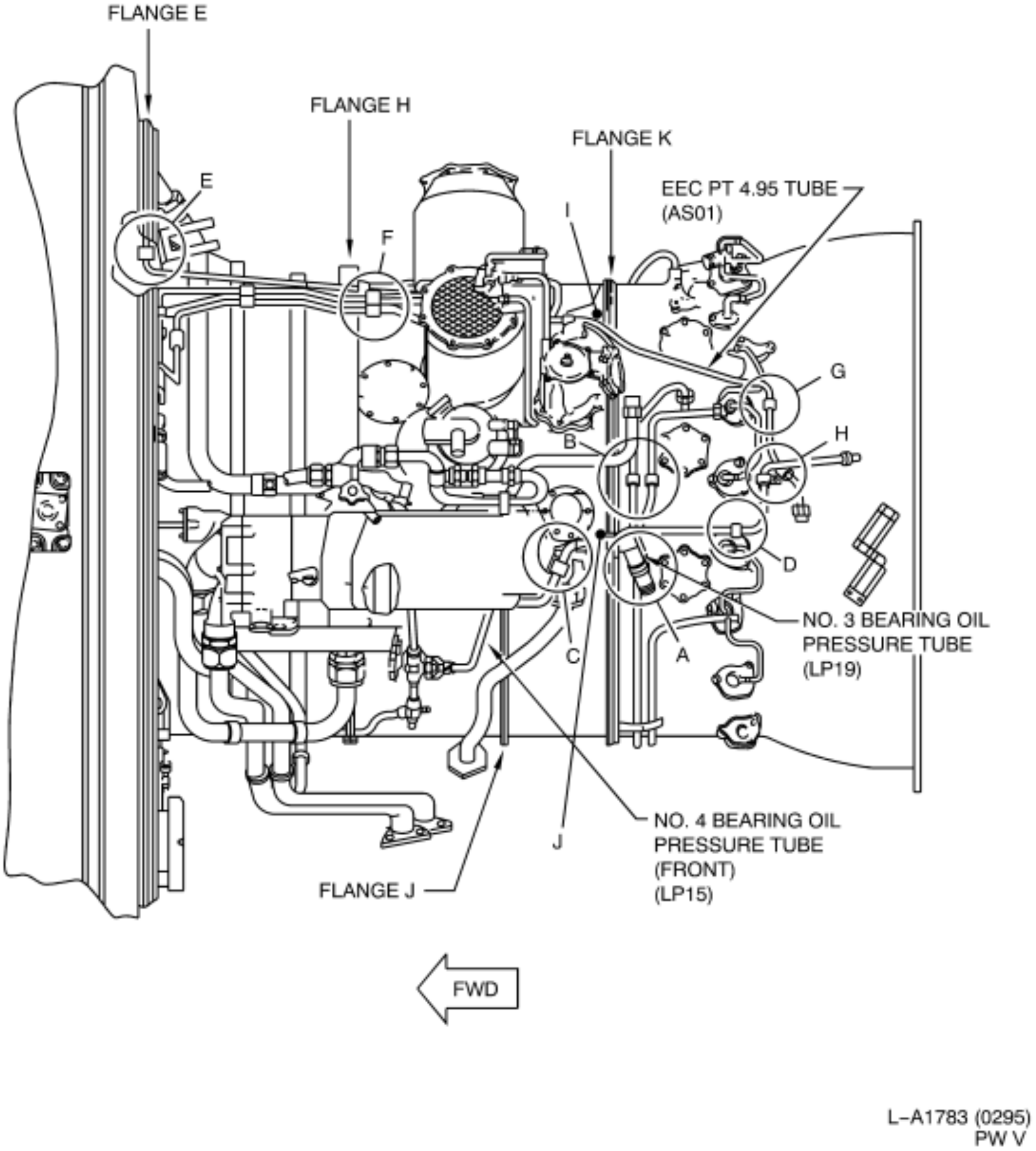

LOCK
GASKET
METAL GASKET
DIFFUSER SEAL AIR VENT TUBE (AP22)
LOCK
DIFFUSER CASE INTERNAL TUBE
TUBE (LB03)
CLAMP
BRACKET
FWD
VIEW G
L-A8780 (1102)

External Plumbing Removal (Post SB PW4ENG 72-567)
Figure 305 (Sheet 10)
(Task 72-00-41-020-002)

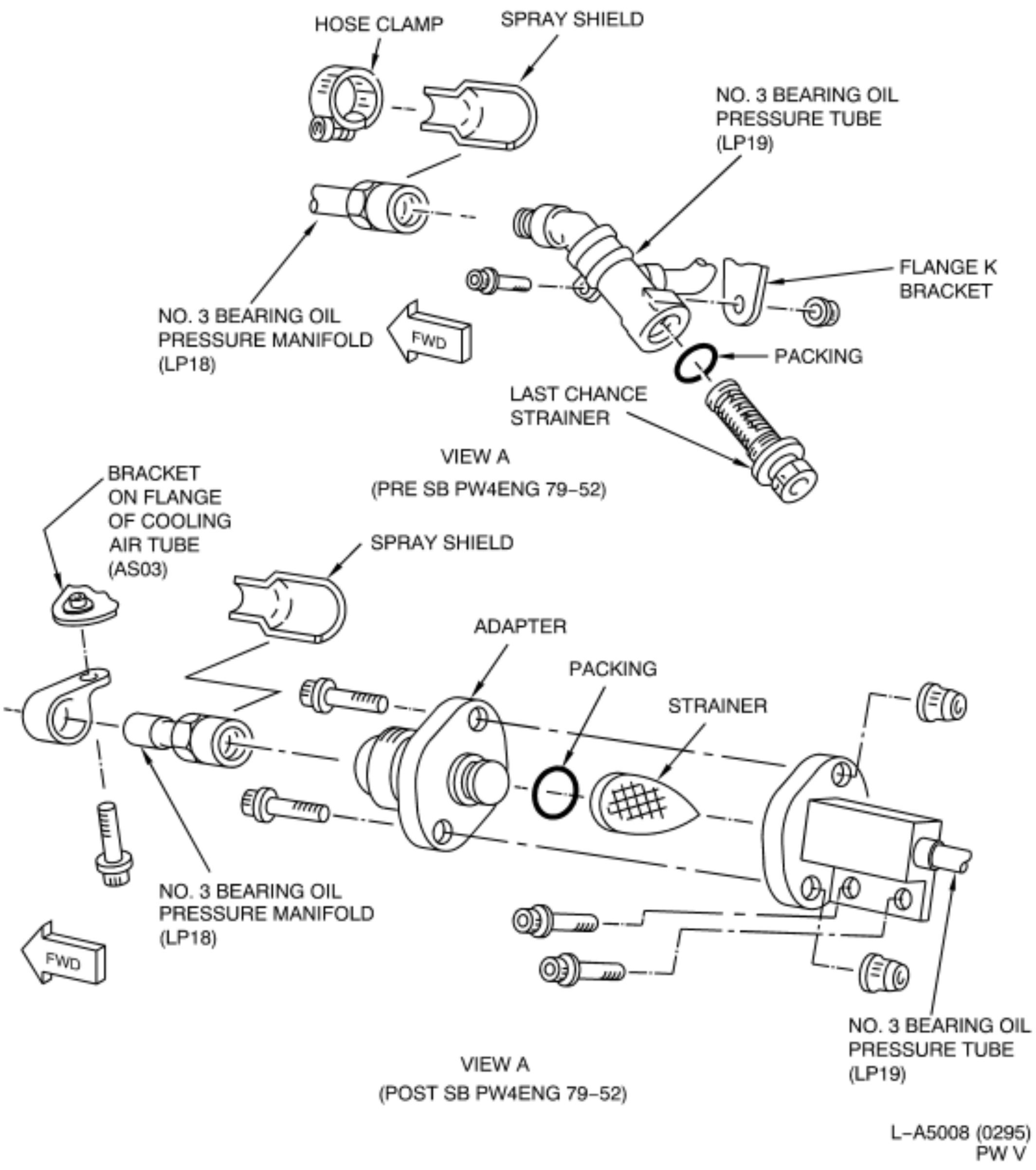

FUEL INJECTOR BRACKET
CLAMP
TUBE (AP22)
VIEW H
L−A8781 (0000)
PW V

External Plumbing Removal (Post SB PW4ENG 72−567)
Figure 305 (Sheet 11)
(Task 72−00−41−020−002)

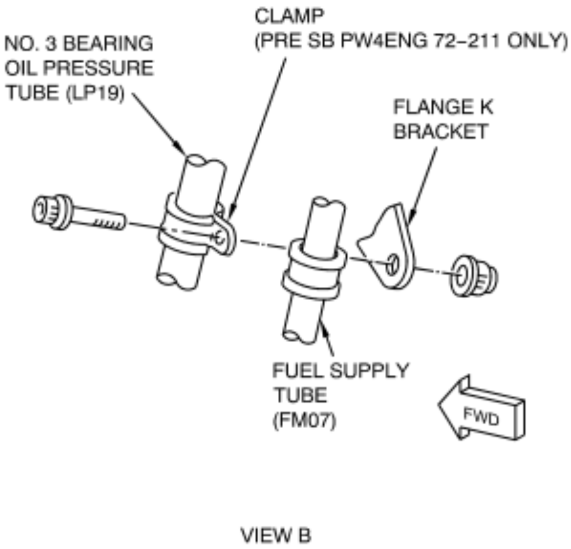
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−02


FLANGE E
FLANGE H
FLANGE K
EEC PT 4.95 TUBE
(AS01)
E
F
I
G
H
B
D
C
A
NO. 3 BEARING OIL
PRESSURE TUBE
(LP19)
NO. 4 BEARING OIL
PRESSURE TUBE
(FRONT)
(LP15)
J
FLANGE J
FWD
L−A1783 (0295)
PW V

External Plumbing Removal
Figure 306 (Sheet 1)
(Task 72−00−41−020−002)

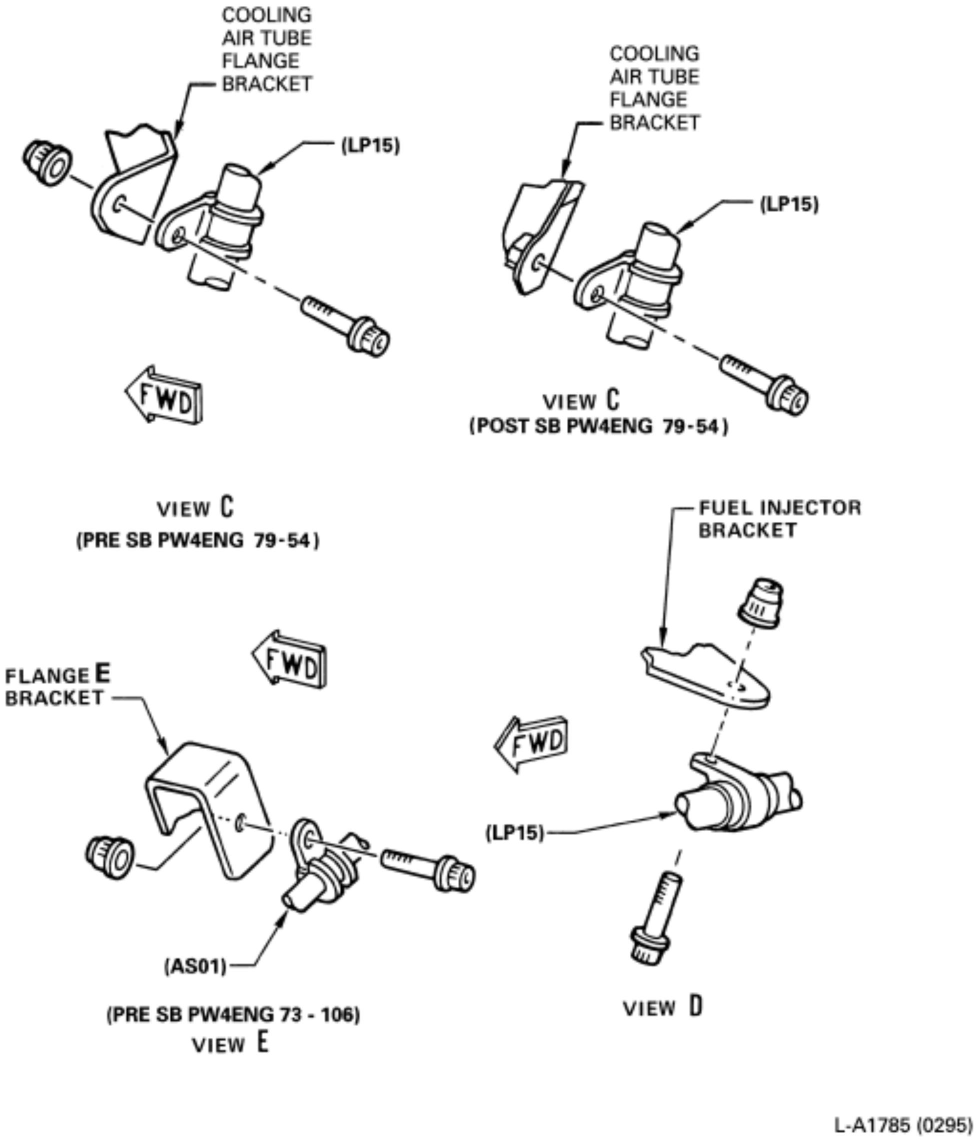

HOSE CLAMP
SPRAY SHIELD
NO. 3 BEARING OIL PRESSURE TUBE (LP19)
FLANGE K BRACKET
NO. 3 BEARING OIL PRESSURE MANIFOLD (LP18)
FWD
PACKING
LAST CHANCE STRAINER
VIEW A
(PRE SB PW4ENG 79-52)
BRACKET ON FLANGE OF COOLING AIR TUBE (AS03)
SPRAY SHIELD
ADAPTER
PACKING
STRAINER
NO. 3 BEARING OIL PRESSURE MANIFOLD (LP18)
FWD
NO. 3 BEARING OIL PRESSURE TUBE (LP19)
VIEW A
(POST SB PW4ENG 79-52)
L-A5008 (0295)
PW V

External Plumbing Removal
Figure 306 (Sheet 2)
(Task 72-00-41-020-002)

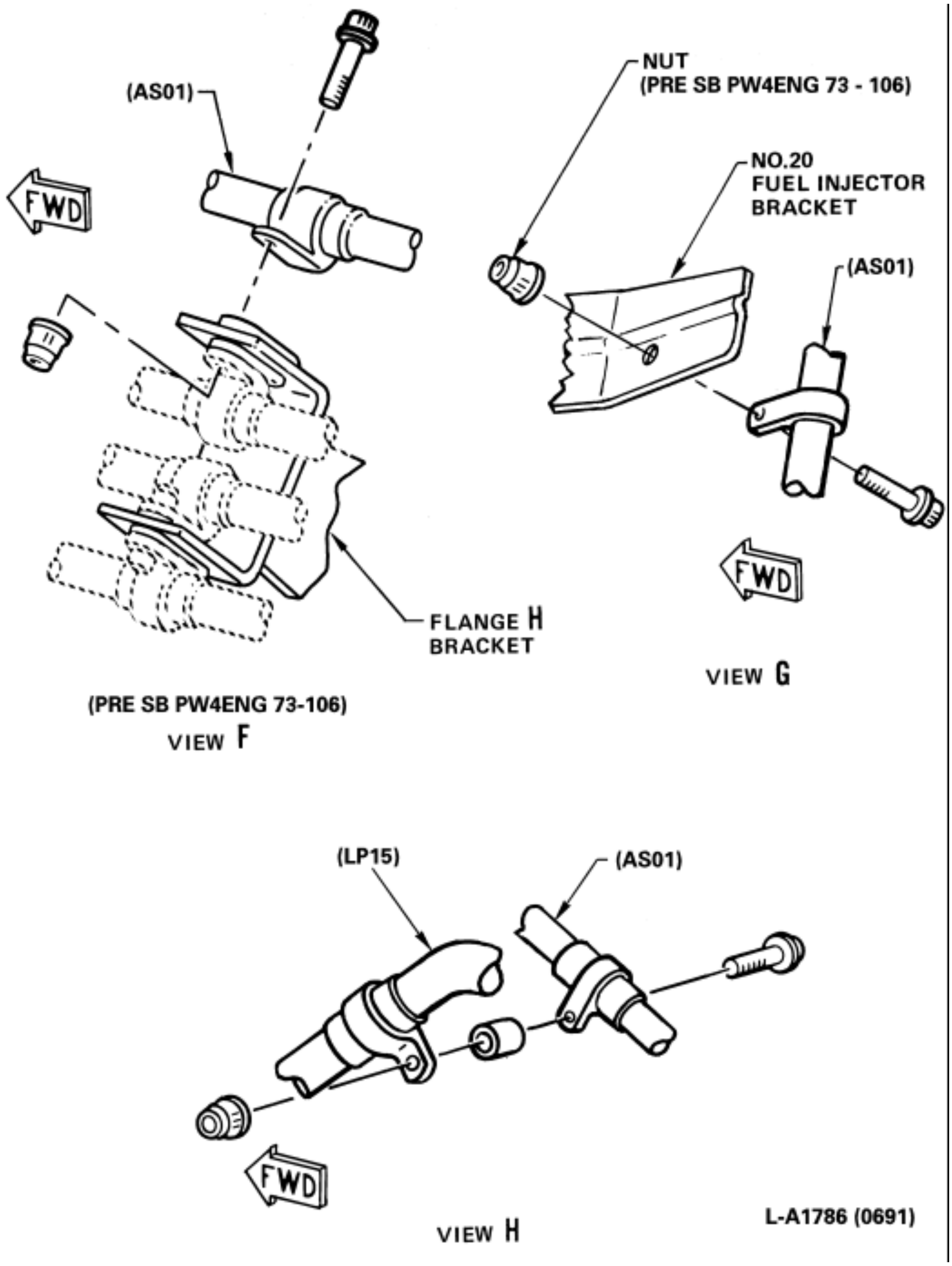

CLAMP
(PRE SB PW4ENG 72−211 ONLY)
NO. 3 BEARING
OIL PRESSURE
TUBE (LP19)
FLANGE K
BRACKET
FUEL SUPPLY
TUBE
(FM07)
FWD
VIEW B

L−A8054 (0295)
PW V

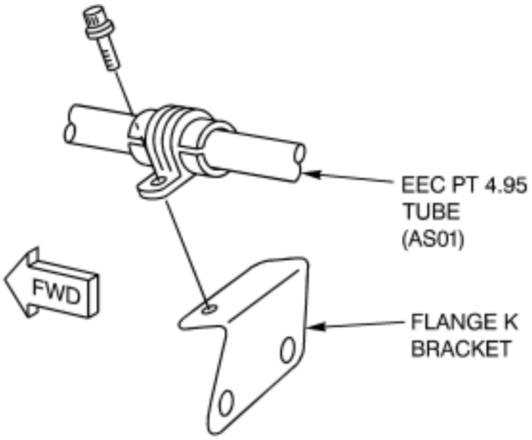
External Plumbing Removal
Figure 306 (Sheet 3)
(Task 72−00−41−020−002)


COOLING AIR TUBE FLANGE BRACKET
(LP15)
FWD
VIEW C
(PRE SB PW4ENG 79-54)
COOLING AIR TUBE FLANGE BRACKET
(LP15)
VIEW C
(POST SB PW4ENG 79-54)
FLANGE E BRACKET
FWD
(AS01)
(PRE SB PW4ENG 73 - 106)
VIEW E
FUEL INJECTOR BRACKET
FWD
(LP15)
VIEW D
L-A1785 (0295)

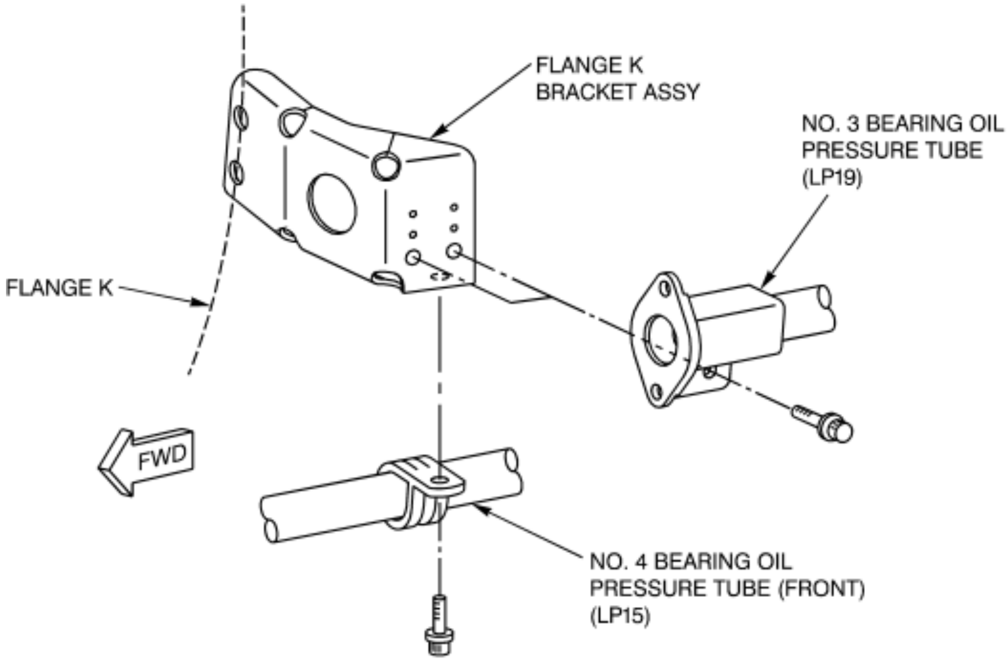
External Plumbing Removal
Figure 306 (Sheet 4)
(Task 72−00−41−020−002)


(AS01)
FWD
NUT
(PRE SB PW4ENG 73 - 106)
NO.20
FUEL INJECTOR
BRACKET
(AS01)
FWD
FLANGE H
BRACKET
VIEW G
(PRE SB PW4ENG 73-106)
VIEW F
(LP15)
(AS01)
FWD
VIEW H
L-A1786 (0691)

External Plumbing Removal
Figure 306 (Sheet 5)
(Task 72-00-41-020-002)


EEC PT 4.95
TUBE
(AS01)
FWD
FLANGE K
BRACKET

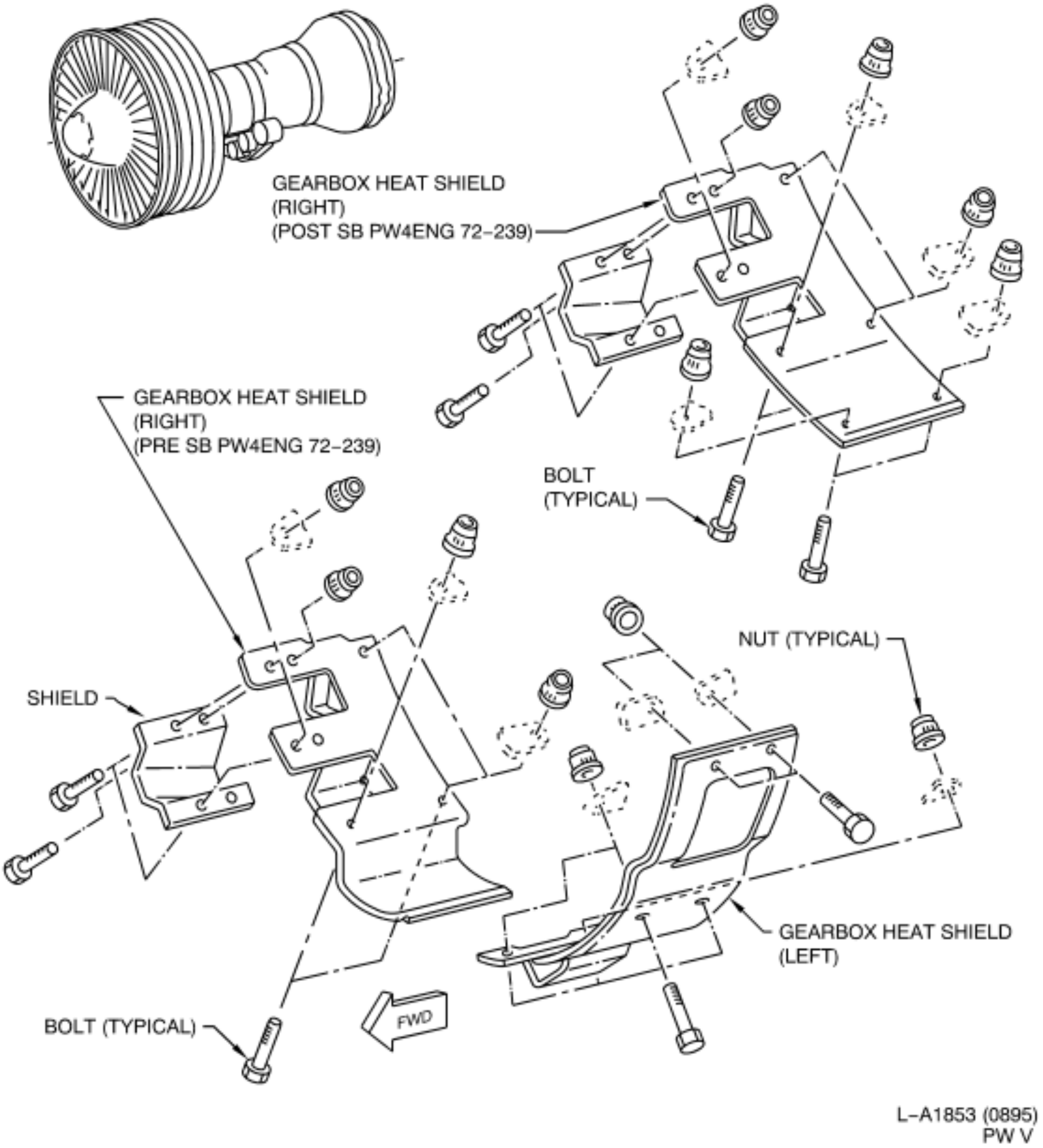
(POST SB PW4ENG 73-106 ONLY)
VIEW I


FLANGE K
BRACKET ASSY
NO. 3 BEARING OIL
PRESSURE TUBE
(LP19)
FLANGE K
FWD
NO. 4 BEARING OIL
PRESSURE TUBE (FRONT)
(LP15)

(POST SB PW4ENG 72-491)
VIEW J

L-A7627 (0295)
PW V

External Plumbing Removal
Figure 306 (Sheet 6)
(Task 72-00-41-020-002)


GEARBOX HEAT SHIELD
(RIGHT)
(POST SB PW4ENG 72-239)
GEARBOX HEAT SHIELD
(RIGHT)
(PRE SB PW4ENG 72-239)
BOLT
(TYPICAL)
SHIELD
NUT (TYPICAL)
GEARBOX HEAT SHIELD
(LEFT)
BOLT (TYPICAL)
FWD
L-A1853 (0895)
PW V

Gearbox Heat Shields Removal
Figure 307
(Task 72-00-41-020-002)

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-02

Task 72-00-41-020-006:

1. Remove External Plumbing Prior To Diffuser And Combustor Removal

A. Equipment And Materials Required - None

B. Procedure
See Figure 301, Figure 302, Figure 303, Figure 304, Figure 305, Figure 306 and Figure 307.

(1) If not previously accomplished, remove four bolts and bracket (Pre SB PW4ENG 73-163 only) securing fuel flowmeter and support to fuel distribution valve. Remove flowmeter and support. Discard packing.

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH
R CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND
R INSTALL A TUBE WITH A FLEX SEGMENT WITH THE
R SAME PRECAUTION USED FOR A TUBE WITHOUT A
R FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A
R TUBE TO HELP WITH THE INSTALLATION OR REMOVAL
R OF THE TUBE OR AN ATTACHED COMPONENT. IF A
R FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE
R A KINK IN THE EXTERNAL WIRE BRAID AND IN THE
R INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND
R LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(2) Remove pressure (CP11) and return (CR13) flex hoses as follows.

(a) Disconnect two hose nuts from turbine case cooling air valve actuator and from manifold couplings. Remove hoses.

(b) Install protective closures.

(3) Remove diffuser seal air vent tube assemblies (AP21) and (AP17) as follows.

(a) Remove the bolt and nut that attach two clamps to the bracket on the tube flange at approximately 3 o'clock position on diffuser case.

(b) Remove the lockwire and the bolts that attach the tube (AP21) and bracket to the diffuser case at approximately 3 o'clock position.

(c) Remove the four bolts that attach the (AP21) tube to the lower (AP17) tube. Remove the bracket from the flange of the tube (AP21).

(d) Remove the bolt, nut, and clamp that attach the tubes to the brackets.

CAUTION: WHEN YOU REMOVE THE (AP21) RIGHT SIDE TUBE LOCK FROM THE INTERNAL DIFFUSER SEAL AIR VENT TUBE ASSEMBLY, YOU MUST BE CAREFUL THAT THE AIR VENT TUBE DOES NOT FALL INTO THE DIFFUSER CASE. AS A PRECAUTION, ATTACH A TEMPORARY SAFETY WIRE AROUND THE INTERNAL DIFFUSER SEAL AIR VENT TUBE ASSEMBLY SO IT WILL NOT FALL INTO THE DIFFUSER CASE. IF THE AIR VENT TUBE FALLS INTO THE DIFFUSER CASE IT IS POSSIBLE THAT MORE ENGINE DISASSEMBLY WILL BE NECESSARY TO GET ACCESS TO REMOVE THE TUBE.

(e) Remove the tube. Remove the locks and gaskets. Discard the gaskets.

(f) Remove the four bolts that attach the (lower) tube to the diffuser case (AP17). Remove the tube, gaskets, and deflector. Discard the gaskets. Install covers.

(4) Remove No. 3 bearing cooler air tube assemblies (AP33) and (AP34) as follows. See Figure 302.

(a) Remove bolts, nuts, and gearbox heat shields to gain access to elbow connections located on HPC rear case at approximately 5 o'clock position.

(b) (Pre SB PW4ENG 75−144) Remove the lockwire from the tube nut and disconnect the No. 3 bearing breather valve air supply tube assembly (AP39) from the air tube (AP34).

(c) Remove lockwire and disconnect No. 3 bearing cooler air tube nuts from cooler at approximately the 2 o'clock position in fan case. Remove lockwire and disconnect tube nuts on rearward ends of tubes from HPC case and diffuser case elbows.

(d) Remove bolts, nuts, and clamps securing tubes to bracket attached to Flange J at approximately 4:30 o'clock position.

R
R

(e) Remove bolt, nut, and clamps securing tubes to Flange H bracket at approximately 3 o'clock position.

(f) Remove bolts, nuts, and clamps securing heat shield to tubes at approximately 2:30 o'clock position forward of Flange H. Remove heat shield from engine.

(g) Remove bolts, and clamps securing tubes to HPC bracket at approximately 2:30 o'clock position. Remove tubes from engine and install protective closures.

(5) Remove HPC air and bleed valve supply tube assembly (AA23) as follows. See Figure 303.

(a) Remove lockwire and disconnect tube nut from upper HPC bleed air filter at approximately 2 o'clock position forward of Flange J.

(b) Remove lockwire and disconnect tube nut from diffuser case adapter at approximately 2 o'clock position.

(c) Remove bolt, nut, and clamps securing tubes to Flange K bracket at approximately the 1 o'clock position. Remove tube from engine and install protective closures.

(6) Remove EEC PB tube assembly (AS09) as follows.

(a) Remove the lockwire and disconnect the tube from the diffuser case at approximately the 3 o'clock position.

(b) Remove lockwire and disconnect tube nut from tube coupling rearward of Flange E at approximately 12:30 o'clock position.

(c) Remove bolts, nuts, spacer, and clamps securing tube to Flange H bracket and HPC bracket at approximately 12:30 o'clock position.

(d) Remove bolt, nut, and clamp securing tube to bracket attached to HPC bleed valve flange at approximately 1:30 o'clock position.

(e) Remove the bolt, nut and clamp that attach the tube to a bracket on Flange K at approximately the 1:30 o'clock position.

(f) Remove the bolt and clamp that attach the tube to a bracket on the diffuser case cover at approximately the 1:30 o'clock position.

(g) Remove the bolt and clamp that attach the tube to a bracket on Flange K at approximately the 2:30 o'clock position.

(h) Remove the tube from the engine and install protective closures.

(7) Remove bleed and HPC air valve supply tube assembly (AA34) as follows. See Figure 304.

(a) Remove lockwire and disconnect tube nut from adapter on diffuser case at approximately 12:30 o'clock position.

(b) Remove lockwire and disconnect tube nut from tube coupling adjacent to air filters at approximately 11 o'clock position.

(c) Remove bolt, nut, and clamp securing tube to Flange J bracket.

(d) Remove bolt, nut, and clamp securing tube to Flange K bracket at approximately 12 o'clock position. Remove tube from engine and install protective closures.

(8) Remove No. 3 bearing breather tube assembly (upper) (LB03) as follows.

(a) Remove lockwire and disconnect tube elbow from diffuser case internal tube nut at approximately 1 o'clock position.

(b) Remove bolt and clamp securing tube to bracket at approximately 11 o'clock position.

(c) Remove the bolt , nut and clamp from the No. 3 bearing breather tube (LB03) that is attached to the bracket on the diffuser case pad with tube assembly (AP22) at approximately the 11:30 o'clock position.

(d) Remove bolts, nuts, and clamps securing tube to Flange K brackets at approximately 10, 12 and 1 o'clock positions. Remove tube from engine and install protective closures.

(9) Remove No. 3 bearing oil vent tube assembly (front) (LD01) as follows.

(a) Remove lockwire and disconnect tube nut from diffuser case coupling at approximately 8 o'clock position.

(b) Remove bolt, nut, and clamp securing tube to diffuser case bracket at approximately 9 o'clock position. Remove tube from engine and install protective closures.

(10) Remove turbine blade cooling tube assembly (upper) (AP38) as follows. See Figure 305.

(a) Remove bolts securing tube to turbine cooling air shutoff valve on HPC at approximately 10 o'clock position.

(b) Remove lockwire and bolts securing tube to diffuser case pad at approximately 2 o'clock position.

(c) Remove bolt, nut, and clamp securing tube to Flange K bracket at approximately 11 o'clock position.

(d) (Pre SB PW4ENG 72-537) Remove tube from engine. Remove and discard gaskets. Remove metering plate and tube locks. Install protective closures.

(e) (Post SB PW4ENG 72-537 and Pre SB PW4ENG 72-627) Remove the tube from the engine. Remove and discard the gaskets. Remove the ring spacer and tube locks. Install the protective closures.

(f) (Post SB PW4ENG 72-627) Remove the tube from the engine. Remove and discard the gaskets. Remove the metering plate and tube locks. Install the protective closures.

(11) Remove the diffuser seal air vent tube assembly (left) (AP22) as follows.

(a) Remove the lockwire and bolts that attach the tube to the diffuser case pad at approximately the 11 o'clock position.

(b) Remove the lockwire and bolts that attach the tube assembly (AP22) and bracket to the diffuser case pad at approximately the 11:30 o'clock position.

(c) Remove bolts, nuts and clamps that attach the PT4.95 tube (AS01) and the turbine vane cooling air valve signal tube (AA76) to the bracket attached to the flanged end of the tube (AP22). Remove the bracket from the engine.

CAUTION: WHEN YOU REMOVE THE (AP22) LEFT SIDE TUBE LOCK FROM THE INTERNAL DIFFUSER SEAL AIR VENT TUBE ASSEMBLY, YOU MUST BE CAREFUL THAT THE AIR VENT TUBE DOES NOT FALL INTO THE DIFFUSER CASE. AS A PRECAUTION, ATTACH A TEMPORARY SAFETY WIRE AROUND THE INTERNAL DIFFUSER SEAL AIR VENT TUBE ASSEMBLY SO IT WILL NOT FALL INTO THE DIFFUSER CASE. IF THE AIR VENT TUBE FALLS INTO THE DIFFUSER CASE IT IS POSSIBLE THAT MORE ENGINE DISASSEMBLY WILL BE NECESSARY TO GET ACCESS TO REMOVE THE TUBE.

(d) Remove the bolt, nut and clamp that attach the tube to a fuel injector bracket. Remove the tube from the engine. Remove the plate (Pre SB PW4ENG 75-110) or deflector (Post SB PW4ENG 75-110) from the recessed area of the diffuser case pad. Remove and discard the gaskets from the tube flanged end and from the diffuser case pad. Remove the tube locks and gaskets from the diffuser case pad and install protective covers.

NOTE: Do not discard metal gasket.

(12) (Pre/Post SB PW4ENG 72-491) Remove the No. 3 bearing oil pressure tube assembly (LP19) as follows. See Figure 306.

(a) Remove the bolt from the clamp that attaches the No. 3 bearing oil pressure manifold (LP18) and spray shield to a bracket attached to flange of cooling air tube (AS03) on the high compressor at approximately the 9 o'clock position. Remove the bolt and spray shield.

(b) Remove the lockwire and disconnect the manifold nut from the tube adapter.

(c) Remove the bolts that attach the ferrule end of the tube (LP19) to a bracket assembly on Flange K. Remove the bolt, nut and clamp that attach the tube to a bracket on Flange K at approximately the 9:30 o'clock position.

(d) Remove the lockwire from the bolts that attach the adapter and a strainer into the ferrule end of the tube. Remove the bolts and nuts from the adapter. Remove the adapter and strainer from the tube. Remove the packing from the adapter and discard.

(e) Remove the lockwire and disconnect the tube nut from the diffuser case internal tube at approximately the 10 o'clock position. Remove the tube from the engine and install protection covers.

NOTE: Do not discard the metal gasket.

(13) (Pre SB PW4ENG 72-491) Remove No. 4 bearing oil pressure tube assembly (front) (LP15) as follows.

(a) Remove hose clamp and spray shield from tube connection at tee forward of Flange J at approximately 8 o'clock position.

(b) Remove lockwire and disconnect tube nut from tee.

(c) Remove bolt, nut, and clamp securing tube to bracket attached to cooling air tube flange at approximately 9 o'clock position.

(d) Remove bolt, nut, and clamp securing tube to fuel injector bracket at approximately 9 o'clock position.

(e) Remove bolt, spacer, nut, and clamp securing tube to EEC PT4.95 tube at approximately 9:30 o'clock position. Remove tube from engine and install protective closures. If equipped remove the clamp and clip-on wear sleeves from PT4.95 tube (AS01).

(14) (Post SB PW4ENG 72-491) Remove No. 4 bearing oil pressure tube assembly (front) (LP15) as follows.

(a) Remove hose clamps and spray shields from tube connection at tee forward of Flange J at approximately 8 o'clock position and the tee fitting at the deoiler idler bearing pressure line (LP35) connection.

(b) Remove lockwire and disconnect tube nuts from tees.

(c) Remove bolt, nut, and clamp securing tube to bracket attached to cooling air tube flange at approximately 9 o'clock position.

(d) Remove bolt, nut, and clamp securing tube to fuel injector bracket at approximately 9 o'clock position.

(e) Remove bolt and clamp that holds the tube to Flange K bracket assembly at approximately 9 o'clock position.

(f) Remove bolt, spacer, nut, and clamp securing tube to EEC PT4.95 tube at approximately 9:30 o'clock position. Remove tubes from engine and install protective closures. If equipped remove the clamp and clip-on wear sleeves from PT4.95 tube (AS01).

(15) Remove EEC PT4.95 tube assembly (AS01) as follows.

(a) Remove lockwire and disconnect tube nut from tube coupling at forward end of tube.

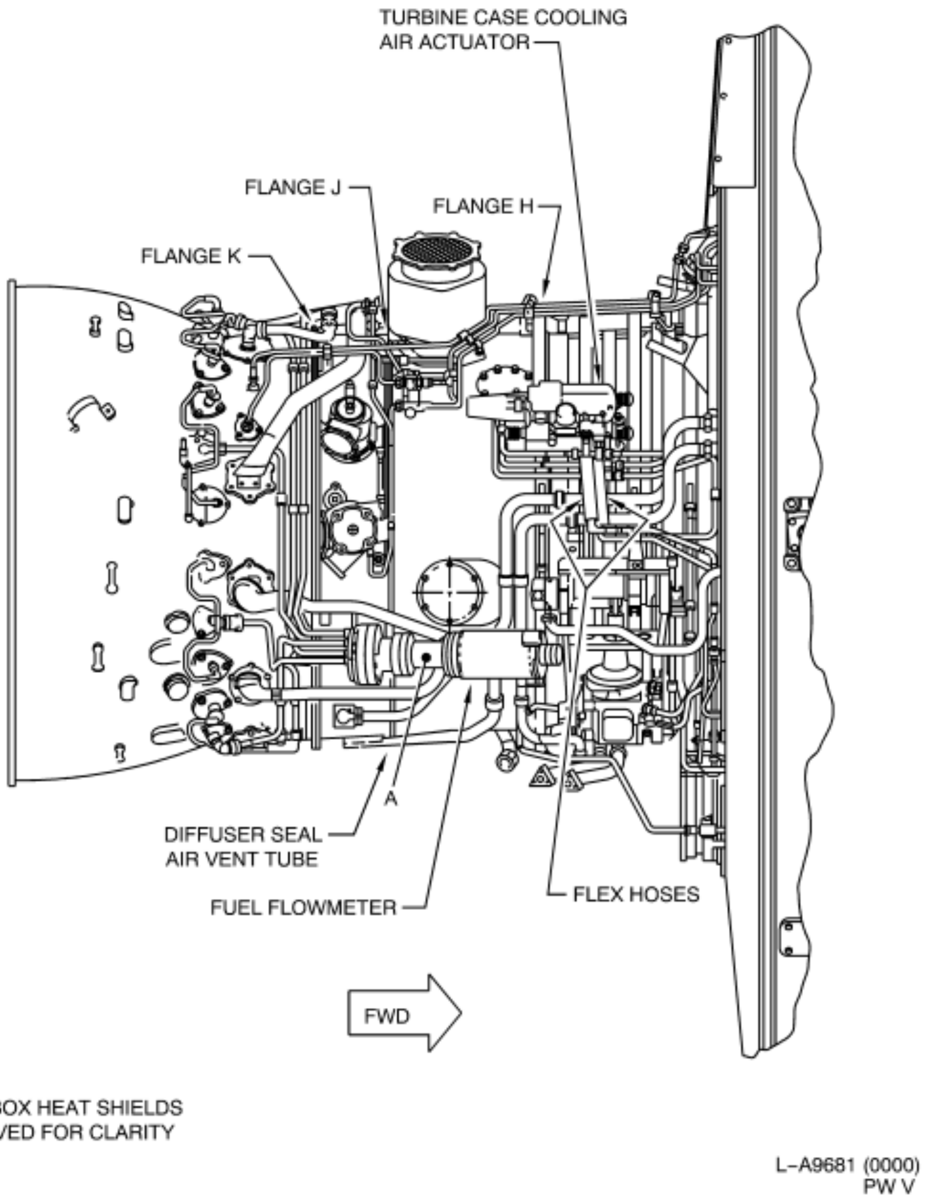
(b) Remove bolts, nuts, and clamps securing tube to engine.

(c) Remove tube from engine and install protective closures.

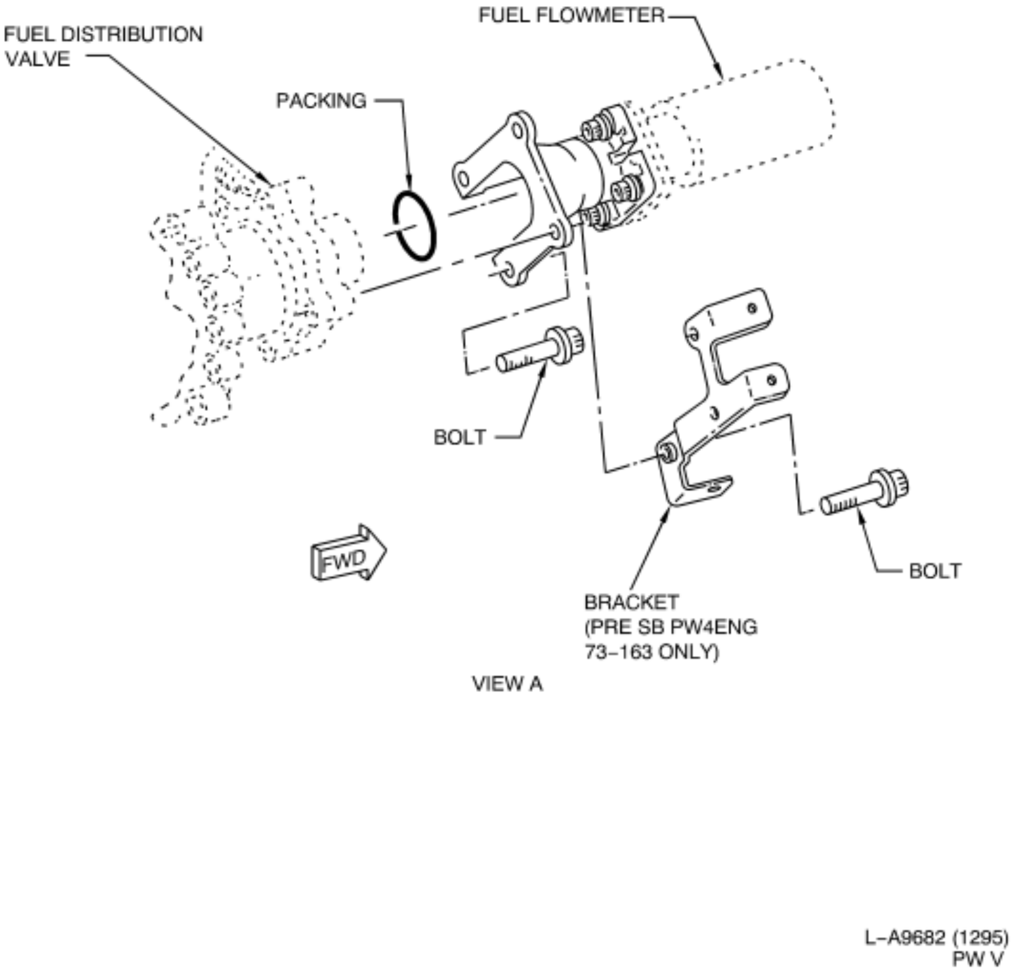
(16) Remove the gearbox heat shields as follows. See Figure 307.

(a) Remove the bolts and nuts that attach the heat shields to the Flanges J and K brackets and to each other.

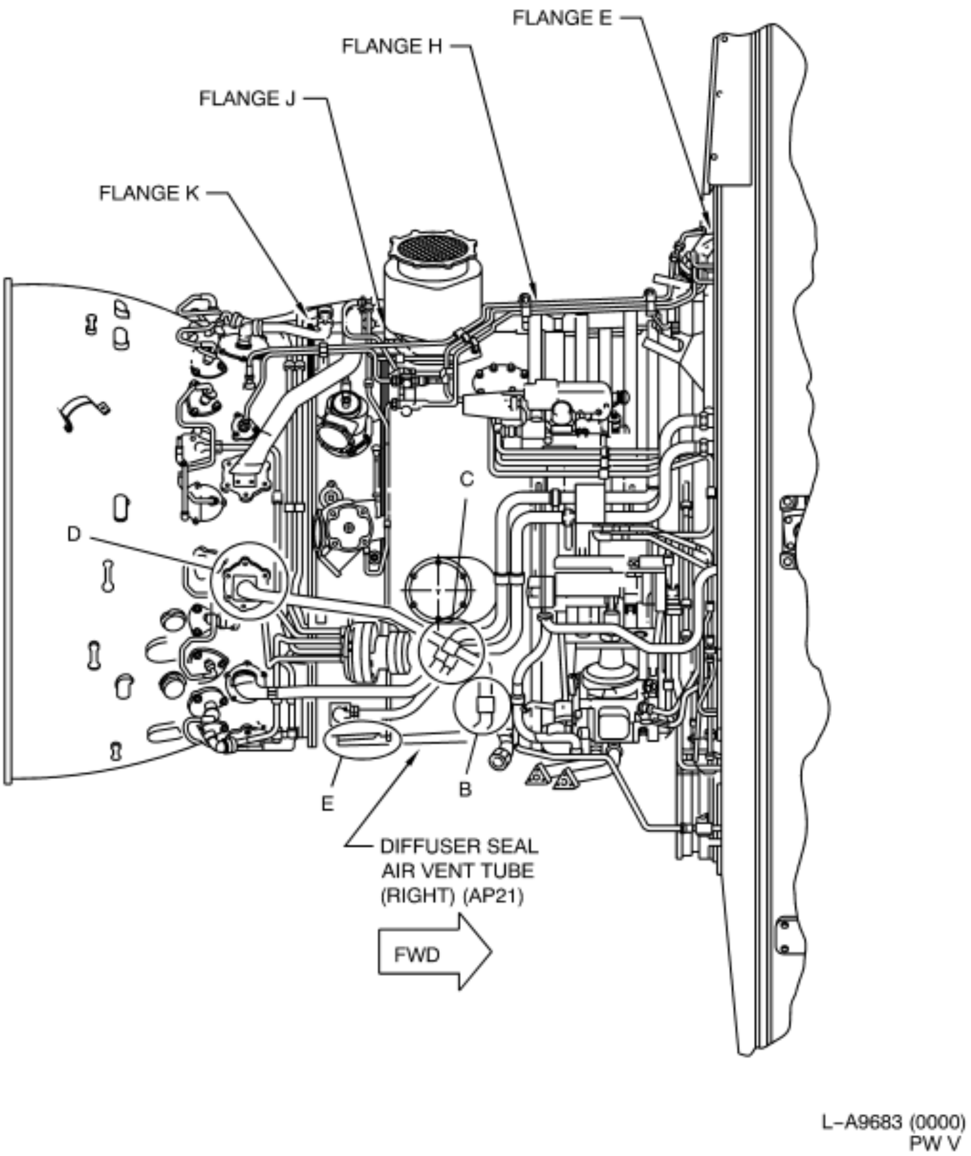
(b) Remove the heat shields.


TURBINE CASE COOLING AIR ACTUATOR
FLANGE J
FLANGE H
FLANGE K
A
DIFFUSER SEAL AIR VENT TUBE
FUEL FLOWMETER
FLEX HOSES
FWD
NOTE: GEARBOX HEAT SHIELDS REMOVED FOR CLARITY
L-A9681 (0000)
PW V

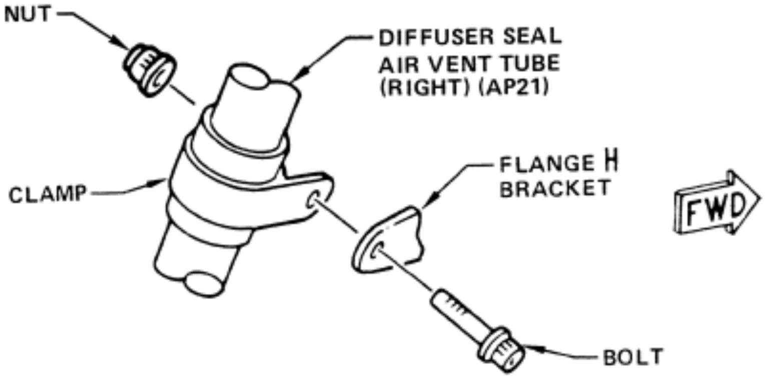
External Plumbing Removal
Figure 301 (Sheet 1)
(Task 72-00-41-020-006)


FUEL DISTRIBUTION VALVE
FUEL FLOWMETER
PACKING
BOLT
FWD
BRACKET (PRE SB PW4ENG 73−163 ONLY)
BOLT
VIEW A
L−A9682 (1295)
PW V

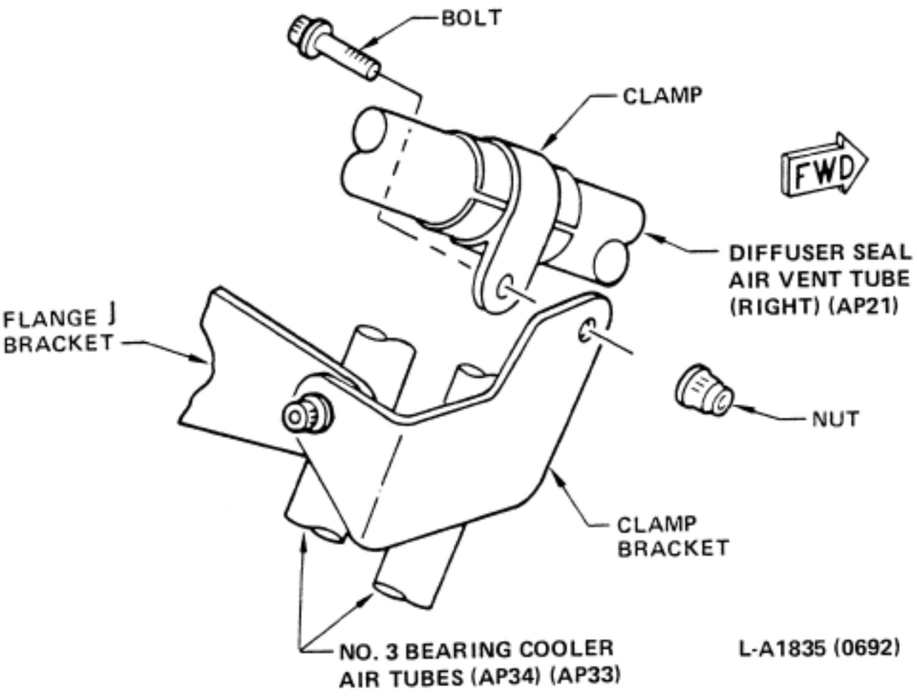
External Plumbing Removal
Figure 301 (Sheet 2)
(Task 72−00−41−020−006)


FLANGE E
FLANGE H
FLANGE J
FLANGE K
C
D
E
B
DIFFUSER SEAL AIR VENT TUBE (RIGHT) (AP21)
FWD
L-A9683 (0000)
PW V

External Plumbing Removal
Figure 301 (Sheet 3)
(Task 72-00-41-020-006)

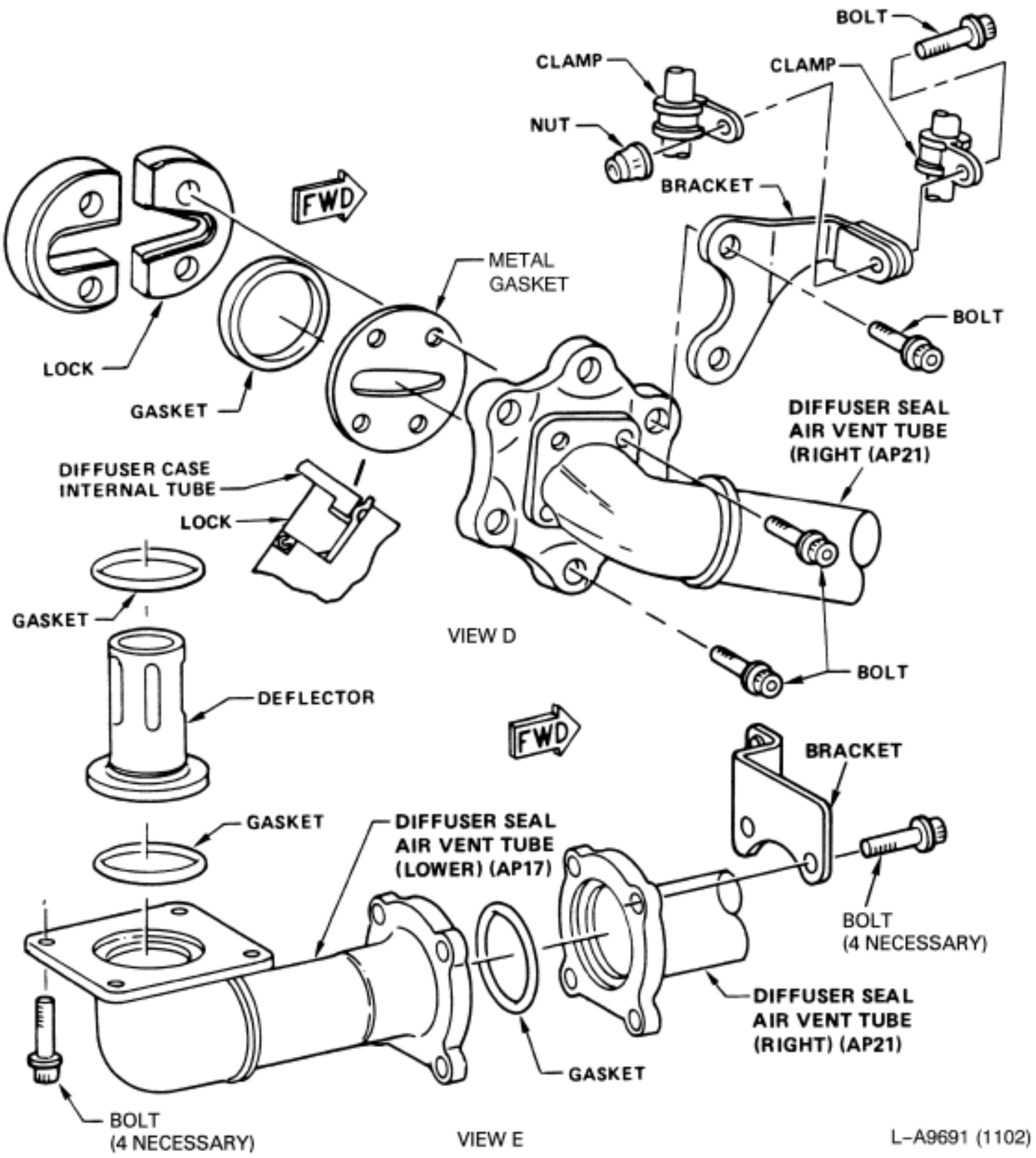

NUT
DIFFUSER SEAL AIR VENT TUBE (RIGHT) (AP21)
FLANGE H BRACKET
FWD
CLAMP
BOLT

VIEW B

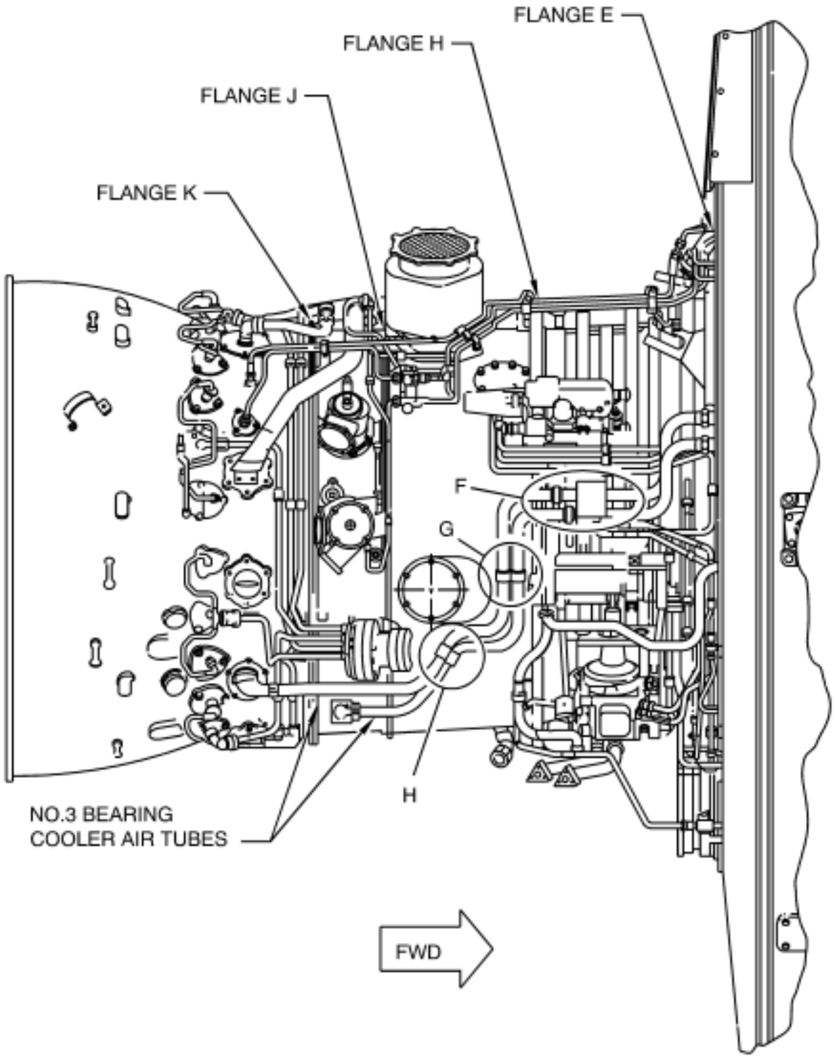

BOLT
CLAMP
FWD
DIFFUSER SEAL AIR VENT TUBE (RIGHT) (AP21)
FLANGE J BRACKET
NUT
CLAMP BRACKET
NO. 3 BEARING COOLER AIR TUBES (AP34) (AP33)
L-A1835 (0692)

VIEW C

External Plumbing Removal
Figure 301 (Sheet 4)
(Task 72-00-41-020-006)

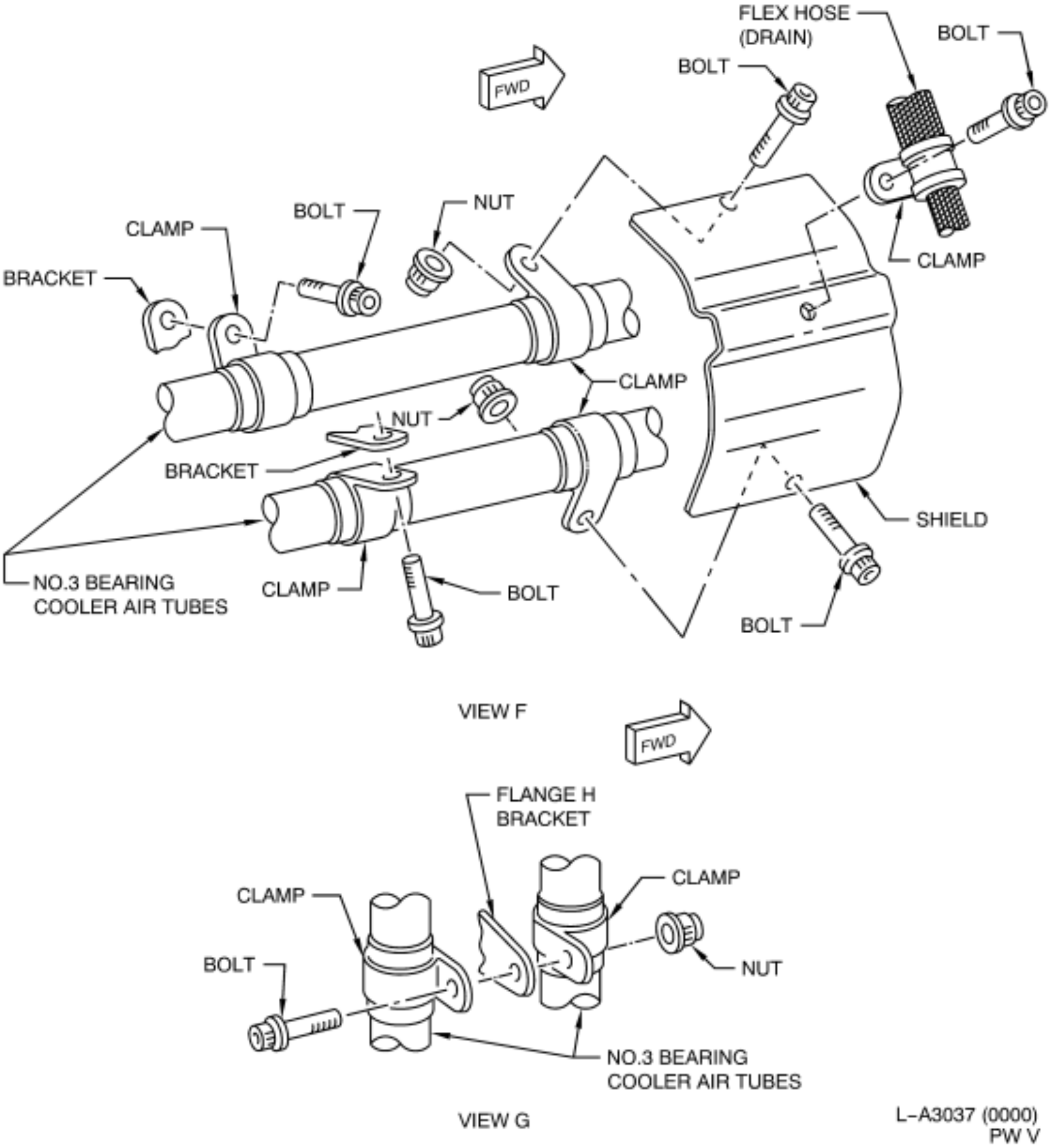

BOLT
CLAMP
CLAMP
NUT
BRACKET
FWD
METAL GASKET
BOLT
LOCK
GASKET
DIFFUSER SEAL AIR VENT TUBE (RIGHT (AP21)
DIFFUSER CASE INTERNAL TUBE
LOCK
GASKET
VIEW D
BOLT
DEFLECTOR
FWD
BRACKET
GASKET
DIFFUSER SEAL AIR VENT TUBE (LOWER) (AP17)
BOLT (4 NECESSARY)
DIFFUSER SEAL AIR VENT TUBE (RIGHT) (AP21)
GASKET
BOLT (4 NECESSARY)
VIEW E
L-A9691 (1102)

External Plumbing Removal
Figure 301 (Sheet 5)
(Task 72-00-41-020-006)


FLANGE E
FLANGE H
FLANGE J
FLANGE K
F
G
H
NO.3 BEARING COOLER AIR TUBES
FWD

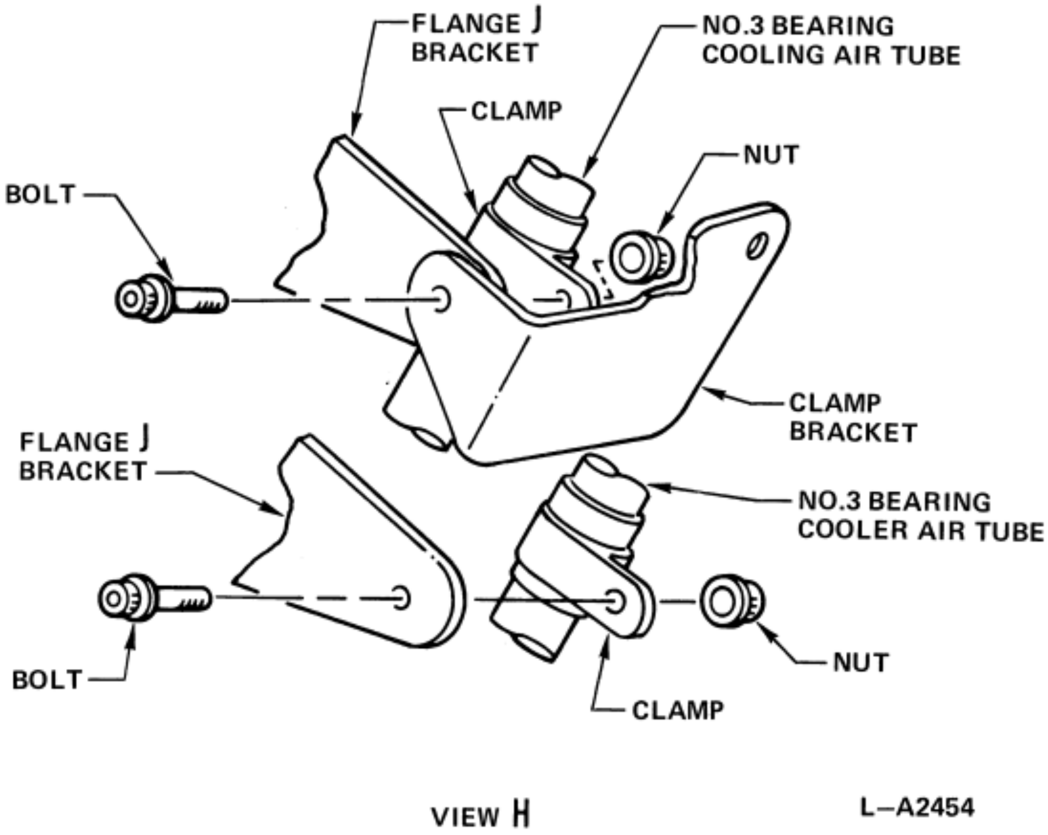
L−A9692 (0000)
PW V

External Plumbing Removal
Figure 302 (Sheet 1)
(Task 72−00−41−020−006)


FWD
FLEX HOSE (DRAIN)
BOLT
BOLT
BOLT
NUT
CLAMP
BRACKET
CLAMP
CLAMP
NUT
BRACKET
SHIELD
NO.3 BEARING COOLER AIR TUBES
CLAMP
BOLT
BOLT
VIEW F
FWD
FLANGE H BRACKET
CLAMP
CLAMP
BOLT
NUT
NO.3 BEARING COOLER AIR TUBES
VIEW G
L-A3037 (0000)
PW V

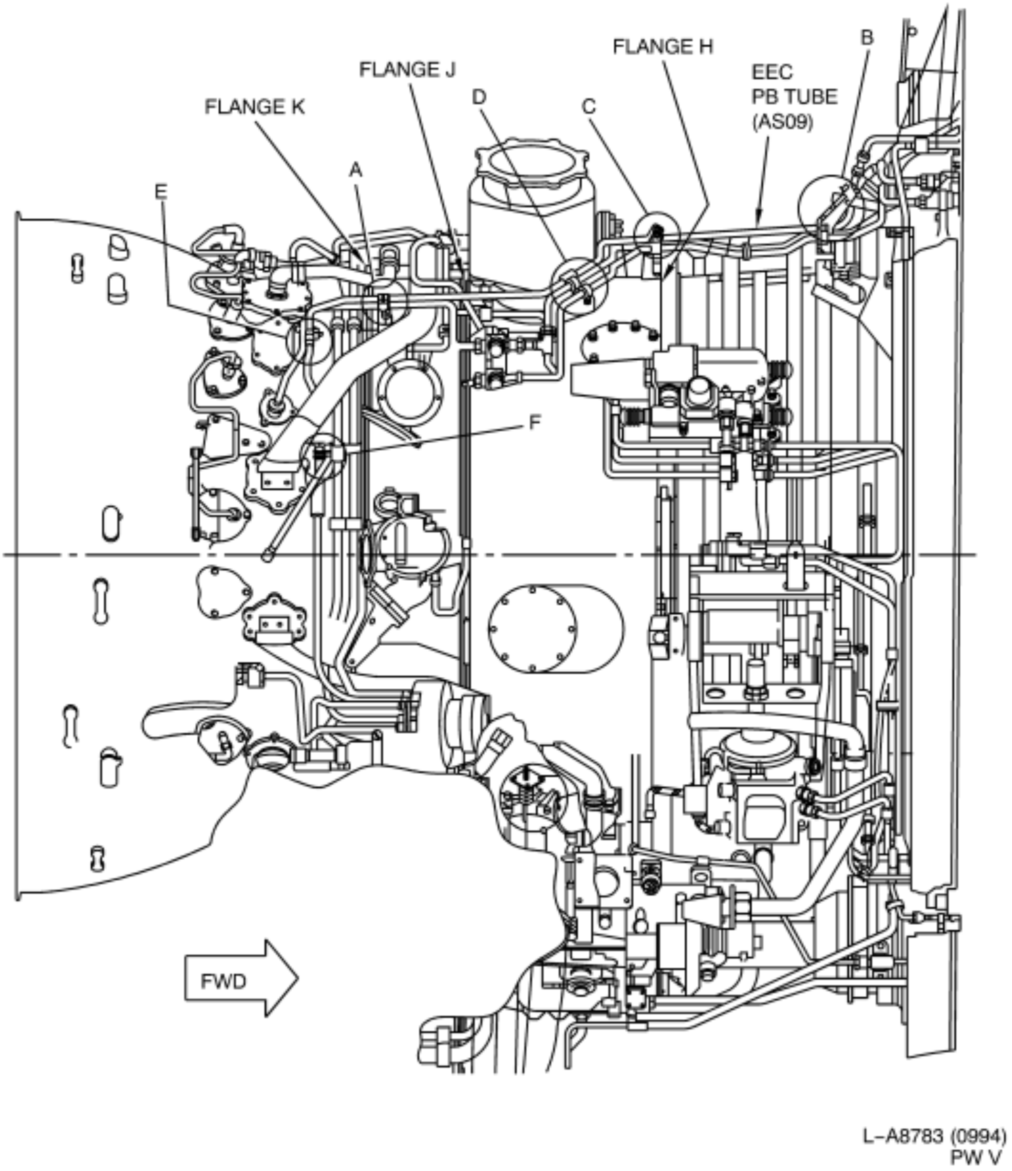
External Plumbing Removal
Figure 302 (Sheet 2)
(Task 72-00-41-020-006)

R
R

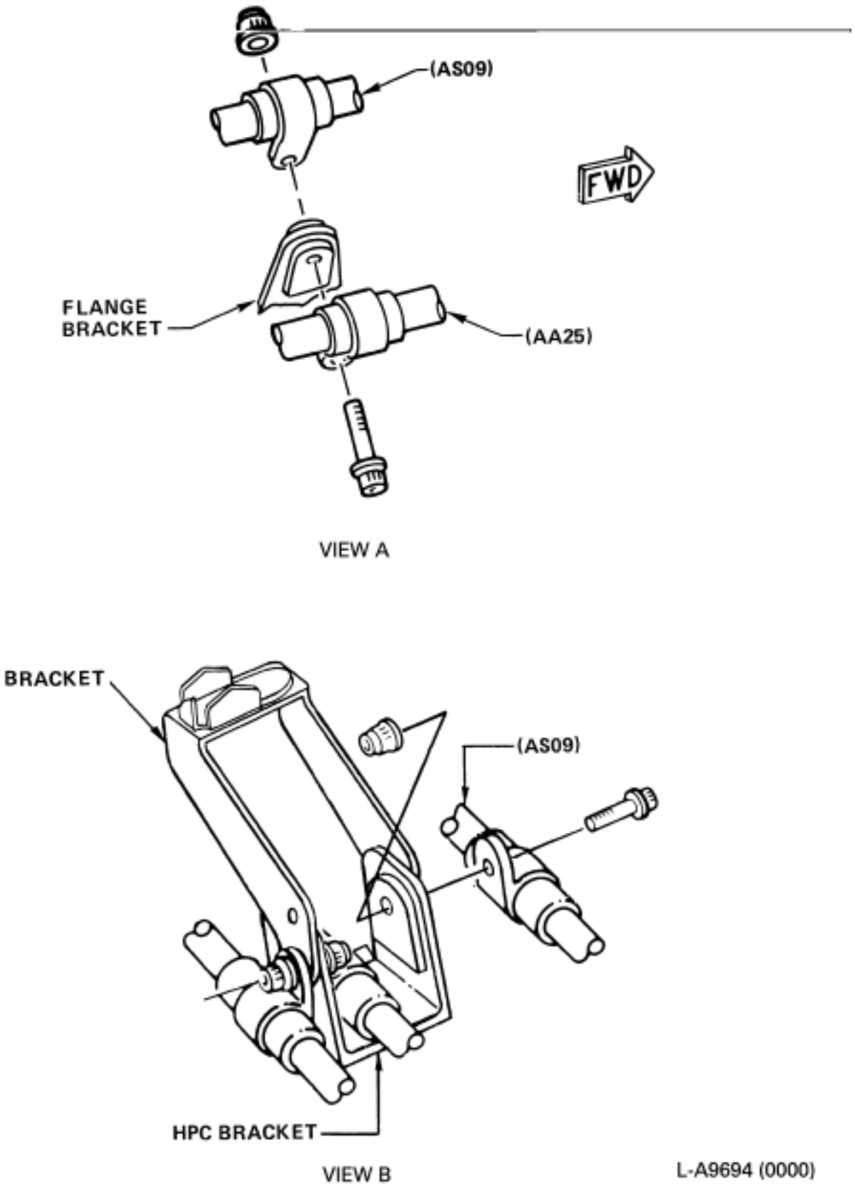

FLANGE J BRACKET
NO.3 BEARING COOLING AIR TUBE
CLAMP
NUT
BOLT
CLAMP BRACKET
FLANGE J BRACKET
NO.3 BEARING COOLER AIR TUBE
BOLT
NUT
CLAMP
VIEW H
L-A2454

External Plumbing Removal
Figure 302 (Sheet 3)
(Task 72-00-41-020-006)

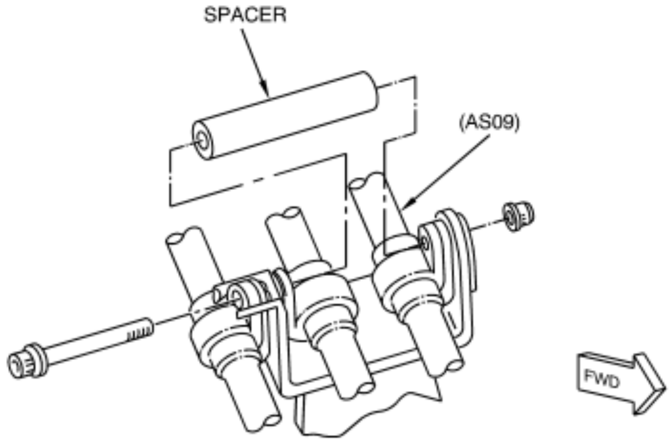
ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-02


FLANGE H
B
FLANGE J
EEC
PB TUBE
(AS09)
D
C
FLANGE K
A
E
F
FWD
L-A8783 (0994)
PW V

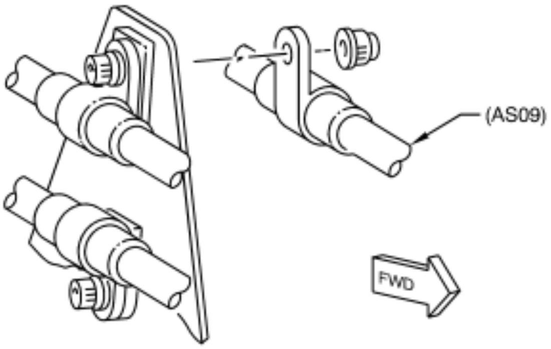
External Plumbing Removal
Figure 303 (Sheet 1)
(Task 72-00-41-020-006)


(AS09)
FWD
FLANGE BRACKET
(AA25)
VIEW A
BRACKET
(AS09)
HPC BRACKET
VIEW B
L-A9694 (0000)

External Plumbing Removal
Figure 303 (Sheet 2)
(Task 72−00−41−020−006)



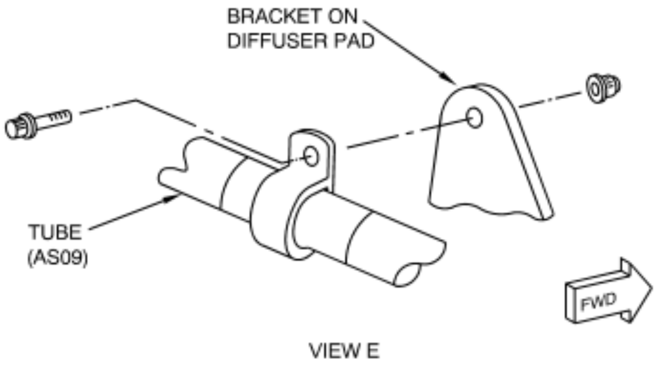
VIEW C

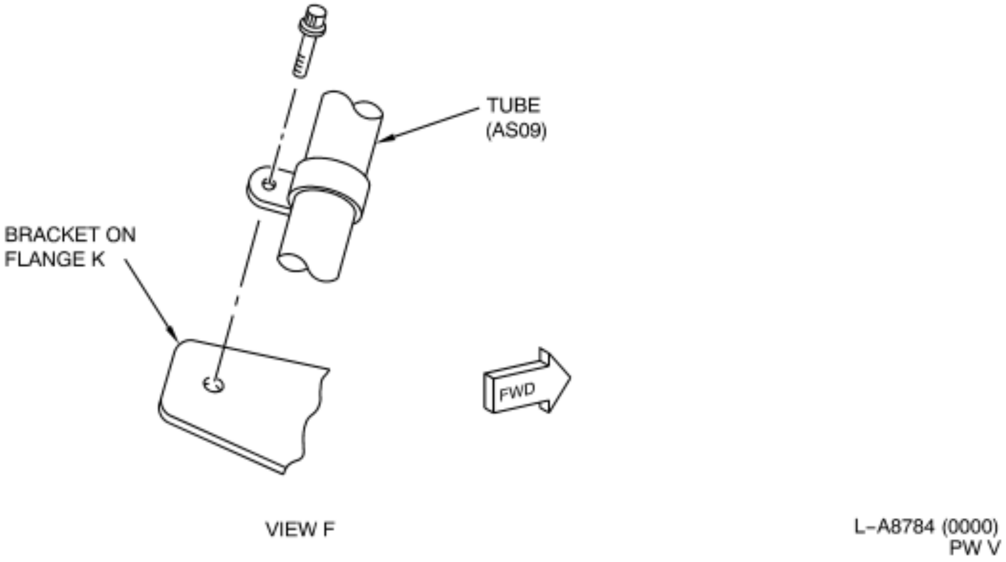


VIEW D

L−A6304 (0196)
PW V

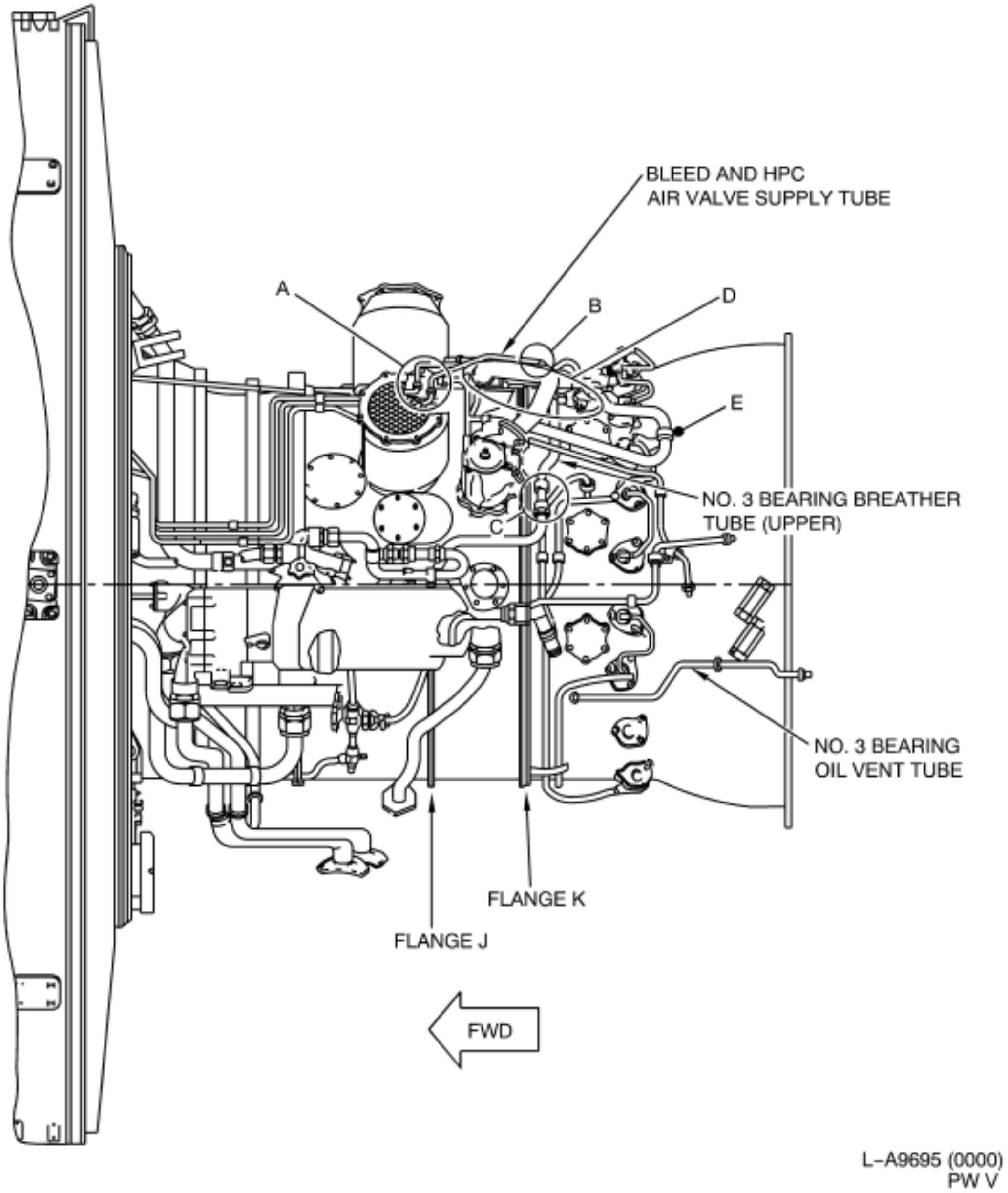
External Plumbing Removal
Figure 303 (Sheet 3)
(Task 72−00−41−020−006)


BRACKET ON
DIFFUSER PAD
TUBE
(AS09)
FWD
VIEW E

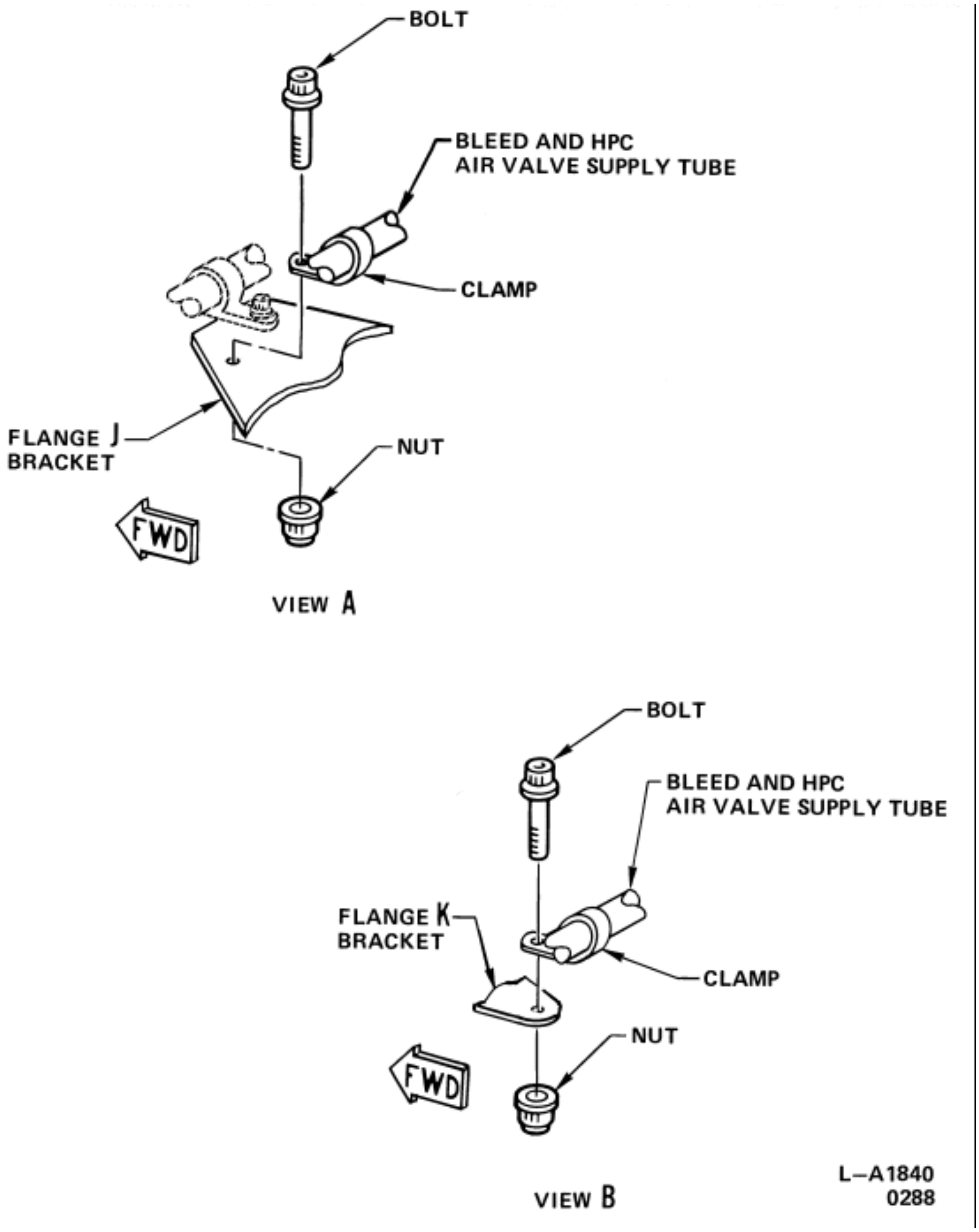

TUBE
(AS09)
BRACKET ON
FLANGE K
FWD
VIEW F
L-A8784 (0000)
PW V

External Plumbing Removal
Figure 303 (Sheet 4)
(Task 72-00-41-020-006)

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-02

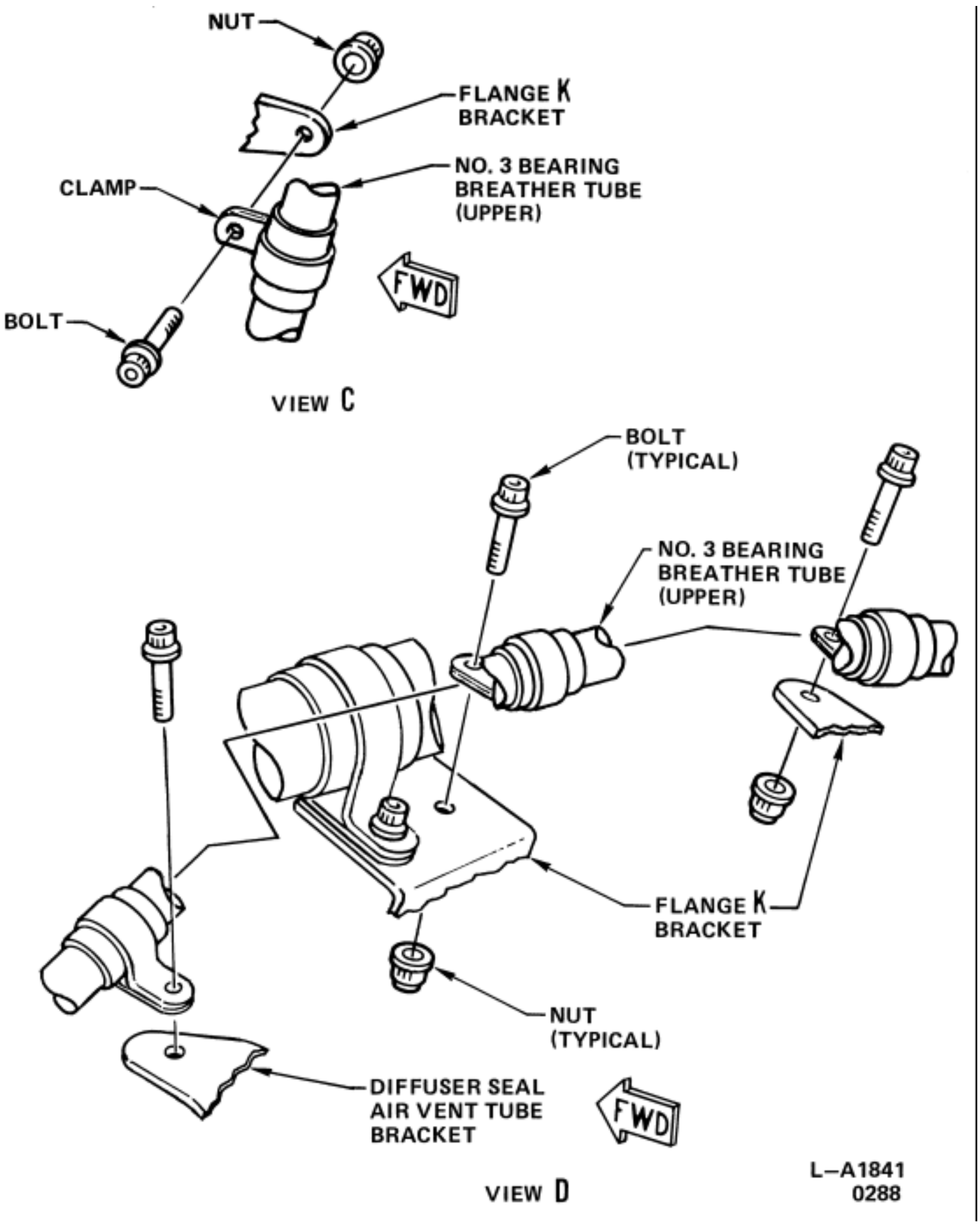

BLEED AND HPC AIR VALVE SUPPLY TUBE
A
B
D
E
NO. 3 BEARING BREATHER TUBE (UPPER)
C
C
C
NO. 3 BEARING OIL VENT TUBE
FLANGE K
FLANGE J
FWD
L-A9695 (0000)
PW V

External Plumbing Removal
Figure 304 (Sheet 1)
(Task 72-00-41-020-006)

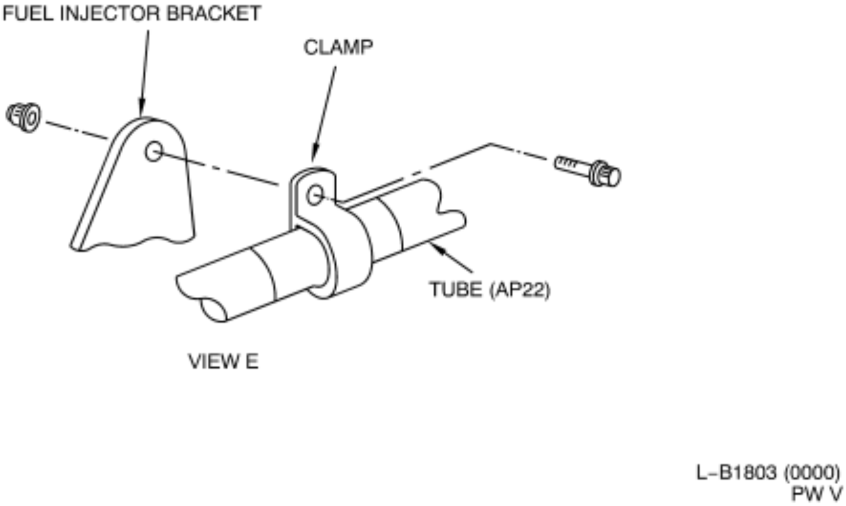

BOLT
BLEED AND HPC AIR VALVE SUPPLY TUBE
CLAMP
FLANGE J BRACKET
NUT
FWD
VIEW A
BOLT
BLEED AND HPC AIR VALVE SUPPLY TUBE
FLANGE K BRACKET
CLAMP
NUT
FWD
VIEW B
L-A1840
0288

External Plumbing Removal
Figure 304 (Sheet 2)
(Task 72-00-41-020-006)

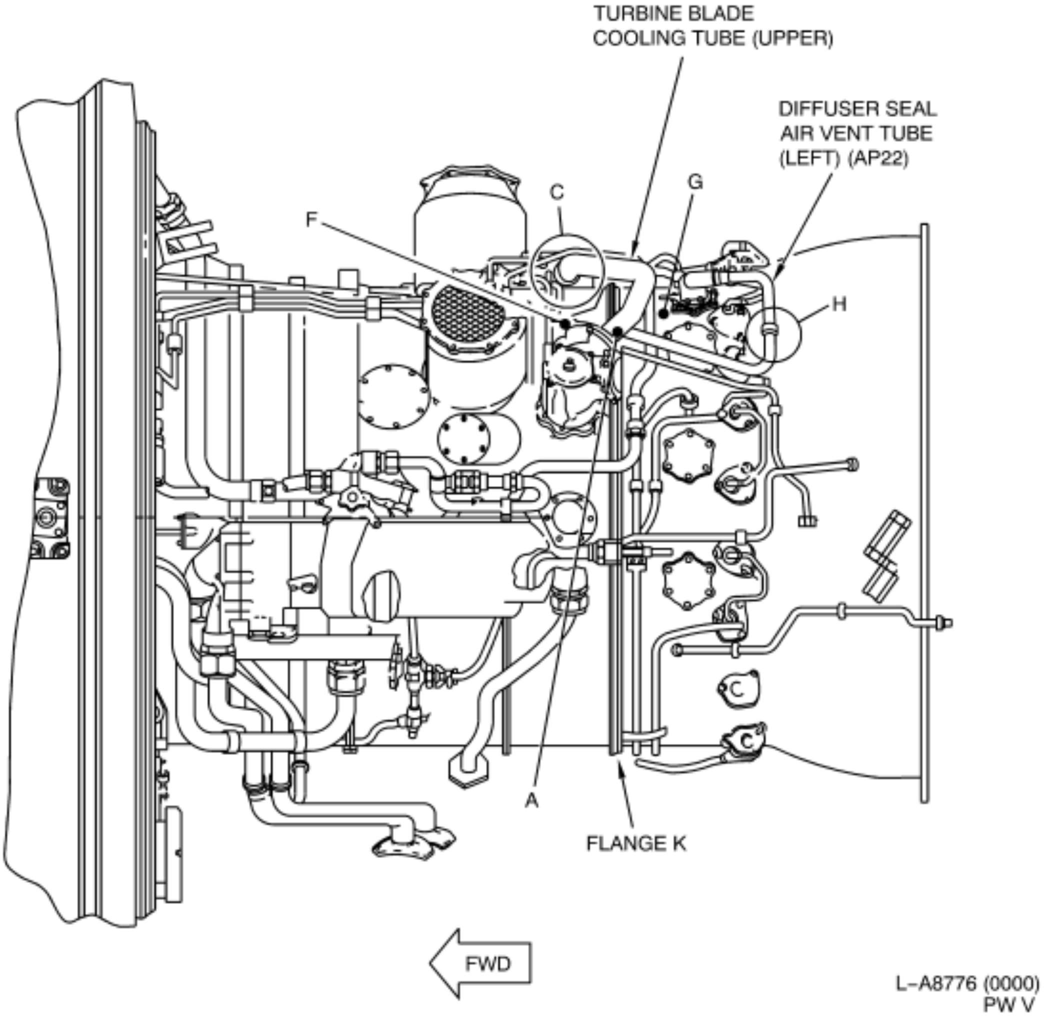
R
R


NUT
FLANGE K BRACKET
NO. 3 BEARING BREATHER TUBE (UPPER)
CLAMP
FWD
BOLT
VIEW C
BOLT (TYPICAL)
NO. 3 BEARING BREATHER TUBE (UPPER)
FLANGE K BRACKET
NUT (TYPICAL)
DIFFUSER SEAL AIR VENT TUBE BRACKET
FWD
L-A1841
0288
VIEW D

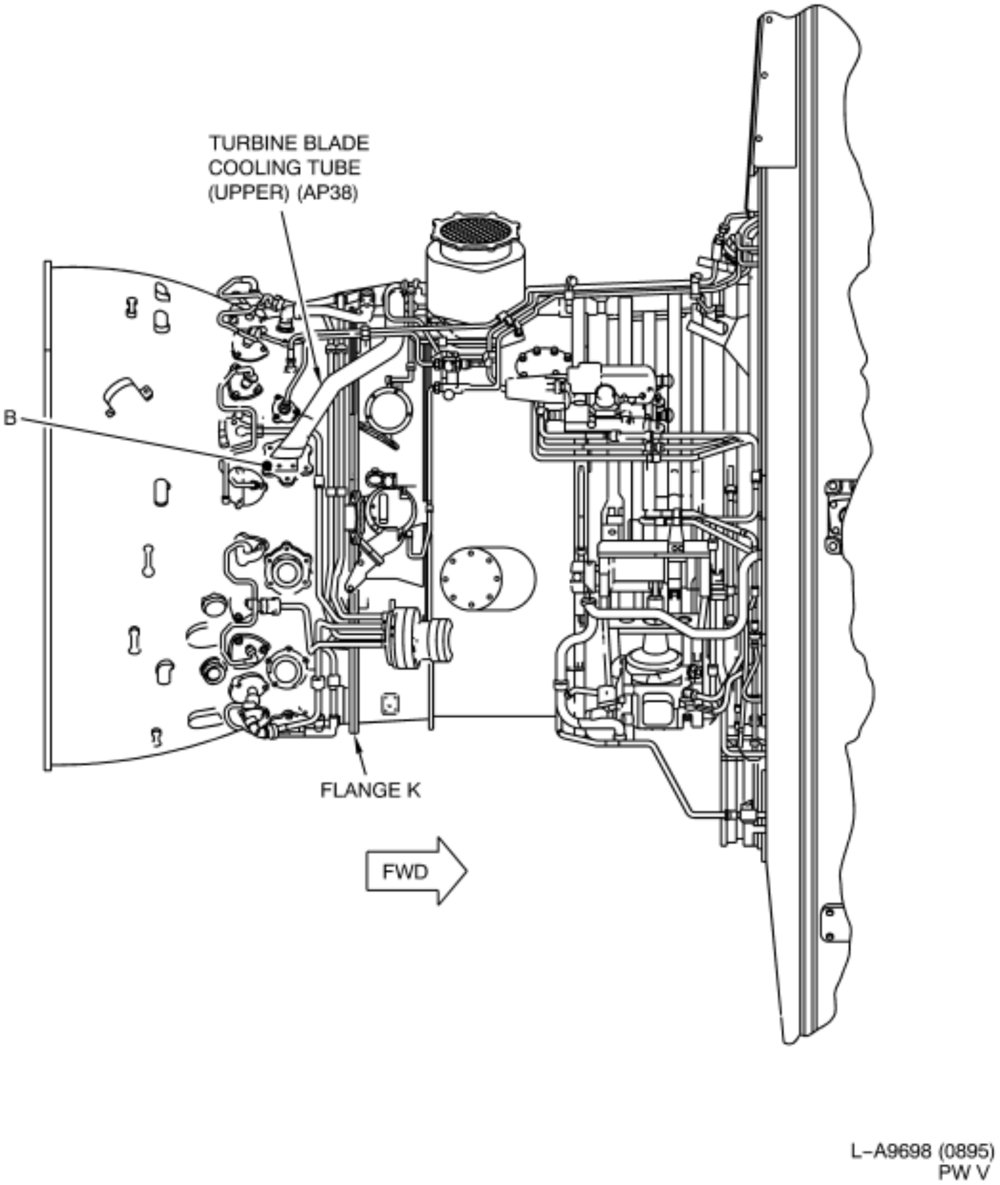
External Plumbing Removal
Figure 304 (Sheet 3)
(Task 72-00-41-020-006)


FUEL INJECTOR BRACKET
CLAMP
TUBE (AP22)
VIEW E
L−B1803 (0000)
PW V

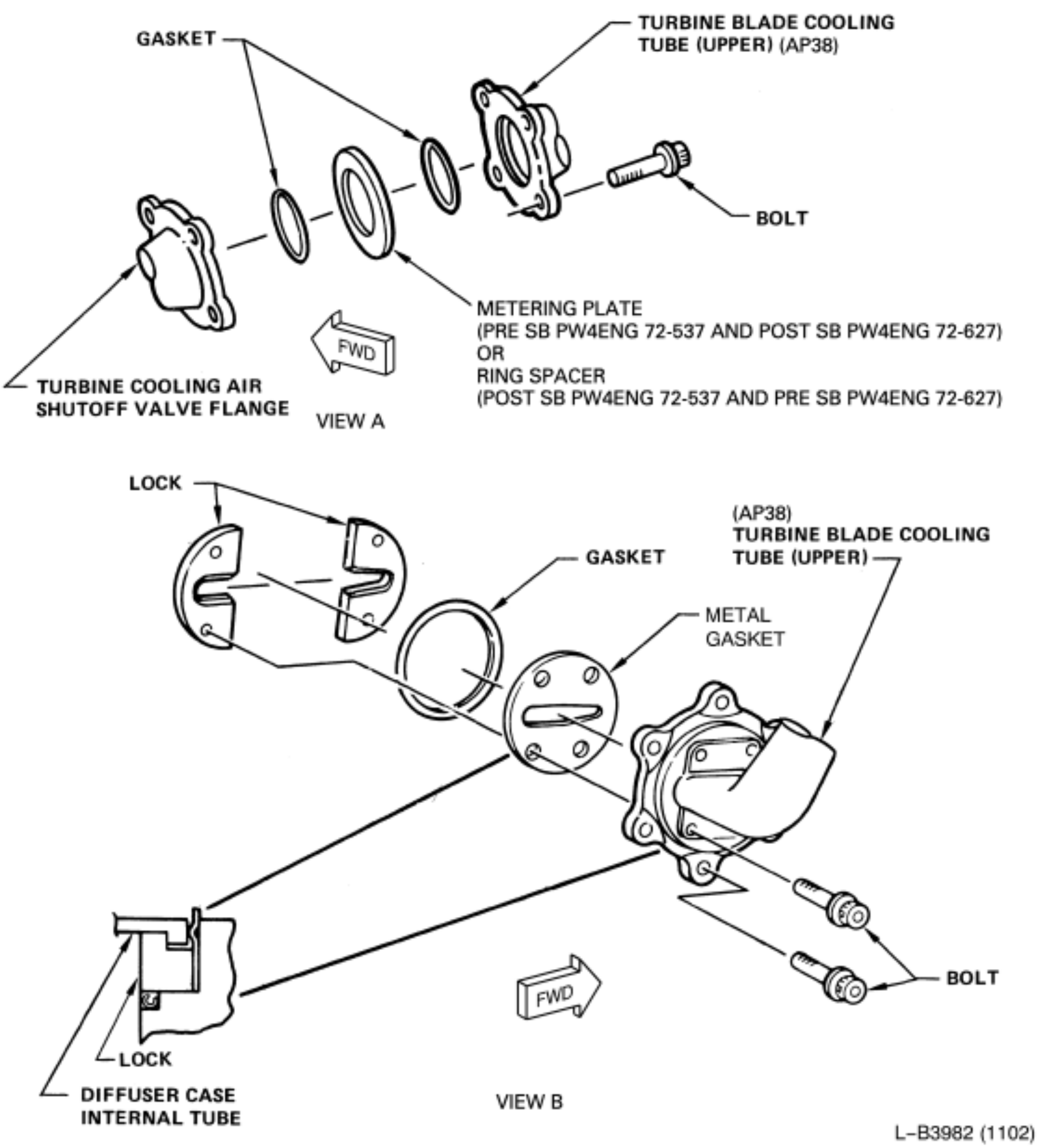
External Plumbing Removal
Figure 304 (Sheet 4)
(Task 72−00−41−020−006)


TURBINE BLADE COOLING TUBE (UPPER)
DIFFUSER SEAL AIR VENT TUBE (LEFT) (AP22)
G
C
F
H
A
FLANGE K
FWD
L-A8776 (0000)
PW V

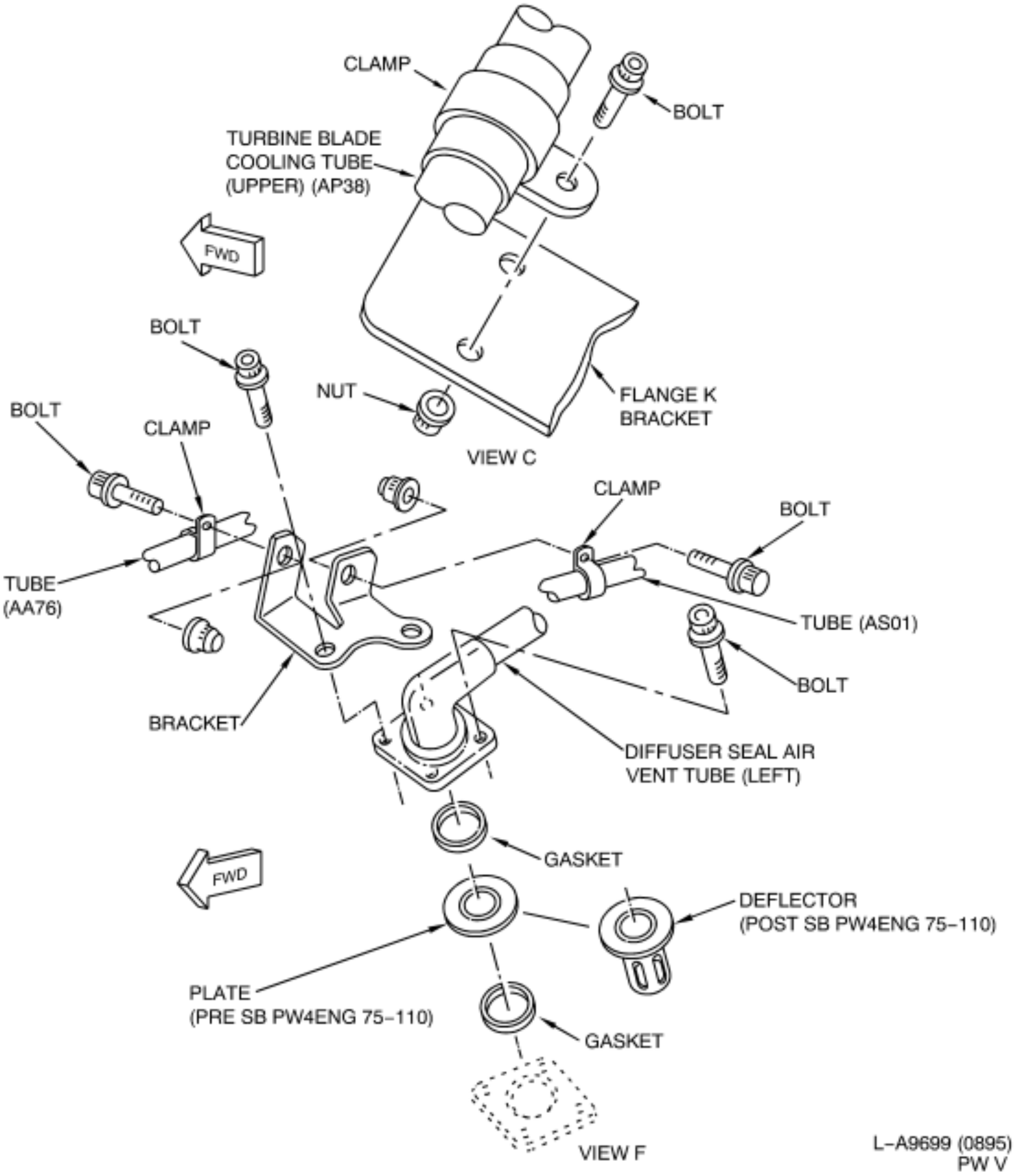
External Plumbing Removal
Figure 305 (Sheet 1)
(Task 72-00-41-020-006)


TURBINE BLADE COOLING TUBE (UPPER) (AP38)
B
FLANGE K
FWD
L−A9698 (0895)
PW V

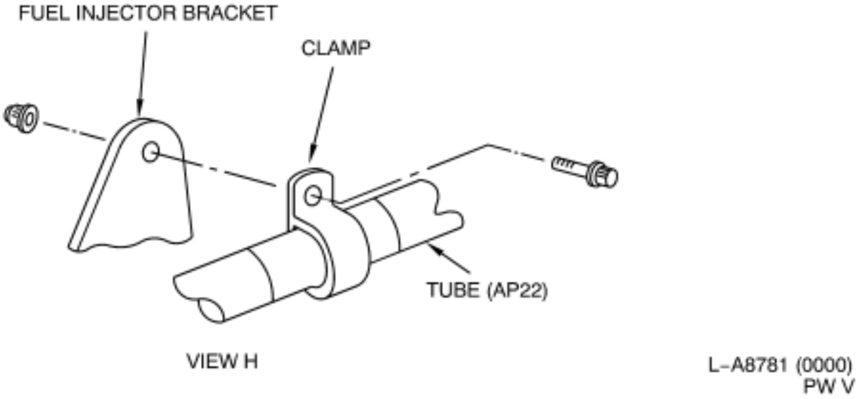
External Plumbing Removal
Figure 305 (Sheet 2)
(Task 72−00−41−020−006)


GASKET
TURBINE BLADE COOLING TUBE (UPPER) (AP38)
BOLT
METERING PLATE
(PRE SB PW4ENG 72-537 AND POST SB PW4ENG 72-627)
OR
RING SPACER
(POST SB PW4ENG 72-537 AND PRE SB PW4ENG 72-627)
FWD
TURBINE COOLING AIR SHUTOFF VALVE FLANGE
VIEW A
LOCK
GASKET
(AP38)
TURBINE BLADE COOLING TUBE (UPPER)
METAL GASKET
BOLT
FWD
LOCK
DIFFUSER CASE INTERNAL TUBE
VIEW B
L-B3982 (1102)

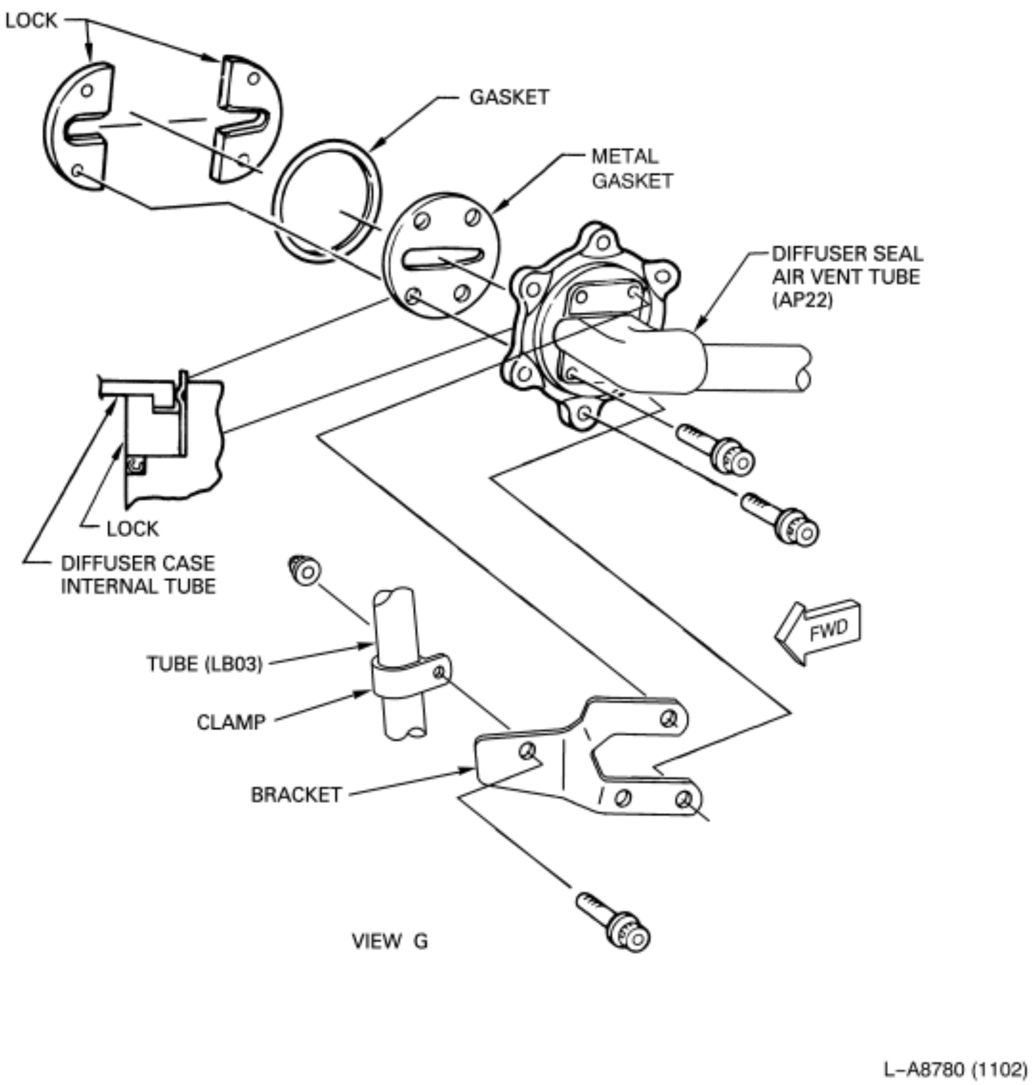
External Plumbing Removal
Figure 305 (Sheet 3)
(Task 72-00-41-020-006)


CLAMP
BOLT
TURBINE BLADE COOLING TUBE (UPPER) (AP38)
FWD
BOLT
NUT
FLANGE K BRACKET
BOLT
CLAMP
VIEW C
CLAMP
BOLT
TUBE (AA76)
TUBE (AS01)
BOLT
BRACKET
DIFFUSER SEAL AIR VENT TUBE (LEFT)
GASKET
FWD
DEFLECTOR (POST SB PW4ENG 75-110)
PLATE (PRE SB PW4ENG 75-110)
GASKET
VIEW F
L-A9699 (0895)
PW V

External Plumbing Removal
Figure 305 (Sheet 4)
(Task 72-00-41-020-006)

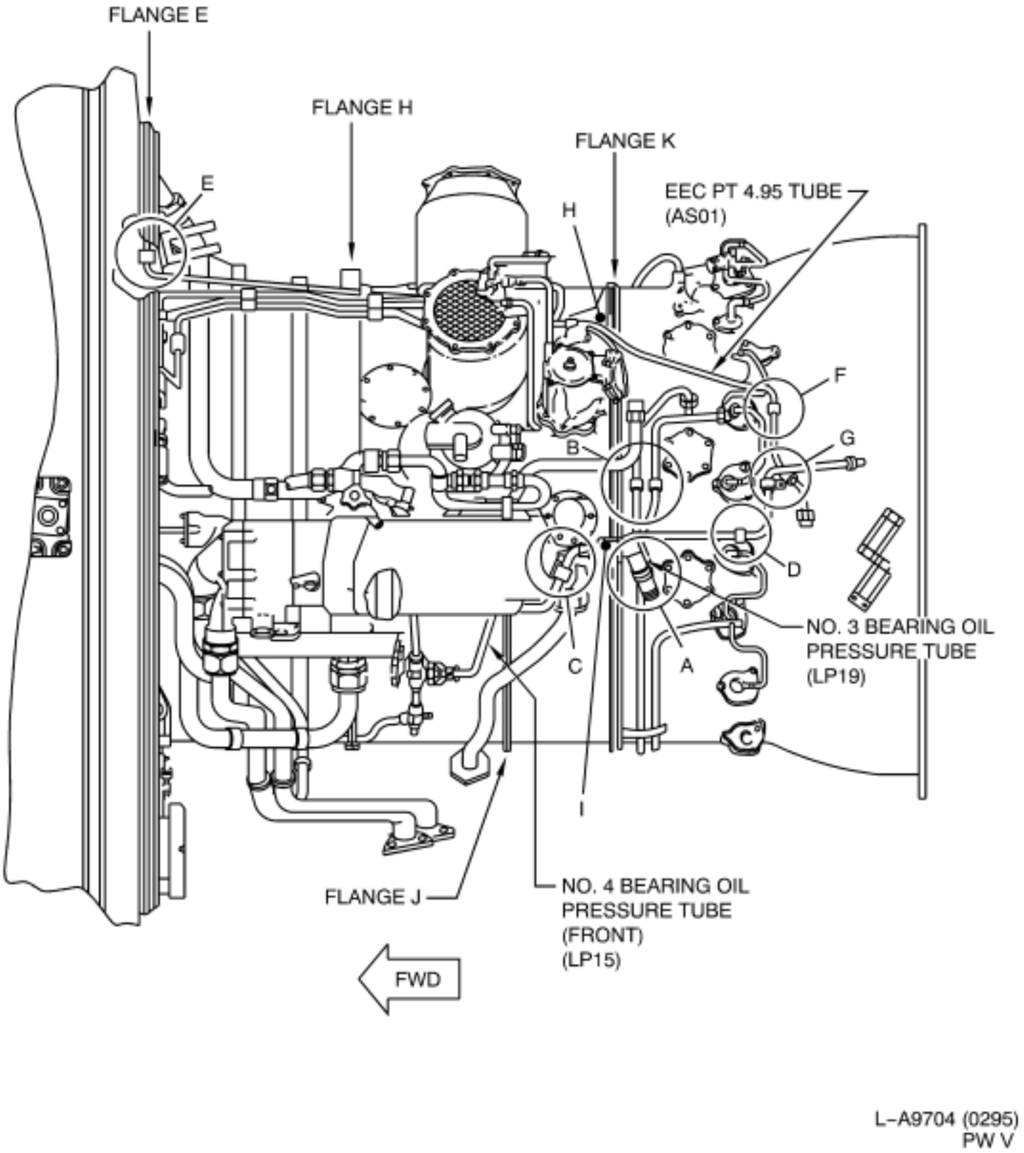

FUEL INJECTOR BRACKET
CLAMP
TUBE (AP22)
VIEW H
L-A8781 (0000)
PW V

External Plumbing Removal
Figure 305 (Sheet 5)
(Task 72-00-41-020-006)

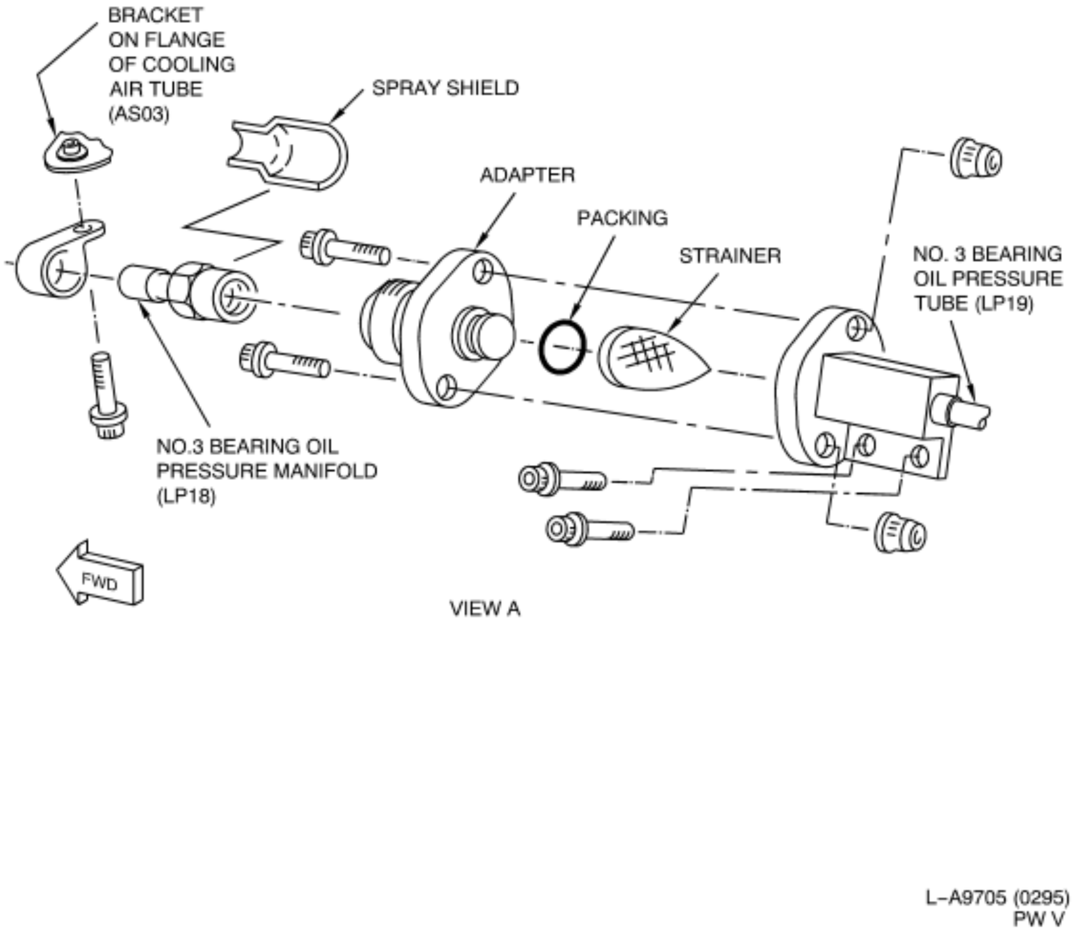

LOCK
GASKET
METAL GASKET
DIFFUSER SEAL AIR VENT TUBE (AP22)
LOCK
DIFFUSER CASE INTERNAL TUBE
FWD
TUBE (LB03)
CLAMP
BRACKET
VIEW G
L-A8780 (1102)

External Plumbing Removal
Figure 305 (Sheet 6)
(Task 72-00-41-020-006)

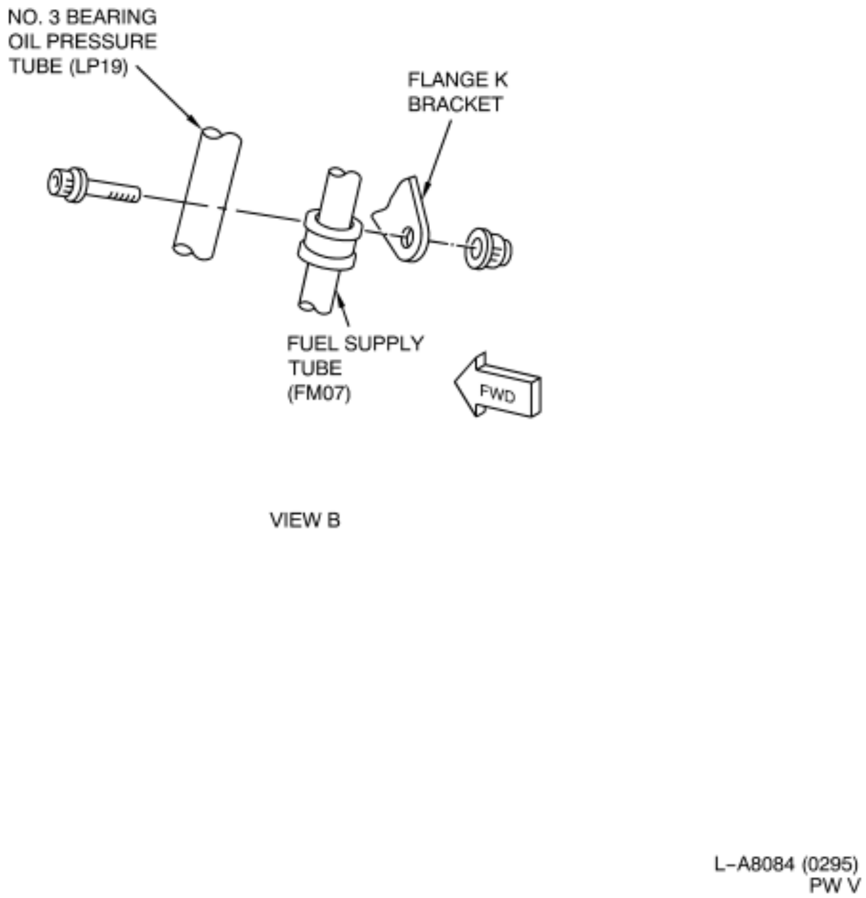
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−02


FLANGE E
FLANGE H
FLANGE K
EEC PT 4.95 TUBE
(AS01)
E
H
F
G
B
D
C
A
NO. 3 BEARING OIL
PRESSURE TUBE
(LP19)
I
FLANGE J
NO. 4 BEARING OIL
PRESSURE TUBE
(FRONT)
(LP15)
FWD
L−A9704 (0295)
PW V

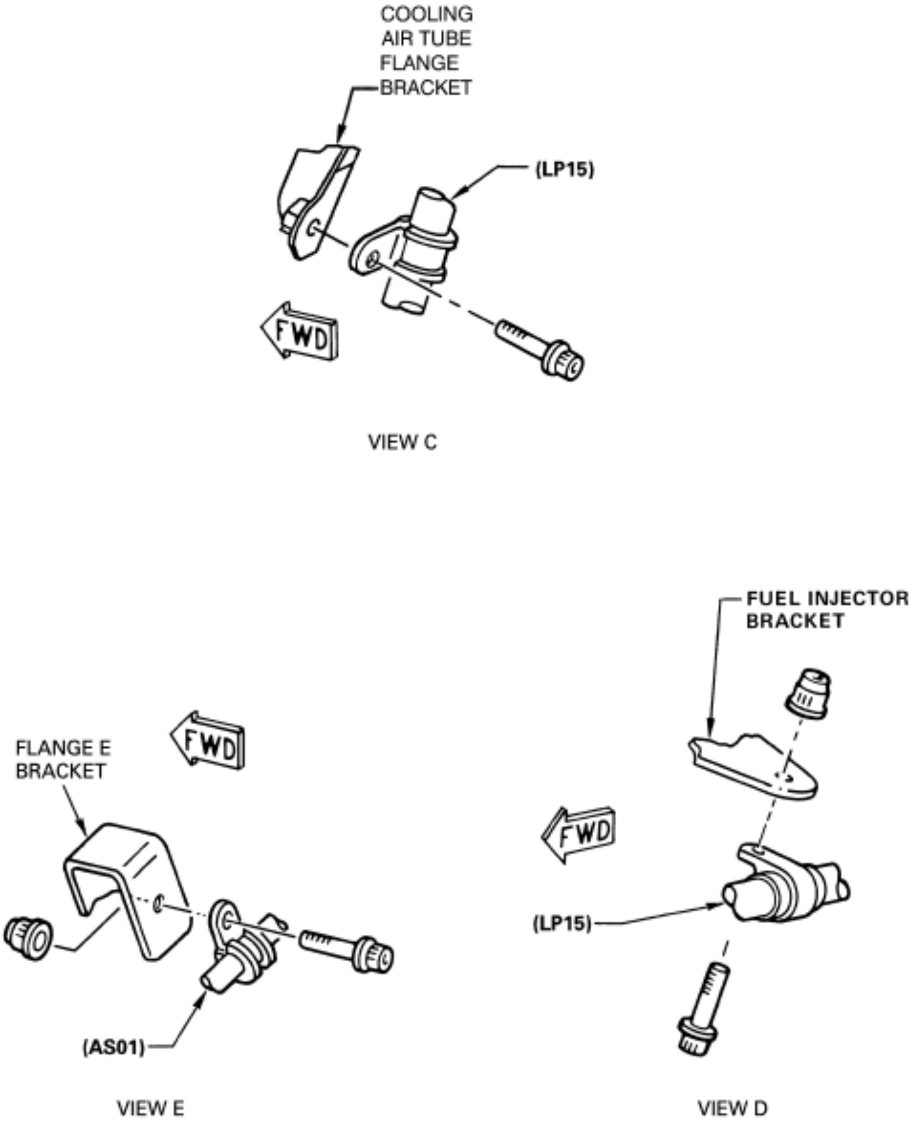
External Plumbing Removal
Figure 306 (Sheet 1)
(Task 72−00−41−020−006)


BRACKET ON FLANGE OF COOLING AIR TUBE (AS03)
SPRAY SHIELD
ADAPTER
PACKING
STRAINER
NO. 3 BEARING OIL PRESSURE TUBE (LP19)
NO.3 BEARING OIL PRESSURE MANIFOLD (LP18)
FWD
VIEW A
L−A9705 (0295)
PW V

External Plumbing Removal
Figure 306 (Sheet 2)
(Task 72−00−41−020−006)

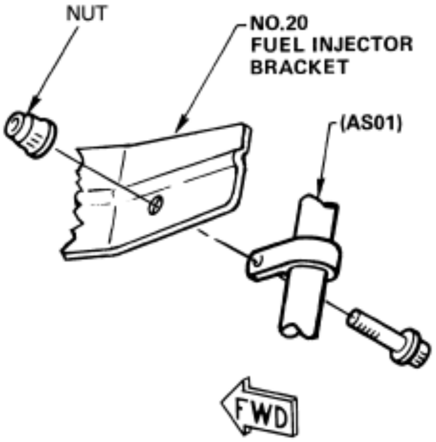

NO. 3 BEARING OIL PRESSURE TUBE (LP19)
FLANGE K BRACKET
FUEL SUPPLY TUBE (FM07)
FWD
VIEW B
L−A8084 (0295)
PW V

External Plumbing Removal
Figure 306 (Sheet 3)
(Task 72−00−41−020−006)

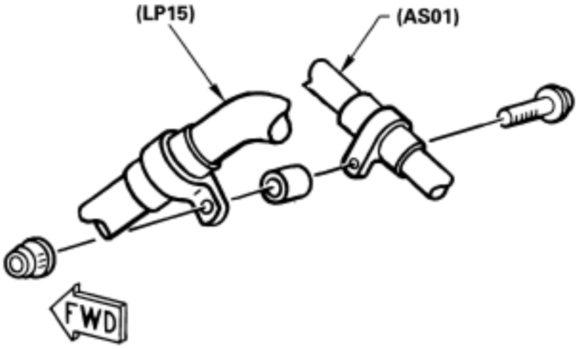

COOLING AIR TUBE FLANGE BRACKET
(LP15)
FWD
VIEW C
FLANGE E BRACKET
FWD
(AS01)
VIEW E
FUEL INJECTOR BRACKET
FWD
(LP15)
VIEW D

L − A9706 (0295)

External Plumbing Removal
Figure 306 (Sheet 4)
(Task 72−00−41−020−006)


NUT
NO.20
FUEL INJECTOR
BRACKET
(AS01)
FWD

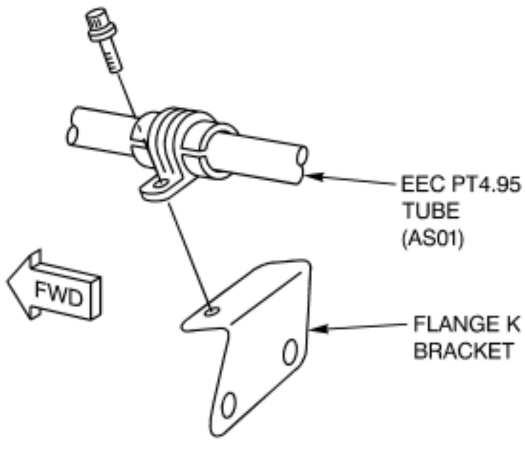
VIEW F


(LP15)
(AS01)
FWD

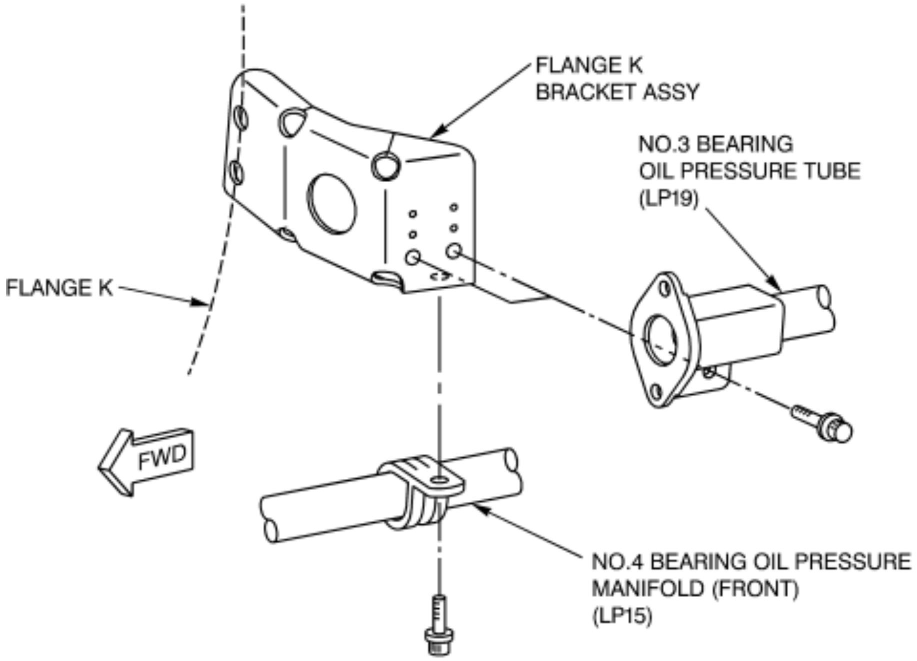
VIEW G

L-A9707 (0000)

External Plumbing Removal
Figure 306 (Sheet 5)
(Task 72−00−41−020−006)


EEC PT4.95
TUBE
(AS01)
FWD
FLANGE K
BRACKET

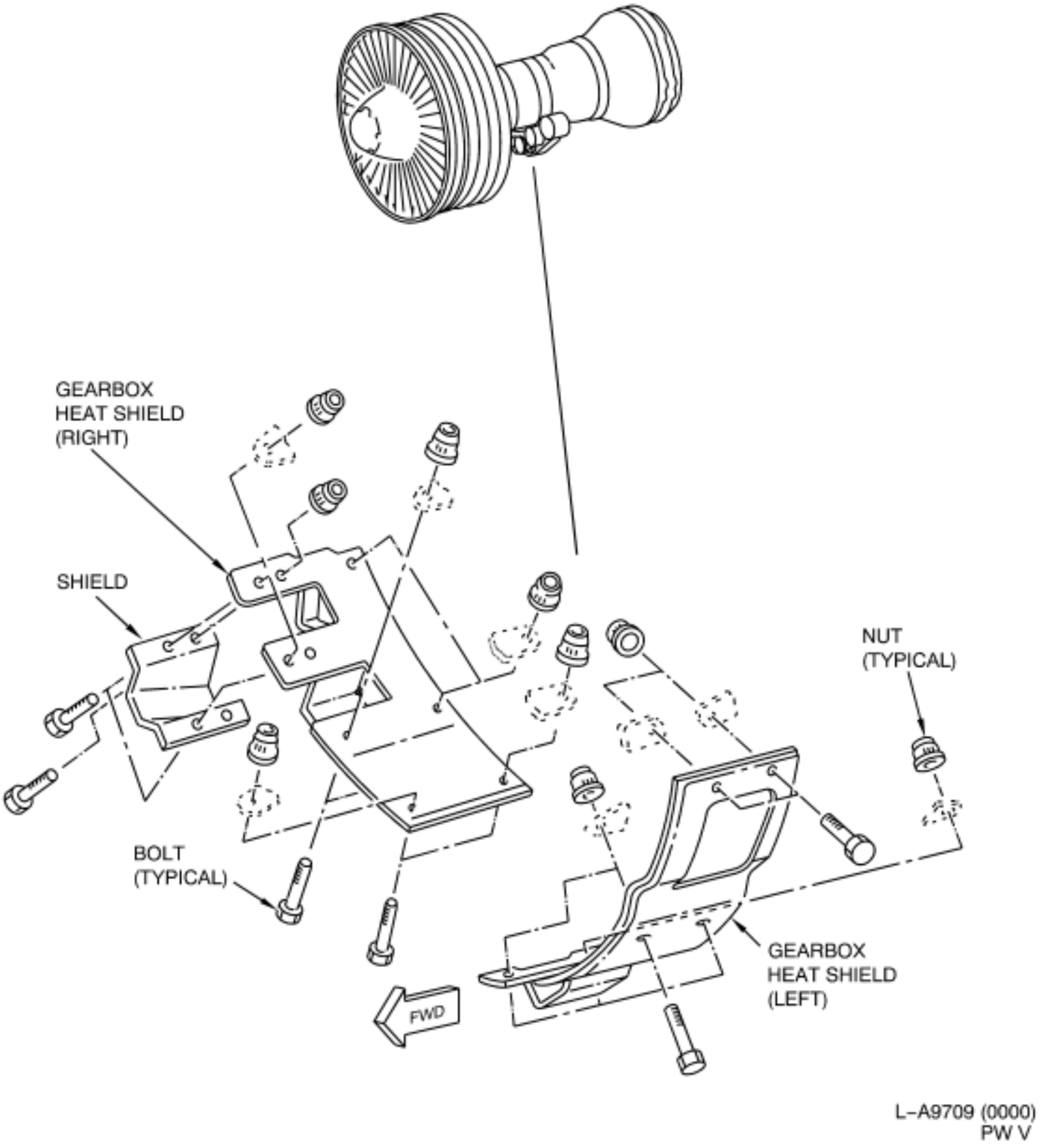
VIEW H


FLANGE K
BRACKET ASSY
NO.3 BEARING
OIL PRESSURE TUBE
(LP19)
FLANGE K
FWD
NO.4 BEARING OIL PRESSURE
MANIFOLD (FRONT)
(LP15)

(POST SB PW4ENG 72-491)
VIEW I

L-A9708 (0295)
PW V

External Plumbing Removal
Figure 306 (Sheet 6)
(Task 72-00-41-020-006)


GEARBOX
HEAT SHIELD
(RIGHT)
SHIELD
NUT
(TYPICAL)
BOLT
(TYPICAL)
GEARBOX
HEAT SHIELD
(LEFT)
FWD
L-A9709 (0000)
PW V

Gearbox Heat Shields Removal
Figure 307
(Task 72-00-41-020-006)

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-03

Task 72-00-41-020-003:

1. Remove No. 3 Bearing Rear Seal Assembly And Rear Seal Seat (Horizontal)

NOTE: See Figure 301 for part/assembly removal procedure sequence.

For vertical removal of No. 3 bearing rear seal assembly and rear seal seat, see Removal-09 (Task 72-00-41-020-004).

A. Prerequisites
   (1) Remove turbine nozzle group per 72-00-51, Removal-01 (Task 72-00-51-020-001).

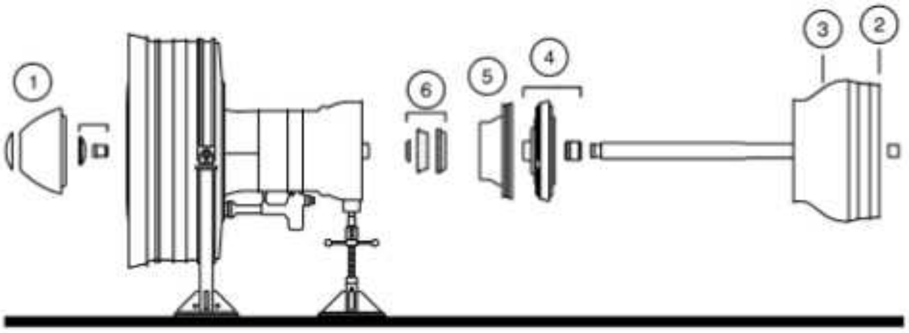
B. Equipment And Materials Required

Standard Tools:
0.250-28 Jackscrews - Four Required

Special Tools:
PWA 29389 Pump, Hydraulic
PWA 85071 Fixture
PWA 85159 Protector Cover
PWA 85697 Puller (2 Required) (Optional to PWA 86629)
PWA 86629 Puller (Optional to PWA 85697)

C. Procedure
See Figure 302.
   (1) Remove 12 bolts (302/6) shouldered washers (302/7) and gaskets (302/8) securing No. 3 bearing rear cooling duct (302/9) to No. 3 bearing rear seal (302/10).
   (2) Remove (PWA 85159) Thread Protector from rear of HPC rear hub.
   (3) Remove No. 3 bearing rear cooling duct (302/9) with two PWA 85697 Pullers (302/5), (optional to PWA 86629 Puller).
      (a) Open jaws of PWA 85697 Puller with knob detail until they can be positioned in and around cooling duct (302/9).
      (b) Locate the outer jaw in front of the puller flange on the outer diameter of the cooling duct. Locate the inner jaw in front of the inner diameter flange of the cooling duct.
      (c) Turn the knob detail to tighten the jaws in position.
      (d) Position the second PWA 85697 Puller 180 degrees apart from the first puller and install by the same method as the first.

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−03



1. REMOVE COMPRESSOR INLET CONE
2. TURBINE EXHAUST CASE
3. REMOVE LOW PRESSURE TURBINE
4. REMOVE HIGH PRESSURE TURBINE
5. REMOVE TURBINE NOZZLE
6. REMOVE NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL SEAT

L−A0248 (0000)
PW V

Procedure Sequence
Figure 301
(Task 72−00−41−020−003)

(e) Operate both pullers knockers at the same time to remove cooling duct.

NOTE: The puller positions must be moved to a new location when the cooling duct has moved out a small distance. Continue movement of pullers until cooling duct is removed.

(f) Remove cooling duct from engine and place on pallet.
(g) Remove pullers from cooling duct.

(4) Remove No. 3 bearing rear cooling duct (302/9) with PWA 86629 Puller (302/22), (optional to PWA 85697 Puller).
(a) Open the three pairs of jaws with the three hand knobs and back off the three drive assemblies.
(b) Carefully install the PWA 86629 Puller over the HPC rear hub.
(c) Put the outer jaws of the puller on the outer diameter of the cooling duct (302/9). Put the inner jaws on the inner diameter flange of the cooling duct (302/9).
(d) Turn the three knob details to tighten the jaws in position. The jaws must touch the flanges fully and be equal.
(e) Tighten the three drive assemblies with a socket wrench slowly and continuously. Turn each drive assembly an equal angle.
(f) After the cooling duct becomes loose, carefully remove the cooling duct and PWA 86629 Puller from the engine. Put the duct and puller on a work bench.
(g) Loosen the three pairs of jaws with the three hand knobs. Move the jaws away from the cooling duct flanges.
(h) Remove the puller from the cooling duct.

(5) Remove the forty (40) bolt (302/12) that attach the No. 3 bearing rear (carbon) seal assembly (302/10) to the No. 3 bearing support in the diffuser case. Install four 0.250−28 Jackscrews.

CAUTION: DO NOT LET (CARBON) SEAL ASSEMBLY DROP WHEN REMOVING. SEAL CAN BE DAMAGED IF DROPPED ONTO REAR COMPRESSOR DRIVE TURBINE SHAFT.

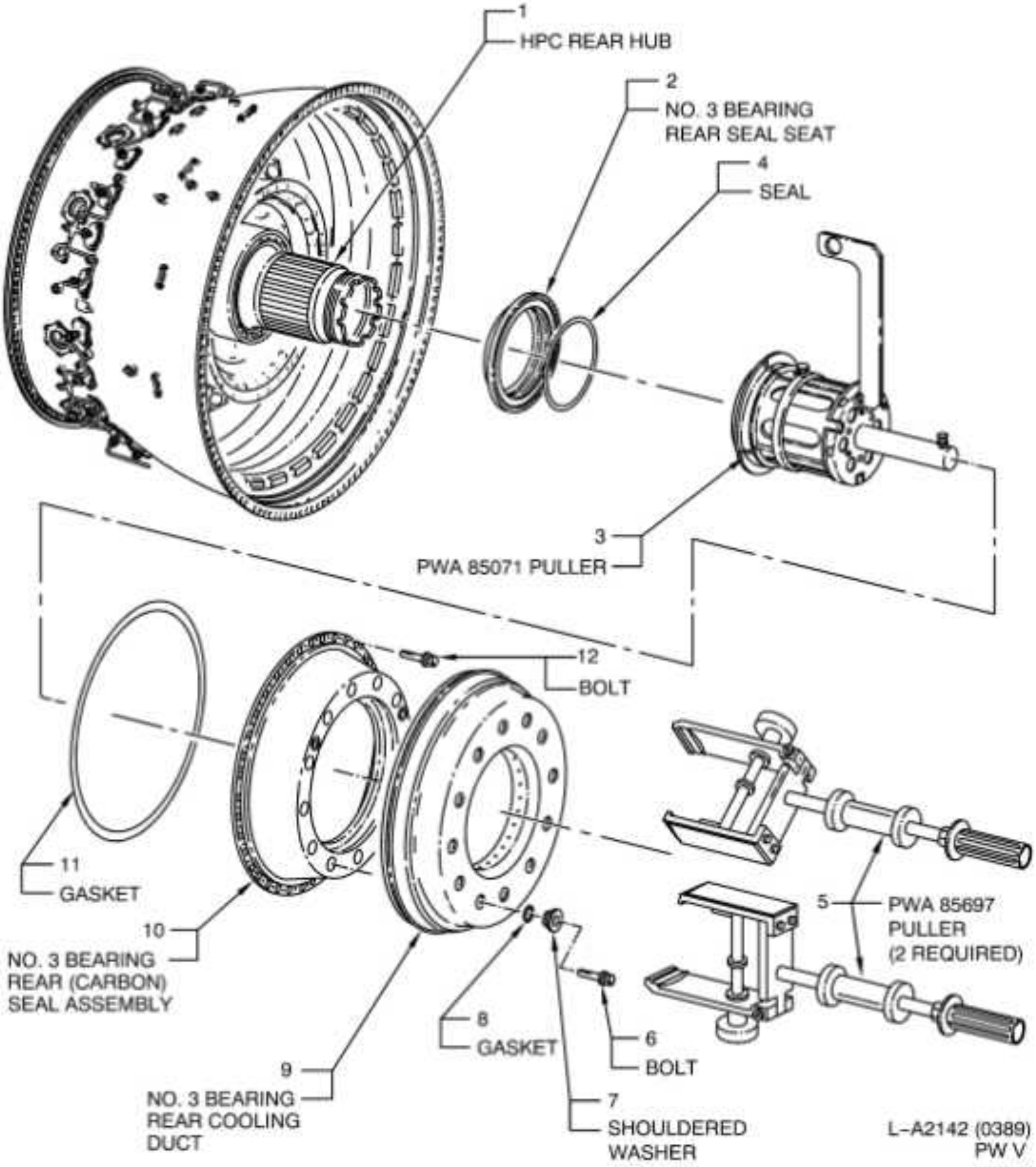
(6) With jackscrews, remove seal assembly (302/9). Discard gasket (302/11).
(7) Remove No. 3 bearing rear seal seat (302/2) using PWA 85071 Puller (302/3).

- (a) Retract hydraulic cylinder ram as required. Remove jaw retaining ring from jaws.
- (b) Position puller over HPC rear hub and engage jaws behind seal seat. Position jaw retaining ring over jaws and secure using knurled knobs.

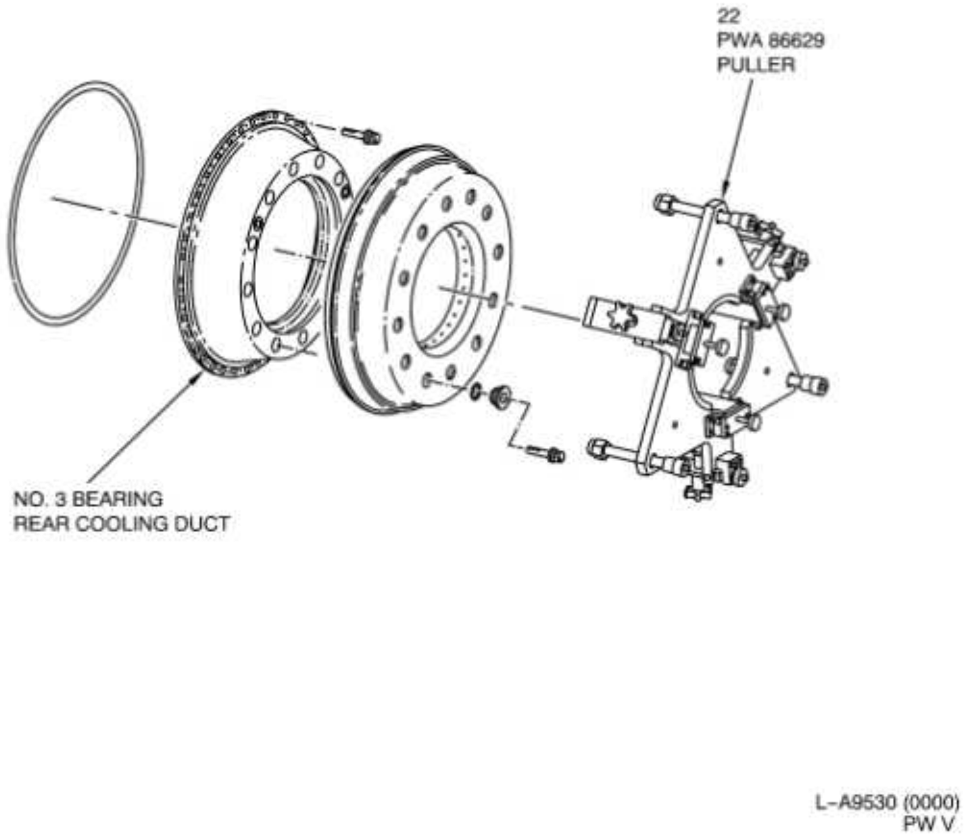
  NOTE: Only corners of puller jaws will be in contact with seal seat.

- (c) Connect PWA 29389 Hydraulic Pump to hydraulic cylinder.
- (d) Actuate hydraulic pump to separate seal seat.
- (e) Disconnect hydraulic pump. Remove retaining ring securing jaws. Remove puller from engine.
- (f) Remove seal seat from HPC rear hub and place in suitable container. Discard seal (302/11).

(8) Install PWA 85159 Protector over threads and splines of HPC rear hub.

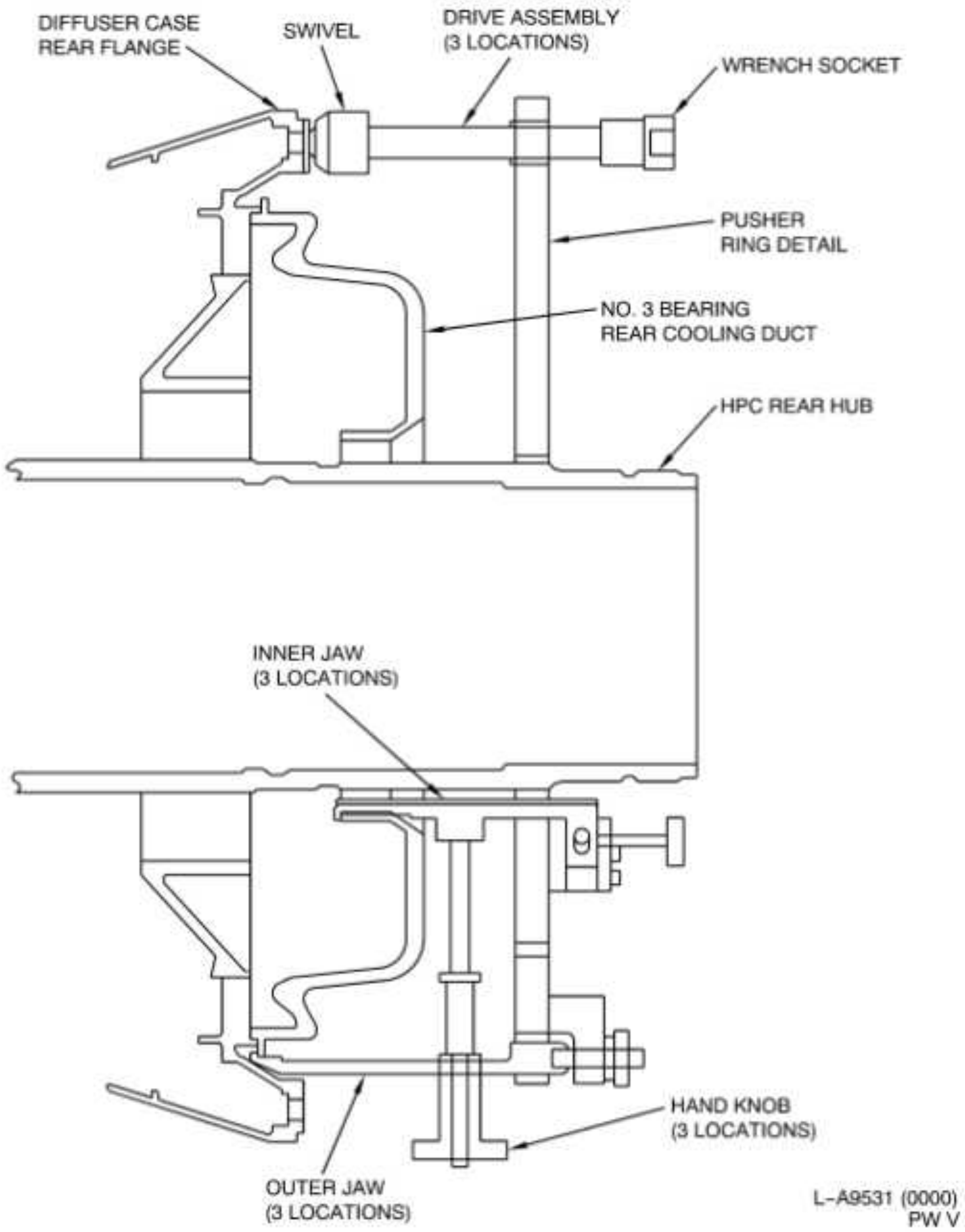

1
HPC REAR HUB
2
NO. 3 BEARING REAR SEAL SEAT
4
SEAL
3
PWA 85071 PULLER
12
BOLT
11
GASKET
10
NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY
5
PWA 85697 PULLER (2 REQUIRED)
8
GASKET
6
BOLT
9
NO. 3 BEARING REAR COOLING DUCT
7
SHOULDERED WASHER
L−A2142 (0389)
PW V

No. 3 Bearing Rear Seal Assembly And Rear Seal Seat Removal
With PWA 85697 Pullers
Figure 302 (Sheet 1)
(Task 72−00−41−020−003)


22
PWA 86629
PULLER
NO. 3 BEARING
REAR COOLING DUCT
L−A9530 (0000)
PW V

No. 3 Bearing Rear Seal Assembly And Rear Seal Seat Removal
With PWA 86629 Puller
Figure 302 (Sheet 2)
(Task 72−00−41−020−003)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−03


DIFFUSER CASE
REAR FLANGE
SWIVEL
DRIVE ASSEMBLY
(3 LOCATIONS)
WRENCH SOCKET
PUSHER
RING DETAIL
NO. 3 BEARING
REAR COOLING DUCT
HPC REAR HUB
INNER JAW
(3 LOCATIONS)
HAND KNOB
(3 LOCATIONS)
OUTER JAW
(3 LOCATIONS)
L-A9531 (0000)
PW V

No. 3 Bearing Rear Seal Assembly And Rear Seal Seat Removal
With PWA 86629 Puller
Figure 302 (Sheet 3)
(Task 72−00−41−020−003)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-04

Task 72-00-41-050-001:

1. Remove Exciter-To-Igniter Plug Cable, (Upper Plug-Upper Box)

A. Equipment And Materials Necessary - None

B. Procedure
See Figure 301 and Figure 302.

WARNING: IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH. IGNITION SWITCH MUST BE IN THE OFF POSITION BEFORE REMOVAL OF ANY IGNITION COMPONENTS. ALLOW SEVERAL MINUTES TO ELAPSE BETWEEN OPERATION OF THE IGNITION SYSTEM AND THE REMOVAL OF COMPONENTS. UPON DETACHING THE CABLE FROM THE IGNITER PLUG, DISCHARGE THE CURRENT BY GROUNDING THE CABLE TERMINAL TO ENSURE COMPLETE DISSIPATION OF ENERGY FROM THE SYSTEM. FAILURE TO FOLLOW THIS PROCEDURE COULD RESULT IN SEVERE INJURY TO PERSONNEL.

(1) Remove the bolt and nut that attaches a clamp on the upper igniter cable to a bracket located between the upper and lower igniter cables.

(2) Loosen the clamp that attaches the heat shield segments at the igniter plug end of the cable. Remove heat shields from cable.

(3) (Post SB PW4ENG 73-192) Loosen the clamps that attach the cooling hoses to the heat shield at the exciter end of the cable. Remove cooling hoses from the heat shield.

NOTE: Pre SB PW4ENG 73-192 engines do not have W5/W6 wiring harness connector cooling.

(4) Loosen the clamps that attaches the heat shield segments at the exciter end of the cable. Remove heat shields from cable.

(5) Loosen the cable coupling nut from the upper exciter at the outboard connector. The coupling nut should only be loose sufficiently to permit free movement of the cable, not removal of the cable.

WARNING: FOR MORE PROTECTION FROM A DANGEROUS ELECTRICAL CHARGE DISCONNECT THE COUPLING NUT

FROM THE IGNITION PLUG AND TOUCH THE CABLE END TO THE IGNITER PLUG BODY SHIELD.

CAUTION: REMOVE THE CABLE ENDS (LEADS) FROM THE IGNITER PLUG AND THE IGNITION EXCITER BY PULLING THE CABLE CONNECTORS IN A STRAIGHT LINE MOVEMENT. IF LATERAL FORCE IS PERMITTED, THE CABLE END CAN BE DAMAGED.

(6) Disconnect the cable coupling nut from the igniter plug and touch the cable end against the igniter plug casing (body) to decrease to zero any remaining electrical charge. Remove the heat shield clamp from cable.

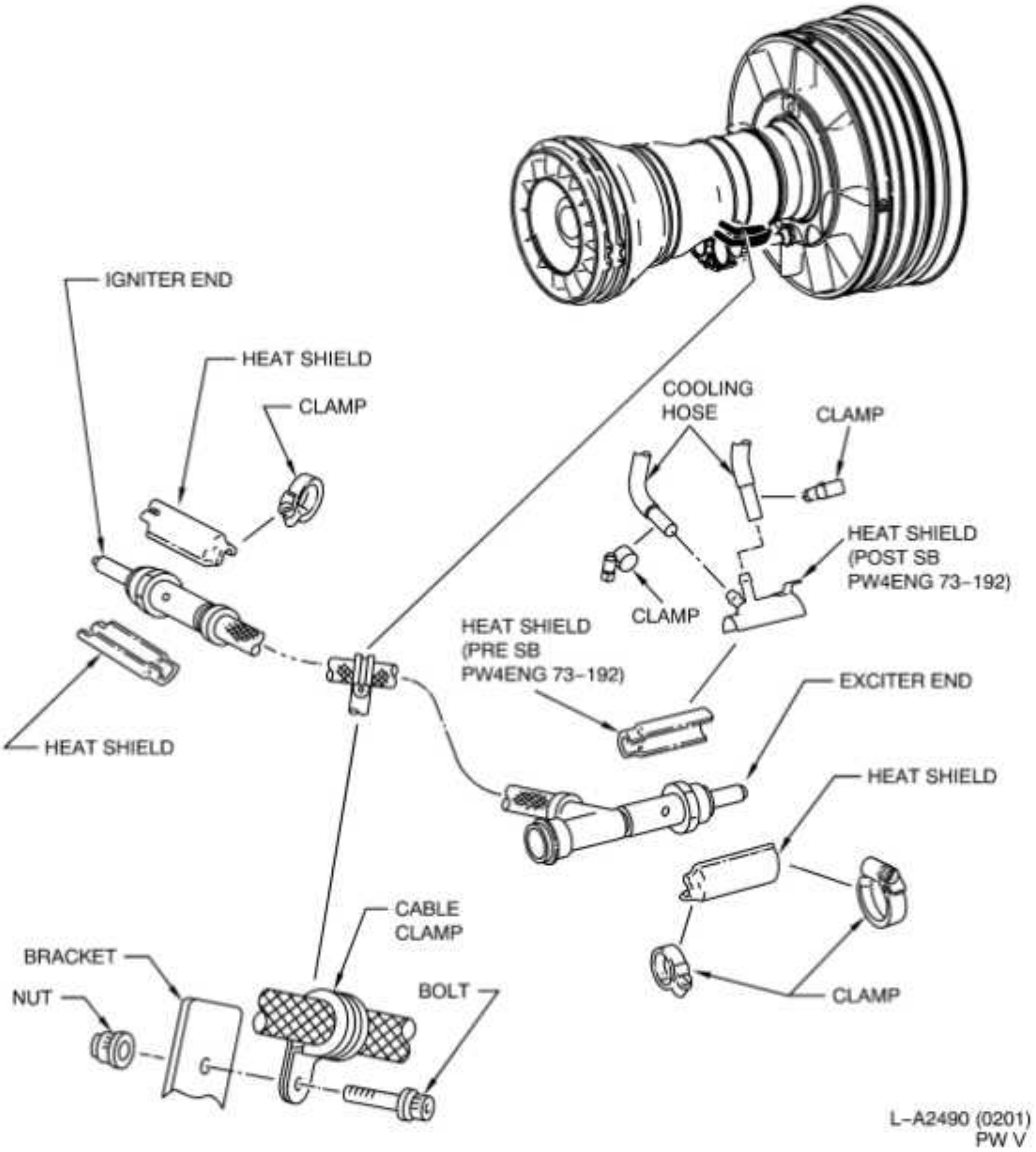
(7) Disconnect the coupling nut from the upper exciter at the outboard connector. Remove the heat shield clamps from the cable and remove the cable from the engine.

NOTE: Perform high tension contact, sleeve, rubber bushing and cable insulation inspection during grommet replacement. See Inspection/Check-04 Task 72-00-41-210-004.

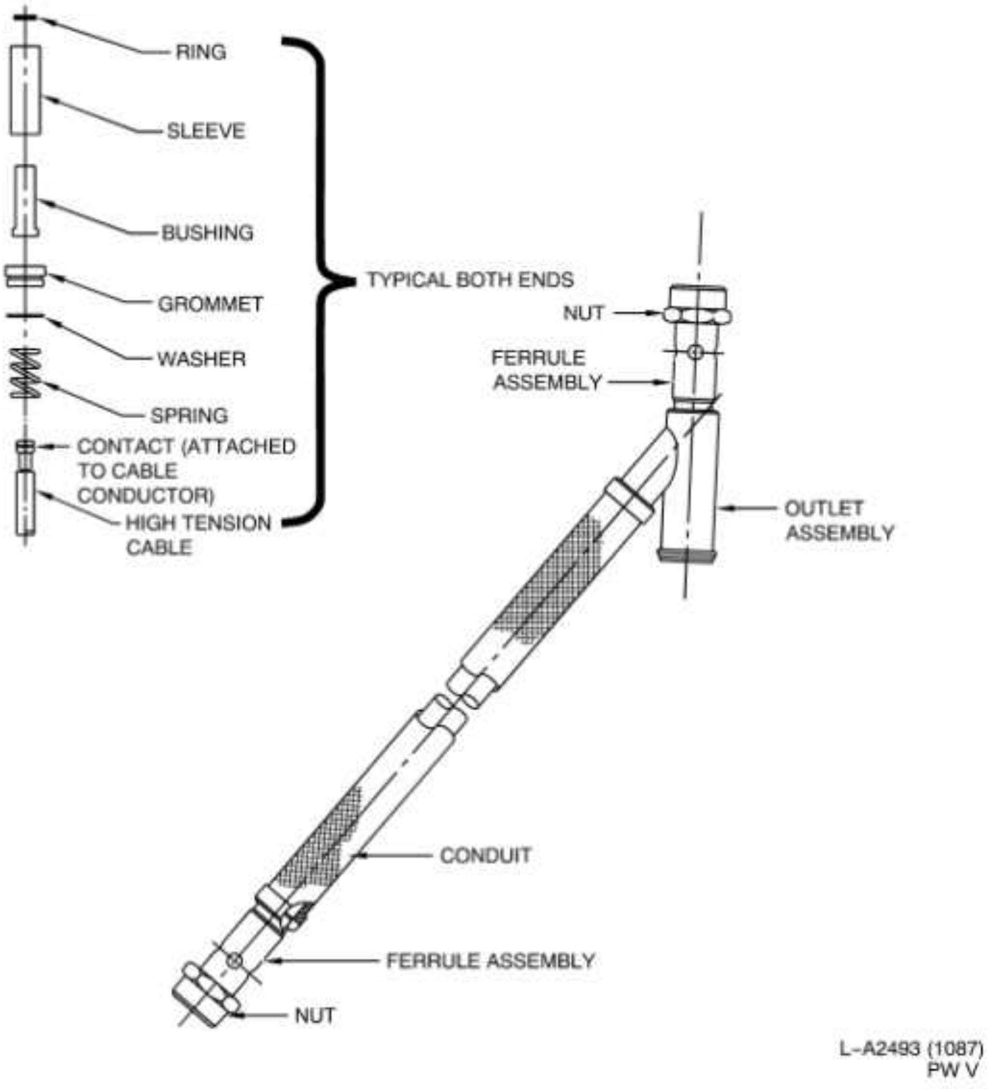
(8) Remove grommets from exciter end and igniter end of cable. Discard grommets.

(9) Install protective caps to coupling nuts on both ends of cable and on threaded output connector on ignition exciter.

NOTE: Additional information concerning detailed maintenance of this component may be found in Exciter-To-Igniter Plug Cable Component Maintenance Manual, 74-21-08, (Bendix Aerospace).


IGNITER END
HEAT SHIELD
CLAMP
COOLING HOSE
CLAMP
HEAT SHIELD (POST SB PW4ENG 73−192)
CLAMP
HEAT SHIELD (PRE SB PW4ENG 73−192)
EXCITER END
HEAT SHIELD
HEAT SHIELD
CLAMP
CABLE CLAMP
BRACKET
NUT
BOLT
L−A2490 (0201)
PW V

Exciter−To−Igniter Plug Cable (Upper)
Figure 301
(Task 72−00−41−050−001)


RING
SLEEVE
BUSHING
GROMMET
WASHER
SPRING
CONTACT (ATTACHED TO CABLE CONDUCTOR)
HIGH TENSION CABLE
TYPICAL BOTH ENDS
NUT
FERRULE ASSEMBLY
OUTLET ASSEMBLY
CONDUIT
FERRULE ASSEMBLY
NUT
L-A2493 (1087)
PW V

Exciter−To−Igniter Plug Cable
Figure 302
(Task 72−00−41−050−001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-05

Task 72-00-41-050-002:

1. Remove Exciter-To-Igniter Plug Cable, (Lower Plug-Lower Box)
   A. Equipment And Materials Required - None
   B. Procedure
   See Figures 301 and 302.

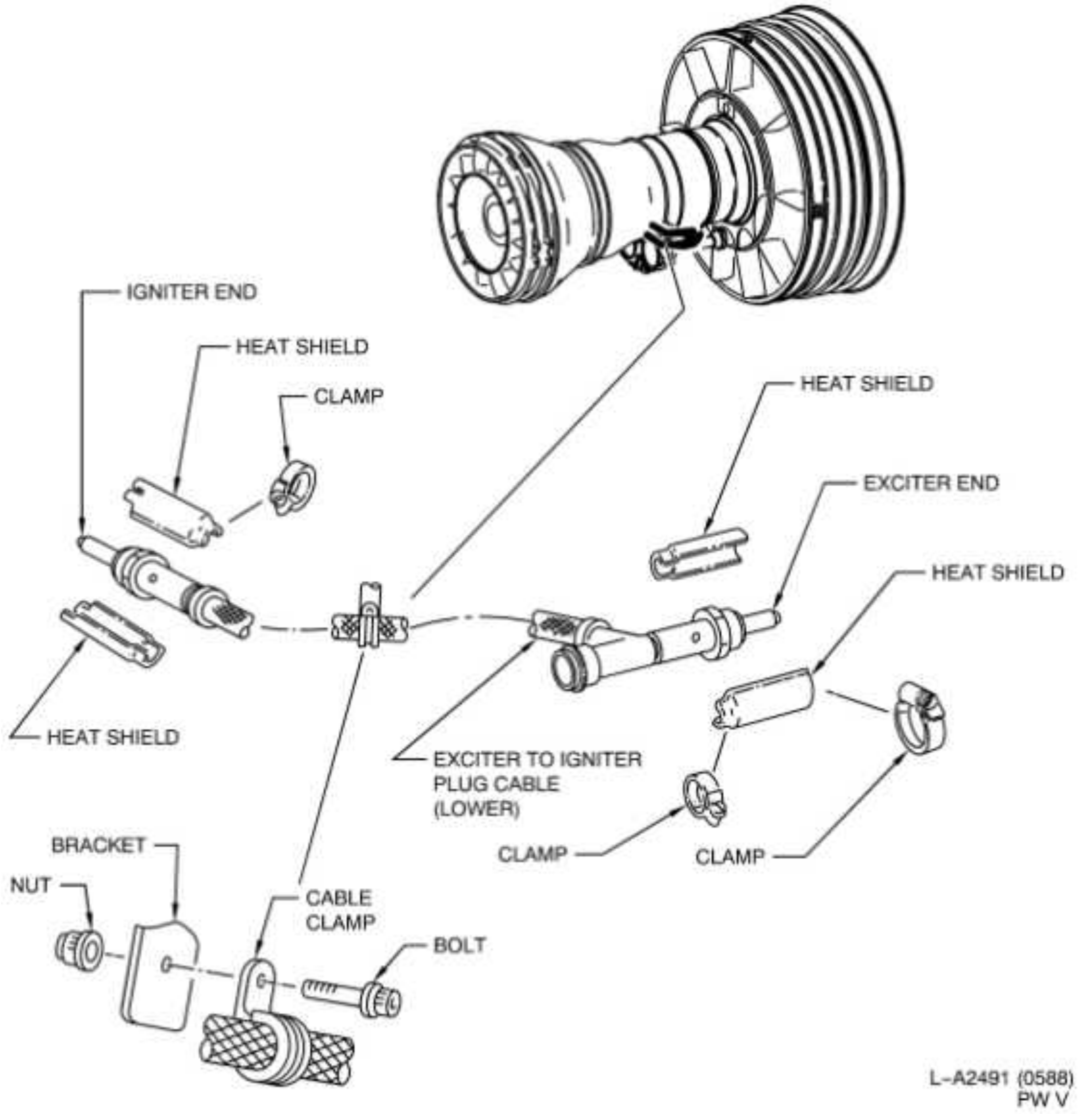
WARNING: IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH. IGNITION SWITCH MUST BE IN THE OFF POSITION BEFORE REMOVAL OF ANY IGNITION COMPONENTS. ALLOW SEVERAL MINUTES TO ELAPSE BETWEEN OPERATION OF THE INGITION SYSTEM AND THE REMOVAL OF COMPONENTS. UPON DETACHING THE CABLE FROM THE IGNITER PLUG, DISCHARGE THE CURRENT BY GROUNDING THE CABLE TERMINAL TO ENSURE COMPLETE DISSIPATION OF ENERGY FROM THE SYSTEM. FAILURE TO FOLLOW THIS PROCEDURE COULD RESULT IN SEVERE INJURY TO PERSONNEL.

(1) Remove the bolt and nut that attaches a clamp on the lower igniter cable to a bracket located between the upper and lower igniter cables.
(2) Loosen the clamp that attaches the heat shield segments at the igniter plug end of the cable. Remove heat shields from cable.
(3) Loosen the clamps that attaches the heat shield segments at the exciter end of the cable. Remove heat shields from cable.
(4) Loosen the cable coupling nut from the lower exciter at the inboard connector. The coupling nut should only be loose sufficiently to permit free movement of the cable, not removal of the cable.

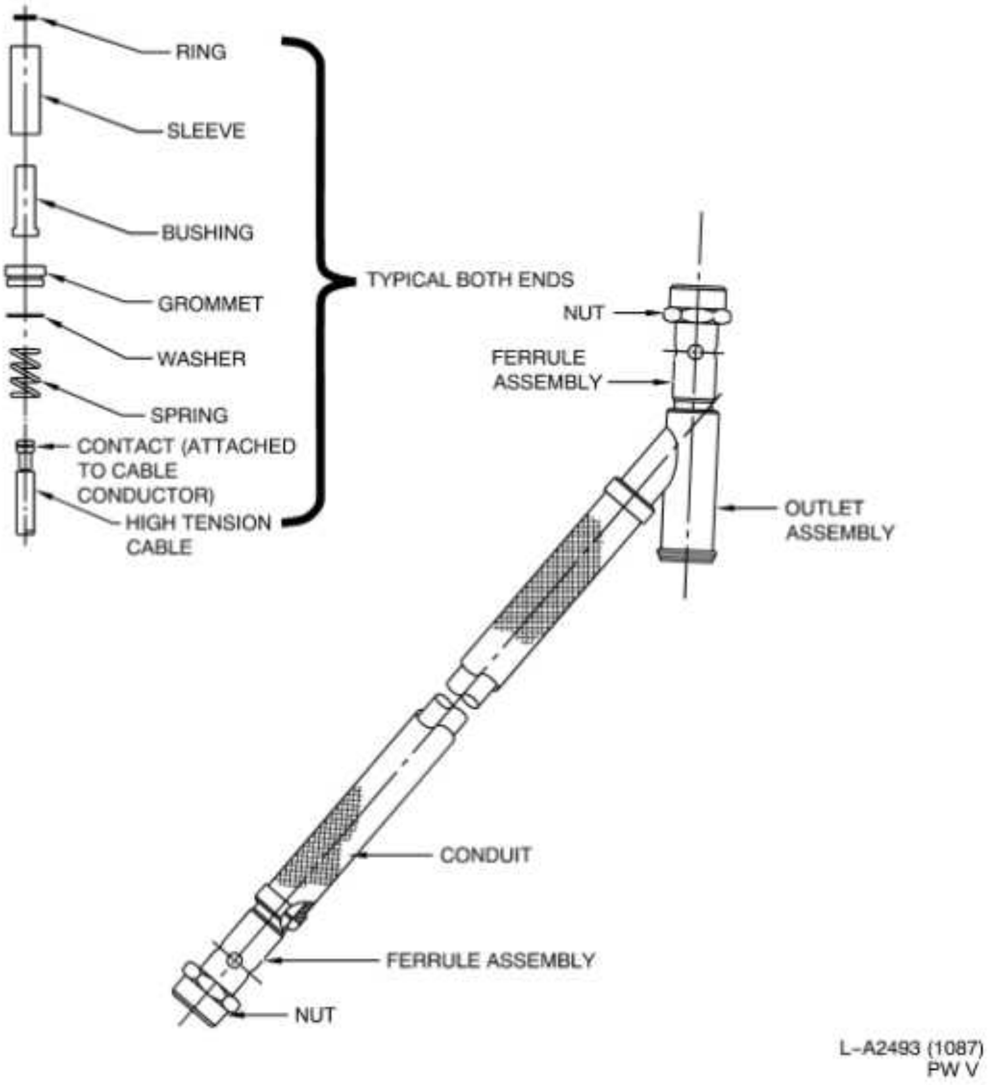
CAUTION: REMOVE THE CABLE ENDS (LEADS) FROM THE IGNITER PLUG AND THE IGNITION EXCITER BY PULLING THE CABLE CONNECTORS IN A STRAIGHT LINE MOVEMENT. IF LATERAL FORCE IS PERMITTED, THE CABLE END CAN BE DAMAGED.

WARNING: FOR MORE PROTECTION FROM A DANGEROUS ELECTRICAL CHARGE DISCONNECT THE COUPLING NUT FROM THE IGNITION PLUG AND TOUCH THE CABLE END TO THE IGNITER PLUG BODY SHIELD.

(5) Disconnect the cable coupling nut from the igniter plug and touch the cable end against the igniter plug casing (body) to decrease to zero any remaining electrical charge. Remove the heat shield clamp from cable.


IGNITER END
HEAT SHIELD
CLAMP
HEAT SHIELD
EXCITER END
HEAT SHIELD
HEAT SHIELD
EXCITER TO IGNITER PLUG CABLE (LOWER)
CLAMP
CLAMP
BRACKET
NUT
CABLE CLAMP
BOLT
L-A2491 (0588)
PW V

Exciter−To−Igniter Plug Cables
Figure 301
(Task 72−00−41−050−002)


RING
SLEEVE
BUSHING
GROMMET
WASHER
SPRING
CONTACT (ATTACHED TO CABLE CONDUCTOR)
HIGH TENSION CABLE
TYPICAL BOTH ENDS
NUT
FERRULE ASSEMBLY
OUTLET ASSEMBLY
CONDUIT
FERRULE ASSEMBLY
NUT
L-A2493 (1087)
PW V

Exciter−To−Igniter Plug Cable
Figure 302
(Task 72−00−41−050−002)

(6) Disconnect the coupling nut from the lower exciter at the inboard connector. Remove the heat shield clamps from the cable and remove the cable from the engine.

NOTE: Perform high tension contact, sleeve, rubber bushing and cable insulation inspection during grommet replacement. See Inspection/Check-04 (Task 72-00-41-210-004).

(7) Remove grommets from exciter end and igniter end of cable. Discard grommets.

(8) Install protective caps to coupling nuts on both ends of cable and on threaded output connector on ignition exciter.

NOTE: Additional information concerning detailed maintenance of this component may be found in Exciter-To-Igniter Plug Cable Component Maintenance Manual, 74-21-08, (Bendix Aerospace).

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ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−06

Task 72−00−41−050−003:

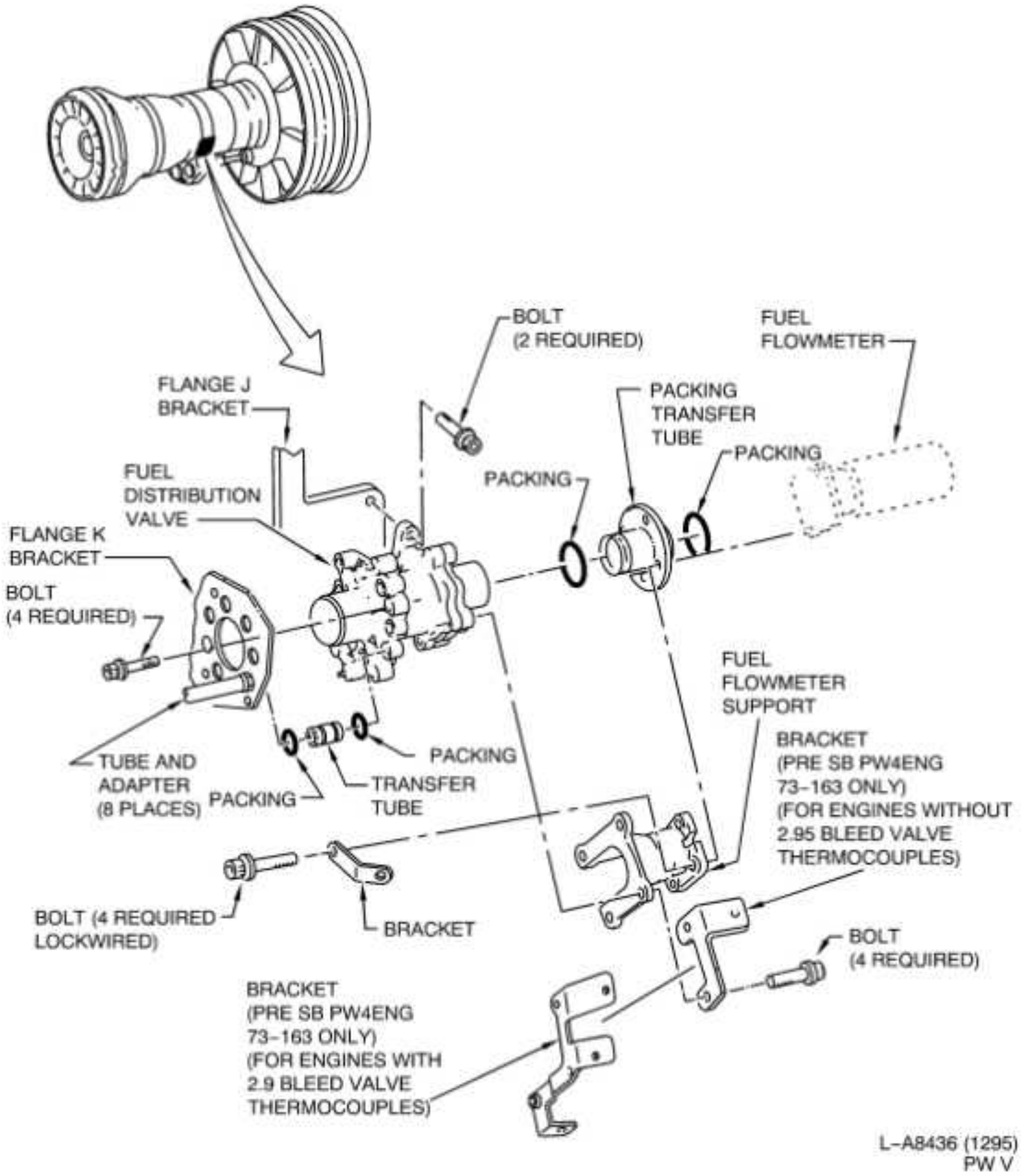
1. Remove Fuel Distribution Valve

   A. Equipment And Materials Required

      Standard Tools:
      0.190−32 Jackscrews (Two Required)

   B. Procedure
      See Figure 301.
      (1) Remove the bolts that secure the front and rear flanges of the fuel flowmeter support and the bracket (SB PW4ENG 73−163 only) to the fuel flowmeter and to the fuel distribution valve. Remove the bracket and the fuel flowmeter support from the engine.
      (2) Be prepared to receive approximately one quart (one liter) of fuel from transfer tube connection.
      (3) Translate packing transfer tube assembly rearward into distribution valve cover.
      (4) Remove the two bolts securing forward end of valve to bracket on Flange J.
      (5) Remove four bolts securing valve to bracket on Flange K and remove valve from engine using two 0.190−32 Jackscrews. Remove jackscrews.
      (6) Remove eight transfer tubes from adapters on fuel supply tubes. Discard packings.
      (7) Remove packing transfer tube from fuel distribution valve. Discard packings.
      (8) Install protective closures.

      NOTE: For additional information concerning detailed maintenance of this component, see Fuel Distribution Valve Component Maintenance Manual, 73−11−08 (Hamilton Standard Division).


BOLT
(2 REQUIRED)
FUEL
FLOWMETER
FLANGE J
BRACKET
PACKING
TRANSFER
TUBE
PACKING
FUEL
DISTRIBUTION
VALVE
PACKING
FLANGE K
BRACKET
BOLT
(4 REQUIRED)
FUEL
FLOWMETER
SUPPORT
PACKING
TUBE AND
ADAPTER
(8 PLACES)
PACKING
TRANSFER
TUBE
BRACKET
(PRE SB PW4ENG
73-163 ONLY)
(FOR ENGINES WITHOUT
2.95 BLEED VALVE
THERMOCOUPLES)
BOLT (4 REQUIRED
LOCKWIRED)
BRACKET
BOLT
(4 REQUIRED)
BRACKET
(PRE SB PW4ENG
73-163 ONLY)
(FOR ENGINES WITH
2.9 BLEED VALVE
THERMOCOUPLES)
L-A8436 (1295)
PW V

Fuel Distribution Valve
Figure 301
(Task 72−00−41−050−003)

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ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-07

Task 72-00-41-050-004:

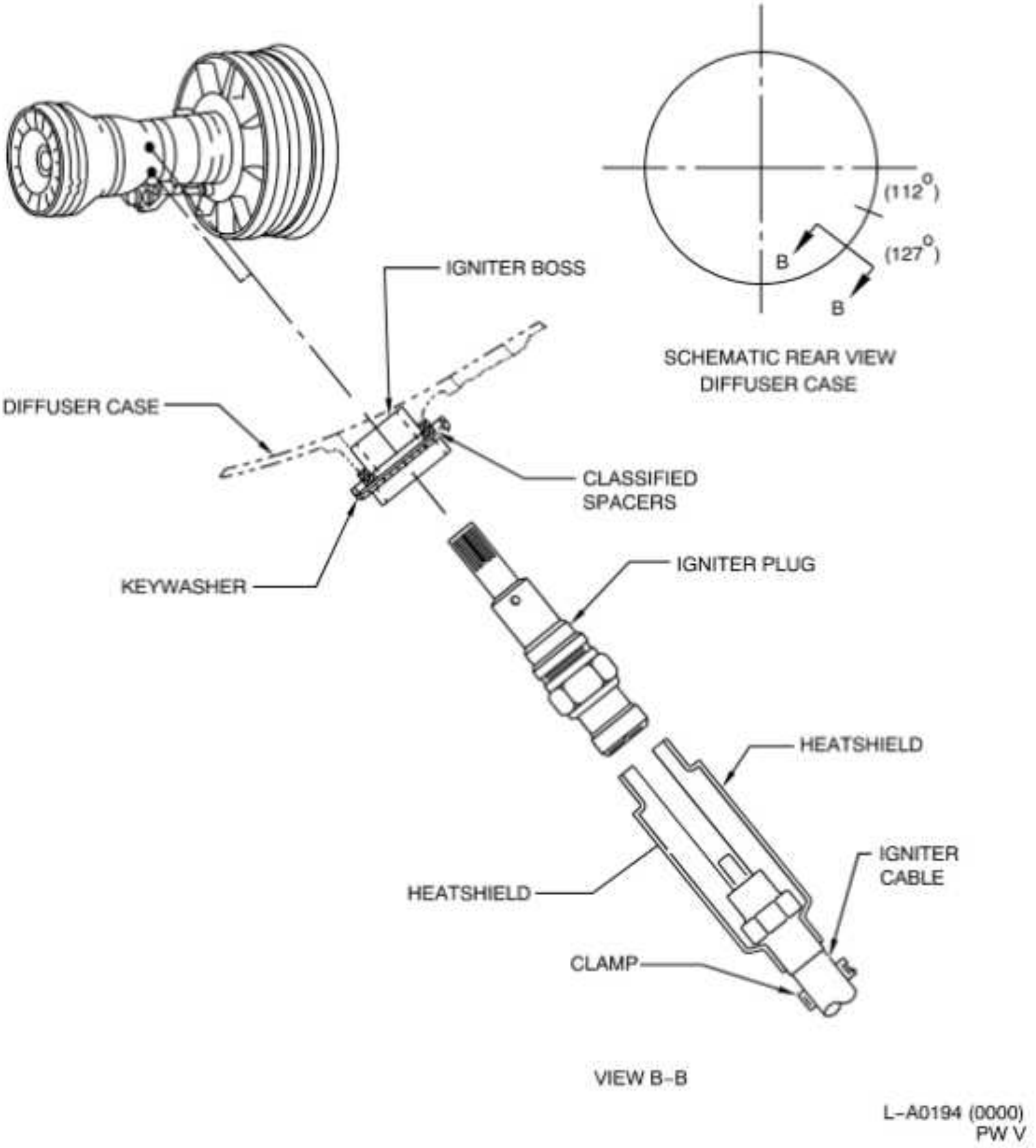
1. Remove Igniter Plug
   A. General
      (1) This procedure applies to both igniter plug locations and is used only for removal and installation (replacement) of igniter plug and/or key washer. If boss and/or spacers are to be replaced see Removal-08.
   B. Equipment And Materials Required - None
   C. Procedure
      See Figure 301.

WARNING: IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH. IGNITION SWITCH MUST BE IN THE OFF POSITION BEFORE REMOVAL OF ANY IGNITION COMPONENTS. ALLOW SEVERAL MINUTES TO ELAPSE BETWEEN OPERATION OF THE IGNITION SYSTEM AND THE REMOVAL OF COMPONENTS. UPON DETACHING THE CABLE FROM THE IGNITER PLUG, DISCHARGE THE CURRENT BY GROUNDING THE CABLE TERMINAL TO ENSURE COMPLETE DISSIPATION OF ENERGY FROM THE SYSTEM. FAILURE TO FOLLOW THIS PROCEDURE COULD RESULT IN SEVERE INJURY TO PERSONNEL.

(1) Remove the bolt and nut that attaches a clamp on the exciter-to-igniter cable (the upper or lower cable as necessary) to a bracket located between the upper and lower igniter cables.
(2) Loosen the clamp that attaches the heat shield segments at the igniter plug end of the cable. Remove the heat shields from the cable.
(3) Loosen the clamps that attach the heat shield segments at the exciter end of the cable. Remove heat shields from the cable.
(4) Loosen the cable coupling nut from the connector on the exciter. The coupling nut should only be loose sufficiently to permit free movement of the cable, not removal of the cable.

CAUTION: REMOVE THE CABLE ENDS (LEADS) FROM THE IGNITER PLUG AND THE IGNITION EXCITER BY PULLING THE CABLE CONNECTORS IN A STRAIGHT LINE MOVEMENT. IF LATERAL FORCE IS PERMITTED, THE CABLE END CAN BE DAMAGED.

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−07


(112°)
(127°)
B
B
SCHEMATIC REAR VIEW
DIFFUSER CASE
IGNITER BOSS
DIFFUSER CASE
CLASSIFIED
SPACERS
KEYWASHER
IGNITER PLUG
HEATSHIELD
HEATSHIELD
IGNITER
CABLE
CLAMP
VIEW B−B
L−A0194 (0000)
PW V

Igniter Plug Replacement
Figure 301
(Task 72−00−41−050−004)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−07

WARNING: FOR MORE PROTECTION FROM A DANGEROUS ELECTRICAL CHARGE DISCONNECT THE COUPLING NUT FROM THE IGNITION PLUG AND TOUCH THE CABLE END TO THE IGNITER PLUG BODY SHIELD.

(5) Disconnect the cable coupling nut from the igniter plug and touch the cable end against the igniter plug casing (body) to decrease to zero any remaining electrical charge. Remove the heat shield clamp from the cable.
(6) Disconnect the coupling nut from the connector on the exciter (upper or lower exciter as necessary). Remove the heat shield clamps from the cable and remove the cable from the engine.
(7) Remove grommet from exiter−to−igniter plug cable and discard.
(8) Install protective caps on cable ends and the connector on the exciter.
(9) Loosen igniter plug while keeping igniter plug boss from turning. Do not remove lockwire from boss.
(10) Remove igniter plug.

NOTE: For additional information concerning detailed maintenance of this component, see Igniter Plug Component Maintenance Manual, 74−22−01, (P&W Manual PN 771346).

(11) If key washer is damaged or worn, unbend tabs, remove and discard key washer.

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ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−08

Task 72−00−41−050−005:

1. Remove Igniter Plug, Igniter Plug Boss And Exciter−To−Igniter Cable

A. General

(1) This procedure applies to both igniter plug locations. If boss or spacer(s) are to be replaced, and parts removed at disassembly are available, use this procedure to check boss and spacer thickness. If none of the above parts are to be replaced, remove igniter plug per Removal−07 Task 72−00−41−050−004.

(2) If boss or spacer(s) are to be replaced, and parts removed at disassembly are not available, igniter plug immersion depth must be determined per Installation−14.

B. Equipment And Materials Required − None

C. Procedure
See Figure 301.

WARNING: IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH. IGNITION SWITCH MUST BE IN THE OFF POSITION BEFORE REMOVAL OF ANY IGNITION COMPONENTS. ALLOW SEVERAL MINUTES TO ELAPSE BETWEEN OPERATION OF THE IGNITION SYSTEM AND THE REMOVAL OF COMPONENTS. UPON DETACHING THE CABLE FROM THE IGNITER PLUG, DISCHARGE THE CURRENT BY GROUNDING THE CABLE TERMINAL TO ENSURE COMPLETE DISSIPATION OF ENERGY FROM THE SYSTEM. FAILURE TO FOLLOW THIS PROCEDURE COULD RESULT IN SEVERE INJURY TO PERSONNEL.

(1) Remove the bolt and nut that attaches a clamp on the exciter−to−igniter cable (the upper or lower cable as necessary) to a bracket located between the upper and lower igniter cables.

(2) Loosen the clamp that attaches the heat shield segments at the igniter plug end of the cable. Remove the heat shields from the cable.

(3) Loosen the clamps that attach the heat shield segments at the exciter end of the cable. Remove heat shields from the cable.

(4) Loosen the cable coupling nut from the connector on the exciter. The coupling nut should only be loose sufficiently to permit free movement of the cable, not removal of the cable.

WARNING: FOR MORE PROTECTION FROM A DANGEROUS ELECTRICAL CHARGE DISCONNECT THE COUPLING NUT FROM THE IGNITION PLUG AND TOUCH THE CABLE END TO THE IGNITER PLUG BODY SHIELD.

CAUTION: REMOVE THE CABLE ENDS (LEADS) FROM THE IGNITER PLUG AND THE IGNITION EXCITER BY PULLING THE CABLE CONNECTORS IN A STRAIGHT LINE MOVEMENT. IF LATERAL FORCE IS PERMITTED, THE CABLE END CAN BE DAMAGED.

(5) Disconnect the cable coupling nut from the igniter plug and touch the cable end against the igniter plug casing (body) to decrease to zero any remaining electrical charge. Remove the heat shield clamp from cable.

(6) Disconnect the coupling nut from the connector on the exciter (upper or lower exciter as necessary). Remove the heat shield clamps from the cable and remove the cable from the engine.

(7) Remove igniter plug from boss on diffuser case.

NOTE: Hold boss with wrench to prevent boss from turning while removing igniter.

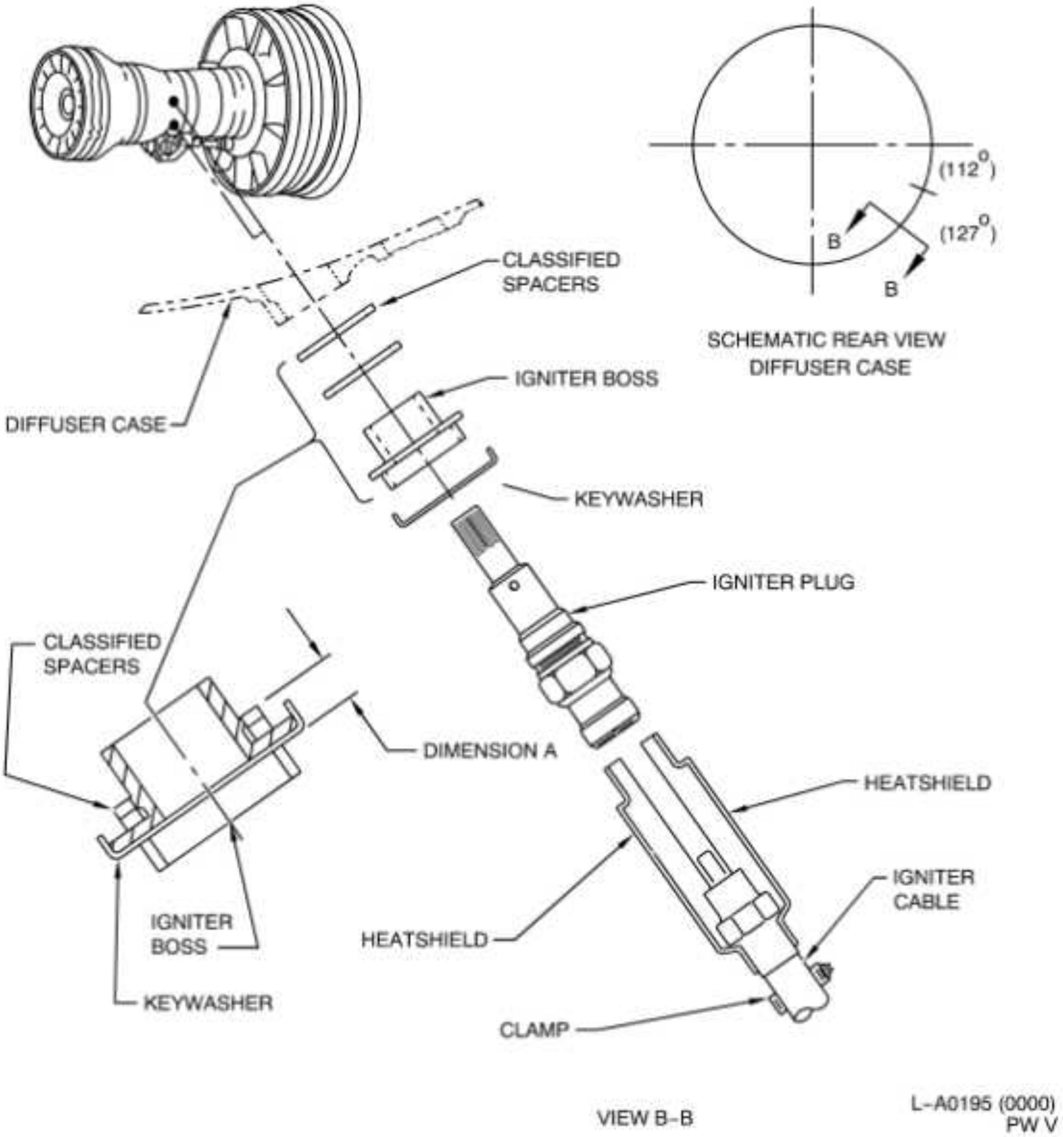
NOTE: For additional information concerning detailed maintenance of this component see Igniter Plug Component Maintenance Manual 74−22−01, (PW Manual PN 771346).

(8) Remove lockwire, igniter boss, and spacers.

(9) If either boss or classified spacers are to be replaced, measure removed boss, spacers and key washer as indicated in Figure 301, Dimension A.

NOTE: Measurement should be retained for reassembly thickness comparison and possible spacer thickness adjustment.

(10) If key washer is damaged, worn or will not provide an adequate seal, remove and discard key washer.


CLASSIFIED SPACERS
DIFFUSER CASE
IGNITER BOSS
KEYWASHER
IGNITER PLUG
CLASSIFIED SPACERS
DIMENSION A
HEATSHIELD
IGNITER CABLE
IGNITER BOSS
HEATSHIELD
KEYWASHER
CLAMP
(112°)
(127°)
B
B
SCHEMATIC REAR VIEW DIFFUSER CASE
VIEW B−B
L−A0195 (0000)
PW V

Igniter Plug (Typical 2 Locations)
Figure 301
(Task 72−00−41−050−005)

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ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-09

Task 72-00-41-020-004:

1. Remove No. 3 Bearing Rear Seal Assembly And Rear Seal Seat (Vertical)

NOTE: See Figure 301 for part/assembly removal procedure sequence.

For horizontal removal of No. 3 bearing rear seal assembly and rear seal seat, see Removal-03 (Task 72-00-41-020-003).

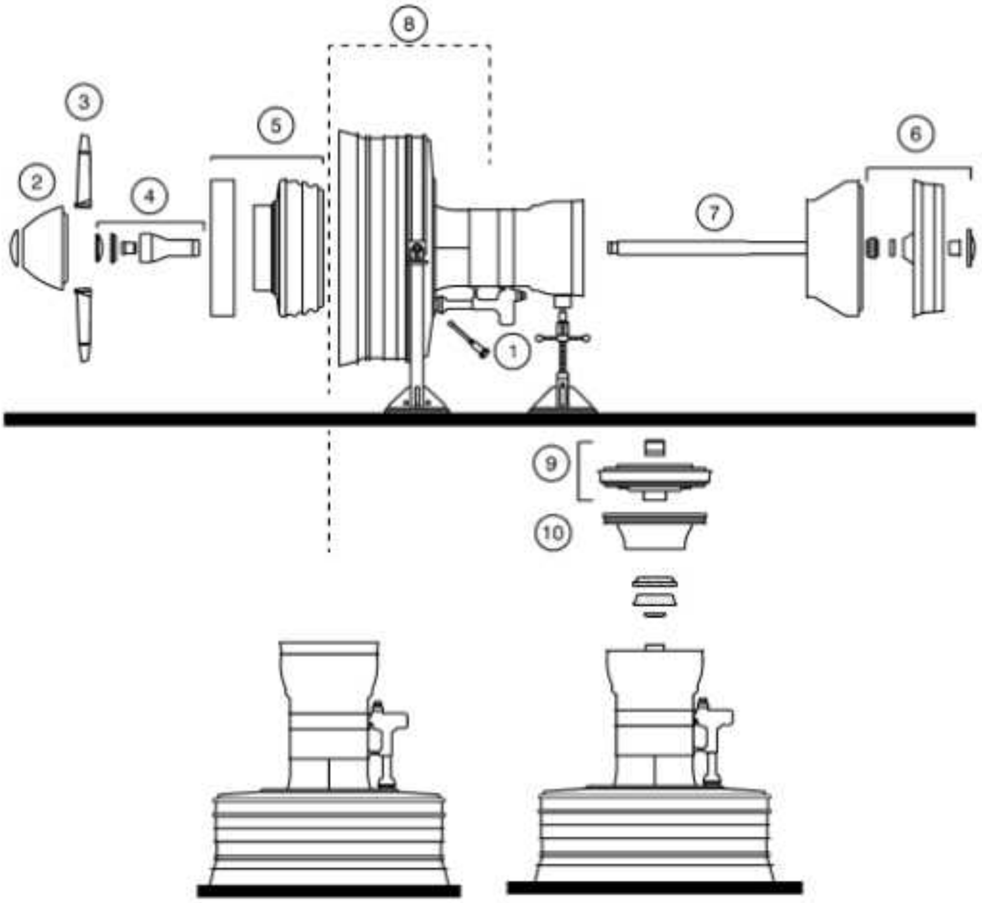
A. Prerequisites
  (1) Remove turbine nozzle group per 72-00-51, Removal-02 (Task 72-00-51-020-002).

B. Equipment And Materials Required

Special Tools:
PWA 29389 Pump, Hydraulic
PWA 85071 Puller, Hydraulic
PWA 85159 Protector, Cover
PWA 85697 Puller (2 Required) (Optional to PWA 86629)
PWA 86629 Puller (Optional to PWA 85697)

Standard Tools:
0.250-28 Jackscrews - Four Required

C. Procedure
See Figure 302.
  (1) Remove 12 bolts (302/1) shouldered washers (302/2) and gaskets (302/3) securing No. 3 bearing rear cooling duct (302/4) to No. 3 bearing rear (carbon) seal (302/5).
  (2) Remove PWA 85159 Thread Protector from rear of HPC rear hub.
  (3) Remove No. 3 bearing rear cooling duct (302/4) with PWA 85697 Pullers. (optional to PWA 86629 Puller).
    (a) Open jaws of PWA 85697 Puller with knob detail until they can be positioned in and around cooling duct.
    (b) Locate the outer jaw in front of the puller flange on the outer diameter of the cooling duct. Locate the inner jaw in front of the inner diameter flange of the cooling duct.
    (c) Turn the knob detail to tighten the jaws in position.
    (d) Position the second PWA 85697 Puller 180 degrees apart from the first puller and install by the same method as the first.



1. REMOVE ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
2. REMOVE COMPRESSOR INLET CONE.
3. REMOVE STAGE 1 LPC BLADE ASSEMBLIES.
4. REMOVE LPC/LPT COUPLING.
5. REMOVE LOW PRESSURE COMPRESSOR (LPC).
6. REMOVE TURBINE EXHAUST CASE.
7. REMOVE LOW PRESSURE TURBINE (LPT).
8. TRUNNION FAN CASES THROUGH HPT TO FRONT END DOWN.
9. REMOVE HIGH PRESSURE TURBINE (HPT).
10. REMOVE TURBINE NOZZLE.

L-A1251 (0000)
PW V

Procedure Sequence
Figure 301
(Task 72-00-41-020-004)

(e) Operate both pullers knockers at the same time to remove cooling duct.

NOTE: The puller positions must be moved to a new location when the cooling duct has moved out a small distance. Continue movement of pullers until cooling duct is removed.

(f) Remove cooling duct from engine and place on pallet.
(g) Remove pullers from cooling duct.

(4) Remove No. 3 bearing rear cooling duct (302/4) with PWA 86629 Puller (302/20), (optional to PWA 85697 Puller).
(a) Open the three pairs of jaws with the three hand knobs and back off the three drive assemblies.
(b) Carefully install the PWA 86629 Puller over the HPC rear hub.
(c) Put the outer jaws of the puller on the outer diameter of the cooling duct (302/4). Put the inner jaws on the inner diameter flange of the cooling duct (302/4).
(d) Turn the three knob details to tighten the jaws in position. The jaws must touch the flanges fully and be equal.
(e) Tighten the three drive assemblies with a socket wrench slowly and continuously. Turn each drive assembly an equal angle.
(f) After the cooling duct becomes loose, carefully remove the cooling duct and PWA 86629 Puller from the engine. Put the duct and puller on a work bench.
(g) Loosen the three pairs of jaws with the three hand knobs. Move the jaws away from the cooling duct flanges.
(h) Remove the puller from the cooling duct.

(5) Remove 40 bolts (302/10) securing No. 3 bearing rear (carbon) seal (302/5) to No. 3 bearing support in diffuser case.

CAUTION: DO NOT LET (CARBON) SEAL ASSEMBLY DROP WHEN REMOVING IT. SEAL CAN BE DAMAGED IF IT DROPS ONTO REAR COMPRESSOR DRIVE TURBINE SHAFT.

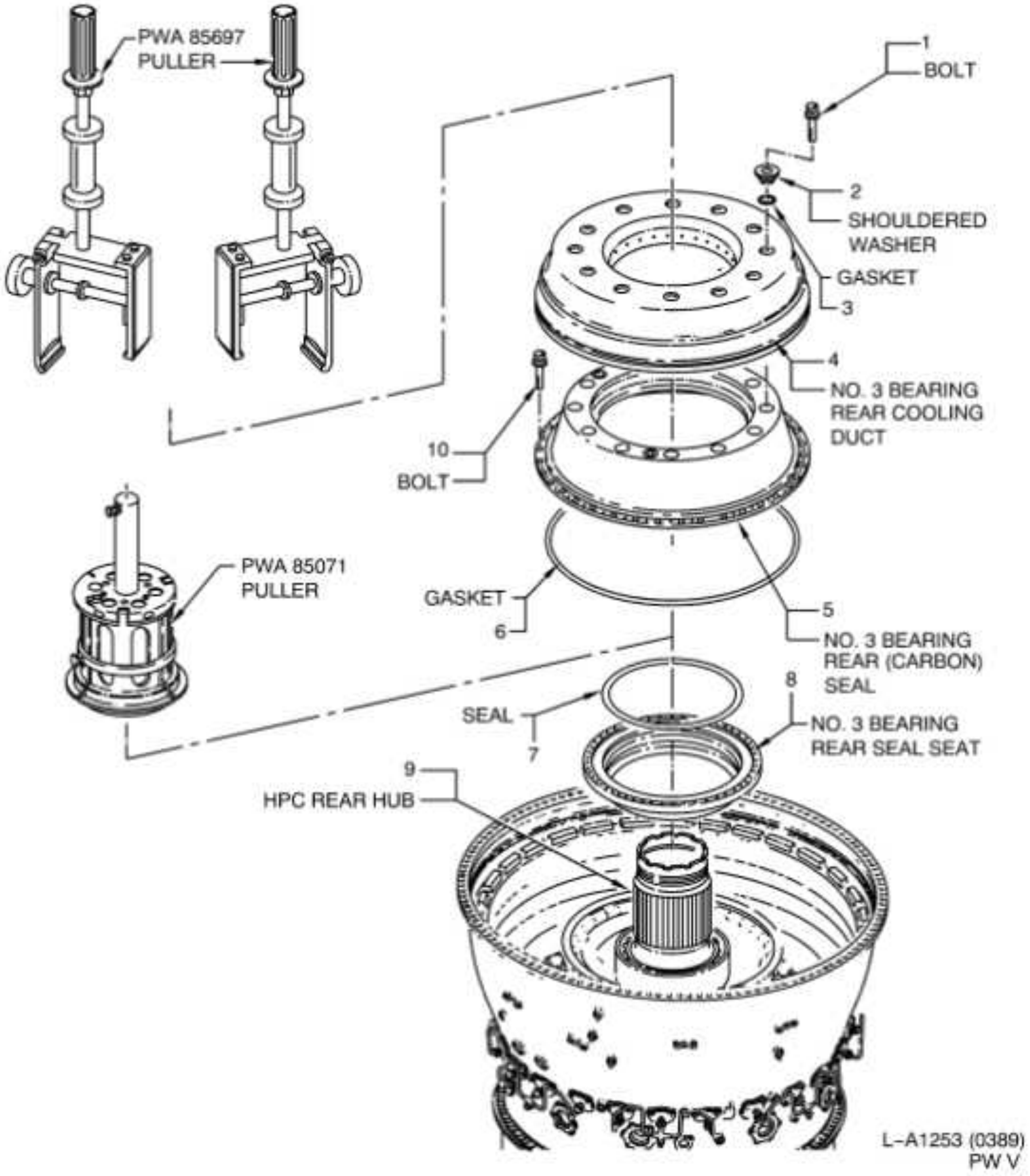
(6) With four 0.250−28 Jackscrews, remove No. 3 bearing rear (carbon) seal assembly. Discard gasket (302/6).
(7) Remove No. 3 bearing rear seal seat (302/8) with PWA 85071 Puller. See Figure 302.

(a) Retract hydraulic cylinder ram as required. Remove jaw retaining ring from jaws.
(b) Position puller over HPC rear hub and engage jaws behind seal seat. Position jaw retaining ring over jaws and secure using knurled knobs.

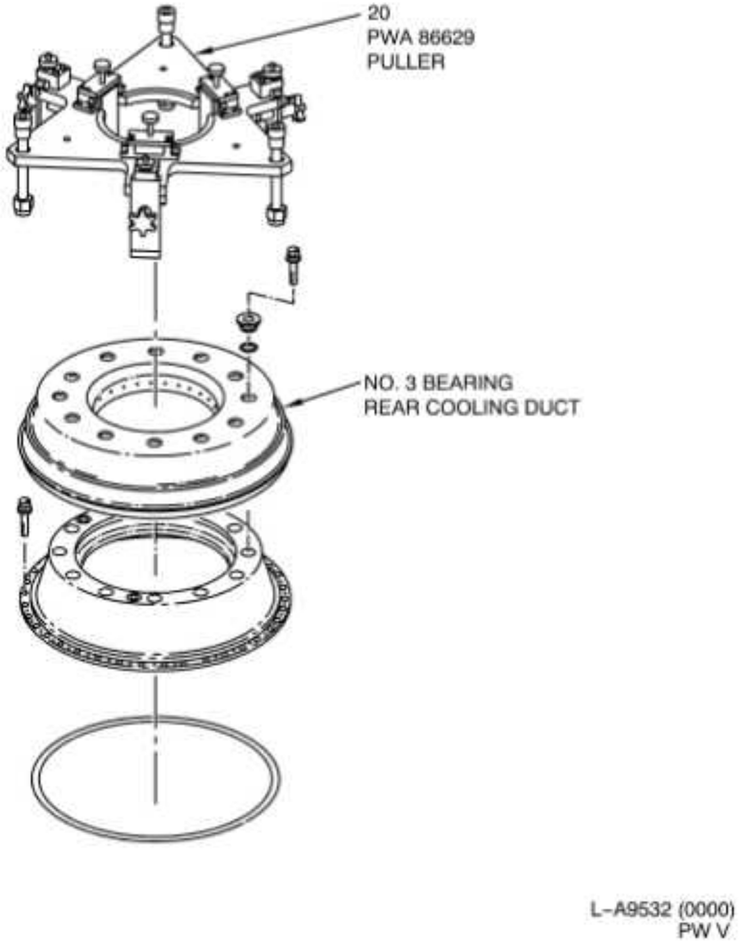
NOTE: Only corners of puller jaws will be in contact with seal seat.

(c) Connect PWA 29389 Hydraulic Pump to hydraulic cylinder.
(d) Actuate hydraulic pump to separate seal seat.
(e) Disconnect hydraulic pump. Remove retaining ring securing jaws. Remove fixture from engine.
(f) Remove seal seat from HPC rear hub and place in suitable container. Discard seal (302/7).

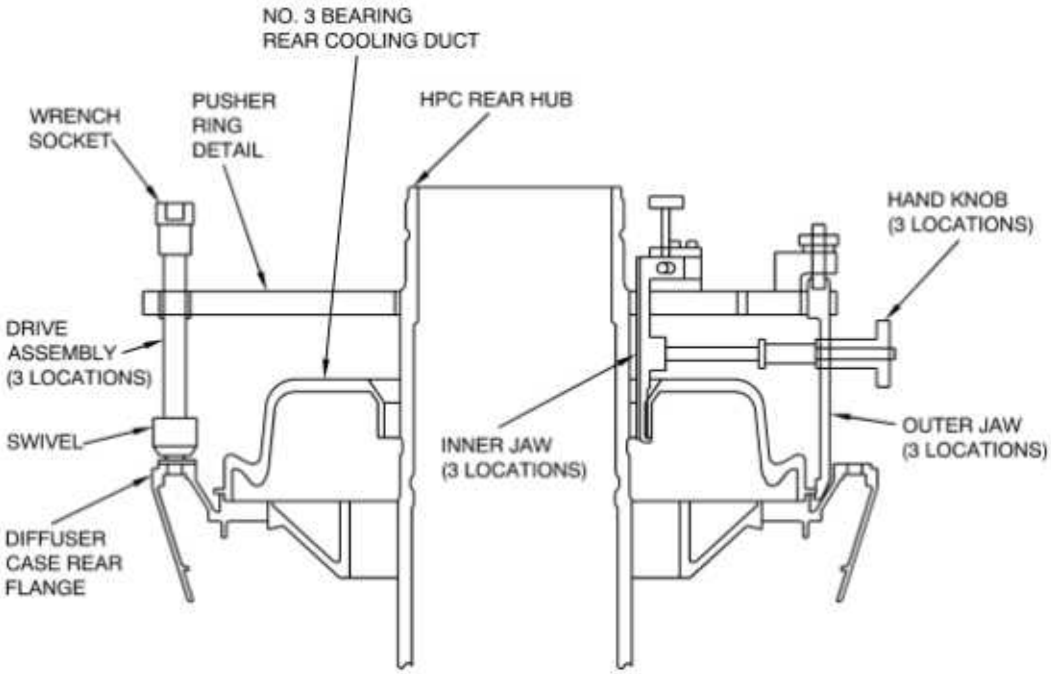
(8) Install PWA 85159 Protector over threads and splines of HPC rear hub.


PWA 85697
PULLER
1
BOLT
2
SHOULDERED
WASHER
GASKET
3
4
NO. 3 BEARING
REAR COOLING
DUCT
10
BOLT
PWA 85071
PULLER
GASKET
6
5
NO. 3 BEARING
REAR (CARBON)
SEAL
8
SEAL
7
NO. 3 BEARING
REAR SEAL SEAT
9
HPC REAR HUB
L−A1253 (0389)
PW V

No. 3 Bearing Rear Seal Assembly And Rear Seal Seat Removal
With PWA 85697 Pullers
Figure 302 (Sheet 1)
(Task 72−00−41−020−004)


20
PWA 86629
PULLER
NO. 3 BEARING
REAR COOLING DUCT
L-A9532 (0000)
PW V

No. 3 Bearing Rear Seal Assembly And Rear Seal Seat Removal
With PWA 86629 Puller
Figure 302 (Sheet 2)
(Task 72-00-41-020-004)


NO. 3 BEARING
REAR COOLING DUCT
WRENCH
SOCKET
PUSHER
RING
DETAIL
HPC REAR HUB
HAND KNOB
(3 LOCATIONS)
DRIVE
ASSEMBLY
(3 LOCATIONS)
SWIVEL
INNER JAW
(3 LOCATIONS)
OUTER JAW
(3 LOCATIONS)
DIFFUSER
CASE REAR
FLANGE

L−A9533 (0000)
PW V

No. 3 Bearing Rear Seal Assembly And Rear Seal Seat Removal
With PWA 86629 Puller
Figure 302 (Sheet 3)
(Task 72−00−41−020−004)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-10

Task 72-00-41-060-001:

1. Remove Fuel Distribution Valve Strainer

A. Equipment And Materials Required

Special Tools:
PWA 86459 Puller, Strainer

B. Procedure

See Figure 301.

(1) Remove the bolts that secure the front and rear flanges of the fuel flowmeter support and the bracket (pre SB PW4ENG 73-163 only) to the fuel flowmeter and to the fuel distribution valve. Remove the fuel flowmeter support and the bracket from the engine.

(2) Be prepared to receive approximately one quart (one liter) of fuel from transfer connection.

(3) Translate packing transfer tube assembly rearward into distribution valve cover.

(4) Remove bolts and washers securing strainer housing cover to distribution valve and remove cover and tube from valve. Remove tube from cover. Discard packings from tube and cover.

CAUTION: USE THE PWA 86459 PULLER TO AVOID DAMAGE TO THE STRAINER.

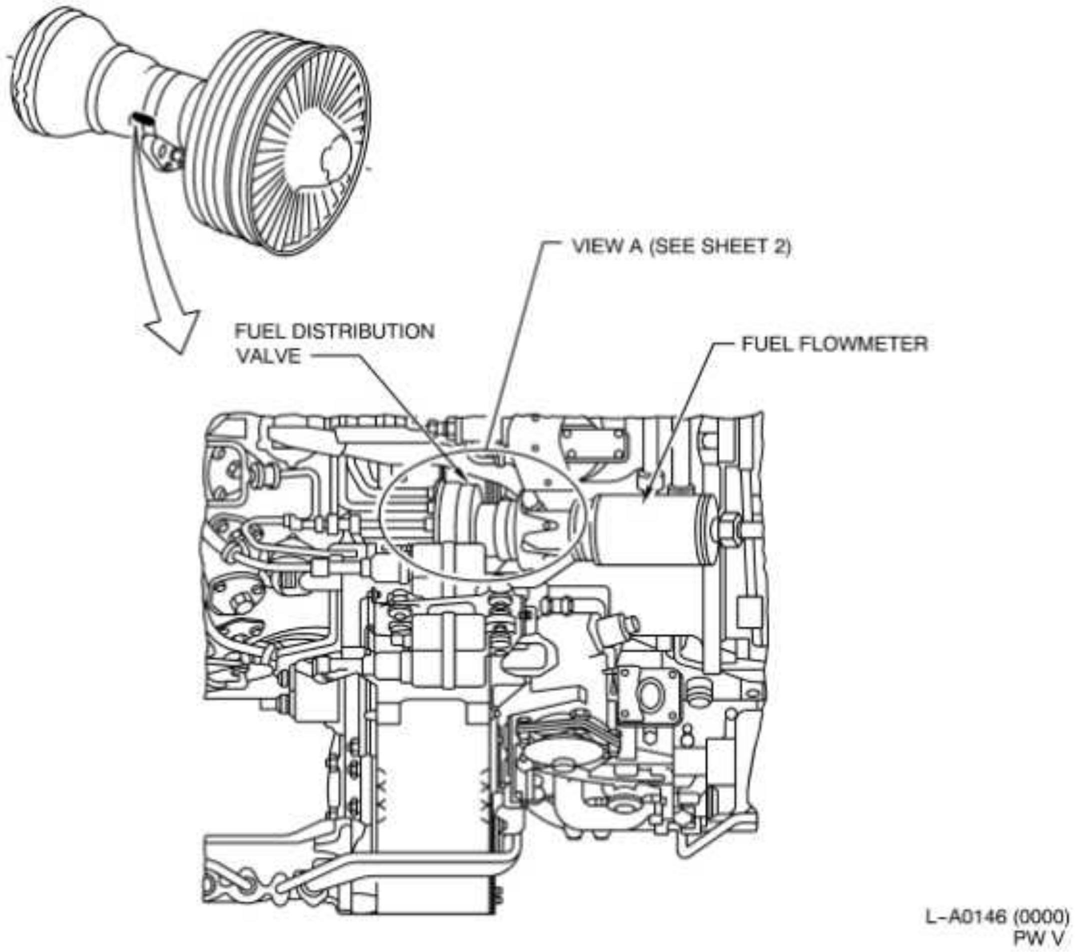
(5) Engage the PWA 86459 Puller to the strainer and pull the strainer from the housing. Disengage the puller from the strainer and remove the puller and strainer from the engine separately. Discard the packing.

(6) Inspect fuel distribution valve strainer per Inspection/Check-05.

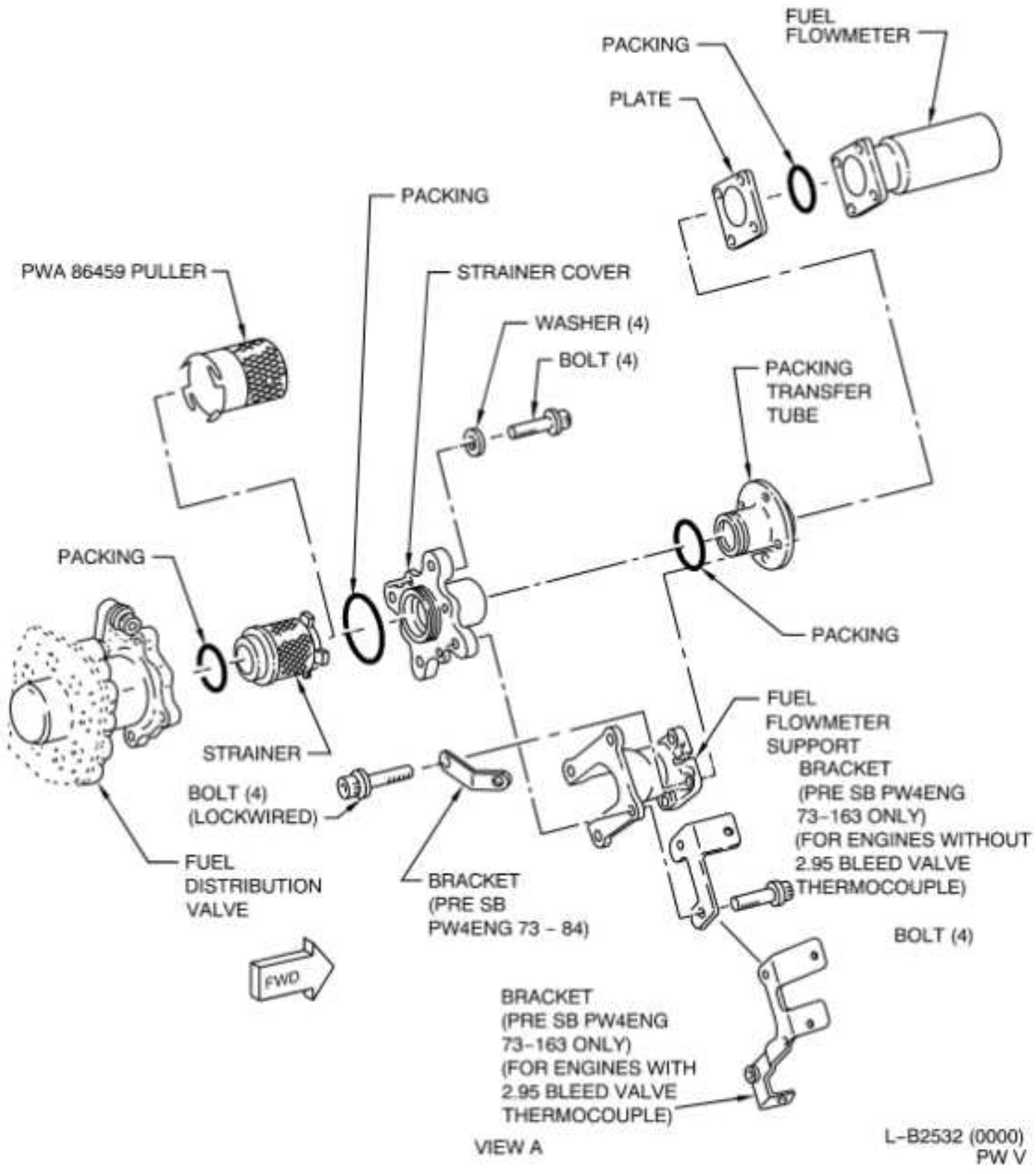
(7) Clean fuel distribution valve strainer per Cleaning-03 or -04.

(8) Install protective closures.

NOTE: For additional information concerning detailed maintenance of this component, see Fuel Distribution Valve Component Maintenance Manual, 73-11-08 (Hamilton Standard Division).


VIEW A (SEE SHEET 2)
FUEL DISTRIBUTION VALVE
FUEL FLOWMETER
L−A0146 (0000)
PW V

Fuel Distribution Valve Strainer
Figure 301 (Sheet 1)
(Task 72−00−41−060−001)


FUEL FLOWMETER
PACKING
PLATE
PACKING
PWA 86459 PULLER
STRAINER COVER
WASHER (4)
BOLT (4)
PACKING TRANSFER TUBE
PACKING
PACKING
FUEL FLOWMETER SUPPORT
BRACKET (PRE SB PW4ENG 73−163 ONLY) (FOR ENGINES WITHOUT 2.95 BLEED VALVE THERMOCOUPLE)
STRAINER
BOLT (4) (LOCKWIRED)
FUEL DISTRIBUTION VALVE
BRACKET (PRE SB PW4ENG 73 − 84)
BOLT (4)
FWD
BRACKET (PRE SB PW4ENG 73−163 ONLY) (FOR ENGINES WITH 2.95 BLEED VALVE THERMOCOUPLE)
VIEW A
L−B2532 (0000)
PW V

Fuel Distribution Valve Strainer
Figure 301 (Sheet 2)
(Task 72−00−41−060−001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-11

Task 72-00-41-020-011:

1. Remove Combustion Chamber (Outer) (Horizontal)

NOTE: See Figure 301 for part/assembly removal procedure sequence.

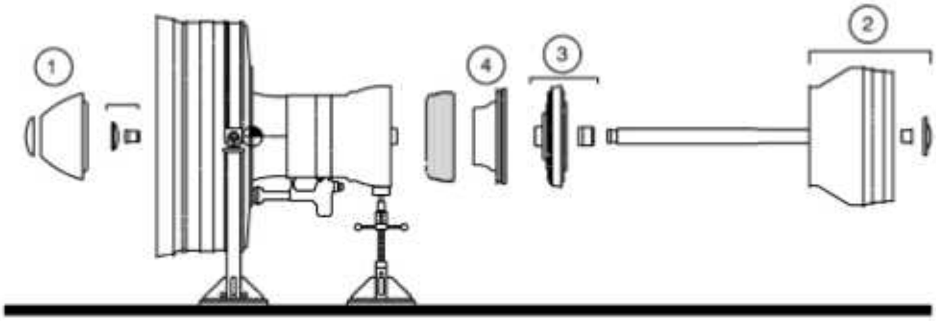
A. Prerequisites
   (1) Remove turbine nozzle - horizontal. See 72-00-51, Removal-01 (Task 72-00-51-020-001).
   (2) Remove igniter plug. See 72-00-41, Removal-07 (Task 72-00-41-050-004).
   (3) Remove fuel injector supply manifold. See 72-00-41, Removal-13 (Task 72-00-41-050-006).

B. Equipment And Materials Required

Special Tools:
PWA 85079 Fixture, Handling

C. Procedure
See Figure 302.
   (1) On PWA 85079 Handling Fixture, loosen two hand knob assemblies to open the clamping plate of the fixture.
   (2) Install the fixture to an overhead hoist and move the fixture to the 12 o'clock position inside the outer combustion chamber. Locate the first step in the clamping plate to the outer rear flange of the combustion chamber and tighten the two hand knob assemblies.
   (3) Remove lockwire loosen and remove twelve doweled end bolts and washers equally spaced around diffuser case.
   (4) Carefully move outer combustion chamber rearward from diffuser case and lower onto pallet. Remove hoist and fixture.

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−11

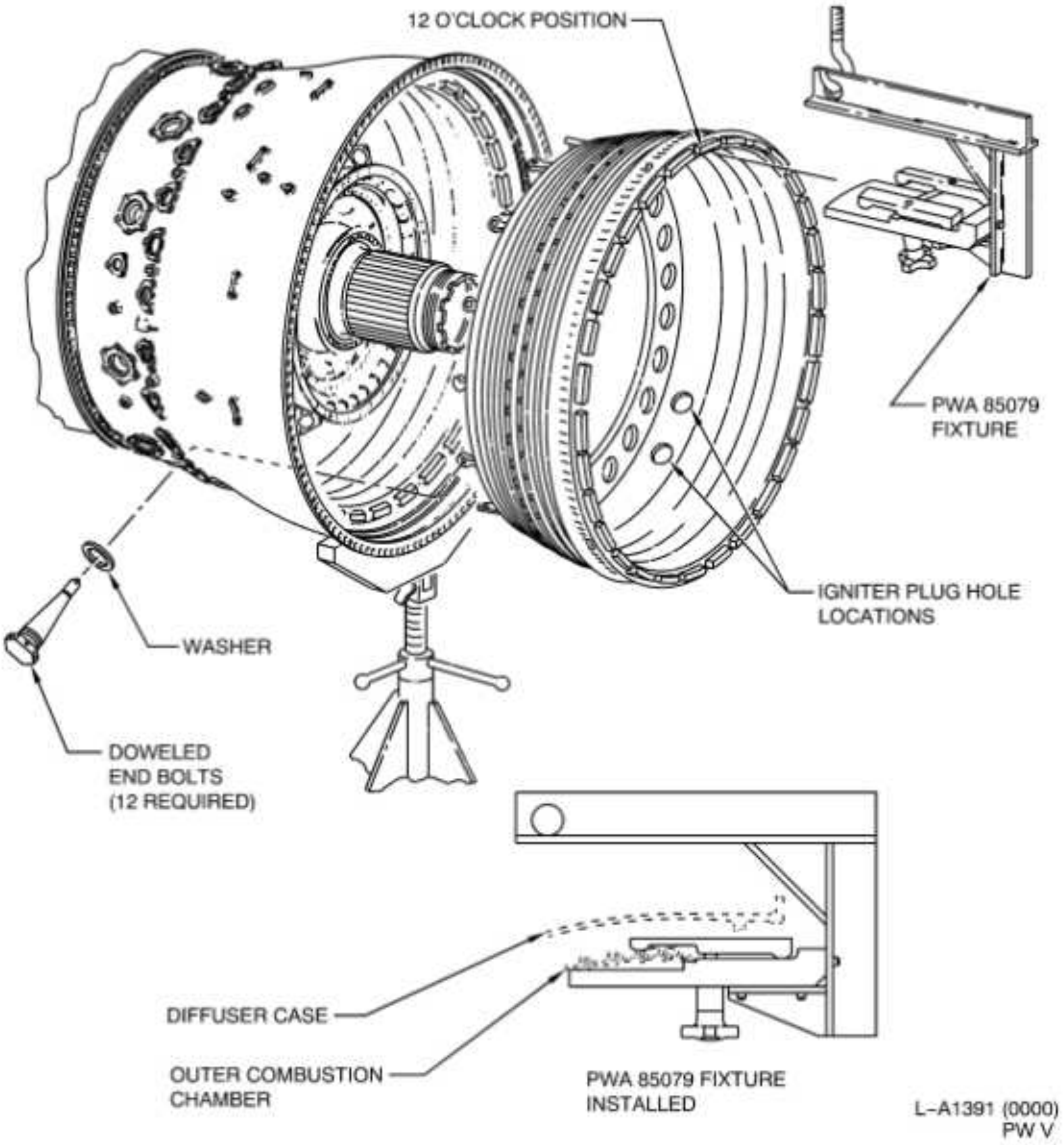


1. REMOVE COMPRESSOR INLET CONE.
2. REMOVE LOW PRESSURE TURBINE AND TURBINE EXHAUST CASE.
3. REMOVE HIGH PRESSURE TURBINE.
4. REMOVE TURBINE NOZZLE.

L−A1390 (0000)
PW V

Procedure Sequence
Figure 301
(Task 72−00−41−020−011)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−11


12 O'CLOCK POSITION
PWA 85079 FIXTURE
IGNITER PLUG HOLE LOCATIONS
WASHER
DOWELED END BOLTS (12 REQUIRED)
DIFFUSER CASE
OUTER COMBUSTION CHAMBER
PWA 85079 FIXTURE INSTALLED
L-A1391 (0000)
PW V

Combustion Chamber (Outer) Removal
Figure 302
(Task 72−00−41−020−011)

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-12

Task 72-00-41-020-012:

1. Remove Diffuser And Combustor (Horizontal)

NOTE: See Figure 301 for part/assembly removal procedure sequence.

A. Prerequisites

(1) Remove The Electronic Engine Control (EEC) Speed Transducer (N1). Refer to 72-00-34, Removal-03 (Task 72-00-34-050-001).

(2) Remove The Compressor Inlet Cone. Refer to 72-00-31, Removal-02 (Task 72-00-31-020-001).

(3) Remove 1st Stage LPC Blade Assemblies. Refer to 72-00-31, Removal-04 (Task 72-00-31-020-002-002).

(4) Remove LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed). Refer to 72-00-32, Removal-01 (Task 72-00-32-020-001).

(5) Remove The Low Pressure Compressor. Refer to 72-00-31, Removal-01 (Task 72-00-31-020-003).

(6) Remove The Turbine Exhaust Case. Refer to 72-00-54, Removal-01 (Task 72-00-54-020-001).

(7) Remove The Low Pressure Turbine With Shaft. Refer to 72-00-53, Removal-01 (Task 72-00-53-020-001).

(8) Remove The Fan Case. Refer to 72-00-33, Removal-01 (Task 72-00-33-020-001).

(9) Remove The No. 1 Bearing Support Assembly. Refer to 72-00-34, Removal-04 (Task 72-00-34-050-002).

(10) Remove The Main Gearbox. Refer to 72-00-61, Removal-01 (Task 72-00-61-020-001).

(11) Remove The High Pressure Turbine. Refer to 72-00-52, Removal-01 (Task 72-00-52-020-001).

(12) Remove The Turbine Nozzle. Refer to 72-00-51, Removal-01 (Task 72-00-51-020-001).

(13) Remove The No. 3 Bearing Rear Seal Assembly. Refer to 72-00-41, Removal-03 (Task 72-00-41-020-003).

(14) Disconnect/Remove The External Parts To Get Access To The Diffuser And Combustor. Refer to 72-00-41, Removal-02 (Task 72-00-41-020-002).

B. Equipment And Materials

Special Tools:

PWA 28657	Sling
PWA 29389	Pump, Hydraulic
PWA 76154	Adapter (Two Required)
PWA 80187	Multiplier, Torque
PWA 85056	Cover (Optional To PWA 85802)
PWA 85067	Fixture
PWA 85068	Fixture
PWA 85069	Puller
PWA 85071	Puller, Hydraulic
PWA 85159	Protector
PWA 85168	Protector
PWA 85308	Guide (Optional To PWA 85701)
PWA 85390	Adapter
PWA 85428	Protector
PWA 85701	Guide
PWA 85751	Bracket (Two Required)
PWA 85797	Wrench (Optional To PWA 86491)
PWA 85802	Cover
PWA 85893	Support, Cantilever
PWA 85909	Adapter, Support
PWA 85910	Adapter, Support
PWA 85983	Adapter, Stabilizer (Two Required Twin Overhead Rail System Only)
PWA 86489	Puller, Jackscrew
PWA 86491	Driver, Torque
PWA 102743	Adapter, Torque
PWA 102744	Adapter, Holder

C. Procedure

(1) Position PWA 85168 Protector (302/11) smaller end first into diffuser case. See Figure 302.

(2) Remove PWA 85159 Thread Protector (302/3) from rear of HPC rear hub.

(3) Install PWA 85390 Lifting Adapter (302/5) to high compressor 8th stage bleed pads to support the engine during diffuser combustor removal.

(4) Remove the saddle (302/12) and pedestal (302/10) positioned at Flange M of diffuser case.

(5) Install PWA 85893 Support (303/2) in engine. See Figure 303.

  (a) Attach the two tubular handles to ends of support.

  CAUTION: ONLY A MINIMUM AMOUNT OF JACKING OF SUPPORT IS NECESSARY SINCE TOO MUCH JACKING CAN EASILY CAUSE BEARING DAMAGE. TO FIND IF THE LOAD HAS BEEN MOVED FROM THE NO. 3 BEARING SUPPORT TO PWA 85893 SUPPORT THE TOP AND BOTTOM BEARING ROLLERS WILL BE FREE TO ROTATE.

  CAUTION: JACK MUST SUPPORT THE HPC DRIVESHAFT AT 12 O'CLOCK POSITION. DO NOT PERMIT SHAFT TO ROTATE.

  (b) With correct sling and hoist install PWA 85893 Support in engine from front or rear with jack detail of support to the rear of the engine. Insert long aluminum handle through center of engine to guide support in place.

  (c) Install PWA 85909 Adapter (303/1) over the front end of PWA 85893 Support and attach to the intermediate case. Remove the two tubular handles from the support.

  NOTE: If fan hub is installed, use PWA 85910 Adapter as an alternate to PWA 85909 Adapter.

  (d) With a speed handle, extension and socket wrench, operate the jack detail until it contacts ID of HPC shaft.

  (e) Monitor rollers of No. 3 bearing and continue to operate jack until bearing rollers have shown the load has moved from No. 3 bearing to PWA 85893 Support. When support jack has the load, lower the knurled nut to the locking position. Remove speed handle, extension and socket wrench.

CAUTION: HANDLE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN LINT FREE GLOVES TO PREVENT BEARING DAMAGE.

CAUTION: DETAIL PARTS OF BEARINGS MUST BE KEPT IN THEIR ORIGINAL ASSEMBLIES. PROTECT BEARINGS BY STORING IN A SUITABLE CONTAINER.

(6) Remove No. 3 bearing inner race and rollers (302/4), (304/8) using PWA 85071 Hydraulic Puller (302/2), 304/6) and PWA 29389 Hydraulic Pump.

NOTE: Install PWA 85802 Protector Cover or PWA 85056 Protector Cover (302/1) over outer race if the No. 3 bearing outer race is not to be removed.

CAUTION: WHEN YOU REMOVE THE NO. 3 BEARING OUTER RACE, YOU MUST EXAMINE THE NO. 3 BEARING HOUSING FOR SIGNS OF WEAR ON THE HOUSING SHOULDER AND JOURNAL SURFACES. SEE PW4000 SERIES CIR, PN 51A357.

(7) Remove No. 3 bearing outer race (304/1) - For engines when it is necessary to remove outer race from diffuser and combustor when it is installed on the high pressure compressor. See Figure 304.

NOTE: See 72-41-00, Removal-01 Task 72-41-00-030-004 for the removal of the No. 3 bearing outer race from the diffuser and combustor when it is not installed on the engine.

NOTE: See 72-41-00, Disassembly-03 Task 72-41-00-030-003-001 or 72-41-00, Dissasembly-04 Task 72-41-00-030-003-002 for removal of outer race from the No. 3 bearing duct and housing after the duct and housing has been removed from the diffuser and combustor.

(a) Remove PWA 85168 Protector (304/14).

(b) Install six workbolts, lubricated with Engine Oil P03-001, into bearing housing channel nuts equally around housing. Torque workbolts to 290 - 325 lb-in. (32.766 - 36.720 N.m).

NOTE: The workbolts are a quality standard bolt with .375-24 by 1.000 inch (25.400 mm) thread length.

(c) Install PWA 85168 Protector (304/14).

(d) Remove rivet (304/4) from retaining nut (304/2) in housing and discard rivet.

(e) With PWA 86491 Driver or PWA 85797 Wrench (304/5), loosen and remove the retaining nut (304/2) from housing.

NOTE: If you use PWA 86491 Driver, you must attach the driver to the bearing housing with the four detail cap screws.

(f) Mechanical Wrench Method (Optional) − See Figure 304, Sheet 2. With PWA 102743 Torque Adapter (304/15), PWA 102744 Holder Adapter (304/16) and PWA 80187 Torque Multiplier (304/17), loosen and remove the retainer nut (304/2) from the housing.

CAUTION: HANDLE NO. 3 BEARING OUTER RACE WITH CLEAN GLOVES TO PREVENT BEARING DAMAGE.

(g) With PWA 86489 Puller (304/3), remove the No. 3 bearing outer race (304/1) from housing as follows.

1 Turn the large hex head cap screw clockwise, the full length of its travel.

2 Turn the three hand knobs counterclockwise, the full length of their travel.

3 Put the puller into position until it touches the bearing housing. Also, the jaws must align with the scallops in the bearing housing.

4 Carefully and equally, turn the hand knobs clockwise until the jaws fully engage the scallops of the bearing housing.

5 Turn the large hex head cap screw counterclockwise until the outer race is loose.

6 Remove the puller. Remove the outer race.

(h) Remove PWA 85168 Protector (304/14) and the six workbolts from the bearing housing.

(i) Install PWA 85168 Protector (304/14), smaller end first, into diffuser case. Push protector into seat in case.

(8) Remove No. 3 bearing seal spacer (302/7) with (304/11) PWA 85068 Fixture (302/8) and PWA 85069 Puller.

(a) Loosen screws and wing nuts securing jaws.

(b) Position puller over HPC rear hub. Slide jaws behind rear flange of seal spacer. Tighten screws and wing nuts to secure jaws.

(c) Pull fixture by hand to remove spacer.

(d) If spacer cannot be removed by hand, install PWA 85069 Puller to upper flange of fixture per following step.

(e) Retract center jackscrew of PWA 85069 Puller and position puller to upper flange of PWA 85068 Fixture. Secure puller to fixture with detail screws. Using standard wrench, tighten center jackscrew to seat center puck in HPC rear hub. Continue tightening jackscrew to remove seal spacer from tight fit on hub. Remove screws securing puller to fixture. Remove puller.

(f) Loosen screws and wing nuts securing jaws to ring detail of PWA 85068 Fixture. Remove fixture.

(g) Remove seal spacer from HPC rear hub.

(9) Remove No. 3 bearing front seal seat (302/6), (304/10) with PWA 85067 Fixture (302/9), (304/13).

(a) Loosen screws and hand knobs securing jaws to fixture.

(b) Position fixture over HPC rear hub with fixture locating on seal seat. Slide jaws outward to engage pulling flange of seat. Tighten upper screws to secure jaws. Tighten hand knobs to fully engage jaws in pulling groove of seal seat.

(c) Pull fixture by hand to remove seal seat.

(d) If seal seat cannot be removed by hand, install PWA 85069 Puller to upper flange of fixture per following step.

(e) Retract center jackscrew of PWA 85069 Puller and position puller to upper flange of PWA 85067 Fixture. Secure puller to fixture with detail screws. Using standard wrench tighten center jackscrew to seat center puck in HPC rear hub. Continue tightening jackscrew to remove seal seat from tight fit on hub. Remove screws securing puller to fixture. Remove puller.

(f) Loosen screws and hand knobs securing jaws to ring detail of fixture. Remove fixture.

(g) Remove seal seat from HPC rear hub.

(10) Install two PWA 85751 Handling Brackets to diffuser case. See Figure 305.

NOTE: If you have a twin overhead rail system you must use PWA 85983 Stabilizer Adapters with PWA 85751 Brackets.

(a) Loosen and remove the clamp bolts that attach the fuel tubes to the Flange K bracket for PWA 85751 Bracket tool installation clearance.

(b) Using hoist, position longer front flange of brackets to rear of front flange of diffuser case at 3 and 9 o'clock locations, locating four pins in front flange of bracket into four boltholes in diffuser case front flange. Position shorter rear flange of bracket to front of diffuser case rear flange and secure with detail nuts and bolts.

(c) Position double spool bracket in rear most two holes as marked on bracket.

(11) Install two PWA 76154 Adapters to spools on PWA 85751 Handling Brackets and attach PWA 28657 Sling and overhead hoist to PWA 76154 Adapters.

(12) Position PWA 85308 Guide or PWA 85701 Guide, larger end first, over HPC rear hub. Seat on rear hub seal plate shoulder.

(13) Remove the Flange K hardware as follows. Refer to 72−00−41, Removal−20 (Task 72−00−41−020−020).

(14) Using 0.250−28 jackscrews to separate Flange K, carefully move diffuser combustor assembly rearward to clear engine and place front end down on pallet.

(15) Remove gasket from rear flange of HPC rear case if equipped (Post SB PW4ENG 72−48).

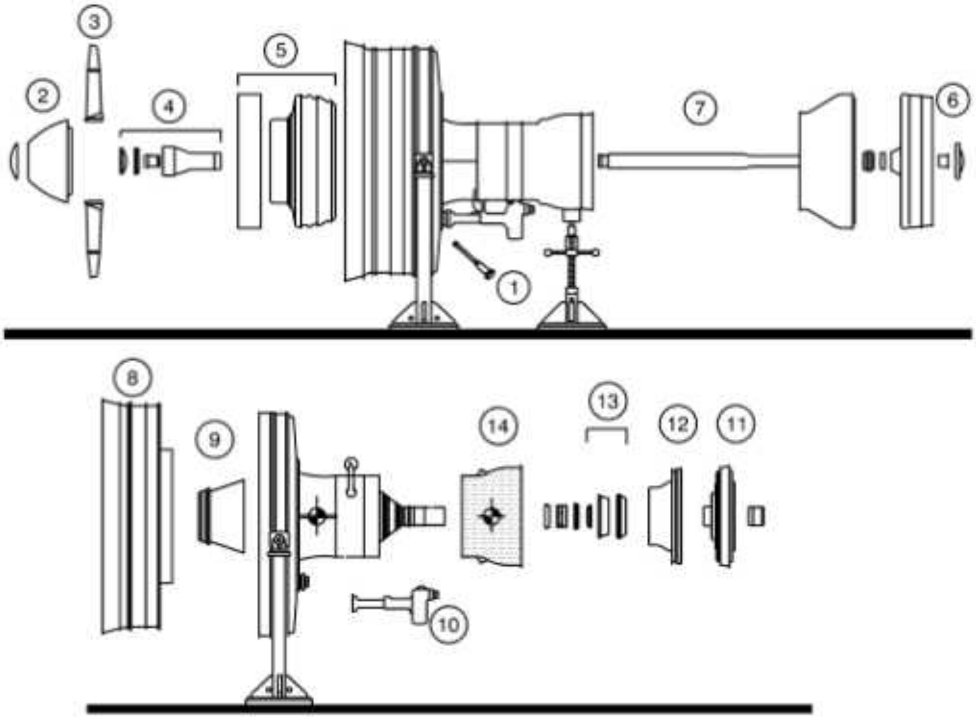
(16) Remove PWA 28657 Sling and PWA 76154 Adapters, from PWA 85045 Handling Brackets.

(17) Remove PWA 85751 Handling Brackets from diffuser case.

(18) Remove PWA 85308 Guide from HPC rear hub.

(19) Install PWA 85428 Protector over No. 3 bearing rear knife−edge on HPC rear hub.

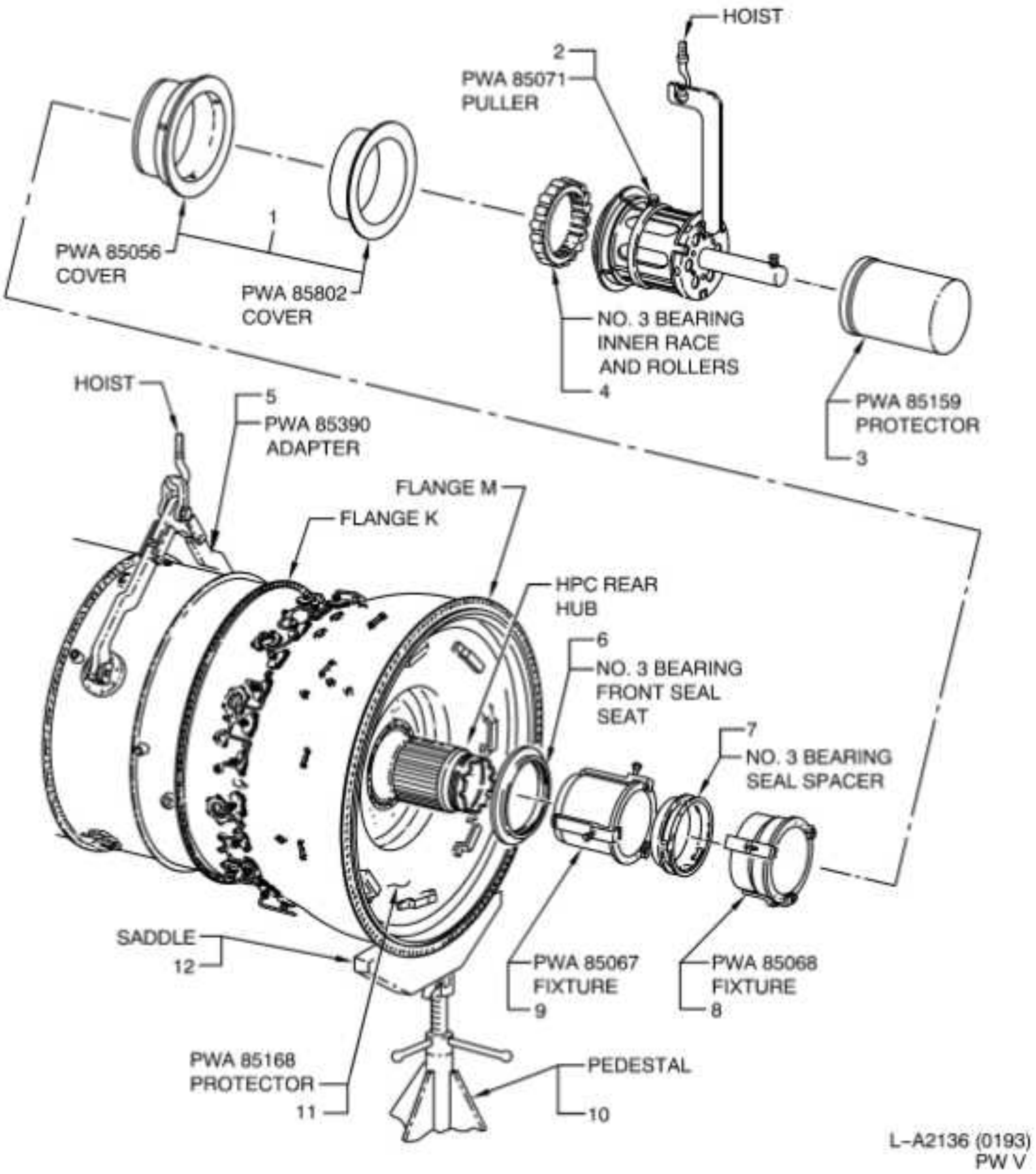
(20) Install PWA 85159 Protector over threads and splines on HPC rear hub.



1. REMOVE ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
2. REMOVE COMPRESSOR INLET CONE.
3. REMOVE STAGE 1 LPC BLADE ASSEMBLIES.
4. REMOVE LPC/LPT COUPLING.
5. REMOVE LOW PRESSURE COMPRESSOR (LPC).
6. REMOVE TURBINE EXHAUST CASE.
7. REMOVE LOW PRESSURE TURBINE (LPT).
8. REMOVE FAN CASE.
9. REMOVE NO. 1 BEARING SUPPORT ASSEMBLY.
10. REMOVE MAIN GEARBOX.
11. REMOVE HIGH PRESSURE TURBINE (HPT).
12. REMOVE TURBINE NOZZLE.
13. REMOVE NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL SEAT.
14. REMOVE DIFFUSER AND COMBUSTER

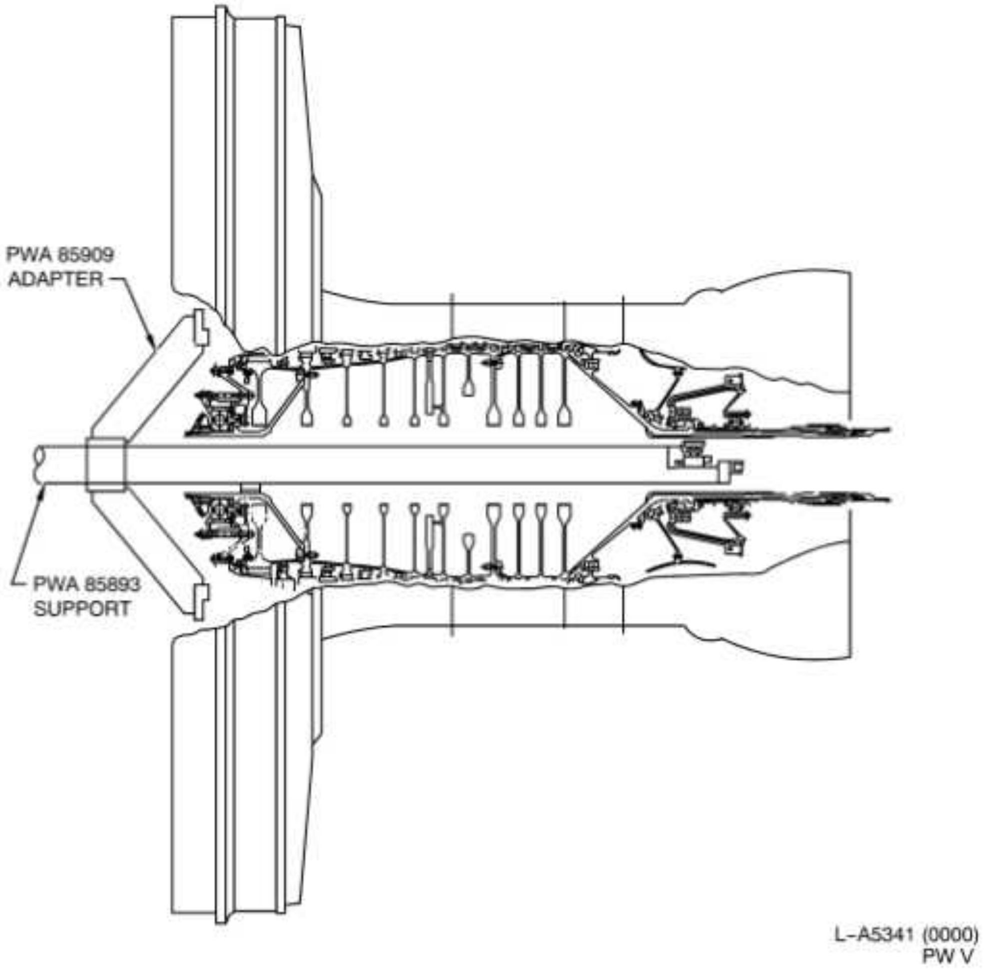
L−A1395 (1086)
PW V

Procedure Sequence
Figure 301
(Task 72−00−41−020−012)

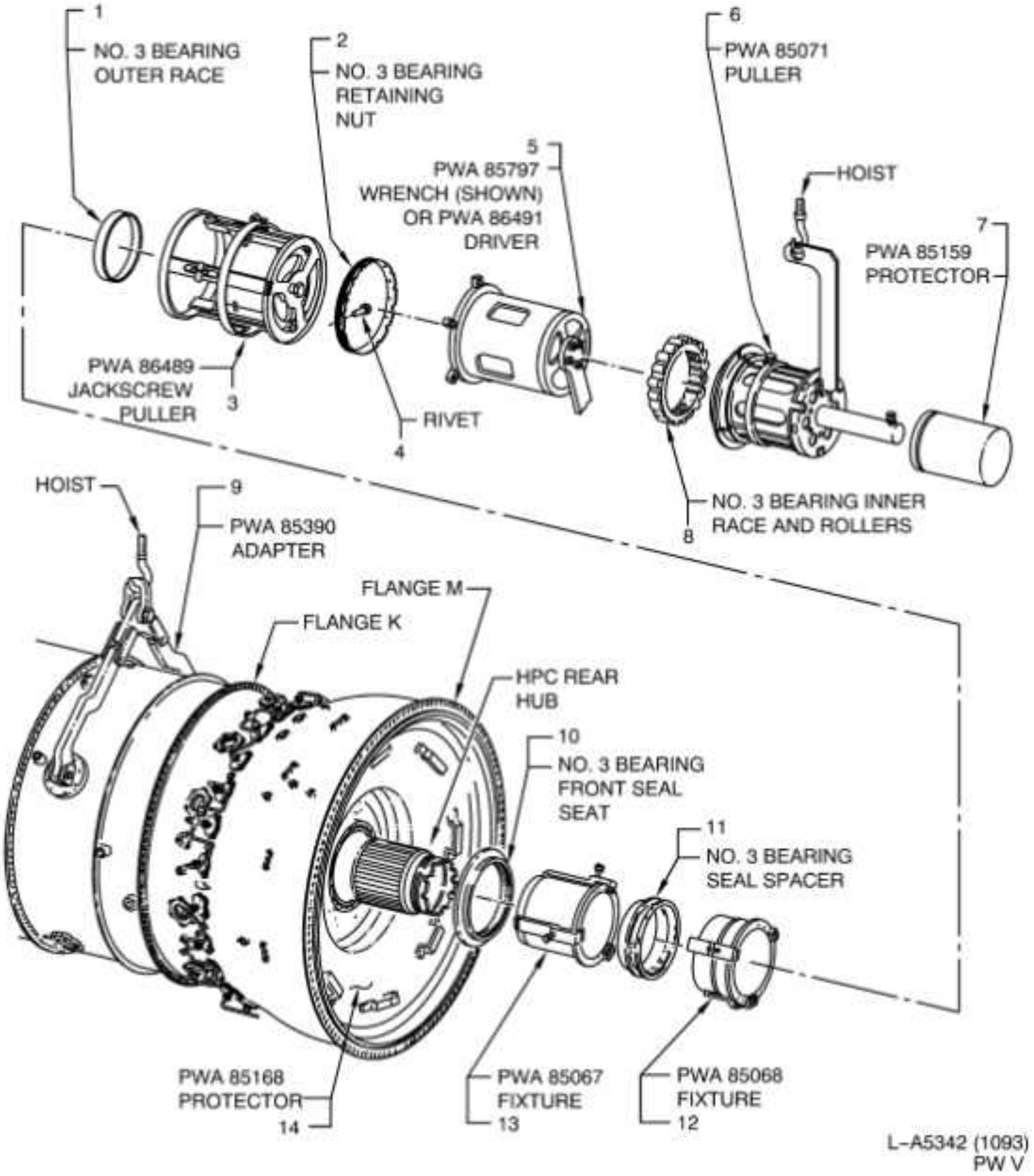

HOIST
2
PWA 85071
PULLER
1
PWA 85056
COVER
PWA 85802
COVER
NO. 3 BEARING
INNER RACE
AND ROLLERS
4
PWA 85159
PROTECTOR
3
HOIST
5
PWA 85390
ADAPTER
FLANGE M
FLANGE K
HPC REAR
HUB
6
NO. 3 BEARING
FRONT SEAL
SEAT
7
NO. 3 BEARING
SEAL SPACER
SADDLE
12
PWA 85067
FIXTURE
9
PWA 85068
FIXTURE
8
PWA 85168
PROTECTOR
11
PEDESTAL
10
L−A2136 (0193)
PW V

Diffuser And Combustor Removal − Not
Required No. 3 Bearing Outer Race Removal
Figure 302
(Task 72−00−41−020−012)

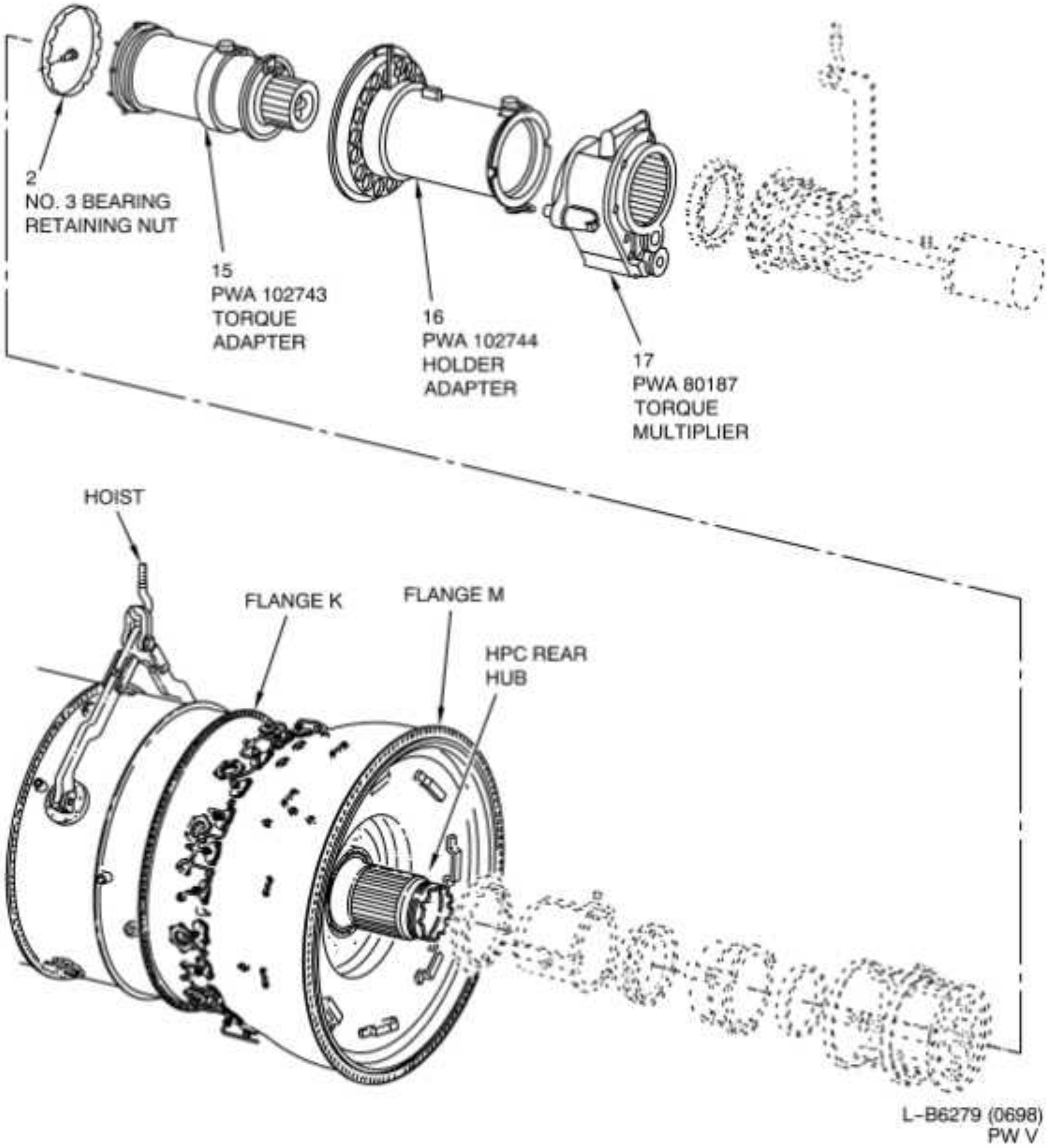
ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-12


PWA 85909
ADAPTER
PWA 85893
SUPPORT
L-A5341 (0000)
PW V

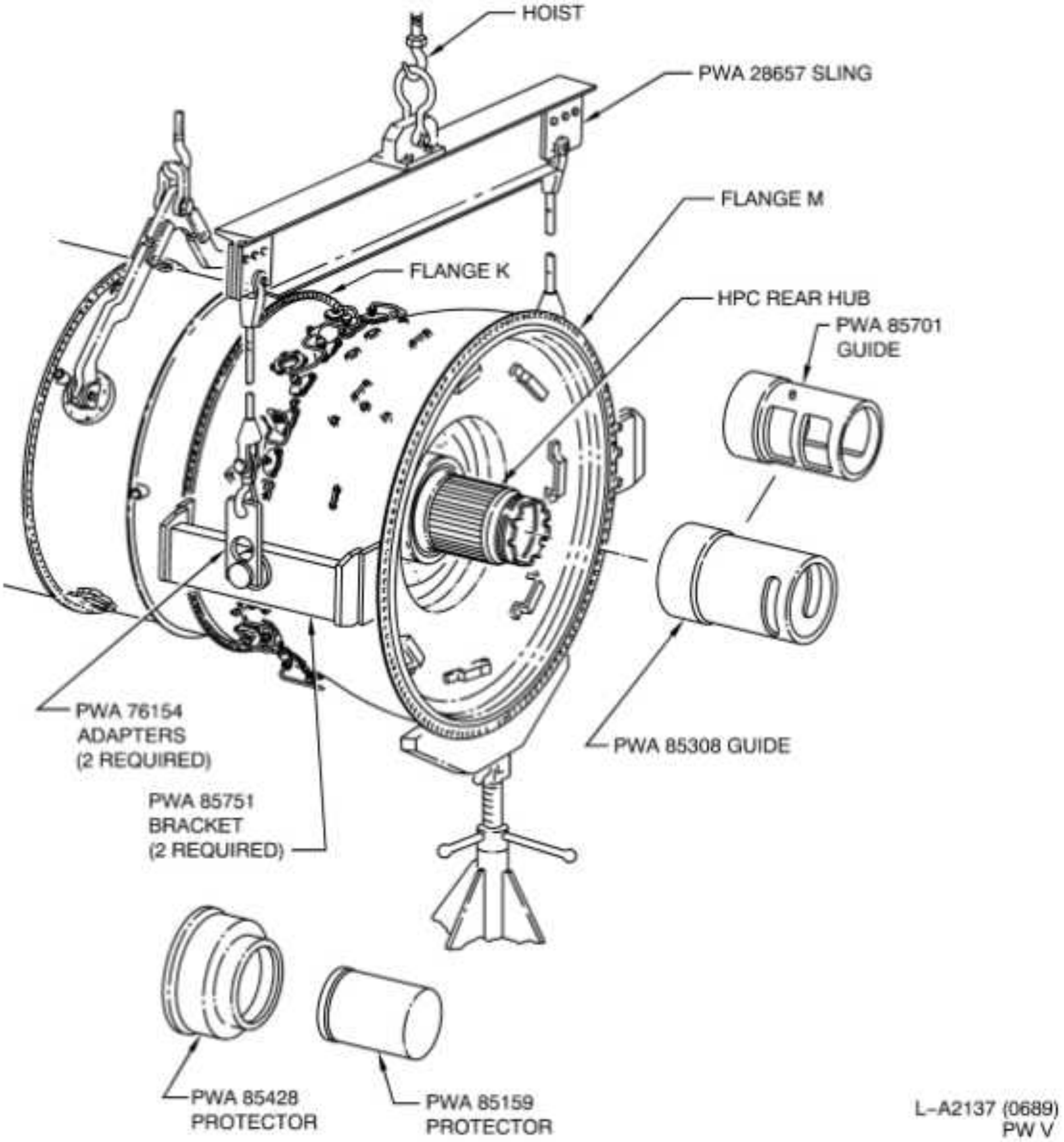
Diffuser And Combustor Removal
Figure 303
(Task 72-00-41-020-012)


1
NO. 3 BEARING OUTER RACE
2
NO. 3 BEARING RETAINING NUT
5
PWA 85797 WRENCH (SHOWN) OR PWA 86491 DRIVER
6
PWA 85071 PULLER
HOIST
7
PWA 85159 PROTECTOR
PWA 86489 JACKSCREW PULLER
3
RIVET
4
NO. 3 BEARING INNER RACE AND ROLLERS
8
HOIST
9
PWA 85390 ADAPTER
FLANGE M
FLANGE K
HPC REAR HUB
10
NO. 3 BEARING FRONT SEAL SEAT
11
NO. 3 BEARING SEAL SPACER
PWA 85168 PROTECTOR
14
PWA 85067 FIXTURE
13
PWA 85068 FIXTURE
12
L−A5342 (1093)
PW V

Diffuser And Combustor Removal − Requiring
No. 3 Bearing Outer Race Removal
Figure 304 (Sheet 1)
(Task 72−00−41−020−012)


2
NO. 3 BEARING
RETAINING NUT
15
PWA 102743
TORQUE
ADAPTER
16
PWA 102744
HOLDER
ADAPTER
17
PWA 80187
TORQUE
MULTIPLIER
HOIST
FLANGE K
FLANGE M
HPC REAR
HUB
L−B6279 (0698)
PW V

Diffuser And Combustor Removal − Requiring
No. 3 Bearing Outer Race Removal
Figure 304 (Sheet 2)
(Task 72−00−41−020−012)


HOIST
PWA 28657 SLING
FLANGE M
FLANGE K
HPC REAR HUB
PWA 85701 GUIDE
PWA 76154 ADAPTERS (2 REQUIRED)
PWA 85308 GUIDE
PWA 85751 BRACKET (2 REQUIRED)
PWA 85428 PROTECTOR
PWA 85159 PROTECTOR
L−A2137 (0689)
PW V

Diffuser And Combustor Removal
Figure 305
(Task 72−00−41−020−012)

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-12

Task 72-00-41-020-013:

1. Remove Diffuser And Combustor (Horizontal)

NOTE: See Figure 301 for part/assembly removal procedure sequence.

A. Prerequisites

(1) Remove The Electronic Engine Control (EEC) Speed Transducer (N1). Refer to 72-00-34, Removal-03 (Task 72-00-34-050-001).

(2) Remove The Compressor Inlet Cone. Refer to 72-00-31, Removal-02 (Task 72-00-31-020-001).

(3) Remove 1st Stage LPC Blade Assemblies. Refer to 72-00-31, Removal-04 (Task 72-00-31-020-002-002).

(4) Remove LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed). Refer to 72-00-32, Removal-01 (Task 72-00-32-020-001).

(5) Remove The Low Pressure Compressor. Refer to 72-00-31, Removal-01 (Task 72-00-31-020-003).

(6) Remove The Turbine Exhaust Case. Refer to 72-00-54, Removal-01 (Task 72-00-54-020-001).

(7) Remove The Low Pressure Turbine With Shaft. Refer to 72-00-53, Removal-01 (Task 72-00-53-020-001).

(8) Remove The Fan Case. Refer to 72-00-33, Removal-01 (Task 72-00-33-020-006).

(9) Remove The No. 1 Bearing Support Assembly. Refer to 72-00-34, Removal-04 (Task 72-00-34-050-002).

(10) Remove The Main Gearbox. Refer to 72-00-61, Removal-01 (Task 72-00-61-020-001).

(11) Remove The High Pressure Turbine. Refer to 72-00-52, Removal-01 (Task 72-00-52-020-001).

(12) Remove The Turbine Nozzle. Refer to 72-00-51, Removal-01 (Task 72-00-51-020-001).

(13) Remove No. 3 Bearing Rear Seal Assembly. Refer to 72-00-41, Removal-03 (Task 72-00-41-020-003).

(14) Disconnect/Remove External Parts To Gain Access To The Diffuser And Combustor. Refer to 72−00−41, Removal−02 Task 72−00−41−020−006.

B. Equipment And Materials

Special Tools:

PWA 28657	Sling
PWA 29389	Pump, Hydraulic
PWA 76154	Adapter (Two Necessary)
PWA 80187	Multiplier, Torque
PWA 85056	Cover (Optional To PWA 85802)
PWA 85067	Fixture
PWA 85068	Fixture
PWA 85069	Puller
PWA 85071	Puller, Hydraulic
PWA 85159	Protector
PWA 85168	Protector
PWA 85308	Guide (Optional To PWA 85701)
PWA 85390	Adapter
PWA 85428	Protector
PWA 85701	Guide
PWA 85751	Bracket (Two Necessary)
PWA 85797	Wrench (Optional To PWA 86491)
PWA 85802	Cover
PWA 85893	Support, Cantilever
PWA 85909	Adapter, Support
PWA 85910	Adapter, Support
PWA 85983	Adapter, Stabilizer (Two Necessary Twin Overhead Rail System Only)
PWA 86489	Puller, Jackscrew
PWA 86491	Driver, Torque
PWA 102743	Adapter, Torque
PWA 102744	Adapter, Holder

C. Procedure

(1) Install the PWA 85168 Protector (302/11) smaller end first into the diffuser case. See Figure 302.

(2) Remove the PWA 85159 Thread Protector (302/3) from the rear of the HPC rear hub.

(3) Install the PWA 85390 Lifting Adapter (302/5) to the high compressor 8th stage bleed pads to support the engine during diffuser combustor removal.

(4) Remove the saddle (302/12) and pedestal (302/10) installed at Flange M of the diffuser case.

(5) Install the PWA 85893 Support (303/2) in the engine. See Figure 303.

  (a) Attach the two tubular handles to the ends of the support.

  CAUTION: ONLY A MINIMUM AMOUNT OF JACKING OF SUPPORT IS NECESSARY SINCE TOO MUCH JACKING CAN EASILY CAUSE BEARING DAMAGE. TO FIND IF THE LOAD HAS BEEN MOVED FROM THE NO. 3 BEARING SUPPORT TO PWA 85893 SUPPORT THE TOP AND BOTTOM BEARING ROLLERS WILL BE FREE TO ROTATE.

  CAUTION: JACK MUST SUPPORT THE HPC DRIVESHAFT AT 12 O'CLOCK POSITION. DO NOT PERMIT SHAFT TO ROTATE.

  (b) With correct sling and hoist install PWA 85893 Support into the engine from the front or rear with the jack detail of the support to the rear of the engine. Insert long aluminum handle through center of engine to guide support in place.

  (c) Install the PWA 85909 Adapter (303/1) over the front end of the PWA 85893 Support and attach to the intermediate case. Remove the two tubular handles from the support.

  NOTE: If the fan hub is installed, use PWA 85910 Adapter as an alternate to PWA 85909 Adapter.

  (d) With a speed handle, extension and socket wrench, operate the jack detail until it contacts the ID of the HPC shaft.

  (e) Monitor the rollers of the No. 3 bearing and continue to operate the jack until the bearing rollers have shown the load has moved from the No. 3 bearing to the PWA 85893 Support. When the support jack has the load, lower the knurled nut to the locking position. Remove speed handle, extension and socket wrench.

CAUTION: TOUCH THE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN LINT FREE GLOVES TO PREVENT BEARING DAMAGE.

CAUTION: DETAIL PARTS OF BEARINGS MUST BE KEPT IN THEIR ORIGINAL ASSEMBLIES. PROTECT BEARINGS BY STORAGE IN AN APPLICABLE CONTAINER.

(6) Remove the No. 3 bearing inner race and rollers (302/4), (304/8) use the PWA 85071 Hydraulic Puller (302/2), (304/6) and PWA 29389 Hydraulic Pump.

NOTE: Install the PWA 85802 Protector Cover or PWA 85056 Protector Cover (302/1) over the outer race if the No. 3 bearing outer race will not be removed.

CAUTION: WHEN YOU REMOVE THE NO. 3 BEARING OUTER RACE, YOU MUST EXAMINE THE NO. 3 BEARING HOUSING FOR SIGNS OF WEAR ON THE HOUSING SHOULDER AND JOURNAL SURFACES. SEE PW4000 SERIES CIR, PN 51A357.

(7) Remove the No. 3 bearing outer race (304/1) − For engines when it is necessary to remove the outer race from the diffuser and combustor when it is installed on the high pressure compressor. See Figure 304.

NOTE: See 72−41−00, Removal−01 Task 72−41−00−030−004 for the removal of the No. 3 bearing outer race from the diffuser and combustor when it is not installed on the engine.

NOTE: See 72−41−00, Disassembly−03 Task 72−41−00−030−003−001 or Dissasembly−04 Task 72−41−00−030−003−002 for removal of outer race from the No. 3 bearing duct and housing after the duct and housing has been removed from the diffuser and combustor.

(a) Remove the PWA 85168 Protector (304/14).

(b) Install six workbolts, lubricated with Engine Oil P03−001, into the bearing housing channel nuts equally around the housing. Torque workbolts to 290 − 325 lb−in. (32.766 − 36.720 N.m).

NOTE: The workbolts are a quality standard bolt with .375−24 by 1.000 inch (25.400 mm) thread length.

(c) Install the PWA 85168 Protector (304/14).

(d) Remove the rivet (304/4) from the retaining nut (304/2) in the housing and discard the rivet.

(e) With the PWA 86491 Wrench or PWA 85797 Wrench (304/5), loosen and remove the retaining nut (304/2) from the housing.

NOTE: If you use PWA 86491 Driver, you must attach the driver to the bearing housing with the four detail cap screws.

(f) Mechanical Wrench Method (Optional) − See Figure 304, Sheet 2. With PWA 102743 Torque Adapter (304/15), PWA 102744 Holder Adapter (304/16) and PWA 80187 Torque Multiplier (304/17), loosen and remove the retaining nut (304/2) from the housing.

CAUTION: TO PREVENT BEARING DAMAGE, WEAR CLEAN LINT FREE GLOVES WHEN YOU TOUCH THE NO. 3 BEARING OUTER RACE.

(g) With the PWA 86489 Puller 304/3), remove the No. 3 bearing outer race (304/1) from the housing as follows.

1 Turn the large hex head cap screw clockwise, the full length of its travel.

2 Turn the three hand knobs counterclockwise, the full length of their travel.

3 Put the puller into position until it touches the bearing housing. Also, the jaws must align with the scallops in the bearing housing.

4 Carefully and equally, turn the hand knobs clockwise until the jaws fully engage the scallops of the bearing housing.

5 Turn the large hex head cap screw counterclockwise until the outer race is loose.

6 Remove the puller. Remove the outer race.

(h) Remove the PWA 85168 Protector (304/14) and the six workbolts from the bearing housing.

(i) Install PWA 85168 Protector (304/14), smaller end first, into the diffuser case. Push the protector into the case.

(8) Remove the No. 3 bearing seal spacer (302/7) with (304/11) the PWA 85068 Fixture (302/8) and PWA 85069 Puller.

(a) Loosen the screws and wing nuts that attach the jaws.

(b) Install the puller over the HPC rear hub. Move the jaws behind the rear flange of the seal spacer. Tighten the screws and wing nuts to attach the jaws.

(c) Pull the fixture by hand to remove the spacer.

(d) If the spacer cannot be removed by hand, install PWA 85069 Puller to the upper flange of the fixture by the steps that follow.

1 Retract the center jackscrew of the PWA 85069 Puller and install the puller to the upper flange of the PWA 85068 Fixture. Attach the puller to the fixture with the detail screws. Use a standard wrench and tighten the center jackscrew to engage the center puck in the HPC rear hub. Continue to tighten the jackscrew to remove the seal spacer from the tight fit on the hub. Remove the screws that attach the puller to the fixture. Remove the puller.

2 Loosen the screws and wing nuts that attach the jaws to the ring detail of the PWA 85068 Fixture. Remove the fixture.

3 Remove the seal spacer from the HPC rear hub.

(9) Remove the No. 3 bearing front seal seat (302/6), (304/10) with the PWA 85067 Fixture (302/9), (304/13).

(a) Loosen the screws and hand knobs that attach the jaws to the fixture.

(b) Install the fixture over the HPC rear hub with the fixture on seal seat. Move the jaws outward to engage the pulling flange of the seat. Tighten the upper screws to attach the jaws. Tighten the hand knobs to fully engage the jaws in the pulling groove of the seal seat.

(c) Pull the fixture by hand to remove the seal seat.

(d) If seal seat cannot be removed by hand, install PWA 85069 Puller to the upper flange of the fixture by the steps that follow.

1 Retract the center jackscrew of the PWA 85069 Puller and install the puller to the upper flange of the PWA 85067 Fixture. Attach the puller to the fixture with detail screws. Use a standard wrench and tighten the center jackscrew to engage the center puck in the HPC rear hub. Continue to tighten the jackscrew to remove the seal seat from the tight fit on the hub. Remove the screws that attach the puller to the fixture. Remove the puller.

2 Loosen the screws and hand knobs that attach the jaws to the ring detail of the fixture. Remove the fixture.

3 Remove the seal seat from the HPC rear hub.

(10) Install two PWA 85751 Handling Brackets to the diffuser case. See Figure 305.

NOTE: If you have a twin overhead rail system you must use PWA 85983 Stabilizer Adapters with PWA 85751 Brackets.

(a) Loosen and remove the clamp bolts that attach the fuel tubes to the Flange K bracket for PWA 85751 Bracket tool installation clearance.

(b) Use a hoist and install the longer front flange of the brackets to the rear of the front flange of the diffuser case at the 3 and 9 o'clock locations, install the four pins in the front flange of the bracket into the four boltholes in the diffuser case front flange. Install the shorter rear flange of the bracket to the front of the diffuser case rear flange and attach with detail nuts and bolts.

(c) Install the double spool bracket in the rear most two holes as marked on the bracket.

(11) Install two PWA 76154 Adapters to the spools on PWA 85751 Handling Brackets and attach the PWA 28657 Sling and overhead hoist to the PWA 76154 Adapters.

(12) Install the PWA 85308 Guide or PWA 85701 Guide, larger end first, over the HPC rear hub to engage on the rear hub seal plate shoulder.

(13) Remove the Flange K Hardware as follows. Refer to 72−00−41, Removal−20 (Task 72−00−41−020−020).

(14) Use 0.250−28 jackscrews to separate Flange K, carefully move the diffuser combustor assembly rearward to clear the engine and put front end down on a pallet.

(15) Remove the gasket from the rear flange of the HPC rear case.

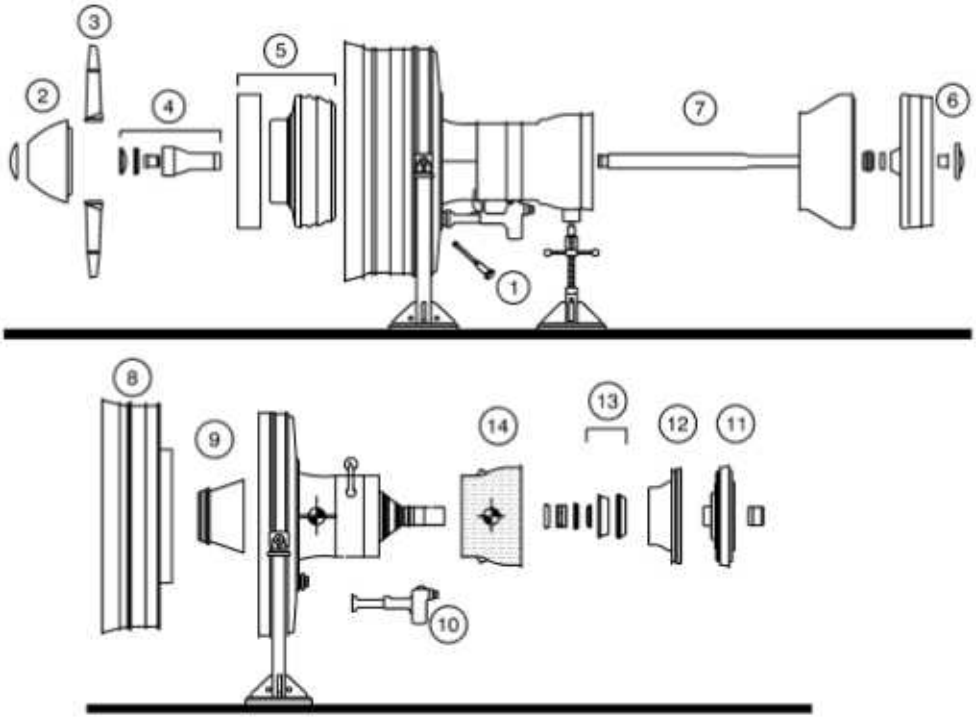
(16) Remove the PWA 28657 Sling and PWA 76154 Adapters, from the PWA 85045 Handling Brackets.

(17) Remove the PWA 85751 Handling Brackets from the diffuser case.

(18) Remove the PWA 85308 Guide from the HPC rear hub.

(19) Install the PWA 85428 Protector over the No. 3 bearing rear knife−edge on the HPC rear hub.

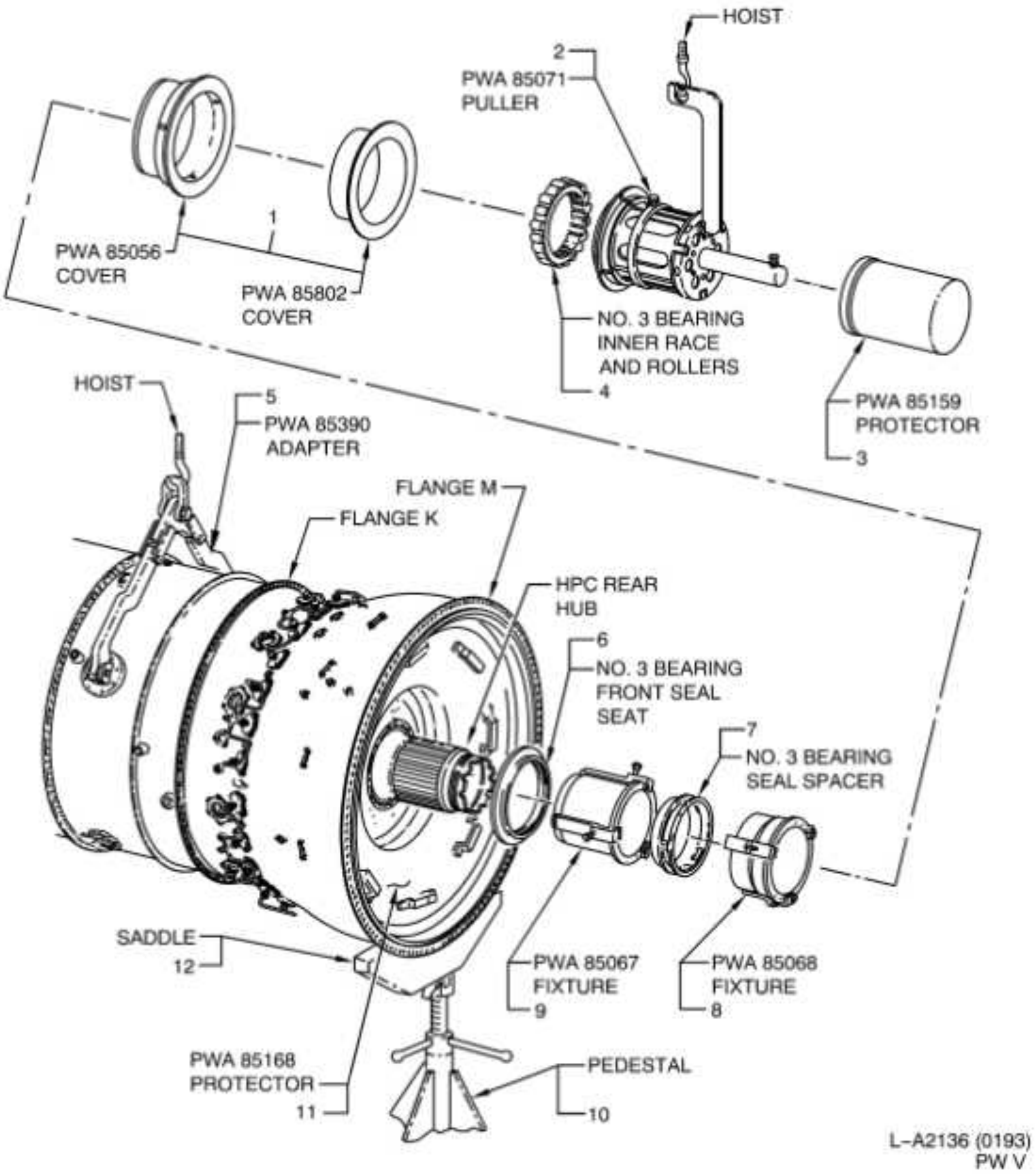
(20) Install the PWA 85159 Protector over the threads and splines on the HPC rear hub.



1. REMOVE ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
2. REMOVE COMPRESSOR INLET CONE.
3. REMOVE STAGE 1 LPC BLADE ASSEMBLIES.
4. REMOVE LPC/LPT COUPLING.
5. REMOVE LOW PRESSURE COMPRESSOR (LPC).
6. REMOVE TURBINE EXHAUST CASE.
7. REMOVE LOW PRESSURE TURBINE (LPT).
8. REMOVE FAN CASE.
9. REMOVE NO. 1 BEARING SUPPORT ASSEMBLY.
10. REMOVE MAIN GEARBOX.
11. REMOVE HIGH PRESSURE TURBINE (HPT).
12. REMOVE TURBINE NOZZLE.
13. REMOVE NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL SEAT.
14. REMOVE DIFFUSER AND COMBUSTER

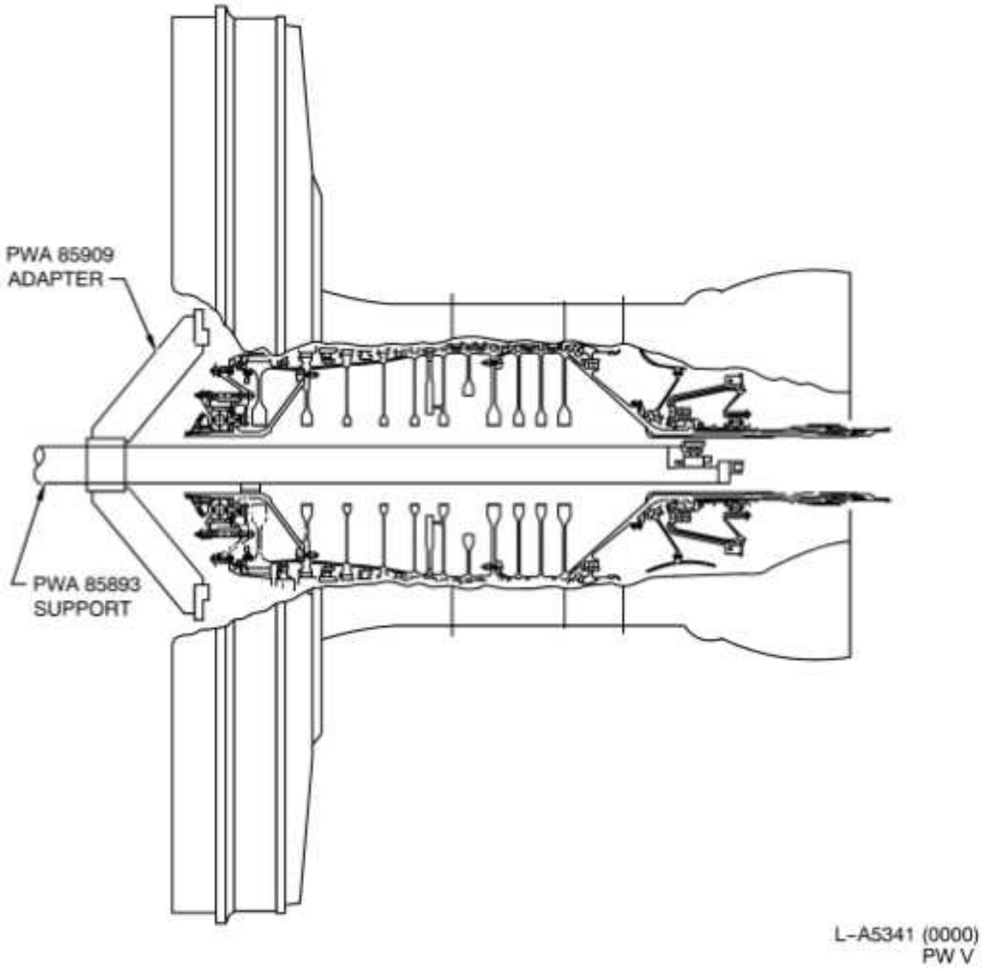
L−A1395 (1086)
PW V

Procedure Sequence
Figure 301
(Task 72−00−41−020−013)

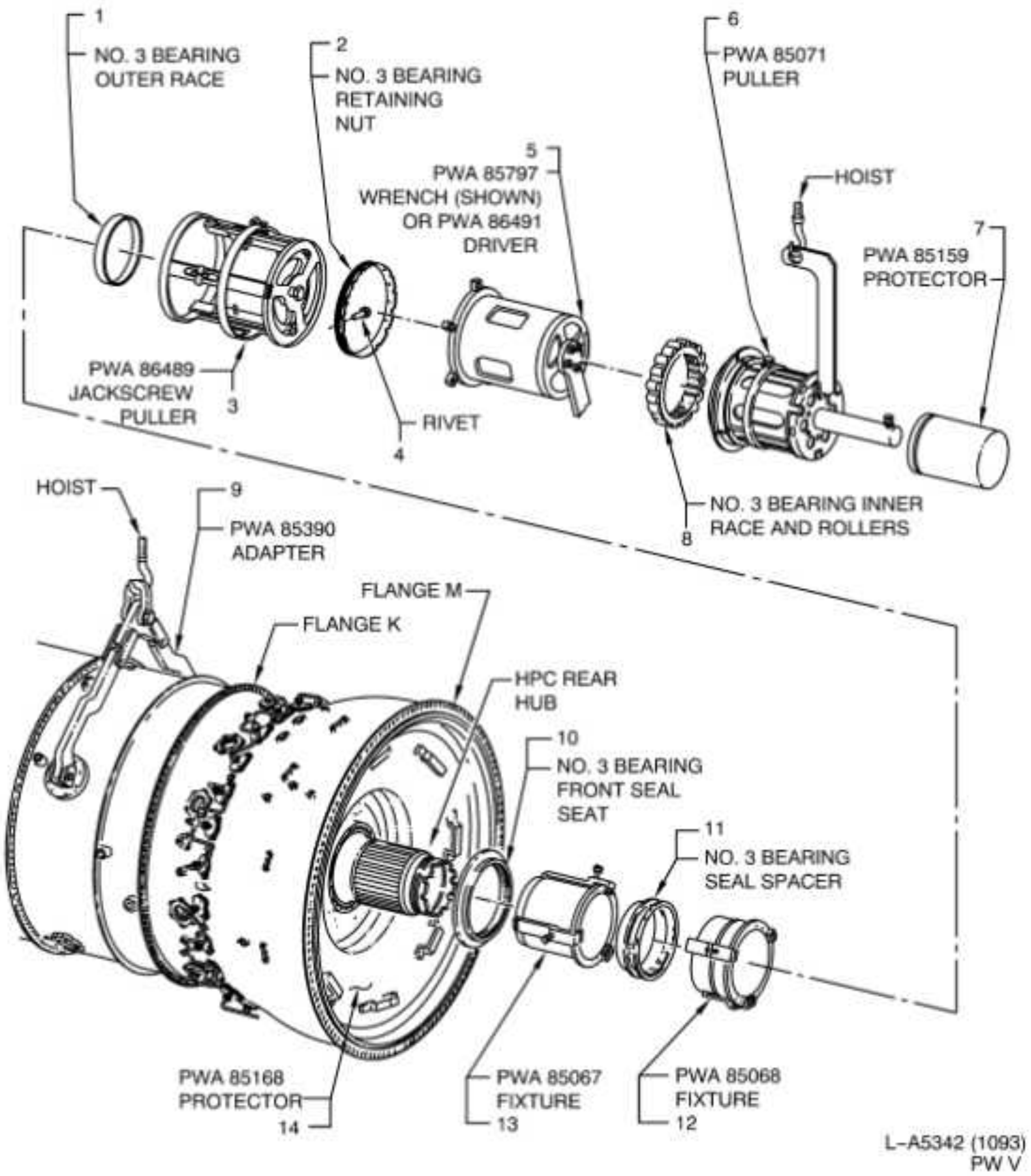

HOIST
2
PWA 85071
PULLER
1
PWA 85056
COVER
PWA 85802
COVER
NO. 3 BEARING
INNER RACE
AND ROLLERS
4
PWA 85159
PROTECTOR
3
HOIST
5
PWA 85390
ADAPTER
FLANGE M
FLANGE K
HPC REAR
HUB
6
NO. 3 BEARING
FRONT SEAL
SEAT
7
NO. 3 BEARING
SEAL SPACER
SADDLE
12
PWA 85067
FIXTURE
9
PWA 85068
FIXTURE
8
PWA 85168
PROTECTOR
11
PEDESTAL
10
L−A2136 (0193)
PW V

Diffuser And Combustor Removal (Engines Where The
No. 3 Bearing Outer Race Removal Is Not Necessary)
Figure 302
(Task 72−00−41−020−013)

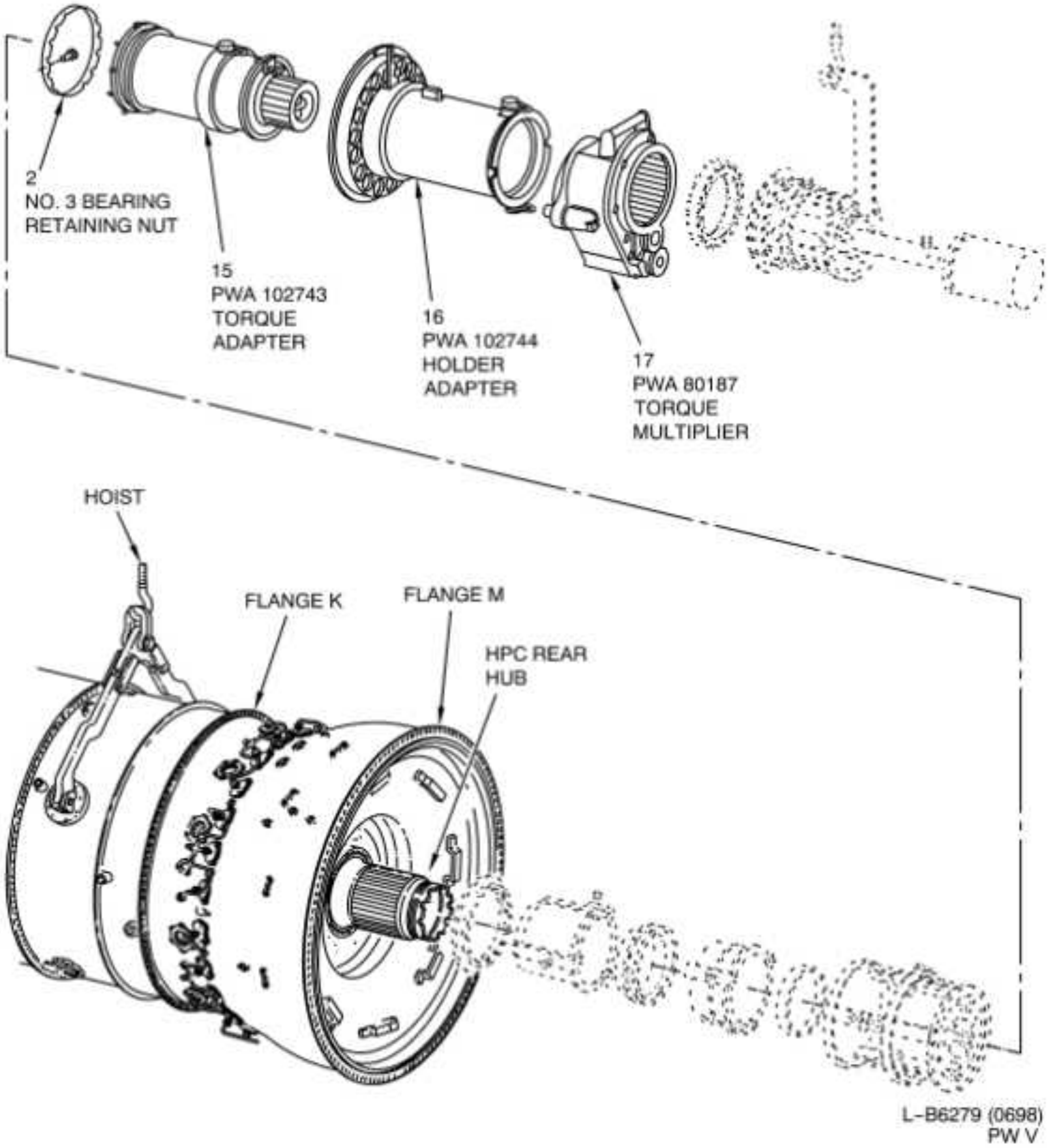
ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-12


PWA 85909
ADAPTER
PWA 85893
SUPPORT
L-A5341 (0000)
PW V

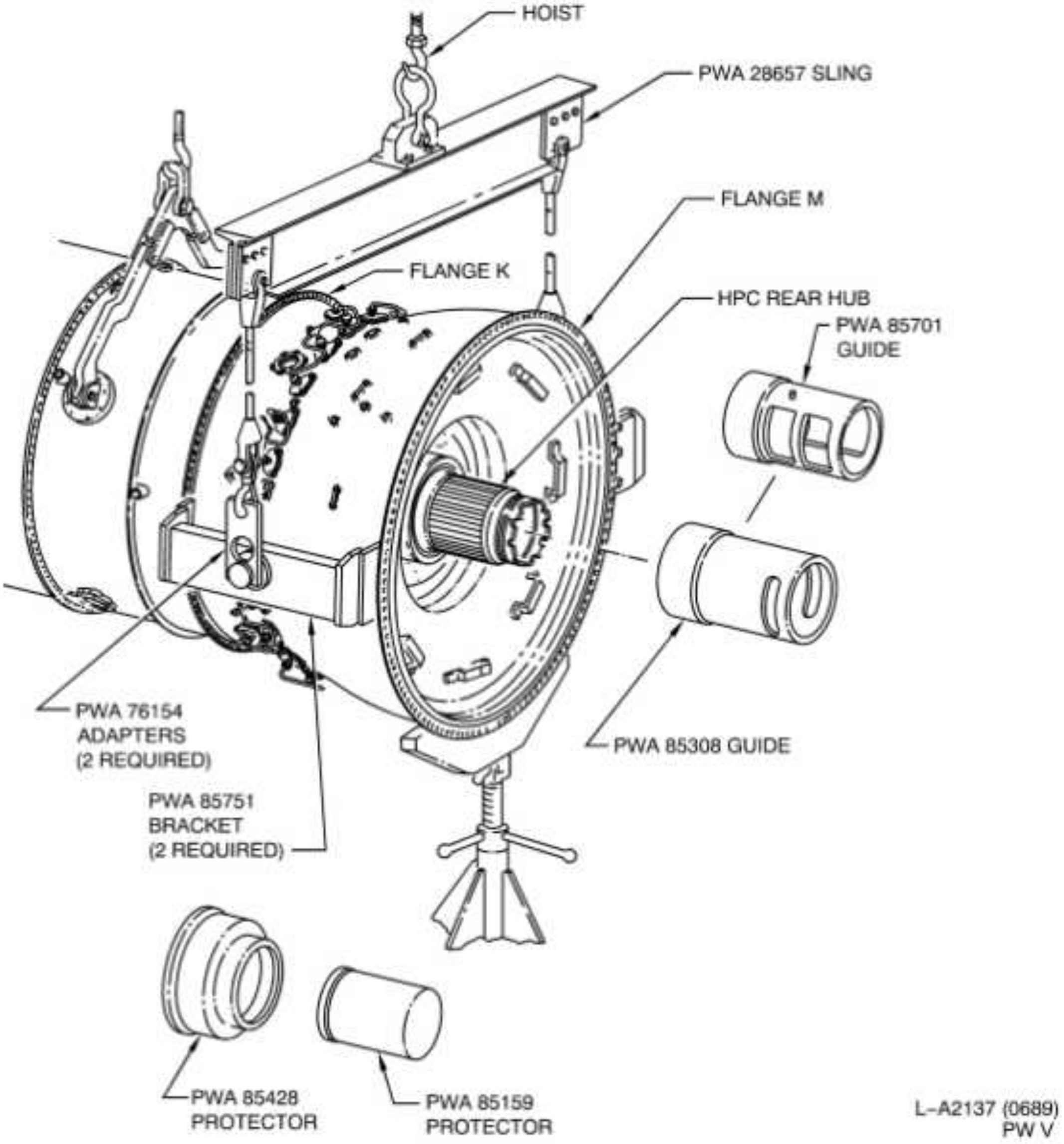
Diffuser And Combustor Removal
Figure 303
(Task 72-00-41-020-013)


1
NO. 3 BEARING OUTER RACE
2
NO. 3 BEARING RETAINING NUT
5
PWA 85797 WRENCH (SHOWN) OR PWA 86491 DRIVER
6
PWA 85071 PULLER
HOIST
7
PWA 85159 PROTECTOR
PWA 86489 JACKSCREW PULLER
3
RIVET
4
NO. 3 BEARING INNER RACE AND ROLLERS
8
HOIST
9
PWA 85390 ADAPTER
FLANGE M
FLANGE K
HPC REAR HUB
10
NO. 3 BEARING FRONT SEAL SEAT
11
NO. 3 BEARING SEAL SPACER
PWA 85168 PROTECTOR
14
PWA 85067 FIXTURE
13
PWA 85068 FIXTURE
12
L−A5342 (1093)
PW V

Diffuser And Combustor Removal (Engines Where The
No. 3 Bearing Outer Race Removal Is Necessary)
Figure 304 (Sheet 1)
(Task 72−00−41−020−013)


2
NO. 3 BEARING
RETAINING NUT
15
PWA 102743
TORQUE
ADAPTER
16
PWA 102744
HOLDER
ADAPTER
17
PWA 80187
TORQUE
MULTIPLIER
HOIST
FLANGE K
FLANGE M
HPC REAR
HUB
L−B6279 (0698)
PW V

Diffuser And Combustor Removal (Engines Where The
No. 3 Bearing Outer Race Removal Is Necessary)
Figure 304 (Sheet 2)
(Task 72−00−41−020−013)


HOIST
PWA 28657 SLING
FLANGE M
FLANGE K
HPC REAR HUB
PWA 85701 GUIDE
PWA 76154 ADAPTERS (2 REQUIRED)
PWA 85308 GUIDE
PWA 85751 BRACKET (2 REQUIRED)
PWA 85428 PROTECTOR
PWA 85159 PROTECTOR
L−A2137 (0689)
PW V

Diffuser And Combustor Removal
Figure 305
(Task 72−00−41−020−013)

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-13

Task 72-00-41-050-006:

1. Remove Fuel Injector And Support

A. Prerequisites

(1) To gain access to fuel injectors No. 16 and 17, remove oil tank per 72-00-61, Removal-28 (Task 72-00-61-050-012).

(2) To gain access to fuel injector No. 20, remove (upper left) turbine cooling tube (AP04) per 72-00-52, Removal-07 Task 72-00-53-050-004.

(3) To gain access to fuel injector No. 7, remove (lower right) turbine cooling tube (AP02) per 72-00-52, Removal-07 Task 72-00-53-050-004.

B. Equipment And Materials Required - None

C. Procedure
See Figure 301, Figure 302, Figure 303, Figure 304, and Figure 305.

(1) If access to injector No. 22 is required, remove (left) diffuser seal air vent tube (AP22) as follows. See Figure 302.

(a) Remove lockwire and disconnect tube nut from diffuser case internal tube at approximately 11 o'clock position.

(b) Loosen bolts, nuts, and clamps securing tubes to bracket attached to forward end of tube.

(c) Remove lockwire and bolts securing tube elbow and bracket to HPC rear case.

(d) Remove bolt, nut, and clamp securing tube to bracket at No. 21 fuel injector.

(e) (Pre SB PW4ENG 72-567) Remove tube from engine and remove deflector from HPC case. Remove and discard gaskets. Install protective closures.

CAUTION: (POST SB PW4ENG 72-567) WHEN YOU REMOVE THE (AP22) LEFT SIDE TUBE LOCK FROM THE INTERNAL DIFFUSER SEAL AIR VENT TUBE ASSEMBLY, YOU MUST BE CAREFUL THAT THE AIR VENT TUBE DOES NOT FALL INTO THE

DIFFUSER CASE. AS A PRECAUTION, ATTACH A TEMPORARY SAFETY WIRE AROUND THE INTERNAL DIFFUSER SEAL AIR VENT TUBE ASSEMBLY SO IT WILL NOT FALL INTO THE DIFFUSER CASE. IF THE AIR VENT TUBE FALLS INTO THE DIFFUSER CASE IT IS POSSIBLE THAT MORE ENGINE DISASSEMBLY WILL BE NECESSARY TO GET ACCESS TO REMOVE THE TUBE.

(f) (Post SB PW4ENG 72−567) Remove the bolt, nut and clamp that attach the tube to a fuel injector bracket. Remove the tube from the engine. Remove the deflector from the recessed area of the diffuser case pad. Remove and discard the gaskets from the tube flanged end and from the diffuser case pad. Remove the tube locks and gaskets from the diffuser case pad and install protective covers.

(2) If access to injector No. 12 is required, remove lower right turbine blade cooling air tube (AP37) as follows. See Figure 303.

(a) Remove lockwire, ten bolts, and bracket securing tube flange to diffuser case at approximately 5 o'clock position.

(b) Remove bolt, nut, and clamp securing fuel injector supply manifold to bracket. Remove bracket.

(c) Remove bolts and bracket securing tube flange to air shutoff valve on HPC case.

(d) Remove bolts, nuts, and clamps securing tube to diffuser case brackets and remove tube from engine.

(e) (Pre SB PW4ENG 72−572 or SB PW4ENG 72−537 or Post SB PW4ENG 72−627) Remove the tube from the engine. Remove and discard the gaskets. Remove the metering plate and tube locks. Install the protective closures.

(f) (Post SB PW4ENG 72−572 and Pre SB PW4ENG 72−627 or Post SB PW4ENG 72−537 and Pre SB PW4ENG 72−627) Remove the tube from the engine. Remove and discard the gaskets. Remove the ring spacer and tube locks. Install the protective closures.

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−13

(3) If access to injector No. 13 is required, remove No. 3 bearing oil scavenge manifold (LR04). See Figure 304.

(a) (Pre SB PW4ENG 79−46) Remove nut, bolt and clamp securing manifold (LR04) to the oil pump bracket. Manifold (LR05) is also secured to this bracket with the same nut and bolt. See Figure 304 (Sheet 1).

(b) (Post SB PW4ENG 79−46 and Pre SB PW4ENG 79−75) Remove nut, bolt and clamp securing manifold (LR04) to the oil pump bracket. Manifold (LR05) is also secured to this bracket with the same nut and bolt. Also remove the additional nut, bolt, grommet halves and clamp on (LR04) manifold where it is clamped to the the (LR05) manifold. See Figure 304 (Sheet 2).

(c) (Post SB PW4ENG 79−75) Remove nuts, bolts and clamps securing the hose and manifold assembly (LR04) to the fluid pressure dampener or (Post SB PW4ENG 79−86) adapter bracket and to the bracket mounted between fuel injector pads 12 and 13. Remove the bracket installed between fuel injector pads 12 and 13. See Figure 304 (Sheets 3 through 6).

(d) Remove lockwire and disconnect diffuser case internal tube nut from manifold elbow at 6 o'clock position.

(e) Remove bolts securing manifold to main oil pump. Remove manifold from engine.

NOTE: Catch oil in container with a capacity of 5 U.S. gallons (19 liters).

(f) Remove and discard packing. Install protective closures.

(4) Remove lockwire and disconnect fuel supply tube from fuel injector supply manifold. See Figure 301.

NOTE: A small amount of fuel will drain from injectors. Be prepared to catch fuel in suitable container.

(5) Remove lockwire and disconnect fuel injector supply manifold nuts from injector being removed and from two adjacent injectors supplied from same manifold. Remove manifold and transfer tube. Discard packings. See Figure 301.

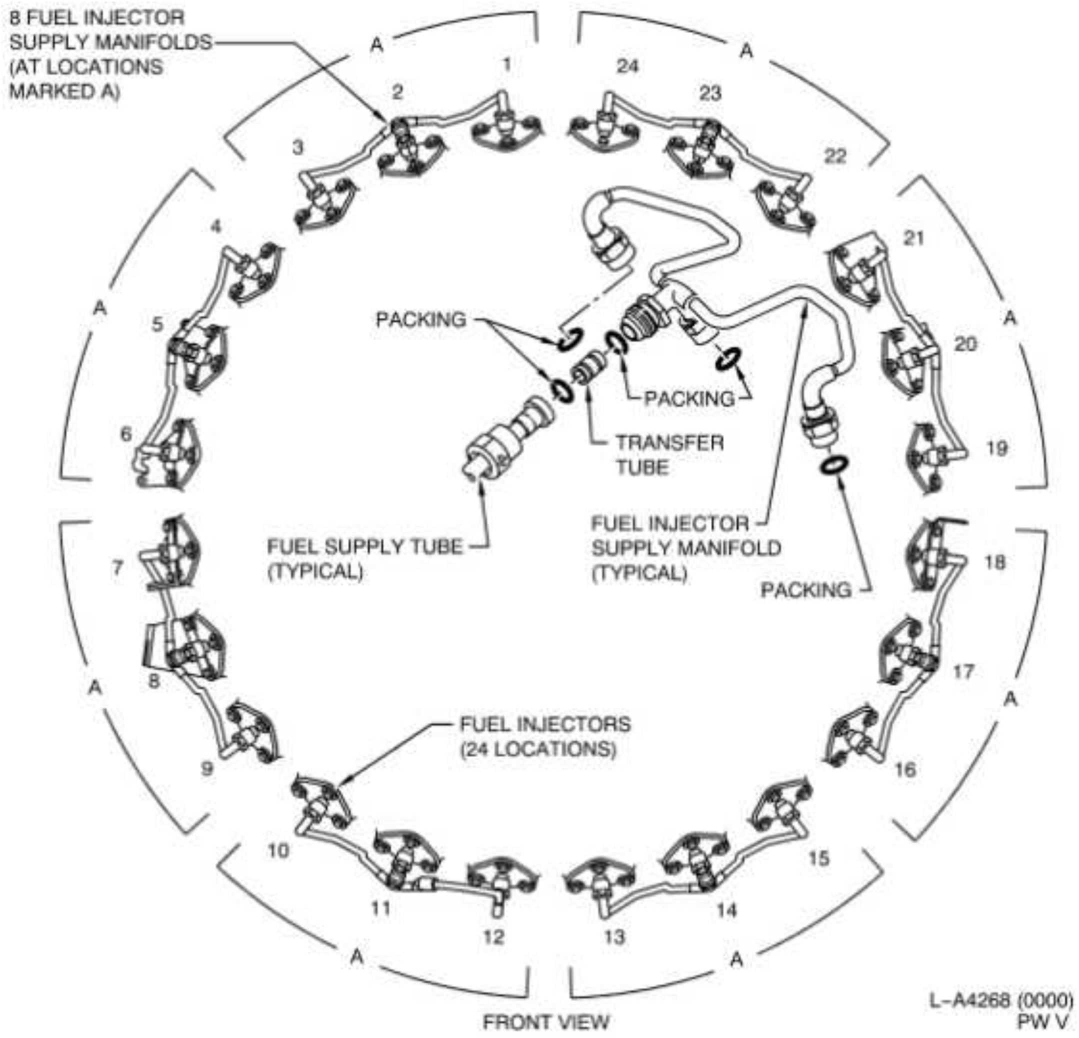
(6) Remove lockwire and bolts securing injector being removed. Remove injector, gasket, and bracket (if applicable). Discard gasket. See Figure 301 and Figure 305.

NOTE: Rotate and/or tilt injector as required to disengage injector from diffuser case. Mark location of removed injectors and brackets to facilitate reassembly.

(7) Install protective closures.

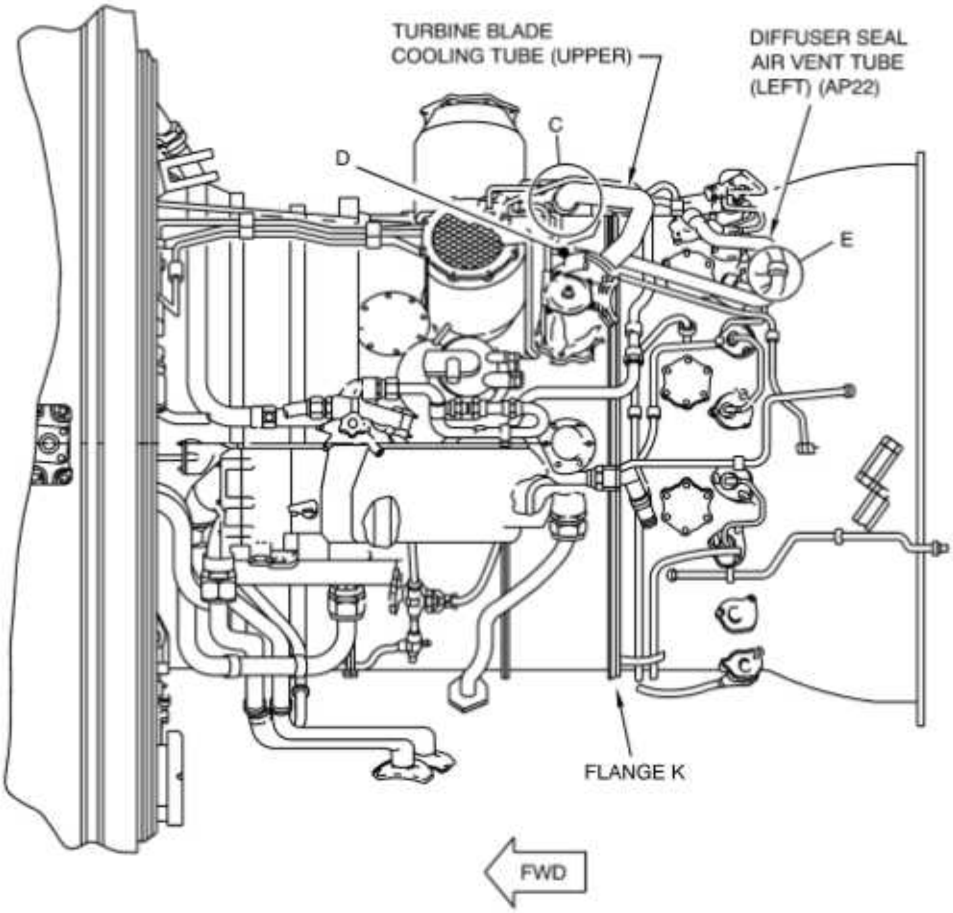
NOTE: For additional information concerning detailed maintenance of this component, see Fuel Injector Component Maintenance Manual, 73−11−11 (P&W Manual PN 50A446).

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−13


8 FUEL INJECTOR SUPPLY MANIFOLDS (AT LOCATIONS MARKED A)
A
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
PACKING
PACKING
TRANSFER TUBE
FUEL SUPPLY TUBE (TYPICAL)
FUEL INJECTOR SUPPLY MANIFOLD (TYPICAL)
PACKING
FUEL INJECTORS (24 LOCATIONS)
FRONT VIEW
L−A4268 (0000)
PW V

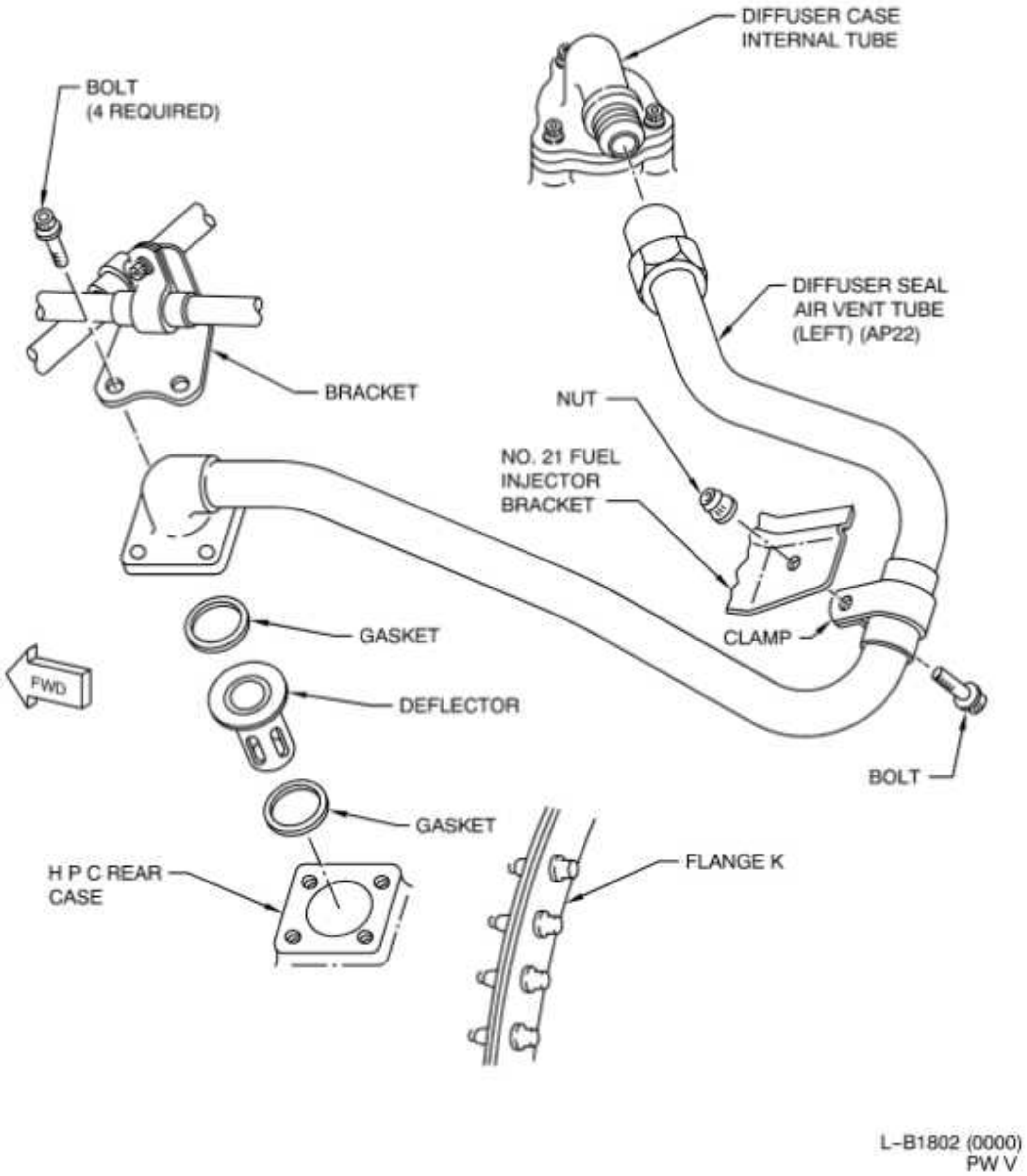
Fuel Injectors And Supply Manifolds Locations
Figure 301
(Task 72−00−41−050−006)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−13

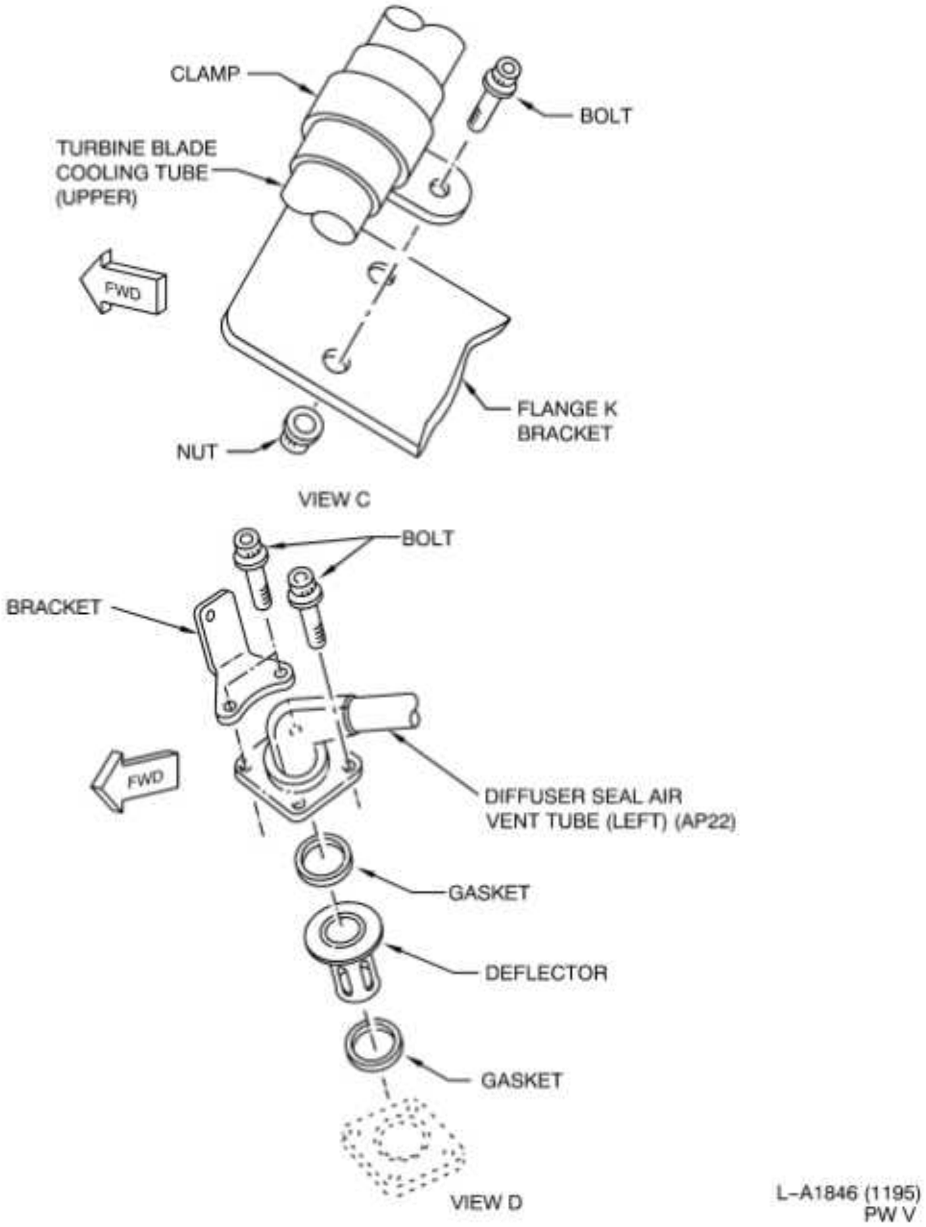

TURBINE BLADE COOLING TUBE (UPPER)
DIFFUSER SEAL AIR VENT TUBE (LEFT) (AP22)
C
D
E
FLANGE K
FWD

L−B5894 (1197)
PW V

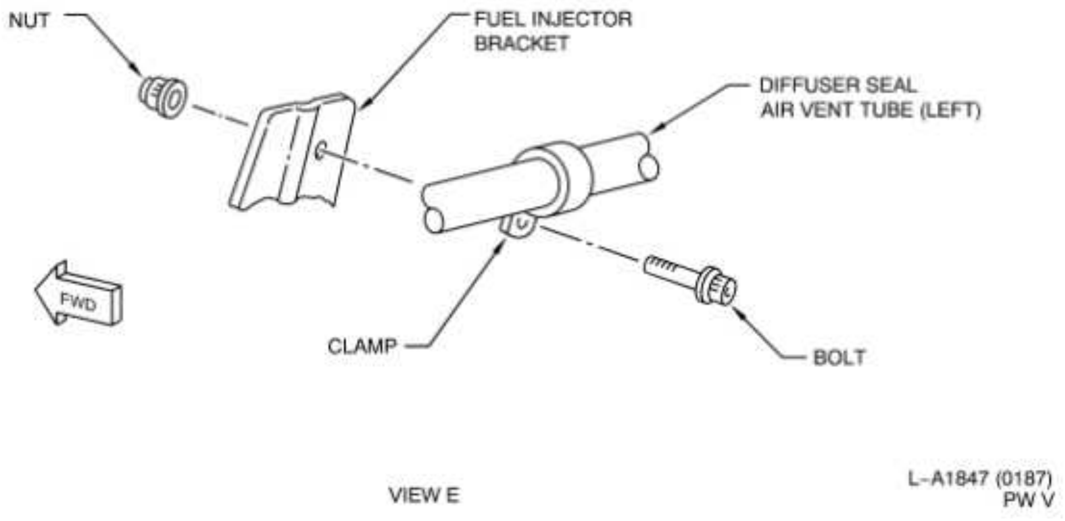
Diffuser Seal Air Vent tube (Left) Removal For Access
To Fuel Injector No. 22 (Pre SB PW4ENG 72−567)
Figure 302 (Sheet 1)
(Task 72−00−41−050−006)


DIFFUSER CASE INTERNAL TUBE
BOLT (4 REQUIRED)
DIFFUSER SEAL AIR VENT TUBE (LEFT) (AP22)
BRACKET
NUT
NO. 21 FUEL INJECTOR BRACKET
GASKET
CLAMP
FWD
DEFLECTOR
BOLT
GASKET
H P C REAR CASE
FLANGE K
L−B1802 (0000)
PW V

Diffuser Seal Air Vent Tube (Left) Removal For Access
To Fuel Injector No. 22 (Pre SB PW4ENG 72−567)
Figure 302 (Sheet 2)
(Task 72−00−41−050−006)

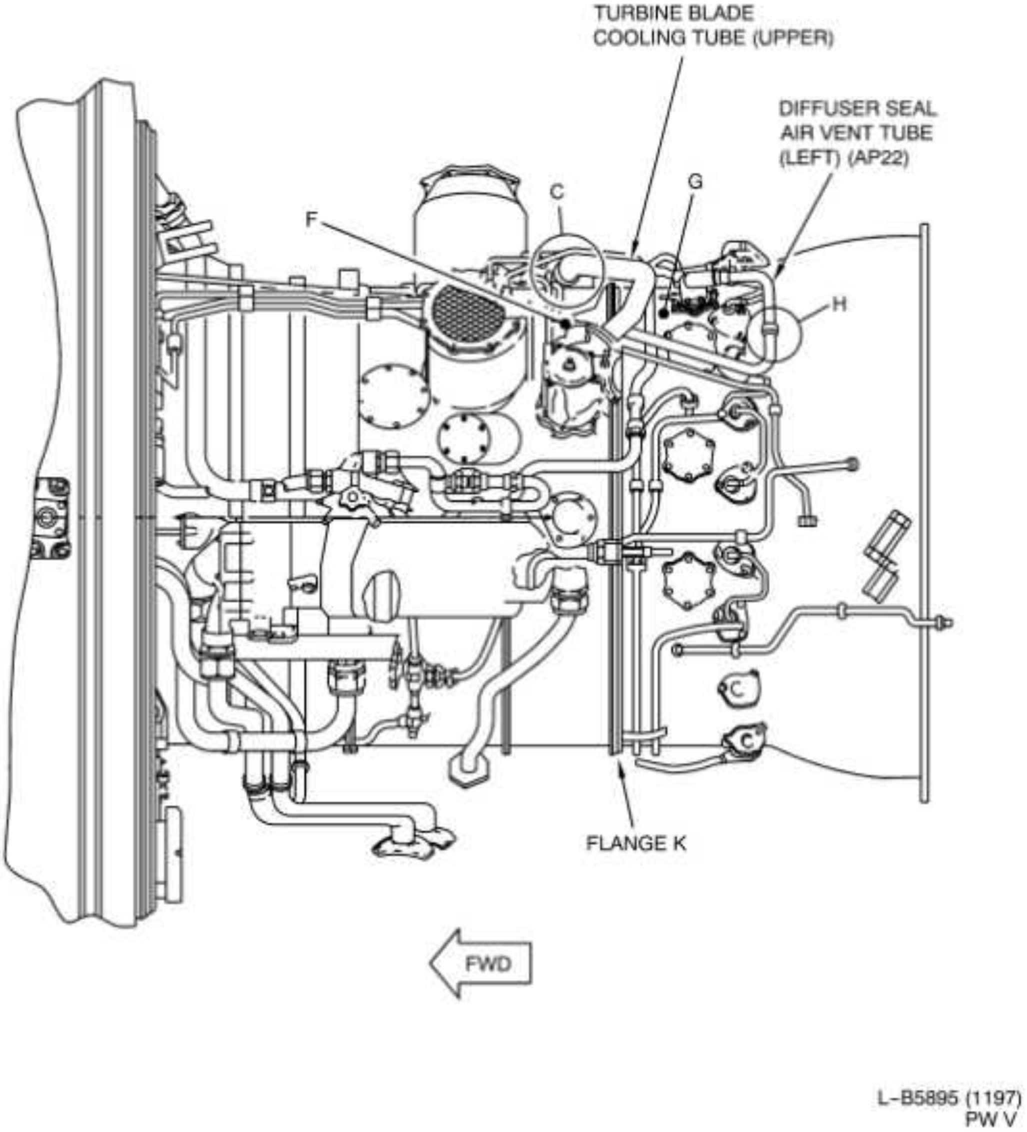

CLAMP
BOLT
TURBINE BLADE COOLING TUBE (UPPER)
FWD
FLANGE K BRACKET
NUT
VIEW C
BOLT
BRACKET
FWD
DIFFUSER SEAL AIR VENT TUBE (LEFT) (AP22)
GASKET
DEFLECTOR
GASKET
VIEW D
L-A1846 (1195)
PW V

Diffuser Seal Air Vent tube (Left) Removal For Access
To Fuel Injector No. 22 (Pre SB PW4ENG 72-567)
Figure 302 (Sheet 3)
(Task 72-00-41-050-006)

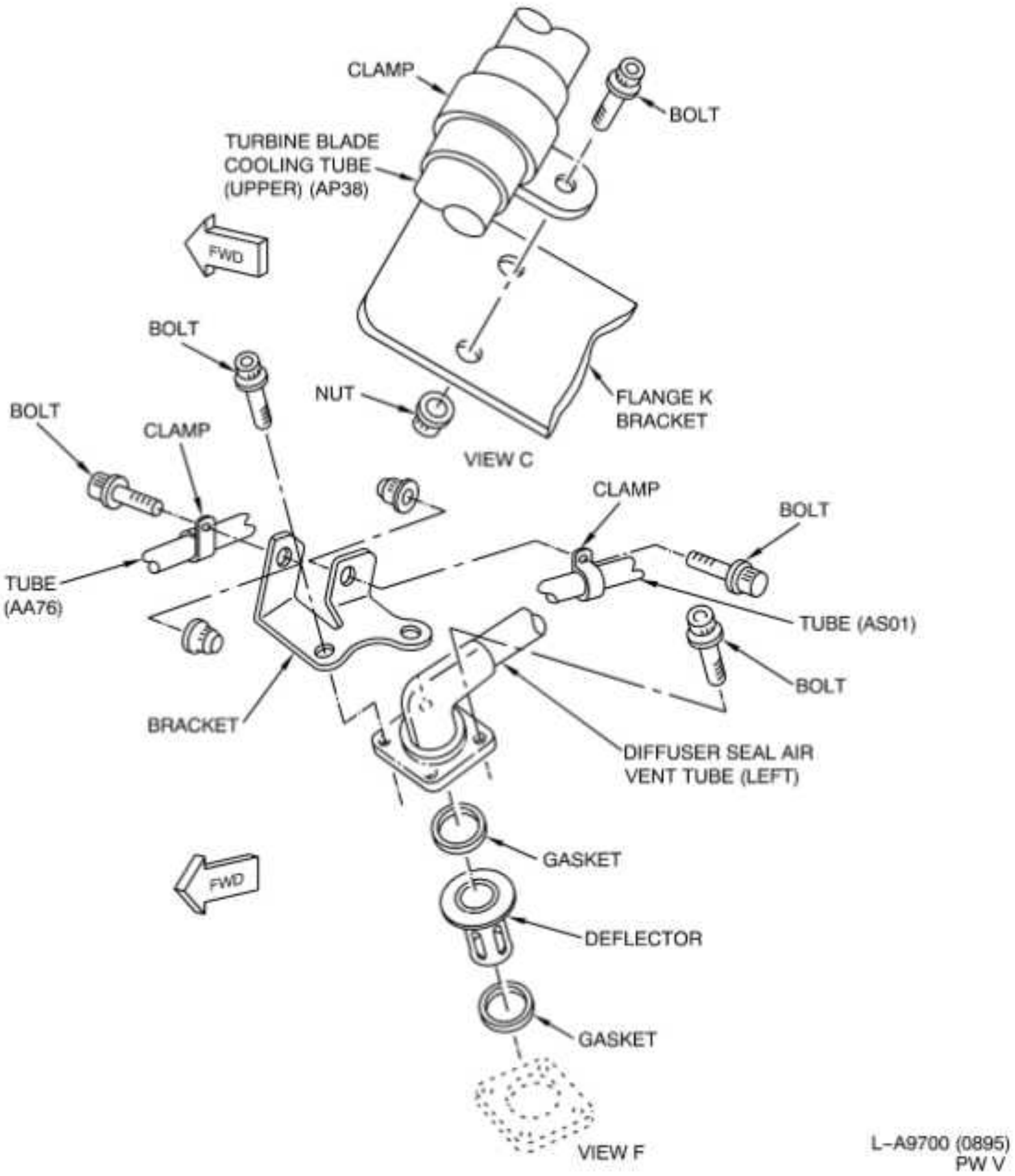

NUT
FUEL INJECTOR BRACKET
DIFFUSER SEAL AIR VENT TUBE (LEFT)
FWD
CLAMP
BOLT
VIEW E
L−A1847 (0187)
PW V

Diffuser Seal Air Vent tube (Left) Removal For Access
To Fuel Injector No. 22 (Pre SB PW4ENG 72−567)
Figure 302 (Sheet 4)
(Task 72−00−41−050−006)

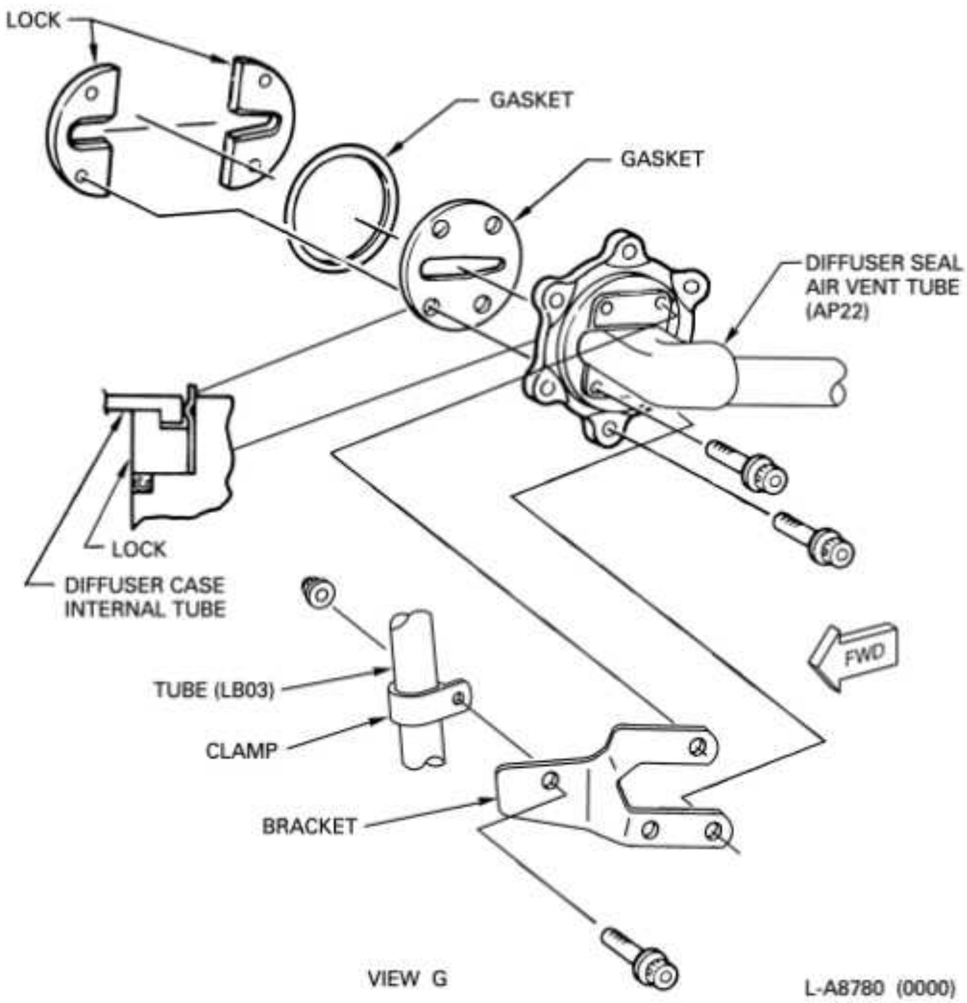
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−13


TURBINE BLADE COOLING TUBE (UPPER)
DIFFUSER SEAL AIR VENT TUBE (LEFT) (AP22)
G
C
F
H
FLANGE K
FWD
L−B5895 (1197)
PW V

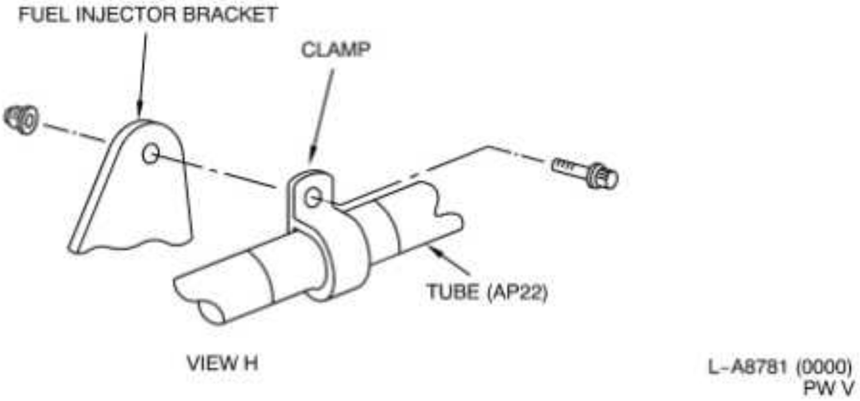
Diffuser Seal Air Vent tube (Left) Removal For Access
To Fuel Injector No. 22 (Post SB PW4ENG 72−567)
Figure 302 (Sheet 5)
(Task 72−00−41−050−006)


CLAMP
BOLT
TURBINE BLADE COOLING TUBE (UPPER) (AP38)
FWD
BOLT
NUT
FLANGE K BRACKET
BOLT
CLAMP
VIEW C
CLAMP
BOLT
TUBE (AA76)
TUBE (AS01)
BOLT
BRACKET
DIFFUSER SEAL AIR VENT TUBE (LEFT)
GASKET
FWD
DEFLECTOR
GASKET
VIEW F
L−A9700 (0895)
PW V

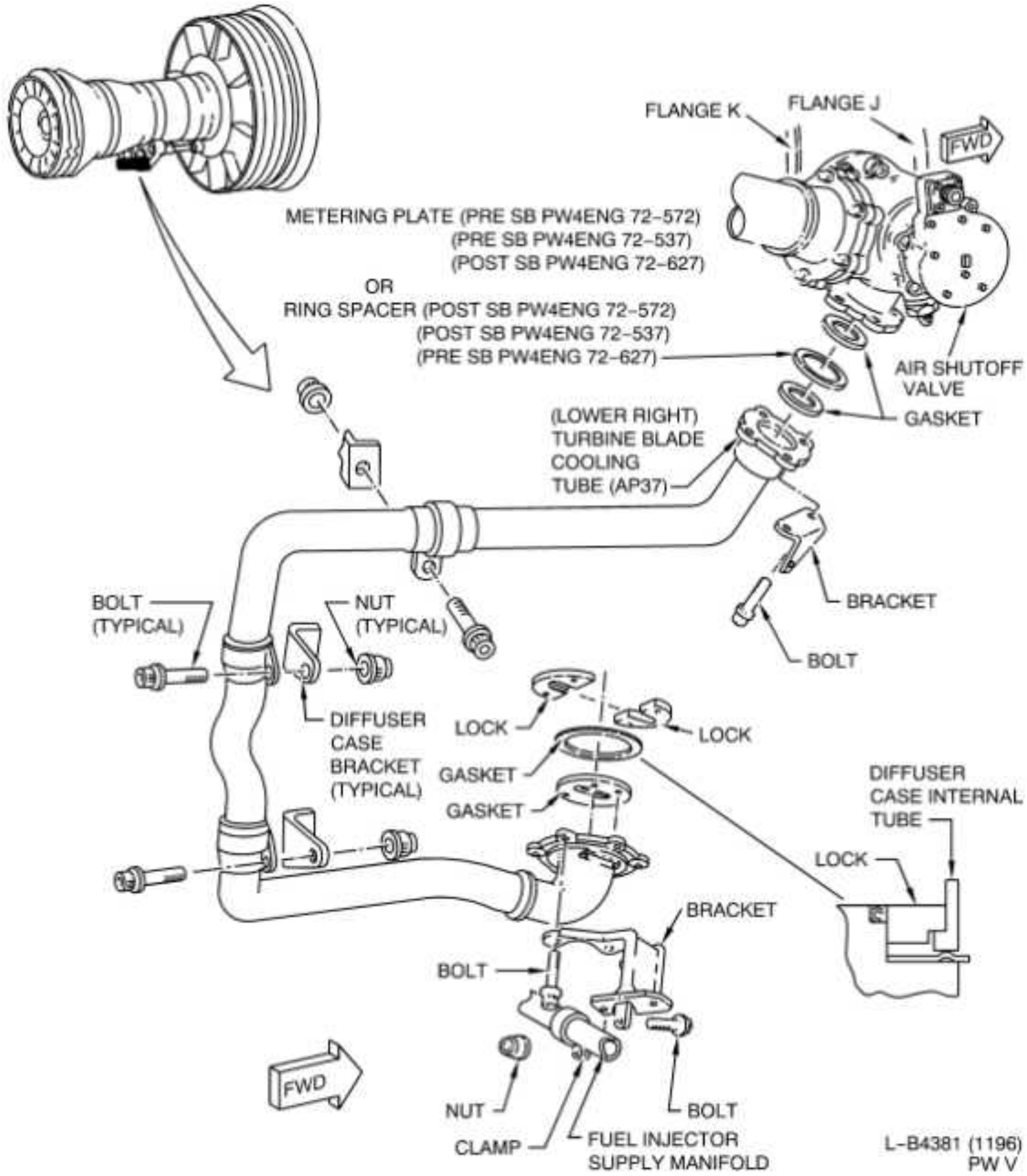
Diffuser Seal Air Vent tube (Left) Removal For Access
To Fuel Injector No. 22 (Post SB PW4ENG 72−567)
Figure 302 (Sheet 6)
(Task 72−00−41−050−006)


LOCK
GASKET
GASKET
DIFFUSER SEAL AIR VENT TUBE (AP22)
LOCK
DIFFUSER CASE INTERNAL TUBE
FWD
TUBE (LB03)
CLAMP
BRACKET
VIEW G
L-A8780 (0000)

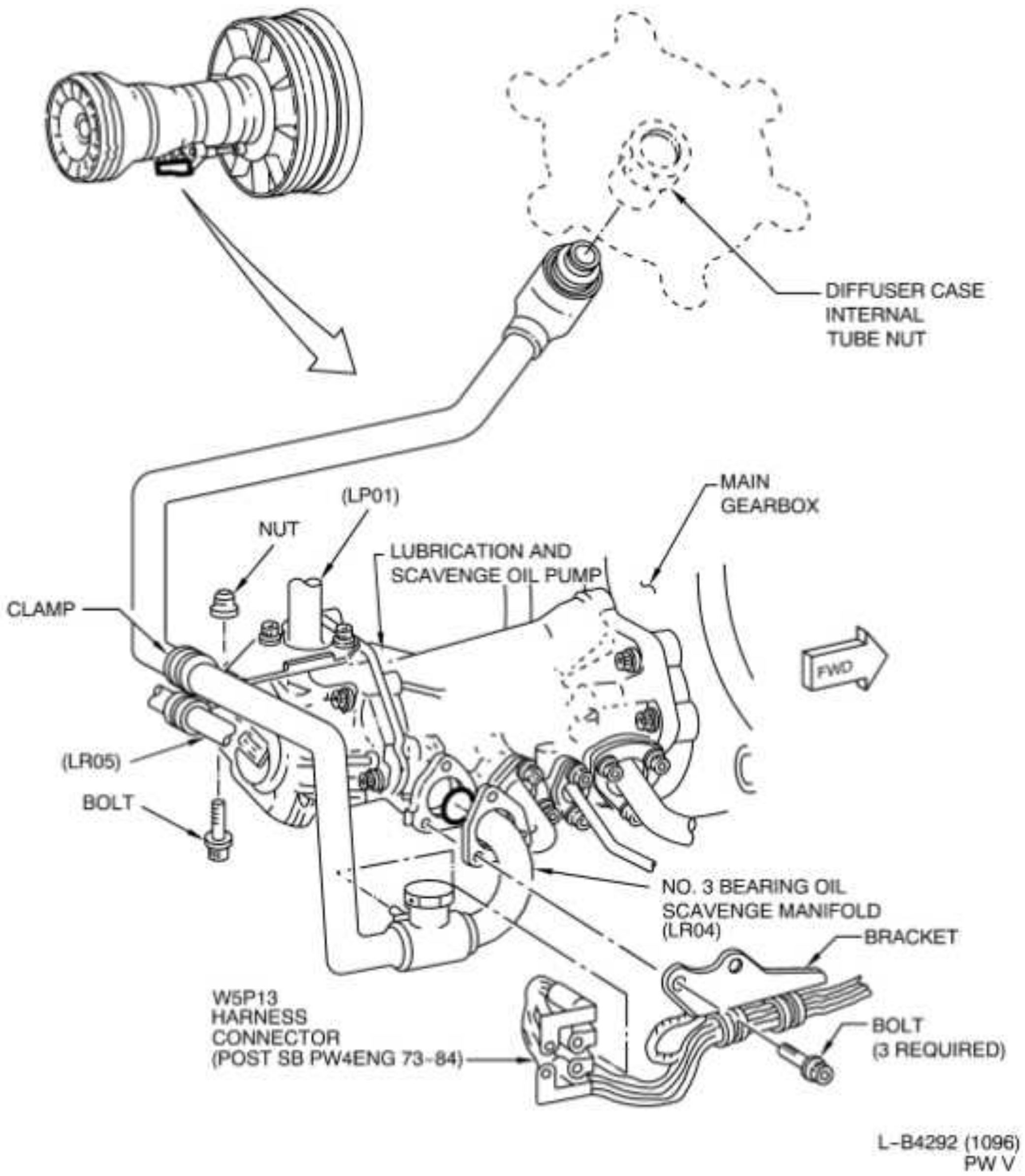
Diffuser Seal Air Vent tube (Left) Removal For Access
To Fuel Injector No. 22 (Post SB PW4ENG 72−567)
Figure 302 (Sheet 7)
(Task 72−00−41−050−006)


FUEL INJECTOR BRACKET
CLAMP
TUBE (AP22)
VIEW H
L-A8781 (0000)
PW V

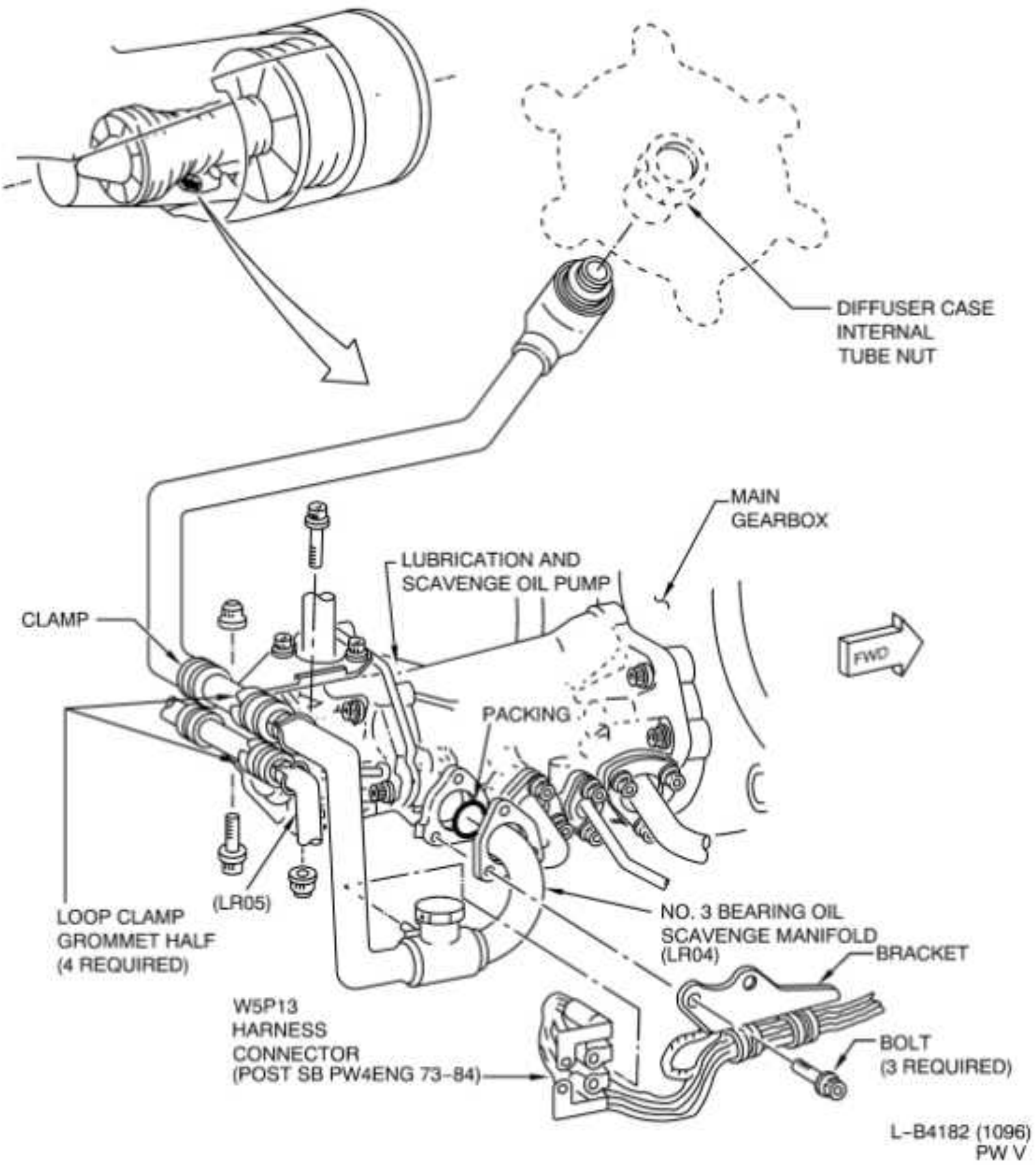
Diffuser Seal Air Vent tube (Left) Removal For Access
To Fuel Injector No. 22 (Post SB PW4ENG 72−567)
Figure 302 (Sheet 8)
(Task 72−00−41−050−006)


FLANGE K
FLANGE J
FWD
METERING PLATE (PRE SB PW4ENG 72-572)
(PRE SB PW4ENG 72-537)
(POST SB PW4ENG 72-627)
OR
RING SPACER (POST SB PW4ENG 72-572)
(POST SB PW4ENG 72-537)
(PRE SB PW4ENG 72-627)
AIR SHUTOFF VALVE
GASKET
(LOWER RIGHT) TURBINE BLADE COOLING TUBE (AP37)
BRACKET
BOLT
BOLT (TYPICAL)
NUT (TYPICAL)
DIFFUSER CASE BRACKET (TYPICAL)
LOCK
LOCK
GASKET
GASKET
DIFFUSER CASE INTERNAL TUBE
LOCK
BRACKET
BOLT
FWD
NUT
BOLT
CLAMP
FUEL INJECTOR SUPPLY MANIFOLD
L-B4381 (1196)
PW V

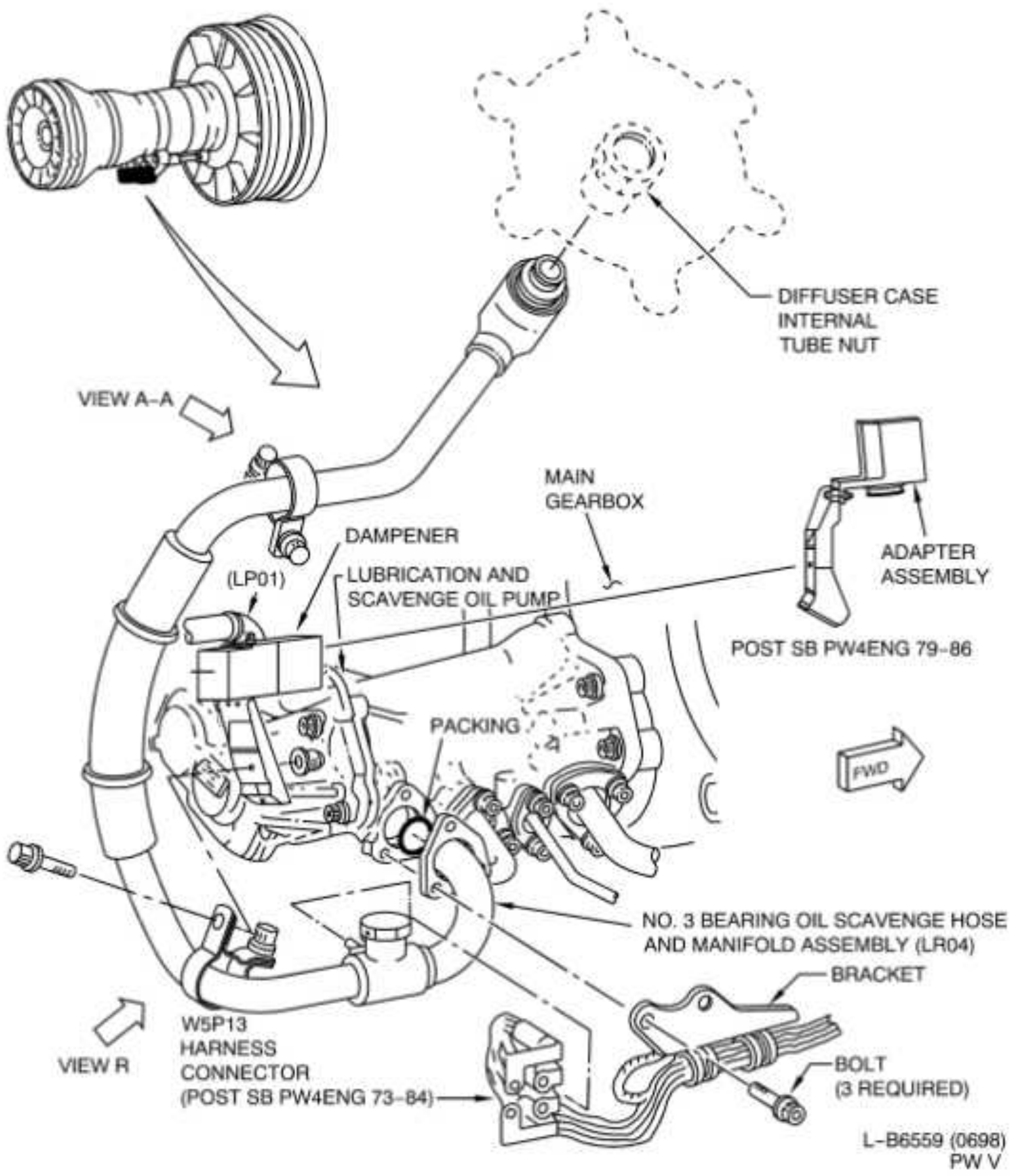
Turbine Blade Cooling Air Tube (Lower Right)
Removal For Access To Fuel Injector No. 12
Figure 303
(Task 72−00−41−050−006)


DIFFUSER CASE INTERNAL TUBE NUT
MAIN GEARBOX
(LP01)
NUT
LUBRICATION AND SCAVENGE OIL PUMP
CLAMP
FWD
(LR05)
BOLT
NO. 3 BEARING OIL SCAVENGE MANIFOLD (LR04)
BRACKET
W5P13 HARNESS CONNECTOR (POST SB PW4ENG 73-84)
BOLT (3 REQUIRED)
L-B4292 (1096)
PW V

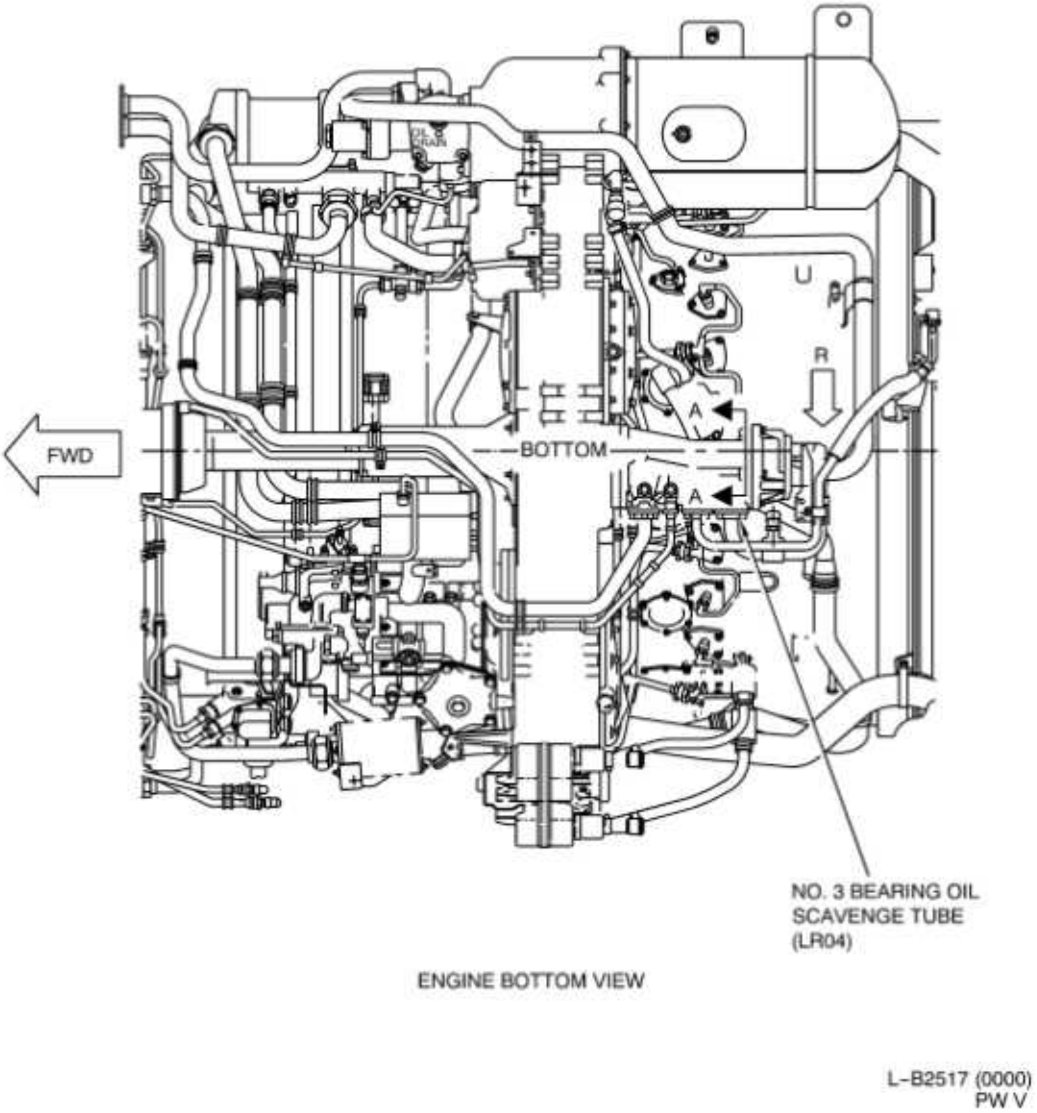
No. 3 Bearing Oil Scavenge Manifold (For Access To Fuel Injector No. 13) (Pre SB PW4ENG 79−46)
Figure 304 (Sheet 1)
(Task 72−00−41−050−006)


DIFFUSER CASE INTERNAL TUBE NUT
MAIN GEARBOX
LUBRICATION AND SCAVENGE OIL PUMP
CLAMP
FWD
PACKING
LOOP CLAMP GROMMET HALF (4 REQUIRED)
(LR05)
NO. 3 BEARING OIL SCAVENGE MANIFOLD (LR04)
BRACKET
W5P13 HARNESS CONNECTOR (POST SB PW4ENG 73-84)
BOLT (3 REQUIRED)
L-B4182 (1096)
PW V

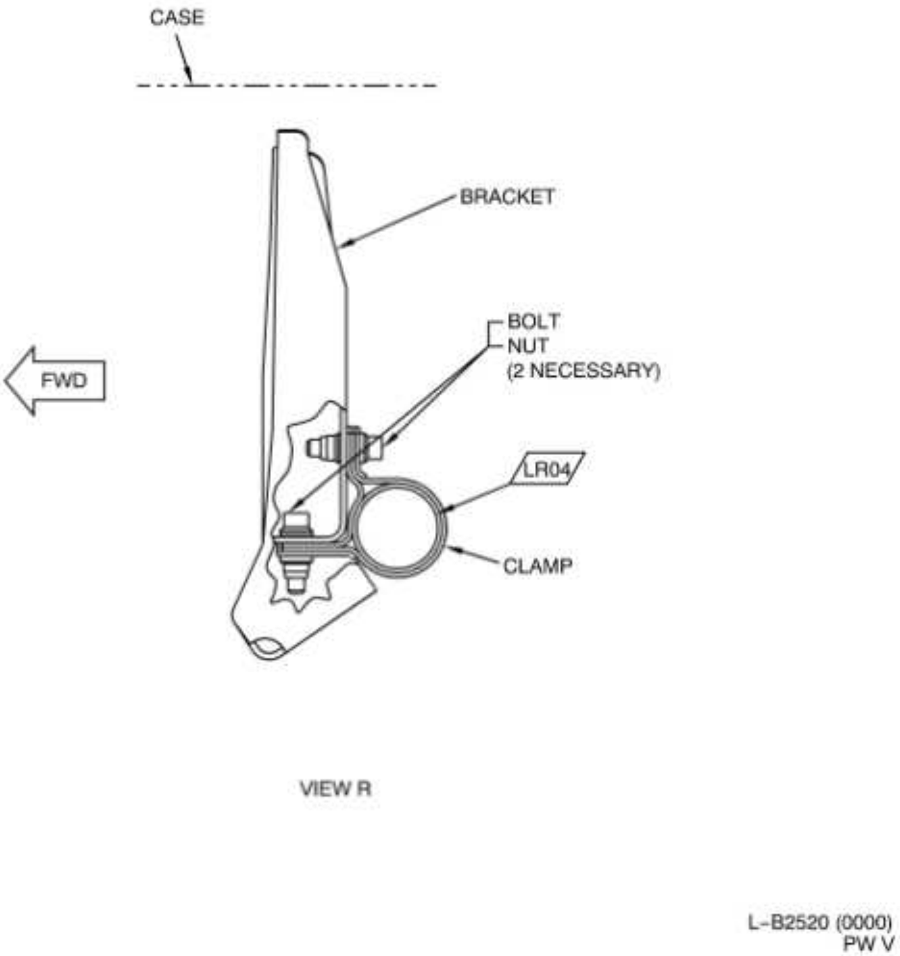
No. 3 Bearing Oil Scavenge Manifold (For Access To Fuel Injector No. 13) (Post SB PW4ENG 79−46 And Pre SB PW4ENG 79−75)
Figure 304 (Sheet 2)
(Task 72−00−41−050−006)


DIFFUSER CASE INTERNAL TUBE NUT
VIEW A-A
MAIN GEARBOX
DAMPENER
ADAPTER ASSEMBLY
(LP01)
LUBRICATION AND SCAVENGE OIL PUMP
POST SB PW4ENG 79-86
PACKING
FWD
NO. 3 BEARING OIL SCAVENGE HOSE AND MANIFOLD ASSEMBLY (LR04)
BRACKET
VIEW R
W5P13 HARNESS CONNECTOR (POST SB PW4ENG 73-84)
BOLT (3 REQUIRED)
L-B6559 (0698)
PW V

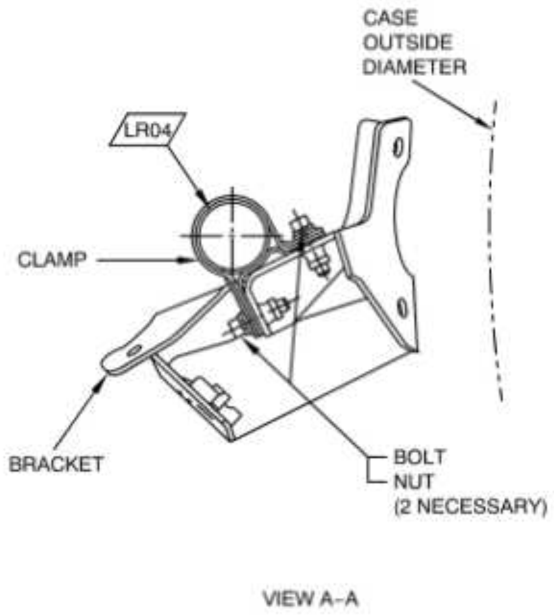
No. 3 Bearing Oil Scavenge Manifold (For Access To Fuel Injector No. 13) (Post SB PW4ENG 79−75)
Figure 304 (Sheet 3)
(Task 72−00−41−050−006)


FWD
BOTTOM
A
A
U
R
NO. 3 BEARING OIL SCAVENGE TUBE (LR04)
ENGINE BOTTOM VIEW
L-B2517 (0000)
PW V

No. 3 Bearing Oil Scavenge Manifold (For Access
To Fuel Injector No. 13) (Post SB PW4ENG 79−75)
Figure 304 (Sheet 4)
(Task 72−00−41−050−006)

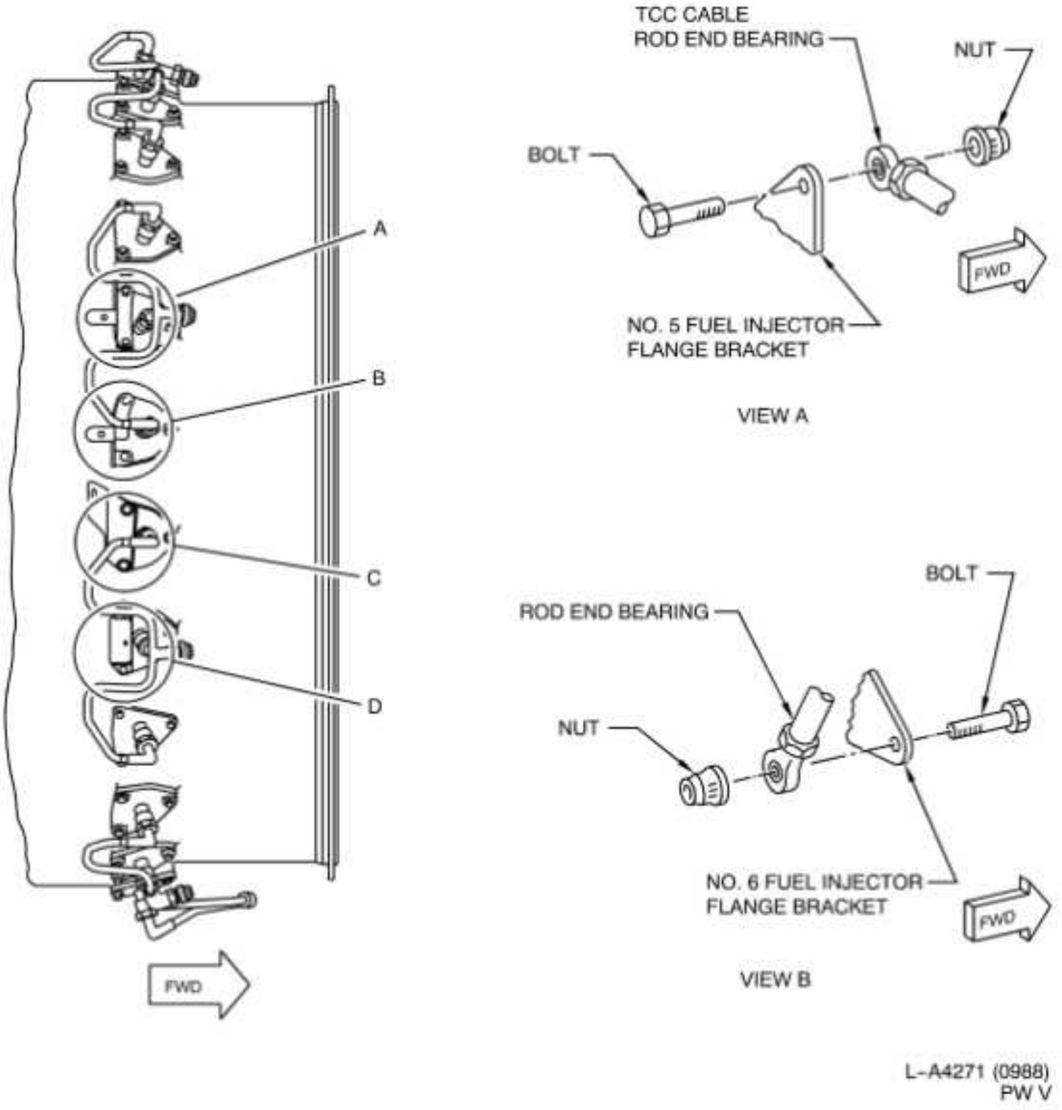

CASE
BRACKET
BOLT
NUT
(2 NECESSARY)
FWD
LR04
CLAMP
VIEW R
L−B2520 (0000)
PW V

No. 3 Bearing Oil Scavenge Manifold (For Access
To Fuel Injector No. 13) (Post SB PW4ENG 79−75)
Figure 304 (Sheet 5)
(Task 72−00−41−050−006)

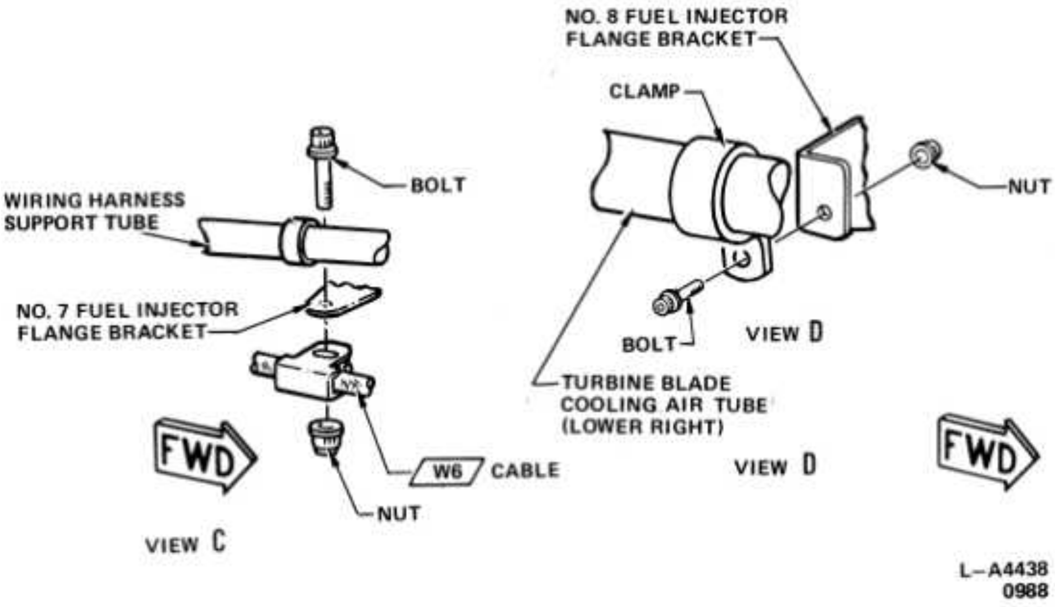

CASE
OUTSIDE
DIAMETER
LR04
CLAMP
BRACKET
BOLT
NUT
(2 NECESSARY)
VIEW A-A

L-B2519 (0000)
PW V

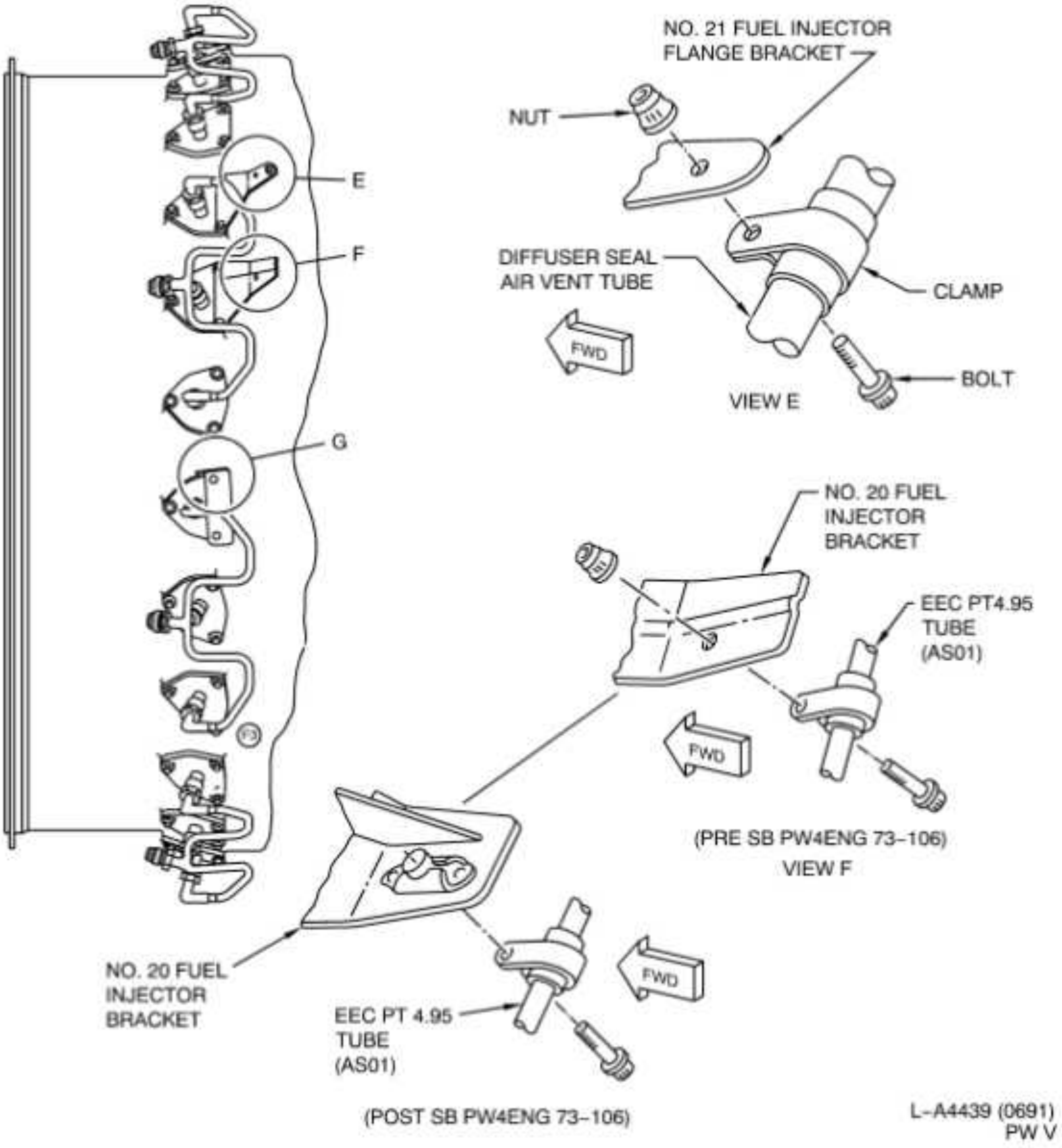
No. 3 Bearing Oil Scavenge Manifold (For Access
To Fuel Injector No. 13) (Post SB PW4ENG 79−75)
Figure 304 (Sheet 6)
(Task 72−00−41−050−006)


TCC CABLE ROD END BEARING
NUT
BOLT
NO. 5 FUEL INJECTOR FLANGE BRACKET
FWD
VIEW A
A
B
C
D
BOLT
ROD END BEARING
NUT
NO. 6 FUEL INJECTOR FLANGE BRACKET
FWD
VIEW B
FWD
L-A4271 (0988)
PW V

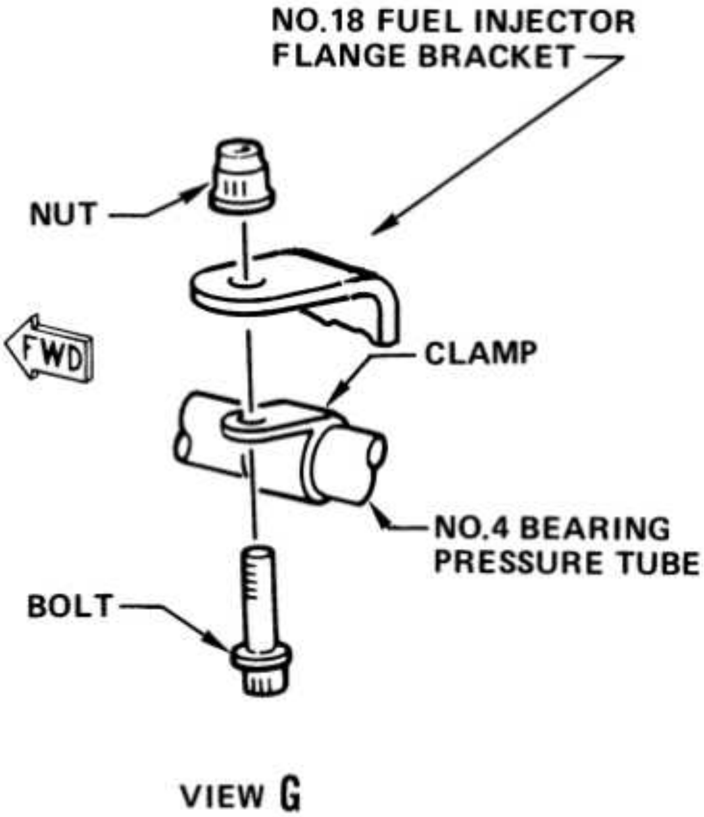
Fuel Injector Flange Brackets And Clamping (Right Side)
Figure 305 (Sheet 1)
(Task 72−00−41−050−006)


NO. 8 FUEL INJECTOR FLANGE BRACKET
CLAMP
BOLT
WIRING HARNESS SUPPORT TUBE
NUT
NO. 7 FUEL INJECTOR FLANGE BRACKET
BOLT
VIEW D
TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT)
FWD
W6
CABLE
VIEW D
FWD
NUT
VIEW C
L−A4438
0988

Fuel Injector Flange Brackets And Clamping (Right Side)
Figure 305 (Sheet 2)
(Task 72−00−41−050−006)


NO. 21 FUEL INJECTOR FLANGE BRACKET
NUT
E
F
DIFFUSER SEAL AIR VENT TUBE
CLAMP
FWD
BOLT
VIEW E
G
NO. 20 FUEL INJECTOR BRACKET
EEC PT4.95 TUBE (AS01)
FWD
(PRE SB PW4ENG 73−106)
VIEW F
NO. 20 FUEL INJECTOR BRACKET
FWD
EEC PT 4.95 TUBE (AS01)
(POST SB PW4ENG 73−106)
L−A4439 (0691)
PW V

Fuel Injector Flange Brackets And Clamping (Left Side)
Figure 305 (Sheet 3)
(Task 72−00−41−050−006)


NO.18 FUEL INJECTOR FLANGE BRACKET
NUT
FWD
CLAMP
NO.4 BEARING PRESSURE TUBE
BOLT
VIEW G

L−A4440
0988

Fuel Injector Flange Brackets And Clamping (Left Side)
Figure 305 (Sheet 4)
(Task 72−00−41−050−006)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−13

Task 72−00−41−050−008:

1. Remove Fuel Injector And Support

A. Prerequisites

(1) To gain access to fuel injectors No. 16 and 17, remove oil tank by 72−00−61, Removal−28 Task 72−00−61−050−012.

(2) To gain access to fuel injector No. 20, remove (upper left) turbine cooling tube (AP04) by 72−00−52, Removal−07 Task 72−00−53−050−004.

(3) To gain access to fuel injector No. 7, remove (lower right) turbine cooling tube (AP02) by 72−00−52, Removal−07 Task 72−00−53−050−004.

B. Equipment And Materials Required − None

C. Procedure
See Figure 301, Figure 302, Figure 303, Figure 304 and Figure 305.

(1) If access to injector No. 22 is necessary, remove the diffuser seal air vent tube assembly (AP22) as follows. See Figure 302.

(a) Remove the lockwire and the bolts that attach the tube to a diffuser case pad at approximately the 11 o'clock position.

(b) (If not removed before) Remove the bolt, nut and clamp from the No. 3 bearing breather tube (LB03) that is attached to the bracket on the diffuser case pad with tube assembly (AP22). Remove the bracket.

(c) Remove the bolts, nuts and clamps that attach the PT4.95 tube (AS01) and the air shutoff valve signal tube (AA76) to the bracket attached to the upper flange end of the tube. Remove the lockwire, bolts and bracket that attach the tube to HPC rear case.

CAUTION: WHEN YOU REMOVE THE (AP22) LEFT SIDE TUBE LOCK FROM THE INTERNAL DIFFUSER SEAL AIR VENT TUBE ASSEMBLY, YOU MUST BE CAREFUL THAT THE AIR VENT TUBE DOES NOT FALL INTO THE DIFFUSER CASE. AS A PRECAUTION, ATTACH A TEMPORARY SAFETY

WIRE AROUND THE INTERNAL DIFFUSER SEAL AIR VENT TUBE ASSEMBLY SO IT WILL NOT FALL INTO THE DIFFUSER CASE. IF THE AIR VENT TUBE FALLS INTO THE DIFFUSER CASE IT IS POSSIBLE THAT MORE ENGINE DISASSEMBLY WILL BE NECESSARY TO GET ACCESS TO REMOVE THE TUBE.

(d) Remove the bolt, nut and clamp that attach the tube to a fuel injector bracket. Remove the tube from the engine. Remove the deflector assembly from the recessed area of the flanged end (with four holes) of the tube. Remove the tube locks from the engine. Remove and discard the gaskets. Install protection covers.

(2) If access to injector No. 12 is required, remove lower right turbine blade cooling air tube (AP37) as follows. See Figure 303.

(a) Remove lockwire, ten bolts, and bracket securing tube flange to diffuser case at approximately 5 o'clock position.

(b) Remove bolt, nut, and clamp securing fuel injector supply manifold to bracket. Remove bracket.

(c) Remove bolts and bracket securing tube flange to air shutoff valve on HPC case.

(d) Remove bolts, nuts, and clamps securing tube to diffuser case brackets.

(e) (Pre SB PW4ENG 72−537 or Post SB PW4ENG 72−627) Remove the tube from the engine. Remove and discard the gaskets. Remove the metering plate and tube locks. Install the protective closures.

(f) (Post SB PW4ENG 72−537 and Pre SB PW4ENG 72−627) Remove the tube from the engine. Remove and discard the gaskets. Remove the ring spacer and tube locks. Install the protective closures.

(3) If access to injector No. 13 is required, remove No. 3 bearing oil scavenge manifold (LR04). See Figure 304.

(a) (Pre SB PW4ENG 79−46) Remove nut, bolt and clamp securing manifold (LR04) to the oil pump bracket. Manifold (LR05) is also secured to this bracket with the same nut and bolt. See Figure 304 (Sheet 1).

(b) (Post SB PW4ENG 79−46 and Pre SB PW4ENG 79−75) Remove nut, bolt and clamp securing manifold (LR04) to the oil pump bracket. Manifold (LR05) is also secured to this bracket with the same nut and bolt. Also remove the additional nut, bolt, grommet halves and clamp on (LR04) manifold where it is clamped to the the (LR05) manifold. See Figure 304 (Sheet 2).

(c) (Post SB PW4ENG 79−75) Remove nuts, bolts and clamps securing the hose and manifold assembly (LR04) to the fluid pressure dampener or (Post SB PW4ENG 79−86) adapter bracket and to the bracket mounted between fuel injector pads 12 and 13. Remove the bracket installed between fuel injector pads 12 and 13. See Figure 304 (Sheets 3 through 6).

(d) Remove lockwire and disconnect diffuser case internal tube nut from manifold elbow at 6 o'clock position.

(e) Remove bolts securing manifold to main oil pump. Remove manifold from engine.

NOTE: Catch oil in container with a capacity of 5 U.S. gallons (19 liters).

(f) Remove and discard packing. Install protective closures.

(4) Remove lockwire and disconnect fuel supply tube from fuel injector supply manifold. See Figure 301.

NOTE: A small amount of fuel will drain from injectors. Be prepared to catch fuel in suitable container.

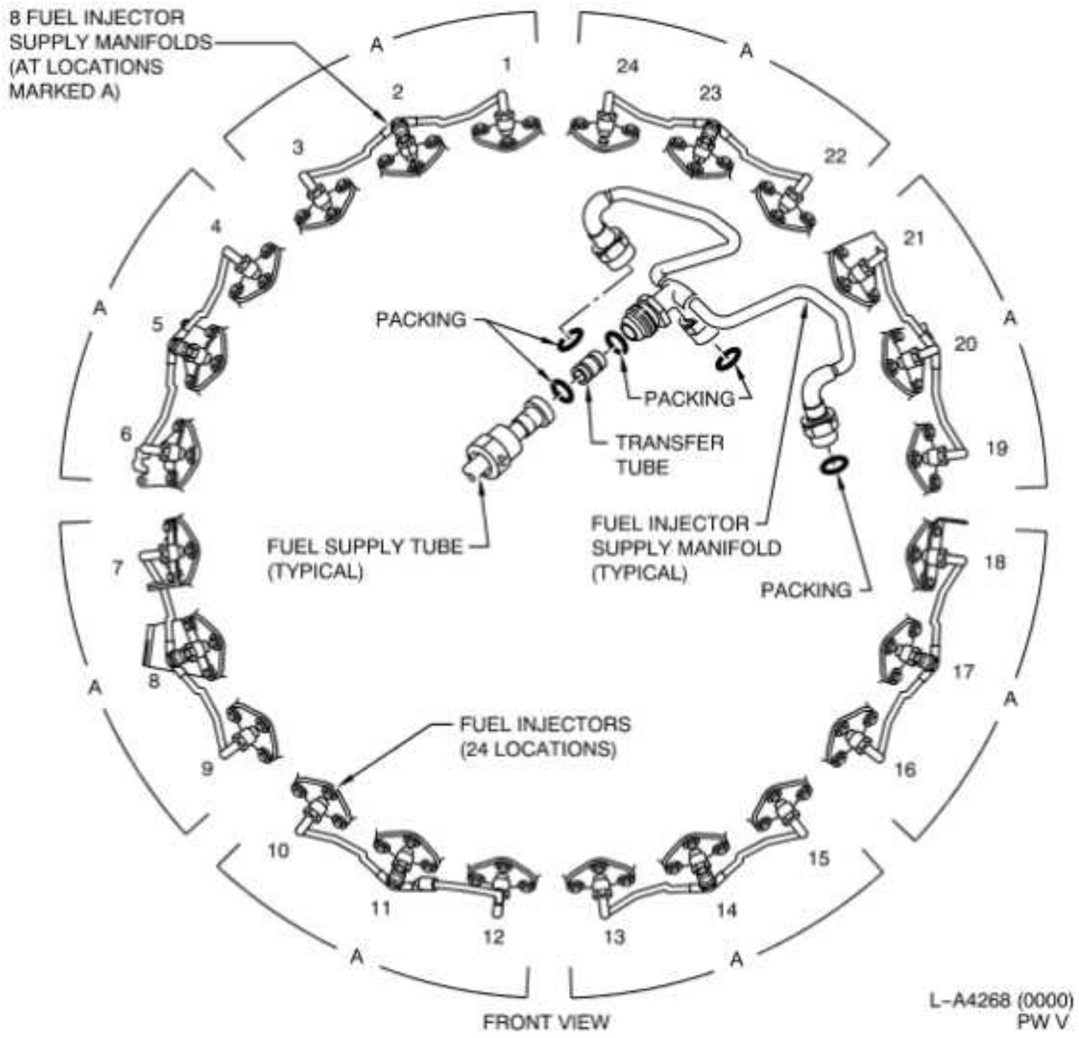
(5) Remove lockwire and disconnect fuel injector supply manifold nuts from injector being removed and from two adjacent injectors supplied from same manifold. Remove manifold and transfer tube. Discard packings. See Figure 301.

(6) Remove lockwire and bolts securing injector being removed. Remove injector, gasket, and bracket (if applicable). Discard gasket. See Figure 301 and Figure 305.

NOTE: Rotate and/or tilt injector as required to disengage injector from diffuser case. Mark location of removed injectors and brackets to facilitate reassembly.

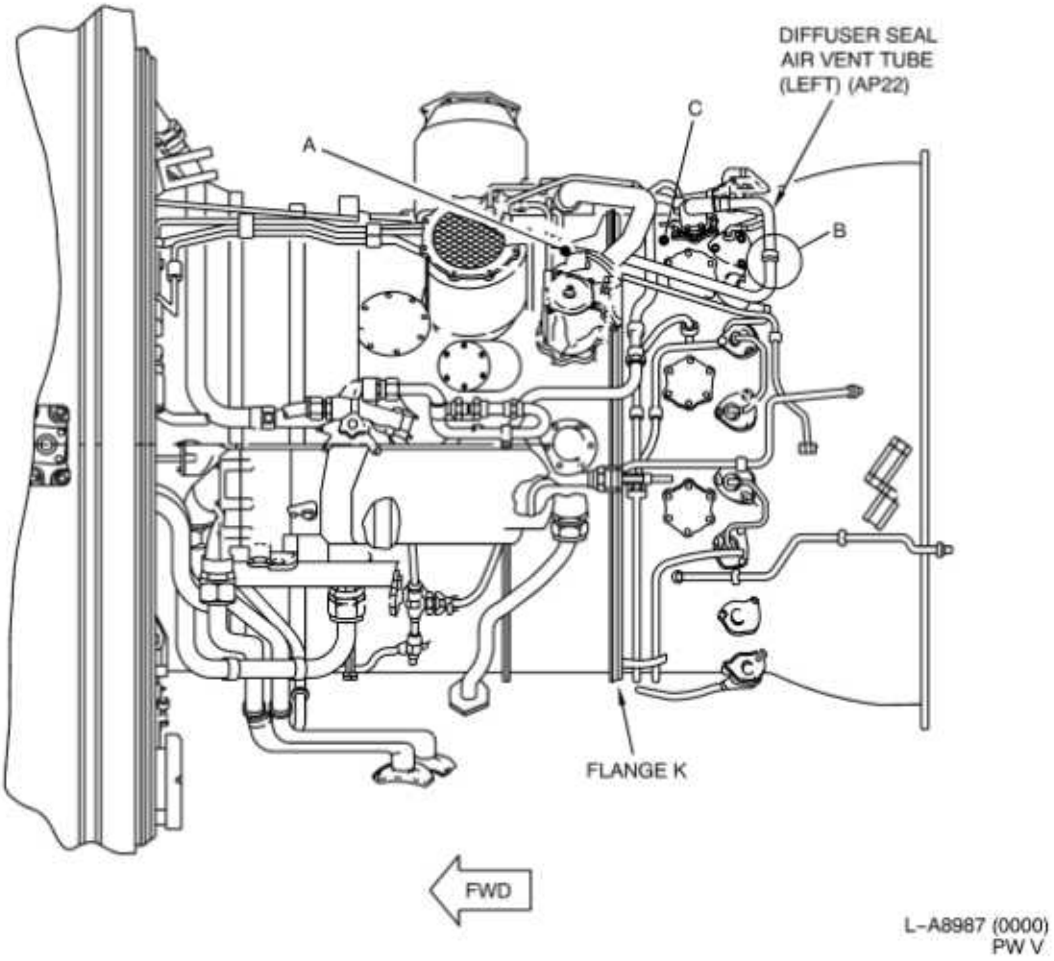
(7) Install protective closures.

NOTE: For additional information concerning detailed maintenance of this component, see Fuel Injector Component Maintenance Manual, 73−11−11 (P&W Manual PN 50A446).

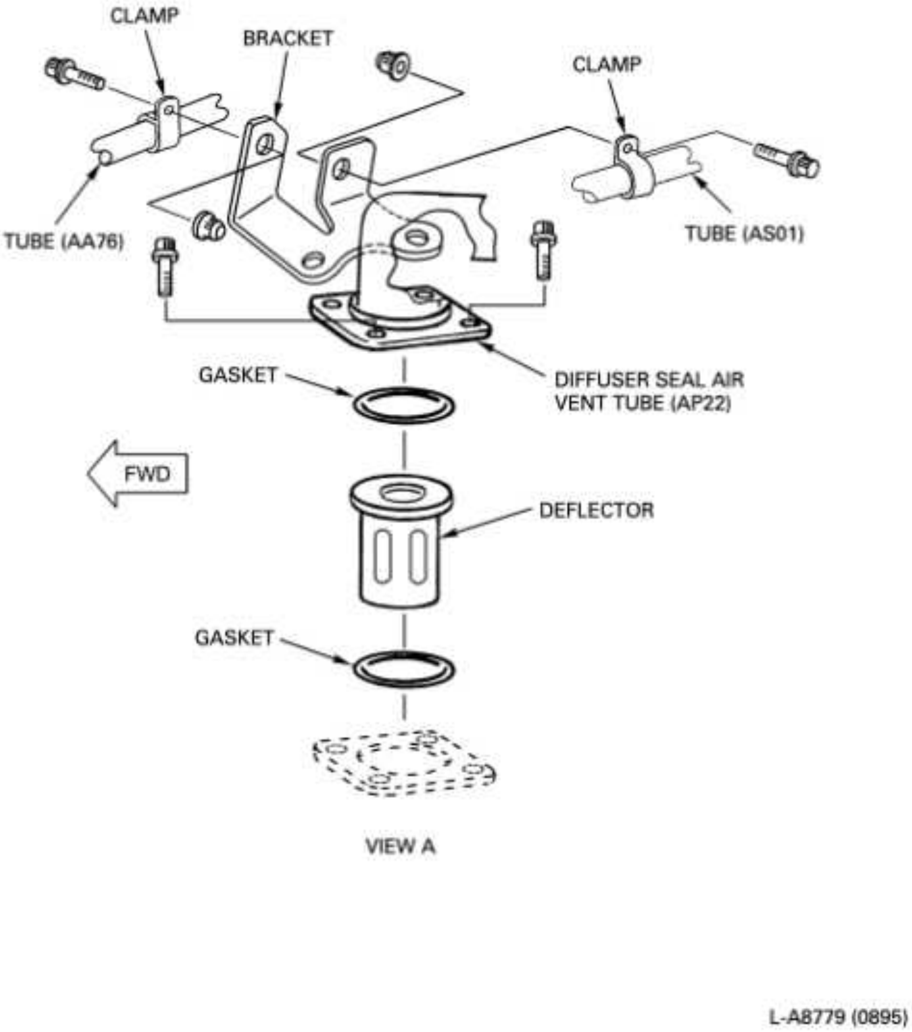

8 FUEL INJECTOR SUPPLY MANIFOLDS (AT LOCATIONS MARKED A)
A
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
PACKING
PACKING
TRANSFER TUBE
FUEL SUPPLY TUBE (TYPICAL)
FUEL INJECTOR SUPPLY MANIFOLD (TYPICAL)
PACKING
FUEL INJECTORS (24 LOCATIONS)
FRONT VIEW
L−A4268 (0000)
PW V

Fuel Injectors And Supply Manifolds Locations
Figure 301
(Task 72−00−41−050−008)

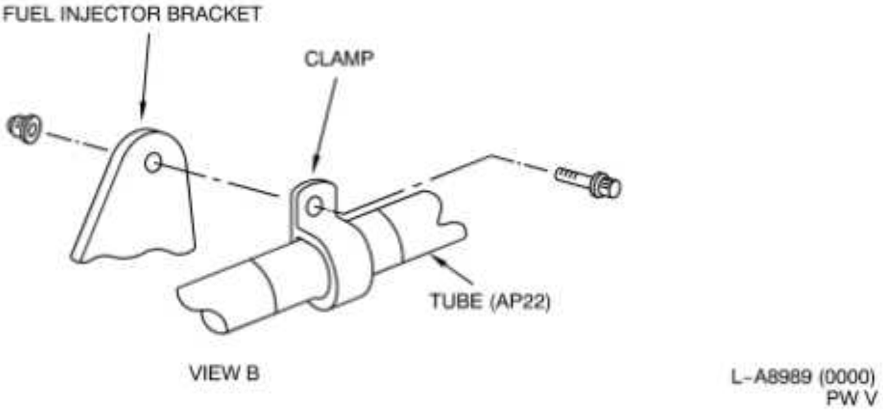
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−13


DIFFUSER SEAL
AIR VENT TUBE
(LEFT) (AP22)
C
A
B
C
C
FLANGE K
FWD
L−A8987 (0000)
PW V

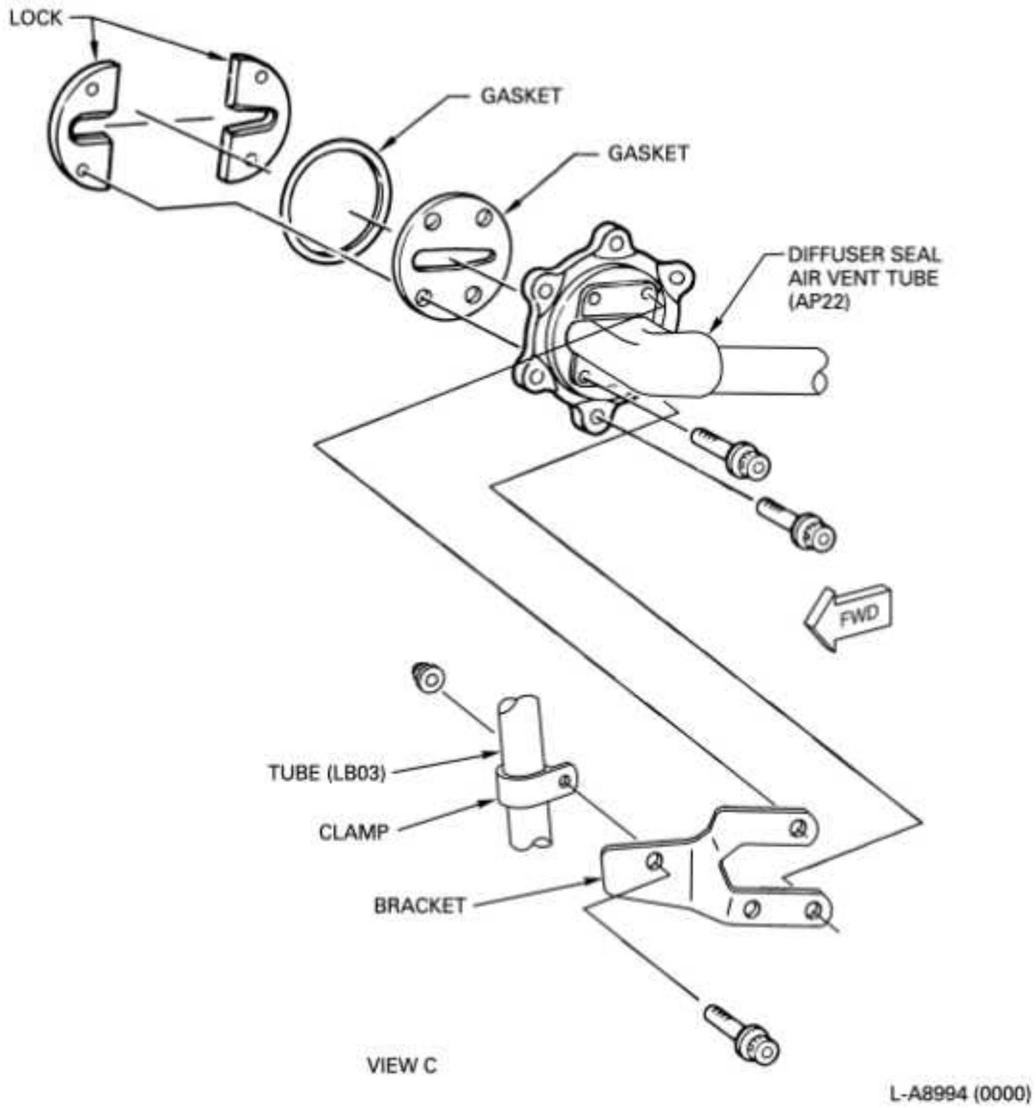
Diffuser Seal Air Vent Tube (Left) Removal
(For Access To No. 22 Fuel Injector)
Figure 302 (Sheet 1)
(Task 72−00−41−050−008)


CLAMP
BRACKET
CLAMP
TUBE (AA76)
TUBE (AS01)
GASKET
DIFFUSER SEAL AIR VENT TUBE (AP22)
FWD
DEFLECTOR
GASKET
VIEW A
L-A8779 (0895)

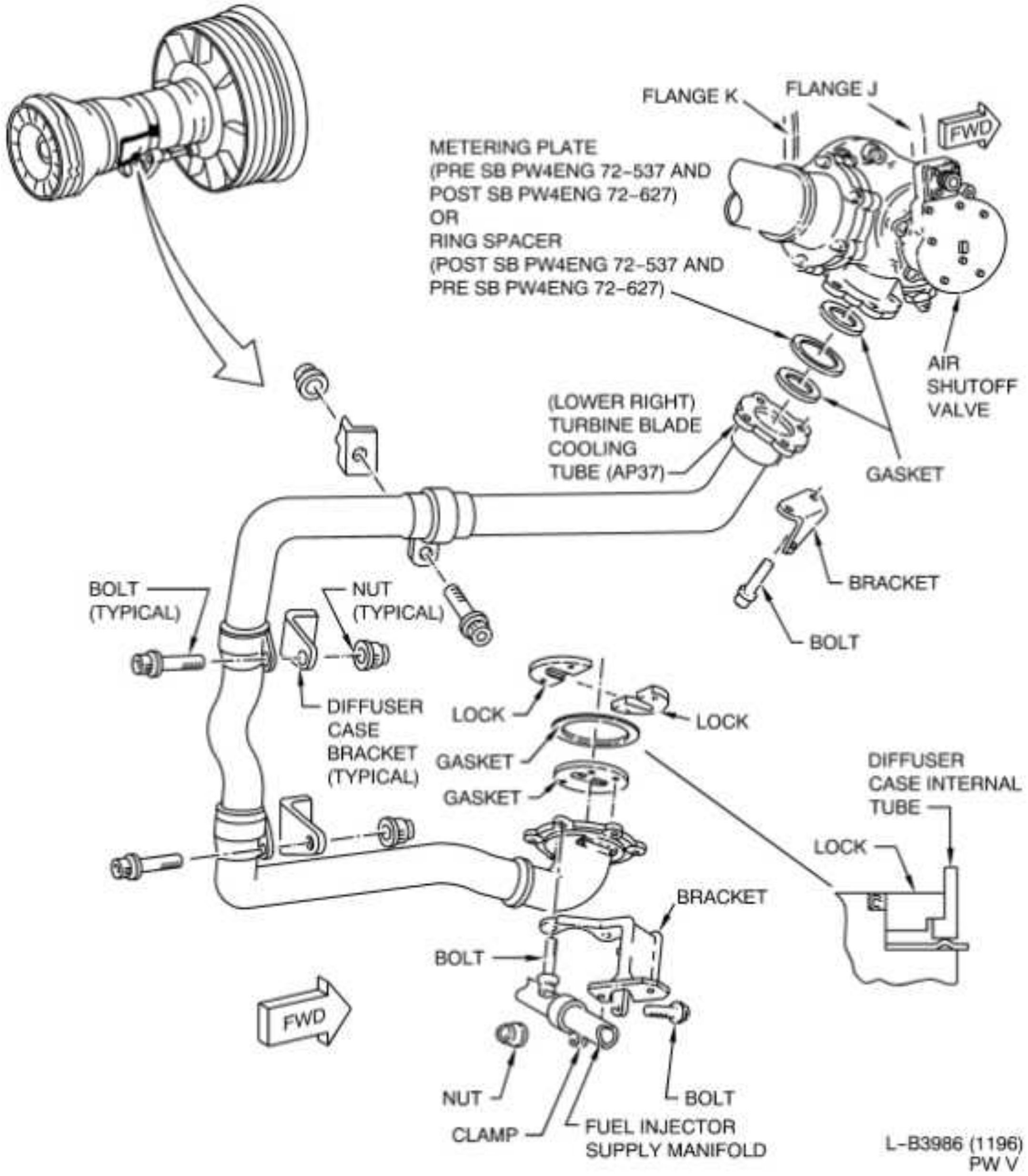
Diffuser Seal Air Vent Tube (Left) Removal
(For Access To No. 22 Fuel Injector)
Figure 302 (Sheet 2)
(Task 72−00−41−050−008)


FUEL INJECTOR BRACKET
CLAMP
TUBE (AP22)
VIEW B
L−A8989 (0000)
PW V

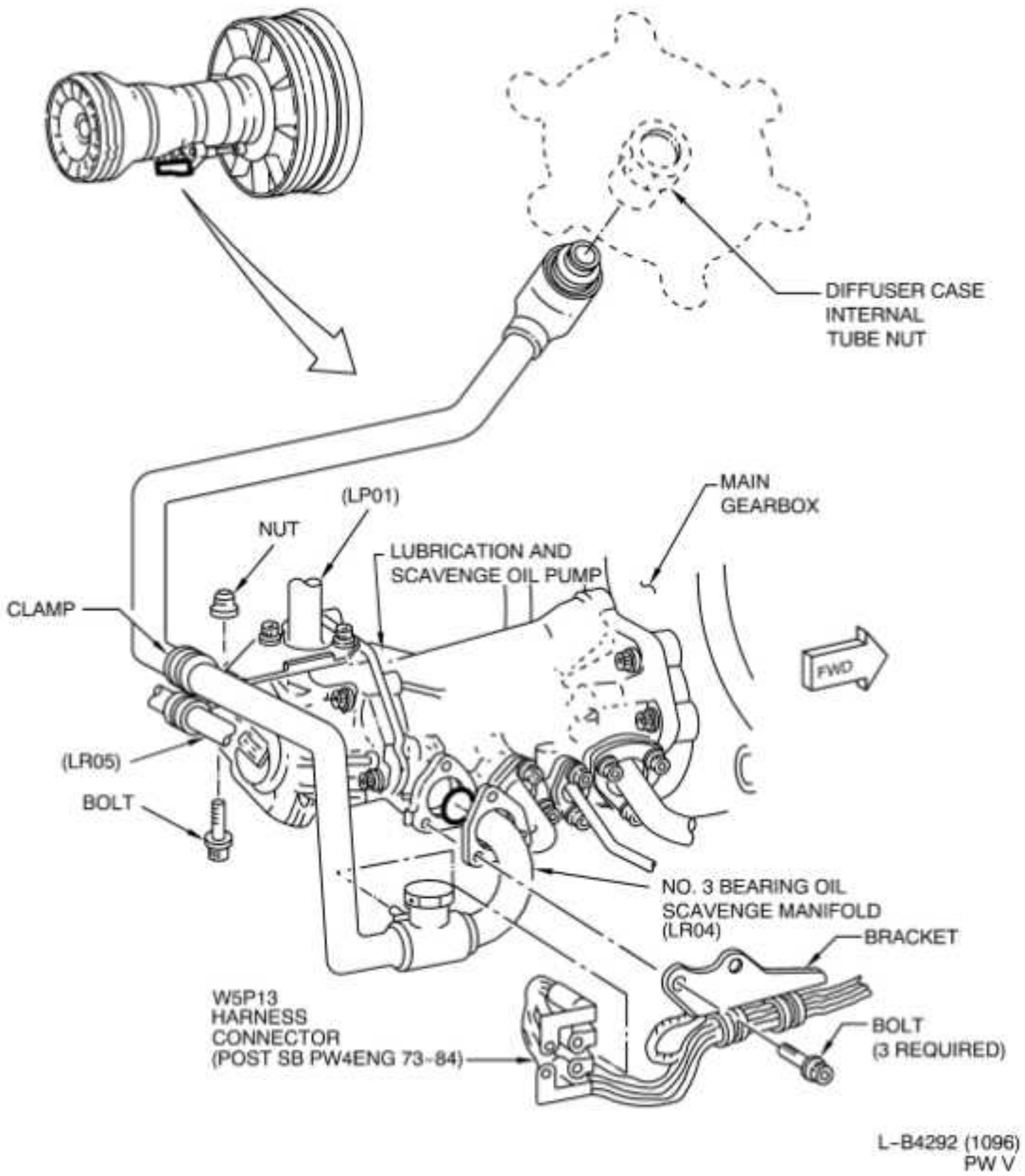
Diffuser Seal Air Vent Tube (Left) Removal
(For Access To No. 22 Fuel Injector)
Figure 302 (Sheet 3)
(Task 72−00−41−050−008)


LOCK
GASKET
GASKET
DIFFUSER SEAL
AIR VENT TUBE
(AP22)
FWD
TUBE (LB03)
CLAMP
BRACKET
VIEW C
L-A8994 (0000)

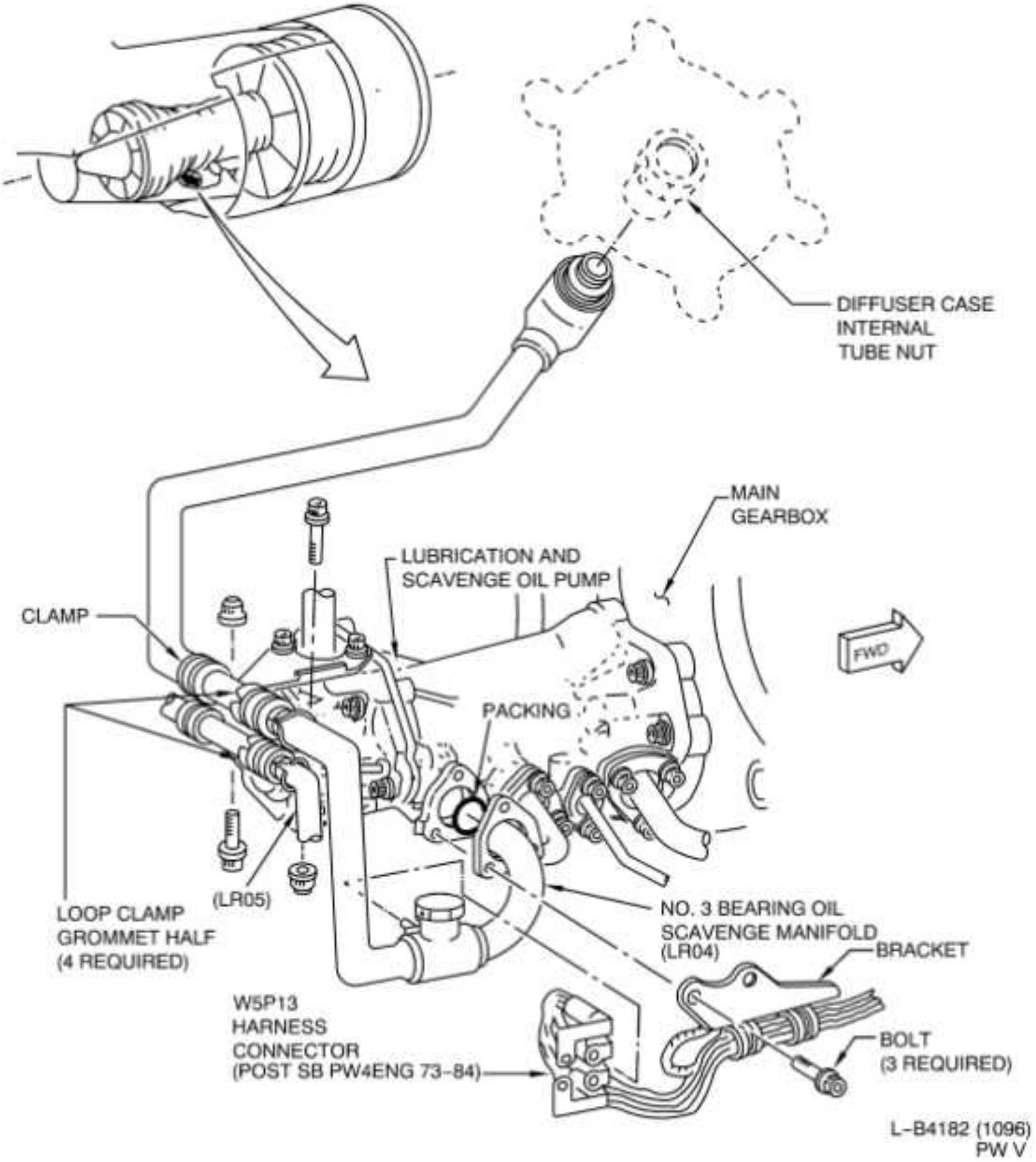
Diffuser Seal Air Vent Tube (Left) Removal
(For Access To No. 22 Fuel Injector)
Figure 302 (Sheet 4)
(Task 72−00−41−050−008)


FLANGE K
FLANGE J
FWD
METERING PLATE
(PRE SB PW4ENG 72-537 AND
POST SB PW4ENG 72-627)
OR
RING SPACER
(POST SB PW4ENG 72-537 AND
PRE SB PW4ENG 72-627)
AIR
SHUTOFF
VALVE
(LOWER RIGHT)
TURBINE BLADE
COOLING
TUBE (AP37)
GASKET
BRACKET
BOLT
BOLT
(TYPICAL)
NUT
(TYPICAL)
DIFFUSER
CASE
BRACKET
(TYPICAL)
LOCK
LOCK
GASKET
GASKET
DIFFUSER
CASE INTERNAL
TUBE
LOCK
BRACKET
BOLT
FWD
NUT
CLAMP
BOLT
FUEL INJECTOR
SUPPLY MANIFOLD
L-B3986 (1196)
PW V

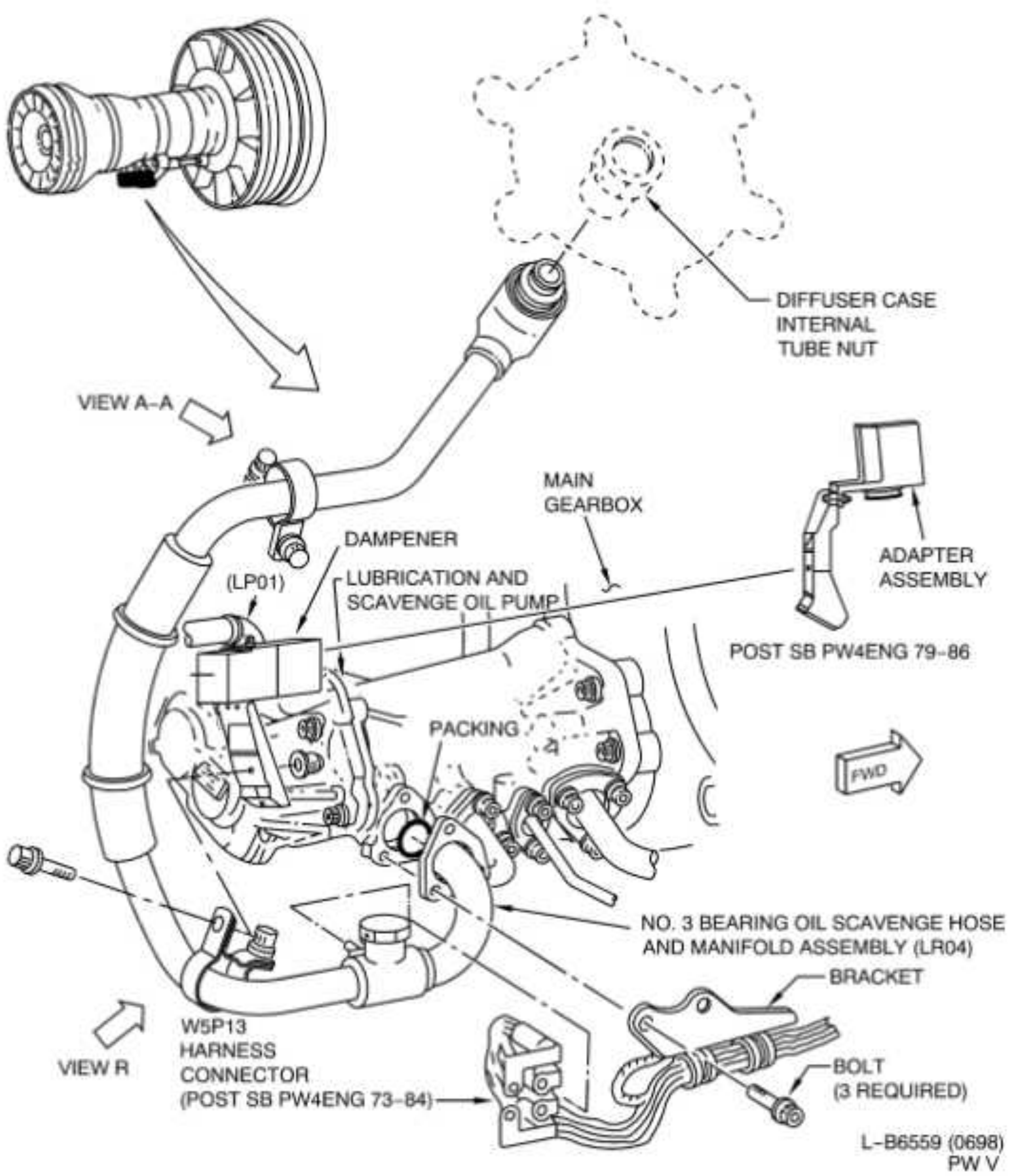
Turbine Blade Cooling Air Tube (Lower Right)
Removal For Access To Fuel Injector No. 12
Figure 303
(Task 72−00−41−050−008)


DIFFUSER CASE INTERNAL TUBE NUT
MAIN GEARBOX
(LP01)
NUT
LUBRICATION AND SCAVENGE OIL PUMP
CLAMP
FWD
(LR05)
BOLT
NO. 3 BEARING OIL SCAVENGE MANIFOLD (LR04)
BRACKET
W5P13 HARNESS CONNECTOR (POST SB PW4ENG 73-84)
BOLT (3 REQUIRED)
L-B4292 (1096)
PW V

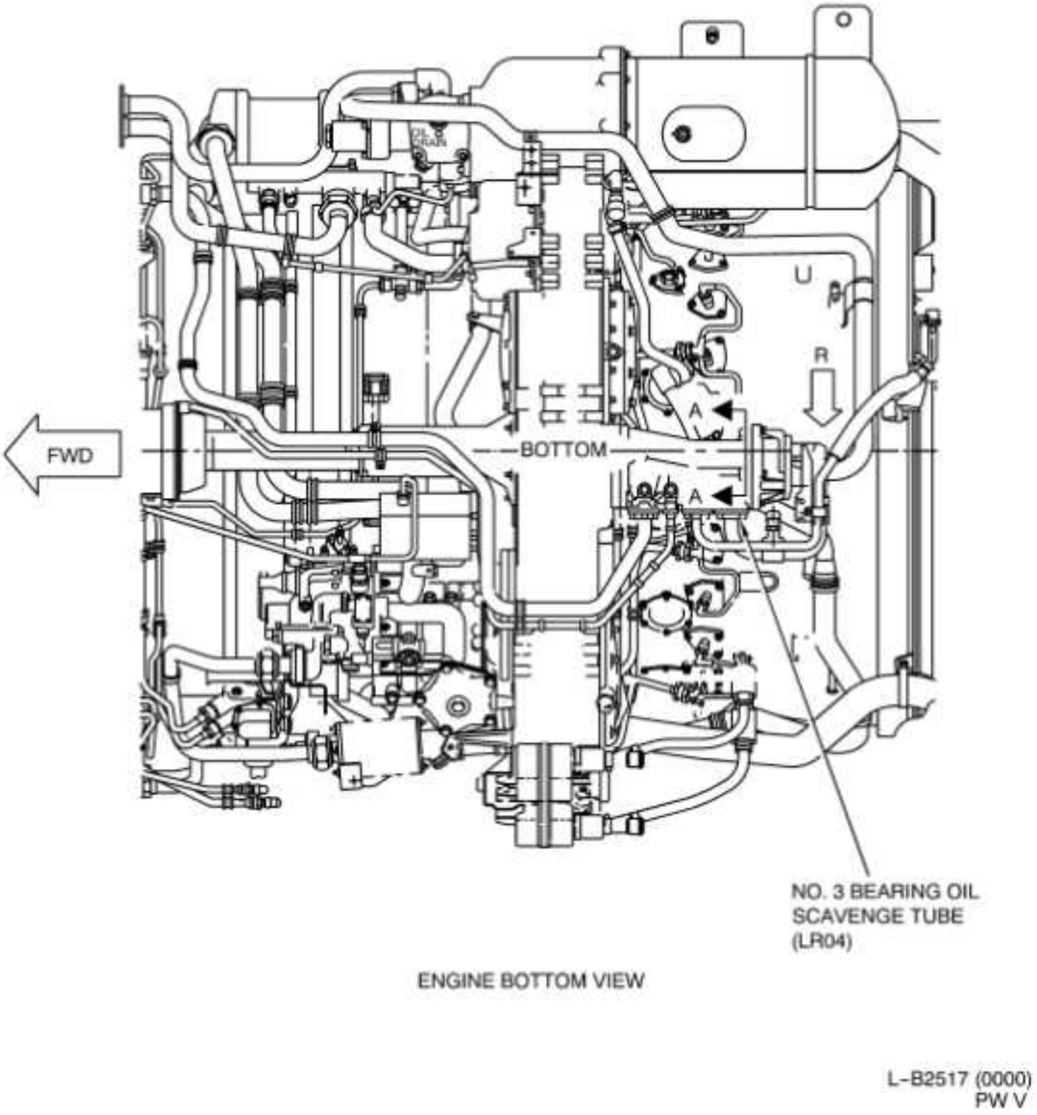
No. 3 Bearing Oil Scavenge Manifold (For Access To Fuel Injector No. 13) (Pre SB PW4ENG 79−46)
Figure 304 (Sheet 1)
(Task 72−00−41−050−008)


DIFFUSER CASE INTERNAL TUBE NUT
MAIN GEARBOX
LUBRICATION AND SCAVENGE OIL PUMP
CLAMP
FWD
PACKING
LOOP CLAMP GROMMET HALF (4 REQUIRED)
(LR05)
NO. 3 BEARING OIL SCAVENGE MANIFOLD (LR04)
BRACKET
W5P13 HARNESS CONNECTOR (POST SB PW4ENG 73-84)
BOLT (3 REQUIRED)
L-B4182 (1096)
PW V

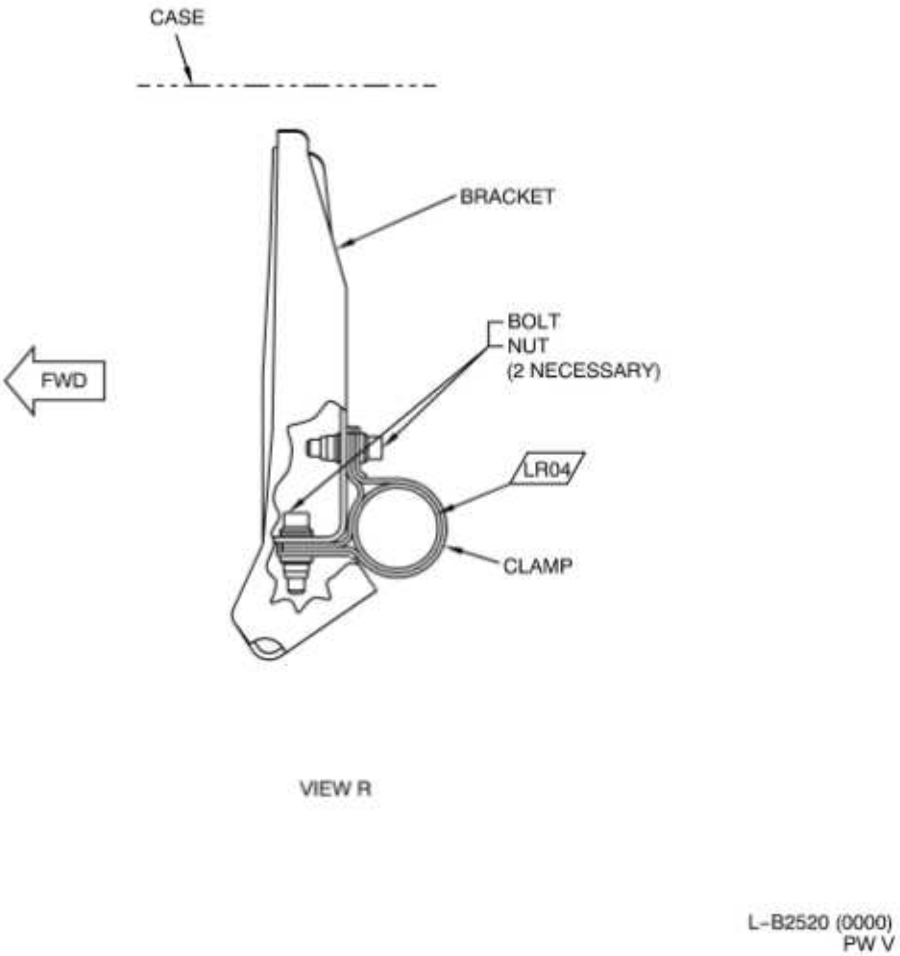
No. 3 Bearing Oil Scavenge Manifold (For Access To Fuel Injector No. 13) (Post SB PW4ENG 79−46 And Pre SB PW4ENG 79−75)
Figure 304 (Sheet 2)
(Task 72−00−41−050−008)


DIFFUSER CASE INTERNAL TUBE NUT
VIEW A-A
MAIN GEARBOX
ADAPTER ASSEMBLY
DAMPENER
(LP01)
LUBRICATION AND SCAVENGE OIL PUMP
POST SB PW4ENG 79-86
PACKING
FWD
NO. 3 BEARING OIL SCAVENGE HOSE AND MANIFOLD ASSEMBLY (LR04)
BRACKET
BOLT (3 REQUIRED)
VIEW R
W5P13 HARNESS CONNECTOR (POST SB PW4ENG 73-84)
L-B6559 (0698)
PW V

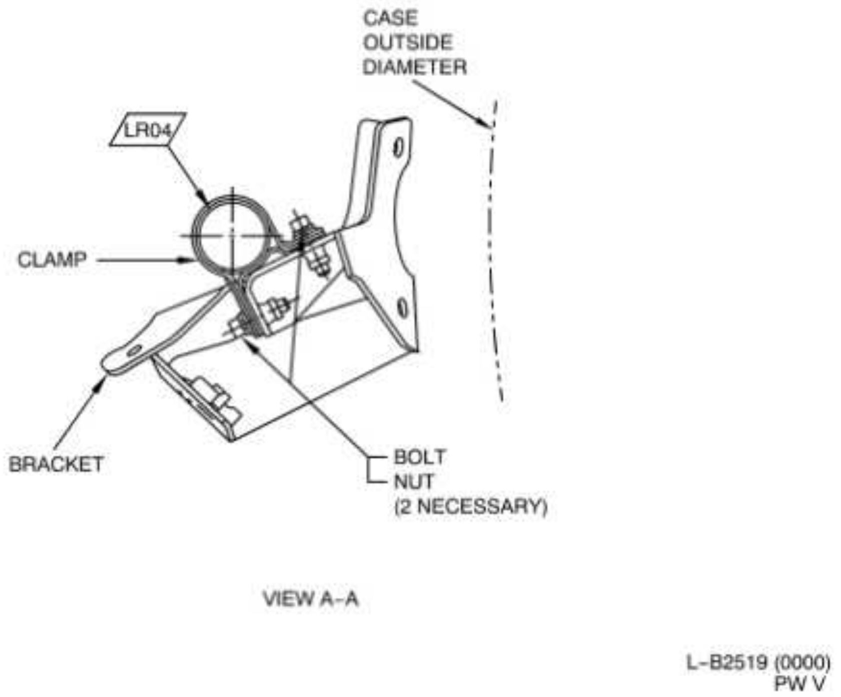
No. 3 Bearing Oil Scavenge Manifold (For Access To Fuel Injector No. 13) (Post SB PW4ENG 79−75)
Figure 304 (Sheet 3)
(Task 72−00−41−050−008)


FWD
BOTTOM
U
R
A
A
NO. 3 BEARING OIL SCAVENGE TUBE (LR04)
ENGINE BOTTOM VIEW
L-B2517 (0000)
PW V

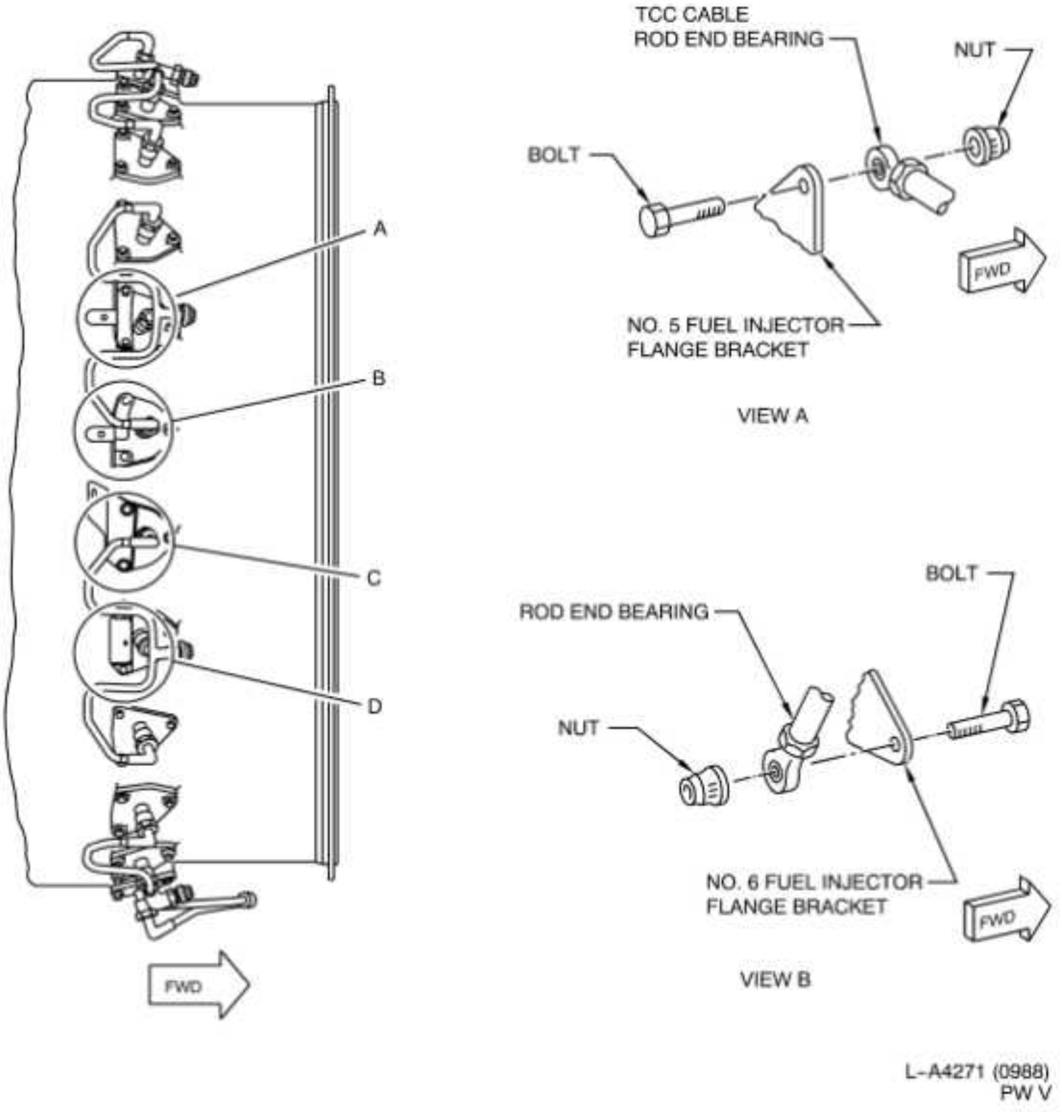
No. 3 Bearing Oil Scavenge Manifold (For Access To Fuel Injector No. 13) (Post SB PW4ENG 79−75)
Figure 304 (Sheet 4)
(Task 72−00−41−050−008)


CASE
BRACKET
BOLT
NUT
(2 NECESSARY)
FWD
LR04
CLAMP
VIEW R
L-B2520 (0000)
PW V

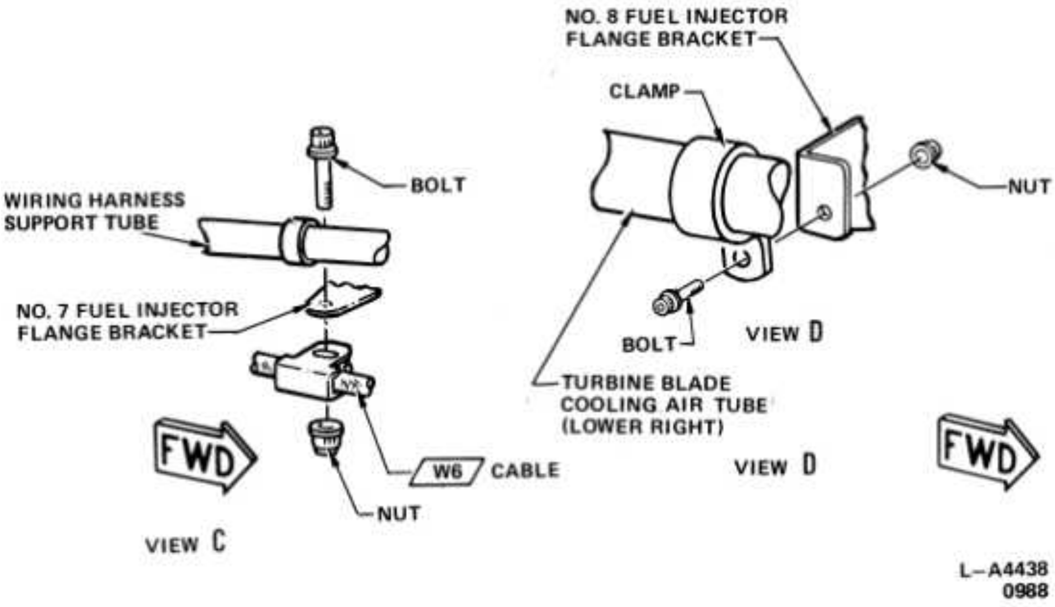
No. 3 Bearing Oil Scavenge Manifold (For Access To Fuel Injector No. 13) (Post SB PW4ENG 79-75)
Figure 304 (Sheet 5)
(Task 72-00-41-050-008)


CASE
OUTSIDE
DIAMETER
LR04
CLAMP
BRACKET
BOLT
NUT
(2 NECESSARY)
VIEW A-A
L-B2519 (0000)
PW V

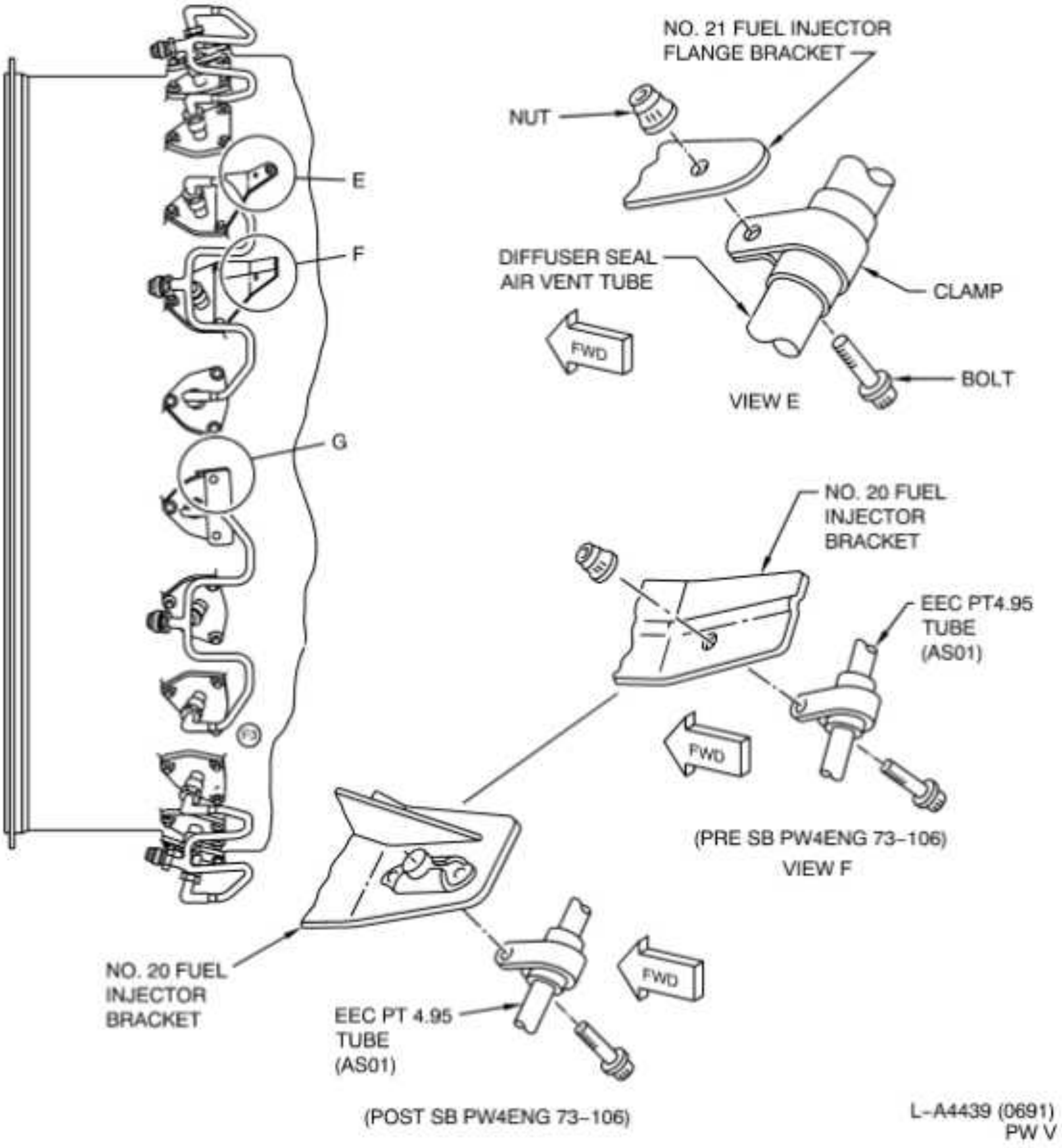
No. 3 Bearing Oil Scavenge Manifold (For Access
To Fuel Injector No. 13) (Post SB PW4ENG 79-75)
Figure 304 (Sheet 6)
(Task 72-00-41-050-008)


A
B
C
D
FWD
TCC CABLE ROD END BEARING
NUT
BOLT
FWD
NO. 5 FUEL INJECTOR FLANGE BRACKET
VIEW A
BOLT
ROD END BEARING
NUT
NO. 6 FUEL INJECTOR FLANGE BRACKET
FWD
VIEW B
L-A4271 (0988)
PW V

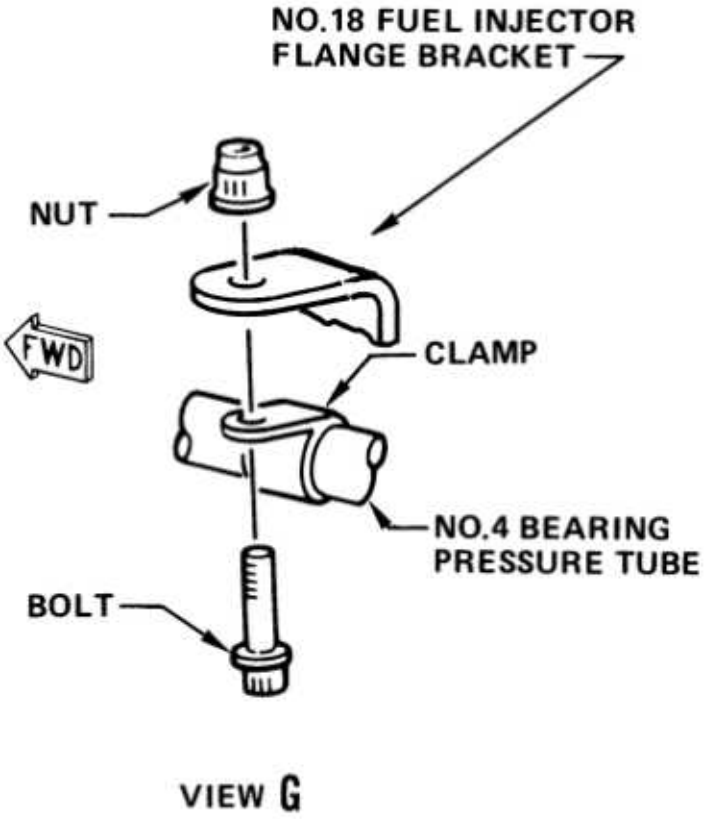
Fuel Injector Flange Brackets And Clamping (Right Side)
Figure 305 (Sheet 1)
(Task 72−00−41−050−008)


NO. 8 FUEL INJECTOR FLANGE BRACKET
CLAMP
BOLT
NUT
WIRING HARNESS SUPPORT TUBE
NO. 7 FUEL INJECTOR FLANGE BRACKET
BOLT
VIEW D
TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT)
FWD
W6 CABLE
VIEW D
FWD
NUT
VIEW C
L−A4438
0988

Fuel Injector Flange Brackets And Clamping (Right Side)
Figure 305 (Sheet 2)
(Task 72−00−41−050−008)


NO. 21 FUEL INJECTOR FLANGE BRACKET
NUT
E
F
G
DIFFUSER SEAL AIR VENT TUBE
CLAMP
FWD
BOLT
VIEW E
NO. 20 FUEL INJECTOR BRACKET
EEC PT4.95 TUBE (AS01)
FWD
(PRE SB PW4ENG 73−106)
VIEW F
NO. 20 FUEL INJECTOR BRACKET
EEC PT 4.95 TUBE (AS01)
FWD
(POST SB PW4ENG 73−106)
L−A4439 (0691)
PW V

Fuel Injector Flange Brackets And Clamping (Left Side)
Figure 306 (Sheet 3)
(Task 72−00−41−050−008)


NO.18 FUEL INJECTOR FLANGE BRACKET
NUT
FWD
CLAMP
NO.4 BEARING PRESSURE TUBE
BOLT
VIEW G

L-A4440
0988

Fuel Injector Flange Brackets And Clamping (Left Side)
Figure 305 (Sheet 4)
(Task 72-00-41-050-008)

Previous Pageblock   Return to Previous Menu   Next Pageblock

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-14

Task 72-00-41-050-007:

1. Remove Igniter Plug And Igniter Plug Boss

A. General

(1) This procedure applies to both igniter plug locations. If boss or spacer(s) are to be replaced, and parts removed at disassembly are not available, igniter plug immersion depth must be determined using this procedure. If none of the above parts are to be replaced, remove igniter plug per Removal-07 Task 72-00-41-050-004.

(2) If boss or spacer(s) are to be replaced, and parts removed at disassembly are available, check boss and spacer thickness per Installation-08 Task 72-00-41-450-005.

B. Equipment And Materials Required - None

C. Procedure
See Figure 301.

WARNING: IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH. IGNITION SWITCH MUST BE IN THE OFF POSITION BEFORE REMOVAL OF ANY IGNITION COMPONENTS. ALLOW SEVERAL MINUTES TO ELAPSE BETWEEN OPERATION OF THE IGNITION SYSTEM AND THE REMOVAL OF COMPONENTS. UPON DETACHING THE CABLE FROM THE IGNITER PLUG, DISCHARGE THE CURRENT BY GROUNDING THE CABLE TERMINAL TO ENSURE COMPLETE DISSIPATION OF ENERGY FROM THE SYSTEM. FAILURE TO FOLLOW THIS PROCEDURE COULD RESULT IN SEVERE INJURY TO PERSONNEL.

(1) Loosen clamp (301/7) securing heat shield segments (301/5, 301/6) at igniter plug (301/4). Slide clamp back on igniter cable (301/8) and remove heat shields. Clamp may remain on cable.

(2) Disconnect cable from igniter plug and touch plug casing with cable end (contact) to dissipate any residual electrical charge.

(3) Remove grommet from plug end of cable and discard.

(4) Install protective closure on cable end.

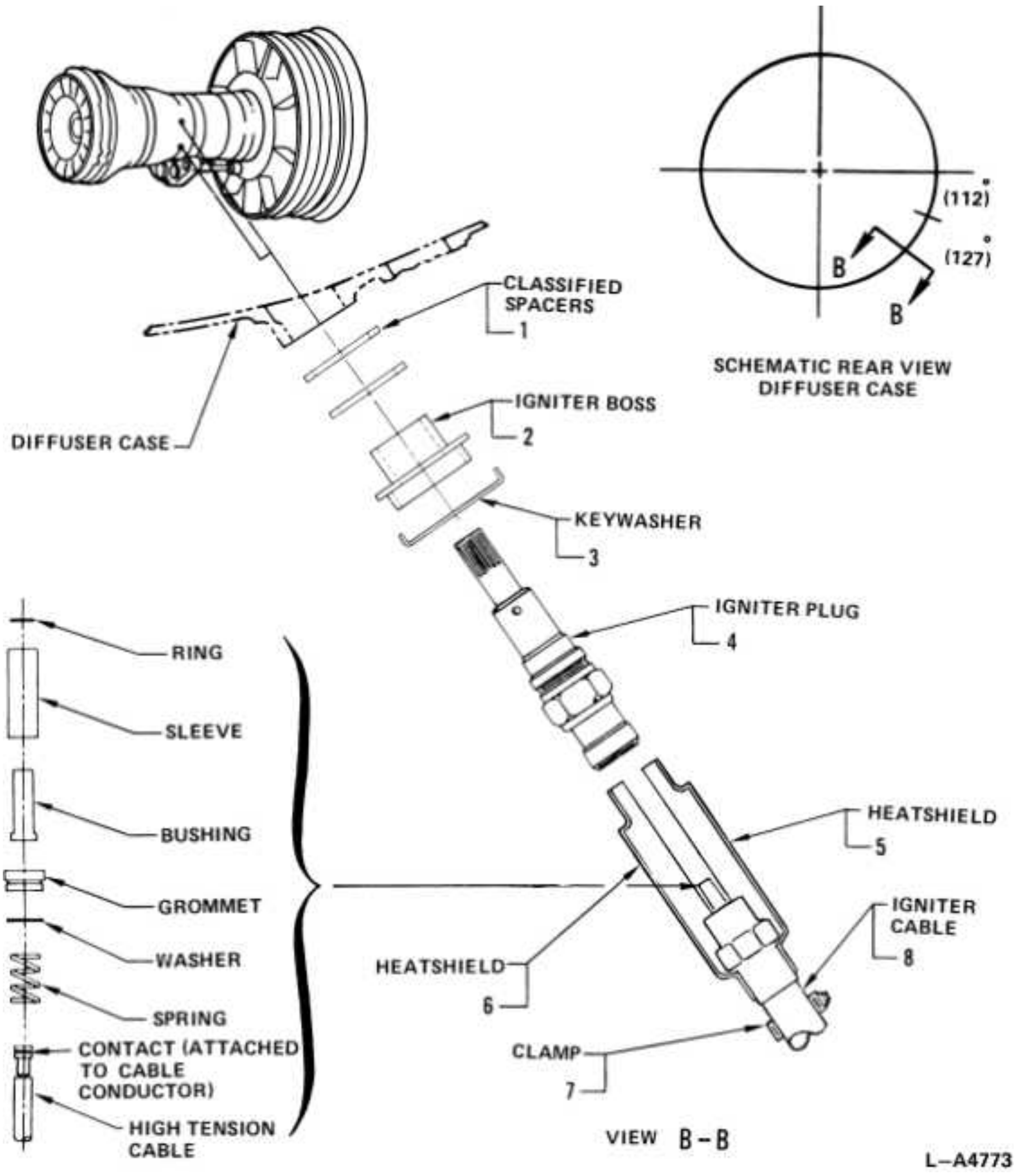
(5) Remove plug from its boss (301/2) on diffuser case.

NOTE: Hold boss with wrench to prevent boss from turning while removing plug.

NOTE: For additional information concerning detailed maintenance of this component, see Igniter Plug Component Maintenance Manual 74−22−01, (PW Manual PN 771346).

(6) Unbend tabs on key washer (301/3). Remove and discard key washer.

(7) Remove lockwire, boss, and spacer(s) (301/1) from diffuser case.


(112)°
(127)°
B
B
SCHEMATIC REAR VIEW
DIFFUSER CASE
CLASSIFIED SPACERS
1
DIFFUSER CASE
IGNITER BOSS
2
KEYWASHER
3
IGNITER PLUG
4
RING
SLEEVE
BUSHING
GROMMET
WASHER
SPRING
CONTACT (ATTACHED TO CABLE CONDUCTOR)
HIGH TENSION CABLE
HEATSHIELD
5
HEATSHIELD
6
IGNITER CABLE
8
CLAMP
7
VIEW B-B
L-A4773

Igniter Plug (Typical Two Locations)
Figure 301
(Task 72−00−41−050−007)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−15

Task 72−00−41−020−000:

1. Remove Diffuser And Combustor − Unassigned

This Removal−15 Is Unassigned

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − REMOVAL−16

Task 72−00−41−040−000:

1. Remove Diffuser And Combustor − Unassigned

This Removal−16 Is Unassigned

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-17

Task 72-00-41-040-001:

1. Remove No. 3 Bearing (Vertical)

NOTE: See Figure 301 for Part/Assembly Removal Procedure Sequence.

A. Prerequisites

(1) Remove The Compressor Inlet Cone. Refer to 72-00-31, Removal-02 (Task 72-00-31-020-001).

(2) Remove The Low Pressure Turbine And Turbine Exhaust Case With Shaft. Refer to 72-00-53, Removal-08 (Task 72-00-53-020-002).

(3) Trunnion The Fan Cases Through HPT From Horizontal To Front End Down Position. Refer to 72-00-00, Special Procedures-12 (Task 72-00-00-020-003).

(4) Remove The High Pressure Turbine. Refer to 72-00-52, Removal-08 (Task 72-00-52-020-002).

(5) Remove The Turbine Nozzle. Refer to 72-00-51, Removal-02 (Task 72-00-51-020-002).

(6) Remove The No. 3 Bearing Rear Seal Assembly And Rear Seal Seat. Refer to 72-00-41, Removal-09 (Task 72-00-41-020-004).

B. Equipment And Materials Required

Special Tools:

PWA 29389	Pump, Hydraulic
PWA 80187	Multiplier, Torque
PWA 85067	Fixture
PWA 85068	Fixture
PWA 85069	Puller, Jackscrew
PWA 85071	Puller, Hydraulic
PWA 85159	Protector
PWA 85168	Protector
PWA 85797	Wrench (Optional To PWA 86491)
PWA 86489	Puller, Jackscrew
PWA 86491	Driver, Torque
PWA 102743	Adapter, Torque
PWA 102744	Adapter, Holder

Consumable Materials:

Item No.	Designation
P03−001	Engine Oil (PWA 521B)

C. Procedure

(1) Position PWA 85168 Protector (302/14), smaller end first, into diffuser case. Push protector down to seat in case.

(2) Remove PWA 85159 Thread Protector (302/2) from rear of HPC rear hub. See Figure 302.

(3) Remove No. 3 bearing inner race and rollers (302/3), with PWA 85071 Puller (302/1) as follows.

(a) Retract hydraulic cylinder ram as required. Remove jaw retaining ring of puller.

(b) Position puller over HPC rear hub (302/13) and engage jaws with puller groove in No. 3 bearing inner race. Position retaining ring over jaws and seat on flange of jaws. Secure retaining ring with knurled screw.

(c) Connect PWA 29389 Hydraulic Pump to hydraulic cylinder.

(d) Actuate hydraulic pump to separate inner race from tight fit on hub.

(e) Remove hydraulic pump. Remove retaining ring securing jaws. Remove puller from engine.

CAUTION: HANDLE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN LINT FREE GLOVES TO PREVENT BEARING DAMAGE.

CAUTION: DETAIL PARTS OF BEARINGS MUST BE KEPT IN THEIR ORIGINAL ASSEMBLIES. PROTECT BEARINGS BY STORING IN A SUITABLE CONTAINER.

(f) Remove bearing inner race and rollers from HPC rear hub and place in suitable labeled container.

CAUTION: WHEN YOU REMOVE THE NO. 3 BEARING OUTER RACE, YOU MUST EXAMINE THE NO. 3 BEARING HOUSING FOR SIGNS OF WEAR ON THE HOUSING SHOULDER AND JOURNAL SURFACES. SEE PW4000 SERIES CIR, PN 51A357.

(4) Remove No. 3 bearing outer race (302/8) from bearing housing as follows.

(a) Remove PWA 85168 Protector (302/14).

(b) Install six workbolts, lubricated with Engine Oil P03−001, into bearing housing channel nuts equally around housing. Torque workbolts to 290 − 325 lb−in. (32.766 − 36.720 N.m).

NOTE: The workbolts are a quality standard bolt with .375−24 by 1.000 inch (25.400 mm) thread length.

(c) Install PWA 85168 Protector (302/14).

(d) Remove rivet (302/5) from retaining nut (302/6) in housing and discard rivet.

(e) With PWA 86491 Driver or PWA 85797 Wrench (302/4), loosen and remove the retaining nut (302/6) from housing.

NOTE: If you use PWA 86491 Driver, you must attach the driver to the bearing housing with the four detail cap screws.

(f) Mechanical Wrench Method (Optional) − See Figure 302, Sheet 2. With PWA 102743 Torque Adapter (302/17), PWA 102744 Holder Adapter (302/16) and PWA 80187 Torque Multiplier (302/15), loosen and remove the retaining nut (302/6) from the housing.

CAUTION: HANDLE NO. 3 BEARING OUTER RACE WITH CLEAN GLOVES TO PREVENT BEARING DAMAGE.

(g) With PWA 86489 Puller (302/7), remove the No. 3 bearing outer race (302/8) from housing as follows.

1 Turn the large hex head cap screw clockwise, the full length of its travel.

2 Turn the three hand knobs counterclockwise, the full length of their travel.

3 Put the puller into position until it touches the bearing housing. Also, the jaws must align with the scallops in the bearing housing.

4 Carefully and equally, turn the hand knobs clockwise until the jaws fully engage the scallops of the bearing housing.

5 Turn the large hex head cap screw counterclockwise until the outer race is loose.

6 Remove the puller. Remove the bearing outer race.

(h) Remove PWA 85168 Protector (302/14) and the six workbolts from the bearing housing.

(i) Install PWA 85168 Protector (302/14), smaller end first, into diffuser case. Push protector down to seat in case.

NOTE: Removal of the seal seat and spacer will make sure that you get an accurate reading, when you take the measurements for the seating of the No. 3 bearing.

(5) Remove the No. 3 bearing seal spacer (302/10) with a PWA 85068 Fixture (302/9) as follows.

(a) Loosen the screws and wing nuts which secure the jaws.

(b) Position puller over the HPC rear hub. Slide jaws behind the rear flange of seal spacer. Tighten the screws and wing nuts to secure the jaws.

(c) Pull the fixture by hand to remove the spacer.

(d) If the spacer cannot be removed by hand, install a PWA 85069 Puller to upper flange of fixture per the following step.

(e) Retract the center jackscrew of PWA 85069 Puller and position the puller to upper flange of the PWA 85068 Fixture. Secure the puller to fixture with detail screws. Using standard wrench, tighten the center jackscrew to seat the center puck into the HPC rear hub. Continue tightening jackscrew to remove the seal spacer from a tight fit on the hub. Remove the screws which secure the puller to fixture. Remove the puller.

(f) Loosen the screws and wing nuts which secure the jaws to the ring detail of the PWA 85068 Fixture. Remove the fixture.

(g) Remove the seal spacer from the HPC rear hub.

(6) Remove the No. 3 bearing front seal seat (302/12) with a PWA 85067 Fixture (302/11) as follows.

(a) Loosen the screws and hand knobs which secure the jaws to the fixture.

(b) Position the fixture over HPC rear hub with the fixture located on the seal seat. Slide the jaws outward to engage the pulling flange of the seat. Tighten the upper screws to secure jaws. Tighten the hand knobs to fully engage jaws in the pull groove of the seal seat.

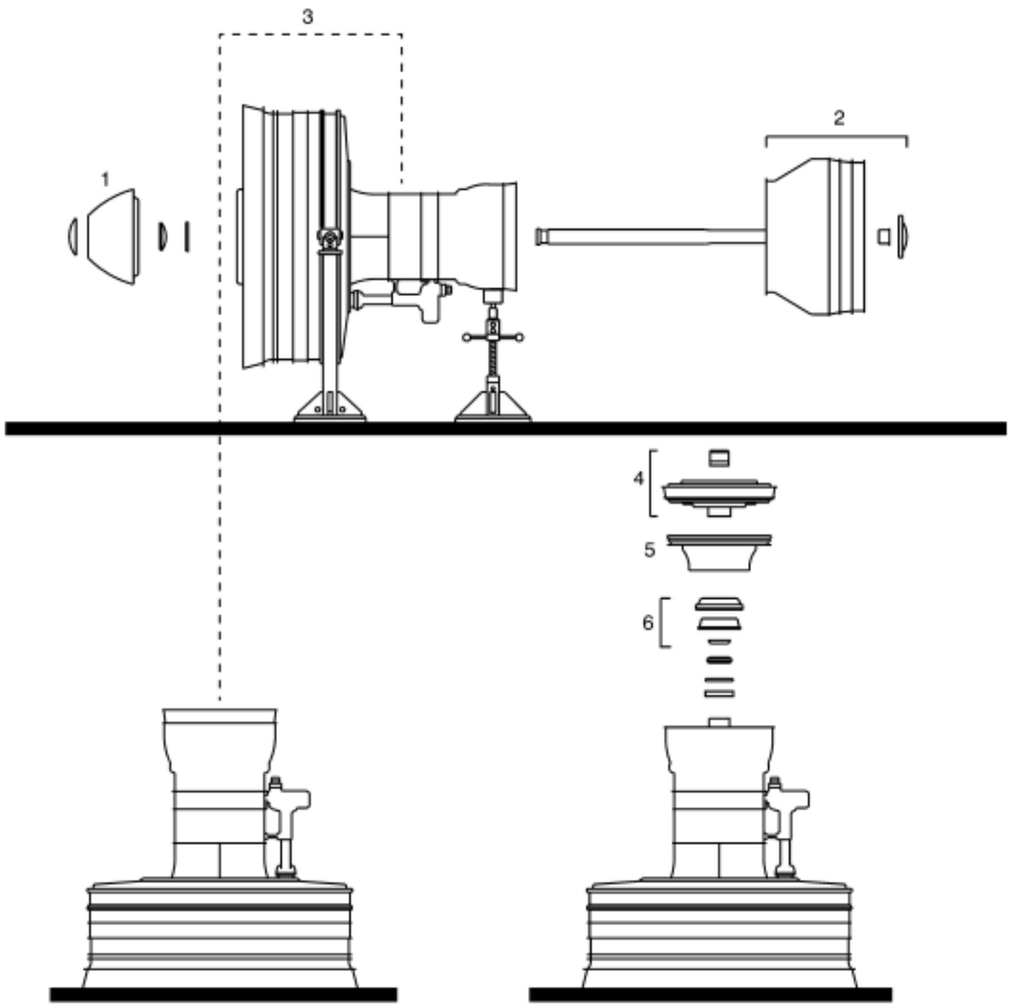
(c) Pull the fixture by hand to remove seal seat.

(d) If the seal seat cannot be removed by hand, install a PWA 85069 Puller to the upper flange of fixture per the following step.

(e) Retract the center jackscrew of PWA 85069 Puller and position the puller to the upper flange of the PWA 85067 Fixture. Secure the puller to fixture with the detail screws. Using a standard wrench tighten the center jackscrew to seat the center puck into the HPC rear hub. Continue tightening jackscrew to remove the seal seat from a tight fit on the hub. Remove the screws which secure the puller to fixture. Remove the puller.

(f) Loosen the screws and hand knobs which secure the jaws to the ring detail of fixture. Remove the fixture.

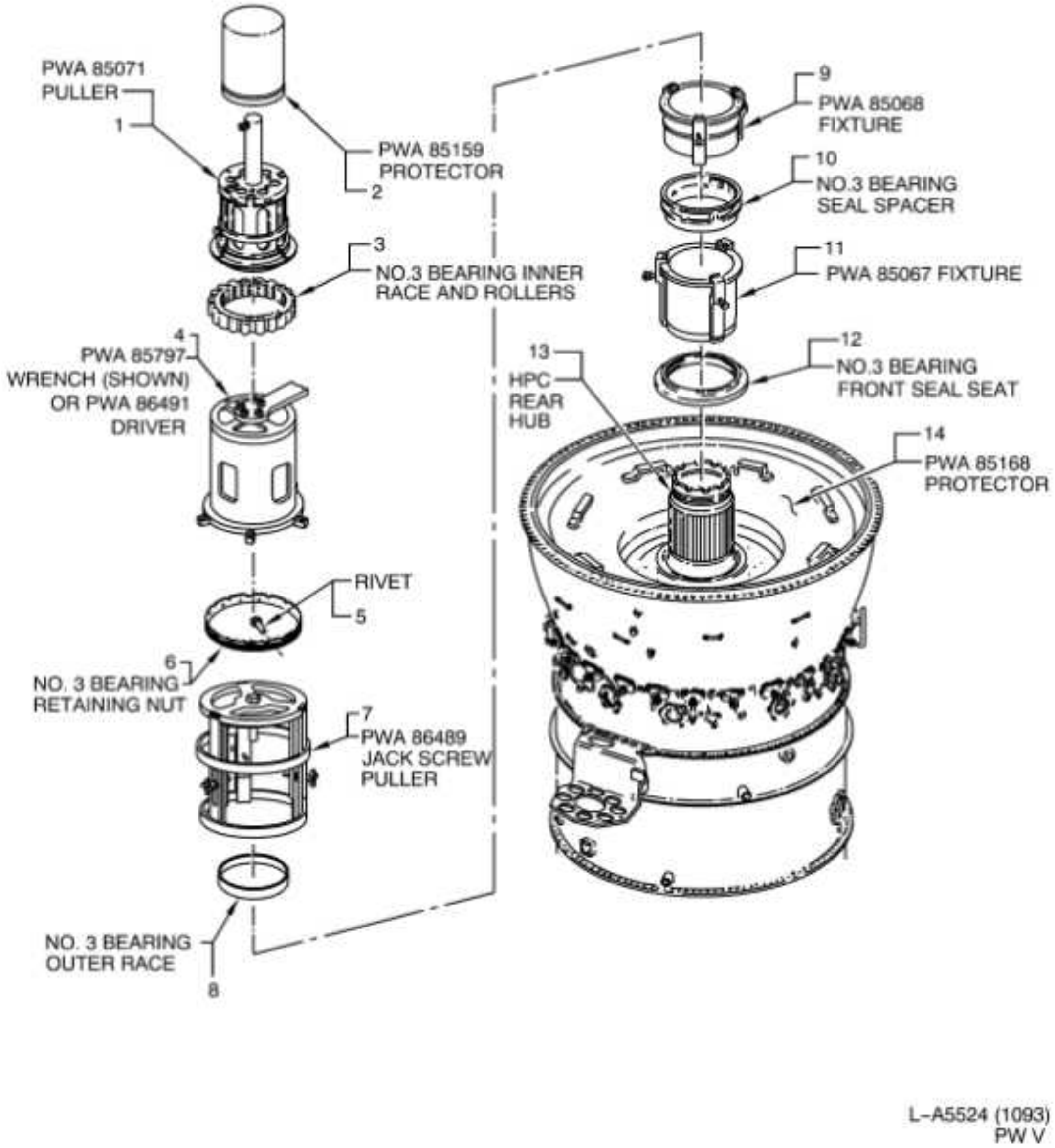
(g) Remove the seal seat from the HPC rear hub.



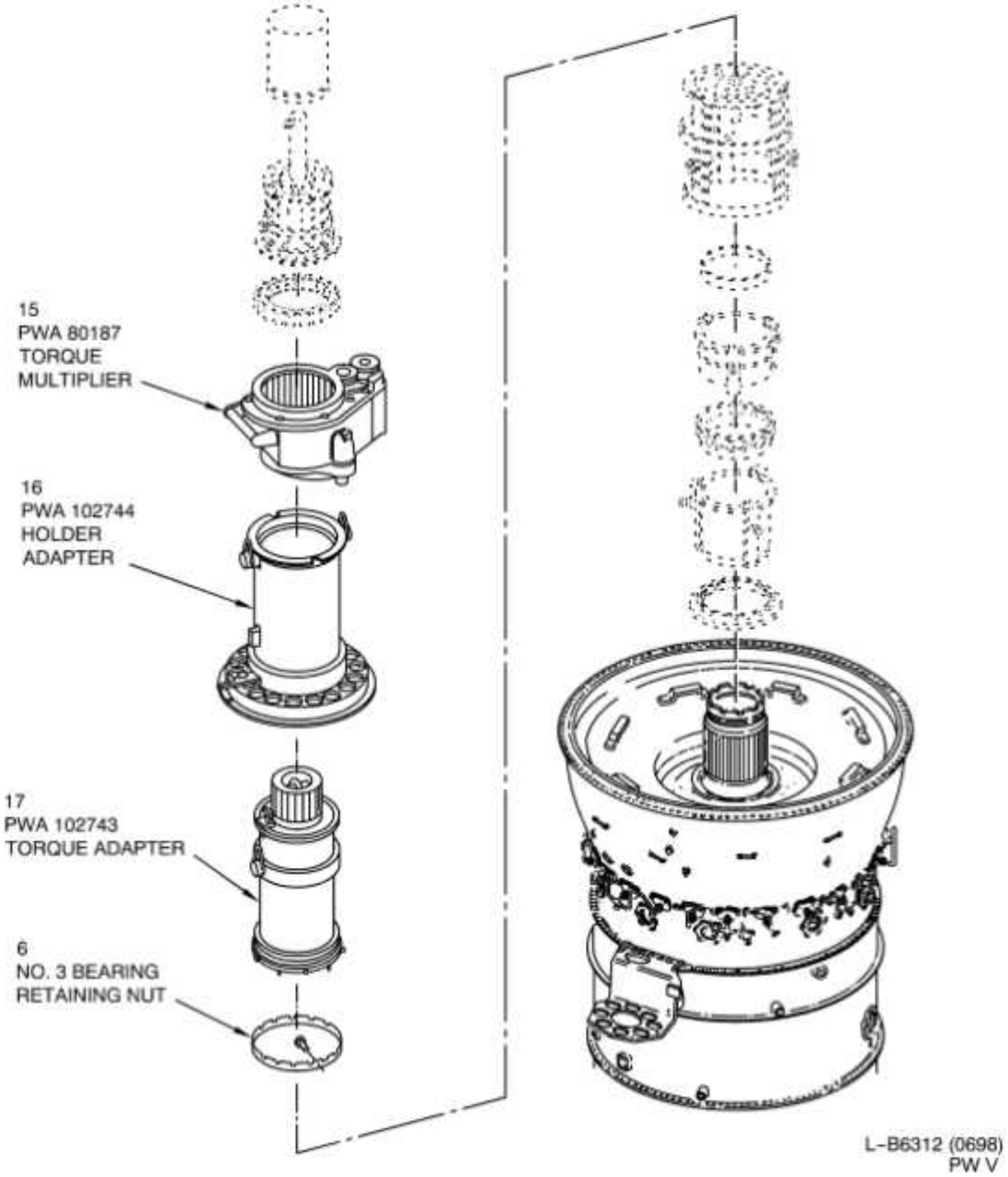
1. REMOVE COMPRESSOR INLET CONE.
2. REMOVE LPT/TEC WITH SHAFT.
3. TRUNNION FAN CASES THROUGH HPT TO FRONT END DOWN.
4. REMOVE HIGH PRESSURE TURBINE (HPT).
5. REMOVE TURBINE NOZZLE.
6. REMOVE NO. 3 BEARING REAR SEAL ASSEMBLY.

L−A5523 (0000)
PW V

Procedure Sequence
Figure 301
(Task 72−00−41−040−001)


PWA 85071
PULLER
1
PWA 85159
PROTECTOR
2
3
NO.3 BEARING INNER
RACE AND ROLLERS
4
PWA 85797
WRENCH (SHOWN)
OR PWA 86491
DRIVER
RIVET
5
6
NO. 3 BEARING
RETAINING NUT
7
PWA 86489
JACK SCREW
PULLER
NO. 3 BEARING
OUTER RACE
8
9
PWA 85068
FIXTURE
10
NO.3 BEARING
SEAL SPACER
11
PWA 85067 FIXTURE
12
NO.3 BEARING
FRONT SEAL SEAT
13
HPC
REAR
HUB
14
PWA 85168
PROTECTOR
L-A5524 (1093)
PW V

No. 3 Bearing Removal
Figure 302 (Sheet 1)
(Task 72−00−41−040−001)


15
PWA 80187
TORQUE
MULTIPLIER
16
PWA 102744
HOLDER
ADAPTER
17
PWA 102743
TORQUE ADAPTER
6
NO. 3 BEARING
RETAINING NUT
L−B6312 (0698)
PW V

No. 3 Bearing Removal
Figure 302 (Sheet 2)
(Task 72−00−41−040−001)

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ENGINE GENERAL - DIFFUSER AND COMBUSTOR - REMOVAL-18

Task 72-00-41-040-002:

1. Remove No. 3 Bearing (Horizontal)

NOTE: See Figure 301 for Part/Assembly Removal Procedure Sequence.

A. Prerequisites

(1) Remove The Compressor Inlet Cone. Refer to 72-00-31, Removal-02 (Task 72-00-31-020-001).

(2) Remove The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed). Refer to 72-00-32, Removal-01 (Task 72-00-32-020-001).

(3) Remove The Low Pressure Turbine And Turbine Exhaust Case With Shaft. Refer to 72-00-53, Removal-08 (Task 72-00-53-020-002).

(4) Remove The High Pressure Turbine. Refer to 72-00-52, Removal-01 (Task 72-00-52-020-001).

(5) Remove The Turbine Nozzle. Refer to 72-00-51, Removal-01 (Task 72-00-51-020-001).

(6) Remove The No. 3 Bearing Rear Seal Assembly And Rear Seal Seat. Refer to 72-00-41, Removal-03 (Task 72-00-41-020-003).

B. Equipment And Materials Required

Special Tools:

PWA 29389	Pump, Hydraulic
PWA 80187	Multiplier, Torque
PWA 85067	Fixture
PWA 85068	Fixture
PWA 85069	Puller, Jackscrew
PWA 85071	Puller, Hydraulic
PWA 85159	Protector
PWA 85168	Protector
PWA 85797	Wrench (Optional To PWA 86491)
PWA 85893	Support, Cantilever
PWA 85910	Adapter, Support
PWA 86489	Puller, Jackscrew
PWA 86491	Driver, Torque
PWA 102743	Adapter, Torque
PWA 102744	Adapter, Holder

Consumable Materials:

Item No.	Designation
P03−001	Engine Oil (PWA 521B)

C. Procedure

(1) Position PWA 85168 Protector (302/9), smaller end first, into diffuser case. See Figure 302.

(2) Remove PWA 85159 Thread Protector (302/7) from rear of HPC rear hub. See Figure 302.

(3) Install PWA 85893 Support (303/2) in engines as follows: See Figure 303.

(a) Attach the two tubular handles to end of support.

CAUTION: ONLY A MINIMUM AMOUNT OF JACKING OF SUPPORT IS NECESSARY SINCE TOO MUCH JACKING CAN EASILY CAUSE BEARING DAMAGE. TO FIND IF THE LOAD HAS BEEN MOVED FROM THIS NO. 3 BEARING SUPPORT TO PWA 85393 SUPPORT THE TOP AND BOTTOM BEARING ROLLERS WILL BE FREE TO ROTATE.

CAUTION: JACK MUST SUPPORT THE HPC DRIVESHAFT AT 12 O'CLOCK POSITION. DO NOT PERMIT SHAFT TO ROTATE.

(b) With correct sling and hoist install PWA 85893 Support in engine from front or rear with jack detail of support to the rear of the engine. Insert long aluminum handle through center of engine to guide support in place.

(c) Install PWA 85910 Adapter (303/1) over the front end of PWA 85893 Support and locate in front fan hub ID. Secure PWA 85910 Adapter with the fan hub locknut.

(d) With a speed handle, extension and socket wrench, operate the jack detail until it contacts ID of HPC shaft.

(e) Monitor rollers of No. 3 bearing and continue to operate jack until bearing rollers have shown the load has moved from No. 3 bearing to PWA 85893 Support. When support jack has the load, lower the knurled nut to the locking position. Remove speed handle, extension and socket wrench.

(4) Remove No. 3 bearing inner race and rollers (302/8), with PWA 85071 Puller (302/6).

(a) Retract hydraulic cylinder ram as required. Remove jaw retaining ring of puller.

(b) Position puller over HPC rear hub and engage jaws with puller groove in No. 3 bearing inner race. Position retaining ring over jaws and seat on flange of jaws. Secure retaining ring with knurled screw.

(c) Connect PWA 29389 Hydraulic Pump to hydraulic cylinder.

(d) Actuate hydraulic pump to separate inner race from tight fit on hub.

(e) Remove hydraulic pump. Remove retaining ring securing jaws. Remove puller from engine.

CAUTION: HANDLE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN LINT FREE GLOVES TO PREVENT BEARING DAMAGE.

CAUTION: DETAIL PARTS OF BEARINGS MUST BE KEPT IN THEIR ORIGINAL ASSEMBLIES. PROTECT BEARINGS BY STORING IN A SUITABLE CONTAINER.

(f) Remove bearing inner race and rolls from HPC rear hub and place in suitable labeled container.

CAUTION: WHEN YOU REMOVE THE NO. 3 BEARING OUTER RACE, YOU MUST EXAMINE THE NO. 3 BEARING HOUSING FOR SIGNS OF WEAR ON THE HOUSING SHOULDER AND JOURNAL SURFACES. SEE PW4000 SERIES CIR, PN 51A357.

(5) Remove No. 3 bearing outer race (302/1) from bearing housing as follows.

(a) Remove PWA 85168 Protector (302/9).

(b) Install six workbolts, lubricated with Engine Oil P03−001, into bearing housing channel nuts equally around housing. Torque workbolts to 290 − 325 lb−in. (32.766 − 36.720 N.m).

NOTE: The workbolts are a quality standard bolt with .375−24 by 1.000 inch (25.400 mm) thread length.

(c) Install PWA 85168 Protector (302/9).

(d) Remove rivet (302/4) from retaining nut (302/2) in housing and discard rivet.

(e) With PWA 86491 Driver or PWA 85797 Wrench (302/5), loosen and remove the retaining nut (302/2) from housing.

NOTE: If you use PWA 86491 Driver, you must attach the driver to the bearing housing with the four detail cap screws.

(f) Mechanical Wrench Method (Optional) − See Figure 302, Sheet 2. With PWA 102743 Torque Adapter (302/14), PWA 102744 Holder Adapter (302/15) and PWA 80187 Torque Multiplier (302/16), loosen the retaining nut (302/2) from the housing.

CAUTION: HANDLE NO. 3 BEARING OUTER RACE WITH CLEAN GLOVES TO PREVENT BEARING DAMAGE.

(g) With PWA 86489 Puller (302/3), remove the No. 3 bearing outer race (302/1) from housing as follows.

1 Turn the large hex head cap screw clockwise, the full length of its travel.

2 Turn the three hand knobs counterclockwise, the full length of their travel.

3 Put the puller into position until it touches the bearing housing. Also, the jaws must align with the scallops in the bearing housing.

4 Carefully and equally, turn the hand knobs clockwise until the jaws fully engage the scallops of the bearing housing.

5 Turn the large hex head cap screw counterclockwise until the outer race is loose.

6 Remove the puller. Remove the bearing outer race.

(h) Remove PWA 85168 Protector (302/9) and the six workbolts from the bearing housing.

(i) Install PWA 85168 Protector (302/9), smaller end first, into diffuser case.

NOTE: Removal of the seal seat and spacer will make sure that you get an accurate reading, when you take the measurements for the seating of the No. 3 bearing.

(6) Remove the No. 3 bearing seal spacer (302/11) with a PWA 85068 Fixture (302/12) as follows.

(a) Loosen the screws and wing nuts which secure the jaws.

(b) Position puller over the HPC rear hub. Slide jaws behind the rear flange of seal spacer. Tighten the screws and wing nuts to secure the jaws.

(c) Pull the fixture by hand to remove the spacer.

(d) If the spacer cannot be removed by hand, install a PWA 85069 Puller to upper flange of fixture per the following step.

(e) Retract the center jackscrew of PWA 85069 Puller and position the puller to upper flange of the PWA 85068 Fixture. Secure the puller to fixture with detail screws. Using standard wrench, tighten the center jackscrew to seat the center puck into the HPC rear hub. Continue tightening jackscrew to remove the seal spacer from a tight fit on the hub. Remove the screws which secure the puller to fixture. Remove the puller.

(f) Loosen the screws and wing nuts which secure the jaws to the ring detail of the PWA 85068 Fixture. Remove the fixture.

(g) Remove the seal spacer from the HPC rear hub.

(7) Remove the No. 3 bearing front seal seat (302/10) with a PWA 85067 Fixture (302/13) as follows.

(a) Loosen the screws and hand knobs which secure the jaws to the fixture.

(b) Position the fixture over HPC rear hub with the fixture located on the seal seat. Slide the jaws outward to engage the pulling flange of the seat. Tighten the upper screws to secure jaws. Tighten the hand knobs to fully engage jaws in the pull groove of the seal seat.

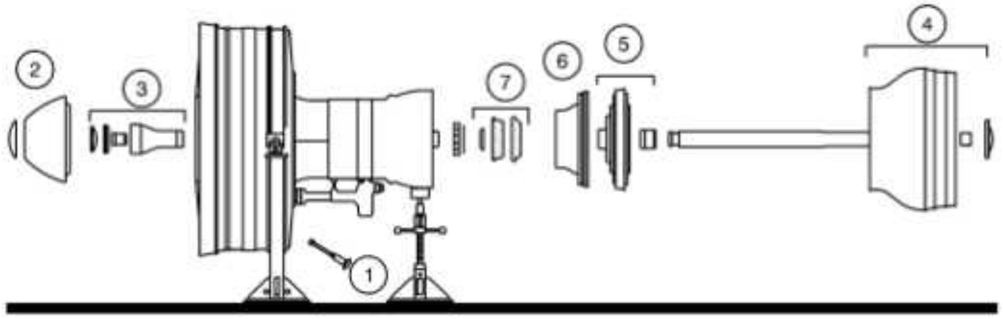
(c) Pull the fixture by hand to remove seal seat.

(d) If the seal seat cannot be removed by hand, install a PWA 85069 Puller to the upper flange of fixture per the following step.

(e) Retract the center jackscrew of PWA 85069 Puller and position the puller to the upper flange of the PWA 85067 Fixture. Secure the puller to fixture with the detail screws. Using a standard wrench tighten the center jackscrew to seat the center puck into the HPC rear hub. Continue tightening jackscrew to remove the seal seat from a tight fit on the hub. Remove the screws which secure the puller to fixture. Remove the puller.

(f) Loosen the screws and hand knobs which secure the jaws to the ring detail of fixture. Remove the fixture.

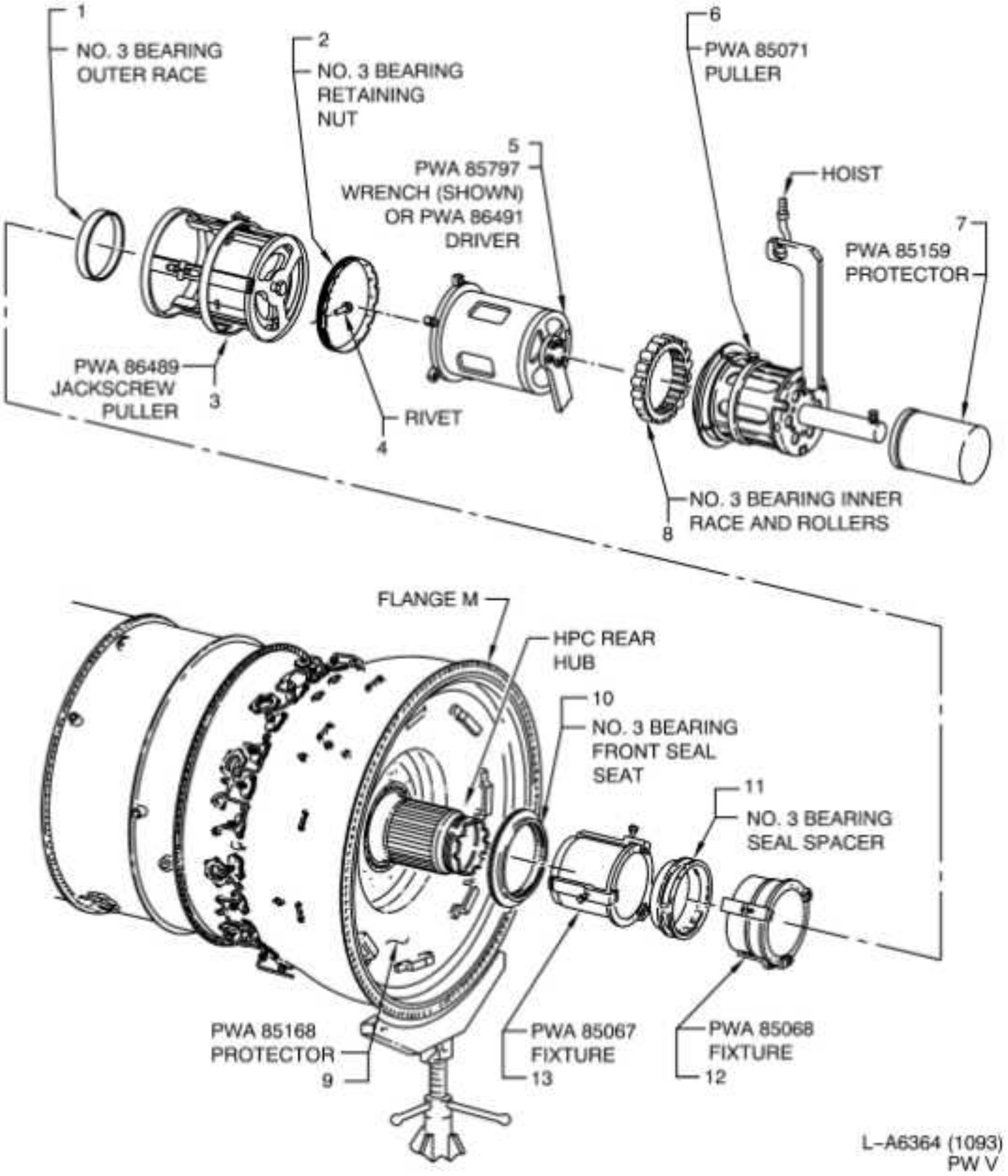
(g) Remove the seal seat from the HPC rear hub.



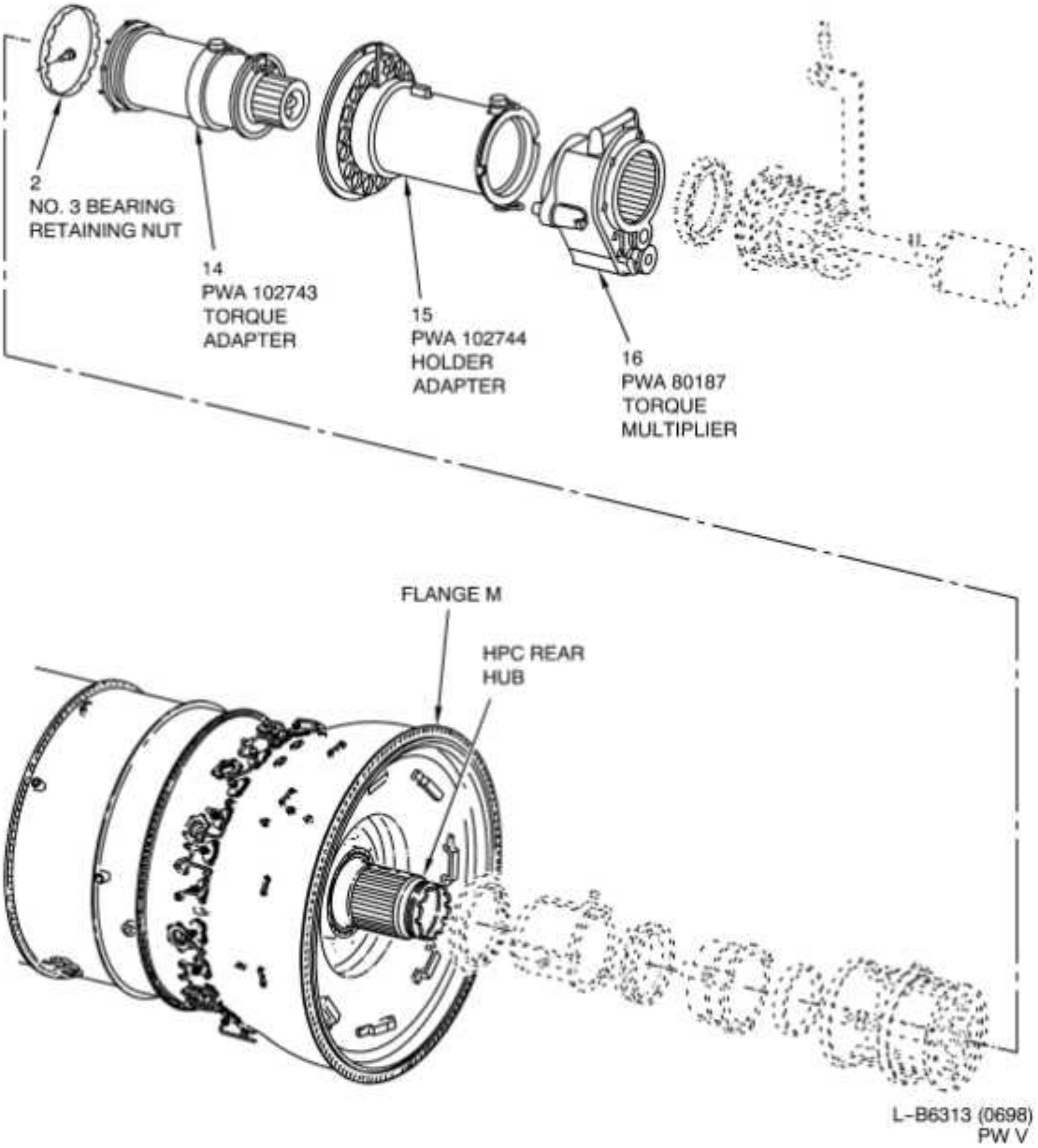
1. REMOVE N1 SPEED SENSOR
2. REMOVE COMPRESSOR INLET CONE
3. REMOVE LPC/LPT COUPLING ASSEMBLY
4. REMOVE LPT/TEC WITH SHAFT
5. REMOVE HIGH PRESSURE TURBINE (HPT)
6. REMOVE TURBINE NOZZLE
7. REMOVE NO. 3 BEARING REAR SEAL ASSEMBLY

L−A6363 (0000)
PW V

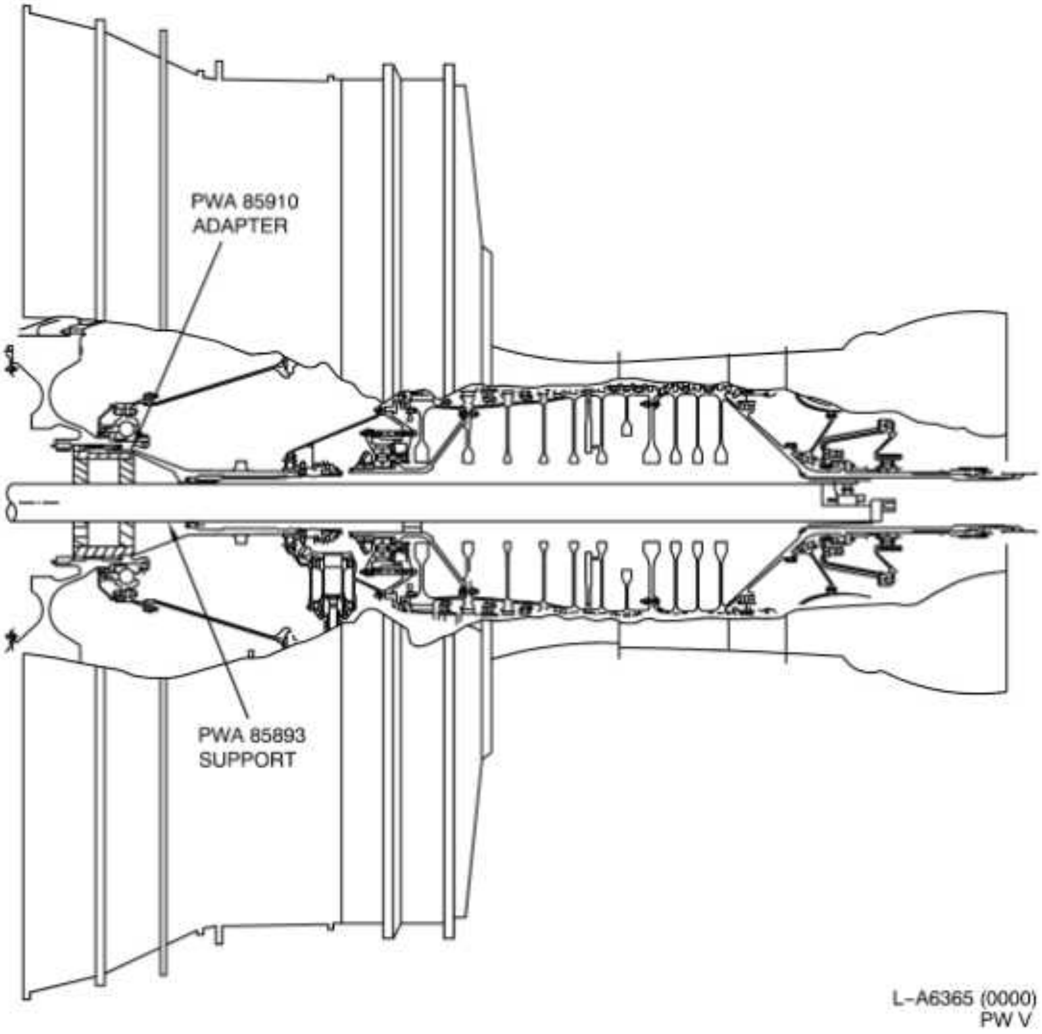
Procedure Sequence
Figure 301
(Task 72−00−41−040−002)


1
NO. 3 BEARING OUTER RACE
2
NO. 3 BEARING RETAINING NUT
5
PWA 85797 WRENCH (SHOWN) OR PWA 86491 DRIVER
6
PWA 85071 PULLER
HOIST
7
PWA 85159 PROTECTOR
PWA 86489 JACKSCREW PULLER
3
RIVET
4
NO. 3 BEARING INNER RACE AND ROLLERS
8
FLANGE M
HPC REAR HUB
10
NO. 3 BEARING FRONT SEAL SEAT
11
NO. 3 BEARING SEAL SPACER
PWA 85168 PROTECTOR
9
PWA 85067 FIXTURE
13
PWA 85068 FIXTURE
12
L−A6364 (1093)
PW V

No. 3 Bearing Removal
Figure 302 (Sheet 1)
(Task 72−00−41−040−002)


2
NO. 3 BEARING
RETAINING NUT
14
PWA 102743
TORQUE
ADAPTER
15
PWA 102744
HOLDER
ADAPTER
16
PWA 80187
TORQUE
MULTIPLIER
FLANGE M
HPC REAR
HUB
L−B6313 (0698)
PW V

No. 3 Bearing Removal
Figure 302 (Sheet 2)
(Task 72−00−41−040−002)


PWA 85910
ADAPTER
PWA 85893
SUPPORT
L−A6365 (0000)
PW V

No. 3 Bearing Removal
Figure 303
(Task 72−00−41−040−002)

ENGINE GENERAL – DIFFUSER AND COMBUSTOR – REMOVAL-20

Task 72-00-41-020-020:

1. Remove The Flange K Brackets And Hardware

   A. Equipment And Materials Necessary - None

   B. Procedure

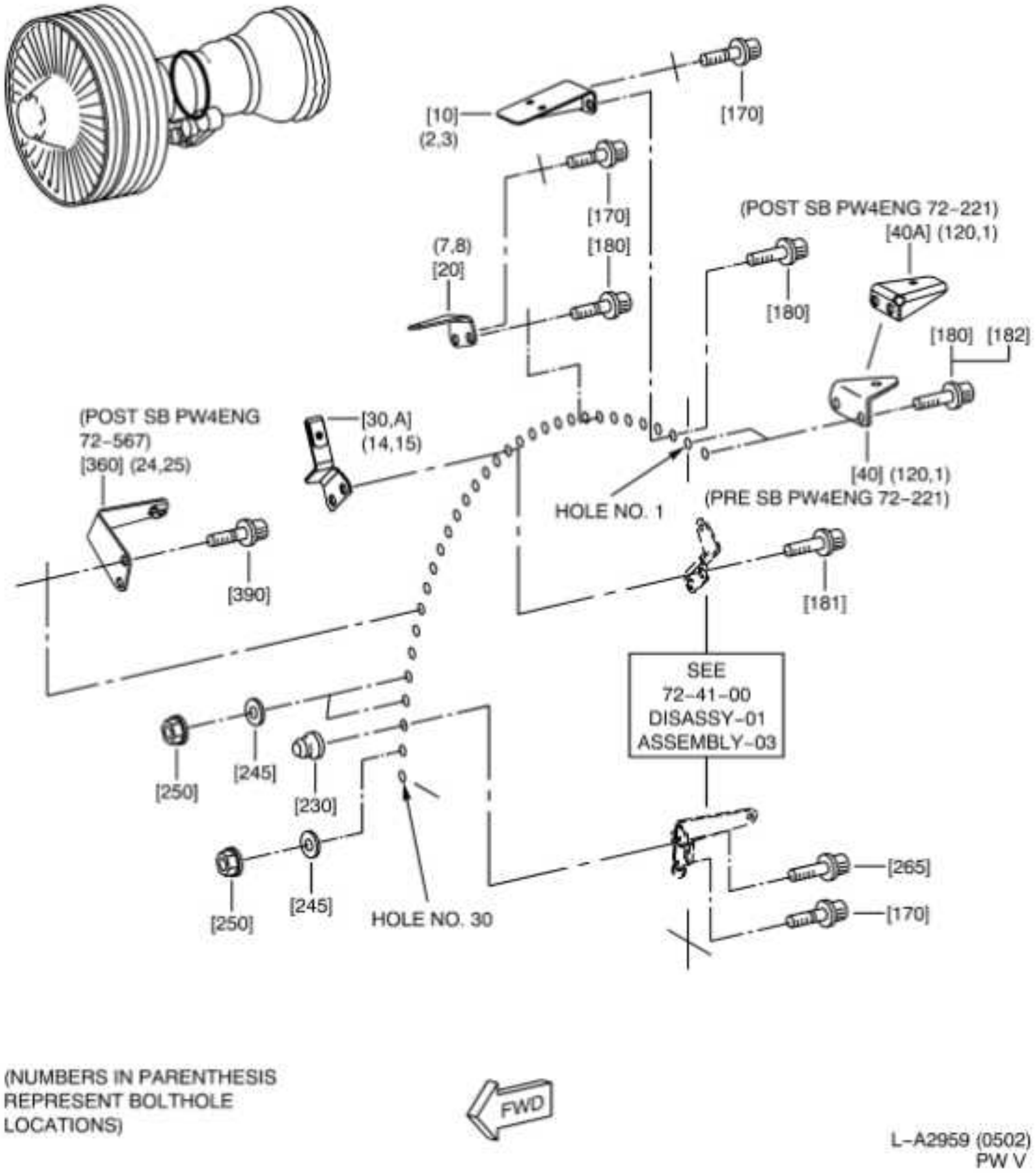
      (1) Remove the Flange K brackets as follows: See Figure 301.

         (a) Tag and identify the flange M hardware for the correct bolthole locations.

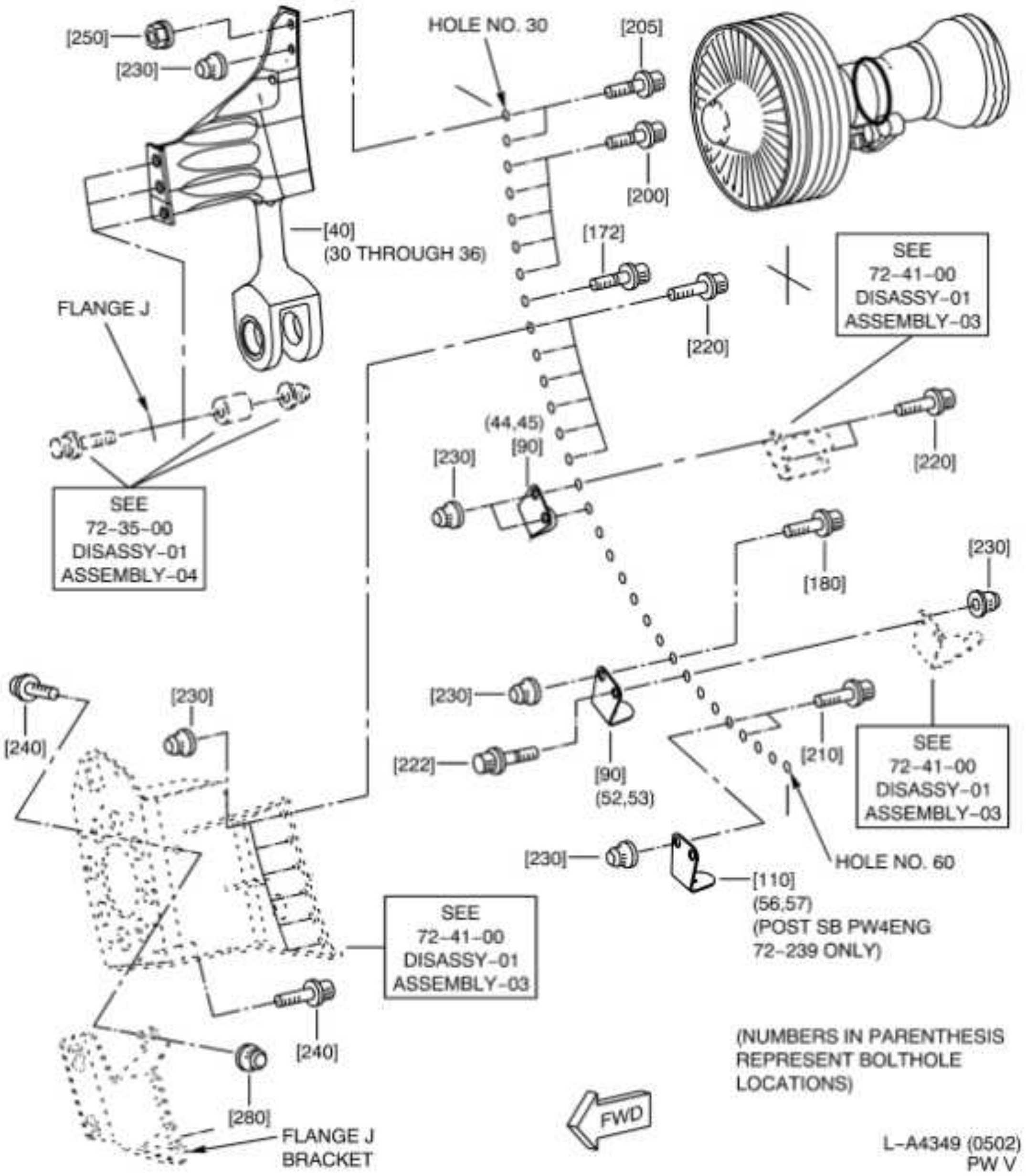
            NOTE: All the part item numbers in the figures are the same as the item numbers in the IPC.

         (b) Remove the lockwire, nuts and bolts, which attach the brackets at Flange K.

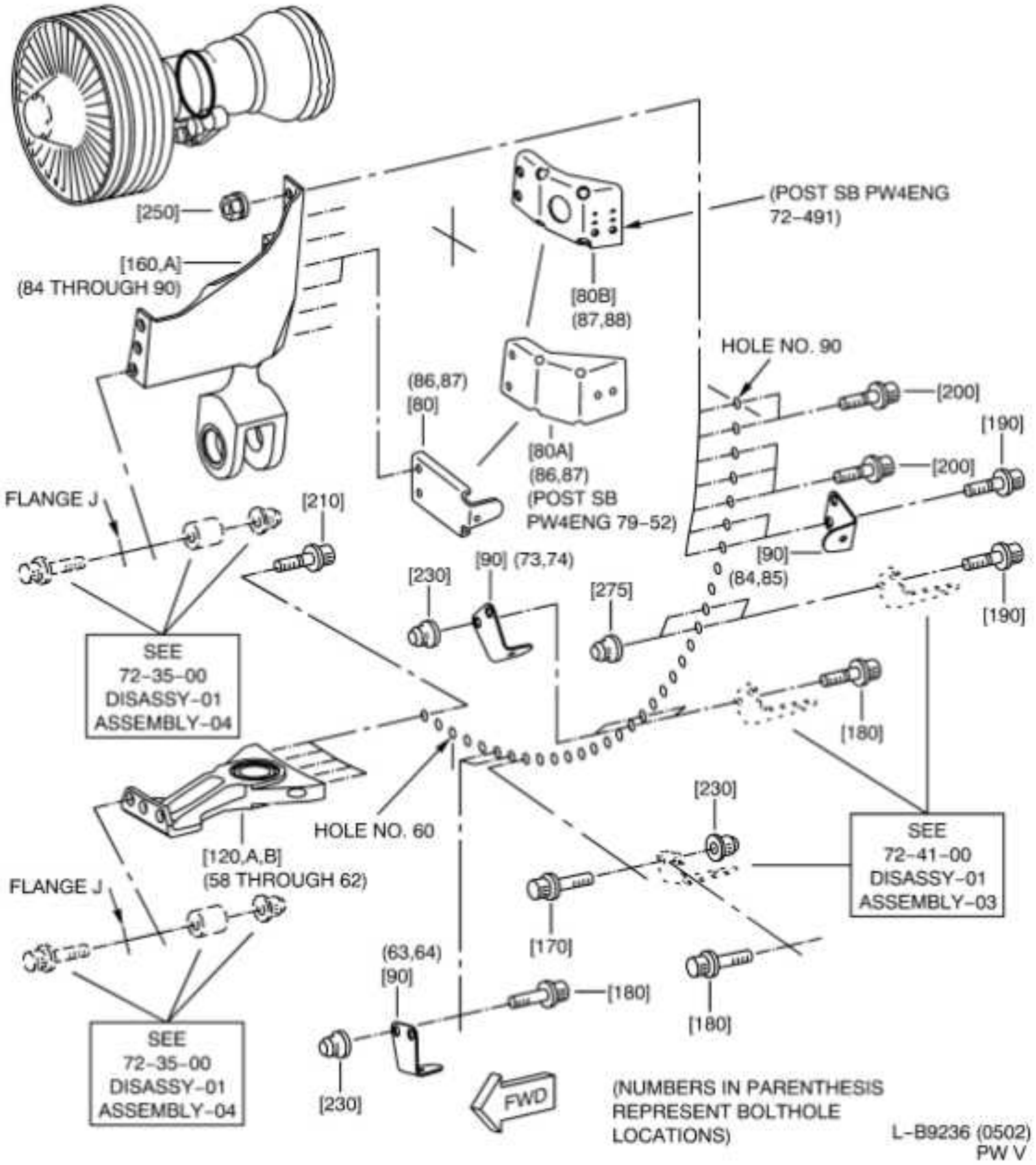
         (c) Remove two bolts and nut securing fuel flow divider valve bracket to Flange J bracket. Remove remaining bolts and nuts securing Flange K.


[10]
(2,3)
[170]
[170]
[180]
(7,8)
[20]
(POST SB PW4ENG 72-221)
[40A] (120,1)
[180]
[180] [182]
(POST SB PW4ENG
72-567)
[360] (24,25)
[30,A]
(14,15)
HOLE NO. 1
[40] (120,1)
(PRE SB PW4ENG 72-221)
[390]
[181]
SEE
72-41-00
DISASSY-01
ASSEMBLY-03
[250]
[245]
[230]
[265]
[170]
[250]
[245]
HOLE NO. 30
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-A2959 (0502)
PW V

The Flange K Brackets And Hardware
Figure 301 (Sheet 1)
(Task 72-00-41-020-020)


[250]
[230]
HOLE NO. 30
[205]
[200]
[40]
(30 THROUGH 36)
[172]
[220]
SEE
72-41-00
DISASSY-01
ASSEMBLY-03
FLANGE J
(44,45)
[90]
[230]
[220]
SEE
72-35-00
DISASSY-01
ASSEMBLY-04
[180]
[230]
[240]
[230]
[230]
[222]
[90]
(52,53)
[210]
SEE
72-41-00
DISASSY-01
ASSEMBLY-03
[230]
HOLE NO. 60
[110]
(56,57)
(POST SB PW4ENG
72-239 ONLY)
SEE
72-41-00
DISASSY-01
ASSEMBLY-03
[240]
[280]
FLANGE J
BRACKET
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-A4349 (0502)
PW V

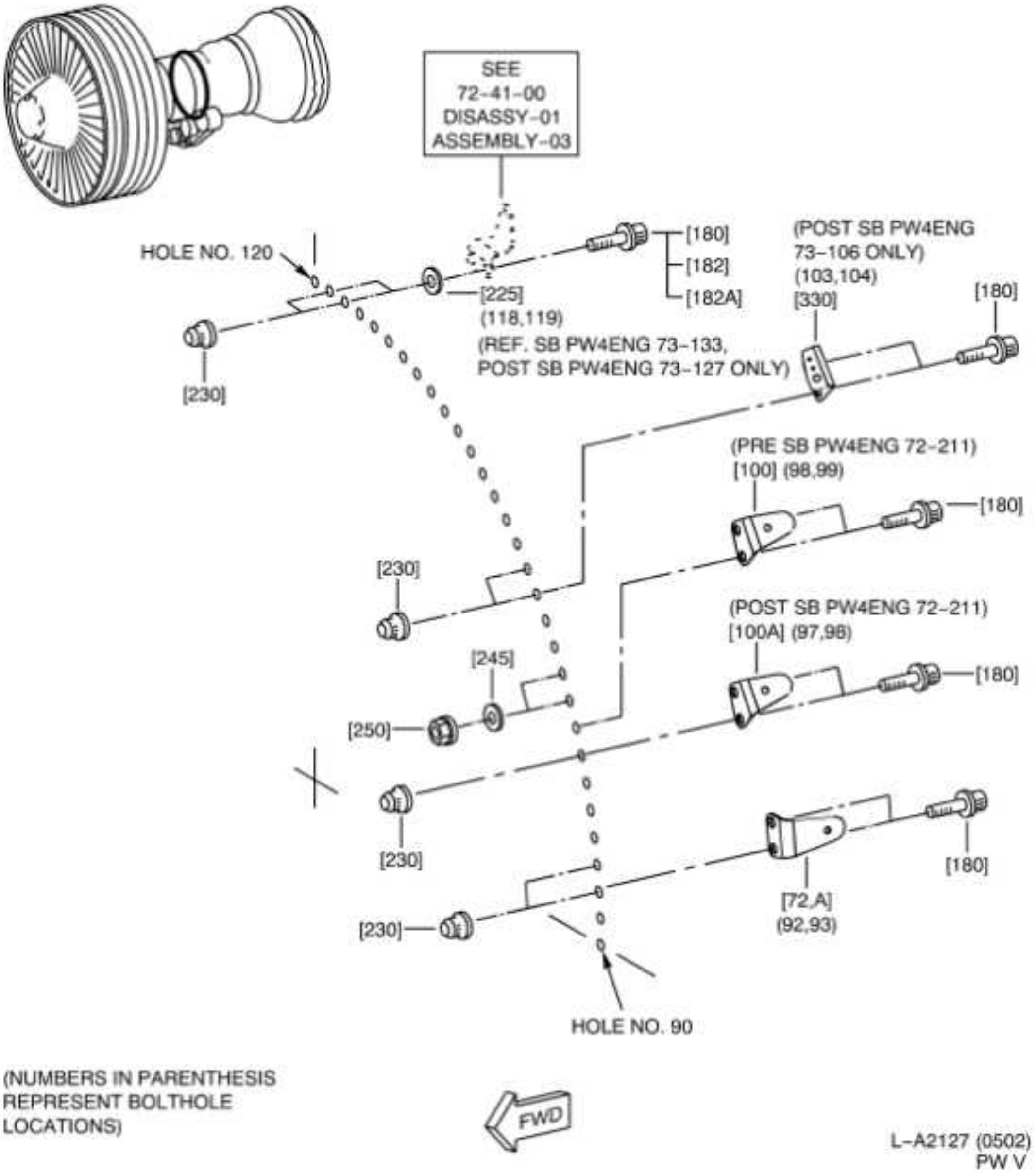
The Flange K Brackets And Hardware
Figure 301 (Sheet 2)
(Task 72−00−41−020−020)


[250]
[160,A]
(84 THROUGH 90)
(POST SB PW4ENG 72-491)
[80B]
(87,88)
HOLE NO. 90
[200]
(86,87)
[80]
[80A]
(86,87)
(POST SB PW4ENG 79-52)
[190]
[200]
FLANGE J
[210]
[90] (73,74)
[230]
[275]
[90]
(84,85)
[190]
SEE
72-35-00
DISASSY-01
ASSEMBLY-04
[180]
HOLE NO. 60
[120,A,B]
(58 THROUGH 62)
[230]
SEE
72-41-00
DISASSY-01
ASSEMBLY-03
FLANGE J
[170]
(63,64)
[90]
[180]
[180]
SEE
72-35-00
DISASSY-01
ASSEMBLY-04
[230]
FWD

(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

L-B9236 (0502)
PW V

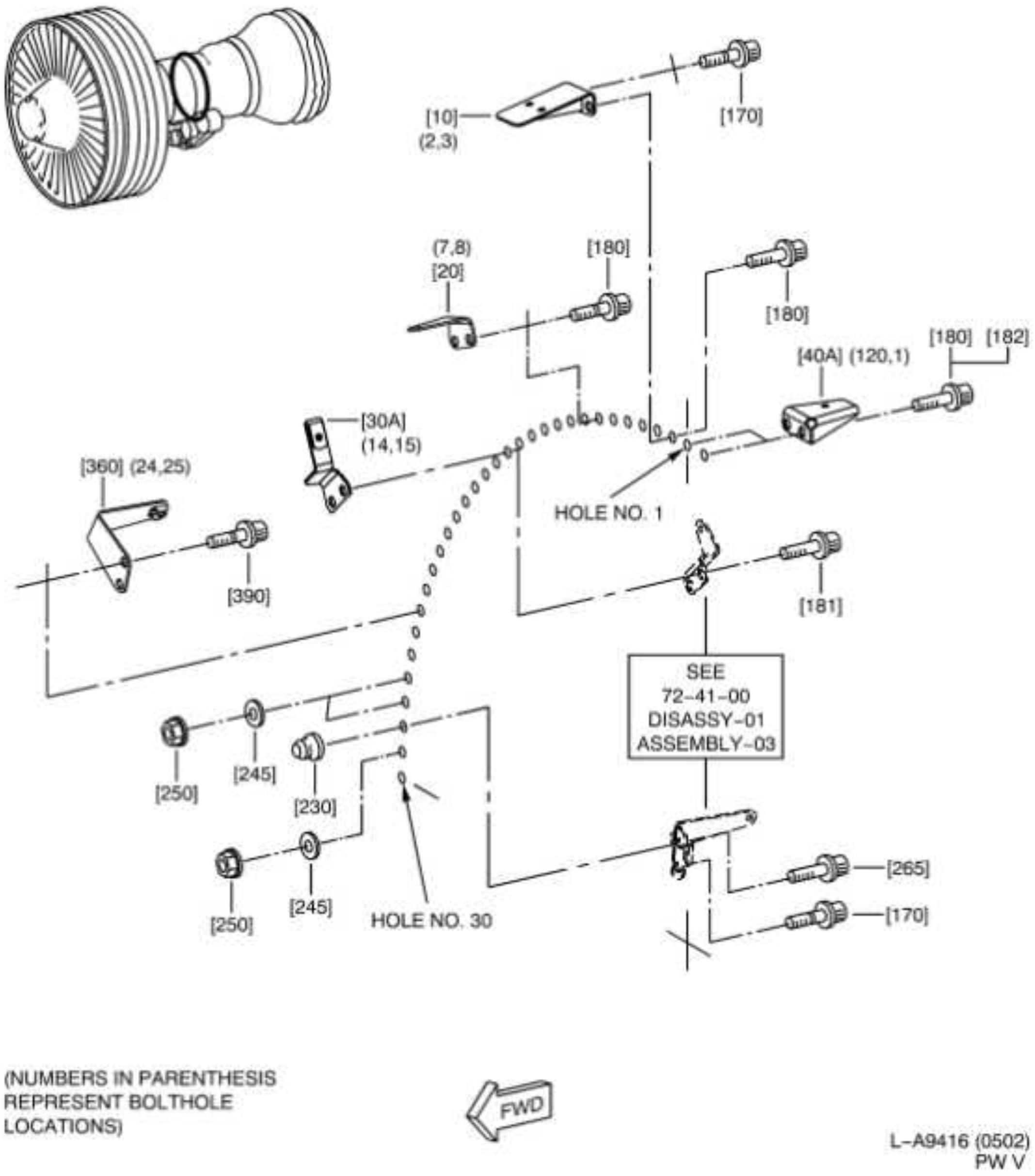
The Flange K Brackets And Hardware
Figure 301 (Sheet 3)
(Task 72-00-41-020-020)


SEE
72-41-00
DISASSY-01
ASSEMBLY-03
HOLE NO. 120
[180]
[182]
[182A]
(POST SB PW4ENG
73-106 ONLY)
(103,104)
[330]
[180]
[225]
(118,119)
(REF. SB PW4ENG 73-133,
POST SB PW4ENG 73-127 ONLY)
[230]
(PRE SB PW4ENG 72-211)
[100] (98,99)
[180]
[230]
[245]
[250]
(POST SB PW4ENG 72-211)
[100A] (97,98)
[180]
[230]
[180]
[72,A]
(92,93)
[230]
HOLE NO. 90
FWD

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

L-A2127 (0502)
PW V

The Flange K Brackets And Hardware
Figure 301 (Sheet 4)
(Task 72−00−41−020−020)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(7,8)
[20]
[180]
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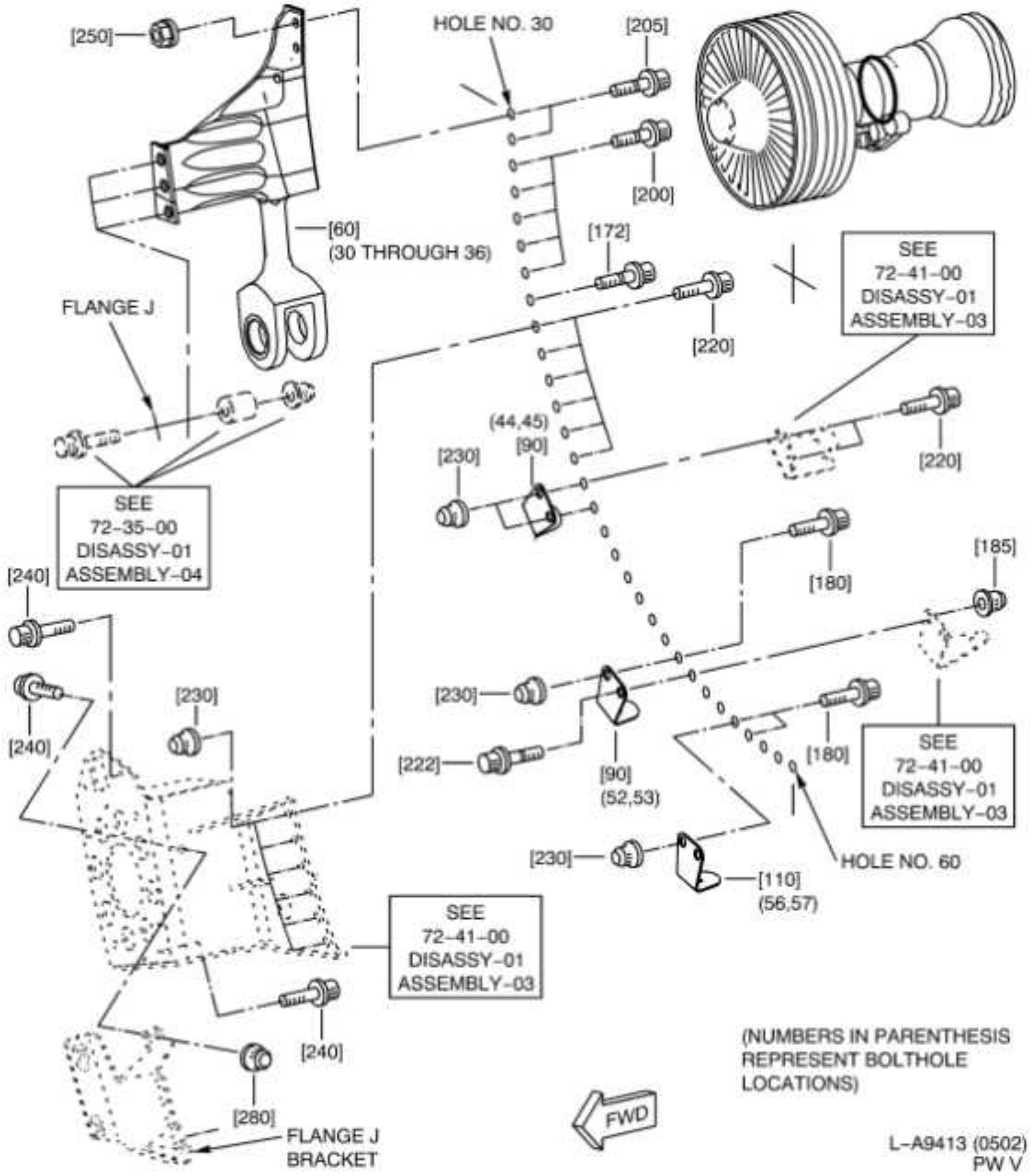
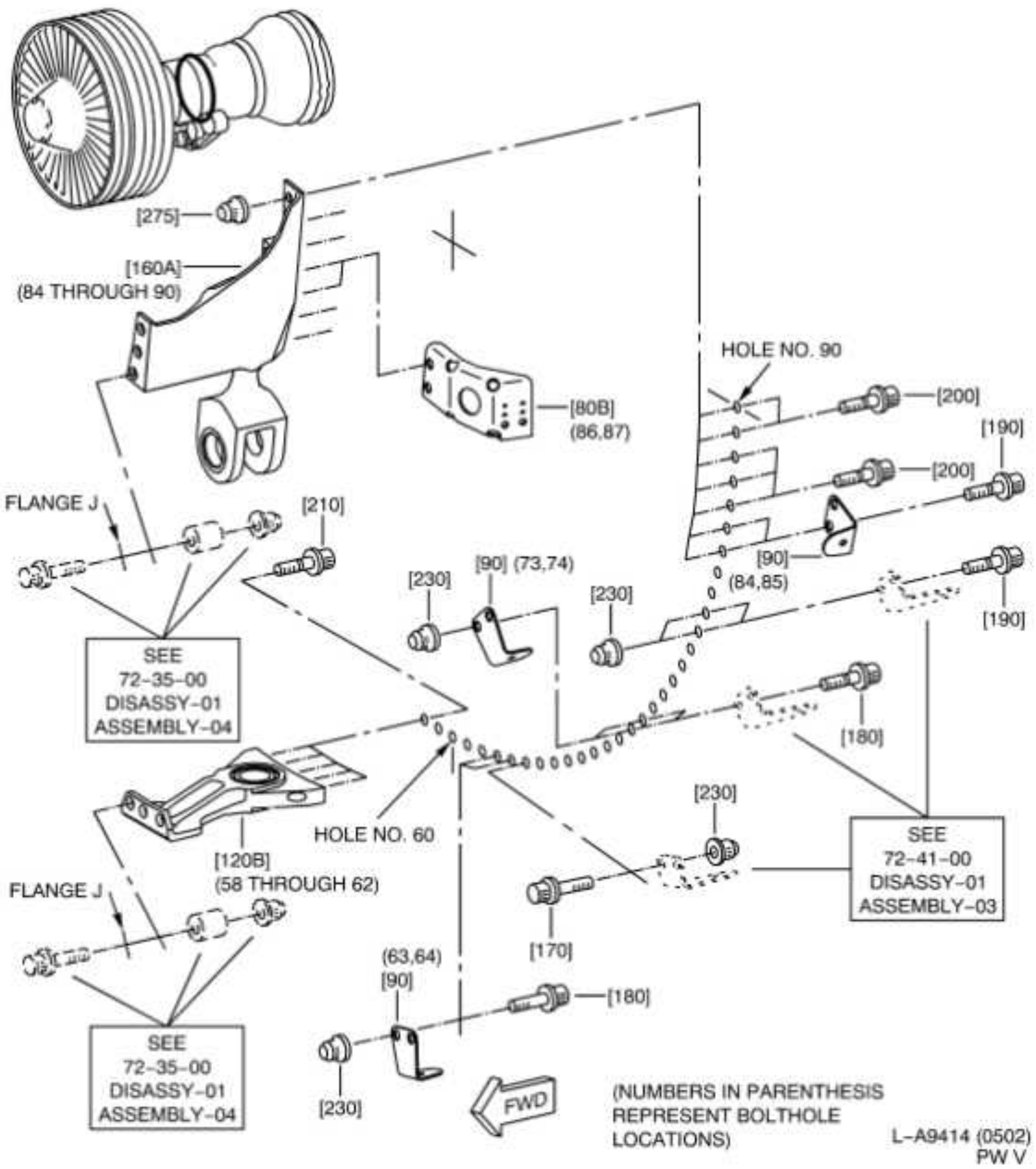
[180] [182]
[40A] (120,1)
[30A]
(14,15)
[360] (24,25)
[390]
HOLE NO. 1
[181]
SEE
72−41−00
DISASSY−01
ASSEMBLY−03
[250]
[245]
[230]
[265]
[170]
[250]
[245]
HOLE NO. 30
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L−A9416 (0502)
PW V

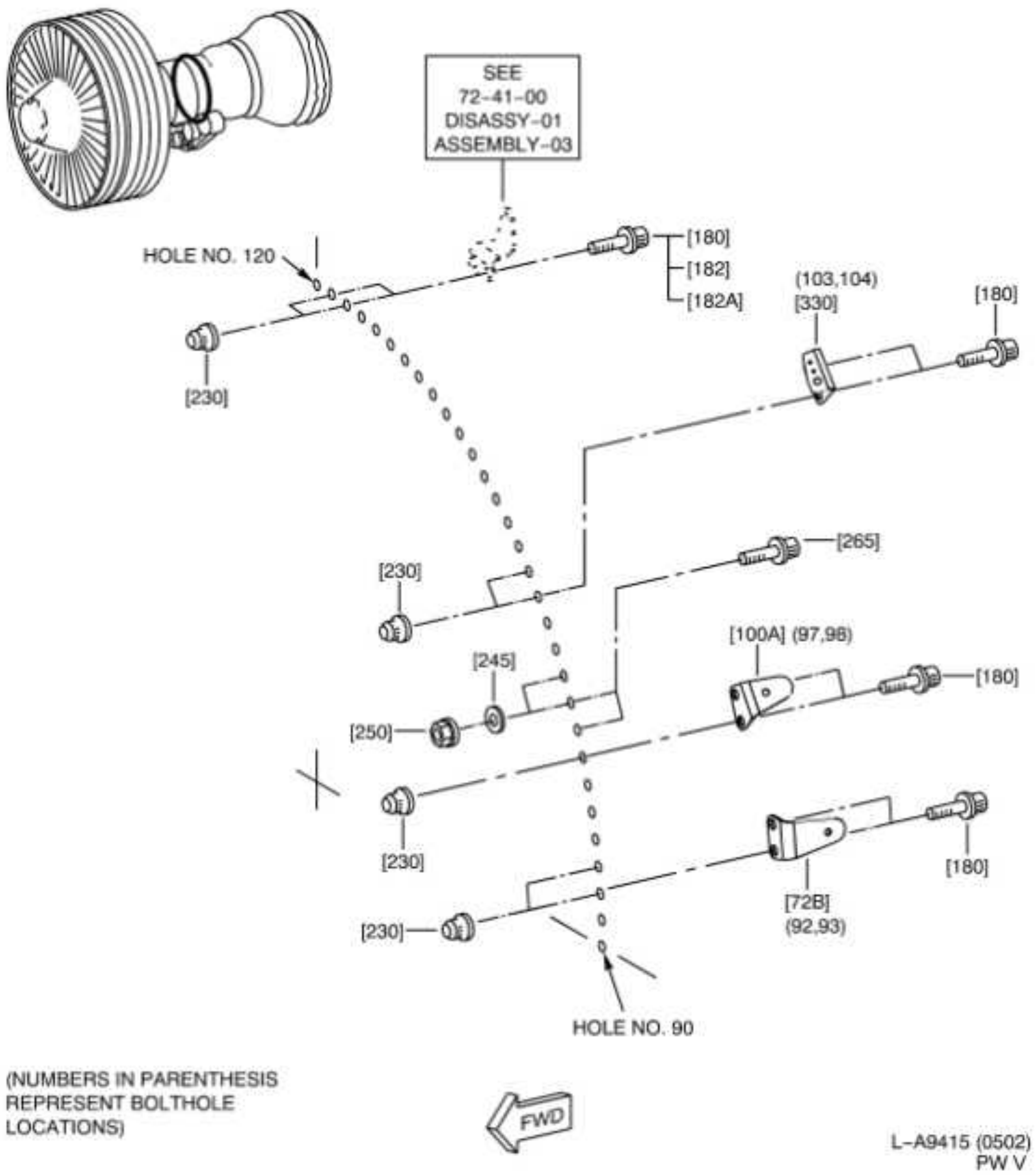
The Flange K Brackets And Hardware
Figure 301 (Sheet 5)
(Task 72−00−41−020−020)


[250]
HOLE NO. 30
[205]
[200]
[60]
(30 THROUGH 36)
[172]
[220]
SEE 72−41−00 DISASSY−01 ASSEMBLY−03
FLANGE J
(44,45)
[90]
[230]
[220]
SEE 72−35−00 DISASSY−01 ASSEMBLY−04
[240]
[180]
[185]
[240]
[240]
[230]
[230]
[222]
[90]
(52,53)
[180]
SEE 72−41−00 DISASSY−01 ASSEMBLY−03
[230]
[110]
(56,57)
HOLE NO. 60
SEE 72−41−00 DISASSY−01 ASSEMBLY−03
[240]
[280]
FLANGE J BRACKET
FWD
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L−A9413 (0502)
PW V

The Flange K Brackets And Hardware
Figure 301 (Sheet 6)
(Task 72−00−41−020−020)


[275]
[160A]
(84 THROUGH 90)
[80B]
(86,87)
HOLE NO. 90
[200]
[190]
[200]
FLANGE J
[210]
[90]
(84,85)
[230]
[90] (73,74)
[230]
[190]
SEE
72−35−00
DISASSY−01
ASSEMBLY−04
[180]
[230]
HOLE NO. 60
[120B]
(58 THROUGH 62)
FLANGE J
SEE
72−41−00
DISASSY−01
ASSEMBLY−03
[170]
(63,64)
[90]
[180]
SEE
72−35−00
DISASSY−01
ASSEMBLY−04
[230]
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L−A9414 (0502)
PW V

The Flange K Brackets And Hardware
Figure 301 (Sheet 7)
(Task 72−00−41−020−020)


SEE
72-41-00
DISASSY-01
ASSEMBLY-03
HOLE NO. 120
[180]
[182]
[182A]
(103,104)
[330]
[180]
[230]
[230]
[265]
[100A] (97,98)
[245]
[250]
[180]
[230]
[180]
[72B]
(92,93)
[230]
HOLE NO. 90
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-A9415 (0502)
PW V

The Flange K Brackets And Hardware
Figure 301 (Sheet 8)
(Task 72-00-41-020-020)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-41-420-001:

1. Install Diffuser And Combustor (Vertical) With No. 3 Bearing Outer Race Installed

NOTE: See Figure 401 for part/assembly installation procedure sequence.

NOTE: See 72-00-41, Installation-15 Task 72-00-41-420-013 for alternate procedure requiring installation of No. 3 bearing outer race into diffuser combustor group after being installed on HPC.

A. Prerequisites

(1) See 72-00-41, Inspection/Check-01 Task 72-00-41-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For Example: (Reference 1234) Torque retaining nut as follows:

(2) For diffuser and combustors that were fully disassembled, assemble the diffuser and combustor by means of 72-41-00, Assembly-01 Task 72-41-00-400-001. For diffuser and combustors with only the No. 3 bearing outer race removed, assemble the diffuser and combustor by 72-41-00, Installation-01 Task 72-41-00-430-001.

B. Equipment And Materials Required

Standard Tools:
0.250-28 Jackscrews (Four Required)
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 28657	Sling
PWA 29606	Control, Heater (Optional To PWA 29754)
PWA 29754	Control, Heater
PWA 76154	Adapter (Two Required)
PWA 85056	Cover (Optional To PWA 85802)
PWA 85067	Fixture
PWA 85068	Fixture
PWA 85070	Drift
PWA 85159	Protector
PWA 85308	Guide (Optional To PWA 85701)
PWA 85310	Pin, Alignment (Three Required)

Special Tools:

(CONTINUED)

PWA 85679	Heater (Optional to PWA 85795)
PWA 85701	Guide
PWA 85751	Bracket (Two Required)
PWA 85795	Heater
PWA 85802	Cover
PWA 85926	Cooler
PWA 85983	Adapter, Stabilizer (Two Required Twin Overhead Rail System Only)
PWA 105513	Heater, Electric (For HPC With The Ring Style Case, Post SB PW4ENG 72−756 Or Or PW4ENG 72−759 As Applicable)

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−059	Wax, Paraffin (PMC 9552)
P05−102	Ice, Dry
P05−289	Lockwire (AS3214−02)
P05−291	Cable, Safety (Optional)
R P05−292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72−00−41/1/1

C. Procedure
See Figure 402.

(1) Remove PWA 85159 Thread Protector (403/7) and PWA 85428 Knife−Edge Protector (403/6) from HPC rear hub.

CAUTION: HANDLE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN LINT FREE GLOVES TO PREVENT BEARING DAMAGE.

CAUTION: THICKNESS OF NO. 3 BEARING FRONT SEAL SEAT MUST BE MEASURED ACROSS THINNER, ID, SECTION OF SEAL SEAT OR INCORRECT DIMENSION WILL RESULT.

(2) Visually inspect HPC rear drum OD thrust balance knife−edge per 72−00−35, Inspection/Check−02 (visual

only) Task 72-00-35-210-004. Reject the airseal with cracks confirmed by visual inspection.

(3) Measure thickness of No. 3 bearing front seal seat across (402/3) thinner, ID, section of seal seat. Measure No. 3 bearing seal spacer (402/2) thickness, No. 3 bearing inner race and rollers (402/1) thickness. Record this total thickness as Dimension A.

(4) Measure distance from end of HPC rear hub (402/4) down to seal seat shoulder (402/5) on hub. Record this dimension as Dimension B.

NOTE: Dimensions A and B will be used to perform a seating check later during this installation procedure.

(5) For engines with a gasket groove on the rear flange of the HPC rear case (Post SB PW4ENG 72-48 and Pre SB PW4ENG 72-756), install gasket to flange groove and secure in place with Paraffin Wax P05-059. See Figure 403.

NOTE: Engines prior to (SB PW4ENG 72-48 and Post SB PW4ENG 72-756) do not accept gasket at Flange K.

(6) For engines with the ring style case (Post SB PW4ENG 72-756), use a PWA 105513 Heater to heat the HPC rear case rear flange as follows:

(a) Move the clamp block outboard until it is clear of the HPC rear case rear flange.

(b) Make sure that the thermocouple is in its stored position Adapter as stamped on the tool to prevent damage.

(c) Carefully move the Heater over the HPC rear shaft and engage the six Locator details on the Rear Case rear flange.

(d) Move the clamp block inboard and tighten the plastic knob.

(e) Move the thermocouple from its stored position adapter to its side of the heater adapter and let it contact the HPC rear case rear flange.

(f) Connect the Heater to the PWA 29606 or PWA 29754 Heater Control.

(g) Heat the HPC rear case rear flange to 300°F (149°C).

(h) When the rear flange is at the correct temperature turn off the Controller.

(i) Put the thermocouple is in its stored position Adapter as stamped on the tool.

(j) Loosen the plastic knob and move the clamp block outboard.

(k) Carefully remove the Heater from the HPC rear case.

(7) Install two PWA 85751 Handling Brackets to diffuser case.

NOTE: If you have a twin overhead rail system you must use PWA 85983 Stabilizer Adapters with PWA 85751 Brackets.

(a) Loosen and remove the clamp bolts that attach the fuel tubes to the Flange K bracket for PWA 85751 Bracket tool installation clearance.

(b) Using hoist, position longer front flange of brackets to rear of front flange of diffuser case at 3 and 9 o'clock locations, locating four pins in front flange of bracket into four boltholes in diffuser case front flange. Position shorter rear flange of bracket to front of diffuser case rear flange and secure with detail nuts and bolts.

(c) Position double spool bracket in rear most two holes as marked on bracket.

(8) For PWA 85701 Guide, retract two setscrews on side of guide. Position PWA 85701 Guide or PWA 85308 Guide larger diameter end first on HPC rear hub and seat on seal seat shoulder. For PWA 85701 Guide, handtighten two setscrews on side of guide.

(9) Install three PWA 85310 Alignment Pins into rear flange of HPC case.

(a) Remove screws from storage locations in plate details of alignment pins.

(b) Locate three equally spaced 0.250−28 Jackscrew holes in rear flange of HPC case.

(c) Insert three equally spaced alignment pins (dowel pins up) through unthreaded holes in rear flange of HPC case. Secure pins with detail screws.

(10) Using hoist, connect PWA 28657 Sling with two PWA 76154 Adapters to outer trunnion spools of PWA 85751 Brackets on diffuser case.

(11) Using hoist position diffuser and combustor assembly over HPC rear hub. Align pins in HPC rear case with mating holes in diffuser case. With workbolts and nuts, seat diffuser case on HPC rear case.

(12) Remove work bolts, nuts, and PWA 85310 Pins. For PWA 85701 Guide, retract two setscrews on side of guide. Remove PWA 85701 Guide or PWA 85308 Guide from HPC rear hub.

(13) Remove PWA 28657 Sling, PWA 76154 Adapters and PWA 85751 Brackets.

(14) Install the Flange K hardware as follows: Refer to 72−00−41, Installation−20 (Task 72−00−41−420−020).

(15) Install PWA 85802 Protector Cover or PWA 85056 Protector Cover (404/5) over No. 3 bearing outer race retaining nut installed in housing. If PWA 85056 Protector Cover is used, slowly rotate cover until the three spring plungers seat in holes in retaining nut.

(16) Assemble PWA 85067 Fixture (404/3) to No. 3 bearing front seal seat (404/4). See Figure 404.

(17) Install fixture with seal seat polished face down over HPC rear hub and drift to seat if necessary. Remove fixture.

(18) Assemble PWA 85068 Fixture (404/1) to No. 3 bearing seal spacer (404/2).

(19) Install fixture with seal spacer over HPC rear hub and drift to seat if necessary. Remove fixture.

(20) Remove PWA 85168 Protector (405/5) from diffuser case. See See Figure 405.

(21) Remove PWA 85802 Protector Cover or PWA 85056 Protector Cover from housing.

(22) Chill HPC hub with PWA 85926 Cooler(405/4) with Dry Ice P05−102.

(23) Install cooler in HPC hub and attach shop air to cooler.

(24) Heat No. 3 bearing outer race with PWA 85795 Heater or PWA 85679 Heater (405/6) and PWA 29754 Control or equivalent (405/3).

(25) After parts are properly heated and chilled, remove heater and cooler.

CAUTION: HANDLE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN LINT FREE GLOVES TO PREVENT BEARING DAMAGE.

(26) Install No. 3 bearing inner race and rollers (405/2) onto HPC rear hub, puller groove up. Seat bearing using PWA 85070 Drift (405/1). Remove drift.

(27) Install PWA 85168 Protector (405/7) to diffuser case.

(28) Using depth gage measure distance from end of HPC rear hub down to rear of inner race and roller. Record this distance as Dimension C. See Figure 402.

(29) Dimension C must not be less than previously taken Dimension B minus Dimension A.

NOTE: Dimension C less than required indicates bearing is not fully seated.

(30) Install PWA 85159 Thread Protector (405/5) over HPC rear hub.

D. Postrequisites

(1) Connect/Install The External Parts To Complete Installation Of Diffuser Combustor. Refer to 72−00−41, Installation−02 (Task 72−00−41−420−002).

(2) Trunnion The Intermediate Case Through Diffuser And Combustor Case From Front End Down To Horizontal Position. Refer to 72-00-00, Special Procedures-10 (Task 72-00-00-420-002-A00).

(3) Install The No. 3 Bearing Seal Assembly And Seal Seat. Refer to 72-00-41, Installation-03 (Task 72-00-41-420-003).

(4) Vacuum Check The No. 3 Bearing Compartment. Refer to 72-00-41, Inspection/Check-07 (Task 72-00-41-720-001).

(5) Install The Turbine Nozzle. Refer to 72-00-51, Installation-01 (Task 72-00-51-420-001).

(6) Install The High Pressure Turbine - Horizontal. Refer to 72-00-52, Installation-01 (Task 72-00-52-420-001).

(7) Install The No. 1 Bearing Support Assembly. Refer to 72-00-34, Installation-04 (Task 72-00-34-450-002).

(8) Install The Fan Case. Refer to 72-00-33, Installation-01 (Task 72-00-33-420-001).

(9) Install The Low Pressure Turbine With Shaft. Refer to 72-00-53, Installation-01 (Task 72-00-53-420-001).

(10) Install The Turbine Exhaust Case. Refer to 72-00-54, Installation-01 (Task 72-00-54-420-001).

(11) Install The Low Pressure Compressor. Refer to 72-00-31, Installation-01 (Task 72-00-31-420-003).

(12) Install The LPC/LPT Coupling. Refer to 72-00-32, Installation-01 (Task 72-00-32-420-001).

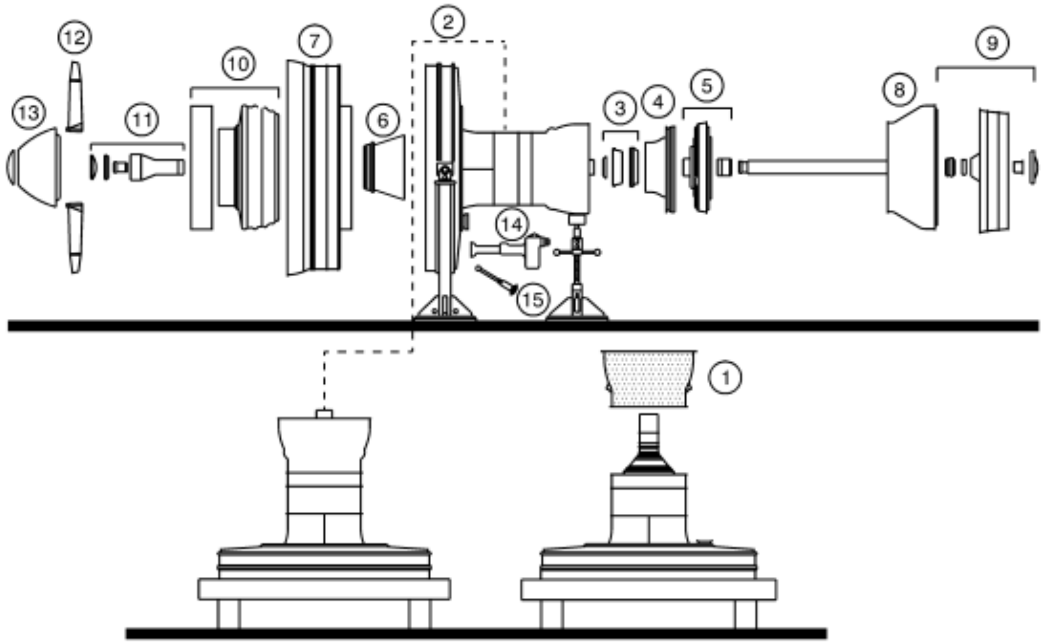
(13) Install The Stage 1 LPC Blade Assemblies. Refer to 72-00-31, Installation-04 (Task 72-00-31-420-002-002).

(14) Install The Compressor Inlet Cone. Refer to 72-00-31, Installation-02 (Task 72-00-31-420-001).

(15) Install The Main Gearbox. Refer to 72-00-61, Installation-01 (Task 72-00-61-420-001).

(16) Install The Electronic Engine Control (EEC) Speed Transducer (N1). Refer to 72-00-34, Installation-03 (Task 72-00-34-450-001).

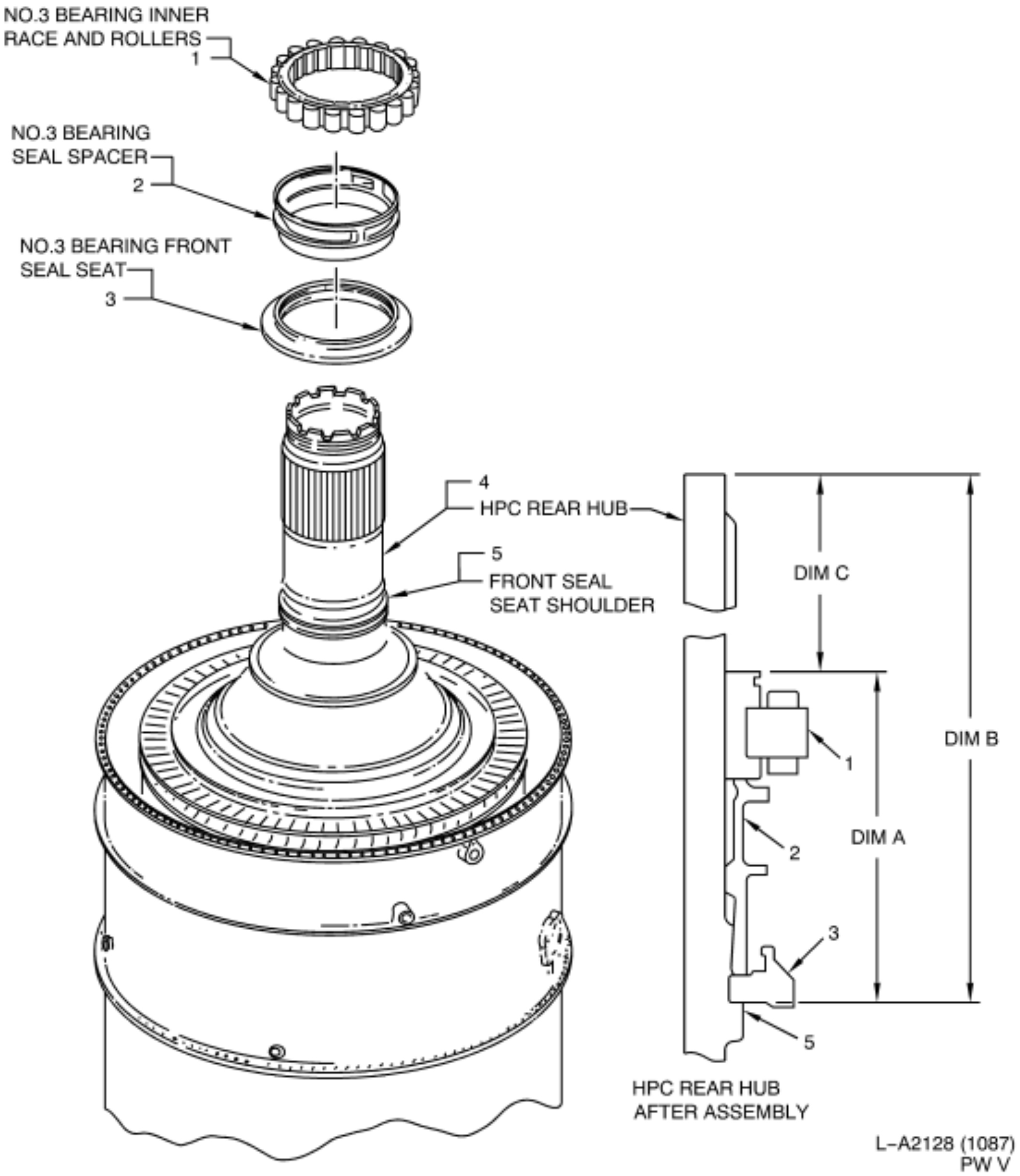
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−01



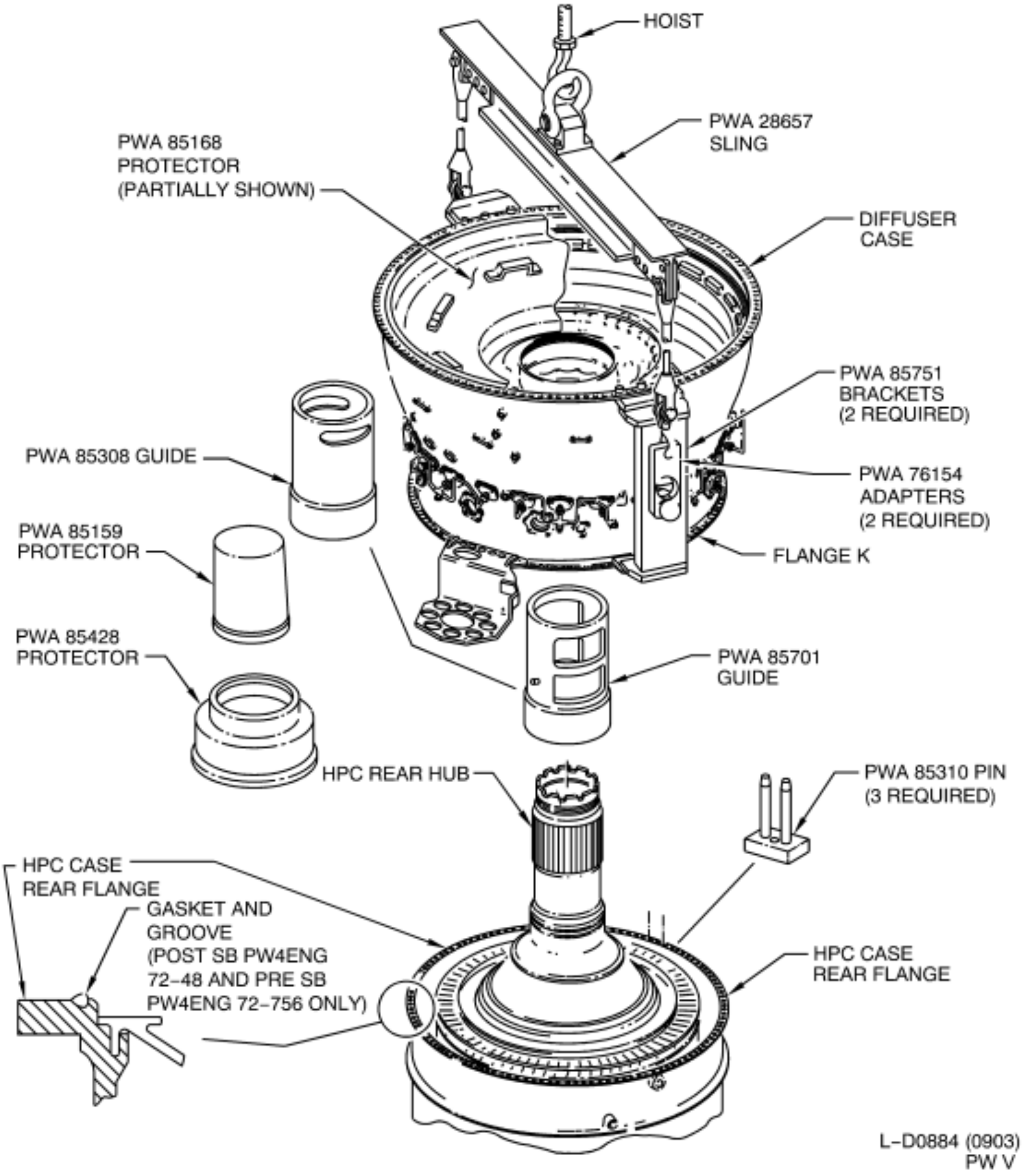
1. INSTALL DIFFUSER AND COMBUSTOR.
2. TRUNNION INTERMEDIATE THROUGH DIFFUSER CASE TO HORIZONTAL.
3. INSTALL NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL SEAT.
4. INSTALL TURBINE NOZZLE.
5. INSTALL HIGH PRESSURE TURBINE (HPT).
6. INSTALL NO. 1 BEARING SUPPORT ASSEMBLY.
7. INSTALL FAN CASE.
8. INSTALL LOW PRESSURE TURBINE (LPT).
9. INSTALL TURBINE EXHAUST CASE.
10. INSTALL LOW PRESSURE COMPRESSOR (LPC).
11. INSTALL LPC/LPT COUPLING.
12. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
13. INSTALL COMPRESSOR INLET CONE.
14. INSTALL MAIN GEARBOX.
15. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).

L−A0257 (0000)
PW V

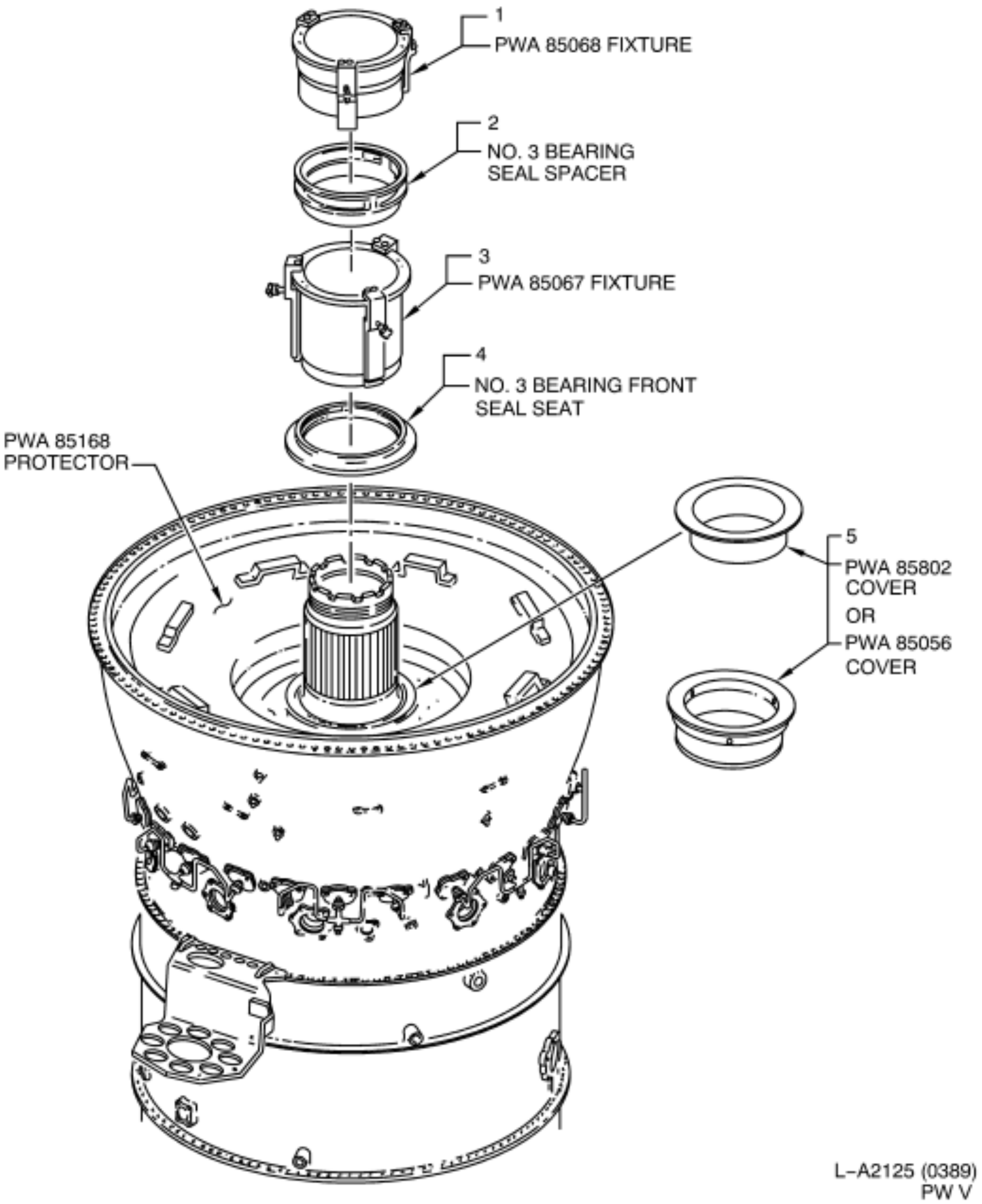
Procedure Sequence
Figure 401
(Task 72−00−41−420−001)


NO.3 BEARING INNER RACE AND ROLLERS
1
NO.3 BEARING SEAL SPACER
2
NO.3 BEARING FRONT SEAL SEAT
3
4
HPC REAR HUB
5
FRONT SEAL SEAT SHOULDER
DIM C
DIM B
DIM A
1
2
3
5
HPC REAR HUB AFTER ASSEMBLY
L-A2128 (1087)
PW V

Diffuser And Combustor Installation
Bearing Seating Check Measurement
Figure 402
(Task 72-00-41-420-001)

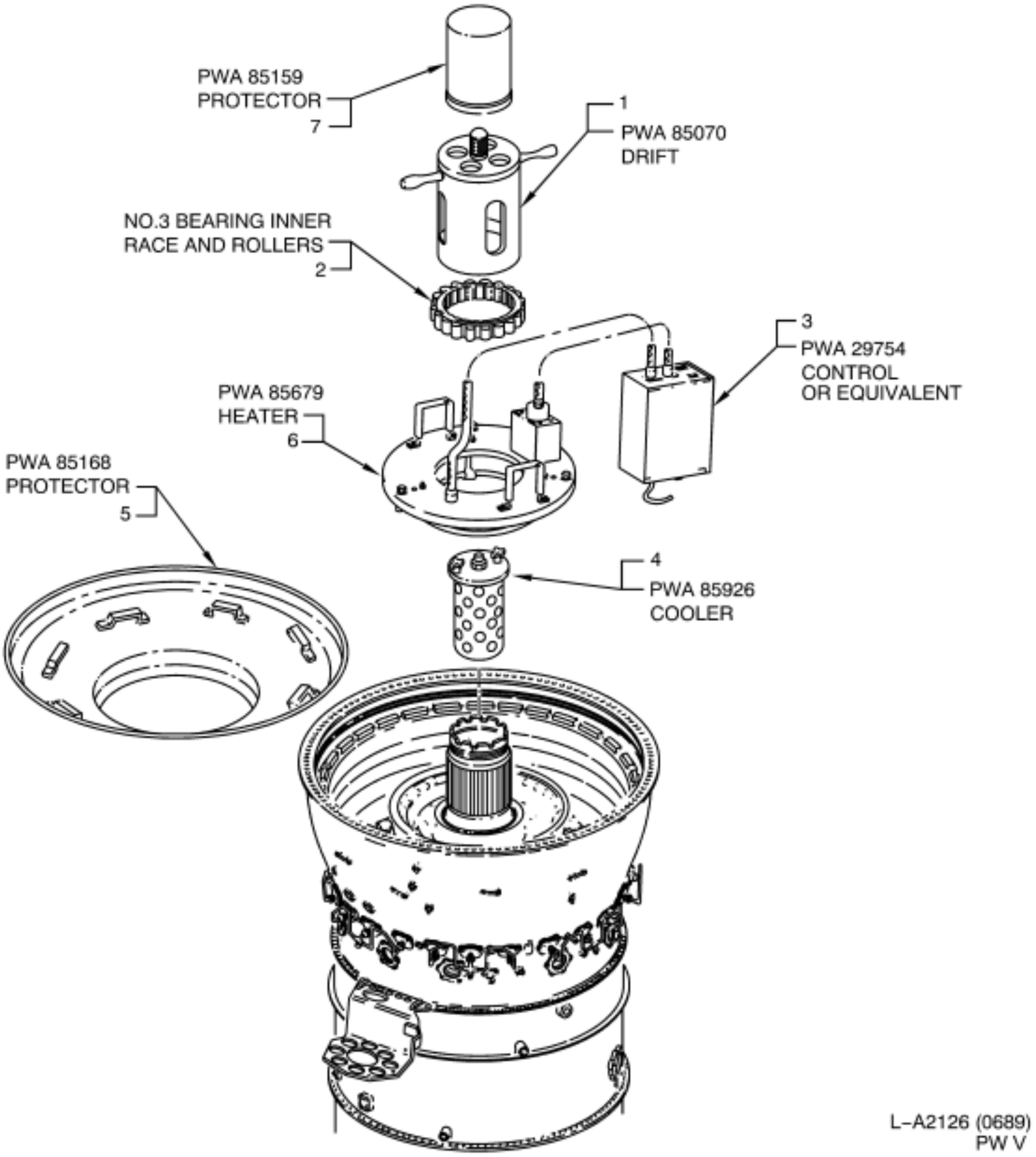

HOIST
PWA 28657 SLING
PWA 85168 PROTECTOR (PARTIALLY SHOWN)
DIFFUSER CASE
PWA 85751 BRACKETS (2 REQUIRED)
PWA 85308 GUIDE
PWA 76154 ADAPTERS (2 REQUIRED)
PWA 85159 PROTECTOR
FLANGE K
PWA 85428 PROTECTOR
PWA 85701 GUIDE
HPC REAR HUB
PWA 85310 PIN (3 REQUIRED)
HPC CASE REAR FLANGE
GASKET AND GROOVE (POST SB PW4ENG 72-48 AND PRE SB PW4ENG 72-756 ONLY)
HPC CASE REAR FLANGE
L-D0884 (0903)
PW V

Diffuser And Combustor Installation
Figure 403
(Task 72−00−41−420−001)


1
PWA 85068 FIXTURE
2
NO. 3 BEARING SEAL SPACER
3
PWA 85067 FIXTURE
4
NO. 3 BEARING FRONT SEAL SEAT
PWA 85168 PROTECTOR
5
PWA 85802 COVER
OR
PWA 85056 COVER
L-A2125 (0389)
PW V

Diffuser And Combustor Installation
Figure 404
(Task 72-00-41-420-001)

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - INSTALLATION-01


PWA 85159
PROTECTOR
7
1
PWA 85070
DRIFT
NO.3 BEARING INNER
RACE AND ROLLERS
2
3
PWA 29754
CONTROL
OR EQUIVALENT
PWA 85679
HEATER
6
PWA 85168
PROTECTOR
5
4
PWA 85926
COOLER
L-A2126 (0689)
PW V

Diffuser And Combustor Installation
Figure 405
(Task 72-00-41-420-001)

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - INSTALLATION-01

Task 72-00-41-420-006:

1. Install Diffuser And Combustor (Vertical) With No. 3 Bearing Outer Race Installed

NOTE: See Figure 401 for part/assembly installation procedure sequence.

NOTE: See 72-00-41, Installation-15 Task 72-00-41-420-013 for the applicable procedure necessary for the installation of the No. 3 bearing outer race into the diffuser combustor group after installation on the HPC.

A. Prerequisites

(1) See 72-00-41, Inspection/Check-01 Task 72-00-41-990-001 for interface fits and clearances. Special torques and special assembly procedures show where necessary in the text that follows and are identified by a reference number. For Example: (Reference 1234) Torque retaining nut as follows:

(2) For diffuser and combustors that were fully disassembled, assemble the diffuser and combustor by 72-41-00, Assembly-01 Task 72-41-00-400-001. For diffuser and combustors with only the No. 3 bearing outer race removed, assemble the diffuser and combustor by 72-41-00, Installation-01 Task 72-41-00-430-001.

B. Equipment And Materials Necessary

Standard Tools:
0.250-28 Jackscrews (Four Necessary)
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 28657	Sling
PWA 29606	Control, Heater (Optional To PWA 29754)
PWA 29754	Control, Heater
PWA 76154	Adapter (Two Necessary)
PWA 85056	Cover (Optional To PWA 85802)
PWA 85067	Fixture
PWA 85068	Fixture
PWA 85070	Drift
PWA 85159	Protector
PWA 85308	Guide (Optional To PWA 85701)
PWA 85310	Pin, Alignment (Three Necessary)
PWA 85679	Heater (Optional To PWA 85795

Special Tools:

(CONTINUED)

PWA 85701	Guide
PWA 85751	Bracket (Two Necessary)
PWA 85795	Heater
PWA 85802	Cover
PWA 85926	Cooler
PWA 85983	Adapter, Stabilizer (Two Necessary Twin Overhead Rail System Only)
PWA 105513	Heater, Electric (For HPC With The Ring Style Case, Post SB PW4ENG 72-756 Or PW4ENG 72-759 As Applicable)

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-059	Wax, Paraffin (PMC 9552)
P05-102	Ice, Dry
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
R P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72-00-41/1/1

C. Procedure
See Figure 402.

(1) Remove the PWA 85159 Thread Protector (403/7) and the PWA 85428 Knife-Edge Protector (403/6) from the HPC rear hub.

CAUTION: WEAR CLEAN LINT FREE GLOVES WHEN YOU TOUCH THE NO. 3 BEARING INNER RACE AND ROLLERS TO PREVENT BEARING DAMAGE.

CAUTION: THICKNESS OF NO. 3 BEARING FRONT SEAL SEAT MUST BE MEASURED ACROSS THINNER, ID, SECTION OF SEAL SEAT OR INCORRECT DIMENSION WILL RESULT.

(2) Make a visual inspection of the HPC rear drum OD thrust balance knife-edge by 72-00-35, Inspection/Check-02

(visual only) Task 72−00−35−210−004. Reject the airseal with cracks found by the visual inspection.

(3) Measure the thickness of the No. 3 bearing front seal seat across (402/3) the thinner, ID, section of the seal seat. Measure the No. 3 bearing seal spacer (402/2) thickness and the No. 3 bearing inner race and rollers (402/1) thickness. Make a record of this total thickness as Dimension A.

(4) Measure the distance from the end of the HPC rear hub (402/4) down to the seal seat shoulder (402/5) on the hub. Make a record of this dimension as Dimension B.

NOTE: Dimensions A and B are used to do a seating check later during this installation procedure.

(5) For engines with a gasket groove on the rear flange of the HPC rear case (Pre SB PW4ENG 72−756, or PW4ENG 72−759 as applicable), install a gasket to the flange groove and hold in place with Paraffin Wax P05−059. See Figure 403.

(6) For engines with the ring style case (Post SB PW4ENG 72−756 or PW4ENG 72−759 as applicable), use a PWA 105513 Heater to heat the HPC rear case rear flange as follows:

(a) Move the clamp block outboard until it is clear of the HPC rear case rear flange.

(b) Make sure that the thermocouple is in its stored position Adapter as stamped on the tool to prevent damage.

(c) Carefully move the Heater over the HPC rear shaft and engage the six Locator details on the rear case rear flange.

(d) Move the clamp block inboard and tighten the plastic knob.

(e) Move the thermocouple from its stored position adapter to its side of the heater adapter and let it contact the HPC rear case rear flange.

(f) Connect the Heater to the PWA 29606 or PWA 29754 Heater Control.

(g) Heat the HPC rear case rear flange to 300°F (149°C).

(h) When the rear flange is at the correct temperature turn off the Controller.

(i) Put the thermocouple is in its stored position Adapter as stamped on the tool.

(j) Loosen the plastic knob and move the clamp block outboard.

(k) Carefully remove the Heater from the HPC rear case.

(7) Install two PWA 85751 Handling Brackets to the diffuser case.

NOTE: If you have a twin overhead rail system you must use PWA 85983 Stabilizer Adapters with PWA 85751 Brackets.

(a) Loosen and remove the clamp bolts that attach the fuel tubes to the Flange K bracket for PWA 85751 Bracket tool installation clearance.

(b) Use a hoist and install the longer front flange of the brackets to the rear of the front flange of the diffuser case at the 3 and 9 o'clock locations. Install the four pins in the front flange of the bracket into the four boltholes in the diffuser case front flange. Install the shorter rear flange of the bracket to the front of diffuser case rear flange and attach with detail nuts and bolts.

(c) Install the double spool bracket to the rear most two holes as marked on the bracket.

(8) For PWA 85701 Guide, retract two setscrews on the side O of the guide. Install the PWA 85701 Guide or PWA 85308 Guide, larger diameter end first, to the HPC rear hub and engage on the seal seat shoulder. For PWA 85701 Guide, handtighten two setscrews on the side of guide.

(9) Install three PWA 85310 Alignment Pins into the rear flange of the HPC case.

(a) Remove the screws from the storage locations in the plate details of the alignment pins.

(b) Locate three equally spaced 0.250−28 Jackscrew holes in the rear flange of the HPC case.

(c) Insert three equally spaced alignment pins (dowel pins up) through the unthreaded holes in the rear flange of the HPC case. Attach the pins with the detail screws.

(10) Use a hoist and connect the PWA 28657 Sling with two PWA 76154 Adapters to the outer trunnion spools of the PWA 85751 Brackets on the diffuser case.

(11) Use a hoist and install the diffuser and combustor assembly over the HPC rear hub. Align the pins in the HPC rear case with the holes in the diffuser case. With workbolts and nuts, seat the diffuser case on the HPC rear case.

(12) Remove the work bolts, nuts, and PWA 85310 Pins. For the PWA 85701 Guide, retract the two setscrews on the side of the guide. Remove the PWA 85701 Guide or PWA 85308 Guide from the HPC rear hub.

(13) Remove PWA 28657 Sling, PWA 76154 Adapters and PWA 85751 Brackets.

(14) Install the Flange K hardware as follows: Refer to 72−41−00, Installation−20 (Task 72−00−41−420−020).

(15) Install the PWA 85802 Protector Cover or PWA 85056 Protector Cover (404/5) over the No. 3 bearing outer race retaining nut installed in the housing. If PWA 85056 Protector Cover is used, slowly turn the cover until the three spring plungers engage in the holes in retaining nut.

(16) Assemble the PWA 85067 Fixture (404/3) to the No. 3 bearing front seal seat (404/4). See Figure 404.

(17) Install the fixture with seal seat polished face down over the HPC rear hub and drift to seat, if necessary. Remove the fixture.

(18) Assemble the PWA 85068 Fixture (404/1) to the No. 3 bearing seal spacer (404/2).

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−01

(19) Install the fixture with the seal spacer over the HPC rear hub and drift to seat, if necessary. Remove the fixture.

(20) Remove the PWA 85168 Protector (405/5) from the diffuser case. See Figure 405.

(21) Remove the PWA 85802 Protector Cover or PWA 85056 Protector Cover from the housing.

(22) Chill the HPC hub with the PWA 85926 Cooler (405/4) with Dry Ice P05−102.

(23) Install the cooler in the HPC hub and attach shop air to the cooler.

(24) Heat the No. 3 bearing outer race with the PWA 85795 Heater or PWA 85679 Heater (405/6) and PWA 29754 Control or equivalent (405/3).

(25) After the parts are correctly heated and chilled, remove the heater and cooler.

CAUTION: WEAR CLEAN LINT FREE GLOVES WHEN YOU TOUCH THE NO. 3 BEARING INNER RACE AND ROLLERS TO PREVENT BEARING DAMAGE.

(26) Install the No. 3 bearing inner race and rollers (405/2) onto the HPC rear hub, puller groove up. Seat the bearing with the PWA 85070 Drift (405/1). Remove the drift.

(27) Install PWA 85168 Protector (405/7) to the diffuser case.

(28) Use a depth gage and measure the distance from the end of the HPC rear hub down to the rear of the inner race and roller. Make a record of this distance as Dimension C. See Figure 402.

(29) Dimension C must not be less than Dimension B minus Dimension A.

NOTE: An indication that the bearing is not fully seated is when Dimension C is less than necessary.

(30) Install PWA 85159 Thread Protector (405/5) over the HPC rear hub.

D. Postrequisites

(1) Connect/Install The External Parts To Complete Installation Of Diffuser Combustor. Refer to 72-00-41, Installation-02 (Task 72-00-41-420-002).

(2) Trunnion The Intermediate Case Through Diffuser And Combustor Case From Front End Down To Horizontal Position. Refer to 72-00-00, Special Procedures-10 (Task 72-00-00-420-002-A00).

(3) Install The No. 3 Bearing Seal Assembly And Seal Seat. Refer to 72-00-41, Installation-03 (Task 72-00-41-420-003).

(4) Vacuum Check The No. 3 Bearing Compartment. Refer to 72-00-41, Inspection/Check-07 (Task 72-00-41-720-001).

(5) Install The Turbine Nozzle. Refer to 72-00-51, Installation-01 (Task 72-00-51-420-001).

(6) Install The High Pressure Turbine - Horizontal. Refer to 72-00-52, Installation-01 (Task 72-00-52-420-001).

(7) Install The No. 1 Bearing Support Assembly. Refer to 72-00-34, Installation-04 (Task 72-00-34-450-002).

(8) Install The Fan Case. Refer to 72-00-33, Installation-01 (Task 72-00-33-420-001).

(9) Install The Low Pressure Turbine With Shaft. Refer to 72-00-53, Installation-01 (Task 72-00-53-420-001).

(10) Install The Turbine Exhaust Case. Refer to 72-00-54, Installation-01 (Task 72-00-54-420-001).

(11) Install The Low Pressure Compressor. Refer to 72-00-31, Installation-01 (Task 72-00-31-420-003).

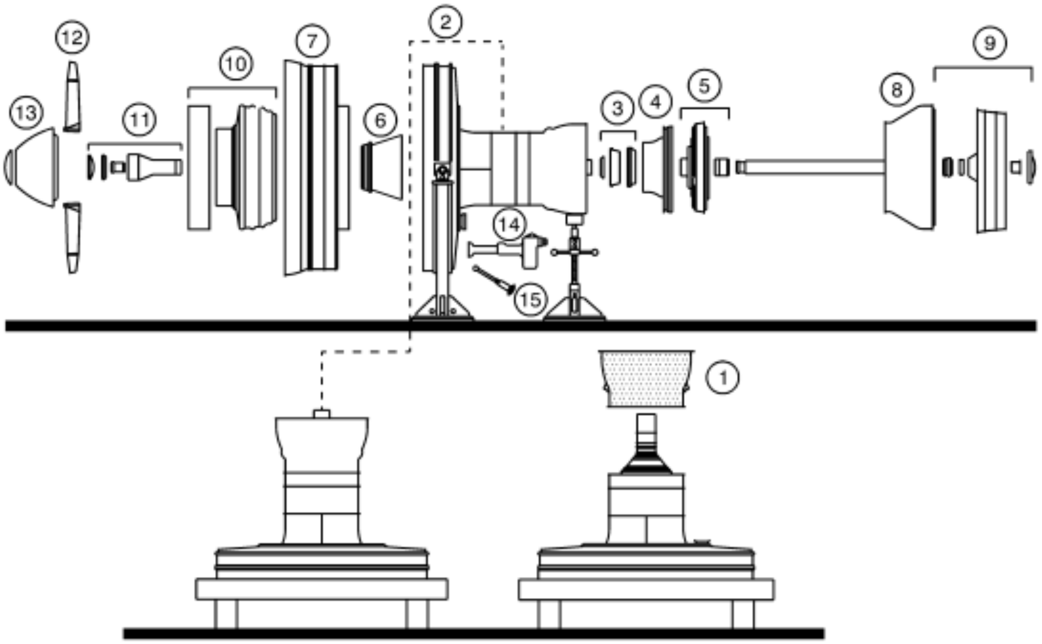
(12) Install The LPC/LPT Coupling. Refer to 72-00-32, Installation-01 (Task 72-00-32-420-001).

(13) Install The Stage 1 LPC Blade Assemblies. Refer to 72-00-31, Installation-04 (Task 72-00-31-420-002-002).

(14) Install The Compressor Inlet Cone. Refer to 72-00-31, Installation-02 (Task 72-00-31-420-001).

(15) Install The Main Gearbox. Refer to 72−00−61, Installation−01 (Task 72−00−61−420−001).

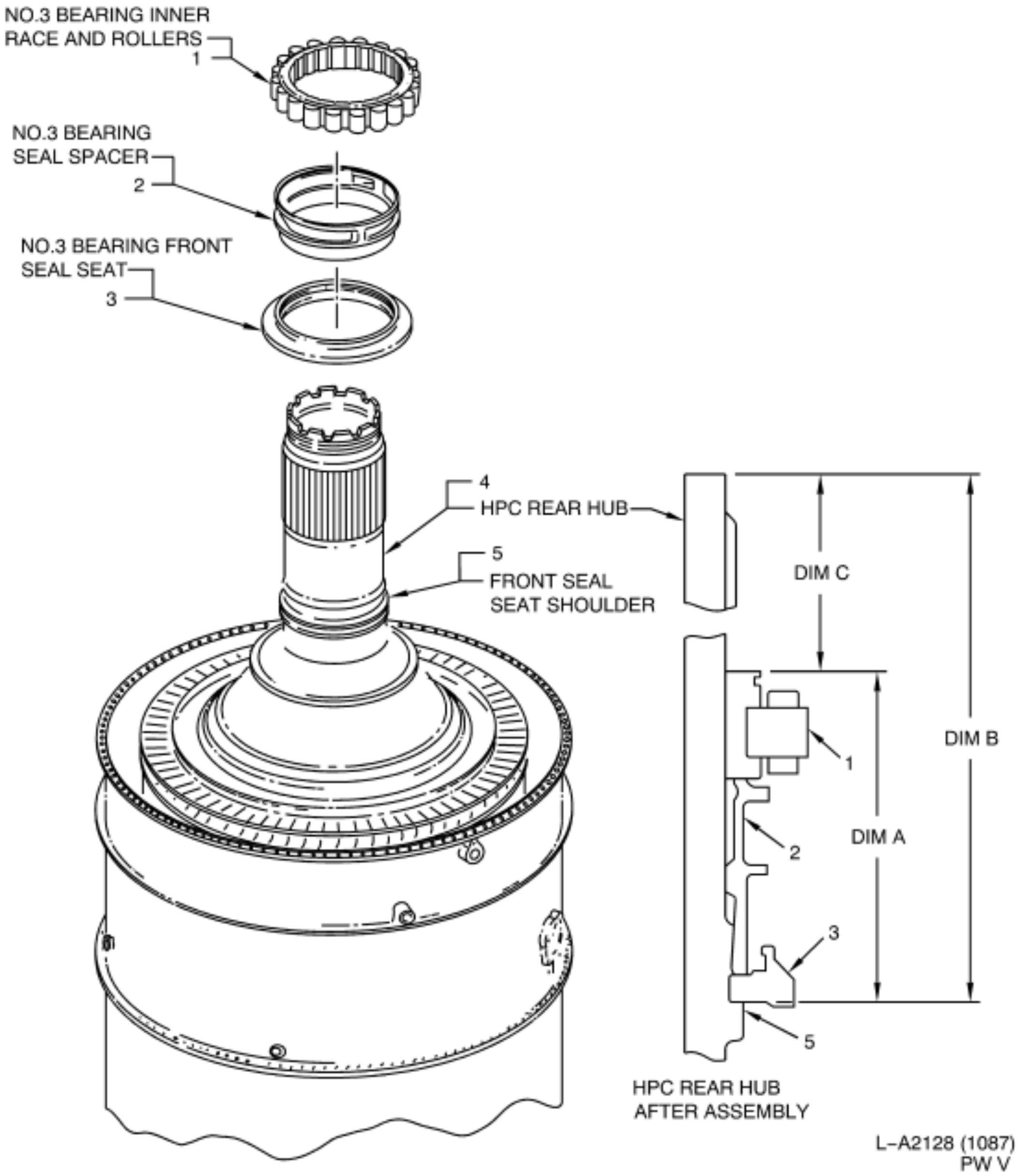
(16) Install The Electronic Engine Control (EEC) Speed Transducer (N1). Refer to 72−00−34, Installation−03 (Task 72−00−34−450−001).



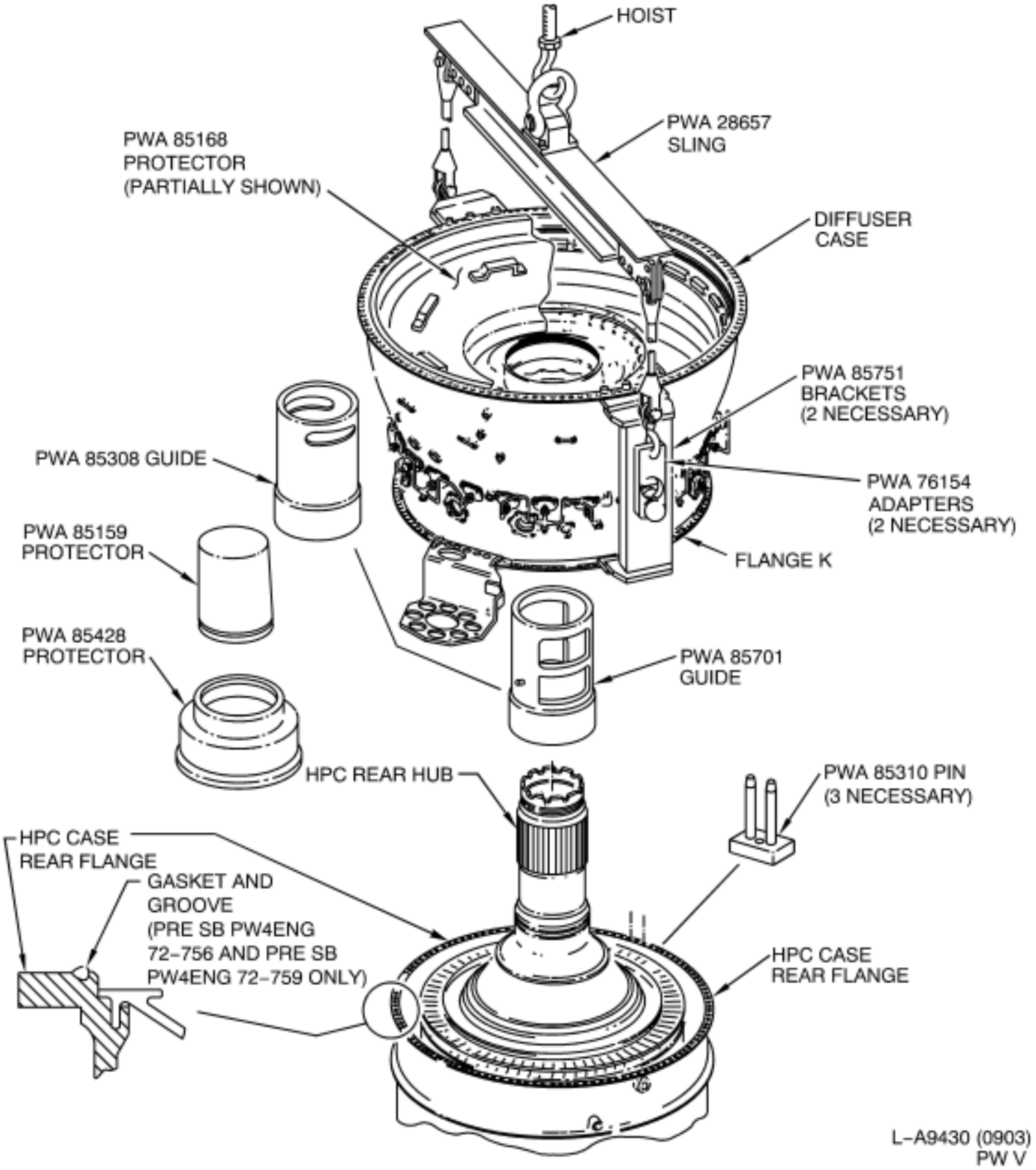
1. INSTALL DIFFUSER AND COMBUSTOR.
2. TRUNNION INTERMEDIATE THROUGH DIFFUSER CASE TO HORIZONTAL.
3. INSTALL NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL SEAT.
4. INSTALL TURBINE NOZZLE.
5. INSTALL HIGH PRESSURE TURBINE (HPT).
6. INSTALL NO. 1 BEARING SUPPORT ASSEMBLY.
7. INSTALL FAN CASE.
8. INSTALL LOW PRESSURE TURBINE (LPT).
9. INSTALL TURBINE EXHAUST CASE.
10. INSTALL LOW PRESSURE COMPRESSOR (LPC).
11. INSTALL LPC/LPT COUPLING.
12. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
13. INSTALL COMPRESSOR INLET CONE.
14. INSTALL MAIN GEARBOX.
15. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).

L−A0257 (0000)
PW V

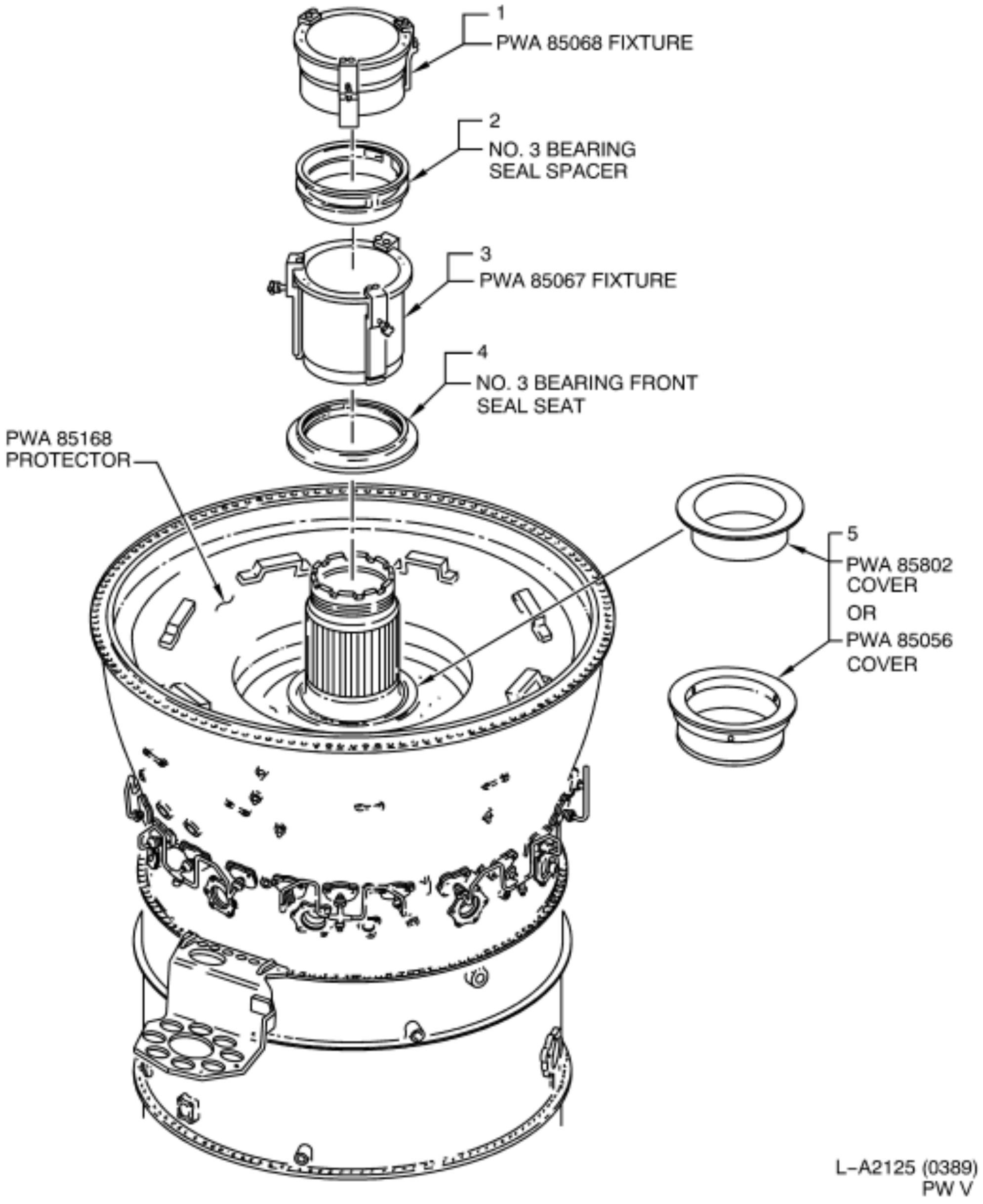
Procedure Sequence
Figure 401
(Task 72−00−41−420−006)


NO.3 BEARING INNER
RACE AND ROLLERS
1
NO.3 BEARING
SEAL SPACER
2
NO.3 BEARING FRONT
SEAL SEAT
3
4
HPC REAR HUB
5
FRONT SEAL
SEAT SHOULDER
DIM C
DIM B
DIM A
1
2
3
5
HPC REAR HUB
AFTER ASSEMBLY
L−A2128 (1087)
PW V

Diffuser And Combustor Installation
Bearing Seating Check Measurement
Figure 402
(Task 72−00−41−420−006)

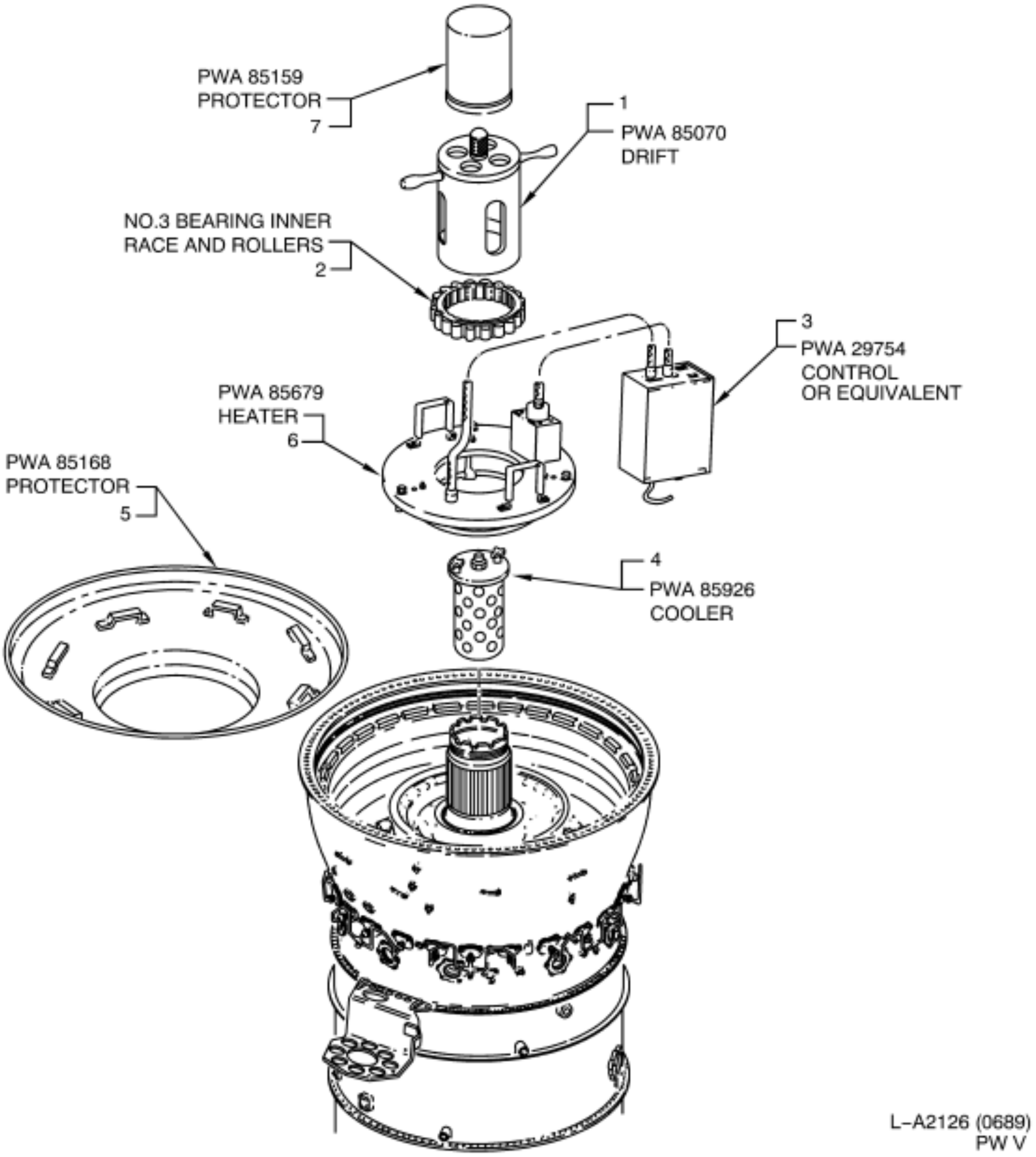

HOIST
PWA 28657
SLING
PWA 85168
PROTECTOR
(PARTIALLY SHOWN)
DIFFUSER
CASE
PWA 85751
BRACKETS
(2 NECESSARY)
PWA 85308 GUIDE
PWA 76154
ADAPTERS
(2 NECESSARY)
PWA 85159
PROTECTOR
FLANGE K
PWA 85428
PROTECTOR
PWA 85701
GUIDE
HPC REAR HUB
PWA 85310 PIN
(3 NECESSARY)
HPC CASE
REAR FLANGE
GASKET AND
GROOVE
(PRE SB PW4ENG
72−756 AND PRE SB
PW4ENG 72−759 ONLY)
HPC CASE
REAR FLANGE
L−A9430 (0903)
PW V

Diffuser And Combustor Installation
Figure 403
(Task 72−00−41−420−006)


1
PWA 85068 FIXTURE
2
NO. 3 BEARING SEAL SPACER
3
PWA 85067 FIXTURE
4
NO. 3 BEARING FRONT SEAL SEAT
PWA 85168 PROTECTOR
5
PWA 85802 COVER
OR
PWA 85056 COVER
L−A2125 (0389)
PW V

Diffuser And Combustor Installation
Figure 404
(Task 72−00−41−420−006)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−01


PWA 85159
PROTECTOR
7
1
PWA 85070
DRIFT
NO.3 BEARING INNER
RACE AND ROLLERS
2
3
PWA 29754
CONTROL
OR EQUIVALENT
PWA 85679
HEATER
6
PWA 85168
PROTECTOR
5
4
PWA 85926
COOLER
L−A2126 (0689)
PW V

Diffuser And Combustor Installation
Figure 405
(Task 72−00−41−420−006)

Task 72-00-41-420-002:

1. Install External Parts After Diffuser And Combustor Installation

A. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-059	Wax, Paraffin (PMC 9552)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
R P06-021	Compound, Antigalling (PWA 550)
R P06-053	Lubricant, Sealing Ring (PWA 36500)
P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	75-26-00/1/20
Gasket	1	75-26-00/1/30
Gasket	2	75-26-00/1/40
Gasket	1	75-37-00/1/20
Gasket	1	75-37-00/1/30
Gasket	2	75-37-00/1/35
Gasket	2	75-37-00/1/135
Gasket	1	75-37-00/1/90
Packing	1	73-13-00/4/70
Packing	1	79-21-00/10/60
Packing	1	79-21-00/10/60
Packing	1	79-21-00/10/60A

B. Procedure
See Figure 401, Figure 402, Figure 403, Figure 404, Figure 405, Figure 406, Figure 407 and Figure 408.

(1) Install EEC PT4.95 tube assembly (AS01) as follows.

CAUTION: DO NOT USE LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF EEC CAN RESULT.

(a) Remove protective closures.

(b) For engines without the maintenance break at Flange K (Pre SB PW4ENG 73-106) connect the tube to the PT4.95 tube (AS04) at 11:30 o'clock position adjacent to Flange E. Tighten by hand.

(c) For engines with the maintenance break at Flange K (Post SB PW4ENG 73-106) connect the tube to the PT4.95 tube (AS41) at 11:00 o'clock position adjacent to Flange K. Tighten by hand.

(d) Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts securing tube to brackets.

(e) Torque all clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(f) Torque forward tube nut to tube coupling to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(2) (Pre SB PW4ENG 72-491) Install No. 4 bearing oil pressure tube assembly (LP15) as follows.

(a) Remove protective closures and lubricate tube threads at each end with Antigalling Compound P06-021. See Figure 401 (Sheet 7). Install the tube to the engine and attach the forward end of the tube to the manifold tee forward of Flange J at approximately the 8 o'clock position handtight only.

(b) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to bracket attached to cooling air tube flange at approximately 9 o'clock position handtight only.

(c) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to fuel injector bracket at approximately 9 o'clock position on diffuser case handtight only.

(d) Install two clamps, bolt, spacer, and nut securing tube to adjacent EEC PT4.95 (AS01) tube handtight only. If the engine does not have brazed wear sleeves on the PT4.95 tube (AS01), install the grommet halves (clip on wear sleeves) to the tube before you install the clamp.

(e) Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(f) Torque forward tube nut to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nut.

(g) (Reference 2151) Position spray shield to inboard side of connection and secure with hose clamp. Torque hose clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(3) (Post SB PW4ENG 72−491) Install No. 4 bearing oil pressure tube assembly (LP15) as follows.

(a) Remove protective closures and lubricate tube threads at each end with Antigalling Compound P06−021. See Figure 401 (Sheet 7). Install the tube to the engine and attach the forward end of the tube to the manifold tee forward of Flange J at approximately the 8 o'clock position, handtight only.

(b) Install the deoiler idler bearing pressure line (LP35) nut to the tee fitting, handtight only.

(c) Install clamp, bolt, threads lubricated with Engine Oil P03−001, and nut securing tube to bracket attached to cooling air tube flange at approximately 9 o'clock position, handtight only.

(d) Install clamp and bolt, threads lubricated with Engine Oil P03−001, to hold the tube to Flange K bracket assembly at approximately 9 o'clock position, handtight only.

(e) Install clamp, bolt, threads lubricated with Engine Oil P03−001, and nut securing tube to fuel injector bracket at approximately 9 o'clock position on diffuser case, handtight only.

(f) Install two clamps, bolt, spacer, and nut securing tube to adjacent EEC PT4.95 (AS01) tube, handtight only. If the engine does not have brazed wear sleeves on the PT4.95 tube (AS01), install the grommet halves (clip on wear sleeves) to the tube before you install the clamp.

(g) Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(h) Torque forward tube nut to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nut.

(i) Torque the nut from the deoiler idler bearing pressure line (LP35) to the tee fitting to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nut.

(j) (Reference 2151) Position spray shields to the inboard side of the forward tube nut connection and the tee fitting connection and secure with hose clamps. Torque hose clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(4) (Pre SB PW4ENG 79−52) Install the (rear) No. 3 bearing oil pressure tube assembly (LP19) as follows.

(a) Remove the protection covers. Lubricate the tube coupling threads at the strainer housing with Antiseize Paste P06−054. Wipe off unwanted paste. Lubricate the threads at the other end with Engine Oil P03−001.

(b) Install the tube to the diffuser case internal tube nut at approximately 9:30 o'clock position. Tighten by hand only. If installed, connect the (front) No. 3 bearing oil pressure manifold (LP18) to the strainer housing and tighten by hand only.

(c) Install the clamps, bolts, lubricated with Engine Oil P03−001, and nuts that attach the tube to the Flange K brackets. Tighten by hand.

NOTE: For engines with the revised clamping (Post SB PW4ENG 72−211) do not attach this tube to the Flange K bracket above the strainer housing. Attach only the fuel tube. Torque the fuel tube clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

CAUTION: DO NOT TORQUE THE TUBE NUTS OR THE CLAMP BOLTS AT THIS TIME. YOU MUST COMPLETE THE INSTALLATION OF THIS TUBE AFTER YOU INSTALL OTHER TUBES AFTER THE GEARBOX INSTALLATION. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

(d) Do not torque the tube nuts or clamp bolts at this time. Install a tag on the manifold "not torqued".

CAUTION: YOU MUST USE THE WRENCHING FLATS ON THE STRAINER HOUSING WHEN YOU LOOSEN OR TIGHTEN THE STRAINER. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

(e) Install the packing, lubricated with Engine Oil P03−001, to the strainer. Lubricate the threads of the strainer with Engine Oil P03−001. Install the strainer to the strainer housing. While you hold the housing with a wrench, torque the strainer to 275 − 300 lb−in. (31.071 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the strainer.

NOTE: You will complete the installation of the above tube (LP19) in 72−00−61, Installation−02 Task 72−00−61−420−002. See the installation of the oil trim pressure tube (LP32).

(5) (Post SB PW4ENG 79−52) (Pre/Post SB PW4ENG 72−491) Install the No. 3 bearing oil pressure tube assembly (LP19) as follows.

(a) Remove the protection covers. Lubricate the threads of the tube nut at the elbow end with Engine Oil P03−001.

(b) Install the tube to the diffuser case internal tube at approximately the 10 o'clock position.

(c) Install the strainer to the (front) of the tube.

(d) Remove the protection covers from the adapter. Install a packing lubricated with Engine Oil P03−001 to the adapter.

(e) Install the adapter to the (front) of the tube and attach with bolts, threads lubricated with Engine Oil P03−001 and nuts.

(f) Install the clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts that attach the tube to the bracket on Flange K.

CAUTION: DO NOT TORQUE THE TUBE NUTS OR THE CLAMP BOLTS AT THIS TIME. YOU MUST COMPLETE THE INSTALLATION OF THIS TUBE AFTER YOU INSTALL OTHER TUBES AFTER THE GEARBOX INSTALLATION. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

(g) Do not torque the tube nuts or clamp bolts at this time. Install a tag on the manifold "not torqued".

NOTE: You will complete the installation of the above tube (LP19) in 72−00−61, Installation−02 Task 72−00−61−420−002. See the installation of the oil trim pressure tube (LP32).

(6) (Pre SB PW4ENG 72−567) Install the (left) diffuser seal air vent tube assembly (AP22) as follows. See Figure 402 (Sheet 1), Figure 402 (Sheet 2), Figure 402 (Sheet 3), Figure 402 (Sheet 8) and Figure 402 (Sheet 9).

(a) Remove protective closures. Install gasket to groove in HPC rear case boss at approximately 10:30 o'clock position. Install deflector aligning pin with hole in HPC rear case boss.

(b) Lubricate tube nut threads with Antiseize Paste P06-054. Wipe off unwanted paste. Install gasket to flanged end of tube and secure in place with Paraffin Wax P05-059.

(c) Install tube to engine and connect tube nut to diffuser case intenal tube at approximately 11 o'clock position handtight only.

(d) Install bracket and bolts, threads lubricated with Engine Oil P03-001, to secure flanged end of tube to HPC rear case handtight only.

(e) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut to secure tube to fuel injector bracket. Torque clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(f) Torque tube nut to 825 - 900 lb-in. (93.212 - 101.686 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(g) Torque bolts securing tube flange to HPC rear case to 85 - 95 lb-in. (9.604 - 10.734 N.m) then retorque without loosening until required torque is maintained. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(h) Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts to secure PT4.95 tube and air shutoff valve signal tube to bracket at flanged end of tube. Torque clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(7) (Post SB PW4ENG 72-567) Install the (left) diffuser seal air vent tube assembly (AP22) as follows. See Figure 402 (Sheet 4), Figure 402 (Sheet 5), Figure 402 (Sheet 6), Figure 402 (Sheet 7), Figure 402 (Sheet 8) and Figure 402 (sheet 9).

NOTE: Make sure to remove the temporary safety wire that is around the internal diffuser seal air vent tube assembly before you install the locks. Be careful not to let the tube drop into the diffuser case after you remove the temporary safety wire.

(a) Remove the protection covers. Install a gasket to the groove in the HPC rear case boss at approximately the 10:30 o'clock position.

(b) Install a gasket to the flanged end (with four holes) of the tube and attach the gasket in place with Paraffin Wax P05-059. Install the plate (pre SB PW4ENG 75-110) to the recessed area of the HPC case boss or align the pin on the deflector (Post SB PW4ENG 75-110) with the hole in the HPC case boss and install the deflector to the recessed area.

CAUTION: INSTALL LOCK PLATES WITH SLOT GROOVE OUTWARD AND PIN (IF EQUIPPED) INWARD. MAKE SURE THE LOCK PLATES ENGAGE THE INTERNAL TUBE LIP FLANGE AS SHOWN IN FIGURE 402.

(c) Install the locks to the diffuser case internal tube inside boss at approximately the 11 o'clock position. Attach the locks in place with Paraffin Wax P05-059.

(d) (Reference 2261) Hold the tube locks inward against the tube lip. Measure and make sure the end of the internal tube is 0.000 - 0.020 inch (0.000 - 0.508 mm) above the tube locks. If the measurement is not within this limit, install the locks again and make sure the internal tube lip is engaged properly.

(e) Install the four hole gasket with the raised portion outward toward the tube flange. Install the second gasket in groove of the same opening and attach both gaskets in place with Paraffin Wax P05-059.

(f) Install the tube to the engine (gaskets in place). Attach the tube to the diffuser case with a bracket and bolts, threads lubricated with Engine Oil P03-001. Tighten the bolts by hand.

(g) Attach the tube to the HPC rear case with a bracket and bolts, threads lubricated with Engine Oil P03-001. Tighten the bolts by hand.

(h) Install a clamp, bolt, threads lubricated with Engine Oil P03-001, and nut to attach the tube to the fuel injector bracket. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(i) Torque the bolts that attach the tube flange to the HPC rear case to 85 - 95 lb-in. (9.604 - 10.734 N.m). Without loosening the bolts, torque again until the 85 - 95 lb-in. (9.604 - 10.734 N.m) is maintained. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(j) Torque the bolts that attach the tube flange to the diffuser case and the four bolts that attach a bracket to the tube flange to 85 - 95 lb-in. (9.604 - 10.734 N.m). Without loosening the bolts, torque again until the 85 - 95 lb-in. (9.604 - 10.734 N.m) is maintained. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(k) Install a clamp to the No. 3 bearing breather tube assembly (LB03). Attach the clamp to the bracket from the diffuser pad at the 11 o'clock position with a bolt, threads lubricated with Engine Oil P03-001, and nut. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(8) Install (upper) turbine blade cooling tube assembly (AP38) as follows.

(a) Remove protective closures. Install gasket to groove in turbine cooling air shutoff valve at approximately 10 o'clock position and secure in place with Paraffin Wax P05-059.

CAUTION: INSTALL LOCK PLATES WITH SLOT GROOVE OUTWARD AND PIN (IF EQUIPPED) INWARD. ENSURE LOCK PLATES ENGAGE INTERNAL TUBE LIP FLANGE AS SHOWN IN FIGURE 402.

(b) Install locks to diffuser case internal tube inside boss at approximately 2 o'clock position. Secure in place with Paraffin Wax P05-059.

(c) (Reference 2261) Hold the tube locks outward against the tube lip. Measure and be sure the end of the internal tube is 0.000 - 0.020 inch (0.000 - 0.508 mm) above the tube locks. If the measurement is not within this limit, install the locks again and be sure you engage the internal tube lip properly.

(d) (Pre SB PW4ENG 72-572 or SB PW4ENG 72-537 or Post SB PW4ENG 72-627) Install the gasket and metering plate in the four hole flanged end of the tube and hold in place with Paraffin Wax P05-059.

(e) (Post SB PW4ENG 72-572 and Pre SB PW4ENG 72-627 or Post SB PW4ENG 72-537 and Pre SB PW4ENG 72-627) Install the gasket and ring spacer in the four hole flanged end of the tube and hold in place with Paraffin Wax P05-059.

(f) Install four hole gasket, with raised portion visible, into tube flange. Install second gasket in groove of same opening and secure both in place with Paraffin Wax P05-059.

(g) Install tube to engine (gaskets in place) and secure to diffuser case with bolts, threads lubricated with Engine Oil P03-001, handtight only.

(h) Secure tube to cooling air shutoff valve with bolts, threads lubricated with Engine Oil P03-001, handtight only.

(i) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut to secure tube to Flange K bracket at approximately 11 o'clock position. Torque clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(j) Torque bolts attaching each end of tube to 85 - 95 lb-in. (9.604 - 10.734 N.m) then retorque to required limit without loosening until required torque is maintained. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(9) Install the (front) No. 3 bearing oil vent tube assembly (LD01) as follows. See Figure 403.

(a) Remove protective closures and lubricate tube nut threads at elbow end with Engine Oil P03-001. Install tube to engine and attach elbow end of tube to diffuser case internal tube at approximately 8 o'clock position handtight only.

(b) Temporarily install clamp, bolt threads lubricated with Engine Oil P03-001, and nut securing tube to diffuser case bracket at approximately 9 o'clock position handtight only.

(c) Torque tube nut to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(10) Install (upper) No. 3 bearing breather tube assembly (LB03) as follows.

(a) Remove protective closures and lubricate elbow threads with Engine Oil P03-001. Install tube to engine and connect elbow to diffuser case internal tube nut at approximately 1 o'clock position handtight only.

(b) Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts securing tube to Flange K brackets at approximately 10, 12 and 1 o'clock positions handtight only.

(c) Torque all clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Torque diffuser case internal tube nut to tube elbow to 650 - 700 lb-in. (73.440 - 79.089 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(11) Install bleed and HPC air valve supply tube assembly (AA34) as follows.

(a) Remove protective closures and lubricate tube nut threads at each end with Antiseize Paste P06-054. Wipe off unwanted paste.

(b) Install tube to engine and secure with clamp, bolt, threads lubricated with Engine Oil P03-001, and nut to Flange J bracket handtight only.

(c) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut to secure tube to Flange K bracket at approximately 12 o'clock position. Torque clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Torque tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(12) (Pre SB PW4ENG 72-567) Install EEC PB tube assembly (AS09) as follows. See Figure 404 (Sheet 1), Figure 404 (Sheet 4) and Figure 404 (Sheet 5).

CAUTION: USE OF LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS COULD RESULT IN CONTAMINATION OF EEC.

(a) Remove protective closures. Install tube to engine and connect elbow end to diffuser case adapter at approximately 1 o'clock position and coupling end to tube at approximately 12:30 o'clock position at Flange E.

(b) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to bracket attached to HPC bleed valve flange at approximately 1:30 o'clock position handtight only.

(c) Install clamp, spacer, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to Flange H bracket at approximately 12:30 o'clock position handtight only.

(d) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to HPC bracket at approximately 12:30 o'clock position rearward of Flange E handtight only.

(e) Torque all clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(f) Torque both ends of tube to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(13) (Post SB PW4ENG 72-567) Install EEC PB tube assembly (AS09) as follows. See Figure 404 (Sheet 2), Figure 404 (Sheet 3), Figure 404 (Sheet 4) and Figure 404 (Sheet 5).

CAUTION: USE OF LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS COULD RESULT IN CONTAMINATION OF EEC.

(a) Remove protective closures. Install tube to engine and connect elbow end to diffuser case adapter at approximately 3 o'clock position and coupling end to tube at approximately 12:30 o'clock position at Flange E.

(b) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to HPC bracket at approximately 12:30 o'clock position rearward of Flange E handtight only. See View B.

(c) Install clamp, bolt, threads lubricated with Engine Oil P03-001 securing tube to Flange H bracket at approximately 12:30 o'clock position handtight only. See View C.

(d) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to bracket attached to HPC bleed valve flange at approximately 1:30 o'clock position handtight only. See View D.

(e) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to bracket on Flange K at approximately 1:30 o'clock position handtight only. See View A.

(f) Attach the tube to a bracket that is attached to a cover on the diffuser case pad at approximately the 1:30 o'clock position with a "clamp and loop type support" and bolt, threads lubricated with Engine Oil P03-001 and nut. Tighten the bolt handtight only. See View E.

(g) Install "clamp and loop type support", bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to bracket on Flange K at approximately 2:30 o'clock position handtight only. See View F.

(h) Torque all clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(i) Torque both ends of the tube to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(14) Install HPC and bleed valve supply tube assembly (AA23) as follows.

(a) Remove protective closures and lubricate tube nut threads with Antiseize Paste P06-054. Wipe off unwanted paste. Install tube to engine and connect to HPC bleed air filter and to diffuser case adapter at approximately 2 o'clock position handtight only.

(b) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut to secure tube to Flange K bracket at approximately the 1 o'clock position. Bolt head towards tube (AA23) clamp and nut against tube (AS09) clamp. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Torque tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(15) Install No. 3 bearing cooler air tube assemblies (AP33) and (AP34) as follows. See Figure 405.

(a) Remove protective closures and lubricate tube nut threads on both tubes with Antigalling Compound P06-021. See Figure 405. Install tubes to engine and secure tube to No. 3 bearing air cooler at approximately 2 o'clock position in fan case handtight only. Secure rear tube nuts to HPC elbow at approximately 5 o'clock position and to diffuser case elbow at approximately 6 o'clock position handtight only.

(b) Install clamps, brackets, bolts, threads lubricated with Engine Oil P03-001, and nuts to attach the tubes to the bracket attached to Flange J at approximately the 4:30 o'clock position handtight only.

(c) Install clamps, bolt, threads lubricated with Engine Oil P03-001, and nut securing tubes to Flange H bracket at approximately the 3 o'clock position handtight only.

(d) Install clamps, heat shield, bolts, threads lubricated with Engine Oil P03-001, and nuts to tubes at approximately 2:30 o'clock position forward of Flange H handtight only.

(e) Install clamps and bolts, threads lubricated with Engine Oil P03-001, securing tubes to HPC bracket at approximately 2:30 o'clock position. Torque all clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(f) Torque all tube nuts at No. 3 bearing air cooler and rear elbows to 825 - 900 lb-in. (93.212 - 101.686 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(16) Install diffuser seal air vent tube assemblies right (AP21) and lower (AP17) as follows. See Figure 406.

NOTE: Make sure to remove the temporary safety wire that is around the internal diffuser seal air vent tube assembly before you install the locks. Be careful not to let the tube drop into the diffuser case after you remove the temporary safety wire.

(a) Remove protective closures. Install gasket to groove in HPC rear case boss at approximately 5:30 o'clock position. Install the deflector as you align the pin with the hole in the HPC rear case boss. Hold in place with Paraffin Wax P05-059.

(b) Install gasket to groove in flange of tube (AP17) (lower) and attach to HPC rear case boss with four bolts, threads lubricated with Engine Oil P03-001, handtight only.

(c) (Post SB PW4ENG 72-514 and Pre SB PW4ENG 72-572) Install the metering plug, smaller OD inward, into the remaining end of the last installed tube (AP17). As necessary, attach the plug in position with Paraffin Wax P05-059.

(d) Install gasket to groove in four bolt hole flange of tube (AP21) (right) and attach in place with Paraffin Wax P05-059.

CAUTION: INSTALL LOCK PLATES WITH SLOT GROOVE OUTWARD AND PIN (IF EQUIPPED) INWARD. ENSURE LOCK PLATES ENGAGE INTERNAL TUBE LIP FLANGE AS SHOWN IN FIGURE 406.

(e) Install locks to diffuser case internal tube inside boss at approximately 3 o'clock position. Secure in place with Paraffin Wax P05-059.

(f) (Reference 2261) Hold the tube locks outward against the tube lip. Measure and be sure the end of the internal tube is 0.000 - 0.020 inch (0.000 - 0.508 mm) above the tube locks. If the measurement is not within this limit, install the locks again and be sure you engage the internal tube lip properly.

(g) Install four hole gasket, with raised portion visible, into the scalloped flange end of the tube (AP21) and align the four bolt holes. Install second gasket to groove of same tube flange and attach both in place with Paraffin Wax P05-059.

(h) Install tube (AP21) (right) to engine and attach to the diffuser case with bolts, threads lubricated with Engine Oil P03-001, and bracket handtight only.

(i) Install bolts, threads lubricated with Engine Oil P03-001 and a bracket (Post SB PW4ENG 75-95) to the flange of the tube (AP21), securing lower end of tube to tube (AP17) attached to HPC rear case handtight only.

(j) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to Flange H bracket at approximately 4 o'clock position handtight only.

(k) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to bracket attached to Flange K bracket. Torque all clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(l) Torque four bolts securing lower tube to HPC case and four bolts securing right tube to lower tube to 85 − 95 lb−in. (9.604 − 10.734 N.m), then retorque to required torque, without loosening, until required torque is maintained.

(m) Torque bolts attaching upper end of tube to diffuser case to 85 − 95 lb−in. (9.604 − 10.734 N.m), then retorque to required torque, without loosening, until required torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(n) Install clamps, bolt, threads lubricated with Engine Oil P03−001, and nut securing fuel tubes to previously installed bracket. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(17) Install gearbox heat shields to Flanges J and K brackets and secure with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 407.

R (18) Install a packing, lubricated with Engine Oil P03−001
R or Sealing Ring Lubricant P06−053 to the groove in
R transfer tube. Install the assembled flowmeter, transfer tube, and support to fuel distribution valve and secure with bracket (Pre SB PW4ENG 73−163 only) and bolts, threads lubricated with Engine Oil P03−001. Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). See Figure 408.

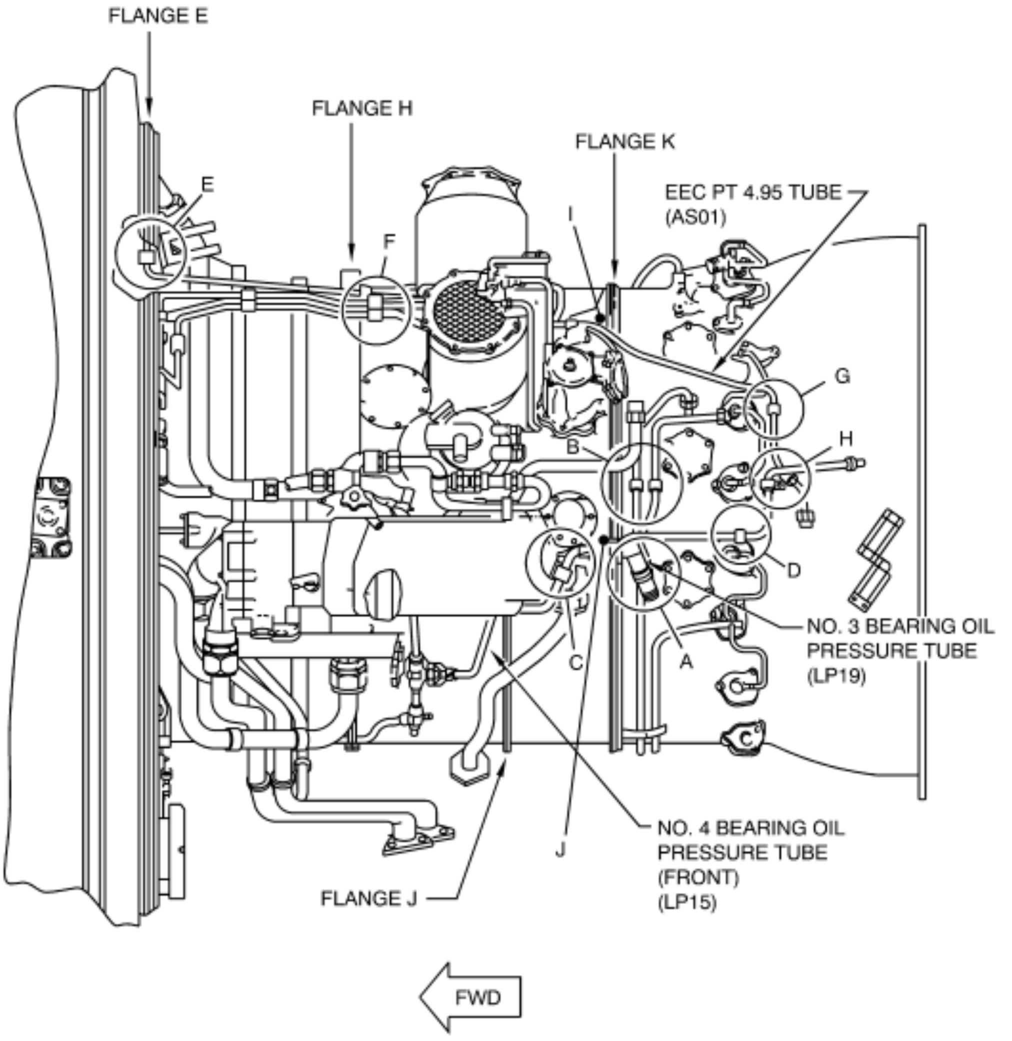
CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(19) Install flex hoses (CP11), (CP13), and the drain flex hose, threads lubricated with Engine Oil P03−001, to turbine case cooling air actuator at approximately 2

o'clock position forward of Flange H and to manifold couplings.

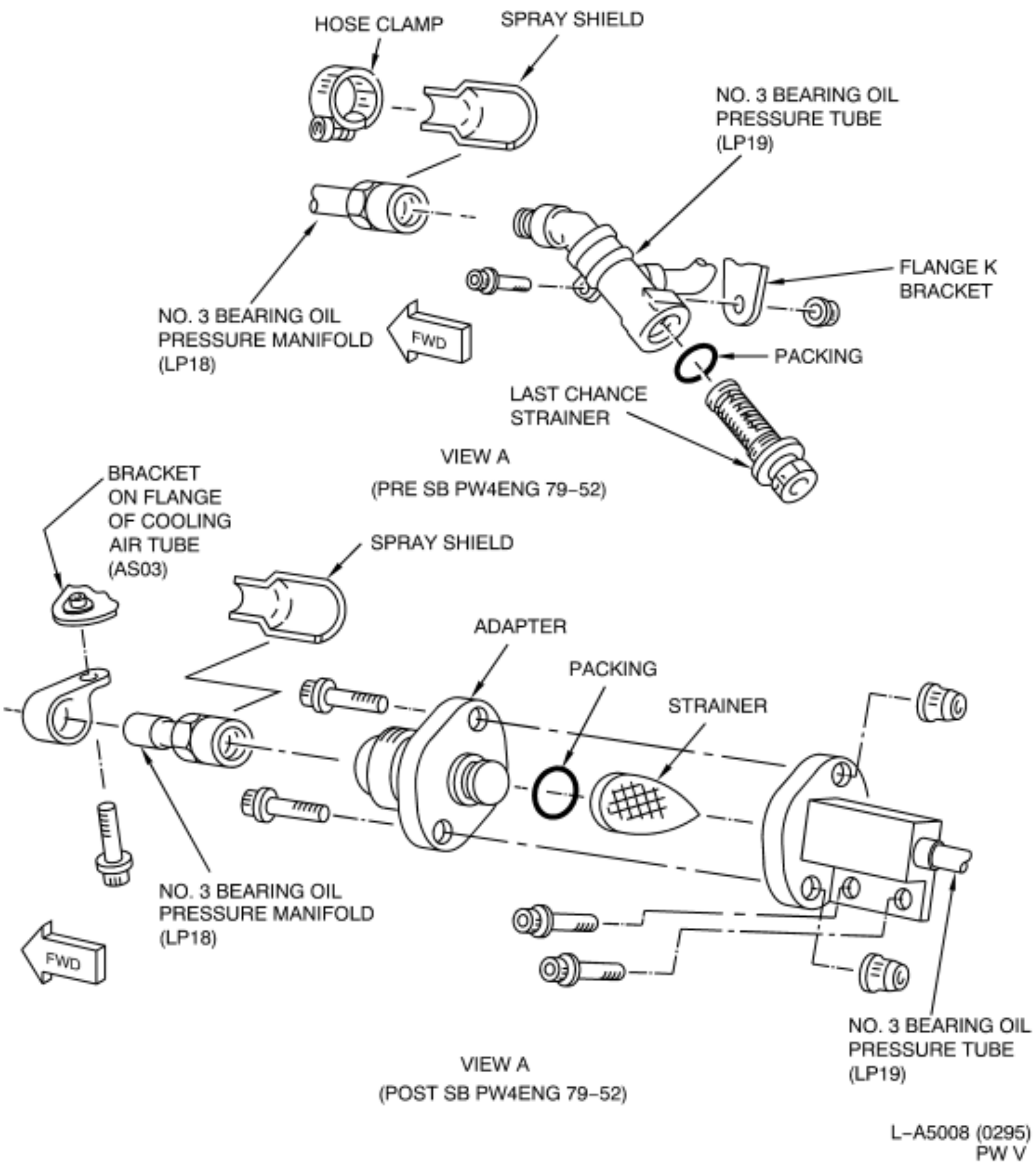
(a) Torque forward hose (smaller nuts) to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nuts.

(b) Torque rearward hose (larger nuts) to 450 − 500 lb−in. (50.843 − 56.492 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nuts.

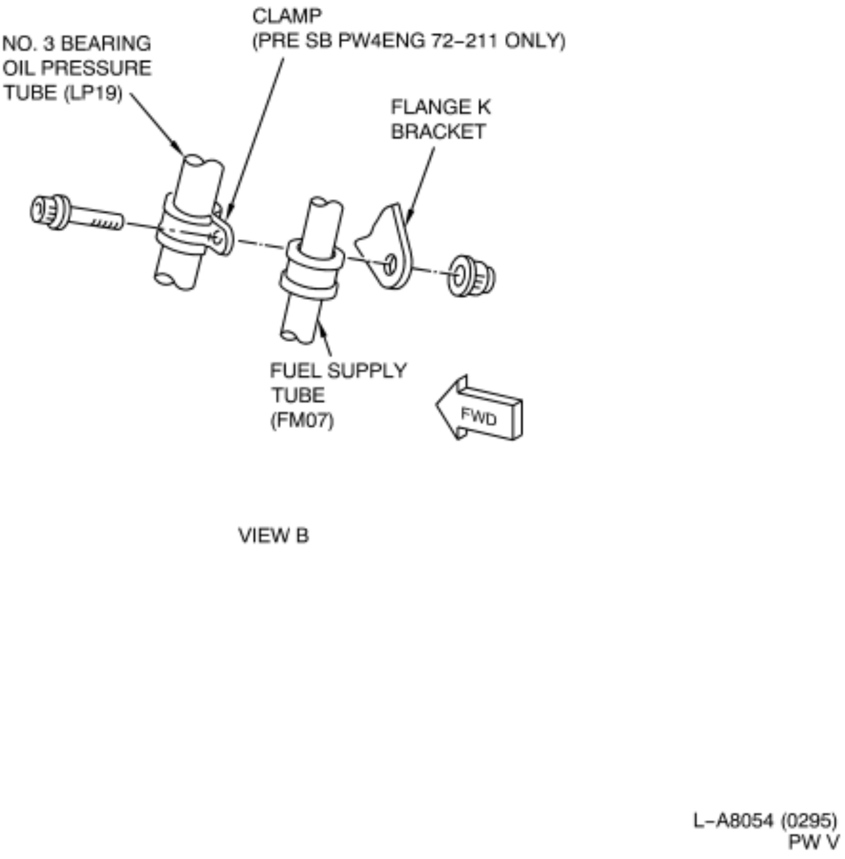

FLANGE E
FLANGE H
FLANGE K
EEC PT 4.95 TUBE
(AS01)
E
F
I
G
H
B
D
C
A
J
NO. 3 BEARING OIL
PRESSURE TUBE
(LP19)
NO. 4 BEARING OIL
PRESSURE TUBE
(FRONT)
(LP15)
FLANGE J
FWD

L−A1783 (0295)
PW V

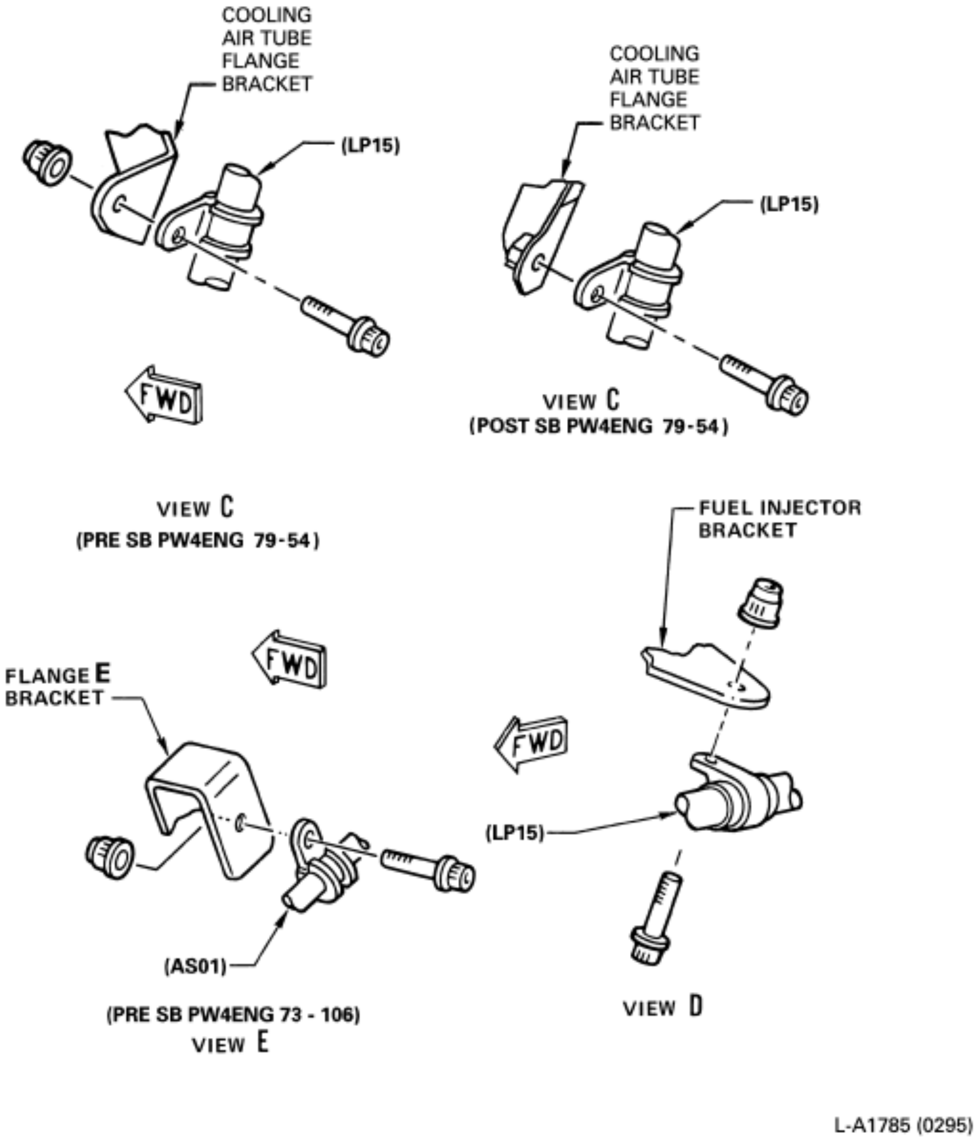
External Plumbing Installation
Figure 401 (Sheet 1)
(Task 72−00−41−420−002)


HOSE CLAMP
SPRAY SHIELD
NO. 3 BEARING OIL PRESSURE TUBE (LP19)
FLANGE K BRACKET
NO. 3 BEARING OIL PRESSURE MANIFOLD (LP18)
FWD
PACKING
LAST CHANCE STRAINER
VIEW A
(PRE SB PW4ENG 79−52)
BRACKET ON FLANGE OF COOLING AIR TUBE (AS03)
SPRAY SHIELD
ADAPTER
PACKING
STRAINER
NO. 3 BEARING OIL PRESSURE MANIFOLD (LP18)
FWD
NO. 3 BEARING OIL PRESSURE TUBE (LP19)
VIEW A
(POST SB PW4ENG 79−52)
L−A5008 (0295)
PW V

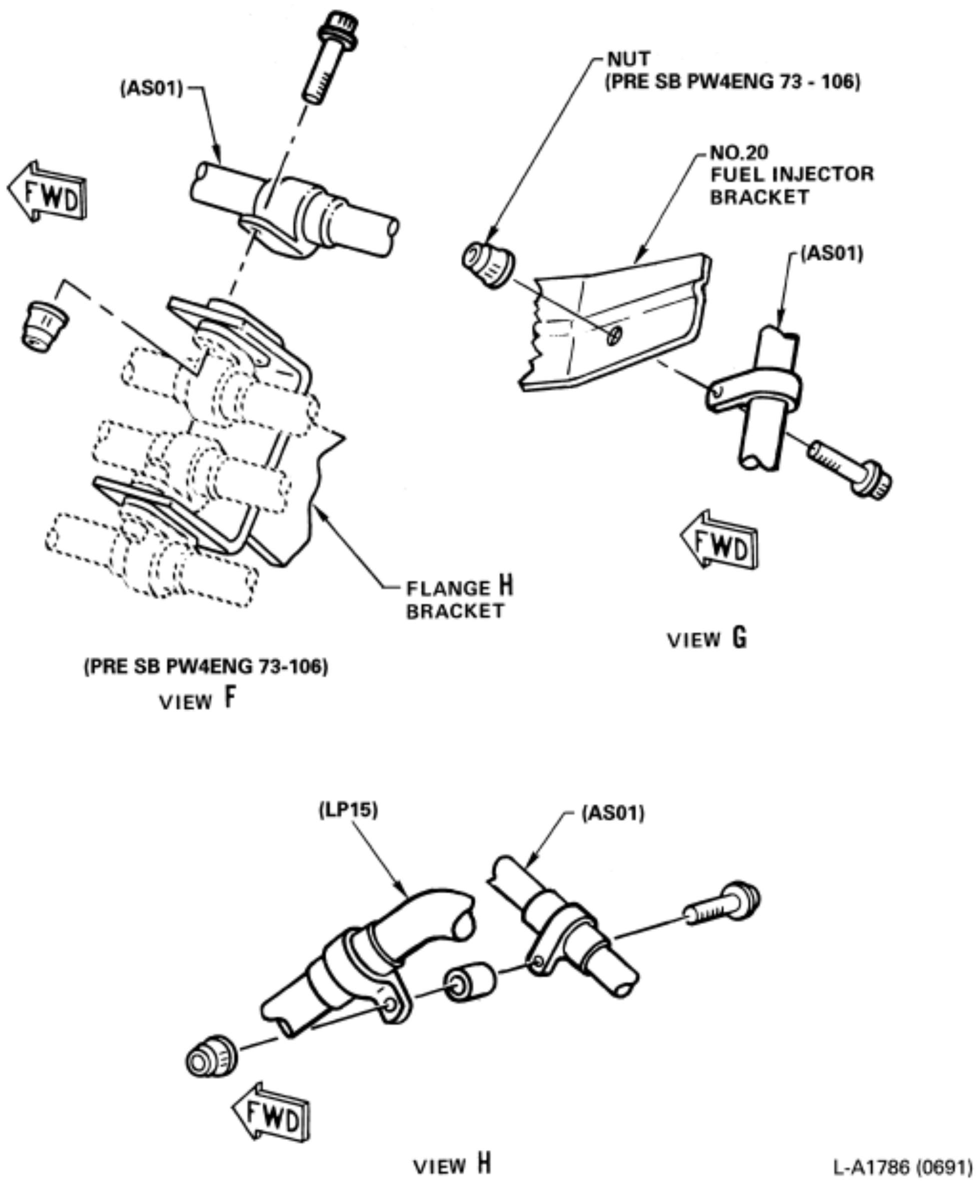
External Plumbing Installation
Figure 401 (Sheet 2)
(Task 72−00−41−420−002)


CLAMP
(PRE SB PW4ENG 72−211 ONLY)
NO. 3 BEARING
OIL PRESSURE
TUBE (LP19)
FLANGE K
BRACKET
FUEL SUPPLY
TUBE
(FM07)
FWD
VIEW B
L−A8054 (0295)
PW V

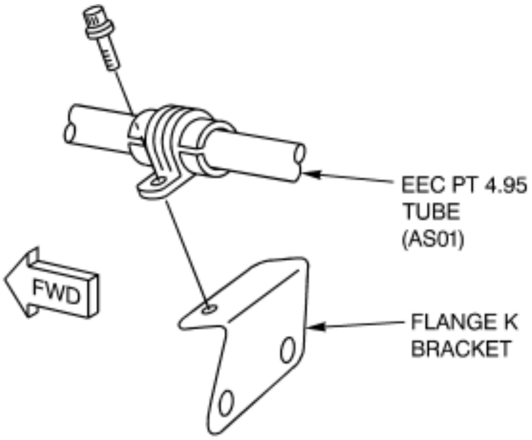
External Plumbing Installation
Figure 401 (Sheet 3)
(Task 72−00−41−420−002)


COOLING AIR TUBE FLANGE BRACKET
(LP15)
FWD
VIEW C
(PRE SB PW4ENG 79-54)
COOLING AIR TUBE FLANGE BRACKET
(LP15)
VIEW C
(POST SB PW4ENG 79-54)
FLANGE BRACKET
E
FWD
(AS01)
(PRE SB PW4ENG 73 - 106)
VIEW E
FUEL INJECTOR BRACKET
FWD
(LP15)
VIEW D
L-A1785 (0295)

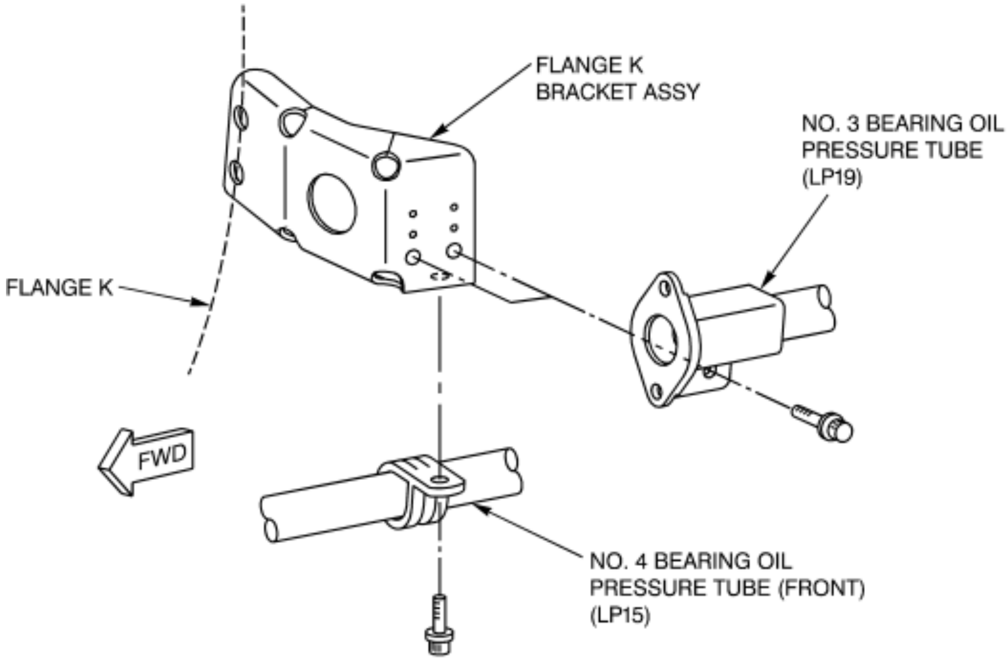
External Plumbing Installation
Figure 401 (Sheet 4)
(Task 72-00-41-420-002)


(AS01)
FWD
(PRE SB PW4ENG 73-106)
VIEW F
FLANGE H
BRACKET
NUT
(PRE SB PW4ENG 73 - 106)
NO.20
FUEL INJECTOR
BRACKET
(AS01)
FWD
VIEW G
(LP15)
(AS01)
FWD
VIEW H
L-A1786 (0691)

External Plumbing Installation
Figure 401 (Sheet 5)
(Task 72−00−41−420−002)


EEC PT 4.95
TUBE
(AS01)
FWD
FLANGE K
BRACKET

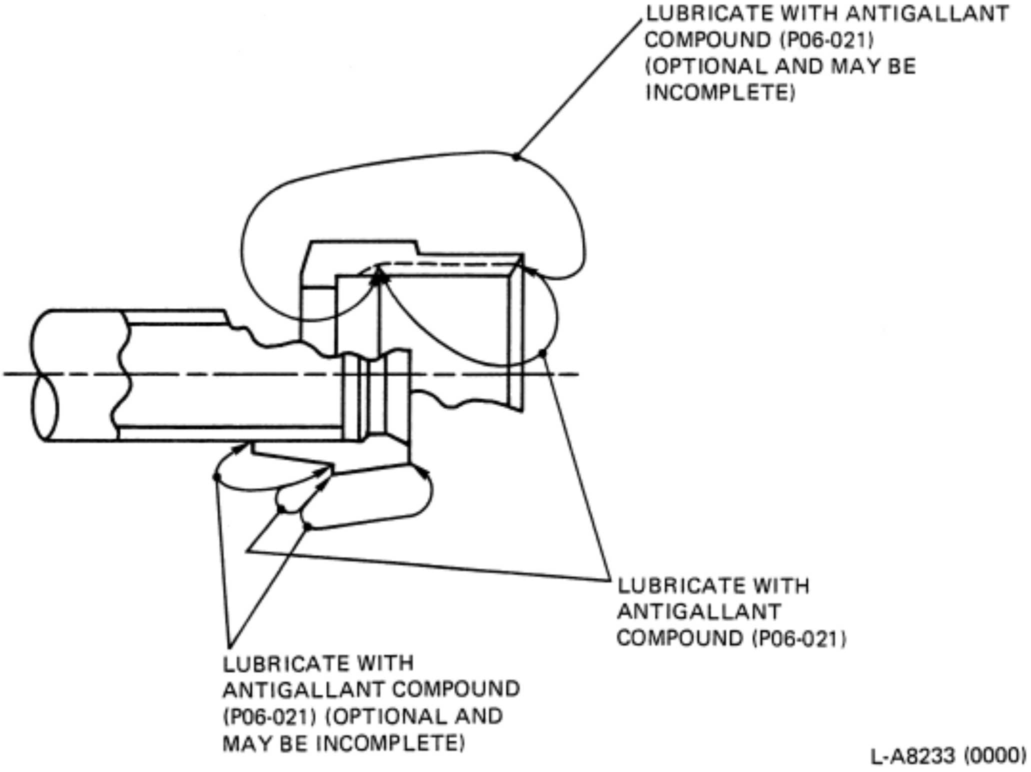
(POST SB PW4ENG 73−106 ONLY)
VIEW I


FLANGE K
BRACKET ASSY
NO. 3 BEARING OIL
PRESSURE TUBE
(LP19)
FLANGE K
FWD
NO. 4 BEARING OIL
PRESSURE TUBE (FRONT)
(LP15)

(POST SB PW4ENG 72−491)
VIEW J

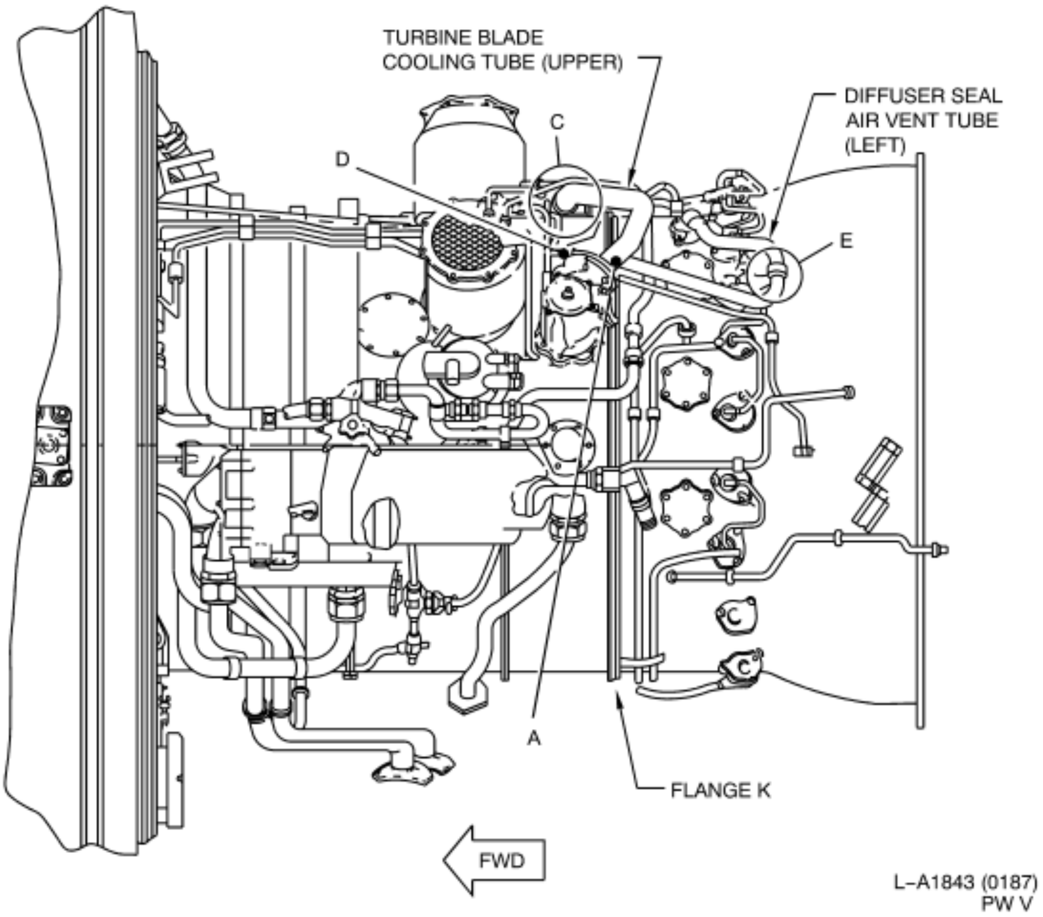
L−A7627 (0295)
PW V

External Plumbing Installation
Figure 401 (Sheet 6)
(Task 72−00−41−420−002)

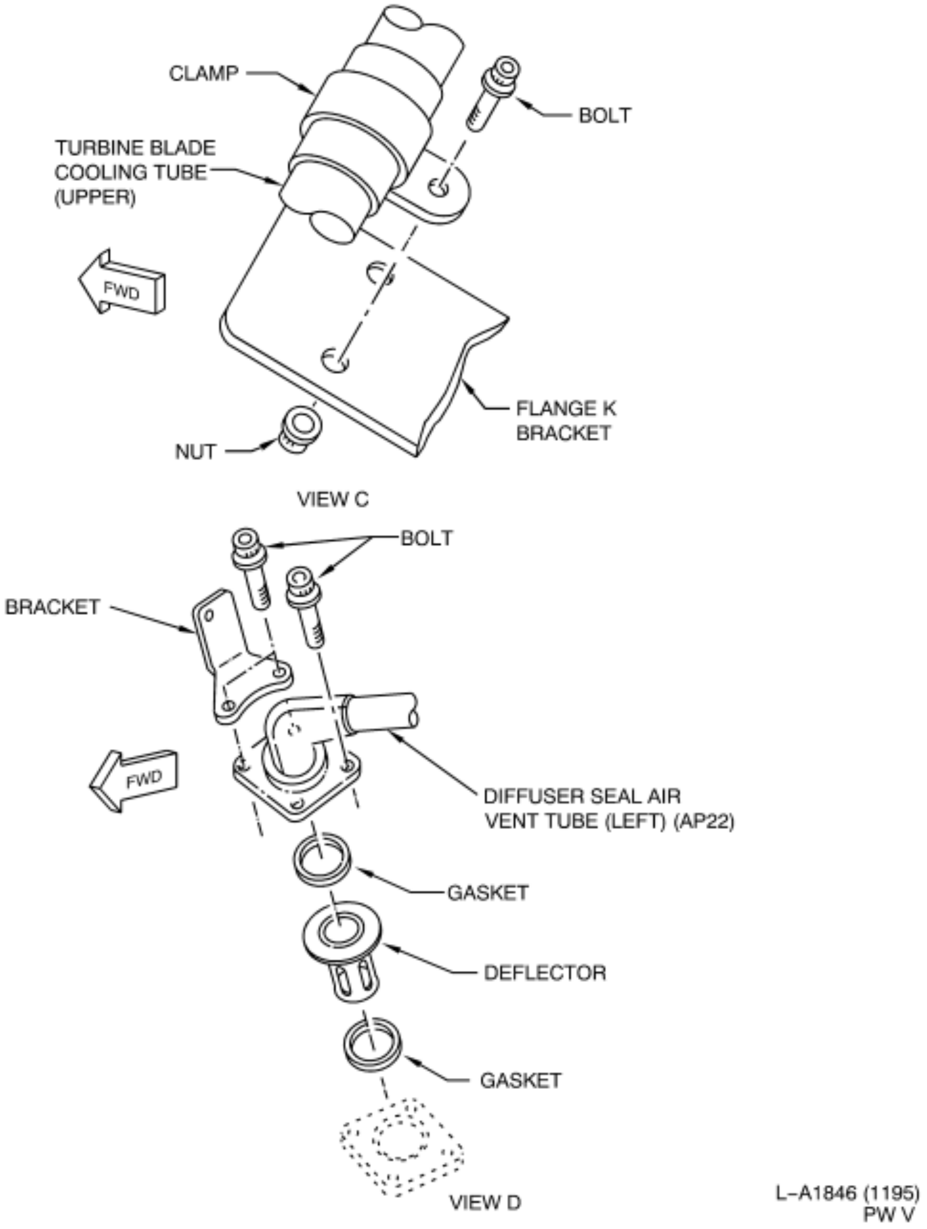

LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
L-A8233 (0000)

External Plumbing Installation
Figure 401 (Sheet 7)
(Task 72−00−41−420−002)

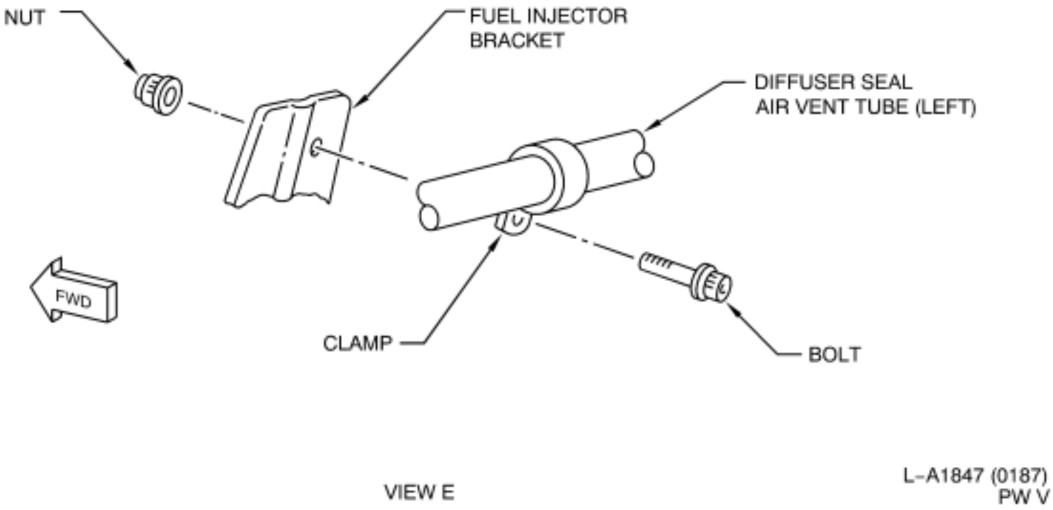
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−02


TURBINE BLADE COOLING TUBE (UPPER)
DIFFUSER SEAL AIR VENT TUBE (LEFT)
C
D
E
A
FLANGE K
FWD
L−A1843 (0187)
PW V

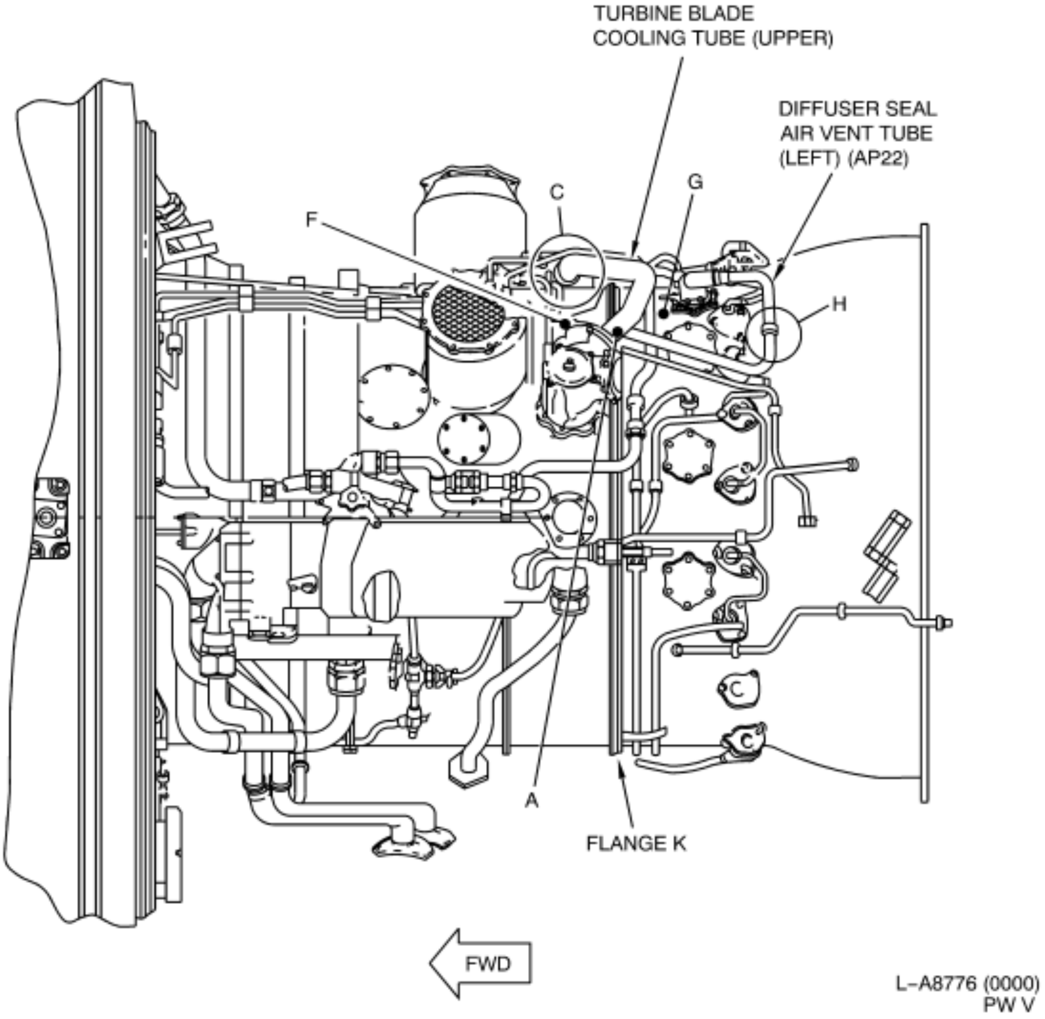
External Plumbing Installation (Pre SB PW4ENG 72−567)
Figure 402 (Sheet 1)
(Task 72−00−41−420−002)


CLAMP
BOLT
TURBINE BLADE COOLING TUBE (UPPER)
FWD
FLANGE K BRACKET
NUT
VIEW C
BOLT
BRACKET
FWD
DIFFUSER SEAL AIR VENT TUBE (LEFT) (AP22)
GASKET
DEFLECTOR
GASKET
VIEW D
L−A1846 (1195)
PW V

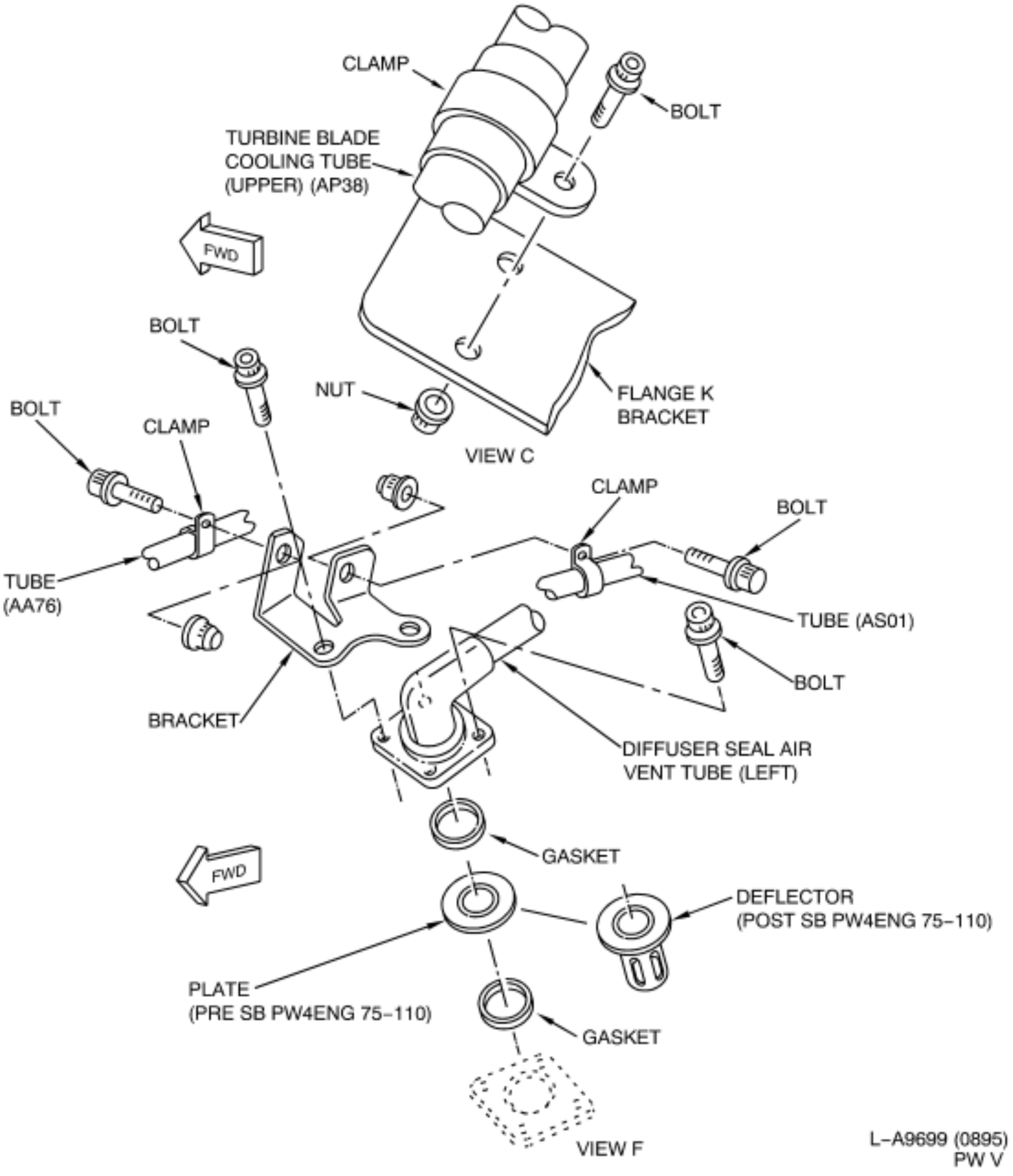
External Plumbing Installation (Pre SB PW4ENG 72−567)
Figure 402 (Sheet 2)
(Task 72−00−41−420−002)


NUT
FUEL INJECTOR BRACKET
DIFFUSER SEAL AIR VENT TUBE (LEFT)
FWD
CLAMP
BOLT
VIEW E
L-A1847 (0187)
PW V

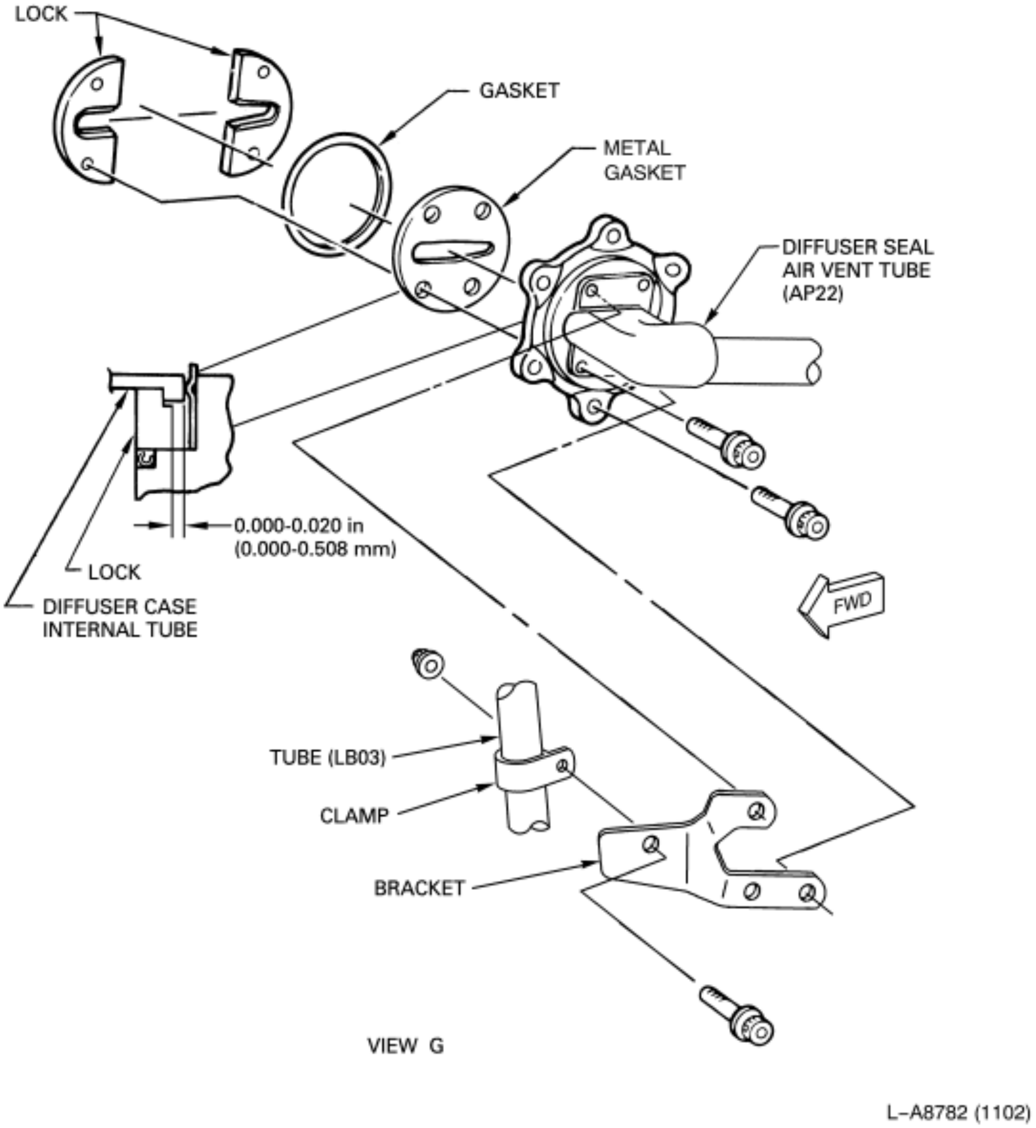
External Plumbing Installation (Pre SB PW4ENG 72-567)
Figure 402 (Sheet 3)
(Task 72-00-41-420-002)


TURBINE BLADE COOLING TUBE (UPPER)
DIFFUSER SEAL AIR VENT TUBE (LEFT) (AP22)
C
G
F
H
A
FLANGE K
FWD
L−A8776 (0000)
PW V

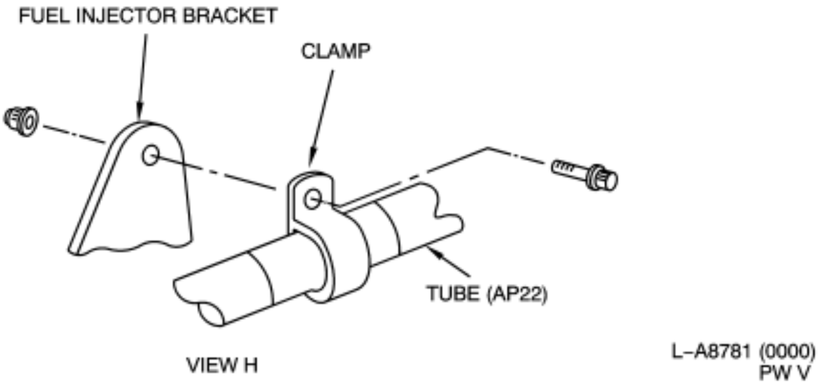
External Plumbing Installation (Post SB PW4ENG 72−567)
Figure 402 (Sheet 4)
(Task 72−00−41−420−002)


CLAMP
BOLT
TURBINE BLADE COOLING TUBE (UPPER) (AP38)
FWD
BOLT
NUT
FLANGE K BRACKET
BOLT
CLAMP
VIEW C
CLAMP
BOLT
TUBE (AA76)
TUBE (AS01)
BOLT
BRACKET
DIFFUSER SEAL AIR VENT TUBE (LEFT)
GASKET
FWD
DEFLECTOR (POST SB PW4ENG 75−110)
PLATE (PRE SB PW4ENG 75−110)
GASKET
VIEW F
L−A9699 (0895)
PW V

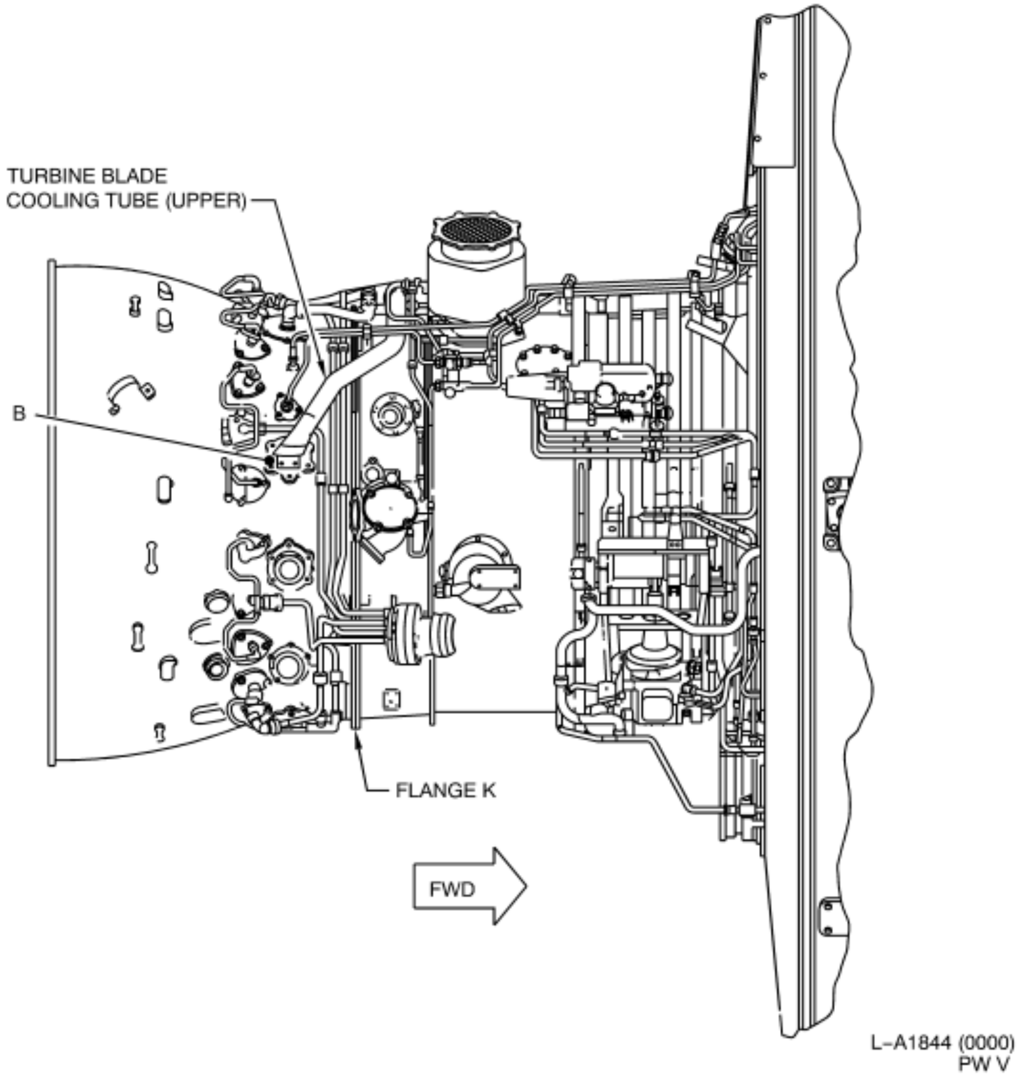
External Plumbing Installation (Post SB PW4ENG 72−567)
Figure 402 (Sheet 5)
(Task 72−00−41−420−002)


LOCK
GASKET
METAL GASKET
DIFFUSER SEAL AIR VENT TUBE (AP22)
0.000-0.020 in (0.000-0.508 mm)
LOCK
DIFFUSER CASE INTERNAL TUBE
FWD
TUBE (LB03)
CLAMP
BRACKET
VIEW G
L-A8782 (1102)

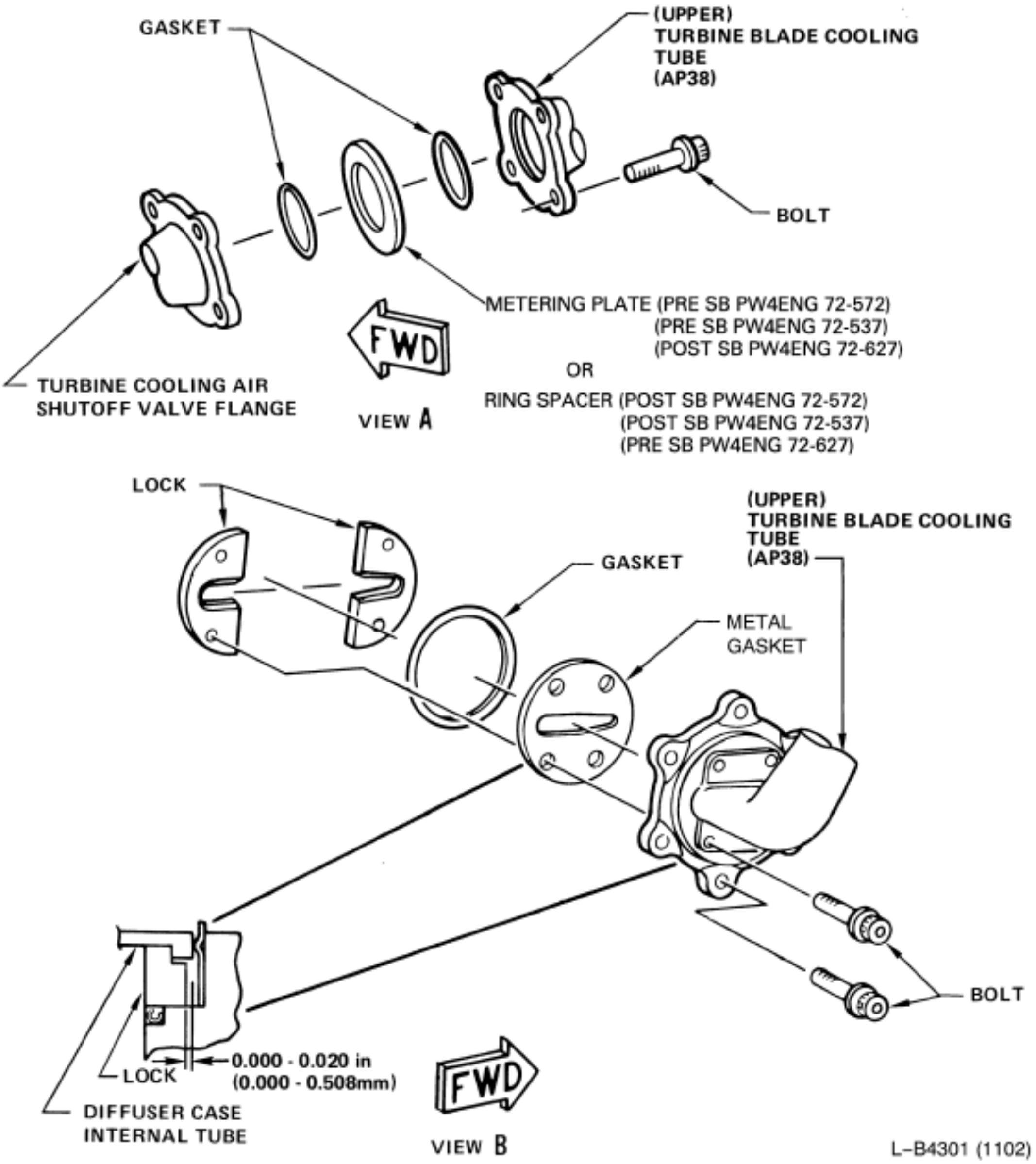
External Plumbing Installation (Post SB PW4ENG 72−567)
Figure 402 (Sheet 6)
(Task 72−00−41−420−002)


FUEL INJECTOR BRACKET
CLAMP
TUBE (AP22)
VIEW H
L−A8781 (0000)
PW V

External Plumbing Installation (Post SB PW4ENG 72−567)
Figure 402 (Sheet 7)
(Task 72−00−41−420−002)

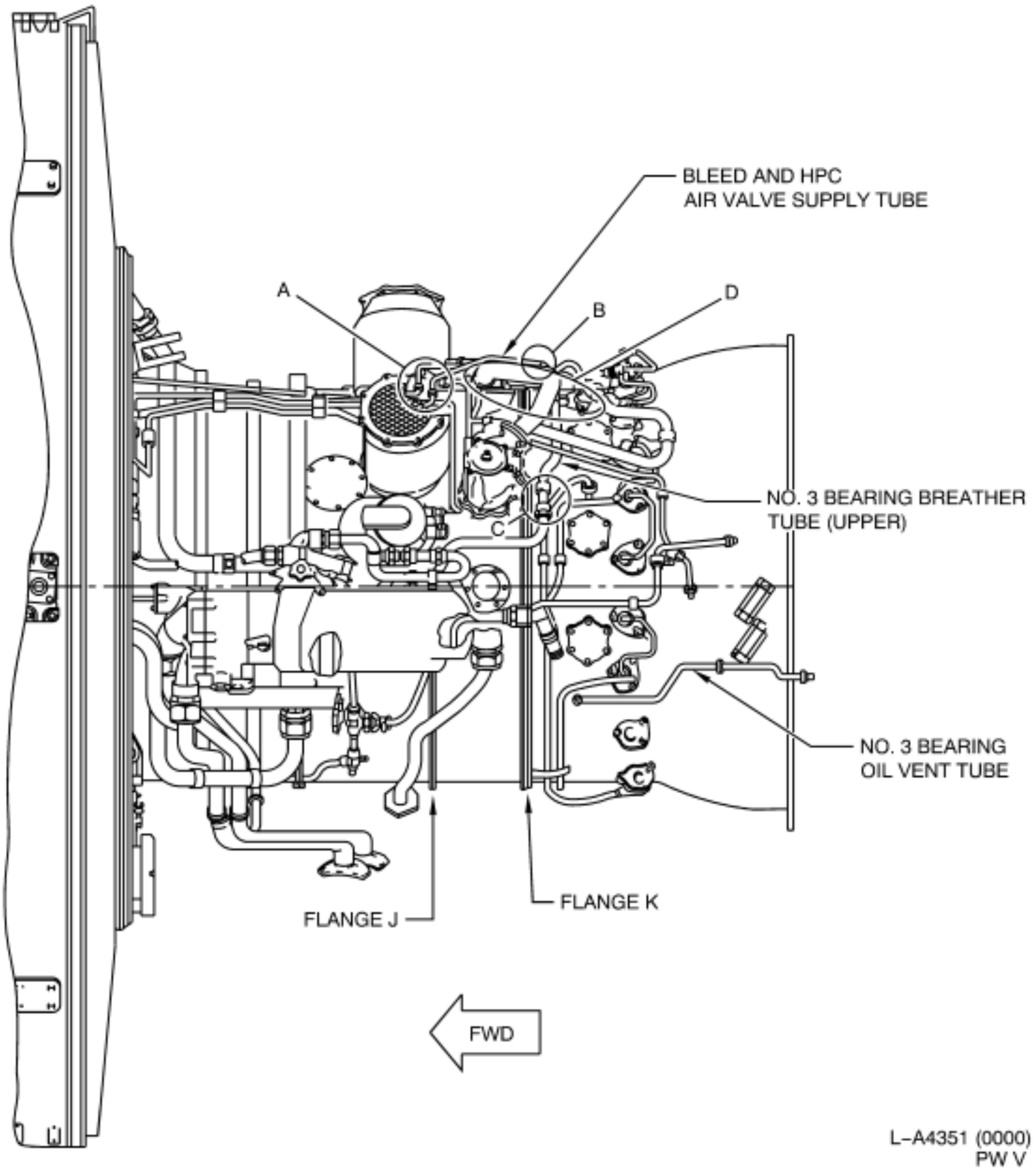

TURBINE BLADE COOLING TUBE (UPPER)
B
FLANGE K
FWD
L−A1844 (0000)
PW V

External Plumbing Installation
Figure 402 (Sheet 8)
(Task 72−00−41−420−002)

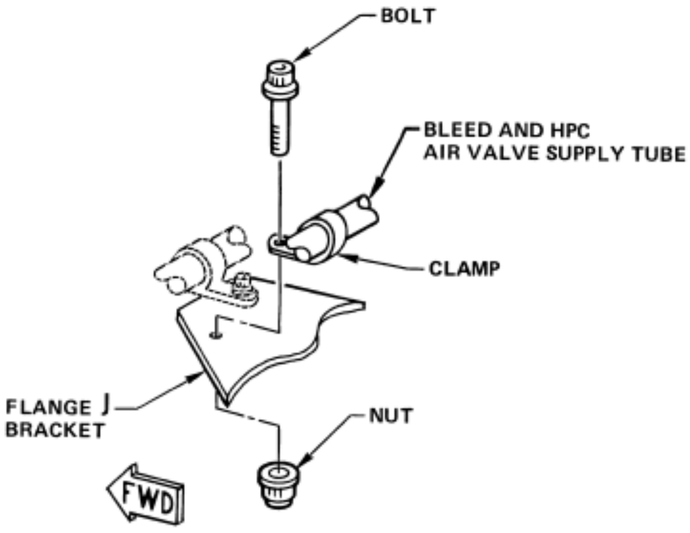

GASKET
(UPPER)
TURBINE BLADE COOLING
TUBE
(AP38)
BOLT
METERING PLATE (PRE SB PW4ENG 72-572)
(PRE SB PW4ENG 72-537)
(POST SB PW4ENG 72-627)
OR
RING SPACER (POST SB PW4ENG 72-572)
(POST SB PW4ENG 72-537)
(PRE SB PW4ENG 72-627)
FWD
VIEW A
TURBINE COOLING AIR
SHUTOFF VALVE FLANGE
LOCK
GASKET
(UPPER)
TURBINE BLADE COOLING
TUBE
(AP38)
METAL
GASKET
BOLT
0.000 - 0.020 in
(0.000 - 0.508mm)
LOCK
DIFFUSER CASE
INTERNAL TUBE
FWD
VIEW B
L-B4301 (1102)

External Plumbing Installation
Figure 402 (Sheet 9)
(Task 72−00−41−420−002)

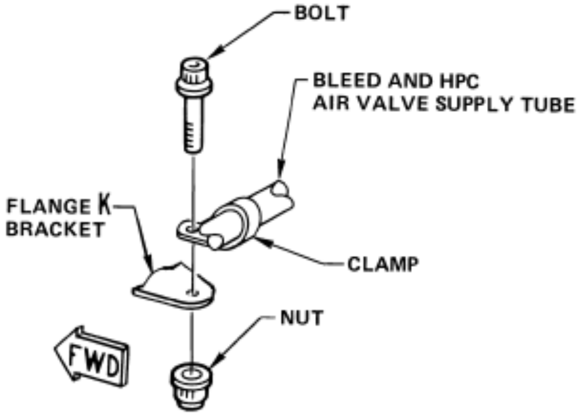
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−02


BLEED AND HPC
AIR VALVE SUPPLY TUBE
A
B
D
NO. 3 BEARING BREATHER
TUBE (UPPER)
C
NO. 3 BEARING
OIL VENT TUBE
FLANGE J
FLANGE K
FWD
L−A4351 (0000)
PW V

External Plumbing Installation
Figure 403 (Sheet 1)
(Task 72−00−41−420−002)


BOLT
BLEED AND HPC AIR VALVE SUPPLY TUBE
CLAMP
FLANGE J BRACKET
NUT
FWD

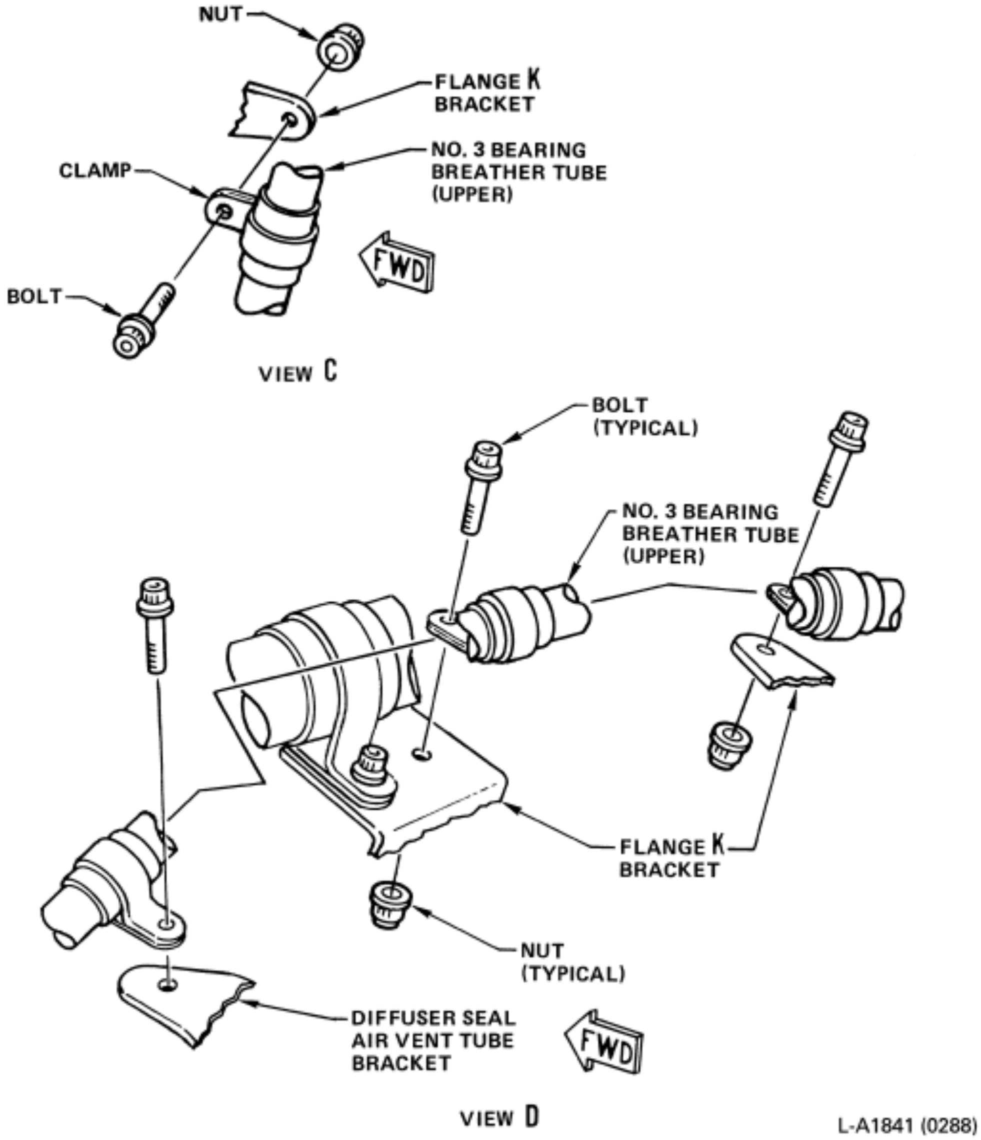
VIEW A


BOLT
BLEED AND HPC AIR VALVE SUPPLY TUBE
FLANGE K BRACKET
CLAMP
NUT
FWD

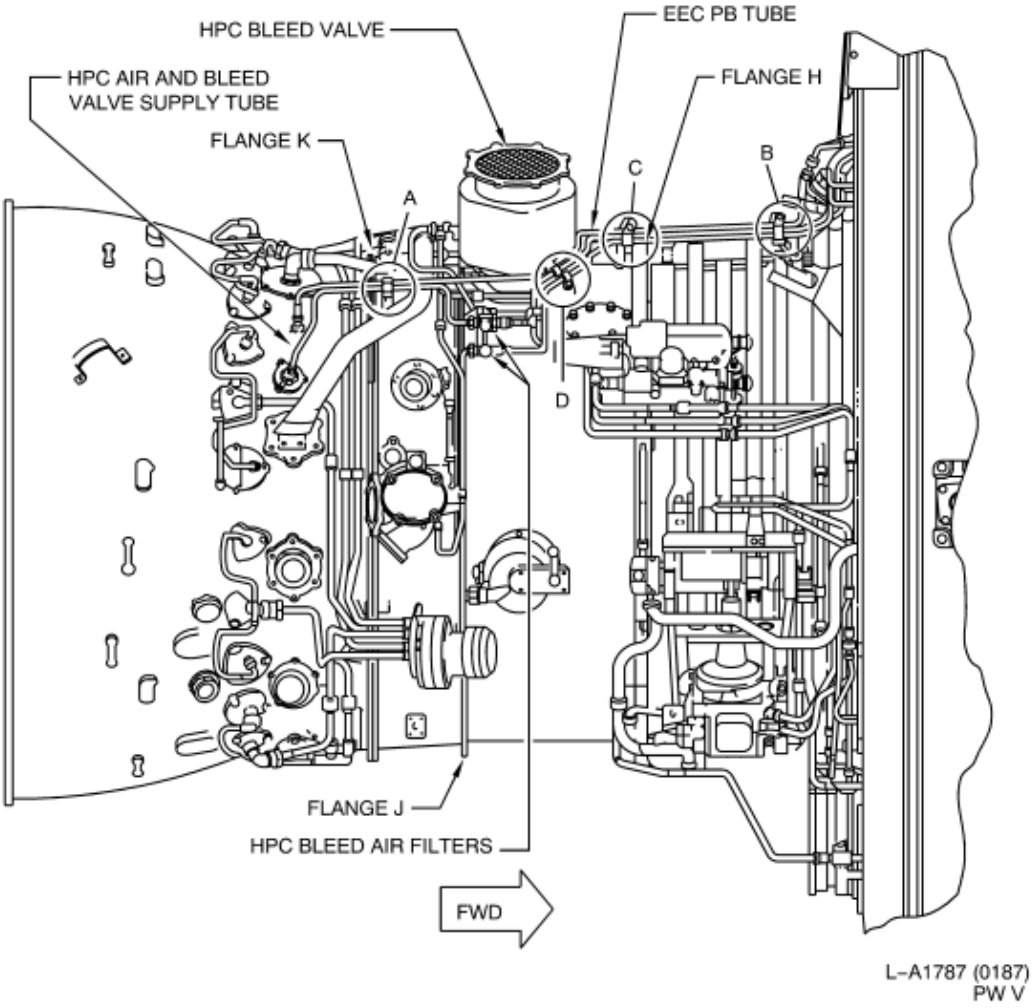
VIEW B

L-A1840 (0288)

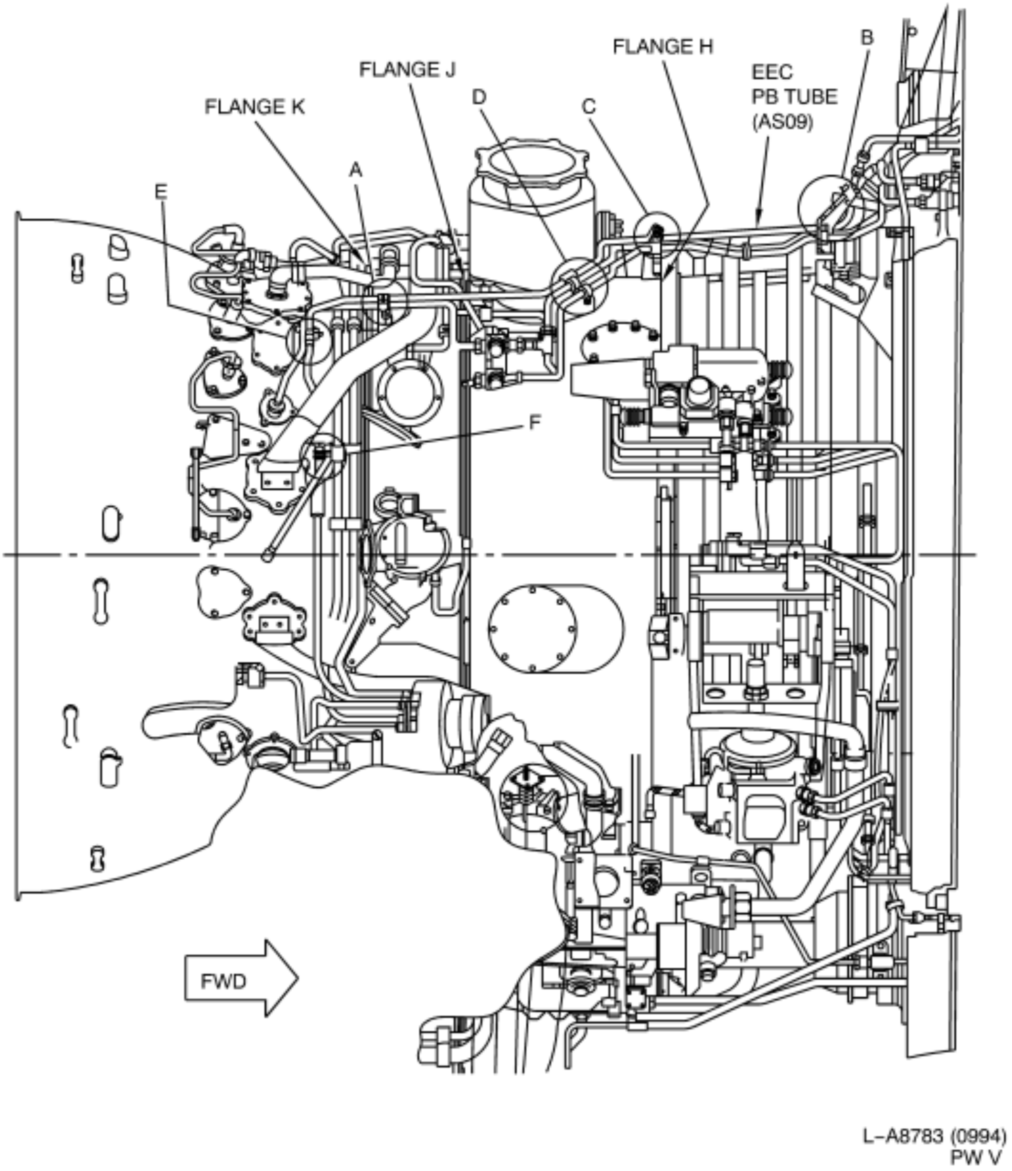
External Plumbing Installation
Figure 403 (Sheet 2)
(Task 72−00−41−420−002)


NUT
FLANGE K BRACKET
NO. 3 BEARING BREATHER TUBE (UPPER)
CLAMP
FWD
BOLT
VIEW C
BOLT (TYPICAL)
NO. 3 BEARING BREATHER TUBE (UPPER)
FLANGE K BRACKET
NUT (TYPICAL)
DIFFUSER SEAL AIR VENT TUBE BRACKET
FWD
VIEW D
L-A1841 (0288)

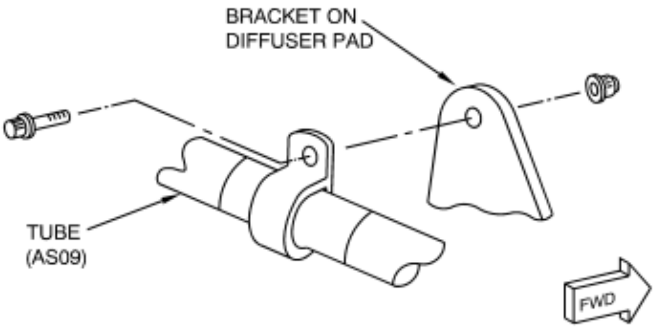
External Plumbing Installation
Figure 403 (Sheet 3)
(Task 72−00−41−420−002)


HPC BLEED VALVE
EEC PB TUBE
HPC AIR AND BLEED VALVE SUPPLY TUBE
FLANGE H
FLANGE K
C
B
A
D
FLANGE J
HPC BLEED AIR FILTERS
FWD
L-A1787 (0187)
PW V

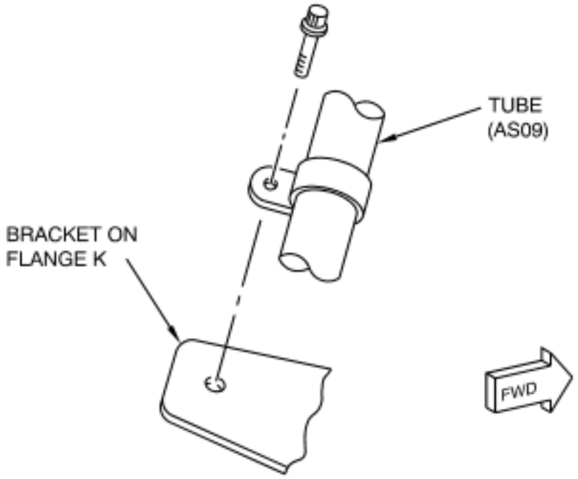
External Plumbing Installation (Pre SB PW4ENG 72-567)
Figure 404 (Sheet 1)
(Task 72-00-41-420-002)


FLANGE H
B
EEC
PB TUBE
(AS09)
FLANGE J
D
C
FLANGE K
A
E
F
FWD
L-A8783 (0994)
PW V

External Plumbing Installation (Post SB PW4ENG 72-567)
Figure 404 (Sheet 2)
(Task 72-00-41-420-002)


BRACKET ON
DIFFUSER PAD
TUBE
(AS09)
FWD

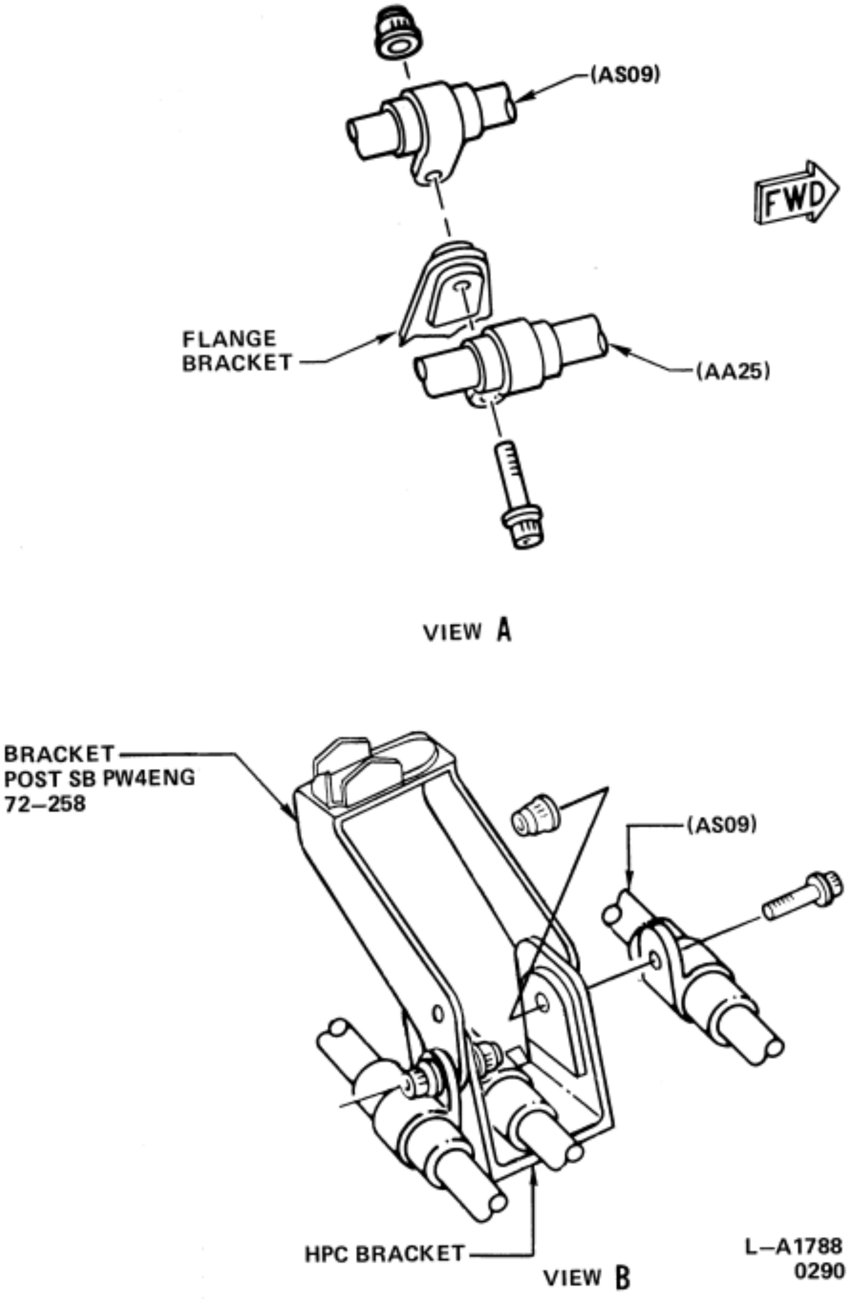
VIEW E


TUBE
(AS09)
BRACKET ON
FLANGE K
FWD

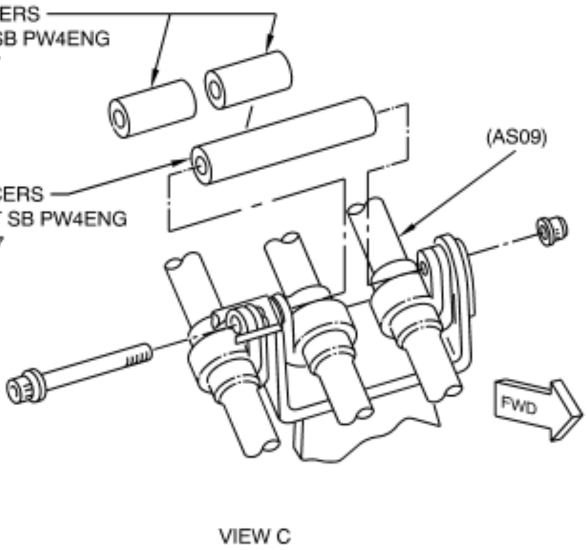
VIEW F

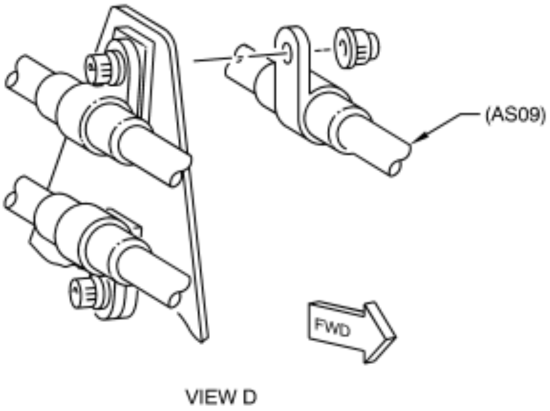
L−A8784 (0000)
PW V

External Plumbing Installation (Post SB PW4ENG 72−567)
Figure 404 (Sheet 3)
(Task 72−00−41−420−002)


(AS09)
FWD
FLANGE BRACKET
(AA25)
VIEW A
BRACKET POST SB PW4ENG 72-258
(AS09)
HPC BRACKET
VIEW B
L-A1788
0290

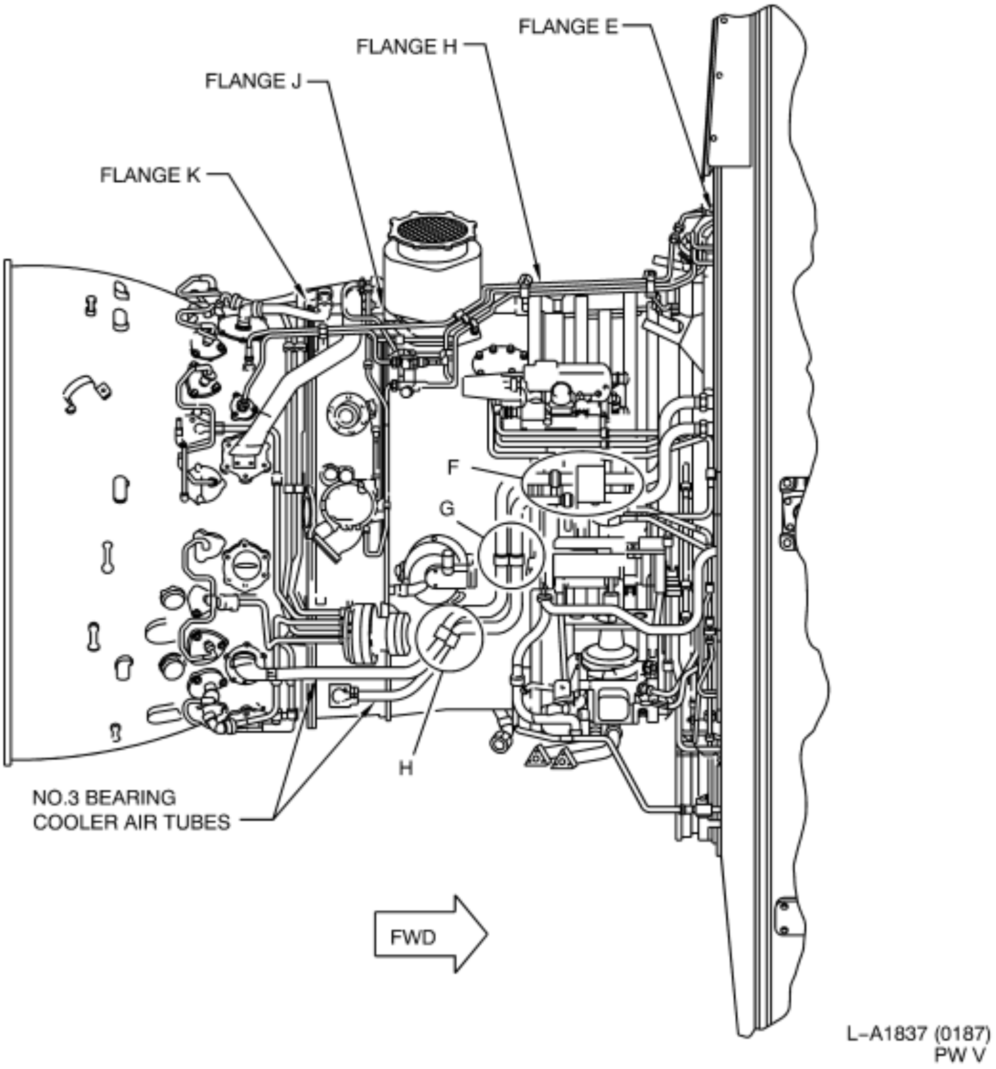
External Plumbing Installation
Figure 404 (Sheet 4)
(Task 72-00-41-420-002)


SPACERS
PRE SB PW4ENG
75−67
SPACERS
POST SB PW4ENG
75−67
(AS09)
FWD
VIEW C


(AS09)
FWD
VIEW D

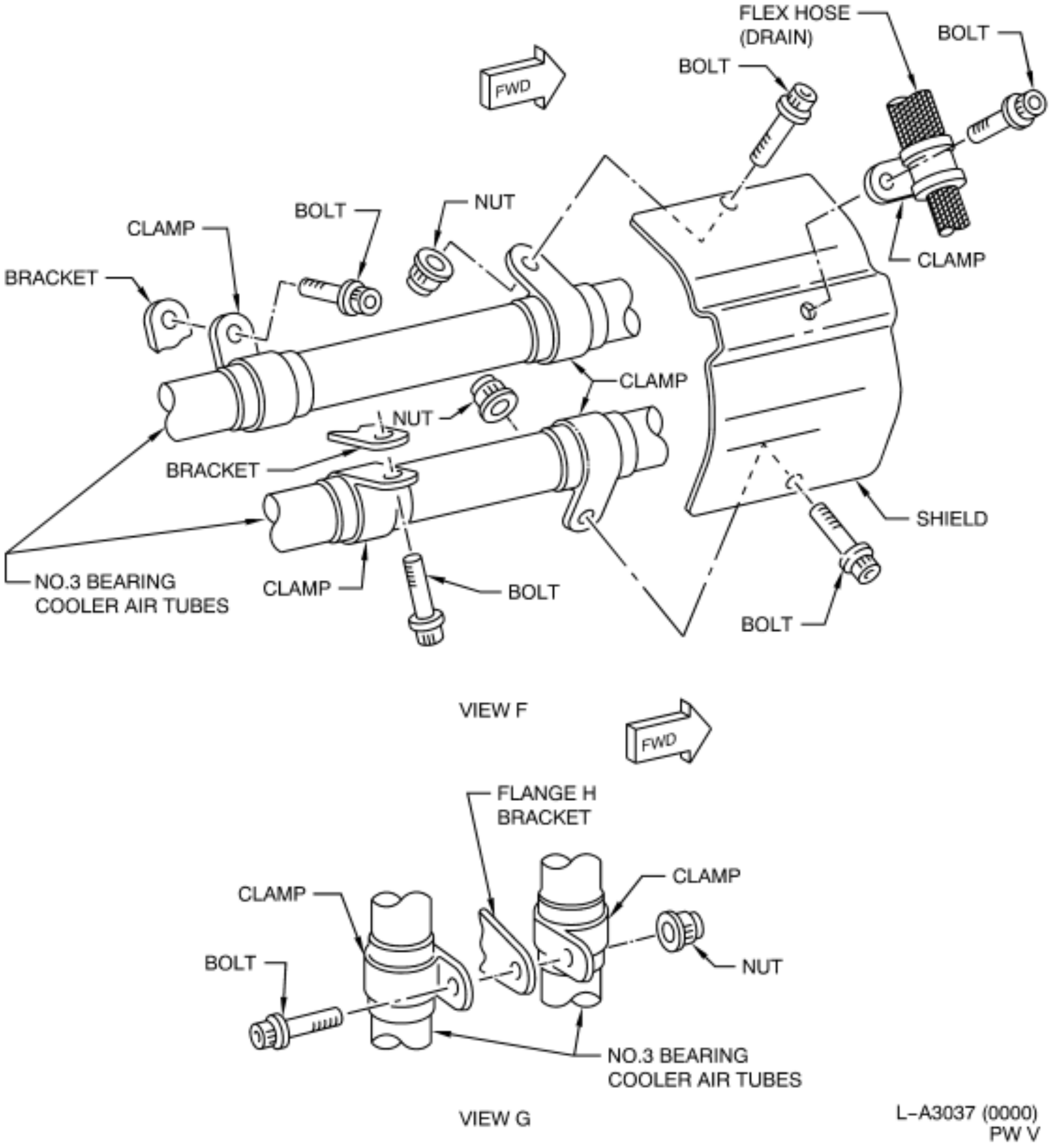
L−A3933 (0196)
PW V

External Plumbing Installation
Figure 404 (Sheet 5)
(Task 72−00−41−420−002)

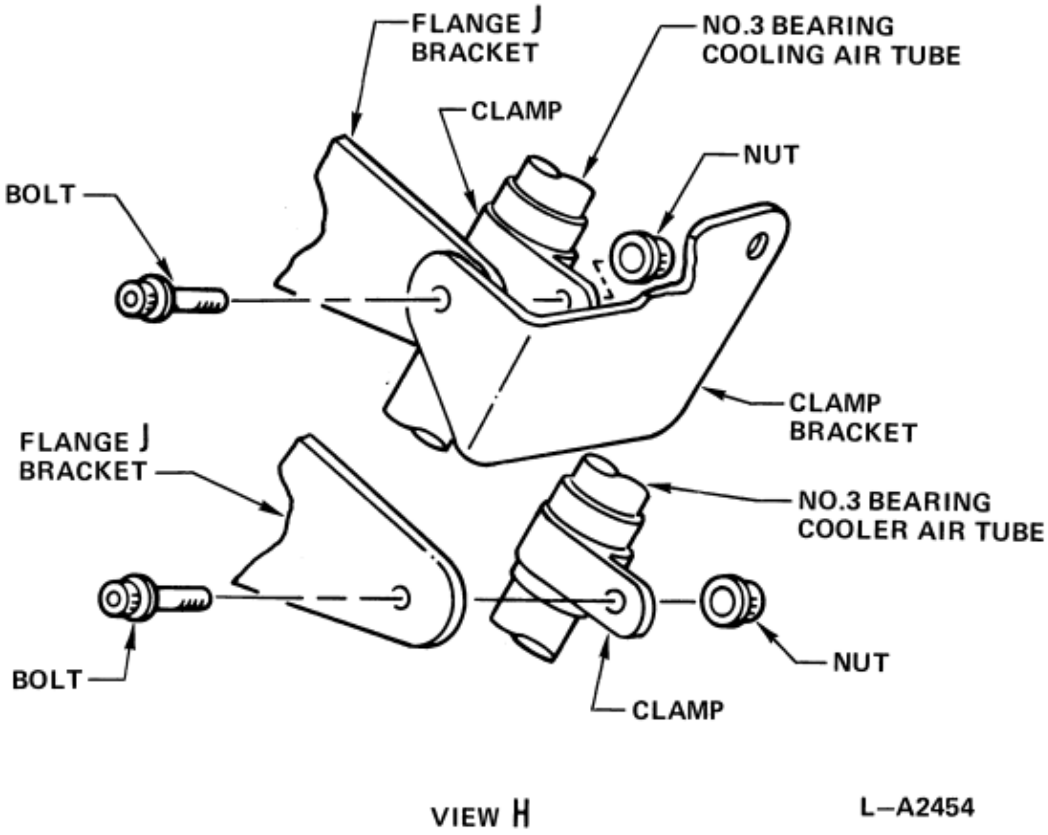

FLANGE E
FLANGE H
FLANGE J
FLANGE K
F
G
H
NO.3 BEARING COOLER AIR TUBES
FWD
L−A1837 (0187)
PW V

External Plumbing Installation
Figure 405 (Sheet 1)
(Task 72−00−41−420−002)

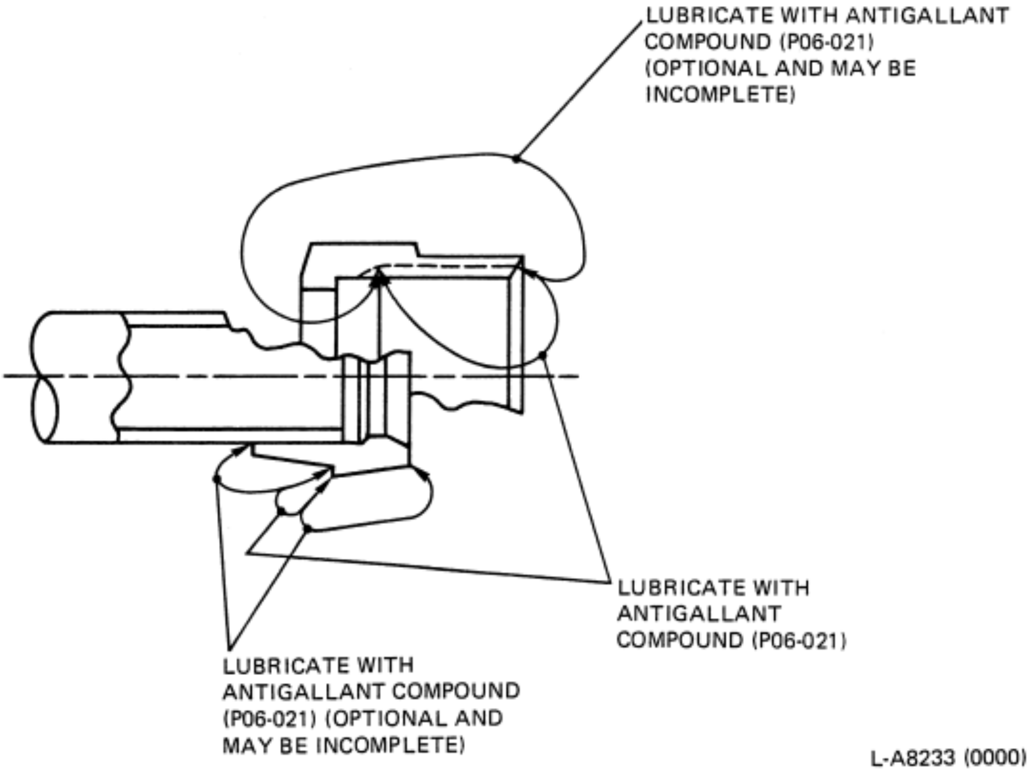
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−02


FWD
FLEX HOSE
(DRAIN)
BOLT
BOLT
BOLT
NUT
CLAMP
BRACKET
BOLT
CLAMP
CLAMP
NUT
BRACKET
SHIELD
NO.3 BEARING
COOLER AIR TUBES
CLAMP
BOLT
BOLT
VIEW F
FWD
FLANGE H
BRACKET
CLAMP
CLAMP
BOLT
NUT
NO.3 BEARING
COOLER AIR TUBES
VIEW G
L−A3037 (0000)
PW V

External Plumbing Installation
Figure 405 (Sheet 2)
(Task 72−00−41−420−002)

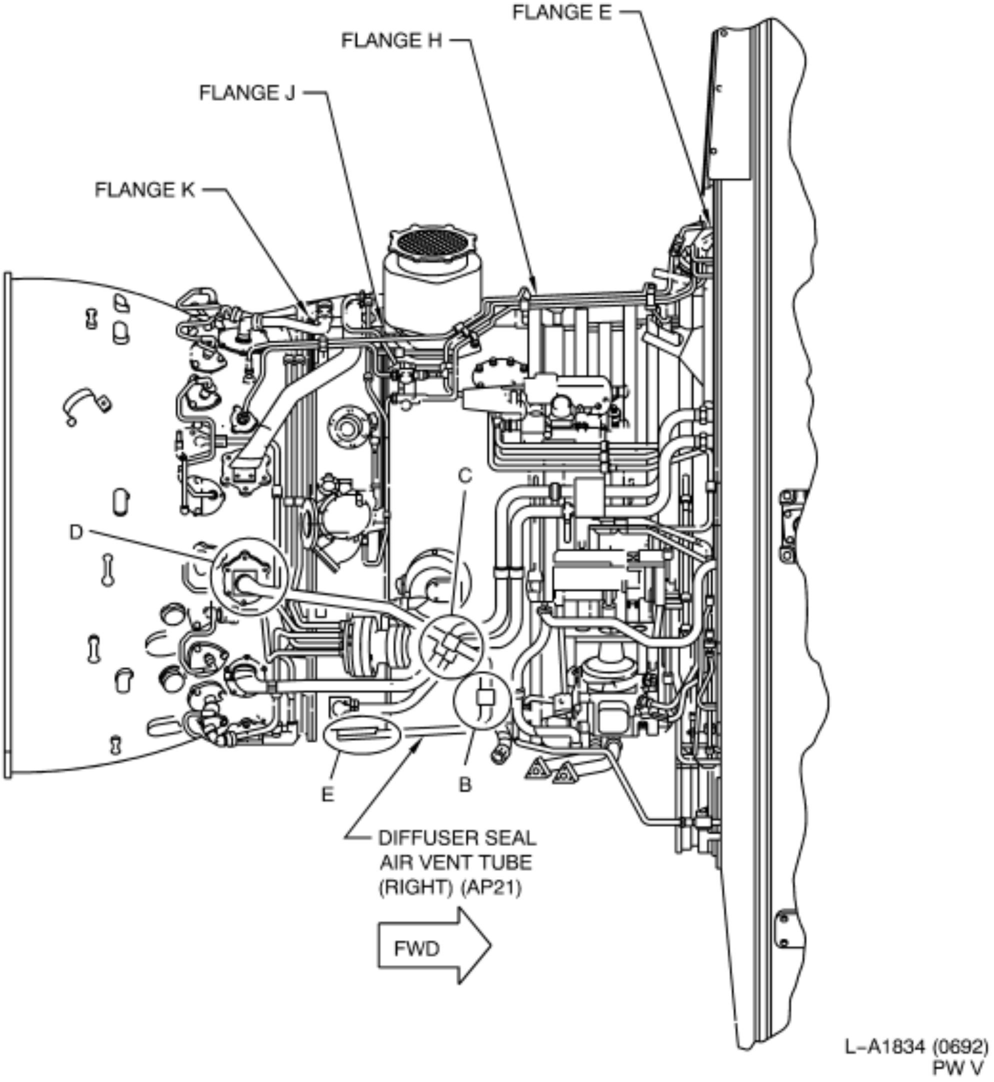

FLANGE J BRACKET
NO.3 BEARING COOLING AIR TUBE
CLAMP
NUT
BOLT
CLAMP BRACKET
FLANGE J BRACKET
NO.3 BEARING COOLER AIR TUBE
BOLT
NUT
CLAMP
VIEW H
L−A2454

External Plumbing Installation
Figure 405 (Sheet 3)
(Task 72−00−41−420−002)

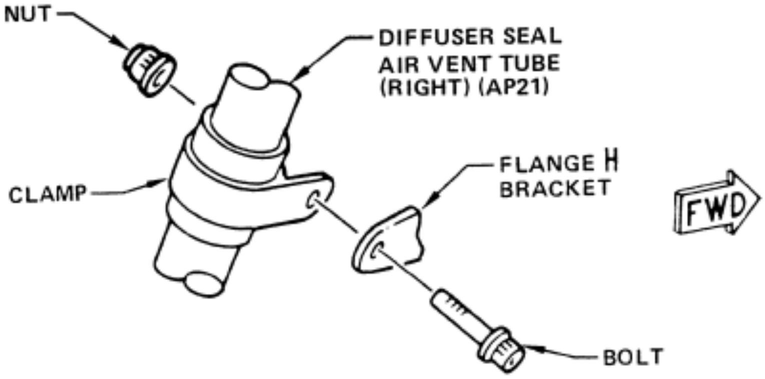

LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
L-A8233 (0000)

External Plumbing Installation (Application Of Antigallant)
Figure 405 (Sheet 4)
(Task 72−00−41−420−002)

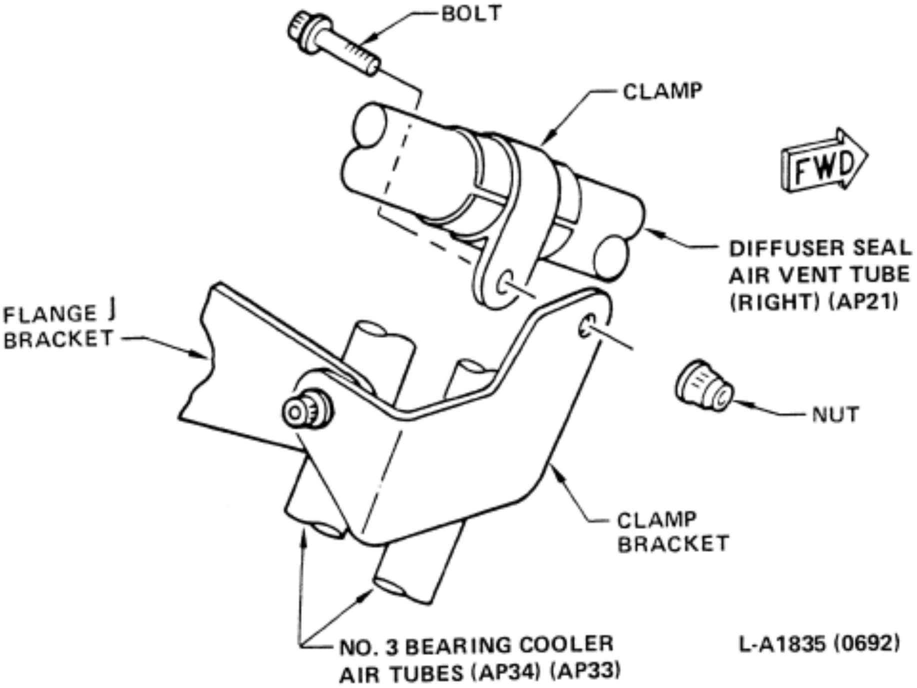
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−02


FLANGE E
FLANGE H
FLANGE J
FLANGE K
D
C
E
B
DIFFUSER SEAL AIR VENT TUBE (RIGHT) (AP21)
FWD
L−A1834 (0692)
PW V

External Plumbing Installation
Figure 406 (Sheet 1)
(Task 72−00−41−420−002)

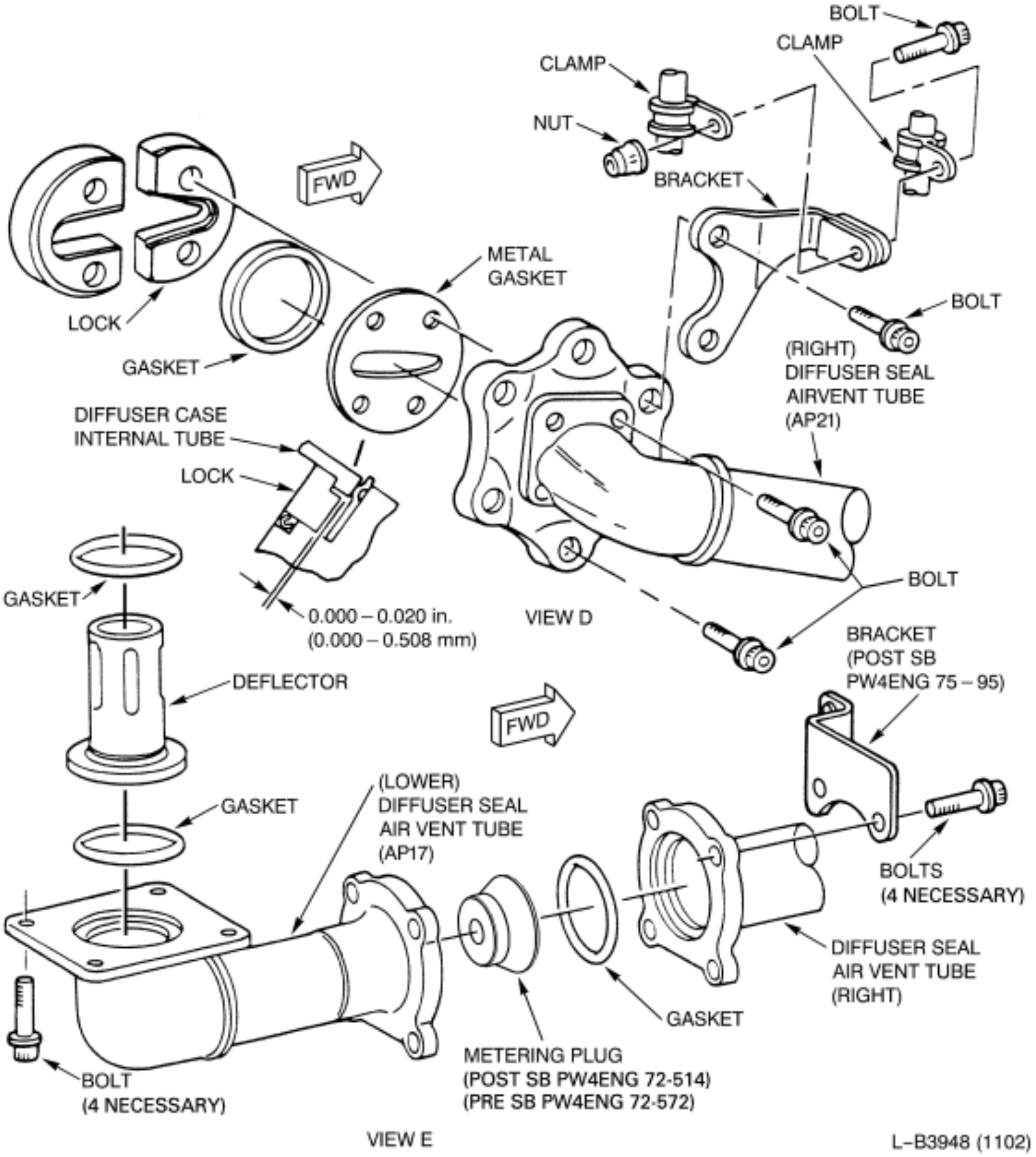

NUT
DIFFUSER SEAL AIR VENT TUBE (RIGHT) (AP21)
CLAMP
FLANGE H BRACKET
FWD
BOLT

VIEW B

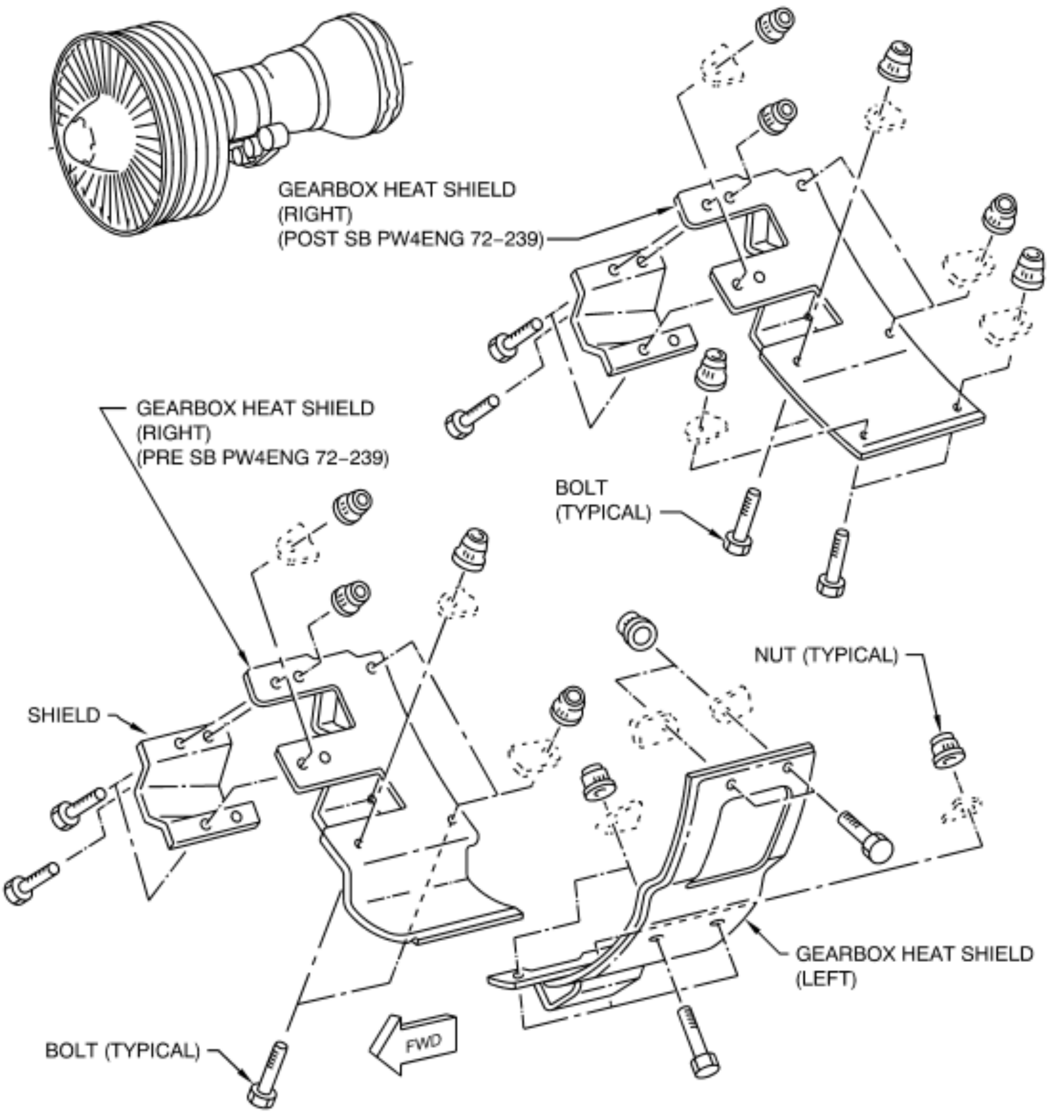

BOLT
CLAMP
FWD
DIFFUSER SEAL AIR VENT TUBE (RIGHT) (AP21)
FLANGE J BRACKET
NUT
CLAMP BRACKET
NO. 3 BEARING COOLER AIR TUBES (AP34) (AP33)
L-A1835 (0692)

VIEW C

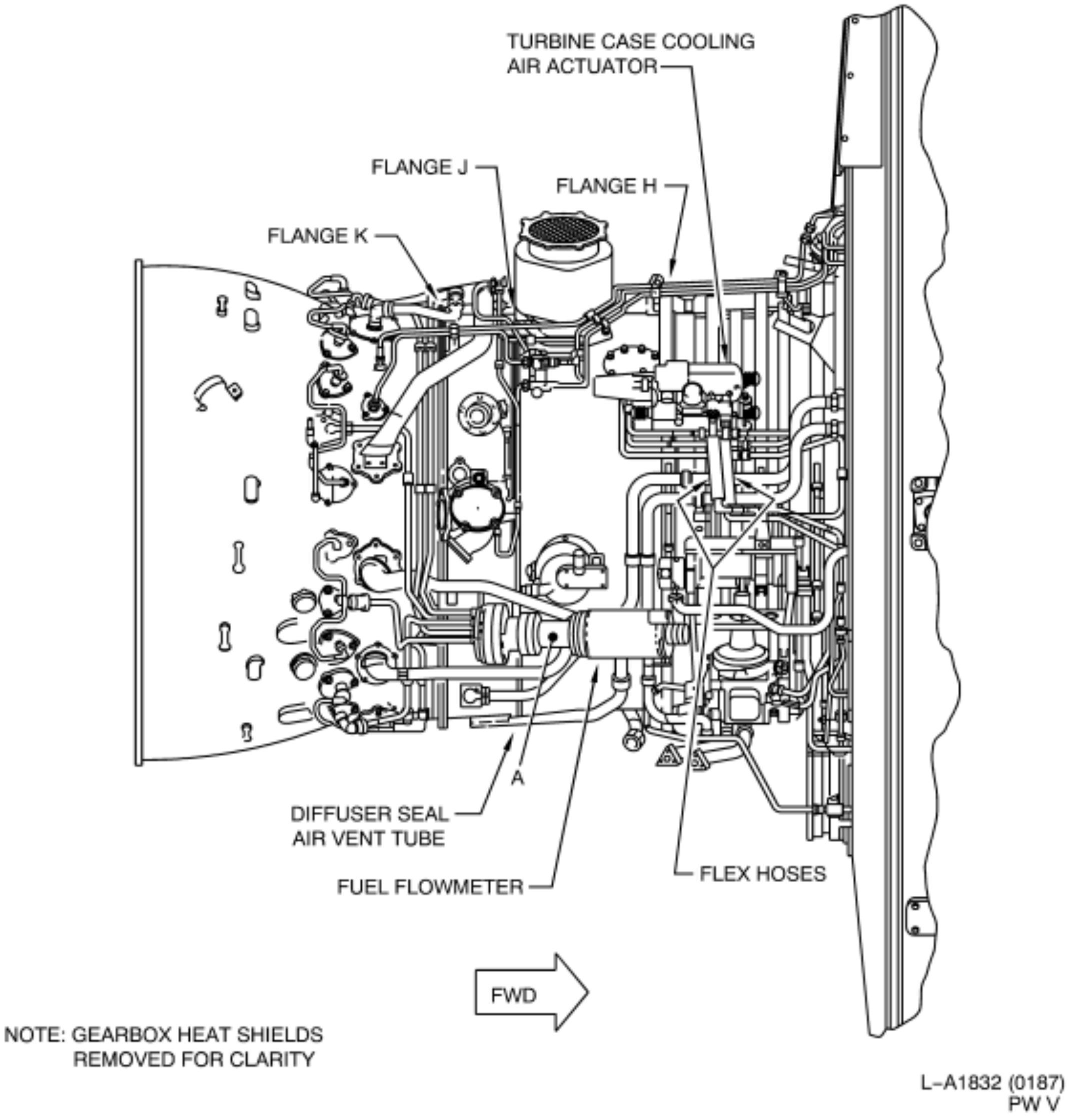
External Plumbing Installation
Figure 406 (Sheet 2)
(Task 72-00-41-420-002)


BOLT
CLAMP
CLAMP
NUT
BRACKET
FWD
METAL GASKET
BOLT
LOCK
GASKET
(RIGHT) DIFFUSER SEAL AIRVENT TUBE (AP21)
DIFFUSER CASE INTERNAL TUBE
LOCK
BOLT
GASKET
0.000 – 0.020 in. (0.000 – 0.508 mm)
VIEW D
BRACKET (POST SB PW4ENG 75 – 95)
DEFLECTOR
FWD
(LOWER) DIFFUSER SEAL AIR VENT TUBE (AP17)
GASKET
BOLTS (4 NECESSARY)
DIFFUSER SEAL AIR VENT TUBE (RIGHT)
GASKET
METERING PLUG (POST SB PW4ENG 72-514) (PRE SB PW4ENG 72-572)
BOLT (4 NECESSARY)
VIEW E
L–B3948 (1102)

External Plumbing Installation
Figure 406 (Sheet 3)
(Task 72−00−41−420−002)

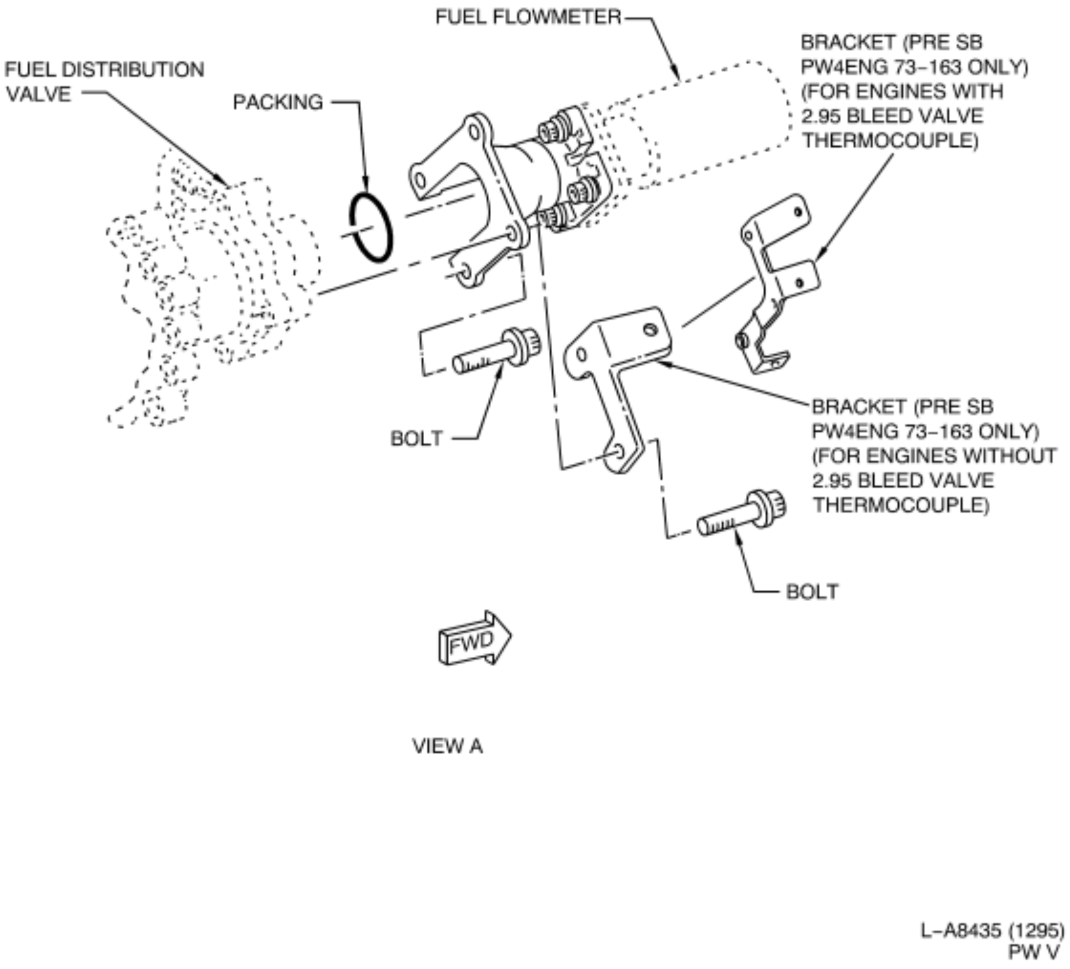

GEARBOX HEAT SHIELD
(RIGHT)
(POST SB PW4ENG 72−239)
GEARBOX HEAT SHIELD
(RIGHT)
(PRE SB PW4ENG 72−239)
BOLT
(TYPICAL)
SHIELD
NUT (TYPICAL)
GEARBOX HEAT SHIELD
(LEFT)
BOLT (TYPICAL)
FWD
L−A1853 (0895)
PW V

Gearbox Heat Shields
Figure 407
(Task 72−00−41−420−002)


TURBINE CASE COOLING AIR ACTUATOR
FLANGE J
FLANGE H
FLANGE K
A
DIFFUSER SEAL AIR VENT TUBE
FUEL FLOWMETER
FLEX HOSES
FWD
NOTE: GEARBOX HEAT SHIELDS REMOVED FOR CLARITY
L−A1832 (0187)
PW V

External Plumbing Installation
Figure 408 (Sheet 1)
(Task 72−00−41−420−002)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−02


FUEL FLOWMETER
BRACKET (PRE SB PW4ENG 73−163 ONLY) (FOR ENGINES WITH 2.95 BLEED VALVE THERMOCOUPLE)
FUEL DISTRIBUTION VALVE
PACKING
BOLT
BRACKET (PRE SB PW4ENG 73−163 ONLY) (FOR ENGINES WITHOUT 2.95 BLEED VALVE THERMOCOUPLE)
BOLT
FWD
VIEW A
L−A8435 (1295)
PW V

External Plumbing Installation
Figure 408 (Sheet 2)
(Task 72−00−41−420−002)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−02

Task 72−00−41−420−005:

1. Install External Parts After Diffuser And Combustor Installation

A. Equipment And Materials Necessary

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03−001	Oil, Engine (PWA 521B)
	P05−059	Wax, Paraffin (PMC 9552)
	P05−289	Lockwire (AS3214−02)
	P05−291	Cable, Safety (Optional)
	P05−292	Ferrule, Safety Cable (Optional)
R	P06−021	Compound, Antigalling (PWA 550)
R	P06−053	Lubricant, Sealing Ring (PWA 36500)
	P06−054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	75−26−00/1/20
Gasket	1	75−26−00/1/30
Gasket	2	75−26−00/1/40
Gasket	1	75−37−00/1/20
Gasket	1	75−37−00/1/30
Gasket	2	75−37−00/1/35
Gasket	2	75−37−00/1/135
Gasket	1	75−37−00/1/90
Packing	1	73−13−00/4/70
Packing	1	79−21−00/10/60
Packing	1	79−21−00/10/60
Packing	1	79−21−00/10/60A

B. Procedure
See Figure 401, Figure 402, Figure 403, Figure 404, Figure 405, Figure 406, Figure 407 and Figure 408.

(1) Install EEC PT4.95 tube assembly (AS01) as follows.

CAUTION: DO NOT USE LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF EEC CAN RESULT.

(a) Remove protective closures.

(b) Connect the tube to the PT4.95 tube (AS41) at the 11:00 o'clock position adjacent to Flange K. Tighten by hand.

(c) Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts securing tube to brackets.

(d) Torque all clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque forward tube nut to tube coupling to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(2) (Pre SB PW4ENG 72-491) Install No. 4 bearing oil pressure tube assembly (LP15) as follows.

(a) Remove protective closures and lubricate tube threads at each end with Antigalling Compound P06-021. See Figure 401 (Sheet 7). Install the tube to the engine and attach the forward end of the tube to the manifold tee forward of Flange J at approximately the 8 o'clock position handtight only.

(b) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to bracket attached to cooling air tube flange at approximately 9 o'clock position handtight only.

(c) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to fuel injector bracket at approximately 9 o'clock position on diffuser case handtight only.

(d) Install two clamps, bolt, spacer, and nut securing tube to adjacent EEC PT4.95 (AS01) tube handtight only. If the engine does not have brazed wear sleeves on the PT4.95 tube (AS01), install the grommet halves (clip on wear sleeves) to the tube before you install the clamp.

(e) Torque all clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(f) Torque forward tube nut to 340 - 375 lb-in. (38.415 - 42.369 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(g) (Reference 2151) Position spray shield to inboard side of connection and secure with hose clamp. Torque hose clamp to 15 - 18 lb-in. (1.695 - 2.034 N.m).

(3) (Post SB PW4ENG 72-491) Install No. 4 bearing oil pressure tube assembly (LP15) as follows.

(a) Remove protective closures and lubricate tube threads at each end with Antigalling Compound P06-021. See Figure 401 (Sheet 7). Install the tube to the engine and attach the forward end of the tube to the manifold tee forward of Flange J at approximately the 8 o'clock position, handtight only.

(b) Install the deoiler idler bearing pressure line (LP35) nut to the tee fitting, handtight only.

(c) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to bracket attached to cooling air tube flange at approximately 9 o'clock position, handtight only.

(d) Install clamp and bolt, threads lubricated with Engine Oil P03-001, to hold the tube to Flange K bracket assembly at approximately 9 o'clock position, handtight only.

(e) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to fuel injector bracket at approximately 9 o'clock position on diffuser case, handtight only.

(f) Install two clamps, bolt, spacer, and nut securing tube to adjacent EEC PT4.95 (AS01) tube, handtight only. If the engine does not have brazed wear sleeves on the PT4.95 tube (AS01), install the grommet halves (clip on wear sleeves) to the tube before you install the clamp.

(g) Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(h) Torque forward tube nut to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(i) Torque the nut from the deoiler idler bearing pressure line (LP35) to the tee fitting to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(j) (Reference 2151) Position spray shields to the inboard side of the forward tube nut connection and the tee fitting connection and secure with hose clamps. Torque hose clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(4) (Pre/Post SB PW4ENG 72−491) Install the No. 3 bearing oil pressure tube assembly (LP19) as follows.

(a) Remove the protection covers. Lubricate the threads of the tube nut at the elbow end with Engine Oil P03−001.

(b) Install the tube to the diffuser case internal tube at approximately the 10 o'clock position.

(c) Install the strainer to the (front) of the tube.

(d) Remove the protection covers from the adapter. Install a packing lubricated with Engine Oil P03−001 to the adapter.

(e) Install the adapter to the (front) of the tube and attach with bolts, threads lubricated with Engine Oil P03−001 and nuts.

(f) Install the clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts that attach the tube to the bracket on Flange K.

CAUTION: DO NOT TORQUE THE TUBE NUTS OR THE CLAMP BOLTS AT THIS TIME. YOU MUST COMPLETE THE INSTALLATION OF THIS TUBE AFTER YOU INSTALL OTHER TUBES AFTER THE GEARBOX

INSTALLATION. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

(g) Do not torque the tube nuts or clamp bolts at this time. Install a tag on the manifold "not torqued".

NOTE: You will complete the installation of the above tube (LP19) in 72-00-61, Installation-02 (Task 72-00-61-420-002). See the installation of the oil trim pressure tube (LP32).

(5) Install the (left) diffuser seal air vent tube assembly (AP22) as follows. See Figure 402.

NOTE: Make sure to remove the temporary safety wire that is around the internal diffuser seal air vent tube assembly before you install the locks. Be careful not to let the tube drop into the diffuser case after you remove the temporary safety wire.

(a) Remove the protection covers. Install a gasket to the groove in the HPC rear case boss at approximately the 10:30 o'clock position.

(b) Install a gasket to the flanged end (with four holes) of the tube and attach the gasket in place with Paraffin Wax P05-059. Install the plate (pre SB PW4ENG 75-110) to the recessed area of the HPC case boss or align the pin on the deflector (Post SB PW4ENG 75-110) with the hole in the HPC case boss and install the deflector to the recessed area.

CAUTION: INSTALL LOCK PLATES WITH SLOT GROOVE OUTWARD AND PIN (IF EQUIPPED) INWARD. MAKE SURE THE LOCK PLATES ENGAGE THE INTERNAL TUBE LIP FLANGE AS SHOWN IN FIGURE 402.

(c) Install the locks to the diffuser case internal tube inside boss at approximately the 11 o'clock position. Attach the locks in place with Paraffin Wax P05-059.

(d) (Reference 2261) Hold the tube locks inward against the tube lip. Measure and make sure the end of the internal tube is 0.000 − 0.020 inch (0.000 − 0.508 mm) above the tube locks. If the measurement is not within this limit, install the locks again and make sure the internal tube lip is engaged properly.

(e) Install the four hole gasket with the raised portion outward toward the tube flange. Install the second gasket in groove of the same opening and attach both gaskets in place with Paraffin Wax P05−059.

(f) Install the tube to the engine (gaskets in place). Attach the tube to the diffuser case with a bracket and bolts, threads lubricated with Engine Oil P03−001. Tighten the bolts by hand.

(g) Attach the tube to the HPC rear case with a bracket and bolts, threads lubricated with Engine Oil P03−001. Tighten the bolts by hand.

(h) Install a clamp, bolt, threads lubricated with Engine Oil P03−001, and nut to attach the tube to the fuel injector bracket. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(i) Torque the bolts that attach the tube flange to the HPC rear case to 85 − 95 lb−in. (9.604 − 10.734 N.m). Without loosening the bolts, torque again until the 85 − 95 lb−in. (9.604 − 10.734 N.m) is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

(j) Torque the bolts that attach the tube flange to the diffuser case and the four bolts that attach a bracket to the tube flange to 85 − 95 lb−in. (9.604 − 10.734 N.m). Without loosening the bolts, torque again until the 85 − 95 lb−in. (9.604 − 10.734 N.m) is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

(k) Install a clamp to the No. 3 bearing breather tube assembly (LB03). Attach the clamp to the bracket from the diffuser pad at the 11 o'clock position with a bolt, threads lubricated with Engine Oil P03−001, and nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(6) Install (upper) turbine blade cooling tube assembly (AP38) as follows.

(a) Remove protective closures. Install gasket to groove in turbine cooling air shutoff valve at approximately 10 o'clock position and secure in place with Paraffin Wax P05−059.

CAUTION: INSTALL LOCK PLATES WITH SLOT GROOVE OUTWARD AND PIN (IF EQUIPPED) INWARD. ENSURE LOCK PLATES ENGAGE INTERNAL TUBE LIP FLANGE AS SHOWN IN FIGURE 402.

(b) Install locks to diffuser case internal tube inside boss at approximately 2 o'clock position. Secure in place with Paraffin Wax P05−059.

(c) (Reference 2261) Hold the tube locks outward against the tube lip. Measure and be sure the end of the internal tube is 0.000 − 0.020 inch (0.000 − 0.508 mm) above the tube locks. If the measurement is not within this limit, install the locks again and be sure you engage the internal tube lip properly.

(d) (Pre SB PW4ENG 72−537 or Post SB PW4ENG 72−627) Install the gasket and metering plate in the four hole flanged end of the tube and hold in place with Paraffin Wax P05−059.

(e) (Post SB PW4ENG 72−537 and Pre SB PW4ENG 72−627) Install the gasket and ring spacer in the four hole flanged end of the tube and hold in place with Paraffin Wax P05−059.

(f) Install four hole gasket, with raised portion visible, into tube flange. Install second gasket in groove of same opening and secure both in place with Paraffin Wax P05−059.

(g) Install tube to engine (gaskets in place) and secure to diffuser case with bolts, threads lubricated with Engine Oil P03−001, handtight only.

(h) Secure tube to cooling air shutoff valve with bolts, threads lubricated with Engine Oil P03−001, handtight only.

(i) Install clamp, bolt, threads lubricated with Engine Oil P03−001, and nut to secure tube to Flange K bracket at approximately 11 o'clock position. Torque clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(j) Torque bolts attaching each end of tube to 85 − 95 lb−in. (9.604 − 10.734 N.m) then retorque to required limit without loosening until required torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(7) Install the (front) No. 3 bearing oil vent tube assembly (LD01) as follows. See Figure 403.

(a) Remove protective closures and lubricate tube nut threads at elbow end with Engine Oil P03−001. Install tube to engine and attach elbow end of tube to diffuser case internal tube at approximately 8 o'clock position handtight only.

(b) Temporarily install clamp, bolt threads lubricated with Engine Oil P03−001, and nut securing tube to diffuser case bracket at approximately 9 o'clock position handtight only.

(c) Torque tube nut to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(8) Install (upper) No. 3 bearing breather tube assembly (LB03) as follows.

(a) Remove protective closures and lubricate elbow threads with Engine Oil P03−001. Install tube to engine and connect elbow to diffuser case internal tube nut at approximately 1 o'clock position handtight only.

(b) Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts securing tube to Flange K brackets at approximately 10, 12 and 1 o'clock positions handtight only.

(c) Install clamp and bolt, threads lubricated with Engine Oil P03-001, attach the tube to the bracket attached to the diffuser case internal tube flange at approximately the 11 o'clock position handtight only.

(d) Torque all clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque diffuser case internal tube nut to tube elbow to 650 - 700 lb-in. (73.440 - 79.089 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(9) Install bleed and HPC air valve supply tube assembly (AA34) as follows.

(a) Remove protective closures and lubricate tube nut threads at each end with Antiseize Paste P06-054. Wipe off unwanted paste.

(b) Install tube to engine and secure with clamp, bolt, threads lubricated with Engine Oil P03-001, and nut to Flange J bracket handtight only.

(c) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut to secure tube to Flange K bracket at approximately 12 o'clock position. Torque clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Torque tube nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(10) Install EEC PB tube assembly (AS09) as follows. See Figure 404.

CAUTION: USE OF LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS COULD RESULT IN CONTAMINATION OF EEC.

(a) Remove protective closures. Install tube to engine and connect elbow end to diffuser case adapter at approximately 1 o'clock position and coupling end to tube at approximately 12:30 o'clock position at Flange E.

(b) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to bracket attached to HPC bleed valve flange at approximately 1:30 o'clock position handtight only.

(c) Install clamp, spacer, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to Flange H bracket at approximately 12:30 o'clock position handtight only.

(d) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to HPC bracket at approximately 12:30 o'clock position rearward of Flange E handtight only.

(e) Torque all clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(f) Torque both ends of tube to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(11) Install HPC and bleed valve supply tube assembly (AA23) as follows.

(a) Remove protective closures and lubricate tube nut threads with Antiseize Paste P06-054. Wipe off unwanted paste. Install tube to engine and connect to HPC bleed air filter and to diffuser case adapter at approximately 2 o'clock position handtight only.

(b) Install clamp, bolt, threads lubricated with Engine Oil P03−001, and nut to secure tube to Flange K bracket at approximately the 1 o'clock position. Bolt head towards tube (AA23) clamp and nut against tube (AS09) clamp. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Torque tube nuts to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(12) Install No. 3 bearing cooler air tube assemblies (AP33) and (AP34) as follows. See Figure 405.

(a) Remove protective closures and lubricate tube nut threads on both tubes with Antigalling Compound P06−021. See Figure 405. Install tubes to engine and secure tube to No. 3 bearing air cooler at approximately 2 o'clock position in fan case handtight only. Secure rear tube nuts to HPC elbow at approximately 5 o'clock position and to diffuser case elbow at approximately 6 o'clock position handtight only.

(b) Install clamps, brackets, bolts, threads lubricated with Engine Oil P03−001, and nuts to attach the tubes to the bracket attached to Flange J at approximately the 4:30 o'clock position handtight only.

(c) Install clamps, bolt, threads lubricated with Engine Oil P03−001, and nut securing tubes to Flange H bracket at approximately the 3 o'clock position handtight only.

(d) Install clamps, heat shield, bolts, threads lubricated with Engine Oil P03−001, and nuts to tubes at approximately 2:30 o'clock position forward of Flange H handtight only.

(e) Install clamps and bolts, threads lubricated with Engine Oil P03−001, securing tubes to HPC bracket at approximately 2:30 o'clock position. Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(f) Torque all tube nuts at No. 3 bearing air cooler and rear elbows to 825 - 900 lb-in. (93.212 - 101.686 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(13) Install diffuser seal air vent tube assemblies right (AP21) and lower (AP17) as follows. See Figure 406.

NOTE: Make sure to remove the temporary safety wire that is around the internal diffuser seal air vent tube assembly before you install the locks. Be careful not to let the tube drop into the diffuser case after you remove the temporary safety wire.

(a) Remove protective closures. Install gasket to groove in HPC rear case boss at approximately 5:30 o'clock position. Install the deflector as you align the pin with the hole in the HPC rear case boss. Hold in place with Paraffin Wax P05-059.

(b) Install gasket to groove in flange of tube (AP17) (lower) and attach to HPC rear case boss with four bolts, threads lubricated with Engine Oil P03-001, handtight only.

(c) Install gasket to groove in four bolt hole flange of tube (AP21) (right) and attach in place with Paraffin Wax P05-059.

CAUTION: INSTALL LOCK PLATES WITH SLOT GROOVE OUTWARD AND PIN (IF EQUIPPED) INWARD. ENSURE LOCK PLATES ENGAGE INTERNAL TUBE LIP FLANGE AS SHOWN IN FIGURE 406.

(d) Install locks to diffuser case internal tube inside boss at approximately 3 o'clock position. Secure in place with Paraffin Wax P05-059.

(e) (Reference 2261) Hold the tube locks outward against the tube lip. Measure and be sure the end of the internal tube is 0.000 - 0.020 inch (0.000 - 0.508 mm) above the tube locks. If the measurement is not within this limit, install the locks again and be sure you engage the internal tube lip properly.

(f) Install four hole gasket, with raised portion visible, into the scalloped flange end of the tube (AP21) and align the four bolt holes. Install second gasket to groove of same tube flange and attach both in place with Paraffin Wax P05−059.

(g) Install tube (AP21) (right) to engine and attach to the diffuser case with bolts, threads lubricated with Engine Oil P03−001, and bracket handtight only.

(h) Install bolts, threads lubricated with Engine Oil P03−001, and bracket to the flange of the tube (AP21), and attach the lower end of the tube to the tube (AP17) attached to the HPC rear case handtight only.

(i) Install clamp, bolt, threads lubricated with Engine Oil P03−001, and nut securing tube to Flange H bracket at approximately 4 o'clock position handtight only.

(j) Install clamp, bolt, threads lubricated with Engine Oil P03−001, and nut securing tube to bracket attached to Flange K bracket. Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(k) Torque four bolts securing lower tube to HPC case and four bolts securing right tube to lower tube to 85 − 95 lb−in. (9.604 − 10.734 N.m), then retorque to required torque, without loosening, until required torque is maintained.

(l) Torque bolts attaching upper end of tube to diffuser case to 85 − 95 lb−in. (9.604 − 10.734 N.m), then retorque to required torque, without loosening, until required torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

(m) Install clamps, bolt, threads lubricated with Engine Oil P03−001, and nut securing fuel tubes to previously installed bracket. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

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(14) Install gearbox heat shields to Flanges J and K brackets and secure with bolts, threads lubricated with Engine Oil P03-001, and nuts. Torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m). See Figure 407.

R R R (15) Install a packing, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the groove in transfer tube. Install the assembled flowmeter, transfer tube and support to fuel distribution valve and secure with bracket (Pre SB PW4ENG 73-163 only) and bolts, threads lubricated with Engine Oil P03-001. Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). See Figure 408.

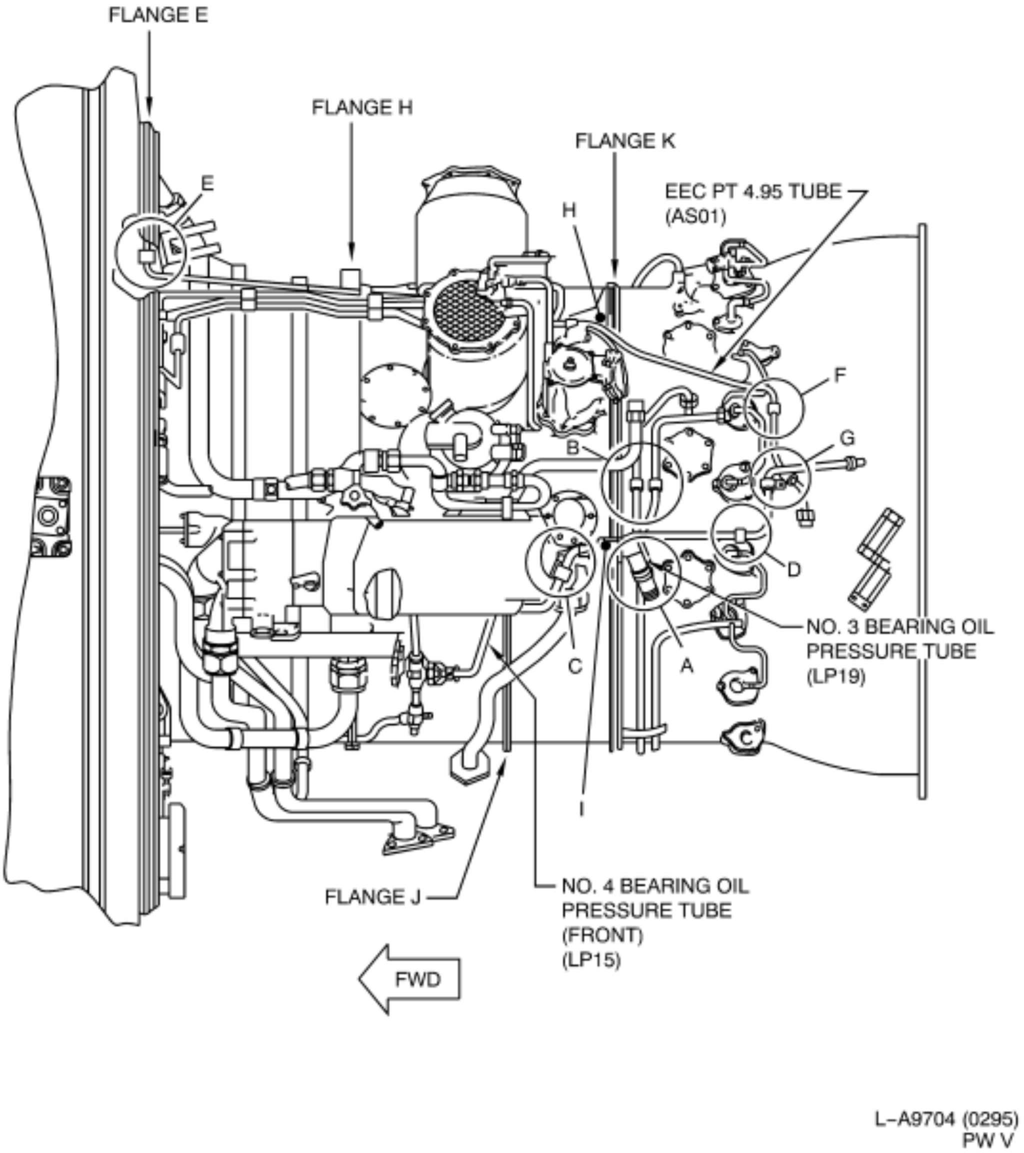
CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(16) Install flex hoses (CP11), (CP13), and the drain flex hose, threads lubricated with Engine Oil P03-001, to turbine case cooling air actuator at approximately 2 o'clock position forward of Flange H and to manifold couplings.

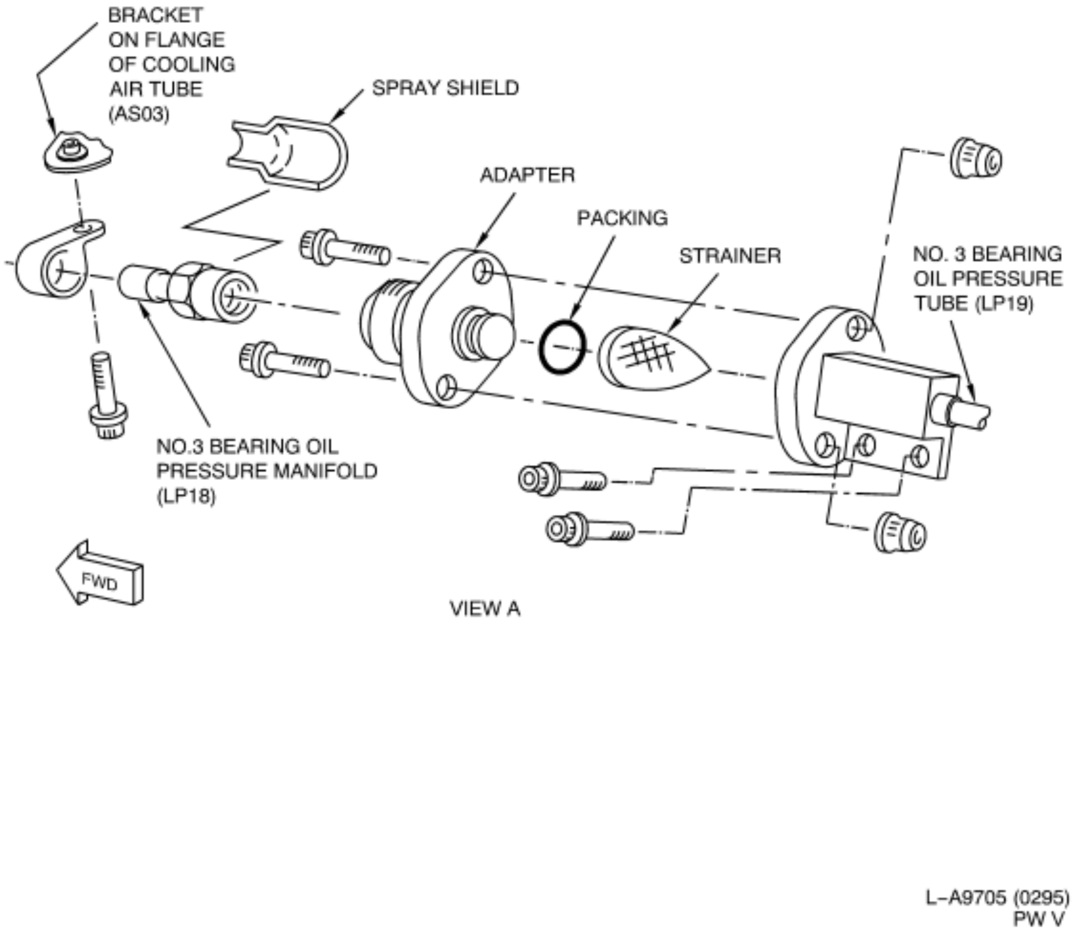
(a) Torque forward hose (smaller nuts) to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(b) Torque rearward hose (larger nuts) to 450 - 500 lb-in. (50.843 - 56.492 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

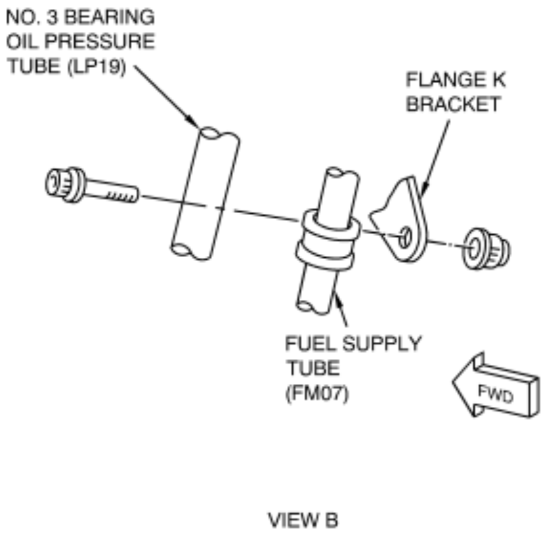
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−02


FLANGE E
FLANGE H
FLANGE K
EEC PT 4.95 TUBE
(AS01)
E
H
F
G
B
D
C
A
I
NO. 3 BEARING OIL
PRESSURE TUBE
(LP19)
FLANGE J
NO. 4 BEARING OIL
PRESSURE TUBE
(FRONT)
(LP15)
FWD
L−A9704 (0295)
PW V

External Plumbing Installation
Figure 401 (Sheet 1)
(Task 72−00−41−420−005)

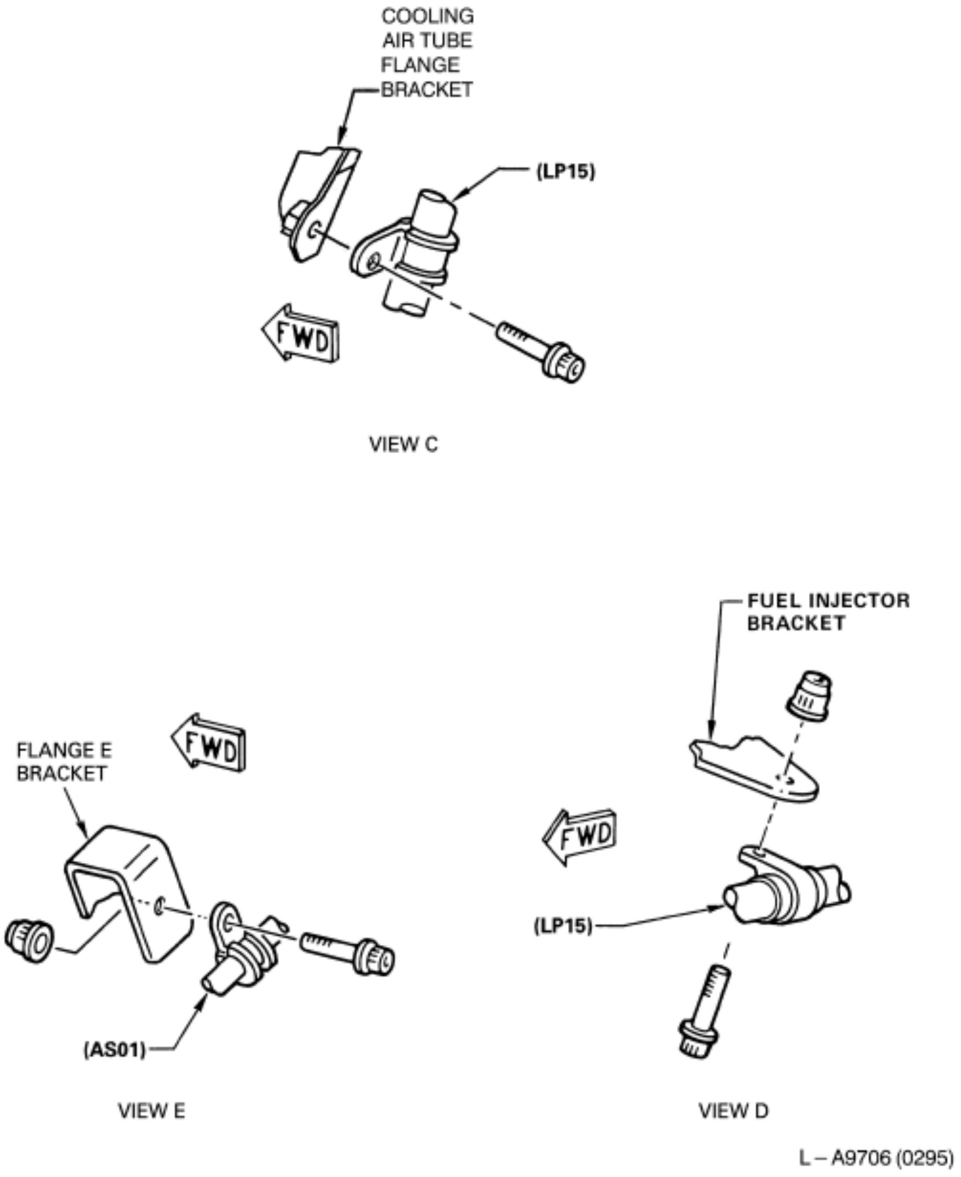

BRACKET ON FLANGE OF COOLING AIR TUBE (AS03)
SPRAY SHIELD
ADAPTER
PACKING
STRAINER
NO. 3 BEARING OIL PRESSURE TUBE (LP19)
NO.3 BEARING OIL PRESSURE MANIFOLD (LP18)
FWD
VIEW A
L−A9705 (0295)
PW V

External Plumbing Installation
Figure 401 (Sheet 2)
(Task 72−00−41−420−005)

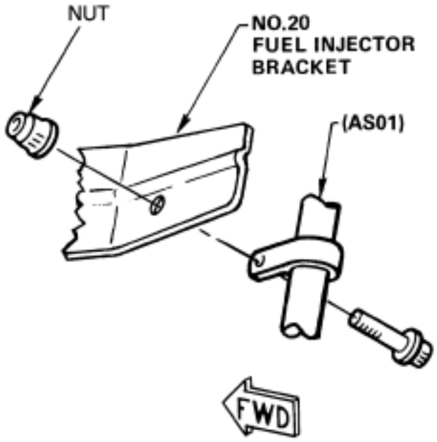

NO. 3 BEARING
OIL PRESSURE
TUBE (LP19)
FLANGE K
BRACKET
FUEL SUPPLY
TUBE
(FM07)
FWD
VIEW B

L-A8084 (0295)
PW V

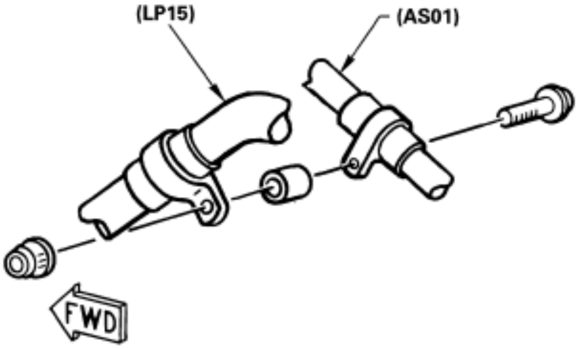
External Plumbing Installation
Figure 401 (Sheet 3)
(Task 72-00-41-420-005)


COOLING AIR TUBE FLANGE BRACKET
(LP15)
FWD
VIEW C
FLANGE E BRACKET
FWD
(AS01)
VIEW E
FUEL INJECTOR BRACKET
FWD
(LP15)
VIEW D
L − A9706 (0295)

External Plumbing Installation
Figure 401 (Sheet 4)
(Task 72−00−41−420−005)


NUT
NO.20
FUEL INJECTOR
BRACKET
(AS01)
FWD

VIEW F

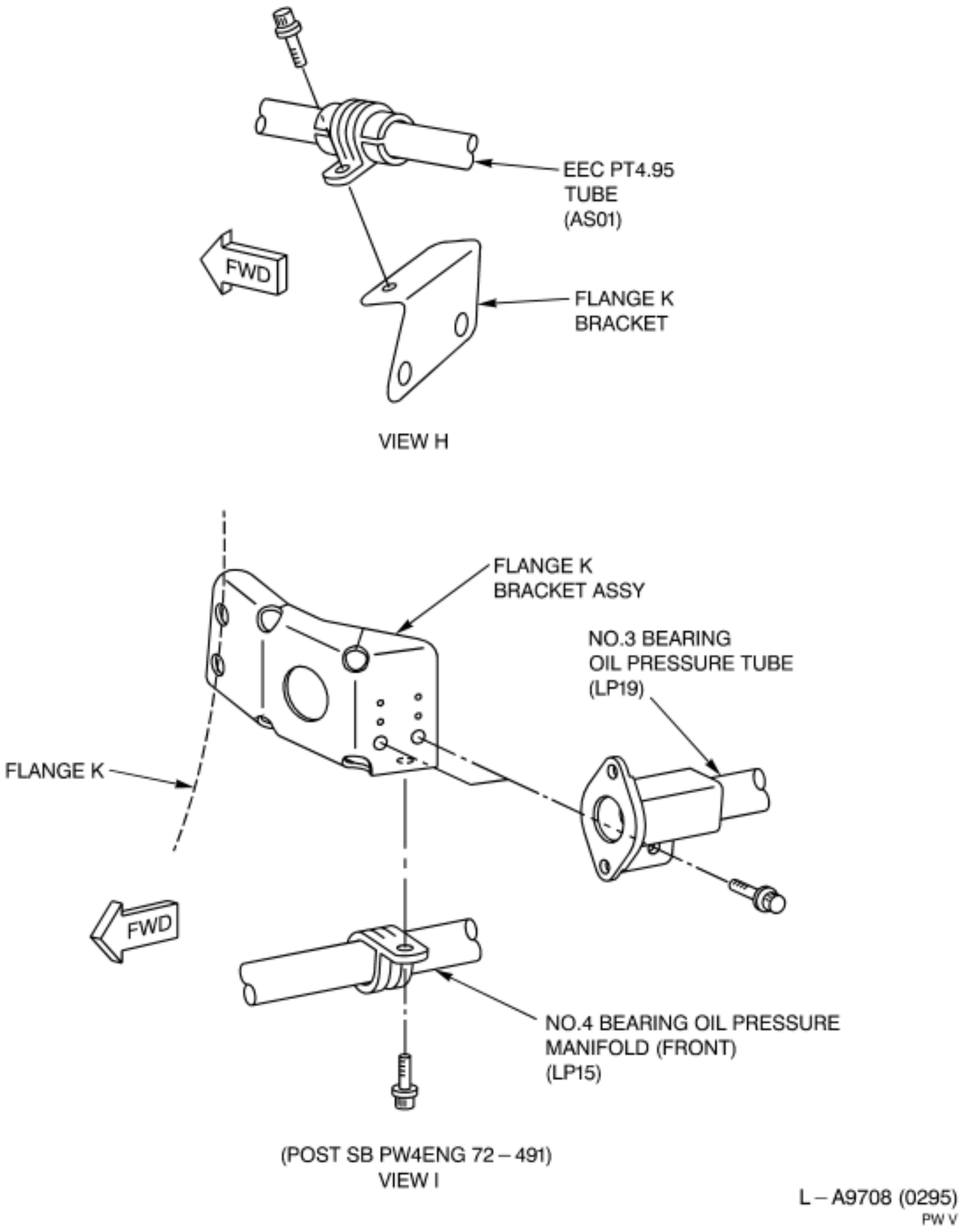

(LP15)
(AS01)
FWD

VIEW G

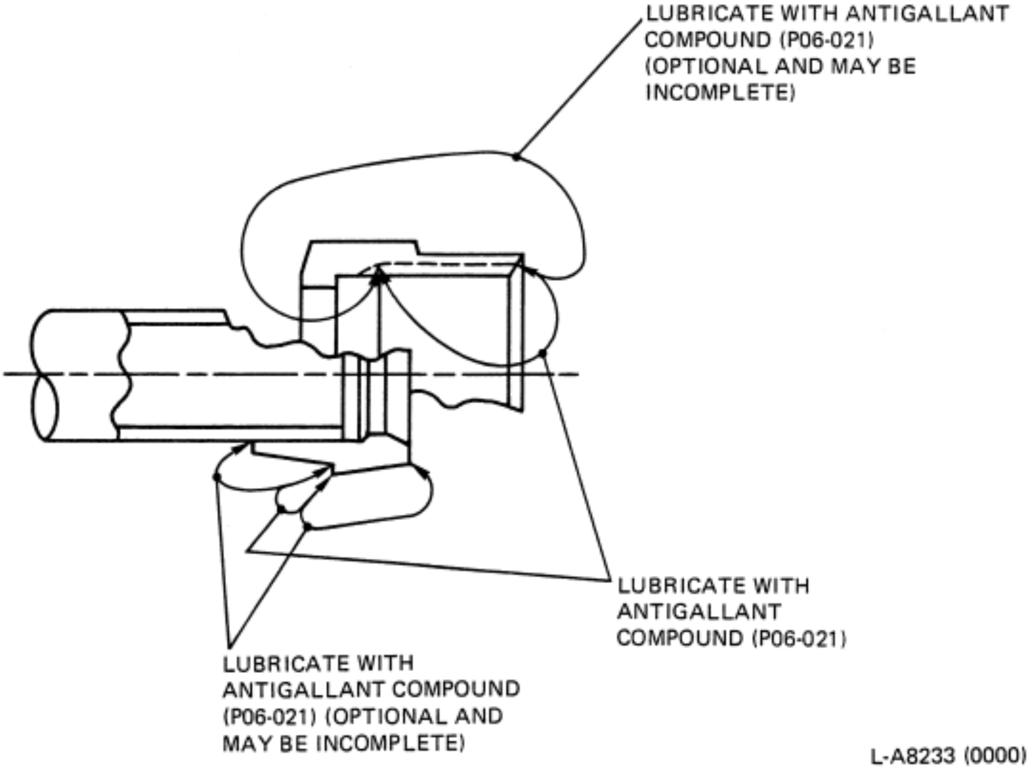
L-A9707 (0000)

External Plumbing Installation
Figure 401 (Sheet 5)
(Task 72−00−41−420−005)

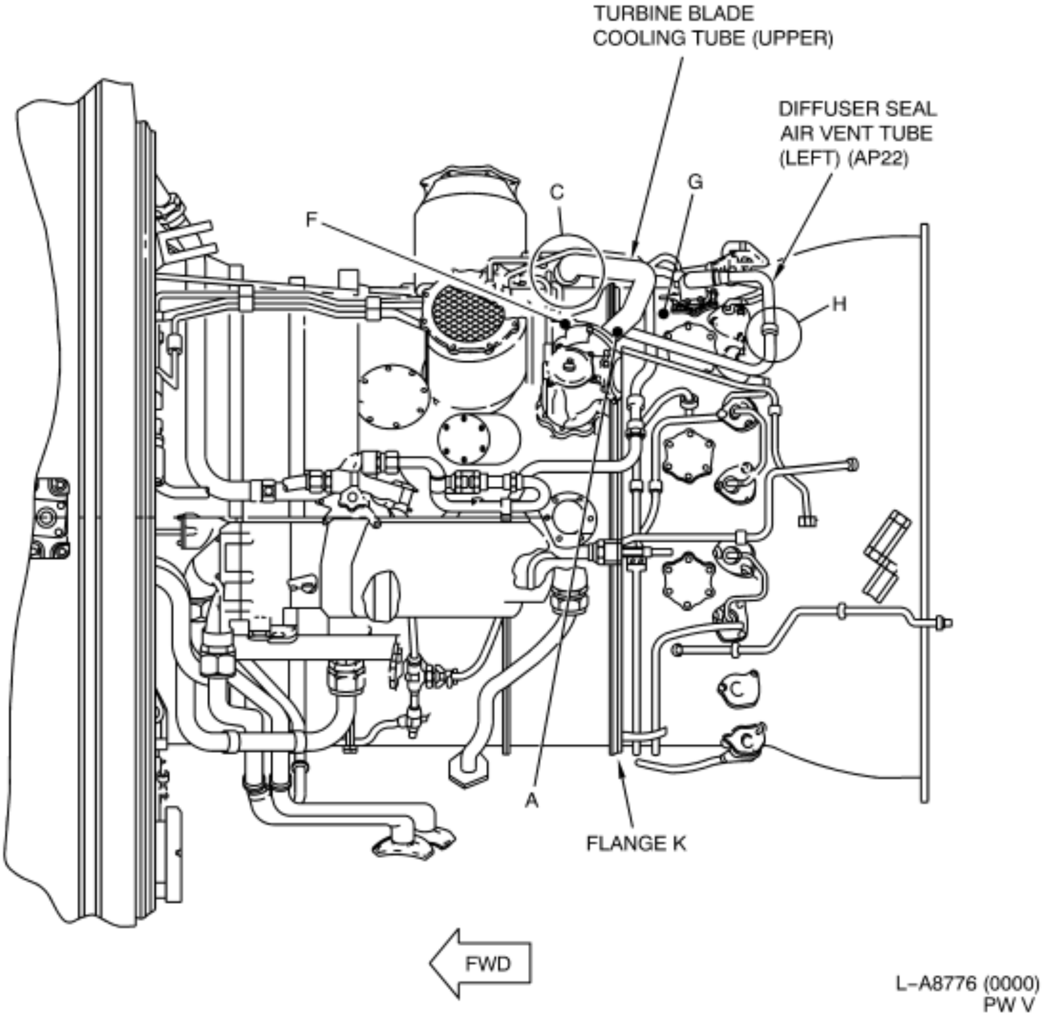
ENGINE GENERAL - DIFFUSER AND COMBUSTOR - INSTALLATION-02


EEC PT4.95
TUBE
(AS01)
FWD
FLANGE K
BRACKET
VIEW H
FLANGE K
BRACKET ASSY
NO.3 BEARING
OIL PRESSURE TUBE
(LP19)
FLANGE K
FWD
NO.4 BEARING OIL PRESSURE
MANIFOLD (FRONT)
(LP15)
(POST SB PW4ENG 72-491)
VIEW I
L-A9708 (0295)
PW V

External Plumbing Installation
Figure 401 (Sheet 6)
(Task 72-00-41-420-005)

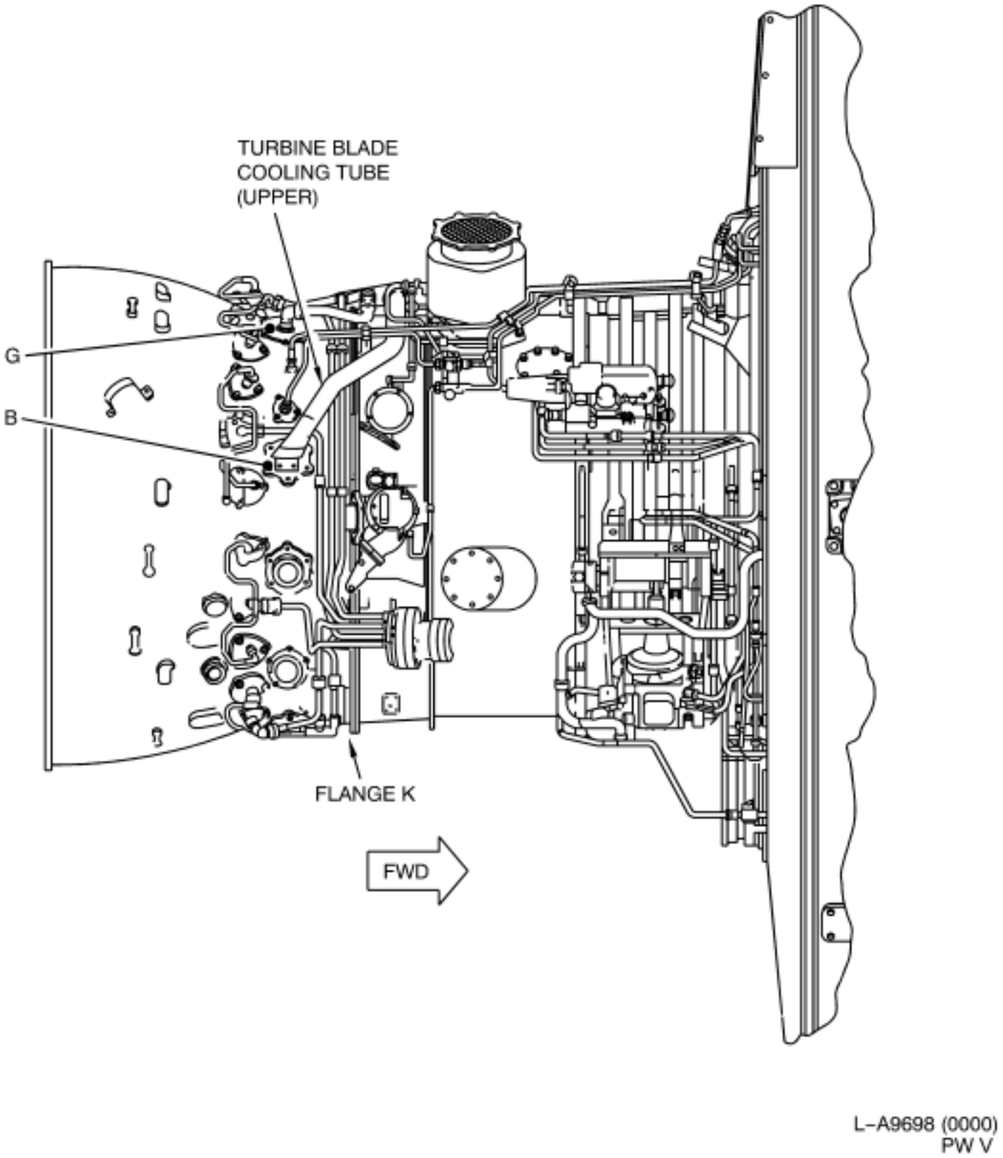

LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
L-A8233 (0000)

External Plumbing Installation
Figure 401 (Sheet 7)
(Task 72−00−41−420−005)

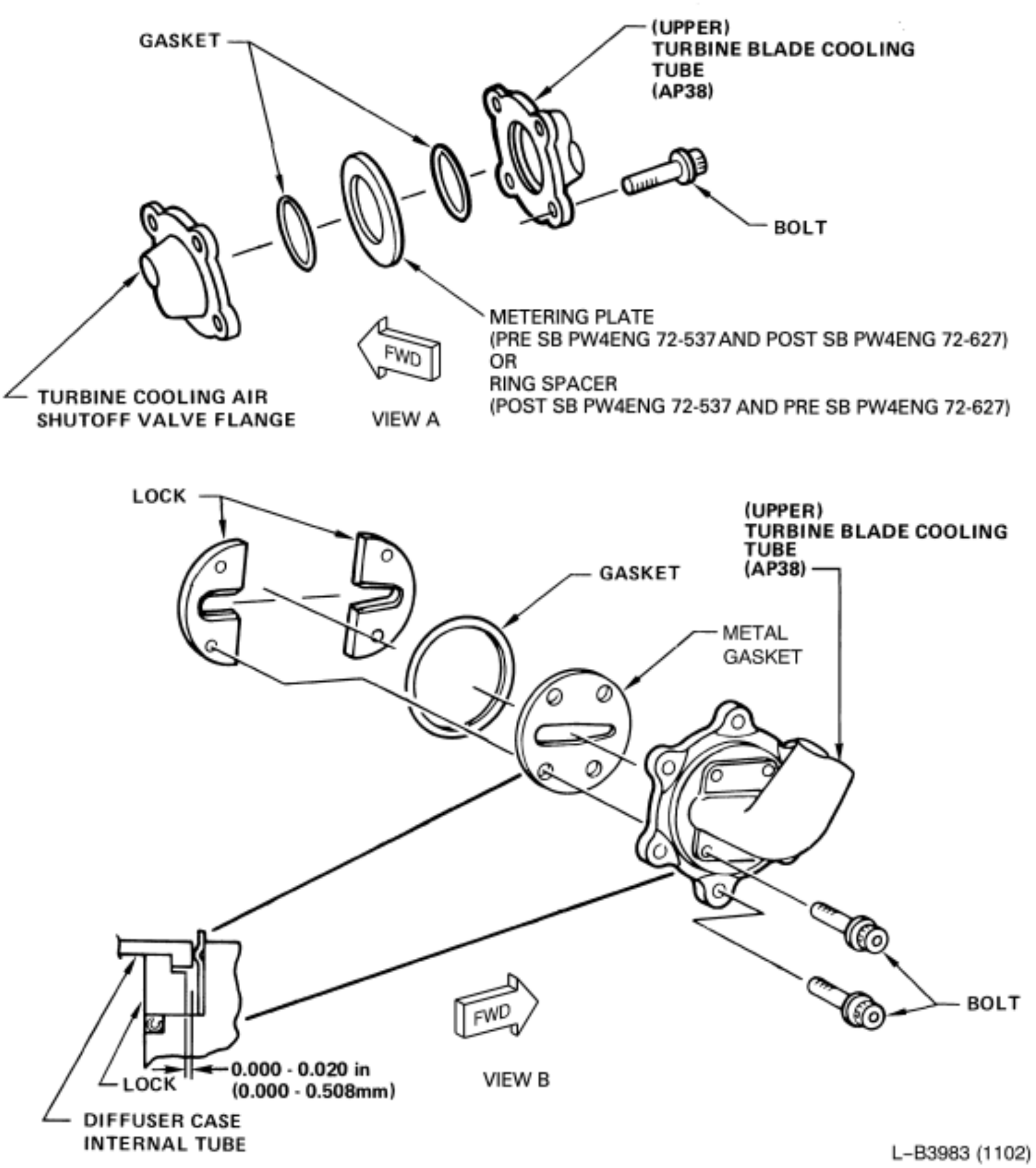

TURBINE BLADE COOLING TUBE (UPPER)
DIFFUSER SEAL AIR VENT TUBE (LEFT) (AP22)
C
G
F
H
C
C
A
FLANGE K
FWD
L−A8776 (0000)
PW V

External Plumbing Installation
Figure 402 (Sheet 1)
(Task 72−00−41−420−005)

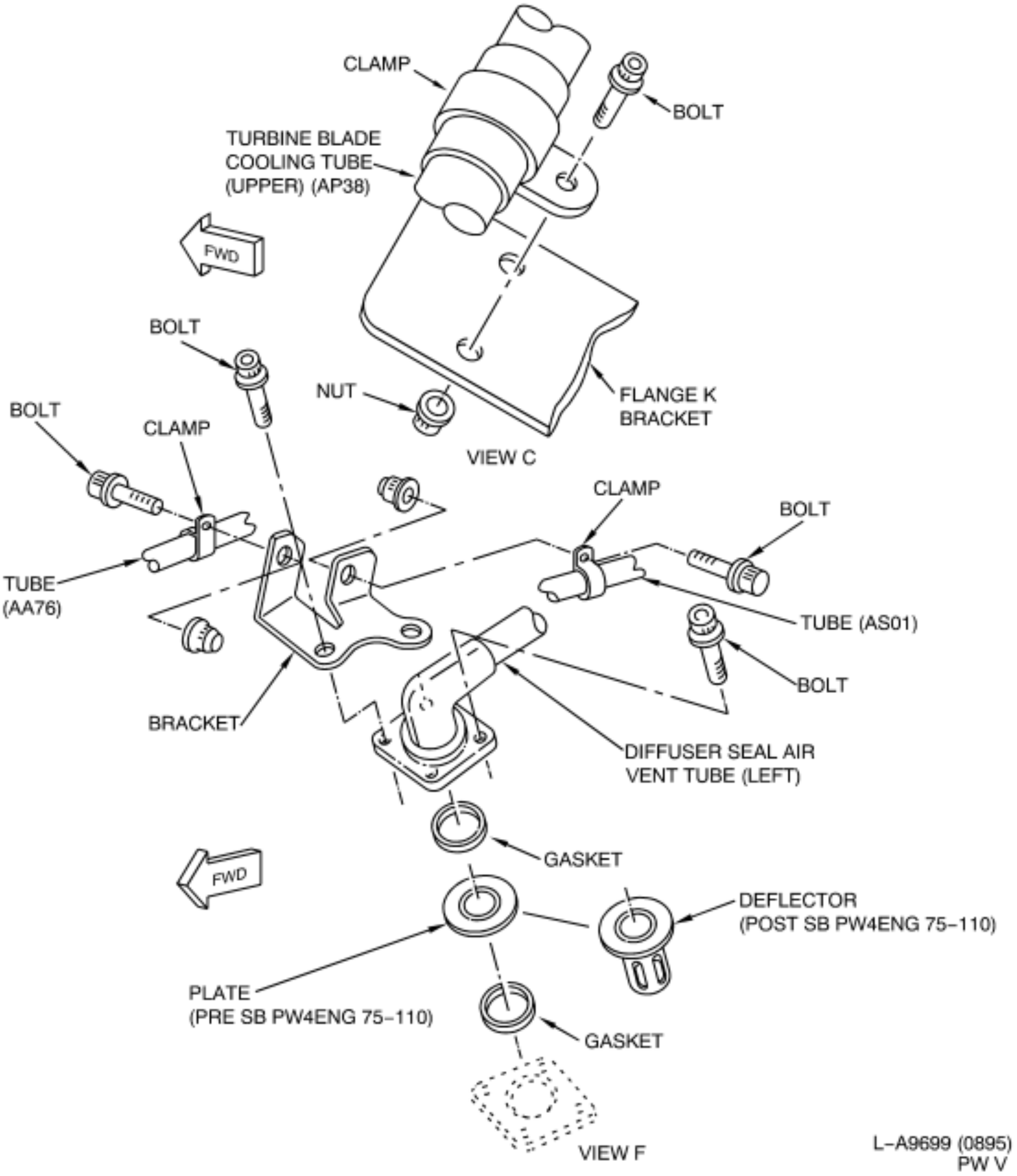
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−02


TURBINE BLADE COOLING TUBE (UPPER)
G
B
FLANGE K
FWD
L−A9698 (0000)
PW V

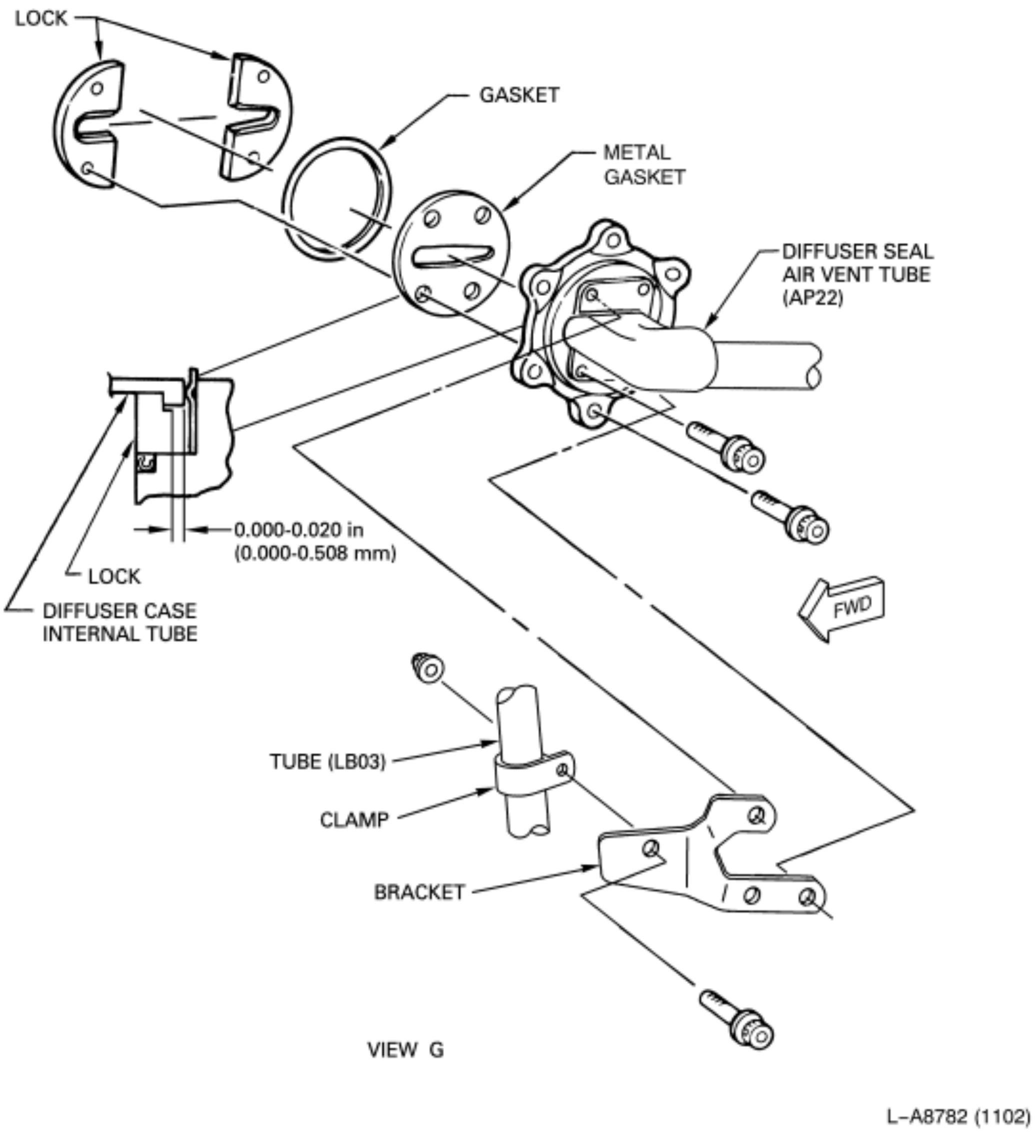
External Plumbing Installation
Figure 402 (Sheet 2)
(Task 72−00−41−420−005)


GASKET
(UPPER)
TURBINE BLADE COOLING
TUBE
(AP38)
BOLT
METERING PLATE
(PRE SB PW4ENG 72-537 AND POST SB PW4ENG 72-627)
OR
RING SPACER
(POST SB PW4ENG 72-537 AND PRE SB PW4ENG 72-627)
FWD
TURBINE COOLING AIR
SHUTOFF VALVE FLANGE
VIEW A
LOCK
(UPPER)
TURBINE BLADE COOLING
TUBE
(AP38)
GASKET
METAL
GASKET
BOLT
FWD
LOCK
0.000 - 0.020 in
(0.000 - 0.508mm)
VIEW B
DIFFUSER CASE
INTERNAL TUBE
L–B3983 (1102)

External Plumbing Installation
Figure 402 (Sheet 3)
(Task 72–00–41–420–005)

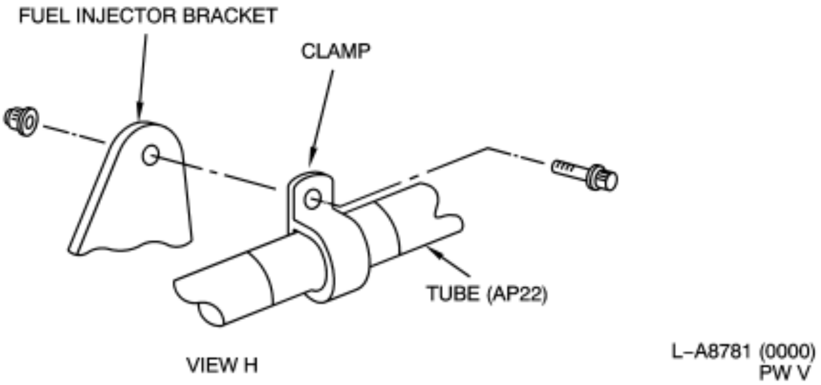

CLAMP
BOLT
TURBINE BLADE COOLING TUBE (UPPER) (AP38)
FWD
BOLT
NUT
FLANGE K BRACKET
BOLT
CLAMP
VIEW C
CLAMP
BOLT
TUBE (AA76)
TUBE (AS01)
BOLT
BRACKET
DIFFUSER SEAL AIR VENT TUBE (LEFT)
GASKET
FWD
DEFLECTOR (POST SB PW4ENG 75-110)
PLATE (PRE SB PW4ENG 75-110)
GASKET
VIEW F
L-A9699 (0895)
PW V

External Plumbing Installation
Figure 402 (Sheet 4)
(Task 72-00-41-420-005)


LOCK
GASKET
METAL GASKET
DIFFUSER SEAL AIR VENT TUBE (AP22)
0.000-0.020 in (0.000-0.508 mm)
LOCK
DIFFUSER CASE INTERNAL TUBE
FWD
TUBE (LB03)
CLAMP
BRACKET
VIEW G
L-A8782 (1102)

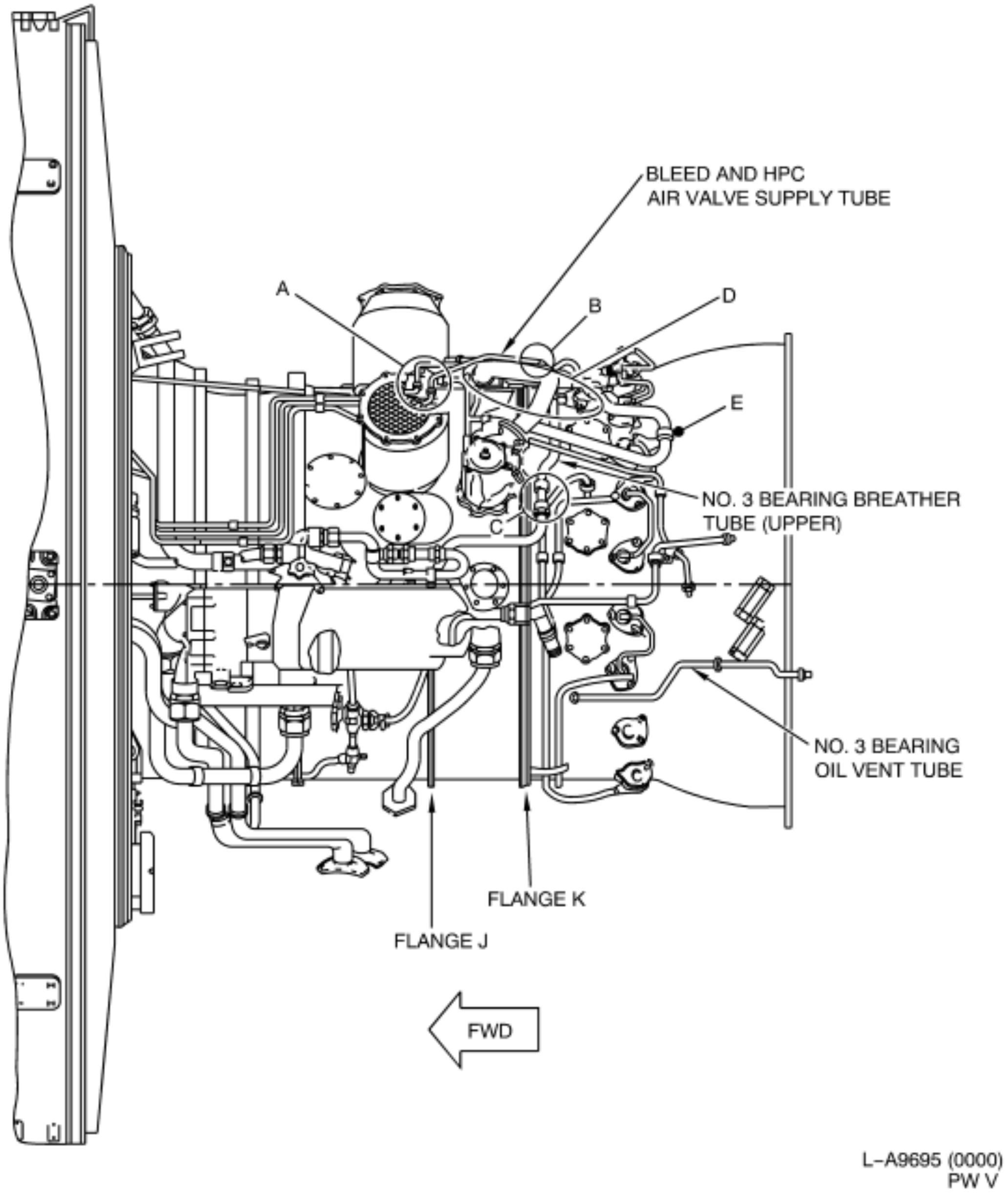
External Plumbing Installation
Figure 402 (Sheet 5)
(Task 72−00−41−420−005)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−02

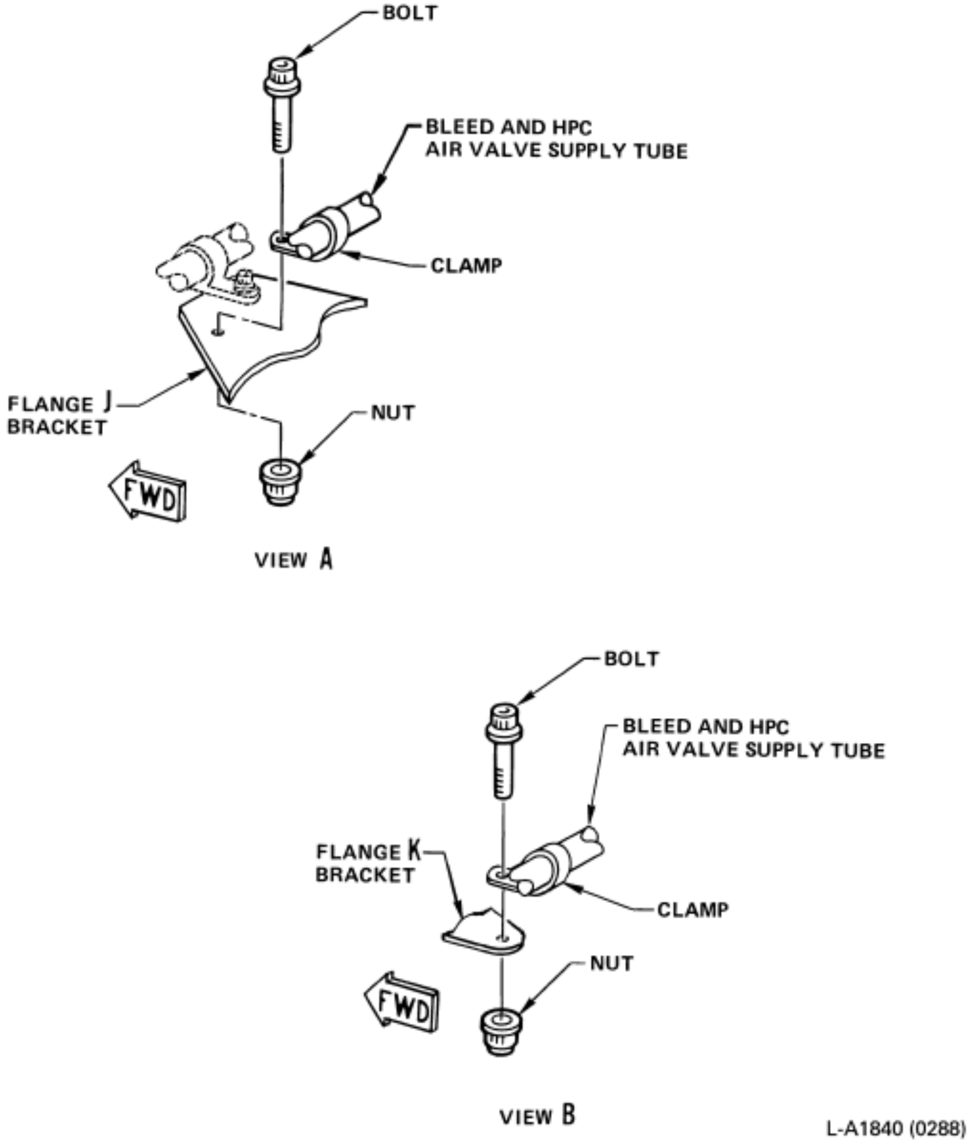

FUEL INJECTOR BRACKET
CLAMP
TUBE (AP22)
VIEW H
L−A8781 (0000)
PW V

External Plumbing Installation
Figure 402 (Sheet 6)
(Task 72−00−41−420−005)

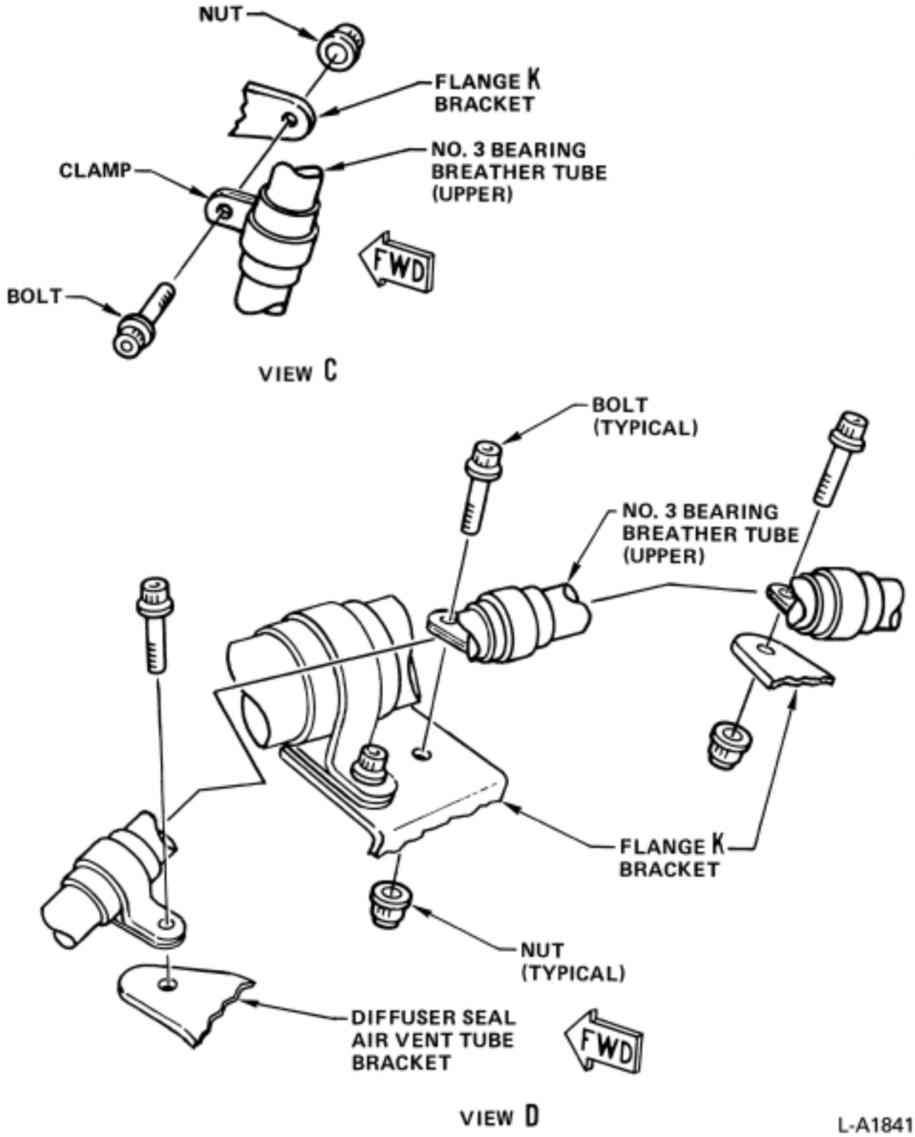
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−02


BLEED AND HPC
AIR VALVE SUPPLY TUBE
A
B
D
E
C
NO. 3 BEARING BREATHER
TUBE (UPPER)
NO. 3 BEARING
OIL VENT TUBE
FLANGE K
FLANGE J
FWD
L−A9695 (0000)
PW V

External Plumbing Installation
Figure 403 (Sheet 1)
(Task 72−00−41−420−005)

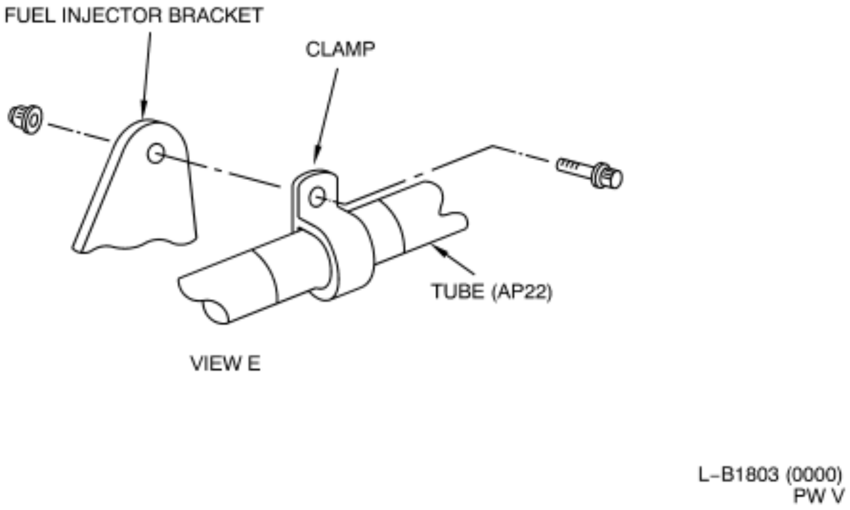

BOLT
BLEED AND HPC
AIR VALVE SUPPLY TUBE
CLAMP
FLANGE J
BRACKET
NUT
FWD
VIEW A
BOLT
BLEED AND HPC
AIR VALVE SUPPLY TUBE
FLANGE K
BRACKET
CLAMP
NUT
FWD
VIEW B
L-A1840 (0288)

External Plumbing Installation
Figure 403 (Sheet 2)
(Task 72−00−41−420−005)


NUT
FLANGE K BRACKET
CLAMP
NO. 3 BEARING BREATHER TUBE (UPPER)
BOLT
FWD
VIEW C
BOLT (TYPICAL)
NO. 3 BEARING BREATHER TUBE (UPPER)
FLANGE K BRACKET
NUT (TYPICAL)
DIFFUSER SEAL AIR VENT TUBE BRACKET
FWD
VIEW D

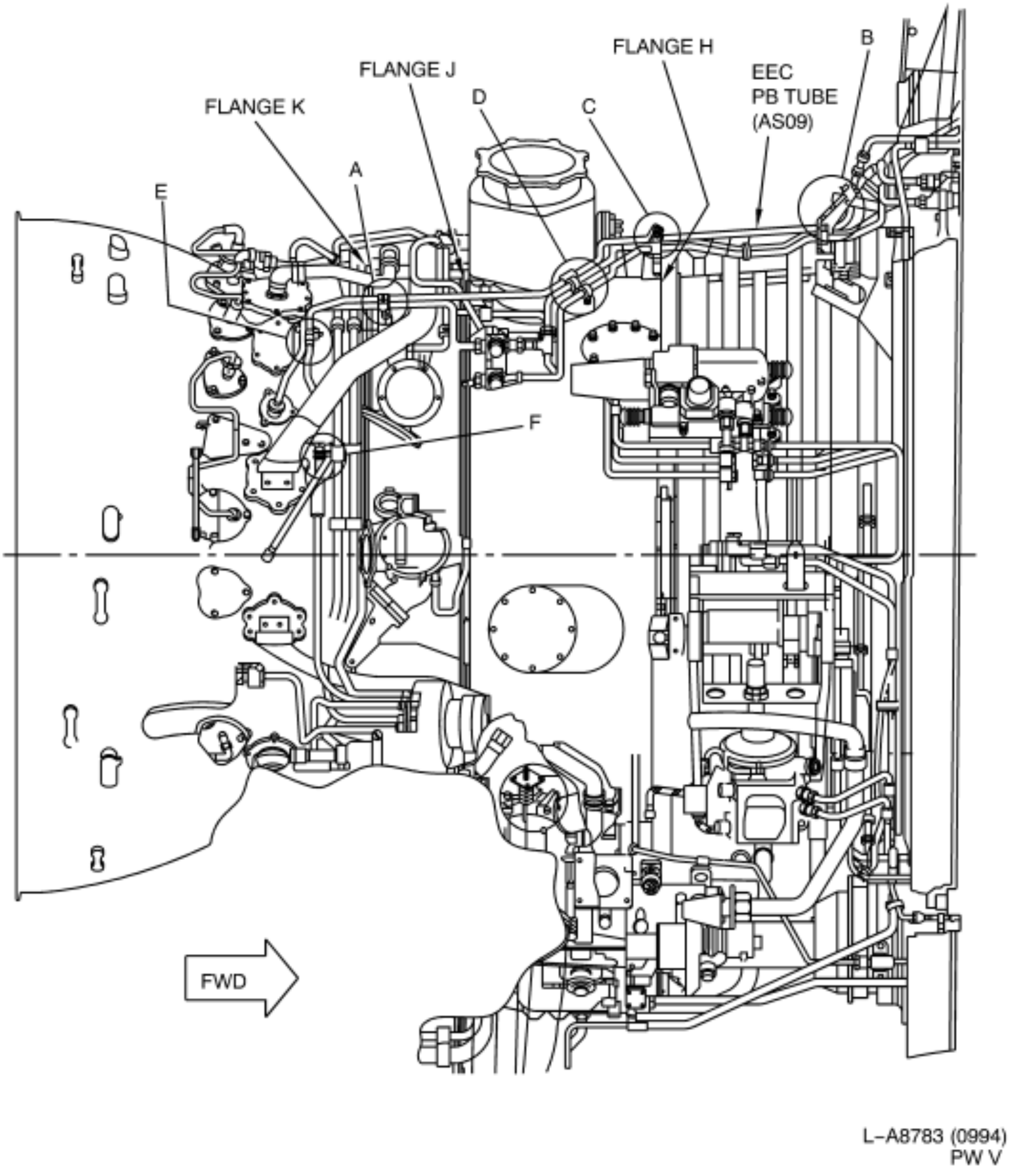
L-A1841 (0288)

External Plumbing Installation
Figure 403 (Sheet 3)
(Task 72−00−41−420−005)

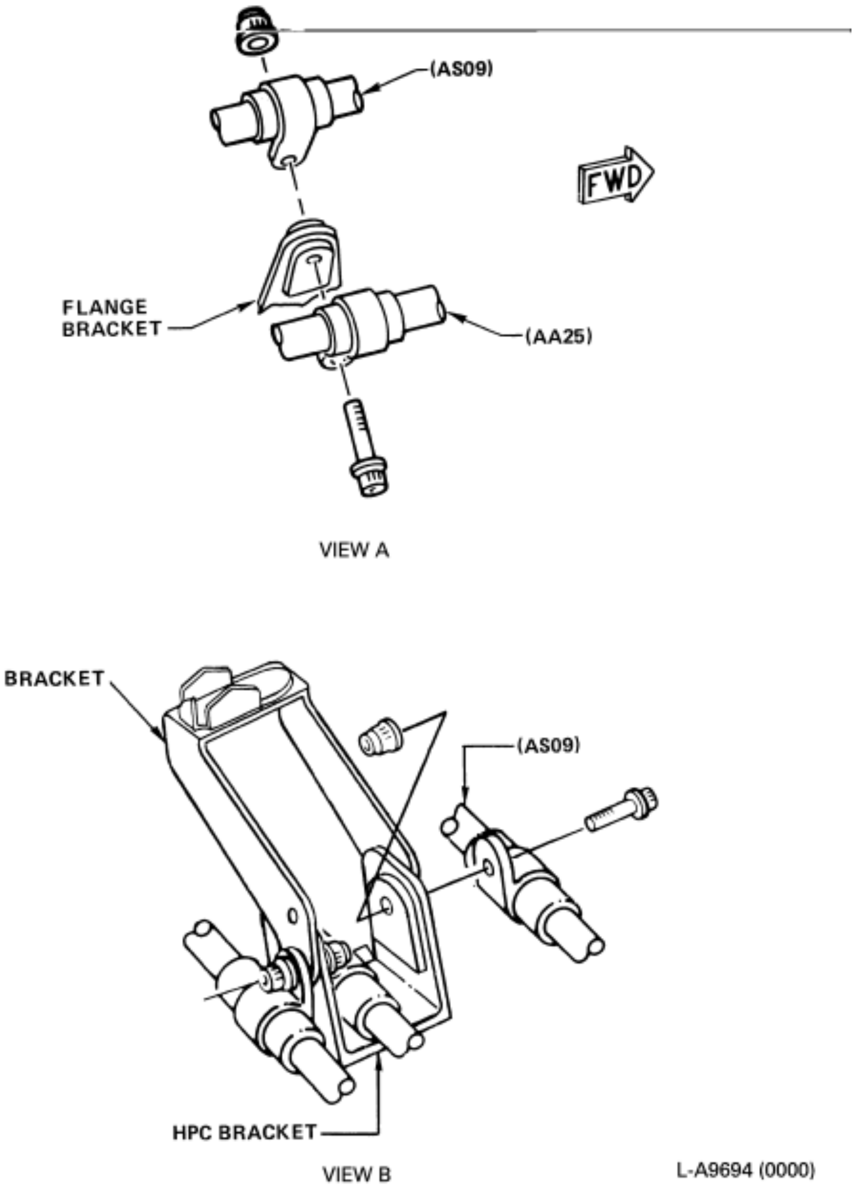

FUEL INJECTOR BRACKET
CLAMP
TUBE (AP22)
VIEW E
L−B1803 (0000)
PW V

External Plumbing Installation
Figure 403 (Sheet 4)
(Task 72−00−41−420−005)

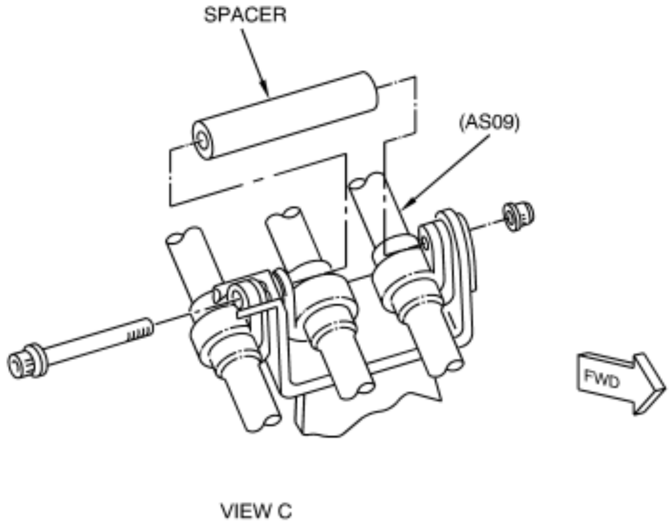
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−02

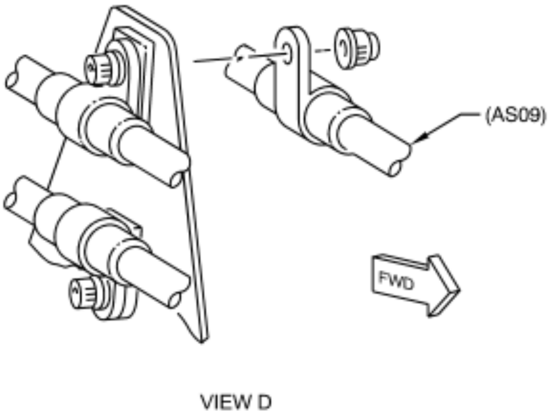

FLANGE K
FLANGE J
FLANGE H
EEC
PB TUBE
(AS09)
A
B
C
D
E
F
FWD
L−A8783 (0994)
PW V

External Plumbing Installation
Figure 404 (Sheet 1)
(Task 72−00−41−420−005)

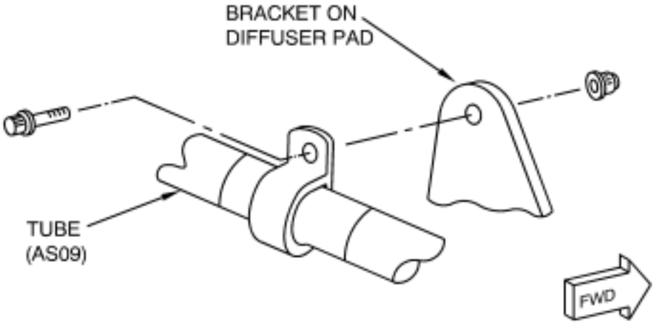

(AS09)
FWD
FLANGE BRACKET
(AA25)
VIEW A
BRACKET
(AS09)
HPC BRACKET
VIEW B
L-A9694 (0000)

External Plumbing Installation
Figure 404 (Sheet 2)
(Task 72−00−41−420−005)

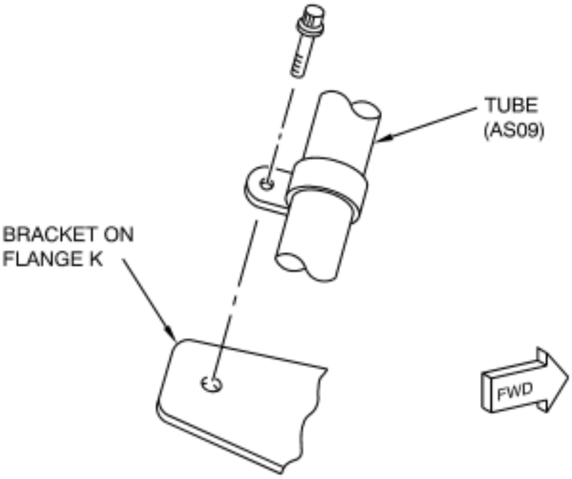

SPACER
(AS09)
FWD
VIEW C


(AS09)
FWD
VIEW D
L−A6304 (0196)
PW V

External Plumbing Installation
Figure 404 (Sheet 3)
(Task 72−00−41−420−005)


BRACKET ON
DIFFUSER PAD
TUBE
(AS09)
FWD

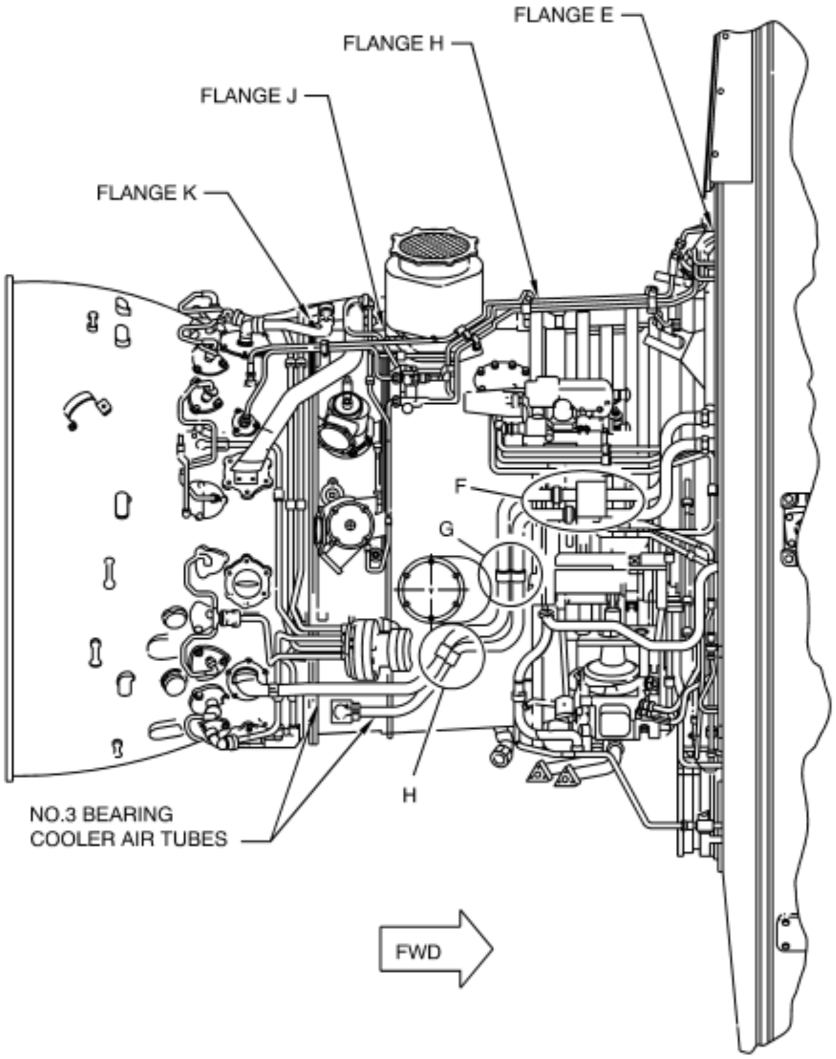
VIEW E


TUBE
(AS09)
BRACKET ON
FLANGE K
FWD

VIEW F

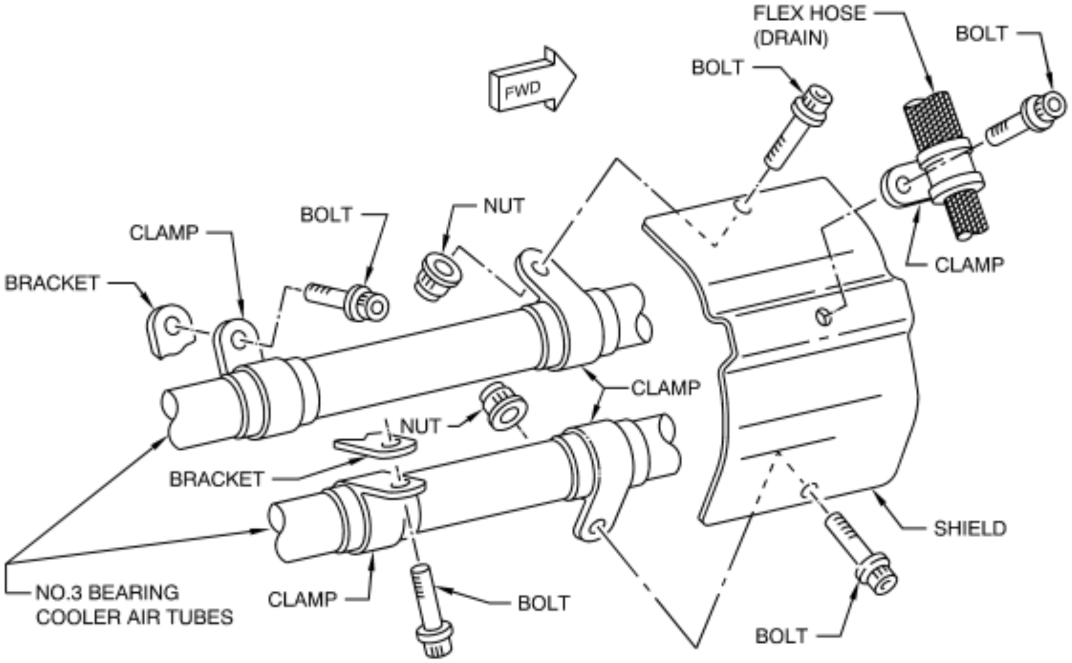
L−A8784 (0000)
PW V

External Plumbing Installation
Figure 404 (Sheet 4)
(Task 72−00−41−420−005)

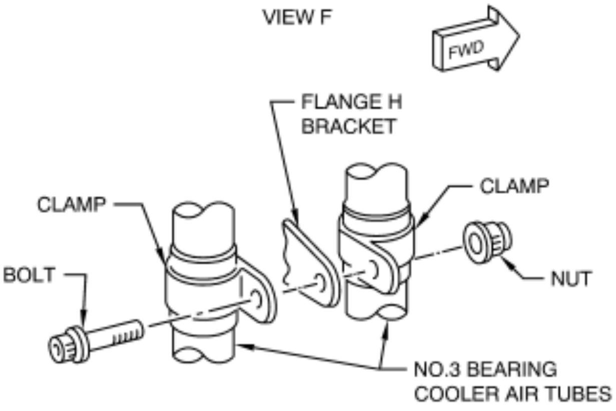

FLANGE E
FLANGE H
FLANGE J
FLANGE K
F
G
H
NO.3 BEARING COOLER AIR TUBES
FWD

L−A9692 (0000)
PW V

External Plumbing Installation
Figure 405 (Sheet 1)
(Task 72−00−41−420−005)


FLEX HOSE
(DRAIN)
BOLT
FWD
BOLT
NUT
BOLT
CLAMP
CLAMP
BRACKET
CLAMP
NUT
BRACKET
SHIELD
NO.3 BEARING
COOLER AIR TUBES
CLAMP
BOLT
BOLT

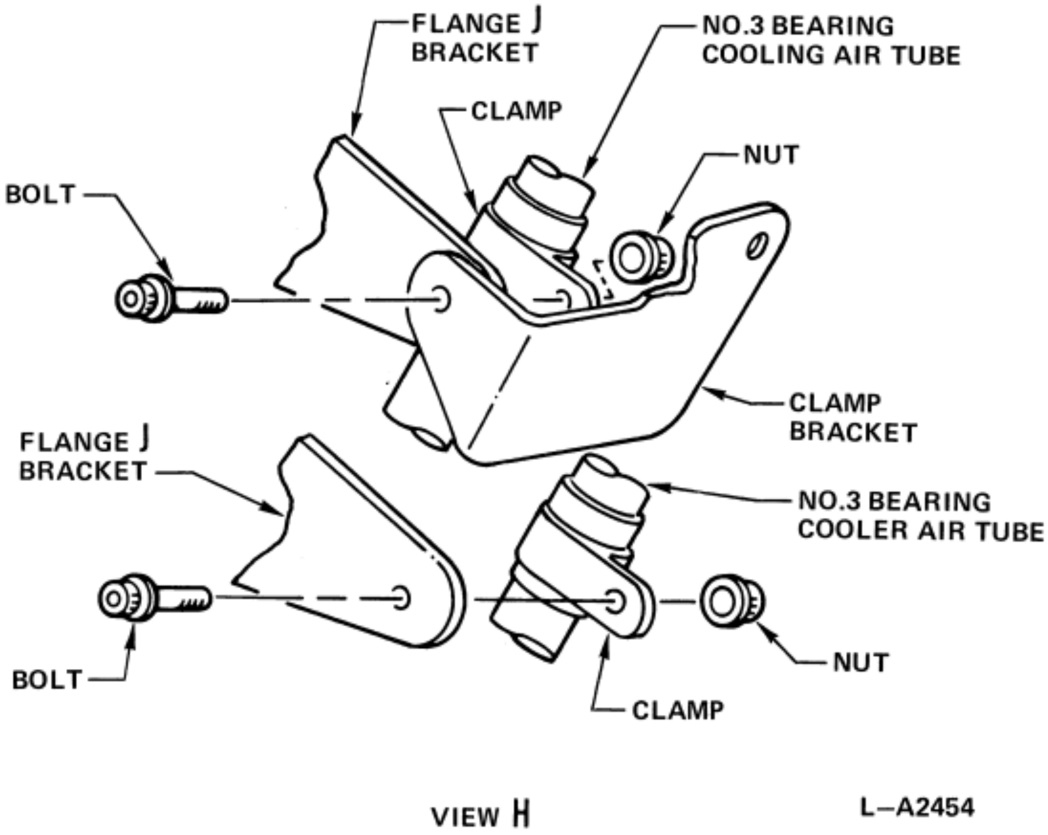
VIEW F


FWD
FLANGE H
BRACKET
CLAMP
CLAMP
BOLT
NUT
NO.3 BEARING
COOLER AIR TUBES

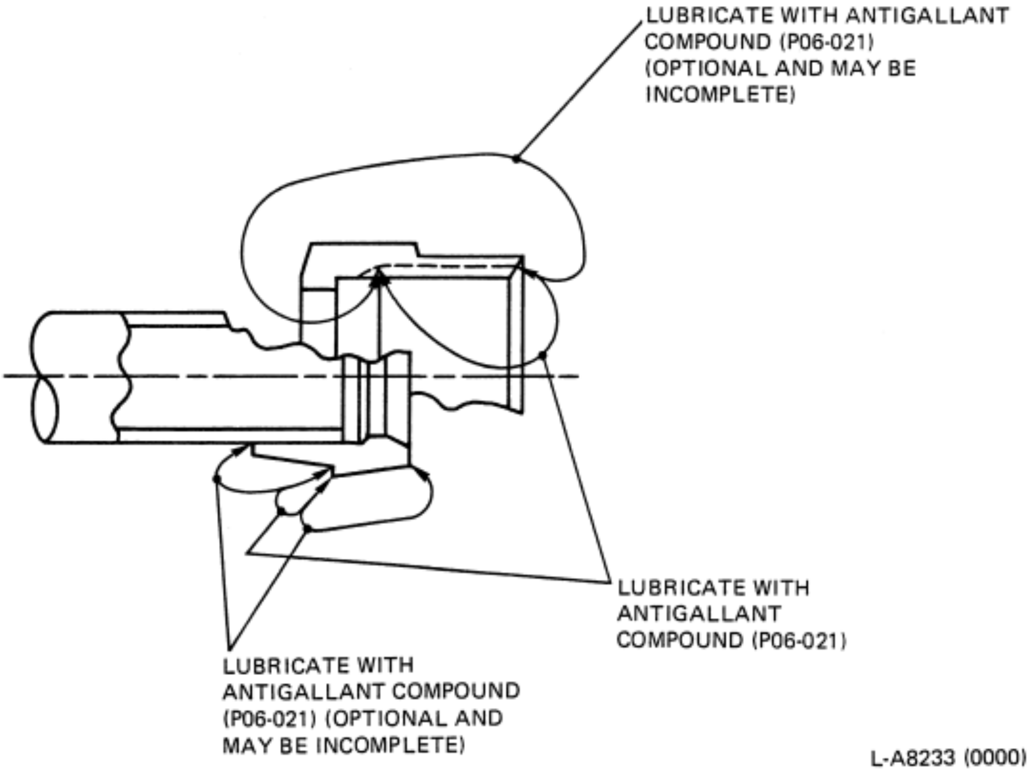
VIEW G

L−A3037 (0000)
PW V

External Plumbing Installation
Figure 405 (Sheet 2)
(Task 72−00−41−420−005)

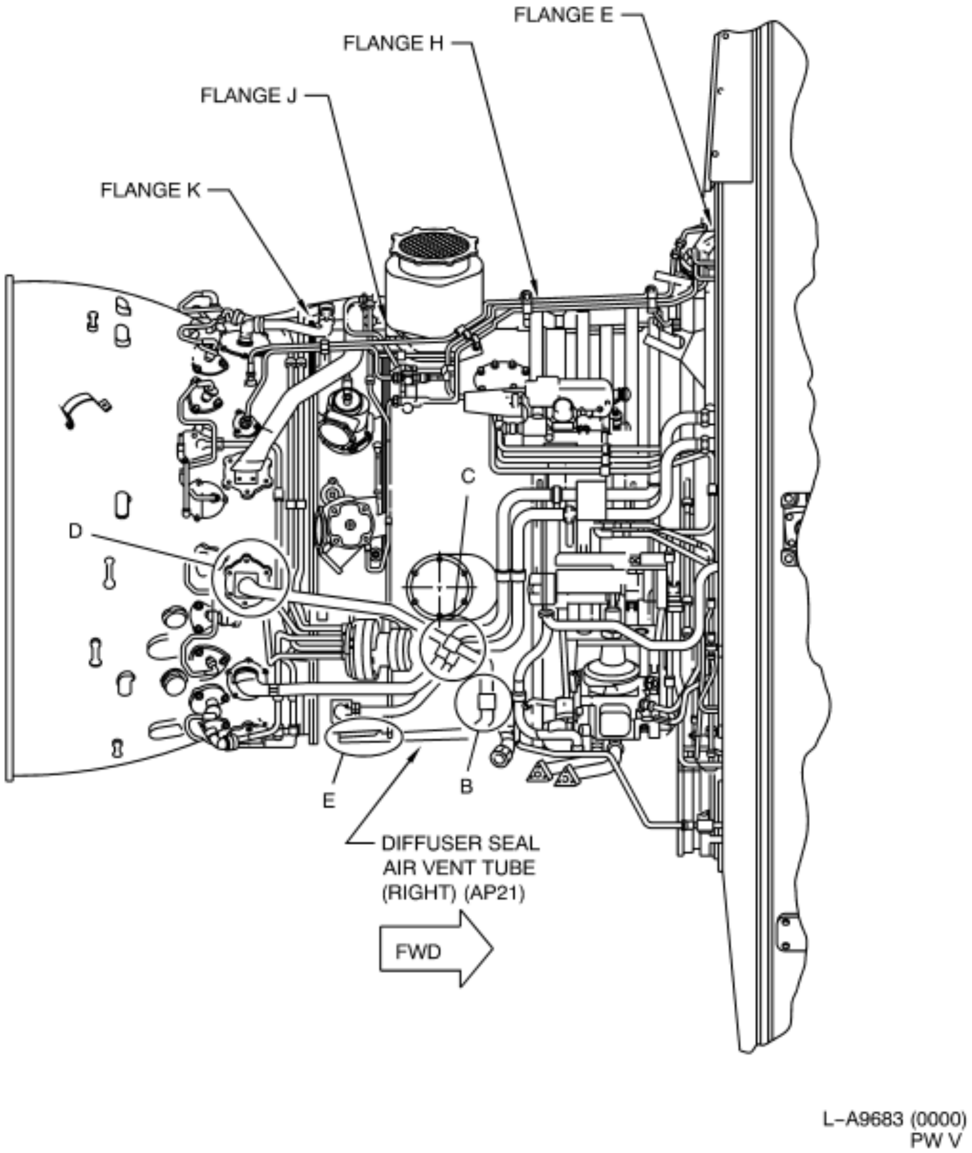

FLANGE J BRACKET
NO.3 BEARING COOLING AIR TUBE
CLAMP
NUT
BOLT
CLAMP BRACKET
FLANGE J BRACKET
NO.3 BEARING COOLER AIR TUBE
BOLT
NUT
CLAMP
VIEW H
L−A2454

External Plumbing Installation
Figure 405 (Sheet 3)
(Task 72−00−41−420−005)

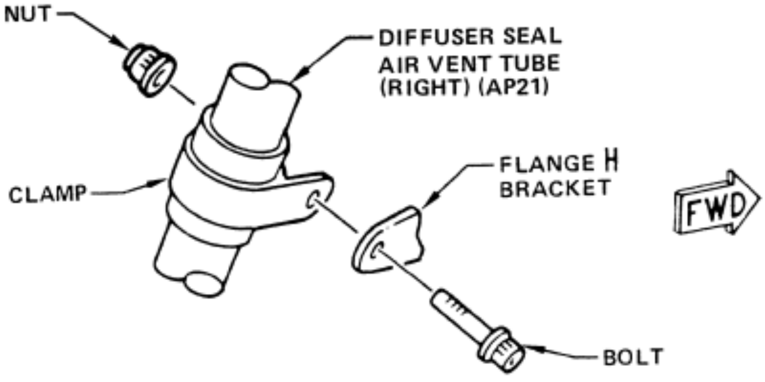

LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
L-A8233 (0000)

External Plumbing Installation (Application Of Antigallant)
Figure 405 (Sheet 4)
(Task 72−00−41−420−005)

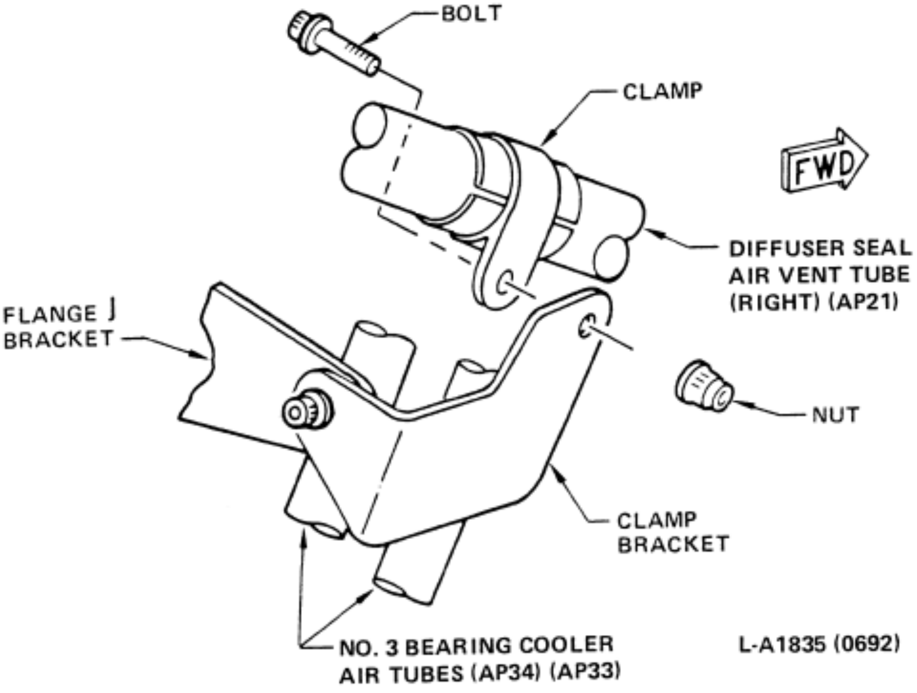
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−02


FLANGE E
FLANGE H
FLANGE J
FLANGE K
C
D
E
B
DIFFUSER SEAL
AIR VENT TUBE
(RIGHT) (AP21)
FWD
L−A9683 (0000)
PW V

External Plumbing Installation
Figure 406 (Sheet 1)
(Task 72−00−41−420−005)

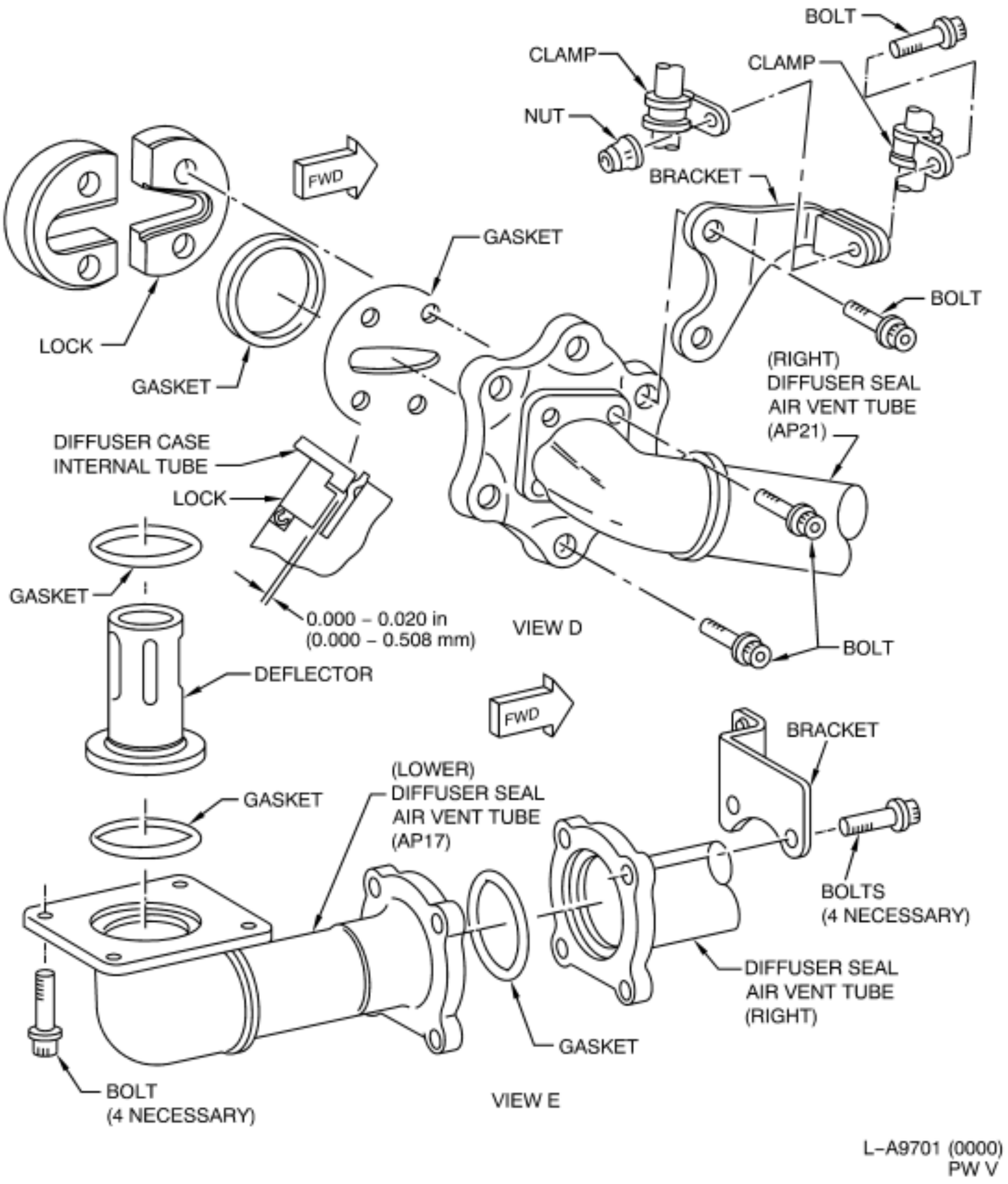

NUT
DIFFUSER SEAL
AIR VENT TUBE
(RIGHT) (AP21)
FLANGE H
BRACKET
FWD
CLAMP
BOLT

VIEW B


BOLT
CLAMP
FWD
DIFFUSER SEAL
AIR VENT TUBE
(RIGHT) (AP21)
FLANGE J
BRACKET
NUT
CLAMP
BRACKET
NO. 3 BEARING COOLER
AIR TUBES (AP34) (AP33)
L-A1835 (0692)

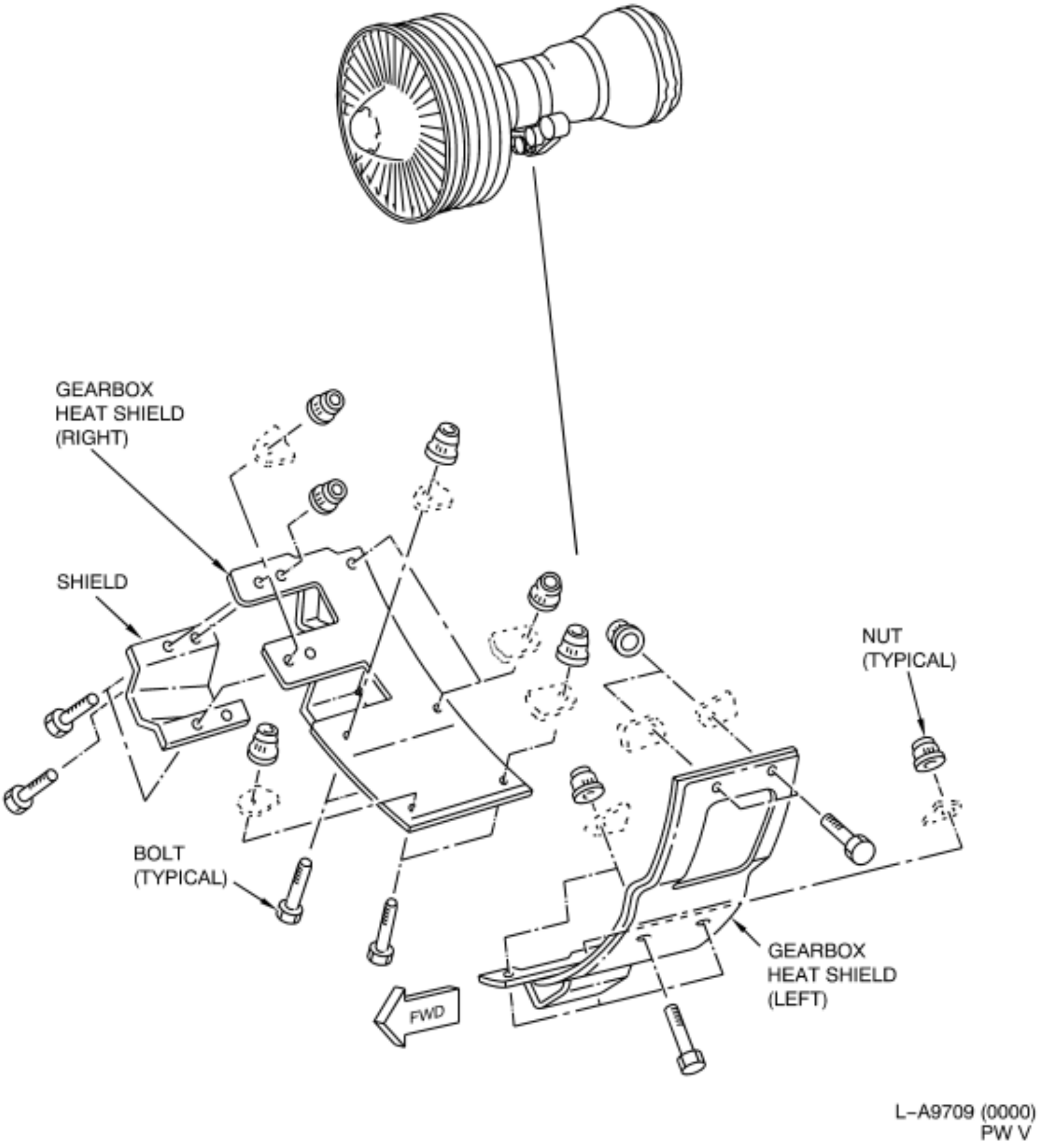
VIEW C

External Plumbing Installation
Figure 406 (Sheet 2)
(Task 72-00-41-420-005)

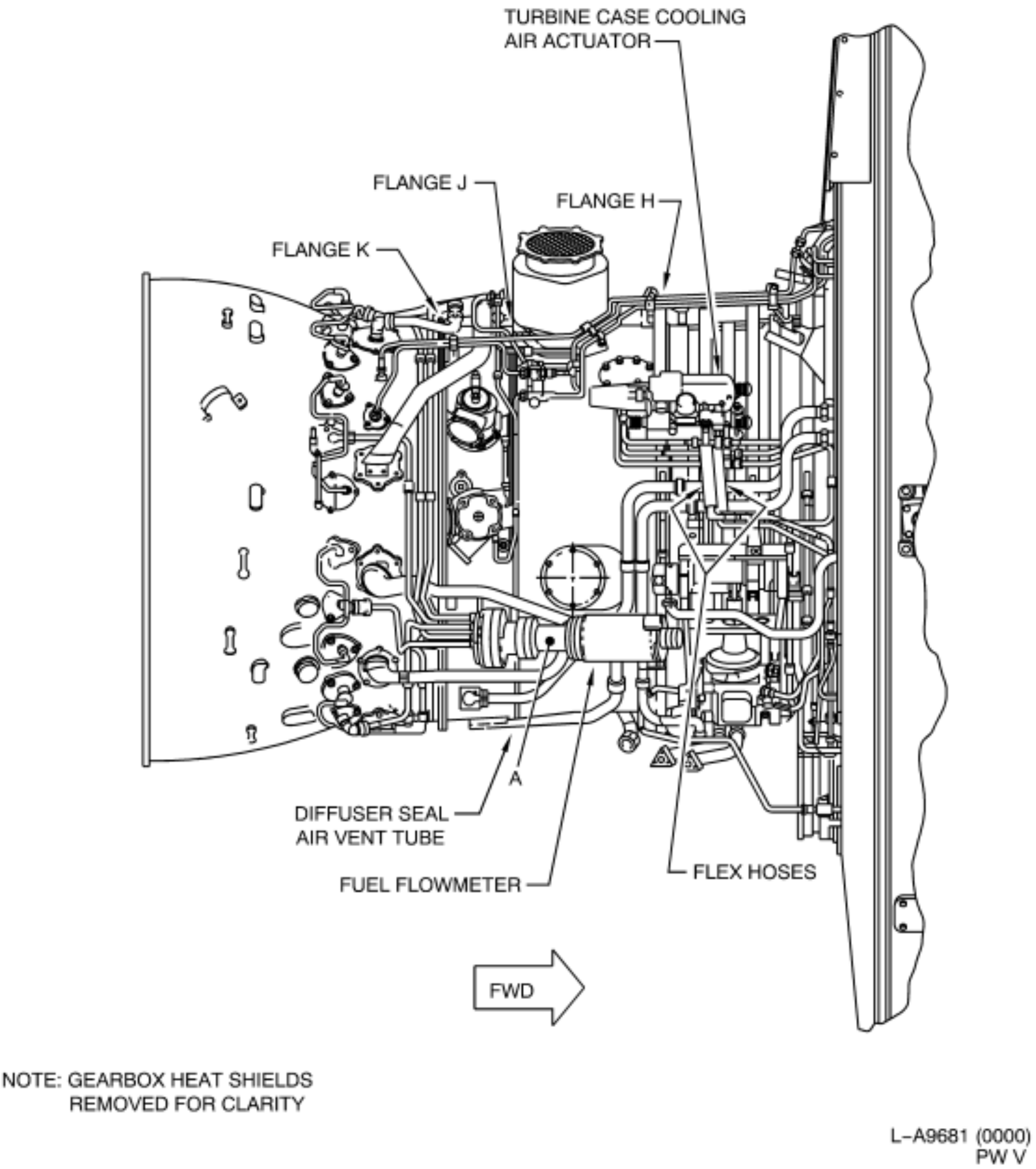

BOLT
CLAMP
CLAMP
NUT
BRACKET
FWD
GASKET
BOLT
LOCK
GASKET
(RIGHT) DIFFUSER SEAL AIR VENT TUBE (AP21)
DIFFUSER CASE INTERNAL TUBE
LOCK
GASKET
0.000 - 0.020 in (0.000 - 0.508 mm)
VIEW D
BOLT
DEFLECTOR
FWD
BRACKET
(LOWER) DIFFUSER SEAL AIR VENT TUBE (AP17)
GASKET
BOLTS (4 NECESSARY)
DIFFUSER SEAL AIR VENT TUBE (RIGHT)
GASKET
BOLT (4 NECESSARY)
VIEW E
L-A9701 (0000)
PW V

External Plumbing Installation
Figure 406 (Sheet 3)
(Task 72-00-41-420-005)

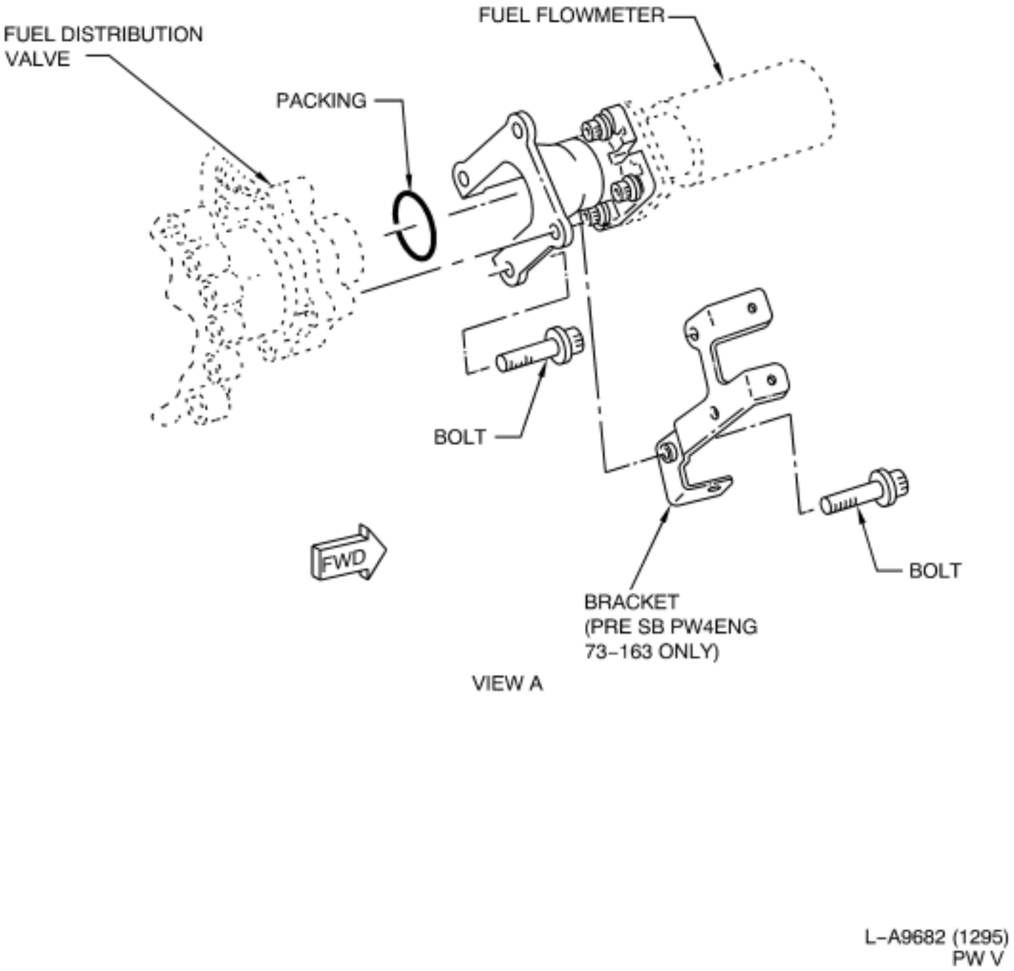
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−02


GEARBOX HEAT SHIELD (RIGHT)
SHIELD
NUT (TYPICAL)
BOLT (TYPICAL)
GEARBOX HEAT SHIELD (LEFT)
FWD
L−A9709 (0000)
PW V

Gearbox Heat Shields
Figure 407
(Task 72−00−41−420−005)


TURBINE CASE COOLING AIR ACTUATOR
FLANGE J
FLANGE H
FLANGE K
A
DIFFUSER SEAL AIR VENT TUBE
FUEL FLOWMETER
FLEX HOSES
FWD
NOTE: GEARBOX HEAT SHIELDS REMOVED FOR CLARITY
L−A9681 (0000)
PW V

External Plumbing Installation
Figure 408 (Sheet 1)
(Task 72−00−41−420−005)


FUEL DISTRIBUTION VALVE
FUEL FLOWMETER
PACKING
BOLT
FWD
BRACKET (PRE SB PW4ENG 73−163 ONLY)
BOLT
VIEW A
L−A9682 (1295)
PW V

External Plumbing Installation
Figure 408 (Sheet 2)
(Task 72−00−41−420−005)

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - INSTALLATION-03

Task 72-00-41-420-003:

1. Install No. 3 Bearing Rear Seal Assembly And Rear Seal Seat (Horizontal)

NOTE: See Figure 401 for part/assembly installation procedure sequence.

NOTE: For vertical installation of No. 3 bearing rear seal assembly and rear seal seat, see Installation-09 Task 72-00-41-420-004.

A. Prerequisites

(1) See Inspection/Check-01 Task 72-00-41-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows:

B. Equipment And Materials Required

Special Tools:

PWA 29855-3	Pin, Aligning (Two Are Necessary)
PWA 29855-5	Pin, Aligning (Two Are Necessary)
PWA 85070	Drift
PWA 85073	Ring, Retaining
PWA 85074	Spacer, Retaining

Consumable Materials:

	Item No.	Designation
	P03-001	Engine Oil (PWA 521B)
R	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72-41-00/12/70
Gasket	12	72-41-00/12/210
Seal	1	72-41-00/12/60

C. Procedure
See Figure 402.

(1) Place No. 3 bearing rear seal seat (402/2), smaller diameter down on workbench.

(2) Install seal (402/3) into groove in ID of rear face of seal seat with open side of seal in rearward direction.

(3) Install PWA 85073 Retaining Ring to seal seat to retain seal in position.

 (a) Loosen three wing nuts on ring.

 (b) Position ring over top of seal seat.

 (c) Rotate three brackets on ring to locate slanted surface of seal seat. Tighten three wing nuts evenly to align ID of ring with ID of seal seat.

(4) With retaining ring installed, position seal seat, polished face rearward, over end of HPC rear shaft. Slide seal seat forward and seat on No. 3 bearing inner race using PWA 85070 Drift. Loosen wing nuts and rotate three bracket details of PWA 85073 Retaining Ring. Remove retaining ring from rear hub.

(5) Install new gasket (402/4) into groove in housing of No. 3 bearing rear (carbon) seal (402/10).

CAUTION: WHEN POSITIONING AND SEATING NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY ON NO. 3 BEARING SUPPORT, USE CAUTION TO PREVENT PINCHING GASKET BETWEEN FLANGE DIAMETERS.

(6) Install No. 3 bearing rear (carbon) seal (402/10).

 (a) Thread two equally spaced PWA 29855−3 Aligning Pins (402/11) into the front No. 3 bearing seal assembly inside the diffuser case.

 (b) Align offset holes and position seal on No. 3 bearing support in diffuser case.

 (c) Treat thread and shank of 40 bolts (402/5) with
R Antiseize Paste P06−054. Wipe off unwanted paste.

 (d) (Reference 980) Remove the two PWA 29855−3 Aligning Pins (402/11) as necessary and install the 40 treated bolts (402/5) to secure seal.

(e) Tighten bolts to 125 - 140 lb-in. (14.123 - 15.818 N.m) in sequence specified in Figure 403. Without loosening bolts, repeat complete tightening sequence specified in Figure 403 two times.

WARNING: BE CAREFUL WHEN YOU USE A FREEZER/DRY-ICE TO COOL PARTS. USE SUITABLE GLOVES WHEN YOU TOUCH THE DRY-ICE OR THE COLD PARTS. THE DRY-ICE OR THE COLD PARTS CAN CAUSE BURNS.

(7) Chill front edge of No. 3 bearing cooling duct assembly (402/9) with dry ice before installation.

(8) Thread two equally spaced PWA 29855-5 Aligning Pins (402/12) into the threaded inserts of the No. 3 bearing rear (carbon) seal (402/10).

(9) Align boltholes and position No. 3 bearing cooling duct assembly (402/9) over No. 3 bearing rear seal.

(10) Remove the two PWA 29855-5 Aligning Pins (402/12) as necessary from the No. 3 bearing rear (carbon) seal (402/10). Attach the duct (402/9) using 12 gaskets (402/6), shouldered washers (402/7) and bolts (402/8) lubricated with Engine Oil P03-001.

(11) Torque the 12 bolts (402/8) to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(12) Install PWA 85074 Spacer, larger ID first, over HPC rear hub and seat against No. 3 bearing rear seal seat. Lubricate threads at No. 3 bearing inner race
R retaining nut with Antiseize Paste P06-054. Wipe off
R unwanted paste. Install nut onto shaft to secure
spacer. Do not torque nut.

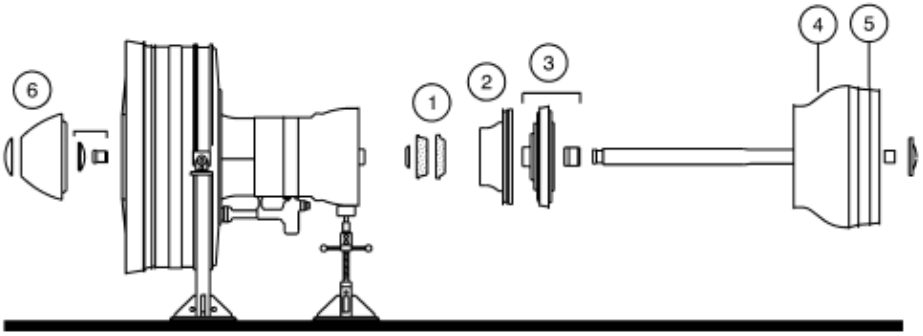
D. Postrequisites

(1) Vacuum check No. 3 bearing compartment per Inspection/ Check-07 Task 72-00-41-720-001.

(2) Install turbine nozzle per 72-00-51, Installation-01 Task 72-00-51-420-001.

(3) Test engine per Repair Test Reference Table. See 71-00-00, Testing-00 Task 71-00-00-990-003.

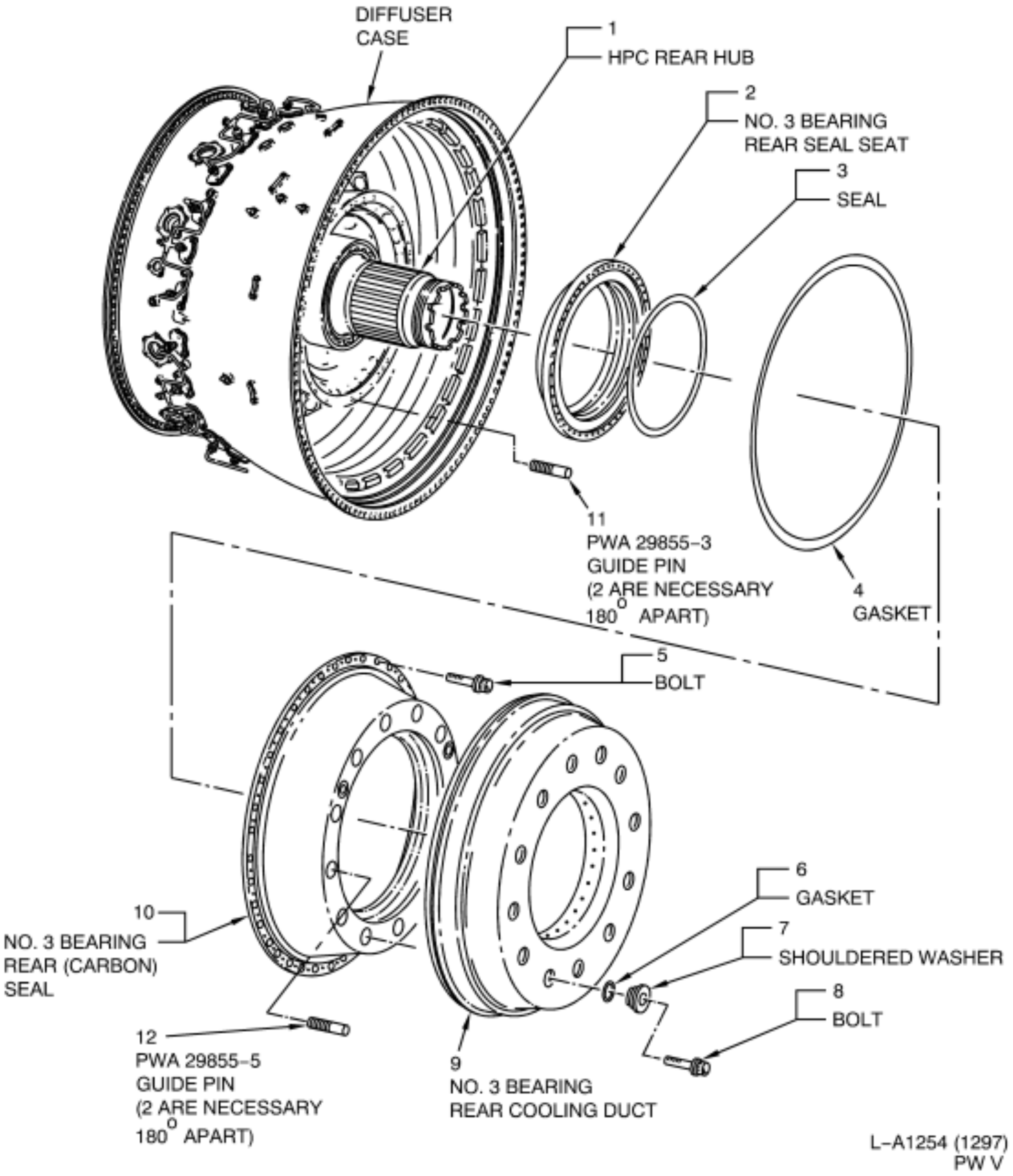
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−03



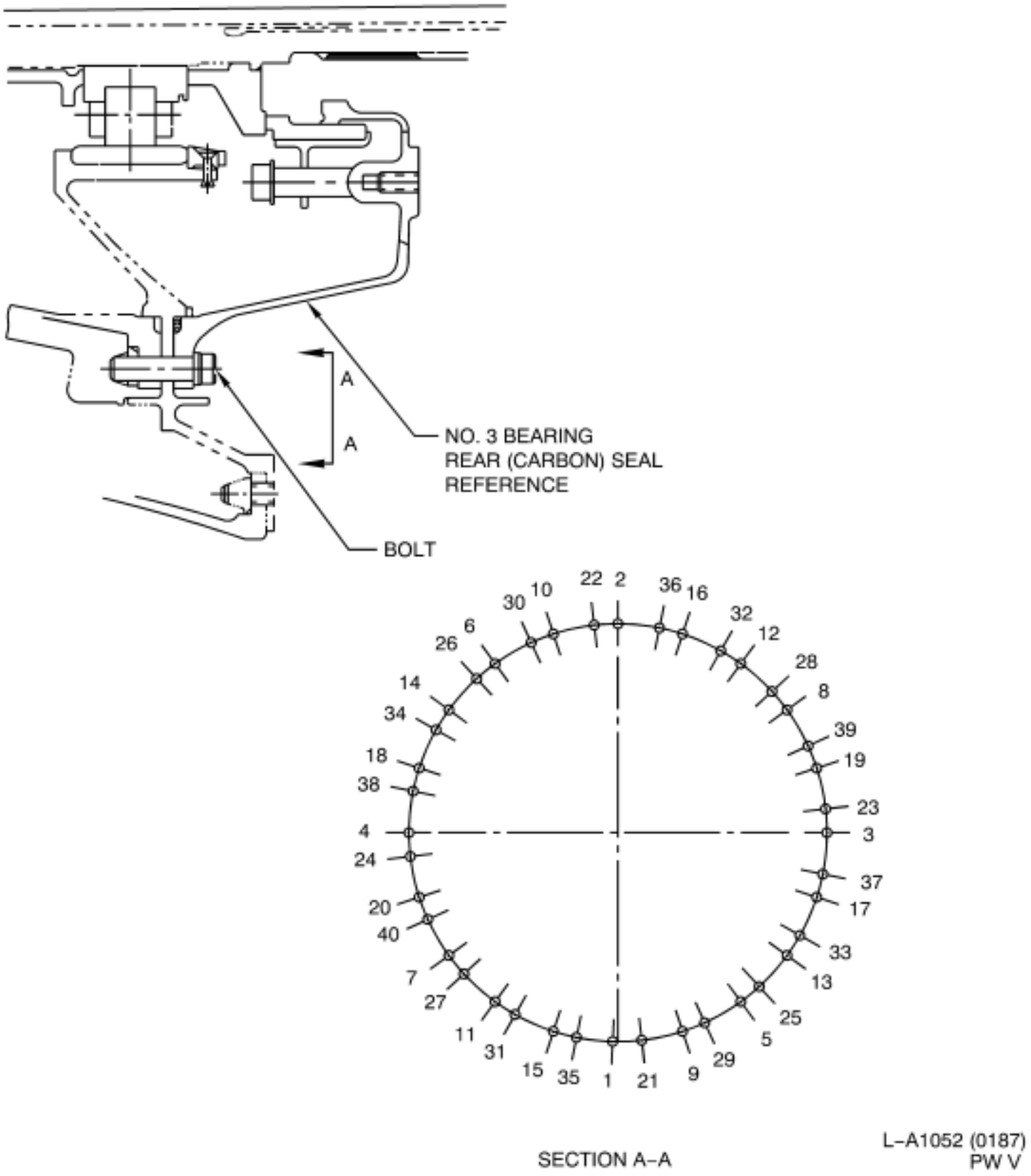
1. INSTALL NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL SEAT
2. INSTALL TURBINE NOZZLE
3. INSTALL HIGH PRESSURE TURBINE
4. INSTALL LOW PRESSURE TURBINE
5. INSTALL TURBINE EXHAUST CASE
6. INSTALL COMPRESSOR INLET CONE

L−A0250 (0000)
PW V

Procedure Sequence
Figure 401
(Task 72−00−41−420−003)


DIFFUSER CASE
1 HPC REAR HUB
2 NO. 3 BEARING REAR SEAL SEAT
3 SEAL
11 PWA 29855−3 GUIDE PIN (2 ARE NECESSARY 180° APART)
4 GASKET
5 BOLT
6 GASKET
7 SHOULDERED WASHER
8 BOLT
10 NO. 3 BEARING REAR (CARBON) SEAL
12 PWA 29855−5 GUIDE PIN (2 ARE NECESSARY 180° APART)
9 NO. 3 BEARING REAR COOLING DUCT
L−A1254 (1297)
PW V

No. 3 Bearing Rear Seal Assembly And Rear Seal Seat Installation
Figure 402
(Task 72−00−41−420−003)


A
A
NO. 3 BEARING REAR (CARBON) SEAL REFERENCE
BOLT
22
2
36
16
32
12
28
8
39
19
23
3
37
17
33
13
25
5
29
9
21
1
35
15
31
11
27
7
40
20
24
4
38
18
34
14
26
6
30
10
SECTION A−A
L−A1052 (0187)
PW V

Torquing Sequence Diagram For No. 3 Bearing Compartment Bolts
Figure 403
(Task 72−00−41−420−003)

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ENGINE GENERAL - DIFFUSER AND COMBUSTOR - INSTALLATION-04

Task 72-00-41-450-001:

1. Install Exciter-To-Igniter Plug Cable, (Upper Plug-Upper Box)

A. Equipment And Materials Necessary

Consumable Material:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-005	Cloth, Cotton Lint Free
P06-009	Compound, Antiseize (PMC 9523)
P06-021	Compound, Antigalling (PWA 550-3)
P06-036	Compound, Antigallant (PWA 36035) (Fel-Pro C-300)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Grommet	2	74-21-00/1/30
Rubber Bushings	2	74-21-00/X/XX
Ring	2	74-21-00/X/XX

B. Procedure
See Figure 401 and Figure 402.

CAUTION: SEE 72-00-00, INSTALLATION-00 (TASK 72-00-00-990-009) FOR GENERAL INSTALLATION OF ELECTRICAL HARNESSES, LEADS, AND CABLES.

(1) Remove protective caps from each end of cable and from mating output connector on upper ignition exciter.

CAUTION: DO NOT TWIST EXCITER-TO-IGNITER PLUG CABLE WHEN TURNING CONNECTOR NUT, OR DAMAGE TO CABLE COULD RESULT.

(2) If new rubber bushings are to be installed comply with the following:

(a) Clean bushings with clean Lint Free Cotton Cloth P05-005, and the SPOP 208 Wipe Method (Task 70-21-00-110-040).

(b) Slide treated rubber bushing with sleeve on cable wire and secure in place with new retaining ring.

(3) Install new grommet on cable ends as follows:

NOTE: This step is not applicable to new cable assemblies.

(a) Clean new grommet with clean Lint Free Cotton Cloth P05−005, and the SPOP 208 Wipe Method (Task 70−21−00−110−040).

(b) Slide grommet on cable.

(4) Place two clamps, smaller clamp first, over exciter end of cable.

(5) Install a clamp on the igniter plug end of the cable.

CAUTION: INSTALL THE CABLE ENDS (LEADS) TO THE IGNITER PLUG AND THE IGNITION EXCITER BY PUSHING THE CABLE CONNECTORS IN A STRAIGHT LINE MOVEMENT. IF LATERAL FORCE IS PERMITTED, THE CABLE END CAN BE DAMAGED.

(6) Lubricate the threads of the coupling nut at the igniter plug end of the cable with Antiseize Compound P06−009 and connect to the igniter plug. Keep the coupling nut loose sufficiently to permit free movement of the cable.

(7) Lubricate the threads of the coupling nut at the exciter end of the cable with Antigallant Compound P06−036 and connect the cable to the output connector on the exciter.

NOTE: When Antigalling Compound P06−036 is not available, an alternative of Antigalling Compound P06−021 can be used.

NOTE: Do not apply an excessive amount of compound to the cable coupling nut threads.

(8) Torque the coupling nuts on the cable until the nuts touch (bottom) on the shoulders of nuts. This torque usually is 140 − 160 lb−in. (15.818 − 18.078 N.m).

NOTE: Insufficient torque on cable nuts at exciter or igniter end can cause ignition radiated noise to be picked up by aircraft radio equipment.

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−04

(9) (Reference 2151) (Pre SB PW4ENG 73−192) Position heat shield segments over exciter end of cable and secure with clamps. Torque clamp screws to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(10) (Reference 2151) (Post SB PW4ENG 73−192) Position heat shield segments over exciter end of cable. Make sure the segment half with hose fittings is pointed up. Secure with clamps. Torque clamp screws to 15 − 18 lb−in. (1.695 − 2.034 N.m).

NOTE: Pre SB PW4ENG 73−192 engines do not have W5/W6 wiring harness connector cooling.

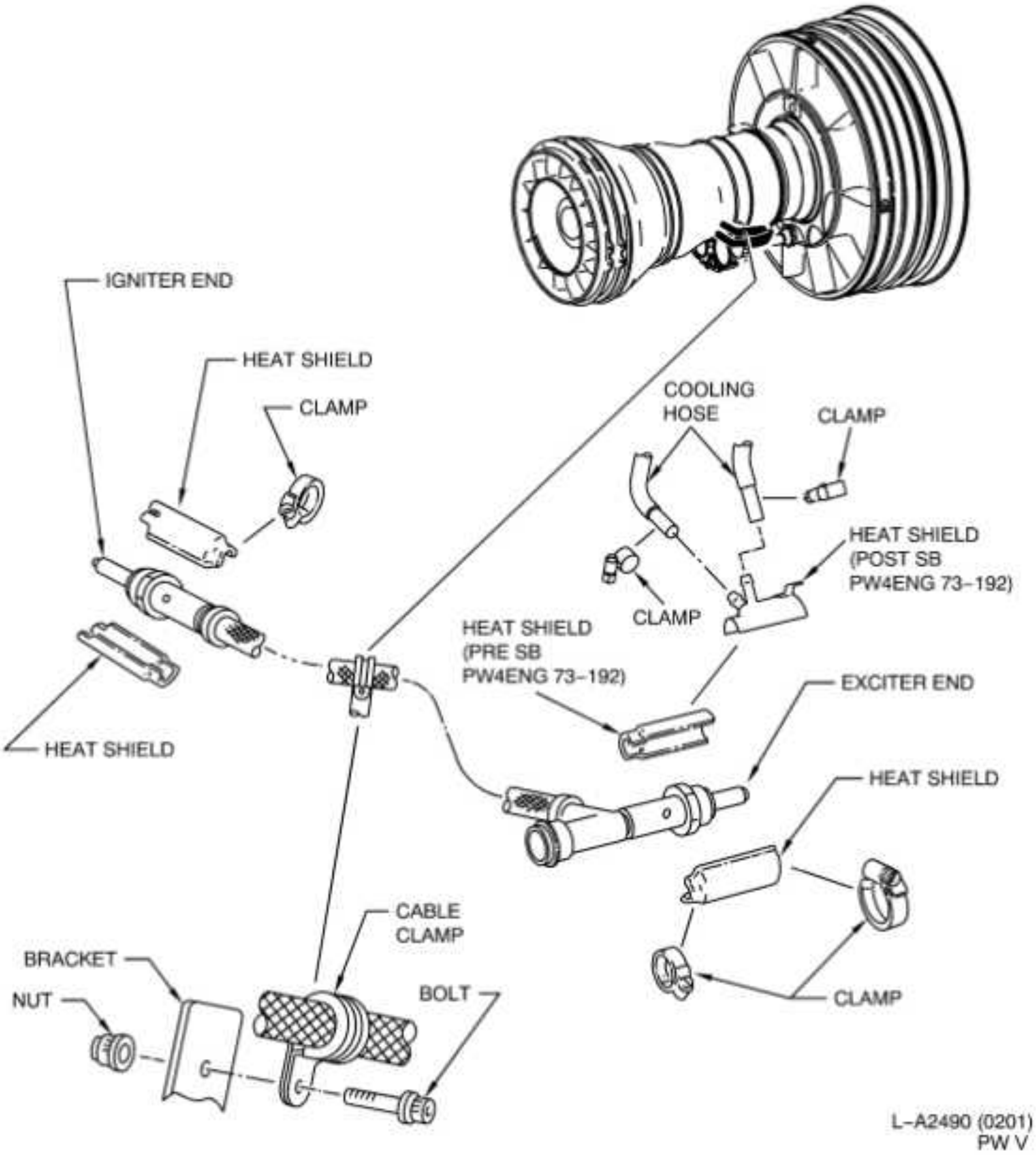
(11) (Post SB PW4ENG 73−192) Install cooling hoses on heat shield fittings and secure with clamps. Torque the hose clamps to 10 − 15 lb−in. (1.130 − 1.695 N.m).

(12) (Reference 2151) Install heat shields at igniter plug. Bend tabs of igniter plug heat shield into groove in boss before securing clamp. Secure with clamp. Torque clamp screw to 15 − 18 lb−in. (1.695 − 2.034 N.m).

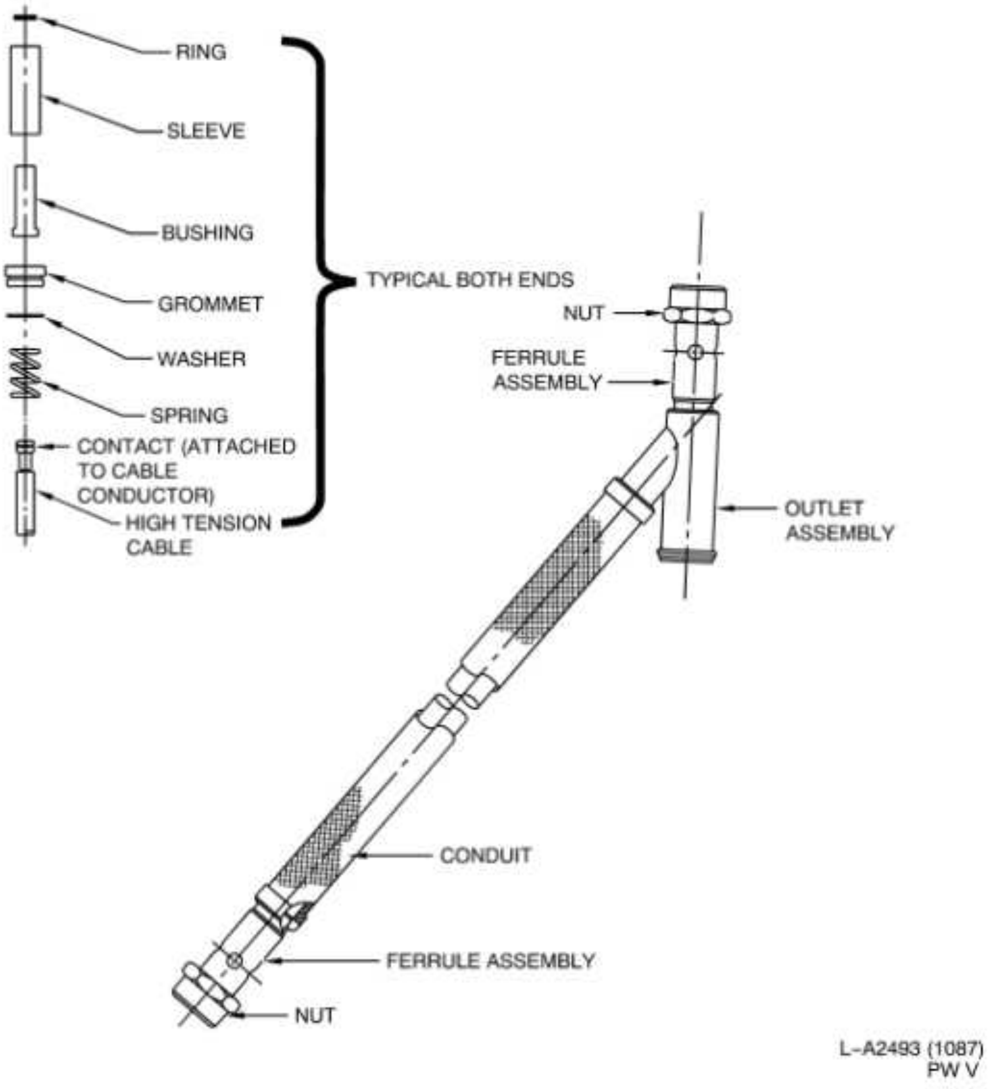
(13) Install cable clamp to upper cable. Lubricate bolt threads with Engine Oil P03−001 and secure cable clamp to bracket with bolt and nut. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

C. Postrequisites

(1) Test engine per Repair Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


IGNITER END
HEAT SHIELD
CLAMP
COOLING HOSE
CLAMP
HEAT SHIELD (POST SB PW4ENG 73−192)
CLAMP
HEAT SHIELD (PRE SB PW4ENG 73−192)
EXCITER END
HEAT SHIELD
HEAT SHIELD
HEAT SHIELD
CABLE CLAMP
BRACKET
NUT
BOLT
CLAMP
L−A2490 (0201)
PW V

Exciter−To−Igniter Plug Cable (Upper)
Figure 401
(Task 72−00−41−450−001)


RING
SLEEVE
BUSHING
GROMMET
WASHER
SPRING
CONTACT (ATTACHED TO CABLE CONDUCTOR)
HIGH TENSION CABLE
TYPICAL BOTH ENDS
NUT
FERRULE ASSEMBLY
OUTLET ASSEMBLY
CONDUIT
FERRULE ASSEMBLY
NUT
L-A2493 (1087)
PW V

Exciter−To−Igniter Plug Cable
Figure 402
(Task 72−00−41−450−001)

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ENGINE GENERAL - DIFFUSER AND COMBUSTOR - INSTALLATION-05

Task 72-00-41-450-002:

1. Install Exciter-To-Igniter Plug Cable, (Lower Plug-Lower Box)
   A. Equipment And Materials Required

Consumable Material:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-005	Cloth, Cotton Lint Free
P06-009	Compound, Antiseize (PMC 9523)
P06-021	Compound, Antigalling (PWA 550-3)
P06-036	Compound, Antigallant (PWA 36035) (Fel-Pro C-300)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Grommets	2	74-21-00	1	30
Rubber Bushings	2	74-21-00	X	XX
Ring	2	74-21-00	X	XX

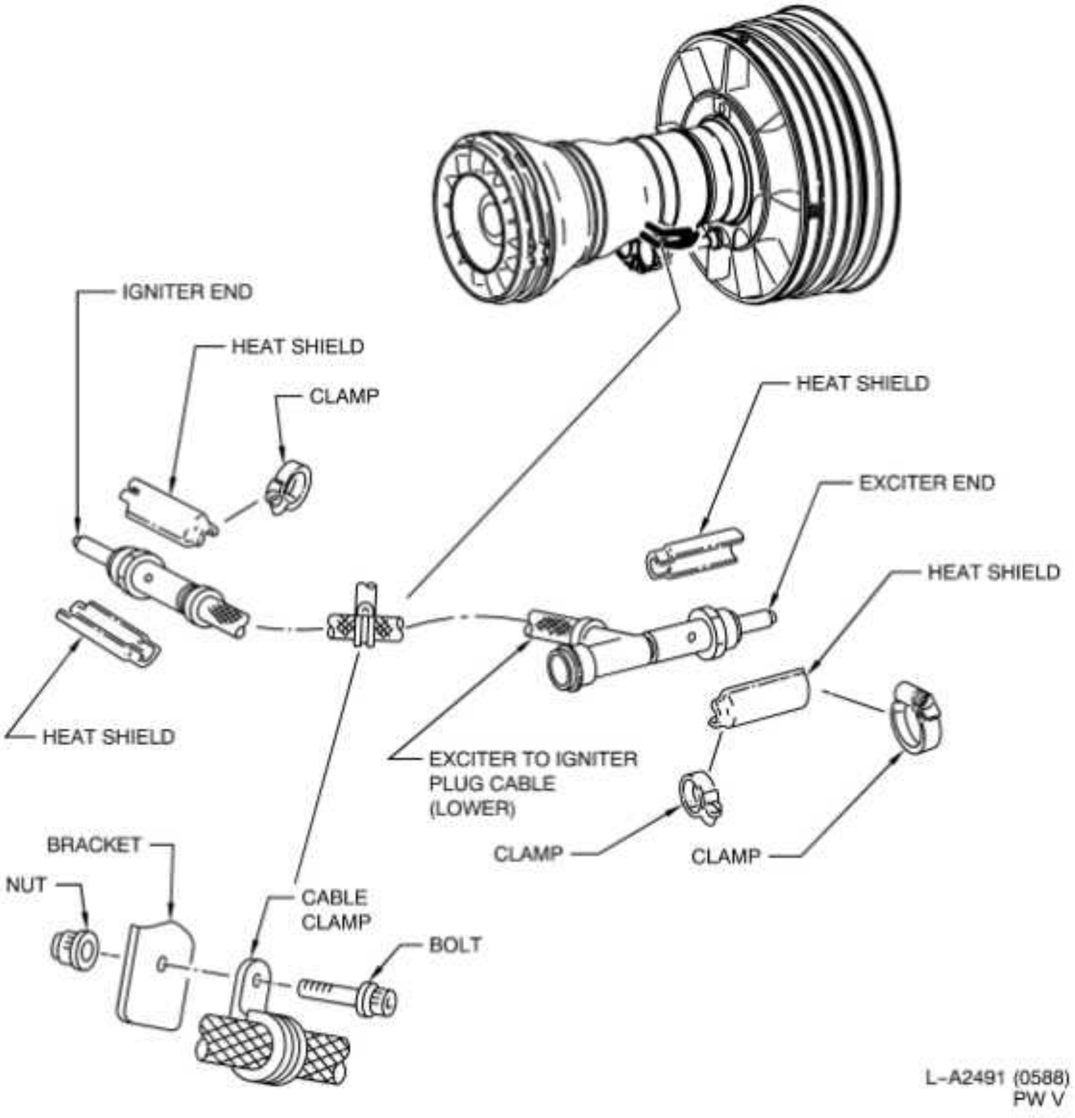
   B. Procedure
   See Figures 401 and 402.

CAUTION: SEE 72-00-00, INSTALLATION-00 (Task 72-00-00-990-009) FOR GENERAL INSTALLATION REQUIREMENTS FOR ELECTRICAL HARNESSES, LEADS, AND CABLES.

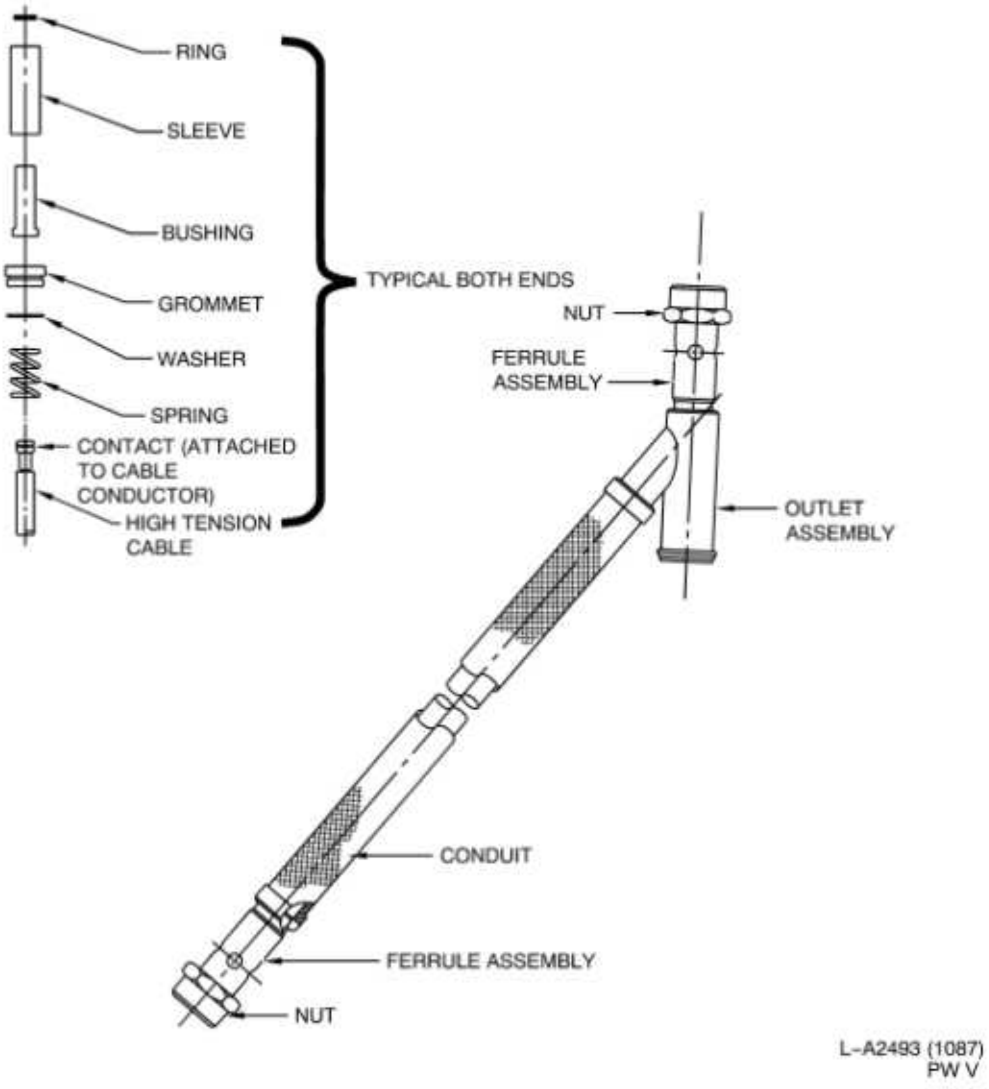
(1) Remove protective caps from each end of cable and from mating output connector on lower ignition exciter.

CAUTION: DO NOT TWIST EXCITER-TO-IGNITER PLUG CABLE WHEN TURNING CONNECTOR NUT, OR DAMAGE TO CABLE COULD RESULT.

(2) If new rubber bushings are to be installed comply with the following:
   (a) Clean bushings with clean Lint Free Cotton Cloth (P05-005), and the SPOP 208 Wipe Method (Task 70-21-00-110-040).
   (b) Slide treated rubber bushing with sleeve on cable wire and secure in place with new retaining ring.


IGNITER END
HEAT SHIELD
CLAMP
HEAT SHIELD
EXCITER END
HEAT SHIELD
HEAT SHIELD
EXCITER TO IGNITER PLUG CABLE (LOWER)
CLAMP
CLAMP
BRACKET
NUT
CABLE CLAMP
BOLT
L-A2491 (0588)
PW V

Exciter−To−Igniter Plug Cable (Lower)
Figure 401
(Task 72−00−41−450−002)


RING
SLEEVE
BUSHING
GROMMET
WASHER
SPRING
CONTACT (ATTACHED TO CABLE CONDUCTOR)
HIGH TENSION CABLE
TYPICAL BOTH ENDS
NUT
FERRULE ASSEMBLY
OUTLET ASSEMBLY
CONDUIT
FERRULE ASSEMBLY
NUT
L-A2493 (1087)
PW V

Exciter-To-Igniter Plug Cable
Figure 402
(Task 72-00-41-450-002)

(3) Install new grommet on cable ends as follows:

NOTE: This step is not applicable to new cable assemblies.

(a) Clean new grommet with clean Lint Free Cotton Cloth (P05−005), and the SPOP 208 Wipe Method (Task 70−21−00−110−040).
(b) Slide grommet on cable.
(4) Place two clamps, smaller clamp first, over exciter end of cable.
(5) Install a clamp on the igniter plug end of the cable.

CAUTION: INSTALL THE CABLE ENDS (LEADS) TO THE IGNITER PLUG AND THE IGNITION EXCITER BY PUSHING THE CABLE CONNECTORS IN A STRAIGHT LINE MOVEMENT. IF LATERAL FORCE IS PERMITTED, THE CABLE END CAN BE DAMAGED.

(6) Lubricate the threads of the coupling nut at the igniter plug end of the cable with Antiseize Compound (P06−009) and connect to the igniter plug. Keep the coupling nut loose sufficiently to permit free movement of the cable.
(7) Lubricate the threads of the coupling nut at the exciter end of the cable with Antigallant Compound (P06−036) and connect the cable to the output connector on the exciter.

NOTE: When Antigallant Compound (P06−036) is not available, an alternative of Antigalling Compound (P06−021) can be used.

Do not apply an excessive amount of compound to the cable coupling nut threads.

(8) Torque the coupling nuts on the cable until the nuts touch (bottom) on the shoulders of nuts. This torque usually is 140 − 160 lb−in. (15.818 − 18.078 N.m).

NOTE: Insufficient torque on cable nuts at exciter or igniter end can cause ignition radiated noise to be picked up by aircraft radio equipment.

(9) (Reference 2151) Position heat shield segments over exciter end of cable and secure with clamps. Torque clamp screws to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(10) (Reference 2151) Install heat shields at igniter plug. Bend tabs of igniter plug heat shield into groove in boss before securing clamp. Secure with clamp. Torque clamp screw to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(11) Install cable clamp to lower cable. Lubricate bolt threads with Engine Oil (P03−001) and secure cable clamp to bracket with bolt and nut. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

C. Postrequisites

(1) Test engine per Repair Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).

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Task 72-00-41-450-003:

1. Install Fuel Distribution Valve

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-053	Lubricant, Seal Ring (PWA 36500)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	16	73-13-00/3/530
Packing	2	73-13-00/4/70

B. Procedure
See Figure 401.

(1) Remove protective closures.

(2) Install two packings lubricated with Seal Ring Lubricant P06-053, to eight transfer tubes. Install transfer tubes to each adapters on fuel supply tubes at Flange K bracket.

(3) Install packings, lubricated with Seal Ring Lubricant P06-053, to grooves in packing transfer tube assembly. Install valve transfer tube into distribution valve cover.

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−06

(4) Install the fuel distribution valve over the eight (8) transfer tubes, aligning the forward mount bracket (Pre SB PW4ENG 73−163 only) with the bracket on Flange J. Secure the valve to the bracket on Flange K with four (4) bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(5) Secure valve to Flange J bracket with two bolts, threads lubricated with Engine Oil P03−001. Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(6) Translate transfer tube forward with dowel pin downward and boltholes aligned.

NOTE: If fuel flowmeter is installed, ensure seal plate is installed to rear flange of flowmeter and dowel pin is aligned.

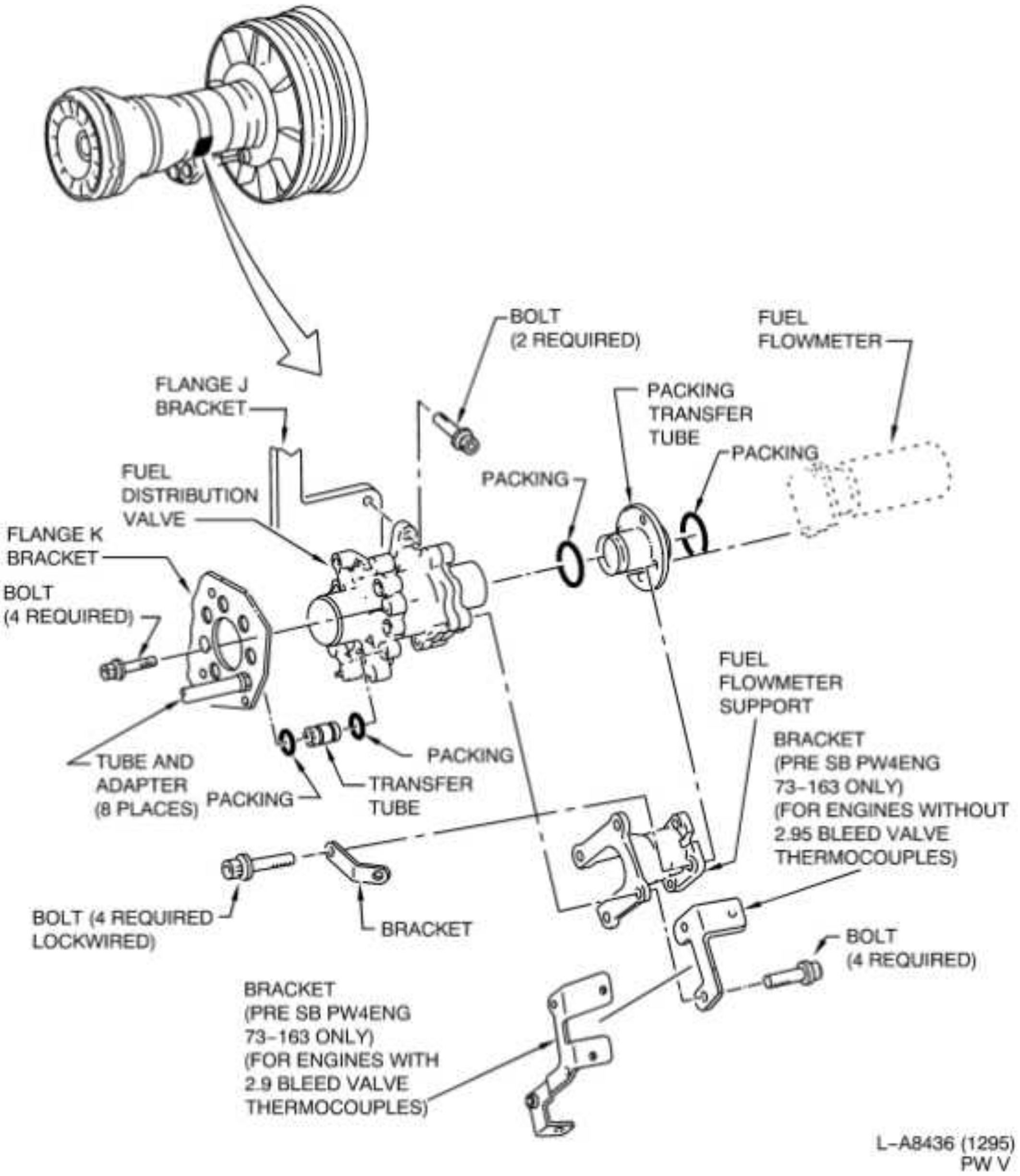
(7) Install fuel flowmeter support over transfer tube aligning dowel pin on transfer tube with slot in support and aligning boltholes in rear (larger) flange. Install bracket over support and position as shown in Figure 401.

(8) Secure rear flange with bolts (without drilled heads) threads lubricated with Engine Oil P03−001. Secure front flange with drilled head bolts, threads lubricated with Engine Oil P03−001.

(9) Torque all bolts at front and rear flanges to 85 − 95 lb−in. (9.604 − 10.734 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts on the front flange.

C. Postrequisites

(1) Test engine per Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


BOLT
(2 REQUIRED)
FUEL
FLOWMETER
FLANGE J
BRACKET
PACKING
TRANSFER
TUBE
PACKING
PACKING
FUEL
DISTRIBUTION
VALVE
FLANGE K
BRACKET
BOLT
(4 REQUIRED)
FUEL
FLOWMETER
SUPPORT
BRACKET
(PRE SB PW4ENG
73−163 ONLY)
(FOR ENGINES WITHOUT
2.95 BLEED VALVE
THERMOCOUPLES)
PACKING
TUBE AND
ADAPTER
(8 PLACES)
PACKING
TRANSFER
TUBE
BOLT (4 REQUIRED
LOCKWIRED)
BRACKET
BOLT
(4 REQUIRED)
BRACKET
(PRE SB PW4ENG
73−163 ONLY)
(FOR ENGINES WITH
2.9 BLEED VALVE
THERMOCOUPLES)
L−A8436 (1295)
PW V

Fuel Distribution Valve
Figure 401
(Task 72−00−41−450−003)

Task 72-00-41-450-004:

1. Install Igniter Plug

A. General

(1) This procedure applies to either igniter plug and is used only for installation of plug and/or key washer. If boss and/or spacers are to be replaced, see Installation-08.

B. Equipment And Materials Required

Consumable Material:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-005	Cloth, Cotton Lint Free
	P06-009	Compound, Antiseize (PMC 9523)
	P06-021	Compound, Antigalling (PWA 550-3)
R	P06-023	Lubricant, Thread (PWA 36001)
	P06-036	Compound, Antigallant (PWA 36035) (Fel-Pro C-300)
	P11-027	Solvent, Petroleum (PMC 9001)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	1	74-21-00/2/20
Grommet	2	74-21-00/1/30

C. Procedure
See Figure 401.

(1) If key washer was removed, install new key washer on boss. Bend tabs of key washer to secure to boss.

R (2) Fully clean the igniter plug threads and boss threads
R with Petroleum Solvent P11-027 to remove carbon
R deposits and thread lubricants.

R CAUTION: DO NOT USE THREAD LUBRICANT P06-023 (SILVER
R GOOP) ON THE IGNITER PLUG THREADS IF A
R DIFFERENT COMPOUND WAS APPLIED BEFORE. MAKE
R SURE THAT YOU REMOVE THE ANTISEIZE COMPOUND
R FULLY BEFORE YOU APPLY THREAD LUBRICANT
R (SILVER GOOP). IF YOU USE THE THREAD
R LUBRICANT (SILVER GOOP) WHERE A DIFFERENT

R COMPOUND WAS APPLIED BEFORE, IT CAN BECOME
R HARD AFTER ENGINE OPERATION.

R (3) Apply Thread Lubricant P06-023 to the igniter plug
R threads. Apply Antiseize Compound P06-009 to the
R threads of cable connector.

NOTE: Do not apply an excessive amount of lubricant to the threads of the cable connector.

(4) (Reference 401) Install igniter plug. Keep igniter plug boss from turning while tightening igniter plug. Torque plug to 300 - 360 lb-in. (33.895 - 40.675 N.m).

(5) Remove protective caps from ends of igniter cable and connector on the exciter.

(6) Check cable contact for evidence of arcing (discoloration and heavy pitting). Check cable ends for evidence of carbon tracking. Replace cable if either condition is found. See Installation-04 and -05.

(7) Install new grommet on cable end as follows:

  (a) Clean new grommet with clean Lint Free Cotton Cloth P05-005, and the SPOP 208 Wipe Method (Task 70-21-00-110-040).

  (b) Slide grommet on cable.

(8) Install two clamps, smaller clamp first, on the exciter end of the cable.

(9) Install a clamp on the igniter plug end of the cable.

CAUTION: INSTALL THE CABLE ENDS (LEADS) TO THE IGNITER PLUG AND THE IGNITION EXCITER BY PUSHING THE CABLE CONNECTORS IN A STRAIGHT LINE MOVEMENT. IF LATERAL FORCE IS PERMITTED, THE CABLE END CAN BE DAMAGED.

(10) Connect the coupling nut of the igniter plug end of the cable to the igniter plug. Keep the coupling nut loose sufficiently to permit free movement of the cable.

(11) Lubricate the threads of the coupling nut at the exciter end of the cable with Antigallant Compound P06-036 and connect the cable to the output connector on the exciter.

NOTE: When Antigallant Compound P06-036 is not available, an alternative of Antigalling Compound P06-021 can be used.

NOTE: Do not apply an excessive amount of compound to the cable coupling nut threads.

(12) Torque the coupling nuts on the cable until the nuts touch (bottom) on the shoulder of nuts. This torque is usually 140 - 160 lb-in. (15.818 - 18.078 N.m).

(13) Install heat shield segments at igniter end of exciter-to-igniter plug cable and reposition securing clamp. Bottom heat shield on igniter plug boss.

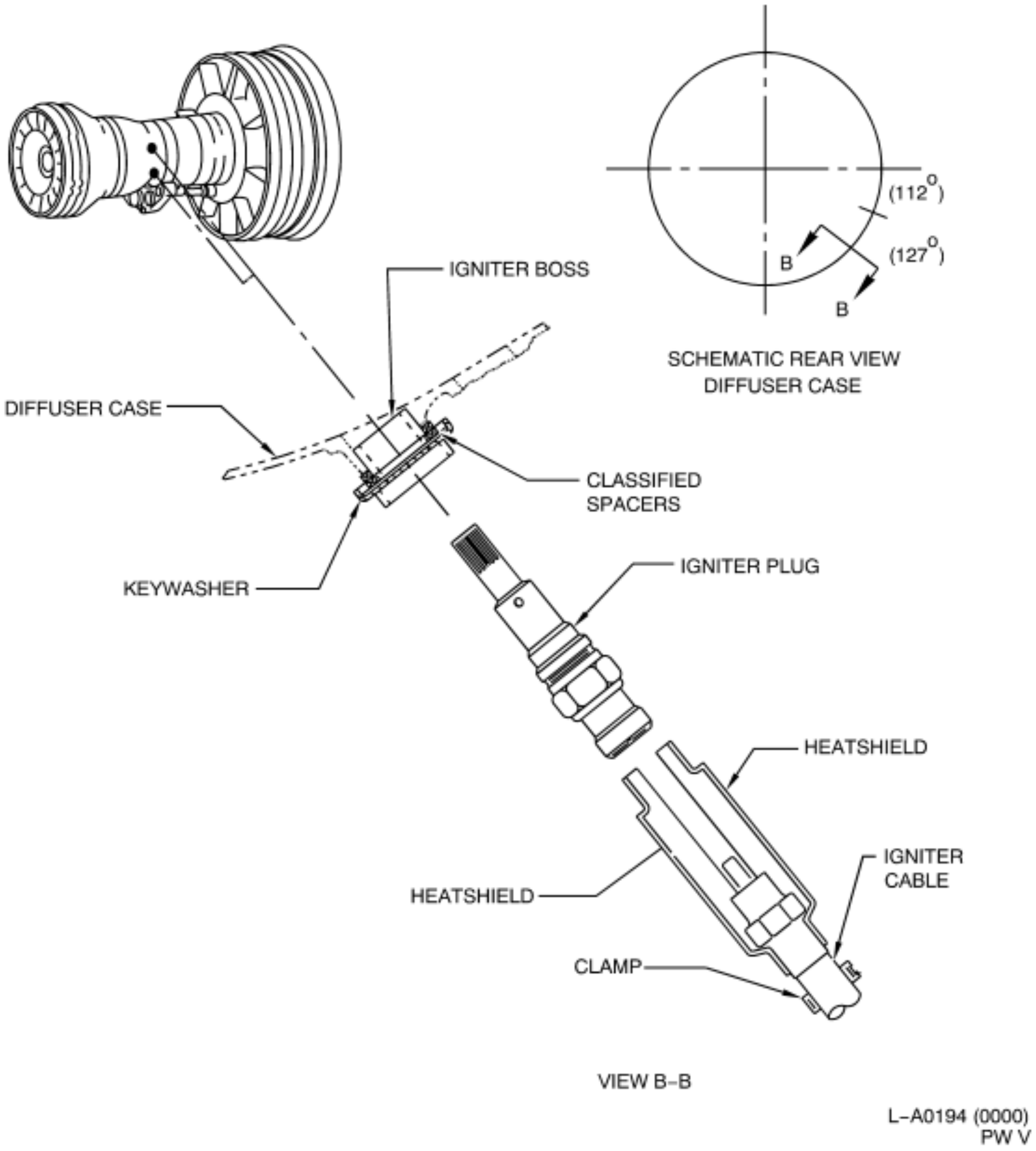
(14) (Reference 2151) Torque clamp screw to 15 - 18 lb-in. (1.695 - 2.034 N.m).

(15) (Reference 2151) Install the heat shields segments at the exciter end of the cable. Put the clamps over the heat shields and torque the clamp screws to 15 - 18 lb-in. (1.695 - 2.034 N.m).

(16) Install the bolt, threads lubricated with Engine Oil P03-001, and nut that attaches a clamp on the igniter cable (the upper or lower cable as necessary) to a bracket located between the upper and lower igniter cable. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

D. Postrequisites

(1) Test engine per Test Reference Table. See 71-00-00, Testing-00 Task 71-00-00-990-003.


(112°)
B
(127°)
B
SCHEMATIC REAR VIEW
DIFFUSER CASE
IGNITER BOSS
DIFFUSER CASE
CLASSIFIED
SPACERS
KEYWASHER
IGNITER PLUG
HEATSHIELD
IGNITER
CABLE
HEATSHIELD
CLAMP
VIEW B-B
L-A0194 (0000)
PW V

Igniter Plug Replacement
Figure 401
(Task 72-00-41-450-004)

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - INSTALLATION-08

Task 72-00-41-450-005:

1. Install Igniter Plug, Igniter Plug Boss And Exciter-To-Igniter Cable

A. General

(1) This procedure applies to both igniter plug locations. If boss or spacer(s) are to be replaced, and parts removed at disassembly are available, use this procedure to check boss and spacer thickness. If none of the above parts are to be replaced, install igniter plug per Installation-07.

(2) If boss or spacer(s) are to be replaced, and parts removed at disassembly are not available, igniter plug immersion depth must be determined per Installation-14.

B. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-005	Cloth, Cotton Lint Free
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-009	Compound, Antiseize (PMC 9523)
P06-021	Compound, Antigalling (PWA 550-3)
P06-023	Lubricant (PWA 36001)
P06-036	Compound, Antigallant (PWA 36035) (Fel-Pro C-300)
P11-027	Solvent, Petroleum (PMC 9001)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	1	74-21-00/2/20
Grommet	2	74-21-00/1/30

C. Procedure

See Figure 401.

(1) If key washer is being replaced, install new key washer to boss and bend tabs of key washer around flange of boss to secure in place.

(2) If igniter boss and/or classified spacers have been removed but will not be replaced continue with installation procedure step (3). If igniter boss and/or spacers are being replaced, check boss and spacer thickness and adjust classified spacer thickness, if necessary as follows:

(a) Install classified spacer(s) to boss and measure total thickness of parts shown in Figure 401, Dimension A.

(b) Compare total thickness of parts with identical dimension of old parts obtained at disassembly. If the assembly dimension is within plus or minus 0.015 inch (0.381 mm) of disassembly dimension, no spacer adjustment is required. If assembly dimension is NOT within 0.015 inch (0.381 mm) of disassembly dimension select one or more classified spacers to equal disassembly dimension within plus or minus 0.010 inch (0.254 mm). See Figure 402. Use a maximum of two spacers per each igniter plug location.

NOTE: Total combined thickness of spacers is not to exceed 0.300 inch (7.620 mm) at each igniter location.

(3) Fully clean plug threads and boss threads with Petroleum Solvent P11−027 to remove carbon deposits and thread lubricants.

(4) Lubricate OD threads of boss with Lubricant P06−023.

(5) (Reference 400) Install classified spacer(s) to boss and install boss to diffuser case. Torque boss to 375 − 440 lb−in. (42.869 − 49.713 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(6) Apply Lubricant P06−023, to threads of igniter plug.

NOTE: Do not apply an excessive amount of lubricant to the threads of the igniter plug.

(7) (Reference 401) Install igniter plug to boss. Torque plug to 300 - 360 lb-in. (33.895 - 40.675 N.m).

NOTE: Keep igniter plug boss from turning while torquing plug.

(8) Remove protective caps from end of igniter plug cable ends and the connector on the exciter.

(9) Check cable contact for evidence of arcing (discoloration and heavy pitting). Check cable ends for evidence of carbon tracking. Replace the cable if either condition is found. See 72-00-41, Removal-04 Task 72-00-41-050-001 or Removal-05 Task 72-00-41-050-002 and Installation-04 Task 72-00-41-450-001 or Installation-05 Task 72-00-41-450-002.

(10) Install new grommet on cable ends as follows:

(a) Clean the new grommet with clean Lint Free Cotton Cloth P05-005, and SPOP 208. See the Standard Practices Manual, PN 585005.

(b) Slide grommet on cable.

(c) Apply Antiseize Compound P06-009, to threads of cable connector on the igniter plug end of the cable.

NOTE: Do not apply an excessive amount of lubricant to the threads of the cable connector.

(11) Install two clamps, smaller clamp first, over exciter end of the cable.

(12) Install a clamp on the igniter plug end of the cable.

CAUTION: INSTALL THE CABLE ENDS (LEADS) TO THE IGNITER PLUG AND THE IGNITION EXCITER BY PUSHING THE CABLE CONNECTORS IN A STRAIGHT LINE MOVEMENT. IF LATERAL FORCE IS PERMITTED, THE CABLE END CAN BE DAMAGED.

(13) Connect the coupling nut of the igniter plug end of the cable to the igniter plug. Keep the coupling nut loose sufficiently to permit free movement of the cable.

(14) Lubricate the threads of the coupling nut at the exciter end of the cable with Antigallant Compound P06−036 and connect the cable to the output connector on the exciter.

NOTE: When Antigallant Compound P06−036 is not available, an alternative of Antigalling Compound P06−021 can be used.

NOTE: Do not apply an excessive amount of compound to the cable coupling nut threads.

(15) Torque the coupling nuts on the cable until the nuts touch (bottom) on the shoulder of nuts. This torque is usually 140 − 160 lb−in. (15.818 − 18.078 N.m).

(16) Install heat shield segments at igniter plug end of exciter−to−igniter plug cable and reposition securing clamp. Bottom heat shield on igniter plug boss.

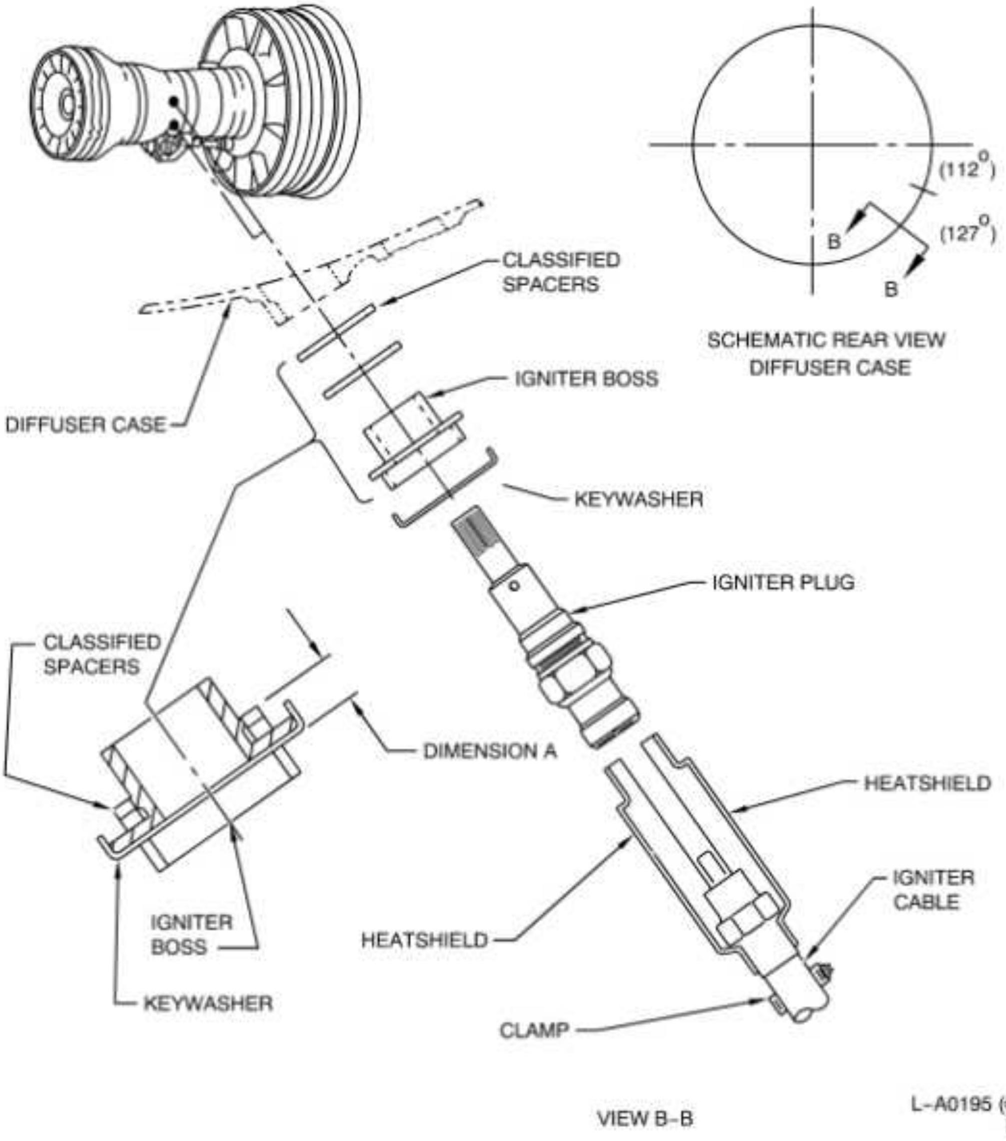
(17) (Reference 2151) Torque clamp screw to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(18) (Reference 2151) Install the heat shields segments at the exciter end of the cable. Put the clamps over the heat shields and torque the clamp screws to 15 − 18 lb−in. (1.695 − 2.034 N.m).

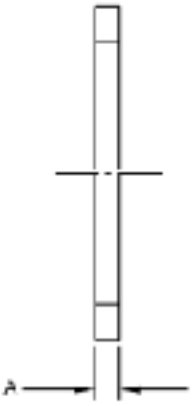
(19) Install the bolt, threads lubricated with Engine Oil P03−001, and nut that attaches a clamp on the igniter cable (the upper or lower cable as necessary) to a bracket located between the upper and lower igniter cable. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

D. Postrequisites

(1) Test engine per Repair Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


(112°)
B
(127°)
B
SCHEMATIC REAR VIEW
DIFFUSER CASE
CLASSIFIED SPACERS
IGNITER BOSS
DIFFUSER CASE
KEYWASHER
IGNITER PLUG
CLASSIFIED SPACERS
DIMENSION A
HEATSHIELD
IGNITER CABLE
IGNITER BOSS
HEATSHIELD
KEYWASHER
CLAMP
VIEW B−B
L−A0195 (0000)
PW V

Igniter Plug (Typical 2 Locations)
Figure 401
(Task 72−00−41−450−005)



Part No.	Dimension A	
	Inches	Millimeters
741073 CL 1	0.008 - 0.018	0.20 - 0.46
741073 CL 2	OVER 0.018 - 0.028	OVER 0.46 - 0.71
741073 CL 3	OVER 0.028 - 0.038	OVER 0.71 - 0.97
741073 CL 4	OVER 0.038 - 0.048	OVER 0.97 - 1.22
741073 CL 5	OVER 0.048 - 0.058	OVER 1.22 - 1.47
741073 CL 6	OVER 0.058 - 0.068	OVER 1.47 - 1.73
741073 CL 7	OVER 0.068 - 0.078	OVER 1.73 - 1.98
741073 CL 8	OVER 0.078 - 0.088	OVER 1.98 - 2.24
741073 CL 9	OVER 0.088 - 0.098	OVER 2.24 - 2.49
741073 CL 10	OVER 0.098 - 0.108	OVER 2.49 - 2.74
741073 CL 11	OVER 0.108 - 0.118	OVER 2.74 - 3.00
741073 CL 12	OVER 0.118 - 0.128	OVER 3.00 - 3.25
741073 CL 13	OVER 0.128 - 0.138	OVER 3.25 - 3.51
741073 CL 14	OVER 0.138 - 0.148	OVER 3.51 - 3.76
741073 CL 15	OVER 0.148 - 0.158	OVER 3.76 - 4.01
741073 CL 16	OVER 0.158 - 0.168	OVER 4.01 - 4.27
741073 CL 17	OVER 0.168 - 0.178	OVER 4.27 - 4.52
741073 CL 18	OVER 0.178 - 0.188	OVER 4.52 - 4.78

Spacer Classification Data

Igniter Boss Classified Spacer
Figure 402
(Task 72-00-41-450-005)

Task 72-00-41-420-004:

1. Install No. 3 Bearing Rear Seal Assembly And Rear Seal Seat (Vertical)

NOTE: See Figure 401 for part/assembly installation procedure sequence.

NOTE: For horizontal installation of No. 3 bearing rear seal assembly and rear seal seat, see Installation-03 Task 72-00-41-420-003.

A. Prerequisites

(1) See Inspection/Check-01 Task 72-00-41-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows:

B. Equipment And Materials Required

Special Tools:

PWA 29855-3	Pin, Aligning (Two Are Necessary)
PWA 29855-5	Pin, Aligning (Two Are Necessary)
PWA 85070	Drift
PWA 85073	Ring, Retaining
PWA 85074	Spacer, Retaining

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
R	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72-41-00/12/70
Seal	1	72-41-00/12/60

C. Procedure
See Figure 402.

(1) Place No. 3 bearing rear seal seat (402/8), smaller diameter down on workbench.

(2) Install seal (402/7) into groove in ID of rear face of seal seat.

(3) Install PWA 85073 Retaining Ring to seal seat.

  (a) Loosen three wing nuts on ring.

  (b) Position ring over top of seal seat.

  (c) Rotate three brackets on ring to locate slanted machined surface on seal seat. Tighten three wing nuts evenly to align ID of ring with ID of seal seat.

(4) Remove thread protector from end of HPC rear hub.

(5) With retaining ring installed, position seal seat, polished face rearward, over end of HPC rear shaft. Slide seal seat forward and seat on No. 3 bearing inner race using PWA 85070 Drift . Loosen wing nuts and rotate three bracket details of PWA 85073 Retaining Ring. Remove retaining ring from seal seat.

(6) Install new gasket (402/6) into groove in No. 3 bearing (carbon) seal (402/5).

  CAUTION: WHEN POSITIONING AND SEATING NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY ON NO. 3 BEARING SUPPORT, USE CAUTION TO PREVENT PINCHING GASKET BETWEEN FLANGE DIAMETERS.

(7) Install No. 3 bearing rear (carbon) seal (402/5).

  (a) Thread two equally spaced PWA 29855−3 Aligning Pins (402/12) into the front No. 3 bearing seal assembly inside the diffuser case.

  (b) Align offset holes and position seal on No. 3 bearing support in diffuser case.

  (c) Treat thread and shank of 40 bolts (402/10) with
R Antiseize Paste P06−054. Wipe off unwanted paste.

  (d) (Reference 980) Remove the two PWA 29855−3 Aligning Pins (402/12) as necessary and install the 40 treated bolts to secure seal.

(e) Tighten the 40 bolts (402/10) to 125 - 140 lb-in. (14.123 - 15.818 N.m) in sequence specified in Figure 403. Without loosening bolts, repeat complete tightening sequence specified in Figure 403 two times.

WARNING: BE CAREFUL WHEN YOU USE A FREEZER/DRY-ICE TO COOL PARTS. USE SUITABLE GLOVES WHEN YOU TOUCH THE DRY-ICE OR THE COLD PARTS. THE DRY-ICE OR THE COLD PARTS CAN CAUSE BURNS.

(8) Chill front edge of No. 3 bearing cooling duct assembly (402/4) with dry ice before installation.

(9) Thread two equally spaced PWA 29855-5 Aligning Pins (402/11) into the threaded inserts of the No. 3 bearing rear (carbon) seal (402/5).

(10) Align boltholes and position No. 3 bearing cooling duct assembly (402/4) over No. 3 bearing rear seal. Tap lightly to seat.

(11) Remove the two PWA 29855-5 Aligning Pins (402/11) as necessary from the No. 3 bearing rear (carbon) seal (402/5). Attach duct using 12 gaskets (402/3), shouldered washers (402/2) and bolts (402/1) lubricated with Engine Oil P03-001.

(12) Torque the 12 bolts (402/1) to 85 - 95 lb-in. (9.604 - 10.734 N.m).

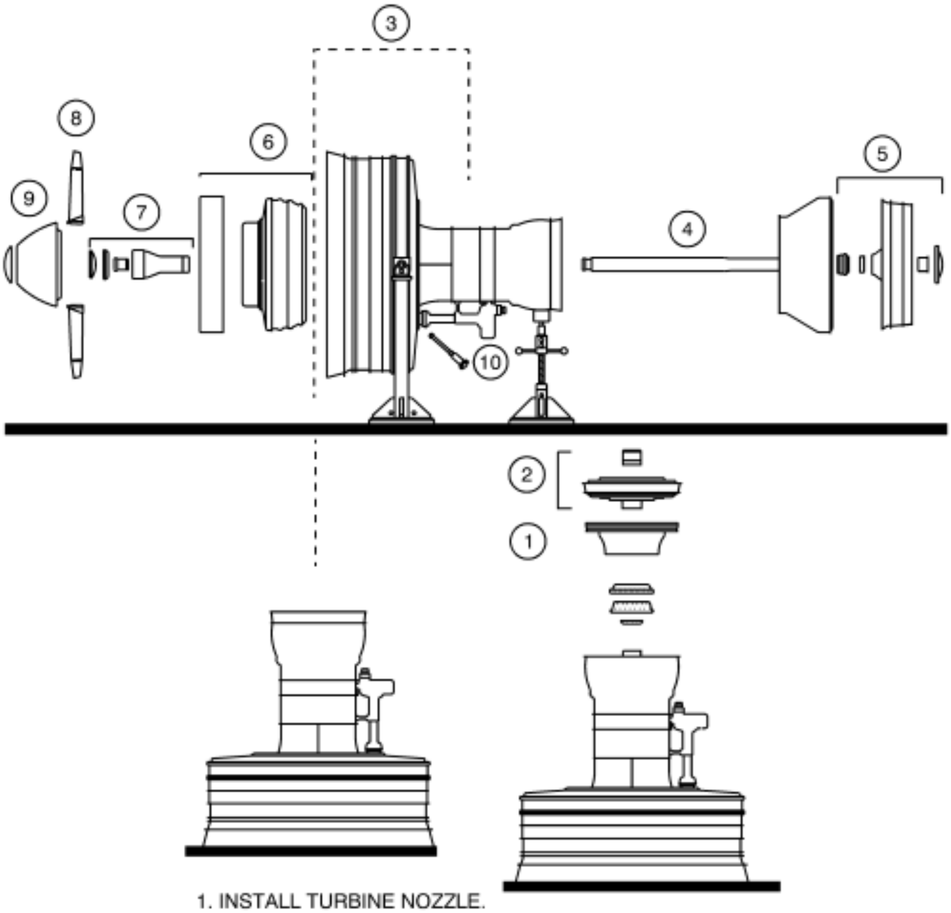
(13) Install PWA 85074 Spacer, larger ID first, over HPC rear hub and seat against No. 3 bearing rear seal seat. Lubricate threads at No. 3 bearing inner race
R retaining nut with Antiseize Paste P06-054. Wipe off
R unwanted paste. Install nut onto shaft to secure spacer. Do not torque nut.

D. Postrequisite Procedures

(1) Install turbine nozzle per 72-00-51, Installation-02 Task 72-00-51-420-002.

(2) Test engine per Repair Test Reference Table. See 71-00-00, Testing-00 Task 71-00-00-990-003.

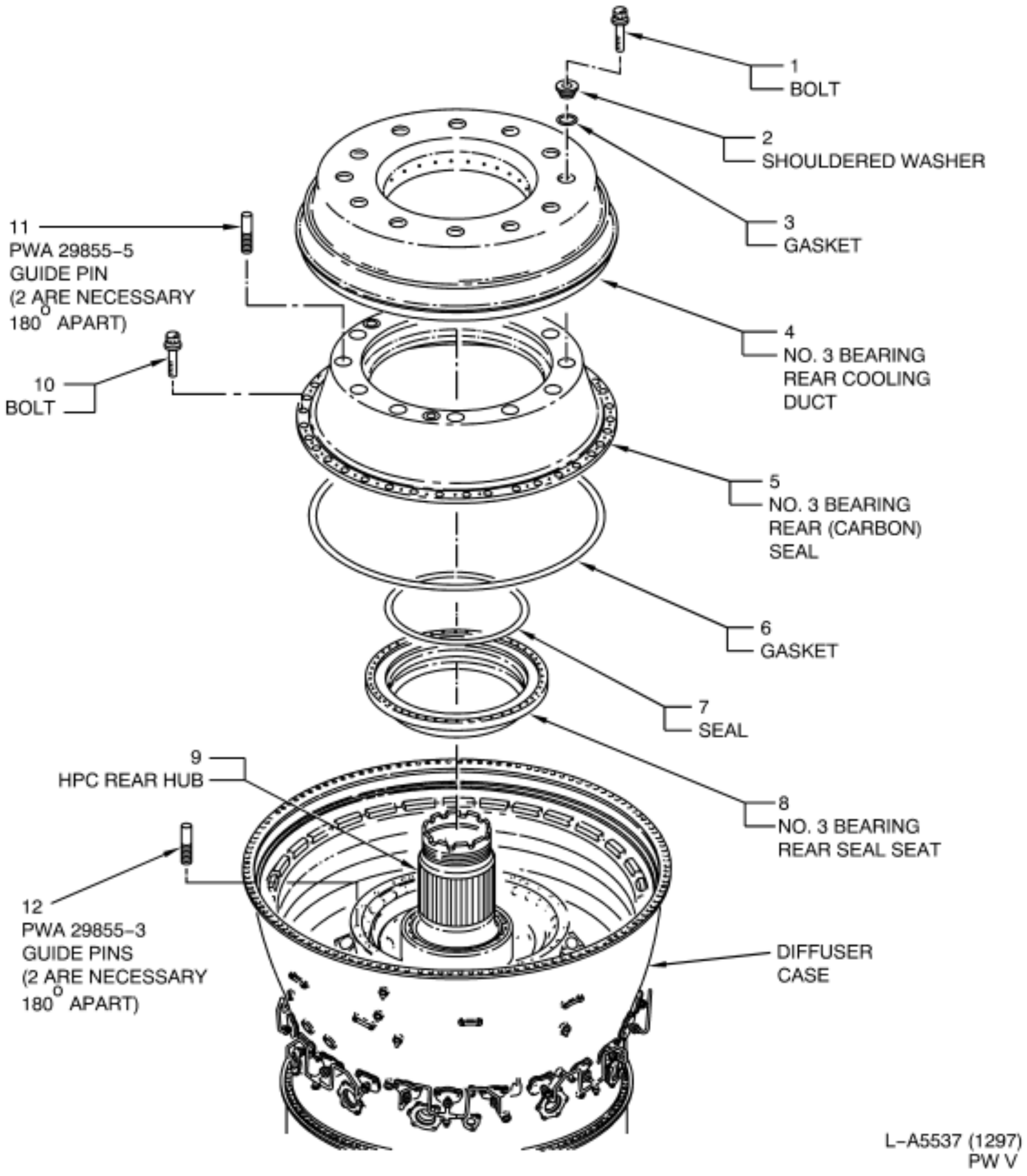
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−09



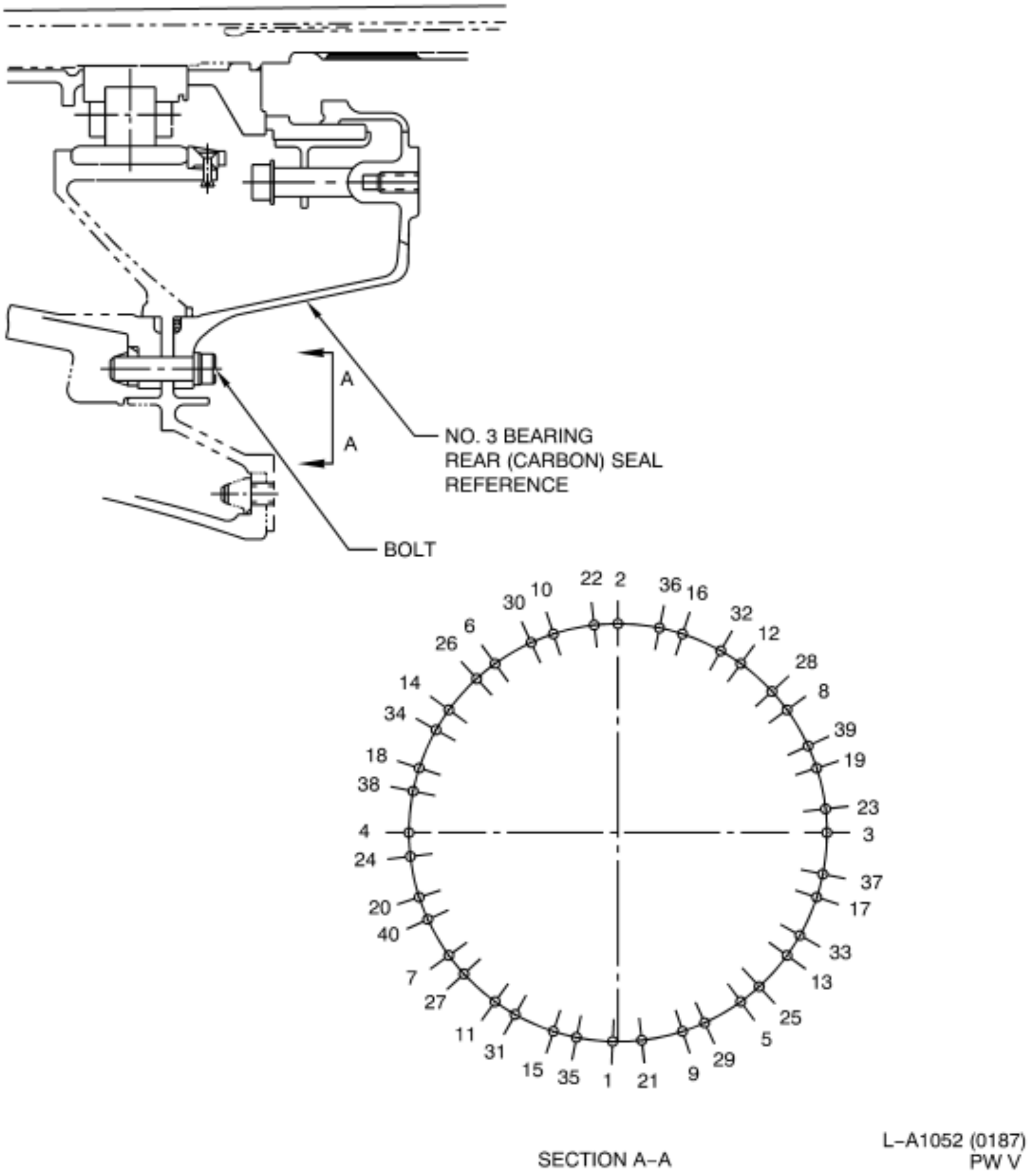
1. INSTALL TURBINE NOZZLE.
2. INSTALL HIGH PRESSURE TURBINE (HPT).
3. TRUNNION FAN CASES THROUGH HPT TO HORIZONTAL.
4. INSTALL LOW PRESSURE TURBINE (LPT).
5. INSTALL TURBINE EXHAUST CASE.
6. INSTALL LOW PRESSURE COMPRESSOR (LPC).
7. INSTALL LPC/LPT COUPLING.
8. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
9. INSTALL COMPRESSOR INLET CONE.
10. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).

L−A1252 (0000)
PW V

Procedure Sequence
Figure 401
(Task 72−00−41−420−004)


1
BOLT
2
SHOULDERED WASHER
3
GASKET
11
PWA 29855-5
GUIDE PIN
(2 ARE NECESSARY
180° APART)
4
NO. 3 BEARING
REAR COOLING
DUCT
10
BOLT
5
NO. 3 BEARING
REAR (CARBON)
SEAL
6
GASKET
7
SEAL
9
HPC REAR HUB
8
NO. 3 BEARING
REAR SEAL SEAT
12
PWA 29855-3
GUIDE PINS
(2 ARE NECESSARY
180° APART)
DIFFUSER
CASE
L-A5537 (1297)
PW V

No. 3 Bearing Rear Seal Assembly And Rear Seal Seat Installation
Figure 402
(Task 72-00-41-420-004)


A
A
NO. 3 BEARING REAR (CARBON) SEAL REFERENCE
BOLT
22 2 36 16 32 12 28 8 39 19 23 3 37 17 33 13 25 5 29 9 21 1 35 15 31 11 27 7 40 20 24 4 38 18 34 14 26 6 30 10
SECTION A−A
L−A1052 (0187)
PW V

Torquing Sequence Diagram For No. 3 Bearing Compartment Bolts
Figure 403
(Task 72−00−41−420−004)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - INSTALLATION-10

Task 72-00-41-460-001:

1. Install Fuel Distribution Valve Strainer

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-053	Lubricant, Seal Ring (PWA 36500)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	2	73-13-00/4/70
Packing	1	73-13-00/5/10
Packing	1	73-13-00/5/30

B. Procedure
See Figure 401.

(1) Remove protective closures.

(2) Install packing lubricated with Seal Ring Lubricant P06-053, to groove on rearward end of strainer and install fuel strainer to ID of fuel distribution valve.

(3) Install two packings lubricated with Seal Ring Lubricant P06-053, to grooves in packing transfer tube assembly. Install valve transfer tube into valve cover.

(4) Install packing lubricated with Seal Ring Lubricant P06-053, to cover and install cover to fuel distribution valve housing. Secure cover with bolts threads lubricated with Engine Oil P03-001. Torque bolts to 30 - 33 lb-in. (3.390 - 3.728 N.m).

(5) Translate transfer tube forward with dowel pin and boltholes aligned.

NOTE: Ensure sealplate is installed against rear flange of fuel flowmeter and dowel pin is aligned.

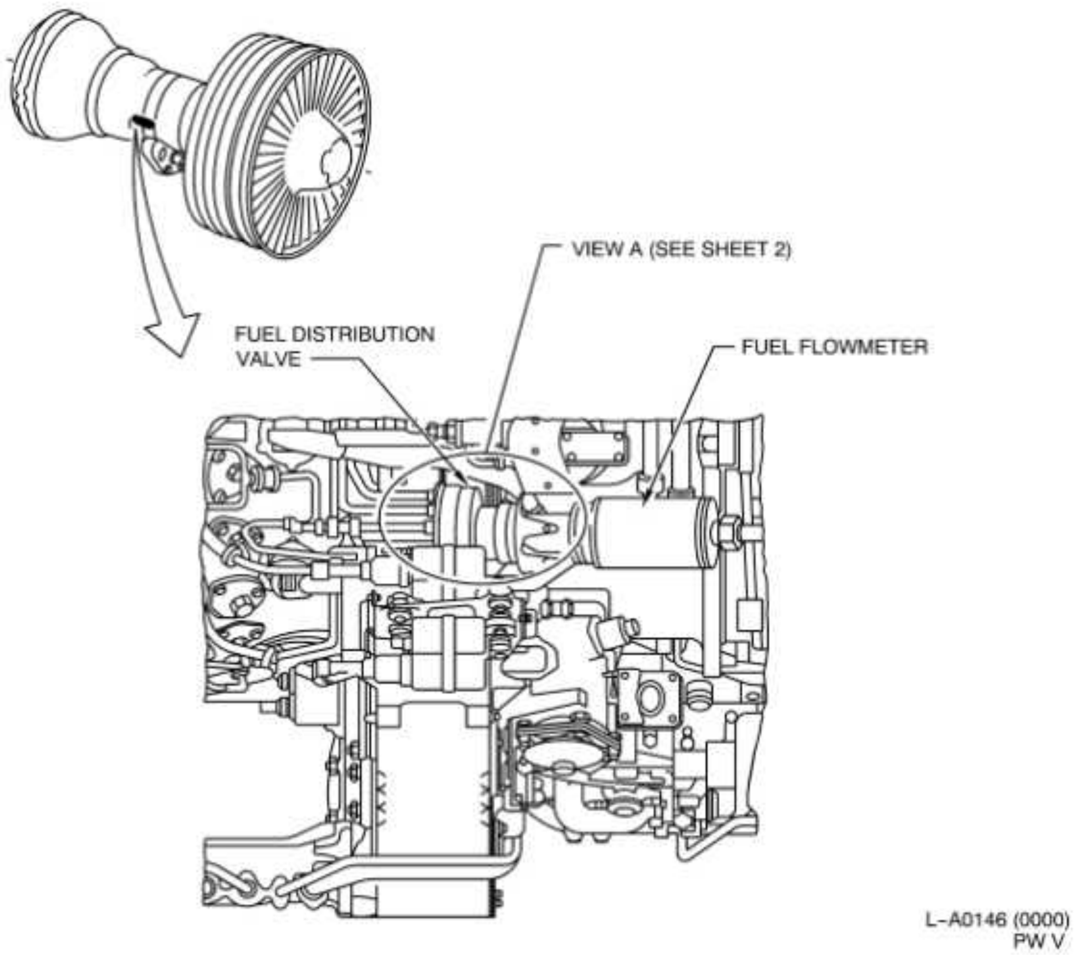
(6) Install the fuel flowmeter support over the transfer tubes, aligning the dowel pin on the transfer tube with the slot in the support. Align the bolt holes in the rear (larger) flange. Install the bracket (Pre SB PW4ENG 73−163 only) over the support and position it as shown in Figure 401.

(7) Secure rear flange with bolts (without drilled heads) lubricated with Engine Oil P03−001. Secure front flange with drilled head bolts lubricated with Engine Oil P03−001.

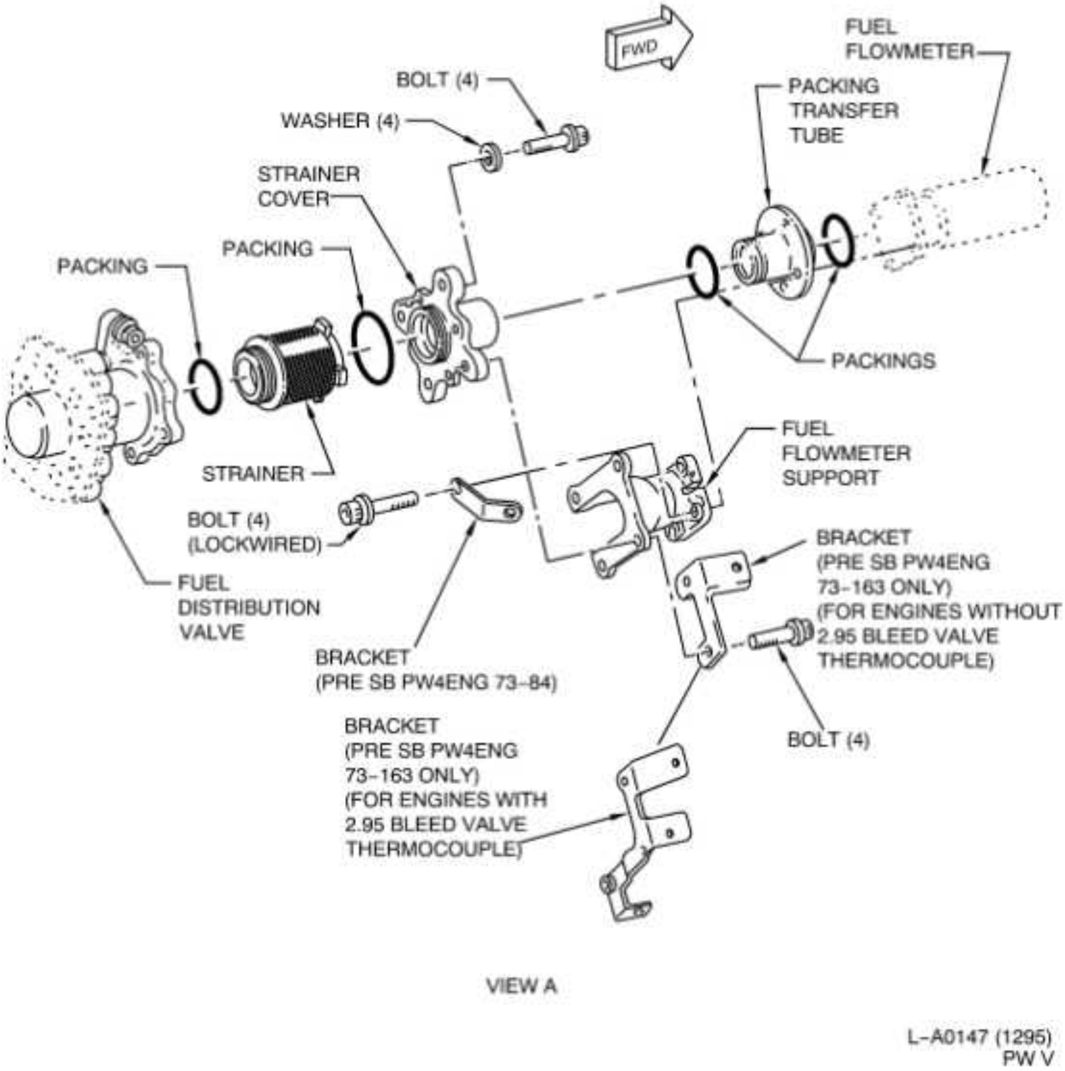
(8) Torque all bolts at front and rear flanges to 85 − 95 lb−in. 9.604 − 10.734 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts at the front flange.

C. Postrequisites

(1) Test engine per Repair Test Reference Table. See 71−00−00, Testing−00 Task 72−00−41−990−003.


VIEW A (SEE SHEET 2)
FUEL DISTRIBUTION VALVE
FUEL FLOWMETER
L−A0146 (0000)
PW V

Fuel Distribution Valve Strainer
Figure 401 (Sheet 1)
(Task 72−00−41−460−001)


FWD
FUEL FLOWMETER
BOLT (4)
WASHER (4)
PACKING TRANSFER TUBE
STRAINER COVER
PACKING
PACKING
PACKINGS
STRAINER
FUEL FLOWMETER SUPPORT
BOLT (4) (LOCKWIRED)
BRACKET (PRE SB PW4ENG 73-163 ONLY) (FOR ENGINES WITHOUT 2.95 BLEED VALVE THERMOCOUPLE)
FUEL DISTRIBUTION VALVE
BRACKET (PRE SB PW4ENG 73-84)
BOLT (4)
BRACKET (PRE SB PW4ENG 73-163 ONLY) (FOR ENGINES WITH 2.95 BLEED VALVE THERMOCOUPLE)
VIEW A
L-A0147 (1295)
PW V

Fuel Distribution Valve Strainer
Figure 401 (Sheet 2)
(Task 72−00−41−460−001)

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - INSTALLATION-11

Task 72-00-41-420-011:

1. Install Combustion Chamber (Outer) (Horizontal)

NOTE: See Figure 401 for part/assembly installation procedure sequence.

A. Prerequisites

(1) See Inspection/Check-01 Task 72-00-41-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows:

B. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 85079	Fixture, Handling
PWA 85060	Pin, Alignment

Consumable Material:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-023	Lubricant (PWA 36001)

C. Procedure
See Figure 402.

CAUTION: WHEN PN 50J488 OUTER COMBUSTION CHAMBER IS INSTALLED PN 50K488 INNER COMBUSTION CHAMBER MUST ALSO BE INSTALLED.

(1) Position outer combustion chamber on its side, with two igniter plug holes at approximately 4 o'clock position as viewed from the rear. Locate 12 o'clock position on the combustion chamber.

(2) Attach overhead hoist to PWA 85079 Fixture and position fixture over combustion chamber.

(3) Loosen two hand knobs on fixture to open clamping plate and position inside the combustion chamber at the 12 o'clock position.

(4) Locate the first step in the clamping plate to the outer rear flange of the combustion chamber and tighten the two hand knobs.

(5) Install three PWA 85060 Alignment Pins equally spaced to bosses on the outer diameter of diffuser case and retract the inner portion of the pins.

(6) Install the combustion chamber into the diffuser case and push the inner portion of the pins in to align the combustion chamber mount lugs with the diffuser case at three places.

(7) Lubricate the threads and seating surface of the twelve doweled end retaining bolts with Lubricant P06−023 and wipe clean any lubricant from other bolt surfaces before installation. Install nine lubricated bolts and washers through the outside of diffuser case to locate the combustion chamber mount lugs. Wipe clean any excess lubricant from the case and/or bolt surfaces.

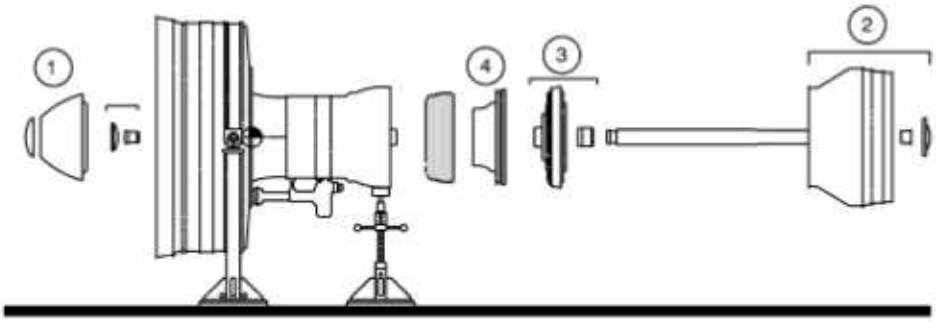
(8) Remove one pin at a time and install the three remaining bolts and washers. (Reference 402). Torque twelve bolts 500 − 600 lb−in. (56.492 − 67.791 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

D. Postrequisites

(1) Install igniter plugs. See 72−00−41, Installation−07 Task 72−00−41−450−004.

(2) Install turbine nozzle − horizontal. See 72−00−51, Installation−01 Task 72−00−51−420−001.

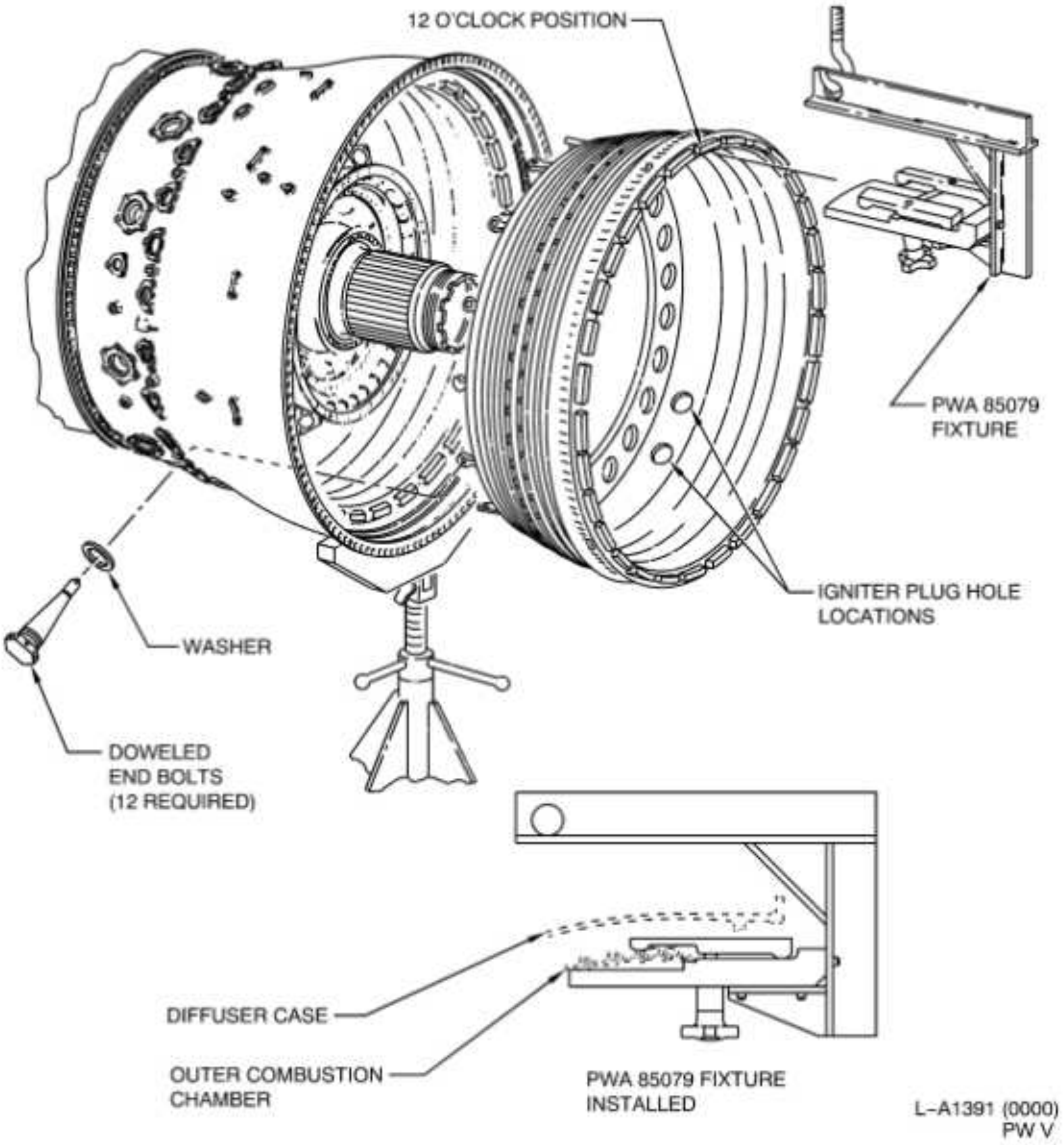
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−11



1. REMOVE COMPRESSOR INLET CONE.
2. REMOVE LOW PRESSURE TURBINE AND TURBINE EXHAUST CASE.
3. REMOVE HIGH PRESSURE TURBINE.
4. REMOVE TURBINE NOZZLE.

L−A1390 (0000)
PW V

Procedure Sequence
Figure 401
(Task 72−00−41−420−011)


12 O'CLOCK POSITION
PWA 85079 FIXTURE
IGNITER PLUG HOLE LOCATIONS
WASHER
DOWELED END BOLTS (12 REQUIRED)
DIFFUSER CASE
OUTER COMBUSTION CHAMBER
PWA 85079 FIXTURE INSTALLED
L−A1391 (0000)
PW V

Combustion Chamber (Outer) Installation
Figure 402
(Task 72−00−41−420−011)

Task 72-00-41-420-012:

1. Install Diffuser And Combustor (Horizontal) With No. 3 Bearing Outer Race Installed

NOTE: See Figure 401 for part/assembly installation procedure sequence.

NOTE: See 72-00-41, Installation-16 Task 72-00-41-420-014 for alternate procedure requiring installation of No. 3 bearing outer race into diffuser combustor group after being installed on HPC.

A. Prerequisites

(1) See 72-00-41, Inspection/Check-01 Task 72-00-41-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows:

(2) For diffuser and combustors that were fully disassembled, assemble the diffuser and combustor by means of 72-41-00, Assembly-01 Task 72-41-00-400-001. For diffuser and combustors with only the No. 3 bearing outer race removed, assemble the diffuser and combustor by 72-41-00, Installation-01 Task 72-41-00-430-001.

B. Equipment And Materials Required

Standard Tools:
0.250-28 Jackscrew (Four Required)
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 26157	Pedestal (Optional To PWA 87359)
PWA 28657	Sling
PWA 29606	Control, Heater (Optional To PWA 29754)
PWA 29754	Control, Heater
PWA 76154	Adapter
PWA 85056	Cover (Optional To PWA 85802)
PWA 85062	Saddle
PWA 85067	Fixture
PWA 85068	Fixture
PWA 85070	Drift

Special Tools:

(CONTINUED)

PWA 85159	Protector
PWA 85168	Protector
PWA 85308	Guide (Optional To PWA 85701)
PWA 85310	Pin (Three Required)
PWA 85679	Heater (Optional To PWA 85795)
PWA 85701	Guide
PWA 85751	Brackets
PWA 85795	Heater
PWA 85802	Cover
PWA 85893	Support
PWA 85909	Adapter
PWA 85910	Adapter
PWA 85926	Cooler
PWA 85983	Adapter, Stabilizer (Two Required Twin Overhead Rail System Only)
PWA 87359	Pedestal
PWA 105513	Heater, Electric (For HPC With The Ring Style Case, Post SB PW4ENG 72−756 Or SB PW4ENG 72−759 As Applicable)

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−059	Wax, Paraffin (PMC 9552)
P05−102	Ice, Dry
P05−289	Lockwire (AS3214−02)
P05−291	Cable, Safety (Optional)
R P05−292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72−00−41/1/1

C. Procedure
See Figure 402.

(1) Remove PWA 85159 Thread Protector and PWA 85428 Knife Edge Protector from HPC rear hub.

CAUTION: HANDLE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN LINT FREE GLOVES TO PREVENT BEARING DAMAGE.

CAUTION: THICKNESS OF NO. 3 BEARING FRONT SEAL SEAT MUST BE MEASURED ACROSS THINNER, ID, SECTION OF SEAL SEAT OR INCORRECT DIMENSION WILL RESULT.

(2) Visually inspect HPC rear drum OD thrust balance knife-edge per 72-00-35, Inspection/Check-02 (visual only) Task 72-00-35-210-004. Reject the airseal with cracks confirmed by visual inspection.

(3) Measure thickness of No. 3 bearing front seal seat across (402/3) thinner, ID, section of seal seat. Measure No. 3 bearing seal spacer (402/2) thickness, No. 3 bearing inner race and rollers (402/1) thickness. Record this total thickness as Dimension A.

(4) Measure distance from end of HPC rear hub (402/4) down to seal seat shoulder (402/5) on hub. Record this dimension as Dimension B.

NOTE: Dimensions A and B will be used to perform a seating check later during this installation procedure.

(5) Install three PWA 85310 Alignment Pins into rear flange of HPC case. See Figure 403 and Figure 404.

(a) Locate three equally spaced 0.250-28 jackscrew holes in HPC rear flange.

(b) Insert three alignment pins (dowel pins rearward) through unthreaded holes in rear Flange K of HPC case. Secure pins with detail screws.

(6) For engines with a gasket groove on the rear flange of the HPC rear case (Post SB PW4ENG 72-48 and Pre SB PW4ENG 72-756), install gasket to the flange groove and hold in place with Paraffin Wax P05-059. See Figure 403.

NOTE: Engines Pre SB PW4ENG 72-48 and Post SB PW4ENG 72-756 do not accept gasket at Flange K.

(7) For engines with the ring style case (Post SB PW4ENG 72−756 or SB PW4ENG 72−759), use a PWA 105513 Heater to heat the HPC rear case rear flange as follows:

(a) Move the clamp block outboard until it is clear of the HPC rear case rear flange.

(b) Make sure that the thermocouple is in its stored position Adapter as stamped on the tool to prevent damage.

(c) Carefully move the Heater over the HPC rear shaft and engage the six Locator details on the rear case rear flange.

(d) Move the clamp block inboard and tighten the plastic knob.

(e) Move the thermocouple from its stored position adapter to its side of the heater adapter and let it contact the HPC rear case rear flange.

(f) Connect the Heater to the PWA 29606 or PWA 29754 Control.

(g) Heat the HPC rear case rear flange to 300°F (149°C).

(h) When the rear flange is at the correct temperature turn off the Controller.

(i) Put the thermocouple is in its stored position Adapter as stamped on the tool.

(j) Loosen the plastic knob and move the clamp block outboard.

(k) Carefully remove the Heater from the HPC rear case.

(8) Position PWA 85308 Guide or PWA 85701 Guide, larger diameter end first, on HPC rear hub and seat.

(9) Install two PWA 85751 Handling Brackets to diffuser case.

NOTE: If you have a twin overhead rail system you must use PWA 85983 Stabilizer Adapters with PWA 85751 Brackets.

(a) Loosen and remove the clamp bolts that attach the fuel tubes to the Flange K bracket for PWA 85751 Bracket tool installation clearance.

(b) Using hoist, position longer front flange of brackets to rear of front flange of diffuser case at 3 and 9 o'clock locations, locating four pins in front flange of bracket into four boltholes in diffuser case front flange. Position shorter rear flange of bracket to front of diffuser case rear flange and secure with detail nuts and bolts.

(c) Position double spool bracket in rear most two holes as marked on bracket.

(10) Install two PWA 76154 Adapters to spools on PWA 85751 Brackets and attach PWA 28657 Sling and overhead hoist to PWA 76154 Adapters .

(11) With hoist position diffuser combustor behind HPC rear hub. Align dowel pins in HPC rear case with mating holes in diffuser case. With workbolts and nuts, seat diffuser case on HPC rear case. See Figure 405.

(12) Remove PWA 85308 Guide or PWA 85701 Guide from HPC rear hub. See Figure 404.

(13) Position PWA 85062 Saddle and either PWA 87359 Pedestal or PWA 26157 Pedestal at Flange M at rear of diffuser case.

(14) Remove PWA 85390 Lifting Adapter and hoist from high compressor 8th stage bleed pads.

(15) Remove PWA 28657 Sling, PWA 76154 Adapters, and PWA 85751 Brackets.

(16) Install the Flange K hardware as follows. Refer to 72-00-41, Installation-20 (Task 72-00-41-420-020).

(17) Install PWA 85802 Protector Cover or PWA 85056 Protector Cover (406/5) over No. 3 bearing outer race retaining nut installed in housing. If PWA 85056 Protector Cover is used, slowly rotate cover until the three spring plungers seat in holes in retaining nut.

(18) Assemble PWA 85067 Fixture to No. 3 bearing front seal seat. See Figure 406.

(19) Install fixture with seal seat, polished face forward over HPC rear hub and drift to seat if necessary. Remove fixture.

(20) Assemble PWA 85068 Fixture to No. 3 bearing seal spacer.

(21) Install fixture with seal spacer over HPC rear hub and drift to seat if necessary. Remove fixture.

(22) Remove PWA 85168 Protector from diffuser case. See Figure 407.

(23) Remove PWA 85802 Protector Cover or PWA 85056 Protector Cover from housing.

(24) Chill HPC hub with PWA 85926 Cooler with Dry Ice P05−102.

(25) Install cooler in HPC hub and attach shop air to cooler.

(26) Heat No. 3 bearing outer race with PWA 85795 Heater or PWA 85679 Heater and PWA 29754 Control or equivalent.

(27) Remove three hex head cap screws with washers from storage holes in heater and attach heater to diffuser case flange with cap screws.

(28) After parts are properly heated and chilled, remove heater and cooler.

CAUTION: HANDLE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN LINT FREE GLOVES TO PREVENT BEARING DAMAGE.

(29) Install No. 3 bearing inner race and rollers onto HPC rear hub, puller groove out. Seat bearing with PWA 85070 Drift.

(30) Install PWA 85168 Protector in diffuser case.

(31) Allow hub and bearing to return to room temperature. With depth gage measure distance from end of HPC rear hub into rear of inner race and rollers. Record this distance as Dimension C. See Figure 402.

(32) Dimension C must not be less than previously taken Dimension B minus Dimension A. See Figure 402.

NOTE: Dimension C less than required indicates bearing is not fully seated.

(33) Remove PWA 85893 Support (407/2) and PWA 85909 Adapter (407/1) or PWA 85910 Adapter if used as an alternate to PWA 85909 Adapter. See Figure 408.

(34) Install PWA 85159 Thread Protector over HPC rear hub.

D. Postrequisites

(1) Connect/Install The External Parts To Complete Installation Of Diffuser Combustor. Refer to 72-00-41, Installation-02 (Task 72-00-41-420-002).

(2) Install The No. 3 Bearing Seal Assembly And Seal Seat. Refer to 72-00-41, Installation-03 (Task 72-00-41-420-003).

(3) Vacuum Check The No. 3 Bearing Compartment. Refer to 72-00-41, Inspection/Check-07 (Task 72-00-41-720-001).

(4) Install The Turbine Nnozzle. Refer to 72-00-51, Installation-01 (Task 72-00-51-420-001).

(5) Install The High Pressure Turbine - Horizontal. Refer to 72-00-52, Installation-01 (Task 72-00-52-420-001).

(6) Install The No. 1 Bearing Support Assembly. Refer to 72-00-34, Installation-04 (Task 72-00-34-450-002).

(7) Install The Fan Case. Refer to 72-00-33, Installation-01 (Task 72-00-33-420-001).

(8) Install The Low Pressure Turbine With Shaft. Refer to 72-00-53, Installation-01 (Task 72-00-53-420-001).

(9) Install The Turbine Exhaust Case. Refer to 72-00-54, Installation-01 (Task 72-00-54-420-001).

(10) Install The Low Pressure Compressor. Refer to 72-00-31, Installation-01 (Task 72-00-31-420-003).

(11) Install The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed). Refer to 72-00-32, Installation-01 (Task 72-00-32-420-001).

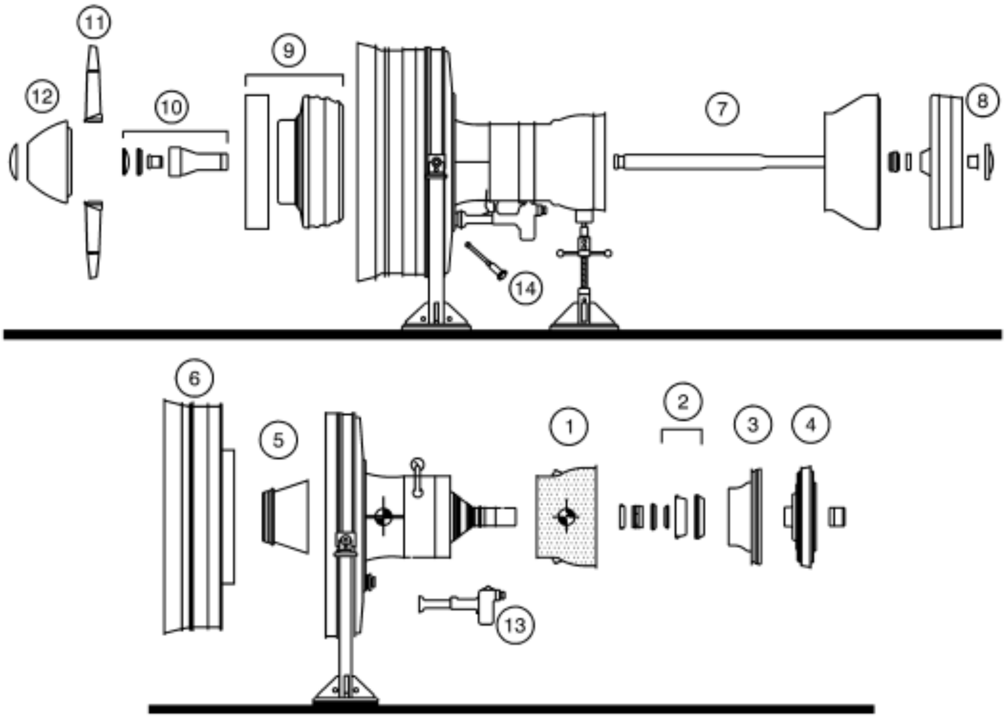
(12) Install The Stage 1 LPC Blade Assemblies. Refer to 72−00−31, Installation−04 (Task 72−00−31−420−002−002).

(13) Install The Compressor Inlet Cone. Refer to 72−00−31, Installation−02 (Task 72−00−31−420−001).

(14) Install The Main Gearbox. Refer to 72−00−61, Installation−01 (Task 72−00−61−420−001).

(15) Install The Electronic Engine Control (EEC) Speed Transducer (N1). Refer to 72−00−34, Installation−03 (Task 72−00−34−450−001).

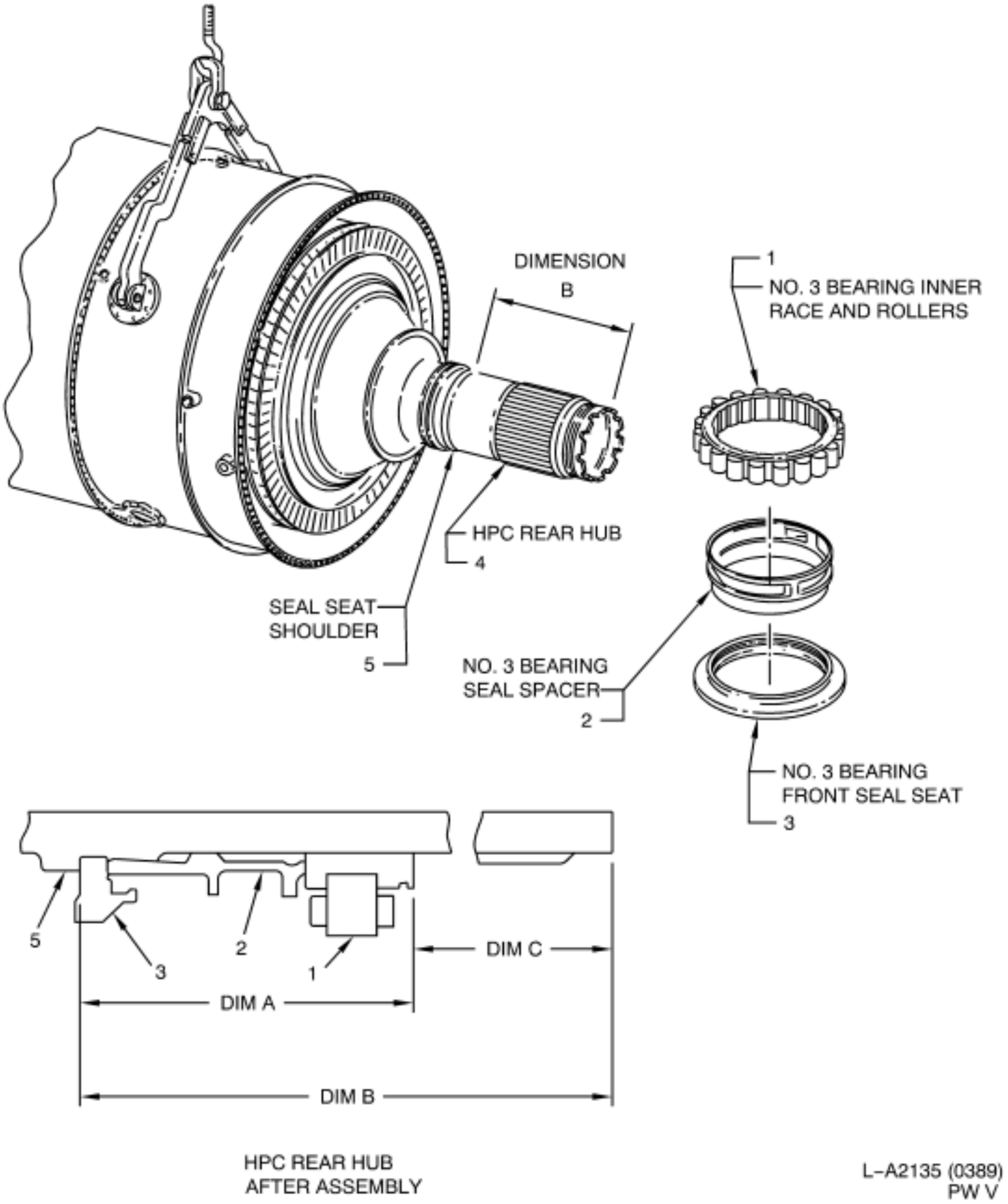
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−12



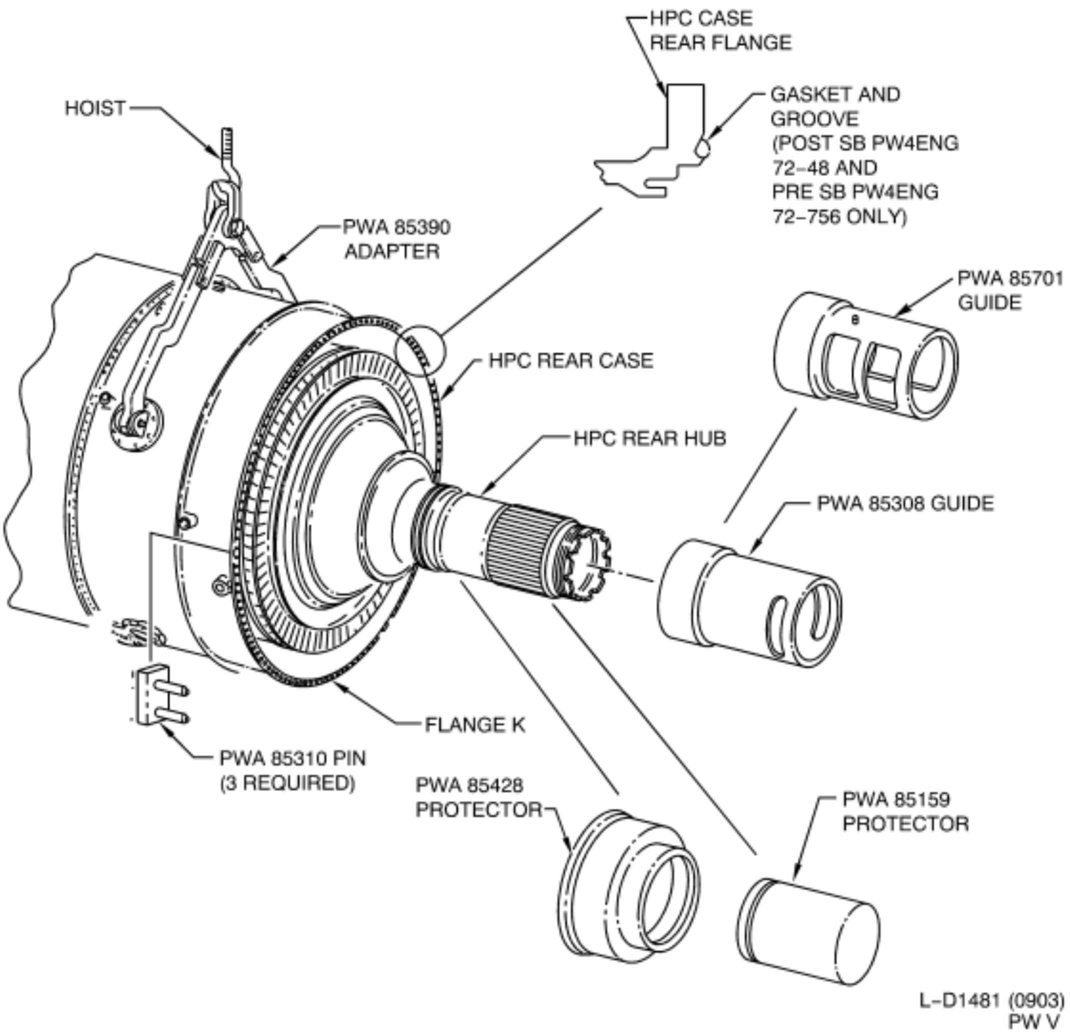
1. INSTALL DIFFUSER AND COMBUSTOR.
2. INSTALL NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL SEAT.
3. INSTALL TURBINE NOZZLE.
4. INSTALL HIGH PRESSURE TURBINE (HPT).
5. INSTALL NO. 1 BEARING SUPPORT ASSEMBLY.
6. INSTALL FAN CASE.
7. INSTALL LOW PRESSURE TURBINE (LPT).
8. INSTALL TURBINE EXHAUST CASE.
9. INSTALL LOW PRESSURE COMPRESSOR (LPC).
10. INSTALL LPC/LPT COUPLING.
11. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
12. INSTALL COMPRESSOR INLET CONE.
13. INSTALL MAIN GEARBOX.
14. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).

L−A1392 (0000)
PW V

Procedure Sequence
Figure 401
(Task 72−00−41−420−012)

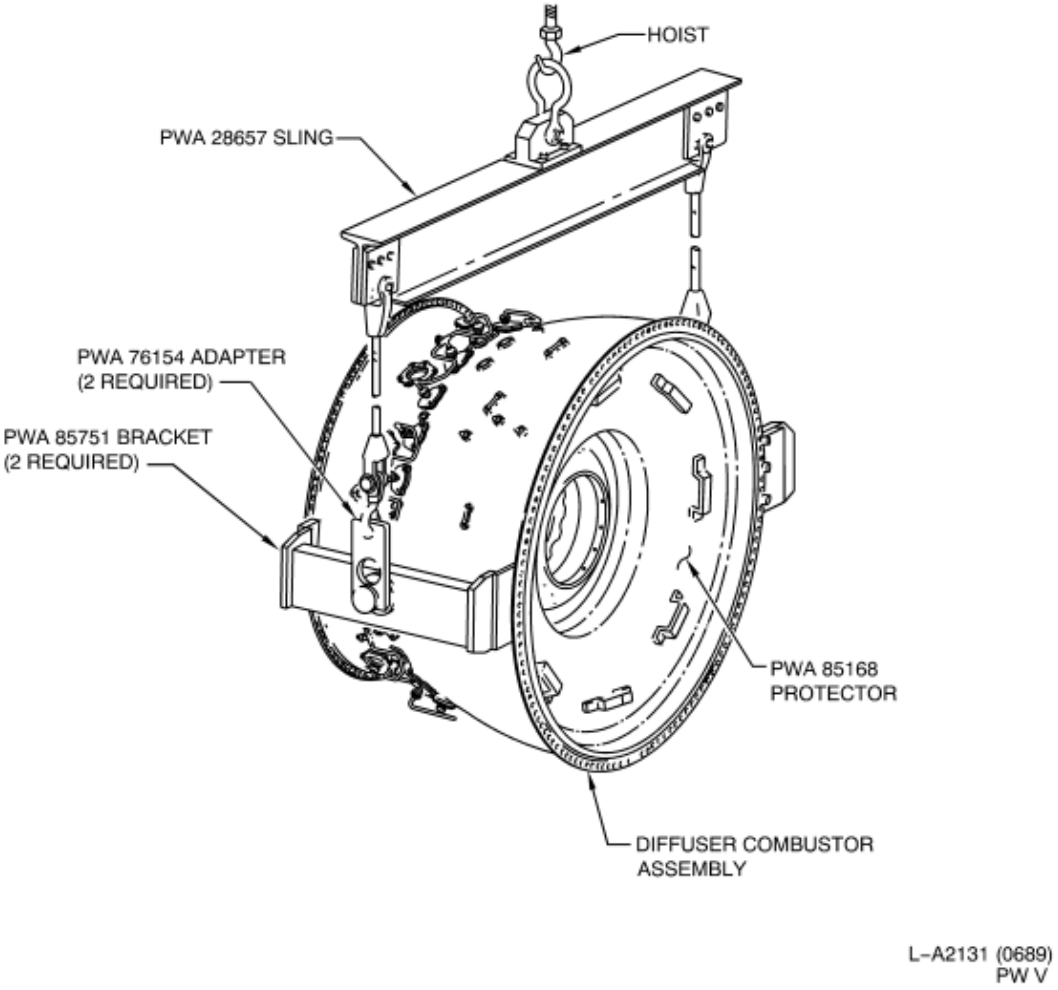

DIMENSION
B
1
NO. 3 BEARING INNER
RACE AND ROLLERS
HPC REAR HUB
4
SEAL SEAT
SHOULDER
5
NO. 3 BEARING
SEAL SPACER
2
NO. 3 BEARING
FRONT SEAL SEAT
3
5
3
2
1
DIM C
DIM A
DIM B
HPC REAR HUB
AFTER ASSEMBLY
L−A2135 (0389)
PW V

No. 3 Bearing Seating Check Measurement
Figure 402
(Task 72−00−41−420−012)


HPC CASE
REAR FLANGE
GASKET AND
GROOVE
(POST SB PW4ENG
72−48 AND
PRE SB PW4ENG
72−756 ONLY)
HOIST
PWA 85390
ADAPTER
PWA 85701
GUIDE
HPC REAR CASE
HPC REAR HUB
PWA 85308 GUIDE
FLANGE K
PWA 85310 PIN
(3 REQUIRED)
PWA 85428
PROTECTOR
PWA 85159
PROTECTOR
L−D1481 (0903)
PW V

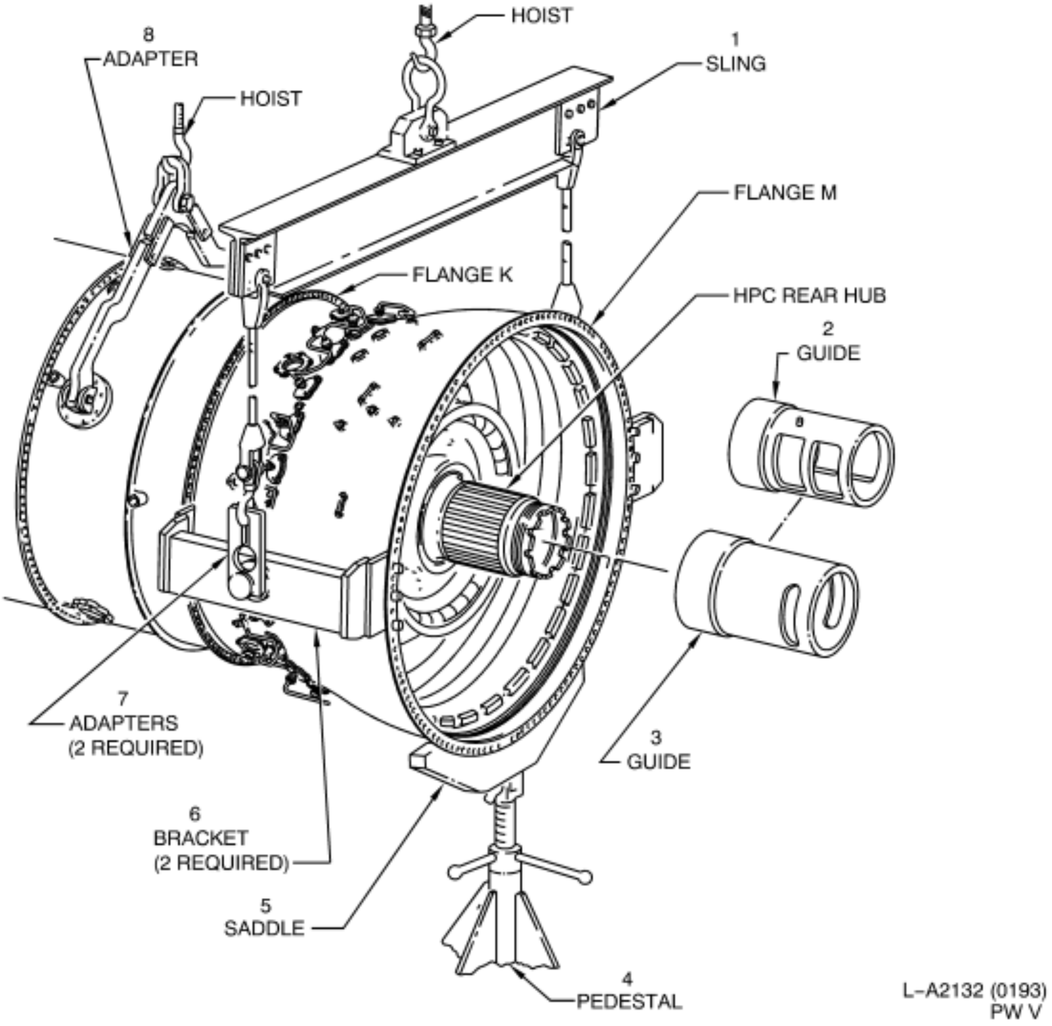
Diffuser And Combustor Installation
Figure 403
(Task 72−00−41−420−012)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−12


HOIST
PWA 28657 SLING
PWA 76154 ADAPTER
(2 REQUIRED)
PWA 85751 BRACKET
(2 REQUIRED)
PWA 85168
PROTECTOR
DIFFUSER COMBUSTOR
ASSEMBLY
L−A2131 (0689)
PW V

Diffuser And Combustor Installation
Figure 404
(Task 72−00−41−420−012)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−12


HOIST
8
ADAPTER
1
SLING
HOIST
FLANGE M
FLANGE K
HPC REAR HUB
2
GUIDE
7
ADAPTERS
(2 REQUIRED)
3
GUIDE
6
BRACKET
(2 REQUIRED)
5
SADDLE
4
PEDESTAL
L−A2132 (0193)
PW V

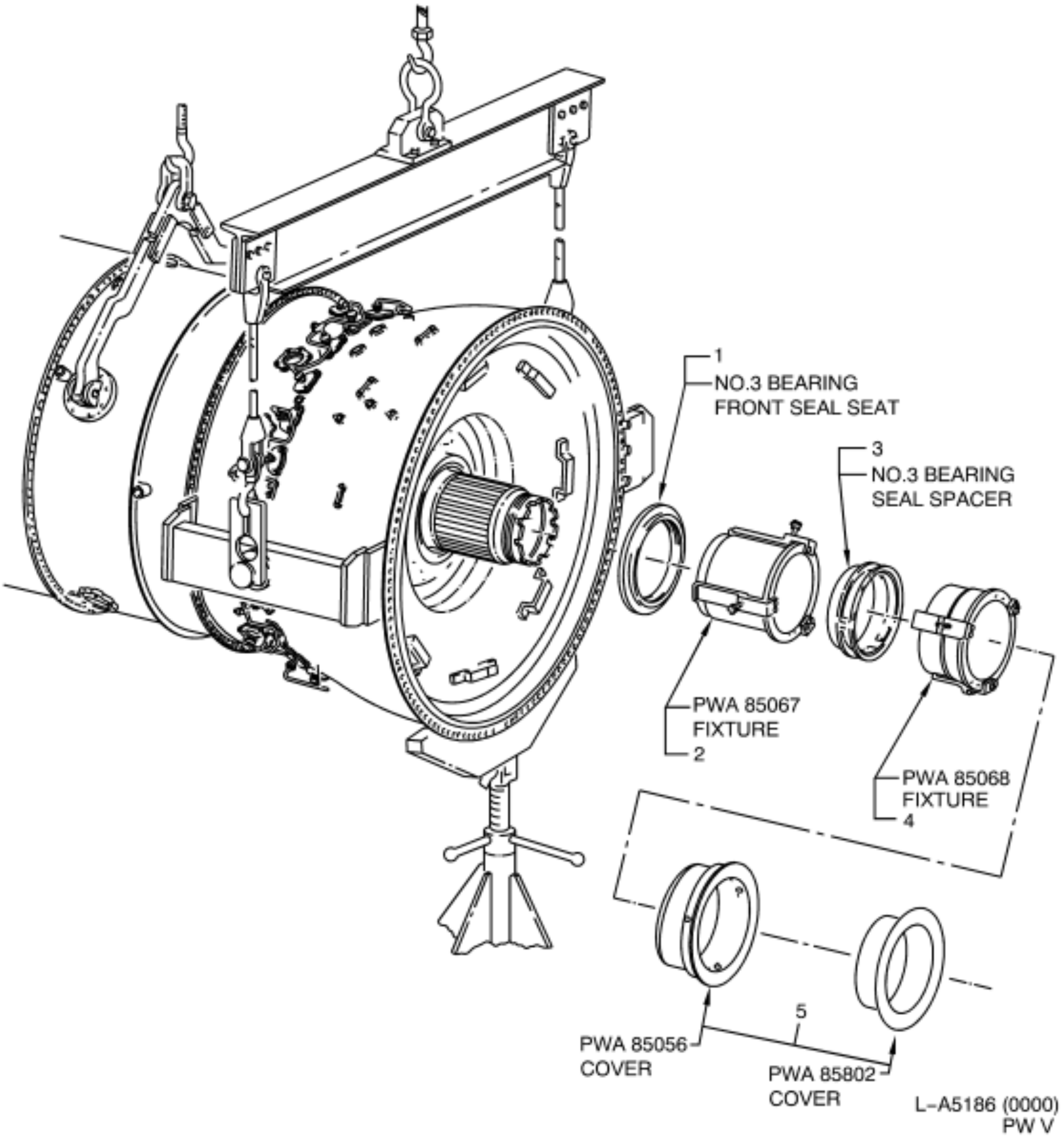
Diffuser And Combustor Installation
Figure 405
(Task 72−00−41−420−012)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−12

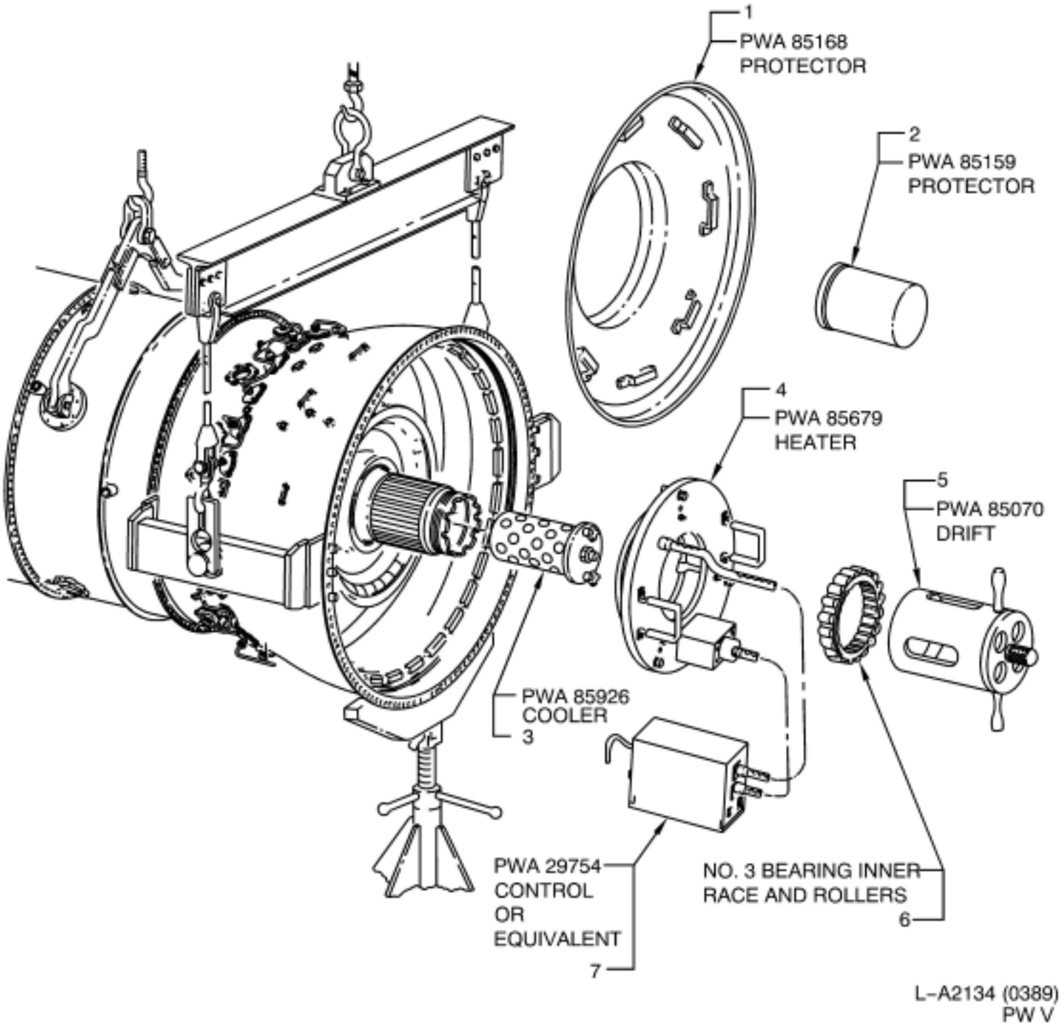
1. PWA 28657
2. PWA 85701
3. PWA 85308
4. PWA 26157 Or 87359
5. PWA 85062
6. PWA 85751
7. PWA 76154
8. PWA 85390

Key to Figure 405

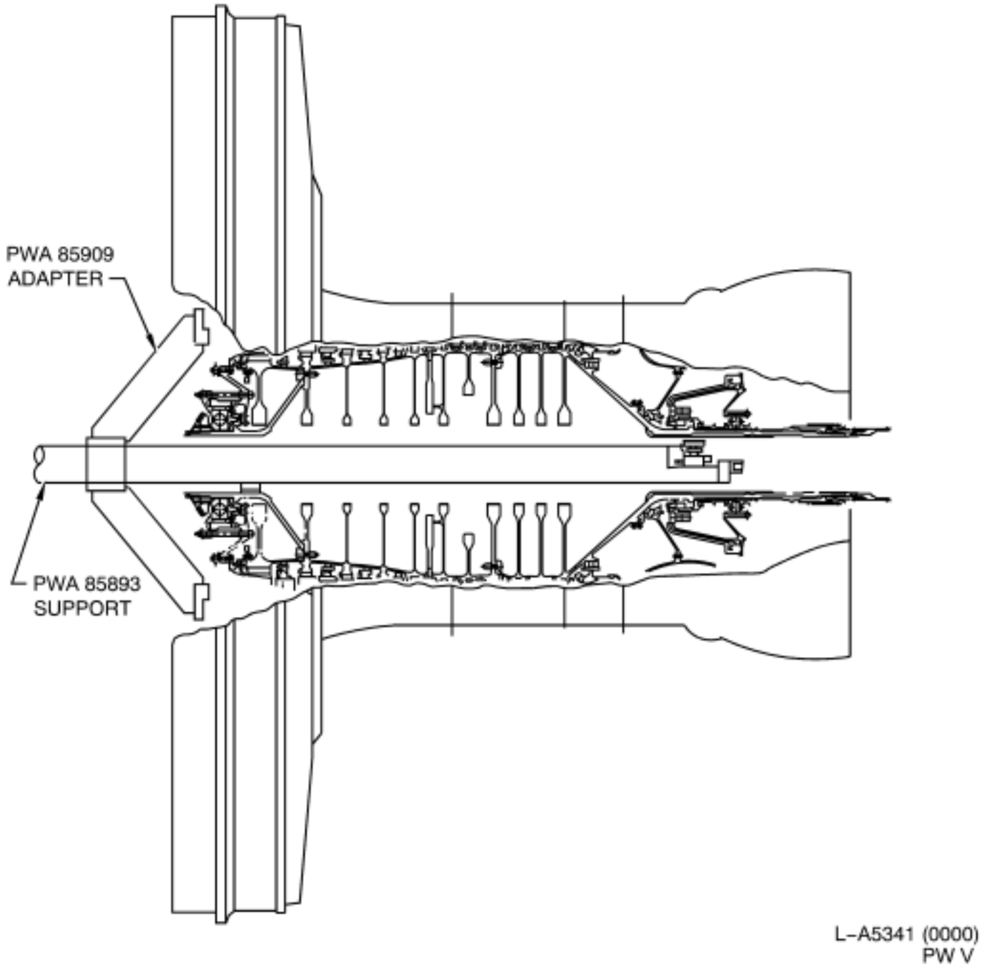
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−12


1
NO.3 BEARING FRONT SEAL SEAT
3
NO.3 BEARING SEAL SPACER
PWA 85067 FIXTURE
2
PWA 85068 FIXTURE
4
5
PWA 85056 COVER
PWA 85802 COVER
L−A5186 (0000)
PW V

Diffuser And Combustor Installation
Figure 406
(Task 72−00−41−420−012)


1
PWA 85168
PROTECTOR
2
PWA 85159
PROTECTOR
4
PWA 85679
HEATER
5
PWA 85070
DRIFT
PWA 85926
COOLER
3
PWA 29754
CONTROL
OR
EQUIVALENT
7
NO. 3 BEARING INNER
RACE AND ROLLERS
6
L−A2134 (0389)
PW V

Diffuser And Combustor Installation
Figure 407
(Task 72−00−41−420−012)


PWA 85909
ADAPTER
PWA 85893
SUPPORT
L−A5341 (0000)
PW V

Diffuser And Combustor Installation
Figure 408
(Task 72−00−41−420−012)

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - INSTALLATION-12

Task 72-00-41-420-014:

1. Install Diffuser And Combustor (Horizontal) With No. 3 Bearing Outer Race Installed

NOTE: See Figure 401 for part/assembly installation procedure sequence.

NOTE: See 72-00-41, Installation-16 Task 72-00-41-420-019 for the applicable procedure necessary for the installation of the No. 3 bearing outer race into the diffuser combustor group after installation onto the HPC.

A. Prerequisites

(1) See 72-00-41, Inspection/Check-01 Task 72-00-41-990-001 for interface fits and clearances. Special torques and special assembly procedures show where necessary in the text that follows and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows:

(2) For diffuser and combustors that were fully disassembled, assemble the diffuser and combustor by 72-41-00, Assembly-01 Task 72-41-00-400-001. For diffuser and combustors with only the No. 3 bearing outer race removed, assemble the diffuser and combustor by 72-41-00, Installation-01 Task 72-41-00-430-001.

B. Equipment And Materials Necessary

Standard Tools:

0.250-28 Jackscrew (Four Necessary)
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 26157	Pedestal (Optional To PWA 87359)
PWA 28657	Sling
PWA 29606	Control, Heater (Optional To PWA 29754)
PWA 29754	Control, Heater
PWA 76154	Adapter
PWA 85056	Cover (Optional To PWA 85802)
PWA 85062	Saddle
PWA 85067	Fixture
PWA 85068	Fixture
PWA 85070	Drift

Special Tools:

(CONTINUED)

PWA 85159	Protector
PWA 85168	Protector
PWA 85308	Guide (Optional To PWA 85701)
PWA 85310	Pin (Three Necessary)
PWA 85679	Heater (Optional To PWA 85795)
PWA 85701	Guide
PWA 85751	Brackets
PWA 85795	Heater
PWA 85802	Cover
PWA 85893	Support
PWA 85909	Adapter
PWA 85910	Adapter
PWA 85926	Cooler
PWA 85983	Adapter, Stabilizer (Two Necessary Twin Overhead Rail System Only)
PWA 87359	Pedestal
PWA 105513	Heater, Electric (For HPC With The Ring Style Case, Post SB PW4ENG 72-756 Or SB PW4ENG 72-759 As Applicable)

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-059	Wax, Paraffin (PMC 9552)
	P05-102	Ice, Dry
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
R	P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72-00-41/1/1

C. Procedure
See Figure 402.

(1) Remove the PWA 85159 Thread Protector and PWA 85428 Knife-Edge Protector from the HPC rear hub.

CAUTION: WEAR CLEAN LINT FREE GLOVES WHEN YOU TOUCH THE NO. 3 BEARING INNER RACE AND ROLLERS TO PREVENT DAMAGE.

CAUTION: THICKNESS OF NO. 3 BEARING FRONT SEAL SEAT MUST BE MEASURED ACROSS THE THINNER, ID, SECTION OF THE SEAL SEAT OR AN INCORRECT DIMENSION WILL RESULT.

(2) Make a visual inspection of the HPC rear drum OD thrust balance knife−edge by 72−00−35, Inspection/Check−02 (visual only) Task 72−00−35−210−004. Reject the airseal with cracks found by visual inspection.

(3) Measure the thickness of the No. 3 bearing front seal seat across (402/3) the thinner, ID, section of the seal seat. Measure the No. 3 bearing seal spacer (402/2) thickness and the No. 3 bearing inner race and rollers (402/1) thickness. Make a record of this total thickness as Dimension A.

(4) Measure the distance from the end of the HPC rear hub (402/4) down to the seal seat shoulder (402/5) on the hub. Make a record this dimension as Dimension B.

NOTE: Dimensions A and B are used to do a seating check later during this installation procedure.

(5) Install three PWA 85310 Alignment Pins into the rear flange of the HPC case. See Figure 403 and Figure 404.

(a) Locate three equally spaced 0.250−28 jackscrew holes in the HPC rear flange.

(b) Insert three alignment pins (dowel pins rearward) through the unthreaded holes in the rear of Flange K of the HPC case. Attach the pins with the detail screws.

(6) For engines with a gasket groove on the rear flange of the HPC rear case (Pre SB PW4ENG 72−756 or SB PW4ENG 72−759), install a gasket to the flange groove and hold in place with Paraffin Wax P05−059. See Figure 403.

(7) For engines with the ring style case, (Post SB PW4ENG 72−756 or SB PW4ENG 72−759), use a PWA 105513 Heater to heat the HPC rear case rear flange as follows:

(a) Move the clamp block outboard until it is clear of the HPC rear case rear flange.

(b) Make sure that the thermocouple is in its stored position Adapter as stamped on the tool to prevent damage.

(c) Carefully move the Heater over the HPC rear shaft and engage the six Locator details on the rear case rear flange.

(d) Move the clamp block inboard and tighten the plastic knob.

(e) Move the thermocouple from its stored position adapter to its side of the heater adapter and let it contact the HPC rear case rear flange.

(f) Connect the Heater to the PWA 29606 or PWA 29754 Control.

(g) Heat the HPC rear case rear flange to 300°F (149°C).

(h) When the rear flange is at the correct temperature turn off the Controller.

(i) Put the thermocouple is in its stored position Adapter as stamped on the tool.

(j) Loosen the plastic knob and move the clamp block outboard.

(k) Carefully remove the Heater from the HPC rear case.

(8) Install the PWA 85308 Guide or PWA 85701 Guide, larger diameter end first, to the HPC rear hub and engage on the seal seat shoulder.

(9) Install two PWA 85751 Handling Brackets to the diffuser case.

NOTE: If you have a twin overhead rail system you must use PWA 85983 Stabilizer Adapters with PWA 85751 Brackets.

(a) Loosen and remove the clamp bolts that attach the fuel tubes to the Flange K bracket for PWA 85751 Bracket tool installation clearance.

(b) Use a hoist and install the longer front flange of the brackets to the rear of the front flange of the diffuser case at the 3 and 9 o'clock locations. Install the four pins in the front flange of the bracket into the four boltholes in the diffuser case front flange. Install the shorter rear flange of the bracket to the front of diffuser case rear flange and attach with detail nuts and bolts.

(c) Install the double spool bracket to the rear most two holes as marked on the bracket.

(10) Install two PWA 76154 Adapters to the spools on the PWA 85751 Brackets and attach the PWA 28657 Sling and overhead hoist to the PWA 76154 Adapters.

(11) Use a hoist and install the diffuser and combustor assembly over the HPC rear hub. Align the dowel pins in the HPC rear case with the holes in the diffuser case. With workbolts and nuts, seat the diffuser case on the HPC rear case.

(12) Remove the PWA 85308 Guide or PWA 85701 Guide from the HPC rear hub. See Figure 404.

(13) Install the PWA 85062 Saddle and the PWA 87359 Pedestal or PWA 26157 Pedestal at Flange M at the rear of the diffuser case.

(14) Remove the PWA 85390 Lifting Adapter and hoist from the high compressor 8th stage bleed pads.

(15) Remove the PWA 28657 Sling, PWA 76154 Adapters and the PWA 85751 Brackets.

(16) Install the Flange K hardware as follows. Refer to 72−00−41, Installation−20 (Task 72−00−41−420−020).

(17) Install the PWA 85802 Protector Cover or PWA 85056 Protector Cover (406/5) over the No. 3 bearing outer race retaining nut installed in the housing. If PWA 85056 Protector Cover is used, slowly turn the cover until the three spring plungers engage in the holes in retaining nut.

(18) Assemble the PWA 85067 Fixture to the No. 3 bearing front seal seat. See Figure 406.

(19) Install the fixture with seal seat, polished face forward over the HPC rear hub and drift to seat if necessary. Remove the fixture.

(20) Assemble the PWA 85068 Fixture to the No. 3 bearing seal spacer.

(21) Install the fixture with the seal spacer over HPC rear hub and drift to seat if necessary. Remove fixture.

(22) Remove the PWA 85168 Protector from the diffuser case. See Figure 407.

(23) Remove the PWA 85802 Protector Cover or PWA 85056 Protector Cover from the housing.

(24) Chill the HPC hub with the PWA 85926 Cooler and Dry Ice P05−102.

(25) Install the cooler in the HPC hub and attach shop air to the cooler.

(26) Heat the No. 3 bearing outer race with the PWA 85795 Heater or PWA 85679 Heater and PWA 29754 Control or equivalent.

(27) Remove three hex head cap screws with washers from the storage holes in the heater and attach the heater to the diffuser case flange with cap screws.

(28) After parts are correctly heated and chilled, remove the heater and cooler.

CAUTION: WEAR CLEAN LINT FREE GLOVES WHEN YOU TOUCH THE NO. 3 BEARING INNER RACE AND ROLLERS TO PREVENT BEARING DAMAGE.

(29) Install the No. 3 bearing inner race and rollers onto the HPC rear hub, puller groove out. Seat the bearing with the PWA 85070 Drift.

(30) Install the PWA 85168 Protector in the diffuser case.

(31) Permit the hub and bearing to return to room temperature. With a depth gage measure the distance from the end of HPC rear hub into the rear of the inner race and rollers. Make a record of this distance as Dimension C. See Figure 402.

(32) Dimension C must not be less than Dimension B minus Dimension A. See Figure 402.

NOTE: An indication that the bearing is not fully seated is when Dimension C is less than necessary.

(33) Remove the PWA 85893 Support (407/2) and PWA 85909 Adapter (407/1) or PWA 85910 Adapter if used as an option to the PWA 85909 Adapter. See Figure 408.

(34) Install the PWA 85159 Thread Protector over the HPC rear hub.

D. Postrequisites

(1) Connect/Install The External Parts To Complete Installation Of Diffuser Combustor. Refer to 72-00-41, Installation-02 (Task 72-00-41-420-002).

(2) Install The No. 3 Bearing Seal Assembly And Seal Seat. Refer to 72-00-41, Installation-03 (Task 72-00-41-420-003).

(3) Vacuum Check The No. 3 Bearing Compartment. Refer to 72-00-41, Inspection/Check-07 (Task 72-00-41-720-001).

(4) Install The Turbine Nnozzle. Refer to 72-00-51, Installation-01 (Task 72-00-51-420-001).

(5) Install The High Pressure Turbine - Horizontal. Refer to 72-00-52, Installation-01 (Task 72-00-52-420-001).

(6) Install The No. 1 Bearing Support Assembly. Refer to 72-00-34, Installation-04 (Task 72-00-34-450-002).

(7) Install The Fan Case. Refer to 72-00-33, Installation-01 (Task 72-00-33-420-001).

(8) Install The Low Pressure Turbine With Shaft. Refer to 72-00-53, Installation-01 (Task 72-00-53-420-001).

(9) Install The Turbine Exhaust Case. Refer to 72-00-54, Installation-01 (Task 72-00-54-420-001).

(10) Install The Low Pressure Compressor. Refer to 72-00-31, Installation-01 (Task 72-00-31-420-003).

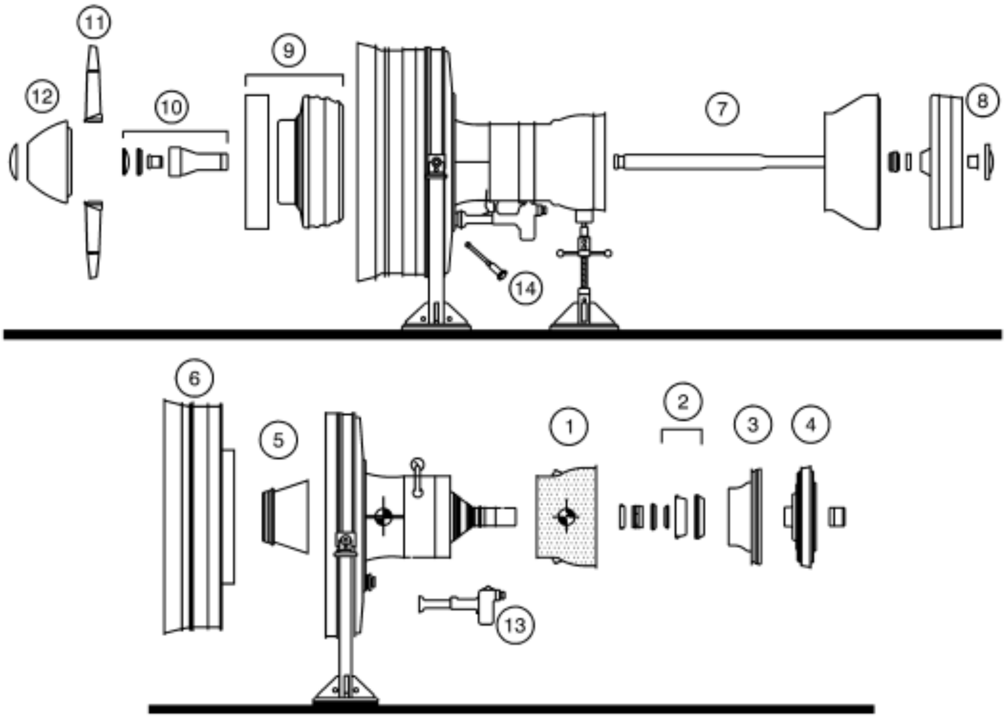
(11) Install The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed). Refer to 72-00-32, Installation-01 (Task 72-00-32-420-001).

(12) Install The Stage 1 LPC Blade Assemblies. Refer to 72-00-31, Installation-04 (Task 72-00-31-420-002-002).

(13) Install The Compressor Inlet Cone. Refer to 72-00-31, Installation-02 (Task 72-00-31-420-001).

(14) Install The Main Gearbox. Refer to 72-00-61, Installation-01 (Task 72-00-61-420-001).

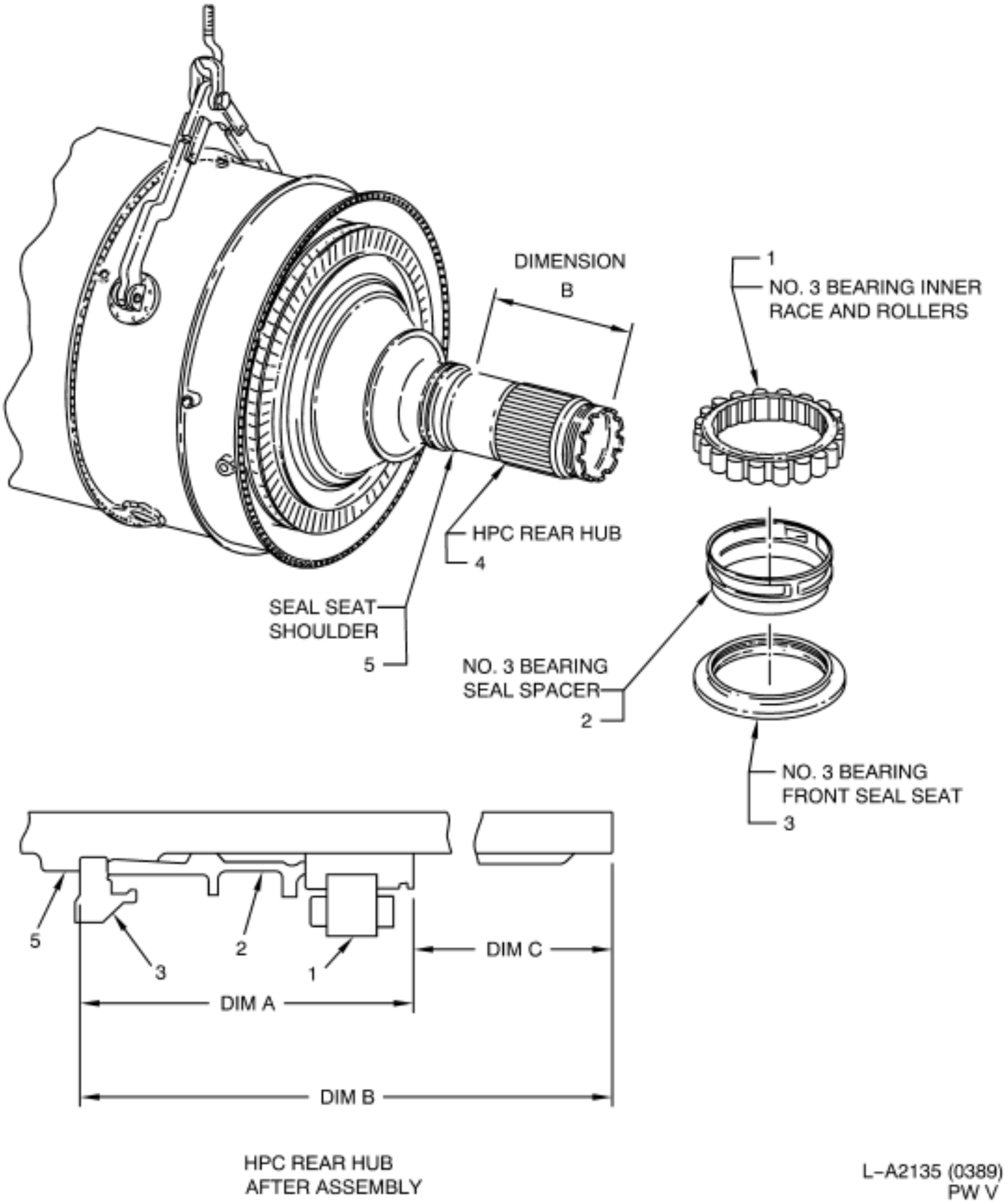
(15) Install The Electronic Engine Control (EEC) Speed Transducer (N1). Refer to 72-00-34, Installation-03 (Task 72-00-34-450-001).



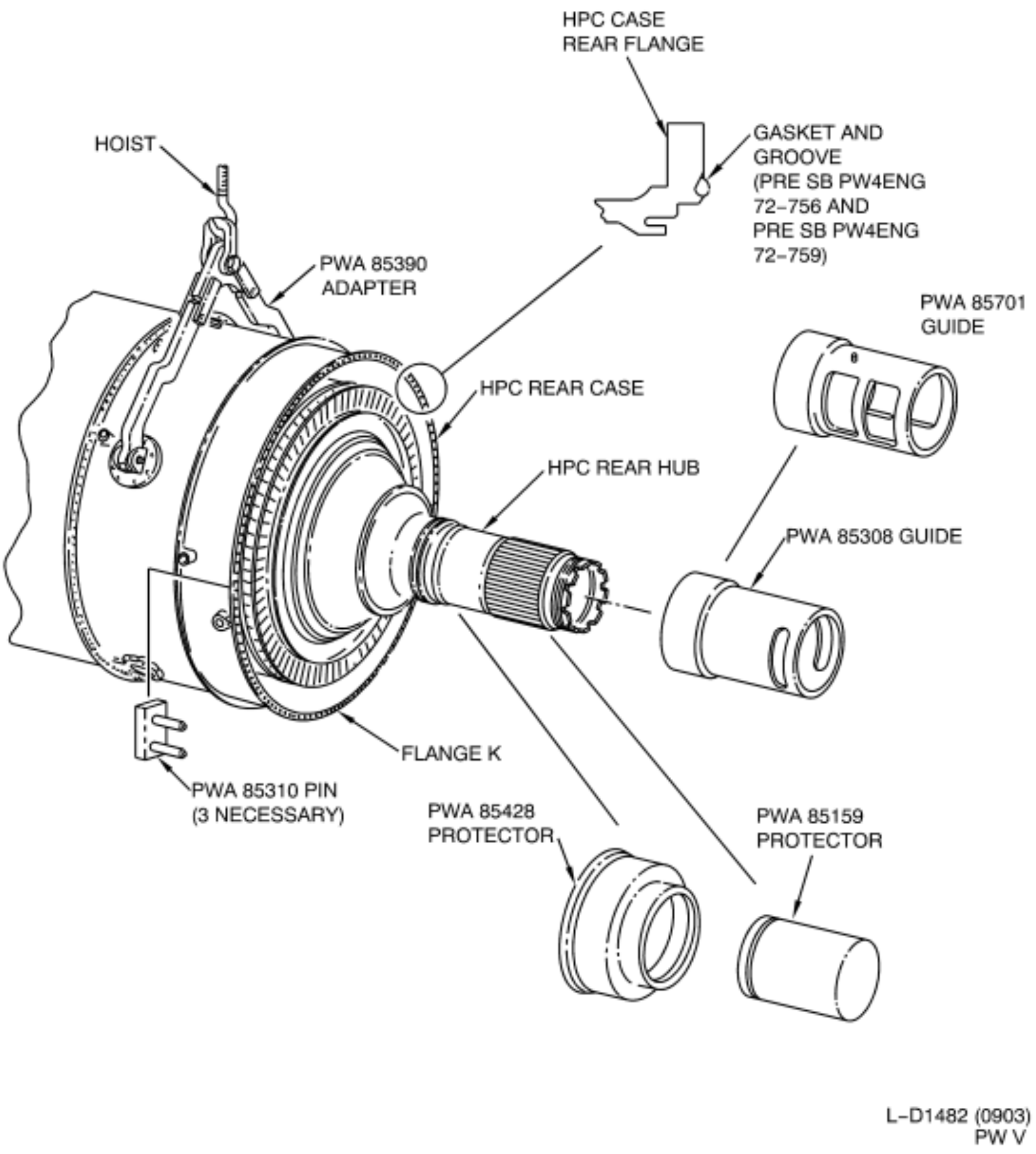
1. INSTALL DIFFUSER AND COMBUSTOR.
2. INSTALL NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL SEAT.
3. INSTALL TURBINE NOZZLE.
4. INSTALL HIGH PRESSURE TURBINE (HPT).
5. INSTALL NO. 1 BEARING SUPPORT ASSEMBLY.
6. INSTALL FAN CASE.
7. INSTALL LOW PRESSURE TURBINE (LPT).
8. INSTALL TURBINE EXHAUST CASE.
9. INSTALL LOW PRESSURE COMPRESSOR (LPC).
10. INSTALL LPC/LPT COUPLING.
11. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
12. INSTALL COMPRESSOR INLET CONE.
13. INSTALL MAIN GEARBOX.
14. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).

L-A1392 (0000)
PW V

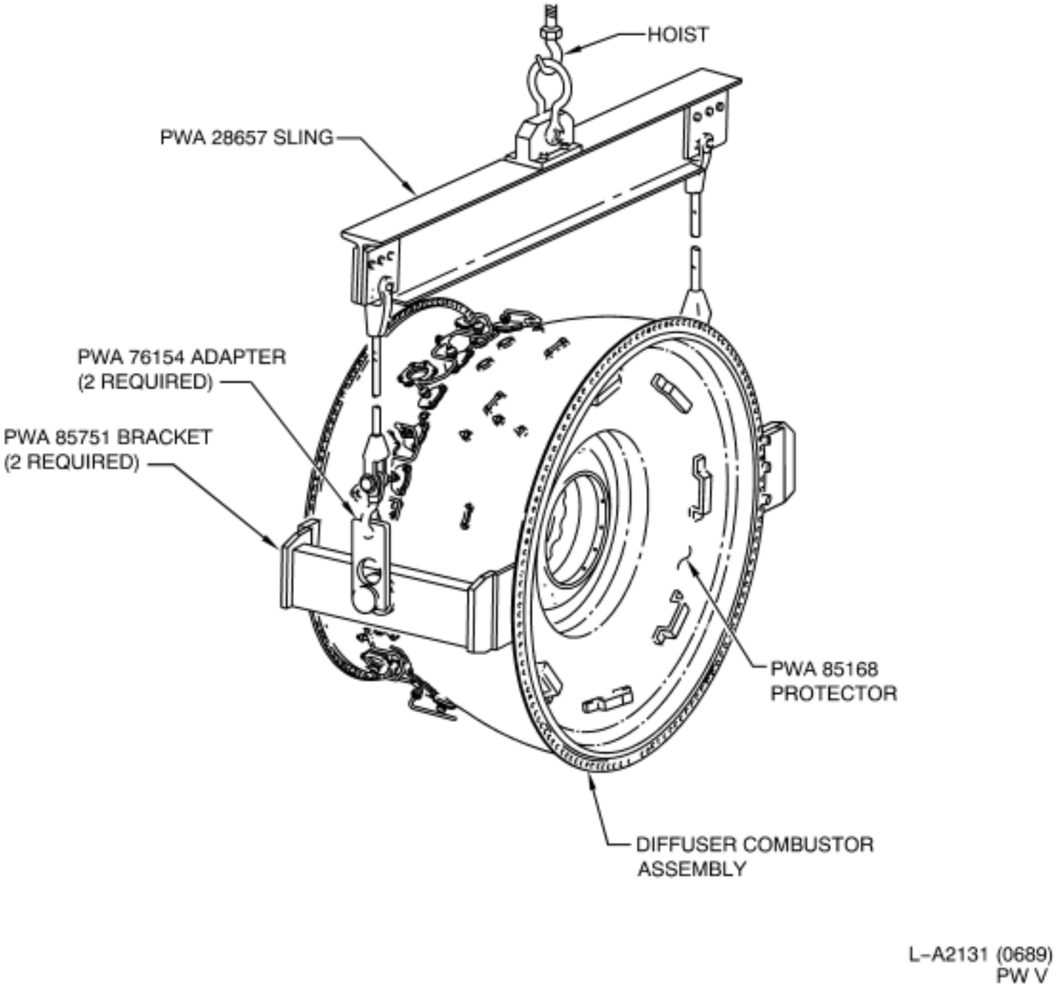
Procedure Sequence
Figure 401
(Task 72-00-41-420-014)


DIMENSION B
1
NO. 3 BEARING INNER RACE AND ROLLERS
HPC REAR HUB
4
SEAL SEAT SHOULDER
5
NO. 3 BEARING SEAL SPACER
2
NO. 3 BEARING FRONT SEAL SEAT
3
5
3
2
1
DIM C
DIM A
DIM B
HPC REAR HUB AFTER ASSEMBLY
L−A2135 (0389)
PW V

No. 3 Bearing Seating Check Measurement
Figure 402
(Task 72−00−41−420−014)

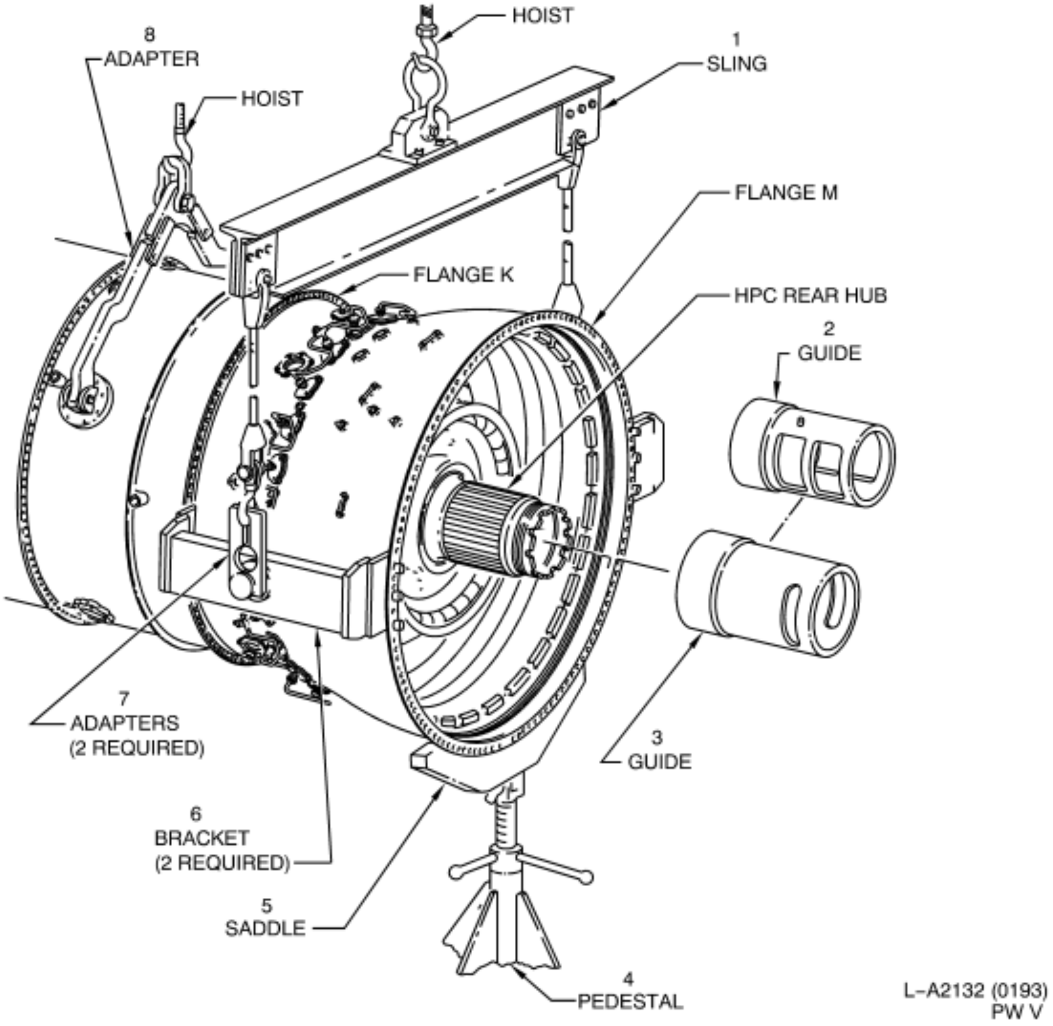

HPC CASE
REAR FLANGE
HOIST
GASKET AND
GROOVE
(PRE SB PW4ENG
72−756 AND
PRE SB PW4ENG
72−759)
PWA 85390
ADAPTER
PWA 85701
GUIDE
HPC REAR CASE
HPC REAR HUB
PWA 85308 GUIDE
FLANGE K
PWA 85310 PIN
(3 NECESSARY)
PWA 85428
PROTECTOR
PWA 85159
PROTECTOR
L−D1482 (0903)
PW V

Diffuser And Combustor Installation
Figure 403
(Task 72−00−41−420−014)


HOIST
PWA 28657 SLING
PWA 76154 ADAPTER
(2 REQUIRED)
PWA 85751 BRACKET
(2 REQUIRED)
PWA 85168
PROTECTOR
DIFFUSER COMBUSTOR
ASSEMBLY
L−A2131 (0689)
PW V

Diffuser And Combustor Installation
Figure 404
(Task 72−00−41−420−014)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−12


HOIST
8
ADAPTER
HOIST
1
SLING
FLANGE M
FLANGE K
HPC REAR HUB
2
GUIDE
7
ADAPTERS
(2 REQUIRED)
3
GUIDE
6
BRACKET
(2 REQUIRED)
5
SADDLE
4
PEDESTAL
L−A2132 (0193)
PW V

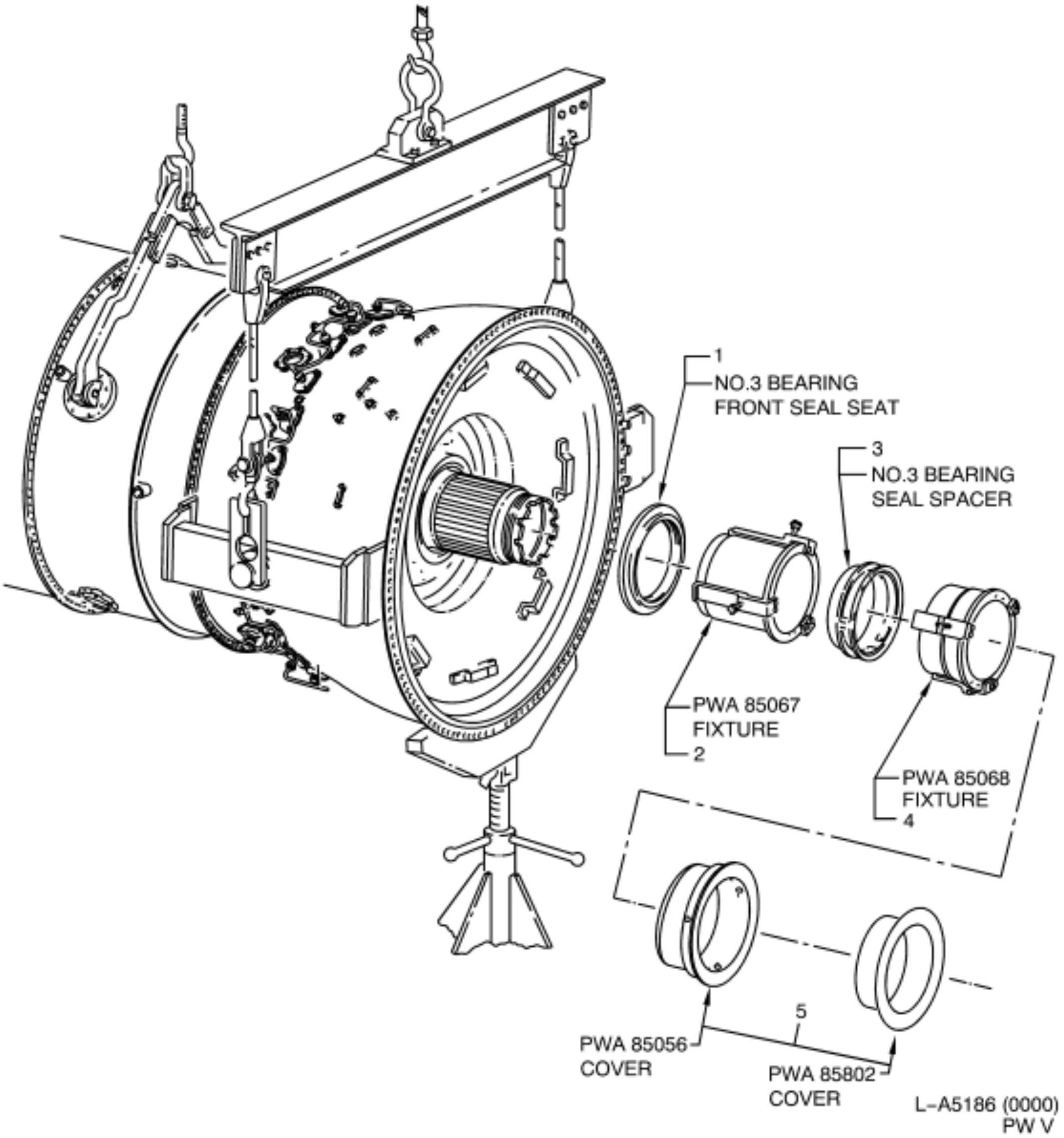
Diffuser And Combustor Installation
Figure 405
(Task 72−00−41−420−014)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−12

1. PWA 28657
2. PWA 85701
3. PWA 85308
4. PWA 26157 Or 87359
5. PWA 85062
6. PWA 85751
7. PWA 76154
8. PWA 85390

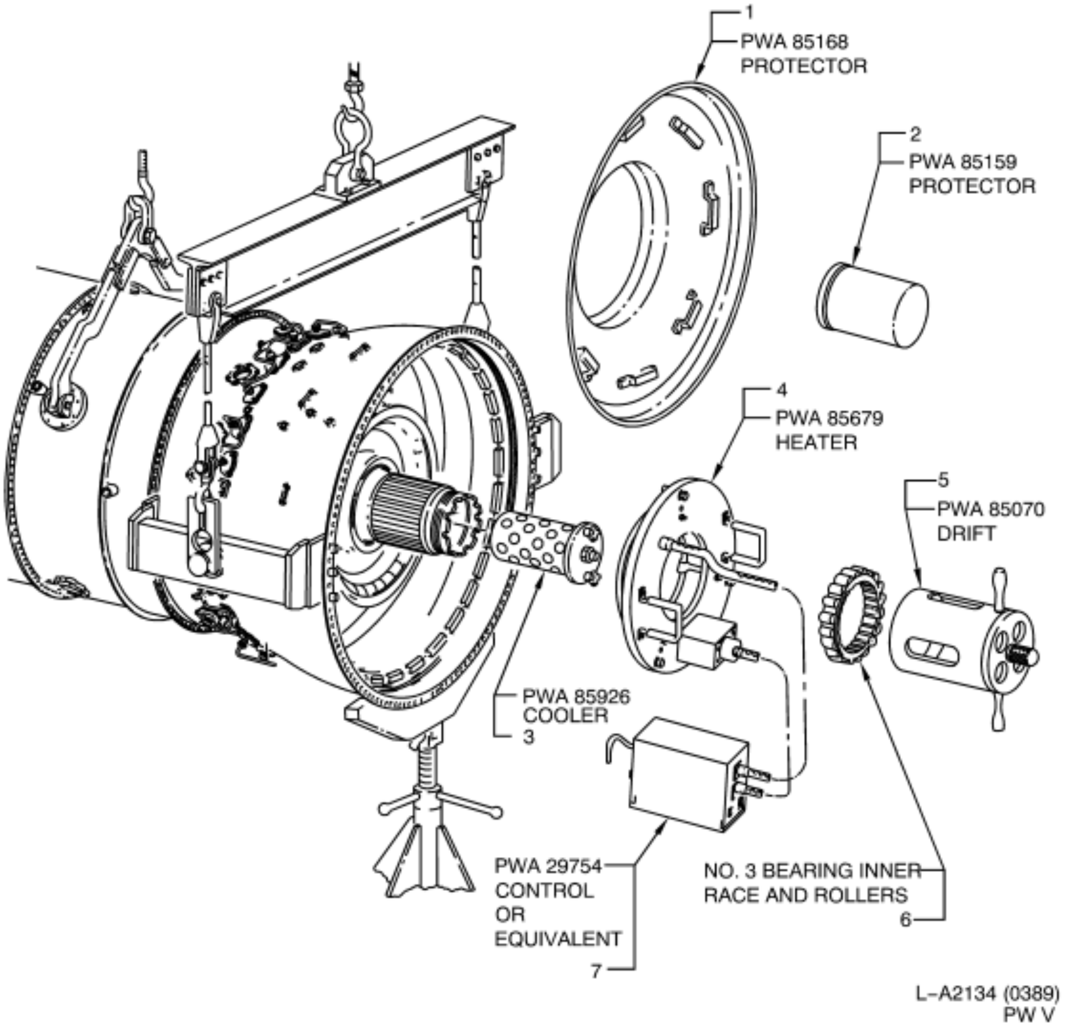
Key to Figure 405

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−12


1
NO.3 BEARING FRONT SEAL SEAT
3
NO.3 BEARING SEAL SPACER
PWA 85067 FIXTURE
2
PWA 85068 FIXTURE
4
5
PWA 85056 COVER
PWA 85802 COVER
L−A5186 (0000)
PW V

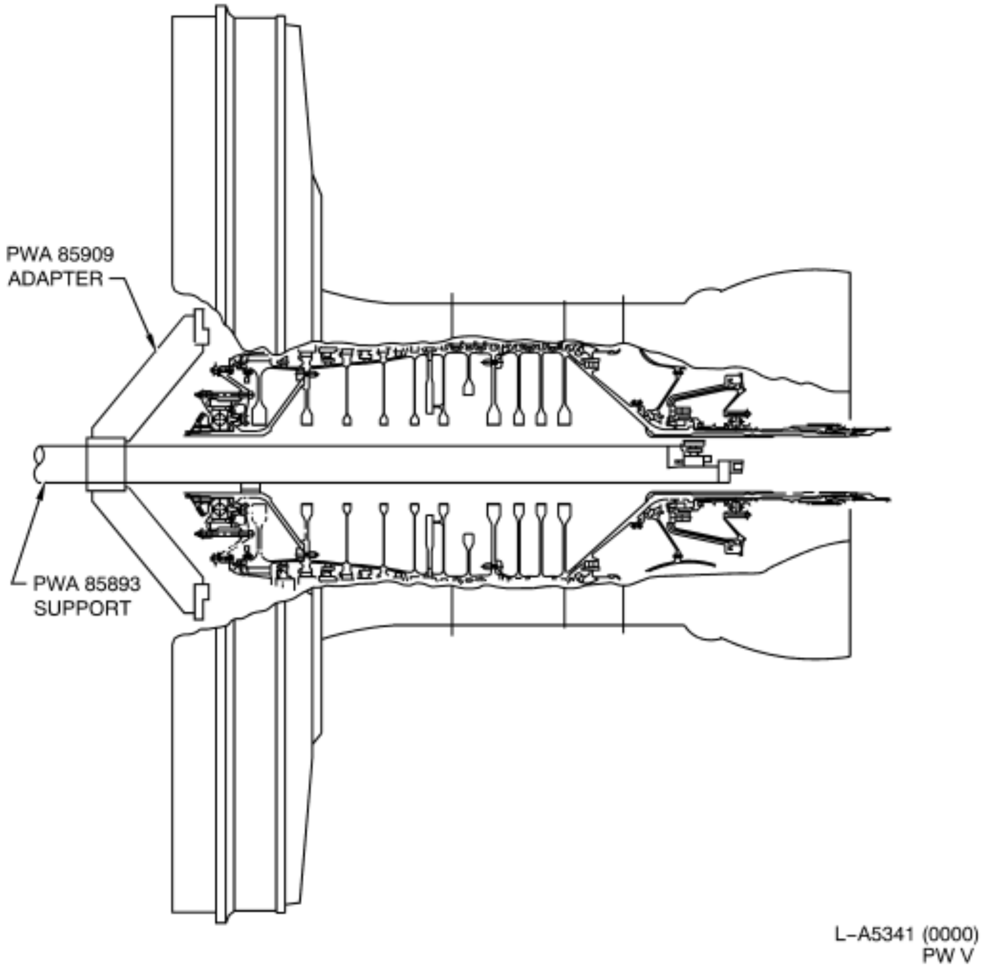
Diffuser And Combustor Installation
Figure 406
(Task 72−00−41−420−014)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−12


1
PWA 85168
PROTECTOR
2
PWA 85159
PROTECTOR
4
PWA 85679
HEATER
5
PWA 85070
DRIFT
PWA 85926
COOLER
3
PWA 29754
CONTROL
OR
EQUIVALENT
7
NO. 3 BEARING INNER
RACE AND ROLLERS
6
L−A2134 (0389)
PW V

Diffuser And Combustor Installation
Figure 407
(Task 72−00−41−420−014)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−12


PWA 85909
ADAPTER
PWA 85893
SUPPORT
L−A5341 (0000)
PW V

Diffuser And Combustor Installation
Figure 408
(Task 72−00−41−420−014)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-41-450-006:

1. Install Fuel Injector And Support

A. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 85579	Adapter

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-007	Fluid, Leak Check (PMC 9569 Or PMC 2277)
	P05-059	Wax, Paraffin (PMC 9552)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
	P05-395	Beeswax
R	P05-396	Paraffin Wax Blend
	P06-035	Lubricating Fluid (PWA 36511)
R	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
*Gasket	1	75-37-00/1/135
*Gasket	2	75-26-00/1/210
*Gasket	1	75-26-00/1/200
*Packing	1	79-22-00/3/1
Gasket	1	73-13-00/1/1
Packing	3	73-13-00/2/1
Packing	2	73-13-00/3/1

NOTE: NOTE: Parts marked with (*) are required only if parts are removed to gain access to specific fuel injectors. See text.

Quantities shown are for replacement of one fuel injector and assumes that the fuel nozzle supply manifold was

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM

(CONTINUED)
completely removed for access. Quantities for removing two or more fuel injectors are not proportional.

B. Procedure
See Figure 401, Figure 402, Figure 403, Figure 404 and Figure 405.

(1) Remove protective closures.

(2) Install gasket, lubricated with Beeswax P05−395 or Paraffin Wax Blend P05−396, and fuel injector to boss on diffuser case. Rotate injector into position and tilt to engage burner.

(3) Install bracket (if applicable) to position marked at disassembly. See Figure 401 and Figure 402. Secure injector with bolts, threads lubricated with Engine Oil P03−001. Tighten bolts to a torque of 65 − 85 lb−in. (7.344 − 9.604 N.m) then without loosening, continue to tighten to same torque until torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(4) (Reference 407) Install packing, lubricated with Lubricating Fluid P06−035 to packing groove on just installed fuel injector and two adjacent injectors.

(5) (Reference 2152) Install two packings, lubricated with Lubricating Fluid P06−035, to grooves in transfer tube.

(6) Install transfer tube into adapter on fuel supply manifold.

(7) Lubricate threads of injector adapters and adapter on fuel supply manifold with Engine Oil P03−001, and install fuel injector supply manifold to injectors and to fuel supply tube, securing tube nuts handtight. Loosen one half turn.

(8) Examine the applicable tube and manifold packings at connections as follows.

(a) Connect the PWA 85579 Adapter to the fuel distribution valve with the packing and bolts.

(b) Supply clean dry air through the adapter at 95 − 105 psig (655.0 − 723.9 kPa). Apply Leak Check Fluid P05−007 to connections and examine for leaks. Maintain pressure for a minimum of five minutes.

NOTE: Be sure all applicable manifold and tube connections are loose enough to find any leaks in the transfer tube packings. Check to be sure that air is flowing from all 24 nozzles. No leakage from any surface, joint or connection is permitted.

(c) If a leak is found, repair or replace the parts as necessary. Repeat this test.

(d) If no leak is found, remove the air source and the PWA 85579 Adapter.

(9) (Reference 2152) Torque tube nut to fuel supply manifold adapter (8 places) to 275 − 325 lb−in. (31.071 − 36.720 N.m).

(10) (Reference 2152) Torque manifold nuts on fuel injectors (24 places) to 185 − 200 lb−in. (20.902 − 22.597 N.m).

(11) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety all the tube and manifold nuts.

(12) If No. 3 bearing oil scavenge manifold (LR04) was removed for access to injector No. 13, comply with the following. See Figure 403.

(a) Remove protective closures and install packing lubricated with Engine Oil P03−001, to packing groove at flanged end of manifold.

(b) Lubricate threads on manifold elbow with Engine Oil P03−001, and install manifold to diffuser case internal tube nut at approximately 6 o'clock position, and to port on main oil pump with bolts,
R threads lubricated with Antiseize Paste P06−054,
R handtight only. Wipe off unwanted paste.

(c) (Pre SB PW4ENG 79-46) Secure manifold to oil pump bracket with clamp, bolt, threads lubricated with Engine Oil P03-001, and nut. Torque clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m). See Figure 403, (Sheet 1).

(d) (Post SB PW4ENG 79-46 and Pre SB PW4ENG 79-75) Secure the (LR04) manifold to the oil pump bracket with clamp, bolt, threads lubricated with Engine Oil P03-001, and nut. Secure the (LR04) manifold to the (LR05) manifold with the loop clamp grommet halves, clamp, bolt threads lubricated with Engine Oil P03-001, and nut. See Figure 403, (Sheet 2). Torque clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) (Post SB PW4ENG 79-75) Secure the (LR04) hose and manifold assembly with clamp, bolt, threads lubricated with Engine Oil P03-001, and nut to the bracket bolted to the fluid pressure dampener or (Post SB PW4ENG 79-86) adapter which is mounted on the top of the lubrication and scavenge oil pump. Also secure the (LR04) hose and manifold assembly with clamp, bolt, threads lubricated with Engine Oil P03-001, and nut to the bracket installed between fuel injector pads 12 and 13. See Figure 403. Torque clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(f) Torque bolts securing manifold flange to main oil pump to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(g) Torque diffuser case internal tube nut to 650 - 700 lb-in. (73.440 - 79.089 N.m), while holding manifold elbow from turning. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(13) If lower right turbine blade cooling air tube (AP37) was removed for access to injector No. 12, comply with the following. See Figure 404.

CAUTION: INSTALL LOCK PLATES WITH SLOT GROOVE OUTWARD. ENSURE LOCK PLATES ENGAGE INTERNAL TUBE LIP FLANGE AS SHOWN IN FIGURE 404.

(a) Remove protective closures. Install gasket, with raised sealing surface visible, to elbow end of tube, aligning tube slot and four bolt holes. Secure in place with Paraffin Wax P05−059. Install ring gasket to elbow groove with Paraffin Wax P05−059. Install locks to engage diffuser case internal tube lip and secure in place with Paraffin Wax P05−059.

(b) (Reference 2261) Hold the tube locks outward against the tube lip. Measure and be sure the end of the internal tube is 0.000 − 0.020 inch (0.000 − 0.508 mm) above the tube locks. If the measurement is not within this limit, install the locks again and be sure you engage the internal tube lip properly. See Figure 404.

(c) (Pre SB PW4ENG 72−572 or SB PW4ENG 72−537 or Post SB PW4ENG 72−627) Install the gasket and metering plate in the four hole air shutoff valve flanged end of the tube. Install gasket to lower flanged opening of air shutoff valve and hold in place with Paraffin Wax P05−059.

(d) (Post PW4ENG 72−572 and Pre SB PW4ENG 72−627 or Post SB PW4ENG 72−537 and Pre SB PW4ENG 72−627) Install the gasket and ring spacer in the four hole air shutoff valve flanged end of the tube. Install gasket to lower flanged opening of air shutoff valve and hold in place with Paraffin Wax P05−059.

(e) Secure elbow end of tube (gaskets in place) and bracket to diffuser case pad at approximately 5 o'clock position with bolts, threads lubricated with Engine Oil P03−001, handtight only.

(f) Secure opposite end of tube to air shutoff valve with bolts, threads lubricated with Engine Oil P03−001, handtight only.

(g) Secure tube to three brackets on diffuser case with clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(h) Torque all bolts at each end of tube to 85 - 95 lb-in. (9.604 - 10.734 N.m), then retorque to required limit without loosening until required torque is maintained. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts at the diffuser case pad.

(i) Secure fuel injector supply manifold to bracket attached to tube flange at diffuser case with clamp, bolt, threads lubricated with Engine Oil P03-001, and nut. Torque bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(14) (Pre SB PW4ENG 72-567) If (left) diffuser seal air vent tube (AP22) was removed for access to injector No. 22, comply with the following. See Figure 405, (Sheets 1 through 4).

(a) Remove protective closures. Install gasket to groove in HPC rear case boss at approximately 10:30 o'clock position. Install deflector aligning pin with hole in HPC rear case boss.

R R (b) Lubricate tube nut threads with Antiseize Paste P06-054. Wipe off unwanted paste. Install gasket to flanged end of tube and secure in place with Paraffin Wa P05-059.

(c) Install tube to engine and connect tube nut to diffuser case intenal tube at approximately 11 o'clock position handtight only.

(d) Install bracket and bolts, threads lubricated with Engine Oil P03-001, to secure flanged end of tube to HPC rear case handtight only.

(e) Secure tube to bracket at No. 21 fuel injector with clamp, bolt, threads lubricated with Engine Oil P03-001, and nut. Torque clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(f) Torque tube nut to 825 - 900 lb-in. (93.212 - 101.686 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(g) Torque bolts securing tube flange and bracket to HPC rear case to 85 − 95 lb−in. (9.604 − 10.734 N.m) then retorque without loosening until same torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(h) Secure PT4.95 tube and air shutoff valve signal tube to bracket at flanged end of vent tube with clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(15) (Post SB PW4ENG 72−567) If (left) diffuser seal air vent tube (AP22) was removed for access to injector No. 22, comply with the following. See Figure 405, (Sheets 5 through 8).

NOTE: Make sure to remove the temporary safety wire that is around the internal diffuser seal air vent tube assembly before you install the locks. Be careful not to let the tube drop into the diffuser case after you remove the temporary safety wire.

(a) Remove the protection covers. Install a gasket to the groove in the HPC rear case boss at approximately the 10:30 o'clock position.

(b) Install a gasket to the flanged end (with four holes) of the tube and attach the gasket in place with Paraffin Wax P05−059. Align the pin on the deflector with the hole in the HPC case boss.

CAUTION: INSTALL LOCK PLATES WITH SLOT GROOVE OUTWARD AND PIN (IF EQUIPPED) INWARD. MAKE SURE THE LOCK PLATES ENGAGE THE INTERNAL TUBE LIP FLANGE AS SHOWN IN FIGURE 402.

(c) Install the locks to the diffuser case internal tube inside boss at approximately the 11 o'clock position. Attach the locks in place with Paraffin Wax P05−059.

R
R

(d) (Reference 2261) Hold the tube locks inward against the tube lip. Measure and make sure the end of the internal tube is 0.000 − 0.020 inch (0.000 − 0.508 mm) above the tube locks. If the measurement is not within this limit, install the locks again and make sure the internal tube lip is engaged properly.

(e) Install the four hole gasket with the raised portion outward toward the tube flange. Install the second gasket in groove of the same opening and attach both gaskets in place with Paraffin Wax P05−059.

(f) Install the tube to the engine (gaskets in place). Attach the tube to the diffuser case with a bracket and bolts, threads lubricated with Engine Oil P03−001. Tighten the bolts by hand.

(g) Attach the tube to the HPC rear case with a bracket and bolts, threads lubricated with Engine Oil P03−001. Tighten the bolts by hand.

(h) Install a clamp, bolt, threads lubricated with Engine Oil P03−001, and nut to attach the tube to the fuel injector bracket. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(i) Torque the bolts that attach the tube flange to the HPC rear case to 85 − 95 lb−in. (9.604 − 10.734 N.m). Without loosening the bolts, torque again until the 85 − 95 lb−in. (9.604 − 10.734 N.m) is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(j) Torque the bolts that attach the tube flange to the diffuser case and the four bolts that attach a bracket to the tube flange to 85 − 95 lb−in. (9.604 − 10.734 N.m). Without loosening the bolts, torque again until the 85 − 95 lb−in. (9.604 − 10.734 N.m) is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(k) Install a clamp to the No. 3 bearing breather tube assembly (LB03). Attach the clamp to the bracket from the diffuser pad at the 11 o'clock position with a bolt, threads lubricated with Engine Oil P03−001, and nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

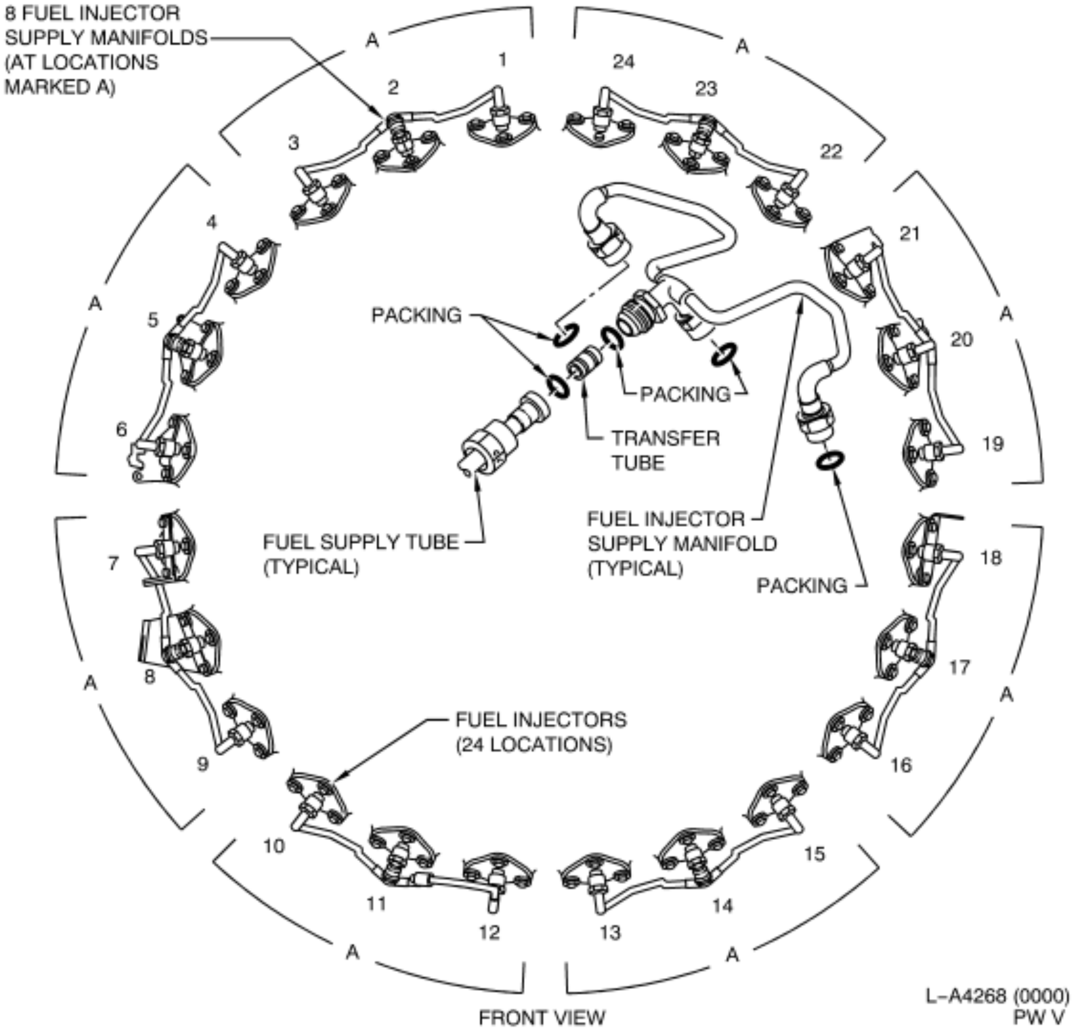
C. Postrequisites

(1) If turbine cooling tube (lower right) was removed for access to injector No. 7, install tube per 72−00−52, Installation−07 Task 72−00−53−450−004.

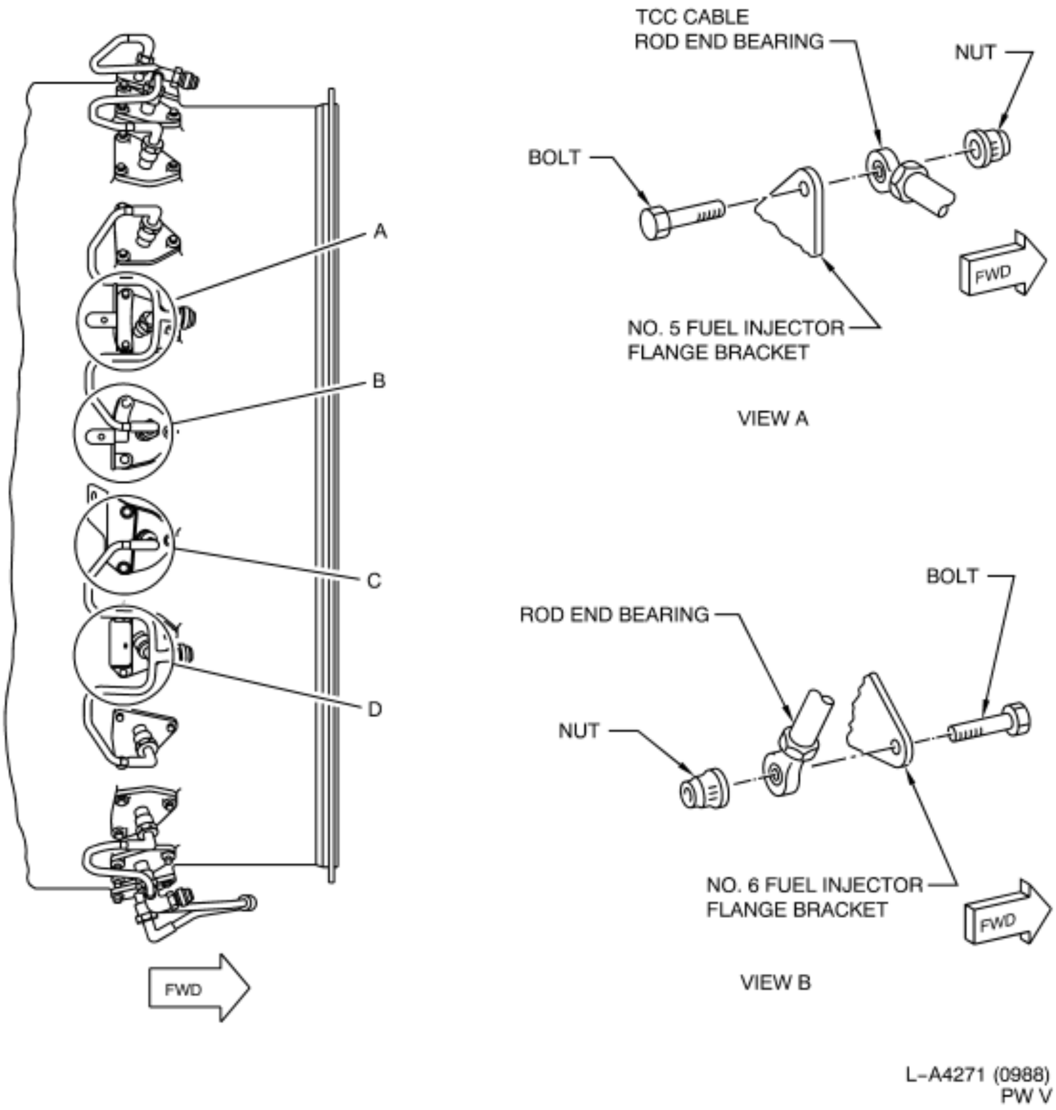
(2) If turbine cooling tube (upper left) was removed for access to injector No. 20, install tube per 72−00−52, Installation−07 Task 72−00−53−450−004.

(3) If oil tank was removed for access to injectors No. 16 and 17, install oil tank per 72−00−61, Installation−28 Task 72−00−61−450−012.

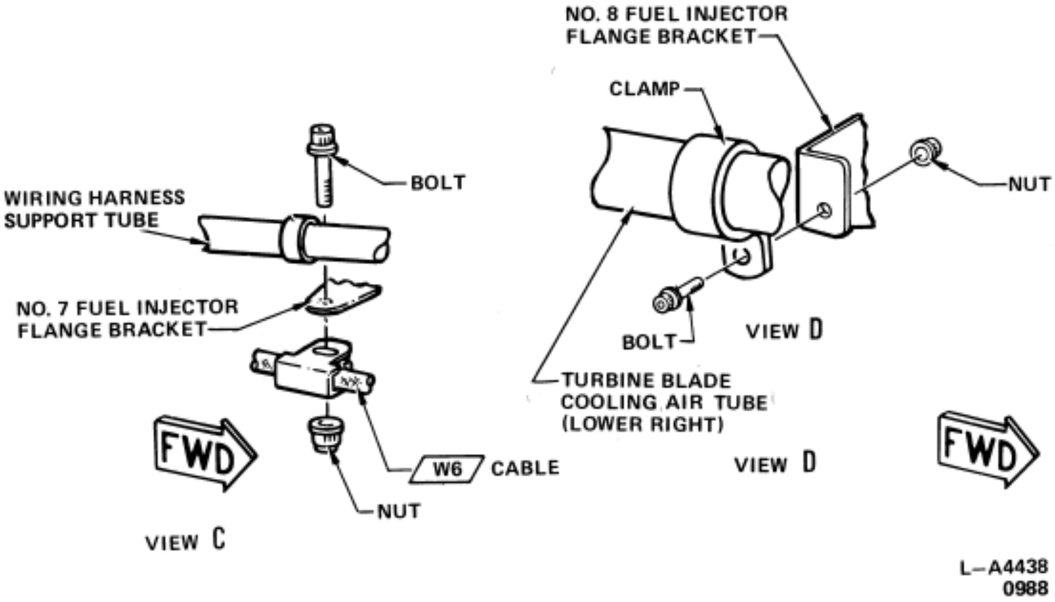
(4) Test engine per Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


8 FUEL INJECTOR SUPPLY MANIFOLDS (AT LOCATIONS MARKED A)
A
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
PACKING
PACKING
TRANSFER TUBE
FUEL SUPPLY TUBE (TYPICAL)
FUEL INJECTOR SUPPLY MANIFOLD (TYPICAL)
PACKING
FUEL INJECTORS (24 LOCATIONS)
FRONT VIEW
L-A4268 (0000)
PW V

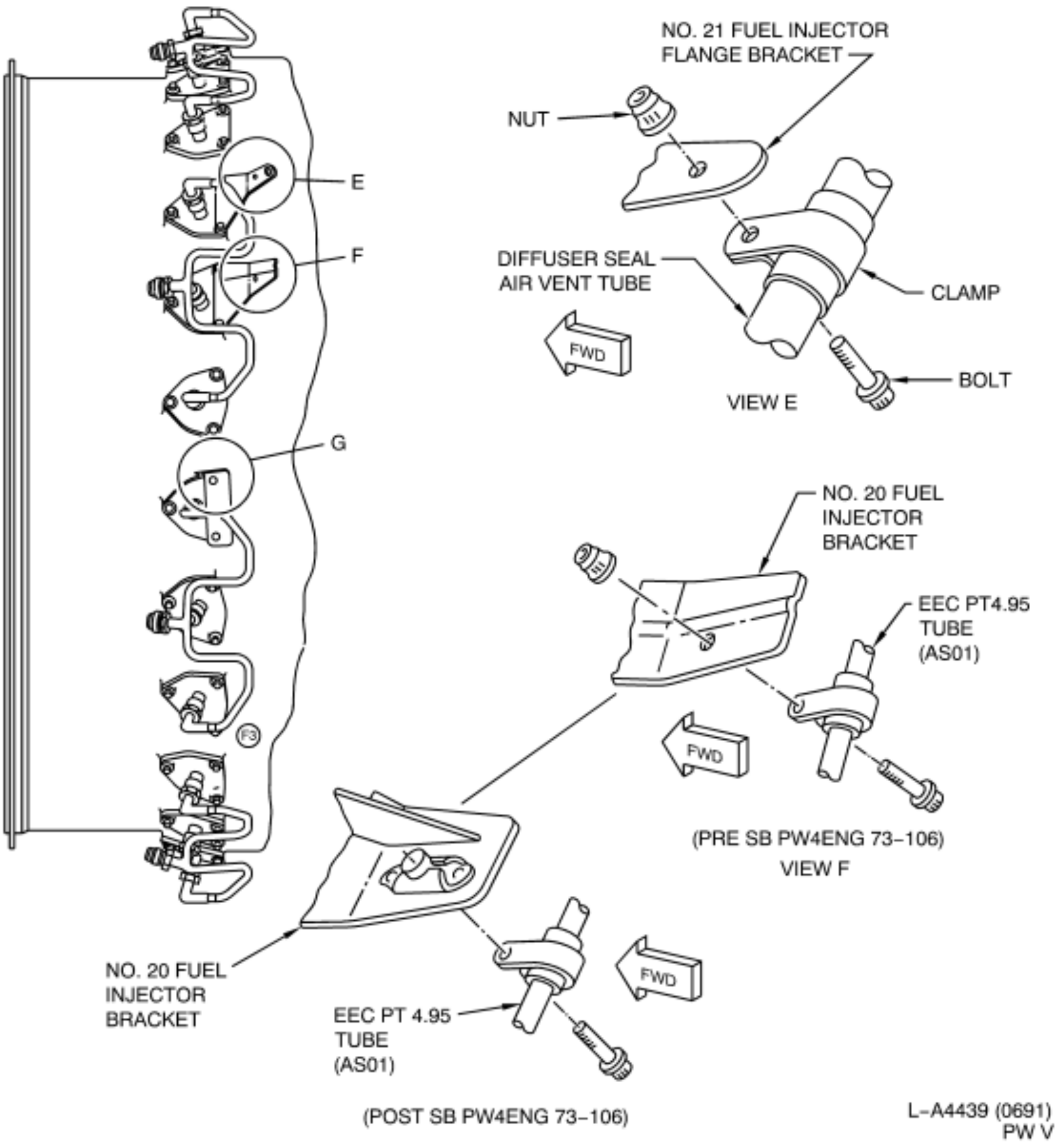
Fuel Injectors And Supply Manifolds Locations
Figure 401
(Task 72-00-41-450-006)


TCC CABLE
ROD END BEARING
NUT
BOLT
FWD
NO. 5 FUEL INJECTOR
FLANGE BRACKET
VIEW A
A
B
C
D
BOLT
ROD END BEARING
NUT
NO. 6 FUEL INJECTOR
FLANGE BRACKET
FWD
VIEW B
FWD
L−A4271 (0988)
PW V

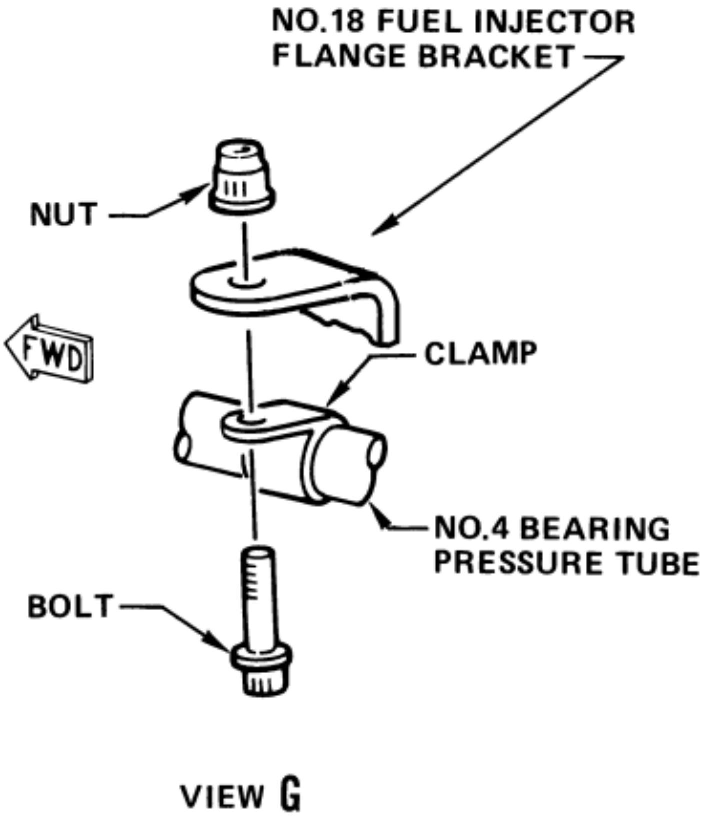
Fuel Injector Flange Brackets And Clamping (Right Side)
Figure 402 (Sheet 1)
(Task 72−00−41−450−006)


NO. 8 FUEL INJECTOR FLANGE BRACKET
CLAMP
BOLT
NUT
WIRING HARNESS SUPPORT TUBE
NO. 7 FUEL INJECTOR FLANGE BRACKET
BOLT
VIEW D
TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT)
W6
CABLE
VIEW D
FWD
FWD
NUT
VIEW C
L−A4438
0988

Fuel Injector Flange Brackets And Clamping (Right Side)
Figure 402 (Sheet 2)
(Task 72−00−41−450−006)

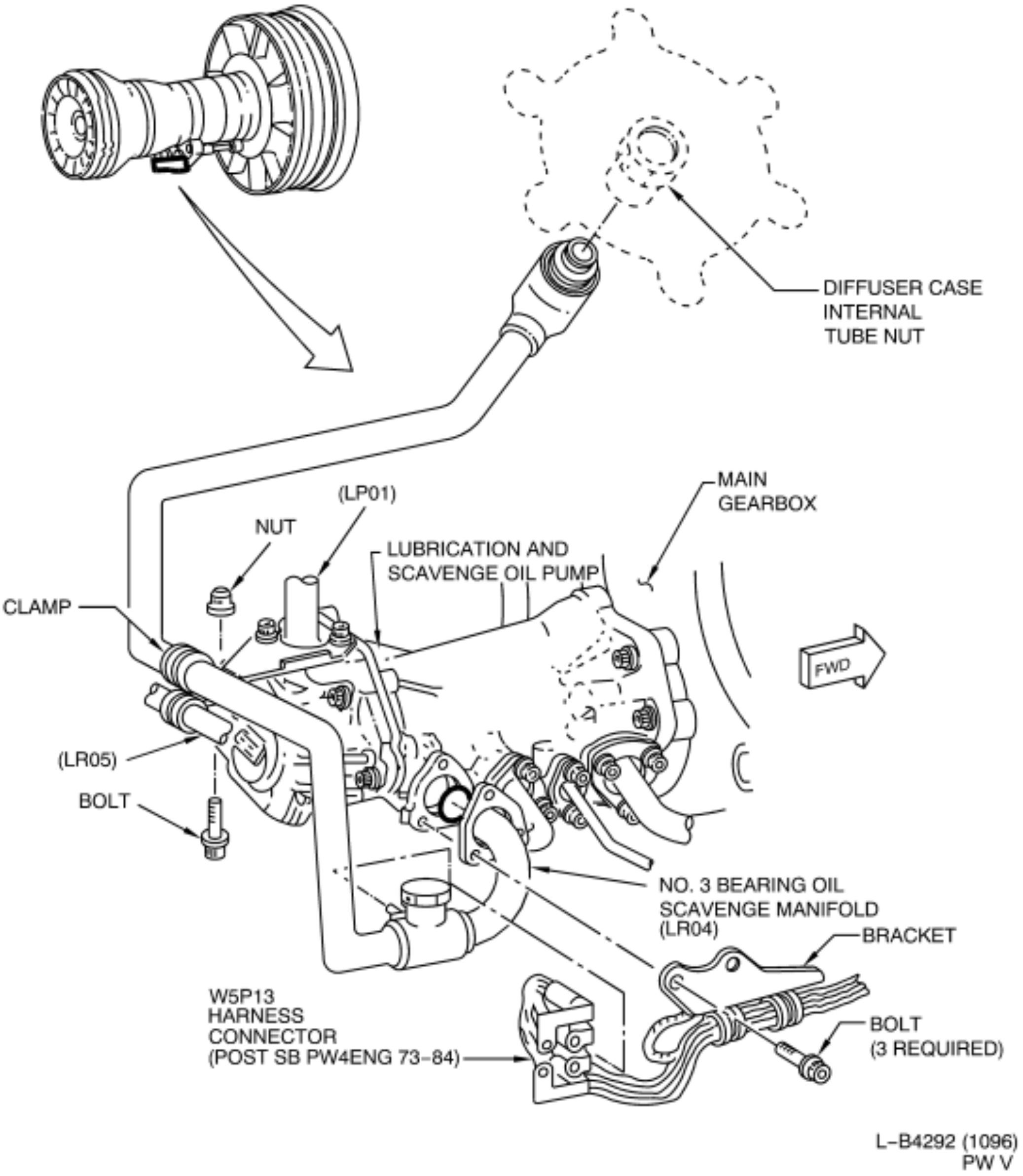

E
F
G
F3
NO. 21 FUEL INJECTOR FLANGE BRACKET
NUT
DIFFUSER SEAL AIR VENT TUBE
CLAMP
FWD
BOLT
VIEW E
NO. 20 FUEL INJECTOR BRACKET
EEC PT4.95 TUBE (AS01)
FWD
(PRE SB PW4ENG 73−106)
VIEW F
NO. 20 FUEL INJECTOR BRACKET
EEC PT 4.95 TUBE (AS01)
FWD
(POST SB PW4ENG 73−106)
L−A4439 (0691)
PW V

Fuel Injector Flange Brackets And Clamping (Left Side)
Figure 402 (Sheet 3)
(Task 72−00−41−450−006)


NO.18 FUEL INJECTOR FLANGE BRACKET
NUT
FWD
CLAMP
NO.4 BEARING PRESSURE TUBE
BOLT
VIEW G

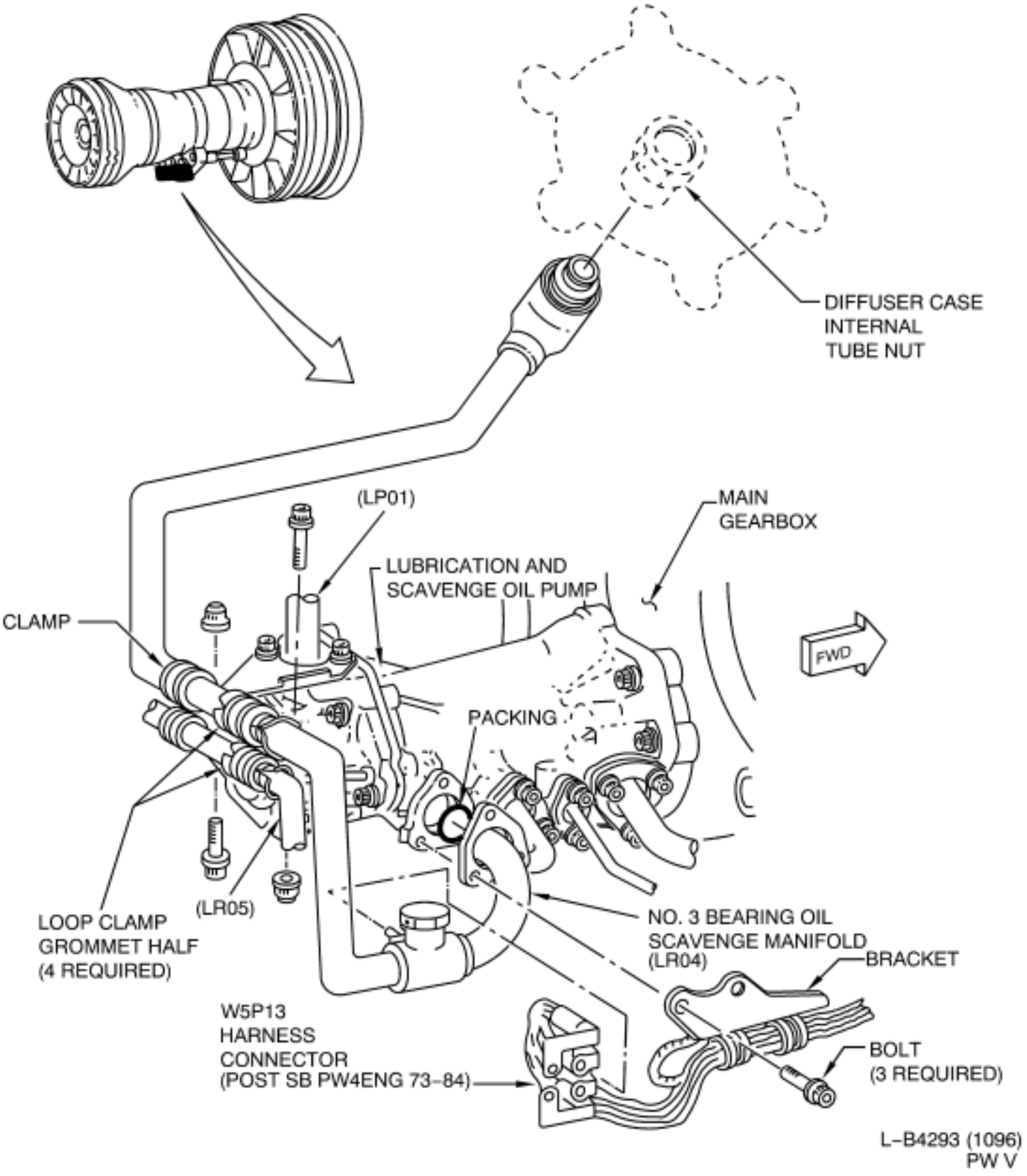
L−A4440
0988

Fuel Injector Flange Brackets And Clamping (Left Side)
Figure 402 (Sheet 4)
(Task 72−00−41−450−006)

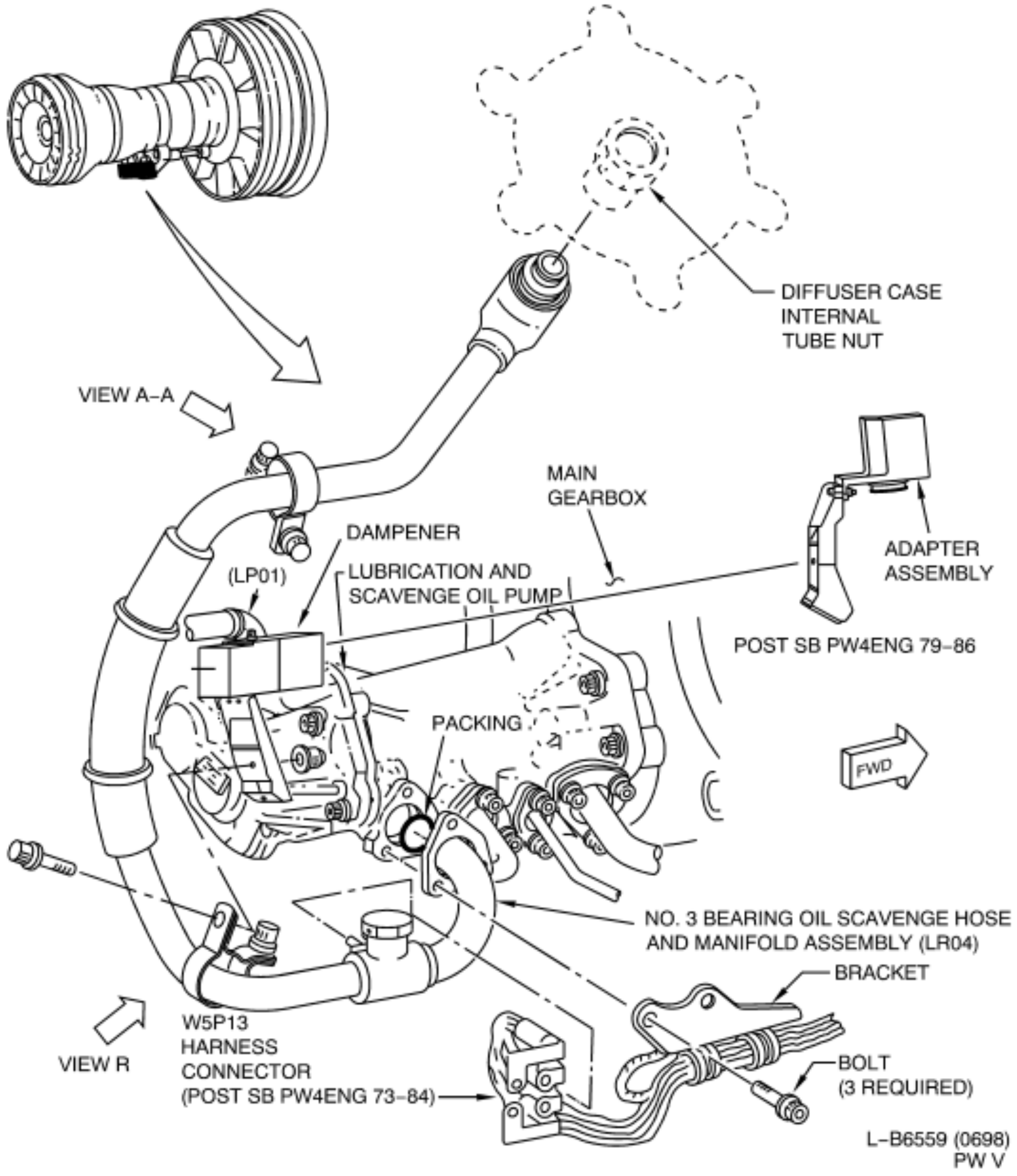

DIFFUSER CASE
INTERNAL
TUBE NUT
MAIN
GEARBOX
(LP01)
NUT
LUBRICATION AND
SCAVENGE OIL PUMP
CLAMP
FWD
(LR05)
BOLT
NO. 3 BEARING OIL
SCAVENGE MANIFOLD
(LR04)
BRACKET
W5P13
HARNESS
CONNECTOR
(POST SB PW4ENG 73−84)
BOLT
(3 REQUIRED)
L−B4292 (1096)
PW V

No. 3 Bearing Oil Scavenge Manifold (For Access To No. 13 Fuel Injector) (Pre SB PW4ENG 79−46)
Figure 403 (Sheet 1)
(Task 72−00−41−450−006)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−13

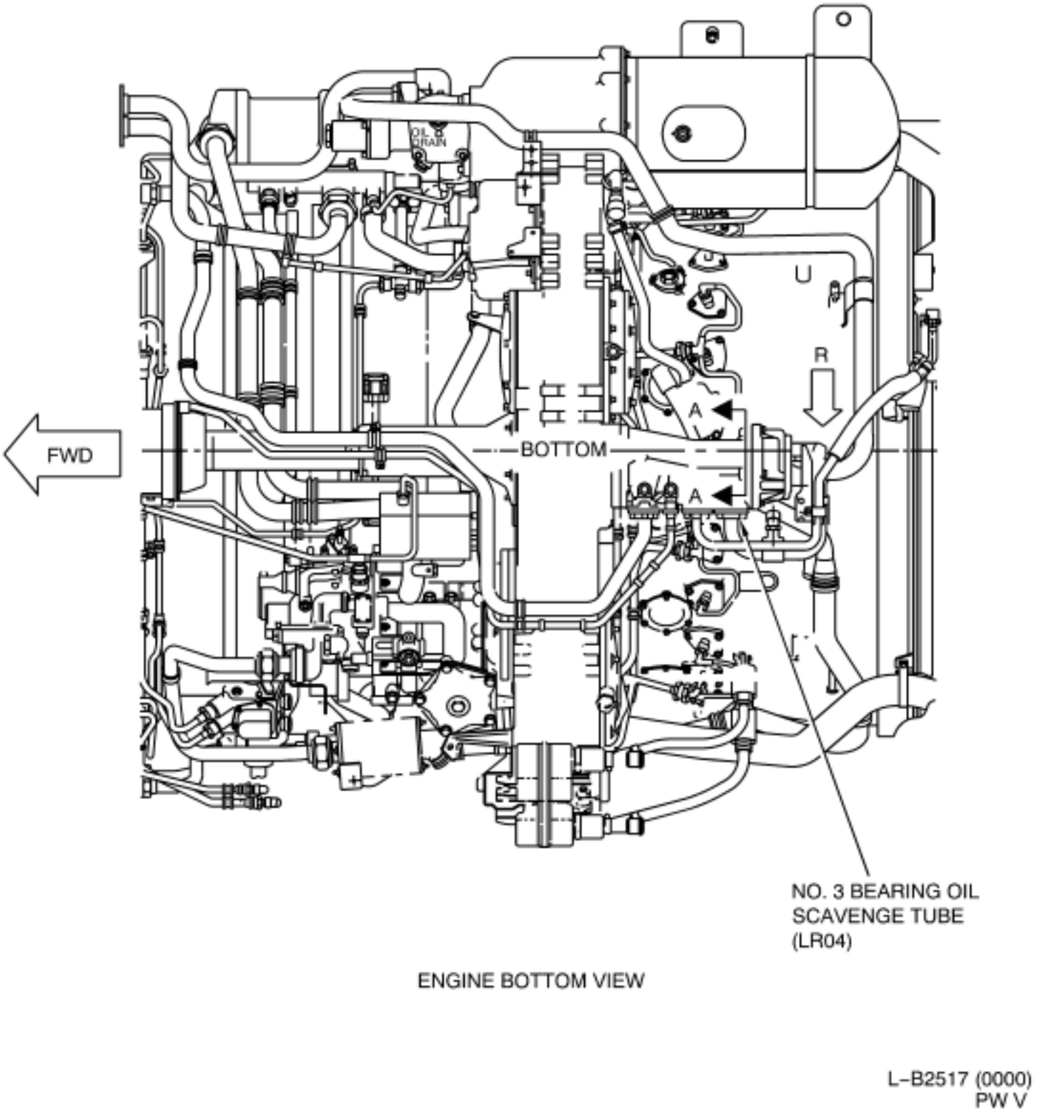

DIFFUSER CASE
INTERNAL
TUBE NUT
(LP01)
MAIN
GEARBOX
LUBRICATION AND
SCAVENGE OIL PUMP
CLAMP
FWD
PACKING
LOOP CLAMP
GROMMET HALF
(4 REQUIRED)
(LR05)
NO. 3 BEARING OIL
SCAVENGE MANIFOLD
(LR04)
BRACKET
W5P13
HARNESS
CONNECTOR
(POST SB PW4ENG 73-84)
BOLT
(3 REQUIRED)
L-B4293 (1096)
PW V

No. 3 Bearing Oil Scavenge Manifold (For Access To No. 13 Fuel Injector) (Post SB PW4ENG 79−46 And Pre SB PW4ENG 79−75)
Figure 403 (Sheet 2)
(Task 72−00−41−450−006)

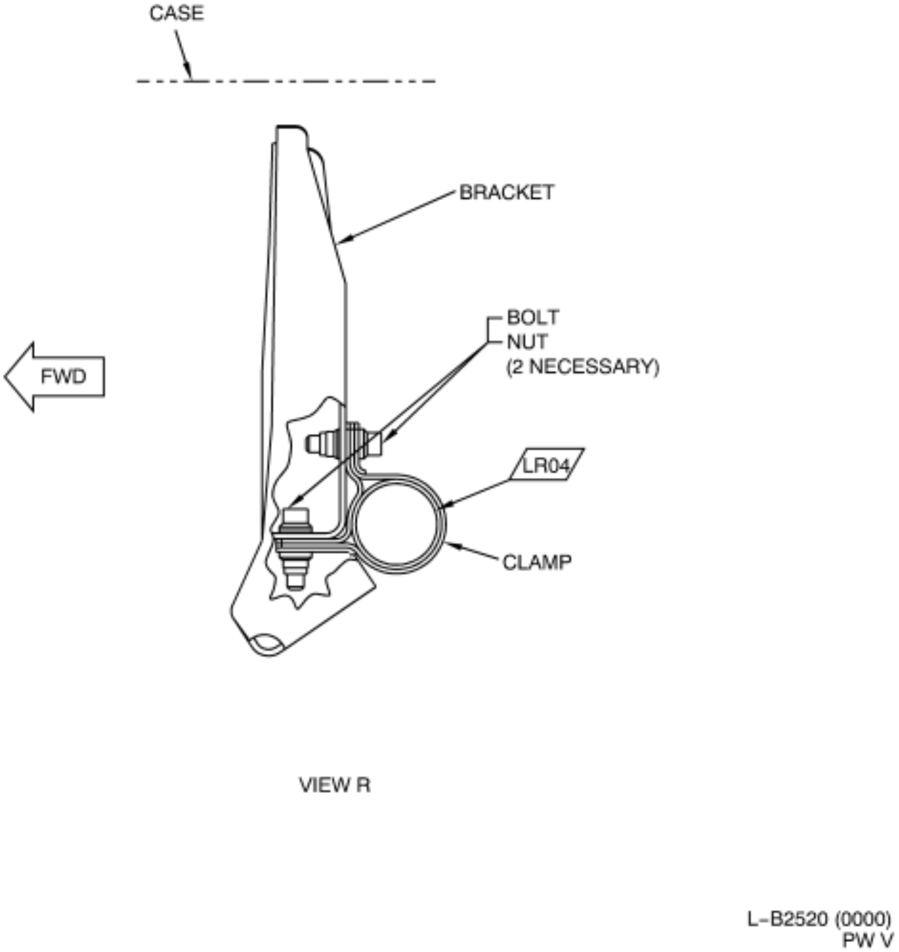

DIFFUSER CASE
INTERNAL
TUBE NUT
VIEW A-A
MAIN
GEARBOX
DAMPENER
(LP01)
LUBRICATION AND
SCAVENGE OIL PUMP
ADAPTER
ASSEMBLY
POST SB PW4ENG 79-86
PACKING
FWD
NO. 3 BEARING OIL SCAVENGE HOSE
AND MANIFOLD ASSEMBLY (LR04)
BRACKET
VIEW R
W5P13
HARNESS
CONNECTOR
(POST SB PW4ENG 73-84)
BOLT
(3 REQUIRED)
L-B6559 (0698)
PW V

No. 3 Bearing Oil Scavenge Manifold (For Access To No. 13 Fuel Injector) (Post SB PW4ENG 79-75)
Figure 403 (Sheet 3)
(Task 72-00-41-450-006)

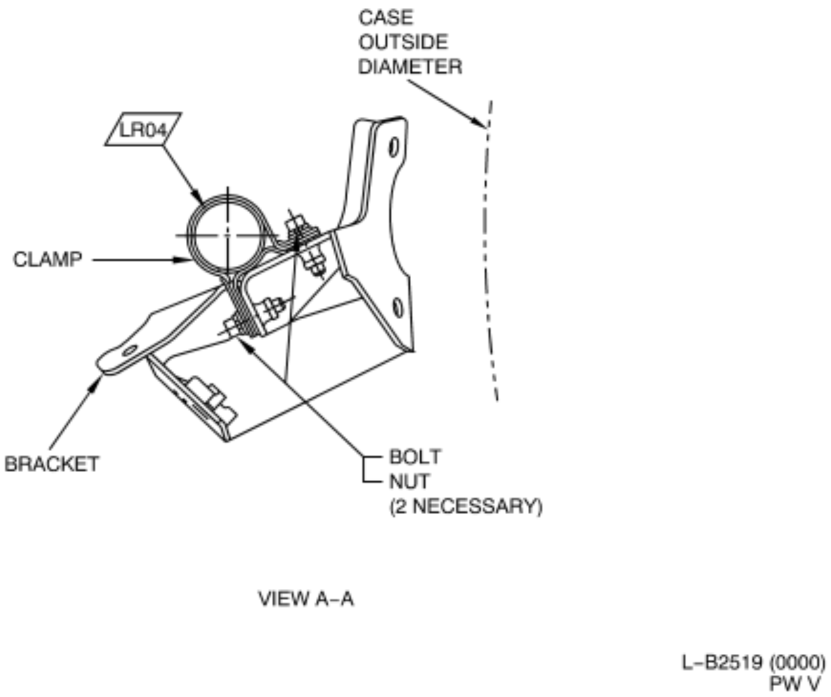
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−13


OIL DRAIN
U
R
A
A
FWD
BOTTOM
NO. 3 BEARING OIL SCAVENGE TUBE (LR04)
ENGINE BOTTOM VIEW
L−B2517 (0000)
PW V

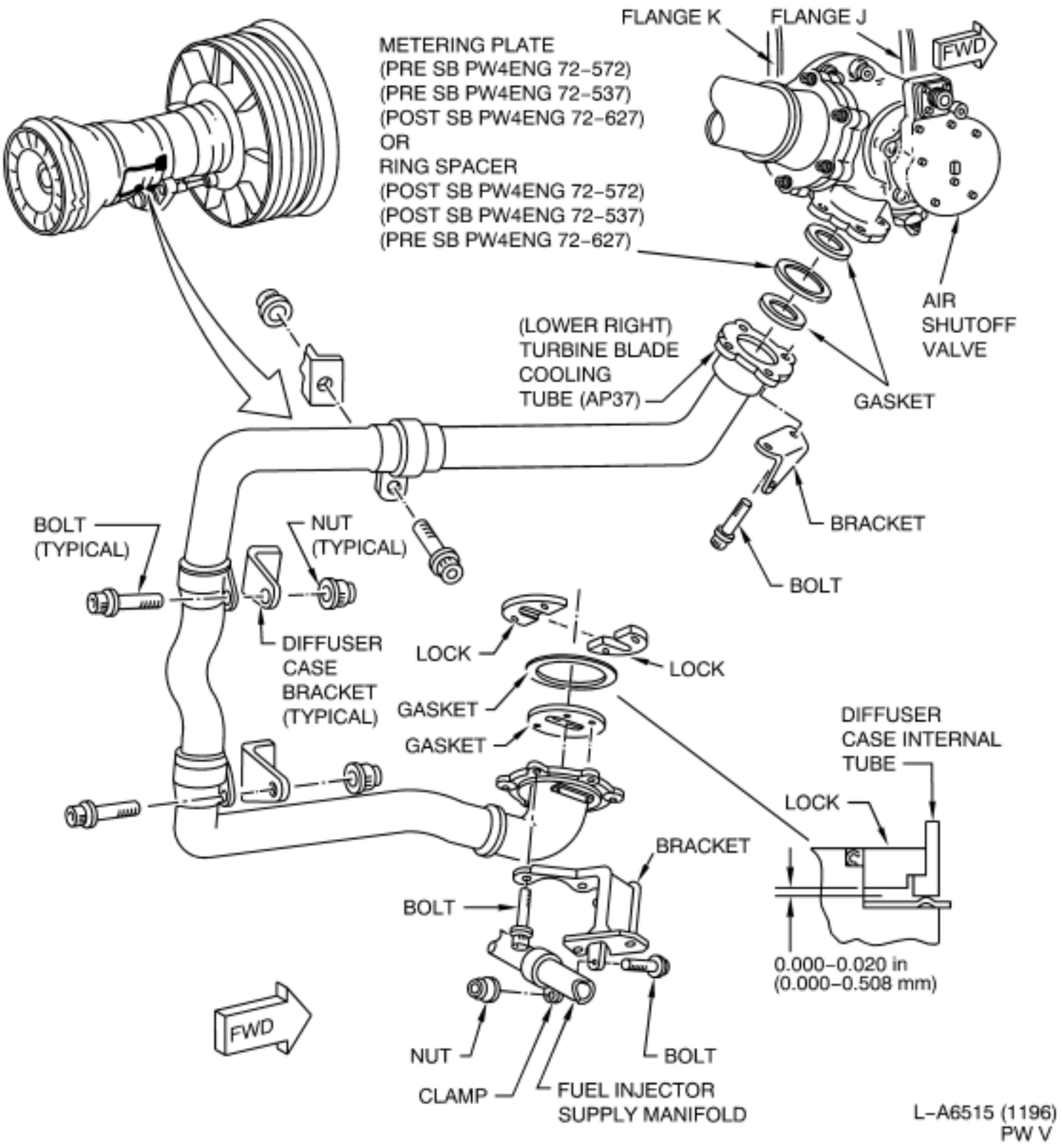
No. 3 Bearing Oil Scavenge Manifold (For Access To No. 13 Fuel Injector) (Post SB PW4ENG 79−75)
Figure 403 (Sheet 4)
(Task 72−00−41−450−006)


CASE
BRACKET
BOLT
NUT
(2 NECESSARY)
FWD
LR04
CLAMP
VIEW R
L−B2520 (0000)
PW V

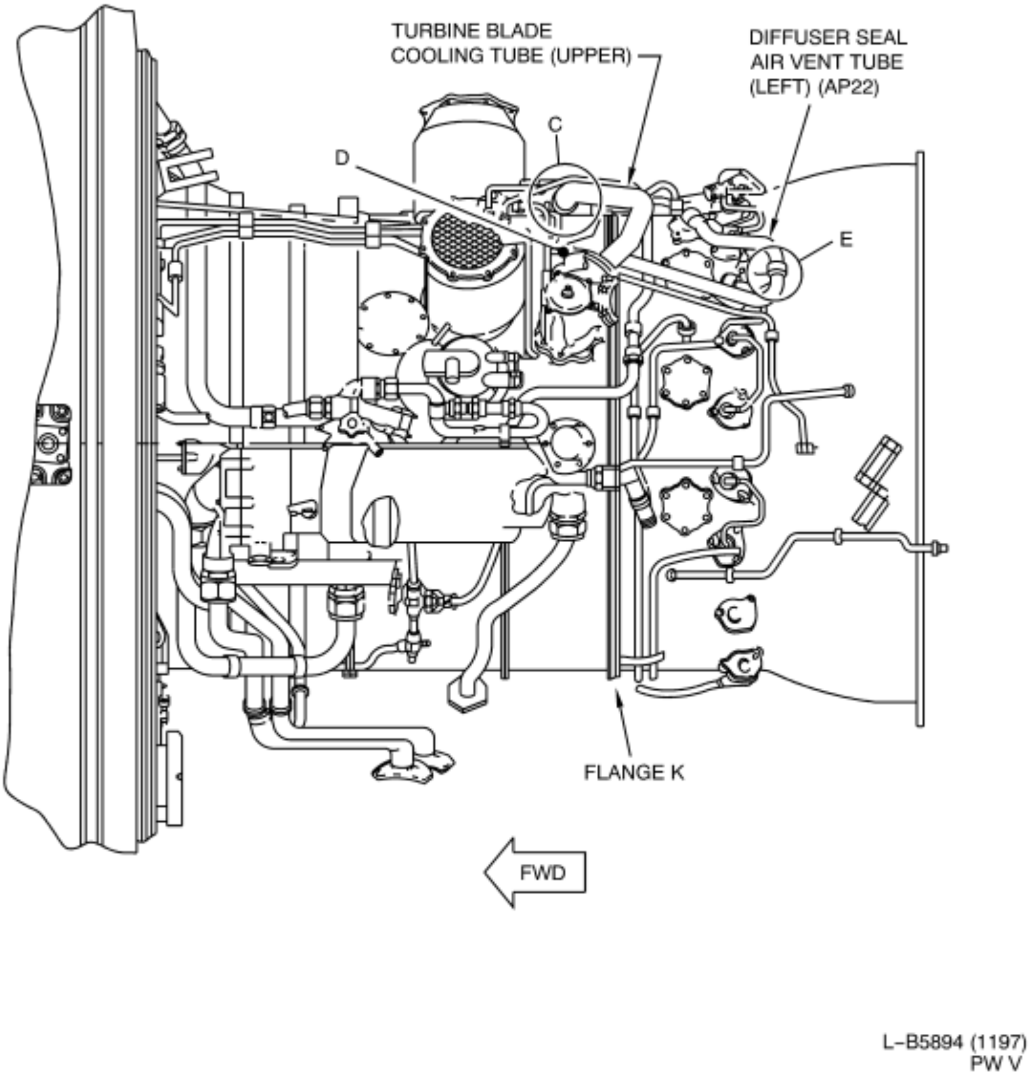
No. 3 Bearing Oil Scavenge Manifold (For Access
To No. 13 Fuel Injector) (Post SB PW4ENG 79−75)
Figure 403 (Sheet 5)
(Task 72−00−41−450−006)


CASE
OUTSIDE
DIAMETER
LR04
CLAMP
BRACKET
BOLT
NUT
(2 NECESSARY)
VIEW A−A
L−B2519 (0000)
PW V

No. 3 Bearing Oil Scavenge Manifold (For Access To No. 13 Fuel Injector) (Post SB PW4ENG 79−75)
Figure 403 (Sheet 6)
(Task 72−00−41−450−006)

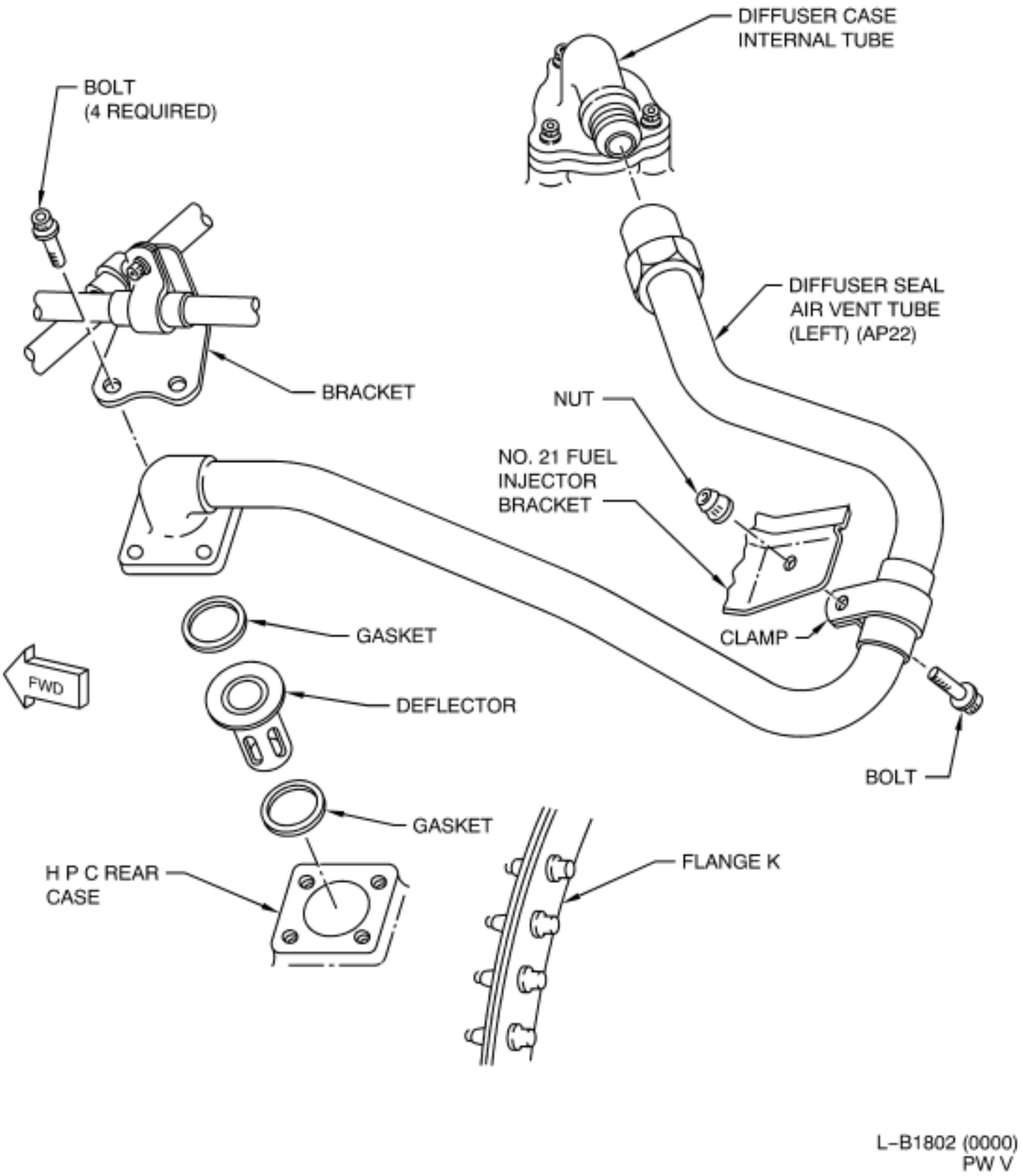

FLANGE K
FLANGE J
FWD
METERING PLATE
(PRE SB PW4ENG 72-572)
(PRE SB PW4ENG 72-537)
(POST SB PW4ENG 72-627)
OR
RING SPACER
(POST SB PW4ENG 72-572)
(POST SB PW4ENG 72-537)
(PRE SB PW4ENG 72-627)
AIR SHUTOFF VALVE
(LOWER RIGHT) TURBINE BLADE COOLING TUBE (AP37)
GASKET
BRACKET
BOLT (TYPICAL)
NUT (TYPICAL)
BOLT
DIFFUSER CASE BRACKET (TYPICAL)
LOCK
LOCK
GASKET
GASKET
DIFFUSER CASE INTERNAL TUBE
LOCK
BRACKET
BOLT
0.000-0.020 in
(0.000-0.508 mm)
FWD
NUT
BOLT
CLAMP
FUEL INJECTOR SUPPLY MANIFOLD
L-A6515 (1196)
PW V

Turbine Blade Cooling Air Tube (Lower Right)
(For Access To No. 12 Fuel Injector)
Figure 404
(Task 72−00−41−450−006)

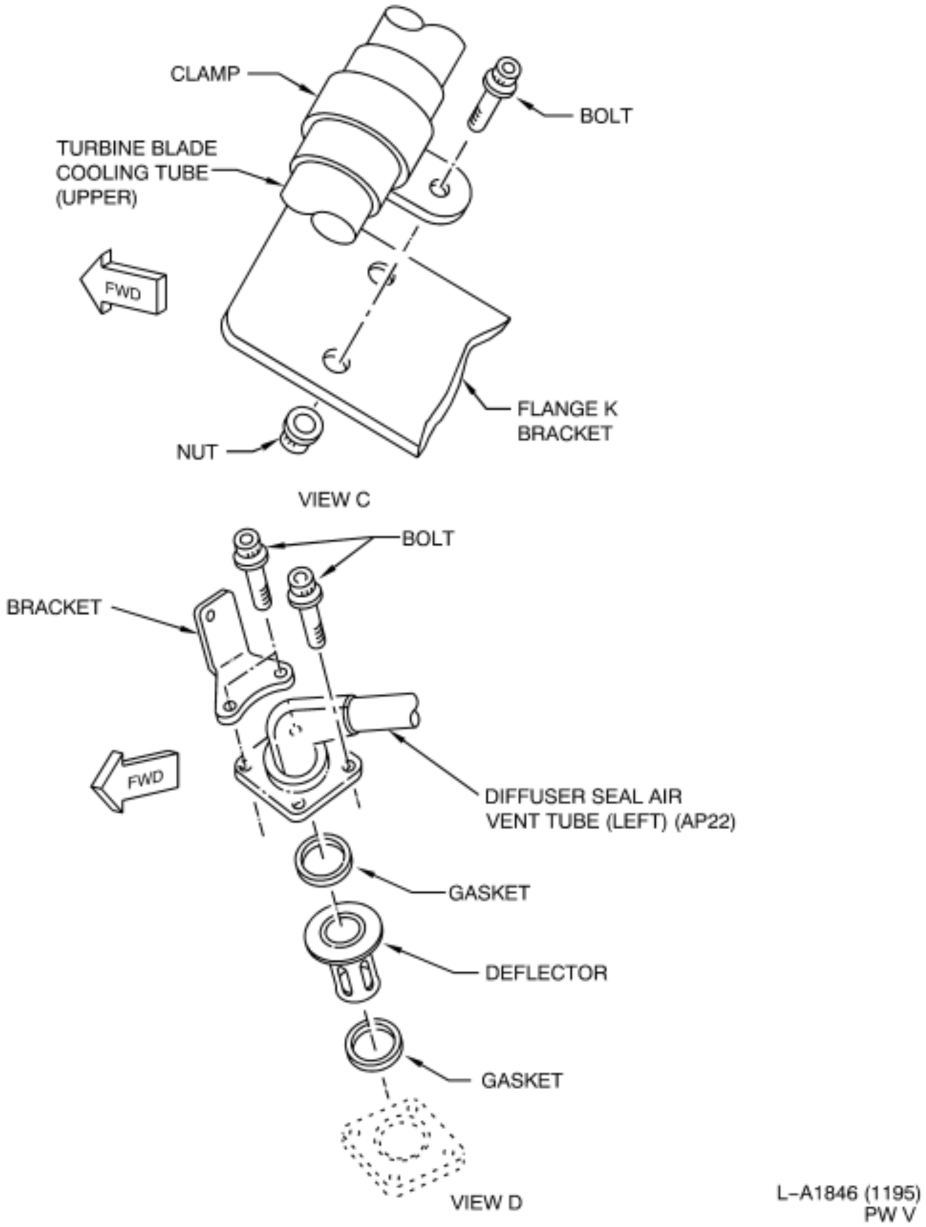

TURBINE BLADE
COOLING TUBE (UPPER)
DIFFUSER SEAL
AIR VENT TUBE
(LEFT) (AP22)
C
D
E
FLANGE K
FWD
L−B5894 (1197)
PW V

Diffuser Seal Air Vent tube (Left) For Access
To Fuel Injector No. 22 (Pre SB PW4ENG 72−567)
Figure 405 (Sheet 1)
(Task 72−00−41−450−006)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−13

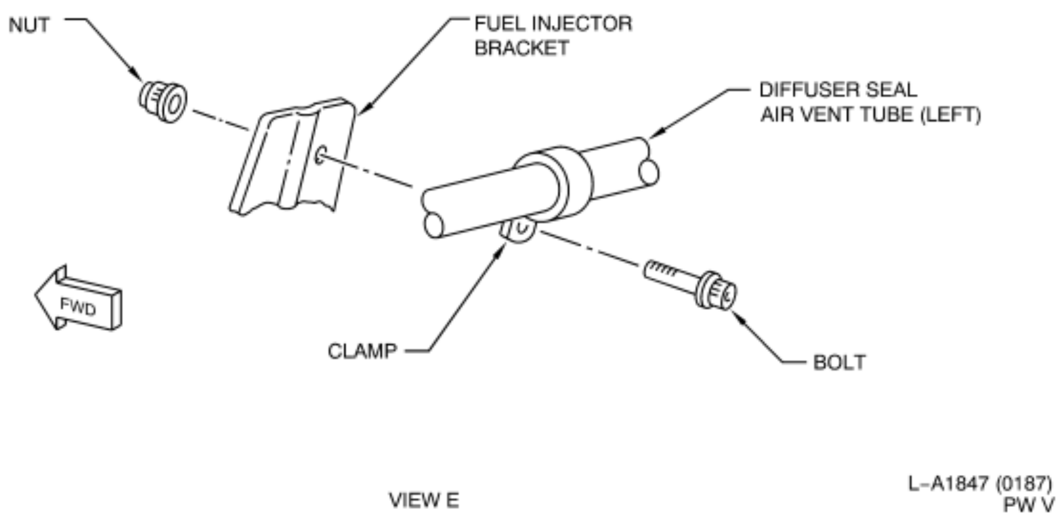

DIFFUSER CASE INTERNAL TUBE
BOLT (4 REQUIRED)
DIFFUSER SEAL AIR VENT TUBE (LEFT) (AP22)
BRACKET
NUT
NO. 21 FUEL INJECTOR BRACKET
GASKET
CLAMP
FWD
DEFLECTOR
BOLT
GASKET
FLANGE K
H P C REAR CASE
L−B1802 (0000)
PW V

Diffuser Seal Air Vent Tube (Left) For Access
To Fuel Injector No. 22 (Pre SB PW4ENG 72−567)
Figure 405 (Sheet 2)
(Task 72−00−41−450−006)

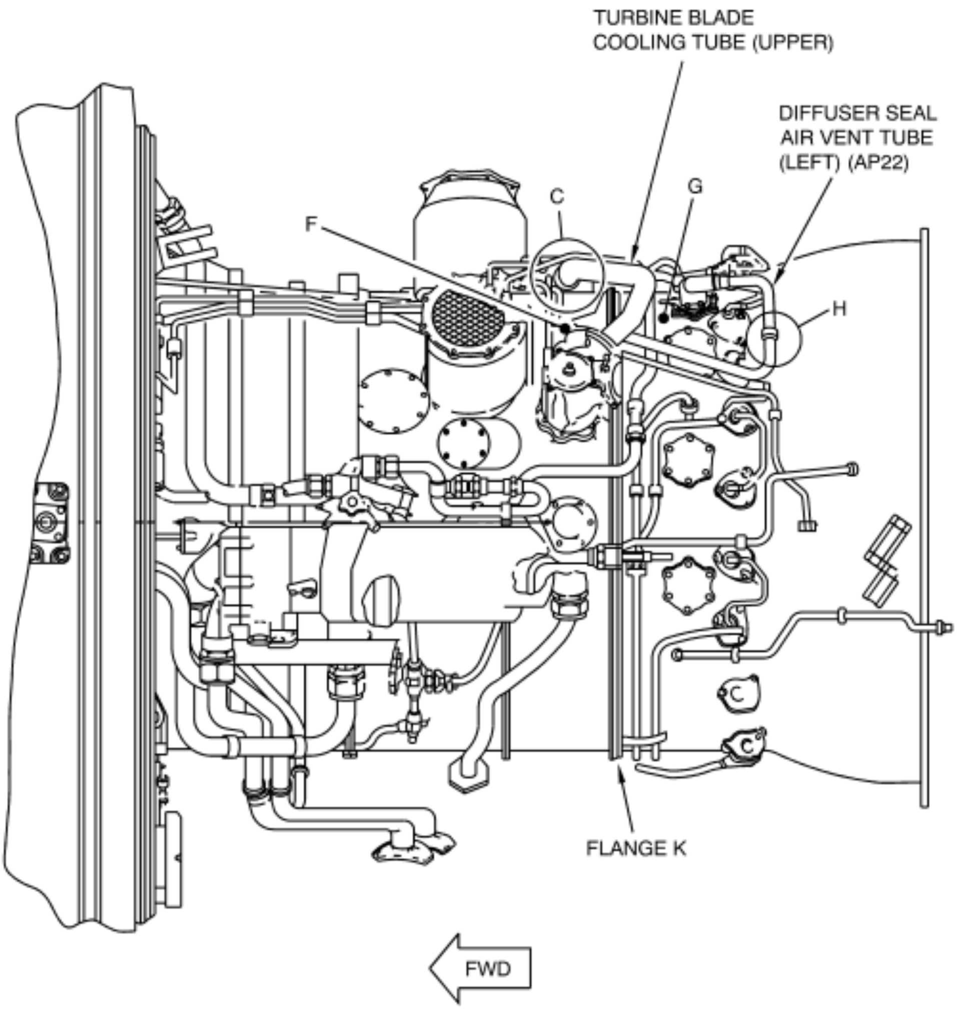

CLAMP
BOLT
TURBINE BLADE COOLING TUBE (UPPER)
FWD
FLANGE K BRACKET
NUT
VIEW C
BOLT
BRACKET
FWD
DIFFUSER SEAL AIR VENT TUBE (LEFT) (AP22)
GASKET
DEFLECTOR
GASKET
VIEW D
L−A1846 (1195)
PW V

Diffuser Seal Air Vent tube (Left) For Access
To Fuel Injector No. 22 (Pre SB PW4ENG 72−567)
Figure 405 (Sheet 3)
(Task 72−00−41−450−006)

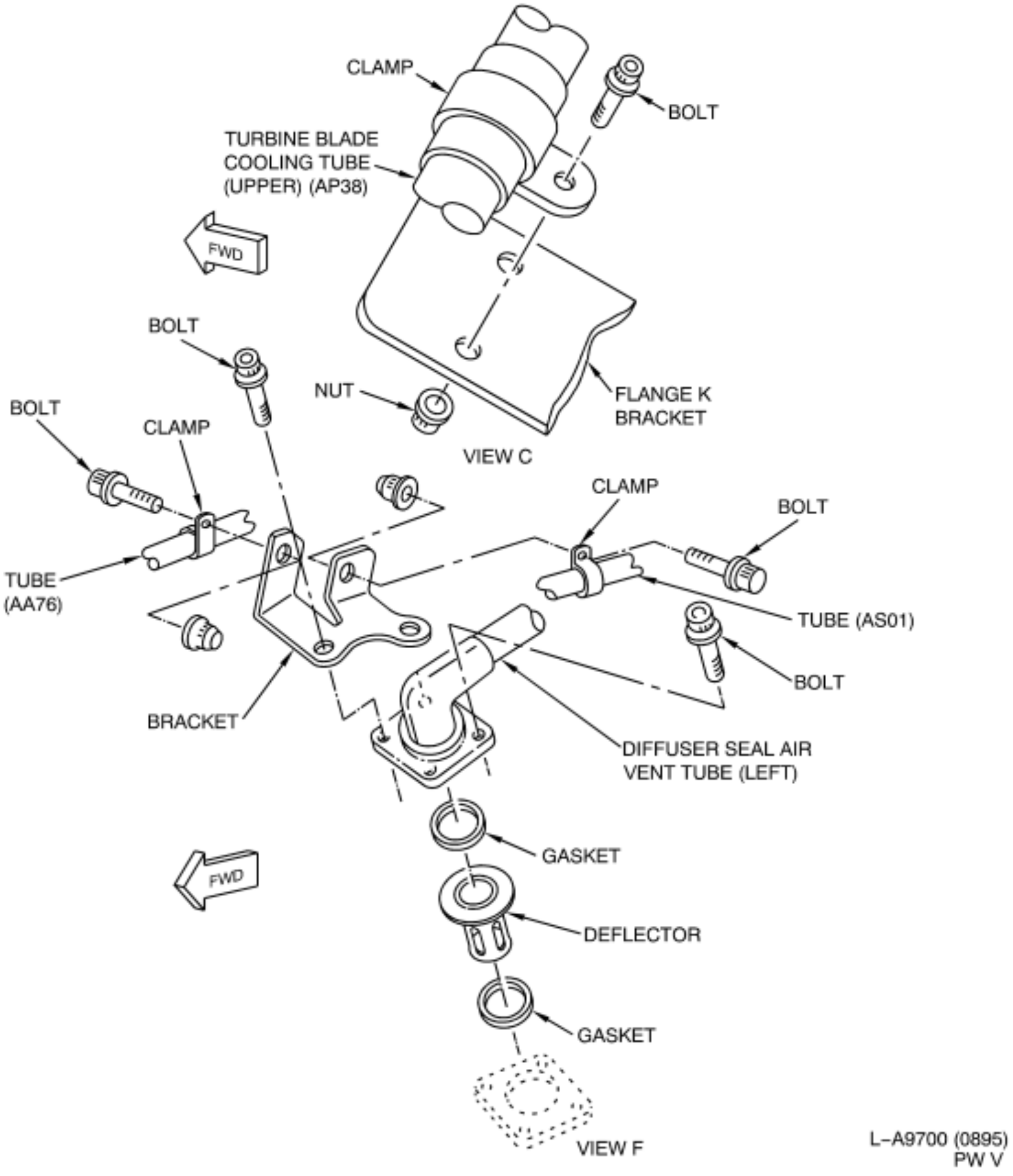
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−13


NUT
FUEL INJECTOR BRACKET
DIFFUSER SEAL AIR VENT TUBE (LEFT)
FWD
CLAMP
BOLT
VIEW E
L−A1847 (0187)
PW V

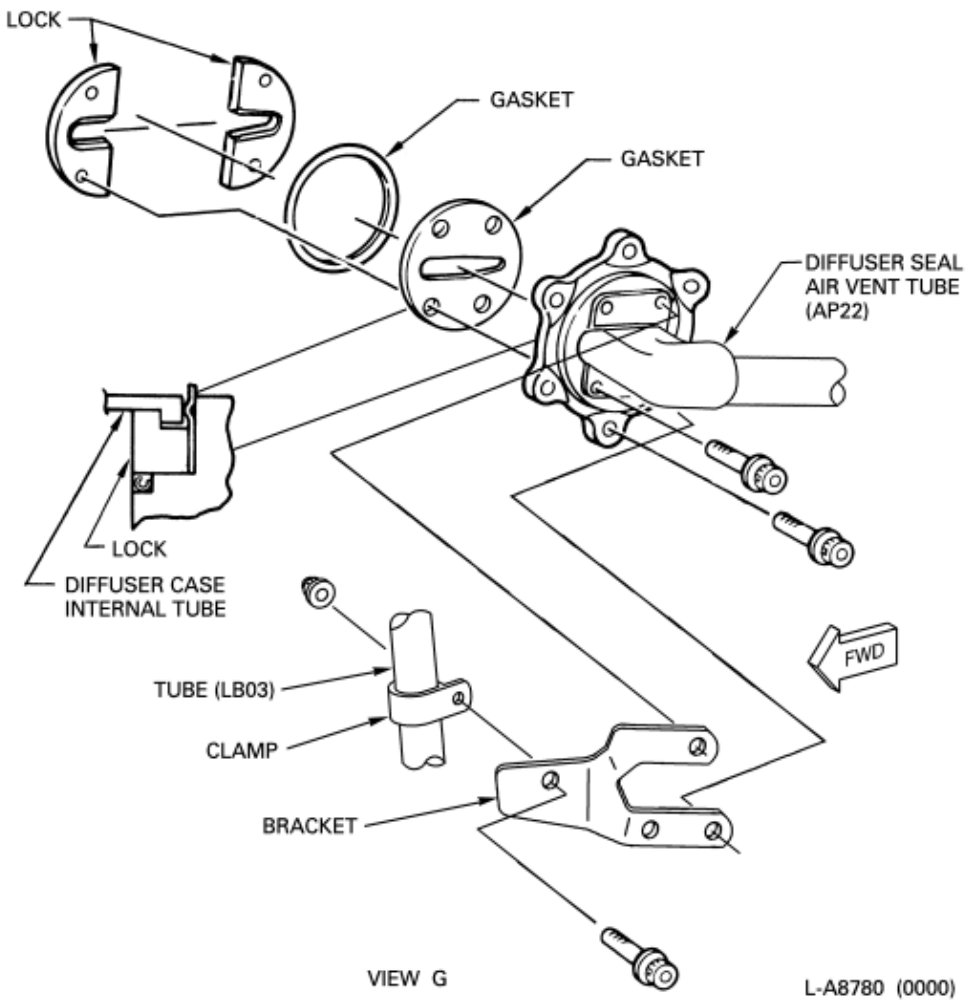
Diffuser Seal Air Vent tube (Left) For Access
To Fuel Injector No. 22 (Pre SB PW4ENG 72−567)
Figure 405 (Sheet 4)
(Task 72−00−41−450−006)


TURBINE BLADE
COOLING TUBE (UPPER)
DIFFUSER SEAL
AIR VENT TUBE
(LEFT) (AP22)
C
G
F
H
FLANGE K
FWD
L−B5895 (1197)
PW V

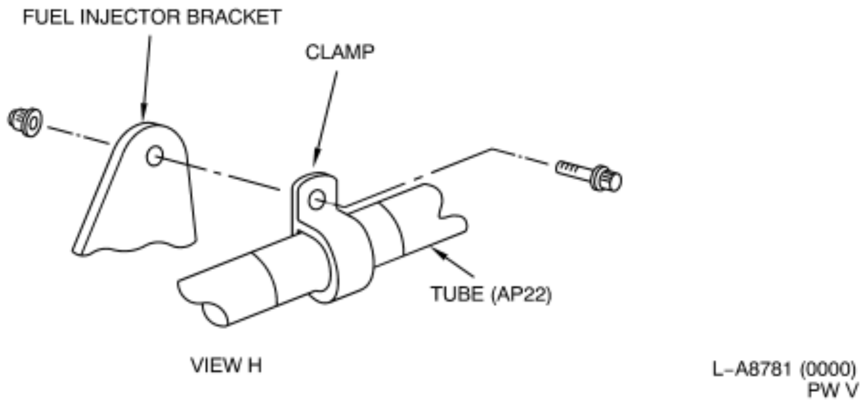
Diffuser Seal Air Vent tube (Left) For Access To
Fuel Injector No. 22 (Post SB PW4ENG 72−567)
Figure 405 (Sheet 5)
(Task 72−00−41−450−006)


CLAMP
BOLT
TURBINE BLADE COOLING TUBE (UPPER) (AP38)
FWD
BOLT
NUT
FLANGE K BRACKET
BOLT
CLAMP
VIEW C
CLAMP
BOLT
TUBE (AA76)
TUBE (AS01)
BOLT
BRACKET
DIFFUSER SEAL AIR VENT TUBE (LEFT)
GASKET
FWD
DEFLECTOR
GASKET
VIEW F
L-A9700 (0895)
PW V

Diffuser Seal Air Vent tube (Left) For Access To
Fuel Injector No. 22 (Post SB PW4ENG 72-567)
Figure 405 (Sheet 6)
(Task 72-00-41-450-006)


LOCK
GASKET
GASKET
DIFFUSER SEAL AIR VENT TUBE (AP22)
LOCK
DIFFUSER CASE INTERNAL TUBE
FWD
TUBE (LB03)
CLAMP
BRACKET
VIEW G
L-A8780 (0000)

Diffuser Seal Air Vent tube (Left) For Access To
Fuel Injector No. 22 (Post SB PW4ENG 72−567)
Figure 405 (Sheet 7)
(Task 72−00−41−450−006)


FUEL INJECTOR BRACKET
CLAMP
TUBE (AP22)
VIEW H
L−A8781 (0000)
PW V

Diffuser Seal Air Vent tube (Left) For Access To
Fuel Injector No. 22 (Post SB PW4ENG 72−567)
Figure 405 (Sheet 8)
(Task 72−00−41−450−006)

Task 72−00−41−450−008:

1. Install Fuel Injector And Support

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 85579	Adapter

Consumable Materials:

	Item No.	Designation
	P03−001	Oil, Engine (PWA 521B)
	P05−007	Fluid, Leak Check (PMC 9569 Or PMC 2277)
	P05−059	Wax, Paraffin (PMC 9552)
	P05−289	Lockwire (AS3214−02)
	P05−291	Cable, Safety (Optional)
	P05−292	Ferrule, Safety Cable (Optional)
	P05−395	Beeswax
R	P05−396	Paraffin Wax Blend
	P06−035	Lubricating Fluid (PWA 36511)
R	P06−054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
*Gasket	1	75−37−00/1/135
*Gasket	2	75−26−00/1/210
*Gasket	1	75−26−00/1/200
*Packing	1	79−22−00/3/1
Gasket	1	73−13−00/1/1
Packing	3	73−13−00/2/1
Packing	2	73−13−00/3/1

NOTE: NOTE: Parts marked with (*) are required only if parts are removed to gain access to specific fuel injectors. See text.

NOTE: Quantities shown are for replacement of one fuel injector and assumes that the fuel nozzle supply manifold was completely removed for access. Quantities for removing two or more fuel injectors are not proportional.

B. Procedure
See Figure 401, Figure 402, Figure 403, Figure 404 and Figure 405.

(1) Remove protective closures.

(2) Install gasket, lubricated with Beeswax P05−395 or Paraffin Wax Blend P05−396, and fuel injector to boss on diffuser case. Rotate injector into position and tilt to engage burner.

(3) Install bracket (if applicable) to position marked at disassembly. See Figure 401 and Figure 402. Secure injector with bolts, threads lubricated with Engine Oil P03−001. Tighten bolts to a torque of 65 − 85 lb−in. (7.344 − 9.604 N.m) then without loosening, continue to tighten to same torque until torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

(4) (Reference 407) Install packing, lubricated with Lubricating Fluid P06−035 to packing groove on just installed fuel injector and two adjacent injectors.

(5) (Reference 2152) Install two packings, lubricated with Lubricating Fluid P06−035, to grooves in transfer tube.

(6) Install transfer tube into adapter on fuel supply manifold.

(7) Lubricate threads of injector adapters and adapter on fuel supply manifold with Engine Oil P03−001, and install fuel injector supply manifold to injectors and to fuel supply tube, securing tube nuts handtight. Loosen one half turn.

(8) Examine the applicable tube and manifold packings at connections as follows.

  (a) Connect the PWA 85579 Adapter to the fuel distribution valve with the packing and bolts.

  (b) Supply clean dry air through the adapter at 95 − 105 psig (655.0 − 723.9 kPa). Apply Leak Check Fluid P05−007 to connections and examine for leaks. Maintain pressure for a minimum of five minutes.

NOTE: Be sure all applicable manifold and tube connections are loose enough to find any leaks in the transfer tube packings. Check to be sure that air is flowing from all 24 nozzles. No leakage from any surface, joint or connection is permitted.

(c) If a leak is found, repair or replace the parts as necessary. Repeat this test.

(d) If no leak is found, remove the air source and the PWA 85579 Adapter.

(9) (Reference 2152) Torque tube nut to fuel supply manifold adapter (8 places) to 275 − 325 lb−in. (31.071 − 36.720 N.m).

(10) (Reference 2152) Torque manifold nuts on fuel injectors (24 places) to 185 − 200 lb−in. (20.902 − 22.597 N.m).

(11) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to all the tube and manifold nuts.

(12) If No. 3 bearing oil scavenge manifold (LR04) was removed for access to injector No. 13, comply with the following. See Figure 403.

(a) Remove protective closures and install packing lubricated with Engine Oil P03−001, to packing groove at flanged end of manifold.

(b) Lubricate threads on manifold elbow with Engine Oil P03−001, and install manifold to diffuser case internal tube nut at approximately 6 o'clock position, and to port on main oil pump with bolts,
R threads lubricated with Antiseize Paste P06−054,
R handtight only. Wipe off unwanted paste.

(c) (Pre SB PW4ENG 79−46) Secure manifold to oil pump bracket with clamp, bolt, threads lubricated with Engine Oil P03−001, and nut. Torque clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 403 (Sheet 1).

(d) (Post SB PW4ENG 79-46 and Pre SB PW4ENG 79-75) Secure the (LR04) manifold to the oil pump bracket with clamp, bolt, threads lubricated with Engine Oil P03-001, and nut. Secure the (LR04) manifold to the (LR05) manifold with the loop clamp grommet halves, clamp, bolt threads lubricated with Engine Oil P03-001, and nut. See Figure 403 (Sheet 2). Torque clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) (Post SB PW4ENG 79-75) Secure the (LR04) hose and manifold assembly with clamp, bolt, threads lubricated with Engine Oil P03-001, and nut to the bracket bolted to the fluid pressure dampener or (Post SB PW4ENG 79-86) adapter which is mounted on the top of the lubrication and scavenge oil pump. Also secure the (LR04) hose and manifold assembly with clamp, bolt, threads lubricated with Engine Oil P03-001, and nut to the bracket installed between fuel injector pads 12 and 13. See Figure 403. Torque clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(f) Torque bolts securing manifold flange to main oil pump to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(g) Torque diffuser case internal tube nut to 650 - 700 lb-in. (73.440 - 79.089 N.m), while holding manifold elbow from turning and secure with the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(13) If lower right turbine blade cooling air tube (AP37) was removed for access to injector No. 12, comply with the following. See Figure 404.

CAUTION: INSTALL LOCK PLATES WITH SLOT GROOVE OUTWARD. ENSURE LOCK PLATES ENGAGE INTERNAL TUBE LIP FLANGE AS SHOWN IN FIGURE 404.

(a) Remove protective closures. Install gasket, with raised sealing surface visible, to elbow end of tube, aligning tube slot and four bolt holes. Secure in place with Paraffin Wax P05-059. Install ring gasket to elbow groove with Paraffin Wax P05-059. Install locks to engage diffuser case internal tube lip and secure in place with Paraffin Wax P05-059.

(b) (Reference 2261) Hold the tube locks outward against the tube lip. Measure and be sure the end of the internal tube is 0.000 - 0.020 inch (0.000 - 0.508 mm) above the tube locks. If the measurement is not within this limit, install the locks again and be sure you engage the internal tube lip properly. See Figure 404.

(c) (Pre SB PW4ENG 72-537 or Post SB PW4ENG 72-627) Install the gasket and metering plate in the four hole air shutoff valve flanged end of the tube and hold in place with Paraffin Wax P05-059. Install gasket to lower flanged opening of air shutoff valve and hold in place with Paraffin Wax P05-059.

(d) (Post SB PW4ENG 72-537 and Pre SB PW4ENG 72-627) Install the gasket and ring spacer in the four hole flanged end of the tube and hold in place with Paraffin Wax P05-059. Install gasket to lower flanged opening of air shutoff valve and hold in place with Paraffin Wax P05-059.

(e) Secure elbow end of tube (gaskets in place) and bracket to diffuser case pad at approximately 5 o'clock position with bolts, threads lubricated with Engine Oil P03-001, handtight only.

(f) (Pre SB PW4ENG 72-537 and Post SB PW4ENG 72-627) Secure opposite end of tube (gasket and metering plate in place) to air shutoff valve with bolts, threads lubricated with Engine Oil P03-001, handtight only.

(g) (Post SB PW4ENG 72-537 and Pre SB PW4ENG 72-627) Secure opposite end of tube (gasket and ring spacer in place) to air shutoff valve with bolts, threads lubricated with Engine Oil P03-001, handtight only.

(h) Secure tube to three brackets on diffuser case with clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts. Torque clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(i) Torque all bolts at each end of tube to 85 − 95 lb−in. (9.604 − 10.734 N.m), then retorque to required limit without loosening until required torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts at the diffuser case pad.

(j) Secure fuel injector supply manifold to bracket attached to tube flange at diffuser case with clamp, bolt, threads lubricated with Engine Oil P03−001, and nut. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(14) If the (left) diffuser seal air vent tube (AP22) was removed for access to injector No. 22, do the steps that follow. See Figure 405 (Sheets 1 through 4).

NOTE: Make sure to remove the temporary safety wire that is around the internal diffuser seal air vent tube assembly before you install the locks. Be careful not to let the tube drop into the diffuser case after you remove the temporary safety wire.

(a) Remove the protection covers. Install a gasket to the groove in the HPC rear case boss at approximately 10:30 o'clock position.

(b) Install a gasket to the flanged end (with four holes) of the tube and attach the gasket in place with Paraffin Wax P05−059. Align the pin on the deflector with the hole in the HPC case as you install the deflector into the HPC rear case boss.

CAUTION: INSTALL LOCK PLATES WITH SLOT GROOVE OUTWARD AND PIN (IF EQUIPPED) INWARD. MAKE SURE THE LOCK PLATES ENGAGE THE INTERNAL TUBE LIP FLANGE AS SHOWN IN FIGURE 405.

(c) Install the locks to the diffuser case internal tube inside boss at approximately the 11 o'clock position. Attach the locks in place with Paraffin Wax P05−059.

(d) (Reference 2261) Hold the tube locks inward against the tube lip. Measure and make sure the end of the internal tube is 0.000 − 0.020 inch (0.000 − 0.508 mm) above the tube locks. If the measurement is not within this limit, install the locks again and make sure the internal tube lip is engaged properly.

(e) Install the four hole gasket with the raised portion outward toward the tube flange. Install the second gasket in groove of the same opening and attach both gaskets in place with Paraffin Wax P05−059.

(f) Install the tube to the engine (gaskets in place). Attach the tube to the diffuser case with a bracket and bolts, threads lubricated with Engine Oil P03−001. Tighten the bolts by hand.

(g) Attach the tube to the HPC rear case with a bracket and bolts, threads lubricated with Engine Oil P03−001. Tighten the bolts by hand.

(h) Install a clamp, bolt, threads lubricated with Engine Oil P03−001, and nut to attach the tube to the fuel injector bracket. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(i) Torque the bolts that attach the tube flange to the HPC rear case to 85 − 95 lb−in. (9.604 − 10.734 N.m). Without loosening the bolts, torque again until the 85 − 95 lb−in. (9.604 − 10.734 N.m) is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

(j) Torque the bolts that attach the tube flange to the diffuser case and the four bolts that attach a bracket to the tube flange to 85 − 95 lb−in. (9.604 − 10.734 N.m). Without loosening the bolts, torque again until the 85 − 95 lb−in. (9.604 − 10.734 N.m) is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

(k) Install a clamp to the No. 3 bearing breather tube assembly (LB03). Attach the clamp to the bracket from the diffuser pad at the 11 o'clock position with a bolt, threads lubricated with Engine Oil P03−001, and nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

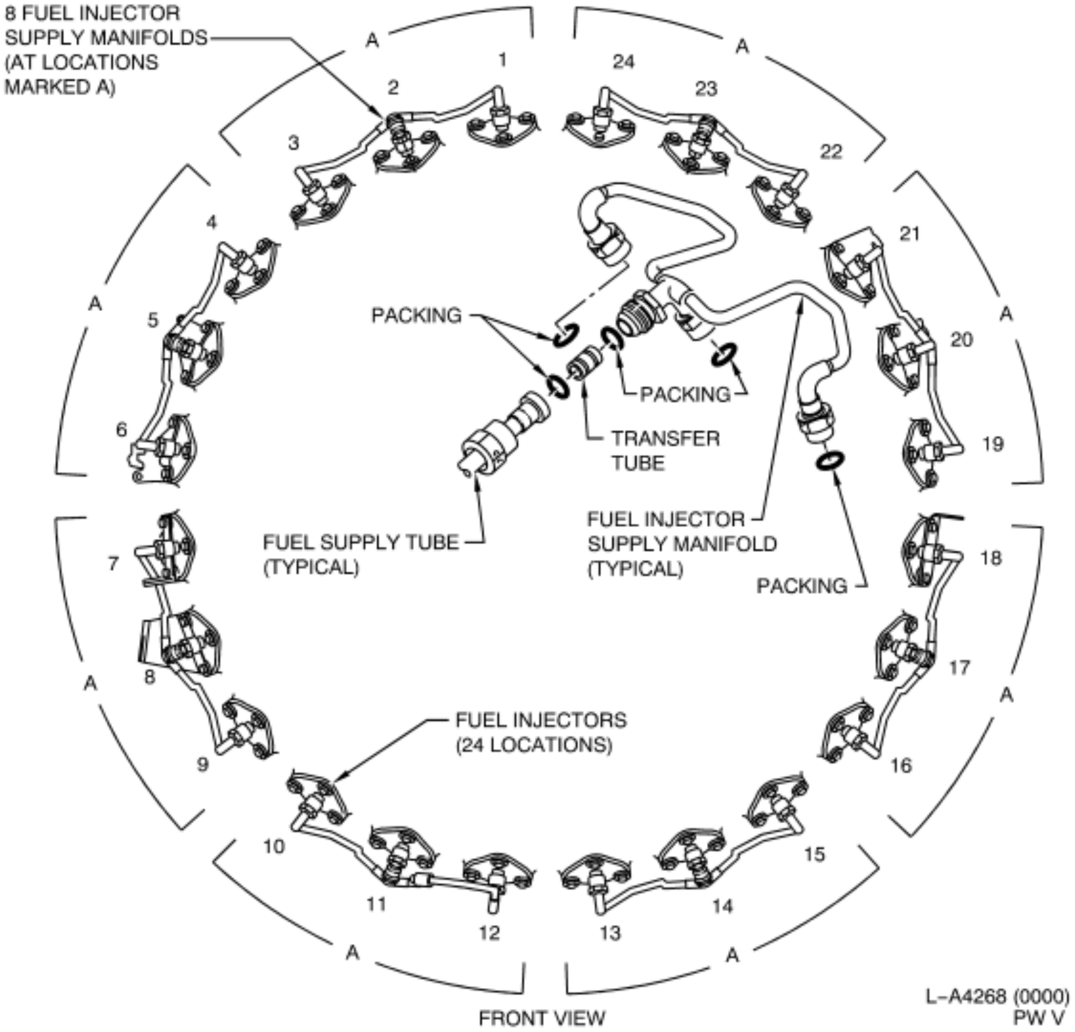
C. Postrequisites

(1) If turbine cooling tube (lower right) was removed for access to injector No. 7, install tube by 72−00−52, Installation−07 Task 72−00−53−450−004.

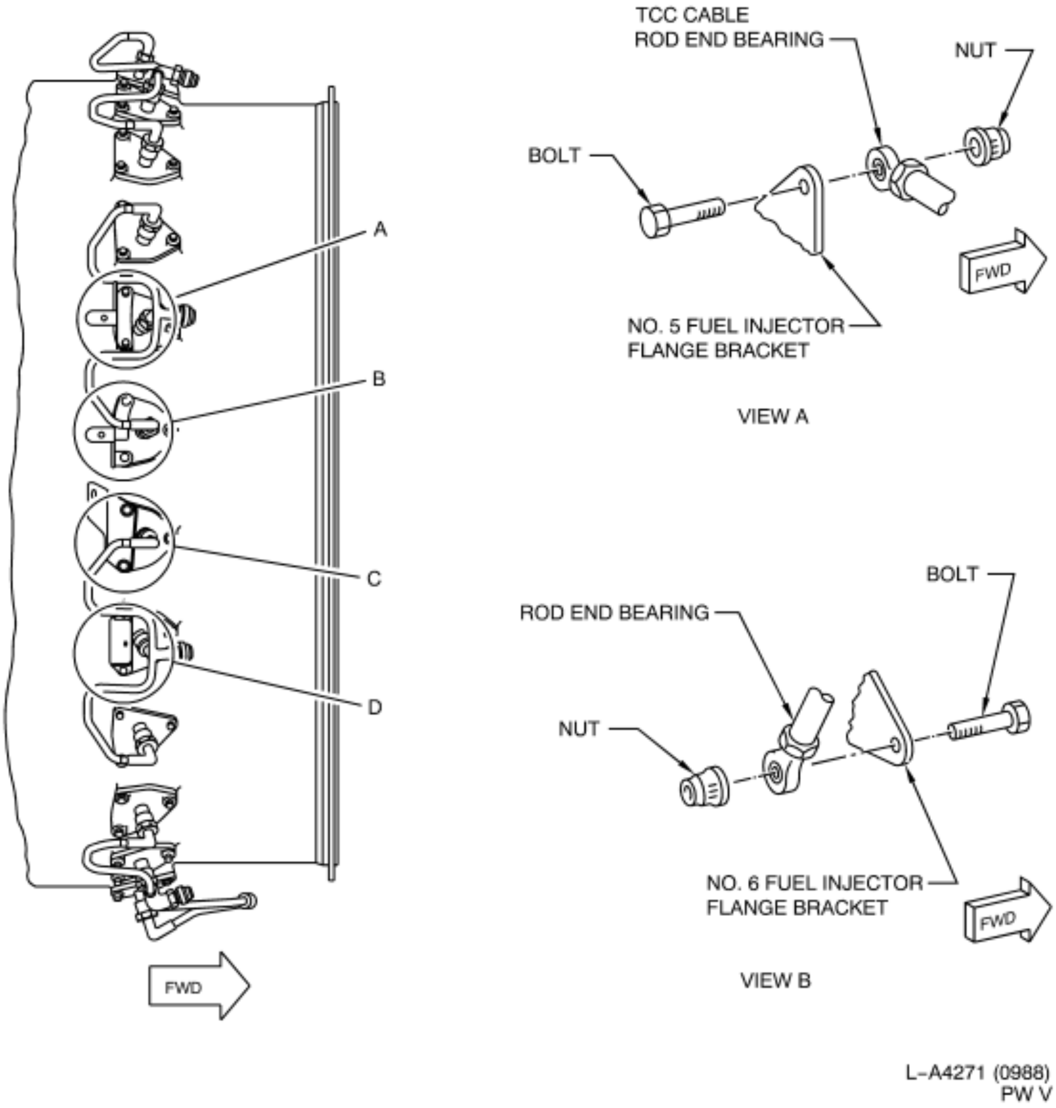
(2) If turbine cooling tube (upper left) was removed for access to injector No. 20, install tube by 72−00−52, Installation−07 Task 72−00−53−450−004.

(3) If oil tank was removed for access to injectors No. 16 and 17, install oil tank by 72−00−61, Installation−28 Task 72−00−61−450−012.

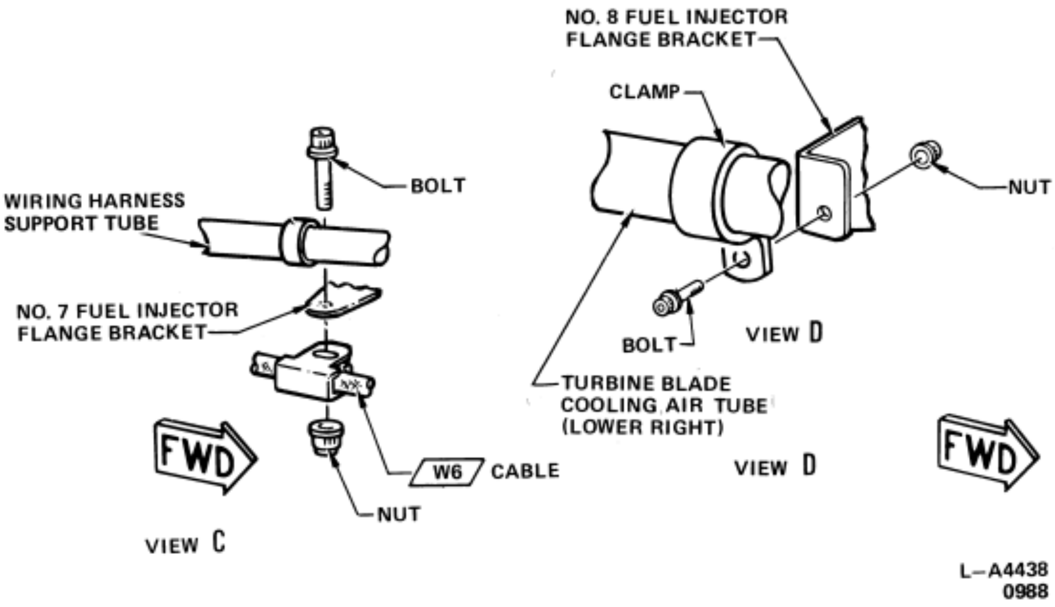
(4) Test engine per Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


8 FUEL INJECTOR SUPPLY MANIFOLDS (AT LOCATIONS MARKED A)
A
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
PACKING
PACKING
TRANSFER TUBE
FUEL SUPPLY TUBE (TYPICAL)
FUEL INJECTOR SUPPLY MANIFOLD (TYPICAL)
PACKING
FUEL INJECTORS (24 LOCATIONS)
FRONT VIEW
L−A4268 (0000)
PW V

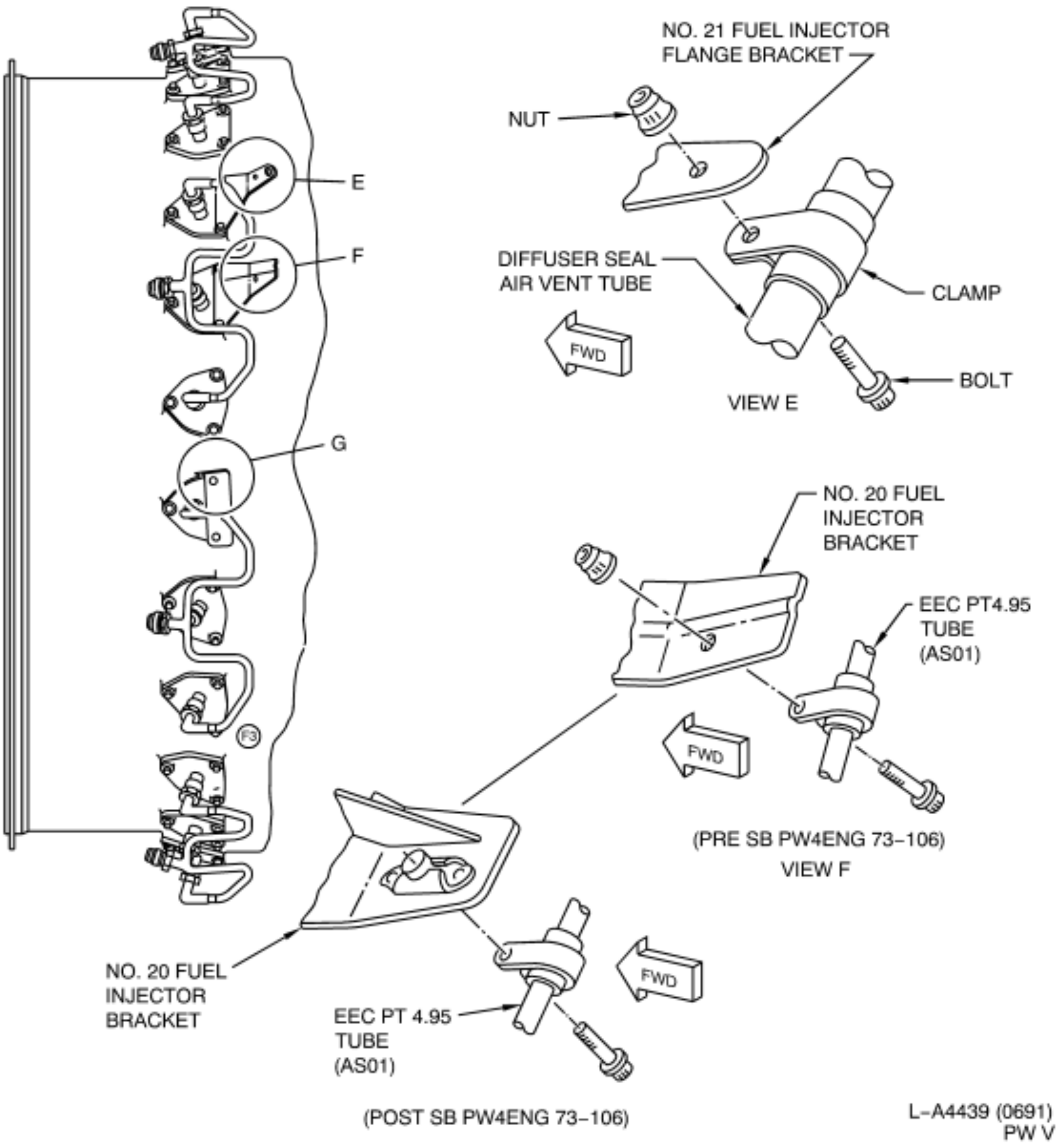
Fuel Injectors And Supply Manifolds Locations
Figure 401
(Task 72−00−41−450−008)


A
B
C
D
FWD
TCC CABLE
ROD END BEARING
NUT
BOLT
NO. 5 FUEL INJECTOR
FLANGE BRACKET
FWD
VIEW A
BOLT
ROD END BEARING
NUT
NO. 6 FUEL INJECTOR
FLANGE BRACKET
FWD
VIEW B
L−A4271 (0988)
PW V

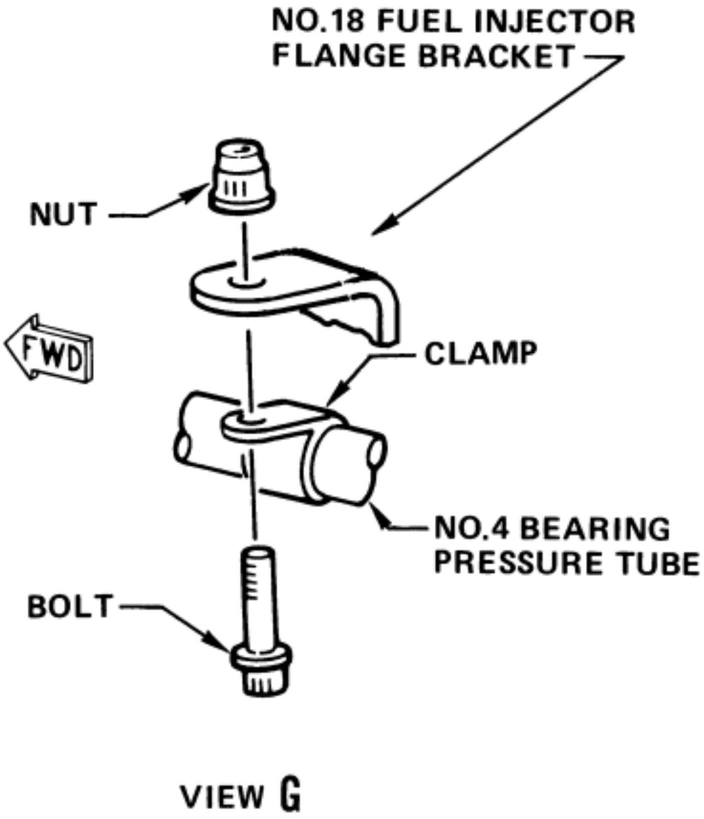
Fuel Injector Flange Brackets And Clamping (Right Side)
Figure 402 (Sheet 1)
(Task 72−00−41−450−008)


NO. 8 FUEL INJECTOR FLANGE BRACKET
CLAMP
BOLT
NUT
WIRING HARNESS SUPPORT TUBE
NO. 7 FUEL INJECTOR FLANGE BRACKET
BOLT
VIEW D
TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT)
FWD
W6
CABLE
VIEW D
FWD
NUT
VIEW C
L−A4438
0988

Fuel Injector Flange Brackets And Clamping (Right Side)
Figure 402 (Sheet 2)
(Task 72−00−41−450−008)

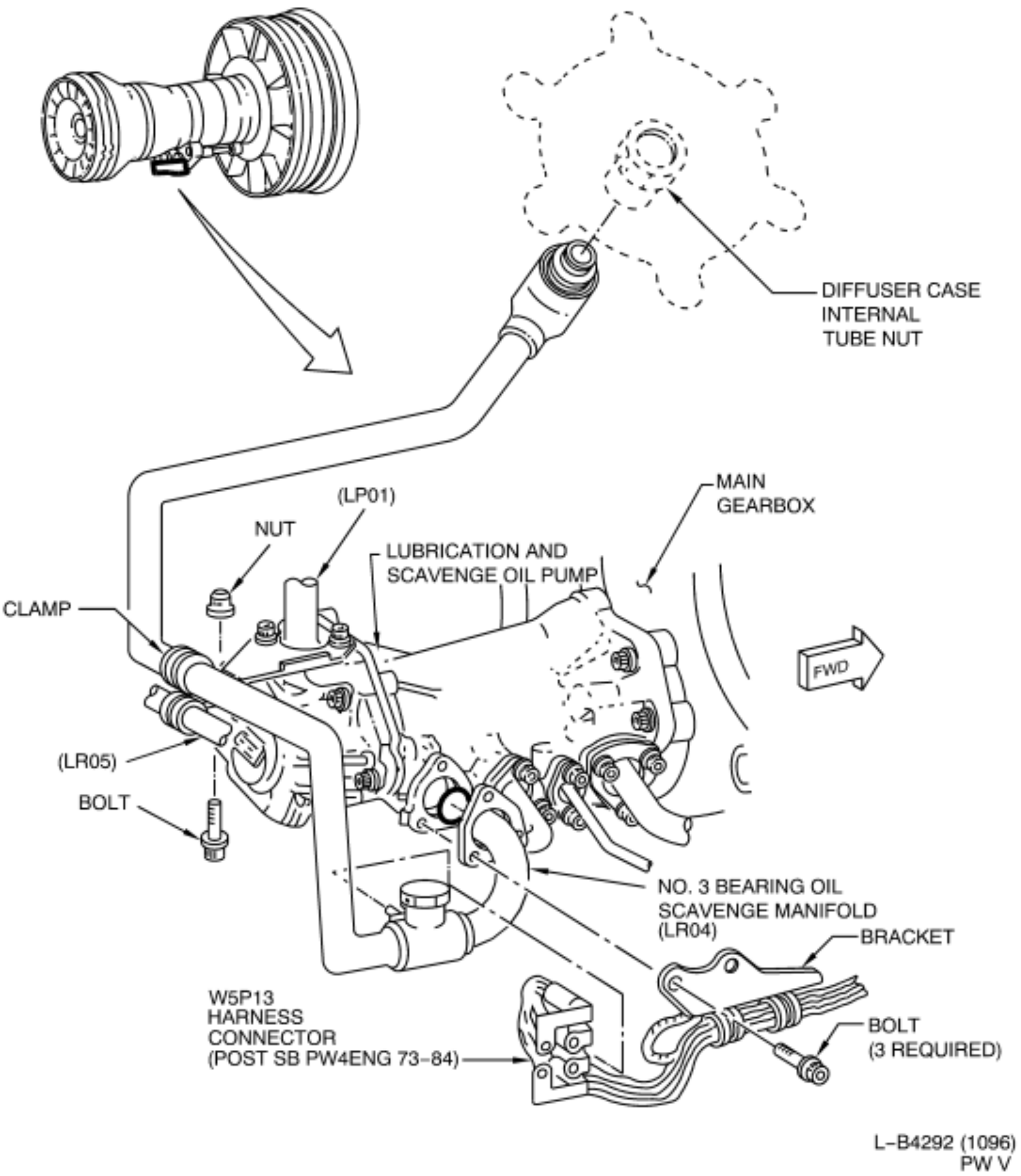

NO. 21 FUEL INJECTOR FLANGE BRACKET
NUT
E
F
DIFFUSER SEAL AIR VENT TUBE
CLAMP
FWD
BOLT
VIEW E
G
NO. 20 FUEL INJECTOR BRACKET
EEC PT4.95 TUBE (AS01)
F3
FWD
(PRE SB PW4ENG 73−106)
VIEW F
NO. 20 FUEL INJECTOR BRACKET
EEC PT 4.95 TUBE (AS01)
FWD
(POST SB PW4ENG 73−106)
L−A4439 (0691)
PW V

Fuel Injector Flange Brackets And Clamping (Left Side)
Figure 402 (Sheet 3)
(Task 72−00−41−450−008)

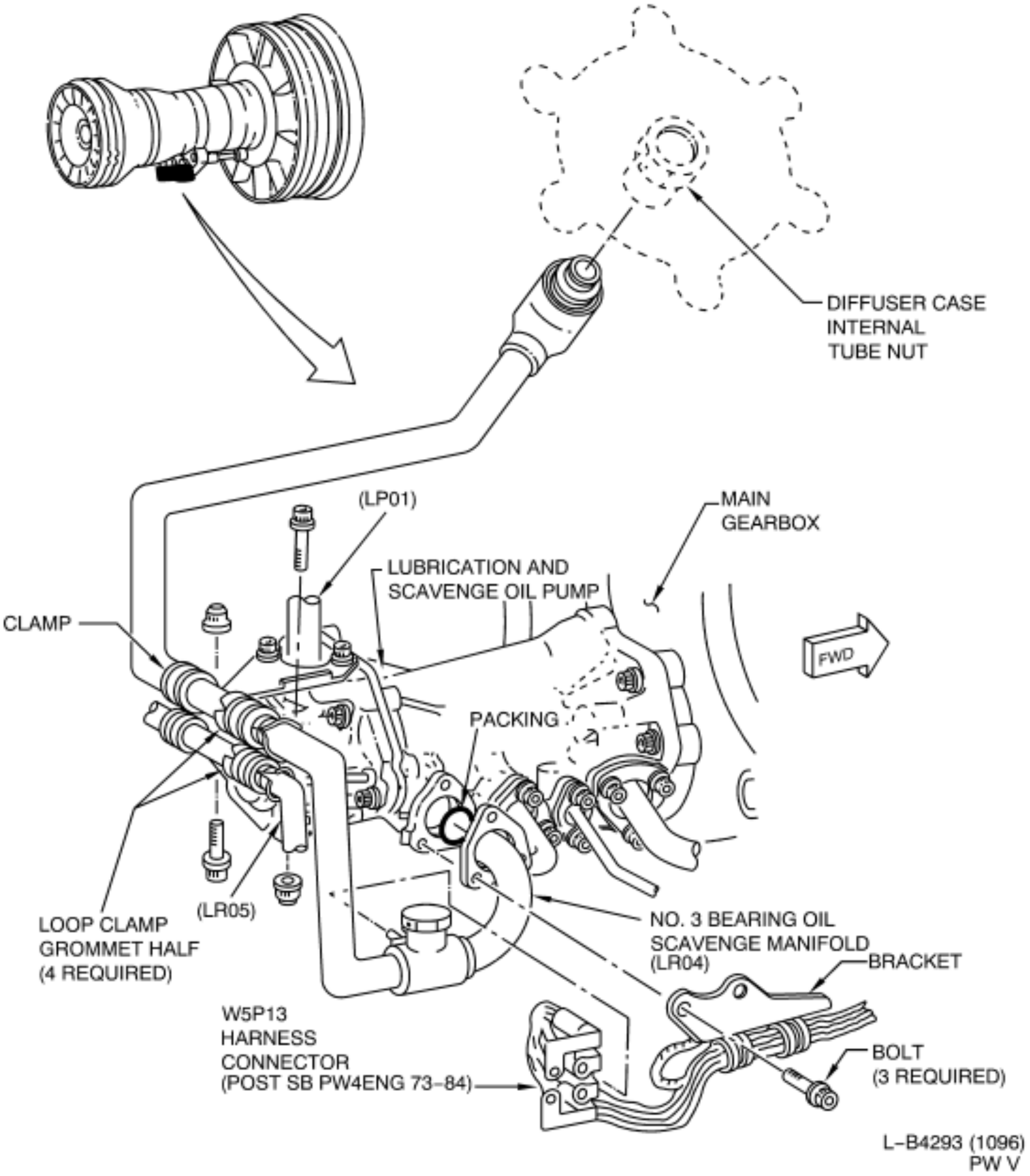

NO.18 FUEL INJECTOR FLANGE BRACKET
NUT
FWD
CLAMP
NO.4 BEARING PRESSURE TUBE
BOLT
VIEW G

L−A4440
0988

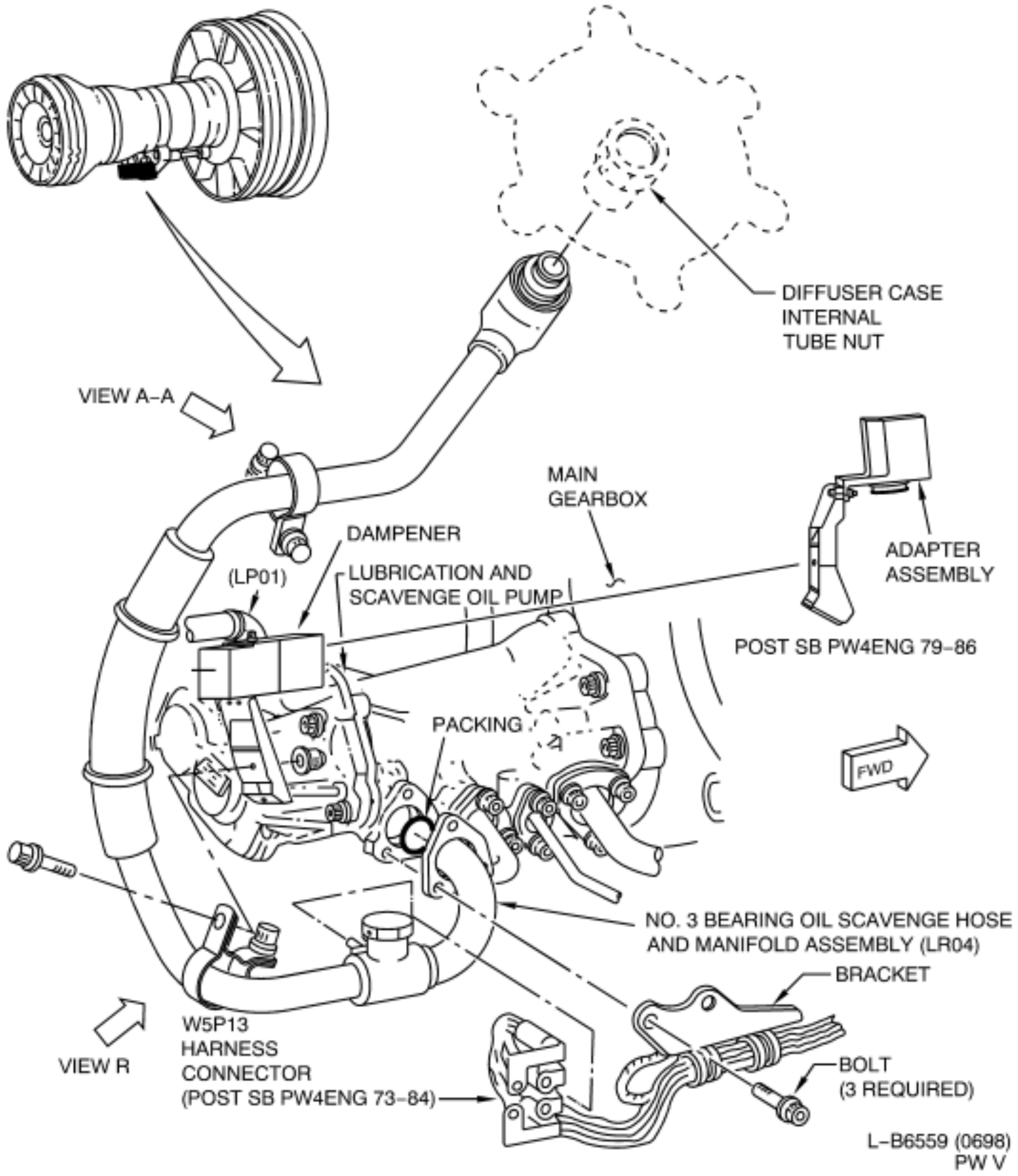
Fuel Injector Flange Brackets And Clamping (Left Side)
Figure 402 (Sheet 4)
(Task 72−00−41−450−008)


DIFFUSER CASE INTERNAL TUBE NUT
MAIN GEARBOX
(LP01)
NUT
LUBRICATION AND SCAVENGE OIL PUMP
CLAMP
FWD
(LR05)
BOLT
NO. 3 BEARING OIL SCAVENGE MANIFOLD (LR04)
BRACKET
W5P13 HARNESS CONNECTOR (POST SB PW4ENG 73-84)
BOLT (3 REQUIRED)
L-B4292 (1096)
PW V

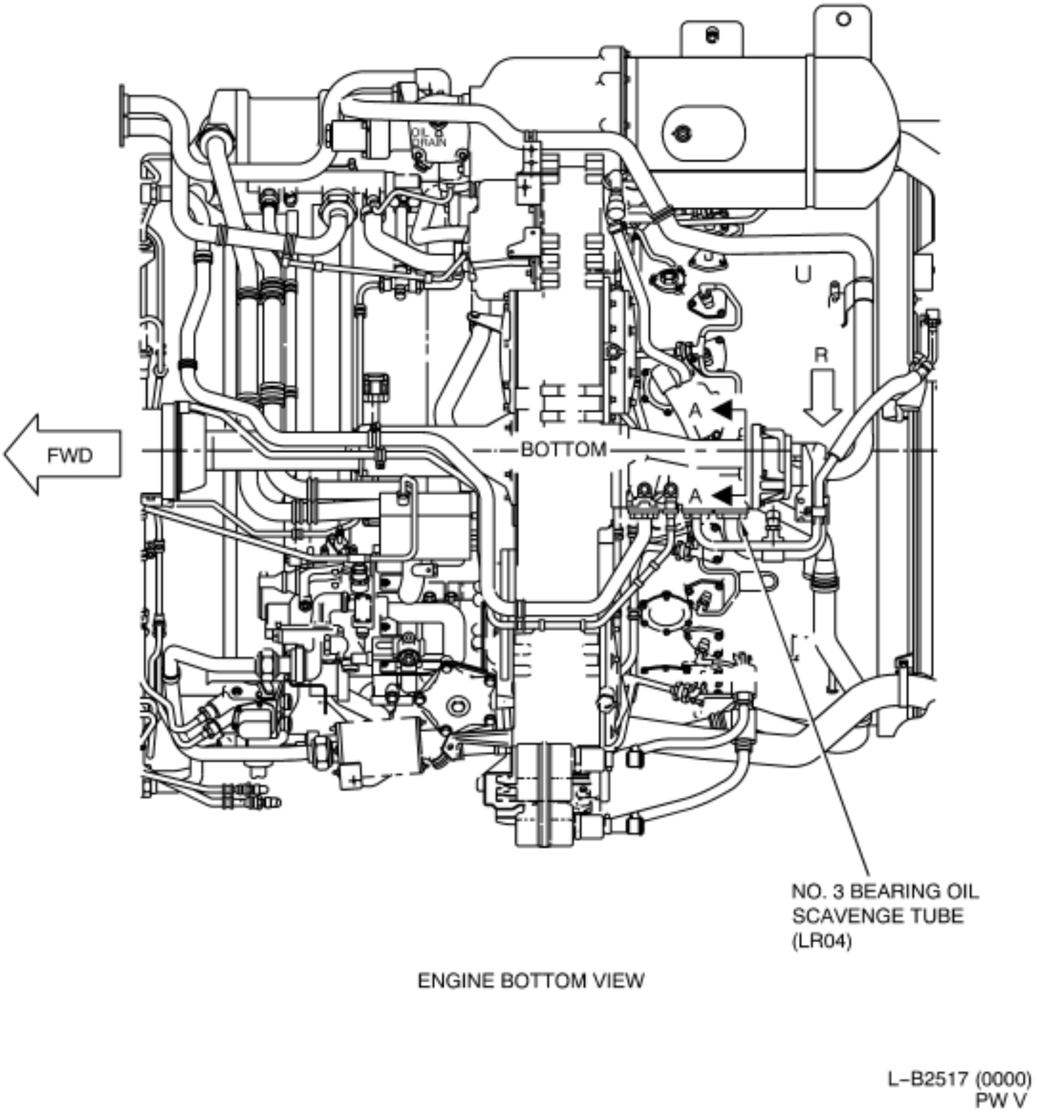
No. 3 Bearing Oil Scavenge Manifold (For Access To No. 13 Fuel Injector) (Pre SB PW4ENG 79-46)
Figure 403 (Sheet 1)
(Task 72-00-41-450-008)


DIFFUSER CASE
INTERNAL
TUBE NUT
(LP01)
MAIN
GEARBOX
LUBRICATION AND
SCAVENGE OIL PUMP
CLAMP
FWD
PACKING
LOOP CLAMP
GROMMET HALF
(4 REQUIRED)
(LR05)
NO. 3 BEARING OIL
SCAVENGE MANIFOLD
(LR04)
BRACKET
W5P13
HARNESS
CONNECTOR
(POST SB PW4ENG 73−84)
BOLT
(3 REQUIRED)
L−B4293 (1096)
PW V

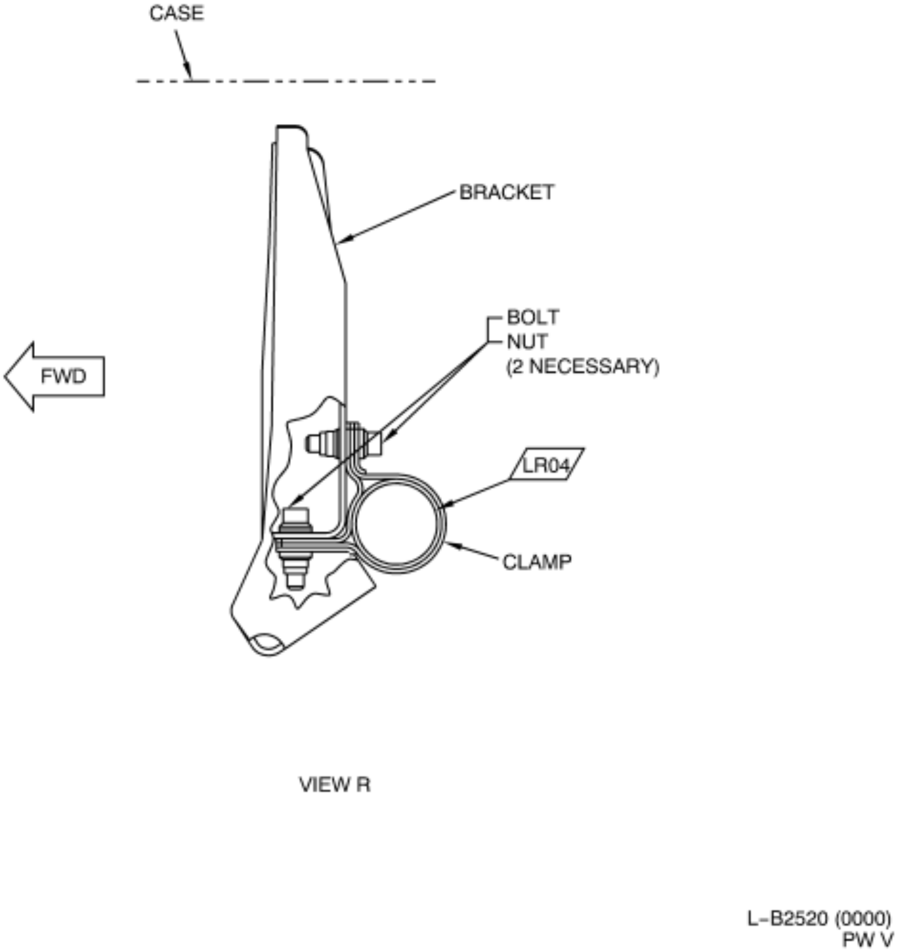
No. 3 Bearing Oil Scavenge Manifold (For Access To No. 13 Fuel Injector) (Post SB PW4ENG 79−46 And Pre SB PW4ENG 79−75)
Figure 403 (Sheet 2)
(Task 72−00−41−450−008)


DIFFUSER CASE
INTERNAL
TUBE NUT
VIEW A-A
MAIN
GEARBOX
ADAPTER
ASSEMBLY
DAMPENER
(LP01)
LUBRICATION AND
SCAVENGE OIL PUMP
POST SB PW4ENG 79-86
PACKING
FWD
NO. 3 BEARING OIL SCAVENGE HOSE
AND MANIFOLD ASSEMBLY (LR04)
BRACKET
VIEW R
W5P13
HARNESS
CONNECTOR
(POST SB PW4ENG 73-84)
BOLT
(3 REQUIRED)
L-B6559 (0698)
PW V

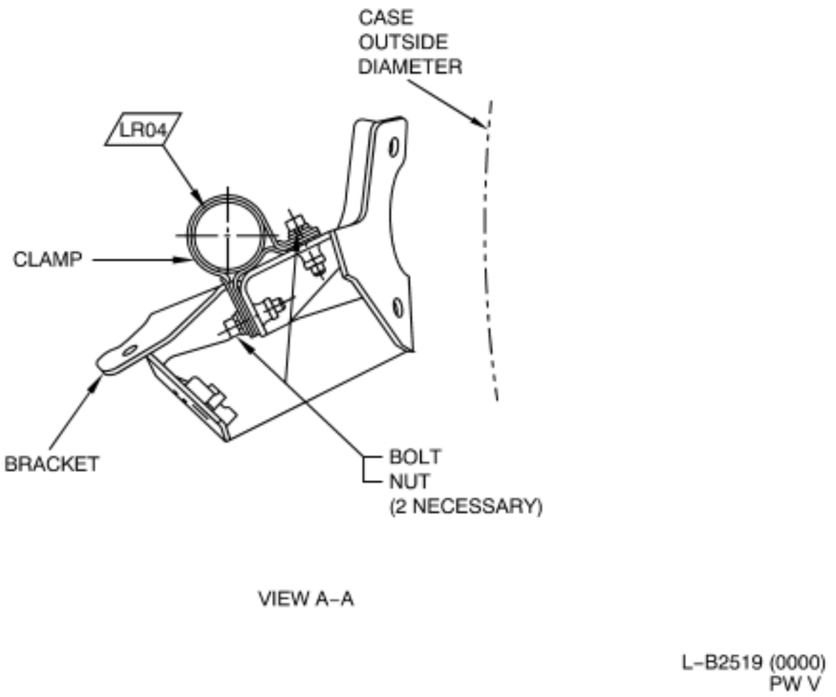
No. 3 Bearing Oil Scavenge Manifold (For Access
To No. 13 Fuel Injector) (Post SB PW4ENG 79-75)
Figure 403 (Sheet 3)
(Task 72-00-41-450-008)


OIL DRAIN
U
R
A
A
FWD
BOTTOM
NO. 3 BEARING OIL SCAVENGE TUBE (LR04)
ENGINE BOTTOM VIEW
L−B2517 (0000)
PW V

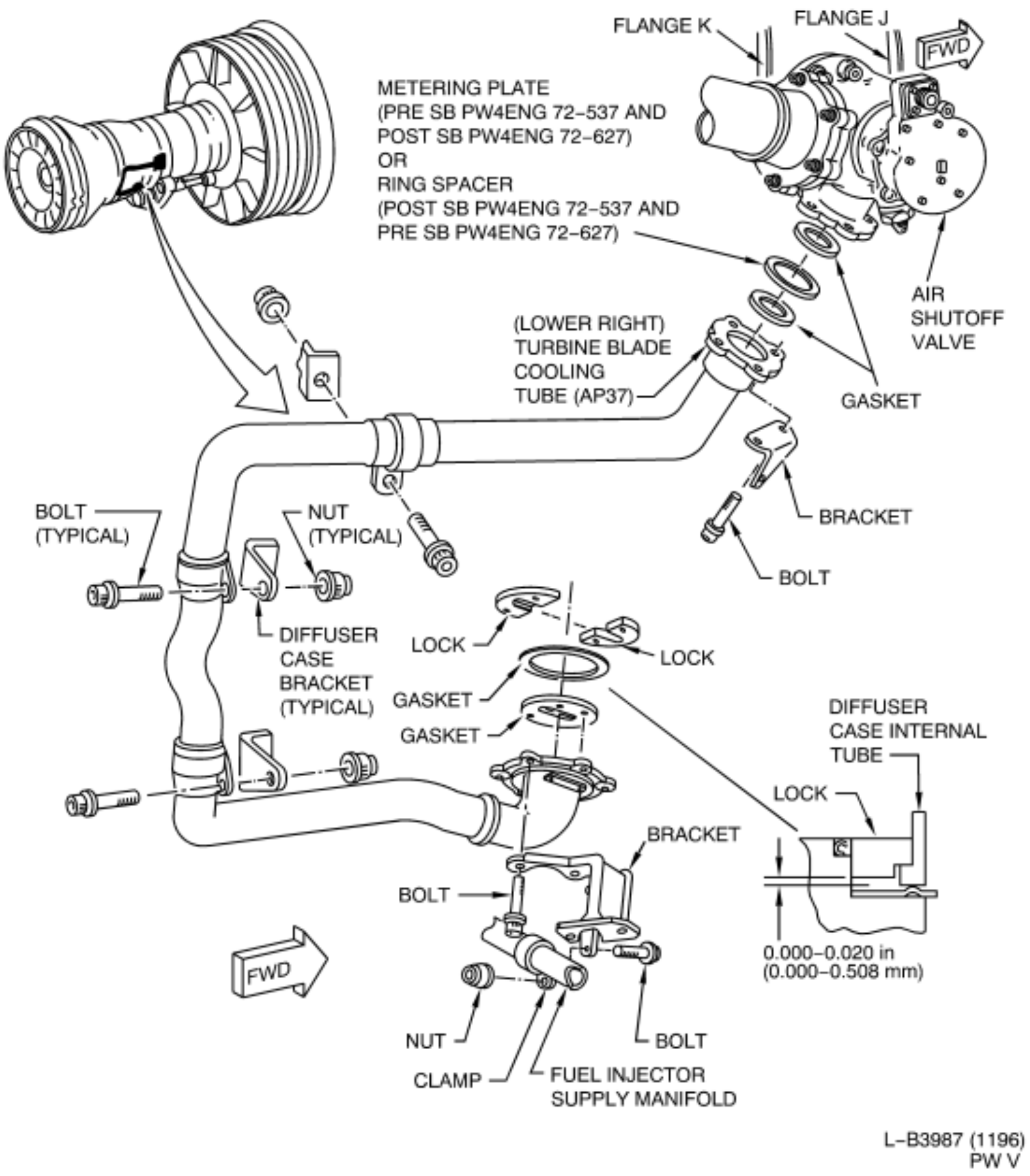
No. 3 Bearing Oil Scavenge Manifold (For Access To No. 13 Fuel Injector) (Post SB PW4ENG 79−75)
Figure 403 (Sheet 4)
(Task 72−00−41−450−008)


CASE
BRACKET
BOLT
NUT
(2 NECESSARY)
FWD
LR04
CLAMP
VIEW R
L-B2520 (0000)
PW V

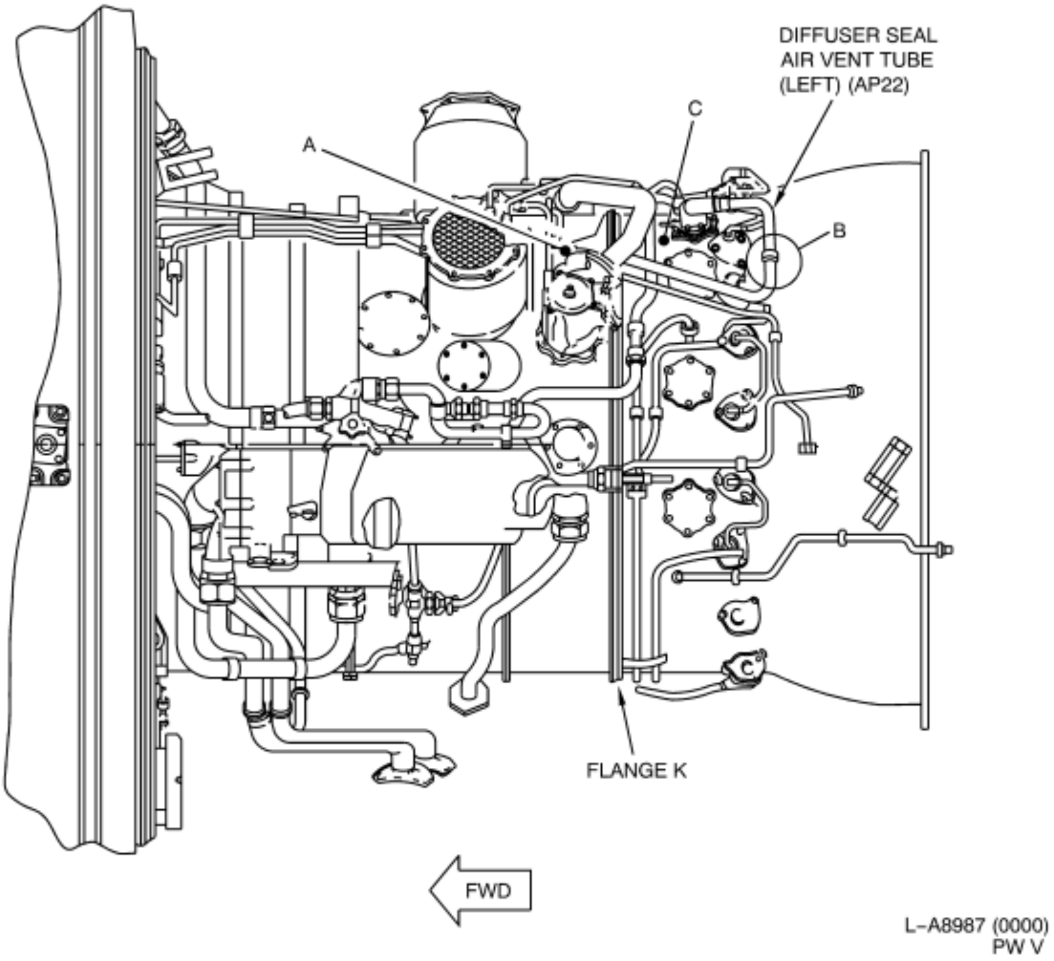
No. 3 Bearing Oil Scavenge Manifold (For Access
To No. 13 Fuel Injector) (Post SB PW4ENG 79-75)
Figure 403 (Sheet 5)
(Task 72-00-41-450-008)


CASE
OUTSIDE
DIAMETER
LR04
CLAMP
BRACKET
BOLT
NUT
(2 NECESSARY)
VIEW A−A
L−B2519 (0000)
PW V

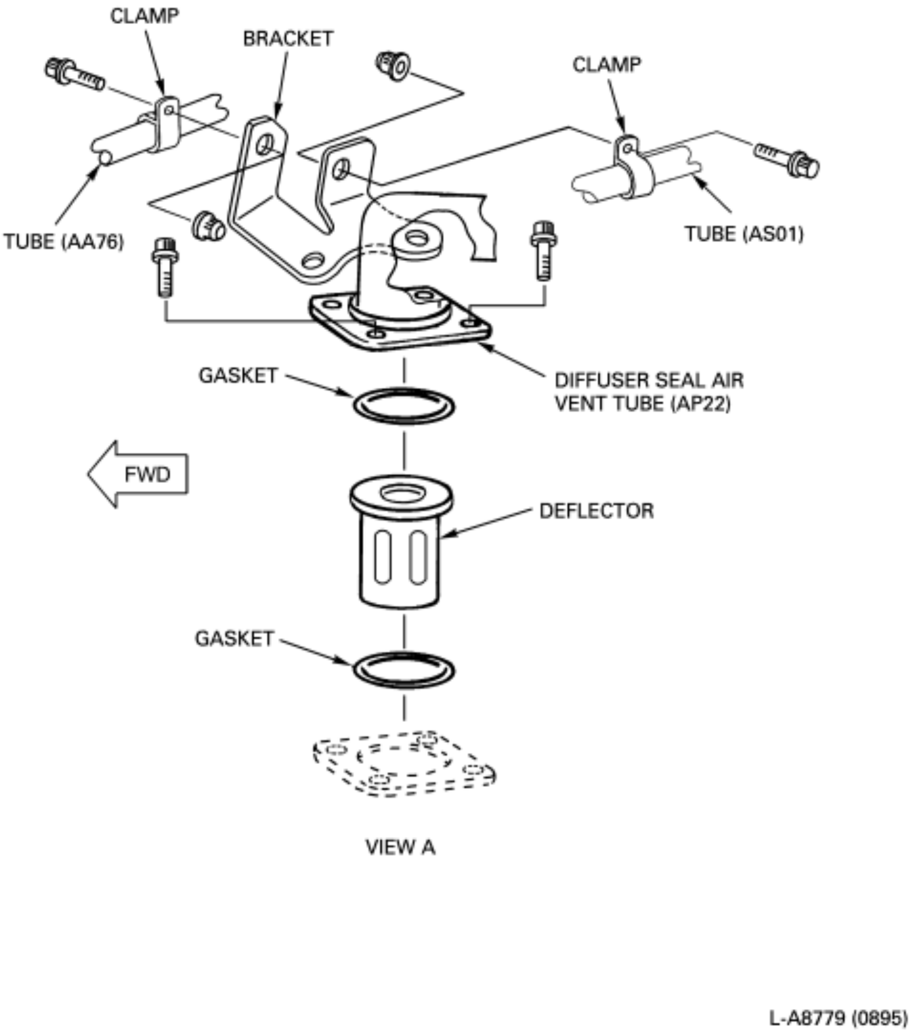
No. 3 Bearing Oil Scavenge Manifold (For Access
To No. 13 Fuel Injector) (Post SB PW4ENG 79−75)
Figure 403 (Sheet 6)
(Task 72−00−41−450−008)


FLANGE K
FLANGE J
FWD
METERING PLATE (PRE SB PW4ENG 72-537 AND POST SB PW4ENG 72-627) OR RING SPACER (POST SB PW4ENG 72-537 AND PRE SB PW4ENG 72-627)
AIR SHUTOFF VALVE
(LOWER RIGHT) TURBINE BLADE COOLING TUBE (AP37)
GASKET
BRACKET
BOLT (TYPICAL)
NUT (TYPICAL)
BOLT
DIFFUSER CASE BRACKET (TYPICAL)
LOCK
LOCK
GASKET
GASKET
DIFFUSER CASE INTERNAL TUBE
LOCK
BRACKET
BOLT
FWD
0.000-0.020 in (0.000-0.508 mm)
NUT
BOLT
CLAMP
FUEL INJECTOR SUPPLY MANIFOLD
L-B3987 (1196)
PW V

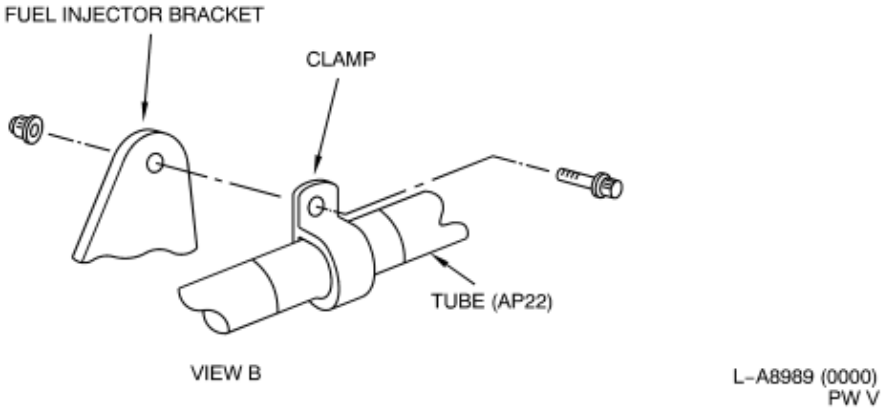
Turbine Blade Cooling Air Tube (Lower Right)
(For Access To No. 12 Fuel Injector)
Figure 404
(Task 72−00−41−450−008)


DIFFUSER SEAL
AIR VENT TUBE
(LEFT) (AP22)
C
A
B
FLANGE K
FWD
L−A8987 (0000)
PW V

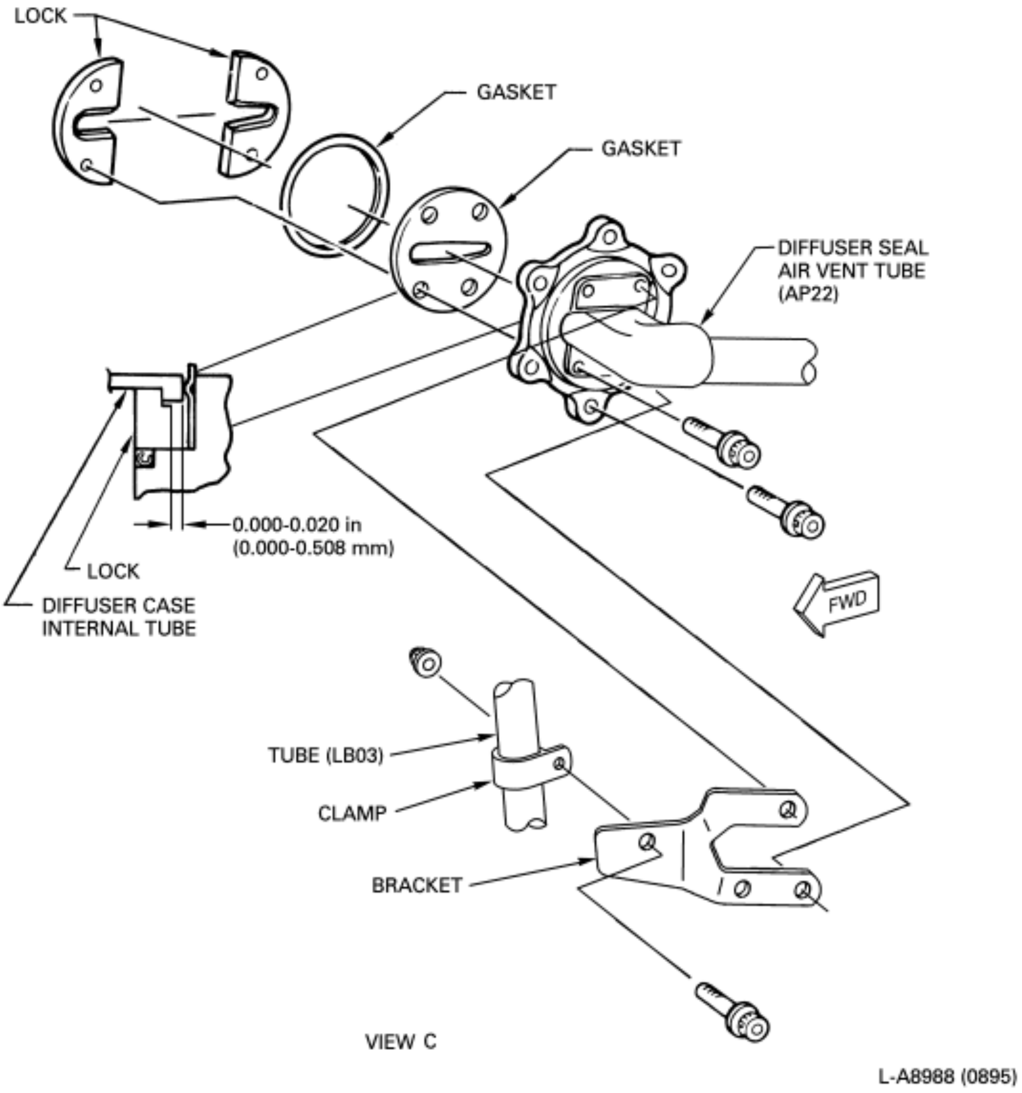
Diffuser Seal Air Vent Tube (Left)
(For Access To No. 22 Fuel Injector)
Figure 405 (Sheet 1)
(Task 72−00−41−450−008)


CLAMP
BRACKET
CLAMP
TUBE (AA76)
TUBE (AS01)
GASKET
DIFFUSER SEAL AIR VENT TUBE (AP22)
FWD
DEFLECTOR
GASKET
VIEW A
L-A8779 (0895)

Diffuser Seal Air Vent Tube (Left)
(For Access To No. 22 Fuel Injector)
Figure 405 (Sheet 2)
(Task 72−00−41−450−008)


FUEL INJECTOR BRACKET
CLAMP
TUBE (AP22)
VIEW B
L−A8989 (0000)
PW V

Diffuser Seal Air Vent Tube (Left)
(For Access To No. 22 Fuel Injector)
Figure 405 (Sheet 3)
(Task 72−00−41−450−008)


LOCK
GASKET
GASKET
DIFFUSER SEAL AIR VENT TUBE (AP22)
0.000-0.020 in (0.000-0.508 mm)
LOCK
DIFFUSER CASE INTERNAL TUBE
FWD
TUBE (LB03)
CLAMP
BRACKET
VIEW C
L-A8988 (0895)

Diffuser Seal Air Vent Tube (Left)
(For Access To No. 22 Fuel Injector)
Figure 405 (Sheet 4)
(Task 72−00−41−450−008)

Task 72−00−41−450−007:

1. Install Igniter Plug And Igniter Plug Boss

A. General

(1) This procedure applies to both igniter plug locations. If boss or spacer(s) are to be replaced, and parts removed at disassembly are not available, igniter plug immersion depth must be determined using this procedure. If none of the above parts are to be replaced, install igniter plug per Installation−07 Task 72−00−41−450−004.

(2) If boss or spacer(s) are to be replaced, and parts removed at disassembly are available, check boss and spacer thickness per Installation−08 Task 72−00−41−450−005.

B. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 24524	Tap−Chasing
PWA 27641	Tap−Chasing
PWA 75509	Gage, Immersion

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−005	Cloth, Cotton Lint−Free
P05−289	Lockwire (AS3214−02)
P05−291	Cable, Safety (Optional)
P05−292	Ferrule, Safety Cable (Optional)
R P06−009	Compound, Antiseize (PMC 9523)
P06−023	Lubricant, Silver Goop (PWA 36001)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	1	74−21−00/2/20
Grommet	1	PN 10−700305

C. Procedure
See Figure 401, Figure 402, Figure 403, Figure 404 and Figure 405.

(1) If necessary, clean threads of boss (402/2, 403/2, 404/2) using PWA 24524 Tap.

(2) Install new key washer (402/4, 403/4, 404/4) to igniter boss (402/2, 403/2, 404/2) with tabs toward boss.

(3) Install boss and key washer to igniter plug (402/3, 403/3, 404/3) fingertight.

(4) (Reference 365) Measure Dimension A from plug tip to bottom face of boss. See Figure 402, Figure 403, and Figure 404. Record Dimension A.

(5) Disassemble key washer and boss from igniter plug and place on bench.

(6) Using a strong light, look in igniter boss hole in diffuser case and determine which igniter plug guide configuration (shielded or unshielded) is installed in outer combustion chamber. See Figure 402, Figure 403, and Figure 404.

NOTE: Presently, there are two igniter plug guide configurations installed in outer combustion chambers. Prior configuration chambers incorporate extended sleeve (402/6) and no shield. Later configuration chambers incorporate a flush sleeve and a shield (403/6) or a flush sleeve and a lock (404/6).

(7) Measure igniter plug immersion depth using PWA 75509 Immersion Gage (402/5, 403/5, 404/5).

(a) Using detail gage master (402/7, 403/7, 404/7), place master between gage hook and gage base. Set gage indicator level to zero.

(b) Insert gage into the igniter boss hole in diffuser case until gage base is seated on face of case boss.

(c) Rotate gage base to obtain an uninterrupted view of dial gage face.

(d) Holding gage base, rotate probe until notch in probe disk is pointing to rear of engine.

(e) Depress probe and slide gage towards rear of engine to seat gage hook against rear ID surface of outer combustion chamber (402/8, 403/8). See Figure 402, Figure 403, and/or Figure 404.

(f) Release probe and record dial gage reading. Add the gage reading to 2.200 inches (55.880 mm) if reading is a plus reading. Subtract the gage reading from 2.200 inches (55.880 mm) if reading is a minus reading. Result is Dimension B.

(g) (Pre SB PW4ENG 72−152) For engines incorporating combustion chambers with extended sleeve (402/6) and no shield, add 0.025 inch (0.635 mm) to Dimension B and subtract that total from Dimension A. The resulting dimension, Dimension C, is the desired spacer thickness.

(h) Select a classified spacer (402/1) or combination of spacers to obtain Dimension C plus or minus 0.010 inch (0.254 mm). Use a maximum of two spacers per plug. Total combined thickness of spacer(s) not to exceed 0.300 inch (7.620 mm). See Figure 402 and Figure 405.

(i) (Post SB PW4ENG 72−152 and Post SB PW4ENG 72−601) For engines incorporating combustion chambers with flush sleeve and a shield (403/6), add 0.125 inch (3.175 mm) to Dimension B and subtract that total from Dimension A. The resulting dimension, Dimension C, is the desired spacer thickness.

(j) Select a classified spacer (403/1) or combination of spacers to obtain Dimension C plus or minus 0.010 inch (0.254 mm). Use a maximum of two spacers per plug. Total combined thickness of spacers(s) not to exceed 0.300 inch (7.620 mm). See Figure 403 and Figure 405.

(k) For engines with Talon Low Emission combustion chambers there is a flush sleeve and a lock (404/6). Add 0.075 inch (1.905 mm) to Dimension B and subtract that total from Dimension A. The resulting dimension, Dimension C, is the desired spacer thickness.

(l) Select a classified spacer (404/1) or combination of spacers to obtain Dimension C plus or minus 0.010 inch (0.254 mm). Use a maximum of two spacers per plug. Total combined thickness of spacer(s) not to exceed 0.300 inch (7.620 mm). See Figure 404 and Figure 405.

(8) If necessary, clean threads in diffuser case port using PWA 27641 Tap.

(9) Install key washer (401/3) to igniter boss (401/2) and bend tabs over to secure.

(10) Lubricate OD threads of boss with Engine Oil P03-001.

(11) (Reference 400) Install previously selected classified spacer(s) to boss and install boss to diffuser case. Torque boss to 600 - 700 lb-in. (67.791 - 79.089 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to the boss.

(12) Apply Thread Lubricant P06-023 to threads of igniter plug.

(13) (Reference 401) Install igniter plug to boss. Torque plug to 300 - 360 lb-in. (33.895 - 40.675 N.m).

NOTE: Keep igniter plug boss from turning while torquing plug.

(14) Remove protective closure from end of igniter plug cable.

(15) Check cable contact for evidence of arcing (discoloration and heavy pitting). Check cable end for evidence of carbon tracking. Replace the cable if either condition is found. See 72-00-41, Removal-04 Task 72-00-41-050-001 or Removal-05 Task 72-00-41-050-002 and Installation-04 Task 72-00-41-450-001 or Installation-05 Task 72-00-41-450-002.

(16) Install new grommet on cable as follows:

(a) Clean new grommet with clean, Lint-Free Cotton Cloth P05-005, and the SPOP 208 Wipe Method. See Standard Practices Manual, PN 585005.

(b) Slide grommet on cable.

(c) Apply Antiseize Compound P06−009, to threads of cable nut.

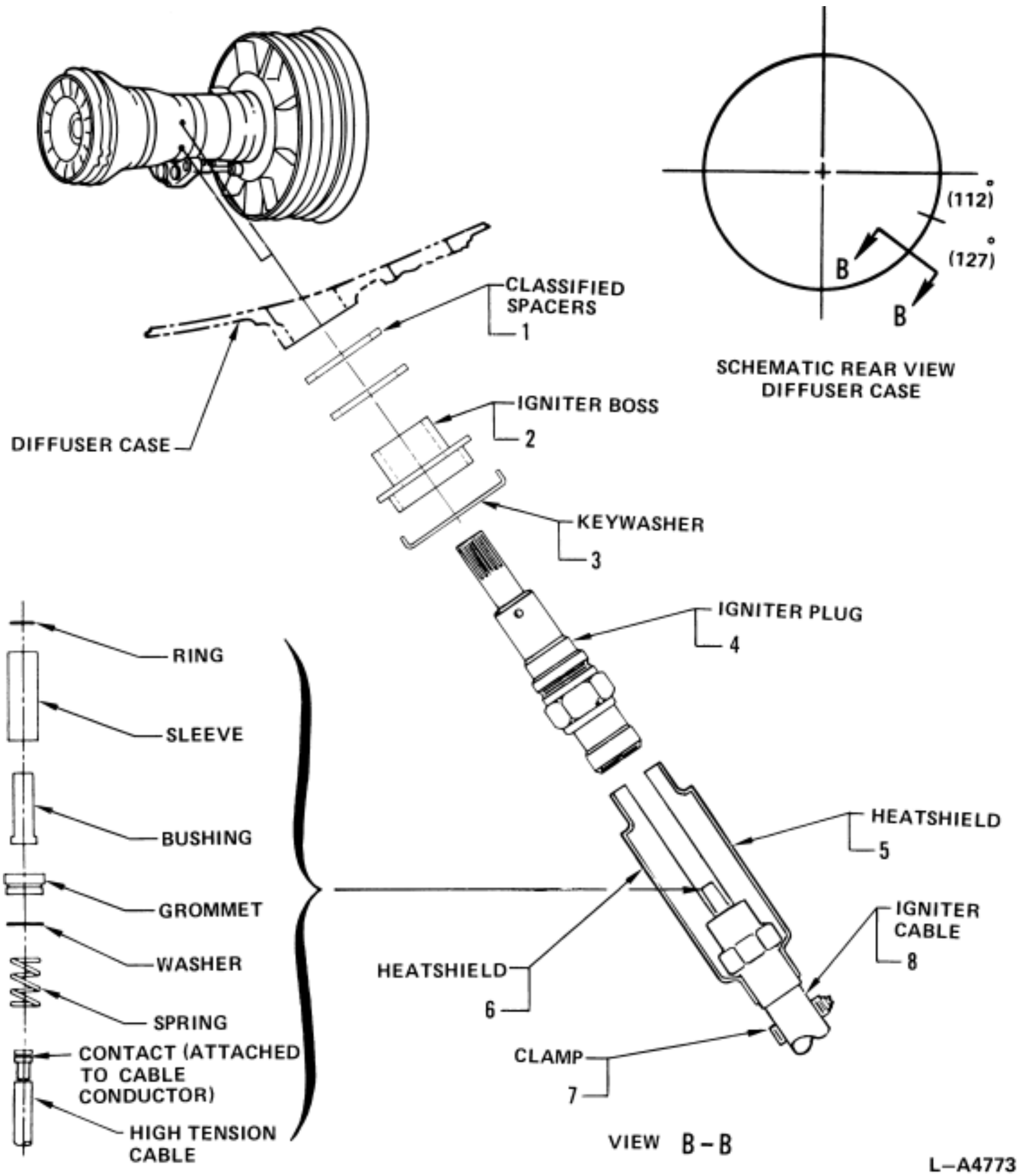
(17) Connect cable to igniter plug. Torque cable nut to 140 − 160 lb−in. (15.818 − 18.078 N.m).

NOTE: Insufficient torque on cable nuts can cause ignition radiated noise to be picked up by aircraft radio equipment.

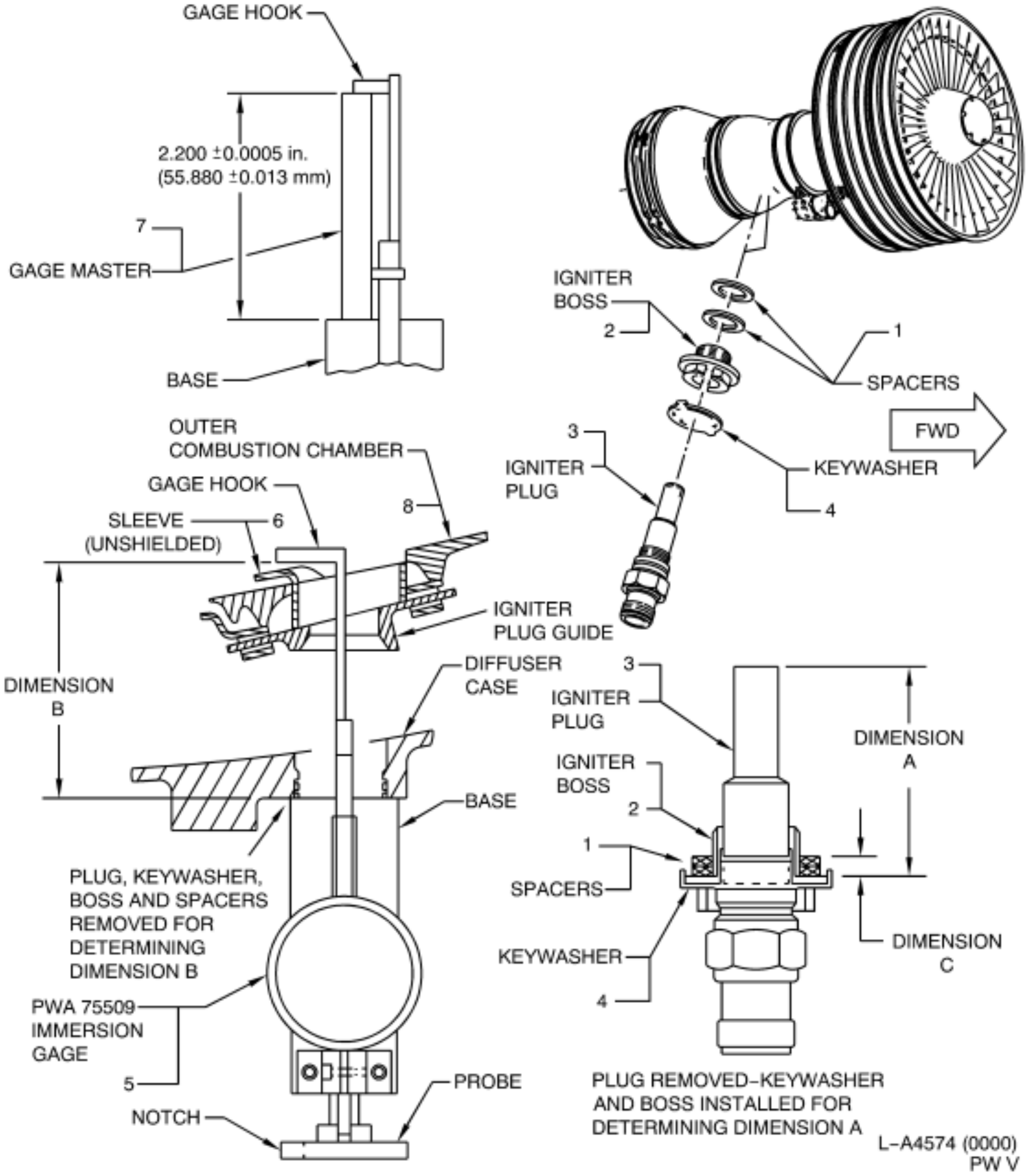
(18) (Reference 2151) Install heat shields (401/5, 401/6) at igniter plug (401/4). Bend tabs of igniter plug heat shields into groove in boss (401/2) before securing clamp (401/7). Secure with clamp. Torque clamp screw to 15 − 18 lb−in. (1.695 − 2.034 N.m).

D. Postrequisites

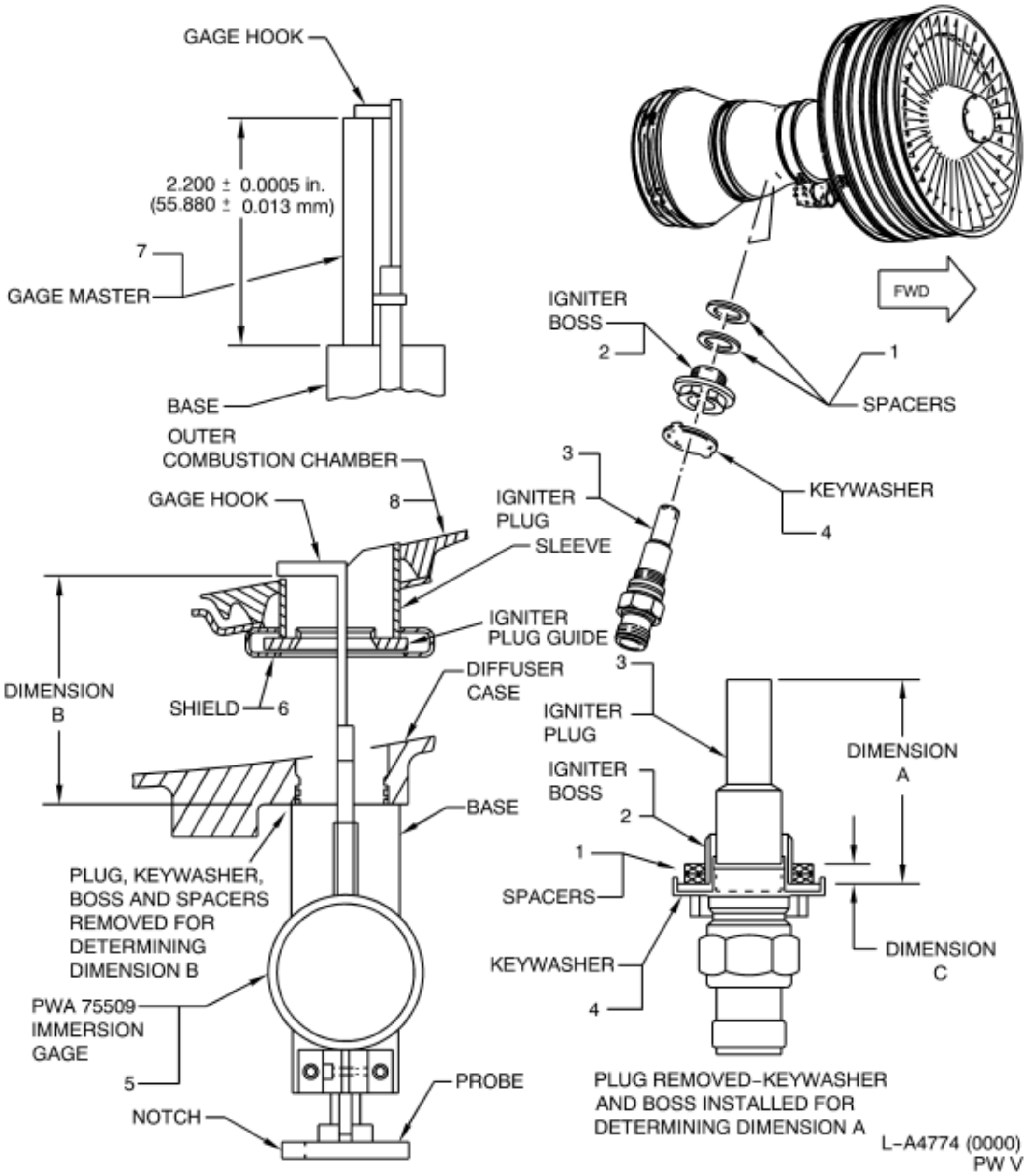
(1) Test engine per Repair Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


CLASSIFIED SPACERS
1
DIFFUSER CASE
IGNITER BOSS
2
KEYWASHER
3
SCHEMATIC REAR VIEW DIFFUSER CASE
(112)°
(127)°
B
B
IGNITER PLUG
4
RING
SLEEVE
BUSHING
GROMMET
WASHER
SPRING
CONTACT (ATTACHED TO CABLE CONDUCTOR)
HIGH TENSION CABLE
HEATSHIELD
5
IGNITER CABLE
8
HEATSHIELD
6
CLAMP
7
VIEW B−B
L−A4773

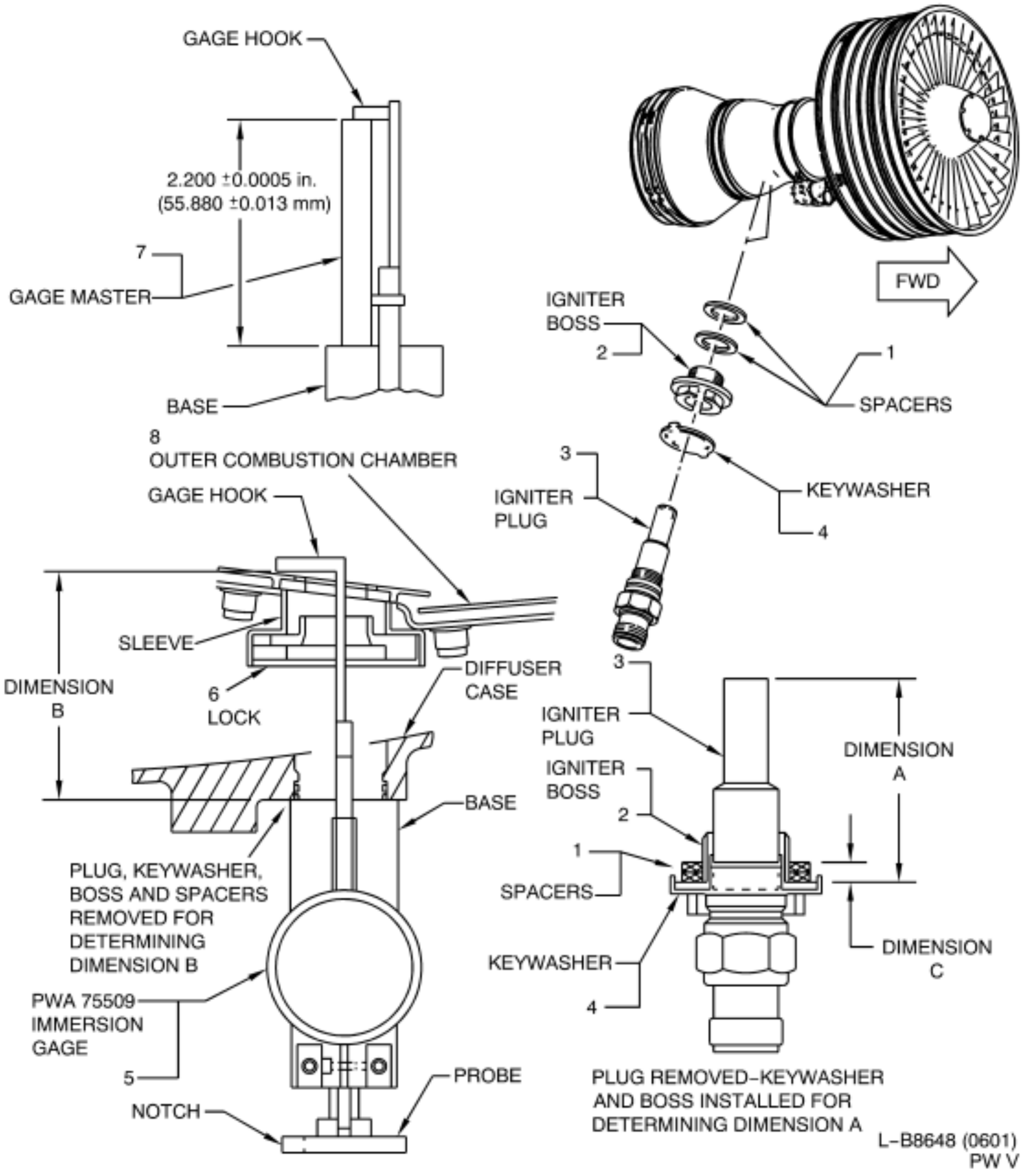
Igniter Plug (Typical Two Locations)
Figure 401
(Task 72−00−41−450−007)


GAGE HOOK
2.200 ±0.0005 in.
(55.880 ±0.013 mm)
7
GAGE MASTER
BASE
OUTER
COMBUSTION CHAMBER
GAGE HOOK
8
SLEEVE
(UNSHIELDED)
6
IGNITER
PLUG GUIDE
DIMENSION
B
DIFFUSER
CASE
BASE
PLUG, KEYWASHER,
BOSS AND SPACERS
REMOVED FOR
DETERMINING
DIMENSION B
PWA 75509
IMMERSION
GAGE
5
NOTCH
PROBE
IGNITER
BOSS
2
1
SPACERS
3
IGNITER
PLUG
KEYWASHER
4
FWD
3
IGNITER
PLUG
IGNITER
BOSS
2
1
SPACERS
KEYWASHER
4
DIMENSION
A
DIMENSION
C
PLUG REMOVED-KEYWASHER
AND BOSS INSTALLED FOR
DETERMINING DIMENSION A
L-A4574 (0000)
PW V

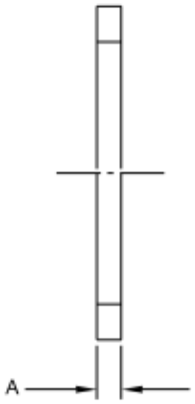
Igniter Plug Immersion Depth Measurement (Pre SB PW4ENG 72-152)
Figure 402
(Task 72-00-41-450-007)


GAGE HOOK
2.200 ± 0.0005 in.
(55.880 ± 0.013 mm)
7
GAGE MASTER
BASE
OUTER
COMBUSTION CHAMBER
GAGE HOOK
8
IGNITER
PLUG
SLEEVE
IGNITER
PLUG GUIDE
DIMENSION
B
SHIELD
6
DIFFUSER
CASE
BASE
PLUG, KEYWASHER,
BOSS AND SPACERS
REMOVED FOR
DETERMINING
DIMENSION B
PWA 75509
IMMERSION
GAGE
5
NOTCH
PROBE
FWD
IGNITER
BOSS
2
1
SPACERS
3
KEYWASHER
4
3
IGNITER
PLUG
DIMENSION
A
IGNITER
BOSS
2
1
SPACERS
KEYWASHER
4
DIMENSION
C
PLUG REMOVED-KEYWASHER
AND BOSS INSTALLED FOR
DETERMINING DIMENSION A
L-A4774 (0000)
PW V

Igniter Plug Immersion Depth Measurement (Post SB PW4ENG 72-152)
Figure 403
(Task 72-00-41-450-007)


GAGE HOOK
2.200 ±0.0005 in.
(55.880 ±0.013 mm)
7
GAGE MASTER
BASE
8
OUTER COMBUSTION CHAMBER
GAGE HOOK
SLEEVE
DIMENSION
B
6
LOCK
DIFFUSER
CASE
BASE
PLUG, KEYWASHER,
BOSS AND SPACERS
REMOVED FOR
DETERMINING
DIMENSION B
PWA 75509
IMMERSION
GAGE
5
NOTCH
PROBE
FWD
IGNITER
BOSS
2
1
SPACERS
3
IGNITER
PLUG
KEYWASHER
4
3
IGNITER
PLUG
IGNITER
BOSS
2
1
SPACERS
KEYWASHER
4
DIMENSION
A
DIMENSION
C
PLUG REMOVED−KEYWASHER
AND BOSS INSTALLED FOR
DETERMINING DIMENSION A
L−B8648 (0601)
PW V

Igniter Plug Immersion Depth Measurement (Talon Low Emission Burner)
Figure 404
(Task 72−00−41−450−007)



L-90275 (0283)
PW V

	Dimension A	
Part No.	Inches	Millimeters
741073 CL1	0.008 - 0.018	0.20 - 0.46
741073 CL2	OVER 0.018 - 0.028	OVER 0.46 - 0.71
741073 CL3	OVER 0.028 - 0.038	OVER 0.71 - 0.97
741073 CL4	OVER 0.038 - 0.048	OVER 0.97 - 1.22
741073 CL5	OVER 0.048 - 0.058	OVER 1.22 - 1.47
741073 CL6	OVER 0.058 - 0.068	OVER 1.47 - 1.73
741073 CL7	OVER 0.068 - 0.078	OVER 1.73 - 1.98
741073 CL8	OVER 0.078 - 0.088	OVER 1.98 - 2.24
741073 CL9	OVER 0.088 - 0.098	OVER 2.24 - 2.49
741073 CL10	OVER 0.098 - 0.108	OVER 2.49 - 2.74
741073 CL11	OVER 0.108 - 0.118	OVER 2.74 - 3.00
741073 CL12	OVER 0.118 - 0.128	OVER 3.00 - 3.25
741073 CL13	OVER 0.128 - 0.138	OVER 3.25 - 3.51
741073 CL14	OVER 0.138 - 0.148	OVER 3.51 - 3.76
741073 CL15	OVER 0.148 - 0.158	OVER 3.76 - 4.01
741073 CL16	OVER 0.158 - 0.168	OVER 4.01 - 4.27
741073 CL17	OVER 0.168 - 0.178	OVER 4.27 - 4.52
741073 CL18	OVER 0.178 - 0.188	OVER 4.52 - 4.78

Spacer Classification Data

Igniter Boss Classified Spacer
Figure 405
(Task 72-00-41-450-007)

Task 72-00-41-420-013:

1. Install Diffuser And Combustor (Vertical) Without No. 3 Bearing Outer Race Previously Installed

NOTE: See Figure 401 for part/assembly installation procedure sequence.

NOTE: See 72-00-41, Installation-01 Task 72-00-41-420-001for alternate procedure with No. 3 bearing outer race installed. Outer race was previously installed into diffuser combustor group before being installed onto HPC.

A. Prerequisites

(1) See 72-00-41, Inspection/Check-01 Task 72-00-41-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For Example: (Reference 1234) Torque retaining nut as follows:

(2) Assemble diffuser and combustor by means of 72-41-00, Assembly-01 Task 72-41-00-400-001.

B. Equipment And Materials Required

Standard Tools:

0.250-28 Jackscrews (Four Required)
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 28657	Sling
PWA 29754	Control (Or Equivalent)
PWA 76154	Adapter (Two Required)
PWA 80187	Multiplier, Torque
PWA 85067	Fixture
PWA 85068	Fixture
PWA 85070	Drift
PWA 85159	Protector
PWA 85168	Protector
PWA 85308	Guide (Optional To PWA 85701)
PWA 85310	Pin, Alignment (Three Required)
PWA 85679	Heater (Optional To PWA 85795)
PWA 85701	Guide
PWA 85751	Bracket (Two Required)
PWA 85795	Heater

Special Tools:

(CONTINUED)

PWA 85797	Wrench (Optional To PWA 86491)
PWA 85798	Drift (Optional To PWA 87433)
PWA 85901	Riveter
PWA 85983	Adapter, Stabilizer (Two Required Twin Overhead Rail System Only)
PWA 86491	Driver, Torque
PWA 87433	Drift
PWA 102743	Adapter, Torque
PWA 102744	Adapter, Holder

Consumable Materials:

	Item No.	Designation
	P03-001	Engine Oil (PWA 521B)
	P05-026	Ink (Marking) (PMC 4057-1)
	P05-059	Wax, Paraffin (PMC 9552)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
R	P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72-00-41/1/1
Rivet	1	72-41-00/12/40

C. Procedure
See Figure 402 and Figure 403.

(1) Remove PWA 85159 Thread Protector (403/7) and PWA 85428 Knife-Edge Protector (403/6) from HPC rear hub.

CAUTION: HANDLE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN LINT FREE GLOVES TO PREVENT BEARING DAMAGE.

(2) Visually inspect HPC rear drum OD thrust balance knife-edge per 72-00-35, Inspection/Check-04 (visual only) Task 72-00-35-210-004. Reject the airseal with cracks confirmed by visual inspection.

(3) Place No. 3 bearing assembly on clean waxed paper on bench.

(4) Separate outer race (402/6) from inner race and rollers (402/1) and place them, serial number up, on bench.

(5) Verify bearing inner and outer race part numbers are the same.

CAUTION: THICKNESS OF NO. 3 BEARING FRONT SEAL SEAT MUST BE MEASURED ACROSS THINNER, ID, SECTION OF SEAL SEAT OR INCORRECT DIMENSION WILL RESULT.

(6) Measure thickness of No. 3 bearing front seal seat (402/3) across thinner ID section of seal seat. Measure No. 3 bearing seal spacer (402/2) thickness, No. 3 bearing inner race and rollers (402/1) thickness. Record this total thickness as Dimension A.

(7) Measure distance from end of HPC rear hub (402/4) down to seal seat shoulder (402/5) on hub. Record this dimension as Dimension B.

NOTE: Dimensions A and B will be used to perform a seating check later during this installation procedure.

(8) Measure thickness of No. 3 bearing outer race (402/6) thickness. Record this dimension as Dimension D.

(9) Measure distance from top of No. 3 bearing support to outer race seating shoulder. Record this dimension as Dimension E.

NOTE: Dimensions D and E will be used to perform a seating check later during this installation procedure.

(10) Locate two dimples on top surface of No. 3 bearing housing (402/7) threaded ID. Mark a line between the dimples with Ink P05-026.

(11) For engines with gasket groove on rear flange of HPC rear case (Post SB PW4ENG 72-48), install gasket to flange groove and secure in place with Paraffin Wax P05-059. See Figure 403.

NOTE: Engines prior to (SB PW4ENG 72-48) do not accept gasket at Flange K.

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−15

(12) Install two PWA 85751 Handling Brackets to diffuser case.

NOTE: If you have a twin overhead rail system you must use PWA 85983 Stabilizer Adapters with PWA 85751 Brackets.

(a) Loosen and remove the clamp bolts that attach the fuel tubes to the Flange K bracket for PWA 85751 Bracket tool installation clearance.

(b) Using hoist, position longer front flange of brackets to rear of front flange of diffuser case at 3 and 9 o'clock locations, locating four pins in front flange of bracket into four boltholes in diffuser case front flange. Position shorter rear flange of bracket to front of diffuser case rear flange and secure with detail nuts and bolts.

(c) Position double spool bracket in rear most two holes as marked on bracket.

(13) For PWA 85701 Guide, retract two setscrews on side of guide. Position PWA 85701 Guide or PWA 85308 Guide larger diameter end first on HPC rear hub and seat on seal seat shoulder. For PWA 85701 Guide, handtighten two setscrews on side of guide.

(14) Install three PWA 85310 Alignment Pins into rear flange of HPC case.

(a) Remove screws from storage locations in plate details of alignment pins.

(b) Locate three equally spaced 0.250−28 jackscrew holes in rear flange of HPC case.

(c) Insert three equally spaced alignment pins (dowel pins up) through unthreaded holes in rear flange of HPC case. Secure pins with detail screws.

(15) With hoist, connect PWA 28657 Sling with two PWA 76154 Adapters to outer trunnion spools of PWA 85045 Brackets on diffuser case.

(16) With hoist position diffuser and combustor assembly over HPC rear hub. Align pins in HPC rear case with mating holes in diffuser case. With workbolts and nuts, seat diffuser case on HPC rear case.

(17) Remove work bolts, nuts, and PWA 85310 Pins. For PWA 85701 Guide, retract two setscrews on side of guide. Remove PWA 85701 Guide or PWA 85308 Guide from HPC rear hub.

(18) Remove PWA 28657 Sling, PWA 76154 Adapters and PWA 85751 Brackets.

(19) Install the Flange K hardware as follows: Refer to 72−00−41, Installation−20 (Task 72−00−41−420−020).

(20) Assemble PWA 85067 Fixture (404/3) to No. 3 bearing front seal seat (404/4). See Figure 404.

(21) Install fixture with seal seat polished face down over HPC rear hub and drift to seat if necessary. Remove fixture.

(22) Assemble PWA 85068 Fixture (404/1) to No. 3 bearing seal spacer (404/2).

(23) Install fixture with seal spacer over HPC rear hub and drift to seat if necessary. Remove fixture.

(24) Heat the No. 3 bearing inner race and rollers.

CAUTION: HANDLE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN INSULATED GLOVES TO PREVENT BEARING DAMAGE.

(25) Remove the heated inner race and rollers from the heat source.

(26) Install the heated No. 3 bearing inner race and rollers (405/2) onto HPC rear hub, puller grooves up. Seat bearing with PWA 85070 Drift (405/1) and keep constant downward pressure on bearing for approximately three minutes to make sure of correct seating. After seating remove drift. See Figure 405.

(27) After inner race has reached room temperature measure distance from end of HPC rear hub down to rear of inner race and rollers with depth gage. Record this distance as Dimension C. See Figure 402.

(28) Dimension C must not be less than previously taken Dimension B minus Dimension A.

NOTE: If Dimension C is less than required it indicates bearing is not fully seated.

(29) Remove PWA 85168 Protector (405/3) from diffuser case. See Figure 405.

(30) Heat No. 3 bearing housing. See Figure 406.

NOTE: If PWA 85679 Heater is used a heat shield must be made locally to protect the No. 3 bearing inner race and rollers.

(a) Install PWA 85795 Heater or PWA 85679 Heater (406/5) to rear flange of housing. Connect power and thermocouple cables to PWA 29754 Control (406/3) or equivalent control.

(b) Set heater to 300°F (149°C) and heat housing for 55 − 60 minutes.

(31) After No. 3 bearing housing is correctly heated turn off heater. Disconnect control and remove heater from housing.

CAUTION: HANDLE NO. 3 BEARING OUTER RACE WITH CLEAN GLOVES TO PREVENT BEARING DAMAGE.

(32) (Reference 1006) Install No. 3 bearing outer race (406/6) into bearing housing with serial number up and align "X" mark on outer race with ink mark between the two dimples on top of housing.

CAUTION: DO NOT HIT BEARING ROLLERS WITH THE DRIFT WHEN SEATING OUTER RACE.

(33) Position PWA 87433 Drift or PWA 85798 Drift (406/2) on outer race and seat race. Make sure outer race is seated against shoulder in housing. Remove the drift.

(34) After the No. 3 bearing temperature has returned to room temperature, do a dimensional check to make sure bearing outer race is correctly seated. See Figure 402.

(a) Measure Distance F from top of No. 3 bearing housing to top of bearing outer race (402/7).

(b) Dimension F must not be less than previously taken Dimension E minus Dimension D.

NOTE: If Dimension F is less than required, it indicates outer race is not fully seated.

CAUTION: A NEW OR SILVER PLATED NO. 3 BEARING OUTER RACE RETAINING NUT MUST BE INSTALLED AT EACH INSTALLATION OR DAMAGE TO MATING PARTS MAY OCCUR.

CAUTION: NO. 3 BEARING OUTER RACE RETAINING NUT MUST BE SILVER PLATED AFTER TORQUING NUT A MAXIMUM OF THREE TIMES FOR EACH INSTALLATION PRIOR TO ENGINE BEING OPERATED, NUT CAN BE SILVER PLATED PER PW4000 SERIES CIR, PN 51A357.

CAUTION: TO AVOID INCORRECT BEARING OUTER RACE DIMENSIONAL CHECKS AND RETAINING NUT TORQUE READING, NO. 3 BEARING AND HOUSING MUST BE AT ROOM TEMPERATURE. SHOP AIR MAY BE USED FOR COOLING. DO NOT USE DRY ICE.

(35) Lubricate the No. 3 bearing outer race retaining nut (406/8) with Engine Oil P03−001.

(36) Install six workbolts, lubricated with Engine Oil P03−001, into bearing housing channel nuts equally around housing. Torque workbolts to 290 − 325 lb−in. (32.766 − 36.720 N.m).

NOTE: The workbolts are a quality standard bolt with .375−24 by 1.000 inch (25.400 mm) thread length.

(37) Install PWA 85168 Protector (406/4) to diffuser case.

(38) Install retaining nut into housing with slots up, handtighten.

(39) Slide PWA 86491 Driver or PWA 85797 Wrench (406/10) over HPC rear hub, locating the teeth of the tool in the slots of the nut.

NOTE: If you use PWA 86491 Driver, you must attach the driver to the bearing housing with the four detail cap screws.

(40) Mechanical Wrench Method (Optional) − See Figure 406, Sheet 2.

(a) Install PWA 102743 Torque Adapter (406/11) to engage the slots in the bearing retaining nut.

(b) Install PWA 102744 Holder Adapter (406/12) over PWA 102743 Torque Adapter (406/11) and attach it to the bearing housing with the four detail bolts. Tighten the bolts.

(c) Install PWA 80187 Torque Multiplier (406/13) to engage both PWA 102743 Torque Adapter (406/11) and PWA 102744 Holder Adapter (406/12).

(41) (Reference 975) Torque retaining nut to 3600 − 4400 lb−in. (406.745 − 497.133 N.m). Turn through angle of 16° − 17° 30'. Loosen to 0 lb−in. (0 N.m) then repeat torque sequence aligning one rivet hole in retaining nut with one rivet hole in housing.

(42) Remove wrench/driver from the No. 3 bearing retaining nut.

(43) Remove the six workbolts from bearing housing.

(44) Install rivet (406/7) into aligned holes in the retaining nut and housing using PWA 85901 Riveter and flare rivet to secure.

(45) Install PWA 85159 Thread Protector (406/1) over HPC rear hub.

D. Postrequisites

(1) Connect/Install The External Parts To The Complete Installation Of The Diffuser Combustor. Refer to 72−00−41, Installation−02 (Task 72−00−41−420−002).

(2) Trunnion The Intermediate Case Through Diffuser And Combustor Case From The Front End Down To The Horizontal Position. Refer to 72−00−00, Special Procedures−10 (Task 72−00−00−420−002−A00).

(3) Install The No. 3 Bearing Seal Assembly And Seal Seat. Refer to 72−00−41, Installation−03 (Task 72−00−41−420−003).

(4) Vacuum Check The No. 3 Bearing Compartment. Refer to 72−00−41, Inspection/Check−07 (Task 72−00−41−720−001).

(5) Install The Turbine Nozzle. Refer to 72-00-51, Installation-01 (Task 72-00-51-420-001).

(6) Install The High Pressure Turbine - Horizontal. Refer to 72-00-52, Installation-01 (Task 72-00-52-420-001).

(7) Install The No. 1 Bearing Support Assembly. Refer to 72-00-34, Installation-04 (Task 72-00-34-450-002).

(8) Install The Fan Case. Refer to 72-00-33, Installation-01 (Task 72-00-33-420-001).

(9) Install The Low Pressure Turbine With Shaft. Refer to 72-00-53, Installation-01 (Task 72-00-53-420-001).

(10) Install The Turbine Exhaust Case. Refer to 72-00-54, Installation-01 (Task 72-00-54-420-001).

(11) Install The Low Pressure Compressor. Refer to 72-00-31, Installation-01 (Task 72-00-31-420-003).

(12) Install The LPC/LPT Coupling (With the Front Compressor Drive Turbine Shaft Installed). Refer to 72-00-32, Installation-01 (Task 72-00-32-420-001).

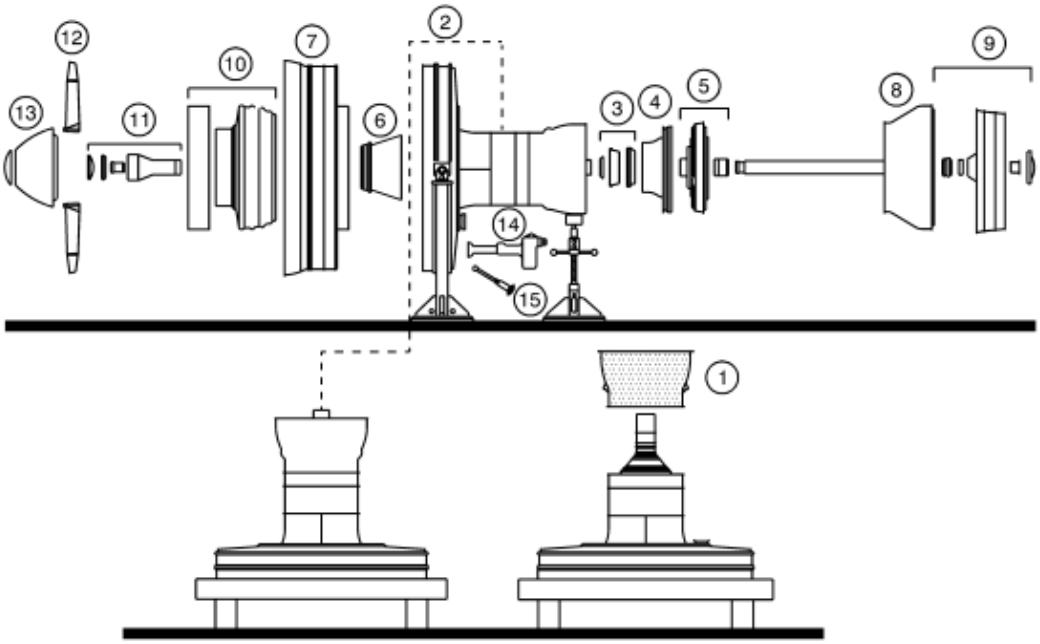
(13) Install The Stage 1 LPC Blade Assemblies. Refer to 72-00-31, Installation-04 (Task 72-00-31-420-002-002).

(14) Install The Compressor Inlet Cone. Refer to 72-00-31, Installation-02 (Task 72-00-31-420-001).

(15) Install The Main Gearbox. Refer to 72-00-61, Installation-01 (Task 72-00-61-420-001).

(16) Install The Electronic Engine Control (EEC) Speed Transducer (N1). Refer to 72-00-34, Installation-03 (Task 72-00-34-450-001).

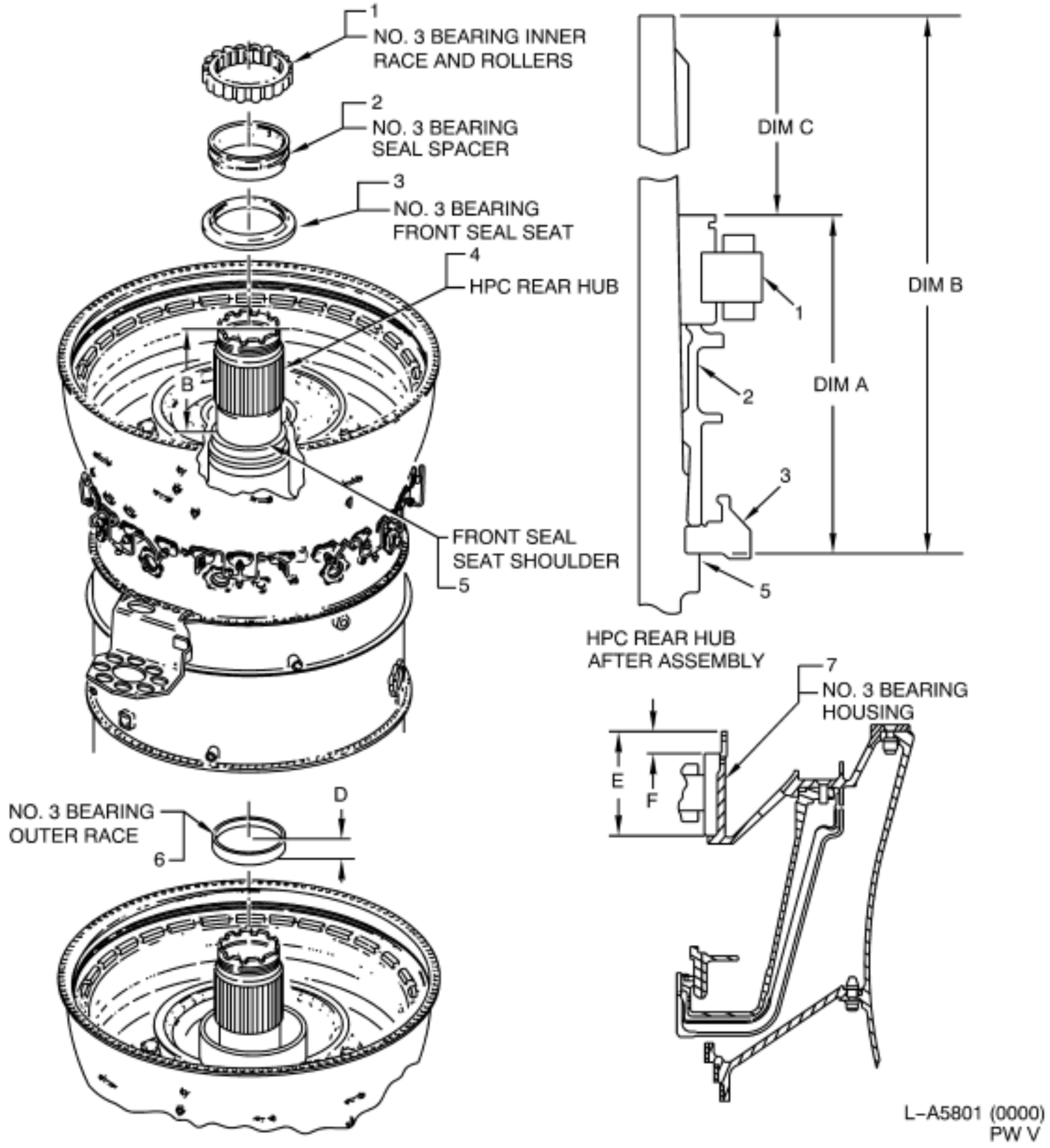
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−15



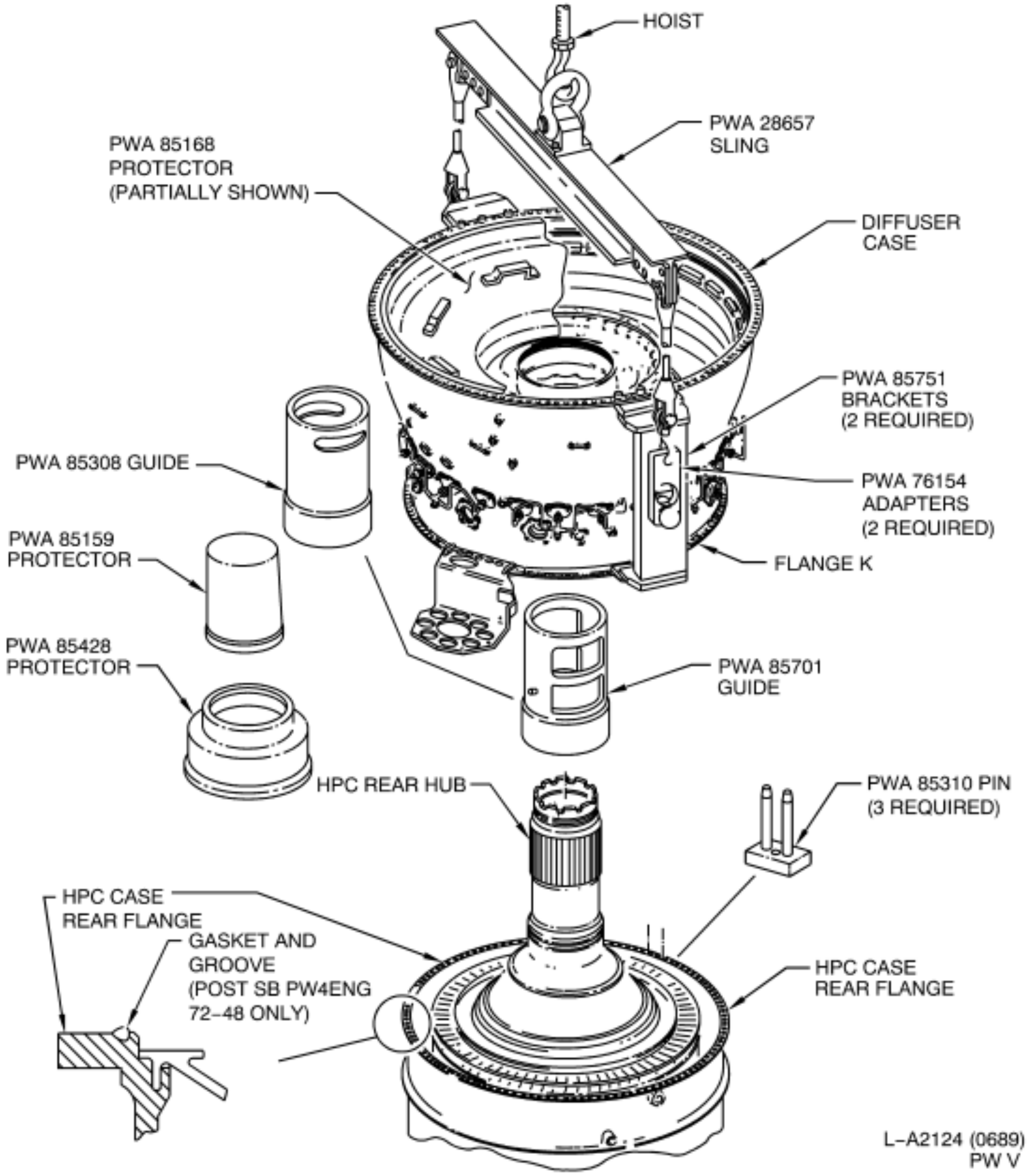
1. INSTALL DIFFUSER AND COMBUSTOR.
2. TRUNNION INTERMEDIATE THROUGH DIFFUSER CASE TO HORIZONTAL.
3. INSTALL NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL SEAT.
4. INSTALL TURBINE NOZZLE.
5. INSTALL HIGH PRESSURE TURBINE (HPT).
6. INSTALL NO. 1 BEARING SUPPORT ASSEMBLY.
7. INSTALL FAN CASE.
8. INSTALL LOW PRESSURE TURBINE (LPT).
9. INSTALL TURBINE EXHAUST CASE.
10. INSTALL LOW PRESSURE COMPRESSOR (LPC).
11. INSTALL LPC/LPT COUPLING.
12. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
13. INSTALL COMPRESSOR INLET CONE.
14. INSTALL MAIN GEARBOX.
15. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).

L−A0257 (0000)
PW V

Procedure Sequence
Figure 401
(Task 72−00−41−420−013)

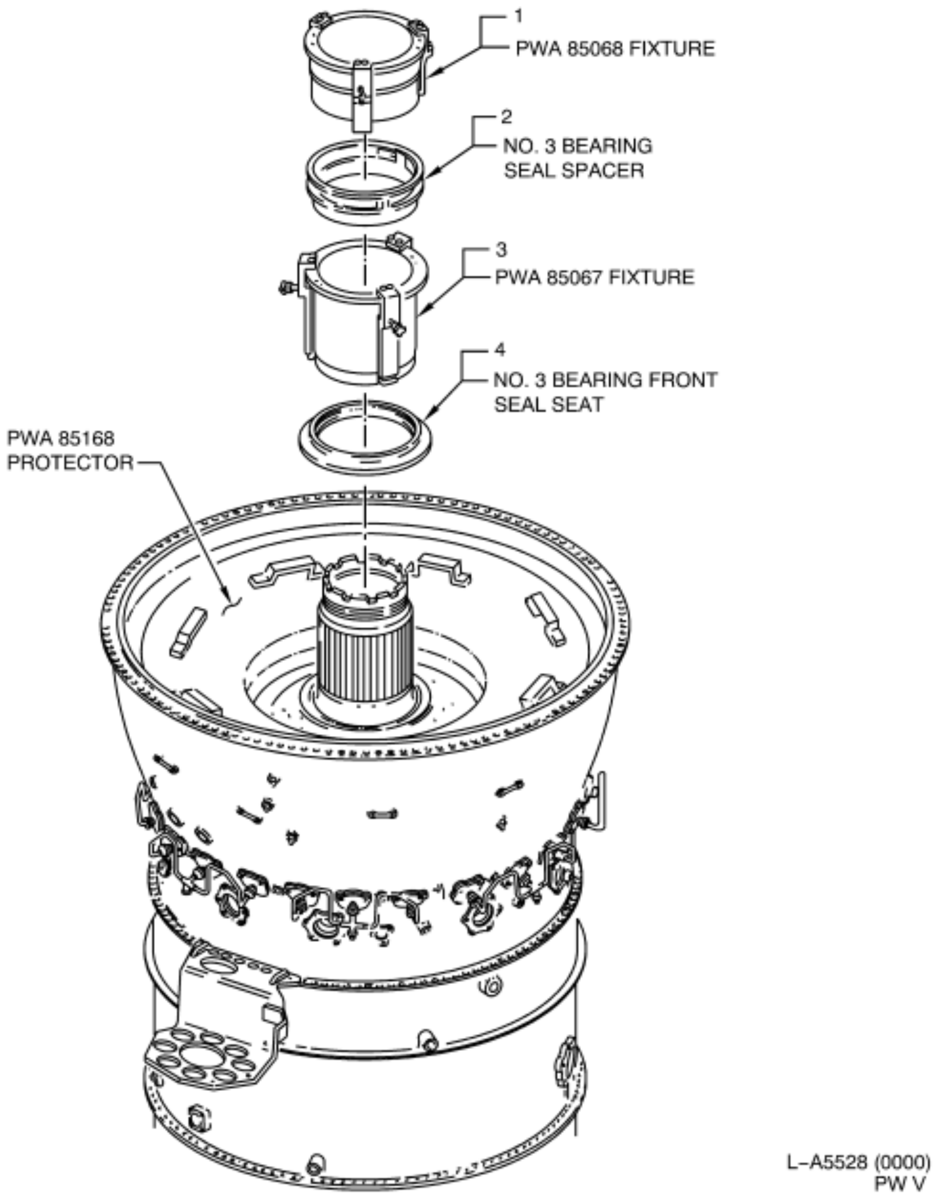

1
NO. 3 BEARING INNER RACE AND ROLLERS
2
NO. 3 BEARING SEAL SPACER
3
NO. 3 BEARING FRONT SEAL SEAT
4
HPC REAR HUB
B
FRONT SEAL SEAT SHOULDER
5
DIM C
DIM B
DIM A
1
2
3
5
HPC REAR HUB AFTER ASSEMBLY
7
NO. 3 BEARING HOUSING
E
F
NO. 3 BEARING OUTER RACE
6
D
L−A5801 (0000)
PW V

Diffuser And Combustor Installation
Bearing Seating Check Measurement
Figure 402
(Task 72−00−41−420−013)


HOIST
PWA 28657 SLING
PWA 85168 PROTECTOR (PARTIALLY SHOWN)
DIFFUSER CASE
PWA 85751 BRACKETS (2 REQUIRED)
PWA 85308 GUIDE
PWA 76154 ADAPTERS (2 REQUIRED)
PWA 85159 PROTECTOR
FLANGE K
PWA 85428 PROTECTOR
PWA 85701 GUIDE
HPC REAR HUB
PWA 85310 PIN (3 REQUIRED)
HPC CASE REAR FLANGE
GASKET AND GROOVE (POST SB PW4ENG 72−48 ONLY)
HPC CASE REAR FLANGE
L−A2124 (0689)
PW V

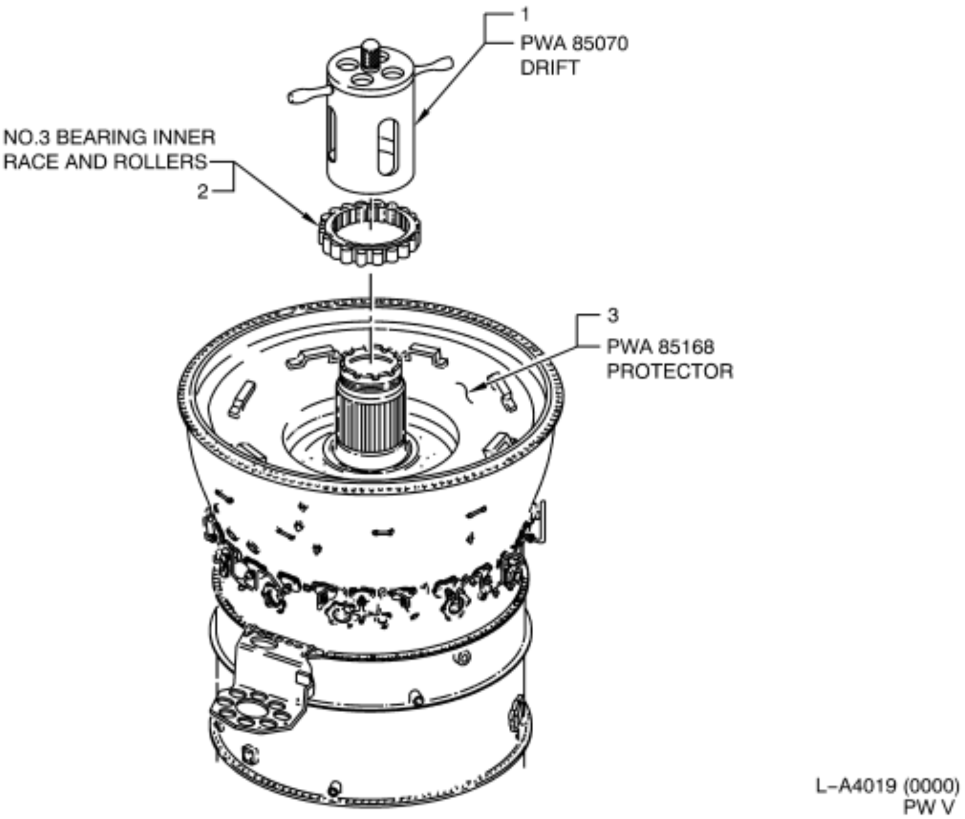
Diffuser And Combustor Installation
Figure 403
(Task 72−00−41−420−013)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−15

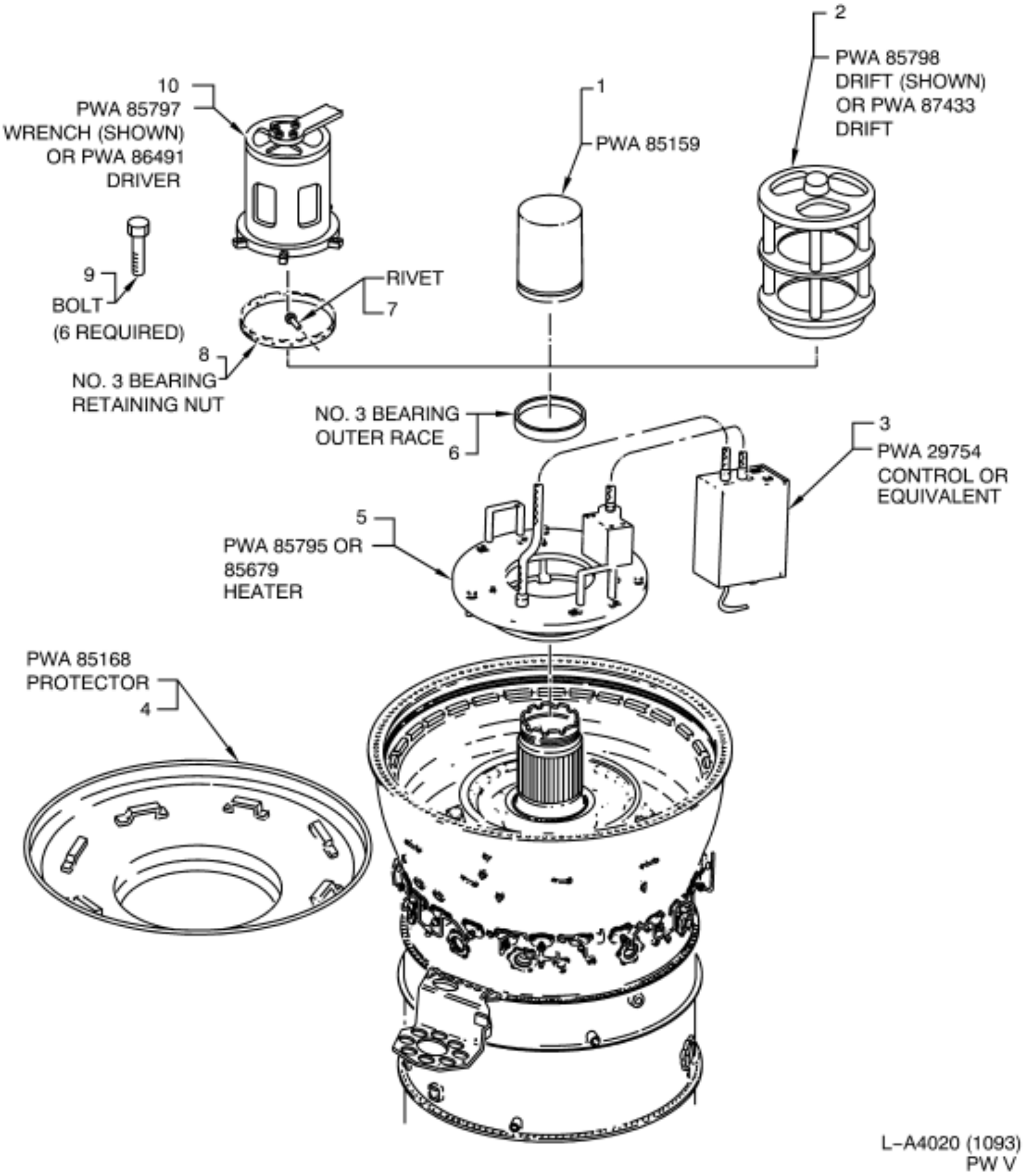

1
PWA 85068 FIXTURE
2
NO. 3 BEARING SEAL SPACER
3
PWA 85067 FIXTURE
4
NO. 3 BEARING FRONT SEAL SEAT
PWA 85168 PROTECTOR
L−A5528 (0000)
PW V

Diffuser And Combustor Installation
Figure 404
(Task 72−00−41−420−013)

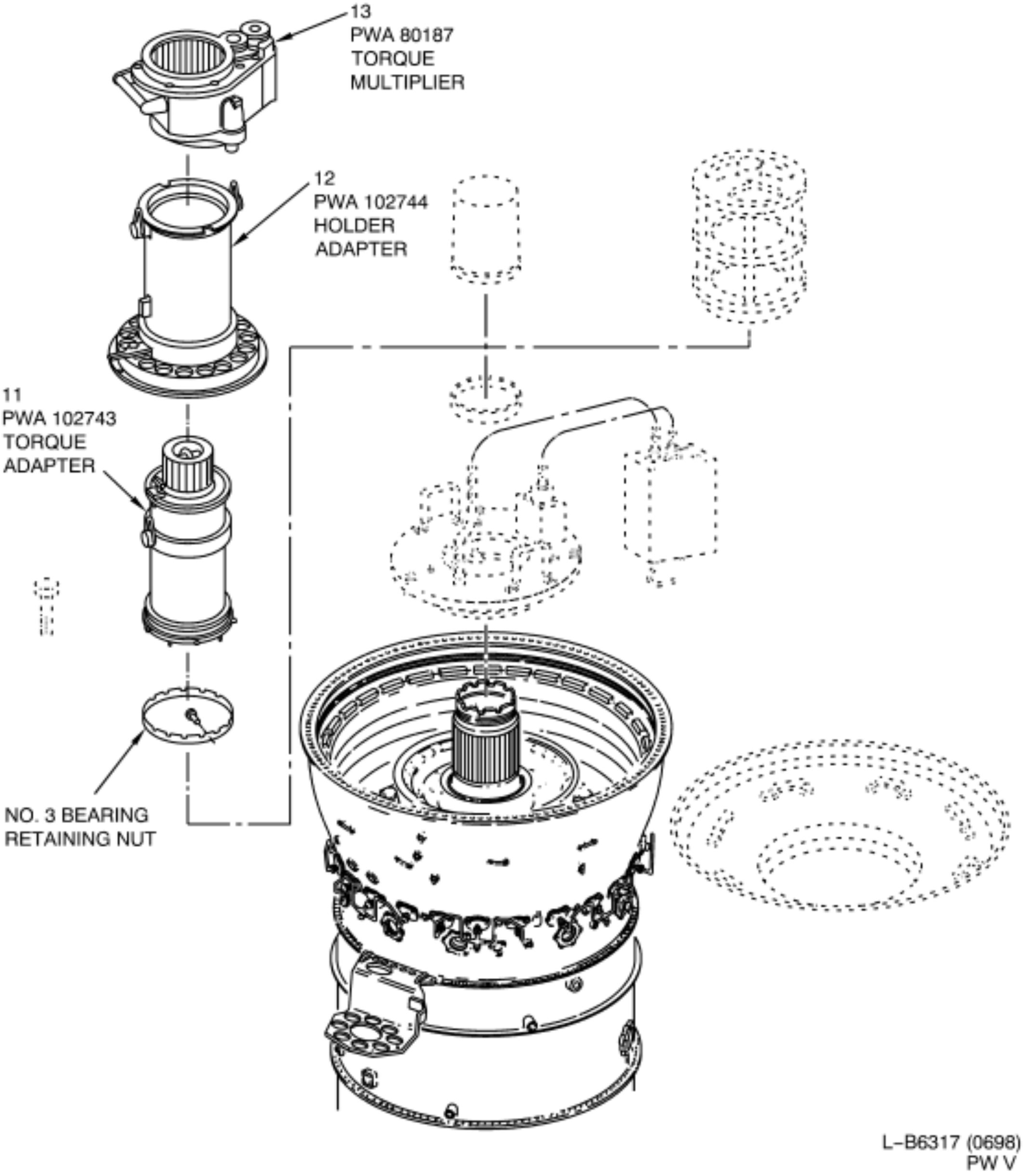
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−15


1
PWA 85070
DRIFT
NO.3 BEARING INNER
RACE AND ROLLERS
2
3
PWA 85168
PROTECTOR
L−A4019 (0000)
PW V

Diffuser And Combustor Installation
Figure 405
(Task 72−00−41−420−013)


10
PWA 85797
WRENCH (SHOWN)
OR PWA 86491
DRIVER
1
PWA 85159
2
PWA 85798
DRIFT (SHOWN)
OR PWA 87433
DRIFT
9
BOLT
(6 REQUIRED)
RIVET
7
8
NO. 3 BEARING
RETAINING NUT
NO. 3 BEARING
OUTER RACE
6
3
PWA 29754
CONTROL OR
EQUIVALENT
5
PWA 85795 OR
85679
HEATER
PWA 85168
PROTECTOR
4
L-A4020 (1093)
PW V

No. 3 Bearing Outer Race Installation
Figure 406 (Sheet 1)
(Task 72-00-41-420-013)


13
PWA 80187
TORQUE
MULTIPLIER
12
PWA 102744
HOLDER
ADAPTER
11
PWA 102743
TORQUE
ADAPTER
NO. 3 BEARING
RETAINING NUT
L−B6317 (0698)
PW V

No. 3 Bearing Outer Race Installation
Figure 406 (Sheet 2)
(Task 72−00−41−420−013)

Task 72-00-41-420-017:

1. Install Diffuser And Combustor (Vertical) Without No. 3 Bearing Outer Race Previously Installed

NOTE: See Figure 401 for part/assembly installation procedure sequence.

NOTE: See 72-00-41, Installation-01 Task 72-00-41-420-006 for optional procedure with the No. 3 bearing outer race installed. The outer race was installed into the diffuser combustor group before installation onto the HPC.

A. Prerequisites

(1) See 72-00-41, Inspection/Check-01 Task 72-00-41-990-001 for interface fits and clearances. Special torques and special assembly procedures show where necessary in the text that follows and are identified by a reference number. For Example: (Reference 1234) Torque retaining nut as follows:

(2) Assemble diffuser and combustor by 72-41-00, Assembly-01 Task 72-41-00-400-001-A00.

B. Equipment And Materials Required

Standard Tools:

0.250-28 Jackscrews (Four Necessary)
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 28657	Sling
PWA 29754	Control (Or Equivalent)
PWA 76154	Adapter (Two Necessary)
PWA 80187	Multiplier, Torque
PWA 85067	Fixture
PWA 85068	Fixture
PWA 85070	Drift
PWA 85159	Protector
PWA 85168	Protector
PWA 85308	Guide (Optional To PWA 85701)
PWA 85310	Pin, Alignment (Three Necessary)
PWA 85679	Heater (Optional To PWA 85795)
PWA 85701	Guide
PWA 85751	Bracket (Two Necessary)

Special Tools:

(CONTINUED)

PWA 85795	Heater
PWA 85797	Wrench (Optional To PWA 86491)
PWA 85798	Drift (Optional To PWA 87433)
PWA 85901	Riveter
PWA 85983	Adapter, Stabilizer (Two Necessary Twin Overhead Rail System Only)
PWA 86491	Driver, Torque
PWA 87433	Drift
PWA 102743	Adapter, Torque
PWA 102744	Adapter, Holder

Consumable Materials:

Item No.	Designation
P03-001	Engine Oil (PWA 521B)
P05-026	Ink (Marking) (PMC 4057-1)
P05-059	Wax, Paraffin (PMC 9552)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
R P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72-00-41/1/1
Rivet	1	72-41-00/12/40

C. Procedure
See Figure 401, Figure 402, Figure 403, Figure 404, Figure 405, and Figure 406.

(1) Remove the PWA 85159 Thread Protector (403/7) and PWA 85428 Knife-Edge Protector (403/6) from the HPC rear hub.

CAUTION: WEAR CLEAN LINT FREE GLOVES WHEN YOU TOUCH THE NO. 3 BEARING INNER RACE AND ROLLERS TO PREVENT BEARING DAMAGE.

(2) Make a visual inspection of the HPC rear drum OD thrust balance knife-edge by 72-00-35, Inspection/Check-04 (visual only) Task 72-00-35-210-004 . Reject the airseal with cracks found by visual inspection.

(3) Put the No. 3 bearing assembly on clean waxed paper on the bench.

(4) Remove the outer race (402/6) from the inner race and rollers (402/1) and put them, serial number up, on the bench.

(5) Make sure the bearing inner and outer race part numbers are the same.

CAUTION: THE THICKNESS OF THE NO. 3 BEARING FRONT SEAL SEAT MUST BE MEASURED ACROSS THE THINNER, ID, SECTION OF THE SEAL SEAT OR INCORRECT DIMENSIONS WILL RESULT.

(6) Measure the thickness of the No. 3 bearing front seal seat (402/3) across the thinner ID section of the seal seat. Measure the No. 3 bearing seal spacer (402/2) thickness and the No. 3 bearing inner race and rollers (402/1) thickness. Make a record of this total thickness as Dimension A.

(7) Measure the distance from the end of the HPC rear hub (402/4) down to the seal seat shoulder (402/5) on the hub. Make a record of this dimension as Dimension B.

NOTE: Dimensions A and B are used to do a seating check later during this installation procedure.

(8) Measure the thickness of the No. 3 bearing outer race (402/6) thickness. Make a record of this dimension as Dimension D.

(9) Measure distance from the top of the No. 3 bearing support to the outer race seating shoulder. Make a record of this dimension as Dimension E.

NOTE: Dimensions D and E are used to do a seating check later during this installation procedure.

(10) Find the two dimples on the top surface of the No. 3 bearing housing (402/7) threaded ID. Make a mark between the dimples with Ink P05−026.

(11) Install a gasket to the flange groove and attach in position with Paraffin Wax P05−059. See Figure 403.

(12) Install two PWA 85751 Handling Brackets to the diffuser case.

NOTE: If you have a twin overhead rail system you must use PWA 85983 Stabilizer Adapters with PWA 85751 Brackets.

(a) Loosen and remove the clamp bolts that attach the fuel tubes to the Flange K bracket for PWA 85751 Bracket tool installation clearance.

(b) Use a hoist and install the longer front flange of the brackets to the rear of the front flange of the diffuser case at the 3 and 9 o'clock locations, install the four pins in the front flange of the bracket into the four boltholes in the diffuser case front flange. Install the shorter rear flange of the bracket to the front of the diffuser case rear flange and attach with detail nuts and bolts.

(c) Install the double spool bracket in the rear most two holes as marked on the bracket.

(13) For PWA 85701 Guide, retract the two setscrews on the side of the guide. Install the PWA 85701 Guide or PWA 85308 Guide larger diameter end first on the HPC rear hub and seat on the seal seat shoulder. For PWA 85701 Guide, handtighten two setscrews on the side of the guide.

(14) Install three PWA 85310 Alignment Pins into the rear flange of the HPC case.

(a) Remove the screws from the storage locations in the plate details of the alignment pins.

(b) Find the three equally spaced 0.250−28 jackscrew holes in the rear flange of the HPC case.

(c) Insert three equally spaced alignment pins (dowel pins up) through the unthreaded holes in the rear flange of the HPC case. Attach the pins with detail screws.

(15) With a hoist, connect the PWA 28657 Sling with two PWA 76154 Adapters to the outer trunnion spools of the PWA 85045 Brackets on the diffuser case.

(16) With a hoist install the diffuser and combustor assembly over the HPC rear hub. Align the pins in the HPC rear case with the mating holes in the diffuser case. With workbolts and nuts, seat the diffuser case on the HPC rear case.

(17) Remove the work bolts, nuts, and PWA 85310 Pins. For PWA 85701 Guide, retract the two setscrews on the side of the guide. Remove the PWA 85701 Guide or PWA 85308 Guide from the HPC rear hub.

(18) Remove the PWA 28657 Sling, PWA 76154 Adapters and PWA 85751 Brackets.

(19) Install the Flange K hardware as follows. Refer to 72−00−41, Installation−20 (Task 72−00−41−020−020).

(20) Install the PWA 85067 Fixture (404/3) to the No. 3 bearing front seal seat (404/4). See Figure 404.

(21) Install the fixture with the seal seat polished face down over the HPC rear hub and drift to seat if necessary. Remove the fixture.

(22) Install the PWA 85068 Fixture (404/1) to the No. 3 bearing seal spacer (404/2).

(23) Install the fixture with the seal spacer over the HPC rear hub and drift to seat if necessary. Remove fixture.

(24) Heat the No. 3 bearing inner race and rollers. See Standard Practices Manual, PN 585005.

CAUTION: WEAR CLEAN INSULATED GLOVES WHEN YOU TOUCH THE NO. 3 BEARING INNER RACE AND ROLLERS TO PREVENT BEARING DAMAGE.

(25) Remove the heated inner race and rollers from the heat source.

(26) Install the heated No. 3 bearing inner race and rollers (405/2) onto the HPC rear hub, puller grooves up. Seat the bearing with PWA 85070 Drift (405/1) and keep constant downward pressure on the bearing for approximately three minutes to make sure of correct seating. After seating remove the drift. See Figure 405.

(27) After the inner race has reached room temperature measure the distance from the end of the HPC rear hub down to the rear of the inner race and rollers with a depth gage. Make a record of this distance as Dimension C. See Figure 402.

(28) Dimension C must not be less than Dimension B minus Dimension A.

NOTE: An indication that the bearing is not fully seated is when Dimension C is less than necessary.

(29) Remove the PWA 85168 Protector (405/3) from the diffuser case. See Figure 405.

(30) Heat the No. 3 bearing housing. See Figure 406.

NOTE: If PWA 85679 Heater is used, you must make a heatshield to protect the No. 3 bearing inner race and rollers.

(a) Install PWA 85795 Heater or PWA 85679 Heater (406/5) to the rear flange of the housing. Connect power and thermocouple cables to the PWA 29754 Control (406/3) or equivalent control.

(b) Set the heater to 300°F (149°C) and heat the housing for 55 − 60 minutes.

(31) After the No. 3 bearing housing is correctly heated turn off the heater. Disconnect the control and remove the heater from the housing.

CAUTION: WEAR CLEAN LINT FREE GLOVES WHEN YOU TOUCH THE NO 3 BEARING OUTER RACE TO PREVENT BEARING DAMAGE.

(32) (Reference 1006) Install the No. 3 bearing outer race (406/6) into the bearing housing with the serial number up and align the "X" mark on the outer race with the ink mark between the two dimples on the top of housing.

CAUTION: DO NOT HIT THE BEARING ROLLERS WITH THE DRIFT WHEN YOU SEAT THE OUTER RACE.

(33) Install the PWA 87433 Drift or PWA 85798 Drift (406/2) on the outer race and seat the race. Make sure the outer race is seated against the shoulder in the housing. Remove the drift.

(34) After the No. 3 bearing temperature has returned to room temperature, do a dimensional check to make sure the bearing outer race is correctly seated. See Figure 402.

(a) Measure the Distance F from the top of the No. 3 bearing housing to the top of the bearing outer race (402/7).

(b) Dimension F must not be less than Dimension E minus Dimension D.

NOTE: An indication that the outer race is not fully seated is when Dimension F is less than necessary.

CAUTION: A NEW OR SILVER PLATED NO. 3 BEARING OUTER RACE RETAINING NUT MUST BE INSTALLED AT EACH INSTALLATION OR DAMAGE TO MATING PARTS CAN OCCUR.

CAUTION: THE NO. 3 BEARING OUTER RACE RETAINING NUT MUST BE SILVER PLATED AFTER YOU TORQUE THE NUT A MAXIMUM OF THREE TIMES FOR EACH INSTALLATION BEFORE THE ENGINE IS OPERATED, THE NUT CAN BE SILVER PLATED PER PW4000 SERIES CIR, PN 51A357.

CAUTION: TO PREVENT INCORRECT BEARING OUTER RACE DIMENSIONAL CHECKS AND RETAINING NUT TORQUE READINGS, THE NO. 3 BEARING AND HOUSING MUST BE AT ROOM TEMPERATURE. SHOP AIR CAN BE USED FOR COOLING. DO NOT USE DRY ICE.

(35) Lubricate the No. 3 bearing outer race retaining nut (406/8) with Engine Oil P03−001.

(36) Install six workbolts, lubricated with Engine Oil P03−001, into the bearing housing channel nuts equally around the housing. Torque the workbolts to 290 − 325 lb−in. (32.766 − 36.720 N.m).

NOTE: The workbolts are a quality standard bolt with .375−24 by 1.000 inch (25.400 mm) thread length.

(37) Install the PWA 85168 Protector (406/4) to the diffuser case.

(38) Install retaining nut into housing with slots up, handtighten.

(39) Slide PWA 86491 Driver or PWA 85797 Wrench (406/10) over the HPC rear hub, install the teeth of the tool in the slots of the nut.

NOTE: If you use PWA 86491 Driver, you must attach the driver to the bearing housing with the four detail cap screws.

(40) Mechanical Wrench Method (Optional) − See Figure 406, Sheet 2.

(a) Install PWA 102743 Torque Adapter (406/11) to engage the slots in the bearing retaining nut.

(b) Install PWA 102744 Holder Adapter (406/12) over PWA 102743 Torque Adapter (406/11) and attach it to the bearing housing with the four detail bolts. Tighten the bolts.

(c) Install PWA 80187 Torque Multiplier (406/13) to engage both PWA 102743 Torque Adapter (406/11) and PWA 102744 Holder Adapter (406/12).

(41) (Reference 975) Torque retaining nut to 3600 − 4400 lb−in. (406.745 − 497.133 N.m). Turn through angle of 16° − 17° 30'. Loosen to 0 lb−in. (0 N.m) then repeat torque sequence aligning one rivet hole in retaining nut with one rivet hole in housing.

(42) Remove the wrench/driver from the No. 3 bearing retaining nut.

(43) Remove the six workbolts from the bearing housing.

(44) Install the rivet (406/7) to the aligned holes in the retaining nut and housing. Use the PWA 85901 Riveter and flare the rivet to attach.

(45) Install the PWA 85159 Thread Protector (406/1) over the HPC rear hub.

D. Postrequisites

(1) Connect/Install The External Parts To The Complete Installation Of The Diffuser Combustor. Refer to 72-00-41, Installation-02 (Task 72-00-41-420-005).

(2) Trunnion The Intermediate Case Through Diffuser And Combustor Case From The Front End Down To The Horizontal Position. Refer to 72-00-00, Special Procedures-10 (Task 72-00-00-420-002-A).

(3) Install The No. 3 Bearing Seal Assembly And Seal Seat. Refer to 72-00-41, Installation-03 (Task 72-00-41-420-003).

(4) Vacuum Check The No. 3 Bearing Compartment. Refer to 72-00-41, Inspection/Check-07 (Task 72-00-41-720-001).

(5) Install The Turbine Nozzle. Refer to 72-00-51, Installation-01 (Task 72-00-51-420-001).

(6) Install The High Pressure Turbine - Horizontal. Refer to 72-00-52, Installation-01 (Task 72-00-52-420-001).

(7) Install The No. 1 Bearing Support Assembly. Refer to 72-00-34, Installation-04 (Task 72-00-34-450-002).

(8) Install The Fan Case. Refer to 72-00-33, Installation-01 (Task 72-00-33-420-001).

(9) Install The Low Pressure Turbine With Shaft. Refer to 72-00-53, Installation-01 (Task 72-00-53-420-001).

(10) Install The Turbine Exhaust Case. Refer to 72-00-54, Installation-01 (Task 72-00-54-420-001).

(11) Install The Low Pressure Compressor. Refer to 72-00-31, Installation-01 (Task 72-00-31-420-003).

(12) Install The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed). Refer to 72-00-32, Installation-01 (Task 72-00-32-420-001).

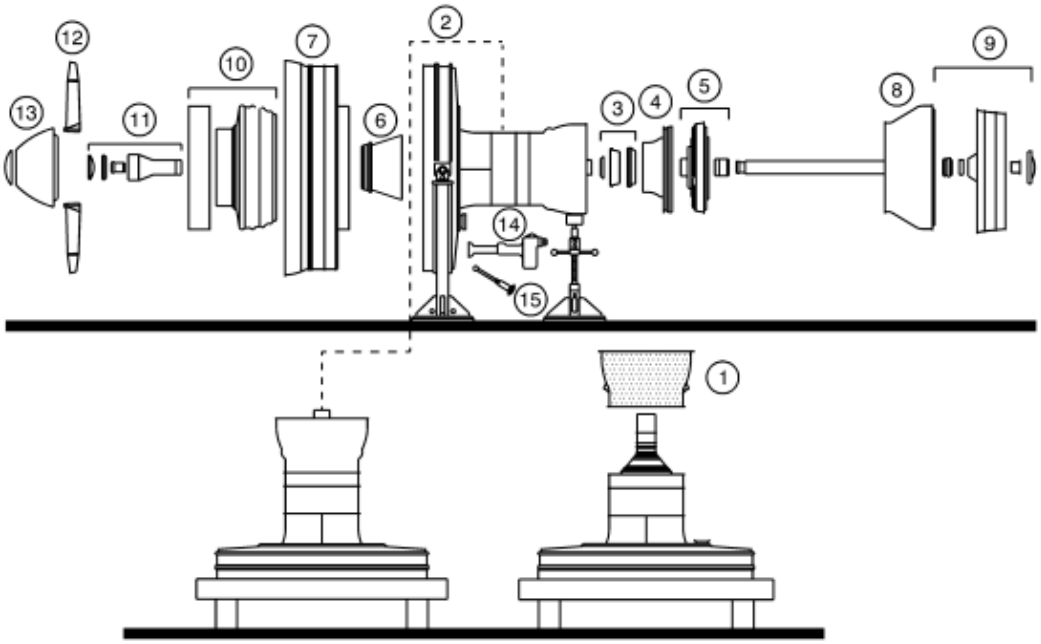
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−15

(13) Install The Stage 1 LPC Blade Assemblies. Refer to 72−00−31, Installation−04 (Task 72−00−31−420−002−002).

(14) Install The Compressor Inlet Cone. Refer to 72−00−31, Installation−02 (Task 72−00−31−420−001).

(15) Install The Main Gearbox. Refer to 72−00−61, Installation−01 (Task 72−00−61−420−001).

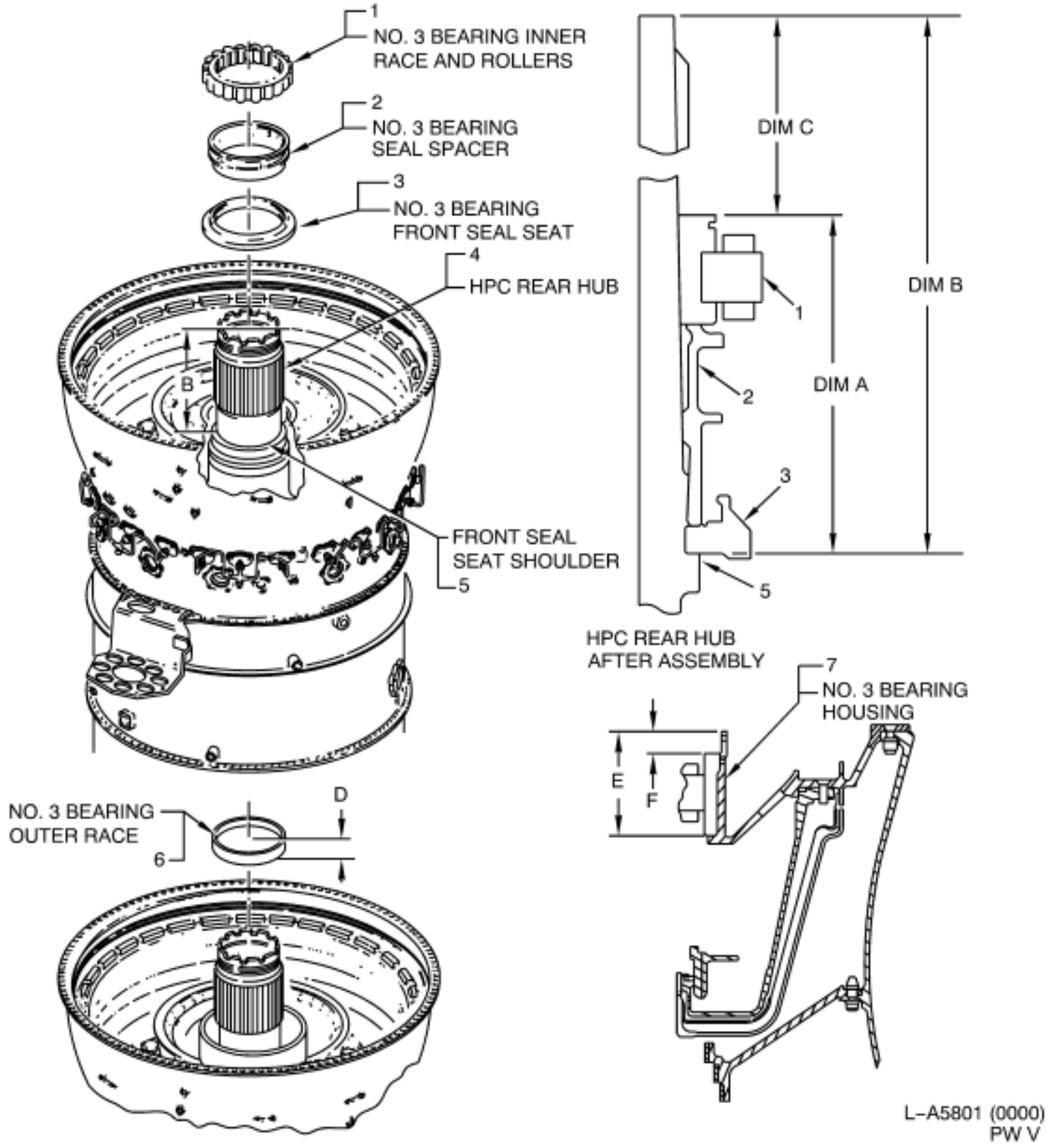
(16) Install The Electronic Engine Control (EEC) Speed Transducer (N1). Refer to 72−00−34, Installation−03 (Task 72−00−34−450−001).



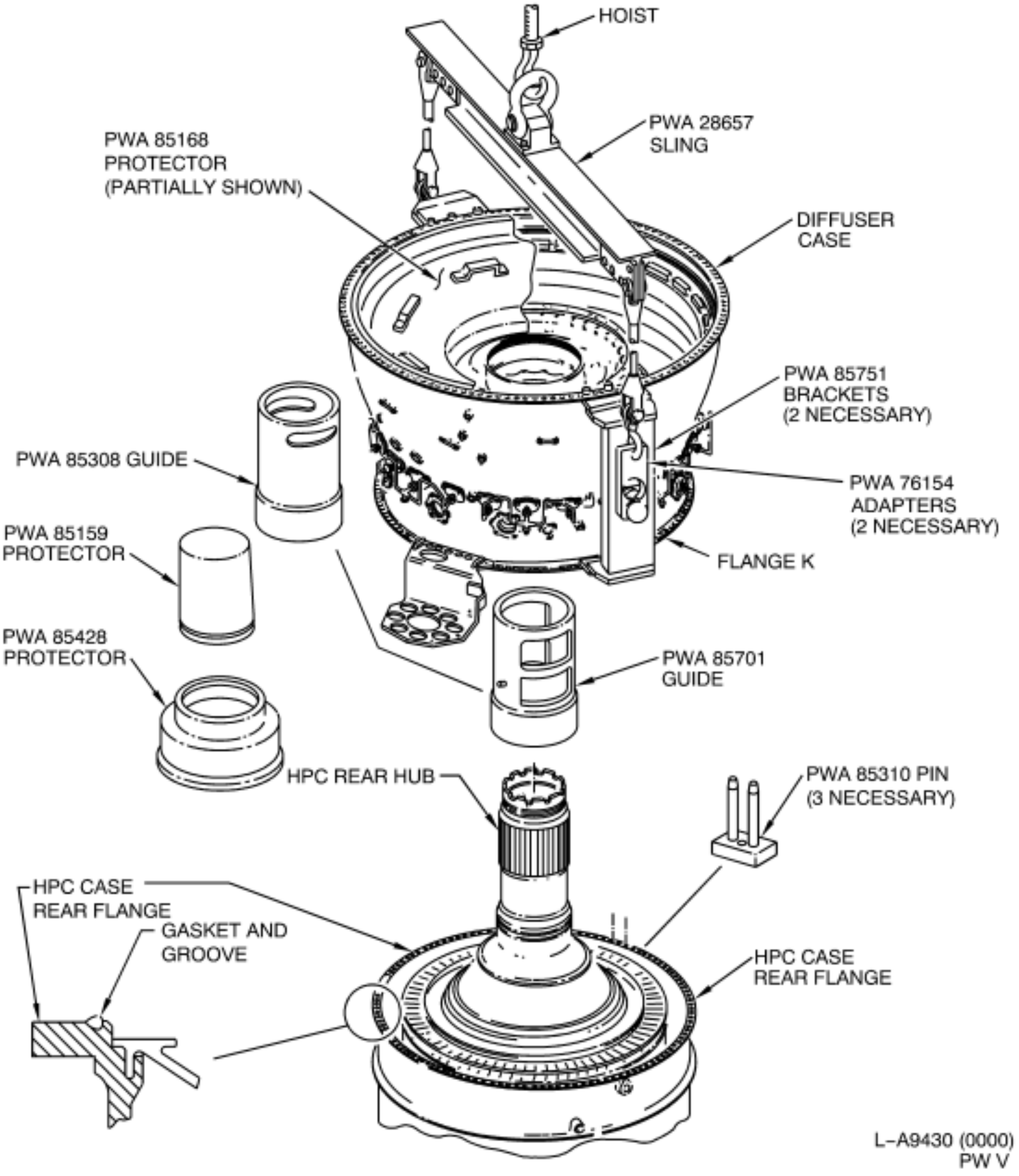
1. INSTALL DIFFUSER AND COMBUSTOR.
2. TRUNNION INTERMEDIATE THROUGH DIFFUSER CASE TO HORIZONTAL.
3. INSTALL NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL SEAT.
4. INSTALL TURBINE NOZZLE.
5. INSTALL HIGH PRESSURE TURBINE (HPT).
6. INSTALL NO. 1 BEARING SUPPORT ASSEMBLY.
7. INSTALL FAN CASE.
8. INSTALL LOW PRESSURE TURBINE (LPT).
9. INSTALL TURBINE EXHAUST CASE.
10. INSTALL LOW PRESSURE COMPRESSOR (LPC).
11. INSTALL LPC/LPT COUPLING.
12. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
13. INSTALL COMPRESSOR INLET CONE.
14. INSTALL MAIN GEARBOX.
15. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).

L−A0257 (0000)
PW V

Procedure Sequence
Figure 401
(Task 72−00−41−420−017)

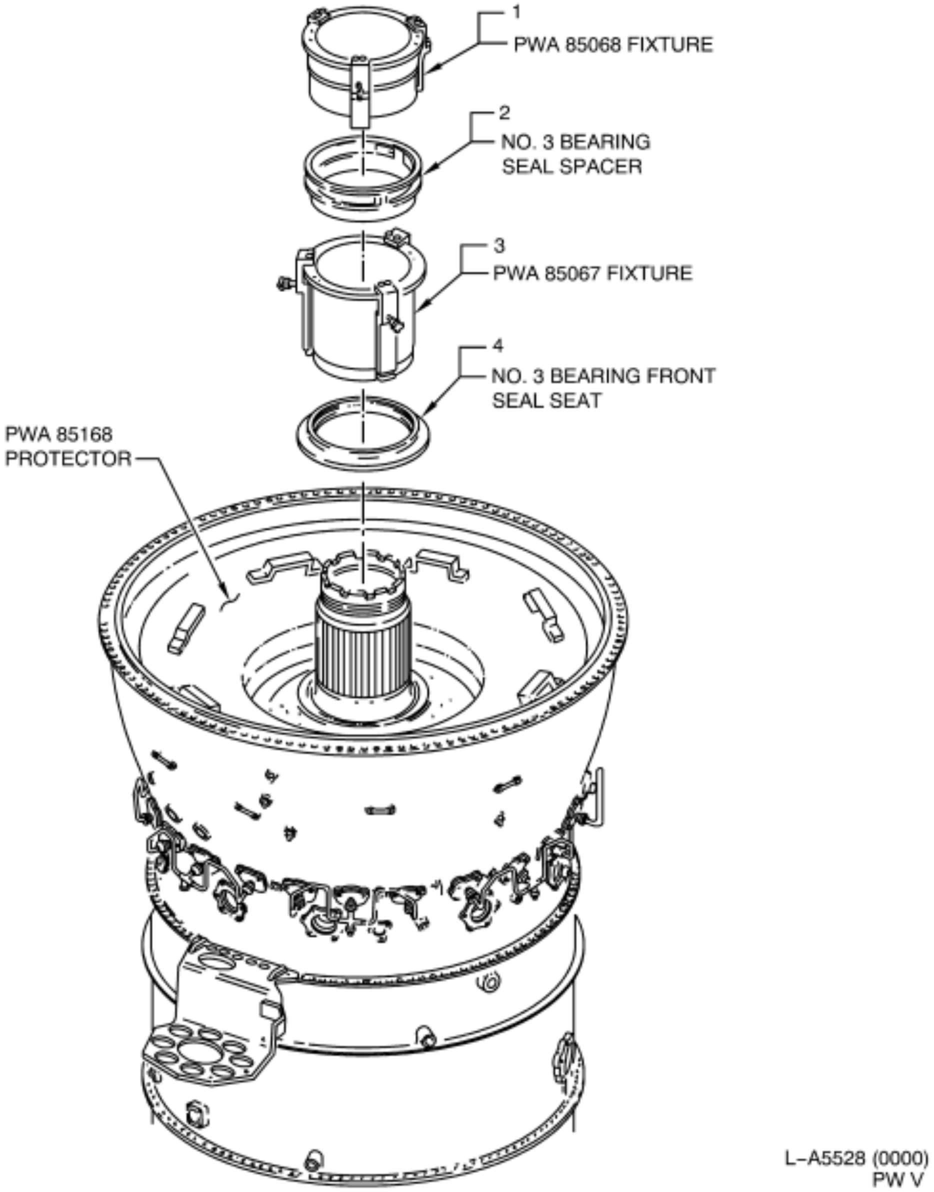

1
NO. 3 BEARING INNER RACE AND ROLLERS
2
NO. 3 BEARING SEAL SPACER
3
NO. 3 BEARING FRONT SEAL SEAT
4
HPC REAR HUB
B
FRONT SEAL SEAT SHOULDER
5
NO. 3 BEARING OUTER RACE
6
D
DIM C
DIM B
DIM A
1
2
3
5
HPC REAR HUB AFTER ASSEMBLY
7
NO. 3 BEARING HOUSING
E
F
L−A5801 (0000)
PW V

Diffuser And Combustor Installation
Bearing Seating Check Measurement
Figure 402
(Task 72−00−41−420−017)


HOIST
PWA 85168
PROTECTOR
(PARTIALLY SHOWN)
PWA 28657
SLING
DIFFUSER
CASE
PWA 85751
BRACKETS
(2 NECESSARY)
PWA 85308 GUIDE
PWA 76154
ADAPTERS
(2 NECESSARY)
PWA 85159
PROTECTOR
FLANGE K
PWA 85428
PROTECTOR
PWA 85701
GUIDE
HPC REAR HUB
PWA 85310 PIN
(3 NECESSARY)
HPC CASE
REAR FLANGE
GASKET AND
GROOVE
HPC CASE
REAR FLANGE
L-A9430 (0000)
PW V

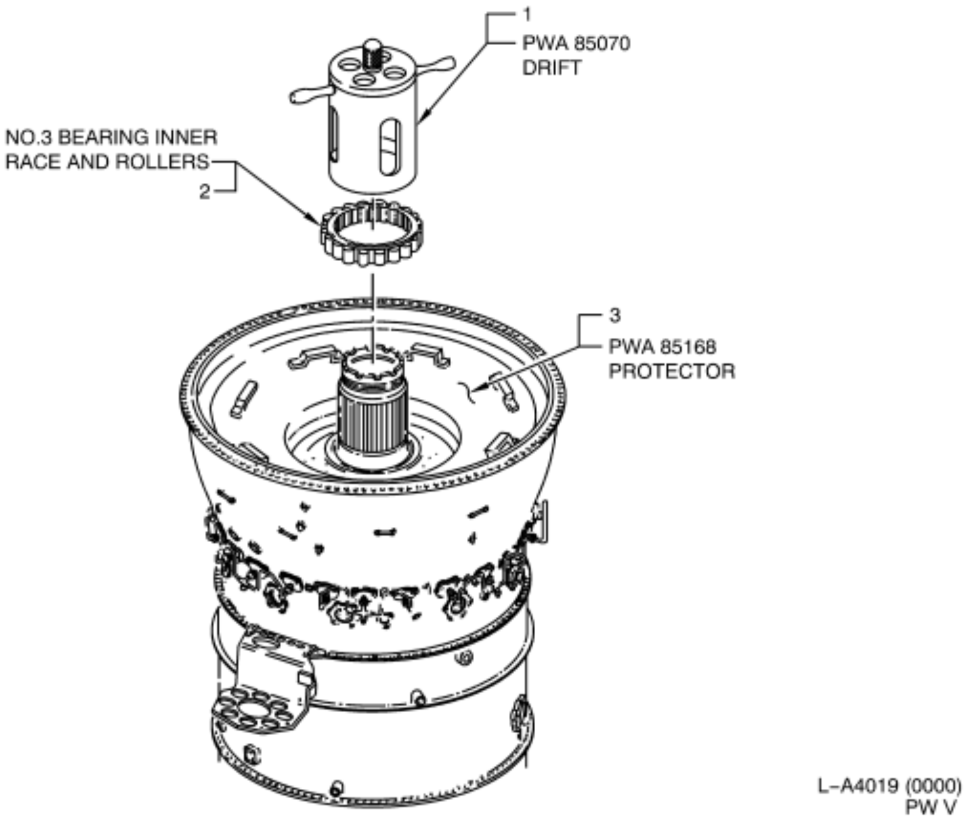
Diffuser And Combustor Installation
Figure 403
(Task 72-00-41-420-017)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−15

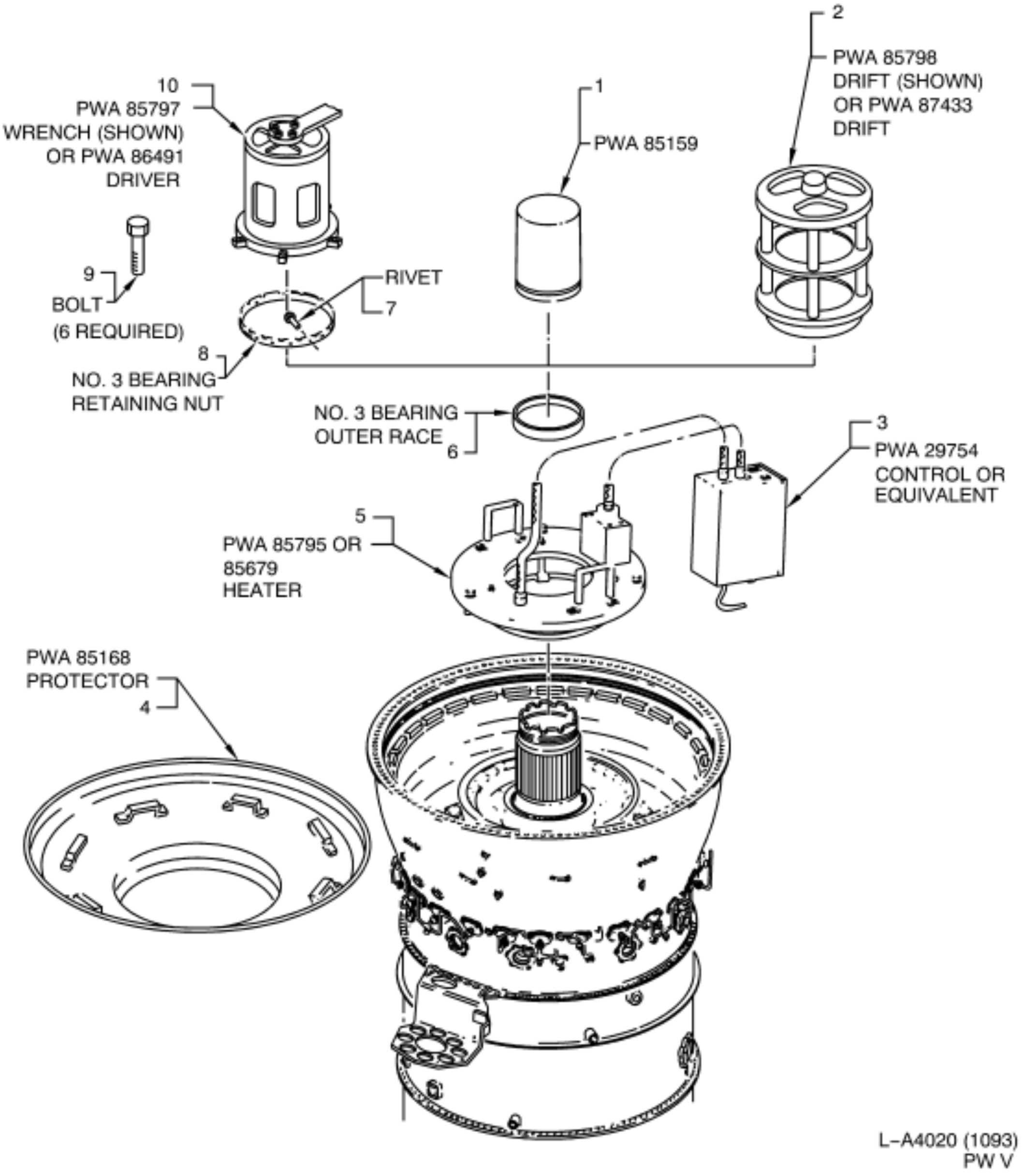

1
PWA 85068 FIXTURE
2
NO. 3 BEARING SEAL SPACER
3
PWA 85067 FIXTURE
4
NO. 3 BEARING FRONT SEAL SEAT
PWA 85168 PROTECTOR
L−A5528 (0000)
PW V

Diffuser And Combustor Installation
Figure 404
(Task 72−00−41−420−017)

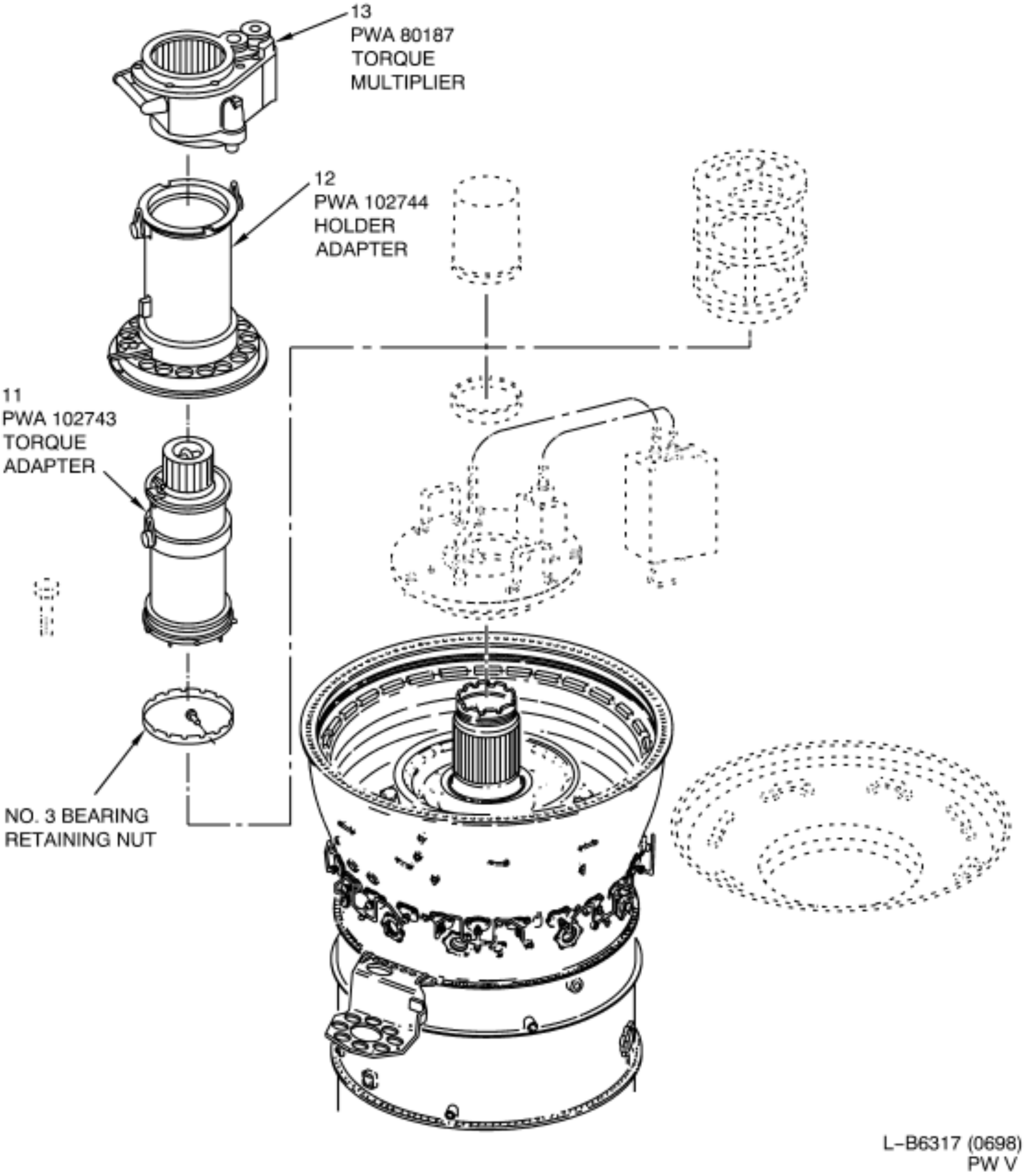
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−15


1
PWA 85070
DRIFT
NO.3 BEARING INNER
RACE AND ROLLERS
2
3
PWA 85168
PROTECTOR
L−A4019 (0000)
PW V

Diffuser And Combustor Installation
Figure 405
(Task 72−00−41−420−017)


2
PWA 85798
DRIFT (SHOWN)
OR PWA 87433
DRIFT
10
PWA 85797
WRENCH (SHOWN)
OR PWA 86491
DRIVER
1
PWA 85159
9
BOLT
(6 REQUIRED)
RIVET
7
8
NO. 3 BEARING
RETAINING NUT
NO. 3 BEARING
OUTER RACE
6
3
PWA 29754
CONTROL OR
EQUIVALENT
5
PWA 85795 OR
85679
HEATER
PWA 85168
PROTECTOR
4
L−A4020 (1093)
PW V

No. 3 Bearing Outer Race Installation
Figure 406 (Sheet 1)
(Task 72−00−41−420−017)


13
PWA 80187
TORQUE
MULTIPLIER
12
PWA 102744
HOLDER
ADAPTER
11
PWA 102743
TORQUE
ADAPTER
NO. 3 BEARING
RETAINING NUT
L−B6317 (0698)
PW V

No. 3 Bearing Outer Race Installation
Figure 406 (Sheet 2)
(Task 72−00−41−420−017)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-41-420-018:

1. Install Diffuser And Combustor (Horizontal) Without No. 3 Bearing Outer Race Previously Installed

NOTE: See Figure 401 for part/assembly installation procedure sequence.

NOTE: See 72-00-41, Installation-12 Task 72-00-41-420-012 for alternate procedure with No. 3 bearing outer race installed. Outer race was previously installed into diffuser combustor group prior to being installed onto HPC.

A. Prerequisites

(1) See 72-00-41, Inspection/Check-01 Task 72-00-41-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For Example: (Reference 1234) Torque retaining nut as follows:

(2) Assemble diffuser and combustor by means of 72-41-00, Assembly-01 Task 72-41-00-400-001.

B. Equipment And Materials Required

Standard Tools:

0.250-28 Jackscrews (Four Required)
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 28657	Sling
PWA 29754	Control (Or Equivalent)
PWA 76154	Adapter (Two Required)
PWA 80187	Multiplier, Torque
PWA 85067	Fixture
PWA 85068	Fixture
PWA 85070	Drift
PWA 85159	Protector
PWA 85168	Protector
PWA 85308	Guide (Optional To PWA 85701)
PWA 85310	Pin, Alignment (Three Required)
PWA 85679	Heater (Optional To PWA 85795)
PWA 85701	Guide
PWA 85751	Bracket (Two Required)

Special Tools:

(CONTINUED)

PWA 85795	Heater
PWA 85797	Wrench (Optional To PWA 86491)
PWA 85798	Drift (Optional To PWA 87433)
PWA 85799	Pins, Guide And Support
PWA 85893	Support
PWA 85901	Riveter
PWA 85909	Adapter
PWA 85910	Adapter
PWA 85983	Adapter, Stabilizer (Two Required Twin Overhead Rail System Only)
PWA 86491	Driver, Torque
PWA 87433	Drift
PWA 102743	Adapter, Torque
PWA 102744	Adapter, Holder

Consumable Materials:

	Item No.	Designation
	P03−001	Engine Oil (PWA 521B)
	P05−026	Ink (Marking) (PMC 4057−1)
	P05−059	Wax, Paraffin (PMC 9552)
	P05−289	Lockwire (AS3214−02)
	P05−291	Cable, Safety (Optional)
R	P05−292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72−00−41/1/1
Rivet	1	72−41−00/12/40

C. Procedure
See Figure 402 and Figure 403.

(1) Remove PWA 85159 Thread Protector and PWA 85428 Knife−Edge Protector from HPC rear hub.

CAUTION: HANDLE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN LINT FREE GLOVES TO PREVENT BEARING DAMAGE.

(2) Visually inspect HPC rear drum OD thrust balance knife-edge per 72-00-35, Inspection/Check-04 (visual only) Task 72-00-35-210-004. Reject the airseal with cracks confirmed by visual inspection.

(3) Place No. 3 bearing assembly on clean waxed paper on bench.

(4) Separate outer race (402/7) from inner race and rollers (402/3) and place them, serial number up, on bench.

(5) Verify bearing inner and outer race part numbers are the same.

CAUTION: THICKNESS OF NO. 3 BEARING FRONT SEAL SEAT MUST BE MEASURED ACROSS THINNER, ID, SECTION OF SEAL SEAT OR INCORRECT DIMENSION WILL RESULT.

(6) Measure thickness of No. 3 bearing front seal seat (402/1) across thinner ID section of seal seat. Measure No. 3 bearing seal spacer (402/2) thickness, No. 3 bearing inner race and rollers (402/3) thickness. Record this total thickness as Dimension A.

(7) Measure distance from end of HPC rear hub (402/4) down to seal seat shoulder (402/5) on hub. Record this dimension as Dimension B.

NOTE: Dimensions A and B will be used to perform a seating check later during this installation procedure.

(8) Measure thickness of No. 3 bearing outer race (402/7) thickness. Record this dimension as Dimension D.

(9) Measure distance from top of No. 3 bearing support to outer race seating shoulder. Record this dimension as Dimension E.

NOTE: Dimensions D and E will be used to perform a seating check later during this installation procedure.

(10) Locate two dimples on top surface of No. 3 bearing housing (402/6) threaded ID. Mark a line between the dimples with Ink P05−026.

(11) For engines with gasket groove on rear flange of HPC rear case (Post SB PW4ENG 72−48), install gasket to flange groove and secure in place with Paraffin Wax P05−059. See Figure 403.

NOTE: Engines prior to (SB PW4ENG 72−48) do not accept gasket at Flange K.

(12) Install two PWA 85751 Handling Brackets to diffuser case. See Figure 404.

NOTE: If you have a twin overhead rail system you must use PWA 85983 Stabilizer Adapters with PWA 85751 Brackets.

(a) Loosen and remove the clamp bolts that attach the fuel tubes to the Flange K bracket for PWA 85751 Bracket tool installation clearance.

(b) Using hoist, position longer front flange of brackets to rear of front flange of diffuser case at 3 and 9 o'clock locations, locating four pins in front flange of bracket into four boltholes in diffuser case front flange. Position shorter rear flange of bracket to front of diffuser case rear flange and secure with detail nuts and bolts.

(c) Position double spool bracket in rear most two holes as marked on bracket.

(13) For PWA 85701 Guide, retract two setscrews on side of guide. Position PWA 85701 Guide or PWA 85308 Guide larger diameter end first on HPC rear hub and seat on seal seat shoulder. For PWA 85701 Guide, handtighten two set screws on side of guide.

(14) Install three PWA 85310 Alignment Pins into rear flange of HPC case. See Figure 403.

(a) Remove screws from storage locations in plate details of alignment pins.

(b) Locate three equally spaced 0.250−28 jackscrew holes in rear flange of HPC case.

(c) Insert three equally spaced alignment pins (dowel pins up) through unthreaded holes in rear flange of HPC case. Secure pins with detail screws.

(15) With hoist, connect PWA 28657 Sling with two PWA 76154 Adapters to outer trunnion spools of PWA 85751 Brackets on diffuser case.

(16) With hoist position diffuser and combustor assembly over HPC rear hub. Align pins in HPC rear case with mating holes in diffuser case. With workbolts and nuts, seat diffuser case on HPC rear case.

(17) Remove work bolts, nuts, and PWA 85310 Pins. For PWA 85701 Guide, retract two setscrews on side of guide. Remove PWA 85701 or PWA 85308 Guide from HPC rear hub. See Figure 405.

(18) Remove PWA 28657 Sling, PWA 76154 Adapters and PWA 85751 Brackets.

(19) Install the Flange K hardware as follows: Refer to 72−00−41, Installation−20 (Task 72−00−41−420−020).

(20) Assemble PWA 85067 Fixture (406/3) to No. 3 bearing front seal seat (406/1). See Figure 406.

(21) Install fixture with seal seat polished face down over HPC rear hub and drift to seat if necessary. Remove fixture.

(22) Torque all bolts securing fuel supply tubes to Flange K brackets to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(23) Assemble PWA 85068 Fixture (406/4) to No. 3 bearing seal spacer (406/3).

(24) Install fixture with seal spacer over HPC rear hub and drift to seat if necessary. Remove fixture.

(25) Heat the No. 3 bearing inner race and rollers. See Standard Practices Manual, PN 585005.

CAUTION: HANDLE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN INSULATED GLOVES TO PREVENT BEARING DAMAGE.

(26) Remove the heated inner race and rollers from the heat source.

(27) Install the heated No. 3 bearing inner race and rollers (407/1) onto HPC rear hub, puller grooves up. Seat bearing with PWA 85070 Drift (407/2) and keep constant downward pressure on bearing for approximately three minutes to make sure of correct seating. After seating remove drift. See Figure 407.

(28) After inner race has reached room temperature measure distance from end of HPC rear hub down to rear of inner race and rollers with depth gage. Record this distance as Dimension C. See Figure 402.

(29) Dimension C must not be less than previously taken Dimension B minus Dimension A.

NOTE: If Dimension C is less than required it indicates bearing is not fully seated.

(30) Remove PWA 85168 Protector (408/7) from diffuser case. See Figure 408.

(31) Heat No. 3 bearing housing.

(a) Install four PWA 85799 Pins (408/10) into the bearing housing channel nuts equally around housing.

(b) Install PWA 85795 Heater or PWA 85679 Heater (408/4) to rear flange of housing on PWA 85799 Pins. Connect power and thermocouple cables to PWA 29754 Control (408/9) or equivalent control.

NOTE: If PWA 85679 Heater is used, a heat shield must be made locally to protect the No. 3 bearing inner race and rollers.

(c) Set heater to 300°F (149°C) and heat housing for 55 − 60 minutes.

(32) After No. 3 bearing housing is correctly heated, turn off heater. Disconnect control and remove heater and four PWA 85799 Pins from housing.

CAUTION: HANDLE NO. 3 BEARING OUTER RACE WITH CLEAN GLOVES TO PREVENT BEARING DAMAGE.

(33) (Reference 1006) Install No. 3 bearing outer race (408/5) into bearing housing with serial number up and align "X" mark on outer race with ink mark between the two dimples on top of housing.

CAUTION: DO NOT HIT BEARING ROLLERS WITH THE DRIFT WHEN SEATING OUTER RACE.

(34) Position PWA 87433 Drift or PWA 85798 Drift (408/8) on outer race and seat race. Make sure outer race is seated against shoulder in housing. Remove the drift.

(35) After the No. 3 bearing temperature has returned to room temperature, do a dimensional check to make sure bearing outer race is correctly seated. See Figure 402.

(a) Measure Distance F from top of No. 3 bearing housing to top of bearing outer race (402/7).

(b) Dimension F must not be less than previously taken Dimension E minus Dimension D.

NOTE: If Dimension F is less than required, it indicates outer race is not fully seated.

CAUTION: A NEW OR SILVER PLATED NO. 3 BEARING OUTER RACE RETAINING NUT MUST BE INSTALLED AT EACH INSTALLATION OR DAMAGE TO MATING PARTS MAY OCCUR.

CAUTION: NO. 3 BEARING OUTER RACE RETAINING NUT MUST BE SILVER PLATED AFTER TORQUING NUT A MAXIMUM OF THREE TIMES FOR EACH INSTALLATION PRIOR TO ENGINE BEING OPERATED, NUT CAN BE SILVER PLATED PER PW4000 SERIES CIR, PN 51A357.

CAUTION: TO AVOID INCORRECT BEARING OUTER RACE DIMENSIONAL CHECKS AND RETAINING NUT TORQUE READING, NO. 3 BEARING AND HOUSING MUST BE AT ROOM TEMPERATURE. SHOP AIR MAY BE USED FOR COOLING. DO NOT USE DRY ICE.

(36) Lubricate the No. 3 bearing outer race retaining nut (408/2) with Engine Oil P03−001.

(37) Install six workbolts, lubricated with Engine Oil P03−001, into bearing housing channel nuts equally around housing. Torque workbolts to 290 − 325 lb−in. (32.766 − 36.720 N.m).

NOTE: The workbolts are a quality standard bolt with .375−24 by 1.000 inch (25.400 mm) thread length.

(38) Install PWA 85168 Protector (408/1) to diffuser case.

(39) Install retaining nut into housing with slots up, handtighten.

(40) Slide PWA 86491 Driver or PWA 85797 Wrench (408/3) over HPC rear hub, locating the teeth of the tool in the slots of the nut.

NOTE: If you use PWA 86491 Driver, you must attach the driver to the bearing housing with the four detail cap screws.

(41) Mechanical Wrench Method (Optional) − See Figure 408, Sheet 2.

(a) Install PWA 102743 Torque Adapter (408/11) to engage the slots in the bearing retaining nut.

(b) Install PWA 102744 Holder Adapter (408/12) over PWA 102743 Torque Adapter (408/11) and attach it to the bearing housing with the four detail bolts. Tighten the bolts.

(c) Install PWA 80187 Torque Multiplier (408/13) to engage both PWA 102743 Torque Adapter (408/11) and PWA 102744 Holder Adapter (408/12).

(42) (Reference 975) Torque retaining nut to 3600 − 4400 lb−in. (406.745 − 497.133 N.m). Turn through angle of 16° − 17° 30'. Loosen to 0 lb−in. (0 N.m) then repeat torque sequence aligning one rivet hole in retaining nut with one rivet hole in housing.

(43) Remove wrench/driver from the No. 3 bearing retaining nut.

(44) Remove the six workbolts from bearing housing.

(45) Install rivet (408/6) into aligned holes in the retaining nut and housing using PWA 85901 Riveter and flare rivet to secure.

(46) Install PWA 85159 Thread Protector (408/7) over HPC rear hub.

D. Postrequisites

(1) Connect/Install External Parts To Complete Installation Of Diffuser Combustor. Refer to 72-00-41, Installation-02 (Task 72-00-41-420-002).

(2) Trunnion The Intermediate Case Through Diffuser And Combustor Case From The Front End Down To The Horizontal Position. Refer to 72-00-00, Special Procedures-10 (Task 72-00-00-420-002-A00).

(3) Install The No. 3 Bearing Seal Assembly And Seal Seat. Refer to 72-00-41, Installation-03 (Task 72-00-41-420-003).

(4) Vacuum Check The No. 3 Bearing Compartment. Refer to 72-00-41, Inspection/ Check-07 (Task 72-00-41-720-001).

(5) Install The Turbine Nozzle. Refer to 72-00-51, Installation-01 (Task 72-00-51-420-001).

(6) Install The High Pressure Turbine - Horizontal. Refer to 72-00-52, Installation-01 (Task 72-00-52-420-001).

(7) Install The No. 1 Bearing Support Assembly. Refer to 72-00-34, Installation-04 (Task 72-00-34-450-002).

(8) Install The Fan Case. Refer to 72-00-33, Installation-01 (Task 72-00-33-420-001).

(9) Install The Low Pressure Turbine With Shaft. Refer to 72-00-53, Installation-01 (Task 72-00-53-420-001).

(10) Install The Turbine Exhaust Case. Refer to 72-00-54, Installation-01 (Task 72-00-54-420-001.

(11) Install The Low Pressure Compressor. Refer to 72-00-31, Installation-01 (Task 72-00-31-420-003).

(12) Install The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed). Refer to 72-00-32, Installation-01 (Task 72-00-32-420-001).

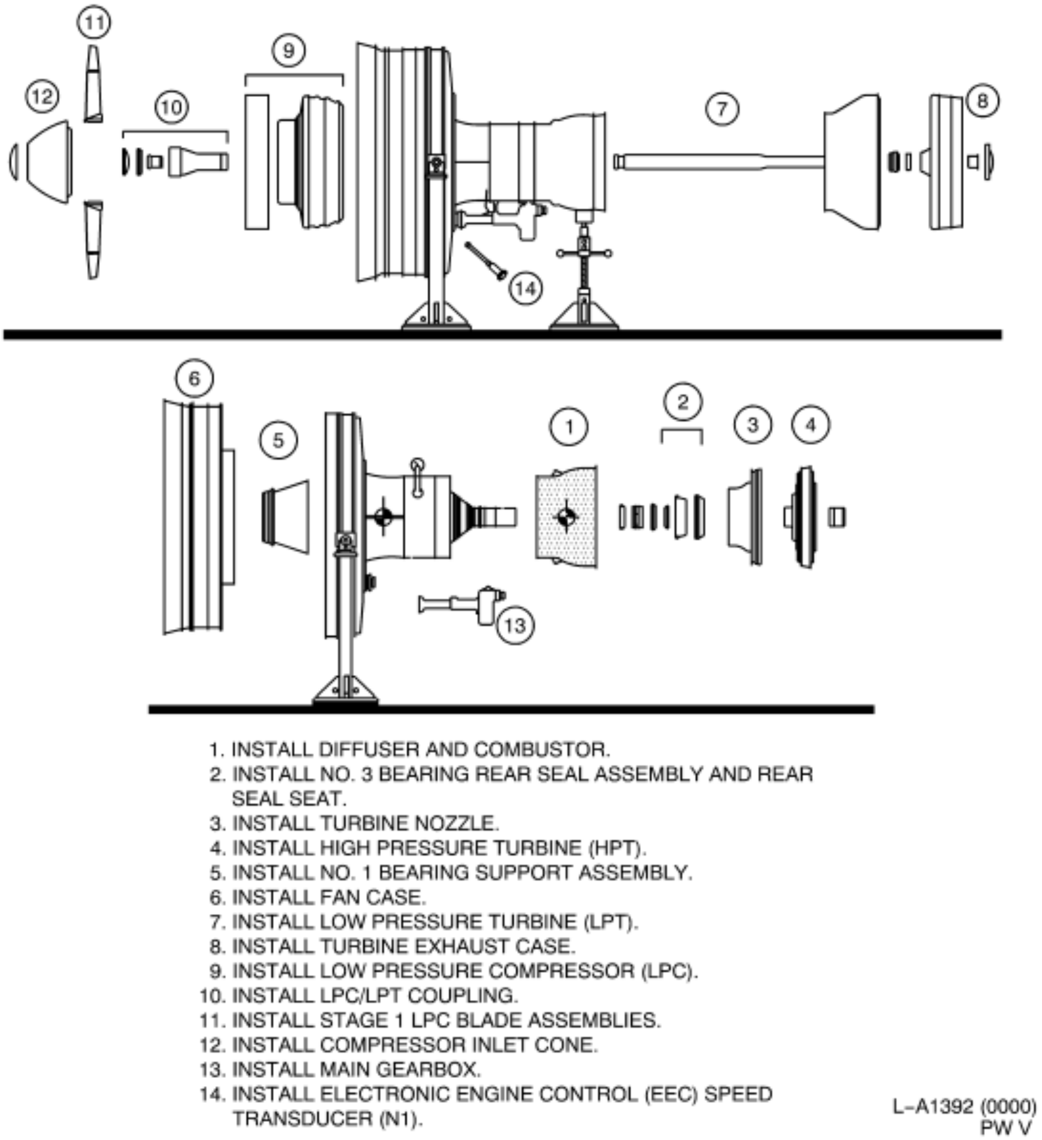
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−16

(13) Install The Stage 1 LPC Blade Assemblies. Refer to 72−00−31, Installation−04 (Task 72−00−31−420−002−002).

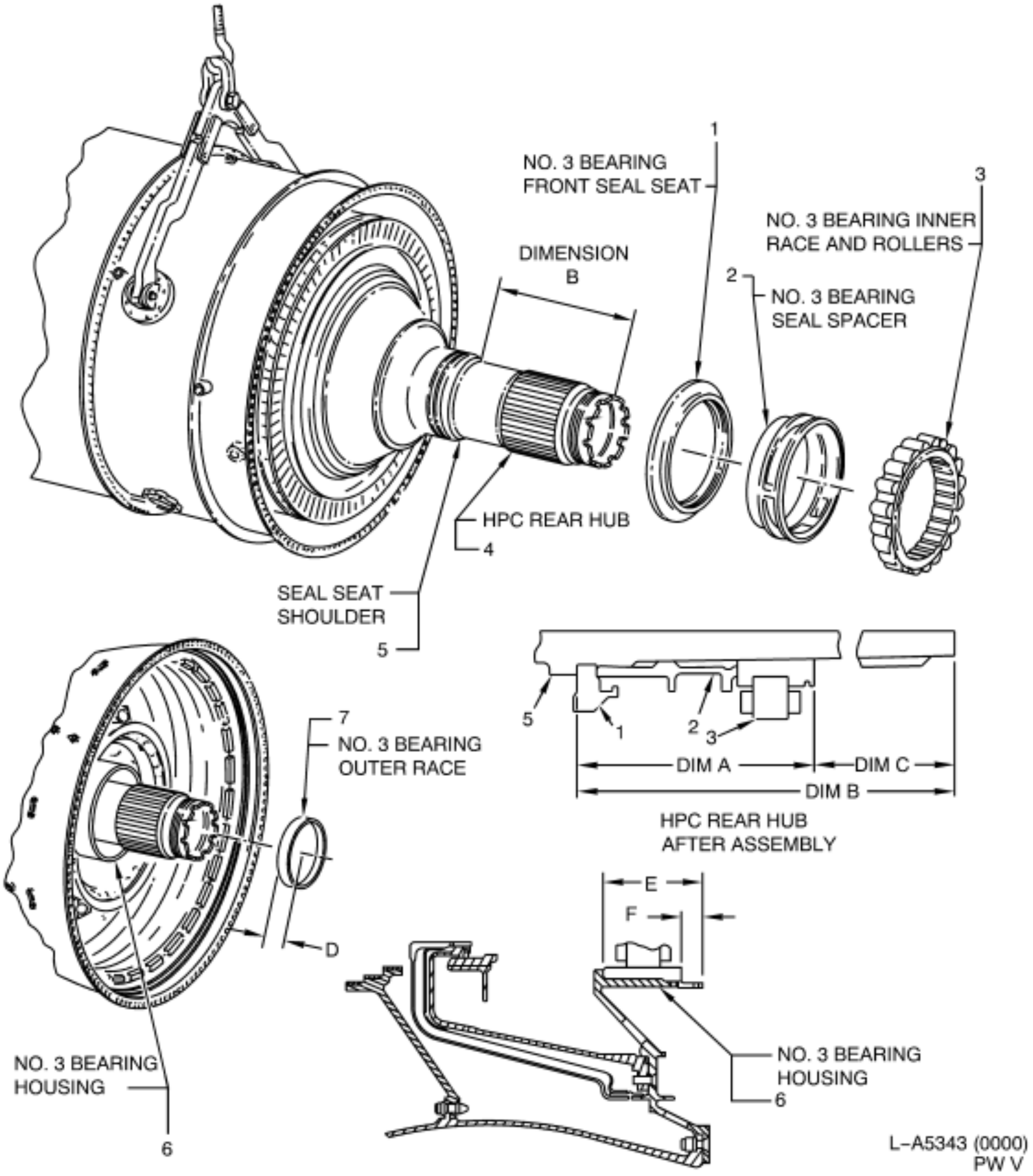
(14) Install The Compressor Inlet Cone. Refer to 72−00−31, Installation−02 (Task 72−00−31−420−001).

(15) Install The Main Gearbox. Refer to 72−00−61, Installation−01 (Task 72−00−61−420−001).

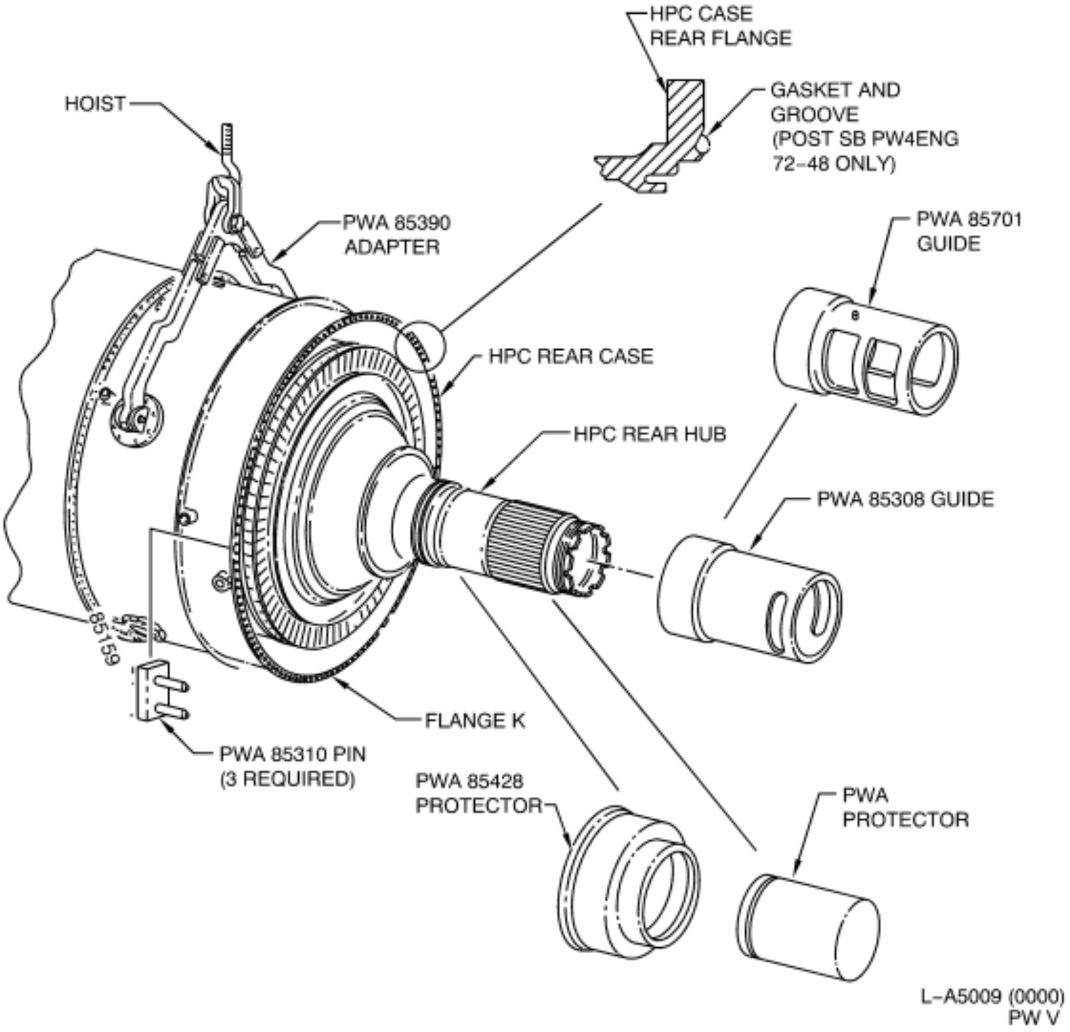
(16) Install The Electronic Engine Control (EEC) Speed Transducer (N1). Refer to 72−00−34, Installation−03 (Task 72−00−34−450−001).


11
12
10
9
7
8
14
6
5
1
2
3
4
13
1. INSTALL DIFFUSER AND COMBUSTOR.
2. INSTALL NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL SEAT.
3. INSTALL TURBINE NOZZLE.
4. INSTALL HIGH PRESSURE TURBINE (HPT).
5. INSTALL NO. 1 BEARING SUPPORT ASSEMBLY.
6. INSTALL FAN CASE.
7. INSTALL LOW PRESSURE TURBINE (LPT).
8. INSTALL TURBINE EXHAUST CASE.
9. INSTALL LOW PRESSURE COMPRESSOR (LPC).
10. INSTALL LPC/LPT COUPLING.
11. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
12. INSTALL COMPRESSOR INLET CONE.
13. INSTALL MAIN GEARBOX.
14. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
L−A1392 (0000)
PW V

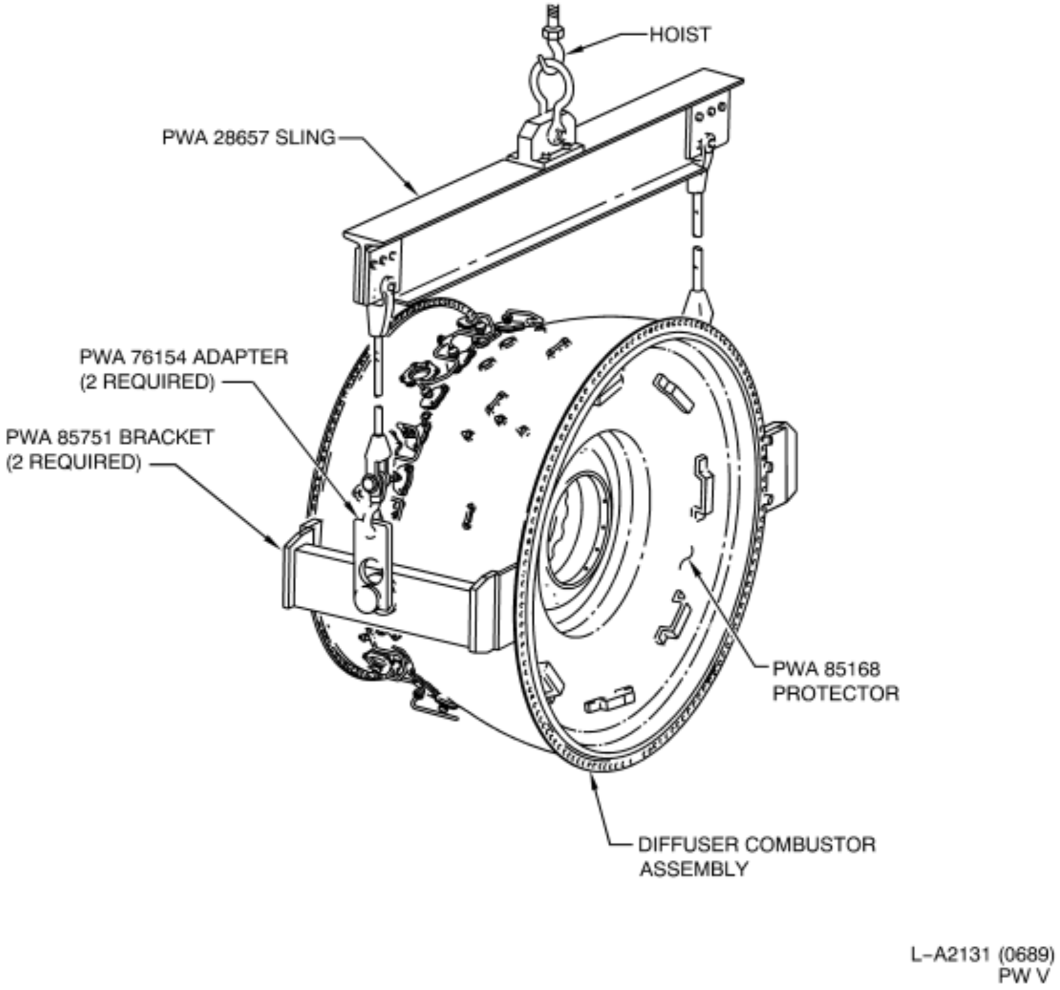
Procedure Sequence
Figure 401
(Task 72−00−41−420−018)


NO. 3 BEARING FRONT SEAL SEAT
1
3
NO. 3 BEARING INNER RACE AND ROLLERS
DIMENSION B
2
NO. 3 BEARING SEAL SPACER
HPC REAR HUB
4
SEAL SEAT SHOULDER
5
7
NO. 3 BEARING OUTER RACE
5
1
2
3
DIM A
DIM C
DIM B
HPC REAR HUB AFTER ASSEMBLY
E
F
D
NO. 3 BEARING HOUSING
6
NO. 3 BEARING HOUSING
6
L−A5343 (0000)
PW V

Diffuser And Combustor Installation
Bearing Seating Check Measurement
Figure 402
(Task 72−00−41−420−018)

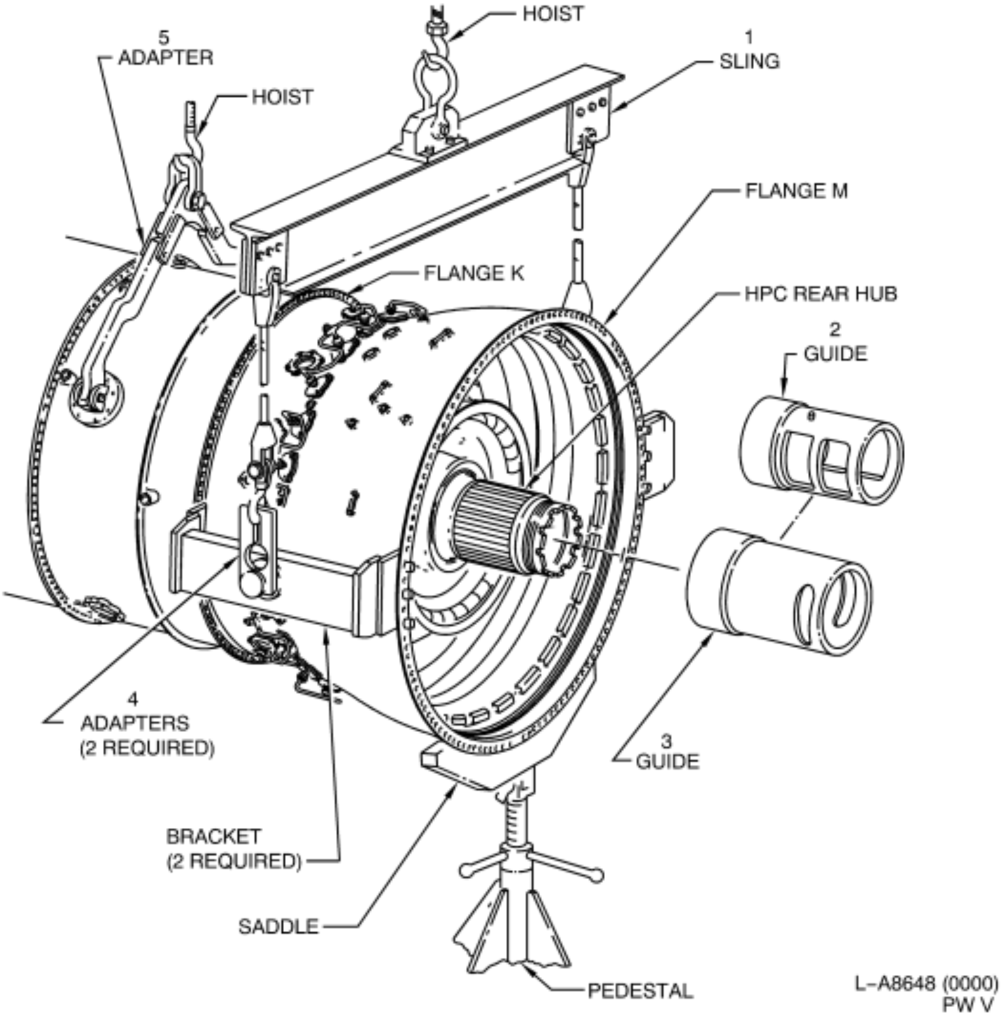

HPC CASE
REAR FLANGE
HOIST
GASKET AND
GROOVE
(POST SB PW4ENG
72−48 ONLY)
PWA 85390
ADAPTER
PWA 85701
GUIDE
HPC REAR CASE
HPC REAR HUB
PWA 85308 GUIDE
PWA
85159
FLANGE K
PWA 85310 PIN
(3 REQUIRED)
PWA 85428
PROTECTOR
PWA
PROTECTOR
L−A5009 (0000)
PW V

Diffuser And Combustor Installation
Figure 403
(Task 72−00−41−420−018)


HOIST
PWA 28657 SLING
PWA 76154 ADAPTER (2 REQUIRED)
PWA 85751 BRACKET (2 REQUIRED)
PWA 85168 PROTECTOR
DIFFUSER COMBUSTOR ASSEMBLY
L−A2131 (0689)
PW V

Diffuser And Combustor Installation
Figure 404
(Task 72−00−41−420−018)

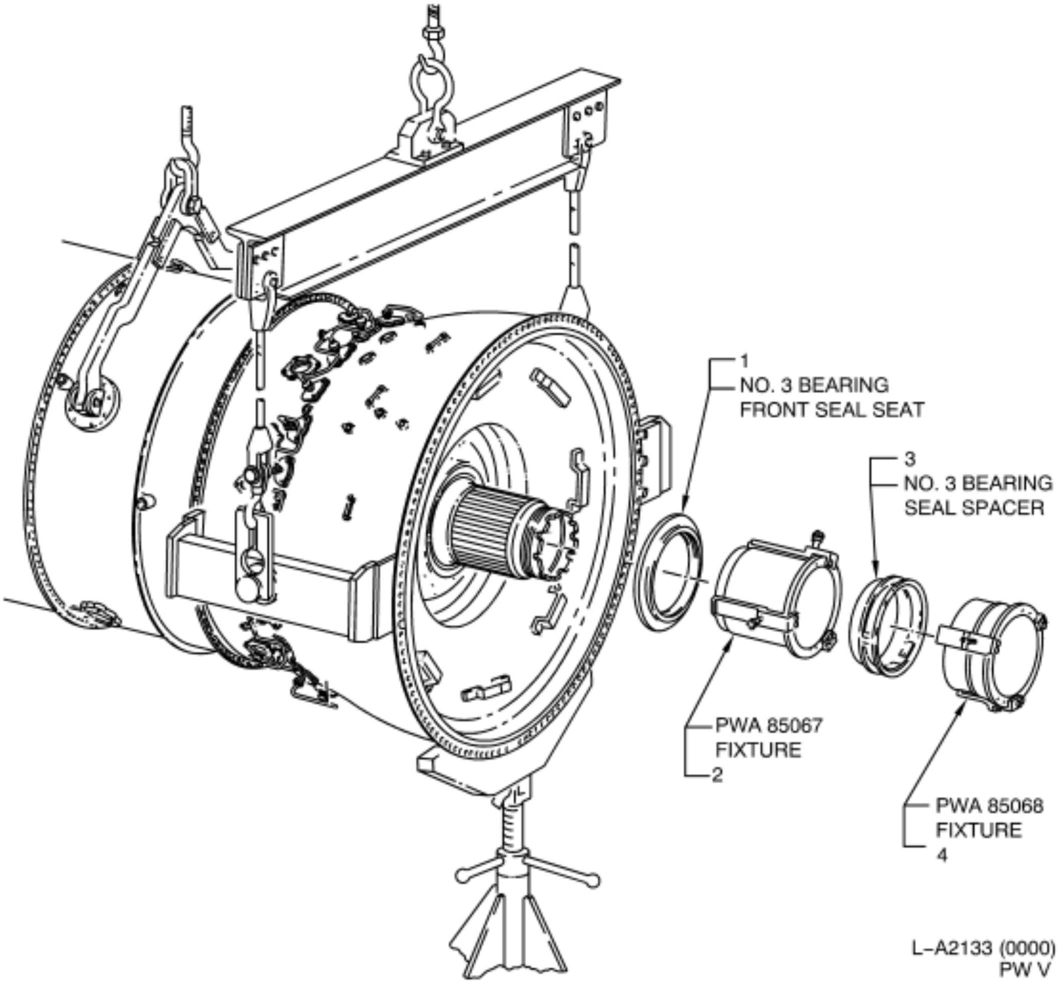
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−16


HOIST
5
ADAPTER
1
SLING
HOIST
FLANGE M
FLANGE K
HPC REAR HUB
2
GUIDE
4
ADAPTERS
(2 REQUIRED)
3
GUIDE
BRACKET
(2 REQUIRED)
SADDLE
PEDESTAL
L−A8648 (0000)
PW V

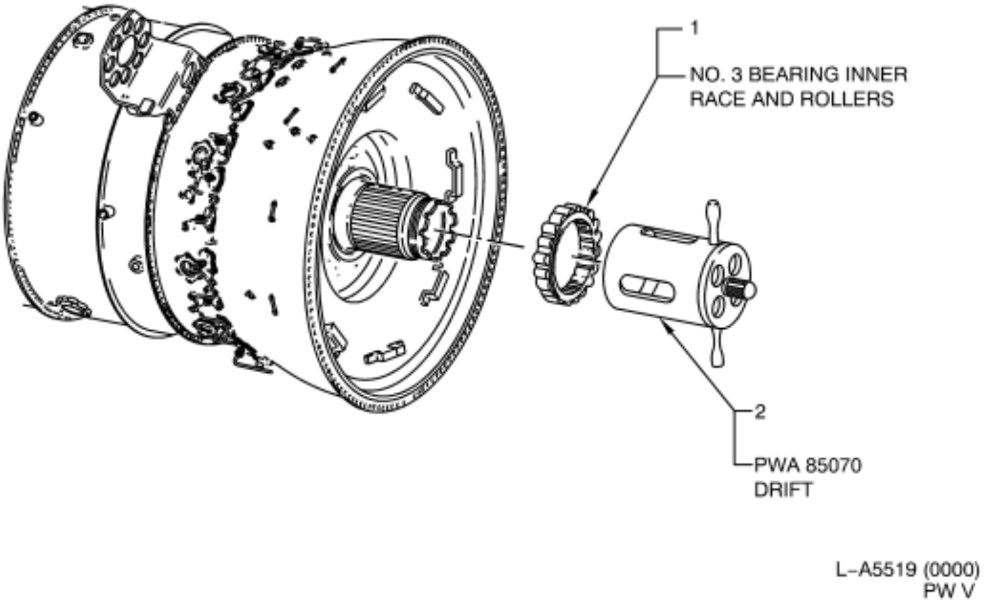
1. PWA 28657
2. PWA 85701
3. PWA 85308
4. PWA 76154
5. PWA 85390

Diffuser And Combustor Installation
Figure 405
(Task 72−00−41−420−018)

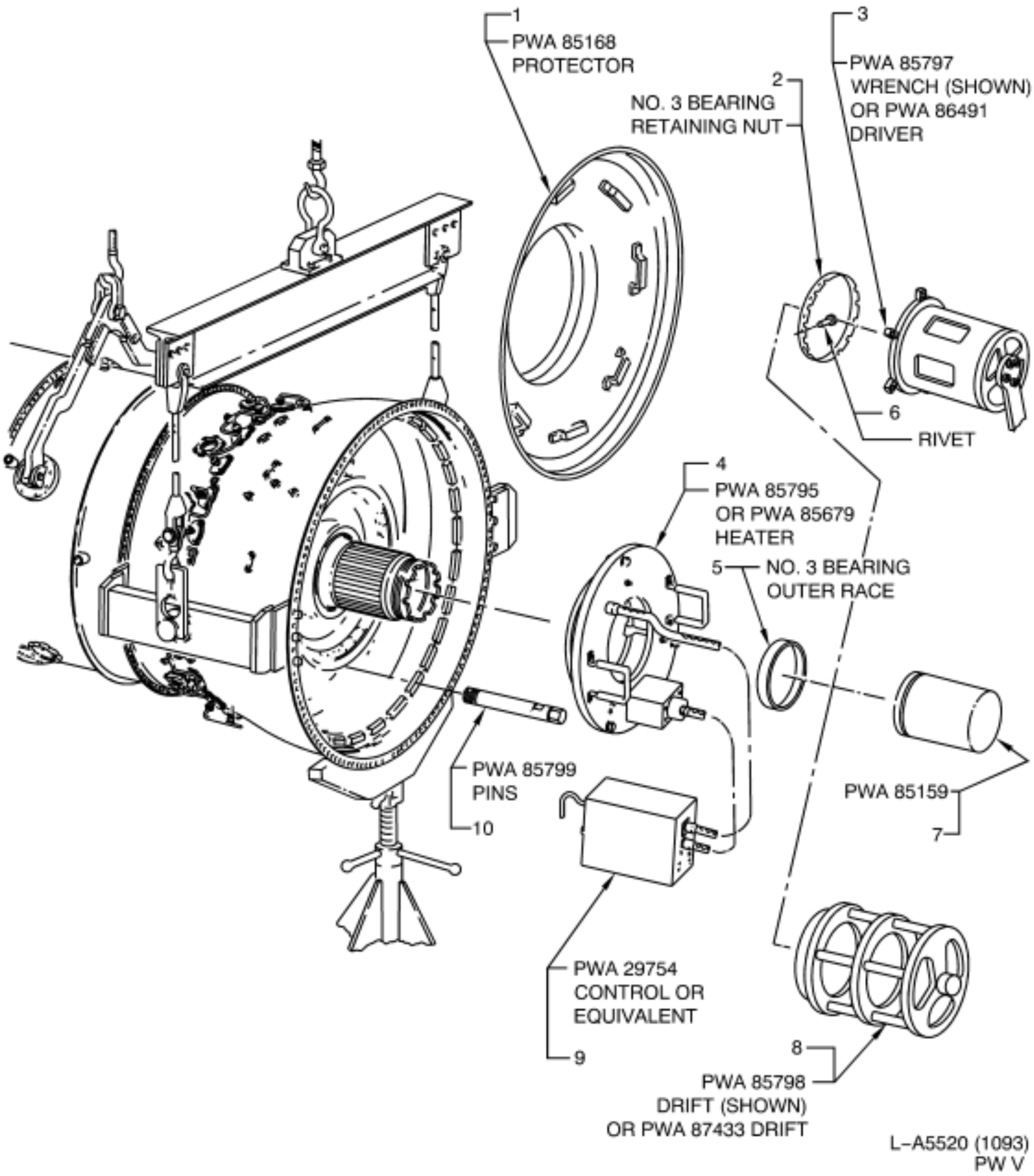
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−16


1
NO. 3 BEARING FRONT SEAL SEAT
3
NO. 3 BEARING SEAL SPACER
PWA 85067 FIXTURE
2
PWA 85068 FIXTURE
4
L−A2133 (0000)
PW V

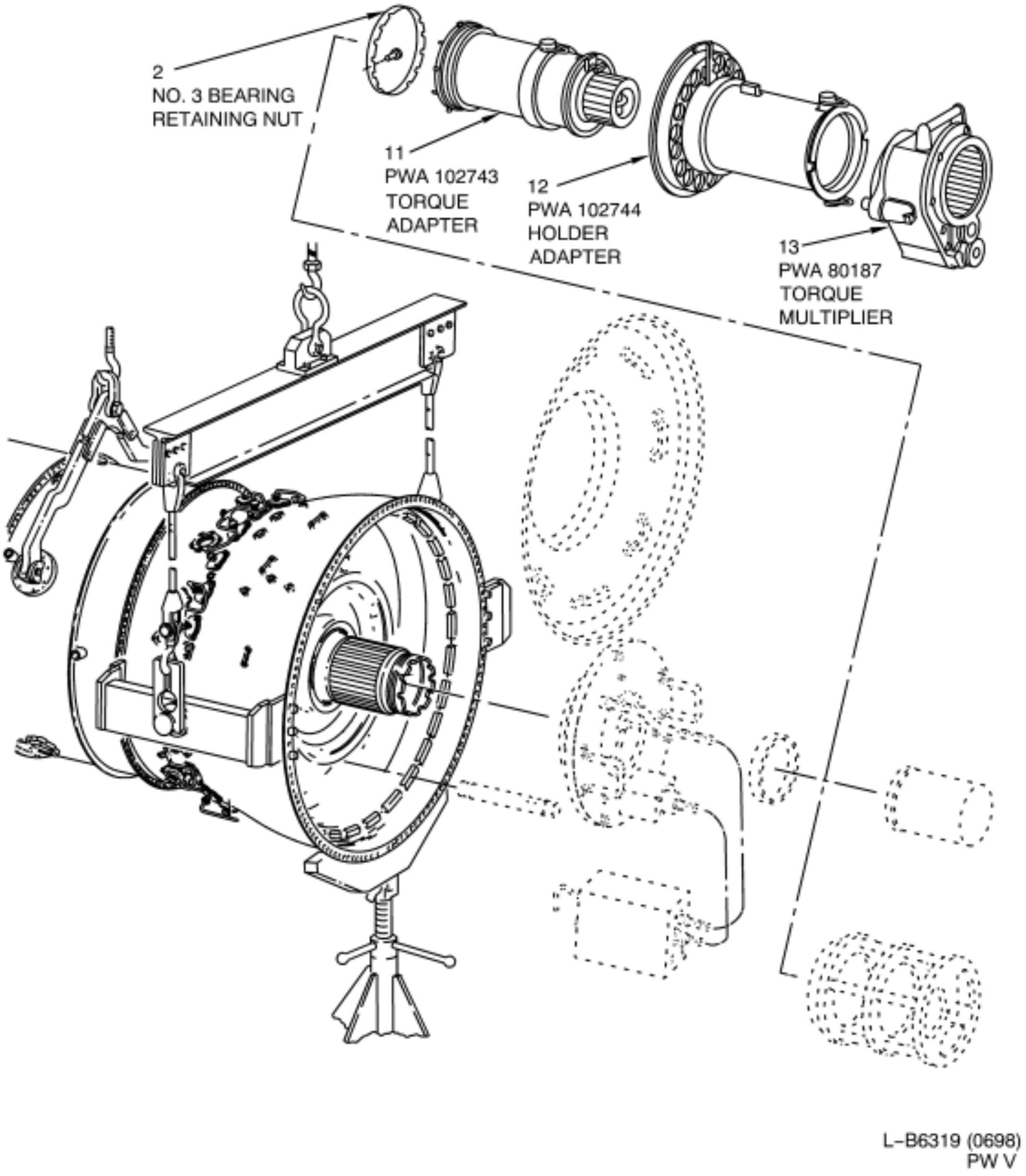
Diffuser And Combustor Installation
Figure 406
(Task 72−00−41−420−018)


1
NO. 3 BEARING INNER RACE AND ROLLERS
2
PWA 85070 DRIFT
L−A5519 (0000)
PW V

Diffuser And Combustor Installation
Figure 407
(Task 72−00−41−420−018)


1
PWA 85168
PROTECTOR
2
NO. 3 BEARING
RETAINING NUT
3
PWA 85797
WRENCH (SHOWN)
OR PWA 86491
DRIVER
6
RIVET
4
PWA 85795
OR PWA 85679
HEATER
5
NO. 3 BEARING
OUTER RACE
PWA 85799
PINS
10
PWA 85159
7
PWA 29754
CONTROL OR
EQUIVALENT
9
8
PWA 85798
DRIFT (SHOWN)
OR PWA 87433 DRIFT
L−A5520 (1093)
PW V

No. 3 Bearing Outer Race Installation
Figure 408 (Sheet 1)
(Task 72−00−41−420−018)


2
NO. 3 BEARING
RETAINING NUT
11
PWA 102743
TORQUE
ADAPTER
12
PWA 102744
HOLDER
ADAPTER
13
PWA 80187
TORQUE
MULTIPLIER
L−B6319 (0698)
PW V

No. 3 Bearing Outer Race Installation
Figure 408 (Sheet 2)
(Task 72−00−41−420−018)

Task 72−00−41−420−019:

1. Install Diffuser And Combustor (Horizontal) Without No. 3 Bearing Outer Race Previously Installed

NOTE: See Figure 401 for part/assembly installation procedure sequence.

NOTE: See 72−00−41, Installation−12 Task 72−00−41−420−014 for the optional procedure with the No. 3 bearing outer race installed. The outer race was installed into the diffuser combustor group before installation onto the HPC.

A. Prerequisites

(1) See 72−00−41, Inspection/Check−01 Task 72−00−41−990−001 for interface fits and clearances. Special torques and special assembly procedures show where necessary in the text that follows and are identified by a reference number. For Example: (Reference 1234) Torque the retaining nut as follows:

(2) Assemble the diffuser and combustor by 72−41−00, Assembly−01 Task 72−41−00−400−001−A00.

B. Equipment And Materials Required

Standard Tools:

0.250−28 Jackscrews (Four Necessary)
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 28657	Sling
PWA 29754	Control (Or Equivalent)
PWA 76154	Adapter (Two Necessary)
PWA 80187	Multiplier, Torque
PWA 85067	Fixture
PWA 85068	Fixture
PWA 85070	Drift
PWA 85159	Protector
PWA 85168	Protector
PWA 85308	Guide (Optional To PWA 85701)
PWA 85310	Pin, Alignment (Three Necessary)
PWA 85679	Heater (Optional To PWA 85795)
PWA 85701	Guide
PWA 85751	Bracket (Two Necessary)

Special Tools:

(CONTINUED)

PWA 85795	Heater
PWA 85797	Wrench (Optional To PWA 86491)
PWA 85798	Drift (Optional To PWA 87433)
PWA 85799	Pins, Guide And Support
PWA 85893	Support
PWA 85901	Riveter
PWA 85909	Adapter
PWA 85910	Adapter
PWA 85983	Adapter, Stabilizer (Two Necessary Twin Overhead Rail System Only)
PWA 86491	Driver, Torque
PWA 87433	Drift
PWA 102743	Adapter, Torque
PWA 102744	Adapter, Holder

Consumable Materials:

	Item No.	Designation
	P03−001	Engine Oil (PWA 521B)
	P05−026	Ink (Marking) (PMC 4057−1)
	P05−059	Wax, Paraffin (PMC 9552)
	P05−289	Lockwire (AS3214−02)
	P05−291	Cable, Safety (Optional)
R	P05−292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72−00−41/1/1
Rivet	1	72−41−00/12/40

C. Procedure

See Figure 401, Figure 402, Figure 403, Figure 404, Figure 405, Figure 406, Figure 407 and Figure 408.

(1) Remove the PWA 85159 Thread Protector and PWA 85428 Knife−Edge Protector from the HPC rear hub.

CAUTION: WEAR CLEAN LINT FREE GLOVES WHEN YOU TOUCH THE NO. 3 BEARING INNER RACE AND ROLLERS TO PREVENT BEARING DAMAGE.

(2) Make a visual inspection of the HPC rear drum OD thrust balance knife−edge by 72−00−35, Inspection/Check−04 (visual only) Task 72−00−35−210−004. Reject the airseal with cracks found by visual inspection.

(3) Put the No. 3 bearing assembly on clean waxed paper on the bench.

(4) Remove the outer race (402/7) from the inner race and rollers (402/3) and put them, serial number up, on the bench.

(5) Make sure the bearing inner and outer race part numbers are the same.

CAUTION: THE THICKNESS OF THE NO. 3 BEARING FRONT SEAL SEAT MUST BE MEASURED ACROSS THE THINNER, ID, SECTION OF THE SEAL SEAT OR INCORRECT DIMENSIONS WILL RESULT.

(6) Measure the thickness of the No. 3 bearing front seal seat (402/1) across the thinner ID section of the seal seat. Measure the No. 3 bearing seal spacer (402/2) thickness and the No. 3 bearing inner race and rollers (402/3) thickness. Make a record of this total thickness as Dimension A.

(7) Measure the distance from the end of the HPC rear hub (402/4) down to the seal seat shoulder (402/5) on the hub. Make a record of this dimension as Dimension B.

NOTE: Dimensions A and B are used to do a seating check later during this installation procedure.

(8) Measure the thickness of the No. 3 bearing outer race (402/7) thickness. Make a record of this dimension as Dimension D.

(9) Measure distance from the top of the No. 3 bearing support to the outer race seating shoulder. Make a record of this dimension as Dimension E.

NOTE: Dimensions D and E are used to do a seating check later during this installation procedure.

(10) Find the two dimples on the top surface of the No. 3 bearing housing (402/6) threaded ID. Make a mark between the dimples with Ink P05−026.

(11) Install a gasket to the flange groove and attach in position with Paraffin Wax P05−059. See Figure 403.

(12) Install two PWA 85751 Handling Brackets to the diffuser case. See Figure 404.

NOTE: If you have a twin overhead rail system you must use PWA 85983 Stabilizer Adapters with PWA 85751 Brackets.

(a) Loosen and remove the clamp bolts that attach the fuel tubes to the Flange K bracket for PWA 85751 Bracket tool installation clearance.

(b) Use a hoist and install the longer front flange of the brackets to the rear of the front flange of the diffuser case at the 3 and 9 o'clock locations, install the four pins in the front flange of the bracket into the four boltholes in the diffuser case front flange. Install the shorter rear flange of the bracket to the front of the diffuser case rear flange and attach with detail nuts and bolts.

(c) Install the double spool bracket in the rear most two holes as marked on the bracket.

(13) For PWA 85701 Guide, retract the two setscrews on the side of the guide. Install the PWA 85701 Guide or PWA 85308 Guide larger diameter end first on the HPC rear hub and seat on the seal seat shoulder. For PWA 85701 Guide, handtighten two setscrews on the side of the guide.

(14) Install three PWA 85310 Alignment Pins into the rear flange of the HPC case. See Figure 403.

(a) Remove the screws from the storage locations in the plate details of the alignment pins.

(b) Find the three equally spaced 0.250−28 jackscrew holes in the rear flange of the HPC case.

(c) Insert three equally spaced alignment pins (dowel pins up) through the unthreaded holes in the rear flange of the HPC case. Attach the pins with detail screws.

(15) With a hoist, connect the PWA 28657 Sling with two PWA 76154 Adapters to the outer trunnion spools of the PWA 85045 Brackets on the diffuser case.

(16) With a hoist install the diffuser and combustor assembly over the HPC rear hub. Align the pins in the HPC rear case with the mating holes in the diffuser case. With workbolts and nuts, seat the diffuser case on the HPC rear case.

(17) Remove the work bolts, nuts, and PWA 85310 Pins. For PWA 85701 Guide, retract the two setscrews on the side of the guide. Remove the PWA 85701 Guide or PWA 85308 Guide from the HPC rear hub. See Figure 405.

(18) Remove the PWA 28657 Sling, PWA 76154 Adapters and PWA 85751 Brackets.

(19) Install the Flange K hardware as follows: Refer to 72-00-41, Installation-20 (Task 72-00-41-420-020).

(20) Install the PWA 85067 Fixture (406/3) to the No. 3 bearing front seal seat (406/1). See Figure 406.

(21) Install the fixture with the seal seat polished face down over the HPC rear hub and drift to seat if necessary. Remove the fixture.

(22) Install the PWA 85068 Fixture (406/4) to the No. 3 bearing seal spacer (406/3).

(23) Install the fixture with the seal spacer over the HPC rear hub and drift to seat if necessary. Remove the fixture.

(24) Heat the No. 3 bearing inner race and rollers. See Standard Practices Manual, PN 585005.

CAUTION: WEAR CLEAN INSULATED GLOVES WHEN YOU TOUCH THE NO. 3 BEARING INNER RACE AND ROLLERS TO PREVENT BEARING DAMAGE.

(25) Remove the heated inner race and rollers from the heat source.

(26) Install the heated No. 3 bearing inner race and rollers (407/1) onto the HPC rear hub, puller grooves up. Seat the bearing with PWA 85070 Drift (407/2) and keep constant downward pressure on the bearing for approximately three minutes to make sure of correct seating. After seating remove the drift. See Figure 407.

(27) After the inner race has reached room temperature measure the distance from the end of the HPC rear hub down to the rear of the inner race and rollers with a depth gage. Make a record of this distance as Dimension C. See Figure 402.

(28) Dimension C must not be less than Dimension B minus Dimension A.

NOTE: An indication that the bearing is not fully seated is when Dimension C is less than necessary.

(29) Remove the PWA 85168 Protector (410/7) from the diffuser case. See Figure 410.

(30) Heat the No. 3 bearing housing.

NOTE: If PWA 85679 Heater is used, you must make a heatshield to protect the No. 3 bearing inner race and rollers.

(a) Install four PWA 85799 Pins (408/10) into the bearing housing channel nuts equally around the housing.

(b) Install PWA 85795 Heater or PWA 85679 Heater (408/4) to the rear flange of the housing. Connect power and thermocouple cables to the PWA 29754 Control (408/9) or equivalent control.

(c) Set the heater to 300°F (149°C) and heat the housing for 55 − 60 minutes.

(31) After the No. 3 bearing housing is correctly heated turn off the heater. Disconnect the control and remove the heater and four PWA 85799 Pins from the housing.

CAUTION: WEAR CLEAN LINT FREE GLOVES WHEN YOU TOUCH THE NO 3 BEARING OUTER RACE TO PREVENT BEARING DAMAGE.

(32) (Reference 1006) Install the No. 3 bearing outer race (408/5) into the bearing housing with the serial number up and align the "X" mark on the outer race with the ink mark between the two dimples on the top of housing.

CAUTION: DO NOT HIT THE BEARING ROLLERS WITH THE DRIFT WHEN YOU SEAT THE OUTER RACE.

(33) Install the PWA 87433 Drift or PWA 85798 Drift (408/8) on the outer race and seat the race. Make sure the outer race is seated against the shoulder in the housing. Remove the drift.

(34) After the No. 3 bearing temperature has returned to room temperature, do a dimensional check to make sure the bearing outer race is correctly seated. See Figure 402.

(a) Measure the Distance F from the top of the No. 3 bearing housing to the top of the bearing outer race (402/7).

(b) Dimension F must not be less than Dimension E minus Dimension D.

NOTE: An indication that the outer race is not fully seated is when Dimension F is less than necessary.

CAUTION: A NEW OR SILVER PLATED NO. 3 BEARING OUTER RACE RETAINING NUT MUST BE INSTALLED AT EACH INSTALLATION OR DAMAGE TO MATING PARTS CAN OCCUR.

CAUTION: THE NO. 3 BEARING OUTER RACE RETAINING NUT MUST BE SILVER PLATED AFTER YOU TORQUE THE NUT A MAXIMUM OF THREE TIMES FOR EACH INSTALLATION BEFORE THE ENGINE IS OPERATED, THE NUT CAN BE SILVER PLATED PER PW4000 SERIES CIR, PN 51A357.

CAUTION: TO PREVENT INCORRECT BEARING OUTER RACE DIMENSIONAL CHECKS AND RETAINING NUT TORQUE READINGS, THE NO. 3 BEARING AND HOUSING MUST

BE AT ROOM TEMPERATURE. SHOP AIR CAN BE USED FOR COOLING. DO NOT USE DRY ICE.

(35) Lubricate the No. 3 bearing outer race retaining nut (408/2) with Engine Oil P03−001.

(36) Install six workbolts, lubricated with Engine Oil P03−001, into the bearing housing channel nuts equally around the housing. Torque the workbolts to 290 − 325 lb−in. (32.766 − 36.720 N.m).

NOTE: The workbolts are a quality standard bolt with .375−24 by 1.000 inch (25.400 mm) thread length.

(37) Install the PWA 85168 Protector (408/1) to the diffuser case.

(38) Install retaining nut into housing with slots up, handtighten.

(39) Slide PWA 86491 Driver or PWA 85797 Wrench (406/3) over the HPC rear hub, install the teeth of the tool in the slots of the nut.

NOTE: If you use PWA 86491 Driver, you must attach the driver to the bearing housing with the four detail cap screws.

(40) Mechanical Wrench Method (Optional) − See Figure 408, Sheet 2.

(a) Install PWA 102743 Torque Adapter (408/11) to engage the slots in the bearing retaining nut.

(b) Install PWA 102744 Holder Adapter (408/12) over PWA 102743 Torque Adapter (408/11) and attach it to the bearing housing with the four detail bolts. Tighten the bolts.

(c) Install PWA 80187 Torque Multiplier (408/13) to engage both PWA 102743 Torque Adapter (408/11) and PWA 102744 Holder Adapter (408/12).

(41) (Reference 975) Torque retaining nut to 3600 − 4400 lb−in. (406.745 − 497.133 N.m). Turn through angle of 16° − 17° 30'. Loosen to 0 lb−in. (0 N.m) then repeat torque sequence aligning one rivet hole in retaining nut with one rivet hole in housing.

(42) Remove the wrench/driver from the No. 3 bearing retaining nut.

(43) Remove the six workbolts from the bearing housing.

(44) Install the rivet (408/6) to the aligned holes in the retaining nut and housing. Use the PWA 85901 Riveter and flare the rivet to attach.

(45) Install the PWA 85159 Thread Protector (408/7) over the HPC rear hub.

D. Postrequisites

(1) Connect/Install The External Parts To The Complete Installation Of The Diffuser Combustor. Refer to 72−00−41, Installation−02 (Task 72−00−41−420−005).

(2) Trunnion The Intermediate Case Through Diffuser And Combustor Case From The Front End Down To The Horizontal Position. Refer to 72−00−00, Special Procedures−10 (Task 72−00−00−420−002−A).

(3) Install The No. 3 Bearing Seal Assembly And Seal Seat. Refer to 72−00−41, Installation−03 (Task 72−00−41−420−003).

(4) Vacuum Check The No. 3 Bearing Compartment. Refer to 72−00−41, Inspection/Check−07 (Task 72−00−41−720−001).

(5) Install The Turbine Nozzle. Refer to 72−00−51, Installation−01 (Task 72−00−51−420−001).

(6) Install The High Pressure Turbine − Horizontal by 72−00−52, Installation−01 (Task 72−00−52−420−001).

(7) Install The No. 1 Bearing Support Assembly. Refer to 72−00−34, Installation−04 (Task 72−00−34−450−002).

(8) Install The Fan Case. Refer to 72−00−33, Installation−01 (Task 72−00−33−420−001).

(9) Install The Low Pressure Turbine With Shaft. Refer to 72−00−53, Installation−01 (Task 72−00−53−420−001).

(10) Install The Turbine Exhaust Case. Refer to 72−00−54, Installation−01 (Task 72−00−54−420−001).

(11) Install The Low Pressure Compressor. Refer to 72−00−31, Installation−01 (Task 72−00−31−420−003).

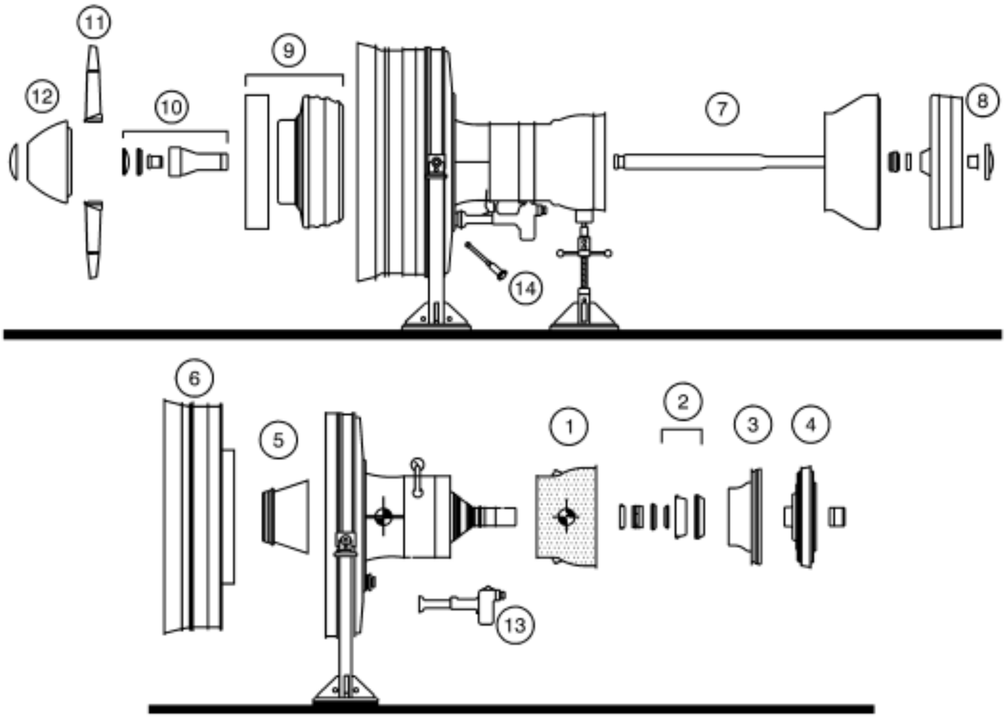
(12) Install The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed). Refer to 72−00−32, Installation−01 (Task 72−00−32−420−001).

(13) Install The Stage 1 LPC Blade Assemblies. Refer to 72−00−31, Installation−04 (Task 72−00−31−420−002−002).

(14) Install The Compressor Inlet Cone. Refer to 72−00−31, Installation−02 (Task 72−00−31−420−001).

(15) Install The Main Gearbox. Refer to 72−00−61, Installation−01 (Task 72−00−61−420−001).

(16) Install The Electronic Engine Control (EEC) Speed Transducer (N1). Refer to 72−00−34, Installation−03 (Task 72−00−34−450−001).

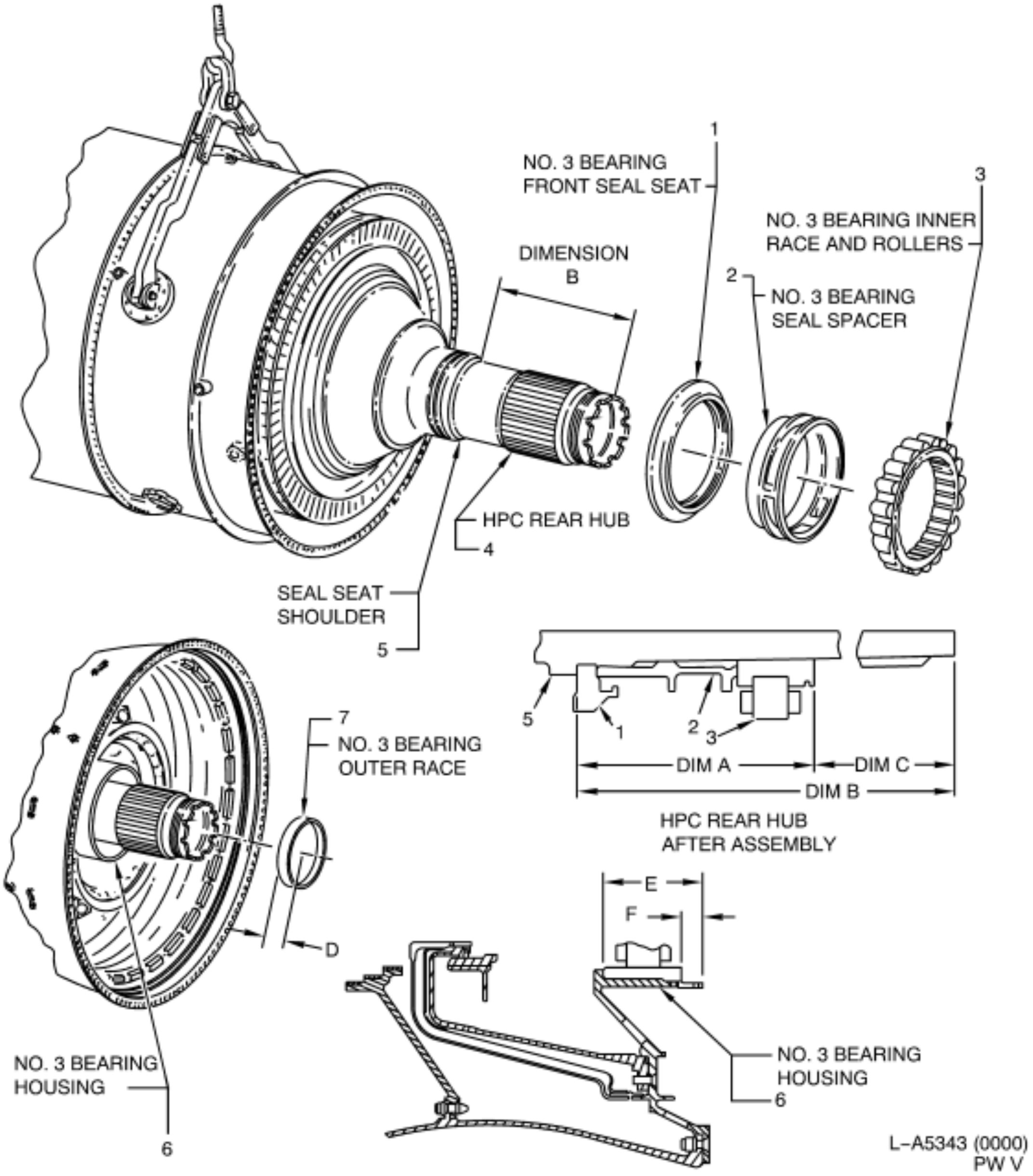


1. INSTALL DIFFUSER AND COMBUSTOR.
2. INSTALL NO. 3 BEARING REAR SEAL ASSEMBLY AND REAR SEAL SEAT.
3. INSTALL TURBINE NOZZLE.
4. INSTALL HIGH PRESSURE TURBINE (HPT).
5. INSTALL NO. 1 BEARING SUPPORT ASSEMBLY.
6. INSTALL FAN CASE.
7. INSTALL LOW PRESSURE TURBINE (LPT).
8. INSTALL TURBINE EXHAUST CASE.
9. INSTALL LOW PRESSURE COMPRESSOR (LPC).
10. INSTALL LPC/LPT COUPLING.
11. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
12. INSTALL COMPRESSOR INLET CONE.
13. INSTALL MAIN GEARBOX.
14. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).

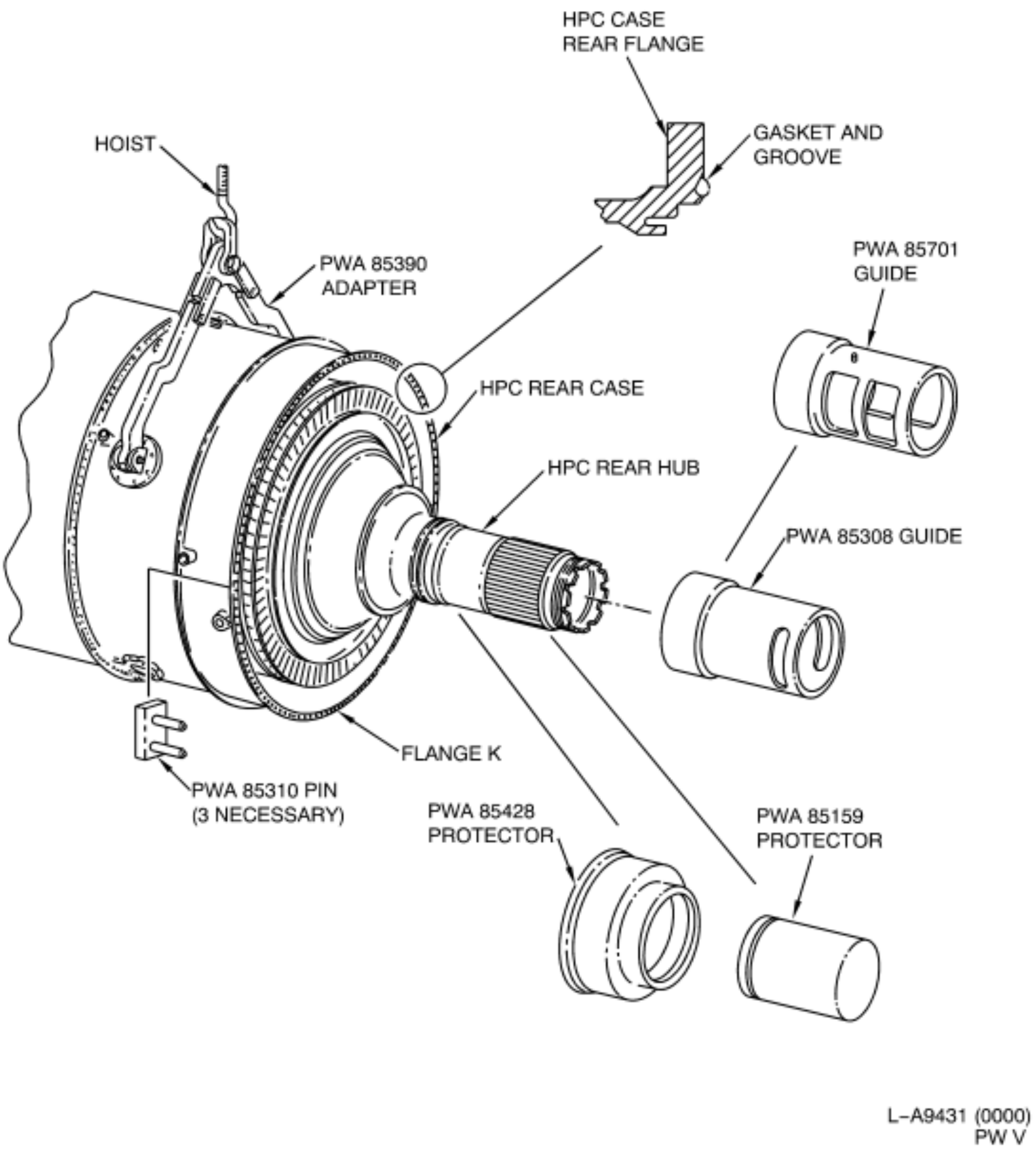
L−A1392 (0000)
PW V

Procedure Sequence
Figure 401
(Task 72−00−41−420−019)

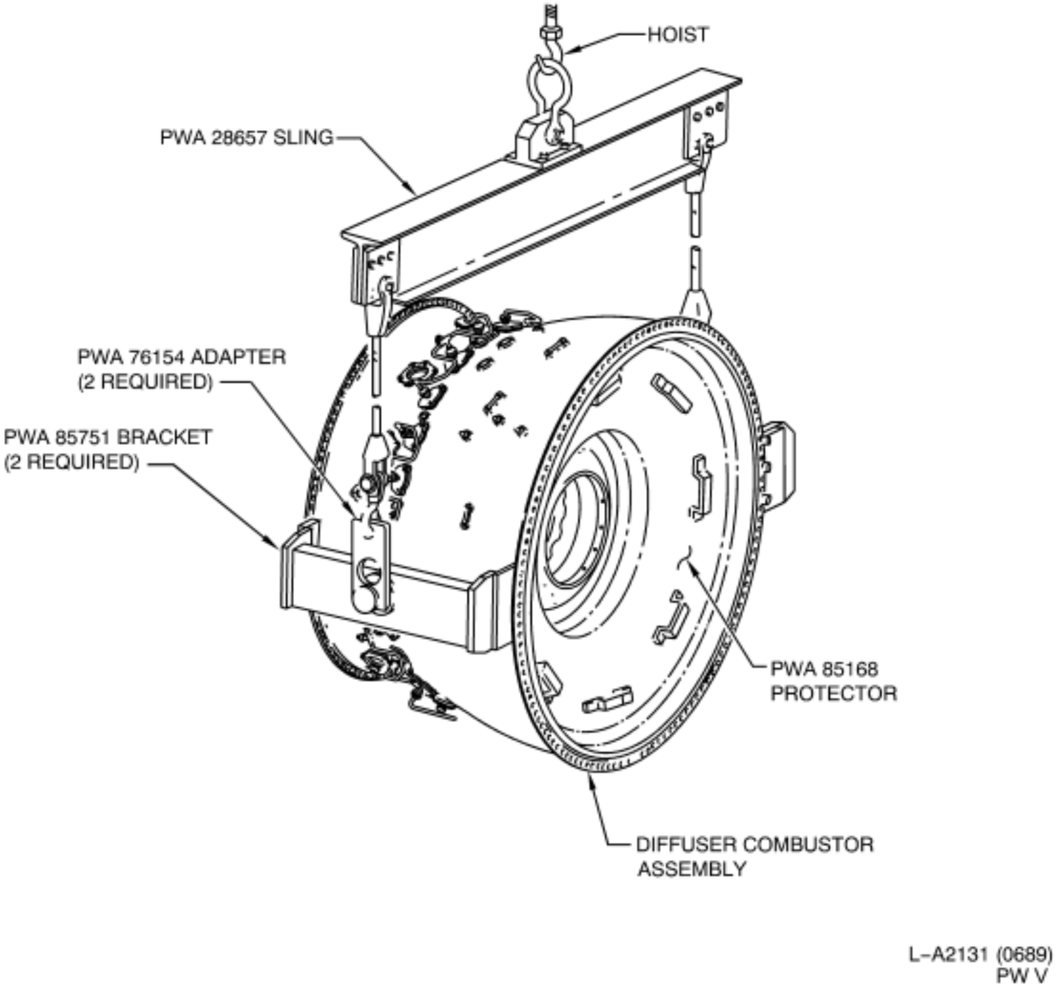
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−16


1
NO. 3 BEARING FRONT SEAL SEAT
3
NO. 3 BEARING INNER RACE AND ROLLERS
DIMENSION B
2
NO. 3 BEARING SEAL SPACER
HPC REAR HUB
4
SEAL SEAT SHOULDER
5
7
NO. 3 BEARING OUTER RACE
5
1
2
3
DIM A
DIM C
DIM B
HPC REAR HUB AFTER ASSEMBLY
E
F
D
NO. 3 BEARING HOUSING
6
NO. 3 BEARING HOUSING
6
L−A5343 (0000)
PW V

Diffuser And Combustor Installation
Bearing Seating Check Measurement
Figure 402
(Task 72−00−41−420−019)

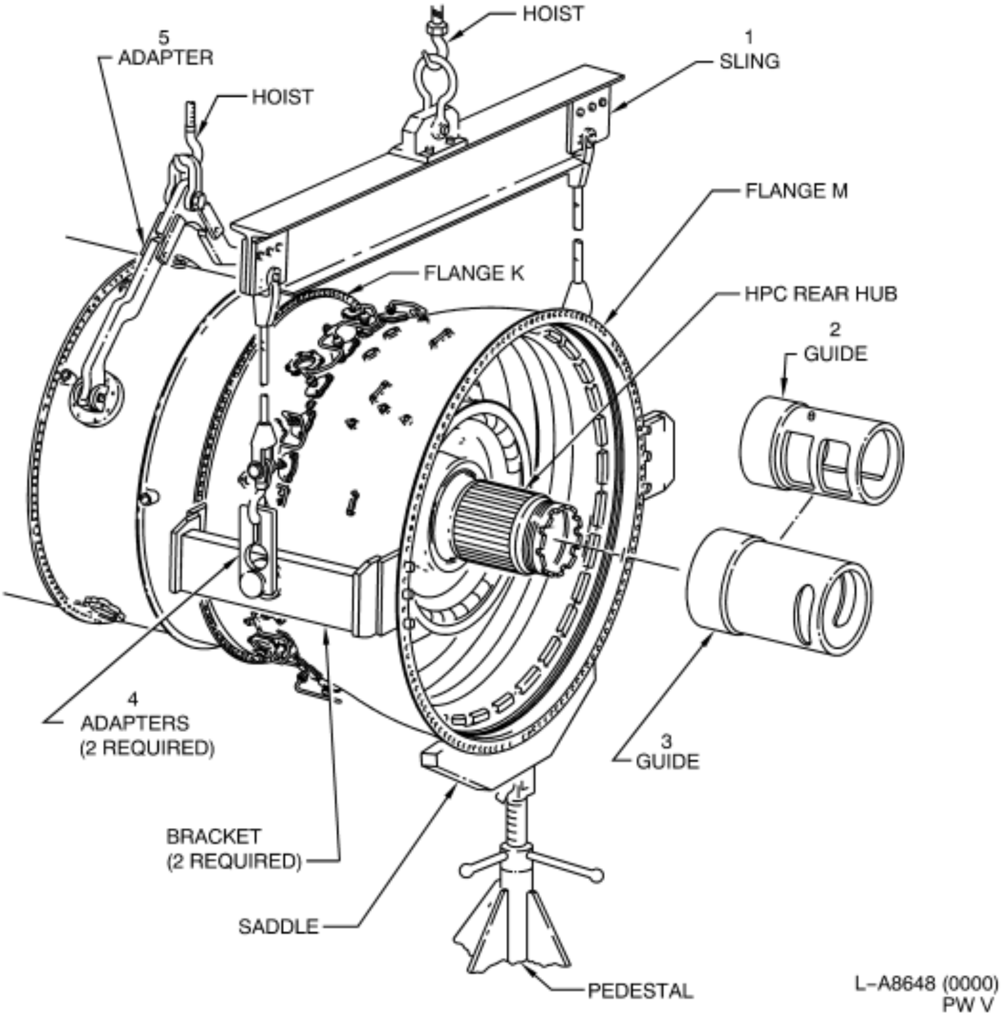

HPC CASE
REAR FLANGE
GASKET AND
GROOVE
HOIST
PWA 85390
ADAPTER
PWA 85701
GUIDE
HPC REAR CASE
HPC REAR HUB
PWA 85308 GUIDE
FLANGE K
PWA 85310 PIN
(3 NECESSARY)
PWA 85428
PROTECTOR
PWA 85159
PROTECTOR
L−A9431 (0000)
PW V

Diffuser And Combustor Installation
Figure 403
(Task 72−00−41−420−019)


HOIST
PWA 28657 SLING
PWA 76154 ADAPTER (2 REQUIRED)
PWA 85751 BRACKET (2 REQUIRED)
PWA 85168 PROTECTOR
DIFFUSER COMBUSTOR ASSEMBLY
L−A2131 (0689)
PW V

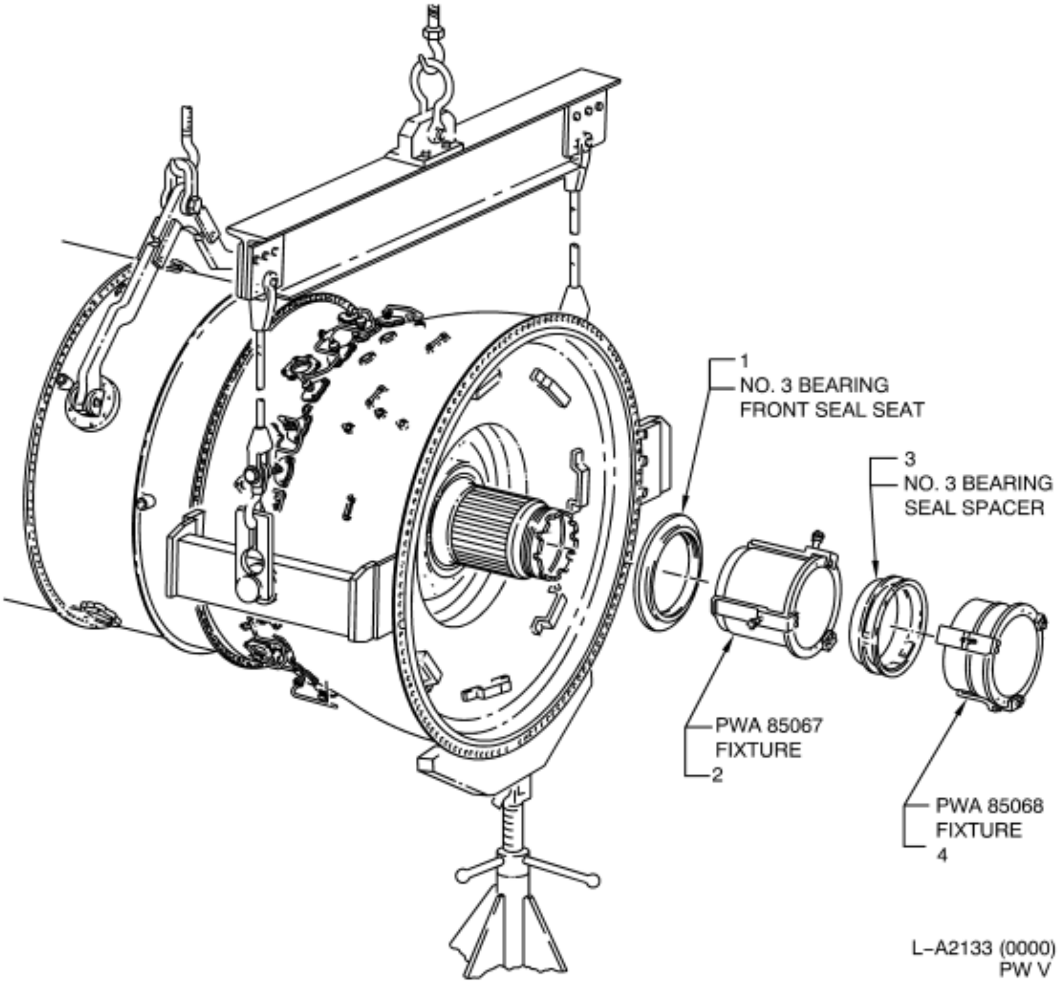
Diffuser And Combustor Installation
Figure 404
(Task 72−00−41−420−019)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−16

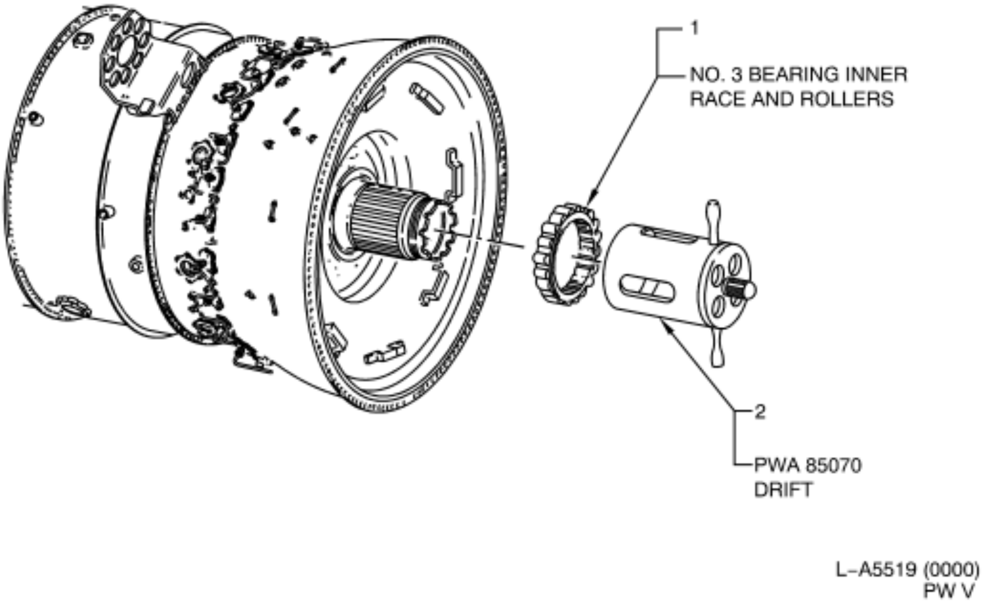

HOIST
5
ADAPTER
1
SLING
HOIST
FLANGE M
FLANGE K
HPC REAR HUB
2
GUIDE
4
ADAPTERS
(2 REQUIRED)
3
GUIDE
BRACKET
(2 REQUIRED)
SADDLE
PEDESTAL
L−A8648 (0000)
PW V

1. PWA 28657
2. PWA 85701
3. PWA 85308
4. PWA 76154
5. PWA 85390

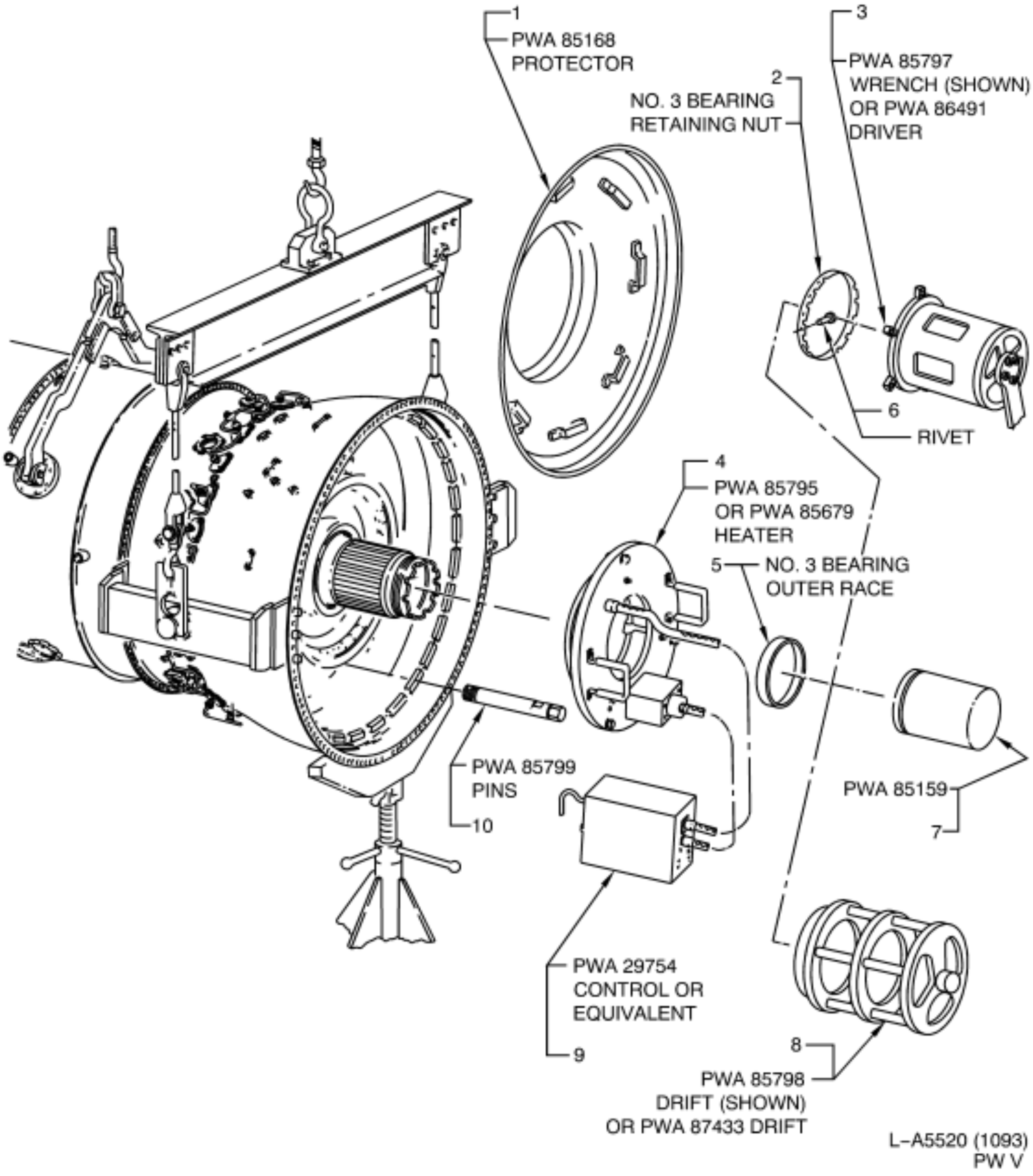
Diffuser And Combustor Installation
Figure 405
(Task 72−00−41−420−019)


1
NO. 3 BEARING
FRONT SEAL SEAT
3
NO. 3 BEARING
SEAL SPACER
PWA 85067
FIXTURE
2
PWA 85068
FIXTURE
4
L−A2133 (0000)
PW V

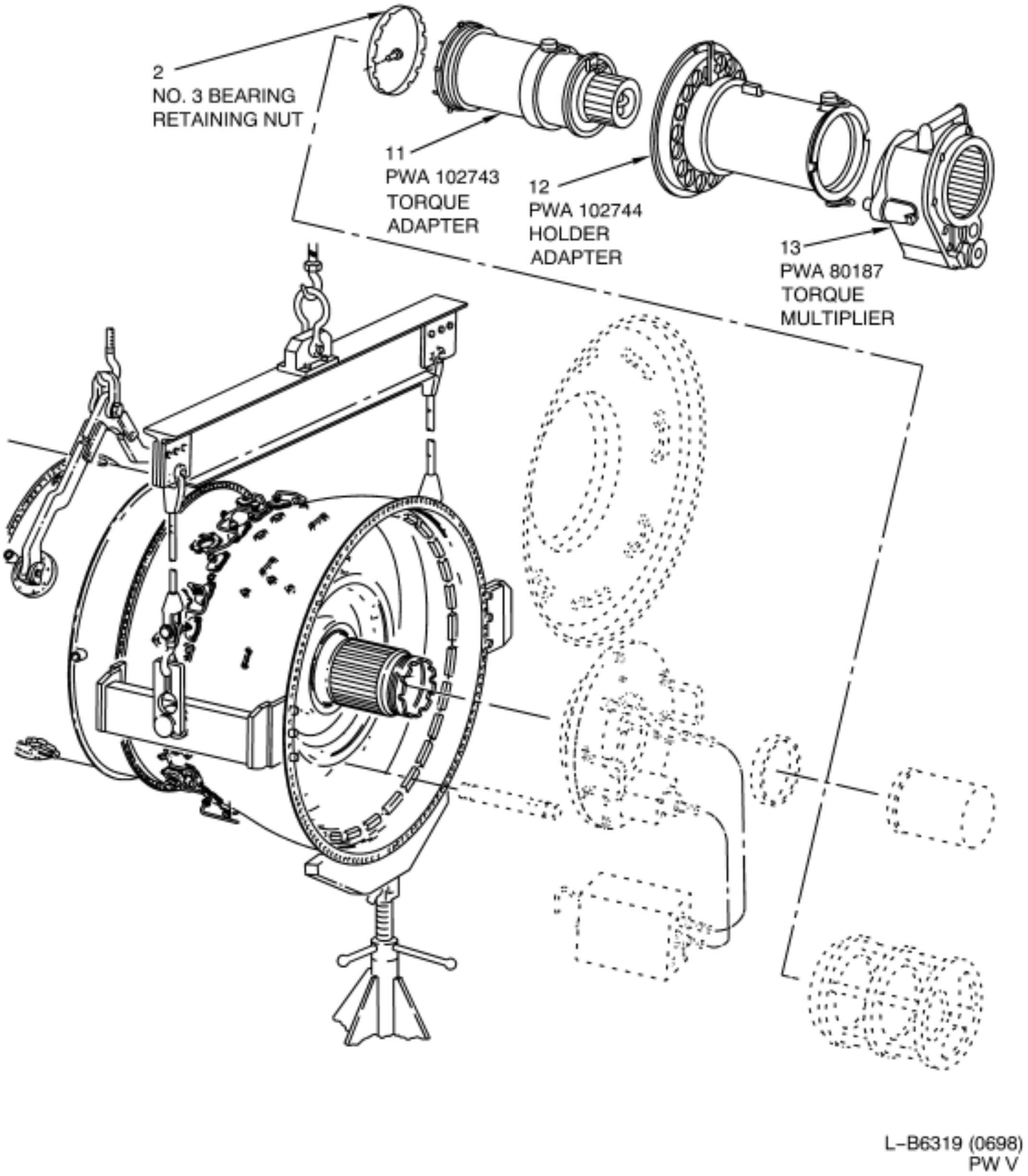
Diffuser And Combustor Installation
Figure 406
(Task 72−00−41−420−019)


1
NO. 3 BEARING INNER RACE AND ROLLERS
2
PWA 85070 DRIFT
L−A5519 (0000)
PW V

Diffuser And Combustor Installation
Figure 407
(Task 72−00−41−420−019)


1
PWA 85168
PROTECTOR
2
NO. 3 BEARING
RETAINING NUT
3
PWA 85797
WRENCH (SHOWN)
OR PWA 86491
DRIVER
6
RIVET
4
PWA 85795
OR PWA 85679
HEATER
5
NO. 3 BEARING
OUTER RACE
PWA 85799
PINS
10
PWA 85159
7
PWA 29754
CONTROL OR
EQUIVALENT
9
8
PWA 85798
DRIFT (SHOWN)
OR PWA 87433 DRIFT
L-A5520 (1093)
PW V

No. 3 Bearing Outer Race Installation
Figure 408 (Sheet 1)
(Task 72-00-41-420-019)


2
NO. 3 BEARING
RETAINING NUT
11
PWA 102743
TORQUE
ADAPTER
12
PWA 102744
HOLDER
ADAPTER
13
PWA 80187
TORQUE
MULTIPLIER
L−B6319 (0698)
PW V

No. 3 Bearing Outer Race Installation
Figure 408 (Sheet 2)
(Task 72−00−41−420−019)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-41-440-001:

1. Install No. 3 Bearing (Vertical)

NOTE: See Figure 401 for part/assembly installation procedure sequence.

A. Prerequisites

(1) See 72-00-41, Inspection/Check-01 Task 72-00-41-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For Example: (Reference 1234) Torque retaining nut as follows:

B. Equipment And Materials Required

Special Tools:

PWA 29754	Control (Or Equivalent)
PWA 80187	Multiplier, Torque
PWA 85067	Fixture
PWA 85068	Fixture
PWA 85070	Drift
PWA 85159	Protector
PWA 85168	Protector
PWA 85310	Pin, Alignment (Three Required)
PWA 85679	Heater (Optional To PWA 85795)
PWA 85795	Heater
PWA 85797	Wrench (Optional To PWA 86491)
PWA 85798	Drift (Optional To PWA 87433)
PWA 85901	Riveter
PWA 86491	Driver, Torque
PWA 87433	Drift
PWA 102743	Adapter, Torque
PWA 102744	Adapter, Holder

Consumable Materials:

Item No.	Designation
P03-001	Engine Oil (PWA 521B)
P05-026	Ink (Marking) (PMC 4057-1)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−17

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Rivet	1	72−41−00/12/1

C. Procedure
See Figure 402 and Figure 403.

(1) Remove PWA 85159 Thread Protector from HPC rear hub.

CAUTION: HANDLE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN LINT FREE GLOVES TO PREVENT BEARING DAMAGE.

(2) Place No. 3 bearing assembly on clean waxed paper on bench.

(3) Separate outer race (403/2) from inner race and rollers (402/1) and place them, serial number up, on bench.

(4) Verify bearing inner and outer race serial numbers are the same.

CAUTION: THICKNESS OF NO. 3 BEARING FRONT SEAL SEAT MUST BE MEASURED ACROSS THINNER, ID, SECTION OF SEAL SEAT OR INCORRECT DIMENSION WILL RESULT.

(5) Measure thickness of the No. 3 bearing front seal seat (402/3) across the thinner ID section of seal seat. Measure the No. 3 bearing seal spacer (402/2) thickness, No. 3 bearing inner race and rollers (402/1) thickness. Record this thickness as Dimension A.

(6) Measure distance from end of HPC rear hub (402/4) down to seal spacer shoulder (402/5) on hub. Record this dimension as Dimension B.

NOTE: Dimensions A and B will be used to perform a seating check later during this installation procedure.

(7) Measure thickness of No. 3 bearing outer race (403/2) thickness. Record this dimension as Dimension D.

(8) Measure distance from top of No. 3 bearing support to outer race seating shoulder. Record this dimension as Dimension E.

NOTE: Dimensions D and E will be used to perform a seating check later during this installation procedure.

(9) Locate two dimples on top surface of No. 3 bearing housing (403/1) threaded ID. Mark a line between the dimples with Ink P05−026.

(10) Assemble a PWA 85067 Fixture (404/3) onto the No. 3 bearing front seal seat (404/4). See Figure 404.

(11) Install the fixture with the seal seat, polished face down, over the HPC rear hub and drift to seat, if necessary. Remove the fixture.

(12) Assemble a PWA 85068 Fixture (404/1) onto the No. 3 bearing seal spacer (404/2).

(13) Install the fixture with the spacer over the HPC rear hub and drift to seat, if necessary. Remove the fixture.

(14) Heat the No. 3 bearing inner race and rollers. See Standard Practices Manual, PN 585005.

CAUTION: HANDLE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN INSULATED GLOVES TO PREVENT BEARING DAMAGE.

(15) Remove the heated inner race and rollers from the heat source.

(16) Install the heated No. 3 bearing inner race and rollers (405/2) onto HPC rear hub, puller grooves up. Seat bearing with PWA 85070 Drift (405/1) and keep constant downward pressure on bearing for approximately three minutes to make sure of correct seating. After seating remove drift. See Figure 405.

(17) After inner race has reached room temperature measure distance from end of HPC rear hub down to rear of inner race and rollers with depth gage. Record this distance as Dimension C. See Figure 402.

(18) Dimension C must not be less than previously taken Dimension B minus Dimension A.

NOTE: If Dimension C is less than required it indicates bearing is not fully seated.

(19) Remove PWA 85168 Protector (406/4) from diffuser case. See Figure 406.

(20) Heat No. 3 bearing housing.

NOTE: If PWA 85679 Heater is used a heat shield must be made locally to protect the No. 3 bearing inner race and rollers.

(a) Install PWA 85795 Heater or PWA 85679 Heater (406/5) to rear flange of housing. Connect power and thermocouple cables to PWA 29754 Control (406/3) or equivalent control.

(b) Set heater to 300°F (149°C) and heat housing for 55 − 60 minutes.

(21) After No. 3 bearing housing is correctly heated turn off heater. Disconnect control and remove heater from housing.

CAUTION: HANDLE NO. 3 BEARING OUTER RACE WITH CLEAN GLOVES TO PREVENT BEARING DAMAGE.

(22) (Reference 1006) Install No. 3 bearing outer race (406/6) into bearing housing with serial number up and align "X" mark on outer race with ink mark between the two dimples on top of housing.

CAUTION: DO NOT HIT BEARING ROLLERS WITH THE DRIFT WHEN SEATING OUTER RACE.

(23) Position PWA 87433 Drift or PWA 85798 Drift (406/2) on outer race and seat race. Make sure outer race is seated against shoulder in housing. Remove the drift.

(24) After the No. 3 bearing temperature has returned to room temperature, do a dimensional check to make sure bearing outer race is correctly seated. See Figure 403.

(a) Measure Distance F from top of No. 3 bearing housing to top of bearing outer race (403/2).

(b) Dimension F must not be less than previously taken Dimension E minus Dimension D.

NOTE: If Dimension F is less than required, it indicates outer race is not fully seated.

CAUTION: A NEW OR SILVER PLATED NO. 3 BEARING OUTER RACE RETAINING NUT MUST BE INSTALLED AT EACH INSTALLATION OR DAMAGE TO MATING PARTS MAY OCCUR.

CAUTION: NO. 3 BEARING OUTER RACE RETAINING NUT MUST BE SILVER PLATED AFTER TORQUING NUT A MAXIMUM OF THREE TIMES FOR EACH INSTALLATION PRIOR TO ENGINE BEING OPERATED, NUT CAN BE SILVER PLATED PER PW4000 SERIES CIR, PN 51A357.

CAUTION: TO AVOID INCORRECT BEARING OUTER RACE DIMENSIONAL CHECKS AND RETAINING NUT TORQUE READING, NO. 3 BEARING AND HOUSING MUST BE AT ROOM TEMPERATURE. SHOP AIR MAY BE USED FOR COOLING. DO NOT USE DRY ICE.

(25) Lubricate the No. 3 bearing outer race retaining nut (406/8) with Engine Oil P03−001.

(26) Install six workbolts, lubricated with Engine Oil P03−001, into bearing housing channel nuts equally around housing. Torque workbolts to 290 − 325 lb−in. (32.766 − 36.720 N.m).

NOTE: The workbolts are a quality standard bolt with .375−24 by 1.000 inch (25.400 mm) thread length.

(27) Install PWA 85168Protector (406/4) to diffuser case.

(28) Install retaining nut into housing with slots up, handtighten.

(29) Slide PWA 86491 Driver or PWA 85797 Wrench (406/10) over HPC rear hub, locating the teeth of the tool in the slots of the nut.

NOTE: If you use PWA 86491 Driver, you must attach the driver to the bearing housing with the four detail cap screws.

(30) Mechanical Wrench Method (Optional) − See Figure 406, Sheet 2.

(a) Install PWA 102743 Torque Adapter (406/11) to engage the slots in the bearing retaining nut.

(b) Install PWA 102744 Holder Adapter (406/12) over PWA 102743 Torque Adapter (406/11) and attach it to the bearing housing with the four detail bolts. Tighten the bolts.

(c) Install PWA 80187 Torque Multiplier (406/13) to engage both PWA 102743 Torque Adapter (406/11) and PWA 102744 Holder Adapter (406/12).

(31) (Reference 975) Torque retaining nut to 3600 - 4400 lb-in. (406.745 - 497.133 N.m). Turn through angle of 16° - 17° 30'. Loosen to 0 lb-in. (0 N.m) then repeat torque sequence aligning one rivet hole in retaining nut with one rivet hole in housing.

(32) Remove wrench/driver from the No. 3 bearing retaining nut.

(33) Remove the six workbolts from bearing housing.

(34) Install rivet (406/7) into aligned holes in the retaining nut and housing using PWA 85901 Riveter and flare rivet to secure.

(35) Install PWA 85159 Thread Protector (406/1) over HPC rear hub.

D. Postrequisites

(1) Install The No. 3 Bearing Seal Assembly And Seal Seat. Refer to 72-00-41, Installation-09 (Task 72-00-41-420-004).

(2) Vacuum Check The No. 3 Bearing Compartment. Refer to 72-00-41, Inspection/Check-07 (Task 72-00-41-720-001).

(3) Install The Turbine Nozzle. Refer to 72-00-51, Installation-02 (Task 72-00-51-420-002).

(4) Install The High Pressure Turbine - Vertical. Refer to 72-00-52, Installation-08 (Task 72-00-52-420-002).

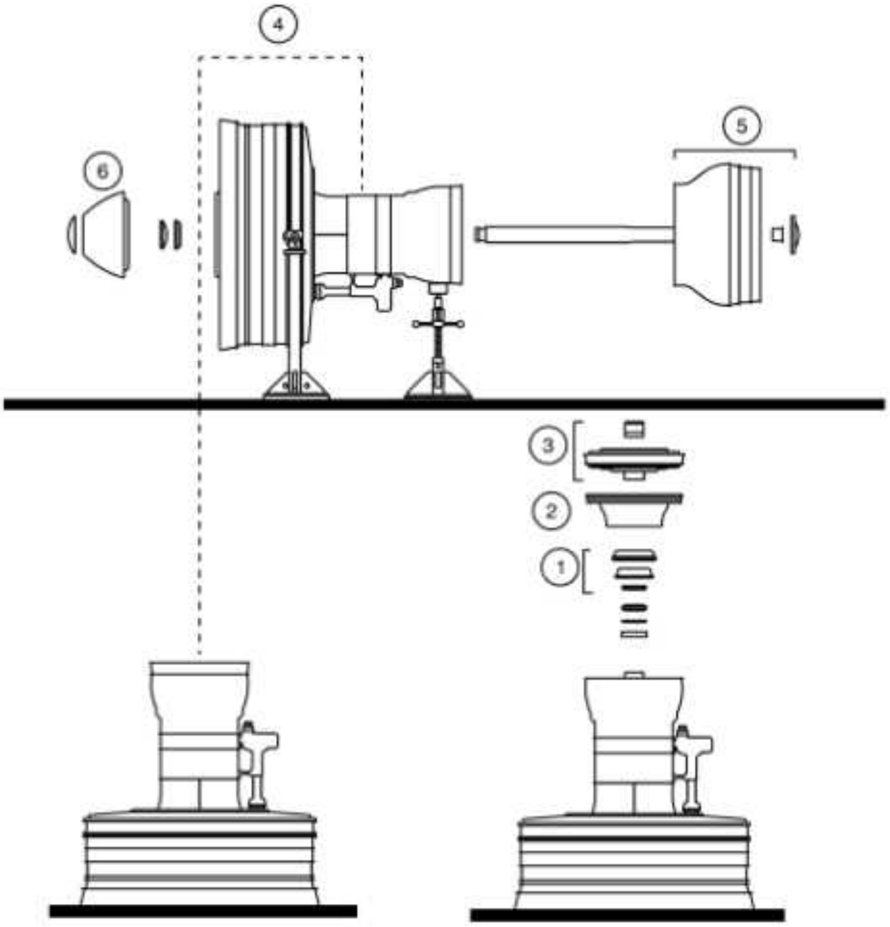
(5) Trunnion The Fan Cases Through HPT From Front End Down To Horizontal Position. Refer to 72-00-00, Special Procedures-13 (Task 72-00-00-420-003).

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−17

(6) Install The Low Pressure Turbine And Turbine Exhaust Case With Shaft. Refer to 72−00−53, Installation−08 (Task 72−00−53−420−002).

(7) Install The Compressor Inlet Cone. Refer to 72−00−31, Installation−02 (Task 72−00−31−420−001).

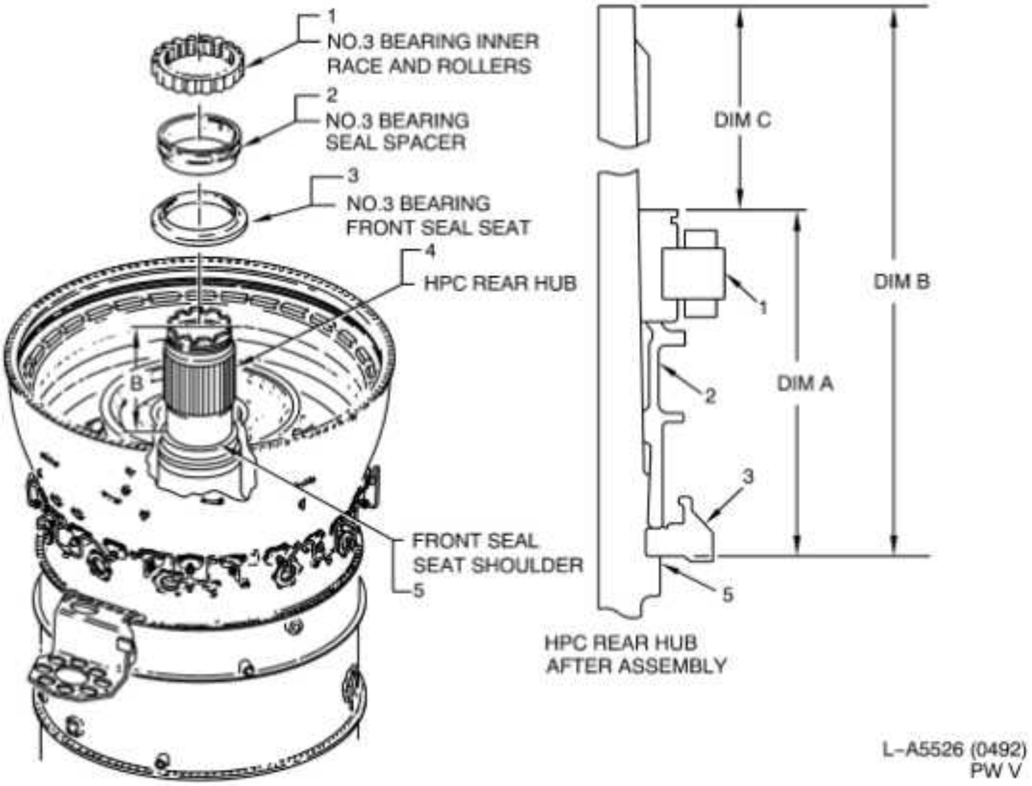
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−17



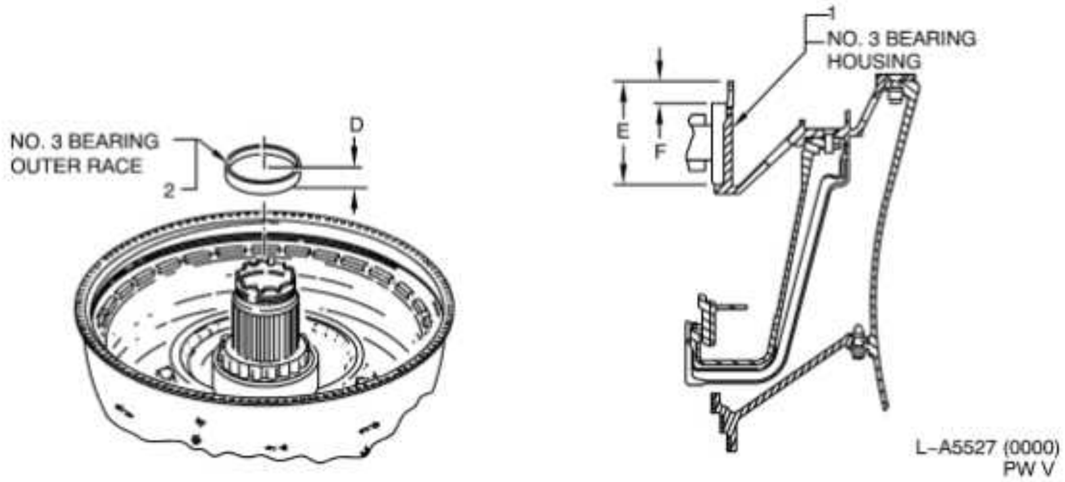
1. INSTALL NO. 3 BEARING REAR SEAL ASSEMBLY
2. INSTALL TURBINE NOZZLE
3. INSTALL HIGH PRESSURE TURBINE (HPT)
4. TRUNNION FAN CASES THROUGH HPT TO HORIZONTAL
5. INSTALL LPT/TEC WITH SHAFT
6. INSTALL COMPRESSOR INLET CONE

L−A5525 (0000)
PW V

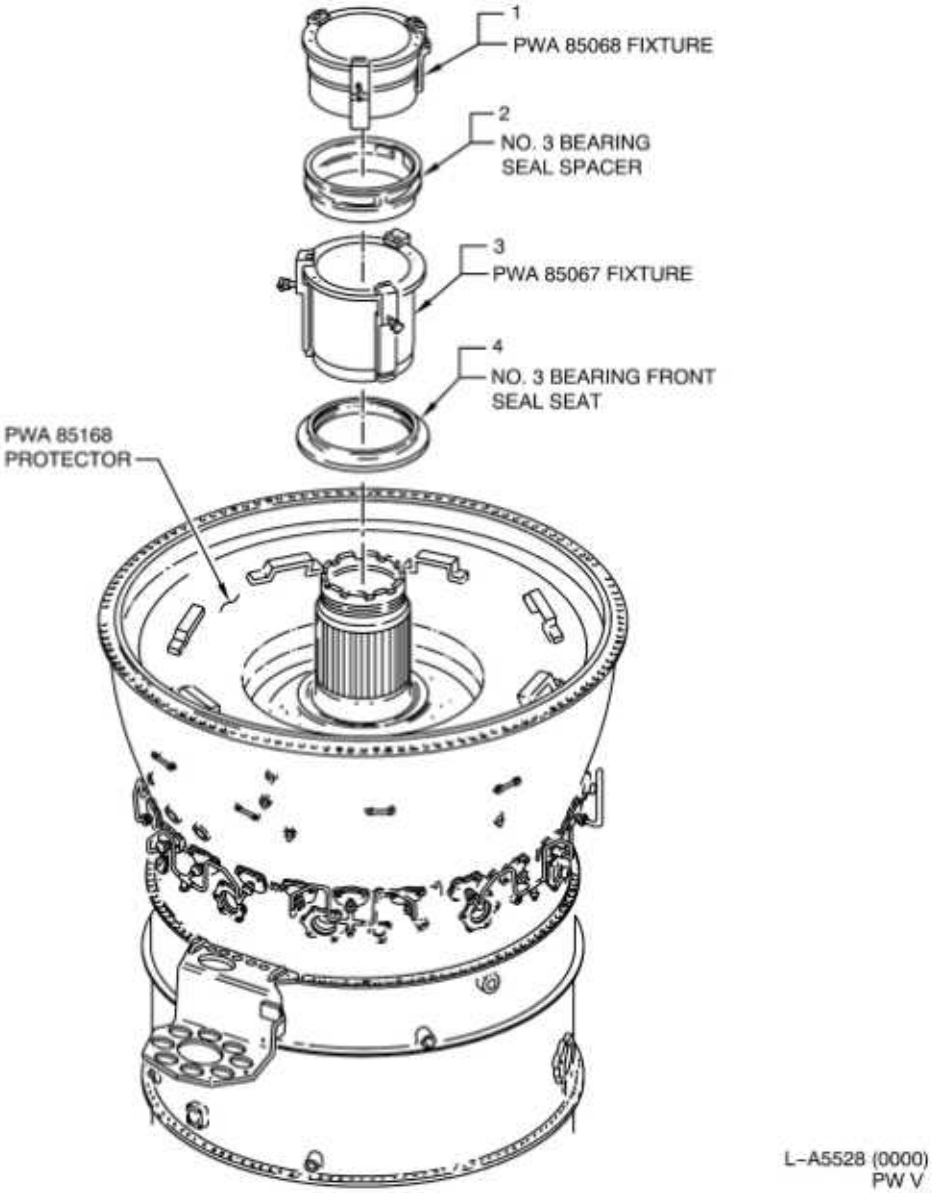
Procedure Sequence
Figure 401
(Task 72−00−41−440−001)


1
NO.3 BEARING INNER RACE AND ROLLERS
2
NO.3 BEARING SEAL SPACER
3
NO.3 BEARING FRONT SEAL SEAT
4
HPC REAR HUB
B
FRONT SEAL SEAT SHOULDER
5
DIM C
DIM B
DIM A
1
2
3
5
HPC REAR HUB AFTER ASSEMBLY
L−A5526 (0492)
PW V

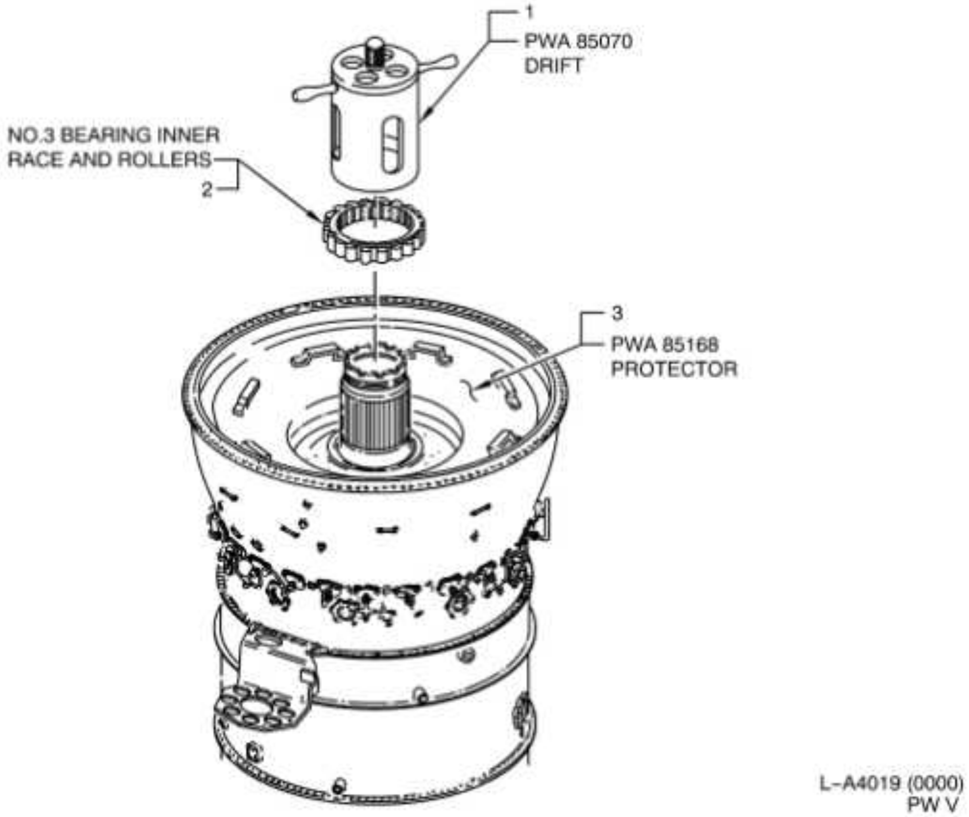
Installation Bearing Inner Race And
Rollers Seating Check Measurement
Figure 402
(Task 72−00−41−440−001)


NO. 3 BEARING OUTER RACE
2
D
E
F
1
NO. 3 BEARING HOUSING
L−A5527 (0000)
PW V

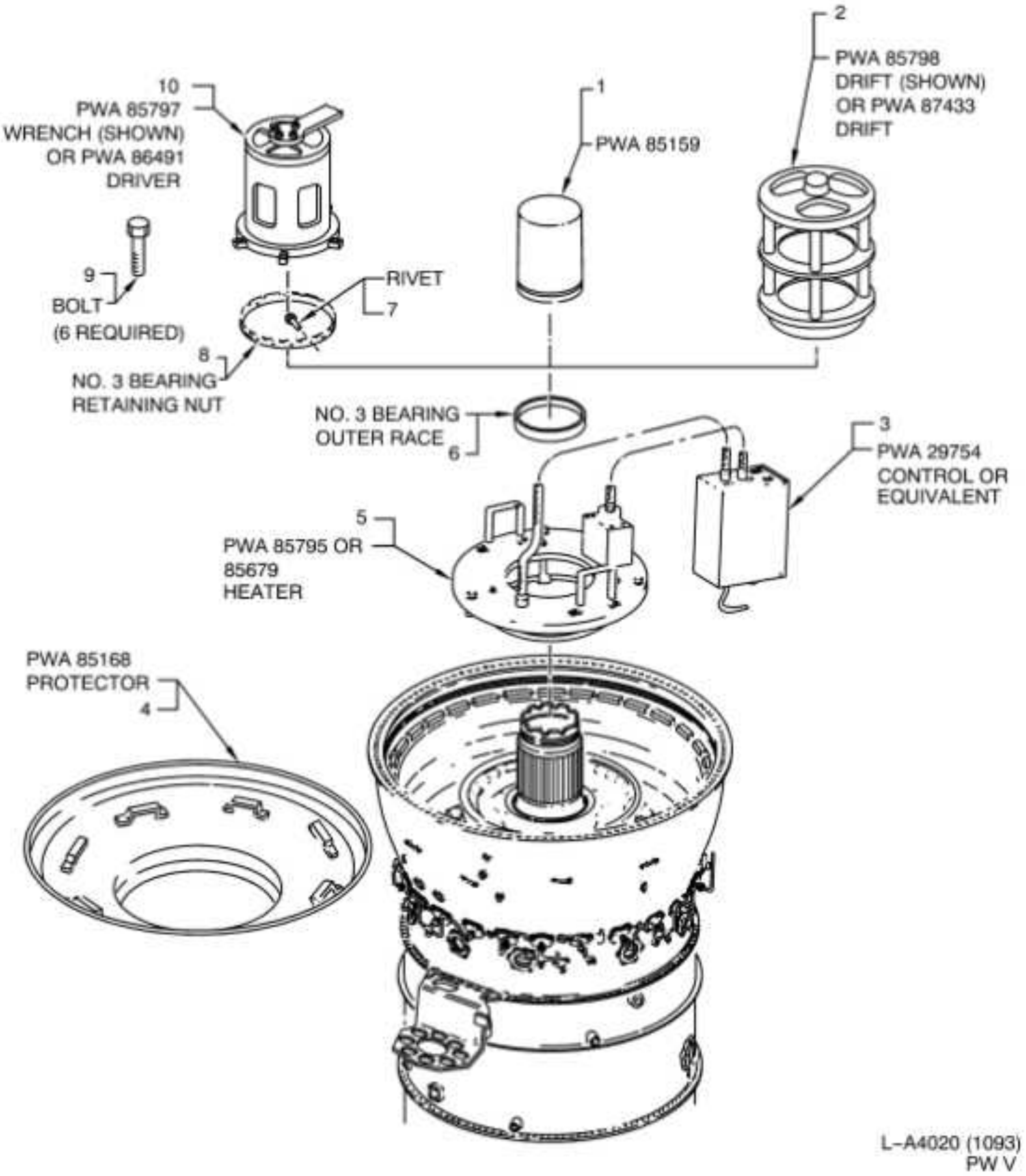
Installation Bearing Outer Race Seating Check Measurement
Figure 403
(Task 72−00−41−440−001)


1
PWA 85068 FIXTURE
2
NO. 3 BEARING SEAL SPACER
3
PWA 85067 FIXTURE
4
NO. 3 BEARING FRONT SEAL SEAT
PWA 85168 PROTECTOR
L−A5528 (0000)
PW V

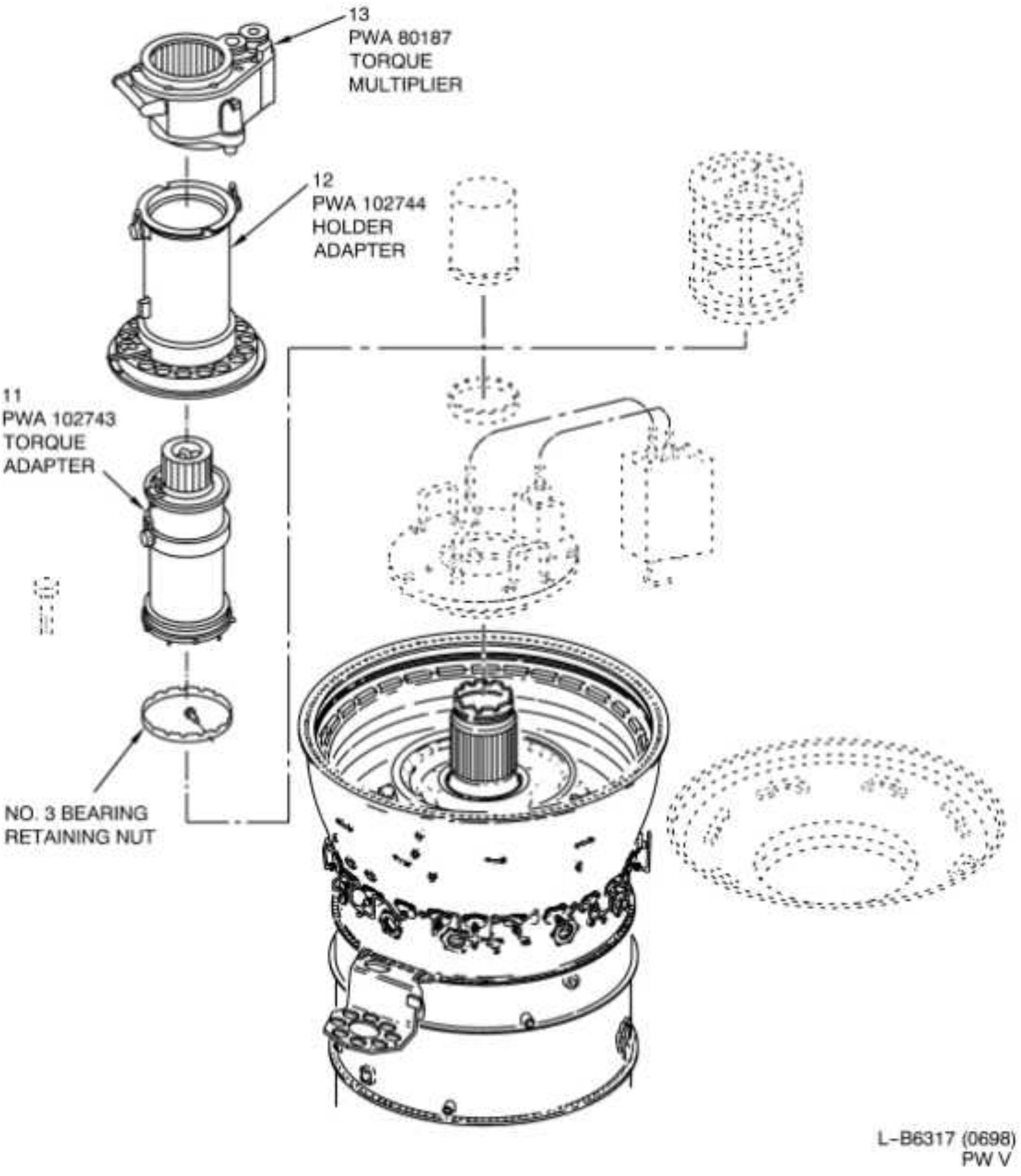
No. 3 Bearing Seal Seat And Spacer Installation
Figure 404
(Task 72−00−41−440−001)


1
PWA 85070
DRIFT
NO.3 BEARING INNER
RACE AND ROLLERS
2
3
PWA 85168
PROTECTOR
L−A4019 (0000)
PW V

No. 3 Bearing Inner Race And Rollers Installation
Figure 405
(Task 72−00−41−440−001)


10
PWA 85797
WRENCH (SHOWN)
OR PWA 86491
DRIVER
1
PWA 85159
2
PWA 85798
DRIFT (SHOWN)
OR PWA 87433
DRIFT
9
BOLT
(6 REQUIRED)
RIVET
7
8
NO. 3 BEARING
RETAINING NUT
NO. 3 BEARING
OUTER RACE
6
3
PWA 29754
CONTROL OR
EQUIVALENT
5
PWA 85795 OR
85679
HEATER
PWA 85168
PROTECTOR
4
L−A4020 (1093)
PW V

No. 3 Bearing Outer Race Installation
Figure 406 (Sheet 1)
(Task 72−00−41−440−001)


13
PWA 80187
TORQUE
MULTIPLIER
12
PWA 102744
HOLDER
ADAPTER
11
PWA 102743
TORQUE
ADAPTER
NO. 3 BEARING
RETAINING NUT
L-B6317 (0698)
PW V

No. 3 Bearing Outer Race Installation
Figure 406 (Sheet 2)
(Task 72−00−41−440−001)

Task 72-00-41-440-002:

1. Install No. 3 Bearing (Horizontal)

NOTE: See Figure 401 for part/assembly installation procedure sequence.

A. Prerequisites

(1) See 72-00-41, Inspection/Check-01 Task 72-00-41-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For Example: (Reference 1234) Torque retaining nut as follows:

B. Equipment And Materials Required

Special Tools:

PWA 29754	Control (Or Equivalent)
PWA 80187	Multiplier, Torque
PWA 85067	Fixture
PWA 85068	Fixture
PWA 85070	Drift
PWA 85159	Protector
PWA 85168	Protector
PWA 85310	Pin, Alignment (Three Required)
PWA 85679	Heater (Optional To PWA 85795)
PWA 85795	Heater
PWA 85797	Wrench (Optional To PWA 86491)
PWA 85798	Drift (Optional To PWA 87433)
PWA 85799	Pins, Guide And Support
PWA 85901	Riveter
PWA 86491	Driver, Torque
PWA 87433	Drift
PWA 102743	Adapter, Torque
PWA 102744	Adapter, Holder

Consumable Materials:

Item No.	Designation
P03-001	Engine Oil (PWA 521B)
P05-026	Ink (Marking) (PMC 4057-1)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Rivet	1	72−41−00/12/40

C. Procedure
See Figure 402 and Figure 403.

NOTE: PWA 85893 Support and PWA 85910 Adapter have been previously installed. Reference 72−00−41, Removal−18 Task 72−00−41−040−002.

(1) Remove PWA 85159 Thread Protector from HPC rear hub.

CAUTION: HANDLE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN LINT FREE GLOVES TO PREVENT BEARING DAMAGE.

(2) Place No. 3 bearing assembly on clean waxed paper on bench.

(3) Separate outer race (403/1) from inner race and rollers (402/2) and place them, serial number up, on bench.

(4) Verify bearing inner and outer race serial numbers are the same.

CAUTION: THICKNESS OF NO. 3 BEARING FRONT SEAL SEAT MUST BE MEASURED ACROSS THINNER, ID, SECTION OF SEAL SEAT OR INCORRECT DIMENSION WILL RESULT.

(5) Measure thickness of the No. 3 bearing front seal seat (402/3) across the thinner ID section of seal seat. Measure the No. 3 bearing seal spacer (402/2) thickness, No. 3 bearing inner race and rollers (402/1) thickness. Record this thickness as Dimension A.

(6) Measure distance from end of HPC rear hub (402/4), to the seal spacer shoulder the on hub. Record this dimension as Dimension B.

NOTE: Dimensions A and B will be used to perform a seating check later during this installation procedure.

(7) Measure thickness of No. 3 bearing outer race (403/1) thickness. Record this dimension as Dimension D.

(8) Measure distance from top of No. 3 bearing support to outer race seating shoulder. Record this dimension as Dimension E.

NOTE: Dimensions D and E will be used to perform a seating check later during this installation procedure.

(9) Locate two dimples on top surface of No. 3 bearing housing (403/2) threaded ID. Mark a line between the dimples with Ink P05−026.

(10) Assemble a PWA 85067 Fixture (404/2) onto the No. 3 bearing front seal seat (404/1). See Figure 404.

(11) Install the fixture with the seal seat, polished face down, over the HPC rear hub and drift to seat, if necessary. Remove the fixture.

(12) Assemble a PWA 85068 Fixture (404/4) onto the No. 3 bearing seal spacer (404/3).

(13) Install the fixture with the spacer over the HPC rear hub and drift to seat, if necessary. Remove the fixture.

(14) Heat the No. 3 bearing inner race and rollers. See Standard Practices Manual, PN 585005.

CAUTION: HANDLE NO. 3 BEARING INNER RACE AND ROLLERS WITH CLEAN INSULATED GLOVES TO PREVENT BEARING DAMAGE.

(15) Remove the heated inner race and rollers from the heat source.

(16) Install the heated No. 3 bearing inner race and rollers (405/1) onto HPC rear hub, puller grooves up. Seat bearing with PWA 85070 Drift (405/2) and keep constant inward pressure on bearing for approximately three minutes to make sure of correct seating. After seating remove drift. See Figure 405.

(17) After inner race has reached room temperature measure distance from end of HPC rear hub to rear of inner race and rollers with depth gage. Record this distance as Dimension C. See Figure 402.

(18) Dimension C must not be less than previously taken Dimension B minus Dimension A.

NOTE: If Dimension C is less than required it indicates bearing is not fully seated.

(19) Remove PWA 85168 Protector (406/1) from diffuser case. See Figure 406.

(20) Heat No. 3 bearing housing.

(a) Install four PWA 85799 Pins (406/10) into the bearing housing channel nuts equally around housing.

(b) Install PWA 85795 Heater or PWA 85679 Heater (406/4) to rear flange of housing on PWA 85799 Pins. Connect power and thermocouple cables to PWA 29754 Control (406/9) or equivalent control.

NOTE: If PWA 85679 Heater is used, a heat shield must be made locally to protect the No. 3 bearing inner race and rollers.

(c) Set heater to 300°F (149°C) and heat housing for 55 − 60 minutes.

(21) After No. 3 bearing housing is correctly heated turn off heater. Disconnect control and remove heater from housing.

CAUTION: HANDLE NO 3. BEARING OUTER RACE WITH CLEAN GLOVES TO PREVENT BEARING DAMAGE.

(22) (Reference 1006) Install No. 3 bearing outer race (406/5) into bearing housing with serial number up and align "X" mark on outer race with ink mark between the two dimples on top of housing.

CAUTION: DO NOT HIT BEARING ROLLERS WITH THE DRIFT WHEN SEATING OUTER RACE.

(23) Position PWA 87433 Drift or PWA 85798 Drift (406/8) on outer race and seat race. Make sure outer race is seated against shoulder in housing. Remove the drift.

(24) After the No. 3 bearing temperature has returned to room temperature, do a dimensional check to make sure bearing outer race is correctly seated. See Figure 403.

(a) Measure Distance F from top of No. 3 bearing housing to top of bearing outer race (403/1).

(b) Dimension F must not be less than previously taken Dimension E minus Dimension D.

NOTE: If Dimension F is less than required, it indicates outer race is not fully seated.

CAUTION: A NEW OR SILVER PLATED NO. 3 BEARING OUTER RACE RETAINING NUT MUST BE INSTALLED AT EACH INSTALLATION OR DAMAGE TO MATING PARTS MAY OCCUR.

CAUTION: NO. 3 BEARING OUTER RACE RETAINING NUT MUST BE SILVER PLATED AFTER TORQUING NUT A MAXIMUM OF THREE TIMES FOR EACH INSTALLATION PRIOR TO ENGINE BEING OPERATED, NUT CAN BE SILVER PLATED PER PW4000 SERIES CIR, PN 51A357.

CAUTION: TO AVOID INCORRECT BEARING OUTER RACE DIMENSIONAL CHECKS AND RETAINING NUT TORQUE READING, NO. 3 BEARING AND HOUSING MUST BE AT ROOM TEMPERATURE. SHOP AIR MAY BE USED FOR COOLING. DO NOT USE DRY ICE.

(25) Lubricate the No. 3 bearing outer race retaining nut (406/2) with Engine Oil P03−001.

(26) Install six workbolts, lubricated with Engine Oil P03−001, into bearing housing channel nuts equally around housing. Torque workbolts to 290 − 325 lb−in. (32.766 − 36.720 N.m).

NOTE: The workbolts are a quality standard bolt with .375−24 by 1.000 inch (25.400 mm) thread length.

(27) Install PWA 85168 Protector (406/1) to diffuser case.

(28) Install retaining nut into housing with slots up, handtighten.

(29) Slide PWA 86491 Driver or PWA 85797 Wrench (406/3) over HPC rear hub, locating the teeth of the tool in the slots of the nut.

NOTE: If you use PWA 86491 Driver, you must attach the driver to the bearing housing with the four detail cap screws.

(30) Mechanical Wrench Method (Optional) − See Figure 406Figure 406, Sheet 2.

(a) Install PWA 102743 Torque Adapter (406/11) to engage the slots in the bearing retaining nut.

(b) Install PWA 102744 Holder Adapter (406/12) over PWA 102743 Torque Adapter (406/11) and attach it to the bearing housing with the four detail bolts. Tighten the bolts.

(c) Install PWA 80187 Torque Multiplier (406/13) to engage both PWA 102743 Torque Adapter (406/11) and PWA 102744 Holder Adapter (406/12).

(31) (Reference 975) Torque retaining nut to 3600 − 4400 lb−in. (406.8 − 497.3 N.m). Turn through angle of 16° − 17° 30'. Loosen to 0 lb−in. (0 N.m) then repeat torque sequence aligning one rivet hole in retaining nut with one rivet hole in housing.

(32) Remove wrench/driver from the No. 3 bearing retaining nut.

(33) Remove the six workbolts from bearing housing.

(34) Install rivet (406/6) into aligned holes in the retaining nut and housing with PWA 85901 Riveter and flare rivet to secure.

(35) Install PWA 85159 Thread Protector (406/7) over HPC rear hub.

D. Postrequisites

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−18

(1) Install The No. 3 Bearing Seal Assembly And Seal Seat. Refer to 72−00−41, Installation−03 (Task 72−00−41−420−003).

(2) Vacuum Check The No. 3 Bearing Compartment. Refer to 72−00−41, Inspection/Check−07 (Task 72−00−41−720−001).

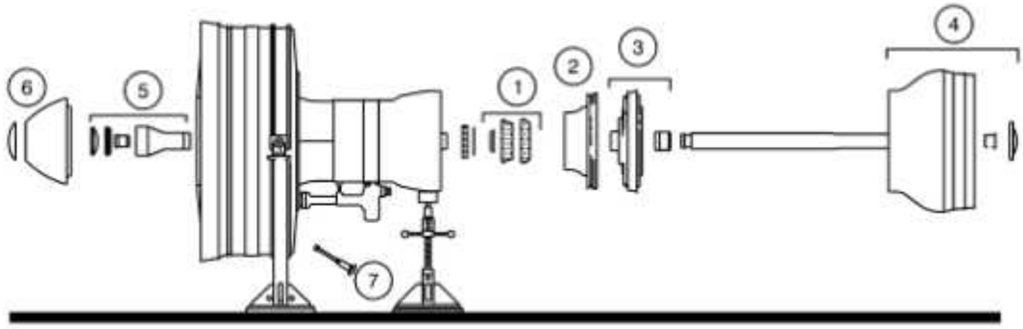
(3) Install The Turbine Nozzle. Refer to 72−00−51, Installation−01 (Task 72−00−51−420−001).

(4) Install The High Pressure Turbine − Horizontal. Refer to 72−00−52, Installation−01 (Task 72−00−52−420−001).

(5) Install The Low Pressure Trbine And Turbine Exhaust Case With Shaft. Refer to 72−00−53, Installation−08 (Task 72−00−53−420−002).

(6) Install The LPC/LPT Coupling (With The Front Compressor Drive Turbine Shaft Installed). Refer to 72−00−32, Installation−01 (Task 72−00−32−420−001).

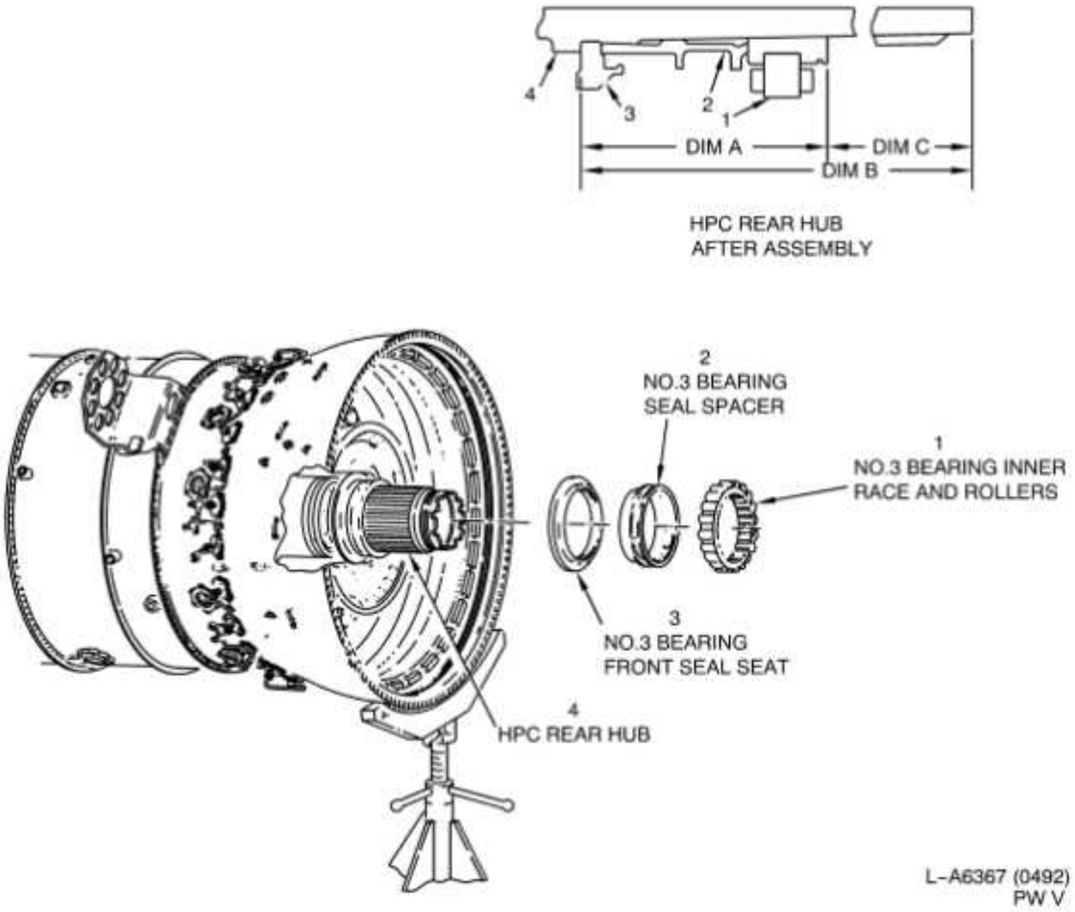
(7) Install The Compressor Inlet Cone. Refer to 72−00−31, Installation−02 (Task 72−00−31−420−001).



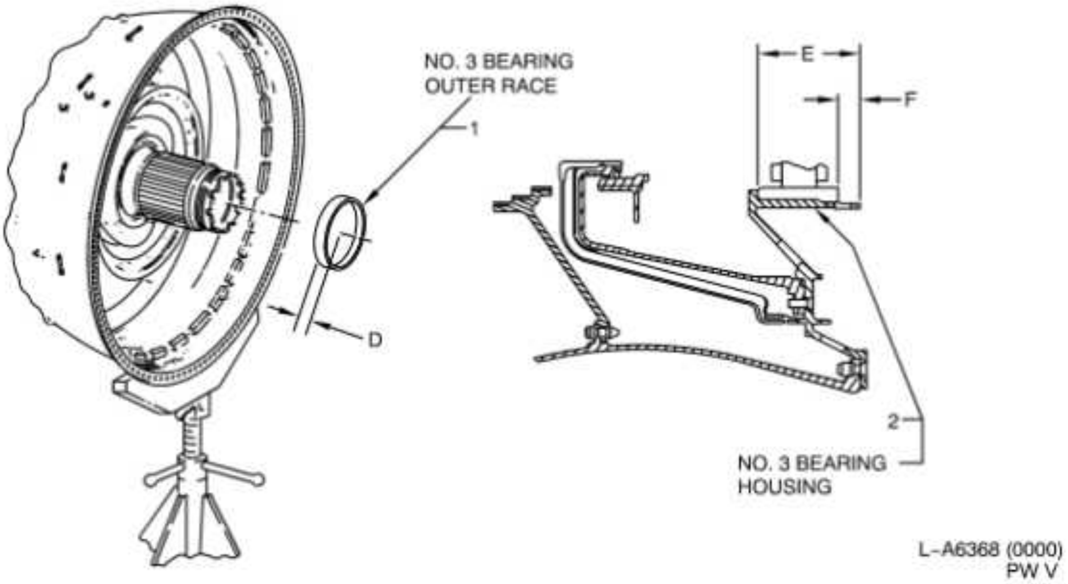
1. INSTALL NO. 3 BEARING REAR SEAL ASSEMBLY
2. INSTALL TURBINE NOZZLE
3. INSTALL HIGH PRESSURE TURBINE (HPT)
4. INSTALL LPT/TEC WITH SHAFT
5. INSTALL LPC/LPT COUPLING ASSEMBLY
6. INSTALL COMPRESSOR INLET CONE
7. INSTALL N1 SPEED SENSOR

L−A6366 (0000)
PW V

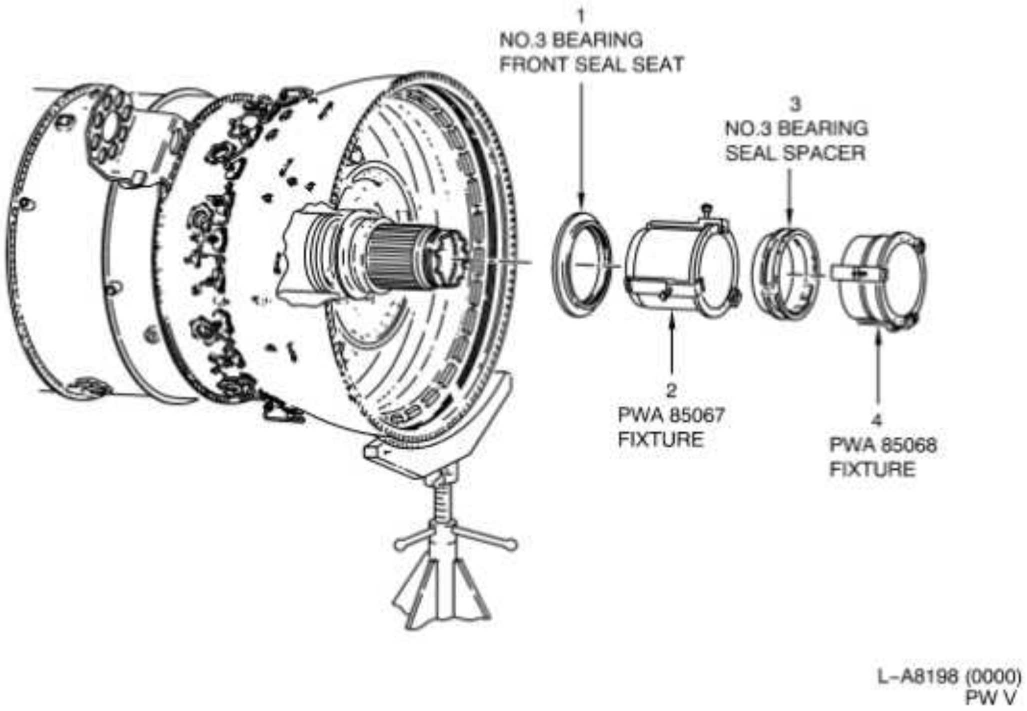
Procedure Sequence
Figure 401
(Task 72−00−41−440−002)


4
3
2
1
DIM A
DIM C
DIM B
HPC REAR HUB
AFTER ASSEMBLY
2
NO.3 BEARING
SEAL SPACER
1
NO.3 BEARING INNER
RACE AND ROLLERS
3
NO.3 BEARING
FRONT SEAL SEAT
4
HPC REAR HUB
L−A6367 (0492)
PW V

Installation Bearing Inner Race And
Rollers Seating Check Measurement
Figure 402
(Task 72−00−41−440−002)

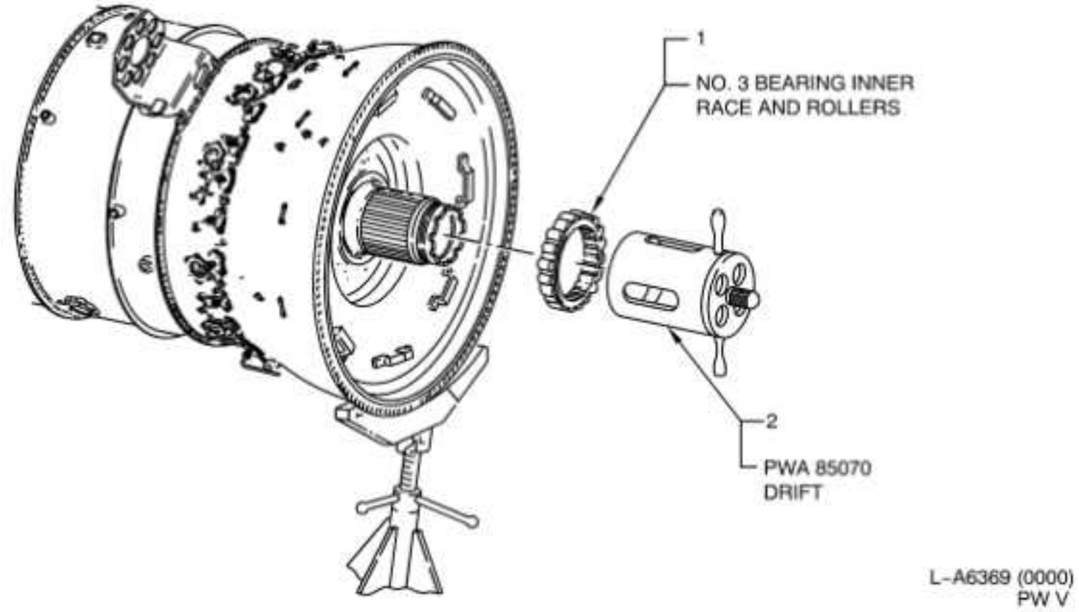

NO. 3 BEARING OUTER RACE
1
D
E
F
2
NO. 3 BEARING HOUSING
L-A6368 (0000)
PW V

Installation Bearing Outer Race Seating Check Measurement
Figure 403
(Task 72−00−41−440−002)

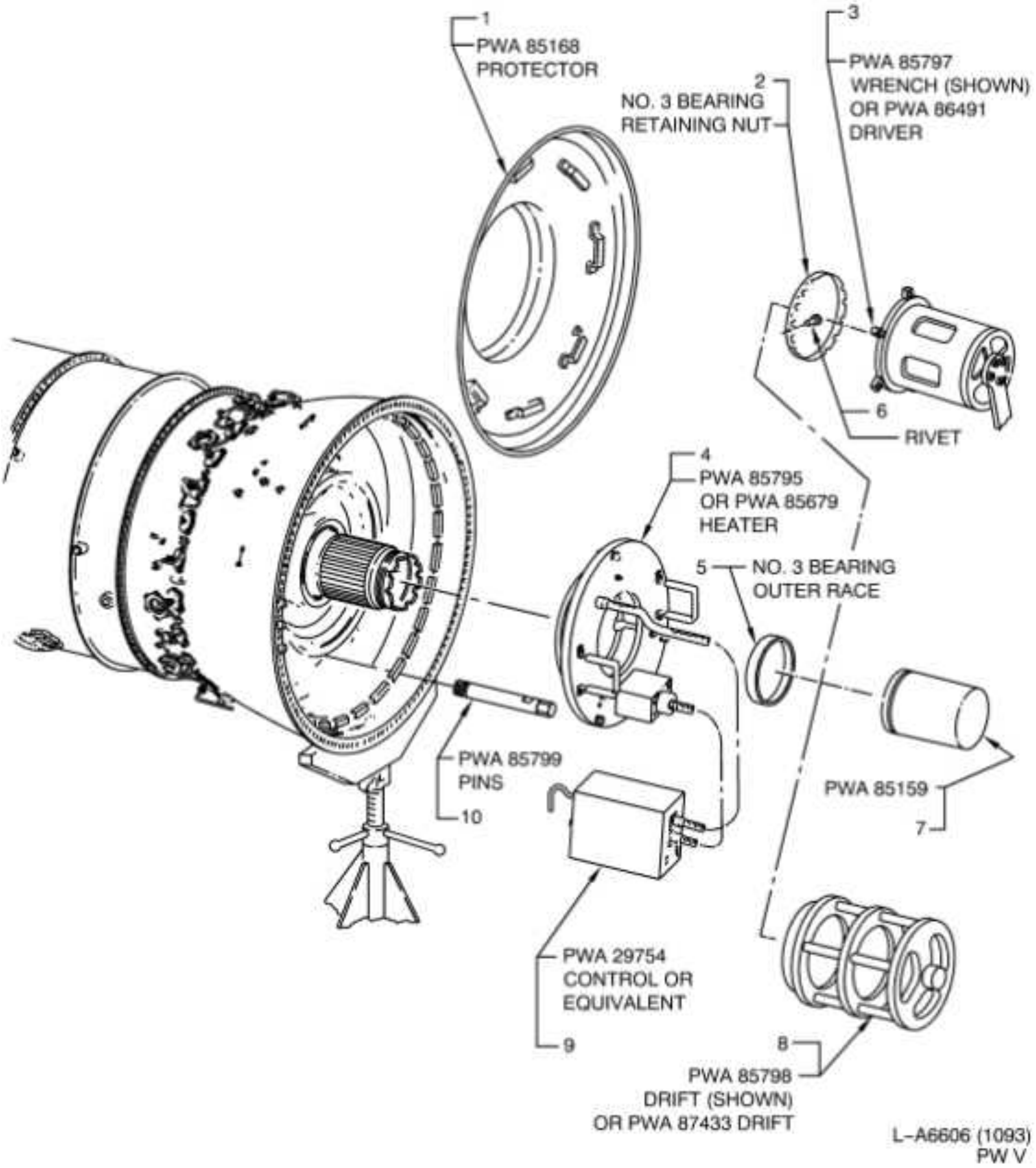

1
NO.3 BEARING
FRONT SEAL SEAT
3
NO.3 BEARING
SEAL SPACER
2
PWA 85067
FIXTURE
4
PWA 85068
FIXTURE
L−A8198 (0000)
PW V

No. 3 Bearing Seal Seat And Spacer Installation
Figure 404
(Task 72−00−41−440−002)

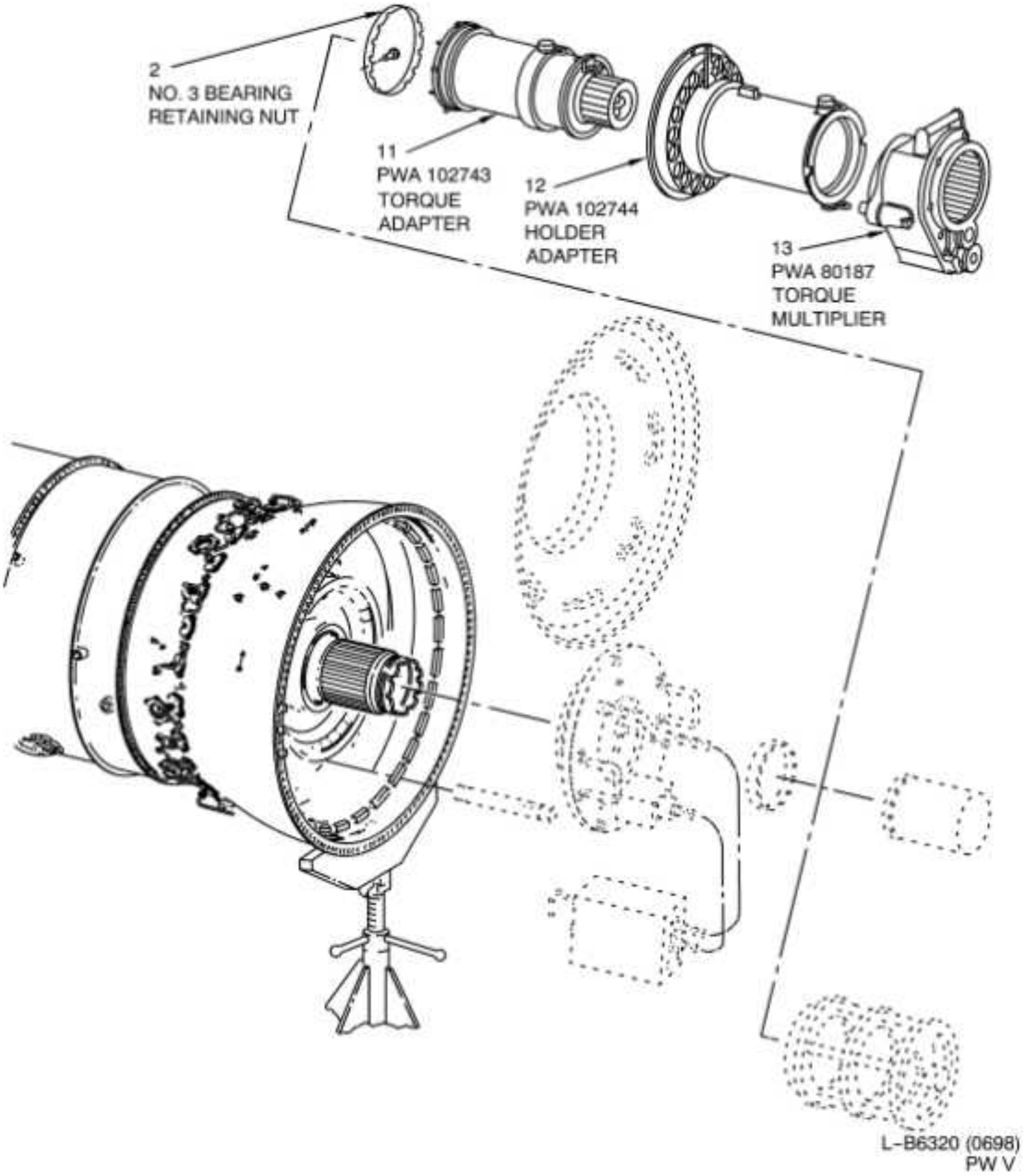
ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−18


1
NO. 3 BEARING INNER RACE AND ROLLERS
2
PWA 85070 DRIFT
L-A6369 (0000)
PW V

No. 3 Bearing Inner Race And Rollers Installation
Figure 405
(Task 72−00−41−440−002)


1
PWA 85168
PROTECTOR
2
NO. 3 BEARING
RETAINING NUT
3
PWA 85797
WRENCH (SHOWN)
OR PWA 86491
DRIVER
6
RIVET
4
PWA 85795
OR PWA 85679
HEATER
5
NO. 3 BEARING
OUTER RACE
PWA 85799
PINS
10
PWA 85159
7
PWA 29754
CONTROL OR
EQUIVALENT
9
8
PWA 85798
DRIFT (SHOWN)
OR PWA 87433 DRIFT
L-A6606 (1093)
PW V

No. 3 Bearing Outer Race Installation
Figure 406 (Sheet 1)
(Task 72−00−41−440−002)


2
NO. 3 BEARING
RETAINING NUT
11
PWA 102743
TORQUE
ADAPTER
12
PWA 102744
HOLDER
ADAPTER
13
PWA 80187
TORQUE
MULTIPLIER
L-B6320 (0698)
PW V

No. 3 Bearing Outer Race Installation
Figure 406 (Sheet 2)
(Task 72–00–41–440–002)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSTALLATION−20

Task 72−00−41−420−020:

1. Install The Flange K Brackets And Hardware

A. Equipment And Materials Necessary

Consumable Materials:

	Item No.	Designation
	P03−001	Oil, Engine (PWA 521B)
	P05−289	Lockwire (AS3214−02)
	P05−291	Cable, Safety (Optional)
	P05−292	Ferrule, Safety Cable (Optional)
R	P06−054	Paste, Antiseize (PWA 36246)

B. Procedure

(1) Install Flange K hardware as follows: See Figure 401.

(a) Install fifteen bolts, threads lubricated with Antiseize Paste P06−054, to brackets at holes 32 through 36, 58 through 62, and 84 through 88 handtight only. Wipe off unwanted paste. R R

(b) Install remaining bolts, threads lubricated with Engine Oil P03−001, and secure with washers and nuts.

NOTE: Washers used under hexagon nuts at holes 26, 27, 31, 99, and 100 only.

(2) (Reference 978) Tighten all Flange K bolts in sets of two groups with groups located opposite each other. The sets must have approximately 16 groups with eight bolts in each group. See Figure 402.

NOTE: Eight of the 16 groups have eight bolts each. The remaining eight groups have seven bolts each. See referenced figure.

(a) Torque flange bolts 32 through 36, 58 through 62 and 84 through 88 to initial torque of 60 − 70 lb−in. (6.779 − 7.909 N.m). Torque all remaining bolts 75 − 100 lb−in. (8.474 − 11.298 N.m).

(b) Final torque bolts 32 through 36, 58 through 62 and 84 through 88 to 130 − 140 lb−in. (14.688 − 15.818 N.m). Torque all remaining bolts 180 − 200 lb−in. (20.337 − 22.597 N.m).

(c) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts at holes 32 through 36, 58 through 62, and 84 through 88.

(3) (Reference 1011) Loosen the four bolts that attach the brackets (items 170 and 180). Install the PWA 87501 Pin through the outer holes of the two brackets. Torque the bolts again to the correct torque. The tool pin will hold the bracket outer holes in 0.0015 inch (0.038 mm) concentricity of each other. Remove the tool pin.

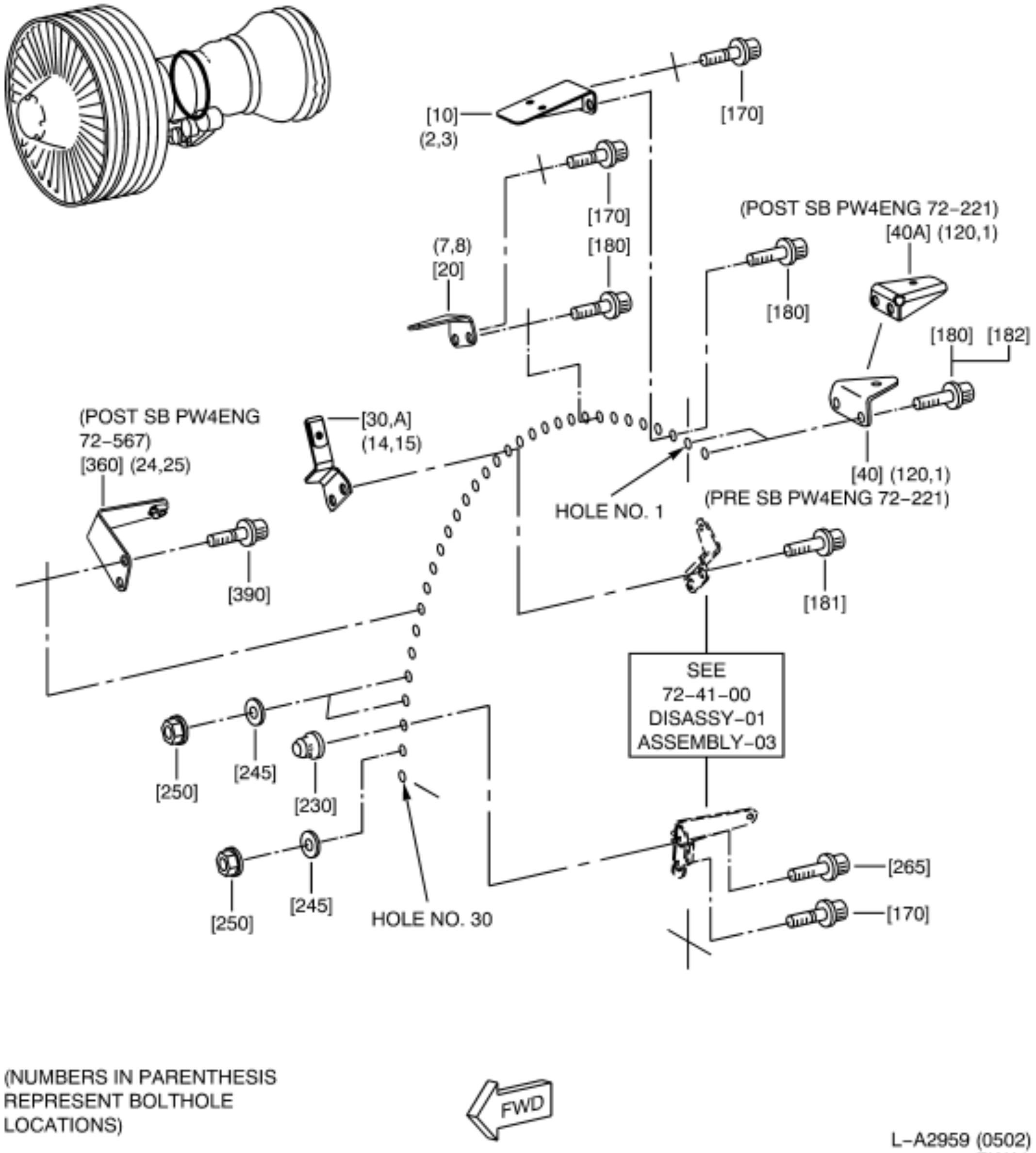
(4) Install two bolts, lubricated with Engine Oil P03−001, and nut to secure fuel flow divider valve bracket to previously installed Flange J bracket.

(a) Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

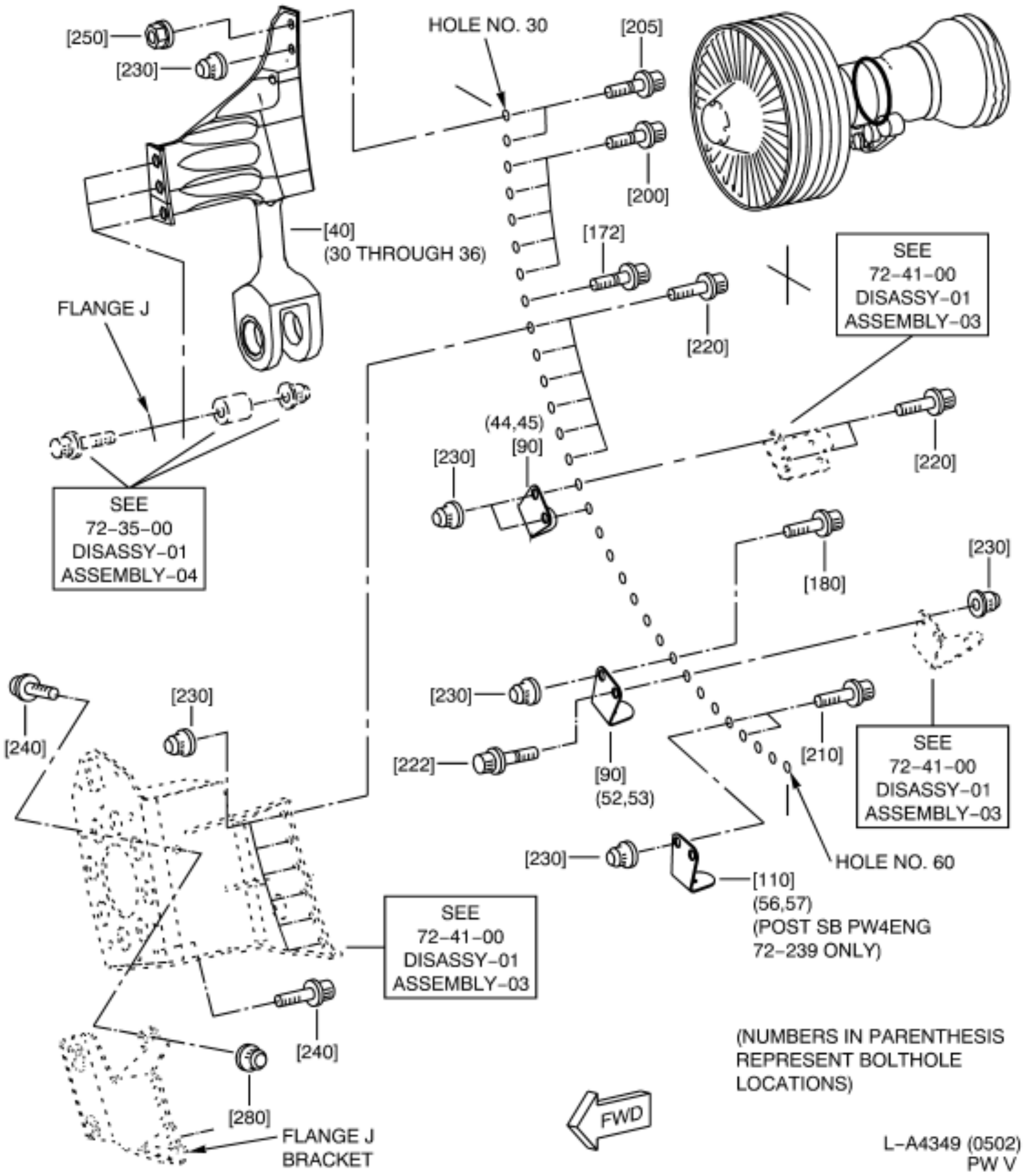
(5) Torque all bolts securing fuel supply tubes to Flange K brackets to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(6) Remove any tags or markings on the brackets or flange.

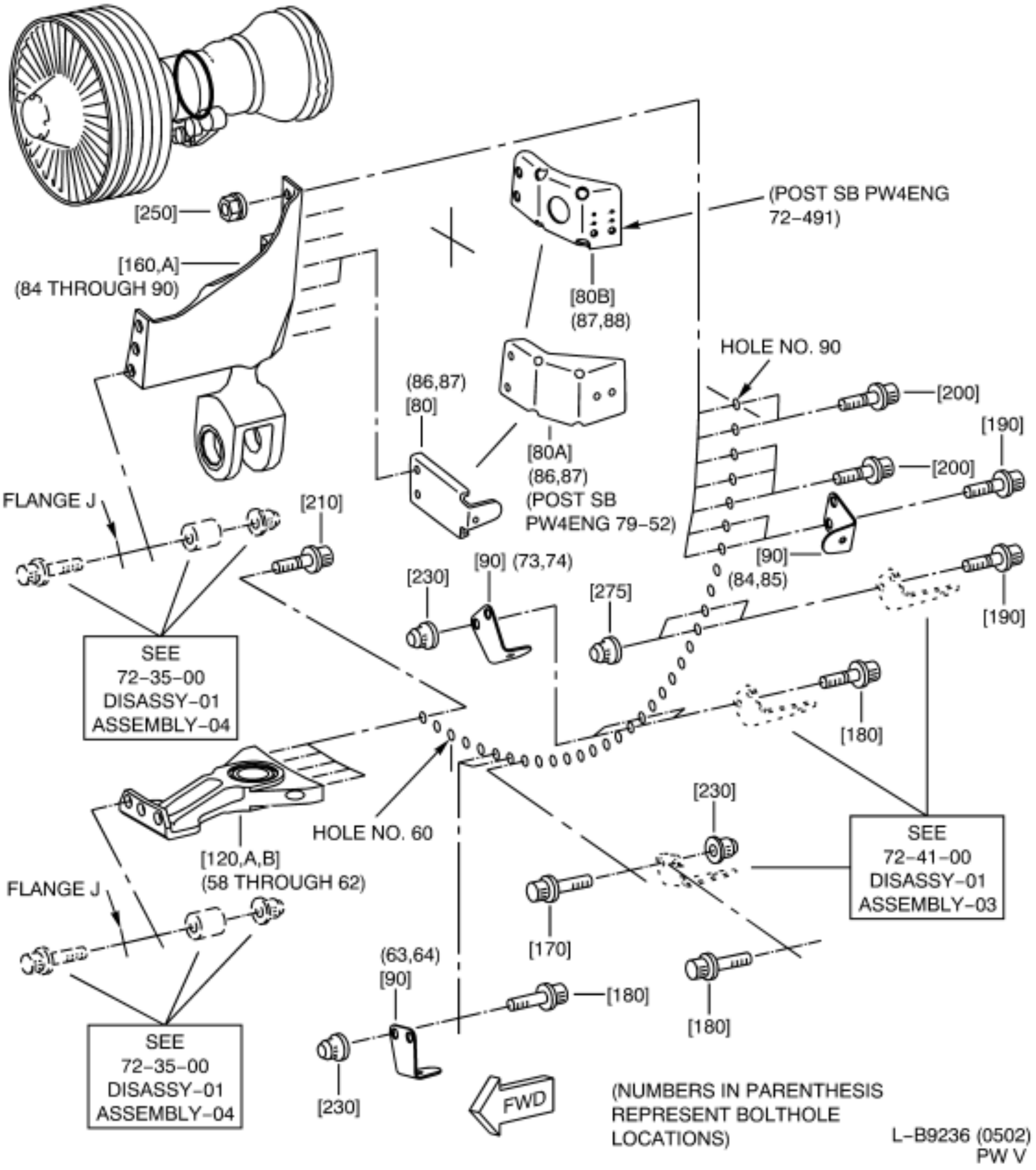
(7) Examine the assembly for foreign objects, damage, and correct assembly.


[10]
(2,3)
[170]
[170]
[180]
(7,8)
[20]
(POST SB PW4ENG 72−221)
[40A] (120,1)
[180]
[180] [182]
(POST SB PW4ENG 72−567)
[360] (24,25)
[30,A]
(14,15)
[40] (120,1)
(PRE SB PW4ENG 72−221)
HOLE NO. 1
[390]
[181]
SEE 72−41−00 DISASSY−01 ASSEMBLY−03
[250]
[245]
[230]
[265]
[170]
[250]
[245]
HOLE NO. 30
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L−A2959 (0502)
PW V

The Flange K Brackets And Hardware
Figure 401 (Sheet 1)
(Task 72−00−41−420−020)


[250]
[230]
HOLE NO. 30
[205]
[200]
[40]
(30 THROUGH 36)
[172]
SEE
72-41-00
DISASSY-01
ASSEMBLY-03
FLANGE J
[220]
(44,45)
[90]
[230]
[220]
SEE
72-35-00
DISASSY-01
ASSEMBLY-04
[180]
[230]
[240]
[230]
[230]
[222]
[90]
(52,53)
[210]
SEE
72-41-00
DISASSY-01
ASSEMBLY-03
[230]
HOLE NO. 60
[110]
(56,57)
(POST SB PW4ENG
72-239 ONLY)
SEE
72-41-00
DISASSY-01
ASSEMBLY-03
[240]
[280]
FLANGE J
BRACKET
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L-A4349 (0502)
PW V

The Flange K Brackets And Hardware
Figure 401 (Sheet 2)
(Task 72-00-41-420-020)


(POST SB PW4ENG 72-491)
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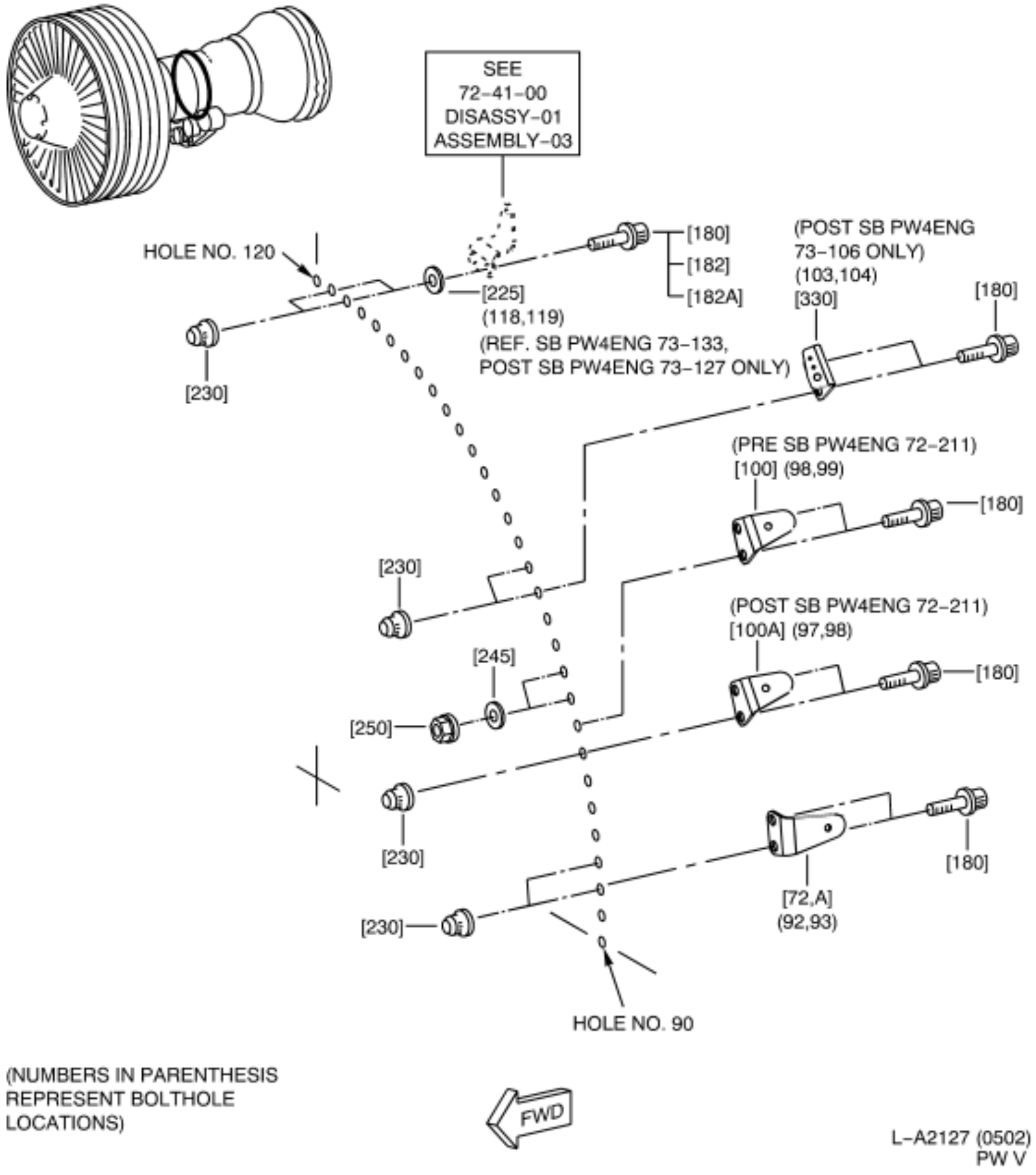
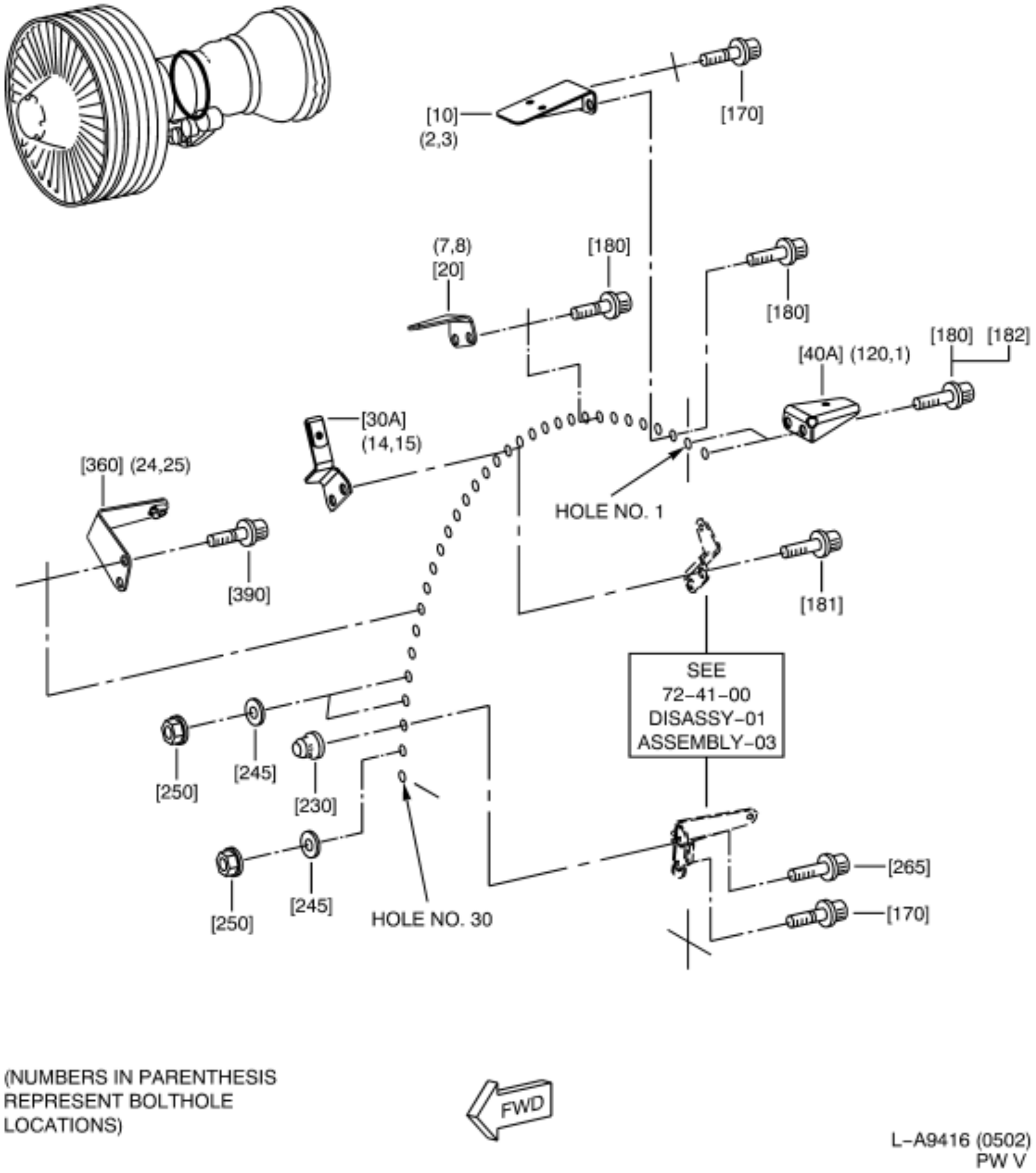
(84 THROUGH 90)
[80B]
(87,88)
HOLE NO. 90
[200]
(86,87)
[80]
[80A]
(86,87)
(POST SB PW4ENG 79-52)
[190]
[200]
FLANGE J
[210]
[90]
(84,85)
[190]
[230]
[90] (73,74)
[275]
[190]
SEE 72-35-00 DISASSY-01 ASSEMBLY-04
[180]
[230]
HOLE NO. 60
[120,A,B]
(58 THROUGH 62)
SEE 72-41-00 DISASSY-01 ASSEMBLY-03
FLANGE J
[170]
(63,64)
[90]
[180]
[180]
SEE 72-35-00 DISASSY-01 ASSEMBLY-04
[230]
FWD
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L-B9236 (0502)
PW V

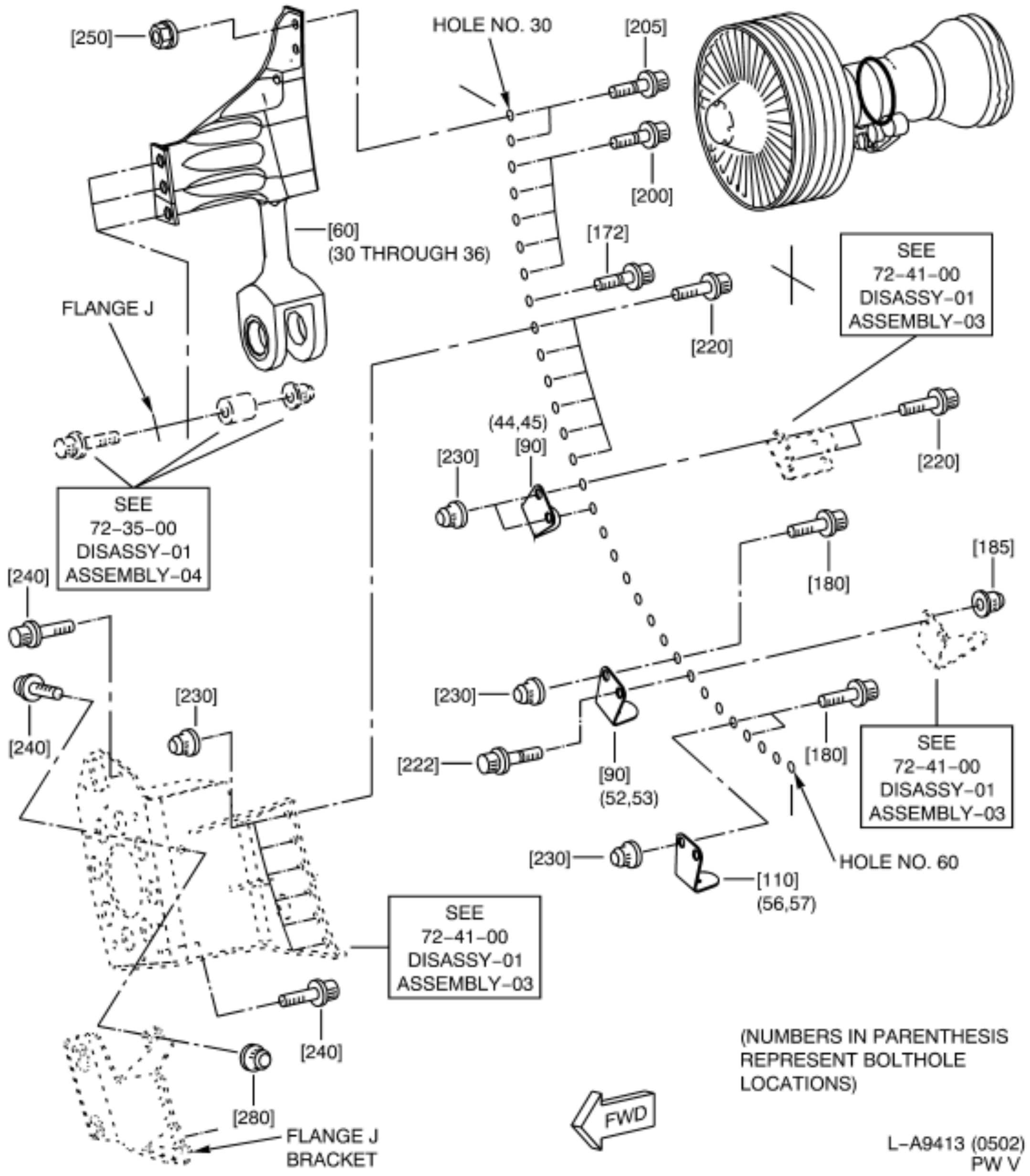
The Flange K Brackets And Hardware
Figure 401 (Sheet 3)
(Task 72-00-41-420-020)


SEE
72−41−00
DISASSY−01
ASSEMBLY−03
HOLE NO. 120
[180]
[182]
[182A]
[225]
(118,119)
(REF. SB PW4ENG 73−133,
POST SB PW4ENG 73−127 ONLY)
[230]
(POST SB PW4ENG
73−106 ONLY)
(103,104)
[330]
[180]
(PRE SB PW4ENG 72−211)
[100] (98,99)
[180]
[230]
(POST SB PW4ENG 72−211)
[100A] (97,98)
[245]
[250]
[180]
[230]
[180]
[72,A]
(92,93)
[230]
HOLE NO. 90
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L−A2127 (0502)
PW V

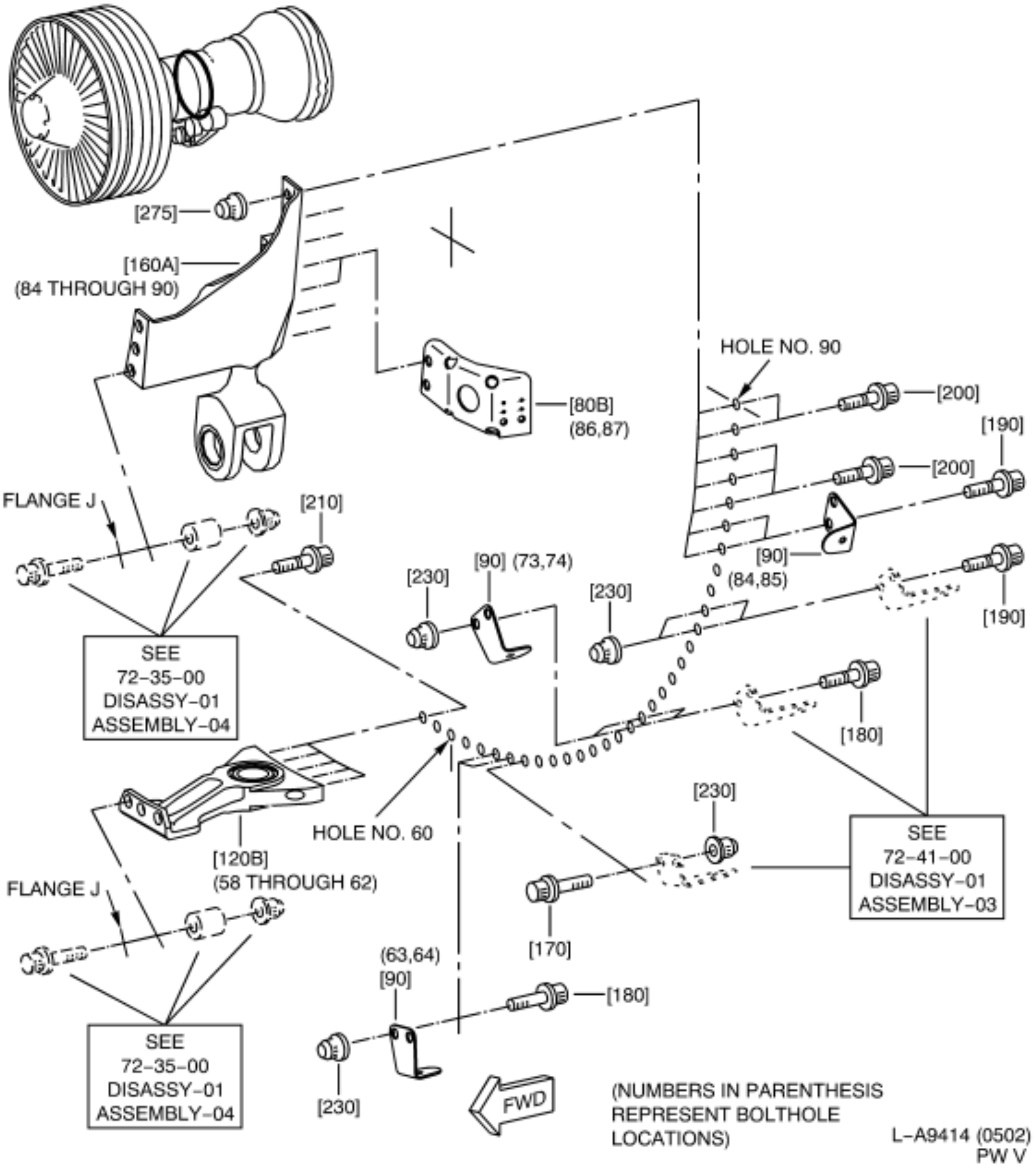
The Flange K Brackets And Hardware
Figure 401 (Sheet 4)
(Task 72−00−41−420−020)


[170]
[10]
(2,3)
(7,8)
[20]
[180]
[180]
[180]
[182]
[40A] (120,1)
[30A]
(14,15)
[360] (24,25)
[390]
HOLE NO. 1
[181]
SEE
72−41−00
DISASSY−01
ASSEMBLY−03
[250]
[245]
[230]
[250]
[245]
HOLE NO. 30
[265]
[170]
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L−A9416 (0502)
PW V

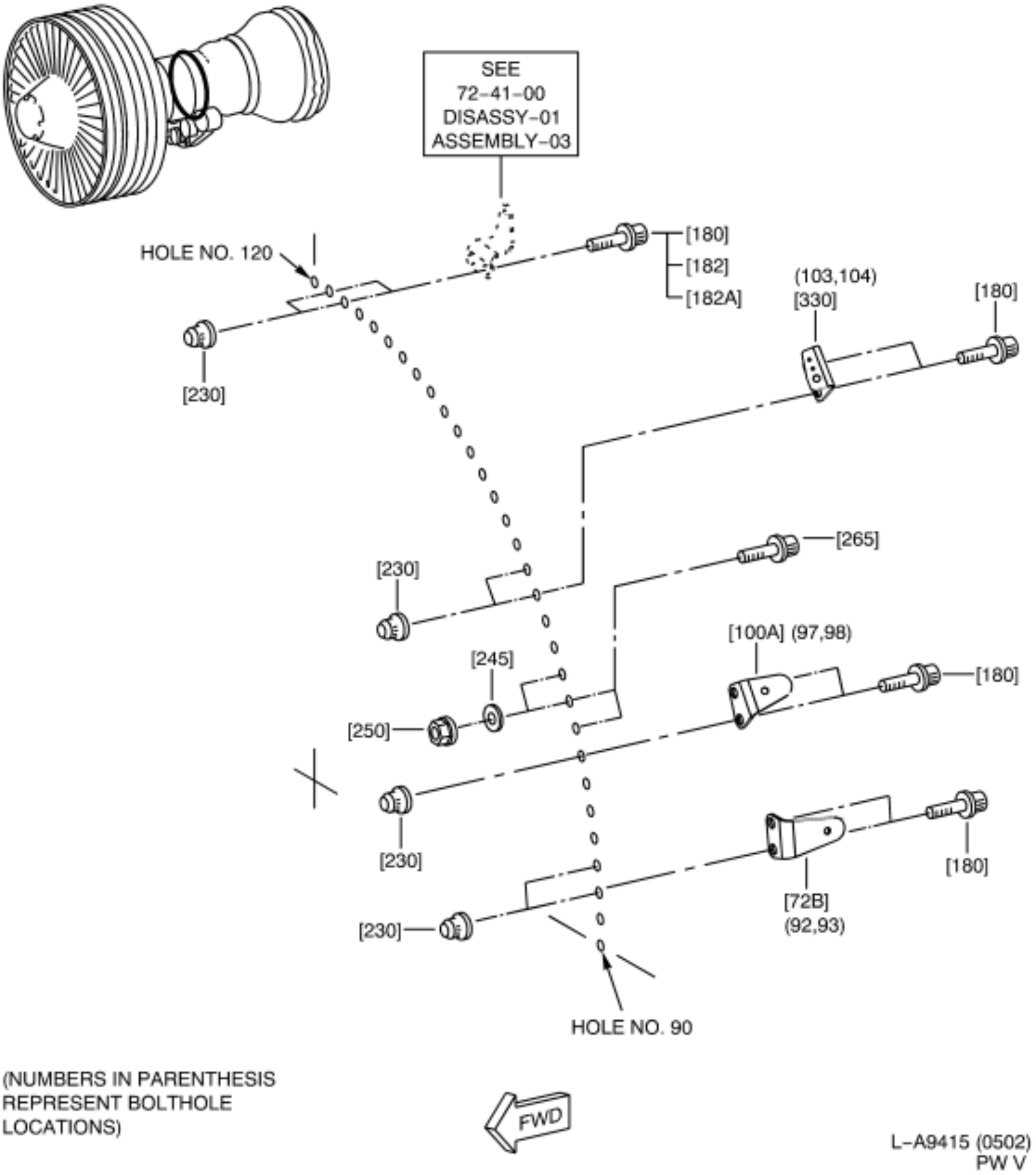
The Flange K Brackets And Hardware
Figure 401 (Sheet 5)
(Task 72−00−41−420−020)


[250]
HOLE NO. 30
[205]
[200]
[60]
(30 THROUGH 36)
[172]
FLANGE J
[220]
SEE
72−41−00
DISASSY−01
ASSEMBLY−03
(44,45)
[90]
[230]
[220]
SEE
72−35−00
DISASSY−01
ASSEMBLY−04
[240]
[180]
[185]
[240]
[230]
[230]
[222]
[90]
(52,53)
[180]
SEE
72−41−00
DISASSY−01
ASSEMBLY−03
[230]
[110]
(56,57)
HOLE NO. 60
SEE
72−41−00
DISASSY−01
ASSEMBLY−03
[240]
[280]
FLANGE J
BRACKET
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L−A9413 (0502)
PW V

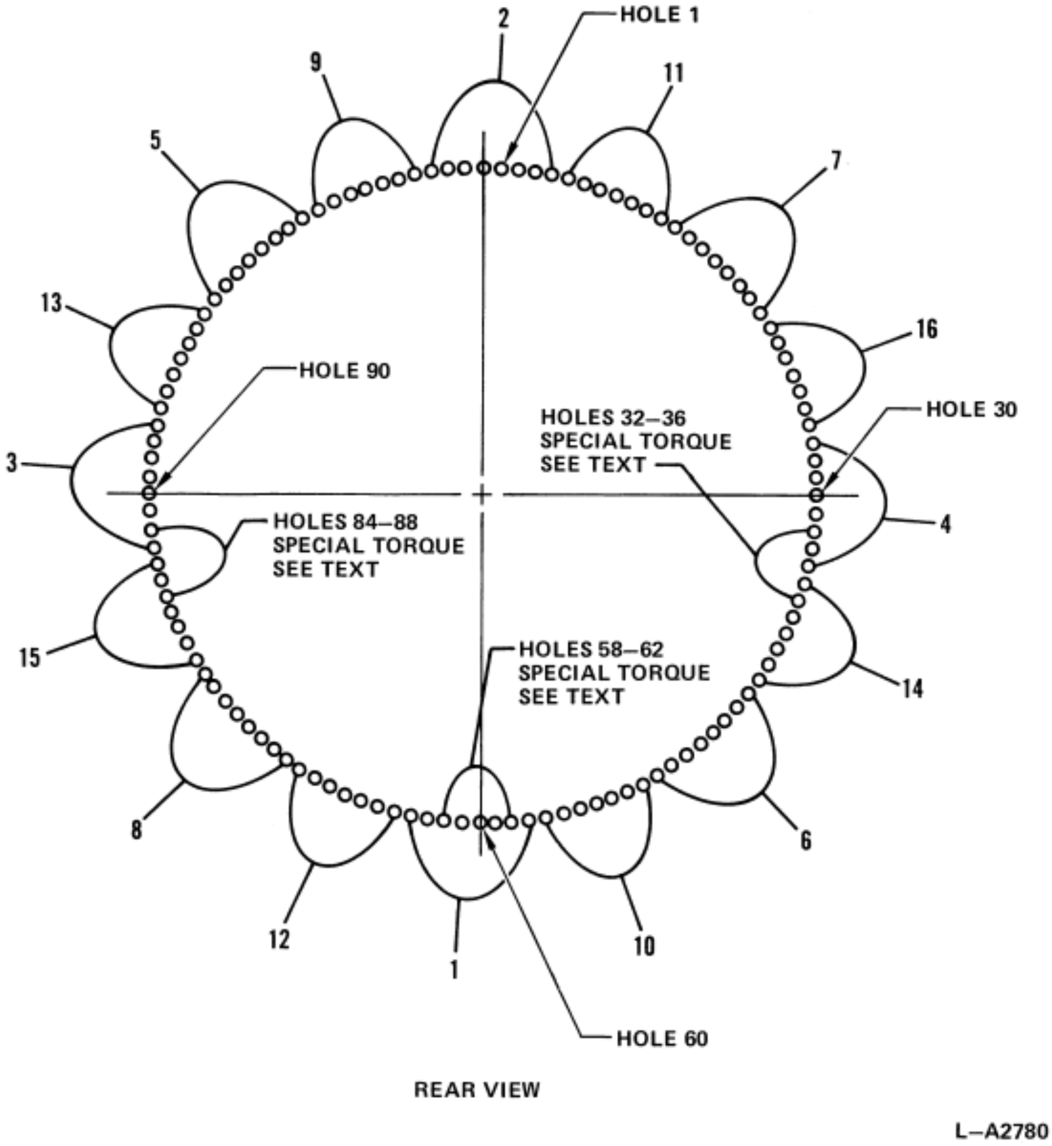
The Flange K Brackets And Hardware
Figure 401 (Sheet 6)
(Task 72−00−41−420−020)


[275]
[160A]
(84 THROUGH 90)
[80B]
(86,87)
HOLE NO. 90
[200]
[190]
[200]
FLANGE J
[210]
[90] (73,74)
[230]
[230]
[90]
(84,85)
[190]
SEE
72-35-00
DISASSY-01
ASSEMBLY-04
[180]
HOLE NO. 60
[120B]
(58 THROUGH 62)
[230]
FLANGE J
SEE
72-41-00
DISASSY-01
ASSEMBLY-03
[170]
(63,64)
[90]
[180]
SEE
72-35-00
DISASSY-01
ASSEMBLY-04
[230]
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L-A9414 (0502)
PW V

The Flange K Brackets And Hardware
Figure 401 (Sheet 7)
(Task 72-00-41-420-020)


SEE
72−41−00
DISASSY−01
ASSEMBLY−03
HOLE NO. 120
[180]
[182]
[182A]
(103,104)
[330]
[180]
[230]
[230]
[265]
[100A] (97,98)
[245]
[250]
[180]
[230]
[180]
[230]
[72B]
(92,93)
HOLE NO. 90
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L−A9415 (0502)
PW V

The Flange K Brackets And Hardware
Figure 401 (Sheet 8)
(Task 72−00−41−420−020)


2
HOLE 1
9
11
5
7
13
16
HOLE 90
HOLE 30
HOLES 32–36
SPECIAL TORQUE
SEE TEXT
3
4
HOLES 84–88
SPECIAL TORQUE
SEE TEXT
15
14
HOLES 58–62
SPECIAL TORQUE
SEE TEXT
8
6
12
10
1
HOLE 60
REAR VIEW
L–A2780

Flange K Bolt Torquing Sequence Diagram
Figure 402
(Task 72−00−41−420−020)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - CLEANING-01

Task 72-00-41-160-001:

1. Clean Igniter Plug
   A. Equipment And Materials Required - None
   B. Procedure
      (1) Outer Shell

WARNING: CLEANING SOLVENT IS FLAMMABLE. USE IN WELL VENTILATED AREA. AVOID CONTACT WITH SKIN.

(a) Degrease igniter plug by SPOP 208 Wipe Method (Task 70-21-00-110-040).

NOTE: Cleaning of recessed center electrode cavity on firing end of igniter plug is not recommended.

(b) Clean outer shell of igniter plug using wire brush.
(c) Use the SPOP 208 Wipe Method (Task 70-21-00-110-040), and a nonmetallic brush, remove deposits from external surface of firing end of igniter plug. It is not necessary to restore ceramic to cleanliness of new ceramic surface.

(2) Contact Well
(a) Remove dirt or foreign matter from inside contact well with compressed air.

NOTE: Compressed air shall be maintained at 30 psig (206.8 kPa) maximum discharge pressure. Dirt on contact surface will cause reduced output or arcing.

(b) Minor arcing of the contact button can be removed by resurfacing the button with abrasive rod, using a circular movement of the hand.

WARNING: USE CLEANING SOLVENT IN WELL-VENTILATED AREA. AVOID CONTACT WITH SKIN.

(c) Clean igniter plug contact well with long bristle, nonmetallic brush and the SPOP 208 Wipe Method (Task 70-21-00-110-040). Dry with compressed air.
(d) Clean inner ceramic walls using circular felt bob, 1/2 inch (12.7 mm) in diameter and approximately 1 3/4 inches (44.450 mm) long, suitable for use with hand chuck. Clean with the SPOP 208 Wipe Method (Task 70-21-00-110-040).

(e) Clean end surface of ceramic at seat of grommet face using short bristle nonmetallic brush and the SPOP 208 Wipe Method (Task 70−21−00−110−040).

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - CLEANING-02

Task 72-00-41-160-002:

1. Clean Exciter-To-Igniter Plug Cable

A. Equipment And Materials Required

Consumable Material:

Item No.	Description
P05-017	Wipers, Cotton (Lint Free)
P05-050	Abrasive Rod, Rubberized

B. Procedure

(1) Remove dirt or foreign matter from inside spring with compressed air.

NOTE: Compressed air shall be maintained at 30 psig (206.8 kPa) maximum discharge pressure.

WARNING: USE CLEANING SOLVENT IN WELL-VENTILATED AREA. AVOID CONTACT WITH SKIN.

(2) Wipe high tension sleeve clean using clean Lint Free Cotton Wipers (P05-017), and the SPOP 208 Wipe Method (Task 70-21-00-110-040). Dry with compressed air.

(3) Wipe conduit assembly with clean Lint Free Cotton Wipers (P05-017), and the SPOP 208 Wipe Method (Task 70-21-00-110-040). Dry with compressed air.

(4) Minor arcing and discoloration of contact button can be removed by resurfacing button with Rubberized Abrasive Rod (P05-050), using a circular hand motion.

(5) Clean high tension contact as required using clean Lint Free Cotton Wipers (P05-017), and the SPOP 208 Wipe Method (Task 70-21-00-110-040). Dry with compressed air.

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − CLEANING−03

Task 72−00−41−160−003:

1. Clean Fuel Distribution Valve Strainer (Solvent)

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P05−058	Brush, Stiff Bristle Nonmetallic
P11−027	Solvent, Petroleum (PMC 9001)

B. Procedure

CAUTION: DO NOT USE PAPER TO CLEAN OR DRY THE STRAINER. LINT FROM THE PAPER CAN CAUSE BLOCKAGE DOWNSTREAM.

DO NOT CLEAN THE STRAINER WITH A WIRE BRUSH, A PROBE OR ANY EQUIVALENT DEVICE. THESE DEVICES CAN CAUSE DAMAGE TO THE WIRE MESH SCREEN.

(1) Clean the strainer as follows, (small quantities of contamination).
   (a) Put the strainer in a container filled with Petroleum Solvent (P11−027).
   (b) Move the strainer quickly in the solvent to loosen the contamination.
   (c) Remove the strainer from the container.
   (d) Clean the wire mesh screen of the strainer with dry compressed air at 30 psi (200 kPa) maximum to remove the contamination deposits.
(2) Clean the strainer as follows, (large quantities of contamination).
   (a) Put the strainer in a container filled with Petroleum Solvent (P11−027) and let the strainer soak for ten minutes.
   (b) Move the strainer quickly in the solvent to loosen the contamination.
   (c) Remove the strainer from the container.
   (d) Clean the wire mesh screen of the strainer with a Stiff Bristle Nonmetallic Brush (P05−058) to remove the contamination deposits.

(3) Put a light inside, or behind the strainer to check for contamination deposits after the cleaning procedure. Do the cleaning procedure again if any contaminant is in the screens. If you see that more than approximately 10 percent of the filtering area of the screen has contamination deposits after cleaning, replace the strainer.

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ENGINE GENERAL - DIFFUSER AND COMBUSTOR - CLEANING-04

Task 72-00-41-110-001:

1. Clean Fuel Distribution Valve Strainer (Ultrasonic)
   A. Equipment And Materials Required - None
   B. Procedure

CAUTION: DO NOT ATTEMPT CLEANING WITH A WIRE BRUSH, PROBE OR OTHER DEVICE WHICH MAY DAMAGE WIRE MESH SCREEN.

(1) Place strainer in an ultrasonic cleaner filled with a solution of water and wetting agent, mixed per manufacturer's instructions.
(2) Sonic clean, as required, to remove contamination.
(3) Insert a light inside strainer to check results of cleaning procedure. Repeat procedure if any contaminants remain in screen. If inspection reveals that more than approximately 10 percent of filtering area remains contaminated after completion of the foregoing instructions, strainer must be replaced.

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ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSPECTION/CHECK−01

Task 72−00−41−990−001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts.Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (−) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (−) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
789	B	Diffuser Case Assembly (72−41−01) HPC Rear Case Assembly (72−35−69) (See Figure 801, Sheet 3)				
		Duffuser Case	32.248 (819.100)	32.252 (819.200)		
		HPC Case	32.242 (819.947)	32.246 (819.048)	.002T (0.051T)	.010T (0.254T)
790	B	Compressor Exit Stator Assembly (72−41−02) HPC (Rear) Stiffener (72−35−70) (See Figure 801, Sheet 3)				
		Stator	27.378 (695.402)	27.382 (695.502)		
		Stiffener	27.383 (695.529)	27.387 (695.629)	.001 (0.025)	.009 (0.229)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
791	B	HPC (Rear) Stiffener (72−35−70) Compressor Exit Stator Assembly (72−41−02) (See Figure 801, Sheet 3)				
		Stiffener	27.780 (705.612)	27.784 (705.713)		
		Stator	27.788 (705.816)	27.792 (705.916)	.004 (0.102)	.012 (0.305)
		FOR THESE MODELS: 4152, 4156A, 4158				
792	A	Drum Rotor (Stages 13, 14 and 15) Disk (Rear Hub) Assembly (72−35−08) Compressor Exit Stator Assembly (72−41−02) (See Figure 801, Sheet 3)				
		HPC Rotor	23.409 (594.59)	23.421 (594.89)		
		Stator	23.441 (595.401)	23.447 (595.554)	.020 (0.51)	.048* (1.22)*
		FOR THESE MODELS: 4152−3, 4156A−3, 4158−3				
792	A	HPC Drum Rotor (Rear) Disk Assembly (72−35−10) Compressor Exit Stator Assembly (72−41−02) (See Figure 801, Sheet 3)				
		HPC Rotor	23.409 (594.59)	23.421 (594.89)		
		Stator	23.441 (595.401)	23.447 (595.554)	.020 (0.51)	.048* (1.22)*
		FOR THESE MODELS: 4152, 4156A, 4158				
793	A	Drum Rotor (Stage 13, 14 and 15) Disk (Rear Hub) Assembly (72−35−08) Stage 15 HPC Air Sealing Ring Assembly (72−41−03) (See Figure 801, Sheet 1)				
		Radial Gap, Cold			.011 (0.279)	.024* (1.12*)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
		FOR THESE MODELS: 4152, 4156A, 4158				
794	A	Diffuser Airseal (72-35-32) Diffuser Air Sealing Ring Assembly (72-41-05) (See Figure 801, Sheet 1)				
		Radial Gap, Cold			.011 (0.279)	.024* (1.12*)
		FOR THESE MODELS: 4152, 4156A, 4158				
795	A	Drum Rotor (Stages 13, 14, 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Bearing Front Cooling Duct Assembly (72-41-06) (See Figure 801, Sheet 2)				
		HPC Rotor	7.986 (202.84)	7.998 (203.15)		
		Duct	8.098 (205.690)	8.102 (205.790)	.100 (2.54)	.126* (3.20)*
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
795	A	HPC Turbine Driveshaft (72-35-09) No. 3 Bearing Front Cooling Duct Assembly (72-41-06) (See Figure 801, Sheet 2)				
		Driveshaft	7.986 (202.84)	7.998 (203.15)		
		Duct	8.098 (205.690)	8.102 (205.790)	.100 (2.54)	.126* (3.20)*
796	A	No. 3 Bearing (Front) Face Seal Assembly (72-41-09)/And No. 3 Bearing (Rear)Face Seal Assembly (72-41-87) (See Figure 801, Sheet 2)				
		Height of Step			.075* (1.905)*	.147 (3.73)

ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSPECTION/CHECK−01

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
		FOR THESE MODELS: 4152, 4156A, 4158				
797	B	Drum Rotor (Stages 13, 14 and 15) Disk (Rear Hub) Assembly (72−35−08) No. 3 Bearing Front Seal Seat (72−41−80) (See Figure 801, Sheet 2)				
		HPC Rotor	7.229 (183.617)	7.231 (183.667)		
		Seal Seat	7.232 (183.693)	7.234 (183.743)	.001 (0.026)	.005 (0.127)
		FOR THESE MODELS: 4152, 4156A, 4158				
798	B	Drum (Stages 13, 14 and 15) Disk (Rear Hub) Assembly (72−35−08) No. 3 Bearing Seal Spacer (72−41−81) (See Figure 801, Sheet 2)				
		HPC Rotor	7.209 (183.109)	7.211 (183.159)		
		Spacer	7.212 (183.185)	7.214 (183.235)	.001 (0.026)	.005 (0.127)
		FOR THESE MODELS: 4152, 4156A, 4158				
799 (1)	A	Drum Rotor (Stages 13, 14 and 15) Disk (Rear Hub) Assembly (72−35−08) No. 3 Roller Bearing (72−41−82) (See Figure 801, Sheet 2)				
		HPC Rotor	7.2076 (183.0731)	7.2080 (183.0832)		
		Bearing (Pre SB PW4ENG 72−611)	7.2040 (182.9816)	7.2047 (182.9993)	.004T (0.101T)	.0029T (0.074T)
		FOR THESE MODELS: 4152, 4156A, 4158				
799 (2)	A	Drum Rotor (Stages 13, 14 and 15) Disk (Rear Hub) Assembly (72−35−08) No. 3 Roller Bearing (72−41−82) (See Figure 801, Sheet 2)				
		HPC Rotor	7.2076 (183.0731)	7.2080 (183.0832)		
		Bearing (Post SB PW4ENG 72−611)	7.2060 (183.0324)	7.2067 (183.0501)	.002T (0.051T)	.0009T (0.023T)

	I		New Part Reference Dimensions		Limits	
Ref. No.	F R	Description	Min	Max	Min	Max
		FOR THESE MODELS: 4152, 4156A, 4158				
800	B	Drum Rotor (Stages 13, 14 and 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Bearing Rear Seal Seat (72-41-84) (See Figure 801, Sheet 2)				
		HPC Rotor	7.1455 (181.496)	7.1465 (181.521)		
		Seal Seat	7.1475 (181.547)	7.1505 (181.622)	.001 (0.026)	.005 (0.127)
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
797	B	HPC Turbine Driveshaft (72-35-09) No. 3 Bearing Front Seal Seat (72-41-80) (See Figure 801, Sheet 2)				
		Driveshaft	7.229 (183.617)	7.231 (183.667)		
		Seal Seat	7.232 (183.693)	7.234 (183.743)	.001 (0.026)	.005 (0.127)
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
798	B	HPC Turbine Driveshaft (72-35-09) No. 3 Bearing Seal Spacer (72-41-81) (See Figure 801, Sheet 2)				
		Driveshaft	7.209 (183.109)	7.211 (183.159)		
		Spacer	7.212 (183.185)	7.214 (183.235)	.001 (0.026)	.005 (0.127)
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
799 (1)	A	HPC Turbine Driveshaft (72-35-09) No. 3 Roller Bearing (72-41-82) (See Figure 801, Sheet 2)				
		Driveshaft	7.2076 (183.0731)	7.2080 (183.0832)		
		Bearing (Pre SB PW4ENG 72-611)	7.2040 (182.9816)	7.2047 (182.9993)	.004T (0.101T)	.0029T (0.074T)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
		FOR THESE MODELS: 4152−3, 4156A−3, 4158−3				
799	A	HPC Turbine Driveshaft (72−35−09)				
(2)		No. 3 Roller Bearing (72−41−82)				
		(See Figure 801, Sheet 2)				
		Driveshaft	7.2076	7.2080		
			(183.0731)	(183.0832)		
		Bearing	7.2060	7.2067	.002T	.0009T
		(Post SB	(183.0324)	(183.0501)	(0.051T)	(0.023T)
		PW4ENG 72−611)				
		FOR THESE MODELS: 4152−3, 4156A−3, 4158−3				
800	B	HPC Turbine Driveshaft (72−35−09)				
		No. 3 Bearing Rear Seal Seat (72−41−84)				
		(See Figure 801, Sheet 2)				
		Driveshaft	7.1455	7.1465		
			(181.496)	(181.521)		
		Seal Seat	7.1475	7.1505	.001	.005
			(181.547)	(181.622)	(0.026)	(0.127)
801	A	No. 3 Bearing Housing (72−41−10)				
		No.3 Bearing Rear (Carbon) Seal				
		Assembly (72−41−85)				
		(See Figure 801, Sheet 2)				
		Housing	14.968	14.972		
			(380.188)	(380.288)		
		Seal	14.966	14.968	.000T	.006T
			(380.137)	(380.187)	(0.000T)	(0.152T)
802	A	Gasket Assembly (Chevron)				
		No. 3 Bearing Rear (Carbon) Seal				
		Assembly (72−41−85)				
		(See Figure 801, Sheet 2)				
		Axial (Pinch) Fit			.011T	0.25T
					(0.28T)	(0.64T)
803	A	No. 3 Bearing Rear Cooling Duct				
		Assembly (72−41−88)				
		No. 3 Bearing (Rear) Seal Ring Holder				
		Assembly (72−41−86)				
		(See Figure 801, Sheet 2)				
		Duct	8.342	8.344		
			(211.887)	(211.937)		
		Seal	8.338	8.342	.000T	.006T
			(211.786)	(211.886)	(0.000T)	(0.152T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
804	A	No. 3 Bearing Rear Cooling Duct Assembly (72-41-10)				
		No. 3 Bearing Housing (72-41-10)				
		(See Figure 801, Sheet 2)				
		Duct	17.449 (443.205)	17.453 (443.306)		
		Housing	17.443 (443.053)	17.447 (443.153)	.002T (0.051T)	.010T (0.254T)
806	A	Inner Combustion Assembly (72-51-05)				
		Outer Combustion Chamber Assembly (72-41-11)				
		(See Figure 801, Sheet 1)				
		Chamber (Inner)	23.233 (590.12)	23.243 (590.37)		
		Chamber (Outer)	23.224 (589.89)	23.234 (590.14)	.001 (0.03)	.019T (0.48T)
831 (1)	A	No. 3 Roller Bearing (72-41-82)				
		No. 3 Bearing Housing (72-41-10)				
		(See Figure 801, Sheet 2)				
		Bearing (Pre SB PW4ENG 72-611)	10.256 (260.503)	10.257 (260.527)		
		Housing	10.255 (260.477)	10.256 (260.502)	.000T (0.000T)	.002T (0.050T)
831 (2)	A	No. 3 Roller Bearing (72-41-82)				
		No. 3 Bearing Housing (72-41-10)				
		(See Figure 801, Sheet 2)				
		Bearing (Post SB PW4ENG 72-611)	10.257 (260.528)	10.258 (260.553)		
		Housing	10.255 (260.477)	10.256 (260.502)	.001T (0.026T)	.003T (0.076T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
852	A	Drum Rotor (Stages 13, 14 and 15) Disk Assembly (72-35-10) HPC Exit Brush Seal Support Assembly (72-41-39) (See Figure 801, Sheet 1) Radial Gap, Cold -	Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357			
853	A	Diffuser Case HPC - Diffuser Airseal (72-35-32) HPC (Rear) Exit Brush Seal Support Assembly (72-41-41) (See Figure 801, Sheet 1) Radial Gap, Cold -	Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357			

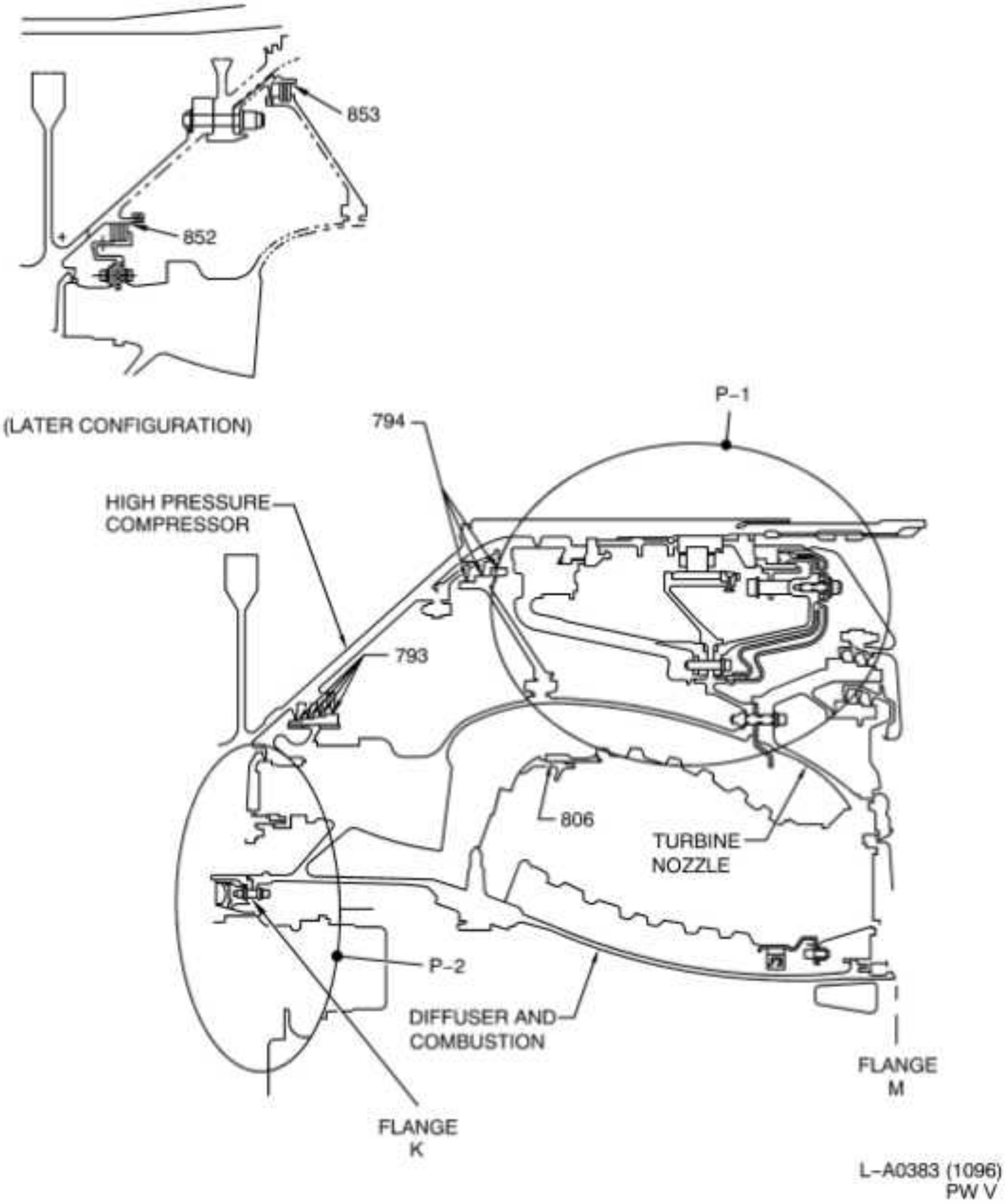
G. Special Torques

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
400	A	Igniter Plug Boss (See Figure 802) See 72-41-00, Assembly-01 Task 72-41-00-400-001				
401	A	Igniter Plug (See Figure 802) See 72-41-00, Assembly-01 Task 72-41-00-400-001				

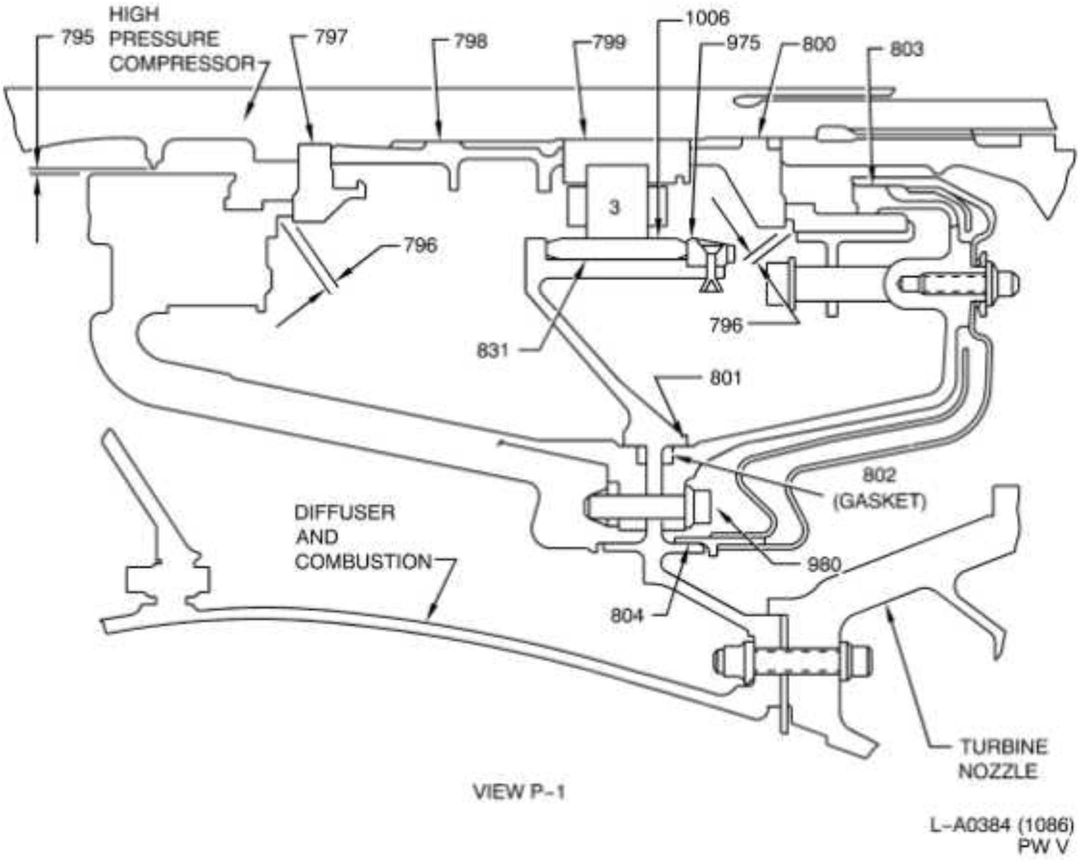
Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
975	A	No. 3 Bearing Outer Race Retaining Nut (See Figure 801, Sheet 2) See 72−00−41, Installation−15 Task 72−00−41−420−013 See 72−00−41, Installation−15 Task 72−00−41−420−017 See 72−00−41, Installation−16 Task 72−00−41−420−018 See 72−00−41, Installation−16 Task 72−00−41−420−019 See 72−00−41, Installation−17 Task 72−00−41−440−001 See 72−00−41, Installation−18 Task 72−00−41−440−002				
980		No. 3 Bearing Housing Bolts (See Figure 801, Sheet 2) See 72−00−41, Installation−03 Task 72−00−41−420−003 See 72−00−41, Installation−09 Task 72−00−41−420−004				
978	A	Peripher Bolts And Nuts At K−Flange (See Figure 801, Sheet 3) See 72−00−41, Installation−01 Task 72−00−41−420−001 See 72−00−41, Installation−12 Task 72−00−41−420−012				
2151	A	Hose/Tube Clamp Screws See 72−00−41, Installation−02 Task 72−00−41−420−002 See 72−00−41, Installation−04 Task 72−00−41−450−001 See 72−00−41, Installation−05 Task 72−00−41−450−002 See 72−00−41, Installation−07 Task 72−00−41−450−004 See 72−00−41, Installation−08 Task 72−00−41−450−005				
2165	A	PB Sense Line Coupling Nuts See 72−00−41, Installation−02 Task 72−00−41−420−002				

H. Special Assembly Procedures

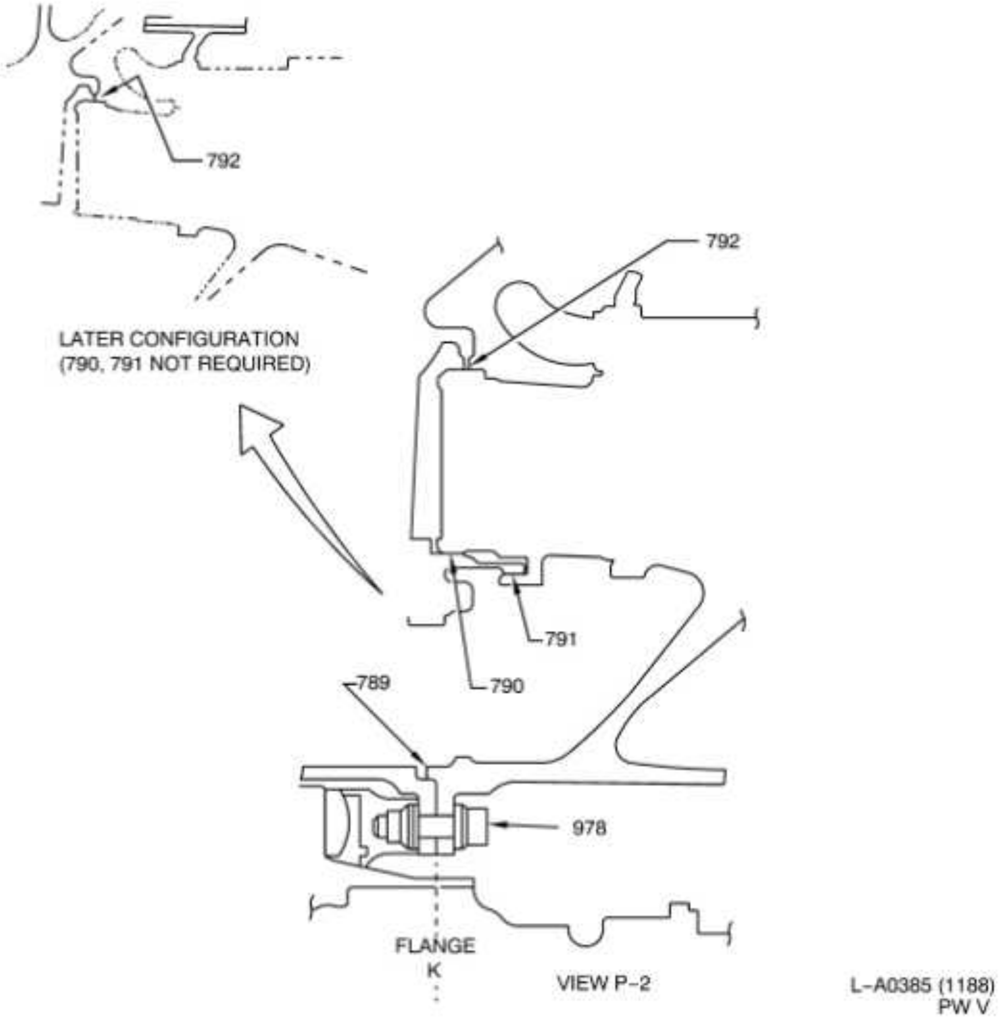
Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
365	A	Igniter Plug Fitting (See Figure 802) See 72−41−00, Assembly−01 Task 72−41−00−400−001				
1006	A	Procedure For Aligning No. 3 Bearing Outer Race With No. 3 Bearing Housing (See Figure 801, Sheet 2) See 72−41−00, Assembly−02 Task 72−41−00−400−002				
2261	A	Procedure For Assembling Diffuser Case Tube Locks See 72−00−41, Installation−02 Task 72−00−41−420−002 See 72−00−41, Installation−13 Task 72−00−41−450−006				


853
852
(LATER CONFIGURATION)
794
P−1
HIGH PRESSURE COMPRESSOR
793
806
TURBINE NOZZLE
P−2
DIFFUSER AND COMBUSTION
FLANGE M
FLANGE K
L−A0383 (1096)
PW V

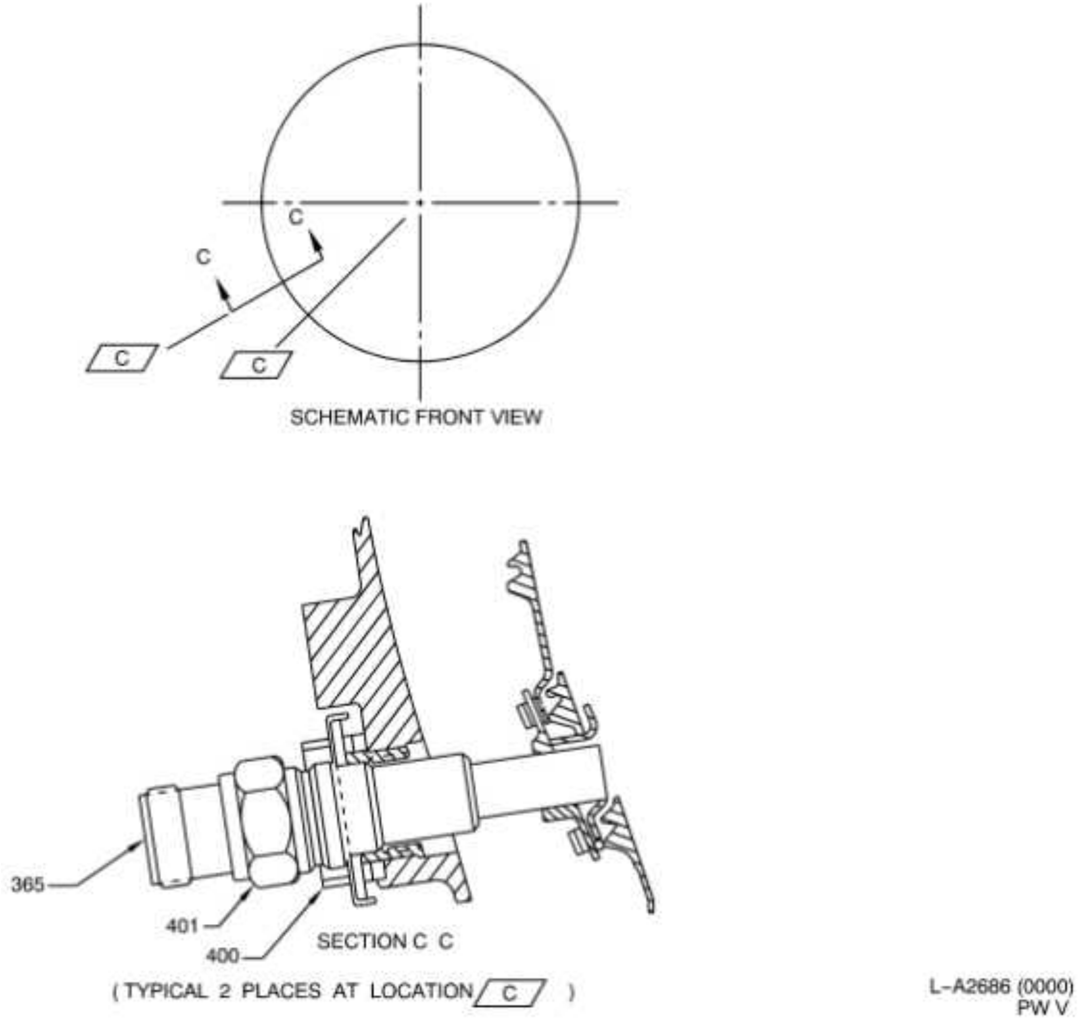
Diffuser And Combustion
Figure 801 (Sheet 1)
(Task 72−00−41−990−001)


HIGH PRESSURE COMPRESSOR
795
797
798
799
1006
975
800
803
3
796
796
831
801
802 (GASKET)
DIFFUSER AND COMBUSTION
980
804
TURBINE NOZZLE
VIEW P-1
L-A0384 (1086)
PW V

Diffuser And Combustion
Figure 801 (Sheet 2)
(Task 72−00−41−990−001)


792
LATER CONFIGURATION
(790, 791 NOT REQUIRED)
792
791
789
790
978
FLANGE
K
VIEW P−2
L−A0385 (1188)
PW V

Diffuser And Combustion
Figure 801 (Sheet 3)
(Task 72−00−41−990−001)


C
C
C
C
SCHEMATIC FRONT VIEW
365
401
400
SECTION C C
(TYPICAL 2 PLACES AT LOCATION C)
L−A2686 (0000)
PW V

Diffuser And Combustion
Figure 802
(Task 72−00−41−990−001)

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ENGINE GENERAL - DIFFUSER AND COMBUSTOR - INSPECTION/CHECK-02

Task 72-00-41-210-002:

1. Inspect Ignition System
   - A. Equipment And Materials Required - None
   - B. Procedure
     - (1) General
       - (a) Following procedures are normal inspection functions. Nature of engine operations determines time interval allowed between inspections.

WARNING: IGNITION SYSTEM IS DANGEROUSLY HIGH. IGNITION SWITCH MUST BE IN THE OFF POSITION BEFORE REMOVAL OF ANY IGNITION COMPONENTS. ALLOW SEVERAL MINUTES TO ELAPSE BETWEEN OPERATION OF THE IGNITION SYSTEM AND THE REMOVAL OF COMPONENTS. UPON DETACHING THE CABLE FROM THE IGNITER PLUG, DISCHARGE THE CURRENT BY GROUNDING THE CABLE TERMINAL TO ENSURE COMPLETE DISSIPATION OF ENERGY FROM THE SYSTEM. FAILURE TO FOLLOW THIS PROCEDURE COULD RESULT IN SEVERE INJURY TO PERSONNEL.

- (2) Inspect ignition system for security of components, wire braid fraying, and for obstruction of cooling air passages.
- (3) Inspect ignition exciter terminal well for arcing and tracking. See 72-00-61, Inspection/Check-01 (Task 72-00-61-210-001).
- (4) Inspect exciter-to-igniter plug cable terminal ends for arcing and tracking. See Inspection/Check-04 (Task 72-00-41-210-004).
- (5) Inspect igniter plug terminal well and tip erosion per Inspection/Check-03 (Task 72-00-41-210-003).

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - INSPECTION/CHECK-03

Task 72-00-41-210-003:

1. Inspect Igniter Plug
   A. Prerequisites
      (1) Clean igniter plug per Cleaning-01, (Task 72-00-41-160-001).
   B. Equipment And Materials Required

Standard Tools:

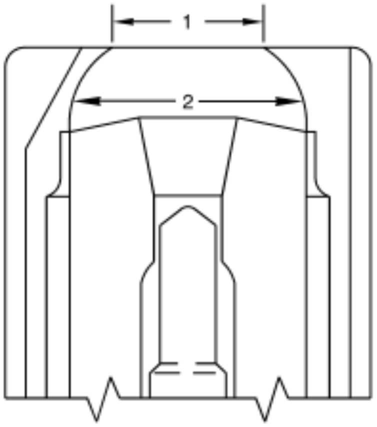
Name	Manufacturer
1.000-20NS Thread Chasing Die	Local Purchase
0.9375-16NS Thread Chasing Die	Local Purchase
Service Wear Measuring Tool CT-492 (or CT-468)	Local Purchase 900, Upton Toledo, OH 43801

   C. Procedure
      See Figures 801 and 802.
      (1) Visually inspect coupling threads and shell threads of igniter plug. Damaged threads can be cleaned-up using 1.000-20NS Thread Chasing Die for coupling threads and 0.9375-16NS Thread Chasing Die for shell threads.
      (2) Inspect ceramic for cracks on either end of plug. Any cracks in ceramic are cause for rejection of igniter plug. Internal ceramic breaks may be detected by shaking plug and listening for rattle.

CAUTION: WHEN PLUG IS EXCESSIVELY ERODED, BROKEN CERAMIC MAY BE INGESTED BY TURBINE.

      (3) Inspect plug for wear by using lighted magnifying glass looking through shell end annulus to determine if insulator supporting shoulder is worn through. Wear of Champion plugs may be measured using CT-492 (or CT-468) Service Wear Measuring Tool. See Figure 801.

NOTE: Visual determination of excessive wear is also a practical means of evaluating plug wear. Maximum outer shell ID erosion is a physical limit to prevent possible loss of ceramic retention by ground shell.



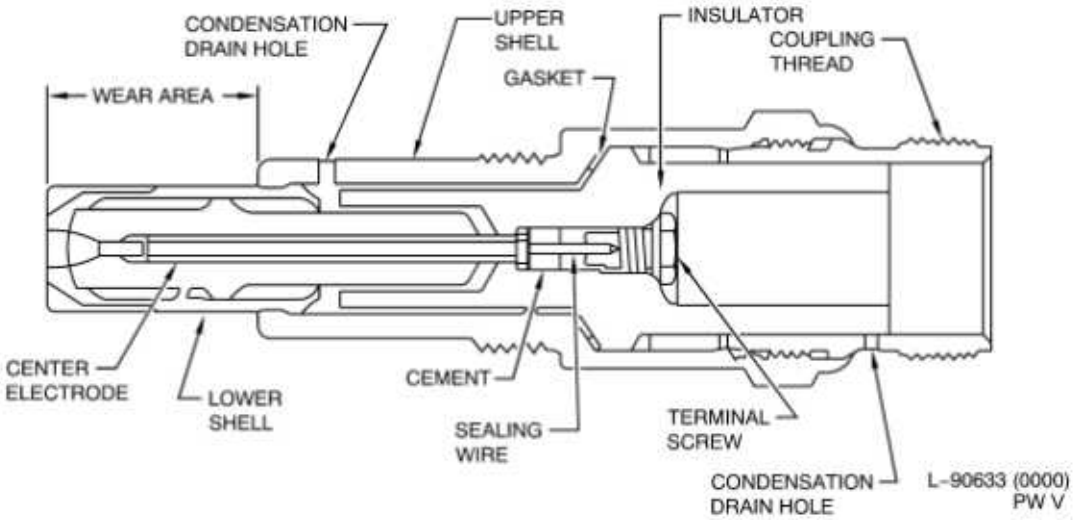
1. 0.300 Inch (7.620 mm) ID Maximum Outer Shell Erosion
2. 0.340 Inch (8.636 mm) ID Maximum Undercut Erosion

Igniter Plug Erosion
Figure 801
(Task 72−00−41−210−003)

(4) Inspect plugs for wear in area shown in Figure 802. Plugs worn beyond 0.030 inch (0.762 mm) depth in area shown shall be rejected.

NOTE: Igniter plug erosion is directly dependent upon ignition−on time. An igniter plug continuously firing will erode beyond acceptable limits in 250 − 300 hours. Installed igniter erosion life, as related to engine time, will therefore vary considerably between operators, dependent upon usage and flight length. Although igniters will continue to fire after exceeding erosion limits, the voltage required to achieve spark is increased to level that can stress other ignition components, particularly high tension leads.

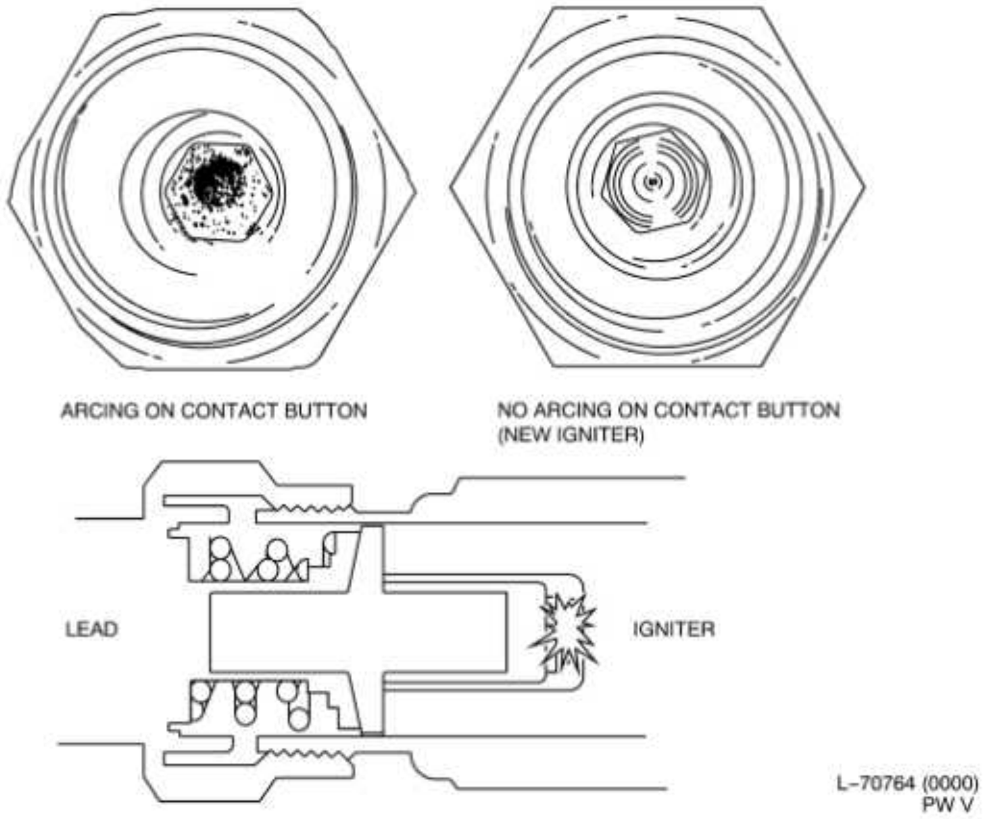
(5) Whenever high tension lead is removed from igniter plug terminal, inspect plug terminal well. Inspection should consist of following:


CONDENSATION DRAIN HOLE
UPPER SHELL
INSULATOR
COUPLING THREAD
GASKET
WEAR AREA
CENTER ELECTRODE
LOWER SHELL
CEMENT
SEALING WIRE
TERMINAL SCREW
CONDENSATION DRAIN HOLE
L−90633 (0000)
PW V

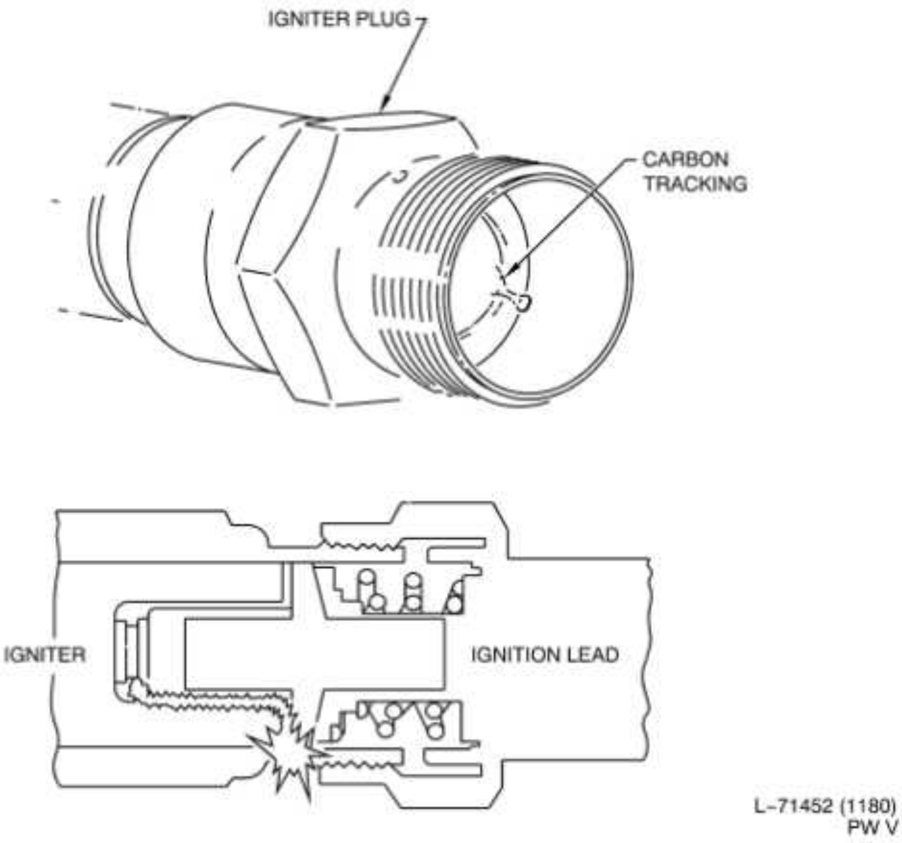
Igniter Plug Wear Limit
Figure 802
(Task 72−00−41−210−003)

(a) Inspect plug terminal well for evidence of arcing and/or flashover. Arcing is identified by pitting or discoloration on contact button. See Figure 803. Minor arcing can be removed per Cleaning−01, (Task 72−00−41−160−001). Flashover is identified by carbon tracking. See Figure 804. If any of these indications are evident, replace plug.

(b) Inspect plug terminal well for presence of oil, dirt and conductive contaminants. Remove contamination per Cleaning−01, (Task 72−00−41−160−001).


ARCING ON CONTACT BUTTON
NO ARCING ON CONTACT BUTTON (NEW IGNITER)
LEAD
IGNITER
L−70764 (0000)
PW V

Arcing On Contact Button
Figure 803
(Task 72−00−41−210−003)


IGNITER PLUG
CARBON TRACKING
IGNITER
IGNITION LEAD
L−71452 (1180)
PW V

Flashover On Ceramic Insulator
Figure 804
(Task 72−00−41−210−003)

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - INSPECTION/CHECK-04

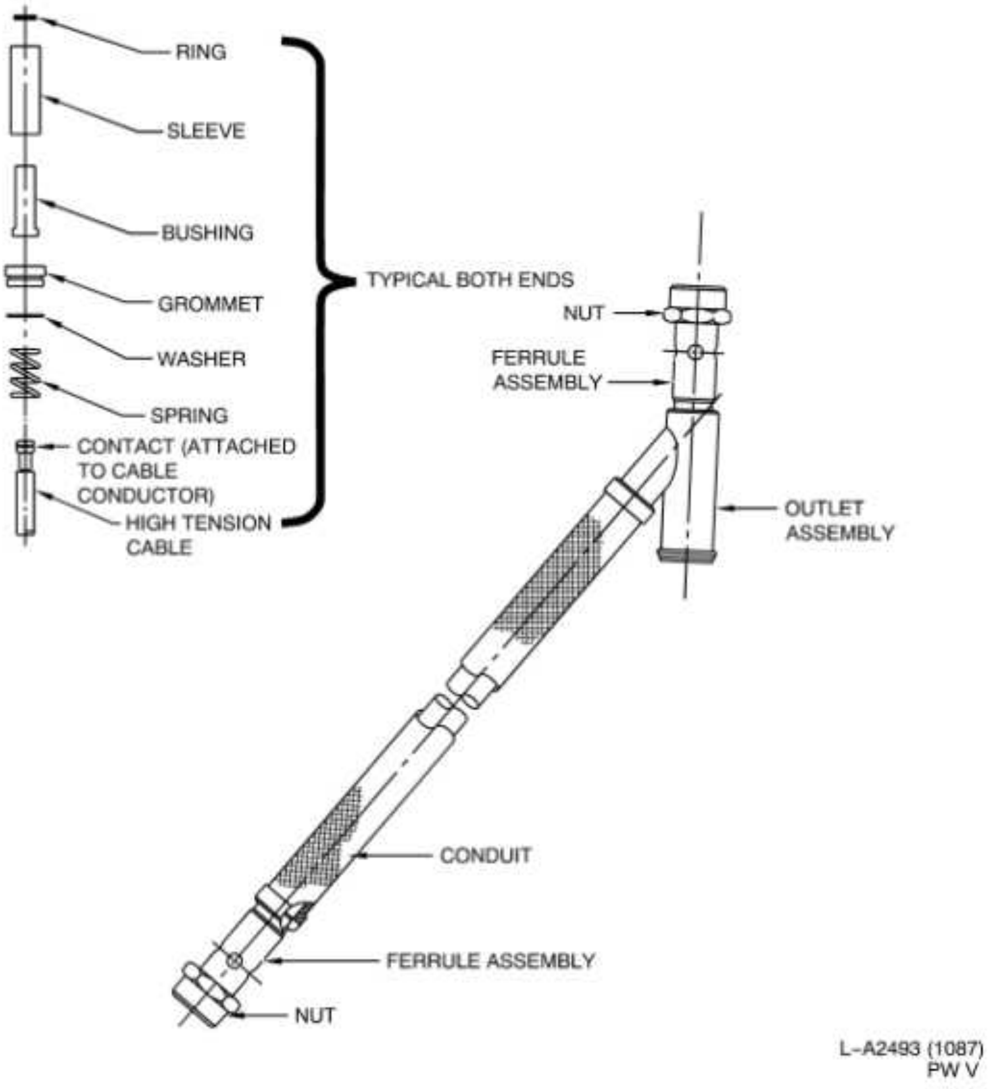
Task 72-00-41-210-004:

1. Inspect Exciter-To-Igniter Plug Cable
   - A. Prerequisites
     - (1) Remove exciter-to-igniter plug cable. See Removal-04, (Task 72-00-41-050-001) or Removal-05 (Task 72-00-41-050-002).
   - B. Equipment And Materials Required - None
   - C. Procedure

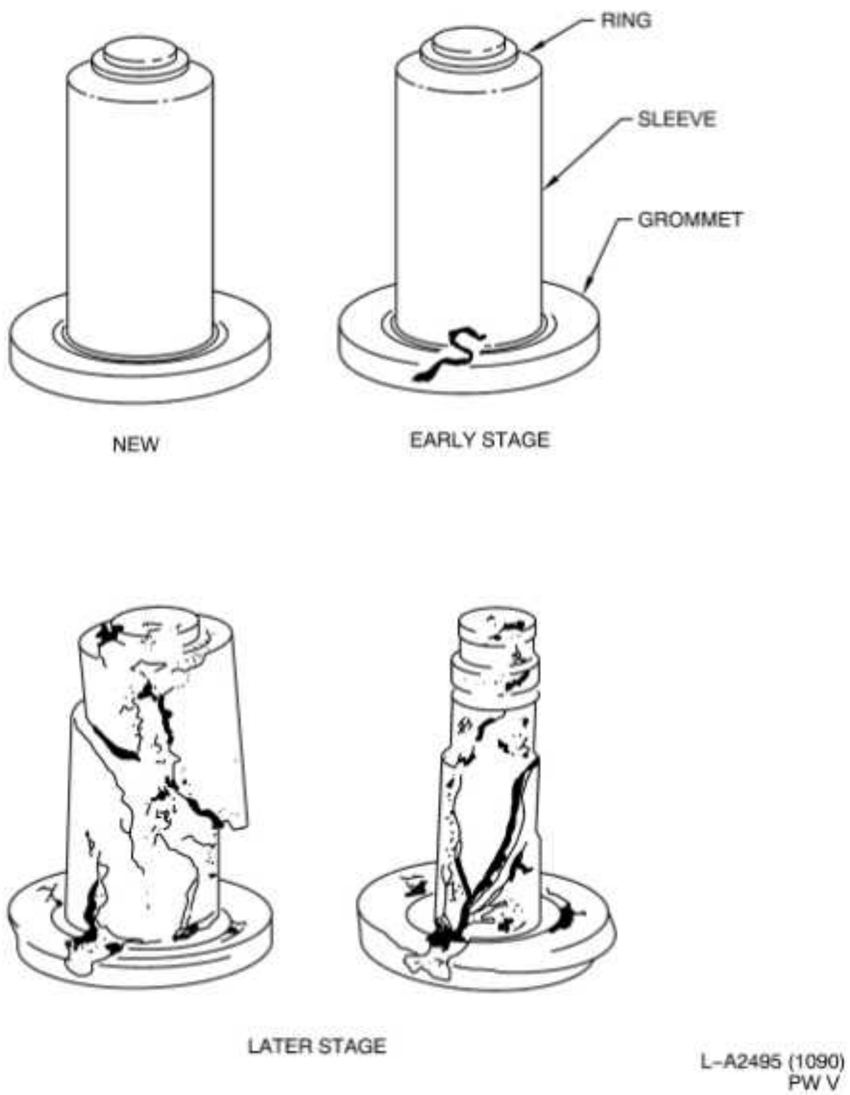
     See Figures 801 and 802.
     - (1) General
       - (a) Inspect conduit for cuts, abrasions, or other damage.
     - (2) Inspect high tension contact, sleeve, rubber bushing, and cable insulation. See Removal-04, (Task 72-00-41-050-001) or Removal-05 (Task 72-00-41-050-002).

       CAUTION: DO NOT BEND OR PULL HIGH TENSION CABLE. INSULATION WILL BE DAMAGED.

       - (a) During grommet replacement, inspect for evidence of arcing or flashover on high tension contact, sleeve, and rubber bushing. Arcing is identified by pitting and discoloration. Flashover is identified by carbon tracking. If major pitting of contact is evident, replace cable. Forward removed cable to appropriate facility for repair. See Figure 802. Minor discoloration and pitting of contact can be cleaned per Cleaning-02, (Task 72-00-41-160-002).
         - 1 If high tension sleeve shows carbon tracking, clean per Cleaning-02, (Task 72-00-41-160-002).
         - 2 If rubber bushing is hard, brittle, cracked, or shows evidence of carbon tracking, remove it. See Removal-04, (Task 72-00-41-050-001) or Removal-05 (Task 72-00-41-050-002). Inspect high tension cable insulation.
           - a If high tension cable insulation is hard, brittle, or cracked, replace cable. Forward removed cable to appropriate facility for repair.
           - b If high tension cable is serviceable, replace rubber bushing.
         - 3 Inspect for presence of oil, dirt, or conductive contaminants on exposed parts. Clean cable per Cleaning-02, (Task 72-00-41-160-002).
     - (3) Inspect cable following rapid shut down.


RING
SLEEVE
BUSHING
GROMMET
WASHER
SPRING
CONTACT (ATTACHED TO CABLE CONDUCTOR)
HIGH TENSION CABLE
TYPICAL BOTH ENDS
NUT
FERRULE ASSEMBLY
OUTLET ASSEMBLY
CONDUIT
FERRULE ASSEMBLY
NUT
L-A2493 (1087)
PW V

Exciter−To−Igniter Plug Cable
Figure 801
(Task 72−00−41−210−004)


RING
SLEEVE
GROMMET
NEW
EARLY STAGE
LATER STAGE
L−A2495 (1090)
PW V

Cable Ceramic Insulator
Flashover Damage
Figure 802
(Task 72−00−41−210−004)

(a) Whenever an engine is rapidly shut down, ignition system may not be sufficiently cooled. Inspect cables, particularly at igniter plug terminal, to ensure that excessive temperatures did not affect lead insulation or rubber bushings in a manner that may result in arcing, flashover, and carbon tracking.

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ENGINE GENERAL - DIFFUSER AND COMBUSTOR - INSPECTION/CHECK-05

Task 72-00-41-210-005:

1. Inspect Fuel Distribution Valve Strainer
    - A. Prerequisites
        - (1) Remove fuel distribution valve strainer per Removal-10.
    - B. Equipment And Materials Required - None
    - C. Procedure
        - (1) Inspect strainer for evidence of damage or an accumulation of contamination.
        - (2) Clean strainer per Cleaning-03 or -04.
        - (3) In the presence of heavy contamination, inspect upstream filter element in fuel pump per 72-00-61, Inspection/Check-03.
    - D. Postrequisites
        - (1) Install fuel distribution valve strainer per Installation-10.

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ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSPECTION/CHECK−06

Task 72−00−41−750−001:

1. Test Igniter Plug (Audible Check)
   - A. Equipment And Materials Required − None
   - B. Procedure

CAUTION: PRIOR TO AUDIBLE CHECK, MOTOR ENGINE IF UNBURNED FUEL IN ENGINE IS SUSPECTED. UNBURNED FUEL COULD RESULT IN AN INTERNAL ENGINE FIRE OR TAILPIPE FIRE.

DO NOT ALLOW ENGINE N2 ROTATION DURING IGNITER AUDIBLE CHECK. WITH N2 ROTATION, FUEL ENTRY INTO COMBUSTION CHAMBER IS POSSIBLE WHEN START LEVER IS ADVANCED TO IDLE AND INADVERTENT LIGHTUP DURING IGNITER CHECK COULD RESULT.

(1) Perform audible check of each igniter plug to confirm that plug is operating. Check each system individually by applying power to one side at a time.

NOTE: Audible check is not positive proof that igniter is functioning. Snapping sound may result from spark jumping in an area other than igniter tip.

(2) After audible check has been completed, position engine ignition switch to OFF position.

ENGINE GENERAL - DIFFUSER AND COMBUSTOR - INSPECTION/CHECK-07

Task 72-00-41-720-001:

1. No. 3 Bearing Compartment Vacuum Check

A. Equipment And Materials Necessary

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

CTE 6075	Vacuum Cart
PWA 85569	Adapter (Pre SB PW4ENG 72-127)
PWA 86136	Adapter (Post SB PW4ENG 72-127)

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
R P06-054	Paste, Antiseize (PWA 36246)

B. Procedure

NOTE: No. 3 bearing compartment vacuum check must be performed following each diffuser and combustor installation.

NOTE: Vacuum check may be performed on engines without having diffuser and combustor replaced by disconnecting and subsequently re-connecting tubes as specified in the following text.

(1) If necessary, disconnect No. 3 bearing scavenge tube (LR04) as follows.

(a) Remove lockwire and disconnect nut securing scavenge from No. 3 bearing (internal) scavenge tube on diffuser case at approximately 6:30 o'clock position.

(b) Loosen bolts securing tube clamps as necessary.

(c) Loosen bolts securing tube to oil pump on gearbox as necessary.

(2) If necessary, disconnect No. 3 bearing oil pressure tube (LP19) as follows.

   (a) Remove lockwire and disconnect nut securing pressure tube to No. 3 bearing oil pressure (internal) tube on diffuser case at approximately 10 o'clock position.

   (b) Loosen bolts securing tube clamps as necessary.

   (c) Loosen nut securing strainer housing to (front) oil pressure tube.

(3) If necessary, disconnect No. 3 bearing breather tube (LB03) as follows.

   (a) Remove lockwire and disconnect nut securing breather tube to No. 3 bearing breather (internal) tube on diffuser case at approximately 1 o'clock position.

   (b) Loosen bolts securing tube clamps as necessary.

   (c) Loosen coupling nut securing tube to (lower) breather tube as necessary.

(4) Install plug MS24404-10, threads lubricated with Engine Oil P03-001, onto No. 3 bearing (internal) scavenge tube located at approximately 6:30 o'clock position. Torque plug to 200 lb-in. (22.597 N.m).

(5) Install cap PN AN929-8, threads lubricated with Engine Oil P03-001 onto oil pressure (internal) tube on diffuser case at approximately 10 o'clock position. Torque plug to 200 lb-in. (22.597 N.m).

(6) Install PWA 85569 Adapter (Pre SB PW4ENG 72-127) or PWA 86136 Adapter (Post SB PW4ENG 72-127), threads lubricated with Engine Oil P03-001 to No. 3 bearing breather (internal) tube on diffuser case at 1 o'clock position. Torque nut to 200 lb-in. (22.597 N.m). See Figure 801.

(7) Vacuum check No. 3 bearing compartment as follows.

   (a) Connect vacuum hose and pressure sense line from CTE 6075 Vacuum Cart to their respective threaded holes in Adapter (PWA 85569) or (PWA 86136).

(b) Vacuum check No. 3 bearing compartment with the vacuum cart pressure set at PAMB minus 10 psi (69 kPa), or PAMB minus 20 inches (508 mm) HG. At sea level this is 5.0 psia (34.5 kPa absolute).

(c) Airflow must not exceed 15 lbs. (6.80 Kg) per hour.

(d) Shut off vacuum. Disconnect lines from adapter.

(8) Remove plug, cap and adapter from tubes located at 6:30, 10, and 1 o'clock positions respectively. Install protective closures.

(9) If previously disconnected to perform vacuum check, reconnect No. 3 bearing scavenge tube (LR04) as follows.

(a) Remove protective closure and lubricate threads on scavenge tube elbow with Engine Oil P03−001. Connect tube to No. 3 bearing (internal) scavenge tube at approximately 6 o'clock position. Tighten nut handtight only.

(b) Lubricate threads of bolt securing clamp. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Using Engine Oil P03−001, lubricate threads of bolts securing tube to port on main oil pump. Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(d) Torque diffuser case internal tube nut to 650 − 700 lb−in. (73.440 − 79.089 N.m), while holding manifold elbow from turning. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(10) If previously disconnected to perform vacuum check, reconnect No. 3 bearing pressure tube (LP19) as follows.

(a) Remove protective closures and lubricate
R tube nut threads with Antiseize Paste P06−054.
Lubricate strainer housing coupling threads with
R Antiseize Paste P06−054. Wipe off unwanted
paste. Attach tube nut to diffuser case No. 3
bearing (internal) pressure tube at approximately
10 o'clock position. Tighten nuts securing tube
handtight only.

(b) Lubricate threads of previously loosened clamp bolts with Engine Oil P03−001. Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Torque tube nut attached to diffuser case internal tube coupling to 450 − 500 lb−in. (50.843 − 56.492 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(d) Torque manifold nut to strainer housing to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292. Position spray shield to inboard side of connection and secure to manifold with hose clamp. Torque hose clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

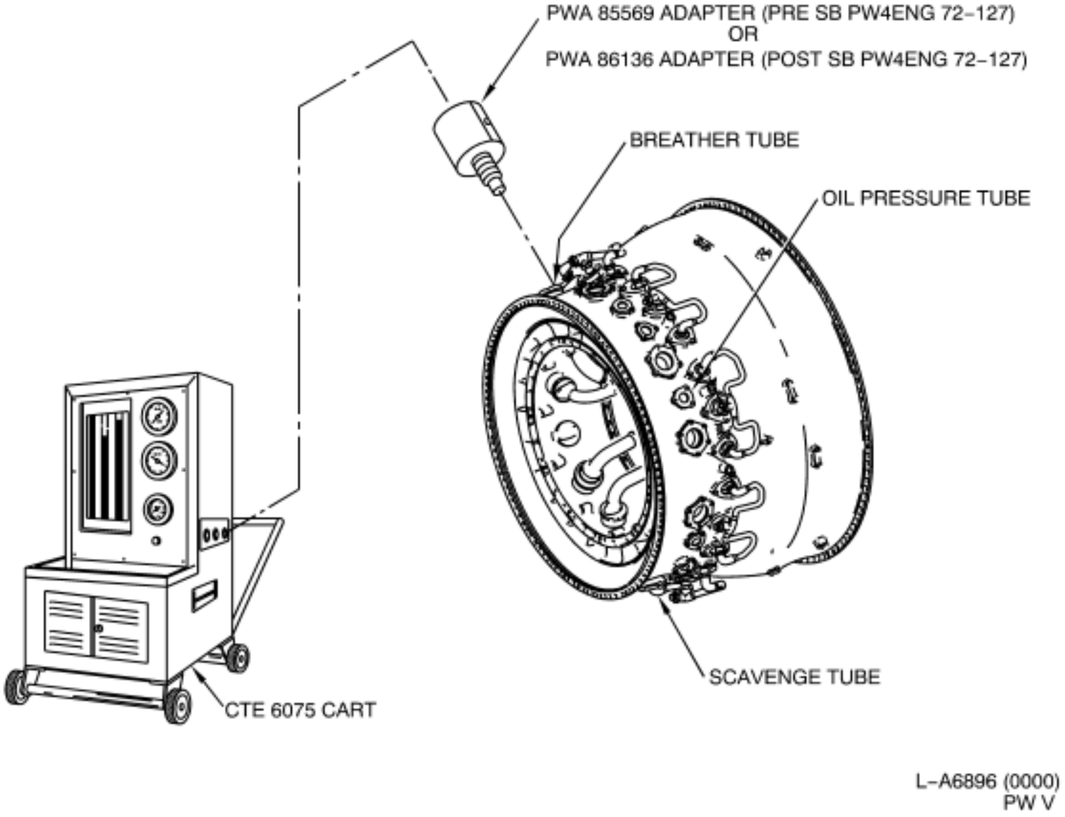
(11) If previously disconnected to perform vacuum check, reconnect the (upper) No. 3 bearing breather tube (LB03) as follows.

(a) Remove protective closures and lubricate threads on breather tube elbow with Engine Oil P03−001. Connect tube to No. 3 bearing (internal) breather tube at approximately 1 o'clock position on diffuser case. Tighten nut handtight only.

(b) Tighten bolts, threads lubricated with Engine Oil P03−001, securing clamps. Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Torque diffuser case internal tube nut to tube elbow to 650 − 700 lb−in. (73.440 − 79.089 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

R (d) Lubricate threads of tube coupling with Antiseize
R Paste P06−054. Wipe off unwanted paste. Torque tube nut to 675 − 750 lb−in. (76.265 − 84.739 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.


PWA 85569 ADAPTER (PRE SB PW4ENG 72−127)
OR
PWA 86136 ADAPTER (POST SB PW4ENG 72−127)
BREATHER TUBE
OIL PRESSURE TUBE
SCAVENGE TUBE
CTE 6075 CART
L−A6896 (0000)
PW V

Vacuum Check
Figure 801
(Task 72−00−41−720−001)

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ENGINE GENERAL − DIFFUSER AND COMBUSTOR − INSPECTION/CHECK−08

Task 72−00−41−210−008:

1. Visually Inspect Diffuser And Combustion Areas

   A. Equipment And Materials Required − None

   B. General Inspection Requiremnts

      (1) The following guidelines are provided for visual inspection to determine the serviceability of the diffuser and combustion areas which may be exposed during a partial engine disassembly.

      (2) Visually inspect the diffuser and combustion areas for obvious surface defects and/or deformations which will preclude the proper functioning of any of the parts. If defects are noted on any of the parts see the individual part section for damage limits.

      (3) Do a visual inspection of the combustion chamber liner segments, bulkhead liner segments and fuel injector guide heat shields for damaged or missing thermal barrier coating.

         (a) Any quantity of missing thermal barrier coating is permitted. However, the rate of deterioration of these parts will increase with higher levels of missing coating.

         (b) Cracks and damage in areas with missing thermal barrier coating must be within individual part section damage limits.

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Task 72-00-41-210-010:

1. Visually Examine The Diffuser And Combustor Module Assembly - Engine General - Diffuser And Combustor

A. Equipment And Materials Necessary - None

B. General Inspection Limits

NOTE: All applicable Airworthiness Directives (ADs) must be complied with and these directives take precedence over all inspections or repairs given in this module inspection.

(1) This inspection does not permit time since overhaul to be set to zero. The use of the limits in this inspection will not give the performance restoration.

(2) These procedures give instructions for the visual inspection of the diffuser and combustor module assembly after removal from the engine. Do these procedures before you do the preservation, packing or module installation procedure. The purpose of these procedures is to find apparent types of damage, which can make it necessary to do more disassembly, inspection or repair.

(3) The inspection table in this section is applicable to the diffuser and combustor modules with some, none or all of the components installed. You do not have to disassemble the module assembly to do this inspection. You can choose to apply individual limits to those areas that are visible at all stages of disassembly. If a condition shows that there can be damage that you cannot see, remove a component to fully examine the damaged area. Use the applicable procedures in this manual to remove the component.

(4) Remove all the components that you find not serviceable at the modular level. Send the applicable components for more inspection and repair at the component level maintenance. Refer to Section 72-41-00 in the PW4000 Series CIR, PN 51A357. All components that you remove from the diffuser and combustor module, after the module removal from the engine, will need a Cleaning, Inspection and Repair Manual component level inspection/check.

R (5) Unless given differently, closed areas without tolerance given in this section are to corners, points of tangency between the surfaces or at the points opposite to one of these locations. Closed areas will have a tolerance of plus 0.125 inch (3.175 mm) in all directions unless adjacent areas are given as areas where damage is not permitted.

R C. Procedure

R (1) Examine the diffuser case. See Table 801, Figure 801 (Sheet 1) and Figure 801 (Sheet 2).

R (2) Examine the diffuser case bosses. See Table 802, Figure 802 (Sheet 1) and Figure 802 (Sheet 2).

R (3) Examine the HPC exit stator assembly. See Table 803 and Figure 803.

R (4) Examine the Stage 5 HPC airsealing ring assembly and front HPC exit brush seal support assembly. See Table 804 and Figure 804.

R (5) Examine the No. 3 bearing housing. See Table 805 and Figure 805.

R (6) Examine the rear HPC exit brush seal support assembly or diffuser airsealing ring assembly. See Table 806, Figure 806 (Sheet 1) and Figure 806 (Sheet 2).

R (7) Examine the double-pass outer combustion chamber configuration. See Table 807, Figure 807 (Sheet 1) and Figure 807 (Sheet 2).

R (8) Examine the talon configuration outer combustion chamber. See Table 808, Figure 808 (Sheet 1) and Figure 808 (Sheet 2).

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
All diffuser case surfaces for: See Figure 801 (Sheet 1) and Figure 801 (Sheet 2)			
1 Nicks, dents and scratches (Inner wall only)	0.010 Inch (0.254 mm) maximum depth is permitted with no sharp edges or burrs. 0.500 inch (12.700 mm) maximum length. No damage in the fillet radii without repair.	0.020 inch (0.508 mm) maximum depth. See the repair for minimum wall thickness, fillet radius and flange repair limits.	Refer to Section 72−41−01, Repair−14 in the PW4000 Series CIR, PN 51A357
2 Nicks, dents and scratches (Outer wall only)	0.010 Inch (0.254 mm) maximum depth is permitted with no sharp edges or burrs. 0.500 inch (12.700 mm) maximum length. No damage in the fillet radii without repair.	Contact Pratt & Whitney for disposition	
1 and 2 Surface burns	Not permitted		

Diffuser Case Visual Inspection
Table 801

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
3 Crack indications on the rear outer flange (Other than boltholes)	0.016 inch (0.406 mm) maximum length is permitted with 0.240 inch (6.096 mm) minimum separation	See Repair-14 for blend limits or Repair-54 for weld repair	Refer to Section 72-41-01, Repair-14 or Repair-54 in the PW4000 Series CIR, PN 51A357
4 Crack indications on rear outer flange (Bolthole cracks)			
Extending radially out	Not permitted	See Repair-14 for blend limits or Repair-54 for weld repair	Refer to Section 72-41-01, Repair-14 or Repair-54 in the PW4000 Series CIR, PN 51A357
Extending radially in	Not permitted	See the repair	Refer to Section 72-41-01, Repair-37 in the PW4000 Series CIR, PN 51A357
5 For cracks	No cracks are permitted	0.020 inch (0.508 mm) maximum depth of blend to remove damage	Refer to Section 72-41-01, Repair-14 or Repair-30 in the PW4000 Series CIR, PN 51A357

Diffuser Case Visual Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
6			
All inner diameter and outer diameter bolt flanges	Not permitted	0.008 inch (0.203 mm) maximum depth locally	Refer to Section 72-41-01, Repair-14 in the PW4000 Series CIR, PN 51A357
7			
Stage 1 HPT vane support mating diameter and slots for damage, wear and galling	0.010 inch (0.254 mm) maximum depth locally for full circumference. No raised material. The average mating diameter must be in limits. Refer to Section 72-41-01, Inspection/ Check-04 in the PW4000 Series CIR, PN 51A357 for dimensional inspection.	Raised material only	Refer to Section 72-41-01, Repair-14 in the PW4000 Series CIR, PN 51A357
Plasma coat on Stage 1 HPT vane support rear face	A maximum of 85 percent of total surface area can be missing	All quantities	Refer to Section 72-41-01, Repair-45 in the PW4000 Series CIR, PN 51A357

Diffuser Case Visual Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
8 Stage 15 compressor stator mating diameter for damage, wear and galling	0.010 inch (0.254 mm) maximum depth locally for full circumference. No raised material. The average mating diameter must be in limits. Refer to Section 72−41−01, Inspection/ Check−04 in the PW4000 Series CIR, PN 51A357 for dimensional inspection.	Raised material only	Refer to Section 72−41−01, Repair−14 in the PW4000 Series CIR, PN 51A357
9 Locating pin for damage or looseness	Not permitted	All quantities	Replace the pin. Refer to Section 72−41−01, Repair−02 in the PW4000 Series CIR, PN 51A357.
10 Gangnut assemblies for damaged threads or looseness	Not permitted	All quantities	Replace the gangnut. Refer to Section 72−41−01, Repair−15 in the PW4000 Series CIR, PN 51A357

Diffuser Case Visual Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
11 Strut leading edge for nicks, dents and scratches	Not permitted	0.080 inch (2.032 mm) maximum axial depth	Refer to Section 72−41−01, Repair−14 in the PW4000 Series CIR, PN 51A357
12 Strut airfoil surface for nicks, dents and scratches	Not permitted	0.010 inch (0.254 mm) maximum depth	Refer to Section 72−41−01, Repair−14 in the PW4000 Series CIR, PN 51A357
13 Pre−diffuser clearance holes and strut surface for cracks	One crack 0.250 inch (6.350 mm) axial length maximum	All quantities for Repair−30 and Repair−31. 0.500 inch (12.700 mm) maximum length for Repair−51.	Refer to Section 72−41−01, Repair−30, Repair−31 and Repair−51 in the PW4000 Series CIR, PN 51A357

Diffuser Case Visual Inspection
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Diffuser case outer diameter bosses for nicks, scratches, wear and galling in: See Figure 802 (Sheet 1)			
Area 1	Not permitted	0.008 inch (0.203 mm) locally with no raised material	Refer to Section 72-41-01, Repair-14 in the PW4000 Series CIR, PN 51A357
Area 2	Not permitted	0.020 inch (0.508 mm) maximum depth	Refer to Section 72-41-01, Repair-14 in the PW4000 Series CIR, PN 51A357
Area 3	Not permitted	0.015 inch (0.381 mm) maximum depth	Refer to Section 72-41-01, Repair-14 in the PW4000 Series CIR, PN 51A357
4 Large and small service boss helical inserts for damage or looseness	Not permitted	All quantities	Refer to Section 72-41-01, Repair-33 in the PW4000 Series CIR, PN 51A357

Diffuser Case Bosses Visual Inspection
Table 802

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	5 Igniter boss threads for damage	Not permitted	All quantities	Refer to Section 72-41-01, Repair-55 in the PW4000 Series CIR, PN 51A357
R	6 Fuel nozzle boss threaded insert for damage or looseness	Not permitted	All quantities	Refer to Section 72-41-01, Repair-16 and Repair-40 in the PW4000 Series CIR, PN 51A357
R	7 Airframe dogbone pads for damaged or loose threaded inserts	Not permitted	All quantities	Refer to Section 72-41-01, Repair-34 and Repair-42 in the PW4000 Series CIR, PN 51A357
R	Diffuser case inner diameter service bosses for wear and galling in: See Figure 802 (Sheet 2)			
R	Area 8 Seal ring contact surfaces for galling	0.025 inch (0.635 mm) maximum depth for an arc of 60 degrees maximum with no raised material	Raised material only	Refer to Section 72-41-01, Repair-14 in the PW4000 Series CIR, PN 51A357

R Diffuser Case Bosses Visual Inspection
R Table 802 (Continued)

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Area 9			
R	Outside surfaces for damage	Not permitted	0.020 inch (0.508 mm) maximum depth	Refer to Section 72−41−01, Repair−14 in the PW4000 Series CIR, PN 51A357

R Diffuser Case Bosses Visual Inspection
R Table 802 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Compressor exit stator outer shroud for: See Figure 803			
1	0.100 inch (2.540 mm) (reference)		
2	0.100 inch (2.540 mm) (reference)		
3	0.250 inch (6.350 mm) (reference)		
4 Outer diameter surface damage and wear	0.020 Inch (0.508 mm) maximum depth for the front 0.500 inch (12.700 mm) with no sharp edged or raised material	Remove the sharp edges and raised material only	Refer to Section 72−41−02, Repair−02 in the PW4000 Series CIR, PN 51A357
5 Front face wear or damage	0.020 inch (0.508 mm) maximum depth with no sharp edges or raised material	Remove the sharp edges and raised material only	Refer to Section 72−41−02, Repair−02 in the PW4000 Series CIR, PN 51A357
		Less than 0.600 sq−in (387. sq−mm) and 0.100 inch (2.540 mm) maximum depth for a maximum of four locations	Refer to Section 72−41−02, Repair−10 in the PW4000 Series CIR, PN 51A357

HPC Exit Stator Assembly Visual Inspection
Table 803

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
6 Circumferential cracks	0.075 inch (1.905 mm) maximum length if minimum separation from the adjacent cracks is twice their combined length	0.375 inch (9.525 mm) maximum length	Refer to Section 72-41-02, Repair-06 in the PW4000 Series CIR, PN 51A357
7 Axial cracks	0.150 inch (3.810 mm) maximum length if minimum separation from the adjacent cracks is twice their combined length and crack does not continue into the leading or trailing edge of the shroud	0.375 inch (9.525 mm) maximum length	Refer to Section 72-41-02, Repair-06 in the PW4000 Series CIR, PN 51A357
8 Axial through-wall crack that will start at the leading or trailing edge	Not permitted	One crack 0.700 inch (17.780 mm) maximum length and must not extend into a vane slot	Refer to Section 72-41-02, Repair-09 in the PW4000 Series CIR, PN 51A357

NOTE: Shroud cracks to the maximum limit are permitted on both concave and convex sides of the same vane.

NOTE: There is no limit to the number of circumferential or axial cracks from the same vane slot.

NOTE: If the total length put together of all cracks is 15.000 inches (381.000 mm) or more,

HPC Exit Stator Assembly Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	than the cracks cannot be repaired and the part must be removed from service.		
Compressor exit stator inner shroud for:			
9 Shroud mounting flange front face for damage	0.010 inch (0.254 mm) maximum depth with no sharp edges or raised material	Remove sharp edges or raised material only	Refer to Section 72-41-02, Repair-02 in the PW4000 Series CIR, PN 51A357 Weld repair the boltholes. Refer to Section 72-41-02, Repair-08 in the PW4000 Series CIR, PN 51A357.
Inner shroud, inner airseal honeycomb for:			
Honeycomb knife-edge groove wear	0.050 inch (1.270 mm) maximum depth and 0.125 inch (3.175 mm) axial width	All quantities	Refer to Section 72-41-02, Repair-03 in the PW4000 Series CIR, PN 51A357
Deformed leading and trailing edge cells	0.125 inch (3.175 mm) maximum axial width to a maximum of 50 percent of the circumference. Damage must not	All quantities	Refer to Section 72-41-02, Repair-03 in the PW4000 Series CIR, PN 51A357

HPC Exit Stator Assembly Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	extend into the knife-edge wear groove.		
Honeycomb gouges, nicks or tears in other areas	All quantities less than 0.250 inch (6.350 mm) circumferential length to a maximum of 3.00 sq-in (1935. sq-mm) total damaged area	All quantities	Refer to Section 72-41-02, Repair-03 in the PW4000 Series CIR, PN 51A357
	All quantities 0.250 inch (6.350 mm) to 0.500 inch (12.700 mm) circumferential length with a 0.100 inch (2.540 mm) minimum separation and a 3.000 sq-in (1935. sq-mm) total damaged area		
10 Disbonded cells	50 percent of the peripheral cells on all the single segments to a maximum of half of the cell width from the edge. Ignore the cells that are not complete or cells affected by a chamfer.	All quantities	Refer to Section 72-41-02, Repair-03 in the PW4000 Series CIR, PN 51A357

HPC Exit Stator Assembly Visual Inspection
Table 803 (Continued)

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Compressor exit stator assembly vane airfoils for:			
R	Trailing edge hairline cracks not directly opposite to an Area A leading edge blend	0.120 inch (3.048 mm) maximum length	0.150 inch (3.810 mm) maximum length	Refer to Section 72−41−02, Repair−02 in the PW4000 Series CIR, PN 51A357
R	Trailing edge hairline cracks directly opposite to an Area A leading edge blend	Not permitted	See the repair	Refer to Section 72−41−02, Repair−02 and Repair−07 in the PW4000 Series CIR, PN 51A357
R	Cracks in the areas other than trailing edge	Not permitted	Not repairable	Remove from service
R	Vane airfoil surface damage repair general limits		Two repaired areas to a maximum depth for each vane	
R			All vanes can have repaired areas to less than maximum depth	
R			36 vanes maximum with repaired areas to the maximum depth	
R			Repaired areas on the leading and trailing	

R HPC Exit Stator Assembly Visual Inspection
R Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)		edges, Area A and Area C cannot be more than 45 percent of edge length	
		Repaired areas on the leading and trailing edges cannot be directly opposite to each other	
		Repairs cannot be done for blended areas	
		Refer to applicable repair for blend ratio limits	
Vane airfoil surface damage in:			
Area A 10 percent region	Not permitted	0.080 inch (2.032 mm) maximum depth in 36 vanes maximum Or 0.100 inch (2.540 mm) maximum depth for 12 vanes maximum	Refer to Section 72−41−02, Repair−02 in the PW4000 Series CIR, PN 51A357

HPC Exit Stator Assembly Visual Inspection
Table 803 (Continued)

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Remaining areas	Not permitted	0.120 inch (3.048 mm) maximum depth in 36 vanes	Refer to Section 72-41-02, Repair-02 in the PW4000 Series CIR, PN 51A357
R	Leading edge dent	Not permitted	0.600 inch (15.240 mm) maximum radial length. 0.250 inch (6.350 mm) maximum axial depth. One repaired dent for each vane. 12 repaired vanes maximum.	Refer to Section 72-41-02, Repair-02 in the PW4000 Series CIR, PN 51A357
R	Area B			
R	10 percent region	Not permitted	Not repairable	
R	Remaining areas	Not permitted	0.010 inch (0.254 mm) maximum depth	Refer to Section 72-41-02, Repair-02 in the PW4000 Series CIR, PN 51A357
R	Area C			
R	10 percent region	Not permitted	0.080 inch (2.032 mm) maximum depth in 36 vanes maximum	Refer to Section 72-41-02, Repair-02 in the PW4000 Series CIR, PN 51A357

R HPC Exit Stator Assembly Visual Inspection
R Table 803 (Continued)

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Remaining areas	Not permitted	0.120 inch (3.048 mm) maximum depth in 36 vanes maximum	Refer to Section 72−41−02, Repair−02 in the PW4000 Series CIR, PN 51A357
R	Trailing edge dent	Not permitted	0.600 inch (15.240 mm) radial length maximum. 0.250 inch (6.350 mm) axial depth maximum. One repaired dent for each vane. 12 repaired vanes maximum.	Refer to Section 72−41−02, Repair−02 in the PW4000 Series CIR, PN 51A357
R	Area D Smooth round bottom dents	0.030 inch (0.762 mm) maximum depth. 0.250 inch (6.350 mm) maximum surface dimension. Two dents for each vane maximum. 0.500 inch (12.700 mm) minimum separation. 12 dented vanes maximum.	Not repairable	Remove from service
R	Nicks and scratches	Not permitted	0.010 inch (0.254 mm) maximum depth	Refer to Section 72−41−02, Repair−02 in the PW4000 Series CIR, PN 51A357

R HPC Exit Stator Assembly Visual Inspection
R Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 15 HPC airsealing ring configuration for: See Figure 804			
1 Honeycomb grooves	360 degree arc to a maximum depth of 0.050 inch (1.270 mm) and a maximum width of 0.225 inch (5.715 mm)	All quantities	Refer to Section 72−41−03, Repair−02 in the PW4000 Series CIR, PN 51A357
Nicks, gouges and tears not in knife−edge groove area	0.250 inch (6.350 mm) in circumferential length	All quantities	Refer to Section 72−41−03, Repair−02 in the PW4000 Series CIR, PN 51A357
	0.250 − 0.500 inch (6.4 − 12.7 mm) in circumferential length and more than 0.100 inch (2.540 mm) apart		
Cell bond loss	Nicks, gouges and tears 0.250 − 0.500 inch (6.4 − 12.7 mm) inch in circumferential length and less than 0.100 inch (2.540 mm) apart are permitted if total area of all damage is	All quantities	Refer to Section 72−41−03, Repair−02 in the PW4000 Series CIR, PN 51A357

Stage 15 HPC Airsealing Ring Assembly And Front HPC Exit Brush Seal Support Assembly Visual Inspection
Table 804

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
	(CONTINUED)			
R		not more than 3.000 sq-in (1935. sq-mm)		
R	Deformed cells, separated or split walls	Maximum 20 cells for all 4.000 sq-in (2581. sq-mm) areas	All quantities	Refer to Section 72-41-03, Repair-02 in the PW4000 Series CIR, PN 51A357
R	2 Flange inner front face for wear and galling	0.005 inch (0.127 mm) maximum depth		
R	Cracks	Not permitted	Not repairable	Replace ring
R	Front brush seal support assembly configuration for: See Figure 804			
R	3 General nicks, dents and scratches	0.005 inch (0.127 mm) maximum depth	0.010 inch (0.254 mm) maximum depth and 0.500 inch (12.700 mm) maximum length	Refer to Section 72-41-39, Repair-05 in the PW4000 Series CIR, PN 51A357
R	Cracks	Not permitted	Not repairable	Replace support

R Stage 15 HPC Airsealing Ring Assembly And Front HPC Exit Brush Seal Support Assembly Visual Inspection
R Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
4			
Wear and galling on flange	Not permitted	0.015 inch (0.381 mm) maximum depth	Refer to Section 72−41−39, Repair−05 in the PW4000 Series CIR, PN 51A357
5			
Rivets loose or worn	Not permitted	All quantities	Replace the rivets. Refer to Section 72−41−39, Repair−01 in the PW4000 Series CIR, PN 51A357.

Stage 15 HPC Airsealing Ring Assembly And Front HPC
Exit Brush Seal Support Assembly Visual Inspection
Table 804 (Continued)

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	See Figure 805			
R	Area A			
R	Bearing journal and shoulder surface for nicks, dents, scratches, raised material and wear step indications	Not permitted	See the repair	Refer to Section 72−41−10, Repair−02 and Repair−03 in the PW4000 Series CIR, PN 51A357
R	Area B			
R	Bearing nut threads for raised material	Not permitted	See the repair	Refer to Section 72−41−10, Repair−01 in the PW4000 Series CIR, PN 51A357
R	Remaining areas of housing surface for nicks, dents, scratches or raised material	Not permitted	See the inspection	Refer to Section 72−41−10, Inspection/ Check−03 in the PW4000 Series CIR, PN 51A357

R No. 3 Bearing Housing Visual Inspection
R Table 805

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Diffuser airsealing ring configuration for: See Figure 806 (Sheet 1)			
1			
Nicks, dents and scratches	0.015 inch (0.381 mm) maximum depth and 0.500 inch (12.700 mm) maximum length		
Galling	Not Permitted	0.015 inch (0.381 mm) maximum depth to a maximum of 50 percent of the inner diameter circumference of the eight bosses	Refer to Section 72-41-05, Repair-13 in the PW4000 Series CIR, PN 51A357
Cracks	Not permitted		Replace the ring assembly
2			
Bent or damaged honeycomb cells (Other than knife-edge rub area)	Three cell rows 0.800 inch (20.320 mm) maximum total circumferential length	All quantities	Refer to Section 72-41-05, Repair-01 in the PW4000 Series CIR, PN 51A357
Rub depth in knife-edge rub area	0.020 inch (0.508 mm) maximum depth	All quantities	Refer to Section 72-41-05, Repair-01 in the PW4000 Series CIR, PN 51A357

Diffuser Airsealing Ring Assembly And Rear HPC Exit Brush Seal Support Assembly Visual Inspection
Table 806

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Rear HPC exit brush seal support configuration for:			
R	3 General nicks, dents and scratches	0.005 inch (0.127 mm) maximum depth	0.015 inch (0.381 mm) maximum depth and 0.500 inch (12.700 mm) maximum length	Refer to Section 72-41-41, Repair-13 in the PW4000 Series CIR, PN 51A357
R	Cracks	Not permitted	Not repairable	
R	4 Brush seal lands	Scattered superficial damage to a maximum of 0.005 inch (0.127 mm) depth	0.010 inch (0.254 mm) maximum depth	Refer to Section 72-41-41, Repair-14 in the PW4000 Series CIR, PN 51A357
R	5 Retaining plate rivets	Not permitted	All quantities of loose or missing rivets	Refer to Section 72-41-41, Repair-01 in the PW4000 Series CIR, PN 51A357
R	6 Inner diameter galling, cracks or other damage on the bosses (Eight locations). See Figure 806 (Sheet 2)	Not permitted	0.015 inch (0.381 mm) maximum depth for 50 percent of the inner diameter	Refer to Section 72-41-05 or 72-41-41, Repair-03 thru Repair-12 in the PW4000 Series CIR, PN 51A357

R Diffuser Airsealing Ring Assembly And Rear HPC Exit
R Brush Seal Support Assembly Visual Inspection
R Table 806 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
7 Wear on buffer air and transfer tube bosses lock slots	Not permitted	0.050 inch (1.270 mm) maximum depth	Refer to Section 72−41−41, Repair−19 in the PW4000 Series CIR, PN 51A357
		More than 0.050 inch (1.270 mm) depth	Refer to Section 72−41−41, Repair−19 in the PW4000 Series CIR, PN 51A357
8 Outer diameter wear on buffer air boss walls	Not permitted	See the repair for minimum wall thickness limits and damage limits	Refer to Section 72−41−41, Repair−17 in the PW4000 Series CIR, PN 51A357

Diffuser Airsealing Ring Assembly And Rear HPC Exit
Brush Seal Support Assembly Visual Inspection
Table 806 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Double−Pass configuration combustion chamber for: See Figure 807 (Sheet 1)			
1 Louvers (One thru nine) for axial cracks or burn through areas	All quantities to a maximum of 0.020 inch (0.508 mm) maximum width and 0.030 inch (0.762 mm) maximum length	Cracks more than 0.020 inch (0.508 mm) length and less than 0.030 inch (0.762 mm) width in the constant thickness area	Refer to Section 72−41−11, Repair−09 in the PW4000 Series CIR, PN 51A357
		Cracks more than 0.020 inch (0.508 mm) length and less than 0.030 inch (0.762 mm) extending into the double−pass section. Five cracks maximum that extend into two or more louvers.	Refer to Section 72−41−11, Repair−10 and Repair−31 in the PW4000 Series CIR, PN 51A357
		Cracks more than 0.030 inch (0.762 mm) width extending into the double−pass section. Five patches maximum with a 4.000 inch (101.600 mm) minimum separation.	Refer to Section 72−41−11, Repair−11 in the PW4000 Series CIR, PN 51A357

Outer Combustion Chamber (Double−Pass Chamber) Visual Inspection
Table 807

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
2 Louvers for circumferential cracks	Not permitted	Not repairable	
3 Rear stiffener for:			
Circumferential cracks	Not permitted	See the repair	Refer to Section 72−41−11, Repair−16 in the PW4000 Series CIR, PN 51A357
Axial cracks	A maximum of 0.450 inch (11.430 mm) length and 0.020 inch (0.508 mm) maximum width	See the repair	Refer to Section 72−41−11, Repair−58 and Repair−59 in the PW4000 Series CIR, PN 51A357
4 Cracks in fillet	Not permitted	Weld repair	Refer to Section 72−41−11, Repair−43 in the PW4000 Series CIR, PN 51A357
5 Rear louver lip area for axial cracks	Not permitted	4.000 inches (101.600 mm) circumferentially and 0.400 inch (10.160 mm) axially	Refer to Section 72−41−11, Repair−44 in the PW4000 Series CIR, PN 51A357
6 Burn holes and surface burns	Not permitted		

Outer Combustion Chamber (Double−Pass Chamber) Visual Inspection
Table 807 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
7 Distorted or bent louvers	Not permitted	See the repair	Refer to Section 72-41-11, Repair-13, Repair-29 and Repair-30 in the PW4000 Series CIR, PN 51A357
8 Erosion around the dilution holes	0.020 inch (0.508 mm) maximum material loss		
9	0.040 - 0.105 inch (1.02 - 2.67 mm) (Reference)		
Double-Pass configuration combustion chamber bulkhead and fuel injectors for: See Figure 807 (Sheet 2)			
10 Individual circumferential cracks	Not permitted		
11 Cracks that extend below the fuel injector heat shield	Not permitted		

Outer Combustion Chamber (Double-Pass Chamber) Visual Inspection
Table 807 (Continued)

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	12 Individual radial cracks	Not permitted		
R	13 Individual cracks that can form a closed loop	Not permitted		
R	14 Burn holes	Not permitted		
R	15 Burned area With erosion	Not permitted		
R	16 Inner and outer heat shield cracks	All quantities less than 0.250 inch (6.350 mm) length. Two cracks can extend fully across face with a 45 degree minimum separation. Cracks cannot intersect.	See the repair	Refer to Section 72−41−11, Repair−65 in the PW4000 Series CIR, PN 51A357
R	17 Inner heat shield face erosion and burning	All quantities, if impingement cooling holes below inner face are not bare	0.100 inch (2.540 mm) maximum width and 3.000 inch (76.200 mm) circumferential maximum length	Refer to Section 72−41−11, Repair−65 in the PW4000 Series CIR, PN 51A357

R Outer Combustion Chamber (Double−Pass Chamber) Visual Inspection
R Table 807 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
18 Outer heat shield face erosion and burning	0.200 inch (5.080 mm) maximum in from outer edge of face to a maximum of the full circumference	See the repair	Refer to Section 72−41−11, Repair−65 in the PW4000 Series CIR, PN 51A357
Fuel injector end cap heat shield for:			
19 Radial cracks	All quantities		
20 Circumferential cracks	All quantities		
21 Missing material	All quantities can be missing		

Outer Combustion Chamber (Double−Pass Chamber) Visual Inspection
Table 807 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Floatwall (Talon) configuration combustion chamber for: See Figure 808 (Sheet 1)			
1 Trailing edge cracks	All quantities to a maximum of 0.400 inch (10.160 mm) length. No intersecting cracks are permitted.	Replace the segment	Refer to Section 72-41-11, Repair-56 in the PW4000 Series CIR, PN 51A357
2 Cracks start in a combustion or ignitor hole	One crack to a maximum of 0.250 inch (6.350 mm) length for each hole	Replace the segment	Refer to Section 72-41-11, Repair-56 in the PW4000 Series CIR, PN 51A357
3 Burn holes or surface burns	Not permitted	Replace the segment	Refer to Section 72-41-11, Repair-56 in the PW4000 Series CIR, PN 51A357
4 Trailing edge burning and erosion (Missing material)	Axially front to the leading edge of the next rear segment. Axially front 0.200 inch (5.080 mm) on the last	Replace the segment	Refer to Section 72-41-11, Repair-56 in the PW4000 Series CIR, PN 51A357

Floatwall (Talon) Outer Combustion Chamber Visual Inspection
Table 808

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
	(CONTINUED)			
R		segment (Row 6 for talon configuration)		
R	Missing thermal barrier coat	All quantities of missing coat is permitted if there is no bare parent metal		
R	Liner segment attach nuts and washers	Must not be loose, worn or missing	All quantities	Refer to Section 72-41-11, Repair-56 in the PW4000 Series CIR, PN 51A357
R	Floatwall (Talon) combustion chamber front bulkhead and fuel injectors for: See Figure 808 (Sheet 2)			
R	5 Bulkhead segment cracks that can form a closed loop	Not permitted	Replace the segment	Refer to Section 72-41-11, Repair-56 in the PW4000 Series CIR, PN 51A357

R Floatwall (Talon) Outer Combustion Chamber Visual Inspection
R Table 808 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
6 Individual bulkhead segment radial and axial cracks	0.200 inch (5.080 mm) length maximum. Cracks cannot intersect.	Replace the segment	Refer to Section 72-41-11, Repair-56 in the PW4000 Series CIR, PN 51A357
7 Bulkhead segment edge burning or erosion	0.500 inch (12.700 mm) length along edge maximum and 0.100 inch (2.540 mm) maximum width from the edge of segment	Replace the segment	Refer to Section 72-41-11, Repair-56 in the PW4000 Series CIR, PN 51A357
8 Missing thermal barrier coat	All quantities can be missing. See Note.		

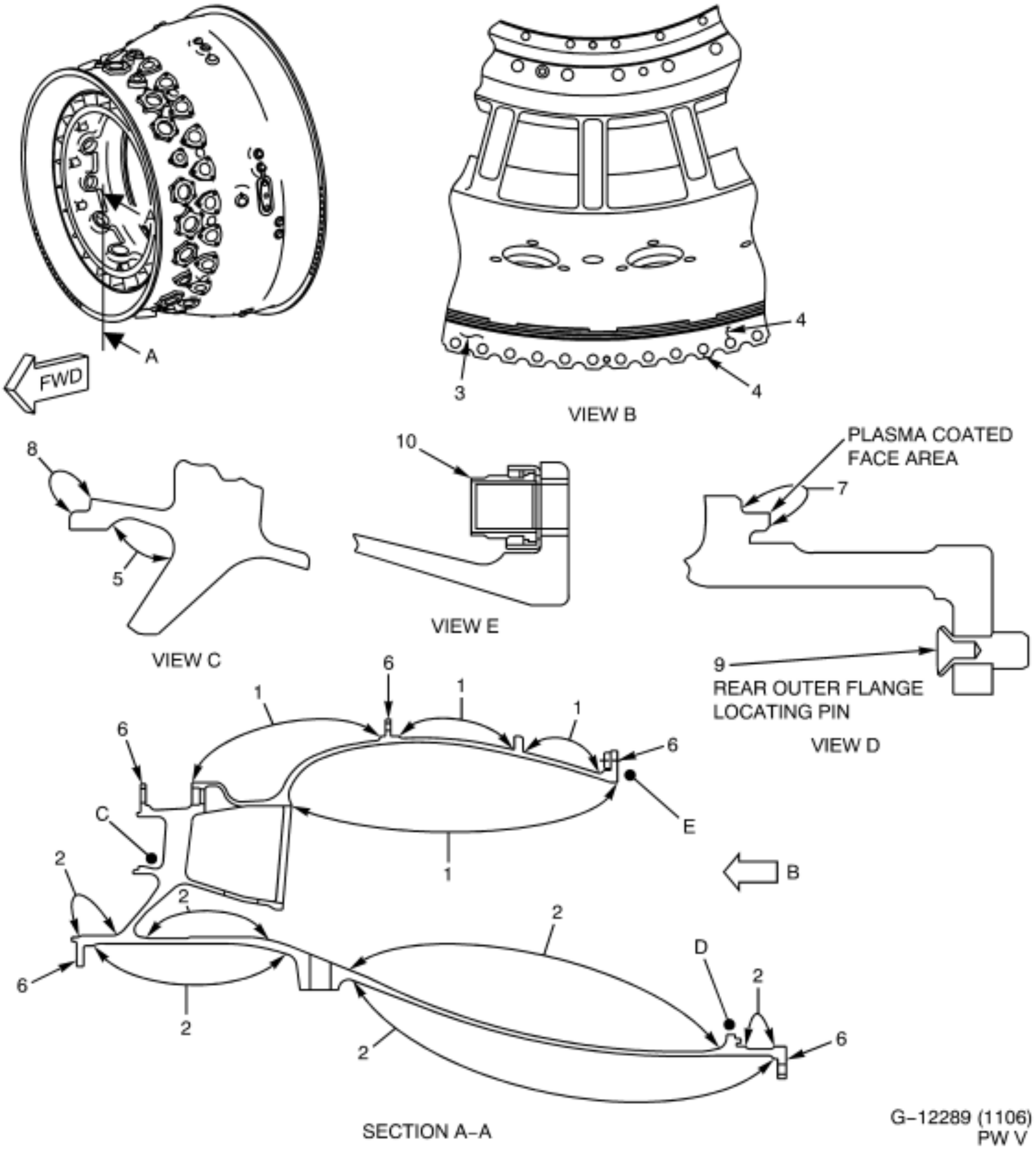
NOTE: Missing thermal barrier coat can result in increased liner segment deterioration.

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
9 Surface burns	All quantities, if a burn hole does not exist		
10 Burn holes	Not permitted	Replace the segment	Refer to Section 72-41-11, Repair-56 in the PW4000 Series CIR, PN 51A357

Floatwall (Talon) Outer Combustion Chamber Visual Inspection
Table 808 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
11 Fuel injector guide cone (Swirler) cracks	All quantities to a maximum of 0.150 inch (3.810 mm) length. Cracks must not intersect.	Replace the swirler	Refer to Section 72−41−11, Repair−56 in the PW4000 Series CIR, PN 51A357
12 Fuel injector guide cone (Swirler) erosion, burning and missing material	0.150 inch (3.810 mm) front from the rear face to a maximum of full circumference	Replace the swirler	Refer to Section 72−41−11, Repair−56 in the PW4000 Series CIR, PN 51A357
13 Fuel injector nozzle end cap for cracks or missing material	Not permitted	Replace the fuel nozzle	

Floatwall (Talon) Outer Combustion Chamber Visual Inspection
Table 808 (Continued)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FWD
VIEW B
3
4
4
8
5
VIEW C
10
VIEW E
PLASMA COATED
FACE AREA
7
9
REAR OUTER FLANGE
LOCATING PIN
VIEW D
6
1
1
1
6
6
C
E
1
B
2
2
2
6
2
D
2
6
2
SECTION A−A
G−12289 (1106)
PW V

R See Table 801 For Index Definitions.

R Diffuser Case Visual Inspection
R Figure 801 (Sheet 1)
R (Task 72−00−41−210−010)

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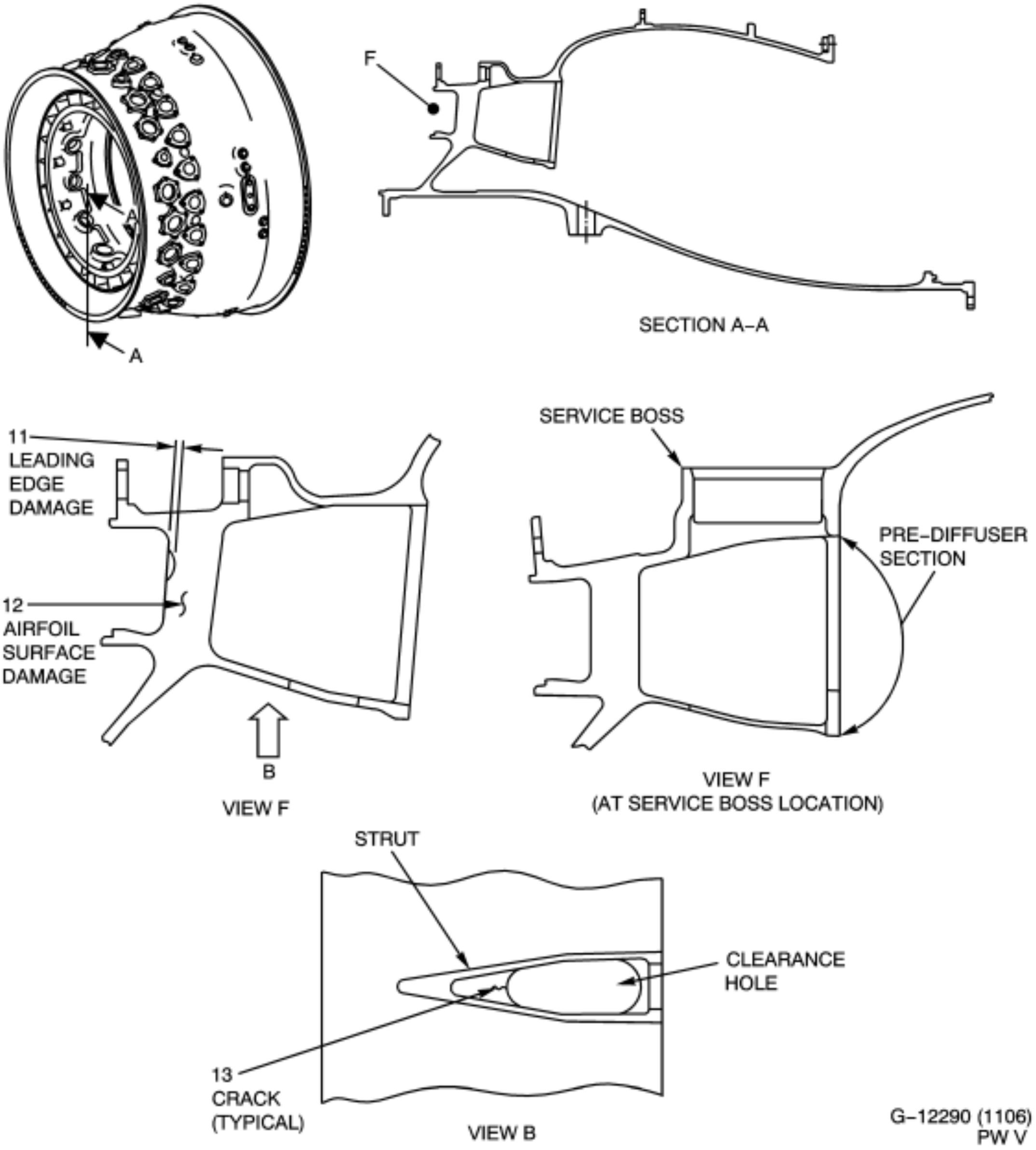
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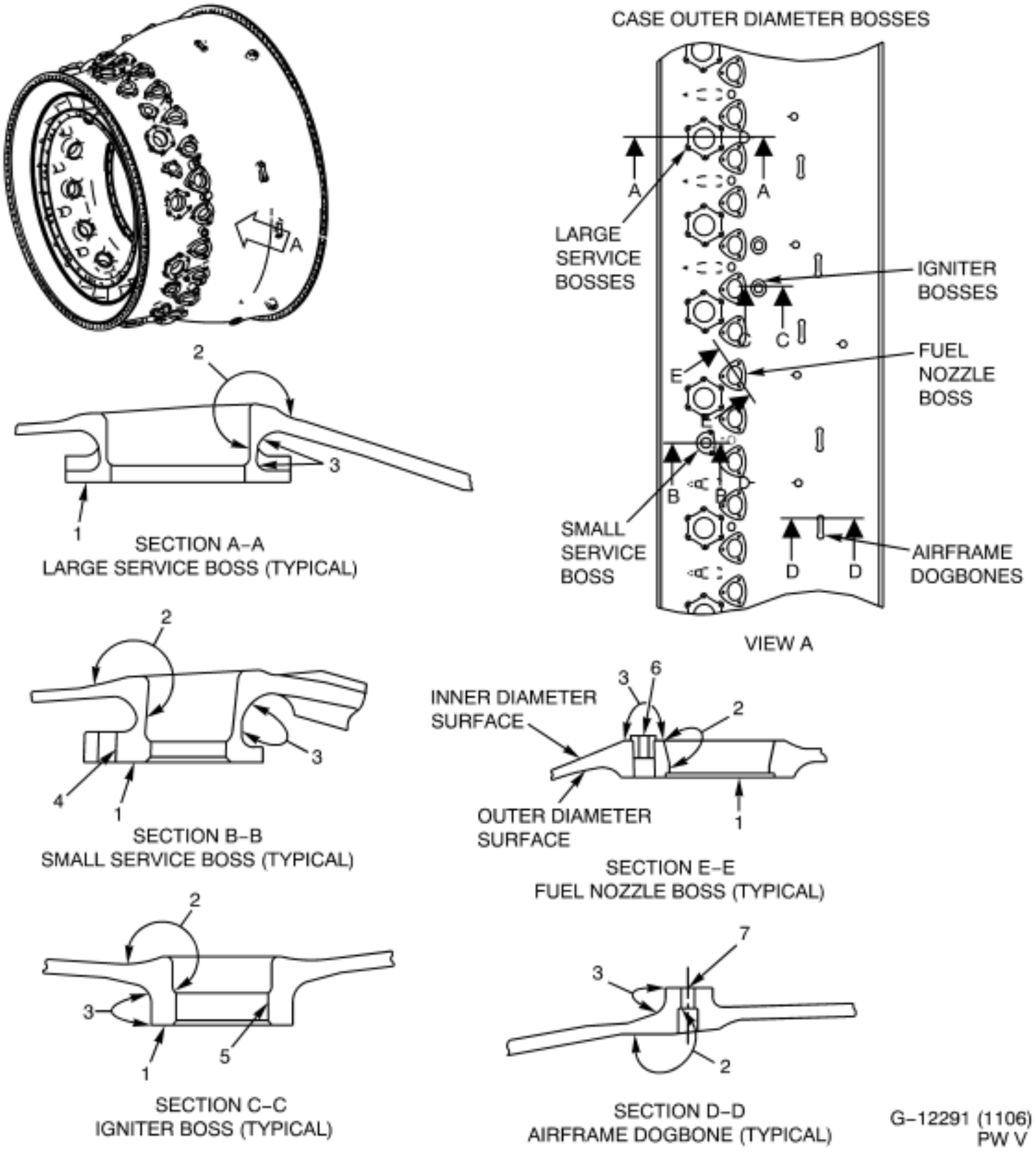
A
A
SECTION A−A
11
LEADING EDGE DAMAGE
12
AIRFOIL SURFACE DAMAGE
B
VIEW F
SERVICE BOSS
PRE−DIFFUSER SECTION
VIEW F
(AT SERVICE BOSS LOCATION)
STRUT
CLEARANCE HOLE
13
CRACK (TYPICAL)
VIEW B
G−12290 (1106)
PW V

R See Table 801 For Index Definitions.

R Diffuser Case Visual Inspection
R Figure 801 (Sheet 2)
R (Task 72−00−41−210−010)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A
A
LARGE SERVICE BOSSES
IGNITER BOSSES
C
C
FUEL NOZZLE BOSS
E
E
B
B
SMALL SERVICE BOSS
D
D
AIRFRAME DOGBONES
VIEW A
2
3
1
SECTION A−A
LARGE SERVICE BOSS (TYPICAL)
2
3
4
1
SECTION B−B
SMALL SERVICE BOSS (TYPICAL)
INNER DIAMETER SURFACE
3
6
2
OUTER DIAMETER SURFACE
1
SECTION E−E
FUEL NOZZLE BOSS (TYPICAL)
2
3
5
1
SECTION C−C
IGNITER BOSS (TYPICAL)
7
3
2
SECTION D−D
AIRFRAME DOGBONE (TYPICAL)
G−12291 (1106)
PW V

R See Table 802 For Index Definitions.

R Diffuser Case Bosses Visual Inspection
R Figure 802 (Sheet 1)
R (Task 72−00−41−210−010)

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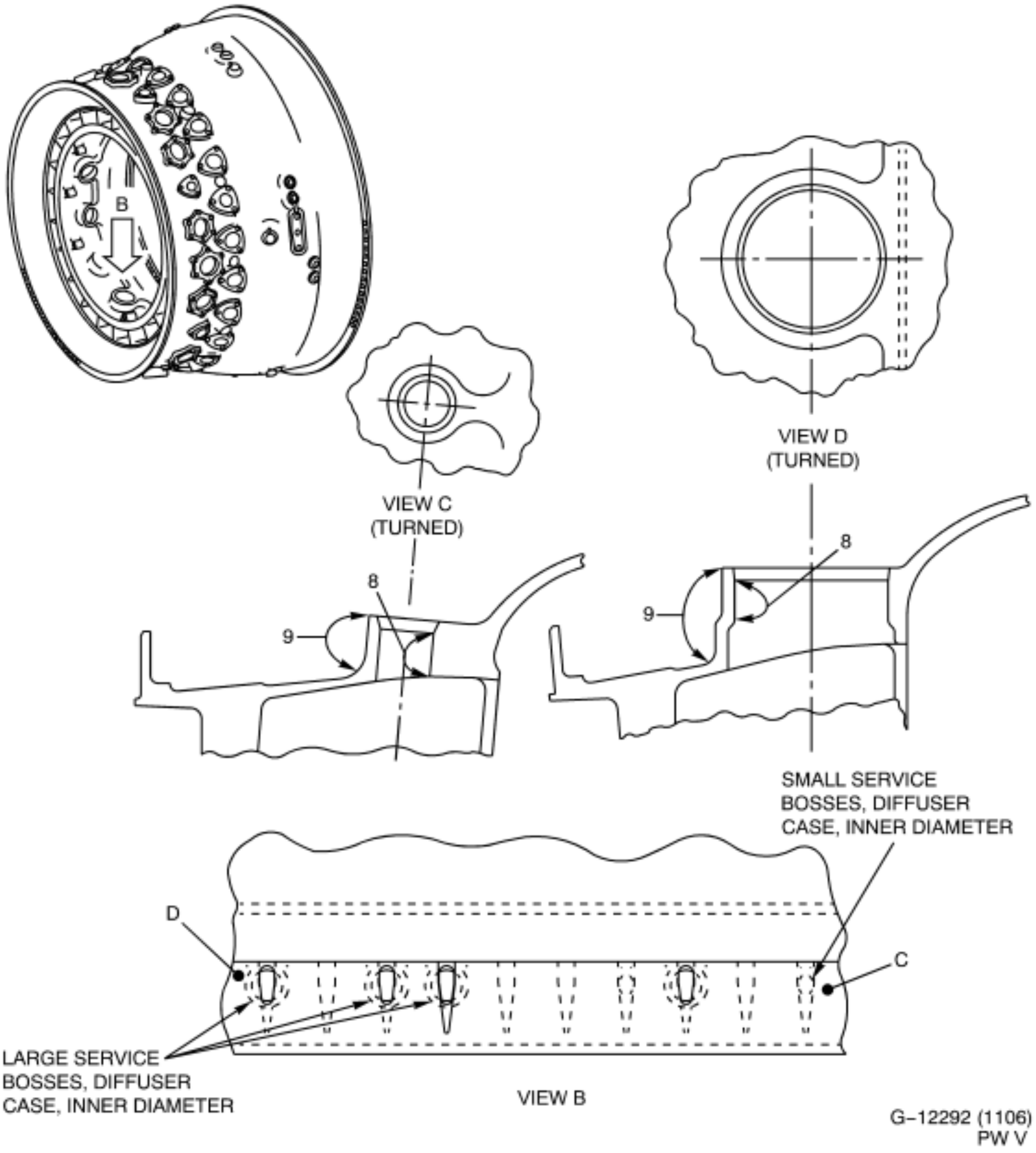
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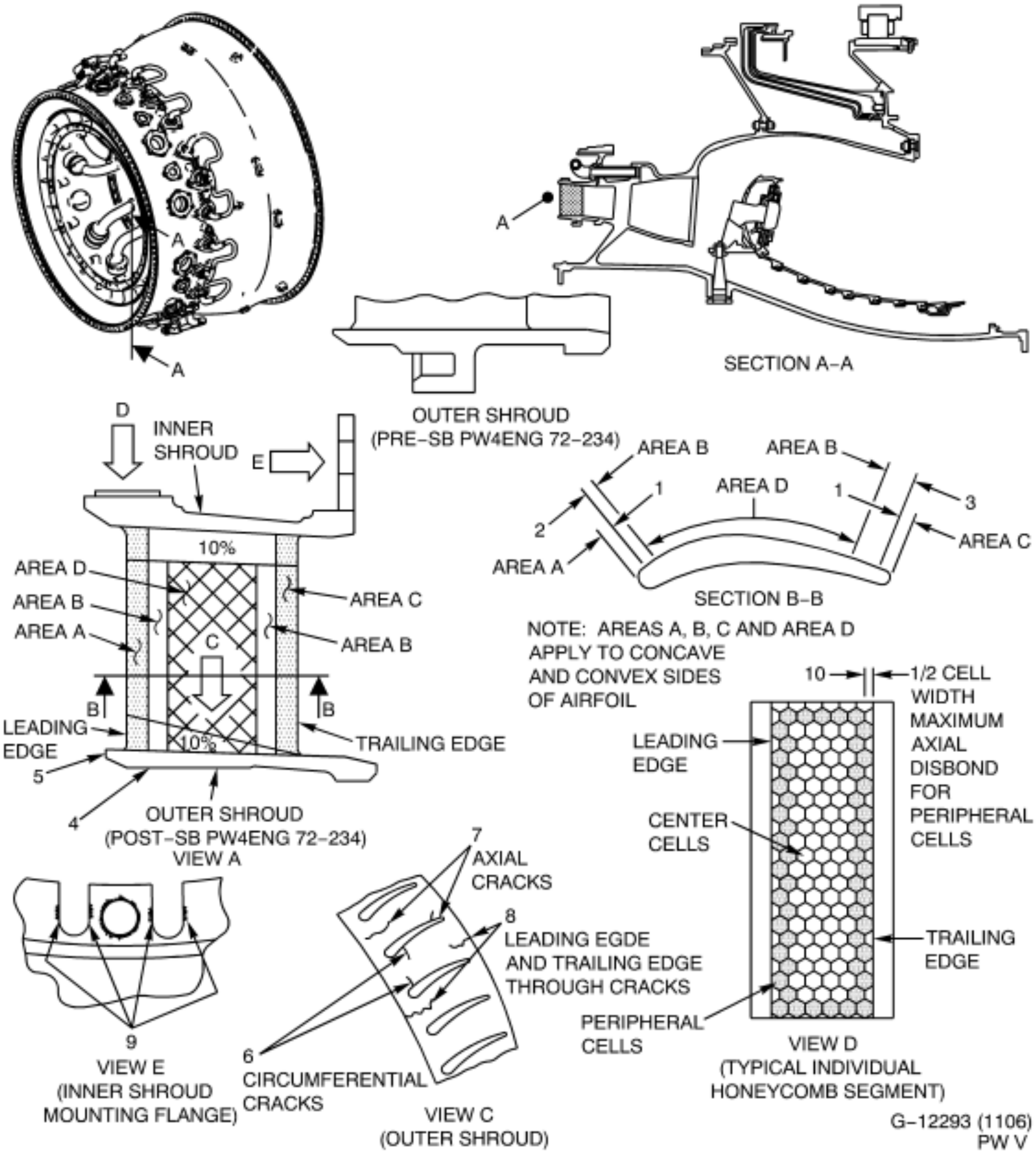
VIEW D
(TURNED)
VIEW C
(TURNED)
8
9
8
9
SMALL SERVICE
BOSSES, DIFFUSER
CASE, INNER DIAMETER
D
C
LARGE SERVICE
BOSSES, DIFFUSER
CASE, INNER DIAMETER
VIEW B
G-12292 (1106)
PW V

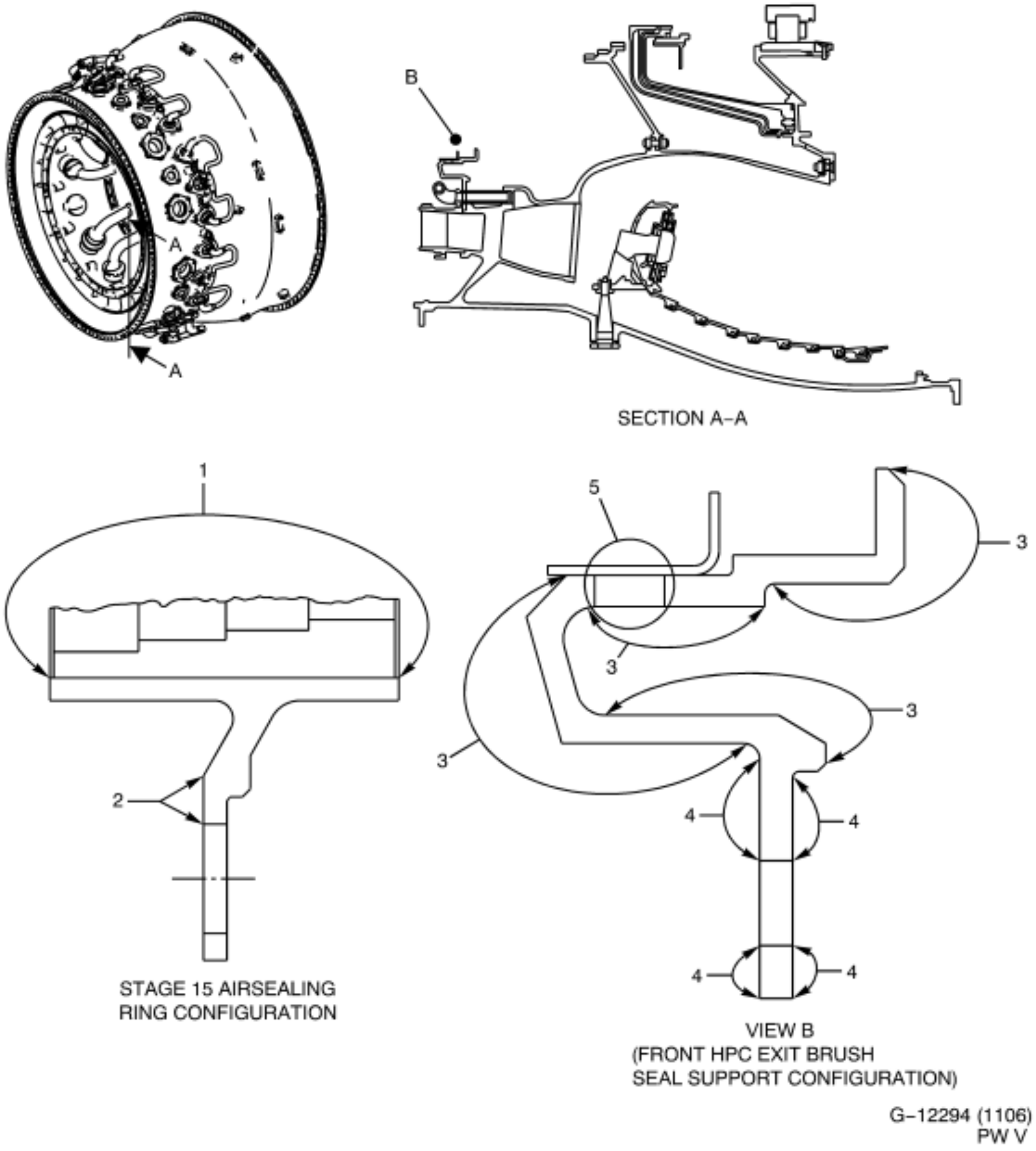
R See Table 802 For Index Definitions.

R Diffuser Case Bosses Visual Inspection
R Figure 802 (Sheet 2)
R (Task 72-00-41-210-010)


A
A
A
SECTION A–A
OUTER SHROUD
(PRE–SB PW4ENG 72–234)
D
INNER SHROUD
E
10%
AREA D
AREA B
AREA A
AREA C
AREA B
C
B
B
LEADING EDGE
TRAILING EDGE
10%
5
4
OUTER SHROUD
(POST–SB PW4ENG 72–234)
VIEW A
AREA B
AREA B
AREA D
1
1
2
3
AREA C
AREA A
SECTION B–B
NOTE: AREAS A, B, C AND AREA D APPLY TO CONCAVE AND CONVEX SIDES OF AIRFOIL
10
1/2 CELL WIDTH MAXIMUM AXIAL DISBOND FOR PERIPHERAL CELLS
LEADING EDGE
CENTER CELLS
TRAILING EDGE
PERIPHERAL CELLS
VIEW D
(TYPICAL INDIVIDUAL HONEYCOMB SEGMENT)
7
AXIAL CRACKS
8
LEADING EGDE AND TRAILING EDGE THROUGH CRACKS
6
CIRCUMFERENTIAL CRACKS
VIEW C
(OUTER SHROUD)
9
VIEW E
(INNER SHROUD MOUNTING FLANGE)
G–12293 (1106)
PW V

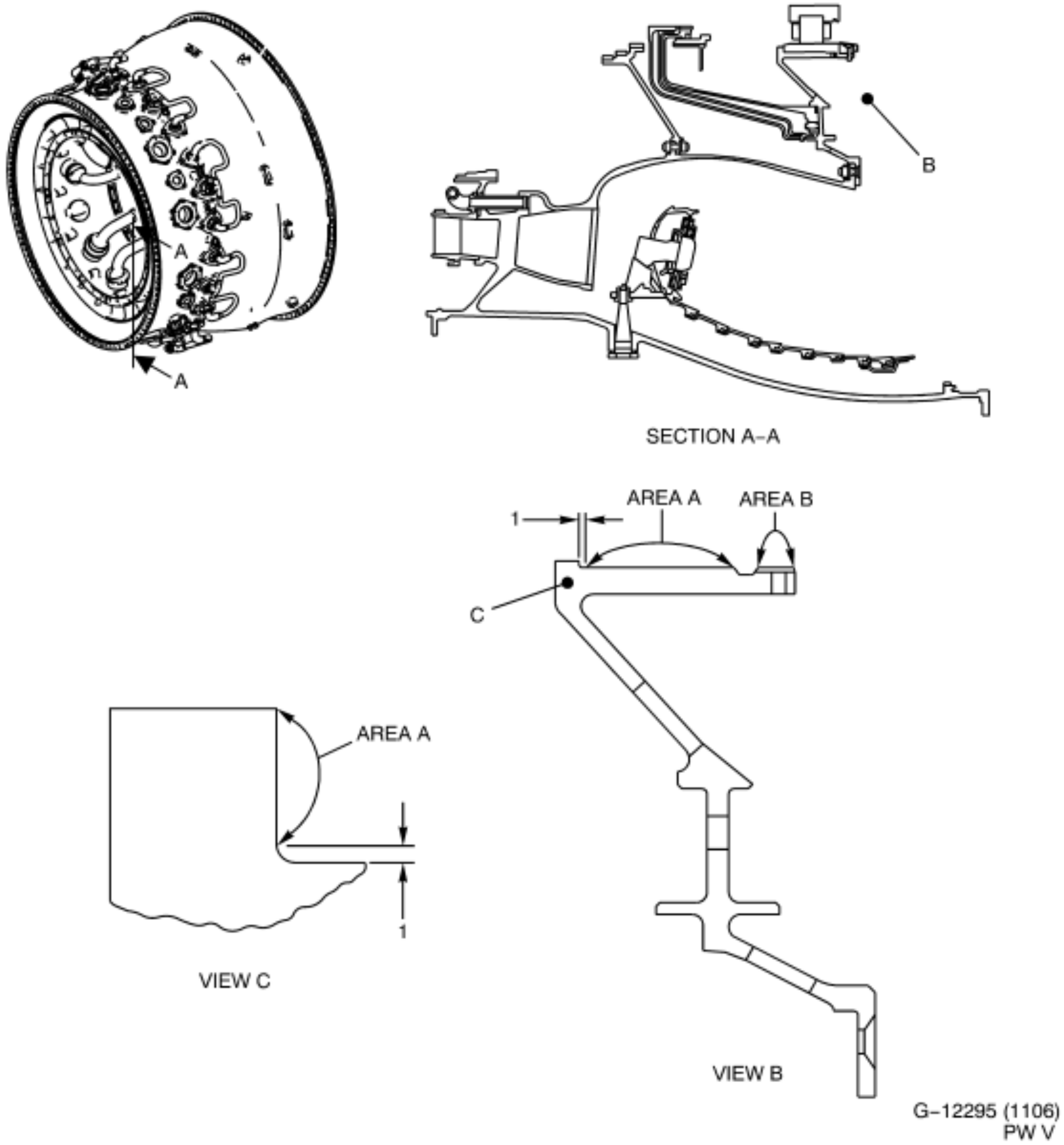
R See Table 803 For Index Definitions.

R HPC Exit Stator Assembly Visual Inspection
R Figure 803
R (Task 72-00-41-210-010)


B
A
A
SECTION A−A
1
2
STAGE 15 AIRSEALING
RING CONFIGURATION
5
3
3
3
3
4
4
4
4
VIEW B
(FRONT HPC EXIT BRUSH
SEAL SUPPORT CONFIGURATION)
G−12294 (1106)
PW V

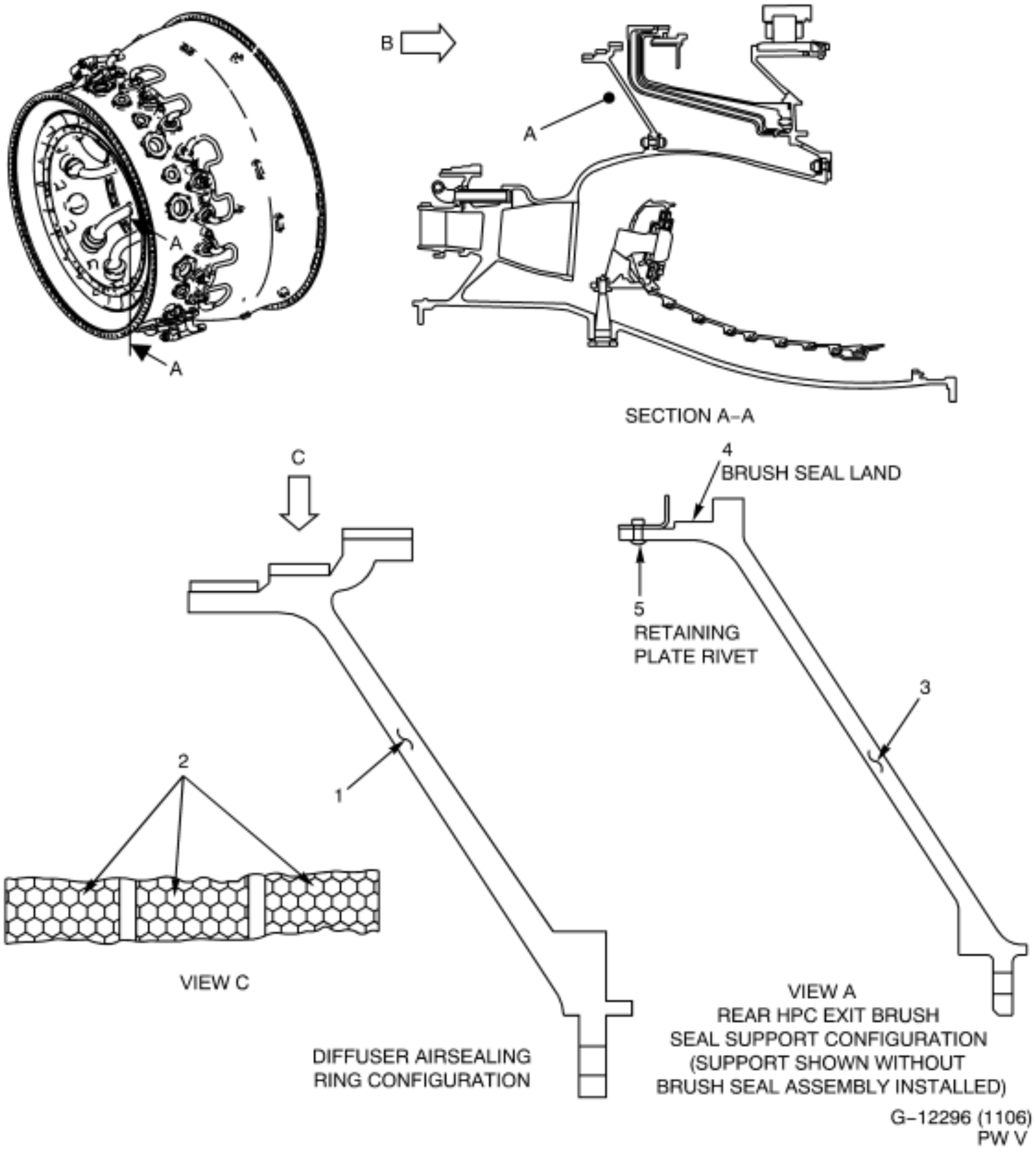
R See Table 804 For Index Definitions.

R Stage 15 HPC Airsealing Ring Assembly And Front HPC
R Exit Brush Seal Support Assembly Visual Inspection
R Figure 804
R (Task 72−00−41−210−010)


A
A
B
SECTION A−A
1
AREA A
AREA B
C
AREA A
1
VIEW C
VIEW B
G−12295 (1106)
PW V

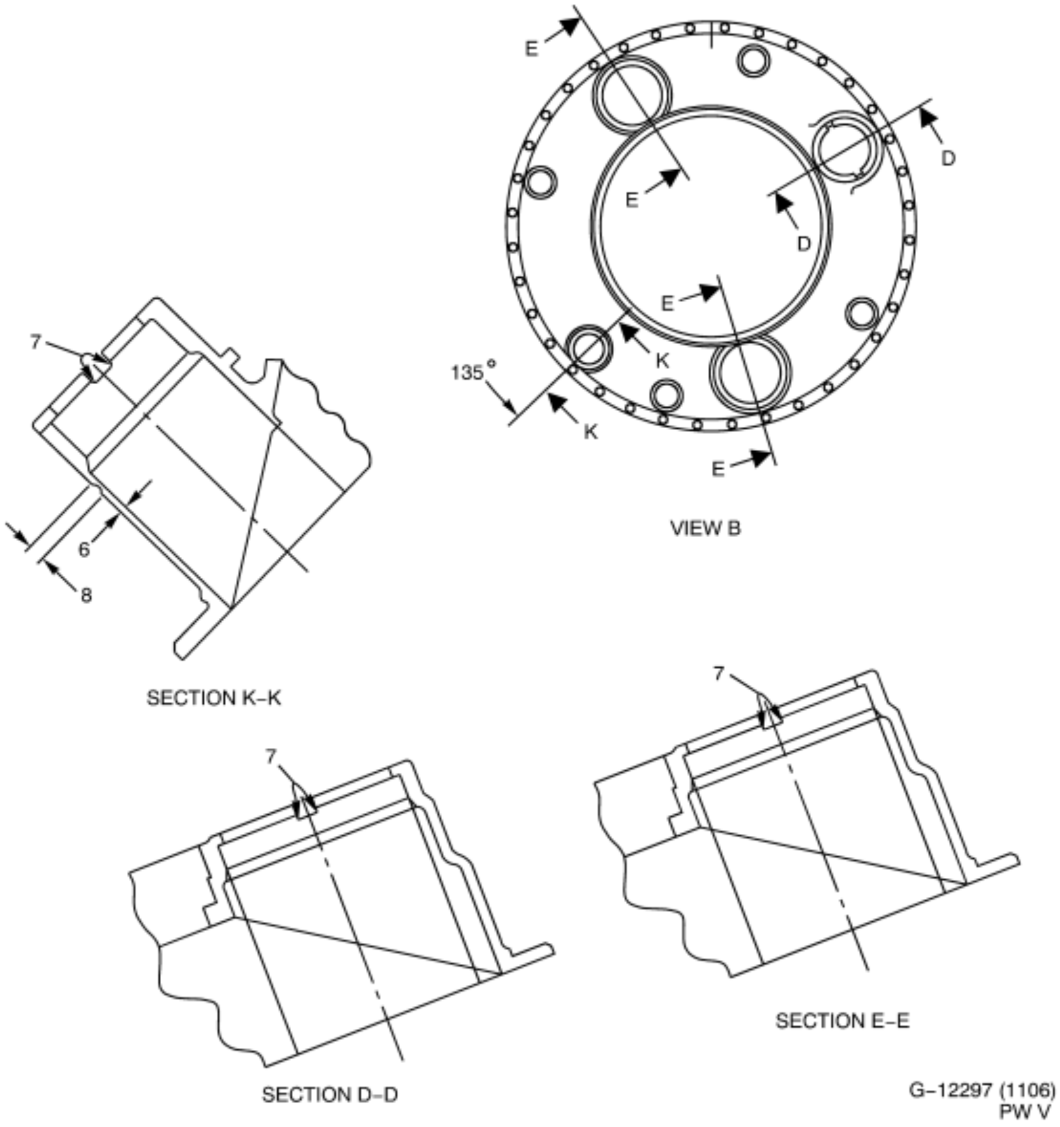
R 1. 0.105 Inch (2.667 mm) Maximum, Chromium Plate Or Plasma Coat Is
R Permitted In This Area And Full Chromium Plate Or Plasma Coat
R Is Not Necessary.

R No. 3 Bearing Housing Visual Inspection
R Figure 805
R (Task 72−00−41−210−010)


B
A
A
A
SECTION A-A
C
4
BRUSH SEAL LAND
5
RETAINING
PLATE RIVET
3
2
1
VIEW C
DIFFUSER AIRSEALING
RING CONFIGURATION
VIEW A
REAR HPC EXIT BRUSH
SEAL SUPPORT CONFIGURATION
(SUPPORT SHOWN WITHOUT
BRUSH SEAL ASSEMBLY INSTALLED)
G-12296 (1106)
PW V

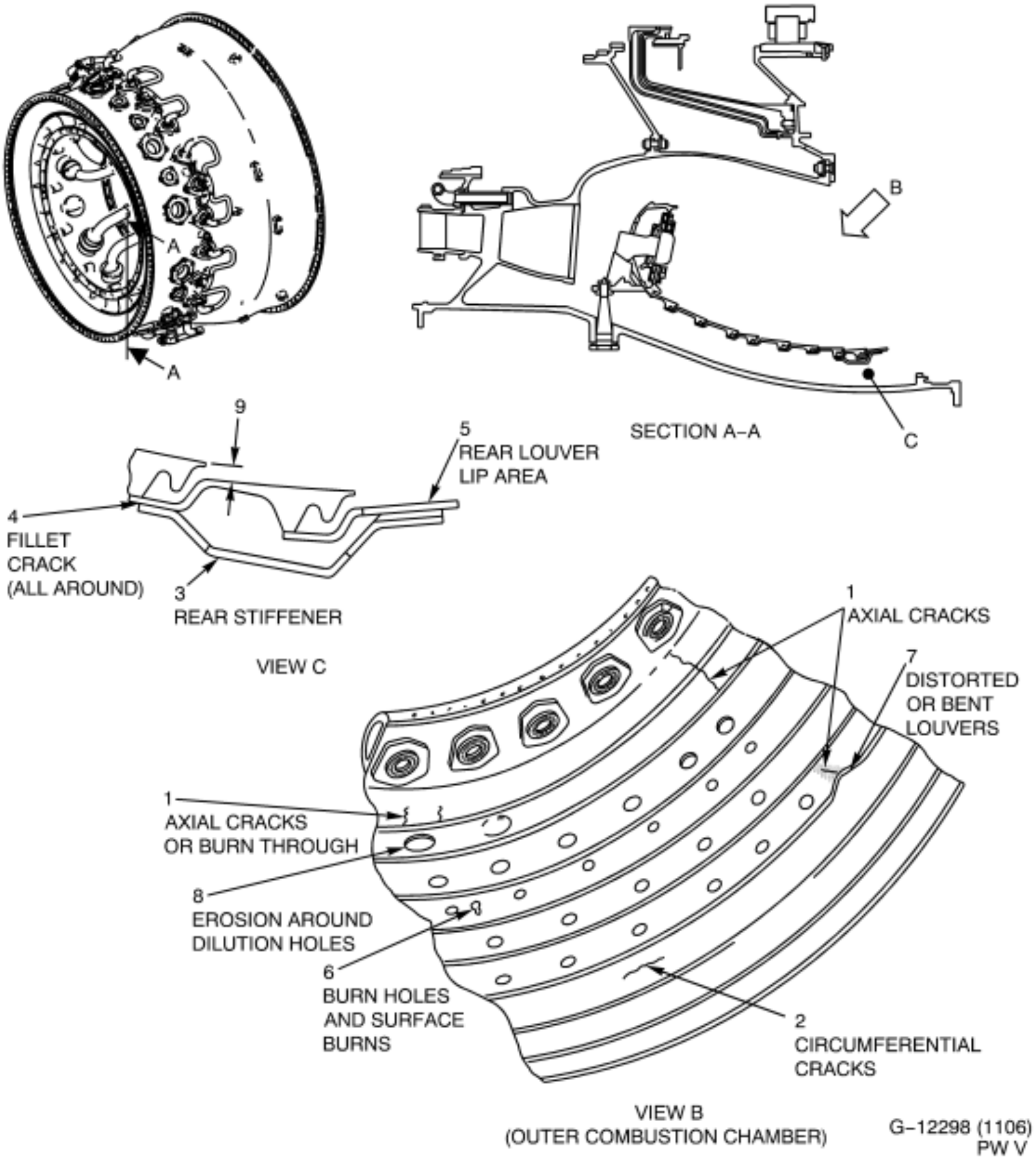
R See Table 806 For Index Definitions.

R Diffuser Airsealing Ring Assembly And Rear HPC Exit
R Brush Seal Support Assembly Visual Inspection
R Figure 806 (Sheet 1)
R (Task 72-00-41-210-010)


E
D
E
D
E
135°
K
K
E
VIEW B
7
6
8
SECTION K-K
7
7
SECTION D-D
SECTION E-E
G-12297 (1106)
PW V

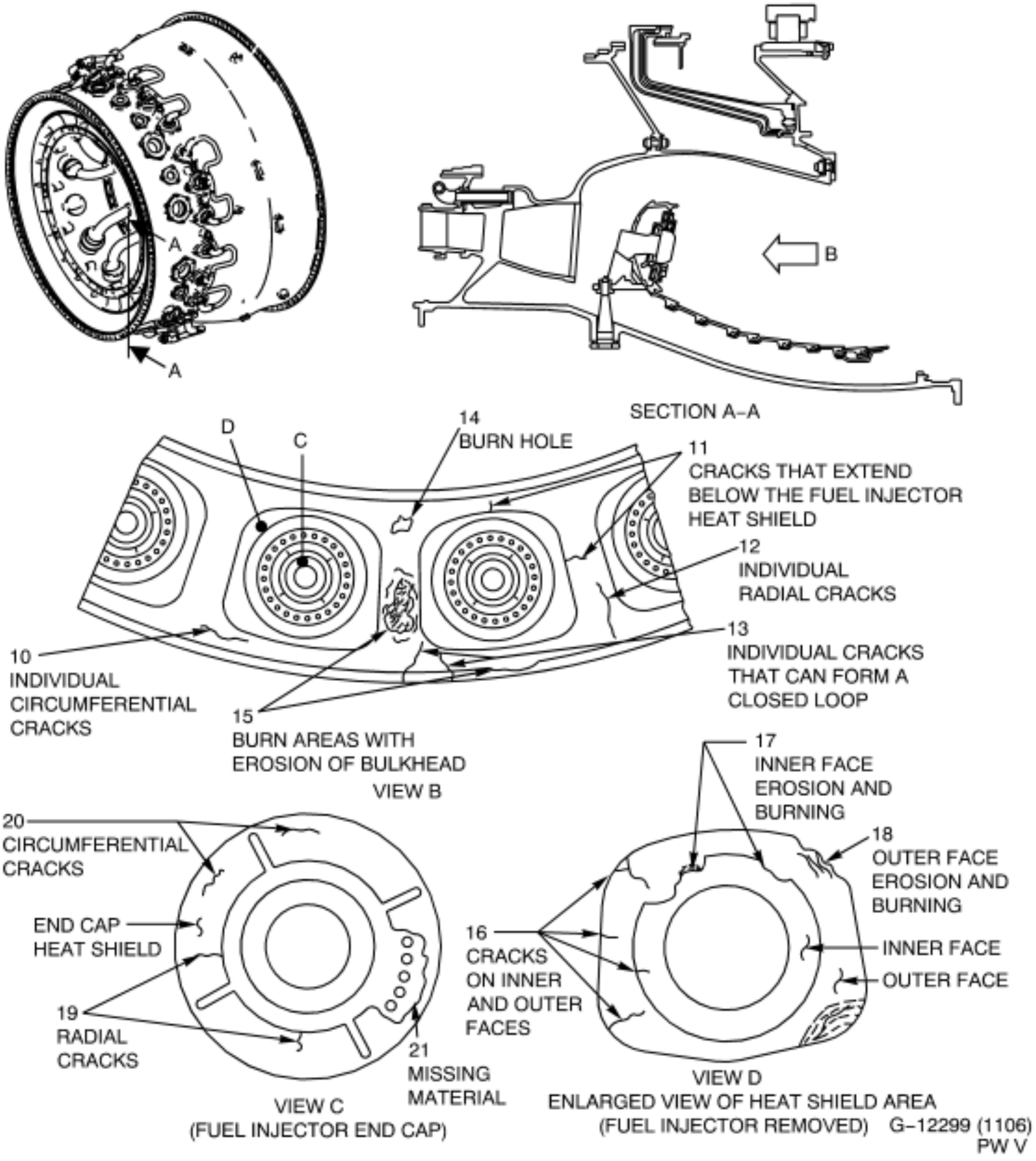
R See Table 806 For Index Definitions.

R Diffuser Airsealing Ring Assembly And Rear HPC Exit
R Brush Seal Support Assembly Visual Inspection
R Figure 806 (Sheet 2)
R (Task 72-00-41-210-010)


A
A
B
SECTION A−A
C
9
5
REAR LOUVER
LIP AREA
4
FILLET
CRACK
(ALL AROUND)
3
REAR STIFFENER
VIEW C
1
AXIAL CRACKS
7
DISTORTED
OR BENT
LOUVERS
1
AXIAL CRACKS
OR BURN THROUGH
8
EROSION AROUND
DILUTION HOLES
6
BURN HOLES
AND SURFACE
BURNS
2
CIRCUMFERENTIAL
CRACKS
VIEW B
(OUTER COMBUSTION CHAMBER)
G−12298 (1106)
PW V

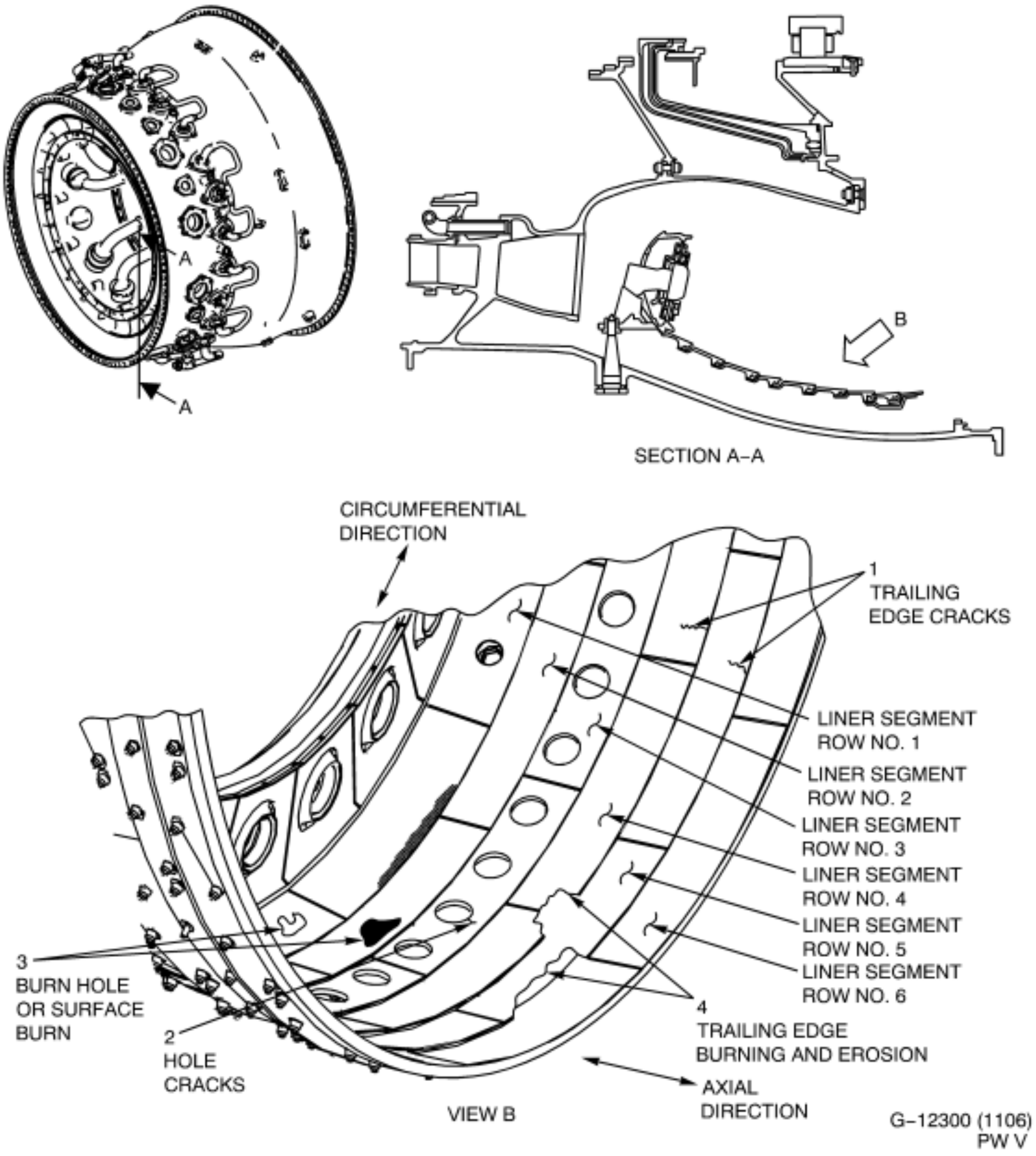
R See Table 807 For Index Definitions.

R Combustion Chamber (Double−Pass Chamber) Visual Inspection
R Figure 807 (Sheet 1)
R (Task 72−00−41−210−010)


A
A
B
SECTION A−A
D
C
14
BURN HOLE
11
CRACKS THAT EXTEND BELOW THE FUEL INJECTOR HEAT SHIELD
12
INDIVIDUAL RADIAL CRACKS
13
INDIVIDUAL CRACKS THAT CAN FORM A CLOSED LOOP
10
INDIVIDUAL CIRCUMFERENTIAL CRACKS
15
BURN AREAS WITH EROSION OF BULKHEAD
VIEW B
17
INNER FACE EROSION AND BURNING
18
OUTER FACE EROSION AND BURNING
20
CIRCUMFERENTIAL CRACKS
END CAP HEAT SHIELD
19
RADIAL CRACKS
16
CRACKS ON INNER AND OUTER FACES
INNER FACE
OUTER FACE
21
MISSING MATERIAL
VIEW C
(FUEL INJECTOR END CAP)
VIEW D
ENLARGED VIEW OF HEAT SHIELD AREA
(FUEL INJECTOR REMOVED)
G−12299 (1106)
PW V

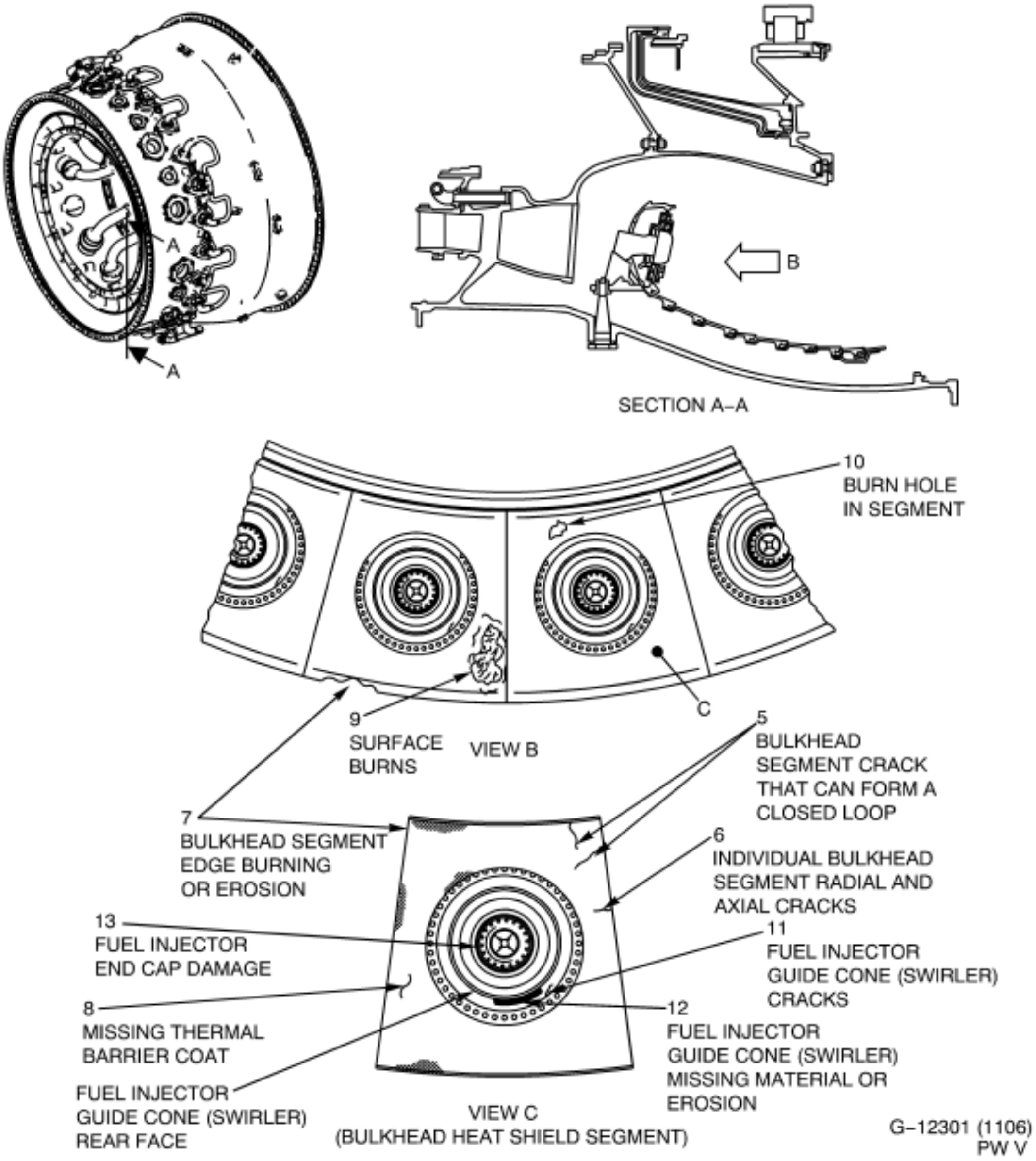
R See Table 807 For Index Definitions.

R Outer Combustion Chamber (Double−Pass Chamber) Visual Inspection
R Figure 807 (Sheet 2)
R (Task 72−00−41−210−010)


A
A
B
SECTION A−A
CIRCUMFERENTIAL DIRECTION
1 TRAILING EDGE CRACKS
LINER SEGMENT ROW NO. 1
LINER SEGMENT ROW NO. 2
LINER SEGMENT ROW NO. 3
LINER SEGMENT ROW NO. 4
LINER SEGMENT ROW NO. 5
LINER SEGMENT ROW NO. 6
3 BURN HOLE OR SURFACE BURN
2 HOLE CRACKS
4 TRAILING EDGE BURNING AND EROSION
AXIAL DIRECTION
VIEW B
G−12300 (1106)
PW V

R See Table 808 For Index Definitions.

R Outer Combustion Chamber (Talon) Visual Inspection
R Figure 808 (Sheet 1)
R (Task 72−00−41−210−010)


A
A
B
SECTION A−A
10
BURN HOLE IN SEGMENT
C
9
SURFACE BURNS
VIEW B
5
BULKHEAD SEGMENT CRACK THAT CAN FORM A CLOSED LOOP
7
BULKHEAD SEGMENT EDGE BURNING OR EROSION
6
INDIVIDUAL BULKHEAD SEGMENT RADIAL AND AXIAL CRACKS
13
FUEL INJECTOR END CAP DAMAGE
11
FUEL INJECTOR GUIDE CONE (SWIRLER) CRACKS
8
MISSING THERMAL BARRIER COAT
12
FUEL INJECTOR GUIDE CONE (SWIRLER) MISSING MATERIAL OR EROSION
FUEL INJECTOR GUIDE CONE (SWIRLER) REAR FACE
VIEW C
(BULKHEAD HEAT SHIELD SEGMENT)
G−12301 (1106)
PW V

R See Table 808 For Index Definitions.

R Outer Combustion Chamber (Talon) Visual Inspection
R Figure 808 (Sheet 2)
R (Task 72−00−41−210−010)

Return to Previous Menu

72−00−51

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	HIGHLIGHTS
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72−00−51	ENGINE GENERAL − TURBINE NOZZLE − REMOVAL−02 • 72−00−51−020−002: Remove Turbine Nozzle − Vertical
72−00−51	ENGINE GENERAL − TURBINE NOZZLE − INSTALLATION−01 • 72−00−51−420−001: Install Turbine Nozzle − Horizontal
72−00−51	ENGINE GENERAL − TURBINE NOZZLE − INSTALLATION−02 • 72−00−51−420−002: Install Turbine Nozzle − Vertical
72−00−51	ENGINE GENERAL − TURBINE NOZZLE − INSPECTION/CHECK−01 • 72−00−51−990−001: Specific Fits And Clearances
72−00−51	ENGINE GENERAL − TURBINE NOZZLE − INSPECTION/CHECK−10 • 72−00−51−210−010: Visually Examine The Turbine Nozzle Module Assembly − Engine General − Turbine Nozzle

ENGINE GENERAL - TURBINE NOZZLE - REMOVAL-01

Task 72-00-51-020-001:

1. Remove Turbine Nozzle - Horizontal

NOTE: See Figure 301 for Part/Assembly Removal Procedure Sequence.

A. Prerequisites

(1) Remove The High Pressure Turbine - Horizontal. Refer to 72-00-52, Removal-01 (Task 72-00-52-020-001).

B. Equipment And Materials Necessary

Standard Tools:
0.3125-24 Jackscrews (Four Necessary)

Special Tools:

PWA 28657	Sling, Handling
PWA 76154	Adapter (Two Necessary)
PWA 85063	Adapter, Wrench
PWA 85078	Fixture, Holding
PWA 85170	Pins, Aligning (Three Necessary)

C. Procedure
See Figure 302.

(1) Remove instrumentation plug (borescope) (302/3) and washer (302/2) from diffuser case (302/1) at 3 o'clock position as viewed from rear. See Figure 302.

(2) Install PWA 85078 Fixture to turbine nozzle. See Figure 303 and Figure 304.

(a) Connect hoist with PWA 28657 Sling and two PWA 76154 Adapters to trunnion spools of PWA 85078 Fixture.

(b) Using hoist, position fixture to rear flange of diffuser case (303/9). Retract four inner clamps (303/1), six outer clamps (303/5) and 12 bolts (303/7).

(c) Using PWA 85063 Wrench Adapter, remove bolts (303/1) underlying inner clamps of fixture.

(d) Seat fixture against 1st stage HPT support (303/4). Slide six clamps (303/5) over rear lip of support and tighten bolts (303/6) to secure clamps.

(e) Slide four clamps (303/1) over cooling duct flange (303/2).

(f) Using 12 bolts (303/7) seat pads (303/8) against rear flange of diffuser case (303/9).

(g) Take up slack in hoist.

(3) Using PWA 85063 Wrench Adapter remove bolts (303/1) securing lst stage HPT cooling duct (303/2) to diffuser case flange. See Figure 303.

(4) Install three PWA 85170 Aligning Pins into boltholes in 1st stage HPT cooling duct, and thread into inner rear flange of diffuser case.

(5) Install four 0.3125−24 Jackscrews into recessed jackscrew holes in front flange of cooling duct.

CAUTION: THE FOUR JACKSCREWS IN THE COOLING DUCT MUST BE TIGHTENED EVENLY IN CONJUNCTION WITH THE 12 BOLTS AND PAD ASSEMBLIES IN THE OUTER RING OF PWA 85078 FIXTURE OR DISTORTION OF OUTER RING MAY OCCUR.

(6) Evenly tighten 12 bolts (304/7) in outer ring of fixture and four jackscrews in cooling duct flange to separate turbine nozzle from diffuser case.

CAUTION: THE TURBINE NOZZLE MUST BE REMOVED FAR ENOUGH SO THAT THE COOLING DUCT SENSE TUBE IS FULLY DISENGAGED FROM THE COOLING DUCT BEFORE YOU ROTATE THE 1ST STAGE HPT COOLING DUCT.

(7) Move the turbine nozzle rearward far enough to disengage the turbine cooling duct sensing tube from the mating hole in the 1st stage HPT cooling duct. The turbine cooling duct sensing tube is located at the rear of the diffuser case at 15 degrees counterclockwise from TDC. Carefully rotate the assembly as required to provide clearance for the lugs of the combustion chamber clamp at 6 o'clock position on the turbine nozzle.

(8) Trunnion assembly to rear end down position and place assembly on pallet.

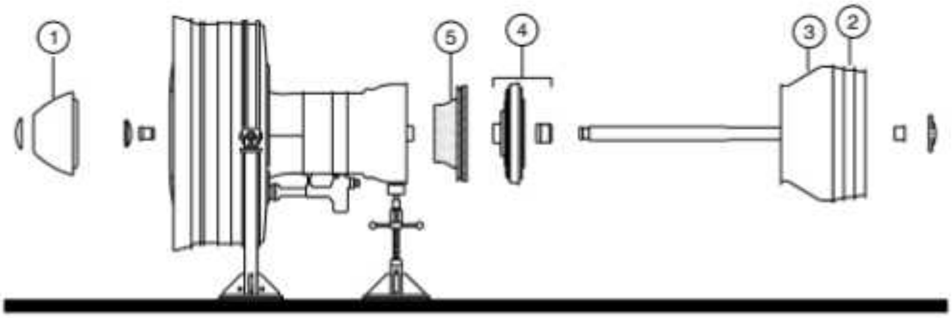
(9) Remove spring gasket (305/1) from upper OD groove in 1st stage HPT support (305/2). See Figure 305.

(10) Using hoist, lift and trunnion assembly to front, inner combustion chamber, end down position. Lower assembly onto pallet.

(11) Turbine nozzle, combustion chamber clamp and spacer, and diffuser outer combustion chamber are a matched set. If turbine nozzle will be disassembled or mated to reworked or different outer combustion chamber, remove nut (306/3), spacer (306/2) and bolt (306/1) securing combustion chamber clamp (306/4). Remove clamp from turbine nozzle. See Figure 306.

NOTE: Matched set was established during previous engine build by machining combustion chamber clamp spacer to specific dimensional requirement of mating outer combustion chamber, turbine nozzle and combustion chamber clamp.

ENGINE GENERAL − TURBINE NOZZLE − REMOVAL−01

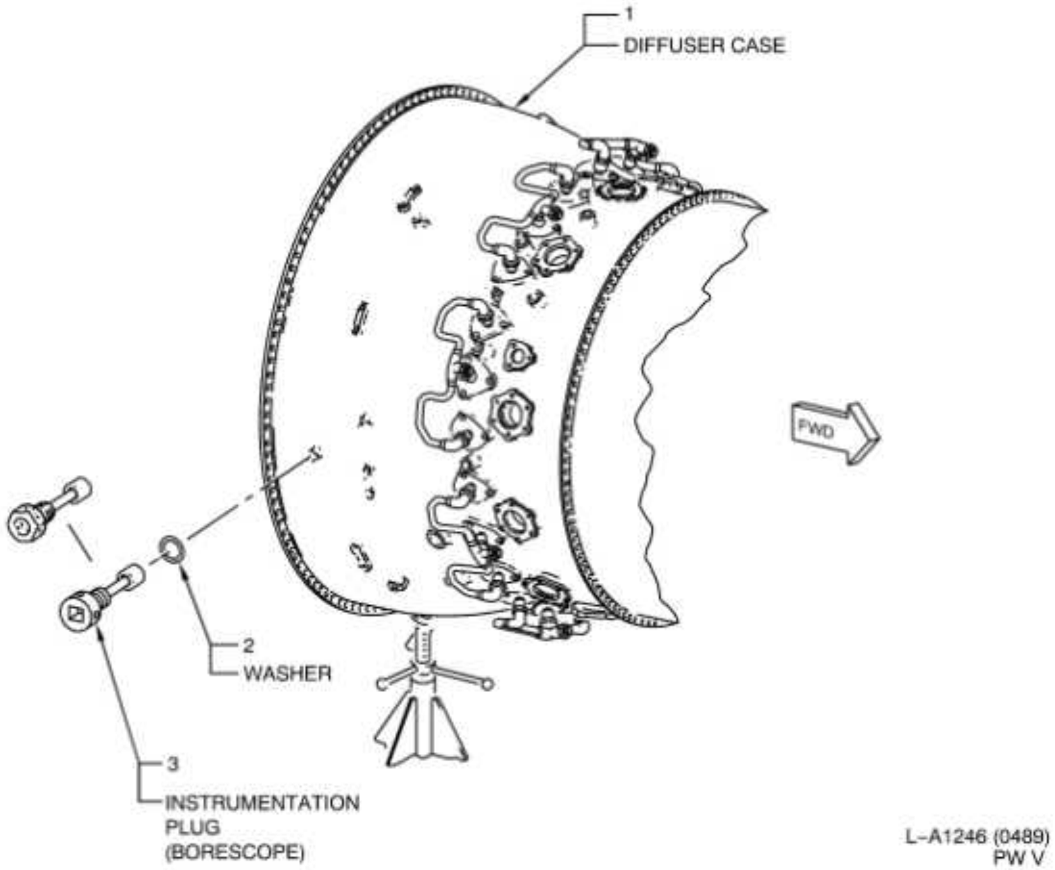


1. REMOVE COMPRESSOR INLET CONE
2. REMOVE TURBINE EXHAUST CASE
3. REMOVE LOW PRESSURE TURBINE
4. REMOVE HIGH PRESSURE TURBINE
5. REMOVE TURBINE NOZZLE

L−A0253 (0000)
PW V

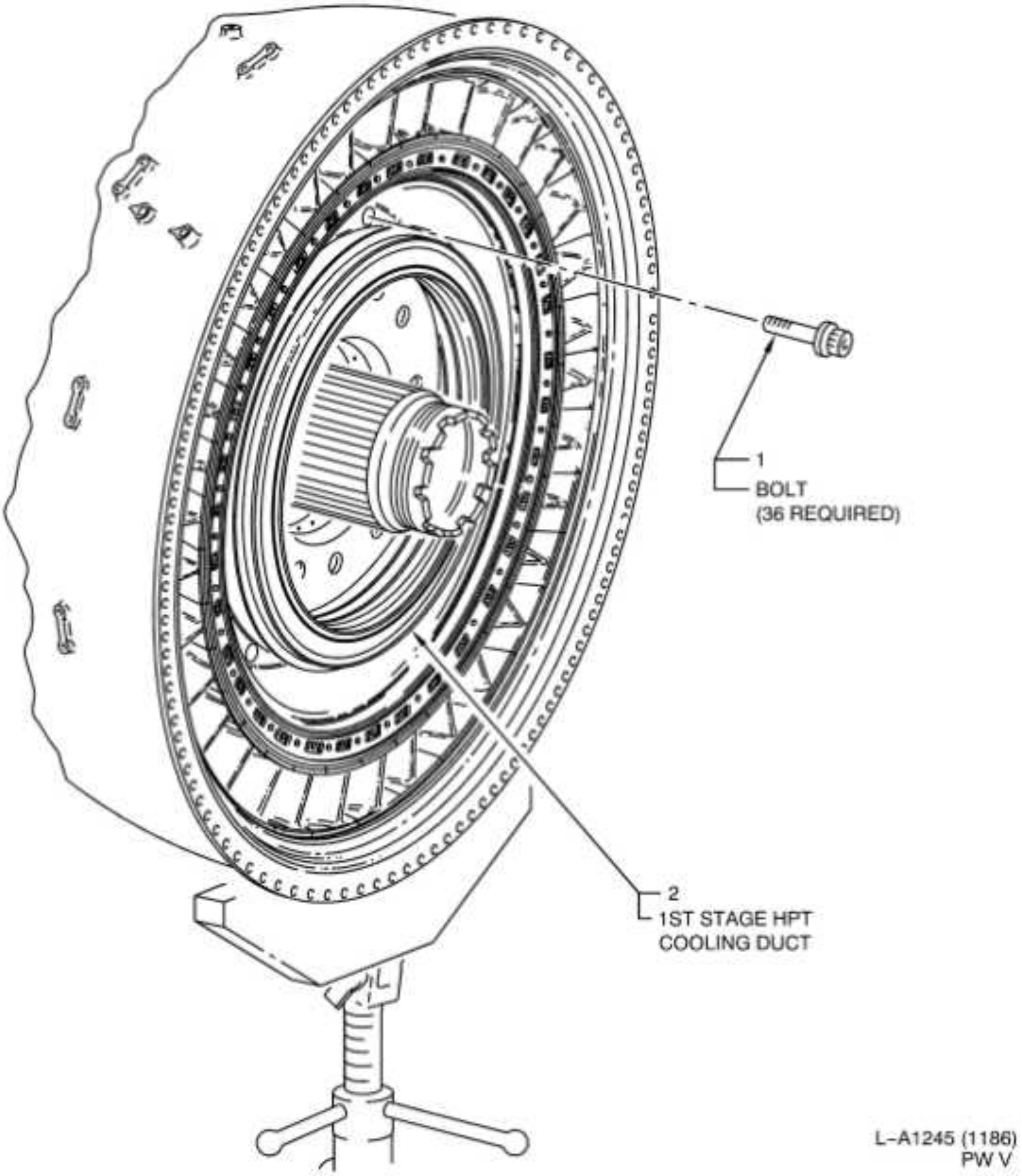
Procedure Sequence
Figure 301
(Task 72−00−51−020−001)

ENGINE GENERAL − TURBINE NOZZLE − REMOVAL−01

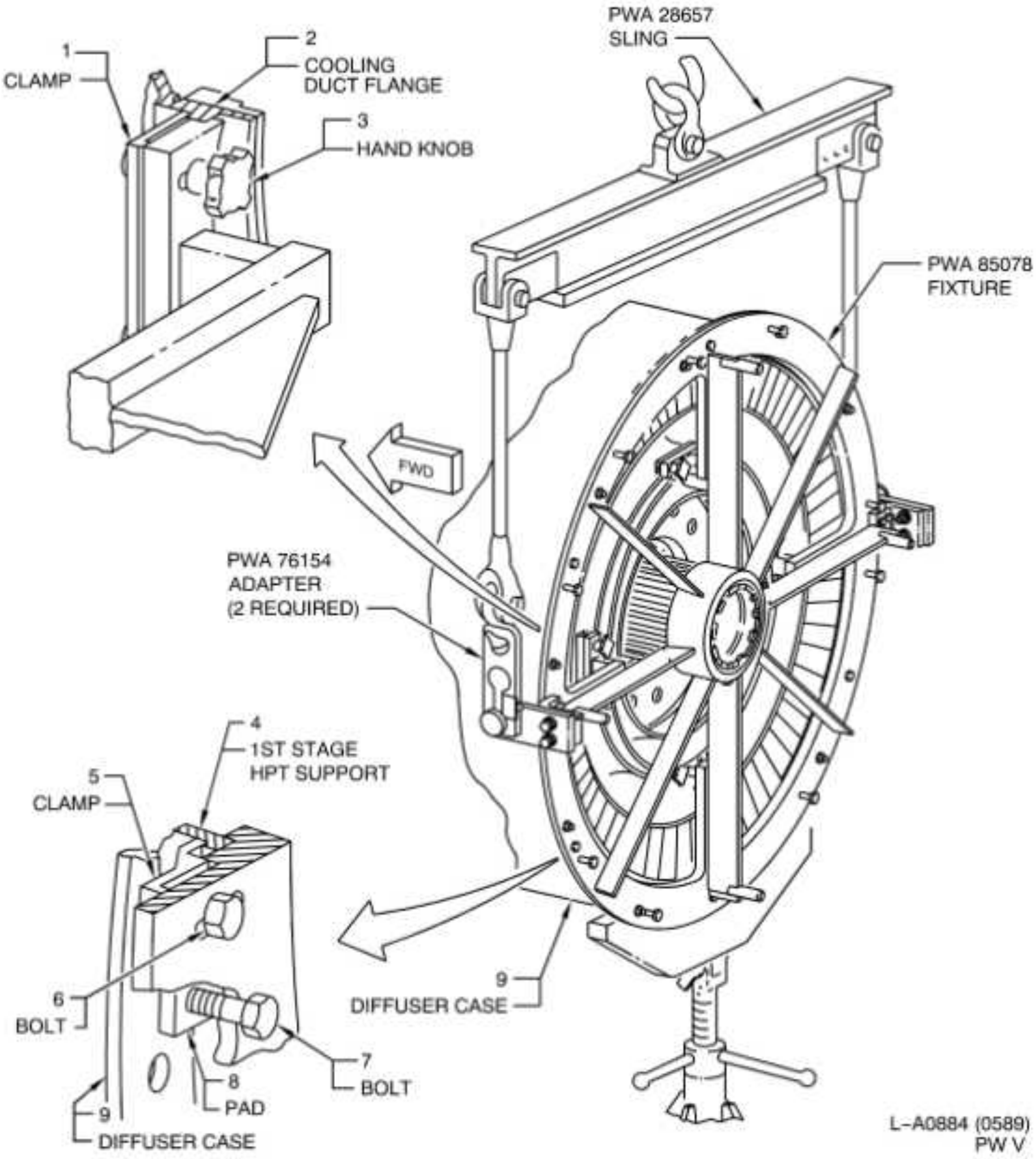

1
DIFFUSER CASE
FWD
2
WASHER
3
INSTRUMENTATION PLUG (BORESCOPE)
L−A1246 (0489)
PW V

Turbine Nozzle Removal
Figure 302
(Task 72−00−51−020−001)

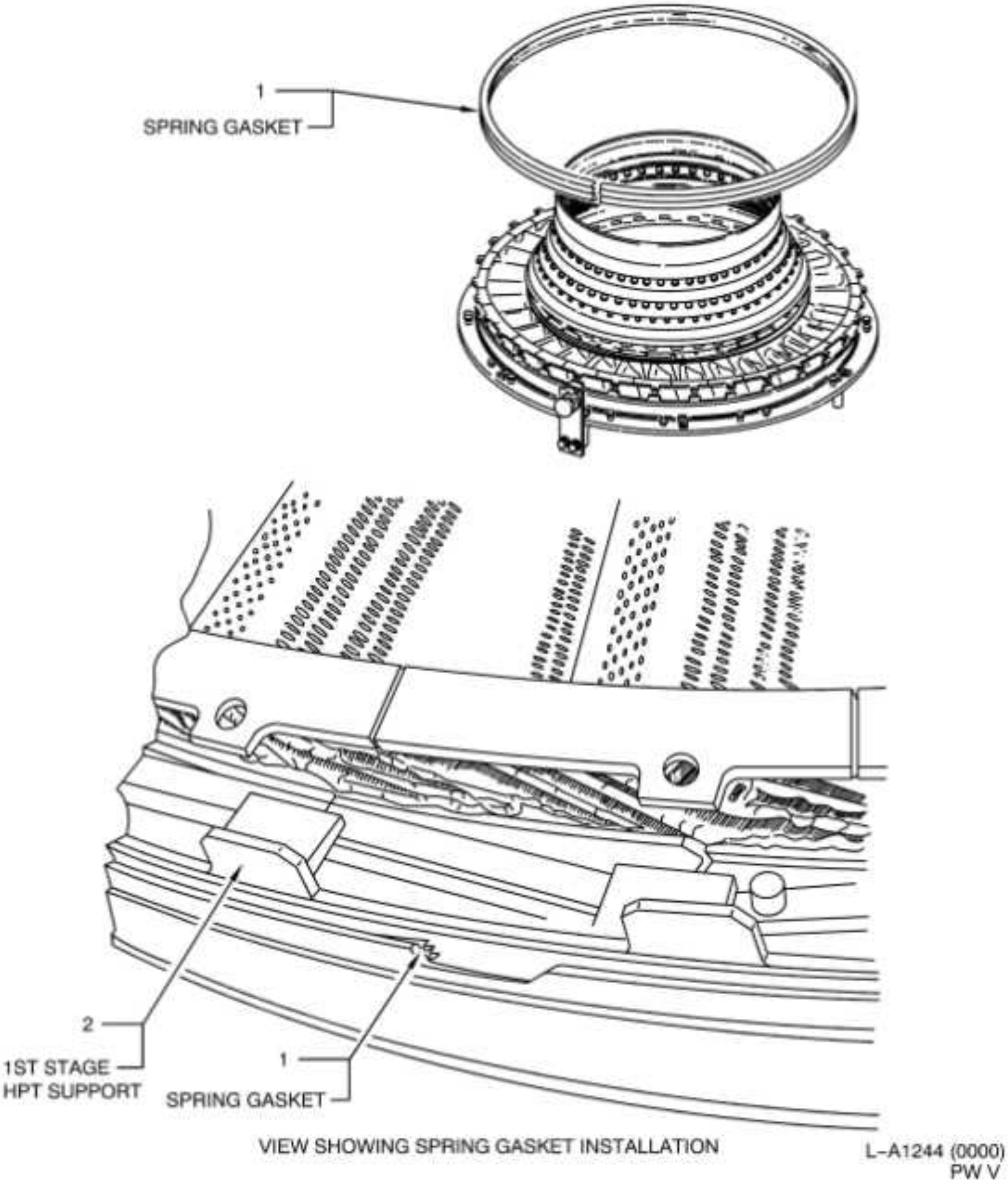
ENGINE GENERAL − TURBINE NOZZLE − REMOVAL−01


1
BOLT
(36 REQUIRED)
2
1ST STAGE HPT
COOLING DUCT
L-A1245 (1186)
PW V

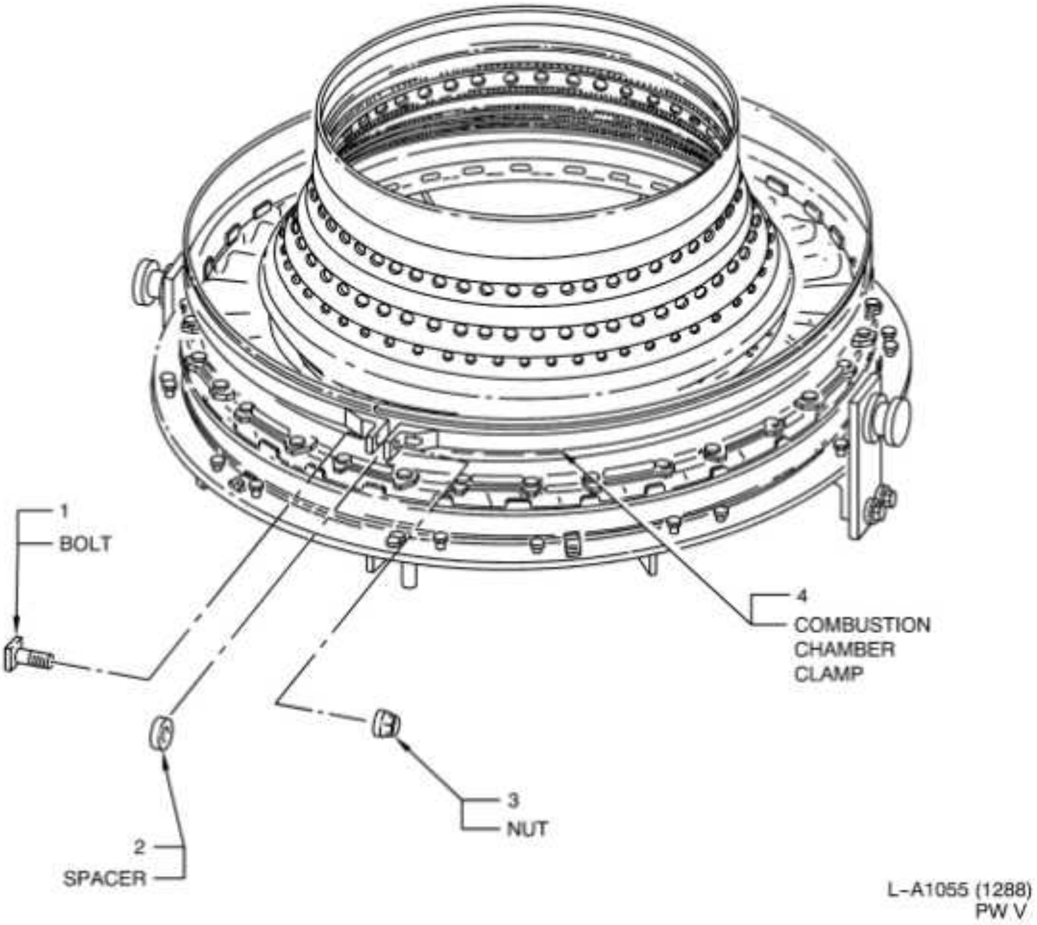
Turbine Nozzle Removal
Figure 303
(Task 72−00−51−020−001)


PWA 28657
SLING
1
CLAMP
2
COOLING
DUCT FLANGE
3
HAND KNOB
PWA 85078
FIXTURE
FWD
PWA 76154
ADAPTER
(2 REQUIRED)
4
1ST STAGE
HPT SUPPORT
5
CLAMP
6
BOLT
9
DIFFUSER CASE
7
BOLT
8
PAD
9
DIFFUSER CASE
L−A0884 (0589)
PW V

Turbine Nozzle Removal
Figure 304
(Task 72−00−51−020−001)


1
SPRING GASKET
2
1ST STAGE
HPT SUPPORT
1
SPRING GASKET
VIEW SHOWING SPRING GASKET INSTALLATION
L-A1244 (0000)
PW V

Spring Gasket Removal
Figure 305
(Task 72−00−51−020−001)


1
BOLT
2
SPACER
3
NUT
4
COMBUSTION
CHAMBER
CLAMP
L−A1055 (1288)
PW V

Outer Combustion Chamber Clamp Removal
Figure 306
(Task 72−00−51−020−001)

Previous Pageblock　　Return to Previous Menu　　Next Pageblock

ENGINE GENERAL - TURBINE NOZZLE - REMOVAL-02

Task 72-00-51-020-002:

1. Remove Turbine Nozzle - Vertical

NOTE: See Figure 301 for Part/Assembly Removal Procedure Sequence.

A. Prerequisites

(1) Remove The High Pressure Turbine - Vertical. Refer to 72-00-52, Removal-08 (Task 72-00-52-020-002).

B. Equipment And Materials Necessary

Standard Tools:
0.3125-24 Jackscrews (Four Required)

Special Tools:

PWA 28657 Sling, Handling
PWA 76154 Adapter (Two Required)
PWA 85063 Adapter, Wrench
PWA 85078 Fixture, Holding
PWA 85170 Pins, Aligning (Three Required)

C. Procedure
See Figure 302.

(1) Remove instrumentation plug (borescope) (302/1) and washer (302/2) from diffuser case (302/3) at 3 o'clock position as viewed from rear. See Figure 302.

(2) Using PWA 85063 Wrench Adapter remove 36 bolts (303/1) securing 1st stage HPT cooling duct (303/2) to diffuser case flange. See Figure 303.

(3) Install PWA 85078 Fixture to turbine nozzle. See Figure 304.

(a) Connect hoist with PWA 28657 Sling and two PWA 76154 Adapters to trunnion spools of Fixture PWA 85078.

(b) Using hoist, position fixture to diffuser case rear flange (304/9). Retract four inner clamps (304/1), six outer clamps (304/5) and 12 bolts (304/7).

(c) Seat fixture against 1st stage HPT support (304/4). Slide six clamps (304/5) over rear lip of support and tighten bolts (304/6) to secure clamps.

(d) Slide four clamps (304/1) over cooling duct flange (304/2).

(e) Using 12 bolts (304/7) seat pads (304/8) against rear flange of diffuser case (304/9).

(f) Take up slack in hoist.

(4) Install three PWA 85170 pins into boltholes in 1st stage HPT cooling duct, and thread into inner rear flange of diffuser case.

CAUTION: THE FOUR JACKSCREWS IN THE COOLING DUCT MUST BE TIGHTENED EVENLY IN CONJUNCTION WITH THE 12 BOLTS AND PAD ASSEMBLIES IN THE OUTER RING OF PWA 85078 FIXTURE OR DISTORTION OF OUTER RING MAY OCCUR.

(5) Install four 0.3125−24 Jackscrews into recessed jackscrew holes in front flange of cooling duct.

(6) Evenly tighten 12 bolts (304/7) in outer ring of fixture and four jackscrews in cooling duct flange to separate turbine nozzle from diffuser case.

CAUTION: THE TURBINE NOZZLE MUST BE REMOVED FAR ENOUGH SO THAT THE COOLING DUCT SENSE TUBE IS FULLY DISENGAGED FROM THE COOLING DUCT BEFORE YOU ROTATE THE 1ST STAGE HPT COOLING DUCT.

(7) Move the turbine nozzle rearward far enough to disengage the turbine cooling duct sensing tube from the mating hole in the 1st stage HPT cooling duct. The turbine cooling duct sensing tube is located at the rear of the diffuser case at 15 degrees counterclockwise from TDC. Carefully rotate the assembly as required to provide clearance for the lugs of the combustion chamber clamp at 6 o'clock position on the turbine nozzle.

(8) Using hoist, lift and trunnion assembly to rear end down position and place assembly on pallet.

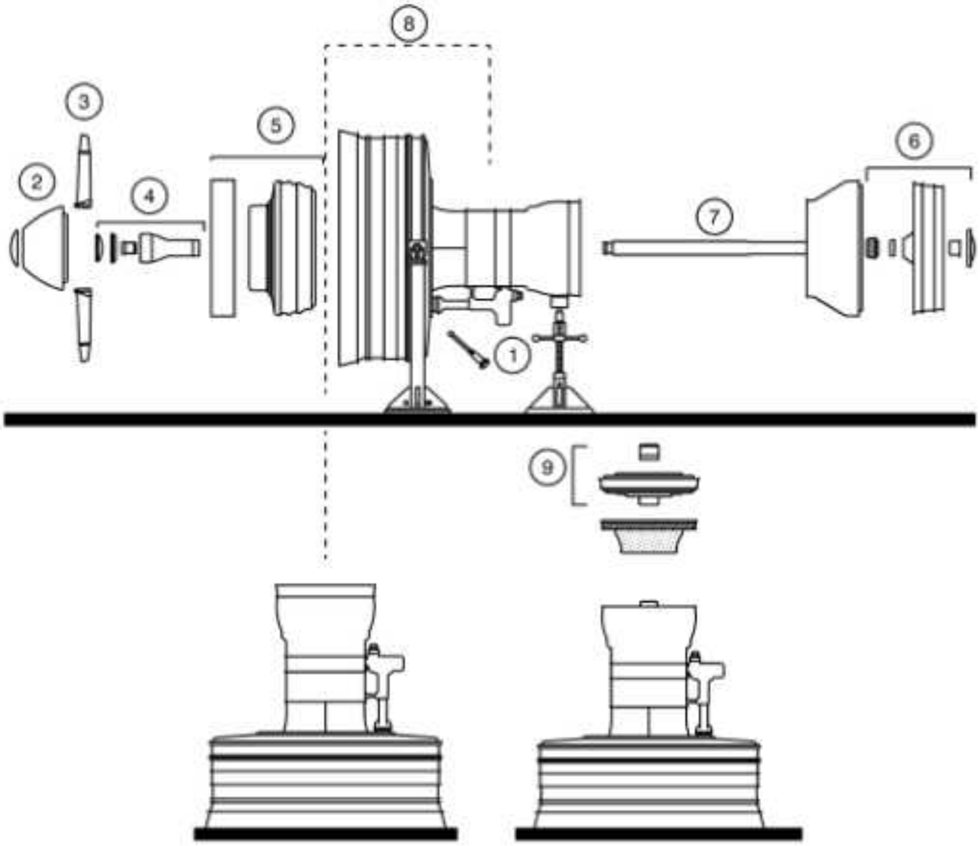
(9) Remove spring gasket (305/1) from upper OD groove in 1st stage HPT support (305/2). See Figure 305.

(10) Using hoist, lift and trunnion assembly to front, inner combustion chamber, end down position. Lower assembly onto pallet.

(11) Turbine nozzle, combustion chamber clamp and spacer, and diffuser outer combustion chamber are a matched set. If turbine nozzle will be disassembled or mated to reworked or different outer combustion chamber, remove nut (306/3), spacer (306/2) and bolt (306/1) securing combustion chamber clamp (306/4). Remove clamp from turbine nozzle. See Figure 306.

NOTE: Matched set was established during previous engine build by machining combustion chamber clamp spacer to specific dimensional requirement of mating outer combustion chamber, turbine nozzle and combustion chamber clamp.

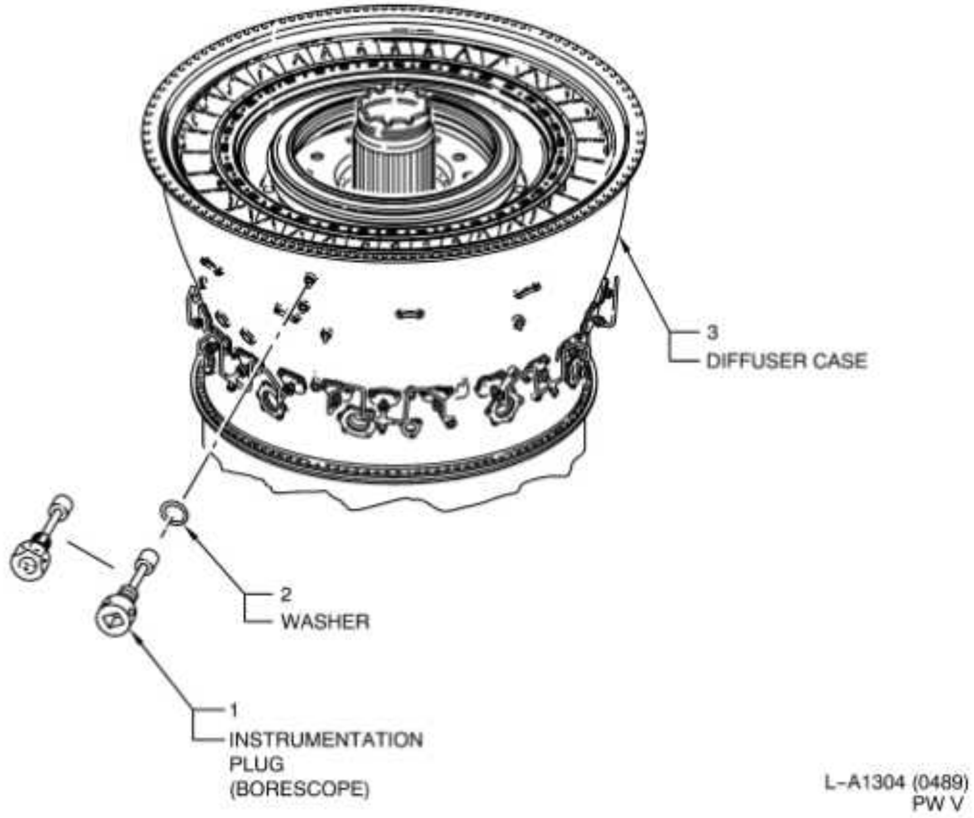
ENGINE GENERAL − TURBINE NOZZLE − REMOVAL−02



1. REMOVE ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
2. REMOVE COMPRESSOR INLET CONE.
3. REMOVE STAGE 1 LPC BLADE ASSEMBLIES.
4. REMOVE LPC/LPT COUPLING.
5. REMOVE LOW PRESSURE COMPRESSOR (LPC).
6. REMOVE TURBINE EXHAUST CASE.
7. REMOVE LOW PRESSURE TURBINE (LPT).
8. TRUNNION FAN CASES THROUGH HIGH PRESSURE TURBINE (HPT) TO FRONT END DOWN.
9. REMOVE HIGH PRESSURE TURBINE (HPT).

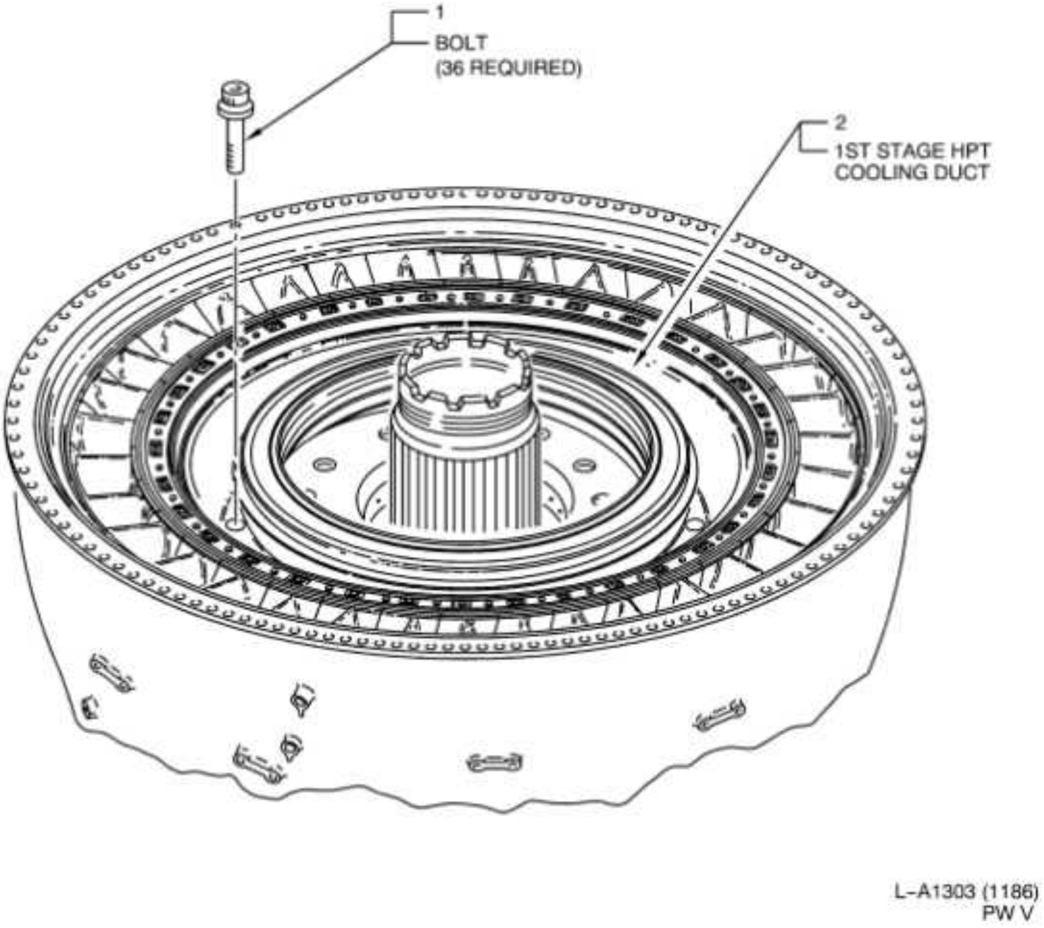
L−A1298 (0000)
PW V

Procedure Sequence
Figure 301
(Task 72−00−51−020−002)


3
DIFFUSER CASE
2
WASHER
1
INSTRUMENTATION
PLUG
(BORESCOPE)
L−A1304 (0489)
PW V

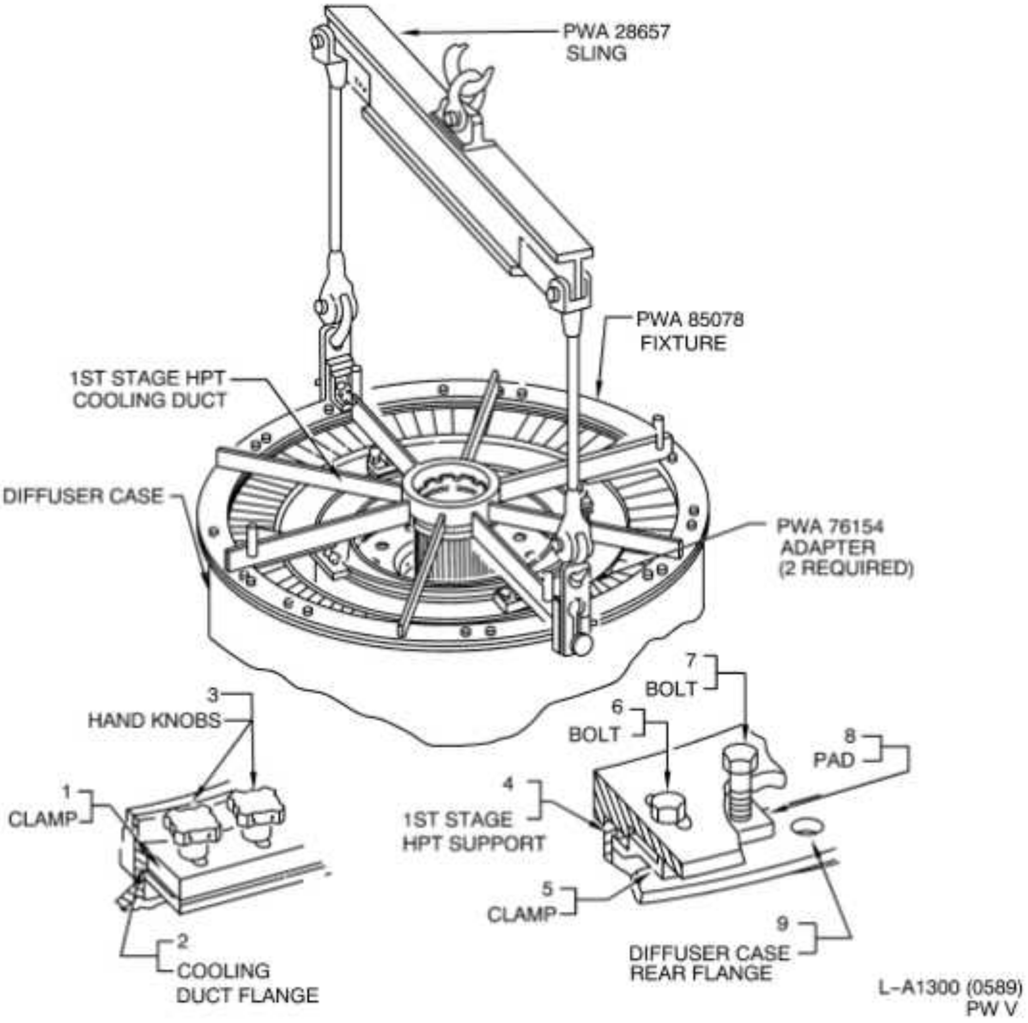
Instrumentation Plug Removal
Figure 302
(Task 72−00−51−020−002)

ENGINE GENERAL − TURBINE NOZZLE − REMOVAL−02

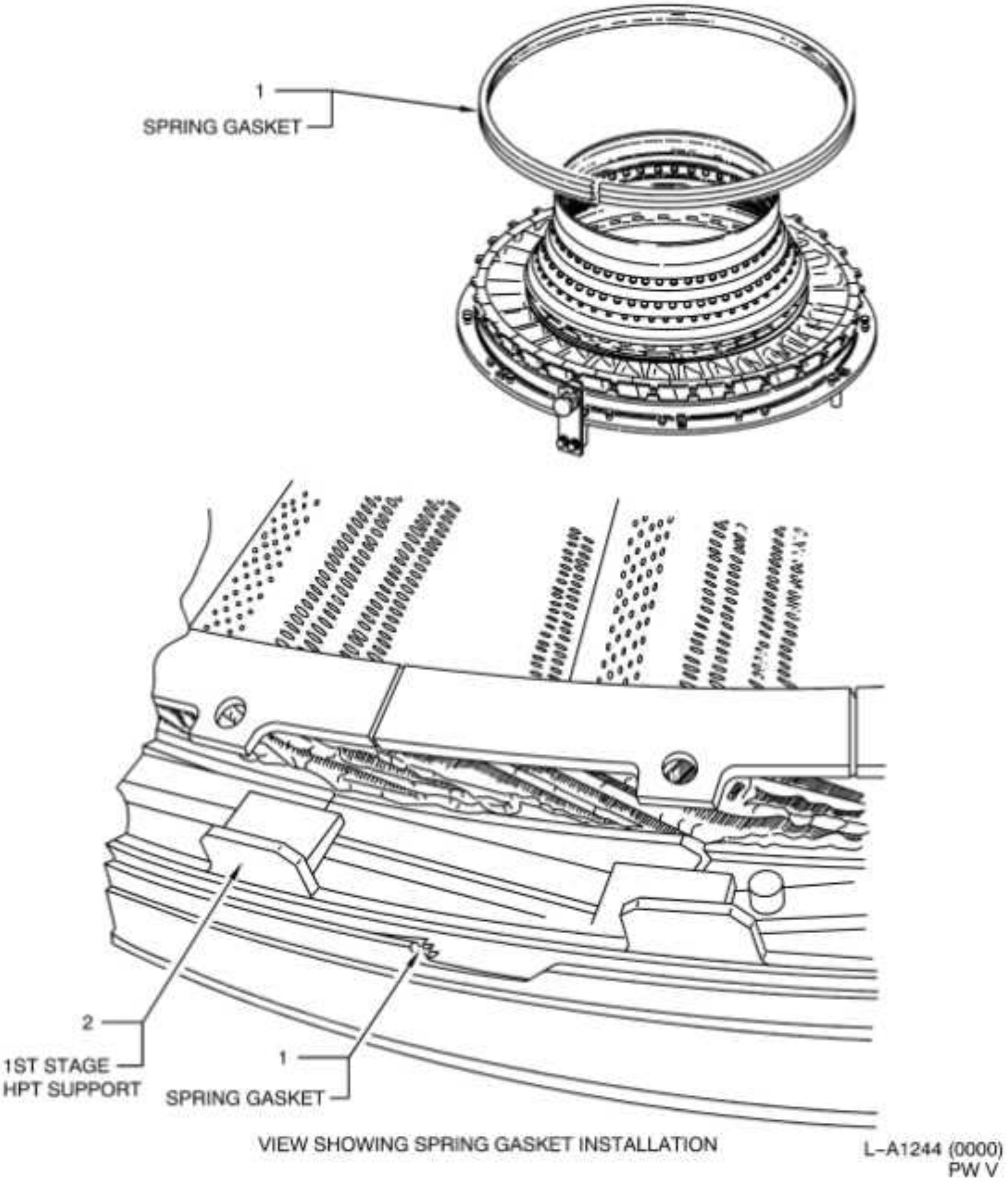

1
BOLT
(36 REQUIRED)
2
1ST STAGE HPT
COOLING DUCT
L-A1303 (1186)
PW V

Turbine Nozzle Removal
Figure 303
(Task 72−00−51−020−002)

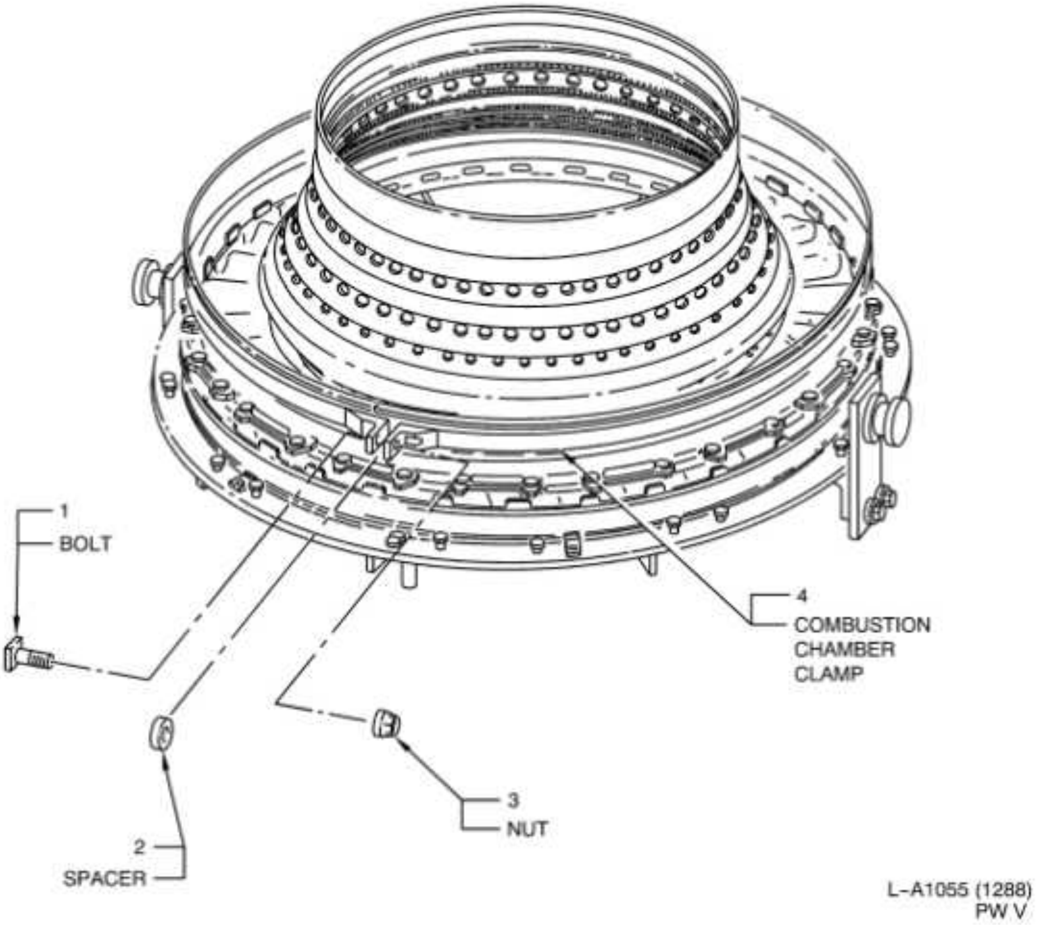
ENGINE GENERAL − TURBINE NOZZLE − REMOVAL−02


PWA 28657
SLING
PWA 85078
FIXTURE
1ST STAGE HPT
COOLING DUCT
DIFFUSER CASE
PWA 76154
ADAPTER
(2 REQUIRED)
7
BOLT
6
BOLT
3
HAND KNOBS
8
PAD
1
CLAMP
4
1ST STAGE
HPT SUPPORT
5
CLAMP
2
COOLING
DUCT FLANGE
9
DIFFUSER CASE
REAR FLANGE
L−A1300 (0589)
PW V

Turbine Nozzle Removal
Figure 304
(Task 72−00−51−020−002)


1
SPRING GASKET
2
1ST STAGE
HPT SUPPORT
1
SPRING GASKET
VIEW SHOWING SPRING GASKET INSTALLATION
L−A1244 (0000)
PW V

Spring Gasket Removal
Figure 305
(Task 72−00−51−020−002)


1
BOLT
2
SPACER
3
NUT
4
COMBUSTION CHAMBER CLAMP
L−A1055 (1288)
PW V

Combustion Chamber Clamp Removal
Figure 306
(Task 72−00−51−020−002)

ENGINE GENERAL - TURBINE NOZZLE - INSTALLATION-01

Task 72-00-51-420-001:

1. Install Turbine Nozzle - Horizontal

NOTE: See Figure 401 for part/assembly installation procedure sequence.

A. Prerequisites

(1) See Inspection/Check-01 Task 72-00-51-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows:

B. Equipment And Materials Necessary

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 28657	Sling, Handling
PWA 29754	Control
PWA 29855-2	Alignment Pins
PWA 76154	Adapter (Two Necessary)
PWA 85063	Adapter, Wrench
PWA 85078	Fixture, Holding
PWA 85170	Pin, Aligning (3 Necessary)
PWA 85644	Ring, Gaging
PWA 87139	Heater
PWA 87172	Ring, Retaining

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-102	Dry Ice
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
	P05-395	Beeswax
R	P05-396	Paraffin Wax Blend
	P06-023	Silver Goop (PWA 36001)
R	P06-054	Antiseize Paste (PWA 36246)

C. Procedure
See Figure 402.

CAUTION: ENGINES THAT HAVE AN OUTER COMBUSTION CHAMBER ASSEMBLY WITH REVISED DILUTION HOLES (DECREASED EMISSIONS) MUST BE USED IN SETS WITH INNER COMBUSTION CHAMBER ASSEMBLY WITH REVISED DILUTION HOLES (REFERENCED SB PW4ENG 72−187).

(1) Install PWA 85078 Fixture to turbine nozzle. See Figure 402.

(a) Connect hoist with PWA 28657 Sling and two PWA 76154 Adapters to trunnion spools of Fixture (PWA 85078).

(b) Retract four inner clamps (402/1), six outer clamps (402/5), and bolts (402/7). Remove ten bolt assemblies (402/8).

(c) Locate the borescope boss line on the fixture ring. Use the hoist to put the fixture over the turbine nozzle. Align the borescope boss line with the instrumentation guide (borescope) detail of the combustion chamber guide. Lower the fixture on the 1st stage HPT support (402/4). Slide the six clamps (402/5) over the rear lip of the support and tighten bolts (402/6) to secure the clamps.

(d) Slide the four clamps (402/1) over the flange of the 1st stage HPT cooling duct (402/3).

(2) Use the hoist to lift and trunnion the assembly to rear end down position and rest it on the feet of the fixture.

CAUTION: SHOULD ANY OF THE FITTED HARDWARE BE REPLACED PRIOR TO FINAL INSTALLATION, THIS PROCEDURE MUST BE PERFORMED AGAIN AND A NEW CLAMP SPACER MAY BE REQUIRED.

(3) (Reference 1000) (Engines Without The Talon II Low Emmision Burner) Determine combustion chamber clamp spacer thickness. See Figure 403 (Sheet 1).

NOTE: You can use a gage ring or the actual combustion chamber assembly to determine the spacer thickness in the following procedure.

(a) If you use PWA 85644 Gaging Ring, measure largest outside diameter at rear of outer combustion chamber. Set the gaging ring to this diameter.

(b) Loosen combustion chamber guide nuts (403/1) one full turn.

(c) If applicable, position gaging ring into combustion chamber guides.

CAUTION: IF YOU USE THE ACTUAL COMBUSTION CHAMBER, USE CARE THAT YOU DO NOT DAMAGE THE PROTECTIVE COATING ON THE COMBUSTION CHAMBER LINER.

(d) If you use the actual outer combustion chamber assembly, use a hoist and suitable sling to put the combustion chamber into the combustion chamber guides.

(e) Install combustion chamber clamp (403/6) around guides and secure with detail bolt (403/2) and 0.250-28 UNJF-3B non-self-locking worknut (403/7). Place clamp split at the 6 o'clock location. Torque bolt to 6 - 10 lb-in. (0.678 - 1.130 N.m).

(f) Measure Gap K between two ends of combustion chamber clamp.

(g) (Pre SB PW4ENG 72-702) Machine the spacer (403/3) to a width of 0.005 - 0.015 inch (0.13 - 0.38 mm) less than Gap K.

(h) (Post SB PW4ENG 72-702) Select the correct class spacer (403/3) to get a width of 0.005 - 0.015 inch (0.13 - 0.38 mm) less than Gap K. See Table 401. If necessary, machine the spacer to get the correct fit.

CLASS	SPACER THICKNESS
CL1	0.105 - 0.111 inch (2.667 - 2.819 mm)
CL2	0.115 - 0.121 inch (2.921 - 3.073 mm)
CL3	0.125 - 0.131 inch (3.175 - 3.327 mm)
CL4	0.135 - 0.141 inch (3.429 - 3.581 mm)
CL5	0.145 - 0.151 inch (3.683 - 3.835 mm)
CL6	0.155 - 0.161 inch (3.937 - 4.089 mm)
CL7	0.165 - 0.171 inch (4.191 - 4.343 mm)
CL8	0.175 - 0.181 inch (4.445 - 4.597 mm)

Table 401

R
R

(CONTINUED)

CLASS	SPACER THICKNESS
CL9	0.185 - 0.191 inch (4.699 - 4.851 mm)
CL10	0.195 - 0.201 inch (4.953 - 5.105 mm)
CL11	0.205 - 0.211 inch (5.207 - 5.359 mm)
CL12	0.215 - 0.221 inch (5.461 - 5.613 mm)
CL13	0.225 - 0.231 inch (5.715 - 5.867 mm)
CL14	0.235 - 0.241 inch (5.969 - 6.121 mm)
CL15	0.245 - 0.251 inch (6.223 - 6.375 mm)
CL16	0.065 - 0.071 inch (1.651 - 1.803 mm)
CL17	0.075 - 0.081 inch (1.905 - 2.057 mm)
CL18	0.085 - 0.091 inch (2.159 - 2.311 mm)
CL19	0.095 - 0.101 inch (2.413 - 2.565 mm)

Table 401 (Continued)

(i) (Pre SB PW4ENG 72-542) As necessary, apply
R Antiseize Paste P06-054 to the threads of the
R bolts before you install the nuts (403/1). Wipe
R off unwanted paste. Torque the nuts (403/1) to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(j) (Post SB PW4ENG 72-542) Torque the nuts (403/1) to 85 - 95 lb-in. (9.604 - 10.734 N.m). As necessary, apply Engine Oil P03-001 to threads of the nuts before you apply the torque.

(k) Loosen bolt detail and remove gaging ring or the actual combustion chamber if applicable, from combustion chamber guides.

(l) Disassemble bolt (403/2) and nut (403/7) from clamp.

(m) Reassemble bolt (403/2), spacer (403/3) and self-locking nut (403/4). Place clamp split at the 6 o'clock location. Torque bolt to 100 - 110 lb-in. (11.298 - 12.428 N.m).

CAUTION: IF ANY OF THE FITTED HARDWARE IS REPLACED BEFORE FINAL INSTALLATION, THEN YOU MUST DO THIS PROCEDURE AGAIN. IT IS POSSIBLE YOU WILL NEED A NEW CLAMP.

(4) (Reference 1015) (Engines With The Talon II Low Emmision Burner) Find the combustion chamber clamp spacer thickness. See Figure 403 (Sheet 2).

(a) Put the combustion chamber clamp on a work bench (the end with the slots down).

(b) Install a bolt (403/11) lubricated with Engine Oil P03−001 (with the head of the bolt to the right) and attach it with a work nut. Tighten the nut sufficiently to move the clamp assembly flanges together.

(c) Measure the ID of the clamp assembly with a PI Tape or other applicable device. Record this as Dimension C.

(d) Loosen the bolt (403/11) and the work nut. Put this bolt on a work bench for subsequent use.

(e) Measure the diameter of the outer burner at its largest OD with a PI Tape or other applicable device. Make sure you measure the middle section of the largest OD. Attach the PI Tape with tape. Record this as Dimension D. This dimension must be 36.638 − 36.658 inches (930.61 − 931.11 mm).

(f) Use the formula which follows to find the value for Dimension E:

E = [PI (3.1416 inches (79.797 mm)) x (D − C)] − 0.009 inch (0.229 mm).

(g) Record the value for Dimension E.

NOTE: You will use Dimension E to get the correct class of spacer (403/12) to use for the combustion chamber clamp (403/14).

(h) Get the class of spacer (403/12) that has a value nearest the value of Dimension E you calculated. Use the table below. If Dimension E is exactly between the spacer classes, use the lower class spacer:

CLASS	DIMENSION E (SPACER THICKNESS)
CL1	0.105 − 0.111 inch (2.667 − 2.819 mm)
CL2	0.115 − 0.121 inch (2.921 − 3.073 mm)
CL3	0.125 − 0.131 inch (3.175 − 3.327 mm)
CL4	0.135 − 0.141 inch (3.429 − 3.581 mm)
CL5	0.145 − 0.151 inch (3.683 − 3.835 mm)
CL6	0.155 − 0.161 inch (3.937 − 4.089 mm)

CLASS DIMENSION E (SPACER THICKNESS)

(CONTINUED)

CL7	0.165 − 0.171 inch (4.191 − 4.343 mm)
CL8	0.175 − 0.181 inch (4.445 − 4.597 mm)
CL9	0.185 − 0.191 inch (4.699 − 4.851 mm)
CL10	0.195 − 0.201 inch (4.953 − 5.105 mm)
CL11	0.205 − 0.211 inch (5.207 − 5.359 mm)
CL12	0.215 − 0.221 inch (5.461 − 5.613 mm)
CL13	0.225 − 0.231 inch (5.715 − 5.867 mm)
CL14	0.235 − 0.241 inch (5.969 − 6.121 mm)
CL15	0.245 − 0.251 inch (6.223 − 6.375 mm)

(i) Install the spacer (403/12) between the ends of the clamp assembly and attach it with the nut (403/13) and bolt (403/11) you used before.

(j) Tighten and torque the nut to 85 − 95 lb−in (9.604 − 10.734 N.m).

(k) Torque the nuts (403/10) to 85 − 95 lb−in. (9.604 − 10.734 N.m). As necessary, apply Engine Oil P03−001 to threads of the nuts before you apply the torque.

(5) Install spring gasket (404/1) in upper OD groove in 1st stage HPT support (404/2). Retain gasket in position using Beeswax P05−395 or Paraffin Wax Blend P05−396, as required. See Figure 404.

(6) Thread three PWA 85170 Aligning Pins into equally spaced boltholes in inner rear flange of diffuser case.

(7) Using hoist, lift assembly and trunnion to horizontal, flight, position.

CAUTION: YOU CAN DAMAGE THE TURBINE COOLING DUCT SENSING TUBE IF IT IS NOT ALIGNED WITH ITS MATING HOLE IN THE 1ST STAGE HPT COOLING DUCT.

(8) Locate the turbine cooling duct sensing tube (405/6) at the rear of the diffuser case at 15 degrees counterclockwise from TDC. Align the sensing tube with the mating hole in the 1st stage HPT cooling duct, and the boltholes with the aligning pins. Move the

assembly forward until it is stopped by the tight fit with the diffuser case. See Figure 405.

NOTE: Rear flange of turbine nozzle may be chilled to facilitate assembly.

CAUTION: MAKE SURE THAT THE INNER COMBUSTION CHAMBER ASSEMBLY (LINER) IS PROPERLY ENGAGED IN THE OUTER COMBUSTION CHAMBER (BULKHEAD) OR MISASSEMBLY OF PARTS CAN OCCUR.

(9) Use a flashlight or equivalent light source to check the engagement of the forward end of the inner combustion chamber assembly (liner) (405/2) in the outer combustion chamber (bulkhead) (405/1). Look between the Stage 1 HPT vanes (405/5) to check the engagement of the parts at the slip joint (405/3) all around. See Figure 405.

(10) Install ten bolt assemblies (406/7) through boltholes in rear flange of diffuser case (406/9) and boltholes in outer ring of Fixture (PWA 85078). Secure the bolts with nuts (406/8). See Figure 406.

(11) Evenly tighten ten nuts (406/8) to seat 1st stage HPT support in diffuser case.

(12) Secure inner flange of 1st stage HPT cooling duct (407/2) to diffuser case with several bolts (407/1) lubricated with Engine Oil P03−001. See Figure 407.

(13) Do a check of the PS4I pressure tube, located at approximately the 11 o'clock position on the OD of the diffuser case, for blockage as follows.

  (a) Attach a connector to the PS4I pressure tube and apply air pressure at 20.0 PSIG (137.9 kPa) to the tube.

  (b) Make sure air passes through the tube. No blockage is permitted.

  (c) If no blockage is found, remove the air source and connector and continue build.

  (d) If blockage is noted, remove and reposition the 1st stage HPT cooling duct to clear the tube.

(14) Remove Fixture (PWA 85078) from the turbine nozzle.

(a) Remove the bolt assemblies (406/7) and nuts (406/8) from the rear flange of diffuser case (406/9).

(b) Loosen the hand knobs (406/3) and retract four clamps (406/1) that hold the fixture to the cooling duct flange (406/2).

(c) Loosen the bolts and retract six clamps (406/5) that hold the fixture to the 1st stage HPT support (406/4).

(d) Use the hoist to remove the fixture from the turbine nozzle.

(15) Removing aligning pins as required, install remaining bolts (407/1), lubricated with Engine Oil P03-001, through boltholes in cooling duct and into diffuser case. Using PWA 85063 Wrench Adapter, torque 36 bolts to 290 - 325 lb-in. (32.766 - 36.720 N.m).

NOTE: If required, aligning pins may be removed using standard 0.250 inch (6.350 mm) universal socket.

(16) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install the Stage 1 HPT brush seal and support assembly into the 1st stage HPT cooling duct assembly. See Figure 408.

(a) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
In the following step, replace the Stage 1 HPT brush seal assembly with a new assembly as follows:

1 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
If the 1st stage HPT inner airseal is replaced with a new or refurbished part.

2 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
If the 1st stage HPT inner airseal was removed and re-installed on the 1st stage turbine hub regardless of the reason for the removal and re-installation.

NOTE: FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
The 1st stage HPT inner airseal is installed in 72-52-01, Assembly-01 (Task 72-52-01-440-001).

3 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
When the match of the 1st stage HPT inner airseal and brush seal is changed. Such as in a module swap.

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Put the stage 1 HPT brush seal and support assembly on the bench, with the brush seal assembly up.

CAUTION: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
WHEN YOU INSTALL THE RETAINING RING IN THE BRUSH SEAL YOU MUST TURN THE RETAINING RING IN A CLOCKWISE DIRECTION OR DAMAGE CAN OCCUR TO THE BRUSH SEAL.

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the PWA 87172 Retaining Ring (small OD down) in the brush seal. Turn the Retaining Ring clockwise and push down until the flange of the ring touches the brush seal support.

(d) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Put the stage 1 brush seal and support assembly and the Retaining Ring in a container with Dry Ice P05−102.

(e) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Attach three PWA 29855−2 Alignment Pins equally spaced through the duct flange that will be heated.

(f) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Put the PWA 87139 Heater onto the duct and over the alignment pins. Use the hanger detail to hold the heater on the duct. The reflector assembly flange will rest on the top of the duct. Attach the PWA 29754 Control to the receptacle and the thermocouple.

(g) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Actuate the control to heat the duct to 200°F (93.3°C) minimum to 240°F (115.6°C) maximum.

(h) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Lubricate the threads of the 24 bolts with Engine Oil P03−001.

(i) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
When the 1st stage HPT cooling duct assembly has the correct temperature, continue as follows.

1 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Wear gloves and remove the thermocouple connector from the heater control. Remove the heater control from the heater. Remove the heater from the cooling duct.

2 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the stage 1 HPT brush seal and support assembly and the Retaining Ring from the dry ice container.

CAUTION: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
WHEN YOU INSTALL THE ASSEMBLED BRUSH SEAL AND RETAINING RING, TURN THE RETAINING RING AND BRUSH SEAL IN A CLOCKWISE DIRECTION AS YOU INSTALL IT ON THE DUCT OR DAMAGE CAN OCCUR TO THE BRUSH SEAL.

3 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the assembled brush seal and retaining ring to the cooling duct. Turn the brush seal and the retaining ring in a clockwise direction on the cooling duct and align the bolt holes.

4 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Attach the brush seal to the cooling duct with the 12 bolts, every other bolt hole, and tighten the bolts to touch the brush seal support to the cooling duct, do not use more 85 − 95 lb−in. (9.604 − 10.734 N.m) of torque.

5 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Allow time for the brush seal and the cooling duct to get to room temperature.

(j) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Loosen the 12 bolts that attach the brush seal to the cooling duct to 0 lb−in. (0 N.m).

(k) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the 12 bolts in the remaining bolt holes to attach the brush seal to the cooling duct.

(l) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Torque the 24 bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

CAUTION: FOR THESE MODELS: 4152-3, 4156A-3, 4158-3 WHEN YOU REMOVE THE RETAINING RING FROM THE ASSEMBLED BRUSH SEAL AND COOLING DUCT, TURN THE RETAINING RING IN A CLOCKWISE DIRECTION OR DAMAGE CAN OCCUR TO THE BRUSH SEAL.

(m) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Turn the Retaining Ring (PWA 87172) in a clockwise direction and rearward to remove the retaining ring from the brush seal.

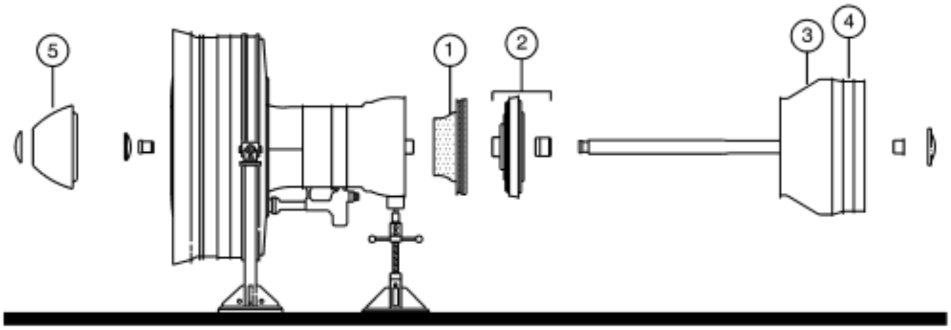
(17) Install washer (409/2) and instrumentation plug (borescope) (409/3), lubricated with Silver Goop P06-023, into the instrumentation port in the diffuser case (409/1) at 3 o'clock position. Torque the plug to 40 - 50 lb-in. (4.519 - 5.649 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to the plug. See Figure 409.

D. Postrequisites

(1) Install The High Pressure Turbine - Horizontal. Refer to 72-00-52, Installation-01 (Task 72-00-52-420-001).

(2) Test the engine per the Repair Test Reference Table. Refer to 71-00-00, Testing-00 (Task 71-00-00-990-003).

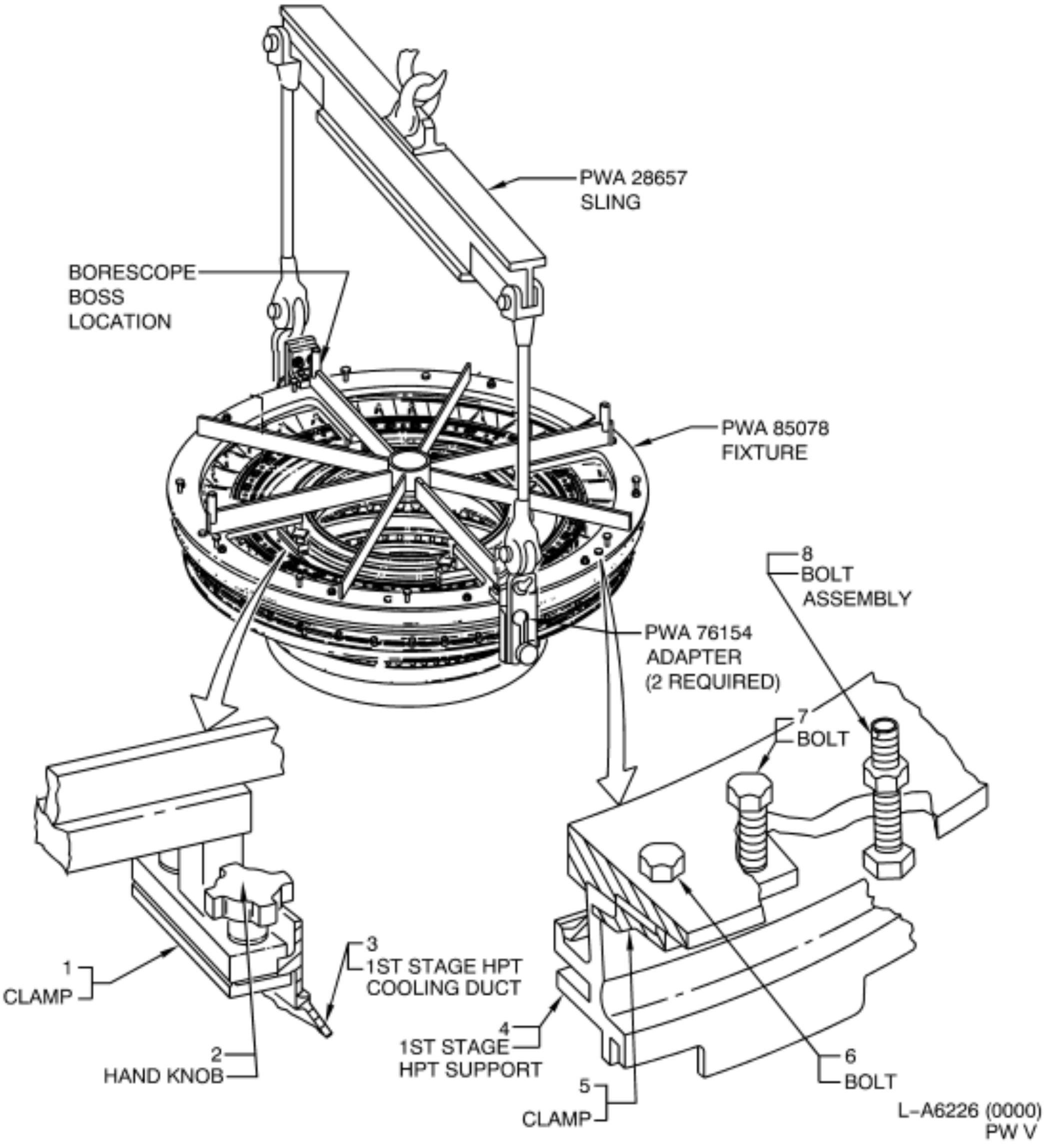
ENGINE GENERAL − TURBINE NOZZLE − INSTALLATION−01



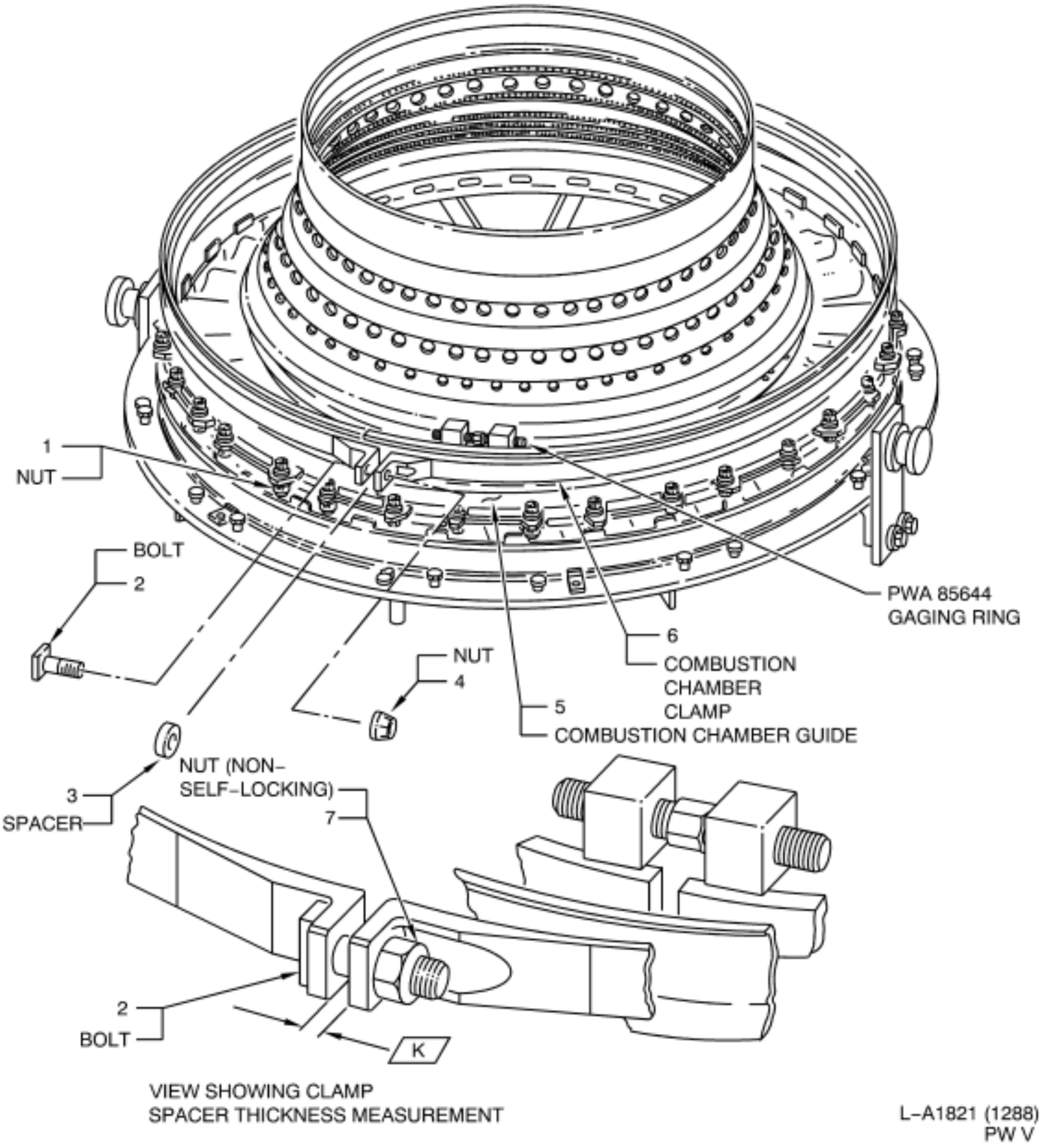
1. INSTALL TURBINE NOZZLE
2. INSTALL HIGH PRESSURE TURBINE
3. INSTALL LOW PRESSURE TURBINE
4. INSTALL TURBINE EXHAUST CASE
5. INSTALL COMPRESSOR INLET CONE

L−A0254 (0000)
PW V

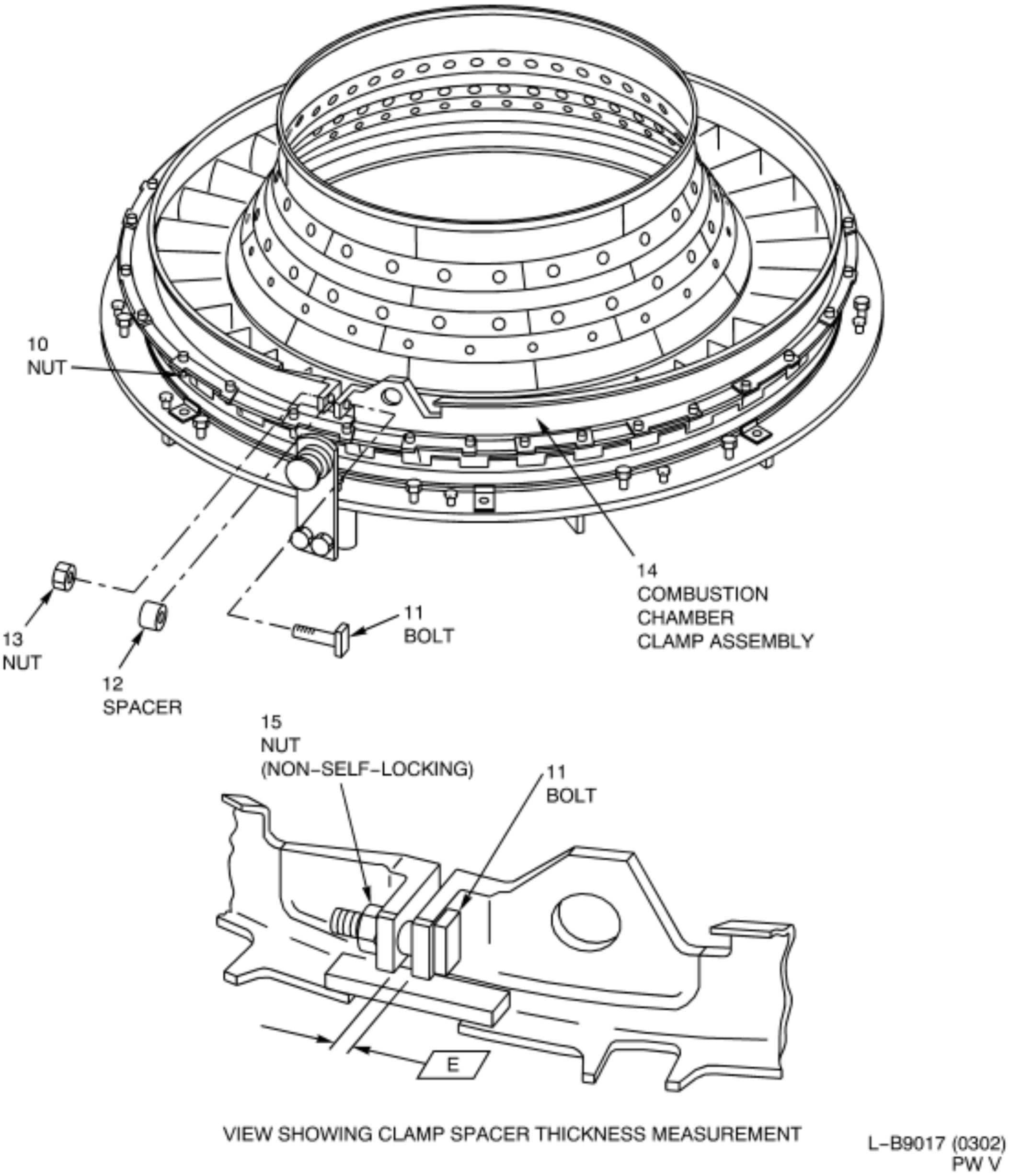
Procedure Sequence
Figure 401
(Task 72−00−51−420−001)


PWA 28657
SLING
BORESCOPE
BOSS
LOCATION
PWA 85078
FIXTURE
8
BOLT
ASSEMBLY
PWA 76154
ADAPTER
(2 REQUIRED)
7
BOLT
1
CLAMP
3
1ST STAGE HPT
COOLING DUCT
2
HAND KNOB
4
1ST STAGE
HPT SUPPORT
6
BOLT
5
CLAMP
L−A6226 (0000)
PW V

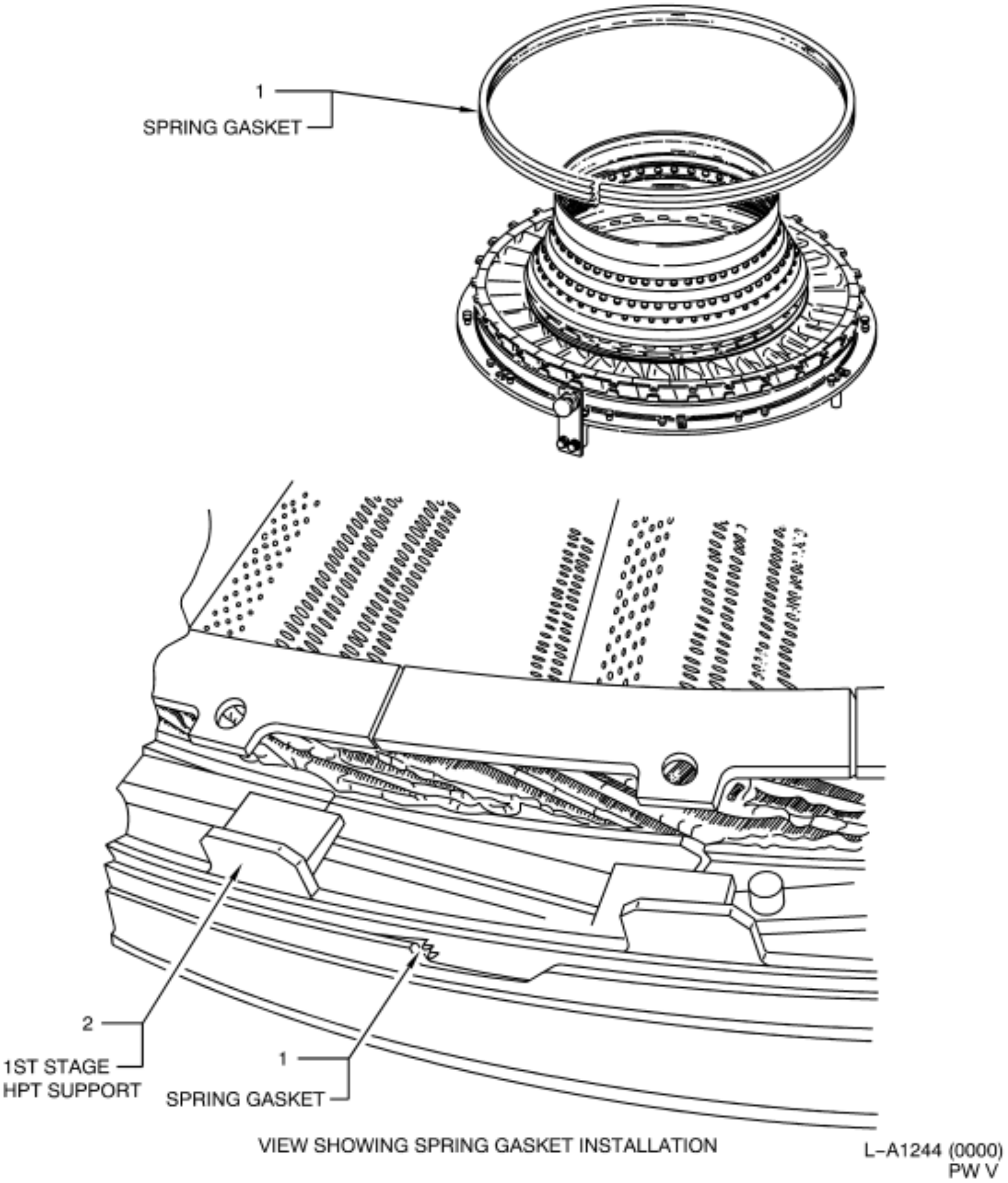
PWA 85078 Fixture Installation
Figure 402
(Task 72−00−51−420−001)


1
NUT
BOLT
2
PWA 85644
GAGING RING
6
COMBUSTION
CHAMBER
CLAMP
NUT
4
5
COMBUSTION CHAMBER GUIDE
NUT (NON−
SELF−LOCKING)
7
3
SPACER
2
BOLT
K
VIEW SHOWING CLAMP
SPACER THICKNESS MEASUREMENT
L−A1821 (1288)
PW V

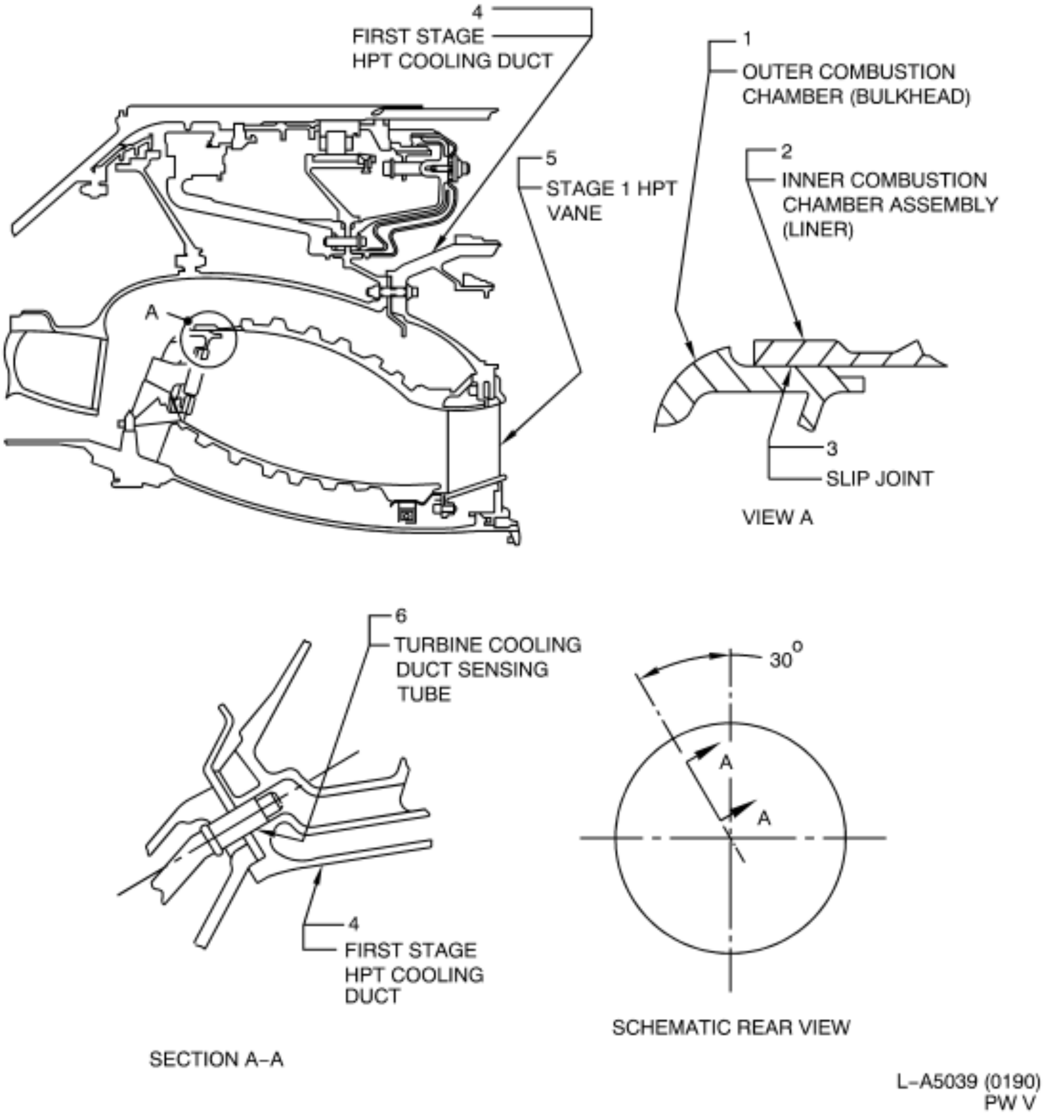
Combustion Chamber Clamp Installation
Figure 403 (Sheet 1)
(Task 72−00−51−420−001)


10
NUT
14
COMBUSTION
CHAMBER
CLAMP ASSEMBLY
13
NUT
12
SPACER
11
BOLT
15
NUT
(NON−SELF−LOCKING)
11
BOLT
E
VIEW SHOWING CLAMP SPACER THICKNESS MEASUREMENT
L−B9017 (0302)
PW V

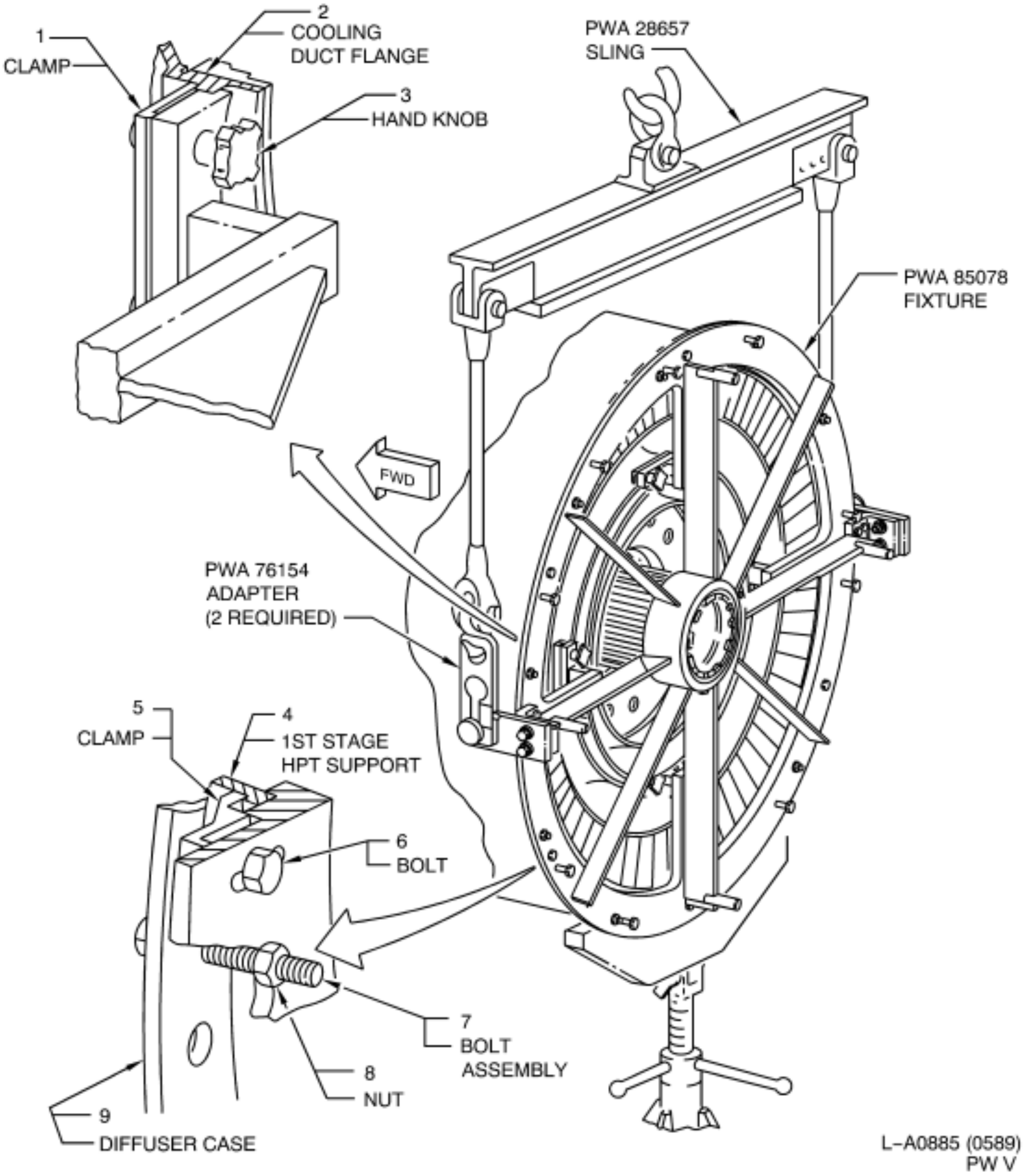
Combustion Chamber Clamp Installation (Talon II Low Emmisions Burner Configuration)
Figure 403 (Sheet 2)
(Task 72−00−51−420−001)


1
SPRING GASKET
2
1ST STAGE
HPT SUPPORT
1
SPRING GASKET
VIEW SHOWING SPRING GASKET INSTALLATION
L-A1244 (0000)
PW V

Spring Gasket Installation
Figure 404
(Task 72-00-51-420-001)

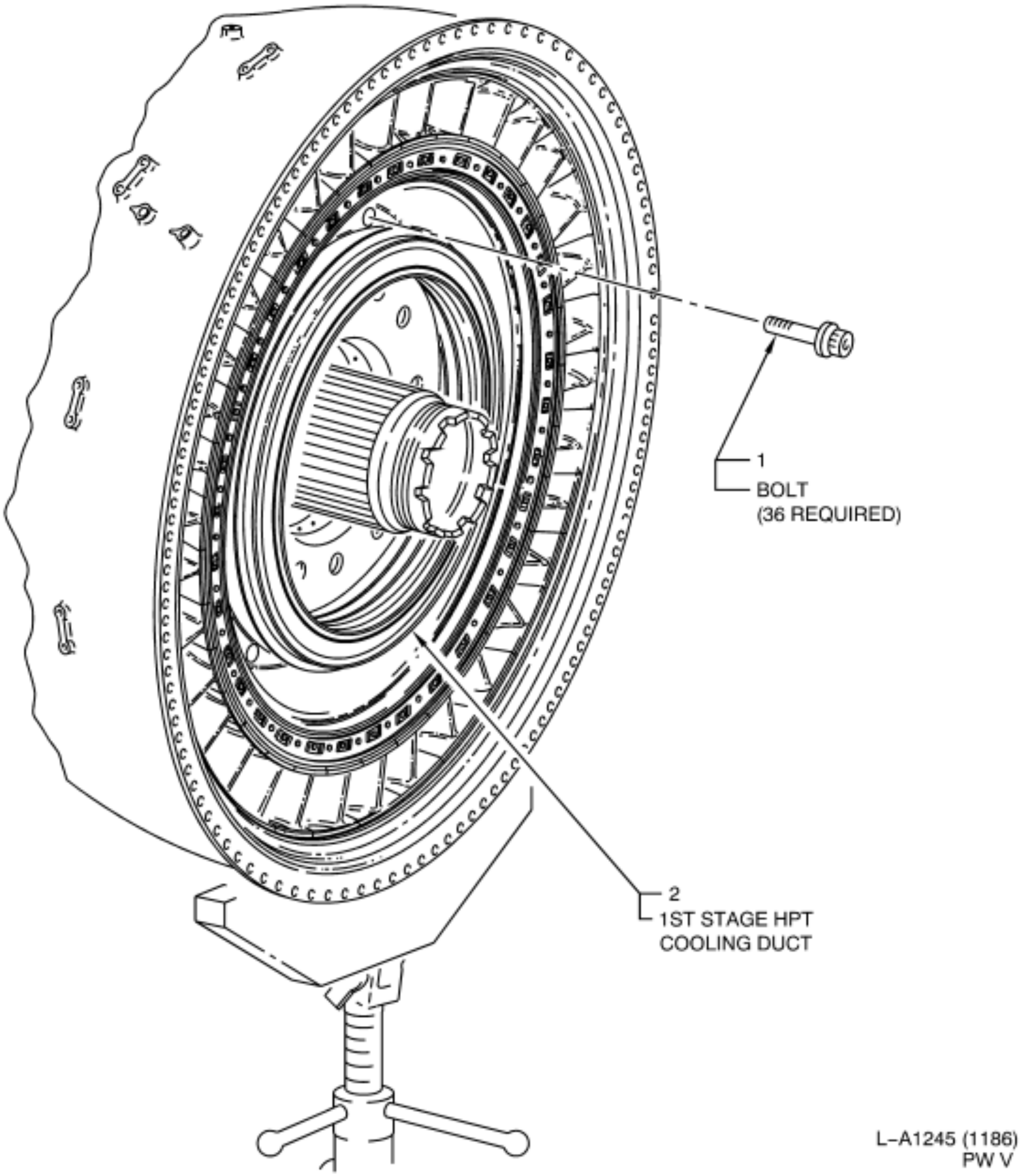

4
FIRST STAGE
HPT COOLING DUCT
1
OUTER COMBUSTION
CHAMBER (BULKHEAD)
5
STAGE 1 HPT
VANE
2
INNER COMBUSTION
CHAMBER ASSEMBLY
(LINER)
A
3
SLIP JOINT
VIEW A
6
TURBINE COOLING
DUCT SENSING
TUBE
30°
A
A
4
FIRST STAGE
HPT COOLING
DUCT
SCHEMATIC REAR VIEW
SECTION A−A
L−A5039 (0190)
PW V

Turbine Nozzle Installation And Inner
Combustion Chamber (Liner) Engagement Check
Figure 405
(Task 72−00−51−420−001)

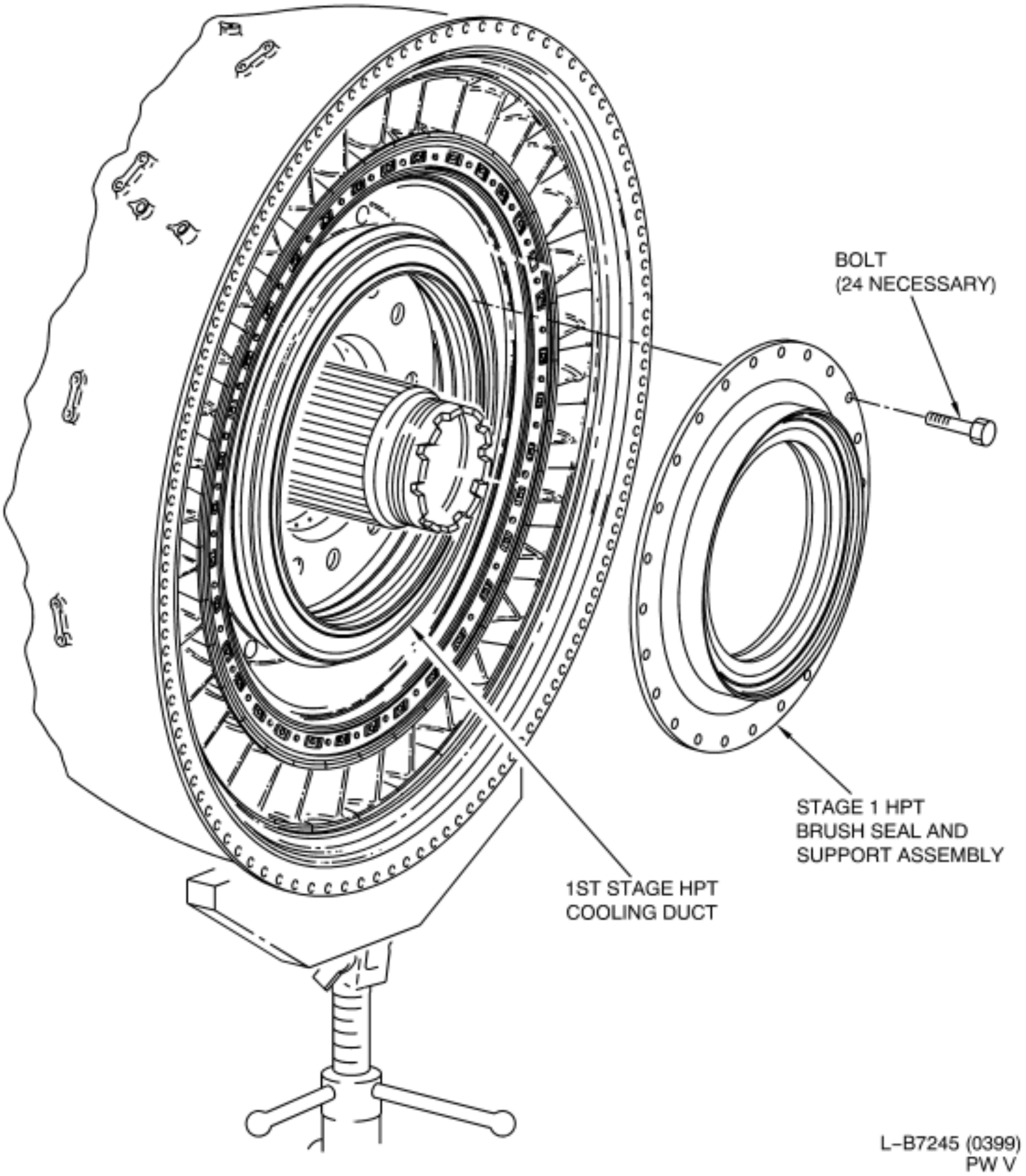

1
CLAMP
2
COOLING
DUCT FLANGE
3
HAND KNOB
PWA 28657
SLING
PWA 85078
FIXTURE
FWD
PWA 76154
ADAPTER
(2 REQUIRED)
5
CLAMP
4
1ST STAGE
HPT SUPPORT
6
BOLT
7
BOLT
ASSEMBLY
8
NUT
9
DIFFUSER CASE
L-A0885 (0589)
PW V

Turbine Nozzle Installation
Figure 406
(Task 72-00-51-420-001)

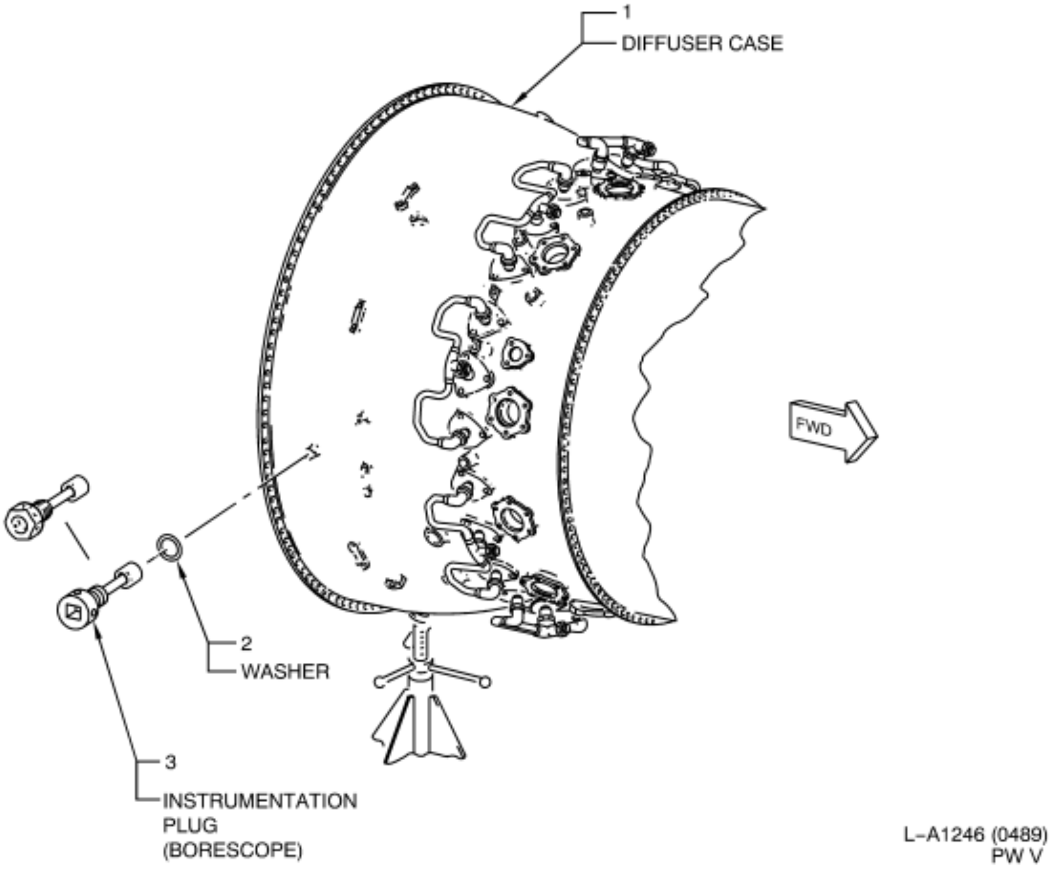
ENGINE GENERAL − TURBINE NOZZLE − INSTALLATION−01


1
BOLT
(36 REQUIRED)
2
1ST STAGE HPT
COOLING DUCT
L−A1245 (1186)
PW V

Turbine Nozzle Installation
Figure 407
(Task 72−00−51−420−001)


BOLT
(24 NECESSARY)
STAGE 1 HPT
BRUSH SEAL AND
SUPPORT ASSEMBLY
1ST STAGE HPT
COOLING DUCT
L-B7245 (0399)
PW V

Stage 1 HPT Brush Seal And Support Installation
Figure 408
(Task 72-00-51-420-001)


1
DIFFUSER CASE
FWD
2
WASHER
3
INSTRUMENTATION
PLUG
(BORESCOPE)
L−A1246 (0489)
PW V

Instrumentation Plug Installation
Figure 409
(Task 72−00−51−420−001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − TURBINE NOZZLE − INSTALLATION−02

Task 72−00−51−420−002:

1. Install Turbine Nozzle − Vertical

NOTE: See Figure 401 for part/assembly installation procedure sequence.

A. Prerequisites

(1) See Inspection/Check−01 Task 72−00−51−990−001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows:

B. Equipment And Materials Necessary

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 28657	Sling, Handling
PWA 29754	Control
PWA 29855−2	Alignment Pins
PWA 76154	Adapter (Two Necessary)
PWA 85063	Adapter, Wrench
PWA 85078	Fixture, Holding
PWA 85170	Pin, Aligning (3 Necessary)
PWA 85644	Ring, Gaging
PWA 87139	Heater
PWA 87172	Ring, Retaining

Consumable Materials:

	Item No.	Designation
	P03−001	Oil, Engine (PWA 521B)
	P05−102	Dry Ice
	P05−289	Lockwire (AS3214−02)
	P05−291	Cable, Safety (Optional)
	P05−292	Ferrule, Safety Cable (Optional)
	P05−395	Beeswax
R	P05−396	Paraffin Wax Blend
	P06−023	Silver Goop (PWA 36001)
R	P06−054	Antiseize Paste (PWA 36246)

C. Procedure
See Figure 402.

CAUTION: ENGINES THAT HAVE AN OUTER COMBUSTION CHAMBER ASSEMBLY WITH REVISED DILUTION HOLES (DECREASED EMISSIONS) MUST BE USED IN SETS WITH INNER COMBUSTION CHAMBER ASSEMBLY WITH REVISED DILUTION HOLES (REFERENCED SB PW4ENG 72-187).

(1) Install PWA 85078 Fixture to turbine nozzle. See Figure 402.

(a) Connect hoist with PWA 28657 Sling and two PWA 76154 Adapters to trunnion spools of Fixture (PWA 85078).

(b) Retract four inner clamps (402/1), six outer clamps (402/5), and ten bolts (402/7). Remove ten bolt assemblies (402/8).

(c) Locate the borescope boss line on the fixture ring. Use the hoist to put the fixture over the turbine nozzle. Align the borescope boss line with the instrumentation guide (borescope) detail of the combustion chamber guide. Lower the fixture on the 1st stage HPT support (402/4). Slide the six clamps (402/5) over the rear lip of the support and tighten bolts (402/6) to secure the clamps.

(d) Slide the four clamps (402/1) over the flange of the 1st stage HPT cooling duct (402/3).

(2) Use the hoist to lift and trunnion the assembly to rear end down position and rest it on the feet of the fixture.

CAUTION: SHOULD ANY OF THE FITTED HARDWARE BE REPLACED PRIOR TO FINAL INSTALLATION, THIS PROCEDURE MUST BE PERFORMED AGAIN AND A NEW CLAMP SPACER MAY BE REQUIRED.

(3) (Reference 1000) (Engines Without The Talon II Low Emmision Burner) Determine combustion chamber clamp spacer thickness. See Figure 403 (Sheet 1).

NOTE: You can use a gage ring or the actual combustion chamber assembly to determine the spacer thickness in the following procedure.

(a) If you use PWA 85644 Gaging Ring, measure largest outside diameter at rear of outer combustion chamber. Set the gaging ring to this diameter.

(b) Loosen combustion chamber guide nuts (403/1) one full turn.

(c) If applicable, position gaging ring into combustion guides.

CAUTION: IF YOU USE THE ACTUAL COMBUSTION CHAMBER, USE CARE THAT YOU DO NOT DAMAGE THE PROTECTIVE COATING ON THE COMBUSTION CHAMBER LINER.

(d) If you use the actual outer combustion chamber assembly, use a hoist and suitable sling to put the combustion chamber into the combustion chamber guides.

(e) Install combustion chamber clamp (403/6) around guides and secure with detail bolt (403/2) and 0.250-28 UNJF-3B non-self-locking worknut (403/7). Place clamp split at the 6 o'clock location. Torque bolt to 6 - 10 lb-in. (0.678 - 1.130 N.m).

(f) Measure Gap K between two ends of combustion chamber clamp.

(g) (Pre SB PW4ENG 72-702) Machine the spacer (403/3) to a width of 0.005 - 0.015 inch (0.13 - 0.38 mm) less than Gap K.

(h) (Post SB PW4ENG 72-702) Select the correct class spacer (403/3) to get a width of 0.005 - 0.015 inch (0.13 - 0.38 mm) less than Gap K. See Table 401. If necessary, machine the spacer to get the correct fit.

CLASS	SPACER THICKNESS
CL1	0.105 - 0.111 inch (2.667 - 2.819 mm)
CL2	0.115 - 0.121 inch (2.921 - 3.073 mm)
CL3	0.125 - 0.131 inch (3.175 - 3.327 mm)
CL4	0.135 - 0.141 inch (3.429 - 3.581 mm)
CL5	0.145 - 0.151 inch (3.683 - 3.835 mm)
CL6	0.155 - 0.161 inch (3.937 - 4.089 mm)
CL7	0.165 - 0.171 inch (4.191 - 4.343 mm)
CL8	0.175 - 0.181 inch (4.445 - 4.597 mm)

Table 401

R
R

(CONTINUED)

CLASS	SPACER THICKNESS
CL9	0.185 - 0.191 inch (4.699 - 4.851 mm)
CL10	0.195 - 0.201 inch (4.953 - 5.105 mm)
CL11	0.205 - 0.211 inch (5.207 - 5.359 mm)
CL12	0.215 - 0.221 inch (5.461 - 5.613 mm)
CL13	0.225 - 0.231 inch (5.715 - 5.867 mm)
CL14	0.235 - 0.241 inch (5.969 - 6.121 mm)
CL15	0.245 - 0.251 inch (6.223 - 6.375 mm)
CL16	0.065 - 0.071 inch (1.651 - 1.803 mm)
CL17	0.075 - 0.081 inch (1.905 - 2.057 mm)
CL18	0.085 - 0.091 inch (2.159 - 2.311 mm)
CL19	0.095 - 0.101 inch (2.413 - 2.565 mm)

Table 401 (Continued)

(i) (Pre SB PW4ENG 72-542) As necessary, apply
R Antiseize Paste P06-054 to the threads of the
R bolts before you install the nuts (403/1). Wipe
R off unwanted paste. Torque the nuts (403/1) to 62
- 72 lb-in. (7.005 - 8.135 N.m).

(j) (Post SB PW4ENG 72-542) Torque the nuts (403/1) to 85 - 95 lb-in. (9.604 - 10.734 N.m). As necessary, apply Engine Oil P03-001 to threads of the nuts before you apply the torque.

(k) Loosen bolt detail and remove gaging ring or the actual combustion chamber if applicable, from combustion chamber guides.

(l) Disassemble bolt (403/2) and nut (403/7) from clamp.

(m) Reassemble bolt (403/2), spacer (403/3) and self-locking nut (403/4). Place clamp split at the 6 o'clock location. Torque bolt to 100 - 110 lb-in. (11.298 - 12.428 N.m).

CAUTION: IF ANY OF THE FITTED HARDWARE IS REPLACED BEFORE FINAL INSTALLATION, THEN YOU MUST DO THIS PROCEDURE AGAIN. IT IS POSSIBLE YOU WILL NEED A NEW CLAMP.

(4) (Reference 1015) (Engines With The Talon II Low Emmision Burner) Find the combustion chamber clamp spacer thickness. See Figure 403 (Sheet 2).

(a) Put the combustion chamber clamp on a work bench (the end with the slots down).

(b) Install a bolt (403/11) lubricated with Engine Oil P03−001 (with the head of the bolt to the right) and attach it with a work nut. Tighten the nut sufficiently to move the clamp assembly flanges together.

(c) Measure the ID of the clamp assembly with a PI Tape or other applicable device. Record this as Dimension C.

(d) Loosen the bolt (403/11) and the work nut. Put this bolt on a work bench for subsequent use.

(e) Measure the diameter of the outer burner at its largest OD with a PI Tape or other applicable device. Make sure you measure the middle section of the largest OD. Attach the PI Tape with tape. Record this as Dimension D. This dimension must be 36.638 − 36.658 inches (930.61 − 931.11 mm).

(f) Use the formula which follows to find the value for Dimension E:

E = [PI (3.1416 inches (79.797 mm)) x (D − C)]
− 0.009 inch (0.229 mm).

(g) Record the value for Dimension E.

NOTE: You will use Dimension E to get the correct class of spacer (403/12) to use for the combustion chamber clamp (403/14).

(h) Get the class of spacer (403/12) that has a value nearest the value of Dimension E you calculated. Use the table below. If Dimension E is exactly between the spacer classes, use the lower class spacer:

CLASS	DIMENSION E (SPACER THICKNESS)
CL1	0.105 − 0.111 inch (2.667 − 2.819 mm)
CL2	0.115 − 0.121 inch (2.921 − 3.073 mm)
CL3	0.125 − 0.131 inch (3.175 − 3.327 mm)
CL4	0.135 − 0.141 inch (3.429 − 3.581 mm)
CL5	0.145 − 0.151 inch (3.683 − 3.835 mm)
CL6	0.155 − 0.161 inch (3.937 − 4.089 mm)

CLASS DIMENSION E (SPACER THICKNESS)

(CONTINUED)

CL7	0.165 − 0.171 inch (4.191 − 4.343 mm)
CL8	0.175 − 0.181 inch (4.445 − 4.597 mm)
CL9	0.185 − 0.191 inch (4.699 − 4.851 mm)
CL10	0.195 − 0.201 inch (4.953 − 5.105 mm)
CL11	0.205 − 0.211 inch (5.207 − 5.359 mm)
CL12	0.215 − 0.221 inch (5.461 − 5.613 mm)
CL13	0.225 − 0.231 inch (5.715 − 5.867 mm)
CL14	0.235 − 0.241 inch (5.969 − 6.121 mm)
CL15	0.245 − 0.251 inch (6.223 − 6.375 mm)

(i) Install the spacer (403/12) between the ends of the clamp assembly and attach it with the nut (403/13) and bolt (403/11) you used before.

(j) Tighten and torque the nut to 85 − 95 lb−in (9.604 − 10.734 N.m).

(k) Torque the nuts (403/10) to 85 − 95 lb−in. (9.604 − 10.734 N.m). As necessary, apply Engine Oil P03−001 to threads of the nuts before you apply the torque.

(5) Install spring gasket (404/1) in upper OD groove in 1st stage HPT support (404/2). Retain gasket in position using Beeswax P05−395 or Paraffin Wax Blend P05−396, as required. See Figure 404.

(6) Thread three PWA 85170 Aligning Pins into equally spaced boltholes in inner rear flange of diffuser case.

(7) Using hoist, lift assembly and trunnion to front end down position.

CAUTION: YOU CAN DAMAGE THE TURBINE COOLING DUCT SENSING TUBE IF IT IS NOT ALIGNED WITH ITS MATING HOLE IN THE 1ST STAGE HPT COOLING DUCT.

(8) Locate the turbine cooling duct sensing tube (405/6) at the rear of the diffuser case at 15 degrees counterclockwise from TDC. Align the sensing tube with the mating hole in the 1st stage HPT cooling duct, and the boltholes with the aligning pins. Move the

assembly forward until it is stopped by the tight fit with the diffuser case. See Figure 405.

NOTE: Rear flange of turbine nozzle may be chilled to facilitate assembly.

CAUTION: MAKE SURE THAT THE INNER COMBUSTION CHAMBER ASSEMBLY (LINER) IS PROPERLY ENGAGED IN THE OUTER COMBUSTION CHAMBER (BULKHEAD) OR MIS−ASSEMBLY OF PARTS CAN OCCUR.

(9) Use a flashlight or equivalent light source to check the engagement of the forward end of the inner combustion chamber assembly (liner) (405/2) in the outer combustion chamber (bulkhead) (405/1). Look between the Stage 1 HPT vanes (405/5) to check the engagement of the parts at the slip joint (405/3) all around. See Figure 405.

(10) Install ten bolt assemblies (406/7) through boltholes in rear flange of diffuser case (406/9) and boltholes in outer ring of Fixture (PWA 85078). Secure the bolts with nuts (406/8). See Figure 406.

(11) Evenly tighten ten nuts (406/8) to seat 1st stage HPT support in diffuser case.

(12) Secure inner flange of 1st stage HPT cooling duct (407/2) to diffuser case with several bolts (407/1) lubricated with Engine Oil P03−001. See Figure 407.

(13) Do a check of the PS4I pressure tube, located at approximately the 11 o'clock position on the OD of the diffuser case, for blockage as follows.

(a) Attach a connector to the PS4I pressure tube and apply air pressure at 20.0 PSIG (137.9 kPa) to the tube.

(b) Make sure air passes through the tube. No blockage is permitted.

(c) If no blockage is found, remove the air source and connector and continue build.

(d) If blockage is noted, remove and reposition the 1st stage HPT cooling duct to clear the tube.

(14) Remove Fixture (PWA 85078) from the turbine nozzle.

(a) Remove the bolt assemblies (406/7) and nuts (406/8) from the rear flange of diffuser case (406/9).

(b) Loosen the hand knobs (406/3) and retract four clamps (406/1) that hold the fixture to the cooling duct flange (406/2).

(c) Loosen the bolts and retract six clamps (406/5) that hold the fixture to the 1st stage HPT support (406/4).

(d) Use the hoist to remove the fixture from the turbine nozzle.

(15) Removing aligning pins as required, install remaining bolts (407/1), lubricated with Engine Oil P03−001, through boltholes in cooling duct and into diffuser case. Using PWA 85063 Wrench Adapter, torque 36 bolts to 290 − 325 lb−in. (32.766 − 36.720 N.m).

NOTE: If required, aligning pins may be removed using standard 0.250 inch (6.350 mm) universal socket.

(16) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the Stage 1 HPT brush seal and support assembly into the 1st stage HPT cooling duct assembly. See Figure 408.

(a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
In the following step, replace the Stage 1 HPT brush seal (not the support) assembly with a new assembly as follows:

1 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
If the 1st stage HPT inner airseal is replaced with a new or refurbished part.

2 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
If the 1st stage HPT inner airseal was removed and re−installed on the 1st stage turbine hub regardless of the reason for the removal and re−installation.

NOTE: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
The 1st stage HPT inner airseal is installed in 72−52−01, Assembly−01 (Task 72−52−01−440−001).

3 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
When the match of the 1st stage HPT inner airseal and brush seal is changed. Such as in a module swap.

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Put the stage 1 HPT brush seal and support assembly on the bench, with the brush seal assembly up.

CAUTION: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
WHEN YOU INSTALL THE RETAINING RING IN THE BRUSH SEAL YOU MUST TURN THE RETAINING RING IN A CLOCKWISE DIRECTION OR DAMAGE CAN OCCUR TO THE BRUSH SEAL.

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the PWA 87172 Retaining Ring (small OD down) in the brush seal. Turn the Retaining Ring clockwise and push down until the flange of the ring touches the brush seal support.

(d) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Put the stage 1 brush seal and support assembly and the Retaining Ring in a container with Dry Ice P05−102.

(e) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Attach three PWA 29855−2 Alignment Pins equally spaced through the duct flange that will be heated.

(f) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Put the PWA 87139 Heater onto the duct and over the alignment pins. The reflector assembly flange will rest on the top of the duct. Attach the PWA 29754 Control to the receptacle and the thermocouple.

(g) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Actuate the control to heat the duct to 200°F (93.3°C) minimum to 240°F (115.6°C) maximum.

(h) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Lubricate the threads of the 24 bolts with Engine Oil P03−001.

(i) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
When the 1st stage HPT cooling duct assembly has the correct temperature, continue as follows.

1 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Wear gloves and remove the thermocouple connector from the heater control. Remove the heater control from the heater. Remove the heater from the cooling duct.

2 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the stage 1 HPT brush seal and support assembly and the Retaining Ring from the dry ice container.

CAUTION: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
WHEN YOU INSTALL THE ASSEMBLED BRUSH SEAL AND RETAINING RING, TURN THE RETAINING RING AND BRUSH SEAL IN A CLOCKWISE DIRECTION AS YOU INSTALL IT ON THE DUCT OR DAMAGE CAN OCCUR TO THE BRUSH SEAL.

3 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the assembled brush seal and retaining ring to the cooling duct. Turn the brush seal and the retaining ring in a clockwise direction on the cooling duct and align the bolt holes.

4 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Attach the brush seal to the cooling duct with the 12 bolts, every other bolt hole, and tighten the bolts to touch the brush seal support to the cooling duct, do not use more 85 − 95 lb−in. (9.604 − 10.734 N.m) of torque.

5 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Allow time for the brush seal and the cooling duct to get to room temperature.

(j) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Loosen the 12 bolts that attach the brush seal to the cooling duct to 0 lb−in. (0 N.m).

(k) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the 12 bolts in the remaining bolt holes to attach the brush seal to the cooling duct.

(l) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Torque the 24 bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

CAUTION: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3 WHEN YOU REMOVE THE RETAINING RING FROM THE ASSEMBLED BRUSH SEAL AND COOLING DUCT, TURN THE RETAINING RING IN A CLOCKWISE DIRECTION OR DAMAGE CAN OCCUR TO THE BRUSH SEAL.

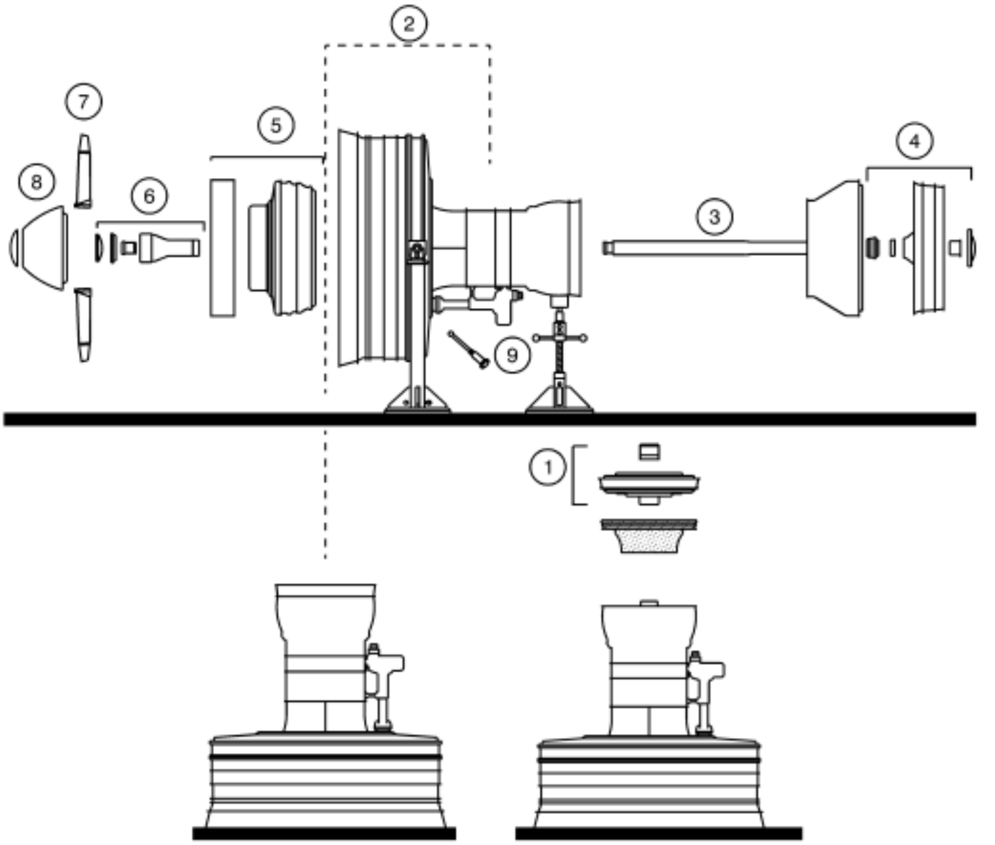
(m) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Turn the Retaining Ring (PWA 87172) in a clockwise direction and lift to remove the retaining ring from the brush seal.

(17) Install washer (409/2) and instrumentation plug (borescope) (409/1), lubricated with Silver Goop P06−023, into the instrumentation port in the diffuser case (409/3) at 3 o'clock position. Torque the plug to 40 − 50 lb−in. (4.519 − 4.649 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the plug. See Figure 409.

D. Postrequisites

(1) Install The High Pressure Turbine − Vertical. Refer to 72−00−52, Installation−08 (Task 72−00−52−420−002).

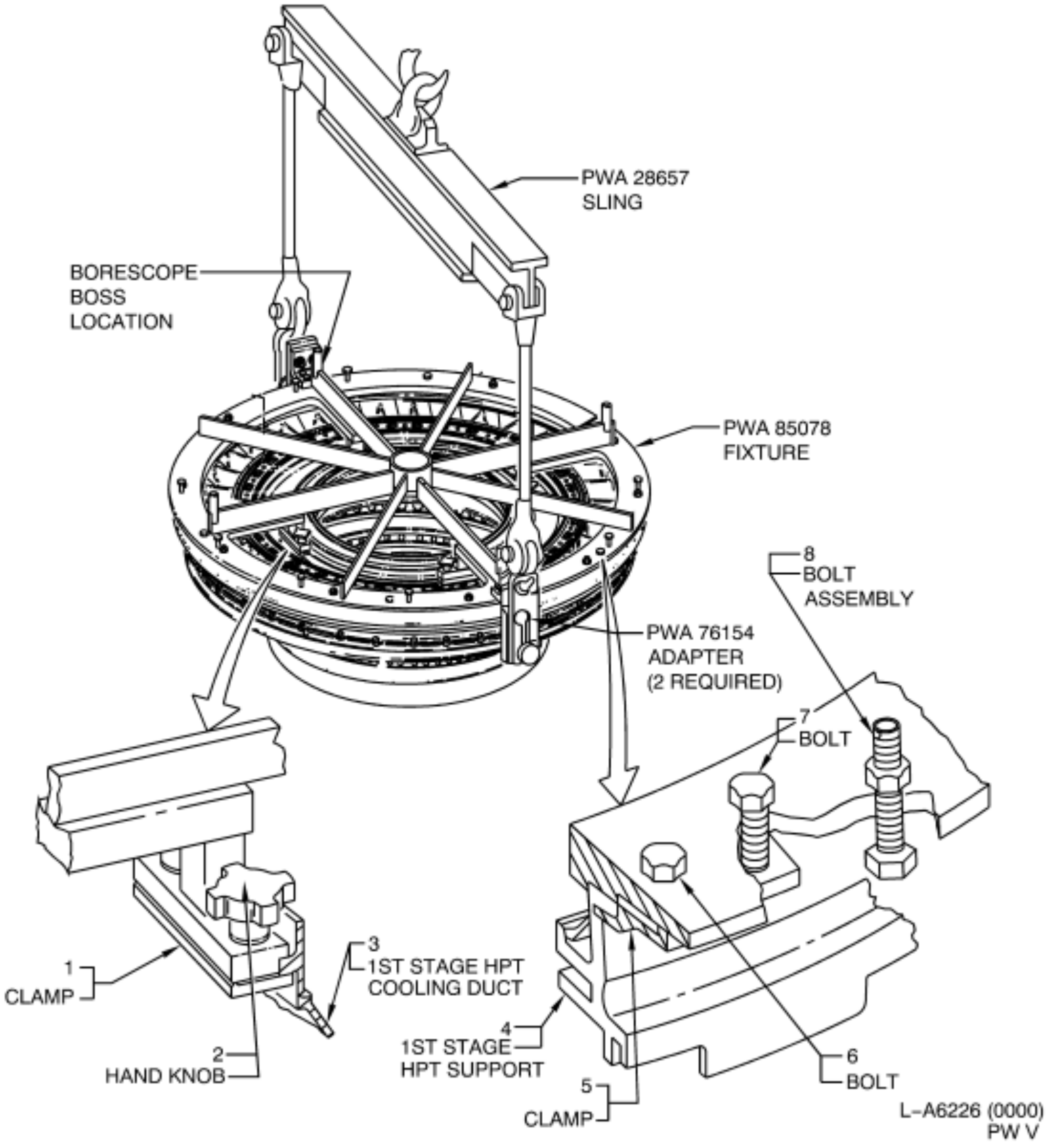
(2) Test the engine per the Repair Test Reference Table. Refer to 71−00−00, Testing−00 (Task 71−00−00−990−003).



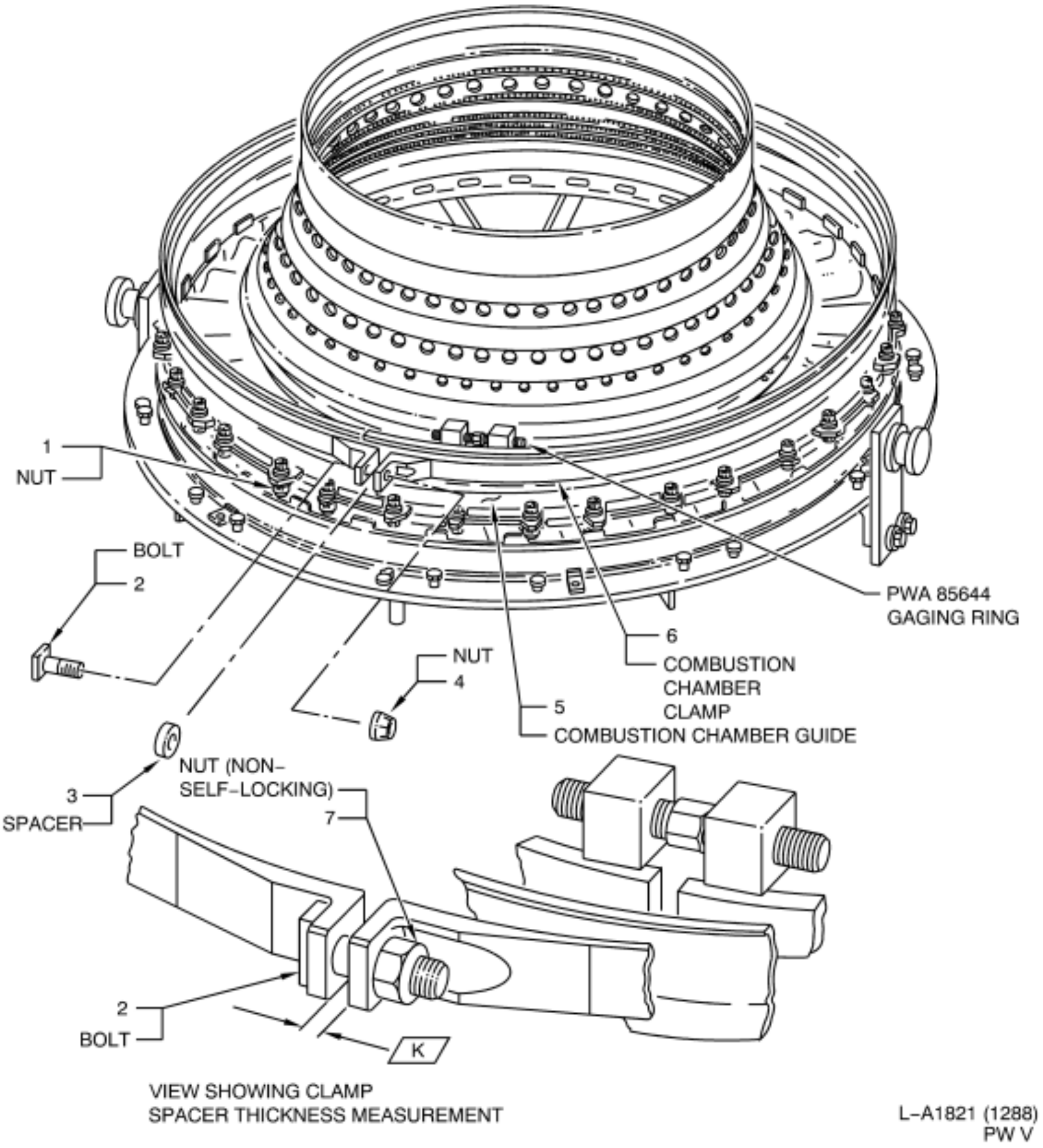
1. INSTALL HIGH PRESSURE TURBINE (HPT).
2. TRUNNION FAN CASE THROUGH HIGH PRESSURE TURBINE (HPT) TO HORIZONTAL.
3. INSTALL LOW PRESSURE TURBINE (LPT).
4. INSTALL TURBINE EXHAUST CASE.
5. INSTALL LOW PRESSURE COMPRESSOR (LPC).
6. INSTALL LPC/LPT COUPLING.
7. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
8. INSTALL COMPRESSOR INLET CONE.
9. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).

L-A1299 (0000)
PW V

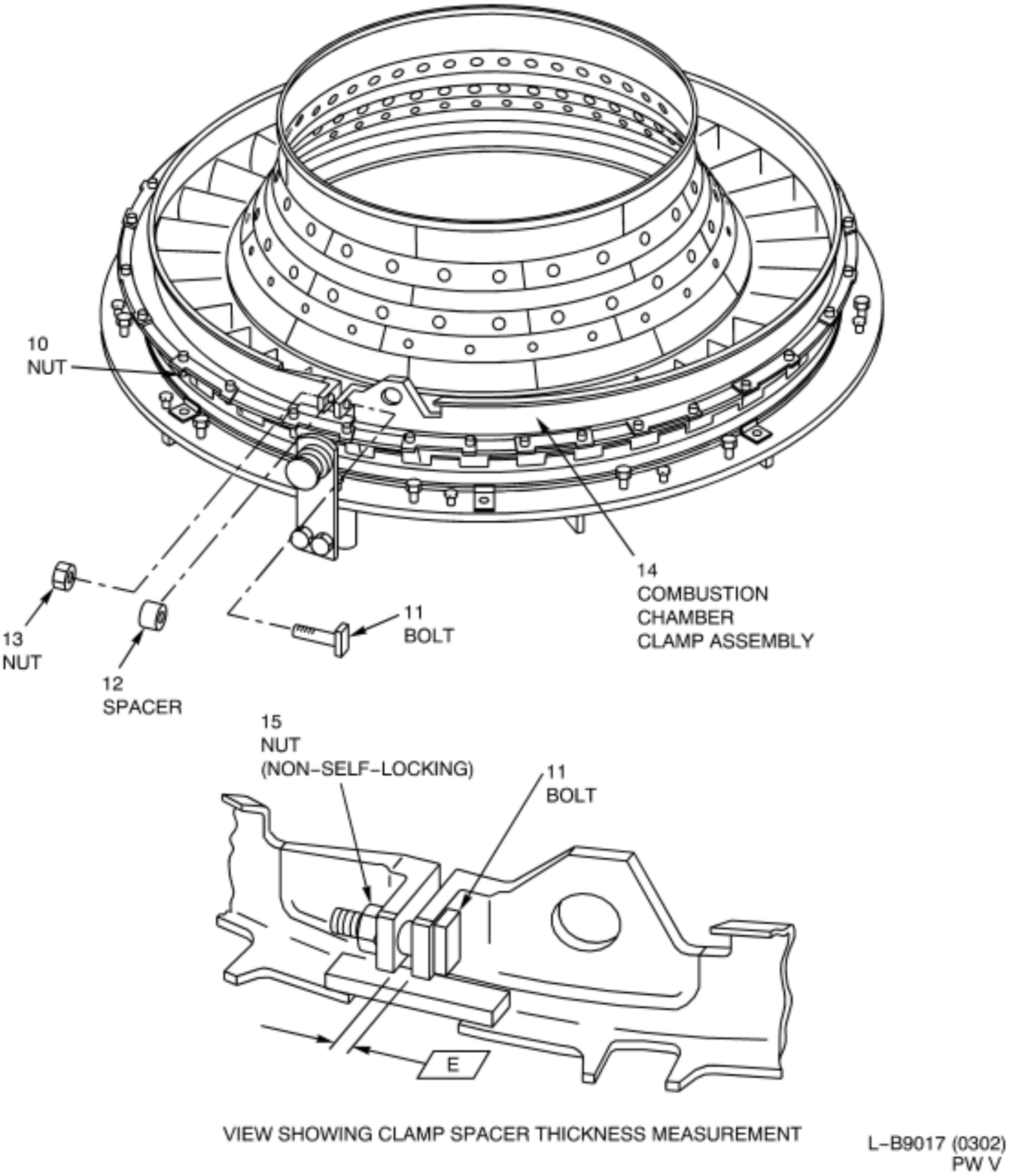
Procedure Sequence
Figure 401
(Task 72-00-51-420-002)


PWA 28657
SLING
BORESCOPE
BOSS
LOCATION
PWA 85078
FIXTURE
8
BOLT
ASSEMBLY
PWA 76154
ADAPTER
(2 REQUIRED)
7
BOLT
1
CLAMP
3
1ST STAGE HPT
COOLING DUCT
4
1ST STAGE
HPT SUPPORT
2
HAND KNOB
6
BOLT
5
CLAMP
L−A6226 (0000)
PW V

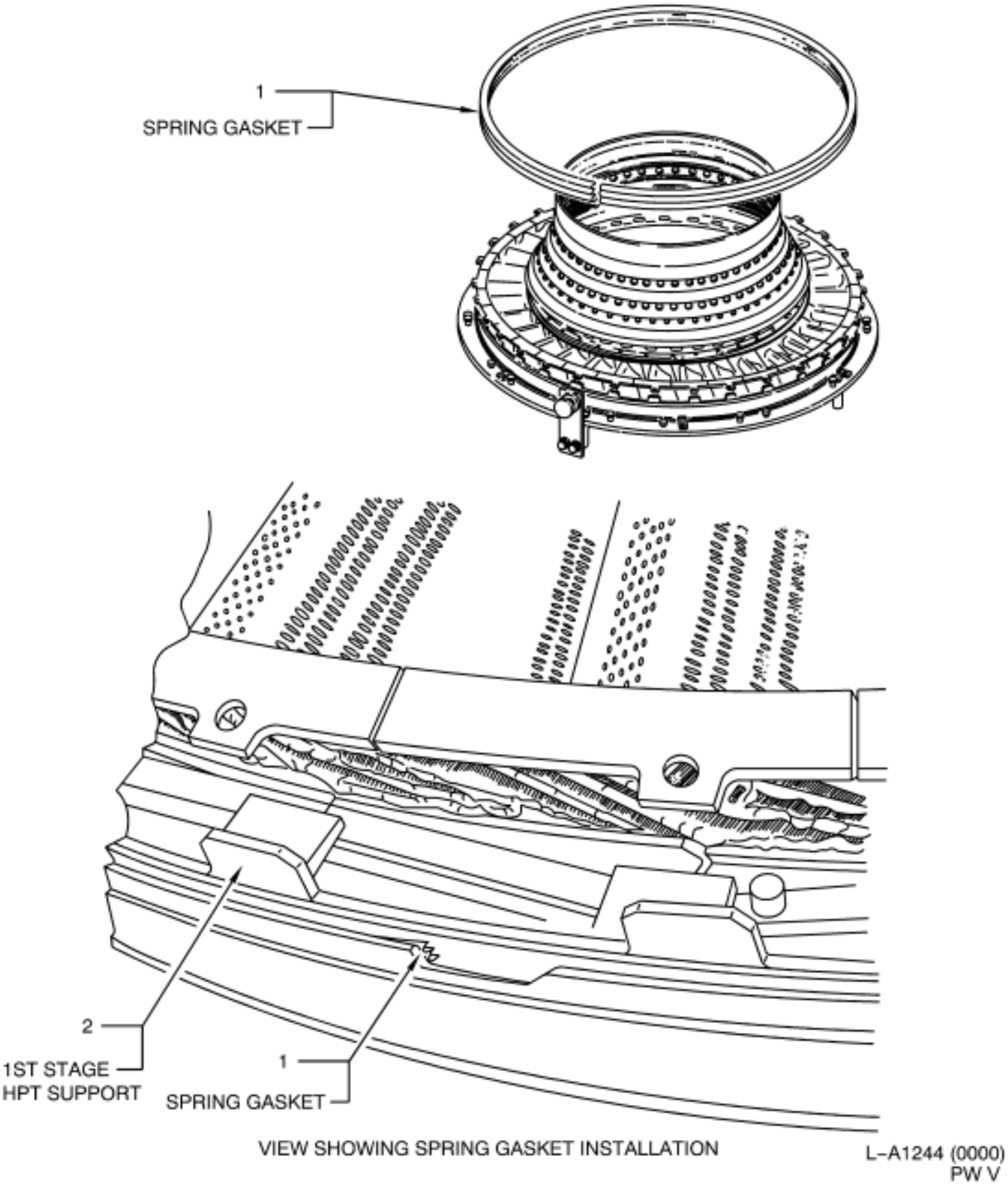
PWA 85078 Fixture Installation
Figure 402
(Task 72−00−51−420−002)


1
NUT
BOLT
2
PWA 85644
GAGING RING
6
COMBUSTION
CHAMBER
CLAMP
NUT
4
5
COMBUSTION CHAMBER GUIDE
3
SPACER
NUT (NON−
SELF−LOCKING)
7
2
BOLT
K
VIEW SHOWING CLAMP
SPACER THICKNESS MEASUREMENT
L−A1821 (1288)
PW V

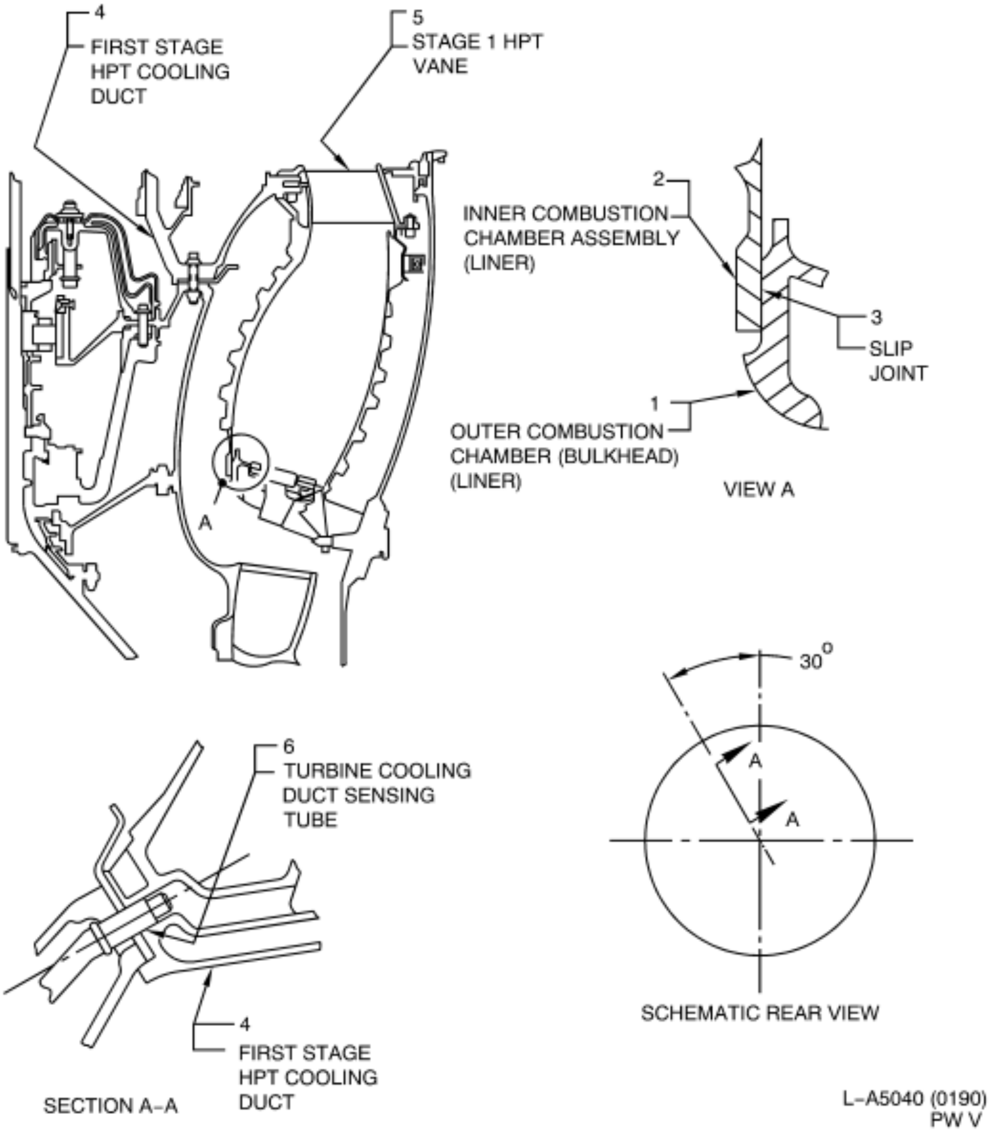
Combustion Chamber Clamp Installation
Figure 403 (Sheet 1)
(Task 72−00−51−420−002)


10
NUT
14
COMBUSTION
CHAMBER
CLAMP ASSEMBLY
13
NUT
12
SPACER
11
BOLT
15
NUT
(NON−SELF−LOCKING)
11
BOLT
E
VIEW SHOWING CLAMP SPACER THICKNESS MEASUREMENT
L−B9017 (0302)
PW V

Combustion Chamber Clamp Installation (Talon II Low Emmisions Burner Configuration)
Figure 403 (Sheet 2)
(Task 72−00−51−420−002)

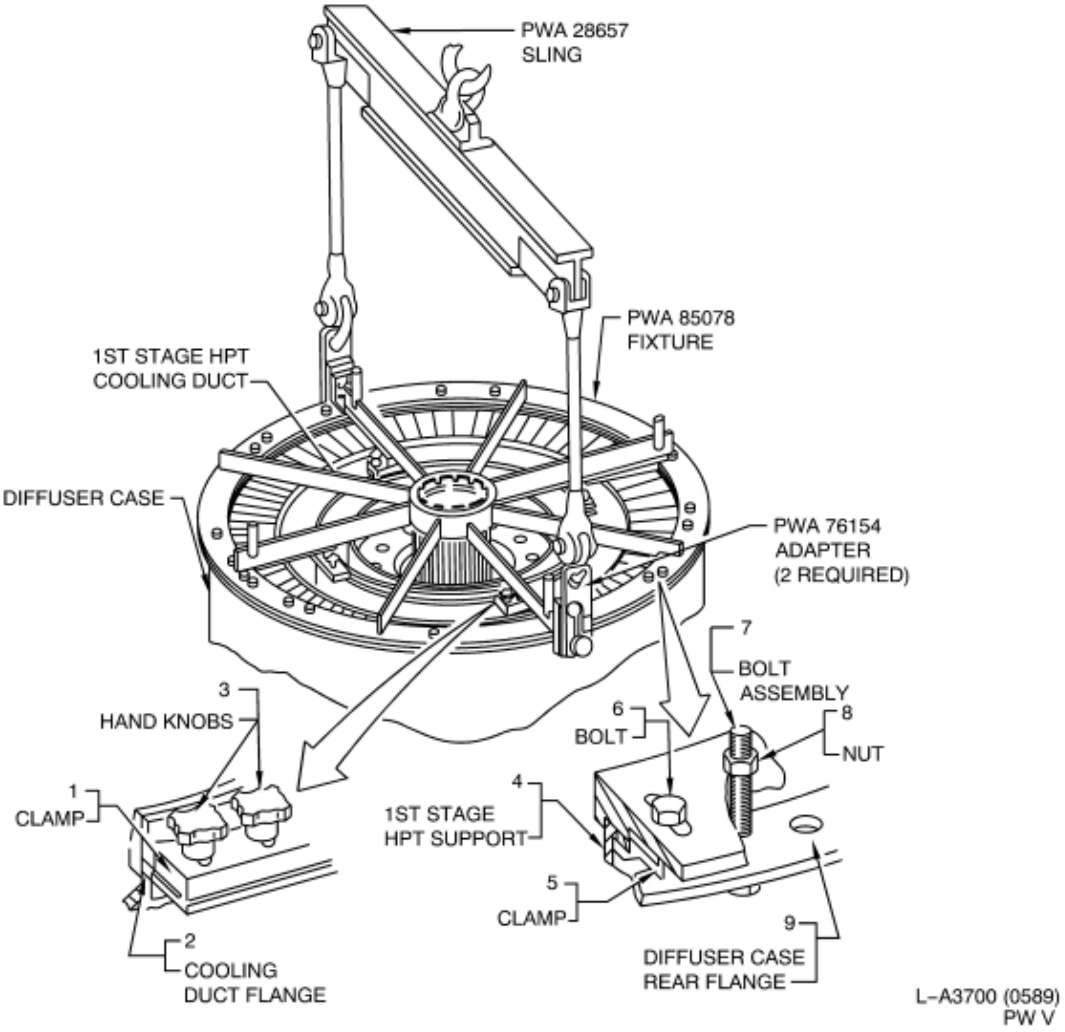

1
SPRING GASKET
2
1ST STAGE
HPT SUPPORT
1
SPRING GASKET
VIEW SHOWING SPRING GASKET INSTALLATION
L-A1244 (0000)
PW V

Spring Gasket Installation
Figure 404
(Task 72-00-51-420-002)


4
FIRST STAGE HPT COOLING DUCT
5
STAGE 1 HPT VANE
2
INNER COMBUSTION CHAMBER ASSEMBLY (LINER)
3
SLIP JOINT
1
OUTER COMBUSTION CHAMBER (BULKHEAD) (LINER)
VIEW A
A
6
TURBINE COOLING DUCT SENSING TUBE
4
FIRST STAGE HPT COOLING DUCT
SECTION A−A
30°
A
A
SCHEMATIC REAR VIEW
L−A5040 (0190)
PW V

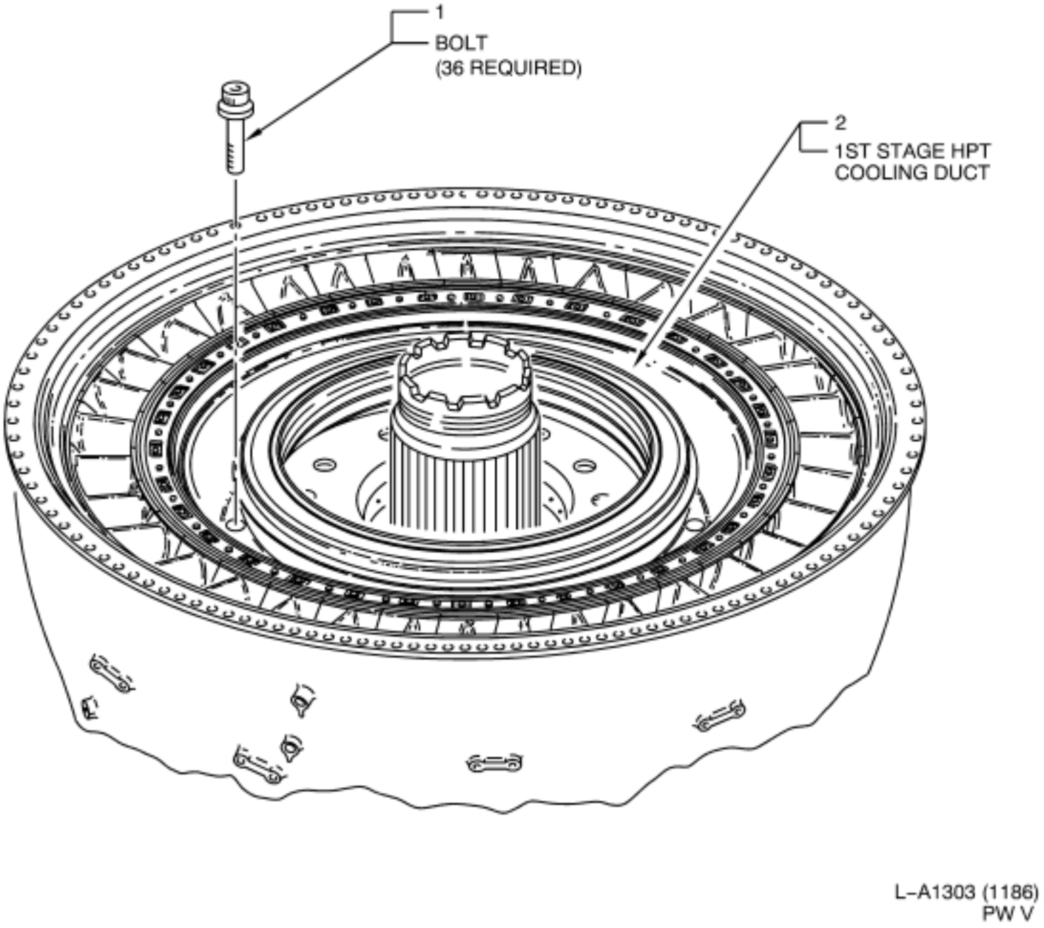
Turbine Nozzle Installation And Inner
Combustion Chamber (Liner) Engagement Check
Figure 405
(Task 72−00−51−420−002)

ENGINE GENERAL − TURBINE NOZZLE − INSTALLATION−02


PWA 28657
SLING
PWA 85078
FIXTURE
1ST STAGE HPT
COOLING DUCT
DIFFUSER CASE
PWA 76154
ADAPTER
(2 REQUIRED)
7
BOLT
ASSEMBLY
3
HAND KNOBS
6
BOLT
8
NUT
4
1ST STAGE
HPT SUPPORT
1
CLAMP
5
CLAMP
9
DIFFUSER CASE
REAR FLANGE
2
COOLING
DUCT FLANGE
L−A3700 (0589)
PW V

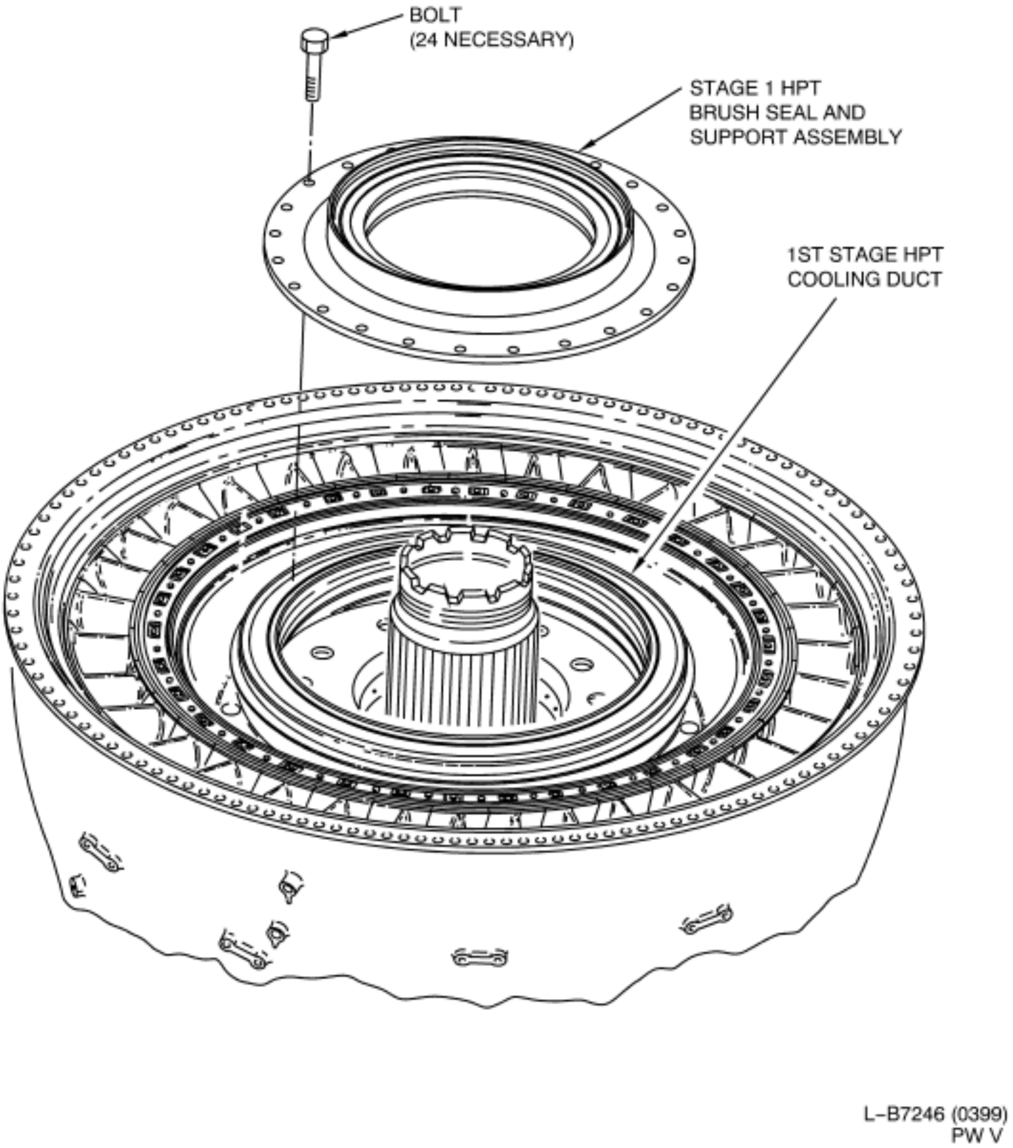
Turbine Nozzle Installation
Figure 406
(Task 72−00−51−420−002)

ENGINE GENERAL − TURBINE NOZZLE − INSTALLATION−02


1
BOLT
(36 REQUIRED)
2
1ST STAGE HPT
COOLING DUCT
L−A1303 (1186)
PW V

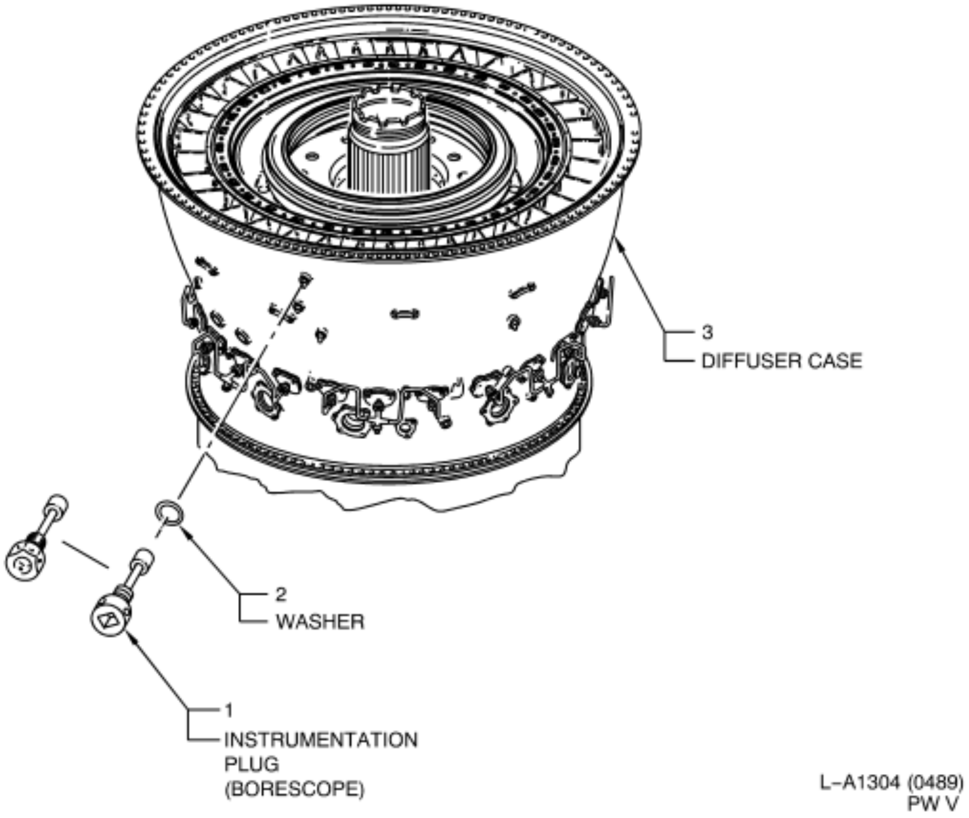
Turbine Nozzle Installation
Figure 407
(Task 72−00−51−420−002)

ENGINE GENERAL − TURBINE NOZZLE − INSTALLATION−02


BOLT
(24 NECESSARY)
STAGE 1 HPT
BRUSH SEAL AND
SUPPORT ASSEMBLY
1ST STAGE HPT
COOLING DUCT
L−B7246 (0399)
PW V

Stage 1 HPT Brush Seal And Support Installation
Figure 408
(Task 72−00−51−420−002)

ENGINE GENERAL − TURBINE NOZZLE − INSTALLATION−02


3
DIFFUSER CASE
2
WASHER
1
INSTRUMENTATION
PLUG
(BORESCOPE)
L−A1304 (0489)
PW V

Instrumentation Plug Installation
Figure 409
(Task 72−00−51−420−002)

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ENGINE GENERAL − TURBINE NOZZLE − INSPECTION/CHECK−01

Task 72-00−51−990−001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (−) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (−) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

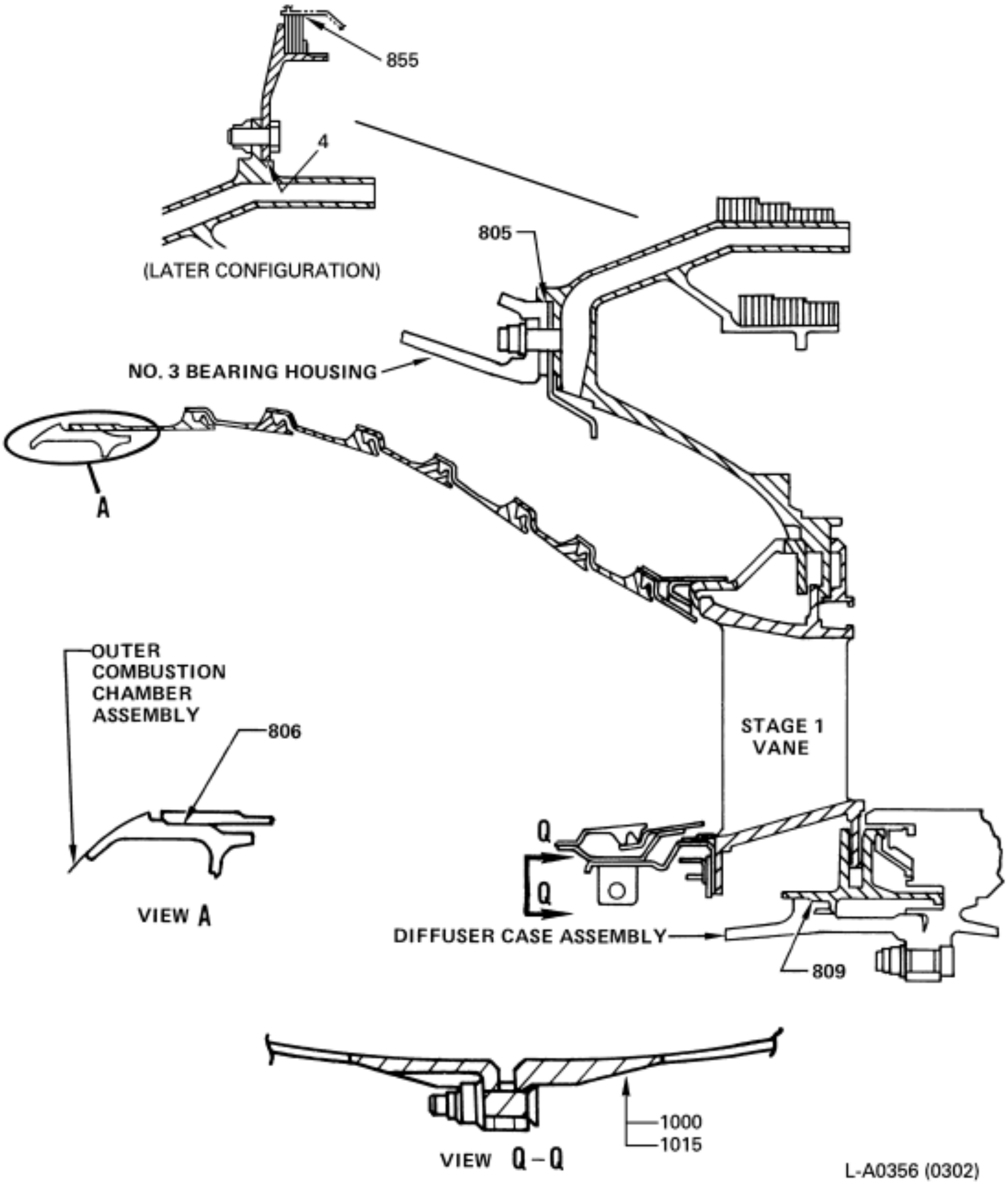
Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
4	B	Stage 1 HPT Brush Seal And Support Assembly (72−51−12) Stage 1 HPT (Blade) Cooling Duct Assembly (72−51−03) (See Figure 801)				
		Brush Seal	16.190 (411.226)	16.194 (411.327)		
		Duct	16.174 (410.820)	16.178 (410.921)	.011T* (0.279T*)	.020T (0.508T)
805	B	Stage 1 HPT (Blade) Cooling Duct Assembly (72−51−03) No. 3 Bearing Housing (72−41−10) (See Figure 801)				
		Duct	19.198 (487.630)	19.202 (487.730)		
		Housing	19.193 (487.503)	19.197 (487.603)	.001T (0.025T)	.009T (0.229T)

	Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
	806	A	Inner Combustion Chamber Assembly (72-41-11) Outer Combustion Chamber Assembly (72-51-05) (See Figure 801)				
			Inner Chamber	23.233 (590.12)	23.243 (590.37)		
			Outer Chamber	23.224 (589.89)	23.234 (590.14)	.001 (0.03)	.019T (0.48T)
	808	B	Turbine Cooling Duct Sensing (Inner Airframe) Tube Assembly (72-41-23) Stage 1 HPT (Blade) Cooling Duct Assembly (72-51-03) (See Figure 802)				
			Tube	.373 (9.474)	.377 (9.576)		
R R			Duct	0.378 (9.601)	0.380 (9.652)	0.001 (0.025)	0.019* (0.483)*
	809	B	Stage 1 (Vane) HPT Support Assembly (72-51-01) Diffuser Case Assembly (72-41-01) (See Figure 801)				
			Support	38.383 (974.93)	38.395 (975.23)		
			Case	38.377 (974.776)	38.383 (974.928)	.011* (0.28)*	.018T (0.46T)
	855		HPT Brush Seal And Support Assembly (72-51-12) HPT Stage 1 Air Sealing Ring (72-52-17) (See Figure 801)				
			Radial Gap Cold -		Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357.		

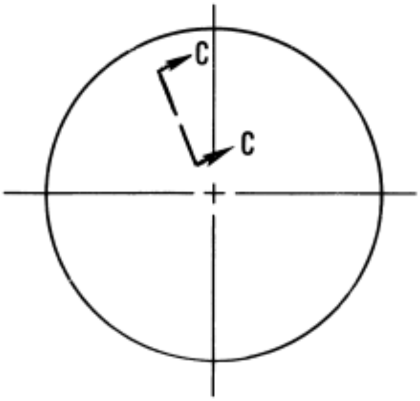
G. Special Assembly Procedures

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1000	A	Rear Burner Seal Clamp - Fitting Procedure (See Figure 801) See 72-00-51, Installation-01				

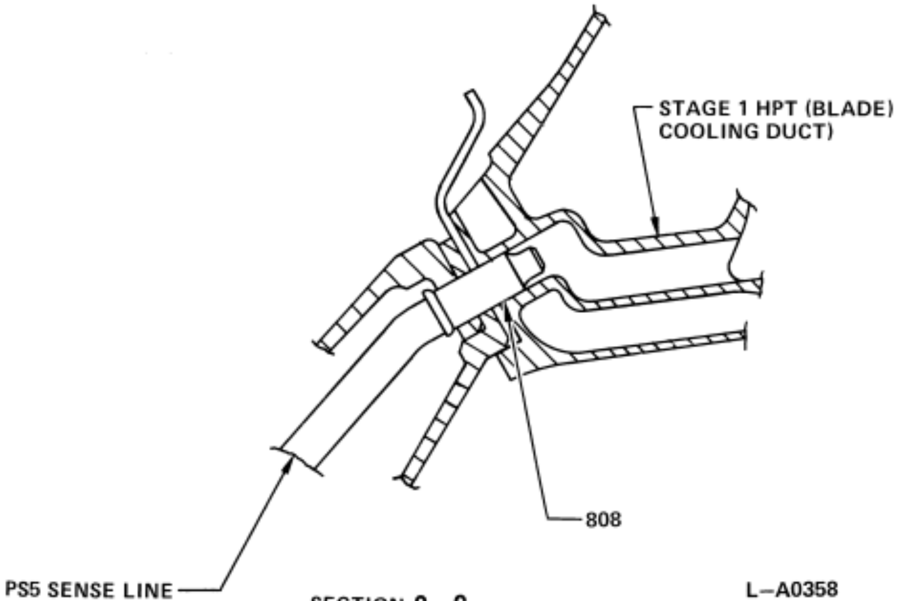
Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)						
		(Task 72−00−51−420−001) See 72−00−51, Installation−02 (Task 72−00−51−420−002) See 72−51−00, Assembly−01 (Task 72−51−00−430−001)				
1015	A	Rear Burner Seal Clamp − Fitting Procedure (See Figure 801) See 72−00−51, Installation−01 (Task 72−00−51−420−001) See 72−00−51, Installation−02 (Task 72−00−51−420−002) See 72−51−00, Assembly−01 (Task 72−51−00−430−001)				


855
4
(LATER CONFIGURATION)
805
NO. 3 BEARING HOUSING
A
OUTER COMBUSTION CHAMBER ASSEMBLY
806
VIEW A
STAGE 1 VANE
Q
Q
DIFFUSER CASE ASSEMBLY
809
1000
1015
VIEW Q−Q
L-A0356 (0302)

Turbine Nozzle
Figure 801
(Task 72−00−51−990−001)



SCHEMATIC REAR VIEW


STAGE 1 HPT (BLADE) COOLING DUCT)
808
PS5 SENSE LINE
L−A0358

SECTION C − C

Turbine Nozzle
Figure 802
(Task 72−00−51−990−001)

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ENGINE GENERAL - TURBINE NOZZLE - INSPECTION/CHECK-10

Task 72-00-51-210-010:

1. Visually Examine The Turbine Nozzle Module Assembly - Engine General - Turbine Nozzle

A. Equipment And Materials Necessary - None

B. General Inspection Limits

NOTE: All applicable Airworthiness Directives (AD's) must be complied with and these directives takes precedence over all inspections or repairs given in this module inspection.

(1) This inspection does not permit time since overhaul to be set to zero. The use of the limits in this inspection will not give performance restoration.

(2) These procedures give instructions for the visual inspection of the turbine nozzle module assembly after removal from the engine. Do these procedures before you do the preservation, packing or module installation procedure. This procedure is to find those easy to see types of damage, which can make it necessary to do more disassembly, inspection or repair. Refer to Section 70-31-00 for the general visual inspection instructions in the Standard Practices Manual, PN 585005.

(3) The inspection table in this section is applicable to the turbine nozzle modules with some, none or all of the components installed. You do not have to disassemble the module assembly to do this inspection. You can choose to apply individual limits to those areas that are visible at all stages of disassembly. If a condition shows that there can be damage that you cannot see, remove a component to fully examine the damaged area. Use the applicable procedures in this manual to remove the component and do an inspection by step (4).

(4) Remove all the components that you find not serviceable at the modular level. Send the applicable components for more inspection and repair at the component level maintenance. Refer to Section 72-51-00 in the PW4000 Series CIR, PN 51A357. Components that you remove from the turbine nozzle module, will need a Cleaning, Inspection and Repair Manual component level inspection/check.

C. Procedure

R ENGINE GENERAL − TURBINE NOZZLE − INSPECTION/CHECK−10

R (1) Examine the Stage 1 vane ceramic coat. See Table 801,
R Figure 801 (Sheet 1) and Figure 801 (Sheet 2).

R (2) Examine the Stage 1 vane for crack. See Table 802,
R Figure 802 (Sheet 1), Figure 802 (Sheet 2), Figure 802
R (Sheet 3) and Figure 802 (Sheet 4).

R (3) Examine the vane outer diameter platform non−gaspath
R side. See Table 803 and Figure 803.

R (4) Examine the inner combustion liner for non−talon
R burners. See Table 804 and Figure 804.

R (5) Examine the inner combustion chamber for the low
R emission talon burner. See Table 805 and Figure 805.

R (6) Examine the cooling duct assembly (tObi). See Table
R 806 and Figure 806.

R (7) Examine the duct segments. See Table 807 and Figure
R 807.

R (8) Examine the Stage 1 vane support. See Table 808 and
R Figure 808.

R (9) Examine the Stage 1 vane platform featherseal. See
R Table 809 and Figure 809.

ENGINE GENERAL - TURBINE NOZZLE - INSPECTION/CHECK-10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Figure 801 (Sheet 1) and Figure 801 (Sheet 2)			
Stage 1 vane coat, all surfaces:	All quantities of coat can be missing if burning, erosion and cracks are in the applicable limits of this table and table 802.	See the repair Note: Operation for a long time with dangerous coat loss will sometime cause base material burning, erosion or material degradation because of which the vane becomes not repairable.	Refer to Section 72-51-02, Repair-08 and Repair-14 in the PW4000 Series CIR, PN 51A357
All surfaces material break through/burn through	Not permitted	Not repairable	Remove from service
All surfaces for burning with no measurable depth in the base material	Permitted		

Stage 1 Vane Coat And Surface Damage Inspection
Table 801

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Concave airfoil surface, convex airfoil surface and platform surfaces, for burning and erosion with measurable depth in the base material	0.010 inch (0.254 mm) maximum depth for 0.010 sq−in (6. sq−mm) maximum total area for each surface		Remove from service
Trailing edge burning and erosion (Burnback)	0.150 inch (3.810 mm) maximum radial length and 0.100 inch (2.540 mm) maximum axial width		Remove from service
Leading edge burning and erosion with measurable depth in the base material	0.010 inch (0.254 mm) maximum depth and 0.300 inch (7.620 mm) maximum diameter		Remove from service
Leading Edge, concave and convex surfaces, trailing edge and platform surfaces for round bottom nicks and dents (other than the fillet radius)	All quantities to a maximum of 0.125 inch (3.175 mm) length or width and 0.0312 inch (0.792 mm) maximum depth	See the repair	Refer to Section 72−51−02, Repair−11 in the PW4000 Series CIR, PN 51A357
		Damage in the airfoil to the platform fillet radius is not repairable	

Stage 1 Vane Coat And Surface Damage Inspection
Table 801 (Continued)

R ENGINE GENERAL − TURBINE NOZZLE − INSPECTION/CHECK−10

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
	(CONTINUED)			
R		Damage in the airfoil to the platform fillet radius is not permitted		

R Stage 1 Vane Coat And Surface Damage Inspection
R Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 1 vane leading edge, concave and convex surfaces, trailing edge and platform for:			
Cracks that form the closed loop on all surfaces	Not permitted	Not repairable	Remove from service
Cracks in the base material where coat loss bares the base material, all surfaces	Not Permitted		Remove from service
Leading edge for Crack: See Figure 802 (Sheet 1)			
1	All quantities of axial or radial single hole to hole cracks with three holes minimum separation		
2	Two Cracks for each vane that extend to the three adjacent leading edge cooling holes or from a leading edge cooling hole to a single first row concave or		

Stage 1 Vane Crack Inspection
Table 802

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			
	convex airfoil cooling hole		
3	One radial crack for each vane starts from the inner diameter or outer diameter platform to a distance of 0.250 inch (6.350 mm) maximum from the platform		
Concave airfoil surface for: See Figure 802 (Sheet 2)			
Cracks that form the closed loop	Not permitted	Not repairable	Remove from service
Cracks (Other than cooling hole)	All quantities of axial or radial cracks 0.120 inch (3.048 mm) maximum length, 0.020 inch (0.508 mm) maximum width. No surface mismatch across a crack in more than 0.020 inch (0.508 mm).	See the repairs	Refer to Section 72-51-02, Repair-12 and Repair-13 in the PW4000 Series CIR, PN 51A357
	Two radial cracks 0.500 inch (12.700 mm) maximum length and		

Stage 1 Vane Crack Inspection
Table 802 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	0.020 inch (0.508 mm) maximum width not extend to the platform. No surface mismatch across a crack in more than 0.020 inch (0.508 mm). Cracks can intersect.		
Cracks (Cooling holes)	One axial crack from one cooling hole group to the next or from the trailing edge to the rear cooling hole group	See the repairs	Refer to Section 72-51-02, Repair-12 and Repair-13 in the PW4000 Series CIR, PN 51A357
	Two axial cracks extend from one cooling hole group half the distance to next cooling hole group or the trailing edge half the distance to the rear cooling hole group		
4 Radial cracks that start on the outer diameter or inner diameter platform	All quantities that extend 0.250 inch (6.350 mm) maximum from platform surface can	See the repairs	Refer to Section 72-51-02, Repair-12 and Repair-13 in the PW4000 Series CIR, PN

Stage 1 Vane Crack Inspection
Table 802 (Continued)

R ENGINE GENERAL - TURBINE NOZZLE - INSPECTION/CHECK-10

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
	(CONTINUED)			
R		not intersect with all other cracks on the airfoil surface		51A357
R	Convex airfoil surface for: See Figure 802 (Sheet 3)			
R	Cracks that form the closed loop	Not permitted	Not repairable	Remove from service
R	Cracks	All quantities of axial or radial cracks 0.120 inch (3.048 mm) maximum length 0.020 inch (0.508 mm) maximum width. No surface mismatch across a crack in more than 0.020 inch (0.508 mm).	No limit	Refer to Section 72-51-02, Repair-12 and Repair-13 in the PW4000 Series CIR, PN 51A357
R		Two radial cracks 0.500 inch (12.700 mm) maximum length and 0.020 inch (0.508 mm) maximum width not extends to the platform. No surface mismatch across a crack in more than 0.020 inch (0.508 mm). Cracks can		

R Stage 1 Vane Crack Inspection
R Table 802 (Continued)

ENGINE GENERAL - TURBINE NOZZLE - INSPECTION/CHECK-10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	intersect.		
	Two axial cracks 0.500 inch (12.700 mm) maximum length and 0.020 inch (0.508 mm) maximum width. One of the cracks can extend from the trailing edge forward 0.750 inch (19.050 mm) maximum. Cracks can intersect.		
5 Radial cracks that start on the outer diameter or the inner diameter platform	All quantities that extend 0.250 inch (6.350 mm) maximum from the platform surface cannot intersect with all other cracks on airfoil surface	See the repairs	Refer to Section 72-51-02, Repair-12 and Repair-13 in the PW4000 Series CIR, PN 51A357
Platform cracks. See Figure 802 (Sheet 4)			

Stage 1 Vane Crack Inspection
Table 802 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
General for platform cracks	0.020 inch (0.508 mm) maximum width for all cracks Cracks can intersect but must not form a closed loop		
Fillet radius cracks	All quantities of cracks 0.250 inch (6.350 mm) maximum length that start in the fillet radius and extend onto the platform One axial crack for each vane in the fillet radius 0.300 inch (7.620 mm) maximum length can intersect other airfoil/platform cracks if the maximum length is 0.750 inch (19.050 mm)		
Circumferential cracks in the vane leading edge fillet radius	Not serviceable	See the repairs	Refer to Section 72−51−02, Repair−12 and Repair−13 in the PW4000 Series CIR, PN 51A357

Stage 1 Vane Crack Inspection
Table 802 (Continued)

R ENGINE GENERAL − TURBINE NOZZLE − INSPECTION/CHECK−10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Outer diameter platform concave side cracks	Five cracks to a maximum of 0.200 inch (5.080 mm) length	See the repairs	Refer to Section 72−51−02, Repair−12 and Repair−13 in the PW4000 Series CIR, PN 51A357
	Three cracks 0.700 inch (17.780 mm) maximum length		
	One crack that extends from airfoil fillet radius to platform edge		
Outer diameter platform convex side cracks	Five cracks to a maximum of 0.200 inch (5.080 mm) length	See the repairs	Refer to Section 72−51−02, Repair−12 and Repair−13 in the PW4000 Series CIR, PN 51A357
	One crack that extends from airfoil fillet radius to platform edge		
Inner diameter platform concave and convex sides	Five cracks to a maximum of 0.200 inch (5.080 mm) length	See the repairs	Refer to Section 72−51−02, Repair−12 and Repair−13 in the PW4000 Series CIR, PN 51A357
	One crack extends from		

Stage 1 Vane Crack Inspection
Table 802 (Continued)

ENGINE GENERAL − TURBINE NOZZLE − INSPECTION/CHECK−10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	airfoil fillet radius to platform edge		

Stage 1 Vane Crack Inspection
Table 802 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 1 vane outer diameter platform non-gaspath side for: See Figure 803			
Impingement cover weld cracks	All quantities of cracks of 0.015 inch (0.381 mm) length	See the repair	Refer to Section 72-51-02, Repair-01 in the PW4000 Series CIR, PN 51A357
Vane cluster weld joint crack	All length of crack(s) is permitted, if 1.000 inch (25.400 mm) of weld joint forward of the inner diameter support flange is not cracked at the inner diameter platform.	See the repair	Refer to Section 72-51-02, Repair-09 and Repair-10 in the PW4000 Series CIR, PN 51A357
Missing impingement cover material	Not permitted	See the repair	Refer to Section 72-51-02, Repair-01 in the PW4000 Series CIR, PN 51A357
Cooling air hole cracks	Not permitted		
Impingement tube cracks	Not permitted		

Stage 1 Vane Outer Diameter Platform (Non-Gaspath Side) Crack Inspection
Table 803

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Impingement tube tack weld cracks	A maximum of two cracked welds are permitted		
R	Support flange anti-rotation pin	0.025 inch (0.635 mm) maximum wear for each pin. One missing anti-rotation pin is permitted for each module.	Pin can be replaced	Refer to Section 72-51-02, Repair-05 in the PW4000 Series CIR, PN 51A357

R Stage 1 Vane Outer Diameter Platform
R (Non-Gaspath Side) Crack Inspection
R Table 803 (Continued)

R ENGINE GENERAL - TURBINE NOZZLE - INSPECTION/CHECK-10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Inner combustion chamber louvers for: See Figure 804			
Burn through (Open holes)	Not Permitted	More than 0.030 inch (0.762 mm) width patch repair	Refer to Section 72-51-05, Repair-08 in the PW4000 Series CIR, PN 51A357
Bent, buckled or distorted louvers	Permitted if no other limits are exceeded		
Thermal barrier ceramic coat loss	All quantities to a maximum of 20 percent of the total coated area	Local chipping	Refer to Section 72-51-05, Repair-05 in the PW4000 Series CIR, PN 51A357
Axial cracks in a louver	All quantities of 0.020 inch (0.508 mm) maximum width and 0.300 inch (7.620 mm) maximum length	See the repair	Refer to Section 72-51-05, Repair-17 in the PW4000 Series CIR, PN 51A357
	Cracks cannot intersect. Cracks cannot extend into the knuckle area or adjacent louver.		Refer to Section 72-51-05, Repair-06 and Repair-07 in the PW4000 Series CIR, PN 51A357

R Inner Combustion Chamber Non-Talon Burners Inspection
R Table 804

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Continuous axial cracks that extend through the knuckle area and/or into an adjacent louver	Not permitted	Five cracks to a maximum of 0.030 inch (0.762 mm) width can be weld repaired. Cracks in more than 0.030 inch (0.762 mm) Width can be patch repaired.	Refer to Section 72−51−05, Repair−06 and Repair−07 in the PW4000 Series CIR, PN 51A357
Circumferential cracks in the lip region only	2.000 inch (50.800 mm) maximum circumferential length	No limit	Replace the liner segment. Refer to Section 72−51−05, Repair−12, Repair−13, Repair−14, and Repair−15 in the PW4000 Series CIR, PN 51A357.
Circumferential cracks all other locations	Not permitted	A maximum of 7 cracks 1.000 inch (25.400 mm) in length. 6.000 inch (152.400 mm) minimum separation.	Refer to Section 72−51−05, Repair−06, Repair−07 and Repair−08 in the PW4000 Series CIR, PN 51A357
Intersection of cracks (axial and/or circumferential)	Not permitted	No limit	Replace the liner segment. Refer to Section 72−51−05, Repair−12, Repair−13, Repair−14, and Repair−15 in the PW4000 Series CIR, PN

Inner Combustion Chamber Non−Talon Burners Inspection
Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			51A357.
1 Hardface coat	Wear or chipping that does not bare the base material		Refer to Section 72−51−05, Repair−04 in the PW4000 Series CIR, PN 51A357

Inner Combustion Chamber Non−Talon Burners Inspection
Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Inner combustion chamber liner segments for: See Figure 805			
Cracks	All quantities of trailing edge cracks 0.200 inch (5.080 mm) maximum length. Cracks must not intersect.	No limit	Replace the liner. Refer to Section 72−51−05, Repair−25 in the PW4000 Series CIR, PN 51A357.
	One crack for each hole starts in a combustion or ignitor hole to a maximum of 0.250 inch (6.350 mm) length and must not intersect. (Other than PN 5lK000)	No limit	Replace the liner. Refer to Section 72−51−05, Repair−25 in the PW4000 Series CIR, PN 51A357.
Burn through (Open holes)	Not permitted	No limit	Replace the liner. Refer to Section 72−51−05, Repair−25 in the PW4000 Series CIR, PN 51A357.
Trailing edge burning or erosion (Missing material)	Can extend axially forward until forward edge of next rearward panel is bare. On last segment row, (Row 6)	No limit	Replace the liner. Refer to Section 72−51−05, Repair−25 in the PW4000 Series CIR, PN 51A357.

Inner Combustion Chamber With Talon (Floatwall) Low Emission Burners Inspection
Table 805

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	burning to a maximum of 0.200 inch (5.080 mm) length is permitted.		
Burn back at corners (Missing material)	0.100 inch (2.540 mm) circumferentially and axially forward until the leading edge of the next rearward panel is bare. 0.100 inch (2.540 mm) axially forward on last (Row 6) segment.	No limit	Replace the liner. Refer to Section 72−51−05, Repair−25 in the PW4000 Series CIR, PN 51A357.
Missing thermal barrier coat	All quantities of spalled and chipped PWA 265 coat, if PWA 265 metallic bond coat is present.	PWA 265 restoration	Refer to Section 72−51−05, Repair−34 in the PW4000 Series CIR, PN 51A357
Liner segment attach nuts and washers	Must not be loose, worn, missing or damaged	No limit	Replace the hardware. Refer to Section 72−51−05, Repair−25 in the PW4000 Series CIR, PN 51A357

Inner Combustion Chamber With Talon (Floatwall) Low Emission Burners Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
1 Hardface coat	wear or chipping that does not bare the base material	Hardface replacement	

Inner Combustion Chamber With Talon (Floatwall) Low Emission Burners Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Cooling duct assembly (TOBI)			
1			
Cracks in all cast surfaces that includes the weld repaired bolt holes	No cracks are permitted	See the repair	Refer to Section 72−51−03, Repair−11 in the PW4000 Series CIR, PN 51A357
Cracks in all the machined surfaces. See Figure 806	All linear indications to a maximum of 0.032 inch (0.813 mm) in length and a minimum separation of 0.135 inch (3.429 mm) are permitted		
2			
Airflow adjustment plug welds	Cracks to a maximum of 0.100 inch (2.540 mm) length separated by at least 0.125 inch (3.175 mm) in all directions are permitted, if they do not extend into the parent material by more than 0.015 inch (0.381 mm).		Remove from service

Cooling Duct Assembly (TOBI) Surface Damage Inspection
Table 806

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
All surfaces for: (other than honeycomb seal area)			
Nicks	0.006 inch (0.152 mm) maximum depth	0.020 inch (0.508 mm) maximum depth	Refer to Section 72-51-03, Repair-25 in the PW4000 Series CIR, PN 51A357
Burning and/or corrosion	Not permitted	Not repairable	Remove from service
Round bottom dents	0.010 inch (0.254 mm) maximum depth	0.020 inch (0.508 mm) maximum depth	Refer to Section 72-51-03, Repair-25 in the PW4000 Series CIR, PN 51A357
Honeycomb Seal area for:			
3 Damaged or bent cells (In knife-edge seal wear areas)	0.025 inch (0.635 mm) maximum depth	Honeycomb can be replaced	Refer to Section 72-51-03, Repair-02 and Repair-16 in the PW4000 Series CIR, PN 51A357

Cooling Duct Assembly (TOBI) Surface Damage Inspection
Table 806 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Damaged or bent cells (Other than knife−edge seal wear areas)	Three rows of cells maximum can be damaged to a maximum of 0.800 inch (20.320 mm) circumferential length on each strip (land)	Honeycomb can be replaced	Refer to Section 72−51−03, Repair−02 and Repair−16 in the PW4000 Series CIR, PN 51A357

Cooling Duct Assembly (TOBI) Surface Damage Inspection
Table 806 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 1 HPT duct Segment (See Figure 807)			
1 All surfaces for:			
Cracks	Not permitted	Not permitted	Remove from service
Round bottom dents and gouges	0.005 inch (0.127 mm) maximum depth	See the repair	Refer to Section 72-51-06, Repair-02 in the PW4000 Series CIR, PN 51A357
Corrosion and pits	A maximum of 0.005 inch (0.127 mm) depth of pits. Clean to remove all the indications of corrosion.	See the repair	Refer to Section 72-51-06, Repair-02 in the PW4000 Series CIR, PN 51A357

Duct Segment Inspection
Table 807

R ENGINE GENERAL - TURBINE NOZZLE - INSPECTION/CHECK-10

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	Stage 1 HPT vane support for: See Figure 808			
R	All surfaces unless given differently: Cracks	Not permitted	Cracks in the anti-rotation lugs to a maximum of 0.125 inch (3.175 mm) can be repaired	Refer to Section 72-51-01, Repair-08 in the PW4000 Series CIR, PN 51A357
R	Round bottom nicks, dents and gouges	All quantities of 0.015 inch (0.381 mm) maximum depth	0.015 - 0.040 inch (0.38 - 1.02 mm) depth	Refer to Section 72-51-01, Repair-08 in the PW4000 Series CIR, PN 51A357
R	1 Anti-rotation lug Wear or crack	0.030 inch (0.762 mm) maximum wear depth on the contact face with Stage 1 vane anti-rotation pins. Cracks are not permitted.	See the repair	Refer to Section 72-51-01, Repair-01 and Repair-12 in the PW4000 Series CIR, PN 51A357
R	2 Coated surface worn, chipped or missing coat	A maximum of 15 percent of the top layer of coat can be chipped or missing. No bare material (missing	See the repair	Refer to Section 72-51-01, Repair-02 and Repair-20 in the PW4000 Series CIR, PN 51A357

R Stage 1 Vane Support Inspection
R Table 808

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	bond coat) is permitted.		
Stage 1 vane support for:			
3 Inner diameter surface cracks	All quantities of cooling hole cracks to a maximum of 0.050 inch (1.270 mm) in axial length are permitted	Cracks to a maximum of 0.060 inch (1.524 mm) in the axial length and less than 0.150 inch (3.810 mm) radial depth with no crack indications at the outer diameter end of the cooling holes. All quantities of adjacent cooling holes can be weld repaired.	Refer to Section 72-51-01, Repair-21 in the PW4000 Series CIR, PN 51A357
		Cracks more than 0.060 inch (1.524 mm) in axial length across the inner diameter surface and less than 0.150 inch (3.810 mm) in radial depth with no crack indications at the outer diameter end of the cooling holes. 10 percent of	Refer to Section 72-51-01, Repair-21 in the PW4000 Series CIR, PN 51A357

Stage 1 Vane Support Inspection
Table 808 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)		the cooling holes can be weld repaired. Repairs can be completed to a maximum of ten adjacent cooling holes.	
		Cracks more than 0.060 inch (1.524 mm) in axial length across the inner diameter surface and less than 0.350 inch (8.890 mm) in radial depth. Crack indications can be at the outer diameter end of the cooling holes. Repairs can be completed to a maximum of two adjacent cooling holes and no more than 20 cooling holes can be repaired.	Refer to Section 72−51−01, Repair−21 in the PW4000 Series CIR, PN 51A357
4 Anti−rotation lug wear and crack	Not Permitted	Crack to a maximum of 0.125 inch (3.175 mm) length	Refer to Section 72−51−01, Repair−08 and Repair−15 in the PW4000 Series CIR, PN 51A357

Stage 1 Vane Support Inspection
Table 808 (Continued)

ENGINE GENERAL - TURBINE NOZZLE - INSPECTION/CHECK-10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 1 vane inner diameter and outer diameter platform for: See Figure 809			
Missing featherseals	A maximum of three featherseals can be missing	All quantities	Replace the missing seals

Stage 1 Vane Platform Feather Seal Inspection
Table 809

R ENGINE GENERAL − TURBINE NOZZLE − INSPECTION/CHECK−10

R
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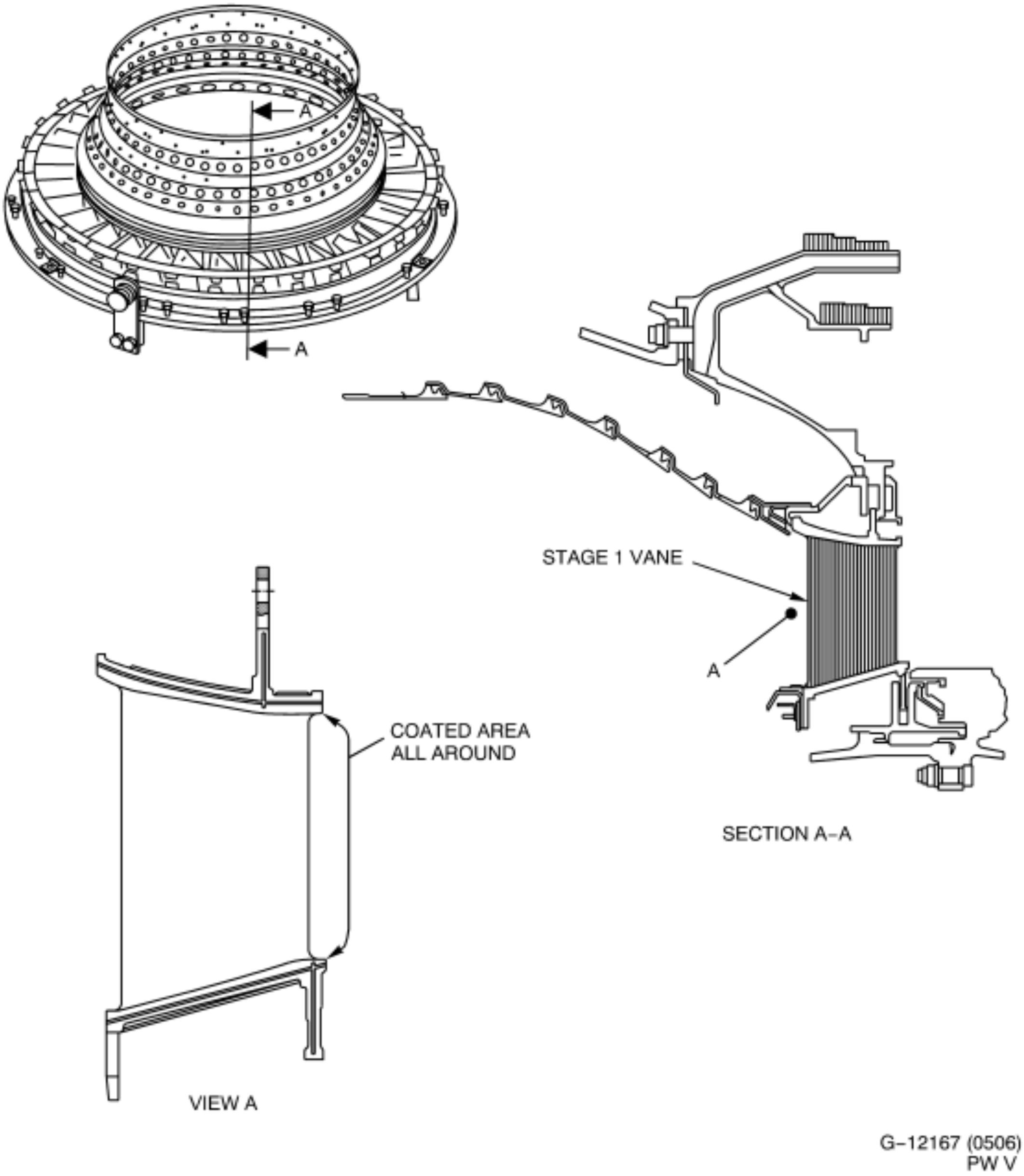
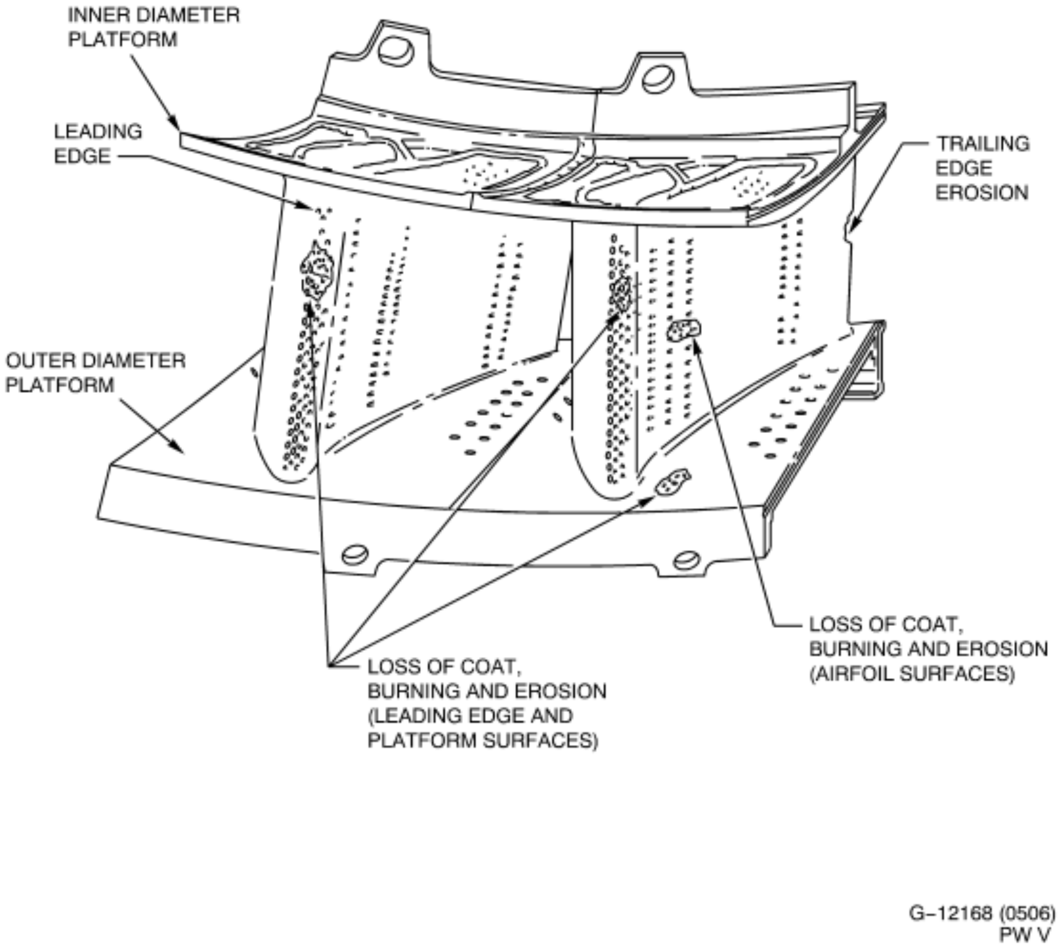
R


A
A
STAGE 1 VANE
A
SECTION A−A
COATED AREA
ALL AROUND
VIEW A
G−12167 (0506)
PW V

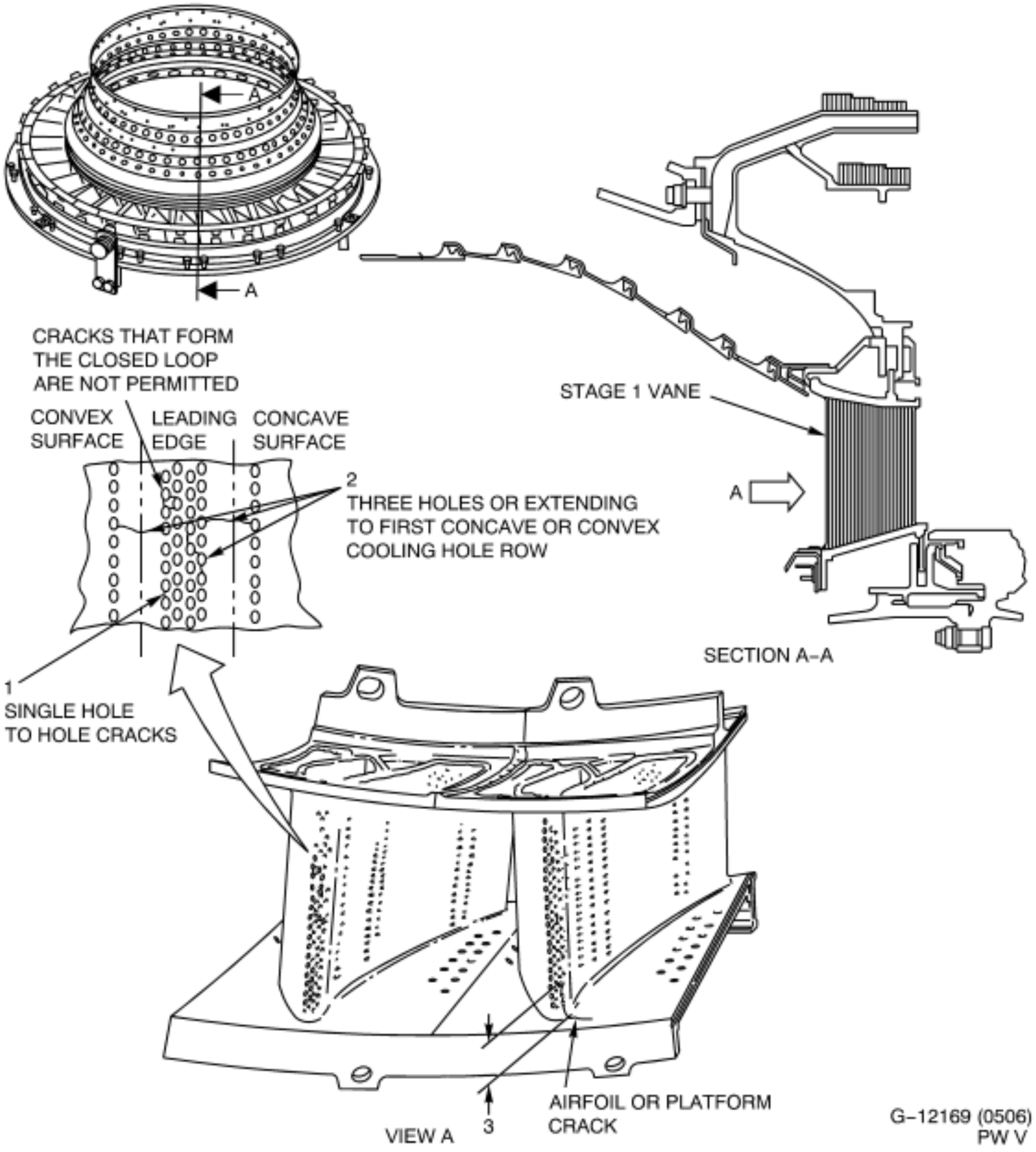
R Stage 1 Vane Coat And Surface Damage Inspection
R Figure 801 (Sheet 1)
R (Task 72−00−51−210−010)

R ENGINE GENERAL − TURBINE NOZZLE − INSPECTION/CHECK−10


INNER DIAMETER PLATFORM
LEADING EDGE
TRAILING EDGE EROSION
OUTER DIAMETER PLATFORM
LOSS OF COAT, BURNING AND EROSION (AIRFOIL SURFACES)
LOSS OF COAT, BURNING AND EROSION (LEADING EDGE AND PLATFORM SURFACES)
G−12168 (0506)
PW V

R See Table 801 For Index Definitions.

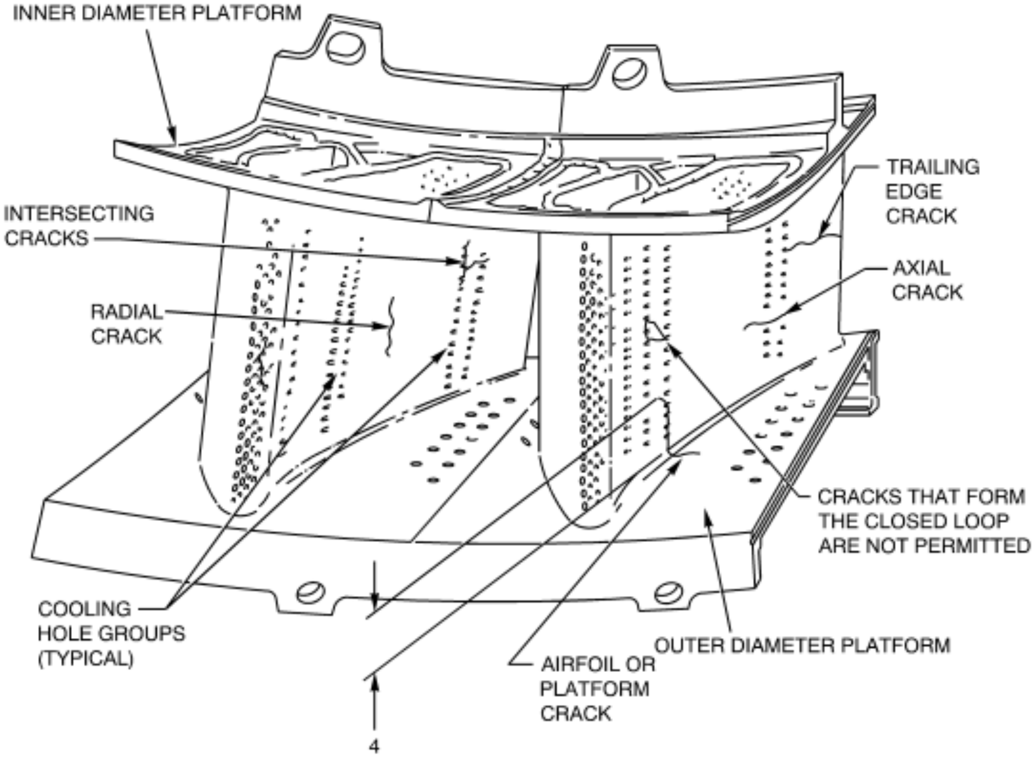
R Stage 1 Vane Coat And Surface Damage Inspection
R Figure 801 (Sheet 2)
R (Task 72−00−51−210−010)


A
A
CRACKS THAT FORM THE CLOSED LOOP ARE NOT PERMITTED
CONVEX SURFACE
LEADING EDGE
CONCAVE SURFACE
STAGE 1 VANE
2
THREE HOLES OR EXTENDING TO FIRST CONCAVE OR CONVEX COOLING HOLE ROW
A
1
SINGLE HOLE TO HOLE CRACKS
SECTION A−A
AIRFOIL OR PLATFORM CRACK
VIEW A
3
G−12169 (0506)
PW V

R See Table 802 For Index Definitions.

R Leading Edge Crack Inspection
R Figure 802 (Sheet 1)
R (Task 72−00−51−210−010)

R ENGINE GENERAL − TURBINE NOZZLE − INSPECTION/CHECK−10

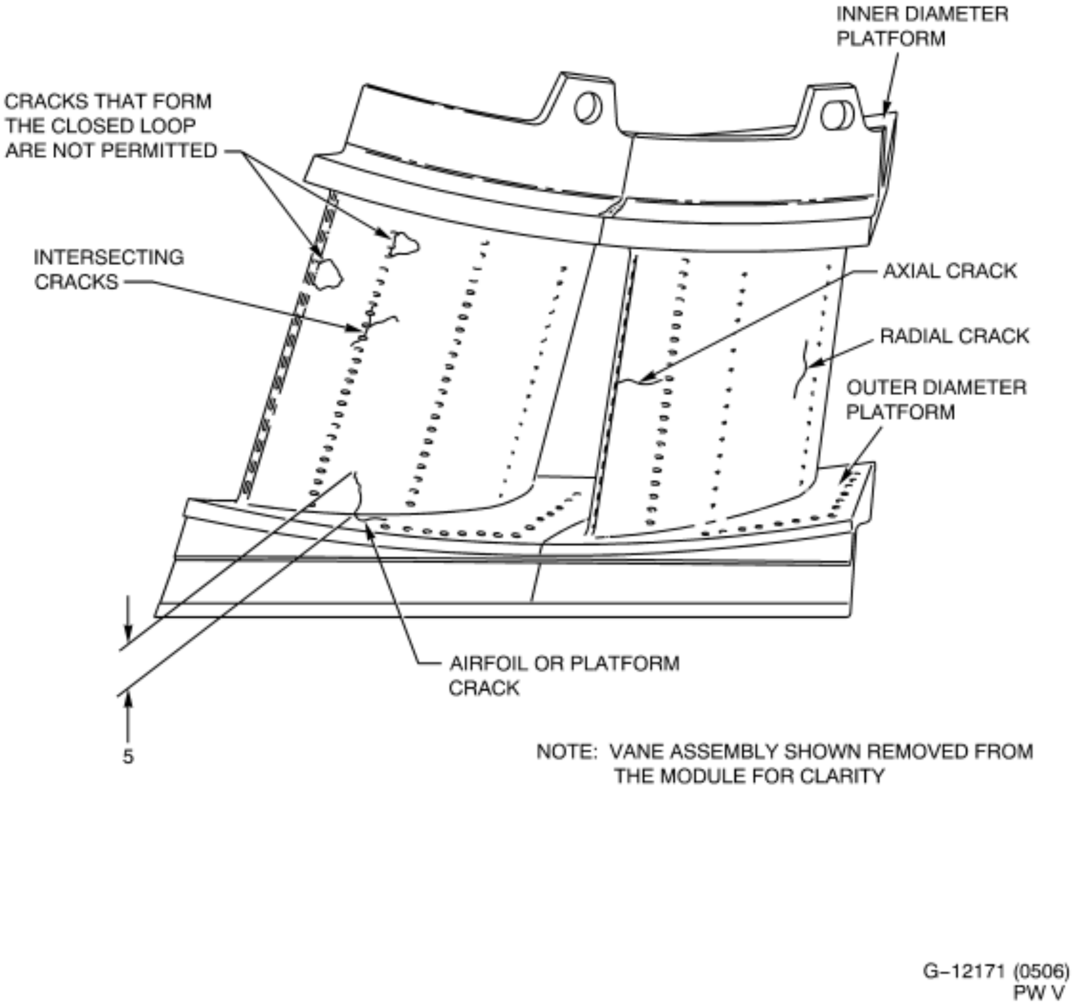

INNER DIAMETER PLATFORM
INTERSECTING CRACKS
RADIAL CRACK
TRAILING EDGE CRACK
AXIAL CRACK
CRACKS THAT FORM THE CLOSED LOOP ARE NOT PERMITTED
COOLING HOLE GROUPS (TYPICAL)
OUTER DIAMETER PLATFORM
AIRFOIL OR PLATFORM CRACK
4

NOTE: VANE ASSEMBLY SHOWN REMOVED FROM THE MODULE FOR CLARITY

G−12170 (0506)
PW V

R See Table 802 For Index Definitions.

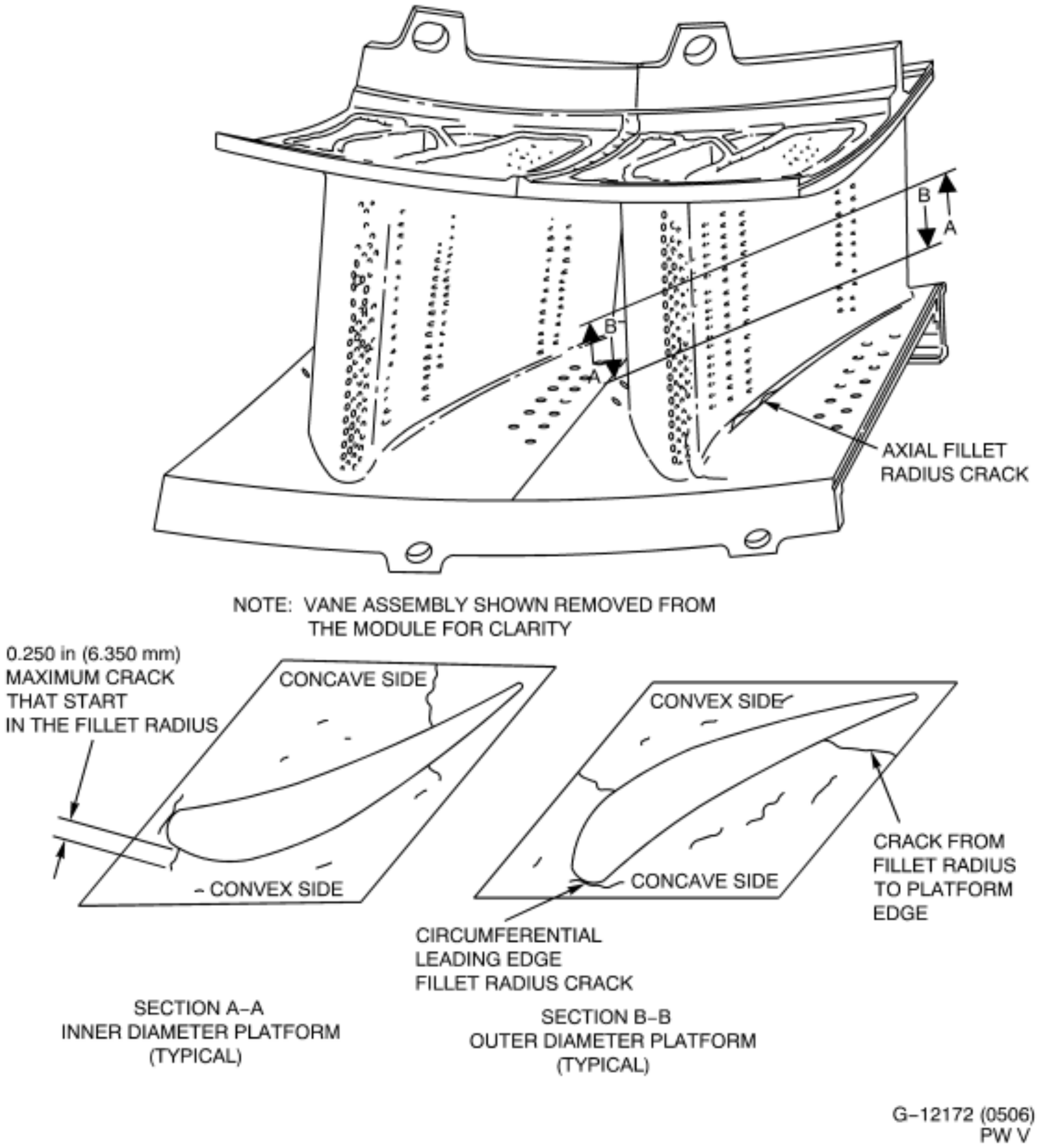
R Concave Airfoil Crack Inspection
R Figure 802 (Sheet 2)
R (Task 72−00−51−210−010)


INNER DIAMETER PLATFORM
CRACKS THAT FORM THE CLOSED LOOP ARE NOT PERMITTED
INTERSECTING CRACKS
AXIAL CRACK
RADIAL CRACK
OUTER DIAMETER PLATFORM
AIRFOIL OR PLATFORM CRACK
5
NOTE: VANE ASSEMBLY SHOWN REMOVED FROM THE MODULE FOR CLARITY
G−12171 (0506)
PW V

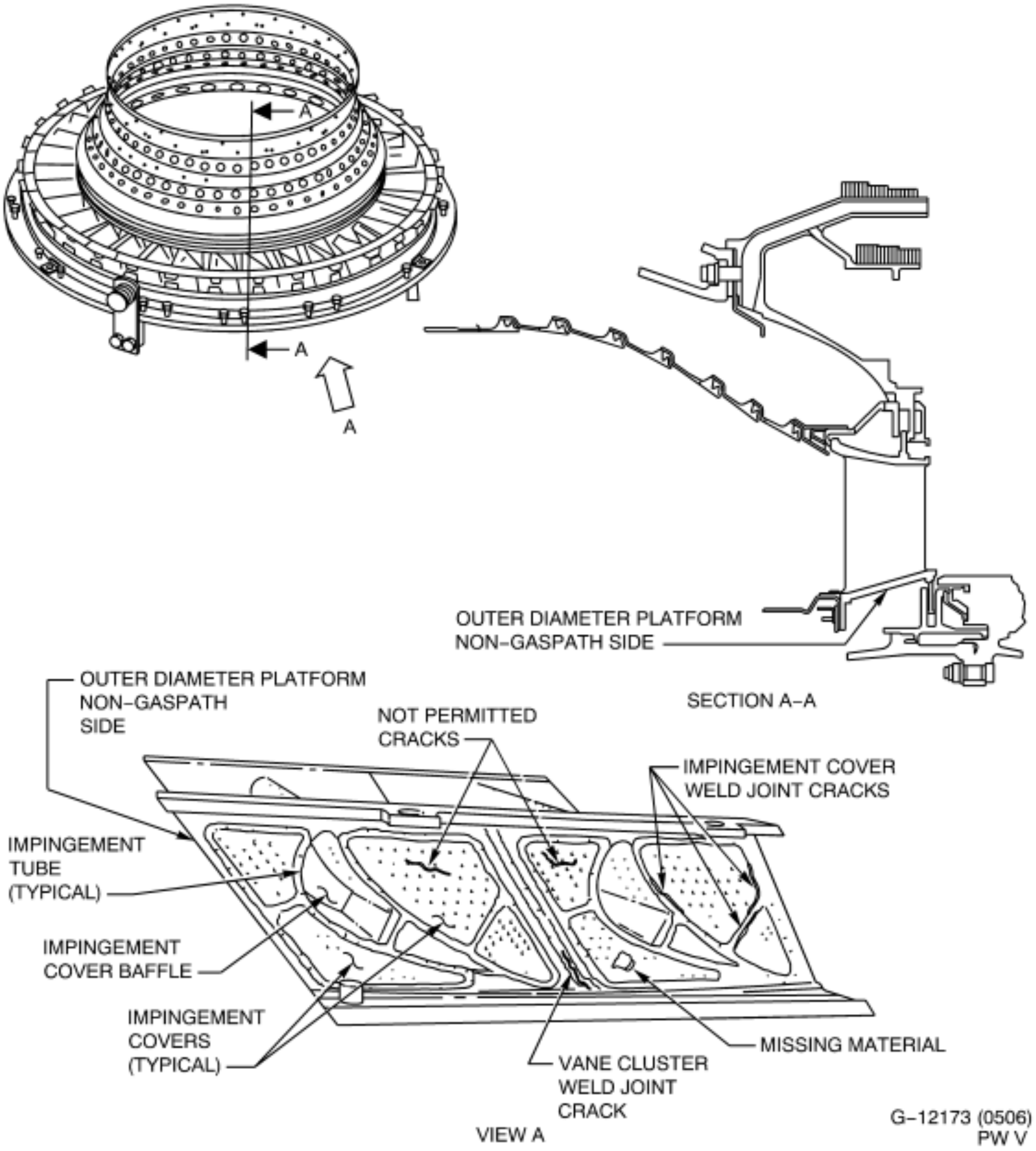
R See Table 802 For Index Definitions.

R Convex Airfoil Crack Inspection
R Figure 802 (Sheet 3)
R (Task 72−00−51−210−010)

R ENGINE GENERAL − TURBINE NOZZLE − INSPECTION/CHECK−10

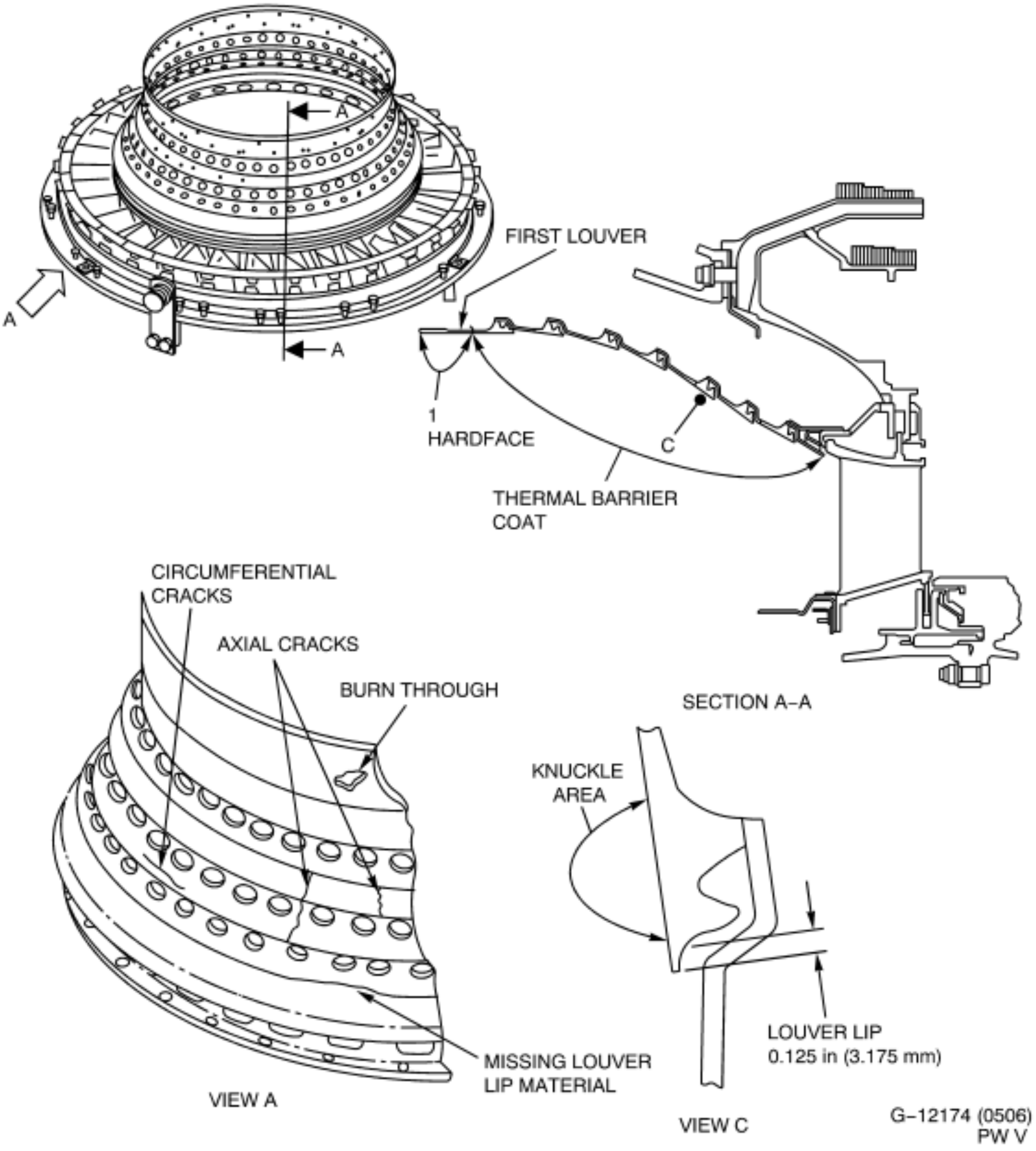

B
A
B
A
AXIAL FILLET RADIUS CRACK
NOTE: VANE ASSEMBLY SHOWN REMOVED FROM THE MODULE FOR CLARITY
0.250 in (6.350 mm) MAXIMUM CRACK THAT START IN THE FILLET RADIUS
CONCAVE SIDE
CONVEX SIDE
CONVEX SIDE
CONCAVE SIDE
CRACK FROM FILLET RADIUS TO PLATFORM EDGE
CIRCUMFERENTIAL LEADING EDGE FILLET RADIUS CRACK
SECTION A−A
INNER DIAMETER PLATFORM
(TYPICAL)
SECTION B−B
OUTER DIAMETER PLATFORM
(TYPICAL)
G−12172 (0506)
PW V

R Inner Diameter And Outer Diameter Platform Crack Inspection
R Figure 802 (Sheet 4)
R (Task 72−00−51−210−010)


A
A
A
OUTER DIAMETER PLATFORM NON−GASPATH SIDE
SECTION A−A
OUTER DIAMETER PLATFORM NON−GASPATH SIDE
NOT PERMITTED CRACKS
IMPINGEMENT COVER WELD JOINT CRACKS
IMPINGEMENT TUBE (TYPICAL)
IMPINGEMENT COVER BAFFLE
IMPINGEMENT COVERS (TYPICAL)
VANE CLUSTER WELD JOINT CRACK
MISSING MATERIAL
VIEW A
G−12173 (0506)
PW V

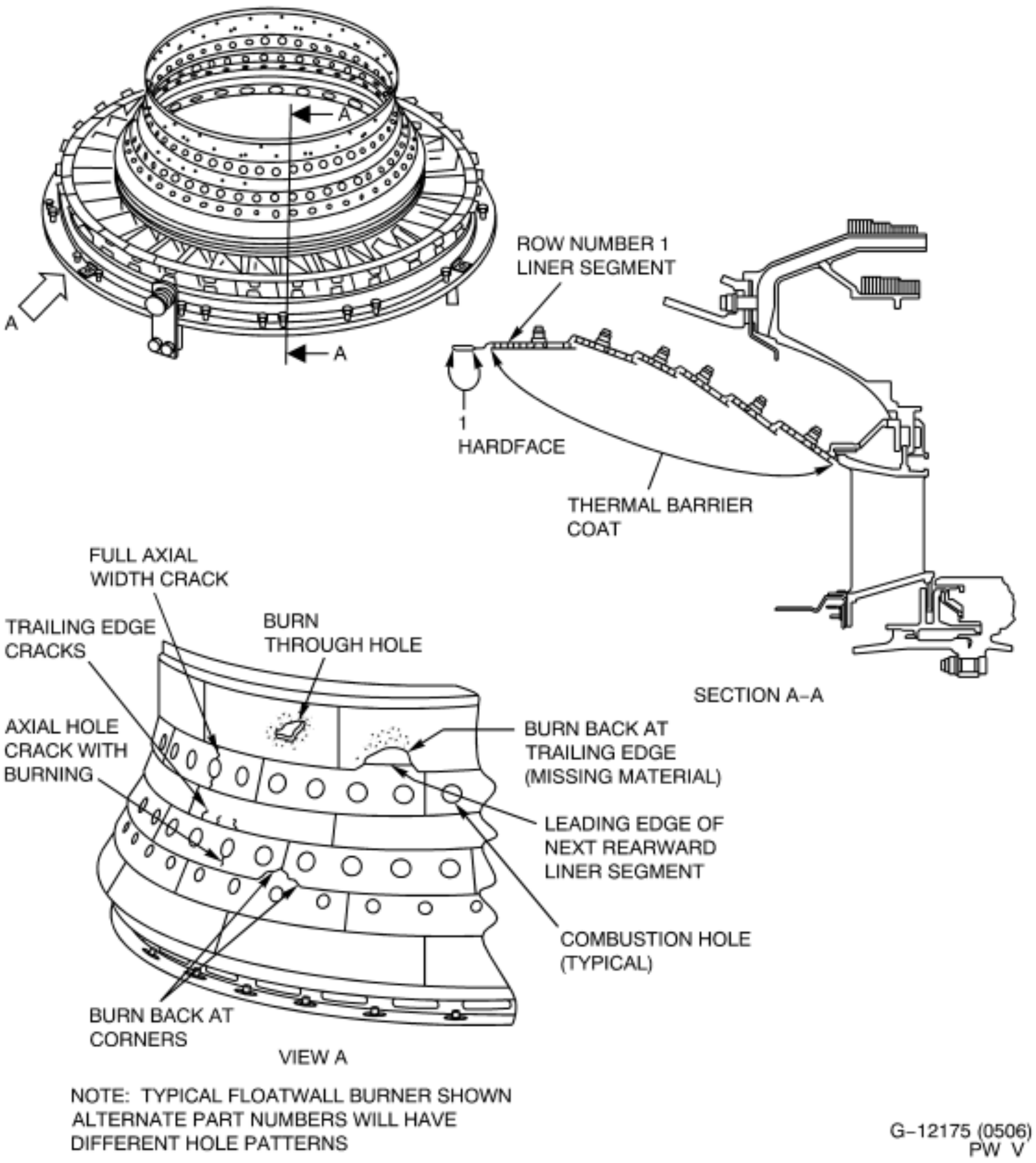
R See Table 803 For Index Definitions.

R Outer Diameter (Non−Gaspath Side) Crack Inspection
R Figure 803
R (Task 72−00−51−210−010)


A
A
A
FIRST LOUVER
1
HARDFACE
C
THERMAL BARRIER COAT
CIRCUMFERENTIAL CRACKS
AXIAL CRACKS
BURN THROUGH
SECTION A-A
KNUCKLE AREA
LOUVER LIP 0.125 in (3.175 mm)
MISSING LOUVER LIP MATERIAL
VIEW A
VIEW C
G-12174 (0506) PW V

R See Table 804 For Index Definitions.

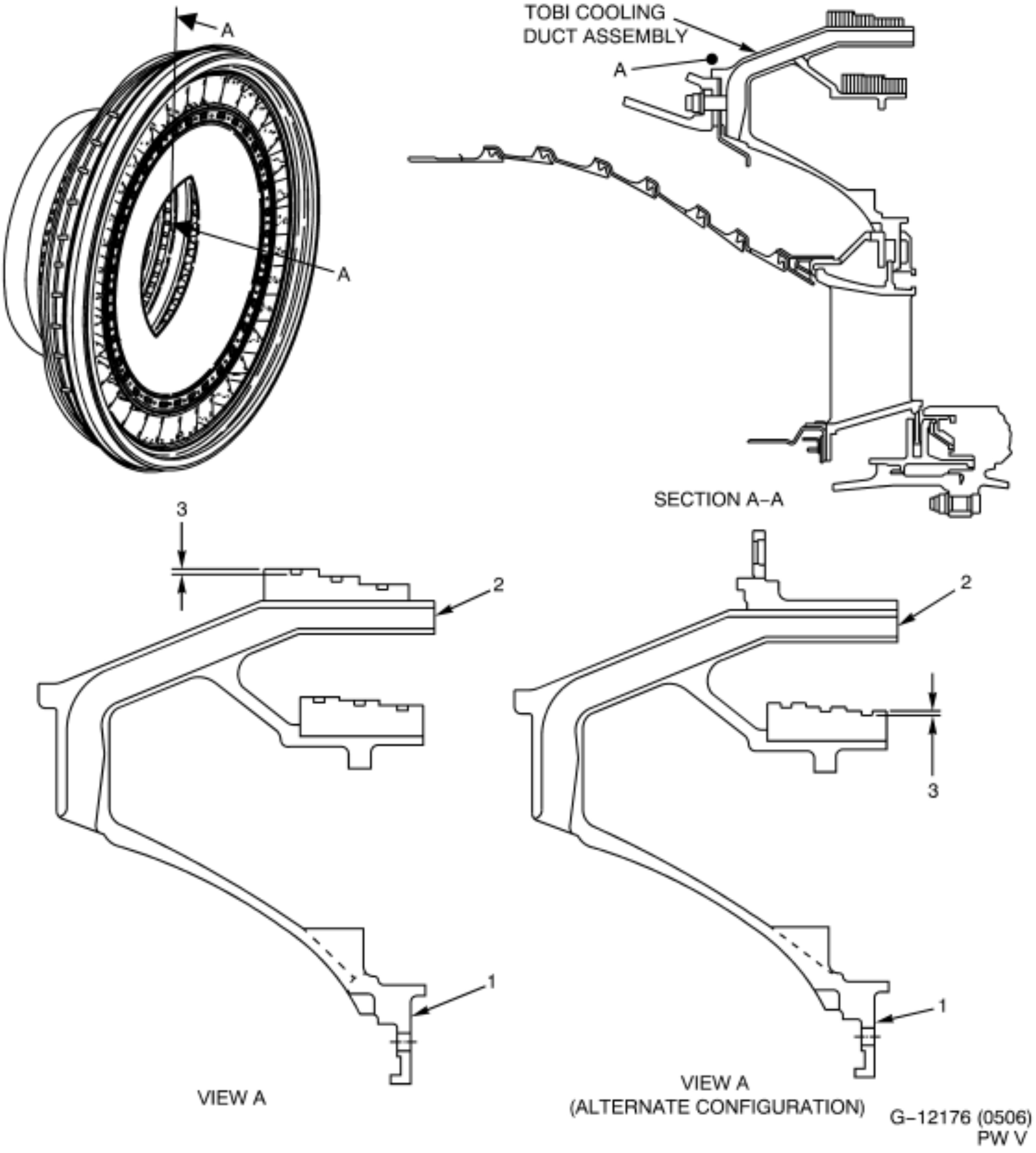
R Inner Combustion Chamber (Non-Talon) Inspection
R Figure 804
R (Task 72-00-51-210-010)


A
A
A
ROW NUMBER 1
LINER SEGMENT
1
HARDFACE
THERMAL BARRIER
COAT
SECTION A–A
FULL AXIAL
WIDTH CRACK
TRAILING EDGE
CRACKS
BURN
THROUGH HOLE
AXIAL HOLE
CRACK WITH
BURNING
BURN BACK AT
TRAILING EDGE
(MISSING MATERIAL)
LEADING EDGE OF
NEXT REARWARD
LINER SEGMENT
COMBUSTION HOLE
(TYPICAL)
BURN BACK AT
CORNERS
VIEW A
G–12175 (0506)
PW V

NOTE: TYPICAL FLOATWALL BURNER SHOWN
ALTERNATE PART NUMBERS WILL HAVE
DIFFERENT HOLE PATTERNS

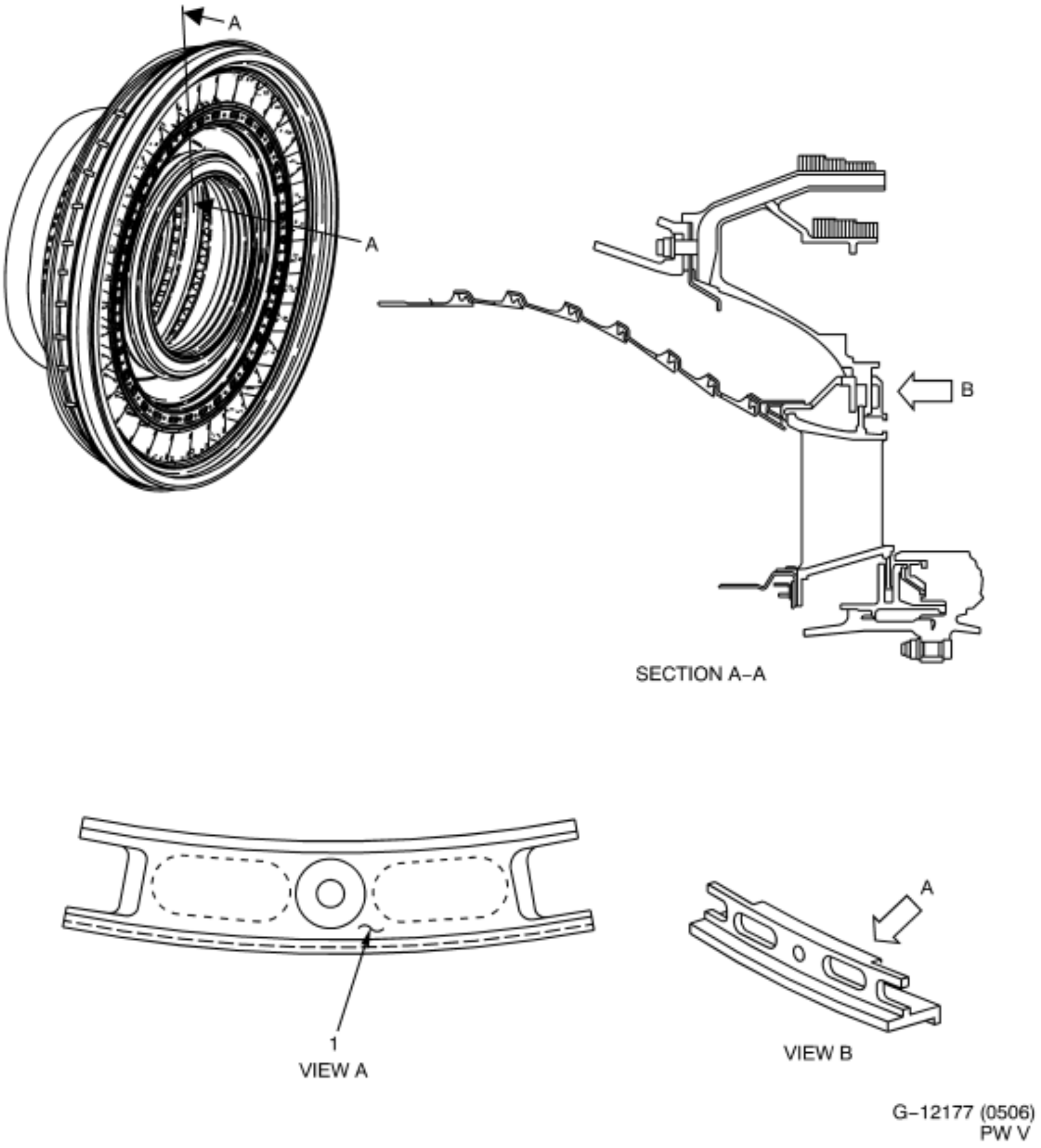
R See Table 805 For Index Definitions.

R Inner Combustion Chamber Inspection (With
R Talon (Floatwall) Low Emission Burner)
R Figure 805
R (Task 72–00–51–210–010)


A
A
TOBI COOLING
DUCT ASSEMBLY
A
SECTION A−A
3
2
VIEW A
1
2
3
VIEW A
(ALTERNATE CONFIGURATION)
1
G−12176 (0506)
PW V

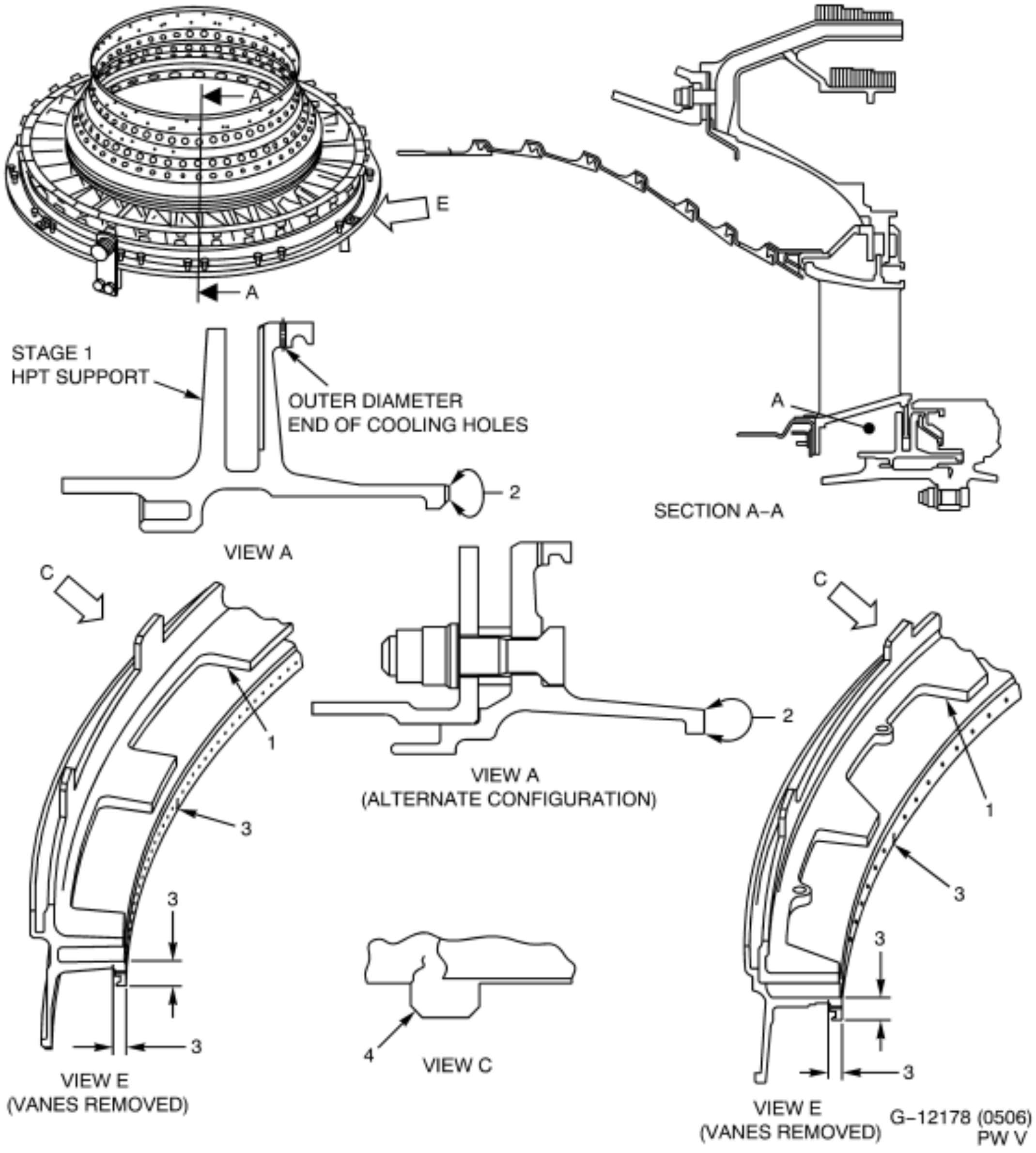
R See Table 806 For Index Definitions.

R Cooling Duct Assembly (TOBI) Inspection
R Figure 806
R (Task 72−00−51−210−010)


A
A
B
SECTION A-A
1
VIEW A
A
VIEW B
G-12177 (0506)
PW V

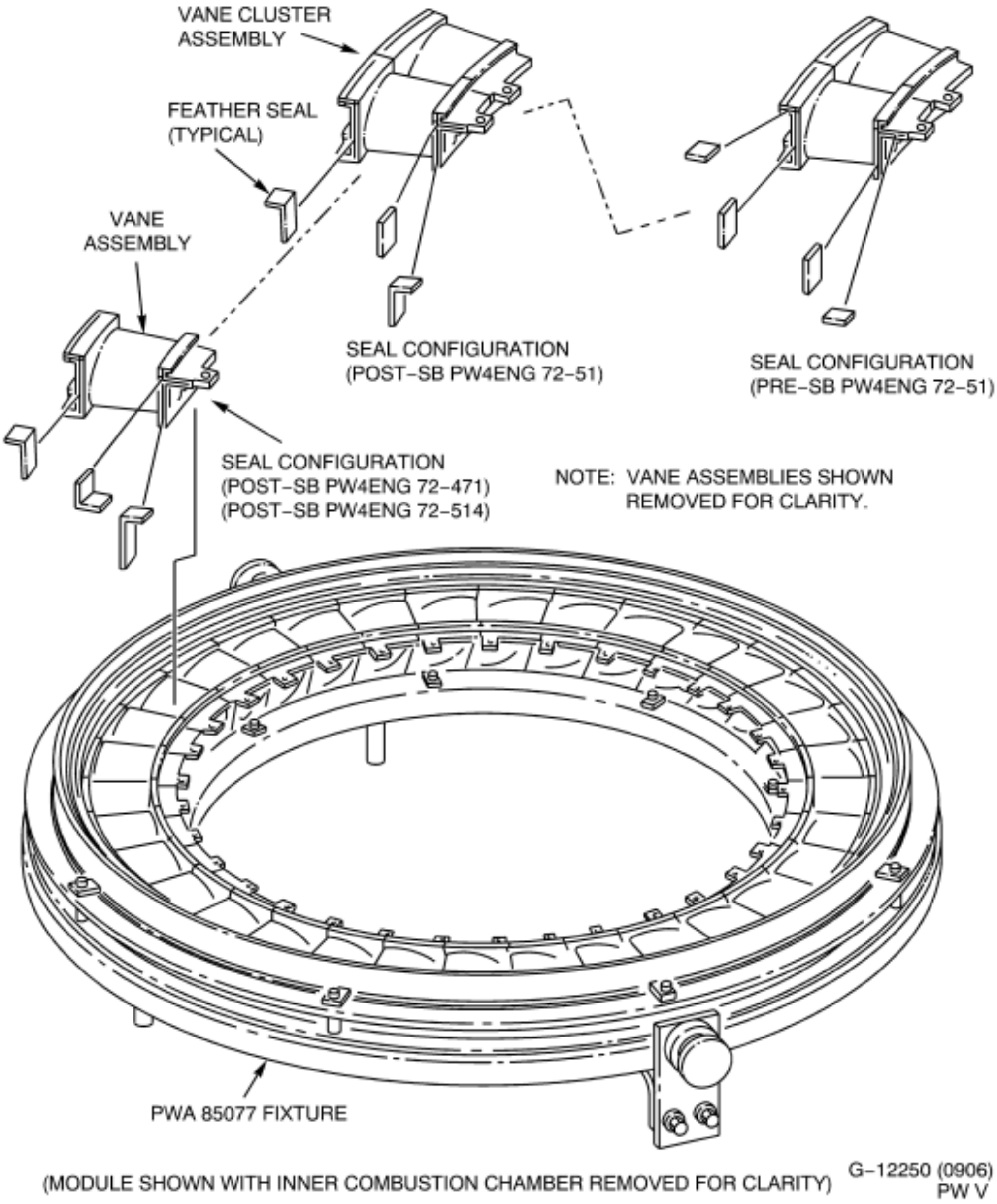
R See Table 807 For Index Definitions.

R Stage 1 Duct Segment Inspection
R Figure 807
R (Task 72-00-51-210-010)


A
E
A
STAGE 1
HPT SUPPORT
OUTER DIAMETER
END OF COOLING HOLES
2
A
SECTION A−A
VIEW A
C
1
3
3
3
2
VIEW A
(ALTERNATE CONFIGURATION)
C
1
3
3
3
4
VIEW C
VIEW E
(VANES REMOVED)
VIEW E
(VANES REMOVED)
G−12178 (0506)
PW V

R See Table 808 For Index Definitions.

R Stage 1 (Vane) HPT Support Assembly Inspection
R Figure 808
R (Task 72−00−51−210−010)


VANE CLUSTER ASSEMBLY
FEATHER SEAL (TYPICAL)
VANE ASSEMBLY
SEAL CONFIGURATION (POST−SB PW4ENG 72−51)
SEAL CONFIGURATION (PRE−SB PW4ENG 72−51)
SEAL CONFIGURATION (POST−SB PW4ENG 72−471) (POST−SB PW4ENG 72−514)
NOTE: VANE ASSEMBLIES SHOWN REMOVED FOR CLARITY.
PWA 85077 FIXTURE
(MODULE SHOWN WITH INNER COMBUSTION CHAMBER REMOVED FOR CLARITY)
G−12250 (0906)
PW V

R Stage 1 Vane Platform Feather Seal Inspection
R Figure 809
R (Task 72−00−51−210−010)

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72−00−52

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72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−02 • 72−00−52−020−001−002: Remove The High Pressure Turbine − Horizontal (Hydraulic Wrench) − Deleted
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−03 • 72−00−52−020−003: Remove The External Plumbing Prior To The High Pressure Turbine Removal
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−04 • 72−00−52−050−001: Remove Turbine Case Cooling (TCC) Air Valve (HPT)
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−05 • 72−00−52−050−002: Remove (HPT) Turbine Case Cooling Manifold (Collector)
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−06 • 72−00−52−050−003: Remove Turbine Case Cooling Manifolds (HPT)
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−07 • 72−00−52−050−004: Remove Turbine Cooling Tubes • 72−00−52−050−005: Remove Turbine Cooling Tubes
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−08 • 72−00−52−020−002: Remove The High Pressure Turbine − Vertical
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−09 • 72−00−52−020−002−002: Remove The High Pressure Turbine − Vertical (Hydraulic Wrench) − Deleted
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−20 • 72−00−52−020−020: Remove The Flange M Brackets And Hardware

72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−01 • 72−00−52−420−001: Install The High Pressure Turbine − Horizontal
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−02 • 72−00−52−420−001−002: Install The High Pressure Turbine − Horizontal (Hydraulic Wrench) − Deleted
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−03 • 72−00−52−420−003: Install The External Plumbing After The High Pressure Turbine Installation
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−04 • 72−00−52−450−001: Install Turbine Case Cooling (TCC) Air Valve (HPT)
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−05 • 72−00−52−450−002: Install Turbine Case Cooling Manifold (Collector)
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−06 • 72−00−52−450−003: Install Turbine Case Cooling Manifolds (HPT)
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−07 • 72−00−52−450−004: Install Turbine Cooling Tubes • 72−00−52−450−005: Install Turbine Cooling Tubes
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−08 • 72−00−52−420−002: Install The High Pressure Turbine − Vertical
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−09 • 72−00−52−420−002−002: Install The High Pressure Turbine − Vertical (Hydraulic Wrench) − Deleted
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−20 • 72−00−52−420−020: Install The Flange M Brackets And Hardware
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−01 • 72−00−52−990−001: Specific Fits And Clearances • 72−00−52−990−002: Specific Fits And Clearances
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−02 • 72−00−52−200−002: Visually Inspect High Pressure Turbine
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−03

	- 72−00−52−200−003: Examine The Stage 1 And Stage 2 HPT Blade Assemblies For Internal Sulfidation Distress
72−00−52	ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−10 - 72−00−52−210−010: Visually Examine The High Pressure Turbine (HPT) Module Assembly − Engine General − High Pressure Turbine (HPT)

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ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - REMOVAL-01

Task 72-00-52-020-001:

1. Remove The High Pressure Turbine - Horizontal

NOTE: See Figure 301 for Part/Assembly Removal Procedure.

A. Prerequisites

(1) Remove The Low Pressure Turbine. Refer to 72-00-53, Removal-01 (Task 72-00-53-020-001).

(2) Remove The External Plumbing Prior To High Pressure Turbine Removal. Refer to 72-00-52, Removal-03 (Task 72-00-52-020-003).

B. Equipment And Materials Necessary

Special Tools:

PWA 3755	Pump, Hydraulic (Optional To PWA 29389)
PWA 25000	Wrench, Hydraulic
PWA 28657	Sling, Strongback
PWA 28668	Pump, Hydraulic (Electric) (Use With Hydraulic Wrench)
PWA 28669	Cart, Storage (Optional) (Use With Hydraulic Wrench)
PWA 29389	Pump, Hydraulic
PWA 29510	Pump, Hydraulic (Hand) (Use With Hydraulic Wrench)
PWA 29614	Wrench, Mechanical*
PWA 45419	Air Torque Multiplier* (Use With Mechanical Wrench)
PWA 76156	Adapter (2 Required)
PWA 80651	Multiplier, Pneumatic* (Use With Mechanical Wrench)
PWA 85107	Fixture, Handling
PWA 85110	Puller, Knocker
PWA 85112	Fixture, Retaining (Optional)
PWA 85114	Wrench, Torque (Use With Hydraulic Wrench)
PWA 85115	Adapter, Wrench (Use With Hydraulic Wrench)
PWA 85116	Wrench, Torque* (Use With Mechanical Wrench)
PWA 85117	Adapter, Wrench* (Use With Mechanical Wrench)
PWA 85984	Adapter, Stabilizing (Optional for operators that hang the engine from an overhead rail support. See the NOTE).
PWA 86058	Retainer, Storage (Optional)
PWA 86537	Cover, Protective (Optional)
PWA 87022	Stand, Storage
PWA 102746	Puller (If Necessary)

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−01

Special Tools:

(CONTINUED)

*See Table 301 for the mechanical wrench tool options as applicable. The table shows the correct combinations of tools to remove the No. 3 bearing retaining nut.

NOTE: For operators that use an overhead rail support to hang the engine, use PWA 85107 Fixture that incorporates Change F, PWA 85984 Adapters and two stabilizing cables. (Reference Tool Bulletin 89−303). Adjust the turnbuckle cables as required to stabilize the turbine.

C. Procedure

CAUTION: FOR ENGINES THAT HAVE SIGNS OF HPT BLADE DAMAGE AND/OR FRACTURE, IT IS NECESSARY THAT YOU DO THE FOLLOWING INSPECTIONS WHEN YOU DO THE DETAIL PART INSPECTIONS:

CAUTION: YOU MUST EXAMINE THE NO. 3 BEARING HOUSING FOR SIGNS OF WEAR OR WEAR STEP ON THE HOUSING JOURNAL OR SHOULDER. NO WEAR OR WEAR STEP IS PERMITTED. SEE PW4000 SERIES CIR, PN 51A357, 72−41−10, INSPECTION/CHECK−03 AND −04 FOR THE SPECIFIC INSPECTION LIMITS.

CAUTION: YOU MUST EXAMINE THE NO. 3 BEARING REAR CARBON SEAL RING HOLDER FOR WEAR OR DAMAGE TO THE CARBON SEAL RING PINS. SEE PW4000 SERIES CIR, PN 51A357, 72−41−86, INSPECTION/CHECK−03 FOR THE SPECIFIC INSPECTION LIMITS.

CAUTION: YOU MUST EXAMINE THE NO. 1.5 AND 2 BEARING SEAL SUPPORT ASSEMBLY FOR BRAZE CRACKS AND/OR PIN FRACTURE. NO CRACK INDICATIONS OF ANY LENGTH OR DEPTH ARE PERMITTED. SEE PW4000 SERIES CIR, PN 51A357, 72−34−36, INSPECTION/CHECK−02 FOR THE SPECIFIC INSPECTION LIMITS.

(1) Remove retaining ring lock (302/3) securing No. 3 bearing nut lock (302/2) to (No.3) bearing retaining nut. See Figure 302.

(2) Remove No. 3 bearing nut lock (302/2) using PWA 85110 Knocker Puller.

(a) Position lugs on plate detail of puller between tabs of nut lock and insert plate into ID of nut lock. Rotate plate clockwise to engage hooked lugs with tabs of nut lock.

(b) Using slide hammer action, remove nut lock from engine.

(3) Remove remaining retaining ring lock (302/3) from No. 3 bearing retaining nut.

(4) For operators that use the mechanical wrench, remove the No. 3 bearing retaining nut as follows:

(a) Install PWA 85116 Wrench into ID of No. 3 bearing retaining nut (303/7) engaging splines of wrench with splines of nut. See Figure 303.

(b) Install PWA 85117 Adapter to turbine intermediate hub (303/6). See Figure 303.

1 Loosen hex nuts (303/5) securing eight clamps (303/4). Slide clamps in slots in opposite direction of arrows on base of fixture and secure clamps with hex nuts.

2 Connect hoist to lifting eye on adapter.

3 Using hoist, position adapter to rear of PWA 85116 Wrench.

4 Insert clamps (303/4) through slots (303/1) between lugs in turbine intermediate hub (303/6).

5 Align teeth of adapter with slots between lugs of hub. Loosen hex nuts and slide clamps in direction of arrows on base of fixture. Rotate clamps as required to position feet under lugs on hub and insert pins (303/3) into holes in base of adapter. Tighten hex nuts to secure clamps.

NOTE: Plate detail of clamp points in direction that clamp feet are facing.

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−01

(c) Using hoist, align splines and slide applicable mechanical wrench over splines of PWA 85116 Wrench. Align anti−torque pins in wrench with bushings (304/1) in PWA 85117 Adapter and seat wrench on adapter. See Table 301 for mechanical wrench options. See Figure 304.

NOTE: Wrenches may be actuated using air torque multipliers to speed up removal of nut. See Table 301.

PWA Mechanical Wrench	PWA Torque Multiplier
PWA 29614	PWA 45419 or PWA 80651

Mechanical Wrench Options
Table 301

(d) Actuate wrench to loosen nut.

(e) Remove wrenches and adapter. Remove nut from HPC (rear hub).

NOTE: No. 3 bearing retaining nut silver plating shall have been replaced prior to each installation. Nut may be removed and retorqued for each installation maximum of three times prior to engine run before requiring silver plating replacement.

(5) For operators that use the a hydraulic wrench, remove the No. 3 bearing retaining nut as follows: See Figure 305.

(a) Install PWA 85114 Wrench into ID of No. 3 bearing retaining nut (305/5) engaging splines of wrench with splines of nut.

(b) Install PWA 85115 Adapter to turbine intermediate hub (305/6).

1 Loosen wing nuts securing eight clamps (305/3). Slide clamps in slots in opposite direction of arrows on base of fixture and secure clamps with wing nuts.

2 Install eyebolt into threaded hole at top of adapter and connect hoist to eyebolt.

3 Using hoist, position adapter over PWA 85114 Wrench and onto rear of HPT.

4 Insert clamp feet through slots (305/1) between lugs of turbine intermediate hub.

5 Align 16 teeth of adapter with slots between lugs of turbine intermediate hub. Loosen wing nuts and slide clamps in direction of arrows on base of fixture. Rotate clamps as required to position feet under lugs on hub and secure with wing nuts.

NOTE: Dowel pin (305/4) in stud detail of clamp points in direction that clamp feet are facing.

(c) Use a hoist and applicable sling to lift the PWA 25000 Hydraulic Wrench. Find the correct direction to turn the drive spline of the wrench. Refer to the PWA 29178 Instruction Decal on the hydraulic wrench to get the position of the shifting mechanism to cause the drive spline to turn in the loosen direction. See Figure 306.

NOTE: PWA 28669 Cart can be used to store and transport PWA 25000 Wrench.

(d) Connect PWA 28668 Pump or PWA 29510 Pump to the hydraulic wrench. Operate the wrench to make sure that the wrench turns in the loosen direction.

(e) Align splines and position PWA 25000 Wrench onto PWA 85114 Wrench. Move wrench forward and engage keys of PWA 85115 Adapter with keyways in PWA 25000 Wrench. See Figure 306.

CAUTION: DO NOT USE A TORQUE OF MORE THAN 1,000,000 LB−IN. (112,985 N.m) OR STRUCTURAL DAMAGE TO THE TURBINE SHAFT CAN OCCUR.

(f) Use the selector to operate the wrench and loosen the nut. Monitor the pressure gages to make sure that the torque does not exceed 1,000,000 lb−in. (112,985 N.m). As the drive spline turns, look at the travel indicator. When the travel indicator reaches its maximum travel, use the selector control valve to let the wrench ratchet return. Repeat this procedure until the nut is loose.

(g) Connect PWA 28668 Pump or PWA 29510 Pump to wrench.

(h) Actuate wrench to loosen nut.

(i) Remove wrenches and adapter. Remove nut from HPC rear hub.

NOTE: No. 3 bearing retaining nut silver plating shall have been replaced prior to each installation. Nut may be removed and retorqued for each installation maximum of three times prior to engine run before requiring silver plating replacement.

CAUTION: ENGINES INCORPORATING NO. 3 BEARING RETAINING NUT PN 50A132 INCORPORATE SHORTER TURBINE SHAFT SPACER WHICH MAY FALL INTO GROOVE IN HPC REAR HUB JUST FORWARD OF THREADS AT REAR OF HUB. INSTALL WORK PACKING INTO GROOVE IN HPC REAR HUB JUST FORWARD OF THREADS OR DAMAGE TO HPC REAR HUB MAY OCCUR.

(6) Determine part number of No. 3 bearing retaining nut. For engines incorporating nut PN 50A132, install work packing PN AS3209−159 into groove in HPC rear hub just forward of threads at rear of hub.

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(7) Install PWA 85107 Fixture onto high pressure turbine. See Figure 307.

(a) If installed, remove rod and attached details, guide pilot, clamp and nuts from coupler. Remove nut and hydraulic cylinder. Remove plug.

(b) Remove 12 screws (307/9) securing plate (307/10) to fixture. Remove retainer (307/11) and jaws (307/4).

(c) For engines (Pre SB PW4ENG 72−176), remove the PWA 86379 Adapter Ring, if installed, from the pilot ring detail of PWA 85107 Fixture.

CAUTION: THE SCREWS THAT HOLD THE PWA 86379 ADAPTER RING MUST BE FLUSH WITH THE ADJACENT SURFACE OR DAMAGE TO THE PARTS CAN OCCUR.

(d) For engines (Post SB PW4ENG 72-176), install the PWA 86379 Adapter Ring, if not installed, on the pilot ring detail of PWA 85107 Fixture. Use six detail cap screws to hold the adapter ring.

NOTE: The turbine intermediate hub, (Post SB PW4ENG 72-176) has a shorter inner hub. The adapter is required with the fixture to set the axial run position on the HPT rotor.

(e) Loosen eight hand knobs (307/14) at center hub (307/2) of fixture and move piloting ring (307/3) rearward until it is flush with or above surface of center hub. Tighten eight hand knobs.

(f) Attach suitable sling to two hoist rings and position fixture onto rear of high pressure turbine.

(g) Secure outer flanges of fixture to high pressure turbine case (307/1) using 26 detail screws (307/12) and spacers (307/13). Remove hoist and sling.

(h) Loosen eight hand knobs (307/14) at center hub and push pilot ring (307/3) forward until it seats against turbine rear hub. Tighten eight hand knobs.

(i) Position four jaws (307/4) into center of fixture, locating lip of jaws in ID cutout of turbine hub. Lightly tighten screws (307/5) to secure jaws.

(j) Thread extension rod (307/7) into plug (307/6). Insert assembly into center of fixture and seat plug against rear of high pressure compressor shaft.

(k) Install retainer (307/11) into center of fixture to retain four jaws (307/4). Tighten four screws (307/5) to secure jaws.

(l) Install plate (307/10) to pilot ring (307/3) and secure with 12 screws (307/9).

(m) Thread hydraulic cylinder (307/8) into plate (307/10).

(8) Using hoist, attach PWA 28657 Sling with two PWA 76156 Adapters to trunnion spools of fixture. Take up slack on sling cables.

(9) Remove Flange M lockwire, bolts, nuts and brackets securing turbine case front flange to diffuser case. Refer to 72−00−52, Removal−20 (Task 72−00−52−020−020).

(10) Attach PWA 29389 Hydraulic Pump or PWA 3755 Hydraulic Pump to ram and apply hydraulic pressure to separate turbine front hub from HPC (rear hub) (approximately 0.750 inch (19.050 mm), while separating turbine case flange from diffuser case.

(a) If necessary, use PWA 102746 Puller to help when you remove the HPT from the HPC.

(11) Remove pump and hydraulic cylinder.

(12) Move turbine rearward and separate it from engine.

(13) Remove turbine shaft spacer from HPC rear hub. If installed, remove work packing from groove in HPC rear hub just forward of threads at rear of hub.

(14) Optional, insert PWA 85112 Retaining Fixture into ID of turbine hubs and align outer surfaces of fixture with turbine hub lock. Rotate knurled knob to secure fixture against lock.

(15) Remove gasket (308/1) from front outer flange of turbine case. See Figure 308.

(16) Place the turbine front end down into the PWA 87022 Storage Stand. See Figure 309.

(17) Optional, position the PWA 86537 Cover between the HPT blades and the PWA 85107 Fixture so that each of the four detail pieces overlaps the adjacent piece.

(18) Adjust the center plug of the storage stand to maintain the running clearance of the turbine rotors. Secure the assembly in the stand.

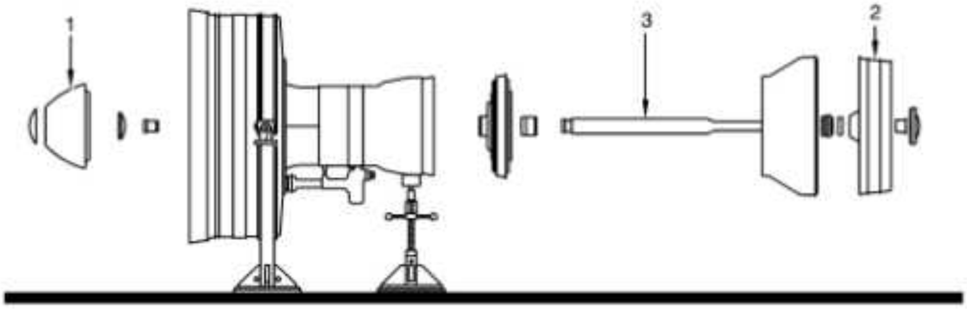
(19) Remove the fixture from the turbine case.

- (a) Remove 12 screws (309/1) securing plate (309/2) to piloting ring (309/10). Remove plate. Store screw details in plate.
- (b) Remove retainer (309/3), extension rod (309/4) and plug (309/5).
- (c) Loosen screws (309/7) securing jaws (309/6) to hub. Remove jaws.
- (d) Remove screws (309/9) and spacers (309/8) securing fixture to case.
- (e) Using hoist and PWA 28657 Sling, remove fixture from case.

(20) If the turbine assembly will be moved while in PWA 87022 Stand, install PWA 86058 Retainer to prevent damage to the knife−edge seals. See Figure 310.

- (a) Put the retainer onto the rear flange of the turbine intermediate hub.
- (b) Align the boltholes and secure the outer flange of the retainer with 14 detail screws and nuts.

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−01

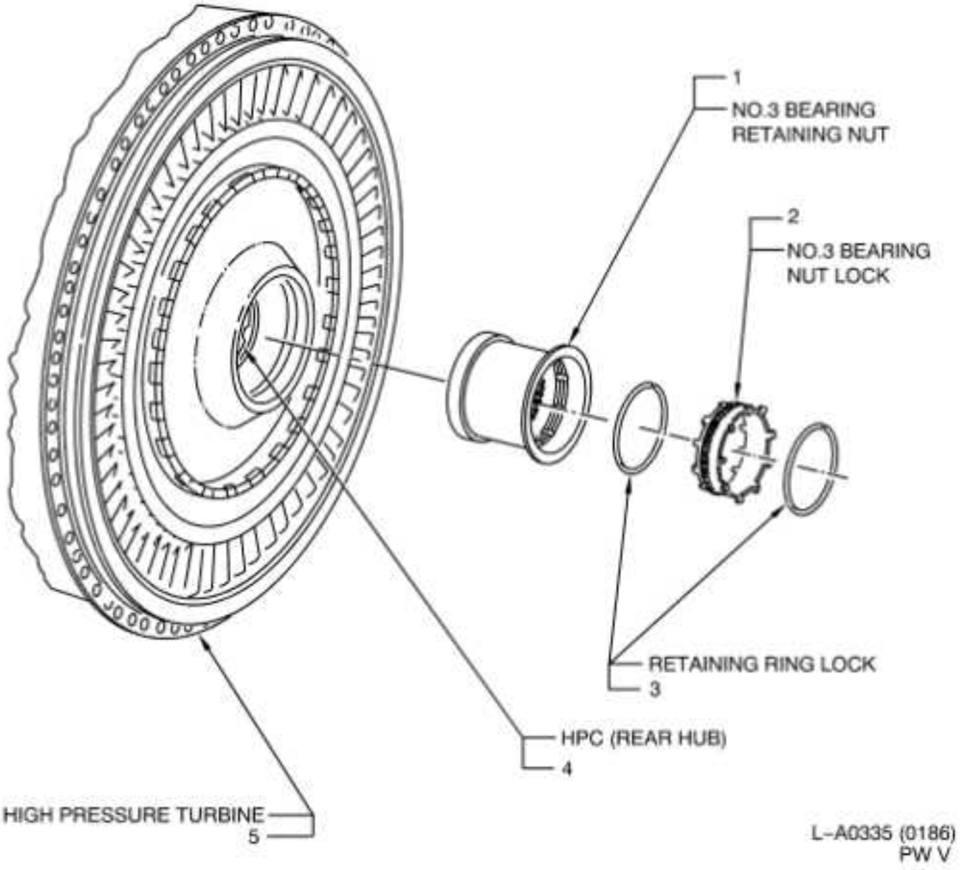


1. REMOVE COMPRESSOR INLET CONE
2. REMOVE TURBINE EXHAUST CASE
3. REMOVE LOW PRESSURE TURBINE

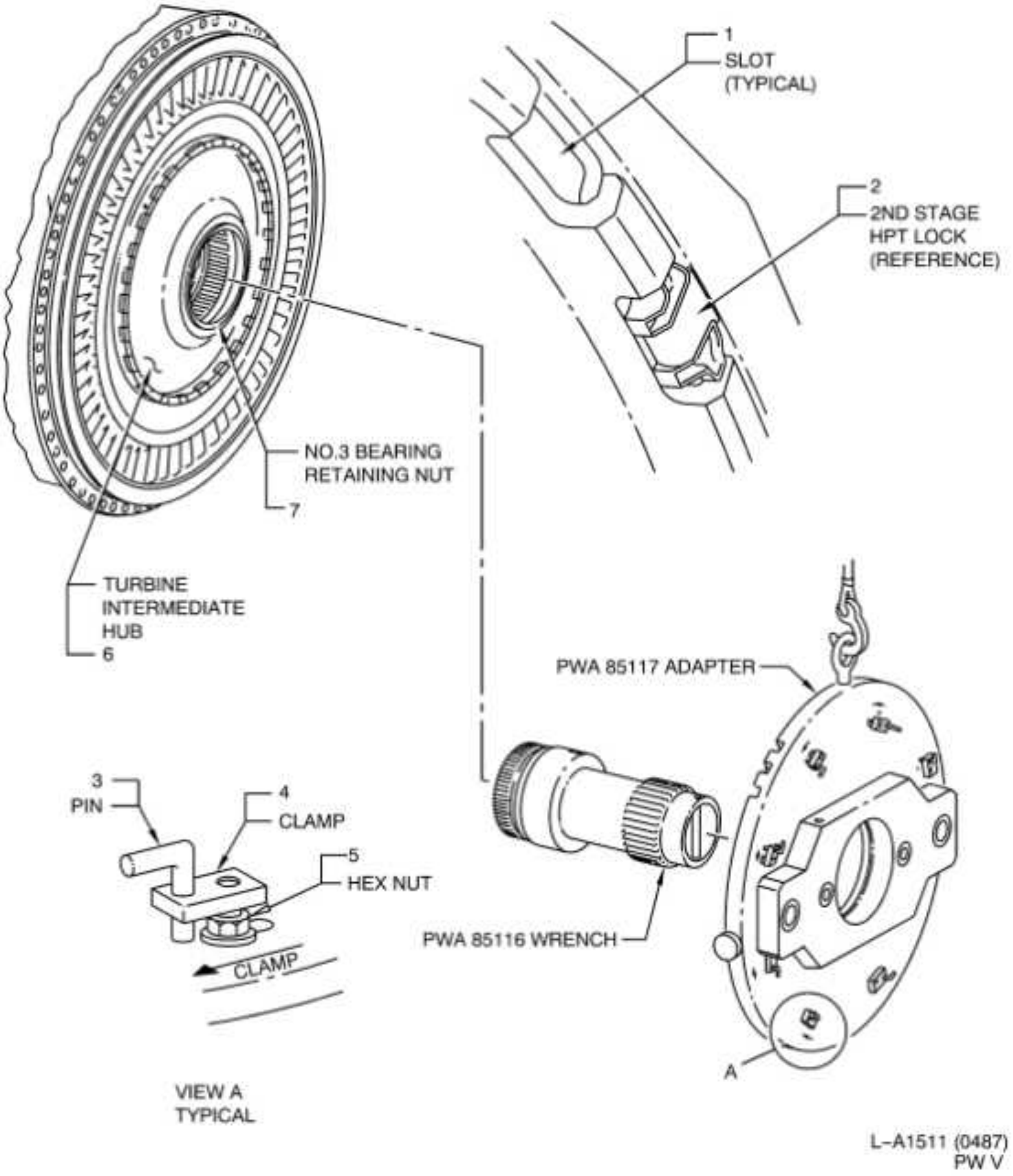
L−A0334 (0000)
PW V

Procedure Sequence
Figure 301
(Task 72−00−52−020−001)

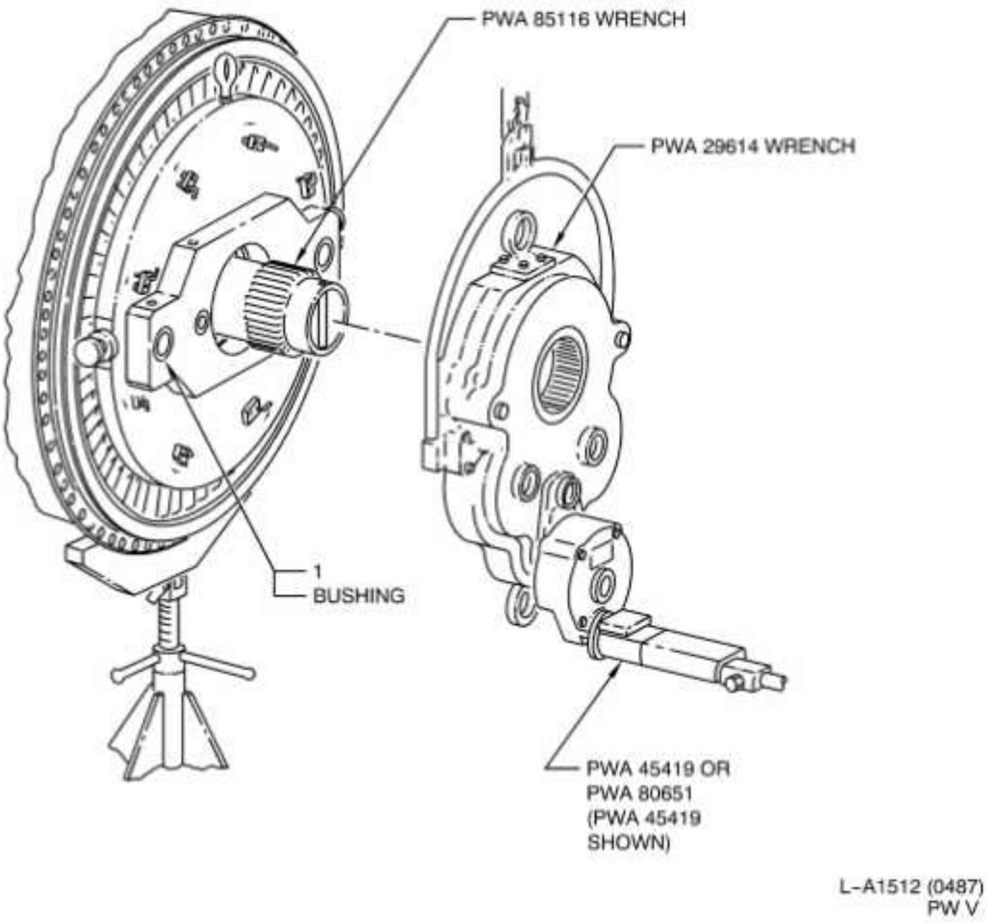
ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−01


1
NO.3 BEARING RETAINING NUT
2
NO.3 BEARING NUT LOCK
RETAINING RING LOCK
3
HPC (REAR HUB)
4
HIGH PRESSURE TURBINE
5
L−A0335 (0186)
PW V

No. 3 Bearing Retaining Nut Removal
Figure 302
(Task 72−00−52−020−001)

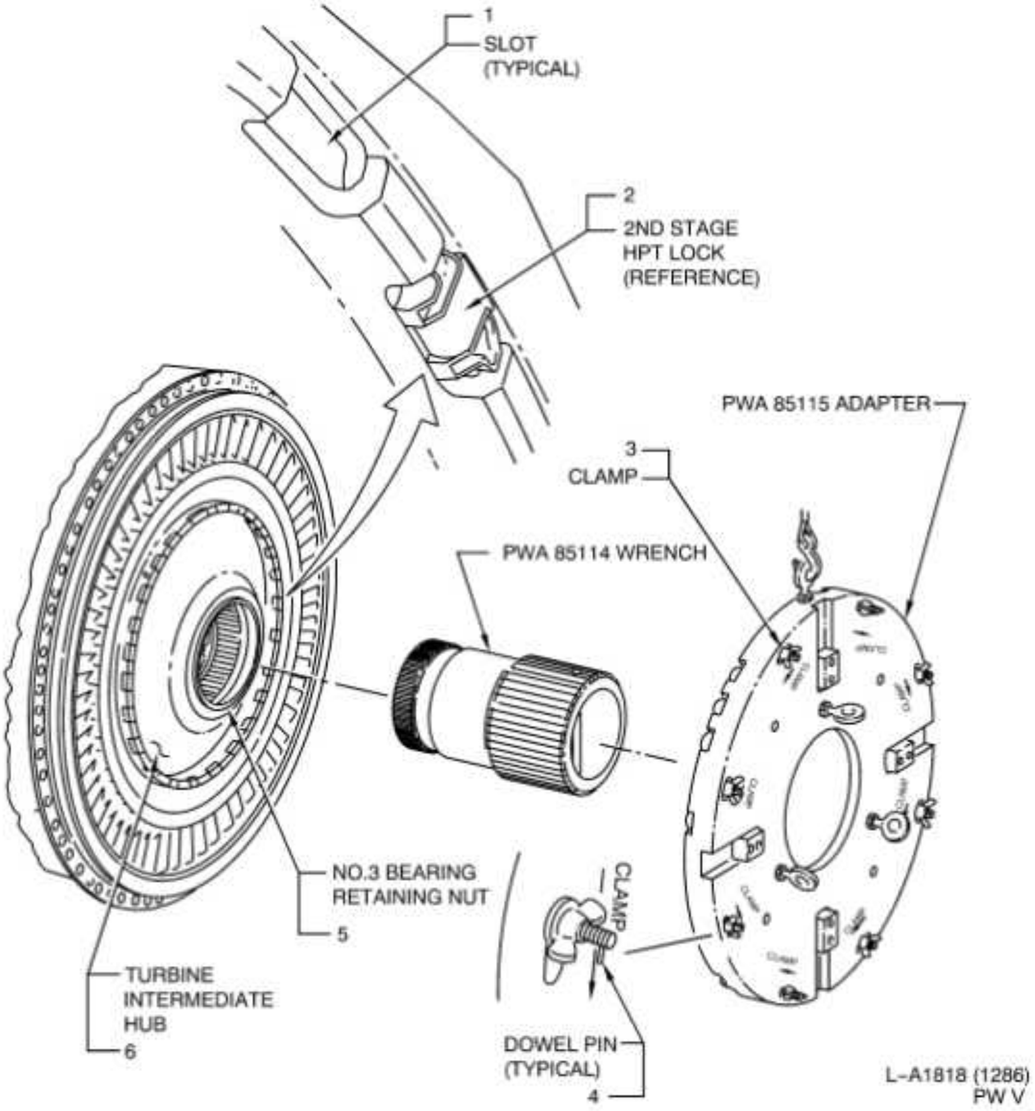

1
SLOT
(TYPICAL)
2
2ND STAGE
HPT LOCK
(REFERENCE)
NO.3 BEARING
RETAINING NUT
7
TURBINE
INTERMEDIATE
HUB
6
PWA 85117 ADAPTER
3
PIN
4
CLAMP
5
HEX NUT
CLAMP
PWA 85116 WRENCH
A
VIEW A
TYPICAL
L−A1511 (0487)
PW V

No. 3 Bearing Retaining Nut Removal
Figure 303
(Task 72−00−52−020−001)

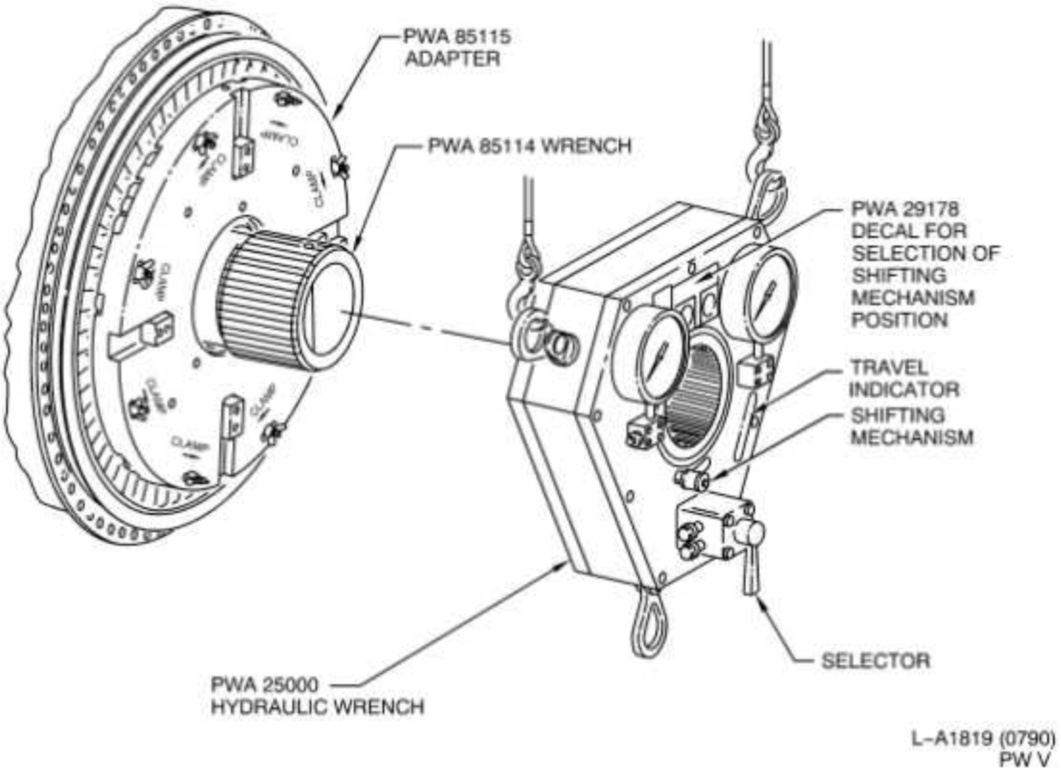

PWA 85116 WRENCH
PWA 29614 WRENCH
1
BUSHING
PWA 45419 OR
PWA 80651
(PWA 45419
SHOWN)
L−A1512 (0487)
PW V

No. 3 Bearing Retaining Nut Removal (Mechanical Wrench)
Figure 304
(Task 72−00−52−020−001)

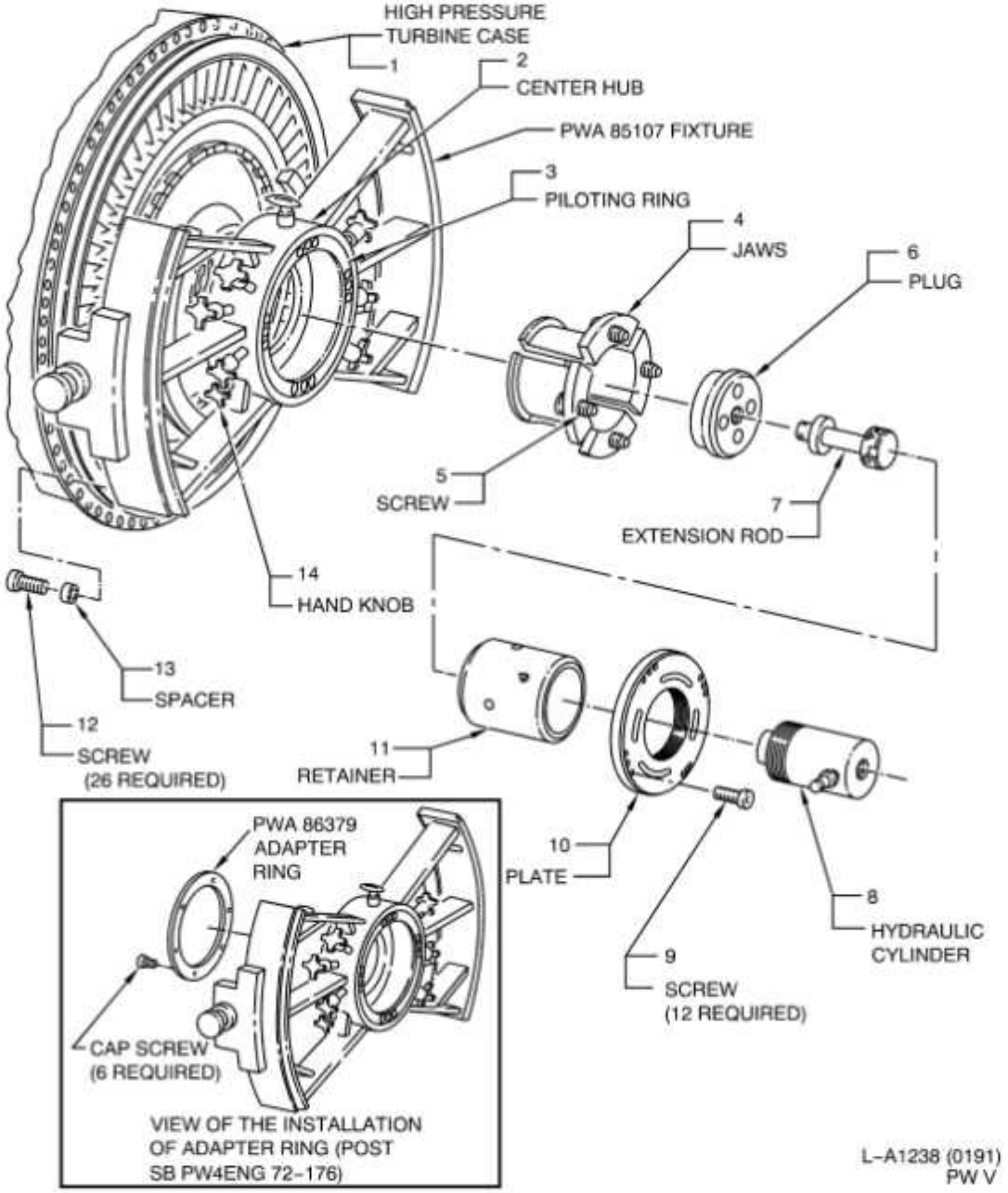
ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−01


1
SLOT
(TYPICAL)
2
2ND STAGE
HPT LOCK
(REFERENCE)
PWA 85115 ADAPTER
3
CLAMP
PWA 85114 WRENCH
NO.3 BEARING
RETAINING NUT
5
CLAMP
TURBINE
INTERMEDIATE
HUB
6
DOWEL PIN
(TYPICAL)
4
L-A1818 (1286)
PW V

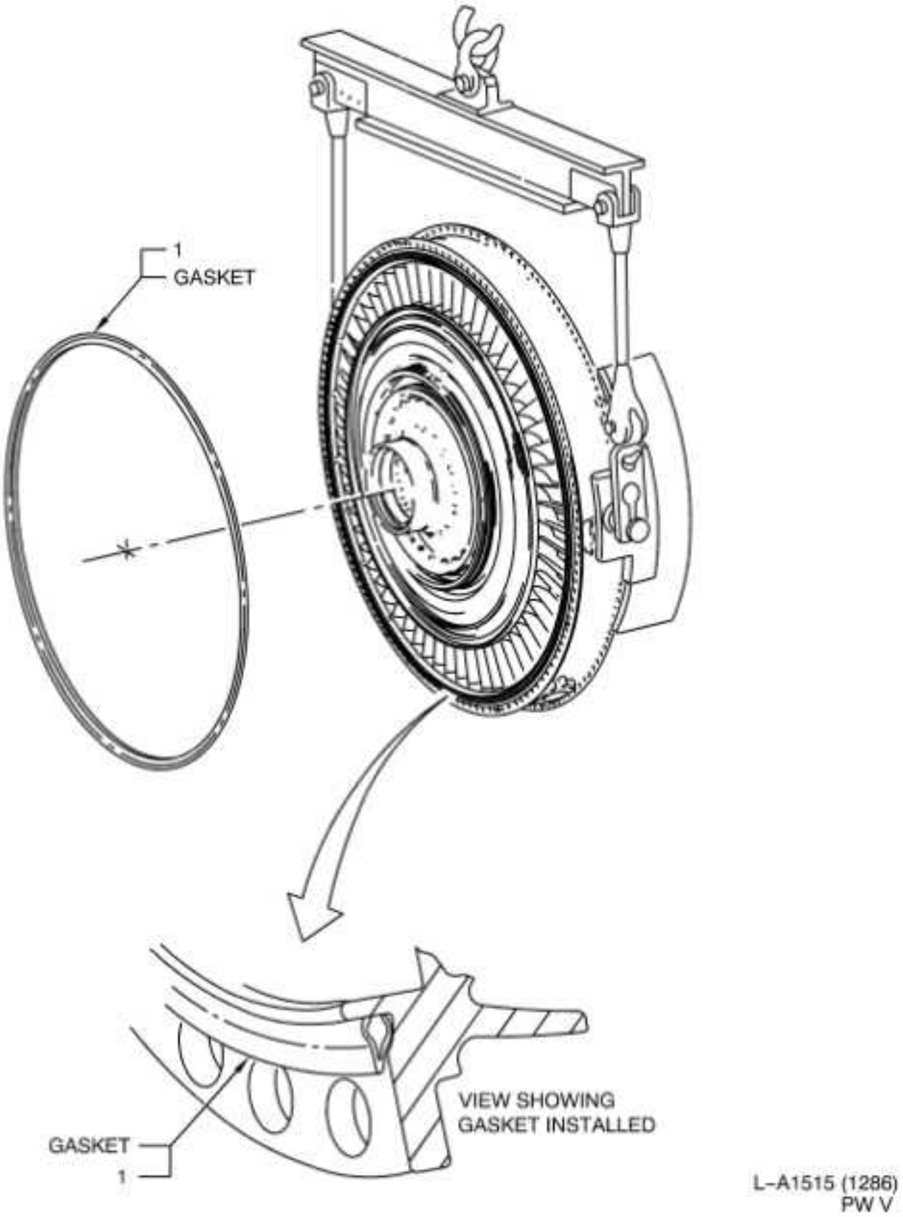
No. 3 Bearing Retaining Nut Removal (Hydralulic Wrench)
Figure 305
(Task 72−00−52−020−001)


PWA 85115 ADAPTER
PWA 85114 WRENCH
PWA 29178 DECAL FOR SELECTION OF SHIFTING MECHANISM POSITION
TRAVEL INDICATOR
SHIFTING MECHANISM
SELECTOR
PWA 25000 HYDRAULIC WRENCH
CLAMP
L−A1819 (0790)
PW V

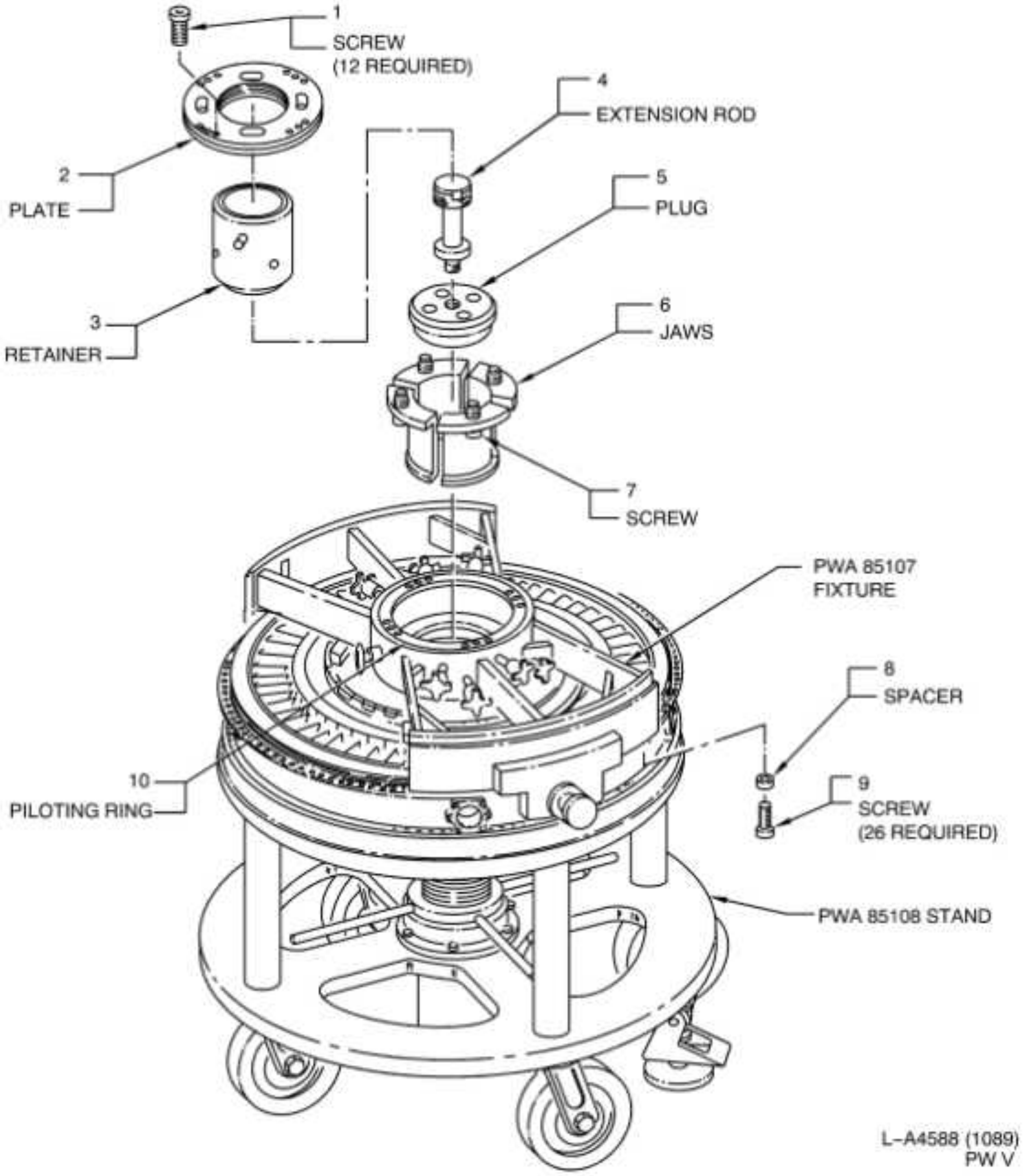
No. 3 Bearing Retaining Nut Removal (Hydralulic Wrench)
Figure 306
(Task 72−00−52−020−001)


HIGH PRESSURE TURBINE CASE
1
2
CENTER HUB
PWA 85107 FIXTURE
3
PILOTING RING
4
JAWS
6
PLUG
5
SCREW
7
EXTENSION ROD
14
HAND KNOB
13
SPACER
12
SCREW
(26 REQUIRED)
11
RETAINER
10
PLATE
8
HYDRAULIC
CYLINDER
9
SCREW
(12 REQUIRED)
PWA 86379
ADAPTER
RING
CAP SCREW
(6 REQUIRED)
VIEW OF THE INSTALLATION
OF ADAPTER RING (POST
SB PW4ENG 72-176)
L-A1238 (0191)
PW V

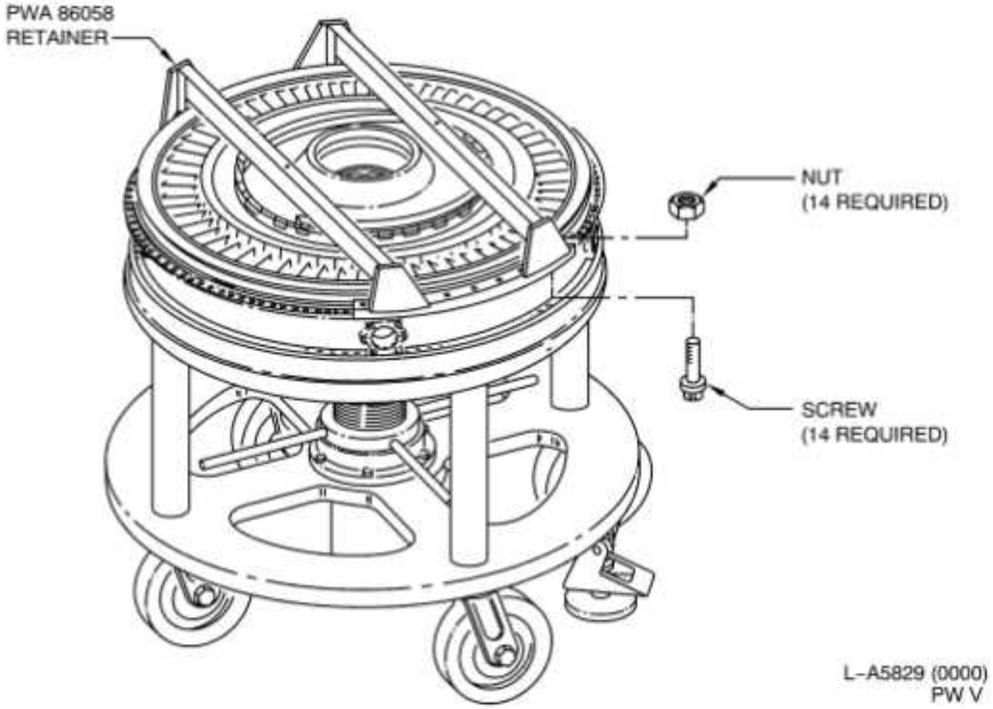
High Pressure Turbine Removal
Figure 307
(Task 72–00–52–020–001)


1
GASKET
VIEW SHOWING
GASKET INSTALLED
GASKET
1
L−A1515 (1286)
PW V

Turbine Case Gasket Removal
Figure 308
(Task 72−00−52−020−001)


1
SCREW
(12 REQUIRED)
4
EXTENSION ROD
2
PLATE
5
PLUG
3
RETAINER
6
JAWS
7
SCREW
PWA 85107
FIXTURE
8
SPACER
10
PILOTING RING
9
SCREW
(26 REQUIRED)
PWA 85108 STAND
L-A4588 (1089)
PW V

High Pressure Turbine Storage
Figure 309
(Task 72−00−52−020−001)


PWA 86058
RETAINER
NUT
(14 REQUIRED)
SCREW
(14 REQUIRED)
L−A5829 (0000)
PW V

PWA 86058 Retainer Installation
Figure 310
(Task 72−00−52−020−001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - REMOVAL-02

Task 72-00-52-020-001-002:

1. Remove The High Pressure Turbine - Horizontal (Hydraulic Wrench) - Deleted

    A. Procedure

        (1) This procedure is relocated to 72-00-52, Removal-01 (Task 72-00-52-020-001).

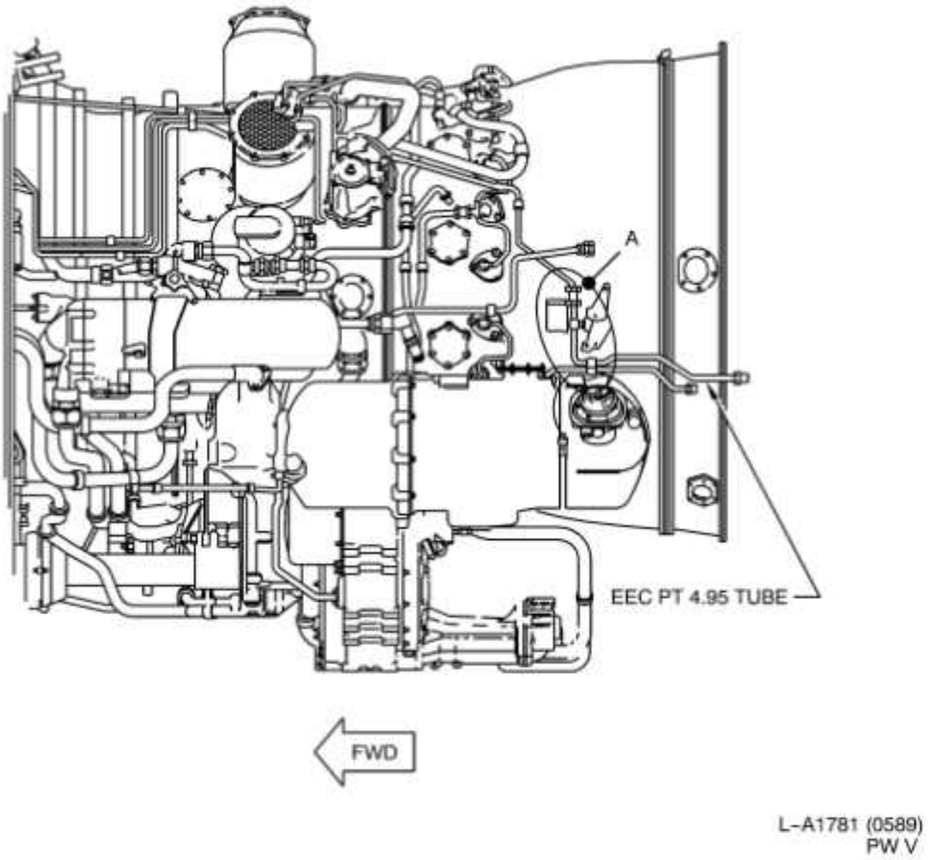
Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - REMOVAL-03

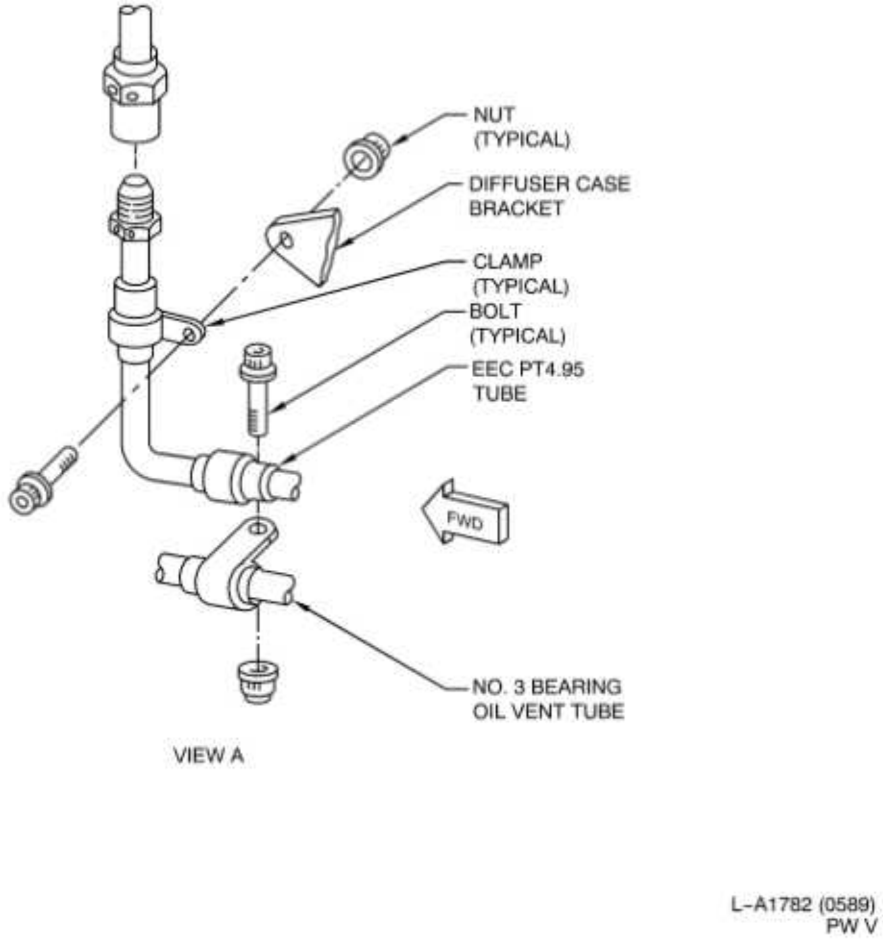
Task 72-00-52-020-003:

1. Remove The External Plumbing Prior To The High Pressure Turbine Removal
   A. Equipment And Materials Required - None
   B. Procedure
      See Figure 301.
      (1) Remove the EEC PT4.95 tube assembly (AS27) as follows.
         (a) Remove the lockwire. Disconnect the tube nut from tube coupling forward of Flange M at approximately 9 o'clock position.
         (b) Remove the bolt, nut and clamp that attach the tube to the diffuser case bracket at approximately 9 o'clock position.
         (c) Remove the bolt, nut and clamp that attach the tube to the adjacent tube forward of Flange M at approximately 8 o'clock position. Remove the tube from the engine. Install covers.

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−03


A
EEC PT 4.95 TUBE
FWD
L-A1781 (0589)
PW V

EEC PT4.95 Tube Assembly
Figure 301 (Sheet 1)
(Task 72−00−52−020−003)


NUT
(TYPICAL)
DIFFUSER CASE
BRACKET
CLAMP
(TYPICAL)
BOLT
(TYPICAL)
EEC PT4.95
TUBE
FWD
NO. 3 BEARING
OIL VENT TUBE
VIEW A
L-A1782 (0589)
PW V

EEC PT4.95 Tube Assembly
Figure 301 (Sheet 2)
(Task 72−00−52−020−003)

ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - REMOVAL-04

Task 72-00-52-050-001:

1. Remove Turbine Case Cooling (TCC) Air Valve (HPT)

   A. Prerequisites

      (1) Remove LPT turbine case cooling (TCC) air valve per 72-00-53, Removal-07, Task 72-00-53-050-001.

   B. Equipment And Materials Required - None

   C. Procedure
   See Figure 301 and Figure 302.

      (1) Disconnect the control cable from the HPT valve idler arm interface point.

      (2) Remove bolts securing upper flange of valve and support link to upper support bracket.

      (3) Position upper support link inward toward case.

      (4) Remove bolts and nuts securing lower flange of valve to lower support bracket.

      (5) Slide valve rearward and outward from between upper and lower support brackets.

      (6) Remove the bolt and nut that attaches the turnbuckle rod end to the idler arm on the valve and remove the rod from the valve.

      (7) FOR THESE MODELS: 4152, 4156A, 4158
      (Pre SB PW4ENG 75-74) If the valve must be replaced, remove the nut that attaches the idler arm to the valve lever and remove the arm and spacer from the valve lever.

      (8) (Pre SB PW4ENG 75-136) If the valve must be replaced, remove the nut that attaches the idler arm to the valve lever and remove the arm from the valve lever.

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−04

(9) (Post SB PW4ENG 75−136) If the valve must be replaced, remove the bearing sleeve assembly that attaches the idler arm to the valve lever and remove the arm from the valve lever.

NOTE: For additional information concerning detailed maintenance of this component see Turbine Case Cooling Air Valve (HPT) Component Maintenance Manual, 75−24−09, (Parker Hannifin).

(10) Examine the bushing and bearing in the idler arm for wear and damage. If necessary, remove the bushing (as applicable) and bearing as follows:

(a) Remove the bearing retaining ring from the idler arm.

(b) Put the idler arm on a work bench with the bearing retaining ring groove side down.

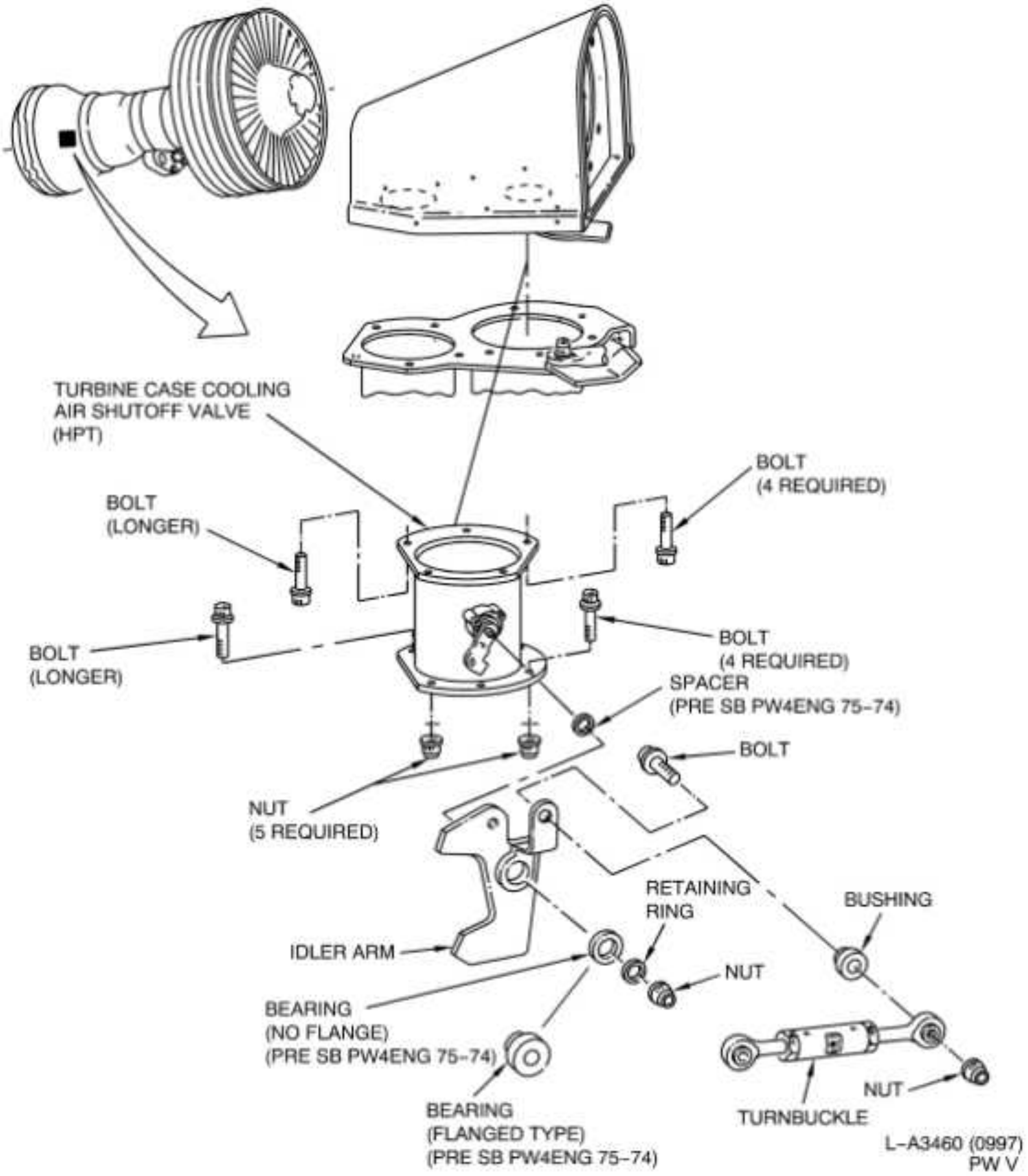
(c) Put a support around the OD of the bearing on the idler arm.

(d) Put a drift on the bearing and carefully hit the drift with a hammer to remove the bearing.

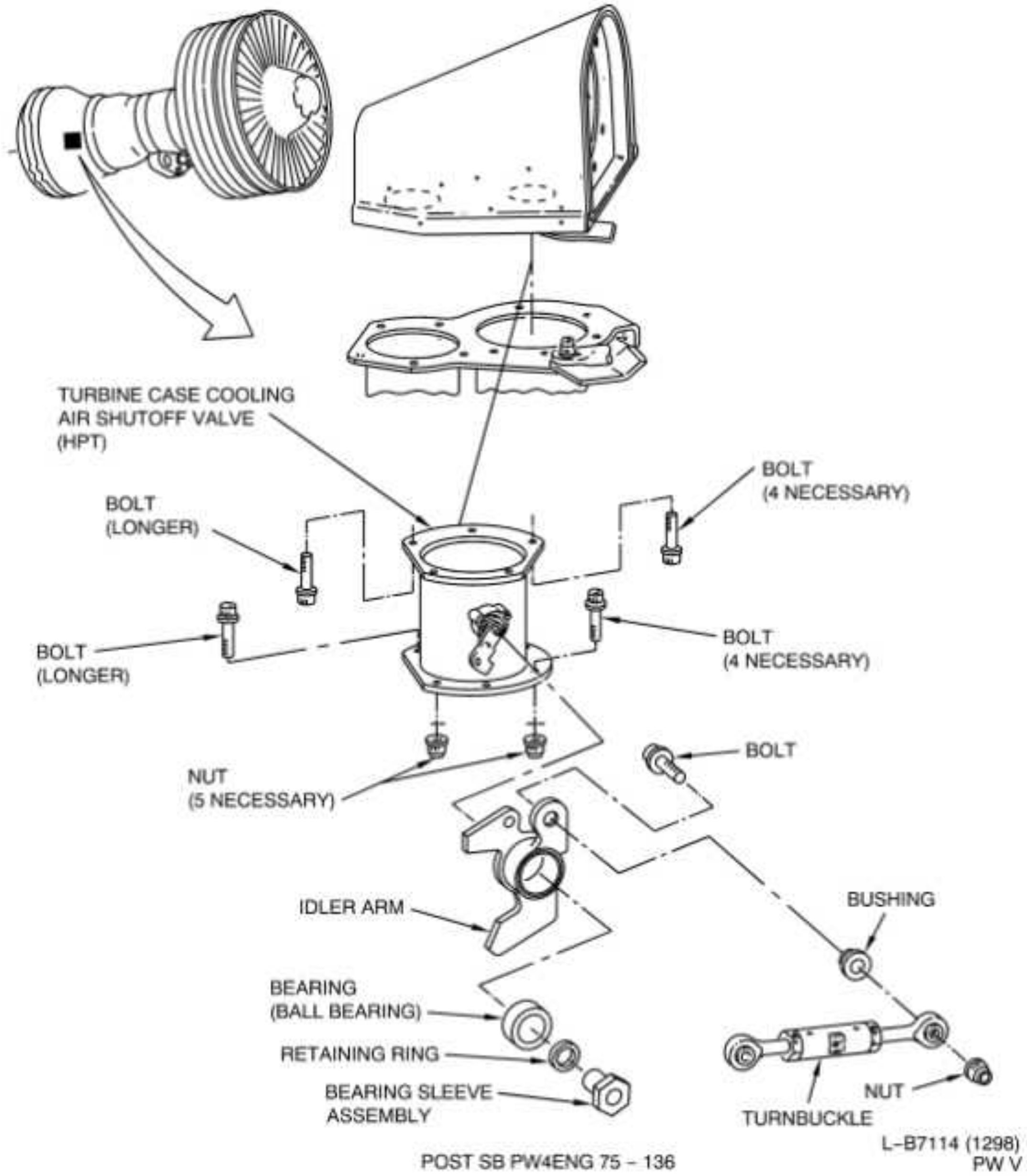
(e) To remove the bushing, put the idler arm on a work bench with the bushing flange side down.

(f) Put a support around the OD of the bushing on the idler arm.

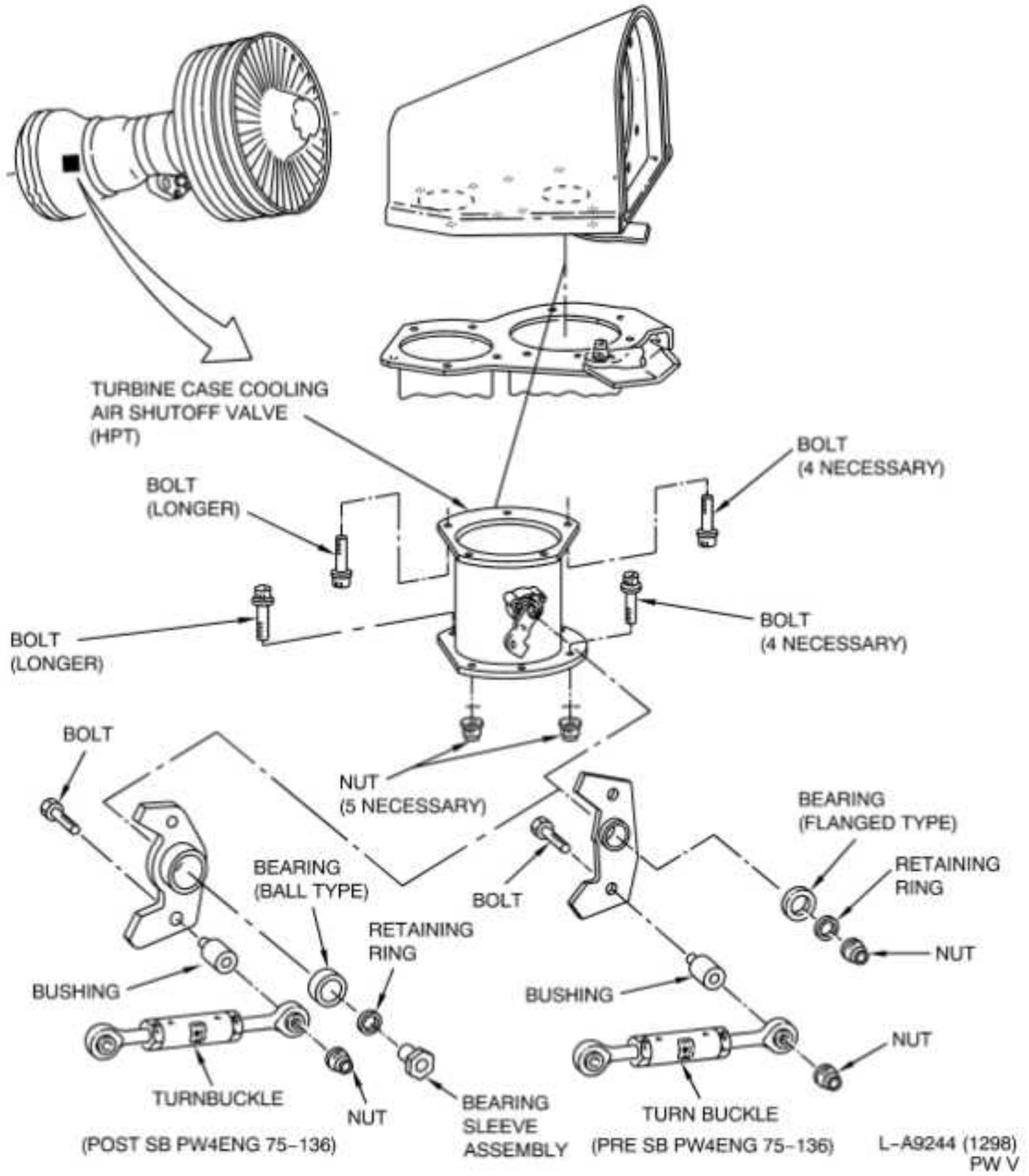
(g) Put a drift on the bushing and carefully hit the drift with a hammer to remove the bushing.


TURBINE CASE COOLING AIR SHUTOFF VALVE (HPT)
BOLT (4 REQUIRED)
BOLT (LONGER)
BOLT (LONGER)
BOLT (4 REQUIRED)
SPACER (PRE SB PW4ENG 75−74)
BOLT
NUT (5 REQUIRED)
RETAINING RING
BUSHING
IDLER ARM
NUT
BEARING (NO FLANGE) (PRE SB PW4ENG 75−74)
NUT
TURNBUCKLE
BEARING (FLANGED TYPE) (PRE SB PW4ENG 75−74)
L−A3460 (0997)
PW V

Turbine Cooling Air Valve (HPT) (Pre And Post SB PW4ENG 72−572, Post SB PW4ENG 72−592 And Pre SB PW4ENG 75−136 Engines)
Figure 301
(Task 72−00−52−050−001)


TURBINE CASE COOLING AIR SHUTOFF VALVE (HPT)
BOLT (4 NECESSARY)
BOLT (LONGER)
BOLT (LONGER)
BOLT (4 NECESSARY)
BOLT
NUT (5 NECESSARY)
IDLER ARM
BUSHING
BEARING (BALL BEARING)
RETAINING RING
BEARING SLEEVE ASSEMBLY
NUT
TURNBUCKLE
L−B7114 (1298)
PW V
POST SB PW4ENG 75 − 136

Turbine Cooling Air Valve (HPT) (Post SB PW4ENG 75−136)
Figure 301 (Sheet 2)
(Task 72−00−52−050−001)


TURBINE CASE COOLING AIR SHUTOFF VALVE (HPT)
BOLT (4 NECESSARY)
BOLT (LONGER)
BOLT (LONGER)
BOLT (4 NECESSARY)
BOLT
NUT (5 NECESSARY)
BEARING (FLANGED TYPE)
RETAINING RING
BEARING (BALL TYPE)
BOLT
RETAINING RING
NUT
BUSHING
BUSHING
NUT
TURNBUCKLE
NUT
BEARING SLEEVE ASSEMBLY
TURN BUCKLE
(POST SB PW4ENG 75-136)
(PRE SB PW4ENG 75-136)
L-A9244 (1298)
PW V

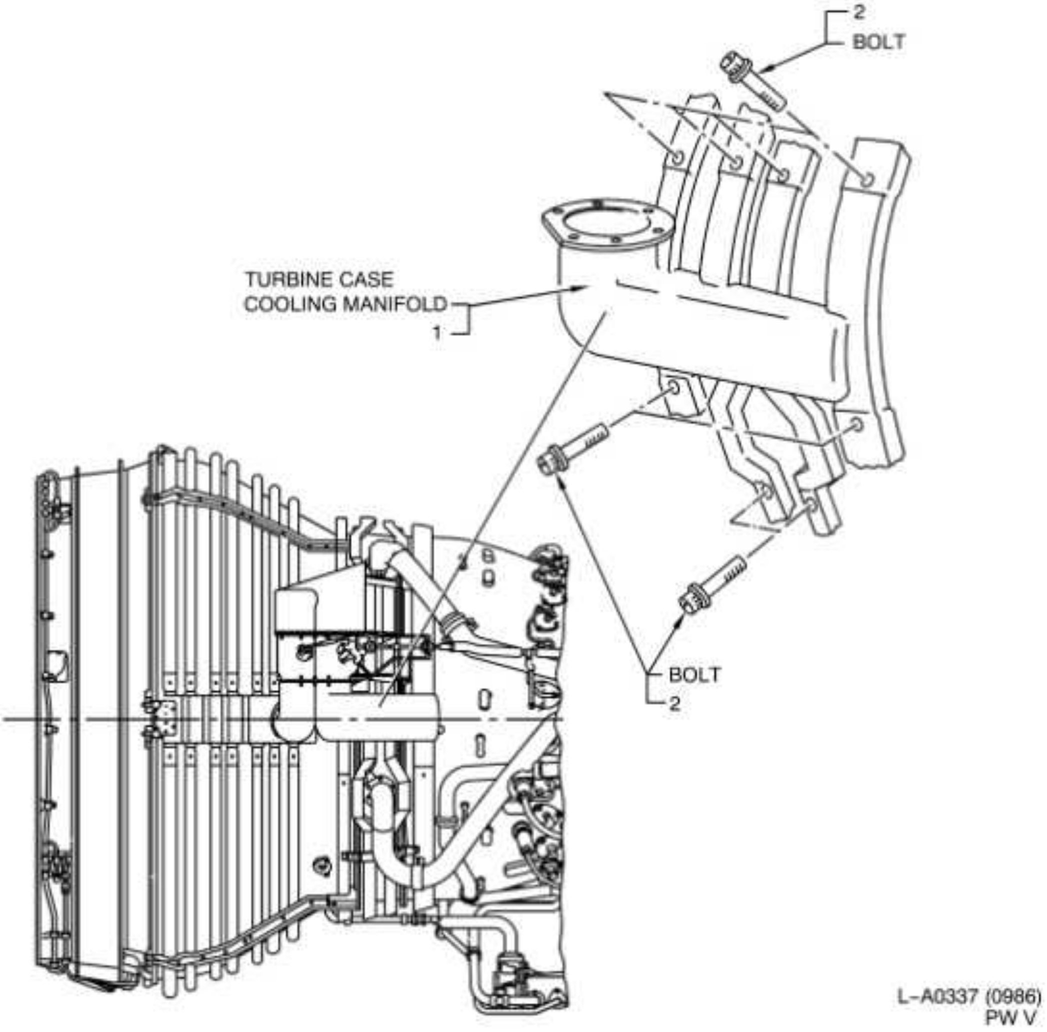
Turbine Cooling Air Valve (HPT) (Phase 3 Engines As Built By P&W)
Figure 302
(Task 72−00−52−050−001)

ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - REMOVAL-05

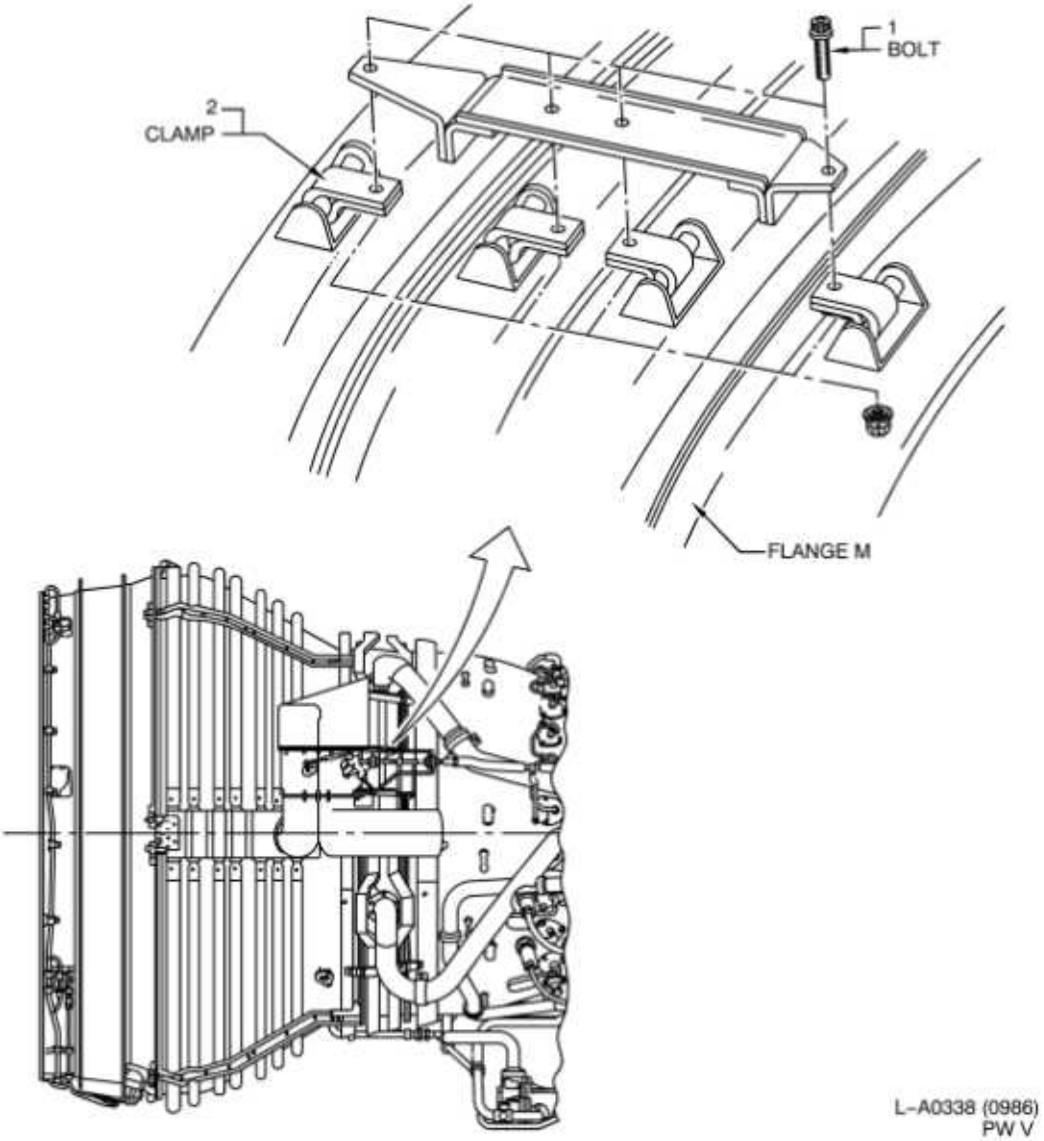
Task 72-00-52-050-002:

1. Remove (HPT) Turbine Case Cooling Manifold (Collector)
    A. Prerequisites
        (1) Remove EEC thermocouple and airframe cable (W6) as required per 72-00-54, Removal-09 (Task 72-00-54-050-006).
        (2) Remove only the lower right turbine cooling tube per Removal-07 (Task 72-00-52-050-004).
    B. Equipment And Materials Required - None
    C. Procedure
        See Figures 301 through 303.

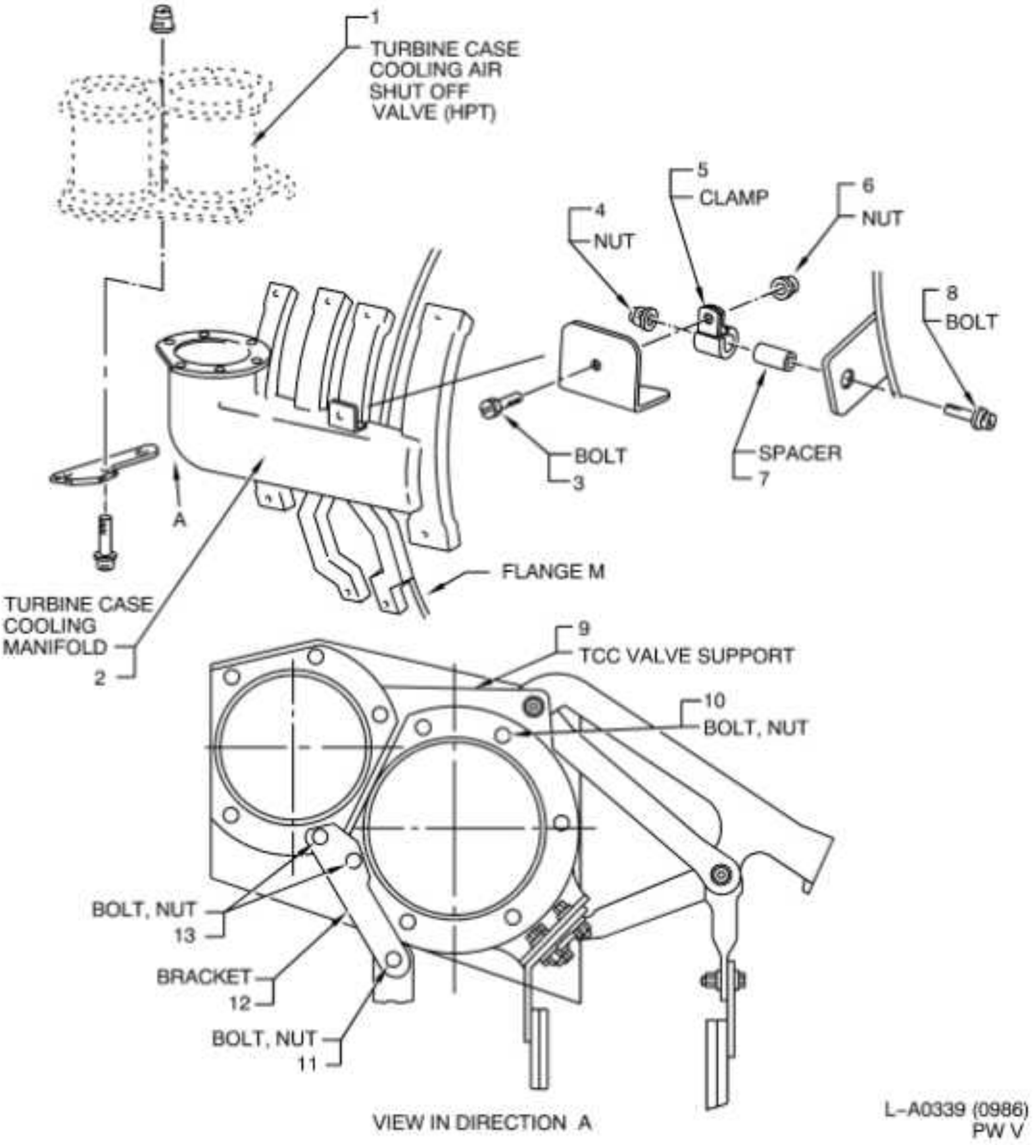
        (1) Remove eight bolts (301/2) securing turbine case cooling manifolds to turbine case cooling manifold (collector) (301/1). See Figure 301.
        (2) Loosen bolts (302/1) and clamps (302/2) securing cooling manifolds to support brackets at six locations. See Figure 302.
        (3) Slide upper and lower cooling manifolds around case as required to clear turbine case cooling manifold (collector) (303/2). See Figure 303.
        (4) Remove bolt (303/8) spacer (303/7) and nut (303/4) securing clamp (303/5) to bracket on Flange M. Remove screw (303/3) and nut (303/6) securing clamp (303/5) to turbine case cooling manifold (collector) (303/2).
        (5) Remove bolts and nuts (303/11) and (303/13) securing bracket (303/12) to engine.
        (6) Remove bolts and nuts (303/10) securing manifold (collector) (303/2) to TCC valve support (303/9) and turbine case cooling air shutoff valve (HPC) (303/1). Remove manifold (collector) (303/2).


2
BOLT
TURBINE CASE
COOLING MANIFOLD
1
BOLT
2
L-A0337 (0986)
PW V

Turbine Case Cooling Manifold Removal
Figure 301
(Task 72-00-52-050-002)


1 BOLT
2 CLAMP
FLANGE M
L−A0338 (0986)
PW V

Turbine Case Cooling Manifold Removal
Figure 302
(Task 72−00−52−050−002)


1
TURBINE CASE COOLING AIR SHUT OFF VALVE (HPT)
5
CLAMP
4
NUT
6
NUT
8
BOLT
BOLT
3
SPACER
7
A
FLANGE M
TURBINE CASE COOLING MANIFOLD
2
9
TCC VALVE SUPPORT
10
BOLT, NUT
BOLT, NUT
13
BRACKET
12
BOLT, NUT
11
VIEW IN DIRECTION A
L-A0339 (0986)
PW V

Turbine Case Cooling Manifold Removal
Figure 303
(Task 72-00-52-050-002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - REMOVAL-06

Task 72-00-52-050-003:

1. Remove Turbine Case Cooling Manifolds (HPT)

A. Prerequisites

(1) Remove EEC thermocouple and airframe cable (W6) as necessary by 72-00-54, Removal-09 Task 72-00-54-050-006-A00.

B. Equipment And Materials Necessary - None

C. Procedure
See Figures 301, 302 and 303.

(1) Remove (rear) No. 4 bearing oil pressure tube assembly (LP16) as follows.

(a) Remove two clamps securing spray shield, to the tube connection and if equipped a bracket, forward of Flange M at approximately 10 o'clock position. Remove the spray shield from the engine. Remove lockwire and disconnect tube nut from tube adapter.

(b) Remove clamp securing spray shield to rear tube connection on exhaust case and remove spray shield. Remove lockwire and disconnect tube nut.

(c) Remove bolts, nuts, and clamps securing tube to brackets attached to Flanges M, N, and P.

(d) Remove bolt, spacer, nut, and clamps securing tube to adjacent scavenge tube rearward of Flange N. Remove tube from engine.

(2) (Pre SB PW4ENG 79-75) Remove (rear) No. 4 bearing oil scavenge tube assembly as (LR06) as follows.

(a) Remove lockwire and disconnect rear scavenge tube elbow from exhaust case internal tube at approximately 10 o'clock position.

(b) Remove bolt, nut, and clamp securing spray shield to bracket on Flange M. Remove clamp securing forward end of spray shield to tube and remove spray shield.

(c) Remove lockwire and disconnect tube nut at Flange M from tube adapter.

(d) Remove bolts, nuts, and clamps securing tube to brackets on Flanges N and P. Remove rear scavenge tube from engine.

(3) (Post SB PW4ENG 79−75) Remove (rear) No. 4 bearing scavenge tube assembly (LR06) as follows.

(a) Remove hose clamp securing the tube shield to the bracket inboard side of Flange M at approximately 7 o'clock position. Remove the lockwire and disconnect the (LR05) hose and tube assembly nut from the (LR06) tube coupling.

(b) Remove lockwire and disconnect tube elbow from exhaust case internal tube nut at approximately 10 o'clock position.

(c) Remove bolts, nuts and clamps securing tube to Flanges N and P brackets. Remove tube from engine and install protective closures.

(d) Remove bolts, nuts and clamp bracket attached to Flanges M and N brackets at approximately 7 o'clock position.

(4) Remove (rear) No. 3 bearing oil vent tube assembly (LD02) as follows.

(a) Remove lockwire and disconnect oil vent tube from adapter on turbine exhaust case at approximately 7 o'clock position.

(b) Remove lockwire and disconnect tube nut at tube connection just rearward of Flange M.

(c) Remove bolt, nut, and clamp securing tube to bracket on Flange N.

(d) Remove bolts, nuts, and clamps securing tube to Flange P brackets.

(e) FOR THESE MODELS: 4152, 4156A, 4158
Remove the bolt, nut, and clamp at approximately the 7:30 o'clock position on the exhaust case that secures the tube to the adjacent PT4.95 tube assembly (Post SB PW4ENG 72−134).

(f) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the bolt, nut, and clamp at approximately the 7:30 o'clock position on the exhaust case that attaches the tube to the adjacent PT4.95 tube assembly.

(g) Remove bolt, nut, and clamp securing tube to adjacent tube between Flanges N and P. Remove tube from engine and install protective closures.

(5) Remove (rear) EEC PT4.95 tube assembly (AS02) as follows.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove lockwire from tube nut securing tube to the tee at the 6 o'clock position (water drain) on PT4.95 manifold, rearward of Flange P and disconnect tube nut (Pre SB PW4ENG 72−134).

(b) FOR THESE MODELS: 4152, 4156A, 4158
Remove the lockwire and disconnect the tube nut from the tube coupling at the rear of Flange P at approximately the 7 o'clock position (Post SB PW4ENG 72−134).

(c) FOR THESE MODELS: 4152, 4156A, 4158
Remove bolt, nut, and clamp that secures the tube to the Flange P bracket at approximately the 7 o'clock position (Pre SB PW4ENG 72−134).

(d) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the lockwire and disconnect the tube nut from the tube coupling at the rear of Flange P at approximately the 7 o'clock position.

(e) Remove lockwire from tube connection rearward of Flange N at approximately the 8 o'clock position and disconnect tube nut from tube adapter.

(f) Remove the tube from the engine and install protective closures.

(6) Remove all bolts at cooling manifold ends which secure manifolds (AC21) through (AC28) (upper and lower) to cooling manifold (collector) detail tubes.

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−06

(7) Remove bolts and nuts securing front lower cooling manifold clamps to brackets and remove clamps. Disengage manifold from (collector) and remove manifold from engine.

(8) Remove bolts and nuts securing front upper cooling manifold clamps to brackets and remove clamps. Disengage manifold from (collector) and remove manifold from engine.

(9) Remove the center two bolts and nuts on the bridge brackets (6 places), to disengage the center TCC tubes (upper and lower) from the bridge brackets.

(10) Remove two end bolts and nuts securing lower bridge brackets (3 places) to Flanges M and N brackets. Disengage lower, center two, cooling manifolds from manifold (collector) and remove manifolds from engine.

(11) Remove the two end bolts and nuts securing upper bridge brackets (3 places) to Flanges M and N brackets. Disengage upper, center two, cooling manifolds from manifold (collector) and remove manifolds from engine.

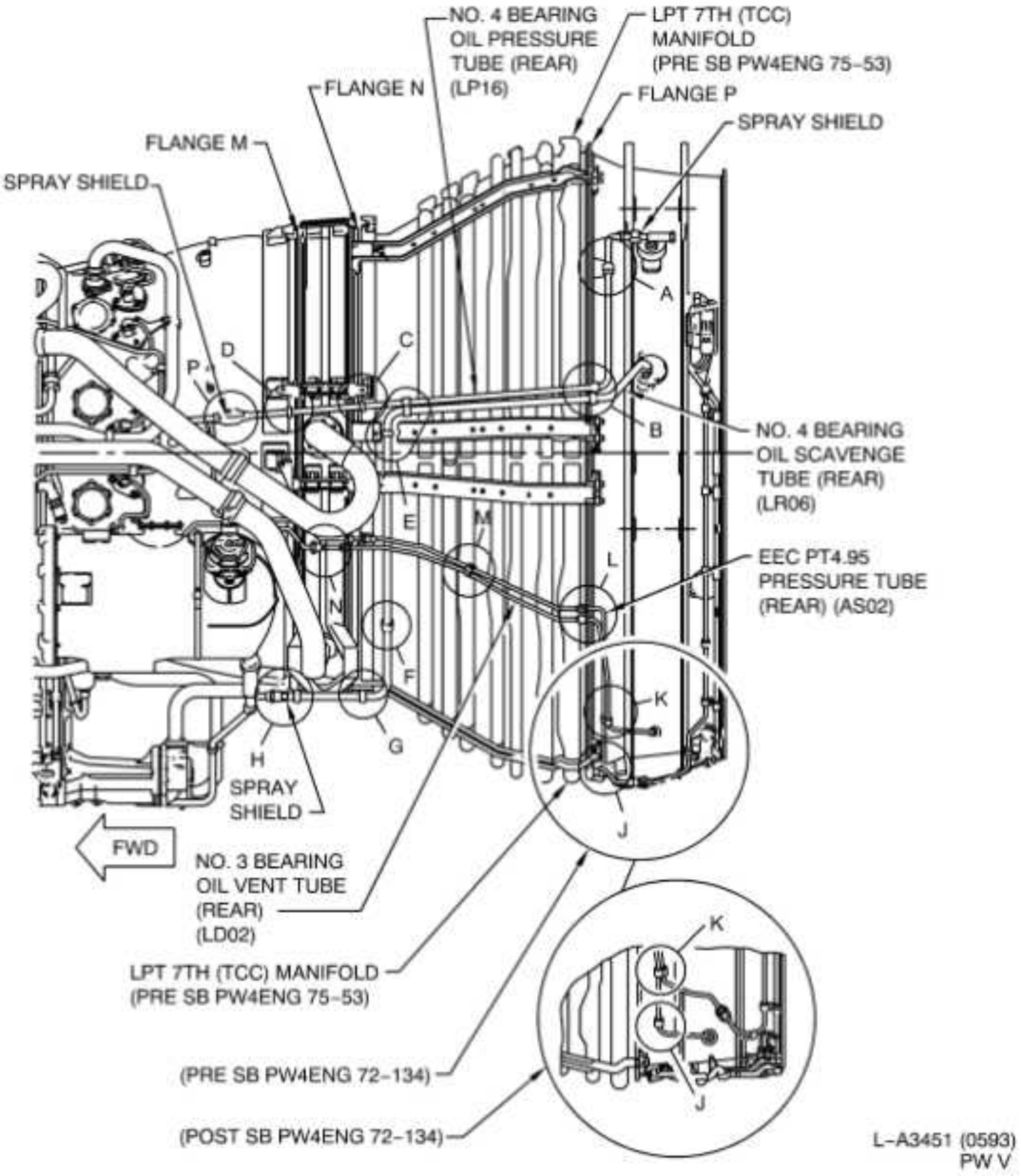
(12) Remove bolts, nuts and clamps securing upper and lower rear cooling manifolds to brackets. Disengage manifolds from collector and move rearward for access to brackets.

(13) Remove bolts and nuts securing rear upper and lower cooling manifold brackets to support brackets on Flange N.

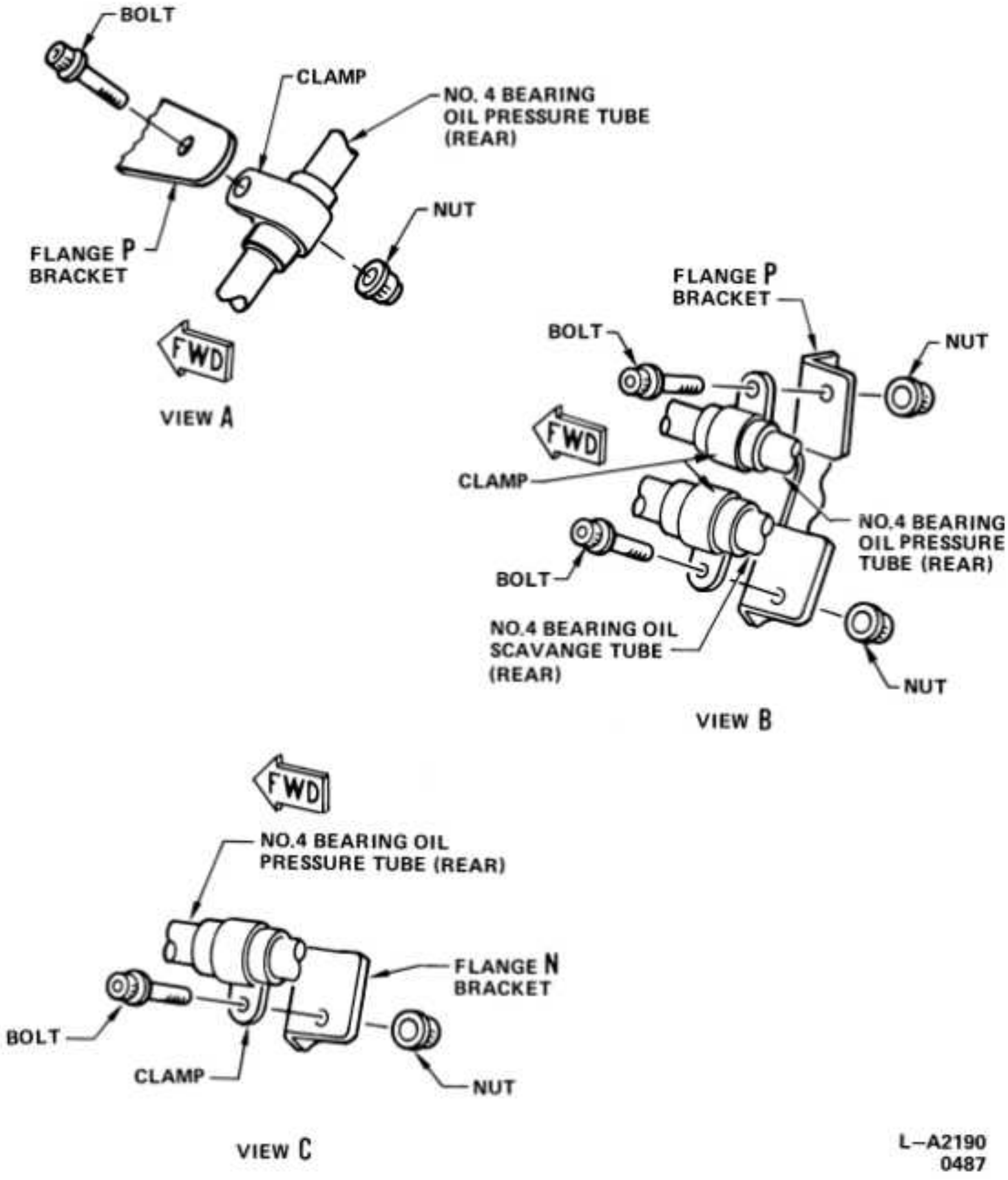
(14) Remove bolts and nuts securing LPT bridge brackets to Flange N brackets, as required and remove Flange N brackets for clearance to remove HPT rear cooling manifolds.

(15) Remove rear upper and lower cooling manifolds.

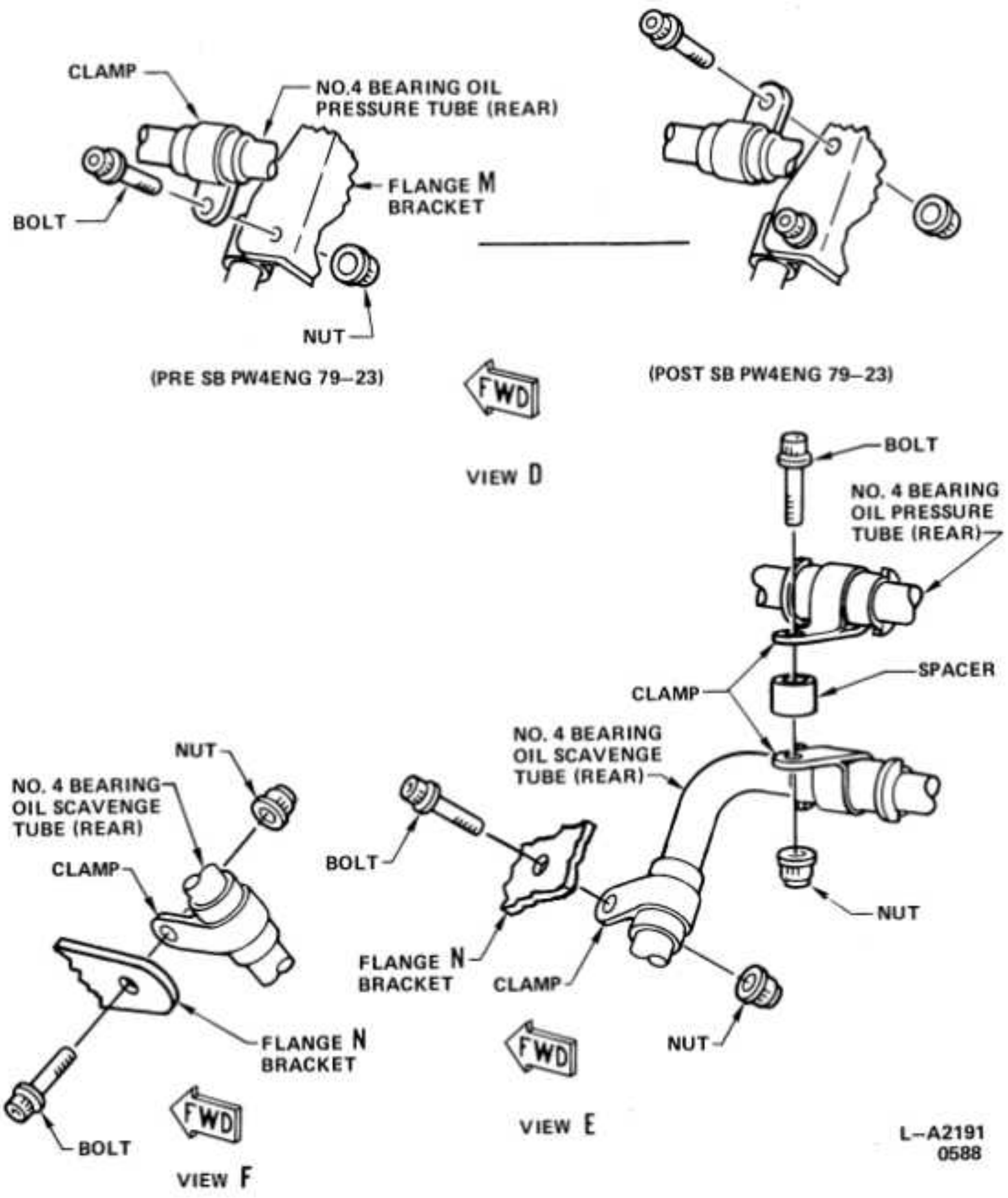
(16) Install protective closures.


NO. 4 BEARING OIL PRESSURE TUBE (REAR) (LP16)
LPT 7TH (TCC) MANIFOLD (PRE SB PW4ENG 75-53)
FLANGE N
FLANGE P
SPRAY SHIELD
FLANGE M
SPRAY SHIELD
A
C
D
P
B
NO. 4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
E
M
L
EEC PT4.95 PRESSURE TUBE (REAR) (AS02)
N
F
K
G
H
SPRAY SHIELD
J
FWD
NO. 3 BEARING OIL VENT TUBE (REAR) (LD02)
LPT 7TH (TCC) MANIFOLD (PRE SB PW4ENG 75-53)
K
(PRE SB PW4ENG 72-134)
J
(POST SB PW4ENG 72-134)
L-A3451 (0593)
PW V

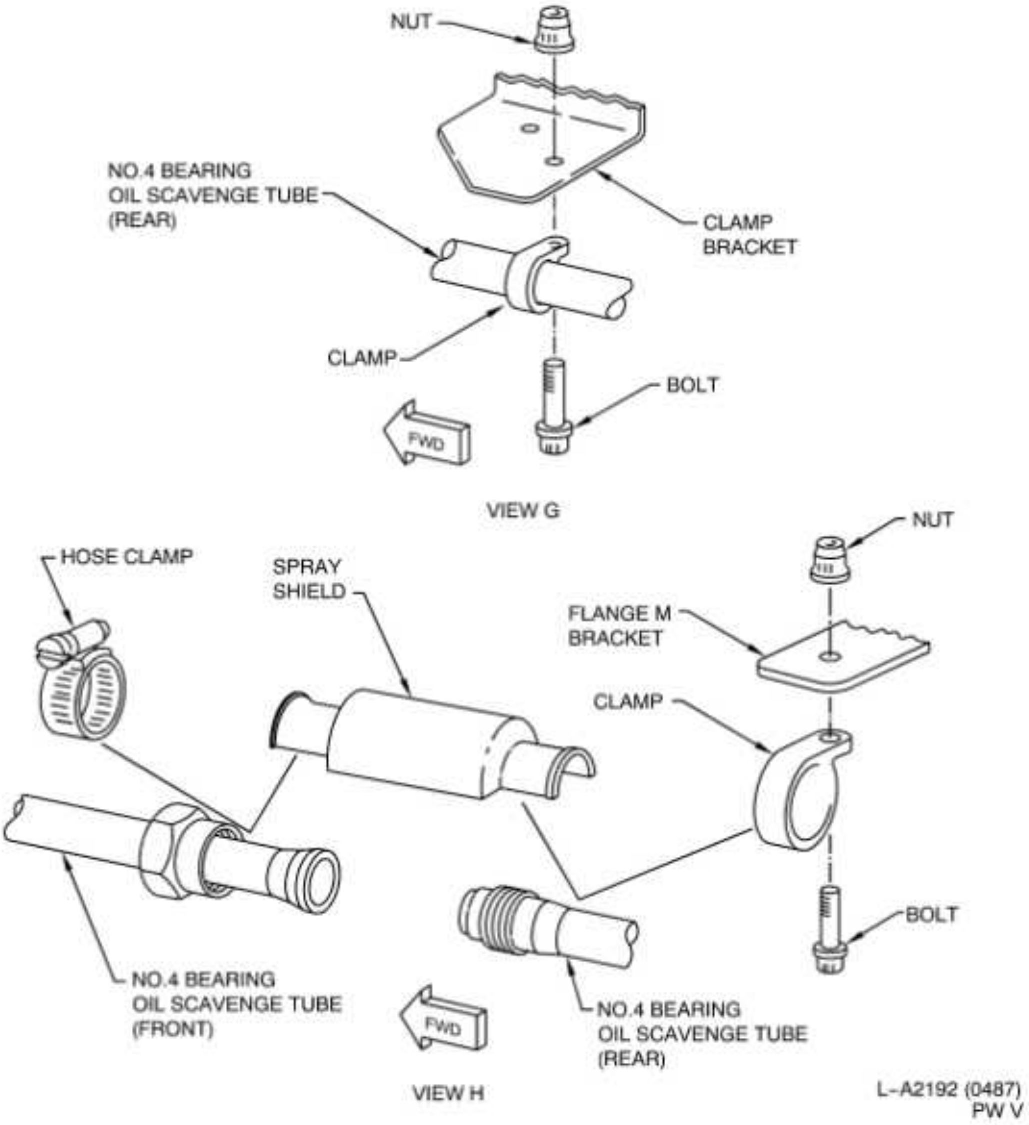
External Tubes For HPT (TCC) Clipping And Brackets
Figure 301 (Sheet 1)
(Task 72-00-52-050-003)


BOLT
CLAMP
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
NUT
FLANGE P BRACKET
FWD
VIEW A
FLANGE P BRACKET
BOLT
NUT
FWD
CLAMP
NO.4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NO.4 BEARING OIL SCAVANGE TUBE (REAR)
NUT
VIEW B
FWD
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE N BRACKET
BOLT
CLAMP
NUT
VIEW C
L−A2190
0487

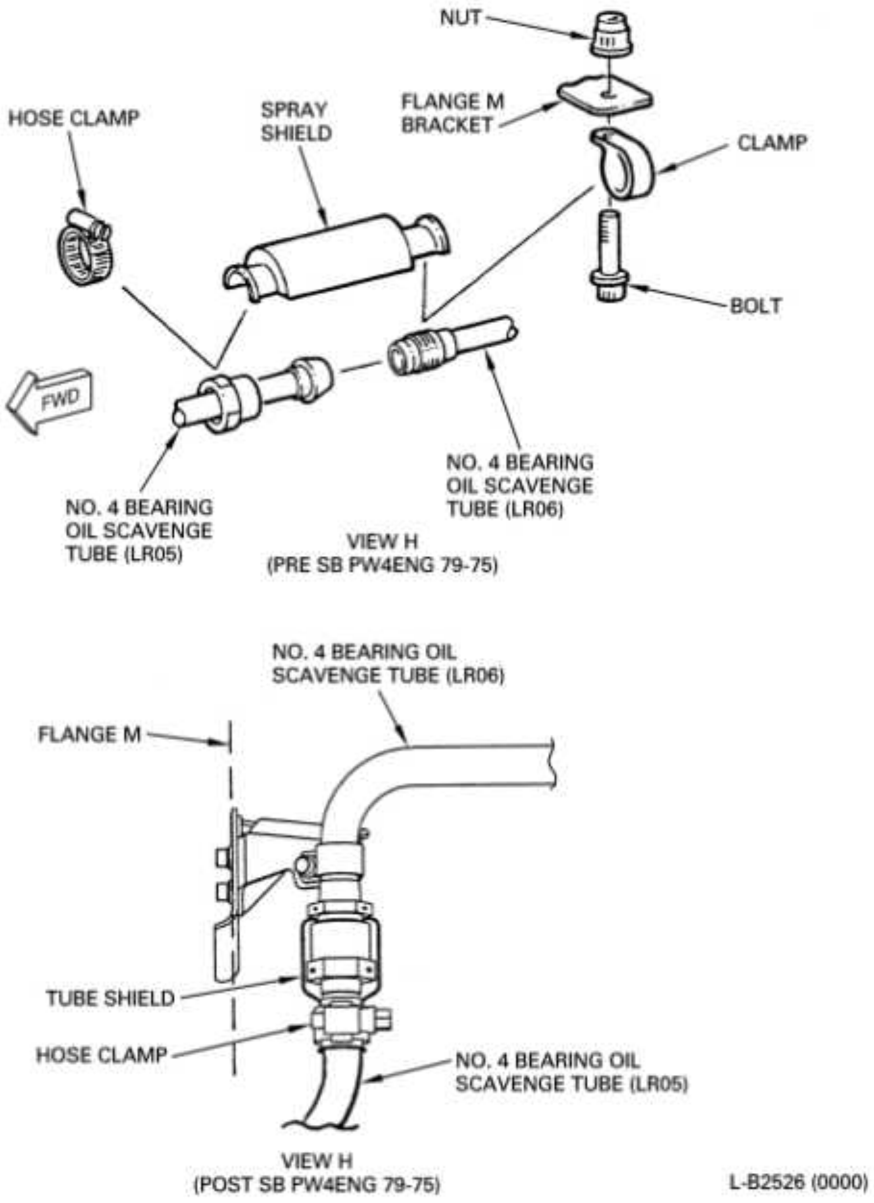
External Tubes For HPT (TCC) Clipping And Brackets
Figure 301 (Sheet 2)
(Task 72−00−52−050−003)


CLAMP
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE M BRACKET
BOLT
NUT
(PRE SB PW4ENG 79–23)
FWD
(POST SB PW4ENG 79–23)
VIEW D
BOLT
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
SPACER
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
NUT
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP
BOLT
FLANGE N BRACKET
CLAMP
NUT
FLANGE N BRACKET
FWD
BOLT
VIEW F
FWD
VIEW E
NUT
L–A2191
0588

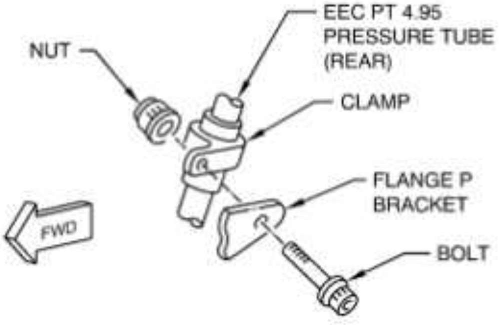
External Tubes For HPT (TCC) Clipping And Brackets
Figure 301 (Sheet 3)
(Task 72−00−52−050−003)


NUT
NO.4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP BRACKET
CLAMP
BOLT
FWD
VIEW G
HOSE CLAMP
SPRAY SHIELD
NUT
FLANGE M BRACKET
CLAMP
BOLT
NO.4 BEARING OIL SCAVENGE TUBE (FRONT)
FWD
NO.4 BEARING OIL SCAVENGE TUBE (REAR)
VIEW H
L-A2192 (0487)
PW V

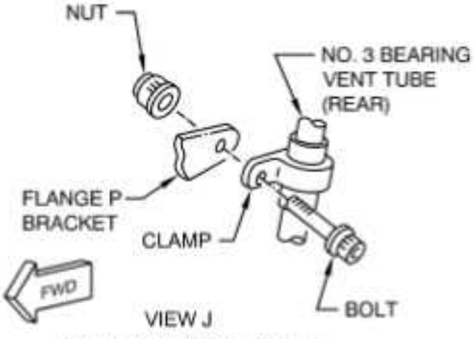
External Tubes For HPT (TCC) Clipping And Brackets
Figure 301 (Sheet 4)
(Task 72−00−52−050−003)


NUT
HOSE CLAMP
SPRAY SHIELD
FLANGE M BRACKET
CLAMP
BOLT
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
VIEW H
(PRE SB PW4ENG 79-75)
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
FLANGE M
TUBE SHIELD
HOSE CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
VIEW H
(POST SB PW4ENG 79-75)
L-B2526 (0000)

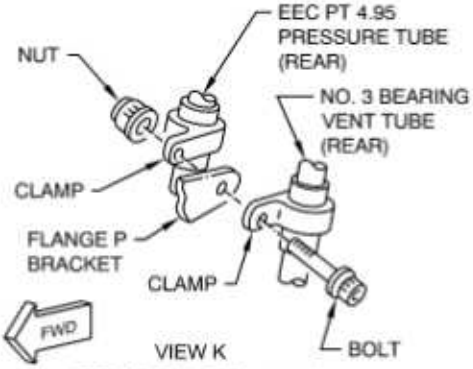
External Tubes For HPT (TCC) Clipping And Brackets
Figure 301 (Sheet 5)
(Task 72−00−52−050−003)


EEC PT 4.95
PRESSURE TUBE
(REAR)
NUT
CLAMP
FLANGE P
BRACKET
FWD
BOLT

VIEW J
(PRE SB PW4ENG 72−134)


NUT
NO. 3 BEARING
VENT TUBE
(REAR)
FLANGE P
BRACKET
CLAMP
FWD
BOLT

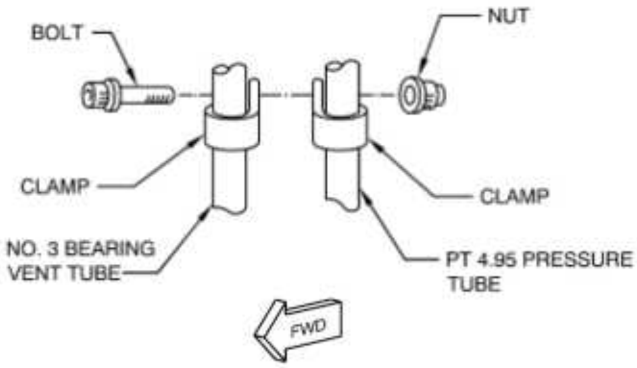
VIEW J
(POST SB PW4ENG 72−134)


EEC PT 4.95
PRESSURE TUBE
(REAR)
NUT
NO. 3 BEARING
VENT TUBE
(REAR)
CLAMP
FLANGE P
BRACKET
CLAMP
FWD
BOLT

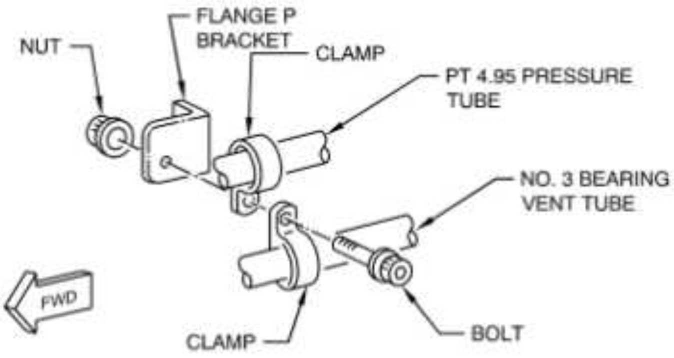
VIEW K
(PRE SB PW4ENG 72−134)

L−A2193 (0189)
PW V

External Tubes For HPT (TCC) Clipping And Brackets
Figure 301 (Sheet 6)
(Task 72−00−52−050−003)


BOLT
NUT
CLAMP
CLAMP
NO. 3 BEARING VENT TUBE
PT 4.95 PRESSURE TUBE
FWD

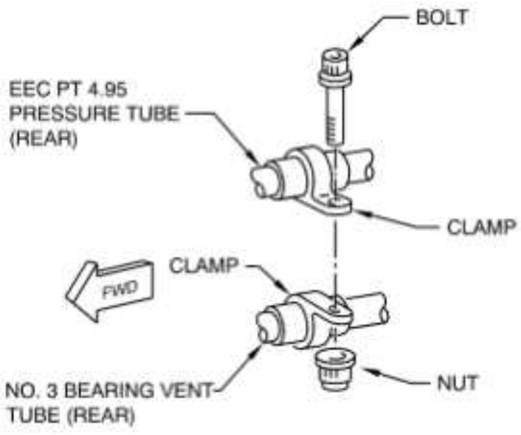
VIEW K
(POST SB PW4ENG 72-134)


NUT
FLANGE P BRACKET
CLAMP
PT 4.95 PRESSURE TUBE
NO. 3 BEARING VENT TUBE
FWD
CLAMP
BOLT

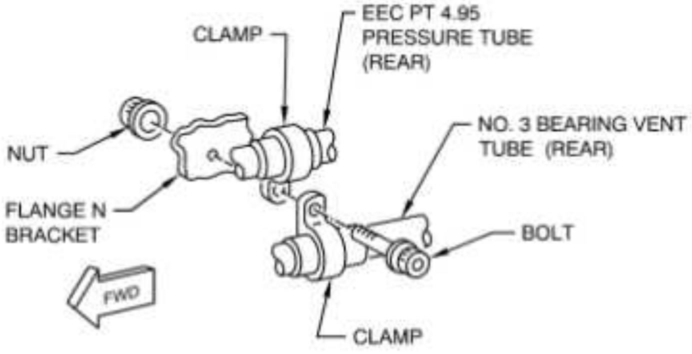
VIEW L

L-A5024 (0000)
PW V

External Tubes For HPT (TCC) Clipping And Brackets
Figure 301 (Sheet 7)
(Task 72−00−52−050−003)


BOLT
EEC PT 4.95
PRESSURE TUBE
(REAR)
CLAMP
CLAMP
FWD
NUT
NO. 3 BEARING VENT
TUBE (REAR)

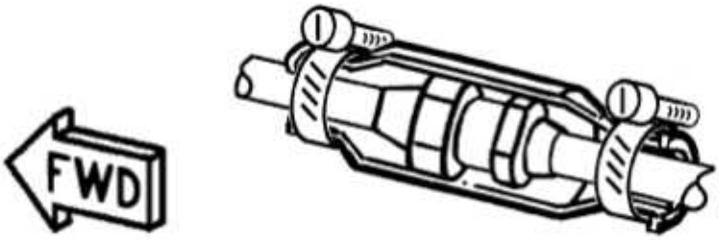
VIEW M


CLAMP
EEC PT 4.95
PRESSURE TUBE
(REAR)
NO. 3 BEARING VENT
TUBE (REAR)
NUT
FLANGE N
BRACKET
BOLT
FWD
CLAMP

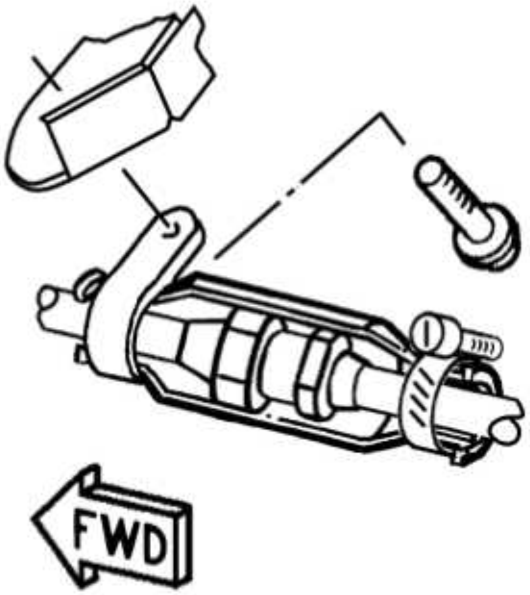
VIEW N

L-A2194 (0487)
PW V

External Tubes For HPT (TCC) Clipping And Brackets
Figure 301 (Sheet 8)
(Task 72-00-52-050-003)



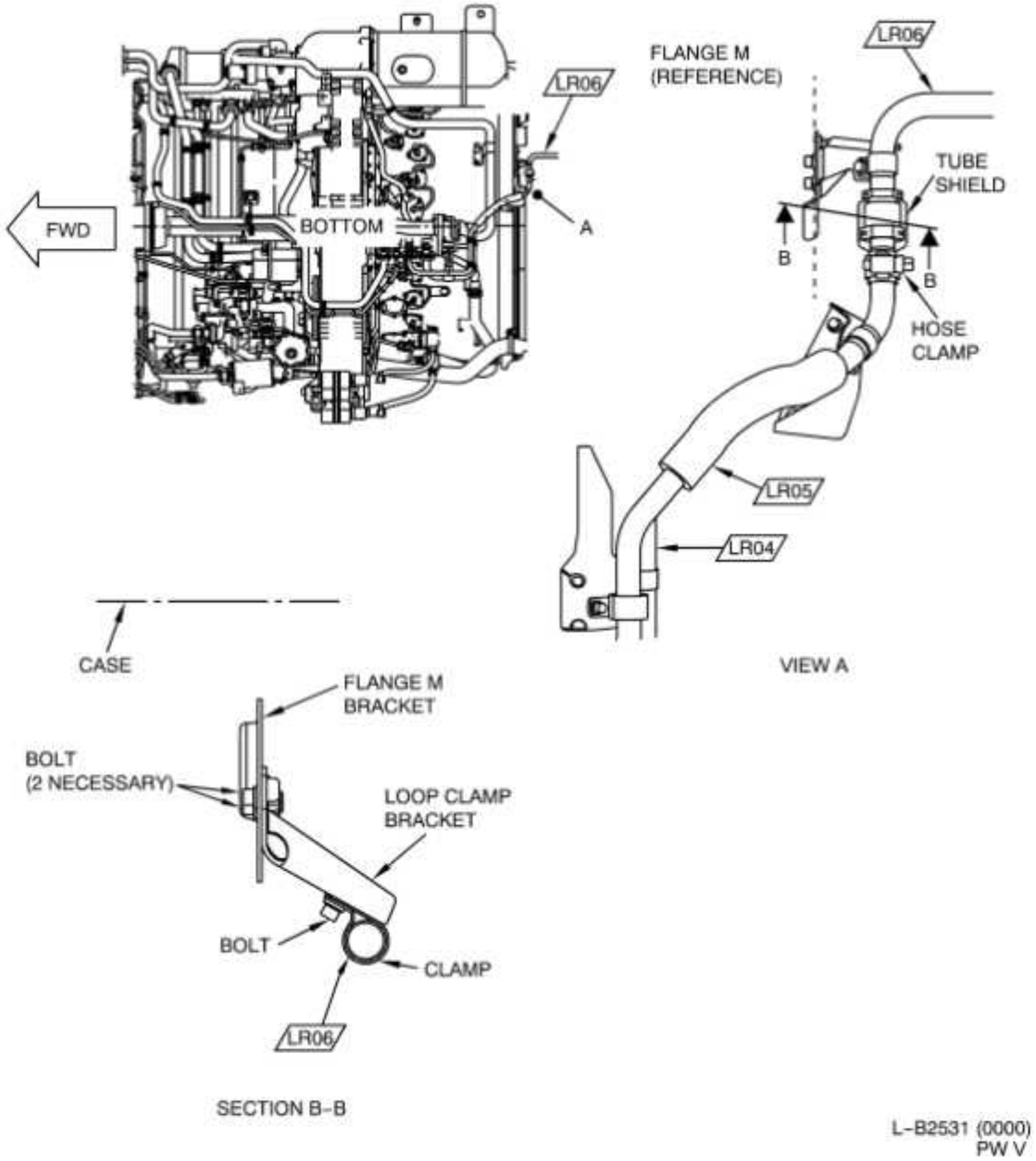
VIEW P
(PRE SB PW4ENG 79-54)



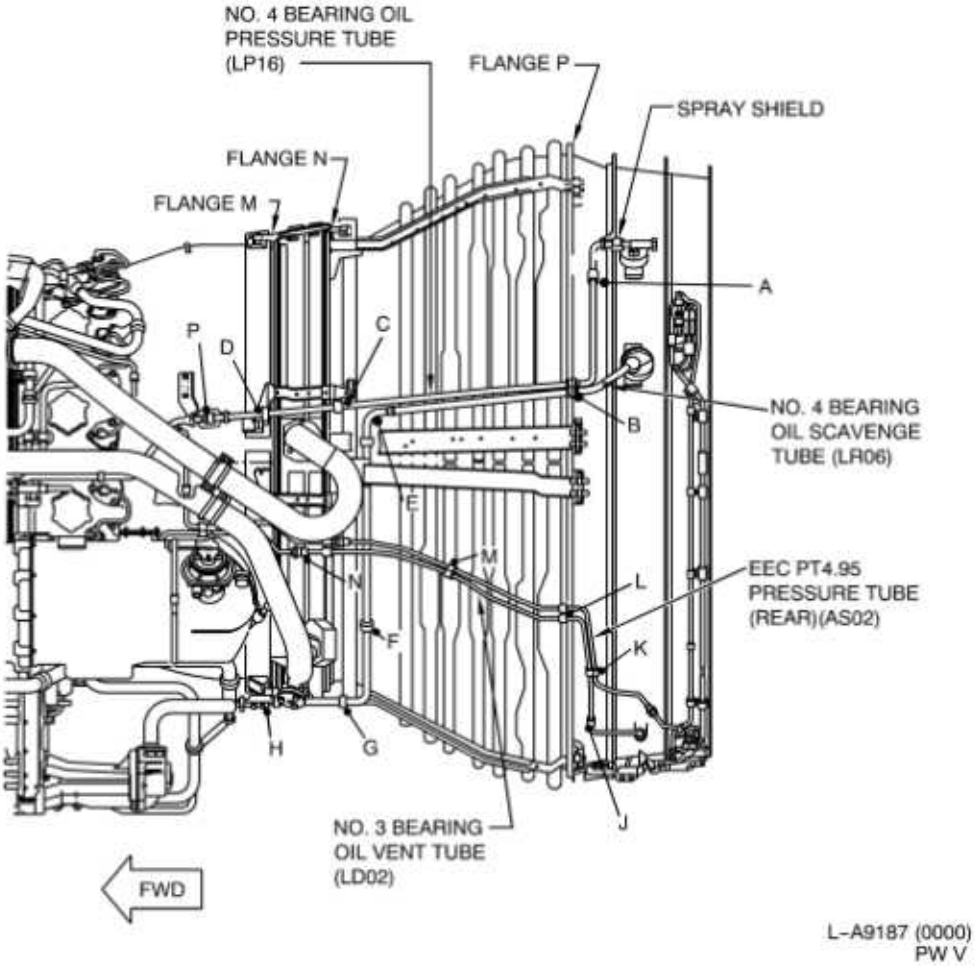
VIEW P
(POST SB PW4ENG 79-54)

L-A6824 (0000)

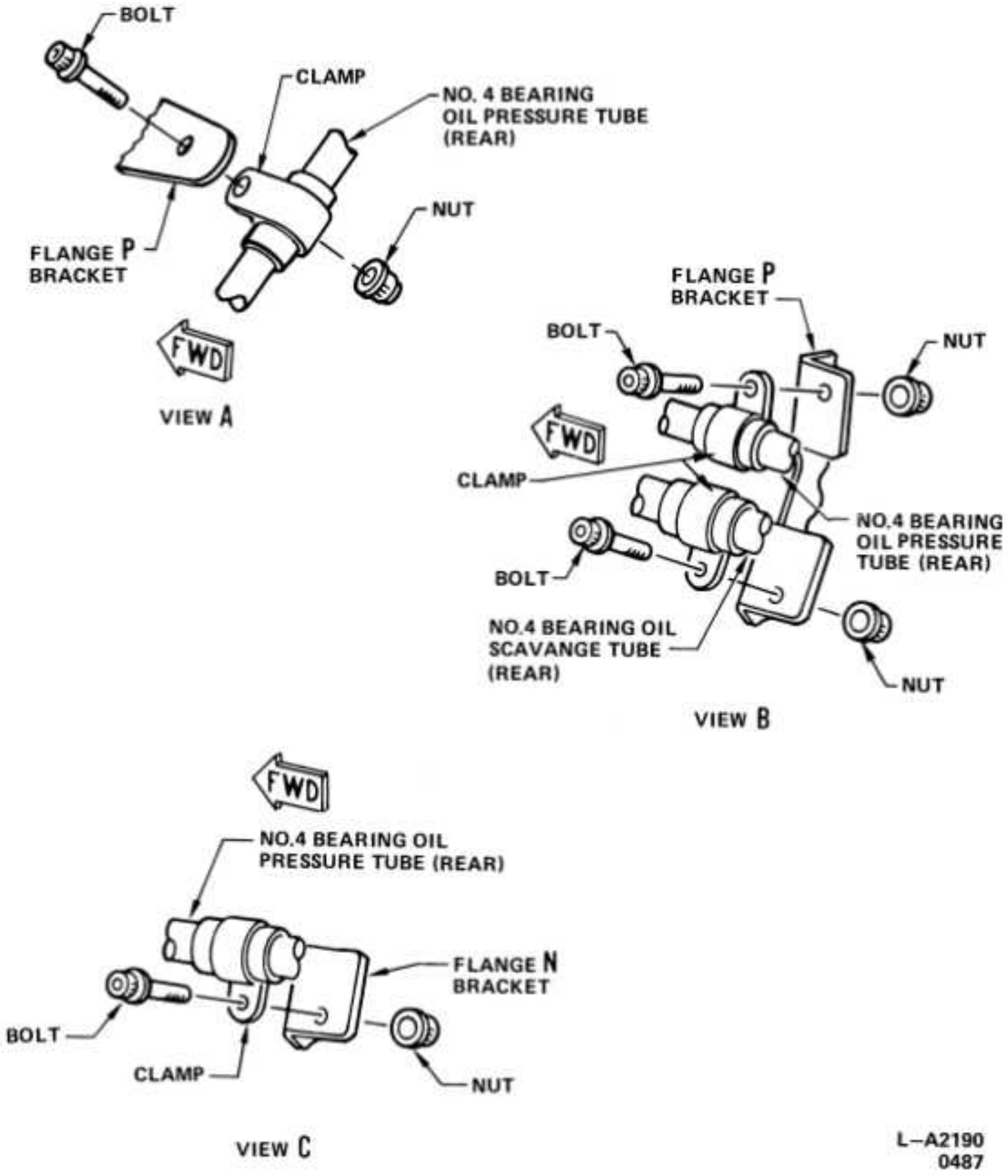
External Tubes For HPT (TCC) Clipping And Brackets
Figure 301 (Sheet 9)
(Task 72−00−52−050−003)


FWD
BOTTOM
LR06
A
FLANGE M
(REFERENCE)
LR06
TUBE
SHIELD
B
B
B
HOSE
CLAMP
LR05
LR04
VIEW A
CASE
FLANGE M
BRACKET
BOLT
(2 NECESSARY)
LOOP CLAMP
BRACKET
BOLT
CLAMP
LR06
SECTION B-B
L-B2531 (0000)
PW V

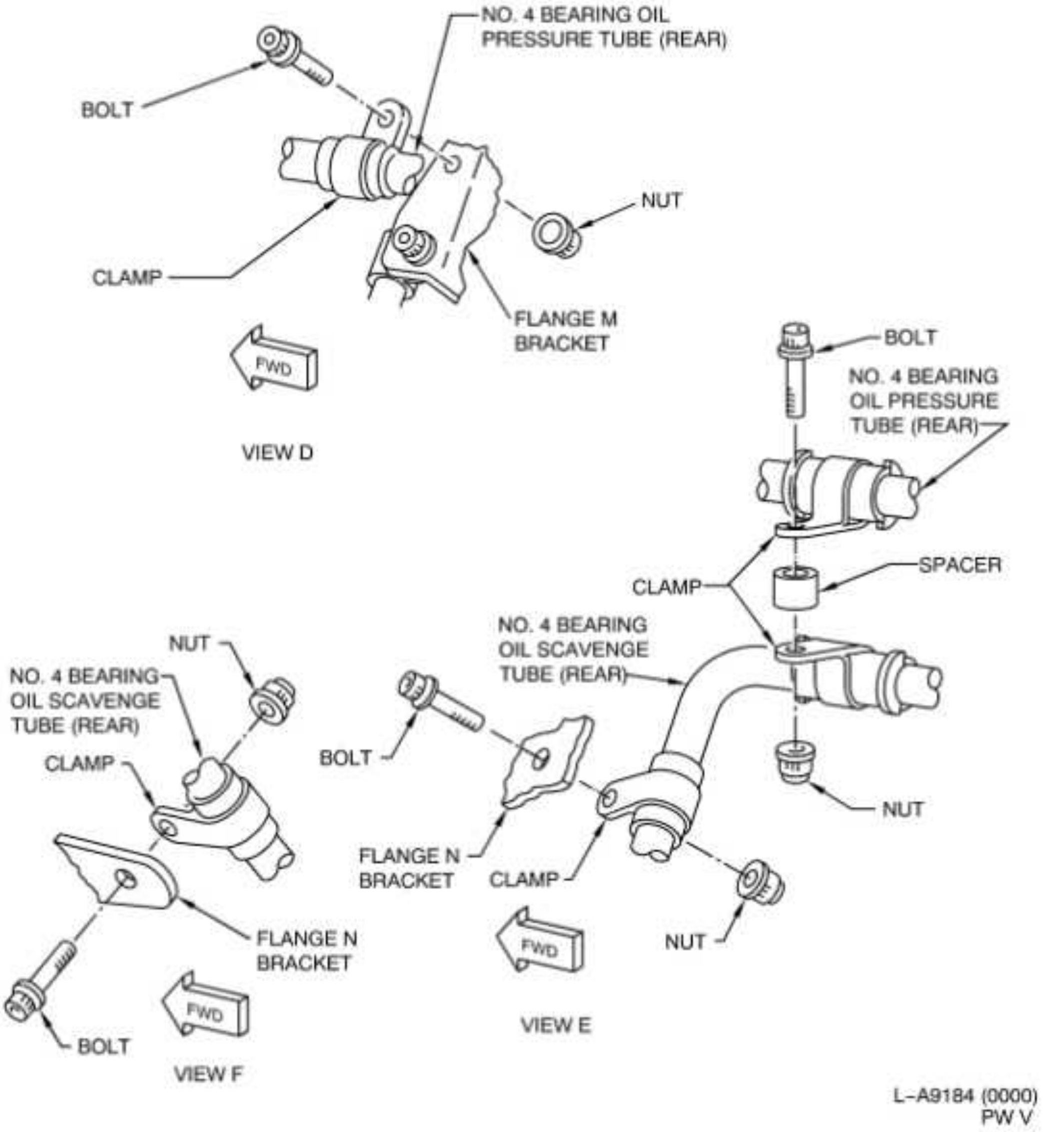
External Tubes For HPT (TCC) Clipping
And Brackets (Post SB PW4ENG 79−75)
Figure 301 (Sheet 10)
(Task 72−00−52−050−003)


NO. 4 BEARING OIL PRESSURE TUBE (LP16)
FLANGE P
SPRAY SHIELD
FLANGE N
FLANGE M
A
C
P
D
B
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
E
M
N
L
EEC PT4.95 PRESSURE TUBE (REAR)(AS02)
F
K
H
G
J
NO. 3 BEARING OIL VENT TUBE (LD02)
FWD
L-A9187 (0000)
PW V

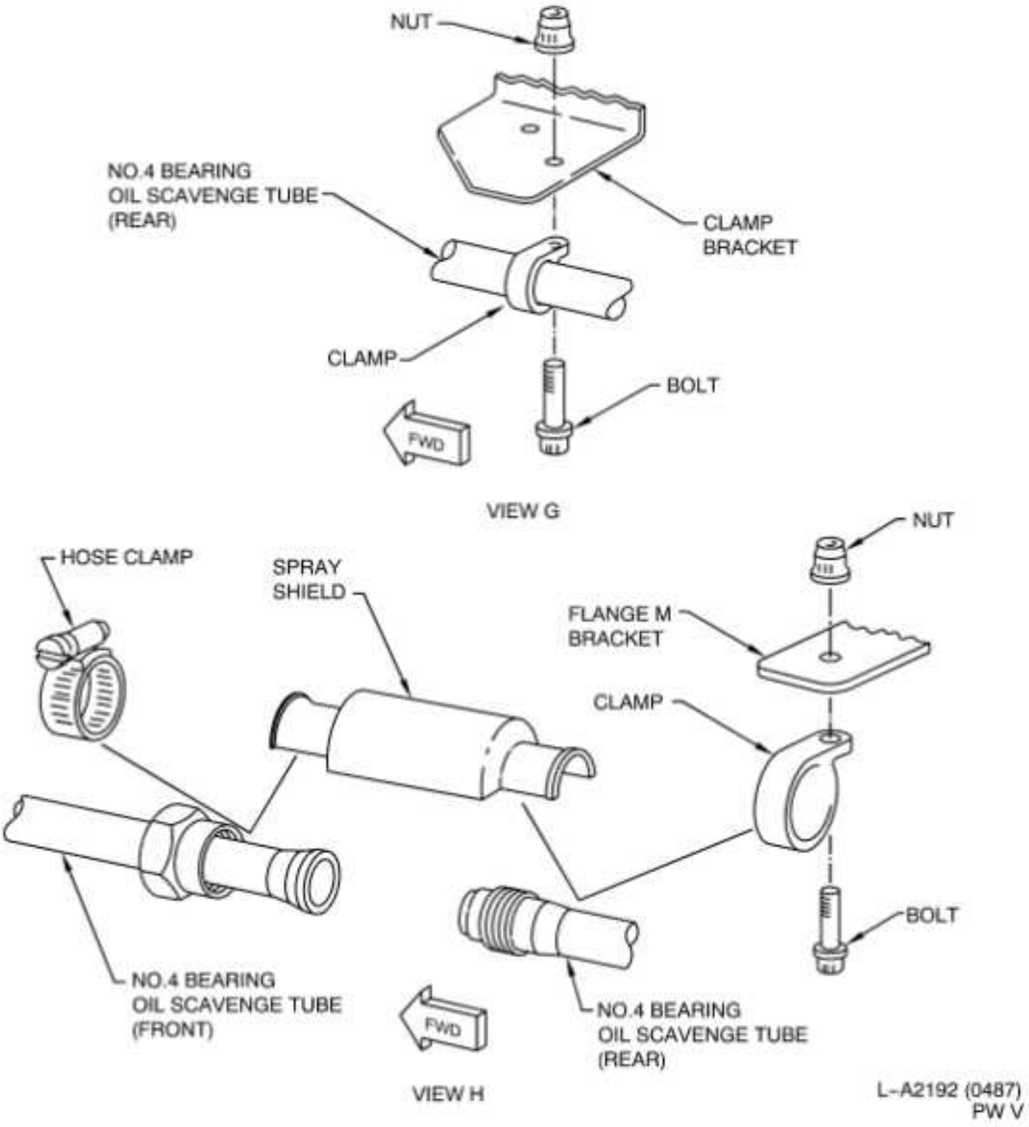
External Tubes For HPT (TCC) Clipping And Brackets
Figure 302 (Sheet 1)
(Task 72-00-52-050-003)


BOLT
CLAMP
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
NUT
FLANGE P BRACKET
FWD
VIEW A
FLANGE P BRACKET
BOLT
NUT
FWD
CLAMP
NO.4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NO.4 BEARING OIL SCAVANGE TUBE (REAR)
NUT
VIEW B
FWD
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE N BRACKET
BOLT
CLAMP
NUT
VIEW C
L−A2190
0487

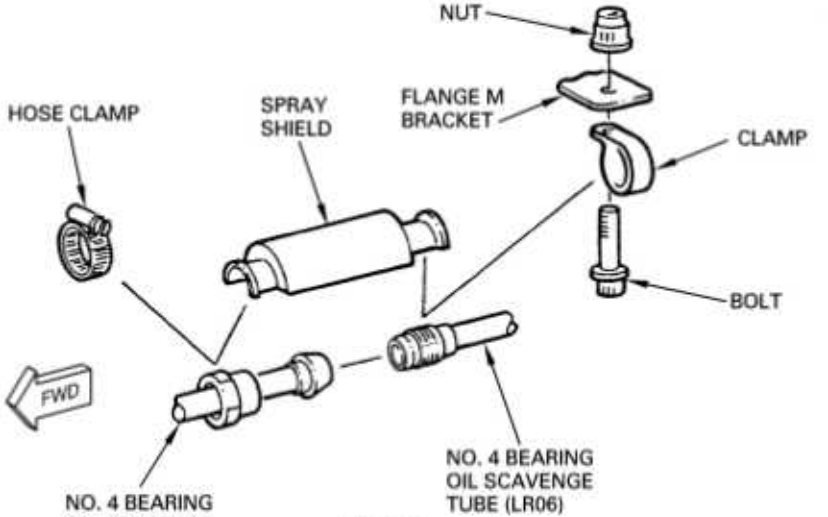
External Tubes For HPT (TCC) Clipping And Brackets
Figure 302 (Sheet 2)
(Task 72−00−52−050−003)


NO. 4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NUT
CLAMP
FLANGE M BRACKET
FWD
VIEW D
BOLT
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
SPACER
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
NUT
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP
BOLT
NUT
FLANGE N BRACKET
CLAMP
FLANGE N BRACKET
FWD
NUT
BOLT
FWD
VIEW E
VIEW F
L-A9184 (0000)
PW V

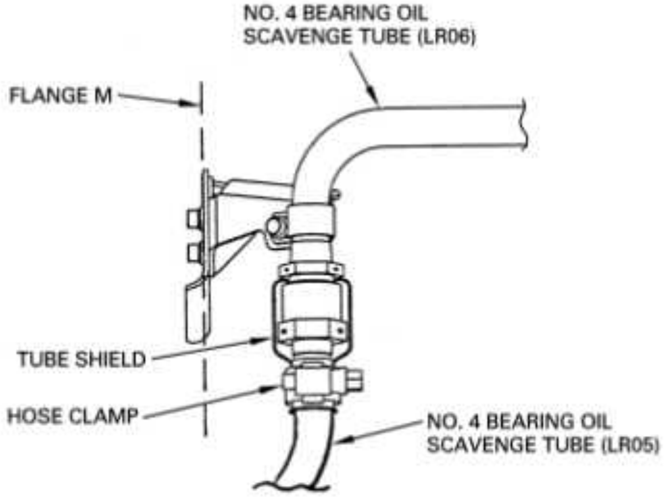
External Tubes For HPT (TCC) Clipping And Brackets
Figure 302 (Sheet 3)
(Task 72-00-52-050-003)


NUT
NO.4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP BRACKET
CLAMP
BOLT
FWD
VIEW G
HOSE CLAMP
SPRAY SHIELD
NUT
FLANGE M BRACKET
CLAMP
BOLT
NO.4 BEARING OIL SCAVENGE TUBE (FRONT)
FWD
NO.4 BEARING OIL SCAVENGE TUBE (REAR)
VIEW H
L-A2192 (0487)
PW V

External Tubes For HPT (TCC) Clipping And Brackets
Figure 302 (Sheet 4)
(Task 72−00−52−050−003)


NUT
HOSE CLAMP
SPRAY SHIELD
FLANGE M BRACKET
CLAMP
BOLT
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)

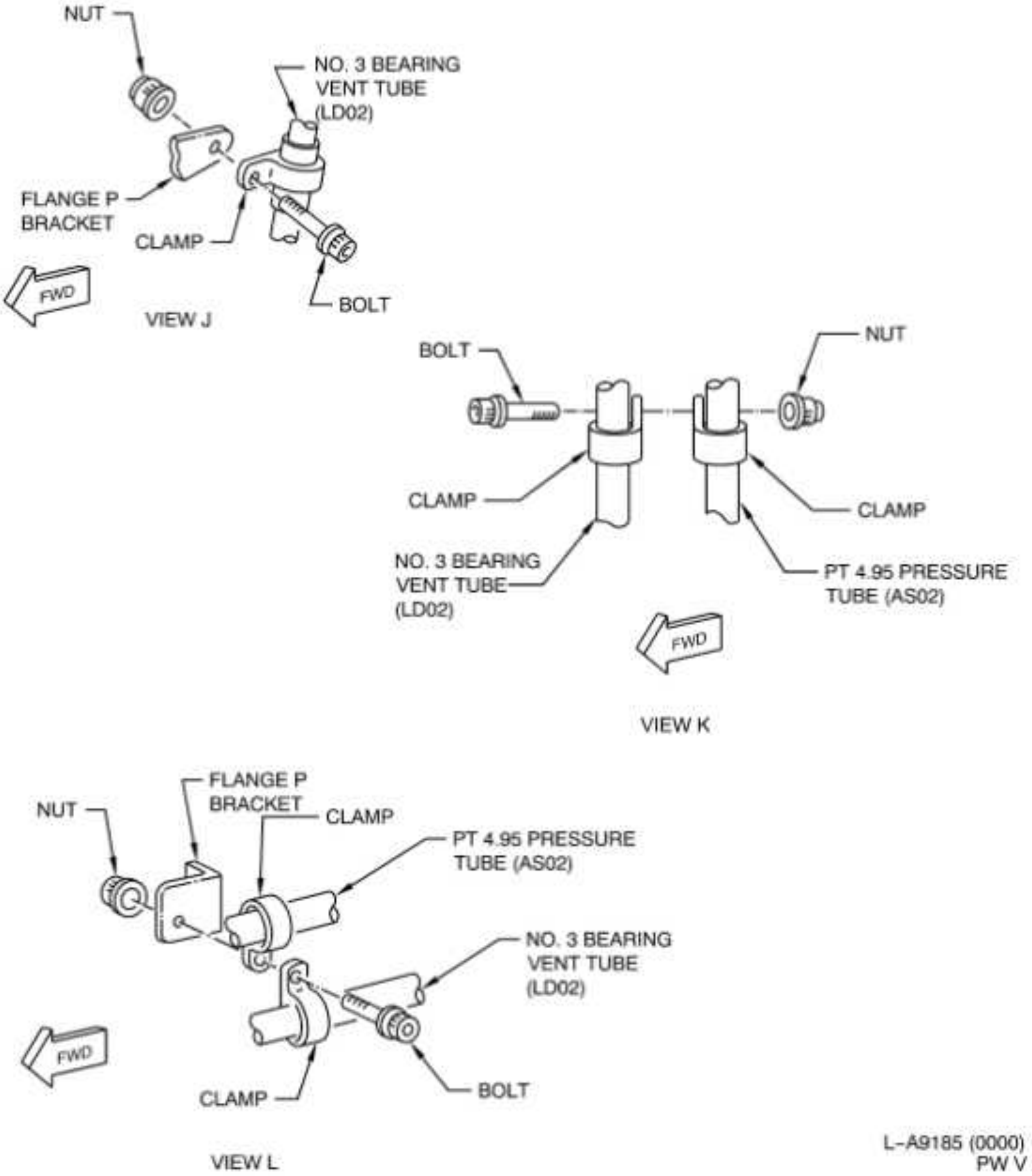
VIEW H
(PRE SB PW4ENG 79-75)


NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
FLANGE M
TUBE SHIELD
HOSE CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)

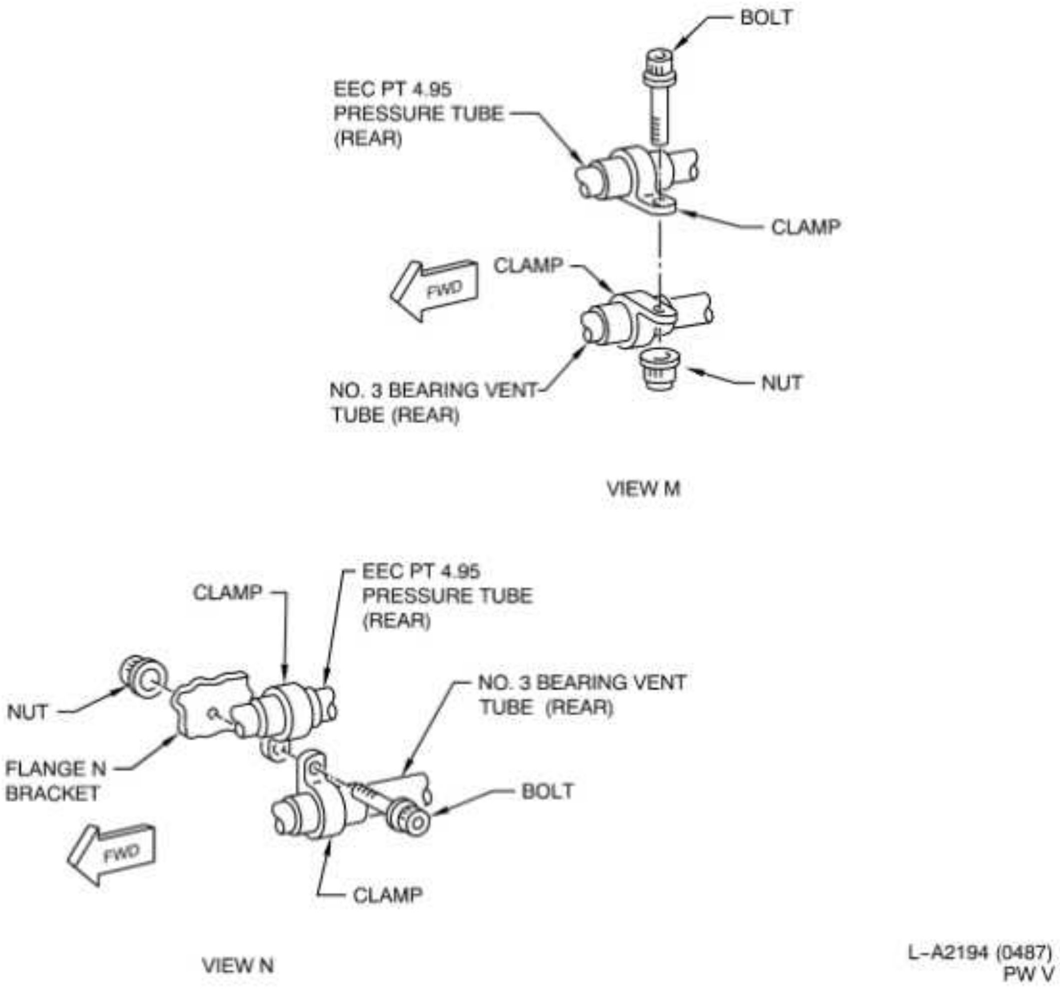
VIEW H
(POST SB PW4ENG 79-75)

L-B2526 (0000)

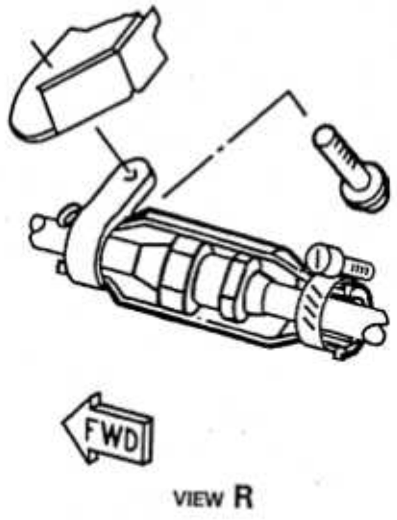
External Tubes For HPT (TCC) Clipping And Brackets
Figure 302 (Sheet 5)
(Task 72−00−52−050−003)


NUT
NO. 3 BEARING VENT TUBE (LD02)
FLANGE P BRACKET
CLAMP
BOLT
FWD
VIEW J
BOLT
NUT
CLAMP
CLAMP
NO. 3 BEARING VENT TUBE (LD02)
PT 4.95 PRESSURE TUBE (AS02)
FWD
VIEW K
FLANGE P BRACKET
NUT
CLAMP
PT 4.95 PRESSURE TUBE (AS02)
NO. 3 BEARING VENT TUBE (LD02)
FWD
CLAMP
BOLT
VIEW L
L-A9185 (0000)
PW V

External Tubes For HPT (TCC) Clipping And Brackets
Figure 302 (Sheet 6)
(Task 72-00-52-050-003)

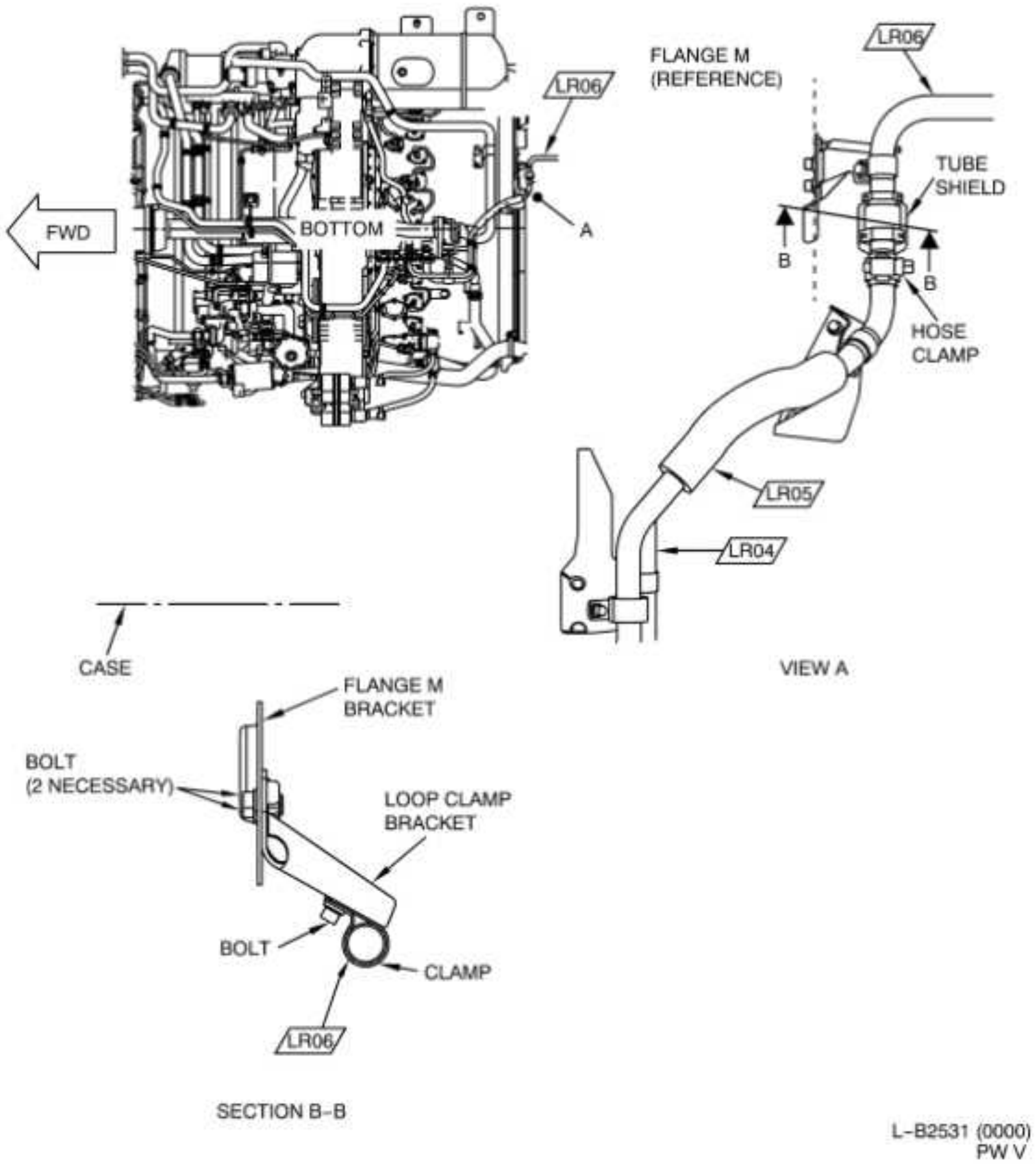

BOLT
EEC PT 4.95 PRESSURE TUBE (REAR)
CLAMP
CLAMP
FWD
NUT
NO. 3 BEARING VENT TUBE (REAR)
VIEW M
CLAMP
EEC PT 4.95 PRESSURE TUBE (REAR)
NUT
NO. 3 BEARING VENT TUBE (REAR)
FLANGE N BRACKET
BOLT
FWD
CLAMP
VIEW N
L-A2194 (0487)
PW V

External Tubes For HPT (TCC) Clipping And Brackets
Figure 302 (Sheet 7)
(Task 72-00-52-050-003)

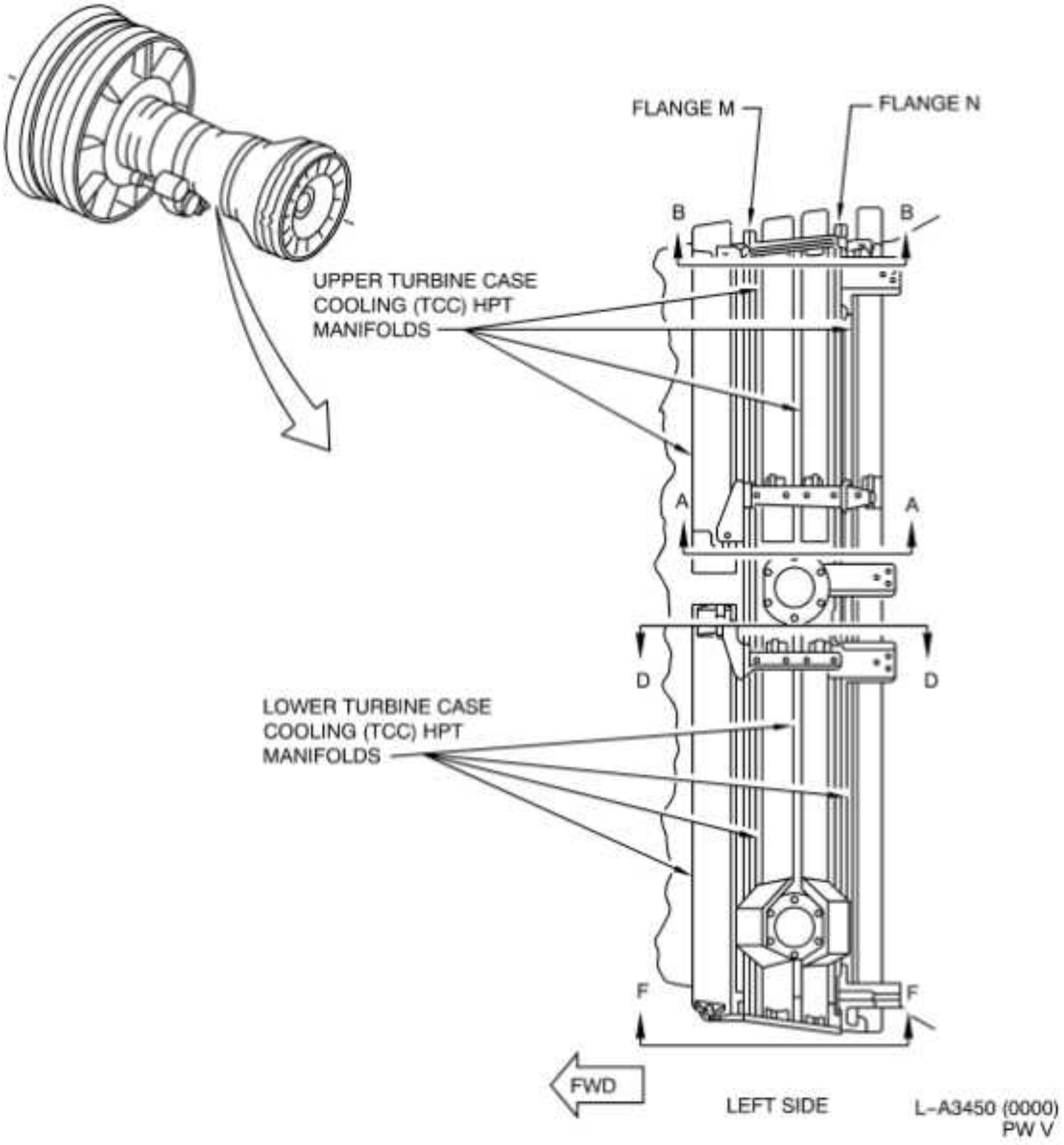


L-A9061 (0000)

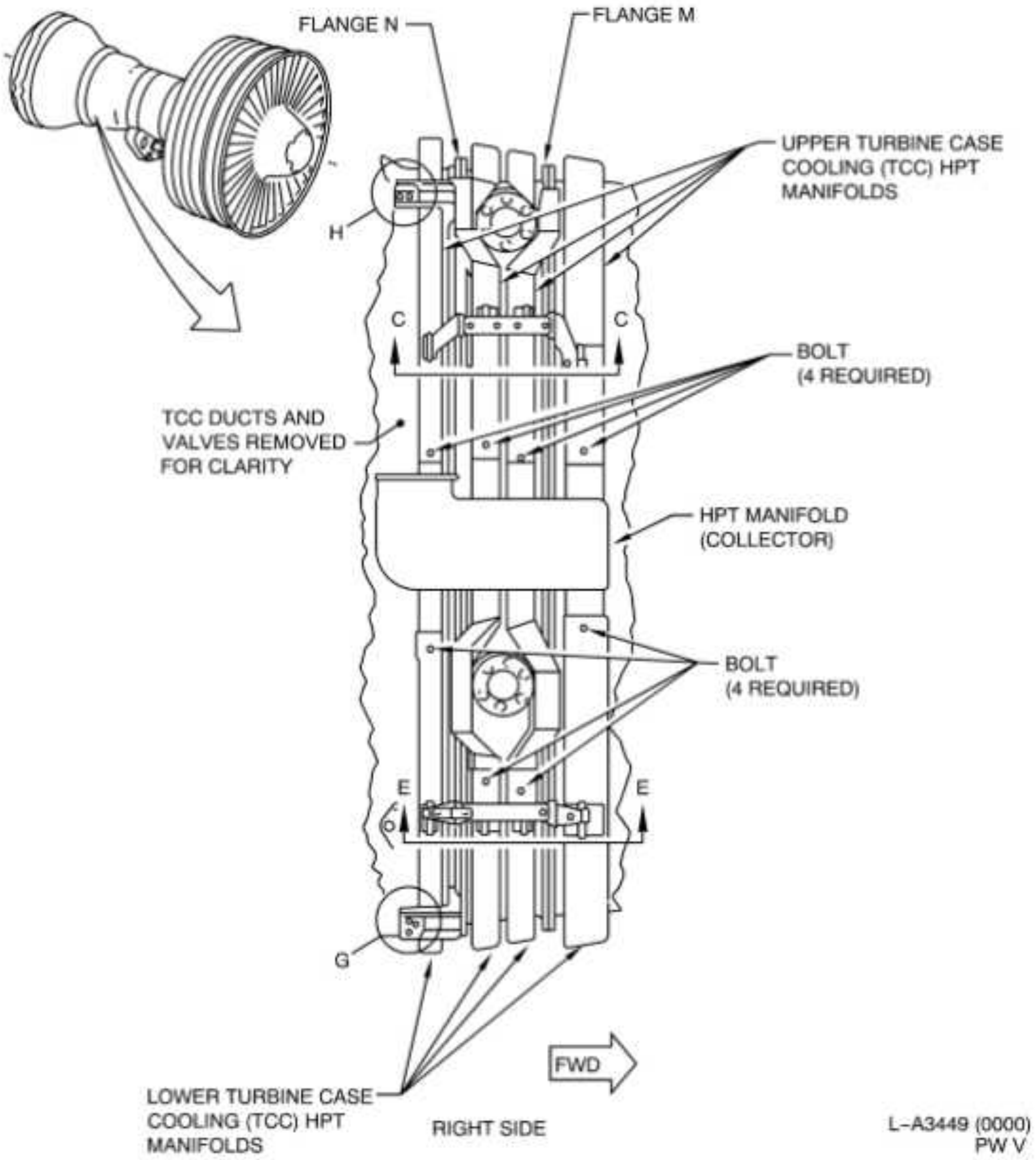
External Tubes For HPT (TCC) Clipping And Brackets
Figure 302 (Sheet 8)
(Task 72−00−52−050−003)


FWD
BOTTOM
LR06
A
FLANGE M
(REFERENCE)
LR06
TUBE
SHIELD
B
B
B
HOSE
CLAMP
LR05
LR04
VIEW A
CASE
FLANGE M
BRACKET
BOLT
(2 NECESSARY)
LOOP CLAMP
BRACKET
BOLT
CLAMP
LR06
SECTION B-B
L-B2531 (0000)
PW V

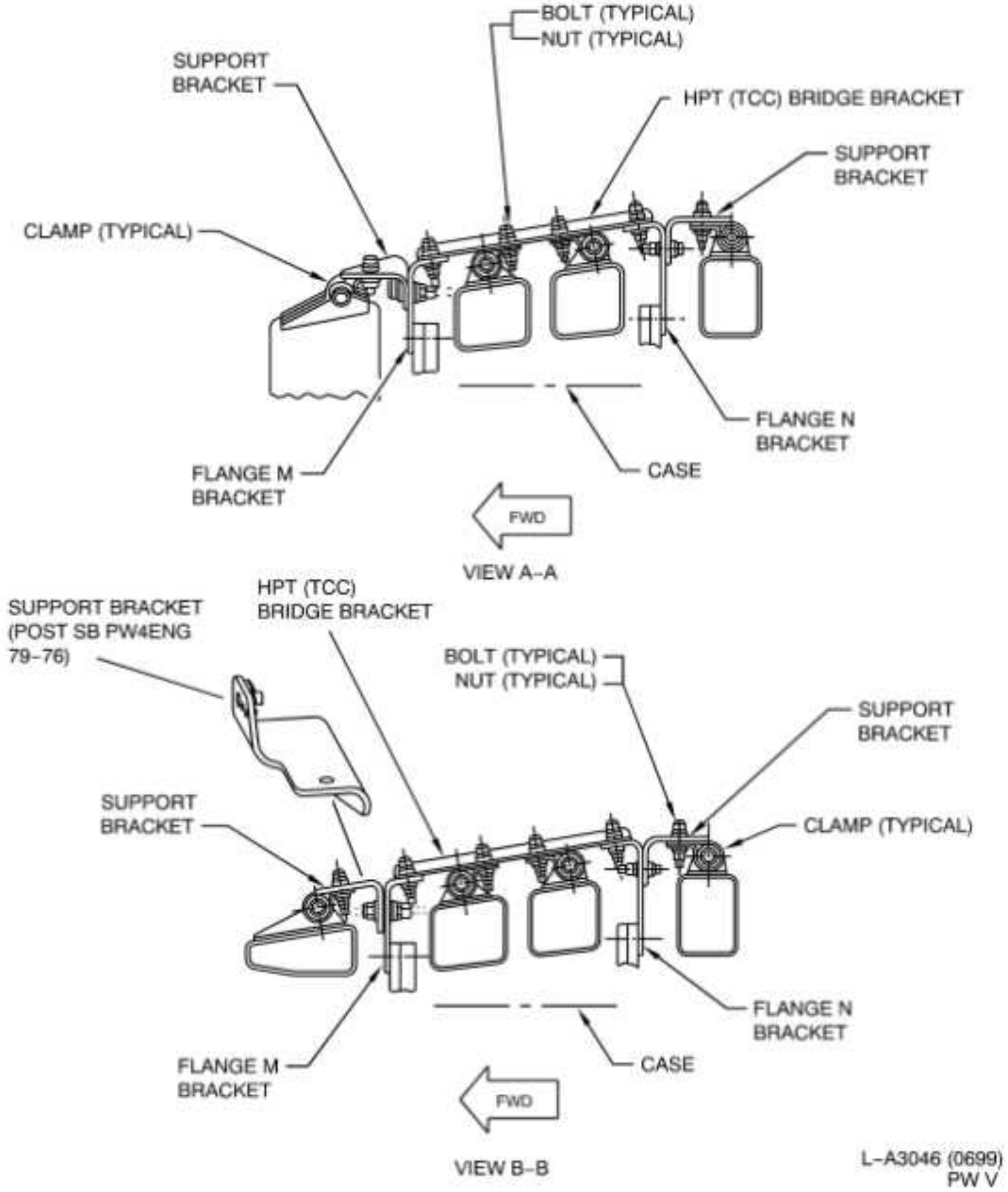
External Tubes For HPT (TCC) Clipping
And Brackets (Post SB PW4ENG 79−75)
Figure 302 (Sheet 9)
(Task 72−00−52−050−003)


FLANGE M
FLANGE N
B
B
UPPER TURBINE CASE COOLING (TCC) HPT MANIFOLDS
A
A
D
D
LOWER TURBINE CASE COOLING (TCC) HPT MANIFOLDS
F
F
FWD
LEFT SIDE
L-A3450 (0000)
PW V

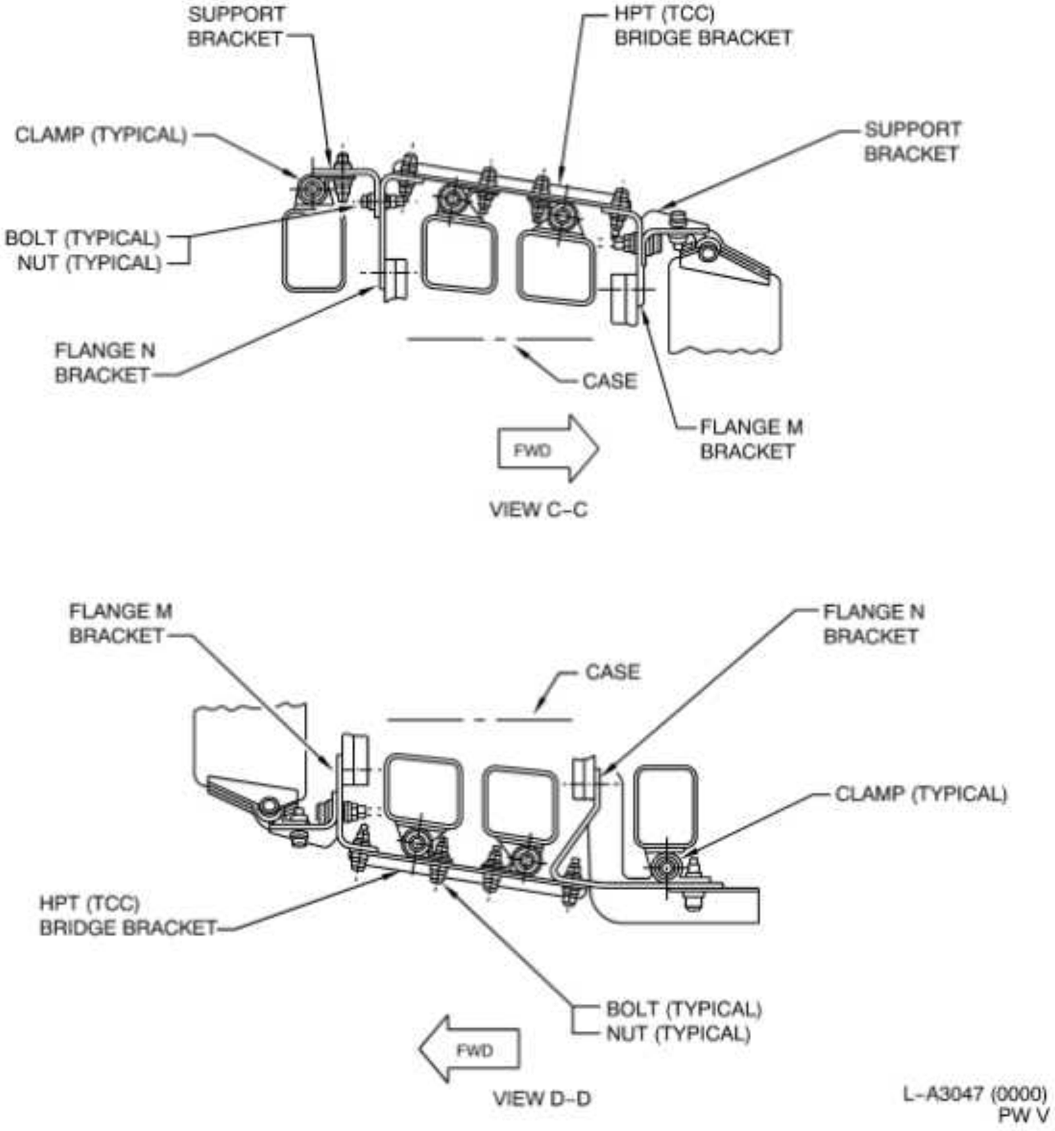
Turbine Case Cooling (TCC) Manifolds Clipping And Brackets
Figure 303 (Sheet 1)
(Task 72−00−52−050−003)


FLANGE N
FLANGE M
UPPER TURBINE CASE COOLING (TCC) HPT MANIFOLDS
H
C
C
BOLT (4 REQUIRED)
TCC DUCTS AND VALVES REMOVED FOR CLARITY
HPT MANIFOLD (COLLECTOR)
BOLT (4 REQUIRED)
E
E
G
FWD
LOWER TURBINE CASE COOLING (TCC) HPT MANIFOLDS
RIGHT SIDE
L−A3449 (0000)
PW V

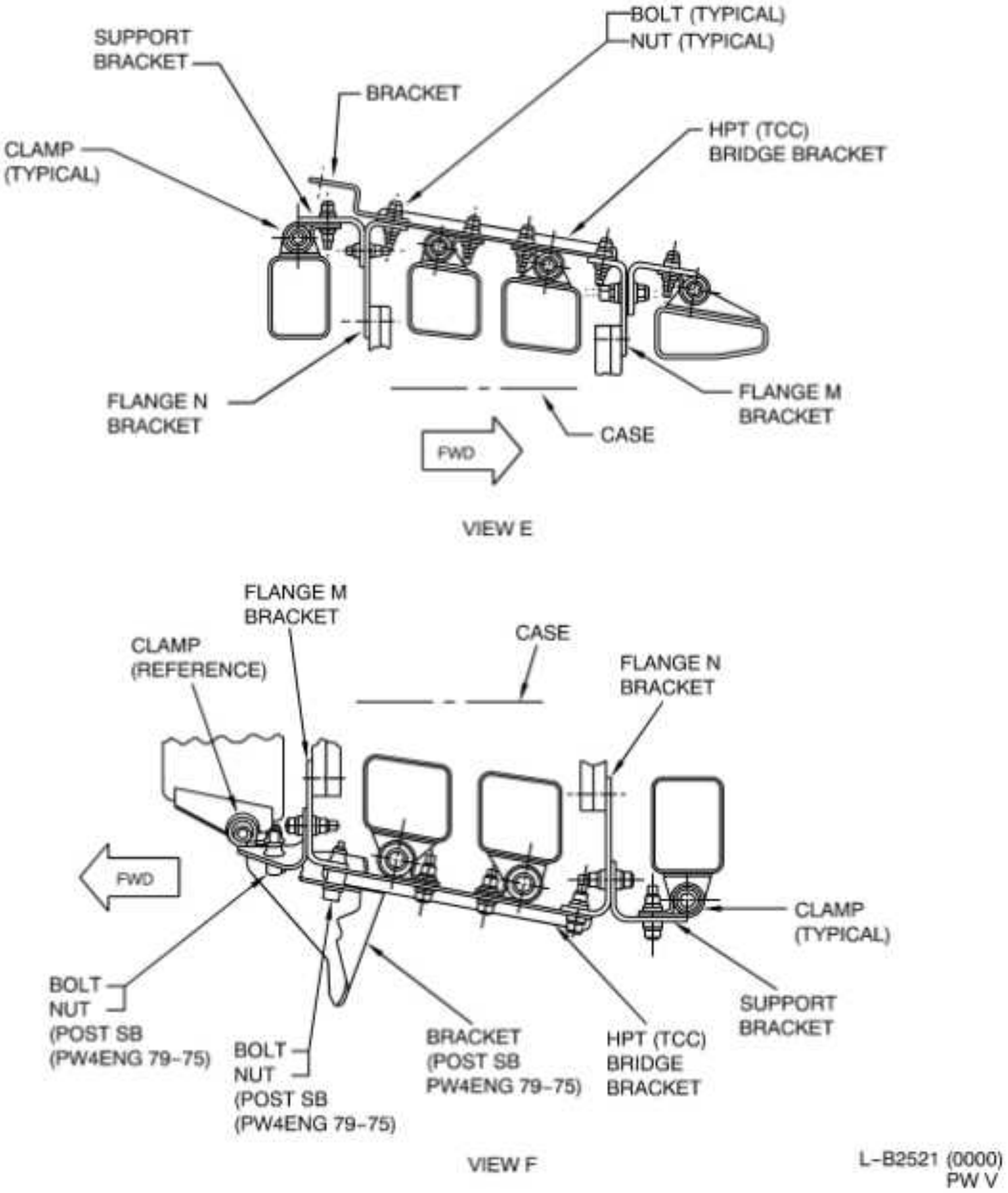
Turbine Case Cooling (TCC) Manifolds Clipping And Brackets
Figure 303 (Sheet 2)
(Task 72−00−52−050−003)


BOLT (TYPICAL)
NUT (TYPICAL)
SUPPORT BRACKET
HPT (TCC) BRIDGE BRACKET
SUPPORT BRACKET
CLAMP (TYPICAL)
FLANGE N BRACKET
CASE
FLANGE M BRACKET
FWD
VIEW A−A
SUPPORT BRACKET (POST SB PW4ENG 79−76)
HPT (TCC) BRIDGE BRACKET
BOLT (TYPICAL)
NUT (TYPICAL)
SUPPORT BRACKET
SUPPORT BRACKET
CLAMP (TYPICAL)
FLANGE N BRACKET
CASE
FLANGE M BRACKET
FWD
VIEW B−B
L−A3046 (0699)
PW V

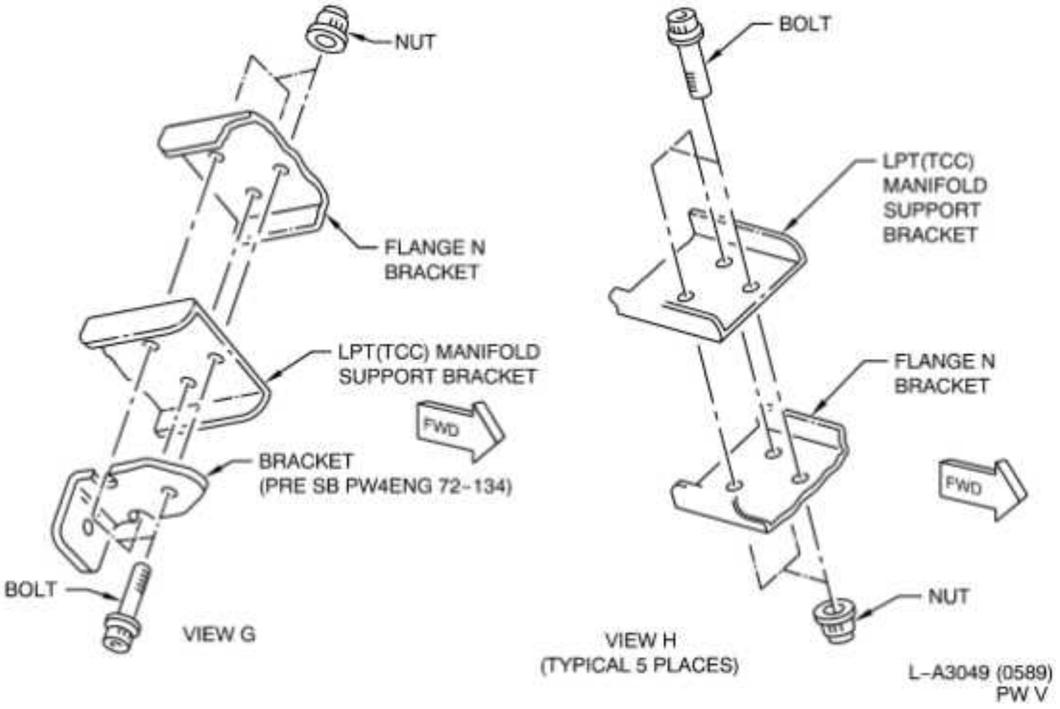
Turbine Case Cooling (TCC) Manifolds Clipping And Brackets
Figure 303 (Sheet 3)
(Task 72−00−52−050−003)


SUPPORT BRACKET
HPT (TCC) BRIDGE BRACKET
CLAMP (TYPICAL)
SUPPORT BRACKET
BOLT (TYPICAL)
NUT (TYPICAL)
FLANGE N BRACKET
CASE
FLANGE M BRACKET
FWD
VIEW C−C
FLANGE M BRACKET
FLANGE N BRACKET
CASE
CLAMP (TYPICAL)
HPT (TCC) BRIDGE BRACKET
BOLT (TYPICAL)
NUT (TYPICAL)
FWD
VIEW D−D
L−A3047 (0000)
PW V

Turbine Case Cooling (TCC) Manifolds Clipping And Brackets
Figure 303 (Sheet 4)
(Task 72−00−52−050−003)


BOLT (TYPICAL)
NUT (TYPICAL)
SUPPORT BRACKET
BRACKET
CLAMP (TYPICAL)
HPT (TCC) BRIDGE BRACKET
FLANGE N BRACKET
FLANGE M BRACKET
CASE
FWD
VIEW E
FLANGE M BRACKET
CLAMP (REFERENCE)
CASE
FLANGE N BRACKET
FWD
CLAMP (TYPICAL)
SUPPORT BRACKET
BOLT
NUT
(POST SB (PW4ENG 79−75)
BOLT
NUT
(POST SB (PW4ENG 79−75)
BRACKET (POST SB PW4ENG 79−75)
HPT (TCC) BRIDGE BRACKET
VIEW F
L−B2521 (0000)
PW V

Turbine Case Cooling (TCC) Manifolds Clipping And Brackets
Figure 303 (Sheet 5)
(Task 72−00−52−050−003)


NUT
FLANGE N BRACKET
LPT(TCC) MANIFOLD SUPPORT BRACKET
FWD
BRACKET (PRE SB PW4ENG 72-134)
BOLT
VIEW G
BOLT
LPT(TCC) MANIFOLD SUPPORT BRACKET
FLANGE N BRACKET
FWD
NUT
VIEW H (TYPICAL 5 PLACES)
L-A3049 (0589)
PW V

Turbine Case Cooling (TCC) Manifolds Clipping And Brackets
Figure 303 (Sheet 6)
(Task 72−00−52−050−003)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - REMOVAL-07

Task 72-00-52-050-004:

1. Remove Turbine Cooling Tubes

   A. Equipment And Materials Required - None

   B. Procedure

      (1) Remove the turbine vane cooling air duct (upper right) (AP01) as follows. See Figure 301.

         (a) Remove lockwire and bolts securing rear flange of cooling air duct to boss on HPT case at approximately the 1 o'clock position.

         (b) Remove lockwire and bolts securing front flange of cooling air duct and bracket to boss on HPC case.

         (c) Remove lockwire and bolts securing clamp to support on diffuser case and remove clamp.

         (d) Remove cooling air duct from engine.

         (e) Remove and discard the gasket from the boss on the HPC case.

         (f) (Pre SB PW4ENG 72-315) Remove and discard the gasket (post SB PW4ENG 75-57) from the boss on the HPT case.

         (g) (Post SB PW4ENG 72-315) Remove and discard the metering orifice seal plate from the boss on the HPT case.

         (h) Install protective closures.

      (2) Remove turbine vane cooling air duct (lower right) (AP02) as follows. See Figure 301.

         (a) Remove lockwire, bolts, and bracket securing rear flange of cooling air duct to boss on HPT case at approximately 4 o'clock position.

         (b) Remove bolts securing front flange of cooling air duct to flange of turbine vane and blade cooling air valve on the HPC case.

(c) Remove bolts, nuts and clamp that attach the cooling air duct to the bracket on Flange M and remove the duct from the engine. Discard the gasket from the front of the duct and the metering orifice seal plate (Engines without SB PW4ENG 75−57 or SB PW4ENG 72−315) or the gasket (Engines with SB PW4ENG 75−57 or SB PW4ENG 72−315) from the rear of the duct.

(d) Install protective closures.

(3) Remove turbine vane cooling air duct (upper Left) (AP04) as follows. See Figure 302.

(a) Remove the bolts that attach the front flange of the cooling air duct to the flange of the turbine vane cooling air valve on the HPC case. Remove and discard the gasket.

(b) Remove the lockwire and bolts that attach the rear flange of the cooling air duct to the boss on the HPT case at approximately the 9 o'clock position.

(c) Remove bolts, nuts, and clamp securing cooling air duct to bracket on diffuser case pad and remove duct from engine. Discard the gasket (Engines with SB PW4ENG 72−315 or SB PW4ENG 75−57) or metering orifice seal plate (Engines without SB PW4ENG 72−315 or SB PW4ENG 75−57).

(d) Install protective closures.

CAUTION: REMOVE BORESCOPE PLUG (IF EQUIPPED) FROM LOWER LEFT TURBINE VANE COOLING AIR DUCT ELBOW PRIOR TO REMOVAL OF DUCT. FAILURE TO DO SO COULD RESULT IN DAMAGE TO PLUG.

(4) Remove turbine vane cooling air duct (lower left) (AP03) as follows. See Figure 302.

(a) For engines equipped, remove lockwire and three bolts securing borescope plug to rear elbow. If necessary use two jackscrews (.190−32 thread) and remove borescope plug evenly.

(b) Remove the lockwire and bolts that attach the front flange of the cooling air duct and tube bracket to the boss on the HPC case.

(c) Remove the bolt and nut that attach the No. 3 bearing pressure manifold (LP18) to the bracket on the front flange of the cooling air tube (AP03).

NOTE: The spray shield for the manifold can stay with the clamp.

(d) Loosen clamp bolt securing No. 4 bearing oil pressure tube (front) (LP15) to bracket at front flange of duct. Move the bracket to permit removal of the duct.

(e) Remove lockwire and bolts securing rear flange of cooling air duct to boss on HPT case at approximately the 7 o'clock position.

(f) Remove bolts, nuts, and clamp securing cooling air duct to bracket on diffuser case pad and remove cooling air duct from engine.

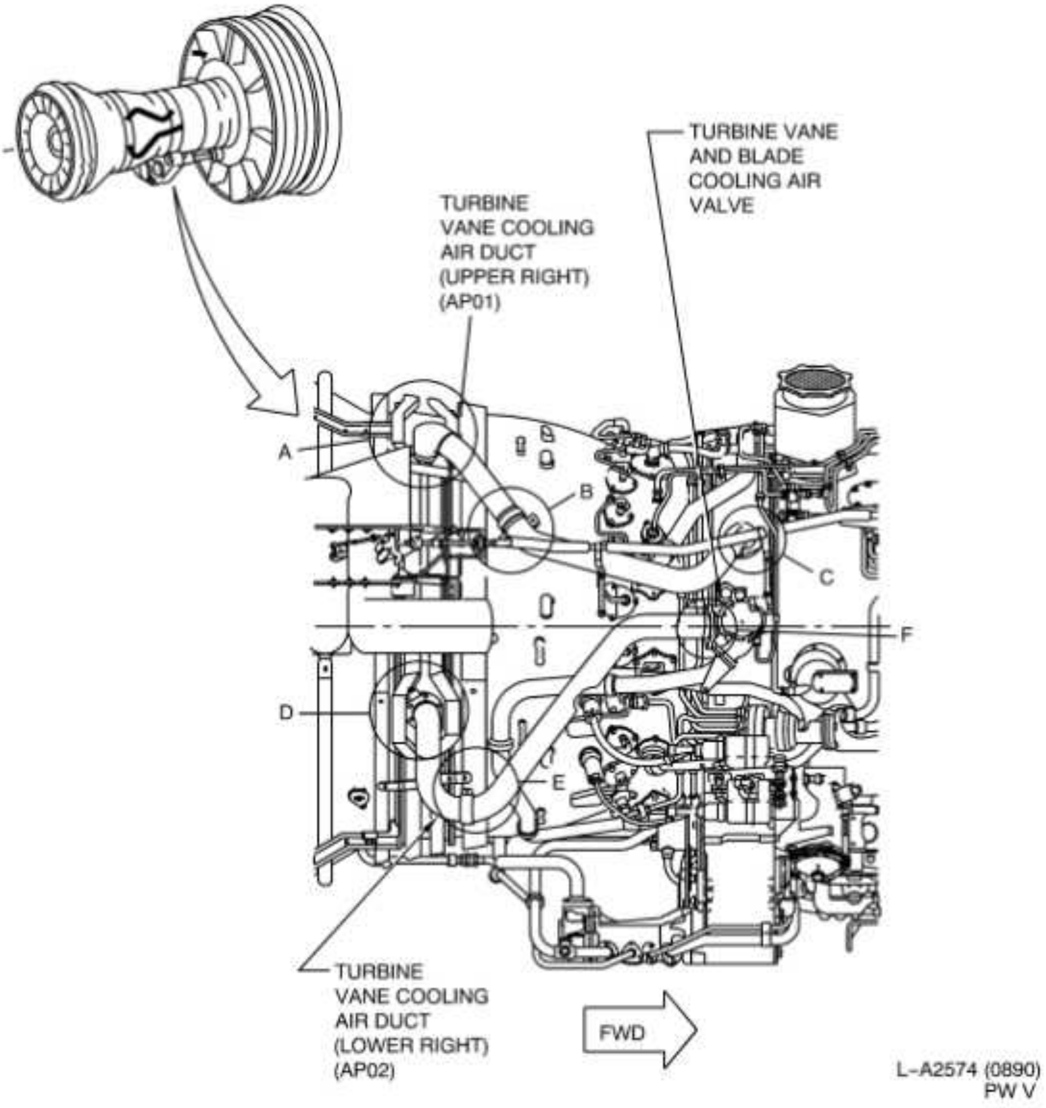
(g) Remove and discard the gasket from the boss on the HPC case.

(h) Remove and discard the metering orifice seal plate from the boss on the HPT case (Engines with SB PW4ENG 72-315 and without SB PW4ENG 75-57).

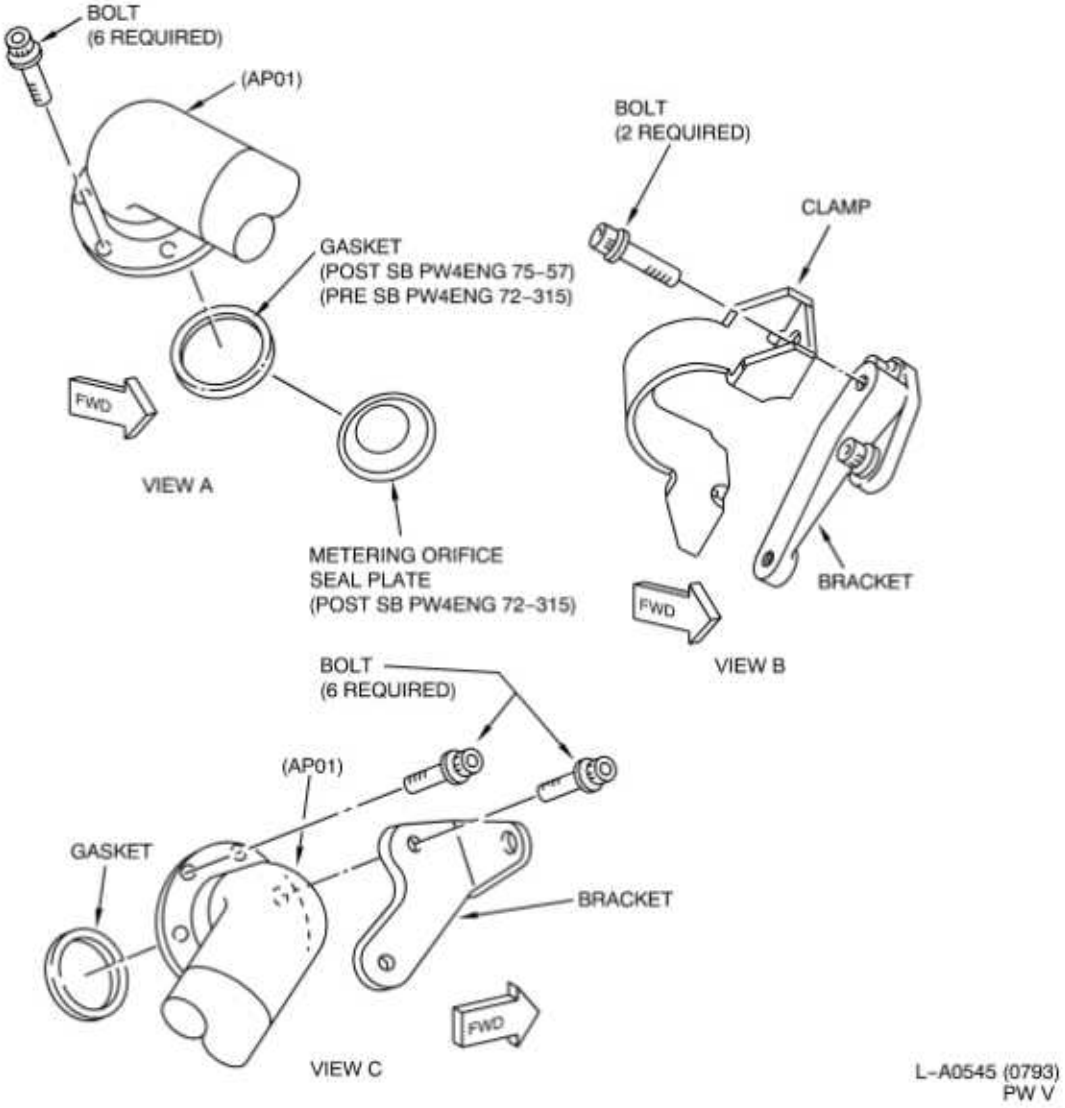
(i) Remove and discard the gasket from the boss on the HPT case (Engines without SB PW4ENG 72-315 and with SB PW4ENG 75-57).

(j) Install protective closures.

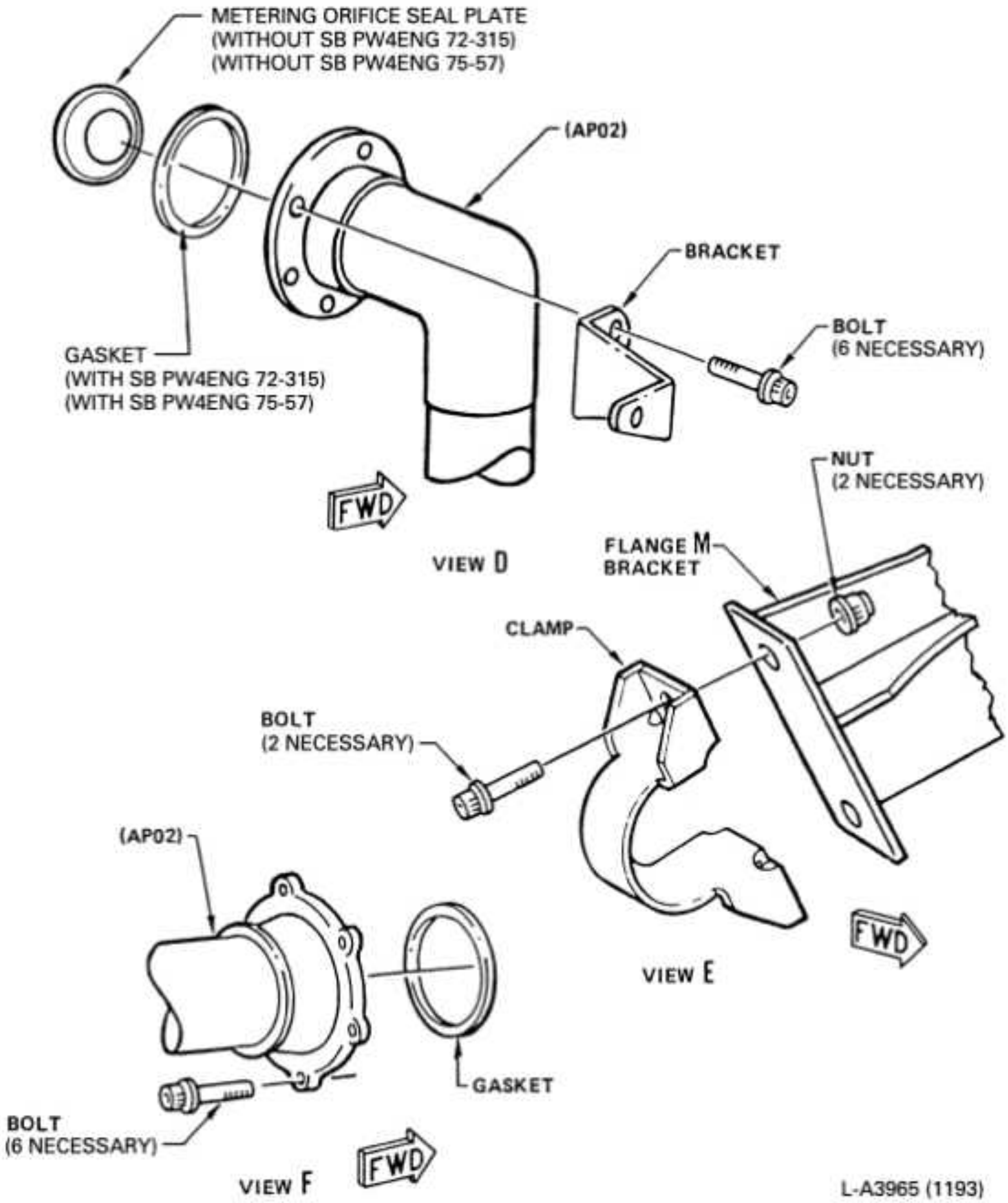
ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−07


TURBINE VANE AND BLADE COOLING AIR VALVE
TURBINE VANE COOLING AIR DUCT (UPPER RIGHT) (AP01)
A
B
C
D
E
F
TURBINE VANE COOLING AIR DUCT (LOWER RIGHT) (AP02)
FWD
L-A2574 (0890)
PW V

Turbine Vane Cooling Air Ducts
(Right Side)
Figure 301 (Sheet 1)
(Task 72−00−52−050−004)

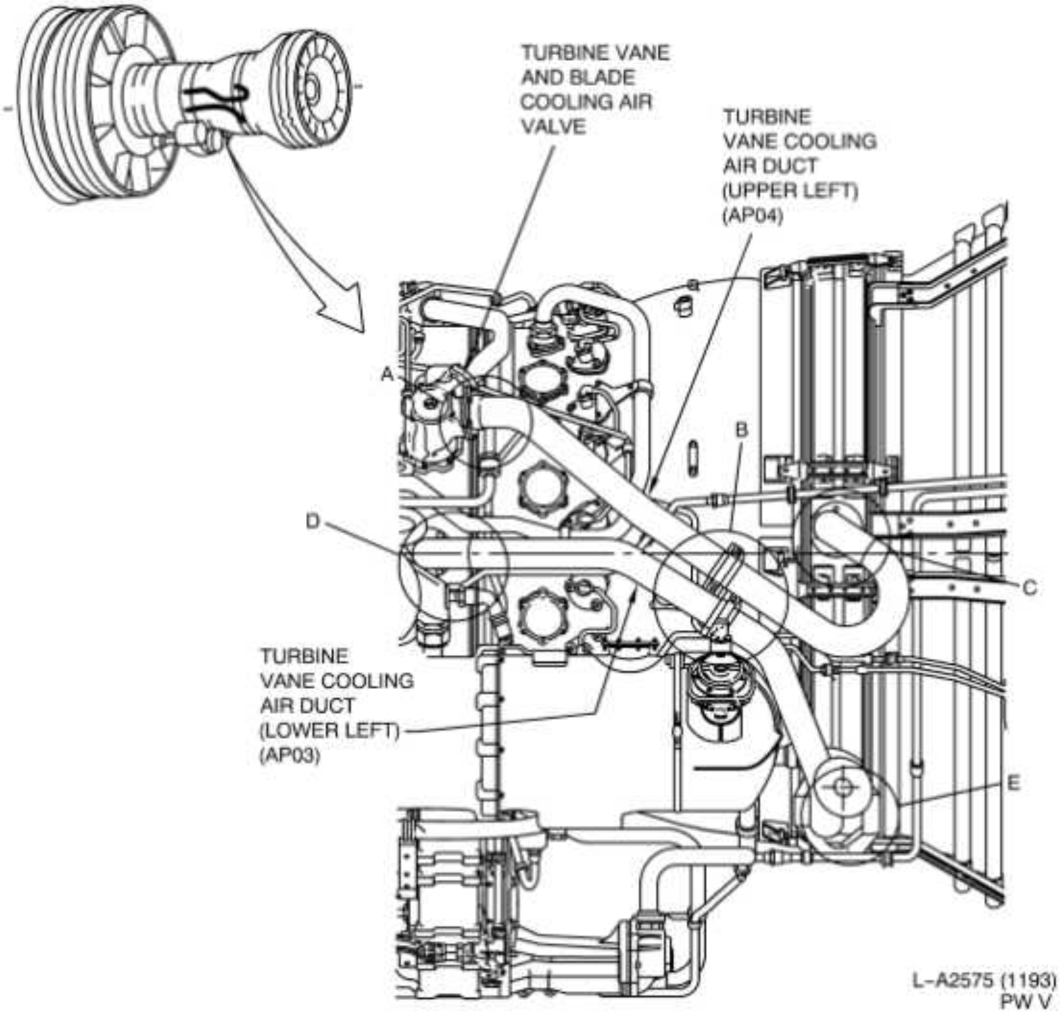

BOLT
(6 REQUIRED)
(AP01)
GASKET
(POST SB PW4ENG 75-57)
(PRE SB PW4ENG 72-315)
FWD
VIEW A
METERING ORIFICE
SEAL PLATE
(POST SB PW4ENG 72-315)
BOLT
(2 REQUIRED)
CLAMP
BRACKET
FWD
VIEW B
BOLT
(6 REQUIRED)
(AP01)
GASKET
BRACKET
FWD
VIEW C
L-A0545 (0793)
PW V

Turbine Vane Cooling Air Ducts
(Right Side)
Figure 301 (Sheet 2)
(Task 72−00−52−050−004)

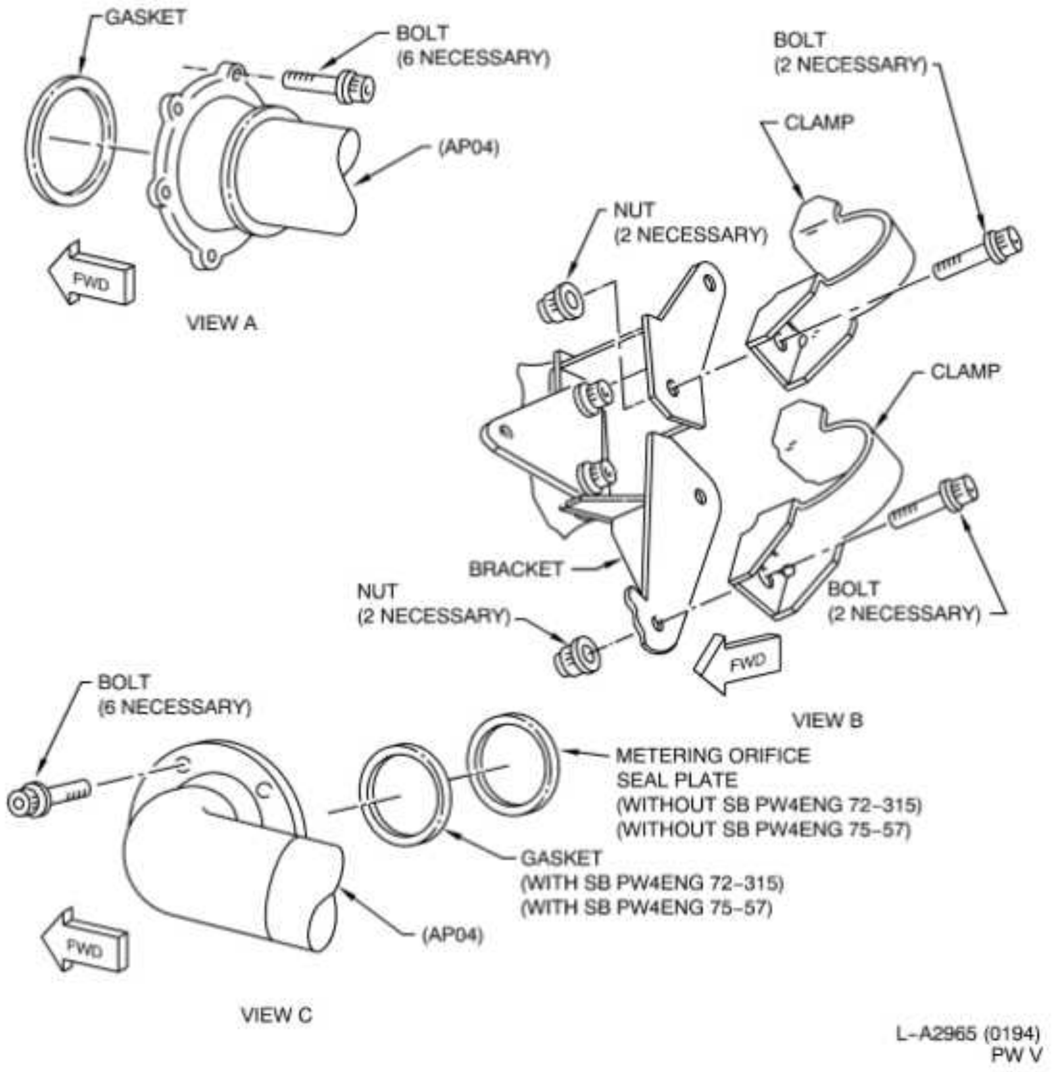

METERING ORIFICE SEAL PLATE
(WITHOUT SB PW4ENG 72-315)
(WITHOUT SB PW4ENG 75-57)
(AP02)
BRACKET
BOLT
(6 NECESSARY)
GASKET
(WITH SB PW4ENG 72-315)
(WITH SB PW4ENG 75-57)
FWD
VIEW D
NUT
(2 NECESSARY)
FLANGE M
BRACKET
CLAMP
BOLT
(2 NECESSARY)
(AP02)
FWD
VIEW E
GASKET
BOLT
(6 NECESSARY)
VIEW F
FWD
L-A3965 (1193)

Turbine Vane Cooling Air Ducts
(Right Side)
Figure 301 (Sheet 3)
(Task 72-00-52-050-004)

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−07

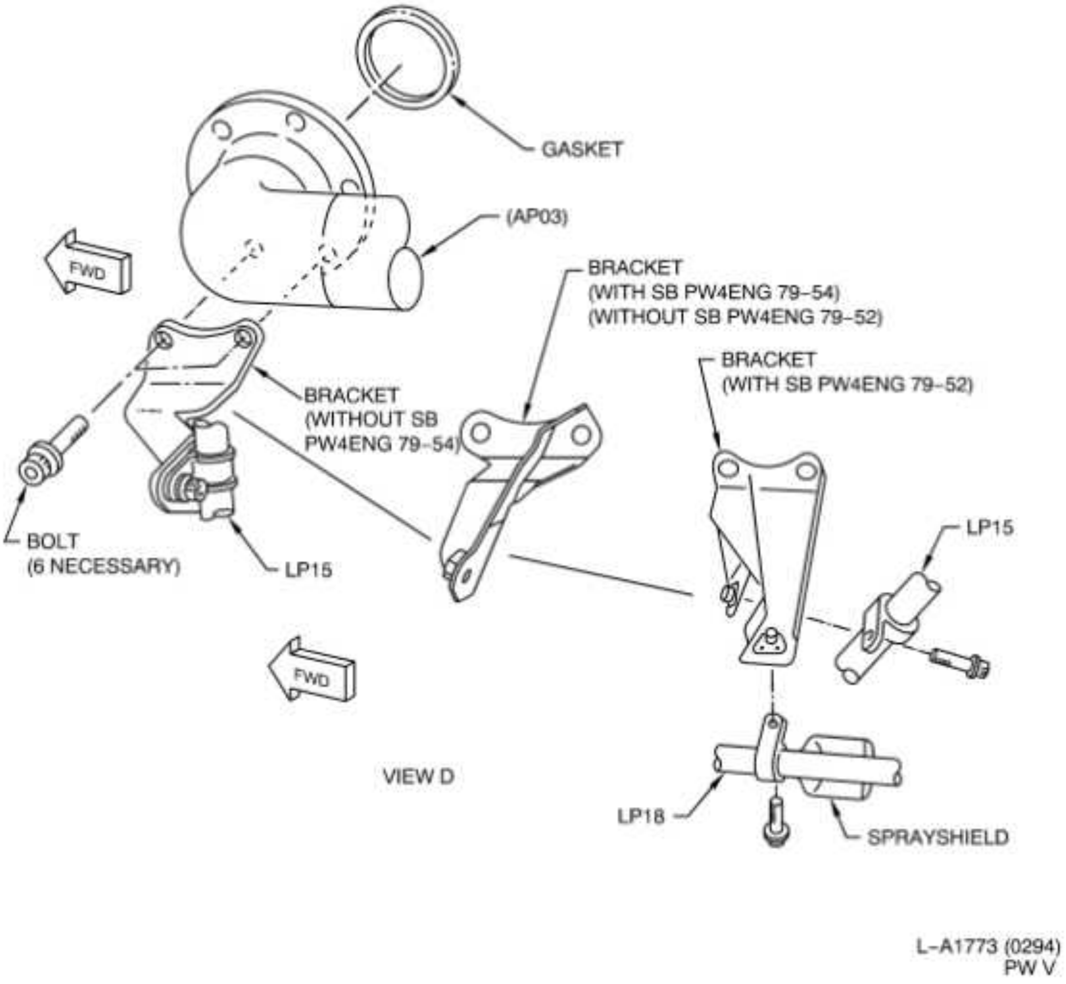

TURBINE VANE AND BLADE COOLING AIR VALVE
TURBINE VANE COOLING AIR DUCT (UPPER LEFT) (AP04)
A
B
C
D
E
TURBINE VANE COOLING AIR DUCT (LOWER LEFT) (AP03)
L−A2575 (1193)
PW V

Turbine Vane Cooling Air Ducts
(Left Side)
Figure 302 (Sheet 1)
(Task 72−00−52−050−004)

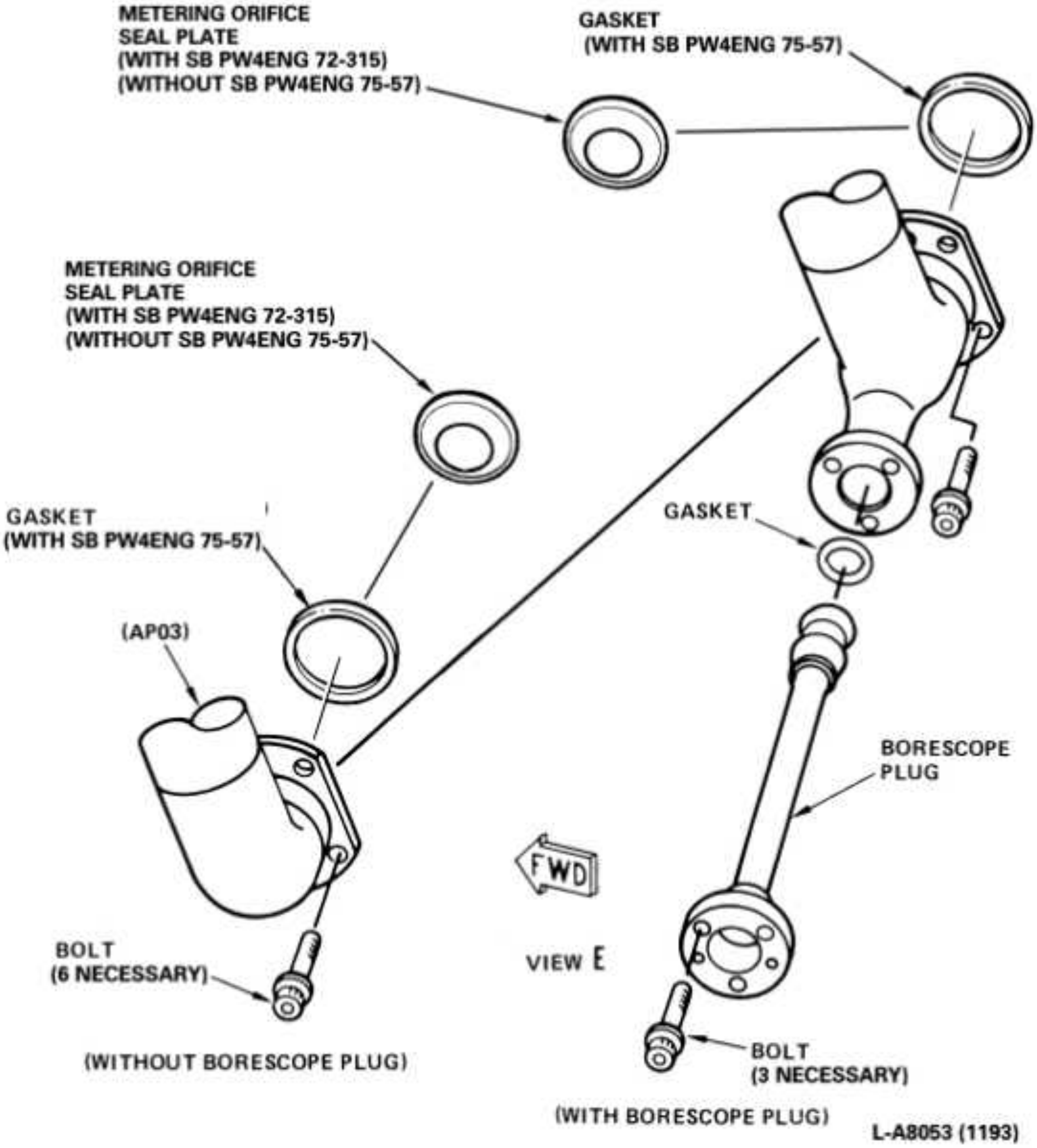

GASKET
BOLT
(6 NECESSARY)
(AP04)
FWD
VIEW A
BOLT
(2 NECESSARY)
CLAMP
NUT
(2 NECESSARY)
CLAMP
BRACKET
NUT
(2 NECESSARY)
BOLT
(2 NECESSARY)
FWD
VIEW B
BOLT
(6 NECESSARY)
METERING ORIFICE
SEAL PLATE
(WITHOUT SB PW4ENG 72-315)
(WITHOUT SB PW4ENG 75-57)
GASKET
(WITH SB PW4ENG 72-315)
(WITH SB PW4ENG 75-57)
(AP04)
FWD
VIEW C
L-A2965 (0194)
PW V

Turbine Vane Cooling Air Ducts
(Left Side)
Figure 302 (Sheet 2)
(Task 72−00−52−050−004)

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−07


GASKET
(AP03)
FWD
BRACKET
(WITH SB PW4ENG 79−54)
(WITHOUT SB PW4ENG 79−52)
BRACKET
(WITHOUT SB
PW4ENG 79−54)
BRACKET
(WITH SB PW4ENG 79−52)
LP15
BOLT
(6 NECESSARY)
LP15
FWD
VIEW D
LP18
SPRAYSHIELD
L−A1773 (0294)
PW V

Turbine Vane Cooling Air Ducts
(Left Side)
Figure 302 (Sheet 3)
(Task 72−00−52−050−004)


METERING ORIFICE SEAL PLATE (WITH SB PW4ENG 72-315) (WITHOUT SB PW4ENG 75-57)
GASKET (WITH SB PW4ENG 75-57)
METERING ORIFICE SEAL PLATE (WITH SB PW4ENG 72-315) (WITHOUT SB PW4ENG 75-57)
GASKET
GASKET (WITH SB PW4ENG 75-57)
(AP03)
BORESCOPE PLUG
FWD
BOLT (6 NECESSARY)
VIEW E
(WITHOUT BORESCOPE PLUG)
BOLT (3 NECESSARY)
(WITH BORESCOPE PLUG)
L-A8053 (1193)

Turbine Vane Cooling Air Ducts
(Left Side)
Figure 302 (Sheet 4)
(Task 72−00−52−050−004)

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−07

Task 72−00−52−050−005:

1. Remove Turbine Cooling Tubes

    A. Equipment And Materials Required − None

    B. Procedure

        (1) Remove the (upper right) turbine vane cooling air duct (AP01) as follows. See Figure 301.

            (a) Remove the lockwire and bolts that attach the rear flange of the cooling air duct to the boss on the HPT case at approximately the 1 o'clock position.

            (b) Remove the lockwire and bolts that attach the front flange of the cooling air duct to the flange of the turbine vane cooling air valve on the HPC case.

            (c) Remove the lockwire and bolts that attach a clamp to the support on the diffuser case. Remove the clamp.

            (d) Remove the cooling air duct from the engine.

            (e) Remove and discard the gasket from the front flange of the duct.

            (f) Remove the metering orifice seal plate from the boss on the HPT case and discard the plate.

            (g) Install protection covers.

        (2) Remove the (lower right) turbine vane cooling air duct (AP02) as follows. See Figure 301.

            (a) Remove the lockwire and bolts that attach the rear flange of the cooling air duct to the boss on the HPT case at approximately the 4 o'clock position.

            (b) Remove the bolts which attach the front flange of the cooling air duct to the flange of the turbine vane and blade cooling air valve on the HPC case.

            (c) Remove the bolts, nuts and clamp that holds the cooling air duct to the bracket on Flange M. Remove the duct from the engine and discard the gaskets.

(d) Install protection covers.

(3) Remove turbine vane cooling air duct (upper Left) (AP04) as follows. See Figure 302.

(a) Remove the bolts that attach the front flange of the cooling air duct to the flange of the turbine vane cooling air valve on the HPC case. Remove and discard the gasket.

(b) Remove the lockwire and bolts that attach the rear flange of the cooling air duct to the boss on the HPT case at approximately the 9 o'clock position.

(c) Remove the bolts, nuts and clamp that attaches the cooling air duct to the bracket on the diffuser case pad and remove the duct from the engine. Discard the gaskets.

(d) Install protective closures.

CAUTION: REMOVE BORESCOPE PLUG (IF EQUIPPED) FROM LOWER LEFT TURBINE VANE COOLING AIR DUCT ELBOW PRIOR TO REMOVAL OF DUCT. FAILURE TO DO SO COULD RESULT IN DAMAGE TO PLUG.

(4) Remove turbine vane cooling air duct (lower left) (AP03) as follows. See Figure 302.

(a) For engines equipped, remove lockwire and three bolts securing borescope plug to rear elbow. If necessary use two jackscrews (.190−32 thread) and remove borescope plug evenly.

(b) Remove the lockwire and bolts that attach the front flange of the cooling air duct and tube bracket to the boss on the HPC case.

(c) Remove the bolt and nut that attach the No. 3 bearing pressure manifold (LP18) to the bracket on the front flange of the cooling air tube (AP03).

NOTE: The spray shield for the manifold can stay with the clamp.

(d) Loosen clamp bolt securing No. 4 bearing oil pressure tube (front) (LP15) to bracket at front flange of duct. Move the bracket to permit removal of the duct.

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−07

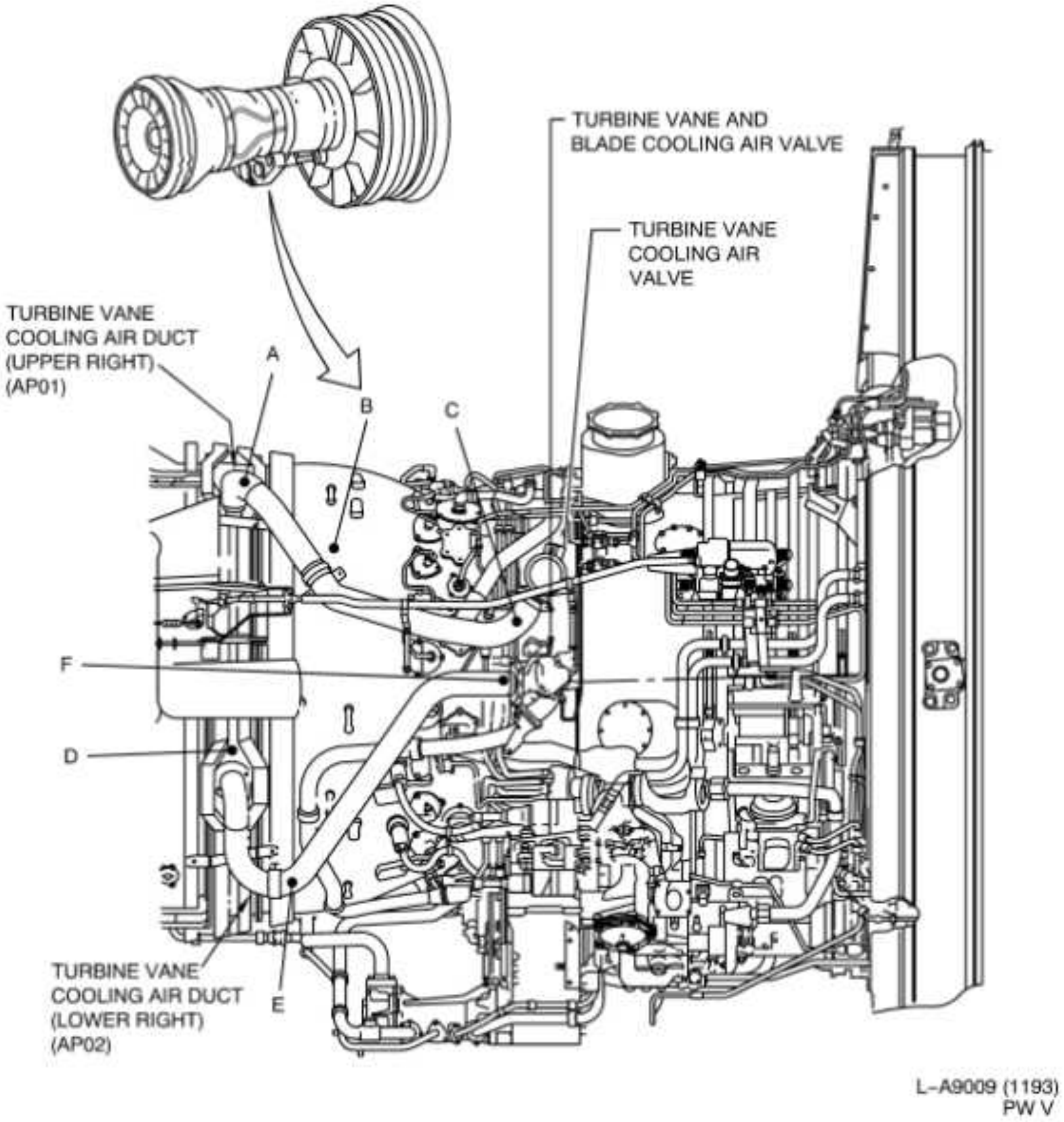
(e) Remove lockwire and bolts securing rear flange of cooling air duct to boss on HPT case at approximately the 7 o'clock position.

(f) Remove bolts, nuts, and clamp securing cooling air duct to bracket on diffuser case pad and remove cooling air duct from engine.

(g) Remove and discard the gasket from the boss on the HPC case.

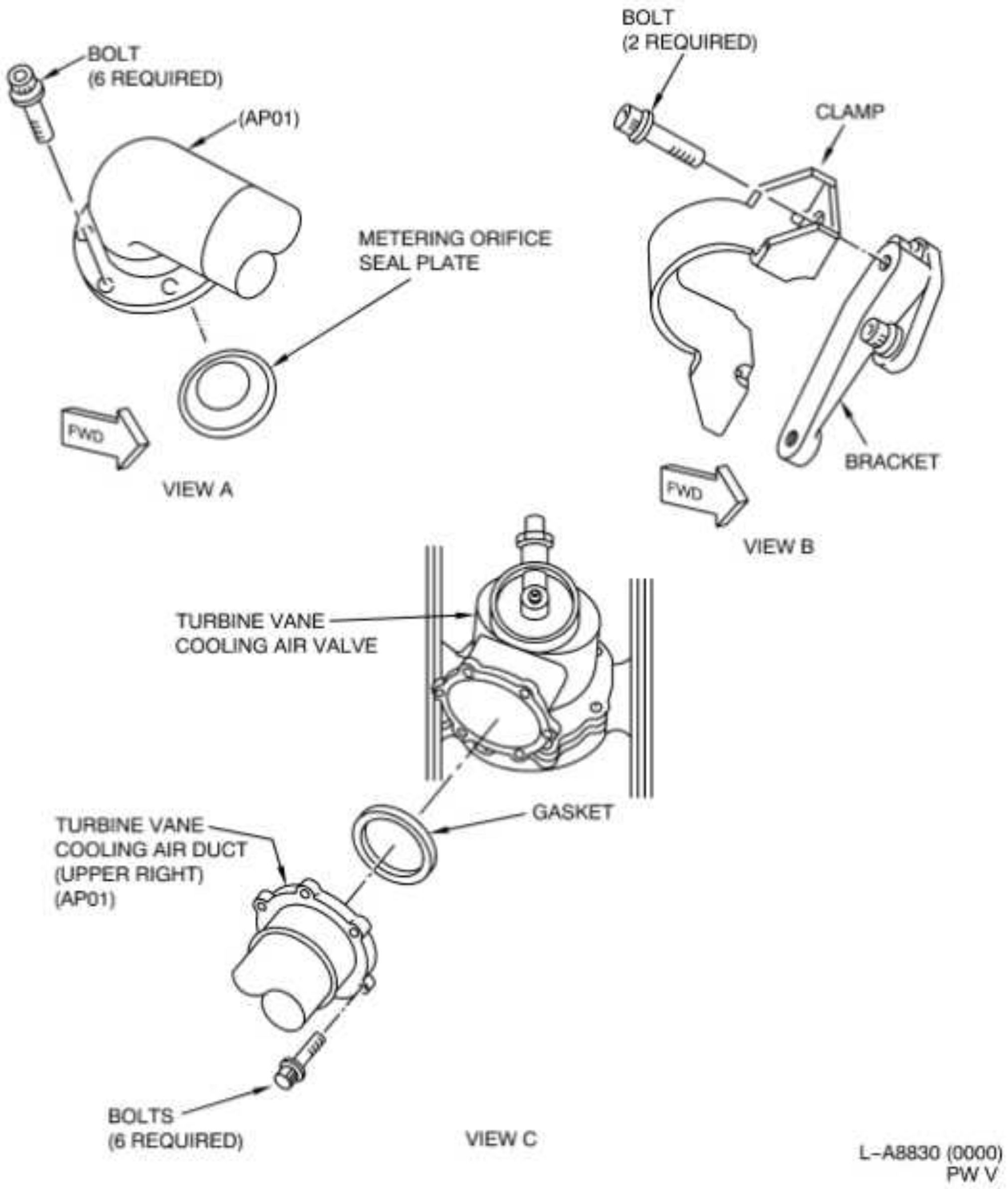
(h) Remove and discard the metering orifice seal plate from the boss on the HPT case.

(i) Install protective closures.

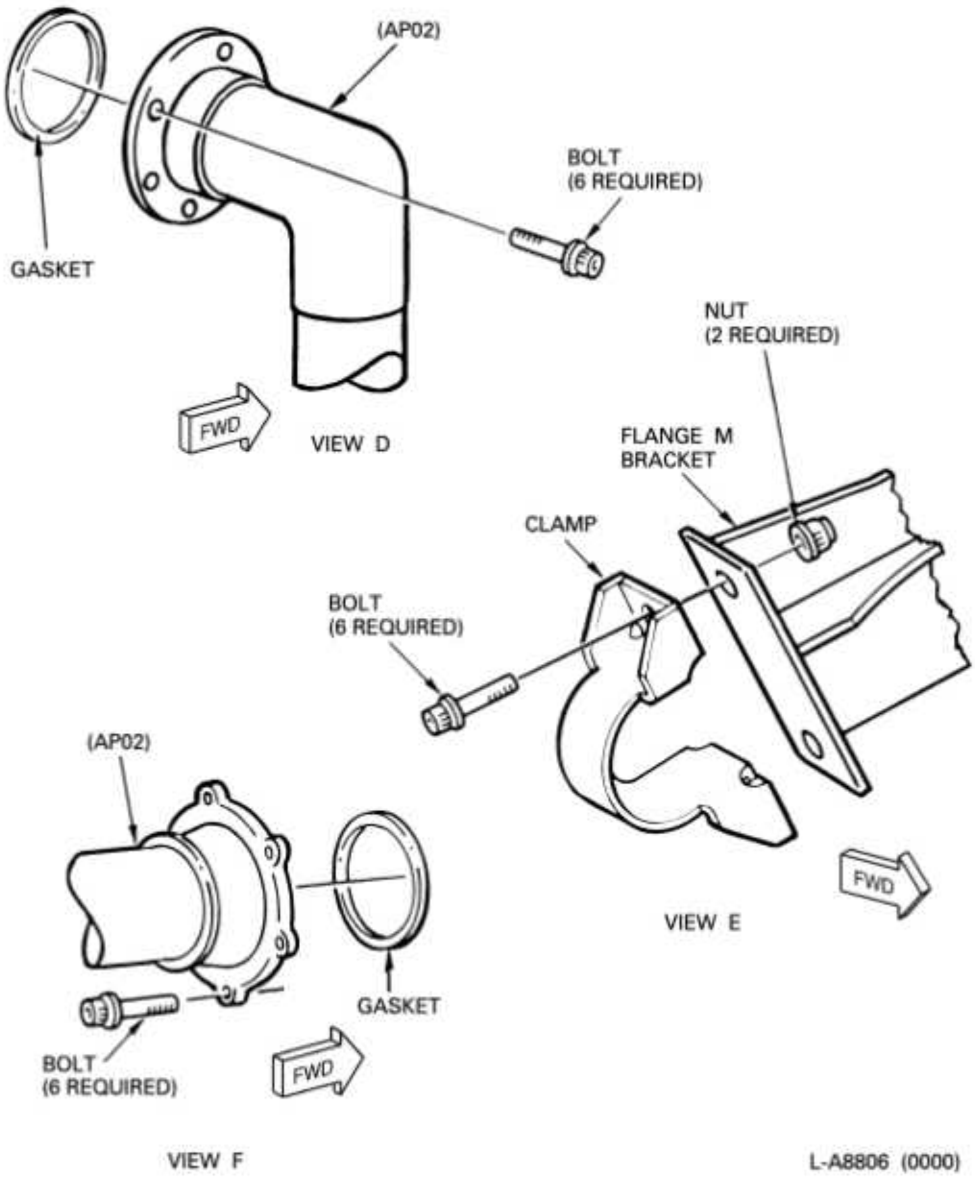

TURBINE VANE AND
BLADE COOLING AIR VALVE
TURBINE VANE
COOLING AIR
VALVE
TURBINE VANE
COOLING AIR DUCT
(UPPER RIGHT)
(AP01)
A
B
C
F
D
TURBINE VANE
COOLING AIR DUCT
(LOWER RIGHT)
(AP02)
E
L−A9009 (1193)
PW V

Turbine Vane Cooling Air Ducts (Right Side)
Figure 301 (Sheet 1)
(Task 72−00−52−050−005)

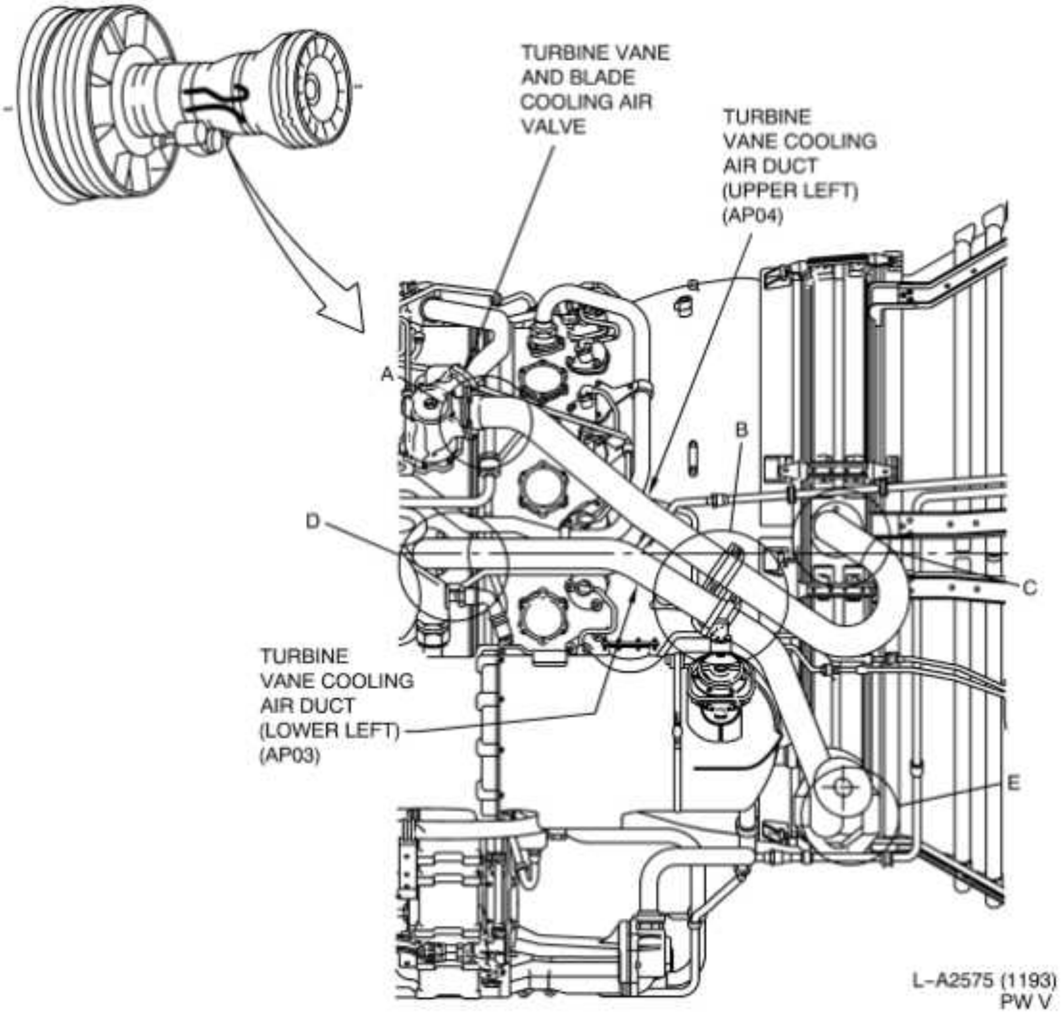
ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−07


BOLT
(6 REQUIRED)
(AP01)
METERING ORIFICE
SEAL PLATE
FWD
VIEW A
BOLT
(2 REQUIRED)
CLAMP
BRACKET
FWD
VIEW B
TURBINE VANE
COOLING AIR VALVE
GASKET
TURBINE VANE
COOLING AIR DUCT
(UPPER RIGHT)
(AP01)
BOLTS
(6 REQUIRED)
VIEW C
L−A8830 (0000)
PW V

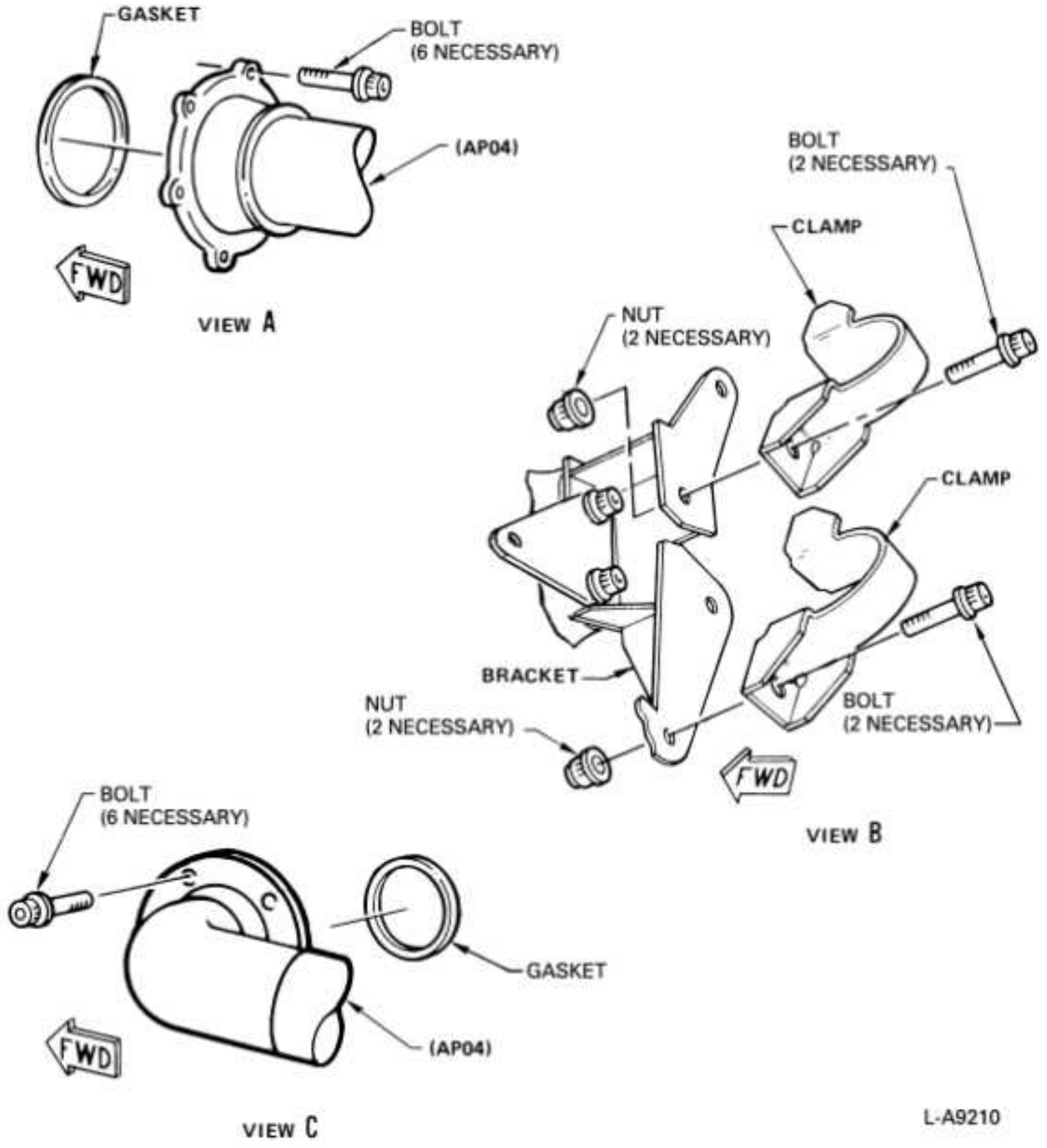
Turbine Vane Cooling Air Ducts (Right Side)
Figure 301 (Sheet 2)
(Task 72−00−52−050−005)


(AP02)
GASKET
BOLT
(6 REQUIRED)
FWD
VIEW D
NUT
(2 REQUIRED)
FLANGE M
BRACKET
CLAMP
BOLT
(6 REQUIRED)
(AP02)
FWD
VIEW E
GASKET
BOLT
(6 REQUIRED)
FWD
VIEW F
L-A8806 (0000)

Turbine Vane Cooling Air Ducts (Right Side)
Figure 301 (Sheet 3)
(Task 72−00−52−050−005)

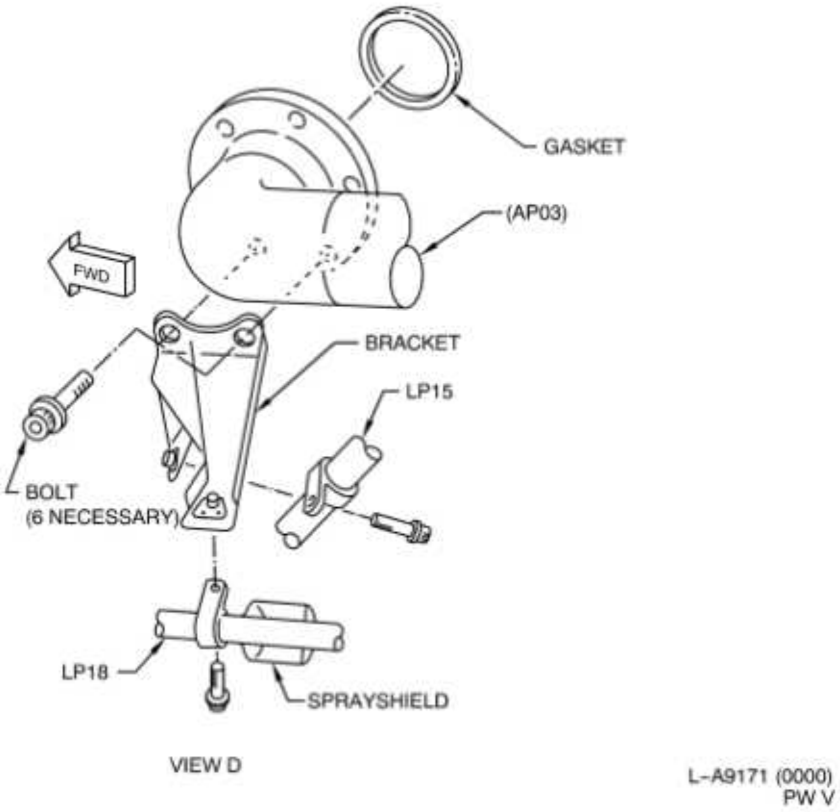

TURBINE VANE AND BLADE COOLING AIR VALVE
TURBINE VANE COOLING AIR DUCT (UPPER LEFT) (AP04)
A
B
C
D
E
TURBINE VANE COOLING AIR DUCT (LOWER LEFT) (AP03)
L−A2575 (1193)
PW V

Turbine Vane Cooling Air Ducts (Left Side)
Figure 302 (Sheet 1)
(Task 72−00−52−050−005)

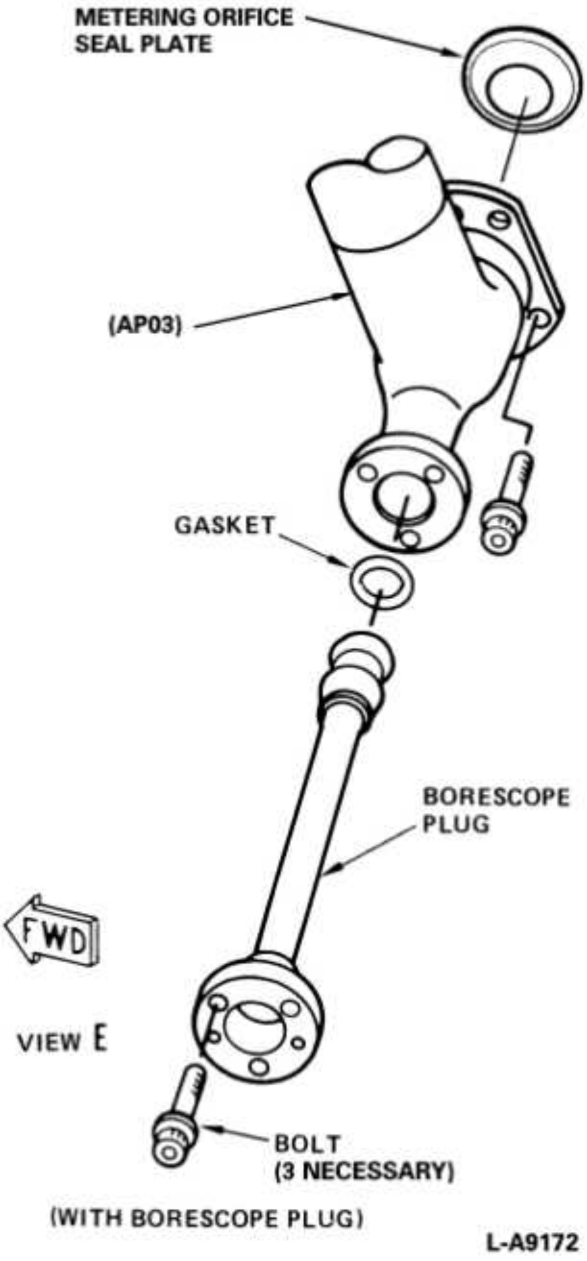

GASKET
BOLT
(6 NECESSARY)
(AP04)
FWD
VIEW A
BOLT
(2 NECESSARY)
CLAMP
NUT
(2 NECESSARY)
CLAMP
BRACKET
NUT
(2 NECESSARY)
BOLT
(2 NECESSARY)
FWD
VIEW B
BOLT
(6 NECESSARY)
GASKET
(AP04)
FWD
VIEW C
L-A9210

Turbine Vane Cooling Air Ducts (Left Side)
Figure 302 (Sheet 2)
(Task 72−00−52−050−005)

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−07


GASKET
(AP03)
FWD
BRACKET
LP15
BOLT
(6 NECESSARY)
LP18
SPRAYSHIELD
VIEW D
L-A9171 (0000)
PW V

Turbine Vane Cooling Air Ducts (Left Side)
Figure 302 (Sheet 3)
(Task 72−00−52−050−005)


METERING ORIFICE SEAL PLATE
(AP03)
GASKET
BORESCOPE PLUG
FWD
VIEW E
BOLT (3 NECESSARY)
(WITH BORESCOPE PLUG)
L-A9172

Turbine Vane Cooling Air Ducts (Left Side)
Figure 302 (Sheet 4)
(Task 72−00−52−050−005)

Previous Pageblock   Return to Previous Menu   Next Pageblock

ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - REMOVAL-08

Task 72-00-52-020-002:

1. Remove The High Pressure Turbine - Vertical

NOTE: See Figure 301 for Part/Assembly Removal Procedure.

A. Prerequisites

(1) Remove The Low Pressure Turbine. Refer to 72-00-53, Removal-01 (Task 72-00-53-020-001).

(2) Remove The External Plumbing Prior To High Pressure Turbine Removal. Refer to 72-00-52, Removal-03 (Task 72-00-52-020-003).

B. Equipment And Materials Required

Special Tools:

PWA 3755	Pump, Hydraulic (Optional To PWA 29389)
PWA 25000	Wrench, Hydraulic
PWA 28657	Sling, Strongback
PWA 28668	Pump, Hydraulic (Electric) (Use With Hydraulic Wrench)
PWA 28669	Cart, Storage (Optional) (Use With Hydraulic Wrench)
PWA 29389	Pump, Hydraulic
PWA 29510	Pump, Hydraulic (Hand) (Use With Hydraulic Wrench)
PWA 29614	Wrench, Mechanical*
PWA 45419	Air Torque Multiplier* (Use With Mechanical Wrench)
PWA 76154	Adapter (2 Necessary)
PWA 76156	Adapter (2 Necessary)
PWA 80651	Multiplier, Pneumatic* (Use With Mechanical Wrench)
PWA 85107	Fixture, Handle
PWA 85110	Puller, Knocker
PWA 85112	Fixture, Retaining (Optional)
PWA 85114	Wrench, Torque (Use With Hydraulic Wrench)
PWA 85115	Adapter, Wrench (Use With Hydraulic Wrench)
PWA 85116	Wrench, Torque* (Use With Mechanical Wrench)
PWA 85117	Adapter, Wrench* (Use With Mechanical Wrench)
PWA 86058	Retainer, Storage (Optional)
PWA 86537	Cover, Protective (Optional)
PWA 87022	Stand, Storage
PWA 88643	Sling, Lifting
PWA 88673	Sling, Lifting
PWA 102746	Puller (If Necessary)

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−08

Special Tools:

(CONTINUED)

*See Table 301 for the mechanical wrench tool options. The table shows the correct combinations of tools to remove the No. 3 bearing retaining nut.

C. Procedure

CAUTION: FOR ENGINES THAT HAVE SIGNS OF HPT BLADE DAMAGE AND/OR FRACTURE, IT IS NECESSARY THAT YOU DO THE FOLLOWING INSPECTIONS WHEN YOU DO THE DETAIL PART INSPECTIONS:

CAUTION: YOU MUST EXAMINE THE NO. 3 BEARING HOUSING FOR SIGNS OF WEAR OR WEAR STEP ON THE HOUSING JOURNAL OR SHOULDER. NO WEAR OR WEAR STEP IS PERMITTED. SEE PW4000 SERIES CIR, PN 51A357, 72−41−10, INSPECTION/CHECK−03 AND −04 FOR THE SPECIFIC INSPECTION LIMITS.

CAUTION: YOU MUST EXAMINE THE NO. 3 BEARING REAR CARBON SEAL RING HOLDER FOR WEAR OR DAMAGE TO THE CARBON SEAL RING PINS. SEE PW4000 SERIES CIR, PN 51A357, 72−41−86, INSPECTION/CHECK−03 FOR THE SPECIFIC INSPECTION LIMITS.

CAUTION: YOU MUST EXAMINE THE NO. 1.5 AND 2 BEARING SEAL SUPPORT ASSEMBLY FOR BRAZE CRACKS AND/OR PIN FRACTURE. NO CRACK INDICATIONS OF ANY LENGTH OR DEPTH ARE PERMITTED. SEE PW4000 SERIES CIR, PN 51A357, 72−34−36, INSPECTION/CHECK−02 FOR THE SPECIFIC INSPECTION LIMITS.

(1) Optional, position PWA 86537 Cover over the turbine blades so that each of the four detail pieces overlaps the adjacent piece.

(2) Remove retaining ring lock (302/3) securing No. 3 bearing nut lock (302/2) to No. 3 bearing retaining nut. See Figure 302.

(3) Remove No. 3 bearing nut lock (302/2) using PWA 85110 Knocker Puller.

(a) Position lugs on plate detail of puller between tabs of nut lock and insert plate into ID of nut lock. Rotate plate clockwise to engage hooked lugs with tabs of nut lock.

(b) Using slide hammer action, remove nut lock from engine.

(4) Remove remaining retaining ring lock (302/3) from No. 3 bearing retaining nut.

(5) For operators that use the mechanical wrench, remove the No. 3 bearing retaining nut as follows.

(a) Install PWA 85116 Wrench into ID of No. 3 bearing retaining nut (303/3) engaging splines of wrench with splines of nut. See Figure 303.

(b) Install PWA 85117 Adapter to turbine intermediate hub (303/4). See Figure 303.

1 Loosen hex nuts (303/1) securing eight clamps (303/2). Slide clamps in slots in opposite direction of arrows on base of fixture and secure clamps with hex nuts.

2 Use a hoist and two PWA 76154 Adapters and connect PWA 88643 Sling, PWA 88673 Sling or PWA 28657 Sling to the trunnion spools on the adapter.

3 Using hoist, position adapter over rear of PWA 85116 Wrench.

4 Insert clamp feet through slots (303/6) between lugs of hub.

5 Align teeth of adapter with slots between lugs of turbine intermediate hub. Loosen hex nuts and slide clamps in direction of arrows on base of adapter. Rotate clamps (303/2) as required to position feet under lugs on hub and insert pins (303/3) into holes in base of adapter. Tighten hex nuts to secure clamps.

NOTE: Plate of clamp points in direction that clamp feet are facing.

(c) Using hoist, align splines and slide applicable mechanical wrench over splines of PWA 85116 Wrench. Align anti−torque pins in wrench with bushings (304/1) in PWA 85117 Adapter and seat wrench on adapter. See Table 301 for mechanical wrench options. See Figure 304.

NOTE: Wrenches can be actuated using air torque multipliers to speed up removal of nut. See Table 301.

PWA Mechanical Wrench	PWA Torque Multiplier
PWA 29614	PWA 45419 or PWA 80651

Mechanical Wrench Options
Table 301

(d) Actuate wrench to loosen nut.

(e) Remove wrenches and adapter.

(f) Remove nut from HPC (rear hub).

NOTE: No. 3 bearing retaining nut silver plating shall have been replaced prior to each installation. Nut may be removed and retorqued for each installation maximum of three times prior to engine run before requiring silver plating replacement.

(6) For operators that use the hydraulic wrench, remove the No. 3 bearing retaining nut as follows:

(a) Install PWA 85114 Wrench into ID of No. 3 bearing retaining nut (305/3) engaging splines of wrench with splines of nut. See Figure 305.

(b) Install PWA 85115 Adapter to turbine intermediate hub (305/4).

1 Loosen wing nuts securing eight clamps (305/1). Slide clamps in slots in opposite direction of arrows on base of fixture and secure clamps with wing nuts.

2 Install three .500−13 inch eyebolts into three equally spaced holes near center of adapter. Using hoist, connect suitable sling to eyebolts.

3 Using hoist, position adapter over PWA 85114 Wrench and onto rear of HPT with 16 teeth of adapter between lugs of turbine intermediate hub.

4 Insert clamp feet through slots (305/5) between lugs of hub.

5 Loosen wing nuts and slide clamps in direction of arrows on base of fixture. Rotate clamps to position feet under lugs on hub and secure with wing nuts.

NOTE: Dowel pin (305/2) in stud detail of clamp points in direction that clamp feet are facing.

CAUTION: YOU MUST TURN THE PWA 25000 HYDRAULIC WRENCH ONLY IN THE LOOSEN DIRECTION. IF YOU TURN THE DRIVE SPLINE IN THE TIGHTEN DIRECTION, YOU CAN STRUCTURALLY DAMAGE THE TURBINE SHAFT.

(c) Use a hoist and applicable sling to lift the PWA 25000 Hydraulic Wrench. Find the correct direction to turn the drive spline of the wrench. Refer to the PWA 29178 Instruction Decal on the hydraulic wrench to get the position of the shifting mechanism to cause the drive spline to turn in the loosen direction. See Figure 306.

NOTE: PWA 28669 Cart can be used to store and transport PWA 25000 Wrench.

(d) Connect PWA 28668 Pump or PWA 29510 Pump to the hydraulic wrench. Operate the wrench to make sure that the wrench turns in the loosen direction.

(e) Align splines and lower PWA 25000 Wrench onto PWA 85114 Wrench. Lower wrench and engage keys of PWA 85115 Adapter with keyways in PWA 25000 Wrench. See Figure 306.

CAUTION: DO NOT USE A TORQUE OF MORE THAN 1,000,000 LB−IN. (112,985 N.m) OR STRUCTURAL DAMAGE TO THE TURBINE SHAFT CAN OCCUR.

(f) Use the selector to operate the wrench and loosen the nut. Monitor the pressure gages to make sure that the torque does not exceed 1,000,000 lb−in. (112,985 N.m). As the drive spline turns, look at the travel indicator. When the travel indicator reaches its maximum travel, use the selector control valve to let the wrench ratchet return. Repeat this procedure until the nut is loose.

(g) Connect PWA 28668 Pump or PWA 29510 Pump to wrench.

(h) Actuate wrench to loosen nut.

(i) Remove wrenches and adapter.

(j) Remove nut from HPC rear hub.

NOTE: No. 3 bearing retaining nut silver plating shall have been replaced prior to each installation. Nut may be removed and retorqued for each installation maximum of three times prior to engine run before requiring silver plating replacement.

CAUTION: ENGINES INCORPORATING NO. 3 BEARING RETAINING NUT PN 50A132 INCORPORATE SHORTER TURBINE SHAFT SPACER WHICH MAY FALL INTO GROOVE IN HPC REAR HUB JUST FORWARD OF THREADS AT REAR OF HUB. INSTALL WORK PACKING INTO GROOVE IN HPC REAR HUB JUST FORWARD OF THREADS OR DAMAGE TO HPC REAR HUB MAY OCCUR.

(7) Determine part number of No. 3 bearing retaining nut. For engines incorporating nut PN 50A132, install work packing PN AS3209−159 into groove in HPC rear hub just forward of threads at rear of hub.

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(8) Install PWA 85107 Fixture onto high pressure turbine. See Figure 307.

(a) If installed, remove rod and attached details, guide pilot, clamp and nuts from coupler. Remove nut and hydraulic cylinder. Remove plug.

(b) Remove 12 screws (307/10) securing plate (307/11) to fixture. Remove retainer (307/8) and jaws (307/4).

(c) For engines (Pre SB PW4ENG 72−176), remove the PWA 86379 Adapter Ring, if installed, from the pilot ring detail of PWA 85107 Fixture.

CAUTION: THE SCREWS THAT HOLD THE PWA 86379 ADAPTER RING MUST BE FLUSH WITH THE ADJACENT SURFACE OR DAMAGE TO THE PARTS CAN OCCUR.

(d) For engines (Post SB PW4ENG 72−176), install the PWA 86379 Adapter Ring, if not installed, on the pilot ring detail of PWA 85107 Fixture. Use six detail cap screws to hold the adapter ring.

NOTE: The turbine intermediate hub, (Post SB PW4ENG 72−176) has a shorter inner hub. The adapter is required with the fixture to set the axial run position on the HPT rotor.

(e) Loosen eight hand knobs (305/12) at center hub (307/2) of fixture and move piloting ring (307/3) rearward until it is flush with or above surface of center hub. Tighten eight hand knobs.

(f) Thread three .500−13 inch eyebolts into tapped holes in rear center hub of fixture. Attach standard three cable sling to eyebolts and position fixture onto rear of high pressure turbine.

(g) Secure outer flanges of fixture to high pressure turbine case (307/1) using 26 detail screws (307/14) and spacers (307/13). Remove hoist and sling.

(h) Loosen eight hand knobs (307/12) at center hub (307/2) of fixture and allow piloting ring (307/3) to slowly seat onto turbine rear hub. Tighten eight hand knobs to secure piloting ring.

(i) Position four jaws (307/4) into center of fixture, locating lip of jaws in ID cutout of turbine hub. Lightly tighten screws (307/5) to secure jaws.

(j) Thread extension rod (307/7) into plug (307/6). Insert assembly into center of fixture and seat plug against rear of high pressure compressor shaft.

(k) Install retainer (307/8) into center of fixture to retain four jaws (307/4). Tighten four screw details of jaws.

(l) Install plate (307/11) to piloting ring (307/3) and secure with 12 screws (307/10).

(m) Thread hydraulic cylinder (307/9) into plate (307/10).

(9) Use a hoist and attach PWA 28657 Sling, PWA 88643 Sling or PWA 88673 Sling with two PWA 76156 Adapters to the trunnion spools of the fixture. Make the sling cables tight.

(10) Remove Flange M lockwire, bolts, nuts and brackets securing turbine case front flange to diffuser case. Refer to 72−00−52, Removal−20 (Task 72−00−52−020−020).

(11) Attach PWA 29389 Hydraulic Pump or PWA 3755 Hydraulic Pump to ram. Apply hydraulic pressure to separate turbine front hub from HPC (rear hub) (approximately 0.750 inch (19.050 mm), while separating turbine case flange from diffuser case.

(a) If necessary, use PWA 102746 Puller to help when you remove the HPT from the HPC.

(12) Remove pump and hydraulic cylinder.

(13) Lift turbine and separate it from engine.

(14) Remove turbine shaft spacer from HPC rear hub. If installed, remove work packing from groove in HPC rear hub just forward of threads at rear of hub.

(15) Optional, insert PWA 85112 Retaining Fixture into ID of turbine hubs and align outer surfaces of fixture with turbine hub lock. Rotate knurled knob to secure fixture against lock.

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−08

(16) Remove gasket (308/1) from front outer flange of turbine case. See Figure 308.

(17) Place the turbine front end down into the PWA 87022 Storage Stand. See Figure 309.

(18) Adjust the center plug of the storage stand to maintain the running clearance of the turbine rotors. Secure the assembly in the stand.

(19) Remove the fixture from the turbine case.

  (a) Remove 12 screws (309/1) securing plate (309/2) to piloting ring (309/10). Remove plate. Store screw details in plate.

  (b) Remove retainer (309/3), extension rod (309/4) and plug (309/5).

  (c) Loosen screws (309/7) securing jaws (309/6) to hub. Remove jaws.

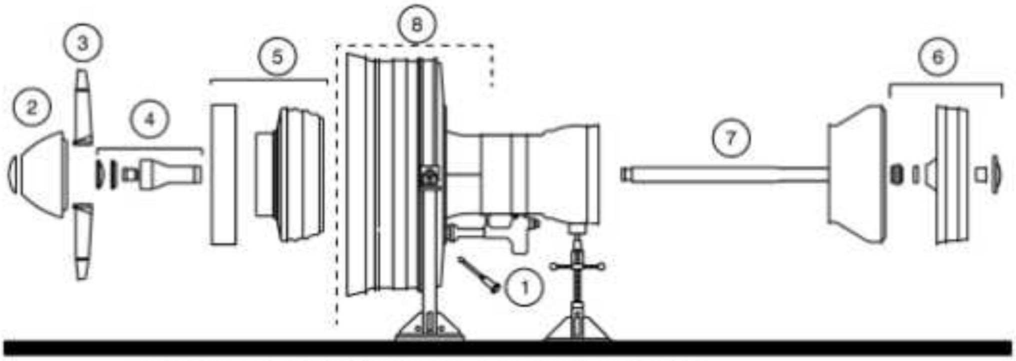
  (d) Remove screws (309/9) and spacers (309/8) securing fixture to case.

  (e) Using hoist and PWA 28657 Sling, remove fixture from case.

(20) If the turbine assembly will be moved while in PWA 87022 Stand, install PWA 86058 Retainer to prevent damage to the knife−edge seals. See Figure 310.

  (a) Put the retainer onto the rear flange of the turbine intermediate hub.

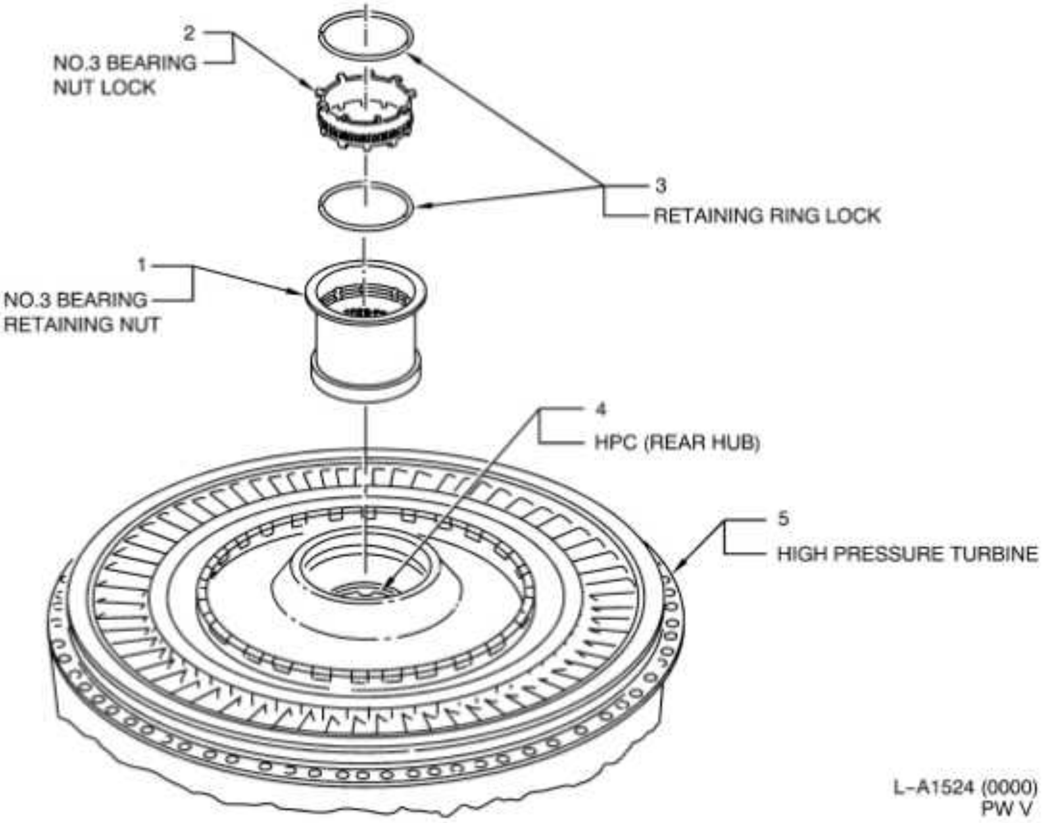
  (b) Align the boltholes and secure the outer flange of the retainer with 14 detail screws and nuts.



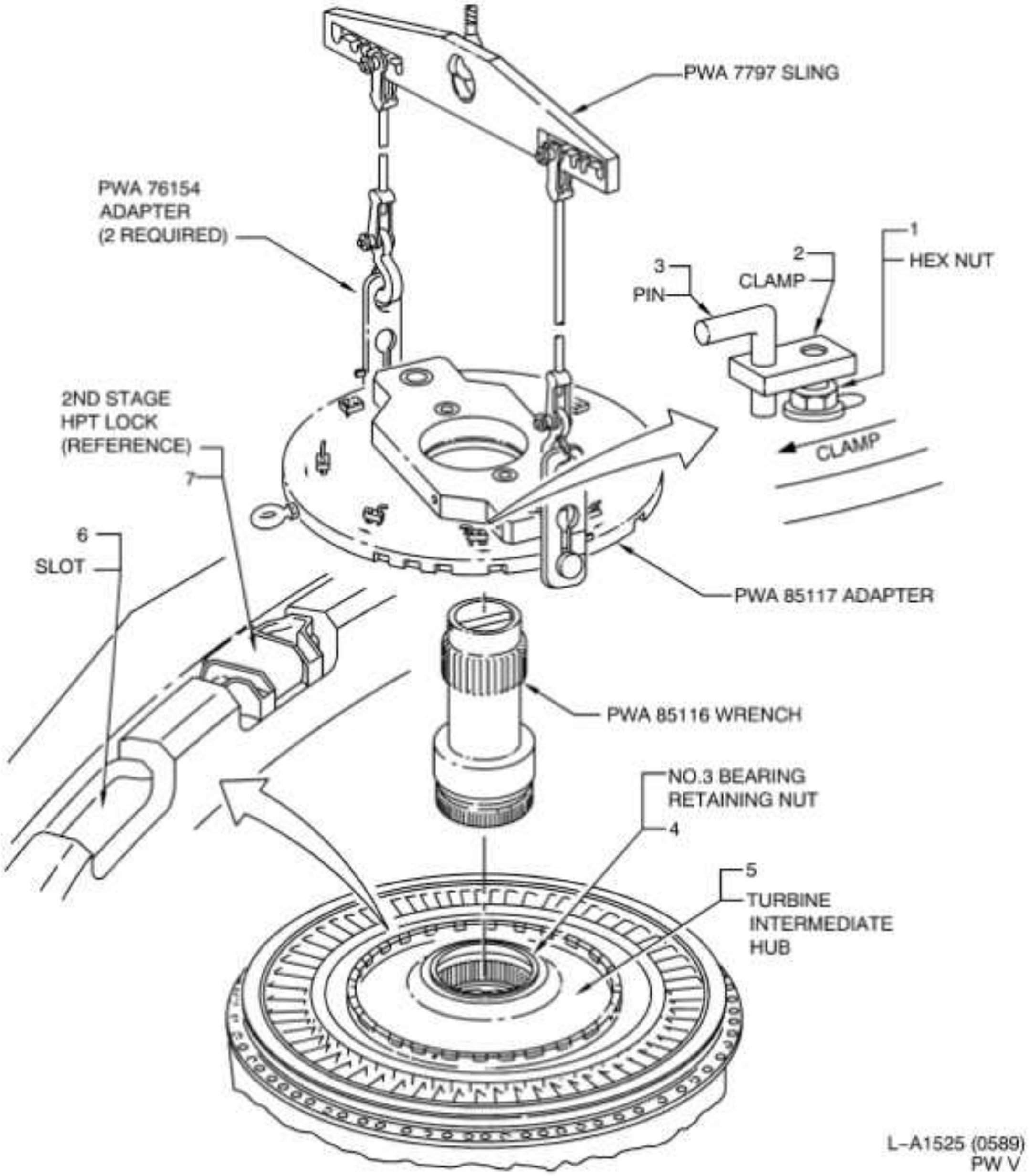
1. REMOVE ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).
2. REMOVE COMPRESSOR INLET CONE.
3. REMOVE STAGE 1 LPC BLADE ASSEMBLIES.
4. REMOVE LPC/LPT COUPLING.
5. REMOVE LOW PRESSURE COMPRESSOR (LPC).
6. REMOVE TURBINE EXHAUST CASE.
7. REMOVE LOW PRESSURE TURBINE (LPT).
8. TRUNNION FAN CASES THROUGH HIGH PRESSURE TURBINE (HPT) TO FRONT END DOWN.

L−A1522 (0000)
PW V

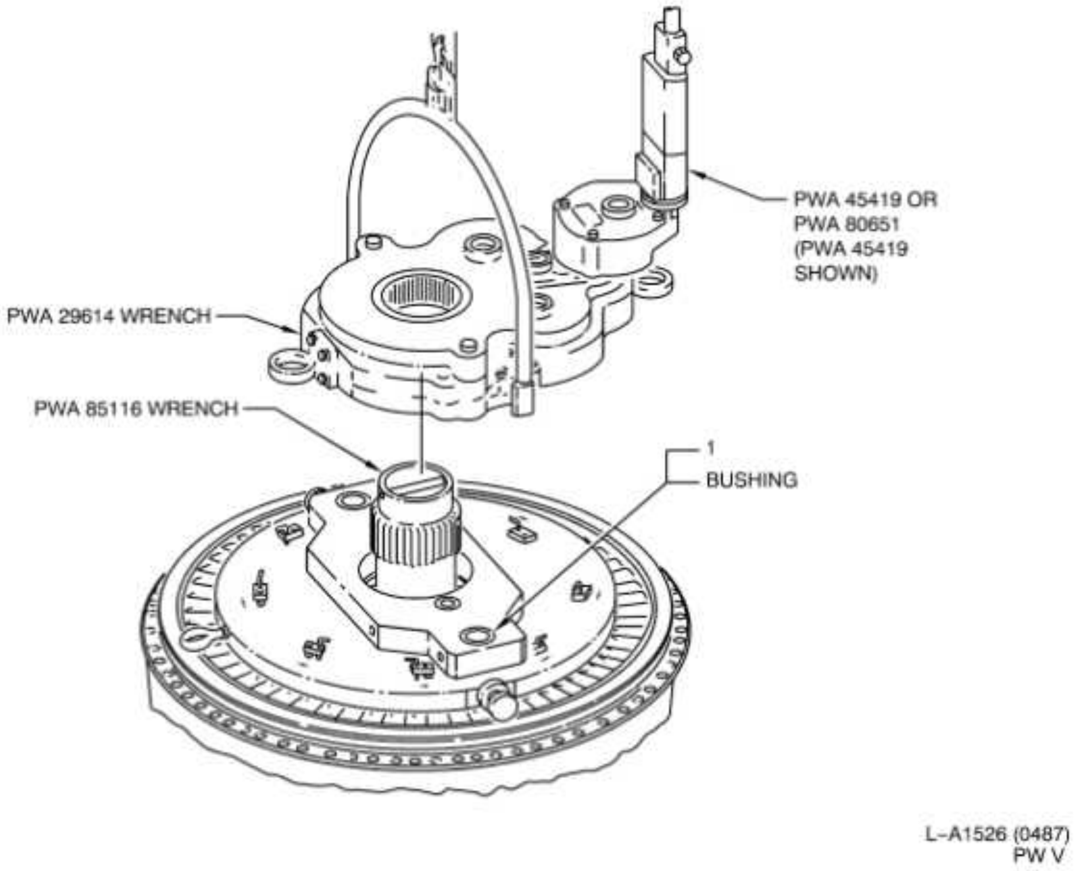
Procedure Sequence
Figure 301
(Task 72−00−52−020−002)


2
NO.3 BEARING NUT LOCK
3
RETAINING RING LOCK
1
NO.3 BEARING RETAINING NUT
4
HPC (REAR HUB)
5
HIGH PRESSURE TURBINE
L-A1524 (0000)
PW V

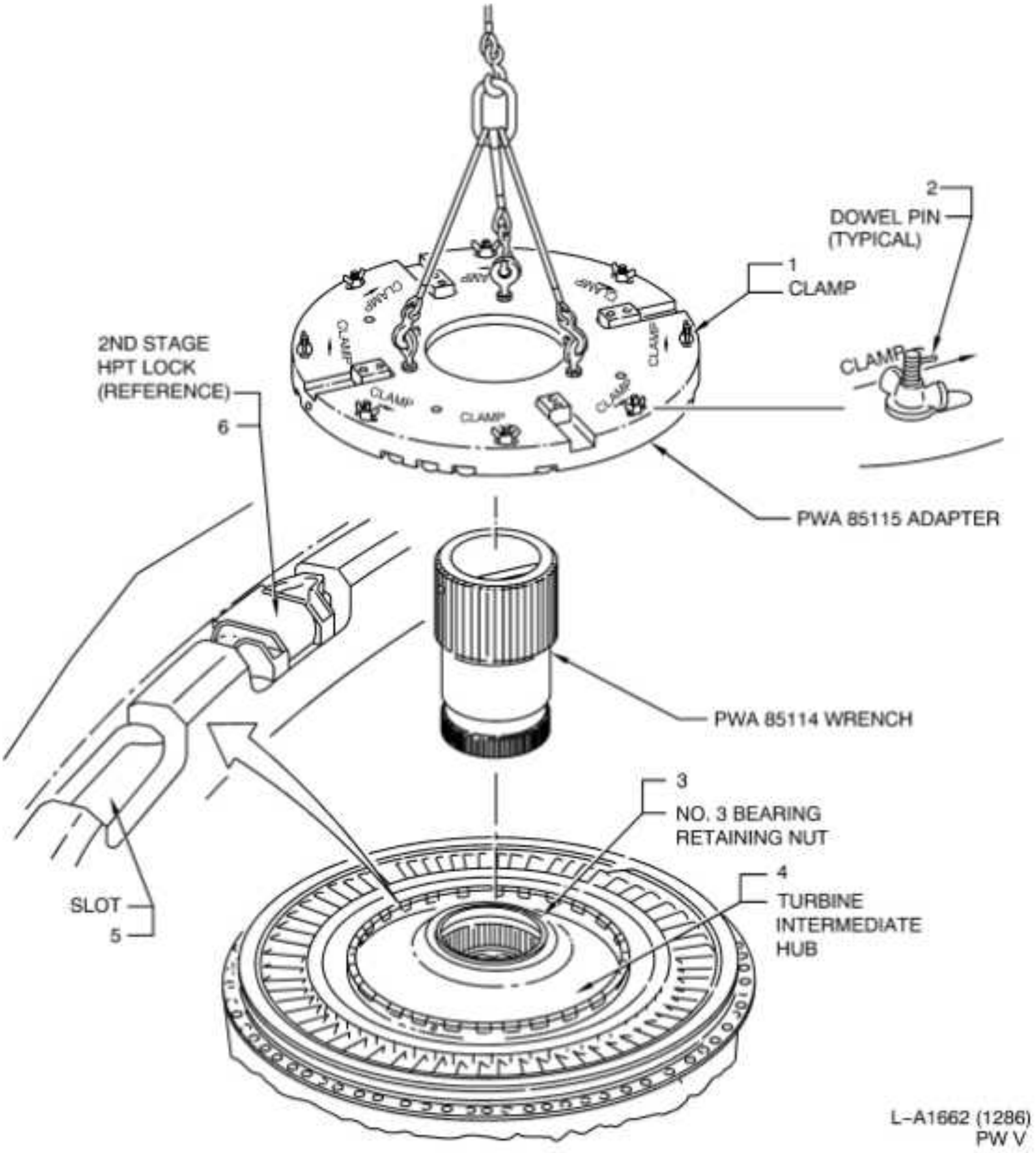
No. 3 Bearing Retaining Nut Removal
Figure 302
(Task 72−00−52−020−002)


PWA 7797 SLING
PWA 76154
ADAPTER
(2 REQUIRED)
1
HEX NUT
2
CLAMP
3
PIN
2ND STAGE
HPT LOCK
(REFERENCE)
7
CLAMP
6
SLOT
PWA 85117 ADAPTER
PWA 85116 WRENCH
NO.3 BEARING
RETAINING NUT
4
5
TURBINE
INTERMEDIATE
HUB
L−A1525 (0589)
PW V

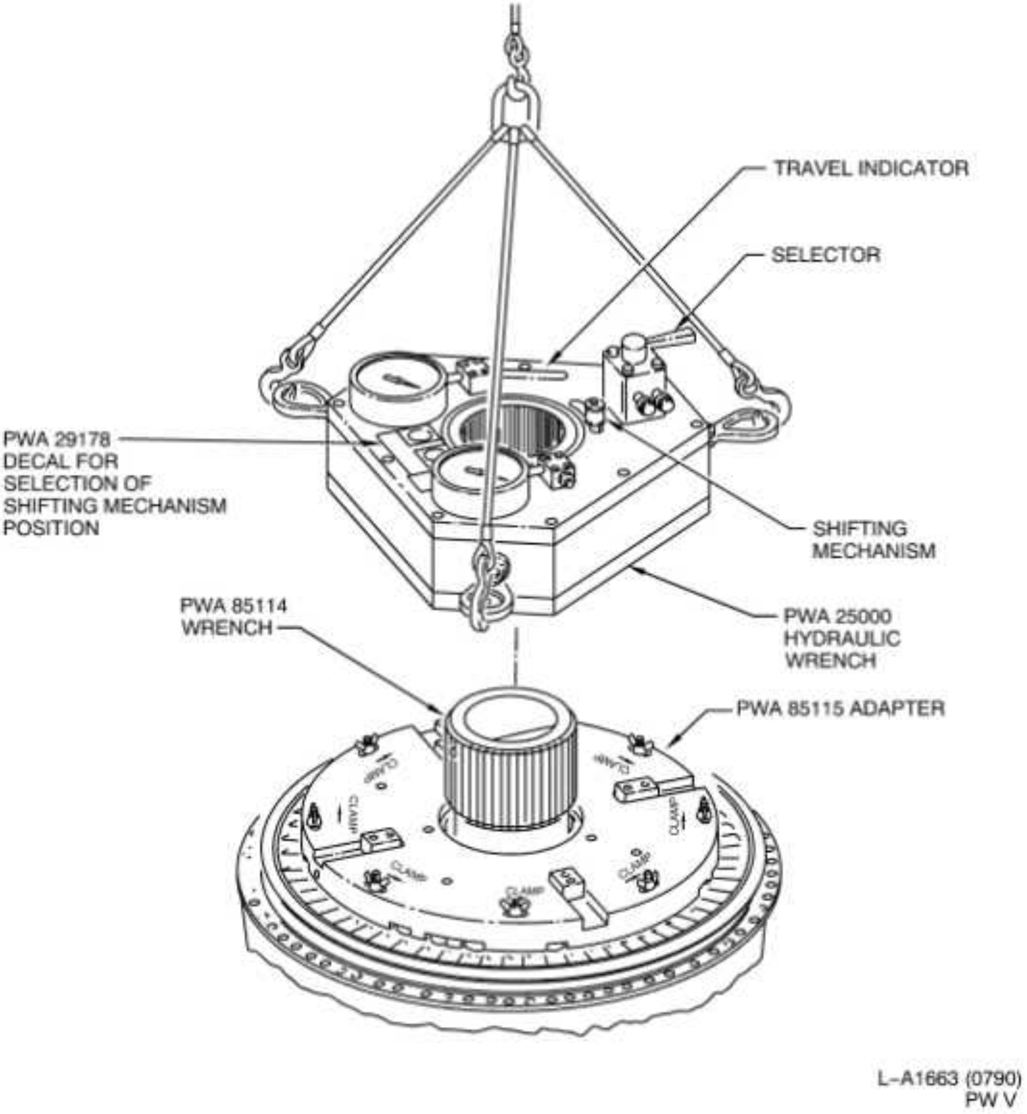
No. 3 Bearing Retaining Nut Removal (Mechanical Wrench)
Figure 303
(Task 72−00−52−020−002)


PWA 45419 OR
PWA 80651
(PWA 45419
SHOWN)
PWA 29614 WRENCH
PWA 85116 WRENCH
1
BUSHING
L−A1526 (0487)
PW V

No. 3 Bearing Retaining Nut Removal (Mechanical Wrench)
Figure 304
(Task 72−00−52−020−002)

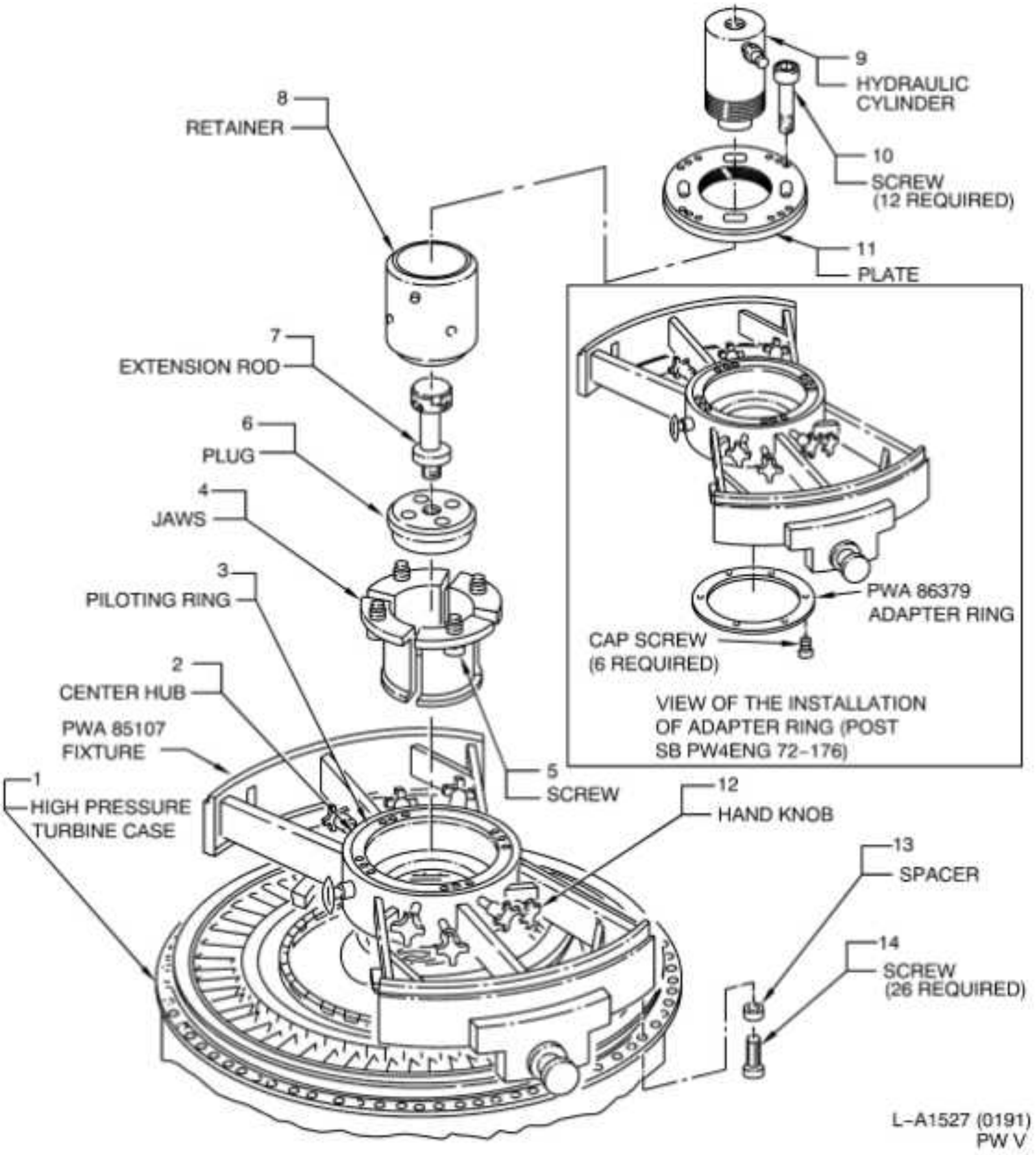

2
DOWEL PIN (TYPICAL)
1
CLAMP
CLAMP
2ND STAGE HPT LOCK (REFERENCE)
6
PWA 85115 ADAPTER
PWA 85114 WRENCH
3
NO. 3 BEARING RETAINING NUT
4
TURBINE INTERMEDIATE HUB
SLOT
5
L−A1662 (1286)
PW V

No. 3 Bearing Retaining Nut Removal (Hydraulic Wrench)
Figure 305
(Task 72−00−52−020−002)

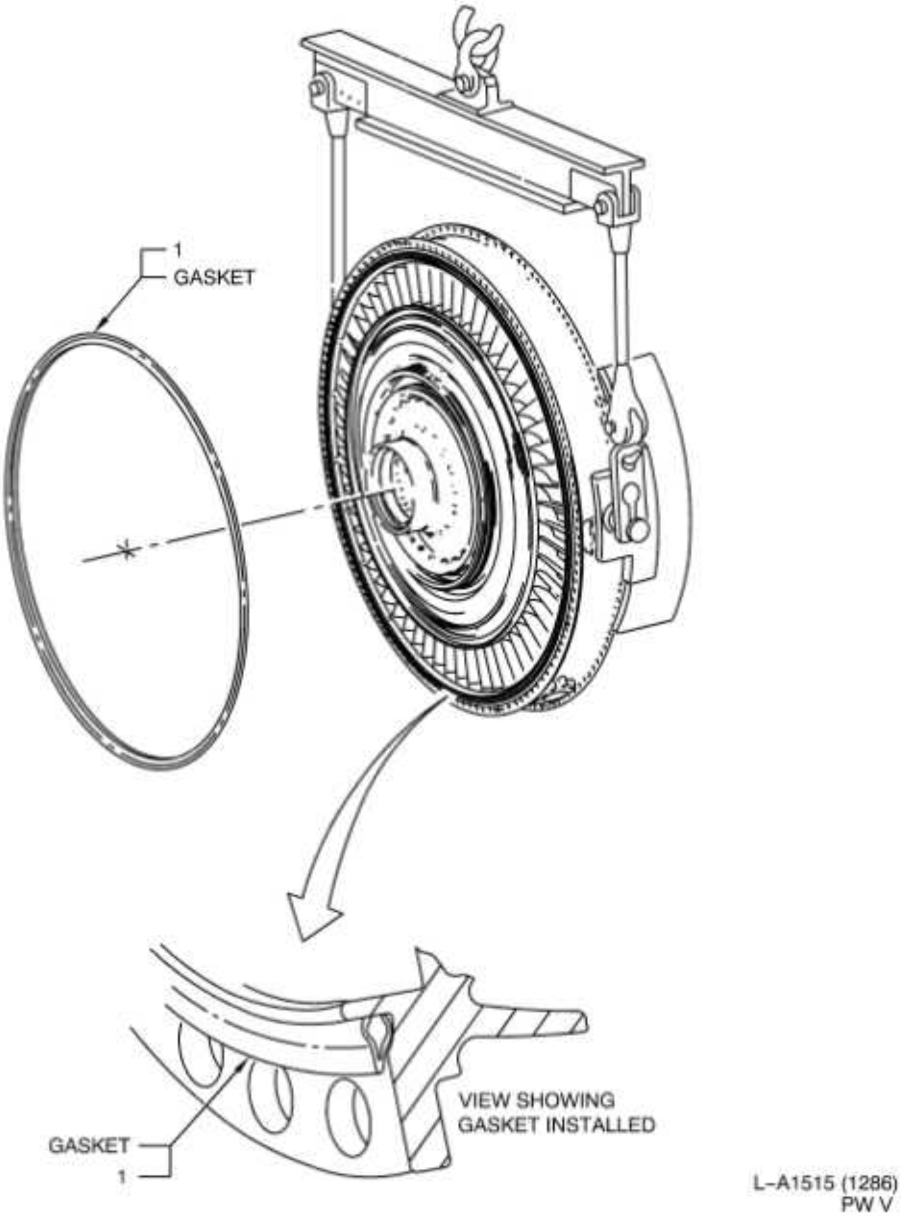

TRAVEL INDICATOR
SELECTOR
PWA 29178 DECAL FOR SELECTION OF SHIFTING MECHANISM POSITION
SHIFTING MECHANISM
PWA 25000 HYDRAULIC WRENCH
PWA 85114 WRENCH
PWA 85115 ADAPTER
CLAMP
CLAMP
CLAMP
CLAMP
CLAMP
CLAMP
CLAMP
L-A1663 (0790)
PW V

No. 3 Bearing Retaining Nut Removal (Hydraulic Wrench)
Figure 306
(Task 72-00-52-020-002)

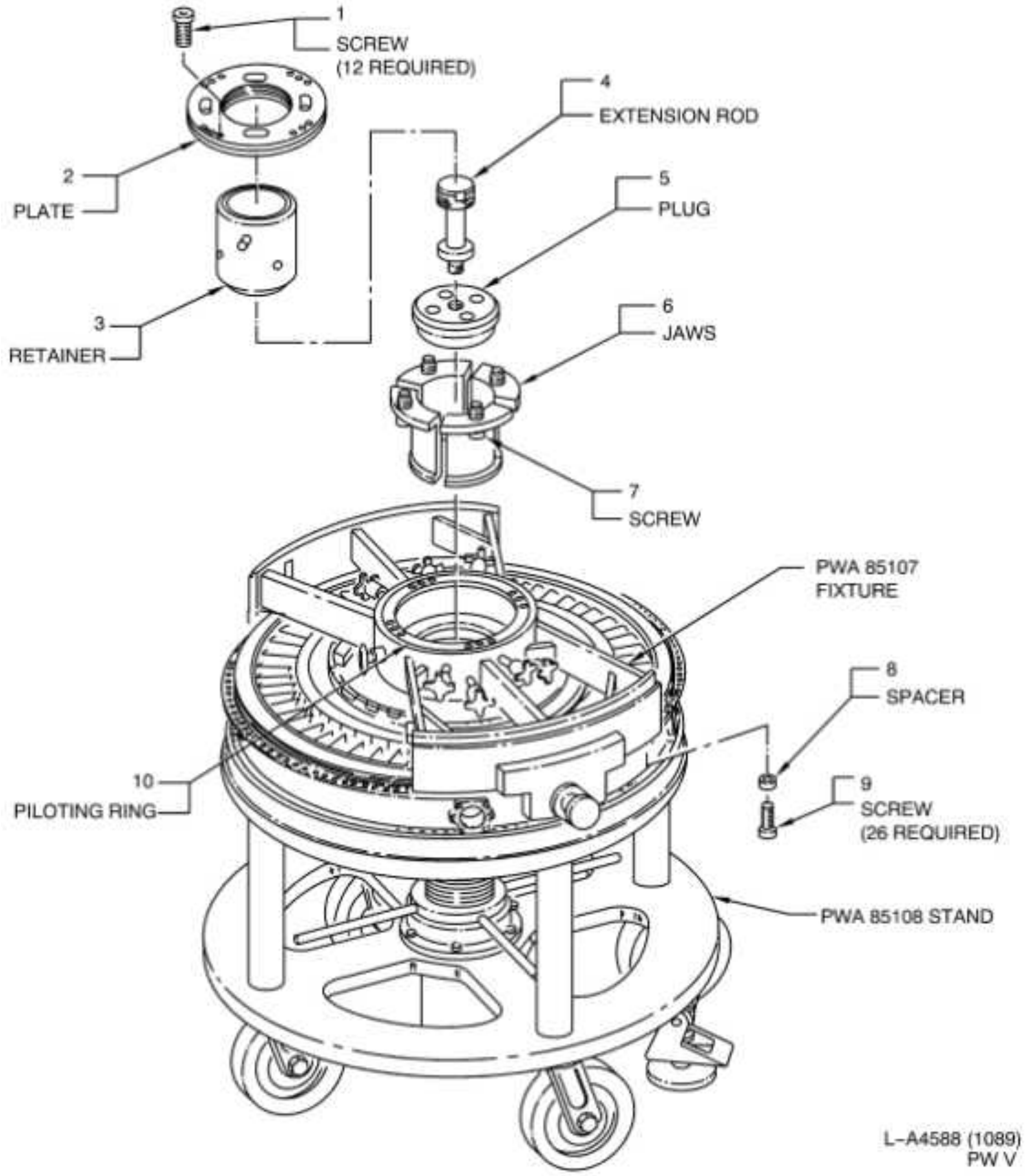
ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - REMOVAL-08


9
HYDRAULIC CYLINDER
8
RETAINER
10
SCREW (12 REQUIRED)
11
PLATE
7
EXTENSION ROD
6
PLUG
4
JAWS
3
PILOTING RING
PWA 86379 ADAPTER RING
CAP SCREW (6 REQUIRED)
2
CENTER HUB
PWA 85107 FIXTURE
VIEW OF THE INSTALLATION OF ADAPTER RING (POST SB PW4ENG 72-176)
1
HIGH PRESSURE TURBINE CASE
5
SCREW
12
HAND KNOB
13
SPACER
14
SCREW (26 REQUIRED)
L-A1527 (0191)
PW V

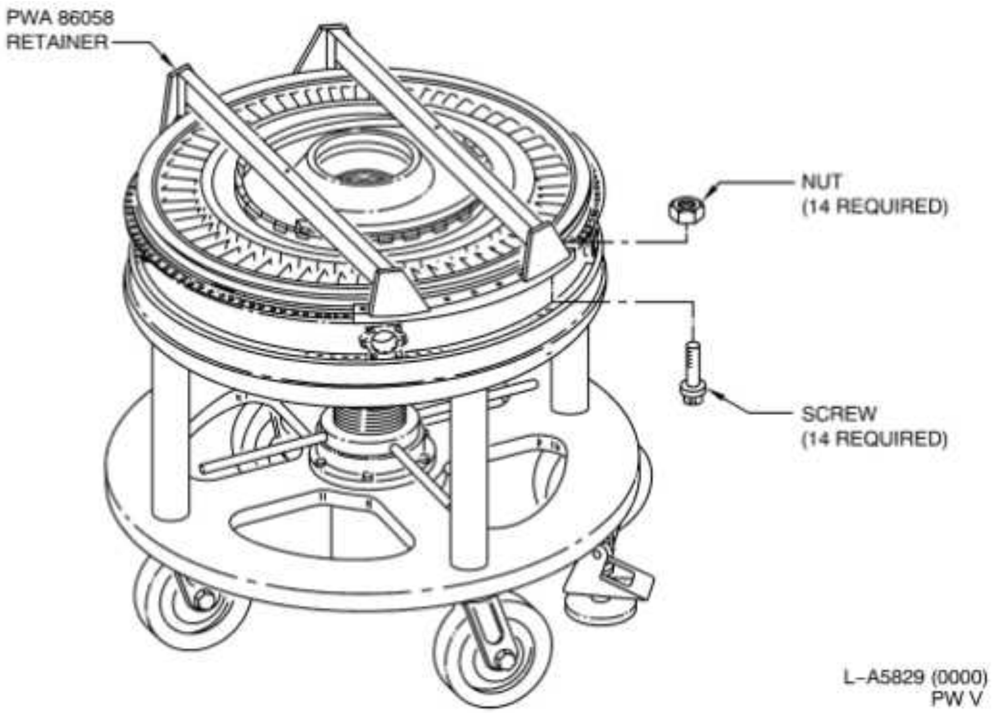
High Pressure Turbine Removal
Figure 307
(Task 72-00-52-020-002)


1
GASKET
VIEW SHOWING
GASKET INSTALLED
GASKET
1
L−A1515 (1286)
PW V

Turbine Case Gasket Removal
Figure 308
(Task 72−00−52−020−002)


1
SCREW
(12 REQUIRED)
4
EXTENSION ROD
2
PLATE
5
PLUG
3
RETAINER
6
JAWS
7
SCREW
PWA 85107
FIXTURE
8
SPACER
10
PILOTING RING
9
SCREW
(26 REQUIRED)
PWA 85108 STAND
L-A4588 (1089)
PW V

High Pressure Turbine Storage
Figure 309
(Task 72−00−52−020−002)


PWA 86058
RETAINER
NUT
(14 REQUIRED)
SCREW
(14 REQUIRED)
L−A5829 (0000)
PW V

PWA 86058 Retainer Installation
Figure 310
(Task 72−00−52−020−002)

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ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - REMOVAL-09

Task 72-00-52-020-002-002:

1. Remove The High Pressure Turbine - Vertical (Hydraulic Wrench) - Deleted

   A. Procedure

      (1) This procedure is relocated to 72-00-52, Removal-08 (Task 72-00-52-020-002).

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−20

Task 72−00−52−020−020:

1. Remove The Flange M Brackets And Hardware

   A. Equipment And Materials Necessary − None

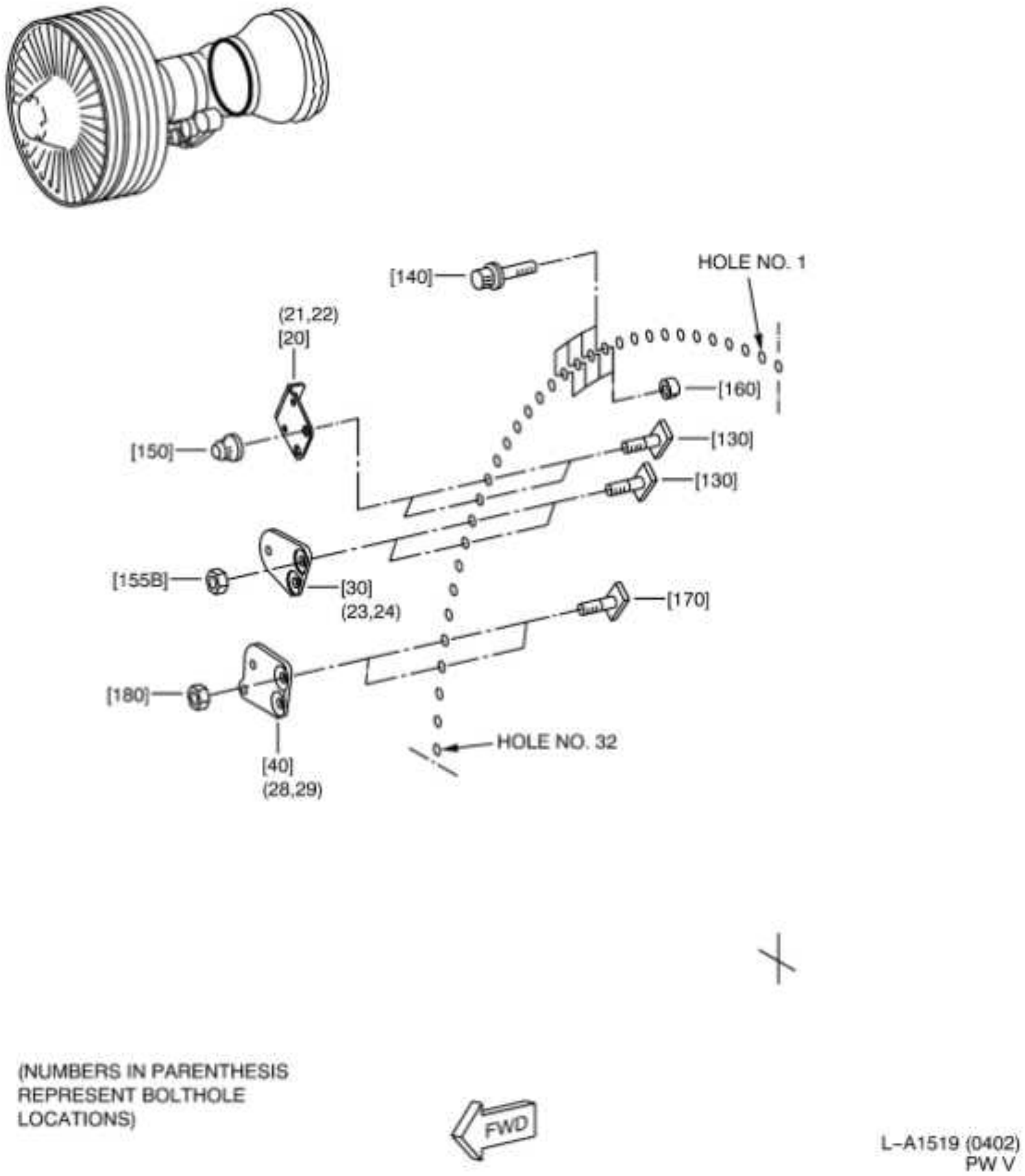
   B. Procedure

      (1) Remove the Flange M brackets as follows: See Figure 301.

         (a) Tag and identify the flange M hardware for the correct bolthole locations.

            NOTE: All the part item numbers in the figures are the same as the item numbers in the IPC.

         (b) Remove the lockwire, nuts and bolts, which attach the brackets at Flange M.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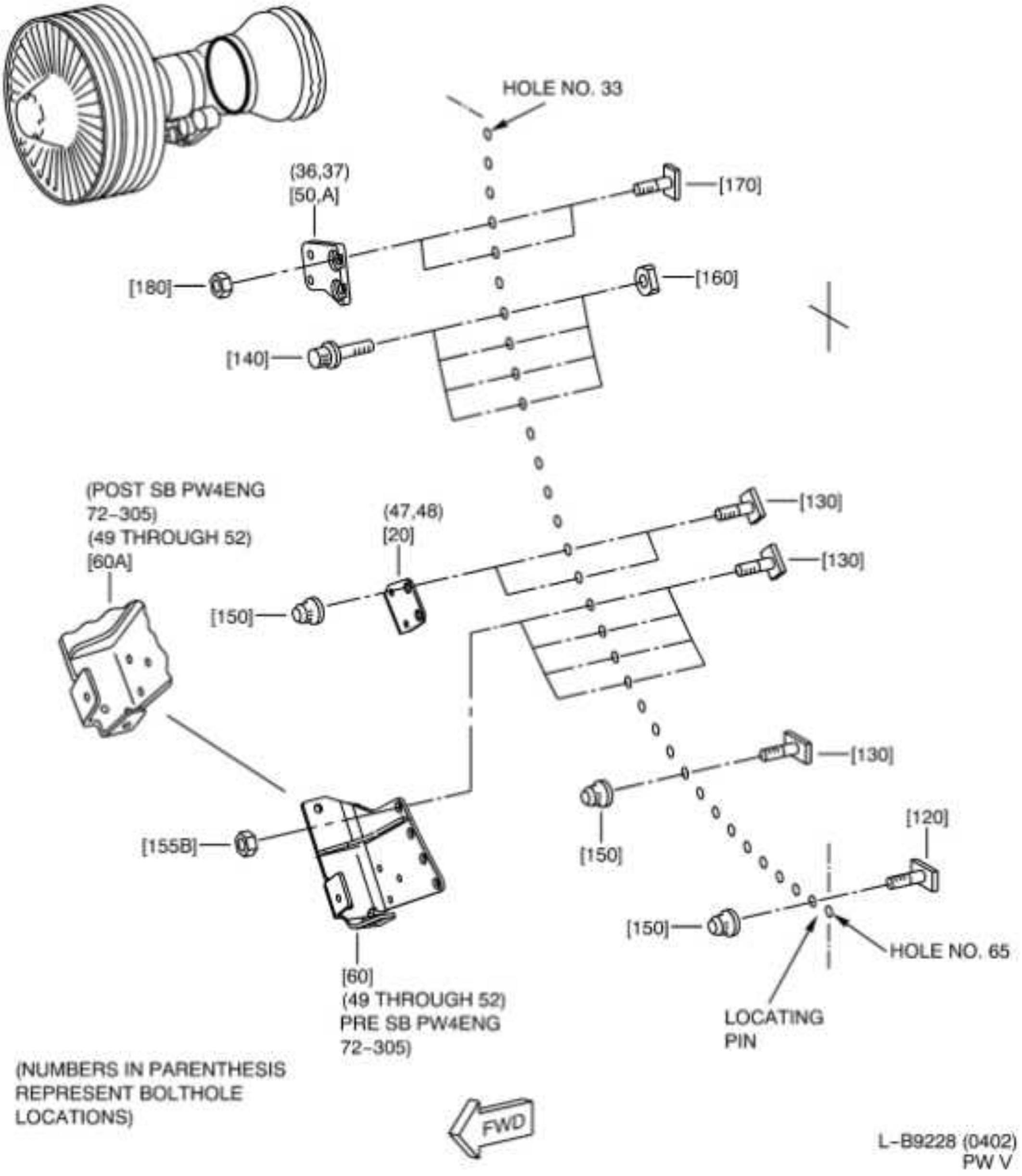
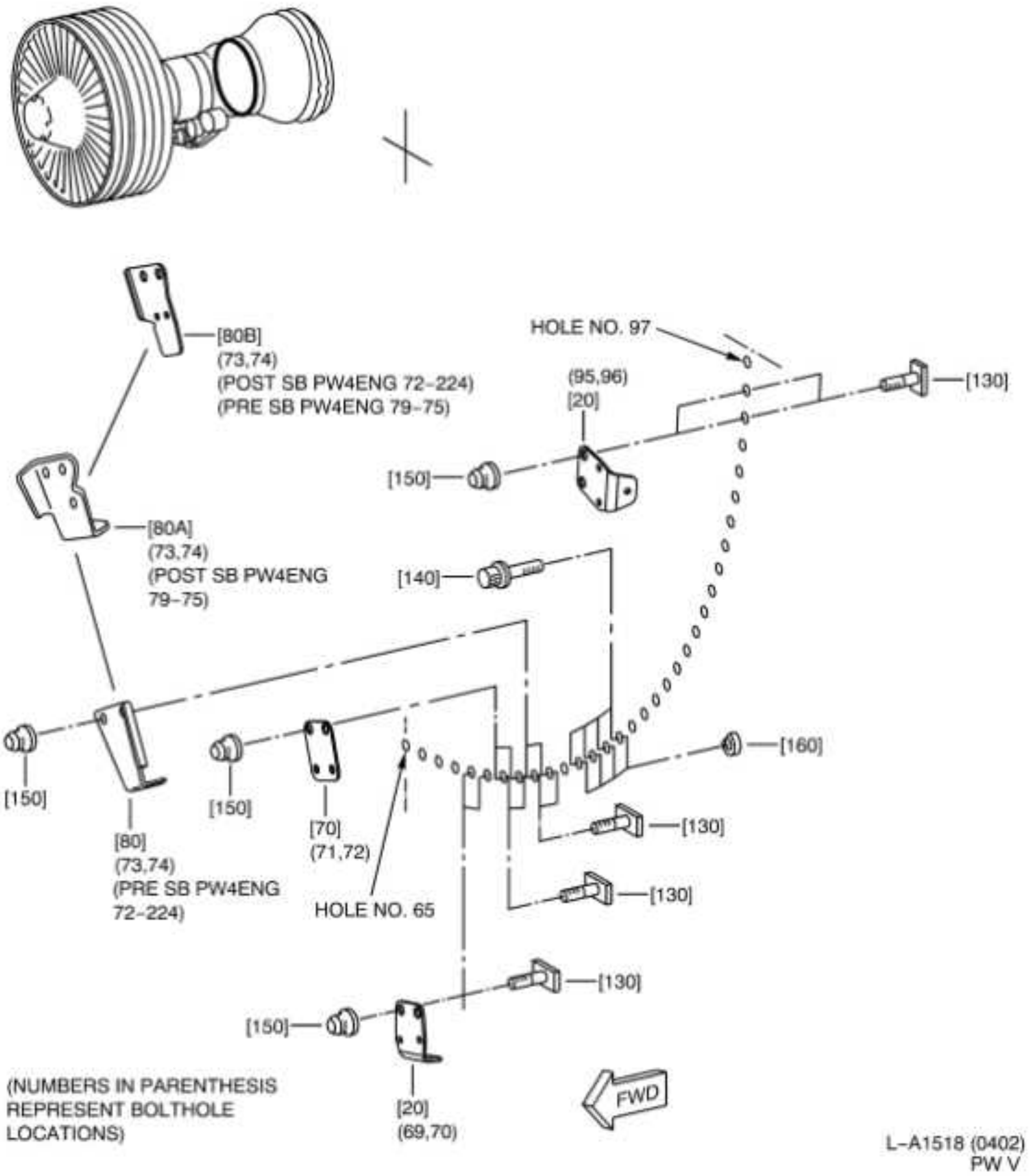
(21,22)
[20]
[160]
[150]
[130]
[130]
[155B]
[30]
(23,24)
[170]
[180]
HOLE NO. 32
[40]
(28,29)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L−A1519 (0402)
PW V

The Flange M Brackets And Hardware
Figure 301 (Sheet 1)
(Task 72−00−52−020−020)

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−20

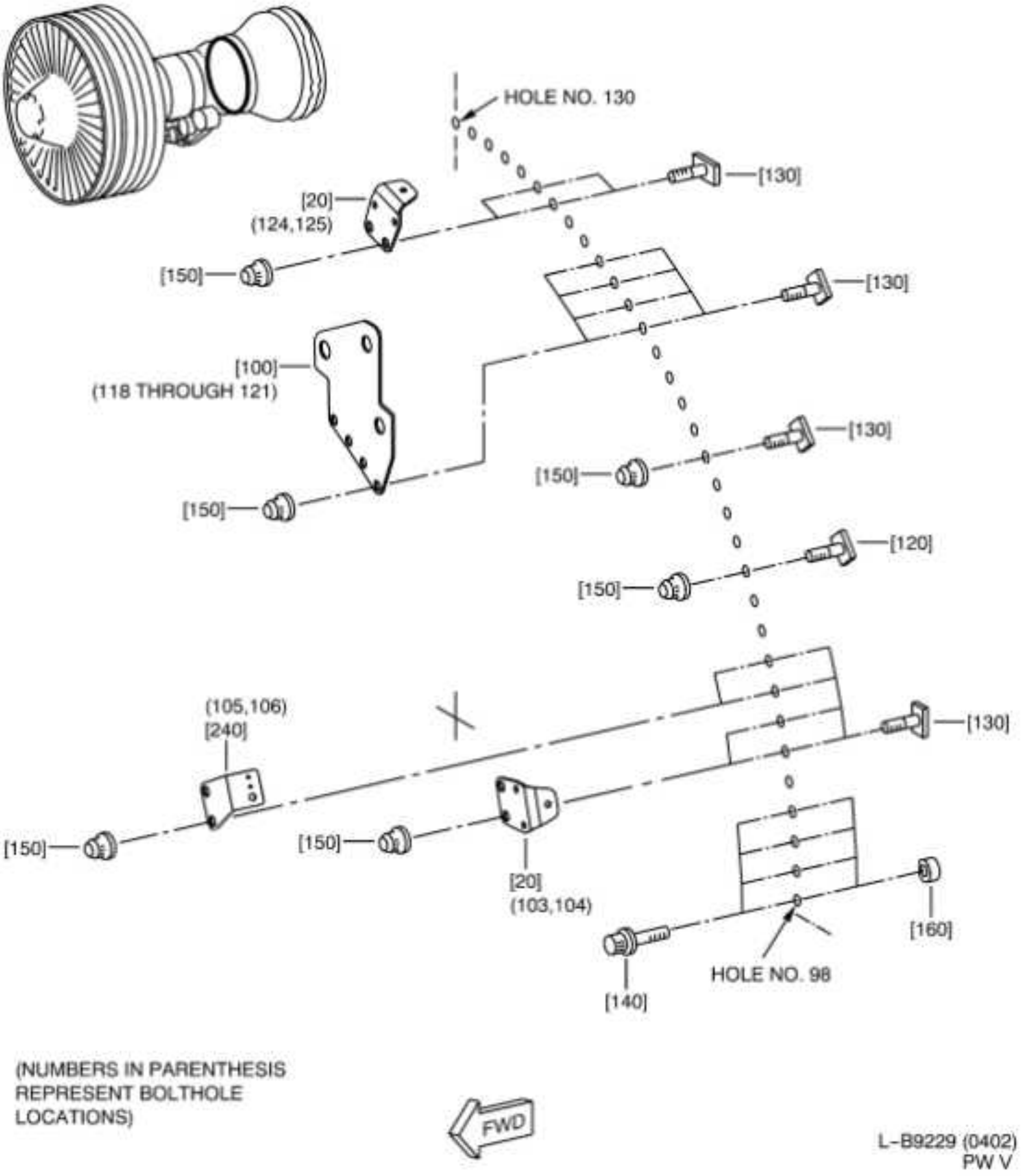

HOLE NO. 33
(36,37)
[50,A]
[170]
[180]
[160]
[140]
(POST SB PW4ENG
72-305)
(49 THROUGH 52)
[60A]
(47,48)
[20]
[130]
[130]
[150]
[155B]
[130]
[150]
[120]
[150]
HOLE NO. 65
[60]
(49 THROUGH 52)
PRE SB PW4ENG
72-305)
LOCATING
PIN
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-B9228 (0402)
PW V

The Flange M Brackets And Hardware
Figure 301 (Sheet 2)
(Task 72−00−52−020−020)


[80B]
(73,74)
(POST SB PW4ENG 72-224)
(PRE SB PW4ENG 79-75)
HOLE NO. 97
(95,96)
[20]
[130]
[150]
[80A]
(73,74)
(POST SB PW4ENG 79-75)
[140]
[160]
[150]
[150]
[80]
(73,74)
(PRE SB PW4ENG 72-224)
[70]
(71,72)
HOLE NO. 65
[130]
[130]
[130]
[150]
[20]
(69,70)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-A1518 (0402)
PW V

The Flange M Brackets And Hardware
Figure 301 (Sheet 3)
(Task 72−00−52−020−020)

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−20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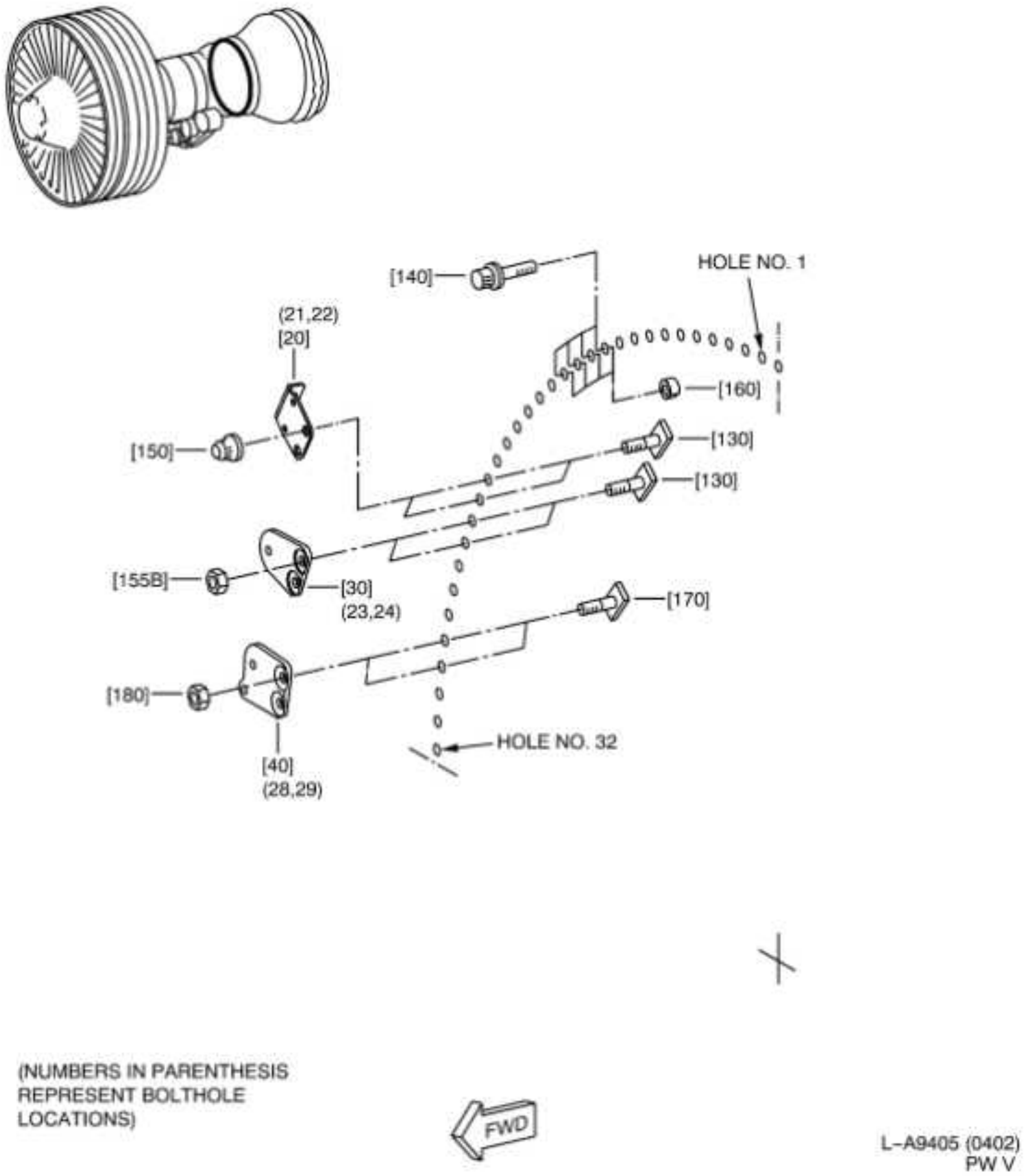
(124,125)
[150]
[130]
[100]
(118 THROUGH 121)
[150]
[130]
[150]
[150]
[120]
(105,106)
[240]
[130]
[150]
[150]
[20]
(103,104)
[160]
[140]
HOLE NO. 98
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B9229 (0402)
PW V

The Flange M Brackets And Hardware
Figure 301 (Sheet 4)
(Task 72−00−52−020−020)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(21,22)
[20]
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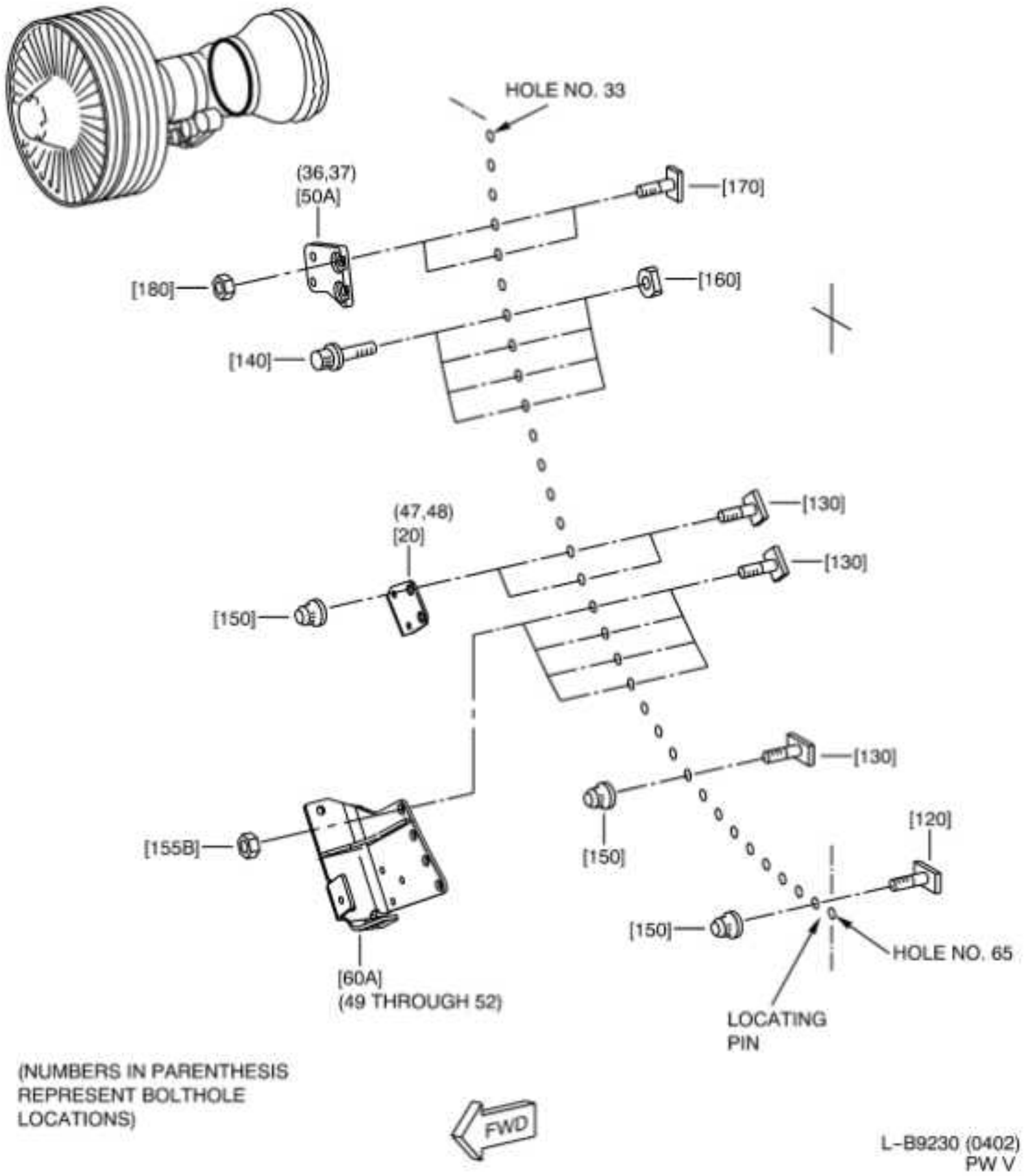
[130]
[155B]
[30]
(23,24)
[170]
[180]
HOLE NO. 32
[40]
(28,29)
FWD
L-A9405 (0402)
PW V

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

The Flange M Brackets And Hardware
Figure 301 (Sheet 5)
(Task 72−00−52−020−020)


HOLE NO. 33
(36,37)
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[140]
(47,48)
[20]
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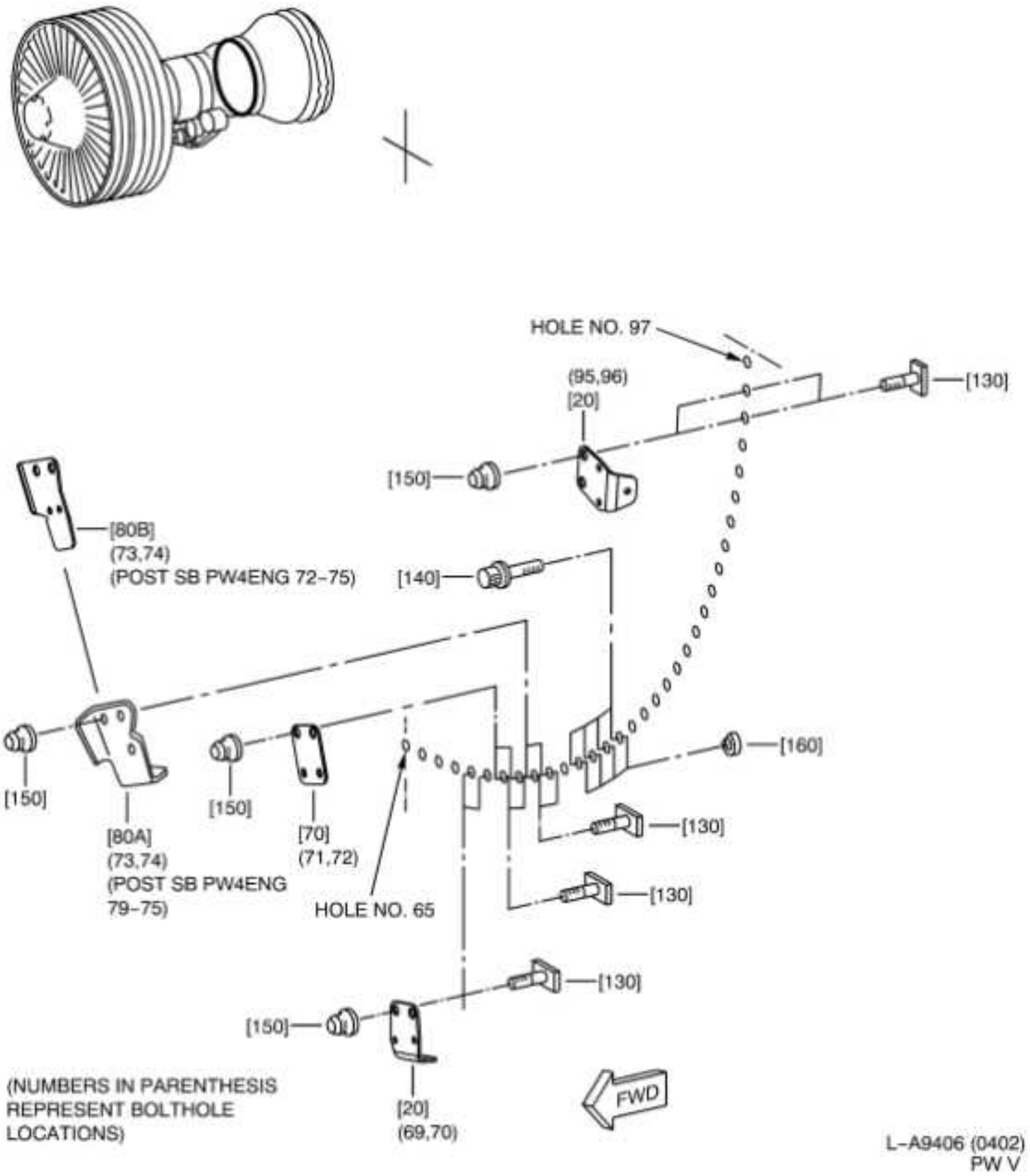
[150]
[130]
[155B]
[150]
[120]
[150]
HOLE NO. 65
[60A]
(49 THROUGH 52)
LOCATING PIN
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B9230 (0402)
PW V

The Flange M Brackets And Hardware
Figure 301 (Sheet 6)
(Task 72−00−52−020−020)

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−20


HOLE NO. 97
(95,96)
[20]
[130]
[150]
[80B]
(73,74)
(POST SB PW4ENG 72-75)
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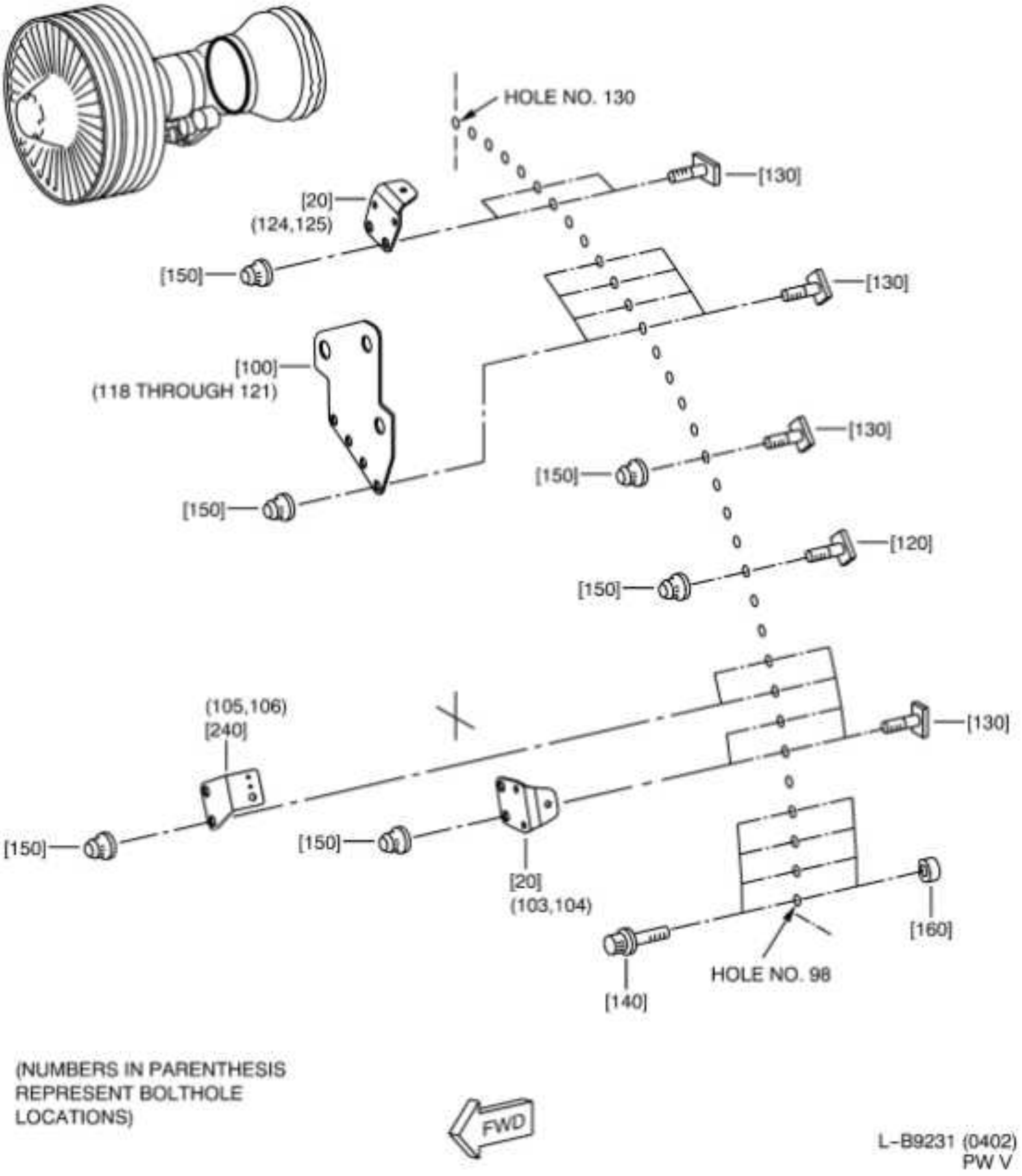
[150]
[150]
[80A]
(73,74)
(POST SB PW4ENG
79-75)
[70]
(71,72)
HOLE NO. 65
[130]
[130]
[130]
[150]
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
[20]
(69,70)
FWD
L-A9406 (0402)
PW V

The Flange M Brackets And Hardware
Figure 301 (Sheet 7)
(Task 72−00−52−020−020)

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − REMOVAL−20


HOLE NO. 130
[130]
[20]
(124,125)
[150]
[130]
[100]
(118 THROUGH 121)
[150]
[130]
[150]
[150]
[120]
[150]
(105,106)
[240]
[130]
[150]
[150]
[20]
(103,104)
[160]
[140]
HOLE NO. 98
FWD
L-B9231 (0402)
PW V

(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

The Flange M Brackets And Hardware
Figure 301 (Sheet 8)
(Task 72−00−52−020−020)

Task 72-00−52−420−001:

1. Install The High Pressure Turbine − Horizontal

NOTE: See Figure 401 for Part/Assembly Installation Procedure Sequence.

A. Prerequisites

(1) See Inspection/Check−01 (Task 72−00−52−990−001) for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows:

B. Equipment And Materials Necessary

Standard Tools:

Name	Manufacturer
Clements Cadillac Flameless Torch Model FT 1000	Clements Manufacturing Co. 6650 S. Narragansett Avenue Chicago, IL 60638

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

NOTE: The flameless torch specified above is optional to the heaters specified in the Special Tools list, and the optional flame torch.

Special Tools:

PWA 3755	Pump, Hydraulic (Optional To PWA 29389)
PWA 25000	Wrench, Hydraulic
PWA 25672	Control, Heater (Optional To PWA 29754)
PWA 28657	Sling, Strongback
PWA 28668	Pump, Hydraulic (Electric) (Use With Hydraulic Wrench)
PWA 28669	Cart, Storage (Optional) (Use With Hydraulic Wrench)
PWA 29389	Pump, Hydraulic
PWA 29510	Pump, Hydraulic (Hand) (Use With Hydraulic Wrench)
PWA 29614	Wrench, Mechanical*
PWA 29754	Control, Heater
PWA 45419	Air Torque Multiplier* (Optional To PWA 80651) (Use With Mechanical Wrench)

Special Tools:

(CONTINUED)

	PWA 75028	Gage
	PWA 76156	Adapter (2 Required)
	PWA 80651	Multiplier, Pneumatic* (Use With Mechanical Wrench)
	PWA 85107	Fixture
	PWA 85113	Wrench
	PWA 85114	Wrench, Torque (Use With Hydraulic Wrench)
	PWA 85115	Adapter, Wrench (Use With Hydraulic Wrench)
	PWA 85116	Wrench, Torque (Use With Mechanical Wrench)
	PWA 85117	Adapter, Wrench (Use With Mechanical Wrench)
	PWA 87870	Heater
R	PWA 88703	Rod Assembly (HPT Installation) (Post SB PW4ENG 72-562) (Replaced By PWA 104153)
R	PWA 102392	Rod Assembly (HPT Installation)
R	PWA 102462	Rod Assembly (HPT Installation) (Pre SB PW4ENG 72-562) (Replaced By PWA 104281)
R	PWA 104152	Arm, Lifting (Used With PWA 102462 And PWA 104142 Rod Assemblies)
R	PWA 104153	Rod Assembly (HPT Installation) (Post SB PW4ENG 72-562)
R	PWA 104159	Arm, Lifting (Used With PWA 88703)
R	PWA 104281	Rod Assembly (HPT Installation) (Pre SB PW4ENG 72-562)
R	PWA 107013	Arm, Lifting (Used With PWA 104153 And PWA 104281 Rod Assemblies)

*See Table 401 for the mechanical wrench tool options. The table shows the correct combinations of tools to install the No. 3 bearing retaining nut.

NOTE: The high pressure turbine is stored on PWA 87022 Stand or optional PWA 85108 Stand.

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-003	Compound, Antigalling (PWA 586)

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−01

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72−00−52/1/10

C. General Assembly Requirements

(1) Where heating is required for assembly, use minimum temperature differential of 125°F (52°C) between parts being assembled. Do not exceed 350°F (176.7°C) on any part.

(2) Where heating is required for assembly, special heaters are specified in the following procedure. However, you can use an optional flameless torch or flame torch as specified in the following steps.

(3) In locations where heating of a component in an oven is not practical or only a flange of the component requires heating, the use of Clements Cadillac Quic Heat flameless torch, Model FT 1000 is recommended.

(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE FLAME WILL DAMAGE OR BURN NON−METAL PARTS.

CAUTION: DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

D. Procedure

CAUTION: FIRST STAGE HPT BLADES WITH THERMAL BARRIER COATING (TBC) (POST SB PW4ENG 72-466) CAN ONLY BE USED IN ENGINES WITH A TURBINE NOZZLE THAT INCORPORATES A STAGE 1 HPT (BLADE) COOLING DUCT ASSEMBLY (POST SB PW4ENG 72-466) THAT WILL SUPPLY INCREASED AIRFLOW OR DAMAGE TO THE BLADES CAN OCCUR.

CAUTION: BEFORE YOU INSTALL AND SEAT THE HPT MODULE, MAKE SURE THE NO. 3 BEARING, SPACERS AND SEALS ARE FULLY SEATED AGAINST THE HPC SHAFT SHOULDER AND EACH OTHER.

(1) If necessary, remove nuts and screws that attach PWA 86058 Retainer to the rear flange of the turbine case. Remove the retainer.

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(2) Install PWA 85107 Fixture to high pressure turbine. See Figure 402.

(a) If installed, remove hydraulic cylinder and plate from pilot ring. Remove center retainer and four jaws.

(b) For engines (Pre SB PW4ENG 72−176), remove the PWA 86379 Adapter Ring, if installed, from the pilot ring detail of PWA 85107 Fixture.

CAUTION: THE SCREWS THAT HOLD THE PWA 86379 ADAPTER RING MUST BE FLUSH WITH THE ADJACENT SURFACE OR DAMAGE TO THE PARTS CAN OCCUR.

(c) For engines (Post SB PW4ENG 72−176), install the PWA 86379 Adapter Ring, if not installed, on the pilot ring detail of PWA 85107 Fixture. Use six detail cap screws to hold the adapter ring.

NOTE: The turbine intermediate hub, (Post SB PW4ENG 72−176) has a shorter inner hub. The adapter is required with the fixture to set the axial run position on the HPT rotor.

(d) Loosen eight hand knobs (402/7) at center hub (402/9) of fixture and move piloting ring rearward until it is flush with or above surface of center hub. Tighten eight hand knobs.

(e) Using hoist, attach PWA 28657 Sling with two PWA 76156 Adapters to trunnion spools of fixture. Trunnion to front end down position.

(f) With dowel at 6 o'clock position, align boltholes and lower fixture onto rear flange of turbine case. Install 26 screws (402/6), with spacers (402/5) under screw heads, through case flange and into two outer flanges of fixture.

(g) Loosen eight hand knobs (402/7) at center hub and carefully lower pilot ring (402/8) until it contacts turbine intermediate hub. Tighten eight hand knobs to secure pilot ring.

(h) Position four jaws (402/3) into center of fixture, locating lip of jaw in ID cutout of turbine hub. Lightly tighten screws (402/4) to secure jaws.

(i) Install retainer (402/10) into center of fixture to retain jaws. Tighten screws (402/4) to secure jaws.

(j) Align bolt holes and position plate (402/2), with plug (402/1), onto piloting ring and secure with 12 screws (402/11).

(3) Make a visual examination of the HPC rear shaft and rear HPC drum to identify which features these parts have. You must do this examination so that you can select the correct installation tools for each type of HPC rear shaft and drum. Examine the inside of the shaft with a light source and a mirror. There are three types of HPC shafts and HPC rear drums, see Figure 403 (Sheet 1) and Figure 403 (Sheet 2):

- HPC rear shaft integral with HPC rear drum (one piece)

- HPC rear shaft bolted to HPC rear drum (two pieces, without shaft bore)

- HPC rear shaft with inside bore that is bolted to HPC rear drum (two pieces)

(4) After you have identified the type of HPC rear shaft and HPC rear drum that you have, make a tool selection to match the type of HPC rear shaft and rear drum as follows:

CAUTION: YOU MUST DO THE EXAMINATION OF THE HPC REAR SHAFT AND REAR DRUM BEFORE YOU SELECT THE INSTALLATION TOOLS. IF YOU USE THE WRONG

TOOLS, MUCH DAMAGE TO THE HPC SHAFT CAN OCCUR.

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(5) FOR THE HPC REAR SHAFT INTEGRAL WITH HPC REAR DRUM (ONE PIECE): Install the PWA 85107 Fixture (prior to Change Letter K) or the PWA 102392 Rod Assembly together with the PWA 85107 Fixture (Change Letter K and subsequent), into the high pressure compressor rear hub. See Figure 404 (Sheet 1) and Figure 404 (Sheet 2).

(a) If required, adjust position of guide (404/2) to allow clamp (404/1) at end of rod to rotate to horizontal position with shaft (404/4). Tighten jamnuts to lock guide in position.

(b) Remove jamnut (404/6) on end of shaft (404/4) and remove clamp (404/5).

(c) Rotate clamp (404/1) to horizontal position. Install shaft (404/4) into HPC rear hub (404/8) until clamp is allowed to tilt and touch on the conical surface in the ID of the HPC rear hub.

(d) Check the position of pilot (404/3). It should be approximately 1.0 inch (25.4 mm) from the end of the HPC rear hub (404/8).

(e) If required, remove shaft (404/4) and clamp assembly. Adjust position of pilot as necessary. Tighten jamnut to secure pilot. Reinstall shaft in HPC rear hub per previous step.

(f) Position clamp, smaller OD end first, onto shaft and secure with jamnut (404/6) to lock shaft assembly in HPC rear hub.

(g) Install the coupler (404/7), a detail of PWA 85107 Fixture, onto the end of the shaft (404/4).

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(6) FOR HPC REAR SHAFT BOLTED TO HPC REAR DRUM (TWO PIECES, WITHOUT SHAFT BORE, PRE SB PW4ENG 72−562): Install the PWA 85107 Fixture (prior to Change Letter K) or the PWA 102462 Rod Assembly together with the PWA 85107 Fixture (Change Letter K and subsequent), into the high pressure compressor rear hub. See Figure 405 (Sheet 1) and Figure 405 (Sheet 2).

R NOTE: You can install the HPT with the optional PWA
R 104281 Rod Assembly.

(a) If necessary, adjust the position of the guide (405/2) to permit the shoe (405/1) at the end of the rod to turn to the horizontal position with the rod (405/5). Tighten the jamnuts to lock the guide (405/2) in position.

(b) Remove the jamnut (405/6) on the end of the rod (405/5) and remove the rod clamp (405/4).

(c) Turn the shoe (405/1) to the horizontal (parallel to rod) position with the push/pull control (405/9) and lock in this position. Install the rod assembly, shoe end first, into the HPC rear hub (405/8) as for as it will go.

(d) Unlock and turn the shoe (405/1) with the push/pull control (405/9) until the shoe (405/1) is in the vertical position (90° to rod). Pull the rod assembly rearward until the shoe (405/1) touches the conical surface in the ID of the HPC rear hub (405/8).

(e) The pilot (405/3) should be approximately 1.0 inch (25.4 mm) from the end of the HPC rear shaft (405/8).

(f) If necessary, remove rod (405/5) and shoe (405/1). Adjust the position of the pilot (405/3) as necessary. Tighten the jamnut to secure the pilot (405/3). Install the rod (405/5) and shoe (405/1) in the HPC rear hub again (405/8).

(g) Position rod clamp (405/4), smaller OD end first, onto the shaft. Tighten jamnut (405/6) to lock rod assembly in the HPC rear hub (405/8).

(h) Install the coupler (405/7), a detail of the PWA 85107 Fixture, onto the end of the shaft (405/8).

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(7) FOR HPC REAR SHAFT WITH INSIDE BORE THAT IS BOLTED TO HPC REAR DRUM (TWO PIECES, POST SB PW4ENG 72-562): Install the PWA 88703 Rod Assembly together with the PWA 85107 Fixture (Change Letter K and subsequent), into the high pressure compressor rear drum, rear disk. The detail hydraulic cylinder, plug, and plate are removed from the rear end of the PWA 85107 Fixture. See Figure 406 (Sheet 1) and Figure 406 (Sheet 2).

R NOTE: See the following step to install the HPT with
R the optional PWA 104153 Rod Assembly.

(a) Attach the detail shoulder eyebolt and coupling of the PWA 85107 Fixture to the rear end of the detail shaft of the PWA 88703 Rod Assembly. Attach an overhead hoist to the eyebolt and lift the PWA 88703 Rod Assembly.

(b) Turn back the rear detail hex nut (406/6) of the shaft until the nut covers the rear red mark on the shaft.

(c) Pull the two detail push-pull controls (406/9) and turn the handles to lock the controls in the retracted position.

(d) Put the front end of the PWA 88703 Rod Assembly into the HPC rear shaft and push the rod assembly forward as far as it will go.

(e) Turn the handles of the push-pull controls (406/9) to unlock the controls and open the two detail feet (406/1).

(f) Carefully pull the rod assembly rearward to engage the detail feet (406/1) against the front face of the HPC rear drum rear flange.

(g) Turn the rear detail hex nut (406/6) on the shaft forward until it touches the detail shaft clamp (406/5). Make sure the forward red mark is visible. If it is not, turn the hex nut (406/6) rearward and shake the rod assembly to get it to properly engage against the HPC rear drum rear flange. Turn the rear detail hex nut (406/6) on the shaft forward until it touches the detail shaft clamp (406/5). Make sure the forward red mark is visible.

(h) Install the coupler (406/7), a detail of the PWA 85107 Fixture, onto the end of the shaft.

R (8) For HPC rear shaft with inside bore that is bolted to
R HPC rear drum (two pieces, post SB PW4ENG 72−562): PWA
R 104153 Rod Assembly. See Figure 406 (Sheet 3) and
R Figure 406 (Sheet 4).

R (a) Put the shaft (406/2), with the foot (406/1), and
R shaft clamp (406/3) assembly on a workbench.

R (b) Turn back the locking nut (406/4) on the shaft
R until the nut covers the rear red mark on the
R shaft.

R (c) Insert the dowel pin (T−handel) (406/6) into the
R guide rod (406/5).

R (d) Pull and turn the dowel pin (T−handle) (406/6) 1/4
R turn to hold the feet in the retracted (closed)
R position.

R (e) Attach the PWA 107013 Lifting Arm (called Arm)
R to the rear end of the detail shaft of the Rod
R Assembly. See Figure 406 (Sheet 4).

R 1 Thread the detail cap (406/7) of the Arm into
R the Rod Assembly.

R 2 Operate the hoist to move the armhole in the
R Arm over the cap detail and rod assembly and
R attach with the detail nut ring (406/8).

R 3 Operate the hoist to lift the Arm and Rod
R Assembly and at the same time turn the hand
R knob to balance the lift arm and Rod Assembly.

R 4 Position the Rod Assembly so that it aligns
R with the HPC rear shaft.

R (f) Put the Rod Assembly into the HPC rear shaft and
R push the rod assembly forward as far as it will
R go.

R (g) Look into the shaft opening to make sure that the
R feet have the necessary clearance to open.

R (h) Push the guide rod (406/5) forward to open the
R feet (406/1).

R (i) Carefully pull the rod assembly rearward until the
R feet (406/1) touch the front face of the HPC rear
R drum.

R (j) Engage the shaft clamp (406/3) into the shaft
R (406/2) ID and lock the shaft clamp in position
R with the locking nut (406/4).

R (k) Make sure that the nut overlaps or gets below the
R red mark on the shaft. If not, loosen the locking
R nut (406/4) and carefully shake the rod assembly
R lightly to re−adjust the feet (406/1).

R (l) Remove the dowel pin (T−handel) (406/6) from the
R guide rod and remove the lifting tool.

R (m) Remove the PWA 107013 Lifting Arm from the Rod
R Assembly.

R 1 Carefully change the hoist and lift Eye to the
R hole marked "LIFT TOOL ONLY".

R 2 Remove the detail nut (406/8).

R 3 Operate the hoist to remove the Lift Arm from
R the Rod Assembly.

R 4 Remove the detail cap (406/7) from the shaft
R (406/2).

R (n) Install the detail coupler (406/7) to the shaft
R (406/2).

(9) Lubricate the ID snap diameters and splines of the HPC shaft with Antigalling Compound P06−003. See Figure 407.

(10) Position PWA 87870 Heater onto a standard workbench.

(11) If necessary, remove the protective cover positioned over the turbine blades. Using hoist, attach PWA 28657 Sling with two PWA 76156 Adapters to trunnion spools of fixture. Lift high pressure turbine from stand and position it on the heater.

CAUTION: THE THERMOCOUPLE MUST TOUCH THE END OF THE TURBINE SHAFT OR YOU CAN HEAT THE PART TOO MUCH.

(12) Connect PWA 29754 Heater Control to the heater. Heat the turbine hub to 270° − 350°F (132.° − 177.°C) maximum. After the hub is heated, remove the heater and controller.

NOTE: After you heat the HPT hubs, do steps (12) through (19) in rapid succession.

(13) Use the hoist to lift turbine from the heater. Trunnion the turbine to the horizontal position, and put it to the rear of the engine.

(14) Install the gasket onto the front outer flange of the turbine case. See Figure 408.

(15) If applicable, locate the optional PWA 85112 Retaining Fixture in ID of turbine between front and rear turbine hubs. Rotate knurled nut to retract fixture. Remove fixture from hubs.

(16) Move turbine into position, aligning turbine front hub splines with HPC (rear hub) splines. Move assembly forward to engage splines. Continue moving assembly forward until stopped at tight fit.

NOTE: Since high pressure turbine rotor cannot be rotated, it may be necessary to rotate high pressure compressor rotor to align splines.

(17) Put hydraulic cylinder (409/2) over coupler (409/5) and against plug (409/6) in the center of fixture (409/1). Attach the hydraulic cylinder with spacer (409/3) and flanged nut (409/4). See Figure 409.

(18) Connect PWA 29389 Pump or PWA 3755 Pump, with PWA 75028 Gage to hydraulic cylinder.

(19) Install ten workbolts and nuts evenly spaced through turbine front case and diffuser case, Flange M, from rear to front.

CAUTION: YOU MUST LOOSEN THE EIGHT HAND KNOBS (409/7), THAT HOLD THE PILOTING RING (402/8), SO THAT THE RING MOVES FREELY AGAINST THE TURBINE INTERMEDIATE HUB BEFORE YOU APPLY A LOAD OF 38,500 − 41,500 LBF. (171,256.5 − 184,601.2 N) FOR THE SECOND TIME OR DAMAGE TO THE ENGINE CAN OCCUR.

(20) (Reference 976) Seat turbine by tightening workbolts while actuating hydraulic pump to apply load of 38,500 − 41,500 lbf. (171,256.5 − 184,601.2 N). Release hydraulic pressure. Loosen eight hand knobs (409/7). Apply load of 38,500 − 41,500 lbf. (171,256.5 − 184,601.2 N).

NOTE: For a 30 ton hydraulic cylinder, a hydraulic pump output of 5,332 − 5,747 psig (36,762.8 − 39,624.2 kPa) will apply a load of 38,500 − 41,500 lbf. (171,256.5 − 184,601.2 N).

NOTE: For a 60 ton hydraulic cylinder, a hydraulic pump output of 2,905 − 3,132 psig (20,029.3 − 21,594.4 kPa) will apply a load of 38,500 − 41,500 lbf. (171,256.5 − 184,601.2 N).

(21) Release the hydraulic load. Remove nut (410/7), spacer (410/6), and hydraulic cylinder (410/5). Remove the screws (410/4) and plate (410/3). Remove retainer (410/2). Loosen the detail screws and remove four jaws (410/1) from the ID of the fixture. See Figure 410.

(22) Lubricate the axial faces of the turbine shaft spacer with Antigalling Compound P06−003. See Figure 411.

(23) Install turbine shaft spacer (410/9) onto the HPC rear hub.

(24) Lubricate the threads and splines of the No. 3 bearing retaining nut with Antigalling Compound P06−003. See Figure 411.

CAUTION: THE NO. 3 BEARING NUT MUST BE SILVER PLATED PRIOR TO EACH HIGH PRESSURE TURBINE INSTALLATION OR DAMAGE TO THE MATING PARTS CAN OCCUR. THE NUT CAN BE REMOVED AND RETORQUED FOR EACH HIGH PRESSURE TURBINE INSTALLATION A MAXIMUM OF THREE TIMES BEFORE REQUIRING REPLATING.

CAUTION: IF THE NUT IS REMOVED AFTER AN ENGINE RUN, IT MUST BE REPLATED.

(25) Thread the No. 3 bearing retaining nut (410/8) to the HPC rear hub. Hand tighten the nut. Use PWA 85113 Hand Wrench. Leave the hand wrench in position. Install plate (410/3) and secure with 12 screws (410/4). Install the hydraulic cylinder (410/5) over the coupler (410/10) and seat against the plug in the center of the plate (410/3). Attach the hydraulic cylinder with spacer (410/6) and nut (410/7).

NOTE: Do not install retainer or jaws.

CAUTION: MAKE SURE THE HYDRAULIC PRESSURE IS KEPT WHILE YOU TIGHTEN THE NUT OR THE NUT WILL NOT SEAT CORRECTLY AND DAMAGE TO THE ENGINE CAN OCCUR.

(26) (Reference 976) Actuate the hydraulic pump and apply a load of 60,000 − 63,000 lbf. (266,893.3 − 280,238.0 N). Use the PWA 85113 Hand Wrench to tighten the nut until the nut is seated on the hub.

NOTE: For a 30 ton hydraulic cylinder, a hydraulic pump output of 8,310 − 8,725 psig (57,295.4 − 60,156.8 kPa) will apply a load of 60,000 − 63,000 lbf. (266,893.3 − 280,238.0 N).

NOTE: For a 60 ton hydraulic cylinder, a hydraulic pump output of 4,528 − 4,755 psig (31,219.5 − 32,784.6 kPa) will apply a load of 60,000 − 63,000 lbf. (266,893.3 − 280,238.0 N).

(27) Release load and remove rod assembly.

(a) Remove hydraulic pump, nut (410/7), spacer (410/6), and hydraulic cylinder (410/5). Remove screws (410/4) and plate (410/3).

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(b) Remove bolts securing PWA 85107 Fixture to the turbine case rear flange. Remove fixture, sling, and hoist.

(c) FOR THE HPC REAR SHAFT INTEGRAL WITH HPC REAR DRUM (ONE PIECE): Remove the PWA 102392 Rod Assembly as follows: See Figure 404.

1 Carefully remove coupler (404/7) and clamp (404/5) from shaft (404/4).

2 Turn clamp (404/1) horizontal and carefully remove rod assembly from HPC rear hub (404/8).

(d) FOR HPC REAR SHAFT BOLTED TO HPC REAR DRUM (TWO PIECES, WITHOUT SHAFT BORE, PRE SB PW4ENG 72-562): Remove the PWA 102462 Rod Assembly as follows: See Figure 405.

1 Carefully remove coupler (405/7) and rod clamp (405/4) from rod (405/5).

2 Use push/pull control (405/9) to turn shoe (405/1) to the horizontal position.

3 Carefully remove rod assembly from the HPC rear hub (405/8).

(e) FOR HPC REAR SHAFT WITH INSIDE BORE THAT IS BOLTED TO HPC REAR DRUM (TWO PIECES, POST SB PW4ENG 72-562): Remove the PWA 88703 Rod Assembly as follows: See Figure 406.

1 Carefully remove coupler (406/7).

2 Turn detail rear hex nut (406/6) on the shaft rearward until it covers the rear red mark on the shaft.

3 Carefully push the rod assembly forward as far as it will go.

4 Turn the two detail handles of the push/pull controls (406/9) to unlock the two detail feet (406/1) and pull the control handles rearward to disengage the feet.

5 Turn the push/pull control handles (406/9) to lock the feet (406/1) in the retracted position.

6 Carefully pull the PWA 88703 Rod Assembly rearward until the fixture is removed from the HPC rear shaft (406/8).

R (f) FOR HPC REAR SHAFT WITH INSIDE BORE THAT IS BOLTED TO HPC REAR DRUM (TWO PIECES, POST SB PW4ENG 72−562): Remove the PWA 104153 Rod Assembly as follows: See Figure 406 (Sheet 3) and Figure 406 (Sheet 4).

R 1 Carefully remove the coupler (406/7). See Figure 406 (Sheet 4).

R 2 Attach the PWA 107013 Lifting Arm to the rear end of the shaft (406/2). See Figure 406 (Sheet 3) .

R a Thread the detail cap (406/7) of the Lifting Arm into the shaft (406/2).

R b Operate the hoist to move the armhole in the Lifting Arm over the detail cap (406/7) and attach the Lifting Arm to the shaft (406/2) with the detail nut ring (406/8).

R 3 Turn detail rear locking nut (406/4) on the shaft rearward until it covers the rear red mark on the shaft.

R 4 Insert the dowel pin (T−handel) (406/6) into the guide rod (406/5).

R 5 Push and turn the dowel pin (T−handle) (406/6) 1/4 turn to hold the feet in the extended position.

R 6 Turn the two detail handles of the push/pull controls (406/9) to unlock the two detail feet (406/1) and pull the control handles rearward to disengage the feet.

R 7 Turn the push/pull control handles (406/9) to lock the feet (406/1) in the retracted position.

R 8 Carefully pull the Rod Assembly rearward until the fixture is removed from the HPC rear shaft.

R 9 Remove the Lifting arm from the Rod Assembly.

(28) For operators that use the mechanical wrench to install the No. 3 bearing retaining nut, install tooling as follows:

(a) Install PWA 85116 Wrench into ID of No. 3 bearing retaining nut (412/7) engaging splines of wrench with splines of nut. See Figure 412.

(b) Install PWA 85117 Adapter to turbine intermediate hub (412/6). See Figure 412.

1 Loosen hex nuts (412/5) securing eight clamps (412/4). Slide clamps in slots in opposite direction that arrow is pointing and secure clamps with hex nuts.

2 Connect hoist to lifting eye on adapter.

3 Using hoist, position adapter to rear of PWA 85116 Wrench.

4 Rotate turbine rotor as required to position clamps (412/4) through slots (412/1) between lugs in turbine intermediate hub.

5 Align teeth of adapter with slots between lugs of hub. Loosen hex nuts and slide clamps in direction of arrows on base of fixture. Rotate clamps as required to position feet under lugs on hub and insert pins (412/3) into holes in base of adapter. Tighten hex nuts to secure clamps.

NOTE: Plate detail of clamp points to direction that clamp feet are facing.

(c) Using hoist, align splines and slide applicable mechanical wrench over splines of PWA 85116 Wrench. Align anti−torque pins in wrench with bushings in PWA 85117 Adapter and seat wrench on adapter. See Table 401 for mechanical wrench options. See Figure 413.

NOTE: Wrenches may be actuated using air torque multipliers to speed up removal of nut. See Table 401.

PWA Mechanical Wrench	PWA Torque Multiplier
PWA 29614	PWA 45419 or PWA 80651

Mechanical Wrench Options
Table 401

(29) For operators that use the hydraulic wrench to install the No. 3 bearing retaining nut, install tooling as follows:

(a) Install PWA 85114 Wrench into ID of No. 3 bearing retaining nut (414/5) engaging splines of wrench with splines of nut. See Figure 414.

(b) Install PWA 85115 Adapter to turbine intermediate hub.

1 Loosen wing nuts securing eight clamps (414/3). Slide clamps in slots in opposite direction of arrows on base of fixture and secure clamps with wing nuts.

2 Install eyebolt into threaded hole at top of adapter and connect hoist to eyebolt.

3 Using hoist, position adapter to PWA 85114 Wrench and onto rear of HPT.

4 Rotate turbine rotor as required to position clamps (414/3) through slots between lugs in turbine intermediate hub (414/6).

5 Align 16 teeth of adapter with slots between lugs of turbine intermediate hub. Loosen wing nuts and slide clamps in direction of arrows on base of fixture. Rotate clamps as required to position feet under lugs on hub and secure with wing nuts.

NOTE: Dowel pin (414/4) in stud detail of clamp points in direction that clamp feet are facing.

(c) Use a hoist and applicable sling to lift the PWA 25000 Hydraulic Wrench. Find the correct direction to turn the drive spline of the wrench. Refer to the PWA 29178 Instruction Decal on the hydraulic wrench to get the position of the shifting mechanism to cause the drive spline to turn in the tighten direction. See Figure 415.

NOTE: PWA 28669 Cart can be used to store and transport PWA 25000 Wrench.

(d) Connect PWA 28668 Pump or PWA 29510 Pump to the hydraulic wrench. Operate the wrench to make sure that the wrench turns in the tighten direction.

(e) Align splines and position PWA 25000 Wrench onto PWA 85114 Wrench. Move wrench forward and engage keys of PWA 85115 Adapter with keyways in PWA 25000 Wrench. See Figure 415.

(f) Use the selector to operate the wrench (in the following step). As the drive spline turns, look at the travel indicator. When the travel indicator reaches its maximum travel, use the selector control valve to let the wrench ratchet return. Repeat this procedure as necessary (in the following step) until the nut is tightened.

(30) (Reference 976) Actuate wrench to torque No. 3 bearing retaining nut.

CAUTION: THE NUT MUST NOT MOVE WITH THIS TORQUE RANGE. IF THE NUT MOVES, THE STACK IS NOT SEATED AND THIS PROCEDURE FROM STEP (16) ONWARD MUST BE DONE AGAIN. IF THE NUT DOES NOT MOVE, CONTINUE WITH THE ANGLE OF TURN. IF THE NUT MOVES AFTER

THE SECOND ATTEMPT OF STEPS (16) AND ON, PROCEED TO THE ANGLE OF TURN.

(a) Torque the nut to 6000 − 10000 lb−in. (677.909 − 1129.848 N.m) to make sure the stack is tight.

(b) Set angle of turn scale to 0 and apply 90 − 94 degrees angle of turn.

(31) After you do the angle of turn, measure the final torque necessary to move the nut in the forward direction. This can be done with a suitable hand torque wrench with the appropriate multiplier on the mechanical wrench. The minimum torque necessary to make sure of the correct loading is 75000 lb−in. (8473.860 N.m). If the final torque is less, continue the angle of turn up to an additional 20 degrees. Use only the additional angle of turn necessary to get the 75000 lb−in. (8473.860 N.m) final torque. If more than the additional 20 degree angle of turn is necessary to get the 75000 lb−in. (8473.860 N.m) final torque then you must do the procedure again from step (16) onward.

(32) Remove wrenches from turbine hub.

(33) Install No. 3 bearing retaining nut lock. See Figure 416.

(a) Install one retaining ring lock (416/2) into groove in ID spline of No. 3 bearing retaining nut (416/3).

(b) Align lugs on front of No. 3 bearing nut lock (416/1) with slots in HPC rear hub while mating splines of nut lock with No. 3 bearing retaining nut.

(c) Install second retaining ring lock (416/2) into groove in ID spline of retaining nut.

(34) Remove all the unwanted antigalling compound from the nut and the hub.

(35) Install Flange M hardware as follows. Refer to 72-00-52, Installation-20 (Task 72-00-52-420-020).

NOTE: Leave protectors on the 2nd stage turbine airseal land and 2nd stage blade trailing edges until low pressure turbine is installed.

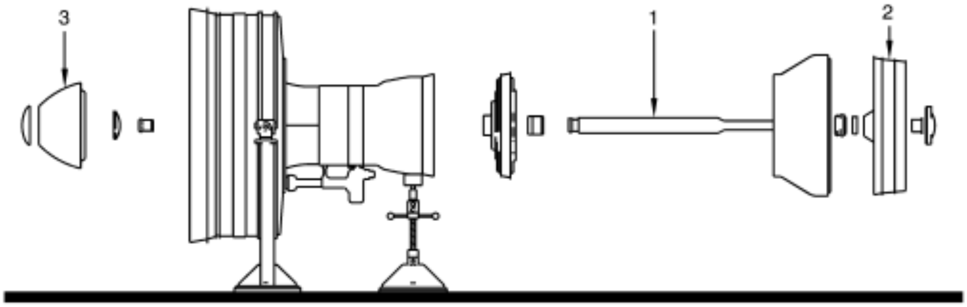
E. Postrequisites

(1) Install The External Plumbing. Refer to 72-00-52, Installation-03 (Task 72-00-52-420-003).

(2) Install The Low Pressure Turbine. Refer to 72-00-53, Installation-01 (Task 72-00-53-420-001).

(3) Test the engine. Refer to the Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).

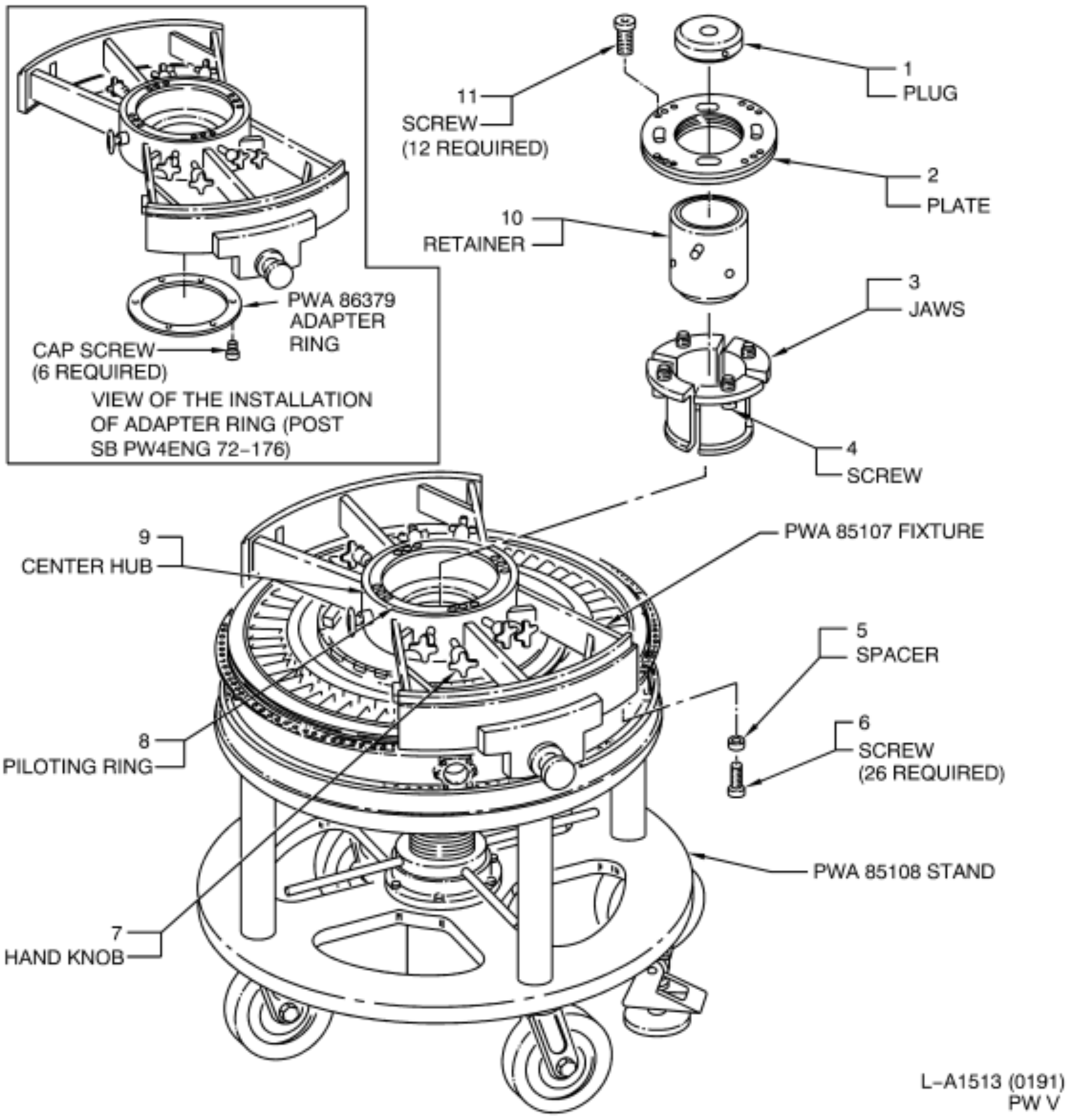
ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−01



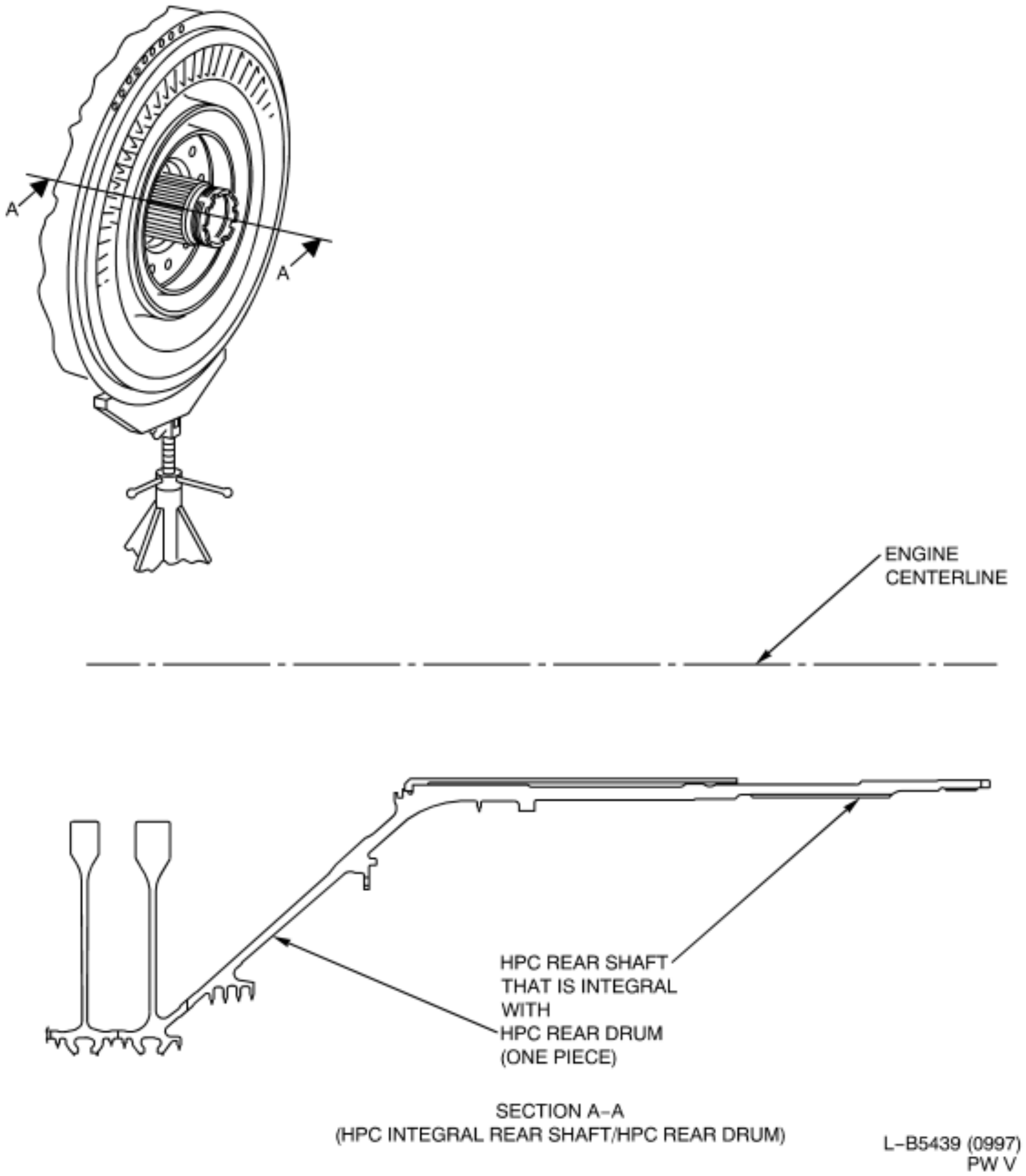
1. INSTALL LOW PRESSURE TURBINE
2. INSTALL EXHAUST CASE
3. INSTALL COMPRESSOR INLET CONE

L−A0336 (0000)
PW V

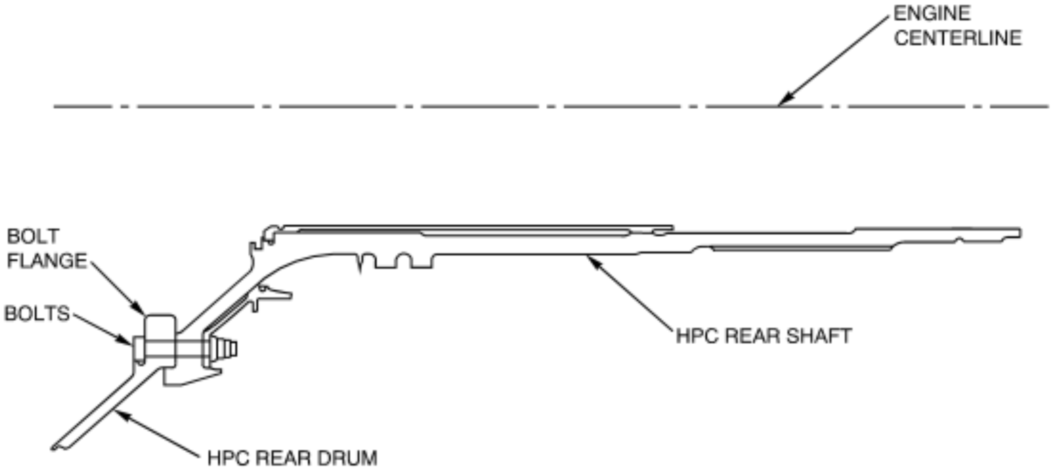
Procedure Sequence
Figure 401
(Task 72−00−52−420−001)


11
SCREW
(12 REQUIRED)
1
PLUG
2
PLATE
10
RETAINER
3
JAWS
4
SCREW
PWA 86379
ADAPTER
RING
CAP SCREW
(6 REQUIRED)
VIEW OF THE INSTALLATION
OF ADAPTER RING (POST
SB PW4ENG 72−176)
9
CENTER HUB
PWA 85107 FIXTURE
5
SPACER
6
SCREW
(26 REQUIRED)
8
PILOTING RING
PWA 85108 STAND
7
HAND KNOB
L−A1513 (0191)
PW V

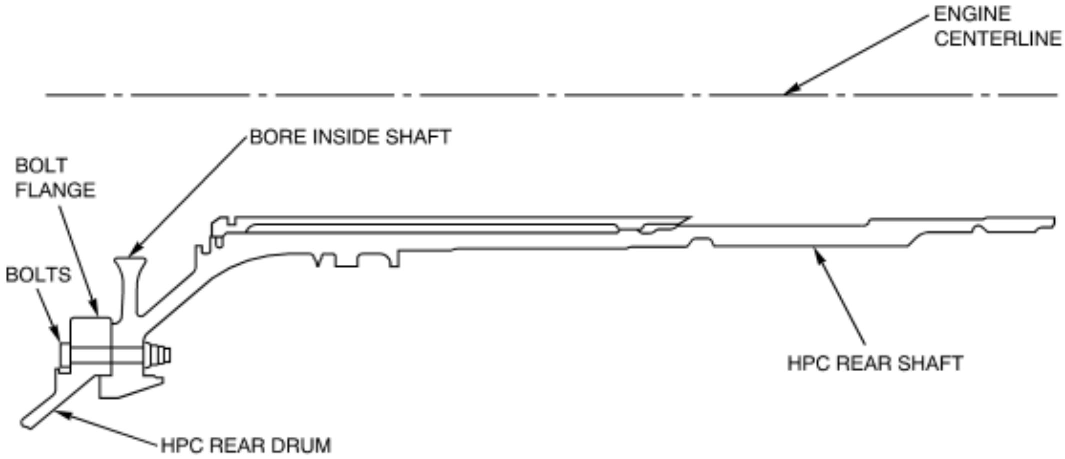
Handling Fixture Installation
Figure 402
(Task 72−00−52−420−001)


A
A
ENGINE CENTERLINE
HPC REAR SHAFT THAT IS INTEGRAL WITH HPC REAR DRUM (ONE PIECE)
SECTION A-A
(HPC INTEGRAL REAR SHAFT/HPC REAR DRUM)
L-B5439 (0997)
PW V

Identification Of HPC Rear Shaft And Rear Drum Features
Figure 403 (Sheet 1)
(Task 72-00-52-420-001)


ENGINE CENTERLINE
BOLT FLANGE
BOLTS
HPC REAR SHAFT
HPC REAR DRUM

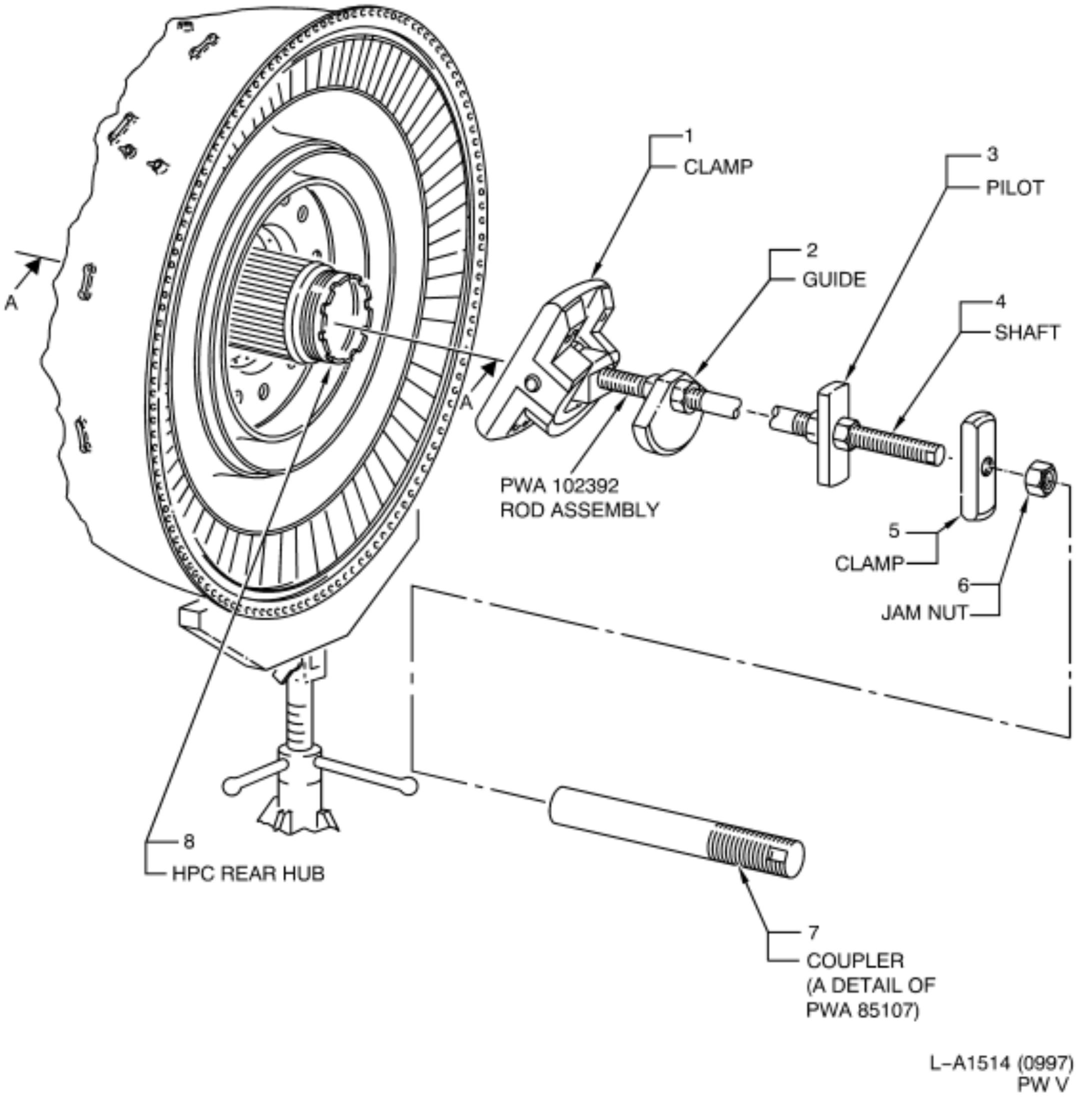
SECTION A−A
(HPC REAR SHAFT BOLTED TO HPC REAR DRUM)


ENGINE CENTERLINE
BORE INSIDE SHAFT
BOLT FLANGE
BOLTS
HPC REAR SHAFT
HPC REAR DRUM

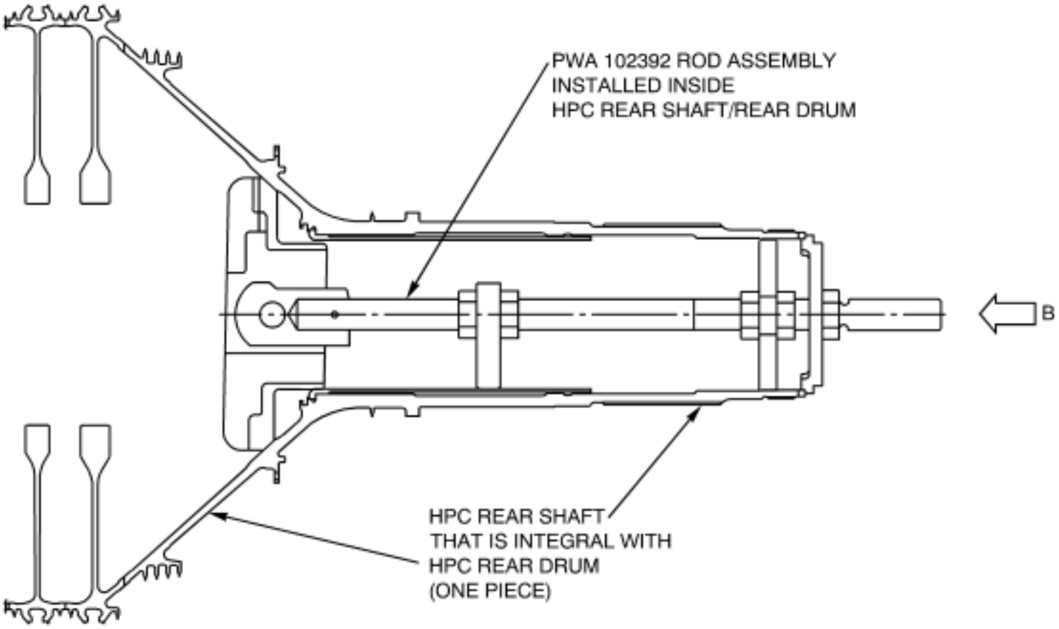
SECTION A−A
(HPC REAR SHAFT WITH INSIDE BORE BOLTED TO HPC REAR DRUM)

L−B5440 (0997)
PW V

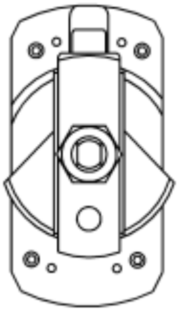
Identification Of HPC Rear Shaft And Rear Drum Features
Figure 403 (Sheet 2)
(Task 72−00−52−420−001)


A
1
CLAMP
3
PILOT
2
GUIDE
4
SHAFT
A
PWA 102392
ROD ASSEMBLY
5
CLAMP
6
JAM NUT
8
HPC REAR HUB
7
COUPLER
(A DETAIL OF
PWA 85107)
L-A1514 (0997)
PW V

PWA 102392 Rod Assembly Installation (Engines
With HPC INTEGRAL REAR SHAFT/HPC REAR DRUM)
Figure 404 (Sheet 1)
(Task 72-00-52-420-001)


PWA 102392 ROD ASSEMBLY
INSTALLED INSIDE
HPC REAR SHAFT/REAR DRUM
B
HPC REAR SHAFT
THAT IS INTEGRAL WITH
HPC REAR DRUM
(ONE PIECE)

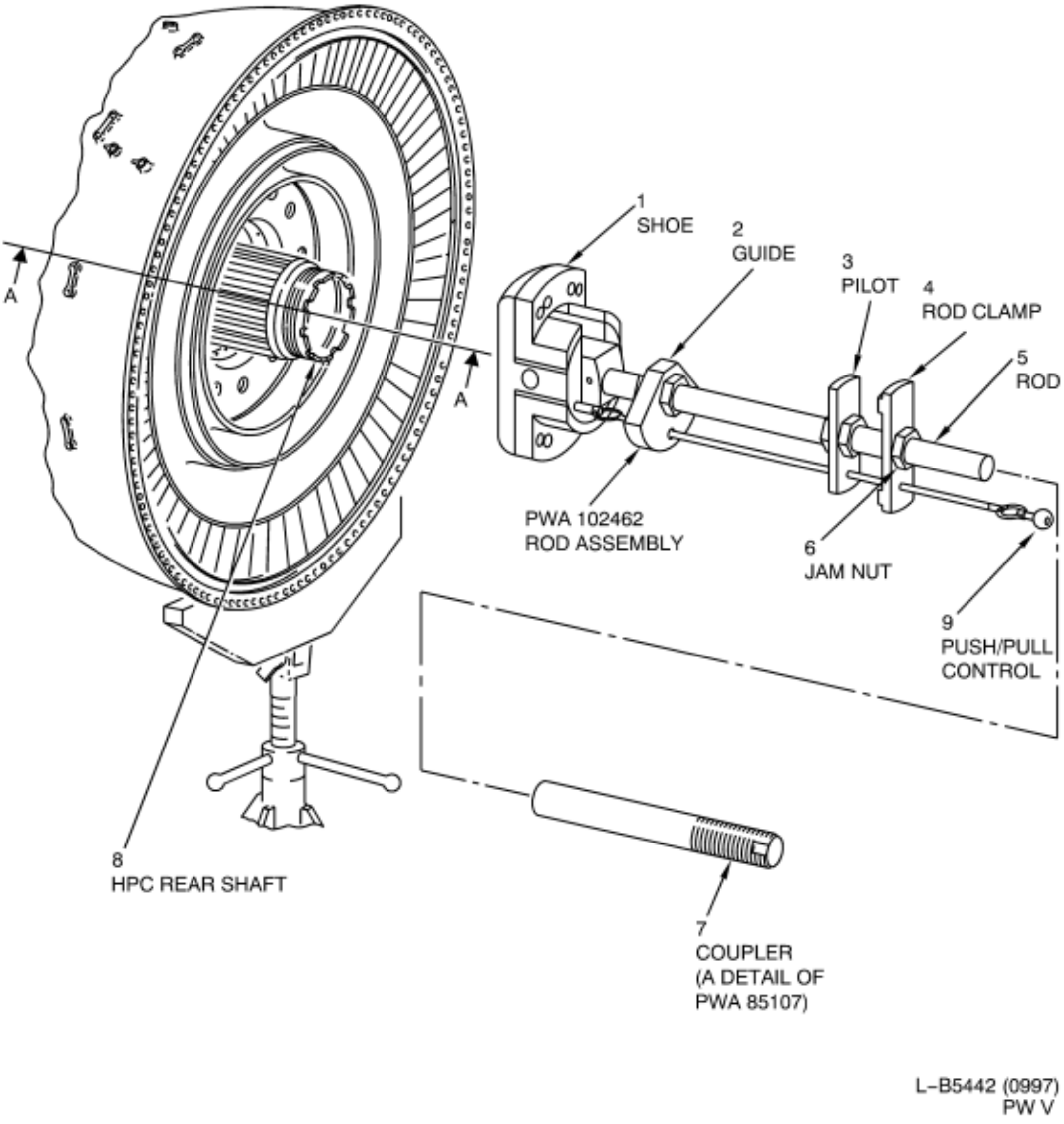
SECTION A-A



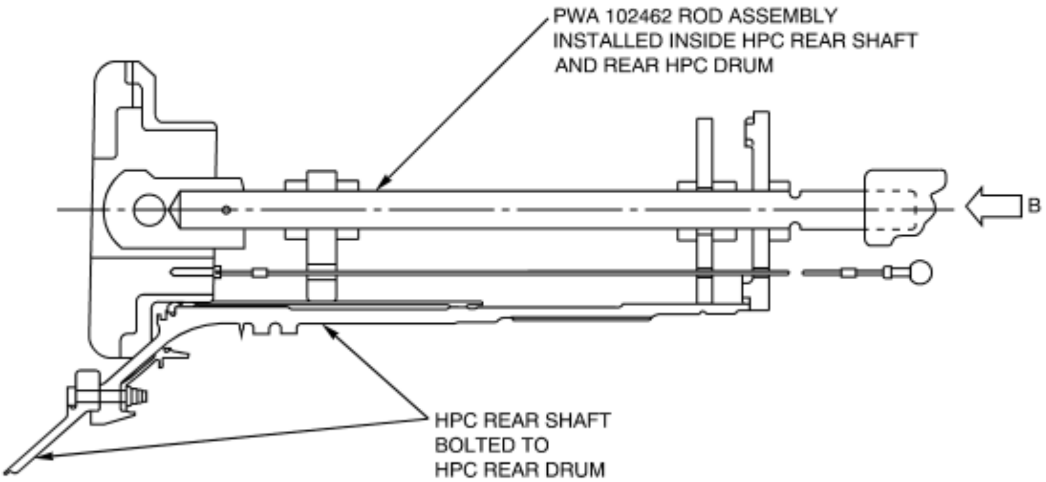
VIEW B

L-B5441 (0997)
PW V

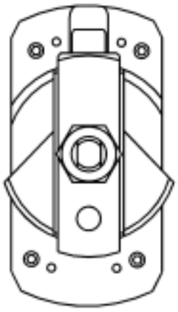
PWA 102392 Rod Assembly Installation (Engines With HPC INTEGRAL REAR SHAFT/HPC REAR DRUM)
Figure 404 (Sheet 2)
(Task 72-00-52-420-001)


1
SHOE
2
GUIDE
3
PILOT
4
ROD CLAMP
5
ROD
A
A
PWA 102462
ROD ASSEMBLY
6
JAM NUT
9
PUSH/PULL
CONTROL
8
HPC REAR SHAFT
7
COUPLER
(A DETAIL OF
PWA 85107)
L−B5442 (0997)
PW V

PWA 102462 Rod Assembly Installation (Engines With HPC REAR SHAFT BOLTED TO THE HPC REAR DRUM) (Pre SB PW4ENG 72−562)
Figure 405 (Sheet 1)
(Task 72−00−52−420−001)


PWA 102462 ROD ASSEMBLY
INSTALLED INSIDE HPC REAR SHAFT
AND REAR HPC DRUM
B
HPC REAR SHAFT
BOLTED TO
HPC REAR DRUM

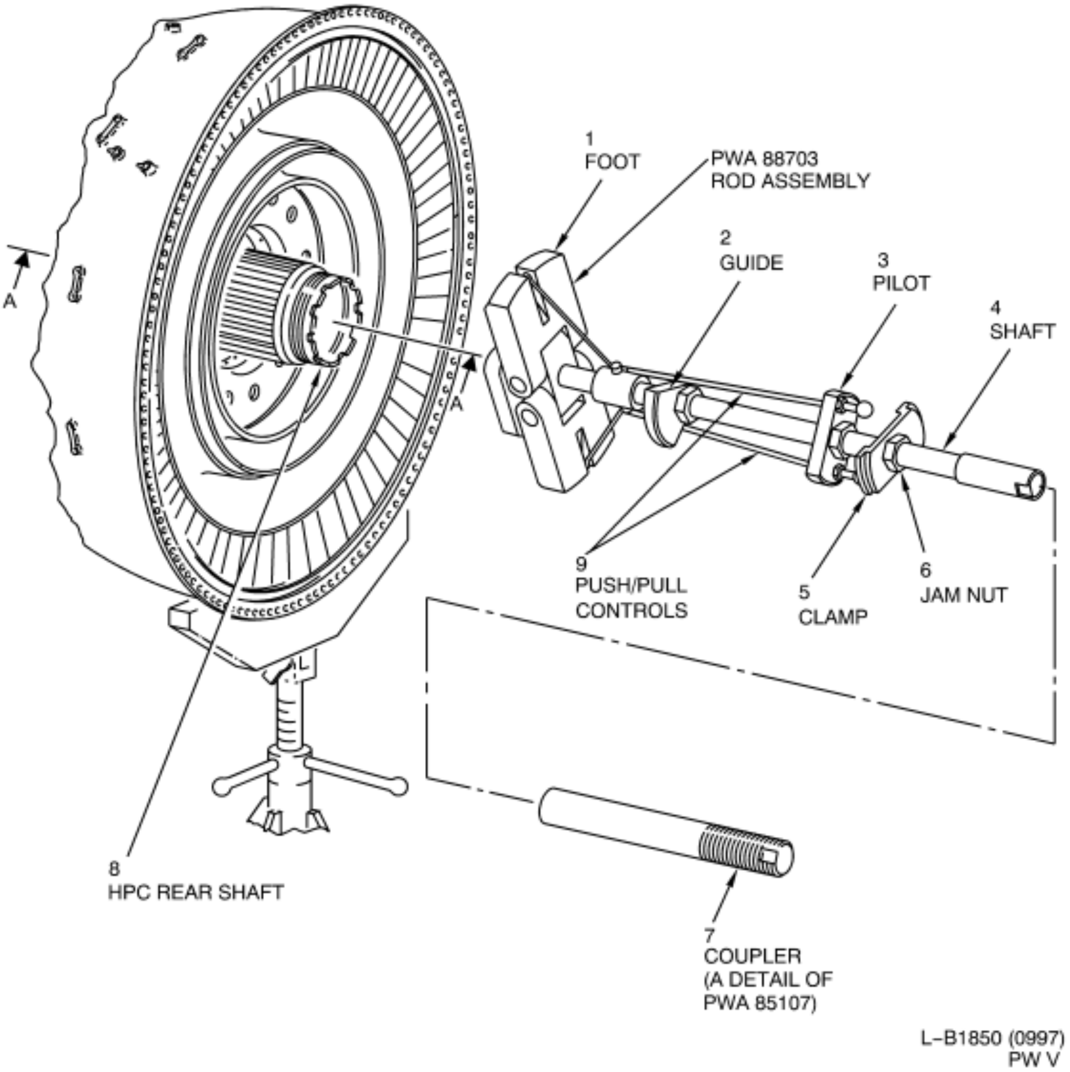
SECTION A-A



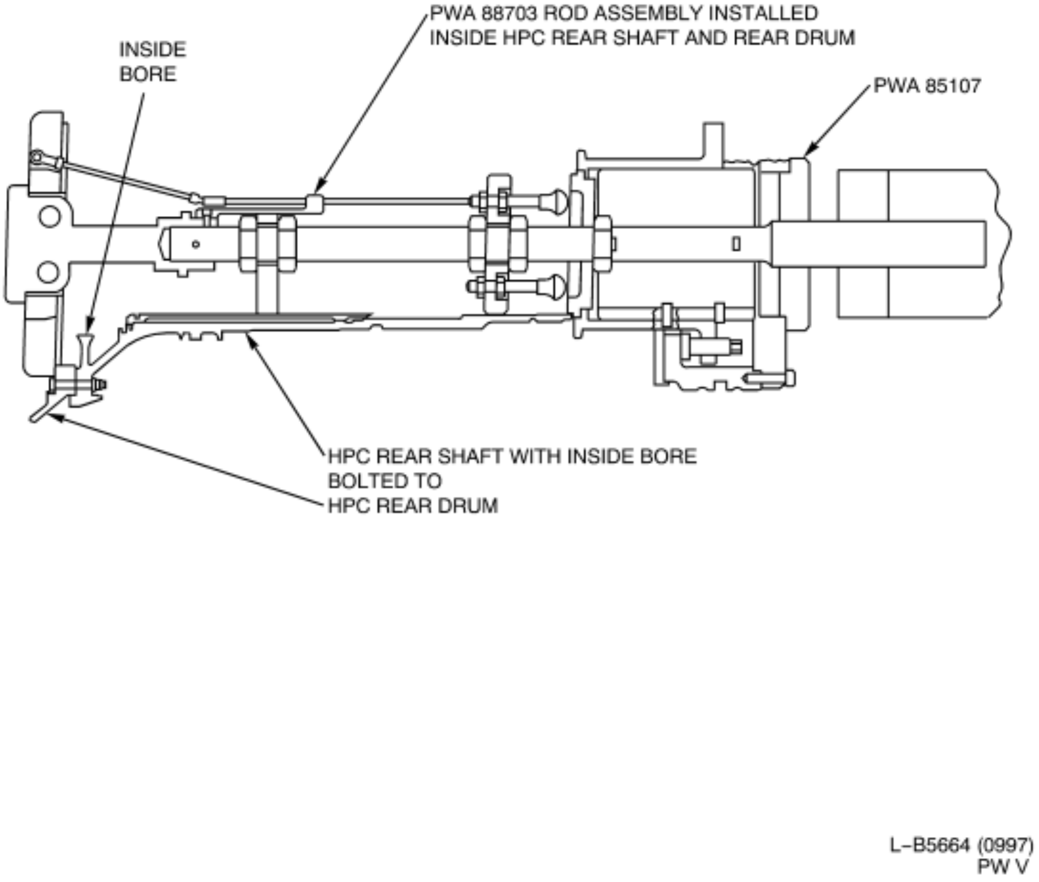
VIEW B

L-B5443 (0997)
PW V

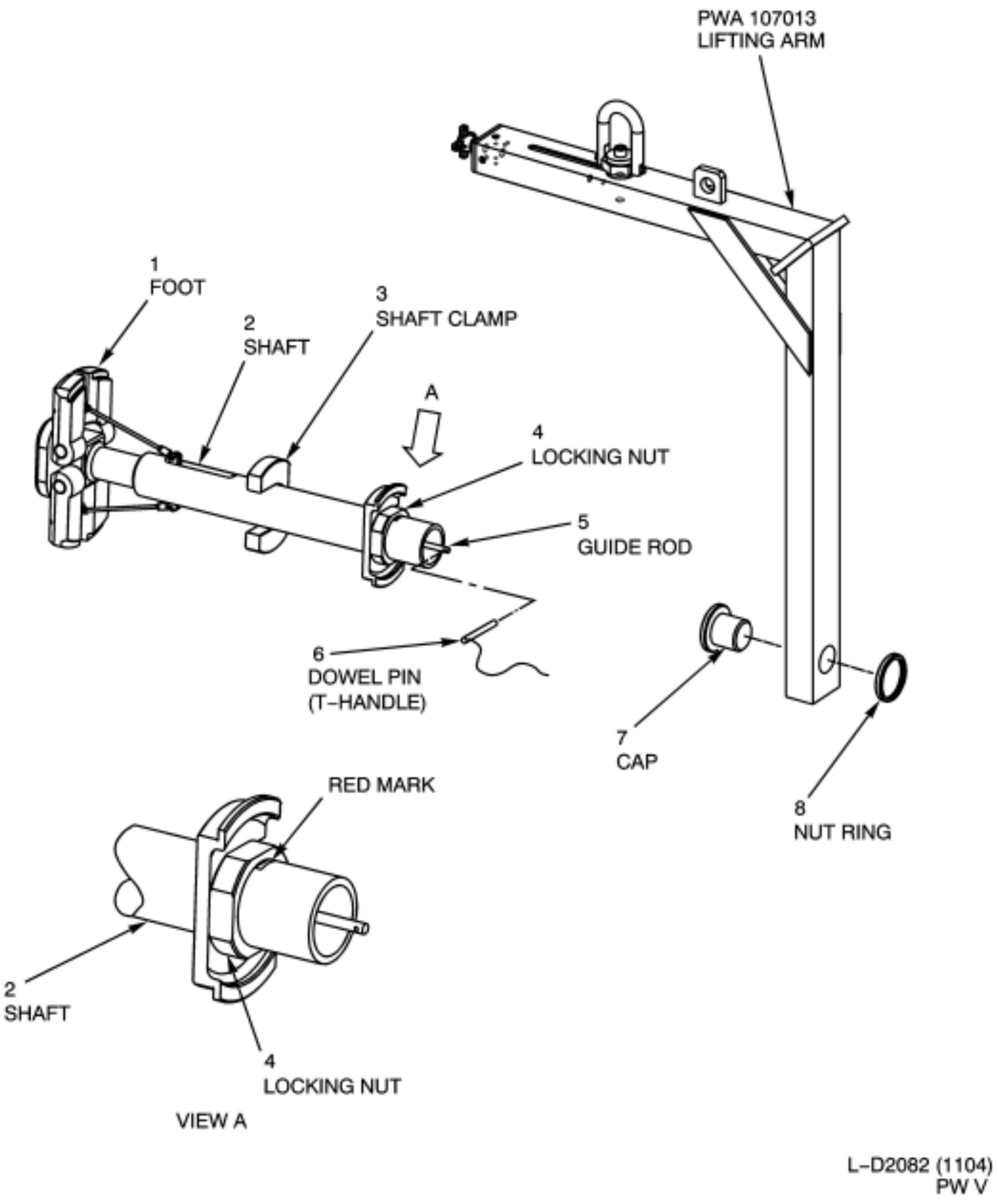
PWA 102462 Rod Assembly Installation (Engines With HPC REAR SHAFT BOLTED TO THE HPC REAR DRUM) (Pre SB PW4ENG 72-562)
Figure 405 (Sheet 2)
(Task 72-00-52-420-001)


1
FOOT
PWA 88703
ROD ASSEMBLY
2
GUIDE
3
PILOT
4
SHAFT
A
A
9
PUSH/PULL
CONTROLS
5
CLAMP
6
JAM NUT
8
HPC REAR SHAFT
7
COUPLER
(A DETAIL OF
PWA 85107)
L−B1850 (0997)
PW V

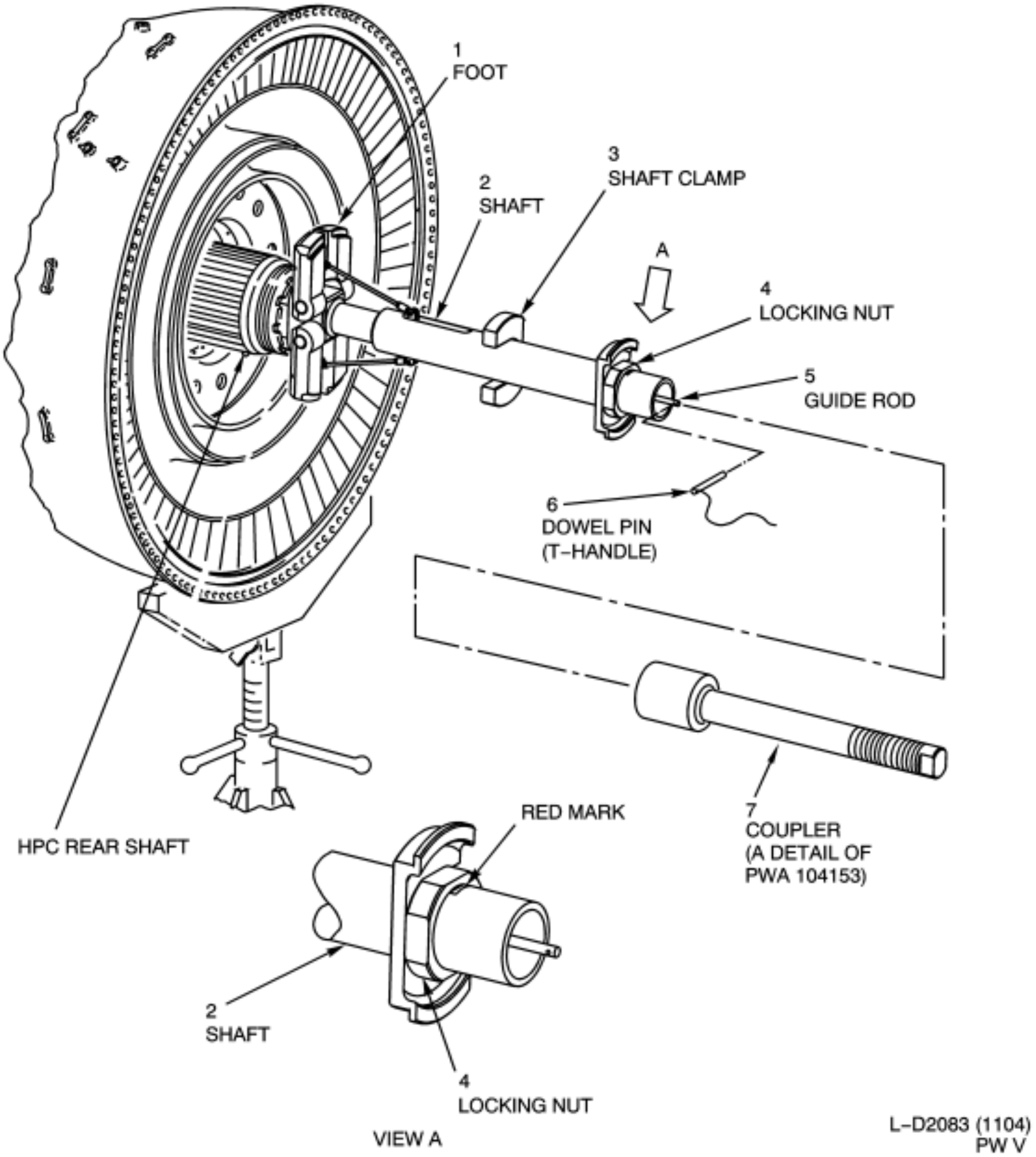
PWA 88703 Rod Assembly Installation (Engines
With HPC REAR SHAFT WITH INSIDE BORE BOLTED TO
THE HPC REAR DRUM) (Post SB PW4ENG 72−562)
Figure 406 (Sheet 1)
(Task 72−00−52−420−001)


PWA 88703 ROD ASSEMBLY INSTALLED INSIDE HPC REAR SHAFT AND REAR DRUM
INSIDE BORE
PWA 85107
HPC REAR SHAFT WITH INSIDE BORE BOLTED TO HPC REAR DRUM
L−B5664 (0997)
PW V

PWA 88703 Rod Assembly Installation (Engines
With HPC REAR SHAFT WITH INSIDE BORE BOLTED TO
THE HPC REAR DRUM) (Post SB PW4ENG 72−562)
Figure 406 (Sheet 2)
(Task 72−00−52−420−001)

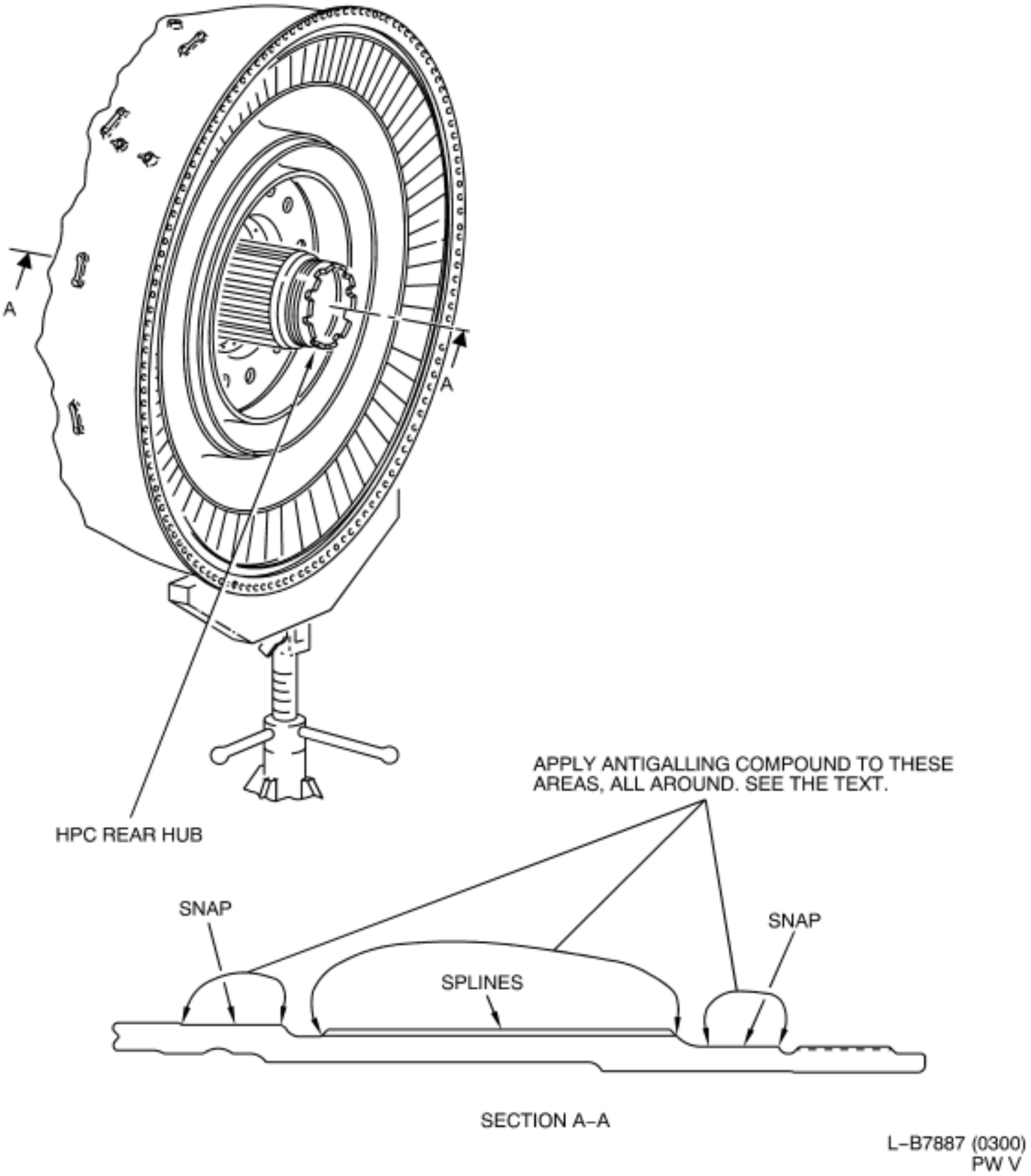

PWA 107013
LIFTING ARM
1
FOOT
2
SHAFT
3
SHAFT CLAMP
A
4
LOCKING NUT
5
GUIDE ROD
6
DOWEL PIN
(T-HANDLE)
7
CAP
8
NUT RING
RED MARK
2
SHAFT
4
LOCKING NUT
VIEW A
L-D2082 (1104)
PW V

R PWA 104281 Rod Assembly Installation (Engines
R With HPC REAR SHAFT WITH INSIDE BORE BOLTED TO
R THE HPC REAR DRUM) (Post SB PW4ENG 72-562)
R Figure 406 (Sheet 3)
R (Task 72-00-52-420-001)

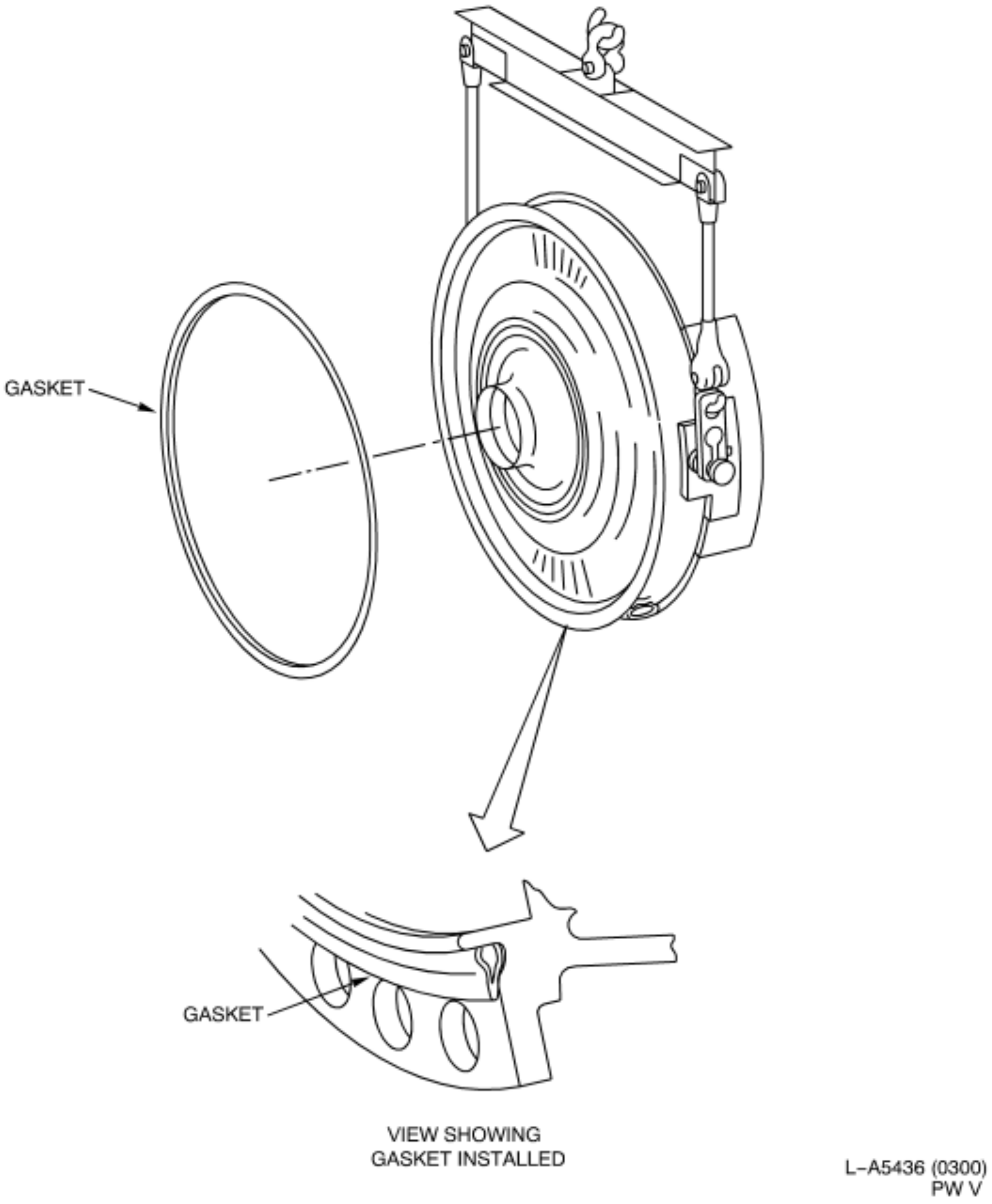

1
FOOT
2
SHAFT
3
SHAFT CLAMP
A
4
LOCKING NUT
5
GUIDE ROD
6
DOWEL PIN
(T-HANDLE)
HPC REAR SHAFT
RED MARK
7
COUPLER
(A DETAIL OF
PWA 104153)
2
SHAFT
4
LOCKING NUT
VIEW A
L-D2083 (1104)
PW V

R PWA 104281 Rod Assembly Installation (Engines
R With HPC REAR SHAFT WITH INSIDE BORE BOLTED TO
R THE HPC REAR DRUM) (Post SB PW4ENG 72-562)
R Figure 406 (Sheet 4)
R (Task 72-00-52-420-001)

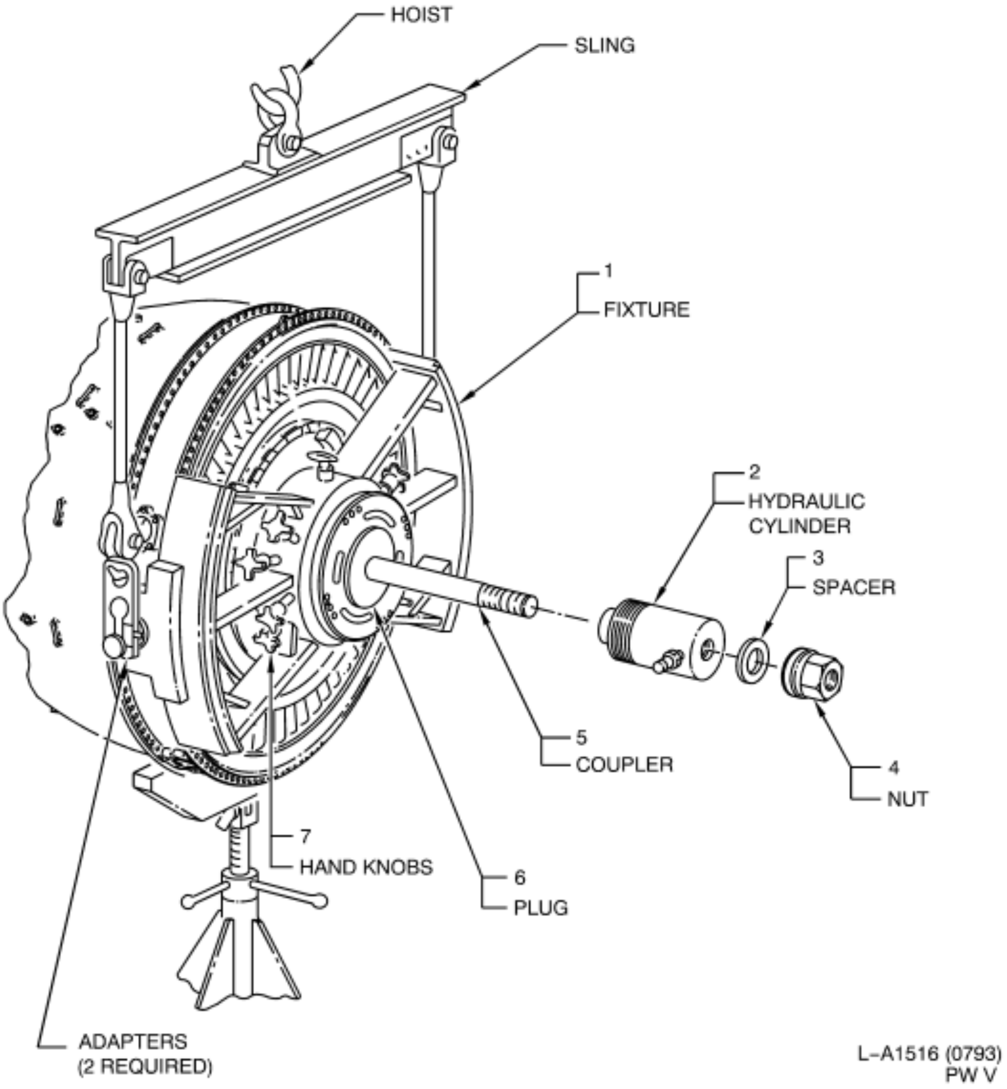
ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−01


A
A
HPC REAR HUB
APPLY ANTIGALLING COMPOUND TO THESE AREAS, ALL AROUND. SEE THE TEXT.
SNAP
SNAP
SPLINES
SECTION A−A
L−B7887 (0300)
PW V

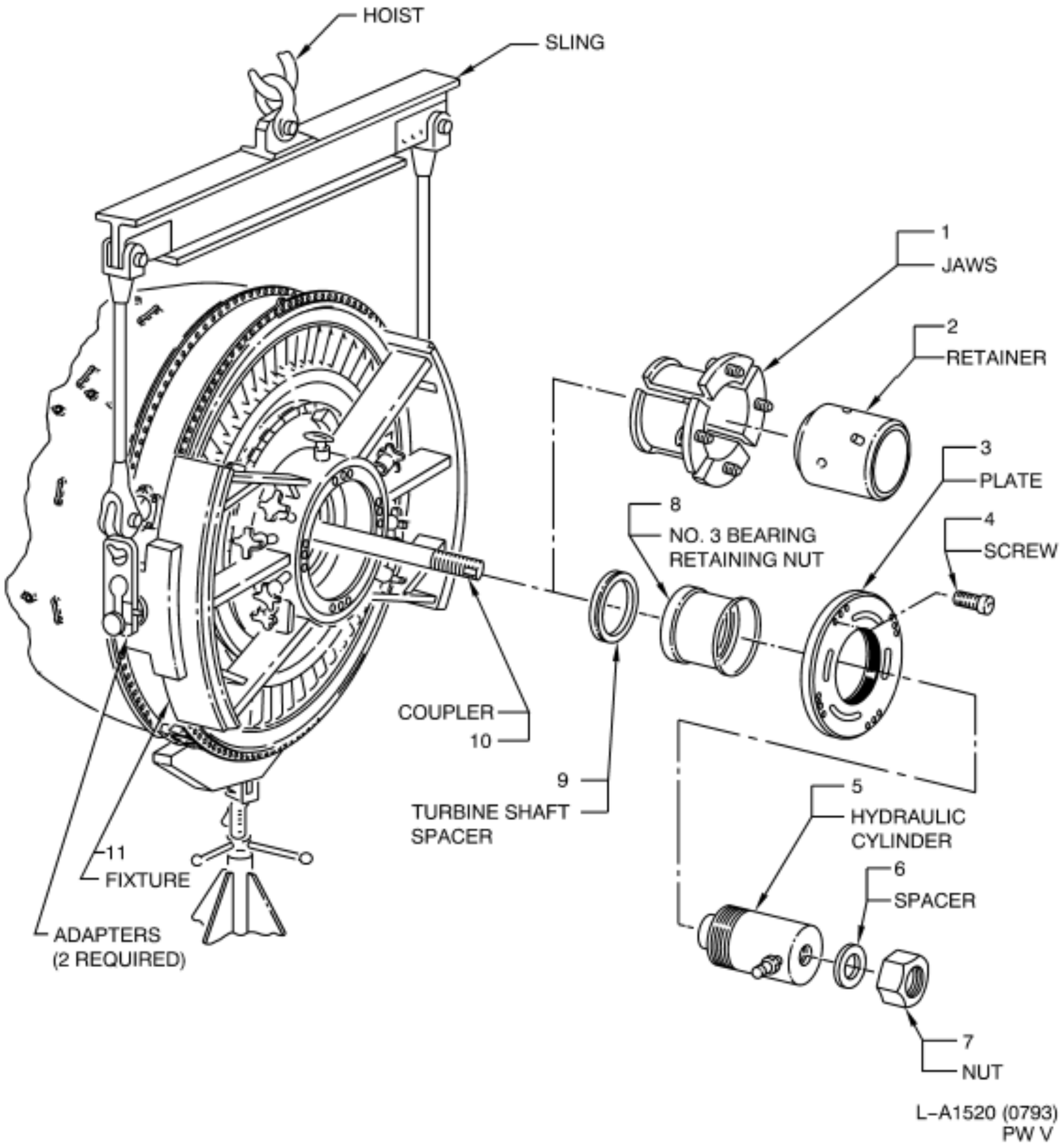
HPC Shaft Antigalling Compound Locations
Figure 407
(Task 72−00−52−420−001)


GASKET
GASKET
VIEW SHOWING
GASKET INSTALLED
L−A5436 (0300)
PW V

Turbine Case Gasket Installation
Figure 408
(Task 72−00−52−420−001)

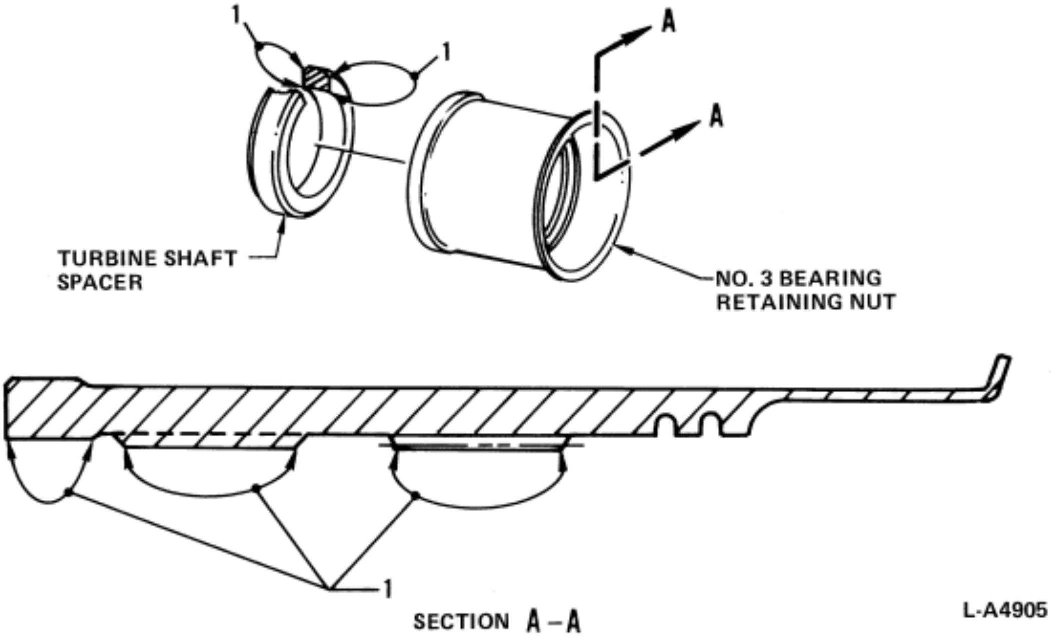

HOIST
SLING
1
FIXTURE
2
HYDRAULIC CYLINDER
3
SPACER
5
COUPLER
4
NUT
7
HAND KNOBS
6
PLUG
ADAPTERS (2 REQUIRED)
L−A1516 (0793)
PW V

High Pressure Turbine Installation
Figure 409
(Task 72−00−52−420−001)


HOIST
SLING
1
JAWS
2
RETAINER
3
PLATE
4
SCREW
8
NO. 3 BEARING
RETAINING NUT
COUPLER
10
9
TURBINE SHAFT
SPACER
5
HYDRAULIC
CYLINDER
6
SPACER
11
FIXTURE
ADAPTERS
(2 REQUIRED)
7
NUT
L−A1520 (0793)
PW V

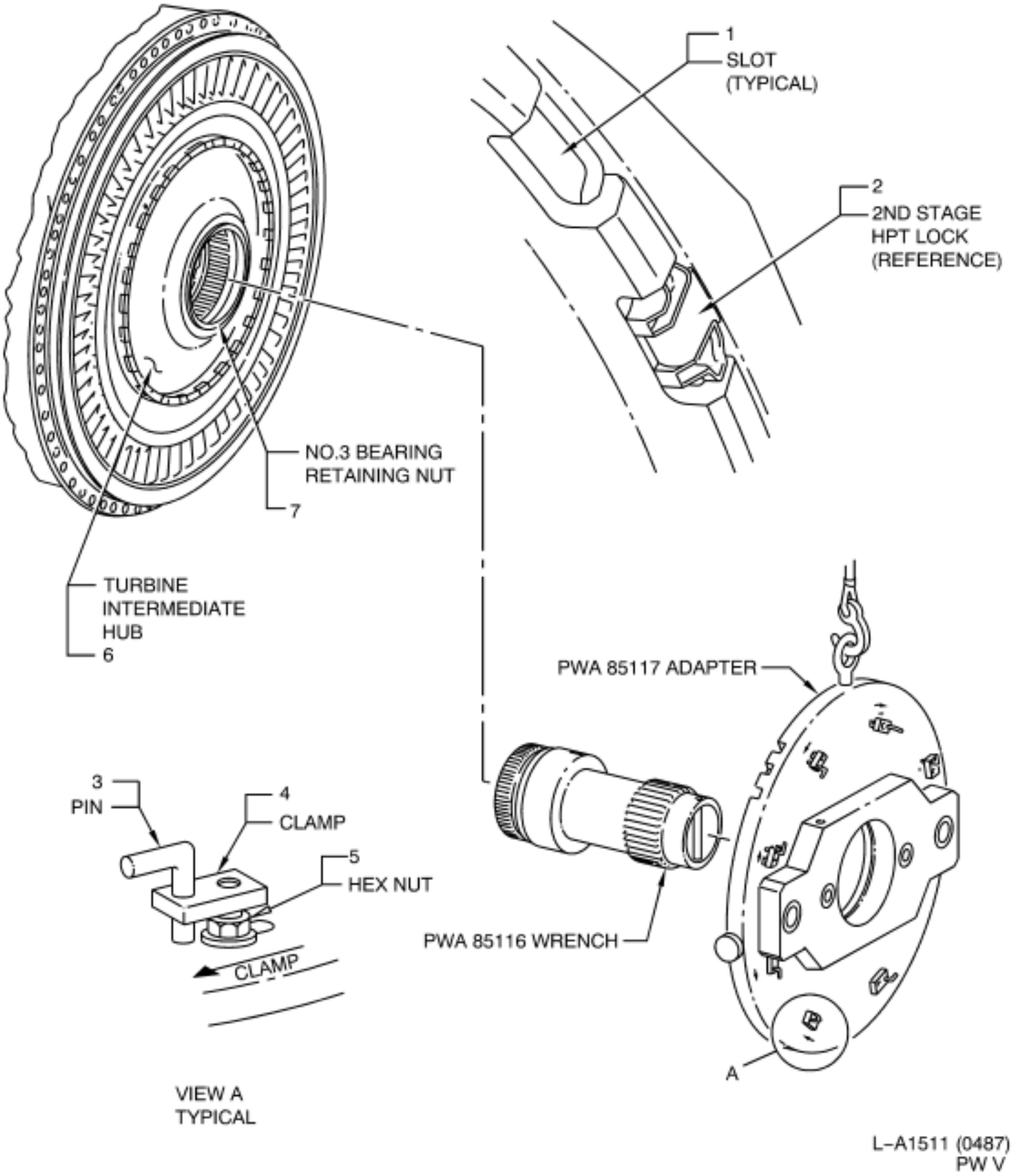
No. 3 Bearing Retaining Nut Installation
Figure 410
(Task 72−00−52−420−001)

R
R

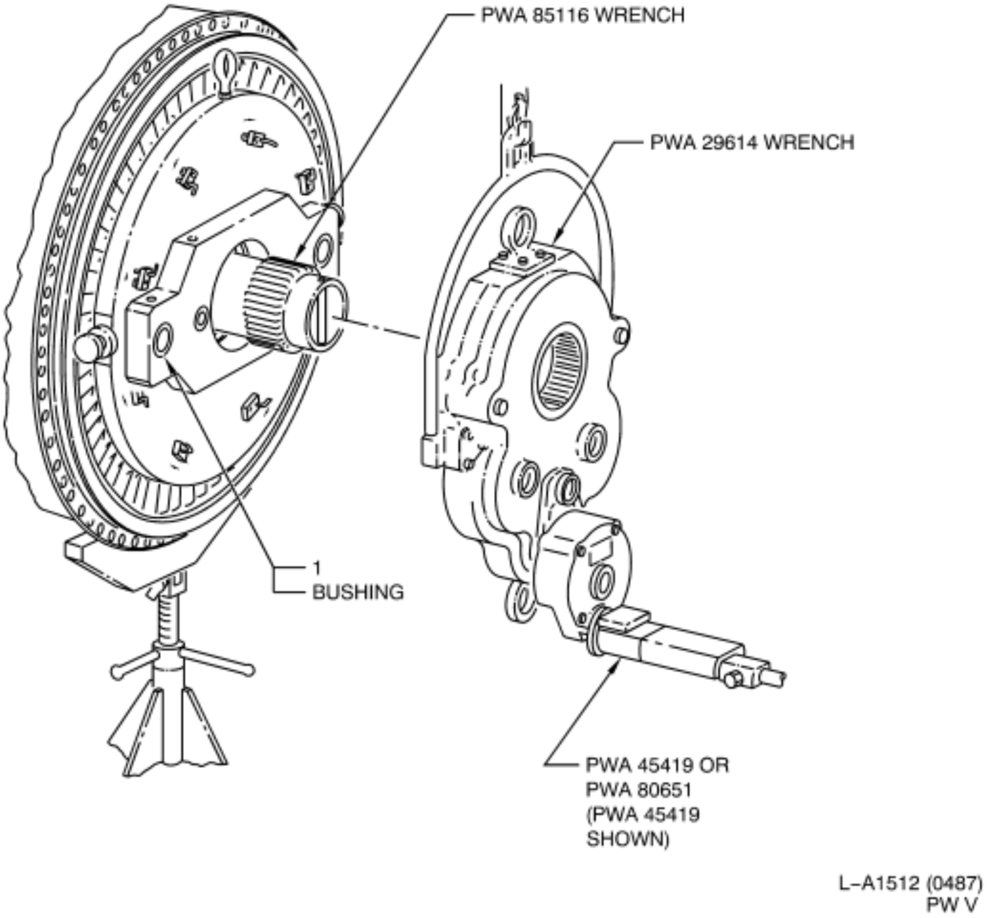

1
1
A
A
TURBINE SHAFT SPACER
NO. 3 BEARING RETAINING NUT
1
SECTION A − A
L-A4905

1. Apply Antigalling Compound To This Area. See The Text.

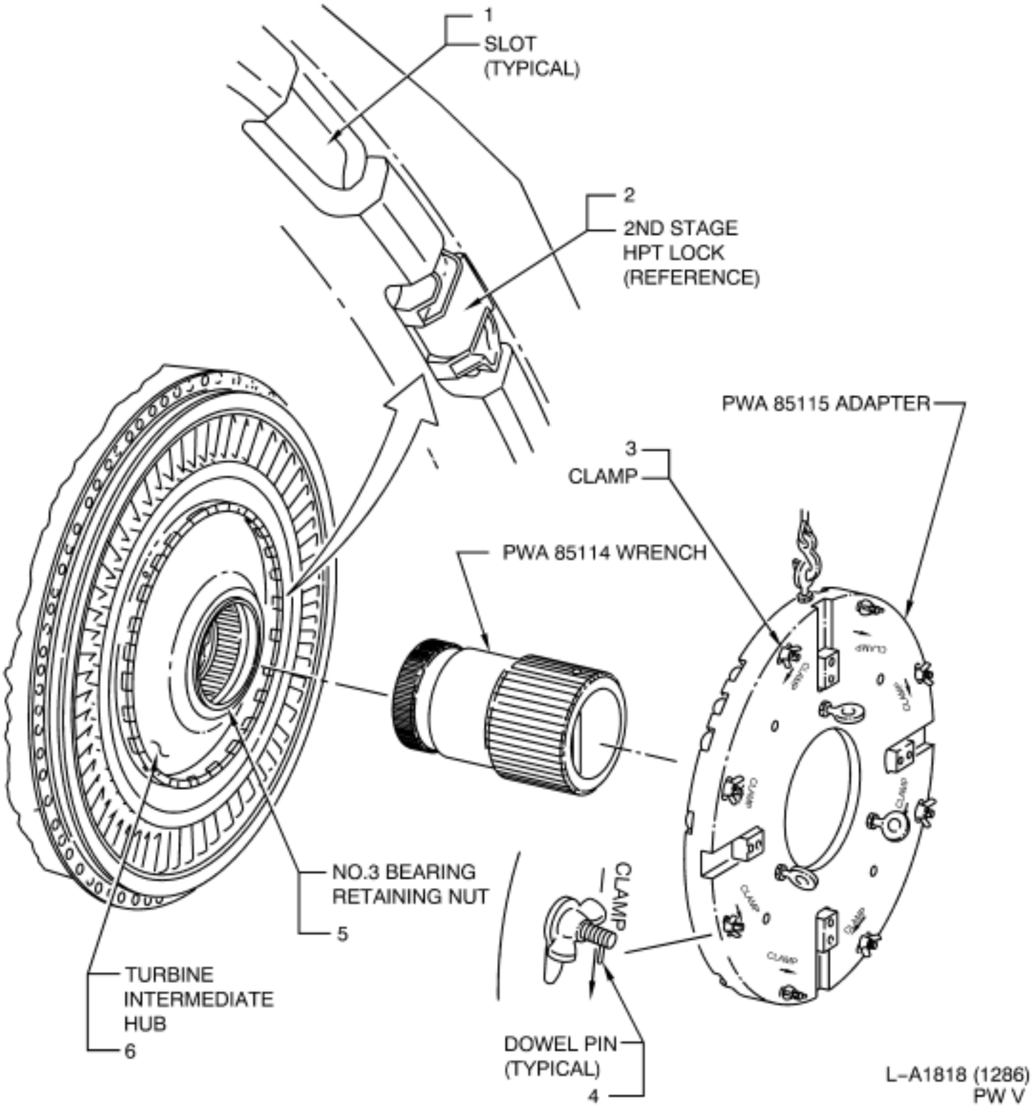
Antigalling Compound Application
Figure 411
(Task 72−00−52−420−001)


1
SLOT
(TYPICAL)
2
2ND STAGE
HPT LOCK
(REFERENCE)
NO.3 BEARING
RETAINING NUT
7
TURBINE
INTERMEDIATE
HUB
6
PWA 85117 ADAPTER
3
PIN
4
CLAMP
5
HEX NUT
CLAMP
PWA 85116 WRENCH
A
VIEW A
TYPICAL
L−A1511 (0487)
PW V

No. 3 Bearing Retaining Nut Torquing (Mechanical Wrench)
Figure 412
(Task 72−00−52−420−001)

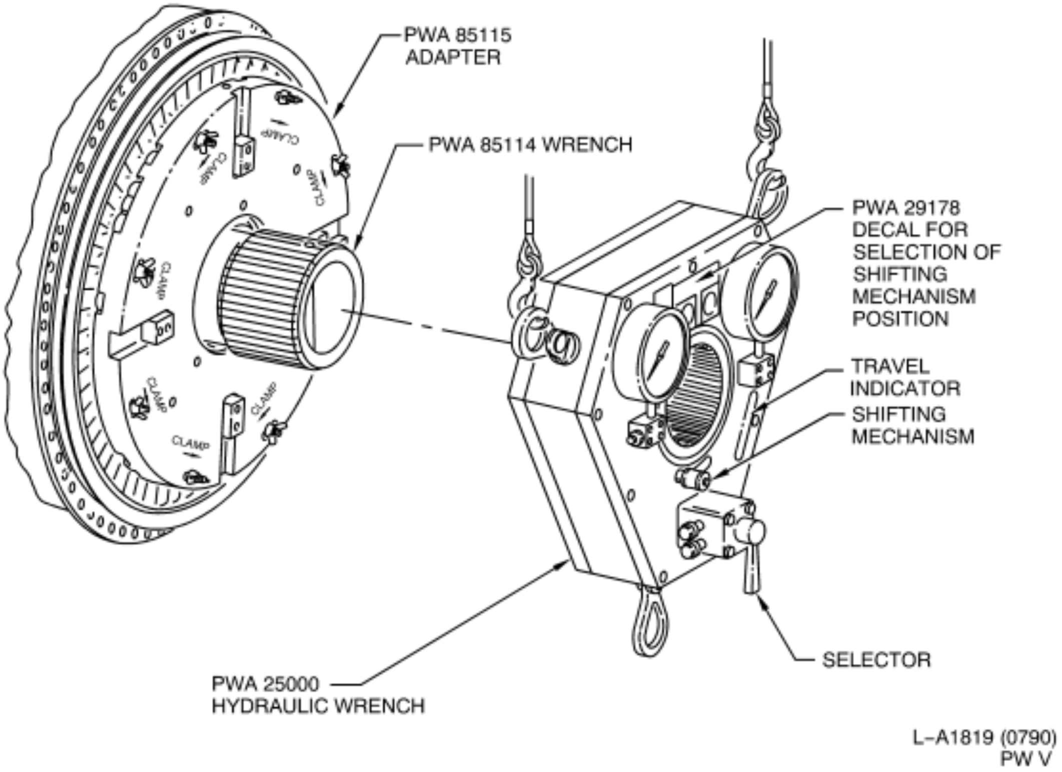

PWA 85116 WRENCH
PWA 29614 WRENCH
1
BUSHING
PWA 45419 OR
PWA 80651
(PWA 45419
SHOWN)
L−A1512 (0487)
PW V

No. 3 Bearing Retaining Nut Torquing (Mechanical Wrench)
Figure 413
(Task 72−00−52−420−001)

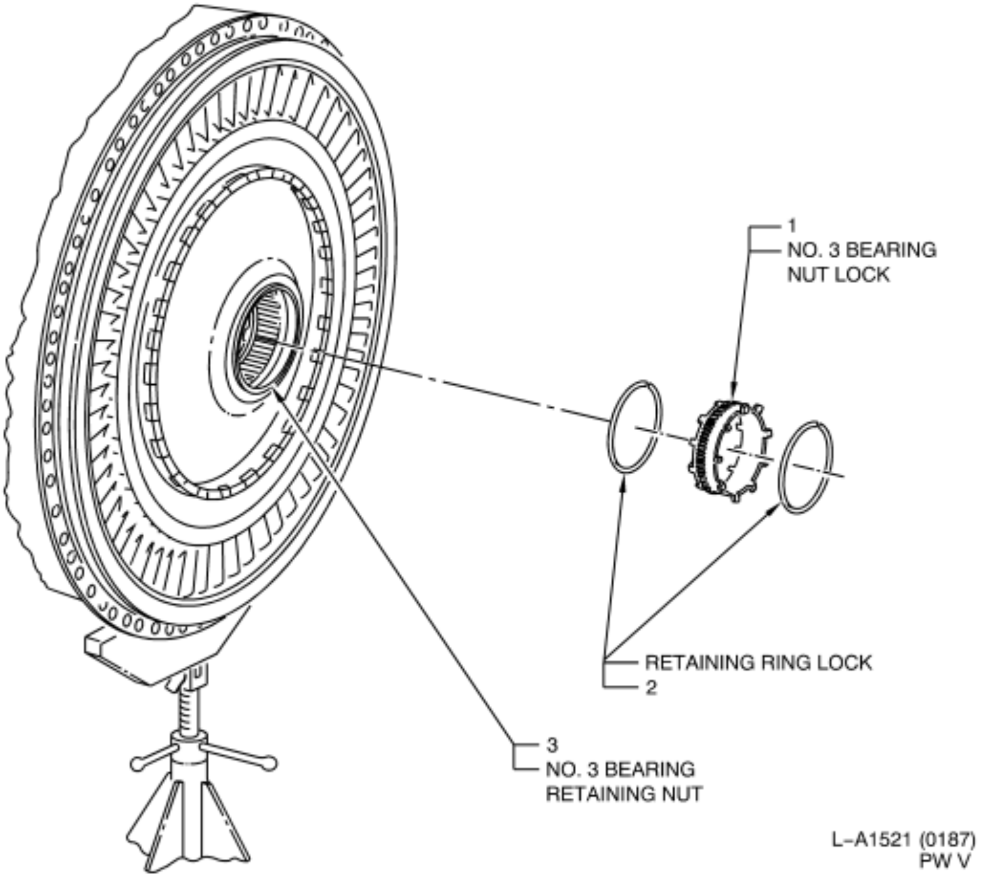

1
SLOT
(TYPICAL)
2
2ND STAGE
HPT LOCK
(REFERENCE)
PWA 85115 ADAPTER
3
CLAMP
PWA 85114 WRENCH
CLAMP
NO.3 BEARING
RETAINING NUT
5
TURBINE
INTERMEDIATE
HUB
6
DOWEL PIN
(TYPICAL)
4
L-A1818 (1286)
PW V

No. 3 Bearing Retaining Nut Installation (Hydraulic Wrench)
Figure 414
(Task 72-00-52-420-001)

R
R


PWA 85115
ADAPTER
PWA 85114 WRENCH
PWA 29178
DECAL FOR
SELECTION OF
SHIFTING
MECHANISM
POSITION
TRAVEL
INDICATOR
SHIFTING
MECHANISM
SELECTOR
PWA 25000
HYDRAULIC WRENCH
CLAMP
CLAMP
CLAMP
CLAMP
CLAMP
CLAMP
CLAMP
L−A1819 (0790)
PW V

No. 3 Bearing Retaining Nut Installation (Hydraulic Wrench)
Figure 415
(Task 72−00−52−420−001)


1
NO. 3 BEARING NUT LOCK
RETAINING RING LOCK
2
3
NO. 3 BEARING RETAINING NUT
L−A1521 (0187)
PW V

No. 3 Bearing Nut Lock Installation
Figure 416
(Task 72−00−52−420−001)

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ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−02

Task 72−00−52−420−001−002:

1. Install The High Pressure Turbine − Horizontal (Hydraulic Wrench) − Deleted

   A. Procedure

      (1) This procedure is relocated to 72−00−52, Installation−01 (Task 72−00−52−420−001).

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−03

Task 72-00−52−420−003:

1. Install The External Plumbing After The High Pressure Turbine Installation

A. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 Or M307

Consumable Materials:

	Item No.	Designation
	P03−001	Oil, Engine (PWA 521B)
	P05−289	Lockwire (AS3214−02)
	P05−291	Cable, Safety (Optional)
R	P05−292	Ferrule, Safety Cable (Optional)

B. Procedure
See Figure 401.

CAUTION: USE OF LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS COULD RESULT IN CONTAMINATION OF EEC.

(1) Install the EEC PT4.95 tube assembly (AS27) as follows.

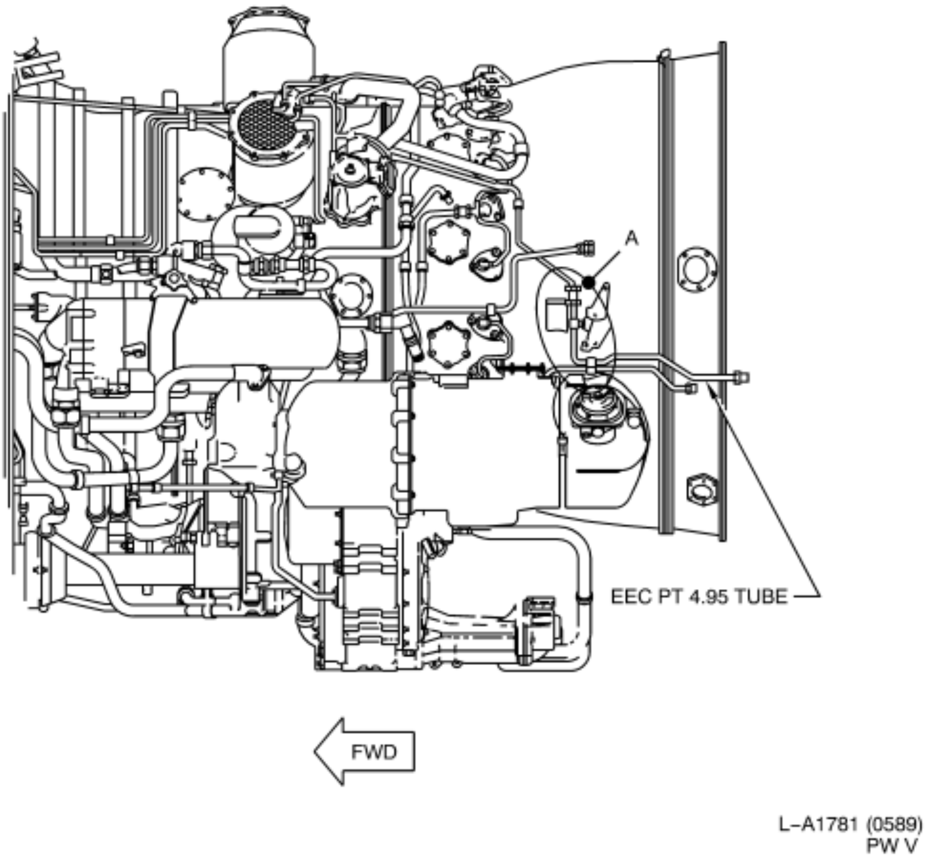
(a) Remove covers. Install the tube to the tube nut forward of Flange M at approximately 9 o'clock position.

(b) Install the clamps, bolt, threads lubricated with Engine Oil P03−001, and nut to the diffuser case bracket at approximately 9 o'clock position.

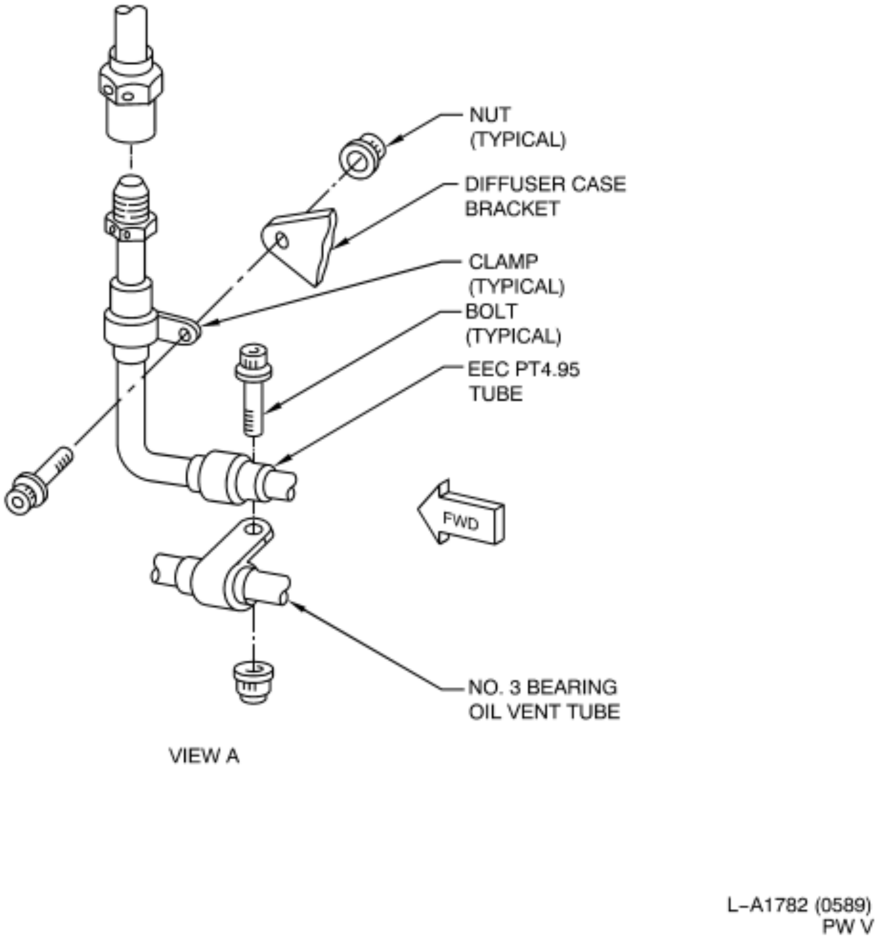
(c) Install the clamps, bolt, threads lubricated with Engine Oil P03−001, and nut that attach the tube to the adjacent tube forward of Flange M at approximately 8 o'clock position.

(d) Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque the tube nut to the tube coupling to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.


A
EEC PT 4.95 TUBE
FWD
L−A1781 (0589)
PW V

EEC PT4.95 Tube Assembly
Figure 401 (Sheet 1)
(Task 72−00−52−420−003)


NUT
(TYPICAL)
DIFFUSER CASE
BRACKET
CLAMP
(TYPICAL)
BOLT
(TYPICAL)
EEC PT4.95
TUBE
FWD
NO. 3 BEARING
OIL VENT TUBE
VIEW A
L-A1782 (0589)
PW V

EEC PT4.95 Tube Assembly
Figure 401 (Sheet 2)
(Task 72-00-52-420-003)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−04

Task 72−00−52−450−001:

1. Install Turbine Case Cooling (TCC) Air Valve (HPT)

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)

B. Procedure
See Figure 401 and Figure 402.

(1) Move the valve, with flow arrows pointing downward, into position between the upper and lower support brackets while you align the bolt holes.

(2) Place the upper support link outward into position at the upper flange of the valve and attach the upper flange of the valve and the support link with five bolts, threads lubricated with Engine Oil P03−001, (longer bolt at support link location) to the upper support bracket.

(3) Secure lower flange of valve with Engine Oil P03−001, lubricated bolts and nuts to lower support bracket.

NOTE: Do not install bolt and nut at lower flange support link location. These are installed during the LPT TCC valve installation.

(4) Torque all bolts securing valve flanges and braces to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(5) If not already installed, install a new bearing and bushing in the idler arm as follows:

(a) Put the idler arm in a preheated 250°F (121.1°C) oven for approximately 15 minutes.

(b) Put the new bushing in a box of dry ice for approximately 15 minutes.

CAUTION: DO NOT TOUCH THE HOT IDLER ARM OR THE DRY ICE AND BUSHING WITH YOUR FINGERS. WEAR GLOVES AND PROTECTIVE CLOTHES. THE HOT PARTS AND DRY ICE CAN BURN YOUR SKIN.

(c) Working quickly, remove the idler arm from the oven with gloves. Put it on a clean work bench with the large diameter of the bearing hole up.

(d) Quickly install the new bearing in the idler arm bearing hole. To seat the bearing, lightly tap the bearing with a nylon drift and a mallet.

(e) Remove the bushing from the dry ice with gloves and quickly install it in the other idler arm hole. Install the bushing with the flange side up. If necessary, use a work bolt, washers and a nut to seat the bushing in the idler arm.

(f) To attach the bearing to the idler arm, install the retaining ring in the retaining ring groove of the idler arm.

(6) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 75−74 only) Install the HPT TCC air shutoff valve idler arm to the HPT TCC air shutoff valve lever arm with a spacer between the two arms. Attach with a nut, threads lubricated with Engine Oil P03−001. Torque the nut to 36 − 40 lb−in. (4.067 − 4.519 N.m).

NOTE: Do not attach cable or push−pull rod to valve at this time. See 72−00−53, Installation−06 Task 72−00−53−450−004 for the assembly of the cable and rod.

(7) (Pre SB PW4ENG 75−136) Install the HPT TCC air shutoff valve idler arm to the HPT TCC air shutoff valve lever arm. Attach with a nut, threads lubricated with Engine Oil P03−001. Torque the nut to 36 − 40 lb−in. (4.067 − 4.519 N.m).

NOTE: Do not attach cable or push−pull rod to valve at this time. See 72−00−53, Installation−06 Task 72−00−53−450−004 for the assembly of the cable and rod.

(8) (Post SB PW4ENG 75−136) Install the HPT TCC air shutoff valve idler arm to the HPT TCC air shutoff valve lever arm. Attach with a bearing sleeve assembly, threads lubricated with Engine Oil P03−001. Torque the bearing sleeve assembly to 36 − 40 lb−in. (4.067 − 4.519 N.m).

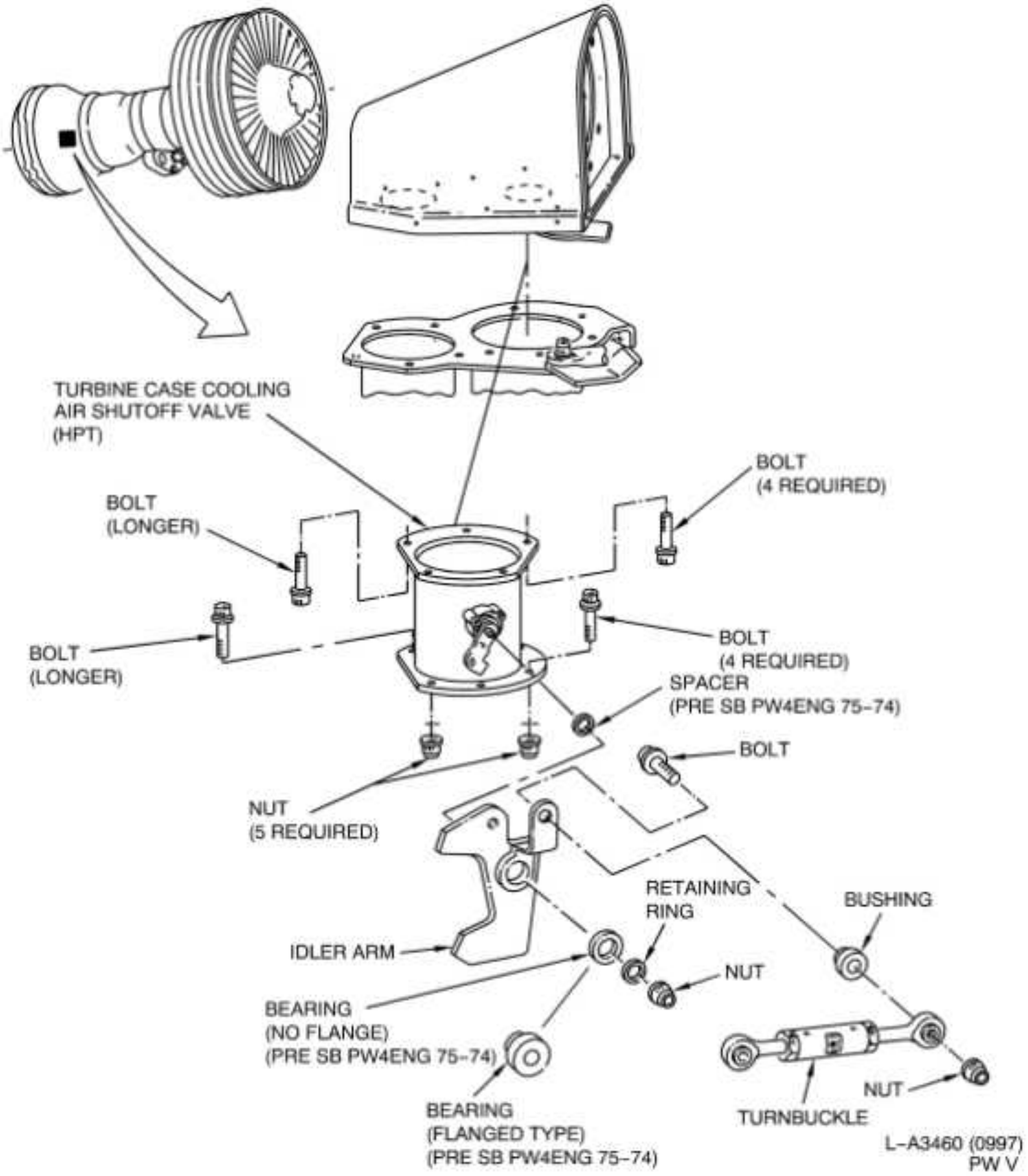
NOTE: Do not attach cable or push−pull rod to valve at this time. See 72−00−53, Installation−06 Task 72−00−53−450−004 for the assembly of the cable and rod.

C. Postrequisites

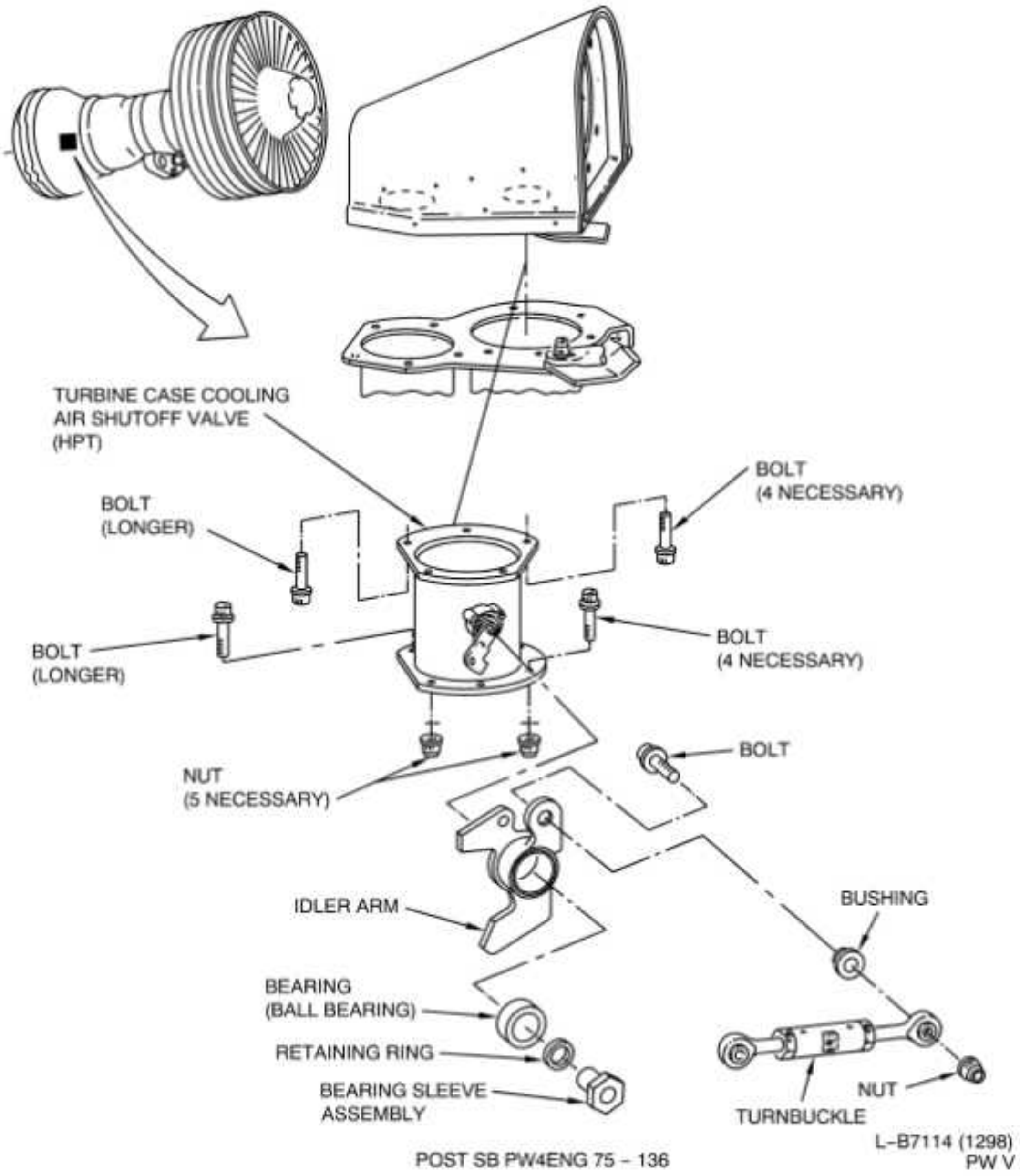
(1) Install LPT turbine case cooling (TCC) air valve by 72−00−53, Installation−07 Task 72−00−53−450−001.

(2) Rig TCC system by 72−00−00, Special Procedures−06 Task 72−00−00−830−004 or Special Procedures−11, Task 72−00−00−830−005 as applicable.

(3) Test engine by Repair Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.

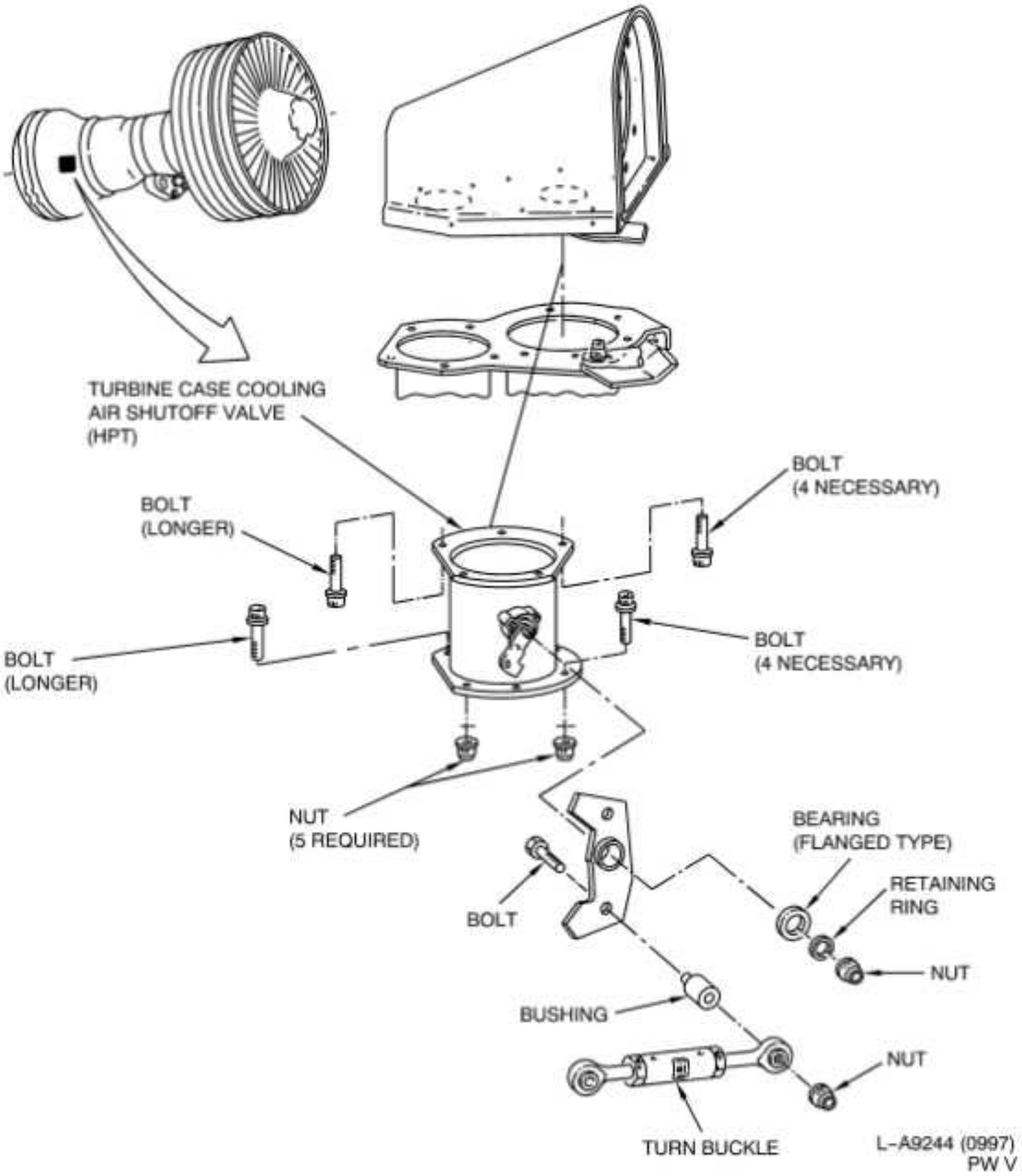

TURBINE CASE COOLING AIR SHUTOFF VALVE (HPT)
BOLT (4 REQUIRED)
BOLT (LONGER)
BOLT (LONGER)
BOLT (4 REQUIRED)
SPACER (PRE SB PW4ENG 75−74)
BOLT
NUT (5 REQUIRED)
RETAINING RING
BUSHING
IDLER ARM
NUT
BEARING (NO FLANGE) (PRE SB PW4ENG 75−74)
BEARING (FLANGED TYPE) (PRE SB PW4ENG 75−74)
NUT
TURNBUCKLE
L−A3460 (0997)
PW V

Turbine Cooling Air Valve (HPT) (Pre And Post SB PW4ENG 72−572,
Post SB PW4ENG 72−592 And Pre SB PW4ENG 75−136 Engines)
Figure 401 (Sheet 1)
(Task 72−00−52−450−001)

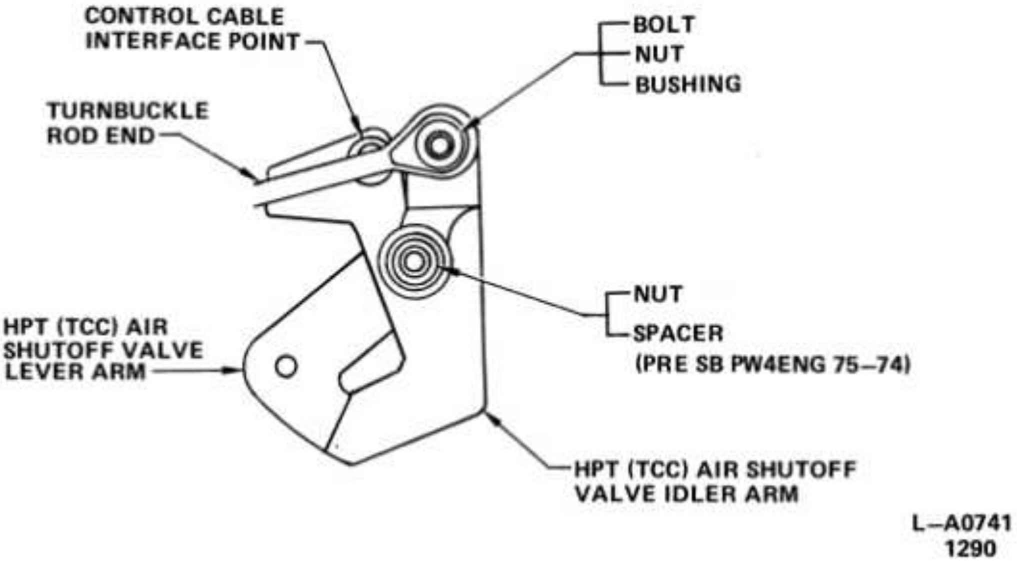

TURBINE CASE COOLING AIR SHUTOFF VALVE (HPT)
BOLT (4 NECESSARY)
BOLT (LONGER)
BOLT (LONGER)
BOLT (4 NECESSARY)
NUT (5 NECESSARY)
BOLT
IDLER ARM
BUSHING
BEARING (BALL BEARING)
RETAINING RING
BEARING SLEEVE ASSEMBLY
NUT
TURNBUCKLE
L−B7114 (1298)
PW V
POST SB PW4ENG 75 − 136

Turbine Cooling Air Valve (HPT) (Post SB PW4ENG 75−136)
Figure 401 (Sheet 2)
(Task 72−00−52−450−001)

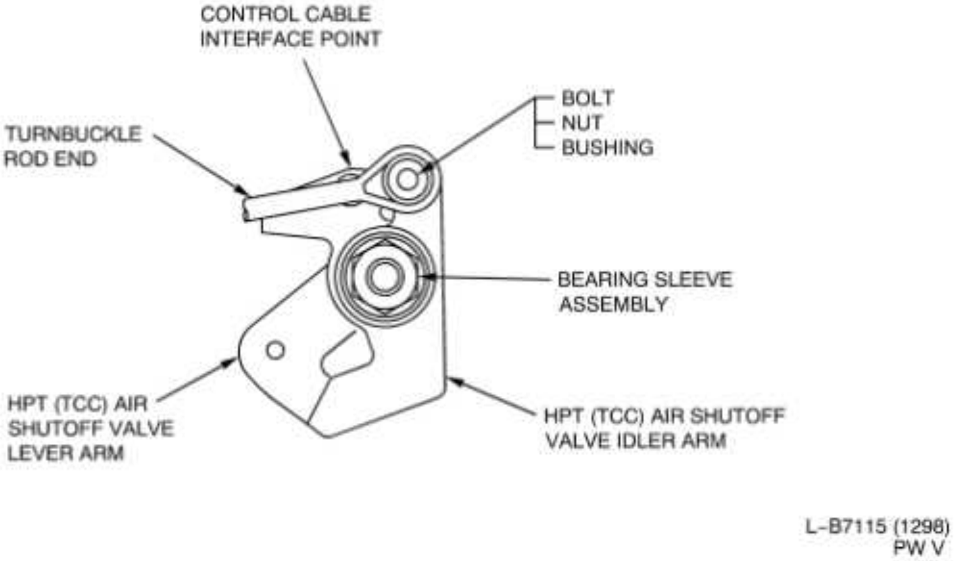
ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−04


TURBINE CASE COOLING
AIR SHUTOFF VALVE
(HPT)
BOLT
(4 NECESSARY)
BOLT
(LONGER)
BOLT
(LONGER)
BOLT
(4 NECESSARY)
NUT
(5 REQUIRED)
BEARING
(FLANGED TYPE)
RETAINING
RING
BOLT
NUT
BUSHING
NUT
TURN BUCKLE
L-A9244 (0997)
PW V

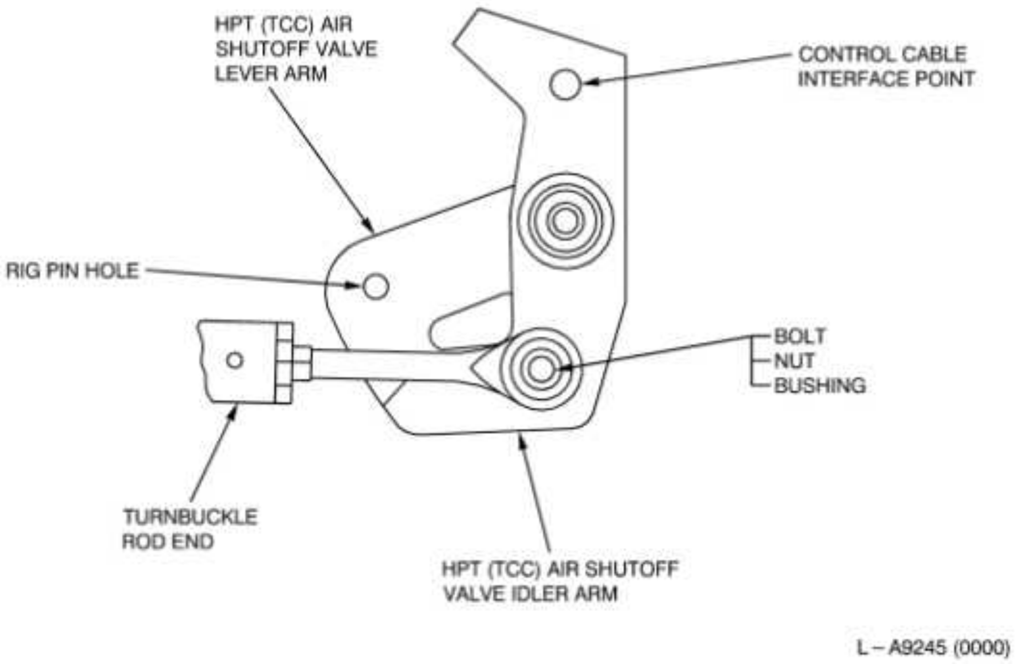
Turbine Cooling Air Valve (HPT) (Phase 3 Engines As Built By P&W)
Figure 402
(Task 72−00−52−450−001)


CONTROL CABLE INTERFACE POINT
TURNBUCKLE ROD END
BOLT
NUT
BUSHING
NUT
SPACER
(PRE SB PW4ENG 75-74)
HPT (TCC) AIR SHUTOFF VALVE LEVER ARM
HPT (TCC) AIR SHUTOFF VALVE IDLER ARM
L-A0741
1290

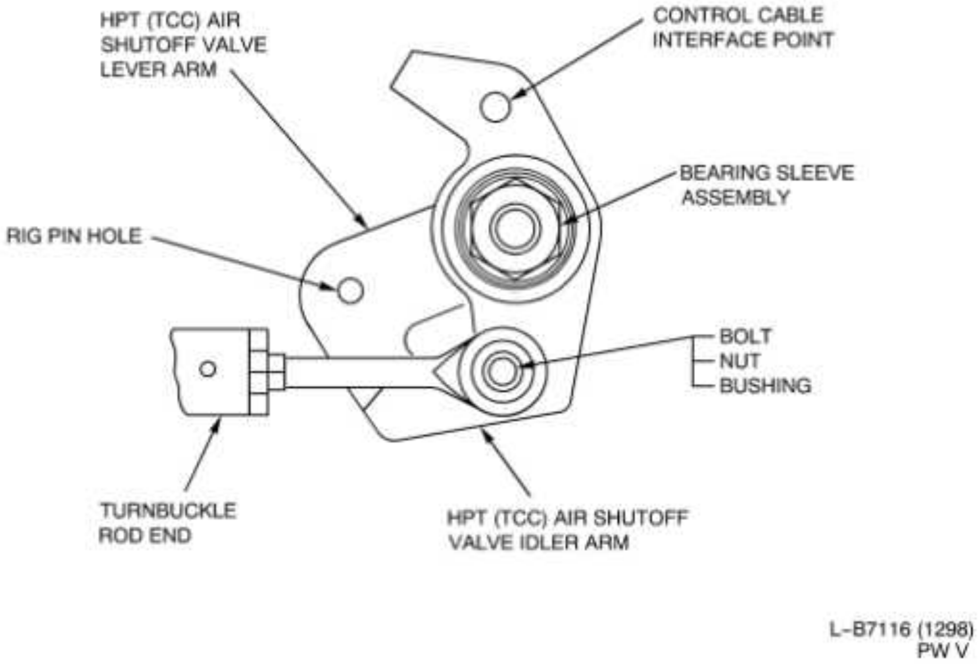
HPT (TCC) Air Shutoff Valve Idler Arm (Shown In Rig Position) (Pre And Post SB PW4ENG 72-572, Post SB PW4ENG 72-592 And Pre SB PW4ENG 75-136 Engines)
Figure 403 (Sheet 1)
(Task 72-00-52-450-001)


CONTROL CABLE INTERFACE POINT
TURNBUCKLE ROD END
BOLT
NUT
BUSHING
BEARING SLEEVE ASSEMBLY
HPT (TCC) AIR SHUTOFF VALVE LEVER ARM
HPT (TCC) AIR SHUTOFF VALVE IDLER ARM
L−B7115 (1298)
PW V

HPT (TCC) Air Shutoff Valve Idler Arm (Shown In Rig Position) (Post SB PW4ENG 75−136 Engines)
Figure 403 (Sheet 2)
(Task 72−00−52−450−001)


HPT (TCC) AIR SHUTOFF VALVE LEVER ARM
CONTROL CABLE INTERFACE POINT
RIG PIN HOLE
BOLT
NUT
BUSHING
TURNBUCKLE ROD END
HPT (TCC) AIR SHUTOFF VALVE IDLER ARM
L−A9245 (0000)

HPT (TCC) Air Shutoff Valve Idler Arm (Shown In Rig Position)
(Phase 3 Engines As Built By P&W)(Pre SB PW4ENG 75−136 Engines)
Figure 404 (Sheet 1)
(Task 72−00−52−450−001)


HPT (TCC) AIR SHUTOFF VALVE LEVER ARM
CONTROL CABLE INTERFACE POINT
BEARING SLEEVE ASSEMBLY
RIG PIN HOLE
BOLT
NUT
BUSHING
TURNBUCKLE ROD END
HPT (TCC) AIR SHUTOFF VALVE IDLER ARM
L−B7116 (1298)
PW V

HPT (TCC) Air Shutoff Valve Idler Arm (Shown In Rig Position) (Phase 3 Engines As Built By P&W) (Post SB PW4ENG 75−136 Engines)
Figure 404 (Sheet 2)
(Task 72−00−52−450−001)

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ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - INSTALLATION-05

Task 72-00-52-450-002:

1. Install Turbine Case Cooling Manifold (Collector)

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-059	Wax, Paraffin (PMC 9552)

B. Procedure
See Figures 401 through 403.

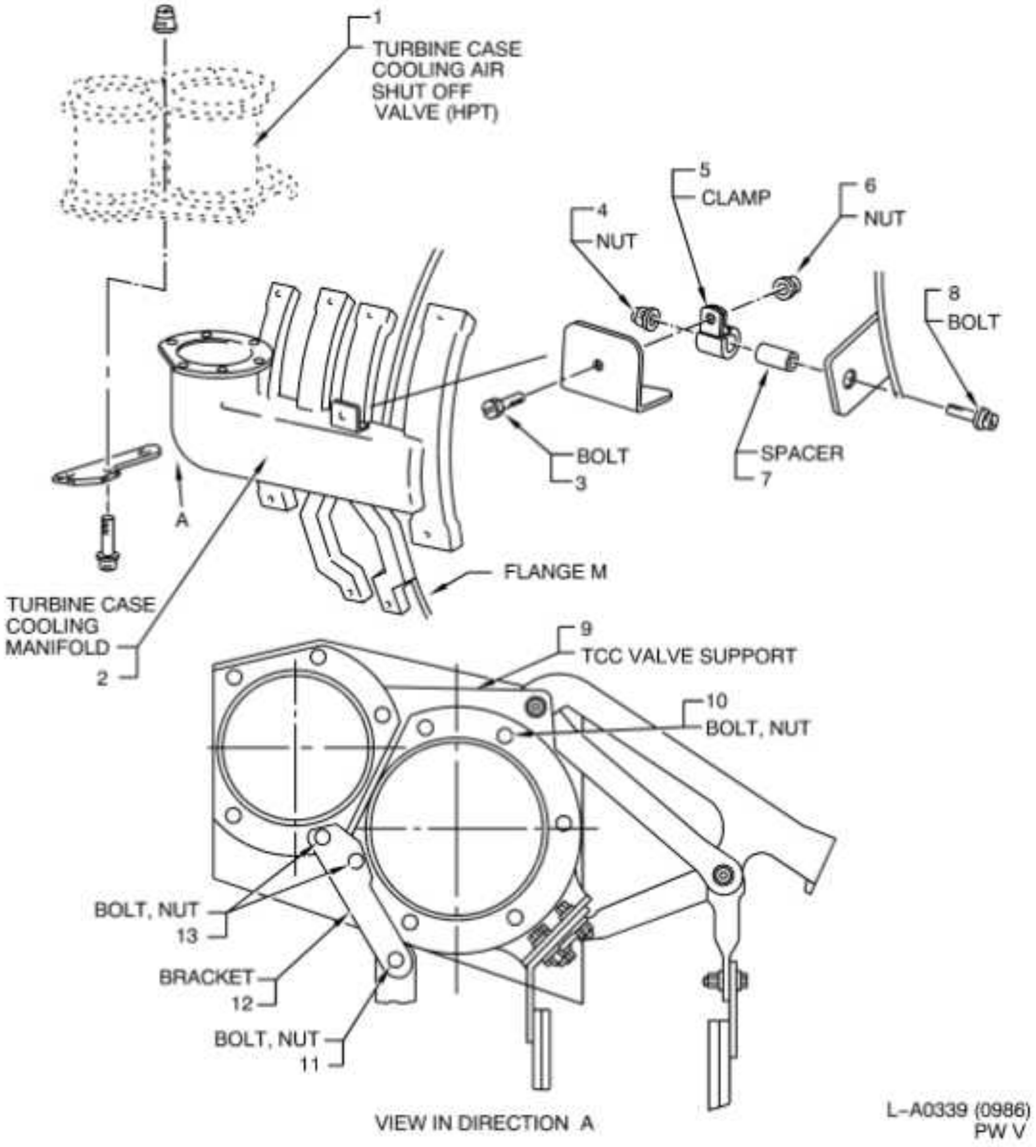
(1) Position turbine case cooling manifold (collector) (401/2) onto TCC valve support (401/9) located on turbine case at 2:30 o'clock position. Secure manifold (collector) to bracket and turbine case cooling air shutoff valve (HPT) (401/1) using bolts, threads lubricated with Engine Oil (P03-001), and nuts (401/10) at five locations. See Figure 401.

(2) Align boltholes in bracket (401/12) with two inboard boltholes of manifold (collector) flanges and lug on turbine case. Using bolts, threads lubricated with Engine Oil (P03-001), secure bracket to lug on turbine case with one bolt and nut (401/11) and secure to support (401/9) with two bolts and nuts (401/13). Torque all eight bolts to secure manifold (401/2) and bracket (401/12) to 85 - 95 lb-in. (9.604 - 10.734 N.m).

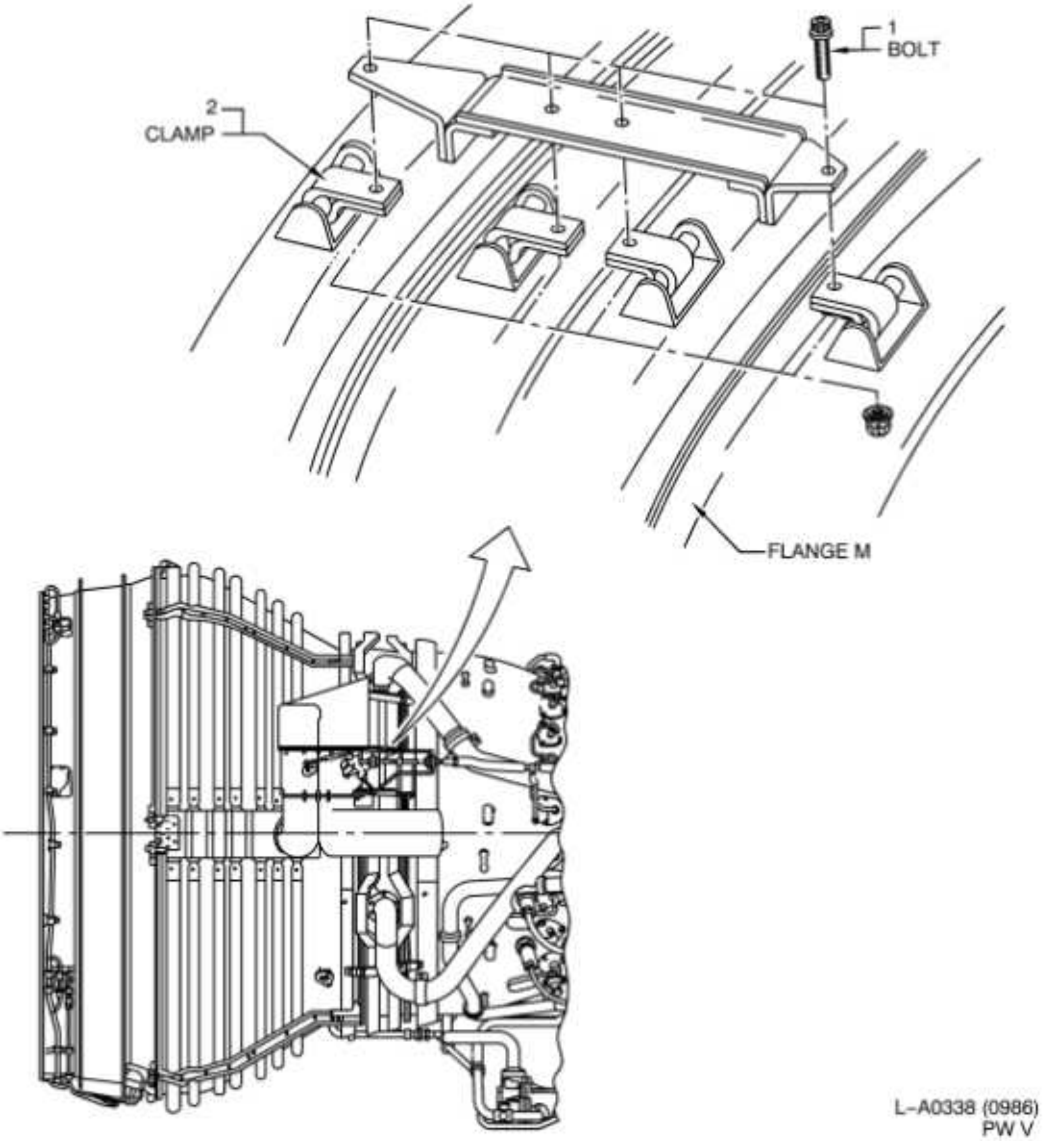
(3) Using screw (401/3), threads lubricated with Engine Oil (P03-001), and nut (401/6), install clamp (401/5) under bracket detail of manifold (401/2). Handtighten bolt.

(4) Install spacer (401/7) into clamp (401/5). Secure clamp to bracket on Flange M using bolt (401/8), threads lubricated with Engine Oil (P03-001), and nut (401/4). Torque bolt (401/8) to 85 - 95 lb-in. (9.604 - 10.734 N.m). Torque previously installed bolt (401/3) to 36 - 40 lb-in. (4.067 - 4.519 N.m).

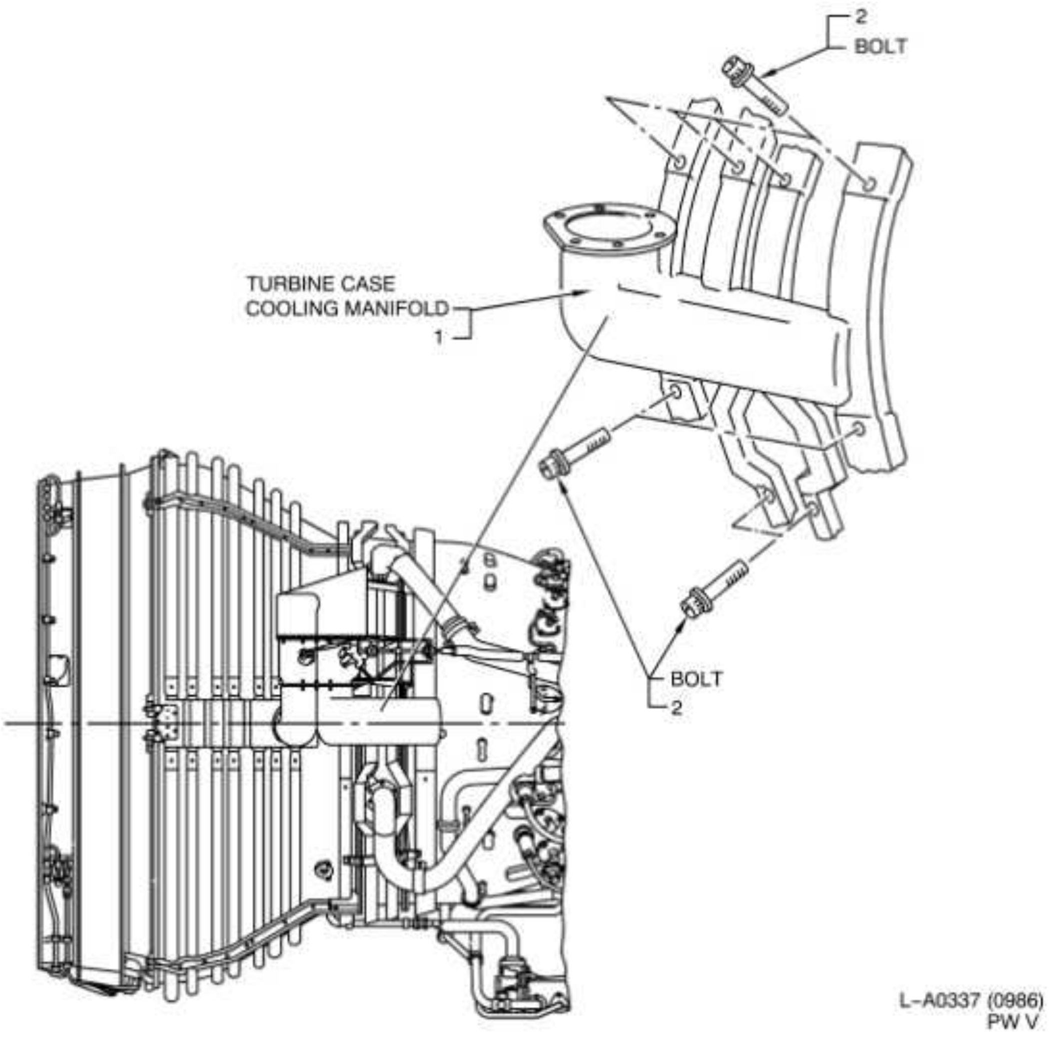
(5) Slide upper and lower turbine case cooling manifolds around case as required to install manifolds onto tube details of manifold (collector) (402/1). Align bolt holes and secure manifolds with eight bolts (402/2), threads lubricated with Engine Oil (P03-001). Torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m). See Figure 402.


1
TURBINE CASE COOLING AIR SHUT OFF VALVE (HPT)
5
CLAMP
4
NUT
6
NUT
8
BOLT
BOLT
3
SPACER
7
A
FLANGE M
TURBINE CASE COOLING MANIFOLD
2
9
TCC VALVE SUPPORT
10
BOLT, NUT
BOLT, NUT
13
BRACKET
12
BOLT, NUT
11
VIEW IN DIRECTION A
L−A0339 (0986)
PW V

Turbine Case Cooling Manifold Installation
Figure 401
(Task 72−00−52−450−002)


1
BOLT
2
CLAMP
FLANGE M
L−A0338 (0986)
PW V

Turbine Case Cooling Manifold Installation
Figure 402
(Task 72−00−52−450−002)


2
BOLT
TURBINE CASE
COOLING MANIFOLD
1
BOLT
2
L−A0337 (0986)
PW V

Turbine Case Cooling Manifold Installation
Figure 403
(Task 72−00−52−450−002)

(6) Torque four bolts (402/1) at six locations to secure four manifold clamps (402/2) to brackets on turbine case at approximately 2, 4:30, 6, 8:30, 10:30 and 11:30 o'clock position. Torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m). See Figure 403.

C. Postrequisites

(1) Install the lower right turbine cooling tube per Installation-07 (Task 72-00-52-450-004).

(2) Install EEC thermocouple and airframe cable (W6) as required per 72-00-54, Installation-09 (Task 72-00-54-450-006).

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Task 72-00-52-450-003:

1. Install Turbine Case Cooling Manifolds (HPT)

A. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
R P06-054	Paste, Antiseize (PWA 36246)

B. Procedure
See Figure 401, Figure 402 and Figure 403.

(1) Remove protective closures.

(2) Position rear upper and lower HPT cooling air manifolds around case with open ends toward collector. Do not secure at this time.

(3) Reinstall HPT rear support brackets (previously removed for access) to Flange N brackets with bolts, threads lubricated with Engine Oil P03-001, and nuts. Torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(4) Reinstall LPT TCC front support brackets to Flange N previously removed for access to HPT rear upper, and lower cooling air manifolds and secure with bolts, threads lubricated with Engine Oil P03-001, and nuts. Torque Flange N nuts to 180 - 200 lb-in. (20.337 - 22.597 N.m).

(5) Attach the Flange N the LPT support brackets to the LPT bridge brackets with bolts, threads lubricated with Engine Oil P03-001, and nuts. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

NOTE: Bolt and nut at approximately the 8 o'clock position holds clamp supporting HPT tube.

(6) Position upper and lower rear HPT cooling air manifolds (AC21) through (AC28) around case and engage ends to HPT collector. Secure to collector with bolts, threads lubricated with Engine Oil P03−001 and tighten handtight only.

(7) Install clamps to brackets on rear upper and lower HPT cooling manifolds and secure to support brackets at Flange N with bolts, threads lubricated with Engine Oil P03−001, and nuts, handtight only.

(8) Install two center, upper HPT cooling air manifolds to engine and engage open ends to collector. Secure manifolds to collector with bolts, threads lubricated with Engine Oil P03−001, handtight only.

(9) Install and secure upper bridge brackets to support brackets on Flanges M and N with bolts, threads lubricated with Engine Oil P03−001, and nuts handtight only.

(10) Secure two upper center TCC manifolds to upper (three) bridge brackets with bolts, threads lubricated with Engine Oil P03−001, clamps, and nuts, handtight only.

(11) Install two center, lower HPT cooling air manifolds to engine and engage open ends to collector. Secure manifolds to collector with bolts, threads lubricated with Engine Oil P03−001, handtight only.

(12) Install and secure lower bridge brackets to support brackets on Flanges M and N with bolts, threads lubricated with Engine Oil P03−001, and nuts handtight only.

(13) Secure two lower center TCC manifolds to lower (three) bridge brackets with bolts, threads lubricated with Engine Oil P03−001, clamps, and nuts, handtight only.

(14) Install front upper and lower cooling air manifolds to engine engaging open ends with detail tubes of collector. Secure manifolds to collector with bolts, threads lubricated with Engine Oil P03−001, handtight only.

(15) Install clamps to upper and lower cooling air manifold brackets and secure with bolts, threads lubricated with Engine Oil P03−001, and nuts handtight only.

ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - INSTALLATION-06

(16) Torque bolts securing HPT cooling air tubes as follows:

(a) Torque bolts securing upper and lower HPT cooling manifolds to collector to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(b) Torque bolts securing bridge brackets to support brackets on Flanges M and N to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Torque bolts securing front and rear cooling air manifolds to support brackets to 36 - 40 lb-in. (4.067 - 4.519 N.m).

CAUTION: USE OF LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS COULD RESULT IN CONTAMINATION OF EEC.

(17) Install (rear) EEC PT4.95 pressure tube assembly (AS02) as follows.

(a) Remove protective closures from the tube fittings.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Secure the tube nut to a tee at approximately the 6 o'clock position and rearward of Flange P (Pre SB PW4ENG 72-134).

(c) FOR THESE MODELS: 4152, 4156A, 4158
Secure the tube nut to the tube coupling at approximately the 7 o'clock position and rearward of Flange P (Post SB PW4ENG 72-134).

(d) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Attach the tube nut to the tube coupling at approximately the 7 o'clock position and rearward of Flange P.

(e) Secure the tube nut to the tube coupling at approximately the 8 o'clock position and rearward of Flange N.

(f) FOR THESE MODELS: 4152, 4156A, 4158
Lubricate the threads of a bolt with Engine Oil P03-001. Secure the tube with a clamp, bolt, and nut to the bracket on Flange P at approximately the 7 o'clock position. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m) (Pre SB PW4ENG 72-134).

(g) Torque tube nuts to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(18) Install (rear) No. 3 bearing oil vent tube assembly (LD02) as follows.

(a) Install oil vent tube to adapter, threads
R lubricated with Antiseize Paste P06-054, on
exhaust case at approximately 7 o'clock position,
and secure tube nut to tube adapter, threads
R lubricated with Antiseize Paste P06-054, rearward
R of Flange M handtight only. Remove unwanted
R paste.

(b) Install clamp to tube and secure to bracket on Flange N with bolt, threads lubricated with Engine Oil P03-001, and nut. Tighten handtight only.

(c) Lubricate the threads of the bolts with Engine Oil P03-001, and install clamps to the tube and adjacent PT4.95 tube assembly. Secure the clamps on the tubes to brackets on Flange P with the bolts and nuts, and tighten by hand.

(d) FOR THESE MODELS: 4152, 4156A, 4158
Lubricate the threads of the bolt with Engine Oil P03-001. Secure tube to the adjacent PT4.95 tube assembly with clamps, bolt, and nut at approximately the 7:30 o'clock position and rearward of Flange P (Post SB PW4ENG 72-134).

(e) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Lubricate the threads of the bolt with Engine Oil P03-001. Secure the tube to the adjacent PT4.95 tube assembly with clamps, bolt, and nut at approximately the 7:30 o'clock position and rearward of Flange P.

(f) Install clamp to tube and secure to adjacent tube between Flange N and Flange P with bolt, threads lubricated with Engine Oil P03-001, and nut handtight only.

(g) Torque all clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(h) Torque tube nuts (both ends) to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(19) (Pre SB PW4ENG 79-75) Install (rear) No. 4 bearing oil scavenge tube assembly (LR06) as follows.

(a) Install rear scavenge tube, elbow threads
R lubricated with Antiseize Paste P06-054, to tube nut on internal tube at approximately 10 o'clock position on exhaust case and to adapter, threads
R lubricated with Antiseize Paste P06-054, of front scavenge tube at Flange M at approximately the 7
R o'clock position, handtight only. Remove unwanted
R paste.

(b) Install clamps to tube and secure to brackets on Flanges P and N with bolts, threads lubricated with Engine Oil P03-001, and nuts, handtight only.

(c) Torque clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Torque tube nut at exhaust case connection to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(e) Torque tube nut at Flange N connection to 475 - 525 lb-in. (53.668 - 59.317 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(f) (Reference 2151) Position spray shield to inboard side of Flange M connection and secure forward end with hose clamp. Torque clamp to 15 - 18 lb-in. (1.695 - 2.034 N.m).

(g) Install clamp to rear of spray shield over tube and secure to Flange M bracket with bolt, threads lubricated with Engine Oil P03-001, and nut. Torque bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(20) (Post SB PW4ENG 79-75) Install (rear) No. 4 bearing scavenge tube assembly (LR06) as follows.

(a) Install rear scavenge tube, threads lubricated
R with Antiseize Paste P06−054, to exhaust case
internal tube nut at approximately 10 o'clock
position, and to the tube (LR05) coupling forward
of Flange M at approximately 7 o'clock position,
R handtight only. Remove unwanted paste.

(b) Install loop clamp bracket on Flange M bracket at approximately 7 o'clock with bolts lubricated with Engine Oil P03−001, handtight only. Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Secure tube to loop clamp bracket on Flange M bracket with one clamp and bolt, lubricated with Engine Oil P03−001, handtight only. Torque clamp bolt to 27 − 30 lb−in. (4.067 − 4.519 N.m).

(d) Install clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts securing tube to Flange N and P brackets. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque tube nut at exhaust case connection to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(f) Torque tube nut at Flange N connection to 475 − 525 lb−in. (53.668 − 59.317 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(g) Position tube shield to inboard side of Flange M connection and secure forward end of shield with hose clamp. Torque hose clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(21) Install (rear) No. 4 bearing oil pressure tube assembly (LP16) as follows.

(a) Install pressure tube to No. 4 last chance oil strainer housing, threads lubricated with Engine Oil P03−001, on exhaust case at approximately 11 o'clock position and to adapter, threads lubricated with Engine Oil P03−001, forward of Flange M at approximately the 10 o'clock position handtight only.

(b) Install clamps to tube and secure to Flanges P, N, and M brackets with bolts, threads lubricated with Engine Oil P03−001, and nuts handtight only.

(c) Install clamps, bolt, threads lubricated with Engine Oil P03−001, spacer, and nut securing tube to adjacent scavenge tube rearward of Flange N handtight only.

(d) Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque tube nuts (both ends) to 450 − 500 lb−in. (50.843 − 56.492 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the tube nuts.

(f) (Reference 2151) Install spray shield to inboard side of forward tube connection and secure in place with clamps. Torque clamps to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(g) FOR THESE MODELS: 4152, 4156A, 4158
(Reference 2151) (Pre SB PW4ENG 79−54) Install spray shield to inboard side of rear tube connection and secure with clamp. Torque clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(h) FOR THESE MODELS: 4152, 4156A, 4158
(Reference 2151) (Post SB PW4ENG 79−54) Install the spray shield to the inboard side of the pressure tube connection forward of Flange M. Secure the forward end of the shield to the bracket on the diffuser case with a clamp, bolt lubricated with Engine Oil P03−001. Torque the clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). Secure the rear of the shield with a hose clamp and torque to 15 − 18 lb−in. (1.695 − 2.034 N.m).

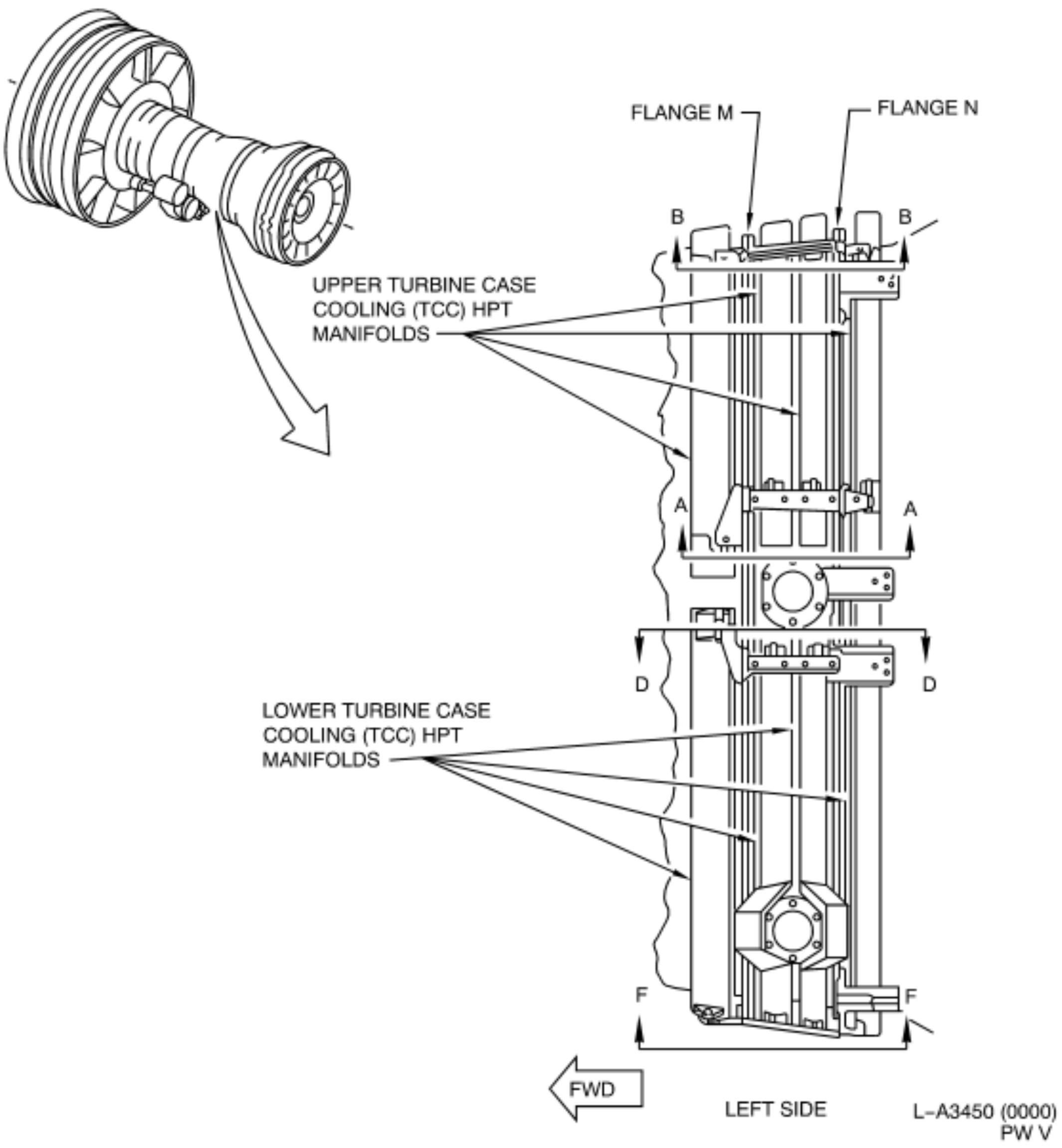
(i) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
(Reference 2151) Install the spray shield to the inboard side of the pressure tube connection forward of Flange M. Attach the forward end of the shield to the bracket on the diffuser case with a clamp and bolt, threads lubricated with Engine Oil P03−001. Torque the clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). Attach the rear of the shield with a hose clamp and torque to 15 − 18 lb−in. (1.695 − 2.034 N.m).

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−06

C. Postrequisites

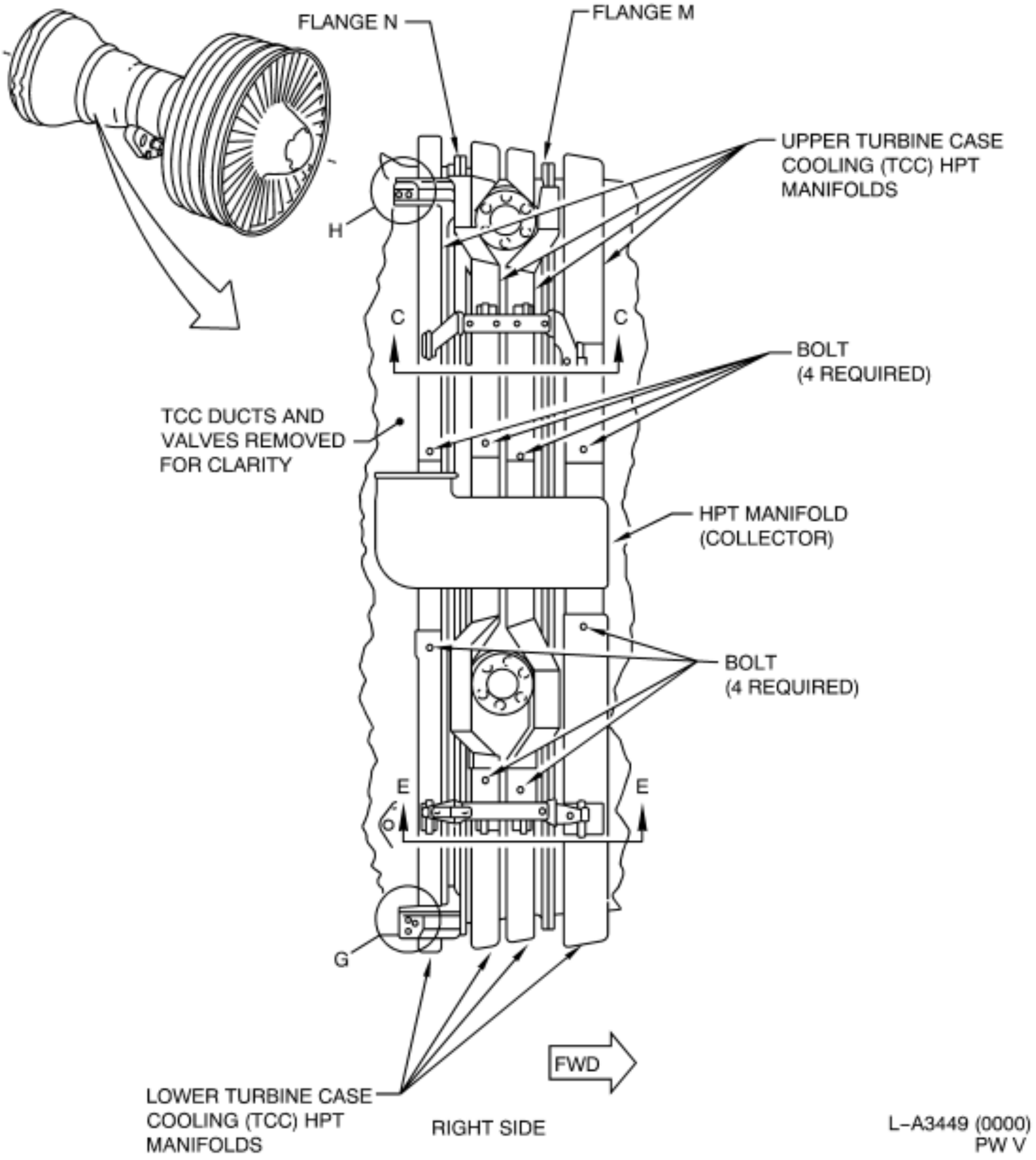
(1) Install EEC thermocouple and airframe cable (W6) as necessary by 72−00−54, Installation−09 Task 72−00−54−450−006−A00.

(2) Test engine by Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.

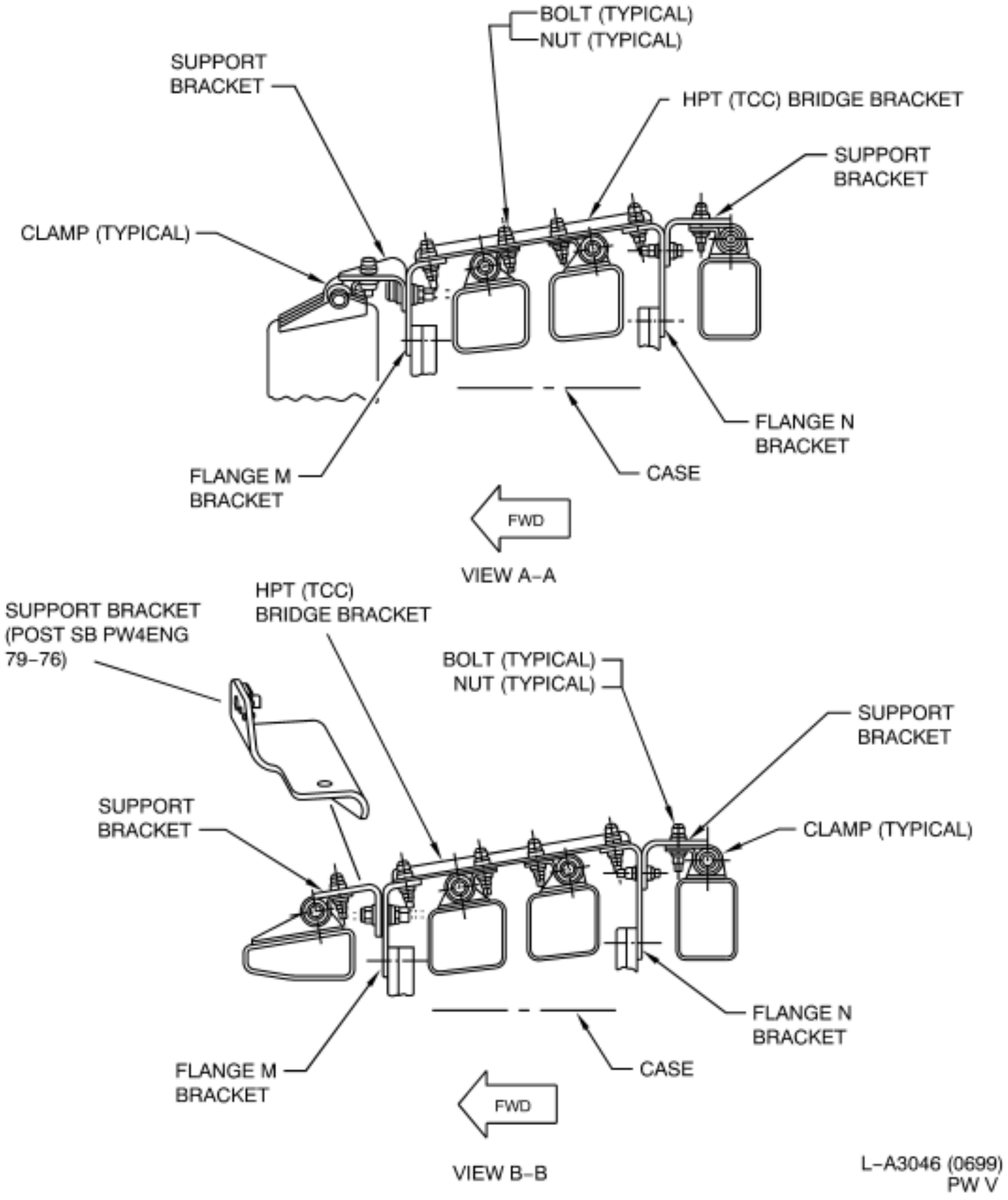

FLANGE M
FLANGE N
B
B
UPPER TURBINE CASE COOLING (TCC) HPT MANIFOLDS
A
A
D
D
LOWER TURBINE CASE COOLING (TCC) HPT MANIFOLDS
F
F
FWD
LEFT SIDE
L-A3450 (0000)
PW V

Turbine Case Cooling (TCC) Manifolds Clipping And Brackets
Figure 401 (Sheet 1)
(Task 72-00-52-450-003)

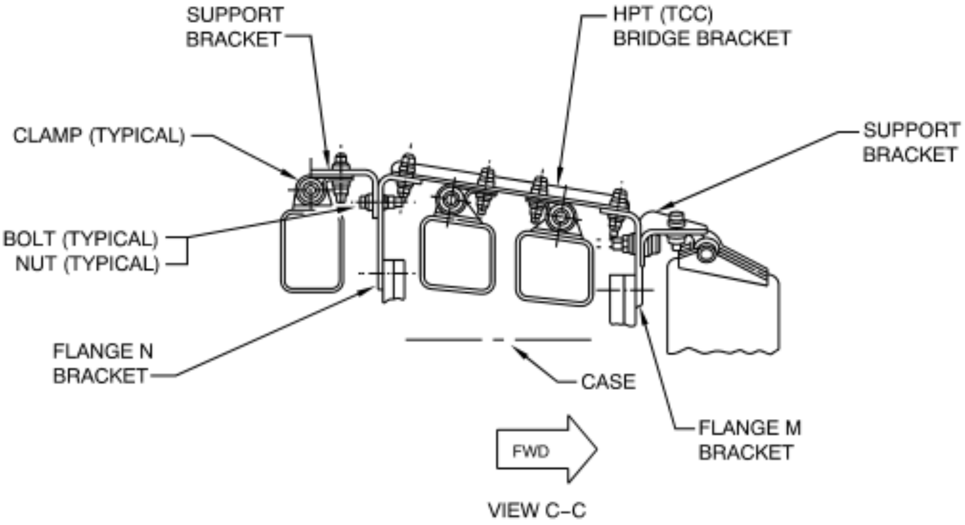
ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−06

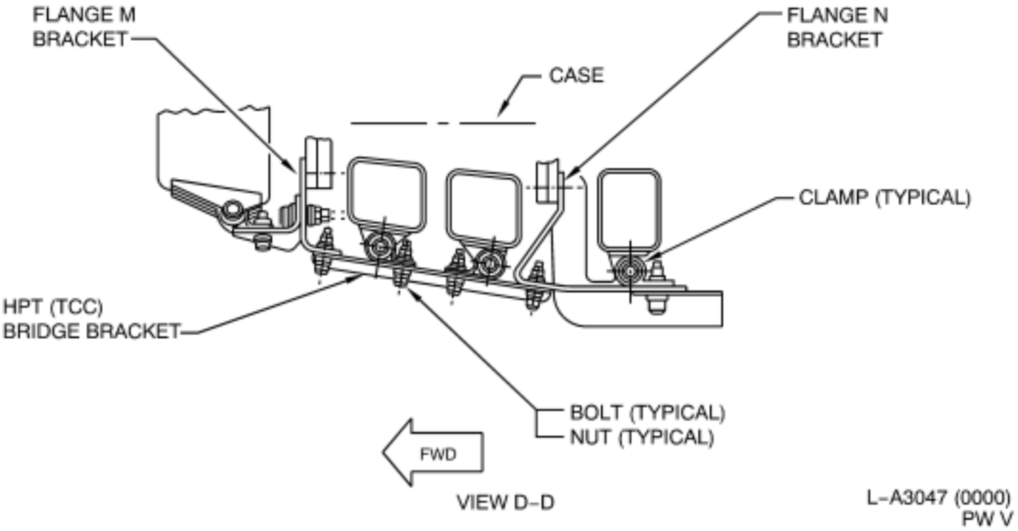

FLANGE N
FLANGE M
UPPER TURBINE CASE COOLING (TCC) HPT MANIFOLDS
H
C
C
BOLT (4 REQUIRED)
TCC DUCTS AND VALVES REMOVED FOR CLARITY
HPT MANIFOLD (COLLECTOR)
BOLT (4 REQUIRED)
E
E
G
FWD
LOWER TURBINE CASE COOLING (TCC) HPT MANIFOLDS
RIGHT SIDE
L−A3449 (0000)
PW V

Turbine Case Cooling (TCC) Manifolds Clipping And Brackets
Figure 401 (Sheet 2)
(Task 72−00−52−450−003)

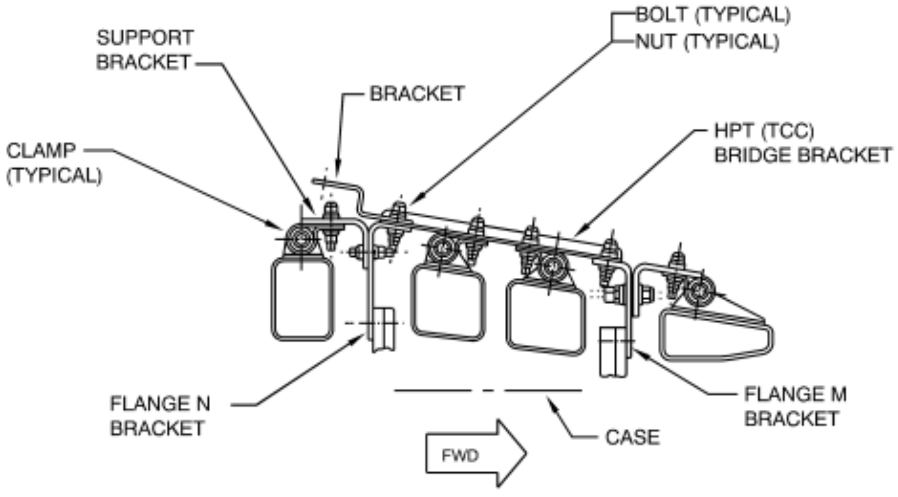

BOLT (TYPICAL)
NUT (TYPICAL)
SUPPORT BRACKET
HPT (TCC) BRIDGE BRACKET
SUPPORT BRACKET
CLAMP (TYPICAL)
FLANGE N BRACKET
CASE
FLANGE M BRACKET
FWD
VIEW A−A
HPT (TCC) BRIDGE BRACKET
SUPPORT BRACKET (POST SB PW4ENG 79−76)
BOLT (TYPICAL)
NUT (TYPICAL)
SUPPORT BRACKET
SUPPORT BRACKET
CLAMP (TYPICAL)
FLANGE N BRACKET
CASE
FLANGE M BRACKET
FWD
VIEW B−B
L−A3046 (0699)
PW V

Turbine Case Cooling (TCC) Manifolds Clipping And Brackets
Figure 401 (Sheet 3)
(Task 72−00−52−450−003)

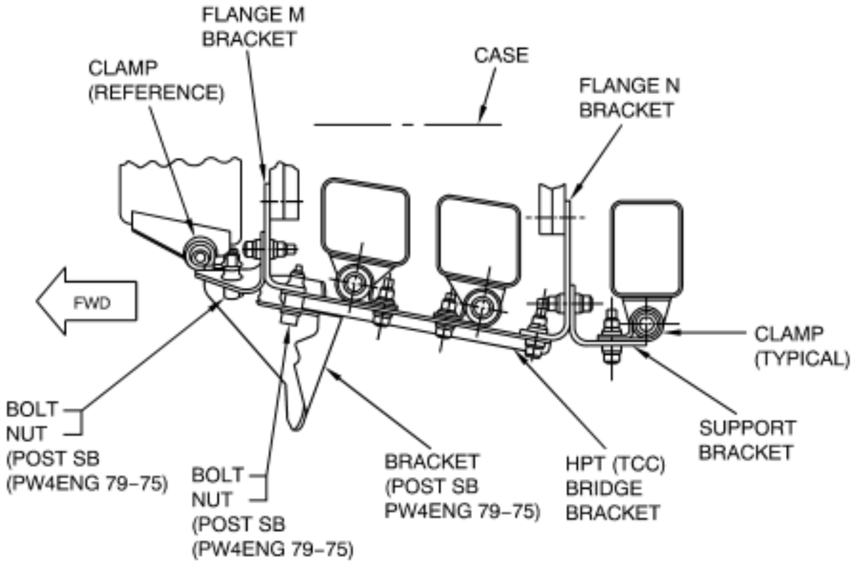

SUPPORT BRACKET
HPT (TCC) BRIDGE BRACKET
CLAMP (TYPICAL)
SUPPORT BRACKET
BOLT (TYPICAL)
NUT (TYPICAL)
FLANGE N BRACKET
CASE
FWD
FLANGE M BRACKET
VIEW C−C


FLANGE M BRACKET
FLANGE N BRACKET
CASE
CLAMP (TYPICAL)
HPT (TCC) BRIDGE BRACKET
BOLT (TYPICAL)
NUT (TYPICAL)
FWD
VIEW D−D
L−A3047 (0000)
PW V

Turbine Case Cooling (TCC) Manifolds Clipping And Brackets
Figure 401 (Sheet 4)
(Task 72−00−52−450−003)


SUPPORT BRACKET
BOLT (TYPICAL)
NUT (TYPICAL)
BRACKET
HPT (TCC) BRIDGE BRACKET
CLAMP (TYPICAL)
FLANGE N BRACKET
FLANGE M BRACKET
CASE
FWD

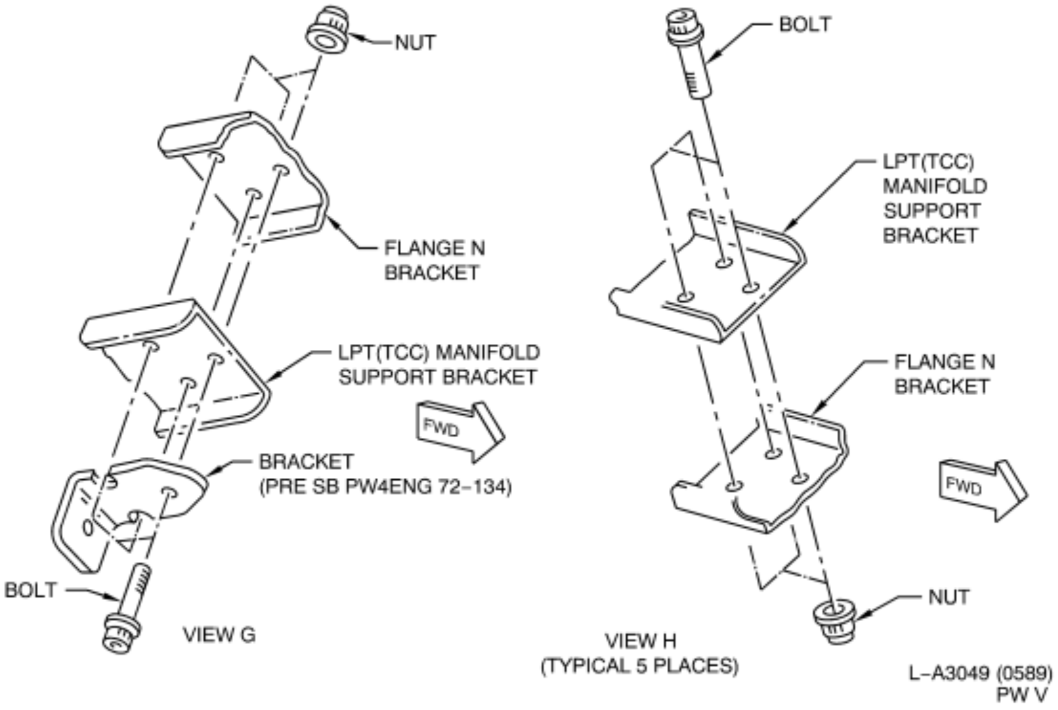
VIEW E


FLANGE M BRACKET
CLAMP (REFERENCE)
CASE
FLANGE N BRACKET
FWD
CLAMP (TYPICAL)
SUPPORT BRACKET
BOLT
NUT
(POST SB (PW4ENG 79−75)
BOLT
NUT
(POST SB (PW4ENG 79−75)
BRACKET (POST SB PW4ENG 79−75)
HPT (TCC) BRIDGE BRACKET

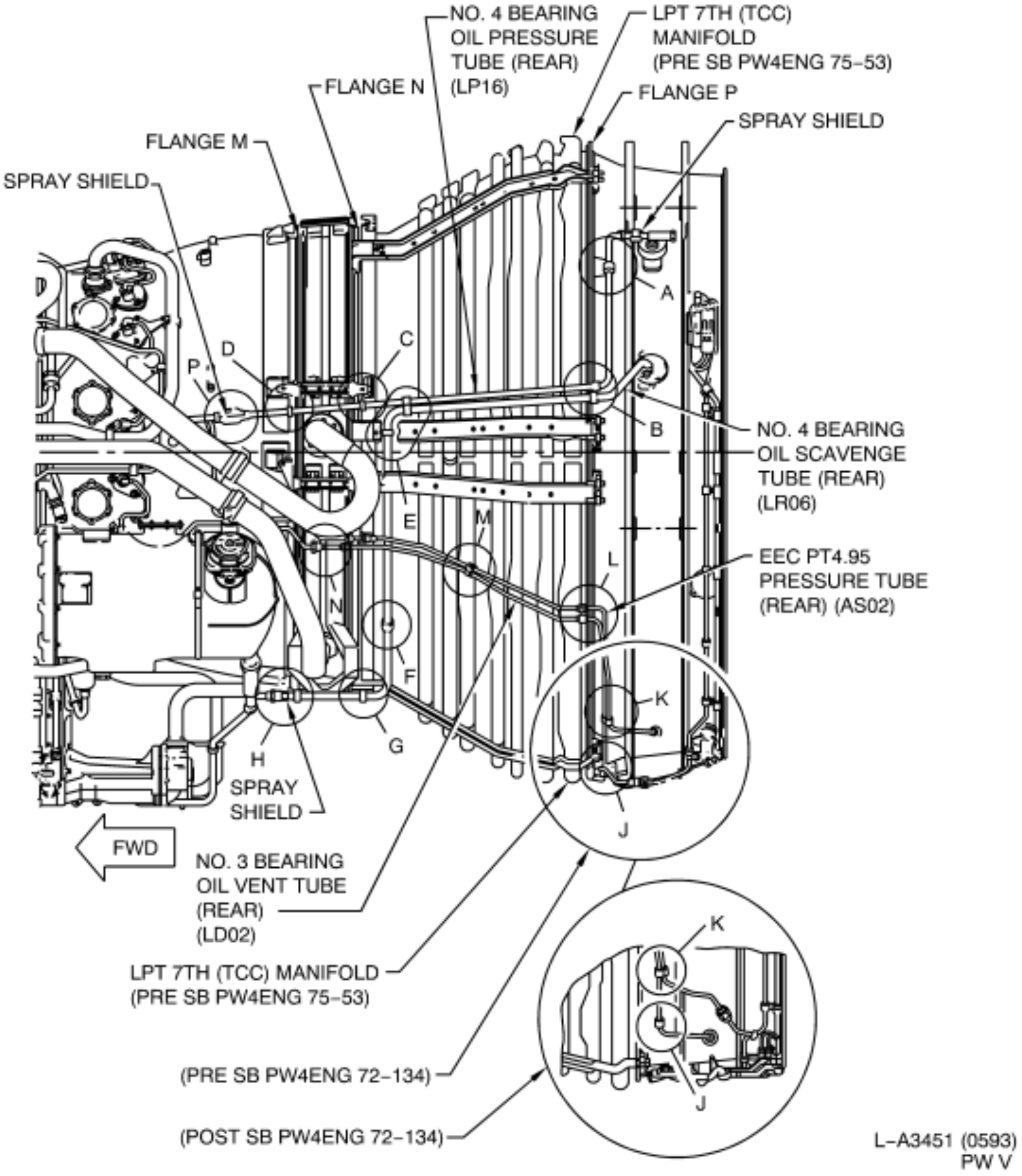
VIEW F

L−B2521 (0000)
PW V

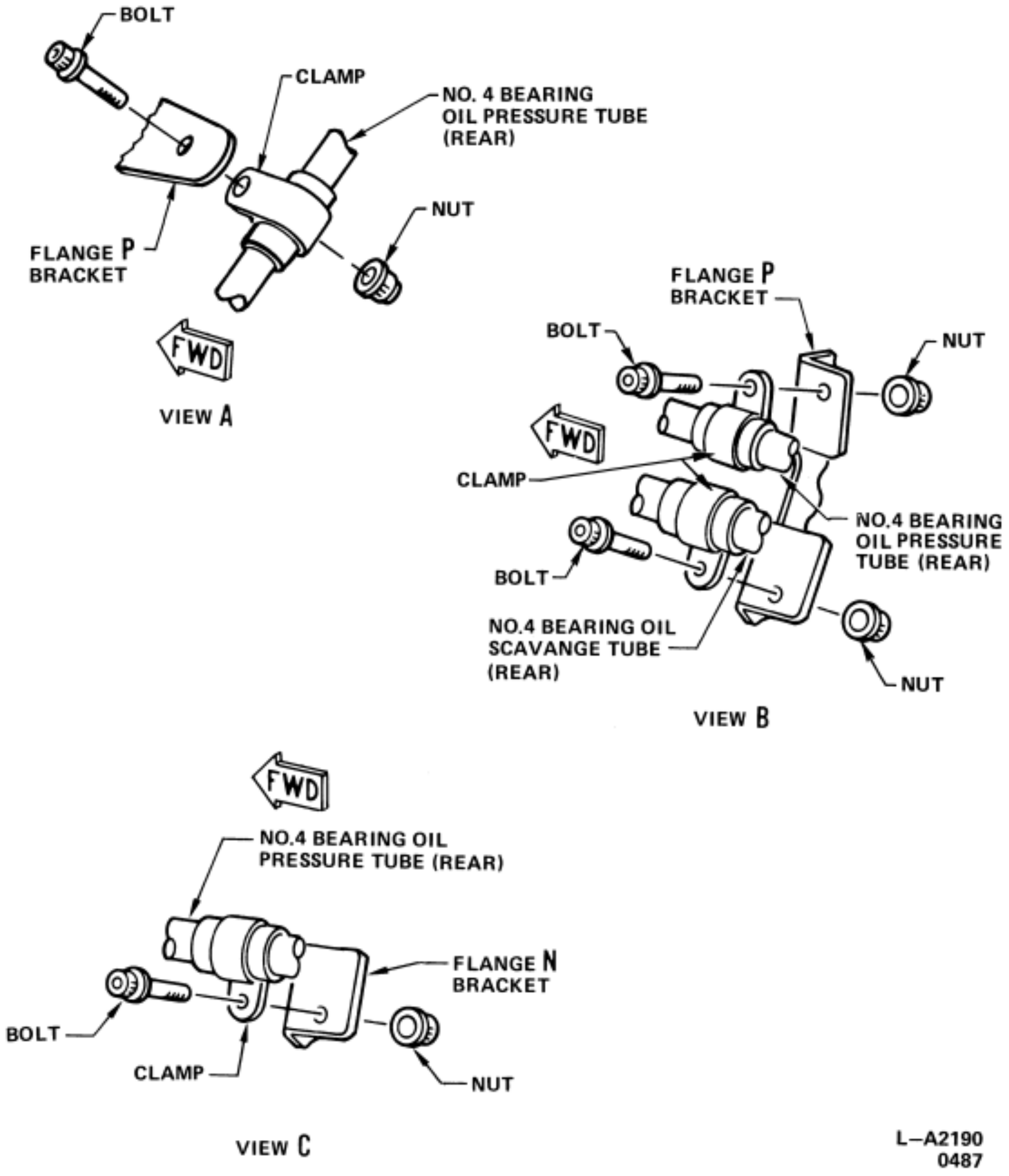
Turbine Case Cooling (TCC) Manifolds Clipping And Brackets
Figure 401 (Sheet 5)
(Task 72−00−52−450−003)


NUT
FLANGE N BRACKET
LPT(TCC) MANIFOLD SUPPORT BRACKET
FWD
BRACKET (PRE SB PW4ENG 72-134)
BOLT
VIEW G
BOLT
LPT(TCC) MANIFOLD SUPPORT BRACKET
FLANGE N BRACKET
FWD
NUT
VIEW H (TYPICAL 5 PLACES)
L-A3049 (0589)
PW V

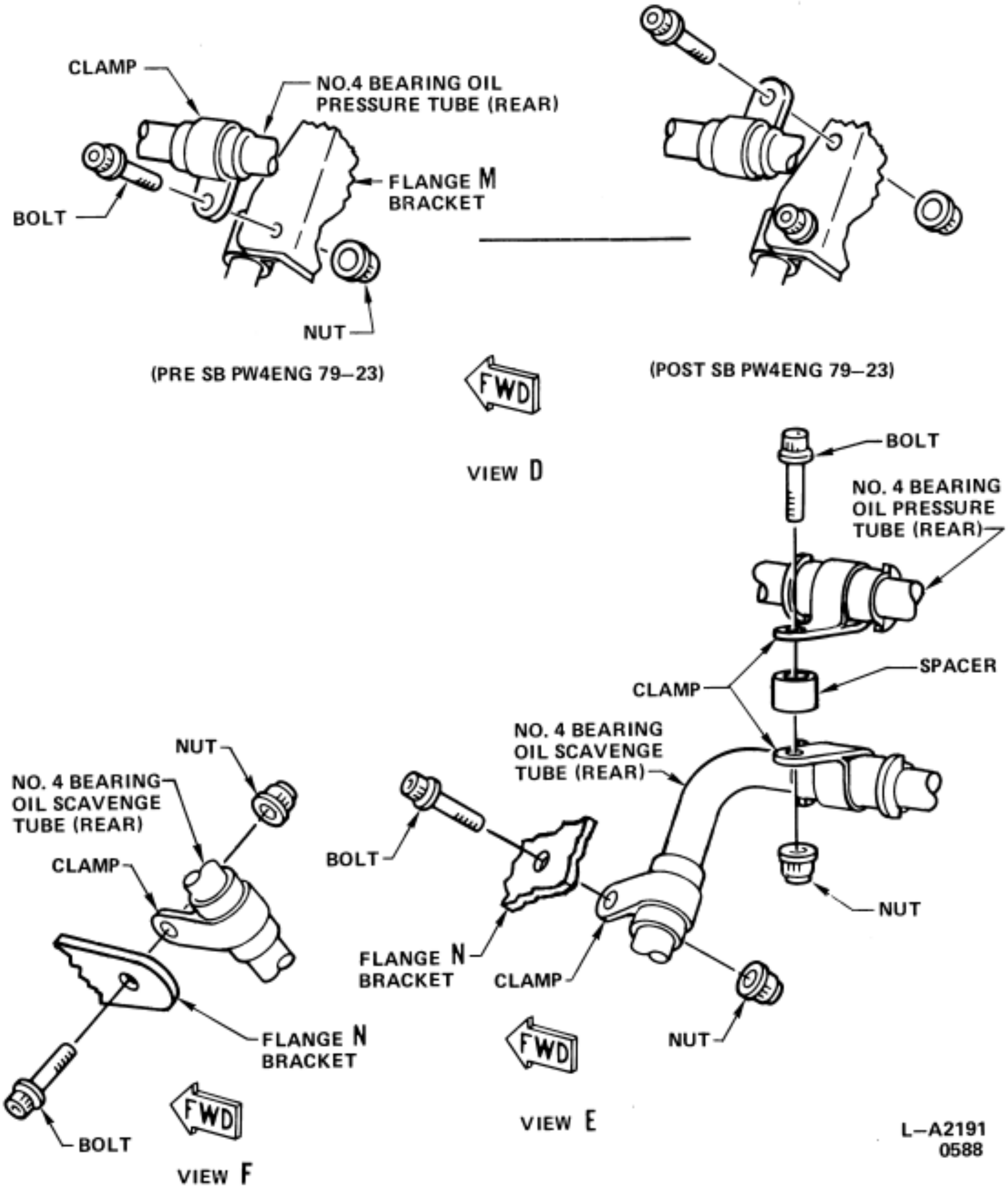
Turbine Case Cooling (TCC) Manifolds Clipping And Brackets
Figure 401 (Sheet 6)
(Task 72−00−52−450−003)


NO. 4 BEARING OIL PRESSURE TUBE (REAR) (LP16)
LPT 7TH (TCC) MANIFOLD (PRE SB PW4ENG 75-53)
FLANGE N
FLANGE P
SPRAY SHIELD
FLANGE M
SPRAY SHIELD
A
C
D
P
B
NO. 4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
E
M
L
EEC PT4.95 PRESSURE TUBE (REAR) (AS02)
N
F
K
G
H
SPRAY SHIELD
J
FWD
NO. 3 BEARING OIL VENT TUBE (REAR) (LD02)
LPT 7TH (TCC) MANIFOLD (PRE SB PW4ENG 75-53)
K
(PRE SB PW4ENG 72-134)
J
(POST SB PW4ENG 72-134)
L-A3451 (0593)
PW V

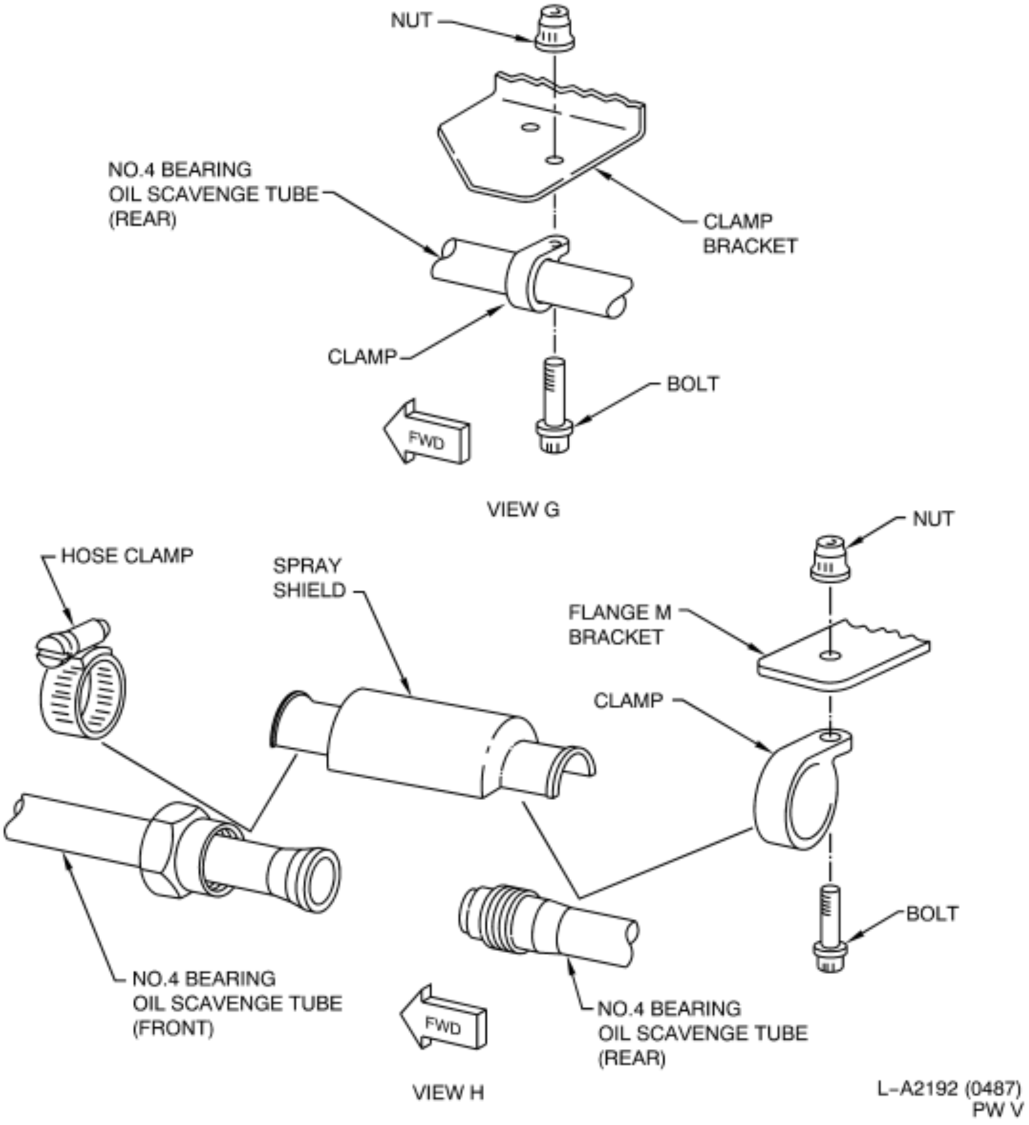
External Tubes For HPT (TCC) Clipping And Brackets
Figure 402 (Sheet 1)
(Task 72−00−52−450−003)


BOLT
CLAMP
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
NUT
FLANGE P BRACKET
FWD
VIEW A
FLANGE P BRACKET
BOLT
NUT
FWD
CLAMP
NO.4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NO.4 BEARING OIL SCAVANGE TUBE (REAR)
NUT
VIEW B
FWD
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE N BRACKET
BOLT
CLAMP
NUT
VIEW C
L−A2190
0487

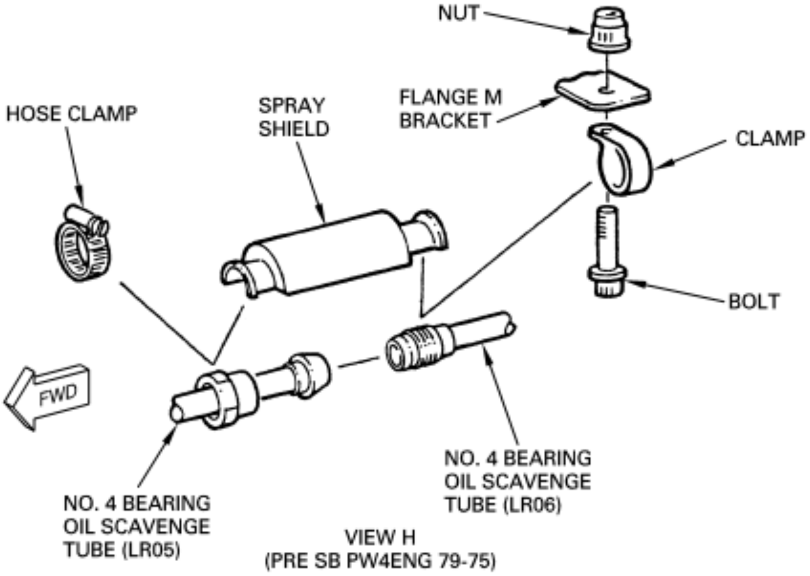
External Tubes For HPT (TCC) Clipping And Brackets
Figure 402 (Sheet 2)
(Task 72−00−52−450−003)

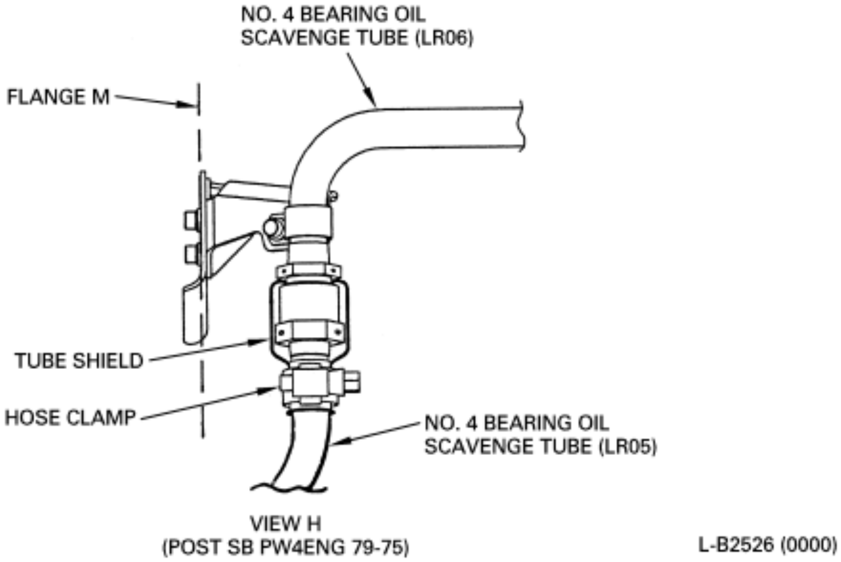

CLAMP
NO.4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
FLANGE M BRACKET
NUT
(PRE SB PW4ENG 79−23)
FWD
(POST SB PW4ENG 79−23)
VIEW D
BOLT
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
SPACER
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
NUT
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP
BOLT
NUT
FLANGE N BRACKET
CLAMP
FLANGE N BRACKET
FWD
NUT
FWD
BOLT
VIEW F
VIEW E
L−A2191
0588

External Tubes For HPT (TCC) Clipping And Brackets
Figure 402 (Sheet 3)
(Task 72−00−52−450−003)

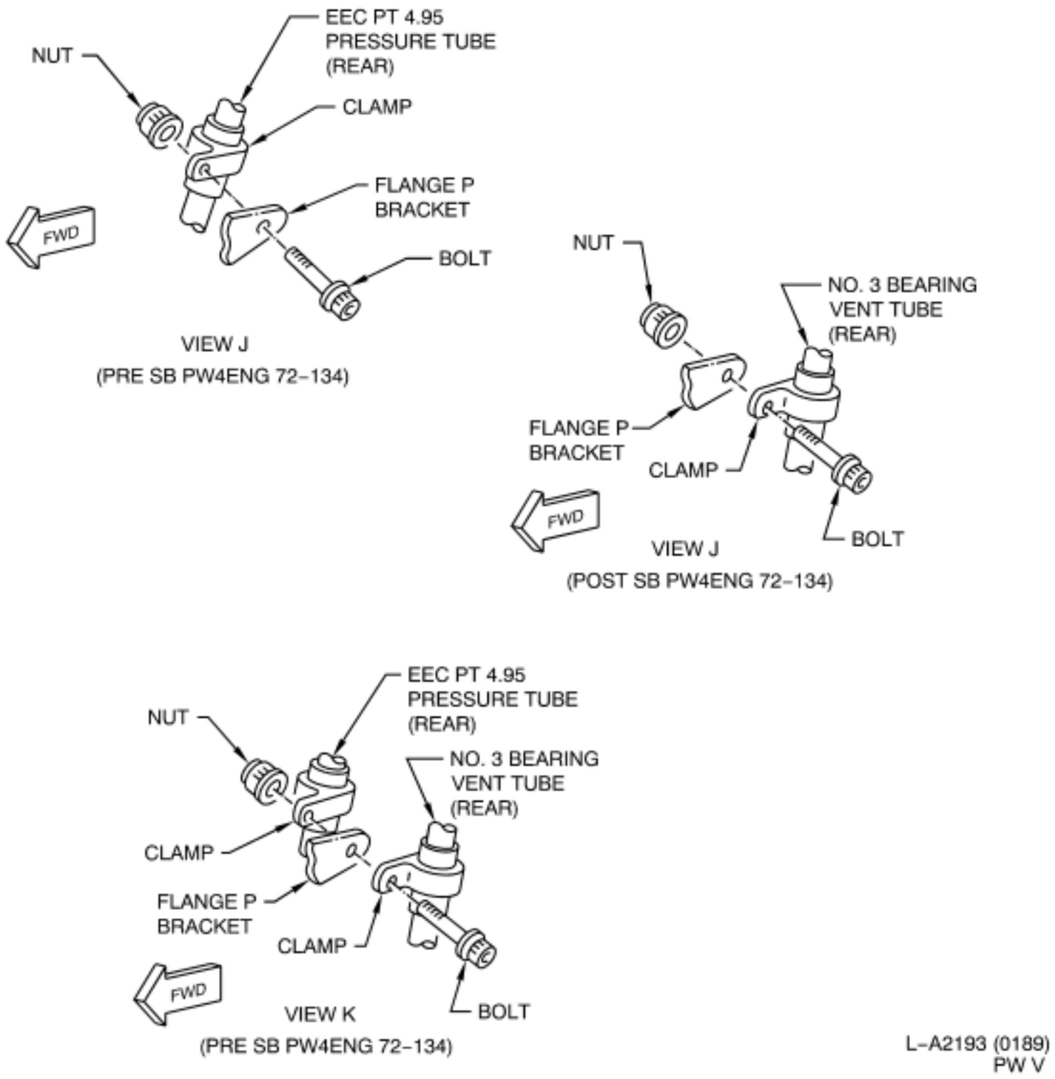

NUT
NO.4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP BRACKET
CLAMP
BOLT
FWD
VIEW G
HOSE CLAMP
SPRAY SHIELD
NUT
FLANGE M BRACKET
CLAMP
BOLT
NO.4 BEARING OIL SCAVENGE TUBE (FRONT)
FWD
NO.4 BEARING OIL SCAVENGE TUBE (REAR)
VIEW H
L−A2192 (0487)
PW V

External Tubes For HPT (TCC) Clipping And Brackets
Figure 402 (Sheet 4)
(Task 72−00−52−450−003)

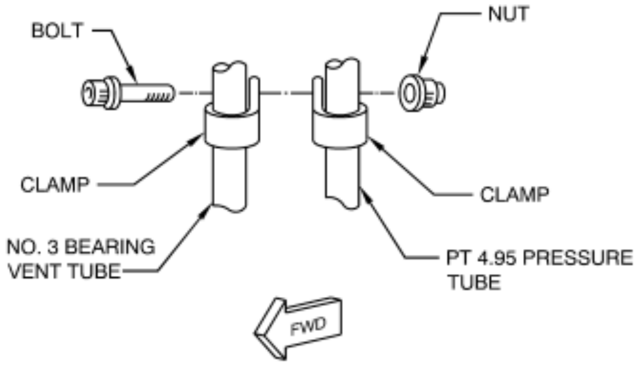

NUT
HOSE CLAMP
SPRAY SHIELD
FLANGE M BRACKET
CLAMP
BOLT
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
VIEW H
(PRE SB PW4ENG 79-75)


NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
FLANGE M
TUBE SHIELD
HOSE CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
VIEW H
(POST SB PW4ENG 79-75)
L-B2526 (0000)

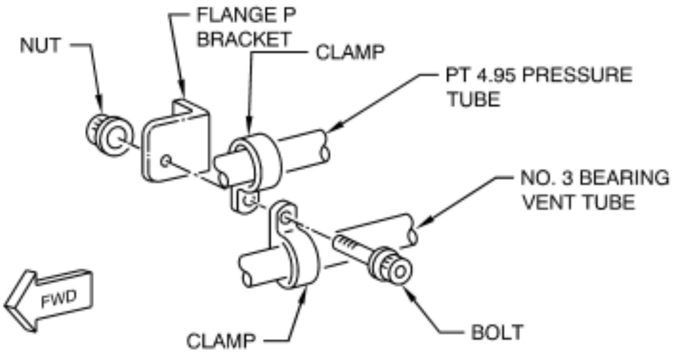
External Tubes For HPT (TCC) Clipping And Brackets
Figure 402 (Sheet 5)
(Task 72−00−52−450−003)


NUT
EEC PT 4.95 PRESSURE TUBE (REAR)
CLAMP
FLANGE P BRACKET
BOLT
FWD
VIEW J
(PRE SB PW4ENG 72−134)
NUT
NO. 3 BEARING VENT TUBE (REAR)
FLANGE P BRACKET
CLAMP
BOLT
FWD
VIEW J
(POST SB PW4ENG 72−134)
NUT
EEC PT 4.95 PRESSURE TUBE (REAR)
NO. 3 BEARING VENT TUBE (REAR)
CLAMP
FLANGE P BRACKET
CLAMP
BOLT
FWD
VIEW K
(PRE SB PW4ENG 72−134)
L−A2193 (0189)
PW V

External Tubes For HPT (TCC) Clipping And Brackets
Figure 402 (Sheet 6)
(Task 72−00−52−450−003)


BOLT
NUT
CLAMP
CLAMP
NO. 3 BEARING VENT TUBE
PT 4.95 PRESSURE TUBE
FWD

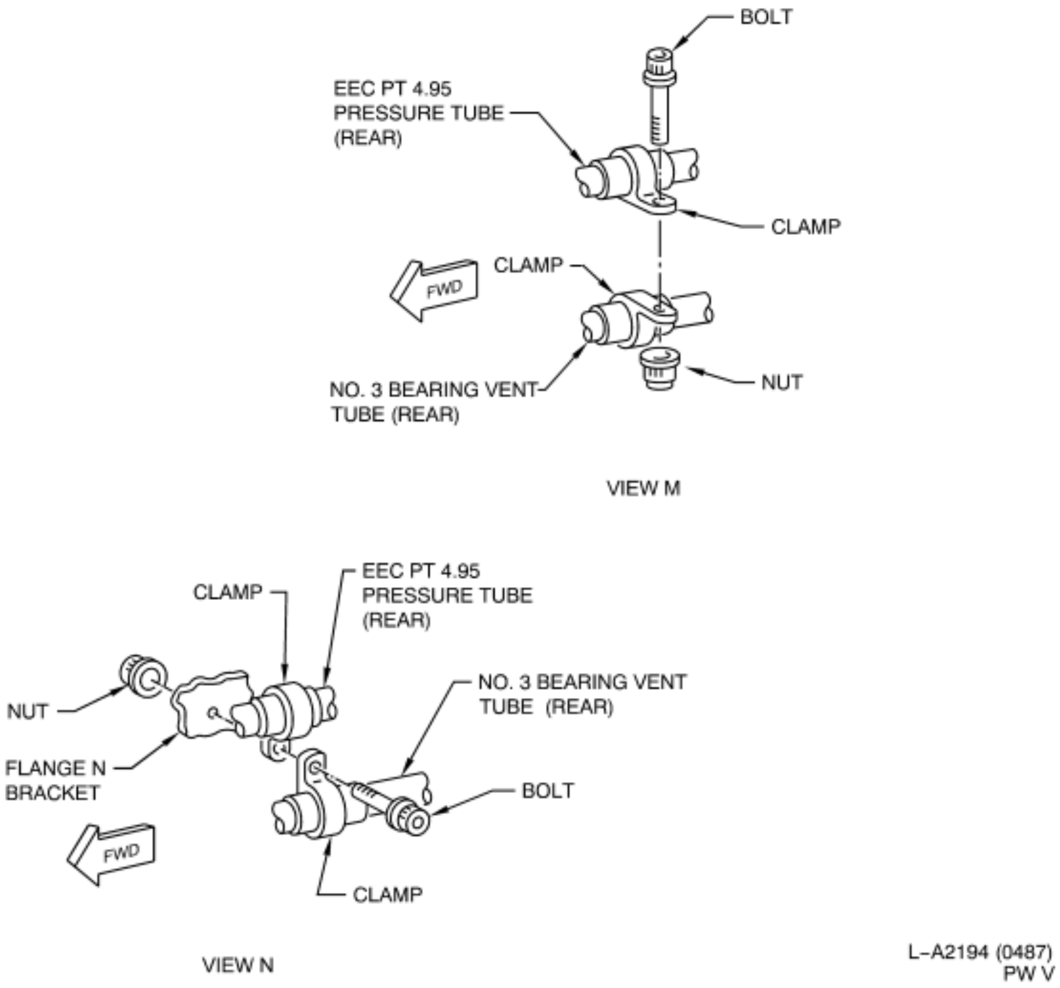
VIEW K
(POST SB PW4ENG 72−134)


NUT
FLANGE P BRACKET
CLAMP
PT 4.95 PRESSURE TUBE
NO. 3 BEARING VENT TUBE
FWD
CLAMP
BOLT

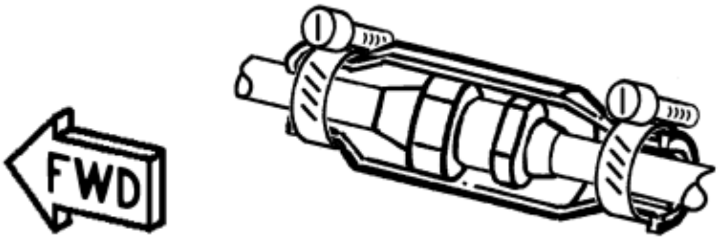
VIEW L

L−A5024 (0000)
PW V

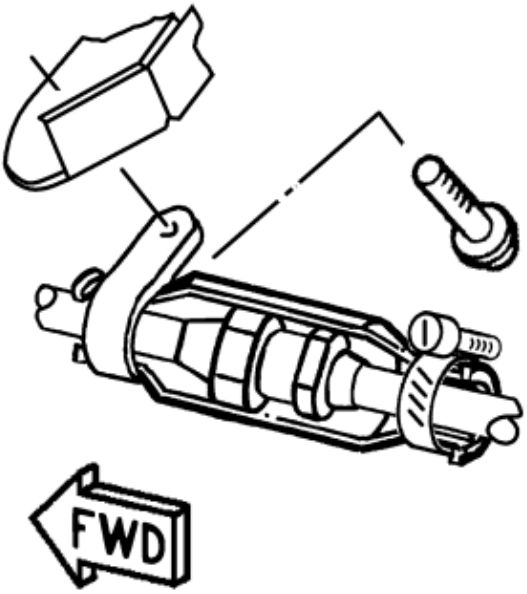
External Tubes For HPT (TCC) Clipping And Brackets
Figure 402 (Sheet 7)
(Task 72−00−52−450−003)


BOLT
EEC PT 4.95
PRESSURE TUBE
(REAR)
CLAMP
FWD
CLAMP
NO. 3 BEARING VENT
TUBE (REAR)
NUT
VIEW M
CLAMP
EEC PT 4.95
PRESSURE TUBE
(REAR)
NUT
NO. 3 BEARING VENT
TUBE (REAR)
FLANGE N
BRACKET
BOLT
FWD
CLAMP
VIEW N
L−A2194 (0487)
PW V

External Tubes For HPT (TCC) Clipping And Brackets
Figure 402 (Sheet 8)
(Task 72−00−52−450−003)



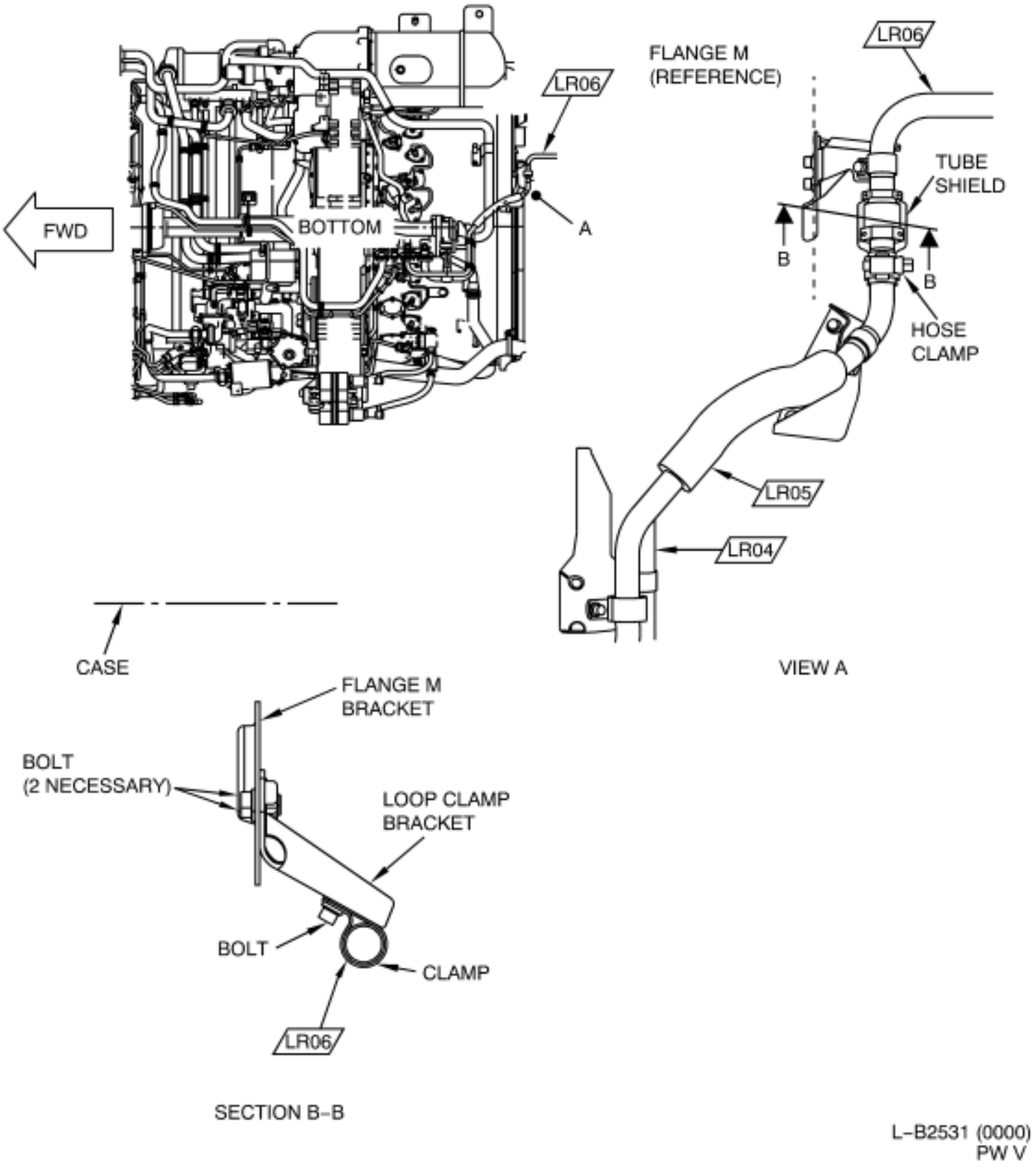
VIEW P
(PRE SB PW4ENG 79-54)



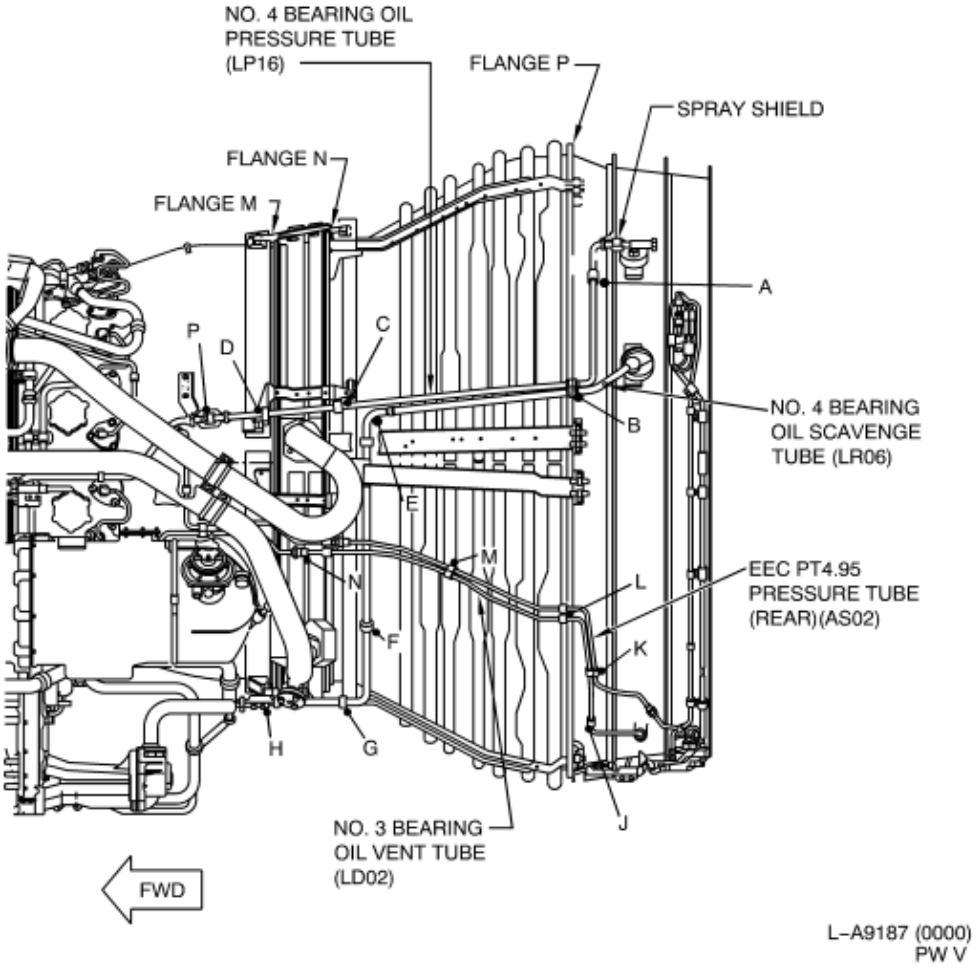
VIEW P
(POST SB PW4ENG 79-54)

L-A6824 (0000)

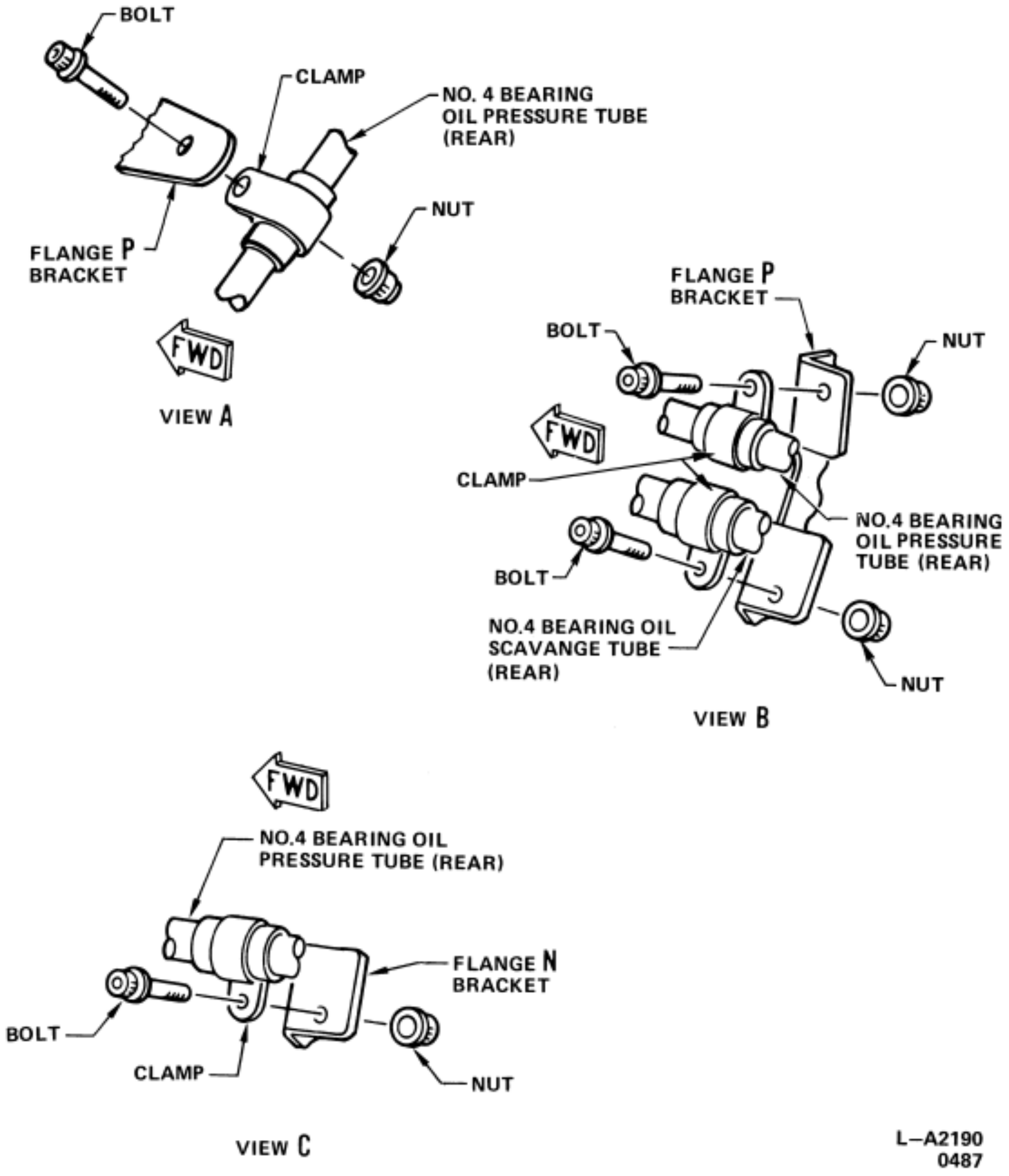
External Tubes For HPT (TCC) Clipping And Brackets
Figure 402 (Sheet 9)
(Task 72−00−52−450−003)


FWD
BOTTOM
LR06
A
FLANGE M
(REFERENCE)
LR06
TUBE
SHIELD
B
B
HOSE
CLAMP
LR05
LR04
CASE
VIEW A
FLANGE M
BRACKET
BOLT
(2 NECESSARY)
LOOP CLAMP
BRACKET
BOLT
CLAMP
LR06
SECTION B-B
L-B2531 (0000)
PW V

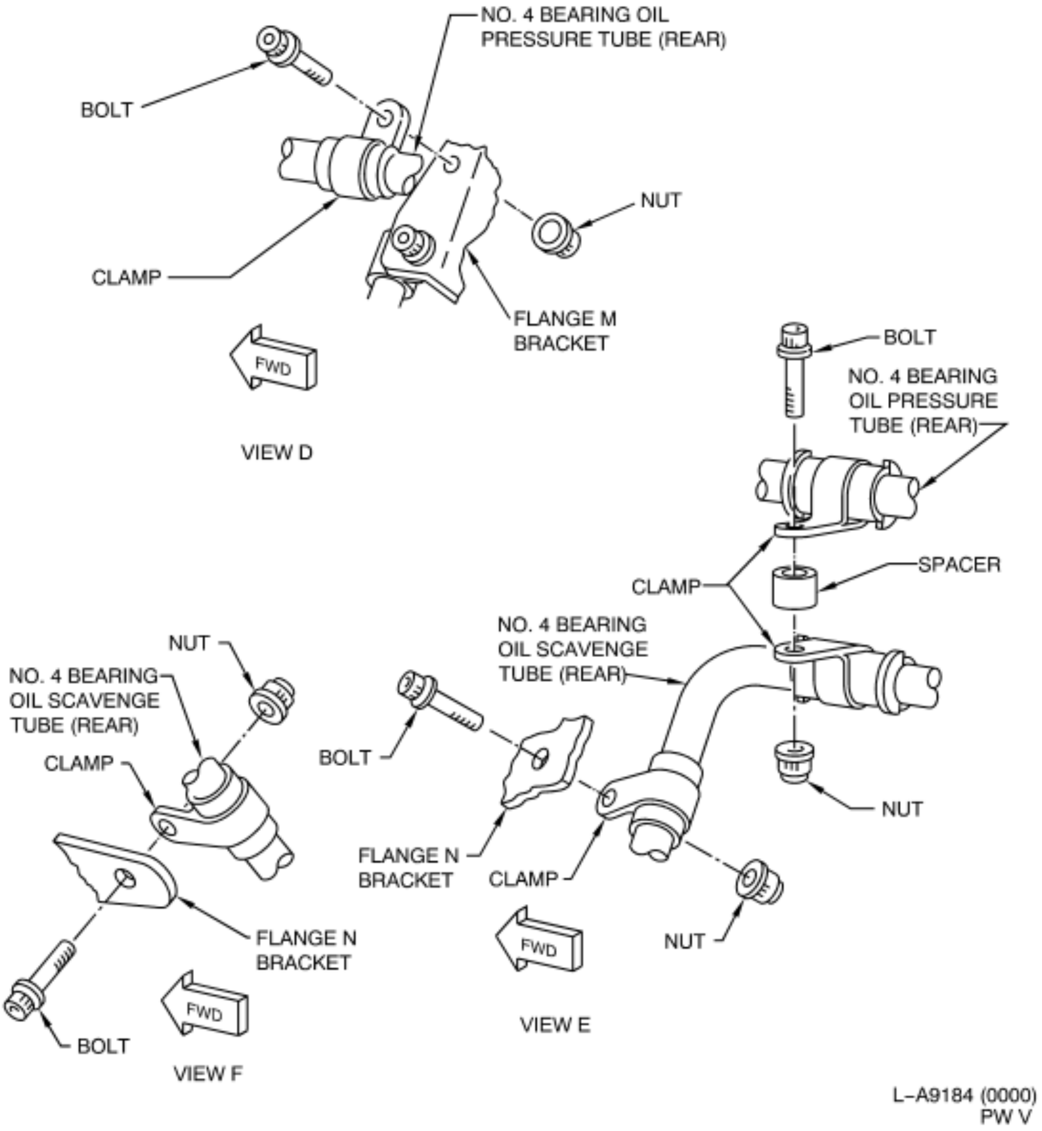
External Tubes For HPT (TCC) Clipping
And Brackets (Post SB PW4ENG 79-75)
Figure 402 (Sheet 10)
(Task 72-00-52-450-003)


NO. 4 BEARING OIL PRESSURE TUBE (LP16)
FLANGE P
SPRAY SHIELD
FLANGE N
FLANGE M
A
P
D
C
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
B
E
M
EEC PT4.95 PRESSURE TUBE (REAR)(AS02)
N
L
F
K
H
G
J
NO. 3 BEARING OIL VENT TUBE (LD02)
FWD
L-A9187 (0000)
PW V

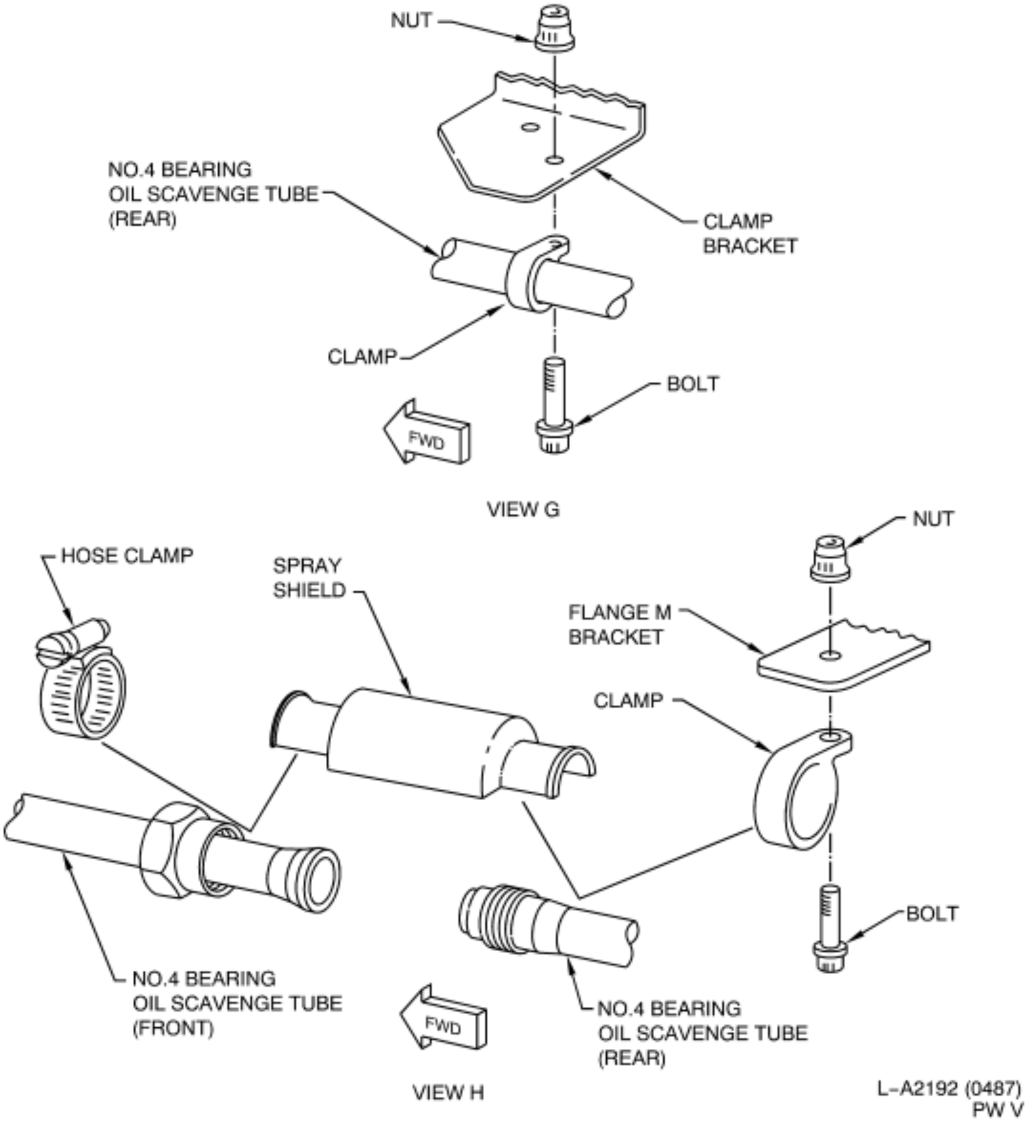
External Tubes For HPT (TCC) Clipping And Brackets
Figure 403 (Sheet 1)
(Task 72-00-52-450-003)


BOLT
CLAMP
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
NUT
FLANGE P BRACKET
FWD
VIEW A
FLANGE P BRACKET
BOLT
NUT
FWD
CLAMP
NO.4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NO.4 BEARING OIL SCAVANGE TUBE (REAR)
NUT
VIEW B
FWD
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE N BRACKET
BOLT
CLAMP
NUT
VIEW C
L−A2190
0487

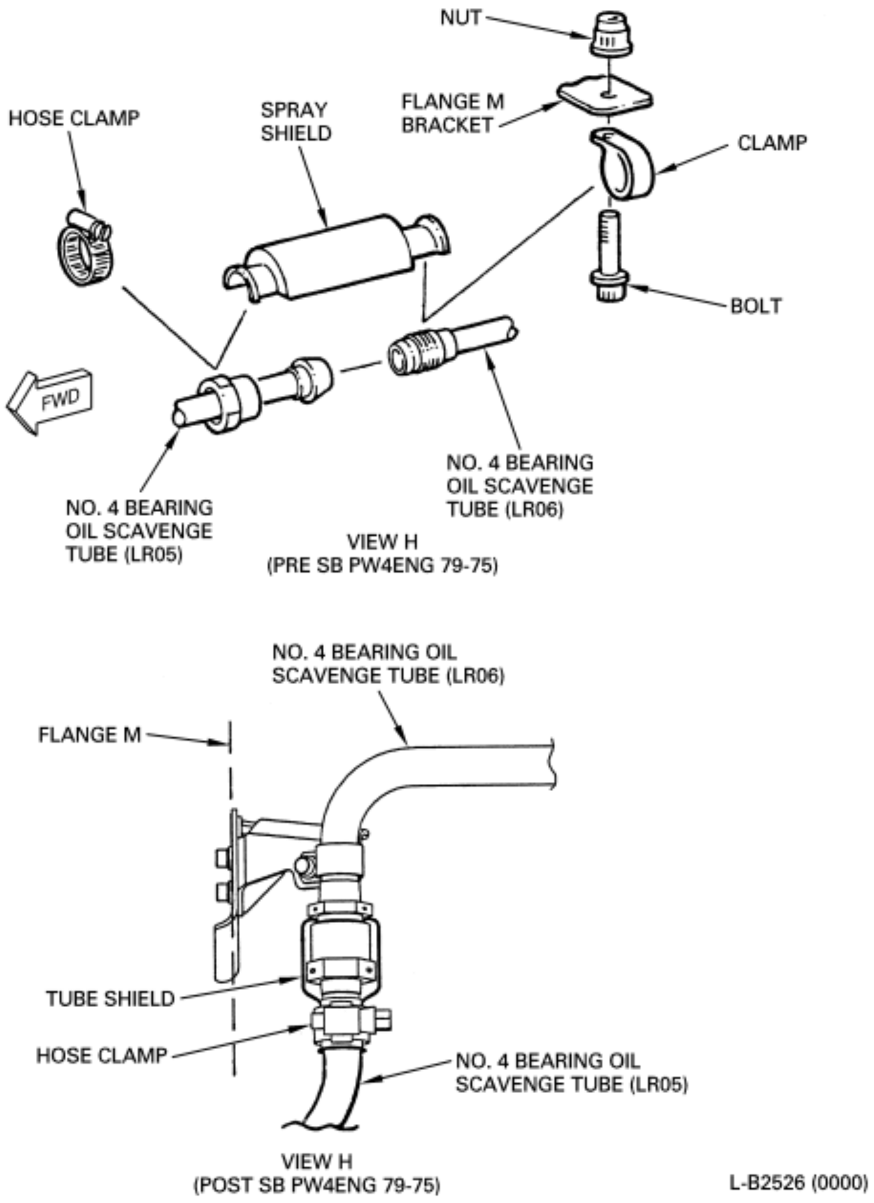
External Tubes For HPT (TCC) Clipping And Brackets
Figure 403 (Sheet 2)
(Task 72−00−52−450−003)


NO. 4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NUT
CLAMP
FLANGE M BRACKET
FWD
VIEW D
BOLT
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
SPACER
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
NUT
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP
BOLT
FLANGE N BRACKET
CLAMP
NUT
NUT
FLANGE N BRACKET
FWD
FWD
BOLT
VIEW F
VIEW E
L−A9184 (0000)
PW V

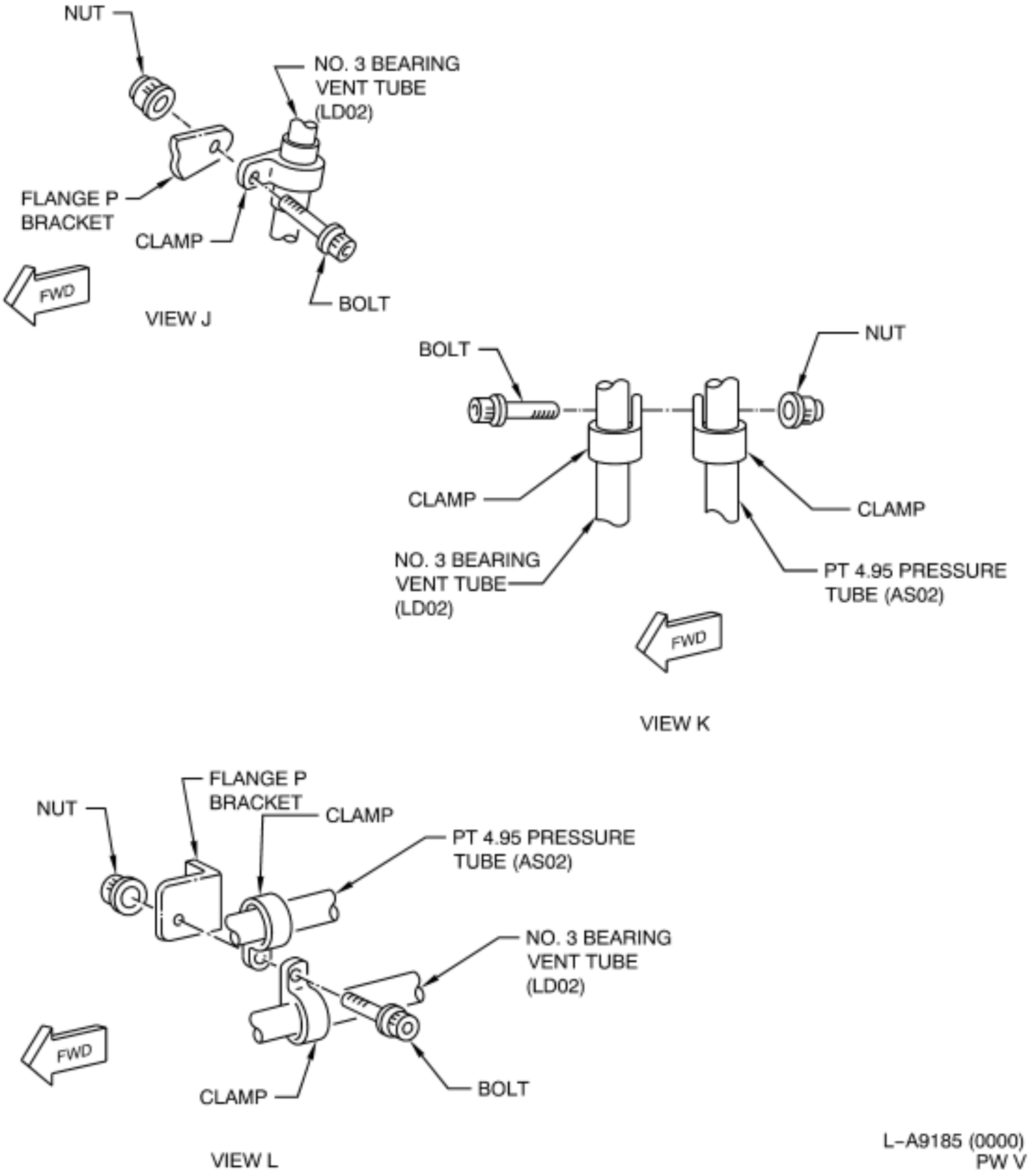
External Tubes For HPT (TCC) Clipping And Brackets
Figure 403 (Sheet 3)
(Task 72−00−52−450−003)


NUT
NO.4 BEARING
OIL SCAVENGE TUBE
(REAR)
CLAMP
BRACKET
CLAMP
BOLT
FWD
VIEW G
NUT
HOSE CLAMP
SPRAY
SHIELD
FLANGE M
BRACKET
CLAMP
BOLT
NO.4 BEARING
OIL SCAVENGE TUBE
(FRONT)
FWD
NO.4 BEARING
OIL SCAVENGE TUBE
(REAR)
VIEW H
L−A2192 (0487)
PW V

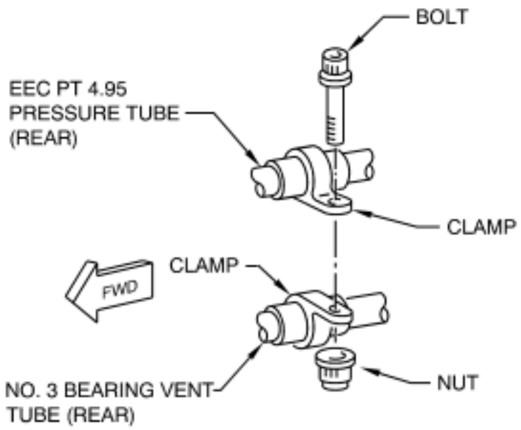
External Tubes For HPT (TCC) Clipping And Brackets
Figure 403 (Sheet 4)
(Task 72−00−52−450−003)


NUT
HOSE CLAMP
SPRAY SHIELD
FLANGE M BRACKET
CLAMP
BOLT
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
VIEW H
(PRE SB PW4ENG 79-75)
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
FLANGE M
TUBE SHIELD
HOSE CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
VIEW H
(POST SB PW4ENG 79-75)
L-B2526 (0000)

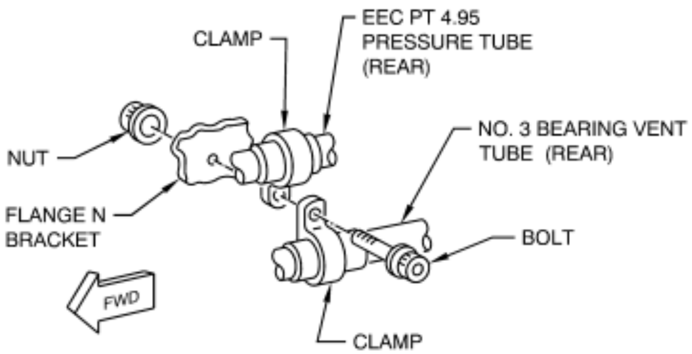
External Tubes For HPT (TCC) Clipping And Brackets
Figure 403 (Sheet 5)
(Task 72−00−52−450−003)


NUT
NO. 3 BEARING VENT TUBE (LD02)
FLANGE P BRACKET
CLAMP
BOLT
FWD
VIEW J
BOLT
NUT
CLAMP
CLAMP
NO. 3 BEARING VENT TUBE (LD02)
PT 4.95 PRESSURE TUBE (AS02)
FWD
VIEW K
FLANGE P BRACKET
NUT
CLAMP
PT 4.95 PRESSURE TUBE (AS02)
NO. 3 BEARING VENT TUBE (LD02)
FWD
CLAMP
BOLT
VIEW L
L−A9185 (0000)
PW V

External Tubes For HPT (TCC) Clipping And Brackets
Figure 403 (Sheet 6)
(Task 72−00−52−450−003)


BOLT
EEC PT 4.95
PRESSURE TUBE
(REAR)
CLAMP
CLAMP
FWD
NUT
NO. 3 BEARING VENT
TUBE (REAR)

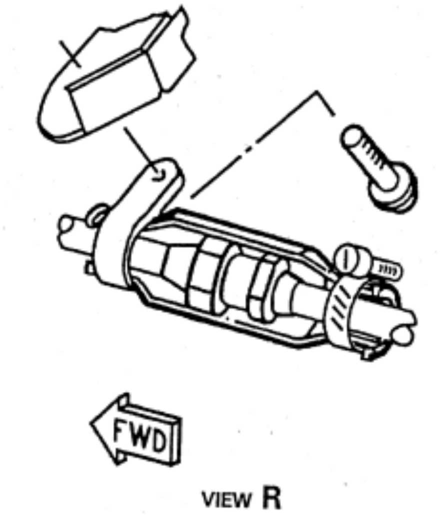
VIEW M


CLAMP
EEC PT 4.95
PRESSURE TUBE
(REAR)
NUT
NO. 3 BEARING VENT
TUBE (REAR)
FLANGE N
BRACKET
BOLT
FWD
CLAMP

VIEW N

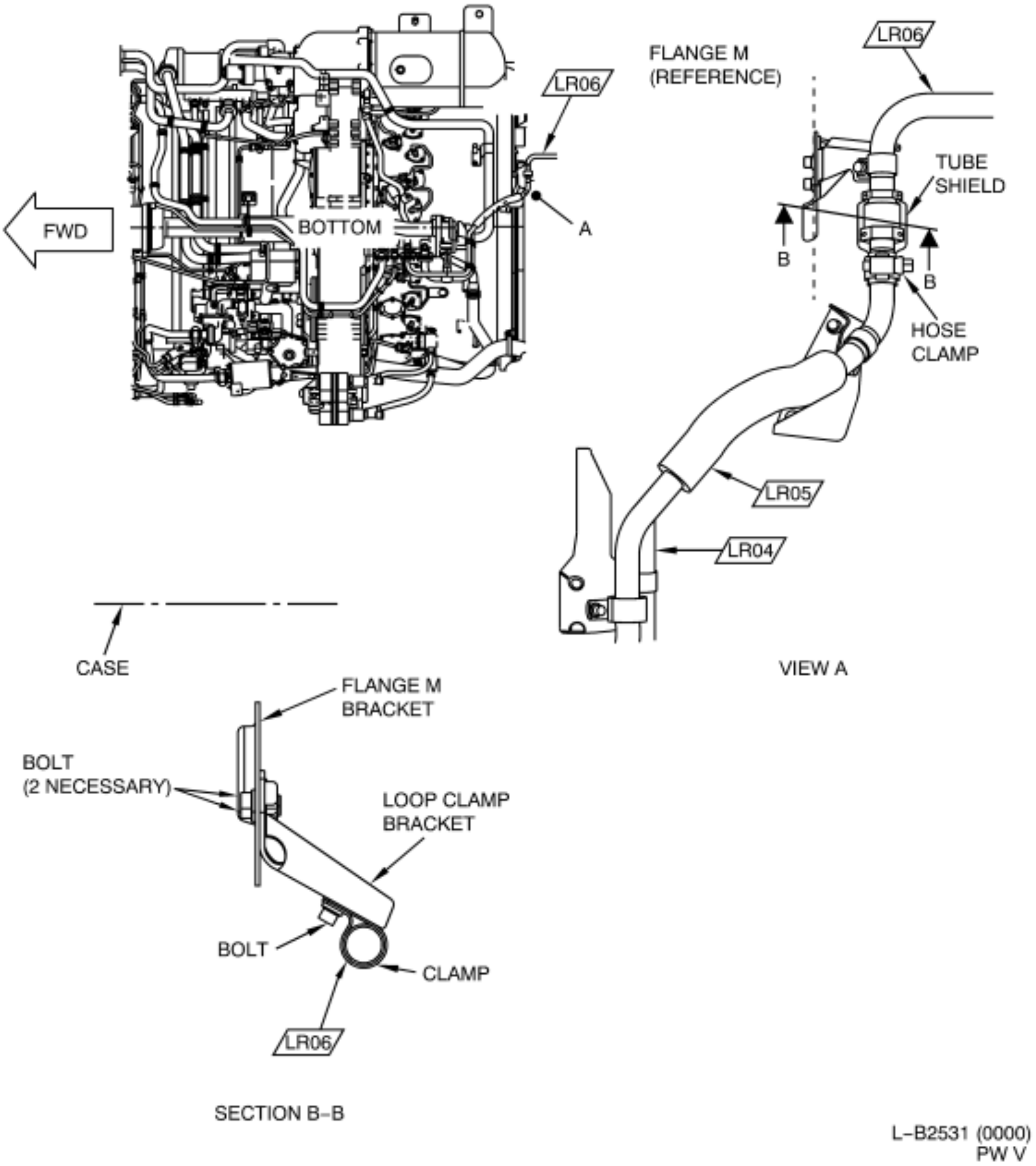
L−A2194 (0487)
PW V

External Tubes For HPT (TCC) Clipping And Brackets
Figure 403 (Sheet 7)
(Task 72−00−52−450−003)



L-A9061 (0000)

External Tubes For HPT (TCC) Clipping And Brackets
Figure 403 (Sheet 8)
(Task 72−00−52−450−003)


FWD
BOTTOM
LR06
A
FLANGE M
(REFERENCE)
LR06
TUBE
SHIELD
B
B
HOSE
CLAMP
LR05
LR04
CASE
VIEW A
FLANGE M
BRACKET
BOLT
(2 NECESSARY)
LOOP CLAMP
BRACKET
BOLT
CLAMP
LR06
SECTION B−B
L−B2531 (0000)
PW V

External Tubes For HPT (TCC) Clipping
And Brackets (Post SB PW4ENG 79−75)
Figure 403 (Sheet 9)
(Task 72−00−52−450−003)

Task 72-00-52-450-004:

1. Install Turbine Cooling Tubes

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-059	Wax, Paraffin (PMC 9552)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Gasket	1	75-24-00	2	5
Gasket	1	75-24-00	2	95
Gasket	1	75-24-00	3	25
Gasket	1	75-24-00	3	125
Seal Plate	1	75-24-00	2	1
Seal Plate	1	75-24-00	2	90
Seal Plate	1	75-24-00	3	20
Seal Plate	1	75-24-00	3	120

B. Procedure

(1) Install turbine vane cooling air duct (upper right) (AP01) as follows. See Figure 401.

(a) Remove protective closures.

(b) Secure new gasket in place on HPC case boss using Paraffin Wax (P05-059) at approximately the 2 o'clock position.

(c) (Pre SB PW4ENG 72-315) Secure new gasket in place on HPT pad with Paraffin Wax (P05-059) at approximately the 1 o'clock position.

(d) (Post SB PW4ENG 72−315) Install a new metering orifice seal plate, convex side outward, in place to the pad at approximately the 1 o'clock position on the HPT case with Paraffin Wax (P05−059).

(e) Position cooling air duct to above pads and secure with bolts, threads lubricated with Engine Oil (P03−001), with larger bolts at the rear flange and bracket at front flange handtight only.

(f) Install clamp over cooling air duct at support on diffuser case. Secure with bolts, threads lubricated with Engine Oil (P03−001). Torque bolts to 65 − 85 lb−in. (7.344 − 9.604 N.m). Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292) to the bolts.

(g) Torque bolts at front flange to 85 − 95 lb−in. (9.604 − 10.734 N.m) then retorque to same limit without loosening until torque is maintained. Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292) to the bolts. Torque bolts at rear flange to 180 − 200 lb−in. (20.337 − 22.597 N.m) then retorque to same limit without loosening until torque is maintained. Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292) to the bolts.

(2) Install turbine vane cooling air duct (lower right) (AP02) as follows. See Figure 401.

(a) Remove protective closures.

(b) Install a new gasket in position on the flange of the turbine vane and blade cooling air valve with Paraffin Wax (P05−059).

(c) Attach a new gasket or metering orifice seal plate in position on the HPT pad with Paraffin Wax (P05−059) at approximately the 4 o'clock position.

(d) Install the cooling air duct to the HPT boss and to the rear of cooling air valve and hold in position with bolts, threads lubricated with Engine Oil (P03−001), handtight only.

(e) Position clamp over cooling air duct at bracket on Flange M and secure with bolts, threads lubricated with Engine Oil (P03−001), and nuts. Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Torque bolts at front flange to 85 − 95 lb−in. (9.604 − 10.735 N.m), then retorque to same limit until torque is maintained. Torque bolts at rear flange to 180 − 200 lb−in. (20.337 − 22.597 N.m) then retorque to same limit without loosening until torque is maintained. Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292) to the bolts at the rear flange of the duct.

(3) Install turbine vane cooling air duct (upper left) (AP04) as follows. See Figure 402.

(a) Remove protective closures.

(b) Secure a new gasket in place on flange of turbine cooling air valve with Paraffin Wax (P05−059).

(c) Install a new metering orifice seal plate (Engines without SB PW4ENG 72−315 or SB PW4ENG 75−57) or a gasket (Engines with SB PW4ENG 72−315 or SB PW4ENG 75−57) in place on the HPT pad with Paraffin Wax (P05−059) at approximately the 9 o'clock position.

(d) Position cooling air duct to HPT boss and to rear of cooling air valve and secure with bolts, threads lubricated with Engine Oil (P03−001), larger bolts at rear flange handtight only.

(e) Position clamp to cooling air duct at bracket on diffuser case and secure with bolts and nuts lubricated with Engine Oil (P03−001). Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Torque bolts at forward flange to 85 − 95 lb−in. (9.604 − 10.734 N.m), then retorque to same limit without loosening until torque is maintained. Torque bolts at rear flange to 180 − 200 lb−in. (20.337 − 22.597 N.m) then retorque to same limit without loosening until torque is maintained. Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292) to the bolts at the rear flange of the duct.

(4) Install turbine vane cooling air duct (lower left) (AP03) as follows. See Figure 402.

(a) Remove protective closures.

(b) Secure a new gasket in place on HPC case boss with Paraffin Wax (P05−059) at approximately 9 o'clock position.

(c) Install a new metering orifice seal plate, convex side outward, in place to the pad at approximately the 7 o'clock position on the HPT case with Paraffin Wax (P05−059) (Engines with SB PW4ENG 72−315 and without SB PW4ENG 75−57).

(d) Install a new gasket in place on the HPT pad with Paraffin Wax (P05−059) at approximately the 7 o'clock position (Engines without SB PW4ENG 72−315 and with SB PW4ENG 75−57).

(e) Position cooling air duct to above pads and secure rear of duct with bolts, threads lubricated with Engine Oil (P03−001), larger bolts at rear flange handtight only.

(f) Align boltholes of bracket (attached to No. 4 bearing oil pressure tube) with boltholes in front flange of duct. Secure front flange and bracket with bolts, threads lubricated with Engine Oil (P03−001), handtight only.

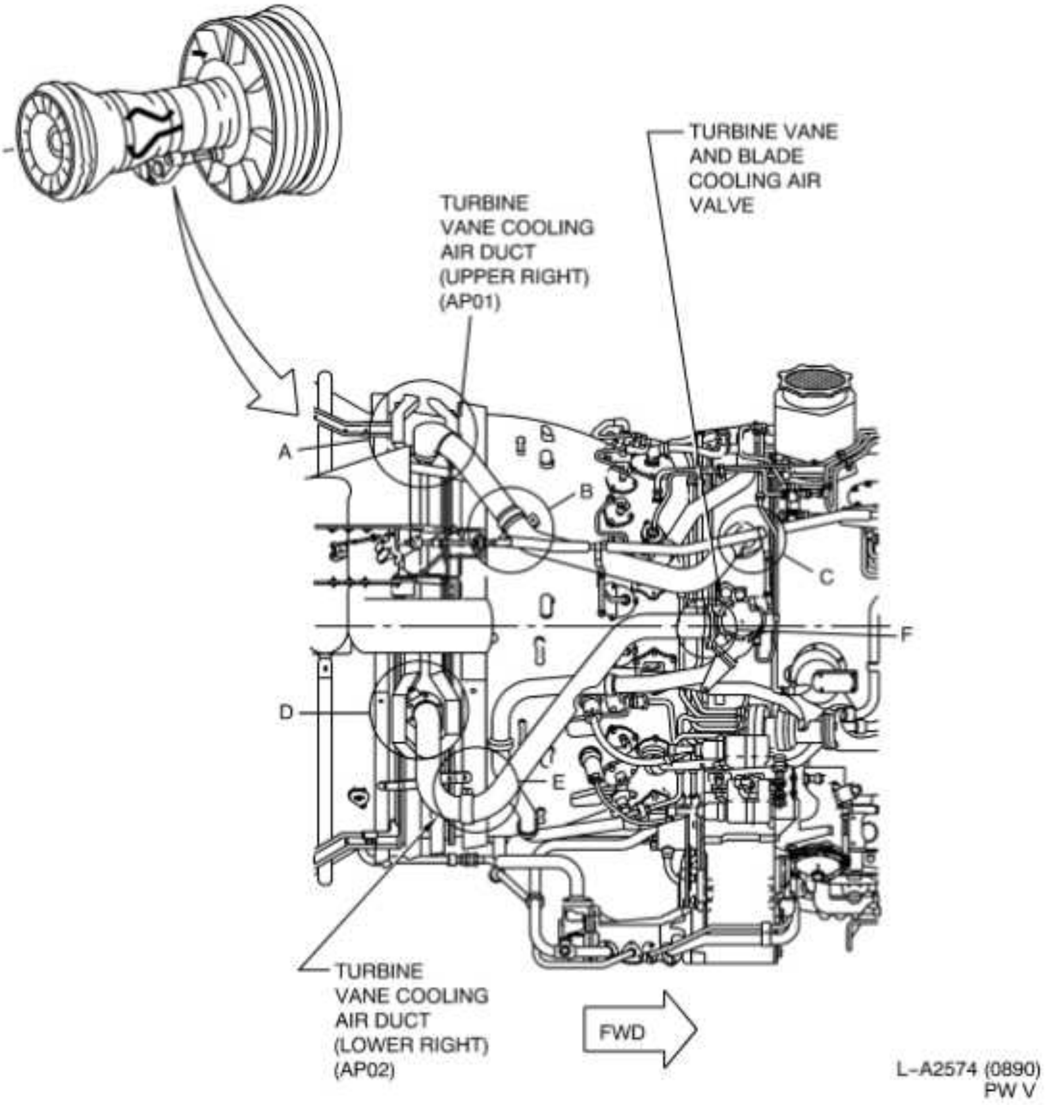
(g) Position clamp over duct at bracket on diffuser case boss and secure to bracket with bolts, threads lubricated with Engine Oil (P03−001), an nuts. Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(h) Torque bolts at front flange to 85 − 95 lb−in. (9.604 − 10.734 N.m), then retorque to same limit without loosening until torque is maintained. Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292) to the bolts. Torque bolts at rear flange to 180 − 200 lb−in. (20.337 − 22.597 N.m), then retorque to same limit without loosening until torque is maintained. Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292) to the bolts.

(i) Torque the clamp bolt that attaches the No. 4 bearing oil pressure tube to 36 − 40 lb−in. (4.067 − 4.519 N.m).

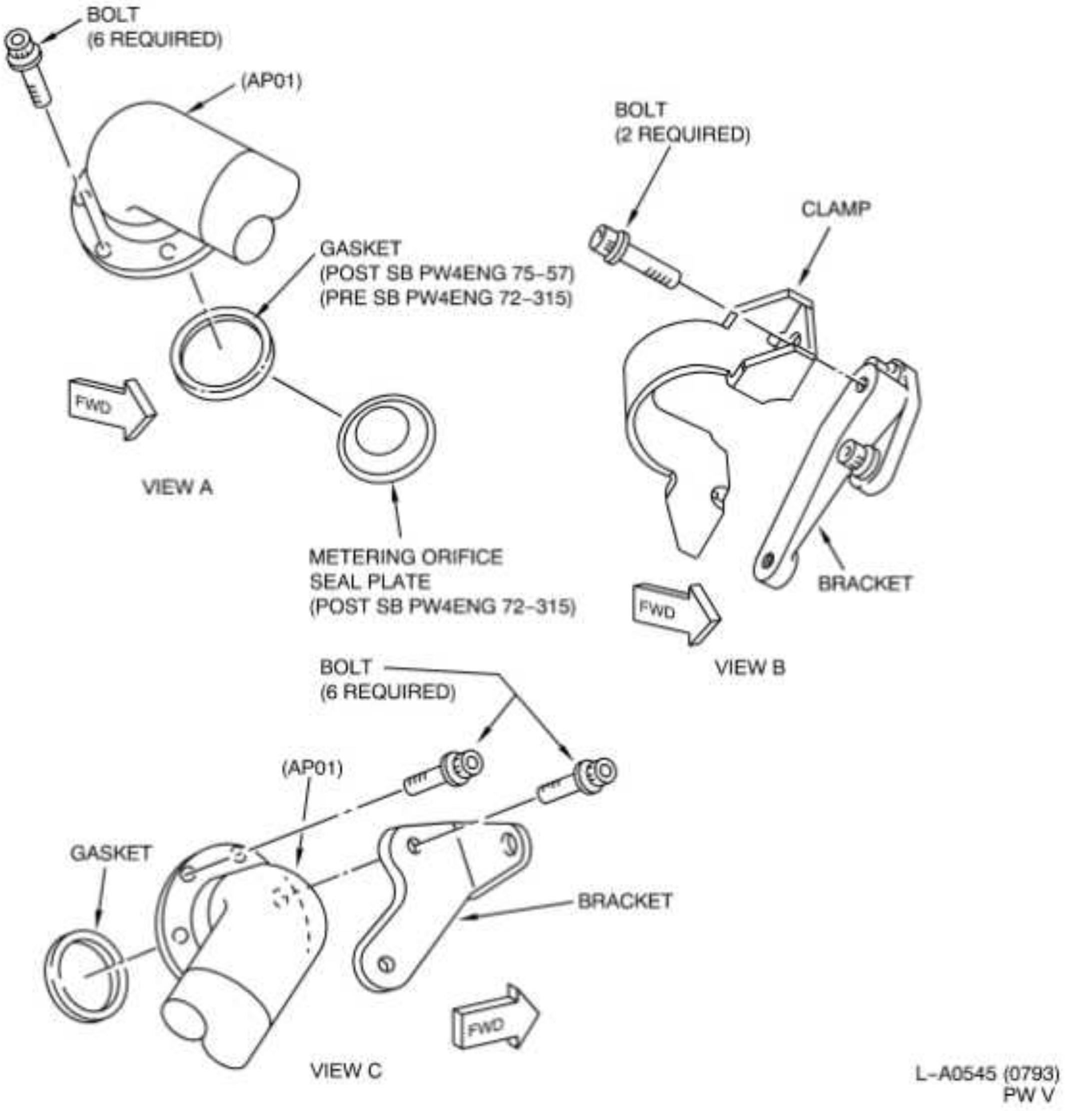
(j) Install a bolt, threads lubricated with Engine Oil (P03−001), and a nut to the clamp that attaches the No. 3 bearing pressure manifold (LP18) to the bracket on the front flange of the cooling air tube. Adjust the spray shield on the inboard side of the manifold and torque the bolt clamp to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(k) For engines equipped, install gasket to borescope plug groove. Install plug to rear elbow and engage end of plug into inner hole to seat. Install three bolts, threads lubricated with Engine Oil (P03−001). Torque bolts to 75 − 85 lb−in. (8.474 − 9.604 N.m), then retorque to same limit without loosening until torque is maintained. Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292).

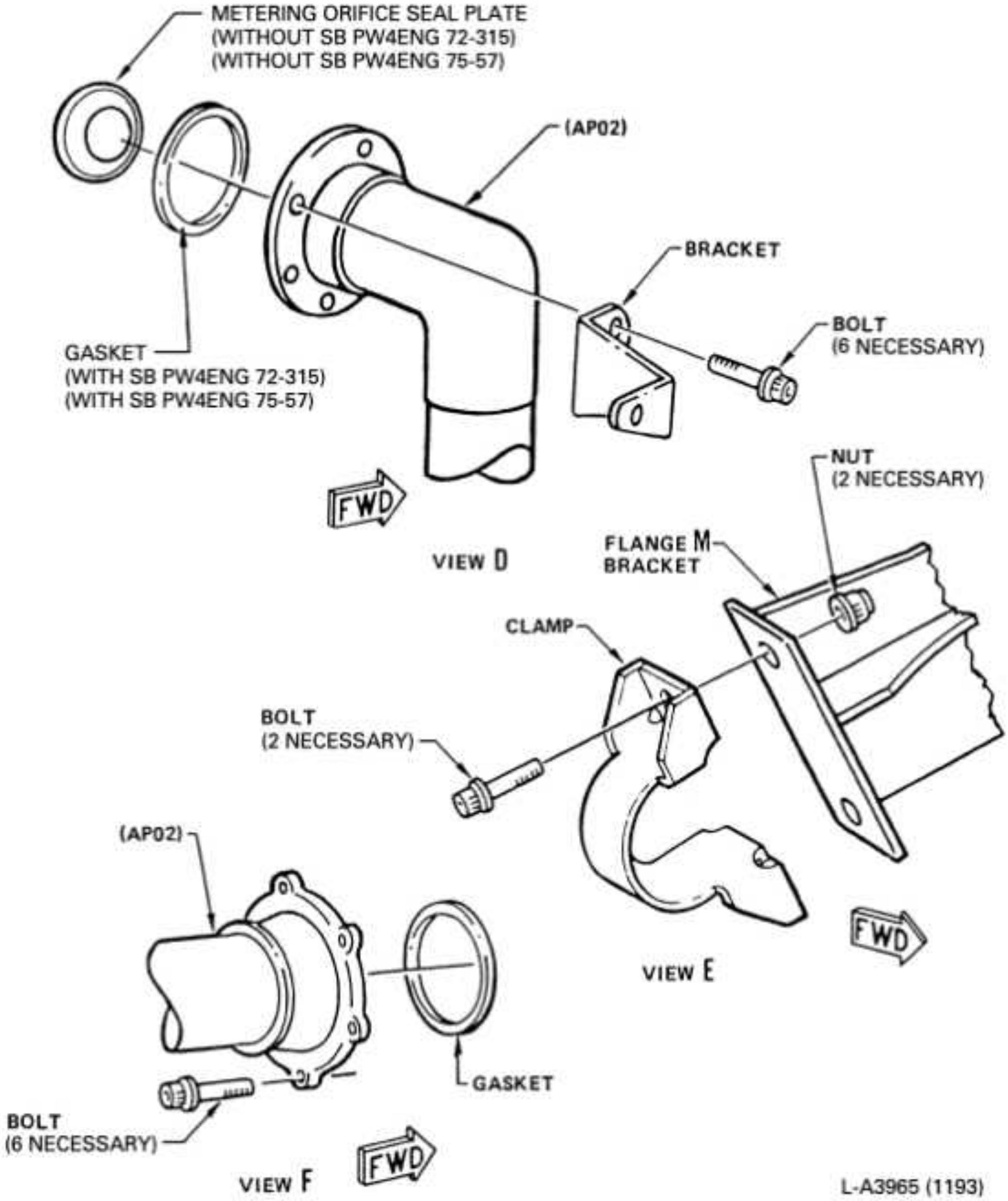

TURBINE VANE AND BLADE COOLING AIR VALVE
TURBINE VANE COOLING AIR DUCT (UPPER RIGHT) (AP01)
A
B
C
D
E
F
TURBINE VANE COOLING AIR DUCT (LOWER RIGHT) (AP02)
FWD
L−A2574 (0890)
PW V

Turbine Vane Cooling Air Ducts
(Right Side)
Figure 401 (Sheet 1)
(Task 72−00−52−450−004)

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−07

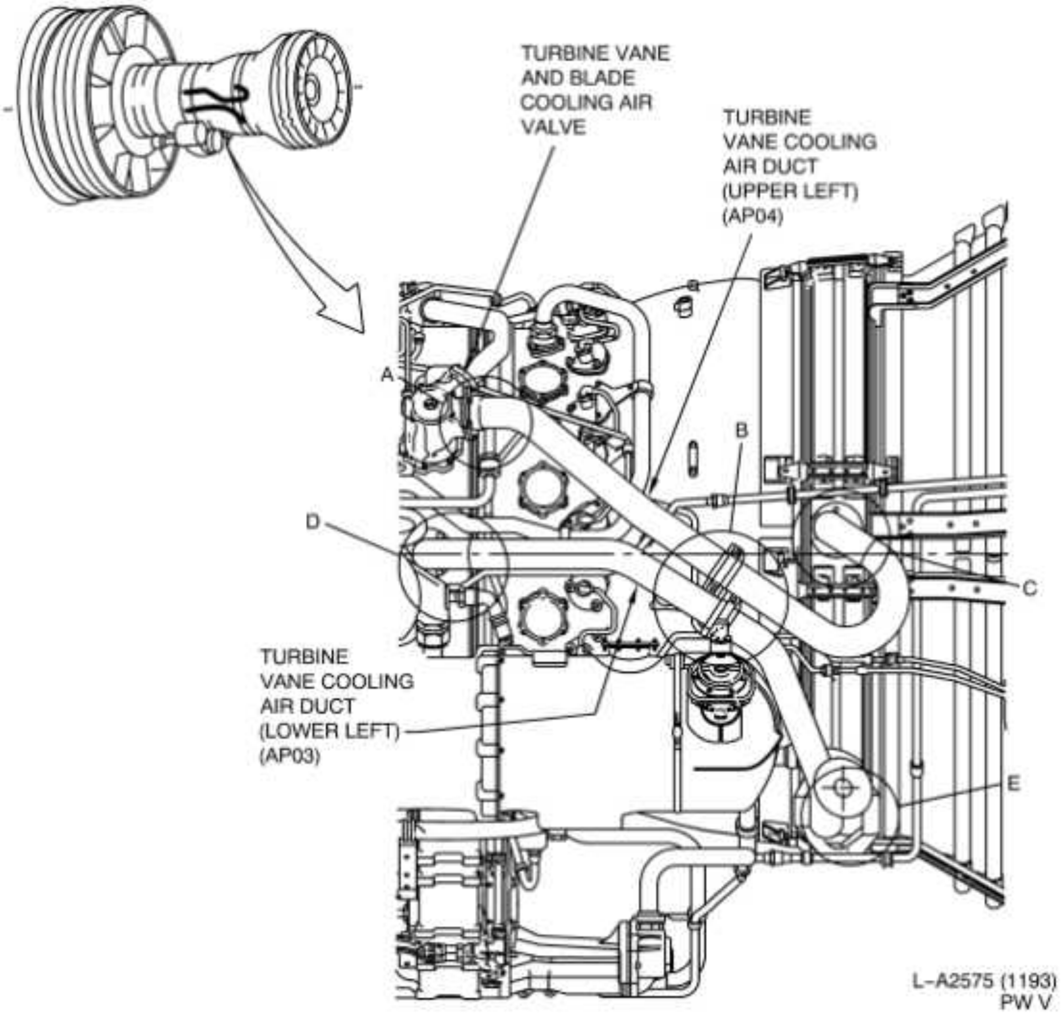

BOLT
(6 REQUIRED)
(AP01)
GASKET
(POST SB PW4ENG 75-57)
(PRE SB PW4ENG 72-315)
FWD
VIEW A
METERING ORIFICE
SEAL PLATE
(POST SB PW4ENG 72-315)
BOLT
(2 REQUIRED)
CLAMP
BRACKET
FWD
VIEW B
BOLT
(6 REQUIRED)
(AP01)
GASKET
BRACKET
FWD
VIEW C
L-A0545 (0793)
PW V

Turbine Vane Cooling Air Ducts
(Right Side)
Figure 401 (Sheet 2)
(Task 72−00−52−450−004)

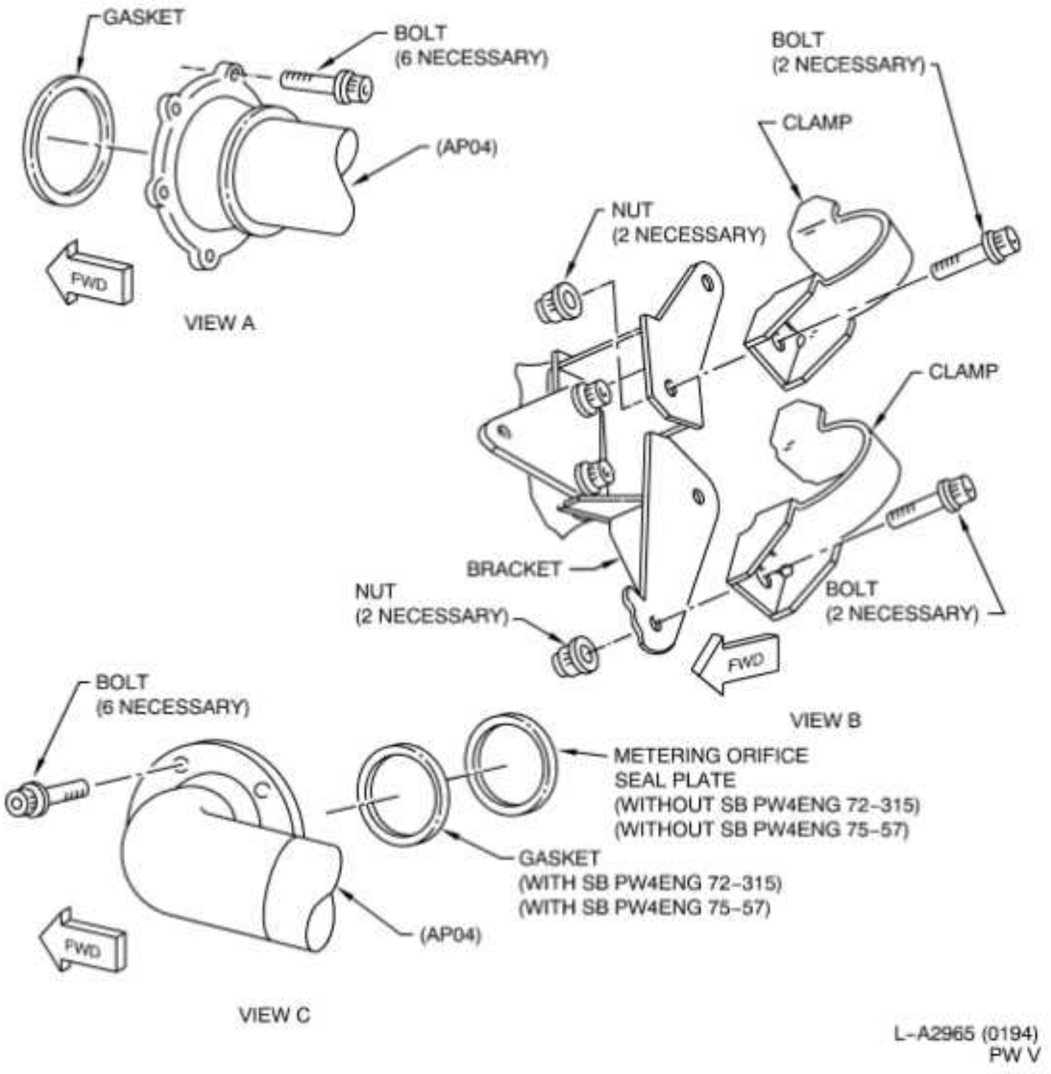

METERING ORIFICE SEAL PLATE
(WITHOUT SB PW4ENG 72-315)
(WITHOUT SB PW4ENG 75-57)
(AP02)
BRACKET
BOLT
(6 NECESSARY)
GASKET
(WITH SB PW4ENG 72-315)
(WITH SB PW4ENG 75-57)
FWD
VIEW D
NUT
(2 NECESSARY)
FLANGE M
BRACKET
CLAMP
BOLT
(2 NECESSARY)
(AP02)
FWD
VIEW E
GASKET
BOLT
(6 NECESSARY)
VIEW F
FWD
L-A3965 (1193)

Turbine Vane Cooling Air Ducts
(Right Side)
Figure 401 (Sheet 3)
(Task 72−00−52−450−004)

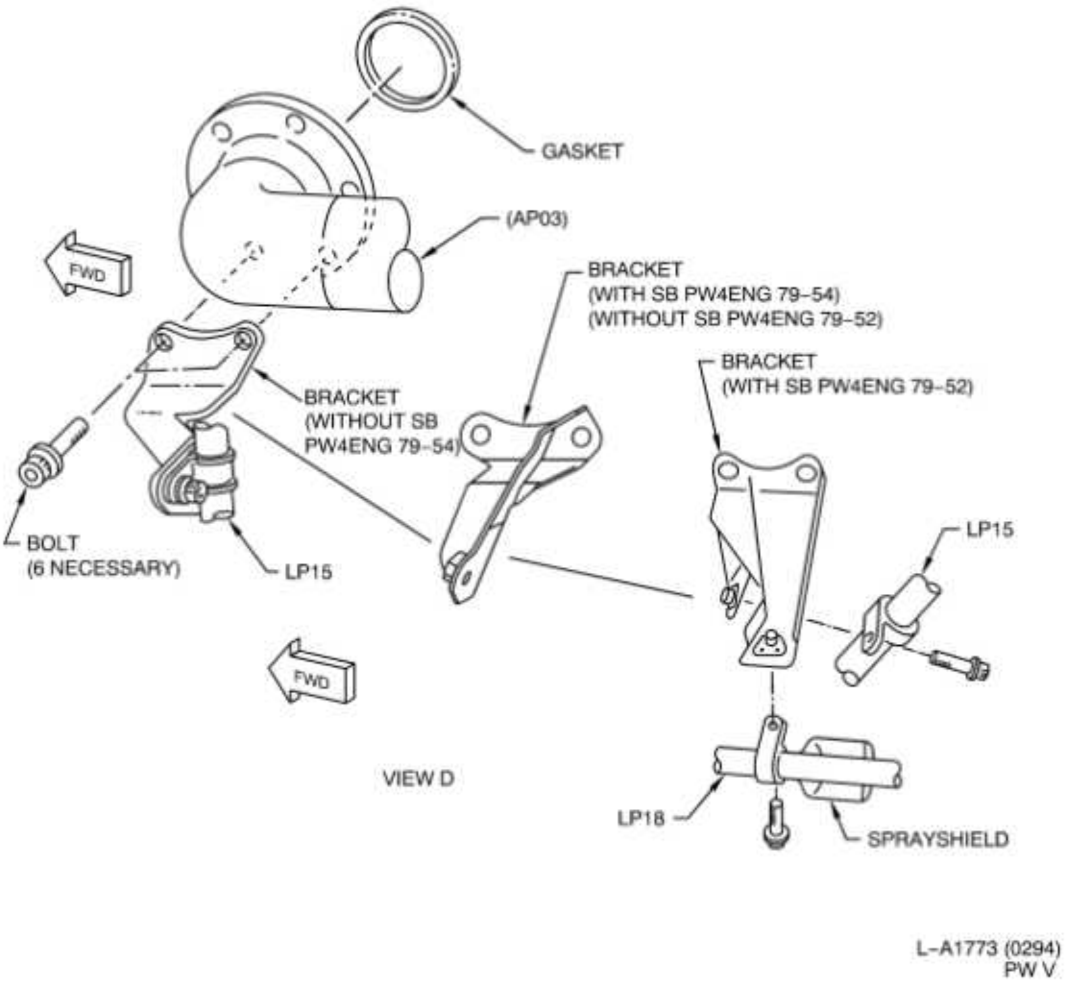
ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−07


TURBINE VANE AND BLADE COOLING AIR VALVE
TURBINE VANE COOLING AIR DUCT (UPPER LEFT) (AP04)
A
B
C
D
E
TURBINE VANE COOLING AIR DUCT (LOWER LEFT) (AP03)
L−A2575 (1193)
PW V

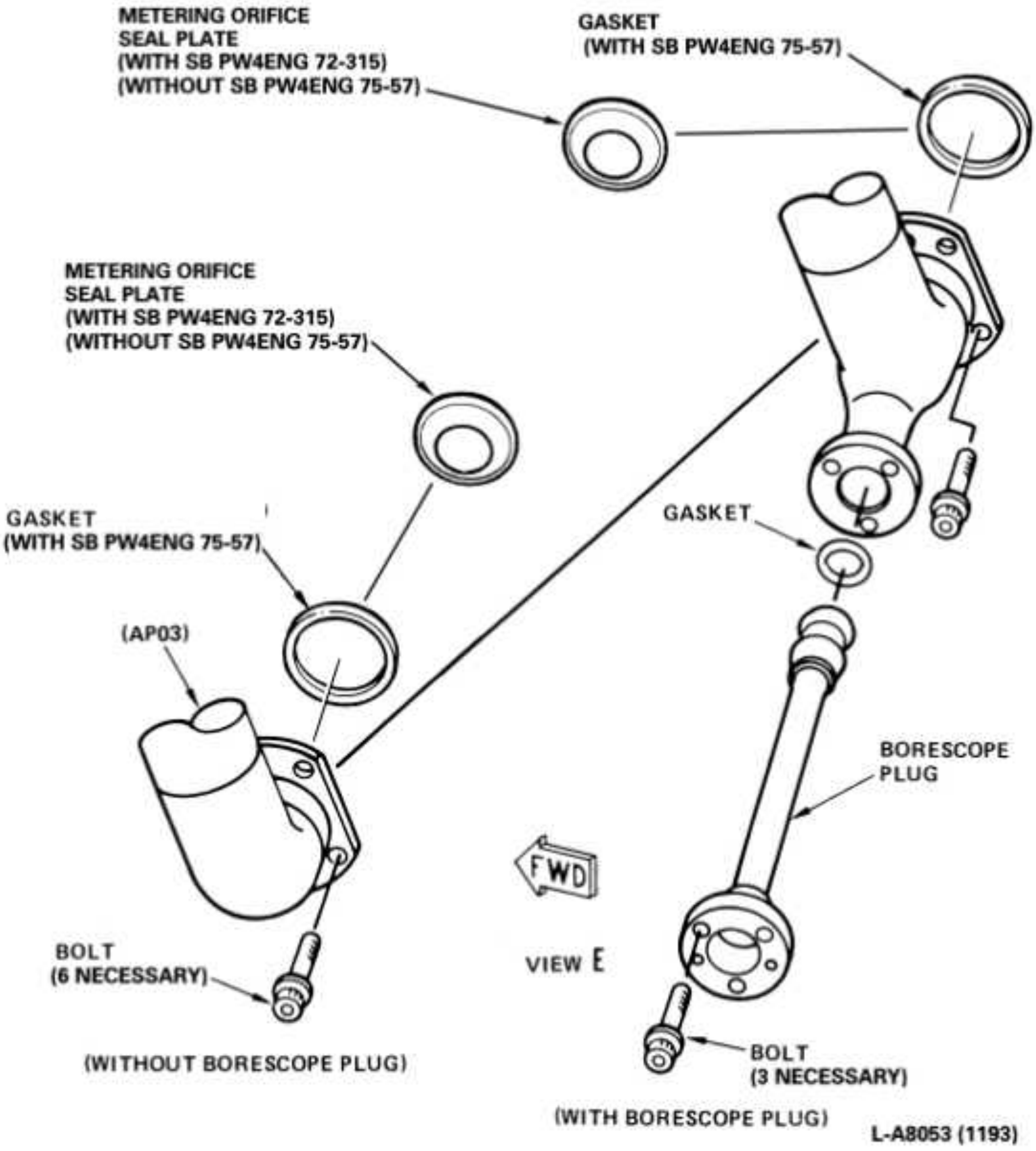
Turbine Vane Cooling Air Ducts
(Left Side)
Figure 402 (Sheet 1)
(Task 72−00−52−450−004)


GASKET
BOLT
(6 NECESSARY)
(AP04)
FWD
VIEW A
BOLT
(2 NECESSARY)
CLAMP
NUT
(2 NECESSARY)
CLAMP
BRACKET
NUT
(2 NECESSARY)
BOLT
(2 NECESSARY)
FWD
VIEW B
BOLT
(6 NECESSARY)
METERING ORIFICE
SEAL PLATE
(WITHOUT SB PW4ENG 72-315)
(WITHOUT SB PW4ENG 75-57)
GASKET
(WITH SB PW4ENG 72-315)
(WITH SB PW4ENG 75-57)
(AP04)
FWD
VIEW C
L-A2965 (0194)
PW V

Turbine Vane Cooling Air Ducts
(Left Side)
Figure 402 (Sheet 2)
(Task 72−00−52−450−004)


GASKET
(AP03)
FWD
BRACKET
(WITH SB PW4ENG 79−54)
(WITHOUT SB PW4ENG 79−52)
BRACKET
(WITH SB PW4ENG 79−52)
BRACKET
(WITHOUT SB
PW4ENG 79−54)
LP15
BOLT
(6 NECESSARY)
LP15
FWD
VIEW D
LP18
SPRAYSHIELD
L−A1773 (0294)
PW V

Turbine Vane Cooling Air Ducts
(Left Side)
Figure 402 (Sheet 3)
(Task 72−00−52−450−004)


METERING ORIFICE SEAL PLATE (WITH SB PW4ENG 72-315) (WITHOUT SB PW4ENG 75-57)
GASKET (WITH SB PW4ENG 75-57)
METERING ORIFICE SEAL PLATE (WITH SB PW4ENG 72-315) (WITHOUT SB PW4ENG 75-57)
GASKET
GASKET (WITH SB PW4ENG 75-57)
(AP03)
BORESCOPE PLUG
FWD
VIEW E
BOLT (6 NECESSARY)
(WITHOUT BORESCOPE PLUG)
BOLT (3 NECESSARY)
(WITH BORESCOPE PLUG)
L-A8053 (1193)

Turbine Vane Cooling Air Ducts
(Left Side)
Figure 402 (Sheet 4)
(Task 72−00−52−450−004)

ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - INSTALLATION-07

Task 72-00-52-450-005:

1. Install Turbine Cooling Tubes

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-059	Wax, Paraffin (PMC 9552)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	75-24-00/2/5
Gasket	1	75-24-00/2/95
Gasket	1	75-24-00/3/25
Gasket	1	75-24-00/3/125
Seal Plate	1	75-24-00/2/1
Seal Plate	1	75-24-00/2/90
Seal Plate	1	75-24-00/3/20
Seal Plate	1	75-24-00/3/120

B. Procedure

(1) Install the (upper right) turbine vane cooling air duct (AP01) as follows. See Figure 401.

(a) Remove the protection covers.

(b) Install a new gasket to the front flange of the cooling air duct. Attach the gasket to the duct flange with Paraffin Wax P05-059.

(c) Install a new metering orifice seal plate, convex side outward, to the HPT pad located approximately at the 1 o'clock position. Attach the plate with Paraffin Wax P05-059.

(d) (Pre SB PW4ENG 75−114) Install the cooling air duct to the HPT pad and to the valve flange. Attach the duct with the bolts, threads lubricated with Engine Oil P03−001, with the larger bolts at the rear flange. Tighten the bolts by hand.

(e) (Post SB PW4ENG 75−114) Install the cooling air duct to the HPT pad and to the valve flange. Attach the duct with the bolts, threads lubricated with Engine Oil P03−001, with the larger bolts at the rear flange and the silver plated bolts at the forward flange. Tighten the bolts by hand.

(f) Install a clamp over the cooling air duct at the support on the diffuser case at approximately the 2 o'clock position. Attach the clamp to the support with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 65 − 85 lb−in. (7.344 − 9.604 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

(g) Torque the bolts at the front flange to 85 − 95 lb−in. (9.604 − 10.734 N.m). Continue to torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m) until the torque is kept. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

(h) Torque the bolts at the rear flange to 180 − 200 lb−in. (20.337 − 22.597 N.m). Continue to torque the bolts to 180 − 200 lb−in. (20.337 − 22.597 N.m) until the torque is kept. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

(2) Install the (lower right) turbine vane cooling air duct (AP02) as follows. See Figure 401.

(a) Remove protective closures.

(b) Install a new gasket to the flange of the turbine vane and blade cooling air valve and hold in position with Paraffin Wax P05−059.

(c) Install a new gasket to the HPT pad at approximately the 4 o'clock position and hold in position with Paraffin Wax P05−059.

(d) Install the cooling air duct to the HPT boss and to the rear of the cooling air valve and attach with bolts, threads lubricated with Engine Oil P03−001, larger bolts at rear flange. Tighten the bolts by hand.

(e) Install the clamp over the cooling air duct and to the bracket on Flange M. Attach with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Torque the bolts at the front flange to 85 − 95 lb−in. (9.604 − 10.735 N.m). Continue to torque the bolts until the torque is kept. Torque the bolts at the rear flange to 180 − 200 lb−in. (20.337 − 22.597 N.m). Continue to torque the bolts until the torque is kept. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts at the rear flange of the duct.

(3) Install turbine vane cooling air duct (upper left) (AP04) as follows. See Figure 402.

(a) Remove protective closures.

(b) Secure a new gasket in place on flange of turbine cooling air valve with Paraffin Wax P05−059.

(c) Install a new gasket in place on the HPT pad with Paraffin Wax P05−059 at approximately the 9 o'clock position.

(d) Position cooling air duct to HPT boss and to rear of cooling air valve and secure with bolts, threads lubricated with Engine Oil P03−001, larger bolts at rear flange handtight only.

(e) Position clamp to cooling air duct at bracket on diffuser case and secure with bolts and nuts lubricated with Engine Oil P03−001. Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Torque bolts at forward flange to 85 − 95 lb−in. (9.604 − 10.734 N.m), then retorque to same limit without loosening until torque is maintained. Torque bolts at rear flange to 180 − 200 lb−in. (20.337 − 22.597 N.m) then retorque to same limit without loosening until torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts at the rear flange of the duct.

(4) Install turbine vane cooling air duct (lower left) (AP03) as follows. See Figure 402.

(a) Remove protective closures.

(b) Secure a new gasket in place on HPC case boss with Paraffin Wax P05−059 at approximately 9 o'clock position.

(c) Install a metering orifice seal plate in place to the pad at approximately the 7 o'clock position on the HPT case with Paraffin Wax P05−059.

(d) Position cooling air duct to above pads and secure rear of duct with bolts, threads lubricated with Engine Oil P03−001, larger bolts at rear flange handtight only.

(e) Align boltholes of bracket (attached to No. 4 bearing oil pressure tube) with boltholes in front flange of duct. Secure front flange and bracket with bolts, threads lubricated with Engine Oil P03−001, handtight only.

(f) Position clamp over duct at bracket on diffuser case boss and secure to bracket with bolts, threads lubricated with Engine Oil P03−001, an nuts. Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

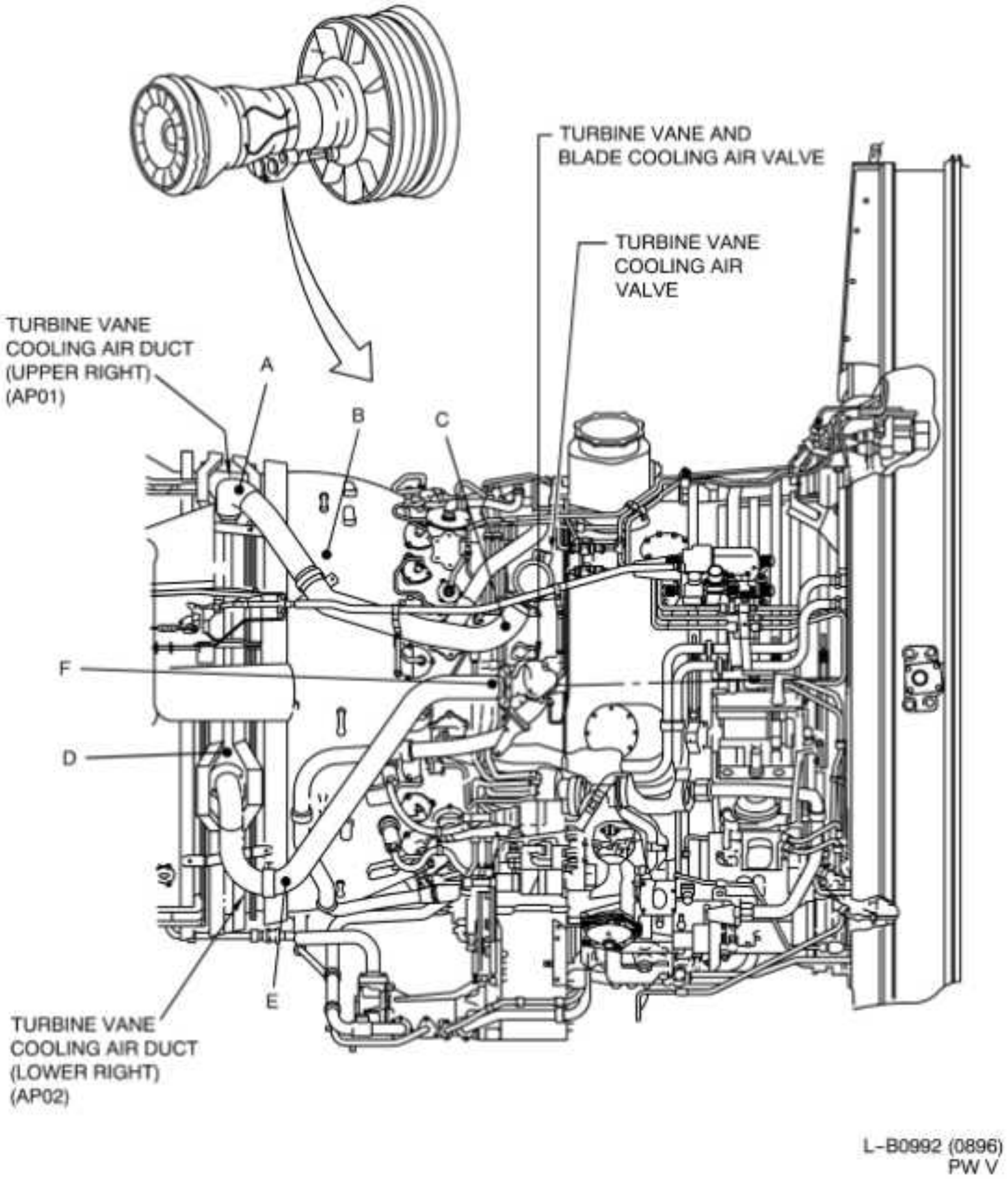
(g) Torque bolts at front flange to 85 − 95 lb−in. (9.604 − 10.734 N.m), then retorque to same limit without loosening until torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts. Torque bolts at rear flange to 180 − 200 lb−in. (20.337 − 22.597 N.m), then retorque to same limit without loosening until torque is maintained. Install the Lockwire P05−289 or

Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

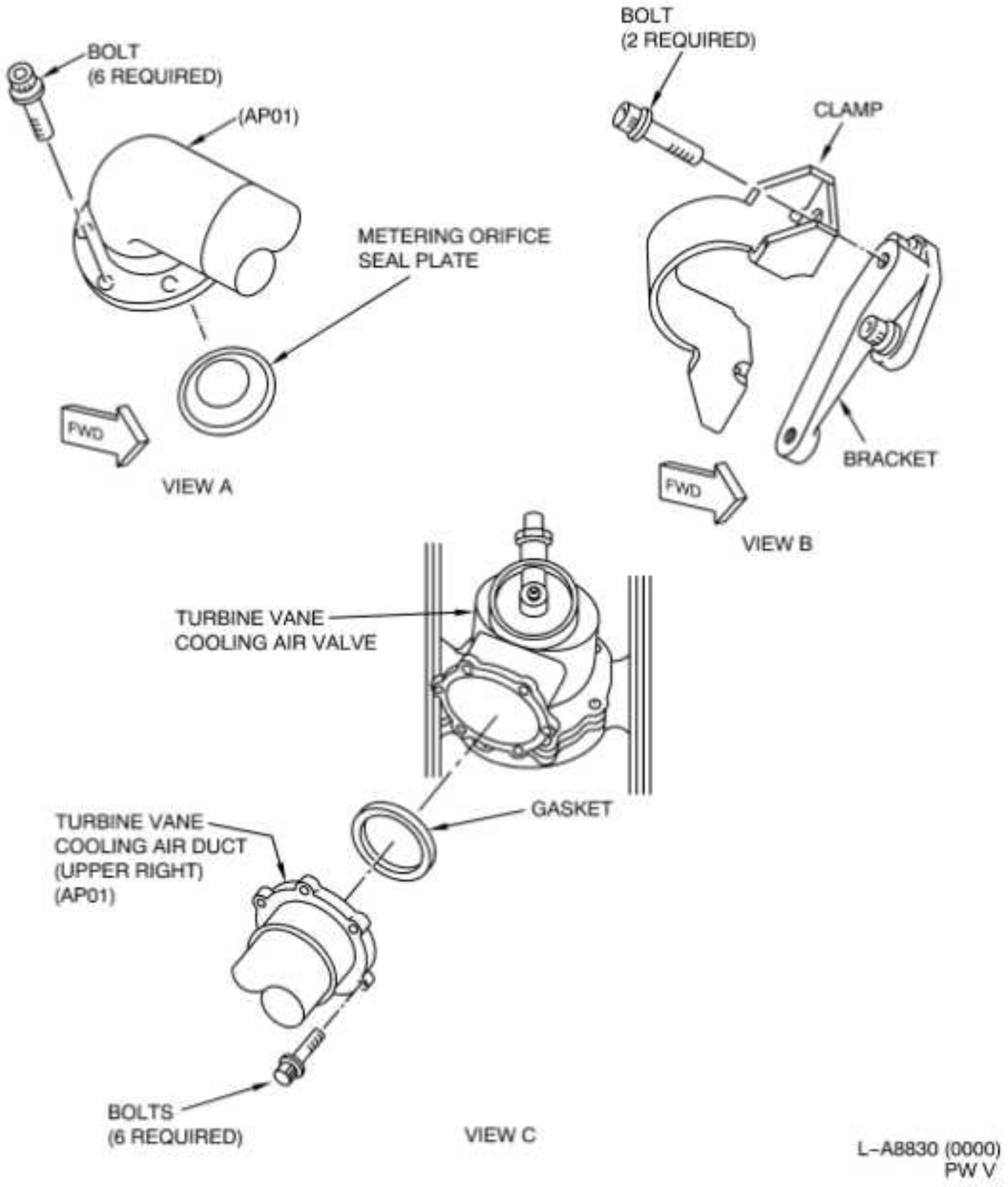
(h) Torque the clamp bolt that attaches the No. 4 bearing oil pressure tube to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(i) Install a bolt, threads lubricated with Engine Oil P03−001, and a nut to the clamp that attaches the No. 3 bearing pressure manifold (LP18) to the bracket on the front flange of the cooling air tube. Adjust the spray shield on the inboard side of the manifold and torque the bolt clamp to 36 − 40 lb−in. (4.067 − 4.519 N.m).

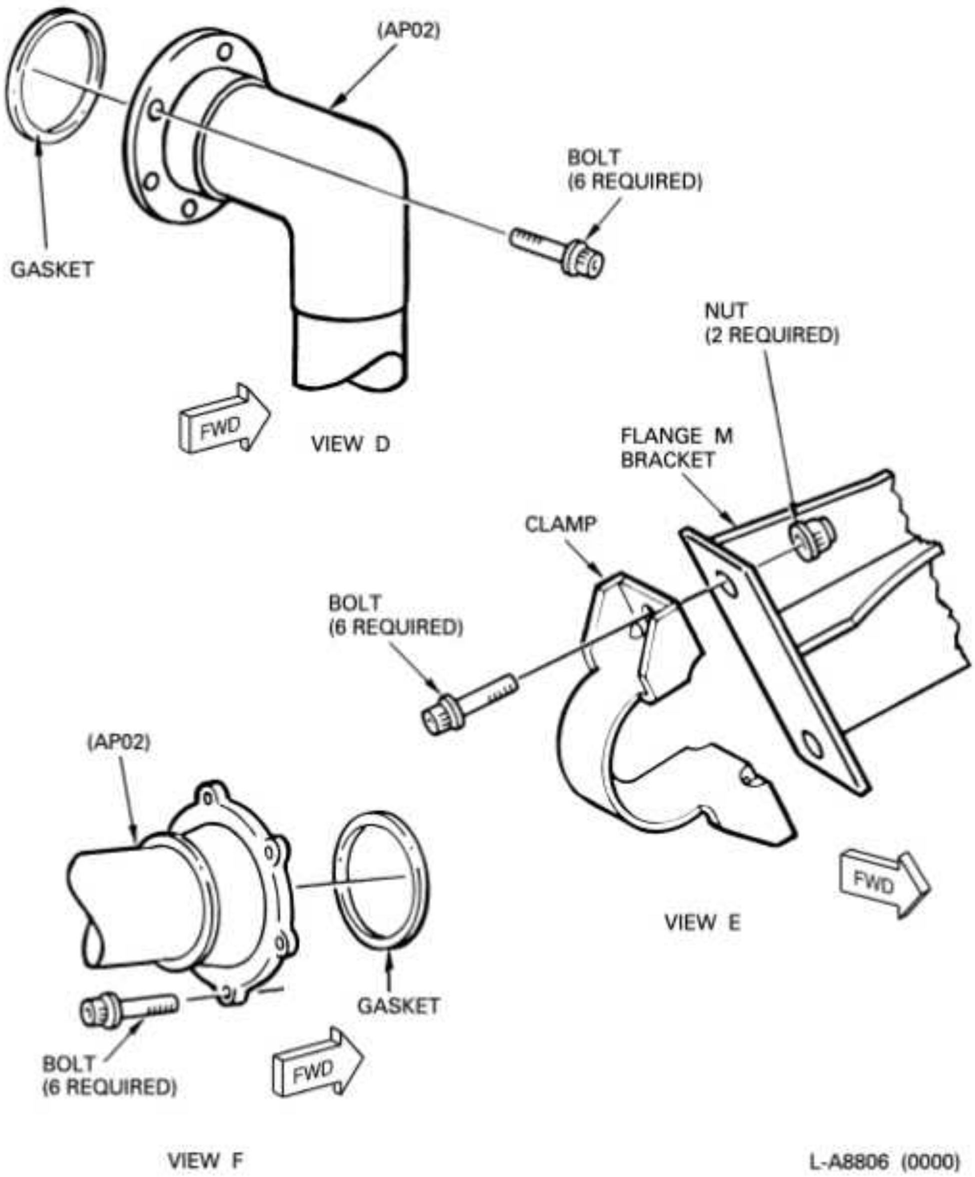
(j) For engines equipped, install gasket to borescope plug groove. Install plug to rear elbow and engage end of plug into inner hole to seat. Install three bolts, threads lubricated with Engine Oil P03−001. Torque bolts to 75 − 85 lb−in. (8.474 − 9.604 N.m), then retorque to same limit without loosening until torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.


TURBINE VANE AND
BLADE COOLING AIR VALVE
TURBINE VANE
COOLING AIR
VALVE
TURBINE VANE
COOLING AIR DUCT
(UPPER RIGHT)
(AP01)
A
B
C
F
D
E
TURBINE VANE
COOLING AIR DUCT
(LOWER RIGHT)
(AP02)
L-B0992 (0896)
PW V

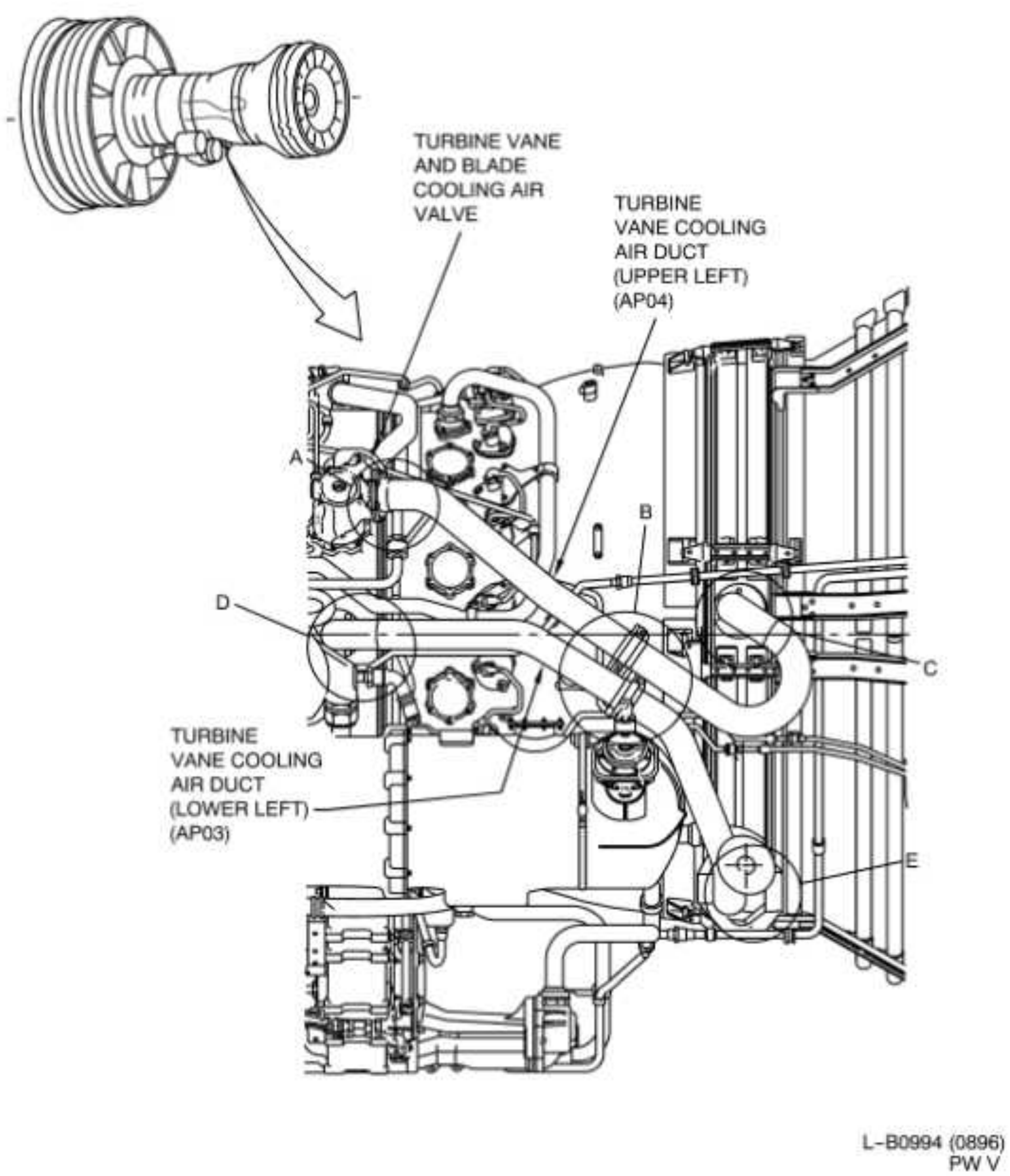
Turbine Vane Cooling Air Ducts (Right Side)
Figure 401 (Sheet 1)
(Task 72−00−52−450−005)


BOLT
(6 REQUIRED)
(AP01)
METERING ORIFICE
SEAL PLATE
FWD
VIEW A
BOLT
(2 REQUIRED)
CLAMP
BRACKET
FWD
VIEW B
TURBINE VANE
COOLING AIR VALVE
GASKET
TURBINE VANE
COOLING AIR DUCT
(UPPER RIGHT)
(AP01)
BOLTS
(6 REQUIRED)
VIEW C
L−A8830 (0000)
PW V

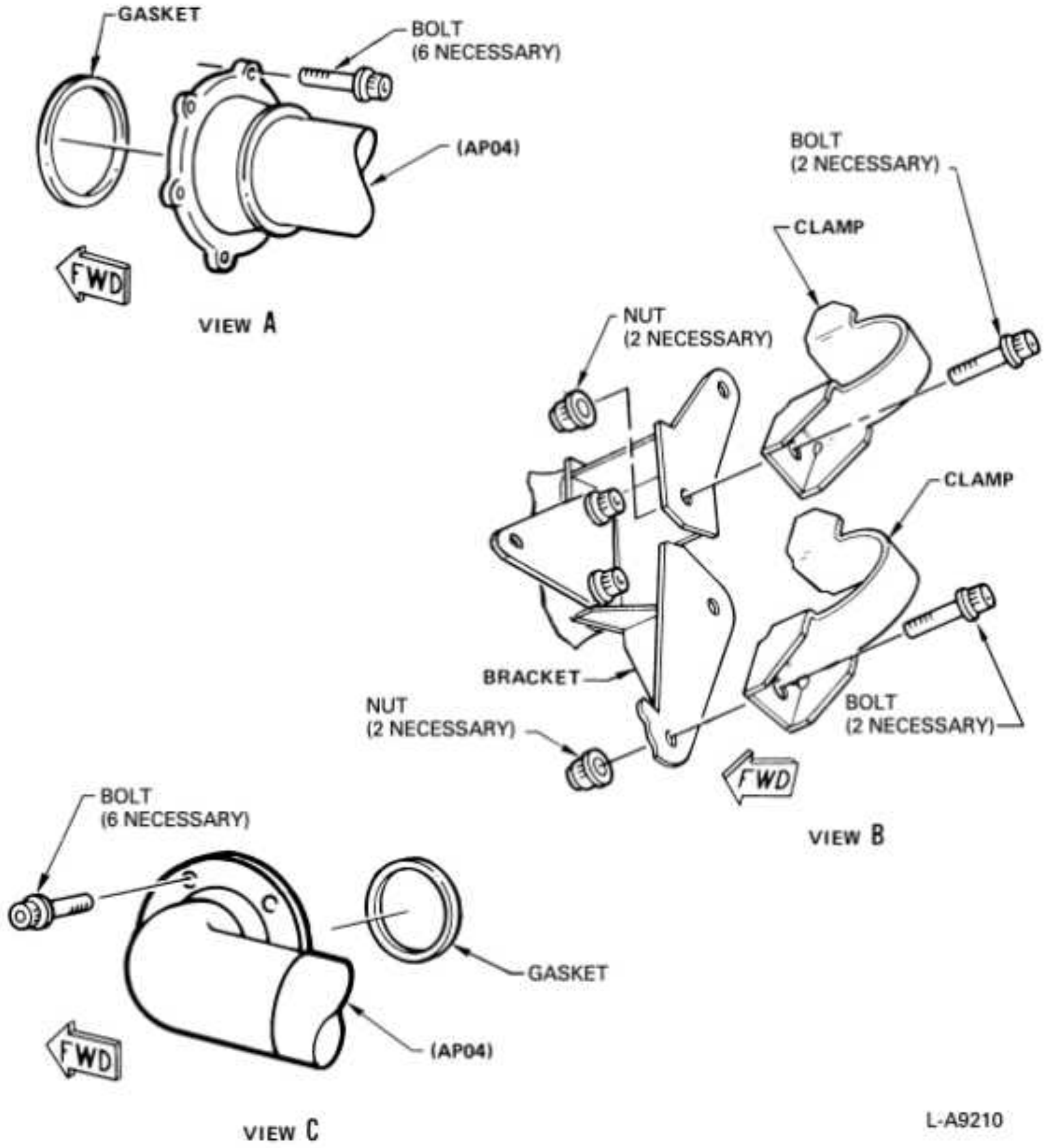
Turbine Vane Cooling Air Ducts (Right Side)
Figure 401 (Sheet 2)
(Task 72−00−52−450−005)


(AP02)
BOLT
(6 REQUIRED)
GASKET
FWD
VIEW D
NUT
(2 REQUIRED)
FLANGE M
BRACKET
CLAMP
BOLT
(6 REQUIRED)
(AP02)
FWD
VIEW E
GASKET
BOLT
(6 REQUIRED)
FWD
VIEW F
L-A8806 (0000)

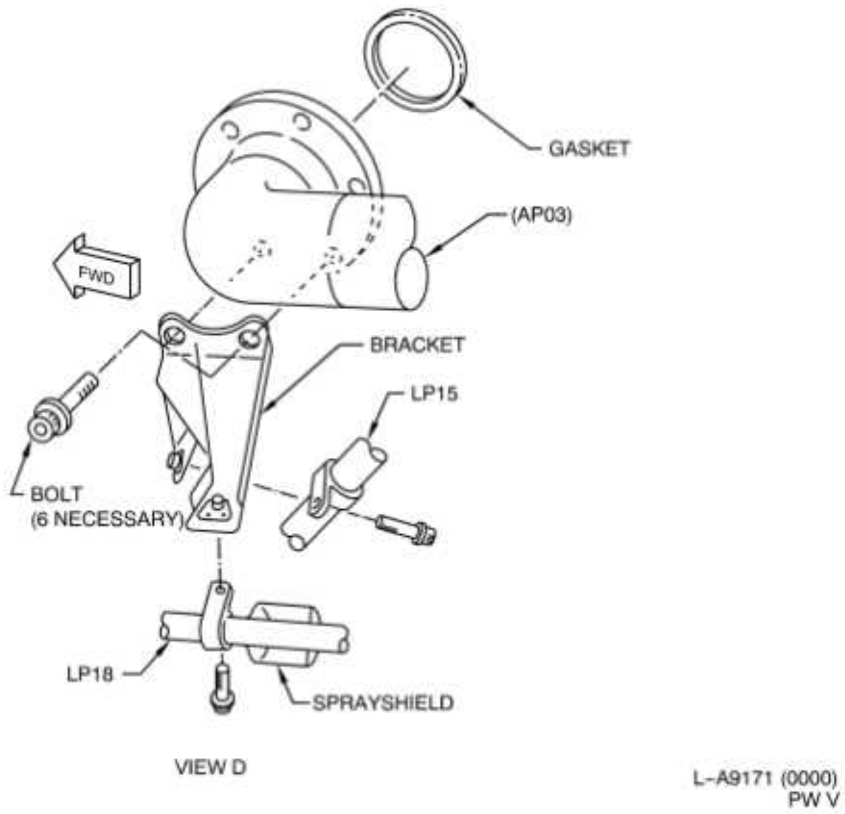
Turbine Vane Cooling Air Ducts (Right Side)
Figure 401 (Sheet 3)
(Task 72−00−52−450−005)


TURBINE VANE AND BLADE COOLING AIR VALVE
TURBINE VANE COOLING AIR DUCT (UPPER LEFT) (AP04)
A
B
D
C
TURBINE VANE COOLING AIR DUCT (LOWER LEFT) (AP03)
E
L-B0994 (0896)
PW V

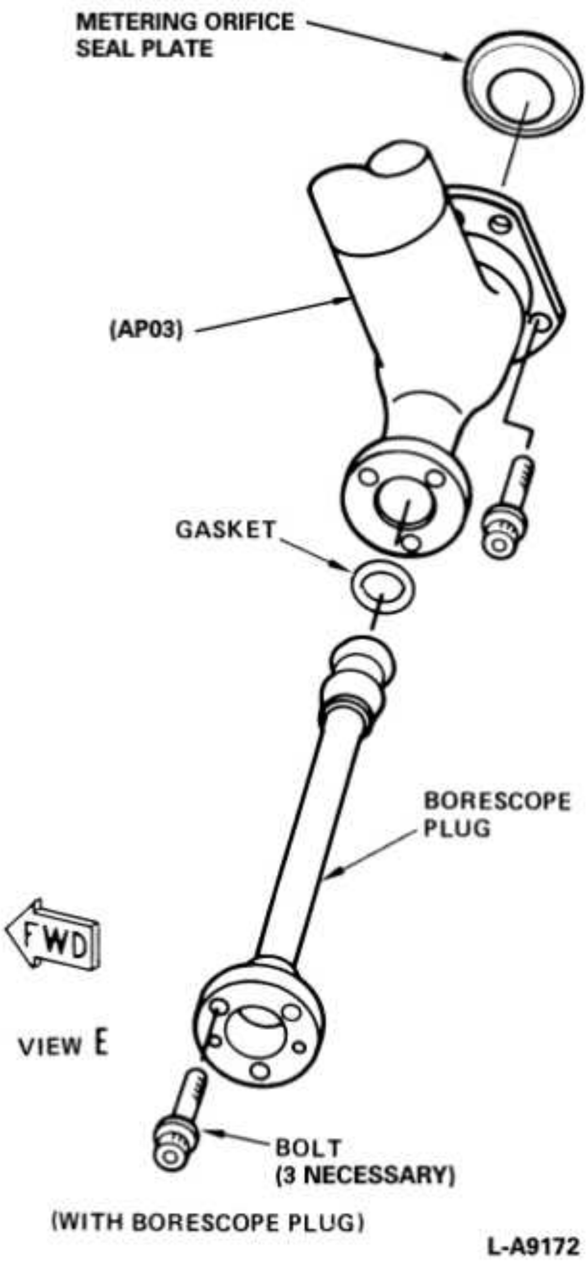
Turbine Vane Cooling Air Ducts (Left Side)
Figure 402 (Sheet 1)
(Task 72−00−52−450−005)


GASKET
BOLT
(6 NECESSARY)
(AP04)
FWD
VIEW A
BOLT
(2 NECESSARY)
CLAMP
NUT
(2 NECESSARY)
CLAMP
BRACKET
NUT
(2 NECESSARY)
BOLT
(2 NECESSARY)
FWD
VIEW B
BOLT
(6 NECESSARY)
GASKET
(AP04)
FWD
VIEW C
L-A9210

Turbine Vane Cooling Air Ducts (Left Side)
Figure 402 (Sheet 2)
(Task 72−00−52−450−005)


GASKET
(AP03)
FWD
BRACKET
LP15
BOLT
(6 NECESSARY)
LP18
SPRAYSHIELD
VIEW D
L-A9171 (0000)
PW V

Turbine Vane Cooling Air Ducts (Left Side)
Figure 402 (Sheet 3)
(Task 72−00−52−450−005)


METERING ORIFICE
SEAL PLATE
(AP03)
GASKET
BORESCOPE
PLUG
FWD
VIEW E
BOLT
(3 NECESSARY)
(WITH BORESCOPE PLUG)
L-A9172

Turbine Vane Cooling Air Ducts (Left Side)
Figure 402 (Sheet 4)
(Task 72-00-52-450-005)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-52-420-002:

1. Install The High Pressure Turbine - Vertical

NOTE: See Figure 401 for Part/Assembly Installation Procedure Sequence.

A. Prerequisites

(1) See Inspection/Check-01 (Task 72-00-52-990-001) for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows:

B. Equipment And Materials Required

Standard Tools:

Name	Manufacturer
Clements Cadillac Flameless Torch Model FT 1000	Clements Manufacturing Co. 6650 S. Narragansett Avenue Chicago, IL 60638

Bergen Mechanical Crimper (Optional) Model M303, M305 Or M307

NOTE: The flameless torch specified above is optional to the heaters specified in the Special Tools list, and the optional flame torch.

Special Tools:

PWA 3755	Pump, Hydraulic (Optional To PWA 29389)
PWA 25000	Wrench, Hydraulic
PWA 25672	Control, Heater (Optional To PWA 29754)
PWA 28657	Sling
PWA 28668	Pump, Hydraulic (Electric) (Use With Hydraulic Wrench)
PWA 28669	Cart, Storage (Optional) (Use With Hydraulic Wrench)
PWA 29389	Pump, Hydraulic
PWA 29510	Pump, Hydraulic (Hand) (Use With Hydraulic Wrench)
PWA 29614	Wrench, Mechanical*
PWA 29754	Control, Heater
PWA 45419	Air Torque Multiplier* (Optional To PWA 80651) (Use With Mechanical Wrench)
PWA 75028	Gage

ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - INSTALLATION-08

Special Tools:

(CONTINUED)

	PWA 76154	Adapter (2 Required)
	PWA 76156	Adapter (2 Required)
	PWA 80651	Multiplier, Pneumatic* (Use With Mechanical Wrench)
	PWA 85107	Fixture
	PWA 85113	Wrench
	PWA 85114	Wrench, Torque (Use With Hydraulic Wrench)
	PWA 85115	Adapter, Wrench (Use With Hydraulic Wrench)
	PWA 85116	Wrench, Torque (Use With Mechanical Wrench)
	PWA 85117	Adapter, Wrench (Use With Mechanical Wrench)
	PWA 102392	Rod Assembly
	PWA 87870	Heater
	PWA 88643	Sling (Optional To PWA 88673)
	PWA 88673	Sling
R R	PWA 88703	Rod Assembly (HPT Installation) (Post SB PW4ENG 72-562) (Replaced By PWA 104153)
R	PWA 102392	Rod Assembly (HPT Installation)
R R	PWA 102462	Rod Assembly (HPT Installation) (Pre SB PW4ENG 72-562) (Replaced By PWA 104281)
R R	PWA 104153	Rod Assembly (HPT Installation) (Post SB PW4ENG 72-562)
R R	PWA 104281	Rod Assembly (HPT Installation) (Pre SB PW4ENG 72-562)

*See Table 401 for the mechanical wrench tool options. The table shows the correct combinations of tools to install the No. 3 bearing retaining nut.

NOTE: The high pressure turbine is stored on PWA 87022 Stand or optional PWA 85108 Stand.

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-003	Compound, Antigalling (PWA 586)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72−00−52/1/10

C. General Assembly Requirements

(1) Where heating is required for assembly, use minimum temperature differential of 125°F (52°C) between parts being assembled. Do not exceed 350°F (176.7°C) on any part.

(2) Where heating is required for assembly, special heaters are specified in the following procedure. However, you can use an optional flameless torch or flame torch as specified in the following steps.

(3) In locations where heating of a component in an oven is not practical or only a flange of the component requires heating, the use of Clements Cadillac Quick Heat flameless torch, Model FT 1000 is recommended.

(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE FLAME WILL DAMAGE OR BURN NON−METAL PARTS. DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

D. Procedure

CAUTION: FIRST STAGE HPT BLADES WITH THERMAL BARRIER COATING (TBC) (POST SB PW4ENG 72−466) CAN ONLY BE USED IN ENGINES WITH A TURBINE NOZZLE THAT INCORPORATES A STAGE 1 HPT (BLADE) COOLING DUCT ASSEMBLY (POST SB PW4ENG 72−466) THAT WILL SUPPLY INCREASED AIRFLOW OR DAMAGE TO THE BLADES CAN OCCUR.

CAUTION: BEFORE YOU INSTALL AND SEAT THE HPT MODULE, MAKE SURE THE NO. 3 BEARING, SPACERS AND SEALS ARE FULLY SEATED AGAINST THE HPC SHAFT SHOULDER AND EACH OTHER.

(1) If necessary, remove nuts and screws that attach PWA 86058 Retainer to the rear flange of the turbine case. Remove the retainer.

R
R

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(2) Install PWA 85107 Fixture to high pressure turbine. See Figure 402.

(a) If installed, remove hydraulic cylinder and plate from pilot ring. Remove center retainer and four jaws.

(b) For engines (Pre SB PW4ENG 72-176), remove the PWA 86379 Adapter Ring, if installed, from the pilot ring detail of PWA 85107 Fixture.

CAUTION: THE SCREWS THAT HOLD THE PWA 86379ADAPTER RING MUST BE FLUSH WITH THE ADJACENT SURFACE OR DAMAGE TO THE PARTS CAN OCCUR.

(c) For engines (Post SB PW4ENG 72-176), install the PWA 86379 Adapter Ring, if not installed, on the pilot ring detail of PWA 85107 Fixture. Use six detail cap screws to hold the adapter ring.

NOTE: The turbine intermediate hub, (Post SB PW4ENG 72-176) has a shorter inner hub. The adapter is required with the fixture to set the axial run position on the HPT rotor.

(d) Loosen eight hand knobs (402/7) at center hub (402/9) of fixture and move piloting ring rearward until it is flush with or above surface of center hub. Tighten eight hand knobs.

(e) Using hoist, attach PWA 28657 Sling with two PWA 76156 Adapters to trunnion spools of fixture. Trunnion to front end down position.

(f) With dowel at 6 o'clock position, align boltholes and lower fixture onto rear flange of turbine case. Install 26 screws (402/6), with spacers (402/5) under screw heads, through case flange and into two outer flanges of fixture.

(g) Loosen eight hand knobs (402/7) at center hub and carefully lower pilot ring (402/8) until it contacts turbine intermediate hub. Tighten eight hand knobs to secure pilot ring.

(h) Position four jaws (402/3) into center of fixture, locating lip of jaw in ID cutout of turbine hub. Lightly tighten screws (402/4) to secure jaws.

(i) Install retainer (402/10) into center of fixture to retain jaws. Tighten screws (402/4) to secure jaws.

(j) Align bolt holes and position plate (402/2), with plug (402/1), onto piloting ring and secure with 12 screws (402/11).

(3) Make a visual examination of the HPC rear shaft and rear HPC drum to identify which features these parts have. You must do this examination so that you can select the correct installation tools for each type of HPC rear shaft and drum. Examine the inside of the shaft with a light source and a mirror. There are three types of HPC shafts and HPC rear drums, see Figure 403 (Sheet 1) and Figure 403 (Sheet 2):

- HPC rear shaft integral with HPC rear drum (one piece)

- HPC rear shaft bolted to HPC rear drum (two pieces, without shaft bore)

- HPC rear shaft with inside bore that is bolted to HPC rear drum (two pieces)

(4) After you have identified the type of HPC rear shaft and HPC rear drum that you have, make a tool selection to match the type of HPC rear shaft and rear drum as follows:

CAUTION: YOU MUST DO THE EXAMINATION OF THE HPC REAR SHAFT AND REAR DRUM BEFORE YOU SELECT THE INSTALLATION TOOLS. IF YOU USE THE WRONG

TOOLS, MUCH DAMAGE TO THE HPC SHAFT CAN OCCUR.

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(5) FOR THE HPC REAR SHAFT INTEGRAL WITH HPC REAR DRUM (ONE PIECE): Install the PWA 85107 Fixture (prior to Change Letter K) or the PWA 102392 Rod Assembly together with the PWA 85107 Fixture (Change Letter K and subsequent), into the high pressure compressor rear hub. See Figure 404 (Sheet 1) and Figure 404 (Sheet 2).

(a) If necessary, adjust position of guide (404/2) to permit the clamp (404/1) at the end of the rod to turn to the horizontal position with the shaft (404/4). Tighten the jamnuts to lock the guide in position.

(b) Remove jamnut (404/6) on end of shaft (404/4) and remove clamp (404/5).

(c) Rotate clamp (404/1) to horizontal position. Install shaft (404/4) into HPC rear hub (404/8) until clamp is allowed to tilt and touch on the conical surface in the ID of the HPC rear hub.

(d) Check the position of pilot (404/3). It should be approximately 1.0 inch (25.4 mm) from the end of the HPC rear hub (404/8).

(e) If required, remove shaft (404/4) and clamp assembly. Adjust position of pilot as necessary. Tighten jamnut to secure pilot. Reinstall shaft in HPC rear hub per previous step.

(f) Position clamp, smaller OD end first, onto shaft and secure with jamnut (404/6) to lock shaft assembly in HPC rear hub.

(g) Install the coupler (404/7), a detail of PWA 85107 Fixture, onto the end of the shaft (404/4).

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(6) FOR HPC REAR SHAFT BOLTED TO HPC REAR DRUM (TWO PIECES, WITHOUT SHAFT BORE, PRE SB PW4ENG 72−562): Install the PWA 85107 Fixture (prior to Change Letter K) or the PWA 102462 Rod Assembly together with the PWA 85107 Fixture (Change Letter K and subsequent), into the high pressure compressor rear hub. See Figure 405 (Sheet 1) and Figure 405 (Sheet 2).

R NOTE: You can install the HPT with the optional PWA
R 104281 Rod Assembly.

(a) If necessary, adjust the position of the guide (405/2) to permit the shoe (405/1) at the end of the rod to turn to the horizontal position with the rod (405/5). Tighten the jamnuts to lock the guide (405/2) in position.

(b) Remove the jamnut (405/6) on the end of the rod (405/5) and remove the rod clamp (405/4).

(c) Turn the shoe (405/1) to the horizontal (parallel to rod) position with the push/pull control (405/6) and lock in this position. Install the rod assembly, shoe end first, into the HPC rear hub (405/9) as for as it will go.

(d) Unlock and turn the shoe (405/1) with the push/pull control (405/6) until the shoe (405/1) is in the vertical position (90° to rod). Pull the rod assembly rearward until the shoe (405/1) touches the conical surface in the ID of the HPC rear hub (405/9).

(e) The pilot (405/3) should be approximately 1.0 inch (25.4 mm) from the end of the HPC rear shaft (405/8).

(f) If necessary, remove rod (405/5) and shoe (405/1). Adjust the position of the pilot (405/3) as necessary. Tighten the jamnut to secure the pilot (405/3). Install the rod (405/5) and shoe (405/1) in the HPC rear hub again (405/9).

(g) Position rod clamp (405/4), smaller OD end first, onto the shaft. Tighten jamnut (405/6) to lock rod assembly in the HPC rear hub (405/9).

(h) Install the coupler (405/8), a detail of the PWA 85107 Fixture, onto the end of the shaft (405/9).

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(7) FOR HPC REAR SHAFT WITH INSIDE BORE THAT IS BOLTED TO HPC REAR DRUM (TWO PIECES, POST SB PW4ENG 72-562): Install the PWA 88703 Rod Assembly together with the PWA 85107 Fixture (Change Letter K and subsequent), into the high pressure compressor rear drum, rear disk. The detail hydraulic cylinder, plug, and plate are removed from the rear end of the PWA 85107 Fixture. See Figure 406 (Sheet 1) and Figure 406 (Sheet 2).

R NOTE: See the following step to install the HPT with
R the optional PWA 104153 Rod Assembly.

(a) Attach the detail shoulder eyebolt and coupling of the PWA 85107 Fixture to the rear end of the detail shaft of the PWA 88703 Rod Assembly. Attach an overhead hoist to the eyebolt and lift the PWA 88703 Rod Assembly.

(b) Turn back the rear detail hex nut (406/6) of the shaft until the nut covers the rear red mark on the shaft.

(c) Pull the two detail push-pull controls (406/9) and turn the handles to lock the controls in the retracted position.

(d) Put the front end of the PWA 88703 Rod Assembly into the HPC rear shaft and push the rod assembly forward as far as it will go.

(e) Turn the handles of the push-pull controls (406/9) to unlock the controls and open the two detail feet (406/1).

(f) Carefully pull the rod assembly rearward to engage the detail feet (406/1) against the front face of the HPC rear drum rear flange.

(g) Turn the rear detail hex nut (406/6) on the shaft forward until it touches the detail shaft clamp (406/5). Make sure the forward red mark is visible. If it is not, turn the hex nut (406/6) rearward and shake the rod assembly to get it to properly engage against the HPC rear drum rear flange. Turn the rear detail hex nut (406/6) on the shaft forward until it touches the detail shaft clamp (406/5). Make sure the forward red mark is visible.

(h) Install the coupler (406/7), a detail of the PWA 85107 Fixture, onto the end of the shaft.

R CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

R (8) FOR HPC REAR SHAFT WITH INSIDE BORE THAT IS BOLTED TO HPC REAR DRUM (TWO PIECES, POST SB PW4ENG 72-562): Install the PWA 104153 Rod Assembly into the high pressure compressor rear drum, rear disk. See Figure 406 (Sheet 3).

R (a) Attach the detail lifting tool (406/5) to the rear end of the detail shaft (406/2) of the PWA 104153 Rod Assembly. Attach an overhead hoist to the lifting tool and lift the shaft.

R (b) Turn back the rear detail locking nut (406/4) on the shaft (406/2) until the nut covers the rear red mark on the shaft.

R (c) Insert the dowel pin (T-handle) (406/6) into the guide rod (406/8).

R (d) Pull on the (T-handle) (406/6) and turn it 1/4 turn to hold the feet (406/1)in the retracted (closed) position.

R (e) Use the hoist to lower the front end of the Rod Assembly into the HPC rear shaft as far as it will go.

R (f) Look into the shaft opening to make sure that the feet (406/1) have the necessary clearance to open.

R (g) Turn the handle 1/4 turn and push the guide rod (406/8) forward to open the feet (406/1).

R (h) Use the hoist to carefully lift the Rod Assembly until the feet (406/1) touch the front face of the HPC rear drum.

R (i) Engage the shaft clamp (406/3) into the turbine shaft ID and lock the shaft clamp in position with the locking nut (406/4).

R (j) Make sure that the nut overlaps or gets below the red mark on the shaft. If not, loosen the locking nut (406/4) and carefully shake the Rod Assembly lightly to re−adjust the feet (406/1).

R (k) Remove the dowel pin (T−handle) (406/6) from the guide rod (406/8).

R (l) Remove the lifting tool (406/5).

R (m) Install the coupler (406/7) onto the end of the shaft (406/2).

R (9) Lubricate the ID snap diameters and splines of the HPC shaft with Antigalling Compound P06−003. See Figure 407.

R (10) Position PWA 87870 Heater onto a standard workbench.

R (11) Using hoist, attach PWA 28657 Sling with two PWA 76156 Adapters to trunnion spools of fixture. Lift high pressure turbine from stand and position it on the heater.

CAUTION: THE THERMOCOUPLE MUST TOUCH THE END OF THE TURBINE SHAFT OR YOU CAN HEAT THE PART TOO MUCH.

R (12) Connect PWA 29754 Heater Control to the heater. Heat the turbine hub to 270° − 350°F (132.° − 177.°C) maximum. After the hub is heated, remove the heater and controller.

NOTE: After you heat the HPT hubs, do steps (12) through (19) in rapid succession.

R (13) Use the hoist to lift turbine from the heater. Trunnion the turbine to the horizontal position, and put it to the rear of the engine.

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSTALLATION−08

R (14) Install the gasket onto the front outer flange of the turbine case. See Figure 408.

R (15) If applicable, locate the optional PWA 85112 Retaining Fixture in ID of turbine between front and rear turbine hubs. Rotate knurled nut to retract fixture. Remove fixture from hubs.

R (16) Move turbine into position, aligning turbine front hub splines with HPC (rear hub) splines. Move assembly forward to engage splines. Continue moving assembly forward until stopped at tight fit.

NOTE: Since high pressure turbine rotor cannot be rotated, it may be necessary to rotate high pressure compressor rotor to align splines.

R (17) Put hydraulic cylinder (409/2) over coupler (409/5) and against plug (409/6) in the center of fixture (409/1). Attach the hydraulic cylinder with spacer (409/3) and flanged nut (409/4). See Figure 409.

R (18) Connect PWA 29389 Pump or PWA 3755 Pump, with PWA 75028 Gage to hydraulic cylinder.

R (19) Install ten workbolts and nuts evenly spaced through turbine front case and diffuser case, Flange M, from rear to front.

CAUTION: YOU MUST LOOSEN THE EIGHT HAND KNOBS (409/6), THAT HOLD THE PILOTING RING (402/8), SO THAT THE RING MOVES FREELY AGAINST THE TURBINE INTERMEDIATE HUB BEFORE YOU APPLY A LOAD OF 38,500 − 41,500 LBF. (171,256.5 − 184,601.2 N) FOR THE SECOND TIME OR DAMAGE TO THE ENGINE CAN OCCUR.

R (20) (Reference 976) Seat turbine by tightening workbolts while actuating hydraulic pump to apply load of 38,500 − 41,500 lbf. (171,256.5 − 184,601.2 N). Release hydraulic pressure. Loosen eight hand knobs (409/6). Apply load of 38,500 − 41,500 lbf. (171,256.5 − 184,601.2 N).

NOTE: For a 30 ton hydraulic cylinder, a hydraulic pump output of 5,332 − 5,747 psig (36,762.8 − 39,624.2 kPa) will apply a load of 38,500 − 41,500 lbf. (171,256.5 − 184,601.2 N).

NOTE: For a 60 ton hydraulic cylinder, a hydraulic pump output of 2,905 − 3,132 psig (20,029.3 − 21,594.4 kPa) will apply a load of 38,500 − 41,500 lbf. (171,256.5 − 184,601.2 N).

R (21) Release the hydraulic load. Remove nut (410/7) and spacer (410/6) and remove hydraulic cylinder (410/5). Remove screws (410/4) and plate (410/3). Remove retainer (410/2) and four jaws (410/1) from the ID of fixture (410/11). See Figure 410.

R (22) Lubricate the axial faces of the turbine shaft spacer with Antigalling Compound P06−003. See Figure 411.

R (23) Install turbine shaft spacer (410/9) onto HPC rear hub.

R (24) Lubricate the threads and splines of the No. 3 bearing retaining nut with Antigalling Compound P06−003. See Figure 411.

CAUTION: THE NO. 3 BEARING NUT MUST BE SILVER PLATED PRIOR TO EACH HIGH PRESSURE TURBINE INSTALLATION OR DAMAGE TO THE MATING PARTS CAN OCCUR. THE NUT CAN BE REMOVED AND RETORQUED FOR EACH HIGH PRESSURE TURBINE INSTALLATION A MAXIMUM OF THREE TIMES BEFORE REQUIRING REPLATING.

CAUTION: IF THE NUT IS REMOVED AFTER AN ENGINE RUN, IT MUST BE REPLATED.

R (25) Thread the No. 3 bearing retaining nut (410/8) to the HPC rear hub. Hand tighten the nut. Use PWA 85113 Hand Wrench. Leave the hand wrench in position. Install the plate (410/3) and secure with 12 screws (410/4). Install the hydraulic cylinder (410/5) over the coupler (410/10) and seat against the plug in the center of plate (410/3). Attach the hydraulic cylinder with spacer (410/6) and nut (410/7).

NOTE: Do not install retainer or jaws.

CAUTION: MAKE SURE THE HYDRAULIC PRESSURE IS KEPT WHILE YOU TIGHTEN THE NUT OR THE NUT WILL NOT SEAT CORRECTLY AND DAMAGE TO THE ENGINE CAN OCCUR.

R (26) (Reference 976) Actuate the hydraulic pump and apply a load of 60,000 − 63,000 lbf. (266,893.3 − 280,238.0

N). Use the PWA 85113 Hand Wrench to tighten the nut until the nut is seated on the hub.

NOTE: For a 30 ton hydraulic cylinder, a hydraulic pump output of 8,310 − 8,725 psig (57,295.4 − 60,156.8 kPa) will apply a load of 60,000 − 63,000 lbf. (266,893.3 − 280,238.0 N).

NOTE: For a 60 ton hydraulic cylinder, a hydraulic pump output of 4,528 − 4,755 psig (31,219.5 − 32,784.6 kPa) will apply a load of 60,000 − 63,000 lbf. (266,893.3 − 280,238.0 N).

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

R (27) Release load and remove rod assembly.

(a) Remove the hydraulic pump, nut (410/7), spacer (410/6) and hydraulic cylinder (410/5). Remove screws (410/4) and plate (410/3).

(b) Remove bolts that attach PWA 85107 Fixture to the turbine case rear flange. Remove the fixture, sling, and hoist.

(c) FOR THE HPC REAR SHAFT INTEGRAL WITH HPC REAR DRUM (ONE PIECE): Remove the PWA 102392 Rod Assembly as follows: See Figure 404 (Sheet 1) and (Sheet 2).

1 Carefully remove the coupler (404/7) and clamp (404/5) from the shaft (404/4).

(d) FOR HPC REAR SHAFT BOLTED TO HPC REAR DRUM (TWO PIECES, WITHOUT SHAFT BORE, PRE SB PW4ENG 72−562): Remove the PWA 102462 Rod Assembly as follows: See Figure 405 (Sheet 1) and (Sheet 2).

1 Carefully remove coupler (405/8) and rod clamp (405/4) from rod (405/5).

2 Use push/pull control (405/6) to turn shoe (405/1) to the horizontal position.

3 Carefully remove rod assembly from the HPC rear shaft (405/9).

(e) FOR HPC REAR SHAFT WITH INSIDE BORE THAT IS BOLTED TO HPC REAR DRUM (TWO PIECES, POST SB PW4ENG 72-562): Remove the PWA 88703 Rod Assembly as follows: See Figure 406.

R NOTE: See the following step to remove the the
R optional PWA 104153 Rod Assembly.

1 Carefully remove coupler (406/7).

2 Turn detail rear hex nut (406/6) on the shaft rearward until it covers the rear red mark on the shaft.

3 Carefully push the rod assembly forward as far as it will go.

4 Turn the two detail handles of the push/pull controls (406/9) to unlock the two detail feet (406/1) and pull the control handles rearward to disengage the feet.

5 Turn the push/pull control handles (406/9) to lock the feet (406/1) in the retracted position.

6 Carefully pull the PWA 88703 Rod Assembly rearward until the fixture is removed from the HPC rear shaft (406/8).

R (f) FOR HPC REAR SHAFT WITH INSIDE BORE THAT IS BOLTED
R TO HPC REAR DRUM (TWO PIECES, POST SB PW4ENG
R 72-562): Remove the PWA 104153 Rod Assembly as
R follows: See Figure 406 (Sheet 3).

R 1 Carefully remove the coupler (406/7) from the
R shaft (406/2).

R 2 Install the lifting tool (406/5) on the shaft
R (406/2).

R 3 Attach a hoist to the lifting tool (406/5).

R 4 Turn the detail locking nut (406/4) on the
R shaft (406/2) rearward until it covers the rear
R red mark on the shaft.

R 5 Insert the dowel pin (T-handle) (406/6) into
R the guide rod (406/8).

R CAUTION: LOWER THE ASSEMBLY ONLY ENOUGH TO
R CLOSE THE FEET (406/1) TO AVOID
R DAMAGE TO THE 15TH STAGE ROTOR DISK
R BORE.

R 6 Use the hoist to carefully lower the assembly
R into the HPC rear shaft to provide the
R necessary clearance to close the feet (406/1).

R a Turn the detail locking nut (406/4) rearward
R as necessary as you lower the assembly.

R b Look into the HPC rear shaft opening to
R make sure that the feet (406/1) have the
R necessary clearance to close.

R c If necessary, repeat the above step to
R provide clearance to close the feet (406/1).

R 7 With the necessary clearance to close the feet
R (406/1), use the T−handle to pull the guide
R rod (406/8) rearward until you can turn the
R T−handle 1/4 turn.

R NOTE: Turning the T−handle (406/6) 1/4 turn
R will hold the feet (406/1) in the
R retracted (closed) position.

R 8 Use the hoist to carefully lift the Rod
R Assembly from the HPC rear shaft.

R 9 Put the Rod Assembly in the storage container.

R 10 Remove the hoist.

R (28) For operators that use the mechanical wrench to install the No. 3 bearing retaining nut, install tooling as follows:

(a) Install PWA 85116 Wrench into ID of No. 3 bearing retaining nut (412/4) engaging splines of wrench with splines of nut. See Figure 412.

(b) Install PWA 85117 Adapter to turbine intermediate hub (412/5) See Figure 412.

1 Loosen hex nuts (412/1) on eight clamps (412/2). Slide clamps in slots in opposite direction that arrow is pointing and secure clamps with hex nuts.

2 Using hoist and two PWA 76154 Adapters, connect PWA 28657 Sling, PWA 88643 Sling, or PWA 88673 Sling to trunnion spools on adapter.

3 Using hoist, position adapter over rear of PWA 85116 Wrench.

4 Insert clamp feet through slots (412/6) between lugs of hub.

5 Align teeth of adapter with slots between lugs of turbine intermediate hub. Loosen hex nuts and slide clamps in direction of arrows on base of fixture. Rotate clamps as required to position feet under lugs on hub and insert pins (412/3) into holes in base of adapter. Tighten hex nuts to secure clamps.

NOTE: Plate in stud detail of clamp points to direction that clamp feet are facing.

(c) Using hoist, align splines and slide applicable mechanical wrench over splines of PWA 85116 Wrench. Align anti−torque pins in wrench with bushings (412/1) in PWA 85117 Adapter and seat wrench on adapter. See Table 401 for mechanical wrench options. See Figure 413.

NOTE: Wrenches may be actuated using air torque multipliers to speed up removal of nut. See Table 401.

PWA Mechanical Wrench	PWA Torque Multiplier
PWA 29614	PWA 45419 or PWA 80651

Mechanical Wrench Options
Table 401

R (29) For operators that use the hydraulic wrench to install the No. 3 bearing retaining nut, install tooling as follows:

(a) Install PWA 85114 Wrench into ID of No. 3 bearing retaining nut (414/3) engaging splines of wrench with splines of nut. See Figure 414.

(b) Install PWA 85115 Adapter to turbine intermediate hub (414/4).

1 Loosen wing nuts securing eight clamps (414/1). Slide clamps in slots in opposite direction of arrows on base of fixture and secure clamps with wing nuts.

2 Install eyebolt into threaded hole at top of adapter and connect hoist to eyebolt.

3 Using hoist, position adapter over PWA 85114 Wrench and onto rear of HPT.

4 Insert clamp feet through slots (414/5) between lugs of hub.

5 Align 16 teeth of adapter with slots between lugs of turbine intermediate hub. Loosen wing nuts and slide clamps in direction of arrows on base of fixture. Rotate clamps as required to position feet under lugs on hub and secure with wing nuts.

NOTE: Dowel pin (414/2) in stud detail of clamp points in direction that clamp feet are facing.

(c) Use a hoist and applicable sling to lift the PWA 25000 Hydraulic Wrench. Find the correct direction to turn the drive spline of the wrench. Refer to the PWA 29178 Instruction Decal on the hydraulic wrench to get the position of the shifting mechanism to cause the drive spline to turn in the tighten direction. See Figure 413.

NOTE: PWA 28669 Cart can be used to store and transport PWA 25000 Wrench.

(d) Connect PWA 28668 Pump or PWA 29510 Pump to the hydraulic wrench. Operate the wrench to make sure that the wrench turns in the tighten direction.

(e) Align splines and position PWA 25000 Wrench onto PWA 85114 Wrench. Move wrench forward and engage keys of PWA 85115 Adapter with keyways in PWA 25000 Wrench. See Figure 414.

(f) Connect PWA 28668 Pump or PWA 29510 Pump to wrench.

(g) Use the selector to operate the wrench (in the following step). As the drive spline turns, look at the travel indicator. When the travel indicator reaches its maximum travel, use the selector control valve to let the wrench ratchet return. Repeat this procedure as necessary (in the following step) until the nut is tightened. See Figure 415.

R (30) (Reference 976) Actuate wrench to torque No. 3 bearing retaining nut.

CAUTION: THE NUT MUST NOT MOVE WITH THIS TORQUE RANGE. IF THE NUT MOVES, THE STACK NOT SEATED AND THIS PROCEDURE FROM STEP (16) ONWARD MUST BE DONE AGAIN. IF THE NUT DOES NOT MOVE, CONTINUE WITH THE ANGLE OF TURN. IF THE NUT MOVES AFTER THE SECOND ATTEMPT OF STEPS (16) AND ON, PROCEED TO THE ANGLE OF TURN.

(a) Torque the nut to 6000 − 10000 lb−in. (677.909 − 1129.848 N.m) to make sure the stack is tight.

(b) Set angle of turn scale to 0 and apply 90 − 94 degrees angle of turn.

R (31) After you do the angle of turn, measure the final torque necessary to move the nut in the forward direction. This can be done with a suitable hand torque wrench with the appropriate multiplier on the mechanical wrench. The minimum torque necessary to make sure of the correct loading is 75000 lb−in. (8473.860 N.m). If the final torque is less, continue the angle of turn up to an additional 20 degrees. Use only the additional angle of turn necessary to get the 75000 lb−in. (8473.860 N.m) final torque. If more than the additional 20 degree angle of turn is necessary to get the 75000 lb−in. (8473.860 N.m) final torque then you must do the procedure again from step (16) onward.

R (32) Remove wrenches from turbine hub.

R (33) Install No. 3 bearing retaining nut lock. See Figure 416.

(a) Install one retaining ring lock (416/2) into groove in ID spline of No. 3 bearing retaining nut (416/3).

(b) Align lugs on front of No. 3 bearing nut lock (416/1) with slots in HPC rear hub while mating splines of nut lock with No. 3 bearing retaining nut.

(c) Install second retaining ring lock (416/2) into groove in ID spline of retaining nut.

R (34) Remove all the unwanted antigalling compound from the nut and the hub.

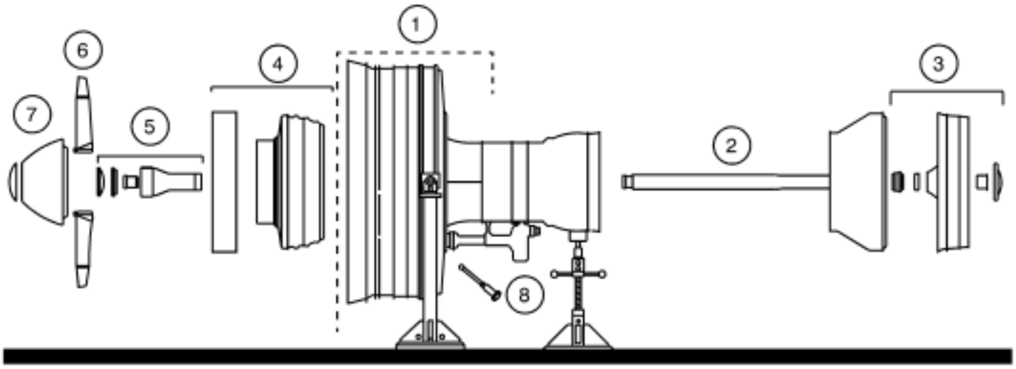
R (35) Install Flange M hardware as follows. Refer to 72−00−52, Installation−20 (Task 72−00−52−420−020).

E. Postrequisites

(1) Install The External Plumbing. Refer to 72−00−52, Installation−03 (Task 72−00−52−420−003).

(2) Install The Low Pressure Turbine. Refer to 72−00−53, Installation−01 (Task 72−00−53−420−001).

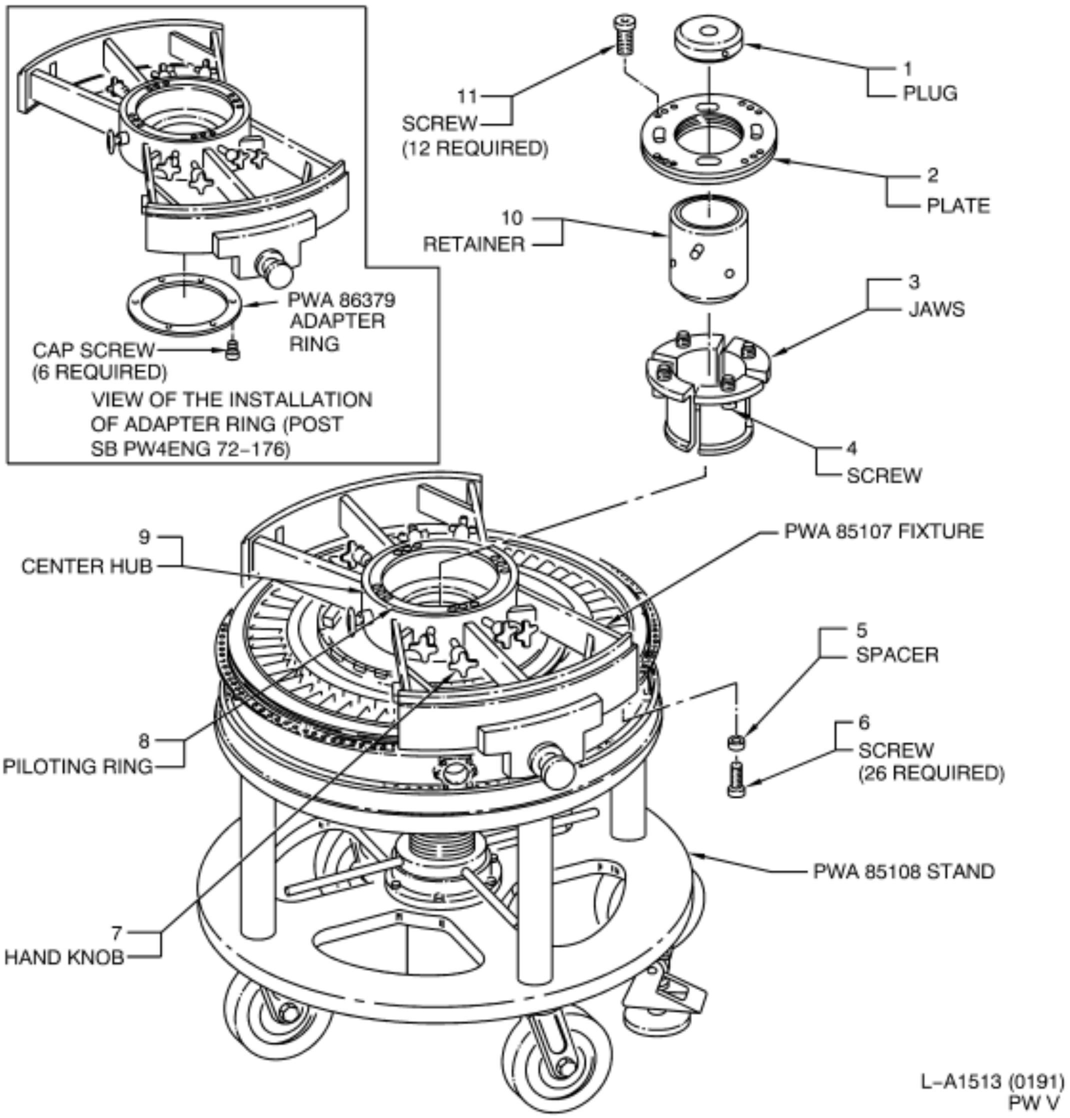
(3) Test the engine per the Test Reference Table. Refer to 71−00−00, Testing−00 (Task 71−00−00−990−003).



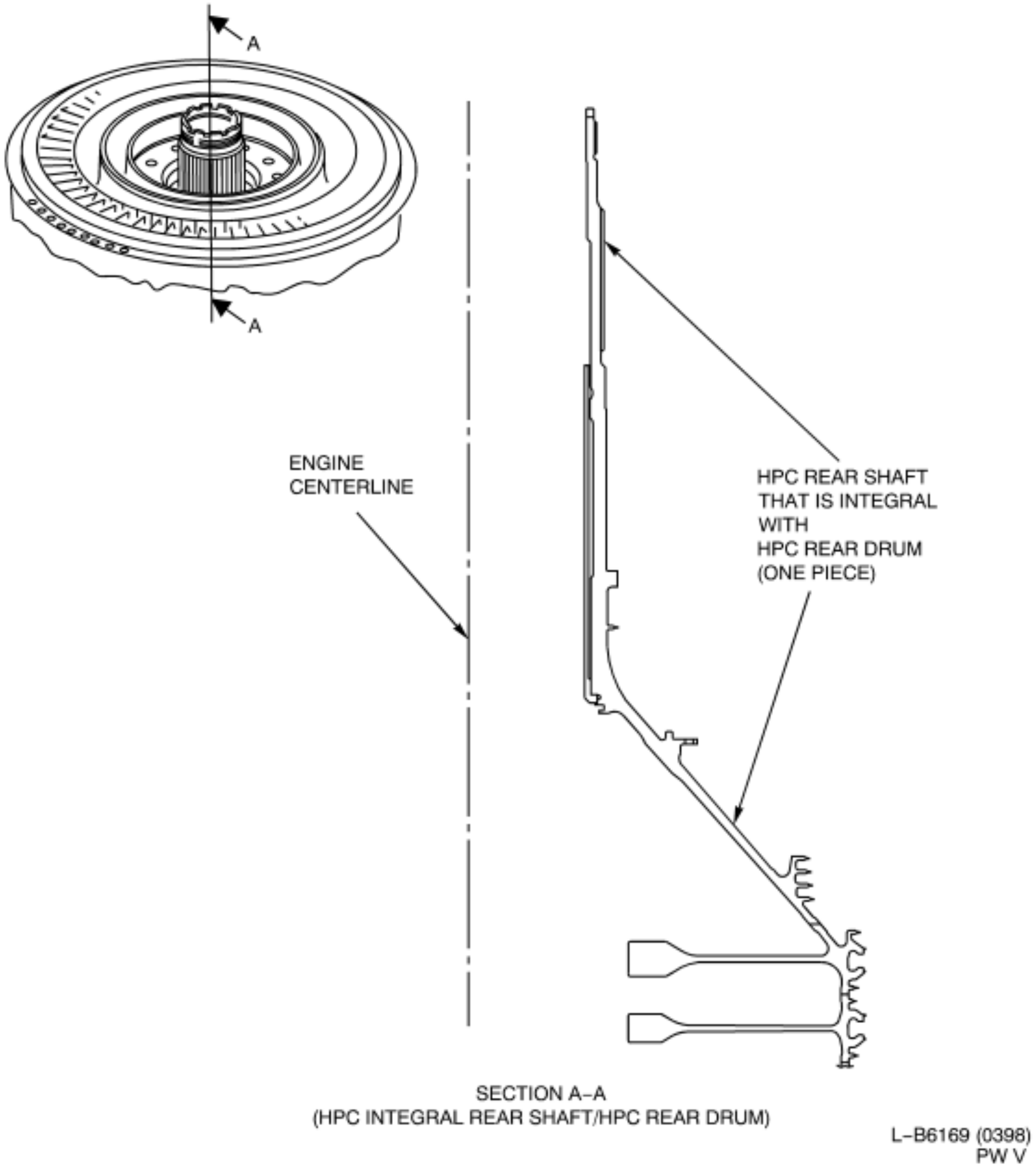
1. TRUNNION FAN CASE THROUGH HIGH PRESSURE TURBINE (HPT) TO HORIZONTAL.
2. INSTALL LOW PRESSURE TURBINE (LPT).
3. INSTALL TURBINE EXHAUST CASE.
4. INSTALL LOW PRESSURE COMPRESSOR (LPC).
5. INSTALL LPC/LPT COUPLING.
6. INSTALL STAGE 1 LPC BLADE ASSEMBLIES.
7. INSTALL COMPRESSOR INLET CONE.
8. INSTALL ELECTRONIC ENGINE CONTROL (EEC) SPEED TRANSDUCER (N1).

L-A1523 (0000)
PW V

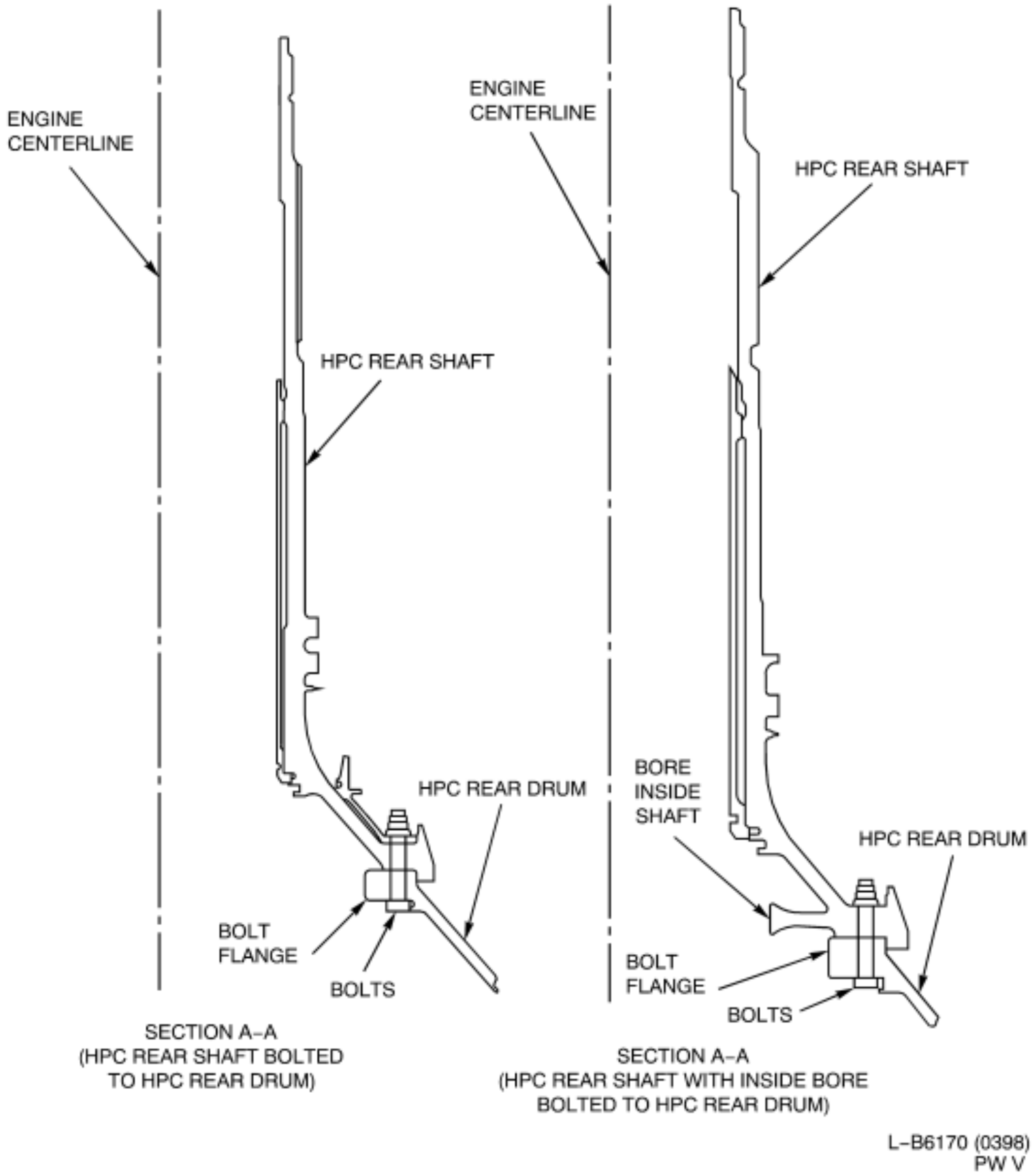
Procedure Sequence
Figure 401
(Task 72-00-52-420-002)


PWA 86379
ADAPTER
RING
CAP SCREW
(6 REQUIRED)
VIEW OF THE INSTALLATION
OF ADAPTER RING (POST
SB PW4ENG 72−176)
11
SCREW
(12 REQUIRED)
1
PLUG
2
PLATE
10
RETAINER
3
JAWS
4
SCREW
9
CENTER HUB
PWA 85107 FIXTURE
5
SPACER
6
SCREW
(26 REQUIRED)
8
PILOTING RING
PWA 85108 STAND
7
HAND KNOB
L−A1513 (0191)
PW V

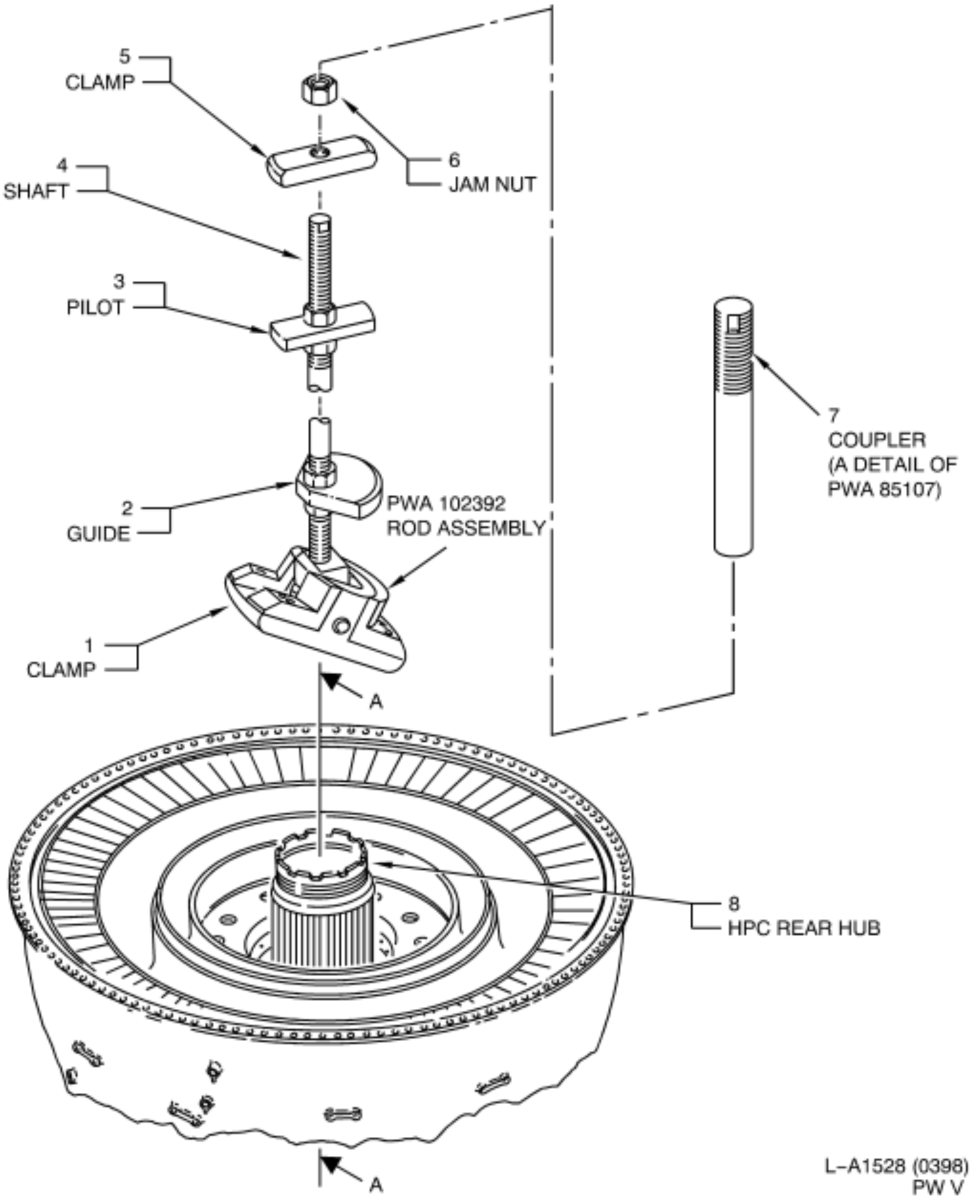
Handling Fixture Installation
Figure 402
(Task 72−00−52−420−002)


A
A
ENGINE CENTERLINE
HPC REAR SHAFT THAT IS INTEGRAL WITH HPC REAR DRUM (ONE PIECE)
SECTION A-A
(HPC INTEGRAL REAR SHAFT/HPC REAR DRUM)
L-B6169 (0398)
PW V

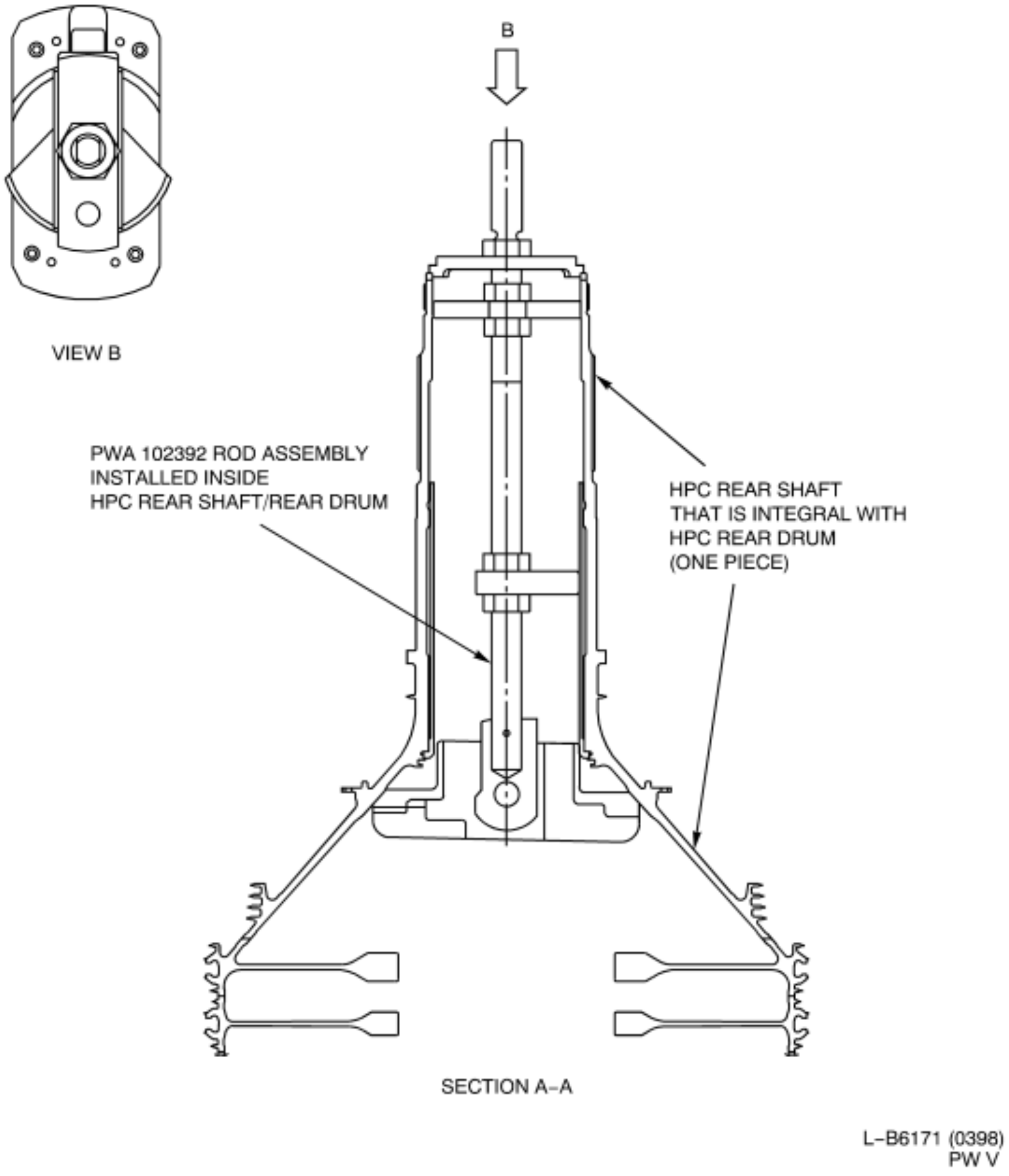
Identification Of HPC Rear Shaft And Rear Drum Features
Figure 403 (Sheet 1)
(Task 72-00-52-420-002)


ENGINE CENTERLINE
HPC REAR SHAFT
HPC REAR DRUM
BOLT FLANGE
BOLTS
SECTION A−A
(HPC REAR SHAFT BOLTED TO HPC REAR DRUM)
ENGINE CENTERLINE
HPC REAR SHAFT
BORE INSIDE SHAFT
HPC REAR DRUM
BOLT FLANGE
BOLTS
SECTION A−A
(HPC REAR SHAFT WITH INSIDE BORE BOLTED TO HPC REAR DRUM)
L−B6170 (0398)
PW V

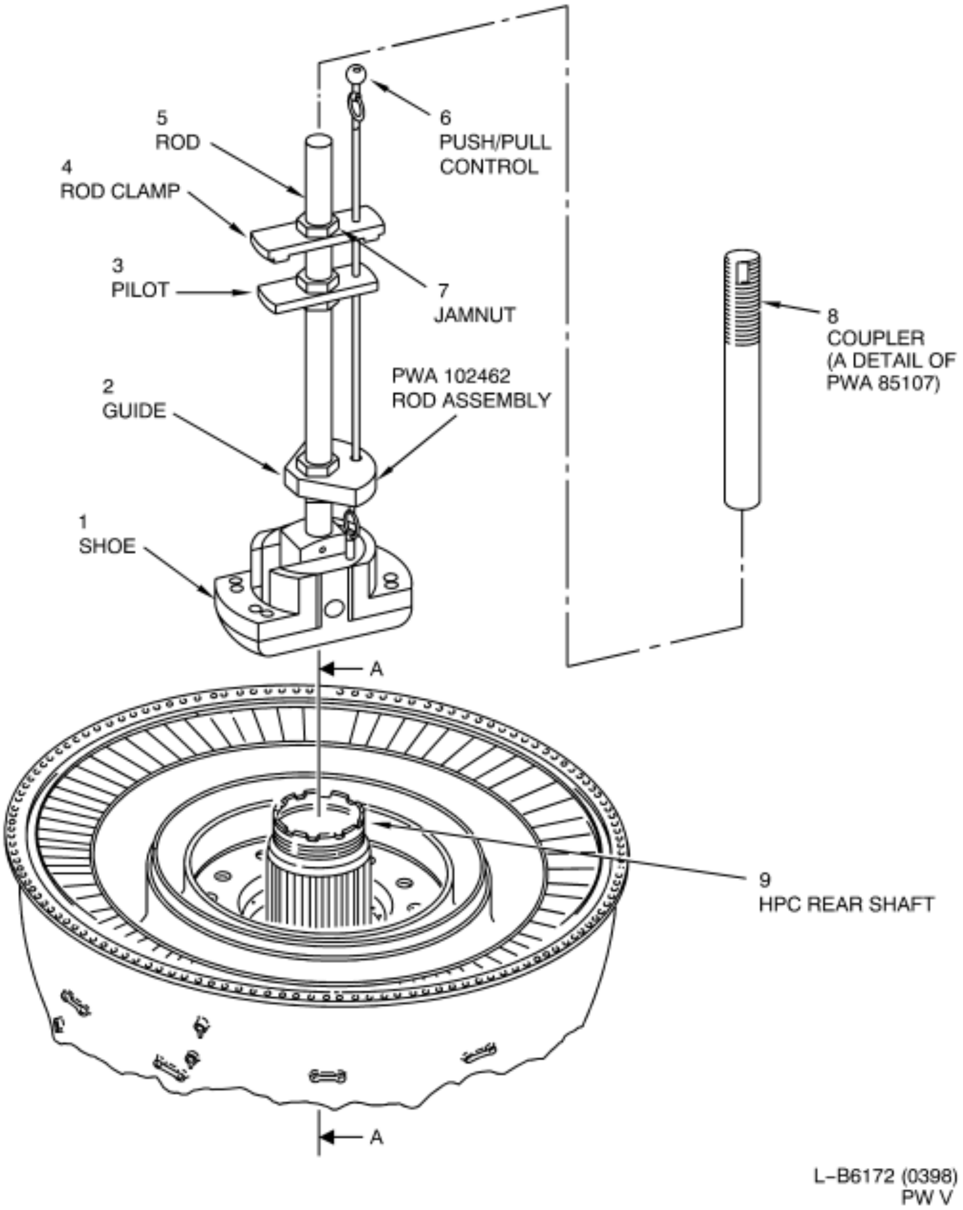
Identification Of HPC Rear Shaft And Rear Drum Features
Figure 403 (Sheet 2)
(Task 72−00−52−420−002)


5
CLAMP
6
JAM NUT
4
SHAFT
3
PILOT
7
COUPLER
(A DETAIL OF
PWA 85107)
2
GUIDE
PWA 102392
ROD ASSEMBLY
1
CLAMP
A
8
HPC REAR HUB
A
L-A1528 (0398)
PW V

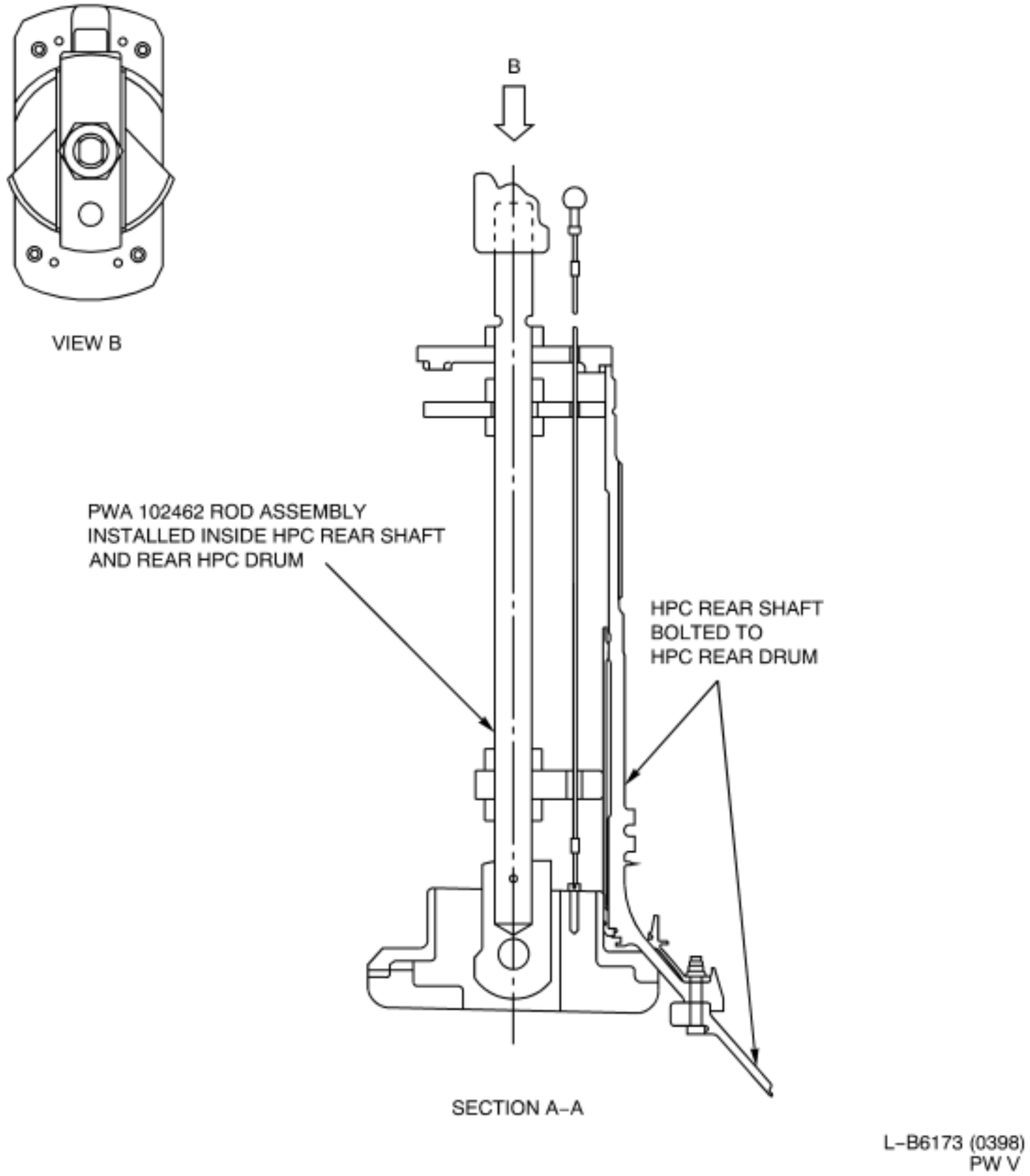
PWA 102392 Rod Assembly Installation (Engines
With HPC INTEGRAL REAR SHAFT/HPC REAR DRUM)
Figure 404 (Sheet 1)
(Task 72-00-52-420-002)


B
VIEW B
PWA 102392 ROD ASSEMBLY
INSTALLED INSIDE
HPC REAR SHAFT/REAR DRUM
HPC REAR SHAFT
THAT IS INTEGRAL WITH
HPC REAR DRUM
(ONE PIECE)
SECTION A-A
L-B6171 (0398)
PW V

PWA 102392 Rod Assembly Installation (Engines With HPC INTEGRAL REAR SHAFT/HPC REAR DRUM)
Figure 404 (Sheet 2)
(Task 72-00-52-420-002)

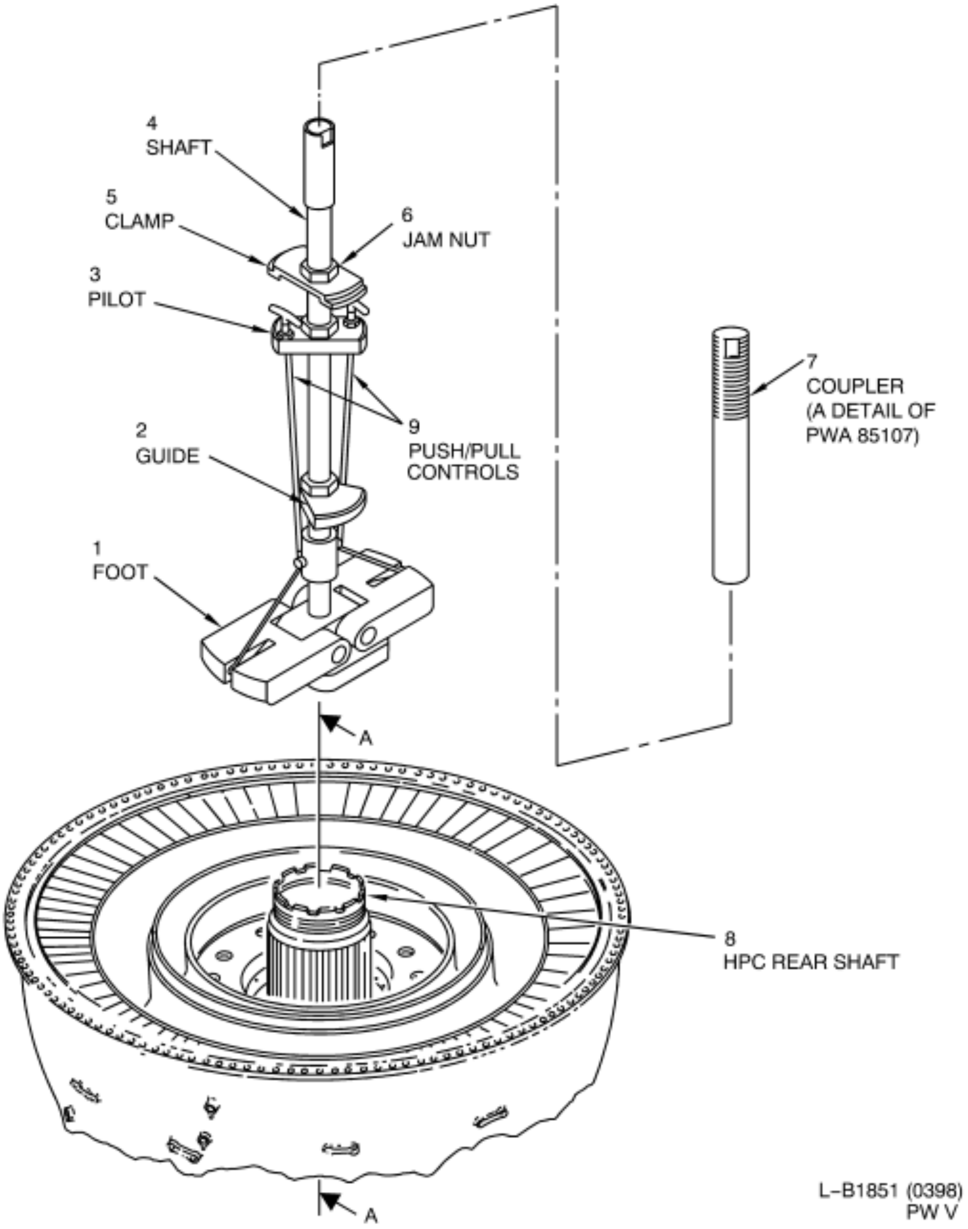

5
ROD
4
ROD CLAMP
3
PILOT
2
GUIDE
1
SHOE
6
PUSH/PULL
CONTROL
7
JAMNUT
PWA 102462
ROD ASSEMBLY
8
COUPLER
(A DETAIL OF
PWA 85107)
A
A
9
HPC REAR SHAFT
L-B6172 (0398)
PW V

PWA 102462 Rod Assembly Installation (Engines With HPC REAR SHAFT BOLTED TO THE HPC REAR DRUM) (Pre SB PW4ENG 72-562)
Figure 405 (Sheet 1)
(Task 72-00-52-420-002)

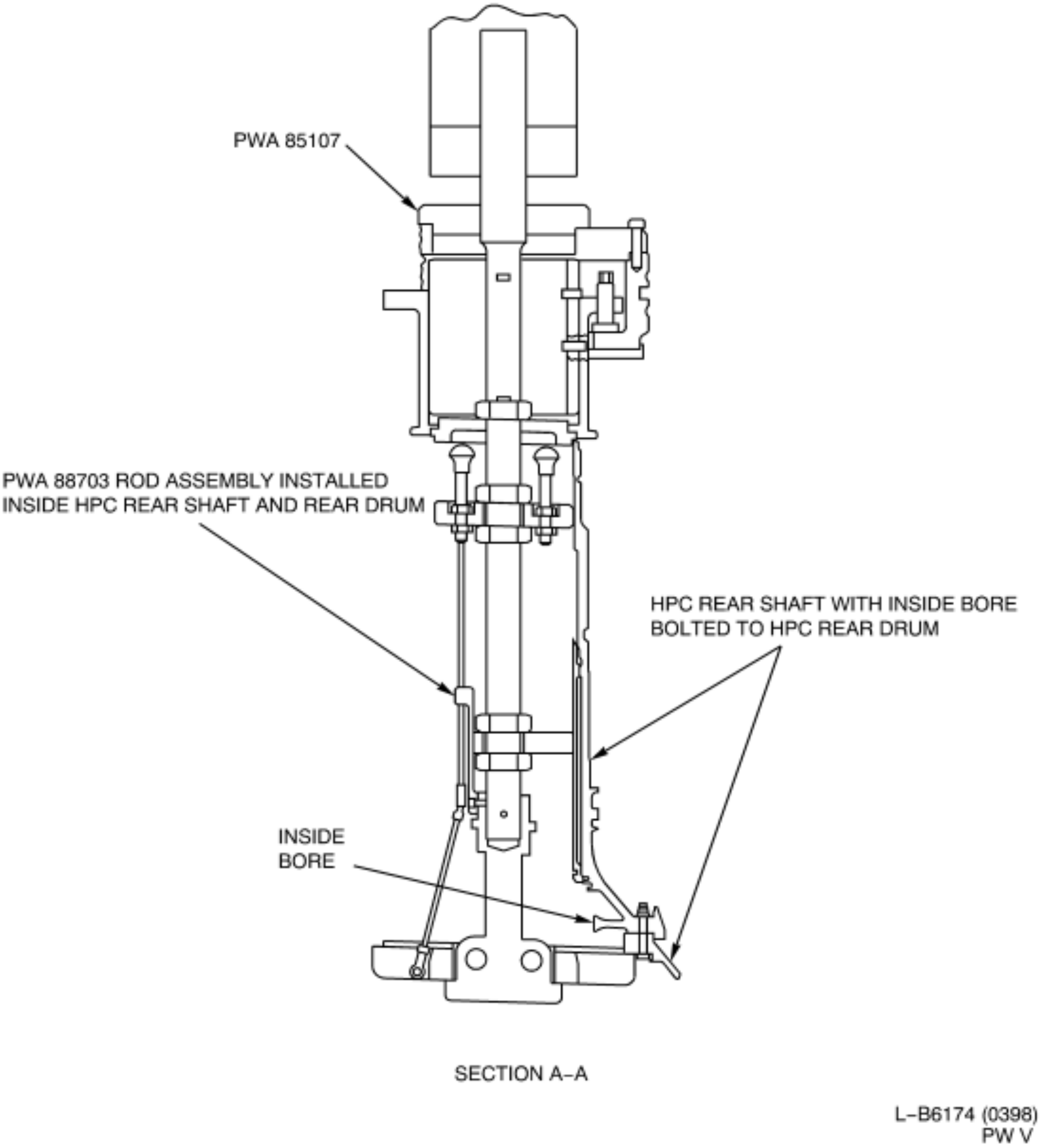

VIEW B
B
PWA 102462 ROD ASSEMBLY INSTALLED INSIDE HPC REAR SHAFT AND REAR HPC DRUM
HPC REAR SHAFT BOLTED TO HPC REAR DRUM
SECTION A-A
L-B6173 (0398)
PW V

PWA 102462 Rod Assembly Installation (Engines With HPC REAR SHAFT BOLTED TO THE HPC REAR DRUM) (Pre SB PW4ENG 72-562)
Figure 405 (Sheet 2)
(Task 72-00-52-420-002)

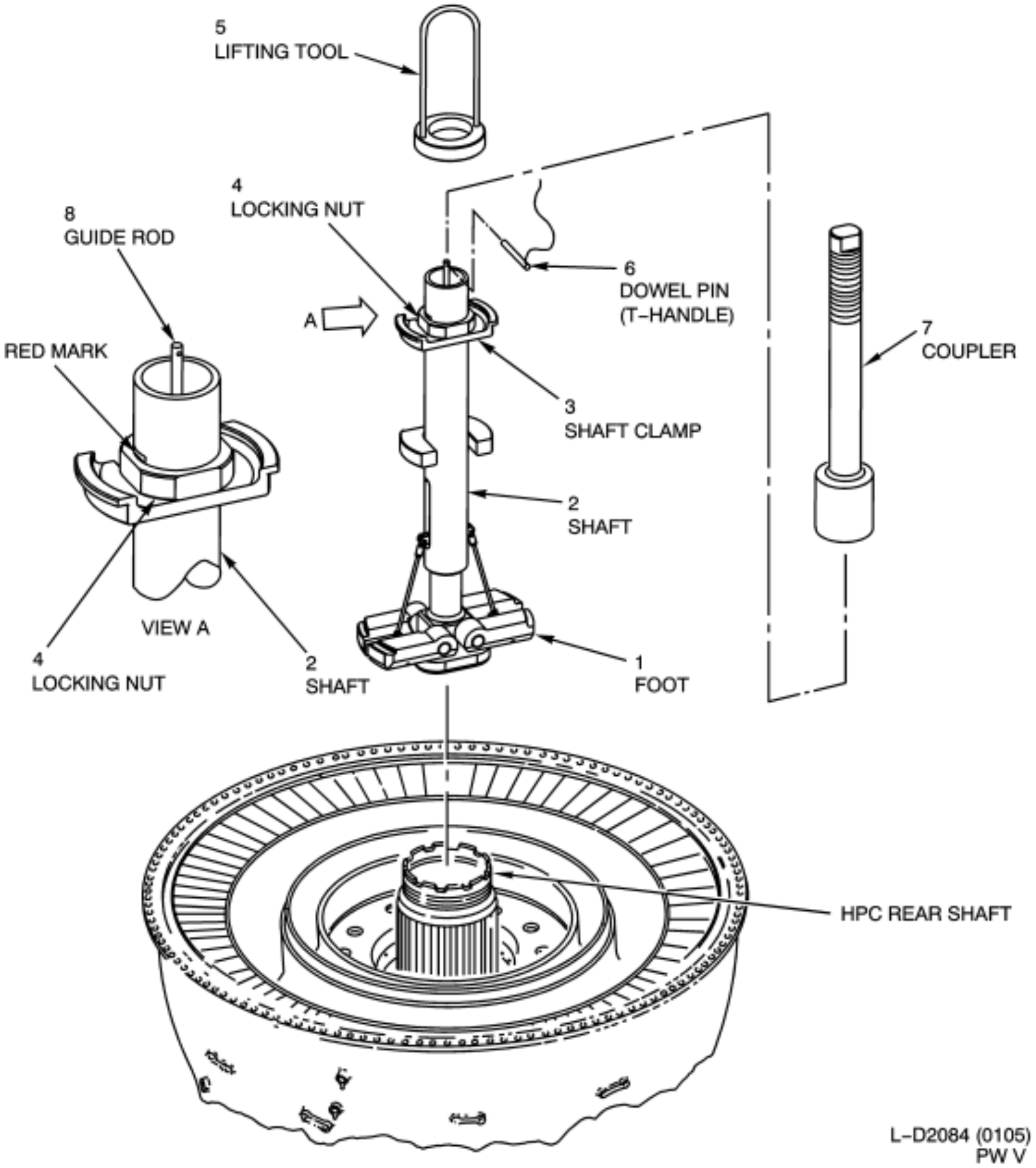
ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - INSTALLATION-08


4
SHAFT
5
CLAMP
6
JAM NUT
3
PILOT
7
COUPLER
(A DETAIL OF
PWA 85107)
2
GUIDE
9
PUSH/PULL
CONTROLS
1
FOOT
A
8
HPC REAR SHAFT
L-B1851 (0398)
PW V
A

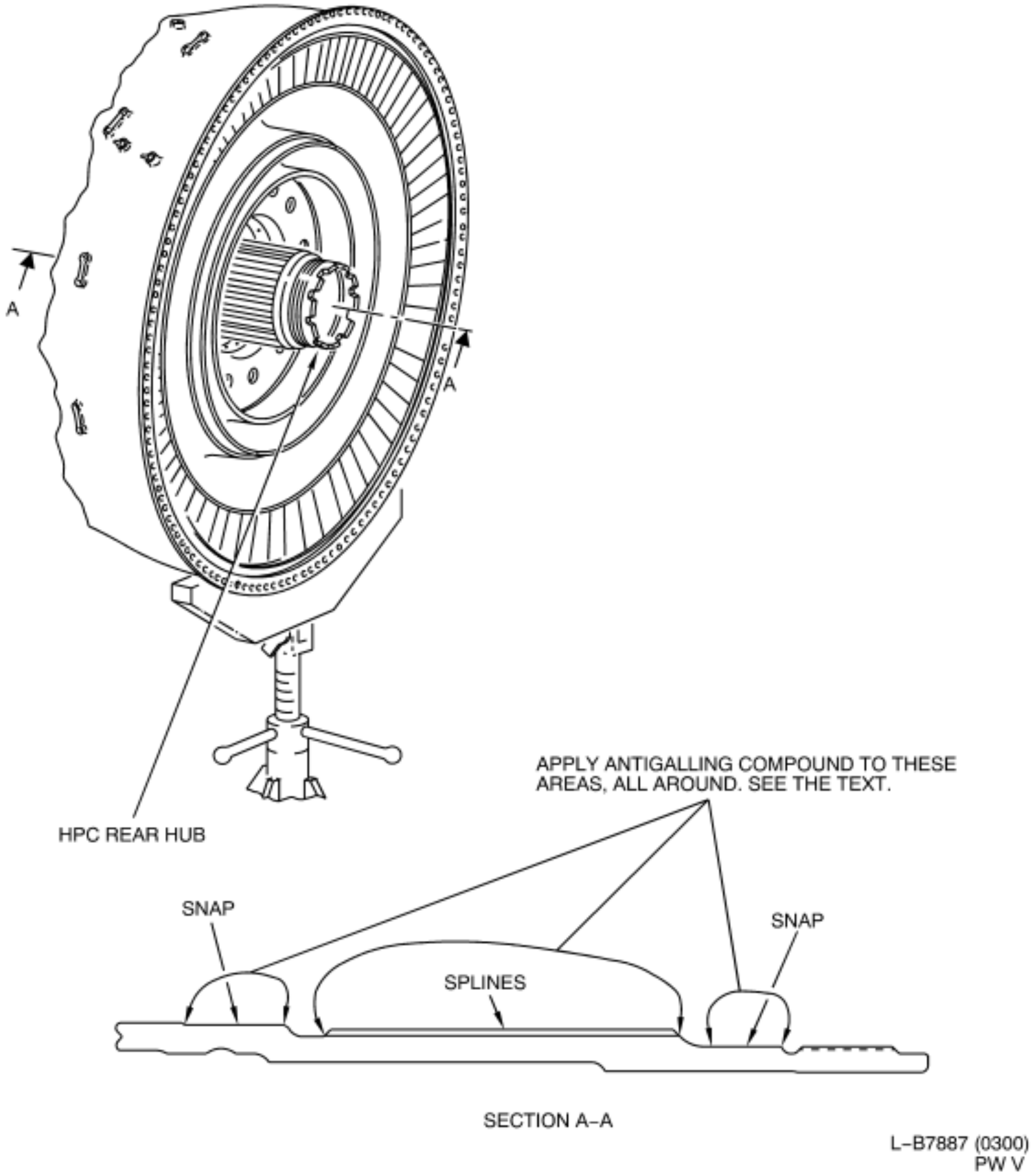
PWA 88703 Rod Assembly Installation (Engines
With HPC REAR SHAFT WITH INSIDE BORE BOLTED TO
THE HPC REAR DRUM) (Post SB PW4ENG 72-562)
Figure 406 (Sheet 1)
(Task 72-00-52-420-002)


PWA 85107
PWA 88703 ROD ASSEMBLY INSTALLED INSIDE HPC REAR SHAFT AND REAR DRUM
HPC REAR SHAFT WITH INSIDE BORE BOLTED TO HPC REAR DRUM
INSIDE BORE
SECTION A−A
L−B6174 (0398)
PW V

PWA 88703 Rod Assembly Installation (Engines
With HPC REAR SHAFT WITH INSIDE BORE BOLTED TO
THE HPC REAR DRUM) (Post SB PW4ENG 72−562)
Figure 406 (Sheet 2)
(Task 72−00−52−420−002)

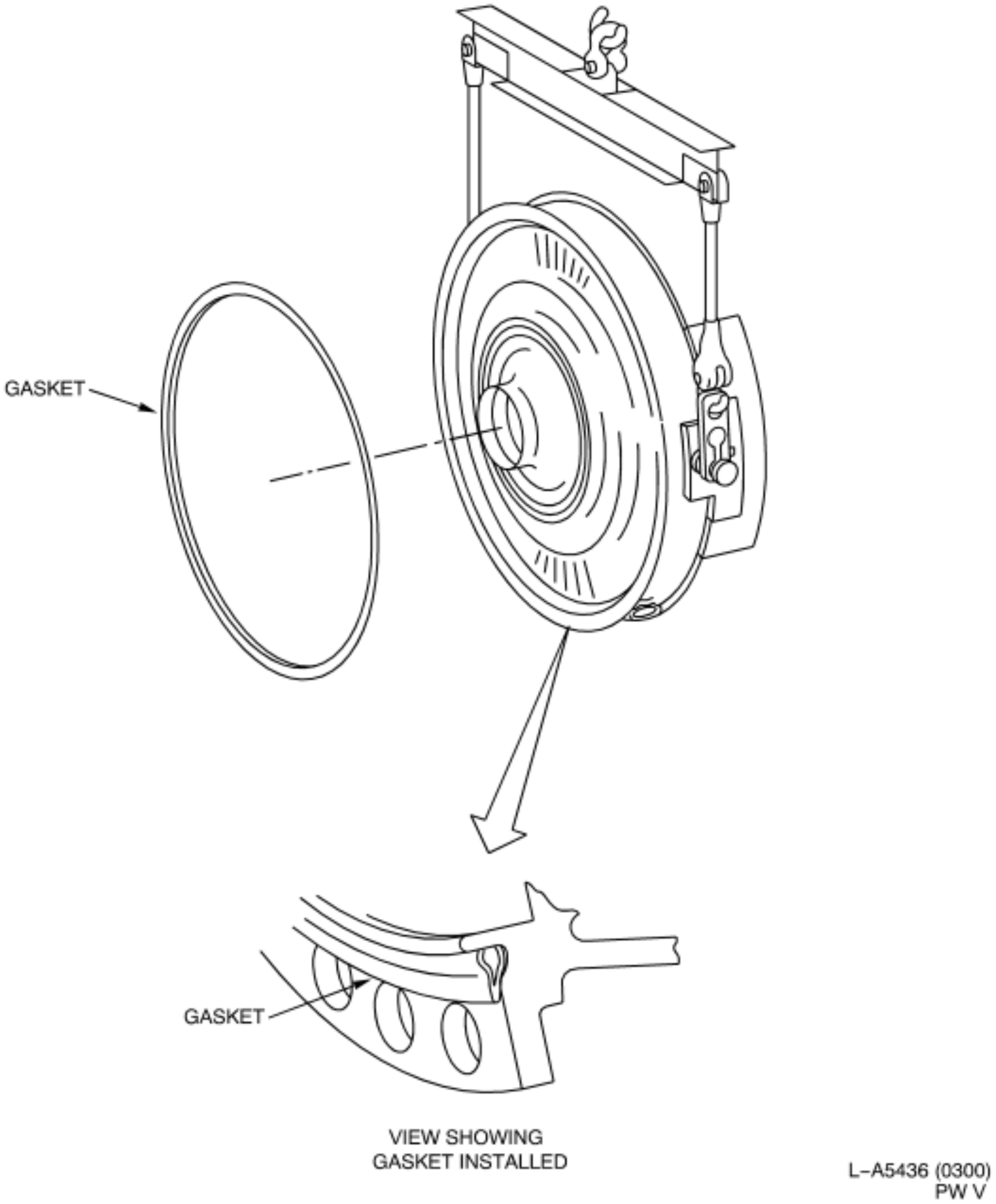

5
LIFTING TOOL
4
LOCKING NUT
8
GUIDE ROD
6
DOWEL PIN
(T−HANDLE)
A
RED MARK
7
COUPLER
3
SHAFT CLAMP
2
SHAFT
VIEW A
4
LOCKING NUT
2
SHAFT
1
FOOT
HPC REAR SHAFT
L−D2084 (0105)
PW V

R PWA 104281 Rod Assembly Installation (Engines
R With HPC REAR SHAFT WITH INSIDE BORE BOLTED TO
R THE HPC REAR DRUM) (Post SB PW4ENG 72−562)
R Figure 406 (Sheet 3)
R (Task 72−00−52−420−002)

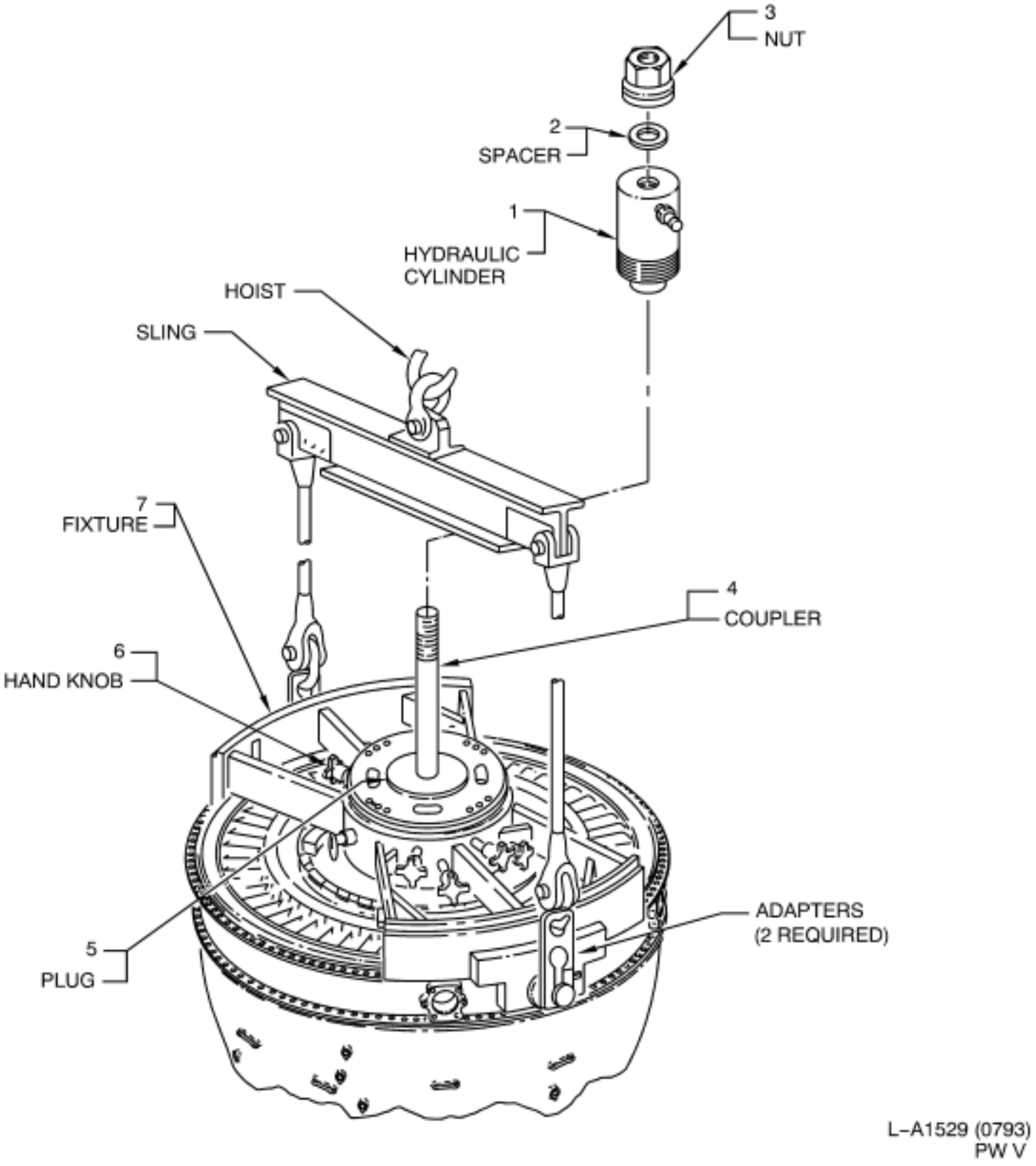

A
A
HPC REAR HUB
APPLY ANTIGALLING COMPOUND TO THESE AREAS, ALL AROUND. SEE THE TEXT.
SNAP
SPLINES
SNAP
SECTION A-A
L-B7887 (0300)
PW V

HPC Shaft Antigalling Compound Locations
Figure 407
(Task 72-00-52-420-002)

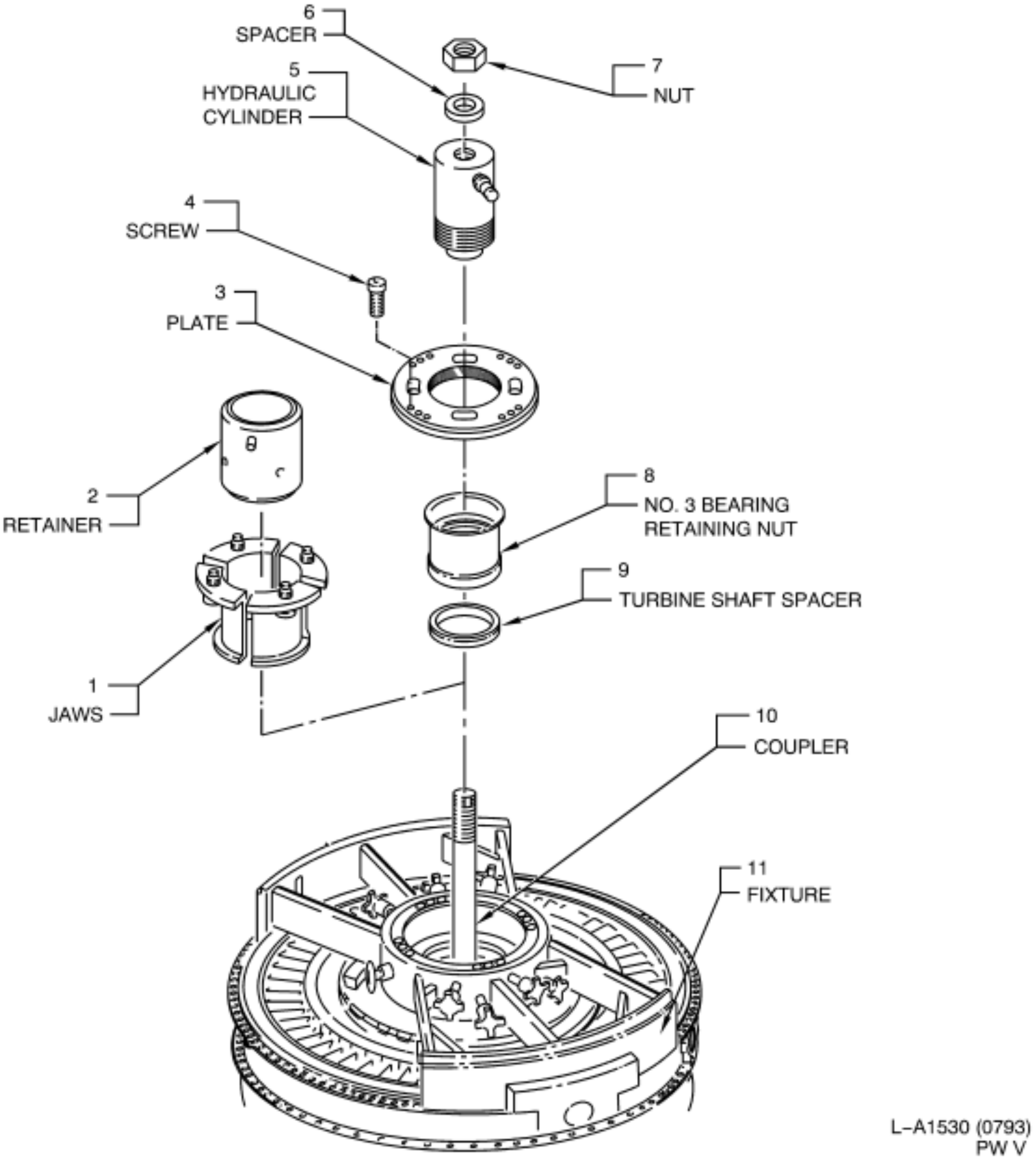
R
R


GASKET
GASKET
VIEW SHOWING
GASKET INSTALLED
L−A5436 (0300)
PW V

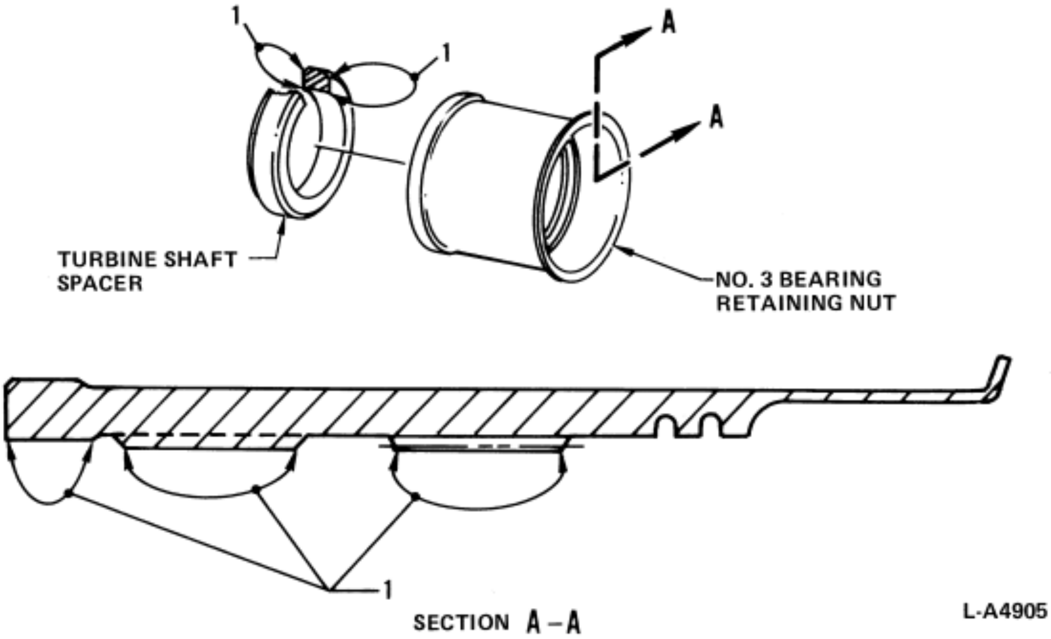
Turbine Case Gasket Installation
Figure 408
(Task 72−00−52−420−002)


3
NUT
2
SPACER
1
HYDRAULIC
CYLINDER
HOIST
SLING
7
FIXTURE
4
COUPLER
6
HAND KNOB
ADAPTERS
(2 REQUIRED)
5
PLUG
L−A1529 (0793)
PW V

High Pressure Turbine Installation
Figure 409
(Task 72−00−52−420−002)

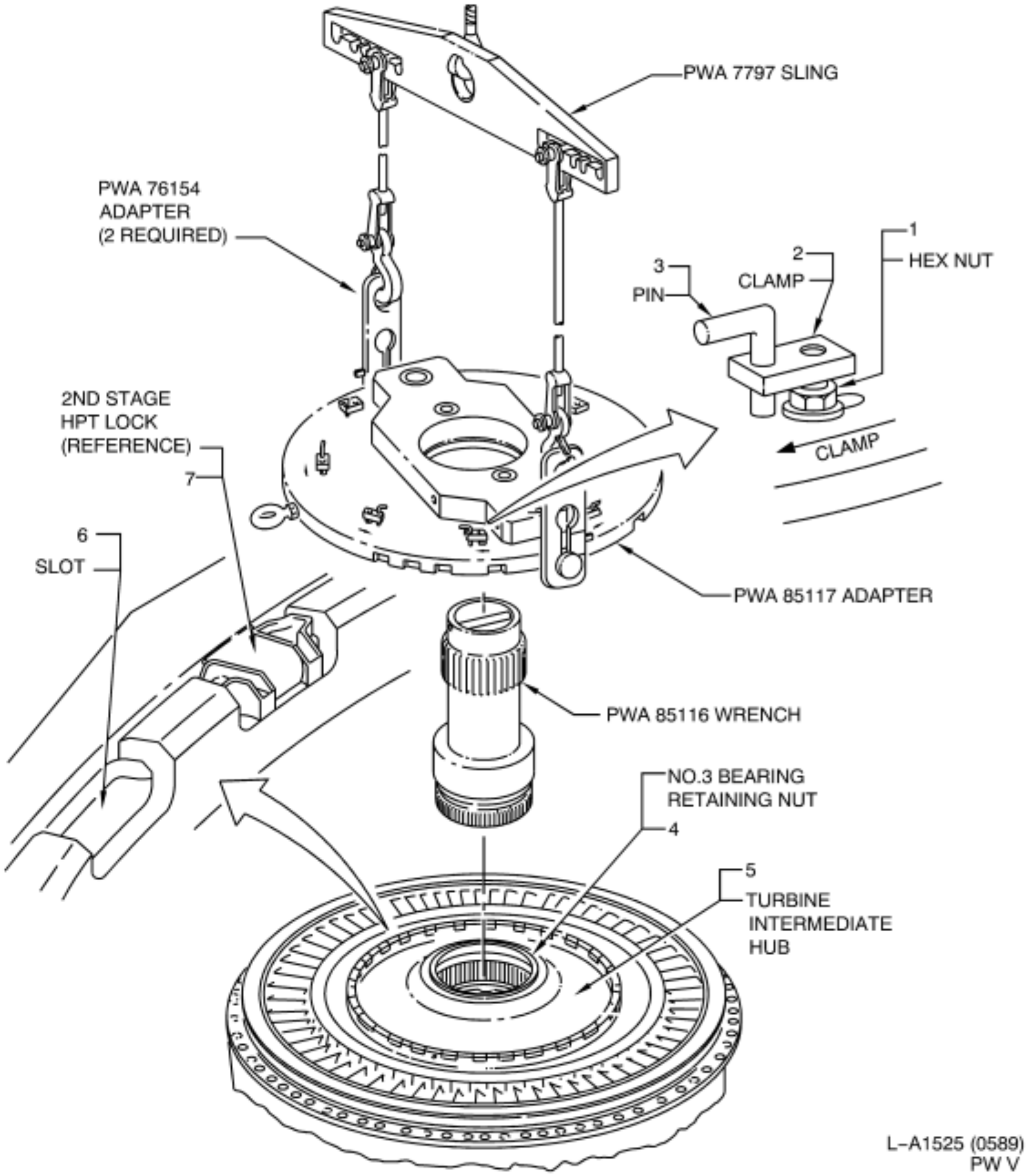

6
SPACER
7
NUT
5
HYDRAULIC CYLINDER
4
SCREW
3
PLATE
2
RETAINER
8
NO. 3 BEARING RETAINING NUT
9
TURBINE SHAFT SPACER
1
JAWS
10
COUPLER
11
FIXTURE
L−A1530 (0793)
PW V

No. 3 Bearing Retaining Nut Installation
Figure 410
(Task 72−00−52−420−002)

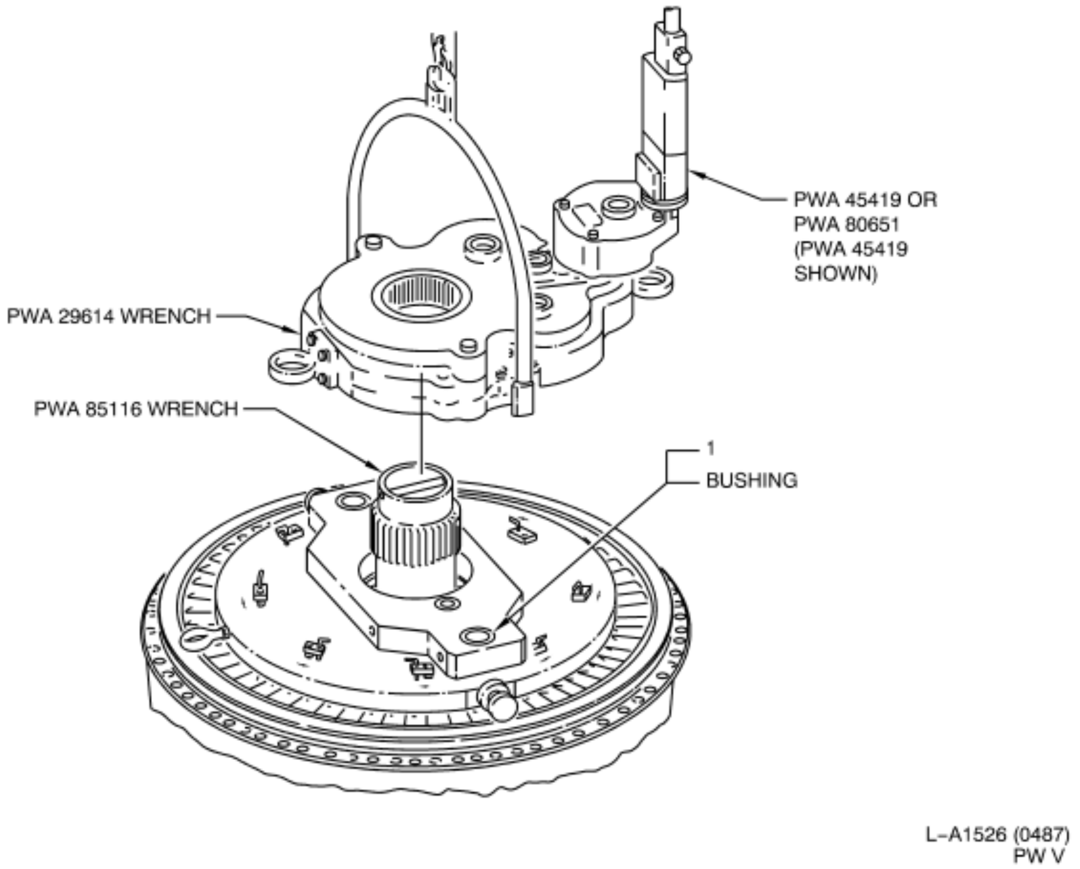

1
1
A
A
TURBINE SHAFT SPACER
NO. 3 BEARING RETAINING NUT
1
SECTION A − A
L-A4905

1. Apply Antigalling Compound To This Area. See The Text.

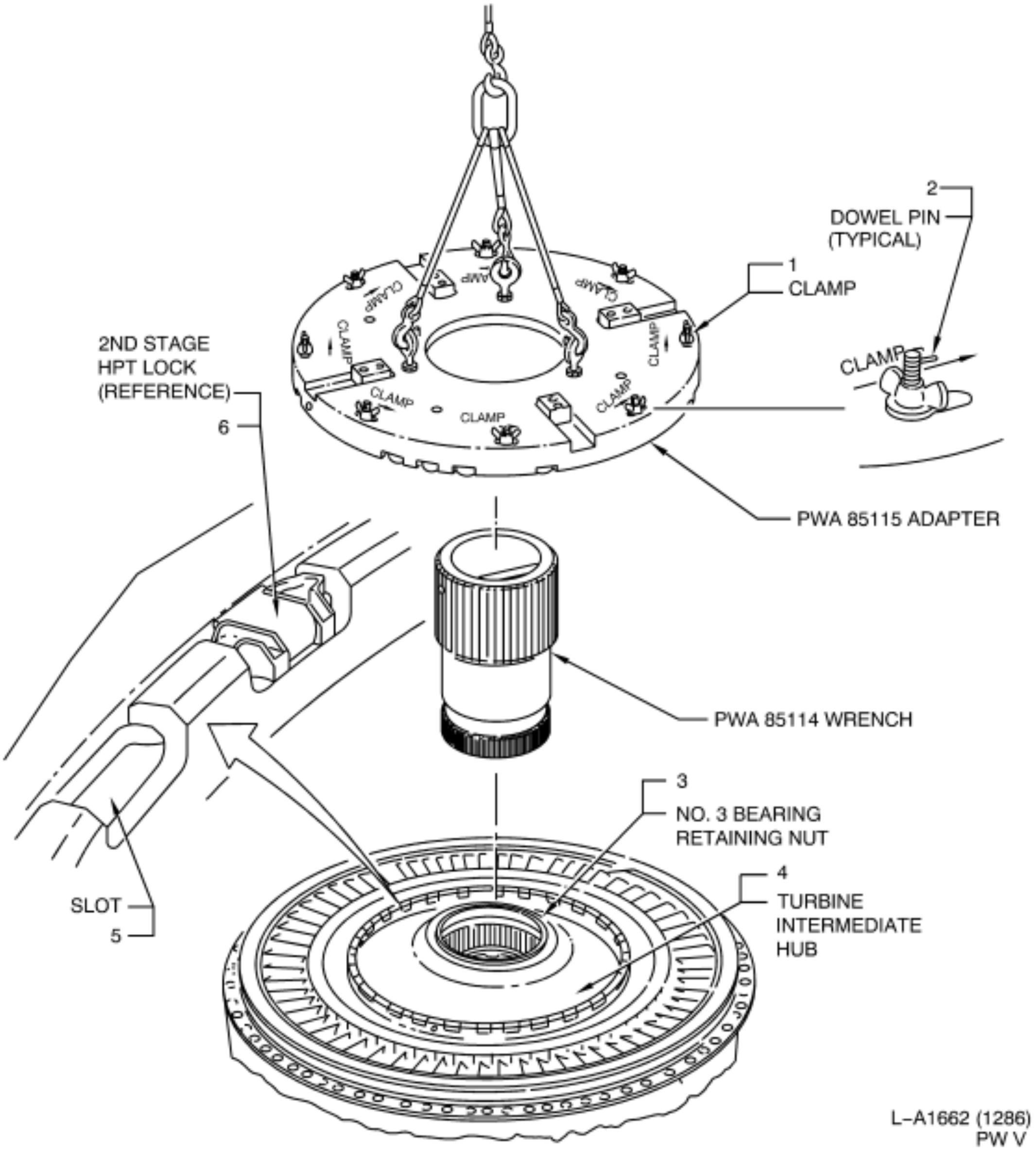
Antigalling Compound Application
Figure 411
(Task 72−00−52−420−002)


PWA 7797 SLING
PWA 76154 ADAPTER (2 REQUIRED)
1 HEX NUT
2 CLAMP
3 PIN
CLAMP
2ND STAGE HPT LOCK (REFERENCE)
7
6
SLOT
PWA 85117 ADAPTER
PWA 85116 WRENCH
NO.3 BEARING RETAINING NUT
4
5
TURBINE INTERMEDIATE HUB
L-A1525 (0589)
PW V

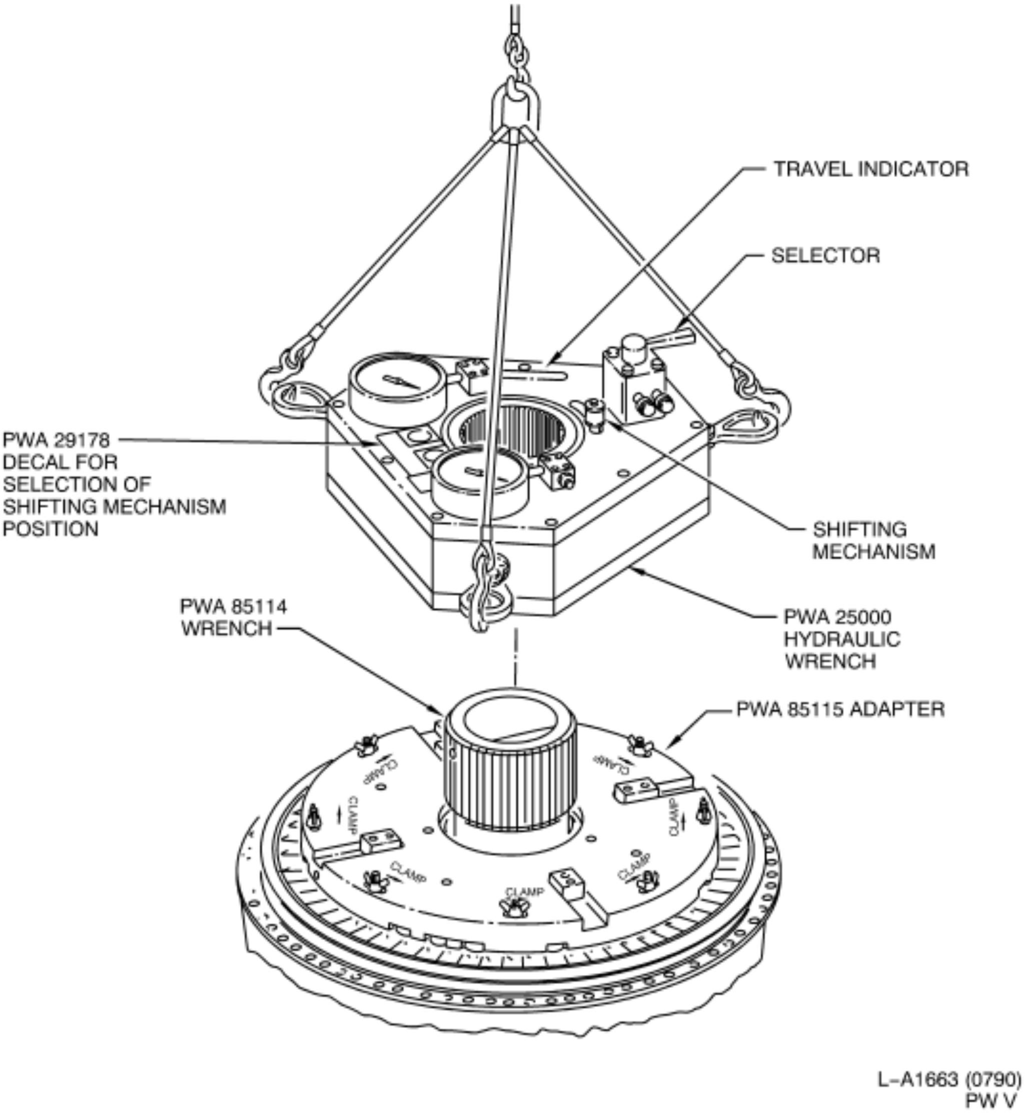
No. 3 Bearing Retaining Nut Torquing (Mechanical Wrench)
Figure 412
(Task 72-00-52-420-002)


PWA 45419 OR
PWA 80651
(PWA 45419
SHOWN)
PWA 29614 WRENCH
PWA 85116 WRENCH
1
BUSHING
L−A1526 (0487)
PW V

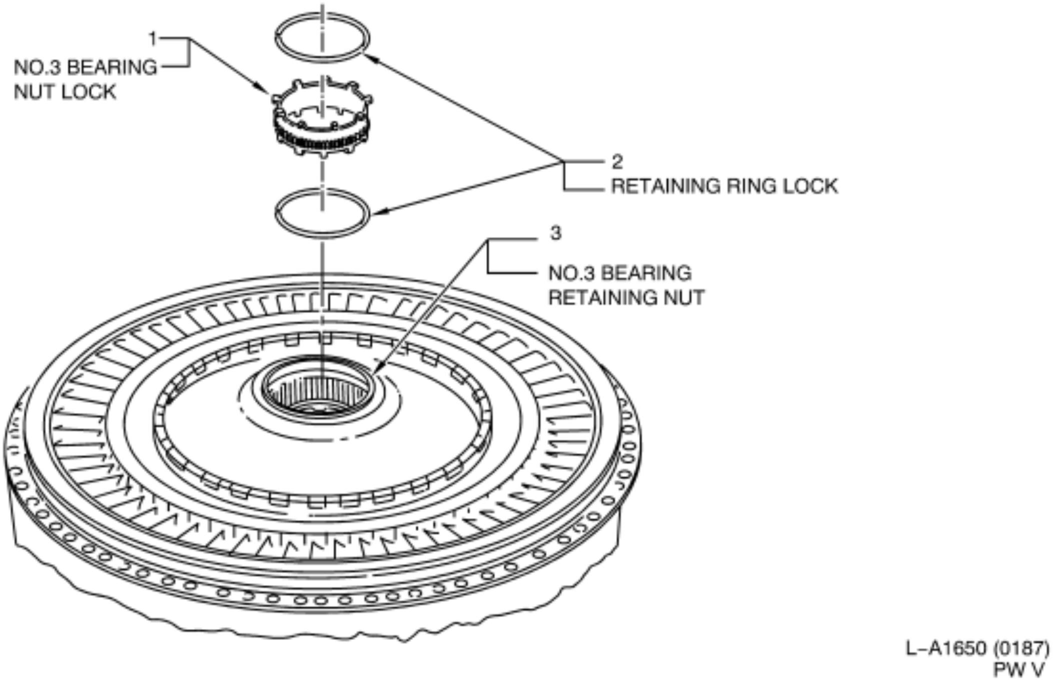
No. 3 Bearing Retaining Nut Torquing (Mechanical Wrench)
Figure 413
(Task 72−00−52−420−002)


2
DOWEL PIN (TYPICAL)
1
CLAMP
CLAMP
2ND STAGE HPT LOCK (REFERENCE)
6
PWA 85115 ADAPTER
PWA 85114 WRENCH
3
NO. 3 BEARING RETAINING NUT
4
TURBINE INTERMEDIATE HUB
SLOT
5
L-A1662 (1286)
PW V

No. 3 Bearing Retaining Nut Installation (Hydraulic Wrench)
Figure 414
(Task 72-00-52-420-002)


TRAVEL INDICATOR
SELECTOR
PWA 29178 DECAL FOR SELECTION OF SHIFTING MECHANISM POSITION
SHIFTING MECHANISM
PWA 85114 WRENCH
PWA 25000 HYDRAULIC WRENCH
PWA 85115 ADAPTER
CLAMP
CLAMP
CLAMP
CLAMP
CLAMP
CLAMP
CLAMP
L−A1663 (0790)
PW V

No. 3 Bearing Retaining Nut Installation (Hydraulic Wrench)
Figure 415
(Task 72−00−52−420−002)


1
NO.3 BEARING NUT LOCK
2
RETAINING RING LOCK
3
NO.3 BEARING RETAINING NUT
L−A1650 (0187)
PW V

No. 3 Bearing Nut Lock Installation
Figure 416
(Task 72−00−52−420−002)

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ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - INSTALLATION-09

Task 72-00-52-420-002-002:

1. Install The High Pressure Turbine - Vertical (Hydraulic Wrench) - Deleted

   A. Procedure

      (1) This procedure is relocated to 72-00-52, Installation-08 (Task 72-00-52-420-002).

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ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - INSTALLATION-20

Task 72-00-52-420-020:

1. Install The Flange M Brackets And Hardware

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03-001	Engine Oil (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

B. Procedure

(1) Install Flange M hardware as follows: See Figure 401.

(a) Secure Flange M using bolts, lubricated with Engine Oil P03-001, nuts and brackets.

NOTE: Workbolts should be progressively removed from case flanges as engine bolts and nuts are installed.

NOTE: Index pin is located between holes 64 and 65.

(2) (Reference 978) Torque Flange M bolts. See Figure 401.

(a) Nuts must be tightened simultaneously in sets of two groups. Sets consist of groups numbered (1,2), (3,4), (5,6), (7,8), (9,10), (11,12), (13,14) and (15,16) See torque sequence specified in referenced figure.

NOTE: Fourteen of the 16 groups consist of eight bolts each. The remaining two groups consist of nine bolts each. See referenced figure.

(b) Tighten all sets of bolt groups described in previous step to initial torque of 75 - 100 lb-in. (8.474 - 11.298 N.m).

(c) Tighten all sets of bolt groups described in previous step to final torque of 180 - 200 lb-in. (20.337 - 22.597 N.m).

(d) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the double hex bolts at bolthole Locations 11 through 14, 39 through 42, 76 through 79, and 98 through 101.

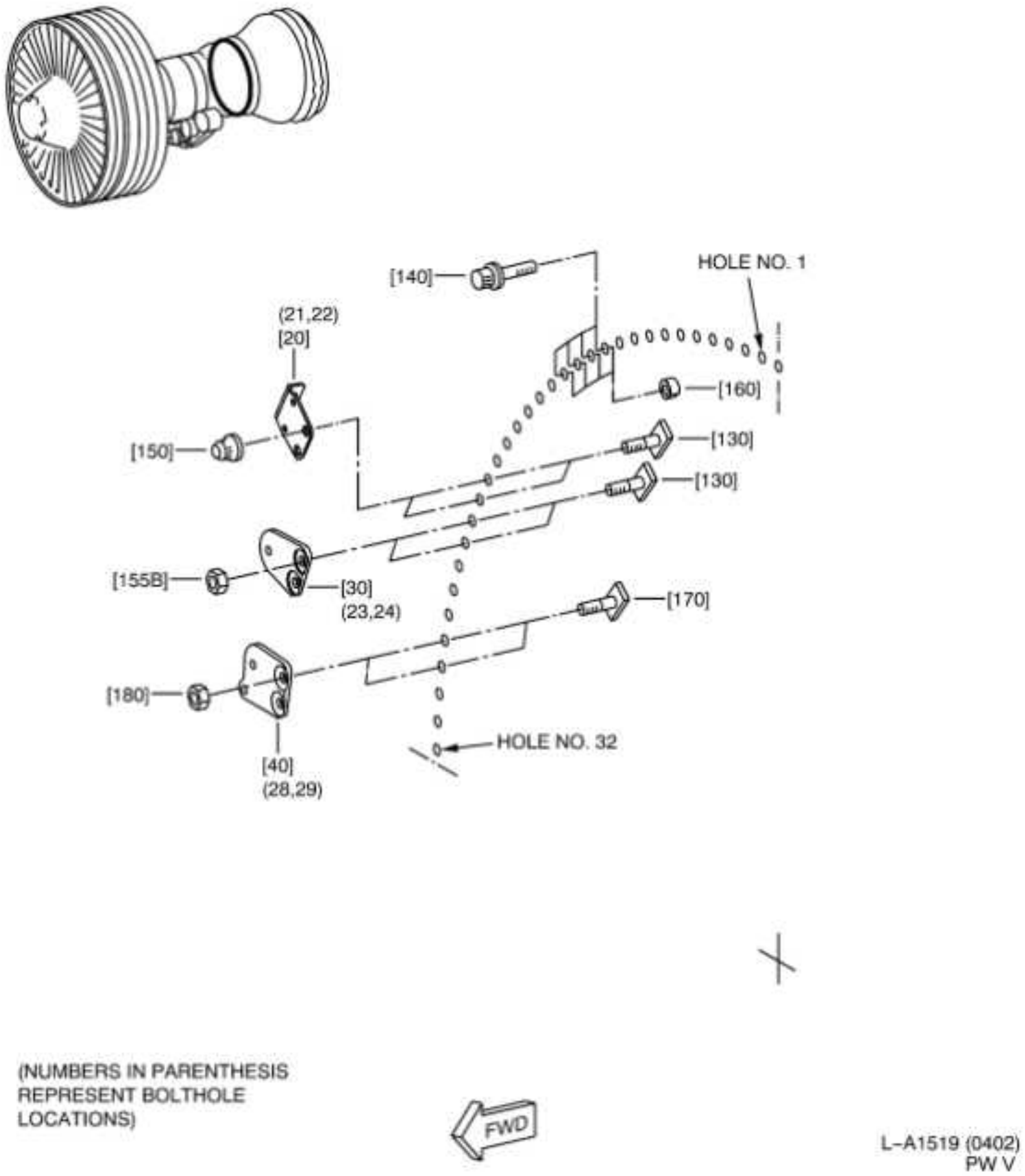
(e) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the hex nuts at bolthole Locations 23 and 24, 28 and 29, 49 through 52, 97, and 112 through 115.

(f) Install two bolts, threads lubricated with Engine Oil P03−001, that attach the two brackets together at approximately the 4:30 o'clock position. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

NOTE: Leave protectors on 2nd stage turbine airseal land and 2nd stage blade trailing edges until low pressure turbine is installed.

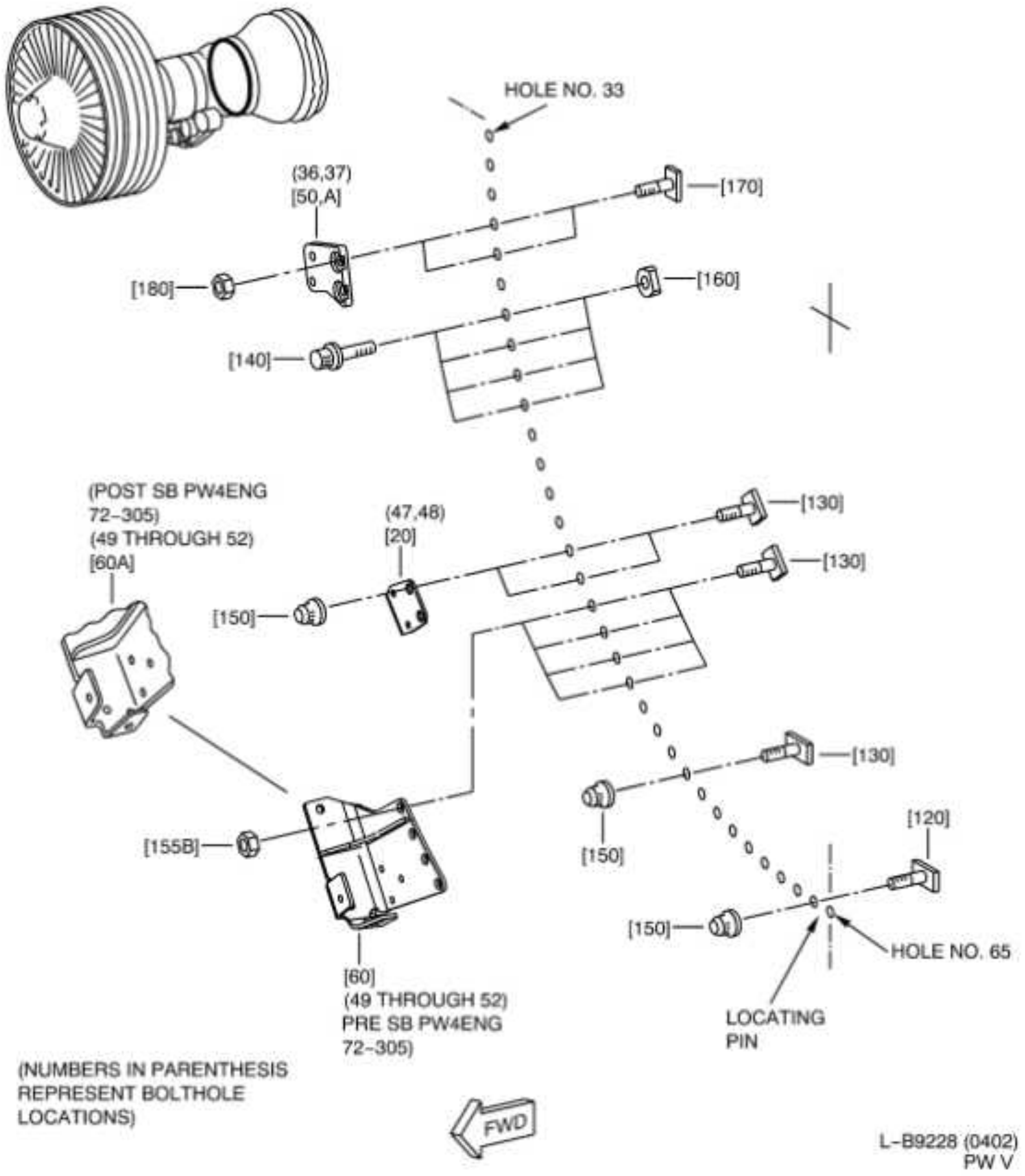
(3) Remove any tags or markings on the brackets or flange.

(4) Examine the assembly for foreign objects, damage, and correct assembly.

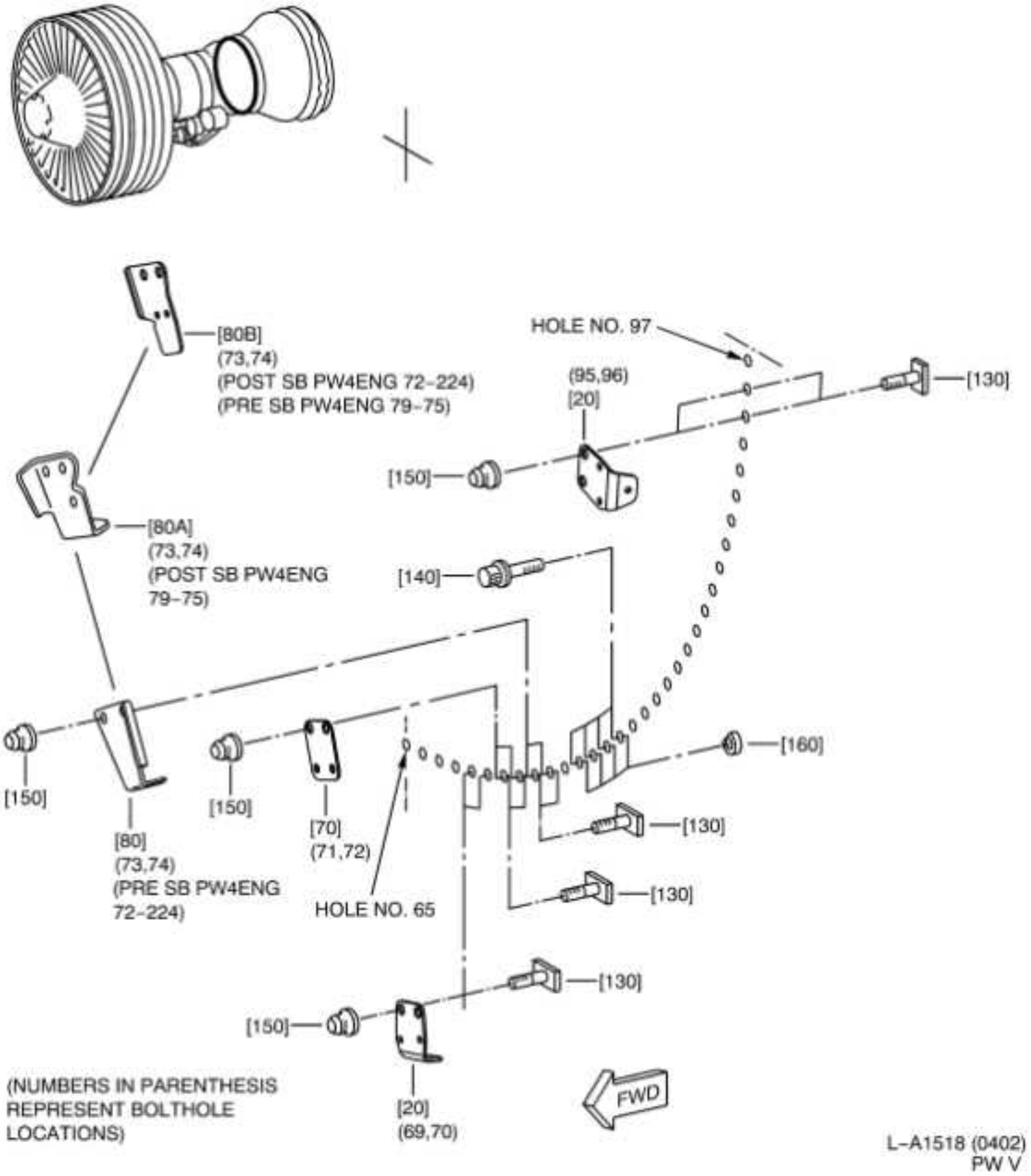

[140]
HOLE NO. 1
(21,22)
[20]
[160]
[150]
[130]
[130]
[155B]
[30]
(23,24)
[170]
[180]
HOLE NO. 32
[40]
(28,29)
FWD
L-A1519 (0402)
PW V

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

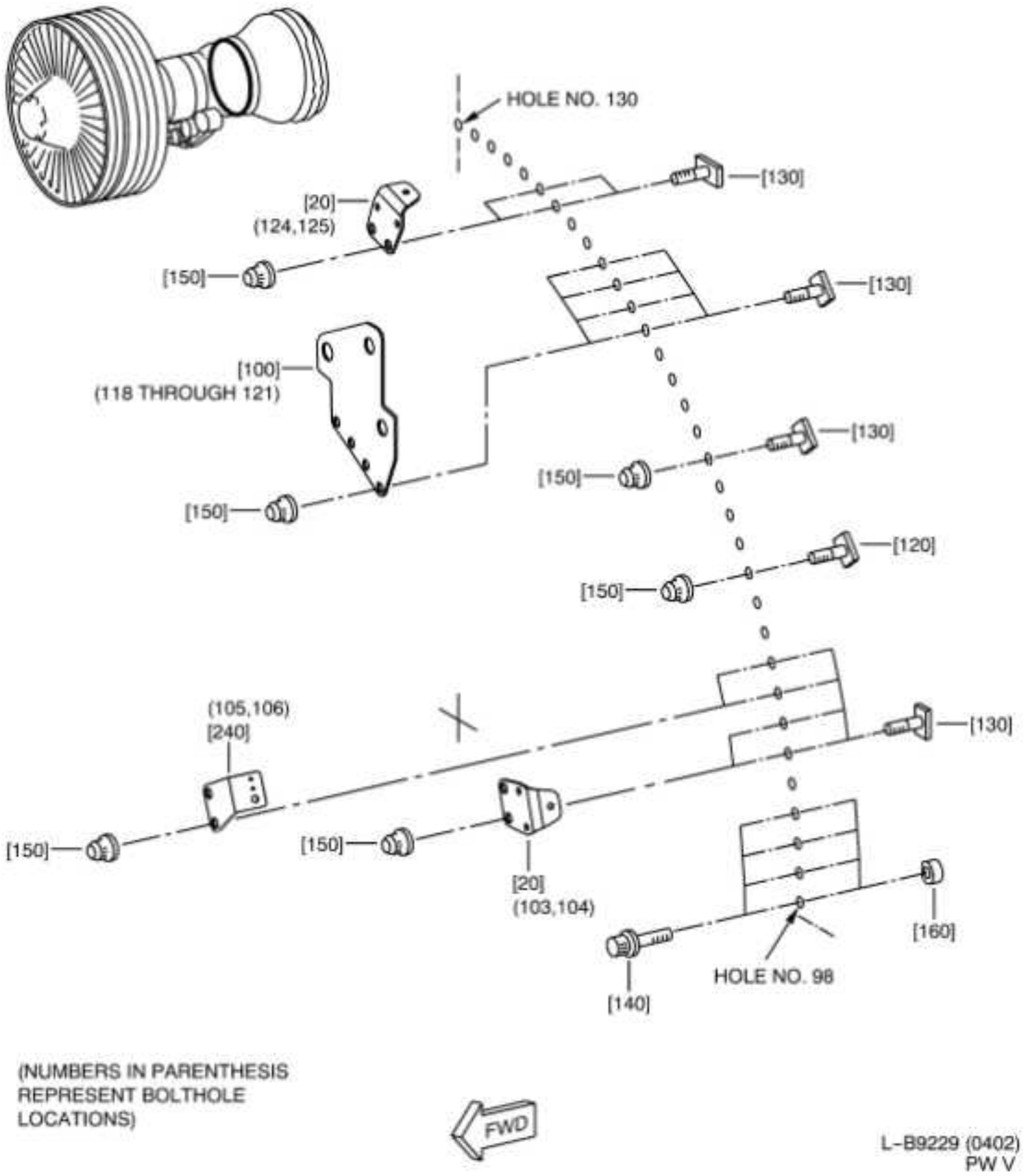
The Flange M Brackets And Hardware
Figure 401 (Sheet 1)
(Task 72−00−52−420−020)


HOLE NO. 33
(36,37)
[50,A]
[170]
[180]
[160]
[140]
(POST SB PW4ENG
72-305)
(49 THROUGH 52)
[60A]
(47,48)
[20]
[130]
[150]
[130]
[130]
[155B]
[150]
[120]
[150]
HOLE NO. 65
[60]
(49 THROUGH 52)
PRE SB PW4ENG
72-305)
LOCATING
PIN
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-B9228 (0402)
PW V

The Flange M Brackets And Hardware
Figure 401 (Sheet 2)
(Task 72−00−52−420−020)


[80B]
(73,74)
(POST SB PW4ENG 72-224)
(PRE SB PW4ENG 79-75)
HOLE NO. 97
(95,96)
[20]
[130]
[150]
[80A]
(73,74)
(POST SB PW4ENG
79-75)
[140]
[160]
[150]
[150]
[130]
[80]
(73,74)
(PRE SB PW4ENG
72-224)
[70]
(71,72)
HOLE NO. 65
[130]
[130]
[150]
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
[20]
(69,70)
FWD
L-A1518 (0402)
PW V

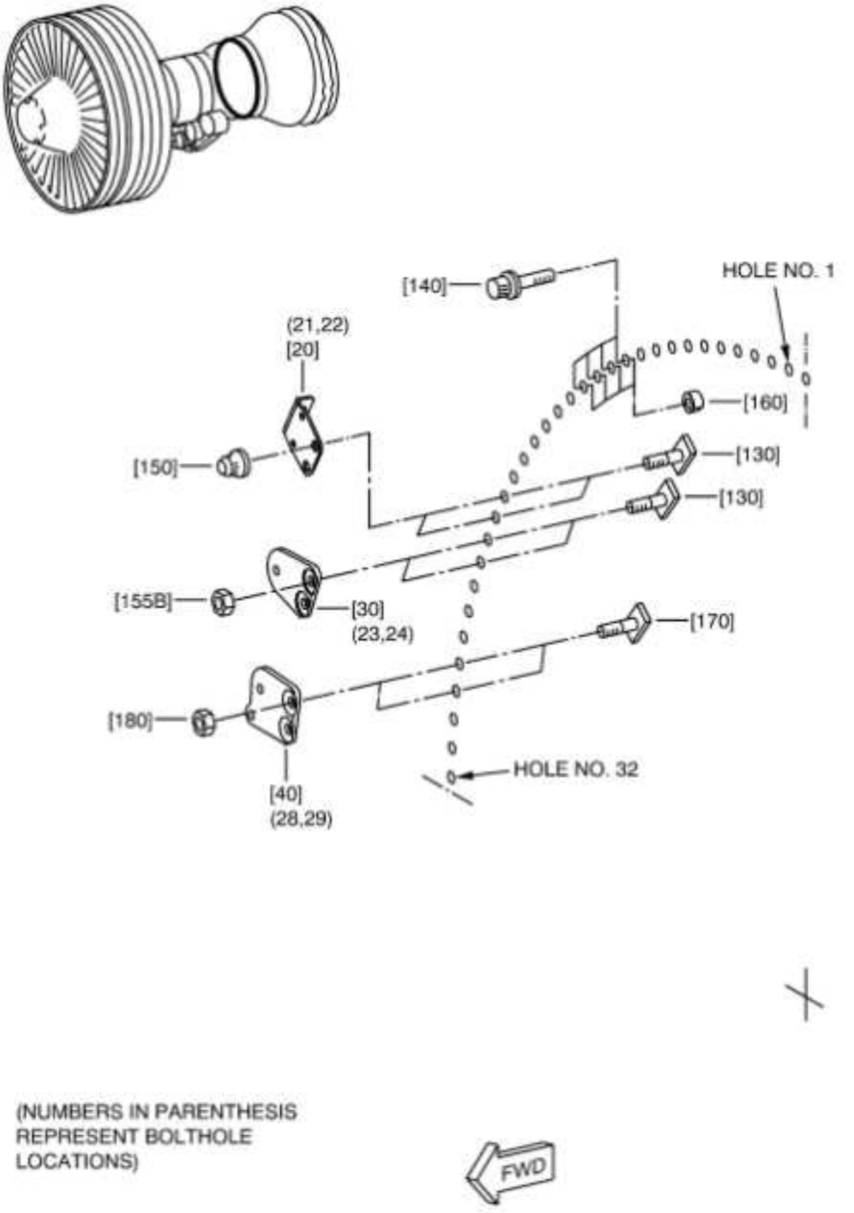
The Flange M Brackets And Hardware
Figure 401 (Sheet 3)
(Task 72−00−52−420−020)


HOLE NO. 130
[130]
[20]
(124,125)
[150]
[130]
[100]
(118 THROUGH 121)
[150]
[130]
[150]
[120]
[150]
(105,106)
[240]
[130]
[150]
[150]
[20]
(103,104)
[160]
HOLE NO. 98
[140]
FWD

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

L-B9229 (0402)
PW V

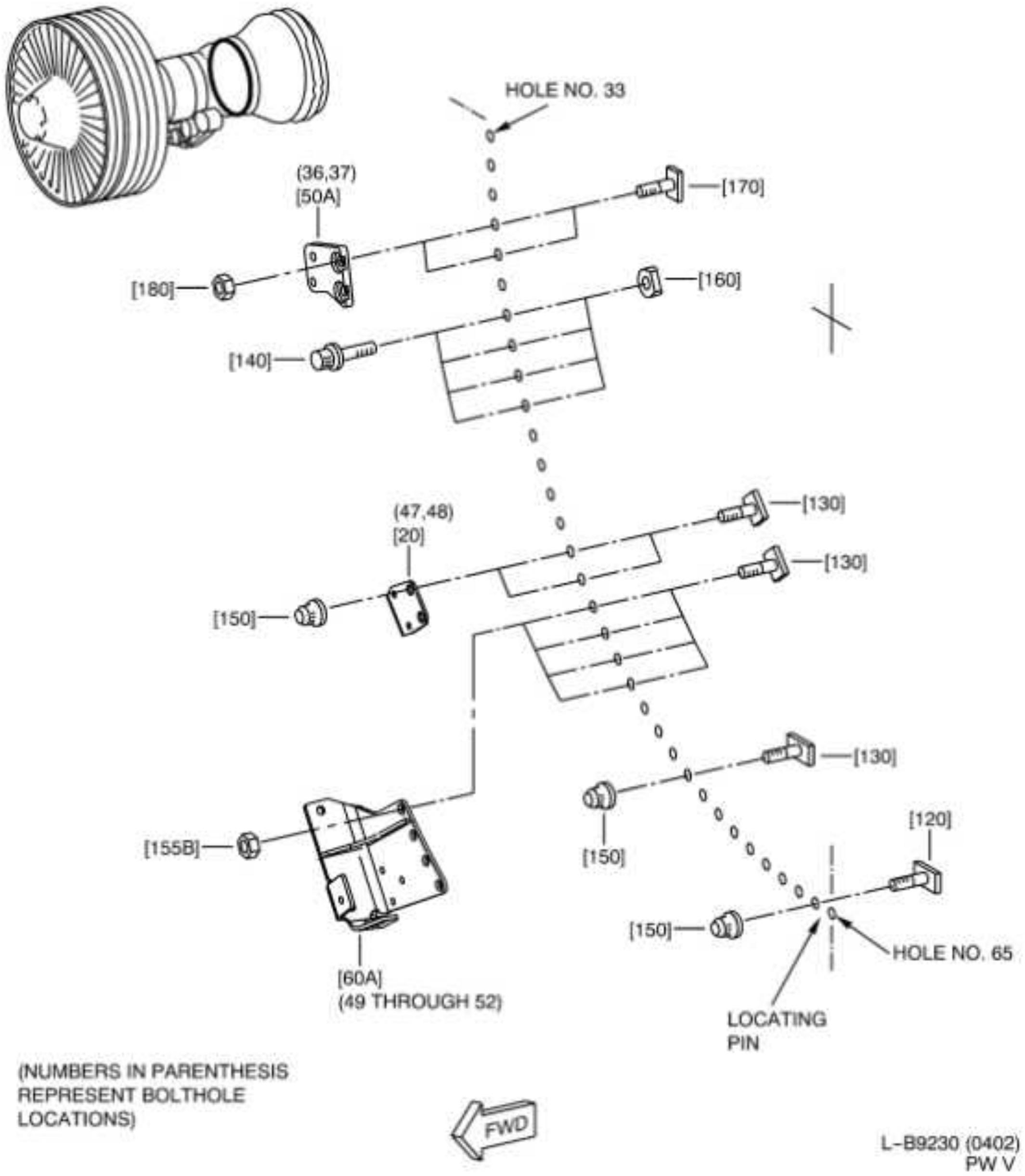
The Flange M Brackets And Hardware
Figure 401 (Sheet 4)
(Task 72-00-52-420-020)


[140]
HOLE NO. 1
(21,22)
[20]
[160]
[150]
[130]
[130]
[155B]
[30]
(23,24)
[170]
[180]
HOLE NO. 32
[40]
(28,29)
FWD

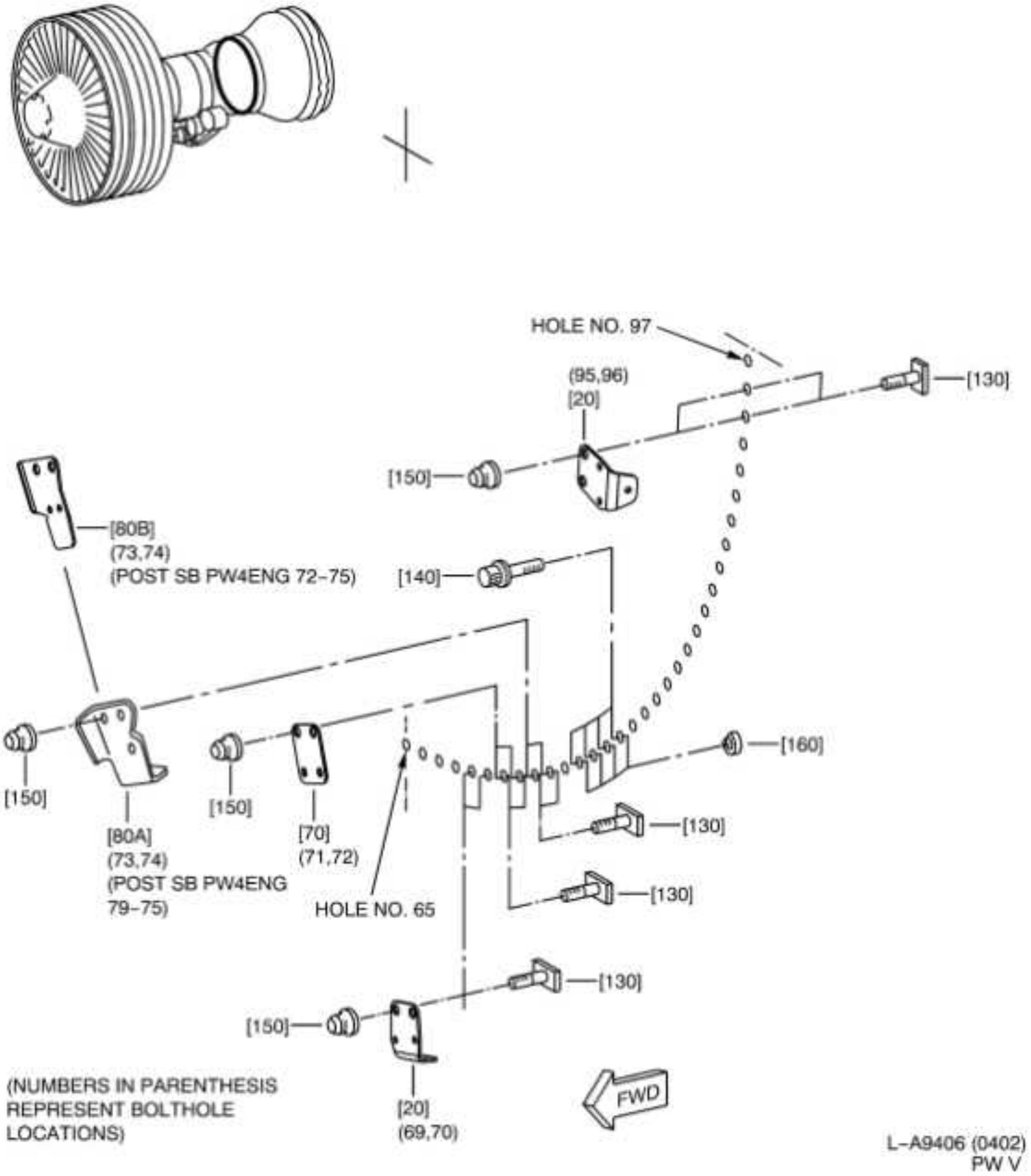
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

L−A9405 (0402)
PW V

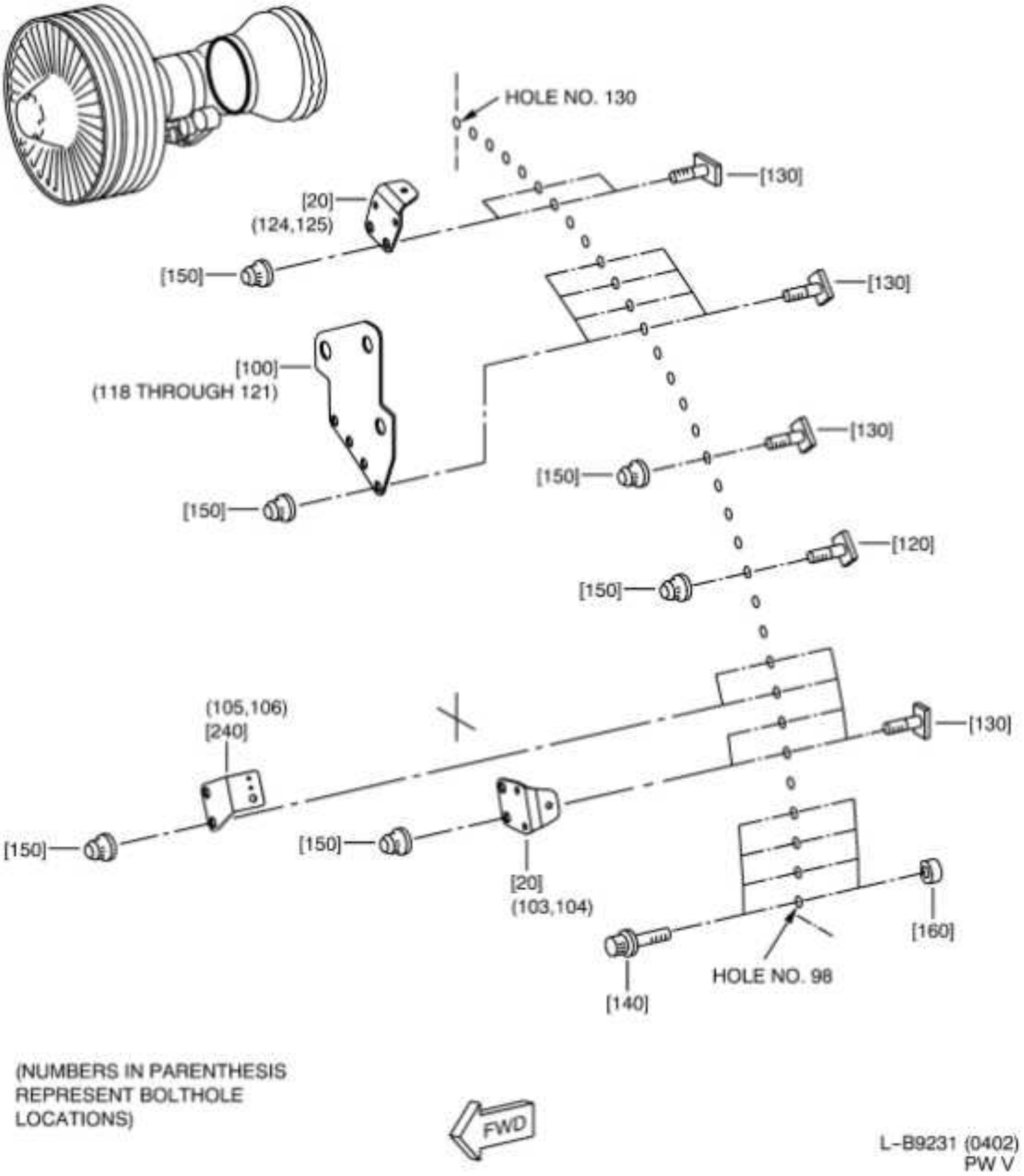
The Flange M Brackets And Hardware
Figure 401 (Sheet 5)
(Task 72−00−52−420−020)


HOLE NO. 33
(36,37)
[50A]
[170]
[180]
[160]
[140]
(47,48)
[20]
[130]
[130]
[150]
[130]
[155B]
[150]
[120]
[150]
HOLE NO. 65
[60A]
(49 THROUGH 52)
LOCATING PIN
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B9230 (0402)
PW V

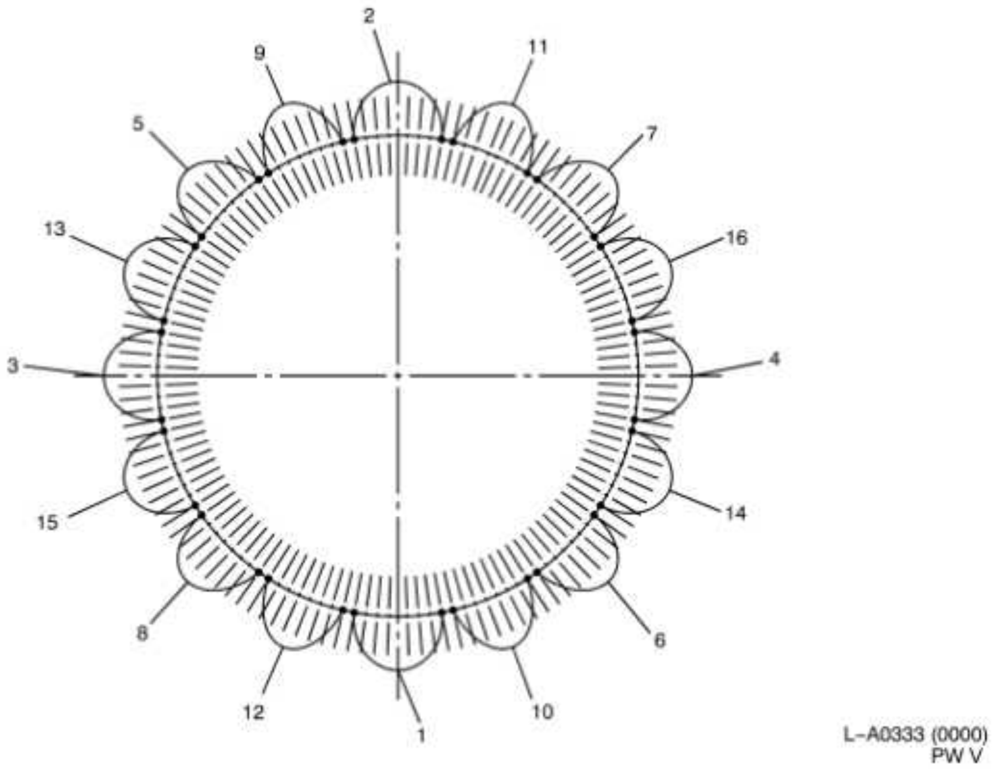
The Flange M Brackets And Hardware
Figure 401 (Sheet 6)
(Task 72−00−52−420−020)


HOLE NO. 97
(95,96)
[20]
[130]
[150]
[80B]
(73,74)
(POST SB PW4ENG 72-75)
[140]
[160]
[150]
[150]
[80A]
(73,74)
(POST SB PW4ENG
79-75)
[70]
(71,72)
HOLE NO. 65
[130]
[130]
[130]
[150]
[20]
(69,70)
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L-A9406 (0402)
PW V

The Flange M Brackets And Hardware
Figure 401 (Sheet 7)
(Task 72−00−52−420−020)


HOLE NO. 130
[130]
[20]
(124,125)
[150]
[130]
[100]
(118 THROUGH 121)
[150]
[130]
[150]
[150]
[120]
(105,106)
[240]
[130]
[150]
[150]
[20]
(103,104)
[160]
[140]
HOLE NO. 98
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B9231 (0402)
PW V

The Flange M Brackets And Hardware
Figure 401 (Sheet 8)
(Task 72−00−52−420−020)


2
9
11
5
7
13
16
3
4
15
14
8
6
12
10
1
L−A0333 (0000)
PW V

Flange M Bolt Torquing Sequence Diagram
Figure 402
(Task 72−00−52−420−020)

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ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−01

Task 72−00−52−990−001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (−) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (−) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
810	B	HPC Drum Rotor Disk (Rear Hub) Assembly (72−35−08) Turbine Front Hub (Stage 1) (72−52−05) (See Figure 801)				
		HPC Hub	7.1455 (181.496)	7.1465 (181.521)		
		HPT Hub	7.1335 (181.191)	7.1355 (181.241)	.010T (0.254T)	.013T (0.330T)
811	B	Turbine Front Hub (Stage 1) (72−52−05) No. 3 Bearing Rear Cooling Duct Assembly (72−41−88) (See Figure 801)				
		Hub	7.988 (202.90)	7.998 (203.15)		
		Duct	8.098 (205.690)	8.102 (205.790)	.100 (2.54)	.114 (2.90)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
812		Stage 1 HPT (Inner Rotating) Air Seal (72−52−21) Stage 1 HPT Blade Cooling Duct Assembly (72−51−03) (See Figure 801)				
		Radial Gap Cold −	Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357.			
813		Stage 1 HPT (Outer Rotating) Air Seal (72−52−20) Stage 1 HPT Blade Cooling Duct Assembly (72−51−03) (See Figure 801)				
		Radial Gap Cold −	Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357.			
814	B	HPC Drum Rotor Disk (Rear Hub) Assembly) (72−35−08) Turbine Intermediate Hub (Stage 2) (72−52−06) (See Figure 801)				
		HPC Hub	6.5947 (167.506)	6.5957 (167.530)		
		HPT Hub	6.5827 (167.201)	6.5847 (167.251)	.007T* (0.178T)*	.013T (0.330T)
815 (1)	B	Turbine Case Assembly (Prior to PN 50L542) (72−52−30) Diffuser Case Assembly (72−41−01) (See Figure 802)				
		Turbine Case	38.839 (986.511)	38.845 (986.663)		
		Diffuser Case	38.827 (986.206)	38.833 (986.358)	.006T (0.15T)	.018T (0.46T)
815 (2)	B	Turbine Case Assembly (PN 50L542 and Subsequent) (72−52−30) Diffuser Case Assembly (72−41−01) (See Figure 802)				
		Turbine Case	38.833 (986.358)	38.839 (986.511)		
		Diffuser Case	38.827 (986.206)	38.833 (986.358)	.000 (0.00)	.012T (0.30T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
816	B	HPC Drum Rotor Disk (Rear Hub) Assembly (72−35−08) No. 3 Bearing (And HPT) Retaining Nut (72−52−80) (See Figure 801)				
		Hub	6.5947 (167.506)	6.5957 (167.530)		
		Nut	6.5967 (167.557)	6.5987 (167.606)	.001 (0.026)	.0052* (0.132)*
844	B	HPC Drum Rotor Disk (Rear Hub) Assembly (72−35−08) Turbine Shaft Spacer (72−52−83) (See Figure 801)				
		Disk (Hub)	6.5947 (167.506)	6.5957 (167.530)		
		Spacer	6.5967 (167.557)	6.5987 (167.606)	.001 (0.026)	.0052* (0.132)*

G. Spline Data

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limit Min	Max
954	B	1. No. 3 Bearing Retaining Nut (72−52−80) Internal Spline (See Figure 801)				
		A. Effective Space Width	.0785 (1.994)	−−−		
		B. Actual Space Width	−−−	.0833 (2.116)		
		2. No. 3 Bearing Nut Lock (72−52−81) External Spline (See Figure 801)				
		A. Effective Tooth Thickness	−−−	.0750 (1.905)		
		B. Actual Tooth Thickness	.0704	−−−		

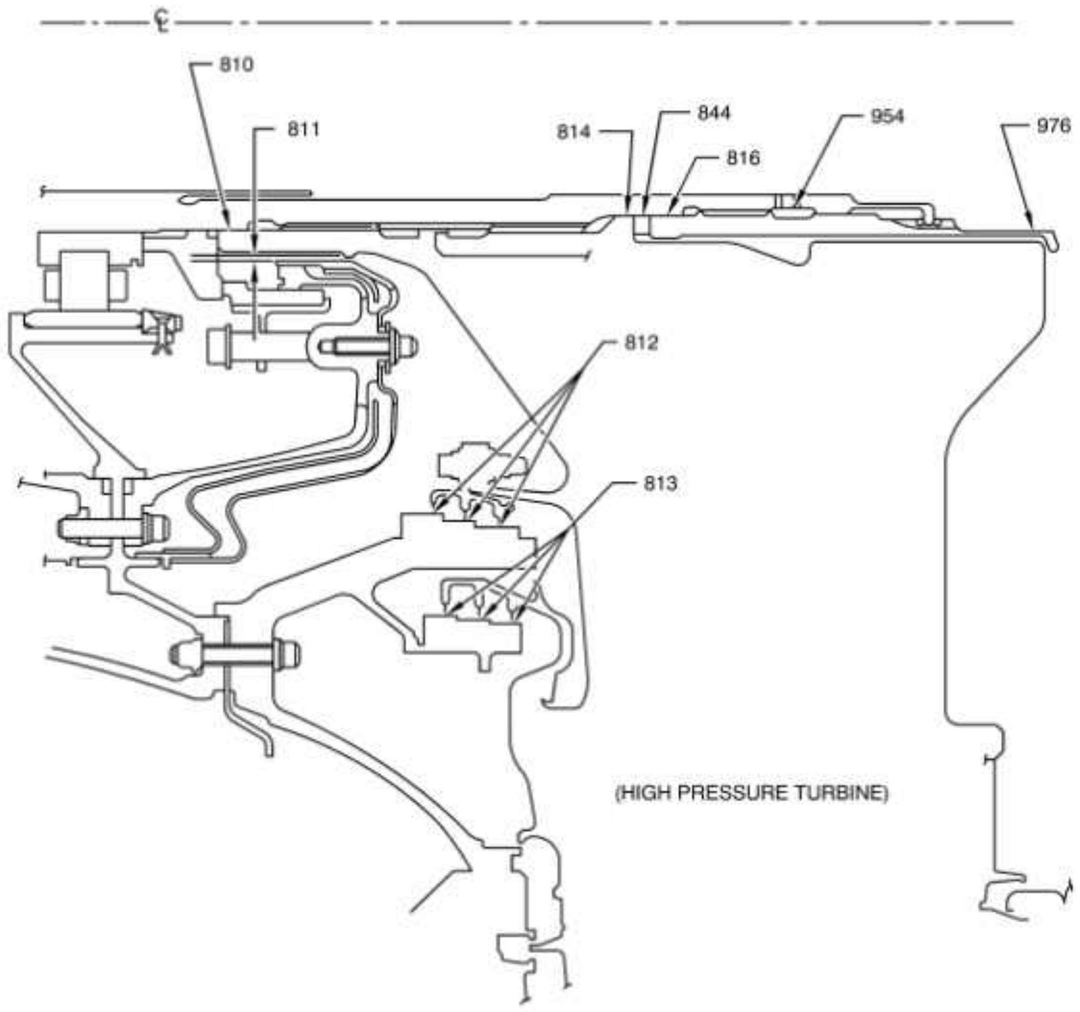
Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limit Min	Limit Max
(CONTINUED)						
			(1.788)			
		3. Fit			.0035 (0.089)	---

H. Special Torques

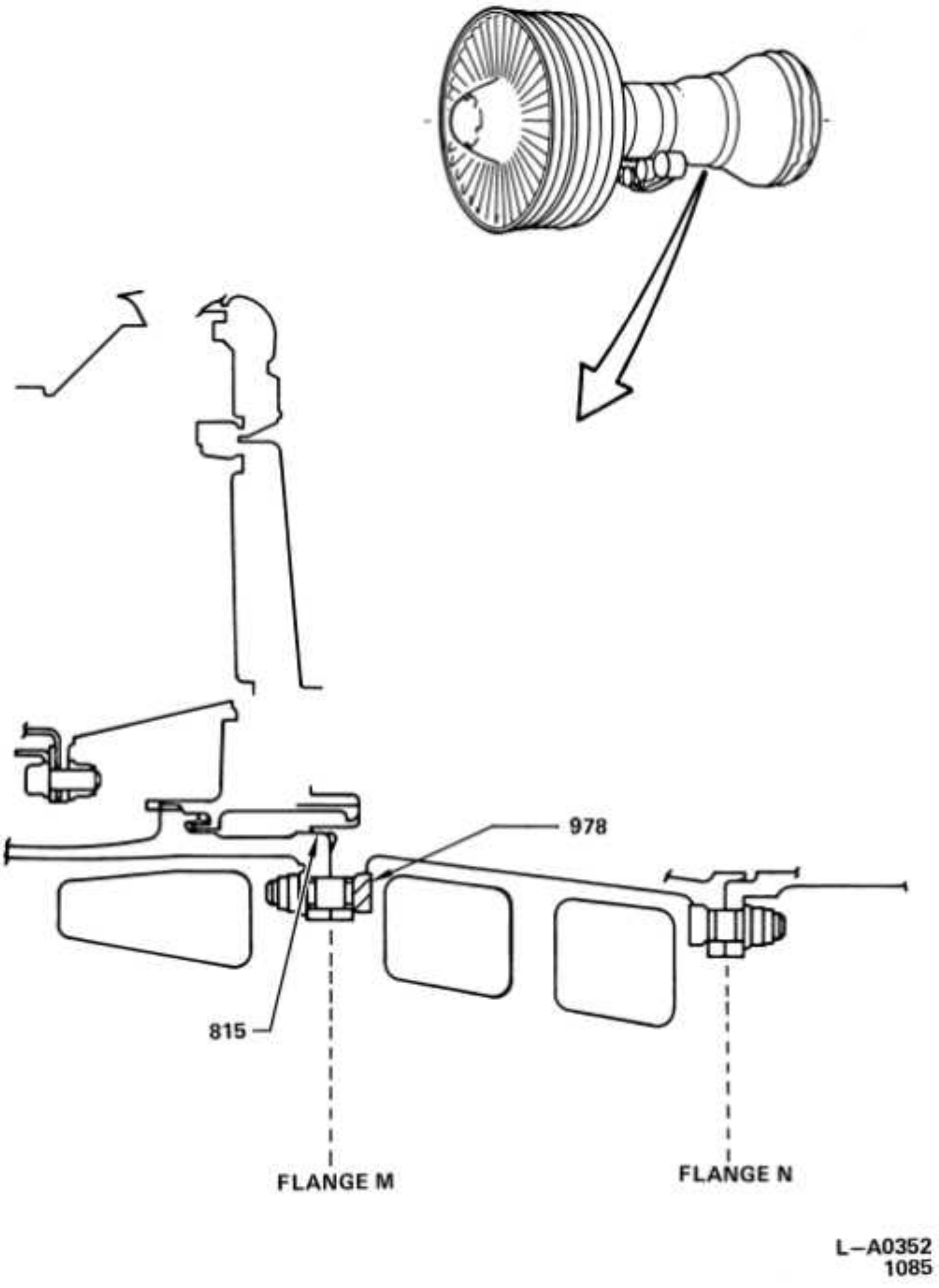
Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
978	A	Peripher Bolts And Nuts At M-Flange (See Figure 802) See 72-00-52, Installation-01 (Task 72-00-52-420-001) See 72-00-52, Installation-08 (Task 72-00-52-420-002)				

I. Special Assembly Procedures

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
976	A	High Pressure Compressor (HPC), Diffuser And Combustor, Turbine Nozzle, High Pressure Turbine (HPT) And Associated No. 3 Bearing Compartment Parts Assembly Procedure (See Figure 801) See 72-00-52, Installation-01 (Task 72-00-52-420-001) See 72-00-52, Installation-08 (Task 72-00-52-420-002)				
2151	A	Hose/Tube Clamp Screws See 72-00-52, Installation-06 (Task 72-00-52-450-003)				


℄
810
811
814
844
816
954
976
812
813
(HIGH PRESSURE TURBINE)
L−A0353 (0599)
PW V

High Pressure Turbine (HPT)
Figure 801
(Task 72−00−52−990−001)


978
815
FLANGE M
FLANGE N
L−A0352
1085

High Pressure Turbine (HPT)
Figure 802
(Task 72−00−52−990−001)

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−01

Task 72−00−52−990−002:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (−) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (−) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
810	B	HPC Turbine Driveshaft (72-35-09)				
		Turbine Front Hub (Stage 1) (72-52-05)				
		(See Figure 801)				
		Driveshaft	7.1455	7.1465		
			(181.496)	(181.521)		
		HPT Hub	7.1335	7.1355	.010T	.013T
			(181.191)	(181.241)	(0.254T)	(0.330T)
811	B	Turbine Front Hub (Stage 1) (72-52-05)				
		No. 3 Bearing Rear Cooling Duct Assembly (72-41-88)				
		(See Figure 801)				
		Hub	7.988	7.998		
			(202.90)	(203.15)		
		Duct	8.098	8.102	.100	.114
			(205.690)	(205.790)	(2.54)	(2.90)
813		Stage 1 HPT (Outer Rotating) Air Seal (72-51-20)				
		Stage 1 HPT Blade Cooling Duct Assembly (72-51-03)				
		(See Figure 801)				
		Radial Gap Cold -		Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357.		
814	B	HPC Turbine Driveshaft (72-35-09)				
		Turbine Intermediate Hub (Stage 2) (72-52-06)				
		(See Figure 801)				
		Driveshaft	6.5947	6.5957		
			(167.506)	(167.530)		
		HPT Hub	6.5827	6.5847	.007T*	.013T
			(167.201)	(167.251)	(0.178T)*	(0.330T)
815	B	Turbine Case Assembly (PN 50L542 and Subsequent) (72-52-30)				
		Diffuser Case Assembly (72-41-01)				
		(See Figure 801)				
		Turbine Case	38.833	38.839		
			(986.358)	(986.511)		
		Diffuser Case	38.827	38.833	.000	.012T
			(986.206)	(986.358)	(0.00)	(0.30T)

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−01

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
816	B	HPC Turbine Driveshaft (72−35−09) No. 3 Bearing (And HPT) Retaining Nut (72−52−80) (See Figure 801)				
		Driveshaft	6.5947 (167.506)	6.5957 (167.530)		
		Nut	6.5967 (167.557)	6.5987 (167.606)	.001 (0.026)	.0052* (0.132)*
844	B	HPC Turbine Driveshaft (72−35−09) Turbine Shaft Spacer (72−52−83) (See Figure 801)				
		Driveshaft	6.5947 (167.506)	6.5957 (167.530)		
		Spacer	6.5967 (167.557)	6.5987 (167.606)	.001 (0.026)	.0052* (0.132)*

G. Spline Data

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
954	B	1. No. 3 Bearing Retaining Nut (72-52-80) Internal Spline (See Figure 801)				
		A. Effective Space Width	.0785 (1.994)	---		
		B. Actual Space Width	---	.0833 (2.116)		
		2. No. 3 Bearing Nut Lock (72-52-81) External Spline (See Figure 801)				
		A. Effective Tooth Thickness	---	.0750 (1.905)		
		B. Actual Tooth Thickness	.0704 (1.788)	---		
		3. Fit			.0035 (0.089)	---

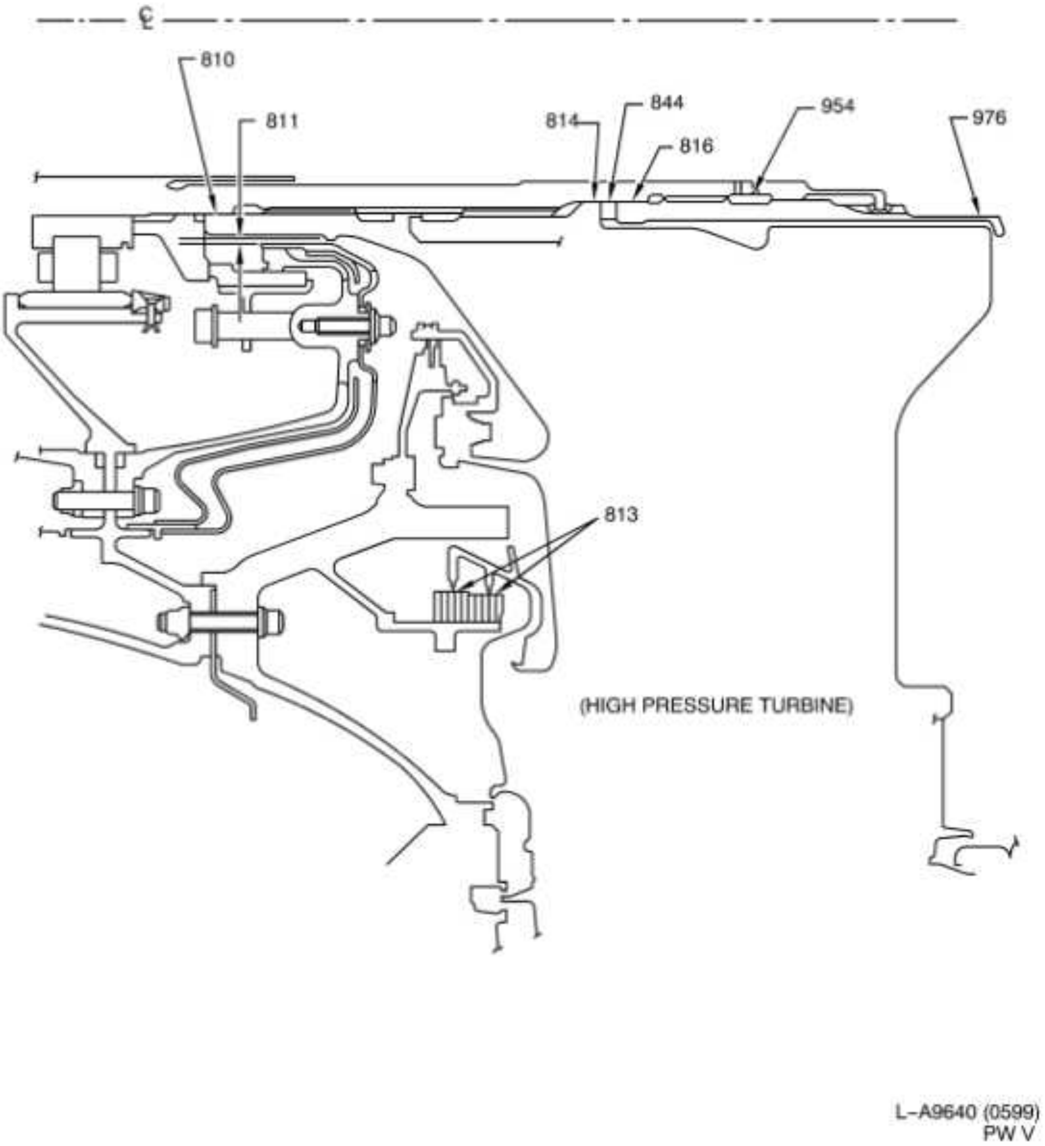
H. Special Torques

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
978	A	Periphery Bolts And Nuts At M-Flange (See Figure 802) See 72-00-52, Installation-01 (Task 72-00-52-420-001) See 72-00-52, Installation-08 (Task 72-00-52-420-002)				

I. Special Assembly Procedures

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−01

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
976	A	High Pressure Compressor (HPC), Diffuser And Combustor, Turbine Nozzle, High Pressure Turbine (HPT) And Associated No. 3 Bearing Compartment Parts Assembly Procedure (See Figure 801) See 72−00−52, Installation-01 (Task 72−00−52−420−001) See 72−00−52, Installation−08 (Task 72−00−52−420−002)				
2151	A	Hose/Tube Clamp Screws See 72−00−52, Installation−06 Task 72−00−52−450−003				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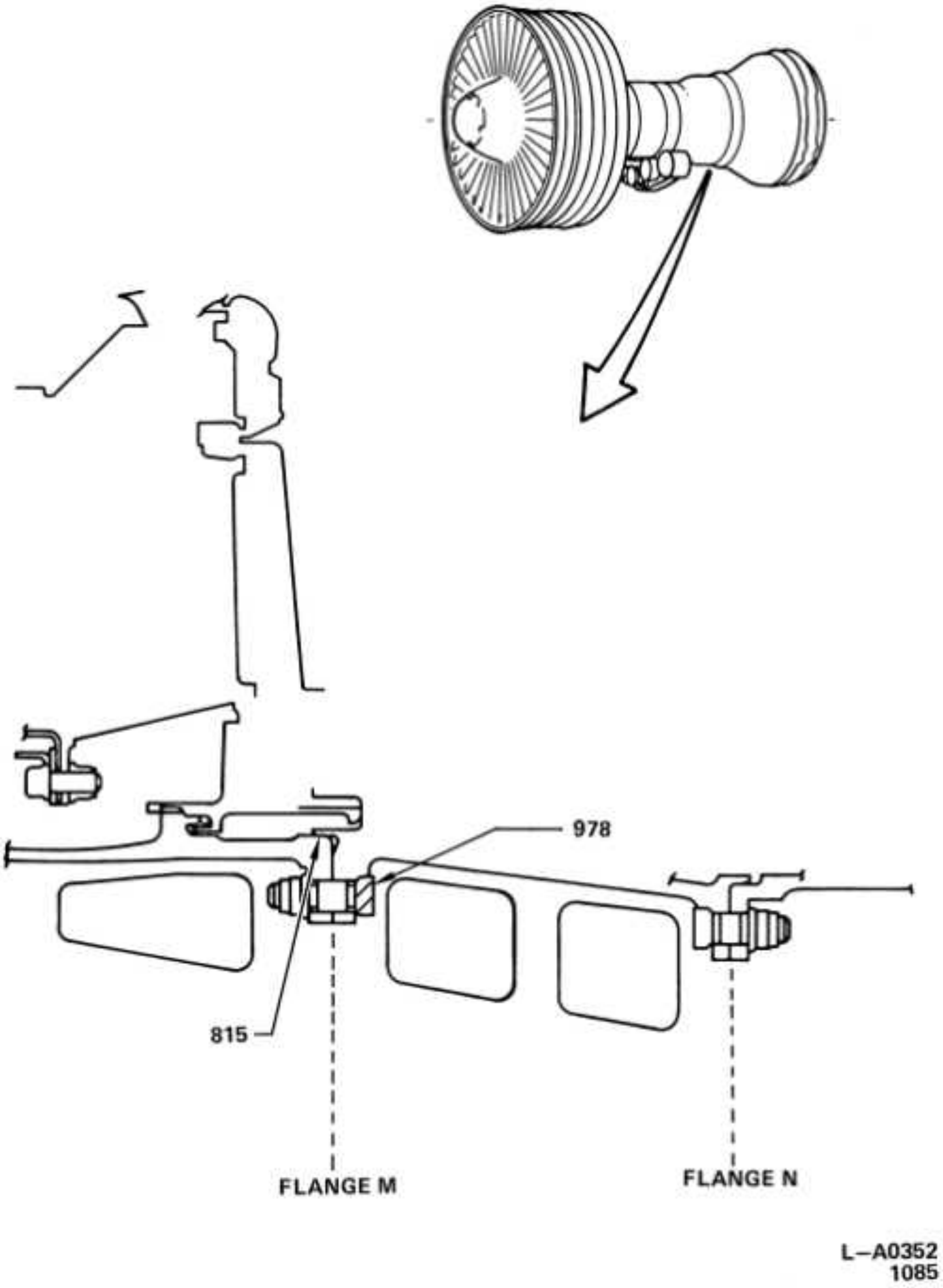
811
814
844
816
954
976
813
(HIGH PRESSURE TURBINE)
L−A9640 (0599)
PW V

High Pressure Turbine (HPT)
Figure 801
(Task 72−00−52−990−002)


978
815
FLANGE M
FLANGE N
L−A0352
1085

High Pressure Turbine (HPT)
Figure 802
(Task 72−00−52−990−002)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-52-200-002:

1. Visually Inspect High Pressure Turbine

A. Equipment And Materials Required − None

B. General Inspection Requirements

(1) Parts which are within the sealing surface rub limits can continue in service without repair. These limits are evaluated from the standpoint of structural integrity, gross performance deficiencies and dimensional requirements for assembly. Excessive discontinuities in rubstrips will cause a decrease in efficiency and performance, and therefore, replacement of the sealing surfaces is suggested if maximum performance levels are desired.

(2) Visually inspect the high pressure turbine for obvious surface defects and/or deformations which will preclude proper functioning of any of the parts. If defects are noted on any of the parts see the individual part section for damage limits.

C. Procedure

Subtask 72-00-52-220-051:

R (1) Visually examine the Stage 1 and Stage 2 HPT duct
R segments ceramic material. See Figure 801 and Table
R 801.

(a) Definitions of inspection terms.

1 Chipped Areas: Ceramic removal areas caused by mechanical means.

2 Cracks: Narrow surface openings where ceramic material has separated.

3 Spalled Areas: Loss of ceramic material down to or into the ceramic/metallic layer caused by engine operating temperatures.

4 Erosion: Loss of the top porous layer of ceramic caused by the impingement of hot gaspath air.

Subtask 72−00−52−220−052:

R (2) Use feeler stock to make an inspection of the Stage
R 1 HPT blade tip clearance. Do the inspection at
R eight blade locations in non−spalled regions of the
R duct segments. The blade tip clearance must be in the
R limits given in Table 802. See Figure 802.

R (3) Use feeler stock to make an inspection of the Stage
R 2 HPT blade tip clearance. Do the inspection at
R eight blade locations in non−spalled regions of the
R duct segments. The blade tip clearance must be in the
R limits given in Table 802A. See Figure 802.

(4) Calculate the average clearance of the 8 measurements. This is the Average Clearance (AC).

(5) Make an estimate of the total percent of each duct segment surface area that is spalled as follows:

  (a) Multiply the number of segments by the percentage of spalling.

  (b) Add the results of the previous step to get the total percent.

  (c) Divide the total percent by 21 to get the average percentage of spalling.

  EXAMPLE: Out of 21 duct segments, 5 are spalled. Two are spalled approximately 30 percent. Three are spalled approximately 50 percent.

    (1) Spalled Segments X percentage of spalling

      2 segments X 30 percent = 60 percent
      3 segments X 50 percent = 150 percent
      Total = 210 percent

    (2) 210 percent/21 segments = 10 percent
    Therefore 10 percent of the segment surface is spalled.

(6) Find the increase in clearance due to ceramic spalling. Refer to Figure 803. This is the Spall Clearance (SC).

(7) Add the Spall Clearance (SC) to the Average Clearance (AC) to find the Effective Clearance (EC).

R (8) Make sure that the Effective Clearance (EC) is in the limits given in Table 802 for the Stage 1 duct segments and Table 802A for the Stage 2 duct segments. If the Effective Clearance (EC) is not in the limits given, the duct segments and/or blades are not serviceable.

(9) Find the Total Effective Clearance Remaining (TECR) for the module as follows:

TECR = (MC1 − EC1) + (MC2 − EC2)

Where MC1 is the Reference Number 1740 maximum permitted radial clearance for Stage 1,
EC1 is the Effective Clearance for Stage 1,
MC2 is the Reference Number 1741 maximum permitted radial clearance for Stage 2,
EC2 is the Effective Clearance for Stage 2.

(10) Find the Exhaust Gas Temperature (EGT) and the Thrust Specific Fuel Consumption (TSFC) remaining on the module. Refer to Figure 804 and Figure 805.

(11) Find that if you use the module again, that it will perform as necessary.
- EGT Margin necessary for the engine
- TSFC necessary for the engine
- Overhaul interval necessary for the engine

R Subtask 72−00−52−220−053:

R (12) Visually examine the Stage 1 airsealing ring for rub track wear. Smooth wear to a maximum of 0.006 inch (0.152 mm) is permitted. See Figure 806.

R	Inspect	Serviceable Limits	Repairable Limits	Repair
	Ceramic Layer Spalling and Chipping	Any number of duct segments can have any amount of spalling in the ceramic layer.		
	Ceramic/Metallic Layer Spalling and Chipping	Only one segment can have one corner spall 50 percent axially and 0.900 inch (22.860 mm) circumferentially. Two segments with one corner spall each with as follows: One at 50 percent axially and 0.500 inch (12.700 mm) circumferentially. One at 25 percent axially and 0.250 inch (6.350 mm) circumferentially.		
	Blade Tip Rub/Erosion	Any amount if the blade tip clearance is within the limits.		
	Blade tip material transfer	Any amount		
	Ceramic Layer Cracks	Any number in the ceramic layer. Cracks can be any length and can intersect.		
	Ceramic/Metallic Layer Cracks	Any number in the ceramic/metallic layer in the region greater than 0.050 inch (1.270 mm) from the metal support. Cracks can be any length and can intersect. One crack up to 0.250 inch (6.350 mm) in length is permitted within 0.050 inch (1.270 mm) of the metal support.		

Duct Segment Ceramic Material Inspection
Table 801

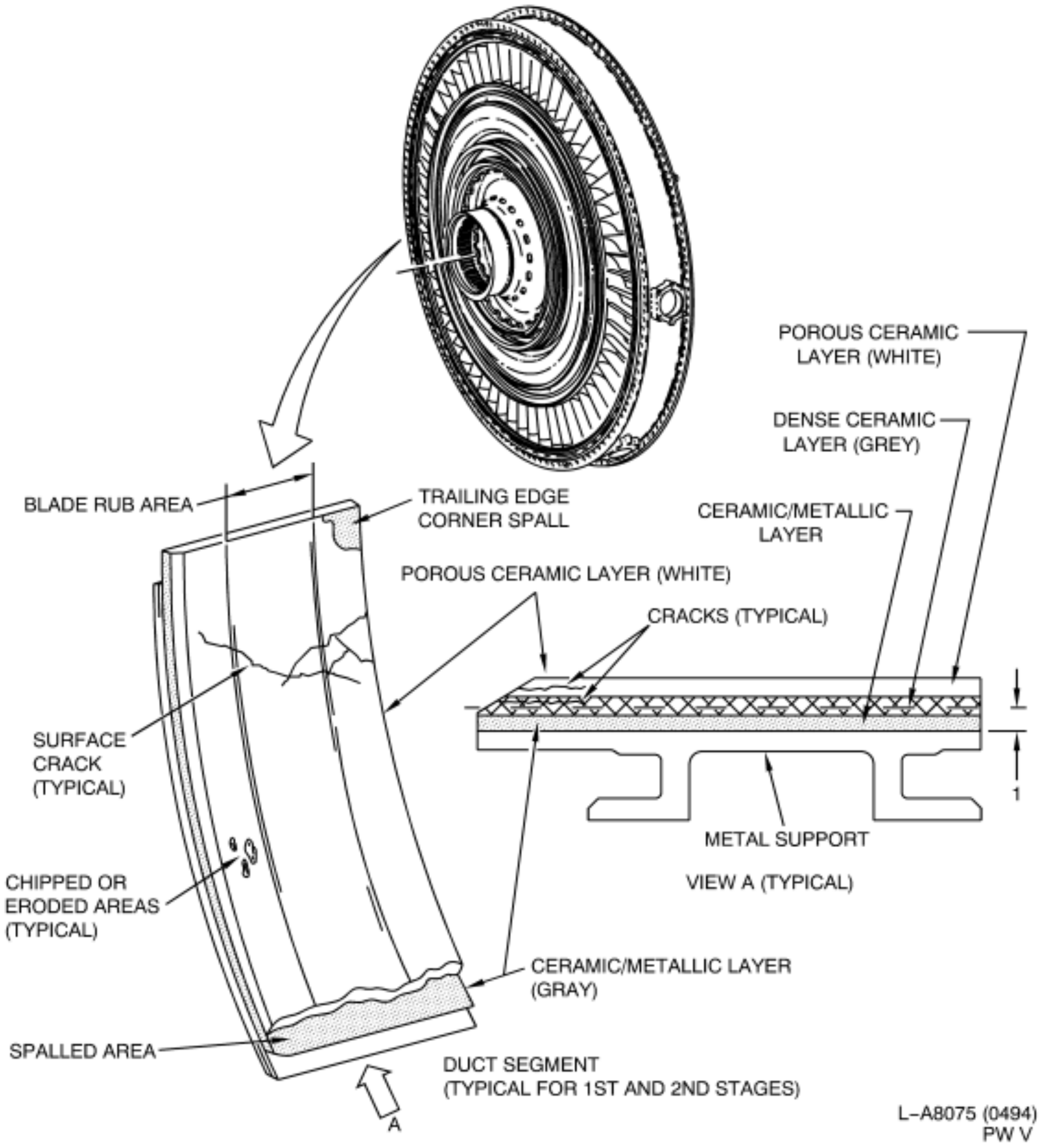
Reference Number	Maximum Acceptable Radial Clearance
1740	0.112 inch (2.845 mm) (Pre SB PW4ENG 72−712) 0.112 inch (2.845 mm) (Post SB PW4ENG 72−712)

Stage 1 HPT Blade Tip Clearance
Table 802

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−02

Reference Number	Turbine Intermediate Hub Part Number	Maximum Acceptable Radial Clearance
FOR THESE MODELS: 4152, 4156A, 4158		
1741	50L602, 50L602−001, 50L602−021, 50L602−022, 50L602−023, 50L602−024, 50L602−025, 50L602−026, 50L602−027	0.107 inch (2.718 mm)
FOR THESE MODELS: 4152, 4156A, 4158		
1741	50L902, 52L002, 50L902−021, 50L902−022, 53L602, 52L802, 52L002−021, 50L902−023	0.117 inch (2.972 mm)
FOR THESE MODELS: 4152−3, 4156A−3, 4158−3		
1741	53L602, 52L402, 52L802	0.117 inch (2.972 mm)

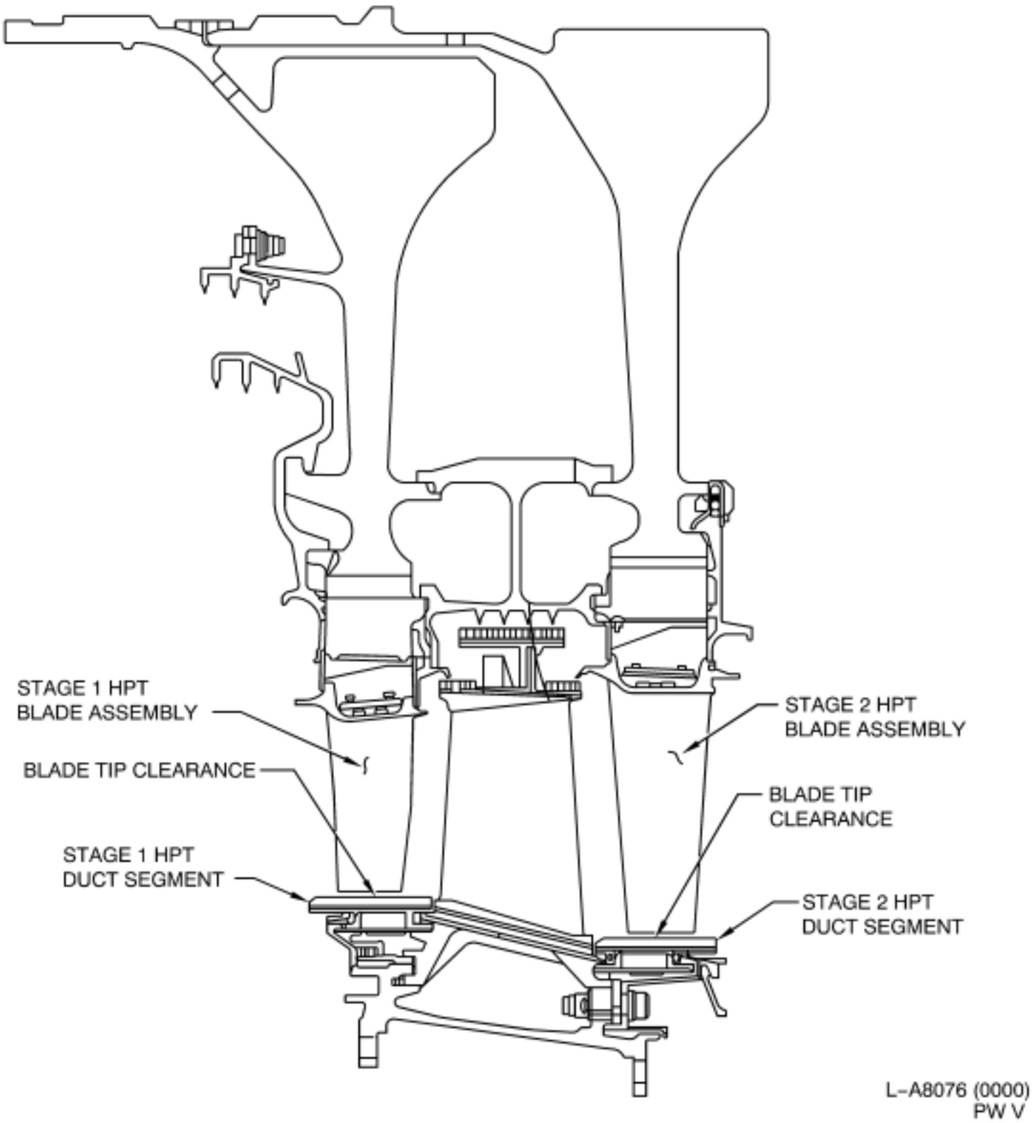
Stage 2 HPT Blade Tip Clearance
Table 802A


POROUS CERAMIC LAYER (WHITE)
DENSE CERAMIC LAYER (GREY)
CERAMIC/METALLIC LAYER
BLADE RUB AREA
TRAILING EDGE CORNER SPALL
POROUS CERAMIC LAYER (WHITE)
CRACKS (TYPICAL)
SURFACE CRACK (TYPICAL)
1
METAL SUPPORT
VIEW A (TYPICAL)
CHIPPED OR ERODED AREAS (TYPICAL)
CERAMIC/METALLIC LAYER (GRAY)
SPALLED AREA
DUCT SEGMENT (TYPICAL FOR 1ST AND 2ND STAGES)
A
L−A8075 (0494)
PW V

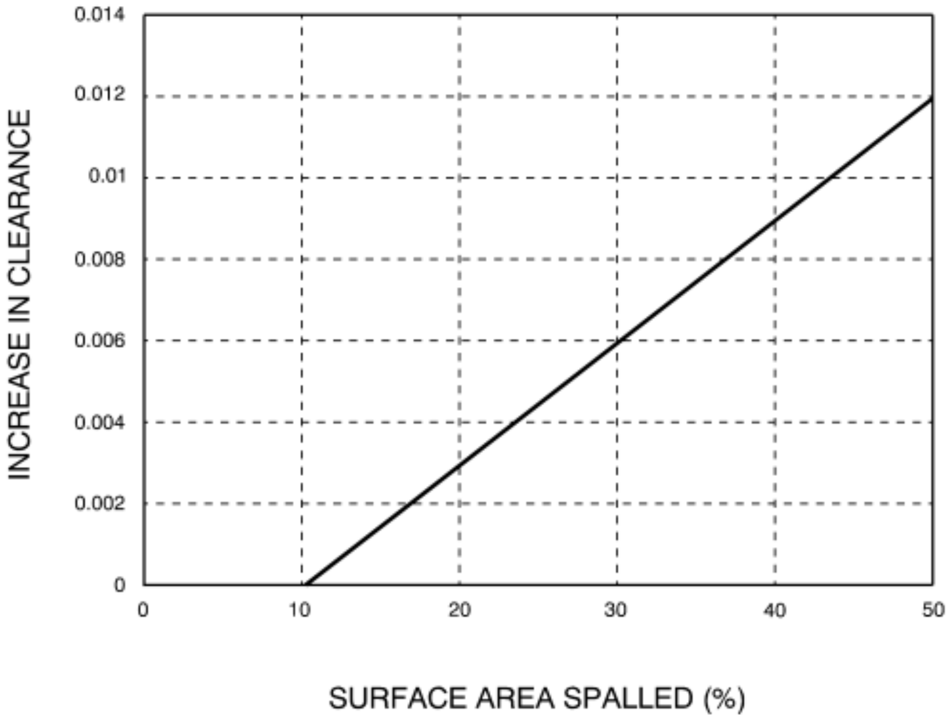
1. 0.050 Inch (1.270 mm), Reference

Duct Segment Ceramic Material Check
Figure 801
(Task 72−00−52−200−002)

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−02

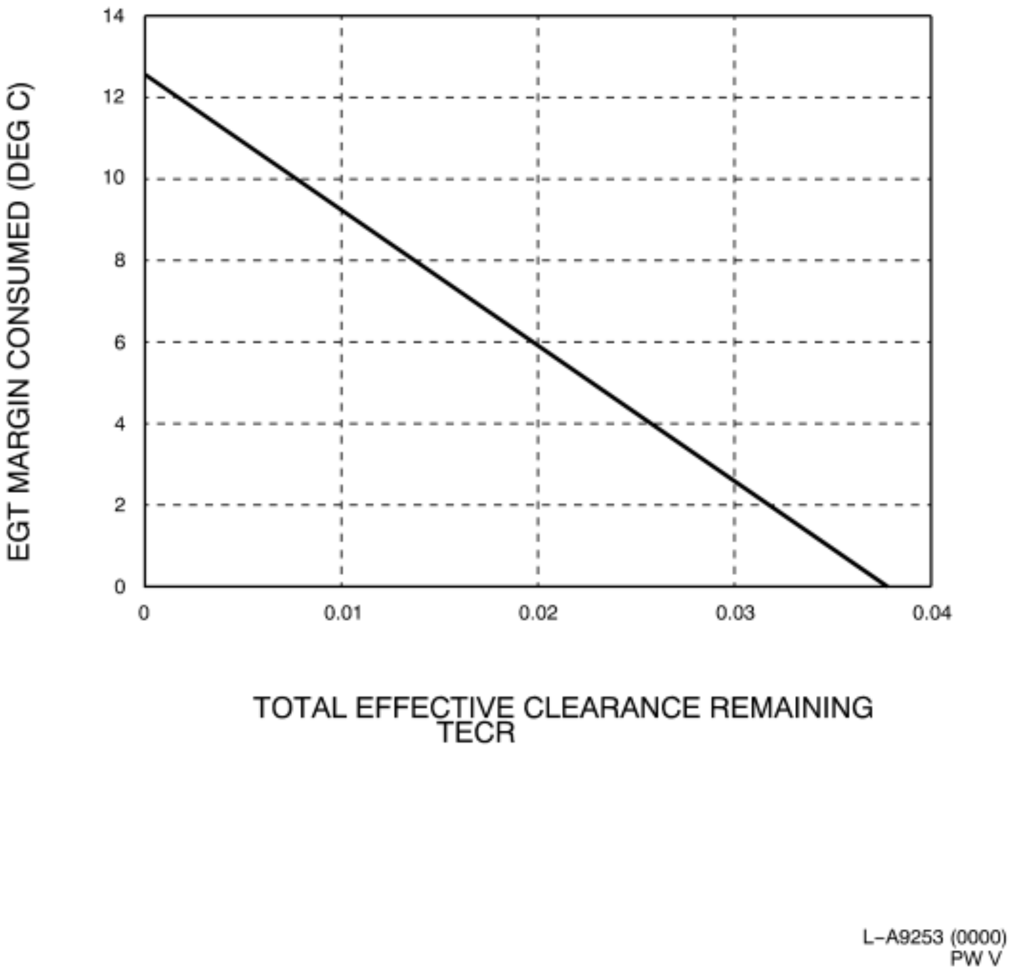

STAGE 1 HPT
BLADE ASSEMBLY
BLADE TIP CLEARANCE
STAGE 1 HPT
DUCT SEGMENT
STAGE 2 HPT
BLADE ASSEMBLY
BLADE TIP
CLEARANCE
STAGE 2 HPT
DUCT SEGMENT
L−A8076 (0000)
PW V

Blade Tip Clearance Check
Figure 802
(Task 72−00−52−200−002)

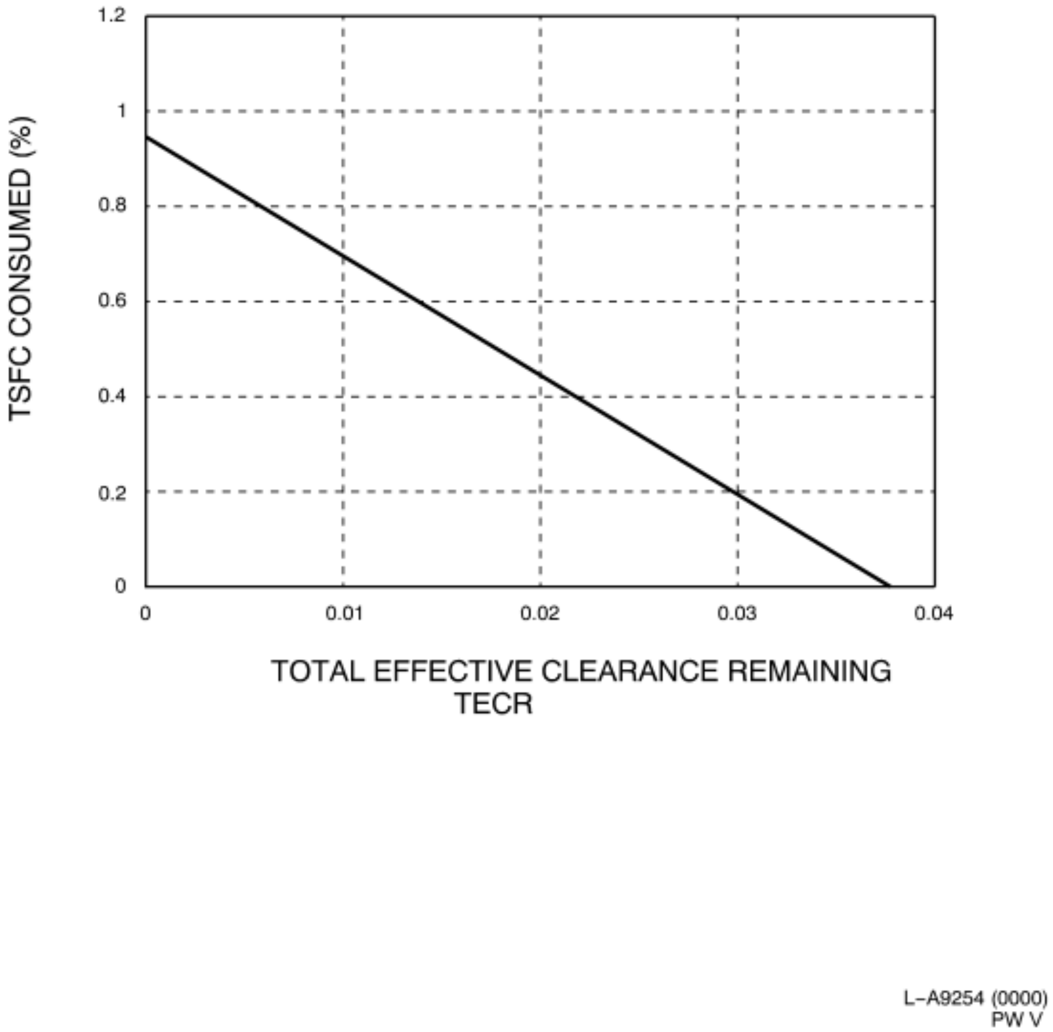


L-A9252 (0000)
PW V

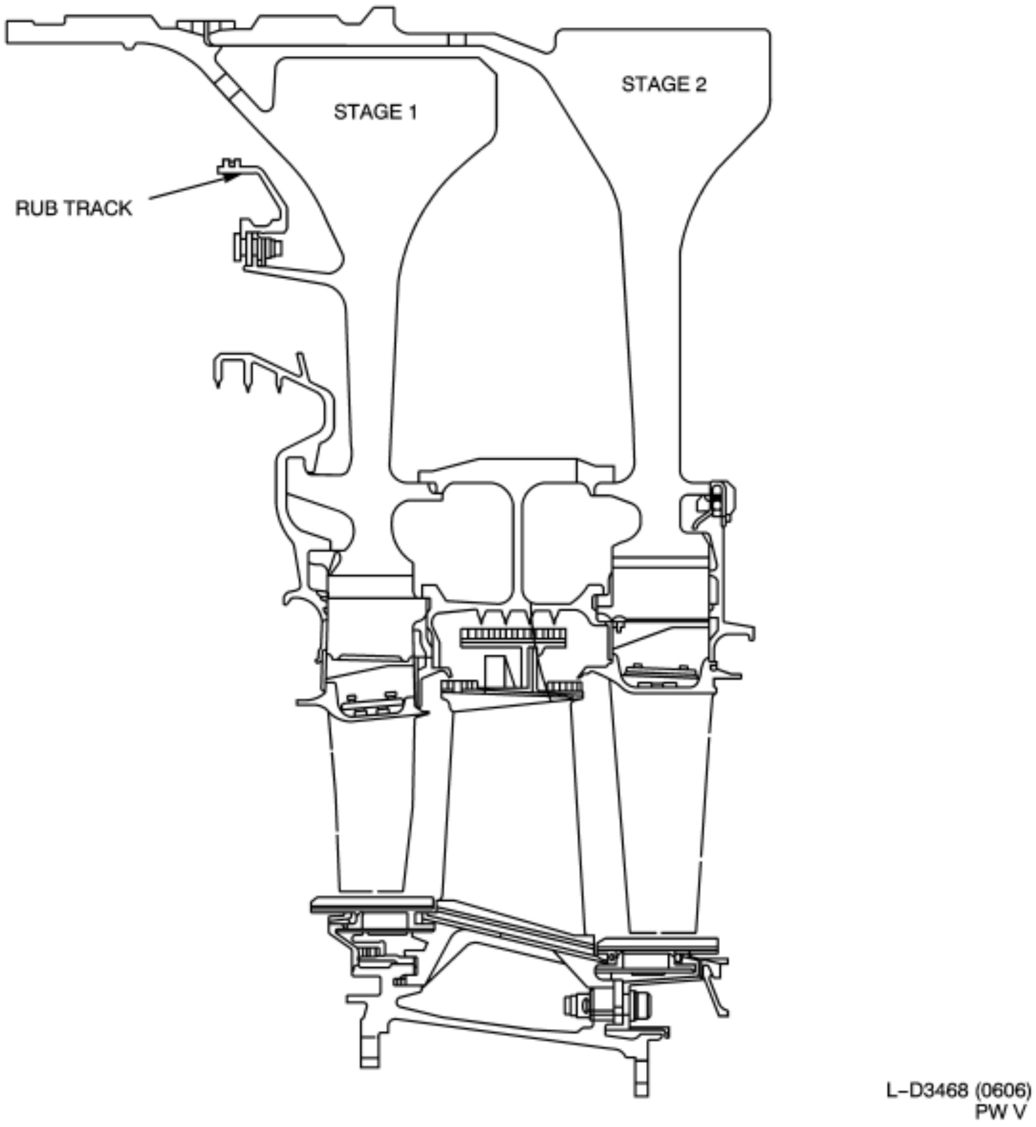
Increase In Blade Tip Clearance/Surface Area Spalled
Figure 803
(Task 72-00-52-200-002)



HPT Blade Tip Clearance Effect On EGT
Figure 804
(Task 72−00−52−200−002)



HPT Blade Tip Clearance Effect On TSFC
Figure 805
(Task 72−00−52−200−002)


STAGE 1
STAGE 2
RUB TRACK
L−D3468 (0606)
PW V

Stage 1 Airseal Rub Track Wear Check
Figure 806
(Task 72−00−52−200−002)

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R ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - INSPECTION/CHECK-03

R Task 72-00-52-200-003:

R 1. Examine The Stage 1 And Stage 2 HPT Blade Assemblies For
R Internal Sulfidation Distress

R A. General

R CAUTION: DO NOT CLEAN THE INTERNAL CAVITIES OF
R THE ENGINE RUN BLADES BEFORE YOU DO THIS
R INSPECTION.

R (1) The purpose of this inspection is to examine the stage
R 1 and stage 2 HPT turbine blades with a permeability
R probe for internal sulfidation. The probe will only
R touch the outer side of the blade airfoil for this
R procedure. This procedure is to examine the blades in
R a bladed rotor or module level configuration.

R NOTE: It is only permitted to clean the external blade
R surfaces using aqueous cleaning by SPOP 209
R (Task 70-21-00-110-041) or dry abrasive grit
R blast by SPOP 218 (Task 70-21-00-120-004) before
R this inspection.

R CAUTION: DO NOT LET THE PERMANENT MAGNET OF THE PROBE
R BECOME DEMAGNETIZED BY OTHER PERMANENT
R MAGNETS OR STRONG ALTERNATING CURRENTS.

R CAUTION: REMOVE THE PROBE PROTECTIVE CAP ONLY WHEN
R MEASUREMENTS WILL BE TAKEN.

R (2) This inspection uses the comparison method to find the
R presence of internal sulfidation with the use of PN
R 1.067-101-12 reference standard. Permeability between
R 1.4 and 1.5 is acceptable with the use of this standard
R only. The use of any other reference standards is not
R acceptable.

R (3) Only remove the probe protective cap from the probe to
R calibrate and take the inspection measurements.

R (4) It is recommended that you read the description and
R operating instructions manual for the Magnetoscop 1.069
R before you do this inspection. This will give you a
R basic knowledge of the Magnetoscop operation with the
R permeability probe.

R (5) The Magnetoscop 1.069 is the latest model release from
R Foerster Instruments Inc. Foerster no longer supports
R production of the Magnetoscop 1.067 and 1.068 models.

R ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−03

R (6) The PN 1.005−1526 permeability probe is manufactured with the Magnetoscop 1.069 adapter for bladed rotors or module inspection. This probe has a 1X sensitivity which will find the level of permeability necessary for this inspection.

R (7) If you use the older permeability probes, PN 1.005−1522 (1X), 1.005−1526 (1X), or 1.005−1532 (10X), designed for use with the Magnetoscop 1.067 and 1.068 models, it is necessary to use a PN 9064001 probe adapter with the Magnetoscop 1.069.

R B. Equipment And Materials Necessary

R Standard Tools:

Name	Manufacturer
Magnetoscop (T) Meter Model 1.069 Permeability Probe PN 1.005−1526 (1X) Or PN 1.005−1522 (1X) Or PN 1.005−1532 (10X)	Institute Dr. Foerster GmbH & Co. KG Im Laisen 70 D−72766 Reutlingen, Germany Or Foerster Instrument Inc. RIDC Park West 140 Industry Drive, Pittsburg, PA 15275 USA
Reference Standard PN 1.067−101−12	
Adapter, Magnetoscop 1.067/1.068 Probe PN 9064001	

R NOTE: All tools can be ordered from one of the above manufacturers.

R Consumable Materials:

Item No.	Designation
P05−018	Pencil, Metal Marking

R C. Calibration Procedure

R ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - INSPECTION/CHECK-03

R (1) Find an area for the inspection which does not have material (permeable or magnetic) that can change the meter needle deflection. See Figure 801 thru Figure 806 for all the tooling and inspection areas.

R (2) Connect the permeability probe to the Magnetoscop field intensity meter.

R (3) Set the power of the unit to ON. Let it operate for 10 minutes to warm up.

R (4) The instrument will find the type of probe you use. If you use an older Magnetoscop 1.067/1.068 probe which needs a 1.069 PN 9064001 probe adapter, a menu will show a list of probes you can use.

R (a) Select the applicable probe from the list.

R 1 If you use a new probe designed for the 1.069 model, the probe will be find it automatically.

R (5) Press the DC/AC/PERM (MODE) button until the instrument displays that it is in the Permeability Comparison Mode.

R (6) Press the RANGE button on the instrument.

R (a) Set the range so that the Magnetoscop will display readings between 1.000 and 2.000 mu.

R (7) Press the MENU button and select the calibration from the main menu.

R (8) Select OFFSET ADJUST from the calibration menu.

R (a) The instrument will adjust the offset of the system automatically. This can take up to one minute to complete.

R (b) The calibration menu will permit you to make another selection after you complete the offset.

R (9) Select PERM PROBE ZERO ADJUST from the calibration menu.

R (a) Adjust the thumb-wheel adjustment or the screw adjustment on the probe until the display is as near to zero as you can get it.

R ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−03

R (b) Once you do this, exit the menu.

R (10) Select the PERMEABILITY CALIBRATION from the
R calibration menu.

R (a) Input the calibration value from the reference
R standard into the instrument display, but do not
R press the ENTER key.

R (11) Put the 1.067−101−12 Reference Standard in an area away
R from permeable materials or magnetic fields.

R (12) Put the probe element on the center of the standard
R while you hold it perpendicular to the surface. See
R Figure 803.

R (13) Press the ENTER key on the instrument.

R (a) The instrument will calibrate itself with the
R value input from the reference standard. When
R completed, the display will return to the
R calibration menu.

R (b) Exit from this menu and the main menu, and then
R the calibration is complete.

R NOTE: When you remove the Magnetoscop from the
R standard and hold it in the air, the
R reading on the Magnetoscop must be 1.000 ±
R 0.005. If this is not the reading, then
R calibrate the system again.

R D. Inspection Procedure

R NOTE: Check the calibration of the permeability probe at
R the start and end of each inspection sequence or
R whenever the inspection was interrupted.

R CAUTION: DO NOT CLEAN THE BLADES INTERNALLY BEFORE
R YOU DO THE PERMEABILITY INSPECTION. THE
R PERMEABILITY LIMITS WERE ESTABLISHED ON
R BLADES THAT WERE IN SERVICE RUN CONDITION
R BEFORE CLEANING. CLEANING, ESPECIALLY THE
R INTERNAL CAVITY, BEFORE INSPECTION, CAN
R REMOVE THE SULFIDATION PRODUCT AND DECREASE
R THE PERMEABILITY VALUE. THIS WILL CHANGE
R THE CALIBRATED RELATIONSHIP BETWEEN THE
R PERMEABILITY AND THE REMAINING WALL THICKNESS

AND RESULT IN BLADES WITH AN UNSATISFACTORY WALL THICKNESS BEING RETURNED TO SERVICE.

(1) Remove all the dirt or deposits from the external airfoil surfaces with a soft bristle brush. See Figure 804.

(2) Traverse the permeability probe tip in a perpendicular orientation, along the external surfaces that you will examine, while you watch the meter for permeability indications. See Figure 805 and Figure 806.

(a) Traverse along the airfoil surface at a constant speed of 0.25 inch (6.35 mm) to 0.50 inch (12.7 mm) per second.

(b) If permeability indications are found, find the area which has the maximum permeability.

(c) Record the maximum permeability at the corresponding location on the airfoil surface. Use on a Metal Marking Pencil P05-018 to mark the blade airfoil.

E. Blade Inspection Limits

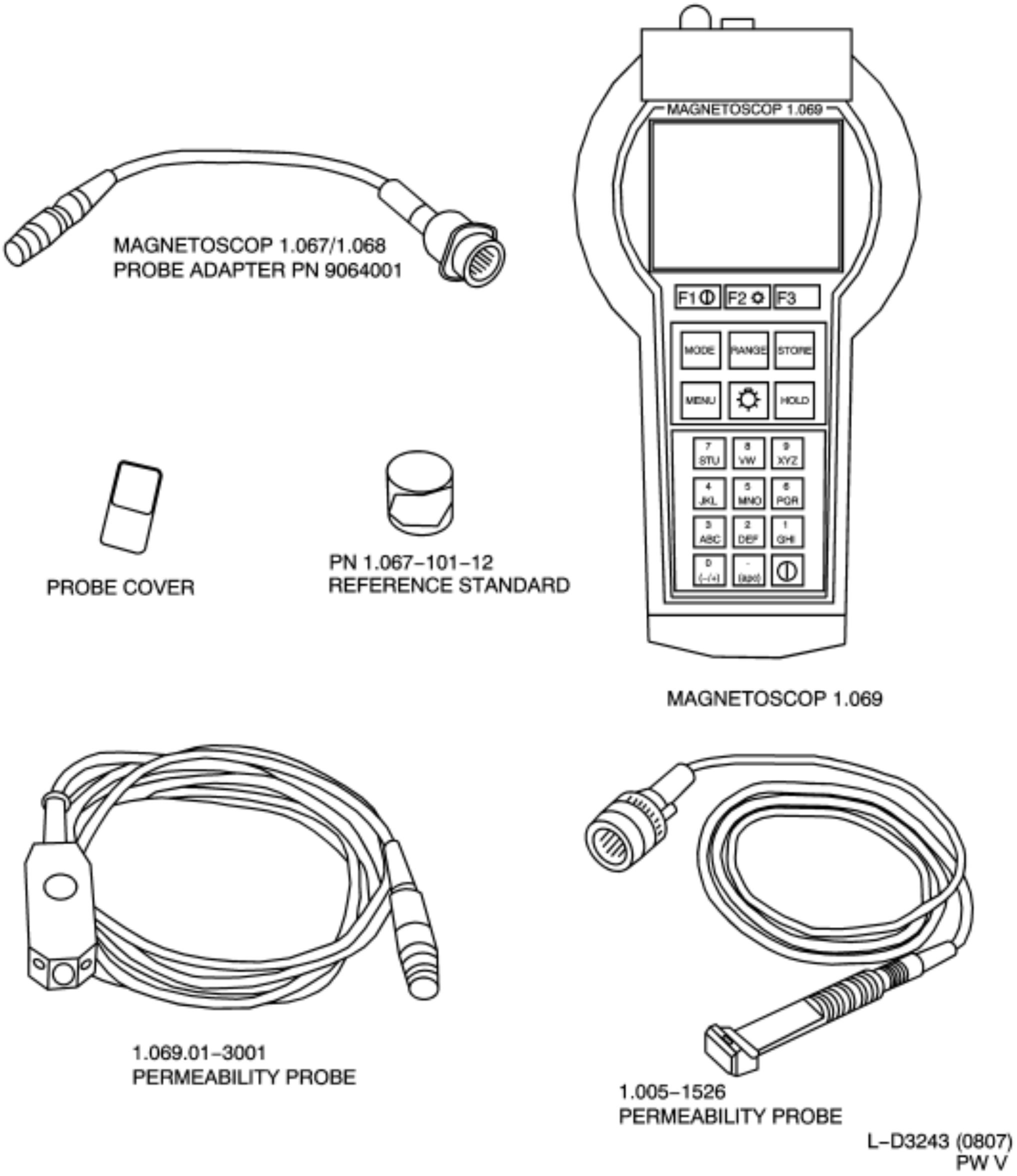
(1) All Stage 1 HPT blades which show a permeability equal to or more than 1.080 on the airfoil in the inspection area must be removed from service.

(2) All Stage 2 HPT blades which show a permeability equal to or more than 1.060 on the airfoil in the inspection area must be removed from service.

F. Report Of Inspection Results

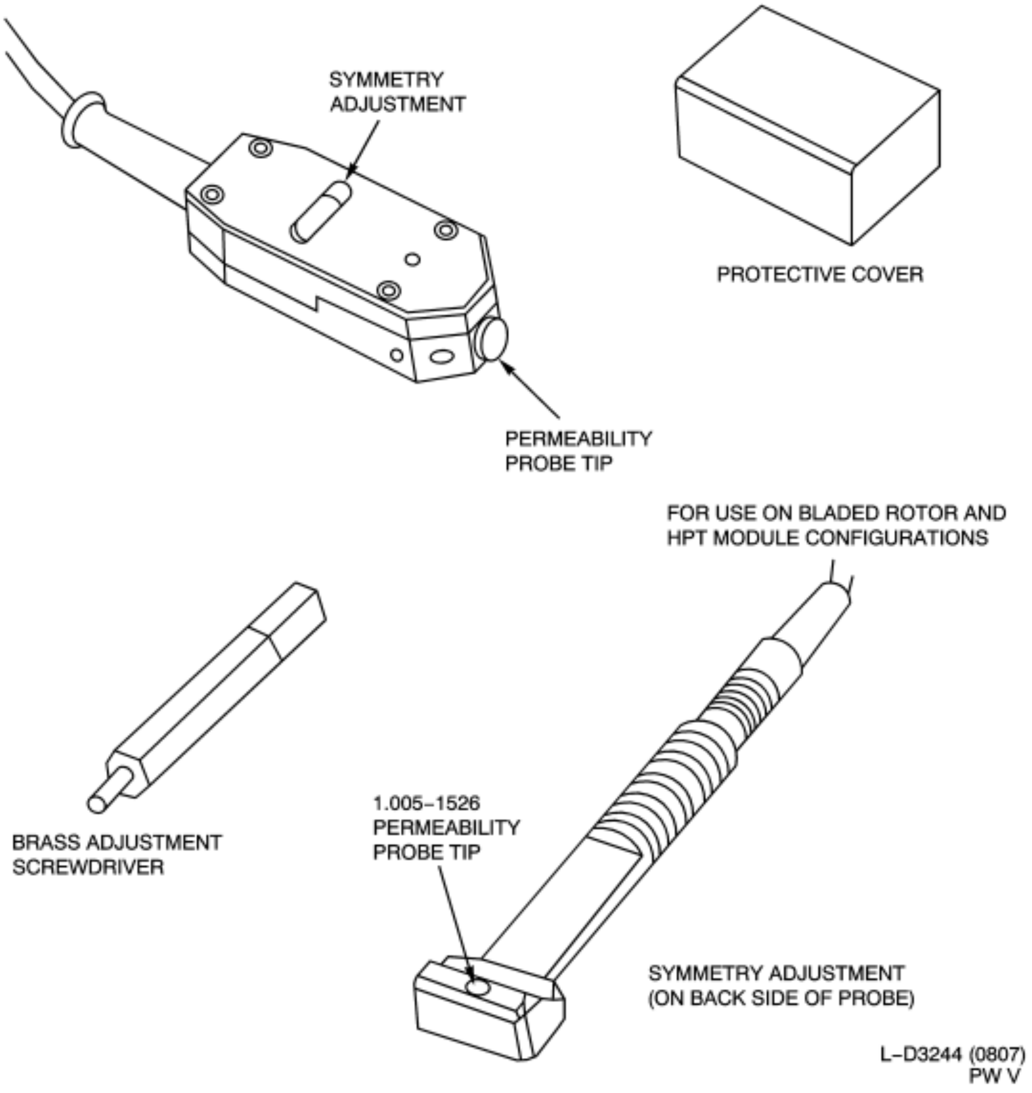
(1) Report the inspection results to the local Pratt & Whitney Representative. Give the information which follows:

- Engine Serial Number
- Operator:
- Stage 1 HPT Blade Part Number:
- Stage 2 HPT Blade Part Number:
- Total Part Time:
- Total Part Cycles:
- Inspection Method:
- Results For Rejected Stage 1 Or Stage 2 HPT Blades:

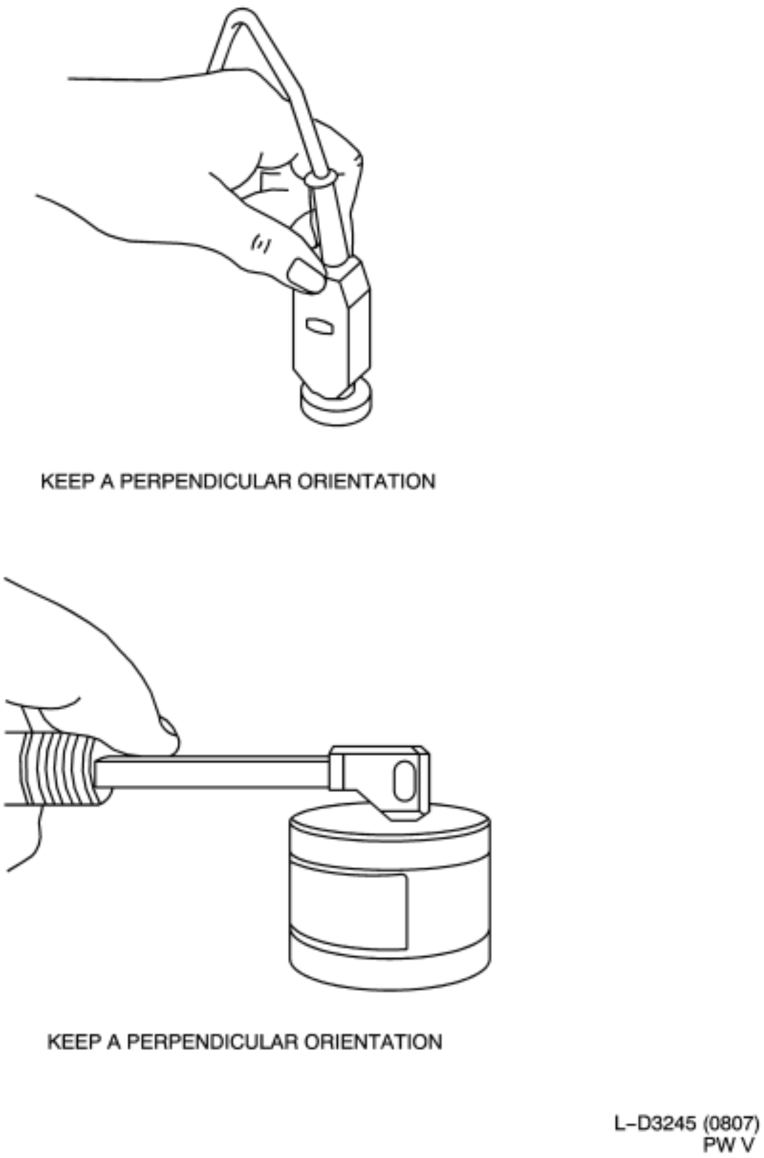

MAGNETOSCOP 1.067/1.068
PROBE ADAPTER PN 9064001
MAGNETOSCOP 1.069
F1
F2
F3
MODE
RANGE
STORE
MENU
HOLD
7 STU
8 VW
9 XYZ
4 JKL
5 MNO
6 PQR
3 ABC
2 DEF
1 GHI
PROBE COVER
PN 1.067−101−12
REFERENCE STANDARD
MAGNETOSCOP 1.069
1.069.01−3001
PERMEABILITY PROBE
1.005−1526
PERMEABILITY PROBE
L−D3243 (0807)
PW V

R Permeability Equipment Necessary
R Figure 801
R (Task 72−00−52−200−003)

R ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−03

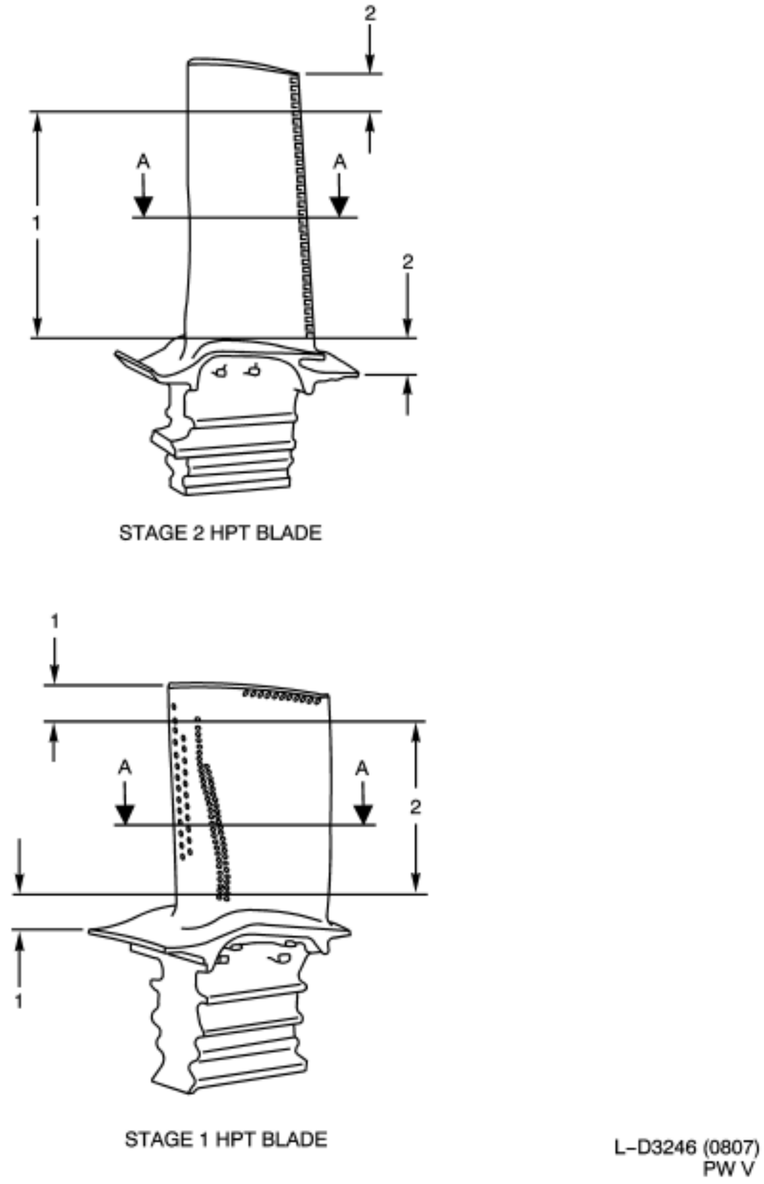

SYMMETRY ADJUSTMENT
PROTECTIVE COVER
PERMEABILITY PROBE TIP
FOR USE ON BLADED ROTOR AND HPT MODULE CONFIGURATIONS
BRASS ADJUSTMENT SCREWDRIVER
1.005−1526 PERMEABILITY PROBE TIP
SYMMETRY ADJUSTMENT (ON BACK SIDE OF PROBE)
L−D3244 (0807)
PW V

R Permeability Probes
R Figure 802
R (Task 72−00−52−200−003)


KEEP A PERPENDICULAR ORIENTATION
KEEP A PERPENDICULAR ORIENTATION
L−D3245 (0807)
PW V

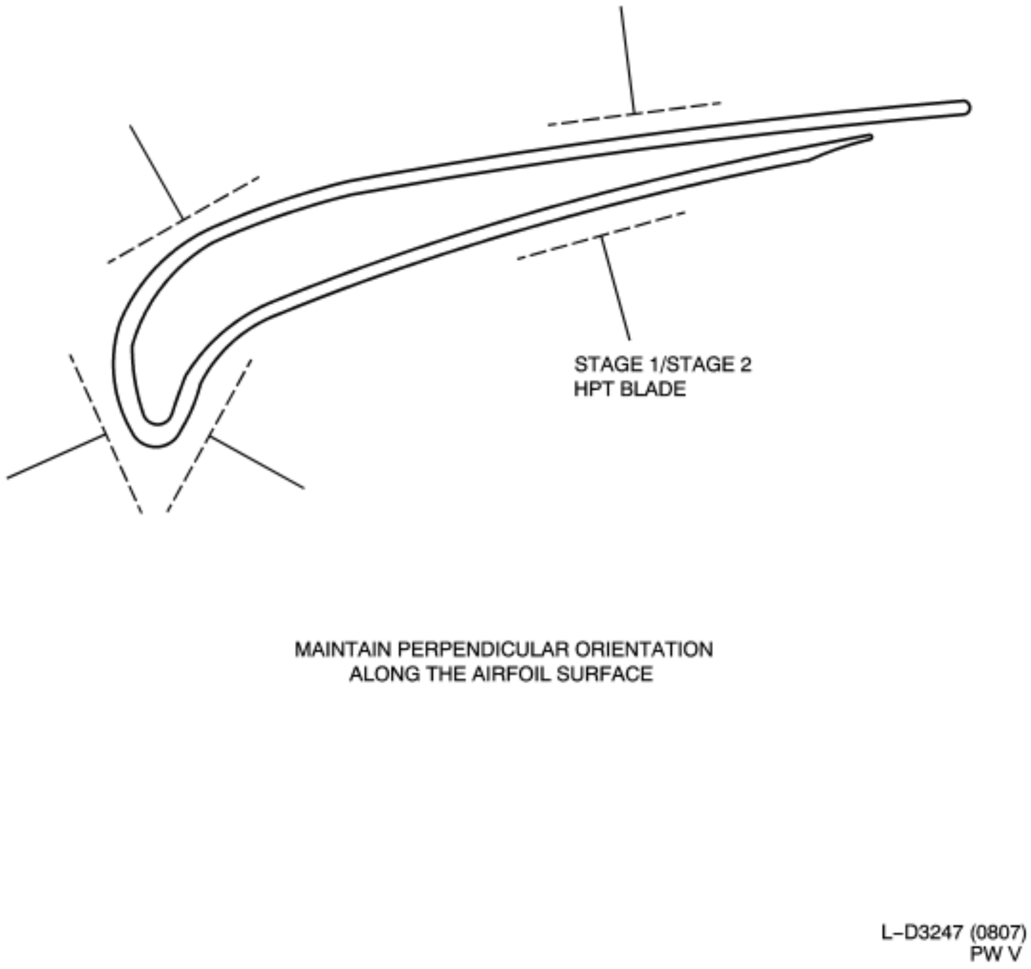
R Orientation Of Permeability Probes To Reference Standard
R Figure 803
R (Task 72−00−52−200−003)

R ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−03

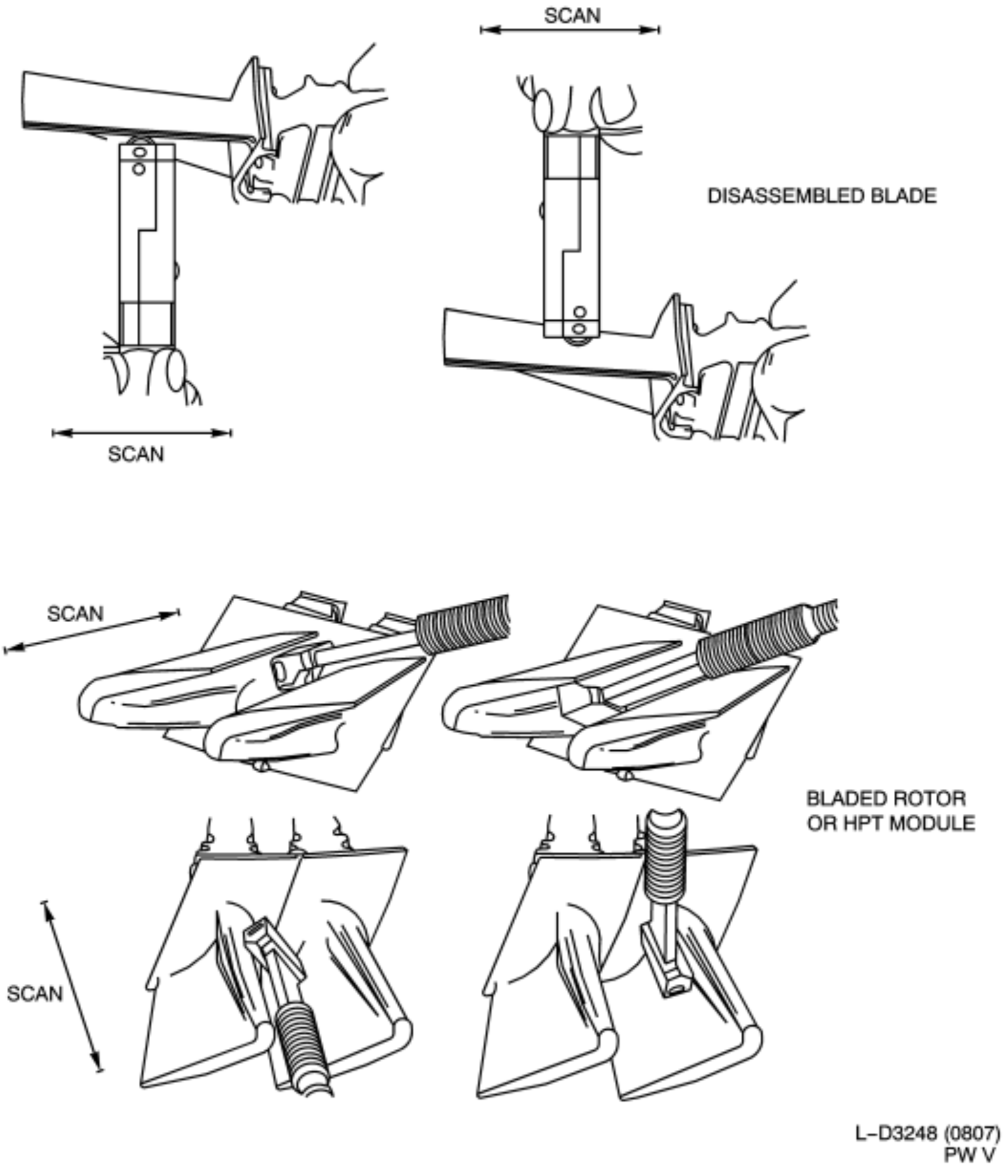

2
A
A
1
2
STAGE 2 HPT BLADE
1
A
A
2
1
STAGE 1 HPT BLADE
L−D3246 (0807)
PW V

R 1. 0.500 Inch (12.700 mm)
R 2. Blade Airfoil Inspection Areas On The Concave And Convex Sides.

R Stage 1 And Stage 2 HPT Blade Inspection Areas
R Figure 804
R (Task 72−00−52−200−003)


STAGE 1/STAGE 2
HPT BLADE
MAINTAIN PERPENDICULAR ORIENTATION
ALONG THE AIRFOIL SURFACE
L−D3247 (0807)
PW V

R Position Of Probe Along Airfoil Surfaces
R Figure 805
R (Task 72−00−52−200−003)


SCAN
SCAN
DISASSEMBLED BLADE
SCAN
BLADED ROTOR
OR HPT MODULE
SCAN
L−D3248 (0807)
PW V

R Position Of Probe And Scan Direction Along Airfoil Surfaces
R Figure 806
R (Task 72−00−52−200−003)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−10

Task 72-00-52-210-010:

1. Visually Examine The High Pressure Turbine (HPT) Module Assembly − Engine General − High Pressure Turbine (HPT)

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P05−421	Nylon Pads And Rolls Abrasive−Impregnated (PMC 4095)

B. General Inspection Limits

NOTE: All applicable Airworthiness Directives (AD's) must be complied with and these directives takes precedence over all inspections or repairs given in this module inspection.

(1) This inspection does not permit time since overhaul to be set to zero. The use of the limits in this inspection will not give the performance restoration.

(2) These procedures give instructions for the visual inspection of the high pressure turbine (HPT) module assembly after removal from the engine. Do these procedures before you do the preservation, packing or module installation procedure. This procedure is to find those easy to see types of damage, which can make it necessary to do more disassembly, inspection or repair. Refer to Section 70−31−00 for the general visual inspection instructions in the Standard Practices Manual, PN 585005.

(3) The inspection table in this section is applicable to the high pressure turbine (HPT) modules with some, none or all of the components installed. You do not have to disassemble the module assembly to do this inspection. You can choose to apply individual limits to those areas that are visible at all stages of disassembly. If a condition shows that there can be damage that you cannot see, remove a component to fully examine the damaged area. Use the applicable procedures in this manual to remove the component.

(4) This inspection does not authorize use of the Cleaning Inspection and Repairs listed at the modular level. Remove all the components that you find not serviceable at the modular level. Send the applicable components for more inspection and repair at the component level maintenance. Refer to Section 72−52−00 in the PW4000 Series CIR, PN 51A357. Components that you remove from the high pressure turbine (HPT) module, after the module removal from the engine, will need a Cleaning, Inspection and Repair Manual component level inspection/check.

(5) Unless given differently, not toleranced areas given in this section are to corners, points of tangency between the surfaces or at the points opposite to one of these locations. The areas shown will have a tolerance of plus 0.125 inch (3.175 mm) in all directions unless adjacent areas are given as areas where damage is not permitted.

(6) Definitions of inspection terms:

   (a) Chipped areas: Loss of the ceramic material that is caused by mechanical means.

   (b) Cracks: Narrow surfaces openings where the ceramic material has separated.

   (c) Spalled Areas: Loss of the ceramic material that is caused by the engine operating temperatures.

   (d) Erosion: Loss of the top porous layer of the ceramic material that is caused by wear from the hot gaspath air and/or particles.

C. Procedure

(1) For all the engine models other than 4158 engine model with more than more than 1000 cycles until the next scheduled shop visit, examine the stage 1 and stage 2 duct segments for damaged coat. See Figure 801 and Table 801.

(2) For the 4158 (Talon II burner) engine model only with more than 500 cycles until the next scheduled shop visit, examine the stage 1 and stage 2 duct segments for damaged coat. See Figure 801 and Table 801.

(3) For all the engine models other than 4158 engine model with 1000 cycles or less until the next scheduled shop visit, examine the stage 1 and stage 2 duct segments for damaged coating. See Figure 801 and Table 802.

(4) For the 4158 (Talon II burner) engine model only with 500 cycles or less until the next scheduled shop visit, examine the stage 1 and stage 2 duct segments for damaged coating. See Figure 801 and Table 802.

(5) Measure the stage 1 and stage 2 blade tip clearance. See Figure 802 and Table 803.

(6) Examine the stage 1 turbine front hub. See Figure 803 (Sheet 1), Figure 803 (Sheet 2) and Table 804.

(7) Examine the stage 1 blade. See Figure 804 (Sheet 1), Figure 804 (Sheet 2) and Table 805.

(8) Examine the stage 1 outer rotating airseal. See Figure 805 and Table 806.

NOTE: If the stage 1 outer rotating airseal exhibits light surface corrosion and pitting, it must be surface cleaned by SPOP 209 (Task 70−21−00−110−041) before this inspection. Refer to Section 70−21−00 in the Standard Practices Manual, PN 585005. If necessary, use Abrasive Impregnated Nylon Pad P05−421 or soft non−metallic brush to clean the inspection area and SPOP 209 can be followed again to remove all the loose debris.

(9) Examine the stage 1 inner rotating airseal. See Figure 806 and Table 807.

(10) Examine the stage 1 airsealing ring. See Figure 807 and Table 808.

(11) Examine the stage 2 turbine intermediate hub. See Figure 808 and Table 809.

NOTE: If the stage 2 turbine intermediate hub is removed, examine the stage 2 rotating airseal by Section 72−52−22, Inspection/Check−03 in the PW4000 Series CIR, PN 51A357.

(12) Examine the turbine case. See Figure 809 (Sheet 1), Figure 809 (Sheet 2) and Table 810.

(13) Examine the stage 2 vane ceramic coat. See Figure 810 (Sheet 1), Figure 810 (Sheet 2), Figure 810 (Sheet 3) and Table 811.

(14) Examine the stage 2 vane. See Figure 811 and Table 812.

(15) Examine the stage 2 blade. See Figure 812 (Sheet 1), Figure 812 (Sheet 2), Figure 812 (Sheet 3) and Table 813.

(16) Examine the stage 2 blade retaining plate. See Figure 813 and Table 814.

(17) Examine the stage 1 duct support assembly. See Figure 814 and Table 815.

(18) Examine the stage 2 duct support assembly. See Figure 815 and Table 816.

(19) Examine the stage 1 HPT duct band segments. See Figure 816 and Table 817.

(20) Examine the stage 2 vane platform feather seal. See Figure 817 and Table 818.

R (21) Do the permeability inspection for internal sulfidation
R distress on the stage 1 and stage 2 HPT blades. Refer
R to Inspection/Check−03 (Task 72−00−52−200−003).

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 1 and Stage 2 duct segments. See Figure 801			
NOTE: If you accept these servicable limits, it can result in exhaust gas temperature (EGT) margin loss and a decrease in the repairability of the duct segments at the next overhaul.			
Ceramic layer surface (crazing) cracks	All quantities of cracks are permitted in the ceramic layer	Ceramic coat can be repaired	See Note
Ceramic layer chipping and spalling	If damage is not in the blade rub area: All quantities to a maximum of 0.125 inch (3.175 mm) diameter or 0.012 sq-in (8. sq-mm) maximum to a depth of 0.060 inch (1.524 mm) maximum A maximum of two chipped areas for each segment to a maximum of 0.250 inch (6.350 mm) diameter or 0.050 sq-in (32. sq-mm) maximum to a depth of 0.060 inch (1.524 mm)	Ceramic coat can be repaired	See Note

Duct Segment Coat Inspection For Engines With More Than 1000 Cycles/500 Cycles (4158 Model Only) Until Next Shop Visit
Table 801

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	maximum One chipped area for each segment to a maximum of 0.500 inch (12.700 mm) in diameter or 0.200 sq-in (129. sq-mm) maximum to a depth of 0.060 inch (1.524 mm) maximum		
Ceramic/ metallic layer chipping and spalling	Not permitted	Ceramic material can be repaired	See Note
Ceramic layer erosion	All quantities if blade tip clearance is in limits given in Table 803	Ceramic material can be repaired	See Note
Blade tip material transfer	All quantities if blade tip clearance is in limits given in Table 803	Ceramic material can be repaired	See Note

NOTE: For stage 1 duct segment: Refer to Section 72-52-32, Repair-01 or Repair-06 in the PW4000 Series CIR, PN 51A357.

NOTE: For stage 2 duct segment: Refer to Section 72-52-35, Repair-01 or Repair-05 in the PW4000 Series CIR, PN 51A357.

Duct Segment Coat Inspection For Engines With More Than 1000 Cycles/500 Cycles (4158 Model Only) Until Next Shop Visit
Table 801 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 1 and Stage 2 duct segments. See Figure 801			
Ceramic layer surface (crazing) cracks	All quantities of cracks are permitted in the ceramic layer	Ceramic coat can be repaired	See Note
Ceramic layer chipping and spalling	All quantities of duct segments can have all quantities of spalling in the ceramic layer	Ceramic coat can be repaired	See Note
Ceramic/ metallic corner spalling	All quantities of segments can have one corner spalled axially for a length of 0.500 inch (12.700 mm) maximum (can extend into the blade rub area) and to a maximum of 0.900 inch (22.860 mm) circumferentially.	Ceramic coat can be repaired	See Note
Ceramic layer erosion	All quantities, if the blade tip clearance is in the limits given in Table 803	Ceramic material can be repaired	See Note

Duct Segment Coat Inspection For Engines With 1000 Cycles/500 Cycles (4158 Model Only) Or Less Until Next Shop Visit
Table 802

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Blade tip material transfer	All quantities if blade tip clearance is in limits given in Table 803	Ceramic material can be repaired	See Note

Duct Segment Coat Inspection For Engines With 1000 Cycles/500 Cycles (4158 Model Only) Or Less Until Next Shop Visit
Table 802 (Continued)

Reference Number	Maximum Radial Clearance Permitted

A. Measure the average tip clearance.

1. Use a feeler stock to do an inspection of the stage 1 HPT blade tip clearance. Do the inspection at eight equal distances apart non-spalled blade locations. Calculate the average clearance of the eight measurements. The blade tip clearance must be in the limits shown below.

2. Use a feeler stock to do an inspection of the stage 2 HPT blade tip clearance. Do the inspection at eight equal distances apart non-spalled blade locations. Calculate the average clearance of the eight measurements. The blade tip clearance must be in the limits shown below.

Stage 1 HPT blade tip clearance:	See Figure 802.
1740	0.112 inch (2.845 mm) (Pre-SB PW4ENG 72-712)
	0.112 inch (2.845 mm) (Post-SB PW4ENG 72-712)
1745	0.112 inch (2.845 mm) (Post-SB PW4ENG 72-735)
Stage 2 HPT blade tip clearance:	See Figure 802.

Reference Number	Turbine Intermediate Hub Part Number	Maximum Radial Clearance Permitted
FOR THESE MODELS: 4152, 4156A, 4158		
1741	50L602, 50L602-001, 50L602-021, 50L602-022, 50L602-023, 50L602-024, 50L602-025, 50L602-026, 50L602-027	0.107 inch (2.718 mm)
FOR THESE MODELS: 4152, 4156A, 4158		
1741	50L902, 50L902-021, 50L902-022, 50L902-023, 52L002, 52L002-021, 52L802, 53L602	0.117 inch (2.972 mm)
FOR THESE MODELS: 4152-3, 4156A-3, 4158-3		
1741	52L402, 52L802, 53L602	0.117 inch (2.972 mm)

Stage 1 And Stage 2 HPT Blade Tip Clearance
Table 803

Reference Number	Maximum Radial Clearance Permitted
FOR THESE MODELS: 4152−3, 4156A−3, 4158−3	
1746	0.117 inch (2.972 mm) (Post−SB PW4ENG 72−735)

Stage 1 And Stage 2 HPT Blade Tip Clearance
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 1 turbine front hub. See Figure 803 (Sheet 1).			
1 (Other than cooling air holes)	Surface damage with no raised material to a maximum of 0.002 inch (0.051 mm) in depth. No damage is permitted in 0.050 inch (1.270 mm) of fillet radii.	0.010 inch (0.254 mm) maximum depth	Refer to Section 72−52−05, Repair−04 in the PW4000 Series CIR, PN 51A357
2 For PN 50L501, 51L201, 51L201−021, 51L601 and 52L401 only: (Other than cooling air holes)	Surface damage with no raised material to a maximum of 0.002 inch (0.051 mm). No damage is permitted in 0.050 inch (1.270 mm) of fillet radii.	0.010 inch (0.254 mm) maximum depth	Refer to Section 72−52−05, Repair−04 in the PW4000 Series CIR, PN 51A357
For PN 51L901 and 52L301 (Other than cooling air holes)	Surface damage with no raised material to a maximum of 0.002 inch (0.051 mm). No damage is permitted in 0.050 inch (1.270 mm) of fillet radii.	0.015 inch (0.381 mm) maximum depth	Refer to Section 72−52−05, Repair−04 in the PW4000 Series CIR, PN 51A357

Stage 1 Turbine Front Hub Inspection
Table 804

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
3			
For PN 50L501, 51L201, 51L201-021, 51L601 and 52L401 only:	Surface damage with no raised material to a maximum of 0.002 inch (0.051 mm). Corrosion pitting is not permitted. No damage is permitted in 0.050 inch (1.270 mm) of fillet radii.	0.010 inch (0.254 mm) maximum depth. Scattered corrosion pitting to a maximum of 0.005 inch (0.127 mm) depth.	Refer to Section 72-52-05, Repair-04 in the PW4000 Series CIR, PN 51A357
For PN 51L901 and 52L301:	Surface damage with no raised material to a maximum of 0.002 inch (0.051 mm). Corrosion pitting is not permitted. No damage is permitted in 0.050 inch (1.270 mm) of fillet radii.	0.015 inch (0.381 mm) maximum depth. Scattered corrosion pitting to a maximum of 0.005 inch (0.127 mm) depth.	Refer to Section 72-52-05, Repair-04 in the PW4000 Series CIR, PN 51A357
4			
For PN 50L501, 51L201, 51L201-021, 51L601 and 52L401 only:	Surface damage with no raised material to a maximum of 0.001 inch (0.025 mm) in depth. No damage is permitted in 0.050 inch (1.270 mm) of fillet radii.	0.010 inch (0.254 mm) maximum depth	Refer to Section 72-52-05, Repair-04 in the PW4000 Series CIR, PN 51A357

Stage 1 Turbine Front Hub Inspection
Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
For PN 51L901 and 52L301:	Surface damage with no raised material to a maximum of 0.001 inch (0.025 mm) in depth. No damage is permitted in 0.050 inch (1.270 mm) of fillet radii.	0.015 inch (0.381 mm) maximum depth, unless given differently	Refer to Section 72-52-05, Repair-04 in the PW4000 Series CIR, PN 51A357
5	Surface damage with no raised material is permitted to a maximum of 0.010 inch (0.254 mm). No damage is permitted in 0.050 inch (1.270 mm) of fillet radii.	0.015 inch (0.381 mm) maximum depth	Refer to Section 72-52-05, Repair-04 in the PW4000 Series CIR, PN 51A357
6 Splines	Scattered surface damage with no raised material is permitted on the inner diameter faces, sides and end of the spline teeth to a maximum of 0.006 inch (0.152 mm) depth	Raised material only. Do not blend below the initial spline surface.	Refer to Section 72-52-05, Repair-04 in the PW4000 Series CIR, PN 51A357 or splines can be polished by Section 70-45-00, SPOP 533 in the Standard Practices Manual, PN 585005
	No damage is permitted on		

Stage 1 Turbine Front Hub Inspection
Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	the spline root fillet radii		
7	Surface damage with no raised material to a maximum of 0.010 inch (0.254 mm) depth on the lug end face.	Not repairable	Remove from service
8 Cooling air holes	No damage is permitted in 0.125 inch (3.175 mm) of holes	0.005 inch (0.127 mm) maximum depth	Refer to Section 72−52−05, Repair−04 in the PW4000 Series CIR, PN 51A357
	No mismatch is permitted inside the slots		
9 See Figure 803 (Sheet 2)	No damage is permitted in 0.050 inch (1.270 mm) of the fillet radii	Not repairable	Remove from service

NOTE: Examine all the areas that you can access where stage 1 rotor is installed or removed.

Stage 1 Turbine Front Hub Inspection
Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 1 blade See Figure 804 (Sheet 1)			
Area A and Area B			
Surface cracks (Other than cooling hole cracks)	Not permitted		Remove from service
Trailing edge axial cracks	Not permitted	Two cracks to a maximum of 0.050 inch (1.270 mm) axial length	Refer to Section 72−52−07, Repair−01 in the PW4000 Series CIR, PN 51A357
Area B Cooling hole crack	Axial, radial or hole to hole cracks are permitted. No breakthrough or open areas. No intersecting cracks or imminent material liberation are permitted.		Remove from service
Area A Cooling hole crack	Not permitted		Remove from service

Stage 1 Blade Inspection
Table 805

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area A, Area B and Area C Burning, erosion and bare base material (Full blade and platform surface)	Not permitted	Not repairable	Remove from service
Areas A, Area B and Area C Spalled or eroded ceramic coat (Full blade and platform surface)	All quantities are permitted	See the repair	Refer to Section 72-52-07, Repair-05 in the PW4000 Series CIR, PN 51A357
Sulfidation on all the bare areas of blade shown by staining or trailing edge scale build-up	Not permitted		Remove from service
Area B Bent tip	Not permitted	Not repairable	Remove from service
Area A and Area B Leading edge, airfoil, tip and trailing edge cooling air holes/slot blockage	One maximum cooling hole/slot in each area can be blocked, If blockage is not sulfidation corrosion build-up.	All quantities can be cleaned if blockage is not sulfidation corrosion scale build-up	Refer to Section 72-52-00, Cleaning-04 in the PW4000 Series CIR, PN 51A357

Stage 1 Blade Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area B Tip rub or plasma coat missing	All quantities are permitted if not rubbed into the internal cavity	See the applicable repair	Refer to Section 72−52−07, Repair−06, Repair−07 and Repair−15 in the PW4000 Series CIR, PN 51A357
Area A and Area B Liberated blade parent material	Not permitted	Not repairable	Remove from service
Area A, Area B and Area C Airfoil bulging	Not permitted	Not repairable	Remove from service
Area D Nicks and dents See Figure 804 (Sheet 2)	Not permitted	Two blends to a maximum of 0.005 inch (0.127 mm) depth	Refer to Section 72−52−07, Repair−01 in the PW4000 Series CIR, PN 51A357
Area E Nicks and dents	All quantities of nicks or dents are permitted to a maximum of 0.005 inch (0.127 mm) depth		Remove from service

Stage 1 Blade Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area F Nicks and dents	One dent to a maximum of 0.010 inch (0.254 mm) depth and 0.100 inch (2.540 mm) maximum length. Dents must not block discharge port more than 50 percent. Nicks are not permitted.	Two blends to a maximum of 0.005 inch (0.127 mm) axial length from trailing edge	Refer to Section 72-52-07, Repair-01 in the PW4000 Series CIR, PN 51A357
Area G Nicks and dents	Not permitted	Not repairable	Remove from service
Area J and Area K Platform cracks (Top and bottom of platform surfaces are included) (See Figure 804 (Sheet 2))	All quantities of cracks are permitted in this area to a maximum of 0.120 inch (3.048 mm) in length. Cracks can go through the platform. Platform must not be curled or bent.		
Area L Platform cracks	All quantities of tight, hairline cracks to a maximum of 0.005 inch width and to a maximum of 0.150 inch in length are permitted.	0.010 inch (0.254 mm) in depth	Refer to Section 72-52-07, Repair-01 in the PW4000 Series CIR, PN 51A357

Stage 1 Blade Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			
	Cracks must be clearly separated and must not intersect.		

Stage 1 Blade Inspection
Table 805 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 1 outer rotating airseal			
1 Surface Damage (See Figure 805)	Not Permitted	Locally blend surface damage to a maximum of 0.010 inch (0.254 mm) depth	Refer to Section 72−52−20, Repair−01 in the PW4000 Series CIR, PN 51A357
2 Surface damage	0.004 inch (0.102 mm) maximum depth other than for knife−edges	Locally blend surface damage to a maximum of 0.010 inch (0.254 mm) depth other than for knife−edges	Refer to Section 72−52−20, Repair−01 in the PW4000 Series CIR, PN 51A357
Knife−edge surface damage	Not permitted	See the repair	Refer to Section 72−52−20, Repair−02 in the PW4000 Series CIR, PN 51A357
3 General corrosion pitting. See Figure 805	0.005 inch (0.127 mm) maximum depth after cleaning. Refer to Section 70−21−00, SPOP 209 in the Standard Practices Manual, PN 585005. If necessary, use Abrasive	See the repair	Refer to Section 72−52−20, Repair−01 in the PW4000 Series CIR, PN 51A357

Stage 1 Outer Rotating Airseal Surface Damage Inspection
Table 806

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	Impregnated Nylon Pad P05-421 or soft non-metallic brush to clean the inspection area and SPOP 209 can be followed again to remove all the loose debris.		
4 Knife-edge area corrosion pitting	Not permitted	See the repair	Refer to Section 72-52-20, Repair-01 in the PW4000 Series CIR, PN 51A357
5 Knife-edge bending	0.020 inch (0.508 mm) maximum from the normal position	0.100 sq-in (65. sq-mm) is the maximum blend area for single knife-edge blend. 0.200 sq-in (129. sq-mm) is the maximum cumulative blend area for all single knife-edge. 0.300 sq-in (194. sq-mm) is the maximum cumulative blend area for three knife-edges	Refer to Section 72-52-20, Repair-02 in the PW4000 Series CIR, PN 51A357

Stage 1 Outer Rotating Airseal Surface Damage Inspection
Table 806 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			
		Blends must have a length to depth ratio of 15 minimum and a blend radius to depth ratio of 30 minimum	

Stage 1 Outer Rotating Airseal Surface Damage Inspection
Table 806 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 1 inner rotating airseal (See Figure 806)			
Corrosion	Not serviceable	See the repair	Refer to Section 72−52−21, Repair−01 in the PW4000 Series CIR, PN 51A357

CAUTION: AIRSEALS, OTHER THAN KNIFE−EDGE AREAS, THAT HAVE CRACKS OR OTHER UNUSUAL CONDITIONS IDENTIFIED BY FLUORESCENT PENETRANT INSPECTION ARE NOT PERMITTED AND CANNOT BE REPAIRED.

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Cracks	Not serviceable	Not repairable	Remove from service
Surface damage:			
1	Not permitted	0.010 inch (0.254 mm) maximum depth	Refer to Section 72−52−21, Repair−01 in the PW4000 Series CIR, PN 51A357
2	0.004 inch (0.102 mm) other than for knife−edge	0.010 inch (0.254 mm) other than for knife−edges	Refer to Section 72−52−21, Repair−01 in the PW4000 Series CIR, PN 51A357
3			
0.050 inch (1.270 mm) (reference)			

Stage 1 Inner Rotating Airseal Corrosion And Pitting Inspection
Table 807

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
4	No damages are permitted in 0.050 inch (1.270 mm) envelope around the full slot in all directions		
5			
Knife−edges for bending	0.020 inch (0.508 mm) maximum from the normal position	0.100 sq−in (65. sq−mm) maximum blend for each incident	Refer to Section 72−52−21, Repair−02 in the PW4000 Series CIR, PN 51A357
		0.200 sq−in (129. sq−mm) maximum all blends each knife−edge	
		0.300 sq−in (194. sq−mm) maximum all blends for the all three knife−edges	

Stage 1 Inner Rotating Airseal Corrosion And Pitting Inspection
Table 807 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 1 airsealing ring (See Figure 807)			
Corrosion	Not permitted on all surfaces	See the repair	Refer to Section 72-52-17, Repair-03 or Repair-05 in the PW4000 Series CIR, PN 51A357
1	Damage to a maximum of 0.004 inch (0.102 mm) in depth with no sharp edges	Damage between 0.004 - 0.010 inch (0.102 - 0.254 mm) in depth	Refer to Section 72-52-17, Repair-01 in the PW4000 Series CIR, PN 51A357
2	No damage is permitted in 0.050 inch (1.270 mm) of the radius	Not repairable	Remove from service
3 Rub track wear	Smooth wear to a maximum of 0.006 inch (0.152 mm) depth	See the repair	Refer to Section 72-52-17, Repair-03 or Repair-05 in the PW4000 Series CIR, PN 51A357
4 Surface damage	Damage to a maximum of 0.004 inch (0.102 mm) in depth with no sharp edges	Damage between 0.004 - 0.010 inch (0.102 - 0.254 mm) in depth	Refer to Section 72-52-17, Repair-01 in the PW4000 Series CIR, PN 51A357

Stage 1 Inner Airsealing Ring Inspection
Table 808

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
5	No damage is permitted without repair	0.030 inch (0.762 mm) maximum depth	Refer to Section 72−52−17, Repair−01 in the PW4000 Series CIR, PN 51A357

Stage 1 Inner Airsealing Ring Inspection
Table 808 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 2 turbine intermediate hub (See Figure 808)			
1	Surface damage to a maximum of 0.002 inch (0.051 mm) in depth unless given differently	0.010 inch (0.254 mm) maximum depth unless given differently	Refer to Section 72-52-06, Repair-08 in the PW4000 Series CIR, PN 51A357
2	Surface damage to a maximum of 0.002 inch (0.051 mm) in depth unless given differently	0.015 inch (0.381 mm) maximum depth unless given differently	Refer to Section 72-52-06, Repair-08 in the PW4000 Series CIR, PN 51A357
3 Cooling holes	No damage is permitted in 0.125 inch (3.175 mm) of holes	0.005 inch (0.127 mm) maximum depth	Refer to Section 72-52-06, Repair-08 in the PW4000 Series CIR, PN 51A357
4	Scattered surface damage to a maximum of 0.003 inch (0.076 mm)		
5	Scattered surface damage to a maximum of 0.005 inch (0.127 mm) depth if the combined damage is not more than 0.100 sq-in (65.		

Stage 2 Turbine Intermediate Hub Inspection
Table 809

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	sq−mm). Raised material is not permitted.		
6 Splines	Scattered surface damage is permitted on the inner diameter faces, sides and end of spline teeth to 0.006 inch (0.152 mm) maximum depth	Splines can be polished by Section 70−45−00, SPOP 533 in the Standard Practices Manual, PN 585005	Refer to Section 72−52−06, Repair−08 in the PW4000 Series CIR, PN 51A357
7 Hub inner diameter surface to spline front surface	Scattered surface damage to a maximum of 0.005 inch (0.127 mm) depth if there is no raised material	Blend to a maximum of 0.010 inch (0.254 mm) depth is permitted in the repair	Refer to Section 72−52−06, Repair−08 in the PW4000 Series CIR, PN 51A357
8 Lug	Surface damage to a maximum of 0.010 inch (0.254 mm) depth	See the repair	Refer to Section 72−52−06, Repair−08 in the PW4000 Series CIR, PN 51A357
9 Metering plugs for damaged loose and missing:			

Stage 2 Turbine Intermediate Hub Inspection
Table 809 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
For hub assembly PN 50L602−023, 50L602−024, 50L902−022 and 53L602:	Make sure that the four plugs are installed tight. Plugs snap in and can turn.	Replace the damaged, missing or loose plugs	Refer to Section 72−52−06, Repair−14 in the PW4000 Series CIR, PN 51A357
For hub assembly PN 50L602−021, 50L602−022, 50L602−025, 50L602−026, 50L902−021, 50L902−023, 52L002−021 and 52L802:	Make sure that the six plugs are installed tight. Plugs snap in and can turn.	Replace the damaged, missing or loose plugs	Refer to Section 72−52−06, Repair−14 in the PW4000 Series CIR, PN 51A357
For hub assembly PN 52L402:	Make sure that the eight plugs are installed tight. Plugs snap in and can turn.	Replace the damaged, missing or loose plugs	Refer to Section 72−52−06, Repair−14 in the PW4000 Series CIR, PN 51A357
For hub assembly PN 54L022:	Make sure that the two plugs are installed tight. Plugs snap in and can turn.	Replace the damaged, missing or loose plugs	Refer to Section 72−52−06, Repair−14 in the PW4000 Series CIR, PN 51A357
NOTE: You do not have to remove the plugs for this inspection.			
10	A maximum of 0.010 inch (0.254 mm) depth with no raised material	A maximum of 0.015 inch (0.381 mm) depth	Refer to Section 72−52−06, Repair−08 in the PW4000 Series CIR, PN 51A357

Stage 2 Turbine Intermediate Hub Inspection
Table 809 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
11	Scattered surface damage to a maximum of 0.003 inch (0.076 mm) depth with no raised material	0.010 inch (0.254 mm) maximum depth	Refer to Section 72−52−06, Repair−08 in the PW4000 Series CIR, PN 51A357

Stage 2 Turbine Intermediate Hub Inspection
Table 809 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Turbine case See Figure 809 (Sheet 1) and Figure 809 (Sheet 2)			
Surface damage all the areas unless given differently as below	0.010 inch (0.254 mm) maximum depth. Damage must not have sharp edges or bottoms. Damage must not include corners.	0.020 inch (0.508 mm) maximum depth	Refer to Section 72-52-30, Repair-09 in the PW4000 Series CIR, PN 51A357
1	0.010 inch (0.254 mm) maximum depth	0.020 inch (0.508 mm) maximum depth	Refer to Section 72-52-30, Repair-09 in the PW4000 Series CIR, PN 51A357
2 Corner damage	Corner damage to 0.020 inch (0.508 mm) maximum depth	0.030 inch (0.762 mm) maximum depth	Refer to Section 72-52-30, Repair-09 in the PW4000 Series CIR, PN 51A357
3 Front flange, rear face, rear flange and front face	No damage is permitted that is not repaired. Raised material is not permitted.	Blend damage to a maximum of 0.010 inch (0.254 mm) depth	Refer to Section 72-52-30, Repair-09 in the PW4000 Series CIR, PN 51A357

Turbine Case Surface Damage Inspection
Table 810

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
4	Superficial damage only with the depth not to be more than the depth of the machine lines.	0.010 inch (0.254 mm) maximum depth	Refer to Section 72−52−30, Repair−09 in the PW4000 Series CIR, PN 51A357
5, 6 Front flange, front face and rear flange, rear face	0.005 inch (0.127 mm) maximum depth. Raised material is not permitted.	Blend damage to a maximum of 0.010 inch (0.254 mm) depth	Refer to Section 72−52−30, Repair−09 in the PW4000 Series CIR, PN 51A357
		Wear more than 0.010 inch (0.254 mm) maximum depth can be repaired to a maximum of the minimum flange thickness	Refer to Section 72−52−30, Repair−03 and Repair−05 in the PW4000 Series CIR, PN 51A357
7	0.005 inch (0.127 mm) maximum depth	0.010 inch (0.254 mm) maximum depth	Refer to Section 72−52−30, Repair−09 in the PW4000 Series CIR, PN 51A357
8, 9 Front and rear outer diameter mating diameter	All quantities of surface damage to a maximum of 0.005 inch (0.127 mm) depth. The length must not be more than the half	0.010 inch (0.254 mm) maximum depth	Refer to Section 72−52−30, Repair−09 in the PW4000 Series CIR, PN 51A357

Turbine Case Surface Damage Inspection
Table 810 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	of the contact width. Raised material is not permitted.		
		Wear more than 0.010 inch (0.254 mm) maximum can be repaired to a maximum of the minimum front lip thickness	Refer to Section 72-52-30, Repair-02 and Repair-04 in the PW4000 Series CIR, PN 51A357
10, 11 Hardface coat for:			
Wear and chipping	Wear and chipping that does not bare the base material is permitted	Worn or chipped coat that bares the base material must be repaired	Refer to Section 72-52-30, Repair-07 and Repair-08 in the PW4000 Series CIR, PN 51A357
Spalling	Spalling because of tooling is permitted. Spalling because of engine service is not permitted.	Spalling because of aging must be repaired. Wear can be repaired to a maximum limit.	
12 Bleed boss fillet radius cracks	Not permitted	See the repair	Refer to Section 72-52-30, Repair-26 in the PW4000 Series CIR, PN 51A357

Turbine Case Surface Damage Inspection
Table 810 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
13 Front flange bolthole crack	Not permitted	Radially outard less than 0.060 inch (1.524 mm) maximum length	Refer to Section 72−52−30, Repair−25 in the PW4000 Series CIR, PN 51A357
		Radially outward 0.060 inch (1.524 mm) and larger	Refer to Section 72−52−30, Repair−27 in the PW4000 Series CIR, PN 51A357

Turbine Case Surface Damage Inspection
Table 810 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 2 vane surface coat. See Figure 810 (Sheet 1), Figure 810 (Sheet 2) and Figure 810 (Sheet 3).			
Area A Ceramic Coat erosion/ chipping (Convex)	A maximum of 100 percent of the area	Replace the ceramic coat	Refer to Section 72-52-34, Repair-09 in the PW4000 Series CIR, PN 51A357
Area B Ceramic Coat erosion/ chipping (Concave and leading edge convex)	A maximum of 100 percent of the area	Replace the ceramic coat	Refer to Section 72-52-34, Repair-09 in the PW4000 Series CIR, PN 51A357
Area C Ceramic coat erosion/ chipping (Concave)	A maximum of 2.000 sq-in (1290. sq-mm) of total area	Replace the ceramic coat	Refer to Section 72-52-34, Repair-09 in the PW4000 Series CIR, PN 51A357
Area D Ceramic coat erosion/ chipping (Concave and convex)	Three areas to a maximum of 0.200 sq-in (129. sq-mm) for each concave and convex airfoil	Replace the ceramic coat	Refer to Section 72-52-34, Repair-09 in the PW4000 Series CIR, PN 51A357

Stage 2 Vane Coat Erosion and Chipping Inspection
Table 811

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area E Ceramic coat erosion/ chipping (Inner diameter and outer diameter platform)	A maximum of 75 percent of the area	Replace the ceramic coat	Refer to Section 72−52−34, Repair−10 in the PW4000 Series CIR, PN 51A357
Area F Ceramic coat erosion/ chipping (Inner diameter and outer diameter Platform)	Three areas maximum on each vane cluster to a maximum of 0.400 sq−in (258. sq−mm)	Replace the ceramic coat	Refer to Section 72−52−34, Repair−09 in the PW4000 Series CIR, PN 51A357
Area G Ceramic coat erosion/ chipping (Outer diameter platform)	A maximum of 100 percent of the area	Replace the ceramic coat	Refer to Section 72−52−34, Repair−09 in the PW4000 Series CIR, PN 51A357
Area H Ceramic coat erosion/ chipping (Outer diameter platform)	A maximum of 100 percent of the area	Replace the ceramic coat	Refer to Section 72−52−34, Repair−09 in the PW4000 Series CIR, PN 51A357

NOTE: Ceramic coat erosion and/or chipping is permitted in the above limits. There must be an undercoat (metal layer) on the damaged areas.

Stage 2 Vane Coat Erosion and Chipping Inspection
Table 811 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 2 vane surface inspection (See Figure 811)			
Concave side crack	One crack 0.787 inch (19.990 mm) maximum length. 0.020 inch (0.508 mm) maximum width. A crack in an area of burned base material is not permitted.	Not repairable	Remove from service
Trailing edge crack	One axial crack starts from the trailing edge to a maximum of 0.250 inch (6.350 mm) in length. However, a crack that extends through the concave and convex walls is not permitted.	See the repair	Refer to Section 72-52-34, Repair-11 in the PW4000 Series CIR, PN 51A357
Inner diameter and outer diameter platform cracks (Gaspath side)	Cracks are permitted, if the cracks do not extend into the platform to airfoil fillet radius and do not extend 0.236 inch (5.994 mm) maximum of platform edge. Cracks must not form	See the repair	Refer to Section 72-52-34, Repair-11 in the PW4000 Series CIR, PN 51A357

Stage 2 Vane Surface Inspection
Table 812

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			
	a closed loop with imminent material liberation.		
Outer diameter platform to airfoil fillet radius base material burning and erosion	Not permitted	Not repairable	Remove from service
Leading edge crack	One leading edge crack to a maximum of 0.400 inch in length and no more than 0.020 inch (0.508 mm) width	Not repairable	Remove from service
Leading edge base material burning	Total burning to a maximum of 0.400 inch in diameter or 0.125 sq−in (81. sq−mm)		Remove from service
Airfoils and leading edge round bottom nicks and dents	All quantities to 0.040 inch (1.016 mm) in depth. Dents to a maximum of 0.250 inch (6.350 mm) in diameter or length other than at trailing edge.	Not repairable	Remove from service

Stage 2 Vane Surface Inspection
Table 812 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Gaspath side inner diameter and outer diameter platforms round bottom nicks and dents	All quantities to a maximum of 0.060 inch (1.524 mm) in depth	Not repairable	Remove from service
Trailing edge round bottom nicks and dents	Dents less than 0.375 inch (9.525 mm) maximum diameter are permitted		Remove from service
Trailing edge plugged slot	Not permitted	All quantities can be cleaned. Vane slots must be fully open and vane must obey airflow limits.	Refer to Section 72−52−00, Cleaning−04 in the PW4000 Series CIR, PN 51A357
Inner diameter and outer diameter platform base material burning and erosion	A maximum of 0.010 inch (0.254 mm) in depth to 0.600 inch (15.240 mm) diameter or 0.283 sq−in (183. sq−mm) maximum		Remove from service
Concave and convex airfoil surfaces burning and erosion	A maximum of 0.010 inch in depth to 0.200 sq−in (129. sq−mm) for each airfoil surface		Remove from service

Stage 2 Vane Surface Inspection
Table 812 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Trailing edge area base material burning and erosion (Concave and convex side)	0.125 inch (3.175 mm) axially from trailing edge and 0.300 inch (7.620 mm) in width		Remove from service

Stage 2 Vane Surface Inspection
Table 812 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 2 blade surface damage. See Figure 812 (Sheet 1) and Figure 812 (Sheet 2).			
Dents general:	Only round bottom dents are permitted on the blade airfoil All dents must have a length to depth ratio of ten to one minimum		
Area A:			
Number	Eight round bottom dents	Two	Refer to Section 72-52-08, Repair-01 and Repair-14 in the PW4000 Series CIR, PN 51A357
Size	0.002 inch (0.051 mm) in maximum depth and 0.150 inch (3.810 mm) maximum diameter	0.010 inch (0.254 mm) depth and 0.075 inch (1.905 mm) maximum diameter	
Area B:			

Stage 2 Blade Surface Inspection
Table 813

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Number	Eight round bottom dents	Four on each side	Refer to Section 72−52−08, Repair−01 and Repair−14 in the PW4000 Series CIR, PN 51A357
Size	0.002 inch (0.051 mm) in maximum depth and 0.150 inch (3.810 mm) maximum diameter	0.010 inch (0.254 mm) in maximum depth and 0.150 inch (3.810 mm) maximum diameter	
Area C:			
Number	Two on each side	Two on each side	Refer to Section 72−52−08, Repair−01 and Repair−14 in the PW4000 Series CIR, PN 51A357
Size	0.005 inch (0.127 mm) in maximum depth	0.010 inch (0.254 mm) in maximum depth	
Area D:			
Number	Two	Two	Refer to Section 72−52−08, Repair−01 and Repair−14 in the PW4000 Series CIR, PN 51A357

Stage 2 Blade Surface Inspection
Table 813 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Size	Dent must not block a single air discharge port by more than 50 percent	Dent must not block a single air discharge port by more than 50 percent	
Area E:			
Number	Four round bottom dents	Not repairable	Remove from service
Size	0.001 inch (0.025 mm) maximum depth and 0.075 inch (1.905 mm) maximum diameter		
Area F:	All quantities to a maximum of 0.005 inch (0.127 mm) depth and 0.075 inch (1.905 mm) maximum diameter Or	All quantities to a maximum of 0.005 inch (0.127 mm) depth and 0.075 inch (1.905 mm) maximum diameter	Refer to Section 72−52−08, Repair−01 and Repair−14 in the PW4000 Series CIR, PN 51A357
	One round bottom dent 0.005 inch (0.127 mm) maximum depth and 0.150 inch (3.810 mm) maximum diameter	Two dents to a maximum of 0.015 inch (0.381 mm) in depth and 0.125 inch (3.175 mm) maximum axial length and 0.250 inch (6.350 mm) maximum radial length.	Refer to Section 72−52−08, Repair−01 and Repair−14 in the PW4000 Series CIR, PN 51A357
Areas of missing coat, burning or erosion in:			

Stage 2 Blade Surface Inspection
Table 813 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area A and Area F	Leading edge damage 0.200 inch (5.080 mm) maximum diameter or 0.031 sq-in (20. sq-mm)		Remove from service
Crack in: See Figure 812 (Sheet 3)			
Area G	Not permitted		Remove from service
Area H	Not permitted		Remove from service
Area J	Axial or radial cracks are permitted if there is no breakthrough, intersecting cracks or imminent material liberation		Remove from service
Trailing edge cooling air slot blockage Area G, Area H and Area J	Not permitted		Remove from service
Full blade surface for the signs of sulfidation (corrosion) pitting	Not permitted		Remove from service

Stage 2 Blade Surface Inspection
Table 813 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Airfoil growth as shown by necking down or localized thinning of airfoil in mid−span region, bending or movement of airfoil in rear direction, trailing edge cooling slot cracks or other signs of obvious blade growth	Not permitted		Remove from service

Stage 2 Blade Surface Inspection
Table 813 (Continued)

ENGINE GENERAL - HIGH PRESSURE TURBINE (HPT) - INSPECTION/CHECK-10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 2 blade retaining plate (See Figure 813)			
Examine all surfaces for:			
Cracks	Not permitted	Not repairable	Remove from service
Corrosion	Not permitted	Not repairable	Remove from service
Examine all the areas for surface damage:			
1	Not permitted	0.010 inch (0.254 mm) maximum depth	Refer to Section 72-52-23, Repair-01 in the PW4000 Series CIR, PN 51A357
2	0.004 inch (0.102 mm) maximum	0.010 inch (0.254 mm) maximum depth, unless given differently	Refer to Section 72-52-23, Repair-01 in the PW4000 Series CIR, PN 51A357
3 Bent knife-edge seal	Bends are permitted if the bends have 0.020 inch (0.508 mm) maximum depth and 0.020 inch (0.508 mm) minimum bend radii. Bends must be smooth		

Stage 2 Blade Retaining Plate Inspection
Table 814

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)	and continuous with no sharp edges. No cracks are permitted.		
4 Knife−edge minor nicks, scratches and dents	Not permitted	A maximum of four local areas are permitted at 1.000 inch (25.400 mm) minimum separation, 0.020 inch (0.508 mm) maximum depth, 1.000 inch (25.400 mm) maximum length	Refer to Section 72−52−23, Repair−01 in the PW4000 Series CIR, PN 51A357

CAUTION: DO NOT STRAIGHTEN A BENT KNIFE−EDGE SEAL OR DAMAGE TO THE PART CAN OCCUR.

Stage 2 Blade Retaining Plate Inspection
Table 814 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 1 duct support assembly (See Figure 814)			
1 Wear	0.005 inch (0.127 mm) maximum depth	0.025 inch (0.635 mm) maximum depth	Refer to Section 72-52-31, Repair-07 in the PW4000 Series CIR, PN 51A357
		0.050 inch (1.270 mm) maximum depth	Refer to Section 72-52-31, Repair-02 in the PW4000 Series CIR, PN 51A357
Examine all the surfaces for:			
Cracks	Not permitted	Not repairable	Remove from service
Nicks, dents and scratches	0.005 inch (0.127 mm) maximum depth with no sharp edges or bottoms. No damage is permitted on the corners.	0.015 inch (0.381 mm) maximum depth must be blended	Refer to Section 72-52-31, Repair-03 in the PW4000 Series CIR, PN 51A357
Corrosion	No corrosion is permitted	Blend all corrosion	Refer to Section 72-52-31, Repair-03 in the PW4000 Series CIR, PN 51A357

Stage 1 Duct Support Assembly Inspection
Table 815

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Locating pins	Missing pins are not permitted	Replace loose, sheared, missing or deformed pins	Refer to Section 72−52−31, Repair−01 in the PW4000 Series CIR, PN 51A357
Feather seal tabs for damage, bent or missing material	Not permitted	Missing material can be blended	Refer to Section 72−52−31, Repair−03 in the PW4000 Series CIR, PN 51A357

Stage 1 Duct Support Assembly Inspection
Table 815 (Continued)

ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 2 duct support assembly (See Figure 815)			
Examine all the surfaces for:			
Cracks	Not permitted	Not repairable	Remove from service
Nicks, dents and corrosion	0.020 inch (0.508 mm) maximum depth	0.050 inch (1.270 mm) maximum depth	
Local wear and galling	0.010 inch (0.254 mm) maximum depth	0.040 inch (1.016 mm) maximum depth	Refer to Section 72−52−37, Repair−02 in the PW4000 Series CIR, PN 51A357
1 Pins	Loose, sheared, deformed or missing pins are not permitted	Replace loose, sheared, deformed or missing pins	Refer to Section 72−52−37, Repair−01 in the PW4000 Series CIR, PN 51A357
2 Wear	No damage is permitted	0.030 inch (0.762 mm) maximum depth	Refer to Section 72−52−37, Repair−02 and Repair−05 in the PW4000 Series CIR, PN 51A357

Stage 2 Duct Support Assembly Inspection
Table 816

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
3 Missing feather seal wall material	0.050 inch (1.270 mm) maximum width and 0.150 inch (3.810 mm) length is permitted on the rear of the support with no sharp edges adjacent to the seal mating groove. No crack is permitted. Lightly blend to remove sharp edges. Examine for cracks by Section 70−33−00, SPOP 70 (normal sensitivity) in the Standard Practices Manual, PN 585005.		Remove from service

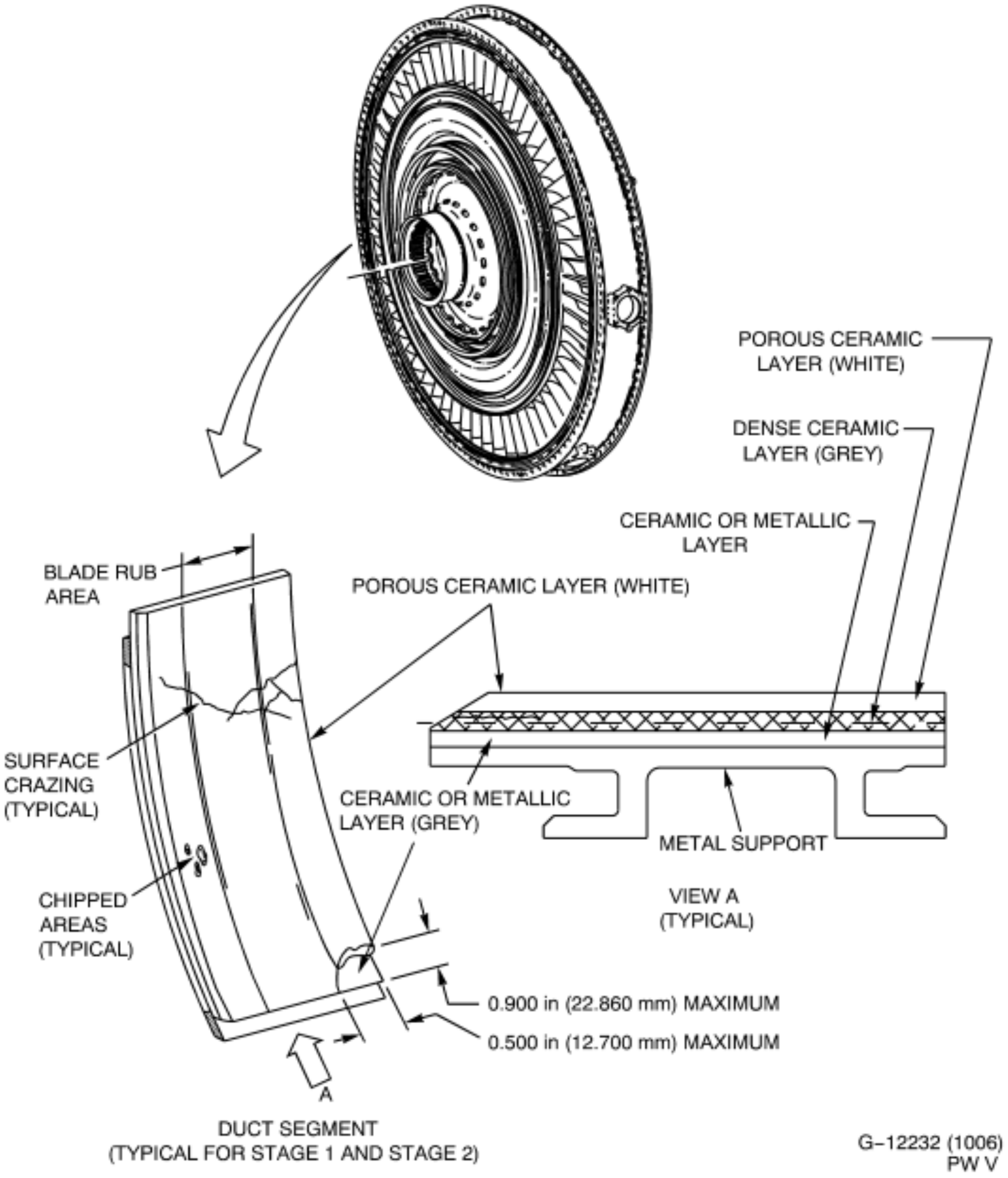
Stage 2 Duct Support Assembly Inspection
Table 816 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
All surfaces for: (See Figure 816)			
Stage 1 duct band segment			
Cracks	Not permitted	1.000 inch (25.400 mm) maximum length	Refer to Section 72−52−33, Repair−01 in the PW4000 Series CIR, PN 51A357
Wear and galling in:			
Area A	All quantities if 0.014 inch (0.356 mm) minimum wall thickness is kept	Not repairable	Remove from service
Area B	All quantities of missing or thinning parent material	Not repairable	Remove from service
All other areas	0.015 inch (0.381 mm) maximum depth	Not repairable	Remove from service
Shiplap tab deformation	All quantities if part can be assembled		Remove from service
Plugged cooling air holes	All holes must be fully open		Clean plugged holes with a 0.029 inch (0.737 mm) diameter wire

Stage 1 Duct Band Segment Inspection
Table 817

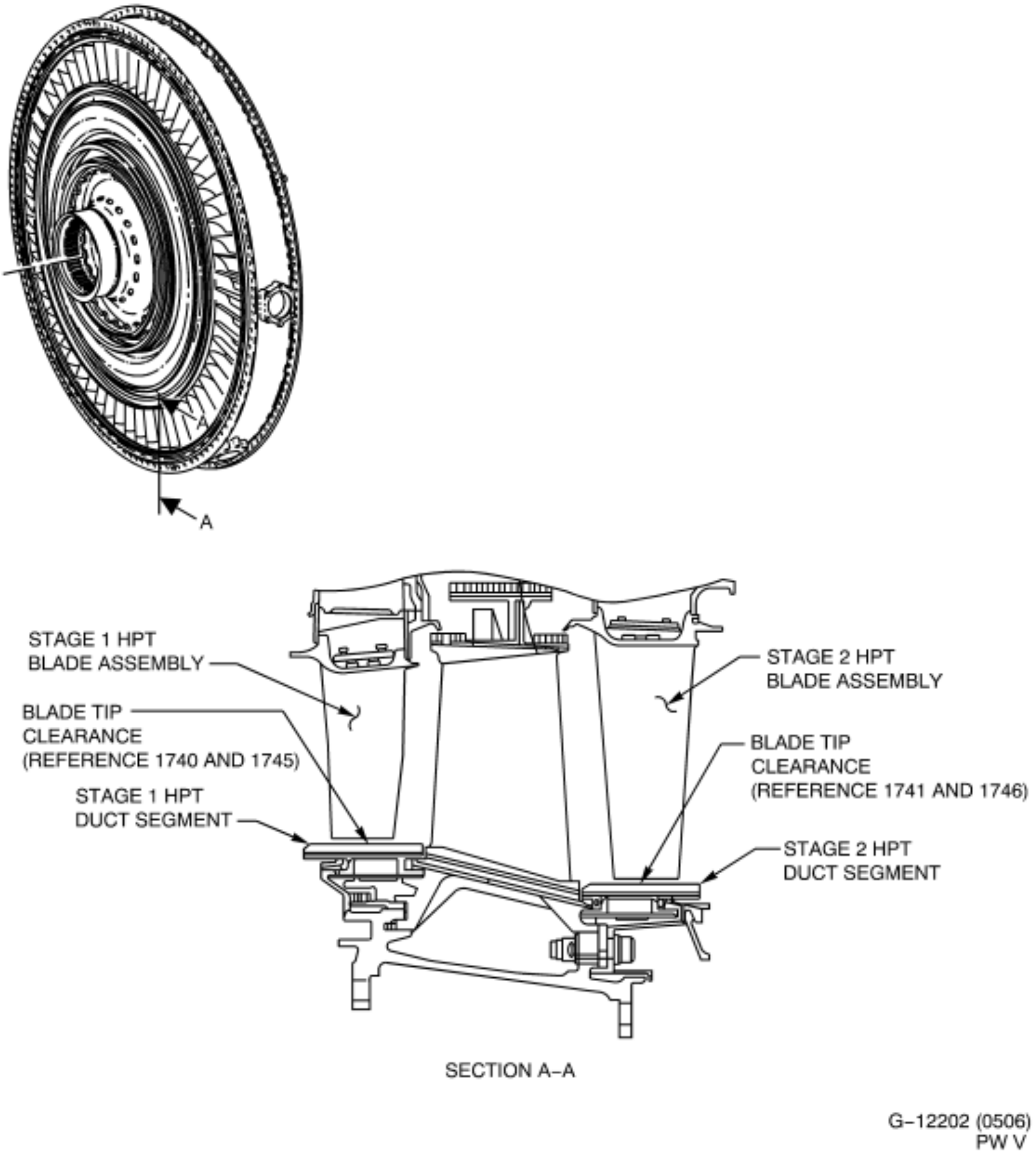
Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 2 vane inner diameter and outer diameter platform for: See Figure 817			
Missing feather seals	A maximum of three feather seals can be missing	All quantities	Replace the missing seals

Stage 2 Vane Platform Feather Seal Inspection
Table 818


POROUS CERAMIC LAYER (WHITE)
DENSE CERAMIC LAYER (GREY)
CERAMIC OR METALLIC LAYER
BLADE RUB AREA
POROUS CERAMIC LAYER (WHITE)
SURFACE CRAZING (TYPICAL)
CERAMIC OR METALLIC LAYER (GREY)
METAL SUPPORT
CHIPPED AREAS (TYPICAL)
VIEW A (TYPICAL)
0.900 in (22.860 mm) MAXIMUM
0.500 in (12.700 mm) MAXIMUM
A
DUCT SEGMENT (TYPICAL FOR STAGE 1 AND STAGE 2)
G−12232 (1006)
PW V

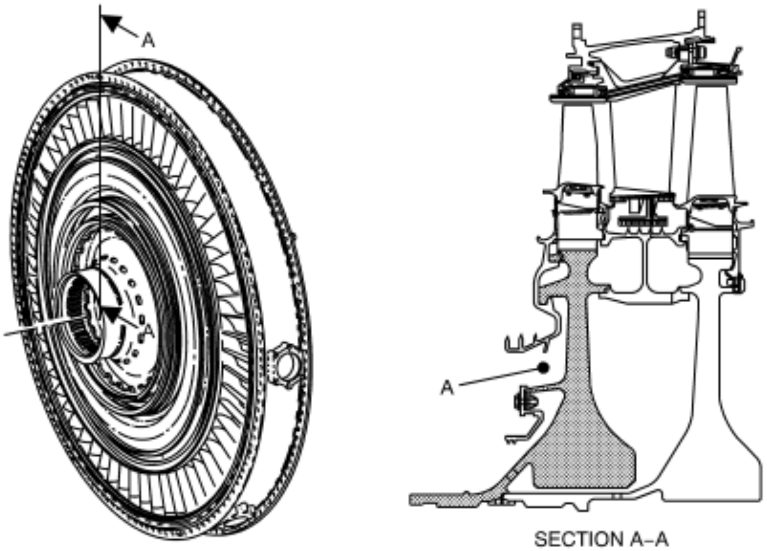
See Table 801 And Table 802 For Index Definitions.

Duct Segment Coat Inspection Areas
Figure 801
(Task 72−00−52−210−010)

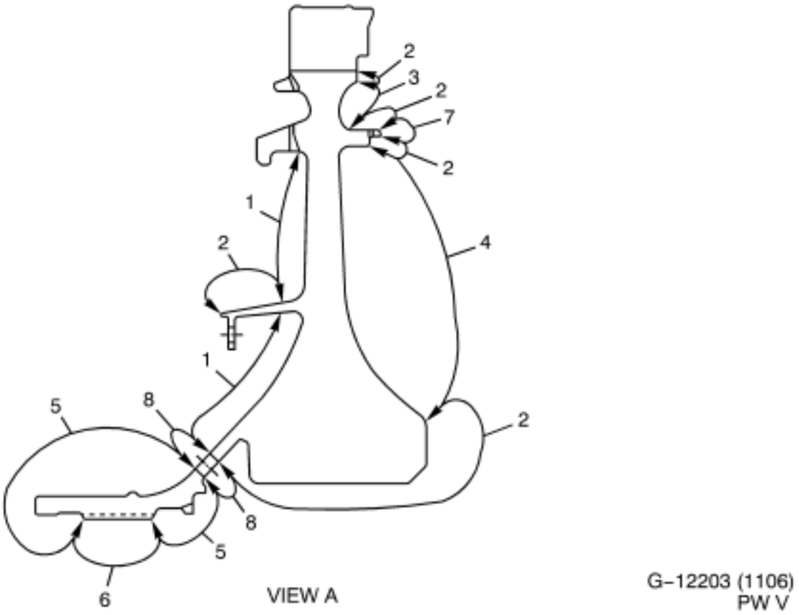

A
STAGE 1 HPT BLADE ASSEMBLY
BLADE TIP CLEARANCE (REFERENCE 1740 AND 1745)
STAGE 1 HPT DUCT SEGMENT
STAGE 2 HPT BLADE ASSEMBLY
BLADE TIP CLEARANCE (REFERENCE 1741 AND 1746)
STAGE 2 HPT DUCT SEGMENT
SECTION A−A
G−12202 (0506)
PW V

See Table 803 For Index Definitions.

Blade Tip Clearance Inspection
Figure 802
(Task 72−00−52−210−010)



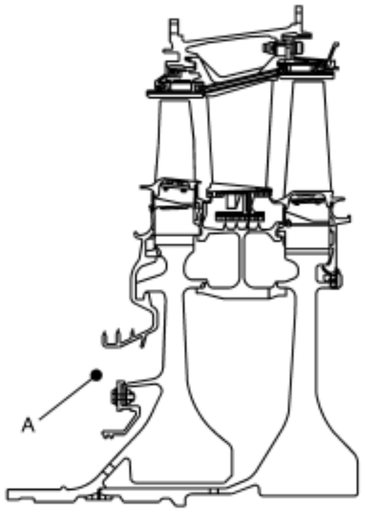
SECTION A−A


2
3
2
7
2
1
4
2
1
5
8
2
8
5
6
G−12203 (1106)
PW V

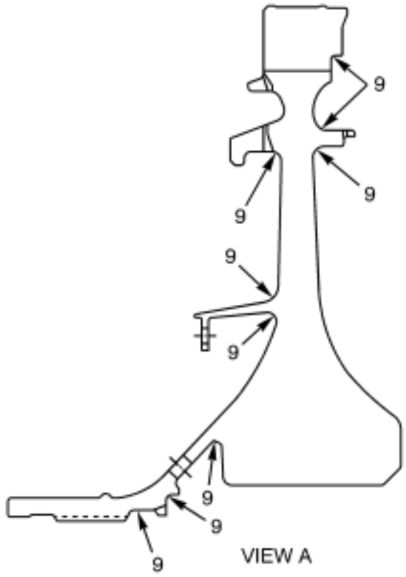
VIEW A

See Table 804 For Index Definitions.

Stage 1 Turbine Front Hub Surface Damage Inspection
Figure 803 (Sheet 1)
(Task 72−00−52−210−010)



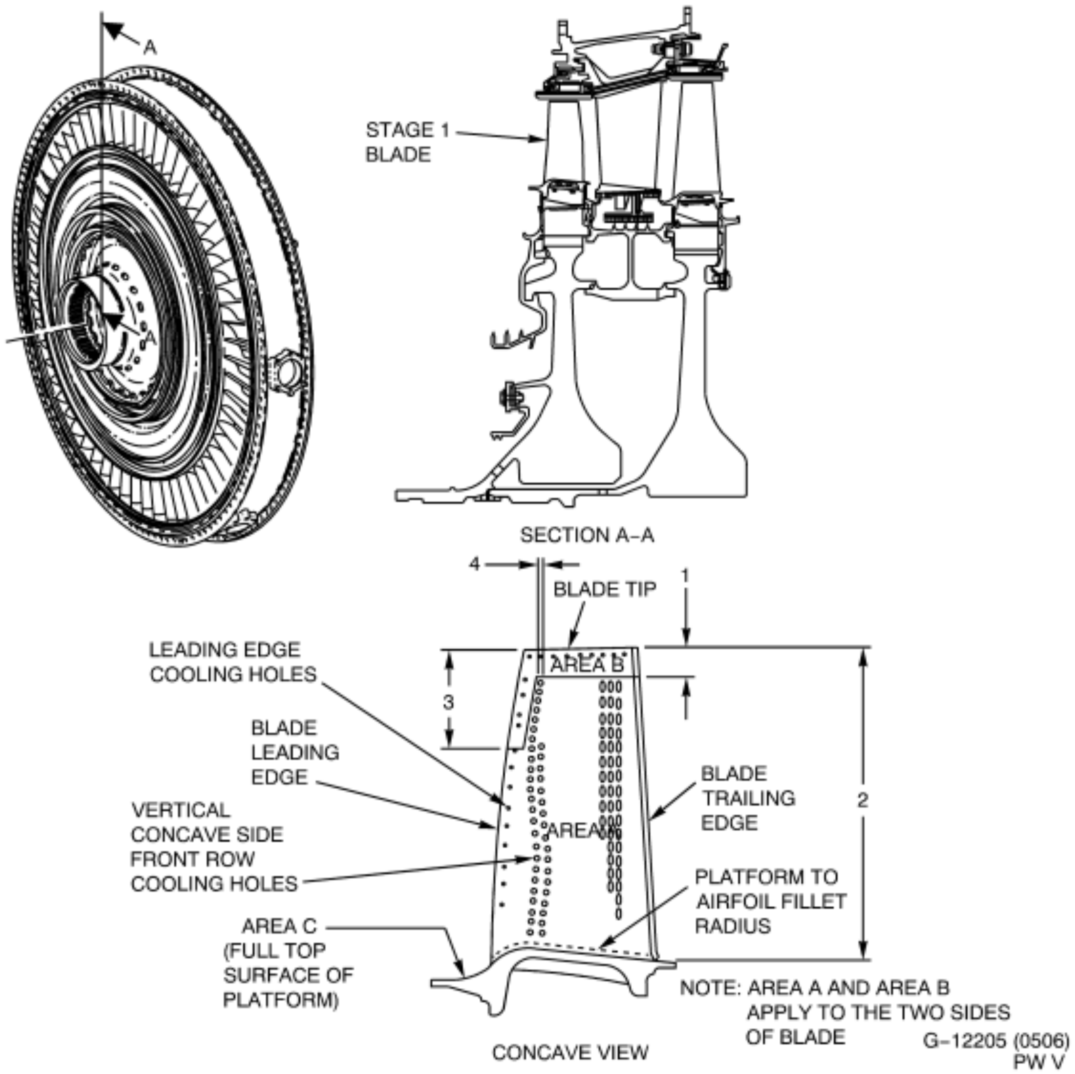
SECTION A−A



VIEW A

See Table 804 For Index Definitions.

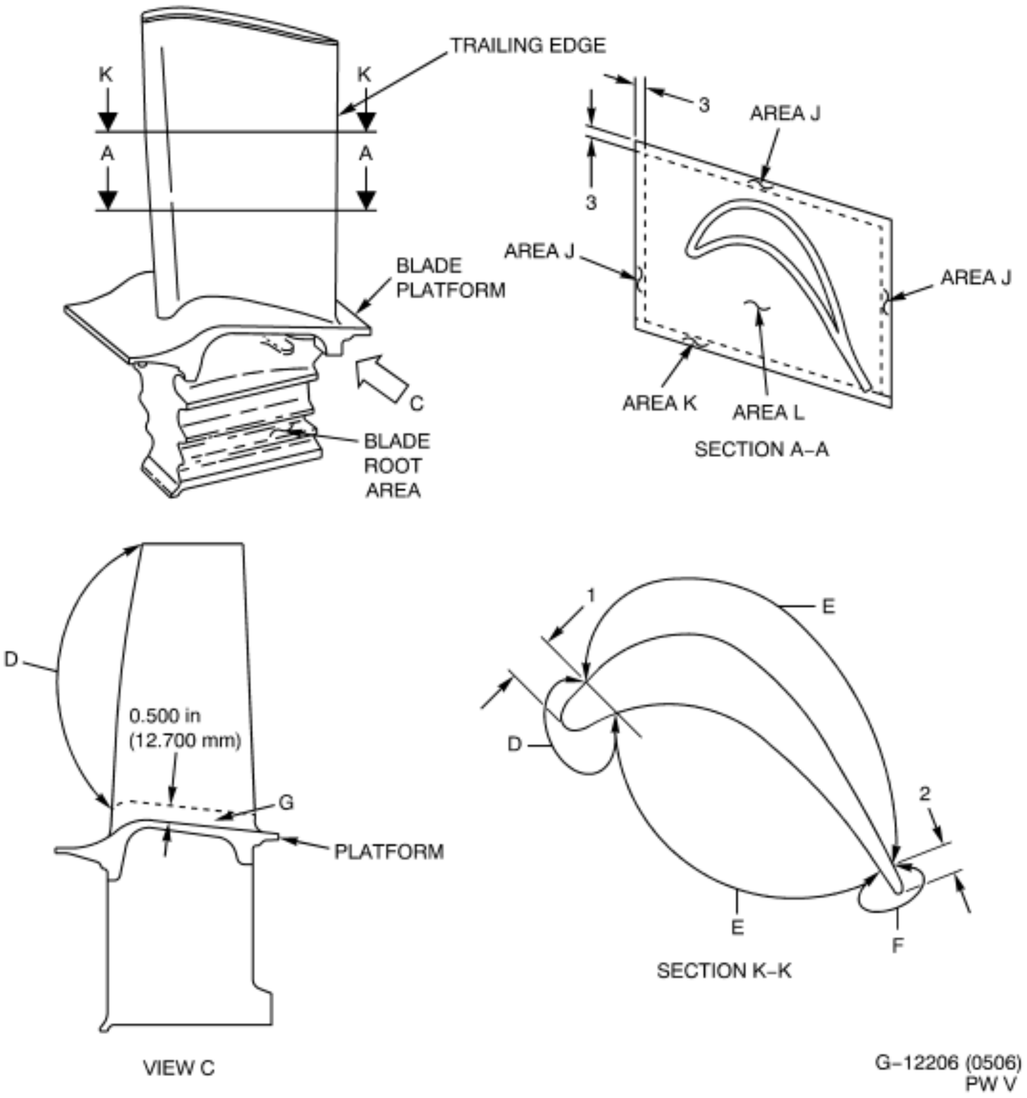
Stage 1 Turbine Front Hub Surface Damage Inspection
Figure 803 (Sheet 2)
(Task 72−00−52−210−010)


A
A
STAGE 1 BLADE
SECTION A−A
4
BLADE TIP
1
LEADING EDGE COOLING HOLES
AREA B
3
BLADE LEADING EDGE
VERTICAL CONCAVE SIDE FRONT ROW COOLING HOLES
AREA A
BLADE TRAILING EDGE
2
PLATFORM TO AIRFOIL FILLET RADIUS
AREA C (FULL TOP SURFACE OF PLATFORM)
NOTE: AREA A AND AREA B APPLY TO THE TWO SIDES OF BLADE
CONCAVE VIEW
G−12205 (0506)
PW V

See Table 805 For Index Definitions.

1. 0.250 Inch (6.350 mm)
2. 2.800 Inches (71.120 mm)
3. 1.000 Inch (25.400 mm)
4. 0.100 Inch (2.540 mm) Forward Of The Vertical Concave Side Front Row Cooling Holes

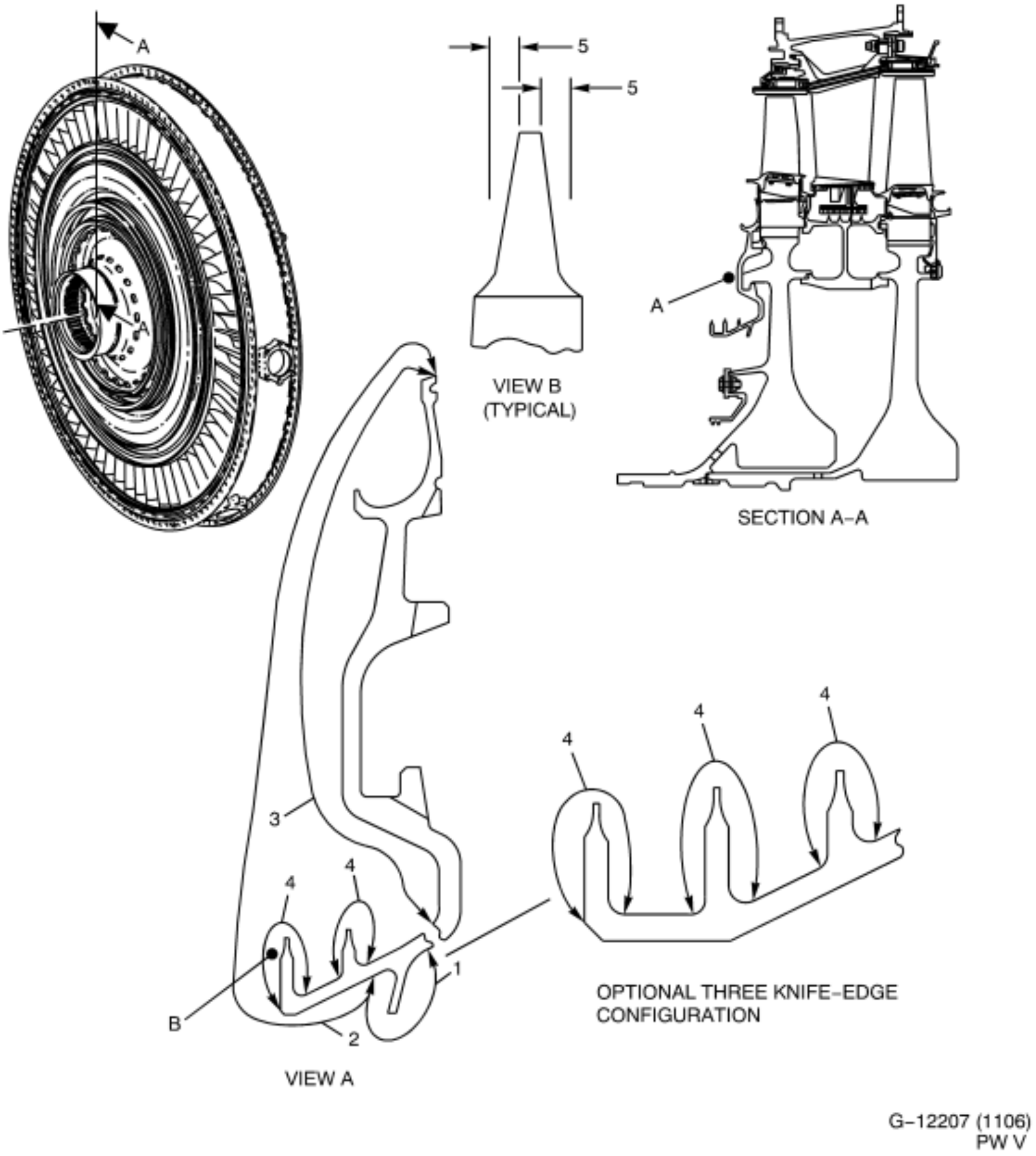
Stage 1 Blade Surface Crack Inspection
Figure 804 (Sheet 1)
(Task 72−00−52−210−010)


TRAILING EDGE
K
K
A
A
BLADE PLATFORM
C
BLADE ROOT AREA
3
3
AREA J
AREA J
AREA J
AREA K
AREA L
SECTION A−A
D
0.500 in (12.700 mm)
G
PLATFORM
VIEW C
1
E
D
2
E
F
SECTION K−K
G−12206 (0506)
PW V

See Table 805 For Index Definitions.

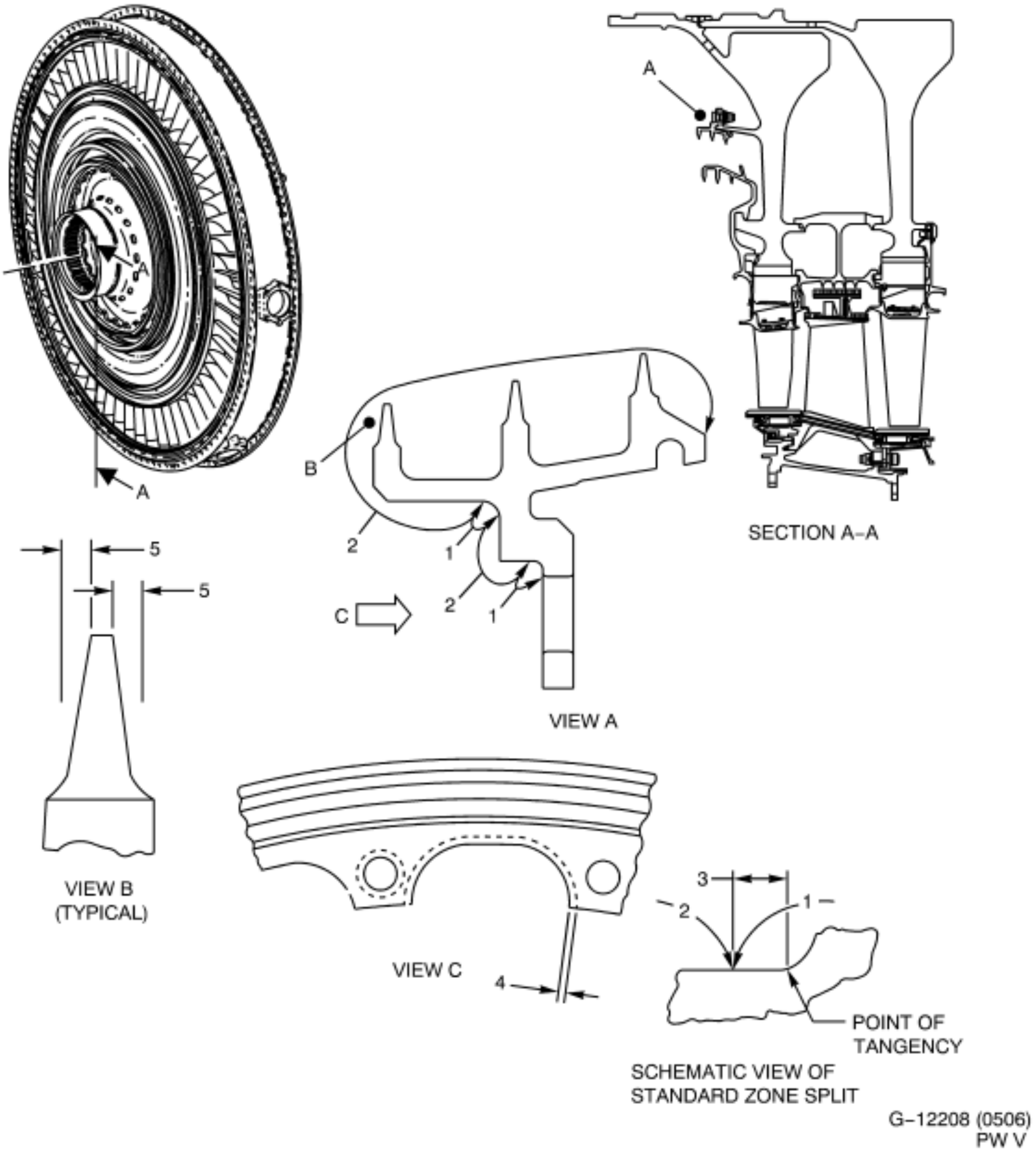
1. 0.100 Inch (2.540 mm)
2. 0.050 Inch (1.270 mm)
3. 0.120 Inch (3.048 mm) All Around

Stage 1 Blade Surface Nicks And Dents Inspection
Figure 804 (Sheet 2)
(Task 72−00−52−210−010)


A
A
5
5
VIEW B
(TYPICAL)
A
SECTION A−A
3
4
4
4
4
4
B
2
1
VIEW A
OPTIONAL THREE KNIFE−EDGE
CONFIGURATION
G−12207 (1106)
PW V

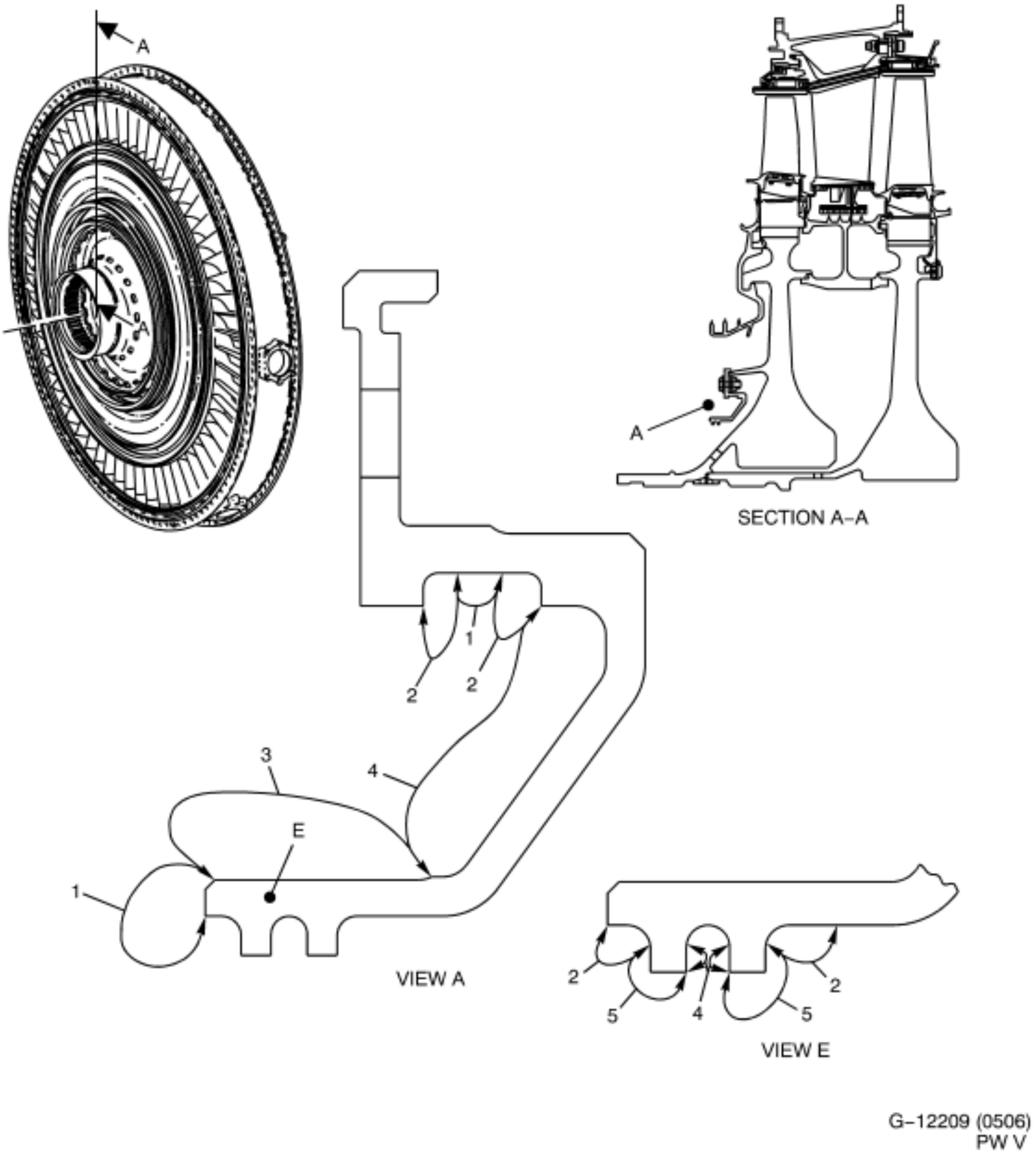
See Table 806 For Index Definitions.

Stage 1 Outer Rotating Airseal Surface Damage Inspection
Figure 805
(Task 72−00−52−210−010)


A
A
A
SECTION A−A
B
2
1
2
1
C
VIEW A
5
5
VIEW B
(TYPICAL)
VIEW C
4
3
2
1
POINT OF
TANGENCY
SCHEMATIC VIEW OF
STANDARD ZONE SPLIT
G−12208 (0506)
PW V

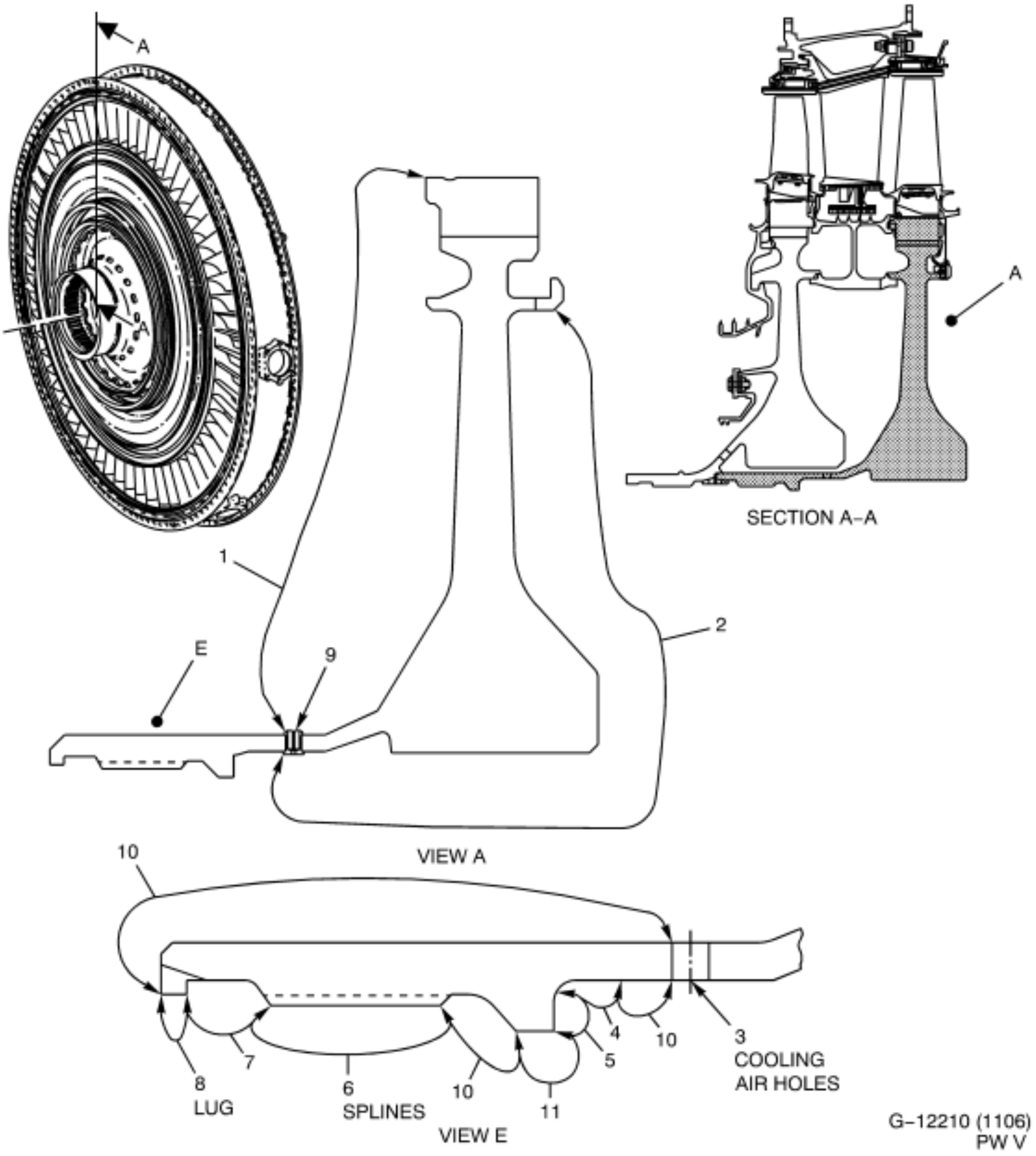
See Table 807 For Index Definitions.

Stage 1 Inner Rotating Airseal Corrosion And Pitting Inspection
Figure 806
(Task 72−00−52−210−010)


A
A
SECTION A−A
A
2
1
2
3
4
E
1
VIEW A
2
2
5
4
5
VIEW E
G−12209 (0506)
PW V

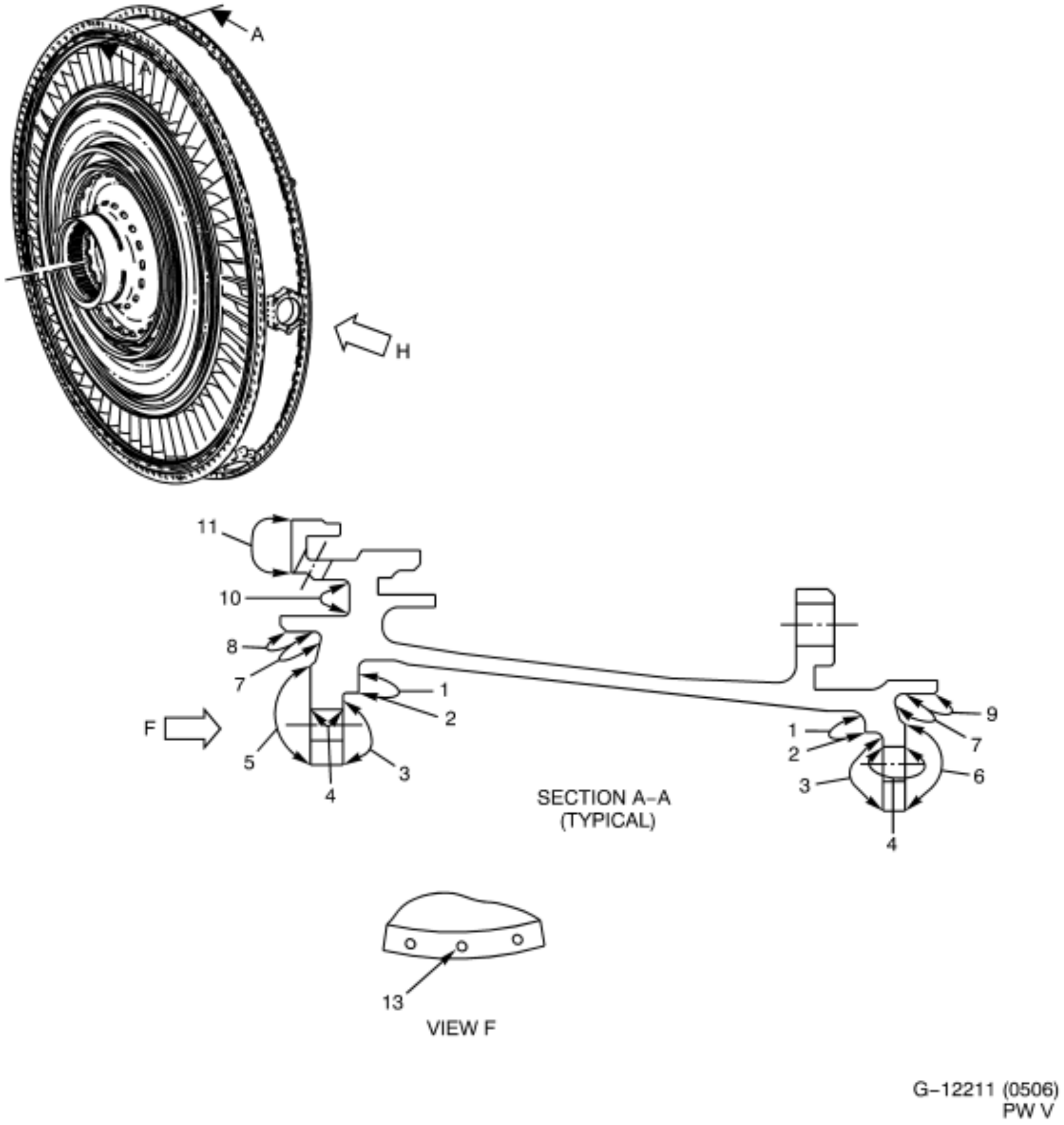
See Table 808 For Index Definitions.

Stage 1 Airsealing Ring Inspection
Figure 807
(Task 72−00−52−210−010)


A
A
SECTION A−A
A
1
2
E
9
VIEW A
10
3
COOLING
AIR HOLES
4
5
10
8
LUG
7
6
SPLINES
10
11
VIEW E
G−12210 (1106)
PW V

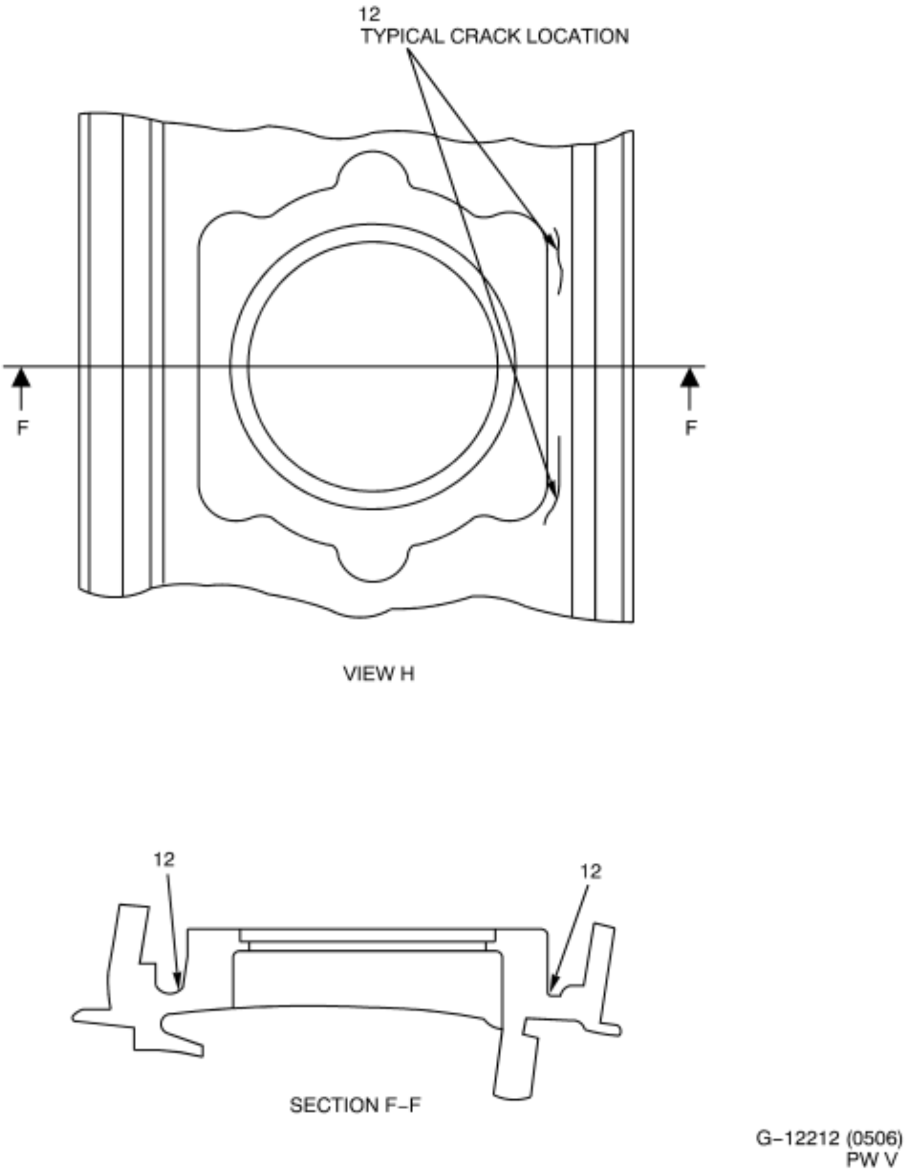
See Table 809 For Index Definitions.

Stage 2 Turbine Intermediate Hub Surface Damage Inspection
Figure 808
(Task 72−00−52−210−010)


A
A
H
11
10
8
7
F
5
4
3
2
1
1
2
3
4
6
7
9
SECTION A−A
(TYPICAL)
13
VIEW F
G−12211 (0506)
PW V

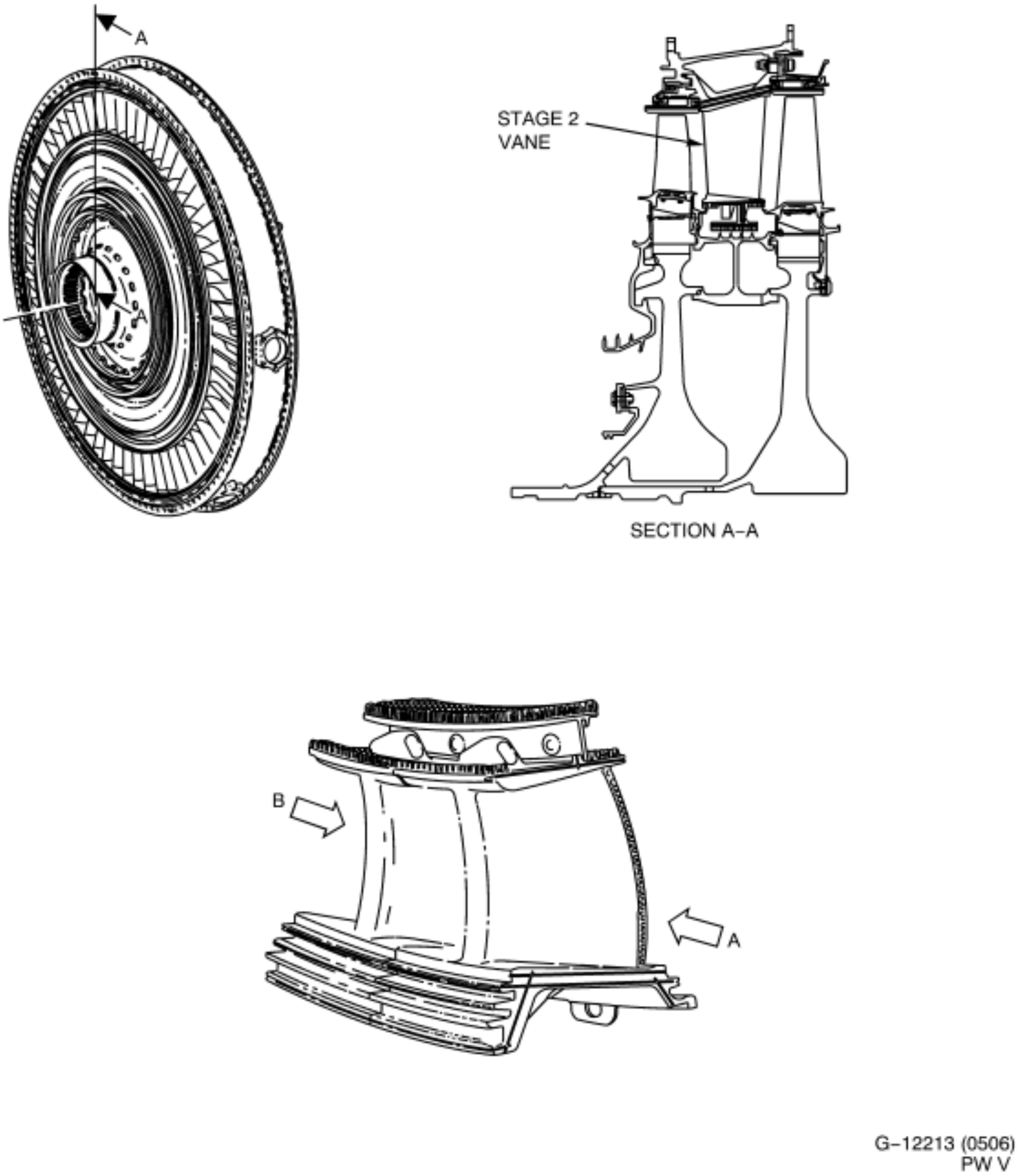
See Table 810 For Index Definitions.

Turbine Case Surface Damage Inspection
Figure 809 (Sheet 1)
(Task 72−00−52−210−010)

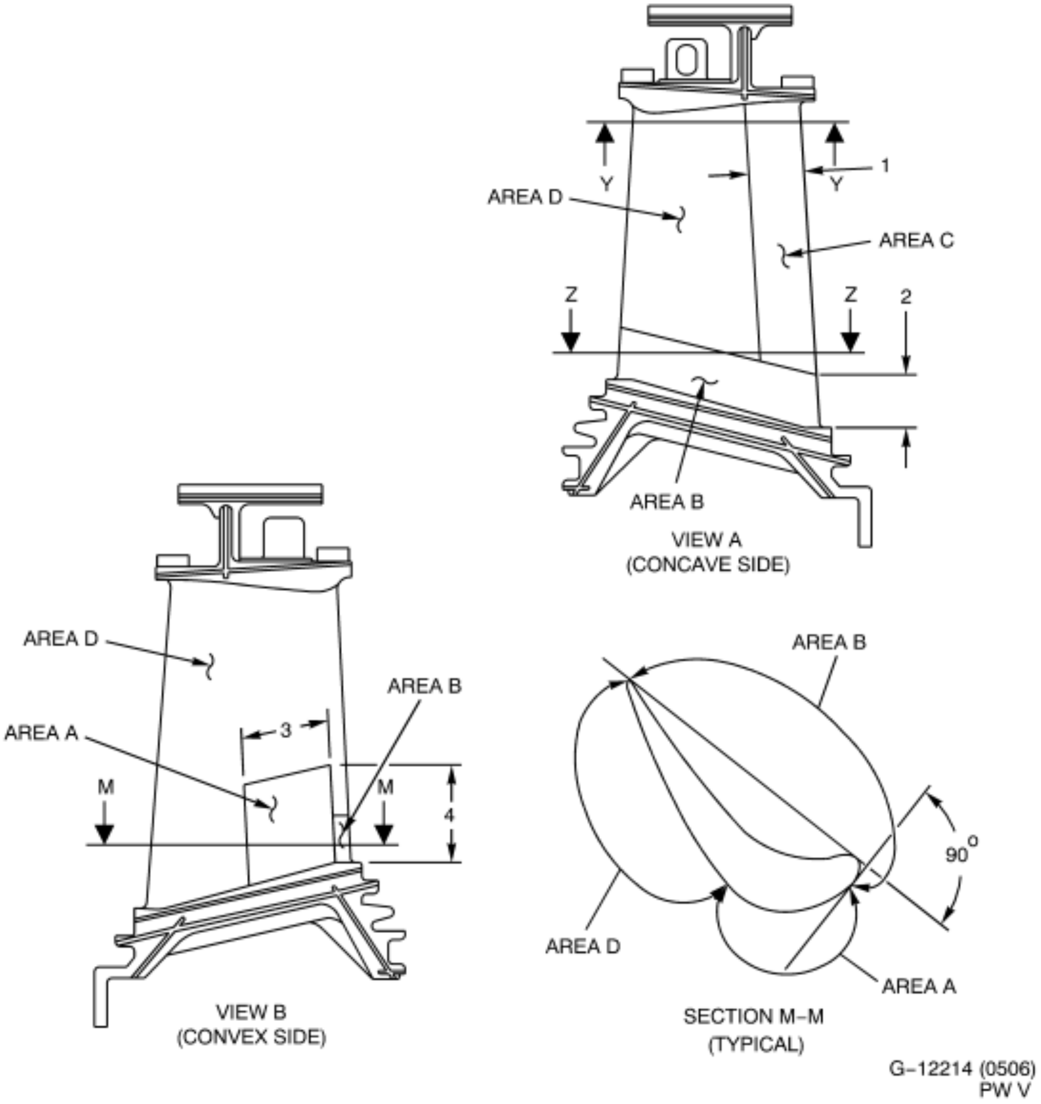

12
TYPICAL CRACK LOCATION
F
F
VIEW H
12
12
SECTION F−F
G−12212 (0506)
PW V

See Table 810 For Index Definitions.

Turbine Case Surface Damage Inspection
Figure 809 (Sheet 2)
(Task 72−00−52−210−010)

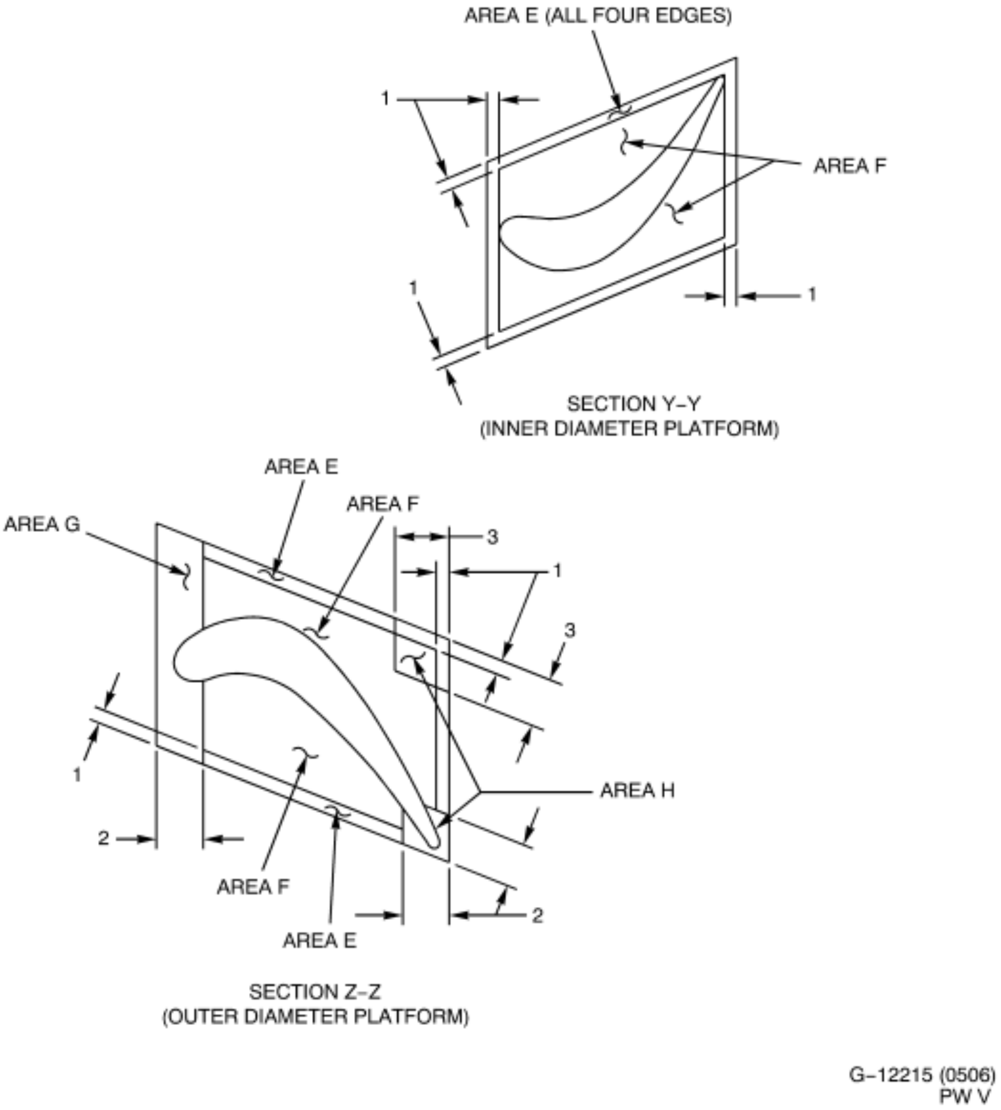

A
A
STAGE 2
VANE
SECTION A−A
B
A
G−12213 (0506)
PW V

Stage 2 Vane Ceramic Coat Erosion/Chipping Inspection
Figure 810 (Sheet 1)
(Task 72−00−52−210−010)


AREA D
Y
Y
1
AREA C
Z
Z
2
AREA B
VIEW A
(CONCAVE SIDE)
AREA D
AREA B
AREA A
3
M
M
4
VIEW B
(CONVEX SIDE)
AREA B
90°
AREA D
AREA A
SECTION M−M
(TYPICAL)
G−12214 (0506)
PW V

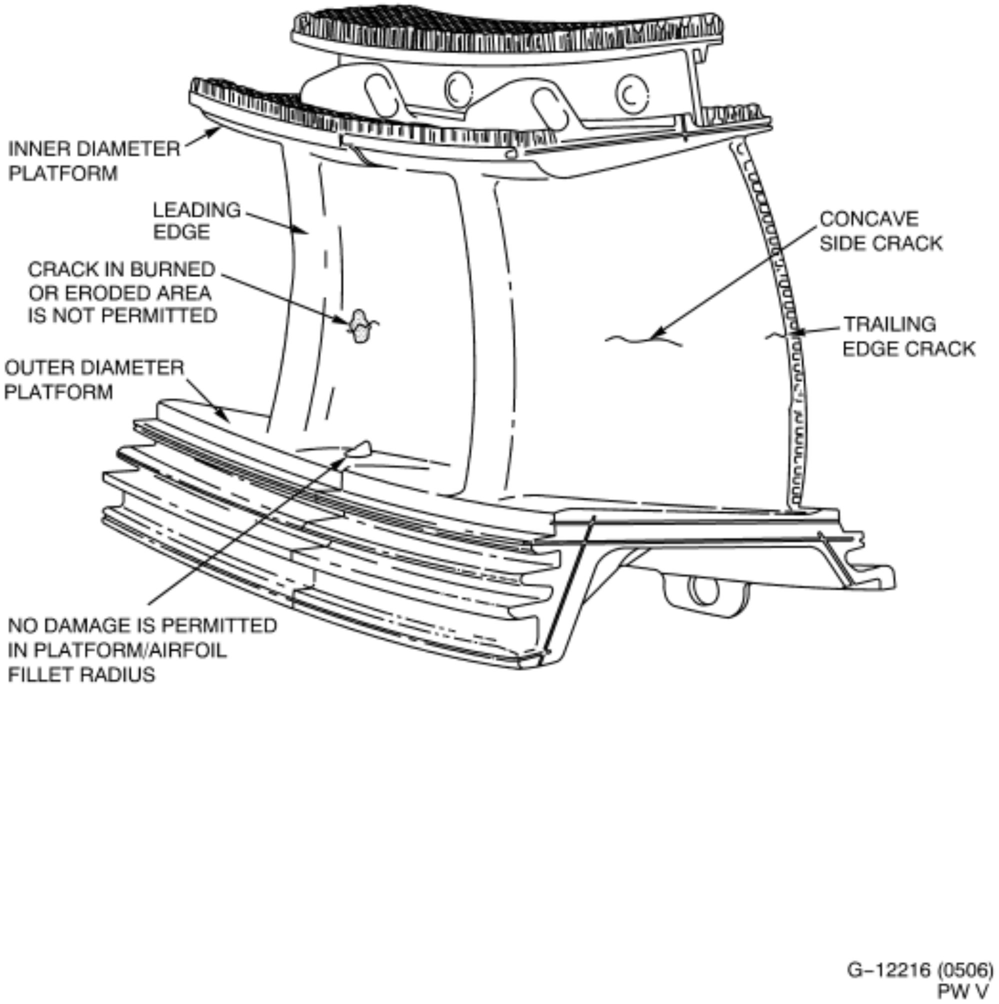
1. 1.000 Inch (25.400 mm) Along The Airfoil Surface
2. 0.500 Inch (12.700 mm)
3. 1.500 Inches (38.100 mm) Along The Airfoil Surface
4. 1.000 Inch (25.400 mm)

Stage 2 Vane Ceramic Coat Erosion/Chipping Inspection
Figure 810 (Sheet 2)
(Task 72−00−52−210−010)

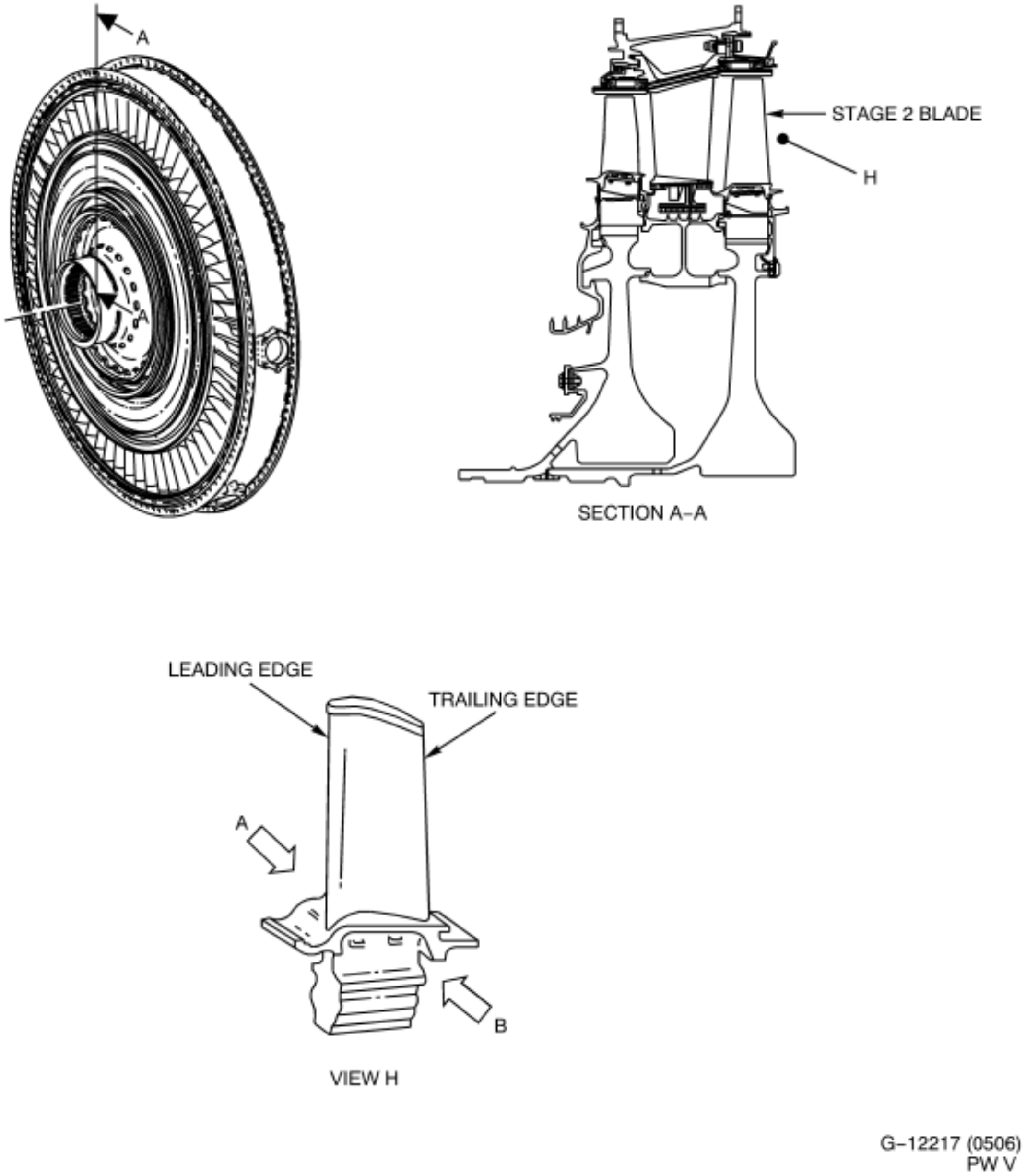

AREA E (ALL FOUR EDGES)
1
AREA F
1
1
SECTION Y−Y
(INNER DIAMETER PLATFORM)
AREA E
AREA F
AREA G
3
1
3
1
AREA H
2
AREA F
AREA E
2
SECTION Z−Z
(OUTER DIAMETER PLATFORM)
G−12215 (0506)
PW V

1. 0.125 Inch (3.175 mm)
2. 0.500 Inch (12.700 mm)
3. 0.750 Inch (19.050 mm)

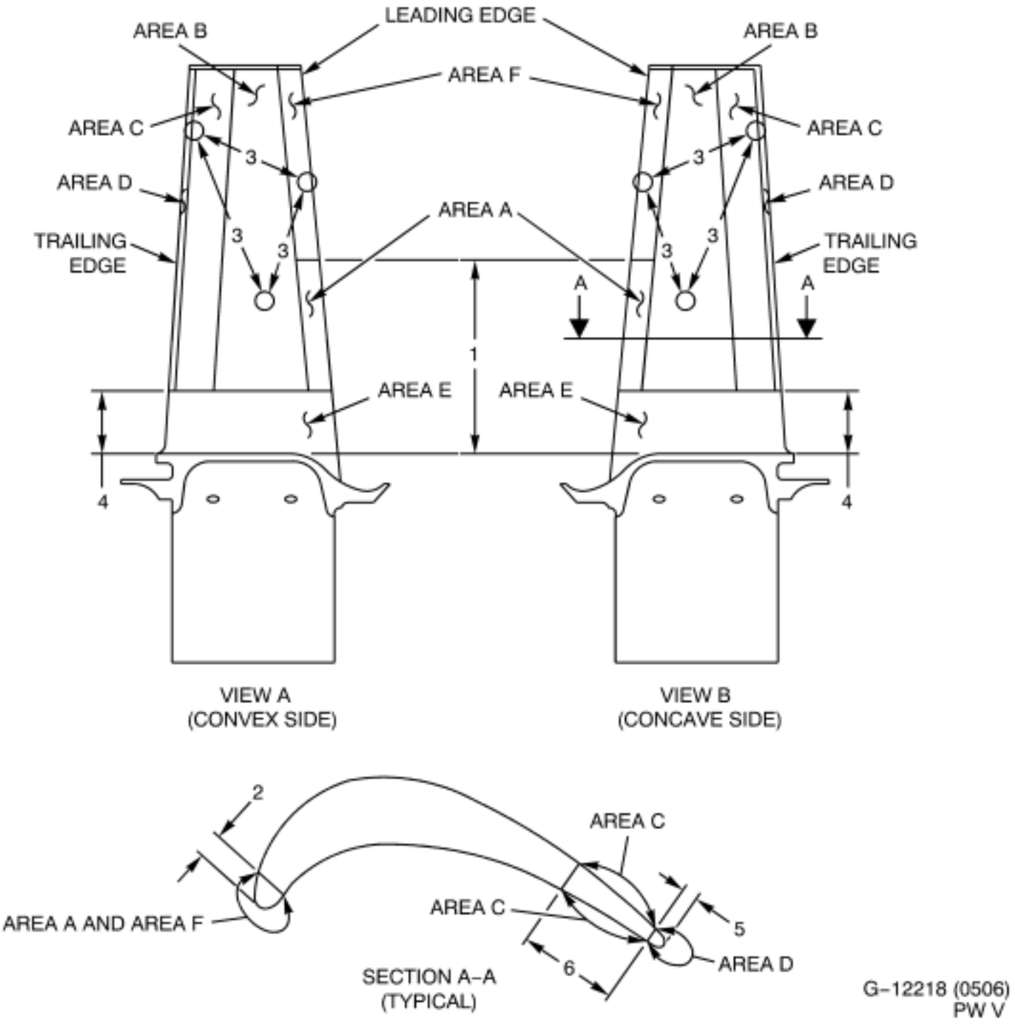
Stage 2 Vane Ceramic Coat Erosion/Chipping Inspection
Figure 810 (Sheet 3)
(Task 72−00−52−210−010)


INNER DIAMETER PLATFORM
LEADING EDGE
CRACK IN BURNED OR ERODED AREA IS NOT PERMITTED
OUTER DIAMETER PLATFORM
NO DAMAGE IS PERMITTED IN PLATFORM/AIRFOIL FILLET RADIUS
CONCAVE SIDE CRACK
TRAILING EDGE CRACK
G−12216 (0506)
PW V

Stage 2 Vane Surface Inspection
Figure 811
(Task 72−00−52−210−010)

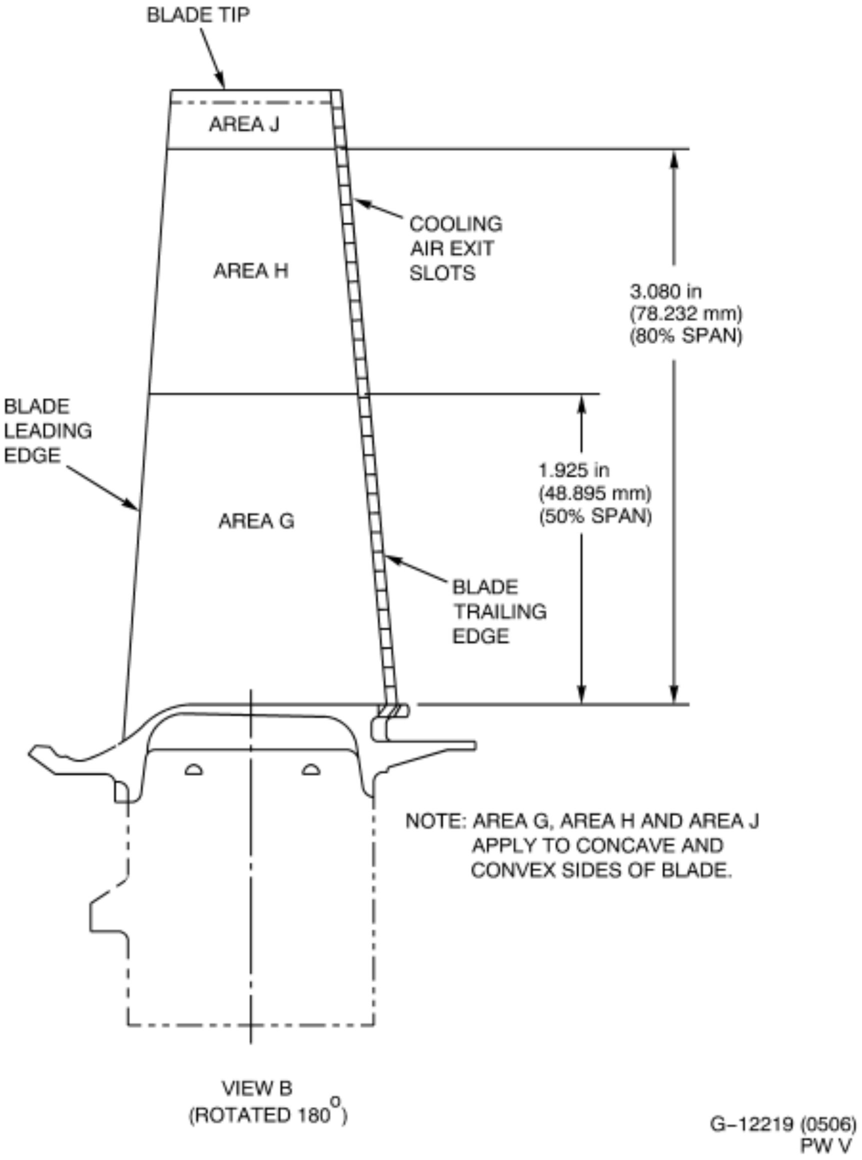

A
A
STAGE 2 BLADE
H
SECTION A−A
LEADING EDGE
TRAILING EDGE
A
B
VIEW H
G−12217 (0506)
PW V

Stage 2 Blade Surface Inspection
Figure 812 (Sheet 1)
(Task 72−00−52−210−010)


LEADING EDGE
AREA B
AREA F
AREA C
AREA D
TRAILING EDGE
AREA A
AREA E
3
1
4
A
VIEW A (CONVEX SIDE)
VIEW B (CONCAVE SIDE)
2
AREA A AND AREA F
AREA C
5
6
AREA D
SECTION A−A (TYPICAL)
G−12218 (0506)
PW V

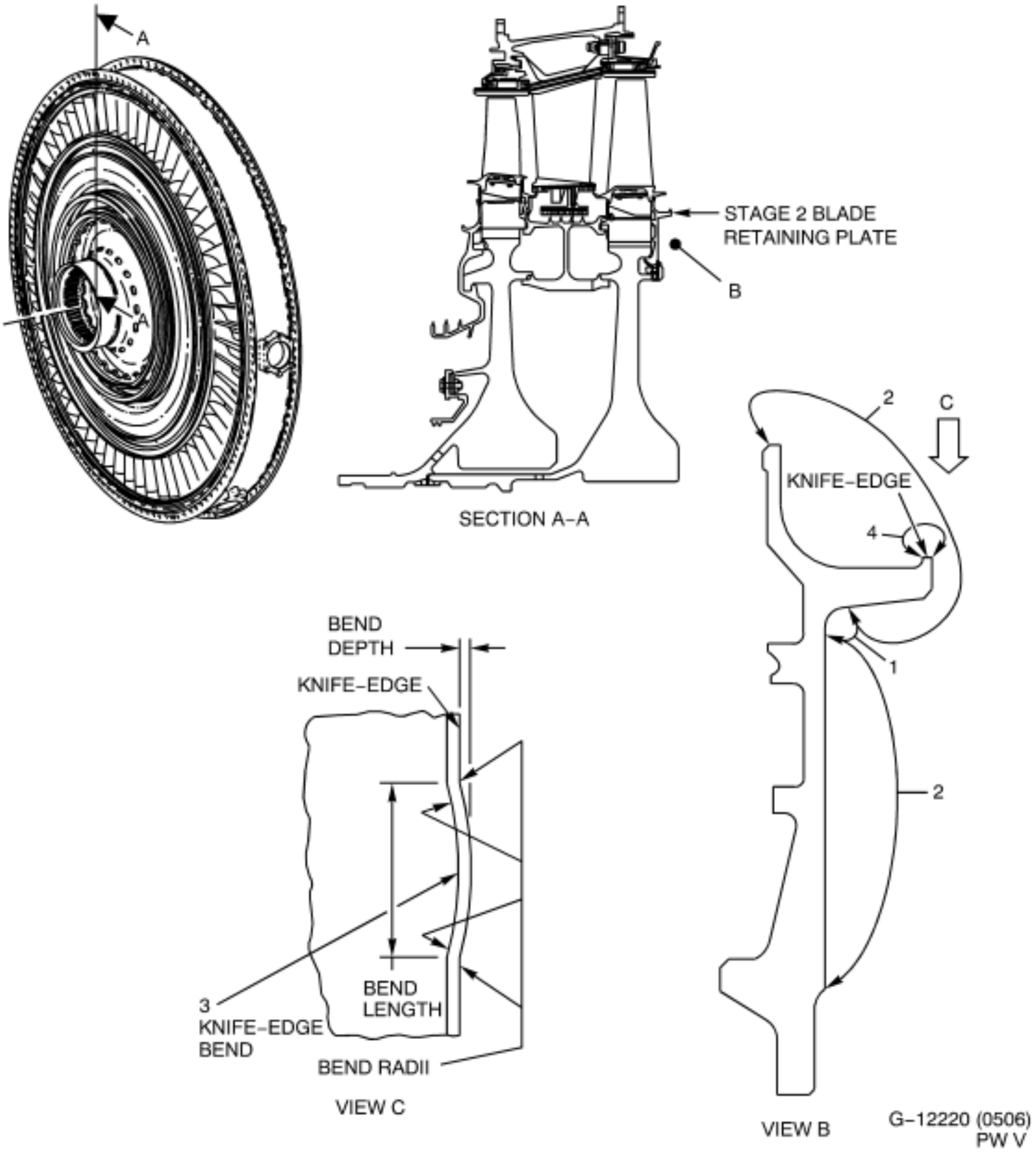
1. 2.000 Inches (50.800 mm)
2. 0.250 Inch (6.350 mm)
3. 0.750 Inch Minimum Separation Between Defects, in All The Areas Other Than Area E, For Dent With Diameter More Than 0.075 Inch (1.905 mm)
4. 0.500 Inch (12.700 mm)
5. 0.025 Inch (0.635 mm)
6. 0.500 Inch (12.700 mm)

Stage 2 Blade Surface Dent Inspection
Figure 812 (Sheet 2)
(Task 72−00−52−210−010)


BLADE TIP
AREA J
COOLING AIR EXIT SLOTS
AREA H
3.080 in (78.232 mm) (80% SPAN)
BLADE LEADING EDGE
1.925 in (48.895 mm) (50% SPAN)
AREA G
BLADE TRAILING EDGE
NOTE: AREA G, AREA H AND AREA J APPLY TO CONCAVE AND CONVEX SIDES OF BLADE.
VIEW B (ROTATED 180°)
G−12219 (0506)
PW V

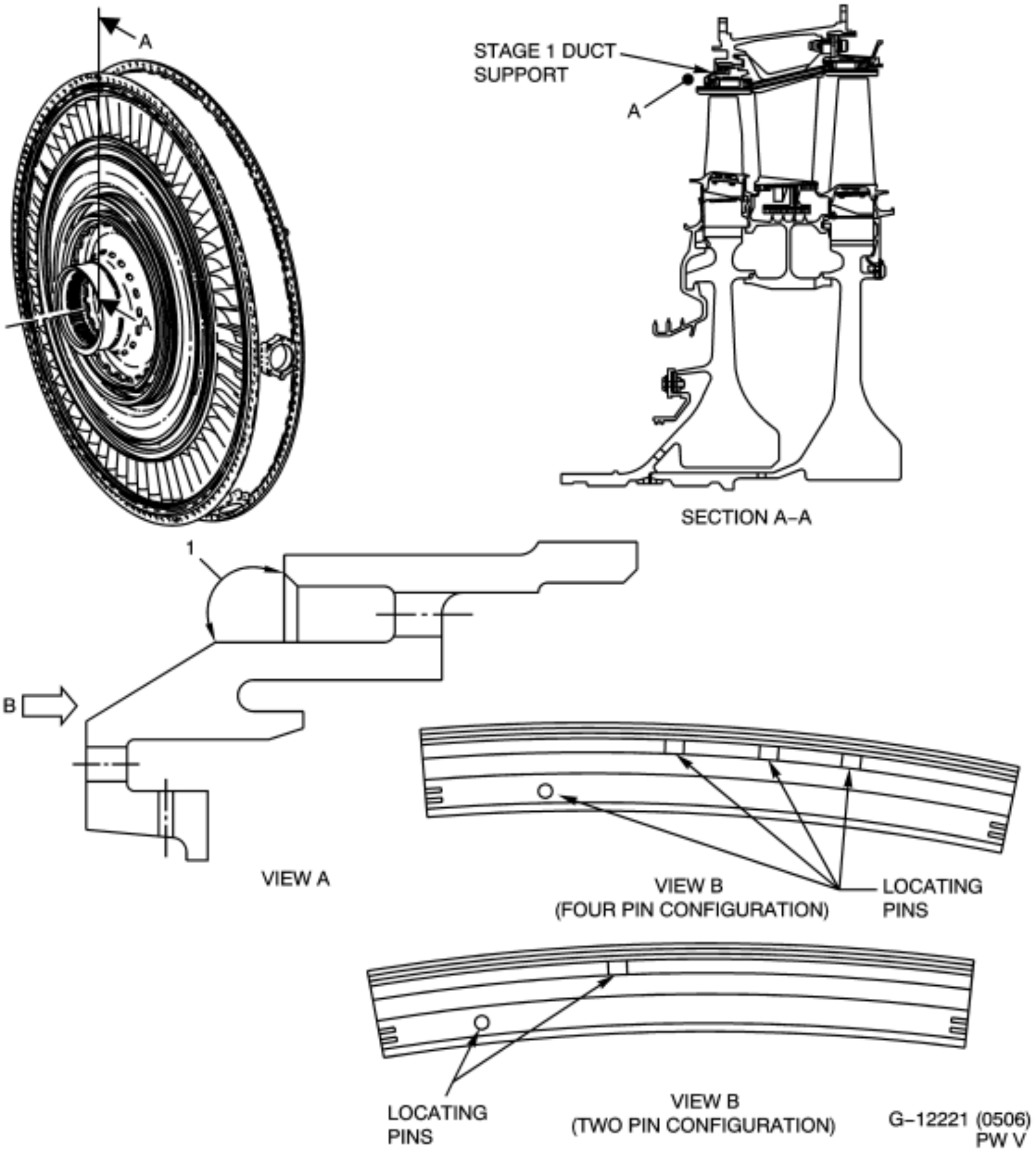
See Table 813 For Index Definitions.

Stage 2 Blade Surface Inspection
Figure 812 (Sheet 3)
(Task 72−00−52−210−010)


A
A
STAGE 2 BLADE
RETAINING PLATE
B
SECTION A−A
2
C
KNIFE−EDGE
4
1
2
BEND
DEPTH
KNIFE−EDGE
3
KNIFE−EDGE
BEND
BEND
LENGTH
BEND RADII
VIEW C
VIEW B
G−12220 (0506)
PW V

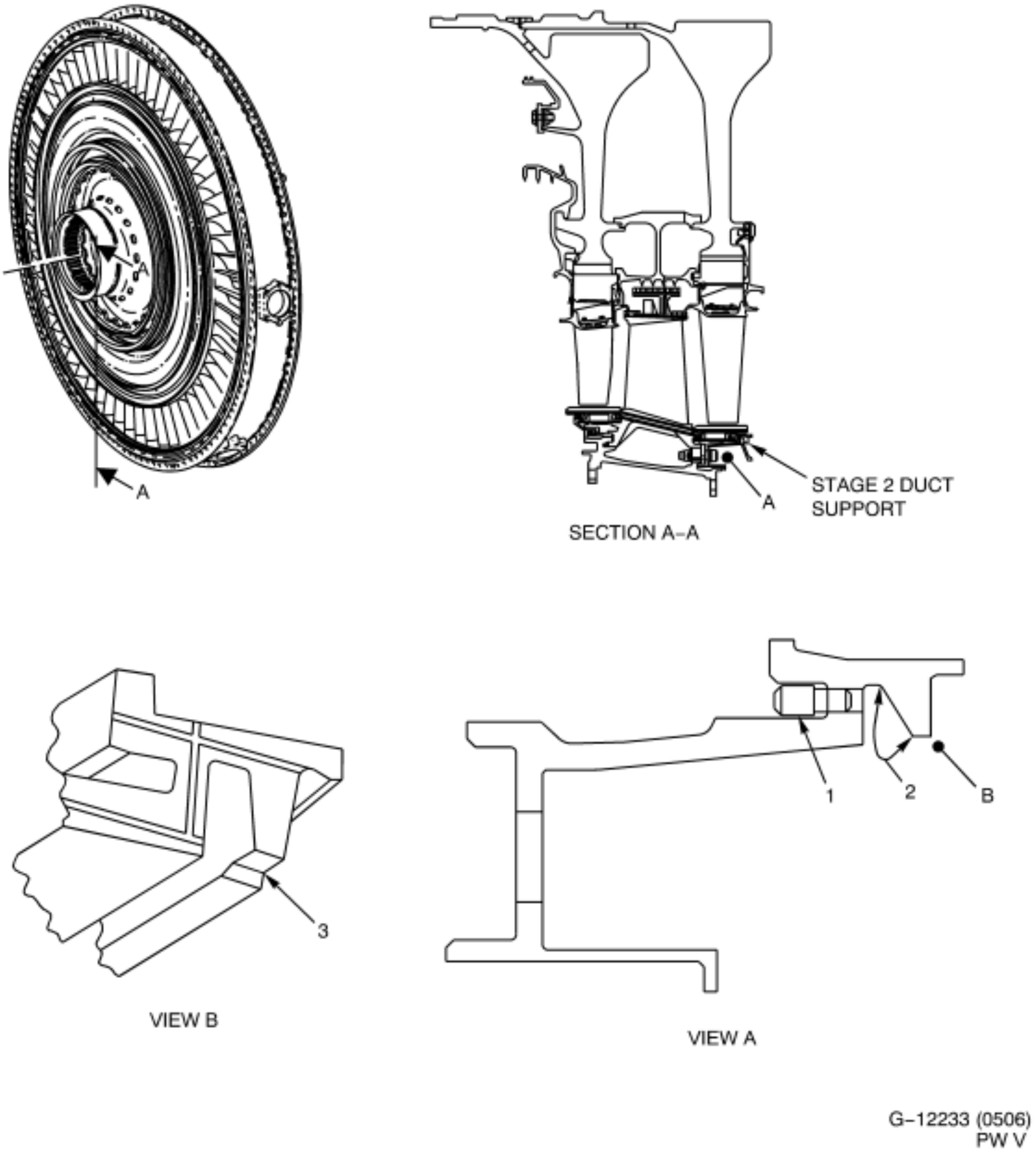
See Table 814 For Index Definitions.

Stage 2 Blade Retaining Plate Surface Inspection
Figure 813
(Task 72−00−52−210−010)


A
STAGE 1 DUCT SUPPORT
A
A
SECTION A−A
1
B
VIEW A
VIEW B
(FOUR PIN CONFIGURATION)
LOCATING PINS
LOCATING PINS
VIEW B
(TWO PIN CONFIGURATION)
G−12221 (0506)
PW V

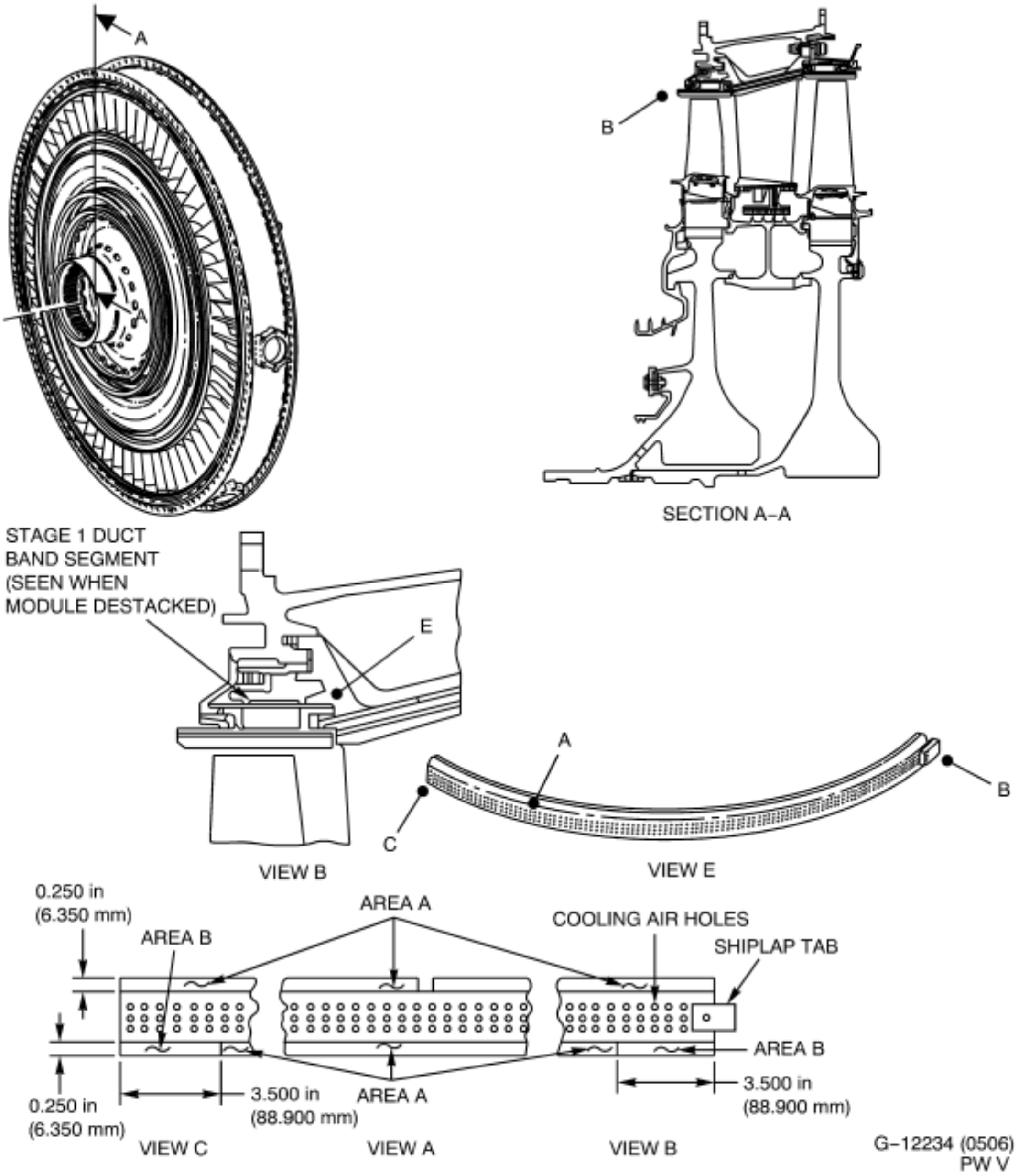
See Table 815 For Index Definitions.

Stage 1 Duct Support Surface Inspection
Figure 814
(Task 72−00−52−210−010)


A
A
STAGE 2 DUCT SUPPORT
A
SECTION A−A
3
VIEW B
1
2
B
VIEW A
G−12233 (0506)
PW V

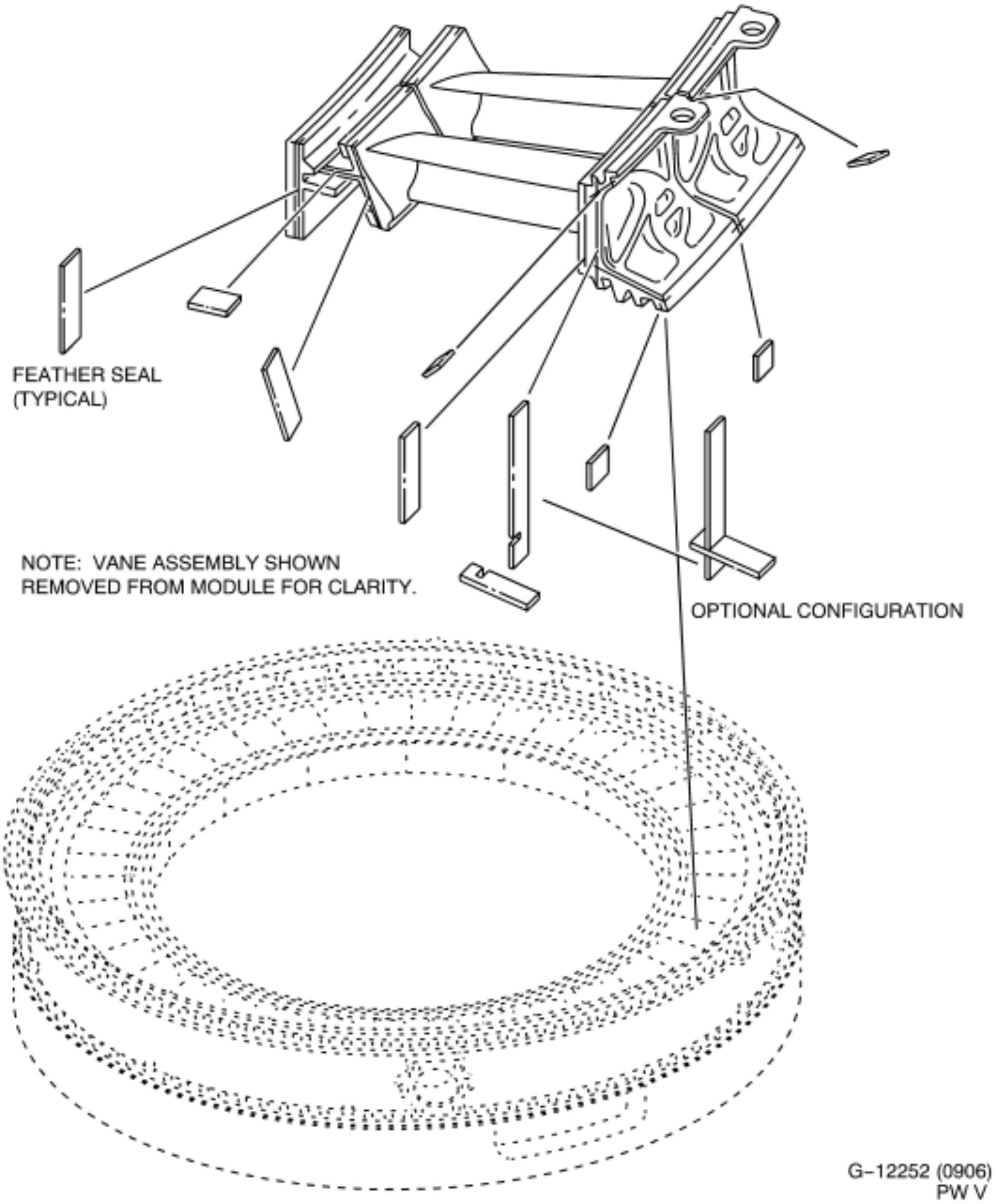
See Table 816 For Index Definitions.

Stage 2 Duct Support Surface Inspection
Figure 815
(Task 72−00−52−210−010)


A
A
B
SECTION A−A
STAGE 1 DUCT BAND SEGMENT (SEEN WHEN MODULE DESTACKED)
E
VIEW B
A
C
B
VIEW E
0.250 in (6.350 mm)
AREA B
AREA A
COOLING AIR HOLES
SHIPLAP TAB
AREA B
0.250 in (6.350 mm)
3.500 in (88.900 mm)
AREA A
3.500 in (88.900 mm)
VIEW C
VIEW A
VIEW B
G−12234 (0506)
PW V

See Table 817 For Index Definitions.

Stage 1 Duct Band Segment Inspection
Figure 816
(Task 72−00−52−210−010)


FEATHER SEAL
(TYPICAL)
NOTE: VANE ASSEMBLY SHOWN
REMOVED FROM MODULE FOR CLARITY.
OPTIONAL CONFIGURATION
G−12252 (0906)
PW V

Stage 2 Vane Platform Feather Seal Inspection
Figure 817
(Task 72−00−52−210−010)

Return to Previous Menu

72−00−53

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	HIGHLIGHTS
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72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−02 • 72−00−53−020−001−002: Remove Low Pressure Turbine With Shaft (Hydraulic Wrench) − Deleted
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−03 • 72−00−53−020−003: Remove External Plumbing Prior To Low Pressure Turbine Removal
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−04 • 72−00−53−050−002: Remove Turbine Case Cooling Manifold (Collector)
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−05 • 72−00−53−050−003: Remove Turbine Case Cooling Manifolds
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−06 • 72−00−53−050−004: Remove Turbine Case Cooling (TCC) Air Valve Control Cable
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−07 • 72−00−53−050−001: Remove Turbine Case Cooling (TCC) Air Valve (LPT)
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−08 • 72−00−53−020−002: Remove Low Pressure Turbine And Turbine Exhaust Case With Shaft
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−09 • 72−00−53−020−002−002: Remove The Low Pressure Turbine And Turbine Exhaust Case With Shaft (Hydraulic Wrench) − Deleted
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−20 • 72−00−53−020−020: Remove The Flange N Brackets And Hardware

72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−01 • 72−00−53−420−001: Install The Low Pressure Turbine With Shaft
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−02 • 72−00−53−420−001−002: Install The Low Pressure Turbine With Shaft (Hydraulic Wrench) − Deleted
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−03 • 72−00−53−420−003: Install External Plumbing After Low Pressure Turbine Installation
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−04 • 72−00−53−450−002: Install Turbine Case Cooling Manifold (Collector)
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−05 • 72−00−53−450−003: Install Turbine Case Cooling (TCC) LPT Manifolds
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−06 • 72−00−53−450−004: Install Turbine Case Cooling (TCC) Air Valve Control Cable
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−07 • 72−00−53−450−001: Install Turbine Case Cooling (TCC) Air Valve (LPT)
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−08 • 72−00−53−420−002: Install The Low Pressure Turbine And Turbine Exhaust Case With Shaft
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−09 • 72−00−53−420−002−002: Install The Low Pressure Turbine And Turbine Exhaust Case With Shaft (Hydraulic Wrench) Deleted
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−20 • 72−00−53−420−020: Install The Flange N Brackets And Hardware
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−01 • 72−00−53−990−001: Specific Fits And Clearances
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−02 • 72−00−53−200−002: Visually Inspect Low Pressure Turbine
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−03

	- 72−00−53−200−003: Inspect Front Compressor Drive Turbine (LPT) Shaft Splines
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−10 - 72−00−53−210−010: Visually Examine The Low Pressure Turbine (LPT) Module Assembly − Engine General
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REPAIR−01 - 72−00−53−300−001: Stop Drill Repair Turbine Case Front Inner Rail Cracks
72−00−53	ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REPAIR−02 - 72−00−53−300−002: In Situ Featherseal Replacement For Assembled LPT Module − 3rd Stage LPT Outer Transition Duct Assembly

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - REMOVAL-01

Task 72-00-53-020-001:

1. Remove Low Pressure Turbine With Shaft

NOTE: See Figure 301 for part/assembly removal procedure sequence.

NOTE: This procedure is for the removal of the low pressure turbine with the turbine exhaust case previously removed.

NOTE: See 72-00-53, Removal-08 (Task 72-00-53-020-002) for the procedure to remove the low pressure turbine with the turbine exhaust case installed.

A. Prerequisites

(1) Remove The Compressor Inlet Cone. Refer to 72-00-31, Removal-02 (Task 72-00-31-020-001).

(2) Remove The Turbine Exhaust Case. Refer to 72-00-54, Removal-01 (Task 72-00-54-020-001).

(3) Disconnect/Remove External Parts For Access To The Low Pressure Turbine (LPT). Refer to 72-00-53, Removal-03 (Task 72-00-53-020-003).

B. Equipment And Materials Necessary

Special Tools:

PWA 3755	Pump (Optional To PWA 29389)
PWA 18872	Wrench (Use With Hydraulic Wrench)
PWA 25096	Stand (Optional To PWA 87330)
PWA 28657	Sling, Strongback, Handling
PWA 28668	Pump, Hydraulic (Use With Hydraulic Wrench)
PWA 28669	Cart (Optional) (Use With Hydraulic Wrench)
PWA 28814	Pump, Electric (Use With Hydraulic Wrench)
PWA 28815	Cart (Optional To PWA 75045) (Use With Hydraulic Wrench)
PWA 29389	Pump, Hydraulic
PWA 29510	Pump, Hydraulic (Hand) (Use With Hydraulic Wrench)
PWA 29614	Wrench, Mechanical (Use With Mechanical Wrench)
PWA 33732	Wrench (Use With Hydraulic Wrench)
PWA 45418	Wrench, Mechanical (Use With Mechanical Wrench)
PWA 45419	Air Torque Multiplier (Use With Mechanical Wrench)
PWA 75046	Cart (Optional) (Use With Hydraulic Wrench)
PWA 76154	Adapter (Two Required)

Special Tools:

(CONTINUED)

PWA 76270	Stand (Optional To PWA 87330)
PWA 80187	Wrench, Mechanical (Use With Mechanical Wrench)
PWA 80651	Multiplier, Pneumatic (Use With Mechanical Wrench)
PWA 85298	Puller, Jackscrew
PWA 85299	Adapter, Wrench (Use With Mechanical Wrench)
PWA 85300	Adapter, Wrench (Use With Mechanical Wrench)
PWA 85306	Puller, Knocker
PWA 85331	Retainer, Rear
PWA 85430	Sleeve, Adapter (Optional To PWA 86424)
PWA 85456	Retainer, Front (Optional To PWA 85996)
PWA 85514	Wrench, Torque (Use With Hydraulic Wrench)
PWA 85515	Adapter (Use With Hydraulic Wrench)
PWA 85562	Sleeve, Support (Used With PWA 25096 And PWA 76270 Stand)
PWA 85769	Fixture (Install/Remove)
PWA 85785	Adapter, Piloting
PWA 85996	Retainer, Front (Optional To PWA 85456)
PWA 86210	Adapter , Piloting
PWA 86424	Sleeve, Adapter
PWA 86604	Stand, Transport (Optional, To Store And Transport PWA 85769 Fixture)
PWA 87330	Stand
PWA 87347	Sleeve, Support (Used With PWA 87330 Stand)
PWA 88204	Guide, Piloting
PWA 102460	Adapter, Wrench (Use With Mechanical Wrench)
PWA 102727	Support
PWA 103636	Base, Support

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)

C. Procedure

(1) Position and adjust the PWA 102727 Fan Case Support to engage and hold the fan inlet case at Flange "A" at the 6 o'clock location. If it is necessary because of the height of the engine in the pedestals, first install the Fan Case Support (PWA 102727) in a PWA 103636 Base

Support. Attach the Fan Case Support (PWA 102727) to the Base Support (PWA 103636) with the three detail bolts and nuts.

NOTE: If necessary several Base Supports (PWA 103636) can be stacked together. They must be attached to each other with the three detail bolts and nuts.

(2) Align boltholes and install PWA 86424 Sleeve or PWA 85430 Sleeve onto rear face of low pressure turbine shaft. Secure sleeve with eight bolts (302/1). See Figure 302.

(3) Install PWA 85331 Retainer to rear of low pressure turbine. See Figure 302.

  (a) Using hoist, connect PWA 28657 Sling to lifting rings of retainer.

  (b) Position retainer to rear of low pressure turbine.

  (c) Align lower bolthole in forward right side of retainer with No. 21 bolthole from locating pin at 6 o'clock position in rear flange of low pressure turbine case.

  (d) Locate No. 21 bolthole on right side, rear flange of turbine case, from locating pin at 6 o'clock position. Align lower right bolthole in front side of fixture with previously located No. 21 bolthole. Secure fixture to rear flange with 48 washers (302/3) and screws (302/4).

  (e) Tighten eight hand knobs (302/2) to secure inner hub of fixture to PWA 86424 Sleeve or PWA 85430 Sleeve as applicable.

  (f) Remove sling. Install sling with two PWA 76154 Adapters to the forward spools on the rear retainer.

(4) Remove shims between outer shroud of 6th stage LPT blades and air sealing ring segments.

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−01

(5) Remove key washer retaining ring (303/1) and retaining nut key washer (303/2) securing turbine shaft plug (303/3) at front of LPC/LPT coupling. Remove plug using PWA 85306 Puller. Discard packing (303/4). See Figure 303.

(6) Remove retaining ring (304/1) and key washer (304/2) securing turbine shaft nut (304/3) to low pressure turbine shaft. See Figure 304.

(7) For operators that use the mechanical wrench, remove the turbine shaft nut as follows.

NOTE: See the following step to remove the turbine shaft nut with the optional hydraulic wrench.

(a) Install PWA 102460 Adapter or PWA 85299 Adapter into LPC/LPT coupling. See Figure 305.

1 Loosen wing nuts (305/1) and slide three clamps (305/2) radially inward.

2 Loosen wing nuts (305/1) and slide three clamps (305/2) radially inward.

3 Align keys in adapter with internal slots in coupling and install adapter in coupling. Index adapter as necessary to seat keys in slots in coupling. Slide three clamps radially outward to engage lugs of coupling. Tighten wing nuts to secure clamps.

(b) Install PWA 85300 Wrench, smaller splined end first, into center of PWA 102460 Adapter or PWA 85299 Adapter. Align spline of wrench with spline in ID of turbine shaft nut. Push wrench inward to seat on face of nut.

(c) Using hoist, align splines and slide applicable mechanical wrench over splines of PWA 85300 Wrench. Align anti−torque pins in wrench with bushings in adapter and seat wrench against adapter face. See Table 301 for mechanical wrench options.

PWA Mechanical Wrench	PWA Torque Multiplier
45418	45419
29614, or 80187	45419, or 80651

Mechanical Wrench Options
Table 301

CAUTION: PWA 80651 TORQUE MULTIPLIER MUST NOT BE USED WITH PWA 45418 WRENCH OR DAMAGE TO WRENCH MAY OCCUR.

(d) Actuate wrench to remove nut from shaft.

NOTE: Wrenches may be actuated using air torque multipliers to speed up removal of nut per Table 301.

(e) Remove wrenches and adapter from coupling.

(f) Remove nut from turbine shaft.

(8) For operators that use the hydraulic wrench, remove the turbine shaft nut as follows: See Figure 306.

(a) Align boltholes and position PWA 85515 Adapter to rear face of PWA 33732 Wrench or PWA 18872 Wrench. Secure adapter with eight bolts (306/3).

(b) Using hoist, position wrench and adapter assembly into front end of LPC/LPT coupling. Align teeth of adapter with slots in coupling and slide three clamps (306/1) outward to engage lugs of coupling. Tighten wing nuts (306/2) to secure adapter to coupling.

NOTE: PWA 28815 Cart or PWA 75046 Cart may be used to transport PWA 33732 Wrench or PWA 18872 Wrench and PWA 28814 Pump or PWA 29510 Pump.

(c) Install PWA 85514 Wrench, smaller splined end first, into center of PWA 33732 Wrench or PWA 18872 Wrench. Align spline of wrench with spline in turbine shaft nut. Push wrench inward to seat on face of nut.

(d) Connect PWA 28814 Electric Pump or PWA 29510 Hand Pump to wrench.

(e) Actuate wrench to remove nut from shaft.

(f) Remove wrenches and adapter from coupling.

(g) Remove nut from turbine shaft.

(9) Remove Flange N lockwire, bolts, nuts and brackets. Refer to 72−00−53, Removal−20 (Task 72−00−53−020−020).

(10) Install PWA 85769 Fixture into front end of front compressor drive turbine shaft. See Figure 307.

(a) Thread plug end of shaft (307/1) into end of turbine shaft until plug bottoms on shoulder of shaft.

(b) Guide body (307/4) and attach parts over previously installed shaft (307/1). Using dowel pin (307/2), retract locking pin. Rotate assembly to position locator plate (307/3) behind lugs at front end of low pressure turbine coupling. Using dowel pin (307/2), release spring loaded locking pin to lock fixture to coupling.

(c) Guide hydraulic cylinder (307/5), threaded end first, over shaft and thread cylinder into fixture.

(d) Connect PWA 29389 Hydraulic Pump or PWA 3755 Hydraulic Pump to hydraulic cylinder.

(11) Install jackscrews into threaded holes in Flange N.

(12) Apply hydraulic pressure to separate turbine shaft from LPC/LPT coupling and tighten jackscrews to break fit between turbine cases.

(13) Using dowel pin (307/2), retract locking pin into housing. Rotate body (307/4) to position lugs of locator plate between lugs of LPC/LPT coupling. Remove body from coupling. Unthread shaft (307/1) from turbine shaft.

(14) Remove jackscrews from turbine case Flange N.

(15) Thread the puck end of PWA 88204 Guide into the front end of the turbine shaft. See Figure 308.

NOTE: The guide can be separated into two parts if required.

(16) If the fan nut and the turbine shaft coupling are in place, slide the PWA 85785 Adapter, clamp end first, over the PWA 88204 Guide. Install the adapter in the ID of the fan nut. Use the detail clamps to attach the adapter to the coupling lugs. See Figure 308.

(17) Optional, if the fan nut and turbine shaft coupling are not in place, slide the PWA 85785 Adapter, clamp end first, over the PWA 888204 Guide. Install the adapter in the 11.120 inch (282.448 mm) diameter of the fan hub. Use the detail clamps to attach the adapter to the flange.

(18) Optional, if the low pressure compressor is not in place, slide the PWA 86210 Adapter, clamp end first, over the PWA 88204 Guide. Use the detail clamps to attach the adapter to the No. 1 bearing support. See Figure 309.

(19) Move low pressure turbine section rearward approximately 12 inches (304.80 mm). If applicable, retain V−seal gasket located between cases until such time as the low pressure turbine is removed from engine.

(20) Align the center hole in PWA 85996 Retainer or PWA 85456 Retainer (310/3) with the dowel pin hole in the turbine case. Attach the retainer to the front flange of the turbine case at 6 and 12 o'clock locations with four bolts (310/2) and nuts (310/1). Attach the clamps of the retainer to the front compressor drive turbine shaft with two bolts (310/4). See Figure 310.

(21) Use a second hoist and install a nylon sling around the turbine shaft. Take up the slack in the sling.

(22) Move the nylon sling as required and move the assembly rearward. Remove the turbine from the engine.

(23) Remove the V−seal gasket located between the cases, if applicable.

(24) Remove the PWA 85785 Adapter or PWA 86210 Adapter as applicable.

(25) Remove the guide from the turbine shaft.

(26) Install PWA 85562 Support Sleeve into the shaft support cradles of PWA 25096 Stand or PWA 76270 Stand or PWA 87347 Support Sleeve into the shaft support cradles of PWA 87330 Stand. Position details−1 and −2 forward and details−3 and −5 rearward with details−2 and −3 down. Tighten the set screws to attach the sleeve details to the stand. See Figure 311.

(27) Place low pressure turbine in the stand. Tighten clamps around turbine shaft and slide chocks inward to contact rear flange of turbine case.

NOTE: Chocks are utilized as a safety device and do not support any portion of assembly.

(28) Remove hoists, sling and adapters from spools low pressure turbine retainer.

(29) Remove nylon sling and hoist from turbine shaft.

(30) Remove turbine shaft (classified) spacer using PWA 85298 Puller. See Figure 312.

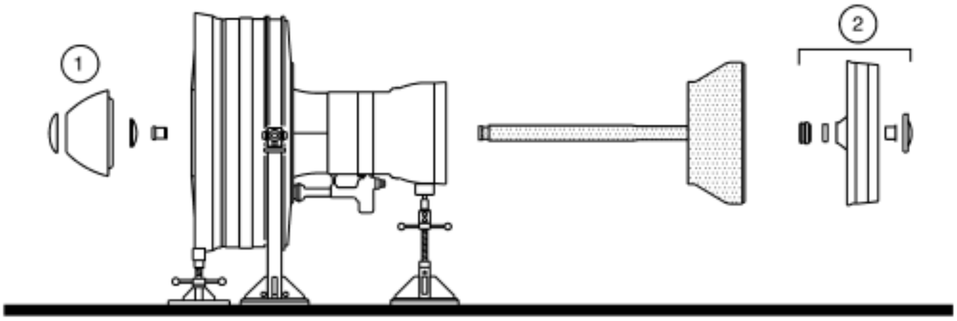
(a) Loosen bolts and slide puller legs inward.

(b) Position puller over LPT shaft and slide legs outward, locating legs in puller groove of spacer. Tighten bolts to secure legs.

(c) Hold threaded bolt at center of puller and turn large hex head nut to remove spacer from end of turbine shaft.

(31) Lubricate the spline area at the front end of the turbine shaft with Engine Oil P03−001. If the shaft is not coated in the area forward or rearward of the spline, lubricate these areas also.

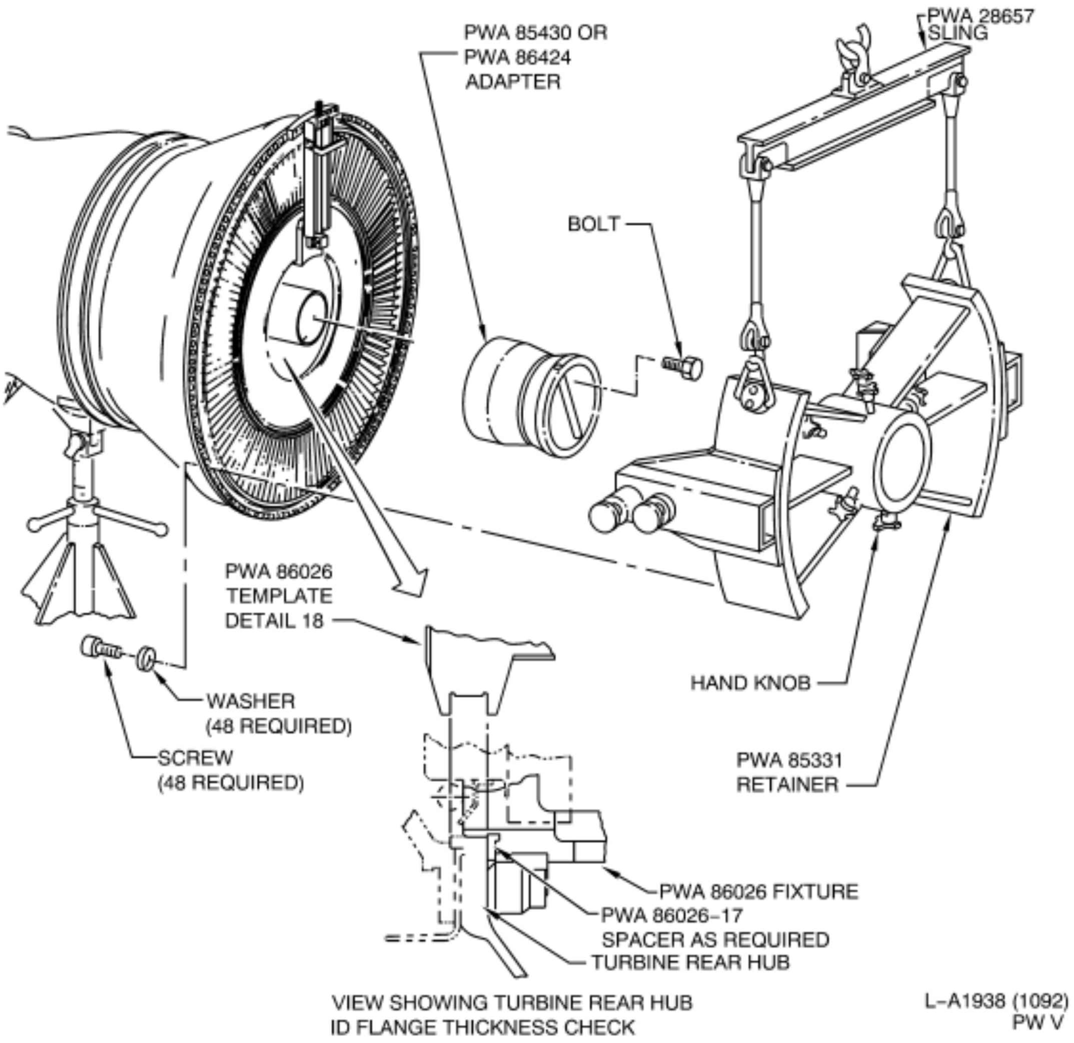
ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−01



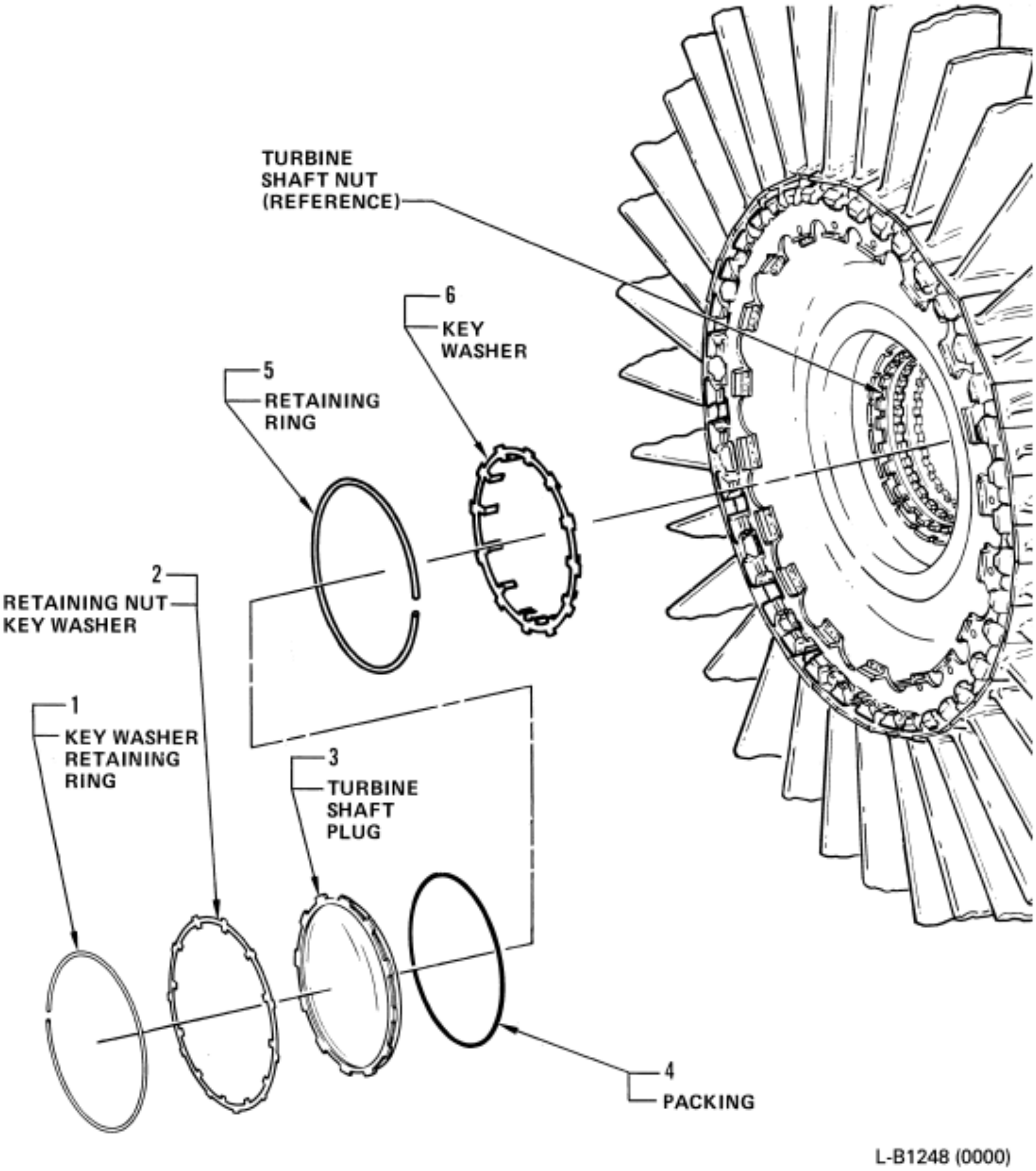
1. REMOVE COMPRESSOR INLET CONE
2. REMOVE TURBINE EXHAUST CASE

L−A0133 (0498)
PW V

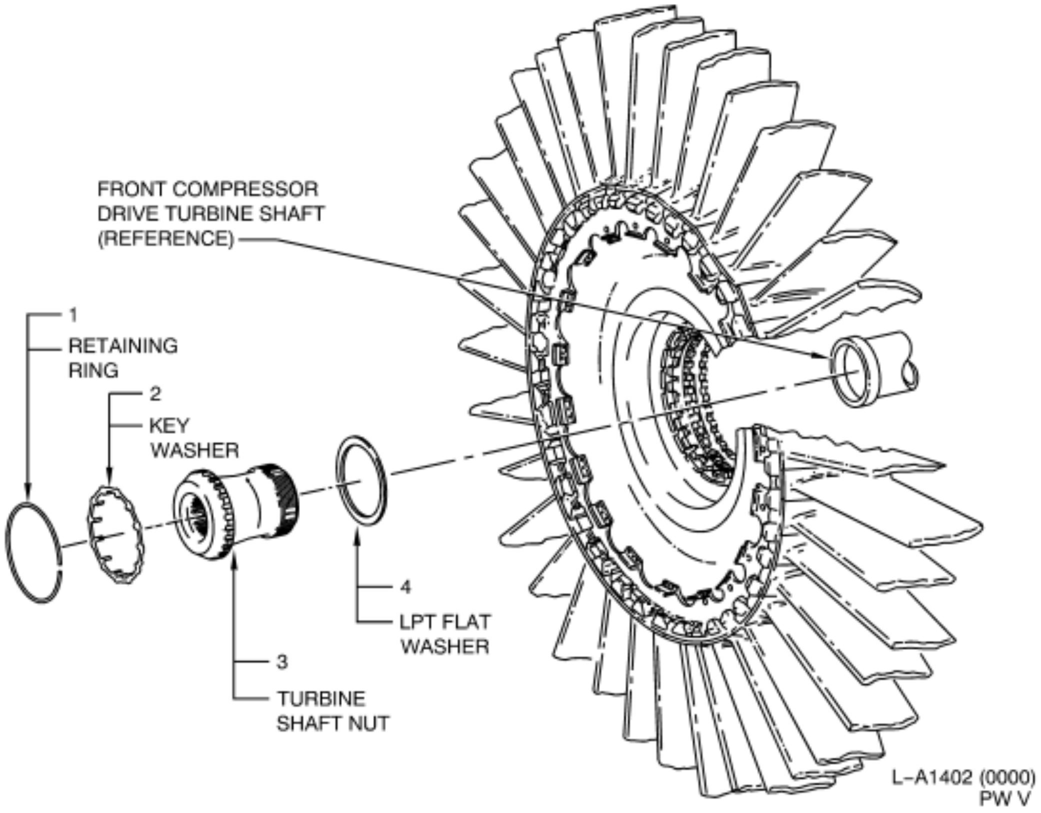
Procedure Sequence
Figure 301
(Task 72−00−53−020−001)


PWA 85430 OR
PWA 86424
ADAPTER
PWA 28657
SLING
BOLT
PWA 86026
TEMPLATE
DETAIL 18
WASHER
(48 REQUIRED)
SCREW
(48 REQUIRED)
HAND KNOB
PWA 85331
RETAINER
PWA 86026 FIXTURE
PWA 86026−17
SPACER AS REQUIRED
TURBINE REAR HUB
VIEW SHOWING TURBINE REAR HUB
ID FLANGE THICKNESS CHECK
L−A1938 (1092)
PW V

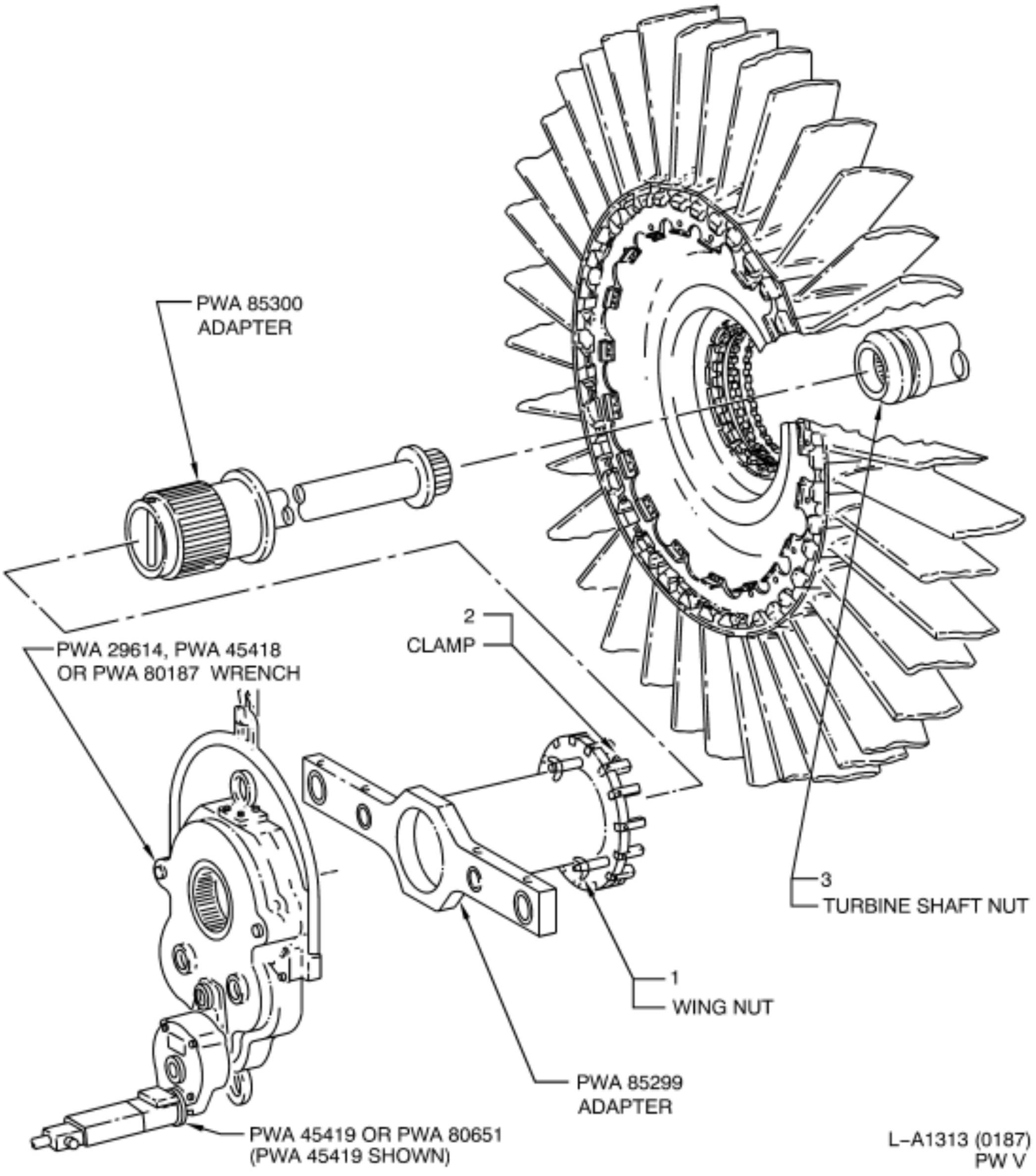
Low Pressure Turbine Rear Retainer Installation
Figure 302
(Task 72−00−53−020−001)


TURBINE SHAFT NUT (REFERENCE)
6
KEY WASHER
5
RETAINING RING
2
RETAINING NUT KEY WASHER
1
KEY WASHER RETAINING RING
3
TURBINE SHAFT PLUG
4
PACKING
L-B1248 (0000)

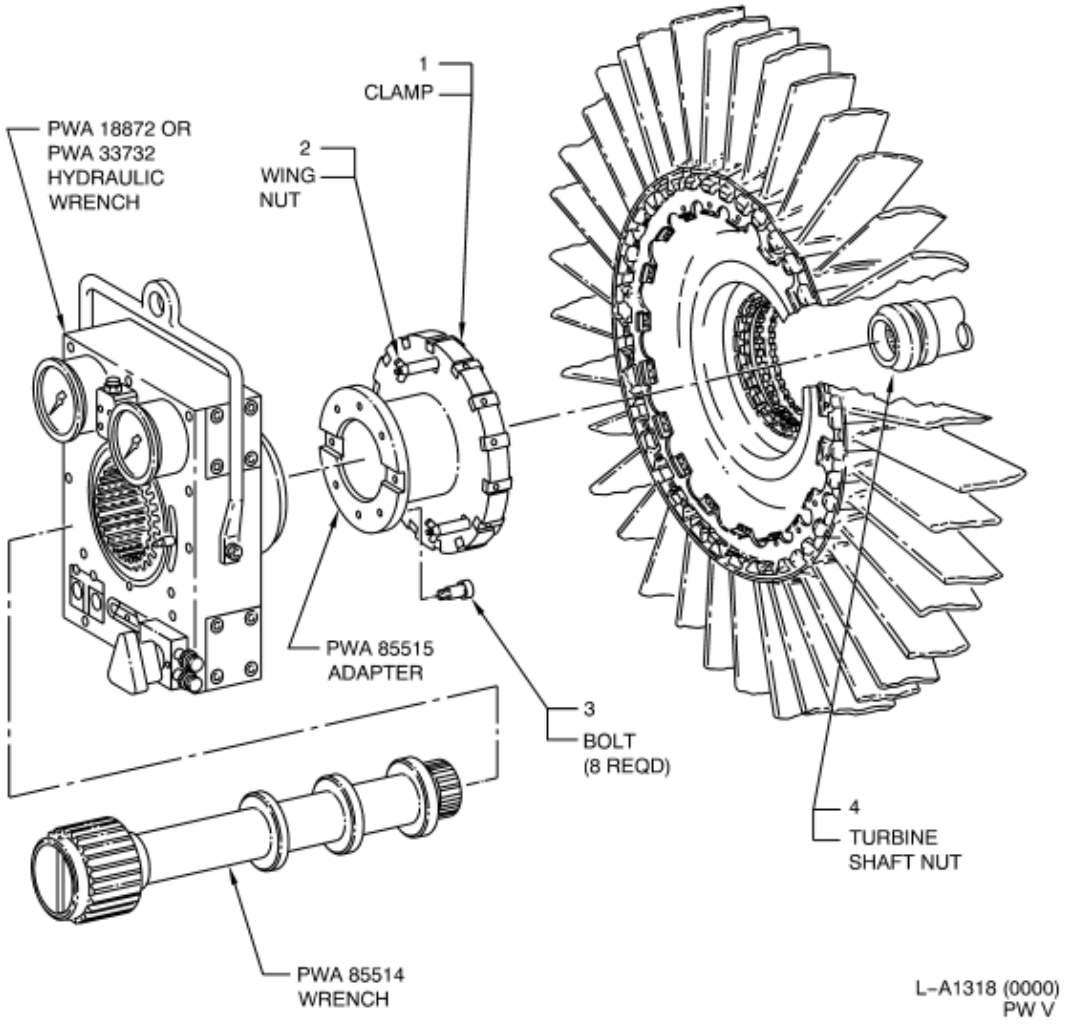
Turbine Shaft Plug Removal
Figure 303
(Task 72−00−53−020−001)


FRONT COMPRESSOR DRIVE TURBINE SHAFT (REFERENCE)
1
RETAINING RING
2
KEY WASHER
3
TURBINE SHAFT NUT
4
LPT FLAT WASHER
L−A1402 (0000)
PW V

Turbine Shaft Nut Removal
Figure 304
(Task 72−00−53−020−001)

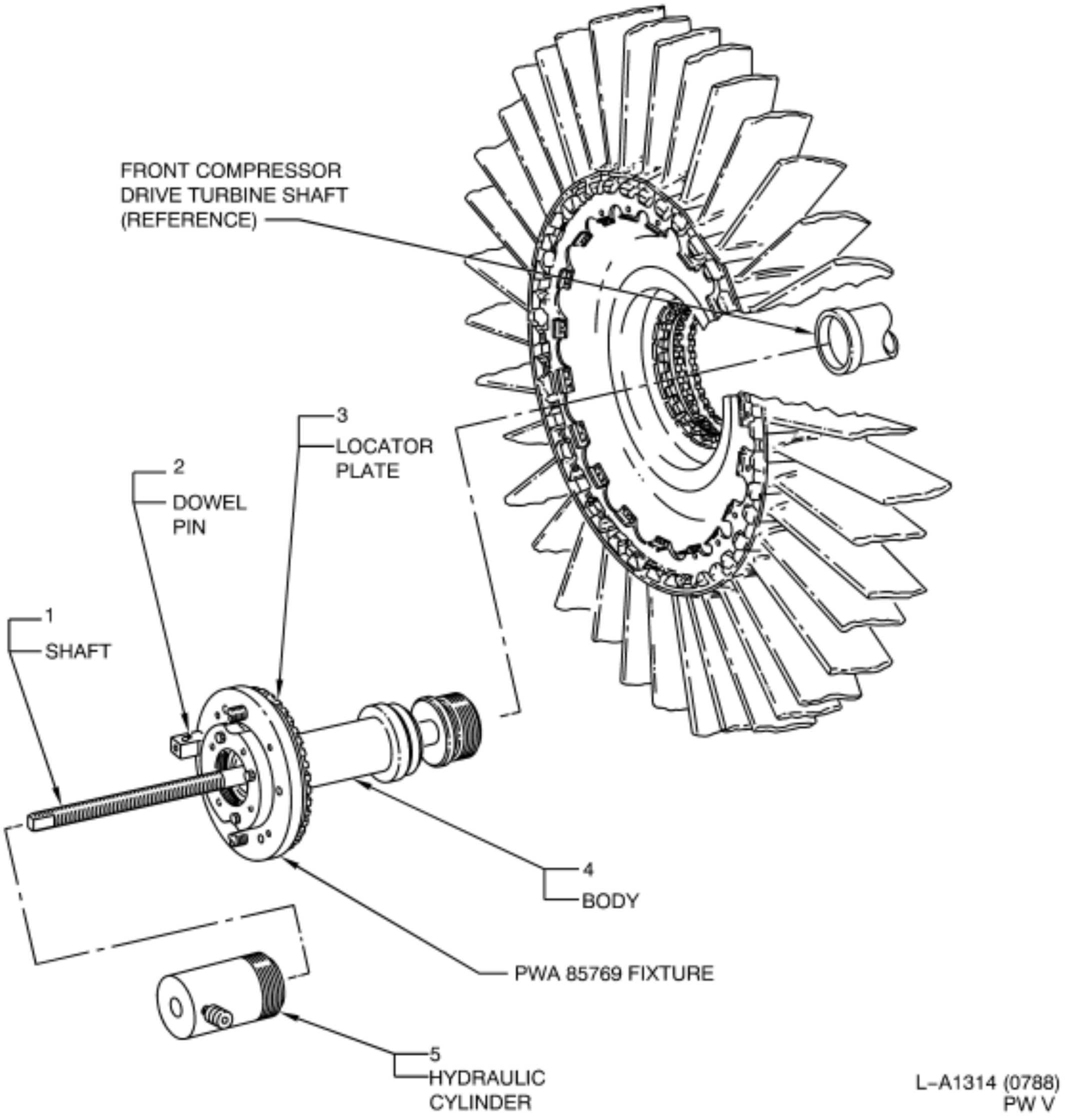

PWA 85300
ADAPTER
PWA 29614, PWA 45418
OR PWA 80187 WRENCH
2
CLAMP
3
TURBINE SHAFT NUT
1
WING NUT
PWA 85299
ADAPTER
PWA 45419 OR PWA 80651
(PWA 45419 SHOWN)
L-A1313 (0187)
PW V

Turbine Shaft Nut Removal (Mechanical Wrench)
Figure 305
(Task 72-00-53-020-001)

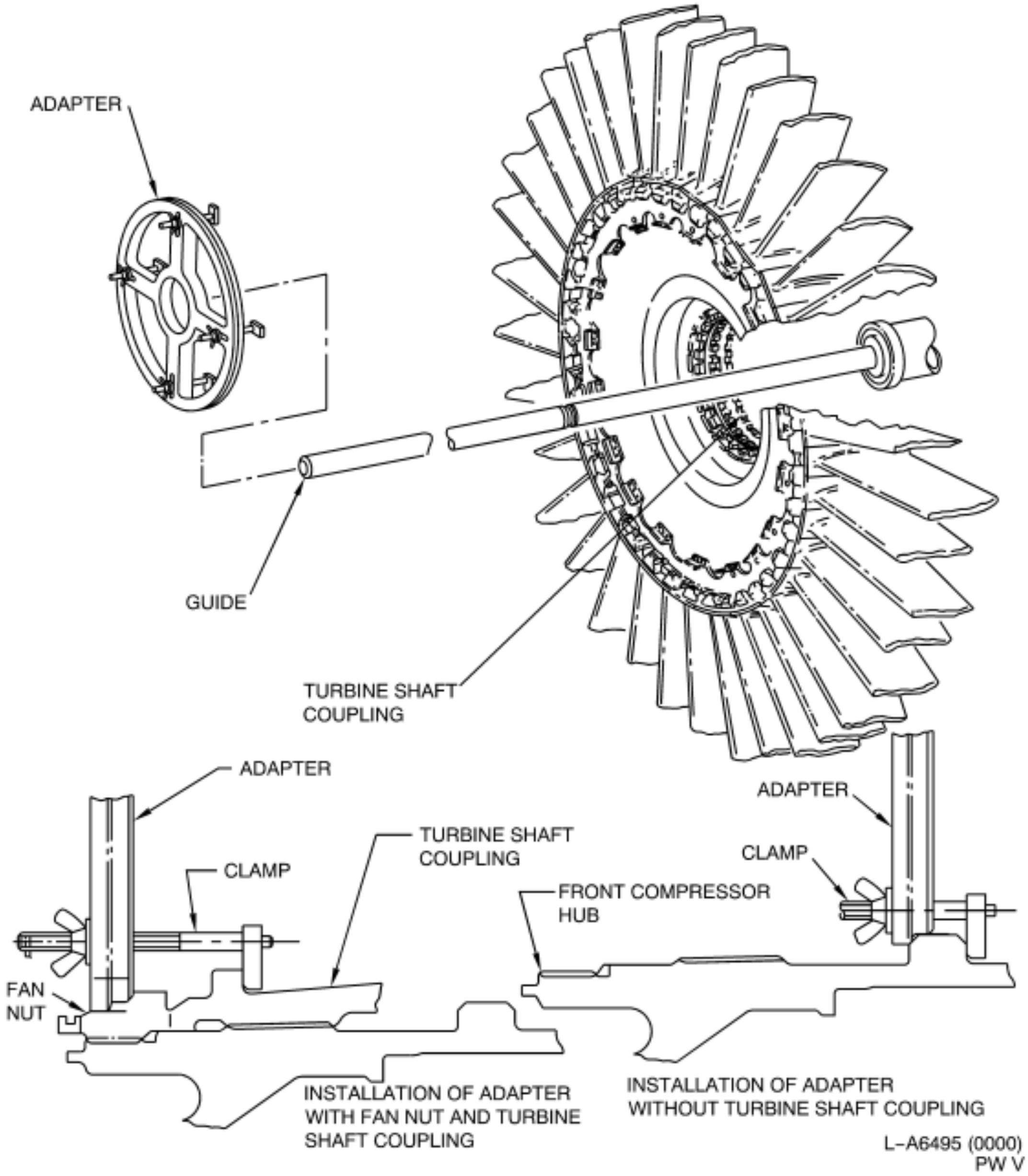

1
CLAMP
PWA 18872 OR
PWA 33732
HYDRAULIC
WRENCH
2
WING
NUT
PWA 85515
ADAPTER
3
BOLT
(8 REQD)
4
TURBINE
SHAFT NUT
PWA 85514
WRENCH
L-A1318 (0000)
PW V

Turbine Shaft Nut Removal (Hydraulic Wrench)
Figure 306
(Task 72-00-53-020-001)

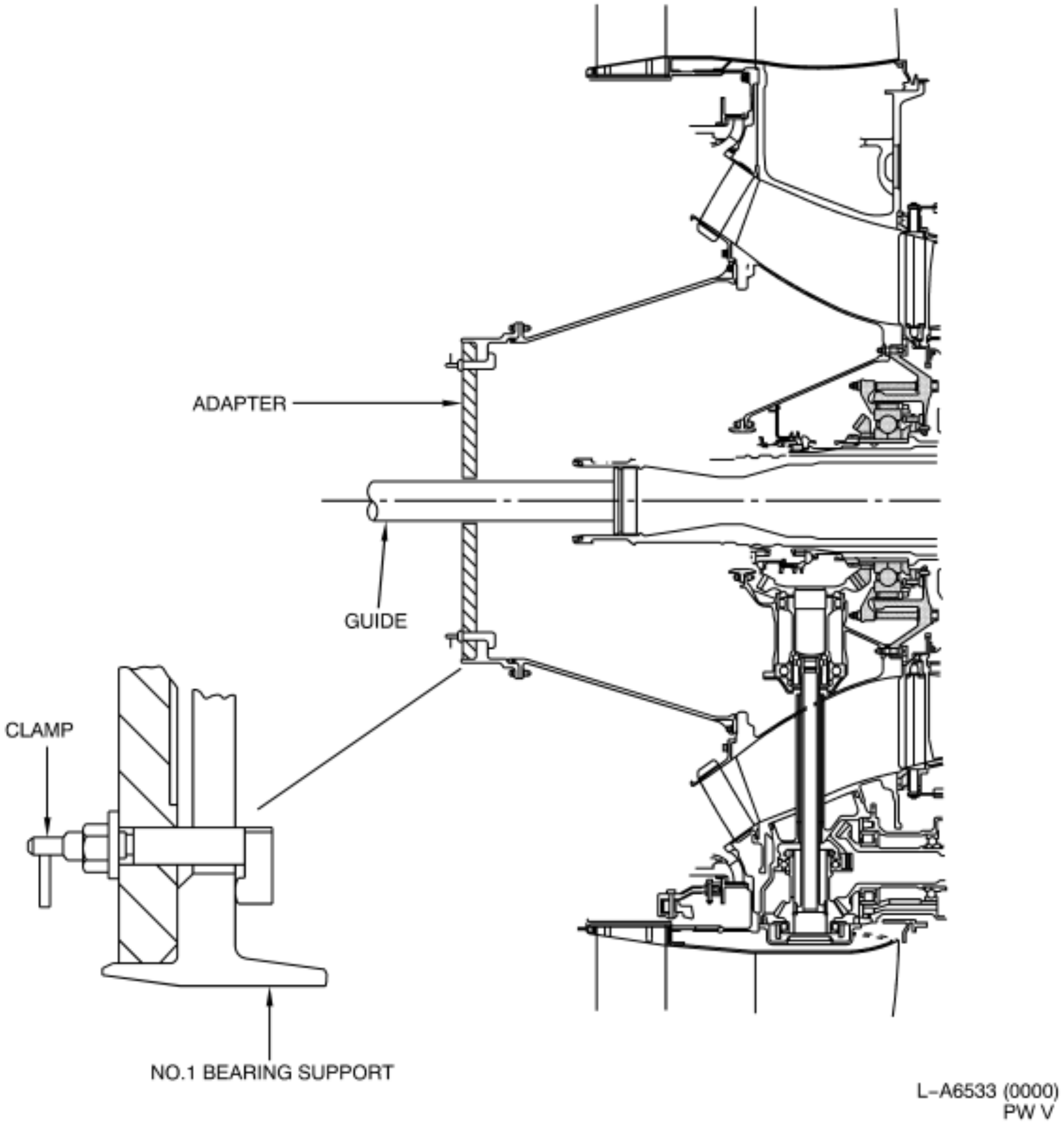
ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−01


FRONT COMPRESSOR
DRIVE TURBINE SHAFT
(REFERENCE)
3
LOCATOR
PLATE
2
DOWEL
PIN
1
SHAFT
4
BODY
PWA 85769 FIXTURE
5
HYDRAULIC
CYLINDER
L−A1314 (0788)
PW V

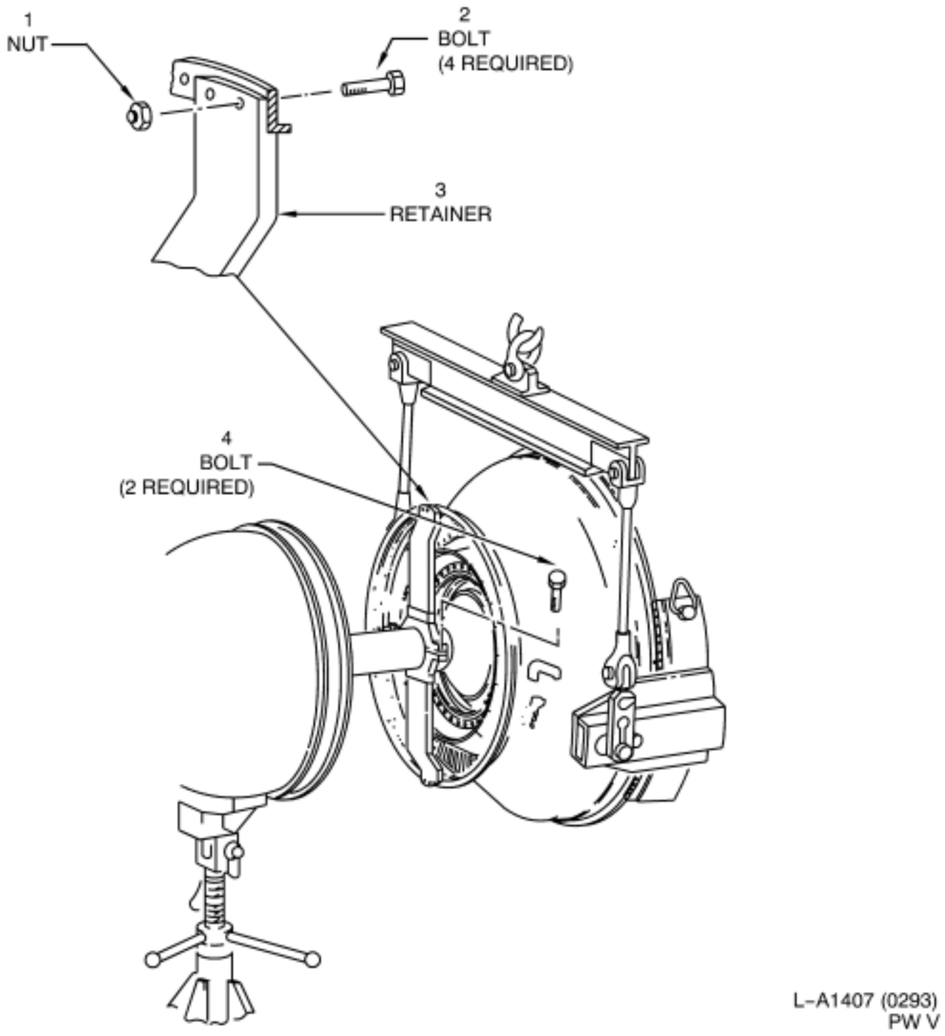
Low Pressure Turbine And Turbine Exhaust Case Removal
Figure 307
(Task 72−00−53−020−001)


ADAPTER
GUIDE
TURBINE SHAFT COUPLING
ADAPTER
CLAMP
TURBINE SHAFT COUPLING
FAN NUT
ADAPTER
CLAMP
FRONT COMPRESSOR HUB
INSTALLATION OF ADAPTER WITH FAN NUT AND TURBINE SHAFT COUPLING
INSTALLATION OF ADAPTER WITHOUT TURBINE SHAFT COUPLING
L-A6495 (0000)
PW V

PWA 88204 Guide And PWA 85785 Adapter Installation
Figure 308
(Task 72−00−53−020−001)

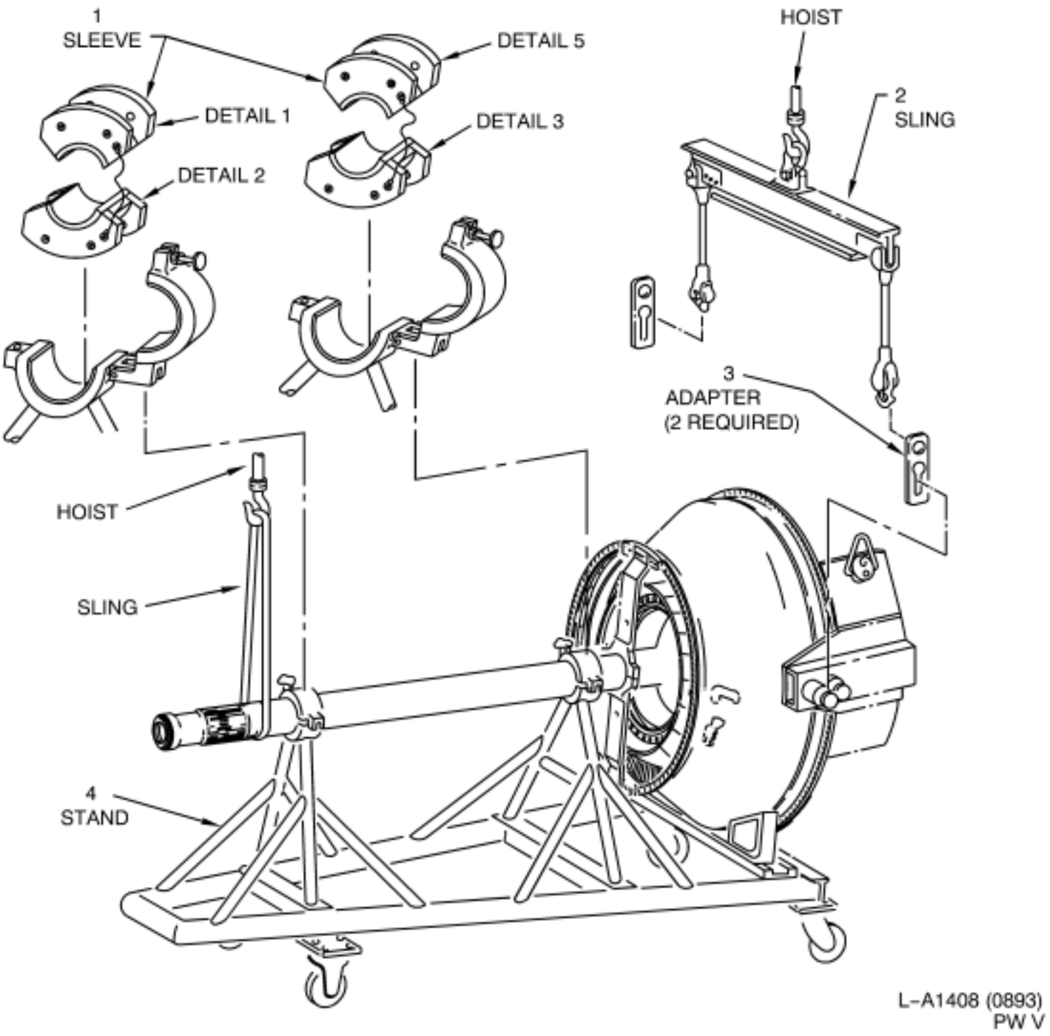

ADAPTER
GUIDE
CLAMP
NO.1 BEARING SUPPORT
L−A6533 (0000)
PW V

PWA 88204 Guide And PWA 86210 Adapter Installation
Figure 309
(Task 72−00−53−020−001)


1
NUT
2
BOLT
(4 REQUIRED)
3
RETAINER
4
BOLT
(2 REQUIRED)
L−A1407 (0293)
PW V

Low Pressure Turbine Front Retainer Installation
Figure 310
(Task 72−00−53−020−001)

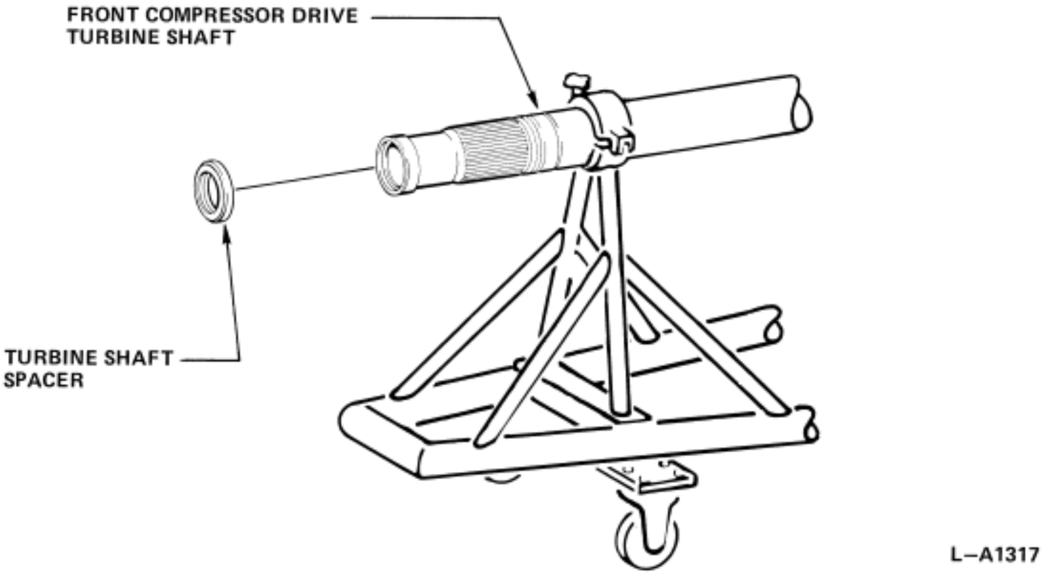
ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−01


1
SLEEVE
DETAIL 5
DETAIL 1
DETAIL 3
DETAIL 2
HOIST
2
SLING
3
ADAPTER
(2 REQUIRED)
HOIST
SLING
4
STAND
L−A1408 (0893)
PW V

1. PWA 85562 Sleeve (Used With PWA 25096 Or PWA 76270 Stand)
   Or PWA 87347 Sleeve (Used With PWA 87330 Stand)

R 2. PWA 28657 Sling
3. PWA 76154 Adapter, Two Required
4. PWA 25096, PWA 76270 Or PWA 87330 Stand

Installation Of Low Pressure Turbine In Stand
Figure 311
(Task 72−00−53−020−001)


FRONT COMPRESSOR DRIVE TURBINE SHAFT
TURBINE SHAFT SPACER
L-A1317

Turbine Shaft Spacer Removal
Figure 312
(Task 72-00-53-020-001)

R
R

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−02

Task 72−00−53−020−001−002:

1. Remove Low Pressure Turbine With Shaft (Hydraulic Wrench) − Deleted

A. Procedure

(1) This procedure is relocated to 72−00−53, Removal−01 (Task 72−00−53−020−001).

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - REMOVAL-03

Task 72-00-53-020-003:

1. Remove External Plumbing Prior To Low Pressure Turbine Removal

   A. Equipment And Materials Necessary - None

   B. Procedure
   See Figure 301, Figure 302, Figure 303 and Figure 304.

      (1) Remove turbine case cooling (TCC) air valve control cable as follows.

         (a) Remove lockwire and disconnect forward end of cable from actuator located at approximately 2 o'clock position on HPC.

         (b) Remove bolt and nut securing cable rod end bearing to value idler arm at HPT case cooling air shutoff valve.

         (c) Remove lockwire from the jamnuts at the cable rear support bracket and loosen the jamnuts.

         (d) Remove bolts, nuts and clamps securing cable. Remove cable from engine.

      (2) Remove turbine case cooling (TCC) air shutoff valves as follows.

         (a) Remove bolts and screw securing both valve flanges to upper support bracket and turbine case cooling duct. Remove duct from engine. If equipped, remove metering plate or blank-off plate.

         (b) Remove bolts, washers and nuts securing braces and struts to Flange M and N brackets.

         (c) Remove bolts, spacers and nuts securing braces and turbine pull control cable bracket to upper and lower support brackets. Remove braces, struts and bracket from engine.

         (d) Remove bolts and nuts securing upper support bracket and upper link to Flange N and LPT case brackets. Remove link and bracket from engine.

         (e) Remove bolts and nuts securing lower flange of HPT case cooling air shutoff valve to lower support bracket. Remove both valves from engine and install protective closures.

(f) Remove bolts and nuts securing lower support bracket and lower link to Flange N and LPT case brackets. Remove link and bracket from engine. Install protective closures.

(3) Remove turbine vane cooling air duct (upper right) (AP01) as follows.

(a) Remove the lockwire and bolts that attach the rear flange of the cooling air duct to the boss on the HPT case at approximately the 1 o'clock position.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Remove lockwire, bolts and bracket securing front flange of tube to boss on the HPC case at approximately the 2 o'clock position.

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the lockwire and bolts that attach the front flange of the cooling air duct to the flange of the turbine vane cooling air valve on the HPC case at approximately the 2 o'clock position.

(d) Remove the lockwire and bolts that attach a clamp to the support on the diffuser case. Remove the clamp.

(e) Remove the cooling air duct from the engine.

(f) FOR THESE MODELS: 4152, 4156A, 4158
Remove and discard the gasket from the boss on the HPC case.

(g) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove and discard the gasket from the front flange of the duct.

(h) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 72−315), Remove and discard the gasket (Post SB PW4ENG 75−57) from the boss on the HPT case.

(i) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 72−315), Remove and discard the metering orifice seal plate from the boss on the HPT case.

(j) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the metering orifice seal plate from the boss on the HPT case and discard the plate.

(k) Install protective closures.

(4) Remove turbine vane cooling air duct (upper left) (AP04) as follows.

(a) Remove the lockwire and bolts that attach the rear flange of the cooling air duct to the boss on the HPT case at approximately the 9 o'clock position.

(b) Remove the bolts that attach the front flange of the cooling air duct to the flange of the turbine vane cooling air valve on the HPC case. Remove and discard the gasket.

(c) FOR THESE MODELS: 4152, 4156A, 4158
Remove bolts, nuts and clamp that attach the cooling air duct to the bracket on the diffuser case pad and remove the duct from the engine. Discard the gasket (Engines with SB PW4ENG 72−315 or SB PW4ENG 75−57) or metering orifice seal plate (Engines without SB PW4ENG 72−315 or SB PW4ENG 75−57).

(d) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the bolts, nuts and clamp that attaches the cooling air duct to the bracket on the diffuser case pad and remove the duct from the engine. Discard the gaskets.

(e) Install protective closures.

CAUTION: REMOVE BORESCOPE PLUG (IF EQUIPPED) FROM LOWER LEFT TURBINE COOLING TUBE ELBOW PRIOR TO REMOVAL OF TUBE. FAILURE TO DO SO COULD RESULT IN DAMAGE TO PLUG.

(5) Remove the turbine vane cooling air duct (lower left) (AP03) as follows.

(a) For engines equipped, remove lockwire and three bolts securing borescope plug to rear elbow. If necessary, use two jackscrews (.190−32 thread) and remove borescope plug evenly.

(b) Remove the lockwire and bolts that attach the rear flange of the cooling air duct to the boss on the HPT case at approximately the 7 o'clock position.

(c) Remove the lockwire and bolts that attach the front flange of the cooling air duct and tube bracket to the boss on the HPC case.

(d) Remove the bolt and nut that attach the No. 3 bearing pressure manifold (LP18) to the bracket on the front flange of the cooling air duct (AP03).

NOTE: The spray shield for the manifold can stay with the clamp.

(e) Loosen the clamp bolt that attaches the No. 4 bearing oil pressure tube (front) (LP15) to the bracket attached at the front flange of the duct. Move the bracket to permit removal of the cooling air duct.

(f) Remove bolts, nuts and clamp that attaches the cooling air duct to the bracket on the diffuser case pad and remove the duct from the engine. position and remove tube from engine.

(g) Remove and discard the gasket from the boss on the HPC case.

(h) FOR THESE MODELS: 4152, 4156A, 4158
Remove and discard the metering orifice seal plate from the boss on the HPT case (Engines with SB PW4ENG 72−315 and without SB PW4ENG 75−57).

(i) FOR THESE MODELS: 4152, 4156A, 4158
Remove and discard the gasket from the boss on the HPT case (Engines without SB PW4ENG 72−315 and with SB PW4ENG 75−57).

(j) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove and discard the metering orifice seal plate from the boss on the HPT case.

(k) Install protective closures.

(6) Remove turbine case cooling (TCC) HPT manifolds (AC21) through (AC28) as follows.

(a) Remove bolts securing manifolds to manifold (collector) at approximately 3 o'clock position.

(b) Remove bolts, nuts and clamps securing upper front manifold to brackets (three locations). Rotate to disengage manifold from collector and remove from engine. Install protective closures.

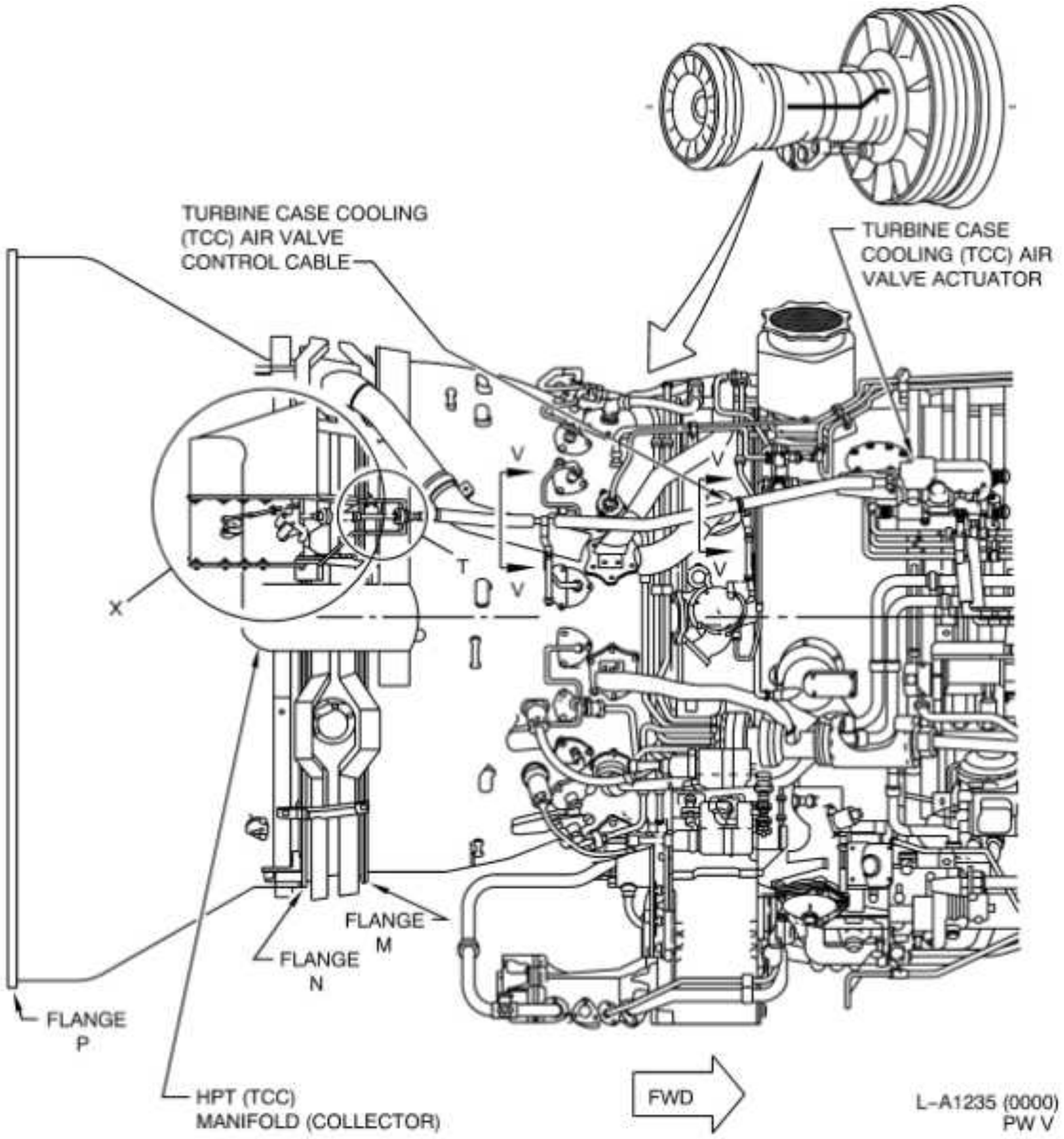
(c) Remove two end bolts and nuts securing upper and lower manifold supports (six locations) to Flange M and N brackets. Rotate to disengage upper and lower (center two) manifolds from manifold (collector) and remove from engine. Install protective closures.

(d) Remove bolts, nuts and clamps securing upper and lower rear manifolds (six locations). Rotate and disengage manifolds from manifold (collector) and remove from engine. Install protective closures.

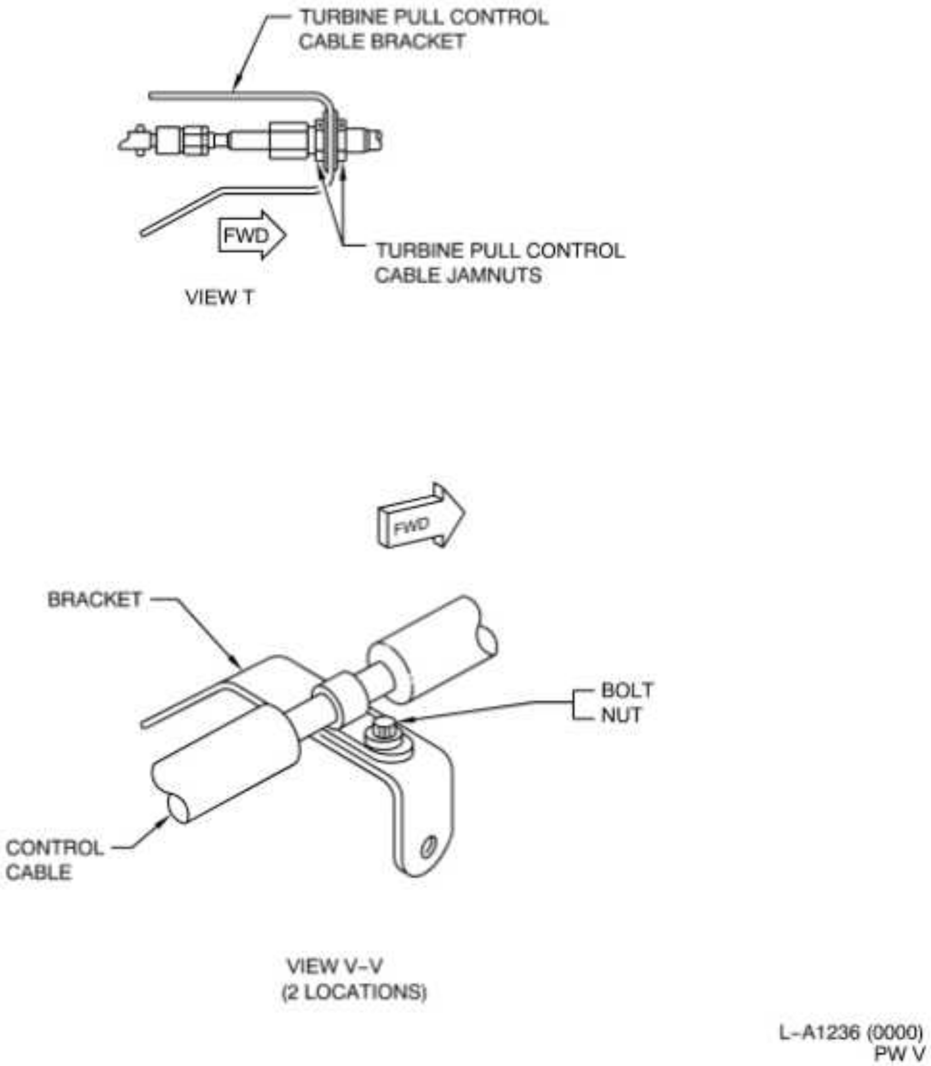
(e) Remove bolts and nuts securing support brackets to Flange M and N and remove brackets from engine.

(7) Remove HPT manifold (collector) assembly.

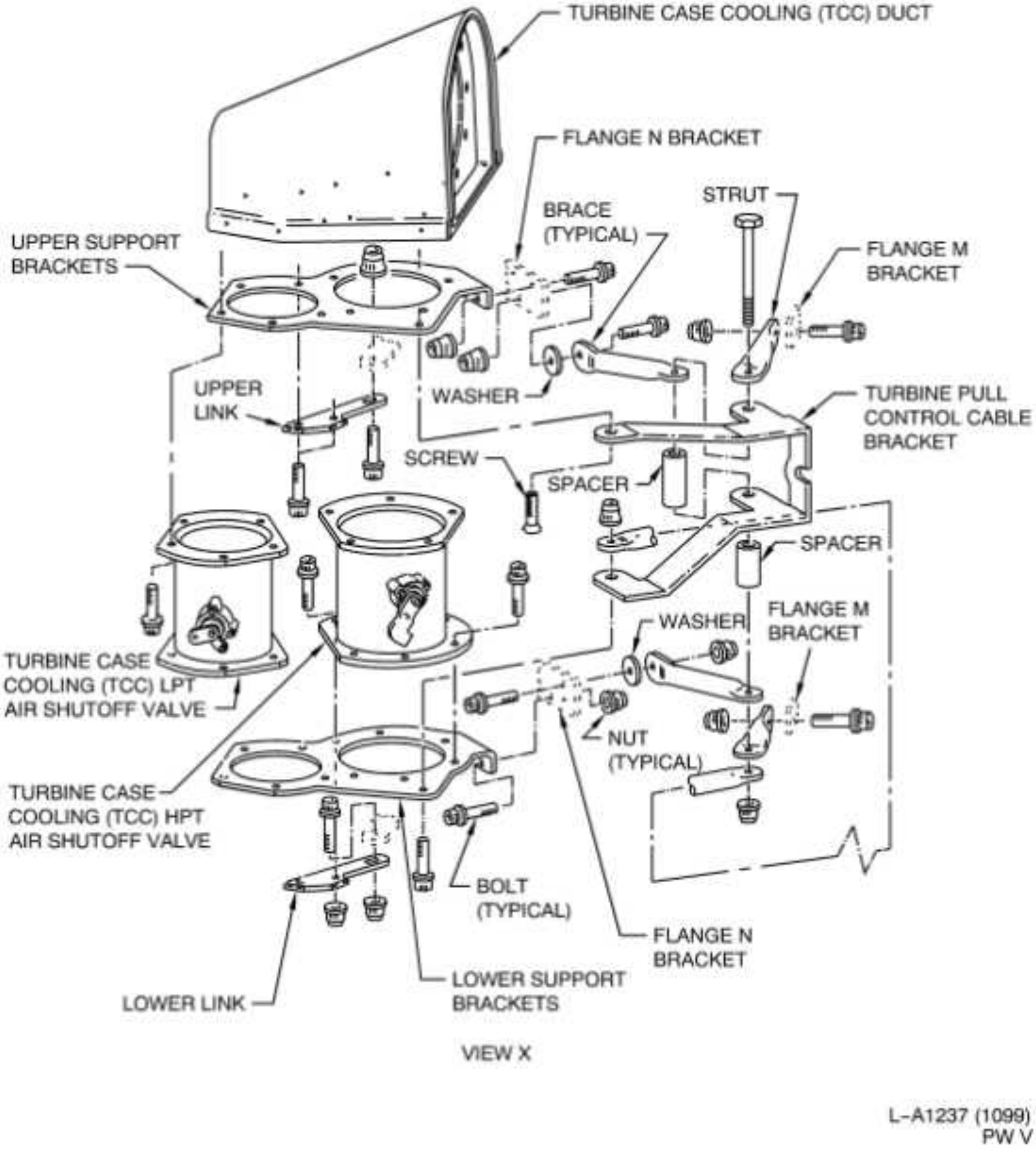
(a) Remove bolt, nut, spacer, screw and clamps securing manifold (collector) to Flange M bracket. Remove manifold (collector) from engine and install protective closures.


TURBINE CASE COOLING (TCC) AIR VALVE CONTROL CABLE
TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
V
V
V
V
T
X
FLANGE M
FLANGE N
FLANGE P
HPT (TCC) MANIFOLD (COLLECTOR)
FWD
L−A1235 (0000)
PW V

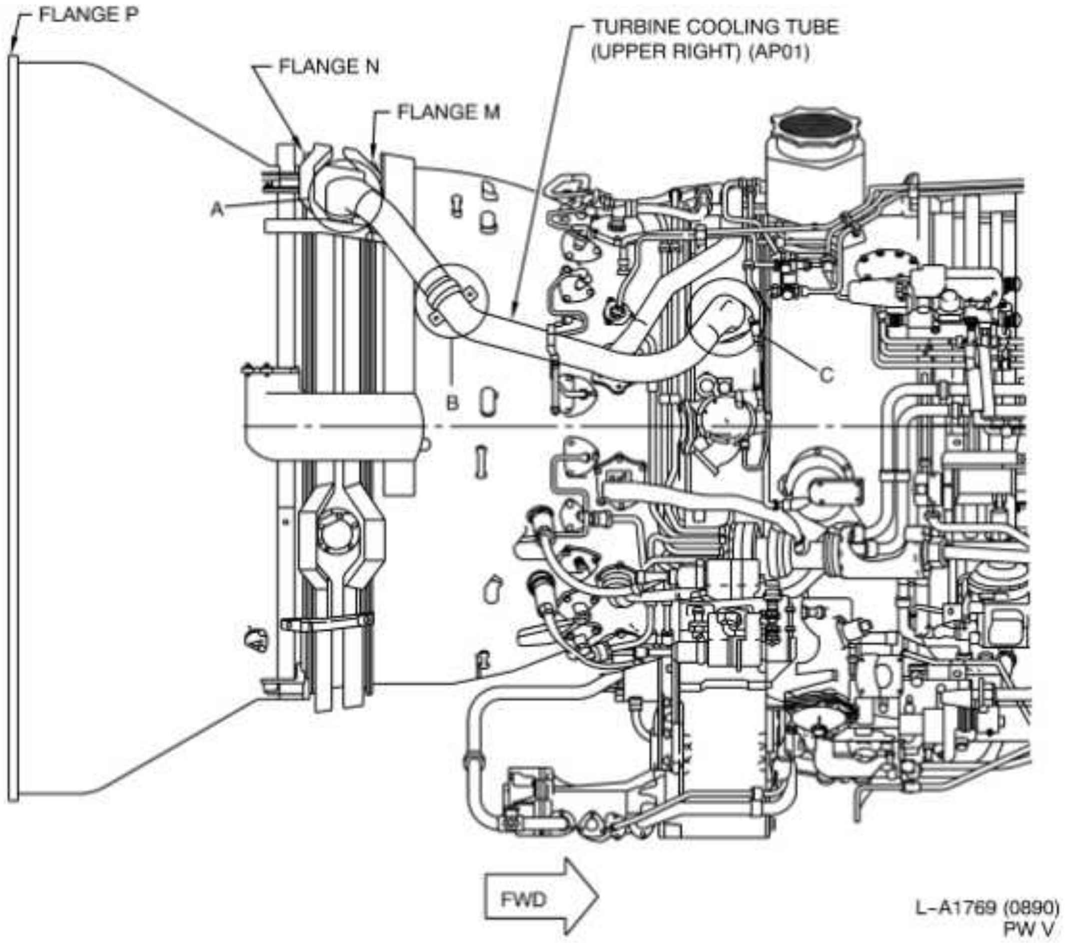
Turbine Case Cooling Air Valves And Control Cable
Figure 301 (Sheet 1)
(Task 72−00−53−020−003)


TURBINE PULL CONTROL CABLE BRACKET
FWD
TURBINE PULL CONTROL CABLE JAMNUTS
VIEW T
FWD
BRACKET
BOLT
NUT
CONTROL CABLE
VIEW V-V
(2 LOCATIONS)
L-A1236 (0000)
PW V

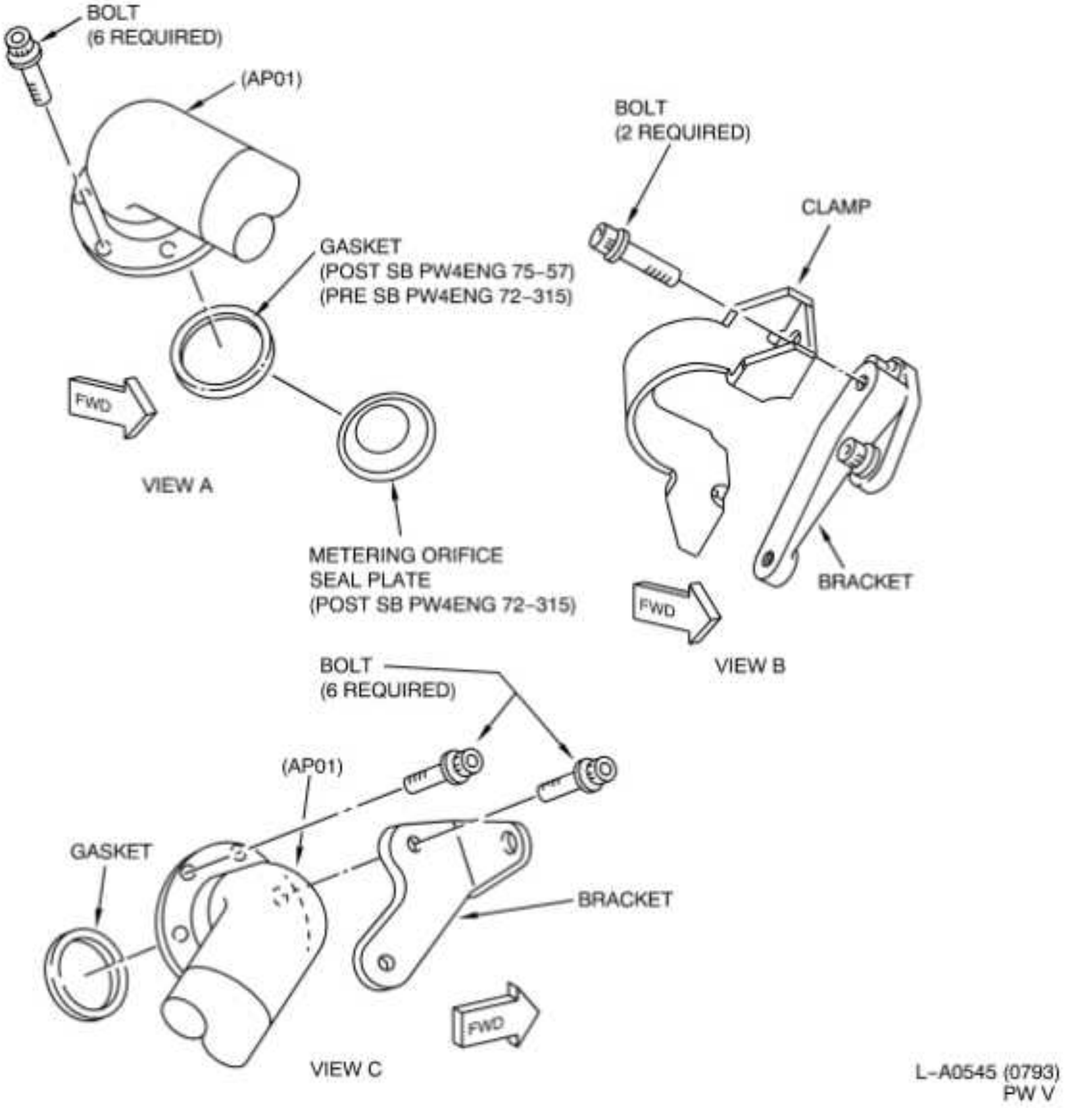
Turbine Case Cooling Air Valves And Control Cable
Figure 301 (Sheet 2)
(Task 72-00-53-020-003)


TURBINE CASE COOLING (TCC) DUCT
FLANGE N BRACKET
STRUT
BRACE (TYPICAL)
FLANGE M BRACKET
UPPER SUPPORT BRACKETS
UPPER LINK
WASHER
TURBINE PULL CONTROL CABLE BRACKET
SCREW
SPACER
SPACER
WASHER
FLANGE M BRACKET
TURBINE CASE COOLING (TCC) LPT AIR SHUTOFF VALVE
NUT (TYPICAL)
TURBINE CASE COOLING (TCC) HPT AIR SHUTOFF VALVE
BOLT (TYPICAL)
FLANGE N BRACKET
LOWER SUPPORT BRACKETS
LOWER LINK
VIEW X
L-A1237 (1099)
PW V

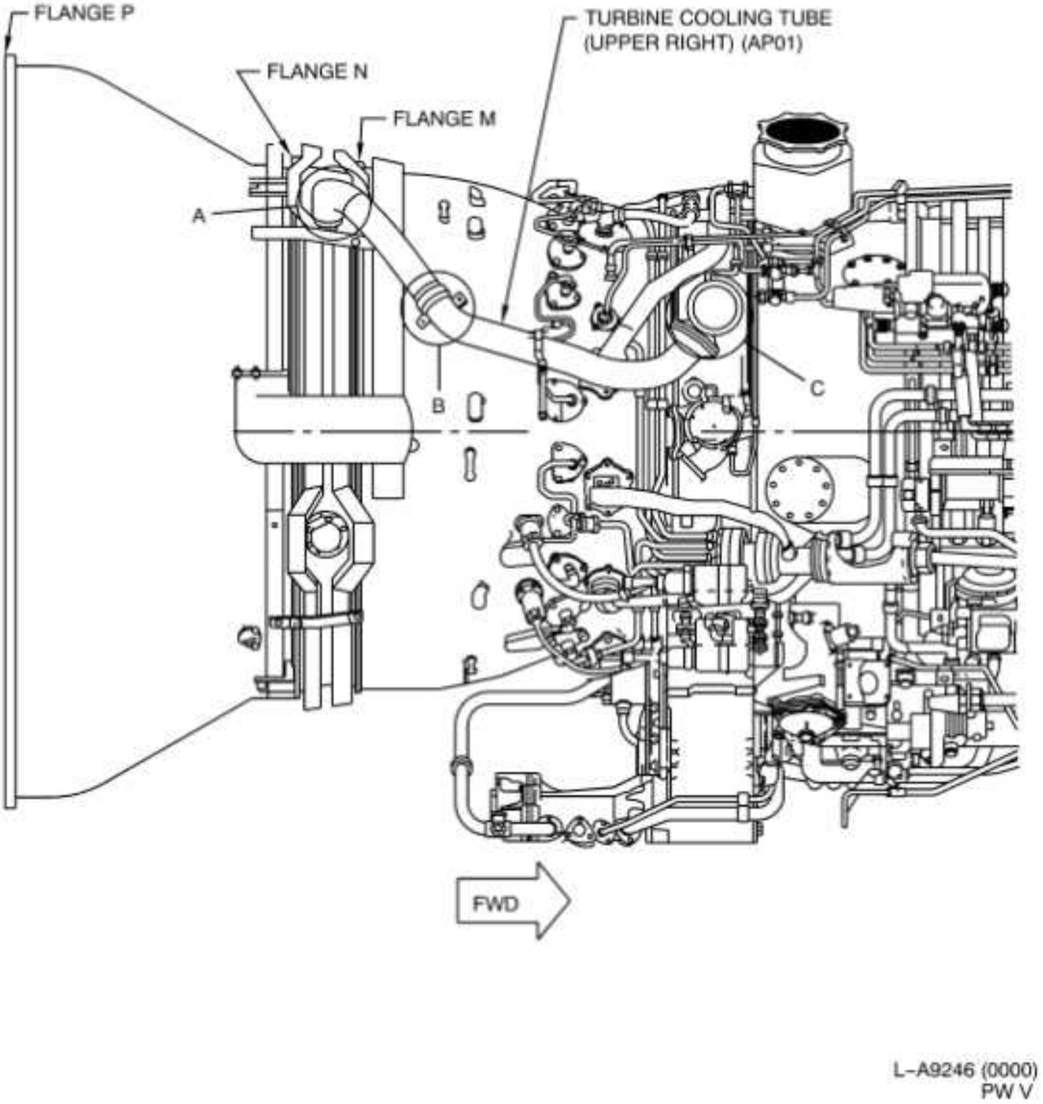
Turbine Case Cooling Air Valves And Control Cable
Figure 301 (Sheet 3)
(Task 72−00−53−020−003)


FLANGE P
FLANGE N
FLANGE M
TURBINE COOLING TUBE (UPPER RIGHT) (AP01)
A
B
C
FWD
L−A1769 (0890)
PW V

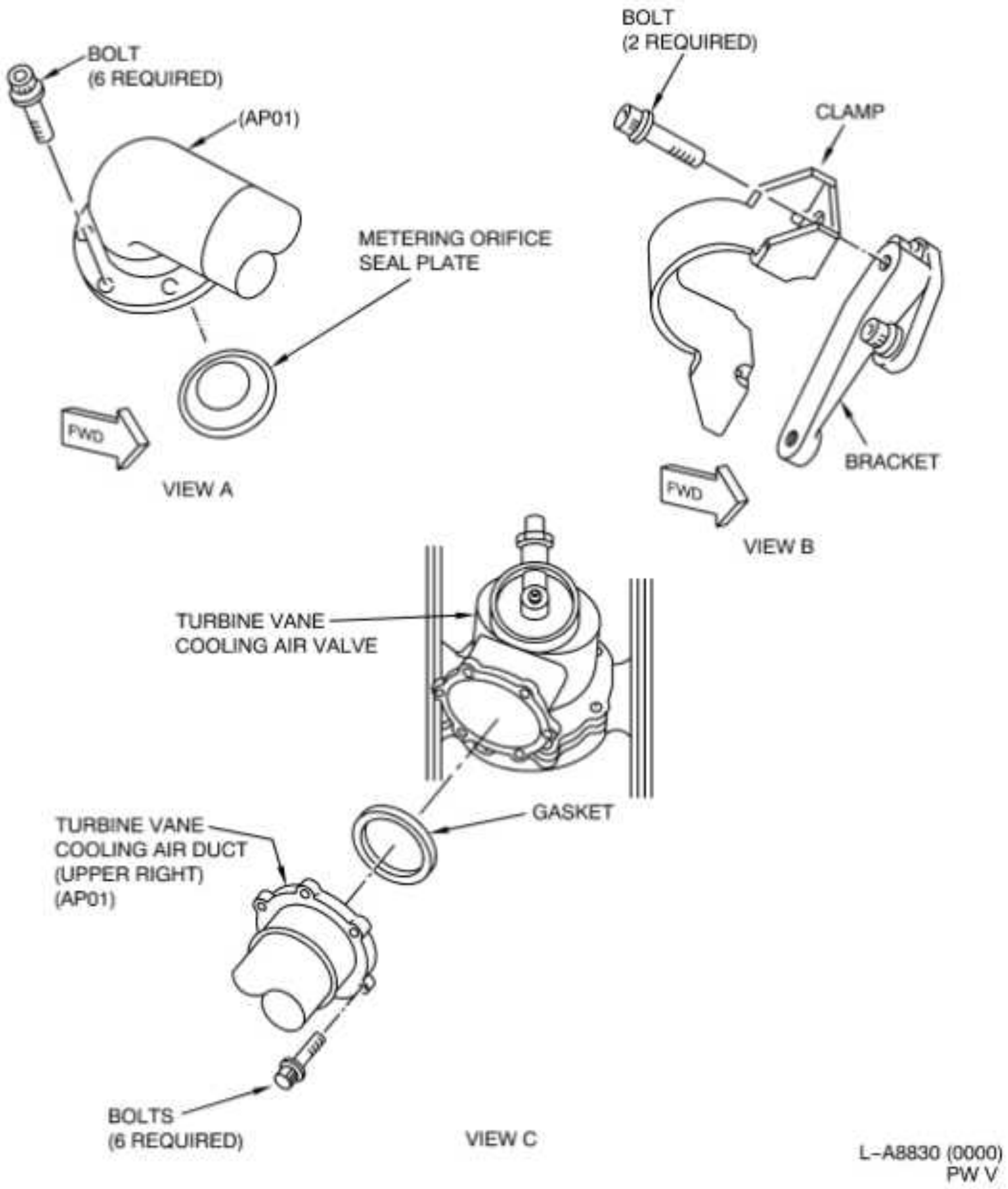
Turbine Vane Cooling Air Ducts (Right Side)
Figure 302 (Sheet 1)
(Task 72−00−53−020−003)


BOLT
(6 REQUIRED)
(AP01)
BOLT
(2 REQUIRED)
CLAMP
GASKET
(POST SB PW4ENG 75-57)
(PRE SB PW4ENG 72-315)
FWD
VIEW A
METERING ORIFICE
SEAL PLATE
(POST SB PW4ENG 72-315)
BRACKET
FWD
VIEW B
BOLT
(6 REQUIRED)
(AP01)
GASKET
BRACKET
FWD
VIEW C
L-A0545 (0793)
PW V

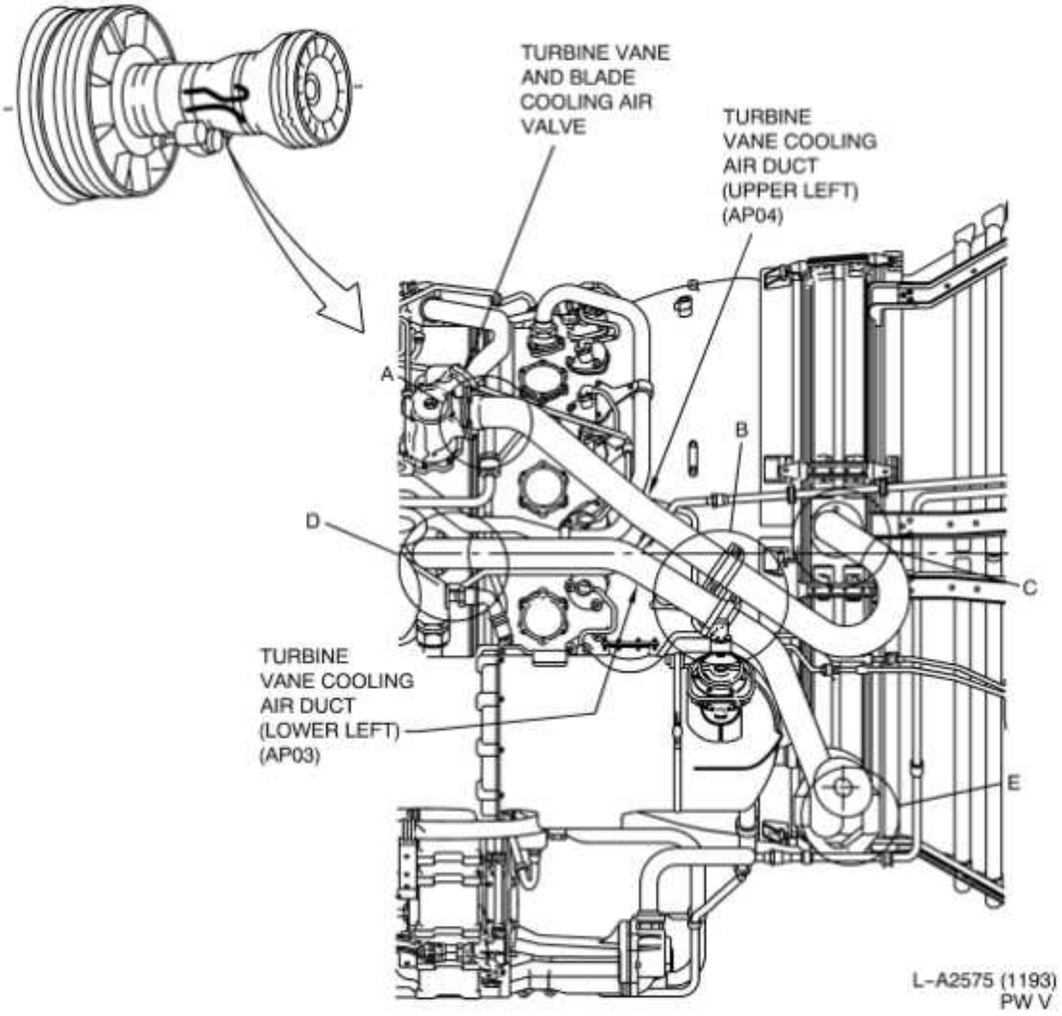
Turbine Vane Cooling Air Ducts (Right Side)
Figure 302 (Sheet 2)
(Task 72−00−53−020−003)


FLANGE P
TURBINE COOLING TUBE
(UPPER RIGHT) (AP01)
FLANGE N
FLANGE M
A
B
C
FWD
L−A9246 (0000)
PW V

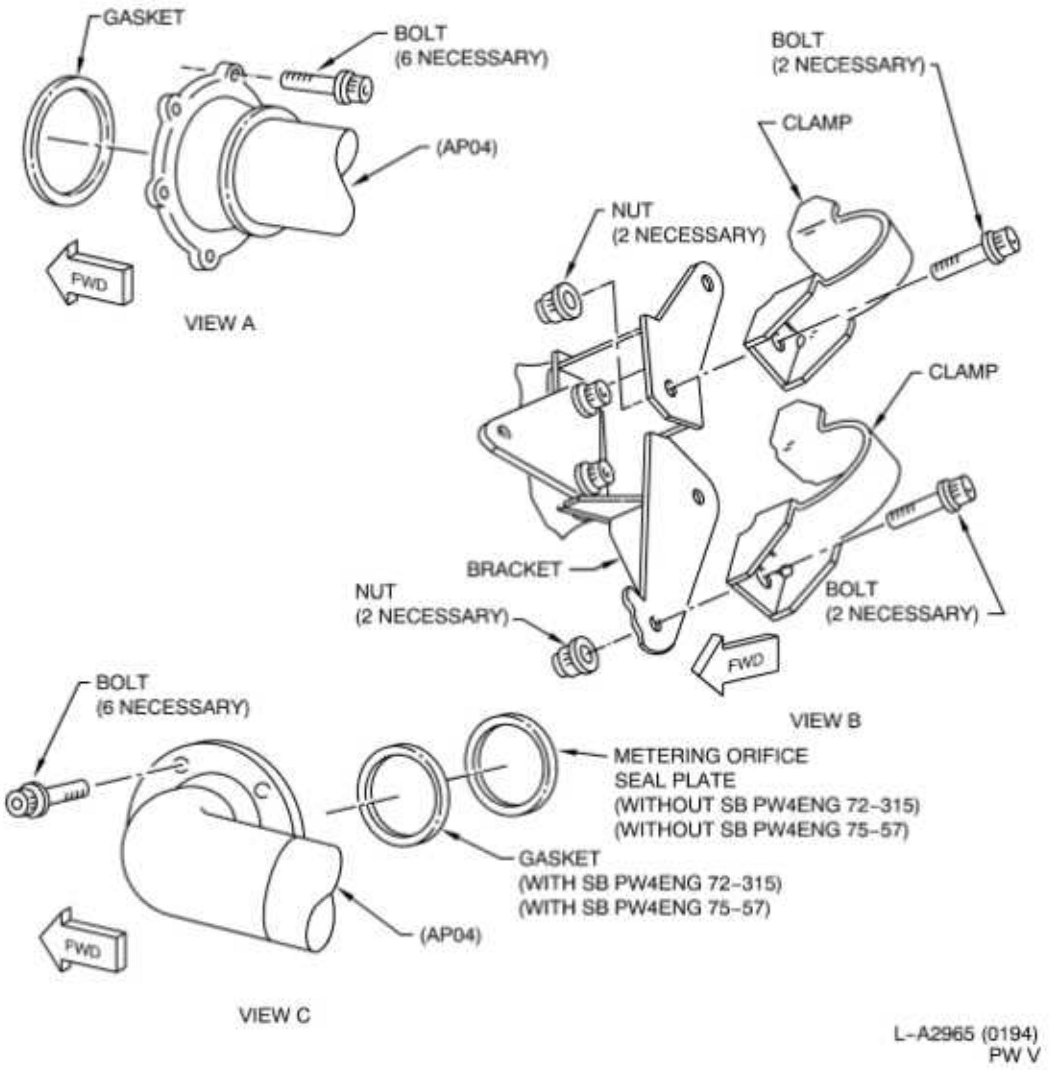
Turbine Vane Cooling Air Ducts (Right Side)
Figure 302 (Sheet 3)
(Task 72−00−53−020−003)


BOLT
(6 REQUIRED)
(AP01)
METERING ORIFICE
SEAL PLATE
FWD
VIEW A
BOLT
(2 REQUIRED)
CLAMP
BRACKET
FWD
VIEW B
TURBINE VANE
COOLING AIR VALVE
GASKET
TURBINE VANE
COOLING AIR DUCT
(UPPER RIGHT)
(AP01)
BOLTS
(6 REQUIRED)
VIEW C
L-A8830 (0000)
PW V

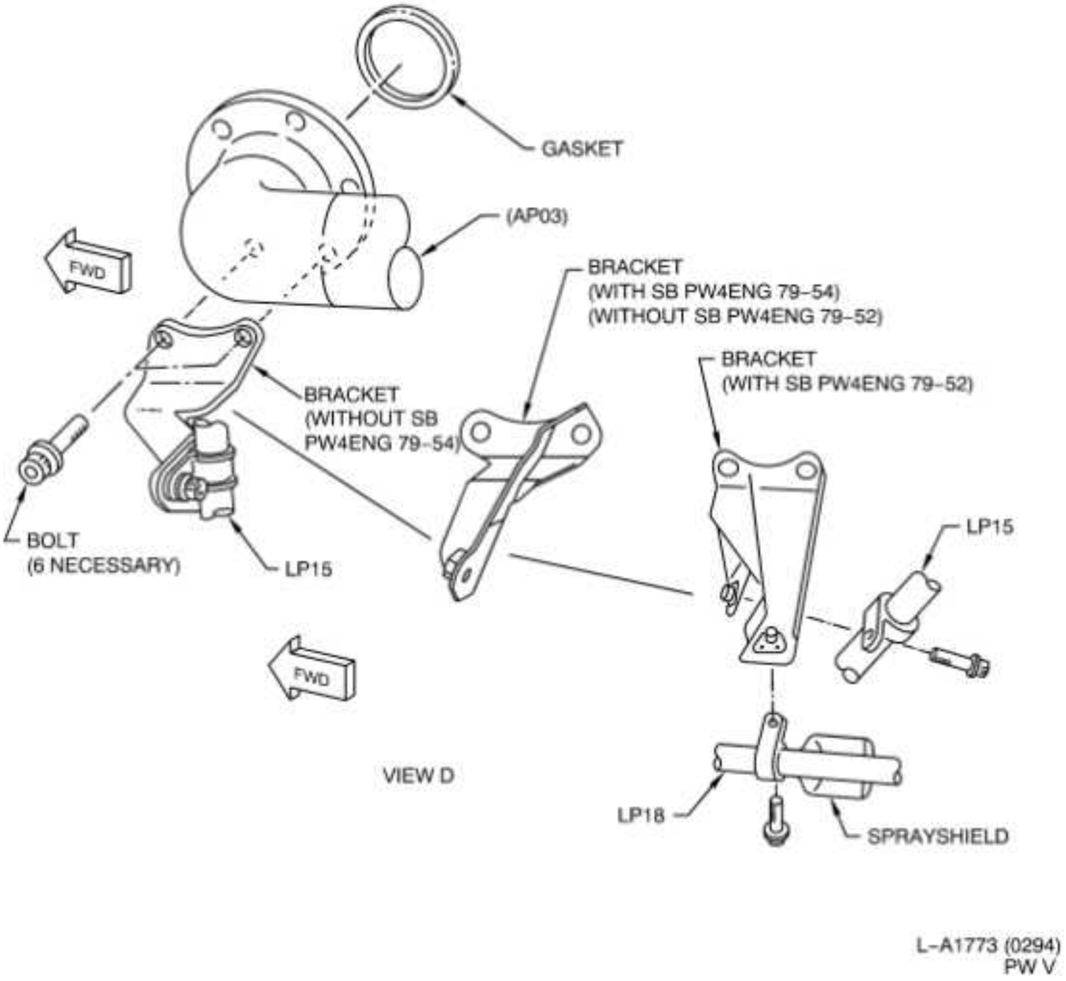
Turbine Vane Cooling Air Ducts (Right Side)
Figure 302 (Sheet 4)
(Task 72-00-53-020-003)


TURBINE VANE AND BLADE COOLING AIR VALVE
TURBINE VANE COOLING AIR DUCT (UPPER LEFT) (AP04)
A
B
D
C
TURBINE VANE COOLING AIR DUCT (LOWER LEFT) (AP03)
E
L-A2575 (1193)
PW V

Turbine Vane Cooling Air Ducts (Left Side)
Figure 303 (Sheet 1)
(Task 72−00−53−020−003)

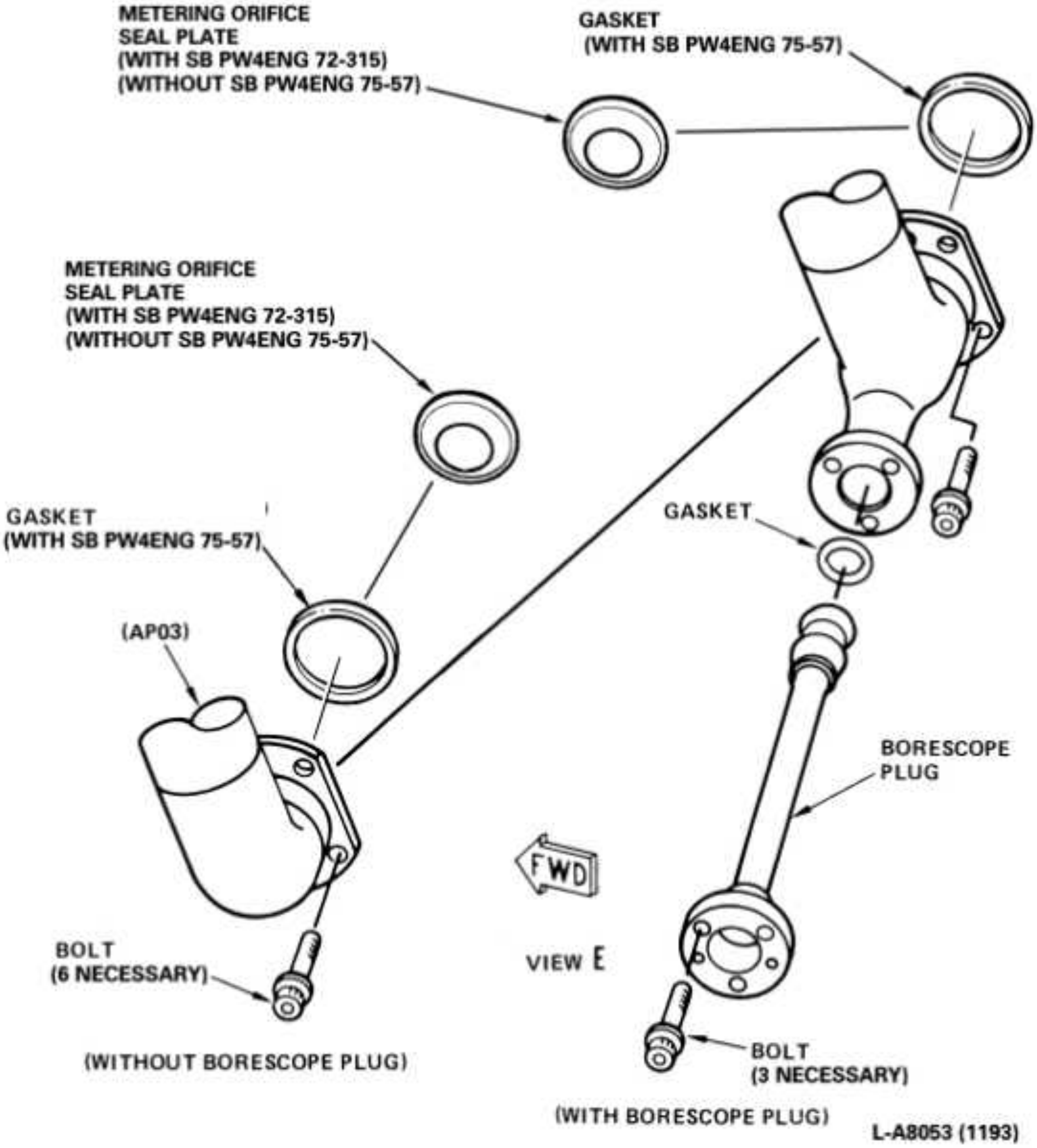

GASKET
BOLT (6 NECESSARY)
(AP04)
FWD
VIEW A
BOLT (2 NECESSARY)
CLAMP
NUT (2 NECESSARY)
CLAMP
BRACKET
NUT (2 NECESSARY)
BOLT (2 NECESSARY)
FWD
VIEW B
BOLT (6 NECESSARY)
METERING ORIFICE SEAL PLATE (WITHOUT SB PW4ENG 72-315) (WITHOUT SB PW4ENG 75-57)
GASKET (WITH SB PW4ENG 72-315) (WITH SB PW4ENG 75-57)
(AP04)
FWD
VIEW C
L-A2965 (0194)
PW V

Turbine Vane Cooling Air Ducts (Left Side)
Figure 303 (Sheet 2)
(Task 72−00−53−020−003)

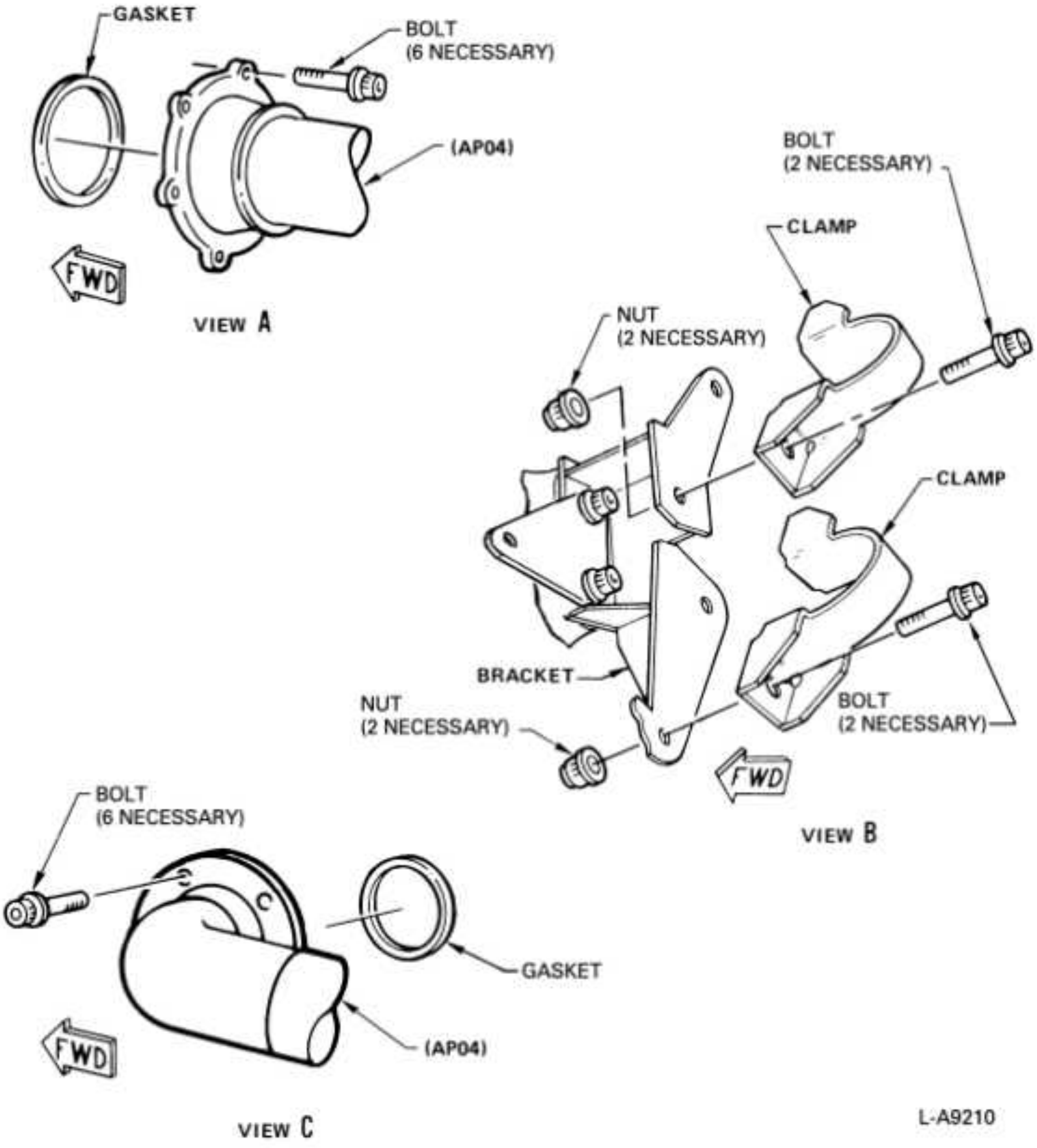

GASKET
(AP03)
FWD
BRACKET
(WITH SB PW4ENG 79-54)
(WITHOUT SB PW4ENG 79-52)
BRACKET
(WITH SB PW4ENG 79-52)
BRACKET
(WITHOUT SB
PW4ENG 79-54)
BOLT
(6 NECESSARY)
LP15
LP15
FWD
VIEW D
LP18
SPRAYSHIELD
L-A1773 (0294)
PW V

Turbine Vane Cooling Air Ducts (Left Side)
Figure 303 (Sheet 3)
(Task 72−00−53−020−003)

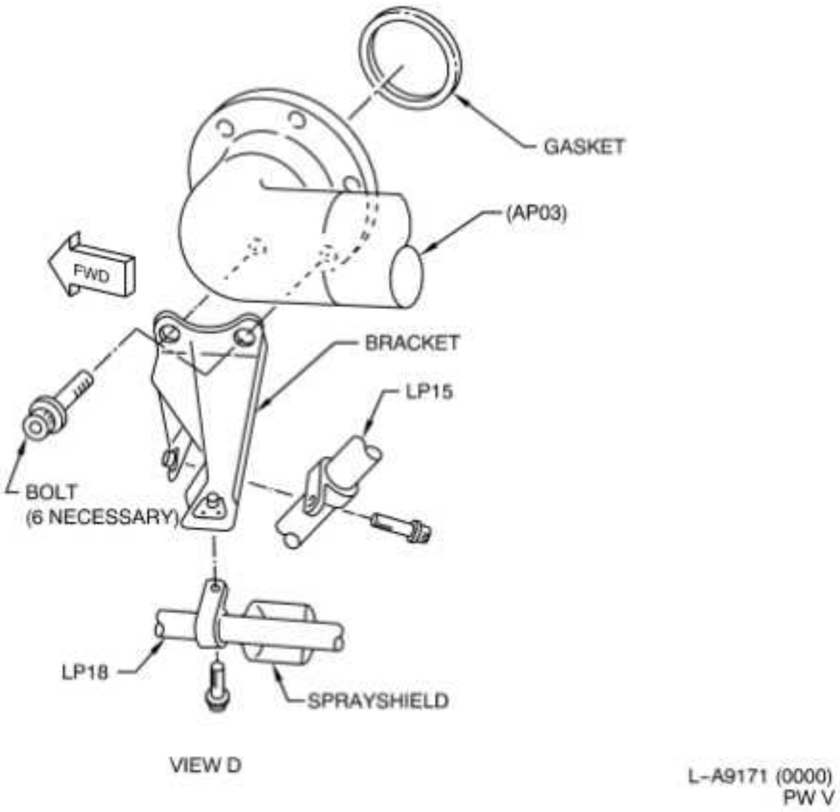
ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−03


METERING ORIFICE SEAL PLATE (WITH SB PW4ENG 72-315) (WITHOUT SB PW4ENG 75-57)
GASKET (WITH SB PW4ENG 75-57)
METERING ORIFICE SEAL PLATE (WITH SB PW4ENG 72-315) (WITHOUT SB PW4ENG 75-57)
GASKET (WITH SB PW4ENG 75-57)
GASKET
(AP03)
BORESCOPE PLUG
FWD
VIEW E
BOLT (6 NECESSARY)
(WITHOUT BORESCOPE PLUG)
BOLT (3 NECESSARY)
(WITH BORESCOPE PLUG)
L-A8053 (1193)

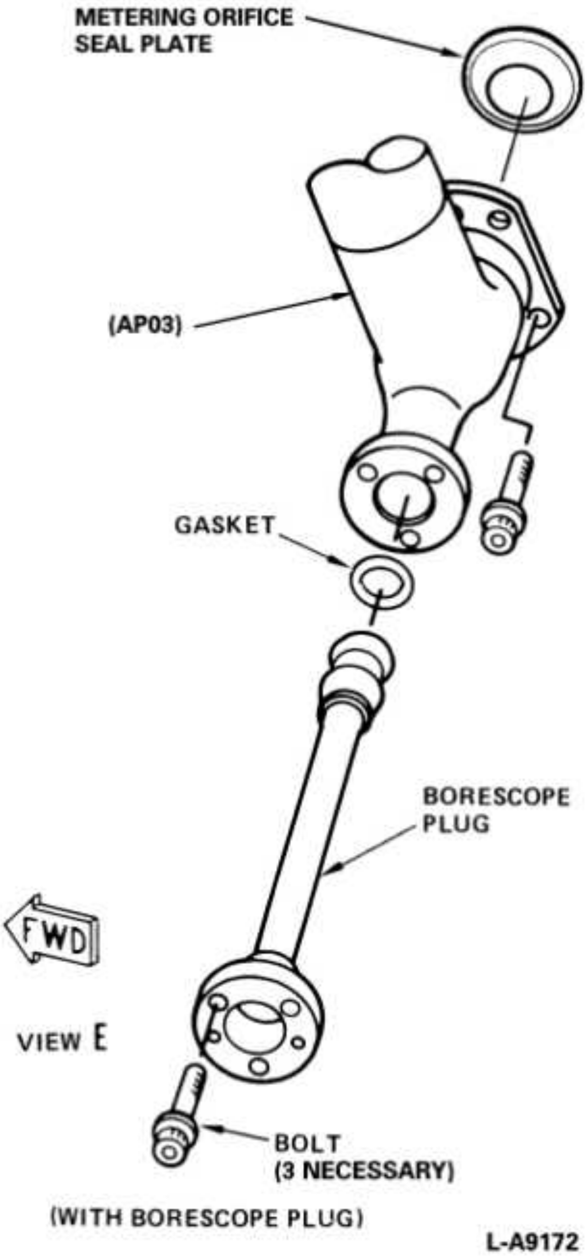
Turbine Vane Cooling Air Ducts (Left Side)
Figure 303 (Sheet 4)
(Task 72−00−53−020−003)


GASKET
BOLT (6 NECESSARY)
(AP04)
FWD
VIEW A
BOLT (2 NECESSARY)
CLAMP
NUT (2 NECESSARY)
CLAMP
BRACKET
NUT (2 NECESSARY)
BOLT (2 NECESSARY)
FWD
VIEW B
BOLT (6 NECESSARY)
GASKET
(AP04)
FWD
VIEW C
L-A9210

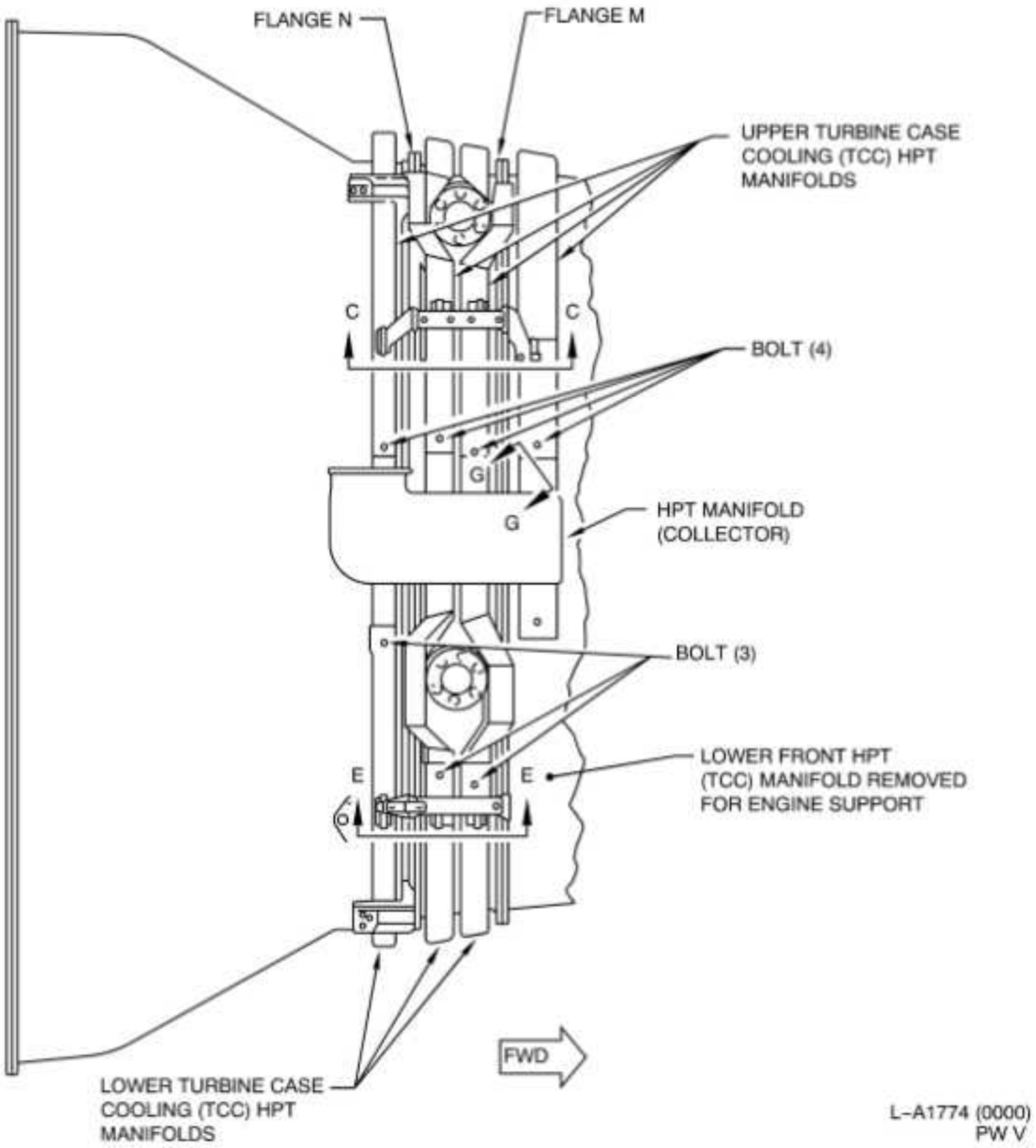
Turbine Vane Cooling Air Ducts (Left Side)
Figure 303 (Sheet 5)
(Task 72−00−53−020−003)


GASKET
(AP03)
FWD
BRACKET
LP15
BOLT
(6 NECESSARY)
LP18
SPRAYSHIELD
VIEW D
L-A9171 (0000)
PW V

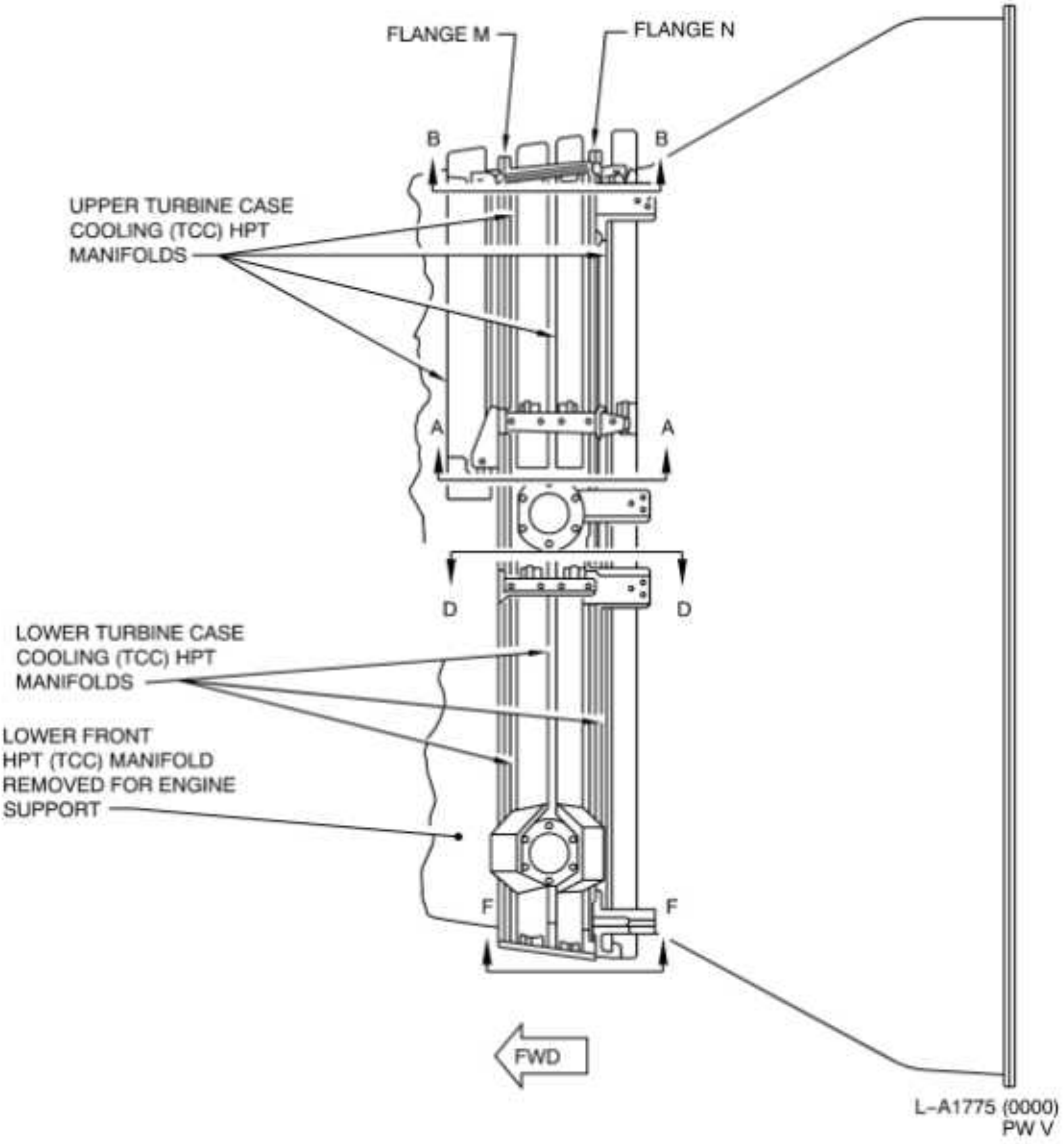
Turbine Vane Cooling Air Ducts (Left Side)
Figure 303 (Sheet 6)
(Task 72−00−53−020−003)


METERING ORIFICE SEAL PLATE
(AP03)
GASKET
BORESCOPE PLUG
FWD
VIEW E
BOLT (3 NECESSARY)
(WITH BORESCOPE PLUG)
L-A9172

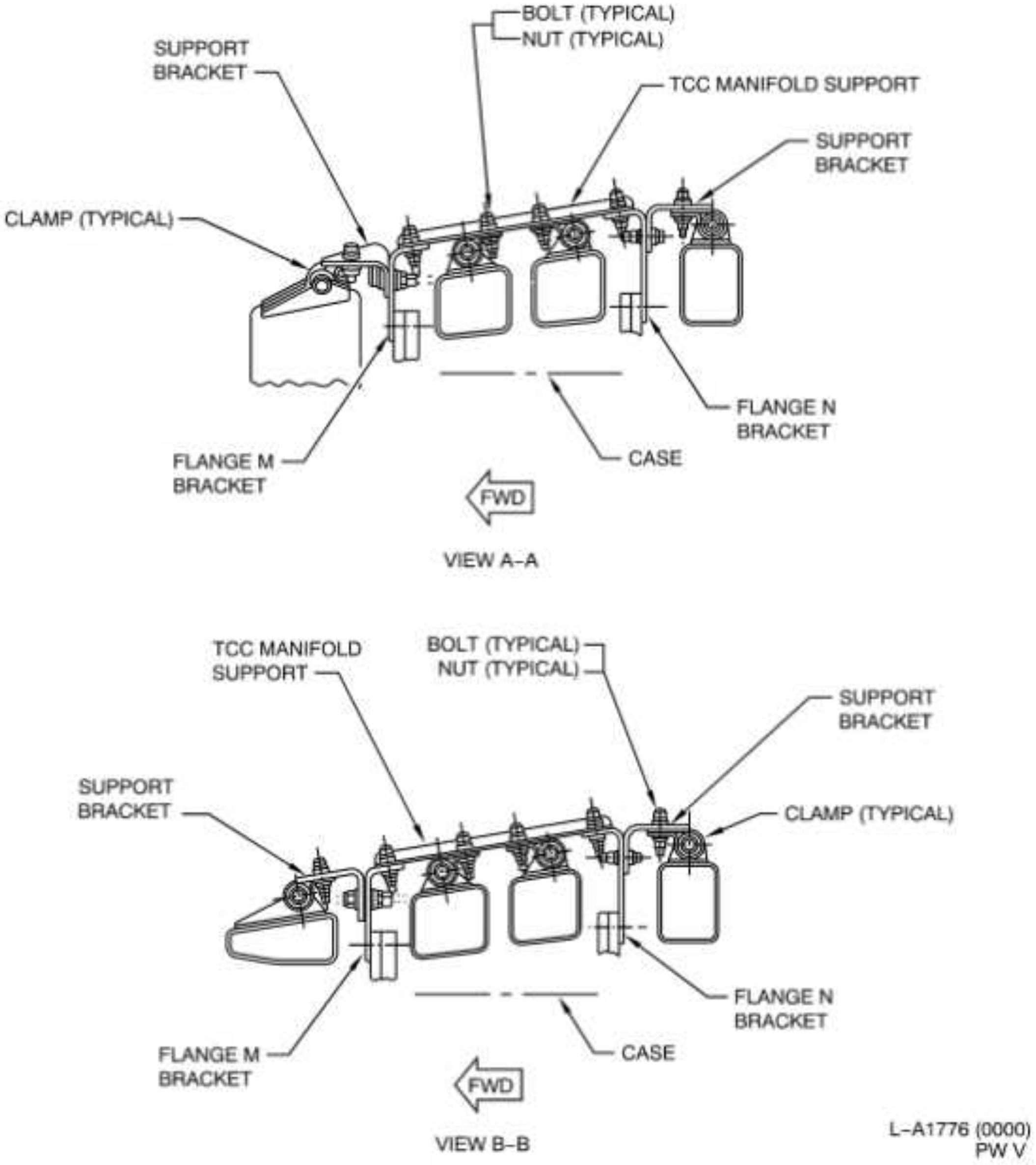
Turbine Vane Cooling Air Ducts (Left Side)
Figure 303 (Sheet 7)
(Task 72−00−53−020−003)


FLANGE N
FLANGE M
UPPER TURBINE CASE COOLING (TCC) HPT MANIFOLDS
C
C
BOLT (4)
G
G
HPT MANIFOLD (COLLECTOR)
BOLT (3)
E
E
LOWER FRONT HPT (TCC) MANIFOLD REMOVED FOR ENGINE SUPPORT
FWD
LOWER TURBINE CASE COOLING (TCC) HPT MANIFOLDS
L−A1774 (0000)
PW V

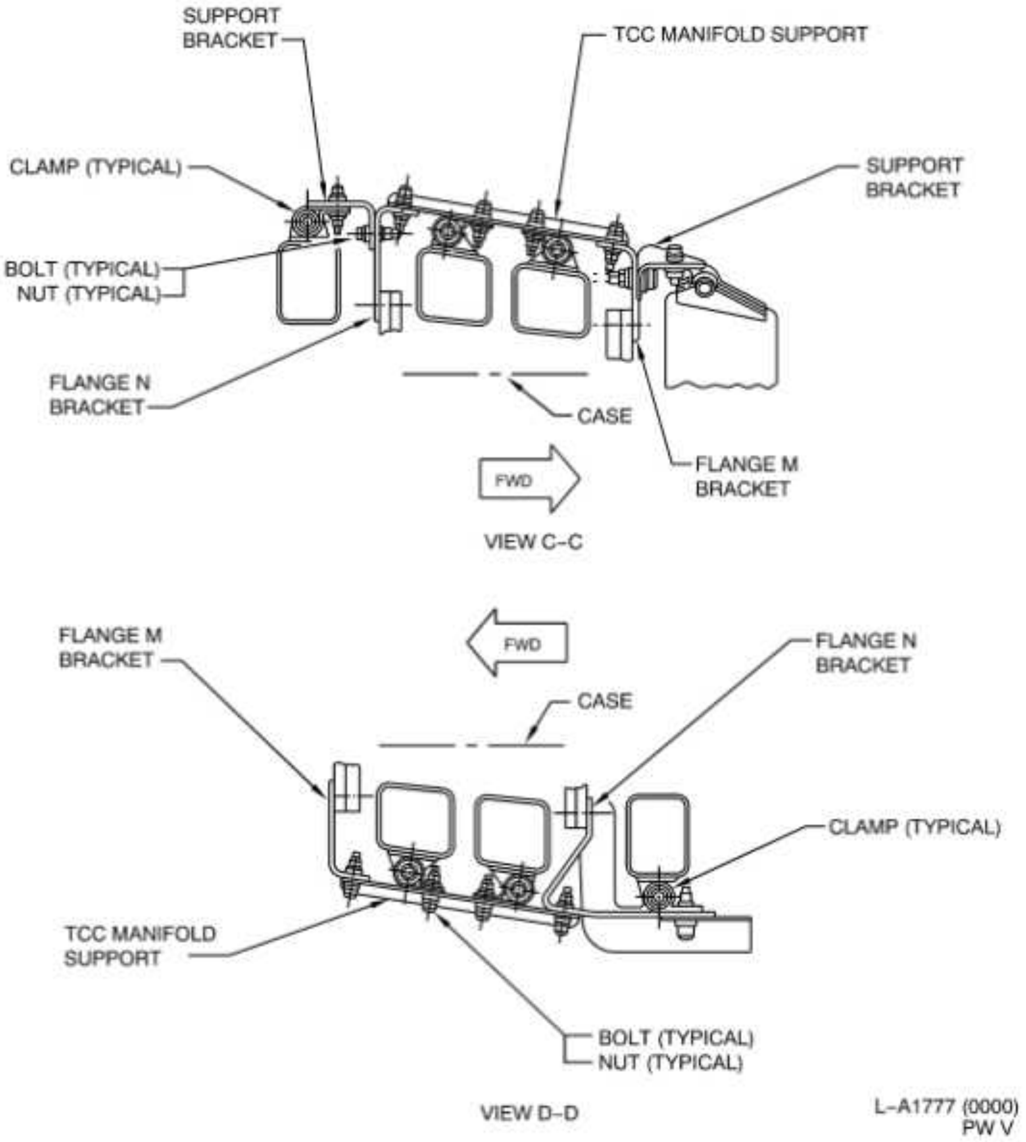
High Pressure Turbine Cooling Air Manifolds
Figure 304 (Sheet 1)
(Task 72−00−53−020−003)


FLANGE M
FLANGE N
B
B
UPPER TURBINE CASE COOLING (TCC) HPT MANIFOLDS
A
A
D
D
LOWER TURBINE CASE COOLING (TCC) HPT MANIFOLDS
LOWER FRONT HPT (TCC) MANIFOLD REMOVED FOR ENGINE SUPPORT
F
F
FWD
L-A1775 (0000)
PW V

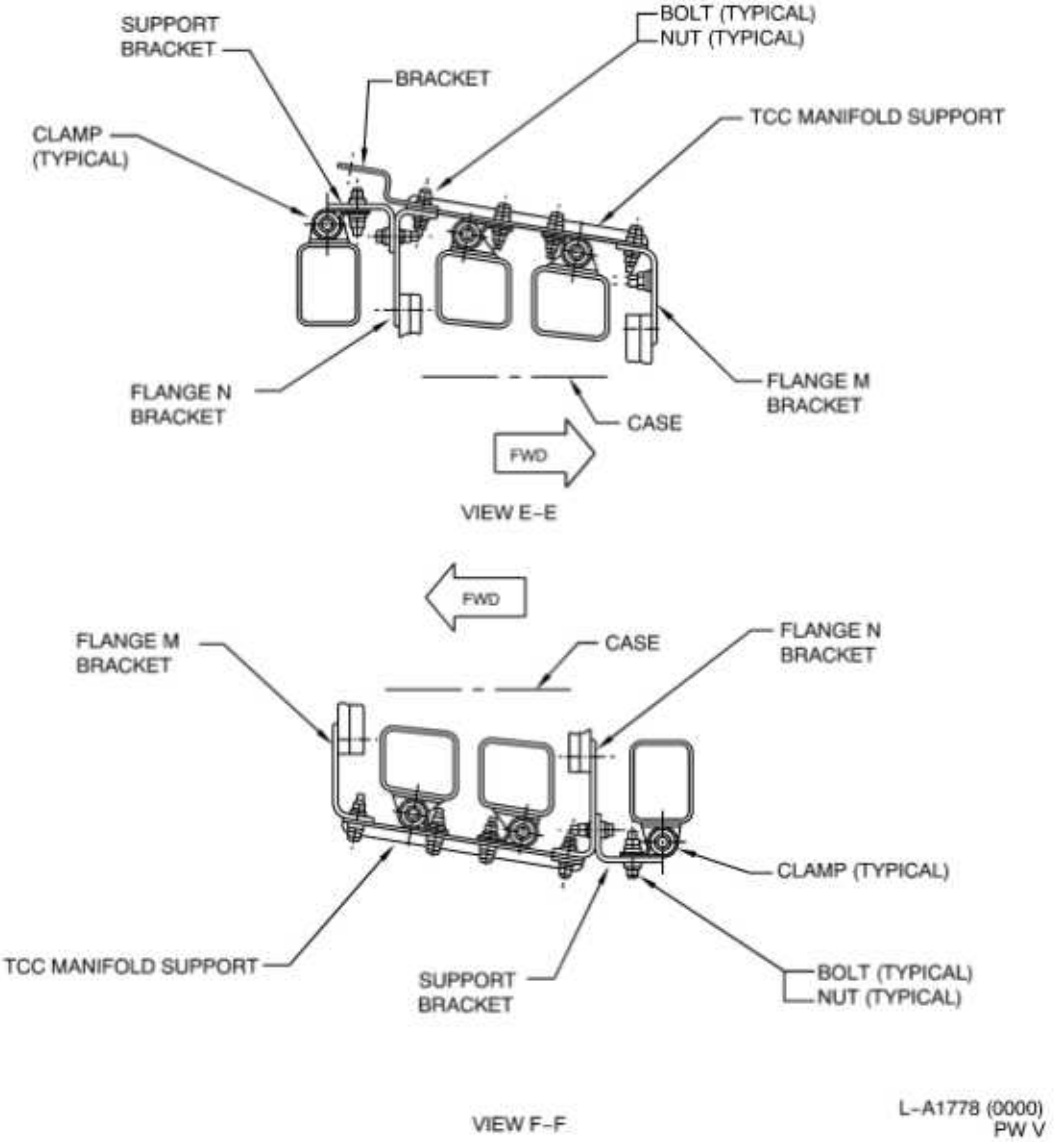
High Pressure Turbine Cooling Air Manifolds
Figure 304 (Sheet 2)
(Task 72-00-53-020-003)


BOLT (TYPICAL)
NUT (TYPICAL)
SUPPORT BRACKET
TCC MANIFOLD SUPPORT
SUPPORT BRACKET
CLAMP (TYPICAL)
FLANGE N BRACKET
CASE
FLANGE M BRACKET
FWD
VIEW A−A
TCC MANIFOLD SUPPORT
BOLT (TYPICAL)
NUT (TYPICAL)
SUPPORT BRACKET
SUPPORT BRACKET
CLAMP (TYPICAL)
FLANGE N BRACKET
CASE
FLANGE M BRACKET
FWD
VIEW B−B
L−A1776 (0000)
PW V

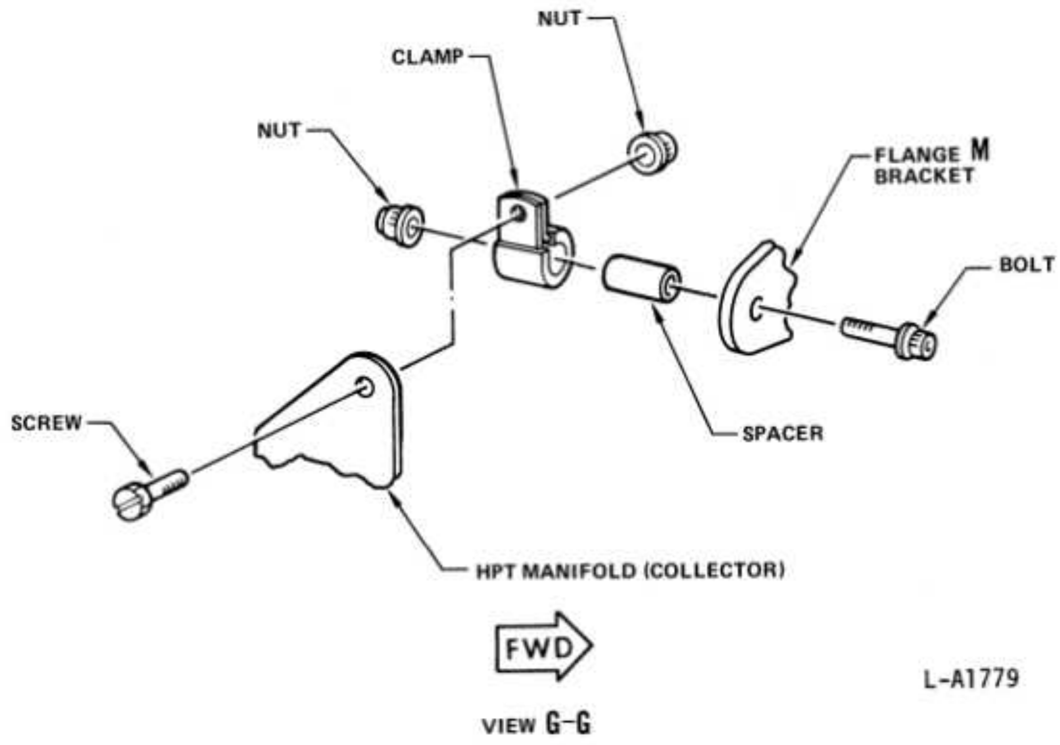
High Pressure Turbine Cooling Air Manifolds
Figure 304 (Sheet 3)
(Task 72−00−53−020−003)


SUPPORT BRACKET
TCC MANIFOLD SUPPORT
CLAMP (TYPICAL)
SUPPORT BRACKET
BOLT (TYPICAL)
NUT (TYPICAL)
FLANGE N BRACKET
CASE
FLANGE M BRACKET
FWD
VIEW C-C
FLANGE M BRACKET
FWD
FLANGE N BRACKET
CASE
CLAMP (TYPICAL)
TCC MANIFOLD SUPPORT
BOLT (TYPICAL)
NUT (TYPICAL)
VIEW D-D
L-A1777 (0000)
PW V

High Pressure Turbine Cooling Air Manifolds
Figure 304 (Sheet 4)
(Task 72-00-53-020-003)


SUPPORT BRACKET
BOLT (TYPICAL)
NUT (TYPICAL)
BRACKET
TCC MANIFOLD SUPPORT
CLAMP (TYPICAL)
FLANGE N BRACKET
FLANGE M BRACKET
CASE
FWD
VIEW E-E
FWD
FLANGE M BRACKET
CASE
FLANGE N BRACKET
CLAMP (TYPICAL)
TCC MANIFOLD SUPPORT
SUPPORT BRACKET
BOLT (TYPICAL)
NUT (TYPICAL)
VIEW F-F
L-A1778 (0000)
PW V

High Pressure Turbine Cooling Air Manifolds
Figure 304 (Sheet 5)
(Task 72-00-53-020-003)


NUT
CLAMP
NUT
FLANGE M
BRACKET
BOLT
SPACER
SCREW
HPT MANIFOLD (COLLECTOR)
FWD
L-A1779
VIEW G-G

High Pressure Turbine Cooling Air Manifolds
Figure 304 (Sheet 6)
(Task 72-00-53-020-003)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - REMOVAL-04

Task 72-00-53-050-002:

1. Remove Turbine Case Cooling Manifold (Collector)

   A. Equipment And Materials Required - None

   B. Procedure

   See Figures 301 and 302.

   (1) Remove bolts securing cooling air manifolds (AC01) through (AC14) to upper and lower sides of turbine case cooling manifold (collector).

   (2) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
   Remove the bolts, nuts and clamps that attach the cooling air manifolds to brackets on Flange P at the six locations.

   (3) FOR THESE MODELS: 4152, 4156A, 4158
   Remove the bolts, nuts and clamps that attach the cooling air manifolds to brackets on Flange P at the six locations.

   (4) Remove bolts and nuts securing cooling air manifold brackets to brackets on Flange N and boss on case.

   (5) Disengage lower cooling manifolds from manifold (collector) by sliding manifolds downward away from manifold (collector).

   (6) Disengage upper cooling manifolds from manifold (collector) by sliding tubes upward away from manifold (collector).

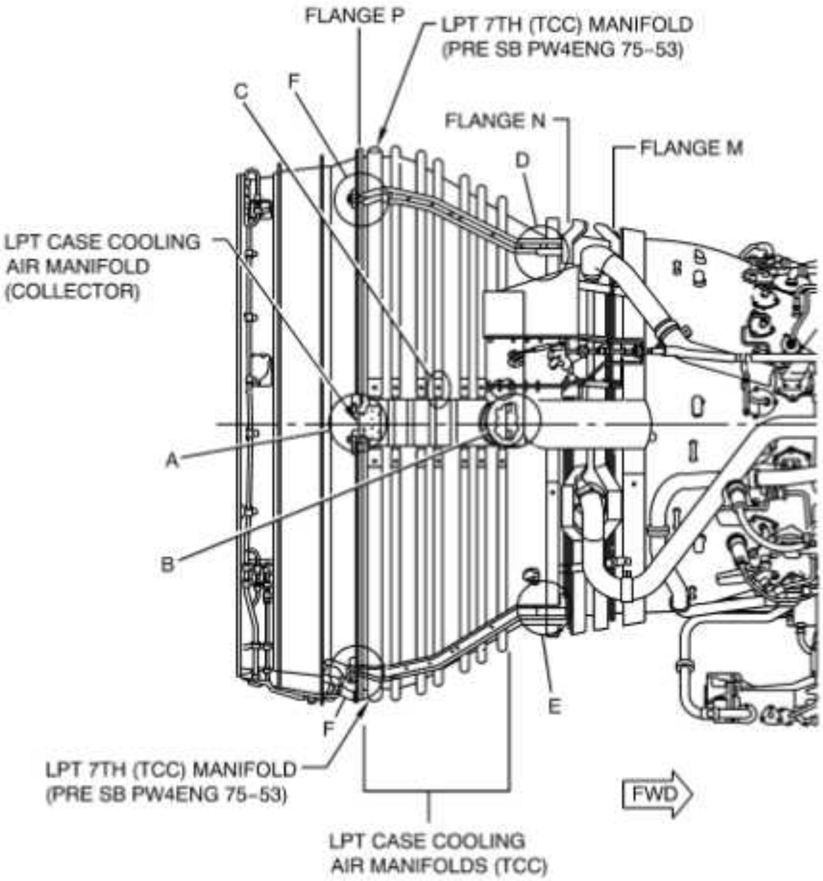
   (7) FOR THESE MODELS: 4152, 4156A, 4158
   Remove the upper and lower cover assembly from the rear (No. 7) of the manifold (collector) (Engines with SB PW4ENG 75-53).

   (8) Remove bolts securing manifold (collector) to support bracket and LPT cooling valve flange.

   (9) Remove bolts and clamps securing inboard bracket on manifold (collector) to bracket on Flange N.

   (10) Remove bolts, nuts, and clamps securing rear of manifold (collector) to brackets on Flange P and remove manifold from engine.

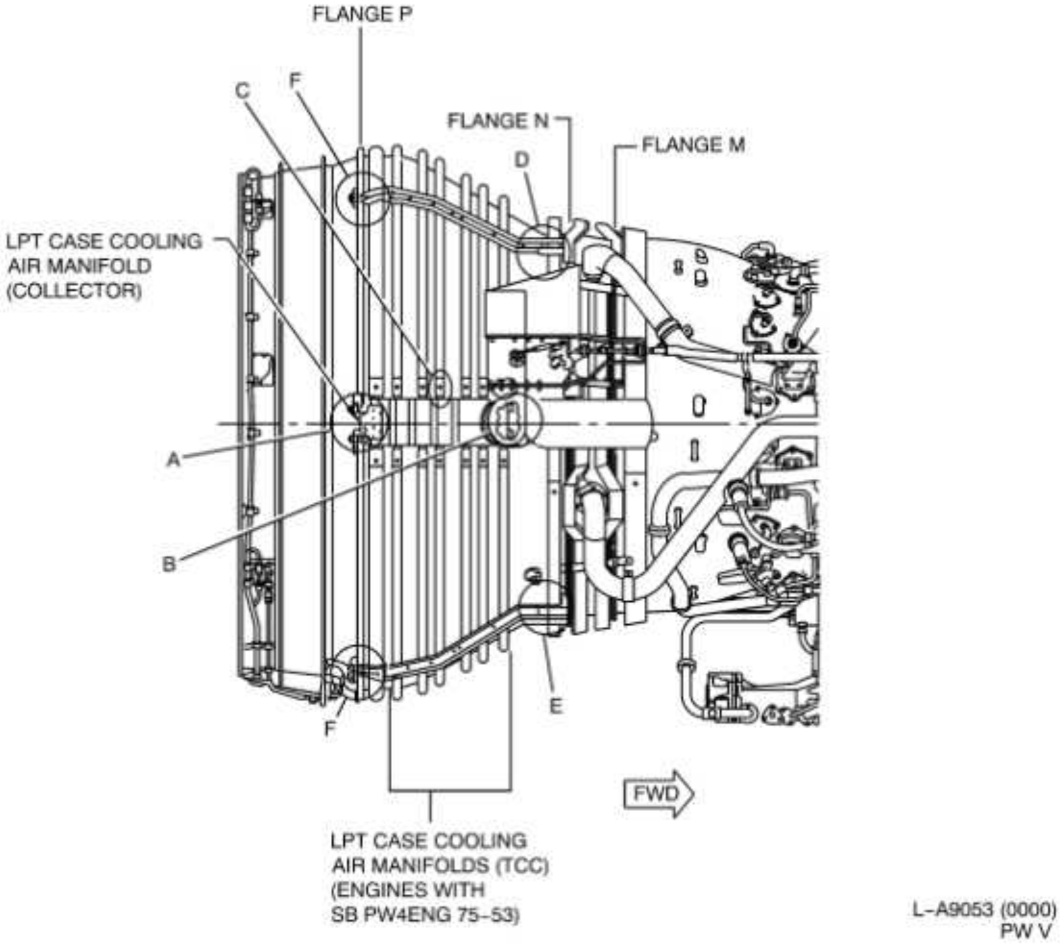
(11) Install protective closures.


FLANGE P
LPT 7TH (TCC) MANIFOLD
(PRE SB PW4ENG 75-53)
C
F
FLANGE N
D
FLANGE M
LPT CASE COOLING
AIR MANIFOLD
(COLLECTOR)
A
B
E
F
LPT 7TH (TCC) MANIFOLD
(PRE SB PW4ENG 75-53)
FWD
LPT CASE COOLING
AIR MANIFOLDS (TCC)

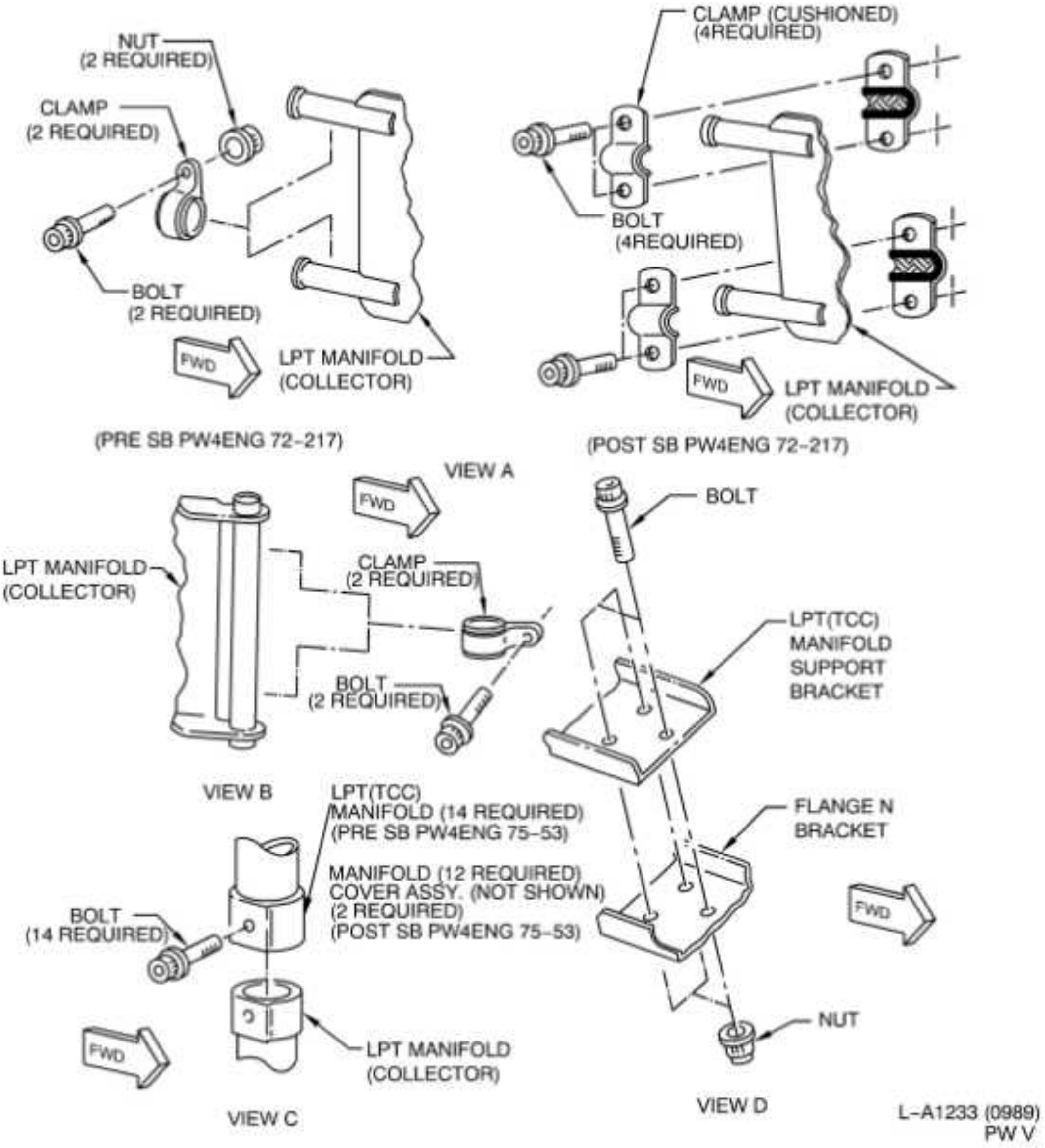
L-A1232 (0593)
PW V

Turbine Case Cooling
Manifold (Collector)
Figure 301 (Sheet 1)
(Task 72−00−53−050−002)

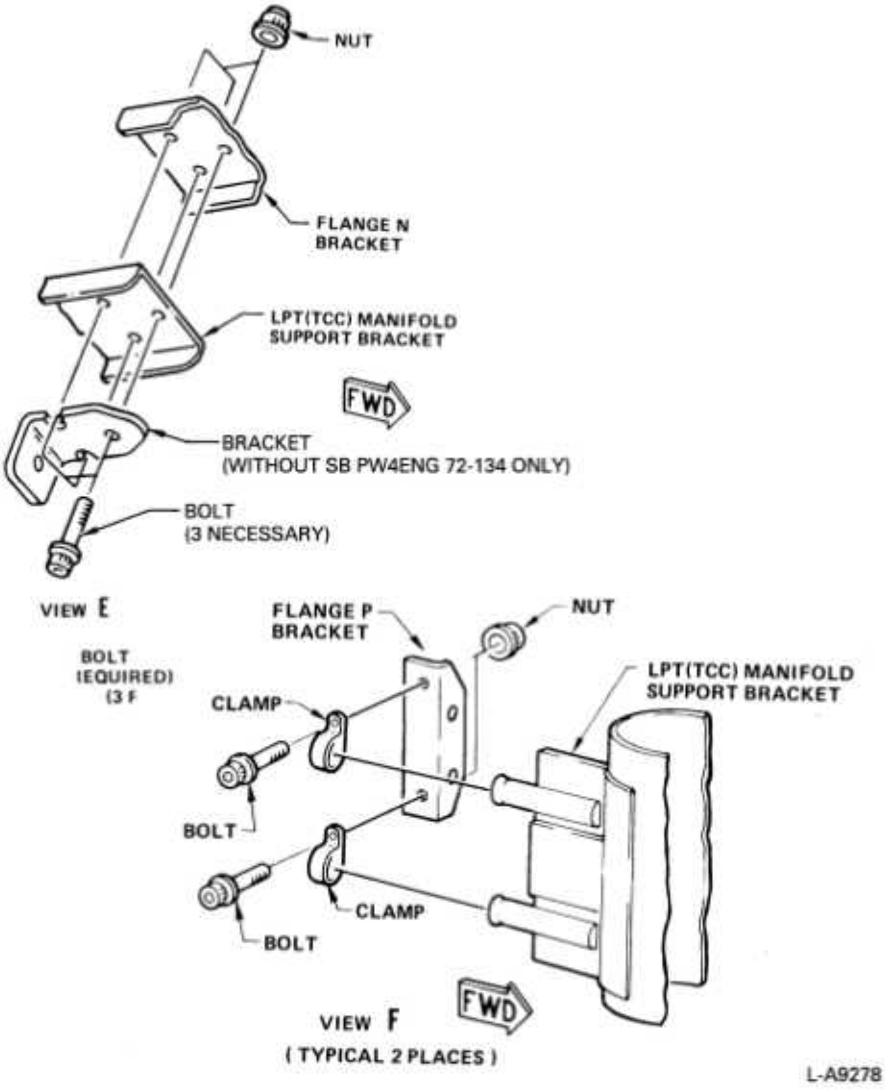
ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−04


FLANGE P
C
F
FLANGE N
FLANGE M
D
LPT CASE COOLING
AIR MANIFOLD
(COLLECTOR)
A
B
F
E
FWD
LPT CASE COOLING
AIR MANIFOLDS (TCC)
(ENGINES WITH
SB PW4ENG 75-53)
L-A9053 (0000)
PW V

Turbine Case Cooling
Manifold (Collector)
Figure 301 (Sheet 2)
(Task 72−00−53−050−002)

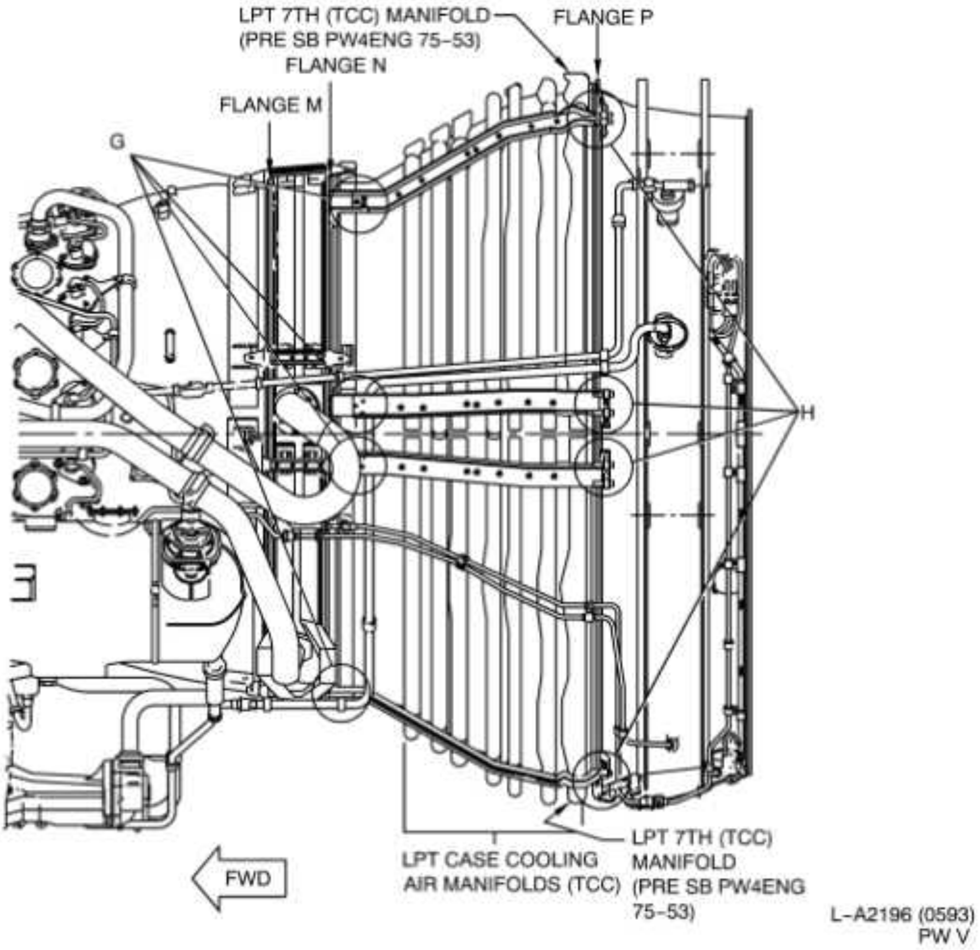

NUT (2 REQUIRED)
CLAMP (2 REQUIRED)
BOLT (2 REQUIRED)
FWD
LPT MANIFOLD (COLLECTOR)
(PRE SB PW4ENG 72-217)
CLAMP (CUSHIONED) (4REQUIRED)
BOLT (4REQUIRED)
FWD
LPT MANIFOLD (COLLECTOR)
(POST SB PW4ENG 72-217)
VIEW A
FWD
LPT MANIFOLD (COLLECTOR)
CLAMP (2 REQUIRED)
BOLT (2 REQUIRED)
VIEW B
BOLT
LPT(TCC) MANIFOLD SUPPORT BRACKET
FLANGE N BRACKET
FWD
NUT
VIEW D
LPT(TCC) MANIFOLD (14 REQUIRED) (PRE SB PW4ENG 75-53)
MANIFOLD (12 REQUIRED) COVER ASSY. (NOT SHOWN) (2 REQUIRED) (POST SB PW4ENG 75-53)
BOLT (14 REQUIRED)
FWD
LPT MANIFOLD (COLLECTOR)
VIEW C
L-A1233 (0989) PW V

Turbine Case Cooling
Manifold (Collector)
Figure 301 (Sheet 3)
(Task 72-00-53-050-002)

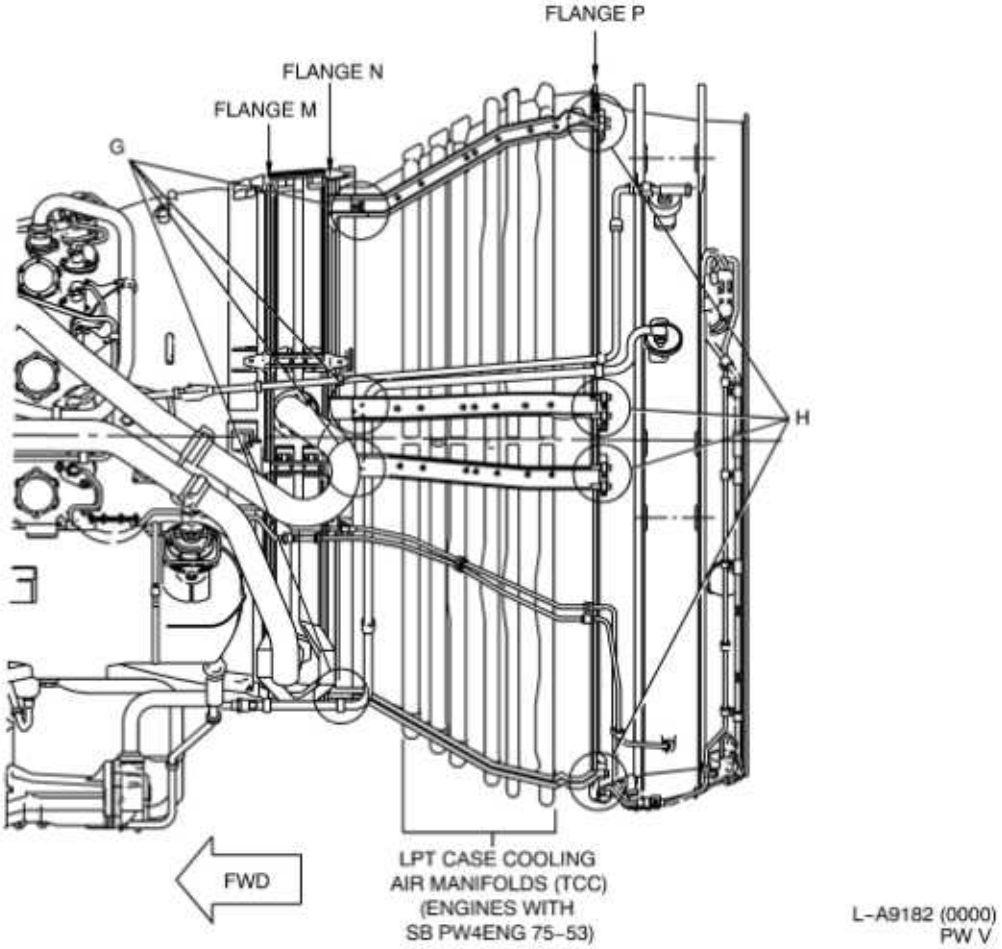

NUT
FLANGE N BRACKET
LPT(TCC) MANIFOLD SUPPORT BRACKET
FWD
BRACKET (WITHOUT SB PW4ENG 72-134 ONLY)
BOLT (3 NECESSARY)
VIEW E
BOLT
(EQUIRED)
(3 F
FLANGE P BRACKET
NUT
LPT(TCC) MANIFOLD SUPPORT BRACKET
CLAMP
BOLT
CLAMP
BOLT
VIEW F
(TYPICAL 2 PLACES)
FWD
L-A9278

Turbine Case Cooling
Manifold (Collector)
Figure 301 (Sheet 3)
(Task 72-00-53-050-002)

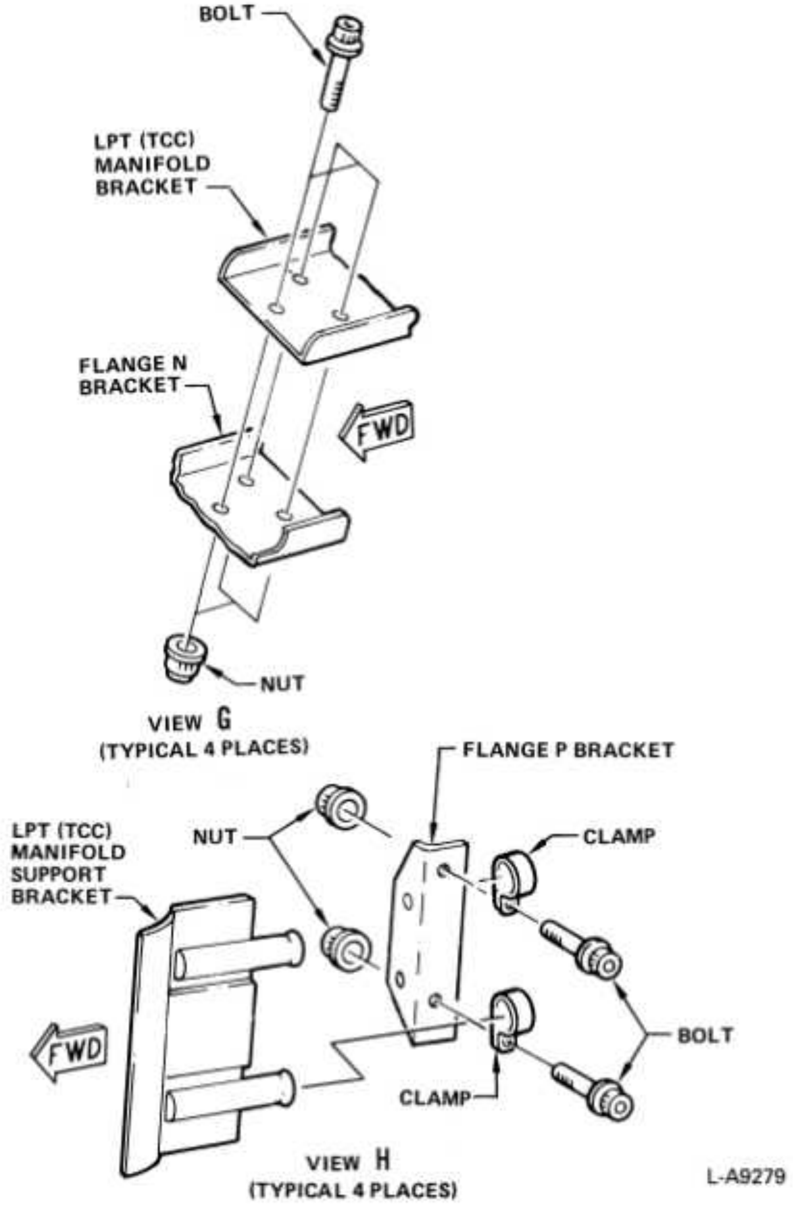
ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−04


LPT 7TH (TCC) MANIFOLD
(PRE SB PW4ENG 75-53)
FLANGE P
FLANGE N
FLANGE M
G
H
FWD
LPT CASE COOLING
AIR MANIFOLDS (TCC)
LPT 7TH (TCC)
MANIFOLD
(PRE SB PW4ENG
75-53)
L-A2196 (0593)
PW V

Turbine Case Cooling
Manifold (Collector)
Figure 301 (Sheet 4)
(Task 72−00−53−050−002)

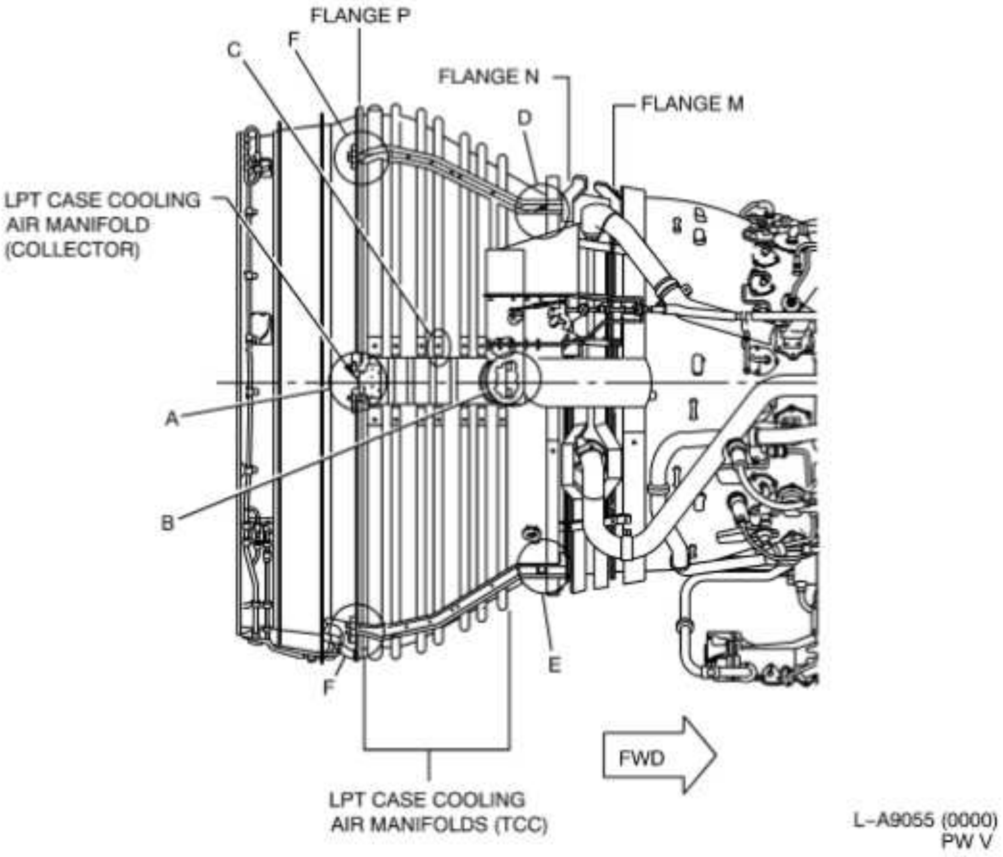

FLANGE P
FLANGE N
FLANGE M
G
H
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC) (ENGINES WITH SB PW4ENG 75-53)
L-A9182 (0000)
PW V

Turbine Case Cooling
Manifold (Collector)
Figure 301 (Sheet 5)
(Task 72−00−53−050−002)

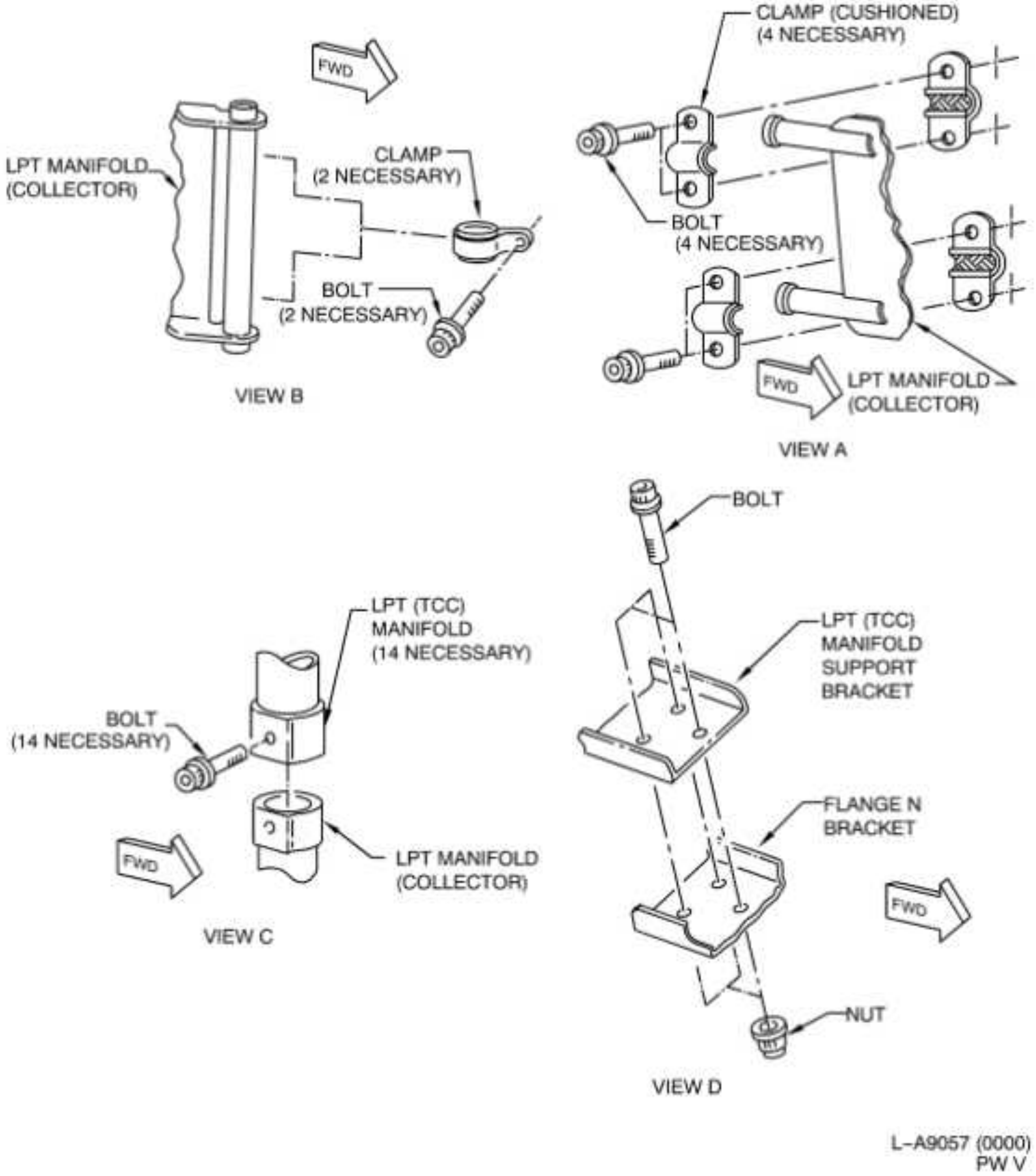

BOLT
LPT (TCC) MANIFOLD BRACKET
FLANGE N BRACKET
FWD
NUT
VIEW G
(TYPICAL 4 PLACES)
FLANGE P BRACKET
NUT
CLAMP
LPT (TCC) MANIFOLD SUPPORT BRACKET
FWD
BOLT
CLAMP
VIEW H
(TYPICAL 4 PLACES)
L-A9279

Turbine Case Cooling
Manifold (Collector)
Figure 301 (Sheet 6)
(Task 72-00-53-050-002)

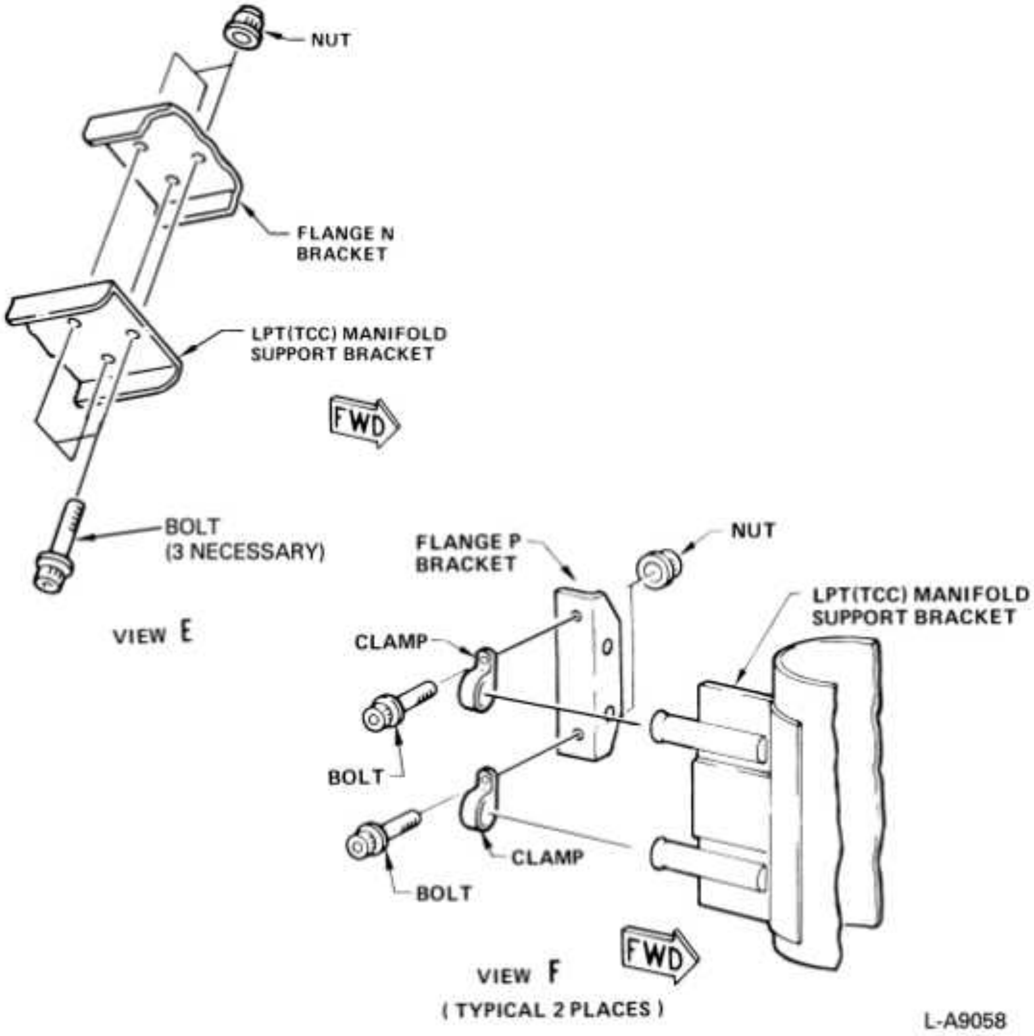
ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−04


FLANGE P
C
F
FLANGE N
D
FLANGE M
LPT CASE COOLING AIR MANIFOLD (COLLECTOR)
A
B
F
E
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC)
L−A9055 (0000)
PW V

Turbine Case Cooling
Manifold (Collector)
Figure 302 (Sheet 1)
(Task 72−00−53−050−002)

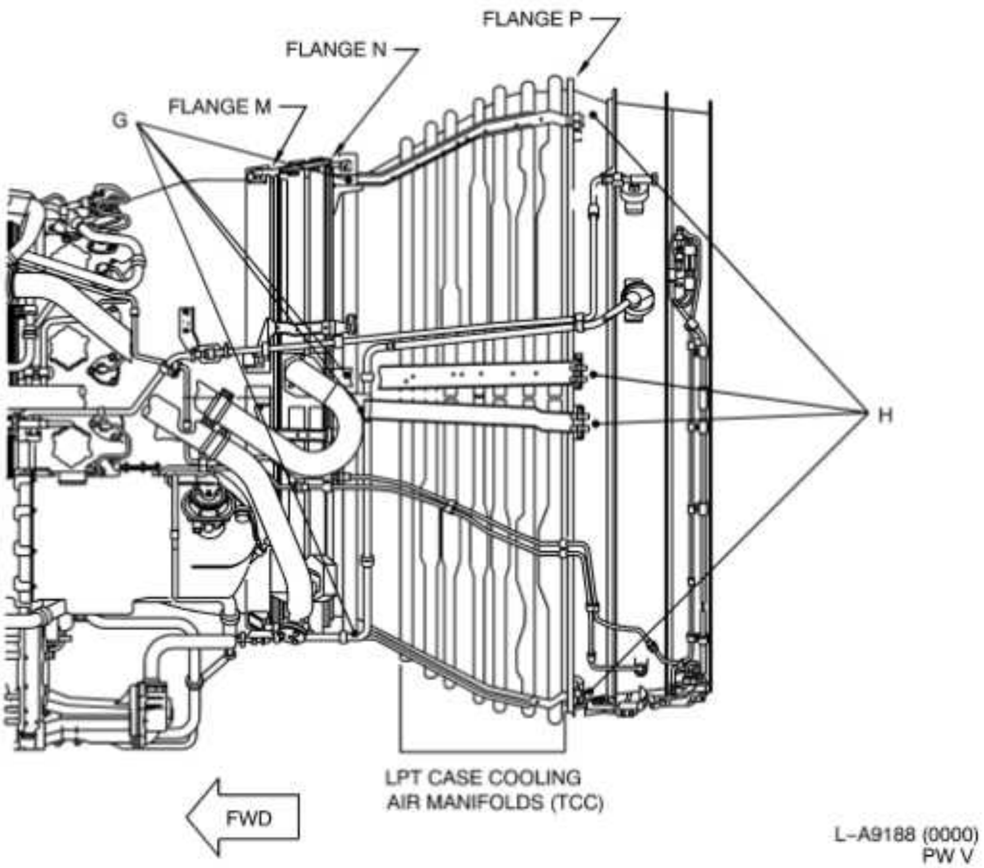

CLAMP (CUSHIONED)
(4 NECESSARY)
FWD
LPT MANIFOLD
(COLLECTOR)
CLAMP
(2 NECESSARY)
BOLT
(4 NECESSARY)
BOLT
(2 NECESSARY)
FWD
LPT MANIFOLD
(COLLECTOR)
VIEW B
VIEW A
BOLT
LPT (TCC)
MANIFOLD
(14 NECESSARY)
LPT (TCC)
MANIFOLD
SUPPORT
BRACKET
BOLT
(14 NECESSARY)
FLANGE N
BRACKET
FWD
LPT MANIFOLD
(COLLECTOR)
FWD
VIEW C
NUT
VIEW D
L-A9057 (0000)
PW V

Turbine Case Cooling
Manifold (Collector)
Figure 302 (Sheet 2)
(Task 72-00-53-050-002)

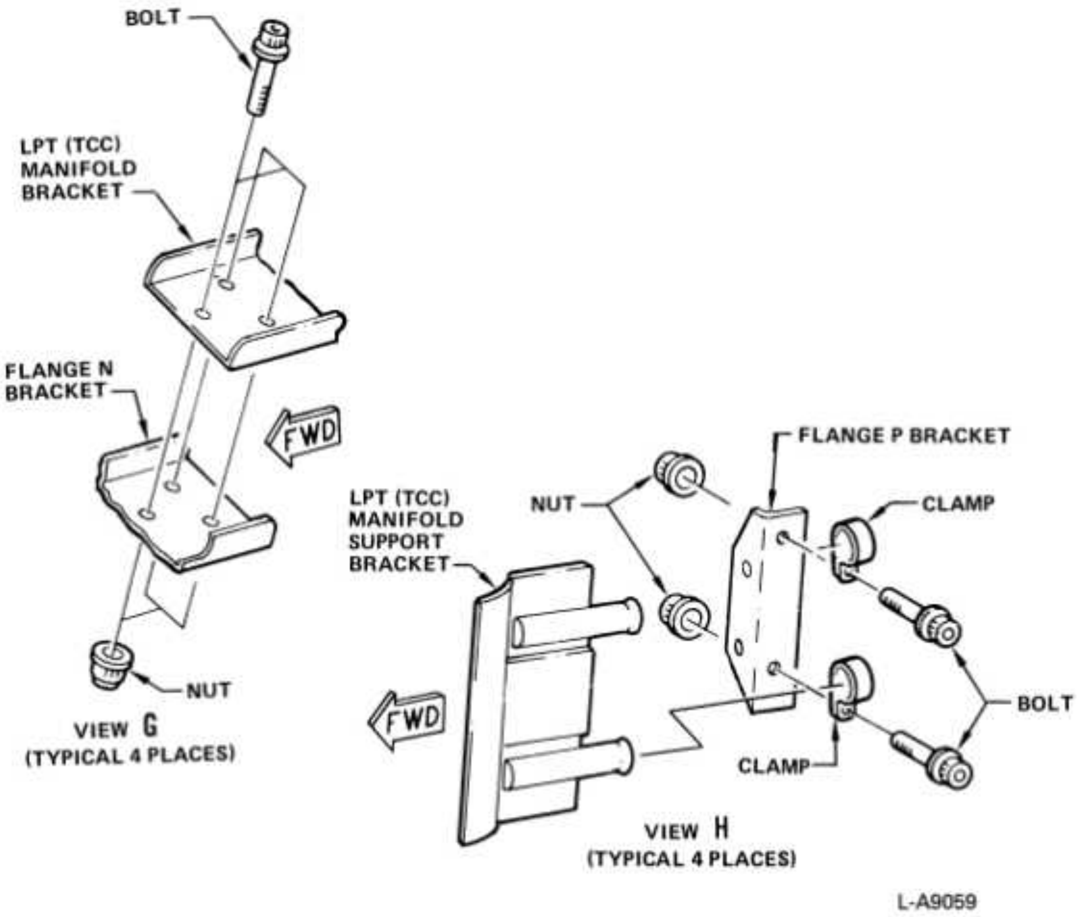

NUT
FLANGE N BRACKET
LPT(TCC) MANIFOLD SUPPORT BRACKET
FWD
BOLT (3 NECESSARY)
VIEW E
FLANGE P BRACKET
NUT
LPT(TCC) MANIFOLD SUPPORT BRACKET
CLAMP
BOLT
CLAMP
BOLT
FWD
VIEW F
(TYPICAL 2 PLACES)
L-A9058

Turbine Case Cooling
Manifold (Collector)
Figure 302 (Sheet 3)
(Task 72−00−53−050−002)

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−04


FLANGE P
FLANGE N
FLANGE M
G
H
LPT CASE COOLING
AIR MANIFOLDS (TCC)
FWD
L−A9188 (0000)
PW V

Turbine Case Cooling
Manifold (Collector)
Figure 302 (Sheet 4)
(Task 72−00−53−050−002)


BOLT
LPT (TCC) MANIFOLD BRACKET
FLANGE N BRACKET
FWD
NUT
VIEW G
(TYPICAL 4 PLACES)
FLANGE P BRACKET
NUT
LPT (TCC) MANIFOLD SUPPORT BRACKET
CLAMP
BOLT
CLAMP
FWD
VIEW H
(TYPICAL 4 PLACES)
L-A9059

Turbine Case Cooling
Manifold (Collector)
Figure 302 (Sheet 5)
(Task 72−00−53−050−002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - REMOVAL-05

Task 72-00-53-050-003:

1. Remove Turbine Case Cooling Manifolds

   A. Prerequisites

      (1) Remove EEC thermocouple and airframe cable (W6) as necessary by 72-00-54, Removal-09 (Task 72-00-54-050-006).

   B. Equipment And Materials Required - None

   C. Procedure

      See Figures 301, 302, 303, 304 and 305.

      (1) (Pre SB PW4ENG 79-76) Remove No. 4 bearing oil pressure tube assembly (LP16) as follows. See Figure 301.

         (a) Remove the clamps securing spray shield, to tube connection and if equipped a bracket, forward of Flange M at approximately 10 o'clock position on diffuser case. Remove the spray shield from the engine. Remove lockwire and disconnect tube nut from tube adapter.

         (b) Remove clamp securing spray shield to rear tube connection on exhaust case and remove spray shield. Remove lockwire and disconnect tube nut.

         (c) Remove bolts, nuts, and clamps securing tube to brackets on Flanges M, N, and P at approximately 10 o'clock position.

         (d) Remove bolt, nut, spacer, and clamps securing tube to adjacent scavenge tube rearward of Flange N. Remove tube from engine.

      (2) (Post SB PW4ENG 79-76) Remove No. 4 bearing oil pressure tube assemblies (LP47) and (LP48) which replace (LP16) as follows. See Figure 305.

         (a) Remove clamps and the tube spray shields at the (LP48) tube to the strainer housing connection, at the (LP47) tube to the (LP48) tube connection and at the (LP47) tube to the (LP15) tube connection. See Views G, CA and LA.

         (b) Remove clamps, bolts and nuts as shown in Views M, N, B1, P, R and F.

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−05

(c) Remove the (LP48) tube from the strainer housing and the (LP47) tube. See Views G and CA.

(d) Remove the element housing from the tube nut at approximately the 7 o'clock position. See View G.

(e) Remove the No. 4 bearing strainer element from the element housing. See View G.

(f) Remove and discard packing from the groove in the strainer element. See View G.

(g) Remove bolts and clamps. See Views U, T, and S.

(h) Remove the coupling nut that attaches (LP15) tube to the (LP47) tube. See View LA.

(3) (Pre SB PW4ENG 79−75) Remove (rear) No. 4 bearing oil scavenge tube assembly (LR06) as follows.

(a) Remove lockwire and disconnect rear scavenge tube elbow from exhaust case internal tube at approximately 10 o'clock position.

(b) Remove bolt, nut, and clamp securing spray shield to bracket on Flange M. Remove clamp securing forward end of shield to tube and remove spray shield.

(c) Remove lockwire and disconnect tube nut at Flange M from tube adapter.

(d) Remove bolt, nut, and clamp securing tube to bracket on Flange P.

(e) Remove bolts, nuts, and clamps securing tube to brackets on Flange N. Remove tube from engine.

(4) (Post SB PW4ENG 79−75 and Pre SB PW4ENG 79−76 only) Remove (rear) No. 4 bearing scavenge tube assembly (LR06) as follows.

(a) Remove hose clamp securing the tube shield to the bracket inboard side of Flange M at approximately 7 o'clock position. Remove the lockwire and disconnect the (LR05) hose and tube assembly nut from the (LR06) tube coupling.

(b) Remove lockwire and disconnect tube elbow from exhaust case internal tube nut at approximately 10 o'clock position.

(c) Remove bolts, nuts and clamps securing tube to Flange N and P brackets. Remove tube from engine and install protective closures.

(d) Remove bolts, nuts and clamp bracket attached to Flange M and N brackets at approximately 7 o'clock position.

(e) FOR THESE MODELS: 4152, 4156A, 4158
Remove the bolt, nut, and clamp at approximately the 7:30 o'clock position on the exhaust case that secures the tube to the adjacent PT4.95 tube assembly (Post SB PW4ENG 72−134).

(f) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the bolt, nut, and clamp at approximately the 7:30 o'clock position on the exhaust case that attaches the tube to the adjacent PT4.95 tube assembly.

(g) Remove bolt, nut, and clamp securing tube to adjacent tube between Flange M and Flange P. Remove tube from engine and install protective closures.

(5) (Post SB PW4ENG 79−76) Remove (rear) No. 4 bearing scavenge tube assemblies (LR21) and (LR22) which replace (LR06) as follows. See Figure 305.

(a) Remove clamps and the tube spray shields at the (LR21) tube to (LR22) tube connection and at the (LR05) tube to the (LR21) tube connection. See Views E and DE.

(b) Remove clamps on the (LR22). See Views A, B, C and D.

(c) Remove the (LR22) tube from the (LR21) tube and the port for the internal tube on the turbine exhaust case. See Views E and AP.

(d) Remove clamps, nuts and bolts that secure (LR21) tube. See Views F, O, Q and R.

(e) Remove the (LR21) tube from the (LR05) tube. See View DE.

(6) (Pre SB PW4ENG 79−76) Remove No. 3 bearing oil vent tube assembly (LD02) as follows.

(a) Remove lockwire and disconnect oil vent tube assembly from adapter on turbine exhaust case at approximately the 7 o'clock position.

(b) Remove lockwire and disconnect tube nut at tube connection just rearward of Flange M.

(c) Remove bolt, nut, and clamp that attach the tube to bracket on Flange N.

(d) Remove bolts, nuts, and clamps that attach the tube to Flange P brackets.

(e) FOR THESE MODELS: 4152, 4156A, 4158
Remove the bolt, nut, and clamp at approximately the 7:30 o'clock position on the exhaust case that attach the tube to the adjacent PT4.95 tube assembly (Post SB PW4ENG 72−134).

(f) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the bolt, nut, and clamp at approximately the 7:30 o'clock position on the exhaust case that attach the tube to the adjacent PT4.95 tube assembly.

(g) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove bolt, nut, and clamp that attach the tube to the adjacent tube between Flange M and Flange P. Remove the tube from the engine and install protective closures.

(7) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
(Pre SB PW4ENG 79−76) Remove the (rear) EEC PT4.95 pressure tube assembly (AS02) as follows.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove lockwire from tube nut securing tube to tee (water drain) on PT4.95 manifold, rearward of Flange P at approximately 6 o'clock position and disconnect tube nut (Pre SB PW4ENG 72−134).

(b) FOR THESE MODELS: 4152, 4156A, 4158
Remove the lockwire and disconnect the tube nut from the tube coupling at the rear of Flange P at approximately the 7 o'clock position (Post SB PW4ENG 72−134).

(c) FOR THESE MODELS: 4152, 4156A, 4158
Remove bolt, nut, and clamp that secures the tube to the Flange P bracket at approximately the 7 o'clock position (Pre SB PW4ENG 72−134).

(d) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the lockwire and disconnect the tube nut from the tube coupling at the rear of Flange P at approximately the 7 o'clock position.

(e) Remove lockwire from tube connection at Flange N at approximately the 8 o'clock position and disconnect tube nut from tube adapter.

(f) Remove the tube from the engine and install protective closures.

(8) (Post SB PW4ENG 79−76) Remove the (rear) No. 3 bearing oil vent tube assembly (LD02) and the (rear) EEC PT4.95 pressure tube assembly (AS02) as follows. See Figure 305.

(a) Remove clamps, nut and bolts from the (AS27) tube, the (LD02) tube, the (AS02) tube and the (LP48) tube. See Views H, I, J, K and L,

(b) Remove the bolt that attaches the (AS02) tube to the bracket. See View G.

(c) Remove the (AS02) tube from the (AS03) and (AS27) tubes. See (Sheet 1).

(d) Remove the (LD02) tube from the (LD01) tube and to the turbine exhaust case. See (Sheet 1).

(9) Remove all bolts securing LPT (TCC) manifolds (AC01) through (AC14) (upper and lower) to manifold (collector).

(10) Remove bolts and nuts securing cooling air manifold brackets to brackets on Flange N.

NOTE: Bolt and nut at approximately the 8 o'clock position holds clamp supporting HPT manifold.

(11) FOR THESE MODELS: 4152, 4156A, 4158
Remove the bolts, nuts, spacers and clamps that attach the rear mounts of the cooling manifolds to brackets on Flange P (Pre SB PW4ENG 75−50).

(12) FOR THESE MODELS: 4152, 4156A, 4158
Remove the bolts, nuts and clamps that attach the rear mounts of the cooling manifolds to brackets on Flange P (Post SB PW4ENG 75−50).

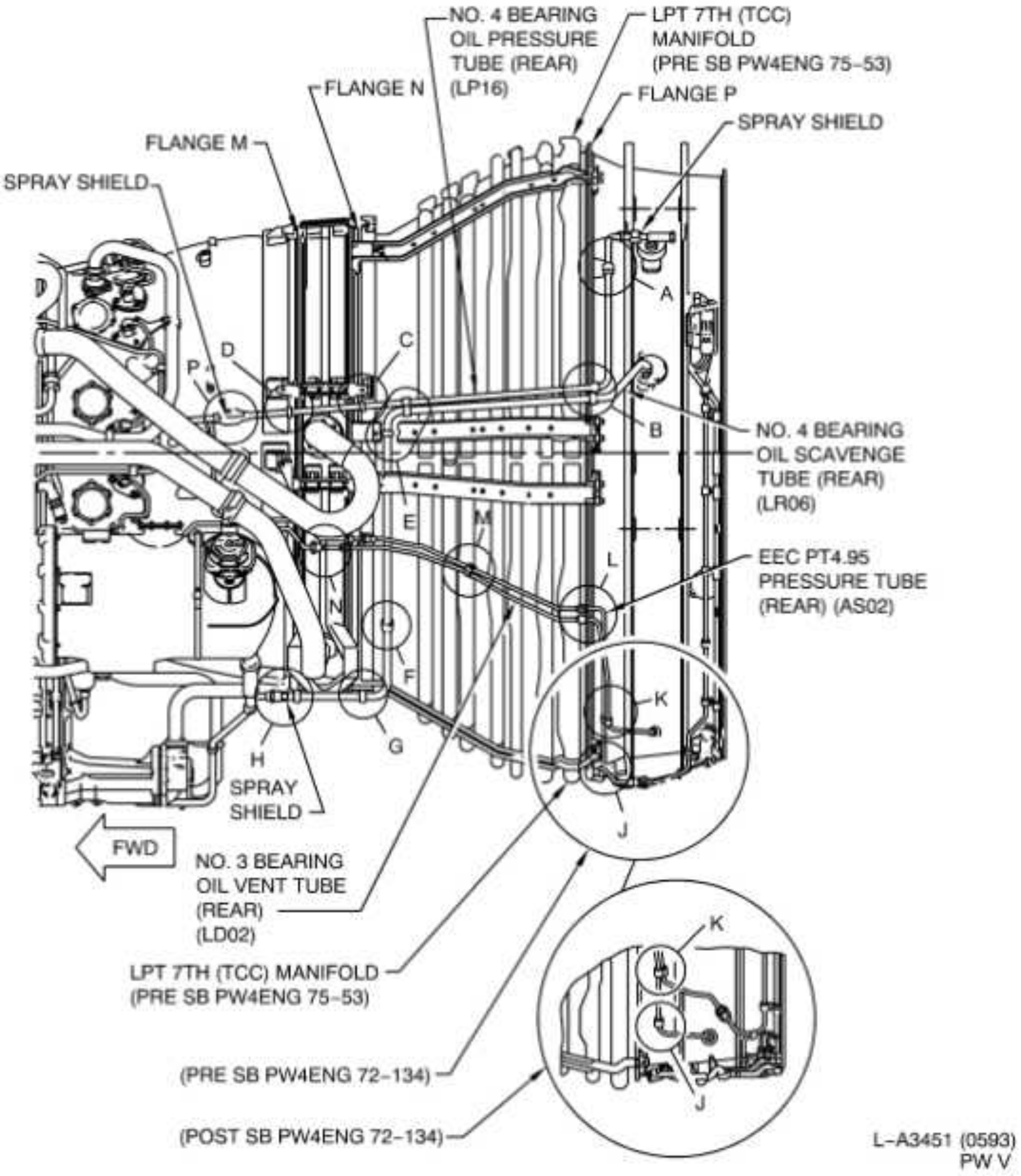
(13) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the bolts, nuts and clamps that attach the rear mounts of the cooling manifolds to the brackets on Flange P.

(14) Rotate lower half of cooling air manifolds around LPT case to disengage from manifold (collector). Remove lower cooling manifolds from engine.

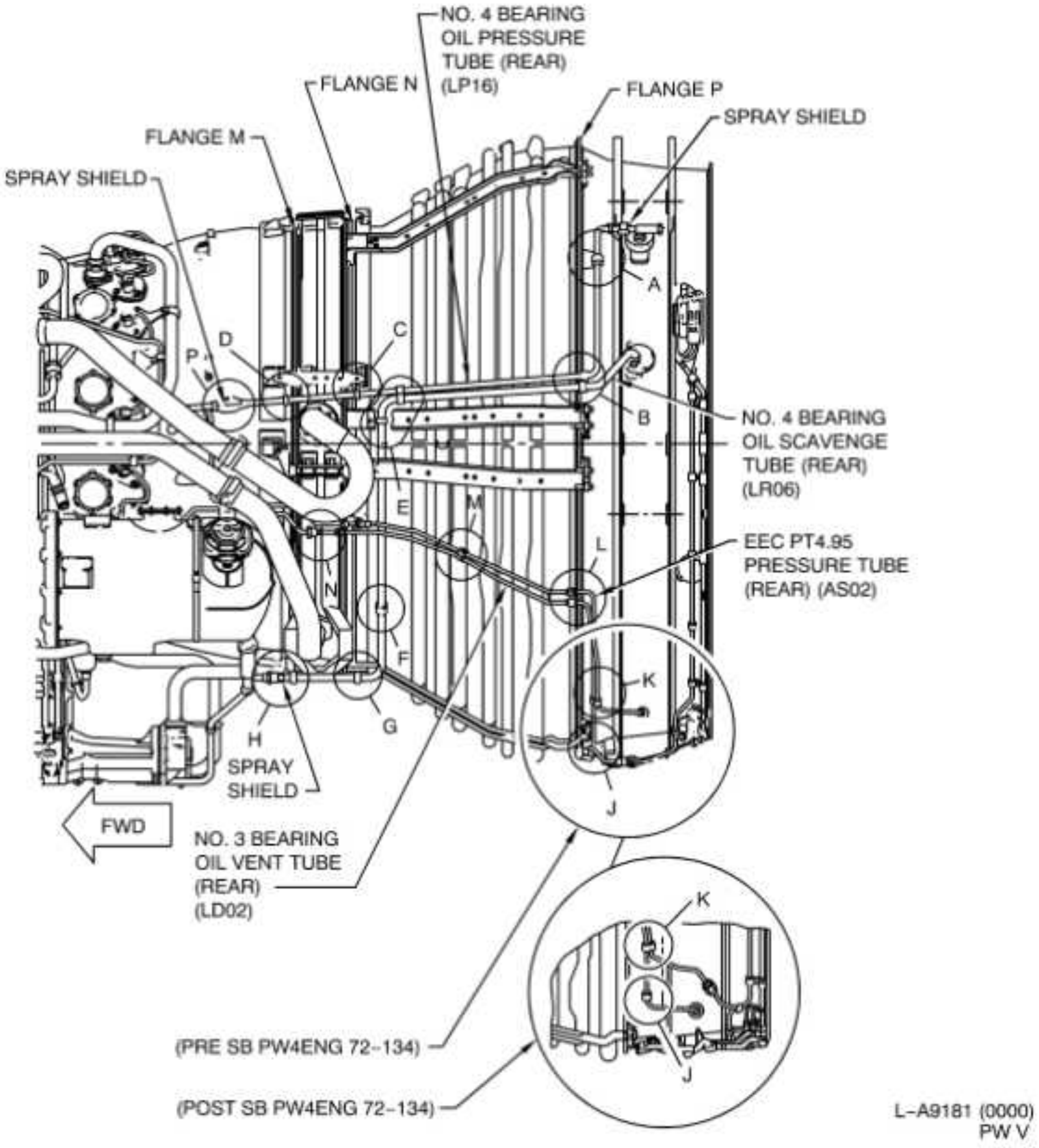
(15) Rotate upper half of cooling air manifolds around LPT case to disengage from manifold (collector). Remove upper cooling manifolds from engine.

(16) FOR THESE MODELS: 4152, 4156A, 4158
Remove the upper and lower cover assembly from the rear (No. 7) of the manifold (collector) (Post SB PW4ENG 75−53).

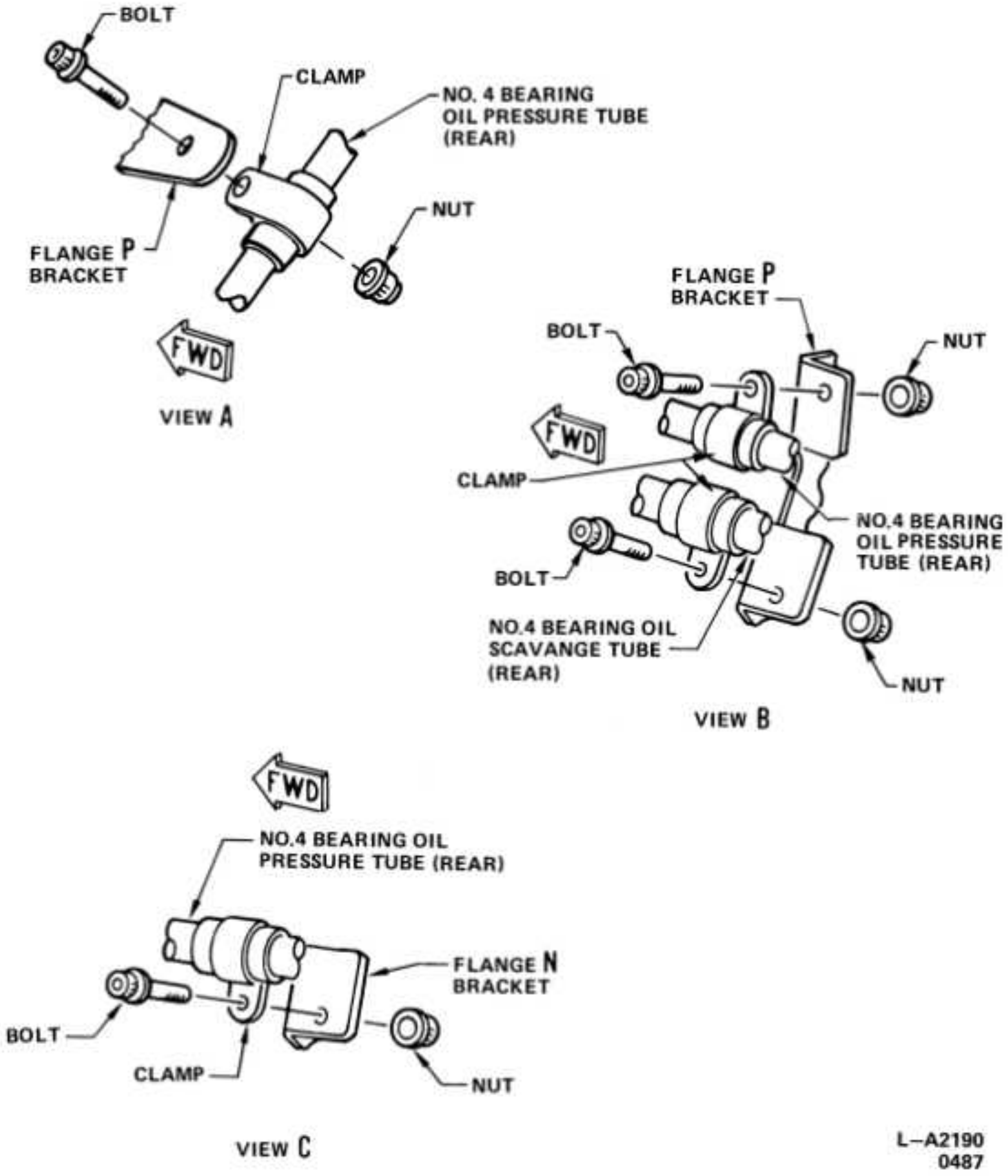
(17) Install protective covers.


NO. 4 BEARING OIL PRESSURE TUBE (REAR) (LP16)
LPT 7TH (TCC) MANIFOLD (PRE SB PW4ENG 75-53)
FLANGE N
FLANGE P
SPRAY SHIELD
FLANGE M
SPRAY SHIELD
A
C
D
P
B
NO. 4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
E
M
L
EEC PT4.95 PRESSURE TUBE (REAR) (AS02)
N
H
F
K
G
H
SPRAY SHIELD
J
FWD
NO. 3 BEARING OIL VENT TUBE (REAR) (LD02)
K
LPT 7TH (TCC) MANIFOLD (PRE SB PW4ENG 75-53)
(PRE SB PW4ENG 72-134)
J
(POST SB PW4ENG 72-134)
L-A3451 (0593)
PW V

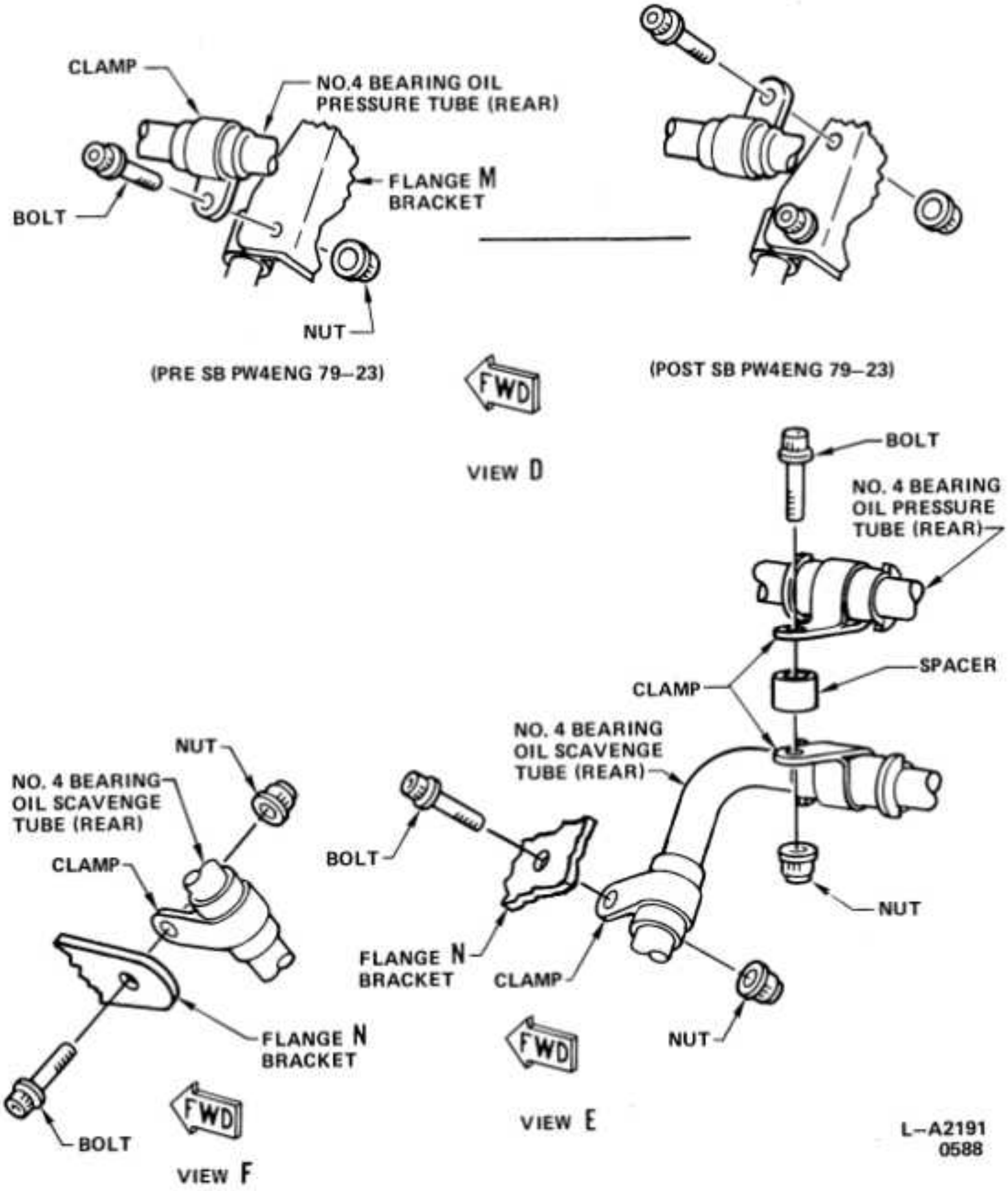
Turbine Case Cooling (TCC) LPT Manifolds
Figure 301 (Sheet 1)
(Task 72-00-53-050-003)


NO. 4 BEARING OIL PRESSURE TUBE (REAR) (LP16)
FLANGE N
FLANGE P
SPRAY SHIELD
FLANGE M
SPRAY SHIELD
A
C
D
P
B
NO. 4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
E
M
L
EEC PT4.95 PRESSURE TUBE (REAR) (AS02)
N
F
K
G
H
SPRAY SHIELD
J
FWD
NO. 3 BEARING OIL VENT TUBE (REAR) (LD02)
K
J
(PRE SB PW4ENG 72-134)
(POST SB PW4ENG 72-134)
L-A9181 (0000)
PW V

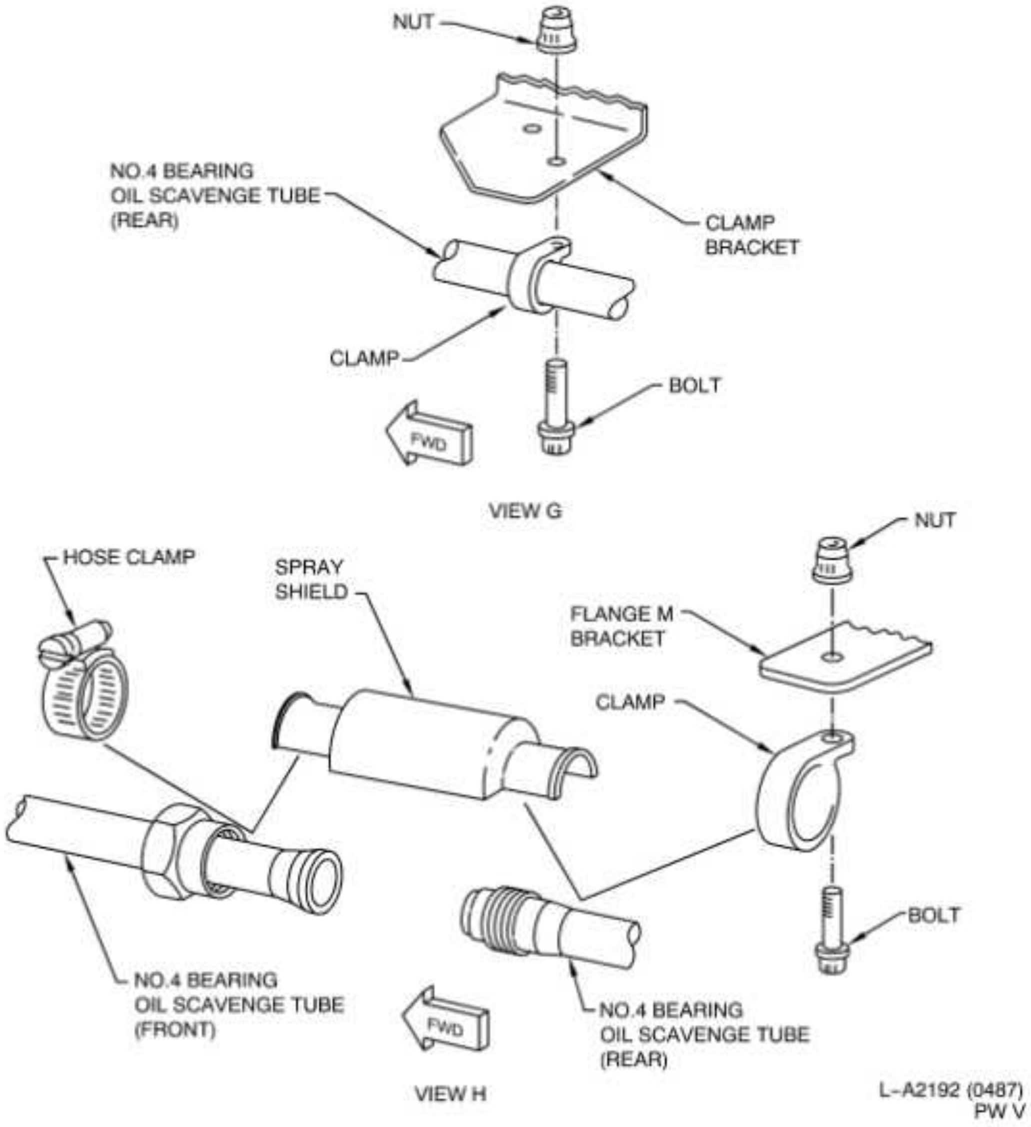
Turbine Case Cooling (TCC) LPT Manifolds
(Engines With SB PW4ENG 75−53)
Figure 301 (Sheet 2)
(Task 72−00−53−050−003)


BOLT
CLAMP
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
NUT
FLANGE P BRACKET
FWD
VIEW A
FLANGE P BRACKET
BOLT
NUT
FWD
CLAMP
NO.4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NO.4 BEARING OIL SCAVANGE TUBE (REAR)
NUT
VIEW B
FWD
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE N BRACKET
BOLT
CLAMP
NUT
VIEW C
L-A2190
0487

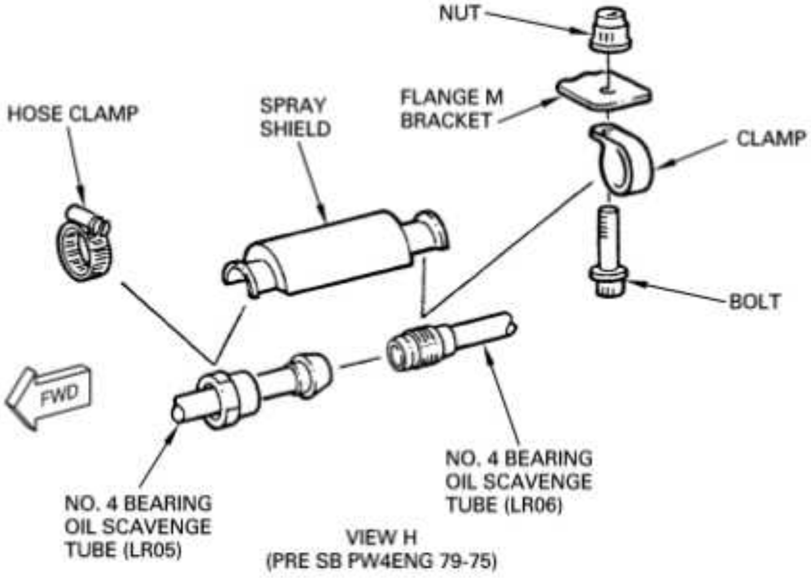
External Plumbing Clipping Views
Figure 301 (Sheet 3)
(Task 72-00-53-050-003)

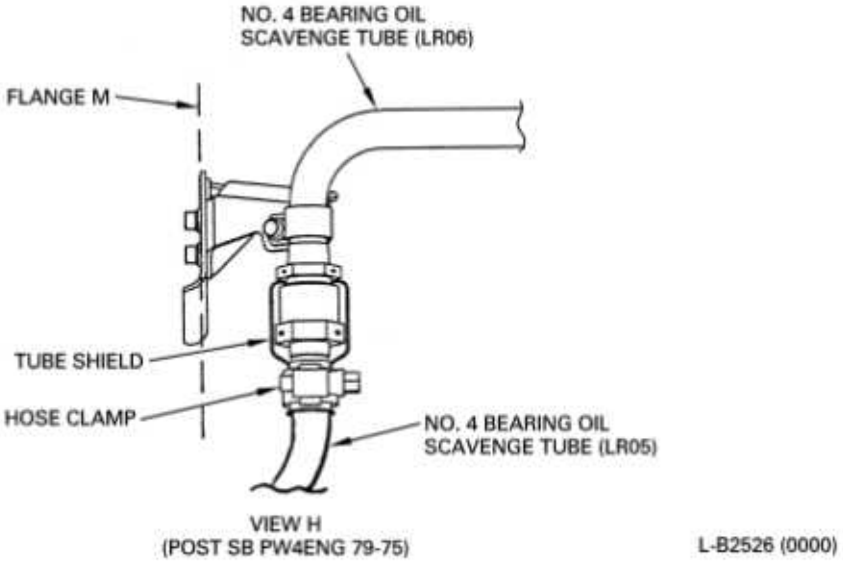

CLAMP
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE M BRACKET
BOLT
NUT
(PRE SB PW4ENG 79–23)
FWD
(POST SB PW4ENG 79–23)
VIEW D
BOLT
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
SPACER
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
NUT
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP
BOLT
FLANGE N BRACKET
CLAMP
NUT
FLANGE N BRACKET
FWD
BOLT
VIEW F
FWD
VIEW E
NUT
L–A2191
0588

External Plumbing Clipping Views
Figure 301 (Sheet 4)
(Task 72−00−53−050−003)

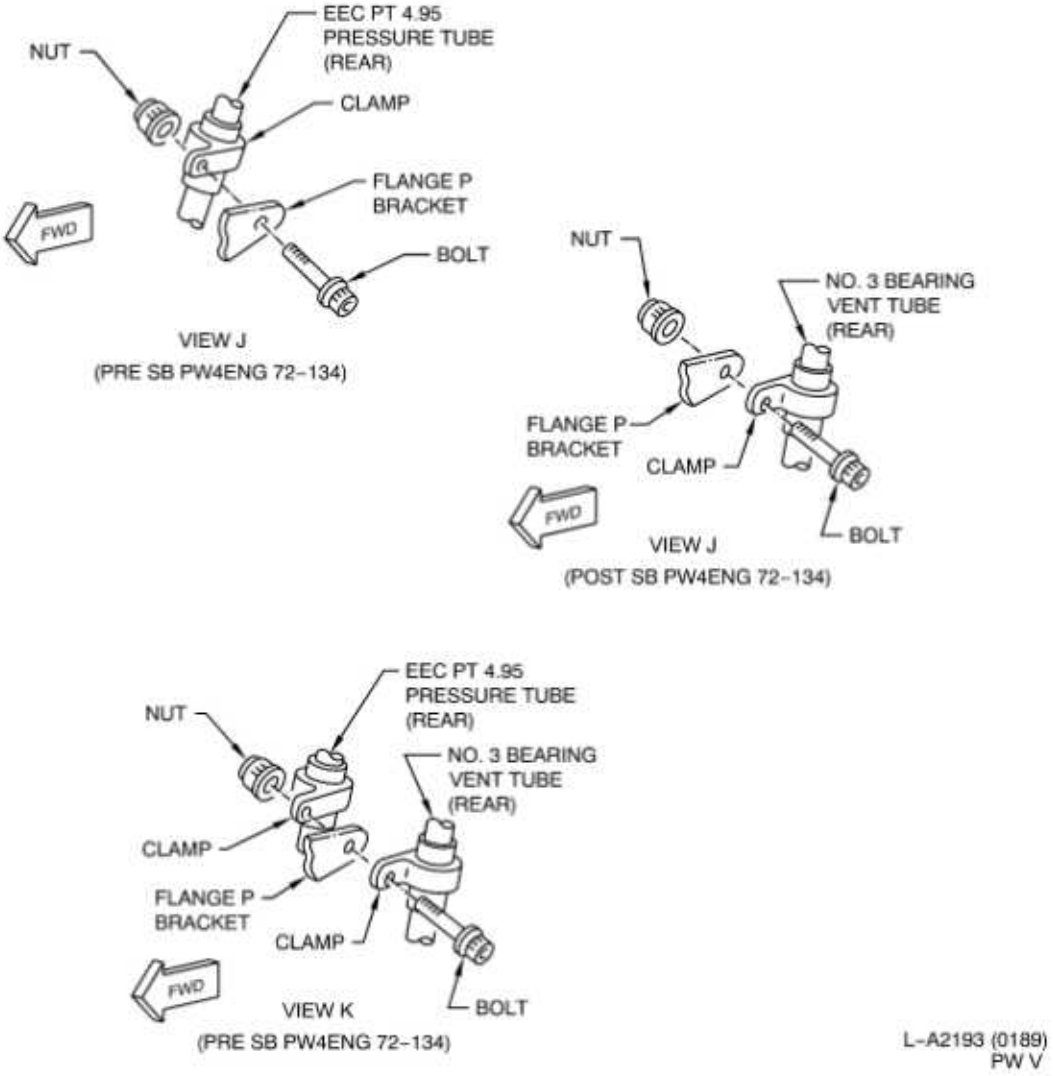

NUT
NO.4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP BRACKET
CLAMP
BOLT
FWD
VIEW G
HOSE CLAMP
SPRAY SHIELD
NUT
FLANGE M BRACKET
CLAMP
BOLT
NO.4 BEARING OIL SCAVENGE TUBE (FRONT)
FWD
NO.4 BEARING OIL SCAVENGE TUBE (REAR)
VIEW H
L-A2192 (0487)
PW V

External Plumbing Clipping Views
Figure 301 (Sheet 5)
(Task 72-00-53-050-003)

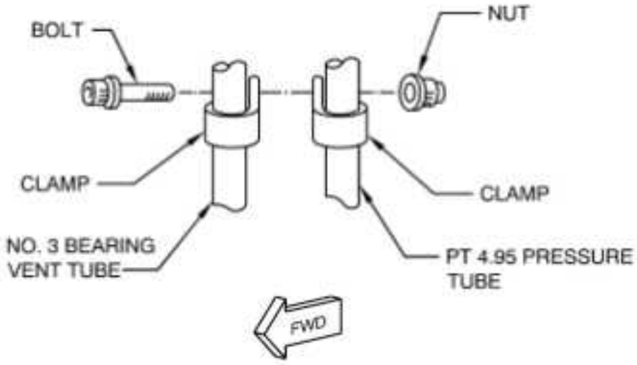

NUT
HOSE CLAMP
SPRAY SHIELD
FLANGE M BRACKET
CLAMP
BOLT
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
VIEW H
(PRE SB PW4ENG 79-75)


NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
FLANGE M
TUBE SHIELD
HOSE CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
VIEW H
(POST SB PW4ENG 79-75)
L-B2526 (0000)

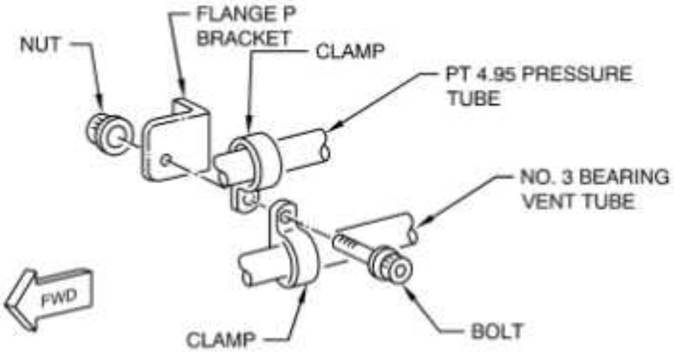
External Tubes For HPT (TCC)
Clipping And Brackets
Figure 301 (Sheet 6)
(Task 72−00−52−050−003)


NUT
EEC PT 4.95 PRESSURE TUBE (REAR)
CLAMP
FLANGE P BRACKET
BOLT
FWD
VIEW J
(PRE SB PW4ENG 72-134)
NUT
NO. 3 BEARING VENT TUBE (REAR)
FLANGE P BRACKET
CLAMP
BOLT
FWD
VIEW J
(POST SB PW4ENG 72-134)
NUT
EEC PT 4.95 PRESSURE TUBE (REAR)
NO. 3 BEARING VENT TUBE (REAR)
CLAMP
FLANGE P BRACKET
CLAMP
BOLT
FWD
VIEW K
(PRE SB PW4ENG 72-134)
L-A2193 (0189)
PW V

External Plumbing Clipping Views
Figure 301 (Sheet 7)
(Task 72-00-53-050-003)


BOLT
NUT
CLAMP
CLAMP
NO. 3 BEARING VENT TUBE
PT 4.95 PRESSURE TUBE
FWD

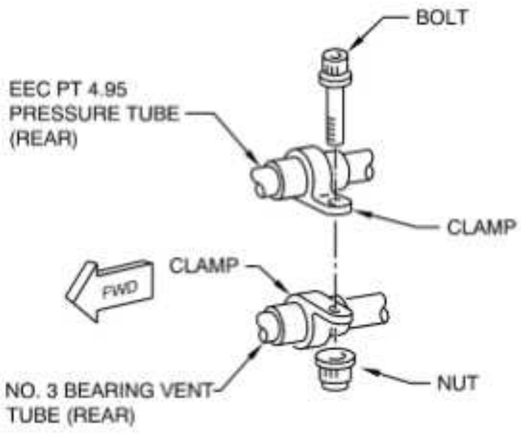
VIEW K
(POST SB PW4ENG 72-134)


FLANGE P BRACKET
NUT
CLAMP
PT 4.95 PRESSURE TUBE
NO. 3 BEARING VENT TUBE
FWD
CLAMP
BOLT

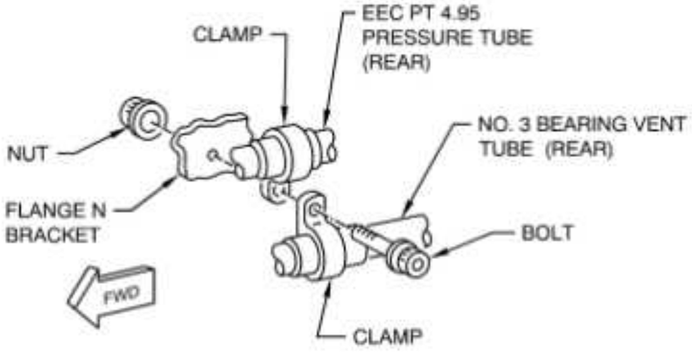
VIEW L

L-A5024 (0000)
PW V

External Plumbing Clipping Views
Figure 301 (Sheet 8)
(Task 72-00-53-050-003)


BOLT
EEC PT 4.95
PRESSURE TUBE
(REAR)
CLAMP
CLAMP
FWD
NO. 3 BEARING VENT
TUBE (REAR)
NUT

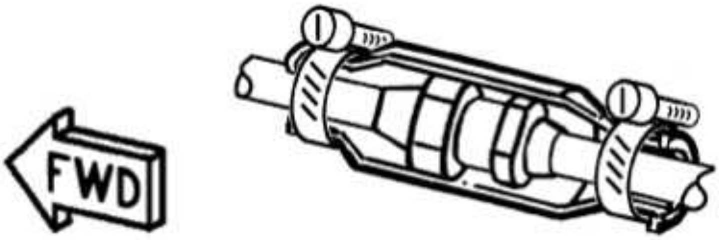
VIEW M


CLAMP
EEC PT 4.95
PRESSURE TUBE
(REAR)
NUT
NO. 3 BEARING VENT
TUBE (REAR)
FLANGE N
BRACKET
BOLT
FWD
CLAMP

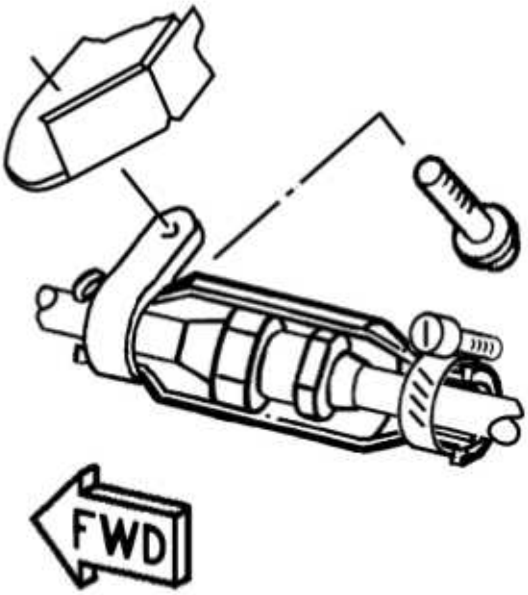
VIEW N

L-A2194 (0487)
PW V

External Plumbing Clipping Views
Figure 301 (Sheet 9)
(Task 72-00-53-050-003)



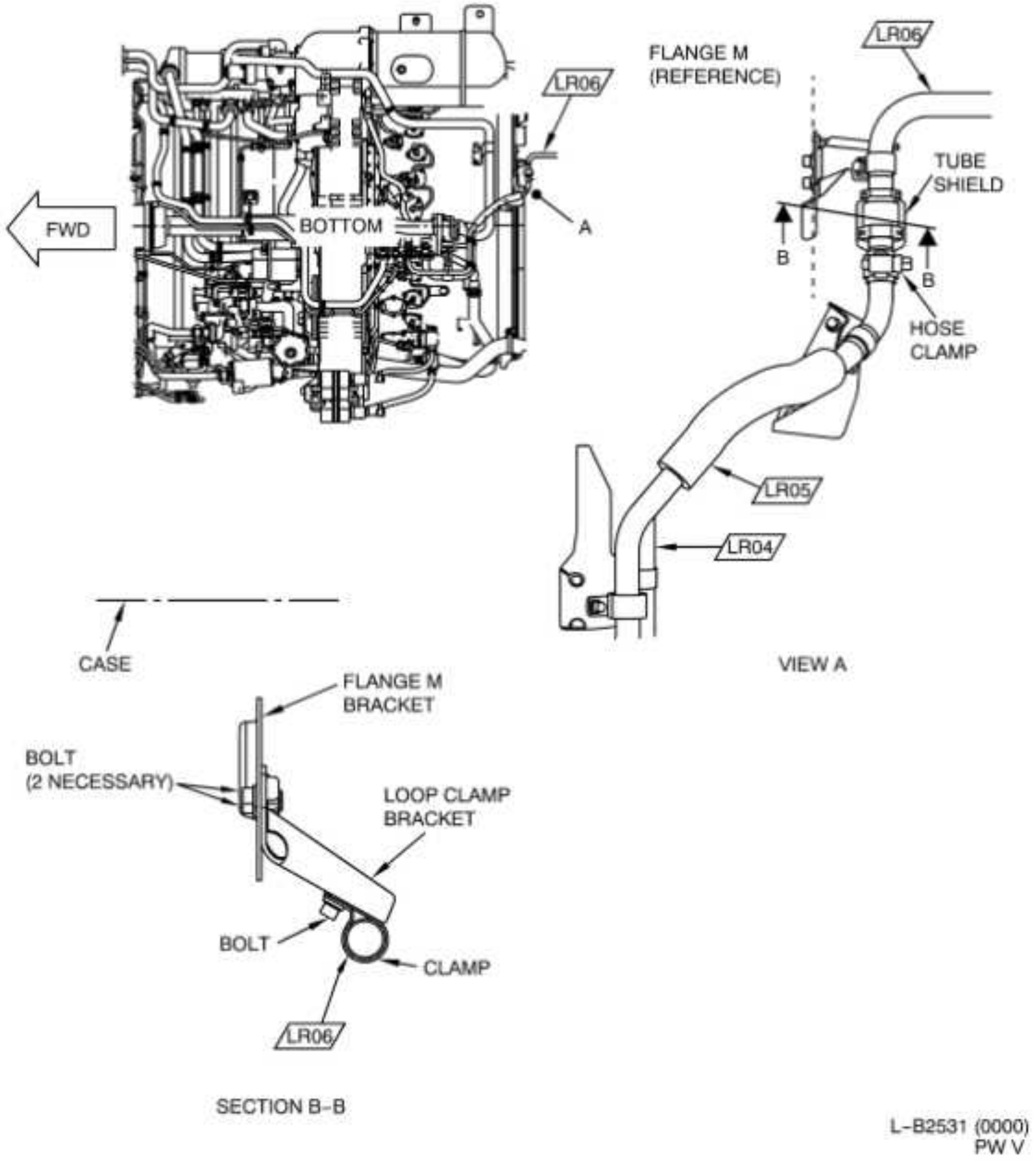
VIEW P
(PRE SB PW4ENG 79-54)



VIEW P
(POST SB PW4ENG 79-54)

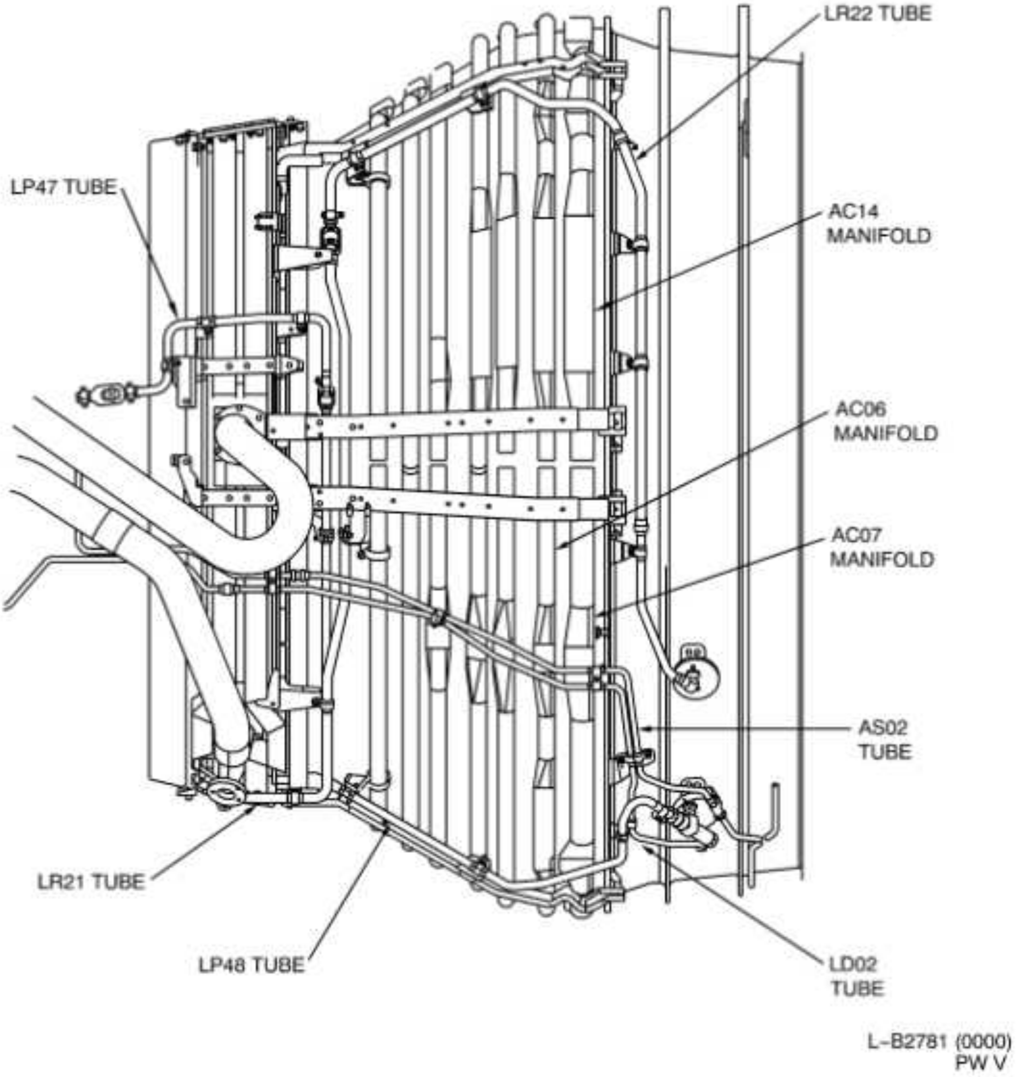
L-A6824 (0000)

External Plumbing Clipping Views
Figure 301 (Sheet 10)
(Task 72−00−53−050−003)

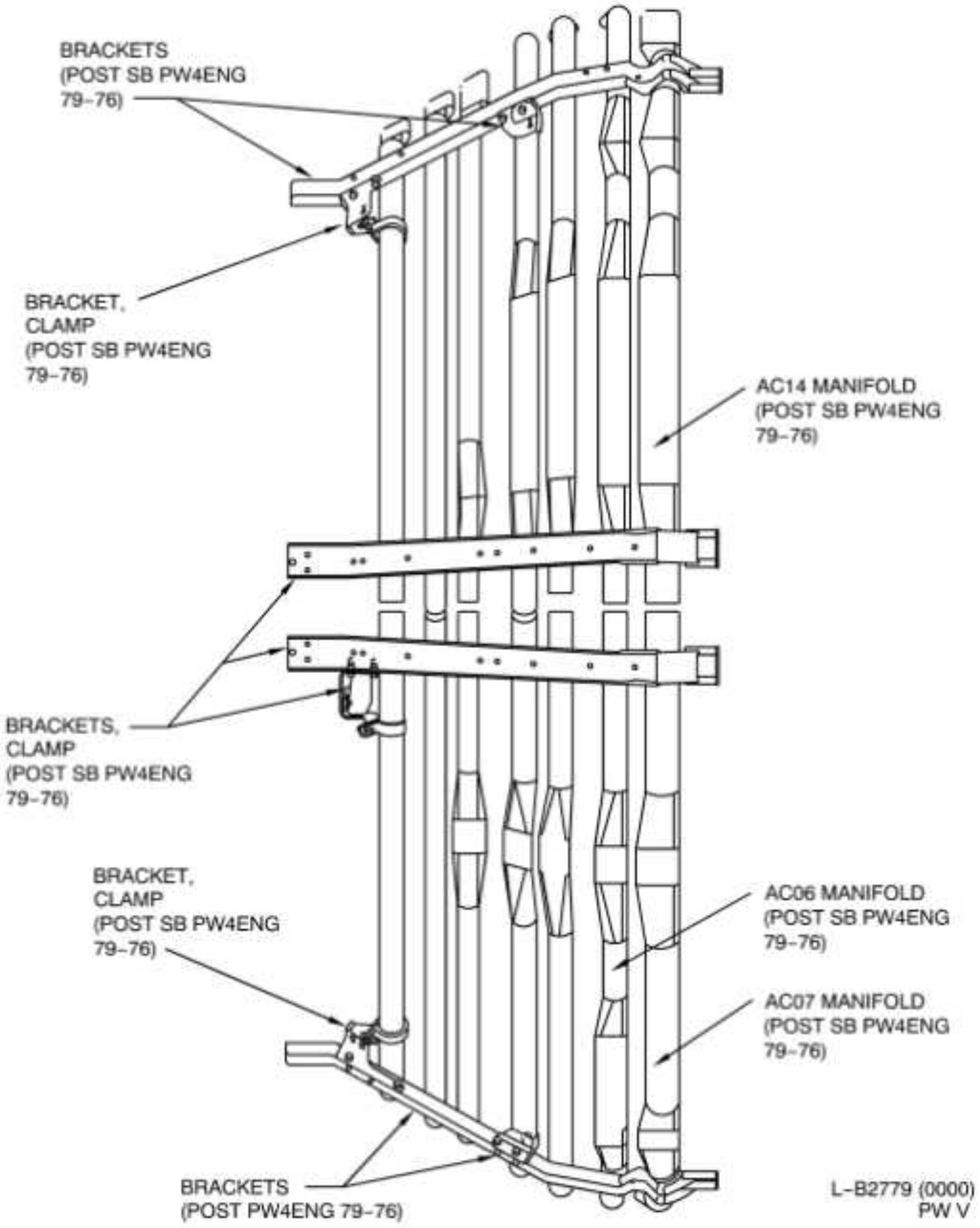

FWD
BOTTOM
LR06
A
FLANGE M
(REFERENCE)
LR06
TUBE
SHIELD
B
B
HOSE
CLAMP
LR05
LR04
VIEW A
CASE
FLANGE M
BRACKET
BOLT
(2 NECESSARY)
LOOP CLAMP
BRACKET
BOLT
CLAMP
LR06
SECTION B-B
L-B2531 (0000)
PW V

External Tubes For HPT (TCC)
Clipping And Brackets
(Post SB PW4ENG 79−75)
Figure 301 (Sheet 11)
(Task 72−00−52−050−003)

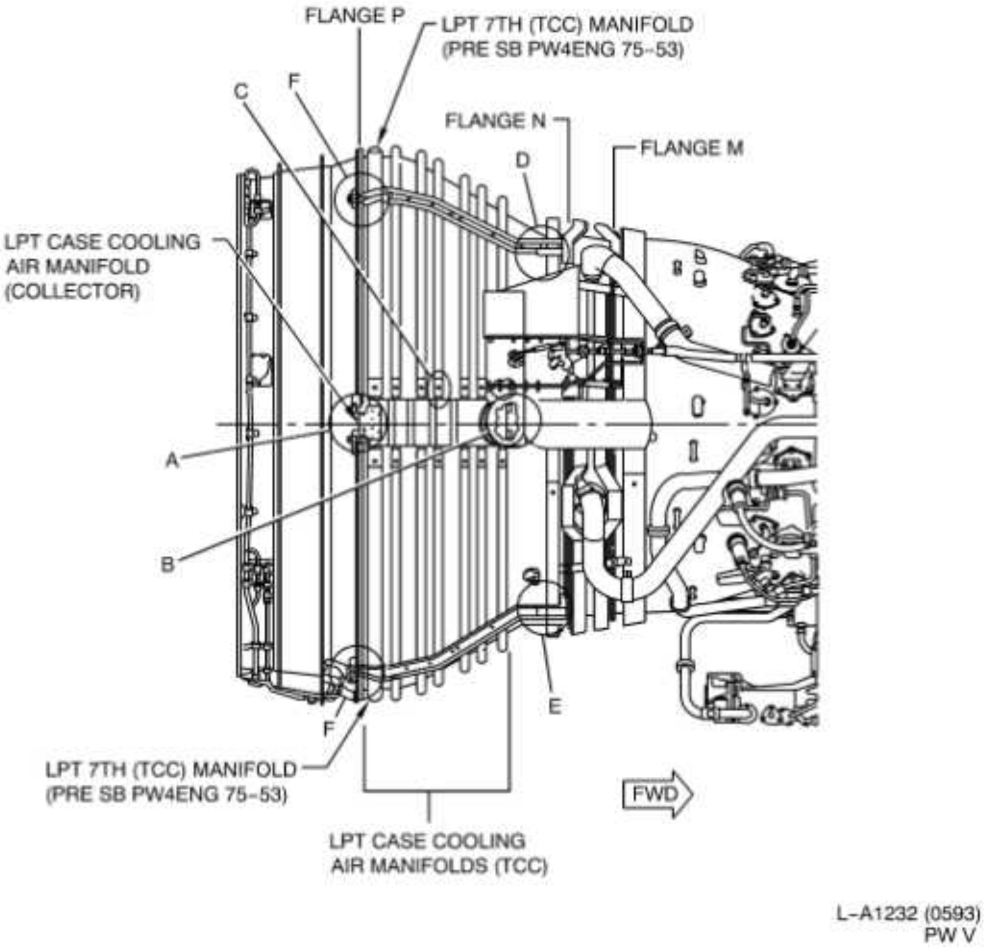
ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−05


LR22 TUBE
LP47 TUBE
AC14 MANIFOLD
AC06 MANIFOLD
AC07 MANIFOLD
AS02 TUBE
LR21 TUBE
LP48 TUBE
LD02 TUBE
L−B2781 (0000)
PW V

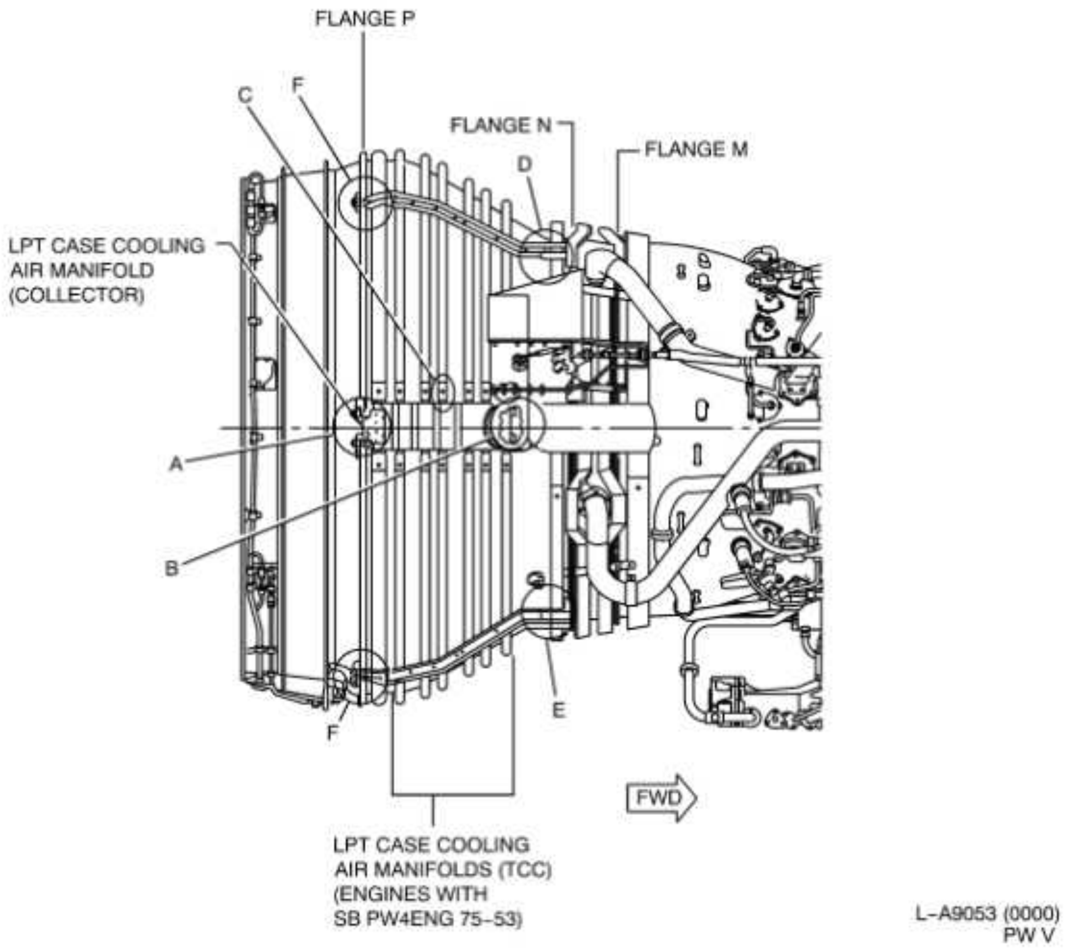
LPT Turbine Case Cooling Manifolds Clipping
(Post SB PW4ENG 79−76)
Figure 301 (Sheet 12)
(Task 72−00−53−050−003)


BRACKETS
(POST SB PW4ENG
79-76)
BRACKET,
CLAMP
(POST SB PW4ENG
79-76)
AC14 MANIFOLD
(POST SB PW4ENG
79-76)
BRACKETS,
CLAMP
(POST SB PW4ENG
79-76)
BRACKET,
CLAMP
(POST SB PW4ENG
79-76)
AC06 MANIFOLD
(POST SB PW4ENG
79-76)
AC07 MANIFOLD
(POST SB PW4ENG
79-76)
BRACKETS
(POST PW4ENG 79-76)
L-B2779 (0000)
PW V

LPT Turbine Case Cooling Manifolds Clipping
(Post SB PW4ENG 79−76)
Figure 301 (Sheet 13)
(Task 72−00−53−050−003)

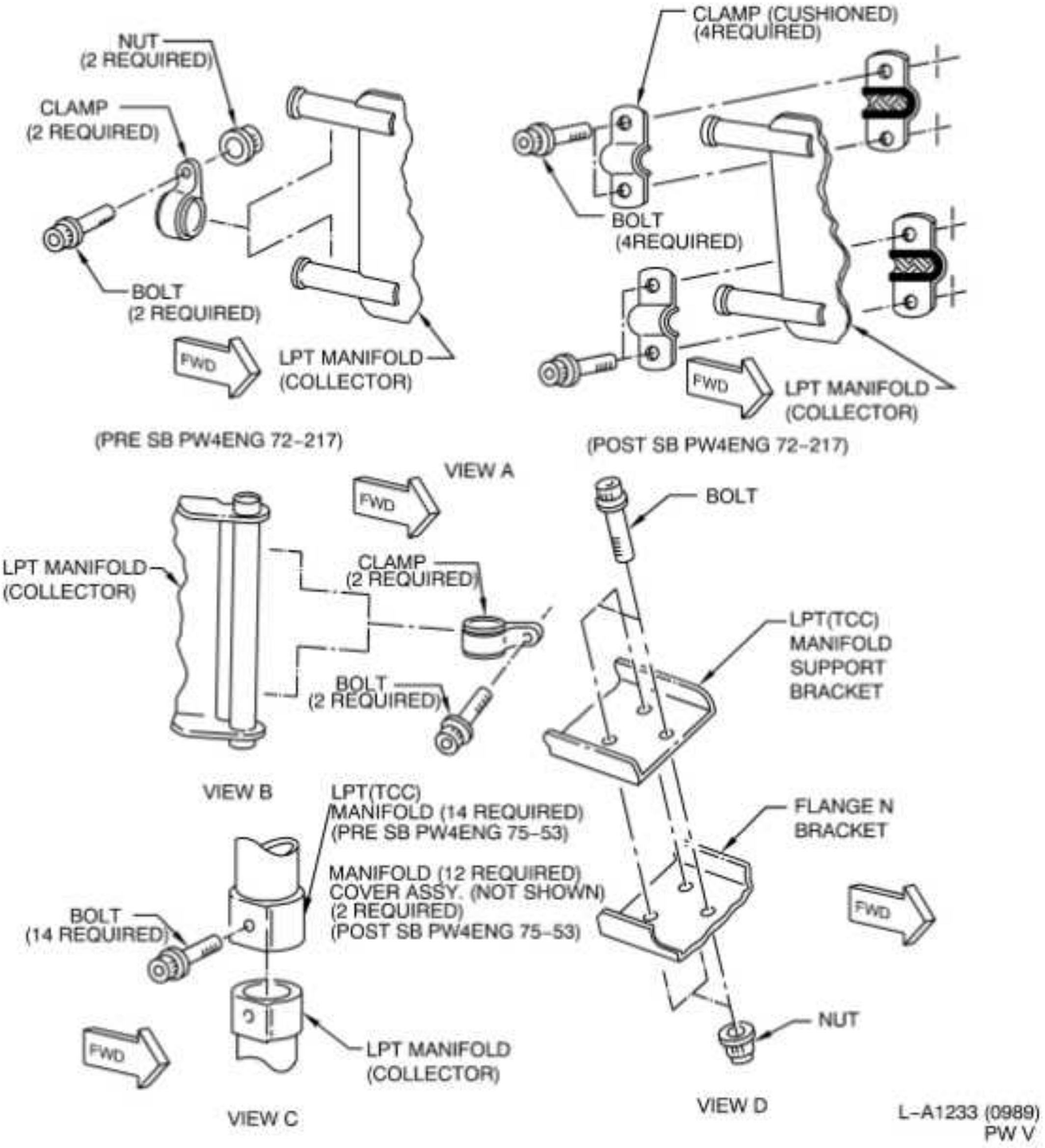

FLANGE P
LPT 7TH (TCC) MANIFOLD
(PRE SB PW4ENG 75-53)
C
F
FLANGE N
D
FLANGE M
LPT CASE COOLING
AIR MANIFOLD
(COLLECTOR)
A
B
E
F
LPT 7TH (TCC) MANIFOLD
(PRE SB PW4ENG 75-53)
FWD
LPT CASE COOLING
AIR MANIFOLDS (TCC)
L-A1232 (0593)
PW V

Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 302 (Sheet 1)
(Task 72−00−53−050−003)

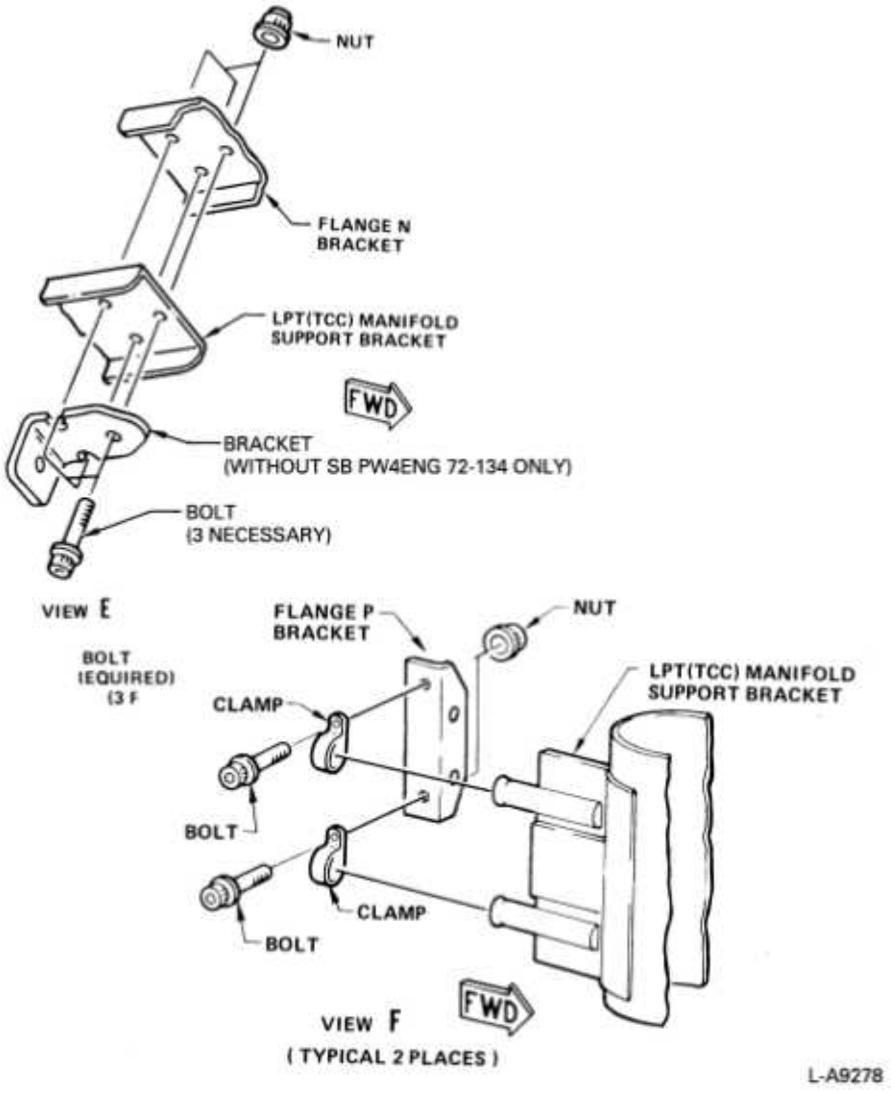

FLANGE P
C
F
FLANGE N
FLANGE M
D
LPT CASE COOLING AIR MANIFOLD (COLLECTOR)
A
B
E
F
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC) (ENGINES WITH SB PW4ENG 75-53)
L-A9053 (0000)
PW V

Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 302 (Sheet 2)
(Task 72-00-53-050-003)

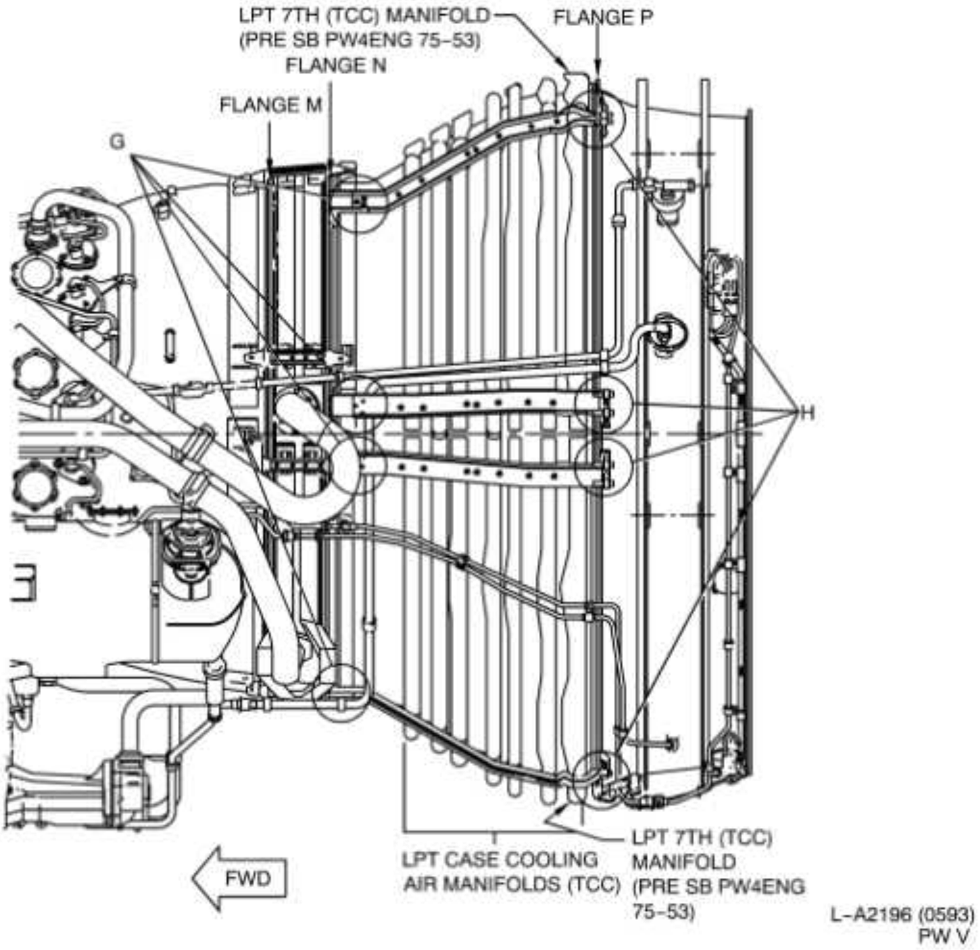
ENGINE GENERAL – LOW PRESSURE TURBINE (LPT) – REMOVAL-05


NUT
(2 REQUIRED)
CLAMP
(2 REQUIRED)
BOLT
(2 REQUIRED)
FWD
LPT MANIFOLD
(COLLECTOR)
(PRE SB PW4ENG 72-217)
CLAMP (CUSHIONED)
(4REQUIRED)
BOLT
(4REQUIRED)
FWD
LPT MANIFOLD
(COLLECTOR)
(POST SB PW4ENG 72-217)
VIEW A
FWD
LPT MANIFOLD
(COLLECTOR)
CLAMP
(2 REQUIRED)
BOLT
(2 REQUIRED)
VIEW B
BOLT
LPT(TCC)
MANIFOLD
SUPPORT
BRACKET
FLANGE N
BRACKET
FWD
NUT
VIEW D
LPT(TCC)
MANIFOLD (14 REQUIRED)
(PRE SB PW4ENG 75-53)
MANIFOLD (12 REQUIRED)
COVER ASSY. (NOT SHOWN)
(2 REQUIRED)
(POST SB PW4ENG 75-53)
BOLT
(14 REQUIRED)
FWD
LPT MANIFOLD
(COLLECTOR)
VIEW C
L-A1233 (0989)
PW V

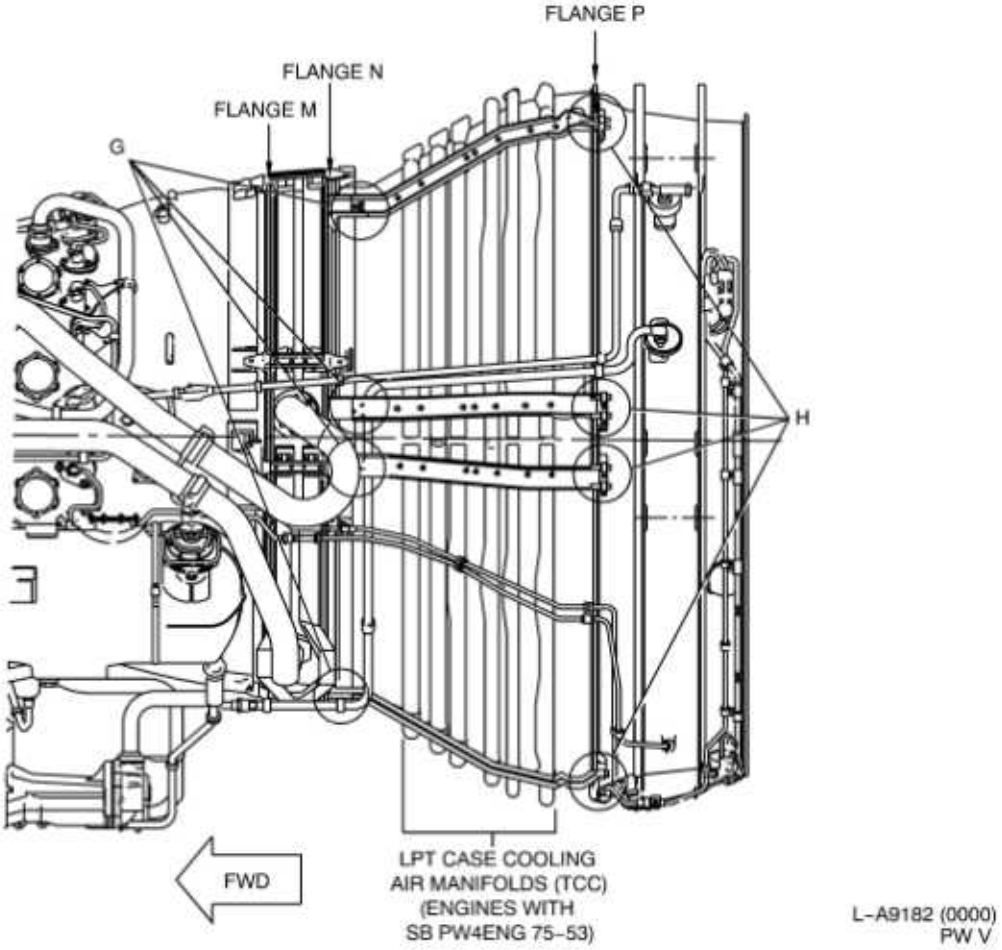
Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 302 (Sheet 3)
(Task 72-00-53-050-003)


NUT
FLANGE N BRACKET
LPT(TCC) MANIFOLD SUPPORT BRACKET
FWD
BRACKET (WITHOUT SB PW4ENG 72-134 ONLY)
BOLT (3 NECESSARY)
VIEW E
BOLT (EQUIRED) (3 F
FLANGE P BRACKET
NUT
LPT(TCC) MANIFOLD SUPPORT BRACKET
CLAMP
BOLT
CLAMP
BOLT
VIEW F
(TYPICAL 2 PLACES)
FWD
L-A9278

Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 302 (Sheet 4)
(Task 72−00−53−050−003)

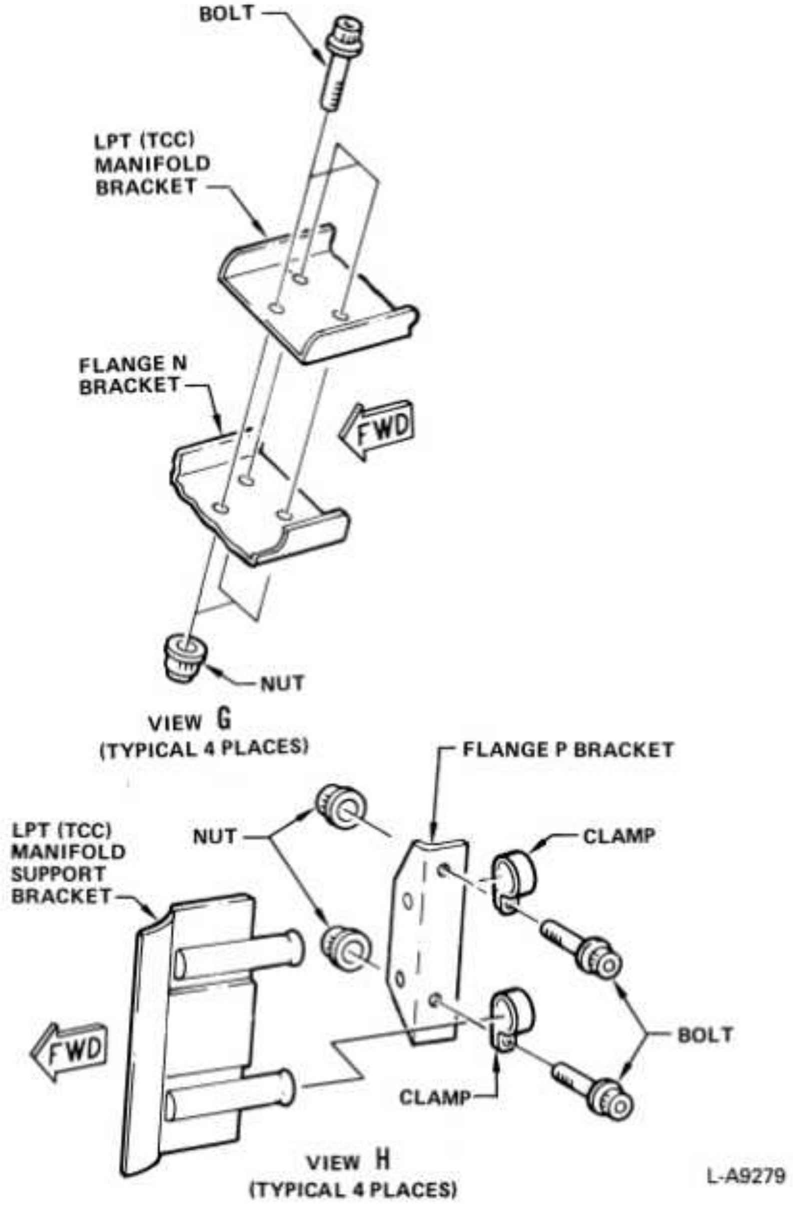

LPT 7TH (TCC) MANIFOLD
(PRE SB PW4ENG 75-53)
FLANGE P
FLANGE N
FLANGE M
G
H
FWD
LPT CASE COOLING
AIR MANIFOLDS (TCC)
LPT 7TH (TCC)
MANIFOLD
(PRE SB PW4ENG
75-53)
L-A2196 (0593)
PW V

Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 302 (Sheet 5)
(Task 72−00−53−050−003)

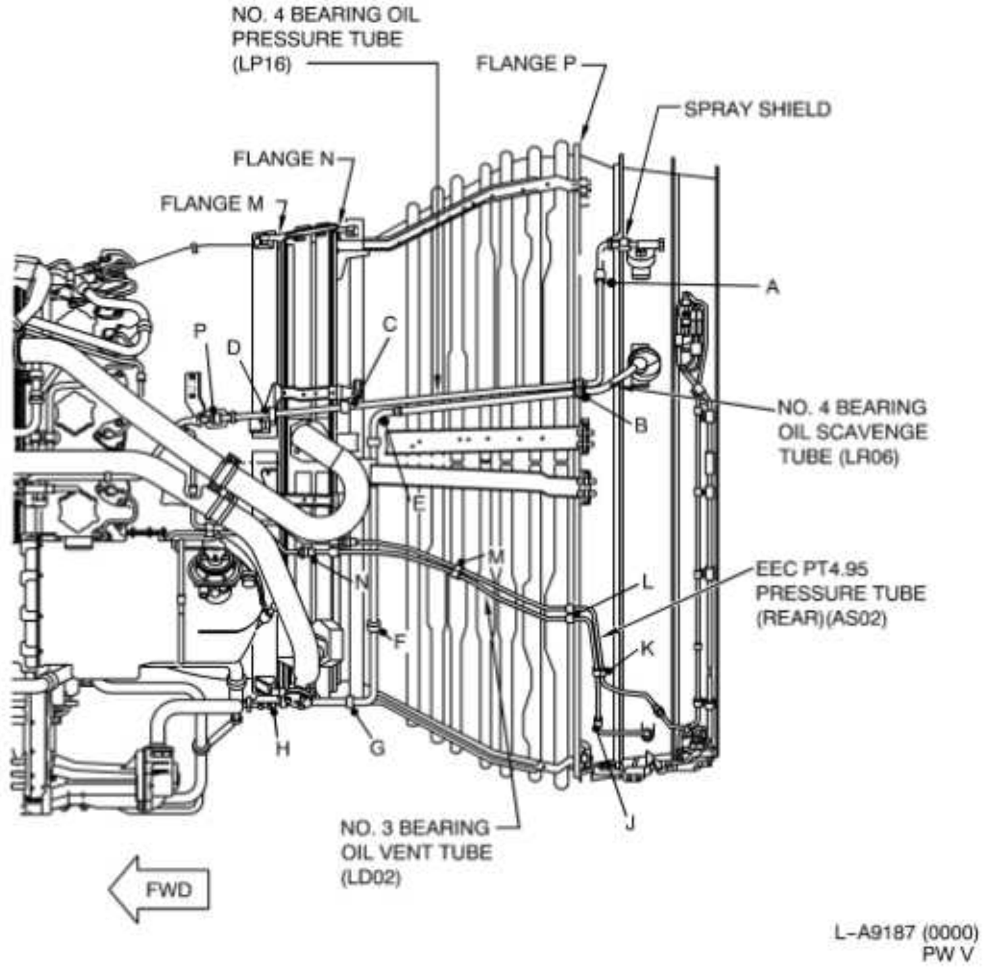

FLANGE P
FLANGE N
FLANGE M
G
H
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC) (ENGINES WITH SB PW4ENG 75-53)
L-A9182 (0000)
PW V

Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 302 (Sheet 6)
(Task 72−00−53−050−003)

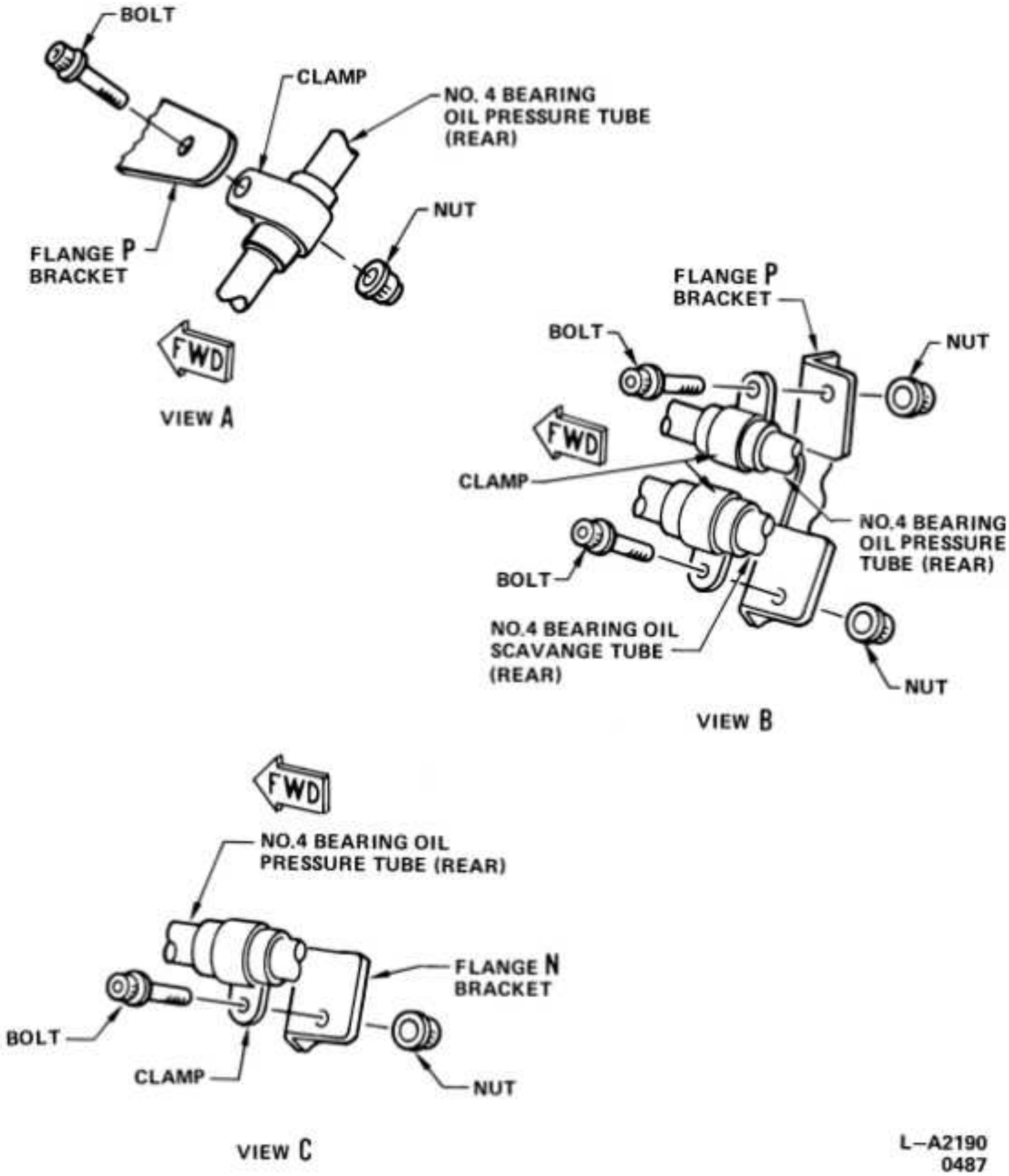
ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - REMOVAL-05


BOLT
LPT (TCC) MANIFOLD BRACKET
FLANGE N BRACKET
FWD
NUT
VIEW G
(TYPICAL 4 PLACES)
FLANGE P BRACKET
LPT (TCC) MANIFOLD SUPPORT BRACKET
NUT
CLAMP
FWD
BOLT
CLAMP
VIEW H
(TYPICAL 4 PLACES)
L-A9279

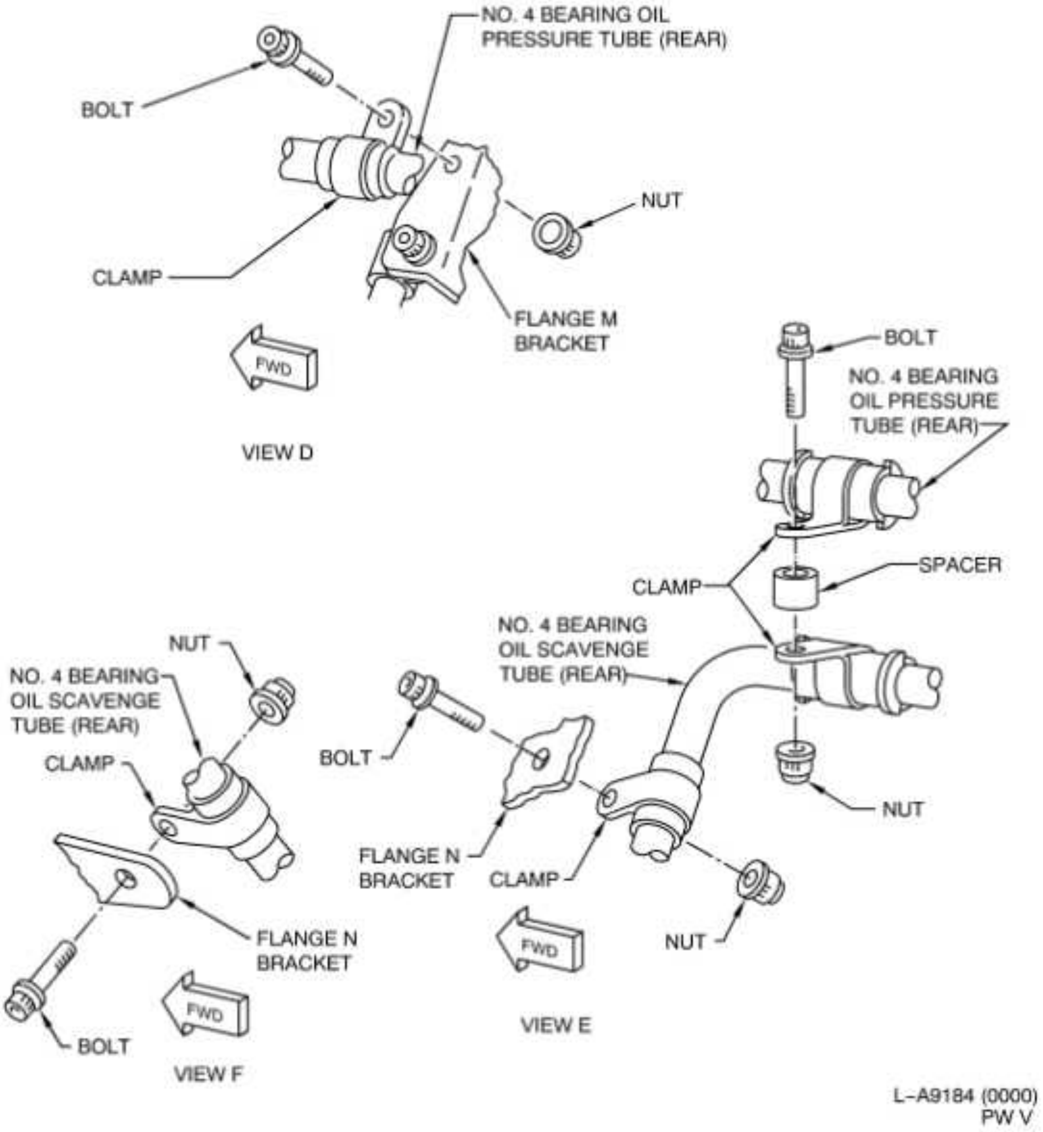
Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 302 (Sheet 7)
(Task 72-00-53-050-003)


NO. 4 BEARING OIL PRESSURE TUBE (LP16)
FLANGE P
SPRAY SHIELD
FLANGE N
FLANGE M
A
P
D
C
B
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
E
M
N
L
EEC PT4.95 PRESSURE TUBE (REAR)(AS02)
F
K
H
G
J
NO. 3 BEARING OIL VENT TUBE (LD02)
FWD
L-A9187 (0000)
PW V

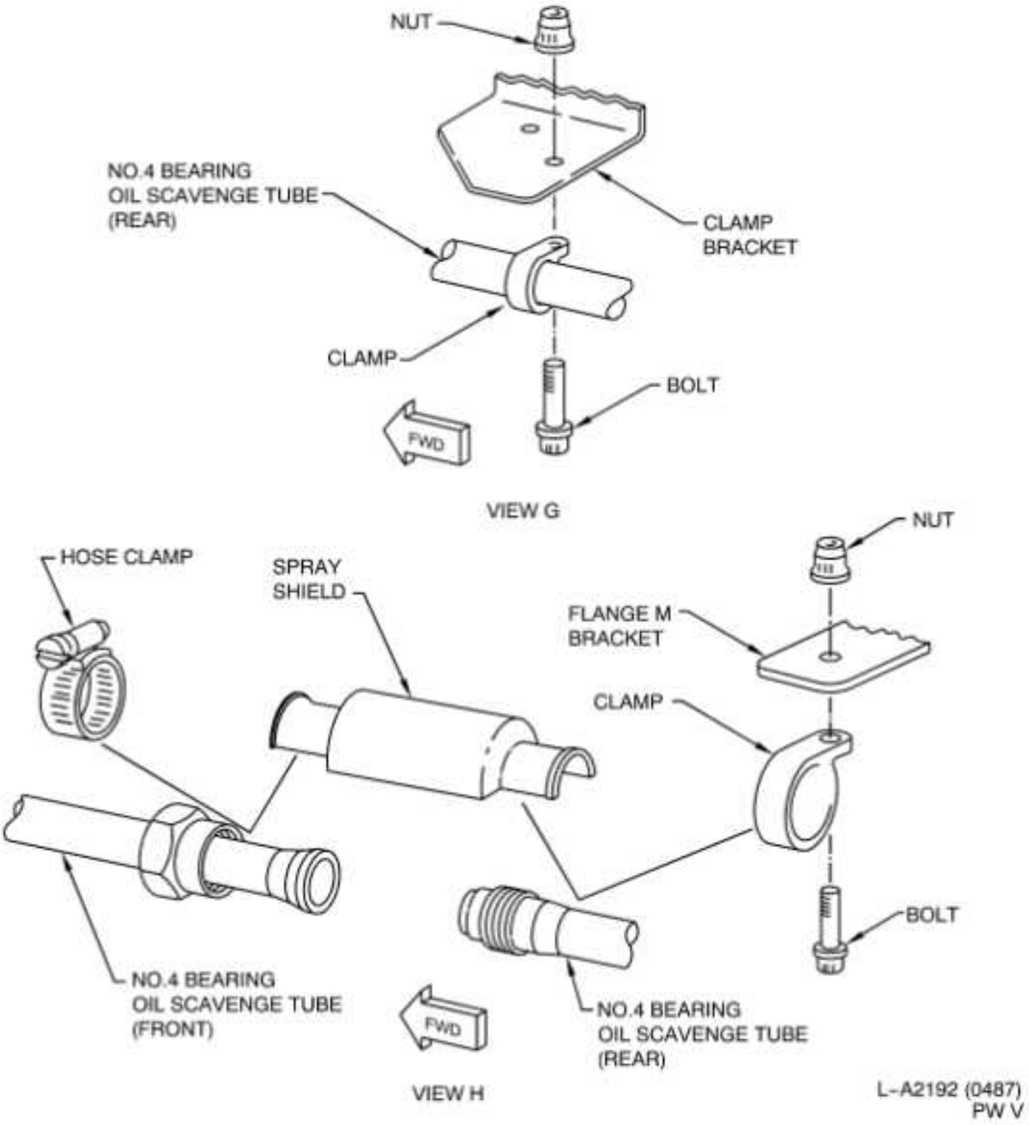
Turbine Case Cooling (TCC) LPT Manifolds
Figure 303 (Sheet 1)
(Task 72-00-53-050-003)


BOLT
CLAMP
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
NUT
FLANGE P BRACKET
FWD
VIEW A
FLANGE P BRACKET
BOLT
NUT
FWD
CLAMP
NO.4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NO.4 BEARING OIL SCAVANGE TUBE (REAR)
NUT
VIEW B
FWD
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE N BRACKET
BOLT
CLAMP
NUT
VIEW C
L−A2190
0487

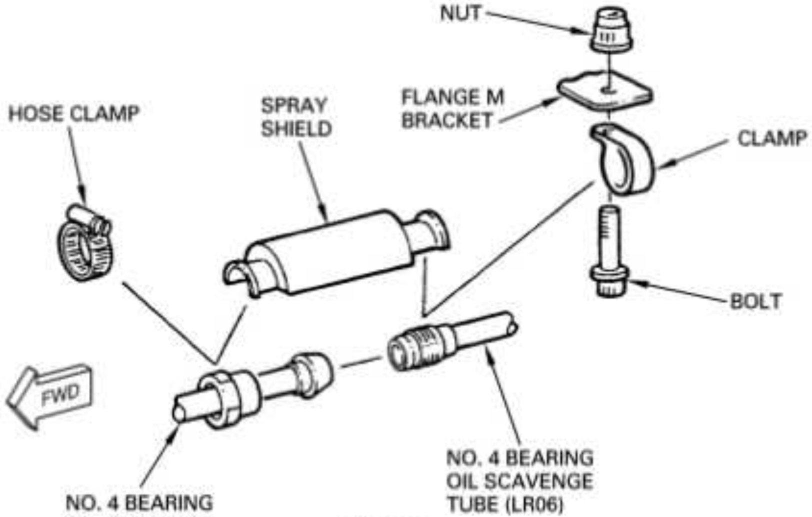
External Plumbing Clipping Views
Figure 303 (Sheet 2)
(Task 72−00−53−050−003)


NO. 4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NUT
CLAMP
FLANGE M BRACKET
FWD
VIEW D
BOLT
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
SPACER
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
NUT
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP
BOLT
NUT
FLANGE N BRACKET
CLAMP
NUT
FLANGE N BRACKET
FWD
BOLT
FWD
VIEW F
VIEW E
L−A9184 (0000)
PW V

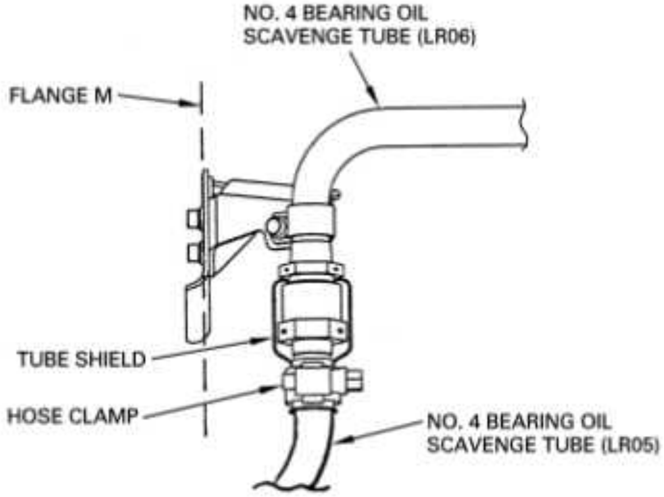
External Plumbing Clipping Views
Figure 303 (Sheet 3)
(Task 72−00−53−050−003)


NUT
NO.4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP BRACKET
CLAMP
BOLT
FWD
VIEW G
HOSE CLAMP
SPRAY SHIELD
NUT
FLANGE M BRACKET
CLAMP
BOLT
NO.4 BEARING OIL SCAVENGE TUBE (FRONT)
FWD
NO.4 BEARING OIL SCAVENGE TUBE (REAR)
VIEW H
L-A2192 (0487)
PW V

External Plumbing Clipping Views
Figure 303 (Sheet 4)
(Task 72−00−53−050−003)


NUT
HOSE CLAMP
SPRAY SHIELD
FLANGE M BRACKET
CLAMP
BOLT
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)

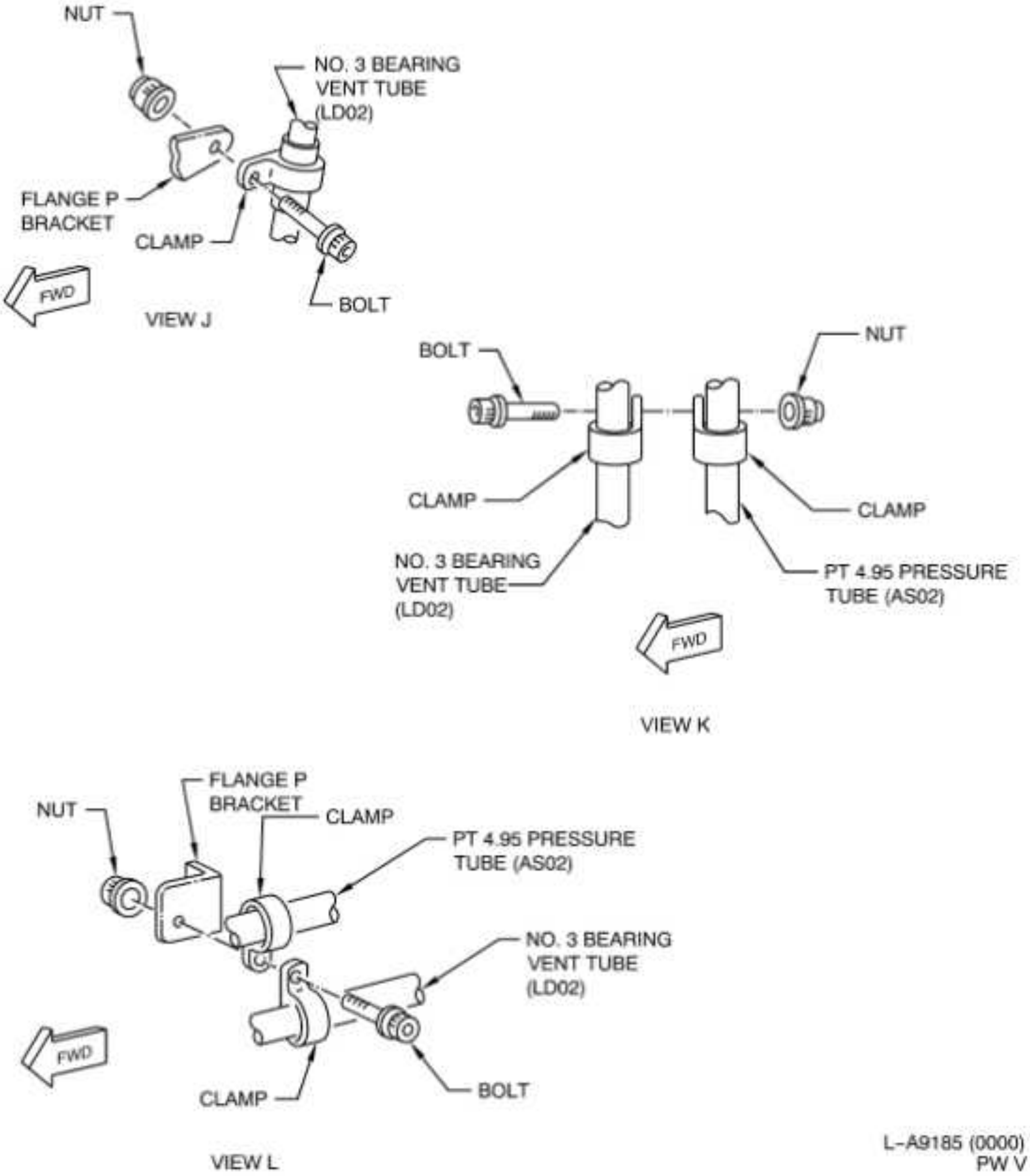
VIEW H
(PRE SB PW4ENG 79-75)


NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
FLANGE M
TUBE SHIELD
HOSE CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)

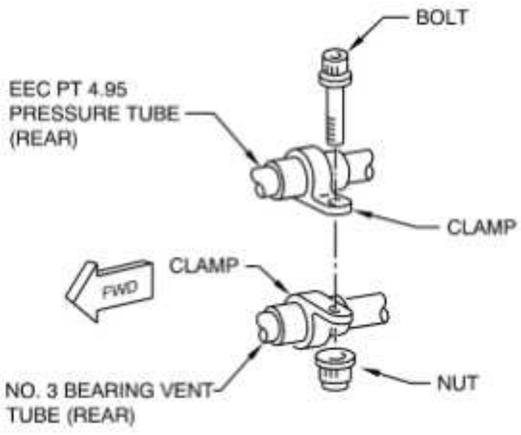
VIEW H
(POST SB PW4ENG 79-75)

L-B2526 (0000)

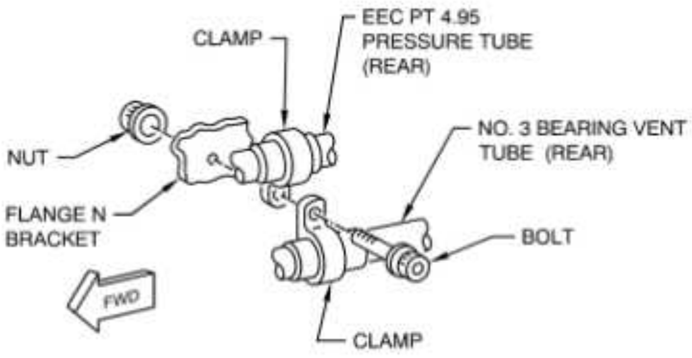
External Tubes For HPT (TCC)
Clipping And Brackets
Figure 303 (Sheet 5)
(Task 72−00−52−050−003)


NUT
NO. 3 BEARING VENT TUBE (LD02)
FLANGE P BRACKET
CLAMP
BOLT
FWD
VIEW J
BOLT
NUT
CLAMP
CLAMP
NO. 3 BEARING VENT TUBE (LD02)
PT 4.95 PRESSURE TUBE (AS02)
FWD
VIEW K
FLANGE P BRACKET
NUT
CLAMP
PT 4.95 PRESSURE TUBE (AS02)
NO. 3 BEARING VENT TUBE (LD02)
FWD
CLAMP
BOLT
VIEW L
L-A9185 (0000)
PW V

External Plumbing Clipping Views
Figure 303 (Sheet 6)
(Task 72−00−53−050−003)


BOLT
EEC PT 4.95
PRESSURE TUBE
(REAR)
CLAMP
CLAMP
FWD
NO. 3 BEARING VENT
TUBE (REAR)
NUT

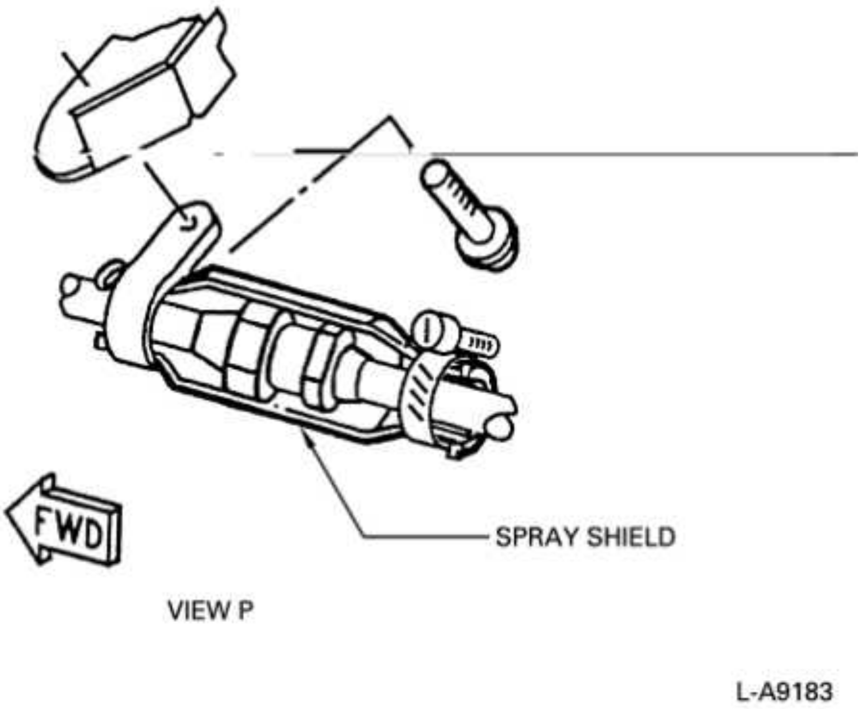
VIEW M


CLAMP
EEC PT 4.95
PRESSURE TUBE
(REAR)
NO. 3 BEARING VENT
TUBE (REAR)
NUT
FLANGE N
BRACKET
BOLT
FWD
CLAMP

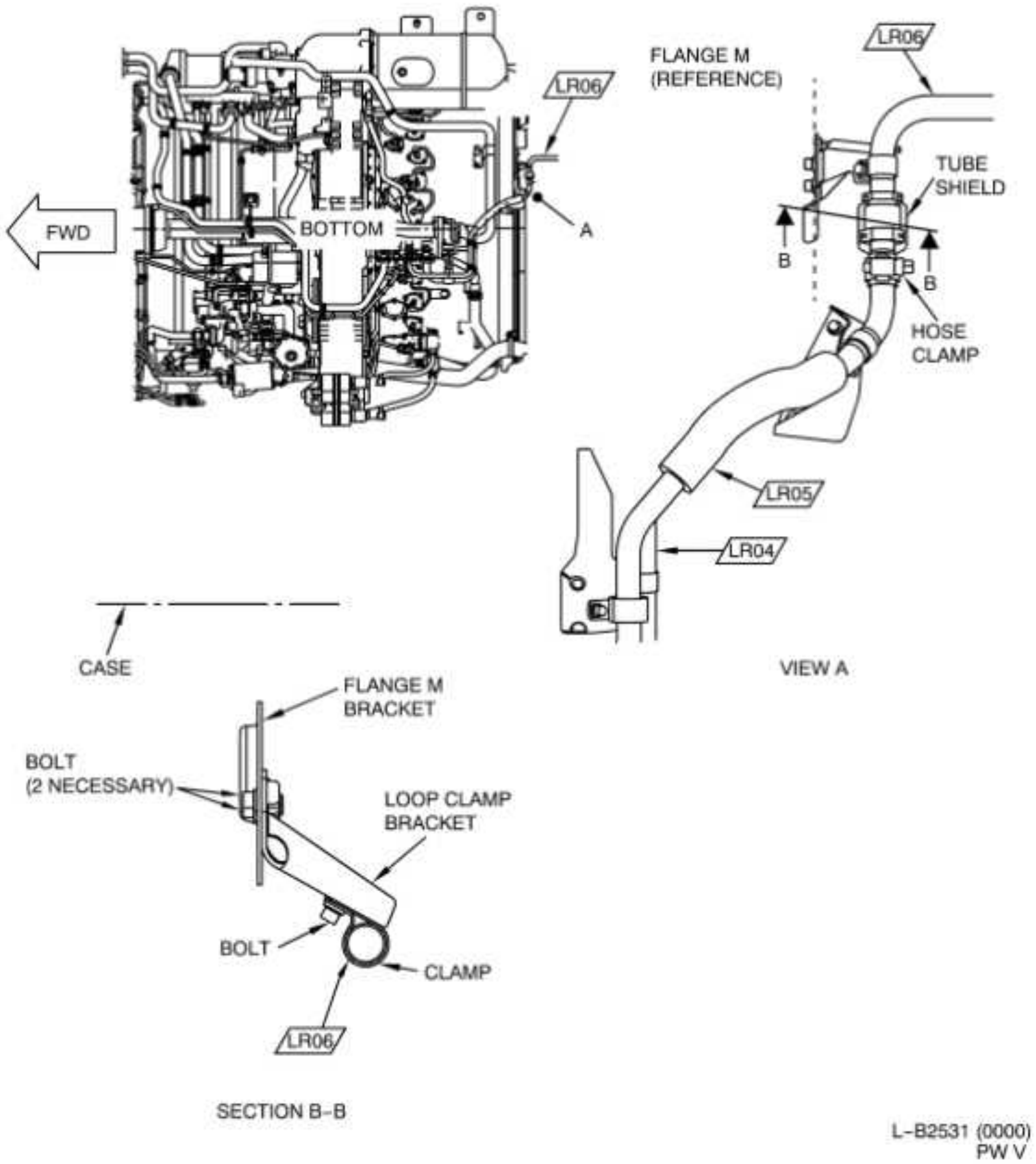
VIEW N

L-A2194 (0487)
PW V

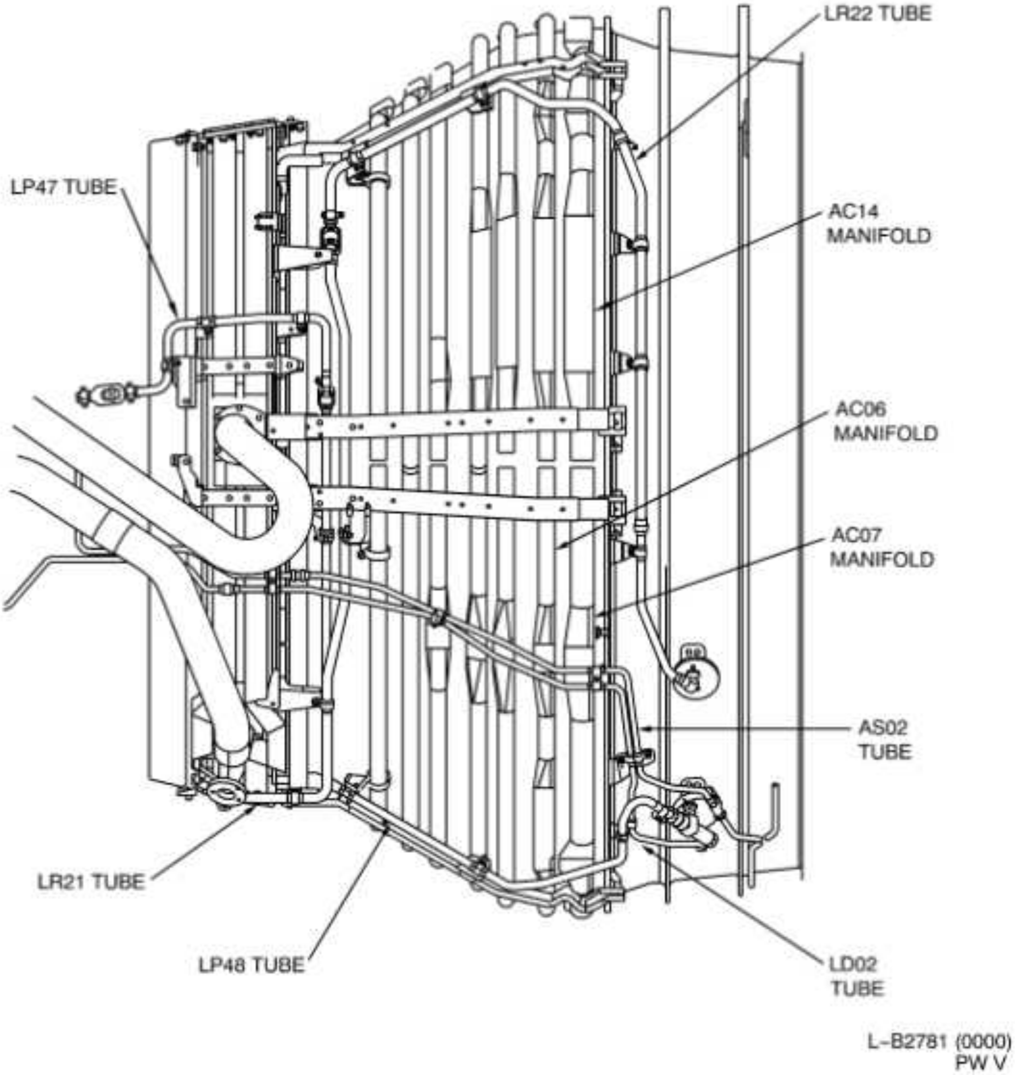
External Plumbing Clipping Views
Figure 303 (Sheet 7)
(Task 72-00-53-050-003)


SPRAY SHIELD
FWD
VIEW P
L-A9183

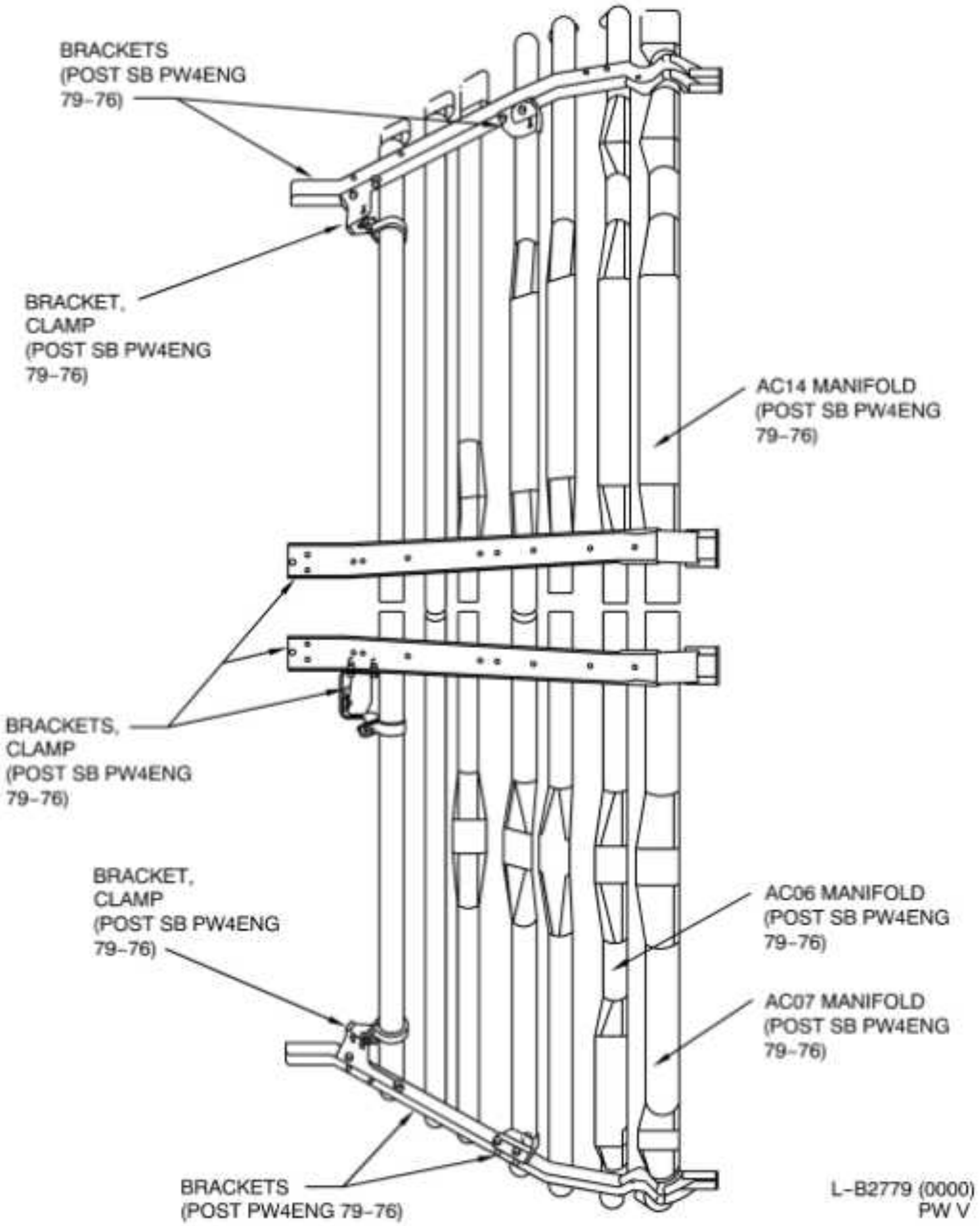
External Plumbing Clipping Views
Figure 303 (Sheet 8)
(Task 72−00−53−050−003)


FWD
BOTTOM
LR06
A
FLANGE M
(REFERENCE)
LR06
TUBE
SHIELD
B
B
B
HOSE
CLAMP
LR05
LR04
VIEW A
CASE
FLANGE M
BRACKET
BOLT
(2 NECESSARY)
LOOP CLAMP
BRACKET
BOLT
CLAMP
LR06
SECTION B-B
L-B2531 (0000)
PW V

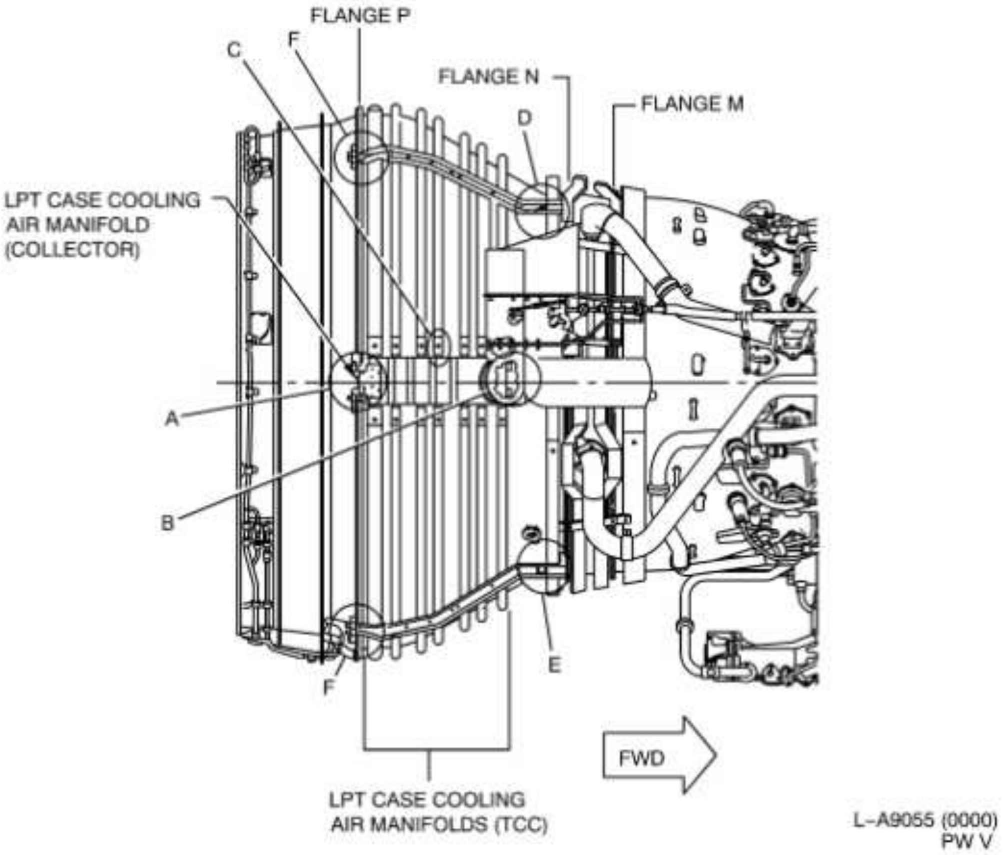
External Tubes For HPT (TCC) Clipping And Brackets
(Post SB PW4ENG 79−75)
Figure 303 (Sheet 9)
(Task 72−00−52−050−003)


LR22 TUBE
LP47 TUBE
AC14 MANIFOLD
AC06 MANIFOLD
AC07 MANIFOLD
AS02 TUBE
LR21 TUBE
LP48 TUBE
LD02 TUBE
L-B2781 (0000)
PW V

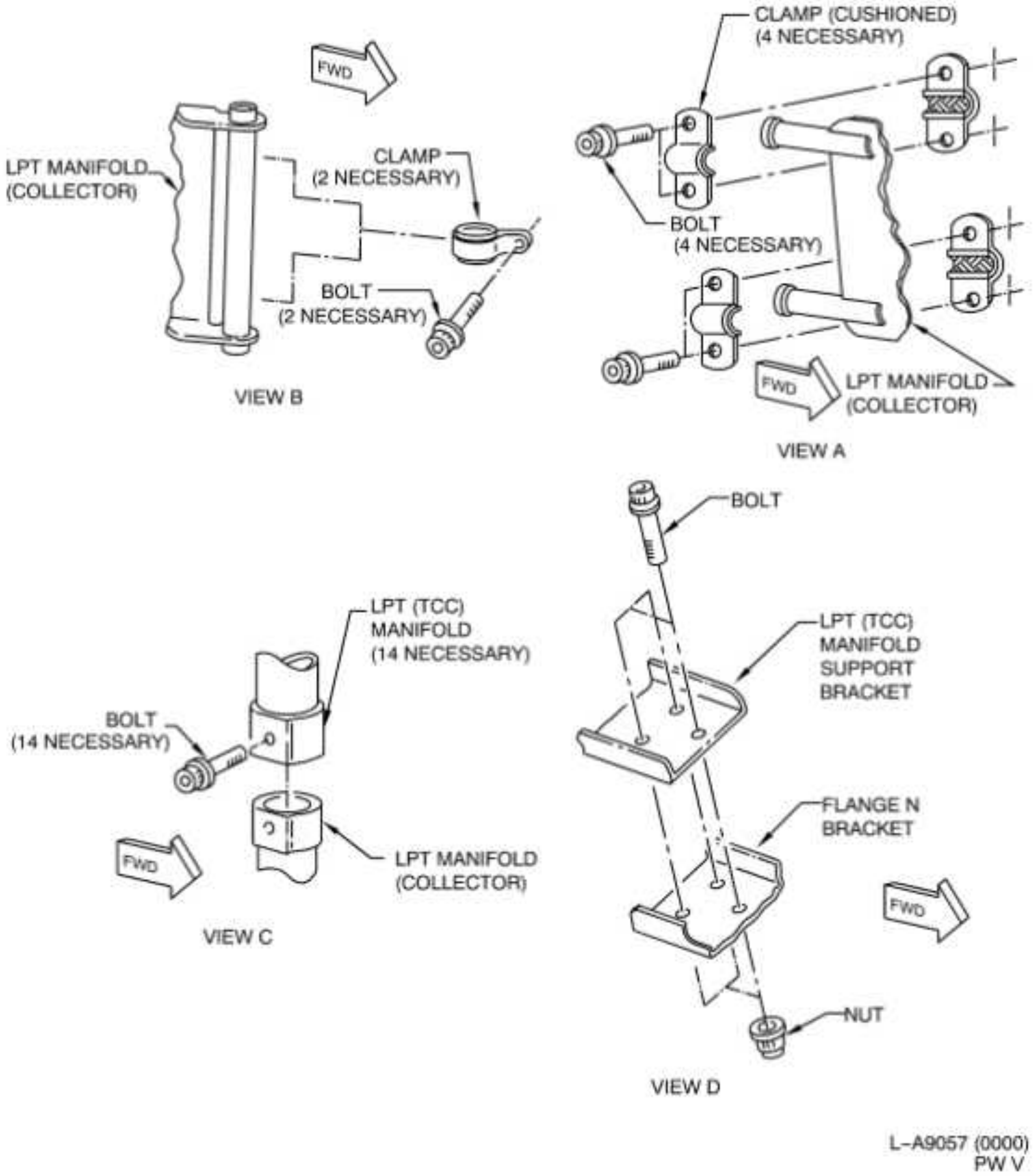
LPT Turbine Case Cooling Manifolds Clipping
(Post SB PW4ENG 79-76)
Figure 303 (Sheet 10)
(Task 72-00-53-050-003)


BRACKETS (POST SB PW4ENG 79-76)
BRACKET, CLAMP (POST SB PW4ENG 79-76)
AC14 MANIFOLD (POST SB PW4ENG 79-76)
BRACKETS, CLAMP (POST SB PW4ENG 79-76)
BRACKET, CLAMP (POST SB PW4ENG 79-76)
AC06 MANIFOLD (POST SB PW4ENG 79-76)
AC07 MANIFOLD (POST SB PW4ENG 79-76)
BRACKETS (POST PW4ENG 79-76)
L-B2779 (0000)
PW V

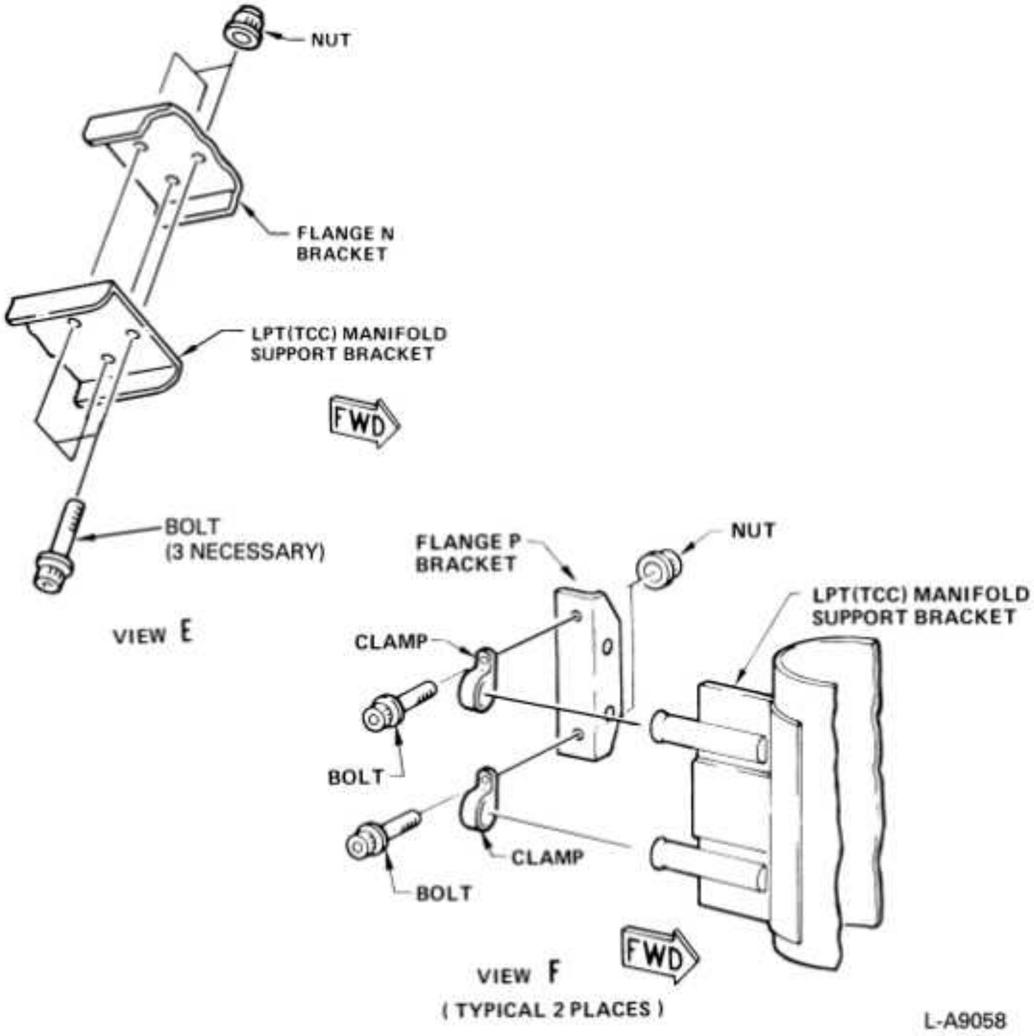
LPT Turbine Case Cooling Manifolds Clipping
(Post SB PW4ENG 79−76)
Figure 303 (Sheet 11)
(Task 72−00−53−050−003)


FLANGE P
C
F
FLANGE N
D
FLANGE M
LPT CASE COOLING AIR MANIFOLD (COLLECTOR)
A
B
E
F
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC)
L−A9055 (0000)
PW V

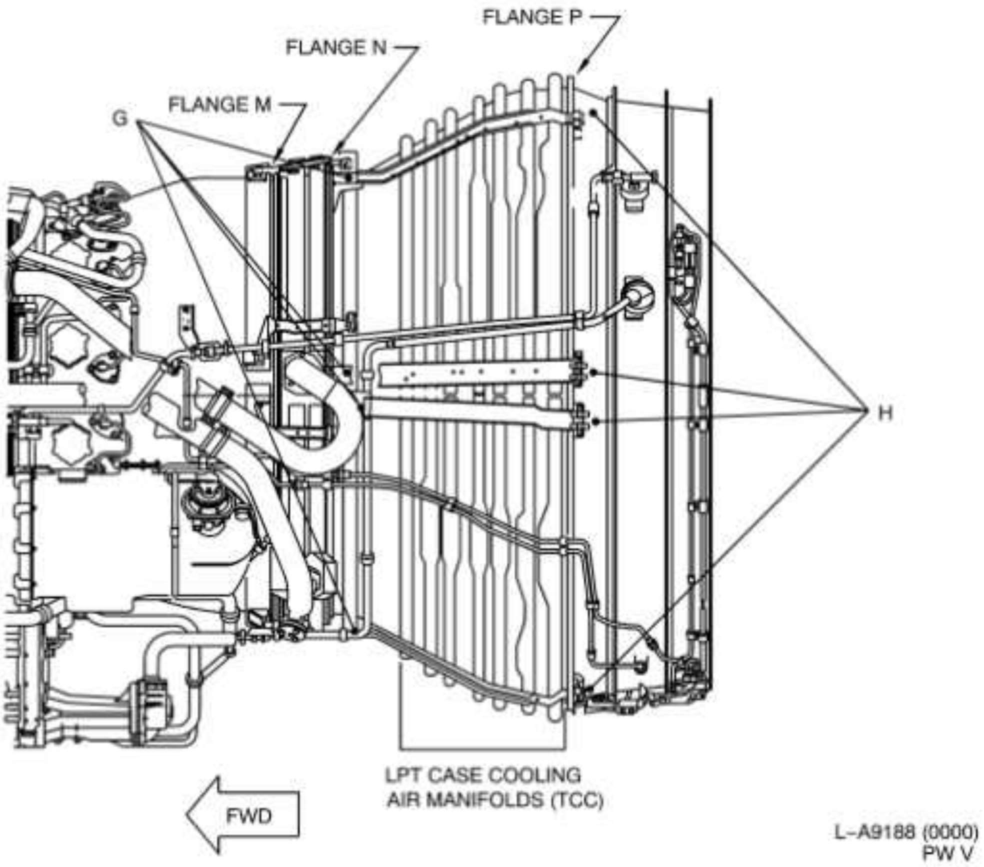
Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 304 (Sheet 1)
(Task 72−00−53−050−003)


FWD
LPT MANIFOLD (COLLECTOR)
CLAMP (2 NECESSARY)
BOLT (2 NECESSARY)
VIEW B
CLAMP (CUSHIONED) (4 NECESSARY)
BOLT (4 NECESSARY)
FWD
LPT MANIFOLD (COLLECTOR)
VIEW A
BOLT
LPT (TCC) MANIFOLD SUPPORT BRACKET
FLANGE N BRACKET
FWD
NUT
VIEW D
LPT (TCC) MANIFOLD (14 NECESSARY)
BOLT (14 NECESSARY)
FWD
LPT MANIFOLD (COLLECTOR)
VIEW C
L-A9057 (0000)
PW V

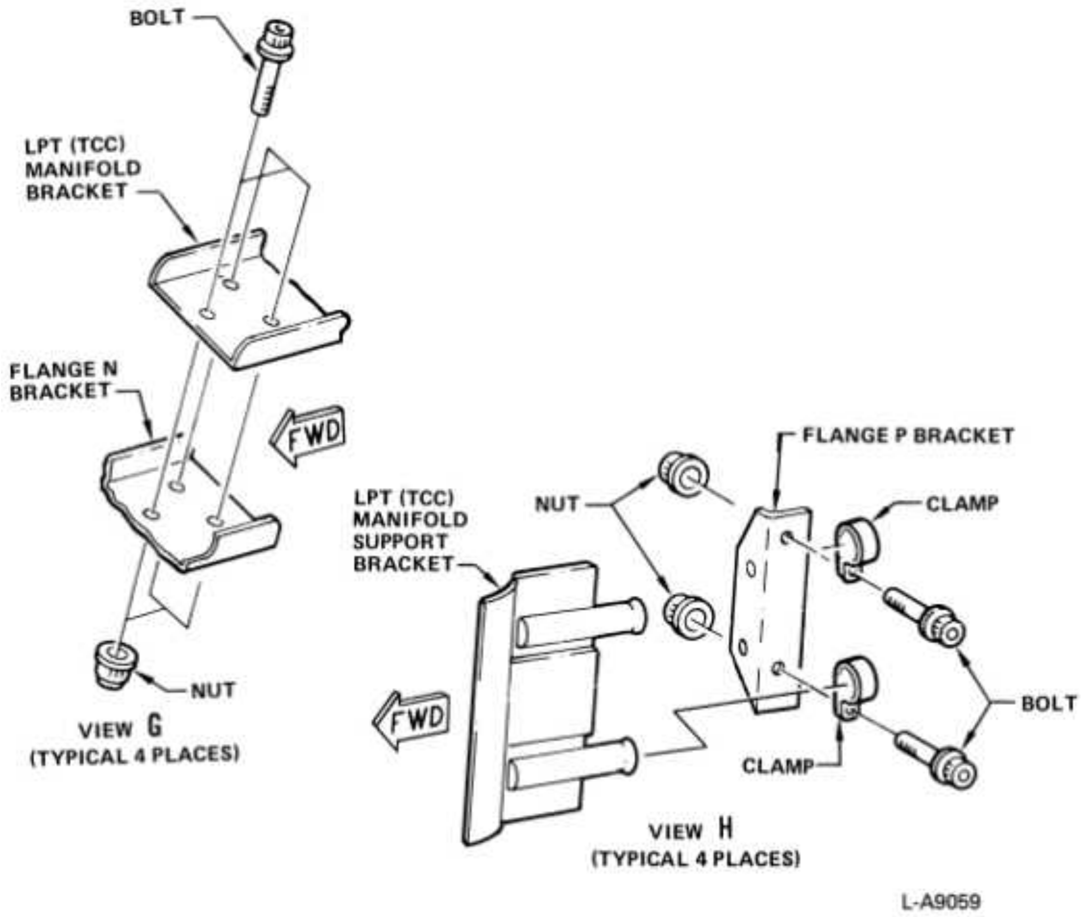
Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 304 (Sheet 2)
(Task 72-00-53-050-003)


NUT
FLANGE N BRACKET
LPT(TCC) MANIFOLD SUPPORT BRACKET
FWD
BOLT (3 NECESSARY)
VIEW E
FLANGE P BRACKET
NUT
LPT(TCC) MANIFOLD SUPPORT BRACKET
CLAMP
BOLT
CLAMP
BOLT
FWD
VIEW F
(TYPICAL 2 PLACES)
L-A9058

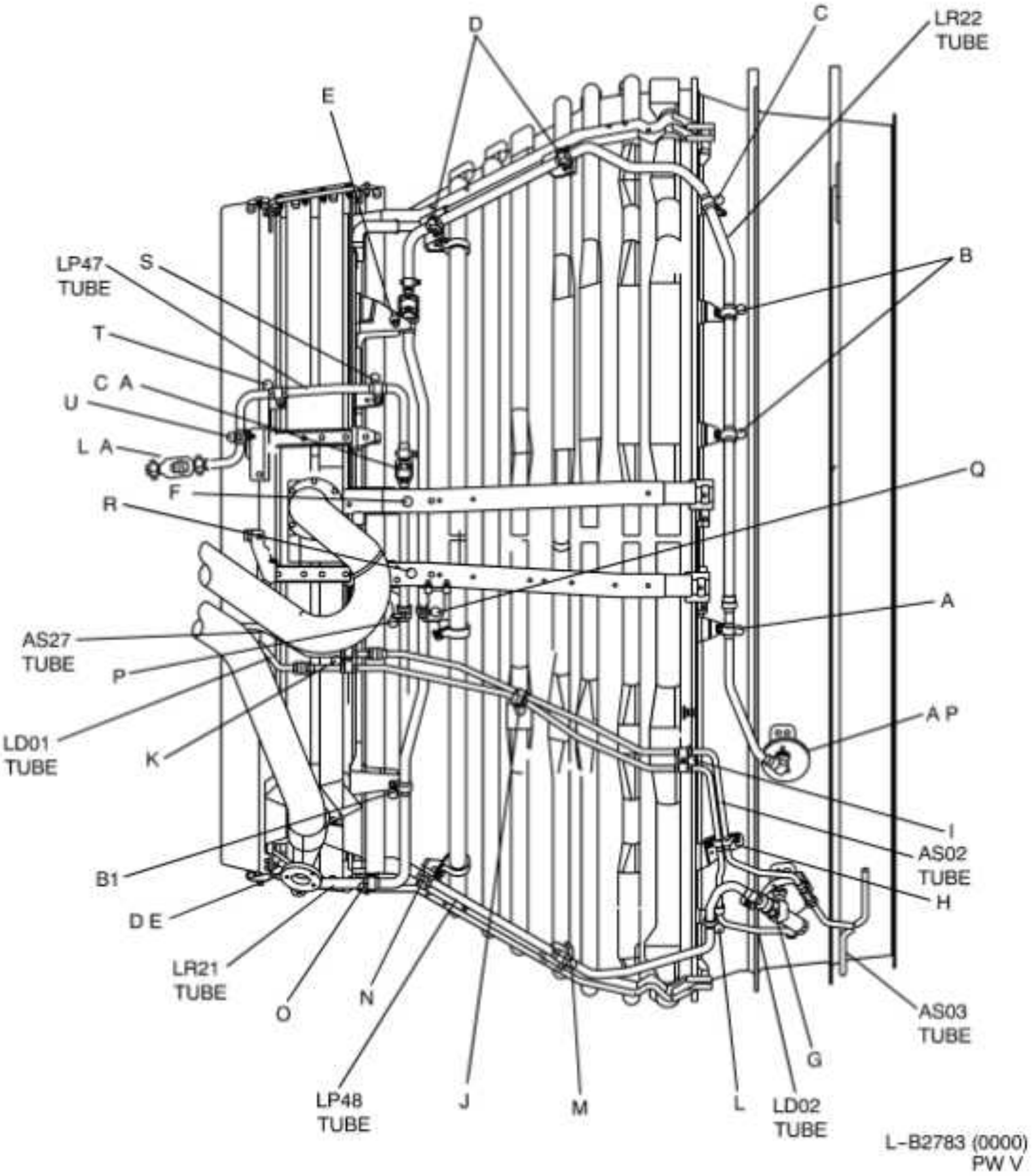
Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 304 (Sheet 3)
(Task 72-00-53-050-003)


FLANGE P
FLANGE N
FLANGE M
G
H
LPT CASE COOLING AIR MANIFOLDS (TCC)
FWD
L−A9188 (0000)
PW V

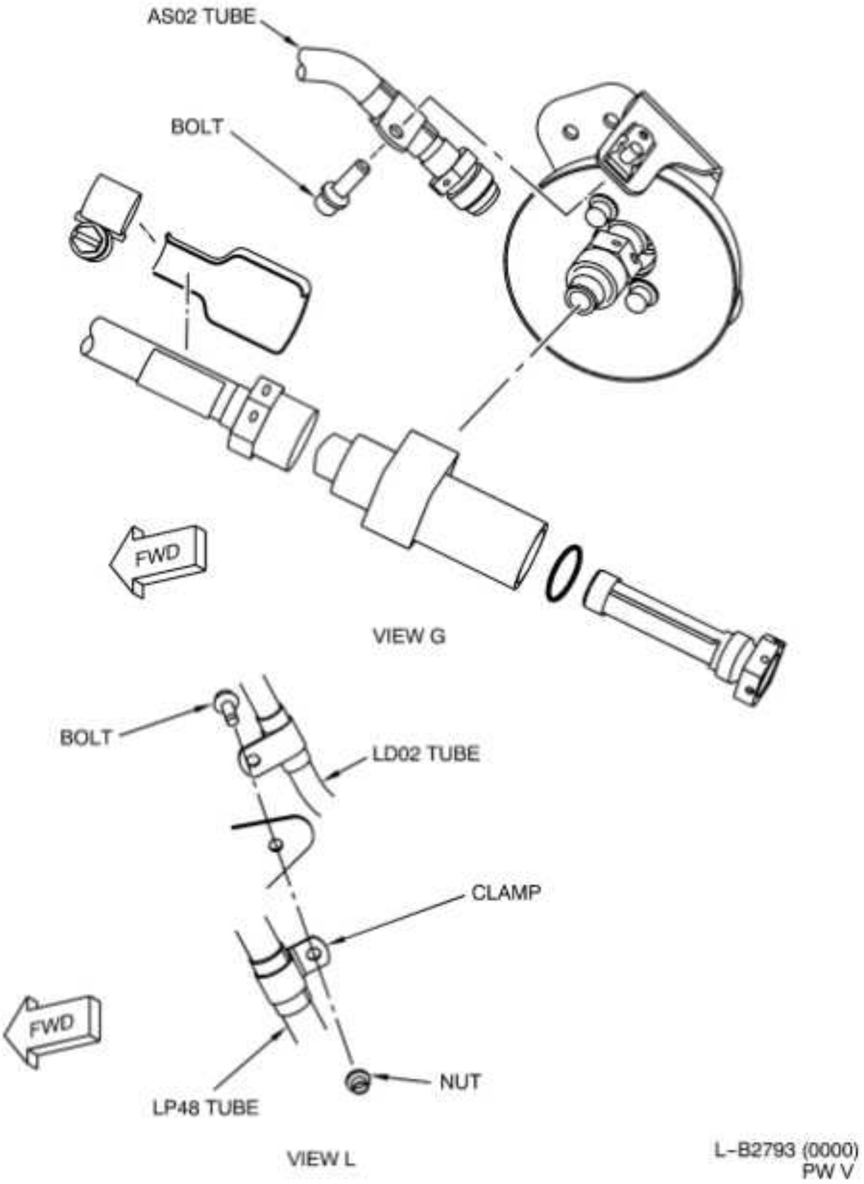
Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 304 (Sheet 4)
(Task 72−00−53−050−003)


BOLT
LPT (TCC) MANIFOLD BRACKET
FLANGE N BRACKET
FWD
NUT
VIEW G
(TYPICAL 4 PLACES)
FLANGE P BRACKET
NUT
CLAMP
LPT (TCC) MANIFOLD SUPPORT BRACKET
FWD
BOLT
CLAMP
VIEW H
(TYPICAL 4 PLACES)
L-A9059

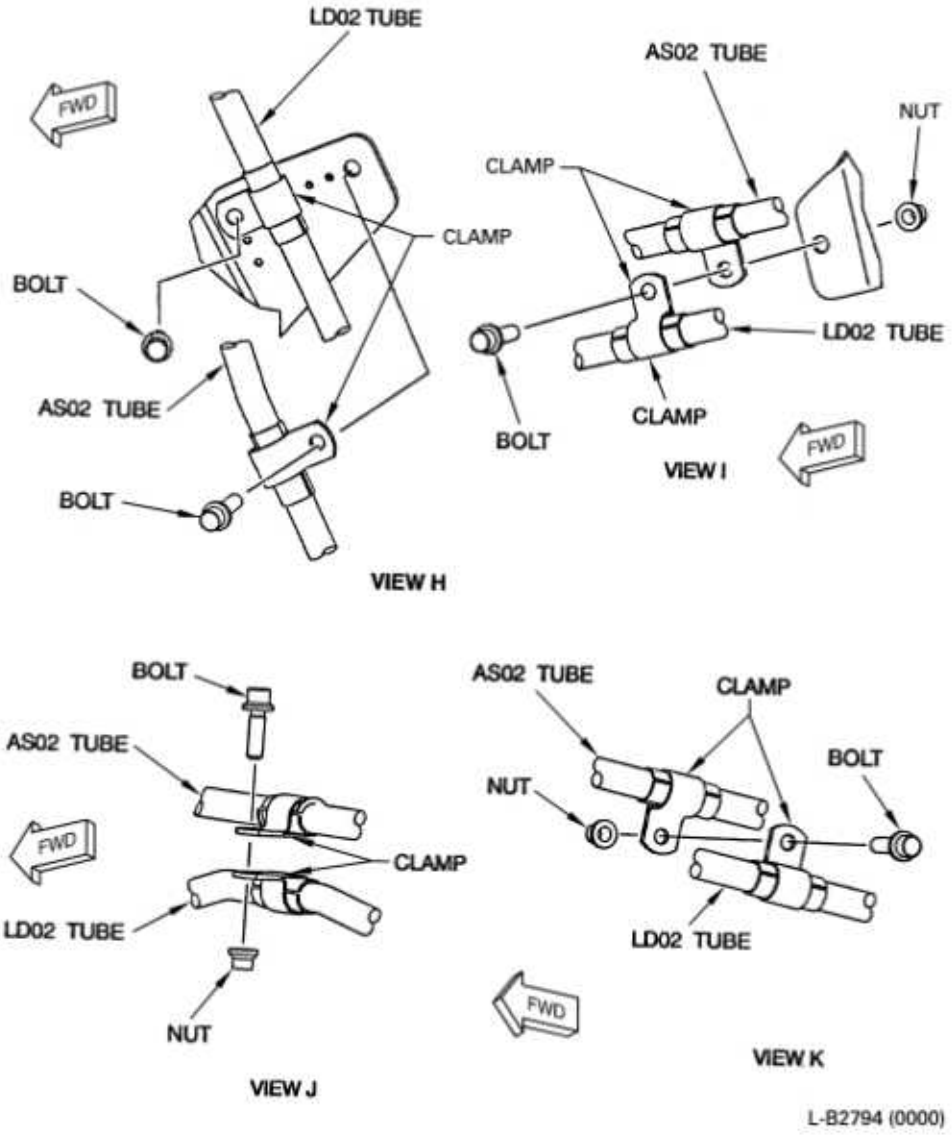
Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 304 (Sheet 5)
(Task 72−00−53−050−003)


D
C
LR22
TUBE
E
LP47
TUBE
S
T
C A
U
L A
F
R
B
Q
A
AS27
TUBE
P
LD01
TUBE
K
A P
I
AS02
TUBE
H
B1
D E
LR21
TUBE
O
N
AS03
TUBE
G
LP48
TUBE
J
M
L
LD02
TUBE
L-B2783 (0000)
PW V

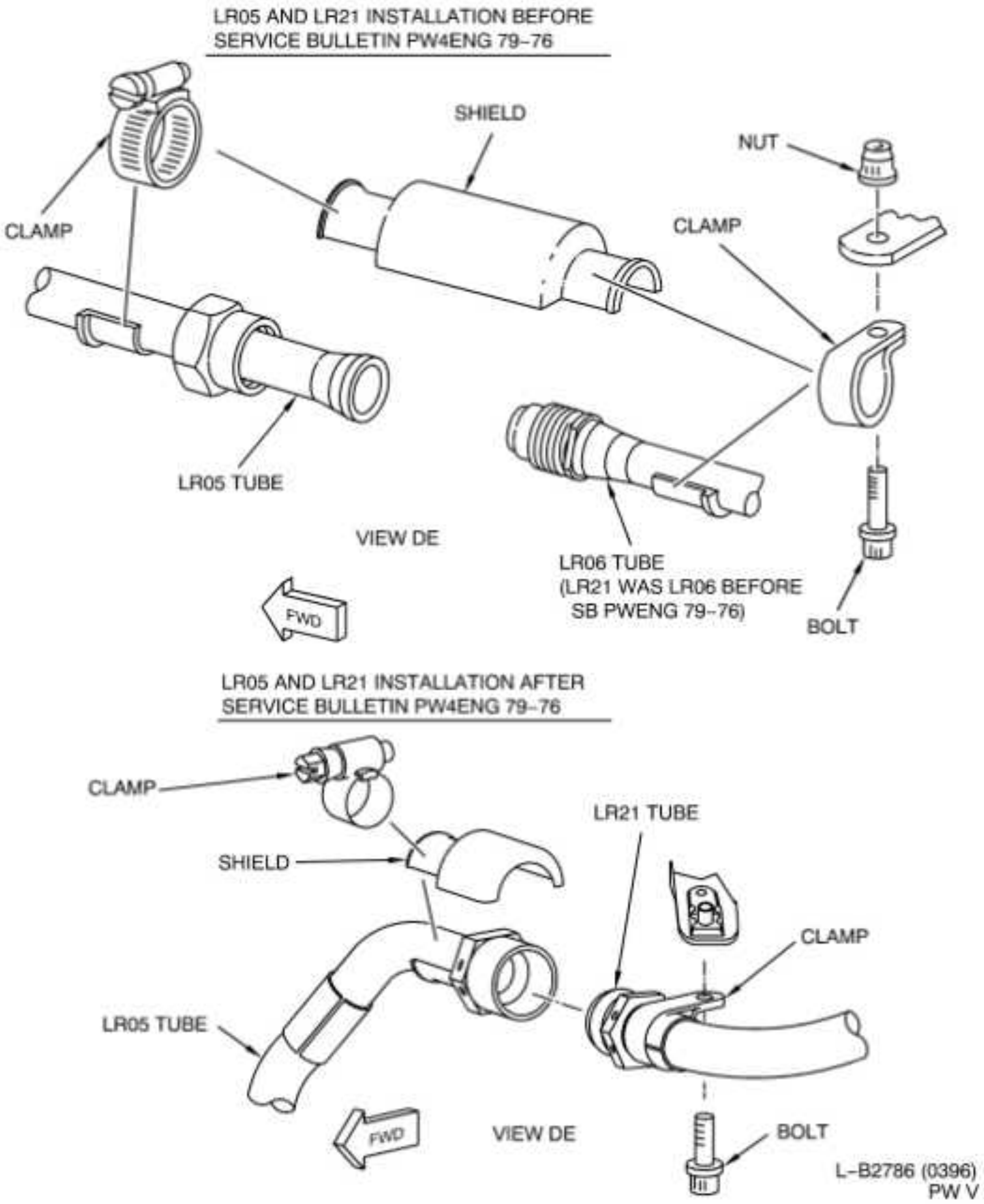
External Plumbing Clipping Views
(Post SB PW4ENG 79−76)
Figure 305 (Sheet 1)
(Task 72−00−53−050−003)


AS02 TUBE
BOLT
FWD
VIEW G
BOLT
LD02 TUBE
CLAMP
FWD
NUT
LP48 TUBE
VIEW L
L-B2793 (0000)
PW V

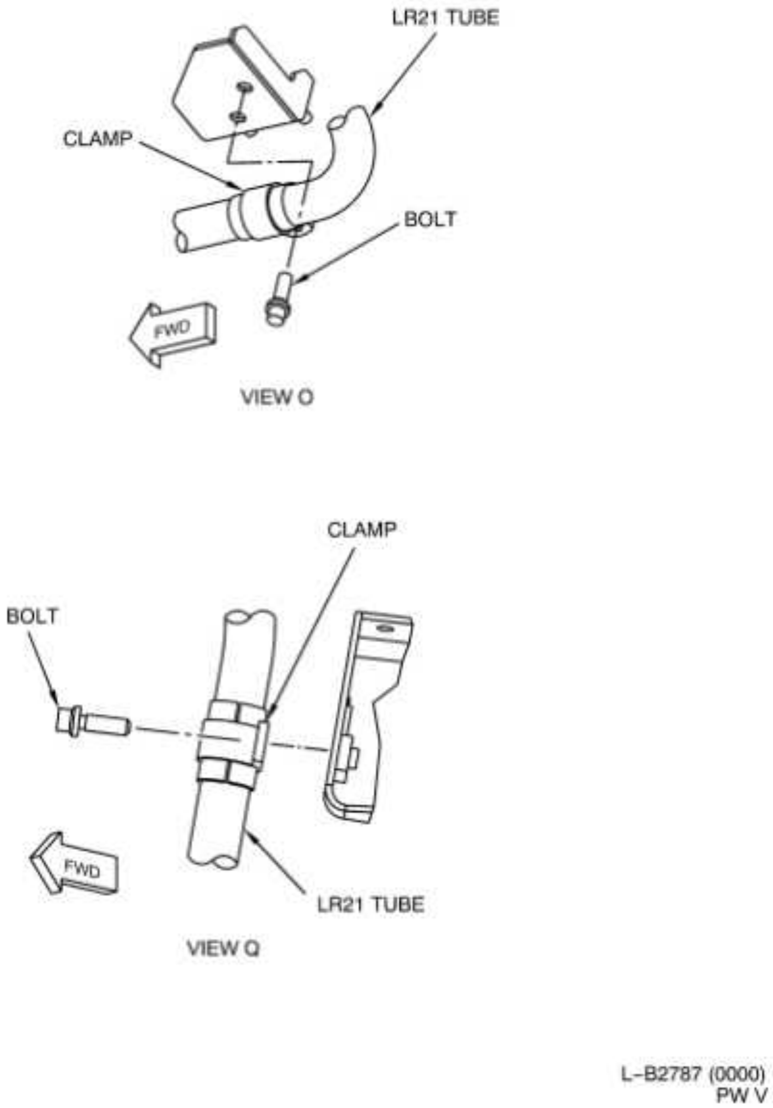
External Plumbing Clipping Views
(Post SB PW4ENG 79–76)
Figure 305 (Sheet 2)
(Task 72–00–53–050–003)


LD02 TUBE
FWD
CLAMP
BOLT
AS02 TUBE
BOLT
VIEW H
AS02 TUBE
NUT
CLAMP
LD02 TUBE
BOLT
CLAMP
FWD
VIEW I
BOLT
AS02 TUBE
FWD
CLAMP
LD02 TUBE
NUT
VIEW J
AS02 TUBE
CLAMP
NUT
BOLT
LD02 TUBE
FWD
VIEW K
L-B2794 (0000)

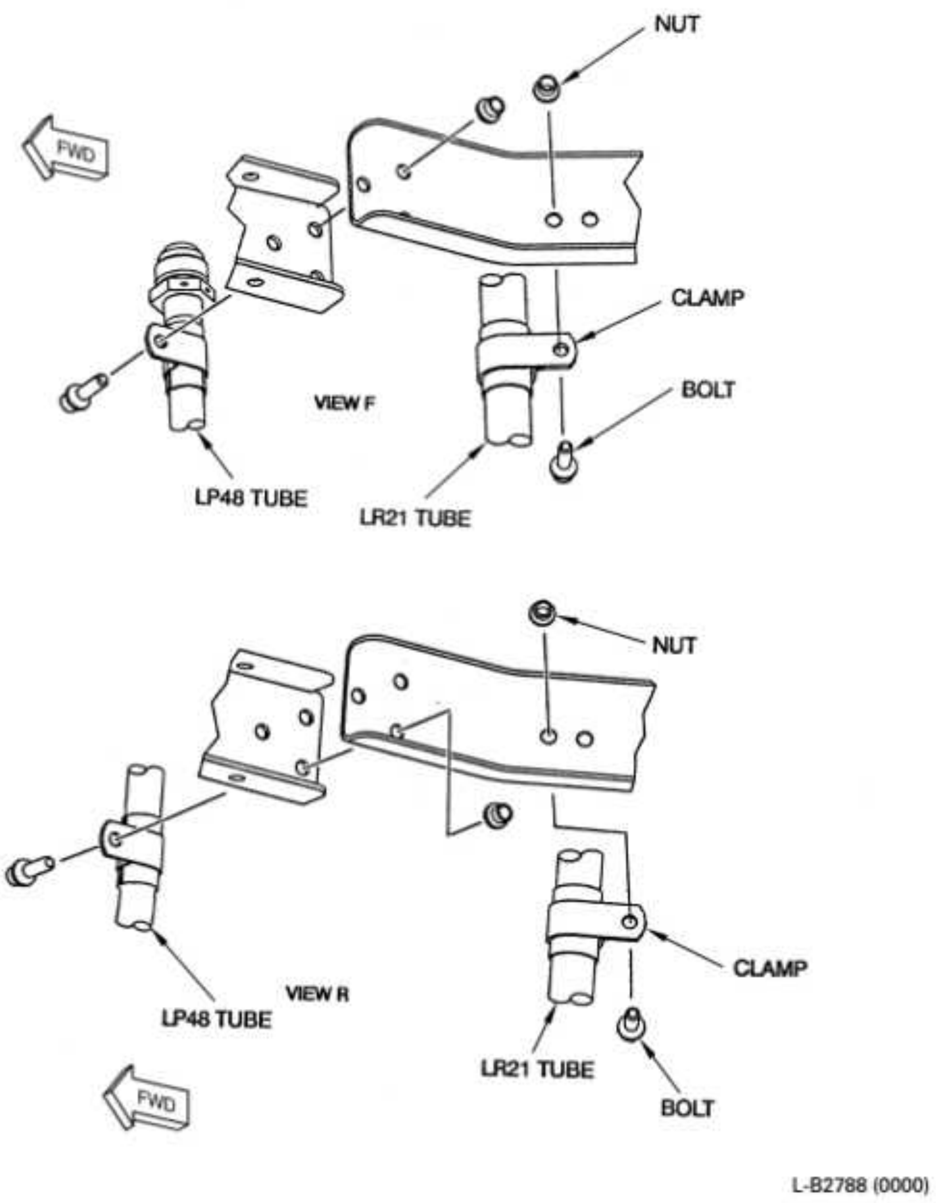
External Plumbing Clipping Views
(Post SB PW4ENG 79-76)
Figure 305 (Sheet 3)
(Task 72-00-53-050-003)


LR05 AND LR21 INSTALLATION BEFORE SERVICE BULLETIN PW4ENG 79-76
SHIELD
NUT
CLAMP
CLAMP
LR05 TUBE
VIEW DE
LR06 TUBE (LR21 WAS LR06 BEFORE SB PWENG 79-76)
BOLT
FWD
LR05 AND LR21 INSTALLATION AFTER SERVICE BULLETIN PW4ENG 79-76
CLAMP
LR21 TUBE
SHIELD
CLAMP
LR05 TUBE
FWD
VIEW DE
BOLT
L-B2786 (0396)
PW V

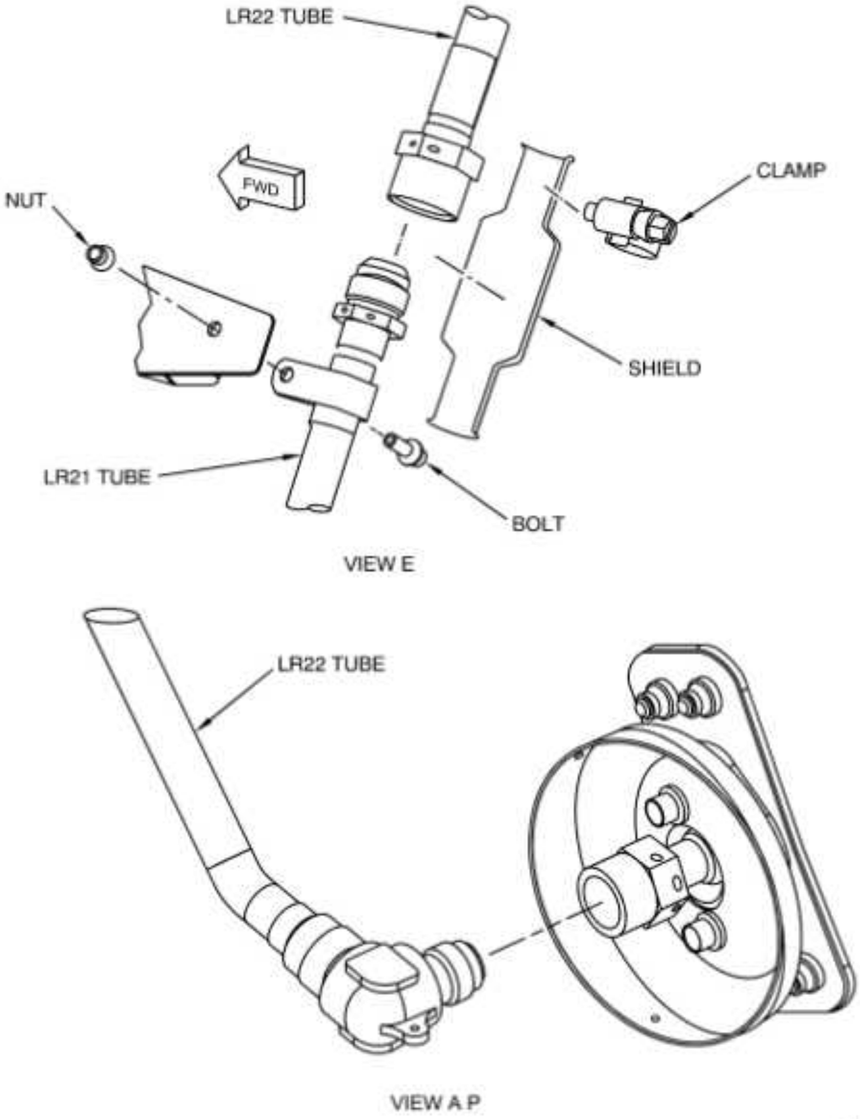
External Plumbing Clipping Views
(Post SB PW4ENG 79−76)
Figure 305 (Sheet 4)
(Task 72−00−53−050−003)


LR21 TUBE
CLAMP
BOLT
FWD
VIEW O
CLAMP
BOLT
FWD
LR21 TUBE
VIEW Q
L-B2787 (0000)
PW V

External Plumbing Clipping Views
(Post SB PW4ENG 79-76)
Figure 305 (Sheet 5)
(Task 72-00-53-050-003)


NUT
FWD
CLAMP
BOLT
VIEW F
LP48 TUBE
LR21 TUBE
NUT
VIEW R
LP48 TUBE
CLAMP
LR21 TUBE
BOLT
FWD
L-B2788 (0000)

External Plumbing Clipping Views
(Post SB PW4ENG 79−76)
Figure 305 (Sheet 6)
(Task 72−00−53−050−003)

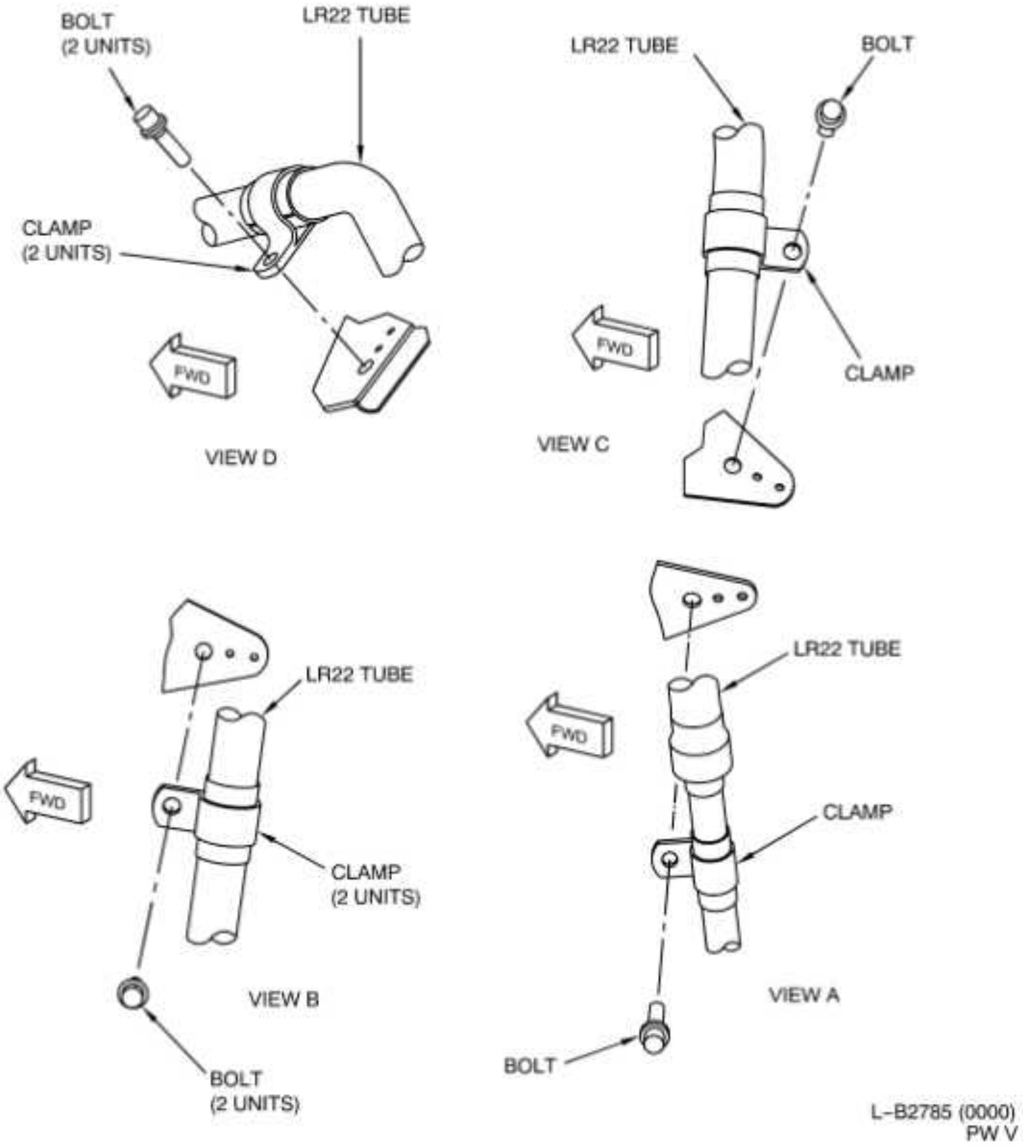

LR22 TUBE
CLAMP
NUT
FWD
SHIELD
LR21 TUBE
BOLT
LR22 TUBE

VIEW E

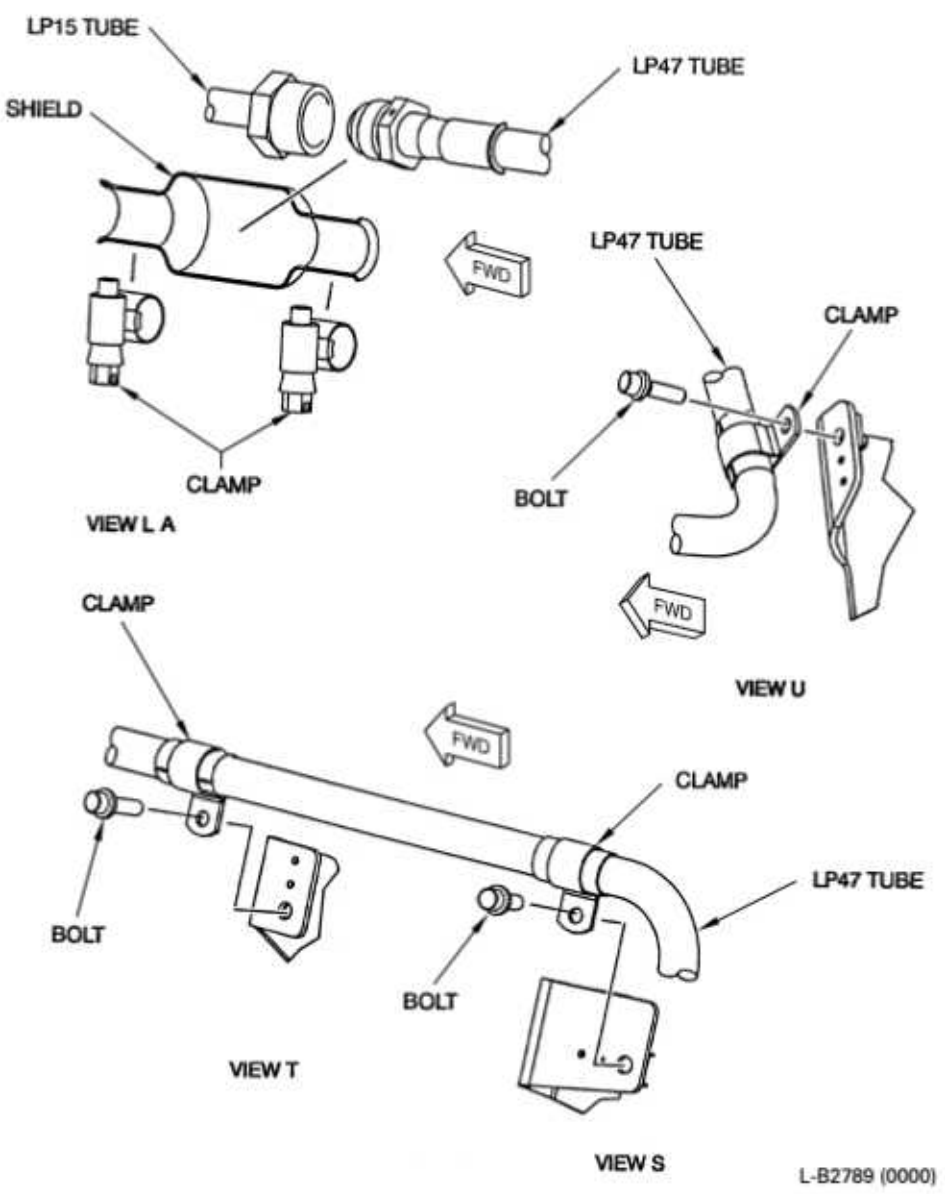
VIEW A P

L-B2784 (0000)
PW V

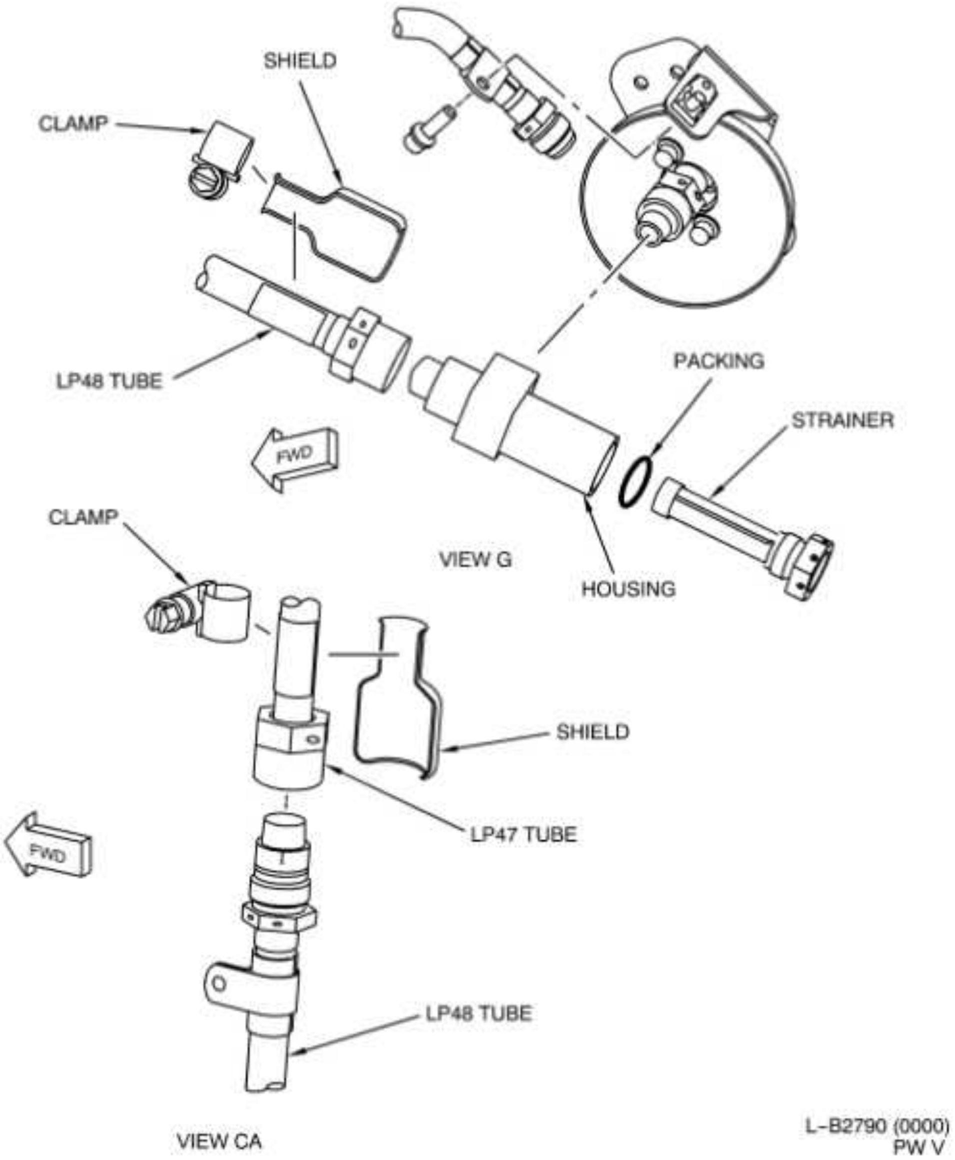
External Plumbing Clipping Views
(Post SB PW4ENG 79-76)
Figure 305 (Sheet 7)
(Task 72-00-53-050-003)


BOLT
(2 UNITS)
LR22 TUBE
CLAMP
(2 UNITS)
FWD
VIEW D
LR22 TUBE
BOLT
FWD
CLAMP
VIEW C
LR22 TUBE
FWD
CLAMP
(2 UNITS)
VIEW B
BOLT
(2 UNITS)
LR22 TUBE
FWD
CLAMP
VIEW A
BOLT
L−B2785 (0000)
PW V

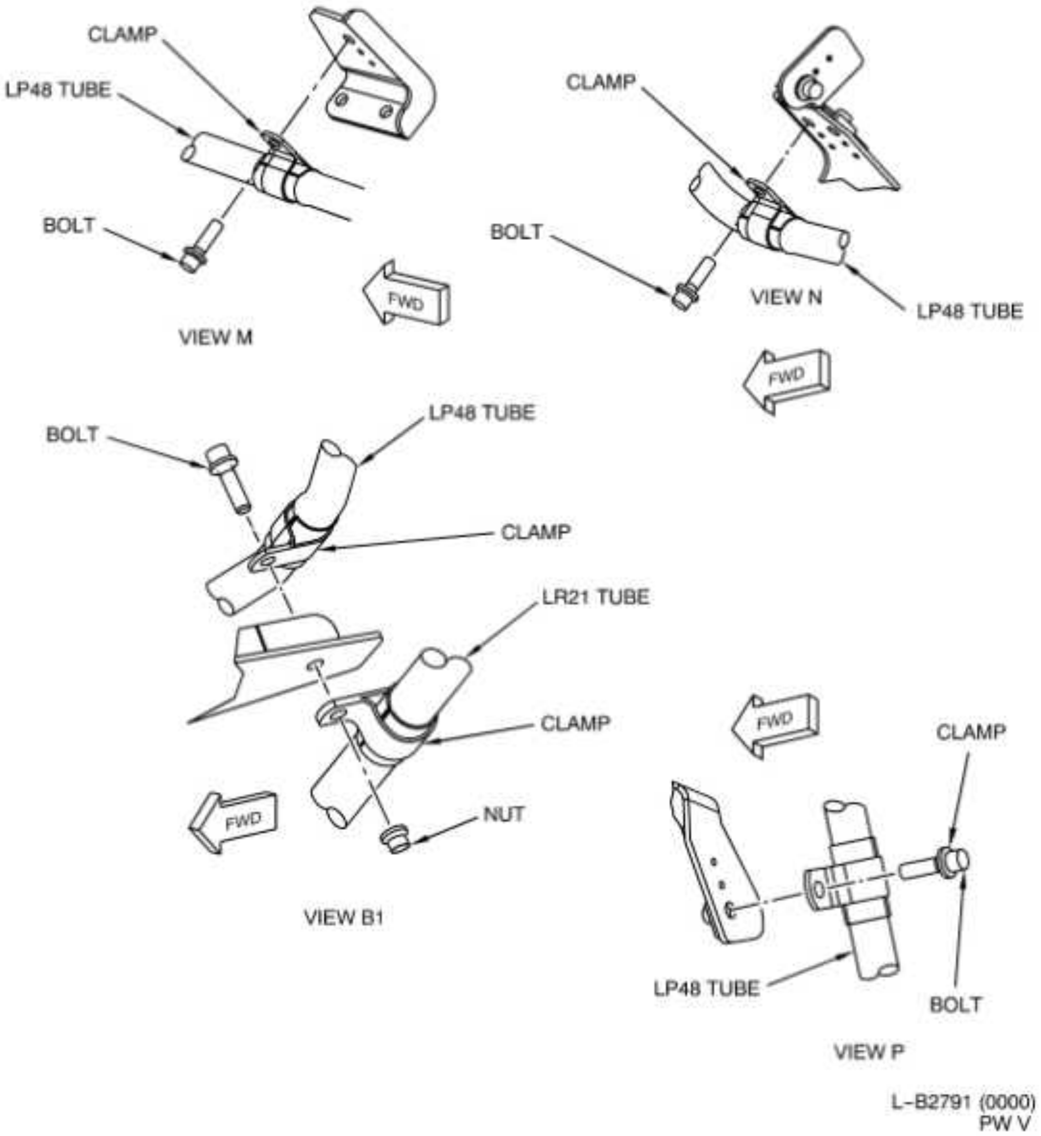
External Plumbing Clipping Views
(Post SB PW4ENG 79−76)
Figure 305 (Sheet 8)
(Task 72−00−53−050−003)


LP15 TUBE
LP47 TUBE
SHIELD
FWD
LP47 TUBE
CLAMP
BOLT
CLAMP
VIEW L A
FWD
VIEW U
CLAMP
FWD
CLAMP
LP47 TUBE
BOLT
BOLT
VIEW T
VIEW S
L-B2789 (0000)

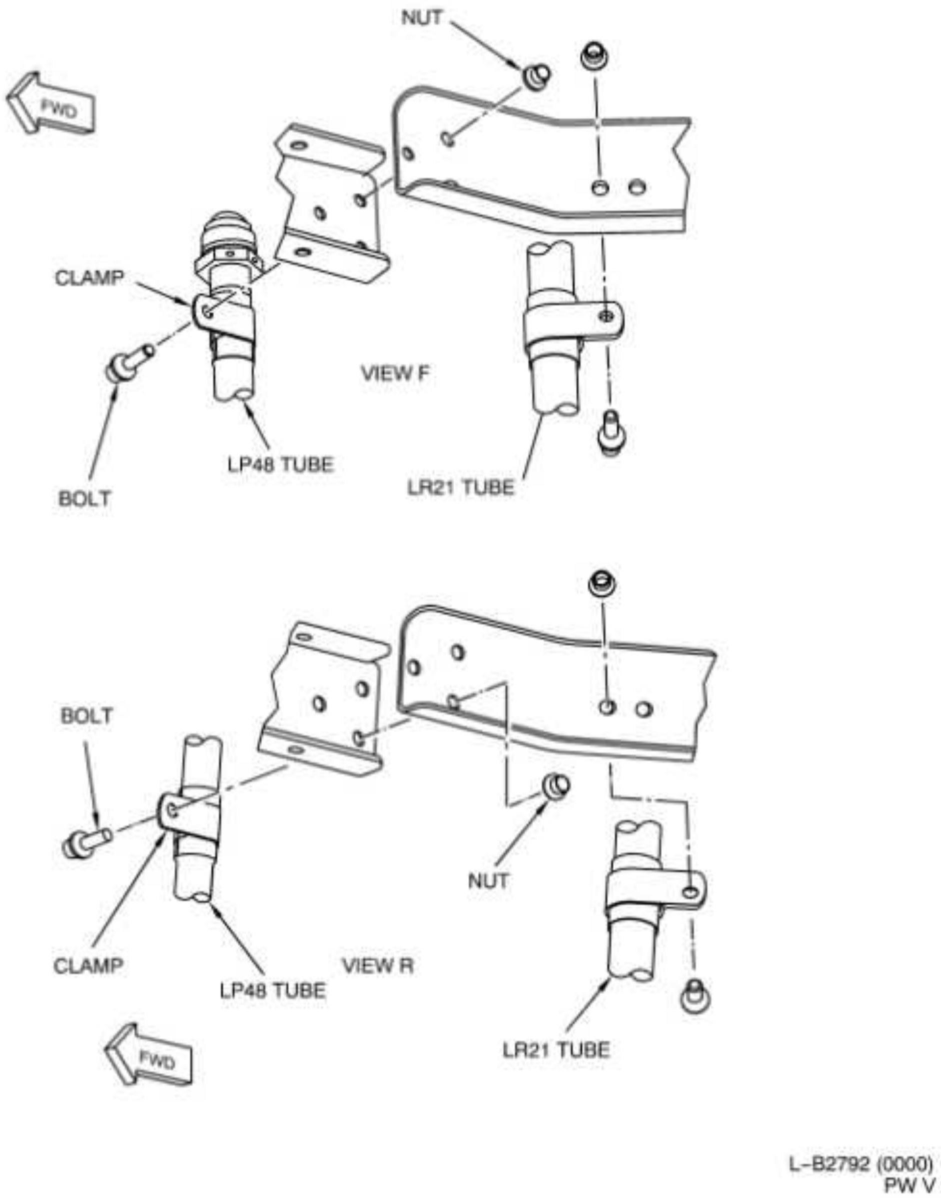
External Plumbing Clipping Views
(Post SB PW4ENG 79−76)
Figure 305 (Sheet 9)
(Task 72−00−53−050−003)


SHIELD
CLAMP
LP48 TUBE
FWD
PACKING
STRAINER
CLAMP
VIEW G
HOUSING
SHIELD
LP47 TUBE
FWD
LP48 TUBE
VIEW CA
L-B2790 (0000)
PW V

External Plumbing Clipping Views
(Post SB PW4ENG 79−76)
Figure 305 (Sheet 10)
(Task 72−00−53−050−003)


CLAMP
LP48 TUBE
BOLT
FWD
VIEW M
CLAMP
BOLT
VIEW N
LP48 TUBE
FWD
BOLT
LP48 TUBE
CLAMP
LR21 TUBE
CLAMP
NUT
FWD
VIEW B1
FWD
CLAMP
LP48 TUBE
BOLT
VIEW P
L-B2791 (0000)
PW V

External Plumbing Clipping Views
(Post SB PW4ENG 79−76)
Figure 305 (Sheet 11)
(Task 72−00−53−050−003)


NUT
FWD
CLAMP
VIEW F
BOLT
LP48 TUBE
LR21 TUBE
BOLT
NUT
CLAMP
LP48 TUBE
VIEW R
LR21 TUBE
FWD
L-B2792 (0000)
PW V

External Plumbing Clipping Views
(Post SB PW4ENG 79-76)
Figure 305 (Sheet 12)
(Task 72-00-53-050-003)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - REMOVAL-06

Task 72-00-53-050-004:

1. Remove Turbine Case Cooling (TCC) Air Valve Control Cable

A. Equipment And Materials Required - None

B. Procedure
See Figure 301.

(1) Remove the lockwire from the forward end of the turbine case cooling (TCC) air valve control cable and disconnect the cable coupling nut (301/8) from the actuator piston shaft.

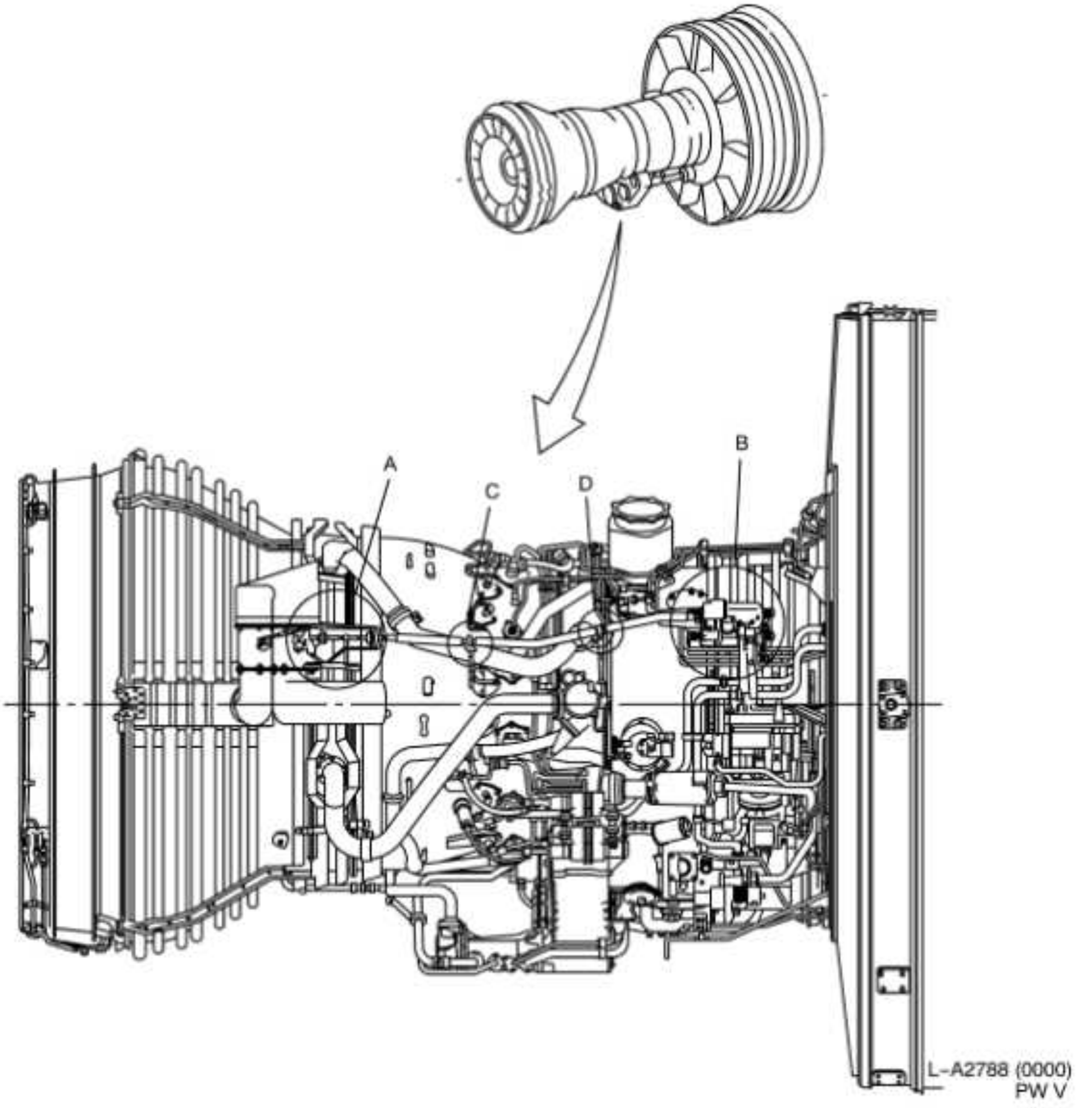
(2) Remove the bolt and nut that attach the cable rod end bearing to the valve idler arm at the turbine case cooling (TCC) air shutoff valve (HPT).

(3) Remove the lockwire from the jamnuts (301/6) at the cable rear support bracket (301/4) and loosen the jamnuts.

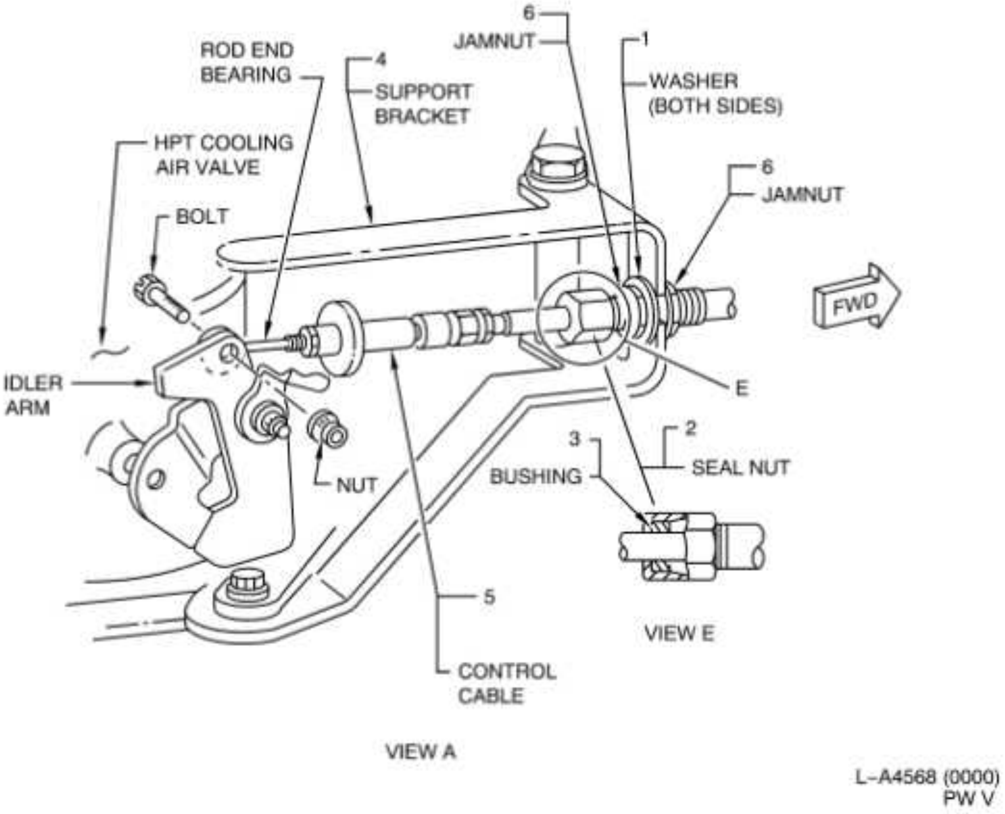
(4) Remove the bolts (301/12) and nuts (301/10) that attach the clamps (301/9) to the cable at the two clamping locations. Remove the clamps from the cable.

(5) Release the forward end of cable from the actuator piston shaft. Remove the cable from the engine.

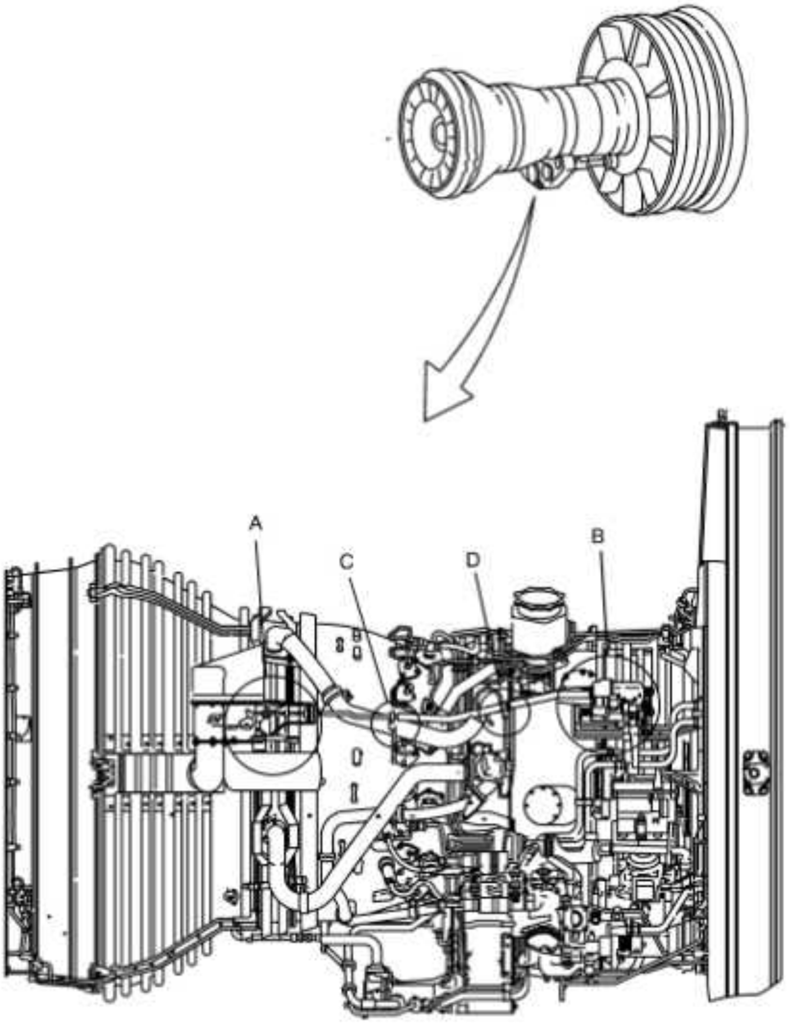
NOTE: For additional information concerning detailed maintenance of this component see Turbine Case Cooling (TCC) Air Valve Control Cable Component Maintenance Manual, 75-24-13 (Controlex/Eanco).



Turbine Case Cooling (TCC) Air Valve Control Cable (Pre And Post SB PW4ENG 72−572 And Post SB PW4ENG 72−592 Engines)
Figure 301 (Sheet 1)
(Task 72−00−53−050−004)

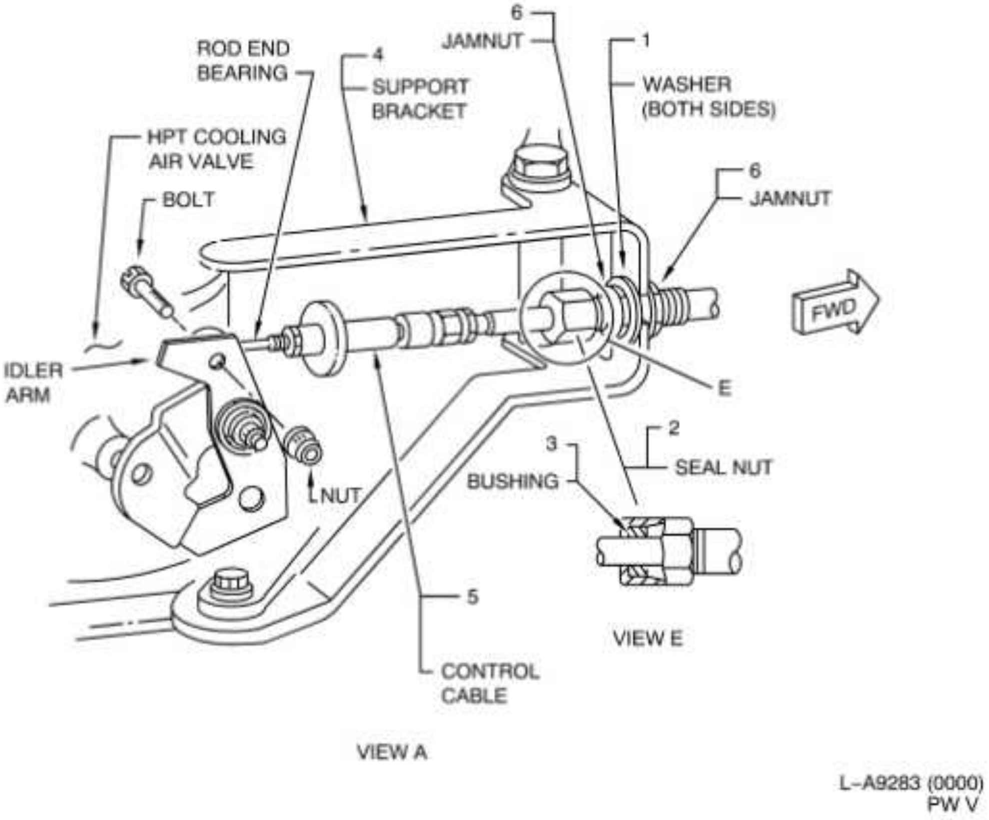

6
JAMNUT
1
ROD END
BEARING
4
SUPPORT
BRACKET
WASHER
(BOTH SIDES)
HPT COOLING
AIR VALVE
6
JAMNUT
BOLT
FWD
IDLER
ARM
E
3
2
SEAL NUT
BUSHING
NUT
5
VIEW E
CONTROL
CABLE
VIEW A
L−A4568 (0000)
PW V

Turbine Case Cooling (TCC) Air Valve Control Cable (Pre And
Post SB PW4ENG 72−572 And Post SB PW4ENG 72−592 Engines)
Figure 301 (Sheet 2)
(Task 72−00−53−050−004)

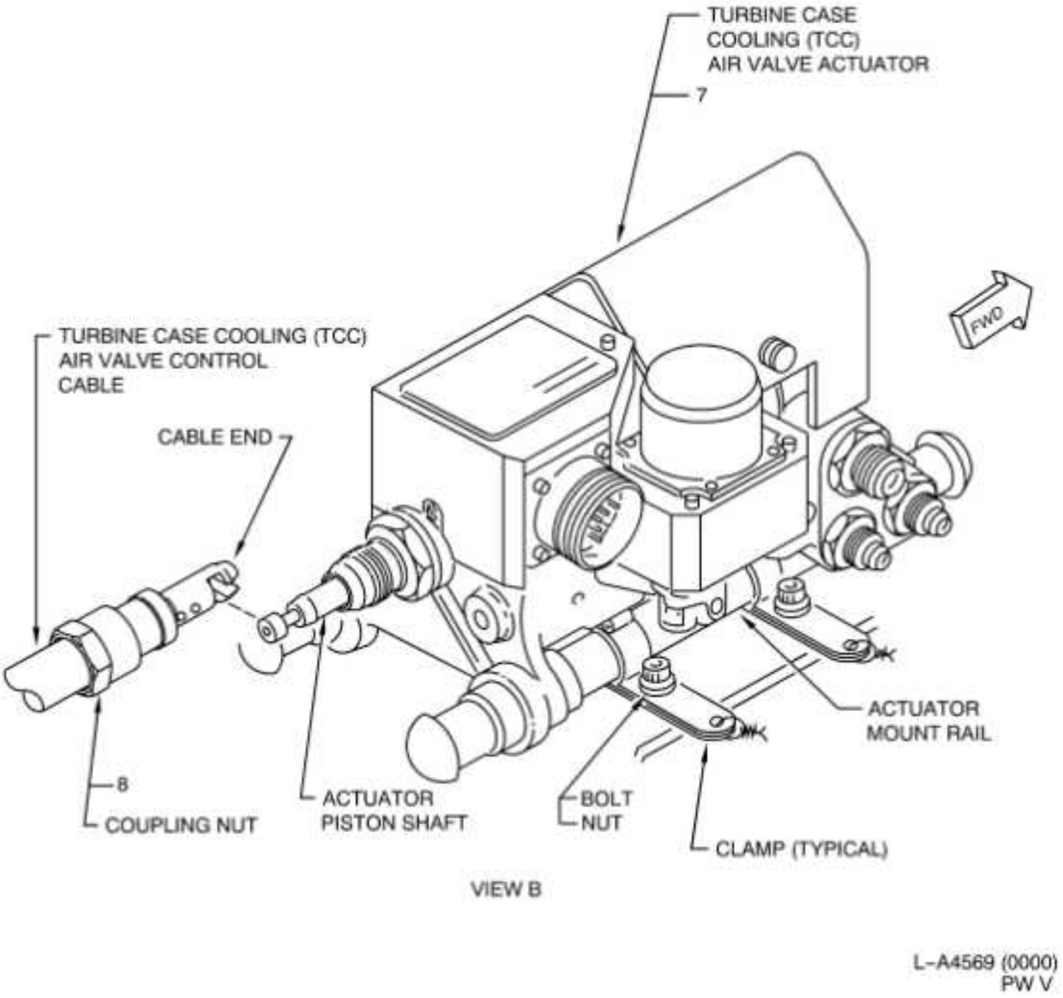


L-A9282 (0000)
PW V

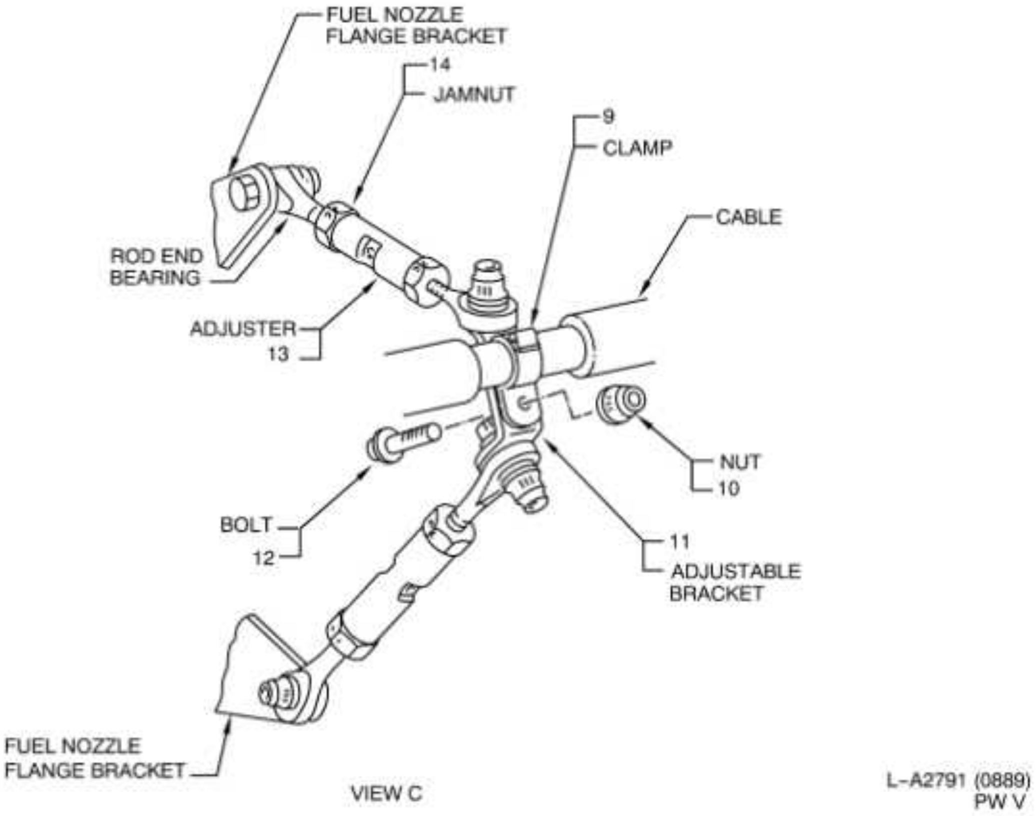
Turbine Case Cooling (TCC) Air Valve Control
Cable (Phase 3 Engines As Built By P&W)
Figure 301 (Sheet 3)
(Task 72-00-53-050-004)


6
JAMNUT
ROD END BEARING
4
SUPPORT BRACKET
1
WASHER (BOTH SIDES)
HPT COOLING AIR VALVE
6
JAMNUT
BOLT
FWD
IDLER ARM
E
2
SEAL NUT
3
BUSHING
NUT
5
CONTROL CABLE
VIEW E
VIEW A
L−A9283 (0000)
PW V

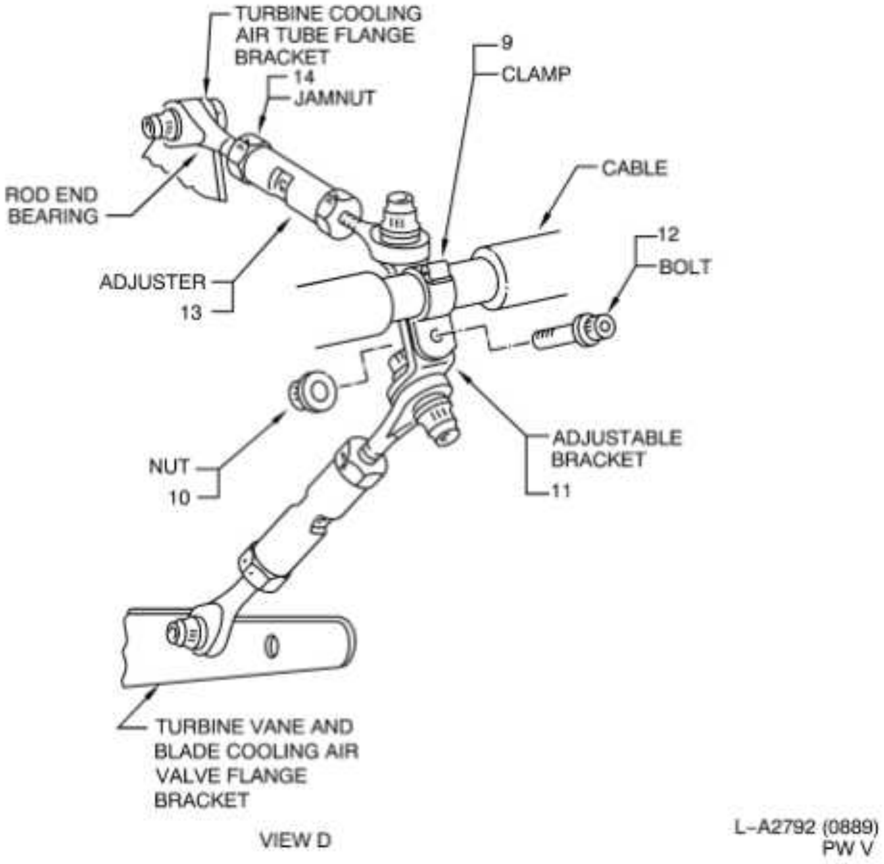
Turbine Case Cooling (TCC) Air Valve Control
Cable (Phase 3 Engines As Built By P&W)
Figure 301 (Sheet 4)
(Task 72−00−53−050−004)


TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
7
FWD
TURBINE CASE COOLING (TCC) AIR VALVE CONTROL CABLE
CABLE END
ACTUATOR MOUNT RAIL
8
COUPLING NUT
ACTUATOR PISTON SHAFT
BOLT
NUT
CLAMP (TYPICAL)
VIEW B
L−A4569 (0000)
PW V

Turbine Case Cooling (TCC) Air Valve Control Cable
Figure 301 (Sheet 5)
(Task 72−00−53−050−004)


FUEL NOZZLE FLANGE BRACKET
14
JAMNUT
9
CLAMP
CABLE
ROD END BEARING
ADJUSTER
13
NUT
10
BOLT
12
11
ADJUSTABLE BRACKET
FUEL NOZZLE FLANGE BRACKET
VIEW C
L-A2791 (0889)
PW V

Turbine Case Cooling (TCC) Air Valve Control Cable
Figure 301 (Sheet 6)
(Task 72−00−53−050−004)


TURBINE COOLING AIR TUBE FLANGE BRACKET
14
JAMNUT
9
CLAMP
CABLE
ROD END BEARING
12
BOLT
ADJUSTER
13
NUT
10
ADJUSTABLE BRACKET
11
TURBINE VANE AND BLADE COOLING AIR VALVE FLANGE BRACKET
VIEW D
L-A2792 (0889)
PW V

Turbine Case Cooling (TCC) Air Valve Control Cable
Figure 301 (Sheet 7)
(Task 72−00−53−050−004)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - REMOVAL-07

Task 72-00-53-050-001:

1. Remove Turbine Case Cooling (TCC) Air Valve (LPT)

   A. Equipment And Materials Required - None

   B. Procedure
      See Figure 301.

      (1) Remove the bolts and nuts that attach the lower support link to the flanges of the HPT and LPT (TCC) manifold collectors and move the support link inward toward the case. See Figure 301.

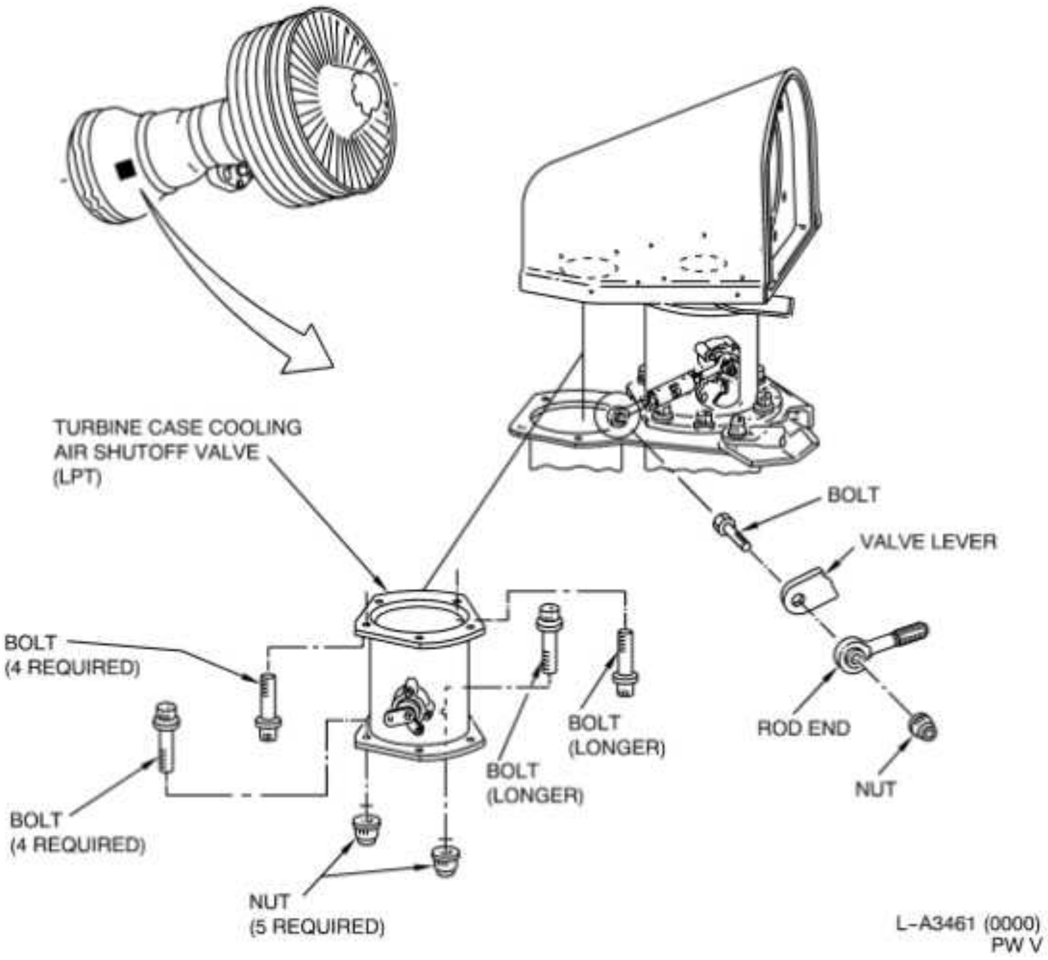
      (2) Remove the bolts and nuts that attach the lower flange of the valve to the lower support bracket.

      (3) Remove the bolts that attach the upper flange of the valve and upper support link to the upper support bracket.

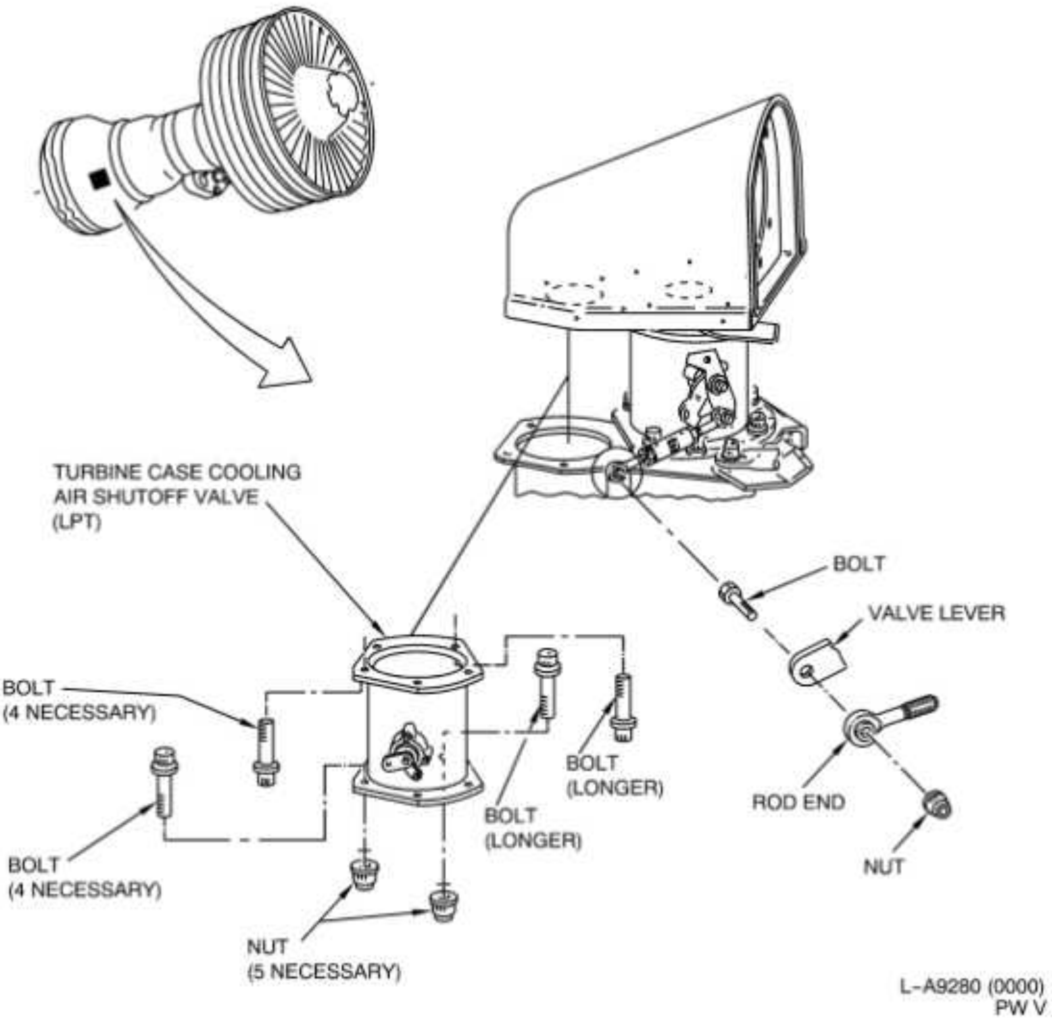
      (4) Disconnect the rod end from the valve lever by removal of the bolt and nut.

      (5) Move the valve rearward and outward from between the support brackets.

         NOTE: For additional information concerning detailed maintenance of this component see Turbine Case Cooling Air Valve (LPT) Component Maintenance Manual, 75-24-11 (Parker Hannifin).


TURBINE CASE COOLING
AIR SHUTOFF VALVE
(LPT)
BOLT
VALVE LEVER
BOLT
(4 REQUIRED)
BOLT
(LONGER)
ROD END
BOLT
(LONGER)
NUT
BOLT
(4 REQUIRED)
NUT
(5 REQUIRED)
L-A3461 (0000)
PW V

Turbine Cooling Air Valve (LPT) (Pre And Post SB PW4ENG 72−572 And Post SB PW4ENG 72−592 Engines)
Figure 301 (Sheet 1)
(Task 72−00−53−050−001)


TURBINE CASE COOLING
AIR SHUTOFF VALVE
(LPT)
BOLT
VALVE LEVER
BOLT
(4 NECESSARY)
BOLT
(LONGER)
ROD END
BOLT
(LONGER)
BOLT
(4 NECESSARY)
NUT
NUT
(5 NECESSARY)
L-A9280 (0000)
PW V

Turbine Cooling Air Valve (LPT) (Phase 3 Engines As Built By P&W)
Figure 301 (Sheet 2)
(Task 72−00−53−050−001)

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - REMOVAL-08

Task 72-00-53-020-002:

1. Remove Low Pressure Turbine And Turbine Exhaust Case With Shaft

NOTE: See Figure 301 for part/assembly removal procedure.

NOTE: See 72-00-53, Removal-01 (Task 72-00-53-020-001) for procedure to remove low pressure turbine with turbine exhaust case previously removed.

A. Prerequisites

(1) Remove The Compressor Inlet Cone. Refer to 72-00-31, Removal-02 (Task 72-00-31-020-002-001).

(2) Remove The EEC Thermocouple And Airframe Cable (W6). Refer to 72-00-54, Removal-09 (Task 72-00-54-050-006-A00).

(3) Remove The External Parts. Refer to72-00-54, Removal-02 (Task 72-00-54-020-003).

(4) Remove The External Parts. Refer to 72-00-53, Removal-03 (Task 72-00-53-020-003).

B. Equipment And Materials Necessary

Standard Tools:

.190-32 Jackscrews, Eight Necessary Per Text

Special Tools:

PWA 3755	Pump (Optional To PWA 29389)
PWA 25096	Stand (Optional To PWA 87330)
PWA 18872	Wrench, Hydraulic (Optional To PWA 33732)
PWA 26157	Pedestal, Engine Support (Optional To PWA 87359)
PWA 26318	Base, Extension
PWA 28657	Sling, Strongback, Handling
PWA 28668	Pump, Hydraulic (Use With Hydraulic Wrench)
PWA 28669	Cart (Optional) (Use With Hydraulic Wrench)
PWA 28814	Pump, Electric
PWA 28815	Cart, Storage (Optional To PWA 75046 For PWA 18872) (Use With Hydraulic Wrench)
PWA 29243	Bracket, Support (Two Necessary)
PWA 29389	Pump Hydraulic
PWA 29510	Pump, Hydraulic (Hand) (Use With Hydraulic Wrench)

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - REMOVAL-08

Special Tools:

(CONTINUED)

PWA 29614	Wrench, Mechanical
PWA 33732	Wrench, Hydraulic
PWA 45418	Wrench, Mechanical
PWA 45419	Air Torque Multiplier (Optional To PWA 80651) (Use With Mechanical Wrench)
PWA 75046	Cart, Storage (Optional)
PWA 76154	Adapter (Two Necessary)
PWA 76270	Stand (Optional To PWA 87330)
PWA 80187	Wrench, Mechanical
PWA 80651	Multiplier, Pneumatic (Use With Mechanical Wrench)
PWA 85062	Saddle, Support
PWA 85298	Puller, Jackscrew
PWA 85299	Adapter, Holding (Optional To PWA 102460 Adapter)
PWA 85300	Wrench, Torque (Use With Mechanical Wrench)
PWA 85306	Puller, Knocker
PWA 85307	Puller, Jackscrew
PWA 85452	Eye, Lifting
PWA 85456	Retainer, Front (Optional To PWA 85996)
PWA 85490	Drift, Assembly
PWA 85514	Wrench, Torque (Use With Hydraulic Wrench)
PWA 85515	Adapter (Use With Hydraulic Wrench)
PWA 85562	Sleeve, Support (Used With PWA 25096 Or PWA 76270 Stand)
PWA 85769	Fixture (Install/Remove)
PWA 85785	Adapter, Piloting
PWA 85996	Retainer, Front (Optional To PWA 85456)
PWA 86210	Adapter, Piloting
PWA 86325	Fixture (Optional To PWA 86437)
PWA 86437	Fixture, Retainer (Optional To PWA 88222)
PWA 86604	Stand, Transport (Optional, To Store And Transport PWA 85769 Fixture)
PWA 87330	Stand
PWA 87347	Sleeve, Support (Used With PWA 87330 Stand)
PWA 87359	Pedestal, Engine Support
PWA 88204	Guide, Piloting
PWA 88222	Fixture, Retainer
PWA 102460	Adapter
PWA 102389	Post, Support (Two Necessary) (Optional To PWA 102393)
PWA 102393	Post, Adjustable Support (Two Necessary) (Optional To PWA 102389)
PWA 102460	Adapter (Use With Mechanical Wrench)
PWA 102727	Support
PWA 103636	Base, Support

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−08

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)

C. Procedure

(1) Position and adjust PWA 102727 Support to engage and hold the fan inlet case at Flange "A" at the 6 o'clock location. If it is necessary because of the height of the engine in the pedestals, first install the Fan Case Support (PWA 102727) in a PWA 103636 Base Support. Attach the Fan Case Support (PWA 102727) to the Base Support (PWA 103636) with the three detail bolts and nuts.

NOTE: If necessary several Base Supports (PWA 103636) can be stacked together. They must be attached to each other with the three detail bolts and nuts.

(2) Install PWA 85062 Saddle to PWA 87359 Pedestal or PWA 26157 Pedestal. Secure saddle to pedestal with ball−lock pin.

(3) Position saddle and pedestal under diffuser case at 6 o'clock location just forward of Flange M. See Figure 302.

(4) Attach PWA 28657 Sling, two PWA 76154 Adapters and hoist to PWA 29243 Brackets on exhaust case at 3 and 9 o'clock.

(5) Adjust pedestal at diffuser case, 6 o'clock location, to support engine.

(6) Raise rear of engine and remove two pedestals from exhaust case location; then lower engine to level position, resting on pedestal at diffuser case. Do not remove sling.

(7) (Post SB PW4ENG 79−76) Remove No. 4 bearing (oil) pressure tube. See Figure 303.

NOTE: It is not necessary to remove the (Pre SB PW4ENG 79−76) No. 4 bearing (oil) pressure tube.

(a) Remove the No. 4 pressure tube (303/10) from the turbine exhaust case at the 4:30 o'clock position.

1 Remove two bolts (303/1) that attach the tube shield (303/16) and bracket (303/2) to the turbine exhaust case.

2 Remove the tube shield (303/16), bracket (303/2), thrust wire (303/18) and nut (303/17) from the outboard end of the pressure tube.

3 Remove the bolt (303/6) and nut (303/12) that attach the tube clamp (303/7) and tube to the bracket (303/8).

4 Cut the restraining straps (303/3) and remove the insulation slide clamp (303/13) and shield sets (303/9) and (303/4) from the tube.

5 Remove the tube nut from the adapter (303/14) and move the tube radially inward and remove the pressure tube from the case.

(b) Install a protective cover on the adapter (303/14).

(c) Secure bolts (303/5) and bracket (303/8) on the turbine exhaust case.

(8) Remove bolts (304/6) securing No. 4 bearing shield (304/5) to turbine exhaust case (rear inner flange) (304/1). Remove shield. Remove No. 4 bearing heat shield (304/4). See Figure 304.

(9) Remove No. 4 bearing cover (304/3).

(a) For No. 4 bearing cover (304/3) that has six small threaded holes (Pre SB PW4ENG 72−385), install the PWA 85307 Jackscrew Puller to the rear inner bolt hole flange (Flange T1) of the exhaust case and attach with two bolts, washers and nut details. Install the small plate of the puller to the six threaded holes in the cover and attach with six knurled screw details. Turn the jackscrew to disengage the cover from the exhaust case. Remove the puller and the cover from the exhaust case. Remove the cover from the puller. Discard the packing (304/2).

(b) For cover that has eight jackscrew holes (Post SB PW4ENG 72−385), install and evenly tighten eight 0.190−32 Jackscrews to remove the cover. Discard the packing (304/2).

(10) (Pre SB PW4ENG 72−472) Remove the No. 4 bearing (oil) nozzle and No. 4 bearing packing transfer tube from boss in the exhaust case (No. 4 bearing compartment) at 1:30 o'clock position. See Figure 305.

(a) Remove bolts (305/8) and key washers (305/6) and (305/7) securing No. 4 bearing packing transfer tube (305/5) to No. 4 bearing nozzle (305/4). Remove tube.

(b) Remove bolts (305/1) and key washers (305/2) and (305/3) securing No. 4 bearing nozzle (305/4) to exhaust case. Remove nozzle.

(11) (Post SB PW4ENG 72−472) Remove the No. 4 bearing (oil) nozzle and front No. 4 bearing nozzle. See Figure 306.

(a) Remove the bolts and key washer (306/1) that attach the front No. 4 bearing nozzle to the No. 4 bearing support flange at the 12 o'clock position. Discard the key washer.

(b) Move the packing transfer tube (306/15) into the elbow of the No. 4 bearing damper supply tube (306/12). Remove the nozzle.

(c) Remove the packing transfer tube from the damper supply tube. Discard the two packings (306/14).

(d) Remove the bolts and key washers (306/16) and (306/17) that attach the No. 4 bearing damper supply tube (306/12) to the No. 4 bearing oil nozzle (306/11). Remove the tube.

(e) Remove the bolts and key washers (306/16) and (306/17) that attach the No. 4 bearing nozzle (306/11) to the exhaust case. Remove the nozzle.

(12) Remove the No. 4 bearing oil scavenge (inner) tube. See Figure 307.

(a) Remove Bolts (307/5 and 307/6) and key washers (307/4 and 307/7). Remove oil scavenge (inner) tube (307/8) from the turbine exhaust case.

(b) Remove and discard gasket (307/3).

(c) Cover hole in tube attachment pad on the case with a protective cover.

(13) Remove eight bolts and tabwashers (308/1) securing bearing retaining plate in rear of front compressor drive turbine shaft (308/2).

(14) Install PWA 86437 Fixture or PWA 86325 Fixture to attach the low pressure turbine shaft to the turbine exhaust case. See Figure 309 (Sheet 1).

NOTE: Use PWA 86325 Fixture with turbine exhaust cases that are (Pre SB PW4ENG 72−456). Use PWA 86437 Fixture with either (Pre or Post SB PW4ENG 72−456) turbine exhaust cases.

(a) Install inner slide (309/5) in ID of No. 4 bearing retaining plate and secure with eight detail screws (309/1).

(b) Install outer slide (309/4) over inner slide, locating slot in outer slide over key on inner slide.

(c) Rotate turbine shaft until scallops in flange of outer slide assembly align oil pressure and scavenge tubes protruding from exhaust case flange. Secure outer slide to exhaust case with eight detail bolts (309/2).

(d) Tighten eight cap screws (309/3).

(15) Install PWA 88222 Fixture or PWA 86437 Fixture to attach the low pressure turbine shaft to the turbine exhaust case. See Figure 309 (Sheet 2).

NOTE: Use PWA 88222 Fixture with (Pre or Post SB PW4ENG 72−456) turbine exhaust cases.

(a) Loosen the locknuts that hold the tube and guide assemblies together and install the fixture to the ID of the turbine exhaust case. The tube assembly detail will mate against the No. 4 bearing retaining plate and the guide assembly detail will mate against the rear inner flange of the exhaust case. Attach the fixture with the captured capscrews of both details.

NOTE: If necessary, turn the LPT rotor to align the holes in the end of the 7th stage disk or LPT shaft, as applicable, with the captured capscrews of the tube assembly detail.

(b) Tighten the capscrews of both details to lock the fixture in position.

(16) Remove key washer retaining ring (310/1) and retaining nut key washer (310/2) securing turbine shaft plug (310/3) at front of coupling. Using PWA 85306 Puller remove plug. Discard packing (310/4). See Figure 310.

(17) Remove retaining ring (310/5) and key washer (310/6) securing turbine shaft nut to LPT shaft.

(18) For operators that use the mechanical wrench, install the turbine shaft nut as follows:

(a) Install PWA 102460 Adapter or PWA 85299 Adapter into LPC/LPT coupling. See Figure 311.

1 Loosen wing nuts (311/1) and slide three clamps (311/2) radially inward.

2 Align keys in adapter with internal slots in coupling and install adapter in coupling. Index adapter as necessary to seat keys in slots in coupling. Slide three clamps radially outward to engage lugs of coupling. Tighten wing nuts to secure clamps.

(b) Install PWA 85300 Wrench, smaller splined end first, into center of PWA 102460 Adapter or PWA 85299 Adapter. Align spline of wrench with spline in ID of turbine shaft nut. Push wrench inward to seat on face of nut.

(c) Using hoist, align splines and slide applicable mechanical wrench over splines of PWA 85300 Wrench. Align anti−torque pins in wrench with bushings in adapter and seat wrench against adapter face. See Table 301 for mechanical wrench options.

NOTE: Wrenches may be actuated using air torque multipliers to speed up removal of nut. Refer to Table 301.

PWA Mechanical Wrench	PWA Torque Multiplier
45418	45419
29614 or 80187	45419 or 80651

Table 301

CAUTION: PWA 80651 TORQUE MULTIPLIER MUST NOT BE USED WITH PWA 45418 WRENCH OR DAMAGE TO WRENCH MAY OCCUR.

(d) Actuate wrench to remove nut from shaft.

(e) Remove wrenches and adapter from coupling.

(f) Remove nut from turbine shaft.

(19) For operators that use the hydraulic wrench, install the turbine shaft nut as follows:

(a) Align boltholes and position PWA 85515 Adapter to rear face of PWA 33732 Wrench or PWA 18872 Wrench. Secure adapter with eight bolts (312/3). See Figure 312.

(b) Using hoist, position wrench and adapter assembly into front end of LPC/LPT coupling. Align teeth of adapter with slots in coupling and slide three clamps (312/1) outward to engage lugs of coupling. Tighten wing nuts (312/2) to secure adapter to coupling.

NOTE: PWA 28815 Cart or PWA 75046 Cart can be used to transport PWA 33732 Wrench or PWA 18872 Wrench and PWA 28814 Pump or PWA 29510 Pump.

(c) Install PWA 85514 Wrench, smaller splined end first, into center of PWA 33732 Wrench or PWA 18872 Wrench. Align spline of wrench with spline in turbine shaft nut (312/4). Push wrench inward to seat on face of nut.

(d) Connect PWA 28814 Electric Pump or PWA 29510 Hand Pump to wrench.

(e) Actuate wrench to remove nut from shaft.

(f) Remove wrenches and adapter from coupling.

(g) Remove nut from turbine shaft.

(20) Remove Flange N lockwire, bolts, nuts and brackets. Refer to 72−00−53, Removal−20 (Task 72−00−53−020−020).

(21) Install PWA 85769 Fixture (Install/Remove) into front end of low pressure turbine shaft. See Figure 313.

(a) Thread plug end of shaft (313/1) into end of turbine shaft until plug bottoms on shoulder of shaft.

(b) Guide body (313/4) and attached parts over previously installed shaft (313/1). Using dowel pin (313/2), retract locking pin. Rotate assembly to position locating plate behind lugs at front end of low pressure turbine coupling. Using dowel pin, release spring loaded locking pin to lock fixture to coupling.

(c) Guide hydraulic cylinder (313/6), threaded end first, over shaft and thread cylinder into body.

(d) Connect PWA 29389 Hydraulic Pump or PWA 3755 Hydraulic Pump to hydraulic cylinder.

(22) Install jackscrews into threaded holes in Flange N.

(23) Apply hydraulic pressure to separate turbine shaft from LPC/LPT coupling and tightening jackscrews to break fit between turbine cases.

(24) Using dowel pin (313/2) retract locking pin into housing. Rotate body (313/4) to position lugs of locator plate between lugs of LPC/LPT coupling. Remove body from coupling. Unthread shaft (313/1) from turbine shaft.

(25) Remove jackscrews from turbine case Flange N.

(26) Thread the puck end of PWA 88204 Guide into the front end of the turbine shaft. See Figure 314.

NOTE: The guide can be separated into two parts if required.

(27) If the fan nut and the turbine shaft coupling are in place, slide the PWA 85785 Adapter, clamp end first, over the PWA 88204 Guide. Install the adapter in the ID of the fan nut. Use the detail clamps to attach the adapter to the coupling lugs. See Figure 314.

(28) Optional, if the fan nut and turbine shaft coupling are not in place, slide the PWA 85785 Adapter, clamp end first, over the PWA 87271 Guide or PWA 85784 Guide. Install the adapter in the 11.120 inch (282.448 mm) diameter of the fan hub. Use the detail clamps to attach the adapter to the flange.

(29) Optional, if the low pressure compressor is not in place, slide the PWA 86210 Adapter, clamp end first, over the PWA 88204 Guide. Use the detail clamps to attach the adapter to the No. 1 bearing support. See Figure 315.

(30) Move turbine assembly rearward approximately 12 inches (304.80 mm). If applicable, retain V−seal gasket located between cases until such time as the low pressure turbine is removed from engine.

(31) Align the center hole in PWA 85996 Front Retainer or PWA 85456 Front Retainer (316/3) with the dowel pin hole in the turbine case. Attach the retainer to the front flange of turbine case at 6 and 12 o'clock locations with four bolts (316/2) and nuts (316/1). Attach the clamps of the retainer to the front compressor drive turbine shaft with two bolts (316/4). See Figure 316.

(32) Use a second hoist and install a nylon sling around the turbine shaft. Take up the slack in the sling.

(33) Move the nylon sling as required and move the assembly rearward. Remove the turbine and exhaust case from the engine.

(34) Remove the V−seal gasket located between the outer flanges of the cases, if applicable.

(35) Remove the PWA 85785 Adapter or PWA 86210 Adapter as applicable.

(36) Remove the guide from the turbine shaft.

(37) Install PWA 85562 Support Sleeve into the shaft support cradles of PWA 25096 Stand or PWA 76270 Stand or PWA 87347 Support Sleeve into the shaft support cradles of PWA 87330 Stand. Position details−1 and −2 forward and details−3 and −5 rearward with details−2 and −3 down. Tighten the set screws to attach the sleeve details to the stand. See Figure 317.

(38) Install PWA 102389 Support Posts or PWA 102393 Adjustable Support Posts onto PWA 87330 Stand.

(39) Place turbine and turbine exhaust case in the stand so that the PWA 29243 Support Brackets align with the support posts. Tighten clamps around turbine shaft and slide chocks inward to contact rear flange of rear turbine case.

NOTE: Chocks are utilized as a safety device and do not support any portion of assembly.

(40) Remove hoist, sling, adapters and brackets from turbine exhaust case.

(41) Remove nylon sling and hoist from turbine shaft.

(42) Remove turbine shaft (classified) spacer using PWA 85298 Puller. See Figure 318.

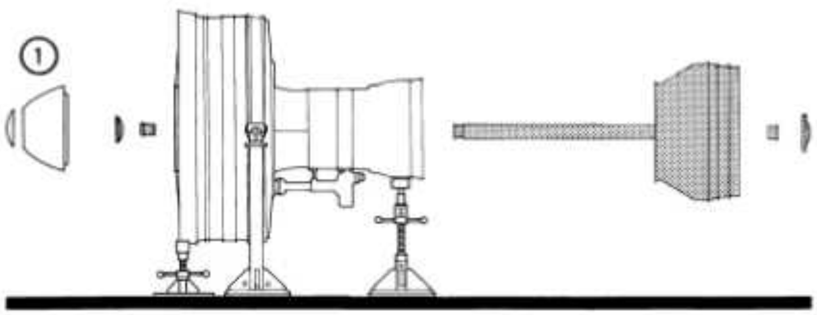
(a) Loosen bolts and slide puller legs inward.

(b) Position puller over LPT shaft and slide legs outward, locating legs in puller groove of spacer. Tighten bolts to secure legs.

(c) Hold threaded bolt at center of puller and turn large hex head nut to remove spacer from end of turbine shaft.

(43) Lubricate the spline area at the front end of the turbine shaft with Engine Oil P03−001. If the shaft is not coated in the area forward or rearward of the spline, lubricate these areas also.

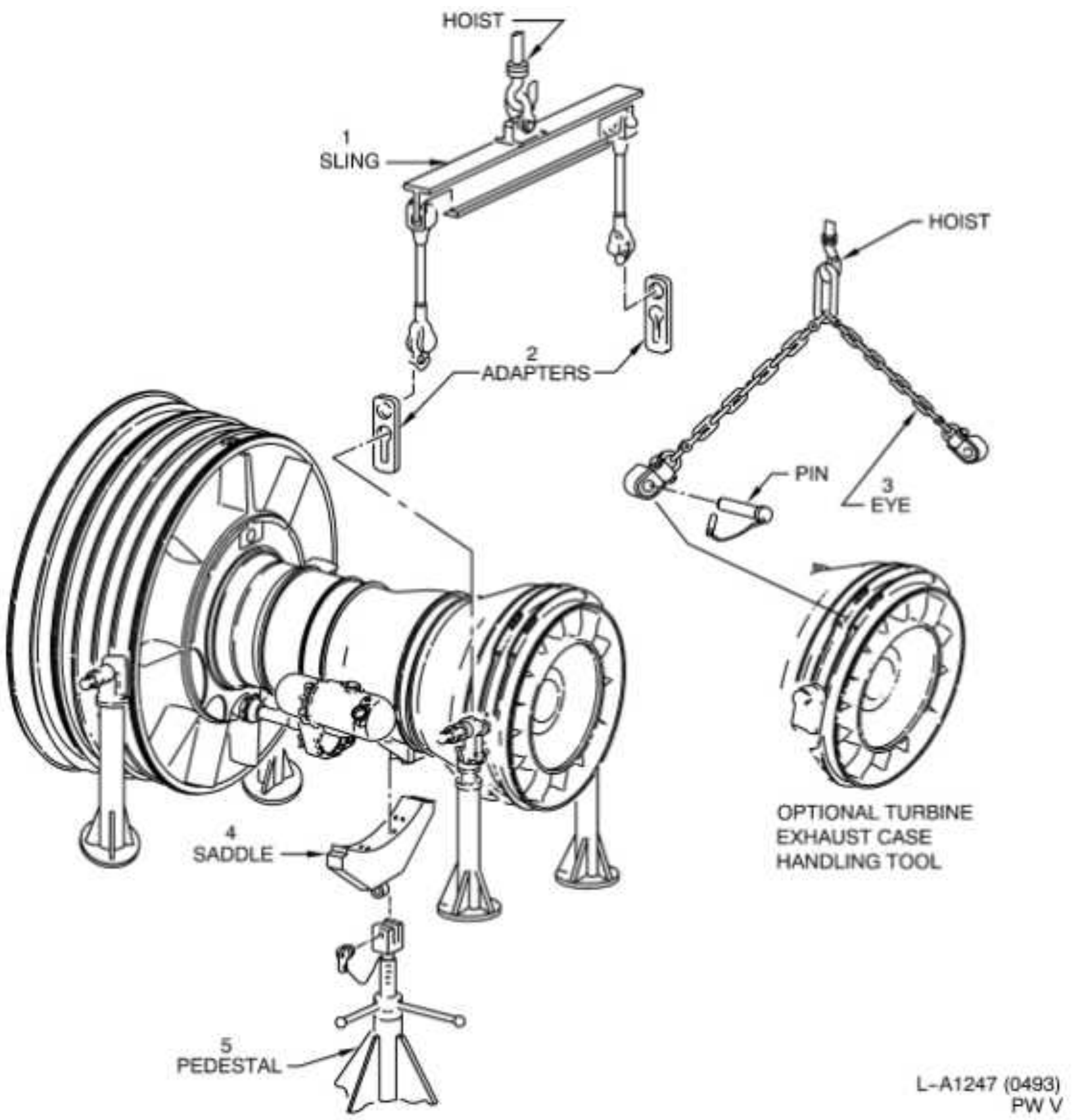
ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−08



1. REMOVE COMPRESSOR INLET CONE

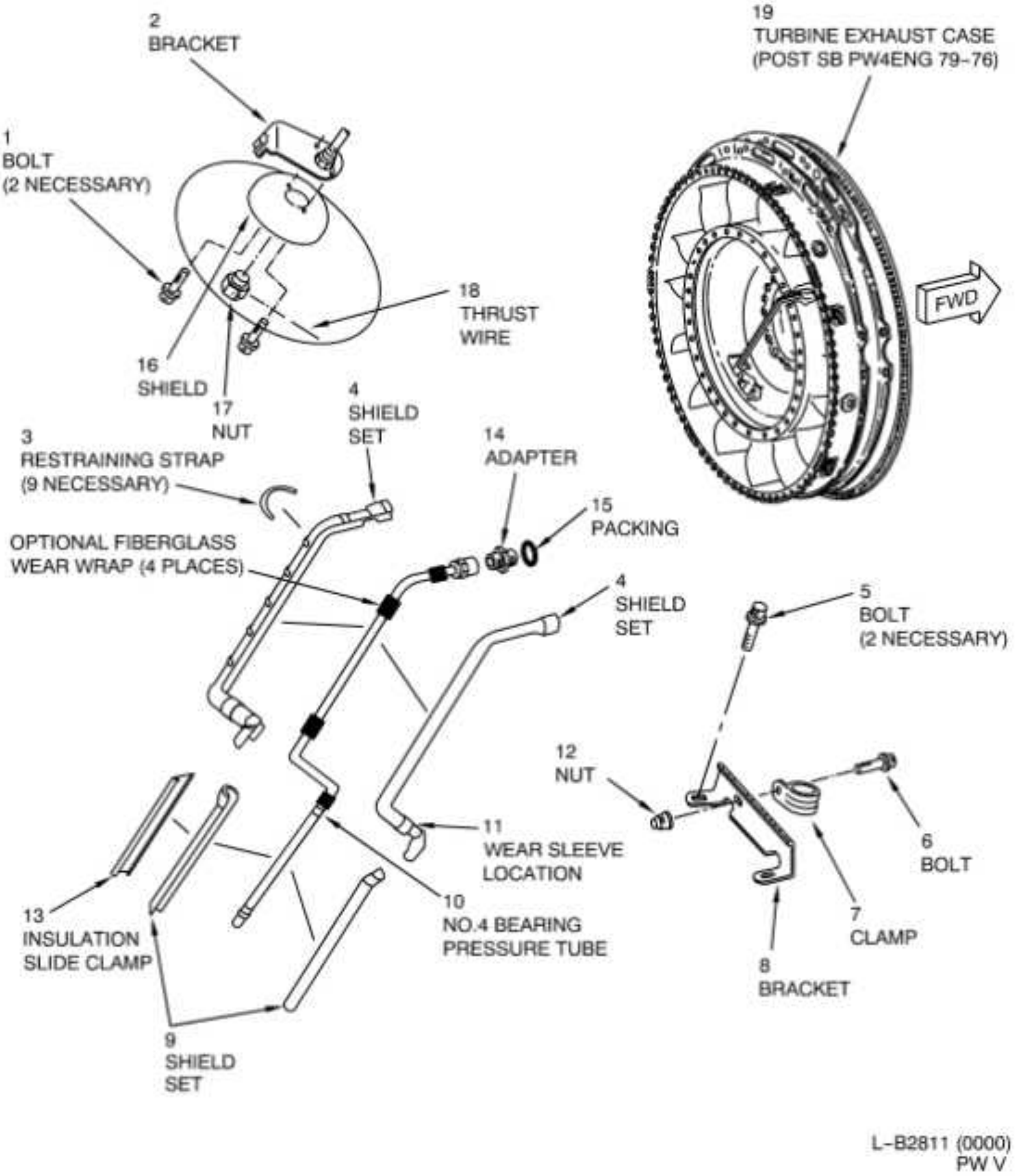
L-A1307 (0498)

Procedure Sequence
Figure 301
(Task 72−00−53−020−002)

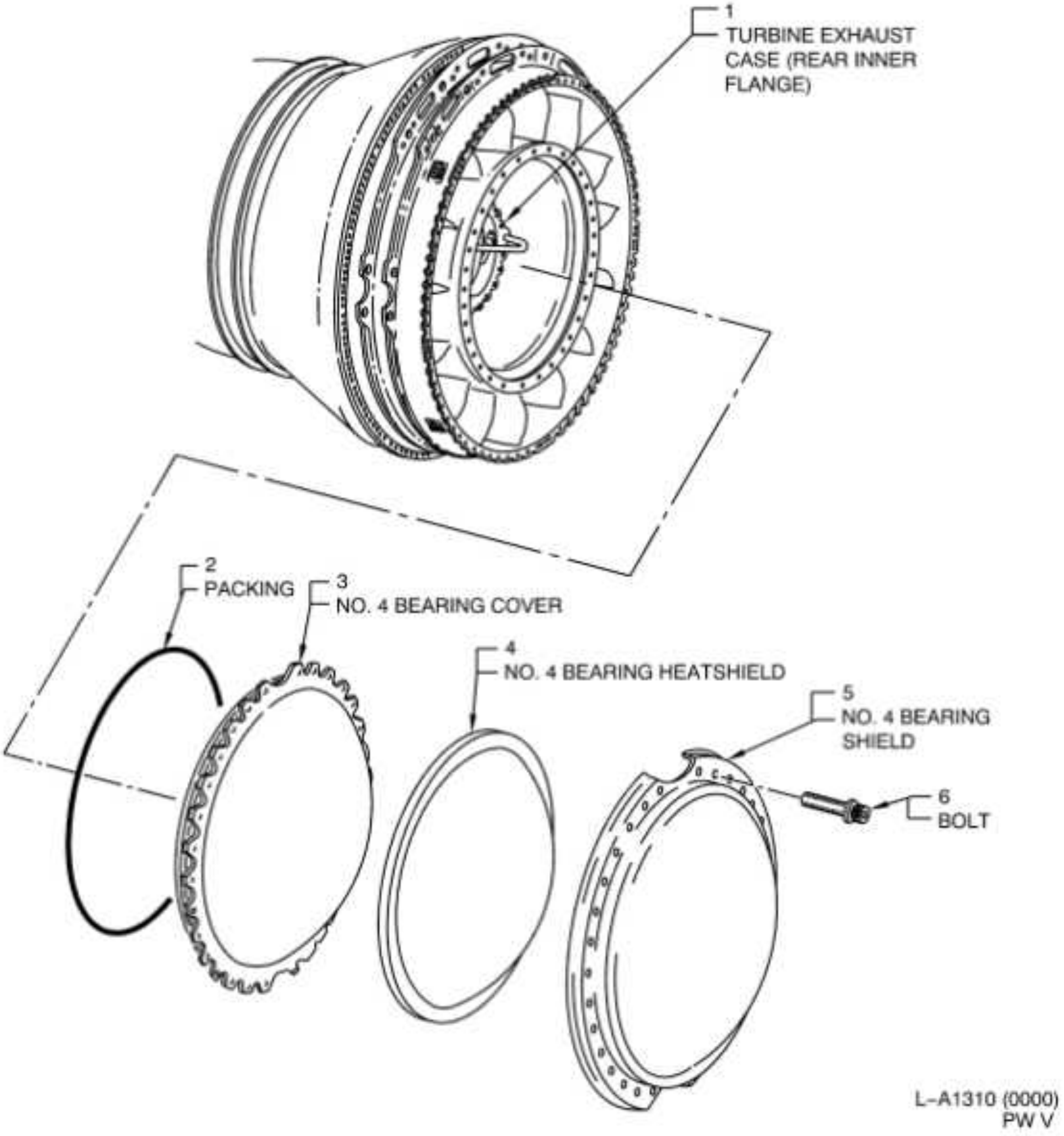

HOIST
1
SLING
HOIST
2
ADAPTERS
PIN
3
EYE
4
SADDLE
OPTIONAL TURBINE
EXHAUST CASE
HANDLING TOOL
5
PEDESTAL
L-A1247 (0493)
PW V

1. PWA 28657 Sling
2. PWA 76154 Adapter (Two Necessary)
3. PWA 85452 Eye, Lifting
4. PWA 85062 Saddle, Support
5. PWA 26157 Or PWA 87359 Pedestal

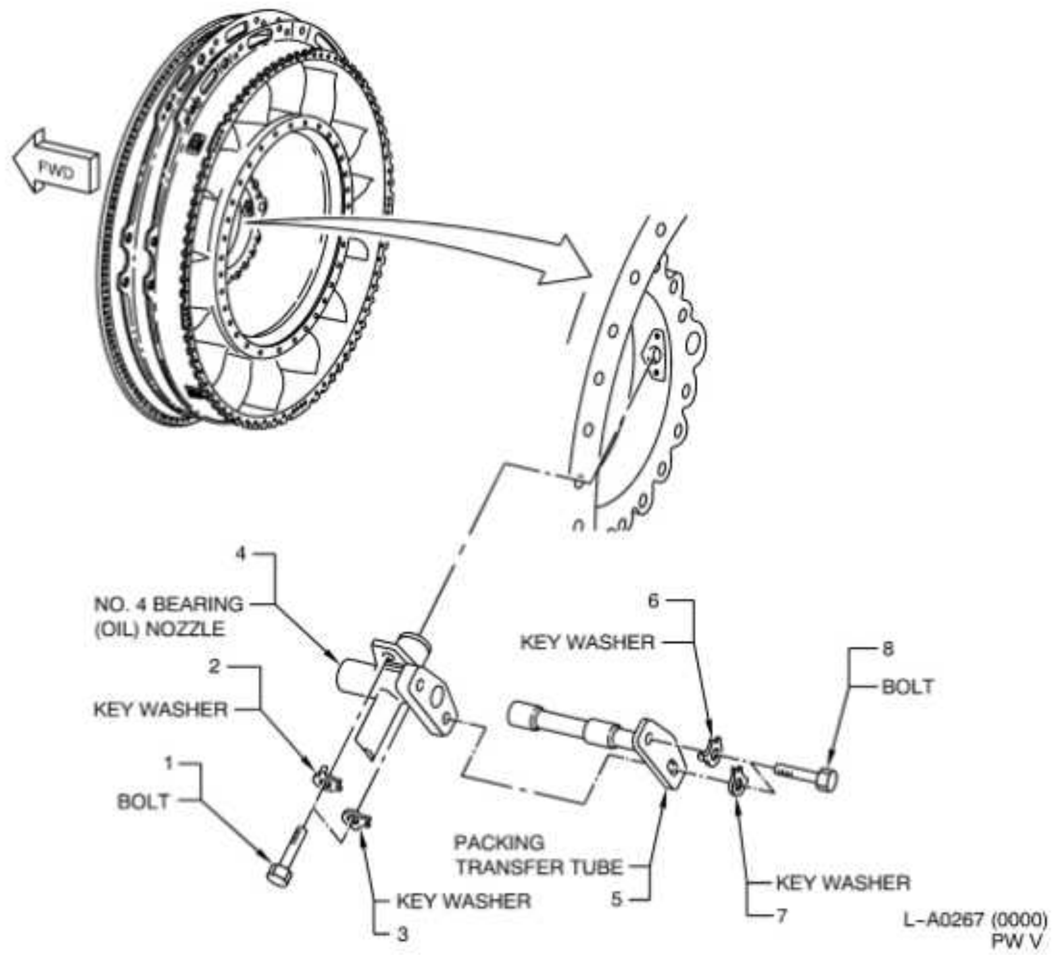
Low Pressure Turbine And Exhaust Case Removal
Figure 302
(Task 72-00-53-020-002)


2
BRACKET
1
BOLT
(2 NECESSARY)
19
TURBINE EXHAUST CASE
(POST SB PW4ENG 79-76)
FWD
18
THRUST
WIRE
16
SHIELD
17
NUT
4
SHIELD
SET
3
RESTRAINING STRAP
(9 NECESSARY)
14
ADAPTER
15
PACKING
OPTIONAL FIBERGLASS
WEAR WRAP (4 PLACES)
4
SHIELD
SET
5
BOLT
(2 NECESSARY)
12
NUT
6
BOLT
11
WEAR SLEEVE
LOCATION
7
CLAMP
13
INSULATION
SLIDE CLAMP
10
NO.4 BEARING
PRESSURE TUBE
8
BRACKET
9
SHIELD
SET
L-B2811 (0000)
PW V

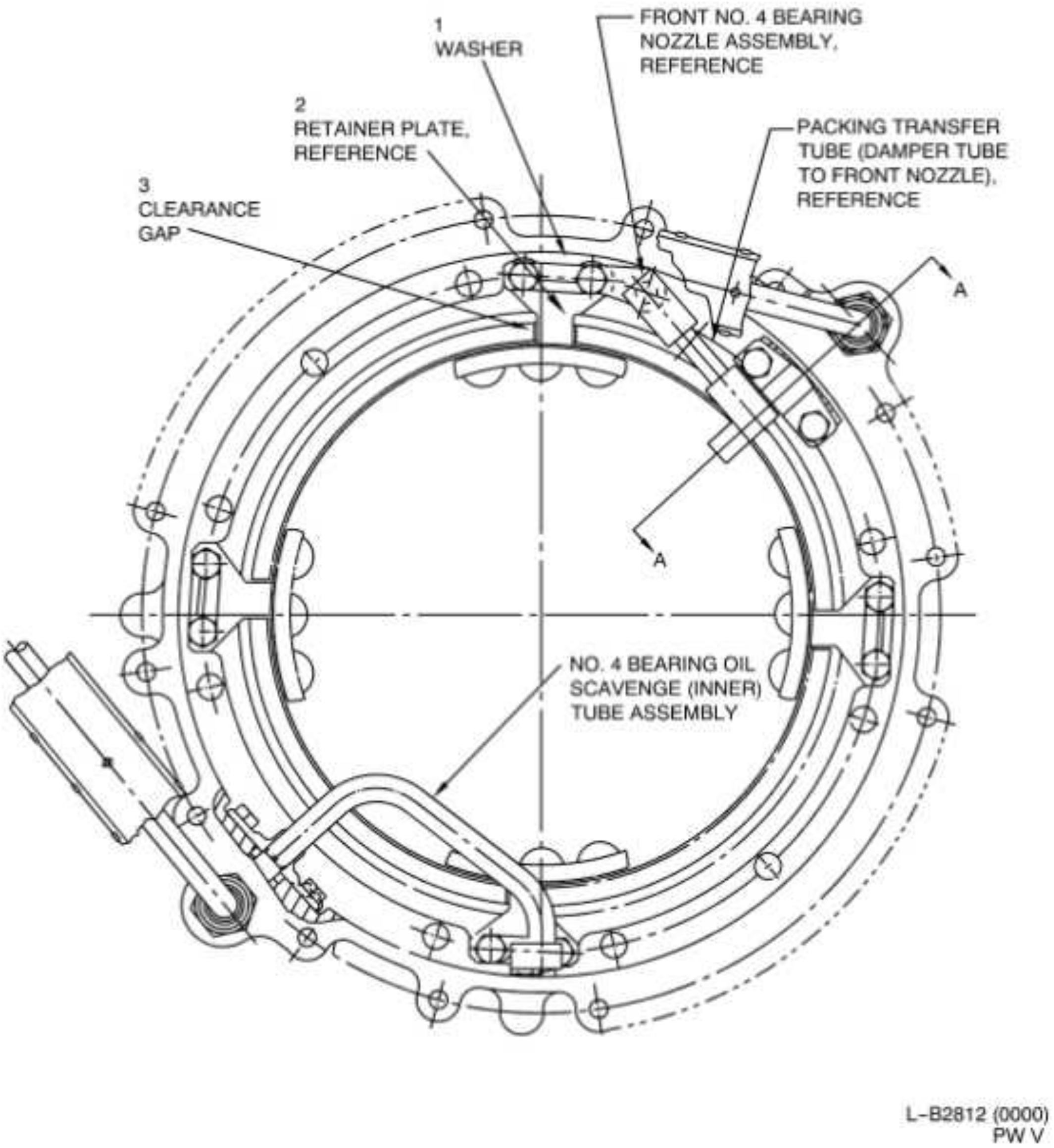
N0. 4 Bearing Pressure Tube Removal
Figure 303
(Task 72−00−53−020−002)


1
TURBINE EXHAUST CASE (REAR INNER FLANGE)
2
PACKING
3
NO. 4 BEARING COVER
4
NO. 4 BEARING HEATSHIELD
5
NO. 4 BEARING SHIELD
6
BOLT
L−A1310 (0000)
PW V

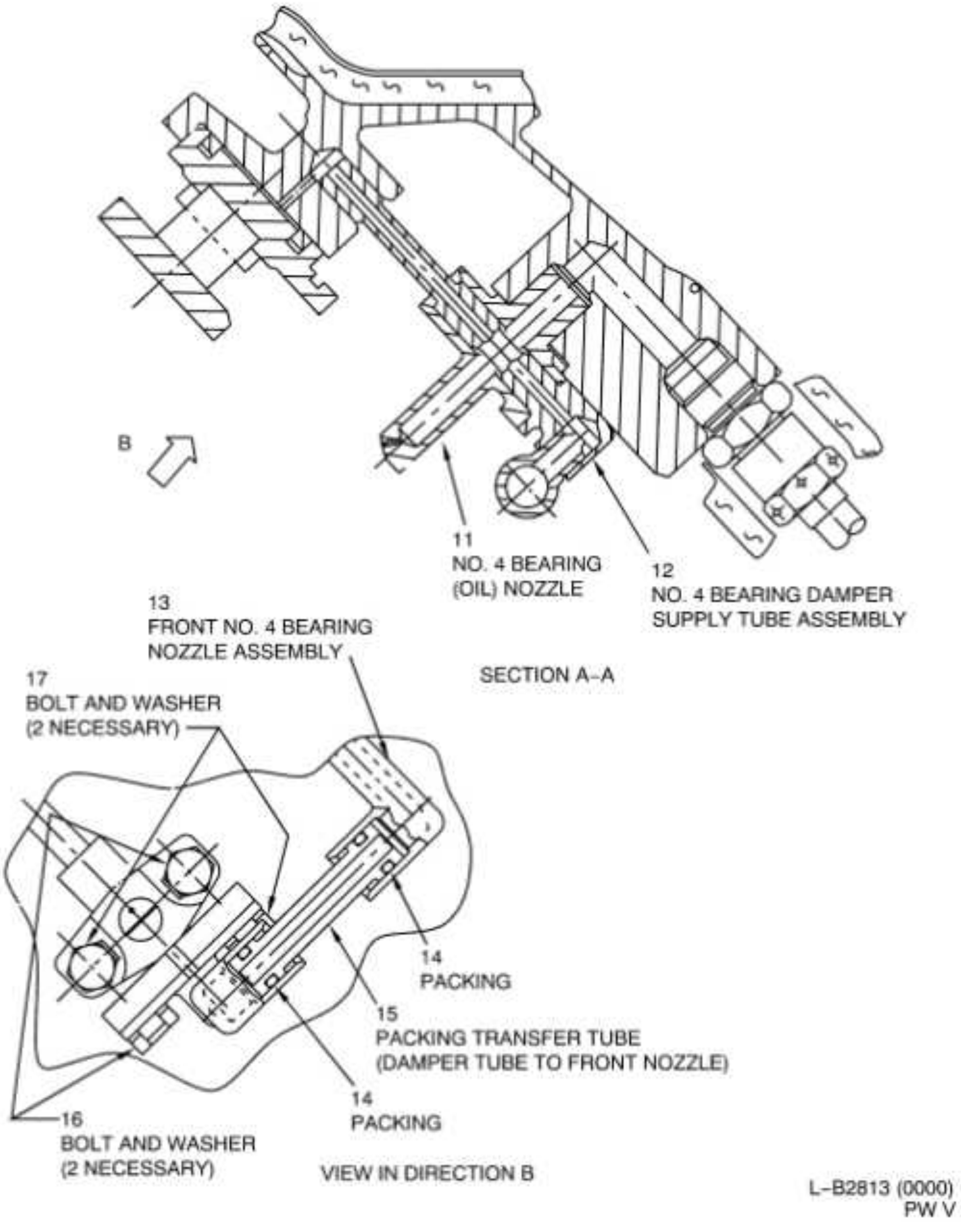
No. 4 Bearing Shield And Cover Removal
Figure 304
(Task 72−00−53−020−002)


FWD
4
NO. 4 BEARING (OIL) NOZZLE
2
KEY WASHER
1
BOLT
KEY WASHER
3
6
KEY WASHER
8
BOLT
PACKING TRANSFER TUBE
5
KEY WASHER
7
L-A0267 (0000)
PW V

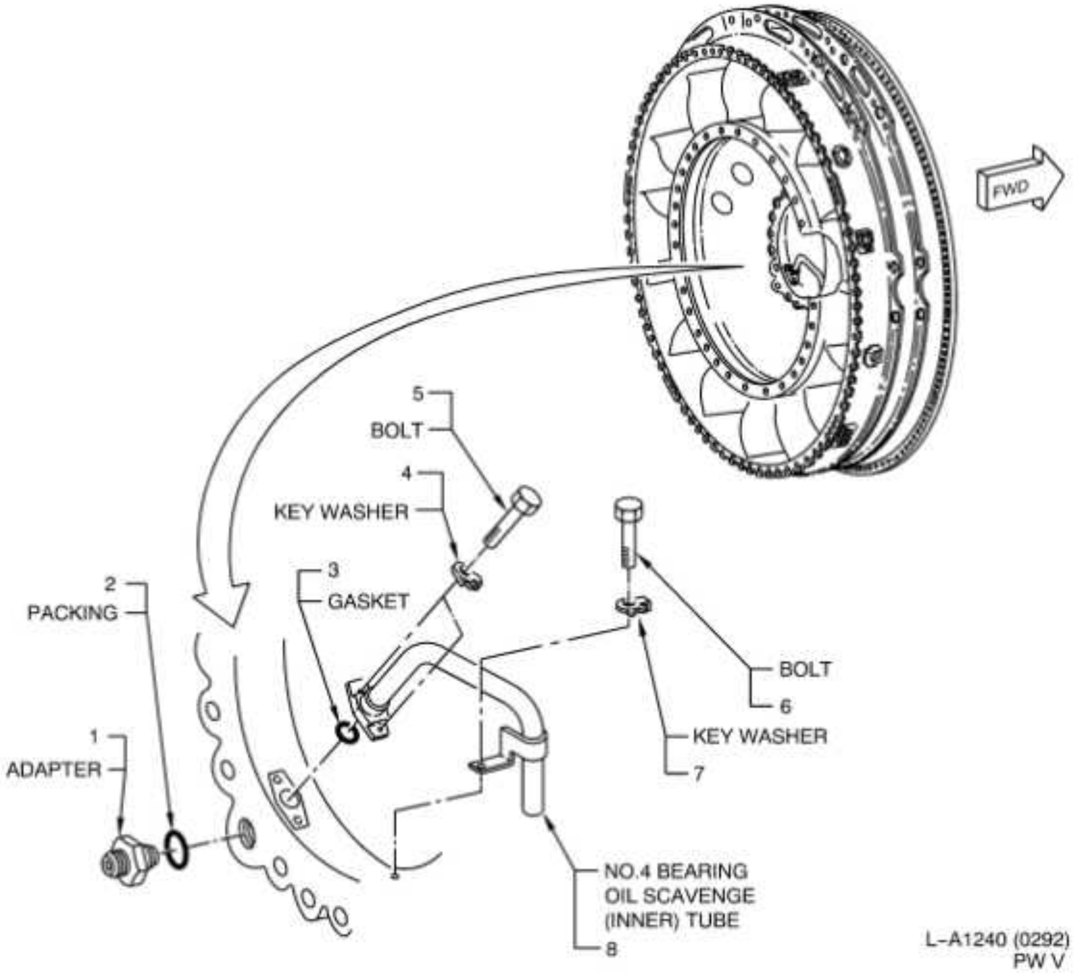
No. 4 Bearing (Oil) Nozzle Removal (Pre SB PW4ENG 72−472)
Figure 305
(Task 72−00−53−020−002)


1
WASHER
FRONT NO. 4 BEARING NOZZLE ASSEMBLY, REFERENCE
2
RETAINER PLATE, REFERENCE
PACKING TRANSFER TUBE (DAMPER TUBE TO FRONT NOZZLE), REFERENCE
3
CLEARANCE GAP
A
A
NO. 4 BEARING OIL SCAVENGE (INNER) TUBE ASSEMBLY
L−B2812 (0000)
PW V

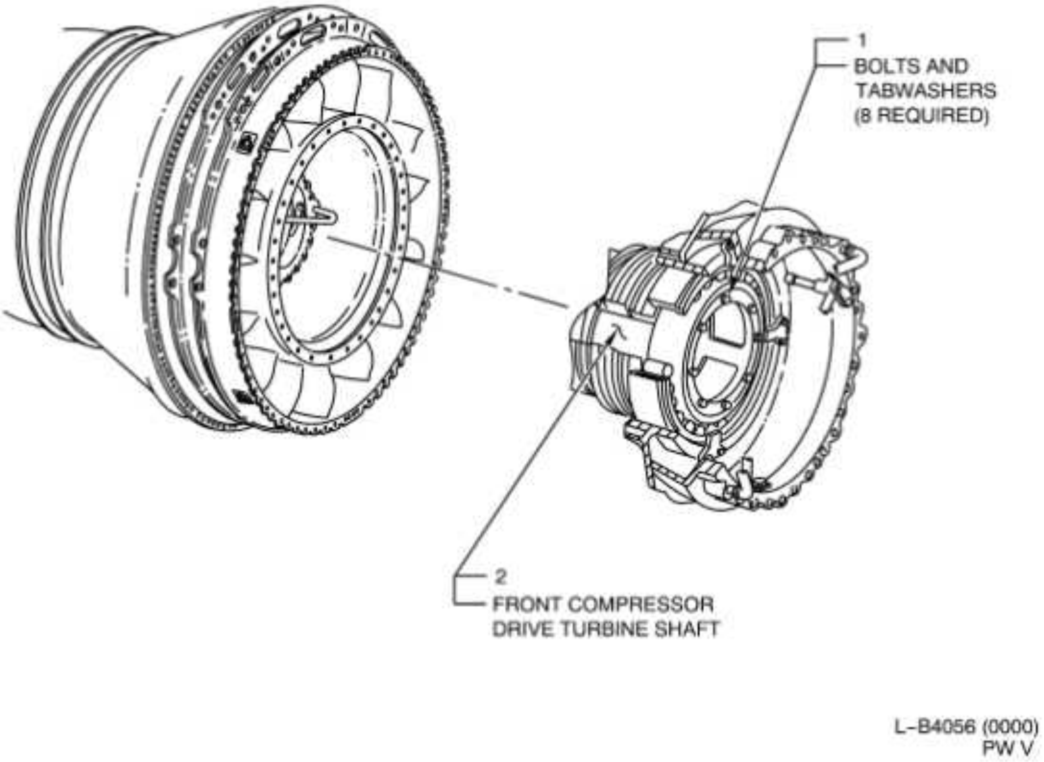
No. 4 Bearing (Oil) Nozzles Removal (Post SB PW4ENG 72−472)
Figure 306 (Sheet 1)
(Task 72−00−53−020−002)


B
11
NO. 4 BEARING
(OIL) NOZZLE
12
NO. 4 BEARING DAMPER
SUPPLY TUBE ASSEMBLY
13
FRONT NO. 4 BEARING
NOZZLE ASSEMBLY
SECTION A-A
17
BOLT AND WASHER
(2 NECESSARY)
14
PACKING
15
PACKING TRANSFER TUBE
(DAMPER TUBE TO FRONT NOZZLE)
14
PACKING
16
BOLT AND WASHER
(2 NECESSARY)
VIEW IN DIRECTION B
L-B2813 (0000)
PW V

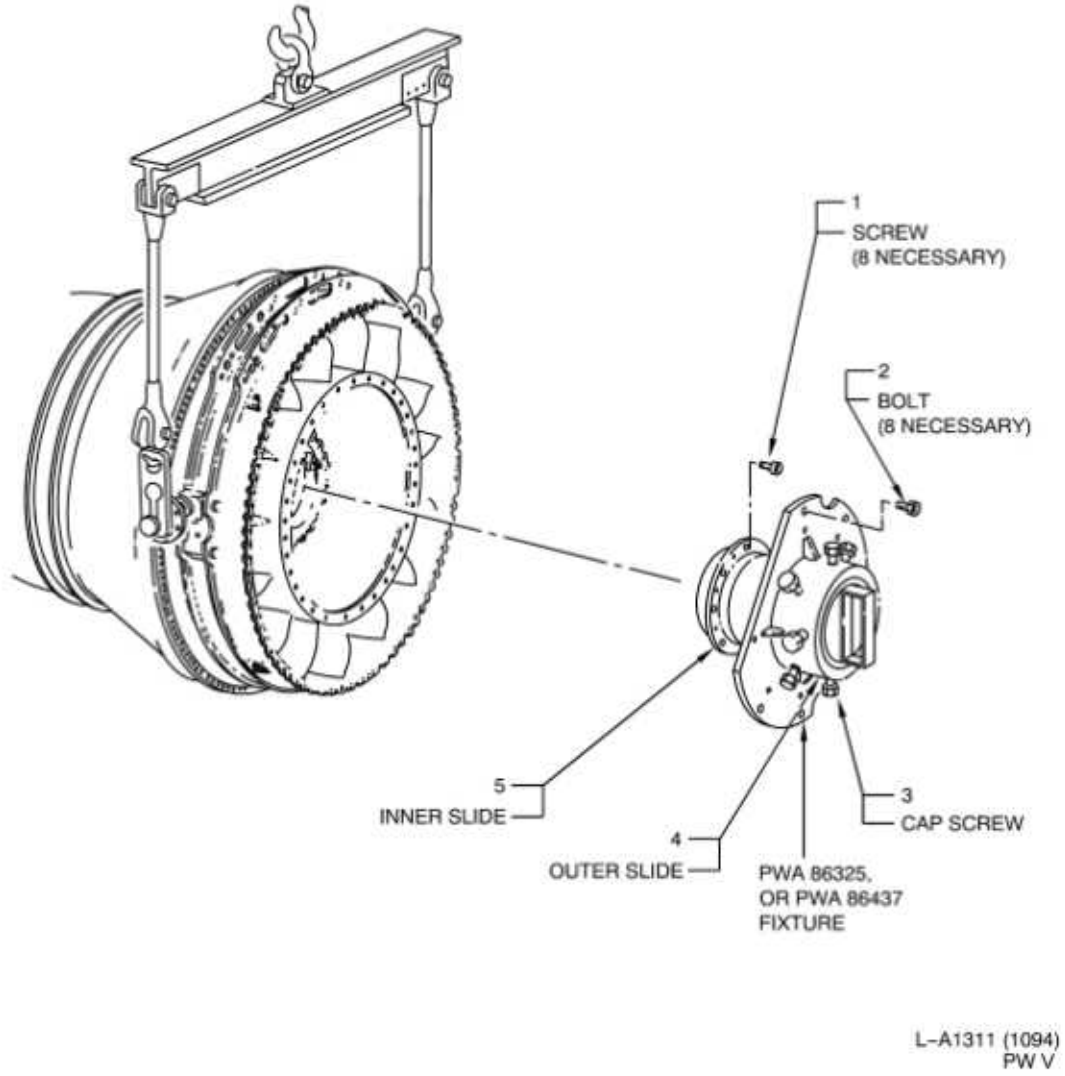
No. 4 Bearing (Oil) Nozzles Removal (Post SB PW4ENG 72-472)
Figure 306 (Sheet 2)
(Task 72-00-53-020-002)


FWD
5
BOLT
4
KEY WASHER
3
GASKET
2
PACKING
1
ADAPTER
BOLT
6
KEY WASHER
7
NO.4 BEARING
OIL SCAVENGE
(INNER) TUBE
8
L-A1240 (0292)
PW V

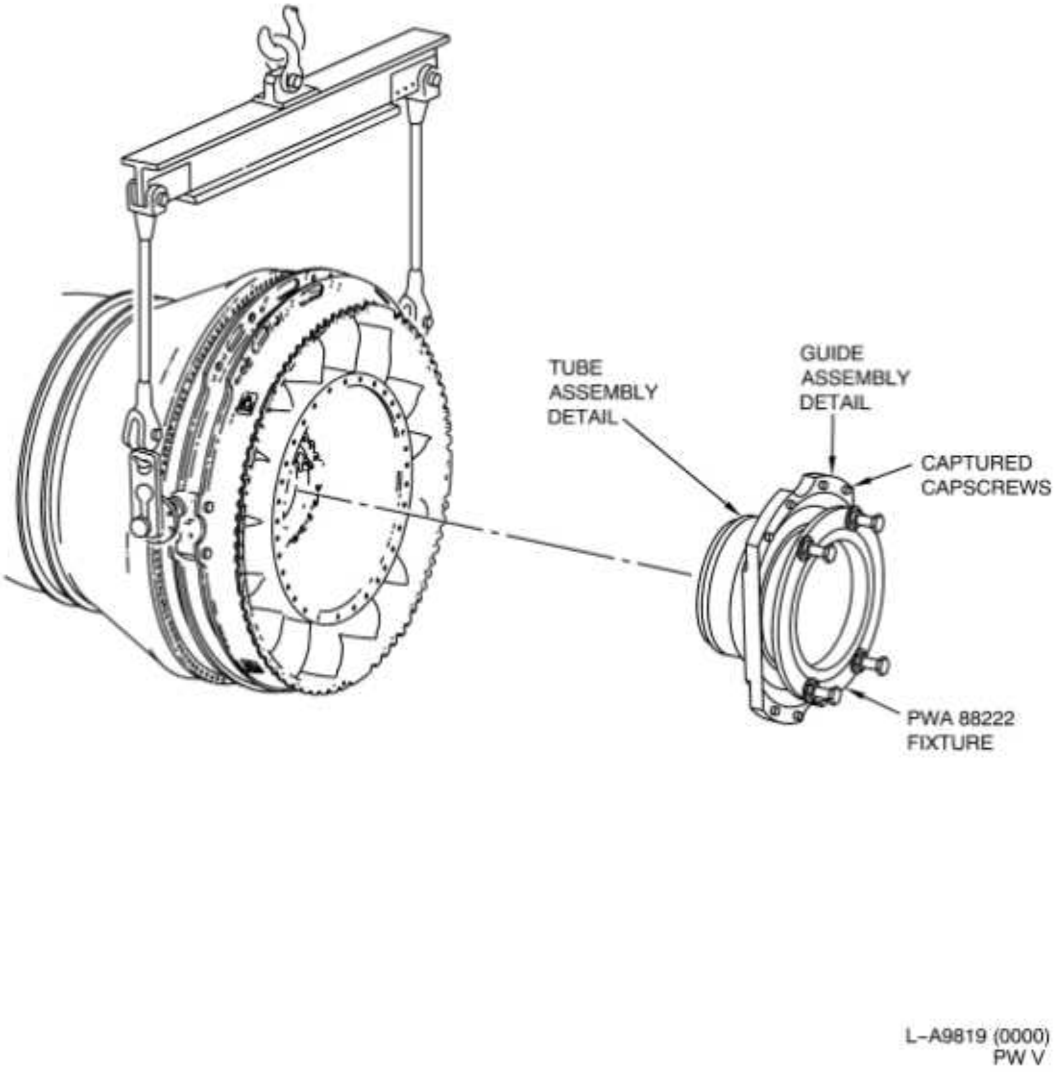
No. 4 Bearing Oil (Inner) Scavenge Tube Removal
Figure 307
(Task 72-00-53-020-002)


1
BOLTS AND
TABWASHERS
(8 REQUIRED)
2
FRONT COMPRESSOR
DRIVE TURBINE SHAFT
L-B4056 (0000)
PW V

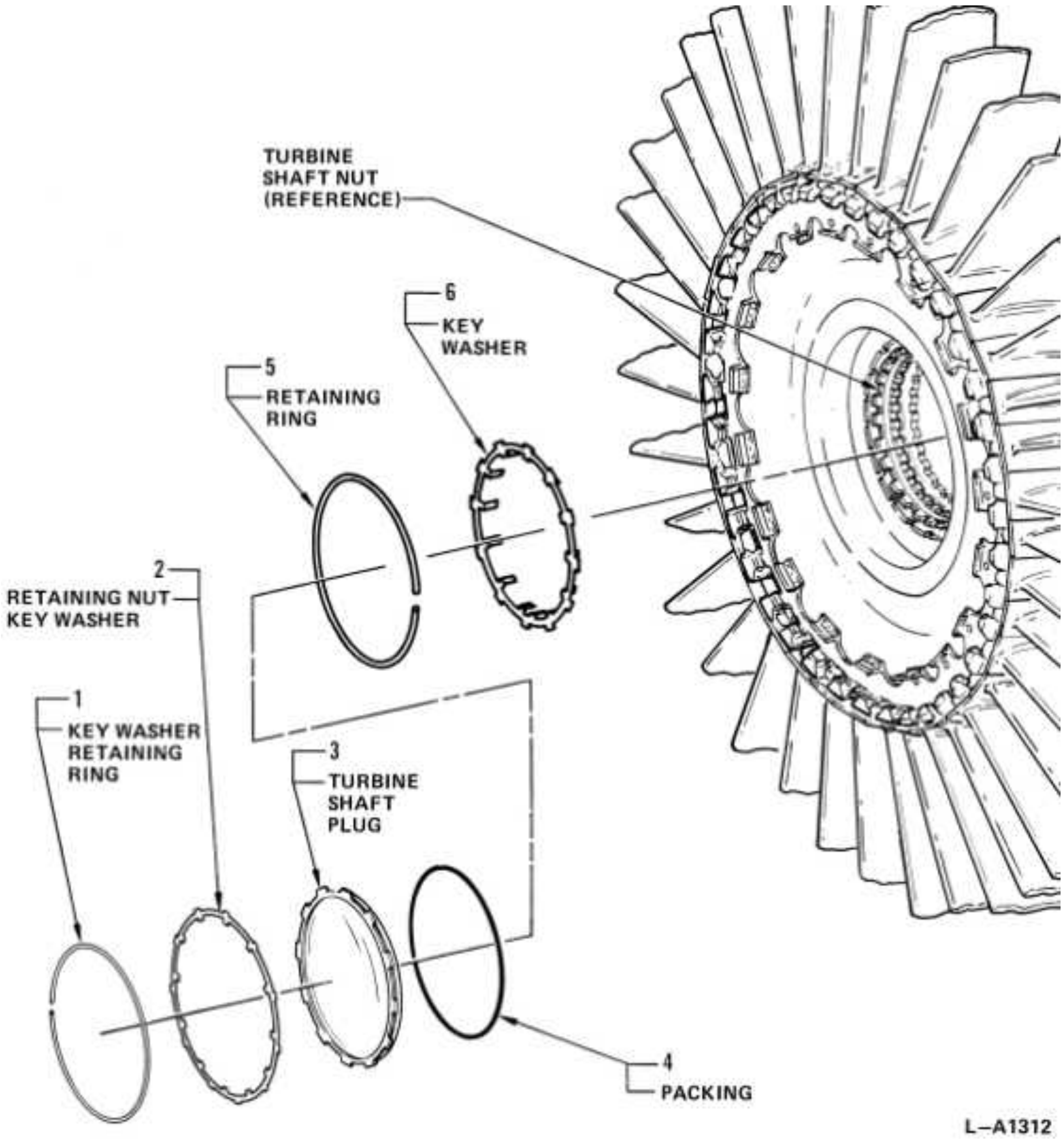
Bearing Retaining Plate Bolts And Tabwashers Removal
Figure 308
(Task 72-00-53-020-002)


1
SCREW
(8 NECESSARY)
2
BOLT
(8 NECESSARY)
3
CAP SCREW
4
OUTER SLIDE
5
INNER SLIDE
PWA 86325,
OR PWA 86437
FIXTURE
L−A1311 (1094)
PW V

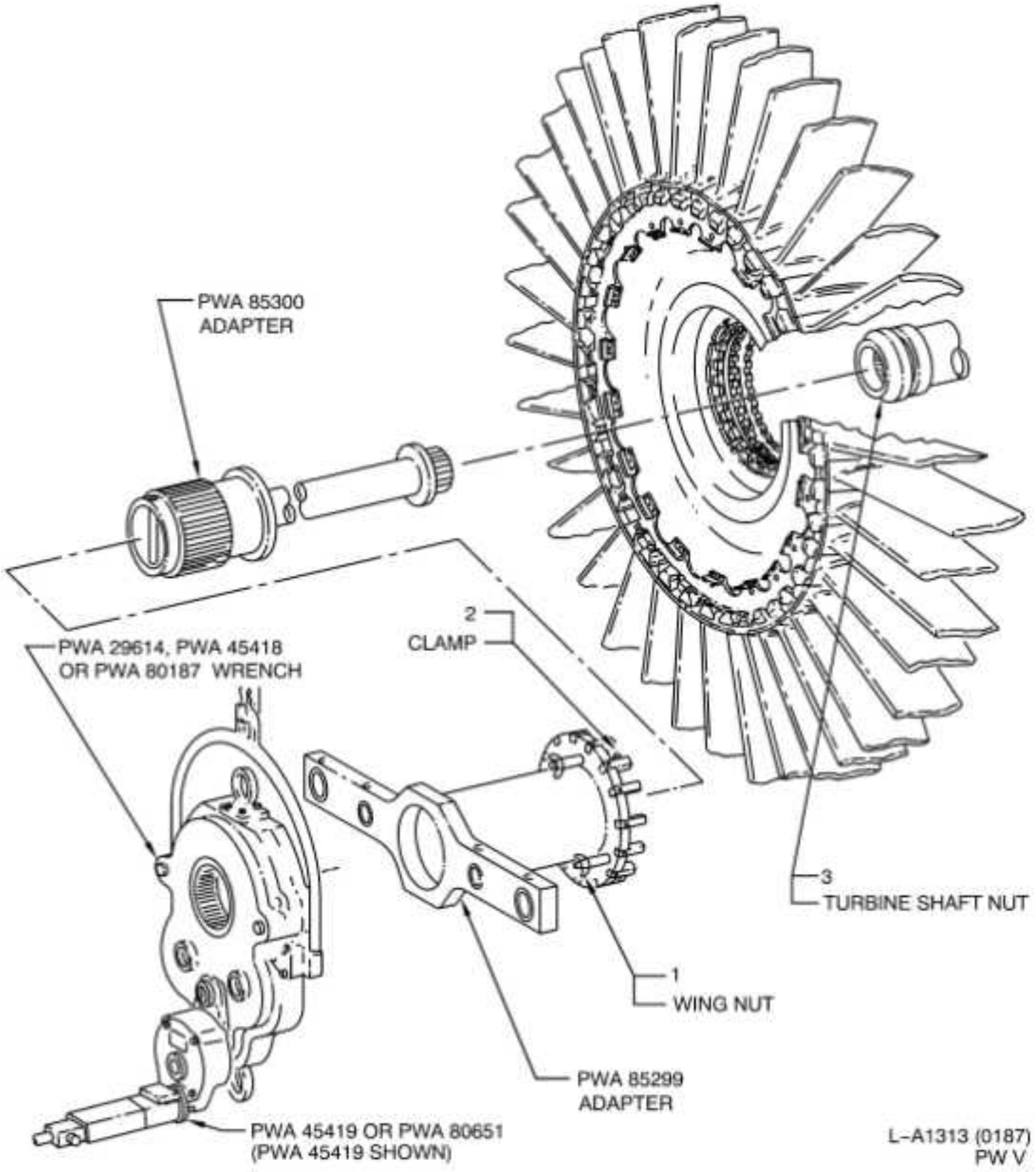
Low Pressure Turbine Rear Retainer Installation
Figure 309 (Sheet 1)
(Task 72−00−53−020−002)


TUBE ASSEMBLY DETAIL
GUIDE ASSEMBLY DETAIL
CAPTURED CAPSCREWS
PWA 88222 FIXTURE
L−A9819 (0000)
PW V

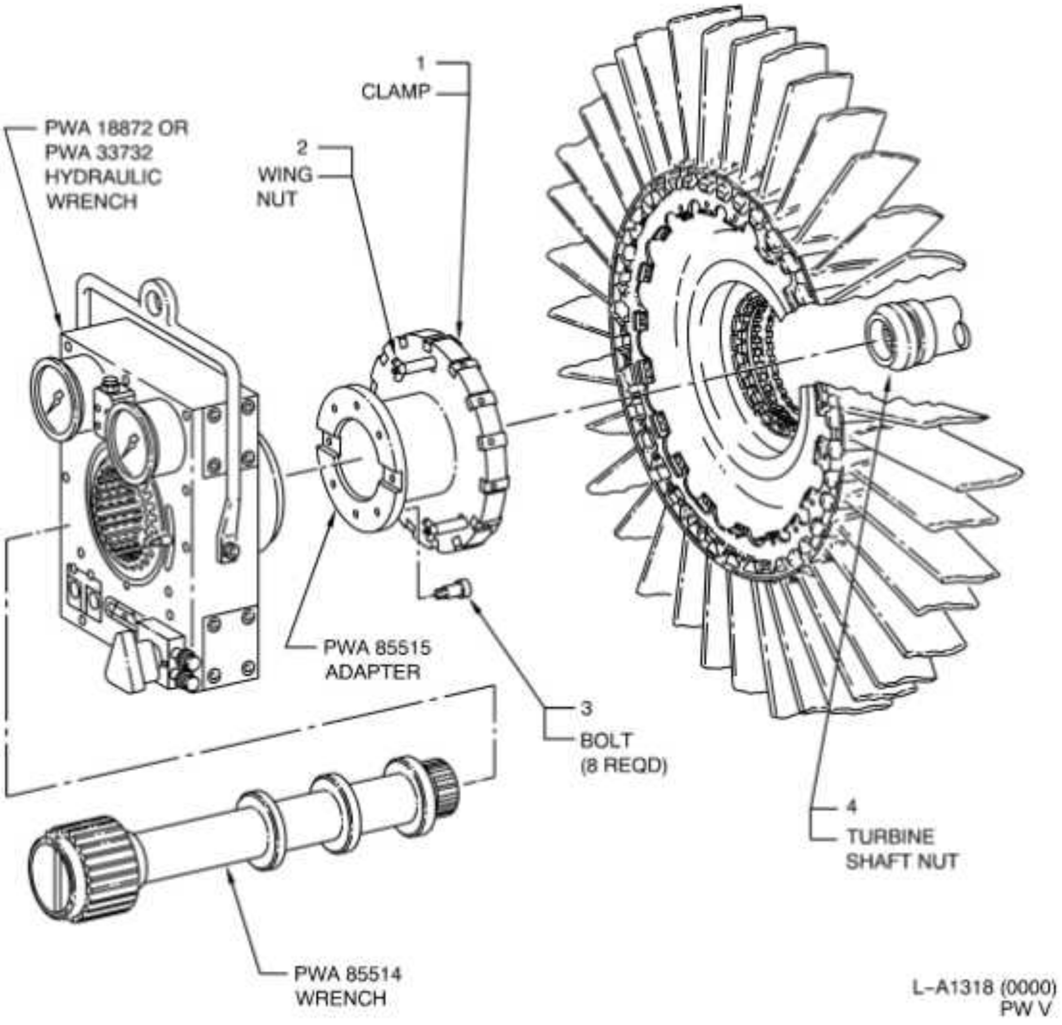
Low Pressure Turbine Rear Retainer Installation
Figure 309 (Sheet 2)
(Task 72−00−53−020−002)


TURBINE SHAFT NUT (REFERENCE)
6
KEY WASHER
5
RETAINING RING
2
RETAINING NUT KEY WASHER
1
KEY WASHER RETAINING RING
3
TURBINE SHAFT PLUG
4
PACKING
L−A1312

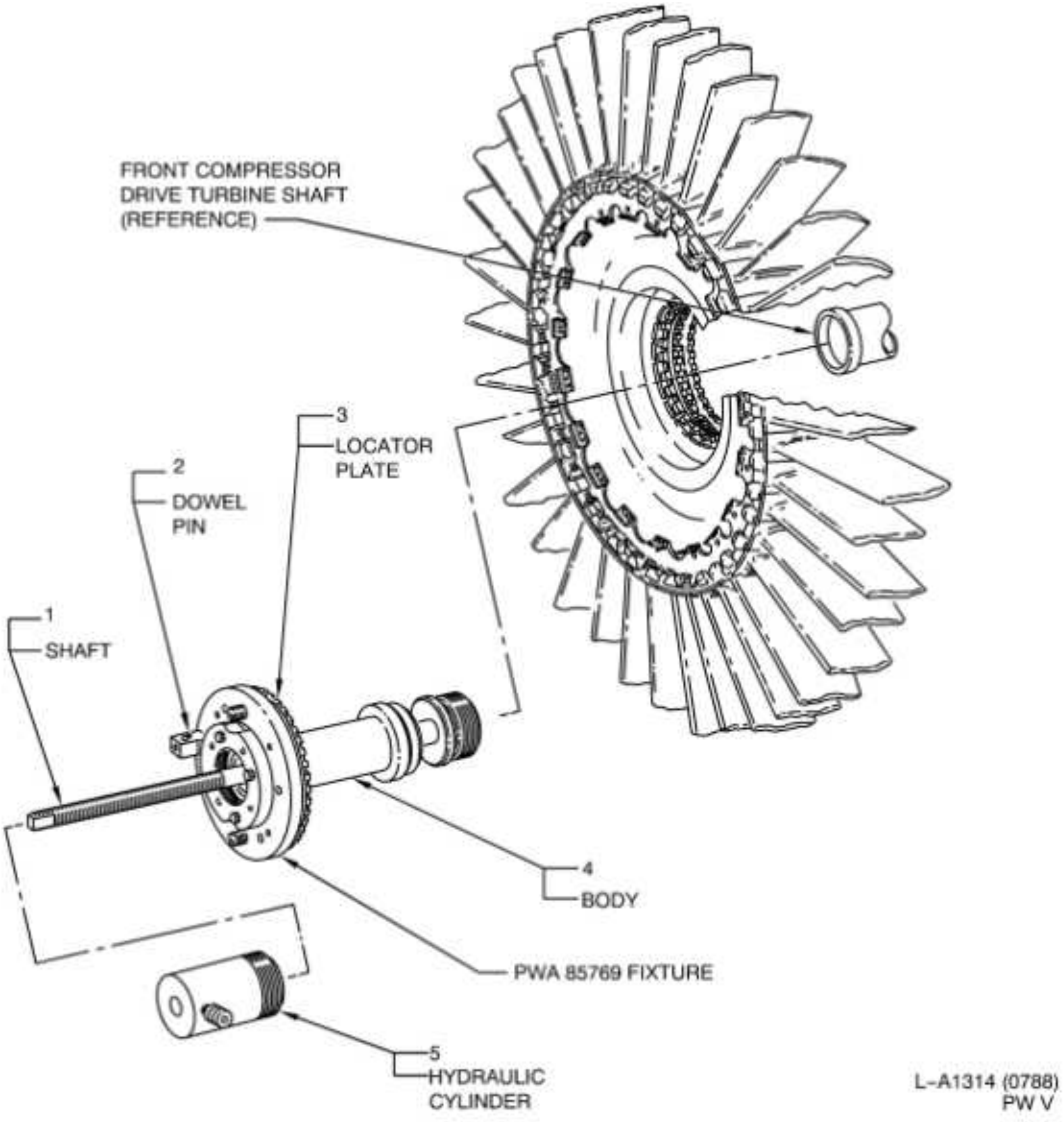
Turbine Shaft Plug And Turbine Shaft Nut Key Washer Removal
Figure 310
(Task 72−00−53−020−002)


PWA 85300
ADAPTER
2
CLAMP
PWA 29614, PWA 45418
OR PWA 80187 WRENCH
3
TURBINE SHAFT NUT
1
WING NUT
PWA 85299
ADAPTER
PWA 45419 OR PWA 80651
(PWA 45419 SHOWN)
L-A1313 (0187)
PW V

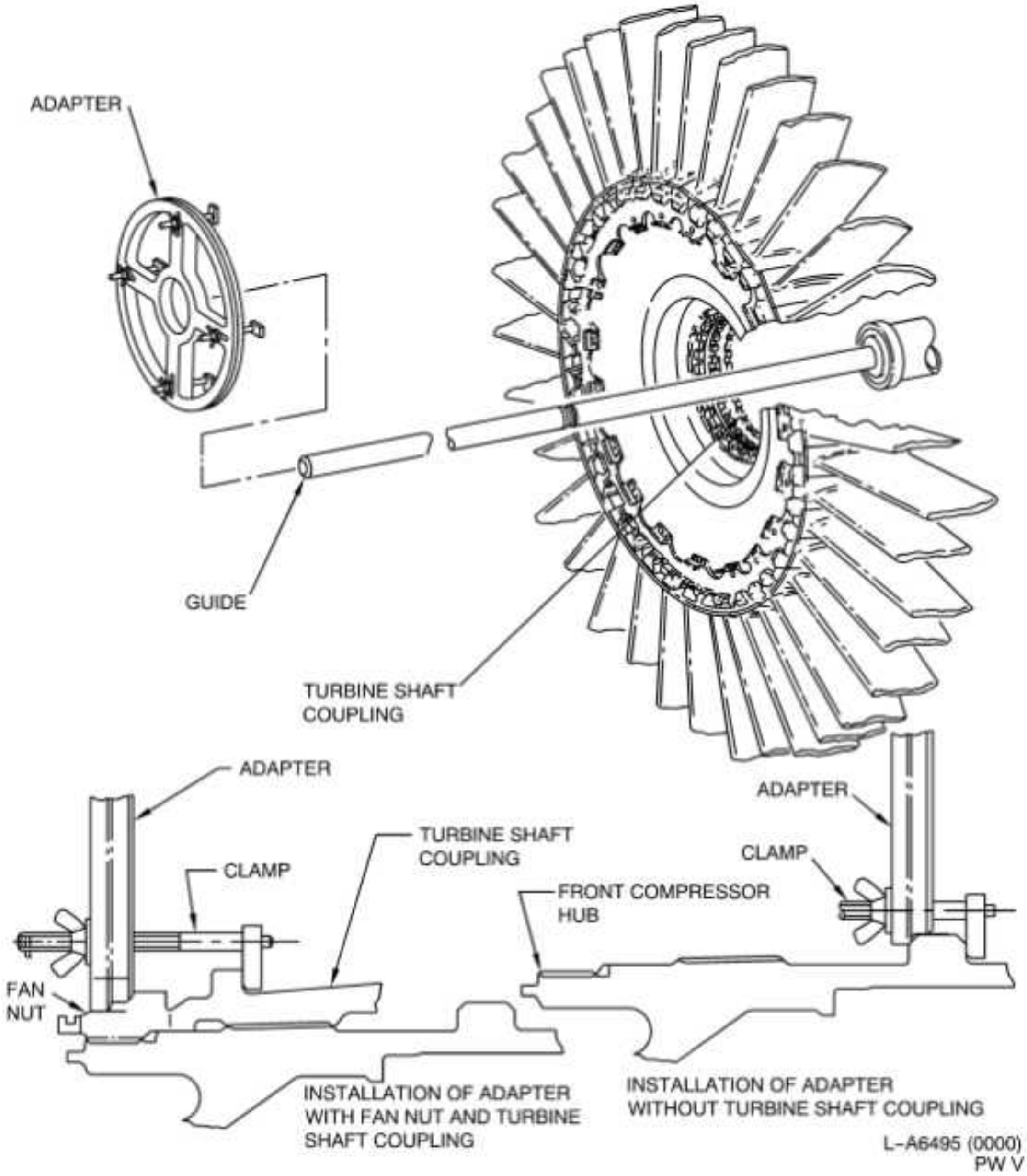
Turbine Shaft Nut Removal (Mechanical Wrench)
Figure 311
(Task 72-00-53-020-002)


1
CLAMP
PWA 18872 OR
PWA 33732
HYDRAULIC
WRENCH
2
WING
NUT
PWA 85515
ADAPTER
3
BOLT
(8 REQD)
4
TURBINE
SHAFT NUT
PWA 85514
WRENCH
L-A1318 (0000)
PW V

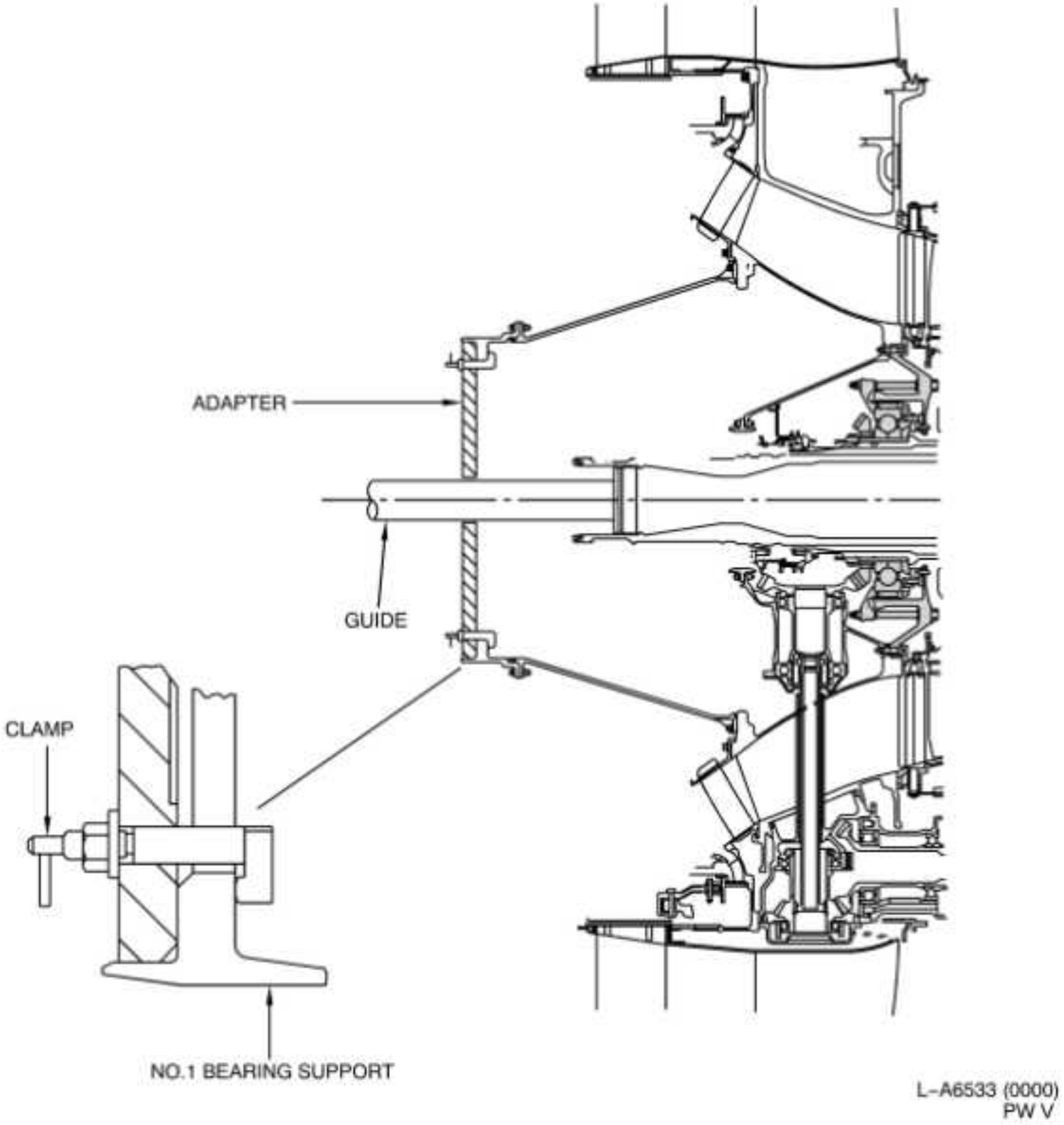
Turbine Shaft Nut Removal (Hydraulic Wrench)
Figure 312
(Task 72-00-53-020-002)


FRONT COMPRESSOR DRIVE TURBINE SHAFT (REFERENCE)
3
LOCATOR PLATE
2
DOWEL PIN
1
SHAFT
4
BODY
PWA 85769 FIXTURE
5
HYDRAULIC CYLINDER
L-A1314 (0788)
PW V

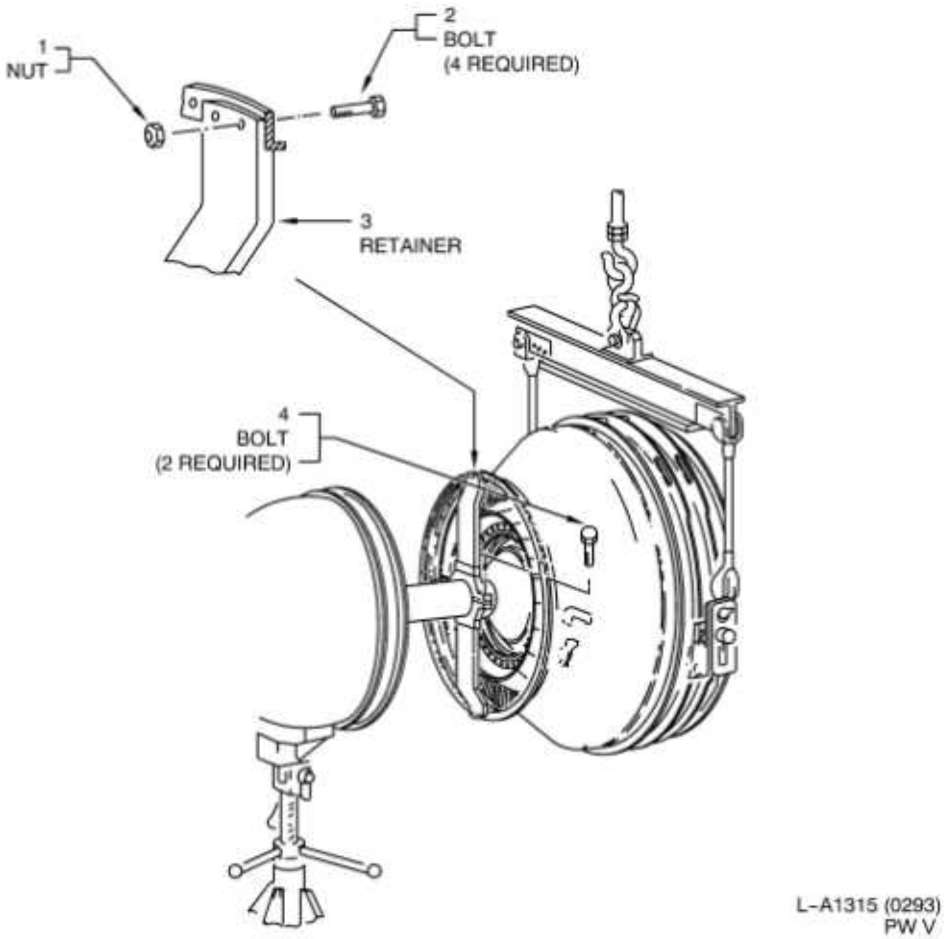
Low Pressure Turbine And Turbine Exhaust Case Removal
Figure 313
(Task 72−00−53−020−002)


ADAPTER
GUIDE
TURBINE SHAFT COUPLING
ADAPTER
CLAMP
TURBINE SHAFT COUPLING
FAN NUT
FRONT COMPRESSOR HUB
ADAPTER
CLAMP
INSTALLATION OF ADAPTER WITH FAN NUT AND TURBINE SHAFT COUPLING
INSTALLATION OF ADAPTER WITHOUT TURBINE SHAFT COUPLING
L-A6495 (0000)
PW V

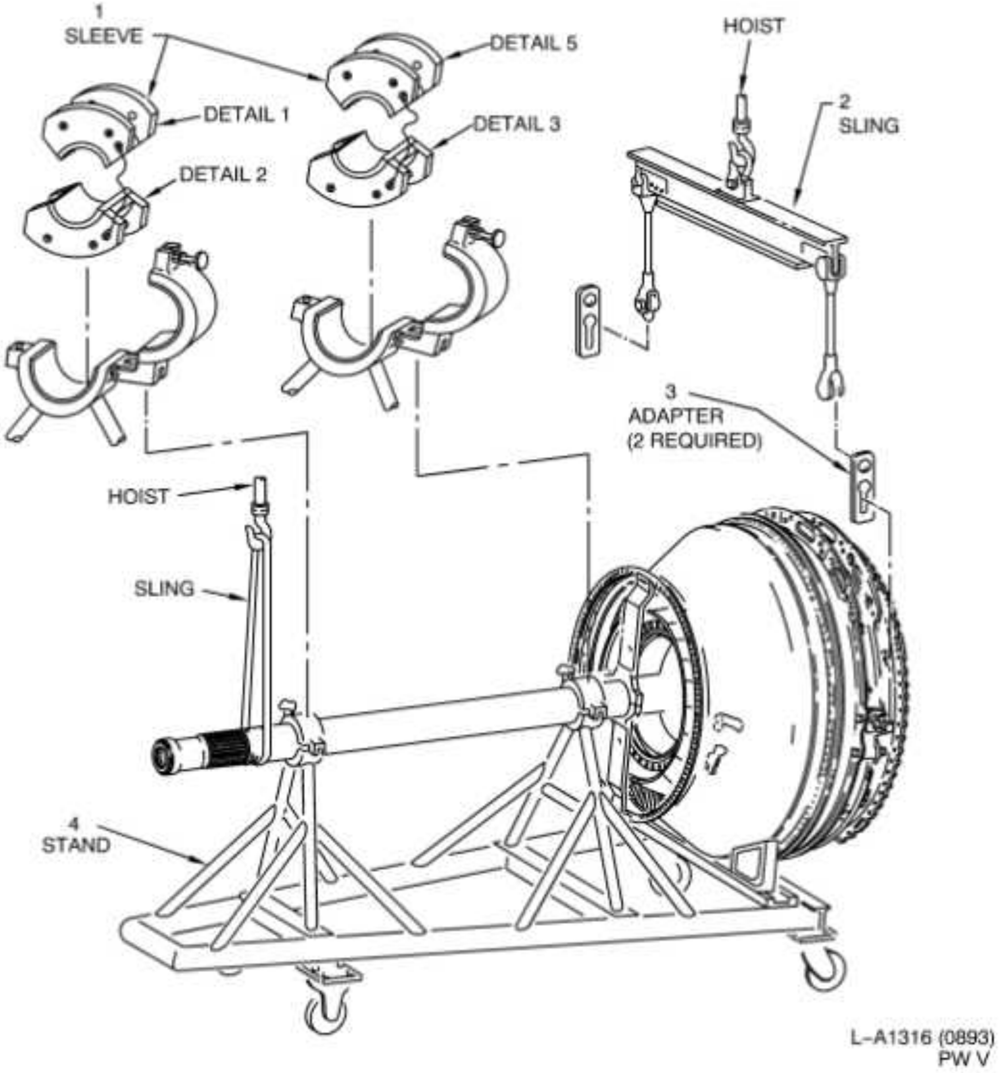
PWA 88204 Guide And PWA 85785 Adapter Installation
Figure 314
(Task 72−00−53−020−002)


ADAPTER
GUIDE
CLAMP
NO.1 BEARING SUPPORT
L−A6533 (0000)
PW V

PWA 88204 Guide And PWA 86210 Adapter Installation
Figure 315
(Task 72−00−53−020−002)

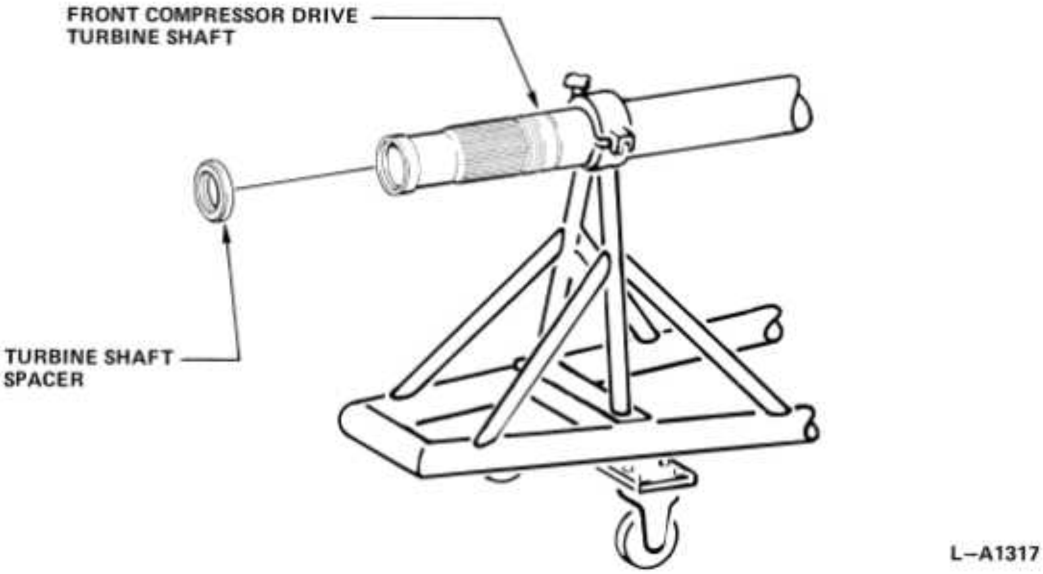

1
NUT
2
BOLT
(4 REQUIRED)
3
RETAINER
4
BOLT
(2 REQUIRED)
L-A1315 (0293)
PW V

Low Pressure Turbine Front Retainer Installation
Figure 316
(Task 72-00-53-020-002)


1
SLEEVE
DETAIL 5
DETAIL 1
DETAIL 3
DETAIL 2
HOIST
2
SLING
3
ADAPTER
(2 REQUIRED)
HOIST
SLING
4
STAND
L-A1316 (0893)
PW V

1. PWA 85562 Sleeve (Used With PWA 25096 Or PWA 76270 Stand)
   Or PWA 87347 Sleeve (Used With PWA 87330 Stand)
2. PWA 28657 Sling
3. PWA 76154 Adapter, Two Required
4. PWA 25096, PWA 76270 Or PWA 87330 Stand

Installation Of Low Pressure Turbine
And Turbine Exhaust Case In Stand
Figure 317
(Task 72-00-53-020-002)


FRONT COMPRESSOR DRIVE TURBINE SHAFT
TURBINE SHAFT SPACER
L-A1317

Turbine Shaft Spacer Removal
Figure 318
(Task 72-00-53-020-002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - REMOVAL-09

Task 72-00-53-020-002-002:

1. Remove The Low Pressure Turbine And Turbine Exhaust Case With Shaft (Hydraulic Wrench) - Deleted

A. Procedure

(1) This procedure is relocated to 72-00-53, Removal-08 (Task 72-00-53-020-002).

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−20

Task 72−00−53−020−020:

1. Remove The Flange N Brackets And Hardware

   A. Equipment And Materials Necessary − None

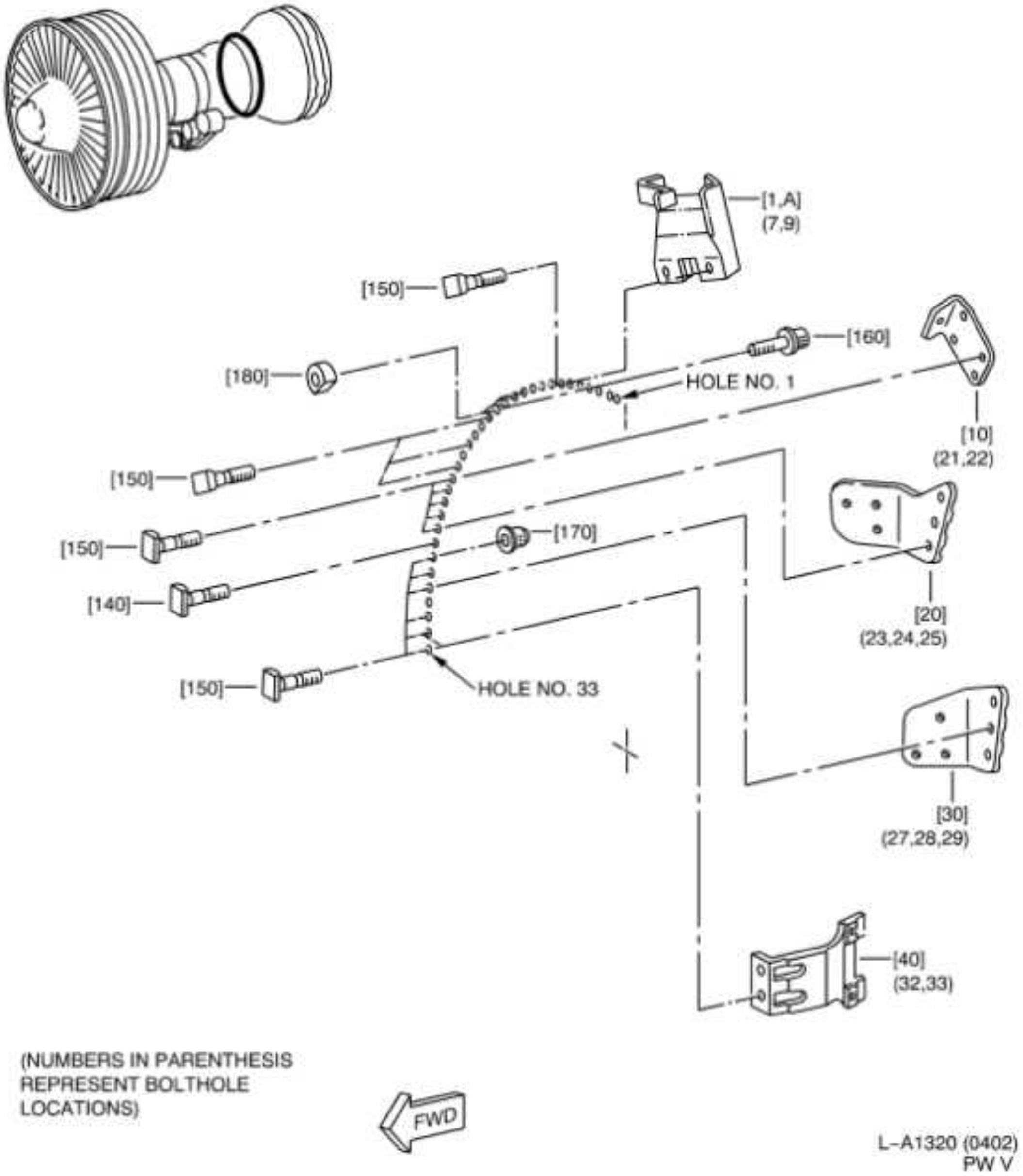
   B. Procedure

      (1) Remove the Flange N brackets as follows. See Figure 301.

         (a) Tag and identify the flange N hardware for the correct bolthole locations.

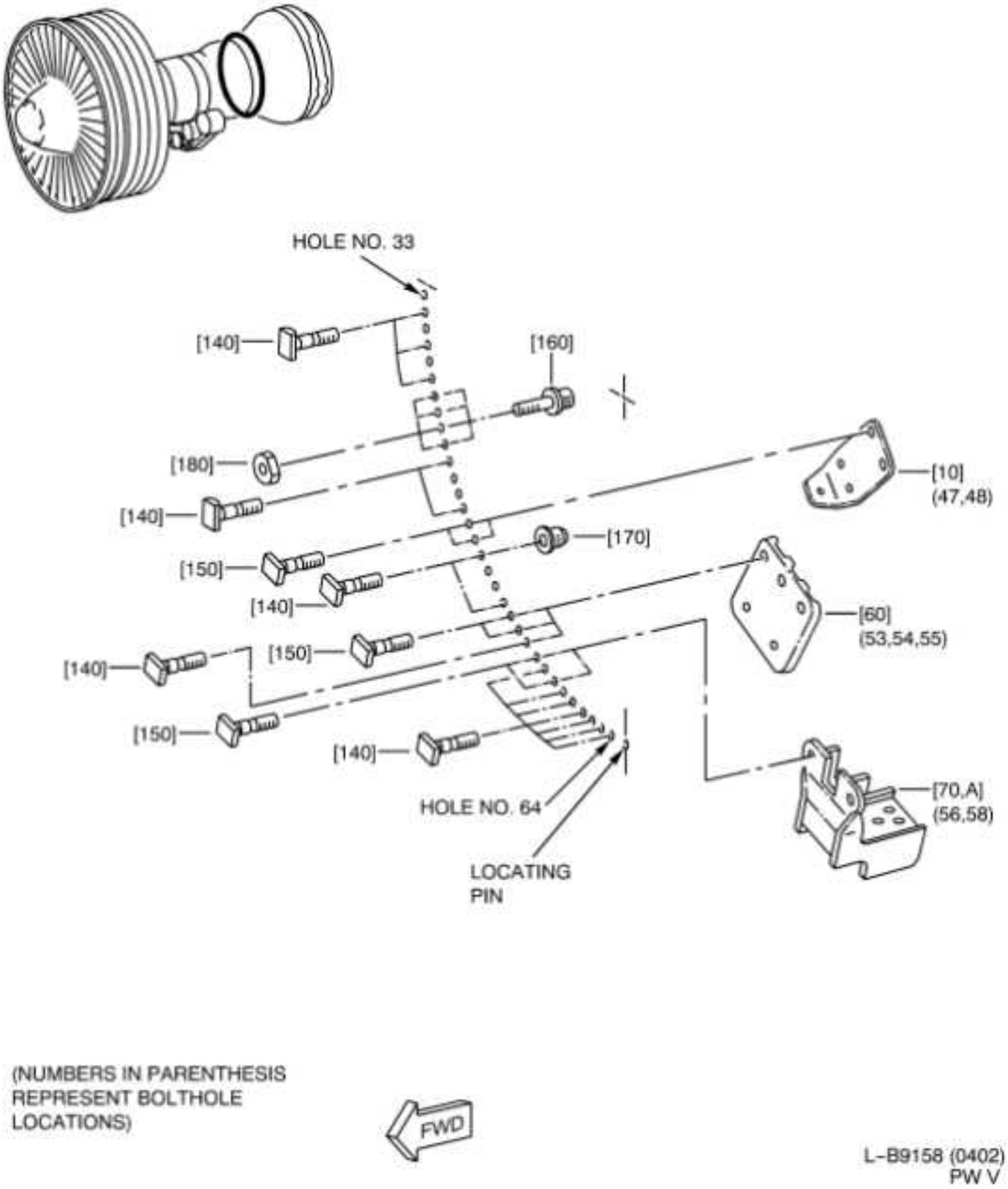
            NOTE: All the part item numbers in the figures are the same as the item numbers in the IPC.

         (b) Remove the lockwire, nuts and bolts, which attach the brackets at Flange N.


[1,A]
(7,9)
[150]
[160]
[180]
HOLE NO. 1
[10]
(21,22)
[150]
[150]
[170]
[140]
[20]
(23,24,25)
[150]
HOLE NO. 33
[30]
(27,28,29)
[40]
(32,33)
FWD
L−A1320 (0402)
PW V

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

The Flange N Brackets And Hardware
Figure 301 (Sheet 1)
(Task 72−00−53−020−020)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[60]
(53,54,55)
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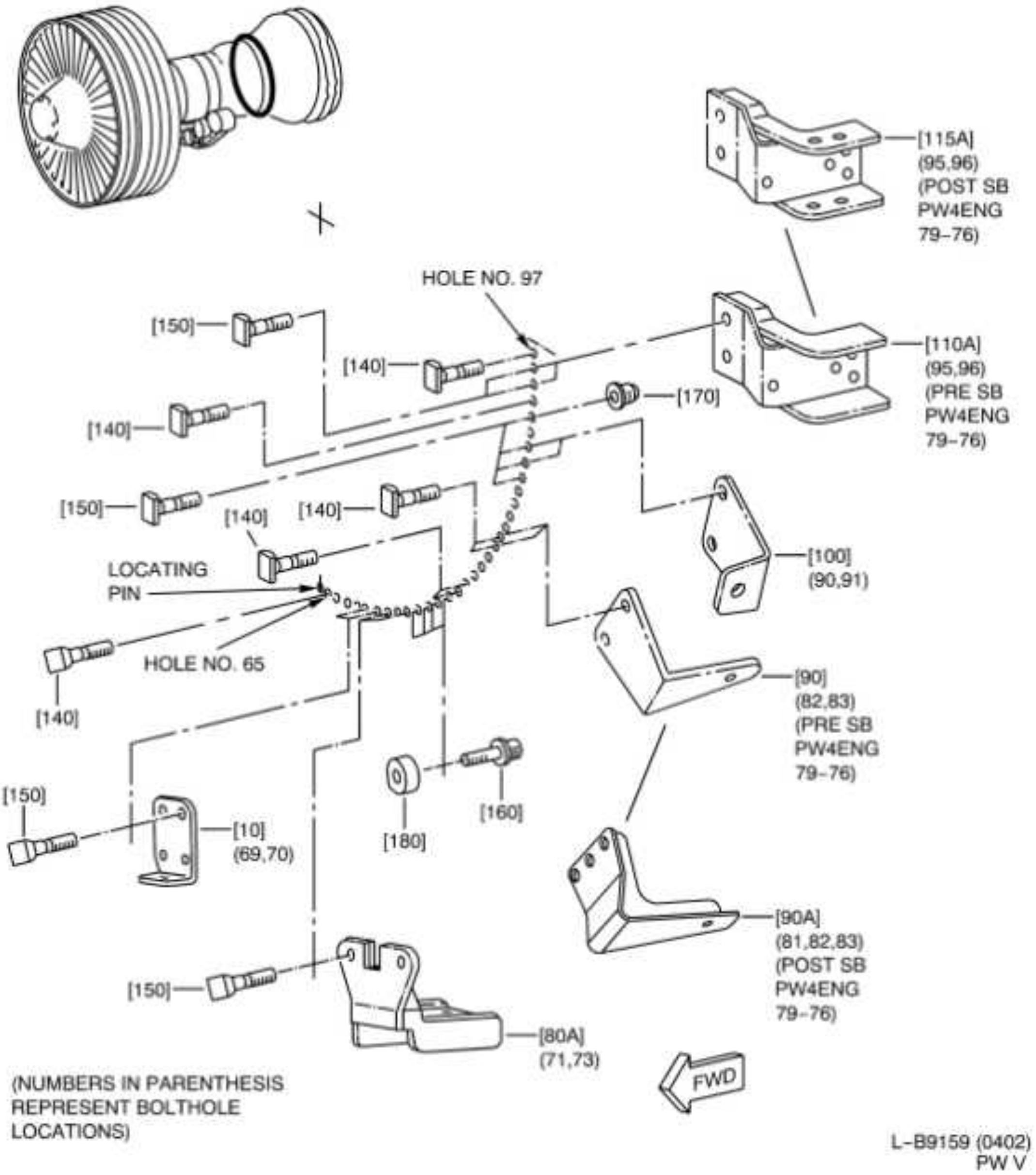
[150]
[150]
[140]
[70,A]
(56,58)
HOLE NO. 64
LOCATING PIN
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B9158 (0402)
PW V

The Flange N Brackets And Hardware
Figure 301 (Sheet 2)
(Task 72−00−53−020−020)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(95,96)
(POST SB
PW4ENG
79-76)
HOLE NO. 97
[150]
[140]
[110A]
(95,96)
(PRE SB
PW4ENG
79-76)
[170]
[140]
[150]
[140]
[140]
LOCATING
PIN
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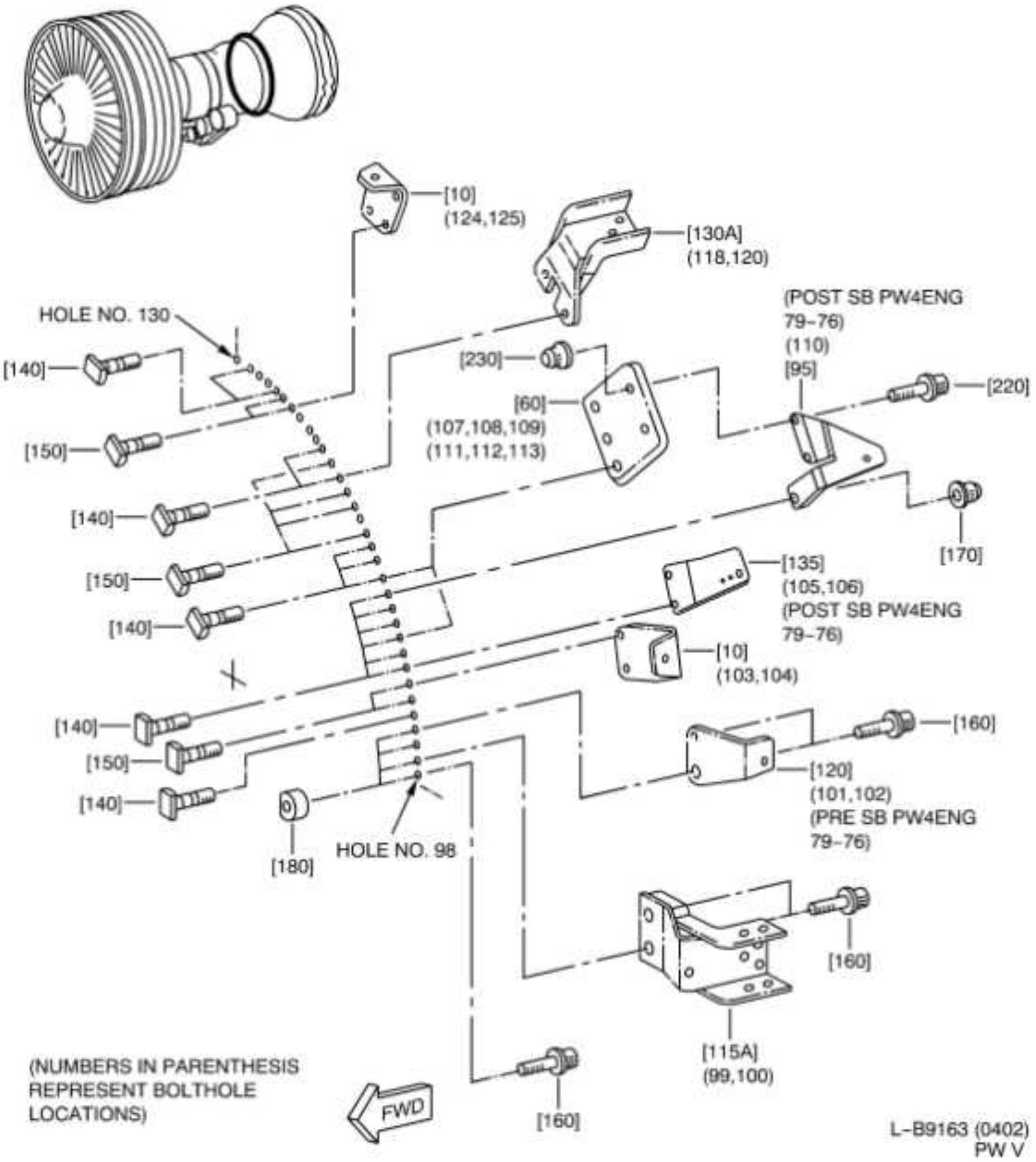
(90,91)
HOLE NO. 65
[140]
[90]
(82,83)
(PRE SB
PW4ENG
79-76)
[150]
[10]
(69,70)
[180]
[160]
[90A]
(81,82,83)
(POST SB
PW4ENG
79-76)
[150]
[80A]
(71,73)
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L-B9159 (0402)
PW V

The Flange N Brackets And Hardware
Figure 301 (Sheet 3)
(Task 72−00−53−020−020)


[10]
(124,125)
[130A]
(118,120)
HOLE NO. 130
(POST SB PW4ENG
79−76)
(110)
[95]
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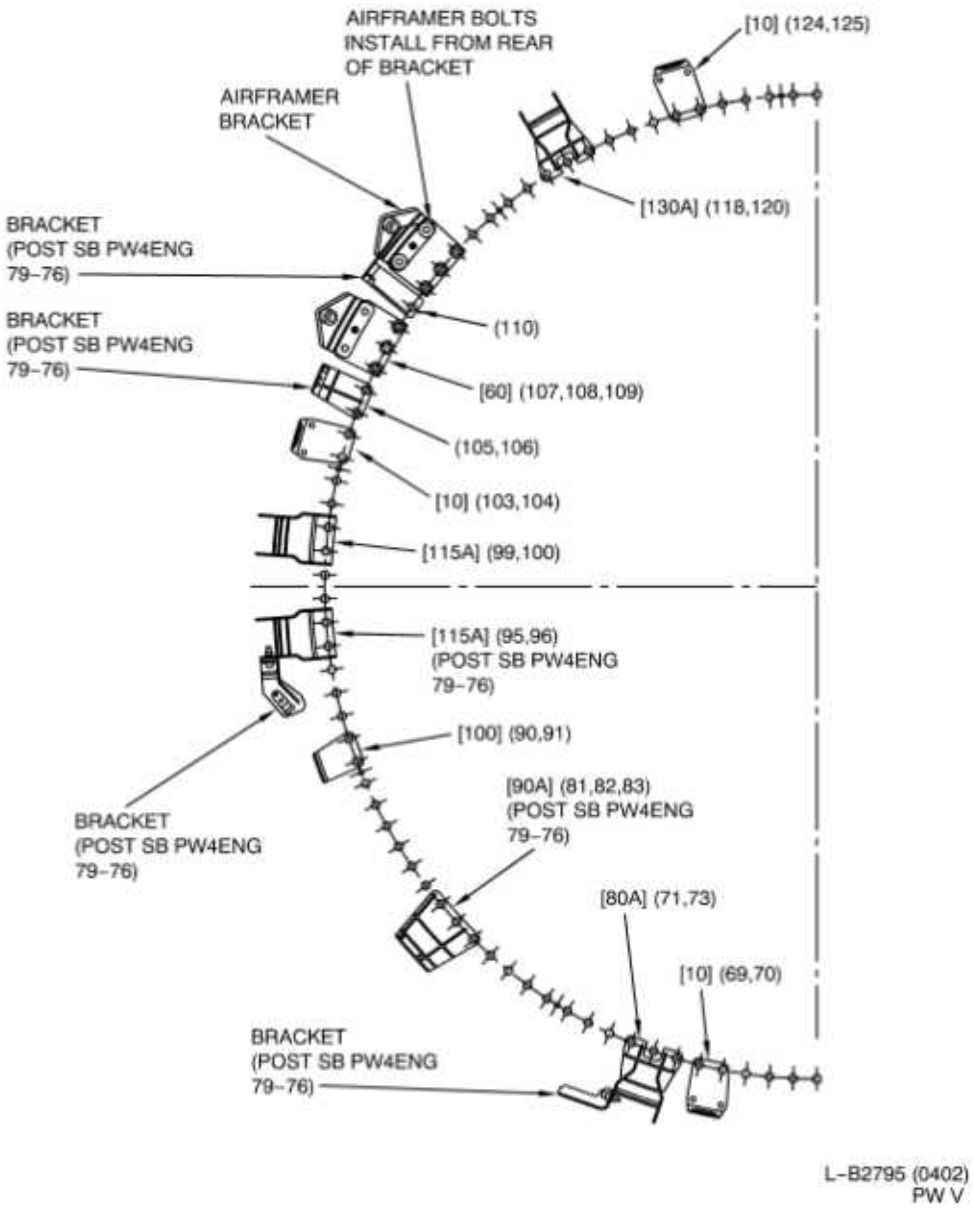
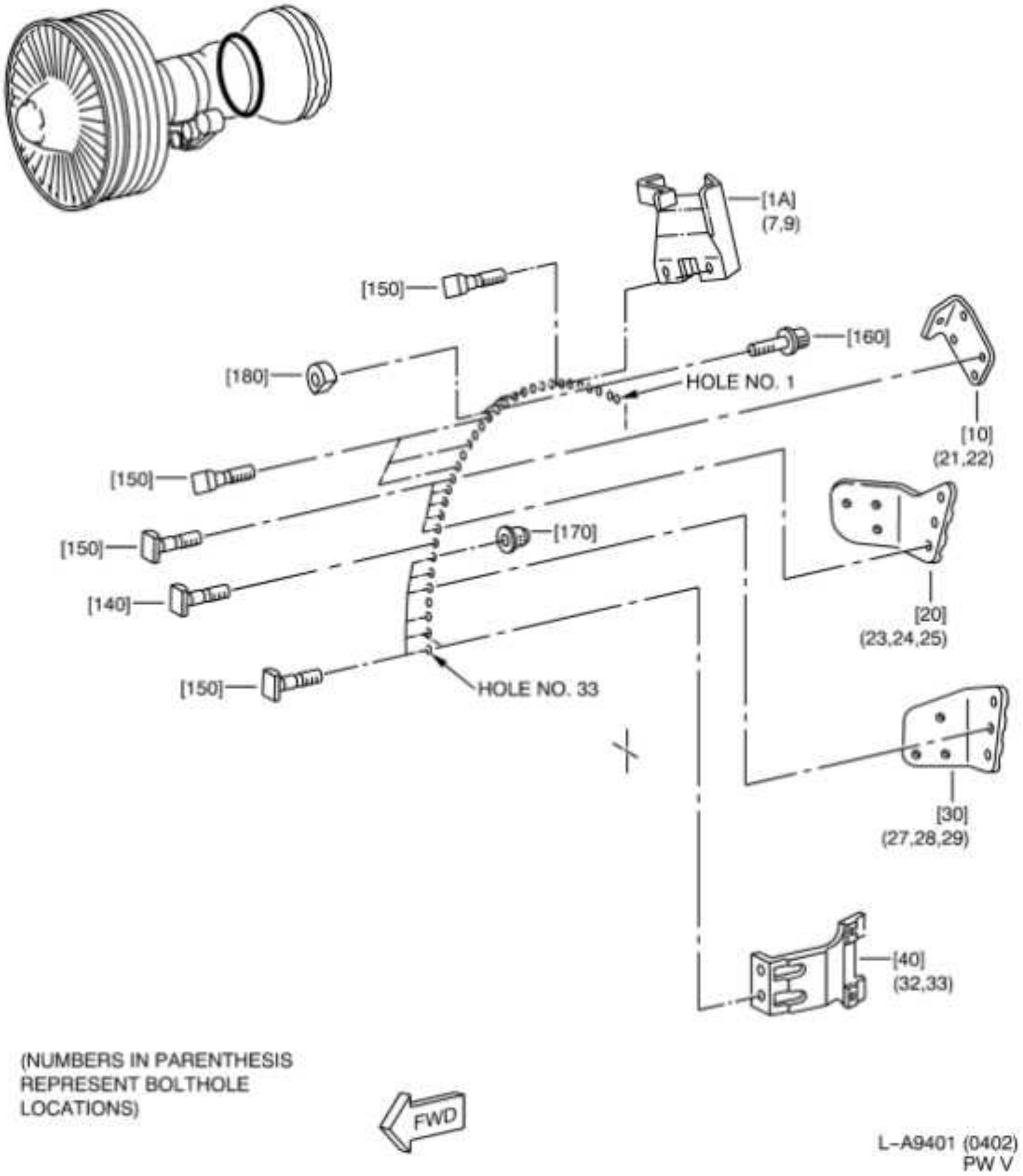
[230]
[220]
[150]
[60]
(107,108,109)
(111,112,113)
[140]
[170]
[150]
[135]
(105,106)
(POST SB PW4ENG
79−76)
[140]
[10]
(103,104)
[140]
[160]
[150]
[120]
(101,102)
(PRE SB PW4ENG
79−76)
[140]
[180]
HOLE NO. 98
[160]
[115A]
(99,100)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
[160]
L−B9163 (0402)
PW V

The Flange N Brackets And Hardware
Figure 301 (Sheet 4)
(Task 72−00−53−020−020)


AIRFRAMER BOLTS INSTALL FROM REAR OF BRACKET
[10] (124,125)
AIRFRAMER BRACKET
[130A] (118,120)
BRACKET (POST SB PW4ENG 79−76)
(110)
BRACKET (POST SB PW4ENG 79−76)
[60] (107,108,109)
(105,106)
[10] (103,104)
[115A] (99,100)
[115A] (95,96) (POST SB PW4ENG 79−76)
[100] (90,91)
BRACKET (POST SB PW4ENG 79−76)
[90A] (81,82,83) (POST SB PW4ENG 79−76)
[80A] (71,73)
[10] (69,70)
BRACKET (POST SB PW4ENG 79−76)
L−B2795 (0402)
PW V

The Flange N Brackets And Hardware
Figure 301 (Sheet 5)
(Task 72−00−53−020−020)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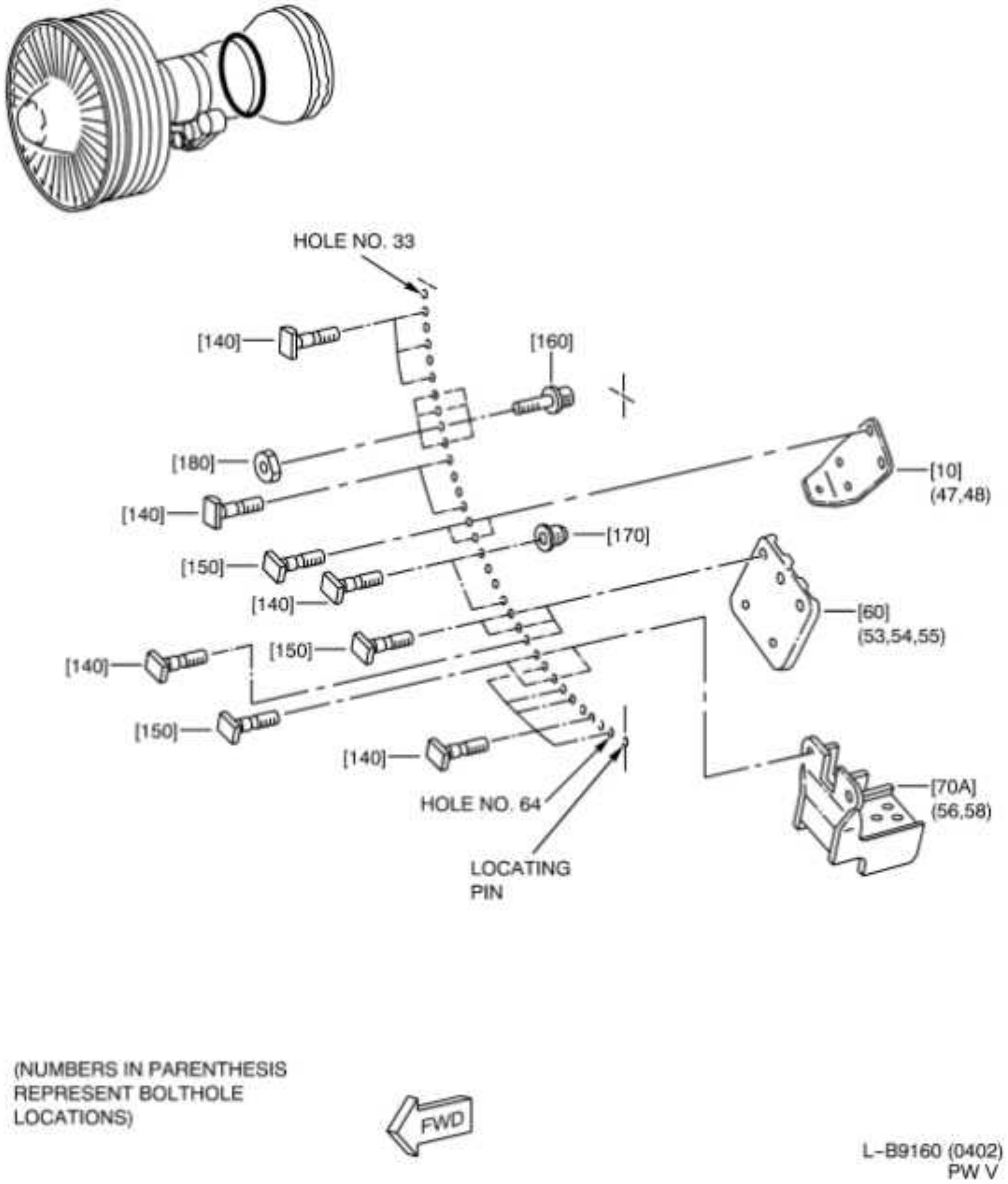
(7,9)
[150]
[160]
[180]
HOLE NO. 1
[10]
(21,22)
[150]
[150]
[170]
[140]
[20]
(23,24,25)
[150]
HOLE NO. 33
[30]
(27,28,29)
[40]
(32,33)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-A9401 (0402)
PW V

The Flange N Brackets And Hardware
Figure 301 (Sheet 6)
(Task 72−00−53−020−020)


HOLE NO. 33
[140]
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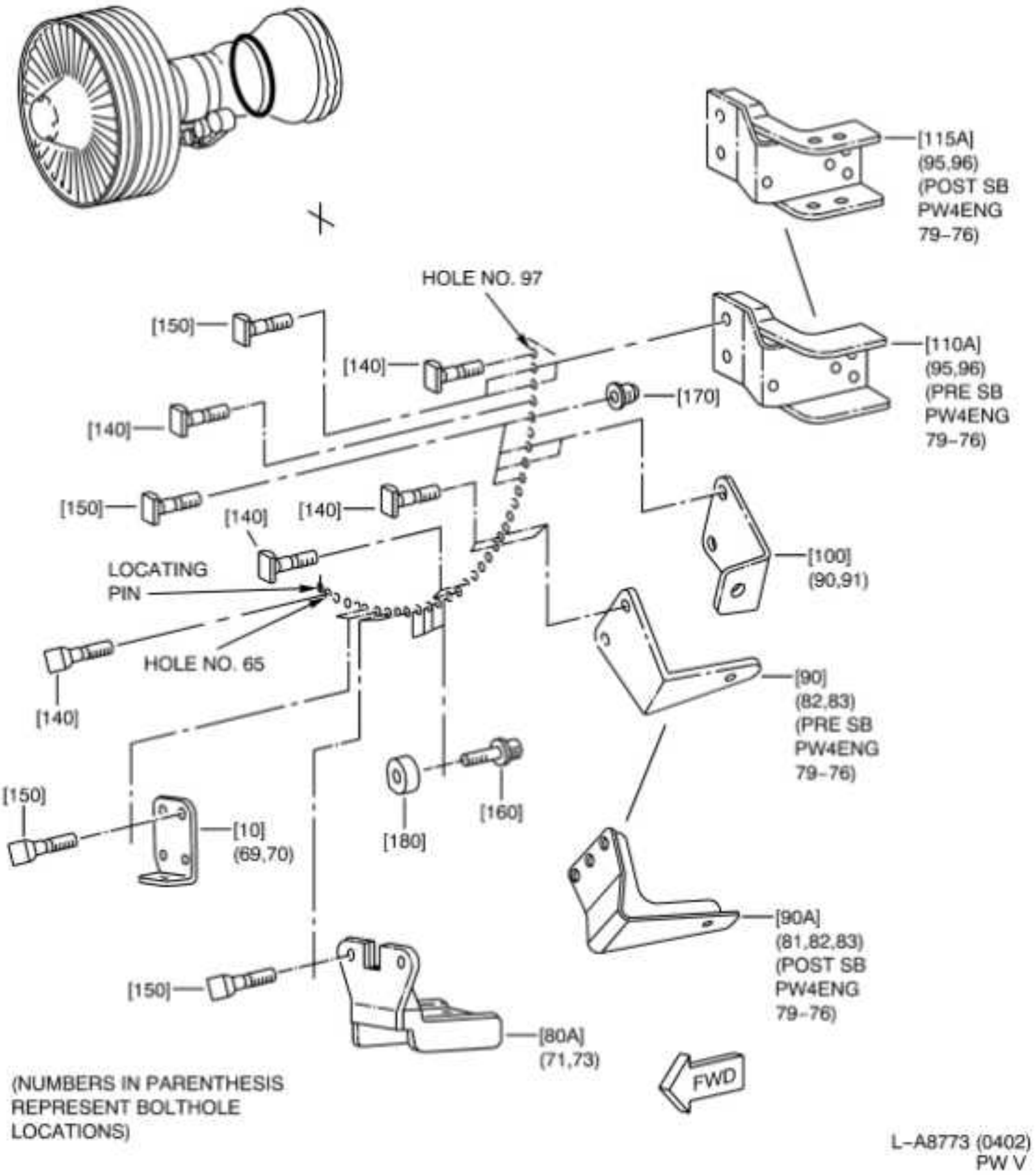
[180]
[10]
(47,48)
[140]
[170]
[150]
[140]
[60]
(53,54,55)
[140]
[150]
[150]
[140]
HOLE NO. 64
LOCATING
PIN
[70A]
(56,58)
FWD
L-B9160 (0402)
PW V

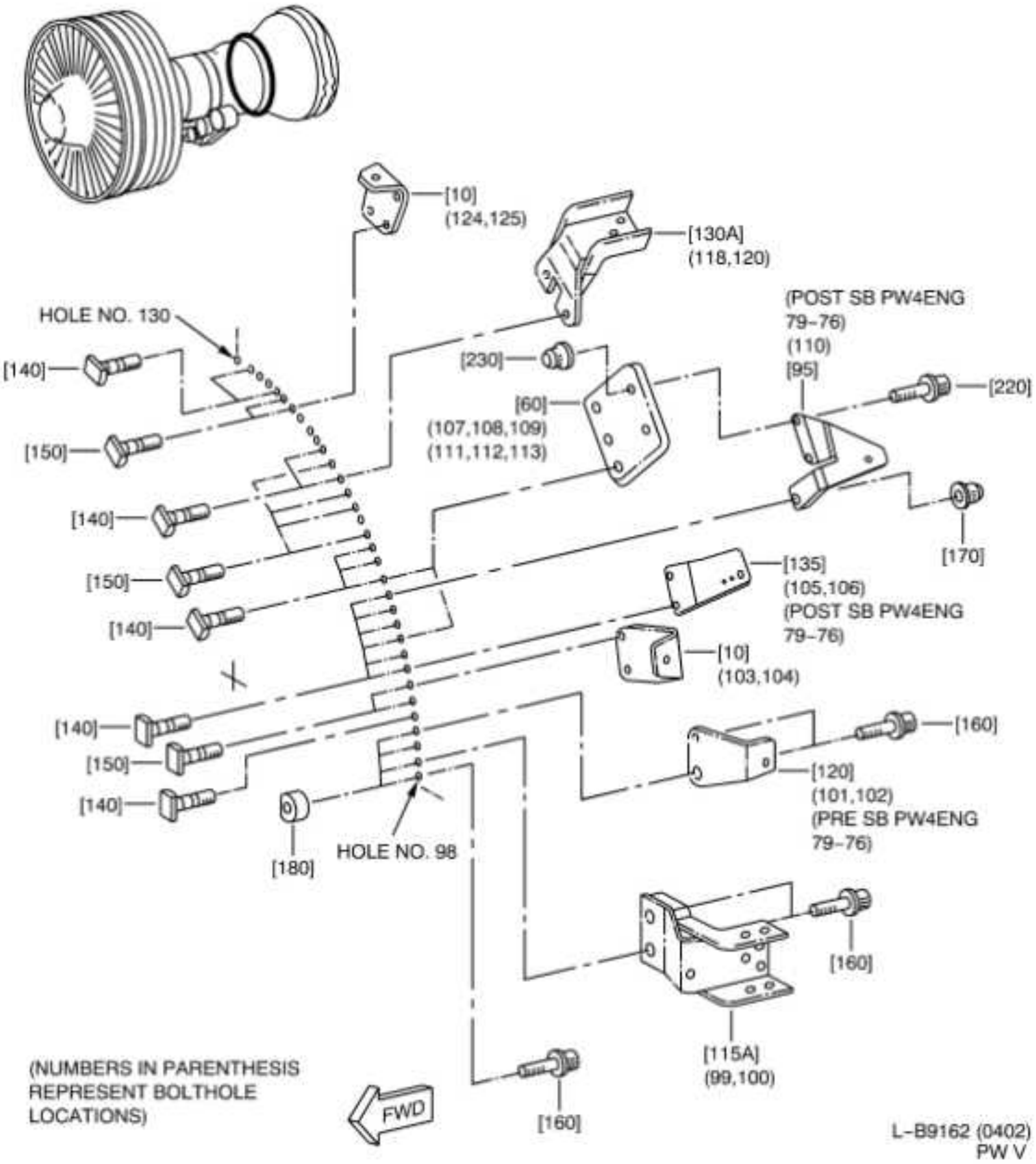
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

The Flange N Brackets And Hardware
Figure 301 (Sheet 7)
(Task 72−00−53−020−020)

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REMOVAL−20


[115A]
(95,96)
(POST SB
PW4ENG
79-76)
HOLE NO. 97
[150]
[140]
[110A]
(95,96)
(PRE SB
PW4ENG
79-76)
[170]
[140]
[150]
[140]
[140]
LOCATING
PIN
[100]
(90,91)
HOLE NO. 65
[140]
[90]
(82,83)
(PRE SB
PW4ENG
79-76)
[150]
[10]
(69,70)
[180]
[160]
[90A]
(81,82,83)
(POST SB
PW4ENG
79-76)
[150]
[80A]
(71,73)
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L-A8773 (0402)
PW V

The Flange N Brackets And Hardware
Figure 301 (Sheet 8)
(Task 72−00−53−020−020)


[10]
(124,125)
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(118,120)
(POST SB PW4ENG 79-76)
(110)
[95]
[220]
HOLE NO. 130
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[230]
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(107,108,109)
(111,112,113)
[150]
[140]
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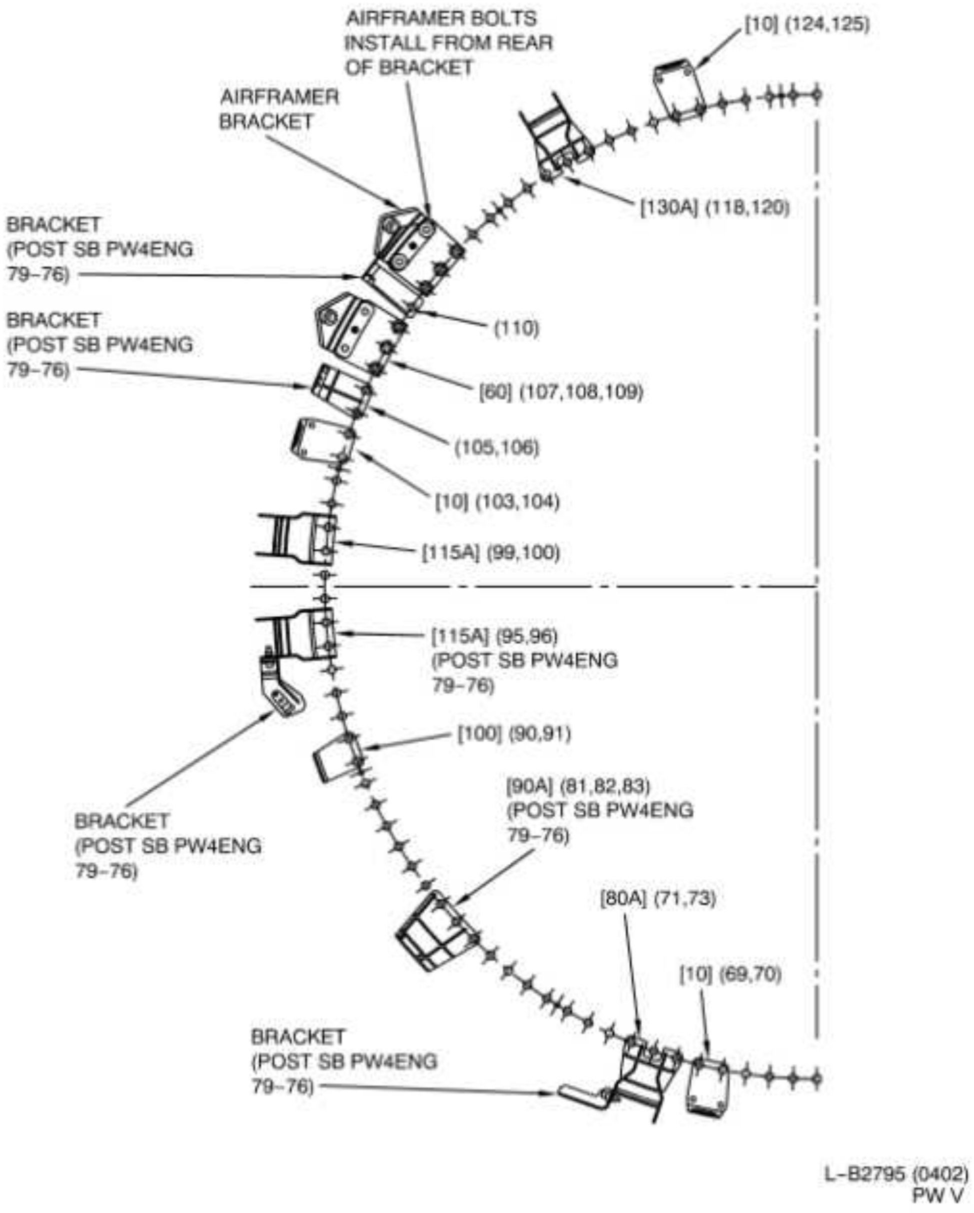
(105,106)
(POST SB PW4ENG 79-76)
[140]
[10]
(103,104)
[140]
[160]
[150]
[120]
(101,102)
(PRE SB PW4ENG 79-76)
[140]
[180]
HOLE NO. 98
[160]
[115A]
(99,100)
FWD
[160]
L-B9162 (0402)
PW V

(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

The Flange N Brackets And Hardware
Figure 301 (Sheet 9)
(Task 72−00−53−020−020)


AIRFRAMER BOLTS
INSTALL FROM REAR
OF BRACKET
[10] (124,125)
AIRFRAMER
BRACKET
[130A] (118,120)
BRACKET
(POST SB PW4ENG
79-76)
(110)
BRACKET
(POST SB PW4ENG
79-76)
[60] (107,108,109)
(105,106)
[10] (103,104)
[115A] (99,100)
[115A] (95,96)
(POST SB PW4ENG
79-76)
[100] (90,91)
BRACKET
(POST SB PW4ENG
79-76)
[90A] (81,82,83)
(POST SB PW4ENG
79-76)
[80A] (71,73)
[10] (69,70)
BRACKET
(POST SB PW4ENG
79-76)
L-B2795 (0402)
PW V

The Flange N Brackets And Hardware
Figure 301 (Sheet 10)
(Task 72−00−53−020−020)

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−01

Task 72−00−53−420−001:

1. Install The Low Pressure Turbine With Shaft

NOTE: See Figure 401 for part/assembly installation procedure sequence.

NOTE: This procedure is for installation of low pressure turbine with turbine exhaust case not installed.

NOTE: To Install The Low Pressure Turbine With Turbine Exhaust Case Installed, refer to 72−00−53, Installation−08 (Task 72−00−53−420−002).

A. Prerequisites

(1) See 72−00−53, Inspection/Check−01 (Task 72−00−53−990−001) for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 Or M307

Special Tools:

PWA 3755	Pump (Optional To PWA 29389)
PWA 18872	Wrench, Hydraulic (Optional To PWA 33732)
PWA 28657	Sling, Strongback, Handling
PWA 29389	Pump, Hydraulic
PWA 29510	Pump, Hydraulic (Hand) (Use With Hydraulic Wrench)
PWA 29614	Wrench, Mechanical
PWA 33732	Wrench, Hydraulic
PWA 45418	Wrench, Mechanical
PWA 45419	Air Torque Multiplier (Optional To PWA 80651) (Use With Mechanical Wrench)
PWA 76154	Adapter
PWA 76270	Stand
PWA 80187	Wrench, Mechanical
PWA 80651	Multiplier, Pneumatic (Use With Mechanical Wrench)
PWA 85291	Pins, Aligning (Two Required (Optional To PWA 101152)
PWA 85299	Adapter, Holding (Optional To PWA 102460)
PWA 85300	Wrench, Torque (Use With Mechanical Wrench)

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−01

Special Tools:

(CONTINUED)

PWA 85331	Retainer, Rear
PWA 85490	Drift, Assembly
PWA 85514	Wrench, Torque (Use With Hydraulic Wrench)
PWA 85515	Adapter (Use With Hydraulic Wrench)
PWA 85769	Fixture (Install/Remove)
PWA 85785	Adapter
PWA 86210	Adapter, Piloting (Optional To PWA 85785. Used If The Low Compressor Is Not Installed)
PWA 86604	Stand, Transport (Optional, To Store And Transport PWA 85769 Fixture)
PWA 88204	Guide, Piloting
PWA 101152	Pins, Aligning (Two Necessary)
PWA 102460	Adapter (Use With Mechanical Wrench)
PWA 102727	Support
PWA 103636	Base, Support

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−289	Lockwire (AS3214−02)
P05−291	Cable, Safety (Optional)
P05−292	Ferrule, Safety Cable (Optional)
P05−395	Beeswax
P05−396	Paraffin Wax Blend
P06−002	Petrolatum, White (PMC 9609)
P06−021	Compound, Antigalling (PWA 550)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72−32−00/2/30

C. Procedure

(1) Install turbine shaft spacer into front end of front compressor drive turbine shaft using PWA 85490 Drift. See Table 401 and Figure 402.

Class	Thickness
1	0.550 − 0.555 Inch (13.970 − 14.097 mm)
2	0.555 − 0.560 Inch (14.097 − 14.224 mm)
3	0.560 − 0.565 Inch (14.224 − 14.351 mm)
4	0.565 − 0.570 Inch (14.351 − 14.478 mm)
5	0.570 − 0.575 Inch (14.478 − 14.605 mm)
6	0.575 − 0.580 Inch (14.605 − 14.732 mm)
7	0.580 − 0.585 Inch (14.732 − 14.859 mm)
8	0.585 − 0.590 Inch (14.859 − 14.986 mm)
9	0.590 − 0.595 Inch (14.986 − 15.113 mm)
10	0.595 − 0.600 Inch (15.113 − 15.240 mm)
11	0.600 − 0.605 Inch (15.240 − 15.367 mm)
12	0.605 − 0.610 Inch (15.367 − 15.494 mm)
13	0.610 − 0.615 Inch (15.494 − 15.621 mm)
14	0.615 − 0.620 Inch (15.621 − 15.748 mm)
15	0.620 − 0.625 Inch (15.748 − 15.875 mm)
16	0.625 − 0.630 Inch (15.875 − 16.002 mm)
17	0.630 − 0.635 Inch (16.002 − 16.129 mm)
18	0.635 − 0.640 Inch (16.129 − 16.256 mm)
19	0.640 − 0.645 Inch (16.256 − 16.383 mm)
20	0.645 − 0.650 Inch (16.383 − 16.510 mm)
21	0.650 − 0.655 Inch (16.510 − 16.637 mm)
22	0.655 − 0.660 Inch (16.637 − 16.764 mm)
23	0.660 − 0.665 Inch (16.764 − 16.891 mm)
24	0.665 − 0.670 Inch (16.891 − 17.018 mm)
25	0.670 − 0.675 Inch (17.018 − 17.145 mm)
26	0.675 − 0.680 Inch (17.145 − 17.272 mm)
27	0.680 − 0.685 Inch (17.272 − 17.399 mm)

Spacer Classification Data
Table 401

(2) Position and adjust PWA 102727 Fan Case Support to engage and hold the fan inlet case at Flange "A" at the 6 o'clock location. If it is necessary because of the height of the engine in the pedestals, first install the Fan Case Support (PWA 102727) in a PWA 103636 Base Support. Attach the Fan Case Support (PWA 102727) to the Base Support (PWA 103636) with the three detail bolts and nuts.

NOTE: If necessary several Base Supports (PWA 103636) can be stacked together. They must be attached to each other with the three detail bolts and nuts.

(3) Using hoist, attach PWA 28657 Sling with two PWA 76154 Adapters to trunnion spools of PWA 85331 Retainer at rear of low pressure turbine. See Figure 403.

(4) Attach second hoist and nylon sling to front compressor drive turbine shaft.

(5) If the turbine shaft spline is not clean, or if it has a heavy type of rust preventive, clean the spline by SPOP 209 (wipe method). See Standard Practices Manual, PN 585005.

(6) Lubricate two interface diameters and the spline area at front end of front compressor drive turbine shaft with Engine Oil P03−001. If the shaft is uncoated in the area forward and rearward of the spline, lubricate these areas also. See Figure 404.

(7) Loosen hand knobs and open clamps securing turbine shaft to PWA 25096 Stand, PWA 76270 Stand or PWA 87330 Stand.

NOTE: After removal of assembly from stand, PWA 85562 Sleeve or PWA 87347 Sleeve details may be removed from front and rear supports of PWA 25096 Stand, PWA 76270 Stand or PWA 87330 Stand.

(8) Using hoists, lift low pressure turbine from stand and align shaft with high pressure compressor rear hub.

CAUTION: DO NOT INSTALL SEAL IN HIGH TURBINE CASES WHICH DO NOT HAVE A SEAL GROOVE IN THE REAR FLANGE. AFFECTED CASES ARE PN 50L170 AND 50L292.

(9) Install seal to rear flange of high pressure turbine case. Seal may be temporarily secured to flange with Beeswax P05−395 or Paraffin Wax Blend P05−396.

(10) If the fan nut and the turbine shaft coupling are in place, install PWA 85785 Adapter in the ID of the fan nut. Use the detail clamps to attach the adapter to the coupling lugs. See Figure 405.

(11) Optional, if the fan nut and turbine shaft coupling are not in place, install PWA 85785 Adapter in the 11.120 inch (282.448 mm) diameter of the fan hub. Use the detail clamps to attach the adapter to the underside of the hub flange. See Figure 405.

(12) Optional, if the low pressure compressor is not in place, install PWA 86210 Adapter to the ID of the No. 1 bearing support. Use the detail clamps to attach the adapter to the support. See Figure 406.

(13) Thread the puck end of PWA 88204 Guide into the front end of the turbine shaft. See Figure 407.

NOTE: The guide can be separated into two parts if required.

(14) Hand guide the assembly from the rear and move the assembly forward. Move the nylon sling as required and insert the guide through the ID of the PWA 85785 Adapter or PWA 86210 Adapter.

(15) Move the assembly forward until the turbine shaft engages the ID spline of the turbine shaft coupling at the front end of the engine.

(16) Remove nylon sling and hoist from turbine shaft. Move assembly forward until approximately 12 inches (304.820 mm) gap exists between turbine front and rear cases.

(17) Remove the retainer (408/3) from the front flange of the turbine rear case and the front compressor drive turbine shaft. See Figure 408.

  (a) Remove two bolts (408/4) securing upper and lower details of retainer.

  (b) Remove bolts (408/2) and nuts (408/1) securing upper and lower retainer details to low pressure turbine case.

(18) Move the turbine forward and install several work bolts and nuts to boltholes in Flange N.

(19) Remove the PWA 85785 Adapter or PWA 86210 Adapter as applicable.

(20) Remove the guide from the turbine shaft.

(21) Install two PWA 85291 Aligning Pins or PWA 101152 Aligning Pins.

  (a) Locate two threaded jackscrew holes 180 degrees apart in front flange of turbine rear case.

(b) Insert pins through boltholes between jackscrew holes from rear side of front flange.

(c) Thread detail bolts into jackscrew holes to secure pins.

(22) Install PWA 85769 Fixture (Install/Remove) into front end of low pressure turbine shaft. See Figure 409.

(a) Thread plug end of shaft (409/1) into end of turbine shaft until plug bottoms on shoulder of shaft.

(b) Guide body (409/4) and attached parts over previously installed shaft (409/1). Using dowel pin (409/2), retract locking pin. Rotate assembly to position locating plate behind lugs at front end of low pressure turbine coupling. Using dowel pin, release spring loaded locking pin to lock fixture to coupling.

(c) Install puck (409/5) onto shaft, and engage small diameter of puck into body (409/4).

(d) Guide hydraulic cylinder (409/6), threaded end first, onto shaft. Secure cylinder with nut (409/7).

CAUTION: LOOSEN HAND KNOBS OF PWA 85331 RETAINER WHEN FRONT FLANGE OF REAR CASE MEETS REAR FLANGE OF TURBINE FRONT CASE TO AVOID DAMAGE TO NO. 1 BEARING IF TURBINE SHAFT COUPLING SPACER IS BELOW REQUIRED DIMENSIONS.

(23) Tighten workbolts in Flange N and apply hydraulic pressure to pusher−puller ram and seat front compressor drive turbine shaft in LPC/LPT coupling. Front flange of turbine rear case should now butt rear flange of turbine front case.

CAUTION: TO ENSURE PROPER SEATING OF CLASSIFIED SPACER, HYDRAULIC PRESSURE MUST BE APPLIED TO PUSHER−PULLER, WHEN PERFORMING LOW PRESSURE TURBINE POSITIONING CHECK.

(24) (Reference 828 or 850) Check running position of low pressure turbine rotor assembly while pressure

is applied to PWA 85293 Pusher−Puller. See Figure 410(Sheet 1).

NOTE: If the coupling is not installed, then install the classified spacer for the low turbine running position during the LPC/LPT coupling 72−00−32, Installation−01 (Task 72−00−32−420−001).

NOTE: Running position check is required whenever low pressure turbine is installed, (except when the LPC/LPT coupling is not in place) regardless of whether same or different unit (from another engine) is installed. Measurement should be an average of at least two measurements taken at equally spaced locations.

(a) Using standard depth micrometer, measure distance from vertical fixture plates to 6th stage LPT disk at four inspection slot locations.

(b) Subtract measured dimension from basic tool dimension 2.000 stamped on plate to determine running position.

(c) (Reference 850) For engines (Post SB PW4ENG 72−256), with the revised LPT airfoils, 5th stage turbine hub, and the new 5th stage airseal, the low pressure turbine axial running position must be within the limits specified for (Reference 850). See Figure 410 (Sheet 2).

(d) (Reference 828) For engines (Pre SB PW4ENG 72−256), without the revised LPT airfoils, the new 5th stage turbine hub, and the new 5th stage airseal, the low pressure turbine axial running position must be within the limits specified for (Reference 828). See Figure 410 (Sheet 2).

(e) If necessary, remove front compressor drive turbine and use a new classified spacer.

1 Make record of axial running position dimension. This dimension will be used to find new spacer class.

2 Remove The Front Compressor Drive Turbine. See 72−00−53, Removal−01 (Task 72−00−53−020−001).

3 Remove classified spacer from end of turbine shaft. Measure and make a record of spacer thickness.

4 Find the new classified spacer necessary to correctly set the running position of the low pressure turbine. Spacer class is found using Table 401.

NOTE: Class of turbine shaft spacer can be changed by 72−53−81, Repair−01. See PW4000 Series CIR, PN 51A357.

5 Install new classified spacer onto end of turbine shaft.

6 Install front compressor drive turbine, with new classified spacer, again.

7 Check axial running position dimension again.

(25) Release hydraulic pressure. Disconnect hydraulic pump.

(26) Remove PWA 85769 Puller from engine.

(a) Using dowel pin (409/2), retract locking pin into housing. Rotate body (409/4) to position lugs of locator plate between lugs of LPC/LPT coupling. Remove body from coupling.

(b) Unthread and remove shaft (409/1) from turbine shaft.

(27) Remove two PWA 85291 Guide Pins or PWA 101152 Guide Pins from Flange N.

(28) Install Flange N as follows. Refer to 72−00−53, Installation−20 (Task 72−00−53−420−020).

(29) Assemble LPT flat washer (411/4) into ID of LPC/LPT coupling. See Figure 411.

NOTE: If LPC/LPT coupling is removed, omit installation of turbine shaft nut and associated hardware specified in following steps. These parts are to be installed with coupling per 72−00−32, Installation−01 (Task 72−00−32−420−001).

(30) Apply Antigalling Compound P06−021, to turbine shaft nut areas specified in Figure 412. Cure compound for five minutes minimum prior to assembly.

(31) Thread turbine shaft nut (411/3) into front compressor drive turbine shaft.

(32) For operators that use the mechanical wrench to install the No. 3 bearing retaining nut, install tooling as follows:

(a) Install PWA 102460 Adapter or PWA 85299 Adapter into LPC/LPT coupling. See Figure 413.

1 Loosen wing nuts (413/1) and slide three clamps (413/2) radially inward.

2 Align keys in adapter with internal slots in coupling and install adapter in coupling. Index adapter as necessary to seat keys in slots in coupling. Slide three clamps radially outward to engage lugs of coupling. Tighten wing nuts to secure clamps.

(b) Install PWA 85300 Wrench, smaller splined end first, into center of PWA 102460 Adapter or PWA 85299 Adapter. Align spline of wrench with spline in ID of turbine shaft nut. Push wrench inward to seat on face of nut.

(c) Using hoist, align splines and slide applicable mechanical wrench over splines of PWA 85300 Wrench. Align antitorque pins in wrench with bushings in adapter and seat wrench against adapter face. See Table 402 for mechanical wrench options.

PWA Mechanical Wrench	PWA Torque Multiplier
45418	45419
29614 or 80187	45419 or 80651

Mechanical Wrench Options
Table 402

(33) For operators that use the hydraulic wrench to install the No. 3 bearing retaining nut, install tooling as follows:

(a) Align boltholes and position PWA 85515 Adapter to rear face of PWA 33732 or PWA 18872 Wrench. Secure adapter with eight bolts (414/3). See Figure 414.

(b) Using hoist, position wrench and adapter assembly into front end of LPC/LPT coupling. Align teeth of adapter with slots in coupling and slide three clamps (414/1) outward to engage lugs of coupling. Tighten wing nuts (414/2) to secure adapter to coupling.

NOTE: PWA 28815 or PWA 75046 Cart may be used to transport Wrench (PWA 33732) or (PWA 18872) and PWA 28814 or PWA 29510 Pump.

(c) Install PWA 85514 Wrench, smaller splined end first, into center of Wrench (PWA 33732) or (PWA 18872). Align spline of wrench with spline in turbine shaft nut (414/4). Push wrench inward to seat on face of nut.

(d) Connect PWA 28814 Electric Pump or PWA 29510 Hand Pump to wrench.

CAUTION: PWA 80651 TORQUE MULTIPLIER MUST NOT BE USED WITH PWA 45418 WRENCH OR DAMAGE TO WRENCH MAY OCCUR.

(34) (Reference 971) Torque turbine shaft nut.

NOTE: Mechanical wrenches may be actuated using air torque multipliers per Table 402.

(a) Tighten nut to 5000 − 7000 lb−in. (564.924 − 790.894 N.m), turn nut through an angle of 43 − 47 degrees. Loosen nut to zero.

(b) Tighten nut to 4000 − 6000 lb−in. (451.939 − 677.909 N.m).

(c) Establish common reference points between nut and its mating part.

(d) Turn nut through an angle of 43 − 47 degrees.

(e) Loosen nut to zero and repeat step (b).

(f) If nut reference point is in line with mating part reference point or beyond it within two degrees maximum, apply final angle of turn per step (d).

(g) If reference points are not within limits, repeat steps (c), (d) and (e) in order, until reference points are within limits. Then perform step (f).

(35) Remove tooling from coupling.

(36) Install key washer (415/6) and retaining ring (415/5) to secure turbine shaft nut. Make sure retaining ring is fully inserted in the retaining nut groove, all around, and ring end gap is 0.010 inch (0.254 mm) minimum. Remove guide from hub.

(37) Install new packing (415/4) lubricated with Petrolatum White P06−002, to turbine shaft plug (415/3). Install plug to coupling ID and secure with key washer (415/2) and retaining ring (415/1). See Figure 415.

D. Postrequisites

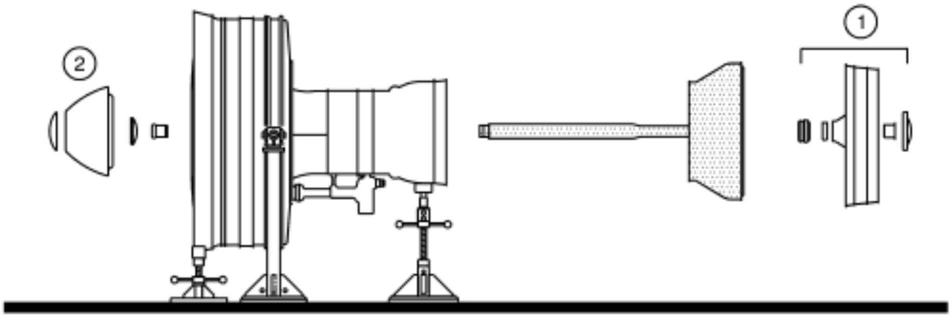
(1) Install/Connect The External Parts To Complete Installation Of The Low Pressure Turbine (LPT). Refer to 72−00−53, Installation−03 (Task 72−00−53−420−003).

(2) Install The Compressor Inlet Cone. Refer to 72−00−31, Installation−02 (Task 72−00−31−420−001).

(3) Install The Turbine Exhaust Case. Refer to 72−00−54, Installation−01 (Task 72−00−54−420−001).

(4) Test the engine per the Test Reference Table. Refer to 71−00−00, Testing−00 (Task 71−00−00−990−003).

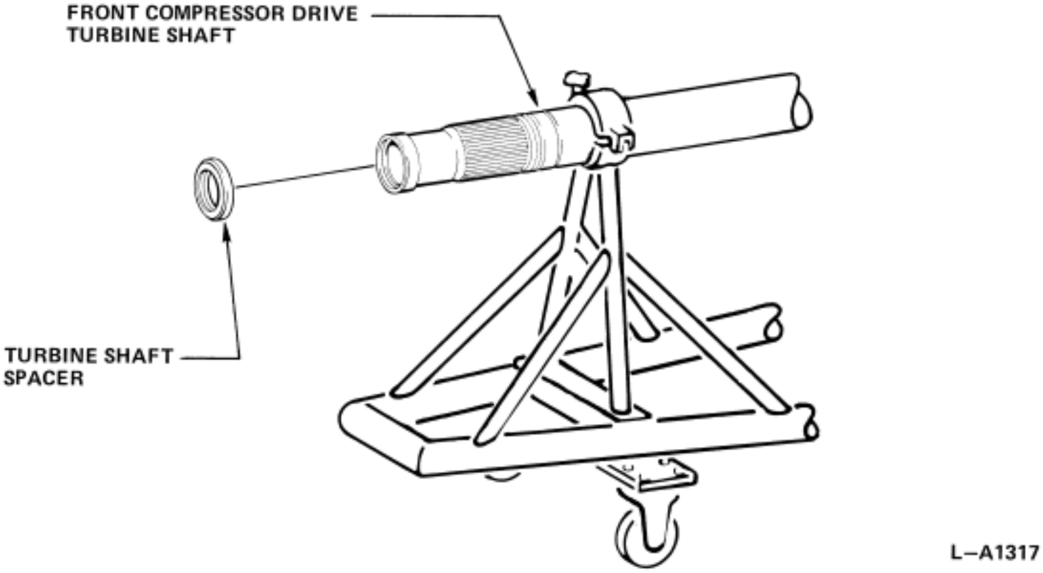
ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−01



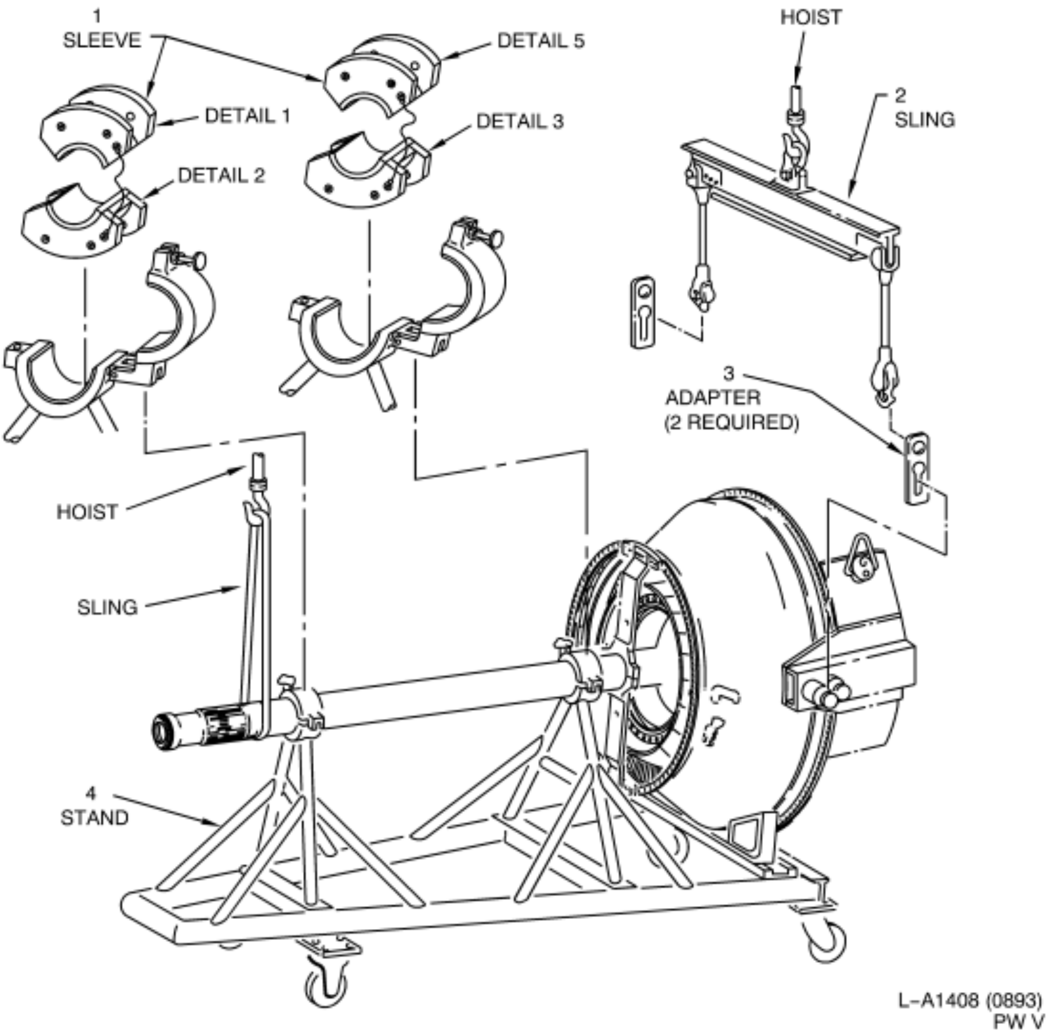
1. INSTALL TURBINE EXHAUST CASE
2. INSTALL COMPRESSOR INLET CONE

L−A0134 (0498)
PW V

Procedure Sequence
Figure 401
(Task 72−00−53−420−001)


FRONT COMPRESSOR DRIVE TURBINE SHAFT
TURBINE SHAFT SPACER
L−A1317

Turbine Shaft Spacer Installation
Figure 402
(Task 72−00−53−420−001)


1
SLEEVE
DETAIL 1
DETAIL 2
DETAIL 5
DETAIL 3
HOIST
2
SLING
3
ADAPTER
(2 REQUIRED)
HOIST
SLING
4
STAND
L−A1408 (0893)
PW V

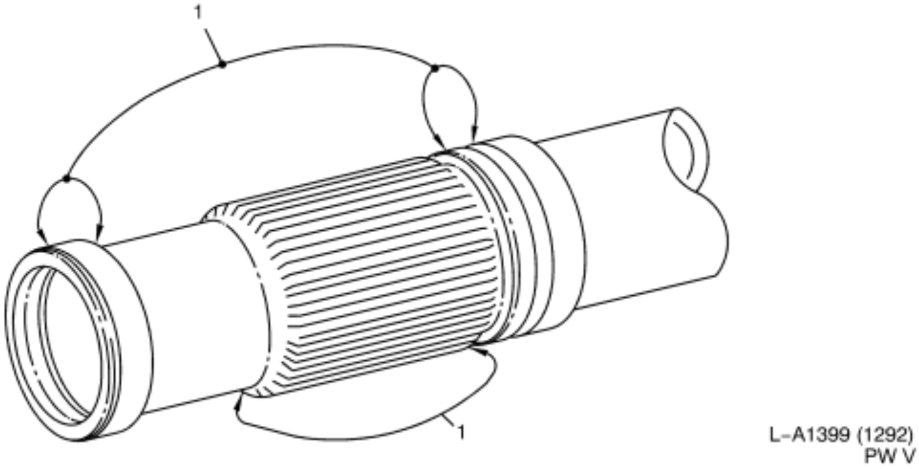
1. PWA 85562 Sleeve (Used With PWA 25096 Or PWA 76270 Stand) Or PWA 87347 Sleeve (Used With PWA 87330 Stand)

R 2. PWA 28657 Sling

3. PWA 76154 Adapter, Two Required.

4. PWA 25096, PWA 76270 Or PWA 87330 Stand.

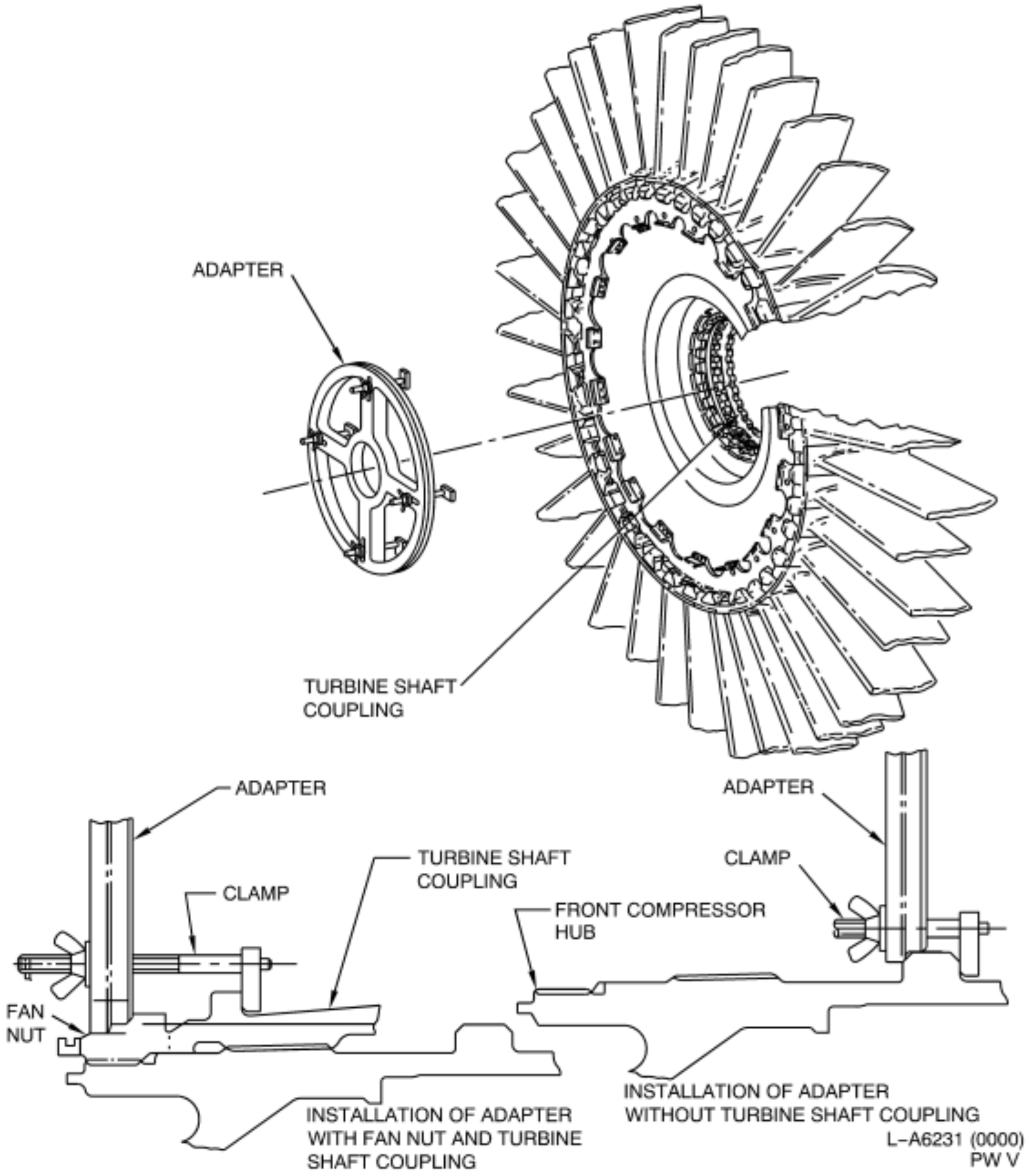
Low Pressure Turbine Installation
Figure 403
(Task 72−00−53−420−001)



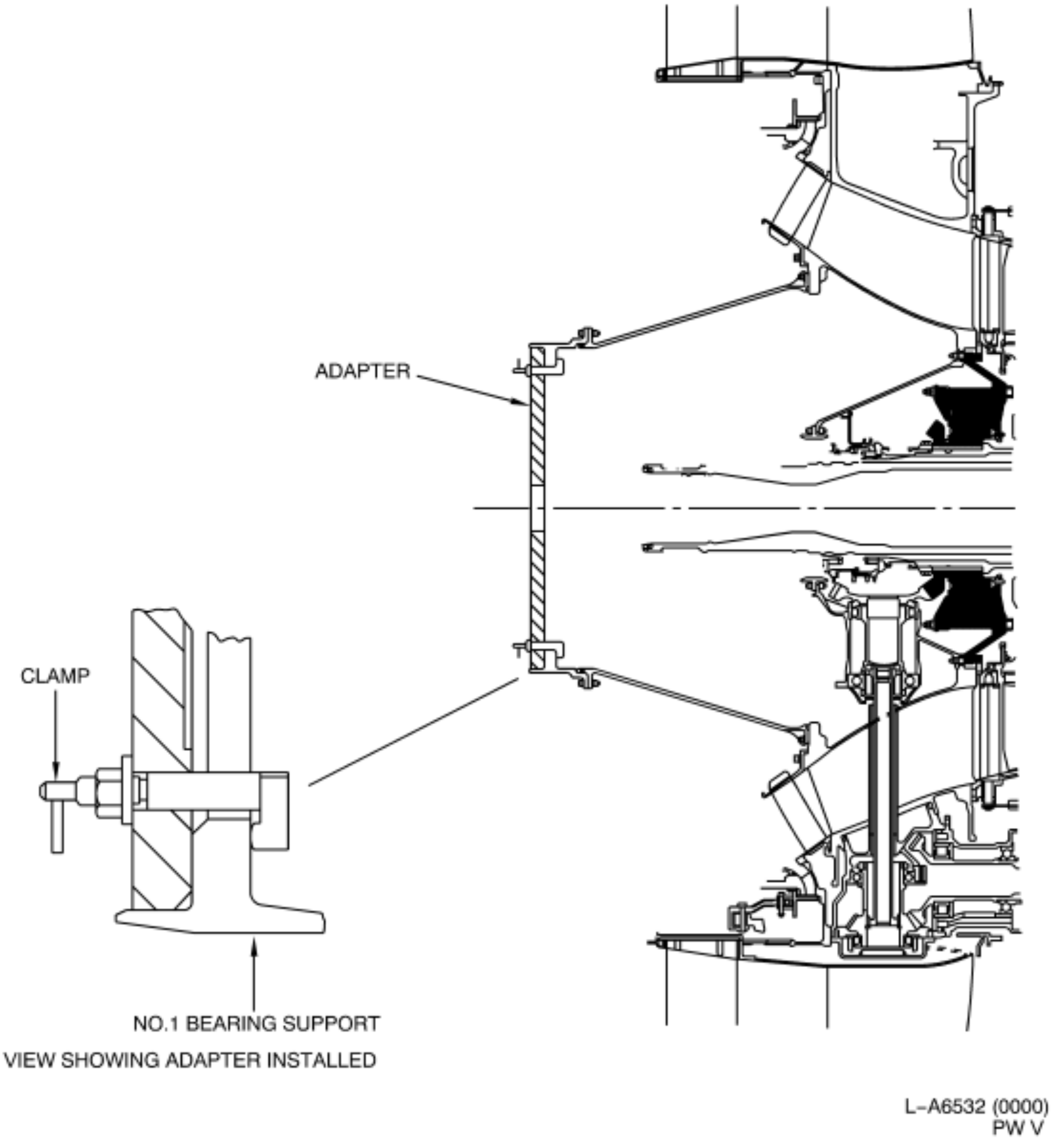
1. Treat Enclosed Area. See Text.

Front Compressor Drive Turbine Shaft Lubrications Areas
Figure 404
(Task 72−00−53−420−001)

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−01

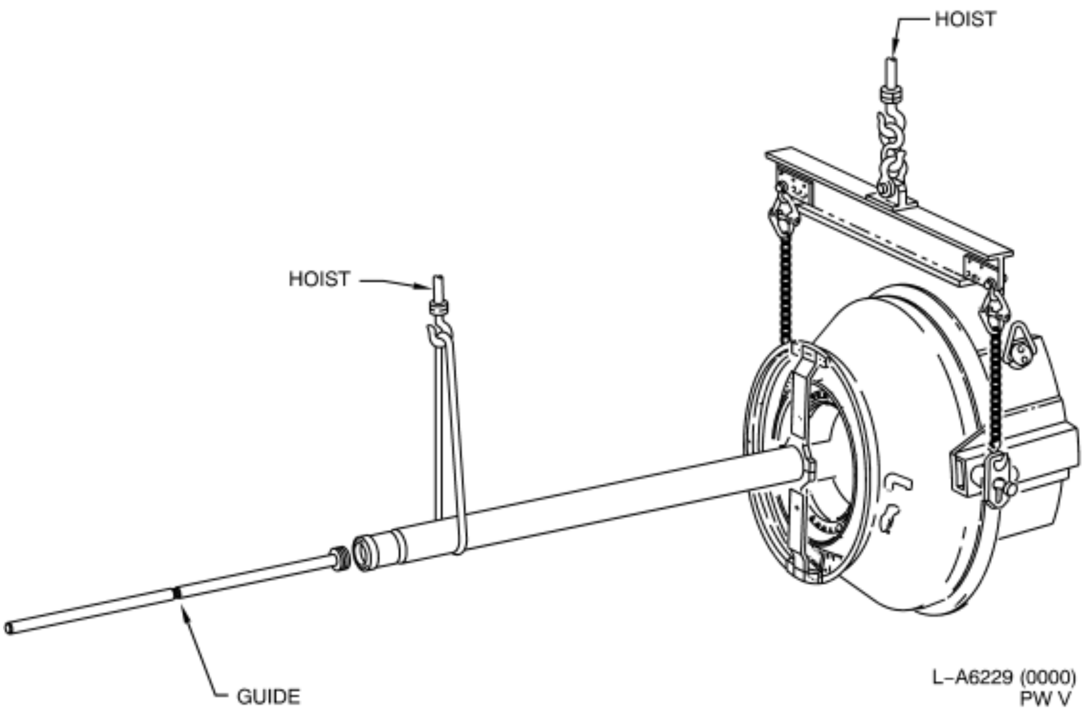

ADAPTER
TURBINE SHAFT COUPLING
ADAPTER
TURBINE SHAFT COUPLING
CLAMP
FAN NUT
INSTALLATION OF ADAPTER WITH FAN NUT AND TURBINE SHAFT COUPLING
ADAPTER
CLAMP
FRONT COMPRESSOR HUB
INSTALLATION OF ADAPTER WITHOUT TURBINE SHAFT COUPLING
L−A6231 (0000)
PW V

PWA 85785 Adapter Installation
Figure 405
(Task 72−00−53−420−001)

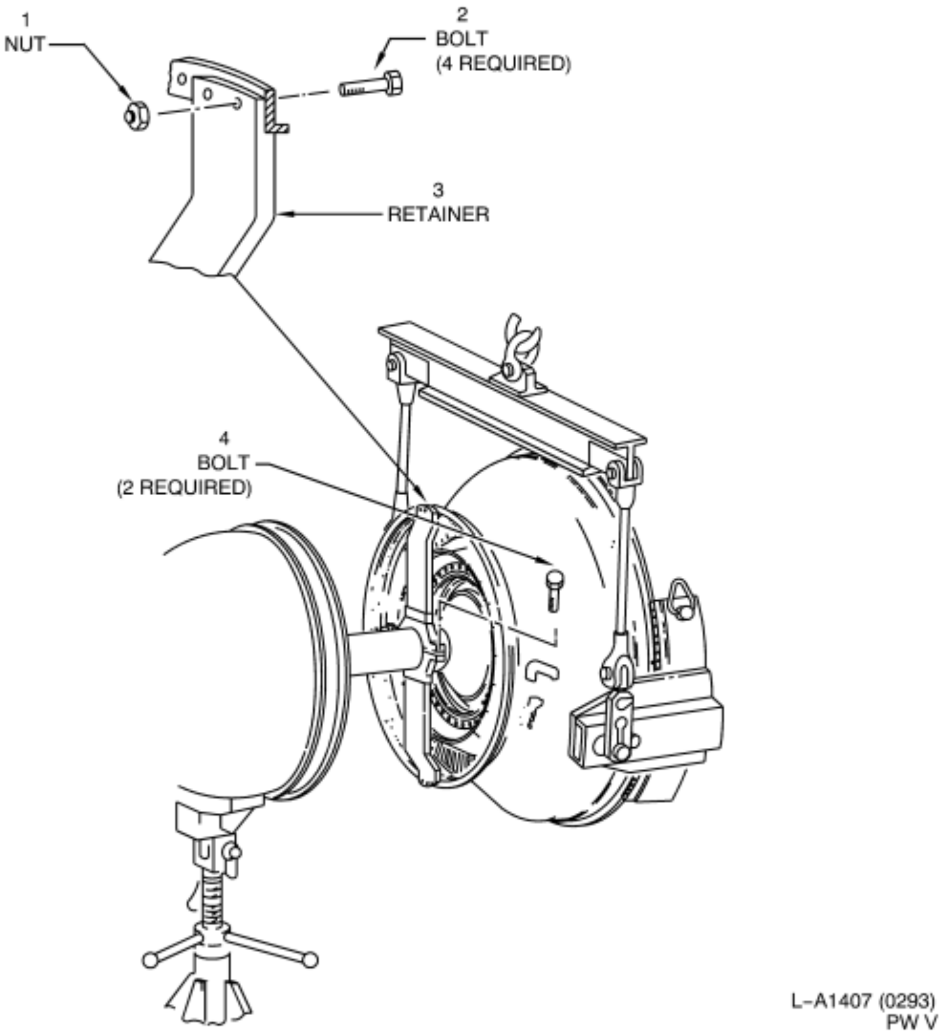

ADAPTER
CLAMP
NO.1 BEARING SUPPORT
VIEW SHOWING ADAPTER INSTALLED
L−A6532 (0000)
PW V

PWA 86210 Adapter Installation
Figure 406
(Task 72−00−53−420−001)

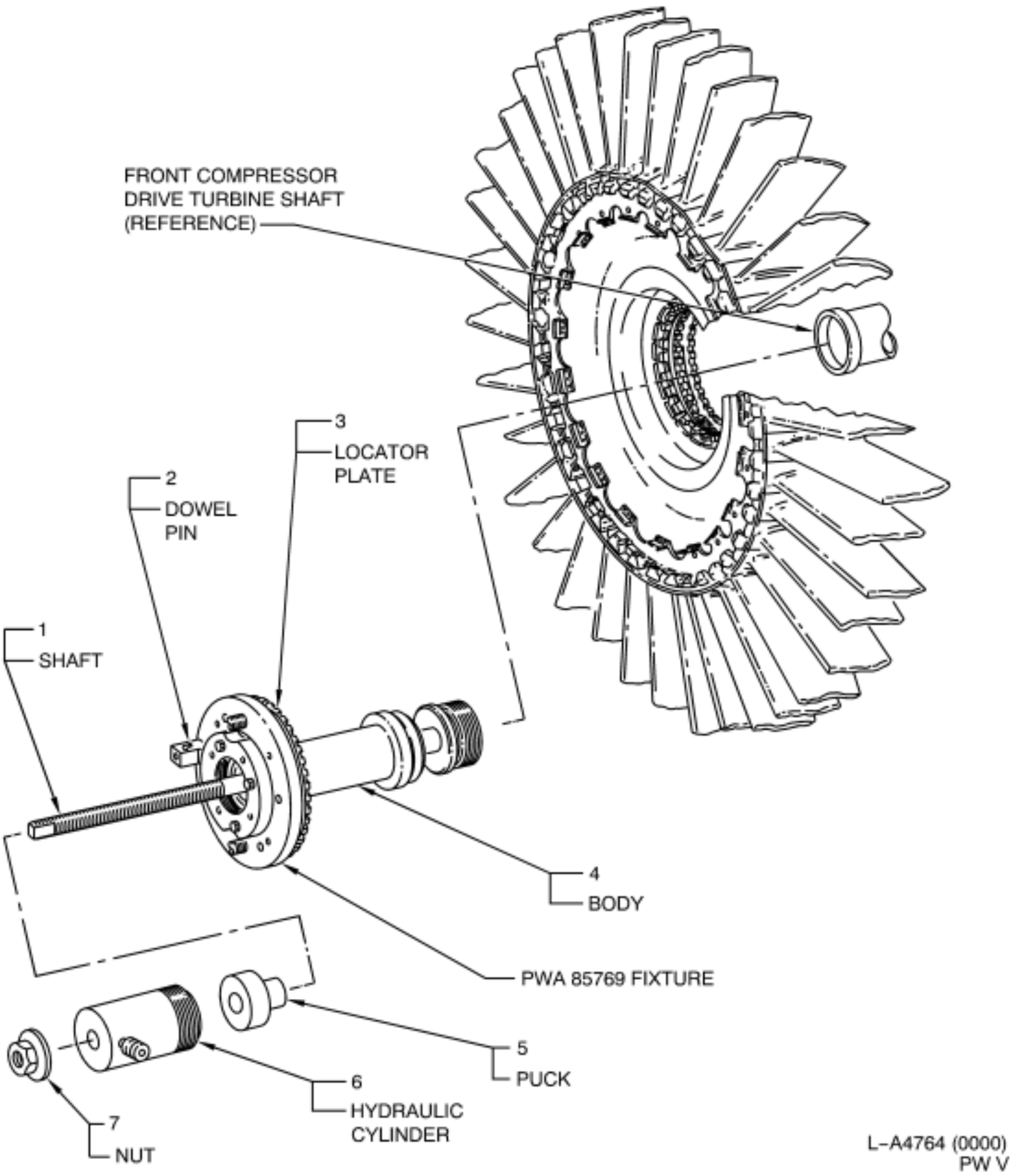
ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−01


HOIST
HOIST
GUIDE
L−A6229 (0000)
PW V

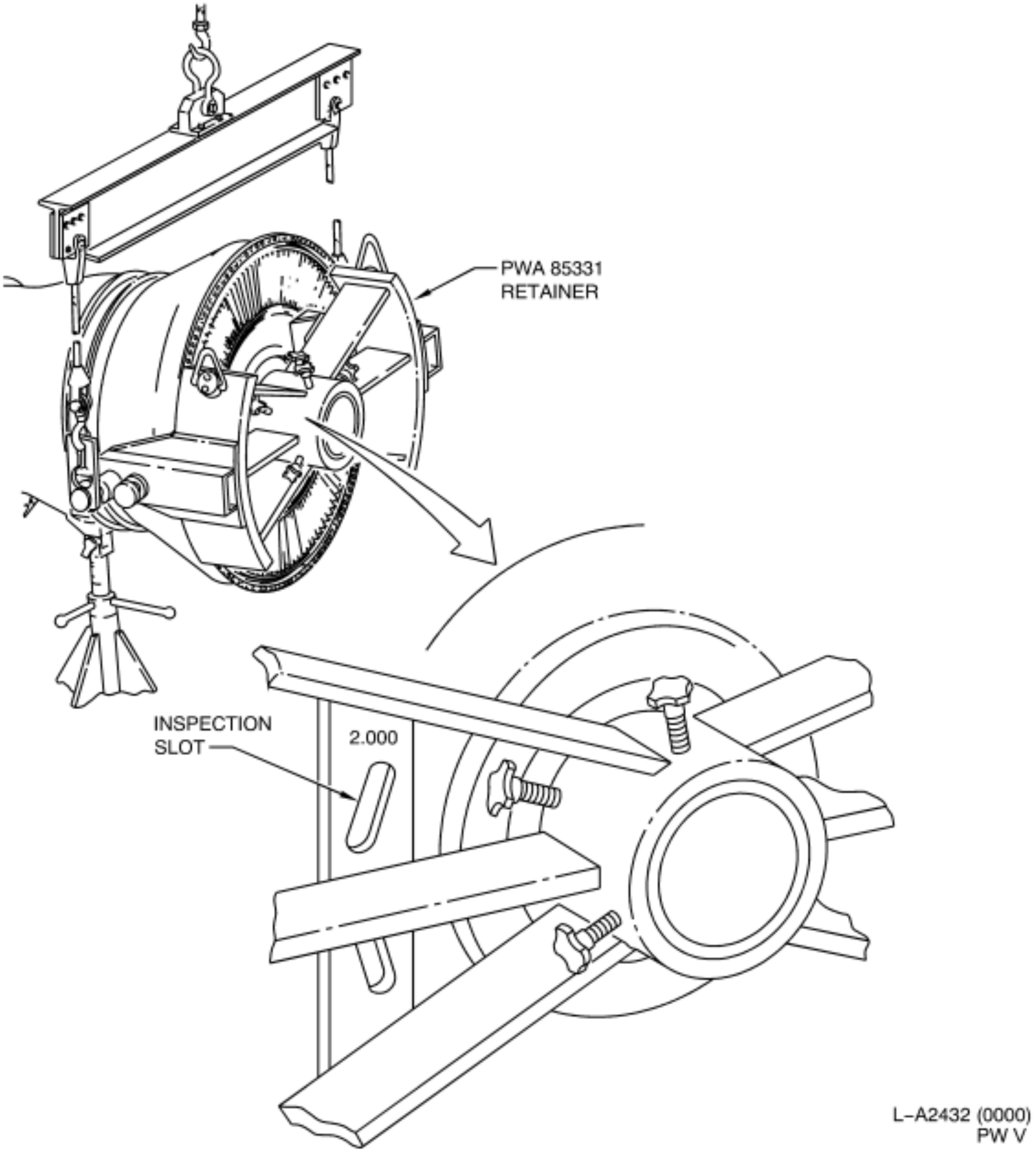
PWA 88204 Guide Installation
Figure 407
(Task 72−00−53−420−001)


1
NUT
2
BOLT
(4 REQUIRED)
3
RETAINER
4
BOLT
(2 REQUIRED)
L−A1407 (0293)
PW V

Low Pressure Turbine Front Retainer Removal
Figure 408
(Task 72−00−53−420−001)

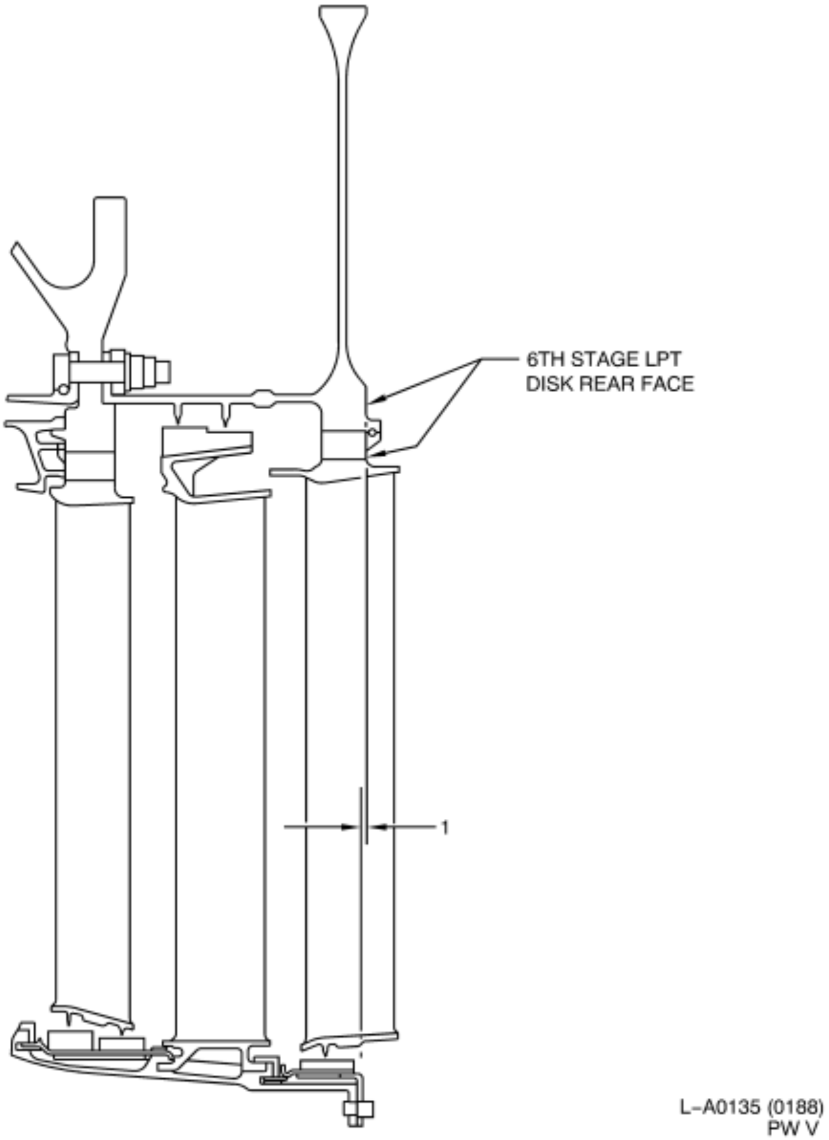

FRONT COMPRESSOR DRIVE TURBINE SHAFT (REFERENCE)
3 LOCATOR PLATE
2 DOWEL PIN
1 SHAFT
4 BODY
PWA 85769 FIXTURE
5 PUCK
6 HYDRAULIC CYLINDER
7 NUT
L-A4764 (0000)
PW V

Low Pressure Turbine Installation
Figure 409
(Task 72-00-53-420-001)


PWA 85331
RETAINER
INSPECTION
SLOT
2.000
L−A2432 (0000)
PW V

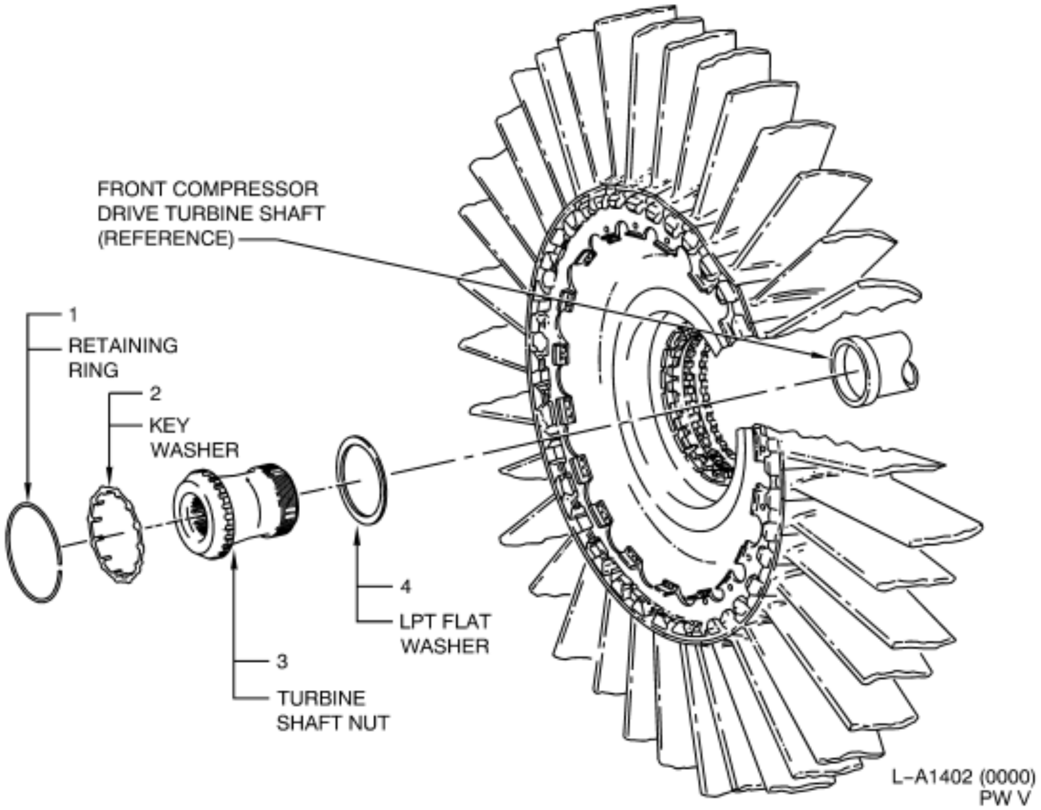
Low Pressure Turbine Axial Position Check
Figure 410 (Sheet 1)
(Task 72−00−53−420−001)

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - INSTALLATION-01

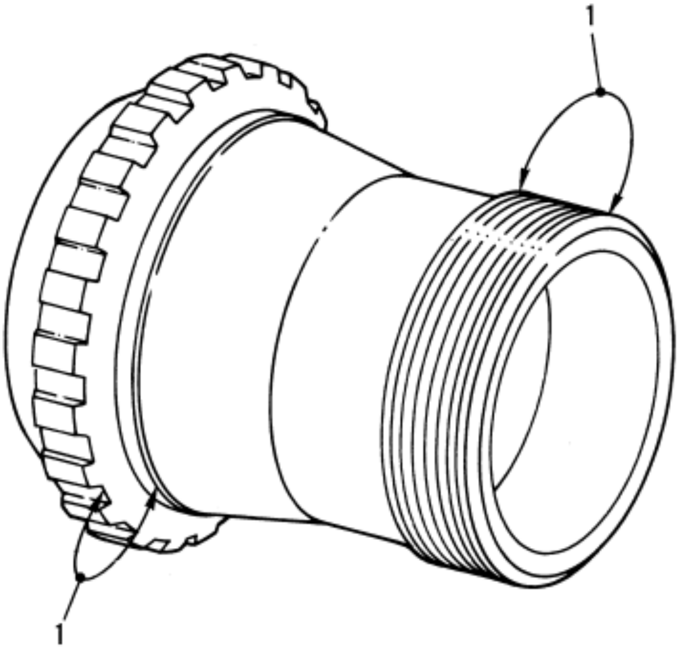

6TH STAGE LPT
DISK REAR FACE
1
L-A0135 (0188)
PW V

1. (Reference 828) (Pre SB PW4ENG 72-256) 0.055 - 0.105 Inch (1.40 - 2.67 mm)
   (Reference 850) (Post SB PW4ENG 72-256) 0.105 - 0.155 Inch (2.67 - 3.94 mm)

Low Pressure Turbine Axial Position Check
Figure 410 (Sheet 2)
(Task 72-00-53-420-001)


FRONT COMPRESSOR DRIVE TURBINE SHAFT (REFERENCE)
1
RETAINING RING
2
KEY WASHER
4
LPT FLAT WASHER
3
TURBINE SHAFT NUT
L−A1402 (0000)
PW V

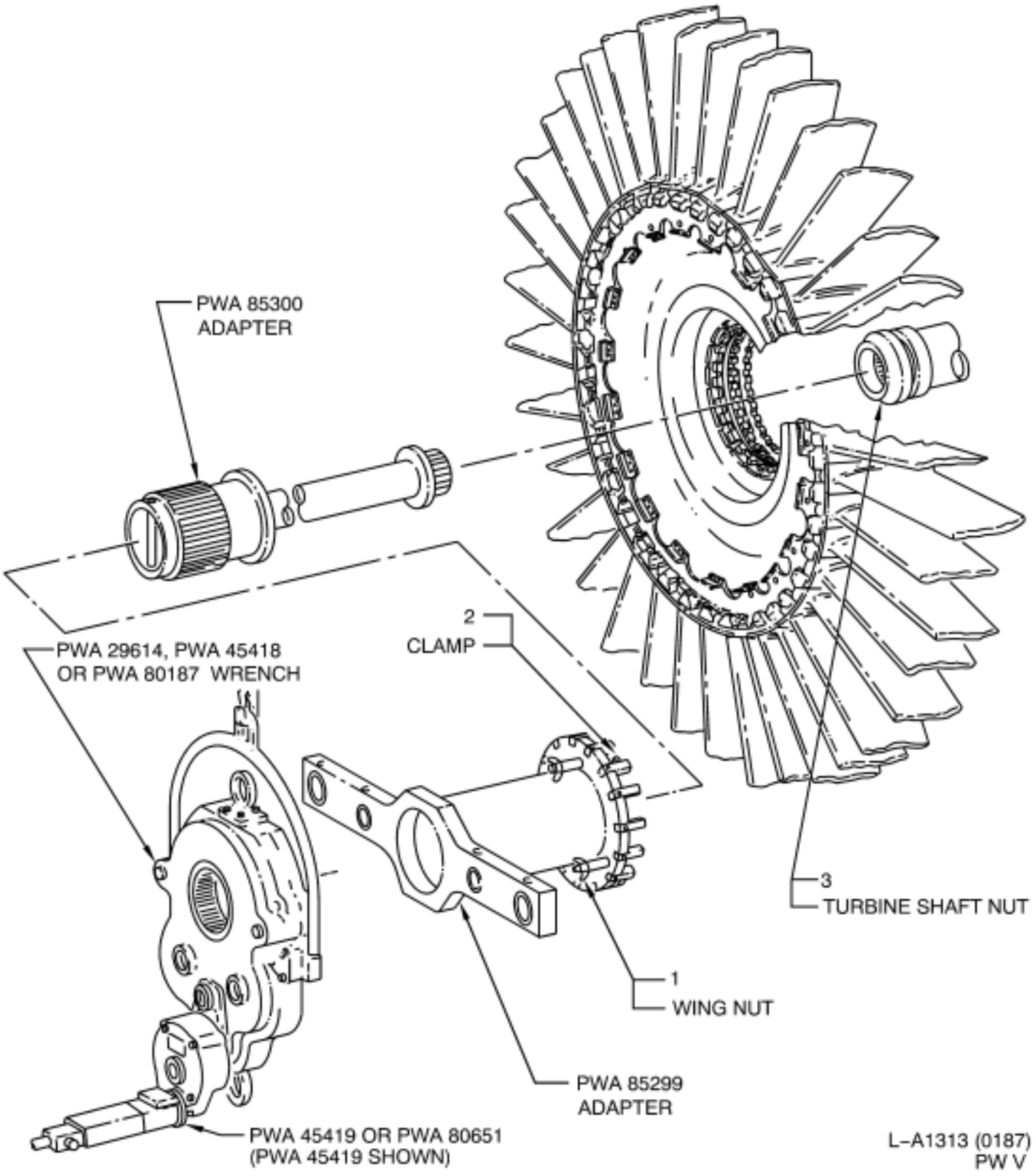
Turbine Shaft Nut Installation
Figure 411
(Task 72−00−53−420−001)



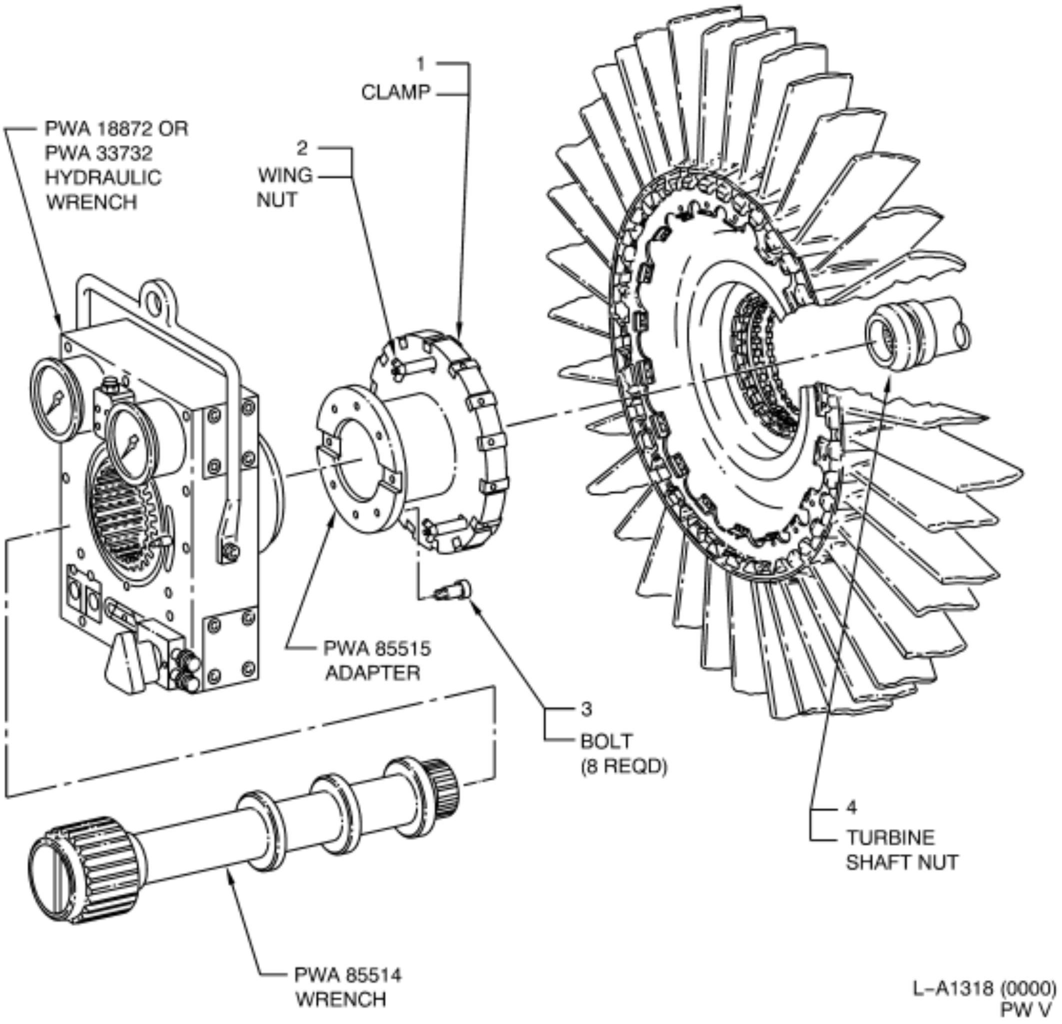
L−A1403
0586

1. Treat Enclosed Area. See Text.

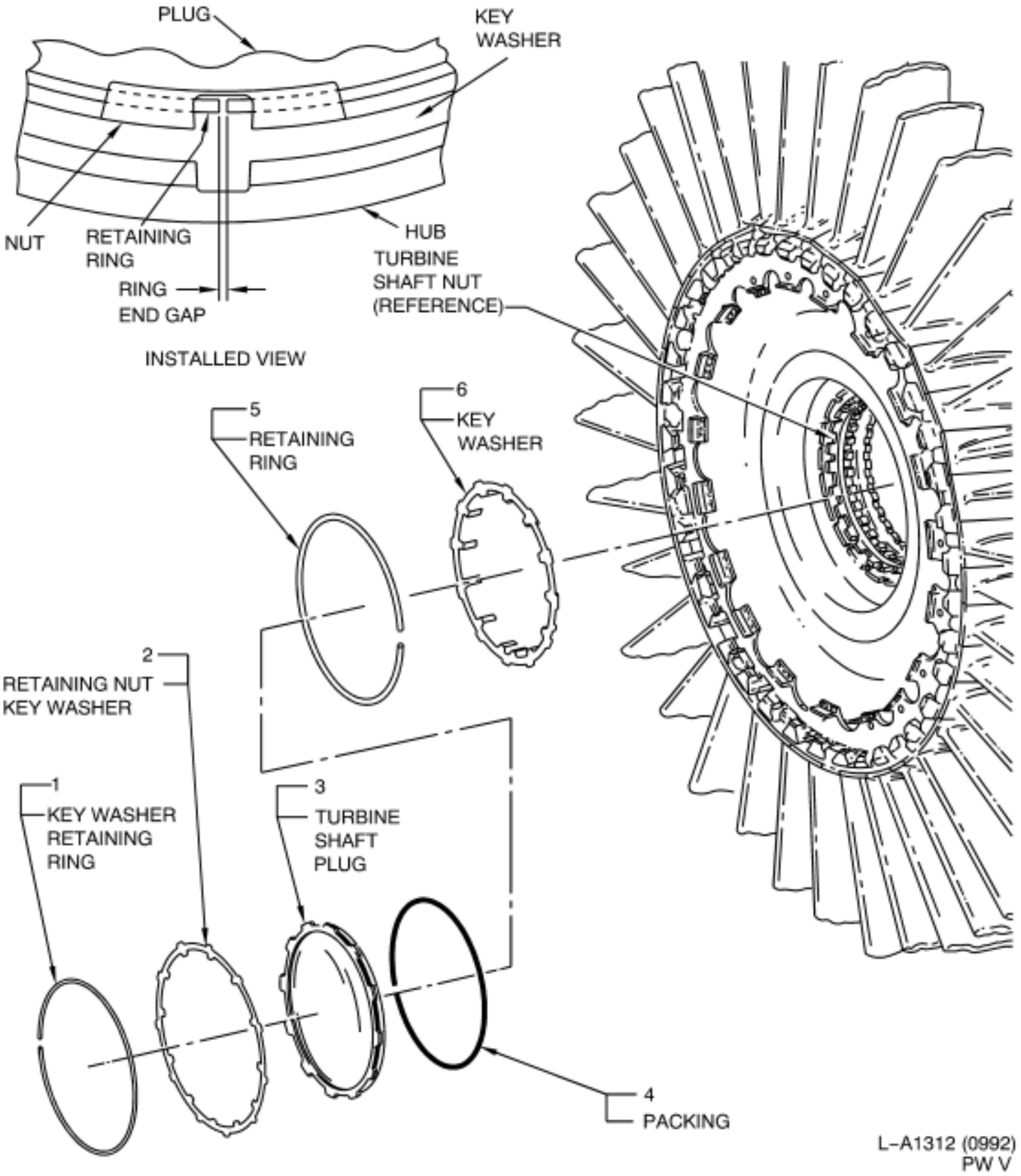
Turbine Shaft Nut Antigalling Compound Application
Figure 412
(Task 72−00−53−420−001)


PWA 85300
ADAPTER
2
CLAMP
PWA 29614, PWA 45418
OR PWA 80187 WRENCH
3
TURBINE SHAFT NUT
1
WING NUT
PWA 85299
ADAPTER
PWA 45419 OR PWA 80651
(PWA 45419 SHOWN)
L−A1313 (0187)
PW V

Turbine Shaft Nut Torquing (Mechanical Wrench)
Figure 413
(Task 72−00−53−420−001)


1
CLAMP
PWA 18872 OR
PWA 33732
HYDRAULIC
WRENCH
2
WING
NUT
PWA 85515
ADAPTER
3
BOLT
(8 REQD)
4
TURBINE
SHAFT NUT
PWA 85514
WRENCH
L-A1318 (0000)
PW V

Turbine Shaft Nut Torquing (Hydraulic Wrench)
Figure 414
(Task 72-00-53-420-001)


PLUG
KEY WASHER
NUT
RETAINING RING
HUB
TURBINE SHAFT NUT (REFERENCE)
RING END GAP
INSTALLED VIEW
5 RETAINING RING
6 KEY WASHER
2 RETAINING NUT KEY WASHER
1 KEY WASHER RETAINING RING
3 TURBINE SHAFT PLUG
4 PACKING
L-A1312 (0992)
PW V

Turbine Shaft Plug Installation
Figure 415
(Task 72-00-53-420-001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−02

Task 72−00−53−420−001−002:

1. Install The Low Pressure Turbine With Shaft (Hydraulic Wrench) − Deleted

A. Procedure

(1) This procedure is relocated to 72−00−53, Installation−01 (Task 72−00−53−420−001).

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - INSTALLATION-03

Task 72-00-53-420-003:

1. Install External Plumbing After Low Pressure Turbine Installation

A. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-059	Wax, Paraffin (PMC 9552)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	75-24-00/2/5
Gasket	1	75-24-00/3/25
Gasket	1	75-24-00/3/125
Seal Plate	1	75-24-00/2/1
Seal Plate	1	75-24-00/3/20
Seal Plate	1	75-24-00/3/120

B. Procedure
See Figures 401, 402, 403 and 404.

(1) Install HPT manifold (collector) assembly as follows.

(a) Install bolt, threads lubricated with Engine Oil P03-001, spacer and nut to Flange M bracket at approximately 3 o'clock position. Torque bolt to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(b) Remove protective closures and install manifold (collector) with clamp, screw, threads lubricated with Engine Oil P03-001, and nut to spacer. Torque screw to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(2) Install turbine case cooling (TCC) HPT manifolds (AC21) through (AC28) (less lower front manifold) as follows.

(a) Install support brackets, angled rearward and on rear side of Flange N brackets (five locations) with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(b) Install support brackets, angled forward, and on front side of Flange M brackets (three locations) with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Remove protective closures and rotate upper and lower rear manifolds to engage manifold (collector). Secure to manifold (collector) with bolts, threads lubricated with Engine Oil P03−001, handtight only. Secure manifolds to support brackets with clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts handtight only.

(d) Remove protective closures and install upper and lower, center two, manifolds to engage manifold collector. Secure to manifold (collector) with bolts, threads lubricated with Engine Oil P03−001, handtight only. Secure manifold supports at each end to brackets (six locations) with bolts, threads lubricated with Engine Oil P03−001, and nuts handtight only.

(e) Remove protective closures and install upper front manifold to engage manifold (collector). Secure to manifold (collector) with bolt, threads lubricated with Engine Oil P03−001, handtight only. Secure manifold to support brackets (three locations) with clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts handtight only.

(f) Torque all bolts securing all manifolds to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(3) Install turbine vane cooling air duct (lower left) (AP03) as follows.

(a) Remove protective closures.

(b) Install a new gasket in place on the HPC case boss with Paraffin Wax P05−059 at approximately the 9 o'clock position.

(c) FOR THESE MODELS: 4152, 4156A, 4158
Install a new metering orifice seal plate, convex side outward, in place to the pad at approximately the 7 o'clock position on the HPT case with Paraffin Wax P05−059 (Engines with SB PW4ENG 72−315 and without SB PW4ENG 75−57).

(d) FOR THESE MODELS: 4152, 4156A, 4158
Install a new gasket in place on the HPT pad with Paraffin Wax P05−059 at approximately the 7 o'clock position (Engines without SB PW4ENG 72−315 and with SB PW4ENG 75−57).

(e) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install a metering orifice seal plate in place to the pad at approximately the 7 o'clock position on the HPT case with Paraffin Wax P05−059.

(f) Position the cooling air duct to the above pads and attach the rear of the duct with bolts, threads lubricated with Engine Oil P03−001, handtight only.

(g) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Align boltholes of bracket (attached to the No. 4 bearing oil pressure tube) with boltholes in the front flange of the duct. Attach the front flange and bracket to the HPC boss with bolts, threads lubricated with Engine Oil P03−001, handtight only.

(h) FOR THESE MODELS: 4152, 4156A, 4158
Attach the front flange of the cooling air duct to the HPC case with two longer bolts and washers at the two uppermost locations and four shorter bolts at the remaining bolt holes (Engines without SB PW4ENG 79−54), threads lubricated with Engine Oil P03−001, handtight only.

(i) FOR THESE MODELS: 4152, 4156A, 4158
Attach the front flange of the cooling air duct to the HPC case with bolts, threads lubricated with Engine Oil P03−001 (Engines with SB PW4ENG 79−54).

(j) Position clamp over duct at bracket on diffuser case boss and secure to bracket with bolts, threads lubricated with Engine Oil P03−001, an nuts. Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(k) Torque bolts at front flange to 85 − 95 lb−in. (9.604 − 10.734 N.m) then retorque to same limit without loosening until torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

(l) Torque bolts at rear flange to 180 − 200 lb−in. (20.337 − 22.597 N.m) then retorque to same limit without loosening until torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

(m) Torque the clamp bolt that attaches the No. 4 bearing oil pressure tube to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(n) Install a bolt, threads lubricated with Engine Oil P03−001, and a nut to the clamp that attaches the No. 3 bearing pressure manifold (LP18) to the bracket on the front flange of the cooling air tube. Adjust the spray shield on the inboard side of the manifold and torque the bolt clamp to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(o) For engines equipped, install gasket to borescope plug groove. Install plug to rear elbow and engage end of plug into inner hole to seat. Install three bolts, threads lubricated with Engine Oil P03−001. Torque bolts to 75 − 85 lb−in. (8.474 − 9.604 N.m), then retorque to same limit without loosening until torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(4) Install turbine vane cooling air duct (upper left) (AP04) as follows.

(a) Remove protective closures.

(b) Secure a new gasket in place on flange of turbine cooling air valve with Paraffin Wax P05−059.

(c) FOR THESE MODELS: 4152, 4156A, 4158
Install a new metering orifice seal plate (Engines without SB PW4ENG 72−315 or SB PW4ENG 75−57) or a gasket (Engines with SB PW4ENG 72−315 or SB PW4ENG 75−57) in place on the HPT pad with Paraffin Wax P05−059 at approximately the 9 o'clock position.

(d) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install a new gasket in place on the HPT pad with Paraffin Wax P05−059 at approximately the 9 o'clock position.

(e) Position cooling air duct to HPT boss and to rear of cooling air valve and secure with bolts, threads lubricated with Engine Oil P03−001, larger bolts at rear flange handtight only.

(f) Position clamp to cooling air duct at bracket on diffuser case and secure with bolts and nuts lubricated with Engine Oil P03−001. Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(g) Torque bolts at forward flange to 85 − 95 lb−in. (9.604 − 10.734 N.m), then retorque to same limit without loosening until torque is maintained.

(h) Torque bolts at rear flange to 180 − 200 lb−in. (20.337 − 22.597 N.m) then retorque to same limit without loosening until torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts at the rear flange of the duct.

(5) FOR THESE MODELS: 4152, 4156A, 4158
Install (upper right) turbine cooling tube assembly (AP01) as follows.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove protective closures.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Secure new gasket in place to pad at approximately 2 o'clock position on HPC rear case with Paraffin Wax P05−059.

(c) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 72−315), Secure new gasket in place to pad at approximately 1 o'clock position on HPT case with Paraffin Wax P05−059.

(d) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 72−315), Install a new metering orifice seal plate, convex side outward, in place to the pad at approximately at the 1 o'clock position on the HPT case with Paraffin Wax P05−059.

(e) FOR THESE MODELS: 4152, 4156A, 4158
Install front flange of tube with smaller bolts, threads lubricated with Engine Oil P03−001, and bracket to HPC boss handtight only.

(f) FOR THESE MODELS: 4152, 4156A, 4158
Install rear flange of tube with larger bolts, threads lubricated with Engine Oil P03−001, to HPT boss handtight only.

(g) FOR THESE MODELS: 4152, 4156A, 4158
Install clamp and bolts, threads lubricated with Engine Oil P03−001, to diffuser case bracket. Torque clamp bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(h) FOR THESE MODELS: 4152, 4156A, 4158
Torque bolts at front flange to 85 − 95 lb−in. (9.604 − 10.734 N.m) then retorque to same limit without loosening until torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

(i) FOR THESE MODELS: 4152, 4156A, 4158
Torque bolts at rear flange to 180 − 200 lb−in. (20.337 − 22.597 N.m) then retorque to same limit without loosening until torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

(6) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the (upper right) turbine vane cooling air duct (AP01) as follows.

(a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the protection covers.

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install a new gasket to the front flange of the cooling air duct. Attach the gasket to the duct flange with Paraffin Wax P05−059.

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install a new metering orifice seal plate, convex side outward, to the HPT pad located approximately at the 1 o'clock position. Attach the plate with Paraffin Wax P05−059.

(d) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the cooling air duct to the HPT pad and to valve flange. Attach the duct with bolts, threads lubricated with Engine Oil P03−001, with the larger bolts at the rear flange. Tighten the bolts by hand.

(e) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install a clamp over the cooling air duct at the support on the diffuser case at approximately the 2 o'clock position. Attach the clamp to the support with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 65 − 85 lb−in. (7.344 − 9.604 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

(f) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Torque the bolts at the front flange to 85 − 95 lb−in. (9.604 − 10.734 N.m). Continue to torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m) until the torque is kept. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

(g) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Torque the bolts at the rear flange to 180 − 200 lb−in. (20.337 − 22.597 N.m). Continue to torque the bolts to 180 − 200 lb−in. (20.337 − 22.597 N.m) until the torque is kept. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

(7) Install turbine case cooling (TCC) air shutoff valves as follows.

NOTE: Be sure and do not use the TCC blank−off plate, PN 53T473, between the upper support bracket and the TCC duct.

NOTE: Be sure and do not use the TCC metering−plate, PN 53T542, for engines with the SCN−8 EEC (Post SB PW4ENG 73−53). For engines prior to the SCN−8 EEC (Pre SB PW4ENG 73−53), use the metering−plate, PN 53T542, between the upper support bracket and the TCC duct. See SB PW4ENG 75−56 if more information is needed.

(a) Remove protective closures and position lower link under flange of manifold (collector) and secure to LPT case bracket with bolt, threads lubricated with Engine Oil P03−001, and nut handtight only.

(b) Position lower support bracket over collector and secure to Flange N bracket with bolts, threads lubricated with Engine Oil P03−001, and nuts handtight only.

(c) Install HPT case cooling air shutoff valve (flow arrows pointing down) on lower support bracket and secure with bolts, threads lubricated with Engine Oil P03−001, and nuts handtight only.

(d) Position upper link under top flange of valve and secure to LPT case bracket with bolt, threads lubricated with Engine Oil P03−001, and nut handtight only.

(e) Position upper support bracket over top flange of valve and secure to Flange N bracket with bolts, threads lubricated with Engine Oil P03−001, and nuts handtight only.

(f) Secure turbine case cooling duct with bolts, threads lubricated with Engine Oil P03−001, to upper support link, valve flange and upper support bracket handtight only.

(g) Slide LPT case cooling air shutoff valve (flow arrows pointing down) between upper and lower support brackets and secure to upper support bracket, link and duct with bolts threads lubricated with Engine Oil P03−001, handtight only. Do not install bolts through bottom flange of LPT valve as yet.

(h) Secure turbine pull control cable bracket to upper support bracket with screw, threads lubricated with Engine Oil P03−001, handtight only.

(i) Install struts to Flange M brackets with bolts, threads lubricated with Engine Oil P03−001, and nuts handtight only.

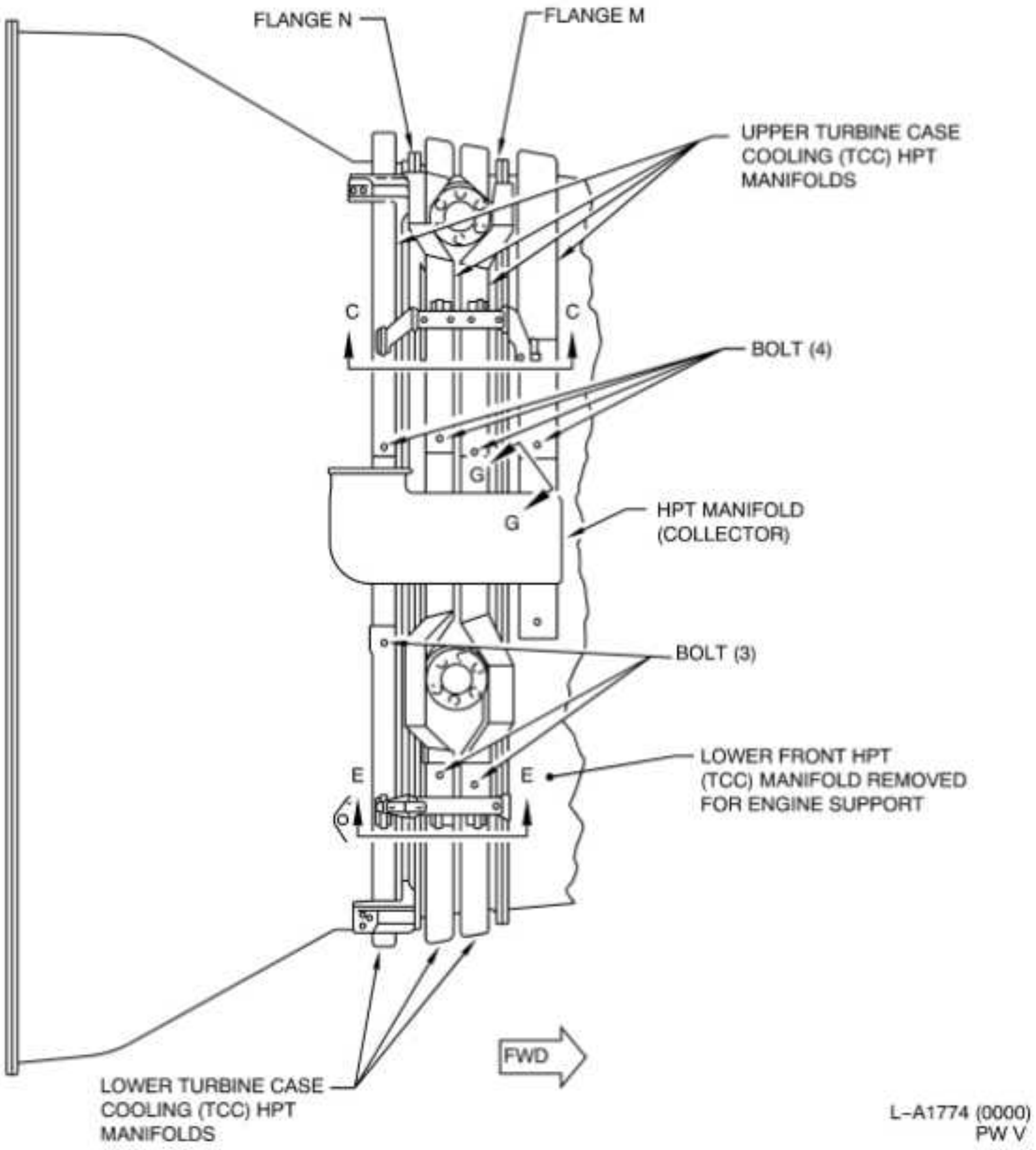
(j) Install braces to Flange N brackets with washers, bolts, threads lubricated with Engine Oil P03−001, and nuts handtight only.

(k) Align struts and braces with turbine pull control cable bracket and install bolt, threads lubricated with Engine Oil P03−001, spacers and nut handtight only.

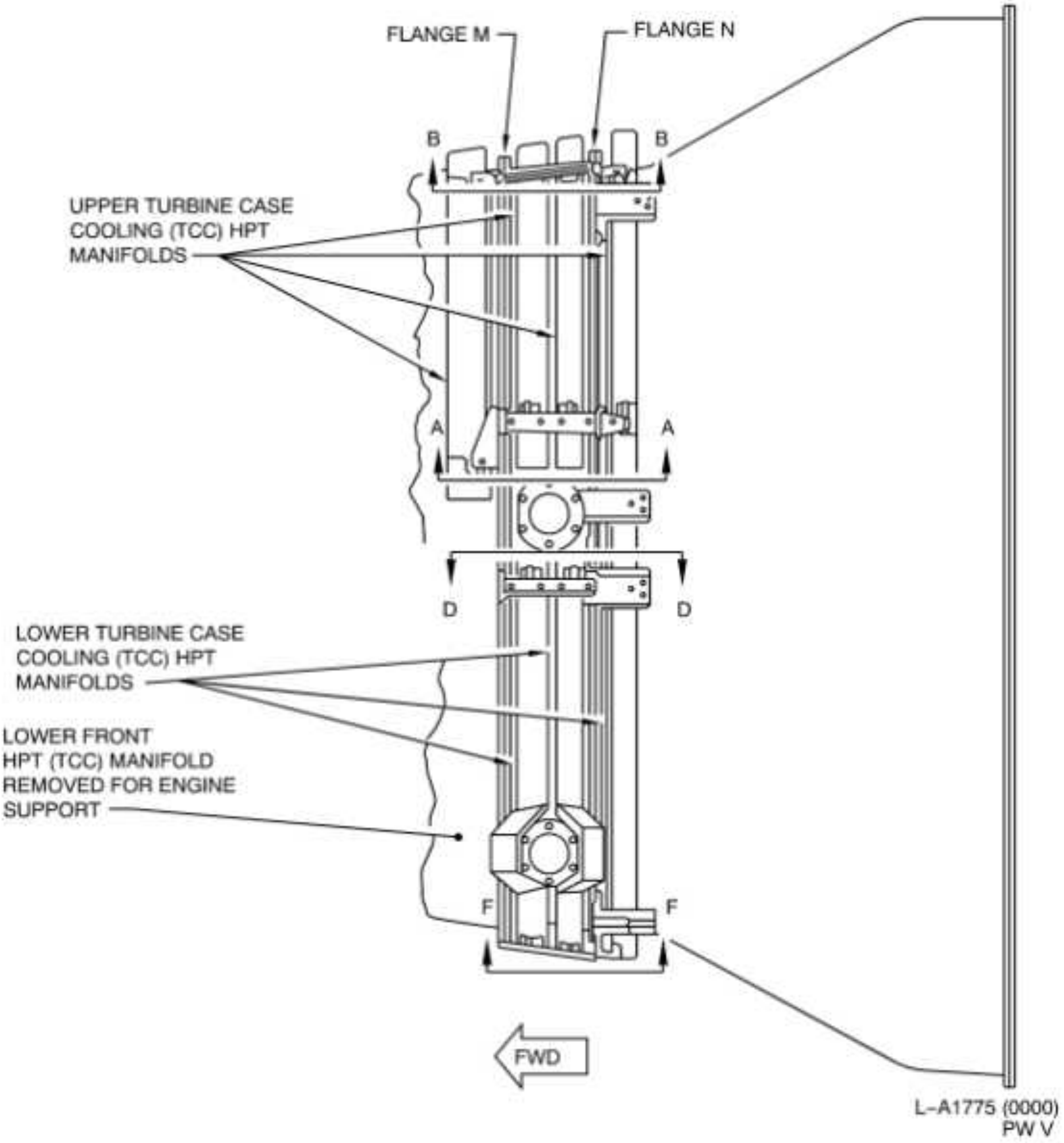
(l) Torque screw and all bolts securing upper and lower links, upper and lower support brackets, valve flanges, duct, struts and braces to 85 − 95 lb−in. (9.604 − 10.734 n.m).

C. Postrequisites

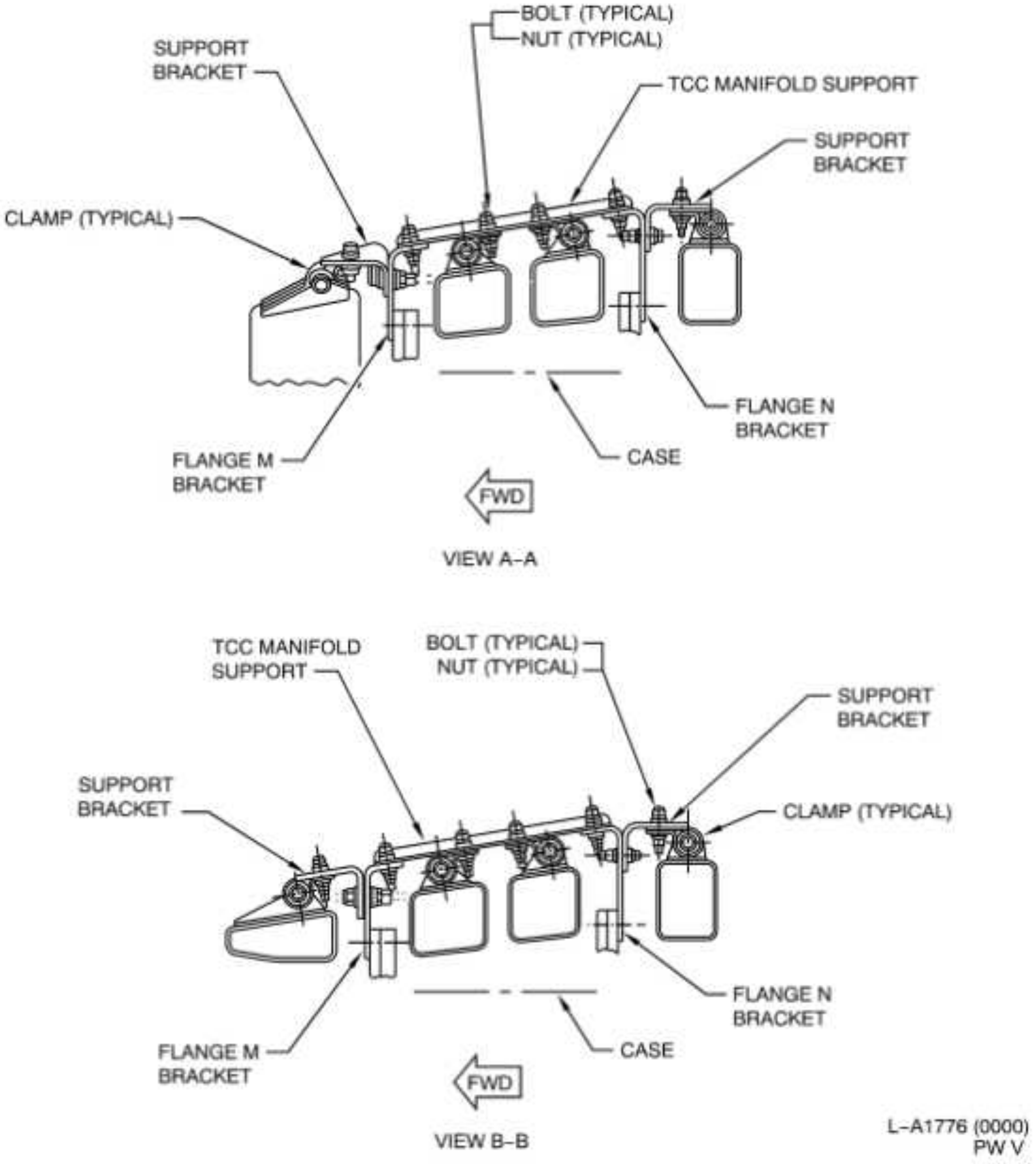
(1) Install turbine case cooling (TCC) air valve control cable per 72−00−53, Installation−06.


FLANGE N
FLANGE M
UPPER TURBINE CASE COOLING (TCC) HPT MANIFOLDS
C
C
BOLT (4)
G
G
HPT MANIFOLD (COLLECTOR)
BOLT (3)
E
E
LOWER FRONT HPT (TCC) MANIFOLD REMOVED FOR ENGINE SUPPORT
FWD
LOWER TURBINE CASE COOLING (TCC) HPT MANIFOLDS
L−A1774 (0000)
PW V

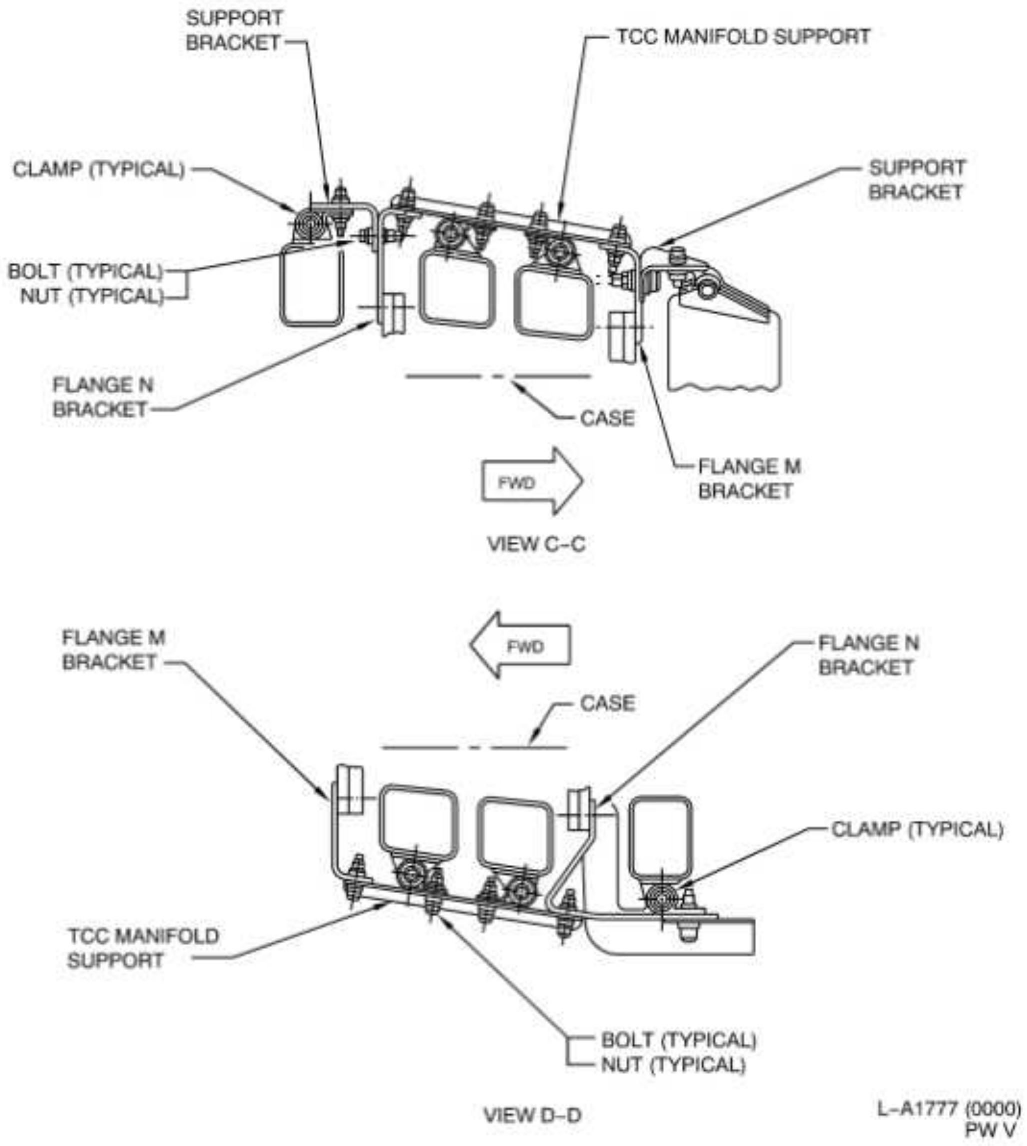
High Pressure Turbine Cooling Air Manifolds
Figure 401 (Sheet 1)
(Task 72−00−53−420−003)


FLANGE M
FLANGE N
B
B
UPPER TURBINE CASE COOLING (TCC) HPT MANIFOLDS
A
A
D
D
LOWER TURBINE CASE COOLING (TCC) HPT MANIFOLDS
LOWER FRONT HPT (TCC) MANIFOLD REMOVED FOR ENGINE SUPPORT
F
F
FWD
L-A1775 (0000)
PW V

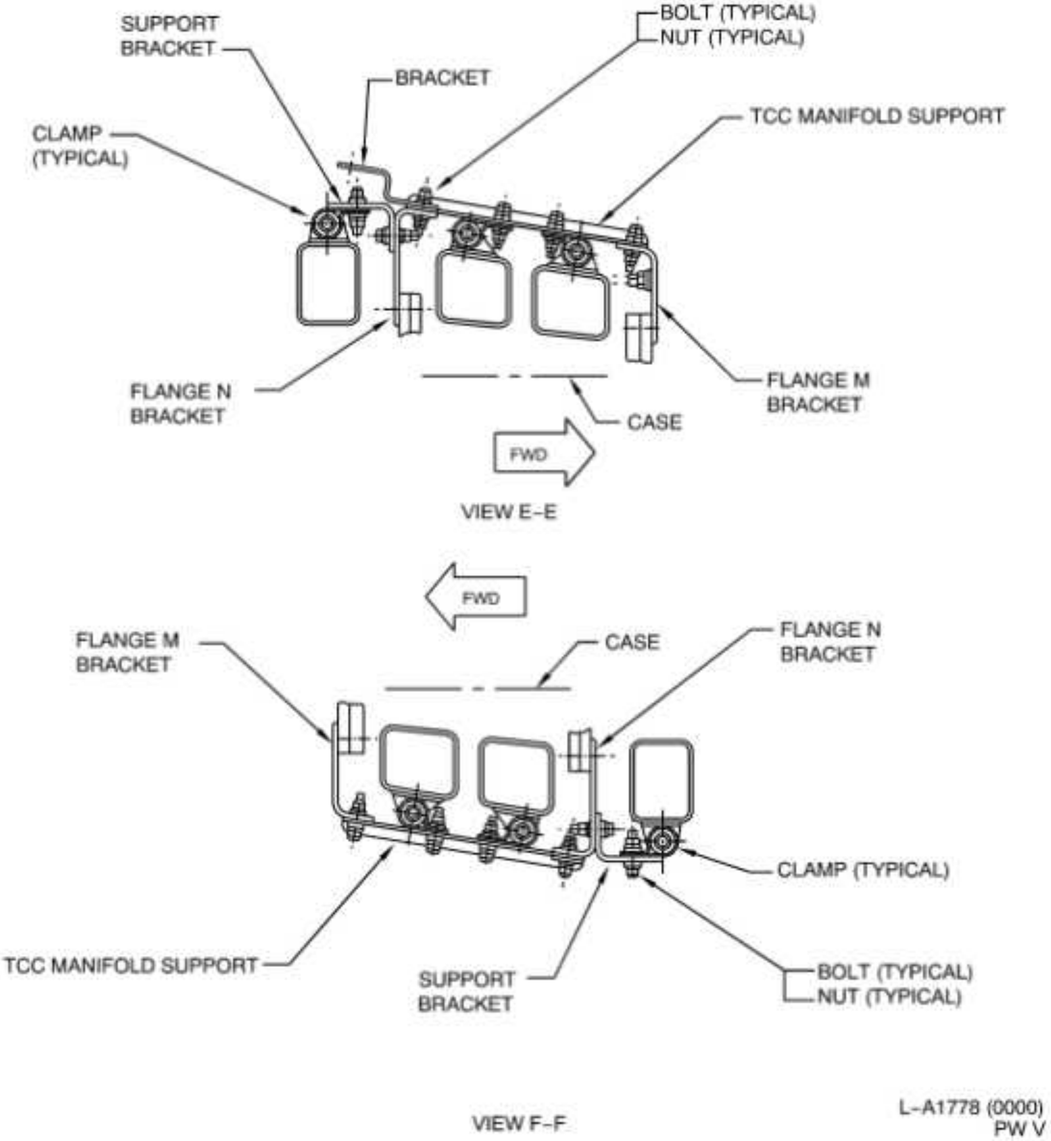
High Pressure Turbine Cooling Air Manifolds
Figure 401 (Sheet 2)
(Task 72-00-53-420-003)


BOLT (TYPICAL)
NUT (TYPICAL)
SUPPORT BRACKET
TCC MANIFOLD SUPPORT
SUPPORT BRACKET
CLAMP (TYPICAL)
FLANGE N BRACKET
CASE
FLANGE M BRACKET
FWD
VIEW A−A
TCC MANIFOLD SUPPORT
BOLT (TYPICAL)
NUT (TYPICAL)
SUPPORT BRACKET
SUPPORT BRACKET
CLAMP (TYPICAL)
FLANGE N BRACKET
CASE
FLANGE M BRACKET
FWD
VIEW B−B
L−A1776 (0000)
PW V

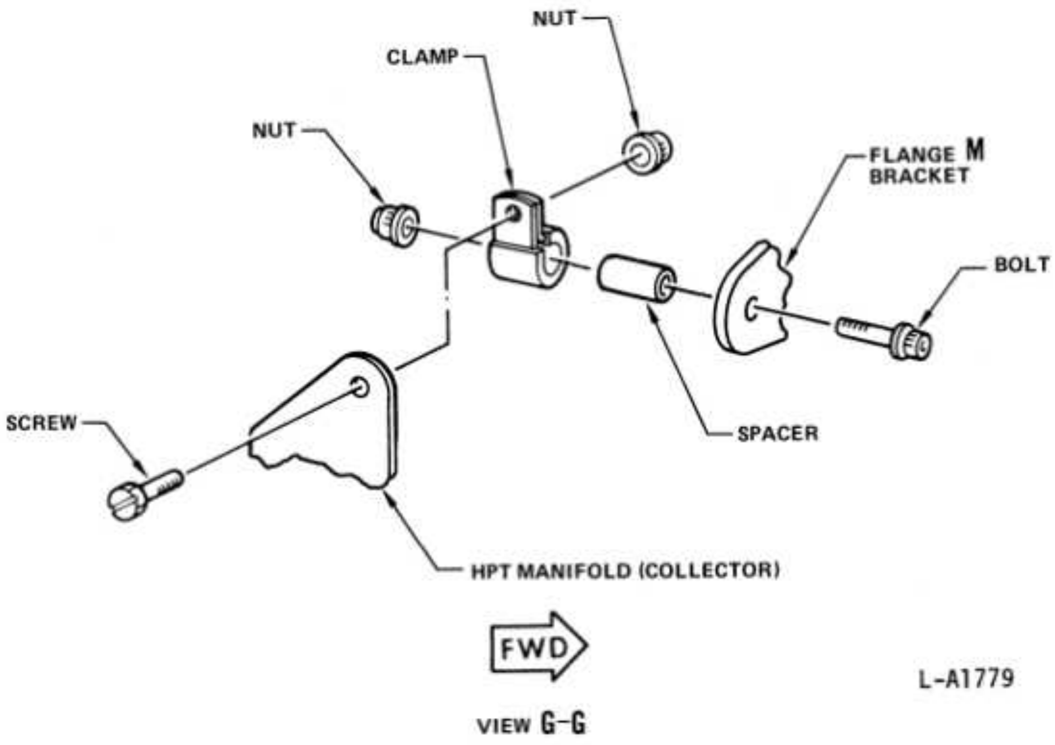
High Pressure Turbine Cooling Air Manifolds
Figure 401 (Sheet 3)
(Task 72−00−53−420−003)


SUPPORT BRACKET
TCC MANIFOLD SUPPORT
CLAMP (TYPICAL)
SUPPORT BRACKET
BOLT (TYPICAL)
NUT (TYPICAL)
FLANGE N BRACKET
CASE
FLANGE M BRACKET
FWD
VIEW C−C
FLANGE M BRACKET
FWD
FLANGE N BRACKET
CASE
CLAMP (TYPICAL)
TCC MANIFOLD SUPPORT
BOLT (TYPICAL)
NUT (TYPICAL)
VIEW D−D
L−A1777 (0000)
PW V

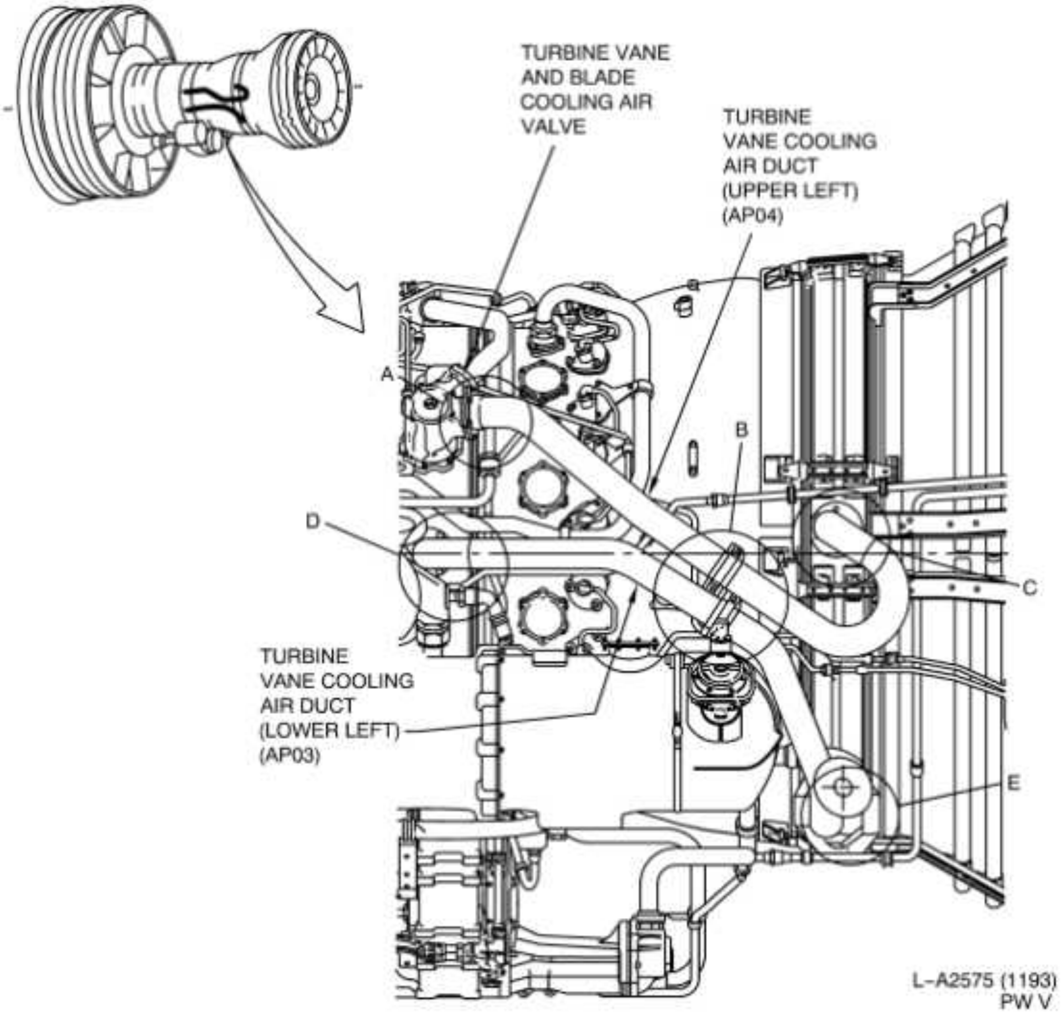
High Pressure Turbine Cooling Air Manifolds
Figure 401 (Sheet 4)
(Task 72−00−53−420−003)


SUPPORT BRACKET
BOLT (TYPICAL)
NUT (TYPICAL)
BRACKET
TCC MANIFOLD SUPPORT
CLAMP (TYPICAL)
FLANGE N BRACKET
FLANGE M BRACKET
CASE
FWD
VIEW E−E
FWD
FLANGE M BRACKET
CASE
FLANGE N BRACKET
CLAMP (TYPICAL)
TCC MANIFOLD SUPPORT
SUPPORT BRACKET
BOLT (TYPICAL)
NUT (TYPICAL)
VIEW F−F
L−A1778 (0000)
PW V

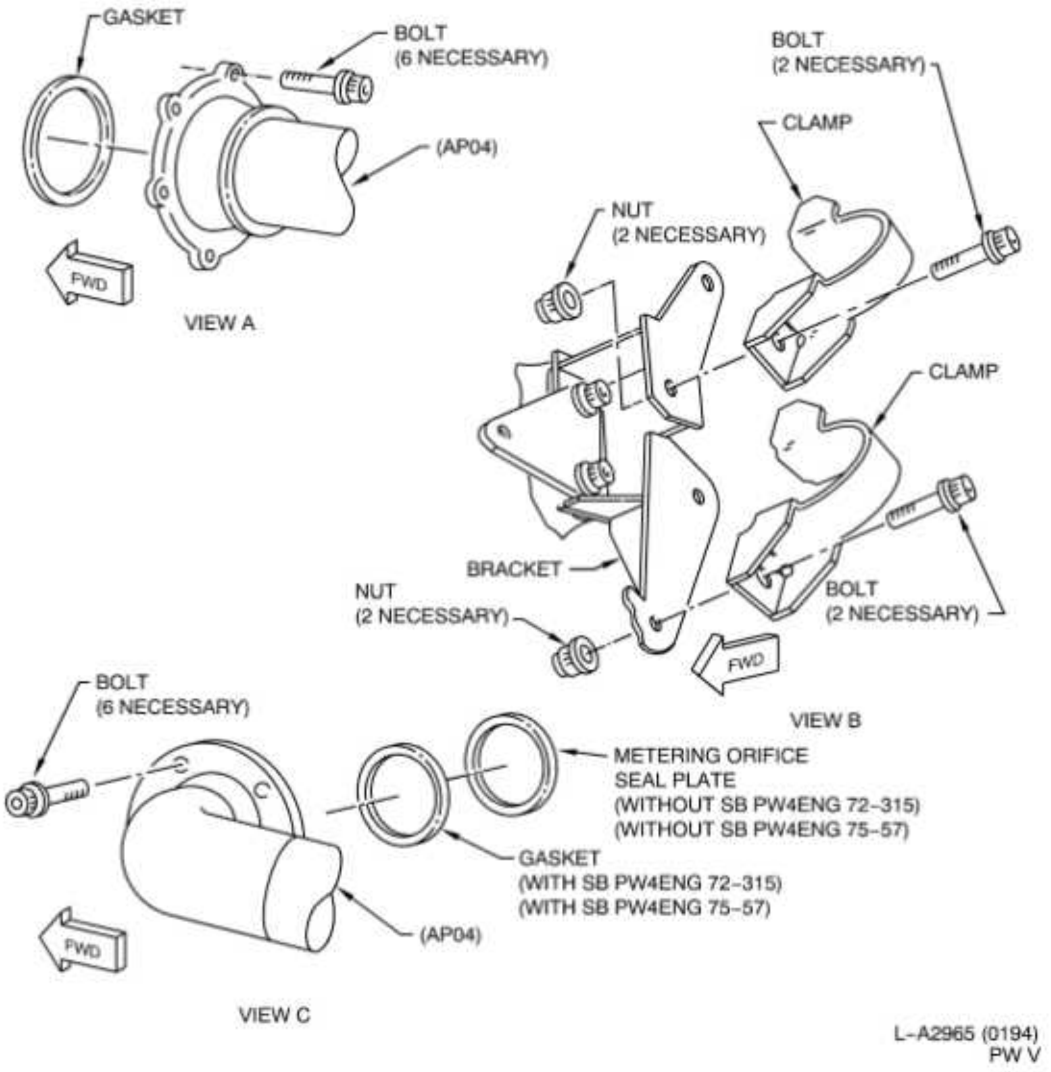
High Pressure Turbine Cooling Air Manifolds
Figure 401 (Sheet 5)
(Task 72−00−53−420−003)


NUT
CLAMP
NUT
FLANGE M
BRACKET
BOLT
SPACER
SCREW
HPT MANIFOLD (COLLECTOR)
FWD
L-A1779
VIEW G-G

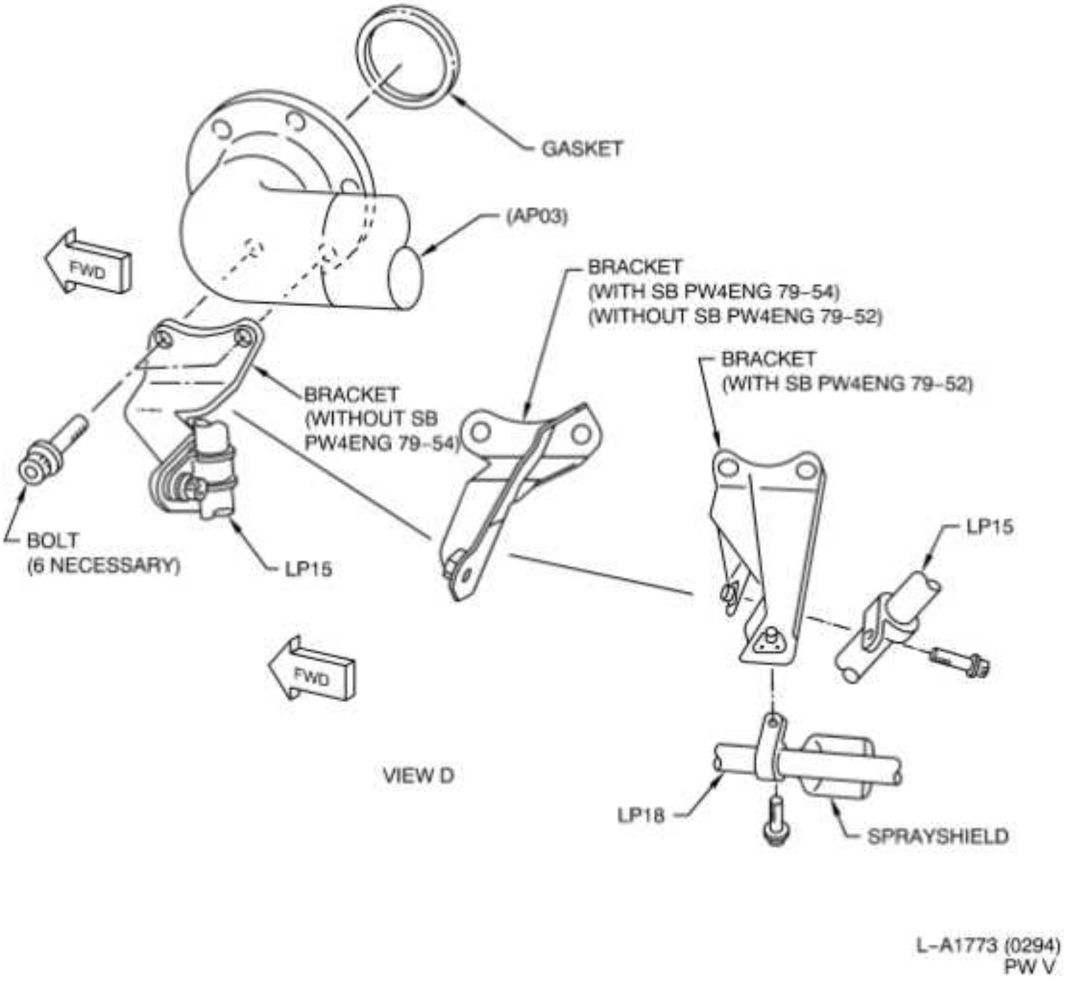
High Pressure Turbine Cooling Air Manifolds
Figure 401 (Sheet 6)
(Task 72−00−53−420−003)


TURBINE VANE AND BLADE COOLING AIR VALVE
TURBINE VANE COOLING AIR DUCT (UPPER LEFT) (AP04)
A
B
C
D
E
TURBINE VANE COOLING AIR DUCT (LOWER LEFT) (AP03)
L-A2575 (1193)
PW V

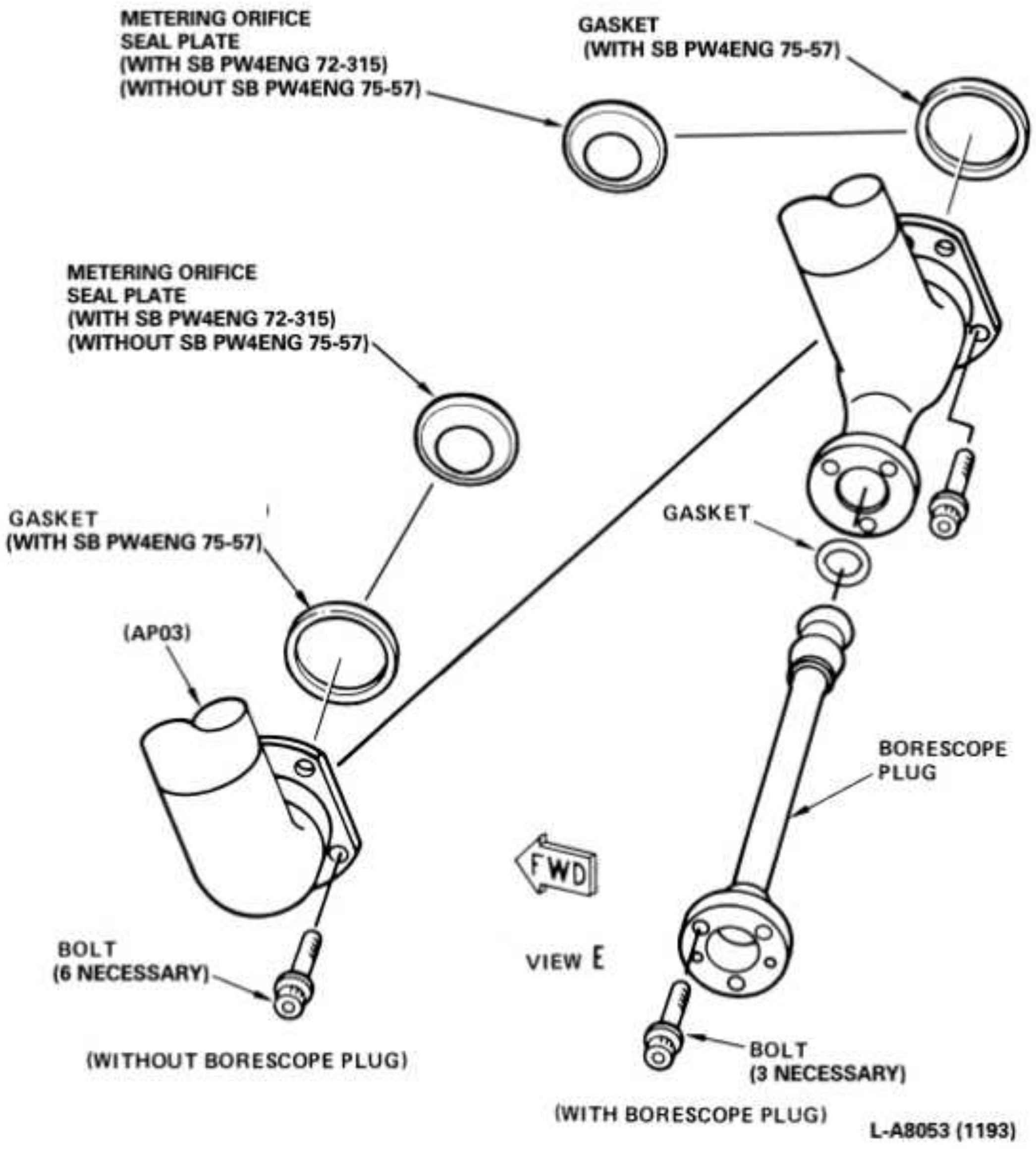
Turbine Vane Cooling Air Ducts (Left Side)
Figure 402 (Sheet 1)
(Task 72−00−53−420−003)


GASKET
BOLT
(6 NECESSARY)
(AP04)
FWD
VIEW A
BOLT
(2 NECESSARY)
CLAMP
NUT
(2 NECESSARY)
CLAMP
BRACKET
NUT
(2 NECESSARY)
BOLT
(2 NECESSARY)
FWD
VIEW B
BOLT
(6 NECESSARY)
METERING ORIFICE
SEAL PLATE
(WITHOUT SB PW4ENG 72-315)
(WITHOUT SB PW4ENG 75-57)
GASKET
(WITH SB PW4ENG 72-315)
(WITH SB PW4ENG 75-57)
(AP04)
FWD
VIEW C
L-A2965 (0194)
PW V

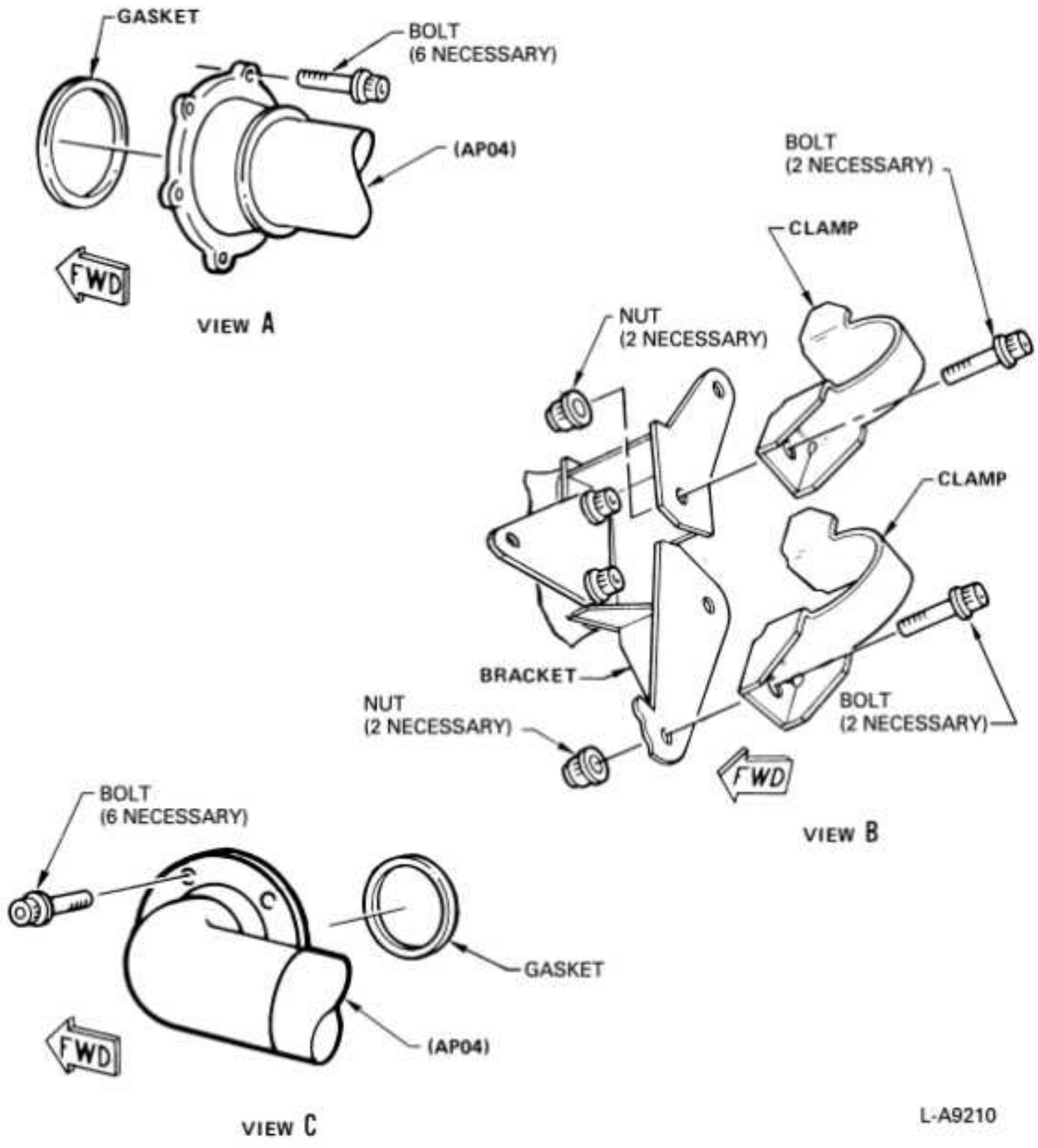
Turbine Vane Cooling Air Ducts (Left Side)
Figure 402 (Sheet 2)
(Task 72−00−53−420−003)


GASKET
(AP03)
FWD
BRACKET
(WITH SB PW4ENG 79−54)
(WITHOUT SB PW4ENG 79−52)
BRACKET
(WITH SB PW4ENG 79−52)
BRACKET
(WITHOUT SB
PW4ENG 79−54)
BOLT
(6 NECESSARY)
LP15
LP15
FWD
VIEW D
LP18
SPRAYSHIELD
L−A1773 (0294)
PW V

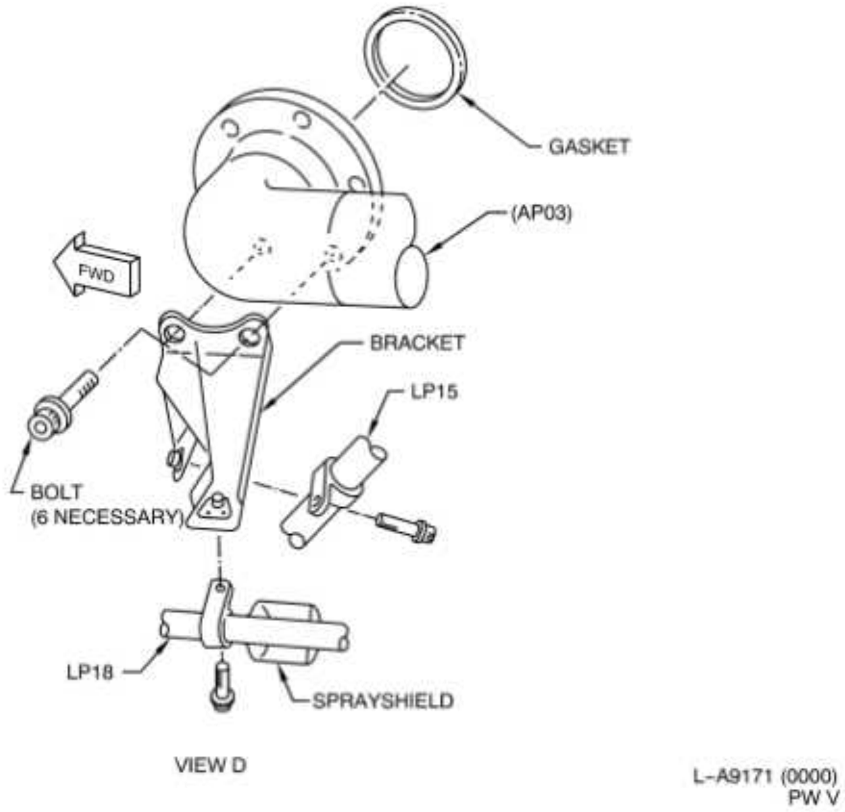
Turbine Vane Cooling Air Ducts (Left Side)
Figure 402 (Sheet 3)
(Task 72−00−53−420−003)


METERING ORIFICE SEAL PLATE (WITH SB PW4ENG 72-315) (WITHOUT SB PW4ENG 75-57)
GASKET (WITH SB PW4ENG 75-57)
METERING ORIFICE SEAL PLATE (WITH SB PW4ENG 72-315) (WITHOUT SB PW4ENG 75-57)
GASKET (WITH SB PW4ENG 75-57)
GASKET
(AP03)
BORESCOPE PLUG
FWD
VIEW E
BOLT (6 NECESSARY)
BOLT (3 NECESSARY)
(WITHOUT BORESCOPE PLUG)
(WITH BORESCOPE PLUG)
L-A8053 (1193)

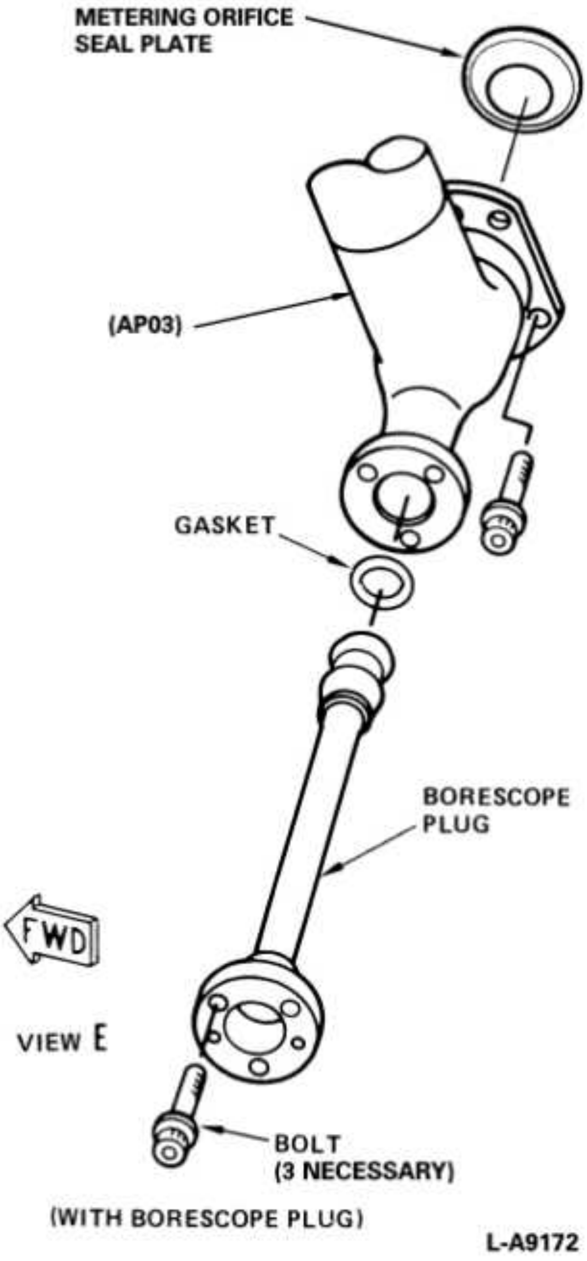
Turbine Vane Cooling Air Ducts (Left Side)
Figure 402 (Sheet 4)
(Task 72−00−53−420−003)


GASKET
BOLT
(6 NECESSARY)
(AP04)
FWD
VIEW A
BOLT
(2 NECESSARY)
CLAMP
NUT
(2 NECESSARY)
CLAMP
BRACKET
NUT
(2 NECESSARY)
BOLT
(2 NECESSARY)
FWD
VIEW B
BOLT
(6 NECESSARY)
GASKET
(AP04)
FWD
VIEW C
L-A9210

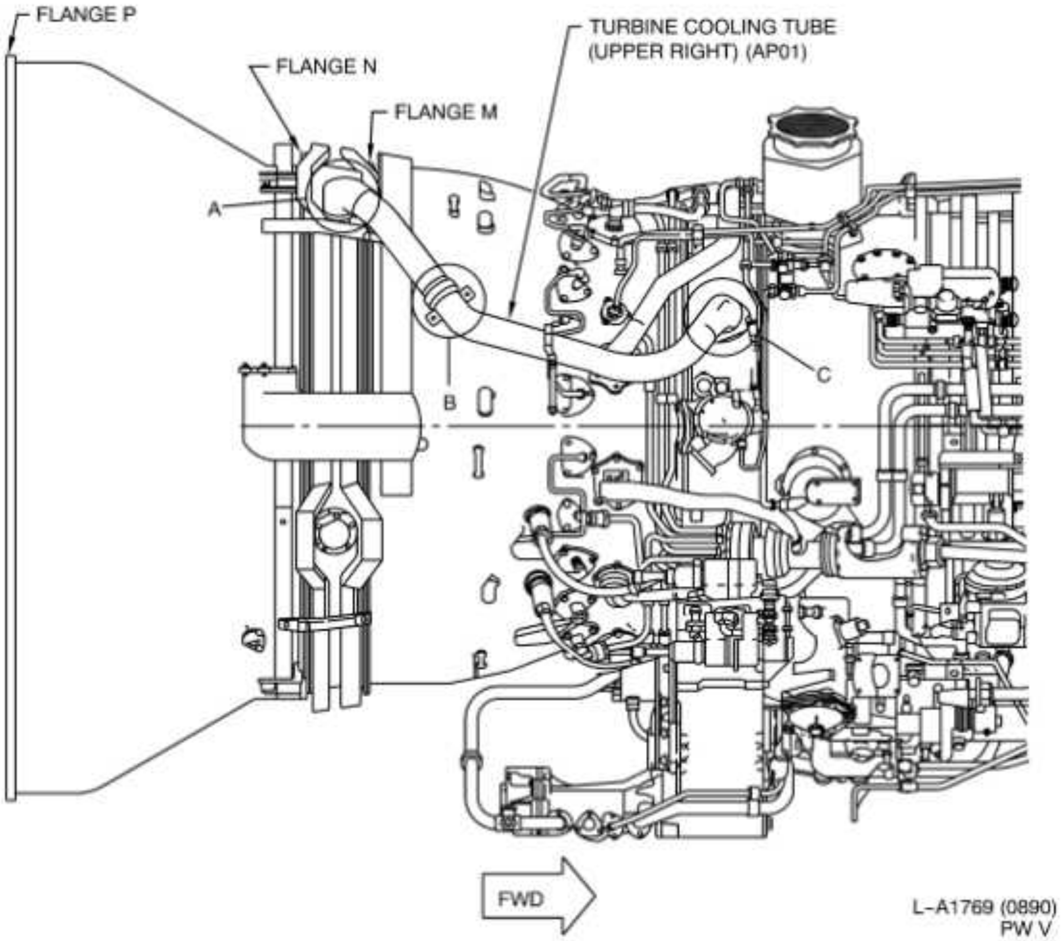
Turbine Vane Cooling Air Ducts (Left Side)
Figure 402 (Sheet 5)
(Task 72−00−53−420−003)


GASKET
(AP03)
FWD
BRACKET
LP15
BOLT
(6 NECESSARY)
LP18
SPRAYSHIELD
VIEW D
L-A9171 (0000)
PW V

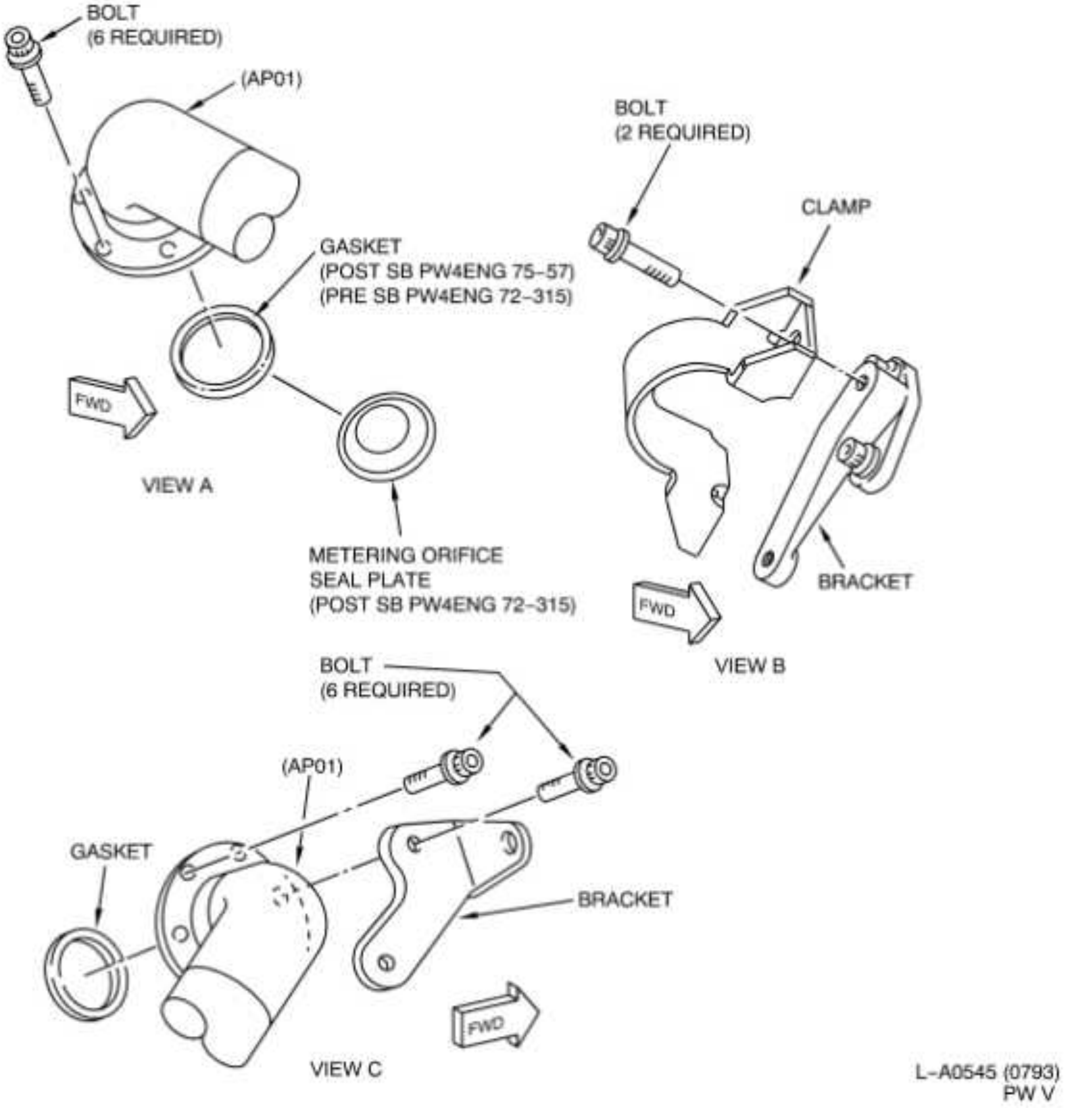
Turbine Vane Cooling Air Ducts (Left Side)
Figure 402 (Sheet 6)
(Task 72−00−53−420−003)


METERING ORIFICE SEAL PLATE
(AP03)
GASKET
BORESCOPE PLUG
FWD
VIEW E
BOLT (3 NECESSARY)
(WITH BORESCOPE PLUG)
L-A9172

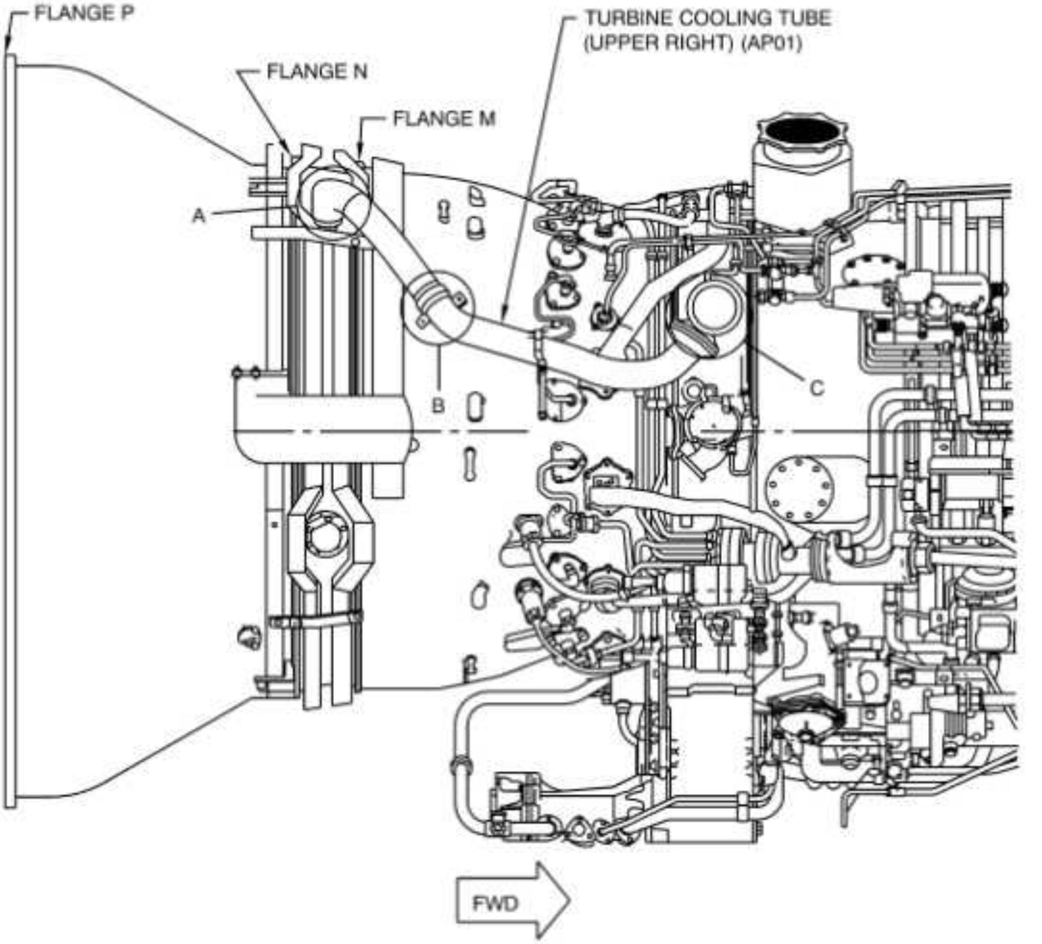
Turbine Vane Cooling Air Ducts (Left Side)
Figure 402 (Sheet 7)
(Task 72−00−53−420−003)


FLANGE P
FLANGE N
FLANGE M
TURBINE COOLING TUBE (UPPER RIGHT) (AP01)
A
B
C
FWD
L−A1769 (0890)
PW V

Turbine Vane Cooling Air Ducts (Right Side)
Figure 403 (Sheet 1)
(Task 72−00−53−420−003)

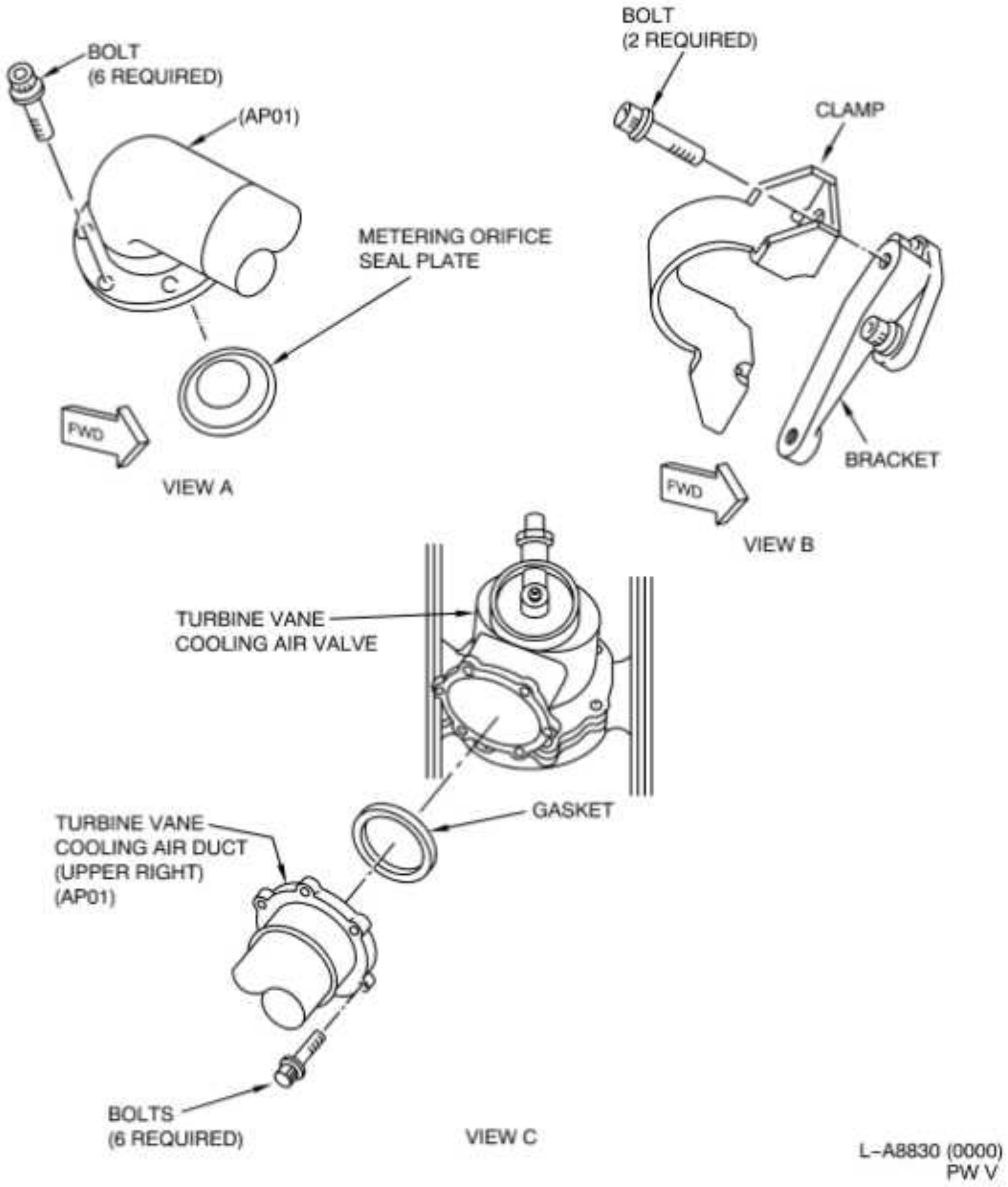

BOLT
(6 REQUIRED)
(AP01)
BOLT
(2 REQUIRED)
CLAMP
GASKET
(POST SB PW4ENG 75-57)
(PRE SB PW4ENG 72-315)
FWD
VIEW A
METERING ORIFICE
SEAL PLATE
(POST SB PW4ENG 72-315)
BRACKET
FWD
VIEW B
BOLT
(6 REQUIRED)
(AP01)
GASKET
BRACKET
FWD
VIEW C
L-A0545 (0793)
PW V

Turbine Vane Cooling Air Ducts (Right Side)
Figure 403 (Sheet 2)
(Task 72−00−53−420−003)

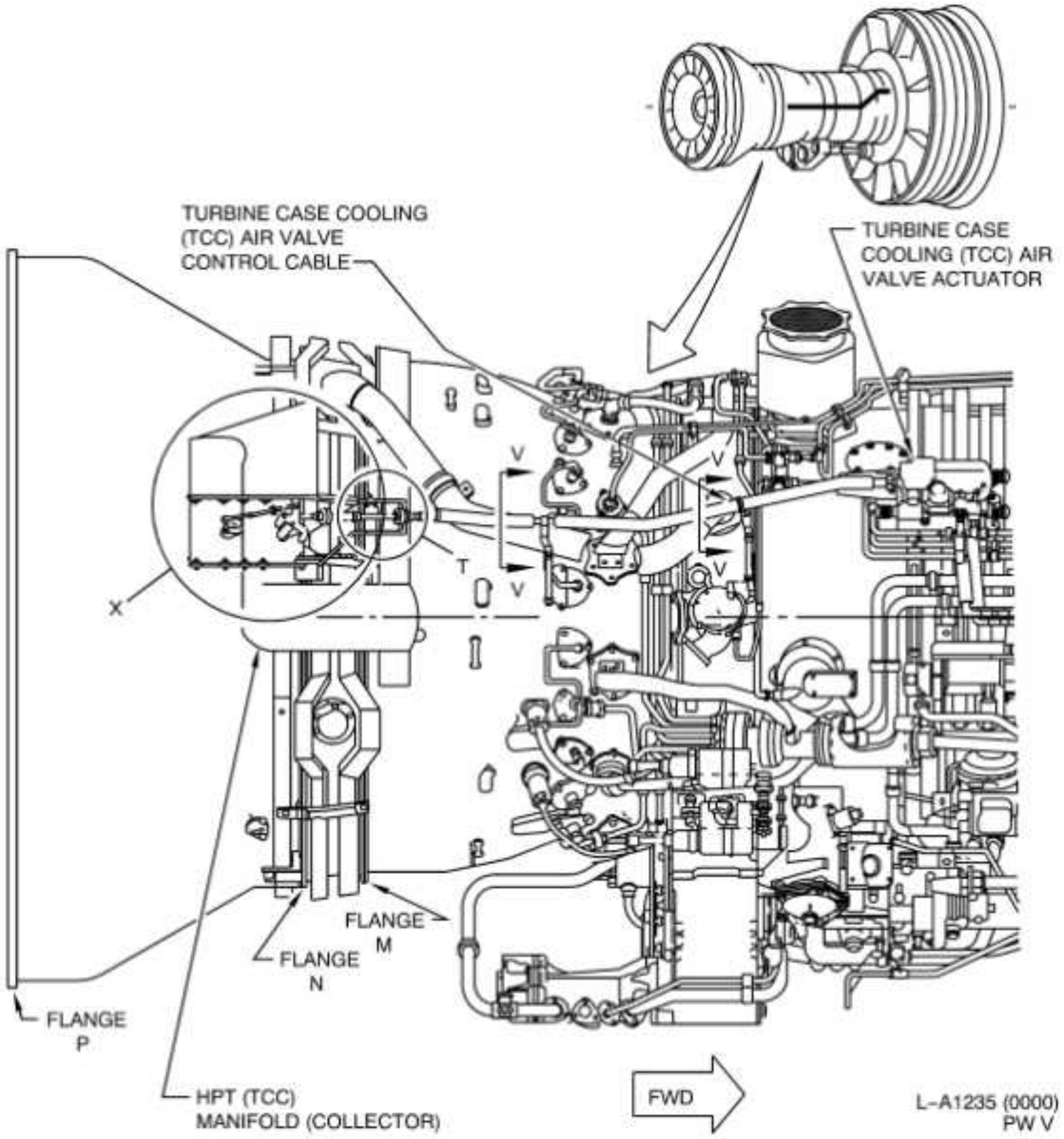

FLANGE P
TURBINE COOLING TUBE
(UPPER RIGHT) (AP01)
FLANGE N
FLANGE M
A
B
C
FWD

L−A9246 (0000)
PW V

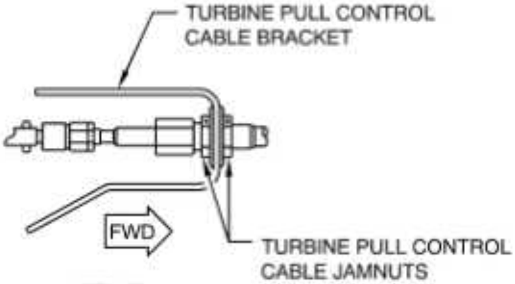
Turbine Vane Cooling Air Ducts (Right Side)
Figure 403 (Sheet 3)
(Task 72−00−53−420−003)


BOLT
(6 REQUIRED)
(AP01)
METERING ORIFICE
SEAL PLATE
FWD
VIEW A
BOLT
(2 REQUIRED)
CLAMP
BRACKET
FWD
VIEW B
TURBINE VANE
COOLING AIR VALVE
GASKET
TURBINE VANE
COOLING AIR DUCT
(UPPER RIGHT)
(AP01)
BOLTS
(6 REQUIRED)
VIEW C
L−A8830 (0000)
PW V

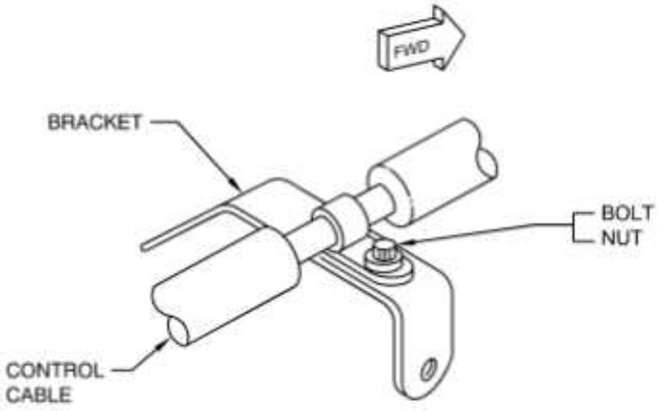
Turbine Vane Cooling Air Ducts (Right Side)
Figure 403 (Sheet 4)
(Task 72−00−53−420−003)


TURBINE CASE COOLING (TCC) AIR VALVE CONTROL CABLE
TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
V
V
V
V
T
X
FLANGE M
FLANGE N
FLANGE P
HPT (TCC) MANIFOLD (COLLECTOR)
FWD
L−A1235 (0000)
PW V

Turbine Case Cooling Air Shutoff Valves
Figure 404 (Sheet 1)
(Task 72−00−53−420−003)


TURBINE PULL CONTROL CABLE BRACKET
FWD
TURBINE PULL CONTROL CABLE JAMNUTS

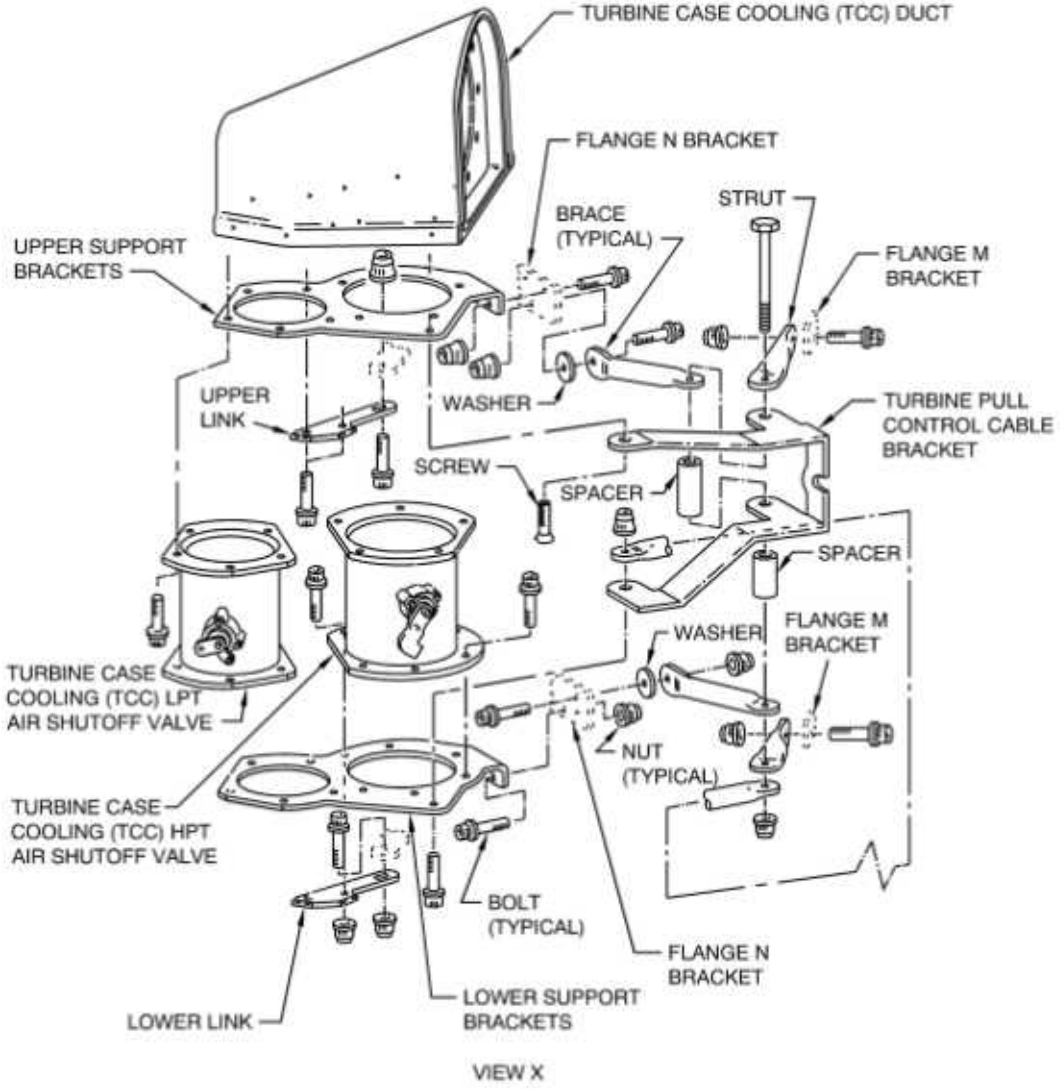
VIEW T


FWD
BRACKET
BOLT
NUT
CONTROL CABLE

VIEW V−V
(2 LOCATIONS)

L−A1236 (0000)
PW V

Turbine Case Cooling Air Shutoff Valves
Figure 404 (Sheet 2)
(Task 72−00−53−420−003)


TURBINE CASE COOLING (TCC) DUCT
FLANGE N BRACKET
STRUT
BRACE (TYPICAL)
FLANGE M BRACKET
UPPER SUPPORT BRACKETS
UPPER LINK
WASHER
TURBINE PULL CONTROL CABLE BRACKET
SCREW
SPACER
SPACER
WASHER
FLANGE M BRACKET
TURBINE CASE COOLING (TCC) LPT AIR SHUTOFF VALVE
NUT (TYPICAL)
TURBINE CASE COOLING (TCC) HPT AIR SHUTOFF VALVE
BOLT (TYPICAL)
FLANGE N BRACKET
LOWER SUPPORT BRACKETS
LOWER LINK
VIEW X

L−A1237 (1099)
PW V

Turbine Case Cooling Air Shutoff Valves
Figure 404 (Sheet 3)
(Task 72−00−53−420−003)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - INSTALLATION-04

Task 72-00-53-450-002:

1. Install Turbine Case Cooling Manifold (Collector)

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

B. Procedure

See Figures 401 and 402.

(1) Remove protective closures.

(2) Position turbine case cooling manifold (collector) to support bracket and LPT cooling valve using bolts, threads lubricated with Engine Oil (P03-001), and nuts handtight only.

(3) Install clamps to front manifold (collector) mount and secure to bracket on Flange N with bolts, threads lubricated with Engine Oil (P03-001), handtight only.

(4) Install clamps to rear manifold (collector) mounts and secure to brackets on Flange P with bolts, threads lubricated with Engine Oil (P03-001), and nuts handtight only.

(5) Slide lower cooling air manifolds upward and engage with manifold (collector) tubes. Secure manifolds with bolts, threads lubricated with Engine Oil (P03-001), handtight only.

(6) Slide upper cooling air manifolds downward engaging cooling manifolds with tubes on manifold (collector). Secure manifolds with bolts, threads lubricated with Engine Oil (P03-001), handtight only.

(7) FOR THESE MODELS: 4152, 4156A, 4158
Install cover assemblies on the upper and lower rear tubes (No. 7) of the manifold (collector). Attach the covers to the tubes with bolts, threads lubricated with Engine Oil (P03-001) and tighten by hand (Engines with PW4ENG 75-53).

(8) Install bolts, threads lubricated with Engine Oil (P03−001), and nuts to secure cooling air manifold brackets to brackets on Flange N and bracket on LPT case handtight only.

(9) Install the clamps to the rear mounts of the cooling air manifold brackets. Attach the manifolds to the brackets on Flange P with bolts, threads lubricated with Engine Oil (P03−001) and nuts tightened by hand.

(10) Torque all bolts, previously installed, as follows:

(a) Torque bolts securing manifold (collector) to support bracket and valve flange to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(b) Torque bolts securing front manifold (collector) mount to Flange N bracket to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Torque bolts securing manifold (collector) rear mount clamps to Flange P brackets to 36 − 40 lb−in. (4.067 − 4.519 N.m).

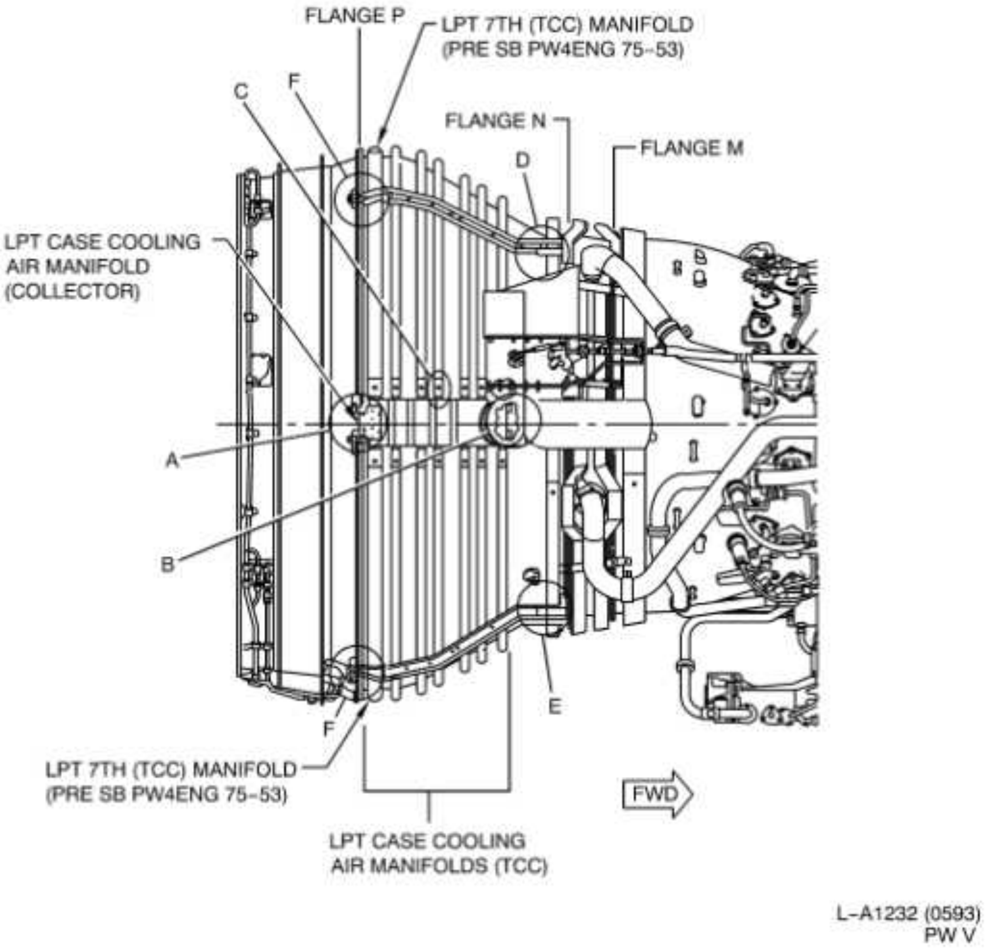
(d) Torque all upper and lower cooling air manifolds retaining bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque all bolts on forward mount brackets to 36 − 40 lb−in. (4.067 − 4.519 N.m).

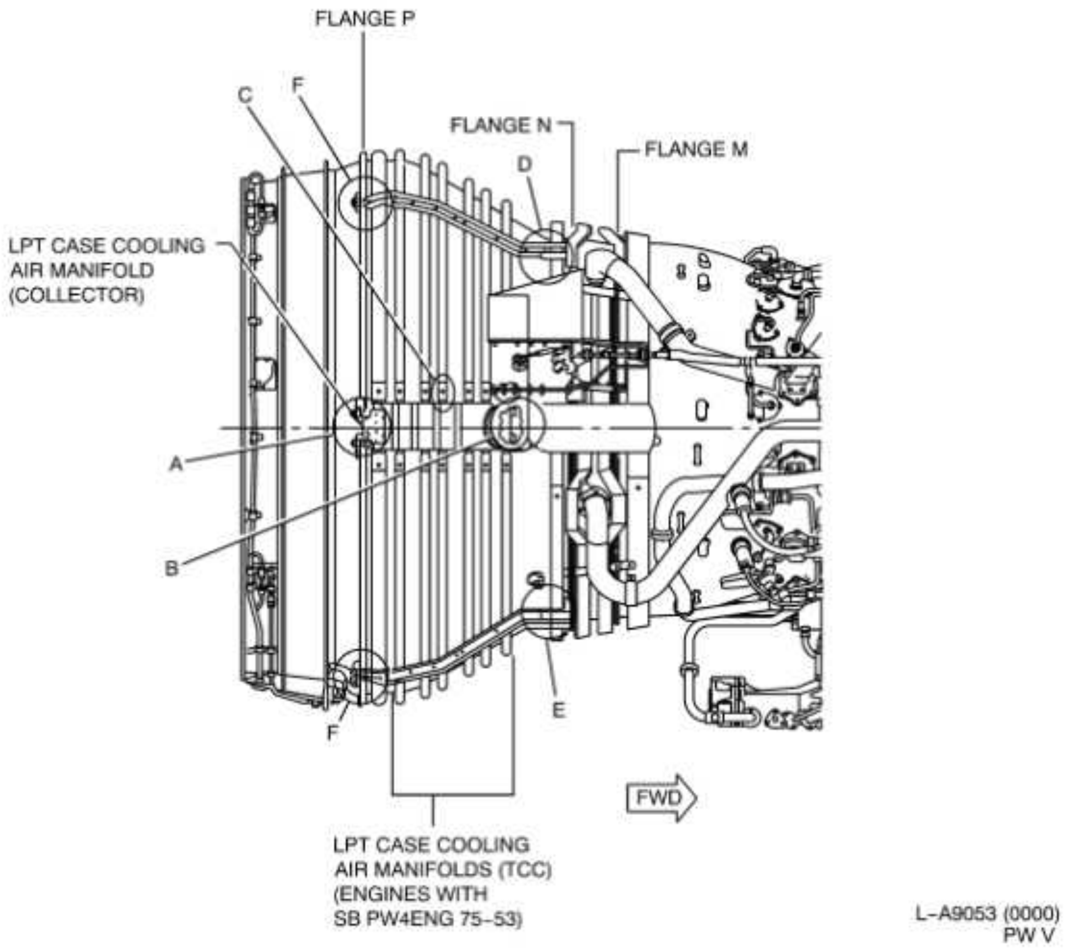
(f) Torque all bolts securing clamps on rear mounts to brackets on Flange P to 36 − 40 lb−in. (4.067 − 4.519 N.m).

C. Postrequisites

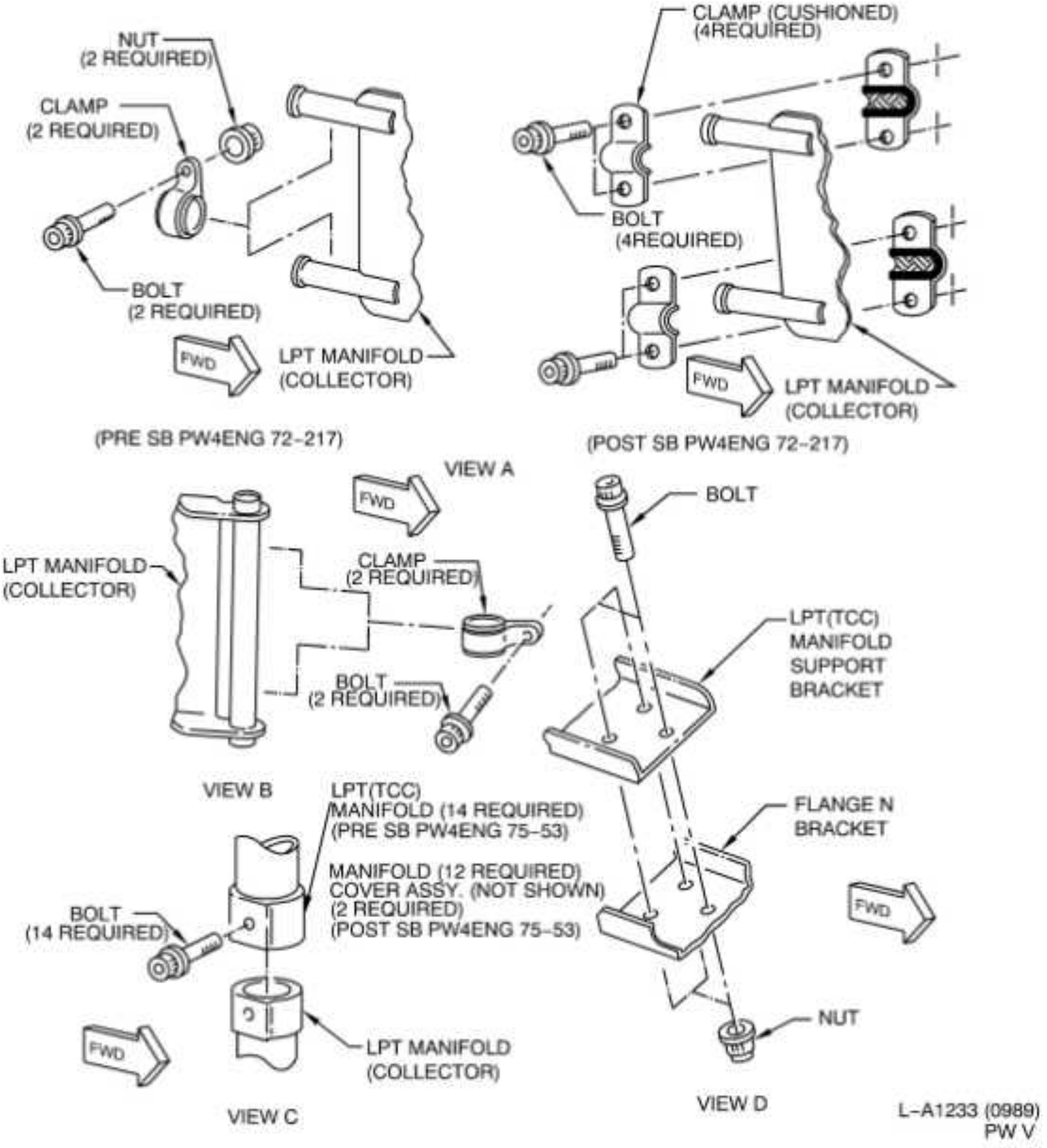
(1) Test engine per Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).


FLANGE P
LPT 7TH (TCC) MANIFOLD
(PRE SB PW4ENG 75-53)
C
F
FLANGE N
FLANGE M
D
LPT CASE COOLING
AIR MANIFOLD
(COLLECTOR)
A
B
E
F
LPT 7TH (TCC) MANIFOLD
(PRE SB PW4ENG 75-53)
FWD
LPT CASE COOLING
AIR MANIFOLDS (TCC)
L-A1232 (0593)
PW V

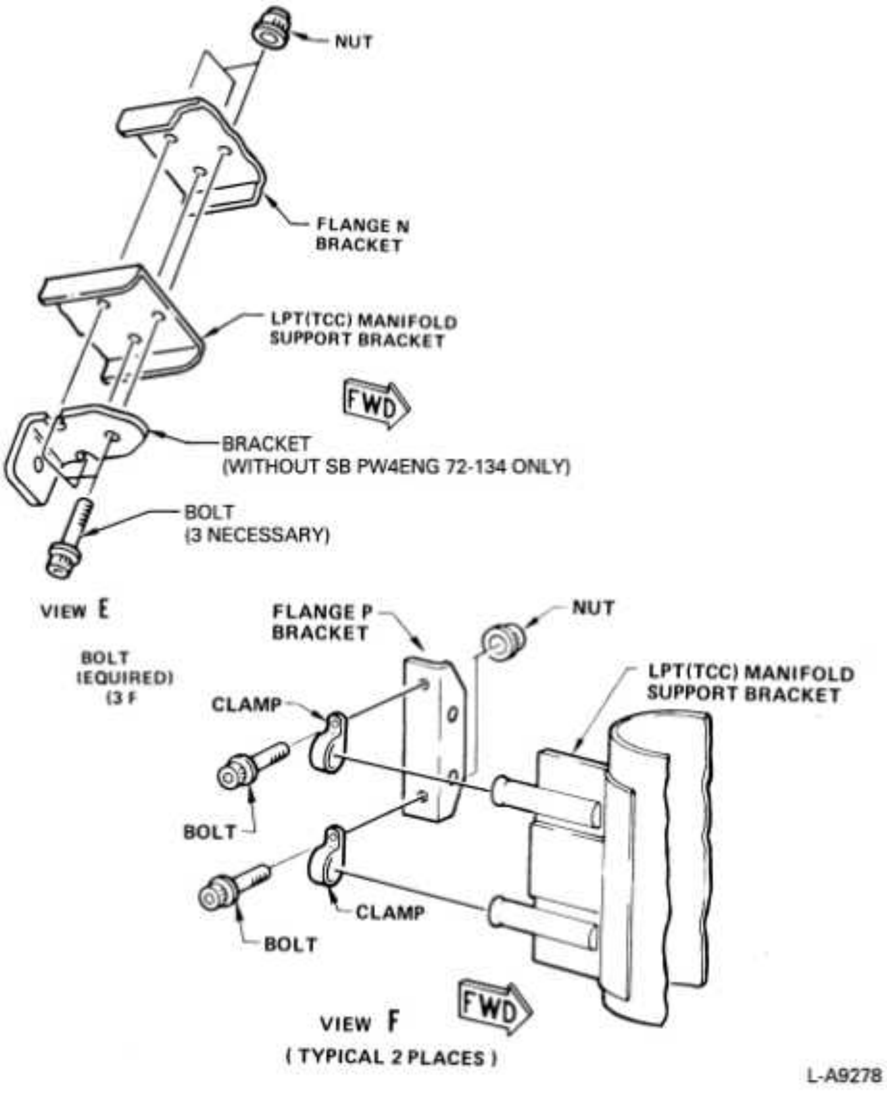
Turbine Case Cooling
Manifold (Collector)
Figure 301 (Sheet 1)
(Task 72-00-53-050-002)


FLANGE P
C
F
FLANGE N
D
FLANGE M
LPT CASE COOLING AIR MANIFOLD (COLLECTOR)
A
B
F
E
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC) (ENGINES WITH SB PW4ENG 75-53)
L-A9053 (0000)
PW V

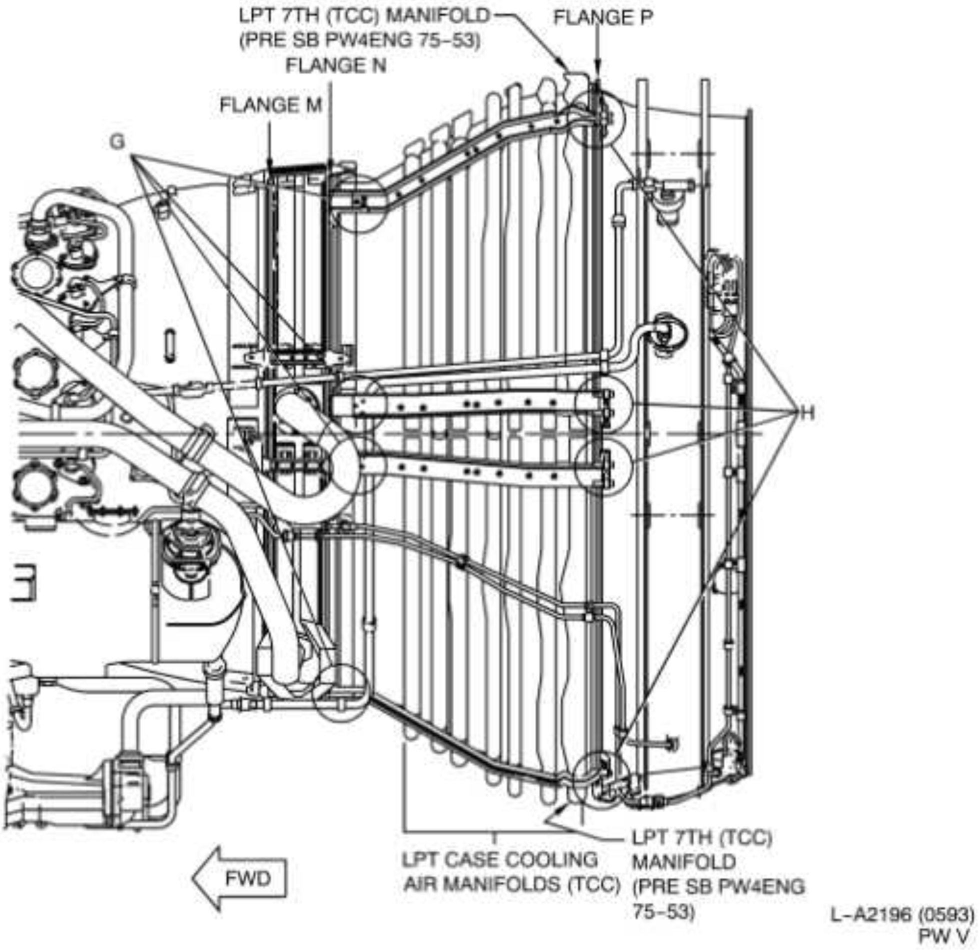
Turbine Case Cooling
Manifold (Collector)
Figure 301 (Sheet 2)
(Task 72−00−53−050−002)


NUT
(2 REQUIRED)
CLAMP
(2 REQUIRED)
BOLT
(2 REQUIRED)
FWD
LPT MANIFOLD
(COLLECTOR)
(PRE SB PW4ENG 72-217)
CLAMP (CUSHIONED)
(4REQUIRED)
BOLT
(4REQUIRED)
FWD
LPT MANIFOLD
(COLLECTOR)
(POST SB PW4ENG 72-217)
VIEW A
FWD
LPT MANIFOLD
(COLLECTOR)
CLAMP
(2 REQUIRED)
BOLT
(2 REQUIRED)
VIEW B
BOLT
LPT(TCC)
MANIFOLD
SUPPORT
BRACKET
FLANGE N
BRACKET
FWD
NUT
VIEW D
LPT(TCC)
MANIFOLD (14 REQUIRED)
(PRE SB PW4ENG 75-53)
MANIFOLD (12 REQUIRED)
COVER ASSY. (NOT SHOWN)
(2 REQUIRED)
(POST SB PW4ENG 75-53)
BOLT
(14 REQUIRED)
FWD
LPT MANIFOLD
(COLLECTOR)
VIEW C
L-A1233 (0989)
PW V

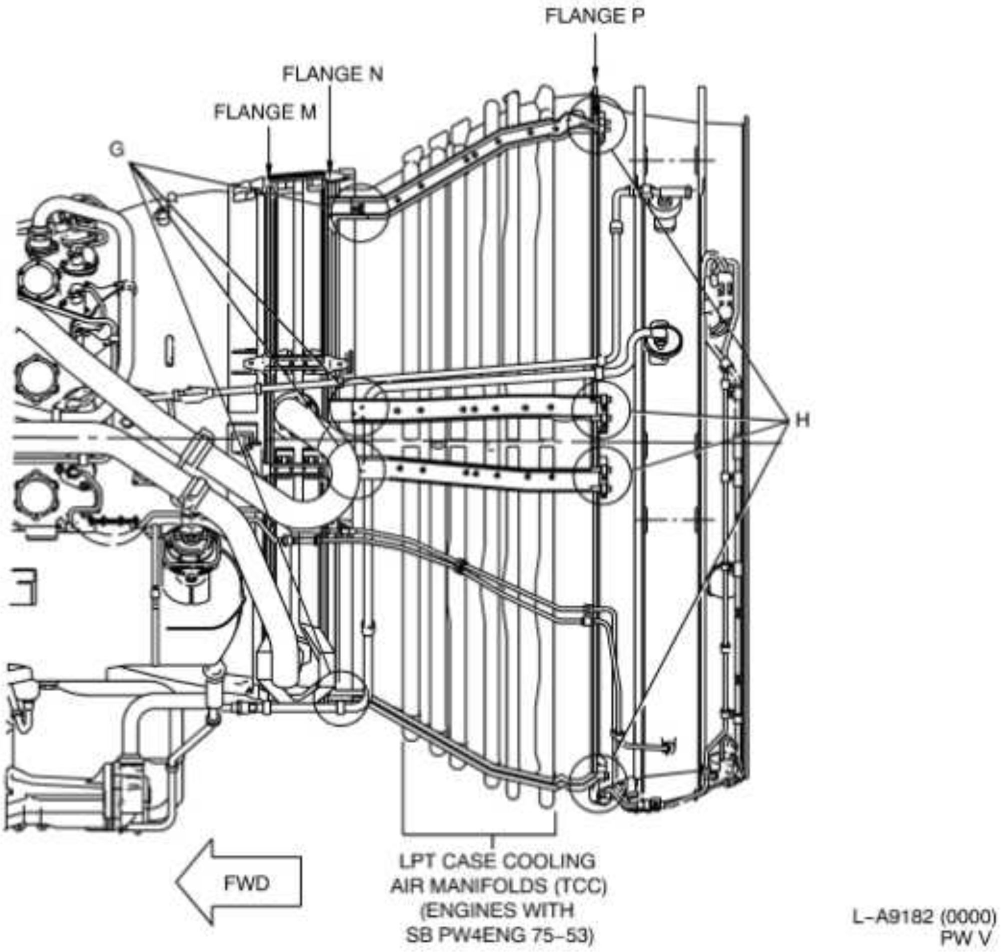
Turbine Case Cooling
Manifold (Collector)
Figure 301 (Sheet 3)
(Task 72−00−53−050−002)


NUT
FLANGE N BRACKET
LPT(TCC) MANIFOLD SUPPORT BRACKET
FWD
BRACKET (WITHOUT SB PW4ENG 72-134 ONLY)
BOLT (3 NECESSARY)
VIEW E
BOLT (EQUIRED) (3 F
FLANGE P BRACKET
NUT
LPT(TCC) MANIFOLD SUPPORT BRACKET
CLAMP
BOLT
CLAMP
BOLT
FWD
VIEW F
(TYPICAL 2 PLACES)
L-A9278

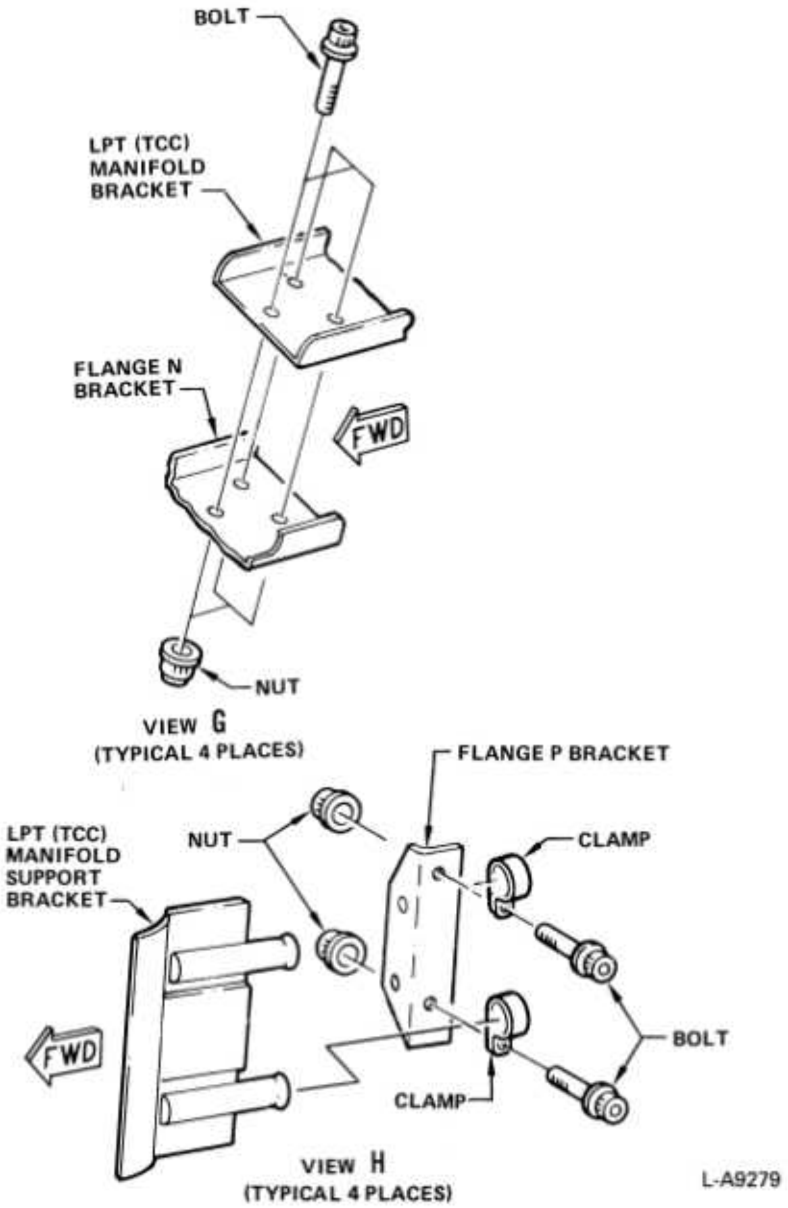
Turbine Case Cooling
Manifold (Collector)
Figure 301 (Sheet 3)
(Task 72−00−53−050−002)


LPT 7TH (TCC) MANIFOLD
(PRE SB PW4ENG 75-53)
FLANGE P
FLANGE N
FLANGE M
G
H
FWD
LPT CASE COOLING
AIR MANIFOLDS (TCC)
LPT 7TH (TCC)
MANIFOLD
(PRE SB PW4ENG
75-53)
L-A2196 (0593)
PW V

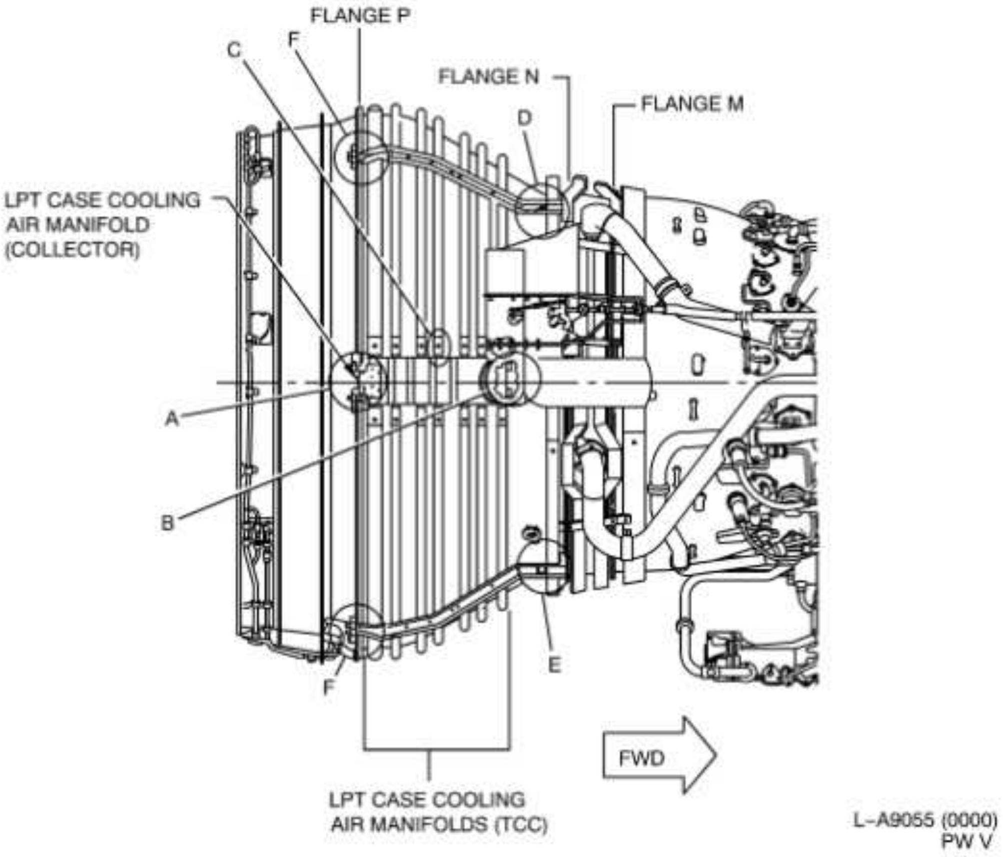
Turbine Case Cooling
Manifold (Collector)
Figure 301 (Sheet 4)
(Task 72−00−53−050−002)


FLANGE P
FLANGE N
FLANGE M
G
H
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC) (ENGINES WITH SB PW4ENG 75-53)
L-A9182 (0000)
PW V

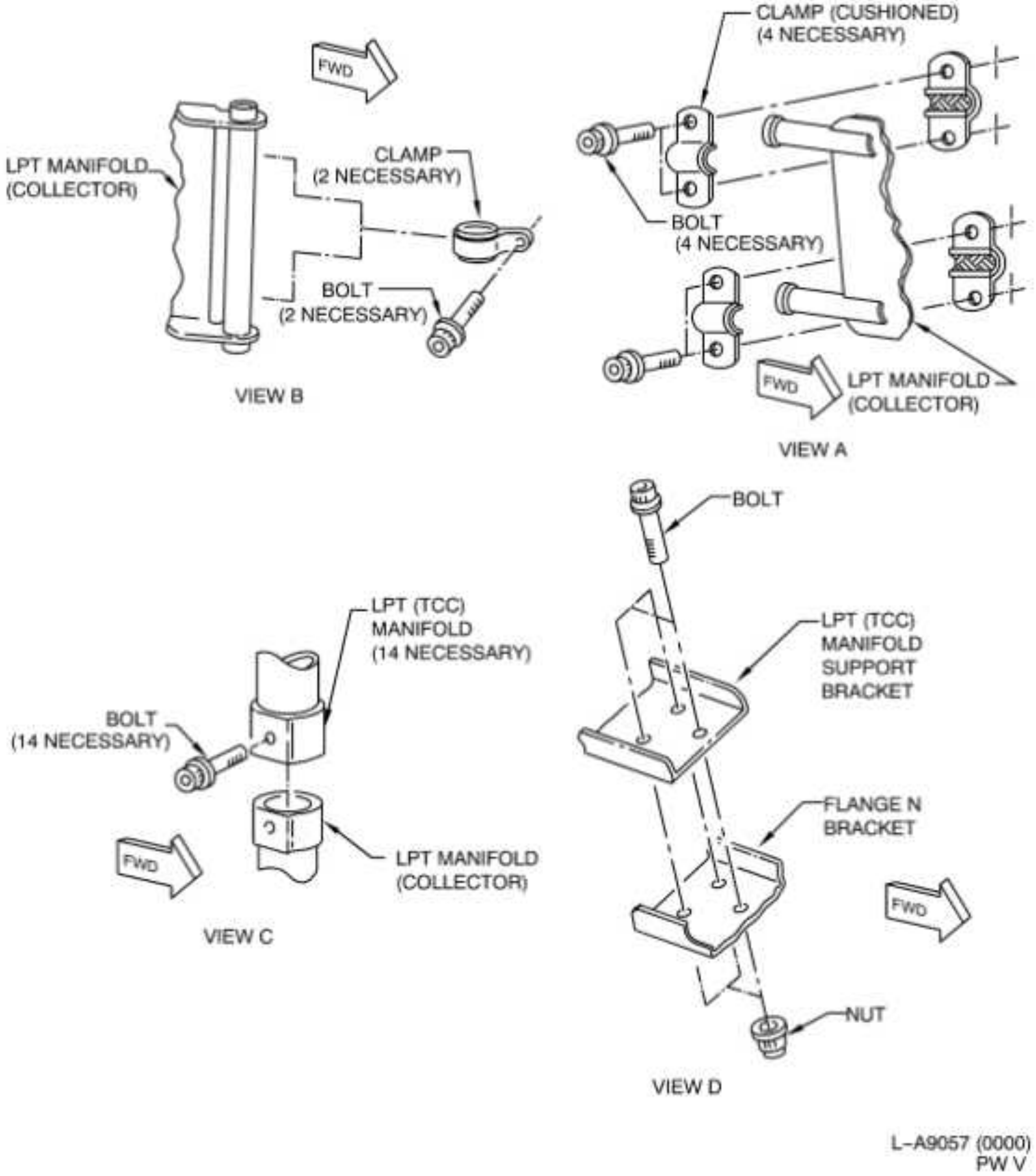
Turbine Case Cooling
Manifold (Collector)
Figure 301 (Sheet 5)
(Task 72−00−53−050−002)


BOLT
LPT (TCC) MANIFOLD BRACKET
FLANGE N BRACKET
FWD
NUT
VIEW G
(TYPICAL 4 PLACES)
FLANGE P BRACKET
LPT (TCC) MANIFOLD SUPPORT BRACKET
NUT
CLAMP
BOLT
FWD
CLAMP
VIEW H
(TYPICAL 4 PLACES)
L-A9279

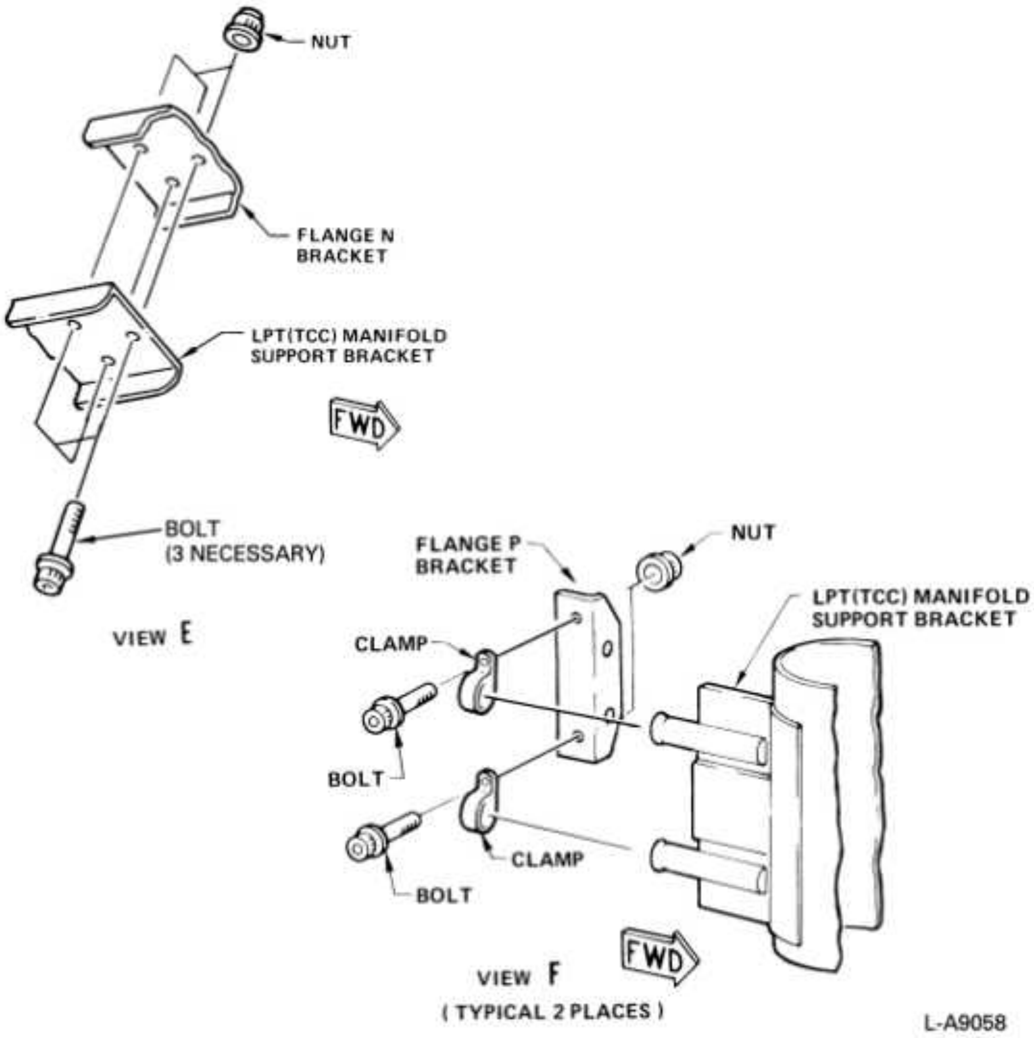
Turbine Case Cooling
Manifold (Collector)
Figure 301 (Sheet 6)
(Task 72−00−53−050−002)


FLANGE P
C
F
FLANGE N
D
FLANGE M
LPT CASE COOLING AIR MANIFOLD (COLLECTOR)
A
B
F
E
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC)
L−A9055 (0000)
PW V

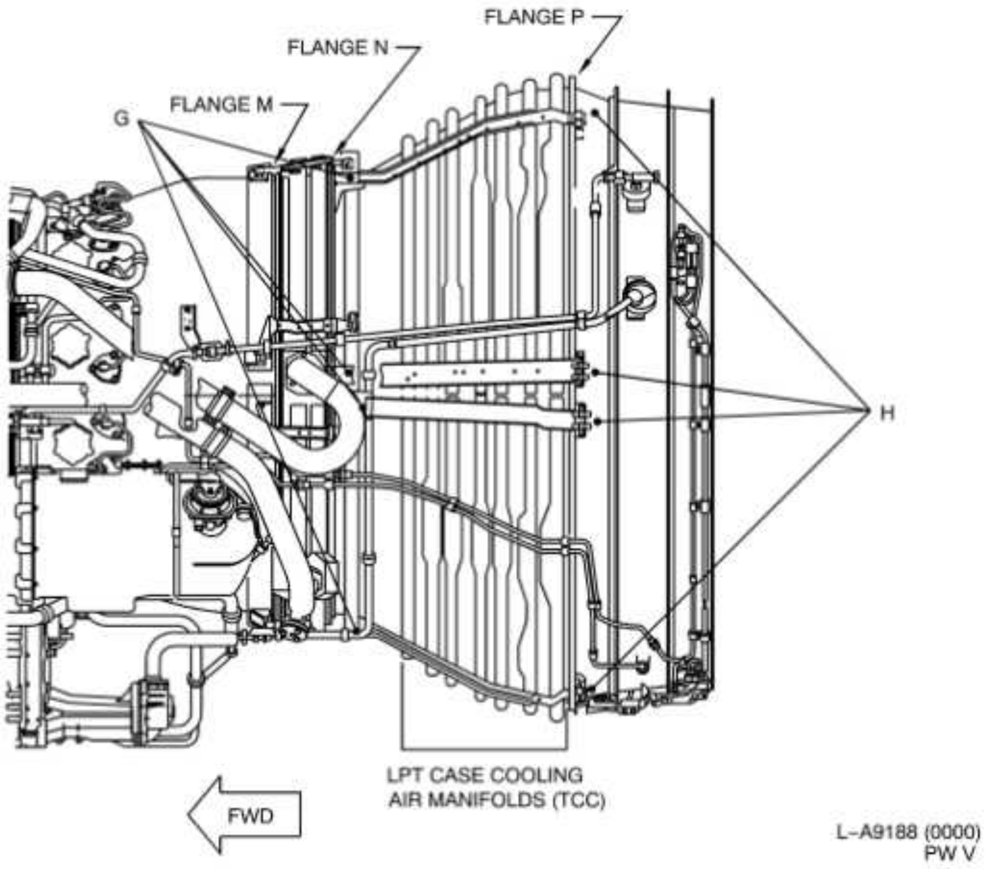
Turbine Case Cooling
Manifold (Collector)
Figure 302 (Sheet 1)
(Task 72−00−53−050−002)


FWD
LPT MANIFOLD (COLLECTOR)
CLAMP (2 NECESSARY)
BOLT (2 NECESSARY)
VIEW B
CLAMP (CUSHIONED) (4 NECESSARY)
BOLT (4 NECESSARY)
FWD
LPT MANIFOLD (COLLECTOR)
VIEW A
LPT (TCC) MANIFOLD (14 NECESSARY)
BOLT (14 NECESSARY)
FWD
LPT MANIFOLD (COLLECTOR)
VIEW C
BOLT
LPT (TCC) MANIFOLD SUPPORT BRACKET
FLANGE N BRACKET
FWD
NUT
VIEW D
L−A9057 (0000)
PW V

Turbine Case Cooling
Manifold (Collector)
Figure 302 (Sheet 2)
(Task 72−00−53−050−002)

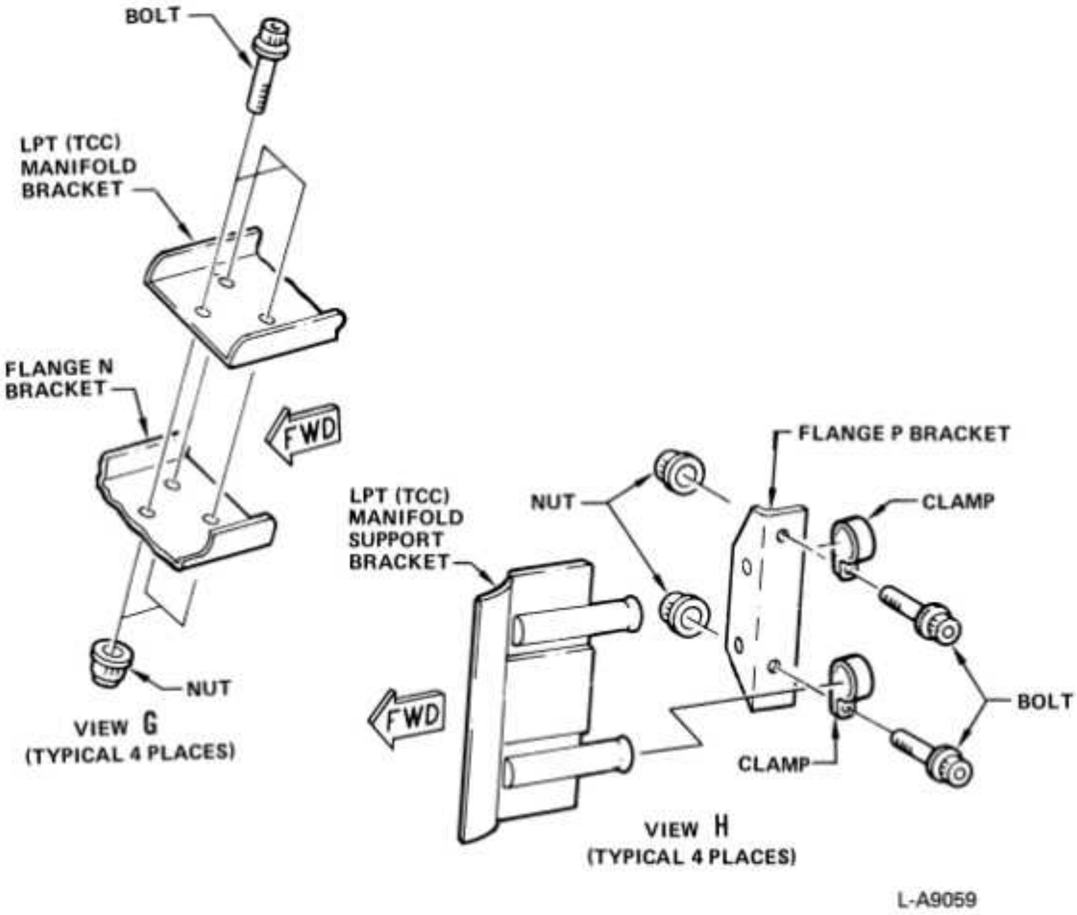

NUT
FLANGE N BRACKET
LPT(TCC) MANIFOLD SUPPORT BRACKET
FWD
BOLT (3 NECESSARY)
VIEW E
FLANGE P BRACKET
NUT
LPT(TCC) MANIFOLD SUPPORT BRACKET
CLAMP
BOLT
CLAMP
BOLT
FWD
VIEW F
(TYPICAL 2 PLACES)
L-A9058

Turbine Case Cooling
Manifold (Collector)
Figure 302 (Sheet 3)
(Task 72−00−53−050−002)


FLANGE P
FLANGE N
FLANGE M
G
H
LPT CASE COOLING
AIR MANIFOLDS (TCC)
FWD
L-A9188 (0000)
PW V

Turbine Case Cooling
Manifold (Collector)
Figure 302 (Sheet 4)
(Task 72-00-53-050-002)

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−04


BOLT
LPT (TCC) MANIFOLD BRACKET
FLANGE N BRACKET
FWD
NUT
VIEW G
(TYPICAL 4 PLACES)
FLANGE P BRACKET
NUT
CLAMP
LPT (TCC) MANIFOLD SUPPORT BRACKET
FWD
BOLT
CLAMP
VIEW H
(TYPICAL 4 PLACES)
L-A9059

Turbine Case Cooling
Manifold (Collector)
Figure 302 (Sheet 5)
(Task 72−00−53−050−002)

Task 72-00-53-450-003:

1. Install Turbine Case Cooling (TCC) LPT Manifolds

A. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 Or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
R	P05-292	Ferrule, Safety Cable (Optional)
	P06-021	Compound, Antigalling (PWA 550)
R	P06-054	Paste, Antiseize (PWA 36246)

B. Procedure

See Figure 401, Figure 402, Figure 403, Figure 404 and Figure 405.

(1) Remove protective closures.

(2) Position upper half of LPT cooling air manifolds (AC08) through (AC14) to LPT case and rotate around case engaging manifold ends with detail tubes of manifold (collector).

(3) Install bolts, threads lubricated with Engine Oil P03-001, to manifold ends to secure upper cooling manifolds to manifold (collector) handtight only.

(4) Position lower half of LPT cooling air manifolds (AC01) through (AC07) to LPT case and rotate around case engaging manifold ends with detail tubes of manifold (collector).

(5) Install bolts, threads lubricated with Engine Oil P03-001, to manifold ends to secure lower cooling manifolds to collector handtight only.

(6) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 75−53 and Pre SB PW4ENG 79−76 only)
Install cover assemblies on the upper and lower rear tubes (No. 7) of the manifold (collector). Attach the covers to the tubes with bolts, threads lubricated with Engine Oil P03−001 and tighten by hand.

(7) FOR THESE MODELS: 4152, 4156A, 4158
Install clamps to the rear mounts of the top half and lower half of the cooling air manifolds. Attach the manifolds to Flange P brackets with bolts, threads lubricated with Engine Oil P03−001, spacers and nuts tightened by hand (Pre SB PW4ENG 75−50).

(8) FOR THESE MODELS: 4152, 4156A, 4158
Install clamps to the rear mounts of the top half and lower half of the cooling air manifolds. Attach the manifolds to Flange P brackets with bolts, threads lubricated with Engine Oil P03−001, and nuts tightened by hand (Post SB PW4ENG 75−50).

(9) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install clamps to the rear mounts of the top half and lower half of the cooling air manifolds. Attach the manifolds to Flange P brackets with bolts, threads lubricated with Engine Oil P03−001, and nuts tightened by hand.

(10) Install bolts, threads lubricated with Engine Oil P03−001, and nuts to secure forward end of cooling air manifold brackets to brackets on Flange N handtight only.

NOTE: When installing bolt and nut at approximately 8 o'clock position; secure LPT tube clamp with bolt and nut.

(11) Torque bolts securing cooling air manifolds as follows:

(a) Torque bolts securing rear mount clamps to Flange P brackets to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(b) Torque all bolts securing forward mount brackets to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Torque all upper and lower cooling air manifolds to collector retaining bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

CAUTION: USE OF LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS COULD RESULT IN CONTAMINATION OF EEC.

(12) (Post SB PW4ENG 79-76) Install brackets on the turbine case cooling brackets. Torque the bolts to 24 - 32 lb-in. (2.712 - 3.616 N.m).

(13) (Pre SB PW4ENG 79-76) Install (rear) EEC PT4.95 tube assembly (AS02) as follows.

(a) Remove protective closures from the tube fittings.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Secure the tube nut to a tee at approximately the 6 o'clock position and rearward of Flange P (Pre SB PW4ENG 72-134).

(c) FOR THESE MODELS: 4152, 4156A, 4158
Secure the tube nut to the tube coupling at approximately the 7 o'clock position and rearward of Flange P (Post SB PW4ENG 72-134).

(d) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Attach the tube nut to the tube coupling at approximately the 7 o'clock position and rearward of Flange P.

(e) Secure the tube nut to the tube coupling at approximately the 8 o'clock position and rearward of Flange N.

(f) FOR THESE MODELS: 4152, 4156A, 4158
Lubricate the threads of a bolt with Engine Oil P03-001. Secure the tube with a clamp, bolt, and nut to the bracket on Flange P at approximately the 6:30 o'clock position. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m) (Pre SB PW4ENG 72-134).

(g) Torque tube nuts to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(14) (Pre SB PW4ENG 79-76) Install (rear) No. 3 bearing oil vent tube assembly (LD02) as follows.

(a) Install oil vent tube to adapter, threads
R lubricated with Antiseize Paste P06−054, on
exhaust case at approximately 7 o'clock position
and secure to adapter, threads lubricated with
R Antiseize Paste P06−054, on forward end of tube to
front oil vent tube just rearward of Flange M,
R handtight only. Wipe off unwanted paste.

(b) Install clamp to tube and secure to bracket on Flange N with bolt, threads lubricated with Engine Oil P03−001, and nut handtight only.

(c) Lubricate the threads of the bolts with Engine Oil P03−001, and install clamps to the tube and adjacent PT4.95 tube assembly. Secure the clamps on the tubes to brackets on Flange P with the bolts and nuts, and tighten by hand.

(d) FOR THESE MODELS: 4152, 4156A, 4158
Lubricate the threads of the bolt with Engine Oil P03−001. Secure tube to the adjacent PT4.95 tube assembly with clamps, bolt, and nut at approximately the 7:30 o'clock position and rearward of Flange P (Post SB PW4ENG 72−134).

(e) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Lubricate the threads of the bolt with Engine Oil P03−001. Attach the tube to the adjacent PT4.95 tube assembly with clamps, bolt, and nut at approximately the 7:30 o'clock position and rearward of Flange P.

(f) Install clamp to tube and secure to adjacent tube between Flange N and Flange P with bolt, threads lubricated with Engine Oil P03−001, and nut handtight only.

(g) Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(h) Torque tube nuts (both ends) to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(15) (Post SB PW4ENG 79−76) Install the (rear) EEC PT4.95 tube assembly (AS02) and the (rear) No. 3 bearing oil vent tube assembly (LD02) as follows. See Figure 405.

(a) Attach the (LD02) tube to the (LD01) and the turbine exhaust case, handtight only. See Figure 405 (Sheet 1).

(b) Attach the (AS02) tube to the (AS03) and (AS27) tubes, handtight only. See Figure 405 (Sheet 1).

(c) Install bolt to attach the (AS02) tube to the bracket handtight only. See Figure 405 (Sheet 2), View G.

(d) Install the clamp on the (LD02) tube and the clamp on the (LP48) tube and secure with nut and bolt, handtight only. See Figure 405 (Sheet 2), View L.

(e) Install the clamp on the (AS02) and (LD02) tubes and secure with a bolt, handtight only. See Figure 405 (Sheet 3), View H.

(f) Install clamp on the (AS02) and (LD02) tubes and secure with nut and bolt, handtight only. See Figure 405 (Sheet 3), View I.

(g) Install clamps on the (AS02) and (LD02) tubes and secure with nut and bolt, handtight only. See Figure 405 (Sheet 3), View J.

(h) Install clamp on (AS27) and (LD02) tubes and secure with nut and bolt, handtight only. See Figure 405 (Sheet 3), View K.

(i) Torque the (AS02) tube to the (AS03) tube and the (AS27) tube to 200 − 225 lb−in. (22.497 − 25.422 N.m).

(j) Torque the (LD02) tube to the internal tube and the (LD01) tube to 200 − 225 lb−in. (22.497 − 25.422 N.m).

(k) Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(16) (Pre SB PW4ENG 79−75) Install (rear) No. 4 bearing oil scavenge tube assembly (LR06) as follows.

(a) Install rear scavenge tube, elbow threads
R lubricated with Antiseize Paste P06-054, to tube
nut on internal tube at approximately 10 o'clock
position on exhaust case and to adapter, threads
R lubricated with Antiseize Paste P06-054, on
front scavenge tube at Flange M at approximately
R 7 o'clock position handtight only. Wipe off
R unwanted paste.

(b) Install clamps to tube and secure to brackets on Flanges N and P with bolts, threads lubricated with Engine Oil P03-001, and nuts handtight only.

(c) Torque clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Torque tube nut at exhaust case connection to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(e) Torque tube nut at Flange N connection to 475 - 525 lb-in. (53.668 - 59.317 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(f) (Reference 2151) Position shield to inboard side of Flange M connection and secure forward end with clamp. Torque clamp to 15 - 18 lb-in. (1.695 - 2.034 N.m).

(g) Install clamp to rear of shield over tube and secure to Flange M bracket with bolt, threads lubricated with Engine Oil P03-001, and nut. Torque bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(17) (Post SB PW4ENG 79-75 and Pre SB PW4ENG 79-76 only) Install (rear) No. 4 bearing scavenge tube assembly (LR06) as follows.

(a) Install rear scavenge tube, threads lubricated
R with Antiseize Paste P06-054, to exhaust case
internal tube nut at approximately 10 o'clock
position, and to the tube (LR05) coupling forward
of Flange M at approximately 7 o'clock position,
R handtight only. Wipe off unwanted paste.

(b) Install loop clamp bracket on Flange M bracket at approximately 7 o'clock with bolts lubricated with Engine Oil P03−001, handtight only. Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Secure tube to loop clamp bracket on Flange M bracket with one clamp and bolt, lubricated with Engine Oil P03−001, handtight only. Torque clamp bolt to 27 − 30 lb−in. (4.067 − 4.519 N.m).

(d) Install clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts securing tube to Flange N and P brackets. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque tube nut at exhaust case connection to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(f) Torque tube nut at Flange N connection to 475 − 525 lb−in. (53.668 − 59.317 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(g) Position tube shield to inboard side of Flange M connection and secure forward end of shield with hose clamp. Torque hose clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(18) (Post SB PW4ENG 79−76) Install (rear) No. 4 bearing scavenge tube assemblies (LR21) and (LR22) which replace (LR06) as follows.

(a) Attach the (LR21) tube to the (LR05) tube handtight only. See Figure 405 (Sheet 4), View DE.

(b) Install clamps and secure with nuts and bolts, handtight only. See Figure 405 (Sheet 5), Views O and Q and (Sheet 6), Views F and R.

(c) Attach the (LR22) tube to the (LR21) tube and the port for the internal tube on the turbine exhaust case, handtight only. Lubricate the threads that are on the internal tube with Engine Oil P03−001. See Figure 405 (Sheet 7), Views E and AP.

(d) Install clamps on the (LR22) tube and secure with bolts, handtight only. See Figure 405 (Sheet 8), Views A, B, C and D.

(e) Torque the (LR21) tube to the (LR05) tube to 475 − 525 lb−in. (56.668 − 59.317 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(f) Torque the (LR21) tube to the (LR22) tube to 475 − 525 lb−in. (56.668 − 59.317 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(g) Torque the internal tube nut to the (LR22) tube to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(19) (Post SB PW4ENG 79−76) Install the shields for the No. 4 bearing oil scavenge lines as follows.

(a) Install shield at the (LR05) tube to the (LR21) tube connection. Secure shield with clamp or bolt as applicable. See Figure 405 (Sheet 4), View DE.

(b) Install shield at the (LR21) tube to the (LR22) tube connection. Secure shield with clamp or bolt as applicable. See Figure 405 (Sheet 7), View E.

(c) Torque the clamps to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(d) Torque the nut and bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(20) (Pre SB PW4ENG 79−76) Install (rear) No. 4 bearing oil pressure tube assembly (LP16) as follows.

(a) Install pressure tube to strainer housing, threads lubricated with Engine Oil P03−001, on exhaust case at approximately 11 o'clock position and to adapter, threads lubricated with Engine Oil P03−001, forward of Flange M at approximately 10 o'clock position. Tighten handtight only.

(b) Install clamps to tube and secure to Flanges M, N, and P brackets with bolts, threads lubricated with Engine Oil P03−001, and nuts, handtight only.

(c) Install clamps, bolt, threads lubricated with Engine Oil P03−001, spacer, and nut securing tube to adjacent scavenge tube rearward of Flange N handtight only.

(d) Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque tube nuts (both ends) to 450 − 500 lb−in. (50.843 − 56.492 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the tube nuts.

(f) (Reference 2151) Install shield to inboard side of forward tube connection and secure in place with clamps. Torque clamps to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(g) FOR THESE MODELS: 4152, 4156A, 4158
(Reference 2151) (Pre SB PW4ENG 79−54) Install shield to inboard side of rear tube connection and secure with clamp. Torque clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(h) FOR THESE MODELS: 4152, 4156A, 4158
(Reference 2151) (Post SB PW4ENG 79−54) Install the spray shield to the inboard side of the pressure tube connection forward of Flange M. Secure the forward end of the shield to the bracket on the diffuser case with a clamp, bolt lubricated with Engine Oil P03−001. Torque the clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). Secure the rear of the shield with a hose clamp and torque to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(i) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
(Reference 2151) Install the spray shield to the inboard side of the pressure tube connection forward of Flange M. Attach the forward end of the shield to the bracket on the diffuser case with a clamp, bolt lubricated with Engine Oil P03−001. Torque the clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). Attach the rear of the shield with a hose clamp and torque to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(21) (Post SB PW4ENG 79−76) Install (rear) No. 4 bearing oil pressure tube assemblies (LP47) and (LP48) which replace (LP16) as follows. Also install the No. 4 bearing strainer element as follows.

(a) Attach the coupling nut on the (LP15) tube to the (LP47) tube, handtight only. See Figure 405 (Sheet 9), View LA.

(b) Install clamps and secure with bolts. See Figure 405 (Sheet 9), Views U, T and S.

(c) Install packing, lubricated with Engine Oil P03−001 to the groove in the No. 4 bearing strainer element. See Figure 405 (Sheet 10), View G.

(d) Install the No. 4 bearing strainer element into the No. 4 bearing strainer element housing, handtight only. Lubricate threads with Engine Oil P03−001. See Figure 405 (Sheet 10), View G.

(e) Install the element housing, lubricated with Engine Oil P03−001, on to the tube nut at approximately the 7 o'clock position, handtight only. See Figure 405 (Sheet 10), View G.

(f) Attach the (LP48) tube to the strainer housing and the (LP47) tube, handtight only. See Figure 405 (Sheet 10), Views G and CA.

(g) Install clamps and secure with bolts and nuts as necessary. See Figure 405 (Sheet 11), Views M, N, B1 and P, and (Sheet 12), Views R and F.

(h) Torque the strainer to the strainer housing to 150 − 170 lb−in. (16.948 − 19.207 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(i) Torque the internal tube nut to the strainer housing to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(j) Torque the (LP48) tube to the strainer housing to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(k) Torque the (LP48) tube to the (LP47) tube to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(l) Torque the (LP15) tube to the (LP47) tube to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(m) Torque all the installed clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(22) (Post SB PW4ENG 79−76) Install the shields for the No. 4 bearing oil pressure lines as follows.

(a) Install shield at the (LP47) tube to the (LP15) tube connection. Secure shield with clamps. See Figure 405 (Sheet 9), View LA.

(b) Install shield at the (LP47) tube to the (LP48) tube connection. Secure shield with clamps. See Figure 405 (Sheet 10), View CA.

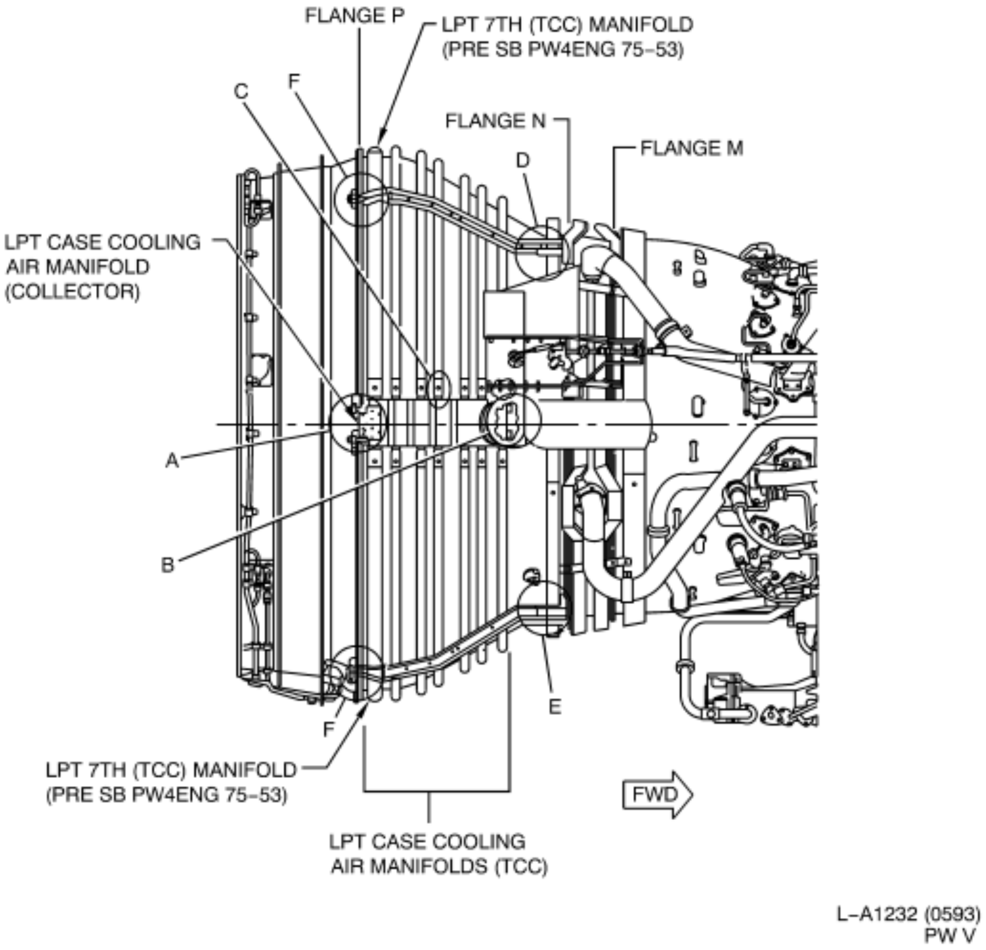
(c) Install shield at the (LP48) tube to the strainer housing connection. Secure shield with clamps. See Figure 405 (Sheet 10), View G.

(d) Torque all clamps to 15 − 18 lb−in. (1.695 − 2.034 N.m).

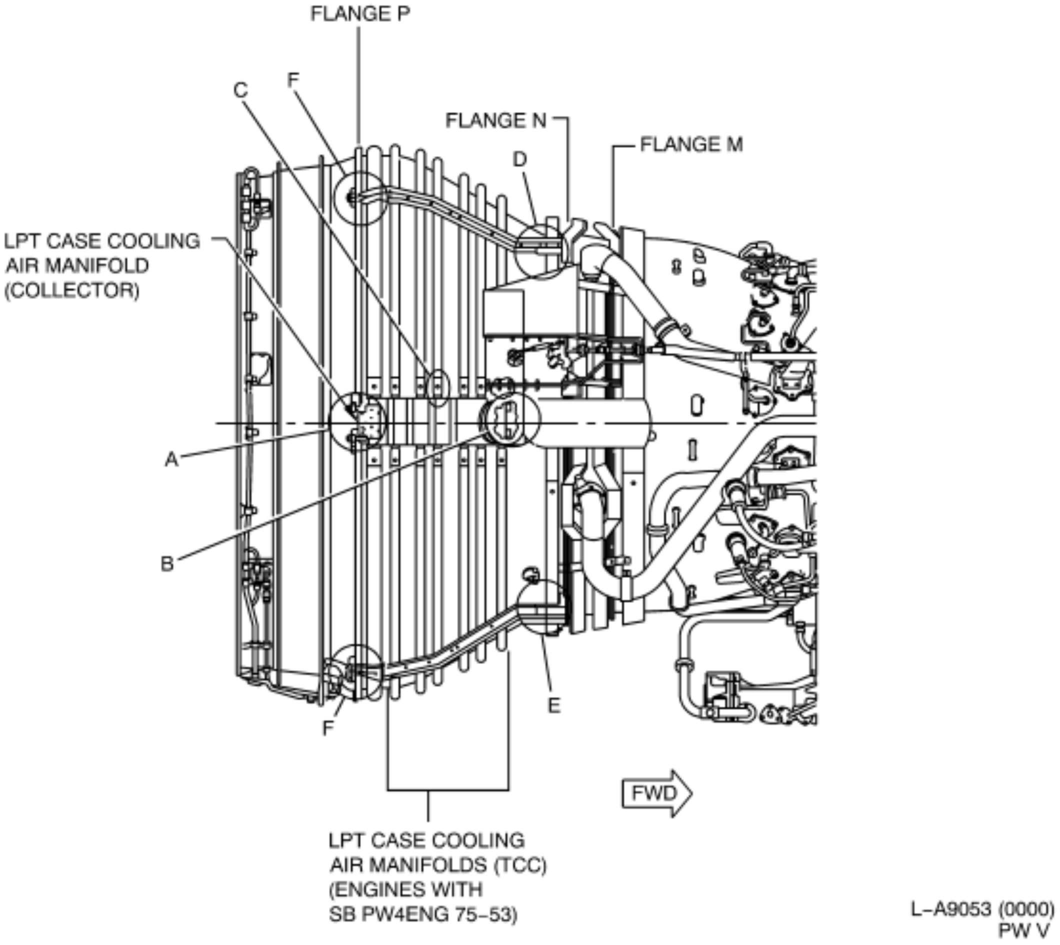
C. Postrequisites

(1) Install EEC thermocouple and airframe cable (W6) as necessary by 72−00−54, Installation−09 (Task 72−00−54−450−006).

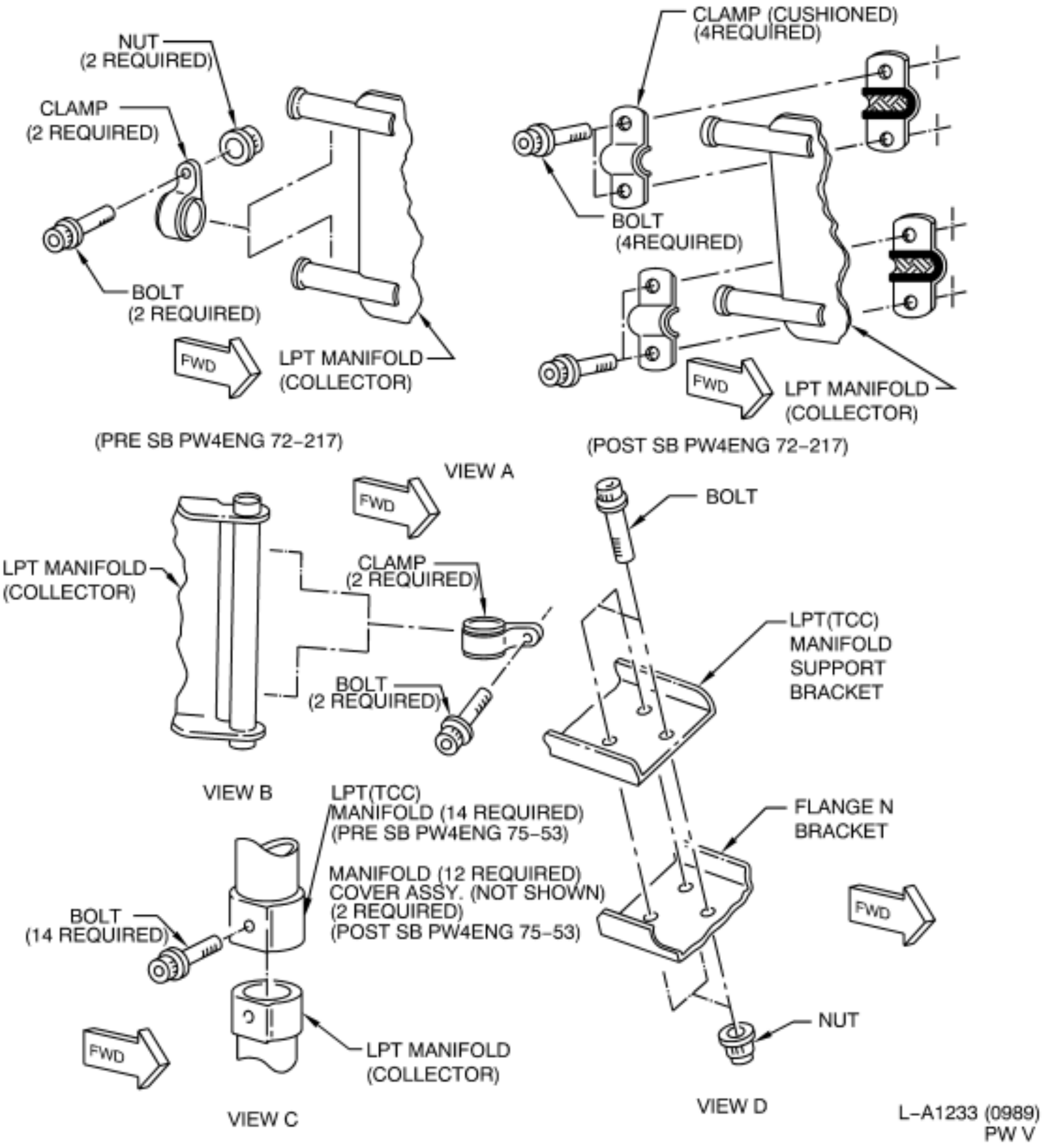
(2) Test engine per Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).


FLANGE P
LPT 7TH (TCC) MANIFOLD
(PRE SB PW4ENG 75-53)
C
F
FLANGE N
D
FLANGE M
LPT CASE COOLING
AIR MANIFOLD
(COLLECTOR)
A
B
E
F
LPT 7TH (TCC) MANIFOLD
(PRE SB PW4ENG 75-53)
FWD
LPT CASE COOLING
AIR MANIFOLDS (TCC)
L-A1232 (0593)
PW V

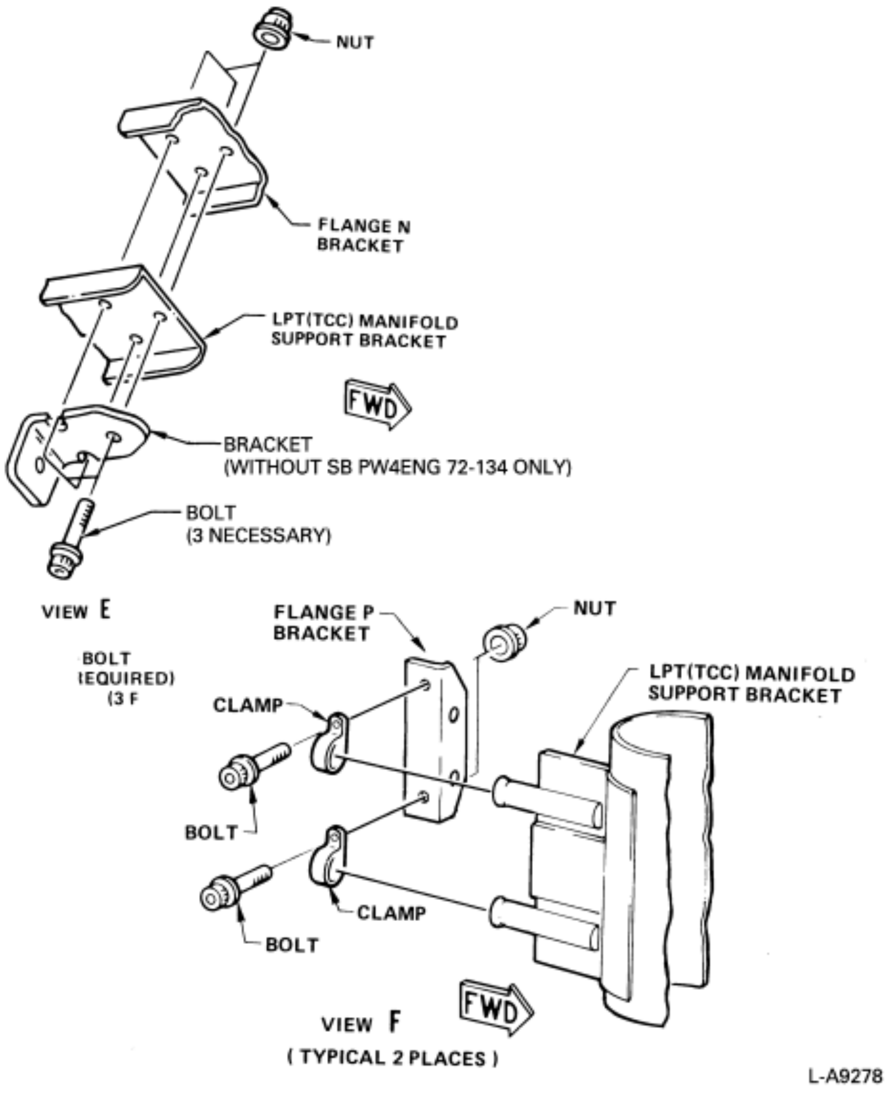
Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 401 (Sheet 1)
(Task 72-00-53-450-003)


FLANGE P
C
F
FLANGE N
D
FLANGE M
LPT CASE COOLING AIR MANIFOLD (COLLECTOR)
A
B
E
F
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC) (ENGINES WITH SB PW4ENG 75−53)
L−A9053 (0000)
PW V

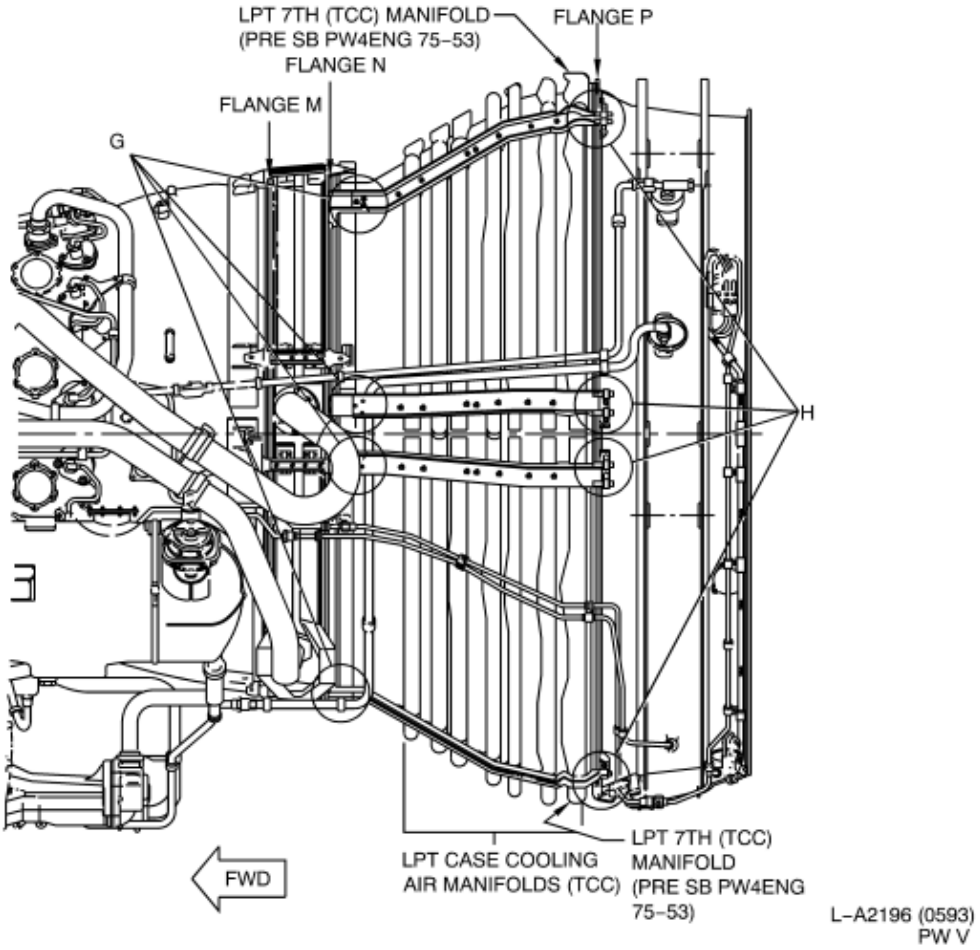
Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 401 (Sheet 2)
(Task 72−00−53−450−003)


NUT
(2 REQUIRED)
CLAMP
(2 REQUIRED)
BOLT
(2 REQUIRED)
FWD
LPT MANIFOLD
(COLLECTOR)
(PRE SB PW4ENG 72-217)
CLAMP (CUSHIONED)
(4REQUIRED)
BOLT
(4REQUIRED)
FWD
LPT MANIFOLD
(COLLECTOR)
(POST SB PW4ENG 72-217)
VIEW A
FWD
LPT MANIFOLD
(COLLECTOR)
CLAMP
(2 REQUIRED)
BOLT
(2 REQUIRED)
VIEW B
BOLT
LPT(TCC)
MANIFOLD
SUPPORT
BRACKET
FLANGE N
BRACKET
FWD
NUT
VIEW D
LPT(TCC)
MANIFOLD (14 REQUIRED)
(PRE SB PW4ENG 75-53)
MANIFOLD (12 REQUIRED)
COVER ASSY. (NOT SHOWN)
(2 REQUIRED)
(POST SB PW4ENG 75-53)
BOLT
(14 REQUIRED)
FWD
LPT MANIFOLD
(COLLECTOR)
VIEW C
L-A1233 (0989)
PW V

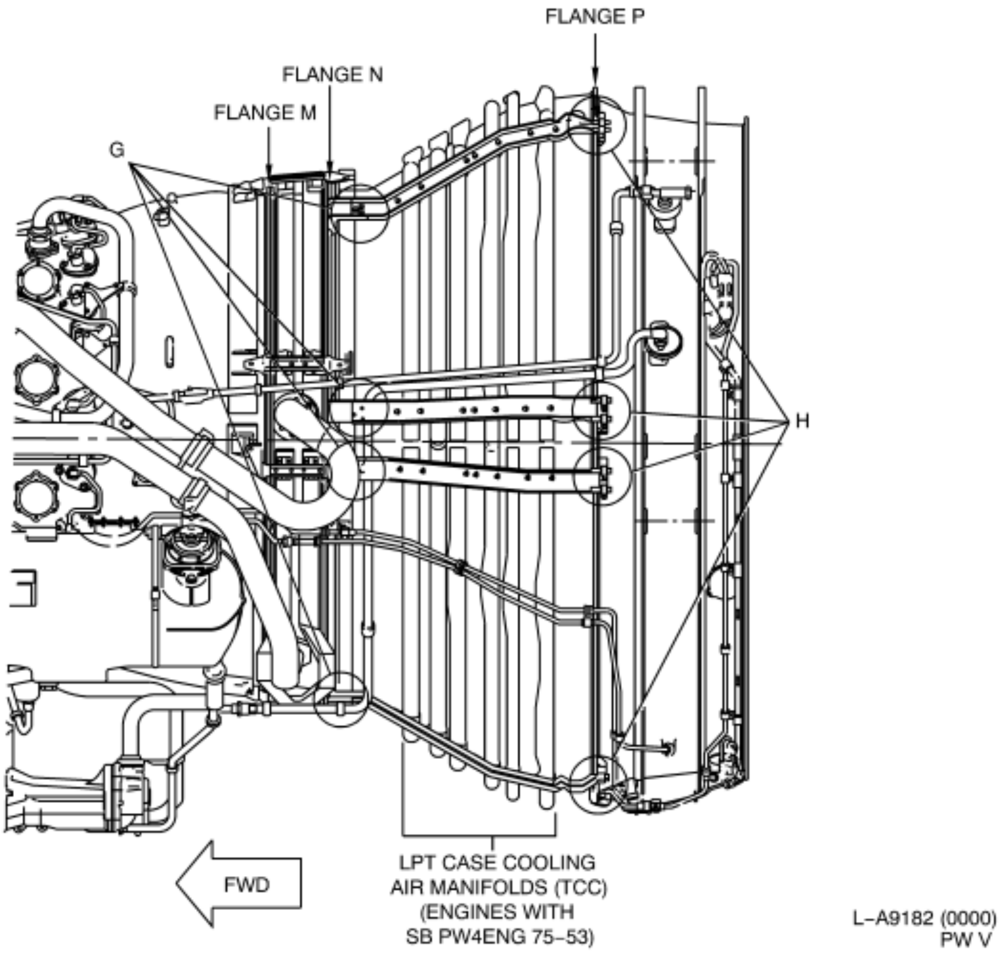
Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 401 (Sheet 3)
(Task 72-00-53-450-003)


NUT
FLANGE N BRACKET
LPT(TCC) MANIFOLD SUPPORT BRACKET
FWD
BRACKET (WITHOUT SB PW4ENG 72-134 ONLY)
BOLT (3 NECESSARY)
VIEW E
BOLT
EQUIRED)
(3 F
FLANGE P BRACKET
NUT
LPT(TCC) MANIFOLD SUPPORT BRACKET
CLAMP
BOLT
CLAMP
BOLT
FWD
VIEW F
(TYPICAL 2 PLACES)
L-A9278

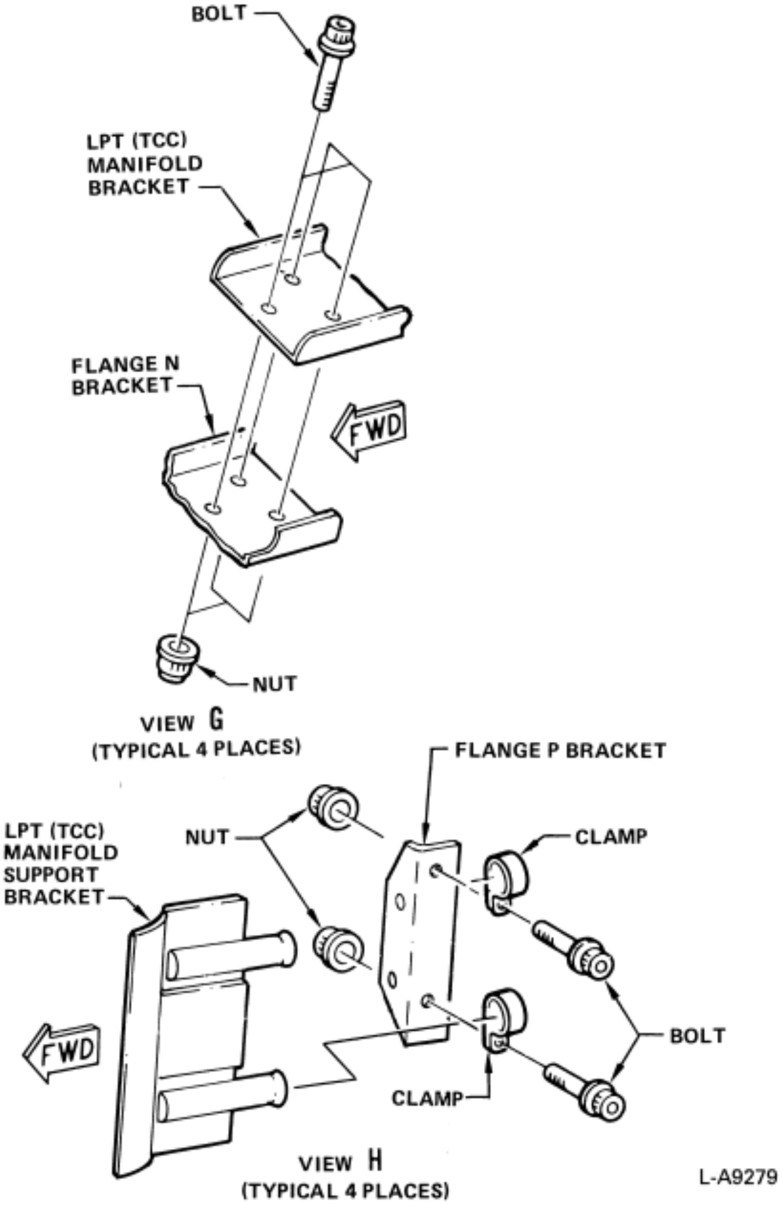
Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 401 (Sheet 4)
(Task 72-00-53-450-003)


LPT 7TH (TCC) MANIFOLD
(PRE SB PW4ENG 75−53)
FLANGE P
FLANGE N
FLANGE M
G
H
FWD
LPT CASE COOLING
AIR MANIFOLDS (TCC)
LPT 7TH (TCC)
MANIFOLD
(PRE SB PW4ENG
75−53)
L−A2196 (0593)
PW V

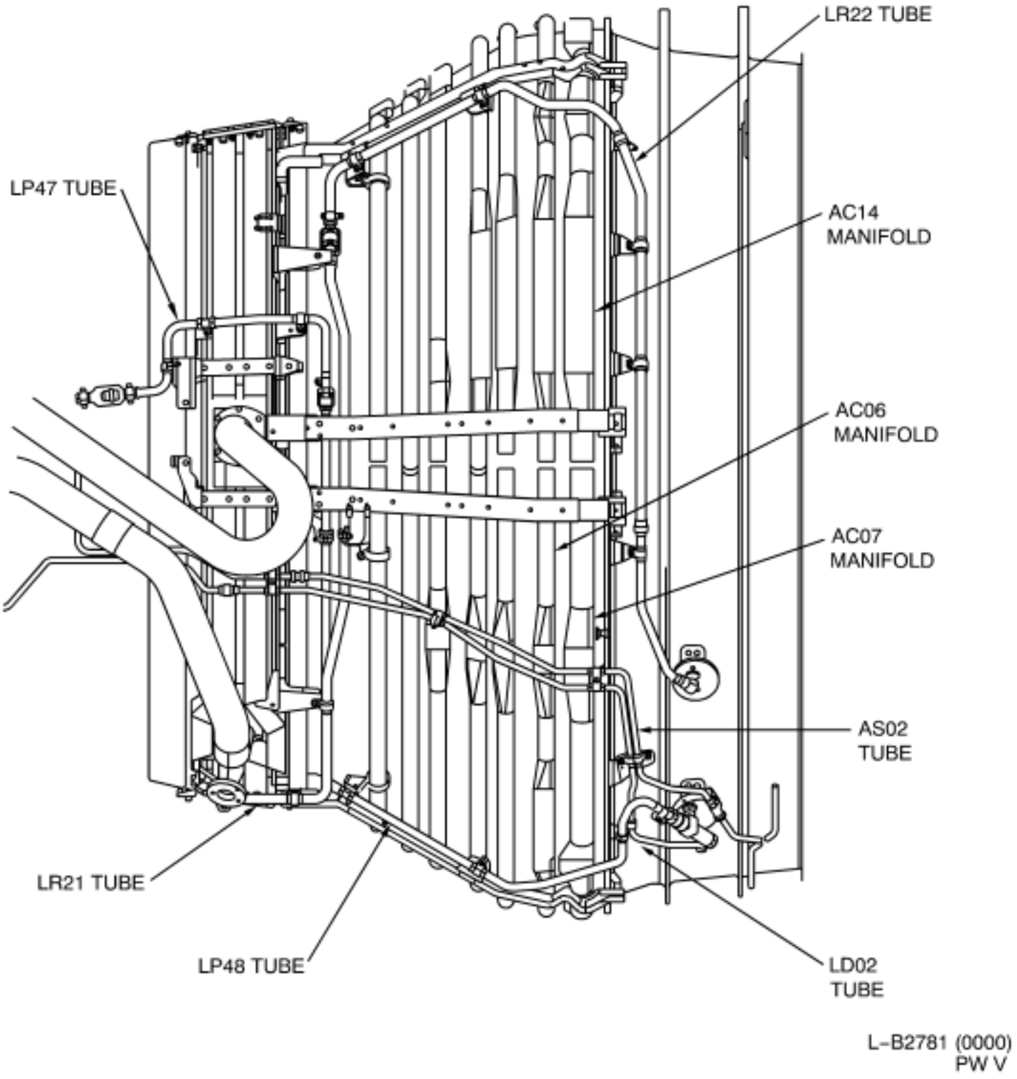
Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 401 (Sheet 5)
(Task 72−00−53−450−003)


FLANGE P
FLANGE N
FLANGE M
G
H
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC) (ENGINES WITH SB PW4ENG 75-53)
L-A9182 (0000)
PW V

Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 401 (Sheet 6)
(Task 72-00-53-450-003)

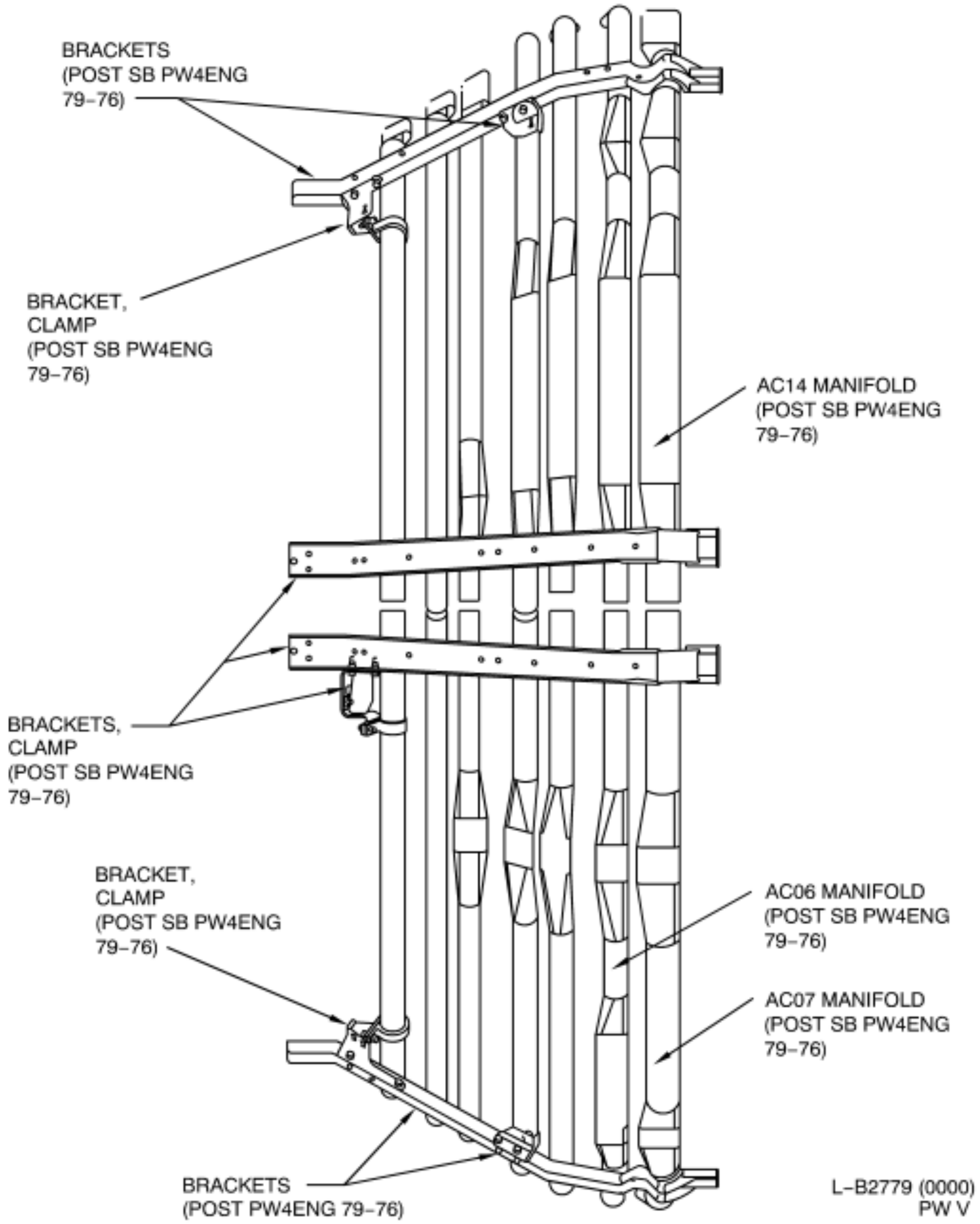

BOLT
LPT (TCC) MANIFOLD BRACKET
FLANGE N BRACKET
FWD
NUT
VIEW G
(TYPICAL 4 PLACES)
FLANGE P BRACKET
LPT (TCC) MANIFOLD SUPPORT BRACKET
NUT
CLAMP
BOLT
FWD
CLAMP
VIEW H
(TYPICAL 4 PLACES)
L-A9279

Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 401 (Sheet 7)
(Task 72−00−53−450−003)

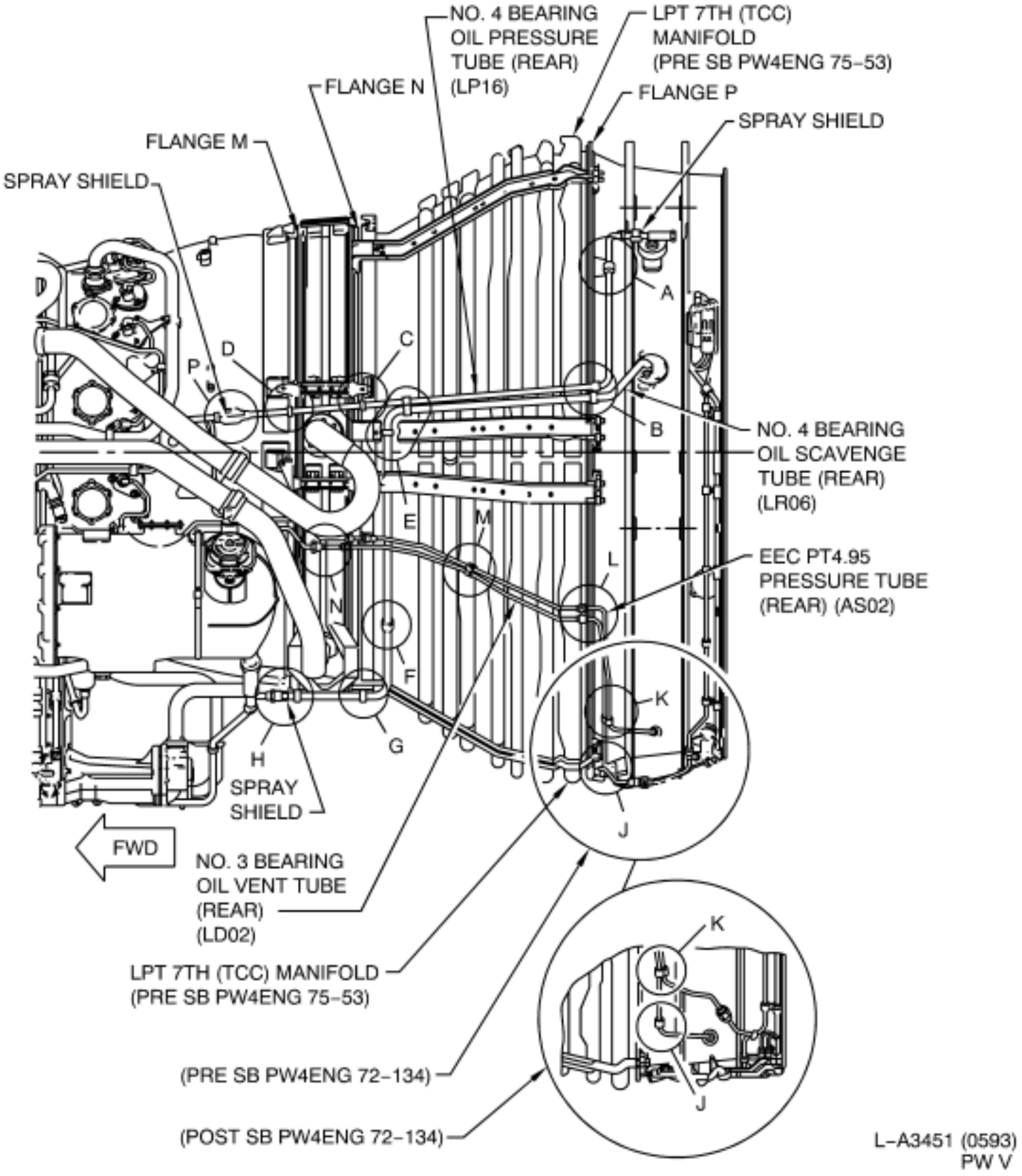

LR22 TUBE
LP47 TUBE
AC14 MANIFOLD
AC06 MANIFOLD
AC07 MANIFOLD
AS02 TUBE
LR21 TUBE
LP48 TUBE
LD02 TUBE
L-B2781 (0000)
PW V

LPT Turbine Case Cooling Manifolds Clipping (Post SB PW4ENG 79-76)
Figure 401 (Sheet 8)
(Task 72-00-53-450-003)

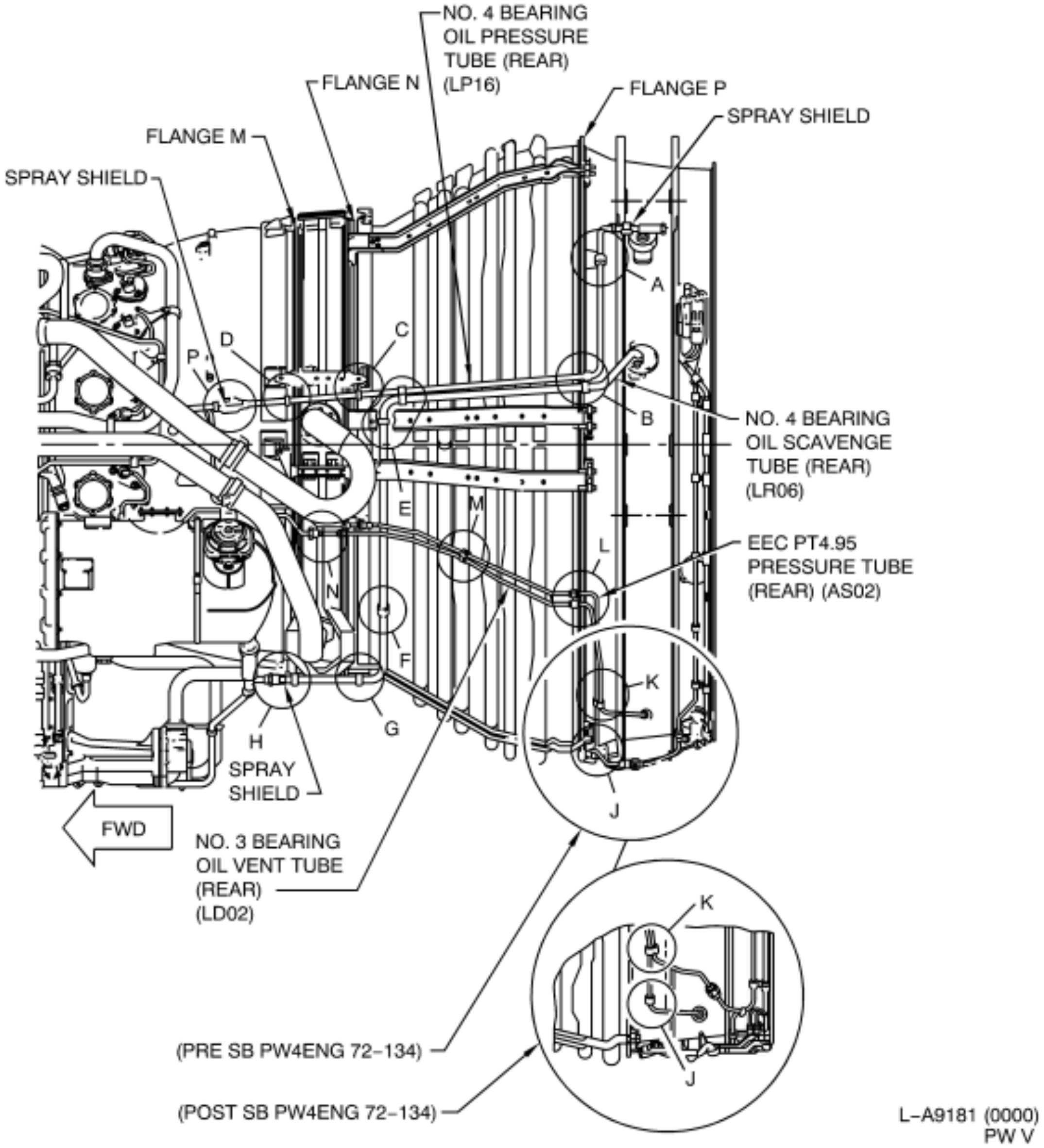
R
R


BRACKETS
(POST SB PW4ENG
79−76)
BRACKET,
CLAMP
(POST SB PW4ENG
79−76)
AC14 MANIFOLD
(POST SB PW4ENG
79−76)
BRACKETS,
CLAMP
(POST SB PW4ENG
79−76)
BRACKET,
CLAMP
(POST SB PW4ENG
79−76)
AC06 MANIFOLD
(POST SB PW4ENG
79−76)
AC07 MANIFOLD
(POST SB PW4ENG
79−76)
BRACKETS
(POST PW4ENG 79−76)
L−B2779 (0000)
PW V

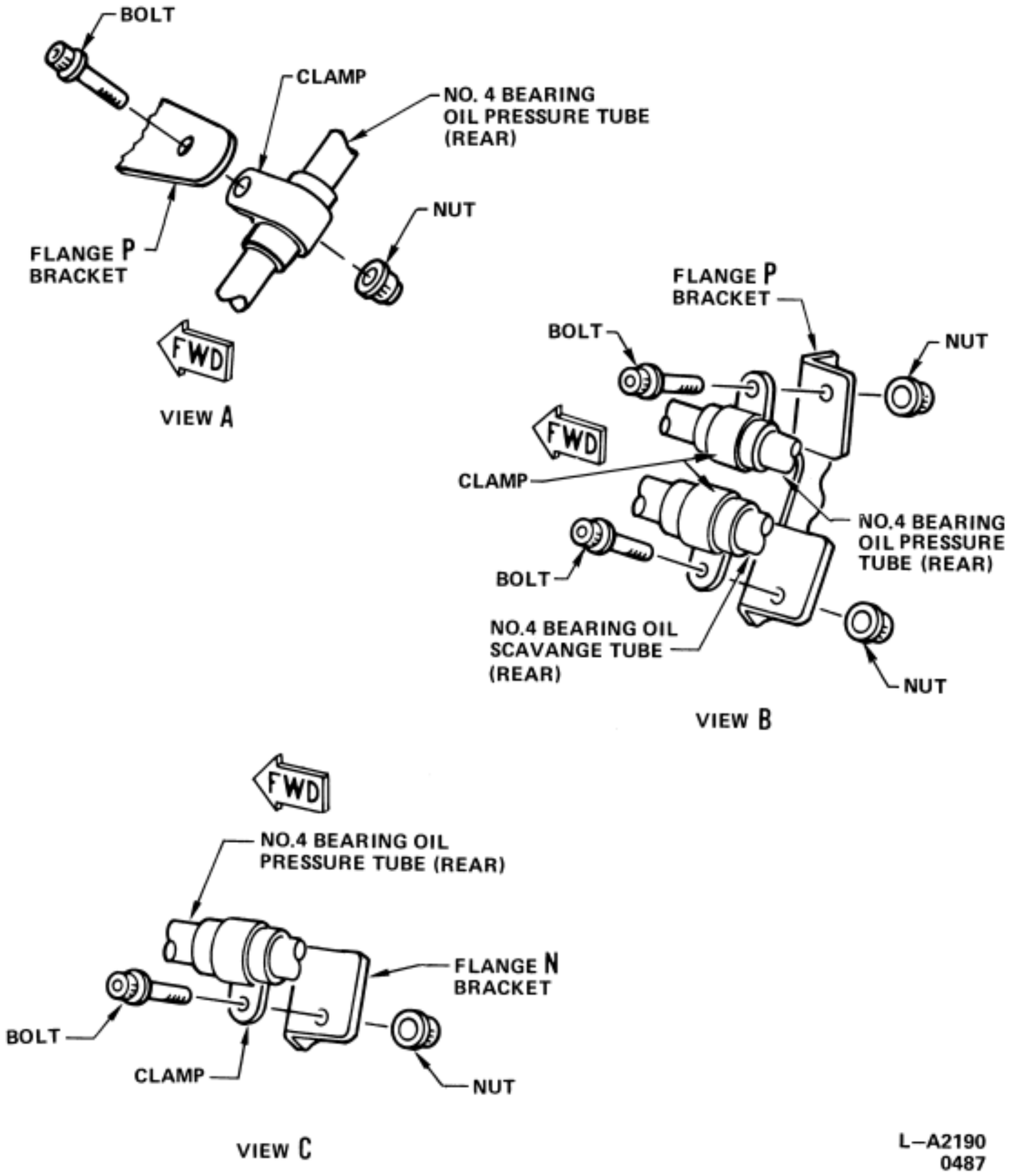
LPT Turbine Case Cooling Manifolds Clipping (Post SB PW4ENG 79−76)
Figure 401 (Sheet 9)
(Task 72−00−53−450−003)


NO. 4 BEARING OIL PRESSURE TUBE (REAR) (LP16)
LPT 7TH (TCC) MANIFOLD (PRE SB PW4ENG 75−53)
FLANGE N
FLANGE P
SPRAY SHIELD
FLANGE M
SPRAY SHIELD
A
P
D
C
B
NO. 4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
E
M
L
EEC PT4.95 PRESSURE TUBE (REAR) (AS02)
N
F
K
H
G
SPRAY SHIELD
J
FWD
NO. 3 BEARING OIL VENT TUBE (REAR) (LD02)
K
LPT 7TH (TCC) MANIFOLD (PRE SB PW4ENG 75−53)
(PRE SB PW4ENG 72−134)
J
(POST SB PW4ENG 72−134)
L−A3451 (0593)
PW V

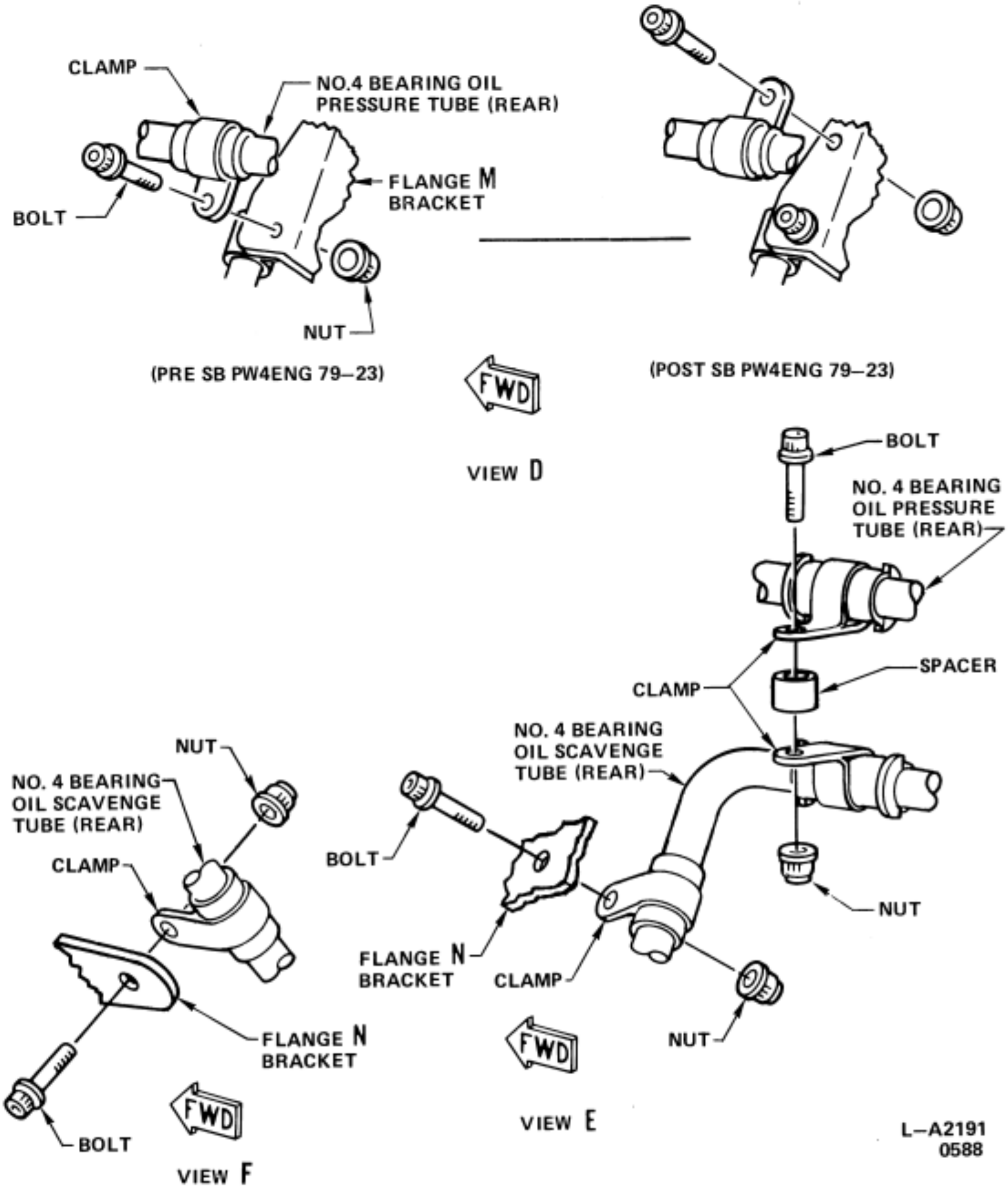
External Plumbing Clipping Views
Figure 402 (Sheet 1)
(Task 72−00−53−450−003)


NO. 4 BEARING OIL PRESSURE TUBE (REAR) (LP16)
FLANGE N
FLANGE P
SPRAY SHIELD
FLANGE M
SPRAY SHIELD
A
C
D
P
B
NO. 4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
E
M
L
EEC PT4.95 PRESSURE TUBE (REAR) (AS02)
N
F
K
H
G
SPRAY SHIELD
J
FWD
NO. 3 BEARING OIL VENT TUBE (REAR) (LD02)
K
J
(PRE SB PW4ENG 72-134)
(POST SB PW4ENG 72-134)
L-A9181 (0000)
PW V

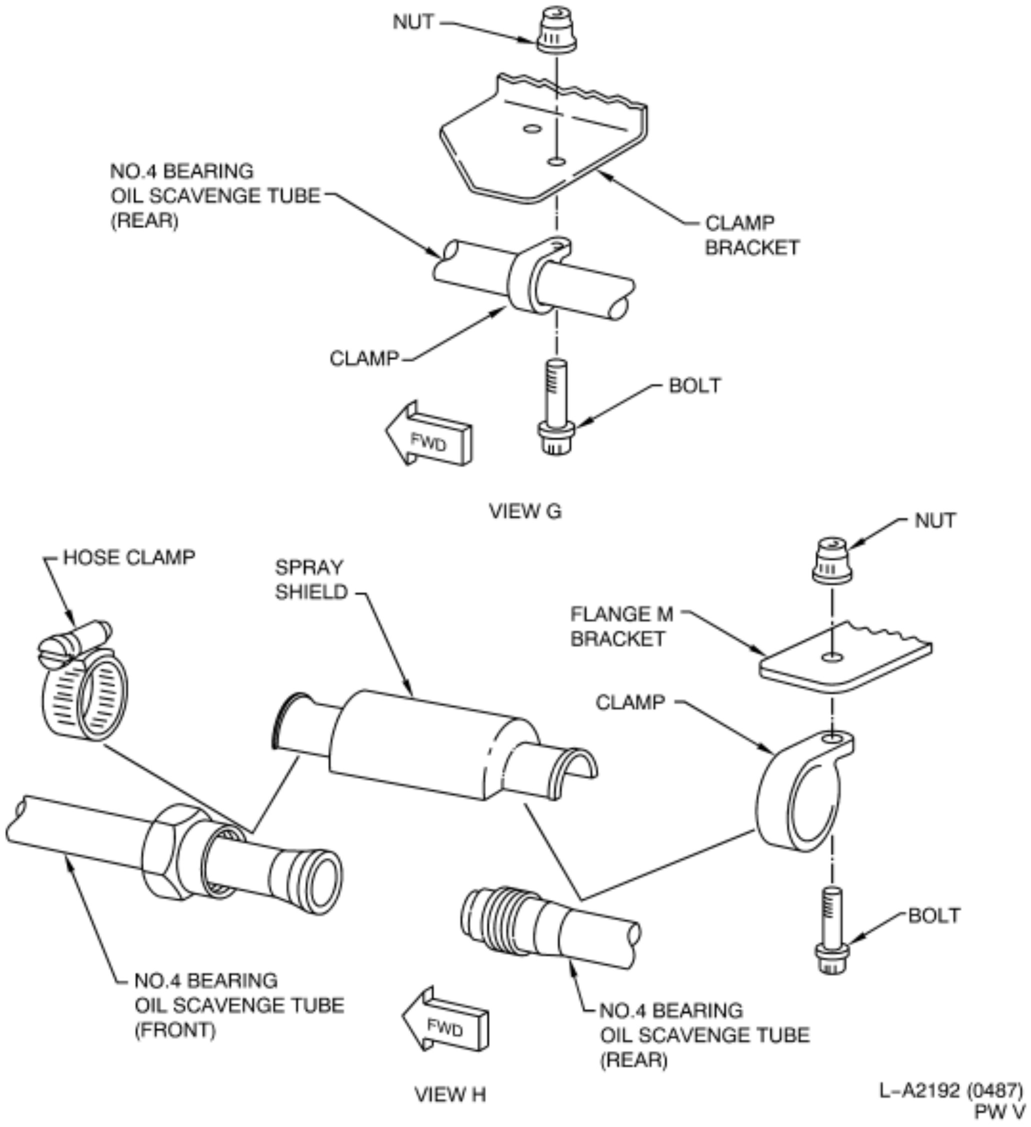
External Plumbing Clipping Views (Engines With SB PW4ENG 75-53)
Figure 402 (Sheet 2)
(Task 72-00-53-450-003)


BOLT
CLAMP
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
NUT
FLANGE P BRACKET
FWD
VIEW A
FLANGE P BRACKET
BOLT
NUT
FWD
CLAMP
NO.4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NO.4 BEARING OIL SCAVANGE TUBE (REAR)
NUT
VIEW B
FWD
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE N BRACKET
BOLT
CLAMP
NUT
VIEW C
L−A2190
0487

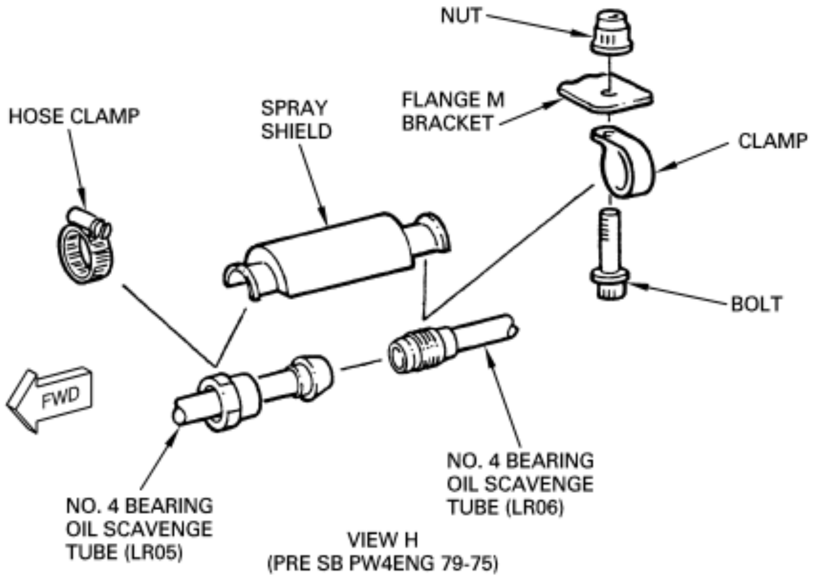
External Plumbing Clipping Views
Figure 402 (Sheet 3)
(Task 72−00−53−450−003)


CLAMP
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE M BRACKET
BOLT
NUT
(PRE SB PW4ENG 79−23)
FWD
(POST SB PW4ENG 79−23)
VIEW D
BOLT
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
SPACER
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
NUT
BOLT
FLANGE N BRACKET
CLAMP
FWD
NUT
VIEW E
NUT
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP
FLANGE N BRACKET
BOLT
FWD
VIEW F
L−A2191
0588

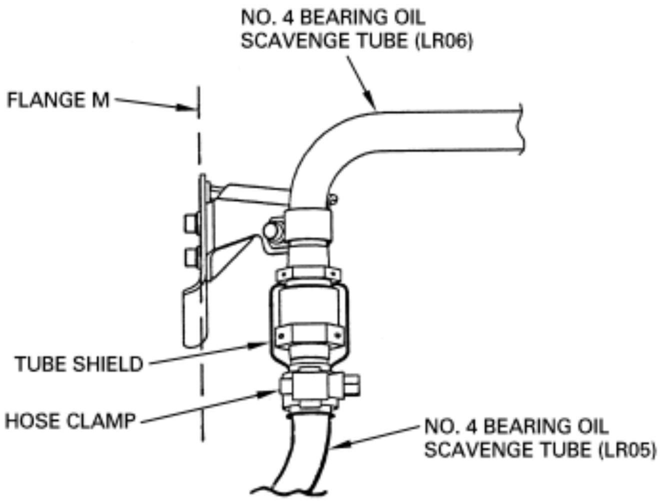
External Plumbing Clipping Views
Figure 402 (Sheet 4)
(Task 72−00−53−450−003)


NUT
NO.4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP BRACKET
CLAMP
BOLT
FWD
VIEW G
HOSE CLAMP
SPRAY SHIELD
NUT
FLANGE M BRACKET
CLAMP
BOLT
NO.4 BEARING OIL SCAVENGE TUBE (FRONT)
FWD
NO.4 BEARING OIL SCAVENGE TUBE (REAR)
VIEW H
L−A2192 (0487)
PW V

External Plumbing Clipping Views
Figure 402 (Sheet 5)
(Task 72−00−53−450−003)


NUT
HOSE CLAMP
SPRAY SHIELD
FLANGE M BRACKET
CLAMP
BOLT
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)

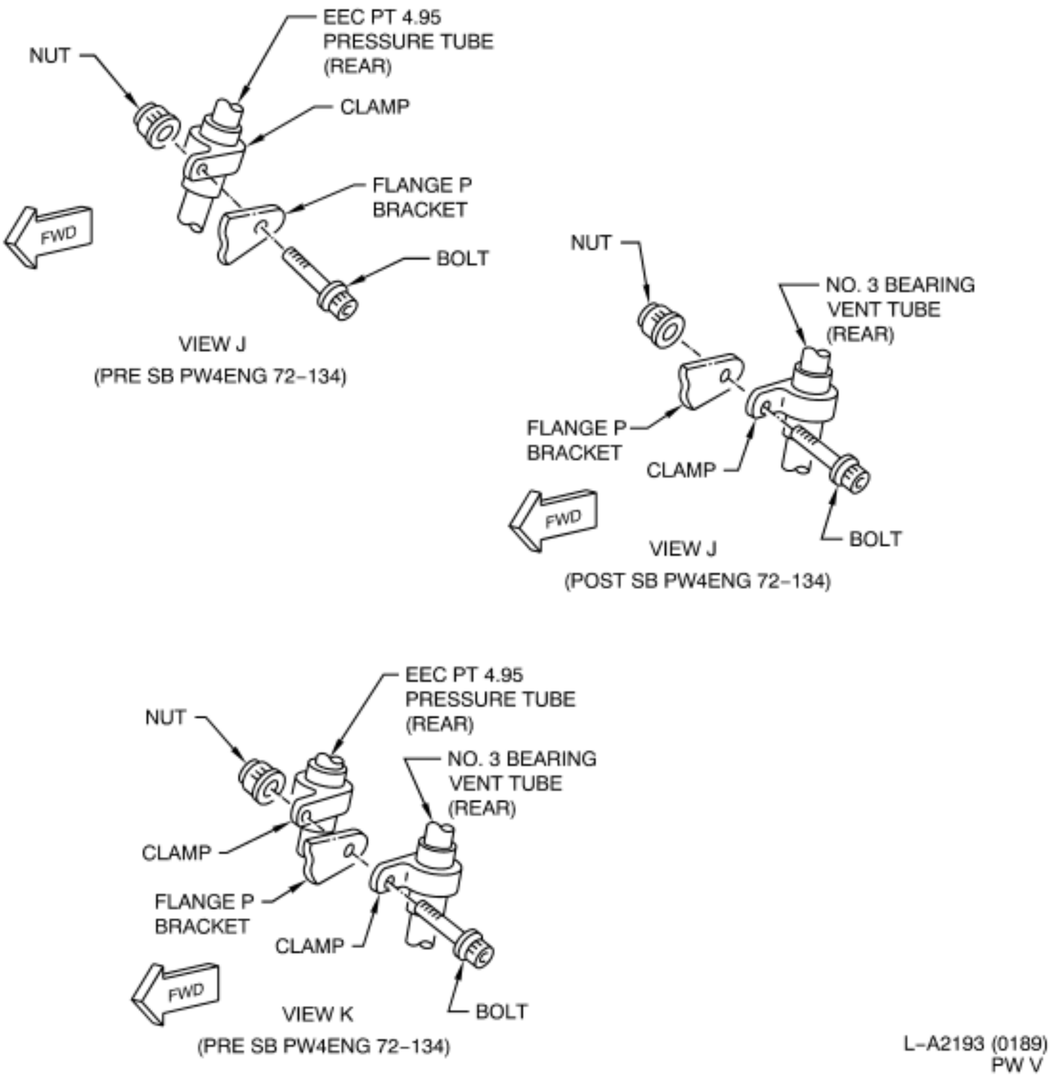
VIEW H
(PRE SB PW4ENG 79-75)


NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
FLANGE M
TUBE SHIELD
HOSE CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)

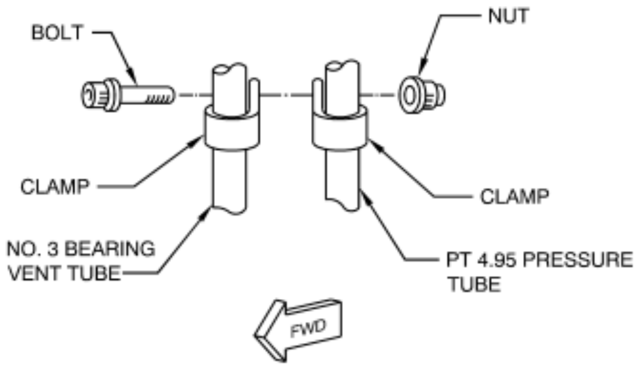
VIEW H
(POST SB PW4ENG 79-75)

L-B2526 (0000)

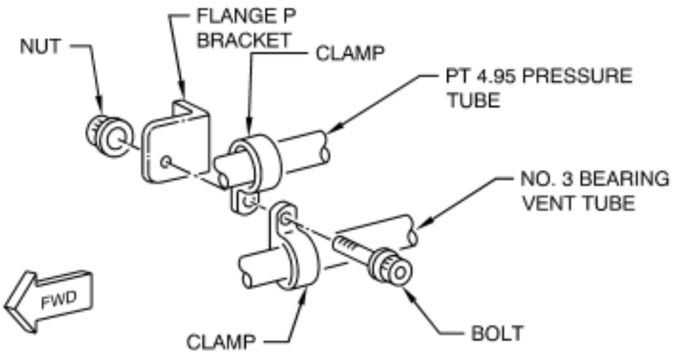
External Tubes For HPT (TCC) Clipping And Brackets
Figure 402 (Sheet 6)
(Task 72-00-53-450-003)


EEC PT 4.95
PRESSURE TUBE
(REAR)
NUT
CLAMP
FLANGE P
BRACKET
FWD
BOLT
VIEW J
(PRE SB PW4ENG 72−134)
NUT
NO. 3 BEARING
VENT TUBE
(REAR)
FLANGE P
BRACKET
CLAMP
FWD
BOLT
VIEW J
(POST SB PW4ENG 72−134)
EEC PT 4.95
PRESSURE TUBE
(REAR)
NUT
NO. 3 BEARING
VENT TUBE
(REAR)
CLAMP
FLANGE P
BRACKET
CLAMP
FWD
BOLT
VIEW K
(PRE SB PW4ENG 72−134)
L−A2193 (0189)
PW V

External Plumbing Clipping Views
Figure 402 (Sheet 7)
(Task 72−00−53−450−003)


BOLT
NUT
CLAMP
CLAMP
NO. 3 BEARING VENT TUBE
PT 4.95 PRESSURE TUBE
FWD

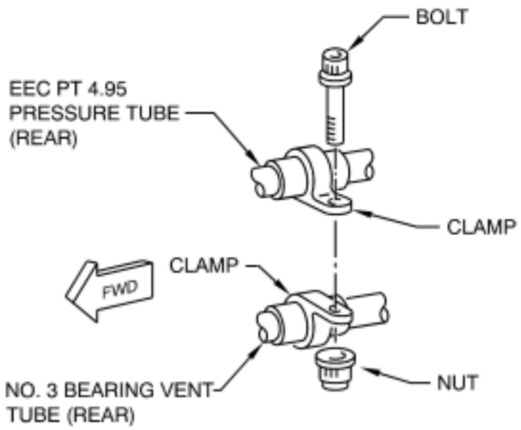
VIEW K
(POST SB PW4ENG 72-134)


FLANGE P BRACKET
NUT
CLAMP
PT 4.95 PRESSURE TUBE
NO. 3 BEARING VENT TUBE
FWD
CLAMP
BOLT

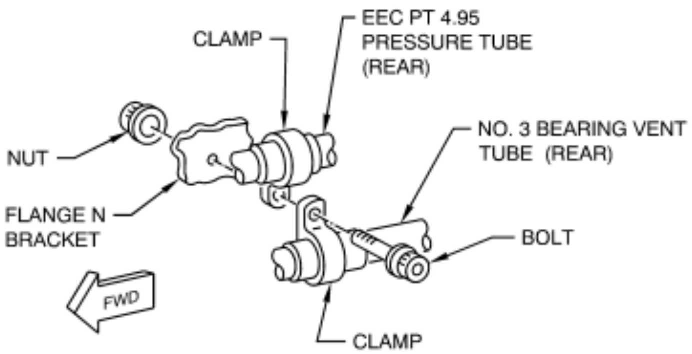
VIEW L

L-A5024 (0000)
PW V

External Plumbing Clipping Views
Figure 402 (Sheet 8)
(Task 72-00-53-450-003)

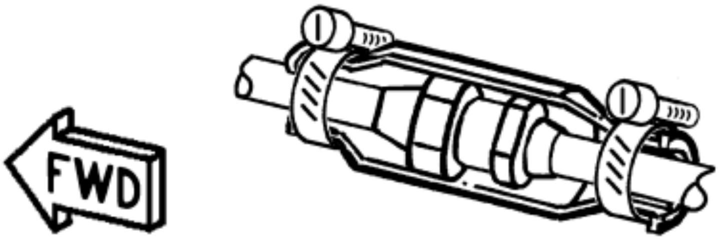

BOLT
EEC PT 4.95
PRESSURE TUBE
(REAR)
CLAMP
CLAMP
FWD
NO. 3 BEARING VENT
TUBE (REAR)
NUT

VIEW M

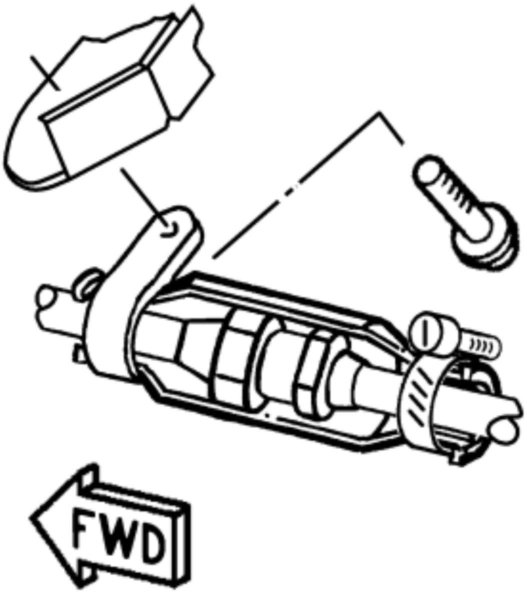

CLAMP
EEC PT 4.95
PRESSURE TUBE
(REAR)
NO. 3 BEARING VENT
TUBE (REAR)
NUT
FLANGE N
BRACKET
BOLT
FWD
CLAMP
L−A2194 (0487)
PW V

VIEW N

External Plumbing Clipping Views
Figure 402 (Sheet 9)
(Task 72−00−53−450−003)



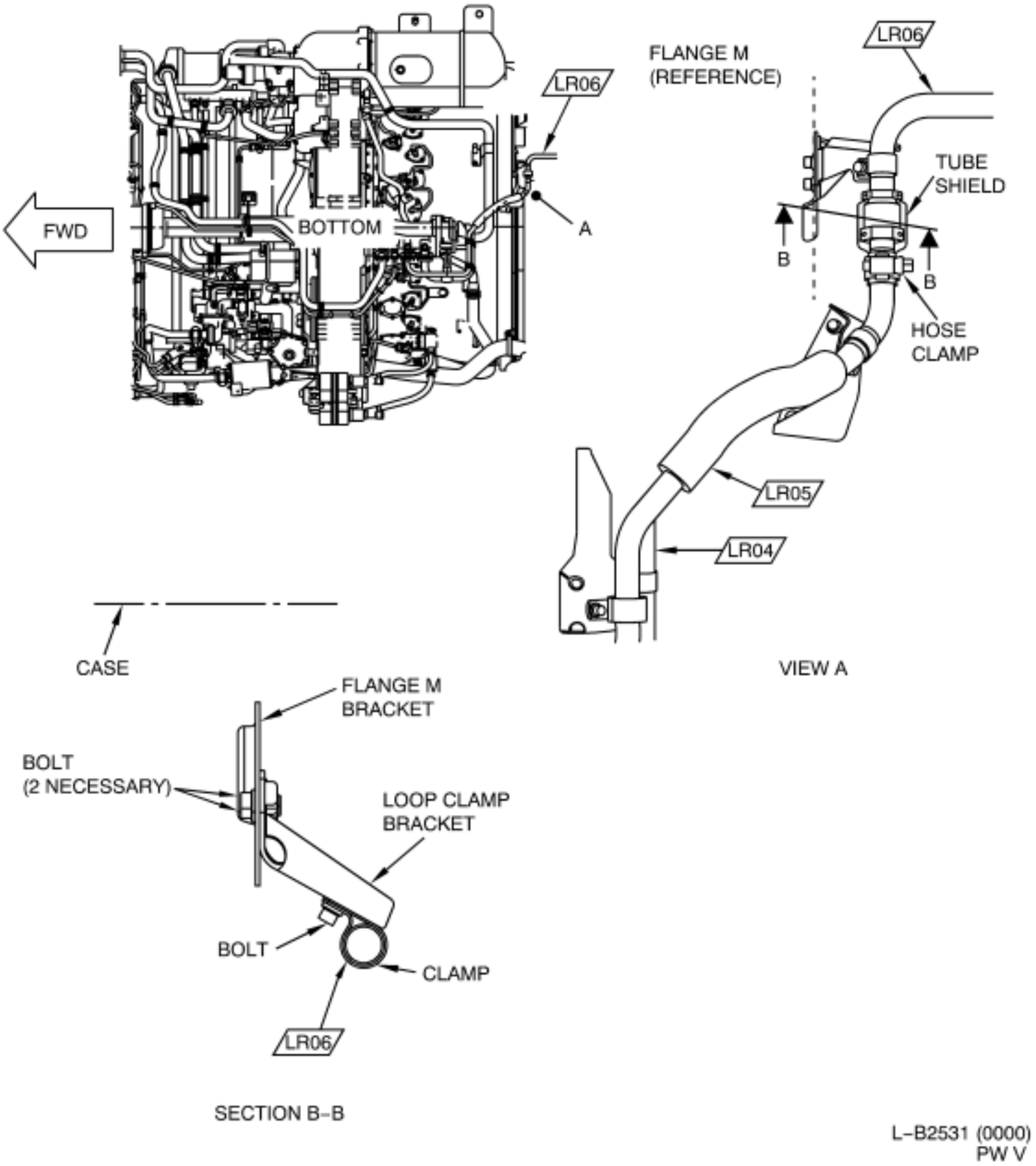
VIEW P
(PRE SB PW4ENG 79-54)



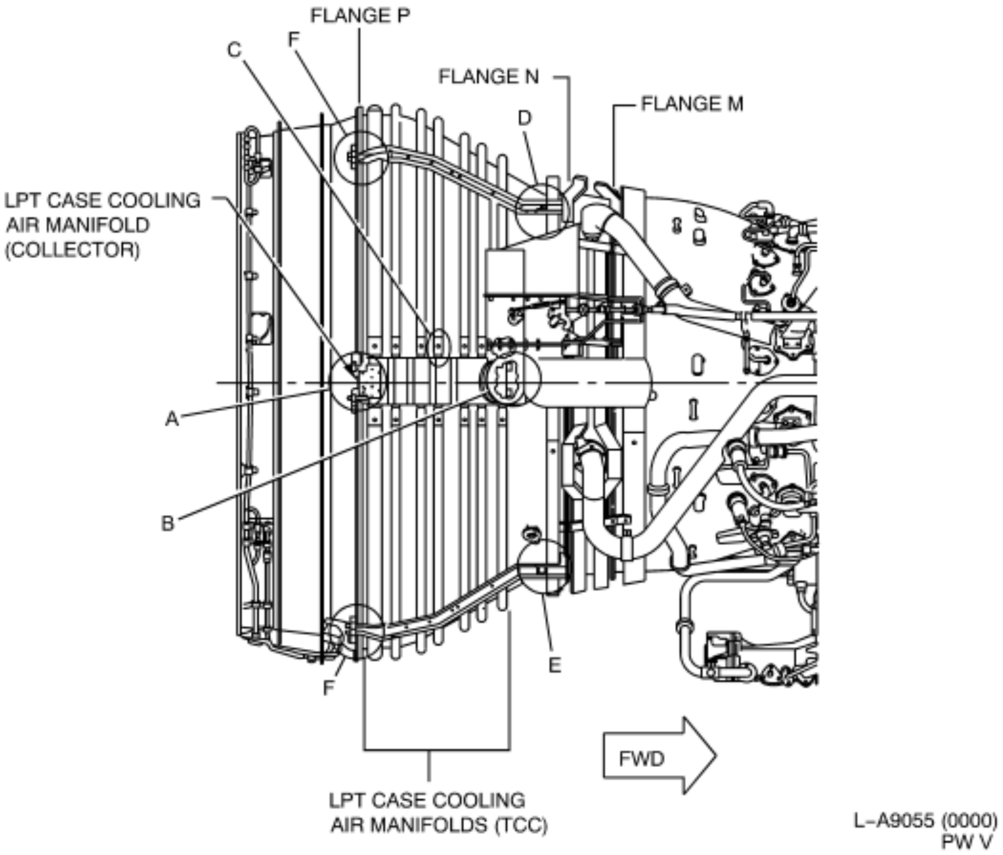
VIEW P
(POST SB PW4ENG 79-54)

L-A6824 (0000)

External Plumbing Clipping Views
Figure 402 (Sheet 10)
(Task 72−00−53−450−003)

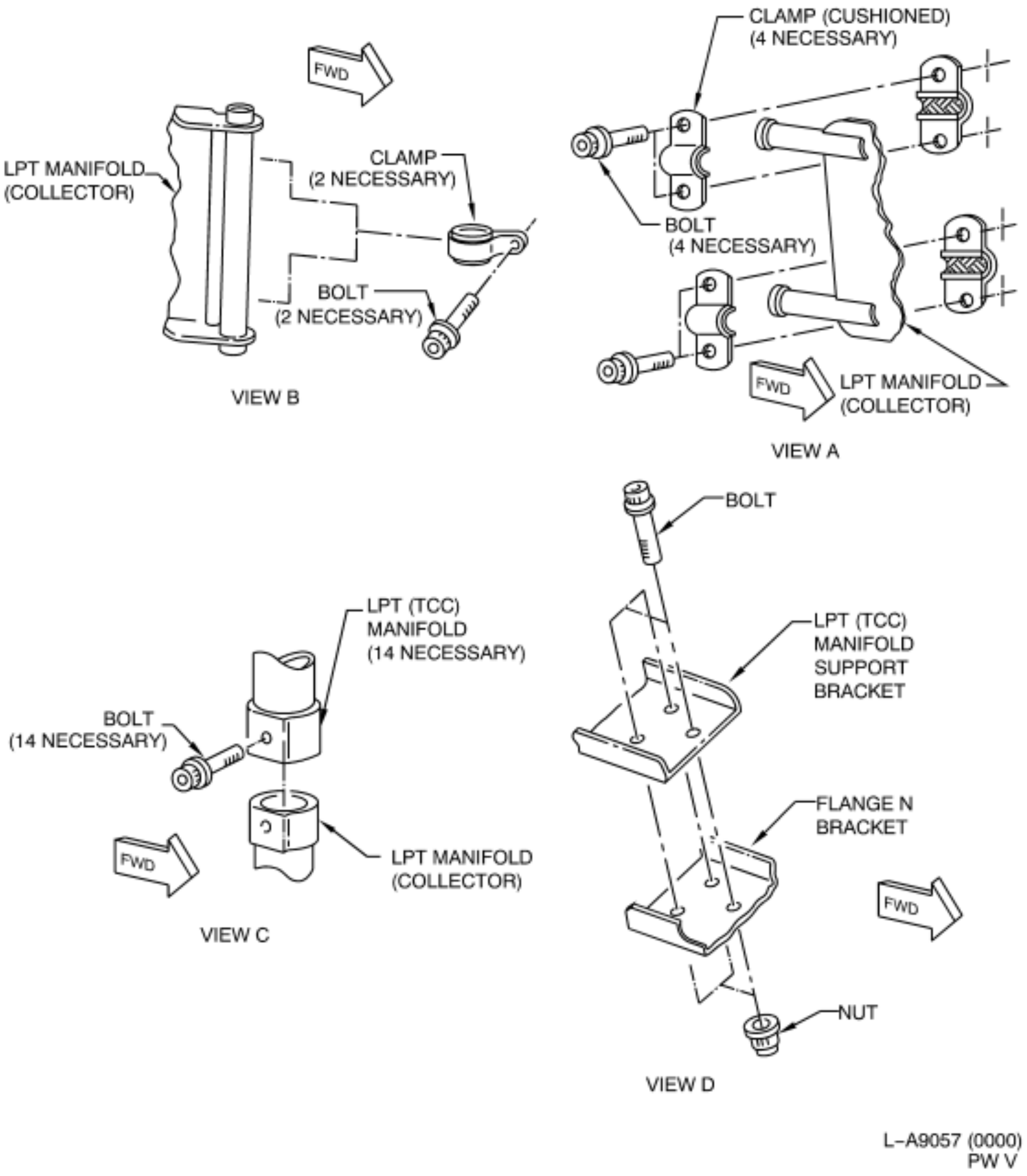

FWD
BOTTOM
LR06
A
CASE
FLANGE M
(REFERENCE)
LR06
TUBE
SHIELD
B
B
HOSE
CLAMP
LR05
LR04
VIEW A
FLANGE M
BRACKET
BOLT
(2 NECESSARY)
LOOP CLAMP
BRACKET
BOLT
CLAMP
LR06
SECTION B-B
L-B2531 (0000)
PW V

External Tubes For HPT (TCC) Clipping
And Brackets (Post SB PW4ENG 79-75)
Figure 402 (Sheet 11)
(Task 72-00-53-450-003)

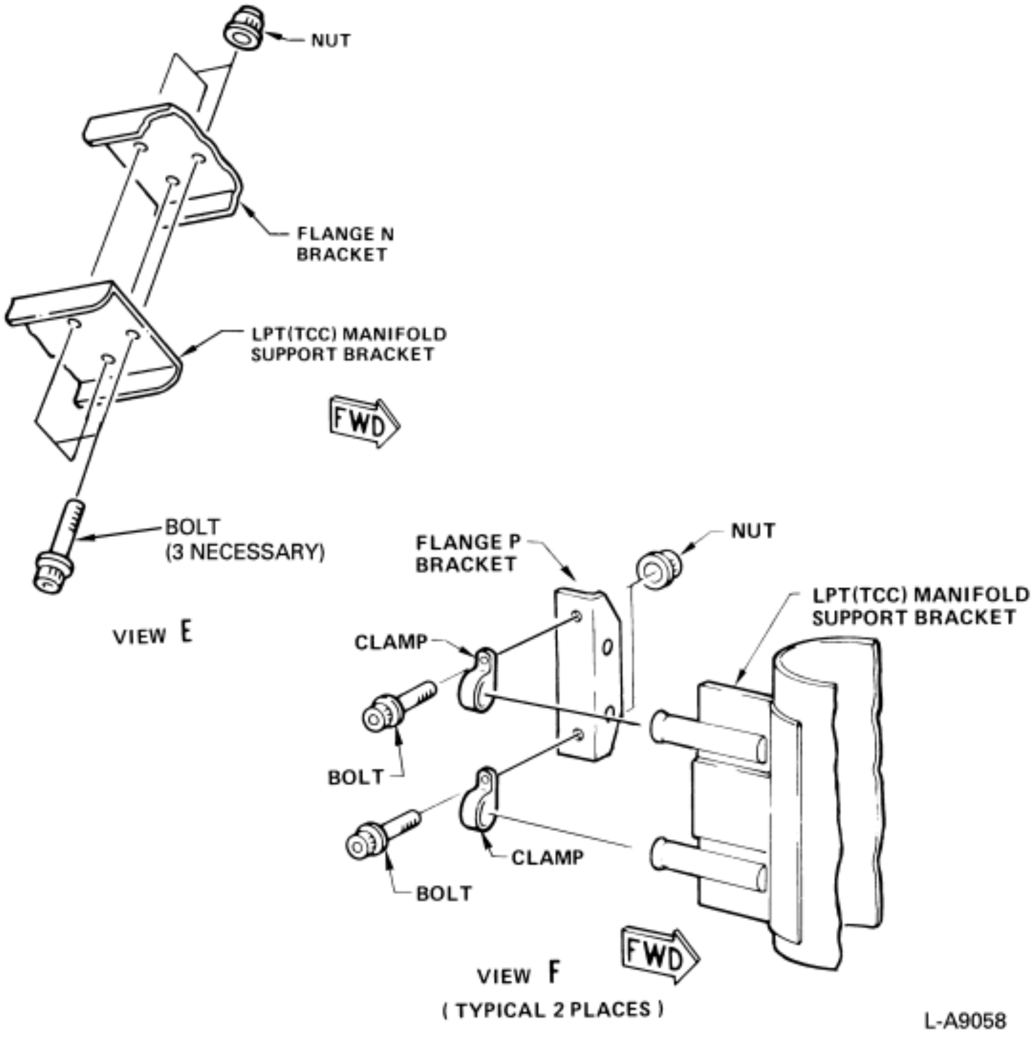

FLANGE P
F
C
FLANGE N
FLANGE M
D
LPT CASE COOLING AIR MANIFOLD (COLLECTOR)
A
B
E
F
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC)
L−A9055 (0000)
PW V

Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 403 (Sheet 1)
(Task 72−00−53−450−003)

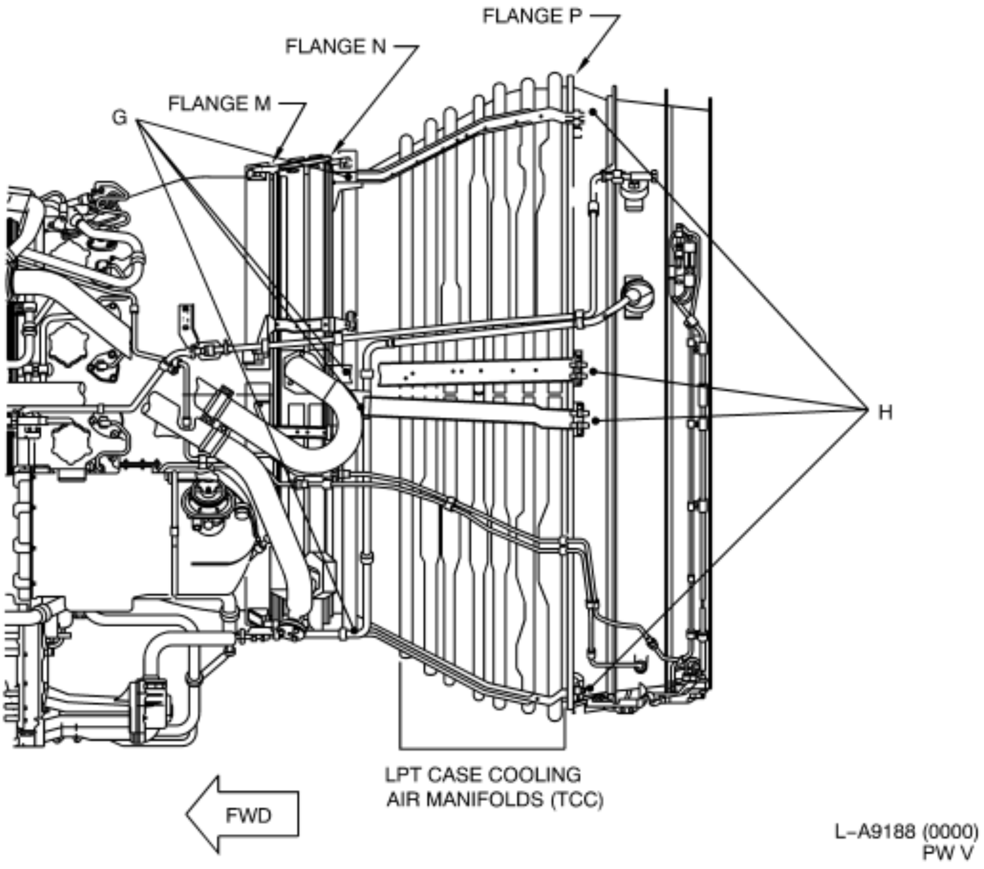
R
R


FWD
LPT MANIFOLD (COLLECTOR)
CLAMP (2 NECESSARY)
BOLT (2 NECESSARY)
VIEW B
CLAMP (CUSHIONED) (4 NECESSARY)
BOLT (4 NECESSARY)
FWD
LPT MANIFOLD (COLLECTOR)
VIEW A
BOLT
LPT (TCC) MANIFOLD (14 NECESSARY)
BOLT (14 NECESSARY)
FWD
LPT MANIFOLD (COLLECTOR)
VIEW C
LPT (TCC) MANIFOLD SUPPORT BRACKET
FLANGE N BRACKET
FWD
NUT
VIEW D
L-A9057 (0000)
PW V

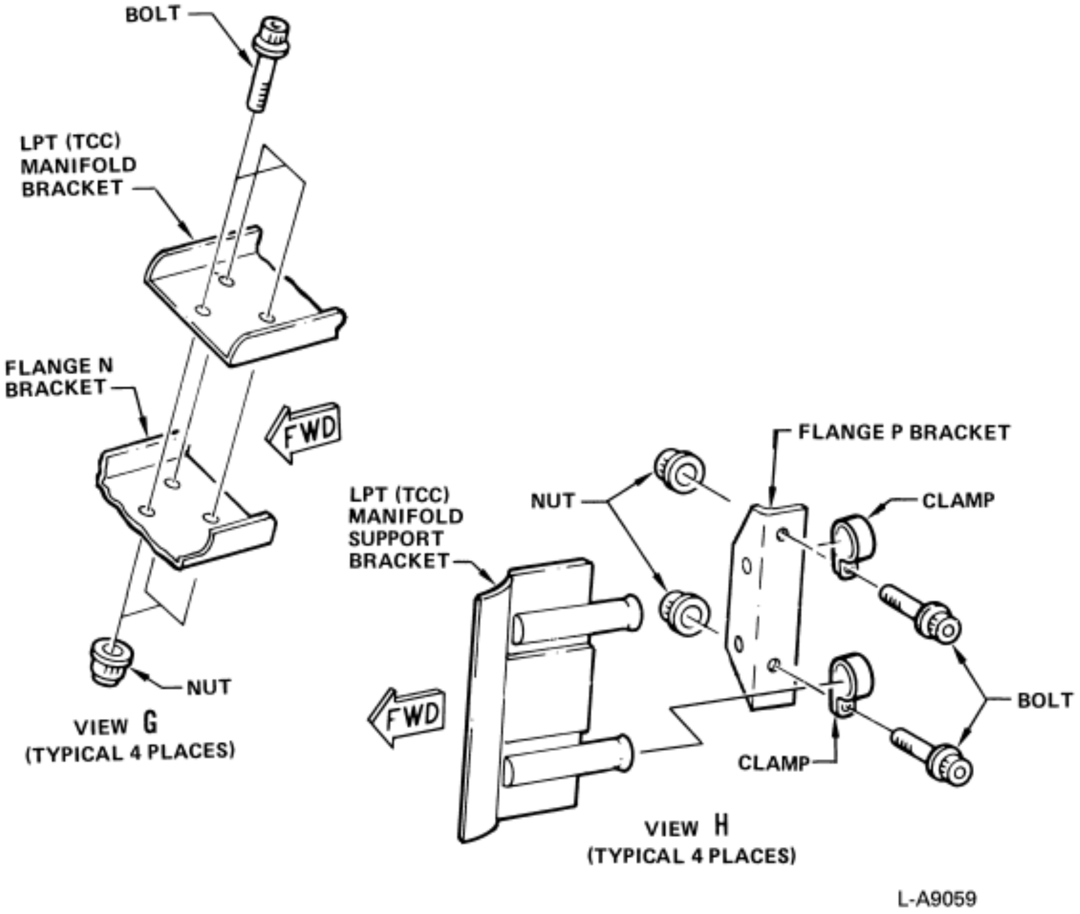
Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 403 (Sheet 2)
(Task 72-00-53-450-003)


NUT
FLANGE N BRACKET
LPT(TCC) MANIFOLD SUPPORT BRACKET
FWD
BOLT (3 NECESSARY)
VIEW E
FLANGE P BRACKET
NUT
LPT(TCC) MANIFOLD SUPPORT BRACKET
CLAMP
BOLT
CLAMP
BOLT
VIEW F
(TYPICAL 2 PLACES)
FWD
L-A9058

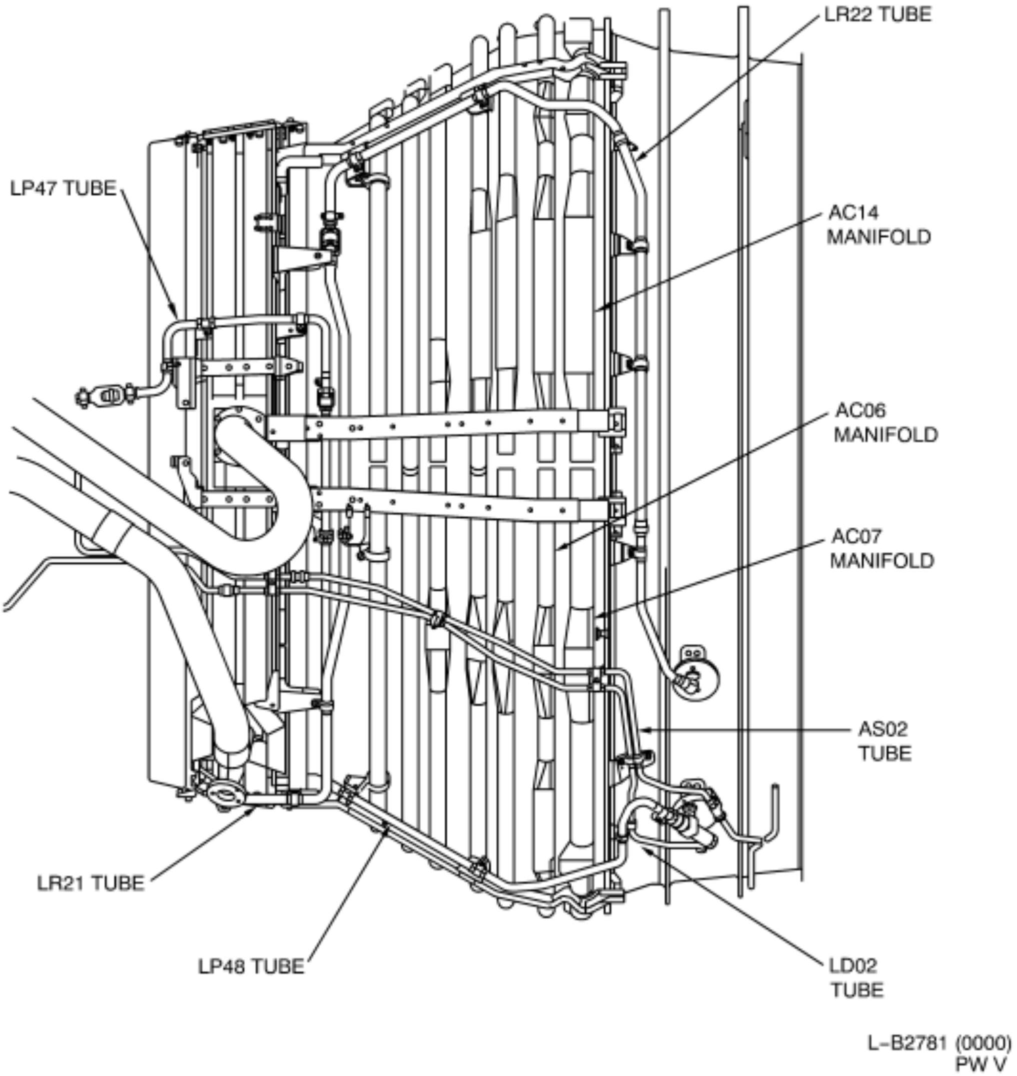
Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 403 (Sheet 3)
(Task 72-00-53-450-003)


FLANGE P
FLANGE N
FLANGE M
G
H
LPT CASE COOLING AIR MANIFOLDS (TCC)
FWD
L−A9188 (0000)
PW V

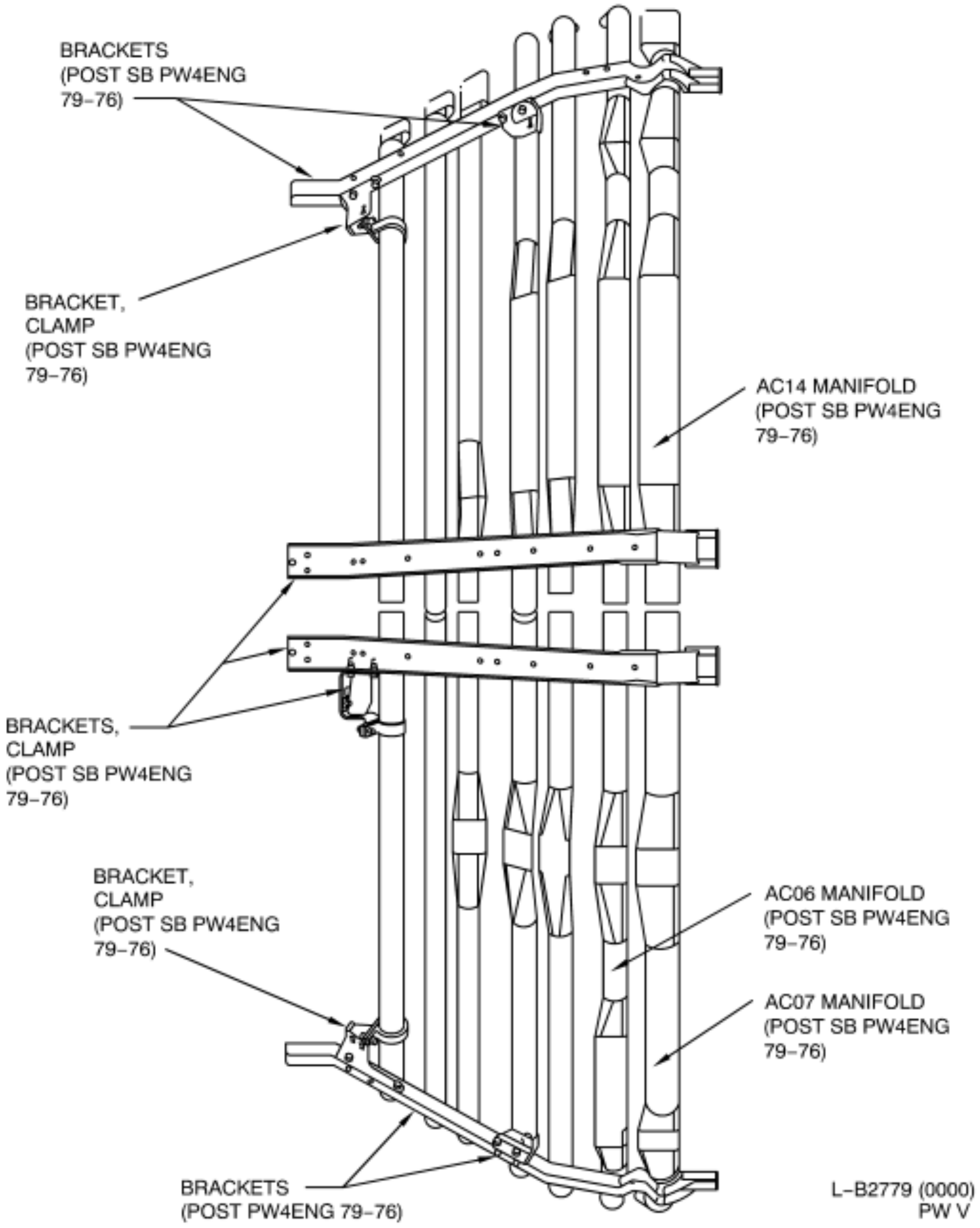
Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 403 (Sheet 4)
(Task 72−00−53−450−003)


BOLT
LPT (TCC) MANIFOLD BRACKET
FLANGE N BRACKET
FWD
NUT
VIEW G
(TYPICAL 4 PLACES)
LPT (TCC) MANIFOLD SUPPORT BRACKET
NUT
FLANGE P BRACKET
CLAMP
BOLT
CLAMP
FWD
VIEW H
(TYPICAL 4 PLACES)
L-A9059

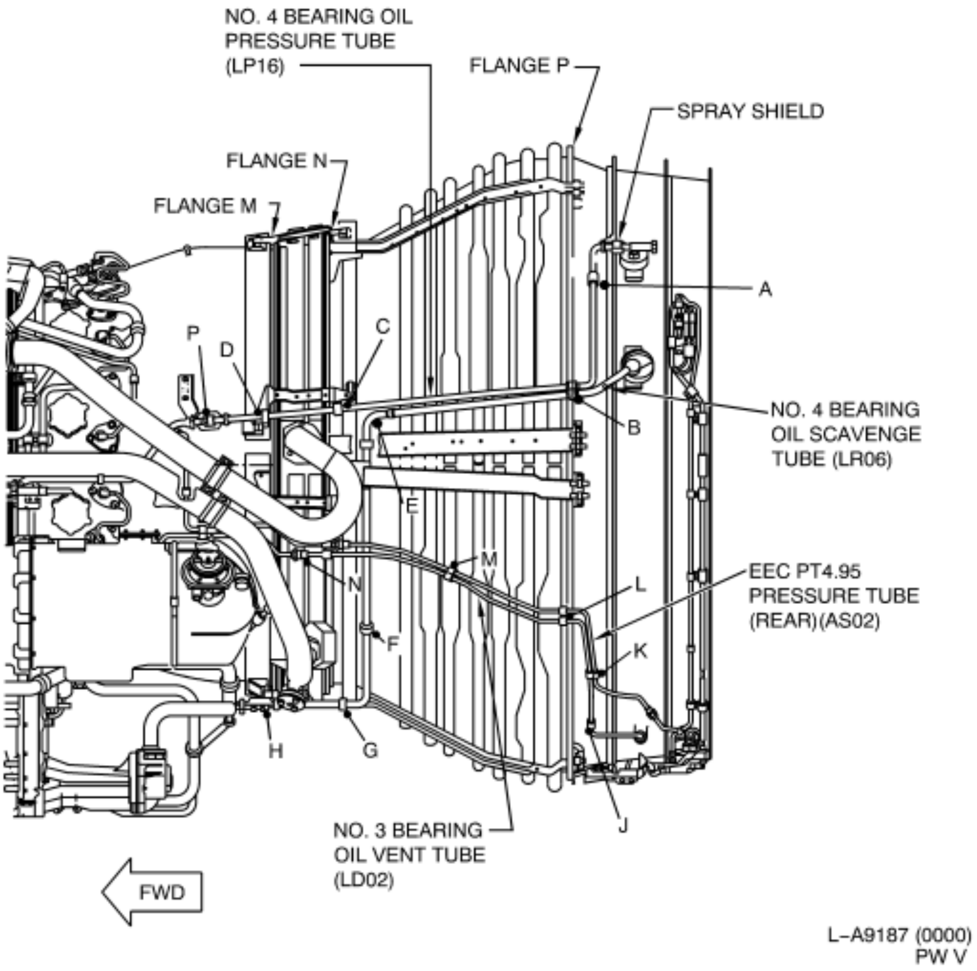
Turbine Case Cooling (TCC) LPT Manifolds Clipping
Figure 403 (Sheet 5)
(Task 72−00−53−450−003)


LR22 TUBE
LP47 TUBE
AC14 MANIFOLD
AC06 MANIFOLD
AC07 MANIFOLD
AS02 TUBE
LR21 TUBE
LP48 TUBE
LD02 TUBE
L-B2781 (0000)
PW V

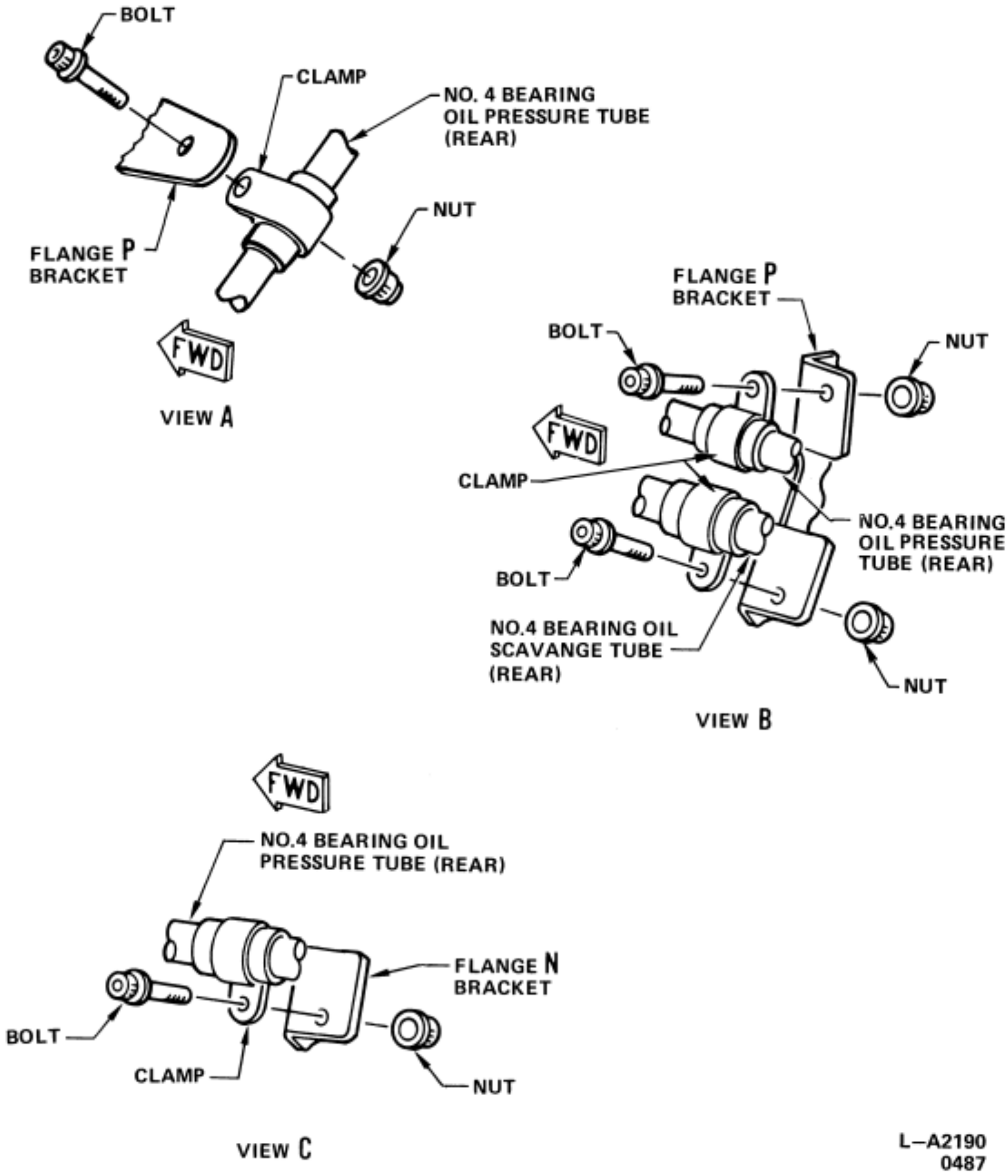
LPT Turbine Case Cooling Manifolds Clipping (Post SB PW4ENG 79-76)
Figure 403 (Sheet 6)
(Task 72-00-53-450-003)


BRACKETS
(POST SB PW4ENG
79-76)
BRACKET,
CLAMP
(POST SB PW4ENG
79-76)
AC14 MANIFOLD
(POST SB PW4ENG
79-76)
BRACKETS,
CLAMP
(POST SB PW4ENG
79-76)
BRACKET,
CLAMP
(POST SB PW4ENG
79-76)
AC06 MANIFOLD
(POST SB PW4ENG
79-76)
AC07 MANIFOLD
(POST SB PW4ENG
79-76)
BRACKETS
(POST PW4ENG 79-76)
L-B2779 (0000)
PW V

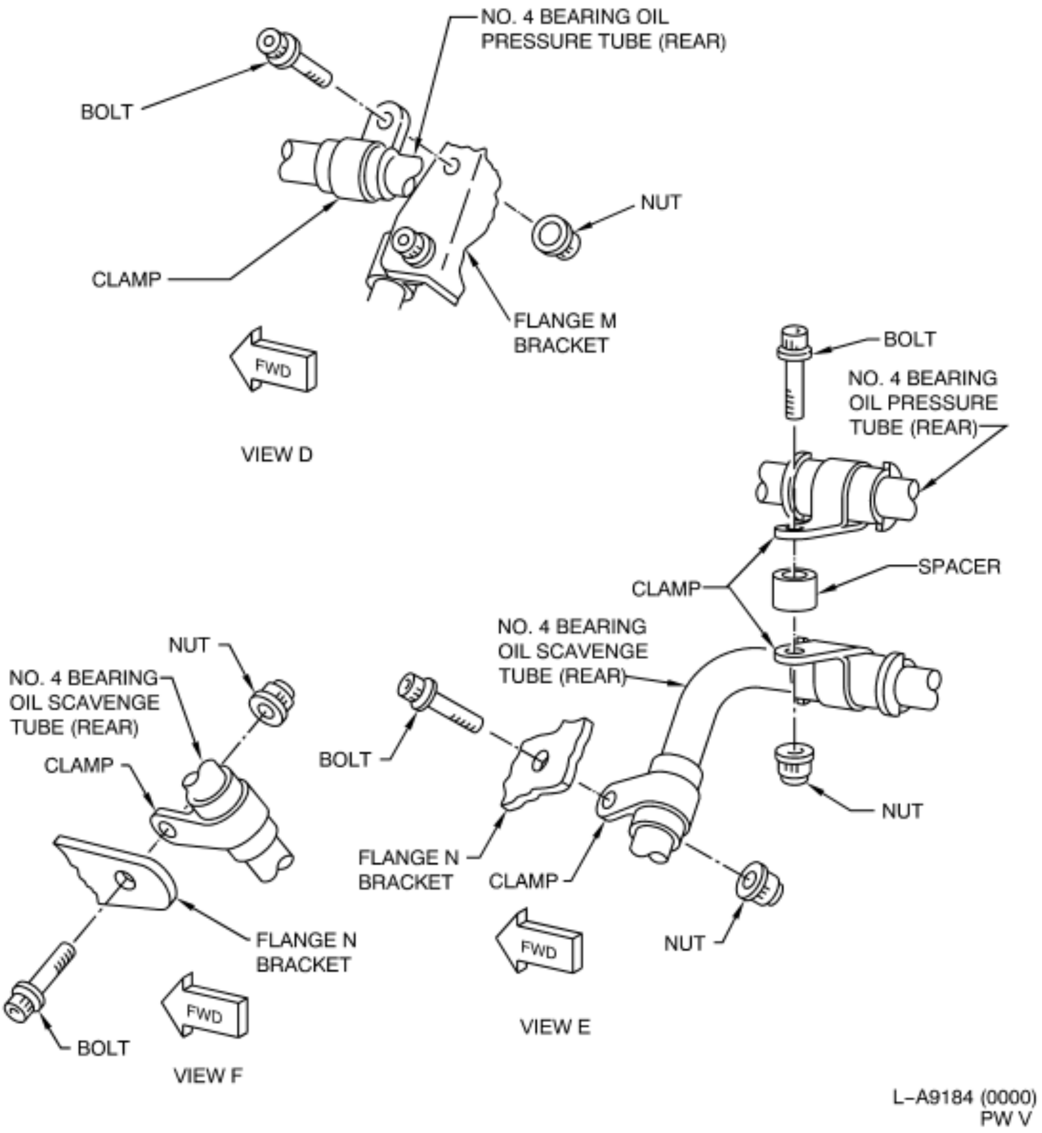
LPT Turbine Case Cooling Manifolds Clipping (Post SB PW4ENG 79-76)
Figure 403 (Sheet 7)
(Task 72-00-53-450-003)


NO. 4 BEARING OIL
PRESSURE TUBE
(LP16)
FLANGE P
SPRAY SHIELD
FLANGE N
FLANGE M
A
P
D
C
NO. 4 BEARING
OIL SCAVENGE
TUBE (LR06)
B
E
M
EEC PT4.95
PRESSURE TUBE
(REAR)(AS02)
L
N
F
K
H
G
J
NO. 3 BEARING
OIL VENT TUBE
(LD02)
FWD
L-A9187 (0000)
PW V

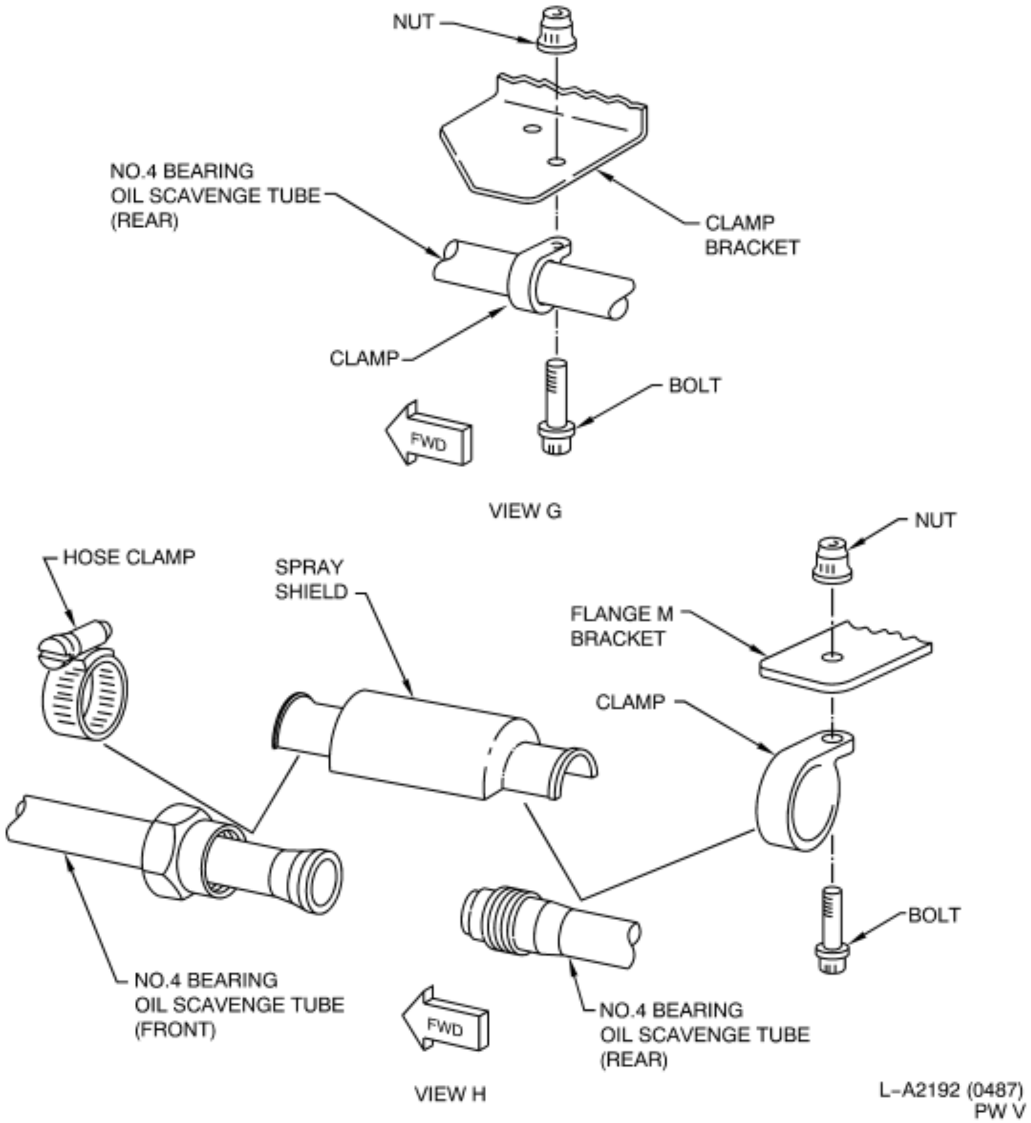
External Plumbing Clipping Views
Figure 404 (Sheet 1)
(Task 72-00-53-450-003)


BOLT
CLAMP
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
NUT
FLANGE P BRACKET
FWD
VIEW A
FLANGE P BRACKET
BOLT
NUT
FWD
CLAMP
NO.4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NO.4 BEARING OIL SCAVANGE TUBE (REAR)
NUT
VIEW B
FWD
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE N BRACKET
BOLT
CLAMP
NUT
VIEW C
L−A2190
0487

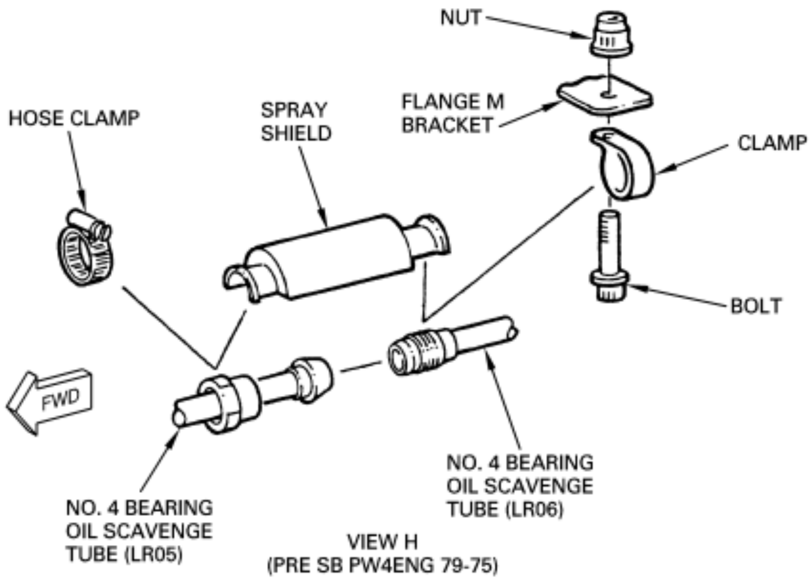
External Plumbing Clipping Views
Figure 404 (Sheet 2)
(Task 72−00−53−450−003)


NO. 4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NUT
CLAMP
FLANGE M BRACKET
FWD
VIEW D
BOLT
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
SPACER
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
NUT
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP
BOLT
NUT
FLANGE N BRACKET
CLAMP
NUT
FWD
VIEW E
FLANGE N BRACKET
BOLT
FWD
VIEW F
L−A9184 (0000)
PW V

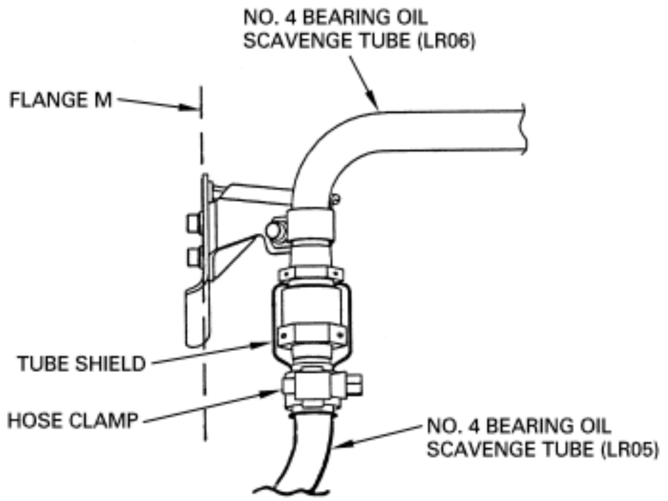
External Plumbing Clipping Views
Figure 404 (Sheet 3)
(Task 72−00−53−450−003)


NUT
NO.4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP BRACKET
CLAMP
BOLT
FWD
VIEW G
HOSE CLAMP
SPRAY SHIELD
NUT
FLANGE M BRACKET
CLAMP
BOLT
NO.4 BEARING OIL SCAVENGE TUBE (FRONT)
FWD
NO.4 BEARING OIL SCAVENGE TUBE (REAR)
VIEW H
L−A2192 (0487)
PW V

External Plumbing Clipping Views
Figure 404 (Sheet 4)
(Task 72−00−53−450−003)


NUT
FLANGE M BRACKET
HOSE CLAMP
SPRAY SHIELD
CLAMP
BOLT
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)

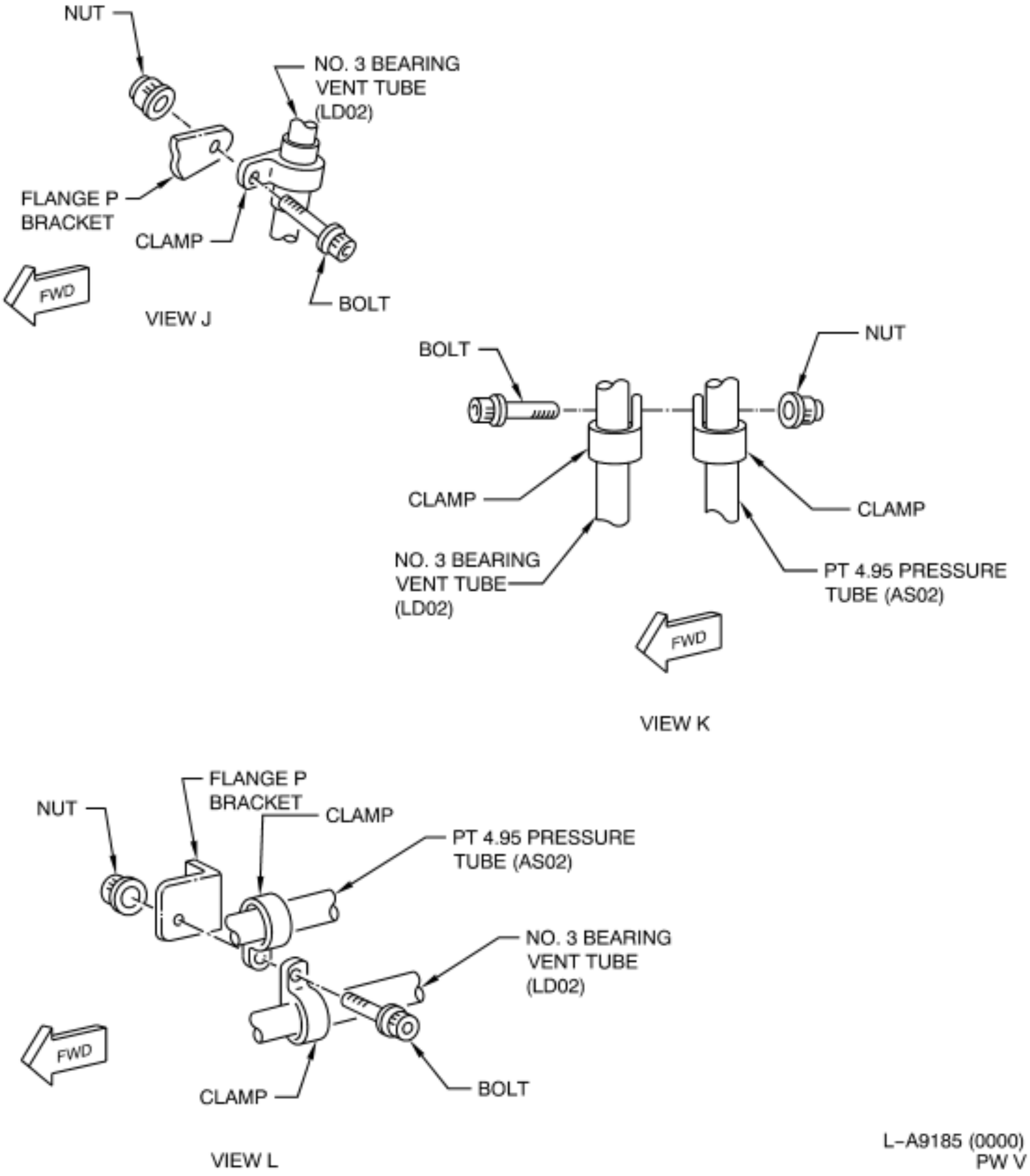
VIEW H
(PRE SB PW4ENG 79-75)


NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
FLANGE M
TUBE SHIELD
HOSE CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)

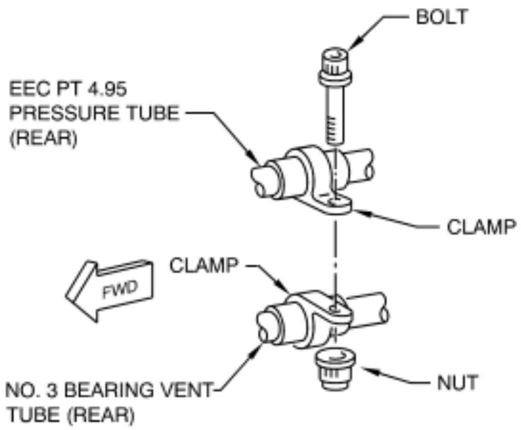
VIEW H
(POST SB PW4ENG 79-75)

L-B2526 (0000)

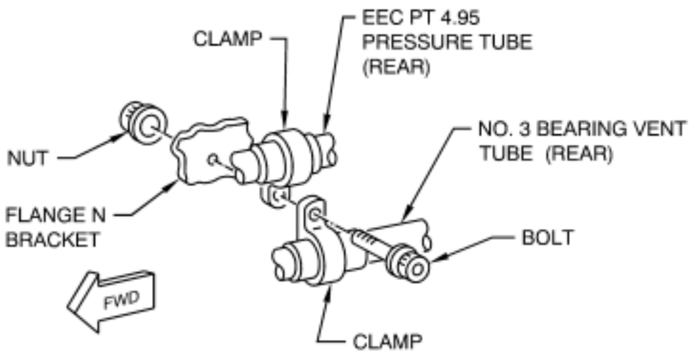
External Tubes For HPT (TCC) Clipping And Brackets
Figure 404 (Sheet 5)
(Task 72−00−53−450−003)


NUT
NO. 3 BEARING VENT TUBE (LD02)
FLANGE P BRACKET
CLAMP
BOLT
FWD
VIEW J
BOLT
NUT
CLAMP
CLAMP
NO. 3 BEARING VENT TUBE (LD02)
PT 4.95 PRESSURE TUBE (AS02)
FWD
VIEW K
FLANGE P BRACKET
NUT
CLAMP
PT 4.95 PRESSURE TUBE (AS02)
NO. 3 BEARING VENT TUBE (LD02)
FWD
CLAMP
BOLT
VIEW L
L-A9185 (0000)
PW V

External Plumbing Clipping Views
Figure 404 (Sheet 6)
(Task 72-00-53-450-003)


BOLT
EEC PT 4.95
PRESSURE TUBE
(REAR)
CLAMP
CLAMP
FWD
NUT
NO. 3 BEARING VENT
TUBE (REAR)

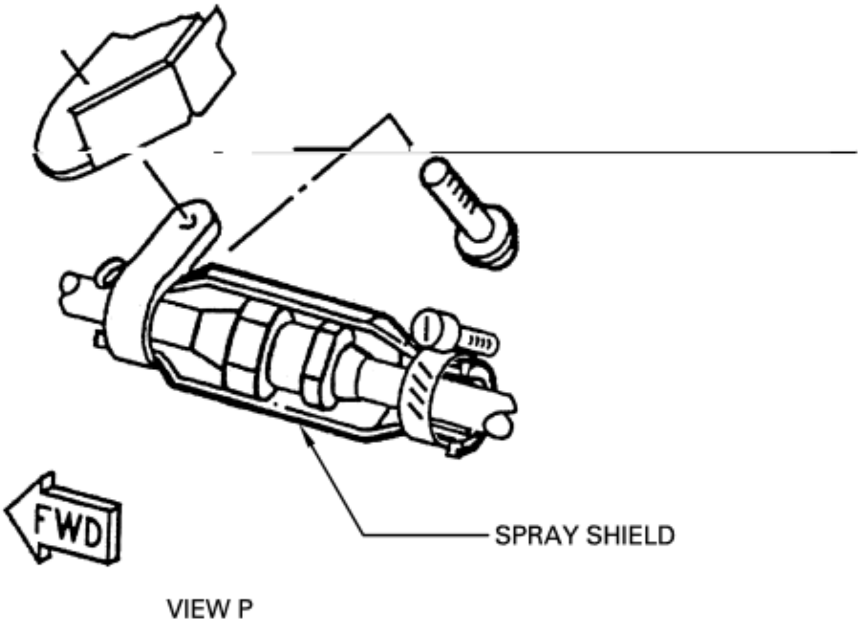
VIEW M


EEC PT 4.95
PRESSURE TUBE
(REAR)
CLAMP
NUT
NO. 3 BEARING VENT
TUBE (REAR)
FLANGE N
BRACKET
BOLT
FWD
CLAMP

VIEW N

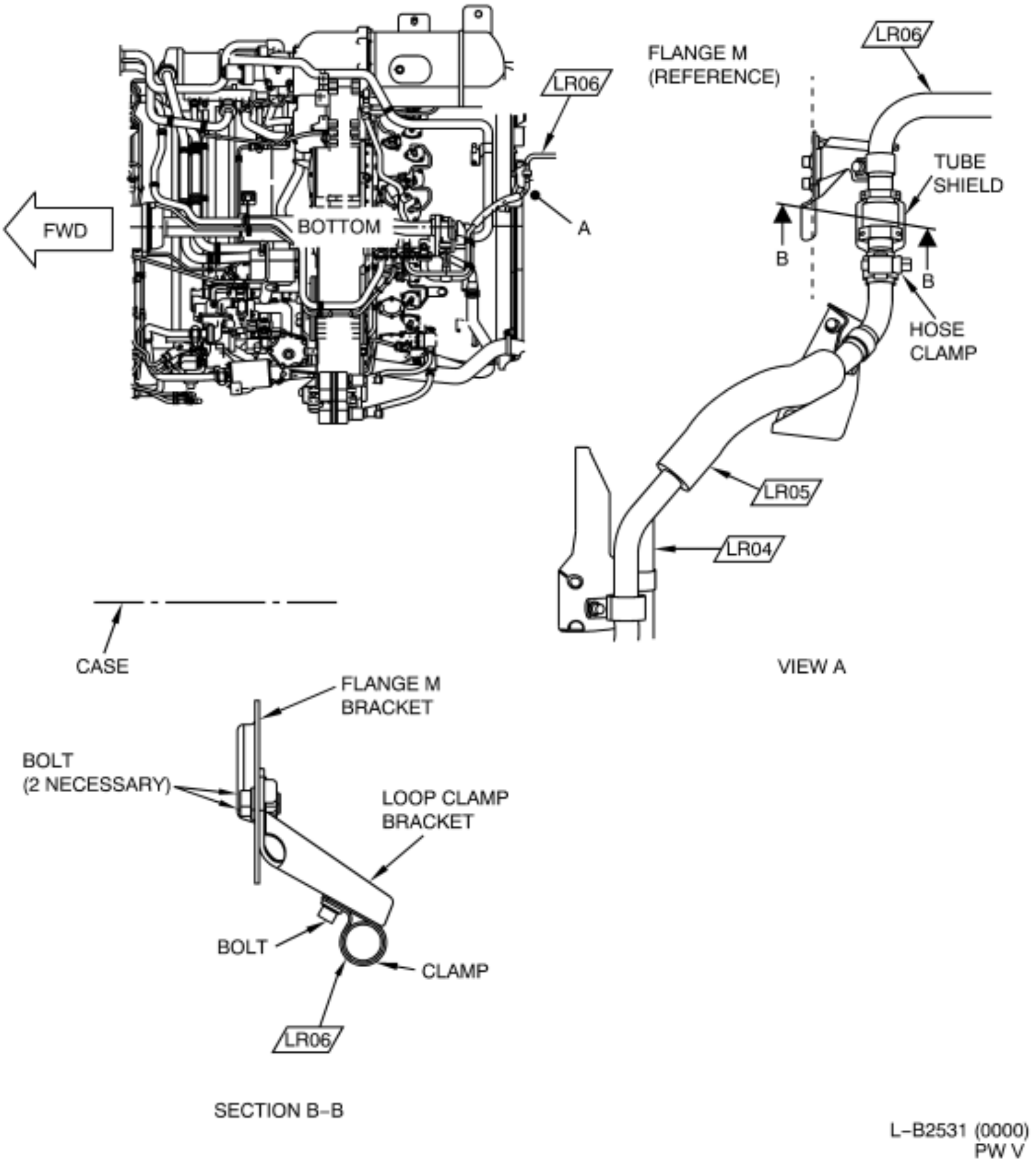
L−A2194 (0487)
PW V

External Plumbing Clipping Views
Figure 404 (Sheet 7)
(Task 72−00−53−450−003)

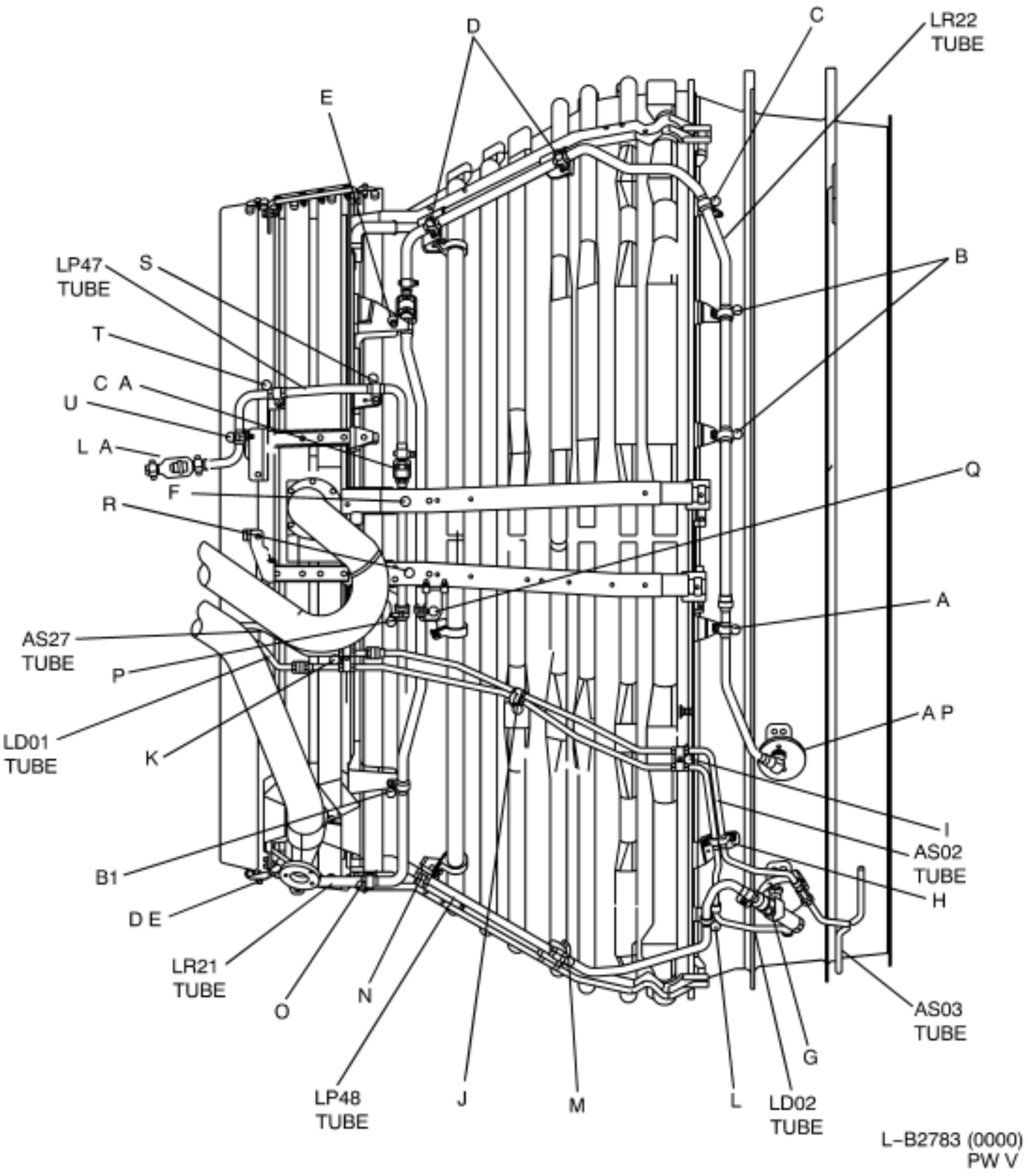


L-A9183

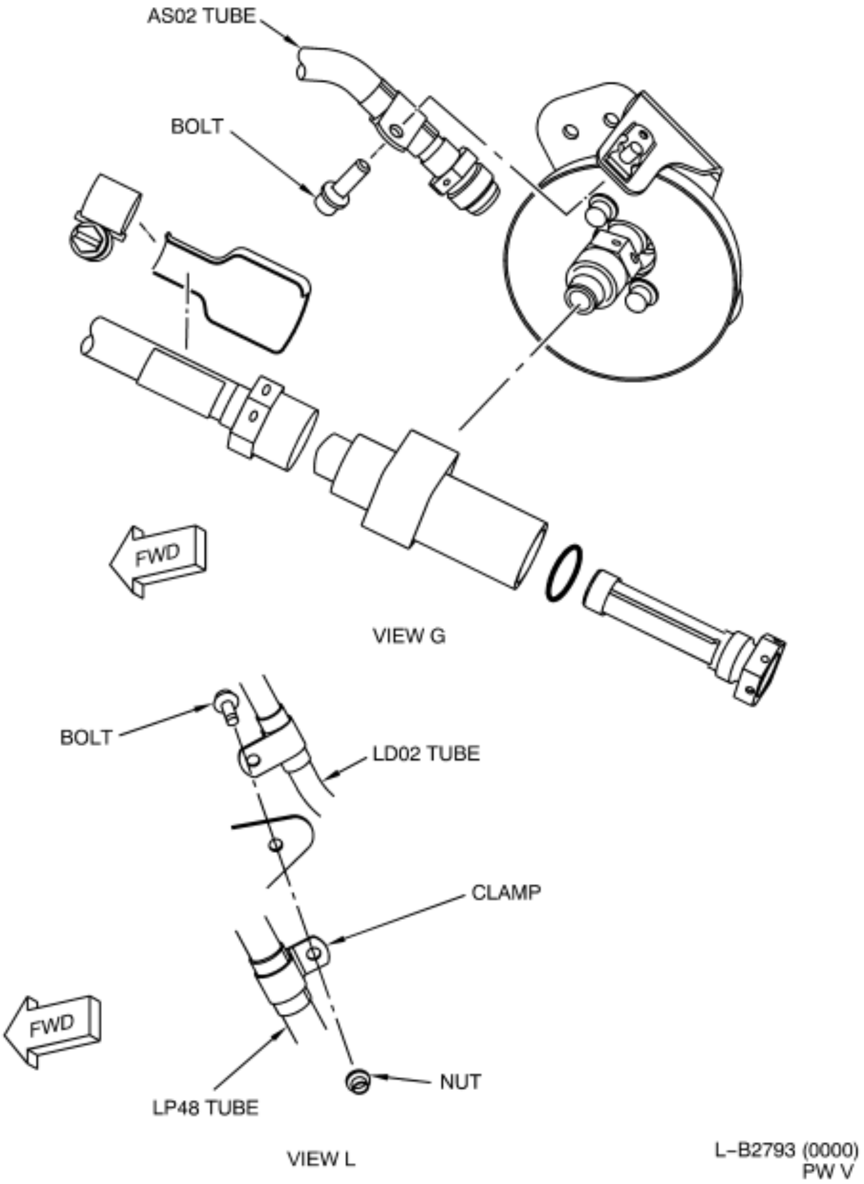
External Plumbing Clipping Views
Figure 404 (Sheet 8)
(Task 72−00−53−450−003)


FWD
BOTTOM
LR06
A
FLANGE M
(REFERENCE)
LR06
TUBE
SHIELD
B
B
HOSE
CLAMP
LR05
LR04
CASE
VIEW A
FLANGE M
BRACKET
BOLT
(2 NECESSARY)
LOOP CLAMP
BRACKET
BOLT
CLAMP
LR06
SECTION B-B
L-B2531 (0000)
PW V

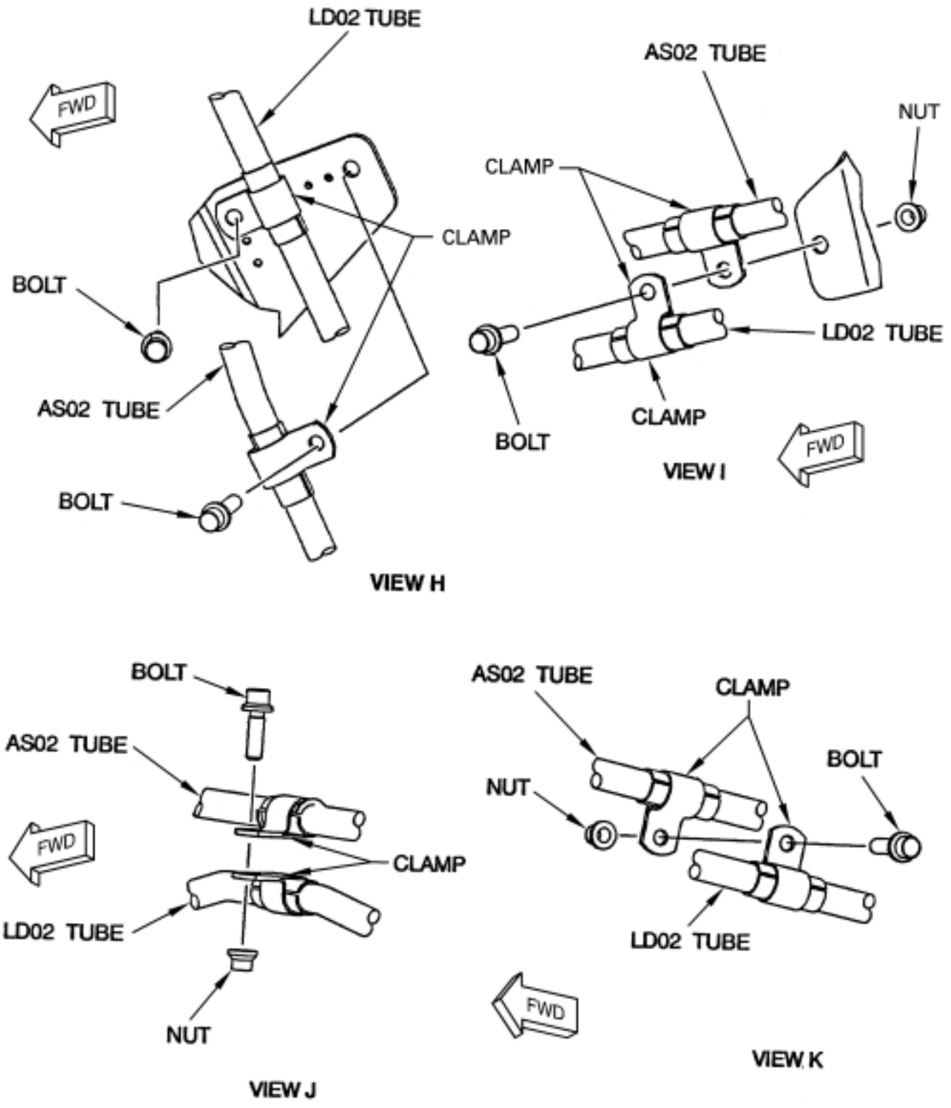
External Tubes For HPT (TCC) Clipping
And Brackets (Post SB PW4ENG 79-75)
Figure 404 (Sheet 9)
(Task 72-00-53-450-003)


D
C
LR22 TUBE
E
LP47 TUBE
S
B
T
C A
U
L A
F
Q
R
A
AS27 TUBE
P
A P
LD01 TUBE
K
I
AS02 TUBE
B1
H
D E
LR21 TUBE
O
N
AS03 TUBE
G
LP48 TUBE
J
M
L
LD02 TUBE
L-B2783 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 1)
(Task 72-00-53-450-003)

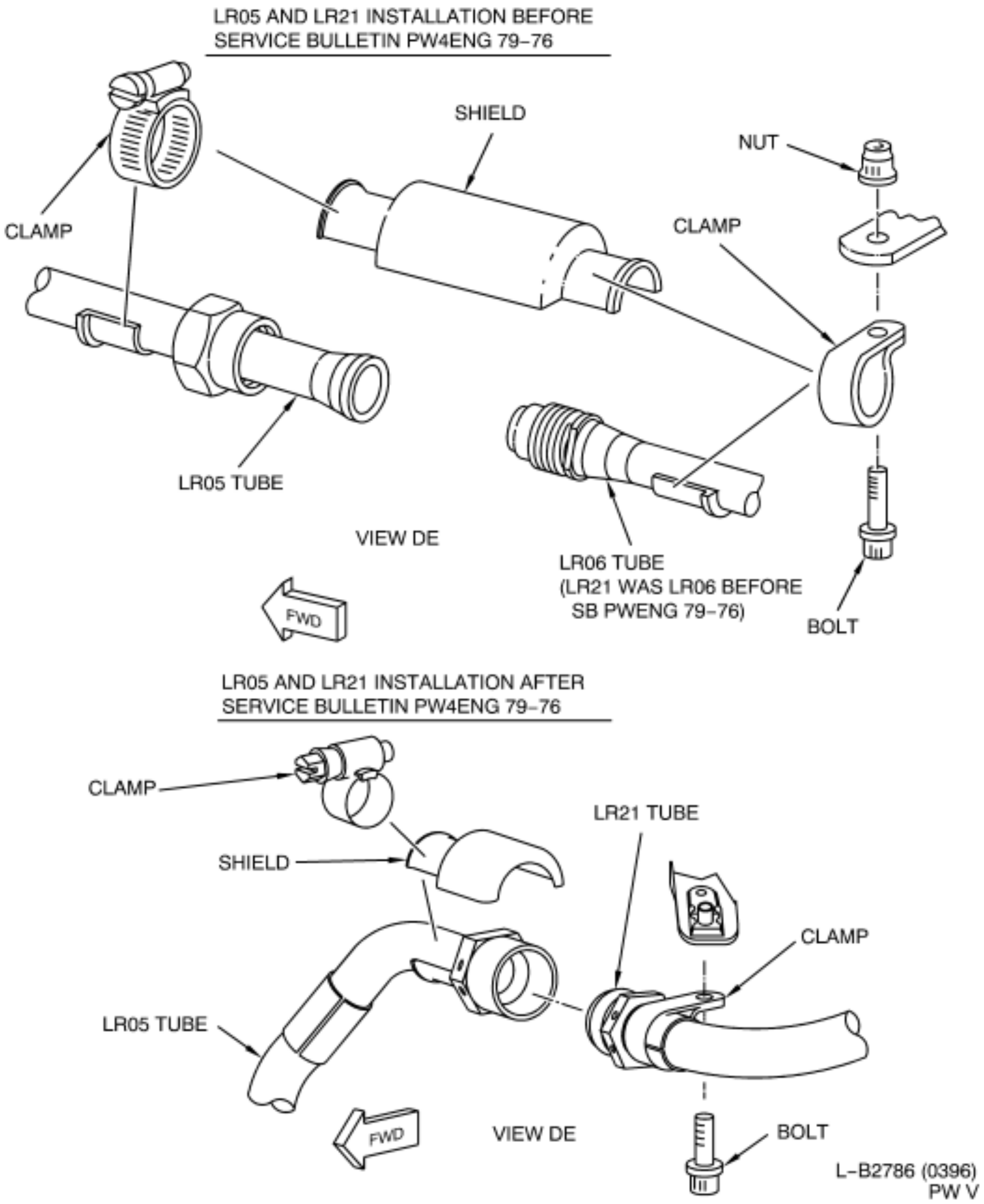

AS02 TUBE
BOLT
FWD
VIEW G
BOLT
LD02 TUBE
CLAMP
FWD
NUT
LP48 TUBE
VIEW L
L-B2793 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 2)
(Task 72-00-53-450-003)

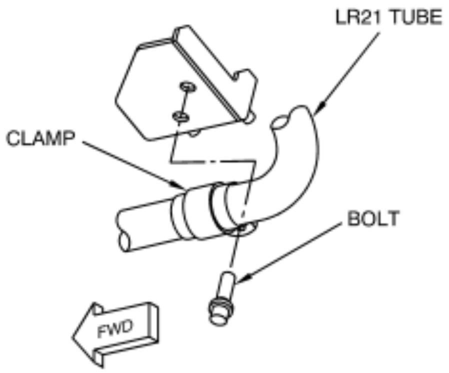

LD02 TUBE
FWD
CLAMP
BOLT
AS02 TUBE
BOLT
VIEW H
AS02 TUBE
NUT
CLAMP
LD02 TUBE
BOLT
CLAMP
FWD
VIEW I
BOLT
AS02 TUBE
FWD
CLAMP
LD02 TUBE
NUT
VIEW J
AS02 TUBE
CLAMP
NUT
BOLT
LD02 TUBE
FWD
VIEW K

L-B2794 (0000)

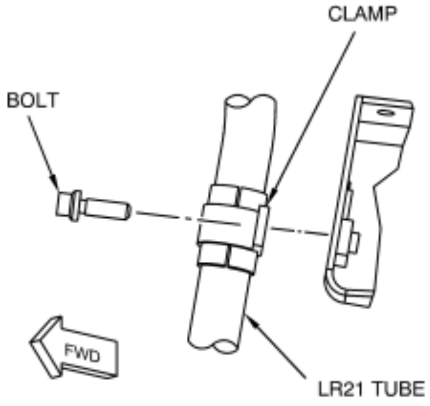
External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 3)
(Task 72-00-53-450-003)


LR05 AND LR21 INSTALLATION BEFORE SERVICE BULLETIN PW4ENG 79-76
SHIELD
NUT
CLAMP
CLAMP
LR05 TUBE
VIEW DE
LR06 TUBE (LR21 WAS LR06 BEFORE SB PWENG 79-76)
BOLT
FWD
LR05 AND LR21 INSTALLATION AFTER SERVICE BULLETIN PW4ENG 79-76
CLAMP
LR21 TUBE
SHIELD
CLAMP
LR05 TUBE
FWD
VIEW DE
BOLT
L-B2786 (0396)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 4)
(Task 72-00-53-450-003)


LR21 TUBE
CLAMP
BOLT
FWD

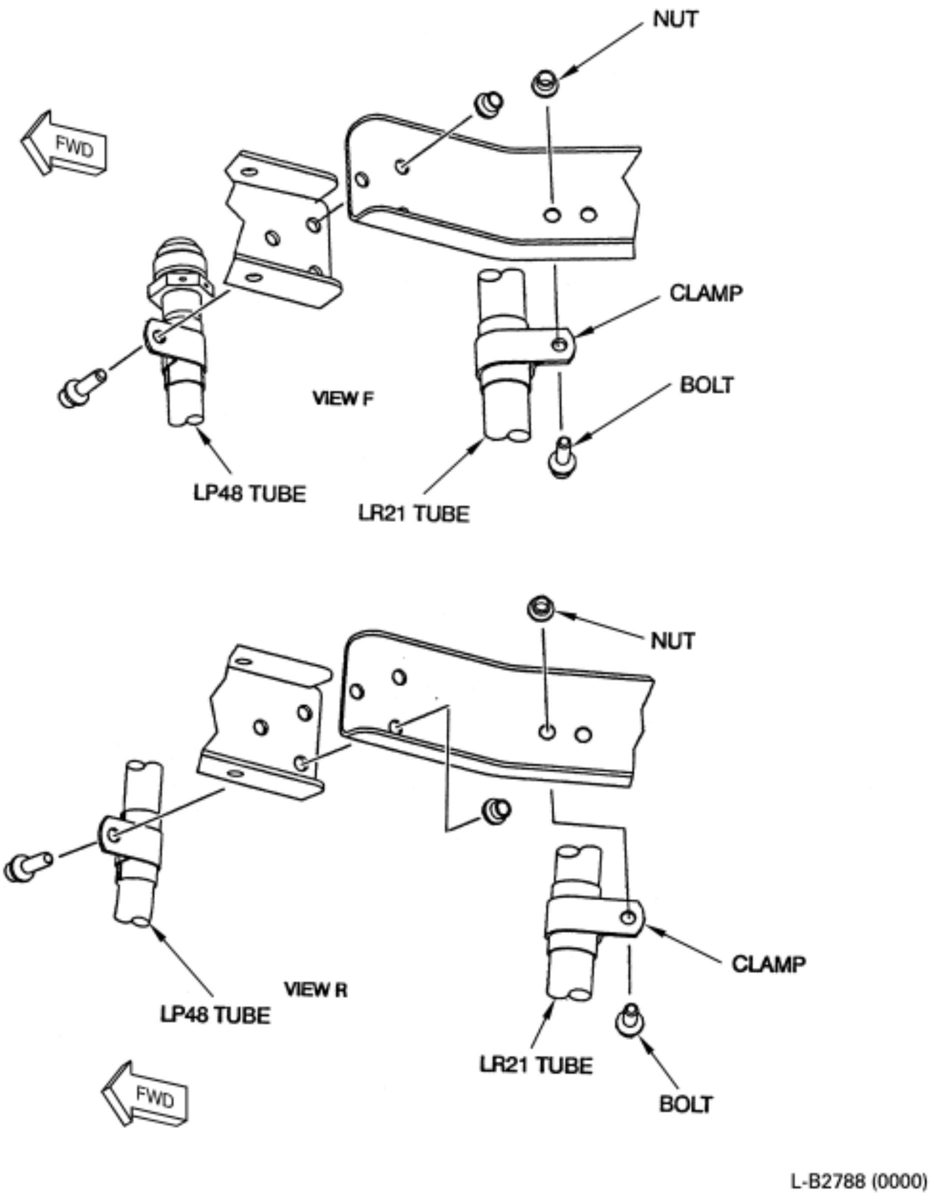
VIEW O


CLAMP
BOLT
FWD
LR21 TUBE

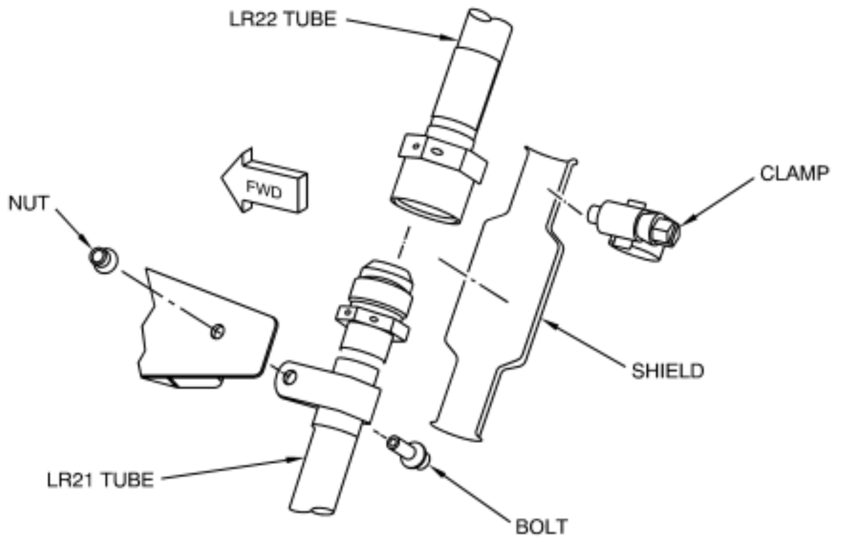
VIEW Q

L-B2787 (0000)
PW V

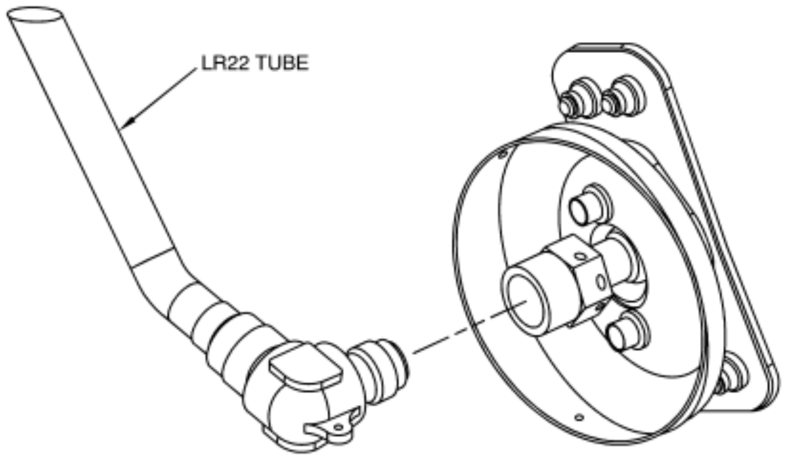
External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 5)
(Task 72-00-53-450-003)


NUT
FWD
CLAMP
BOLT
VIEW F
LP48 TUBE
LR21 TUBE
NUT
VIEW R
LP48 TUBE
CLAMP
LR21 TUBE
BOLT
FWD
L-B2788 (0000)

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 6)
(Task 72-00-53-450-003)


LR22 TUBE
CLAMP
FWD
NUT
SHIELD
LR21 TUBE
BOLT

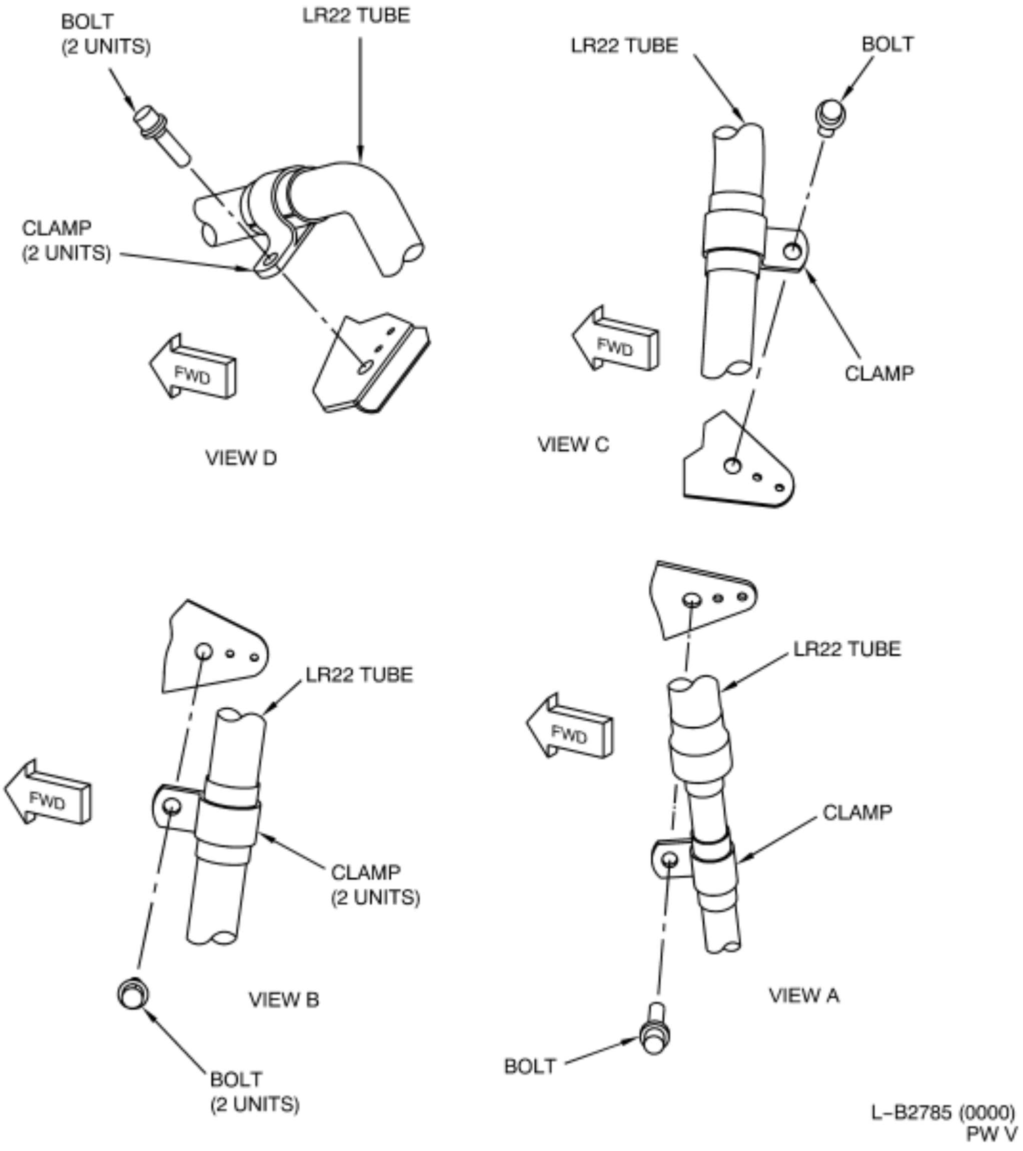
VIEW E


LR22 TUBE

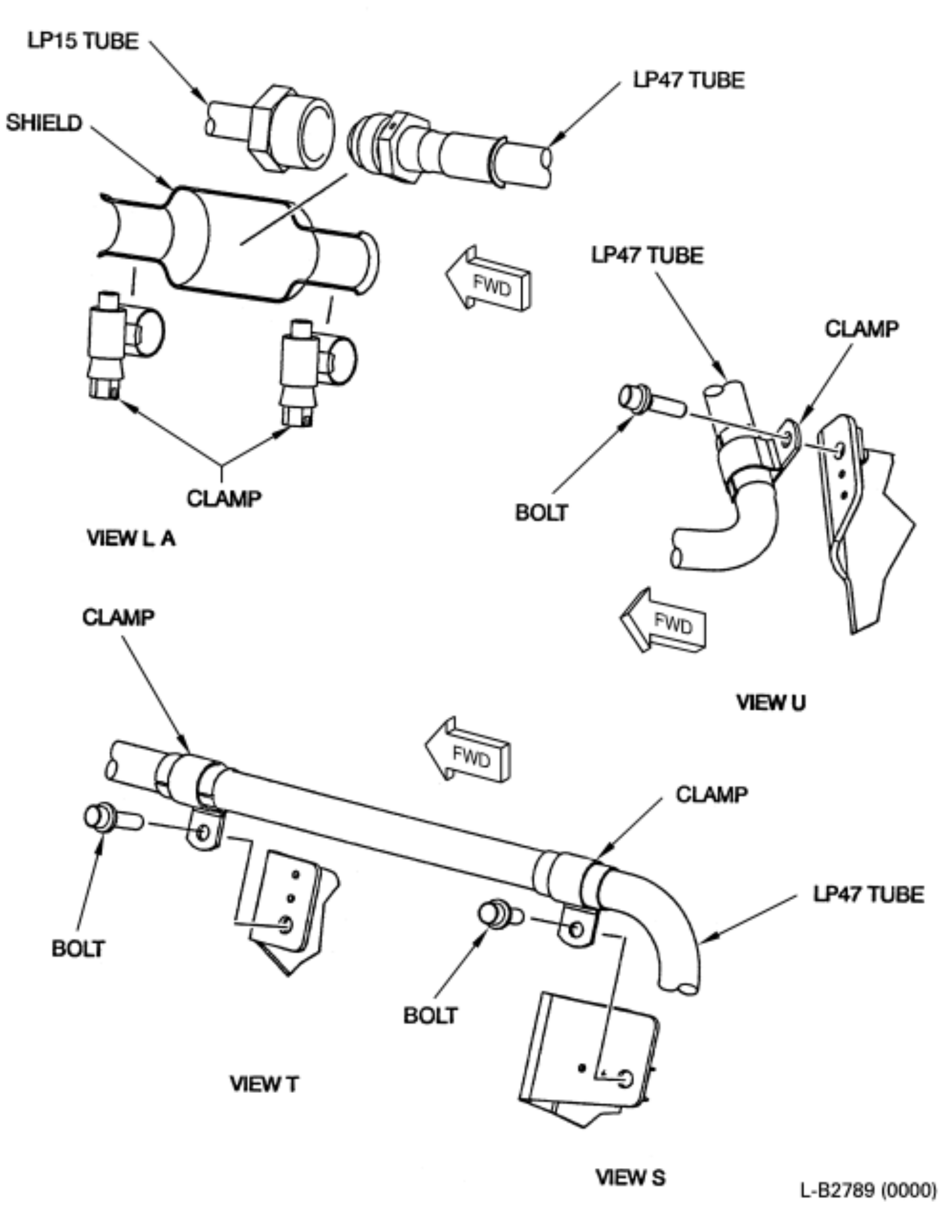
VIEW A P

L-B2784 (0000)
PW V

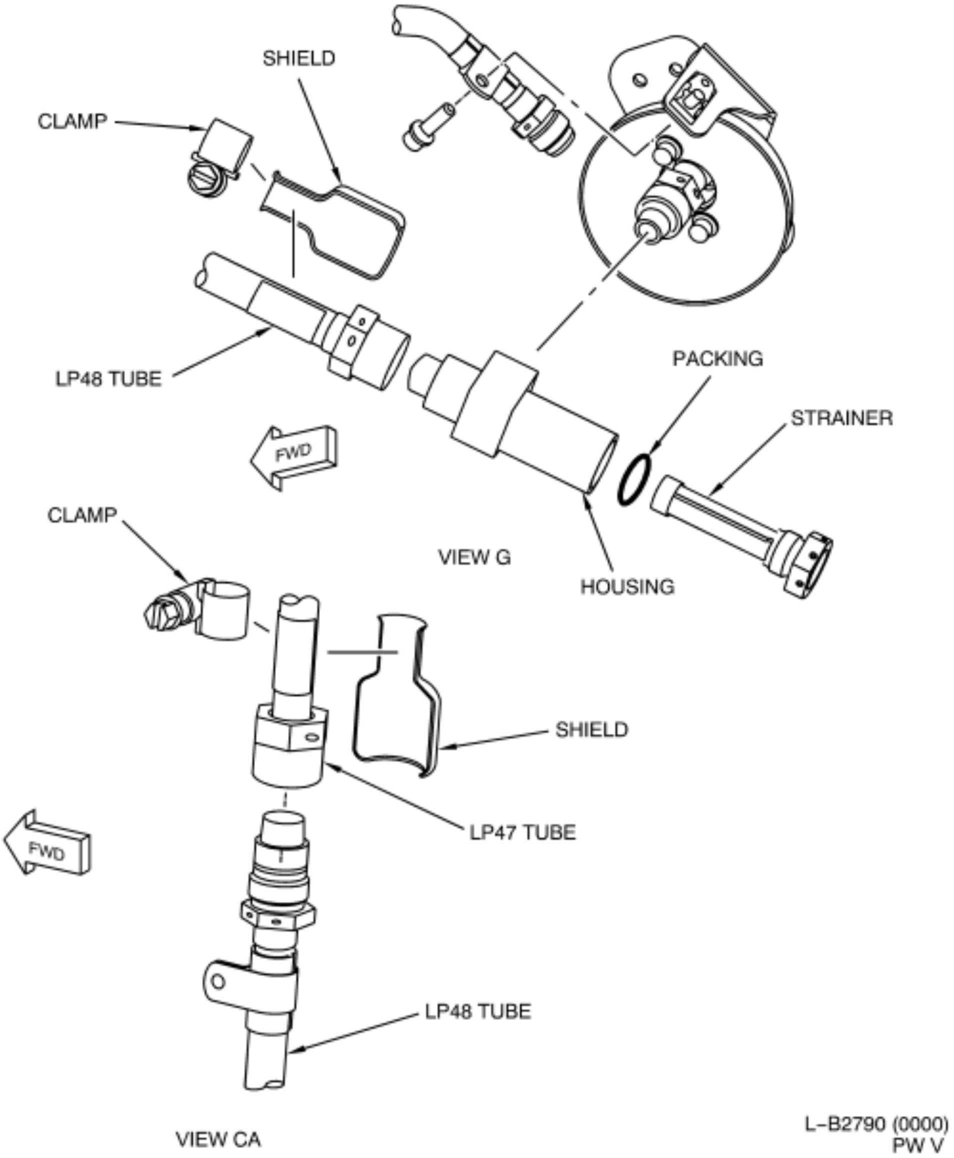
External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 7)
(Task 72-00-53-450-003)


BOLT
(2 UNITS)
LR22 TUBE
CLAMP
(2 UNITS)
FWD
VIEW D
LR22 TUBE
BOLT
FWD
CLAMP
VIEW C
LR22 TUBE
FWD
CLAMP
(2 UNITS)
VIEW B
BOLT
(2 UNITS)
LR22 TUBE
FWD
CLAMP
VIEW A
BOLT
L-B2785 (0000)
PW V

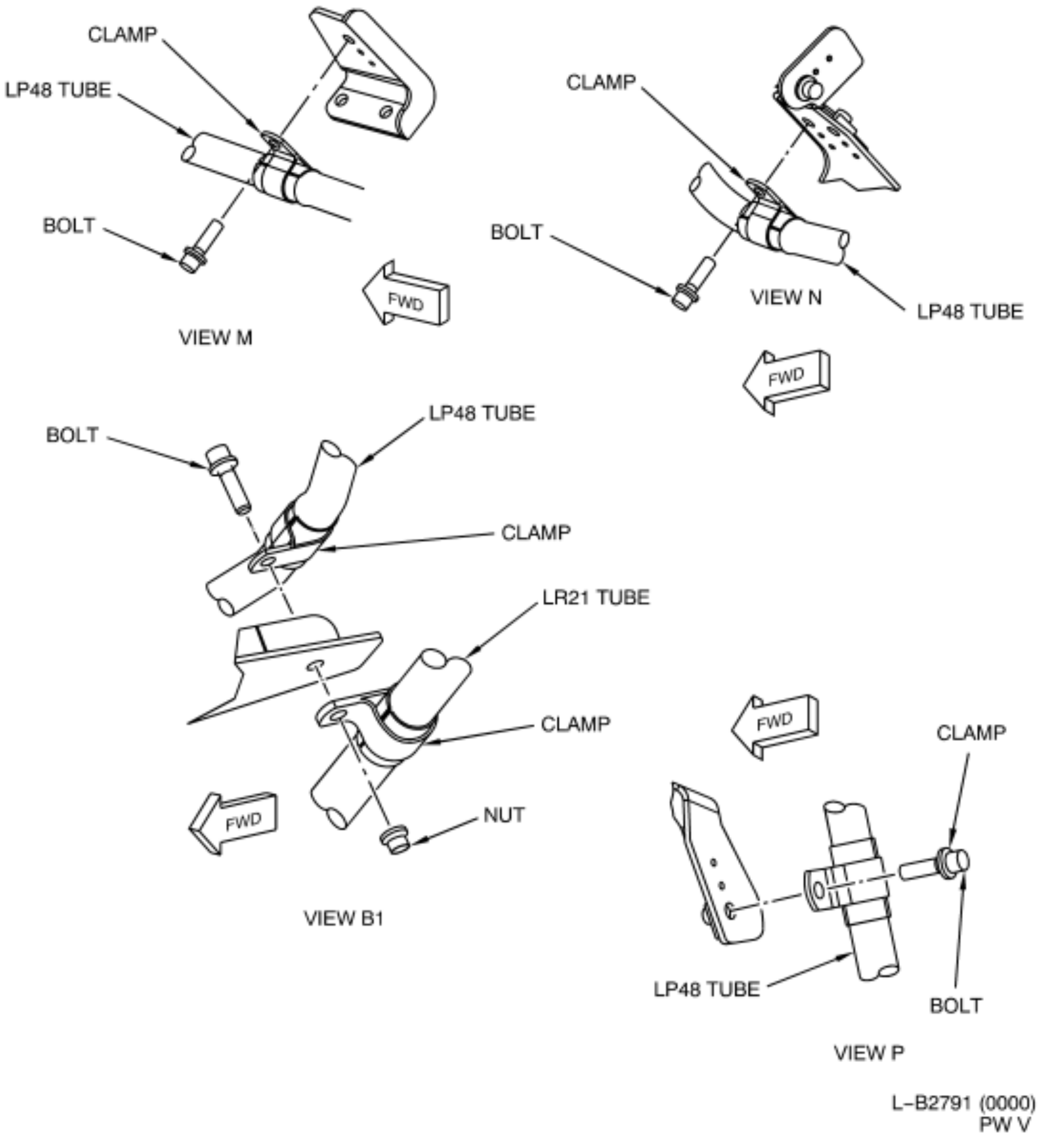
External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 8)
(Task 72-00-53-450-003)


LP15 TUBE
LP47 TUBE
SHIELD
FWD
LP47 TUBE
CLAMP
CLAMP
BOLT
VIEW L A
CLAMP
FWD
VIEW U
FWD
CLAMP
LP47 TUBE
BOLT
BOLT
VIEW T
VIEW S
L-B2789 (0000)

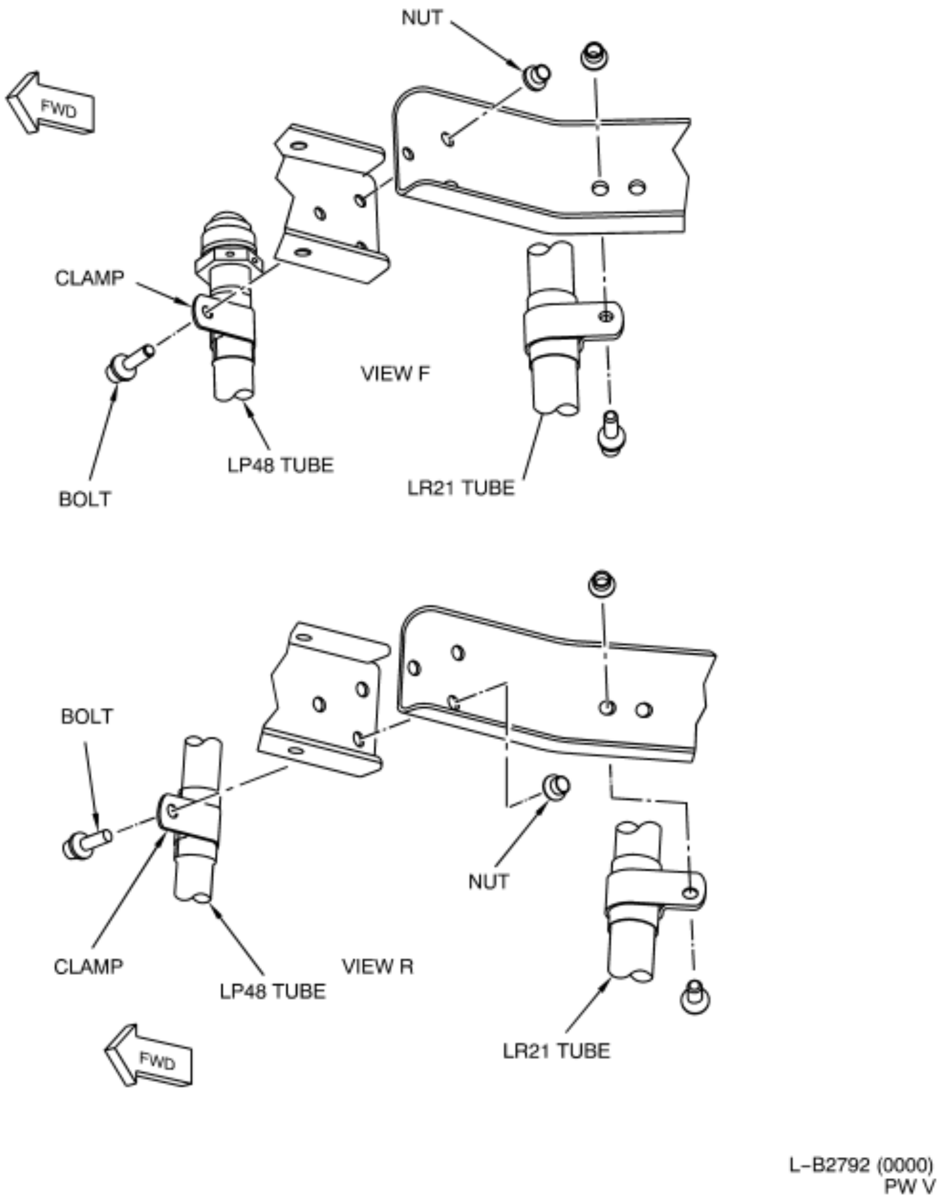
External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 9)
(Task 72-00-53-450-003)


SHIELD
CLAMP
LP48 TUBE
FWD
PACKING
STRAINER
CLAMP
VIEW G
HOUSING
SHIELD
LP47 TUBE
FWD
LP48 TUBE
VIEW CA
L−B2790 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 405 (Sheet 10)
(Task 72−00−53−450−003)


CLAMP
LP48 TUBE
BOLT
FWD
VIEW M
CLAMP
BOLT
VIEW N
LP48 TUBE
FWD
BOLT
LP48 TUBE
CLAMP
LR21 TUBE
CLAMP
NUT
FWD
VIEW B1
FWD
CLAMP
LP48 TUBE
BOLT
VIEW P
L-B2791 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 11)
(Task 72-00-53-450-003)


NUT
FWD
CLAMP
BOLT
LP48 TUBE
VIEW F
LR21 TUBE
BOLT
CLAMP
LP48 TUBE
VIEW R
NUT
LR21 TUBE
FWD
L-B2792 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 12)
(Task 72-00-53-450-003)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−06

Task 72−00−53−450−004:

1. Install Turbine Case Cooling (TCC) Air Valve Control Cable

A. Equipment And Materials Required

CONSUMABLE MATERIALS:

ITEM NO.	DESIGNATION
P03−001	Oil, Engine (PWA 521B)
P05−289	Lockwire (AS3214−02)

B. Procedure
See Figure 401.

(1) (For engines with Pre SB PW4ENG 75−117 control cable only) (Reference 2010) Hold the cable with a wrench and torque the seal nut (401/2) in the rear of the cable (401/5) to 150 − 200 lb−in. (16.948 − 22.597 N.m) to make sure the bushing (401/3) is seated. The bushing is seated when the resistance to the torque load increases substantially. The torque must not be more than 300 lb−in. (33.895 N.m). Loosen the nut one quarter to one half turn.

(2) (2) (Reference 2010) Move the turbine case cooling (TCC) air valve actuator (401/7) forward on the mount rails until the actuator touches the stop bracket on the forward end of the mount bracket.

NOTE: It is permitted for the actuator to be off the stop by up to 0.125 inch (3.175 mm).

(3) Lubricate the forward coupling nut (401/8) threads with Engine Oil P03−001. Engage the forward end of the cable with the actuator piston shaft and tighten the coupling nut handtight until the nut is seated then loosen the nut one quarter to one half turn.

(4) Turn the cable (401/5) until it engages in the U−shaped slot on the rear support bracket (401/4) and then handtighten the jamnuts (401/6).

NOTE: The jamnuts (401/6) on the cable (401/5) must be installed on each side of the U−shaped slot of the support bracket (401/4) with washers (401/1) between the jamnuts and the bracket.

(5) Check to make sure the actuator (401/7) stayed against the forward bracket stop and that the coupling nut (401/8) turns freely. If the coupling nut does not turn freely, do steps (2), (3), (4) and (5) again.

(6) While you keep the actuator (401/7) forward, make sure the rearward end of the cable stayed seated in the slot of the rear support bracket. Tighten the forward jamnut against the rear support bracket handtight only.

(7) Tighten the rear jamnut against the support bracket handtight only. While you hold the rear jamnut with a wrench, torque the forward jamnut to 675 - 750 lb-in. (76.265 - 84.739 N.m). Install the Lockwire P05-289 to the jamnuts.

(8) Check to make sure the actuator (401/7) stayed against the forward bracket stop and that the coupling nut (401/8) turns freely. If the coupling nut does not turn freely, do steps (2) through (7) again.

(9) Torque the coupling nut (401/8) to 100 - 125 lb-in. (11.298 - 14.123 N.m). Install the Lockwire P05-289 to the coupling nut.

(10) Attach the cable (401/5) to the adjustable brackets (401/11) with clamps (401/9), bolts (401/12), threads lubricated with Engine Oil P03-001, and nuts (401/10). Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

NOTE: Do not apply stress to the cable when you install the clamps. If necessary, remove the lockwire from the adjusters (401/13), loosen the jamnuts (401/14) and readjust the adjusters (401/13) to make sure of the correct clamp to bracket installation.

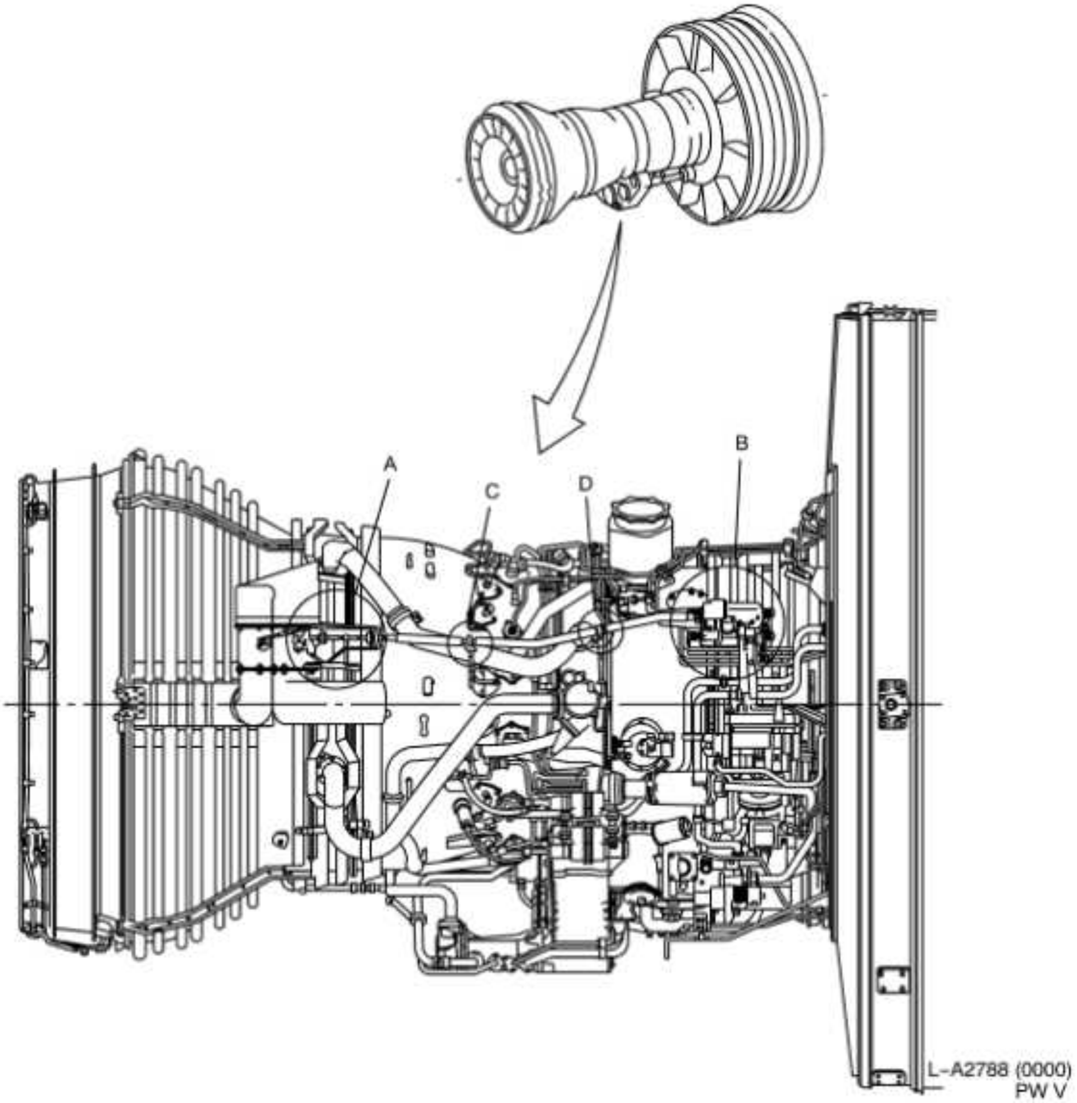
(11) If the adjusters (401/13) were adjusted, do the following.

(a) Torque the jamnuts (401/14), threads lubricated with Engine Oil P03-001, to 14 - 16 lb-in. (1.582 - 1.808 N.m). Install the Lockwire P05-289 to the jamnuts.

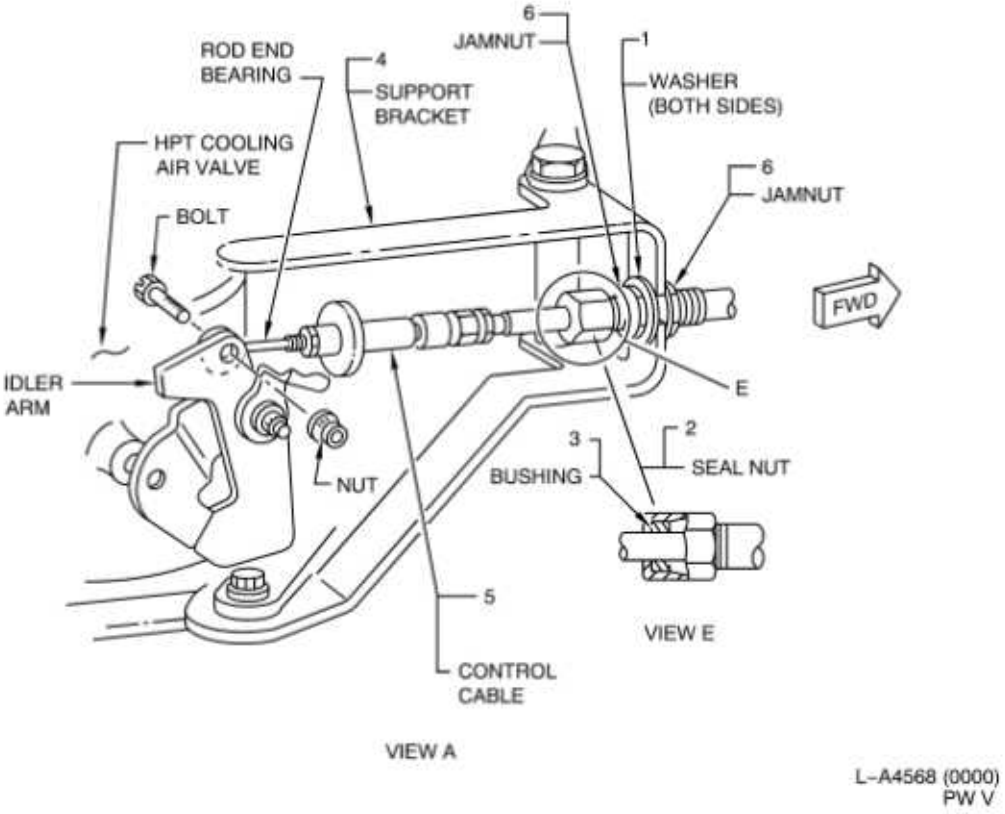
NOTE: The cable rod end bearing is installed as part of 72-00-00, Special Procedure-11 Task 72-00-00-830-005.

C. Postrequisites

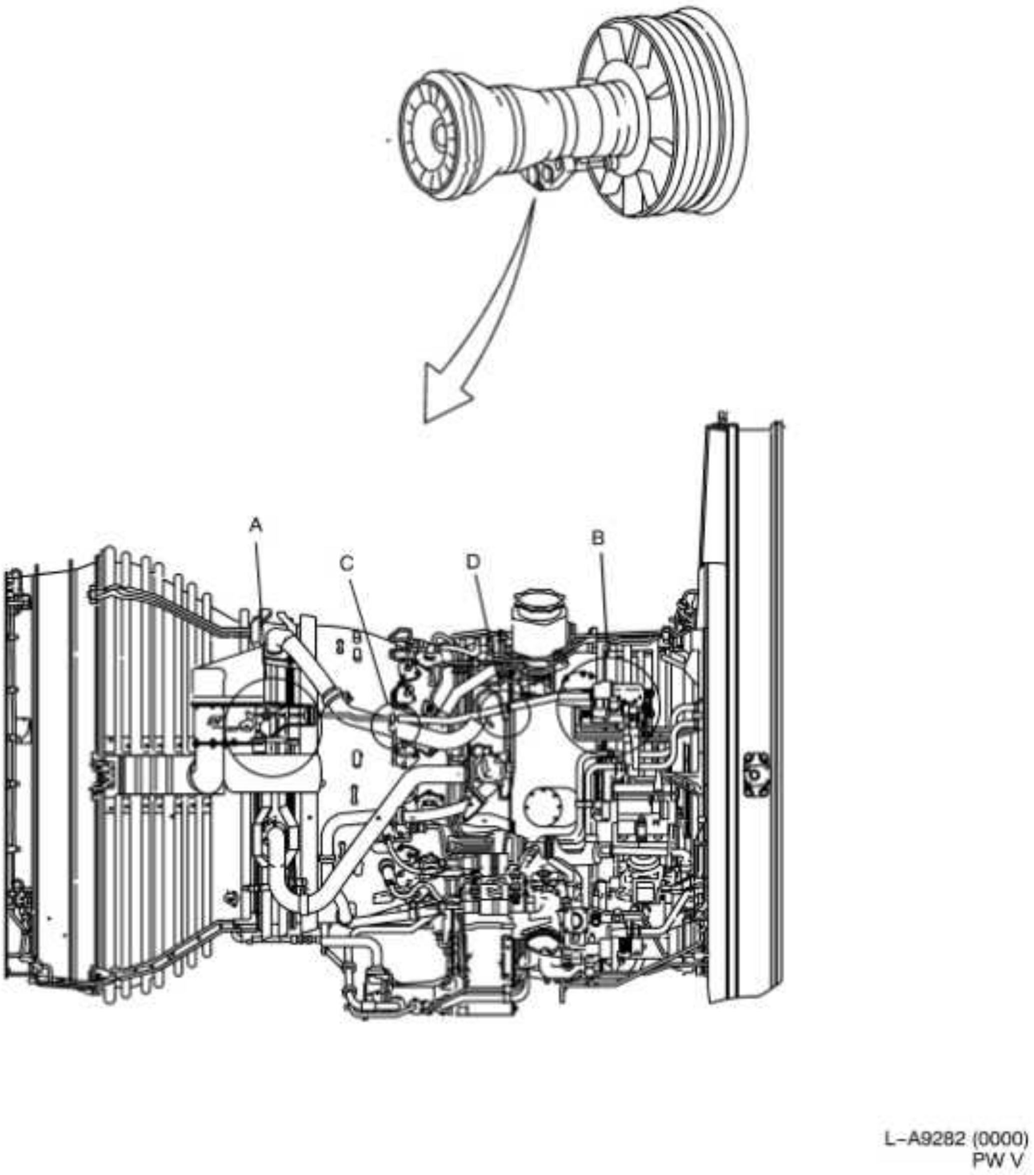
(1) Rig automatic turbine rotor clearance control system by 72−00−00, Special Procedures−06 Task 72−00−00−830−004 or Special Procedures−11 Task 72−00−00−830−005, as applicable.



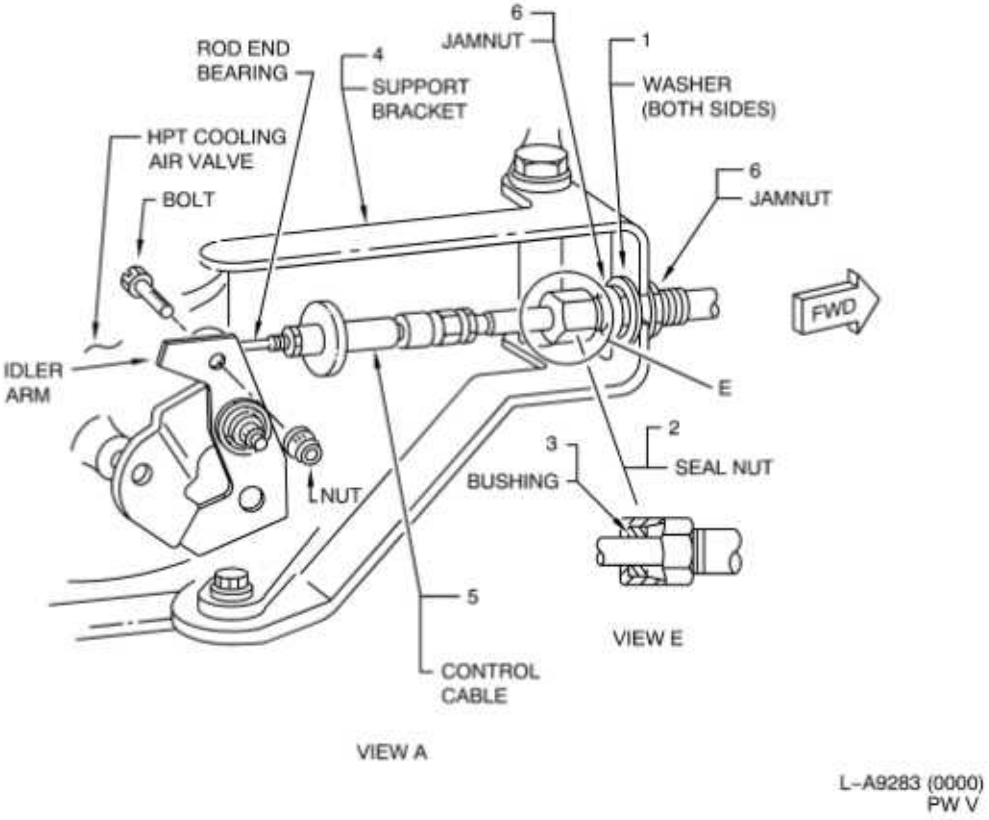
Turbine Case Cooling (TCC) Air Valve Control Cable (Pre And Post SB PW4ENG 72−572 And Post SB PW4ENG 72−592 Engines)
Figure 401 (Sheet 1)
(Task 72−00−53−450−004)


6
JAMNUT
ROD END BEARING
4
SUPPORT BRACKET
1
WASHER (BOTH SIDES)
HPT COOLING AIR VALVE
6
JAMNUT
BOLT
FWD
IDLER ARM
E
3
BUSHING
2
SEAL NUT
NUT
5
VIEW E
CONTROL CABLE
VIEW A
L−A4568 (0000)
PW V

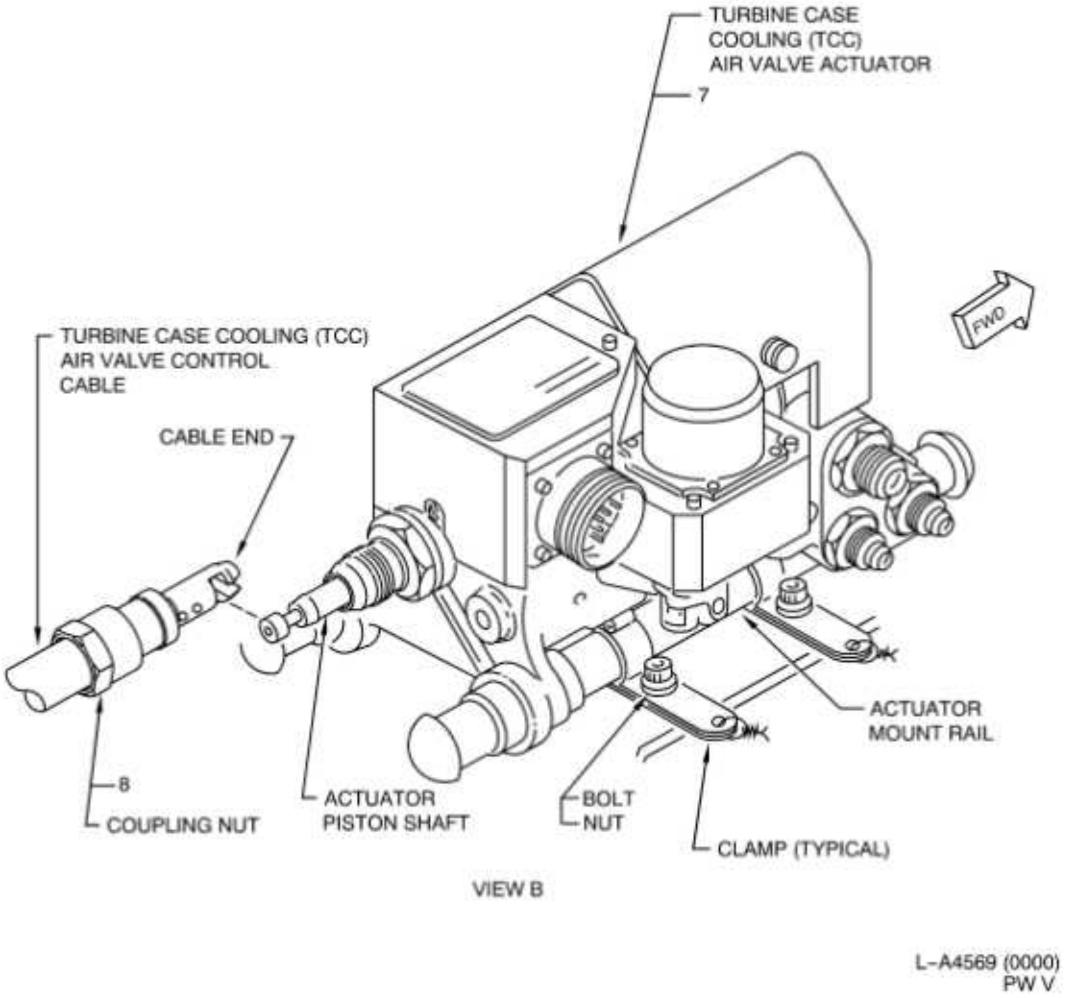
Turbine Case Cooling (TCC) Air Valve Control Cable (Pre And Post SB PW4ENG 72−572 And Post SB PW4ENG 72−592 Engines)
Figure 401 (Sheet 2)
(Task 72−00−53−450−004)



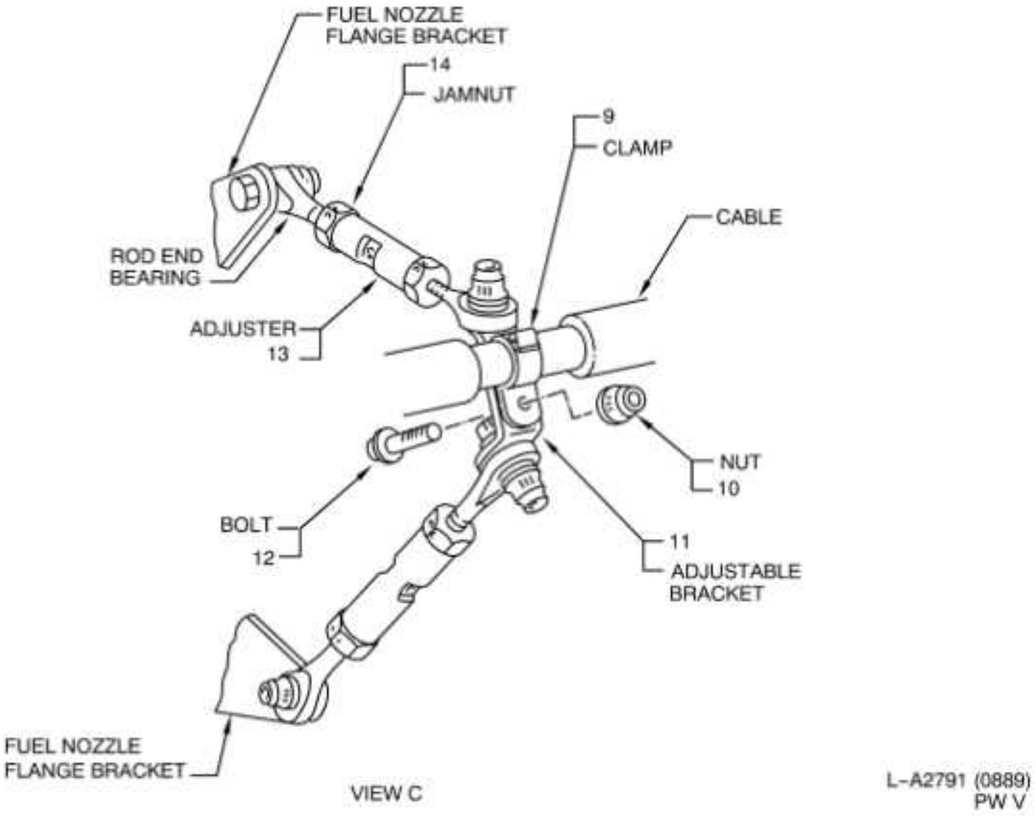
Turbine Case Cooling (TCC) Air Valve Control
Cable (Phase 3 Engines As Built By P&W)
Figure 401 (Sheet 3)
(Task 72−00−53−450−004)


6
JAMNUT
ROD END
BEARING
4
SUPPORT
BRACKET
1
WASHER
(BOTH SIDES)
HPT COOLING
AIR VALVE
6
JAMNUT
BOLT
FWD
IDLER
ARM
E
2
SEAL NUT
3
BUSHING
NUT
5
VIEW E
CONTROL
CABLE
VIEW A
L−A9283 (0000)
PW V

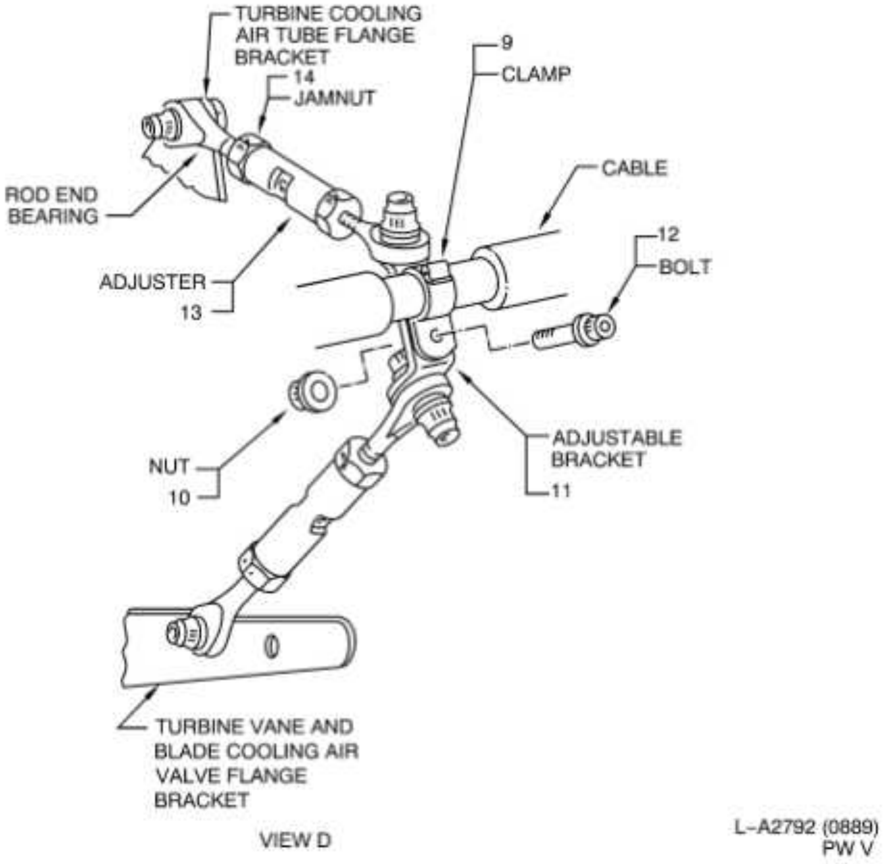
Turbine Case Cooling (TCC) Air Valve Control
Cable (Phase 3 Engines As Built By P&W)
Figure 401 (Sheet 4)
(Task 72−00−53−450−004)


TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
7
FWD
TURBINE CASE COOLING (TCC) AIR VALVE CONTROL CABLE
CABLE END
ACTUATOR MOUNT RAIL
8
COUPLING NUT
ACTUATOR PISTON SHAFT
BOLT
NUT
CLAMP (TYPICAL)
VIEW B
L−A4569 (0000)
PW V

(TCC) Control Cable And Air Valve Actuator
Figure 401 (Sheet 5)
(Task 72−00−53−450−004)


FUEL NOZZLE FLANGE BRACKET
14
JAMNUT
9
CLAMP
CABLE
ROD END BEARING
ADJUSTER
13
NUT
10
BOLT
12
11
ADJUSTABLE BRACKET
FUEL NOZZLE FLANGE BRACKET
VIEW C
L-A2791 (0889)
PW V

Adjustable Bracket And Clipping View
Figure 401 (Sheet 6)
(Task 72−00−53−450−004)


TURBINE COOLING AIR TUBE FLANGE BRACKET
14
JAMNUT
9
CLAMP
CABLE
ROD END BEARING
12
BOLT
ADJUSTER
13
NUT
10
ADJUSTABLE BRACKET
11
TURBINE VANE AND BLADE COOLING AIR VALVE FLANGE BRACKET
VIEW D
L−A2792 (0889)
PW V

Adjustable Bracket And Clipping View
Figure 401 (Sheet 7)
(Task 72−00−53−450−004)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - INSTALLATION-07

Task 72-00-53-450-001:

1. Install Turbine Case Cooling (TCC) Air Valve (LPT)

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

B. Procedure
See Figure 401 and Figure 402.

(1) Move the valve, with flow arrows downward, into position between the upper and lower support brackets while you align the bolt holes.

(2) Attach the upper flange and the upper support link with bolts, threads lubricated with Engine Oil P03-001. Make sure the longer bolt is installed to the inner support link location.

(3) Install the lower support link to the flanges of the HPT and LPT (TCC) manifold collectors and attach the lower flange of the valve and support link with bolts, threads lubricated with Engine Oil P03-001, with the longer bolts at the inner support link location, and nuts.

(4) Torque all the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

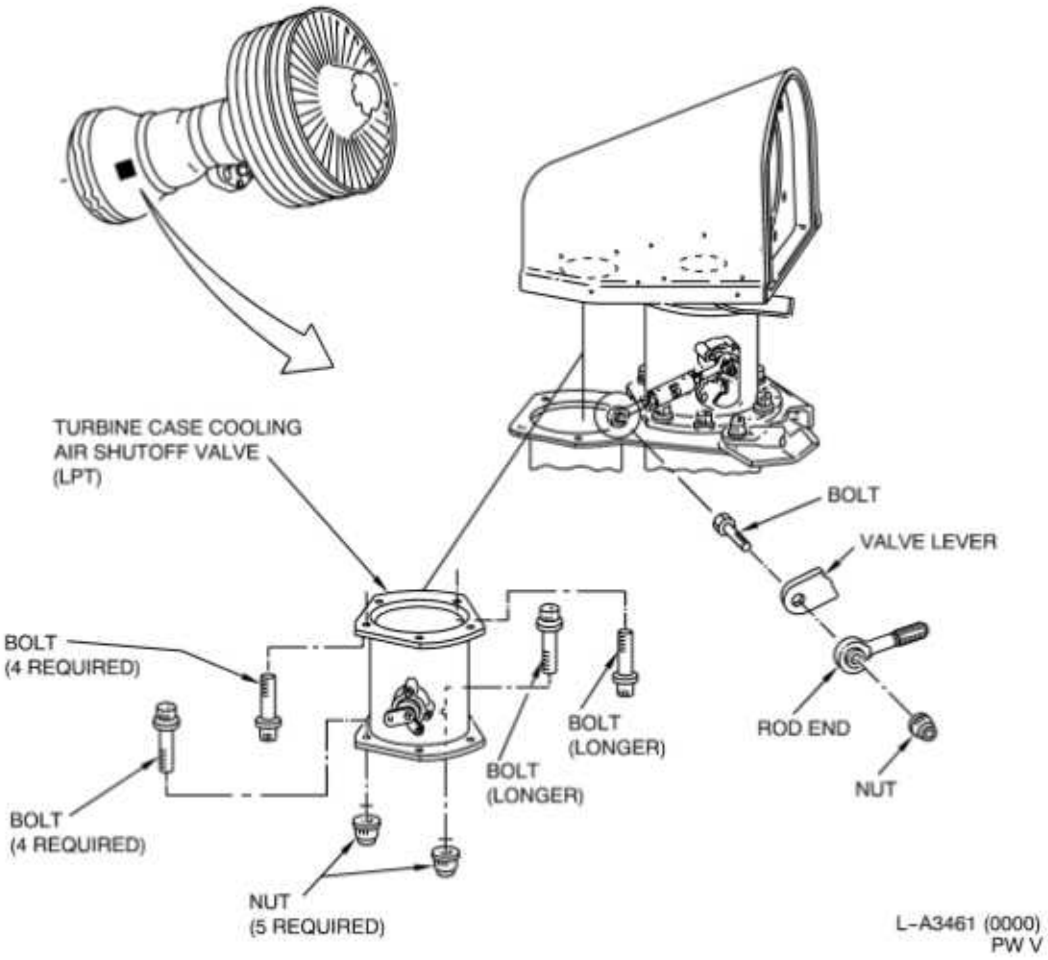
NOTE: You install the HPT/LPT TCC valve linkage during adjustment/test.

C. Postrequisites

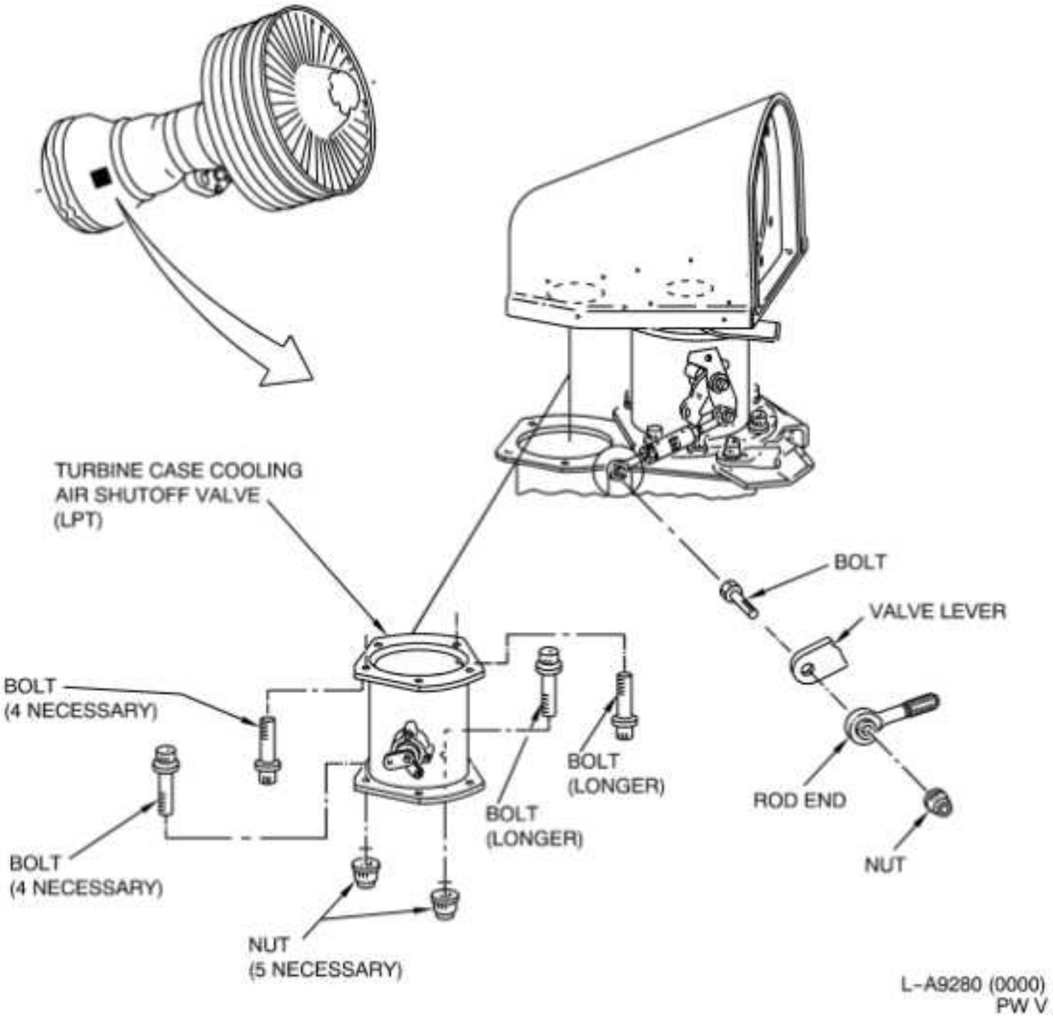
(1) Rig TCC system by 72-00-00, Special Procedures-06 Task 72-00-00-830-004.

(2) Test engine by Repair Test Reference Table. See 71-00-00, Testing-00 Task 71-00-00-990-003.

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−07


TURBINE CASE COOLING AIR SHUTOFF VALVE (LPT)
BOLT
VALVE LEVER
BOLT (4 REQUIRED)
BOLT (LONGER)
ROD END
BOLT (LONGER)
NUT
BOLT (4 REQUIRED)
NUT (5 REQUIRED)
L-A3461 (0000)
PW V

Turbine Cooling Air Valve (LPT) (Pre And Post SB PW4ENG 72−572 And Post SB PW4ENG 72−592 Engines)
Figure 401
(Task 72−00−53−450−001)


TURBINE CASE COOLING AIR SHUTOFF VALVE (LPT)
BOLT
VALVE LEVER
BOLT (4 NECESSARY)
BOLT (LONGER)
BOLT (LONGER)
ROD END
BOLT (4 NECESSARY)
NUT
NUT (5 NECESSARY)
L-A9280 (0000)
PW V

Turbine Cooling Air Valve (LPT) (Phase 3 Engines As Built By P&W)
Figure 402
(Task 72−00−53−450−001)

ENGINE GENERAL – LOW PRESSURE TURBINE (LPT) – INSTALLATION-08

Task 72-00-53-420-002:

1. Install The Low Pressure Turbine And Turbine Exhaust Case With Shaft

NOTE: See Figure 401 for part/assembly installation procedure sequence.

NOTE: This procedure is for installation of low pressure turbine with turbine exhaust case previously installed.

NOTE: To install the low pressure turbine with the turbine exhaust case previously removed, refer to 72-00-53, Installation-01 (Task 72-00-53-420-001).

A. Prerequisites

(1) See 72-00-53, Inspection/Check-01 Task 72-00-53-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 3755	Pump (Optional To PWA 29389)
PWA 18872	Wrench, Hydraulic (Optional To PWA 33732)
PWA 25040	Bracket, Support (Optional To PWA 85195 Bracket For Engines With Exhaust Nozzle Removed)
PWA 25041	Bracket, Support (Optional To PWA 85195 Bracket For Engines With Exhaust Nozzle Removed)
PWA 25757	Pedestal, Fixed
PWA 25758	Pedestal, Adjustable
PWA 25926	Adapter (Two Necessary)
PWA 26318	Base, Extension
PWA 28414	Bracket, Support (Optional To PWA 85195 Bracket For Engine Horizontal Support)
PWA 28657	Sling, Strongback, Handling
PWA 29243	Bracket, Support (Two Necessary) (Optional To PWA 85195)
PWA 29389	Pump, Hydraulic

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−08

Special Tools:

(CONTINUED)

PWA 29510	Pump, Hydraulic (Hand) (Use With Hydraulic Wrench)
PWA 33732	Wrench, Hydraulic
PWA 45418	Wrench, Mechanical
PWA 45419	Air Torque Multiplier (Optional To PWA 80651) (Use With Mechanical Wrench)
PWA 76154	Adapter
PWA 76270	Stand
PWA 80071	Wrench, Mechanical
PWA 80187	Wrench, Mechanical
PWA 80651	Multiplier, Pneumatic (Use With Mechanical Wrench)
PWA 85195	Bracket (Two Necessary)
PWA 85291	Pins, Aligning (Two Necessary − Optional To PWA 101152)
PWA 85299	Adapter, Holding (Optional To PWA 102460) (Use With Mechanical Wrench)
PWA 85300	Wrench, Torque (Use With Mechanical Wrench)
PWA 85306	Puller, Knocker
PWA 85452	Eye, Lifting
PWA 85456	Retainer, Front
PWA 85490	Drift
PWA 85504	Gage, Indicator
PWA 85514	Wrench, Torque (Use With Hydraulic Wrench)
PWA 85515	Adapter (Use With Hydraulic Wrench)
PWA 85562	Sleeve, Support
PWA 85769	Fixture (Install/Remove)
PWA 85785	Adapter, Piloting
PWA 86210	Adapter, Piloting (Optional To PWA 85785, Use If The Low Pressure Compressor Is Not Installed)
PWA 86325	Fixture (Optional To PWA 86437)
PWA 86437	Fixture, Retainer (Optional To PWA 88222)
PWA 86604	Stand, Transport (Optional, To Store And Transport PWA 85769 Fixture)
PWA 88204	Guide, Piloting
PWA 88222	Fixture, Retainer
PWA 101152	Pins, Aligning (Two Necessary)
PWA 102460	Adapter (Use With Mechanical Wrench)
PWA 102727	Support
PWA 103636	Base, Support

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−289	Lockwire (AS3214−02)
P05−291	Cable, Safety (Optional)
P05−292	Ferrule, Safety Cable (Optional)
P05−395	Beeswax
P05−396	Paraffin Wax Blend
P06−002	Petrolatum, White (PMC 9609)
P06−021	Compound, Antigalling (PWA 550)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	8	72−54−00/4/110
Packing	1	72−54−00/5/90

C. Procedure

(1) Install turbine shaft spacer into front end of front compressor drive turbine shaft using PWA 85490 Drift. See Table 401 and Figure 402.

Class	Thickness
1	0.550 − 0.555 Inch (13.970 − 14.097 mm)
2	0.555 − 0.560 Inch (14.097 − 14.224 mm)
3	0.560 − 0.565 Inch (14.224 − 14.351 mm)
4	0.565 − 0.570 Inch (14.351 − 14.478 mm)
5	0.570 − 0.575 Inch (14.478 − 14.605 mm)
6	0.575 − 0.580 Inch (14.605 − 14.732 mm)
7	0.580 − 0.585 Inch (14.732 − 14.859 mm)
8	0.585 − 0.590 Inch (14.859 − 14.986 mm)
9	0.590 − 0.595 Inch (14.986 − 15.113 mm)
10	0.595 − 0.600 Inch (15.113 − 15.240 mm)
11	0.600 − 0.605 Inch (15.240 − 15.367 mm)
12	0.605 − 0.610 Inch (15.367 − 15.494 mm)
13	0.610 − 0.615 Inch (15.494 − 15.621 mm)
14	0.615 − 0.620 Inch (15.621 − 15.748 mm)
15	0.620 − 0.625 Inch (15.748 − 15.875 mm)
16	0.625 − 0.630 Inch (15.875 − 16.002 mm)
17	0.630 − 0.635 Inch (16.002 − 16.129 mm)
18	0.635 − 0.640 Inch (16.129 − 16.256 mm)
19	0.640 − 0.645 Inch (16.256 − 16.383 mm)
20	0.645 − 0.650 Inch (16.383 − 16.510 mm)
21	0.650 − 0.655 Inch (16.510 − 16.637 mm)

Spacer Classification Data
Table 401

(CONTINUED)

Class	Thickness
22	0.655 − 0.660 Inch (16.637 − 16.764 mm)
23	0.660 − 0.665 Inch (16.764 − 16.891 mm)
24	0.665 − 0.670 Inch (16.891 − 17.018 mm)
25	0.670 − 0.675 Inch (17.018 − 17.145 mm)
26	0.675 − 0.680 Inch (17.145 − 17.272 mm)
27	0.680 − 0.685 Inch (17.272 − 17.399 mm)

Spacer Classification Data
Table 401 (Continued)

(2) Position and adjust PWA 102727 Fan Case Support to engage and hold the fan inlet case at Flange "A" at the 6 o'clock location. If it is necessary because of the height of the engine in the pedestals, first install the Fan Case Support (PWA 102727) in a PWA 103636 Base Support. Attach the Fan Case Support (PWA 102727) to the Base Support (PWA 103636) with the three detail bolts and nuts.

NOTE: If necessary several Base Supports (PWA 103636) can be stacked together. They must be attached to each other with the three detail bolts and nuts.

(3) Install PWA 85195 Support Brackets, PWA 25040 Support Brackets and PWA 25041 Support Brackets, or PWA 28414 Support Brackets to turbine exhaust case at 3 and 9 o'clock locations. See Figure 403.

NOTE: PWA 29243 Brackets may be used in place of PWA 85195 Brackets for horizontal support only.

NOTE: PWA 25040 Brackets and PWA 25041 Brackets may be used in place of PWA 85195 Brackets on engines with exhaust nozzle removed.

(a) Position brackets between case rails and align holes.

NOTE: If applicable, install PWA 25040 Bracket at 3 o'clock and PWA 25041 Bracket at 9 o'clock positions.

(b) For PWA 85195 Brackets or PWA 25040 Brackets and PWA 25041 Brackets, install pin from rear through flange and bracket. Secure pin with safety pin as required.

(c) For other brackets, insert pin through flanges and bracket and install bushings through flanges and into bracket. Secure pins with nuts.

(4) If the turbine shaft spline is not clean, or if it has a heavy type of rust preventive, clean the spline by SPOP 209 (wipe method). See Standard Practices Manual, PN 585005.

(5) Using hoist, attach PWA 28657 Sling with two PWA 76154 Adapters to trunnion spools of brackets at 3 and 9 o'clock locations on exhaust case. See Figure 404.

(6) Attach second hoist and nylon sling to front compressor drive turbine shaft.

(7) Lubricate two interface diameters and the spline area at front end of front compressor drive turbine shaft with Engine Oil P03−001. If the shaft is uncoated in the area forward and rearward of the spline, lubricate these areas also. See Figure 405.

(8) Loosen hand knobs and open clamps securing turbine shaft to PWA 25096 Stand, PWA 76270 Stand or PWA 87330 Stand.

NOTE: After removal of assembly from stand, PWA 85562 Sleeve or PWA 87347 Sleeve details may be removed from front and rear supports of PWA 25096 Stand, PWA 76270 Stand or PWA 87330 Stand.

CAUTION: DO NOT INSTALL SEAL IN HIGH TURBINE CASES WHICH DO NOT HAVE A SEAL GROOVE IN THE REAR FLANGE. AFFECTED CASES ARE 50L170 AND 50L292.

(9) Install seal to rear flange of high pressure turbine case. Seal may be temporarily secured to flange with Beeswax P05−395 or Paraffin Wax Blend P05−396.

(10) Using hoists, lift low pressure turbine and turbine exhaust case from stand and align shaft with high pressure compressor rear hub.

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−08

(11) If the fan nut and the turbine shaft coupling are in place, install PWA 85785 Adapter in the ID of the fan nut. Use the detail clamps to attach the adapter to the coupling lugs. See Figure 406.

(12) Optional, if the fan nut and turbine shaft coupling are not in place, install PWA 85785 Adapter in the 11.120 inch (282.448 mm) diameter of the fan hub. Use the detail clamps to attach the adapter to the underside of the hub flange. See Figure 406.

(13) Optional, if the low pressure compressor is not in place, install PWA 86210 Adapter to the ID of the No. 1 bearing support. Use the detail clamps to attach the adapter to the support. See Figure 407.

(14) Thread the puck end of PWA 88204 Guide into the front end of the turbine shaft. See Figure 408.

NOTE: The guide can be separated into two parts if required.

(15) Hand guide the assembly from the rear and move the assembly forward. Move the nylon sling as required and insert the guide through the ID of the PWA 85785 Adapter or PWA 86210 Adapter.

(16) Move the assembly forward until the turbine shaft engages the ID spline of the turbine shaft coupling at the front end of the engine.

(17) Remove nylon sling and hoist from turbine shaft. Move assembly forward until approximately 12 inches (304.80 mm) gap exists between turbine front and rear cases.

(18) Remove the retainer (409/3) from the front flange of the turbine rear case and the front compressor drive turbine shaft. See Figure 409.

(a) Remove two bolts (409/4) that attach the upper and lower details of the retainer.

(b) Remove bolts (409/2) and nuts (409/1) securing upper and lower retainer details to low pressure turbine case.

(19) Install several work bolts and nuts to boltholes in Flange N.

(20) Remove the PWA 85785 Adapter or PWA 86210 Adapter as applicable.

(21) Remove the guide from the turbine shaft.

(22) Install two PWA 85291 Aligning Pins or PWA 101152 Aligning Pins.

  (a) Locate two threaded jackscrew holes 180 degrees apart in front flange of turbine rear case.

  (b) Insert pins through boltholes between jackscrew holes from rear side of front flange.

  (c) Thread detail bolts into jackscrew holes to secure pins.

(23) Install PWA 85769 Fixture (Pusher) into front end of low pressure turbine shaft. See Figure 410.

  (a) Thread plug end of shaft (410/1) into end of turbine shaft until plug bottoms on shoulder of shaft.

  (b) Guide body (410/4) and attached parts over previously installed shaft (410/1). Using dowel pin (410/2), retract locking pin. Rotate assembly to position locating plate behind lugs at front end of low pressure turbine coupling. Using dowel pin, release spring loaded locking pin to lock fixture to coupling.

  (c) Install puck (410/5) onto shaft, and engage small diameter of puck into body (410/4).

  (d) Guide hydraulic cylinder (410/6), threaded end first, onto shaft. Secure cylinder with nut (410/7).

CAUTION: LOOSEN THE EIGHT CAP SCREWS (411/3) OF THE RETAINING FIXTURE WHEN FRONT FLANGE OF REAR CASE MEETS REAR FLANGE OF TURBINE FRONT CASE TO AVOID DAMAGE TO NO. 1 BEARING IF TURBINE SHAFT COUPLING SPACER IS BELOW REQUIRED DIMENSIONS.

(24) Tighten workbolts in Flange N and apply hydraulic pressure to pusher−puller ram and seat front compressor drive turbine shaft in LPC/LPT coupling. Front flange

of turbine rear case should now butt rear flange of turbine front case.

(25) Remove PWA 86325 Retainer, PWA 86437 Retainer or PWA 88222 Retainer from the turbine exhaust case and shaft. See Figure 411 (Sheet 1) or Figure 411 (Sheet 2).

CAUTION: TO ENSURE PROPER SEATING OF CLASSIFIED SPACER, HYDRAULIC PRESSURE MUST BE APPLIED TO PUSHER−PULLER, WHEN PERFORMING LOW PRESSURE TURBINE POSITIONING CHECK.

(26) (Reference 847 or 851) Check low pressure turbine axial position using PWA 85504 Gage while pressure is applied to pusher puller. See Figure 412 and Figure 413.

NOTE: If the coupling is not installed, then install the classified spacer for the low turbine running position during the LPC/LPT coupling 72−00−32, Installation−01 (Task 72−00−32−420−001).

NOTE: Running position check is required whenever low pressure turbine is installed, (except when the LPC/LPT coupling is not in place) regardless of whether same or different unit (from another engine) is installed. Measurement should be an average of at least two measurements taken at equally spaced locations.

(a) (Reference 847) For engines (Pre SB PW4ENG 72−256) without the revised LPT airfoils, 5th stage turbine hub, and 5th stage airseal, you must remove two screws (412/7) and gage plate (412/8) from the top of the bar if it is there. Put the gage plate and screws in the storage location on the bar.

(b) (Reference 851) For engines (Post SB PW4ENG 72−256) with the revised LPT airfoils, 5th stage turbine hub, and 5th stage airseal, put the gage plate (412/8) on the top of the bar (412/2) with two screws (412/7).

(c) Move the dial indicator with its support block away from the spring−loaded rod (412/4).

(d) Push the spring−loaded flush pin assembly (412/6) into tubular housing and rotate to engage the dowel pin (412/5) in the slot to secure the flush pin.

(e) Find the 1.0 inch by 1.5 inch (25.4 mm by 38.1 mm) slot in the inner front flange of the turbine exhaust case at either the 12 o'clock or 6 o'clock location.

(f) Put the bar (412/2) between two exhaust case struts and next to one of the slots in the case inner front flange.

(g) Put the gage bar on two rear flanges (inner and outer) of the turbine exhaust case and put the flush pin assembly over the 6th stage LPT disk (412/9). Hold the gage to the case with two bolts (412/3) and nuts (412/1).

(h) Release the rod from the locked position and allow the flush pin to touch the disk. Make sure that the flush pin touches the disk and not the blade (you can rotate the rotor if necessary).

(i) Zero the dial indicator on the back face of the bar.

(j) Move the dial indicator into position over the spring−loaded rod (412/4) to read the turbine running position.

(k) (Reference 851) For engines (Post SB PW4ENG 72−256), with the revised LPT airfoils, 5th stage turbine hub, and the new 5th stage airseal, the low pressure turbine axial running position must be within the limits specified for (Reference 851). See Figure 413.

NOTE: Mean dimension of 12.330 inches (313.182 mm) is indicated when rod detail of tool is flush with gaging surface.

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - INSTALLATION-08

(l) (Reference 847) For engines (Pre SB PW4ENG 72-256), without the revised LPT airfoils, the new 5th stage turbine hub, and the new 5th stage airseal, the low pressure turbine axial running position must be within the limits specified for (Reference 847). See Figure 413.

NOTE: Mean dimension of 12.380 inch (314.452 mm), is indicated when rod detail of tool is flush with gaging surface.

(m) Remove the gage and repeat measurement at the opposite slot location.

(n) If necessary, remove front compressor drive turbine with exhaust case and use a new classified spacer.

1 Make record of axial running position dimension. This dimension will be used to find new spacer class.

2 Remove The Front Compressor Drive Turbine. Refer to 72-00-53, Removal-08 (Task 72-00-53-020-002).

3 Remove classified spacer from end of turbine shaft. Measure and make a record of spacer thickness.

4 Find the new classified spacer necessary to correctly set the running position of the low pressure turbine. Spacer class is found using Table 401.

NOTE: Class of turbine shaft spacer can be changed by 72-53-81, Repair-01. See PW4000 Series CIR, PN 51A357.

5 Install new classified spacer onto end of turbine shaft.

6 Install front compressor drive turbine, with new classified spacer, again.

7 Check axial running position dimension again.

(27) Secure No. 4 bearing retaining plate using bolts lubricated with Engine Oil P03-001 and key washers. Torque bolts to 75 - 85 lb-in. (8.474 - 9.604 N.m). Bend tabs of key washers. See Figure 414.

(28) Release hydraulic pressure. Disconnect hydraulic pump.

(29) Remove PWA 85769 Puller from engine.

(a) Using dowel pin (410/2), retract locking pin into housing. Rotate body (410/4) to position lugs of locator plate between lugs of LPC/LPT coupling. Remove body from coupling.

(b) Unthread and remove shaft (410/1) from turbine shaft.

(30) Remove two PWA 85291 Guide Pins or PWA 101152 Guide Pins from Flange N.

(31) Install Flange N hardware. Refer to 72-00-53, Installation-20 (Task 72-00-53-420-020).

(32) Install two PWA 25926 Adapters, one on one PWA 25757 Pedestal and second on one PWA 25758 Pedestal.

(33) Using previously attached sling, hoist and adapters at turbine exhaust case, lift rear of engine and position pedestals under brackets at 3 and 9 o'clock positions on exhaust case.

(34) Remove PWA 26157 Pedestal and PWA 85062 Saddle from diffuser/combustion section.

(35) Lower engine to pedestals and remove PWA 28657 Sling and hoist.

(36) Assemble LPT flat washer (415/4) into ID of LPC/LPT coupling. See Figure 415.

NOTE: If LPC/LPT coupling is removed, omit installation of turbine shaft nut, No. 4 bearing cover and associated hardware specified in following steps. These parts are to be installed with coupling per 72-00-32, Installation-01 (Task 72-00-32-420-001).

(37) Apply Antigalling Compound P06−021, to turbine shaft nut areas specified in Figure 416. Cure compound for five minutes minimum prior to assembly.

(38) Thread turbine shaft nut (415/3) into front compressor drive turbine shaft.

(39) For operators that use the mechanical wrench to install the No. 3 bearing retaining nut, install tooling as follows:

(a) Install PWA 102460 Adapter or PWA 85299 Adapter into LPC/LPT coupling. See Figure 417.

1 Loosen wing nuts (417/1) and slide three clamps (417/2) radially inward.

2 Align keys in adapter with internal slots in coupling and install adapter in coupling. Index adapter as necessary to seat keys in slots in coupling. Slide three clamps radially outward to engage lugs of coupling. Tighten wing nuts to secure clamps.

(b) Install PWA 85300 Wrench, smaller splined end first, into center of PWA 102460 Adapter or PWA 85299 Adapter. Align spline of wrench with spline in ID of turbine shaft nut. Push wrench inward to seat on face of nut.

(c) Using hoist, align splines and slide applicable mechanical wrench over splines of PWA 85300 Wrench. Align anti−torque pins in wrench with bushings in adapter and seat wrench against adapter face. See Table 402 for mechanical wrench options.

PWA Mechanical Wrench	PWA Torque Multiplier
45418	45419
80071 or 80187	45419 or 80651

Mechanical Wrench Options
Table 402

(40) For operators that use the hydraulic wrench to install the No. 3 bearing retaining nut, install tooling as follows:

(a) Align boltholes and position PWA 85515 Adapter to rear face of PWA 18872 Wrench or PWA 33732 Wrench. Secure adapter with eight bolts (418/3). See Figure 418.

(b) Using hoist, position wrench and adapter assembly into front end of LPC/LPT coupling. Align teeth of adapter with slots in coupling and slide three clamps (418/1) outward to engage lugs of coupling. Tighten wing nuts (418/2) to secure adapter to coupling.

NOTE: PWA 28815 Cart or PWA 75046 Cart can be used to transport PWA 18872 Wrench or PWA 33732 Wrench and PWA 28814 Pump or PWA 29510 Pump.

(c) Install PWA 85514 Wrench, smaller splined end first, into center of PWA 18872 Wrench or PWA 33732 Wrench. Align spline of wrench with spline in turbine shaft nut (418/4). Push wrench inward to seat on face of nut.

(d) Connect PWA 28814 Electric Pump or PWA 29510 Hand Pump to wrench.

CAUTION: PWA 80651 TORQUE MULTIPLIER MUST NOT BE USED WITH PWA 45418 WRENCH OR DAMAGE TO WRENCH MAY OCCUR.

(41) (Reference 971) Torque turbine shaft nut.

NOTE: Wrenches may be actuated using air torque multipliers per Table 402.

(a) Tighten nut to 5000 − 7000 lb−in. (564.924 − 790.894 N.m), turn nut through an angle of 43 − 47 degrees. Loosen nut to zero.

(b) Tighten nut to 4000 − 6000 lb−in. (451.939 − 677.909 N.m).

(c) Establish common reference points between nut and its mating part.

(d) Turn nut through an angle of 43 − 47 degrees.

(e) Loosen nut to zero and repeat step (b).

(f) If nut reference point is in line with mating part reference point or beyond it within two degrees maximum, apply final angle of turn per step (d).

(g) If reference points are not within limits, repeat steps (c), (d) and (e) in order, until reference points are within limits. Then perform step (f).

(42) Remove tooling from coupling.

(43) Install key washer (419/6) and retaining ring (419/5) to secure turbine shaft nut. Make sure retaining ring is fully inserted in the retaining nut groove, all around, and ring end gap is 0.010 inch (0.254 mm) minimum. Remove guide from hub. See Figure 419.

(44) Install new packing (419/4) lubricated with Petrolatum White P06−002, to turbine shaft plug (419/3). Install plug to coupling ID and secure with key washer (419/2) and retaining ring (419/1). See Figure 419.

(45) Install No. 4 bearing oil scavenge (inner) tube. See Figure 420.

(a) Remove protective cover from the mount pad recess in turbine exhaust case rear inner diameter.

(b) Install new gasket (420/3) in groove in recess in exhaust case rear inner diameter.

(c) Align boltholes in flange of No. 4 bearing oil scavenge tube (420/8) with boltholes in recessed mount pad in exhaust case rear inner diameter. Align bolthole in detail tube bracket with bolthole in exhaust case rear inner diameter. Secure tube using three bolts (420/6) lubricated with Engine Oil P03−001 and key washers (420/7). Torque bolts to 32 − 36 lb−in. (3.616 − 4.067 N.m). Bend tabs of key washers.

(46) (Pre SB PW4ENG 72−472) Install the No. 4 bearing (oil) nozzle and the No. 4 bearing packing transfer tube in the exhaust case No. 4 bearing compartment at the 1:30 o'clock position. See Figure 421.

(a) Install the nozzle (421/4) in the exhaust case and secure with key washers (421/2 and 421/3) and bolts (421/1). Bend the tabs on the key washers.

(b) Install the No. 4 bearing packing transfer tube (421/5) to the No. 4 bearing nozzle (421/4) and secure with key washers (421/6 and 421/7) and bolts (421/8). Bend the tabs on the key washers.

(47) (Post SB PW4ENG 72−472) Install No. 4 bearing (oil) nozzle and No. 4 bearing damper supply tube. See Figure 422.

(a) Install the No. 4 bearing nozzle (422/11) in the port in the pad on the exhaust case rear inner diameter at the 1:30 o'clock position. Install the nozzle with two bolts (422/16 and 422/17), with threads lubricated with Engine Oil P03−001, and two washers (422/16 and 422/17).

(b) Install the No. 4 bearing damper supply tube (422/12) through the 0.380 inch (9.652 mm) diameter hole in the nozzle (422/11) and into the port in the exhaust case rear flange. Install the damper tube with two bolts (422/16 and 422/17) with threads lubricated with Engine Oil P03−001, and washers (422/16 and 422/17). Torque the bolts that attach the nozzle to the exhaust case and bolts that attach the damper supply tube to the nozzle to 75 − 85 lb−in. (8.474 − 9.604 N.m). Bend the tabs of washers.

(48) (Post SB PW4ENG 72−472) Install No. 4 bearing front nozzle assembly and the packing transfer tube (damper tube to front nozzle). See Figure 422 (Sheet 1) and (Sheet 2).

(a) Lubricate two packings (422/14) with Engine Oil P03−001. Install the packings in the grooves of the packing transfer tube (422/15). Insert one end of the tube into the port in the front No. 4 bearing nozzle (422/13).

(b) Align the boltholes in the flange of the front nozzle with the two retainer plate boltholes at the 12 o'clock position; and insert the nozzle through the hole in the No. 4 bearing support flange at the 1:30 o'clock position. Insert the end of the transfer tube in the port in the elbow of the No. 4 bearing damper supply tube. Put the retaining plate (422/2), chamfered side out, on the retainer plate pad (under the nozzle flange). Put the key washer (422/1) over the oil nozzle flange, and install two bolts, with threads lubricated with Engine Oil P03−001.

(c) (Reference 90) Make sure that the clearance gap (422/3) between the retaining plate and the grooves in the bearing outer race is in the limit specified in Index 2, Figure 423. Torque the bolts that attach the retainer plate to 75 − 85 lb−in. (8.474 − 9.604 N.m).

(d) Bend the tabs of washer (422/1).

CAUTION: YOU MUST APPLY ENGINE OIL FULLY TO THE COVER PACKING OR YOU WILL CUT THE PACKING DURING INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN−FLIGHT SHUTDOWN.

CAUTION: INSTALL THE COVER INTO POSITION USING FOUR WORK BOLTS EQUALLY SPACED AROUND THE COVER. TIGHTEN THE BOLTS EQUALLY IN SMALL INCREMENTS TO PULL THE COVER INTO POSITION EQUALLY. MONITOR THE ENGAGEMENT OF THE COVER TO MAKE SURE THAT THE PACKING IS NOT CUT DURING INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN−FLIGHT SHUTDOWN.

(49) Install the No. 4 bearing cover as follows: See Figure 424.

(a) Apply Engine Oil P03−001 fully to the new packing (424/2).

(b) Install the new packing into the groove at the rear flange of the No. 4 bearing cover (424/3).

(c) Install the cover into the rear inner flange of the exhaust case (424/5).

(d) Install 4 work bolts equally spaced around the cover.

(e) Tighten the bolts equally in small increments to pull the cover into position equally.

(f) Monitor the engagement of the cover to make sure the packing is not cut.

(g) Remove the work bolts.

(50) Install the No. 4 bearing heat shield (424/4) into recess in the No. 4 bearing shield (424/5). Align bolt holes and install shield over No. 4 bearing cover at the rear inner flange of the exhaust case. Install the shield with 30 bolts, lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(51) (Post SB PW4ENG 79−76) Install No. 4 bearing (oil) pressure tube. See Figure 425.

(a) Remove protective cover from adapter (425/5).

NOTE: The No. 4 bearing (oil) pressure tube of (Pre SB PW4ENG 79−76) would not have been removed for split−shipment.

(b) No. 4 bearing pressure tube option to prevent possible wear to the No. 4 bearing pressure tube (425/14), a fiberglass tape wear Wrap P05−136, (425/17) is provided as an option.

(c) Install the shield set (425/15) and the heat shield insulation slide clamp (425/16) on the elliptical section of the No. 4 scavenge tube (425/14).

NOTE: The shield is installed on the section of the tube that goes through the strut of the turbine exhaust case.

(d) Install the shield set (425/7) on the No. 4 pressure tube as follows.

1 Place the two halves over the round section of tube.

2 Install one restraining strap (425/18) through the loops on the section of the shield that overlaps the shield set (425/15).

3 Make tight the shield set on the tube by pulling the strap tight. Cut off excess strap material.

4 Put the loop clamp (425/10) on the wear sleeve of the shield set and secure temporarily with a work bolt and nut.

(e) Attach bracket (425/11) to the turbine exhaust case with two bolts (425/8). Torque the bolts to 75 − 85 lb−in. (8.474 − 9.604 N.m).

(f) Install the No. 4 pressure tube through the strut at the 4:30 o'clock position.

1 Attach the tube nut to the adapter (425/5), handtight.

NOTE: The shield may be separated to attach the tube nut to the adapter.

2 Remove the work bolt and replace with bolt (425/9) and nut (425/12) and attach to the bracket (425/11).

3 Torque the tube nut to the adapter (425/5) to 225 − 250 lb−in. (25.422 − 28.246 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the tube nut.

4 Torque the bolt (425/9) that attaches the clamp (425/10) to the bracket (425/11) to 32 − 36 lb−in. (3.616 − 4.067 N.m).

5 Install the four additional straps (422/18) to hold the shield in place.

6 Make tight the shield set on the tube by pulling the straps tight. Cut off excess strap material.

7 Install bracket (425/2) over the outboard end of the tube.

8 Position the nut (425/4) on the outboard end of the tube and secure the nut to the tube with thrust wire (425/19).

9 Attach the tube shield (425/3) to the turbine exhaust case at the 4:30 o'clock position, pushing it on over the nut (425/4). Line up the shield with the bracket (425/2).

10 Install two bolts (425/1) to retain shield and bracket and torque to 32 − 36 lb−in. (3.616 − 4.067 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts.

D. Postrequisites

(1) Install The Compressor Inlet Cone. Refer to 72−00−31, Installation−02 (Task 72−00−31−420−001).

(2) Install The External Parts. Refer to 72−00−53, Installation−03 (Task 72−00−53−420−003).

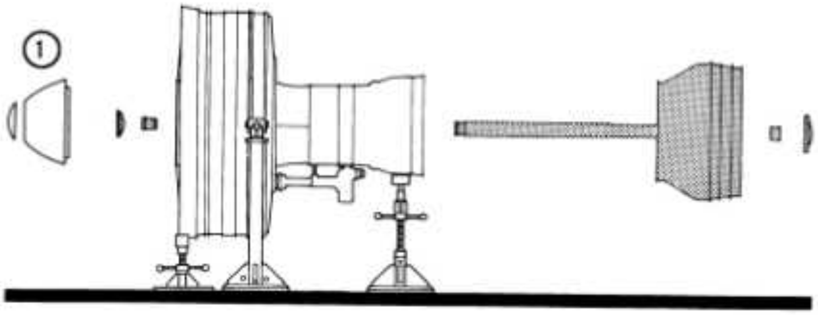
(3) Install The External Parts. Refer to 72−00−54, Installation−02 (Task 72−00−54−420−003).

(4) Install The EEC Thermocouple And Airframe Cable (W6). Refer to 72−00−54, Installation−09 (Task 72−00−54−450−006−A00).

(5) Airflow Check The No. 4 Bearing Oil Nozzle. Refer to 72−54−00, Assembly−01, (Task 72−54−00−400−001).

(6) Test the engine per the Repair Test Reference Table. Refer to 71−00−00, Testing−00 (Task 71−00−00−990−003).

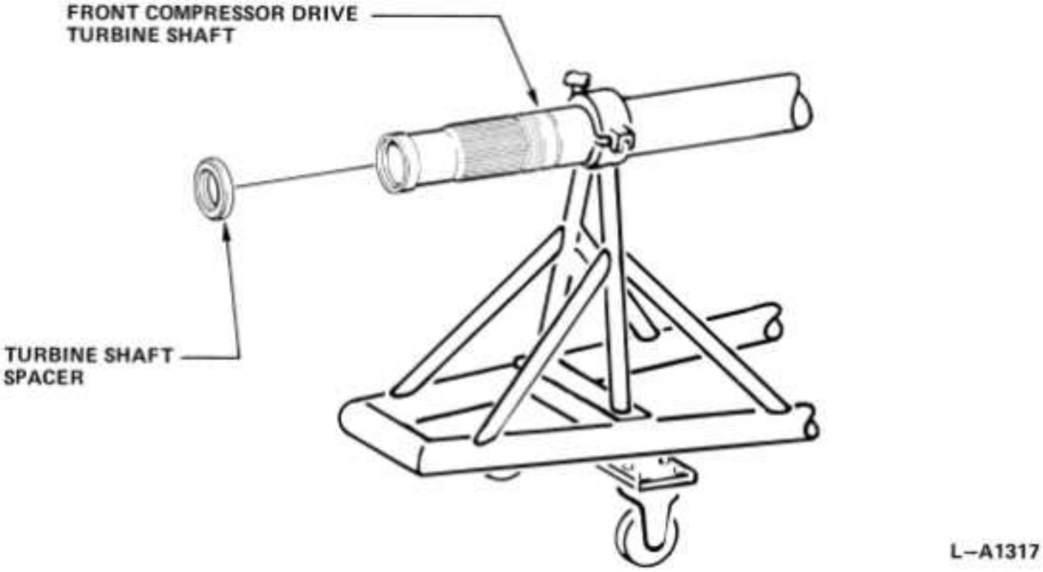
ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−08



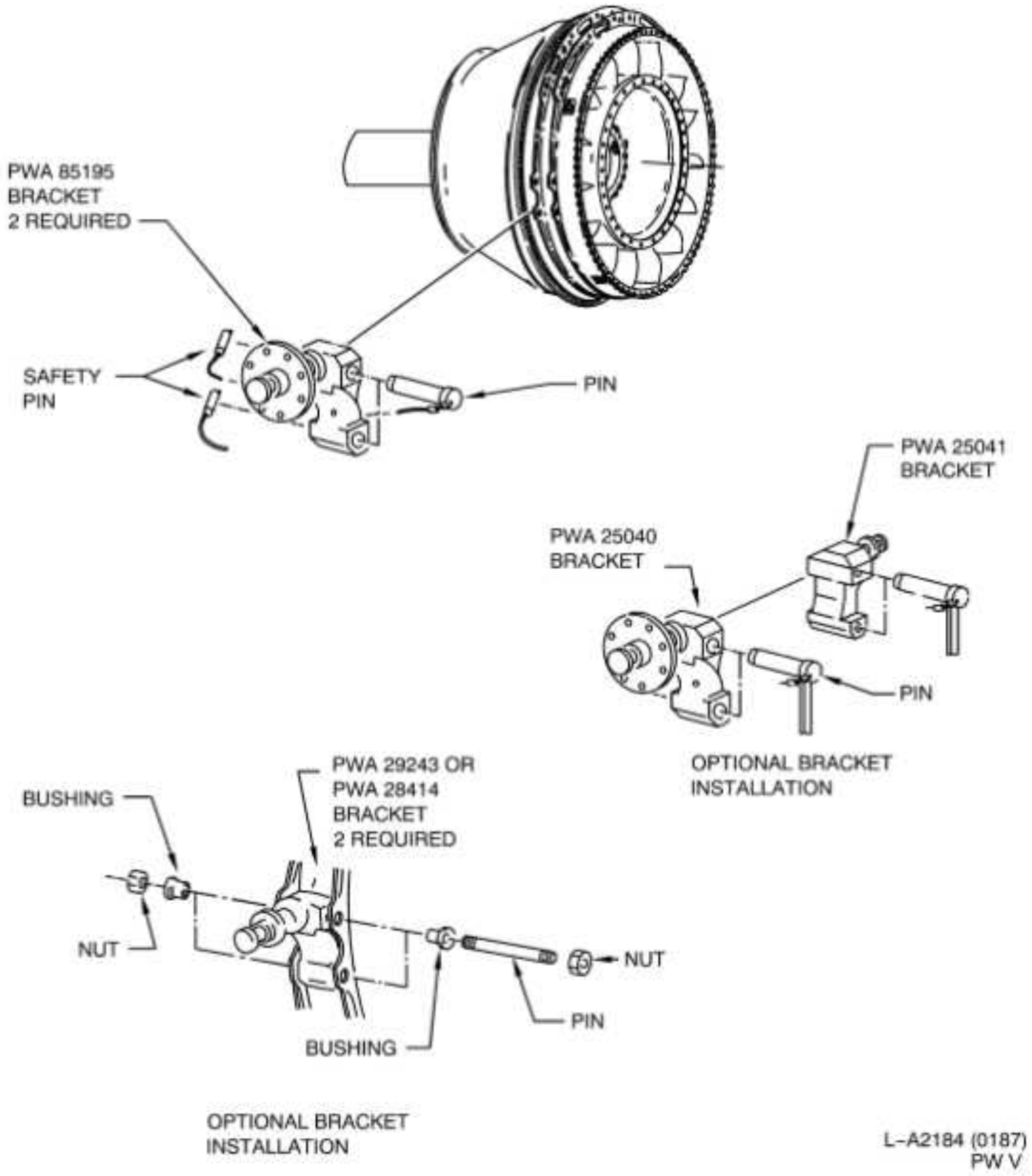
1. INSTALL COMPRESSOR INLET CONE

L-A1308 (0498)

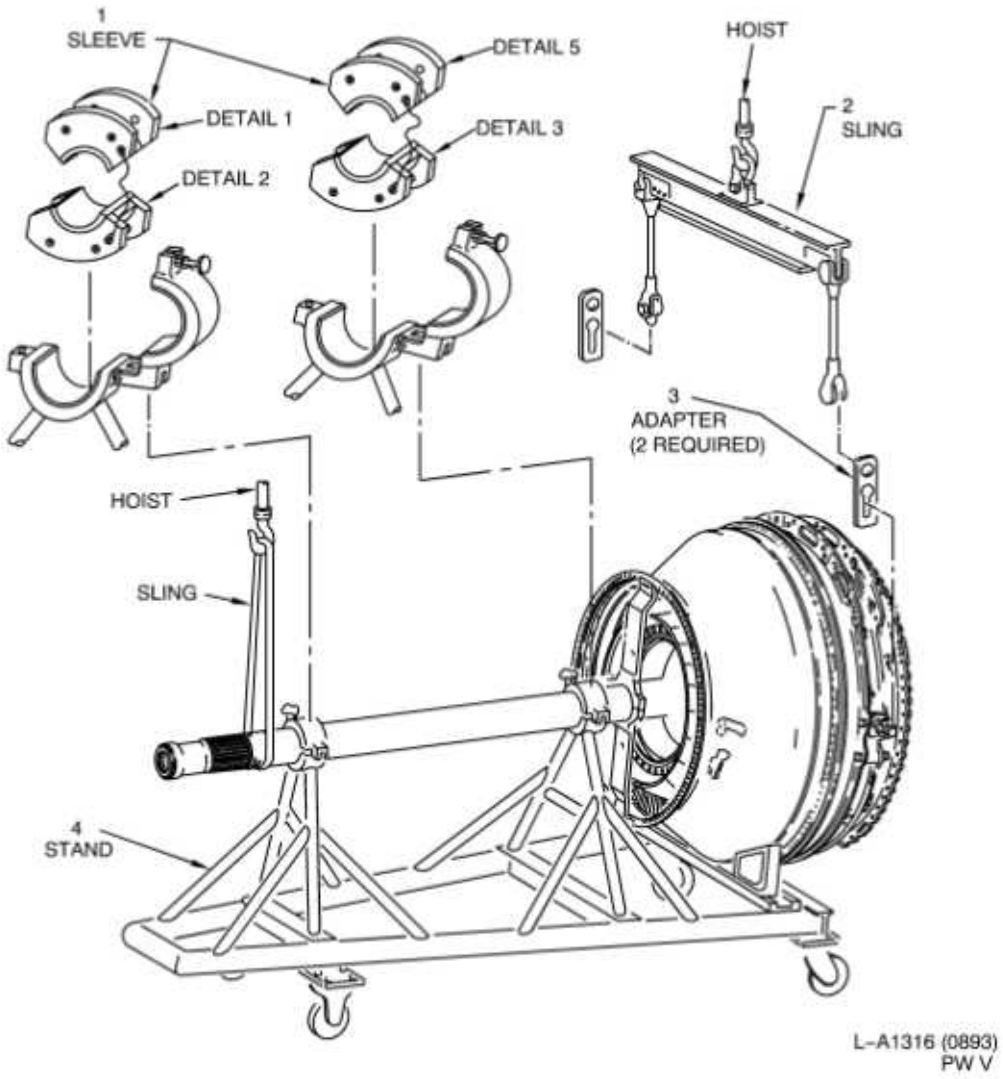
Procedure Sequence
Figure 401
(Task 72−00−53−420−002)


FRONT COMPRESSOR DRIVE TURBINE SHAFT
TURBINE SHAFT SPACER
L−A1317

Turbine Shaft Spacer Installation
Figure 402
(Task 72−00−53−420−002)

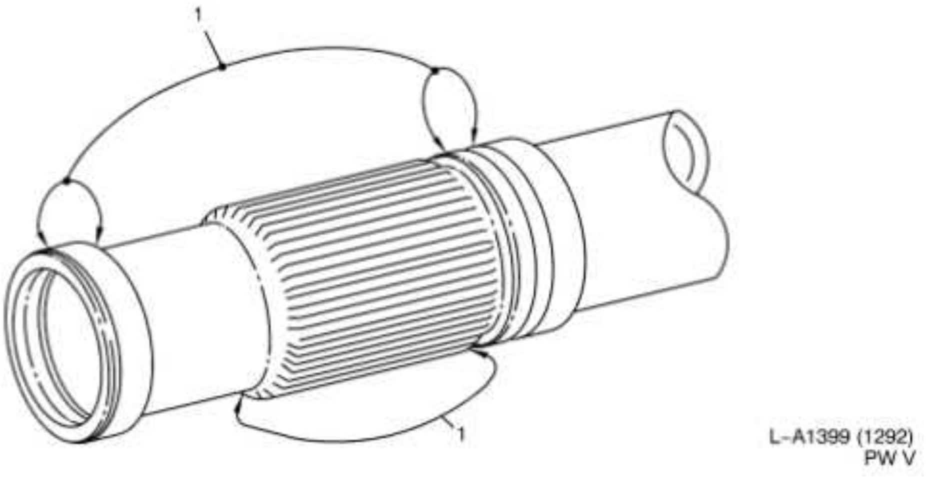

PWA 85195
BRACKET
2 REQUIRED
SAFETY
PIN
PIN
PWA 25041
BRACKET
PWA 25040
BRACKET
PIN
OPTIONAL BRACKET
INSTALLATION
PWA 29243 OR
PWA 28414
BRACKET
2 REQUIRED
BUSHING
NUT
NUT
PIN
BUSHING
OPTIONAL BRACKET
INSTALLATION
L−A2184 (0187)
PW V

Support Bracket Installation
Figure 403
(Task 72−00−53−420−002)


1
SLEEVE
DETAIL 5
DETAIL 1
DETAIL 3
DETAIL 2
HOIST
2
SLING
3
ADAPTER
(2 REQUIRED)
HOIST
SLING
4
STAND
L-A1316 (0893)
PW V

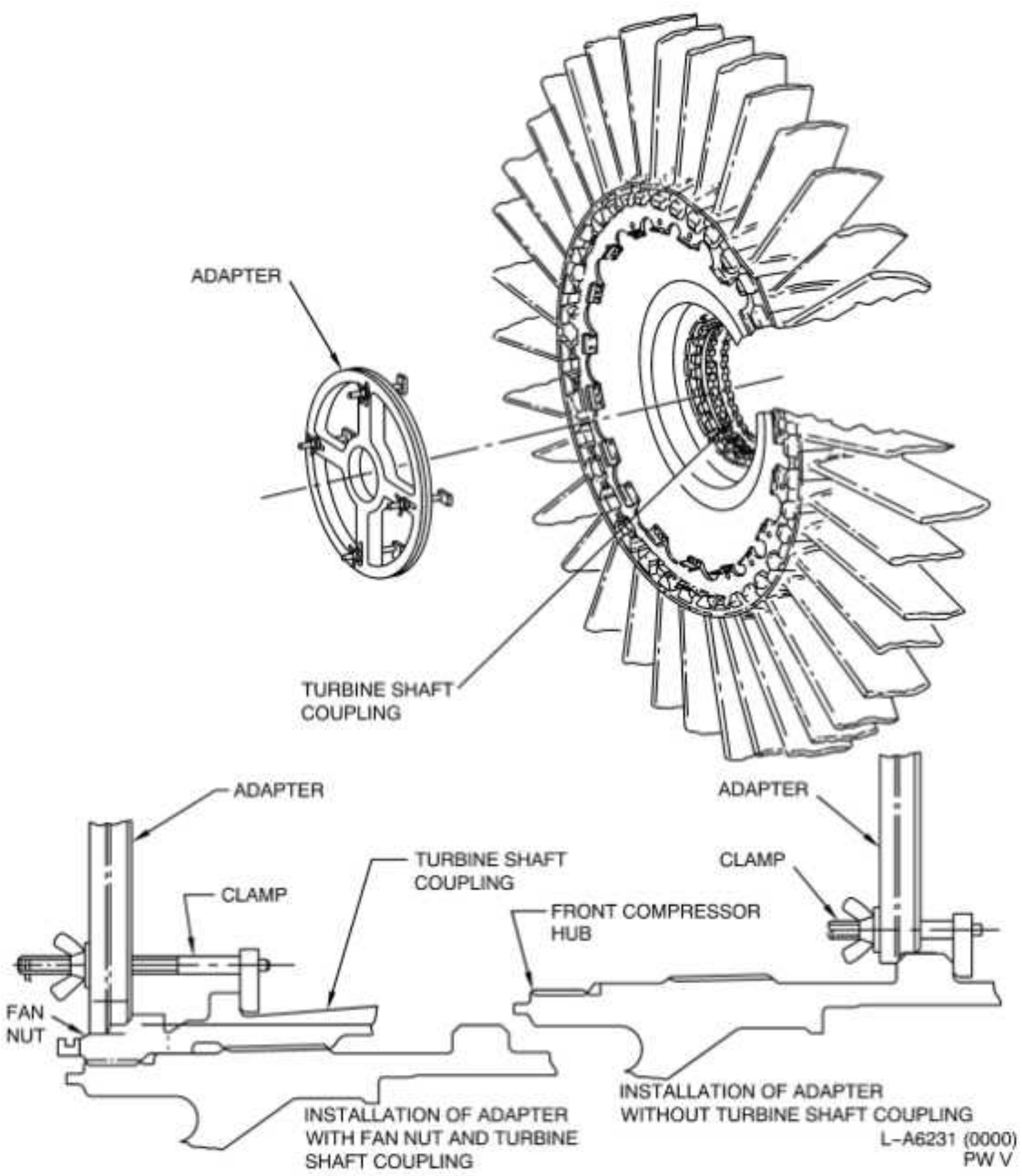
1. PWA 85562 Sleeve (Used With PWA 25096 Or PWA 76270 Stand)
 Or PWA 87347 Sleeve (Used With PWA 87330 Stand)
2. PWA 28657 Sling
3. PWA 76154 Adapter, Two Required
4. PWA 25096, PWA 76270 Or PWA 87330 Stand

Low Pressure Turbine And Turbine Exhaust Case Assembly Installation
Figure 404
(Task 72−00−53−420−002)

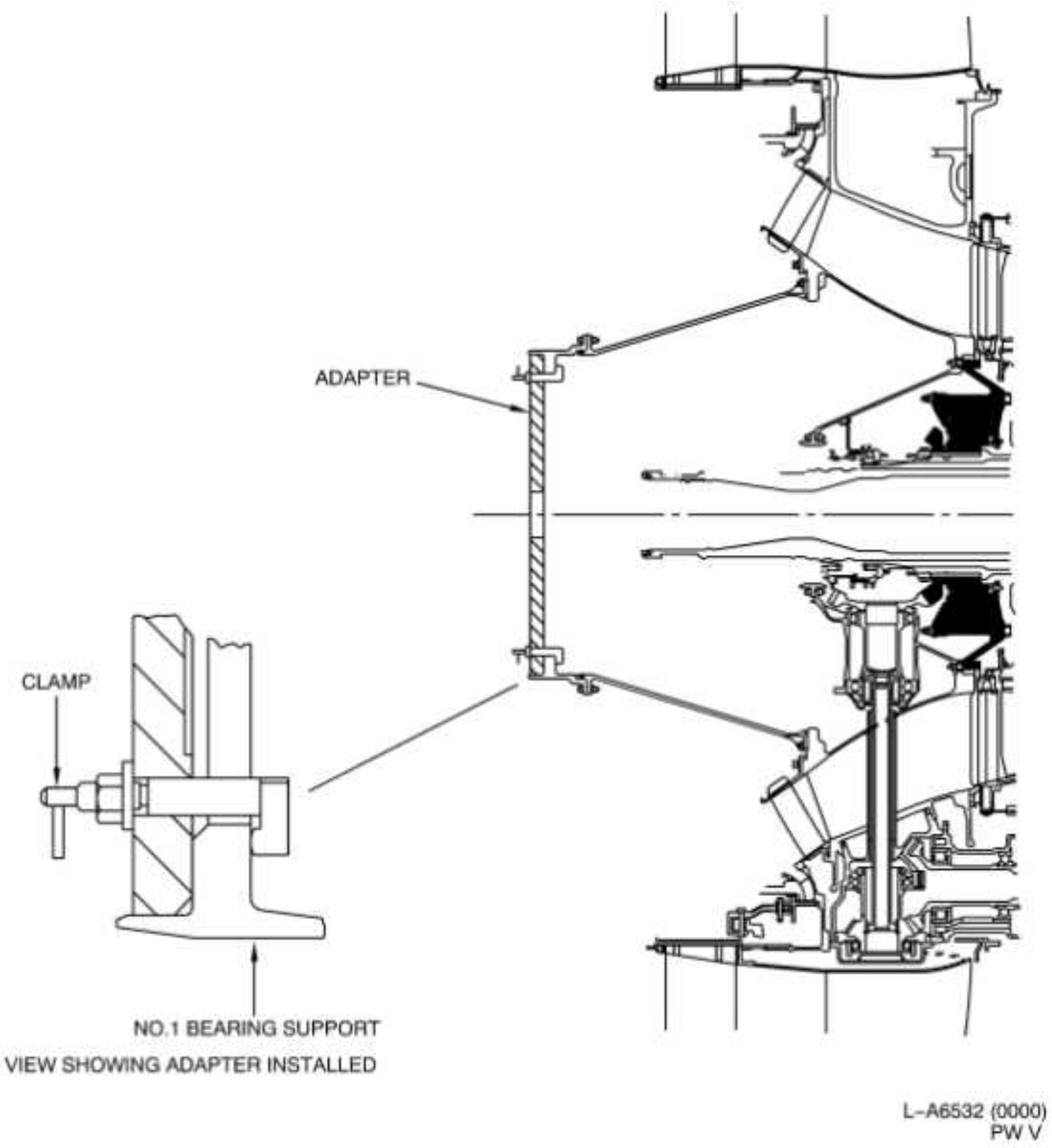


1. Treat Enclosed Area. See Text.

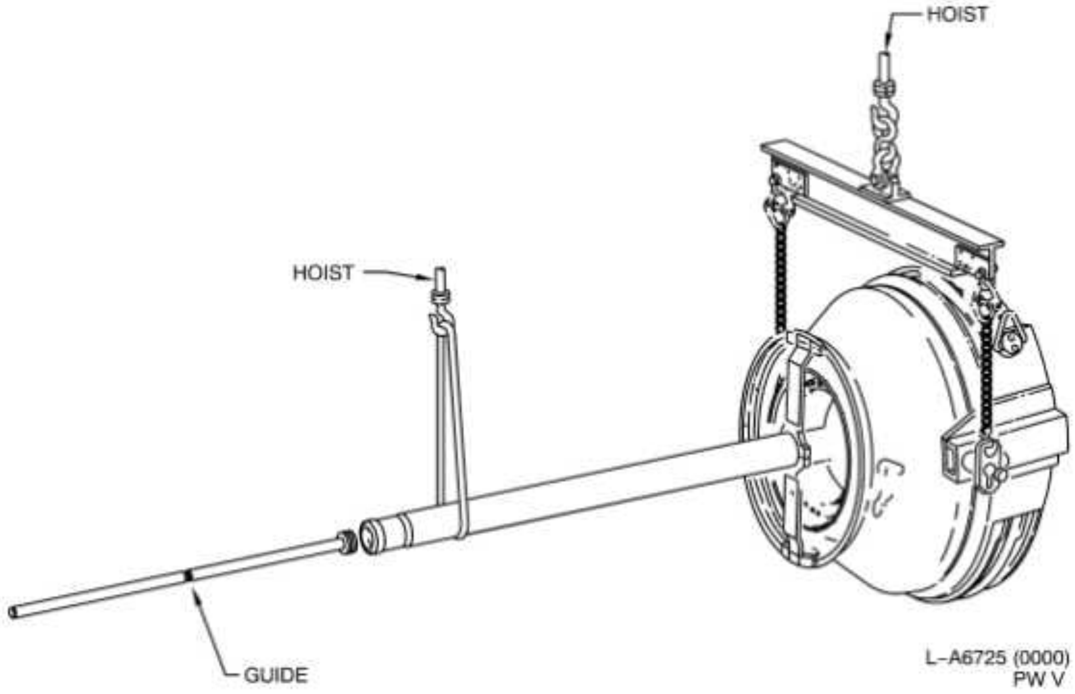
Front Compressor Drive Turbine Shaft Lubrication Areas
Figure 405
(Task 72−00−53−420−002)


ADAPTER
TURBINE SHAFT COUPLING
ADAPTER
TURBINE SHAFT COUPLING
CLAMP
FAN NUT
INSTALLATION OF ADAPTER WITH FAN NUT AND TURBINE SHAFT COUPLING
ADAPTER
CLAMP
FRONT COMPRESSOR HUB
INSTALLATION OF ADAPTER WITHOUT TURBINE SHAFT COUPLING
L−A6231 (0000)
PW V

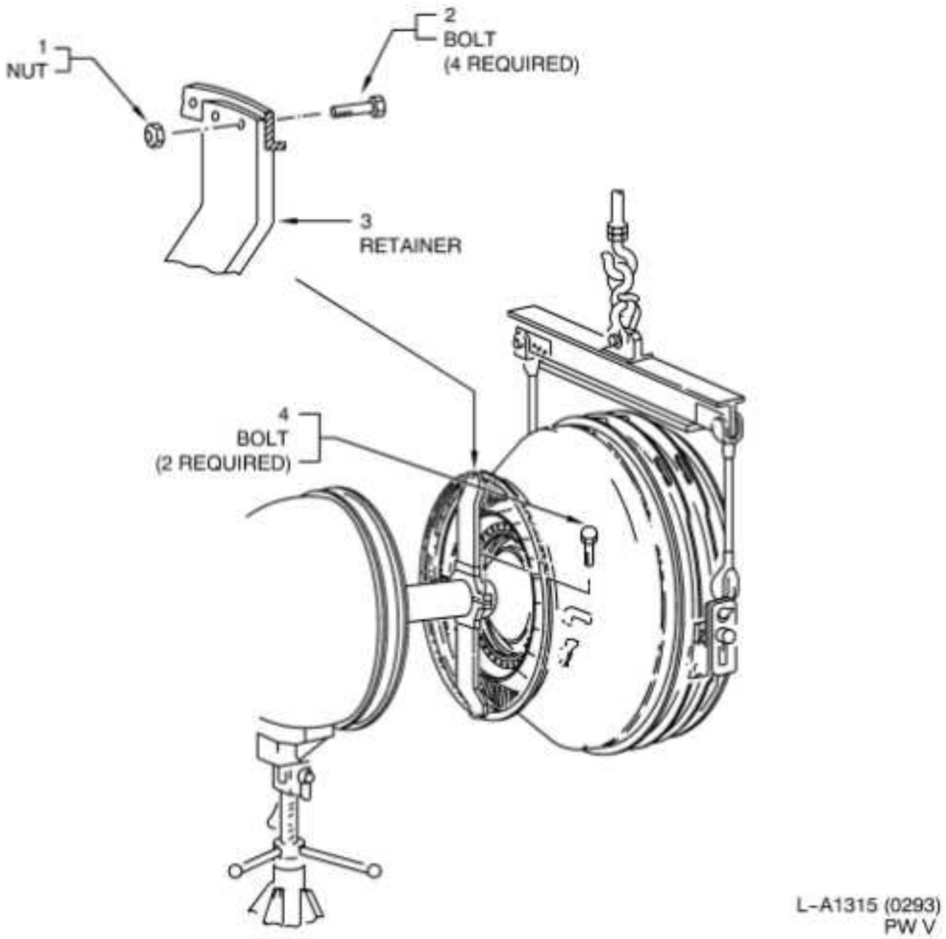
PWA 85785 Adapter Installation
Figure 406
(Task 72−00−53−420−002)


ADAPTER
CLAMP
NO.1 BEARING SUPPORT
VIEW SHOWING ADAPTER INSTALLED
L−A6532 (0000)
PW V

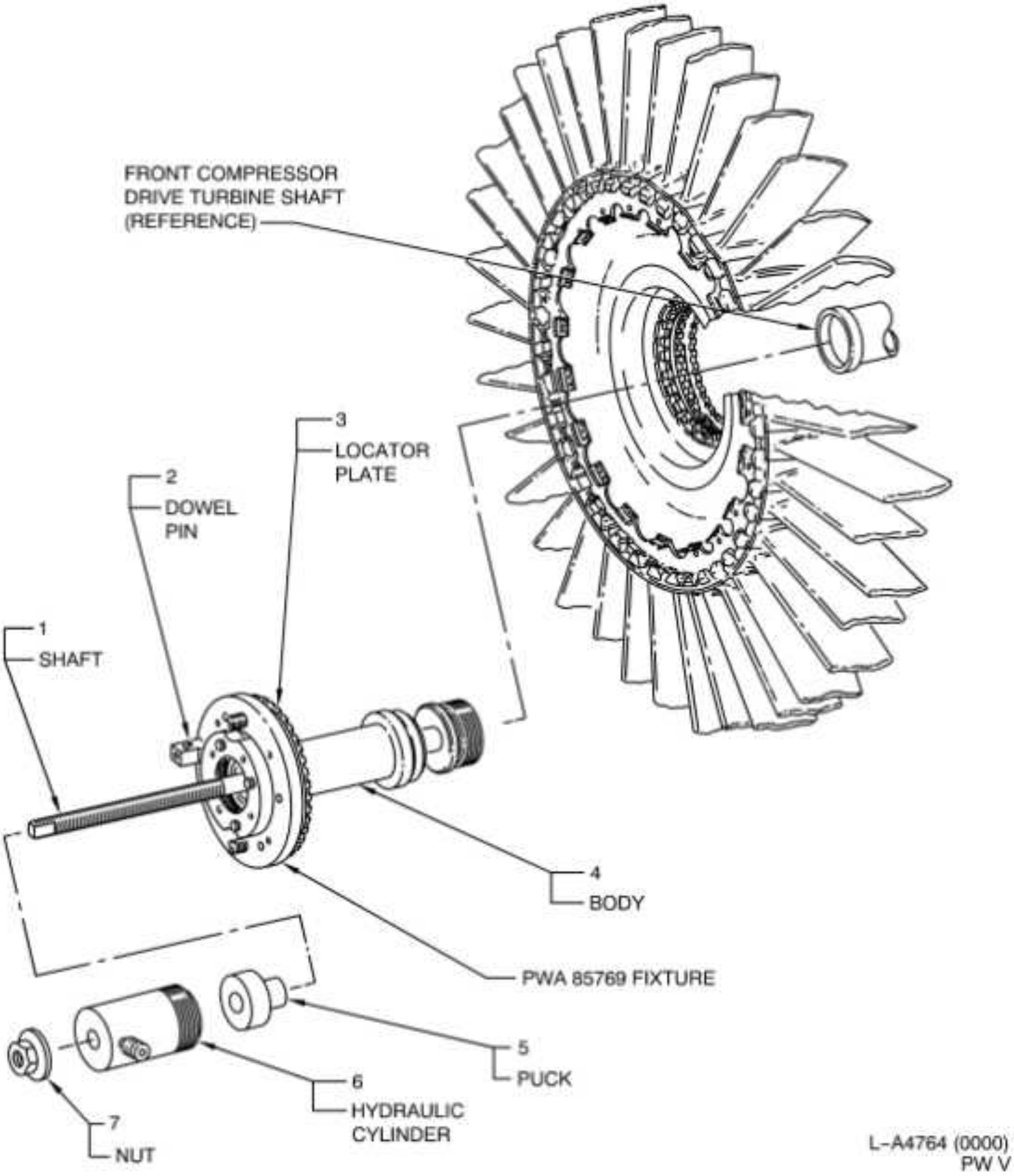
PWA 86210 Adapter Installation
Figure 407
(Task 72−00−53−420−002)


HOIST
HOIST
GUIDE
L−A6725 (0000)
PW V

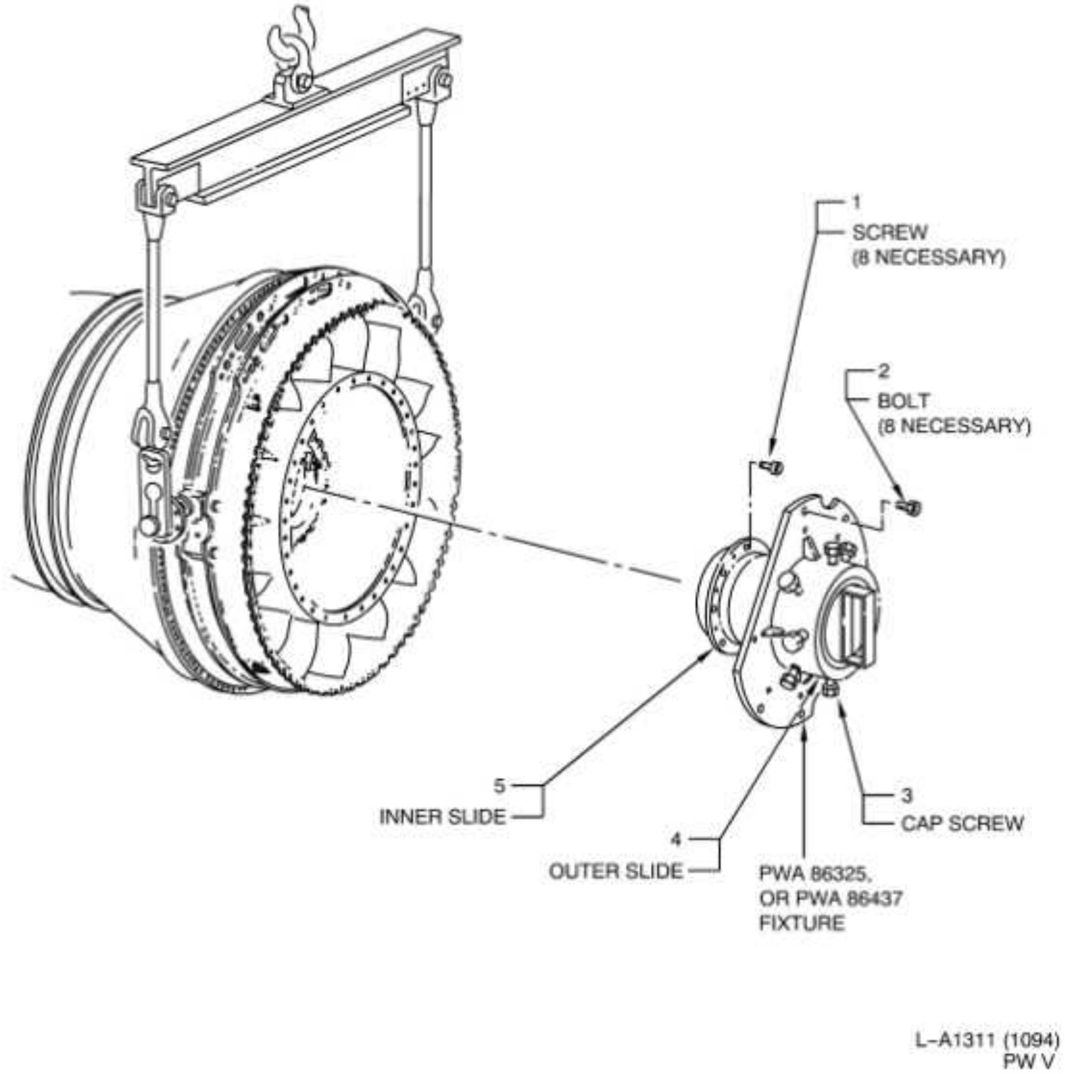
PWA 88204 Guide Installation
Figure 408
(Task 72−00−53−420−002)


1
NUT
2
BOLT
(4 REQUIRED)
3
RETAINER
4
BOLT
(2 REQUIRED)
L−A1315 (0293)
PW V

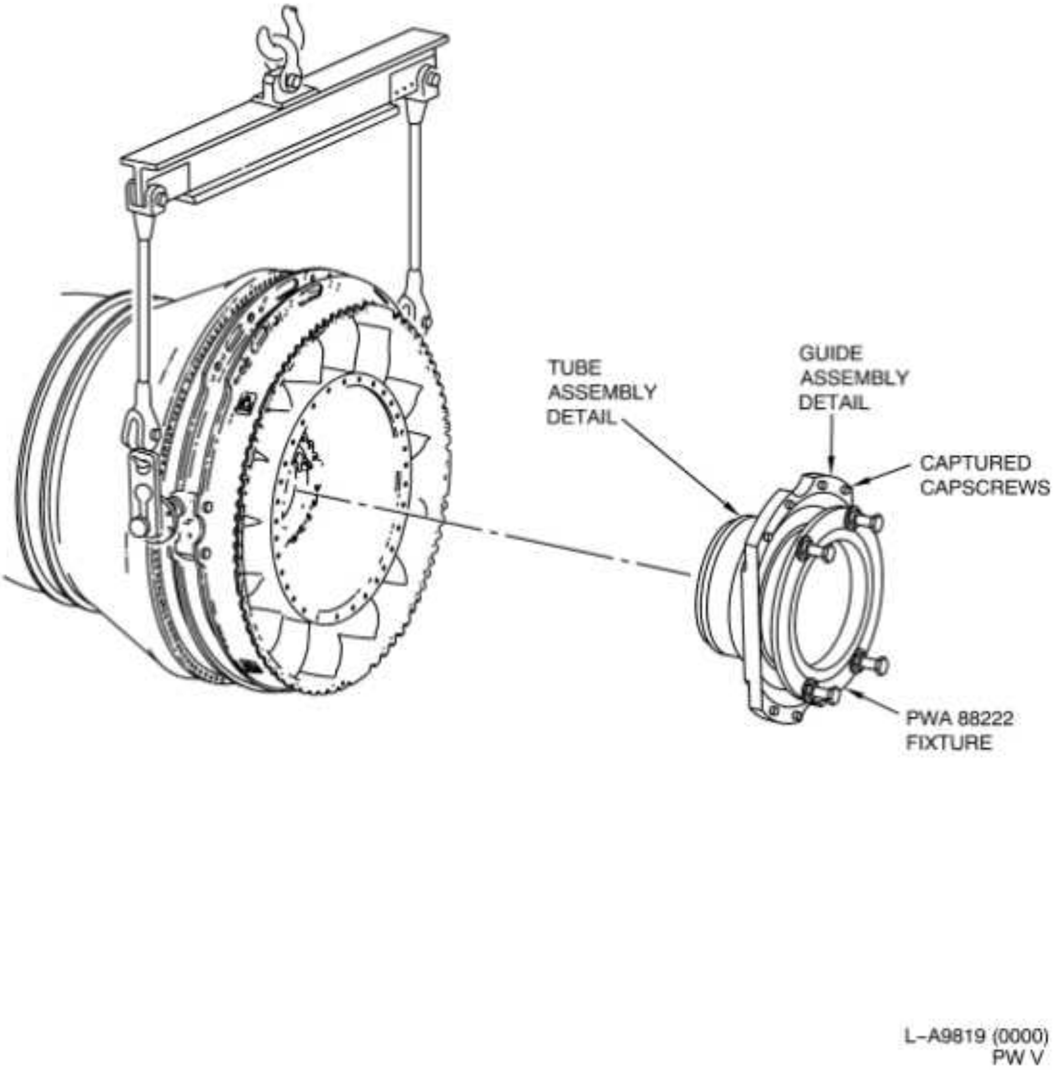
Low Pressure Turbine Front Retainer Removal
Figure 409
(Task 72−00−53−420−002)


FRONT COMPRESSOR DRIVE TURBINE SHAFT (REFERENCE)
3
LOCATOR PLATE
2
DOWEL PIN
1
SHAFT
4
BODY
PWA 85769 FIXTURE
5
PUCK
6
HYDRAULIC CYLINDER
7
NUT
L-A4764 (0000)
PW V

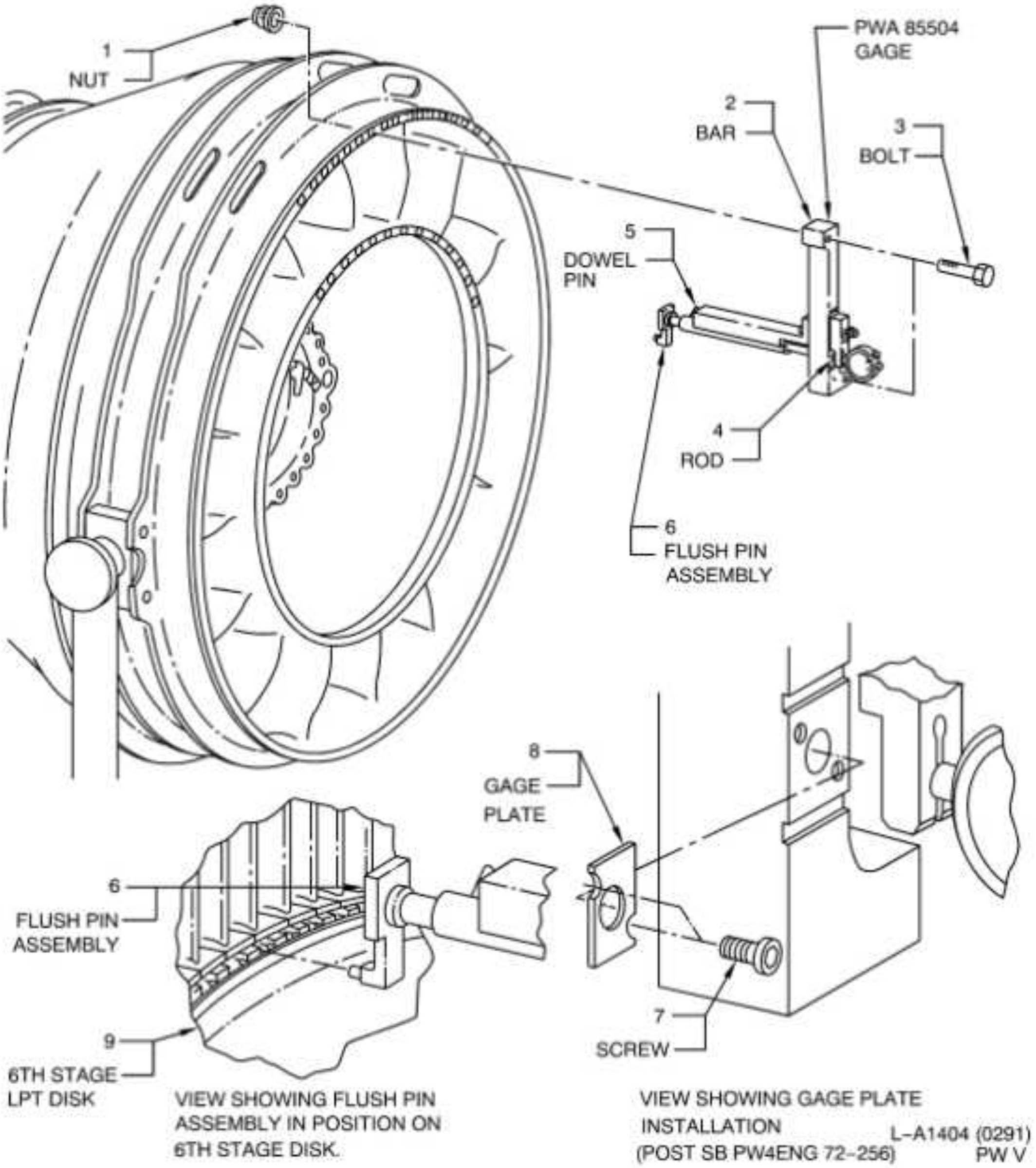
Low Pressure Turbine And Exhaust Case Installation
Figure 410
(Task 72−00−53−420−002)


1
SCREW
(8 NECESSARY)
2
BOLT
(8 NECESSARY)
3
CAP SCREW
4
OUTER SLIDE
5
INNER SLIDE
PWA 86325,
OR PWA 86437
FIXTURE
L−A1311 (1094)
PW V

Low Pressure Turbine Rear Retainer Removal
Figure 411 (Sheet 1)
(Task 72−00−53−420−002)

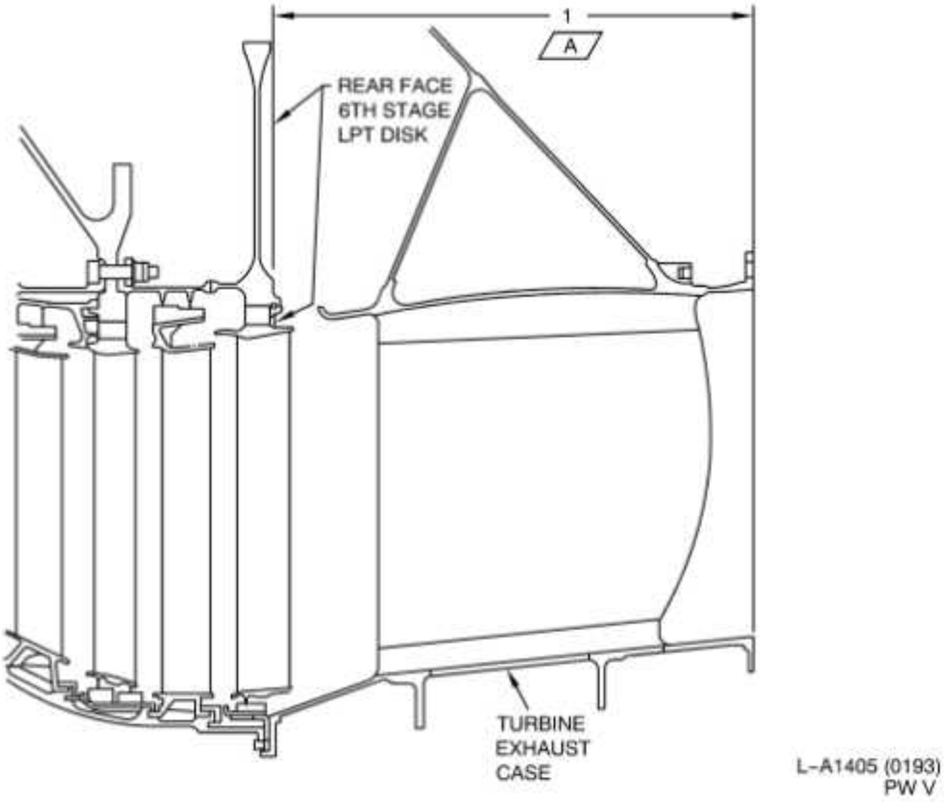

TUBE
ASSEMBLY
DETAIL
GUIDE
ASSEMBLY
DETAIL
CAPTURED
CAPSCREWS
PWA 88222
FIXTURE
L−A9819 (0000)
PW V

Low Pressure Turbine Rear Retainer Removal
Figure 411 (Sheet 2)
(Task 72−00−53−420−002)


1
NUT
PWA 85504
GAGE
2
BAR
3
BOLT
5
DOWEL
PIN
4
ROD
6
FLUSH PIN
ASSEMBLY
8
GAGE
PLATE
6
FLUSH PIN
ASSEMBLY
9
6TH STAGE
LPT DISK
7
SCREW
VIEW SHOWING FLUSH PIN
ASSEMBLY IN POSITION ON
6TH STAGE DISK.
VIEW SHOWING GAGE PLATE
INSTALLATION
(POST SB PW4ENG 72-256)
L-A1404 (0291)
PW V

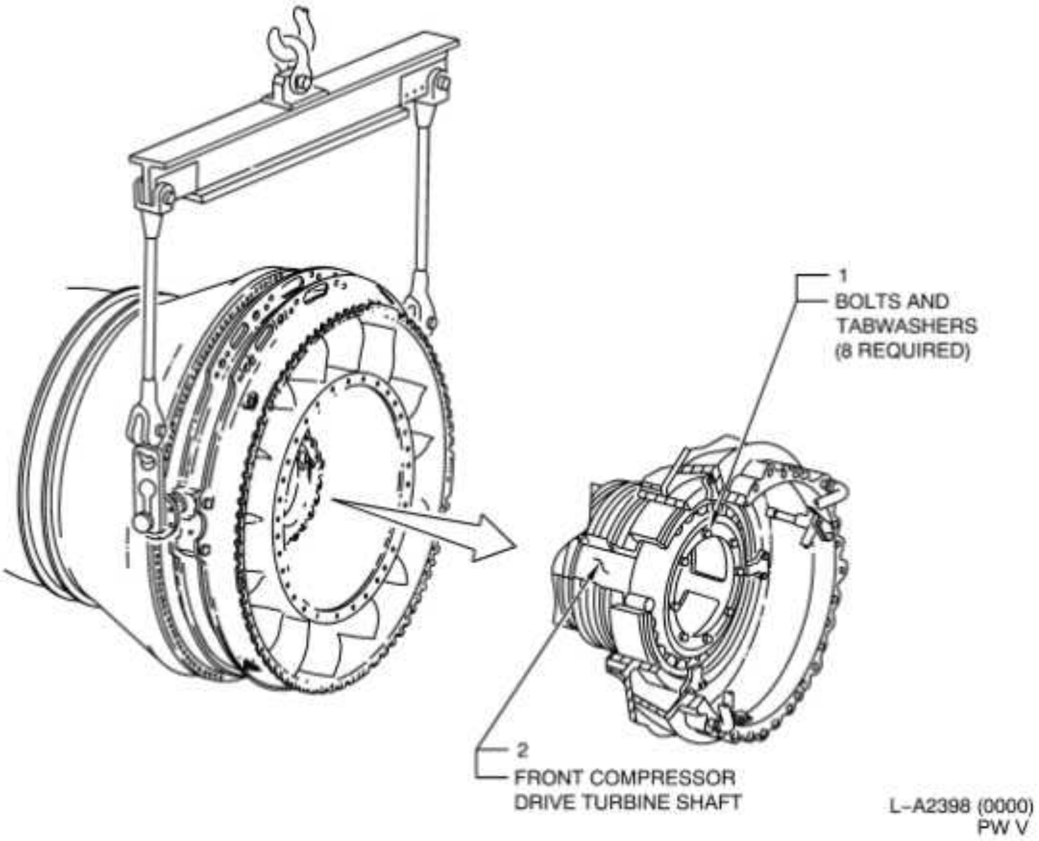
Low Pressure Turbine Axial Position Check
Figure 412
(Task 72−00−53−420−002)

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−08

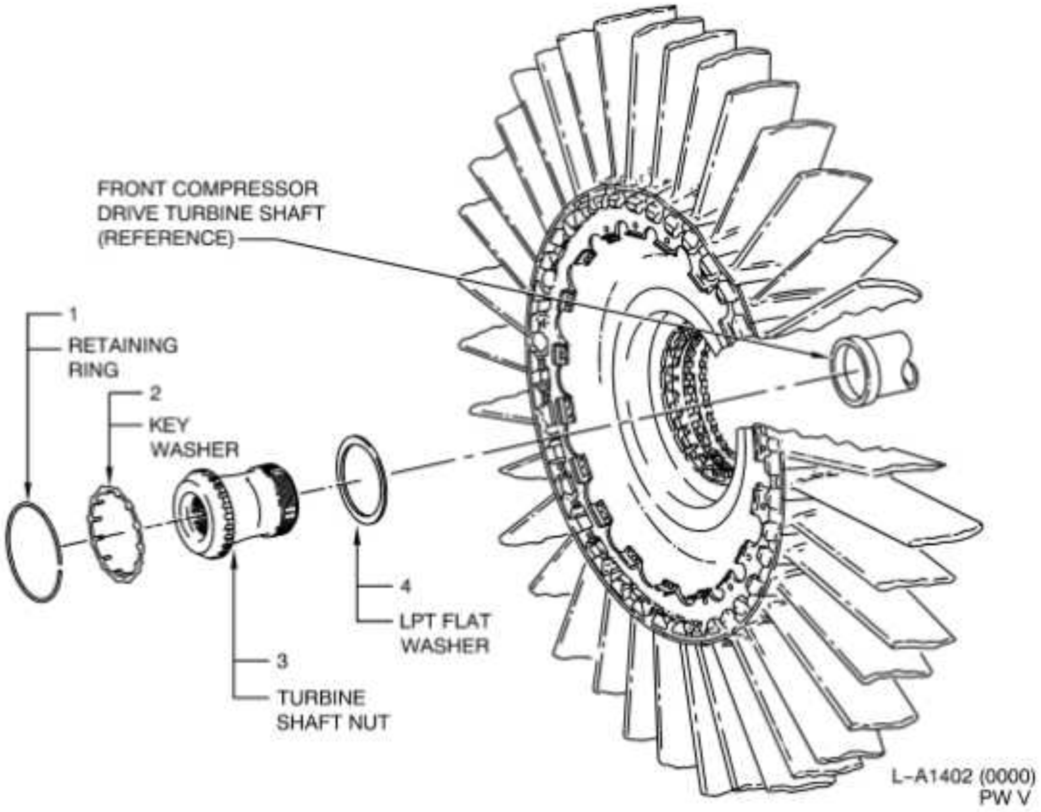

1
A
REAR FACE 6TH STAGE LPT DISK
TURBINE EXHAUST CASE
L−A1405 (0193)
PW V

1. (Reference 847) (Pre SB PW4ENG 72−256) 12.355 − 12.405 Inches
   (313.82 − 315.09 mm) Distance A
   (Reference 851) (Post SB PW4ENG 72−256) 12.305 − 12.355 Inches
   (312.55 − 313.82 mm) Distance A

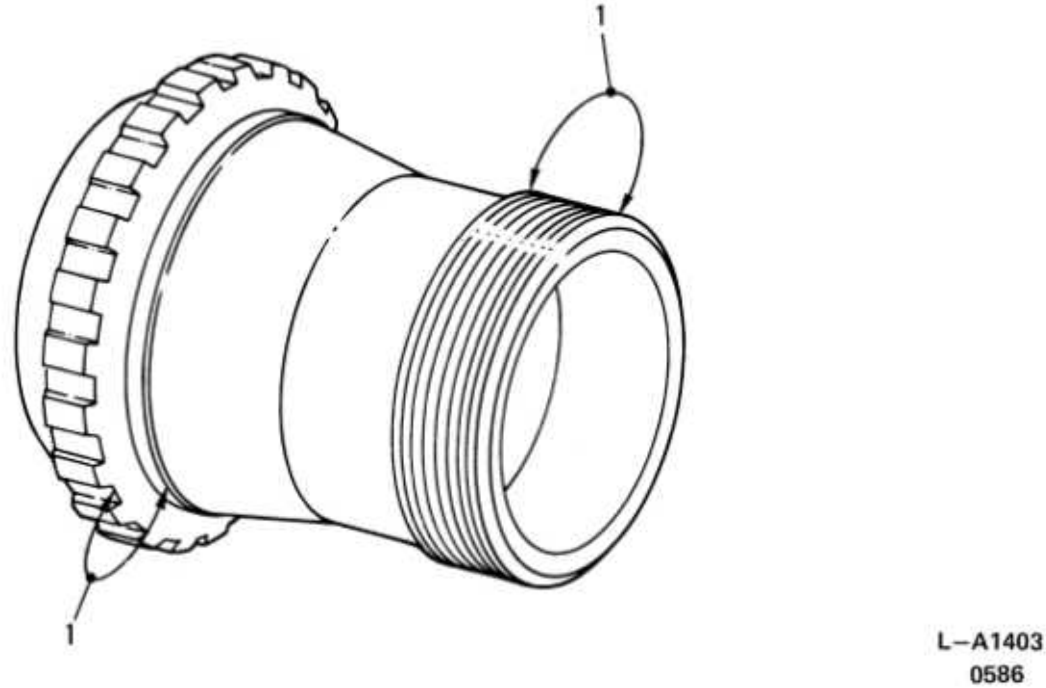
Low Pressure Turbine Axial Position Check
Figure 413
(Task 72−00−53−420−002)


1
BOLTS AND
TABWASHERS
(8 REQUIRED)
2
FRONT COMPRESSOR
DRIVE TURBINE SHAFT
L−A2398 (0000)
PW V

Bearing Retaining Plate Bolts And Tabwashers Installation
Figure 414
(Task 72−00−53−420−002)

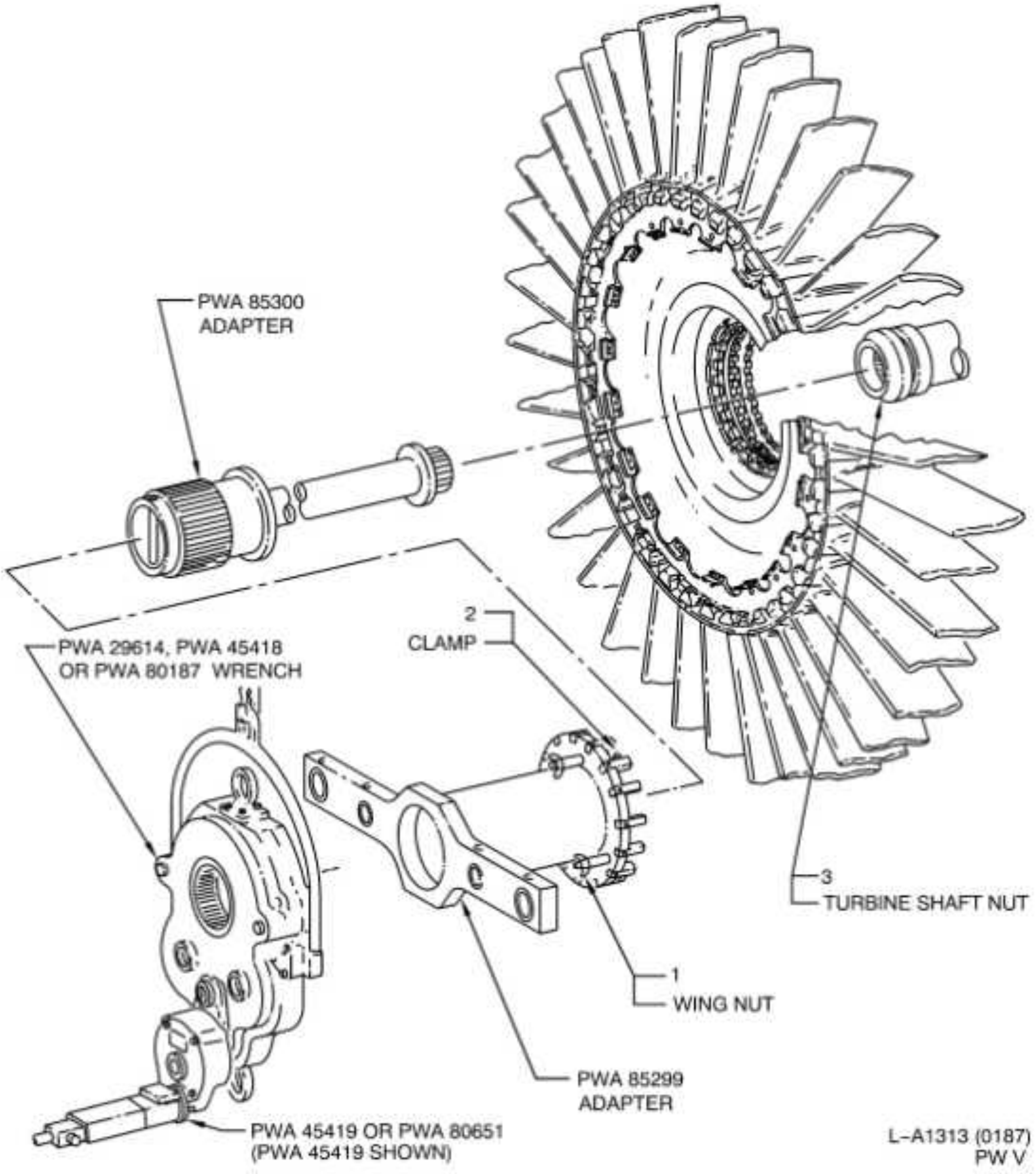

FRONT COMPRESSOR
DRIVE TURBINE SHAFT
(REFERENCE)
1
RETAINING
RING
2
KEY
WASHER
3
TURBINE
SHAFT NUT
4
LPT FLAT
WASHER
L-A1402 (0000)
PW V

Turbine Shaft Nut Installation
Figure 415
(Task 72−00−53−420−002)

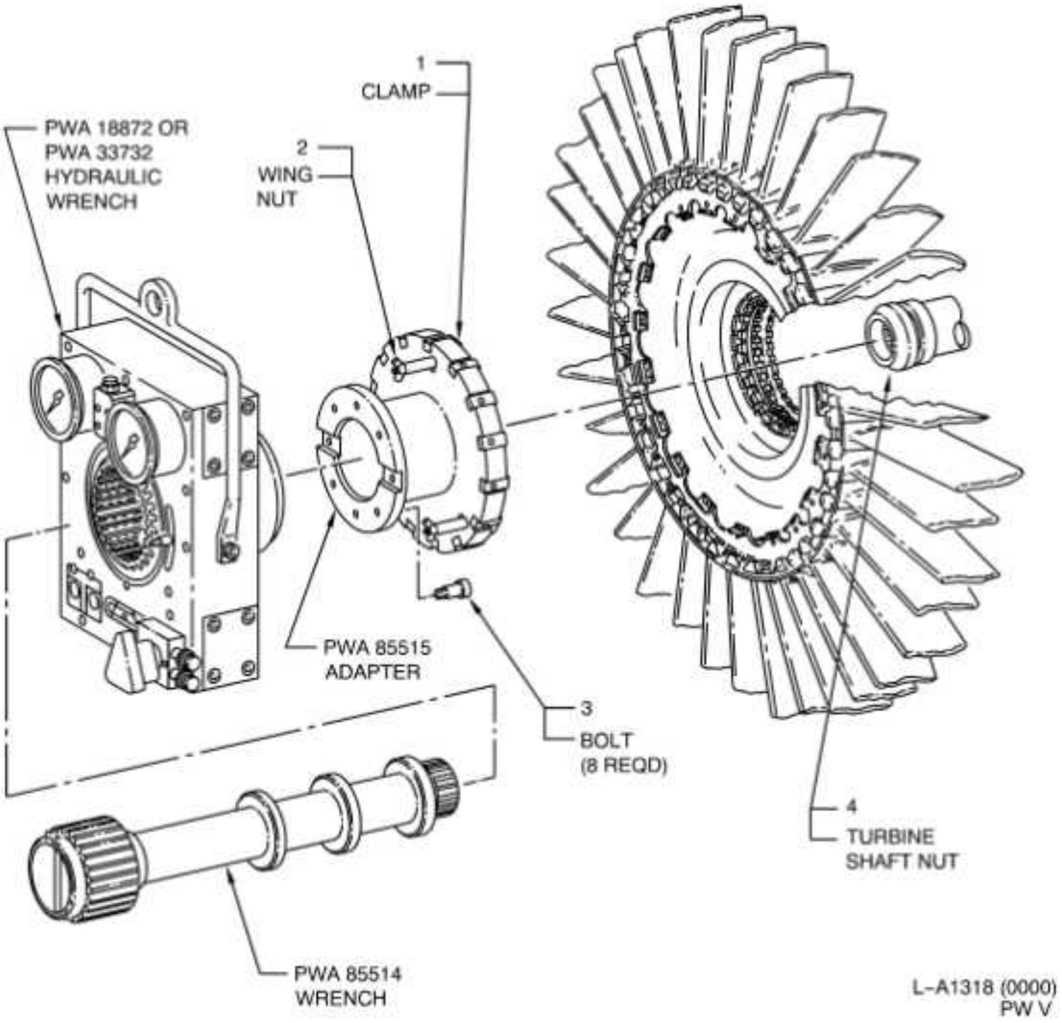


1. Treat Enclosed Area. See Text.

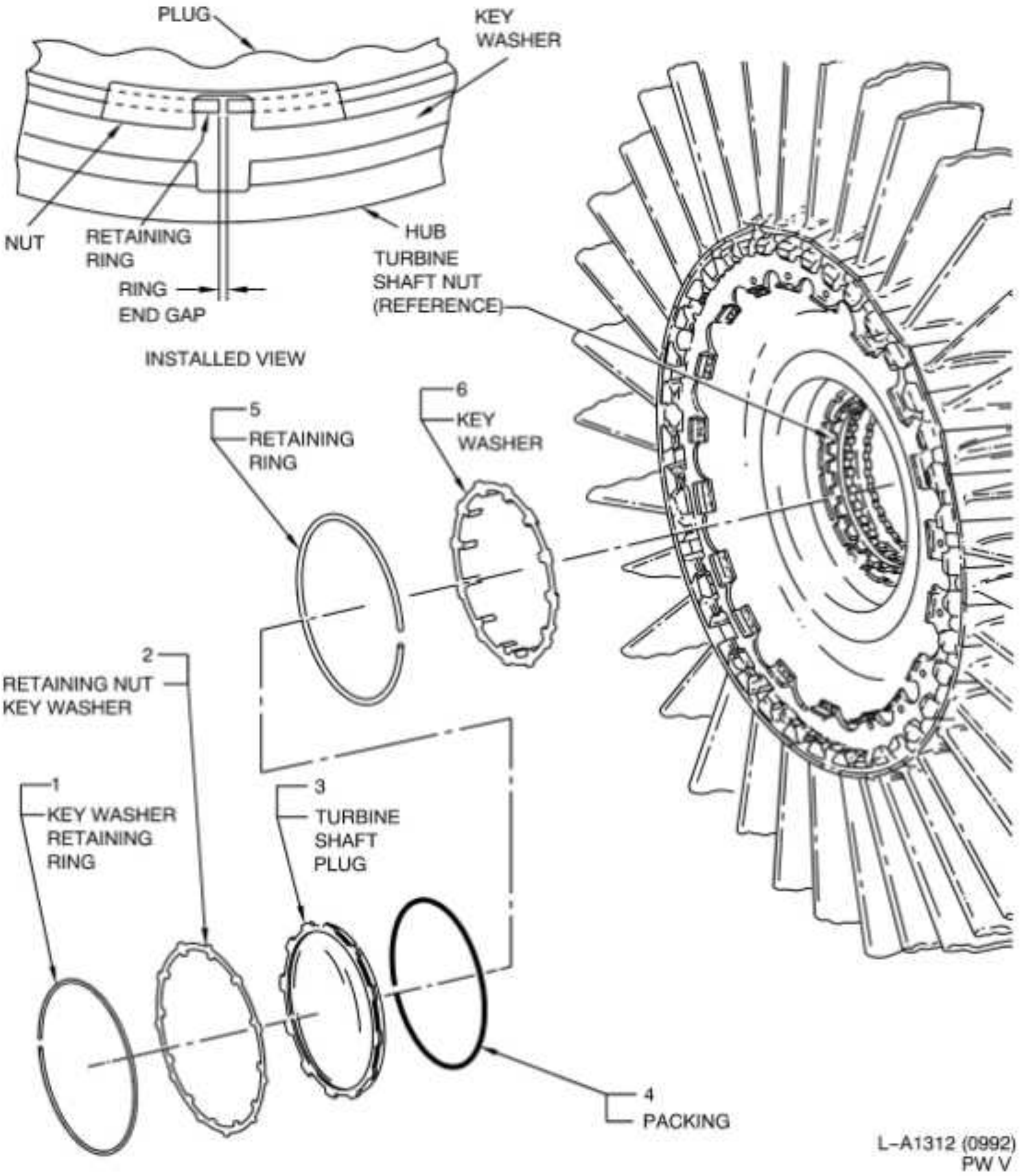
Turbine Shaft Nut Antigalling Compound Application
Figure 416
(Task 72−00−53−420−002)


PWA 85300
ADAPTER
2
CLAMP
PWA 29614, PWA 45418
OR PWA 80187 WRENCH
3
TURBINE SHAFT NUT
1
WING NUT
PWA 85299
ADAPTER
PWA 45419 OR PWA 80651
(PWA 45419 SHOWN)
L−A1313 (0187)
PW V

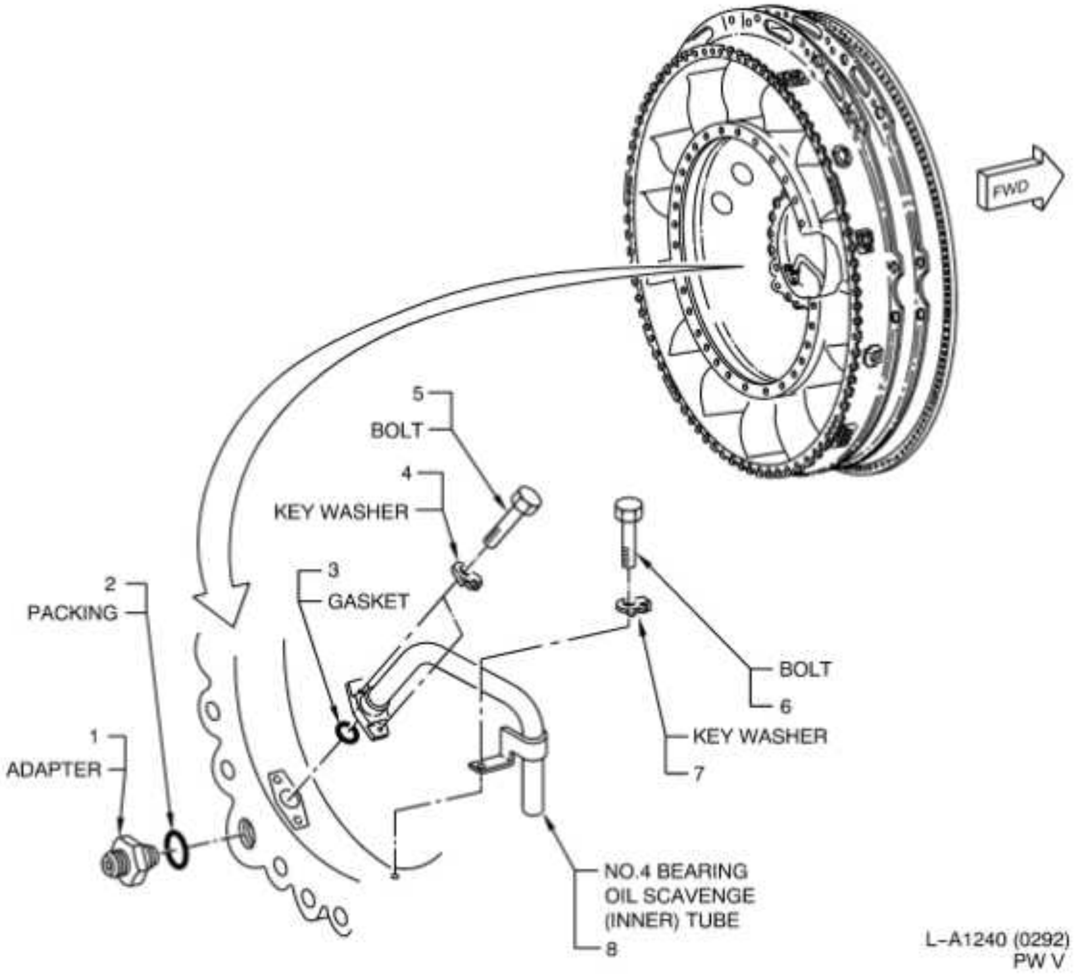
Turbine Shaft Nut Torquing (Mechanical Wrench)
Figure 417
(Task 72−00−53−420−002)


1
CLAMP
PWA 18872 OR
PWA 33732
HYDRAULIC
WRENCH
2
WING
NUT
PWA 85515
ADAPTER
3
BOLT
(8 REQD)
4
TURBINE
SHAFT NUT
PWA 85514
WRENCH
L−A1318 (0000)
PW V

Turbine Shaft Nut Torquing (Hydraulic Wrench)
Figure 418
(Task 72−00−53−420−002)

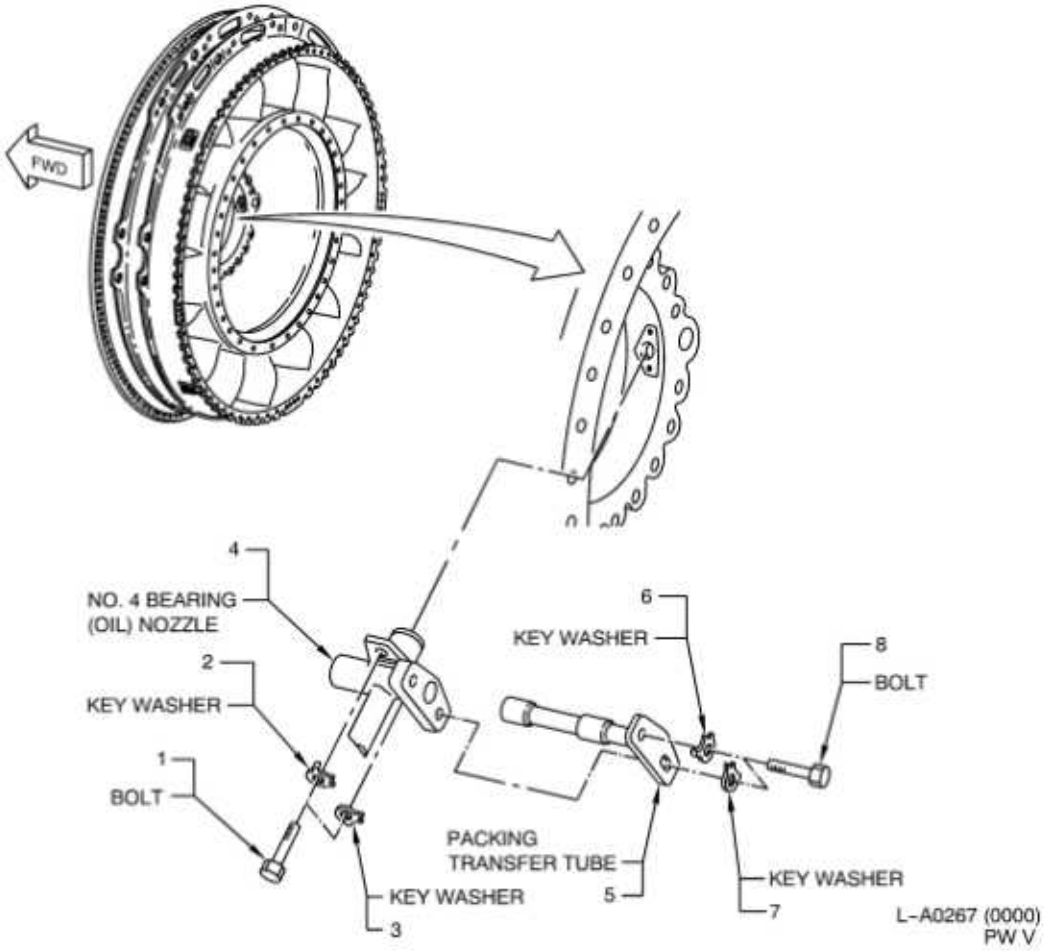

PLUG
KEY WASHER
NUT
RETAINING RING
HUB
RING END GAP
TURBINE SHAFT NUT (REFERENCE)
INSTALLED VIEW
5 RETAINING RING
6 KEY WASHER
2 RETAINING NUT KEY WASHER
1 KEY WASHER RETAINING RING
3 TURBINE SHAFT PLUG
4 PACKING
L-A1312 (0992)
PW V

Turbine Shaft Plug Installation
Figure 419
(Task 72−00−53−420−002)

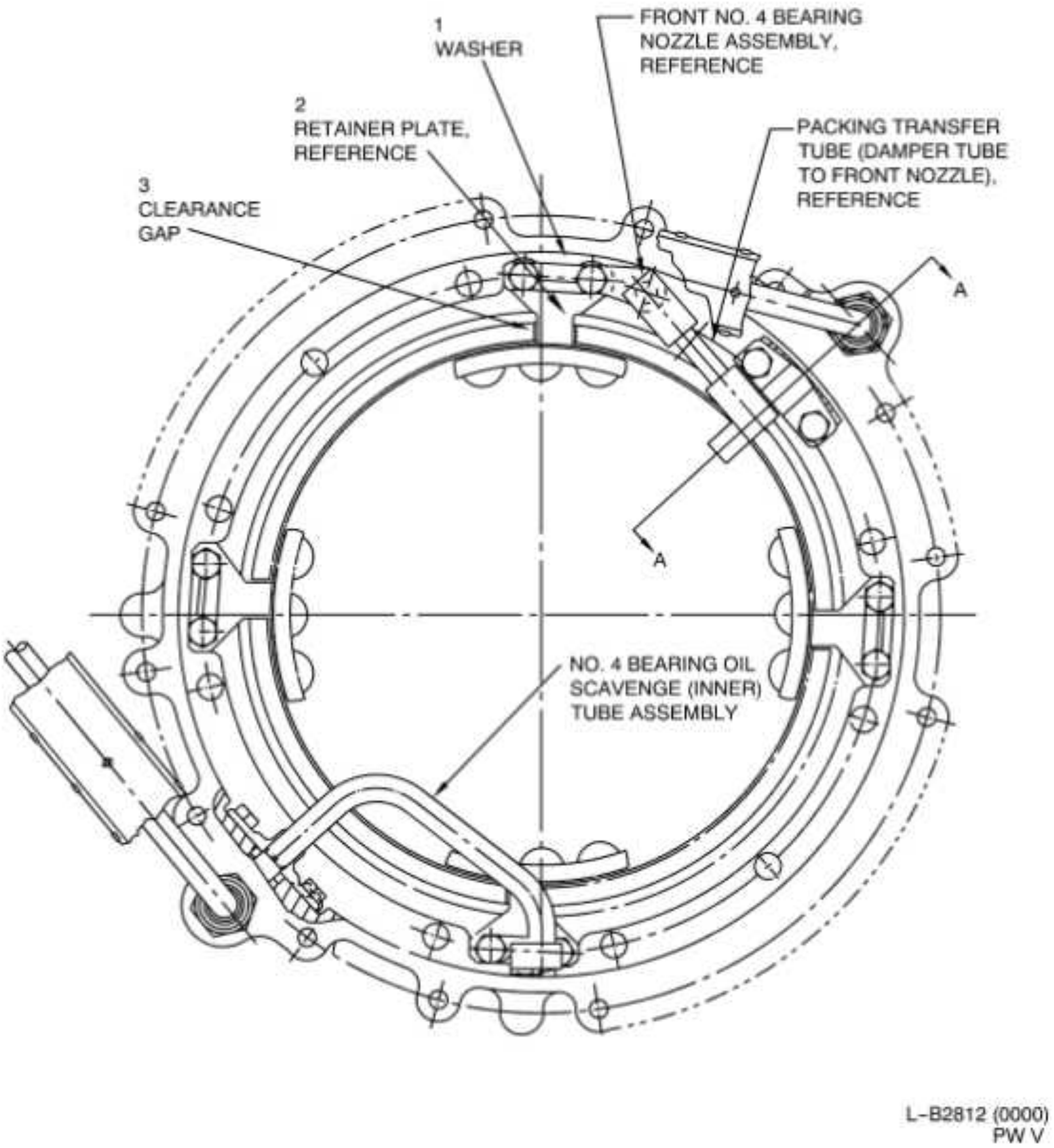

FWD
5
BOLT
4
KEY WASHER
3
GASKET
2
PACKING
1
ADAPTER
BOLT
6
KEY WASHER
7
NO.4 BEARING
OIL SCAVENGE
(INNER) TUBE
8
L−A1240 (0292)
PW V

No. 4 Bearing Scavenge Tubes Installation
Figure 420
(Task 72−00−53−420−002)

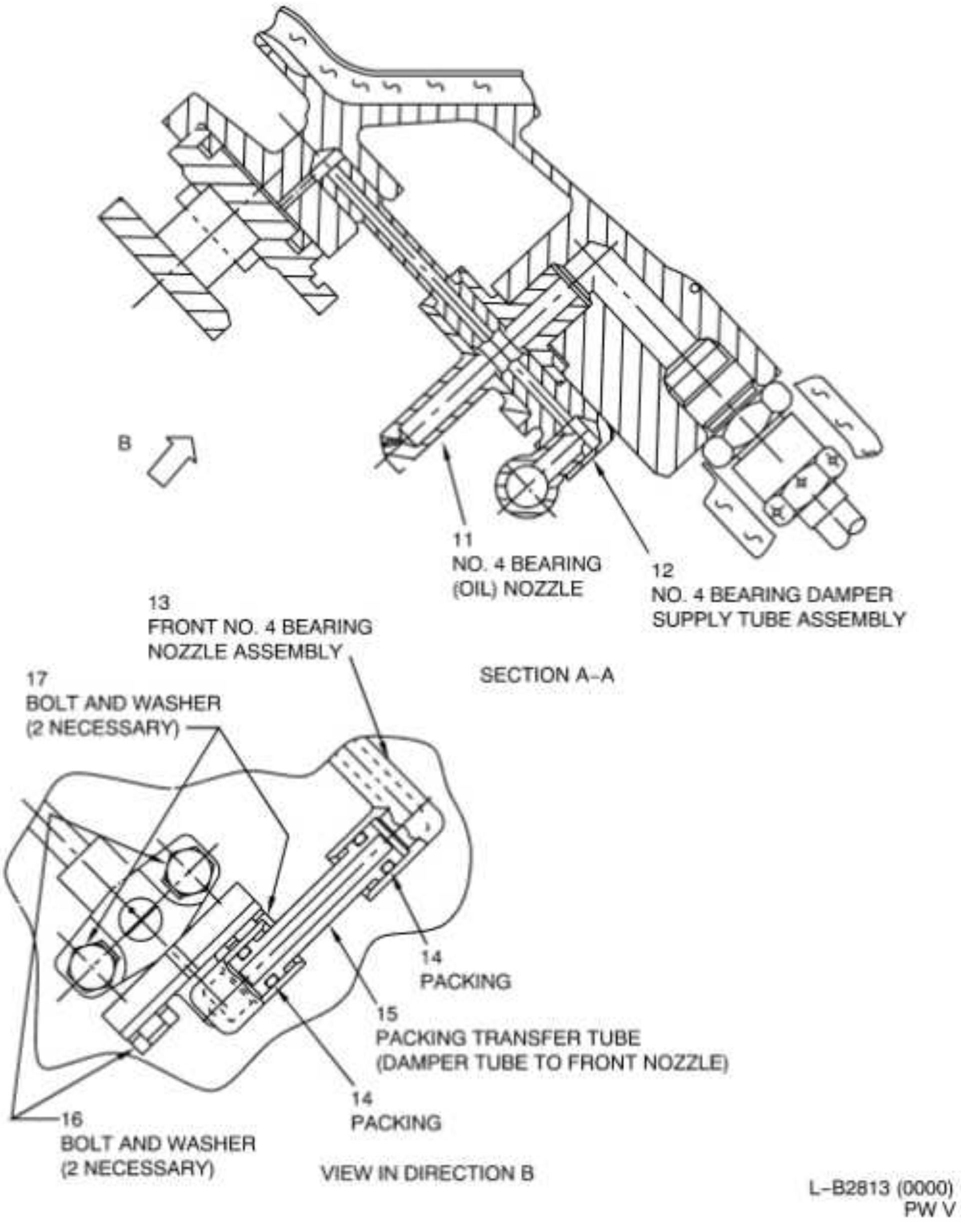
ENGINE GENERAL – LOW PRESSURE TURBINE (LPT) – INSTALLATION-08


FWD
4
NO. 4 BEARING
(OIL) NOZZLE
2
KEY WASHER
1
BOLT
KEY WASHER
3
6
KEY WASHER
8
BOLT
PACKING
TRANSFER TUBE
5
KEY WASHER
7
L-A0267 (0000)
PW V

No. 4 Bearing (Oil) Nozzle And Front
Nozzle Installation (Pre SB PW4ENG 72-472)
Figure 421
(Task 72-00-53-420-002)

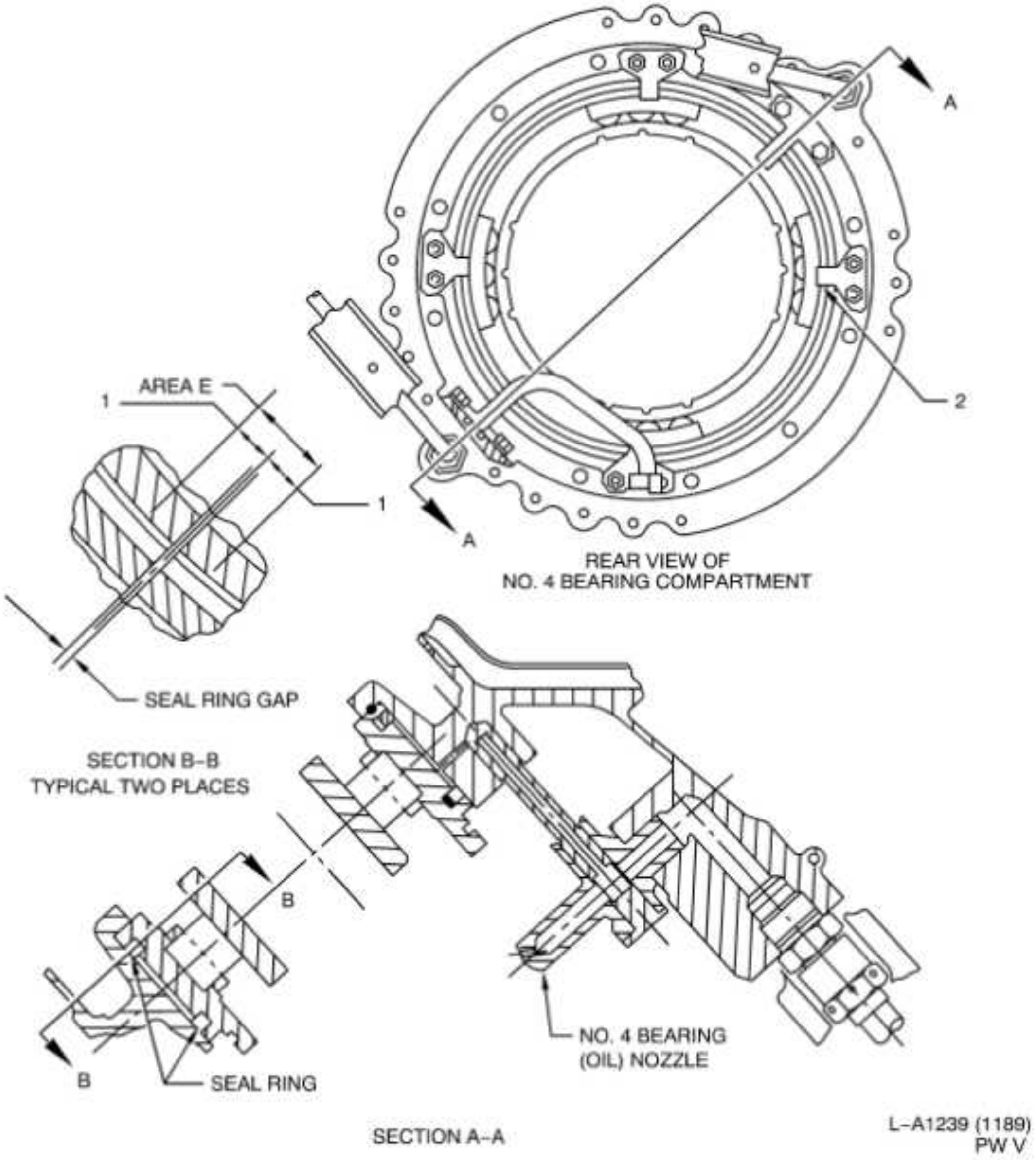

1
WASHER
FRONT NO. 4 BEARING NOZZLE ASSEMBLY, REFERENCE
2
RETAINER PLATE, REFERENCE
PACKING TRANSFER TUBE (DAMPER TUBE TO FRONT NOZZLE), REFERENCE
3
CLEARANCE GAP
A
A
NO. 4 BEARING OIL SCAVENGE (INNER) TUBE ASSEMBLY
L−B2812 (0000)
PW V

No. 4 Bearing (Oil) Nozzle And Front
Nozzle Installation (Post SB PW4ENG 72−472)
Figure 422 (Sheet 1)
(Task 72−00−53−420−002)


B
11
NO. 4 BEARING
(OIL) NOZZLE
12
NO. 4 BEARING DAMPER
SUPPLY TUBE ASSEMBLY
13
FRONT NO. 4 BEARING
NOZZLE ASSEMBLY
SECTION A−A
17
BOLT AND WASHER
(2 NECESSARY)
14
PACKING
15
PACKING TRANSFER TUBE
(DAMPER TUBE TO FRONT NOZZLE)
14
PACKING
16
BOLT AND WASHER
(2 NECESSARY)
VIEW IN DIRECTION B
L−B2813 (0000)
PW V

No. 4 Bearing (Oil) Nozzle And Front
Nozzle Installation (Post SB PW4ENG 72−472)
Figure 422 (Sheet 2)
(Task 72−00−53−420−002)

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−08

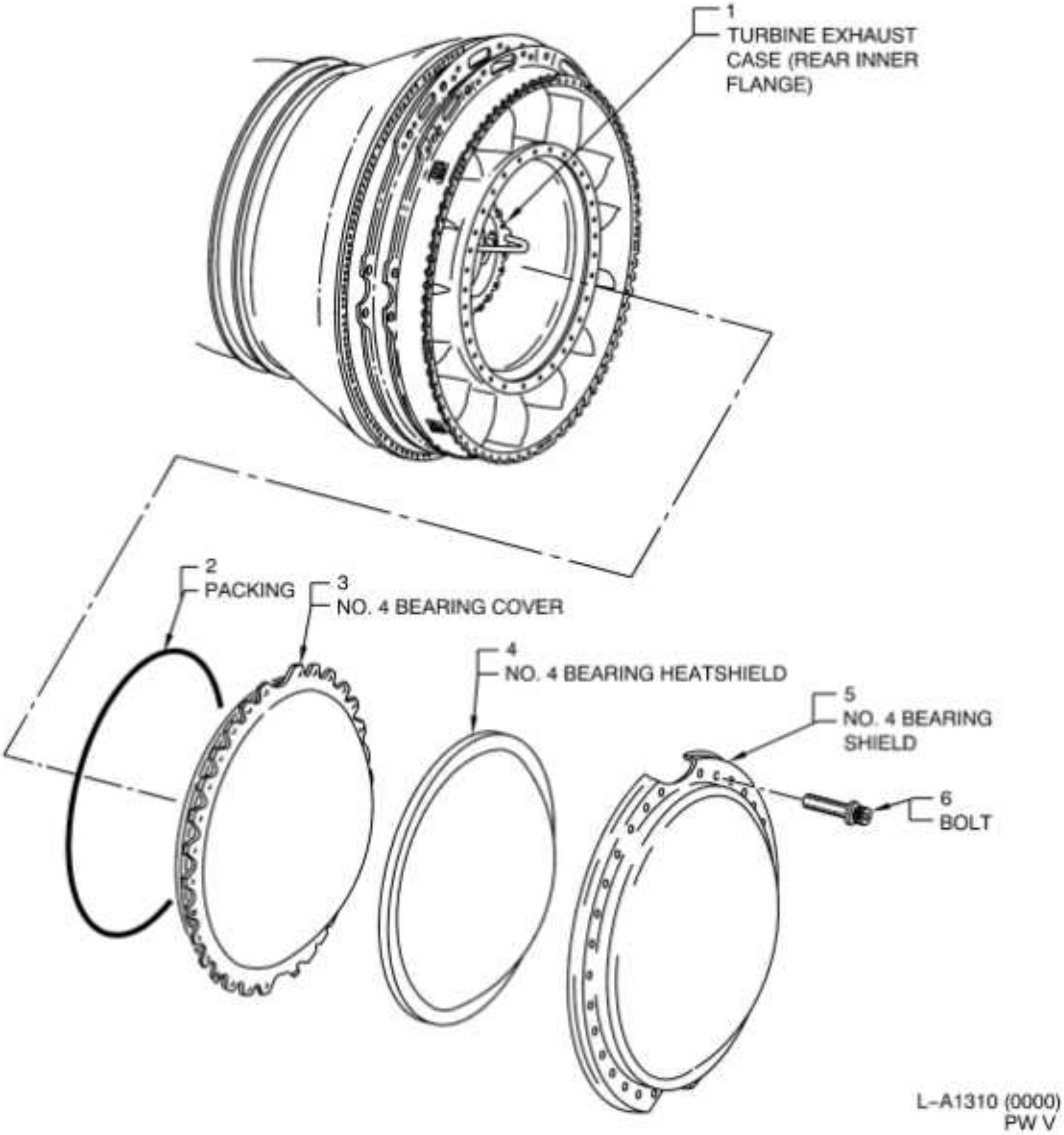

A
2
AREA E
1
1
A
REAR VIEW OF
NO. 4 BEARING COMPARTMENT
SEAL RING GAP
SECTION B−B
TYPICAL TWO PLACES
B
B
SEAL RING
NO. 4 BEARING
(OIL) NOZZLE
SECTION A−A
L−A1239 (1189)
PW V

No. 4 Bearing Outer Race Installation
Figure 423
(Task 72−00−53−420−002)

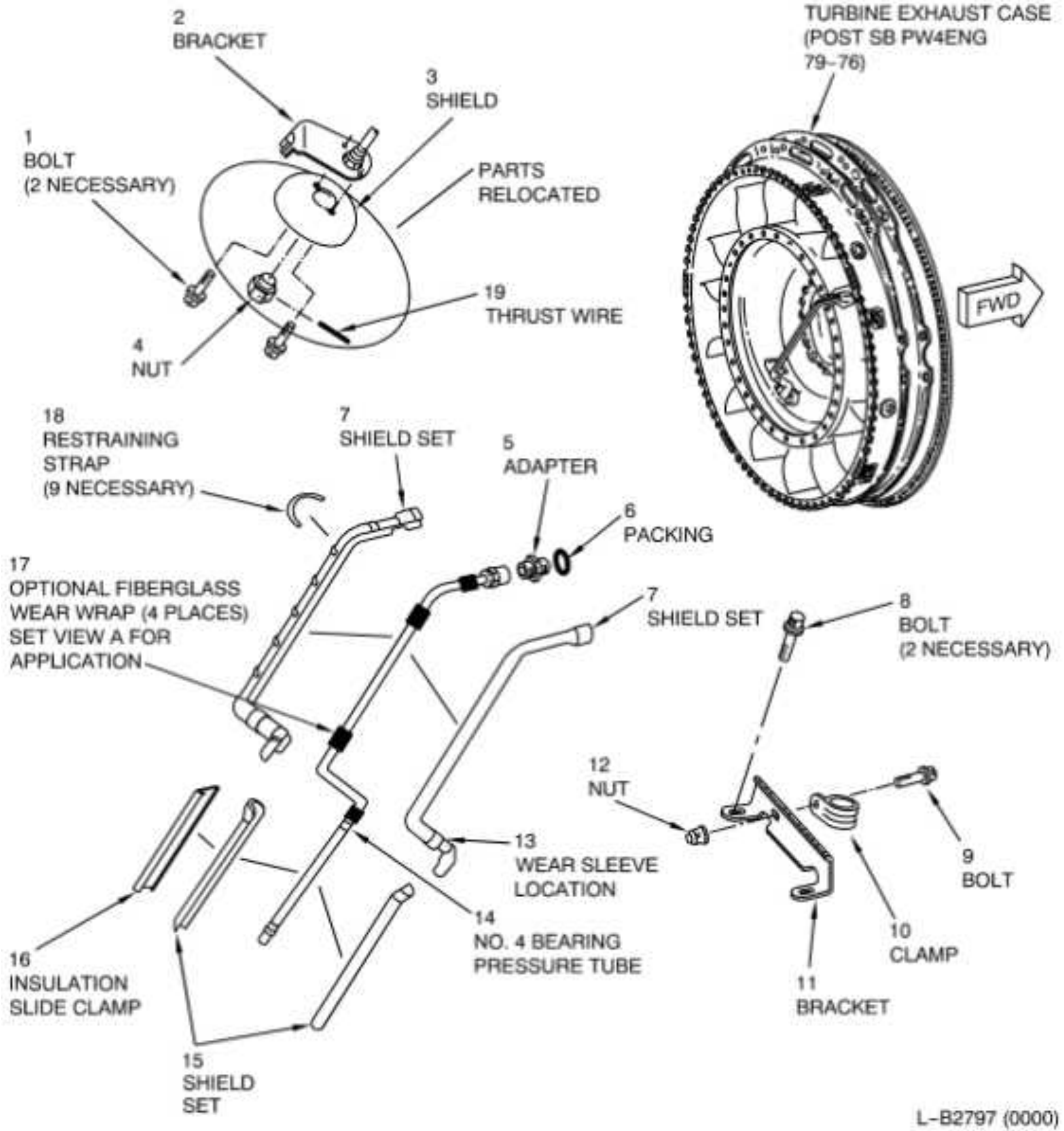
ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−08

1. 0.500 Inch (12.700 mm) Maximum
2. (Reference 90) 0.010 − 0.050 Inch (0.254 − 1.270 mm), Four Locations

Key to Figure 423


1
TURBINE EXHAUST CASE (REAR INNER FLANGE)
2
PACKING
3
NO. 4 BEARING COVER
4
NO. 4 BEARING HEATSHIELD
5
NO. 4 BEARING SHIELD
6
BOLT
L−A1310 (0000)
PW V

Installation Of The No. 4 Bearing Cover And Shield
Figure 424
(Task 72−00−53−420−002)


2
BRACKET
3
SHIELD
1
BOLT
(2 NECESSARY)
PARTS
RELOCATED
19
THRUST WIRE
4
NUT
TURBINE EXHAUST CASE
(POST SB PW4ENG
79–76)
FWD
18
RESTRAINING
STRAP
(9 NECESSARY)
7
SHIELD SET
5
ADAPTER
6
PACKING
17
OPTIONAL FIBERGLASS
WEAR WRAP (4 PLACES)
SET VIEW A FOR
APPLICATION
7
SHIELD SET
8
BOLT
(2 NECESSARY)
12
NUT
13
WEAR SLEEVE
LOCATION
9
BOLT
14
NO. 4 BEARING
PRESSURE TUBE
10
CLAMP
11
BRACKET
16
INSULATION
SLIDE CLAMP
15
SHIELD
SET

L-B2797 (0000)
PW V

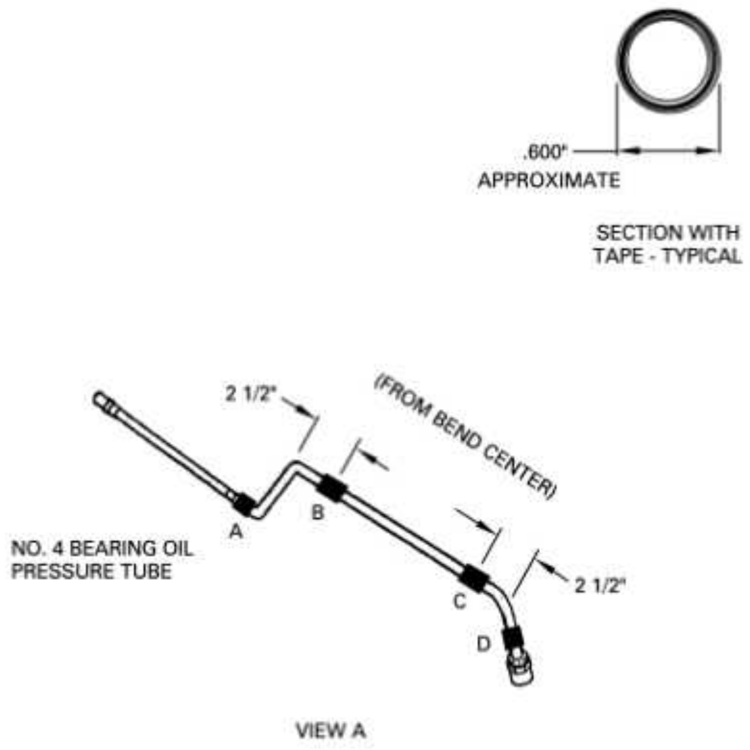
Installation Of The No. 4 Bearing
Pressure Tube (Post SB PW4ENG 79−76)
Figure 425 (Sheet 1)
(Task 72−00−53−420−002)

1. WRAP 1.00 INCH (25.400 mm) WIDE FIBERGLASS TAPE, P05-136, AT FOUR (4) LOCATIONS:

   -A & D AT TUBE ENDS AS SHOWN

   -B & C AT STRAIGHT SECTION AS SHOWN

2. WRAP TAPE TO BE 0.600 INCH DIAMETER (15.240 mm) AND ABOUT 0.100 INCH (2.54 mm) HEIGHT ABOVE TUBE SURFACE.


.600"
APPROXIMATE
SECTION WITH
TAPE - TYPICAL
2 1/2"
(FROM BEND CENTER)
NO. 4 BEARING OIL
PRESSURE TUBE
A
B
C
D
2 1/2"
VIEW A

L-B2800 (0000)

No. 4 Bearing Pressure Tube Installation Optional Chafing Wear Prevention (Post SB PW4ENG 79−76)
Figure 425 (Sheet 2)
(Task 72−00−53−420−002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - INSTALLATION-09

Task 72-00-53-420-002-002:

1. Install The Low Pressure Turbine And Turbine Exhaust Case With Shaft (Hydraulic Wrench) Deleted

A. Procedure

(1) This procedure is relocated to 72-00-53, Installation-08 (Task 72-00-53-420-002).

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - INSTALLATION-20

Task 72-00-53-420-020:

1. Install The Flange N Brackets And Hardware

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03-001	Engine Oil (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

B. Procedure

(1) Install the Flange N hardware as follows. See Figure 401 and Figure 402.

(a) Apply Engine Oil P03-001 to the bolts.

NOTE: Boltholes are numbered clockwise from the rear. The Index pin is located between boltholes 64 and 65.

(b) Install the bolts and brackets to Flange N and attach with nuts handtight only.

NOTE: Remove the work bolts and replace them with the engine bolts one at a time to keep the case seated.

NOTE: Numbers in parenthesis in the figure are the bolthole locations of the brackets.

(c) (Reference 978) Torque the Flange N bolts as follows.

1 Nuts must be tightened simultaneously in sets of two groups. Sets consist of groups number (1,2), (3,4), (5,6), (7,8), (9,10),(11,12) (13,14) and (15,16). See torque sequence specified in reference figure.

NOTE: Eight of the 14 groups consist of eight bolts each. The remaining two groups consist of nine bolts each. See reference Figure 402.

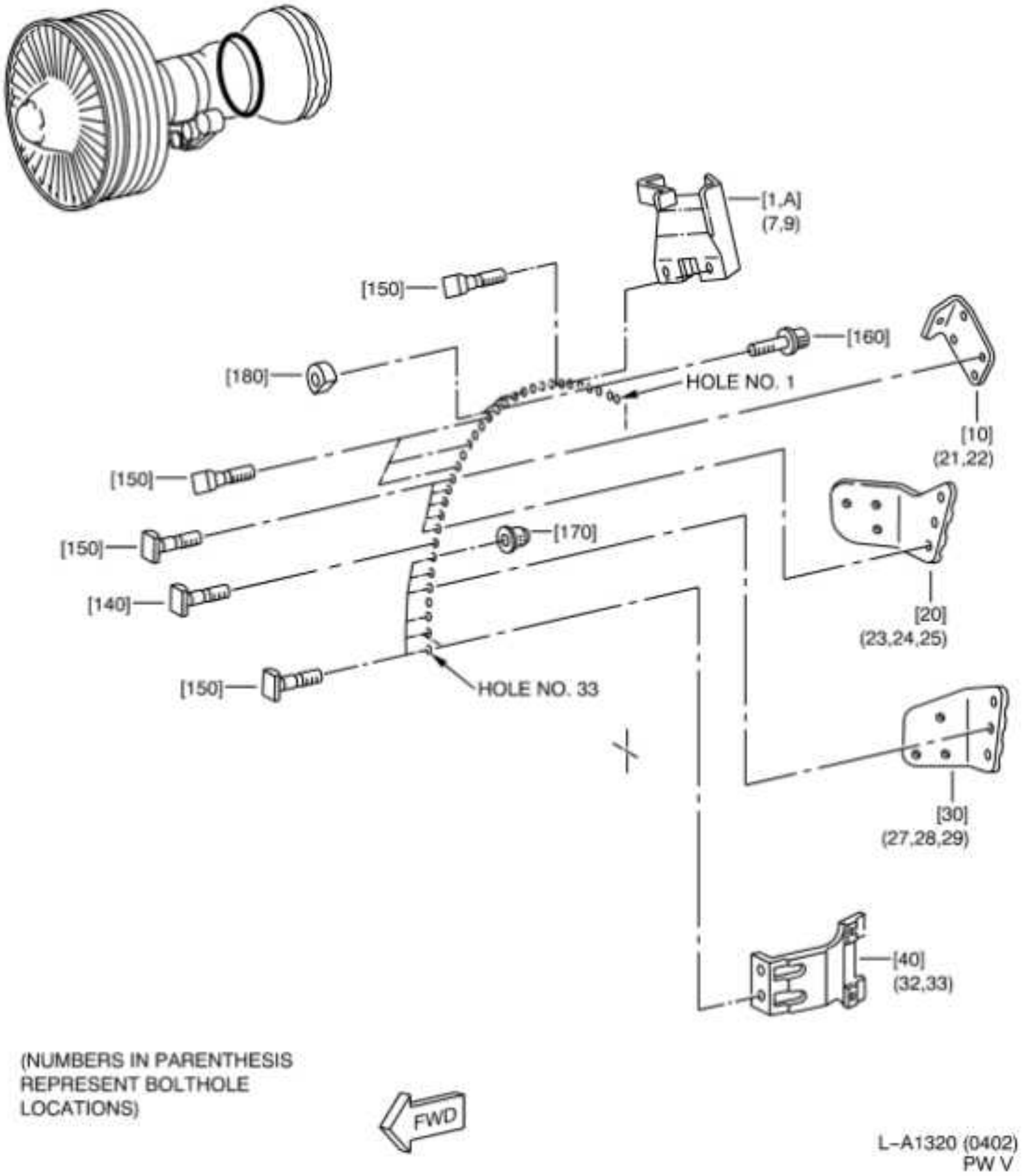
2 Tighten all sets of bolt groups described in previous step to initial torque of 75 − 100 lbf−in (8.474 − 11.298 N.m).

3 Tighten all set of bolt groups described in previous step to final torque of 180 − 200 lbf−in (20.337 − 22.597 N.m).

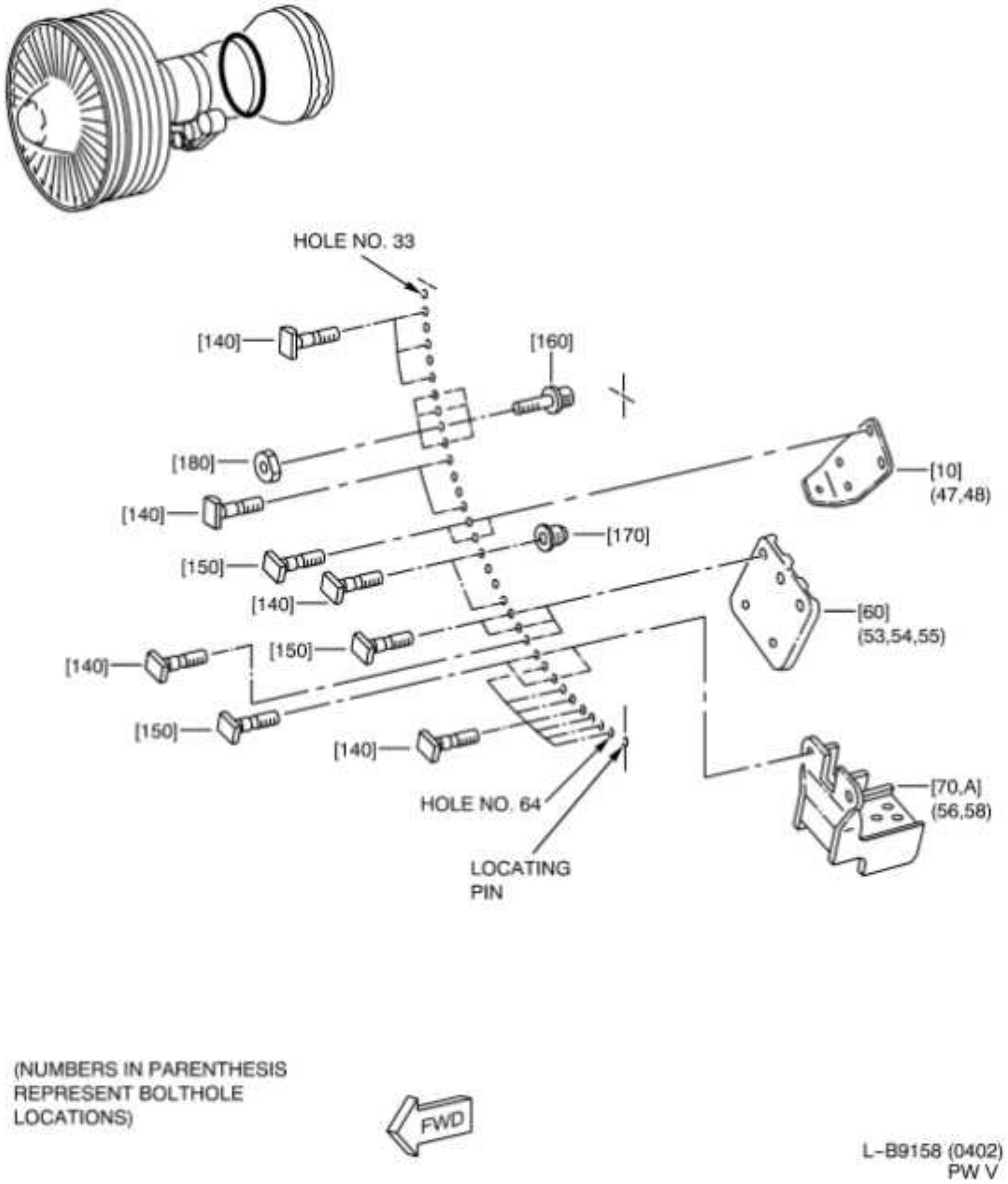
4 Install Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the bolts at bolthole Locations 11 through 14, 39 through 42, 76 through 79, and 98 through 101.

(2) Remove any tags or markings on the brackets or flange.

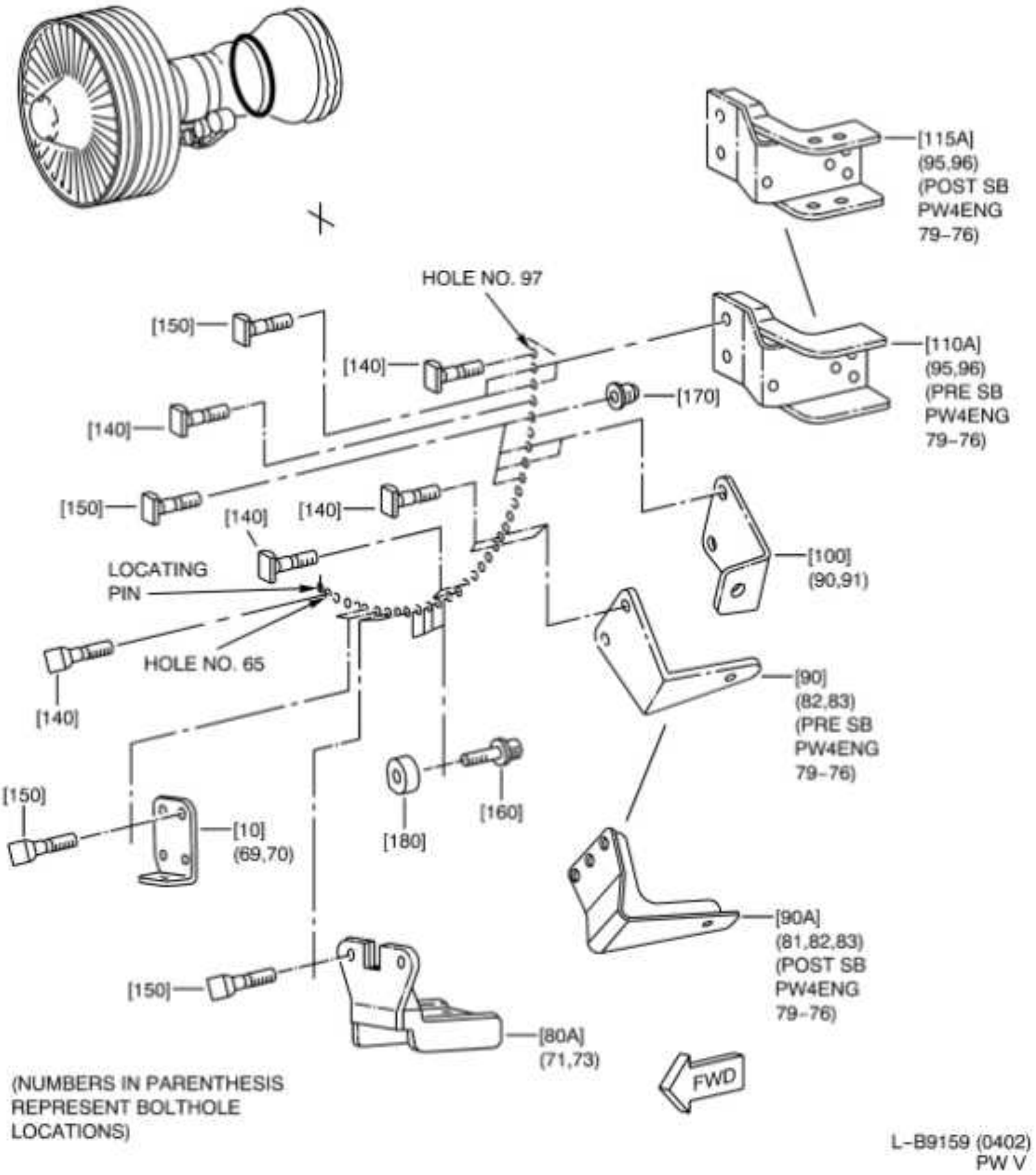
(3) Examine the assembly for foreign objects, damage, and correct assembly.


[1,A]
(7,9)
[150]
[160]
[180]
HOLE NO. 1
[10]
(21,22)
[150]
[150]
[170]
[140]
[20]
(23,24,25)
[150]
HOLE NO. 33
[30]
(27,28,29)
[40]
(32,33)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L−A1320 (0402)
PW V

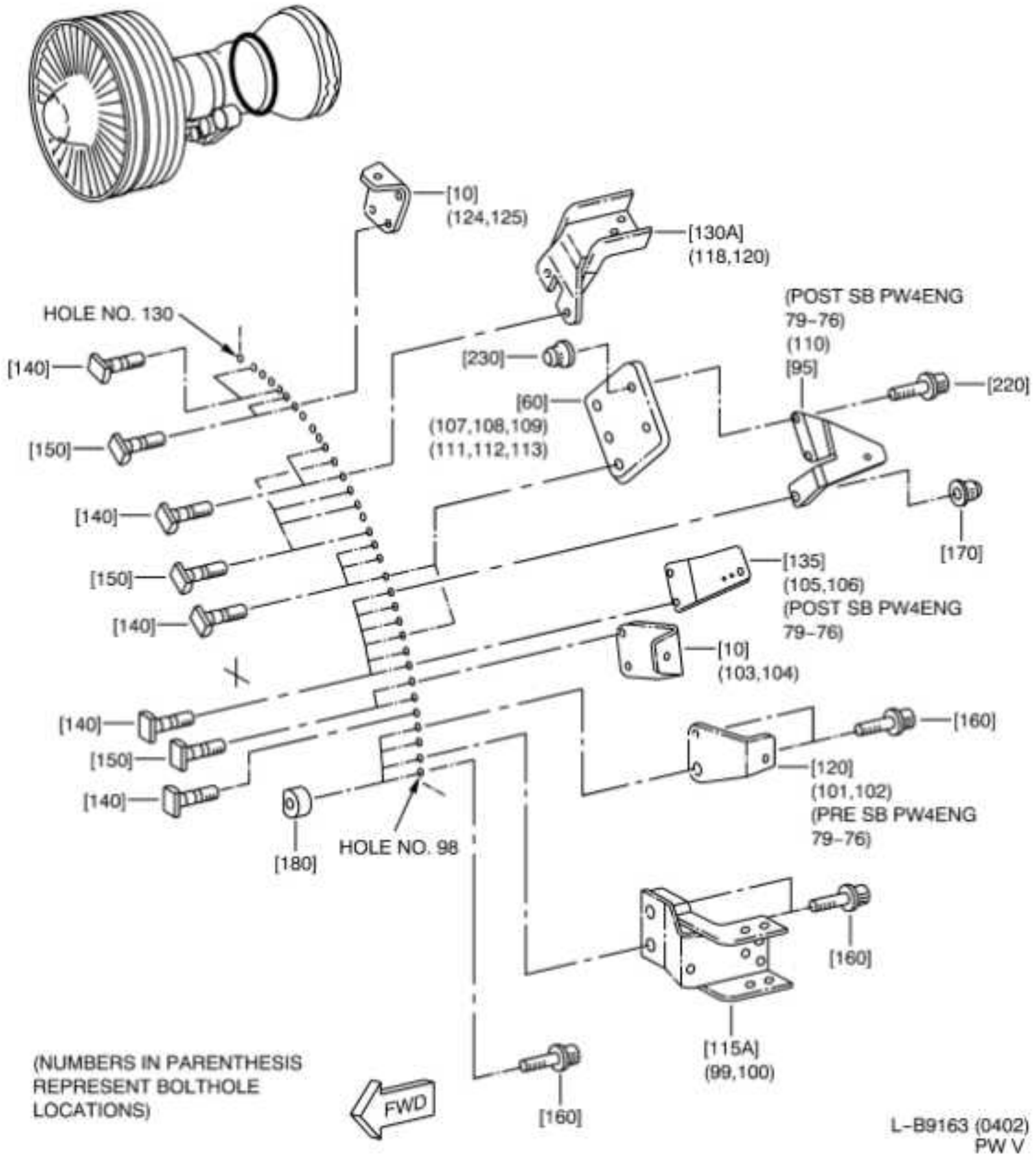
The Flange N Brackets And Hardware
Figure 401 (Sheet 1)
(Task 72−00−53−420−020)


HOLE NO. 33
[140]
[160]
[180]
[140]
[10]
(47,48)
[150]
[170]
[140]
[60]
(53,54,55)
[140]
[150]
[150]
[140]
[70,A]
(56,58)
HOLE NO. 64
LOCATING PIN
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B9158 (0402)
PW V

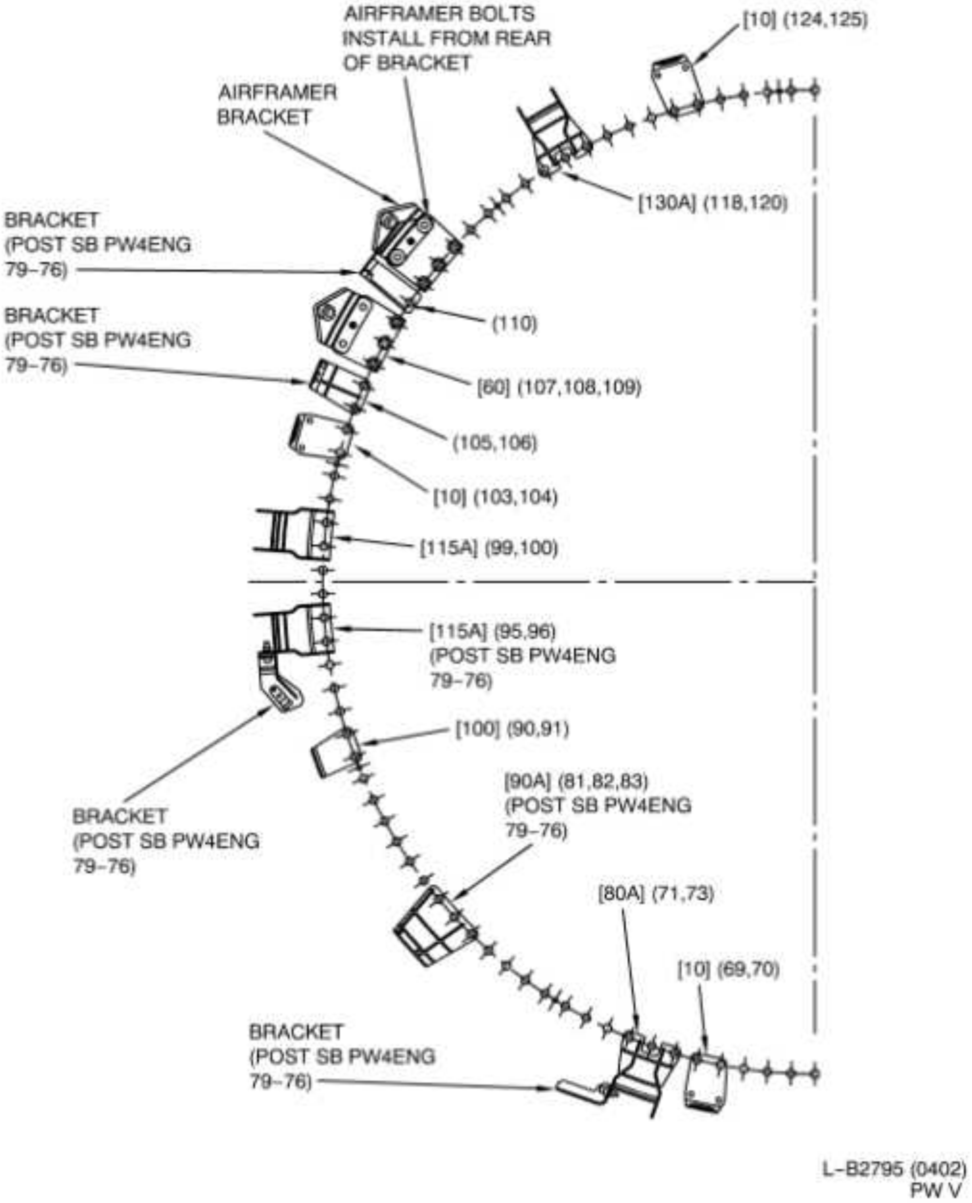
The Flange N Brackets And Hardware
Figure 401 (Sheet 2)
(Task 72−00−53−420−020)


[115A]
(95,96)
(POST SB
PW4ENG
79-76)
HOLE NO. 97
[150]
[140]
[110A]
(95,96)
(PRE SB
PW4ENG
79-76)
[170]
[140]
[150]
[140]
[140]
[100]
(90,91)
LOCATING
PIN
HOLE NO. 65
[140]
[90]
(82,83)
(PRE SB
PW4ENG
79-76)
[150]
[10]
(69,70)
[180]
[160]
[90A]
(81,82,83)
(POST SB
PW4ENG
79-76)
[150]
[80A]
(71,73)
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L-B9159 (0402)
PW V

The Flange N Brackets And Hardware
Figure 401 (Sheet 3)
(Task 72−00−53−420−020)

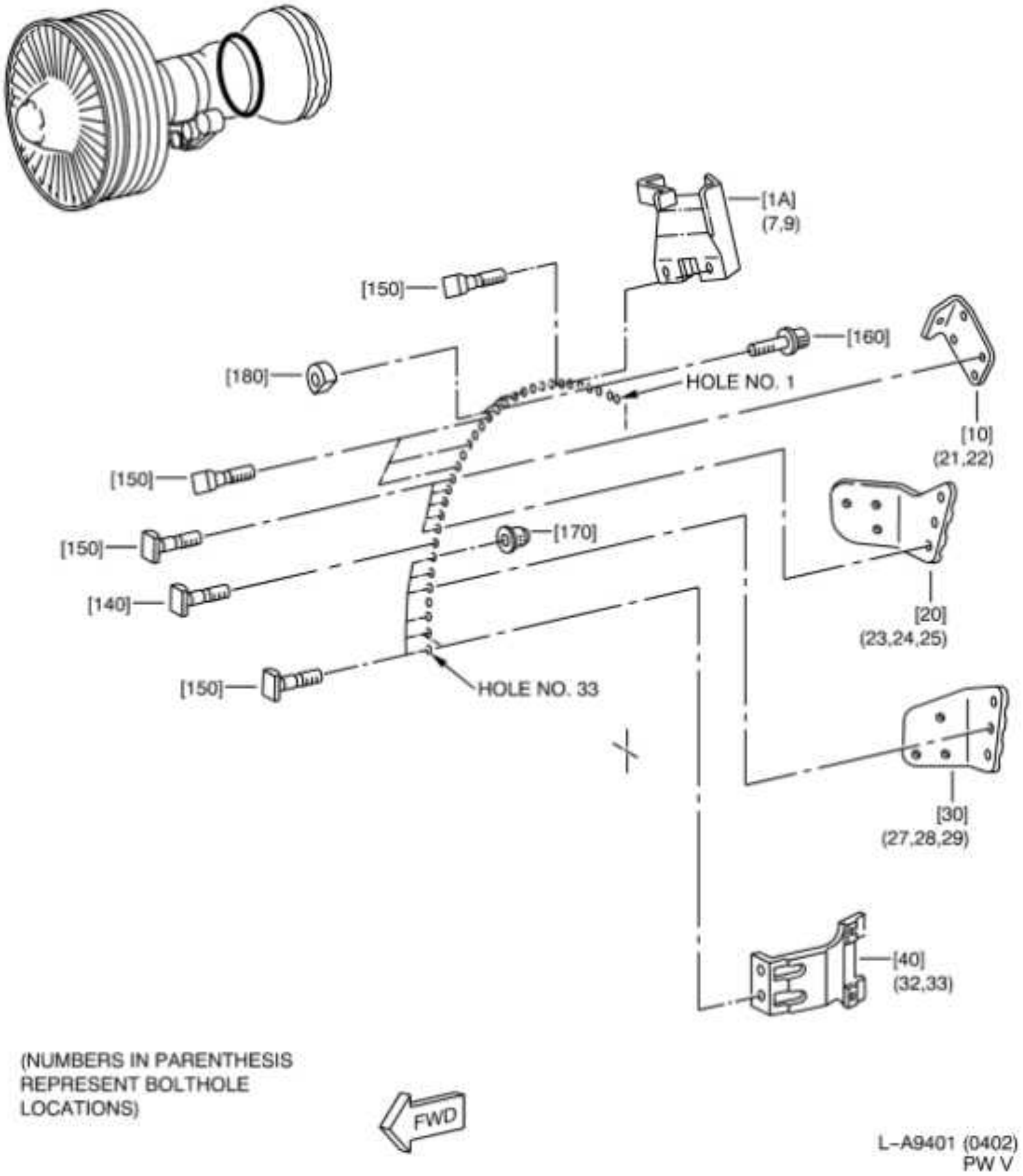

[10]
(124,125)
[130A]
(118,120)
HOLE NO. 130
(POST SB PW4ENG
79–76)
(110)
[95]
[140]
[230]
[220]
[60]
(107,108,109)
(111,112,113)
[150]
[140]
[170]
[150]
[135]
(105,106)
(POST SB PW4ENG
79–76)
[140]
[10]
(103,104)
[140]
[160]
[150]
[120]
(101,102)
(PRE SB PW4ENG
79–76)
[140]
[180]
HOLE NO. 98
[160]
[115A]
(99,100)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
[160]
L–B9163 (0402)
PW V

The Flange N Brackets And Hardware
Figure 401 (Sheet 4)
(Task 72–00–53–420–020)

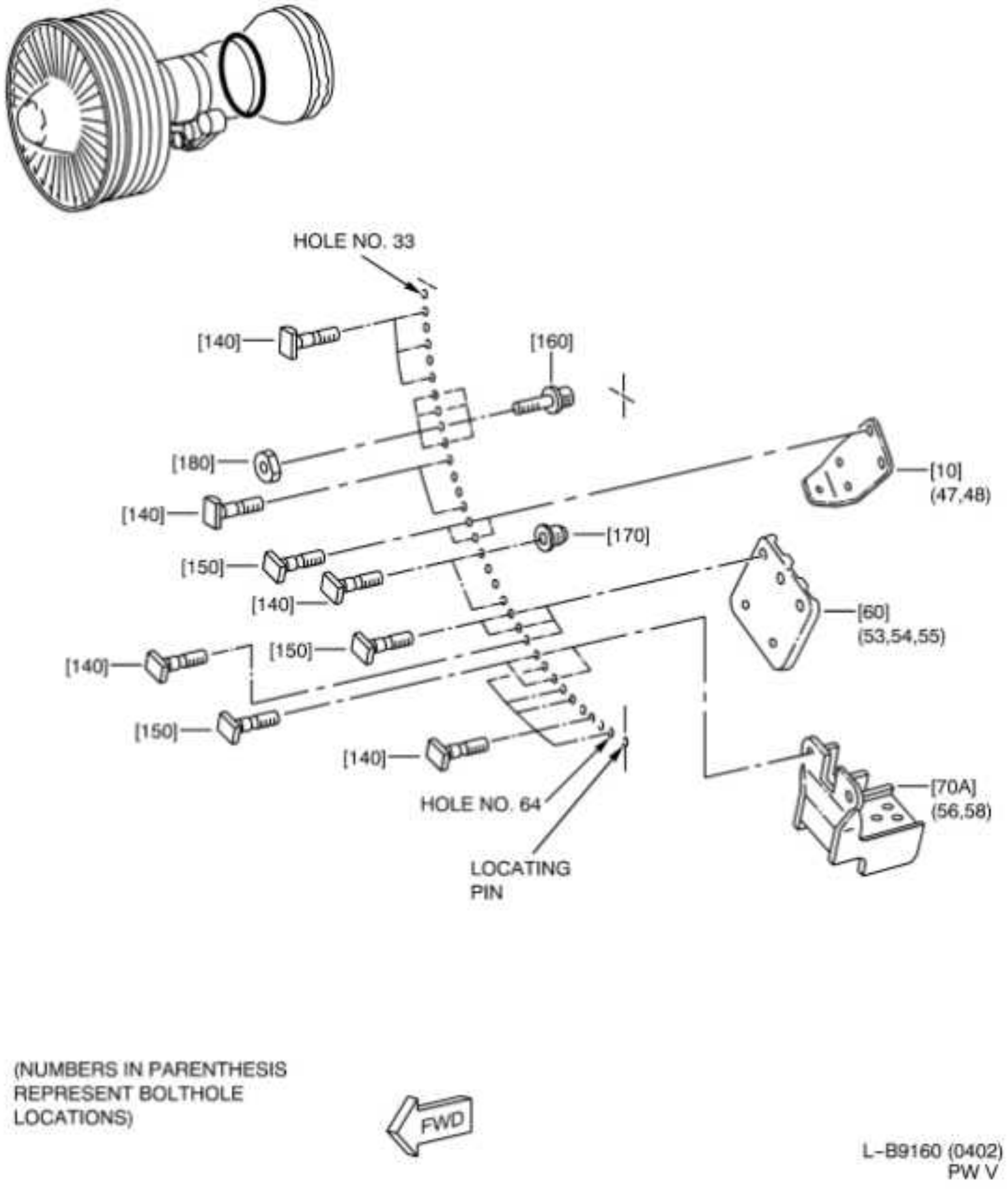

AIRFRAMER BOLTS INSTALL FROM REAR OF BRACKET
[10] (124,125)
AIRFRAMER BRACKET
[130A] (118,120)
BRACKET (POST SB PW4ENG 79−76)
(110)
BRACKET (POST SB PW4ENG 79−76)
[60] (107,108,109)
(105,106)
[10] (103,104)
[115A] (99,100)
[115A] (95,96) (POST SB PW4ENG 79−76)
[100] (90,91)
BRACKET (POST SB PW4ENG 79−76)
[90A] (81,82,83) (POST SB PW4ENG 79−76)
[80A] (71,73)
[10] (69,70)
BRACKET (POST SB PW4ENG 79−76)
L−B2795 (0402)
PW V

The Flange N Brackets And Hardware
Figure 401 (Sheet 5)
(Task 72−00−53−420−020)

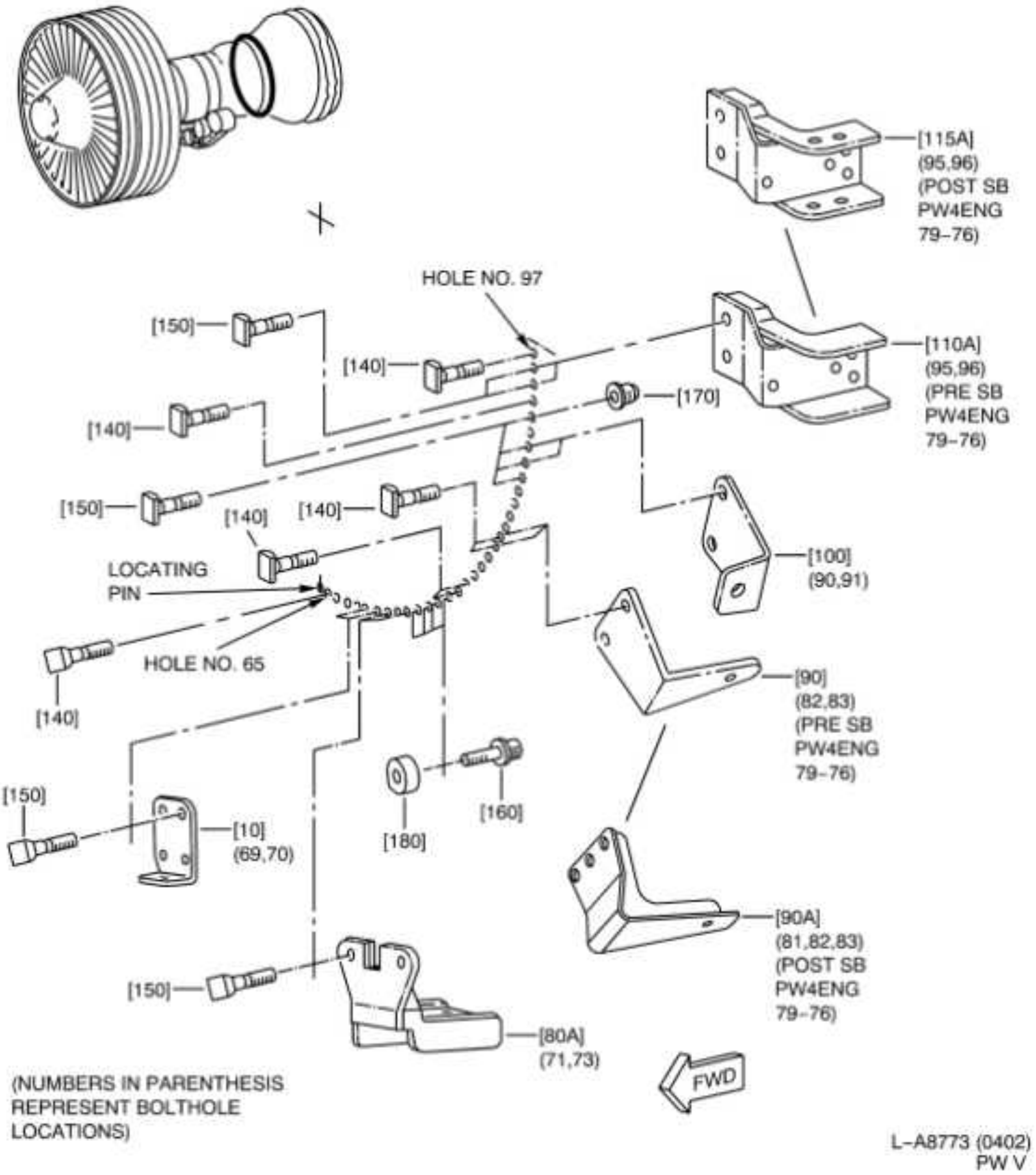
ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSTALLATION−20


[1A]
(7,9)
[150]
[160]
[180]
HOLE NO. 1
[10]
(21,22)
[150]
[150]
[170]
[140]
[20]
(23,24,25)
[150]
HOLE NO. 33
[30]
(27,28,29)
[40]
(32,33)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-A9401 (0402)
PW V

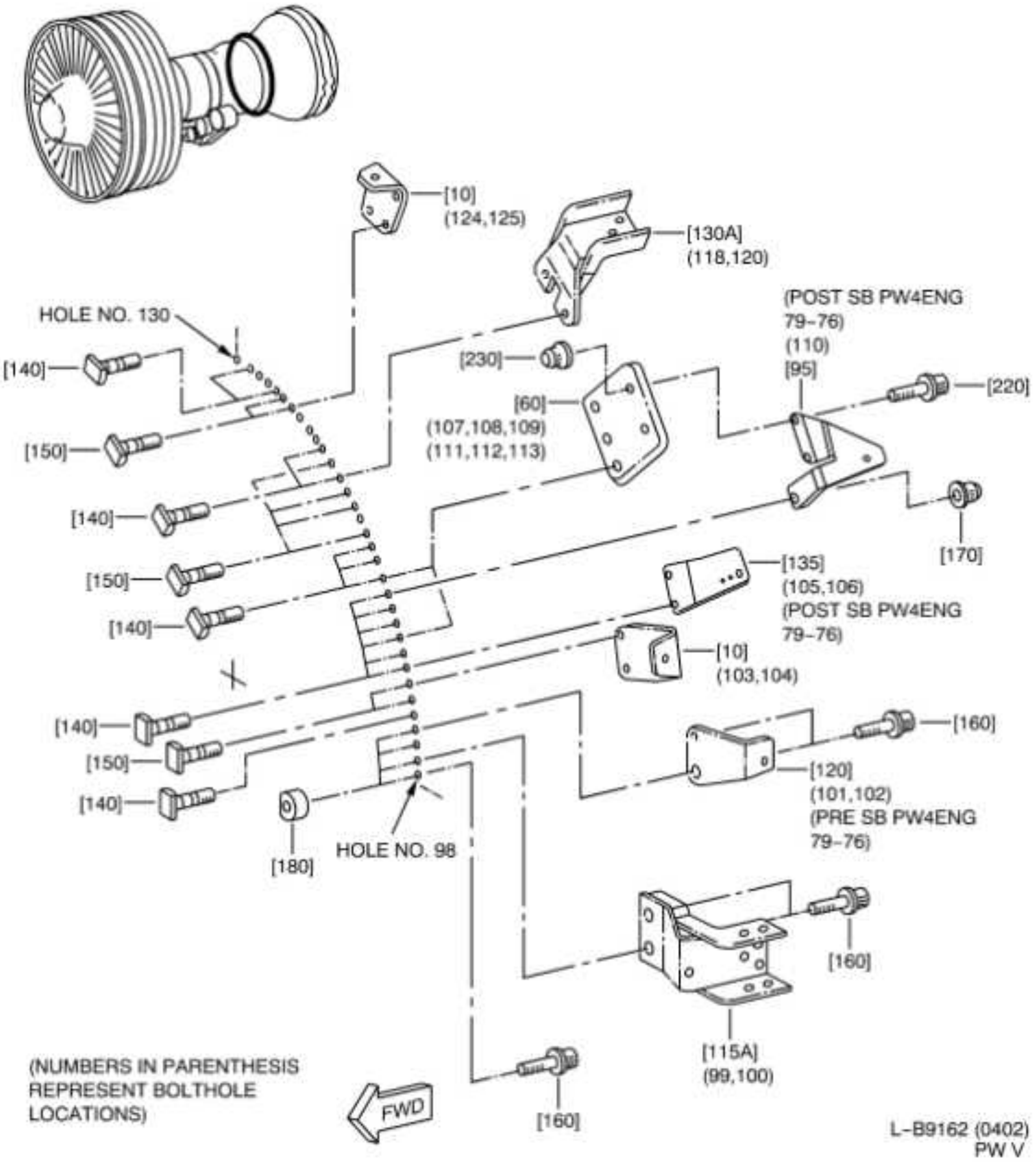
The Flange N Brackets And Hardware
Figure 401 (Sheet 6)
(Task 72−00−53−420−020)


HOLE NO. 33
[140]
[160]
[180]
[10]
(47,48)
[140]
[170]
[150]
[140]
[60]
(53,54,55)
[140]
[150]
[150]
[140]
HOLE NO. 64
LOCATING PIN
[70A]
(56,58)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B9160 (0402)
PW V

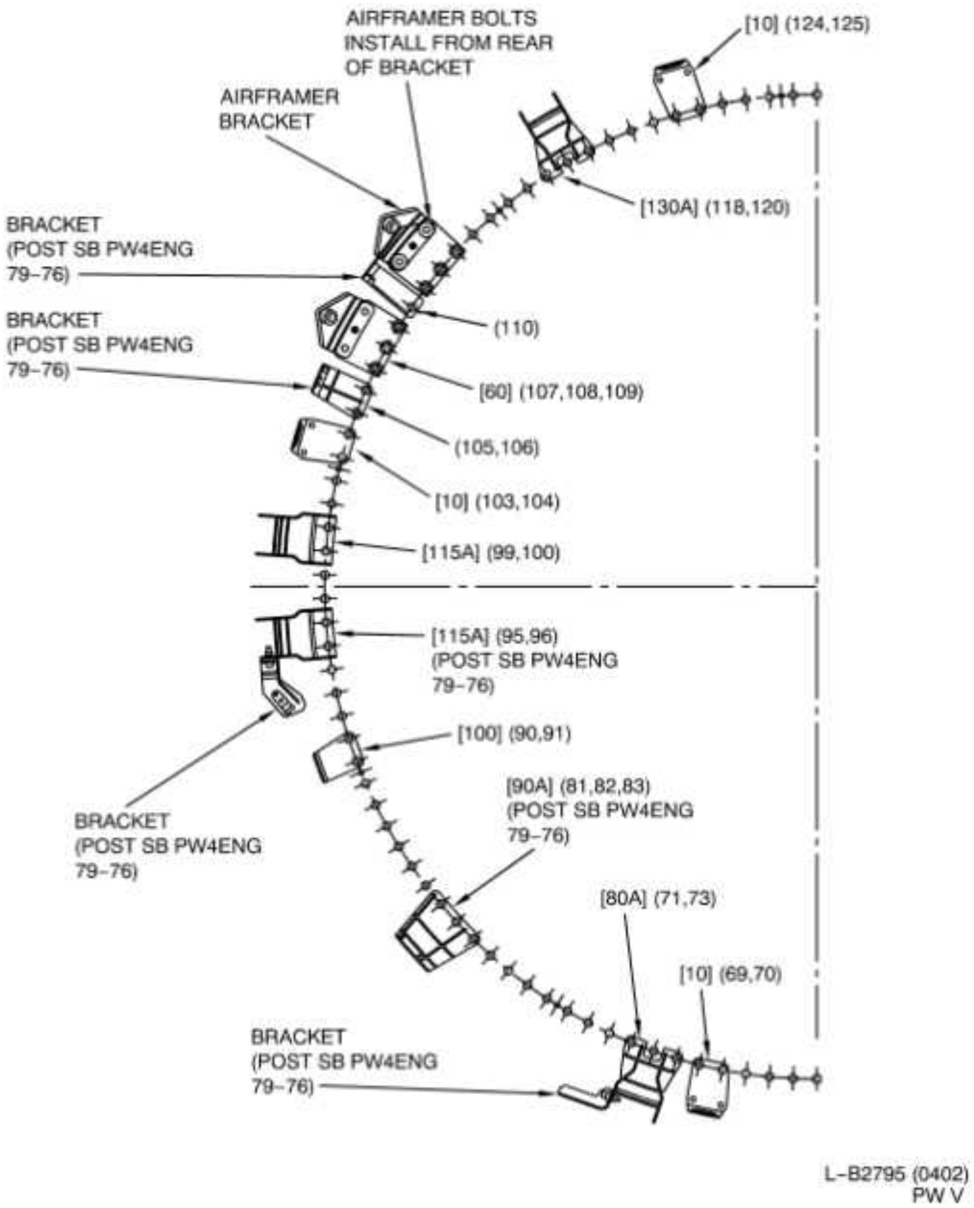
The Flange N Brackets And Hardware
Figure 401 (Sheet 7)
(Task 72−00−53−420−020)


[115A]
(95,96)
(POST SB
PW4ENG
79-76)
HOLE NO. 97
[150]
[140]
[110A]
(95,96)
(PRE SB
PW4ENG
79-76)
[170]
[140]
[150]
[140]
[140]
LOCATING
PIN
[100]
(90,91)
HOLE NO. 65
[140]
[90]
(82,83)
(PRE SB
PW4ENG
79-76)
[150]
[10]
(69,70)
[180]
[160]
[90A]
(81,82,83)
(POST SB
PW4ENG
79-76)
[150]
[80A]
(71,73)
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L-A8773 (0402)
PW V

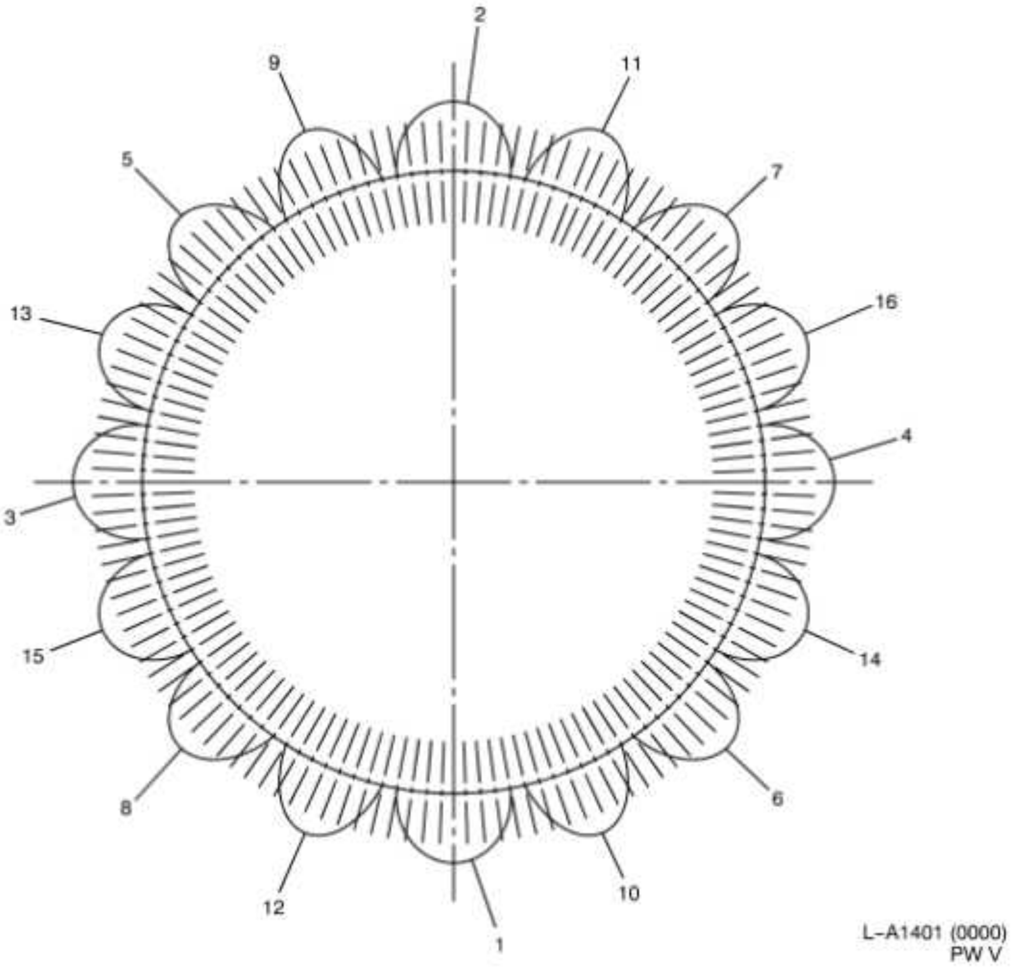
The Flange N Brackets And Hardware
Figure 401 (Sheet 8)
(Task 72−00−53−420−020)


[10]
(124,125)
[130A]
(118,120)
HOLE NO. 130
(POST SB PW4ENG
79-76)
(110)
[95]
[140]
[230]
[220]
[60]
(107,108,109)
(111,112,113)
[150]
[140]
[170]
[150]
[135]
(105,106)
(POST SB PW4ENG
79-76)
[140]
[10]
(103,104)
[140]
[160]
[150]
[120]
(101,102)
(PRE SB PW4ENG
79-76)
[140]
[180]
HOLE NO. 98
[160]
[115A]
(99,100)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
[160]
L-B9162 (0402)
PW V

The Flange N Brackets And Hardware
Figure 401 (Sheet 9)
(Task 72−00−53−420−020)


AIRFRAMER BOLTS INSTALL FROM REAR OF BRACKET
[10] (124,125)
AIRFRAMER BRACKET
[130A] (118,120)
BRACKET (POST SB PW4ENG 79−76)
(110)
BRACKET (POST SB PW4ENG 79−76)
[60] (107,108,109)
(105,106)
[10] (103,104)
[115A] (99,100)
[115A] (95,96) (POST SB PW4ENG 79−76)
[100] (90,91)
BRACKET (POST SB PW4ENG 79−76)
[90A] (81,82,83) (POST SB PW4ENG 79−76)
[80A] (71,73)
[10] (69,70)
BRACKET (POST SB PW4ENG 79−76)
L−B2795 (0402)
PW V

The Flange N Brackets And Hardware
Figure 401 (Sheet 10)
(Task 72−00−53−420−020)


2
9
11
5
7
13
16
4
3
15
14
8
6
12
10
1
L-A1401 (0000)
PW V

Flange N Bolt Torquing Sequence Diagram
Figure 402
(Task 72-00-53-420-020)

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Task 72-00−53−990−001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (−) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (−) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	IFR	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	IFR	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
769	B	Front Compressor Drive Turbine (LPT) Shaft (72−53−80) Turbine Shaft Coupling Assembly (72−32−01) (See Figure 801)				
		Shaft	5.2995 (134.608)	5.3005 (134.632)		
		Coupling	5.2975 (134.557)	5.2985 (134.581)	.001T (0.026T)	.003T (0.076T)
771	B	Front Compressor Drive Turbine (LPT) Shaft (72−53−80) Turbine Shaft Coupling Assembly (72−32−01) (See Figure 801)				
		Shaft	5.6995 (144.768)	5.7005 (144.792)		
		Coupling	5.6975 (144.717)	5.6985 (144.741)	.003T (0.076T)	.001T (0.026T)

	Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
	817	B	Turbine Case And Vane Assembly (72−52−30) Rear Turbine (LPT) Case Assembly (72−53−17) (See Figure 803)				
			Case	39.995 (1015.873)	40.001 (1016.025)		
R R			Rear Case	39.983 (1015.568)	39.989 (1015.721)	.025T* (0.635T)*	.006* (0.152)*
	826	B	Rear Turbine (LPT) Case Assembly (72−53−17) Turbine Exhaust Case Assembly (72−54−01) (See Figure 802)				
			LPT Case	57.560 (1462.024)	57.564 (1462.125)		
			Exhaust Case	57.552 (1461.821)	57.560 (1462.024)	.064* (1.626)*	.012T (0.30T)
	827	B	Turbine Shaft Spacer (72−53−81) Front Compressor Drive Turbine (LPT) Shaft (72−53−80) (See Figure 801)				
			Spacer	4.999 (126.975)	5.001 (127.025)		
			Shaft	4.997 (126.924)	4.999 (126.974)	.000T (0.000T)	.004T (0.101T)

G. Spline Data

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
951	B	1. Turbine Shaft Coupling Assembly (72−32−01) Internal Spline (Straight, Uncrowned, Portion Of Spline) (See Figure 801)				
		A. Effective Space Width	.1309 (3.325)	−−−		
		B. Actual Space Width		.1341 (3.406)		
		2. Front Compressor Drive Shaft (72−53−80) External Spline				

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)						
		(See Figure 801) A. Effective Tooth Thickness		.1294 (3.287)		
		B. Actual Tooth Thickness	.1262 (3.205)			
		3. Fit			.0015 (0.038)	---

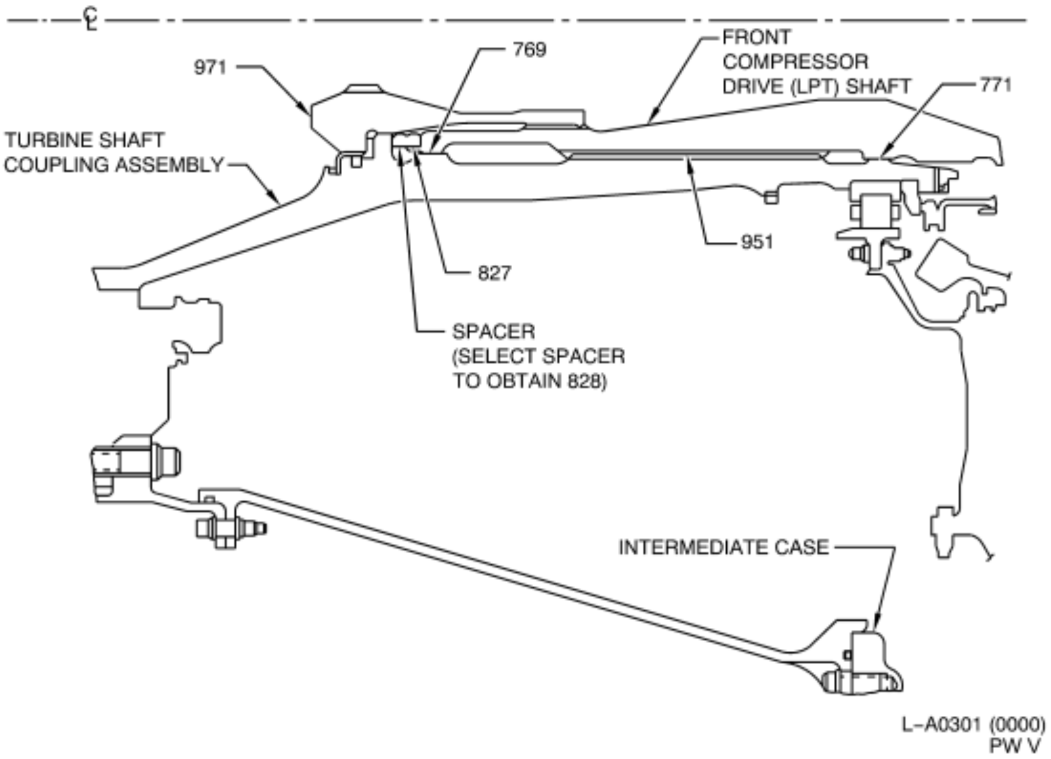
H. Special Torques

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
971	A	Turbine Shaft (LPT To Coupling) Nut (See Figure 801) See 72-00-53, Installation-01 (Task 72-00-53-420-001) See 72-00-53, Installation-08 (Task 72-00-53-420-002)				
978	A	Perimeter Bolts And Nuts At N-Flange (See Figure 804) See 72-00-53, Installation-01 (Task 72-00-53-420-001) See 72-00-53, Installation-08 (Task 72-00-53-420-002)				
2151	A	Hose/Tube Clamp Screw See 72-00-53, Installation-05 Task 72-00-53-450-003				

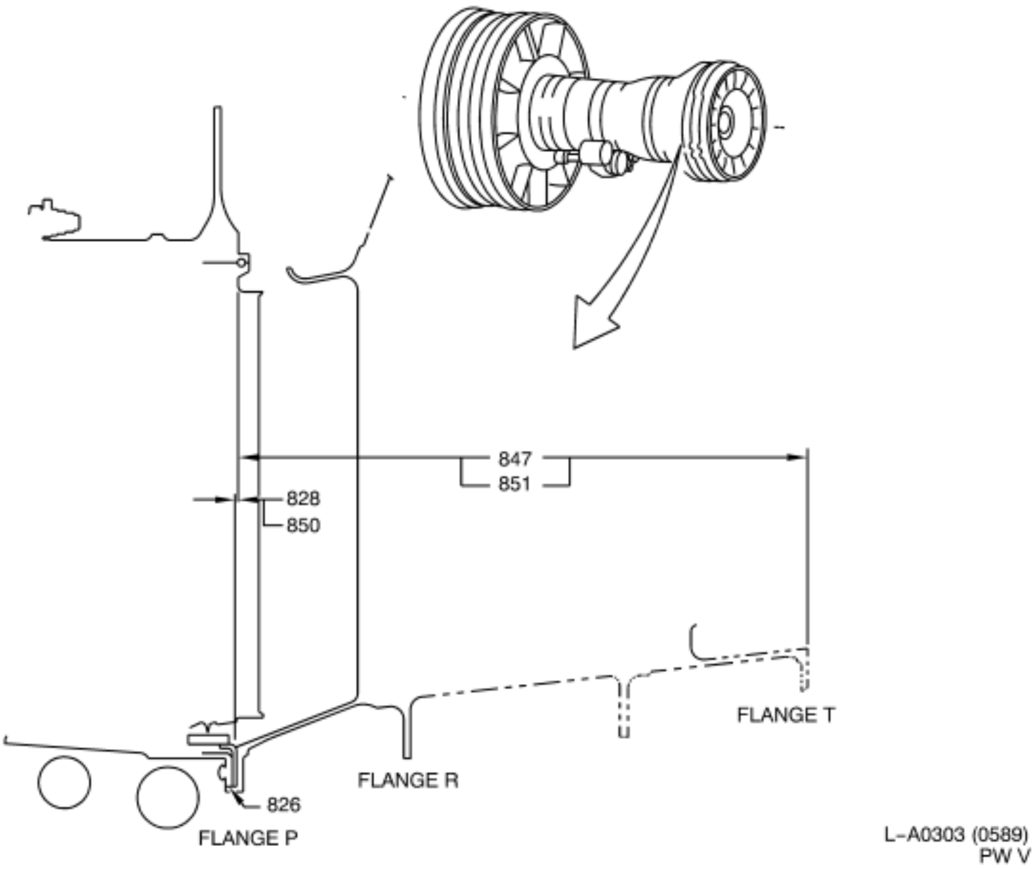
I. Special Assembly Procedures

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−01

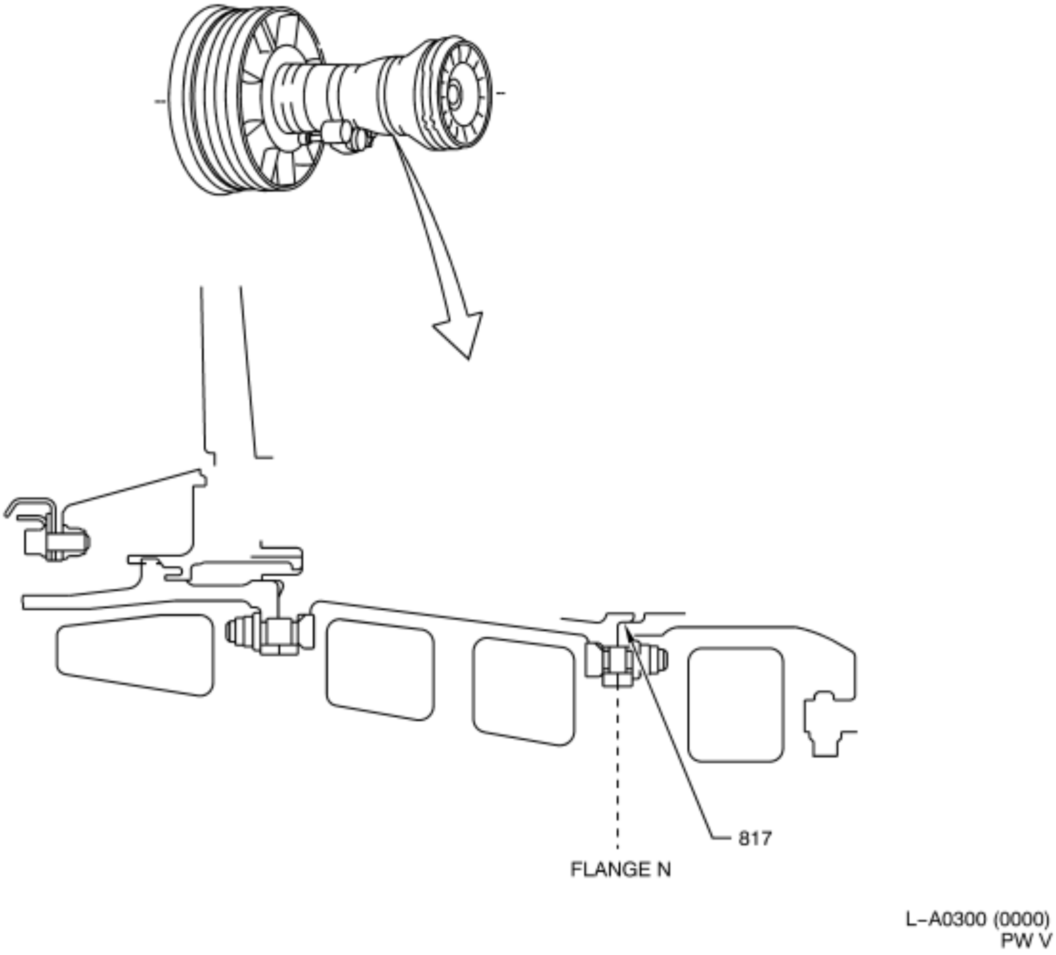
Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
828	A	Front Compressor Drive Turbine Rotor To Stator Spacing (See Figure 802) See 72−00−53, Installation−01 (Task 72−00−53−420−001)				
847	A	Front Compressor Drive Turbine Rotor To Stator Spacing (With Turbine Exhaust Case Installed) (See Figure 802) See 72−00−53, Installation−08 (Task 72−00−53−420−002)				
850	A	Front Compressor Drive Turbine Rotor To Stator Spacing (See Figure 802) See 72−00−53, Installation−01 (Task 72−00−53−420−001)				
851	A	Front Compressor Drive Turbine Rotor To Stator Spacing (With Turbine Exhaust Case Installed) (See Figure 802) See 72−00−53, Installation−08 (Task 72−00−53−420−002)				
2010	A	Turbine Case Cooling (TCC) Actuation System Assembly And Rigging Procedure (See Figure 805) See 72−00−53, Installation−06 Task 72−00−53−450−004 See 72−00−00, Special Procedure−11 Task 72−00−00−830−005				


℄
971
769
FRONT COMPRESSOR DRIVE (LPT) SHAFT
771
TURBINE SHAFT COUPLING ASSEMBLY
951
827
SPACER (SELECT SPACER TO OBTAIN 828)
INTERMEDIATE CASE
L−A0301 (0000)
PW V

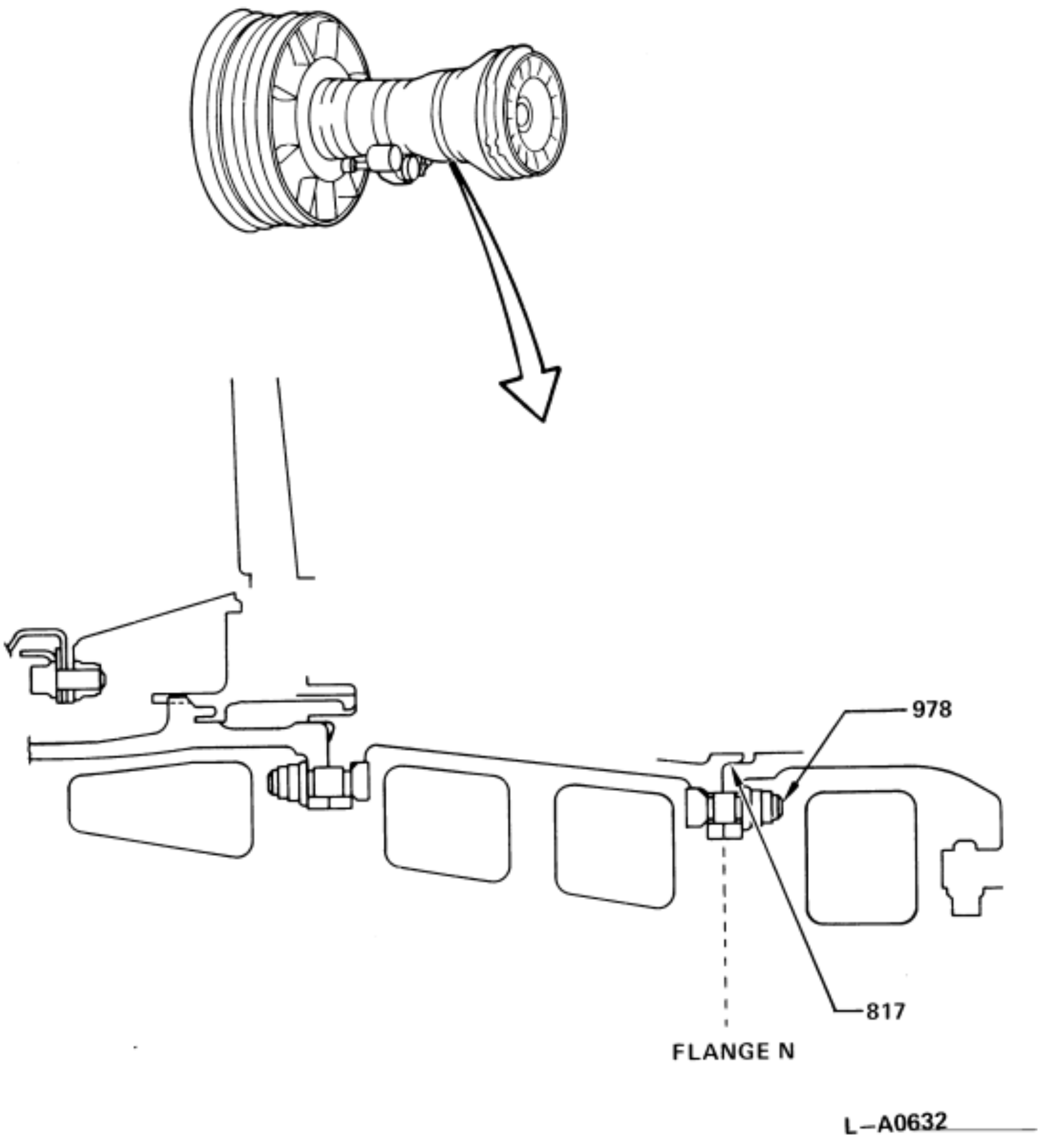
Low Pressure Turbine (LPT)
Figure 801
(Task 72−00−53−990−001)


847
851
828
850
FLANGE T
FLANGE R
826
FLANGE P
L−A0303 (0589)
PW V

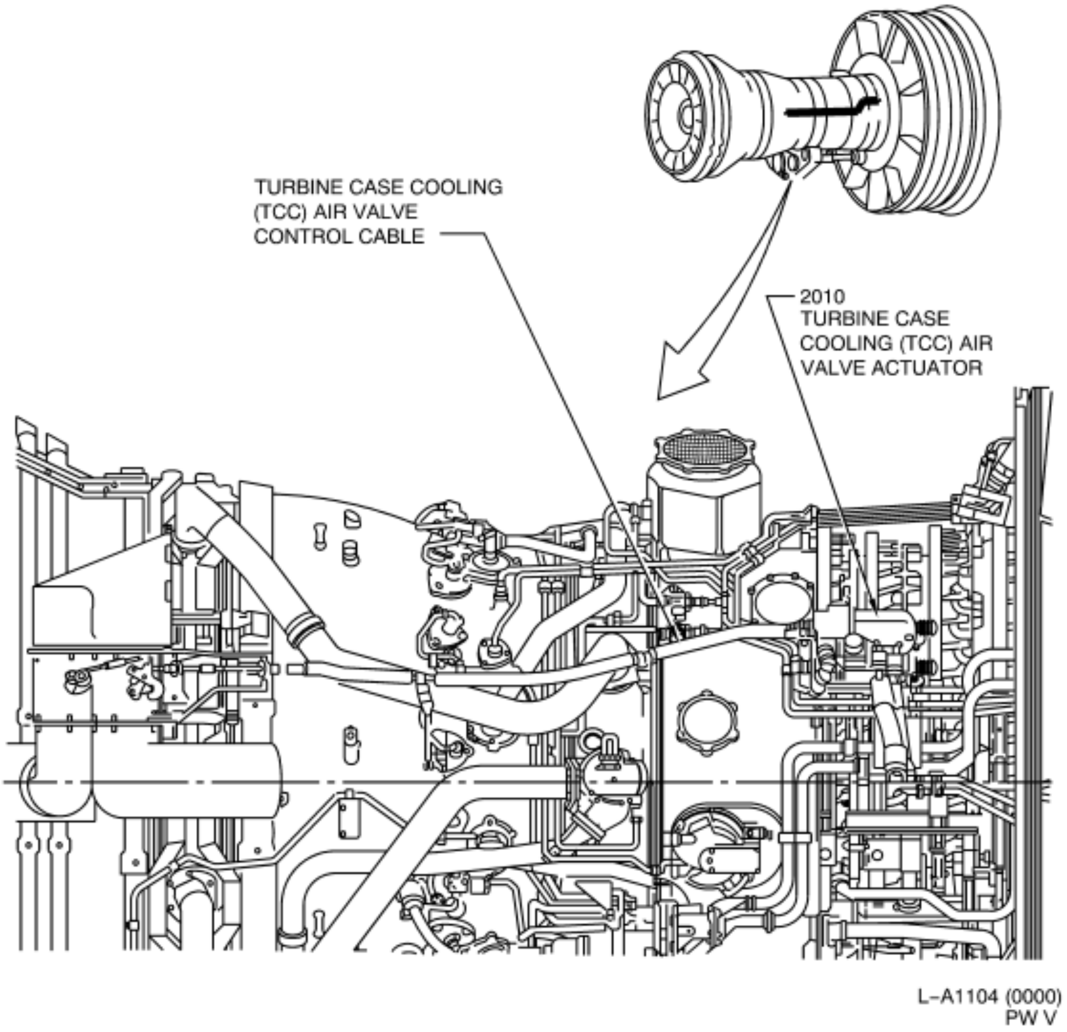
Low Pressure Turbine (LPT)
Figure 802
(Task 72−00−53−990−001)


817
FLANGE N
L−A0300 (0000)
PW V

Low Pressure Turbine (LPT)
Figure 803
(Task 72−00−53−990−001)



Low Pressure Turbine (LPT)
Figure 804
(Task 72−00−53−990−001)


TURBINE CASE COOLING
(TCC) AIR VALVE
CONTROL CABLE
2010
TURBINE CASE
COOLING (TCC) AIR
VALVE ACTUATOR
L−A1104 (0000)
PW V

Turbine Case Cooling (TCC) Actuation System
Figure 805
(Task 72−00−53−990−001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - INSPECTION/CHECK-02

Task 72-00-53-200-002:

1. Visually Inspect Low Pressure Turbine

R A. General Inspection - Low Pressure Turbine (LPT)

R (1) For inspection limits applicable to installed (that you
R can access) parts of low pressure turbine module, refer
R to Inspection/Check-10 (Task 72-00-53-210-010).

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - INSPECTION/CHECK-03

Task 72-00-53-200-003:

1. Inspect Front Compressor Drive Turbine (LPT) Shaft Splines

   A. Equipment And Materials Necessary - None

   B. Procedure

      (1) Clean the shaft splines before you do the fluorescent penetrant inspection. See SPOP 208 in the Standard Practices Manual, PN 585005. Use a brass wire brush to remove loose material from the splines.

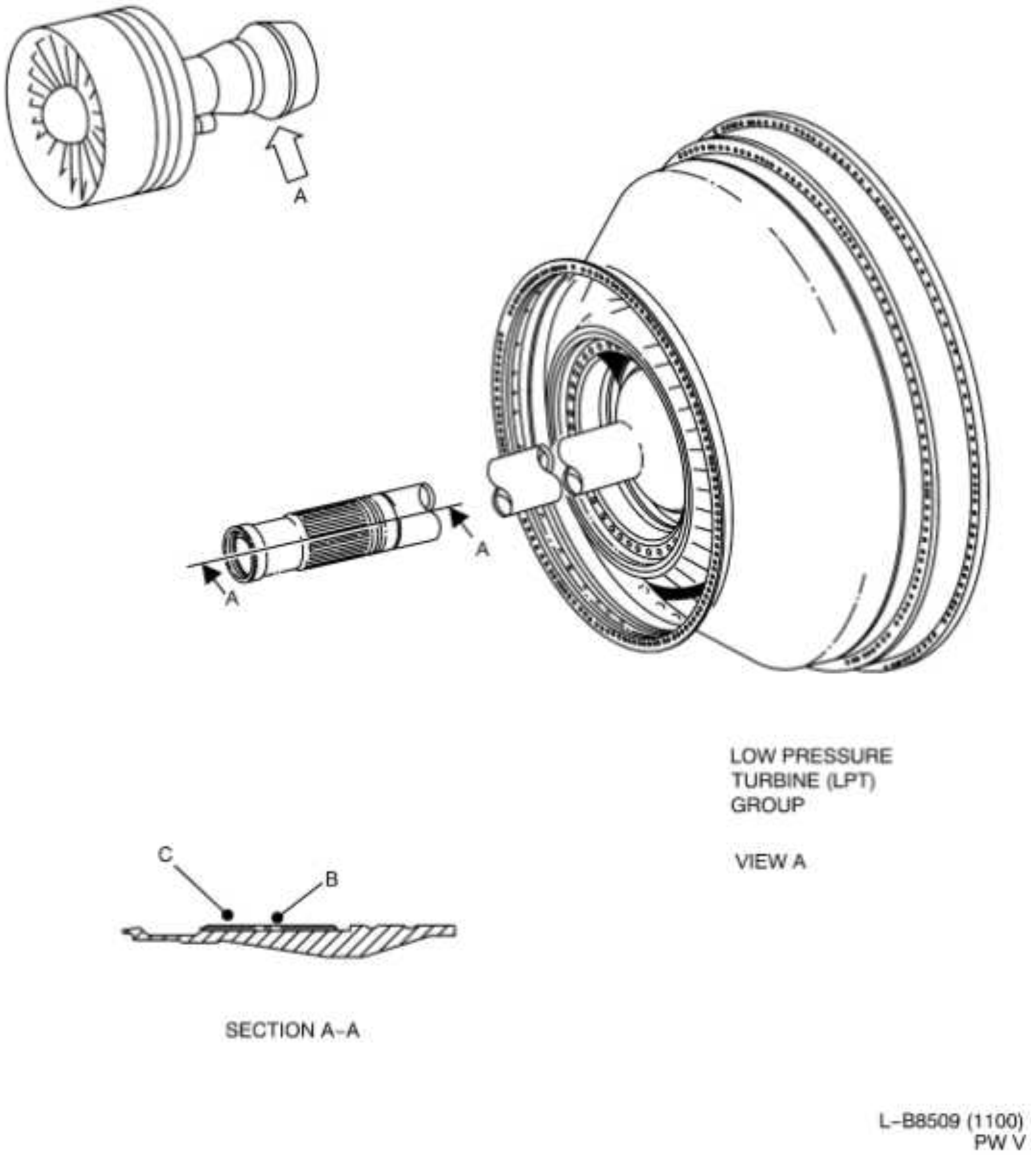
      (2) Do a local fluorescent penetrant inspection on the spline area. See Figure 801 for applicable areas of the shaft. See SPOP 70, ultra high sensitivity, in the Standard Practices Manual, PN 585005.

         (a) Carefully inspect the areas shown in Figure 801.

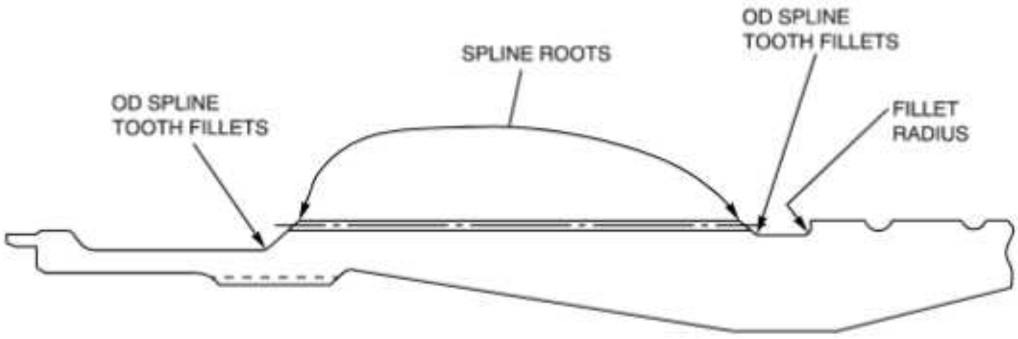
      (3) Shaft inspection limits.

         (a) If linear indications at 45 degrees to the axis of the shaft are found, the shaft must be removed from the LPT module and inspected by 72-53-80, Inspection/Check-02 of the PW4000 Series CIR, PN 51A357.

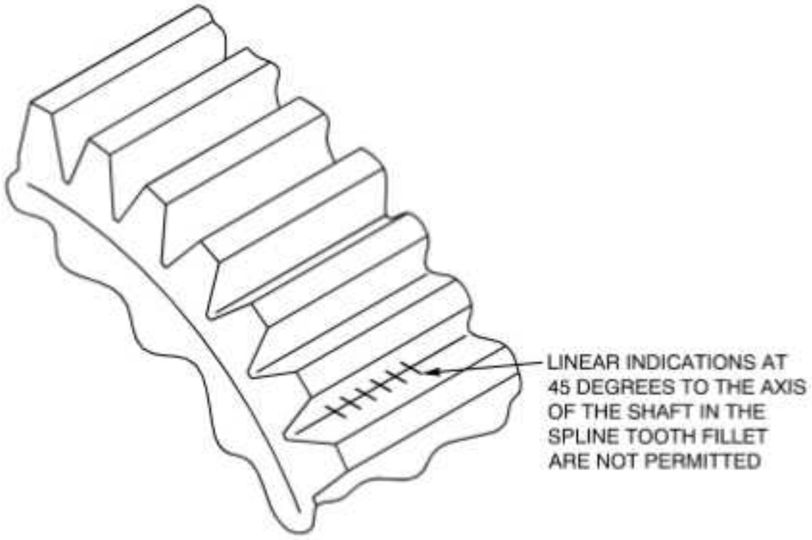
         (b) See 72-53-80, Inspection/Check-03, CONFIG-1, of the PW4000 Series CIR, PN 51A357 for servicable limits of other types of indications.


A
A
A
LOW PRESSURE TURBINE (LPT) GROUP
VIEW A
C
B
SECTION A–A
L−B8509 (1100)
PW V

Front Compressor Drive Turbine (LPT) Shaft Spline Inspection Areas
Figure 801 (Sheet 1)
(Task 72−00−53−200−003)


OD SPLINE TOOTH FILLETS
SPLINE ROOTS
OD SPLINE TOOTH FILLETS
FILLET RADIUS

VIEW B


LINEAR INDICATIONS AT 45 DEGREES TO THE AXIS OF THE SHAFT IN THE SPLINE TOOTH FILLET ARE NOT PERMITTED

VIEW C

L-B8510 (1100)
PW V

Front Compressor Drive Turbine (LPT) Shaft Spline Inspection Areas
Figure 801 (Sheet 2)
(Task 72-00-53-200-003)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - INSPECTION/CHECK-10

Task 72-00-53-210-010:

1. Visually Examine The Low Pressure Turbine (LPT) Module Assembly - Engine General

A. Equipment And Materials Necessary

Special Tools:

PWA 86543	Gage

B. General Inspection Limits

NOTE: All applicable Airworthiness Directives (AD) must be complied with and these directives takes precedence over all inspections or repairs given in this module inspection.

(1) This inspection does not permit time since overhaul to be set to zero.

(2) These procedures give instructions for the visual inspection of the low pressure turbine (LPT) module assembly after removal from the engine. Do these procedures before you do the preservation, packing or module installation procedure. This procedure is to find those easy to see types of damage, which can make it necessary to do more disassembly, inspection or repair. Refer to Section 70-31-00 for the general visual inspection instructions in the Standard Practices Manual, PN 585005.

(3) The inspection table in this section is applicable to the low pressure turbine (LPT) modules with some, none or all of the components installed. You do not have to disassemble the module assembly to do this inspection. You can choose to apply individual limits to those areas that are visible at all stages of disassembly. If a condition shows that there can be damage that you cannot see, remove a component to fully examine the damaged area. Use the applicable procedures in this manual to remove the component and do an inspection by step (4).

(4) Remove all the components that you find not serviceable at the modular level. Send the applicable components for more inspection and repair at the component level maintenance. Refer to Section 72-53-00 in the PW4000 Series CIR, PN 51A357.

(5) Unless given differently, not toleranced areas given in this section are to corners, points of tangency between the surfaces or at the points opposite to one of these locations. The areas shown will have a tolerance of plus 0.125 inch (3.175 mm) in all directions unless adjacent areas are given as areas where damage is not permitted.

C. Procedure

(1) Examine the external low pressure turbine (LPT) case. See Table 801 and Figure 801.

(2) Examine the turbine case front inner rail. See Table 802 and Figure 802.

(3) Examine the turbine case cooling manifolds and supply tubes. See Table 803 and Figure 803.

(4) Examine the Stage 3 outer (transition) duct segments, flow guide seal and seals between the segments. See Table 804 and Figure 804 (Sheet 1), Figure 804 (Sheeet 2) and Figure 804 (Sheet 3).

(5) Examine the Stage 3 inner (transition) duct segments for wear, damage and coat condition. Examine the seals between the segments. See Table 805 and Figure 805.

(6) Examine the inner and outer seals between the Stage 3 vane cluster assemblies. See Table 806 and Figure 806.

(7) Examine the Stage 3 vane airfoil surfaces. See Table 807 and Figure 807.

(8) Examine the Stage 3 blade airfoil surfaces. See Table 808 and Figure 808.

(9) Examine the Stage 3 inner rotating airseal surfaces. See Table 809 and Figure 809.

(10) Examine the inner air sealing ring assembly. See Table 810 and Figure 810.

NOTE: If the Stage 3 (inner) rotating airseal assembly is removed, do not use Table 809 and Figure 809. Examine the rotating airseal by Section 72-53-38, Inspection/Check-03 in the PW4000 Series CIR, PN 51A357.

R ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−10

R (11) Examine the Stages 3, 4, 5 and 6 disks. See Table 811 and Figure 811 (Sheet 1), Figure 811 (Sheet 2).

R NOTE: Examine the Stage 3 disk only if the inner rotating airseal is removed. The disk cannot be seen if the inner rotating airseal is installed.

R (12) Examine the Stage 6 blade airfoil surfaces. See Table 812 and Figure 812.

R (13) Examine the Stage 6 vane airfoil surfaces. See Table 813 and Figure 813.

R (14) Examine the LPT shaft surfaces. See Table 814 and Figure 814.

R ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−10

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	LPT case surface: See Figure 801			
R	1 Front and rear flange boltholes	Not permitted	Remove the raised material only. No other material removal is permitted.	Refer to Section 72−53−17, Repair−05 in the PW4000 Series CIR, PN 51A357
R	2 Front and rear flanges	Nicks and dents to a maximum of 0.004 inch (0.102 mm) depth	Blend surface damage to a maximum of 0.010 inch (0.254 mm) depth and to a maximum of 20 percent of one surface and to a maximum of 80 percent of the radial width of the surface.	Refer to Section 72−53−17, Repair−05 in the PW4000 Series CIR, PN 51A357
R	3 Case outer surface	Nicks and dents to a maximum of 0.004 inch (0.102 mm) depth	Blend surface damage to a maximum of 0.010 inch (0.254 mm) depth unless given differently.	Refer to Section 72−53−17, Repair−05 in the PW4000 Series CIR, PN 51A357

R Rear Turbine (LPT) Case Surface Damage Inspection
R Table 801

	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
R	1	0.300 inch (7.620 mm) reference		
R	2 Front inner rail crack width	The total width of all the cracks measure at 0.300 inch (7.620 mm) radial depth must not be more than 0.050 inch (1.270 mm). Do not include the width of the cracks that are less than 0.300 inch (7.620 mm) radial length.	Stop drill to a maximum of 43 cracks and with a radial length of 0.300 - 0.425 inch (7.6 - 10.8 mm)	Refer to Section 72-00-53, Repair-01 in the PW4152 Series Engine Manual, PN 50A443
R			Replace the front flange and inner rail, if more than 43 cracks or individual crack radial length is more than 0.425 inch (10.795 mm).	Refer to Section 72-53-17, Repair-24 and Repair-52 in the PW4152 Series Engine Manual, PN 50A443
R	3	All cracks to a maximum of 0.300 inch (7.620 mm) radial length		

R Front Inner Rail Visual Inspection
R Table 802

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Cracks in all areas	Not permitted	See the repair	Refer to Section 72−09−76, Repair−01 in the PW4000 Series CIR, PN 51A357
Dents in all areas	0.100 inch (2.540 mm) maximum	All quantities, depth, length and width	Refer to Section 72−09−76, Repair−01 in the PW4000 Series CIR, PN 51A357
Nicks, scratches and wear in bends and corners	0.005 inch (0.127 mm) maximum	See the repair	Refer to Section 72−09−76, Repair−01 in the PW4000 Series CIR, PN 51A357
Nicks and scratches in circular sections and flat areas	0.005 inch (0.127 mm) maximum	0.005 − 0.010 inch (0.127 − 0.254 mm)	Smoothly blend in all the directions
		All quantities more than 0.010 inch (0.254 mm)	Refer to Section 72−09−76, Repair−01 in the PW4000 Series CIR, PN 51A357
Wear in circular sections and flat areas	0.010 inch (0.254 mm) maximum	See the repair	Refer to Section 72−09−76, Repair−01 in the PW4000 Series CIR, PN 51A357

LPT Case Cooling Manifold And Supply Tubes Visual Inspection
Table 803

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Wear in the 14 air supply tubes	Not permitted	None, replace the worn tubes	Refer to Section 72-09-76, Repair-02 in the PW4000 Series CIR, PN 51A357
		Patch repair the worn tubes. See the repair for the limits.	Refer to Section 72-09-76, Repair-05 in the PW4000 Series CIR, PN 51A357
Wear in the rear mount guides	0.020 inch (0.508 mm) maximum	All quantities more than 0.020 inch (0.508 mm)	Refer to Section 72-09-76, Repair-03 in the PW4000 Series CIR, PN 51A357
Wear in the front bracket rod	0.020 inch (0.508 mm) maximum	All quantities more than 0.020 inch (0.508 mm)	Refer to Section 72-09-76, Repair-04 in the PW4000 Series CIR, PN 51A357

LPT Case Cooling Manifold And Supply Tubes Visual Inspection
Table 803 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Outer duct segments for: See Figure 804 (Sheet 1).			
PWA 73 coat chipping	The total area of the chipping must not be more than 0.500 inch (12.700 mm) diameter circle for each segment	Coat can be replaced	Refer to Section 72-53-29, Repair-05 and Repair-15 in the PW4000 Series CIR, PN 51A357
1 Featherseal seal gap	A maximum of three seals can be displaced and can have to a maximum of 0.030 inch (0.762 mm) gap	If the gap is more than the serviceable limit, repair.	Refer to Section 72-00-53, Repair-02 in the PW4152 Series Engine Manual, PN 50A443
2 Missing or damaged featherseal	For three separate seals to a maximum of 30 percent of the axial length of the seal can be missing, cracked, eroded or one full seal can be missing	If the damage is more than the serviceable limit, repair.	Refer to Section 72-00-53, Repair-02 in the PW4152 Series Engine Manual, PN 50A443
Duct segment flow guide seal for: See Figure 804 (Sheet 2).			

Stage 3 Outer (Transition) Duct Segment
Seals And Seal Plates Inspection
Table 804

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
3			
Crack(s)	A maximum of two cracks for each duct segment seal (flow guide) are permitted.	Cracks to a maximum of 0.500 inch (12.700 mm) in length	Refer to Section 72-53-29, Repair-17 in the PW4000 Series CIR, PN 51A357
	Crack(s) can traverse towards the front of the seal or towards the inner diameter.	No limit	Refer to Section 72-53-29, Repair-11 in the PW4000 Series CIR, PN 51A357
4			
Rivets	A maximum of four loose rivets are permitted for each duct segment	No limit	Refer to Section 72-53-29, Repair-11 in the PW4000 Series CIR, PN 51A357
Nicks, dents and surface damage	All quantities to a maximum of 0.015 inch (0.381 mm) depth	No limit	Replace the seal. Refer to Section 72-53-29, Repair-11 in the PW4000 Series CIR, PN 51A357.
Local deformation	Local surface deformation to a maximum of 0.015 inch (0.381 mm) depth	Local surface deformation to a maximum of 0.030 inch (0.762 mm) depth and to a maximum of 0.200 inch (5.080 mm) length	Refer to Section 72-53-29, Repair-18 in the PW4000 Series CIR, PN 51A357

Stage 3 Outer (Transition) Duct Segment
Seals And Seal Plates Inspection
Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			
		axially at one location.	
Seal wear	0.020 inch (0.508 mm) minimum thickness to a maximum of 0.150 sq−in (97. sq−mm) for each incident	0.020 inch (0.508 mm) minimum thickness and more than 0.150 sq−in (97. sq−mm) for each incident	Refer to Section 72−53−29, Repair−17 in the PW4000 Series CIR, PN 51A357
Duct segment deflection. See Figure 804 (Sheet 3)	0.100 inch (2.540 mm) maximum deflection for each segment	No limit	Replace the duct segment

NOTE: Use PWA 86543 Gage to measure the deflection of the ducts at the approximate center of each duct segment. Press down on the gage approximately 1.000 inches (25.400 mm) from the end of the tool. Measure the deflection at the forward end of the gage as shown in Figure 804 (Sheet 3). The gage is divided into increments of 0.050 inch (1.270 mm).

Stage 3 Outer (Transition) Duct Segment
Seals And Seal Plates Inspection
Table 804 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
1 Duct segment coated area chipped or missing	A maximum of 0.175 inch (4.445 mm) from the rear edge for the full width of the segment is permitted. Maximum depth of surface degradation to a maximum of 0.020 inch (0.508 mm).	Coat must be touched up	Refer to Section 72-53-18, Repair-01 in the PW4000 Series CIR, PN 51A357
		Coat must be replaced	Replace the coat. Refer to Section 72-53-18, Repair-02 and Repair-11 in the PW4000 Series CIR, PN 51A357.
2 Seal gap. See Figure 805.	A maximum of three seals can be displaced and can have a maximum of 0.030 inch (0.762 mm) gap.		
3 Missing or damaged seals	A maximum of 30 percent of the axial length of the seal can be missing, cracked or eroded	Replace the damaged or missing seals	Refer to Section 72-53-18, Repair-05 in the PW4000 Series CIR, PN 51A357

Stage 3 Inner (Transition) Duct Inspection
Table 805

R ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - INSPECTION/CHECK-10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 3 vane cluster outer seals for: See Figure 806.			
Missing or damaged seals	To a maximum of two seals can be out of the slots and bent above the vane platform or be missing. Bent seals that are loose must be removed. A total number of two seals can be damaged, missing and removed. The damaged, missing or removed seals must be separated by a 45 degree arc minimum.		

Stage 3 Outer Seals Between The Vane Segments
Table 806

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
All areas for cracking, tearing and sulfadation	Not permitted	See the repair	Replace the vane
Airfoil for surface damage in: See Figure 807.			
Area A	0.030 inch (0.762 mm) maximum depth round bottom dents	See the repair	Refer to Section 72-53-23, Repair-01 in the PW4000 Series CIR, PN 51A357
Area B	0.015 inch (0.381 mm) maximum depth round bottom dents	See the repair	Refer to Section 72-53-23, Repair-01 in the PW4000 Series CIR, PN 51A357
Area C	0.020 inch (0.508 mm) maximum depth round bottom dents	See the repair	Refer to Section 72-53-23, Repair-01 in the PW4000 Series CIR, PN 51A357

Stage 3 Vane Inspection
Table 807

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - INSPECTION/CHECK-10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
All areas for cracking, tearing and sulfadation	Not permitted	No limit	Replace the blade
Blade surface damage in: See Figure 808.			
Area A for:			
Nicks	All quantities to a 0.015 inch (0.381 mm) maximum depth	See the repair	Refer to Section 72-53-07, Repair-06 in the PW4000 Series CIR, PN 51A357
Round bottom dents	All quantities to a maximum of 0.020 inch (0.508 mm) depth or 0.125 inch (3.175 mm) diameter metal displacement	See the repair	Refer to Section 72-53-07, Repair-06 in the PW4000 Series CIR, PN 51A357
Loss of coat	No limit		
Burning and erosion	All quantities to a maximum of 0.020 inch (0.508 mm) depth and 0.300 inch (7.620 mm) diameter maximum	See the repair	Refer to Section 72-53-07, Repair-06 in the PW4000 Series CIR, PN 51A357
Area B for:			
Nicks	Not permitted	See the repair	Refer to Section 72-53-07, Repair-06 in the PW4000 Series CIR, PN 51A357

Stage 3 Blade Inspection
Table 808

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Round bottom dents	All quantities to a maximum of 0.010 inch (0.254 mm) depth or 0.125 inch (3.175 mm) diameter metal displacement	See the repair	Refer to Section 72−53−07, Repair−06 in the PW4000 Series CIR, PN 51A357
Burning and erosion	All quantities to a maximum of 0.010 inch (0.254 mm) depth or 0.300 inch (7.620 mm) diameter metal displacement	See the repair	Refer to Section 72−53−07, Repair−06 in the PW4000 Series CIR, PN 51A357
Area C for:			
Nicks	All quantities to a maximum of 0.015 inch (0.381 mm) depth.	See the repair	Refer to Section 72−53−07, Repair−06 in the PW4000 Series CIR, PN 51A357
Round bottom dents	All quantities to a maximum of 0.020 inch (0.508 mm) depth or 0.125 inch (3.175 mm) diameter metal displacement	See the repair	Refer to Section 72−53−07, Repair−06 in the PW4000 Series CIR, PN 51A357
Loss of coat	No limit		
Burning and erosion	All quantities to a maximum of 0.020 inch (0.508 mm) depth and 0.300 inch (7.620 mm) maximum diameter	See the repair	Refer to Section 72−53−07, Repair−06 in the PW4000 Series CIR, PN 51A357

Stage 3 Blade Inspection
Table 808 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area D for:			
Nicks	All quantities to a maximum of 0.015 inch (0.381 mm) depth	See the repair	Refer to Section 72-53-07, Repair-06 in the PW4000 Series CIR, PN 51A357
Round bottom dents	All quantities to a maximum of 0.020 inch (0.508 mm) depth or 0.125 inch (3.175 mm) diameter metal displacement	See the repair	Refer to Section 72-53-07, Repair-06 in the PW4000 Series CIR, PN 51A357
Loss of coat	No limit		
Burning and erosion	All quantities to a maximum of 0.020 inch (0.508 mm) depth and 0.300 inch (7.620 mm) maximum diameter	See the repair	Refer to Section 72-53-07, Repair-06 in the PW4000 Series CIR, PN 51A357
Area E for:			
Nicks	All quantities to a maximum of 0.015 inch (0.381 mm) depth	See the repair	Refer to Section 72-53-07, Repair-06 in the PW4000 Series CIR, PN 51A357
Round bottomed dents	All quantities less than 0.020 inch (0.508 mm) maximum depth and 0.100 inch (2.540 mm) maximum diameter.	See the repair	Refer to Section 72-53-07, Repair-06 in the PW4000 Series CIR, PN 51A357

Stage 3 Blade Inspection
Table 808 (Continued)

R ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			
	One dent 0.030 inch (0.762 mm) depth maximum and 0.500 inch (12.700 mm) maximum diameter		
Loss of coat	No limit		
Burning and erosion	All quantities to a maximum of 0.020 inch (0.508 mm) depth and 0.300 inch (7.620 mm) maximum diameter	See the repair	Refer to Section 72−53−07, Repair−06 in the PW4000 Series CIR, PN 51A357

Stage 3 Blade Inspection
Table 808 (Continued)

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - INSPECTION/CHECK-10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
1 General for: See Figure 809.			
Cracks	Not serviceable	Not repairable	Remove from service
Corrosion	Not serviceable	Remove the corrosion	Refer to Section 72-53-00, Cleaning-01 in the PW4000 Series CIR, PN 51A357
Nicks, dents, scratches, scoring and pitting	0.004 inch (0.102 mm) maximum depth	0.008 inch (0.203 mm) maximum depth. Damage is not permitted on the same area on the opposite side of the part.	Refer to Section 72-53-38, Repair-02 in the PW4000 Series CIR, PN 51A357
2 Knife-edges for surface damage and bending	Bending to a maximum of 0.015 inch (0.381 mm) from normal position with no other damage	Blends are permitted in the area as follows:	
		0.300 sq-in (194. sq-mm) is the maximum total blend area for the four knife-edge configuration	Refer to Section 72-53-38, Repair-01 in the PW4000 Series CIR, PN 51A357
		0.150 sq-in (97. sq-mm) is the maximum total blend	Refer to Section 72-53-38, Repair-06 in

Inner Rotating Airseal Visual Inspection
Table 809

R ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−10

R	Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
	(CONTINUED)			
R			area for the two knife−edge configuration	the PW4000 Series CIR, PN 51A357

R Inner Rotating Airseal Visual Inspection
R Table 809 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
1 Areas of Stage 3 inner sealing ring assembly that you can access (other than in the areas of honeycomb) for: See Figure 810.			
Nicks and dents	0.005 inch (0.127 mm) depth	Not repairable	Remove from service
Radial and axial cracks	Not permitted	A maximum of 100 percent of the axial length of the part	Refer to Section 72-53-19, Repair-03 in the PW4000 Series CIR, PN 51A357
Circumferential cracks	Not permitted	Not repairable	Remove from service
2 Honeycomb area for:			
Damaged and bent cells (Other than in areas of the blade knife-edge contact)	Maximum damage size is 3 rows width by 0.800 inch (20.320 mm) length. Maximum of 5 damaged areas	Replace the honeycomb	Refer to Section 72-53-19, Repair-02 in the PW4000 Series CIR, PN 51A357

Inner Stage 3 Sealing Ring Visual Inspection
Table 810

R ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 3 disk (If airseal is removed) for: See Figure 811 (Sheet 1).			
Area A Fretting, galling, wear, scattered dents, nicks and scratches	0.003 inch (0.076 mm) maximum depth	0.003 − 0.015 inch (0.08 − 0.38 mm) maximum depth	Refer to Section 72−53−13, Repair−01 in the PW4000 Series CIR, PN 51A357
Stage 4 disk Area B Fretting, galling, wear, scattered dents, nicks and scratches	0.003 inch (0.076 mm) maximum depth	0.003 − 0.015 inch (0.08 − 0.38 mm) maximum depth	Refer to Section 72−53−14, Repair−01 in the PW4000 Series CIR, PN 51A357
Area C Fretting and galling	0.001 inch (0.025 mm) maximum depth	0.003 inch (0.076 mm) maximum depth to a maximum of 20 percent of the surface area	Refer to Section 72−53−14, Repair−01 in the PW4000 Series CIR, PN 51A357
		A maximum of 0.010 inch (0.254 mm) depth A maximum of 10 percent of the surface area.	
Stage 5 rear turbine hub. See Figure 811 (Sheet 2).			

R Stages 3, 4, 5 And 6 Disks Visual Inspection
R Table 811

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area D Fretting, galling, wear, scattered dents, nicks and scratches	0.003 inch (0.076 mm) maximum depth	0.003 - 0.015 inch (0.08 - 0.38 mm) maximum depth	Refer to Section 72-53-15, Repair-01 in the PW4000 Series CIR, PN 51A357
If turbine exhaust case removed Stage 6 disk for:			
Area E Fretting, galling, wear, scattered dents, nicks and scratches	0.003 inch (0.076 mm) maximum depth	0.003 - 0.015 inch (0.08 - 0.38 mm) in depth	Refer to Section 72-53-16, Repair-02 in the PW4000 Series CIR, PN 51A357
Area F Fretting and galling	Not permitted	0.003 inch (0.076 mm) maximum depth to a maximum of 20 percent of the surface area	Refer to Section 72-53-16, Repair-02 in the PW4000 Series CIR, PN 51A357
		A maximum of 0.010 inch (0.254 mm) depth A maximum of 10 percent of the surface area	

R Stages 3, 4, 5 And 6 Disks Visual Inspection
R Table 811 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area G			
Fretting, galling, wear, scattered dents, nicks and scratches	Not permitted	0.015 inch (0.381 mm) maximum depth	Refer to Section 72−53−16, Repair−02 in the PW4000 Series CIR, PN 51A357

Stages 3, 4, 5 And 6 Disks Visual Inspection
Table 811 (Continued)

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - INSPECTION/CHECK-10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 6 LPT blade for: See Figure 812			
Cracks in all areas	Not permitted	No limit	Replace the blade
Area A Nicks and dents	Not permitted	No limit	Refer to Section 72-53-10, Repair-05 in the PW4000 Series CIR, PN 51A357
Area B Nicks and dents	All quantities to a maximum of 0.015 inch (0.381 mm) depth and 0.030 inch (0.762 mm) diameter metal displacement maximum	No limit	Refer to Section 72-53-10, Repair-05 in the PW4000 Series CIR, PN 51A357
Area C Nicks and dents	Not permitted	No limit	Refer to Section 72-53-10, Repair-05 in the PW4000 Series CIR, PN 51A357
Area D Nicks and dents	All quantities to a maximum of 0.020 inch (0.508 mm) depth	No limit	Refer to Section 72-53-10, Repair-05 in the PW4000 Series CIR, PN 51A357

Stage 6 Blade Surface Damage Inspection
Table 812

R ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - INSPECTION/CHECK-10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Stage 6 LPT vane airfoil for: See Figure 813.			
Cracks in all areas	Not permitted	No limit	Replace the vane
Area A Dents and nicks	Not permitted	No limit	Refer to Section 72-53-26, Repair-01 in the PW4000 Series CIR, PN 51A357
Area B Nicks and dents	All quantities to a maximum of 0.015 inch (0.381 mm) depth. 0.030 inch (0.762 mm) diameter maximum metal displacement with no cracking.	No limit	Refer to Section 72-53-26, Repair-01 in the PW4000 Series CIR, PN 51A357
Area C Nicks and dents	Not permitted	No limit	Refer to Section 72-53-26, Repair-01 in the PW4000 Series CIR, PN 51A357

R Stage 6 Vane Airfoil Surface Inspection
R Table 813

R ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−10

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area D			
Nicks and dents	All quantities to a maximum of 0.020 inch (0.508 mm) depth	No limit	Refer to Section 72−53−26, Repair−01 in the PW4000 Series CIR, PN 51A357

NOTE: Only one airfoil side, shrouds and trailing edge are seen. If you see damage on the side of the vane, a full inspection of the vane must be done. Use boroscope, mirrors or other necessary tooling to see the vane leading edge and remainder of the airfoil surfaces.

Stage 6 Vane Airfoil Surface Inspection
Table 813 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
	CAUTION: ALL INDICATIONS MUST BE EXAMINED BY NON-DESTRUCTIVE INSPECTION PROCEDURE. IF THE INDICATION IS A CRACK, THE SHAFT IS NOT REPAIRABLE AND MUST BE REMOVED FROM SERVICE.		
1	0.050 inch (1.270 mm) reference		
Area A for: See Figure 814. Scratches, nicks, chips and missing coat	Not permitted	No limit	Restore the coat. Refer to Section 72-53-80, Repair-03 in the PW4000 Series CIR, PN 51A357 Touch up the coat. Refer to Section 72-53-80, Repair-15 in the PW4000 Series CIR, PN 51A357
		Surface damage into the base metal to a maximum of 0.010 inch (0.254 mm) depth	Blend repair. Refer to Section 72-53-80, Repair-02 in the PW4000 Series CIR, PN 51A357
Corrosion and pitting	Not permitted	Shafts with indication of corrosion must be stripped and repair by Repair-29	Refer to Section 72-53-80, Repair-29 in the PW4000 Series CIR, PN 51A357

LPT Shaft Surface Inspection
Table 814

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area B Front outer diameter fillet radius for pitting	Not permitted	A maximum of 0.027 inch (0.686 mm) depth	Refer to Section 72-53-80, Repair-02 in the PW4000 Series CIR, PN 51A357
Area C Front outer diameter for pitting	Not permitted	See the repair	Refer to Section 72-53-80, Repair-29 in the PW4000 Series CIR, PN 51A357
Area D Front (66 tooth) Spline for:			
Pitting on the spline face surfaces	All quantities to a maximum of 0.003 inch (0.076 mm) depth on the loaded surface		
	All quantities to a maximum of 0.005 inch (0.127 mm) depth on the not loaded surface		
Pitting in the spline root radius	All quantities to a maximum of 0.001 inch (0.025 mm) depth on the rear 1.000 inch (25.400 mm) of the spline root radius		

LPT Shaft Surface Inspection
Table 814 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)			
	All quantities to a maximum of 0.002 inch (0.051 mm) depth on the remainder of the spline root radius		
Rough edges and raised material	Not permitted	See the repair	Refer to Section 72-53-80, Repair-02 in the PW4000 Series CIR, PN 51A357
Area E			
Bolt flange and mating part surfaces for galling, pitting and scoring	Not permitted	0.015 inch (0.381 mm) maximum depth for 15 percent of the area maximum. See repair applicable to damage.	Refer to Section 72-53-80, Repair-02, Repair-05, Repair-06, Repair-07, Repair-08, Repair-09, Repair-13 and Repair-15 in the PW4000 Series CIR, PN 51A357
Area F			
Threads for galling, pitting, scoring and raised material	Not permitted	6.000 inches (152.400 mm) total length of the thread can be repaired	
		2.000 inches (50.800 mm) maximum thread removal at all locations	

LPT Shaft Surface Inspection
Table 814 (Continued)

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
(CONTINUED)		2.500 inches (63.500 mm) minimum not damaged thread between the two damaged or removed sections of the thread. See the notes.	

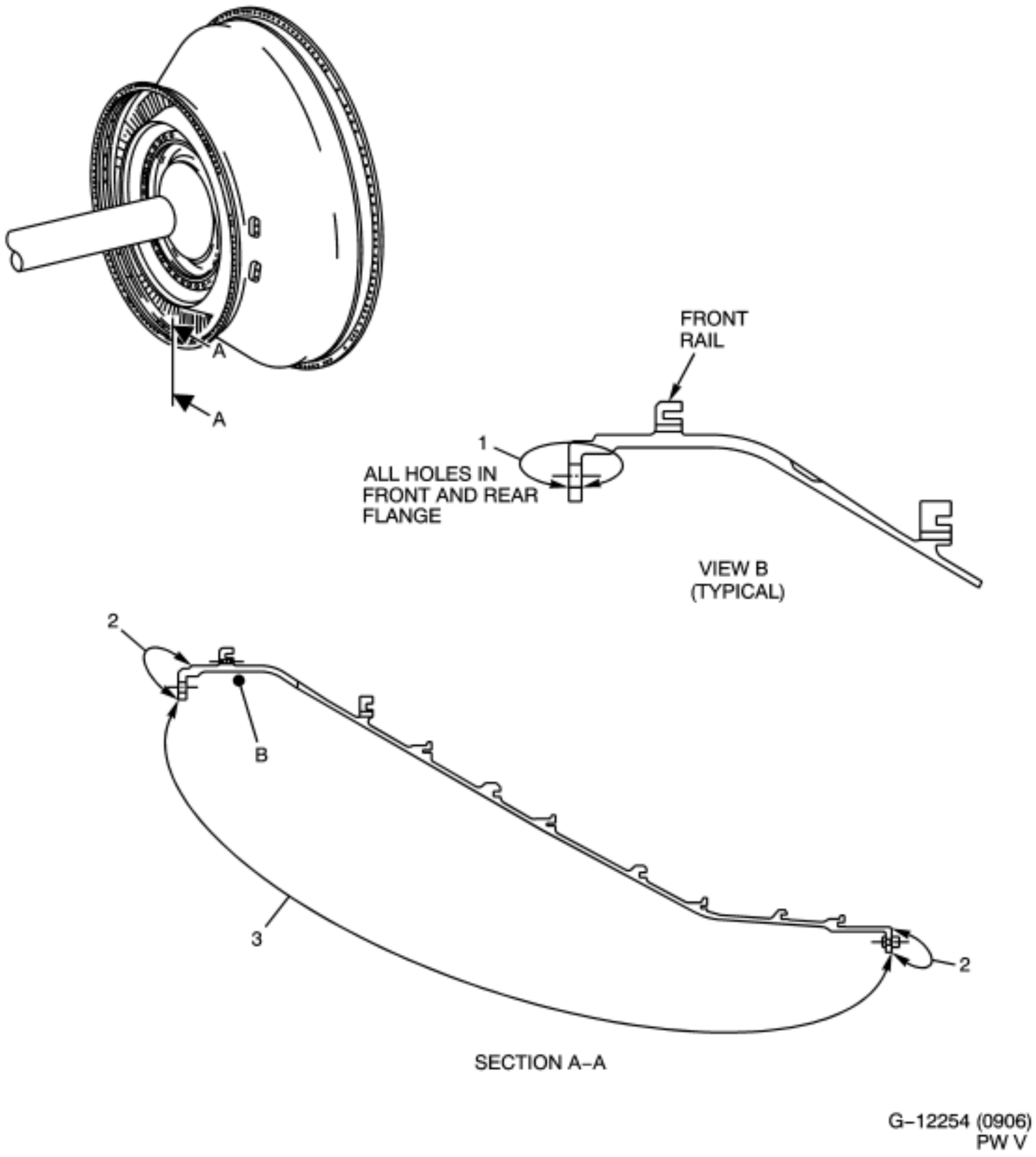
NOTE: All the length measurements are along the outer diameter circumference of the thread.

NOTE: You can remove the damaged threads for the full length or pitch of the thread (hold to a minimum) and to a depth necessary to clean up the damaged threads (hold to a minimum).

Examine	Serviceable Limits	Repairable Limits	Disposition/ Repair
Area G Mating diameter and shoulder face	Not permitted	See the repair	Refer to Section 72−53−80, Repair−14 in the PW4000 Series CIR, PN 51A357

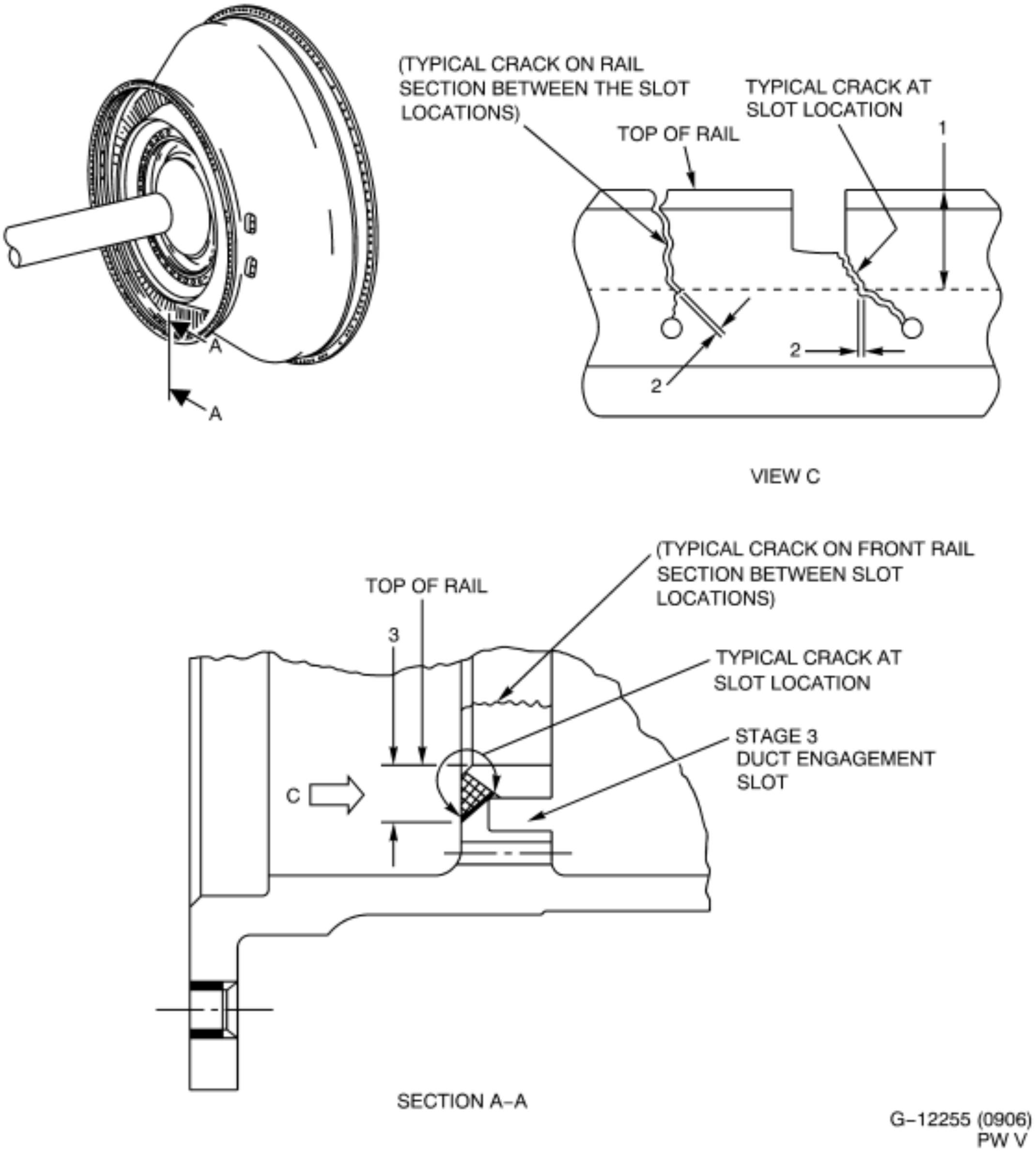
LPT Shaft Surface Inspection
Table 814 (Continued)

R ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−10


A
A
FRONT RAIL
1
ALL HOLES IN FRONT AND REAR FLANGE
VIEW B (TYPICAL)
2
B
3
2
SECTION A−A
G−12254 (0906)
PW V

R See Table 801 For Index Definitions.

R Rear Turbine Case Surface Damage Inspection
R Figure 801
R (Task 72−00−53−210−010)


A
A
(TYPICAL CRACK ON RAIL SECTION BETWEEN THE SLOT LOCATIONS)
TOP OF RAIL
TYPICAL CRACK AT SLOT LOCATION
1
2
2
VIEW C
TOP OF RAIL
3
(TYPICAL CRACK ON FRONT RAIL SECTION BETWEEN SLOT LOCATIONS)
TYPICAL CRACK AT SLOT LOCATION
STAGE 3 DUCT ENGAGEMENT SLOT
C
SECTION A−A
G−12255 (0906)
PW V

R See Table 802 For Index Definitions.

R Front Inner Rail Visual Inspection Areas
R Figure 802
R (Task 72−00−53−210−010)

R ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−10

R
R
R
R
R
R
R
R
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R
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R
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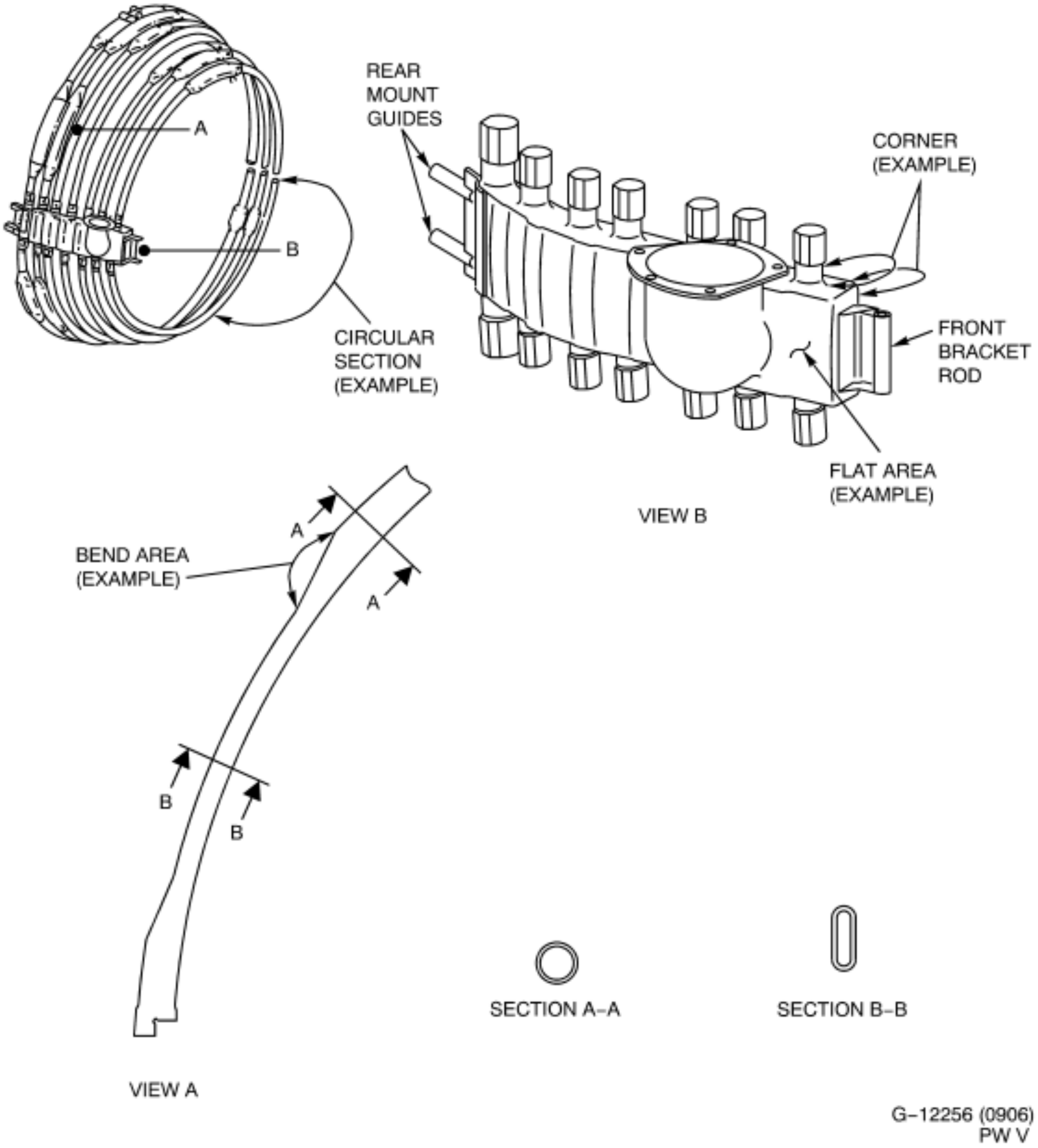
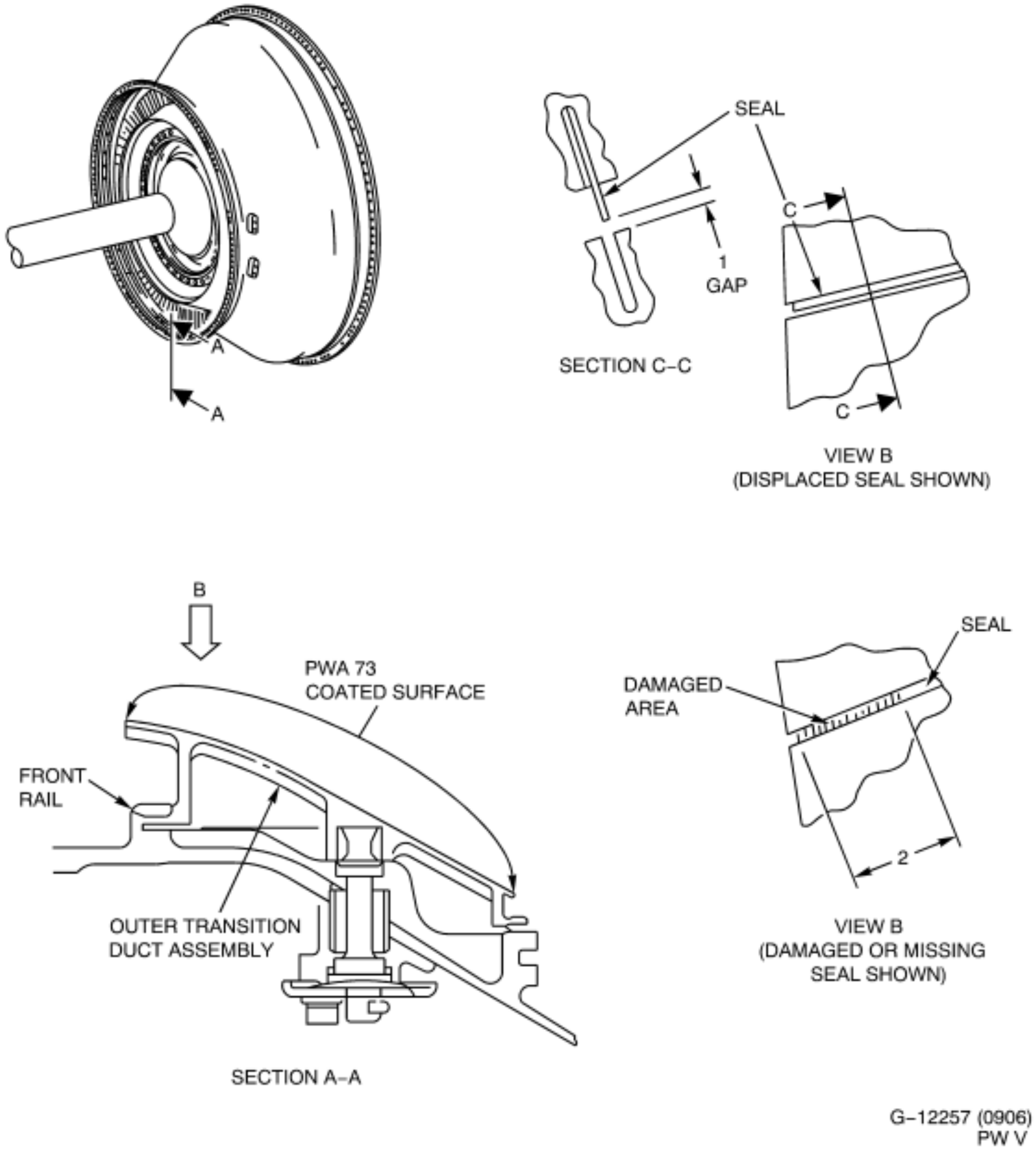
R
R
R

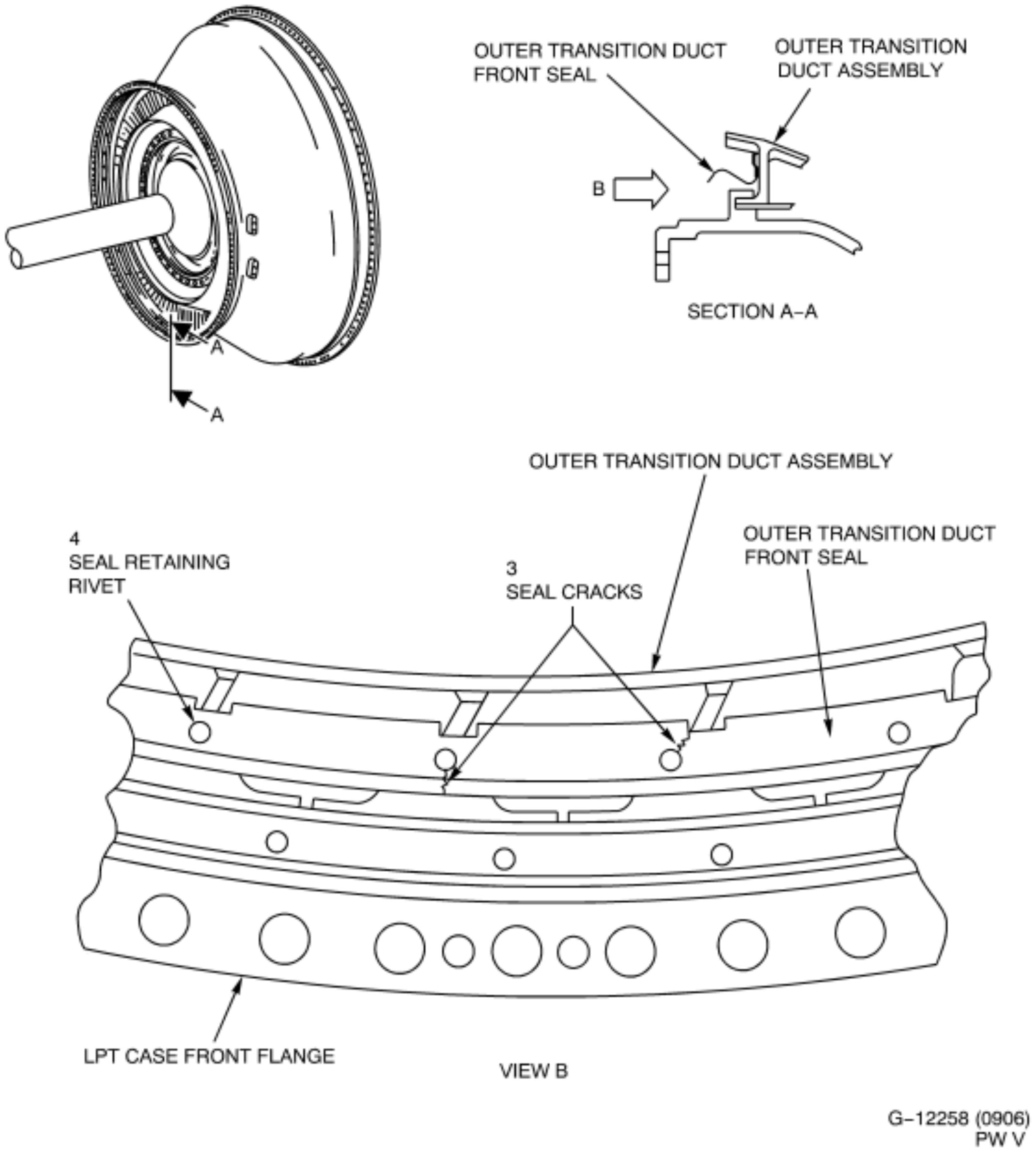

A
B
REAR
MOUNT
GUIDES
CORNER
(EXAMPLE)
CIRCULAR
SECTION
(EXAMPLE)
FRONT
BRACKET
ROD
FLAT AREA
(EXAMPLE)
VIEW B
BEND AREA
(EXAMPLE)
A
A
B
B
SECTION A−A
SECTION B−B
VIEW A
G−12256 (0906)
PW V

R LPT Case Cooling Manifold And Supply Tubes Inspection
R Figure 803
R (Task 72−00−53−210−010)


SEAL
1
GAP
SECTION C-C
C
C
VIEW B
(DISPLACED SEAL SHOWN)
A
A
B
PWA 73
COATED SURFACE
FRONT
RAIL
OUTER TRANSITION
DUCT ASSEMBLY
SECTION A-A
DAMAGED
AREA
SEAL
2
VIEW B
(DAMAGED OR MISSING
SEAL SHOWN)
G-12257 (0906)
PW V

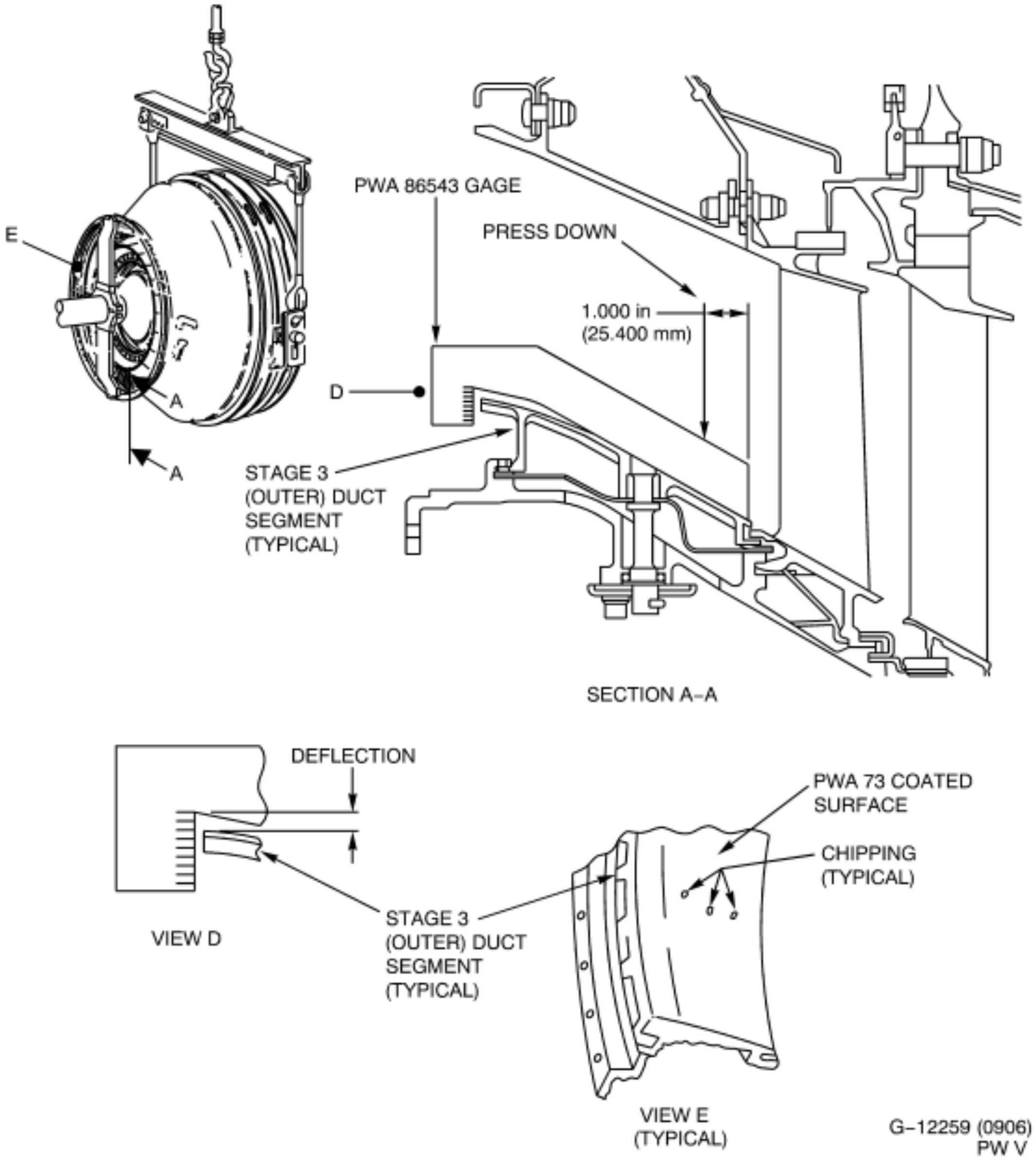
R See Table 804 For Index Definitions.

R Stage 3 Outer (Transition) Duct Segment Inspection
R Figure 804 (Sheet 1)
R (Task 72-00-53-210-010)


OUTER TRANSITION DUCT FRONT SEAL
OUTER TRANSITION DUCT ASSEMBLY
B
SECTION A–A
A
A
OUTER TRANSITION DUCT ASSEMBLY
OUTER TRANSITION DUCT FRONT SEAL
4
SEAL RETAINING RIVET
3
SEAL CRACKS
LPT CASE FRONT FLANGE
VIEW B
G–12258 (0906)
PW V

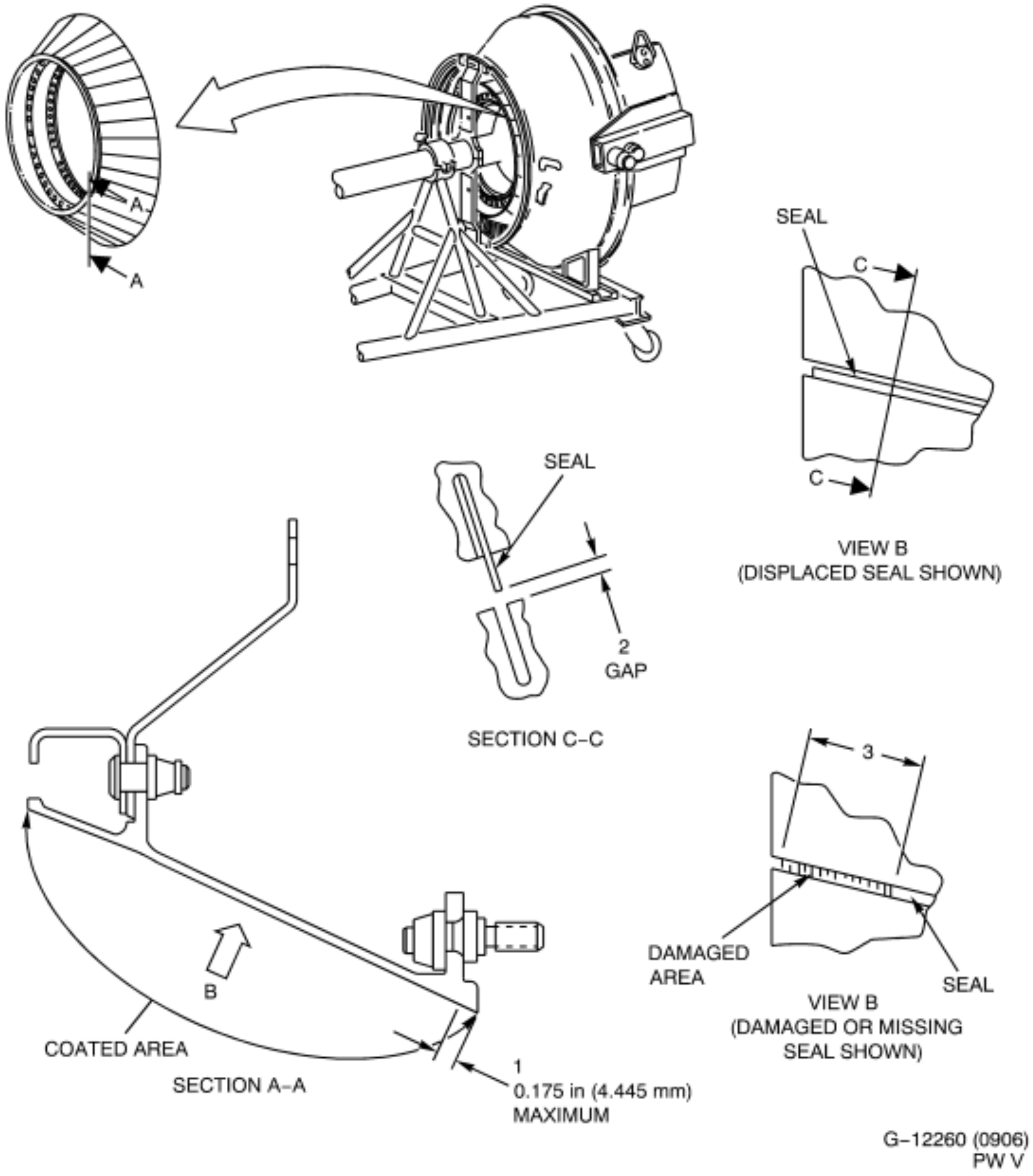
R See Table 804 For Index Definitions.

R Stage 3 Outer (Transition) Duct
R Segment Seals (Flow Guide) Inspection
R Figure 804 (Sheet 2)
R (Task 72–00–53–210–010)


E
A
A
PWA 86543 GAGE
PRESS DOWN
1.000 in
(25.400 mm)
D
STAGE 3
(OUTER) DUCT
SEGMENT
(TYPICAL)
SECTION A−A
DEFLECTION
VIEW D
STAGE 3
(OUTER) DUCT
SEGMENT
(TYPICAL)
PWA 73 COATED
SURFACE
CHIPPING
(TYPICAL)
VIEW E
(TYPICAL)
G−12259 (0906)
PW V

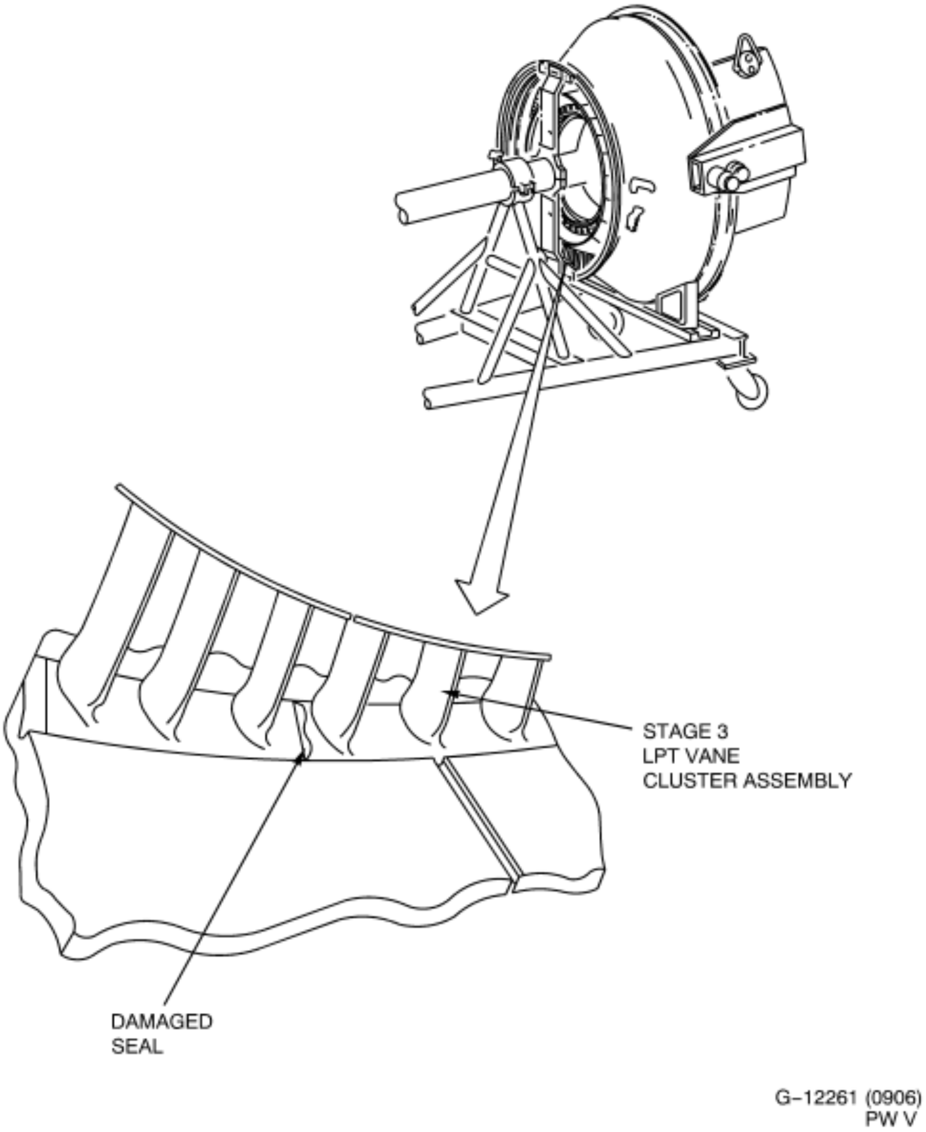
R See Table 804 For Index Definitions.

R Stage 3 Outer (Transition) Duct Segment Inspection
R Figure 804 (Sheet 3)
R (Task 72−00−53−210−010)

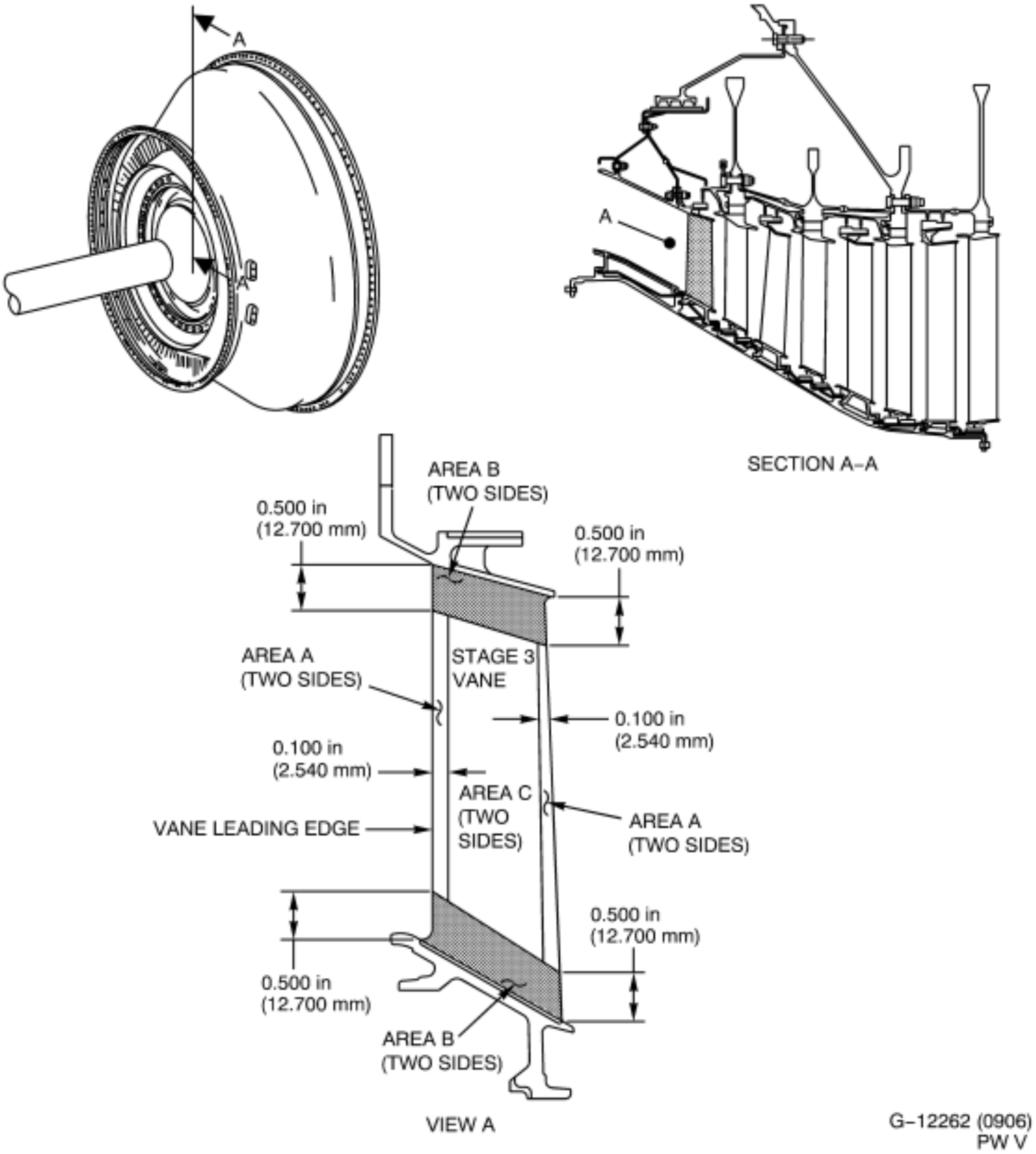

A
A
SEAL
C
C
VIEW B
(DISPLACED SEAL SHOWN)
SEAL
2
GAP
SECTION C-C
3
DAMAGED
AREA
SEAL
VIEW B
(DAMAGED OR MISSING
SEAL SHOWN)
B
COATED AREA
SECTION A-A
1
0.175 in (4.445 mm)
MAXIMUM
G-12260 (0906)
PW V

R See Table 805 For Index Definitions.

R Stage 3 Inner (Transition) Duct Visual Inspection
R Figure 805
R (Task 72-00-53-210-010)

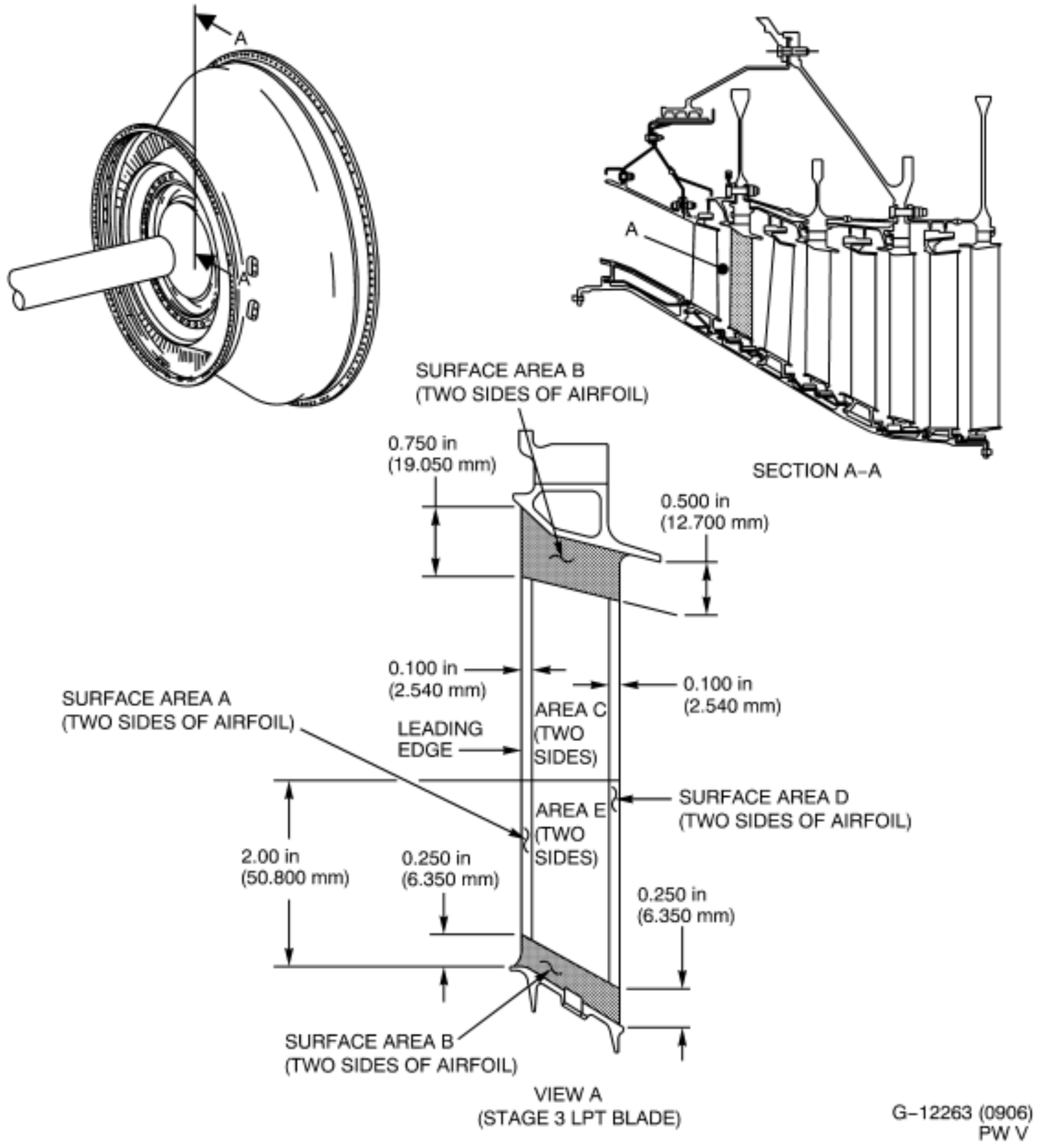

STAGE 3
LPT VANE
CLUSTER ASSEMBLY
DAMAGED
SEAL
G−12261 (0906)
PW V

R Stage 3 Outer Seals Between The Vane Segments
R Figure 806
R (Task 72−00−53−210−010)


A
A
A
SECTION A−A
AREA B
(TWO SIDES)
0.500 in
(12.700 mm)
0.500 in
(12.700 mm)
AREA A
(TWO SIDES)
STAGE 3
VANE
0.100 in
(2.540 mm)
0.100 in
(2.540 mm)
AREA C
(TWO
SIDES)
VANE LEADING EDGE
AREA A
(TWO SIDES)
0.500 in
(12.700 mm)
0.500 in
(12.700 mm)
AREA B
(TWO SIDES)
VIEW A
G−12262 (0906)
PW V

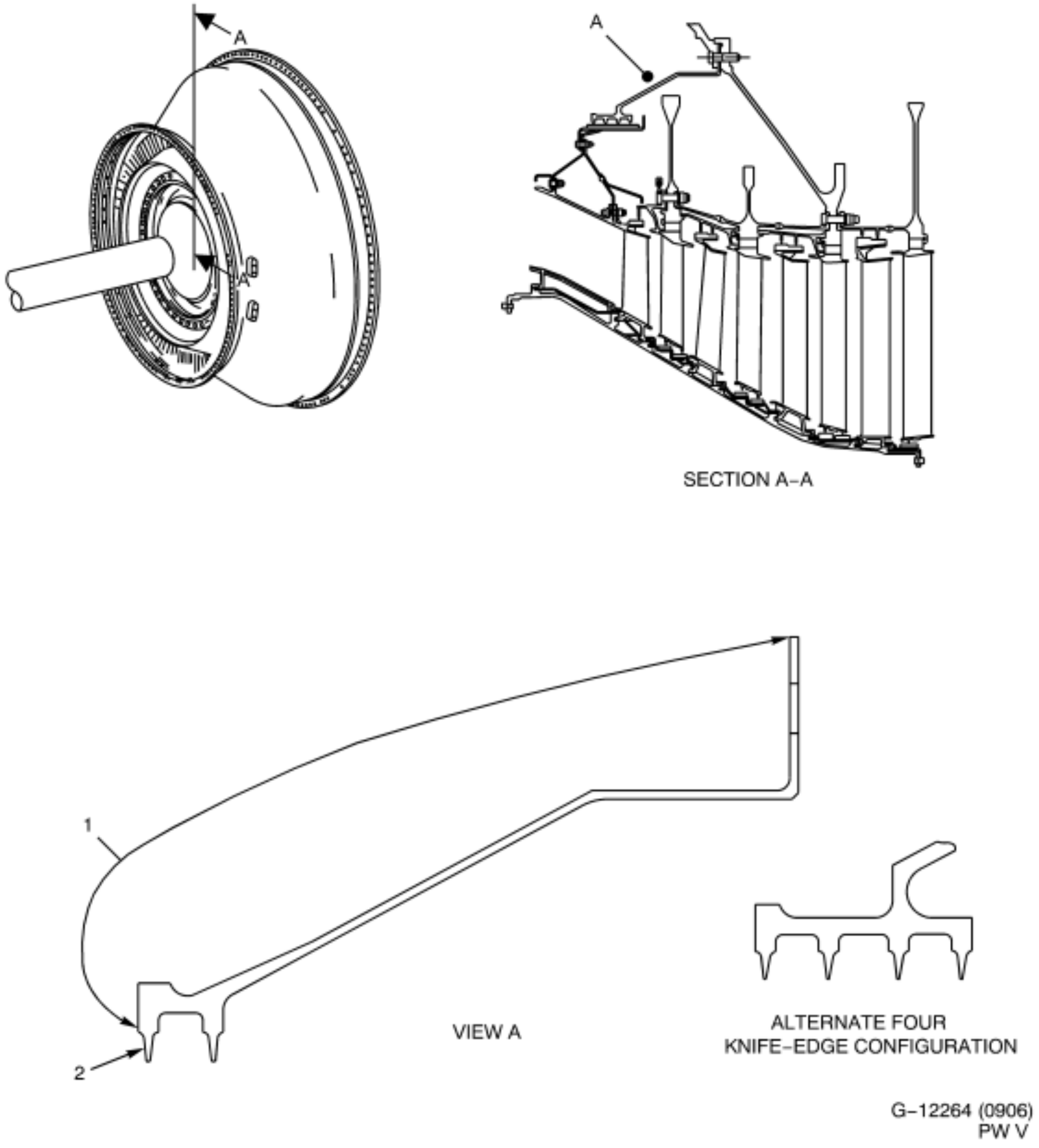
R See Table 807 For Index Definitions.

R Stage 3 Vane Surface Damage Inspection
R Figure 807
R (Task 72−00−53−210−010)


A
A
A
SURFACE AREA B
(TWO SIDES OF AIRFOIL)
SECTION A-A
0.750 in
(19.050 mm)
0.500 in
(12.700 mm)
0.100 in
(2.540 mm)
0.100 in
(2.540 mm)
SURFACE AREA A
(TWO SIDES OF AIRFOIL)
LEADING
EDGE
AREA C
(TWO
SIDES)
AREA E
(TWO
SIDES)
SURFACE AREA D
(TWO SIDES OF AIRFOIL)
2.00 in
(50.800 mm)
0.250 in
(6.350 mm)
0.250 in
(6.350 mm)
SURFACE AREA B
(TWO SIDES OF AIRFOIL)
VIEW A
(STAGE 3 LPT BLADE)
G-12263 (0906)
PW V

R See Table 808 For Index Definitions.

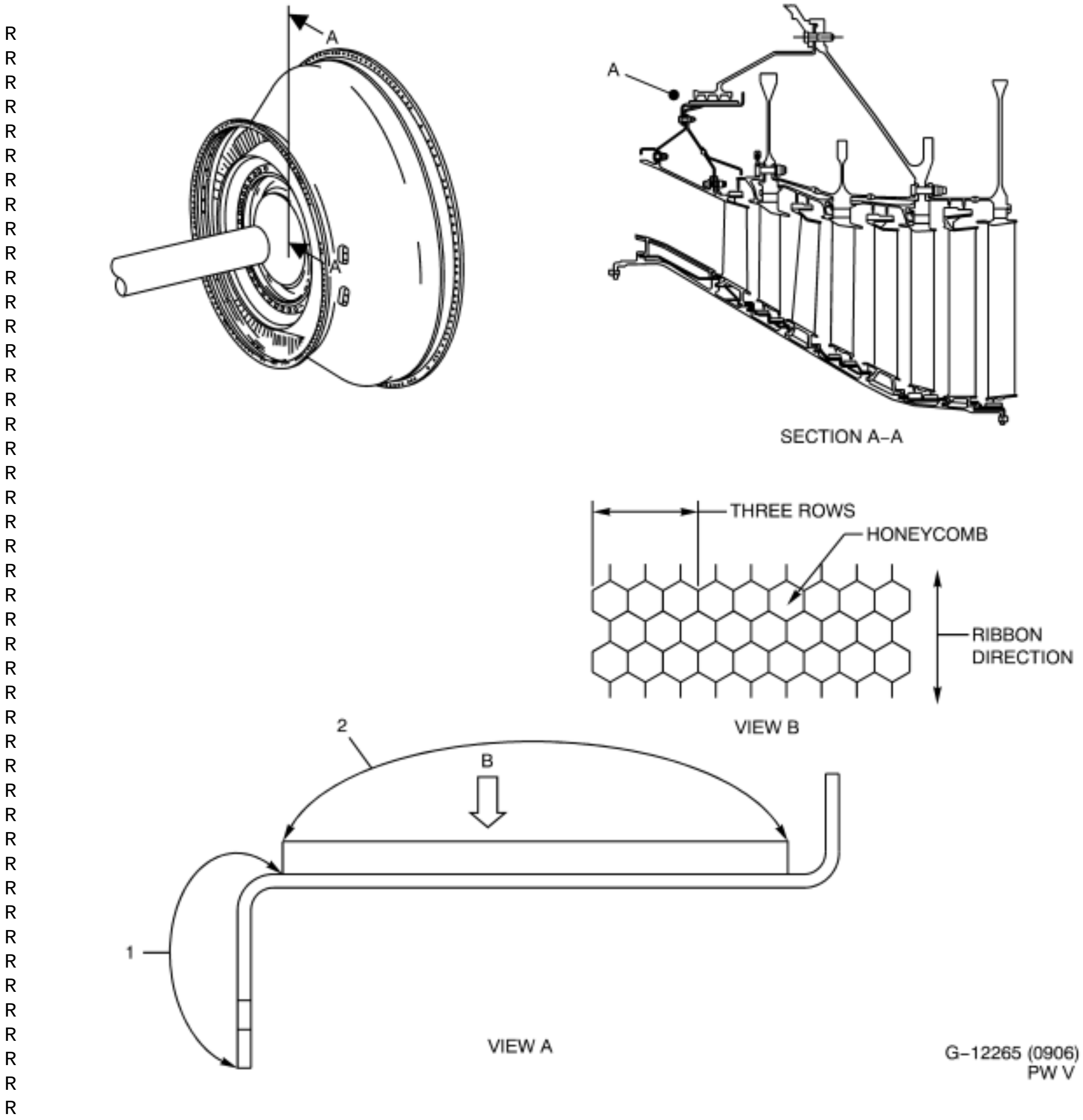
R Stage 3 Blade Surface Damage Inspection
R Figure 808
R (Task 72-00-53-210-010)


A
A
A
SECTION A−A
1
2
VIEW A
ALTERNATE FOUR
KNIFE−EDGE CONFIGURATION
G−12264 (0906)
PW V

R See Table 809 For Index Definitions.

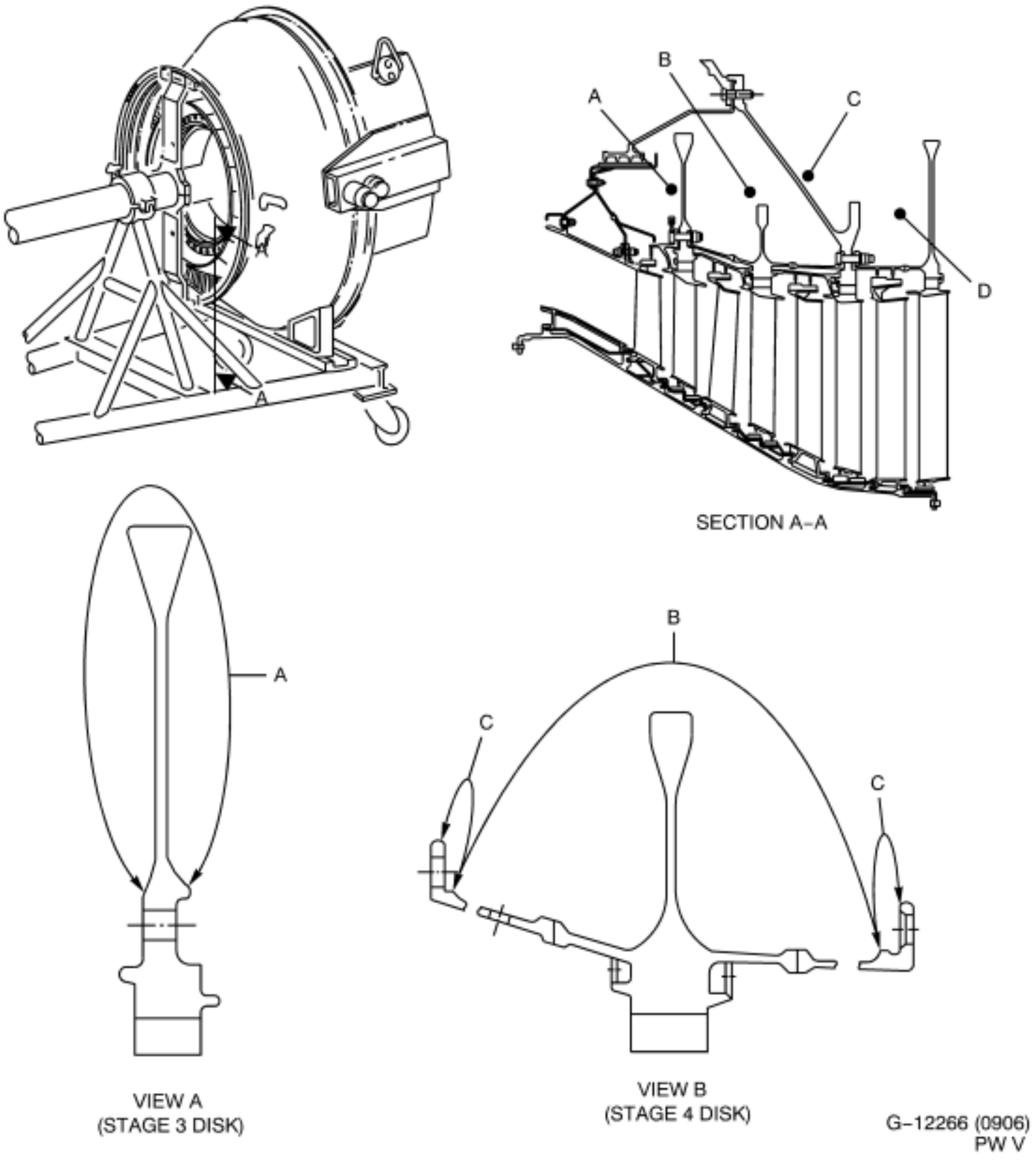
R Inner Rotating Airseal Visual Inspection
R Figure 809
R (Task 72−00−53−210−010)

R ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−10


A
A
A
SECTION A−A
THREE ROWS
HONEYCOMB
RIBBON DIRECTION
VIEW B
2
B
1
VIEW A
G−12265 (0906)
PW V

R See Table 810 For Index Definitions.

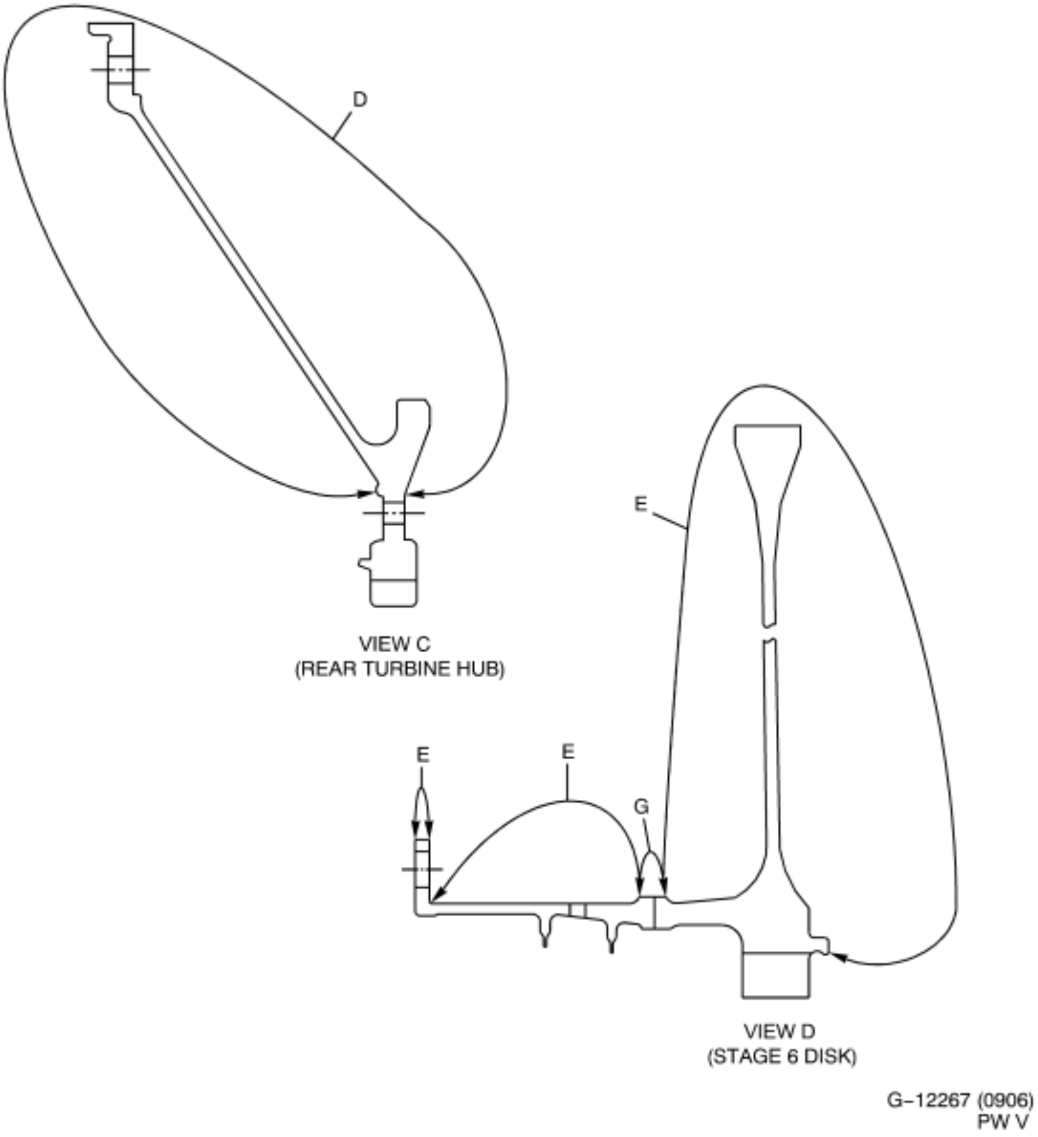
R Stage 3 Inner Air Sealing Ring Visual Inspection
R Figure 810
R (Task 72−00−53−210−010)


A
B
A
C
D
SECTION A−A
A
VIEW A
(STAGE 3 DISK)
B
C
C
VIEW B
(STAGE 4 DISK)
G−12266 (0906)
PW V

R See Table 811 For Index Definitions.

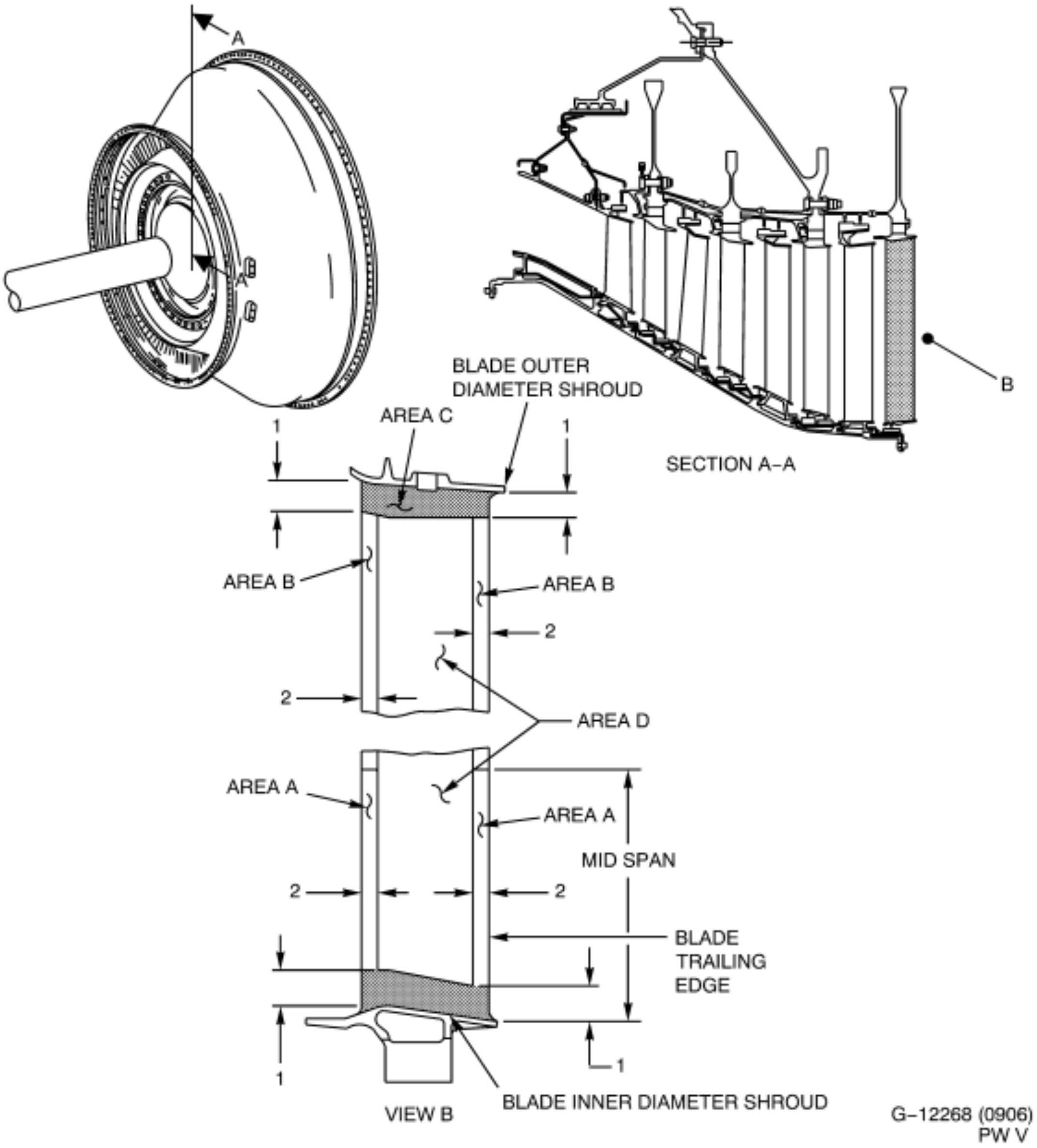
R Stage 3, 4, 5 And 6 Disk Visual Inspection
R Figure 811 (Sheet 1)
R (Task 72−00−53−210−010)

R ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - INSPECTION/CHECK-10


D
VIEW C
(REAR TURBINE HUB)
E
E
E
G
VIEW D
(STAGE 6 DISK)
G-12267 (0906)
PW V

R See Table 811 For Index Definitions.

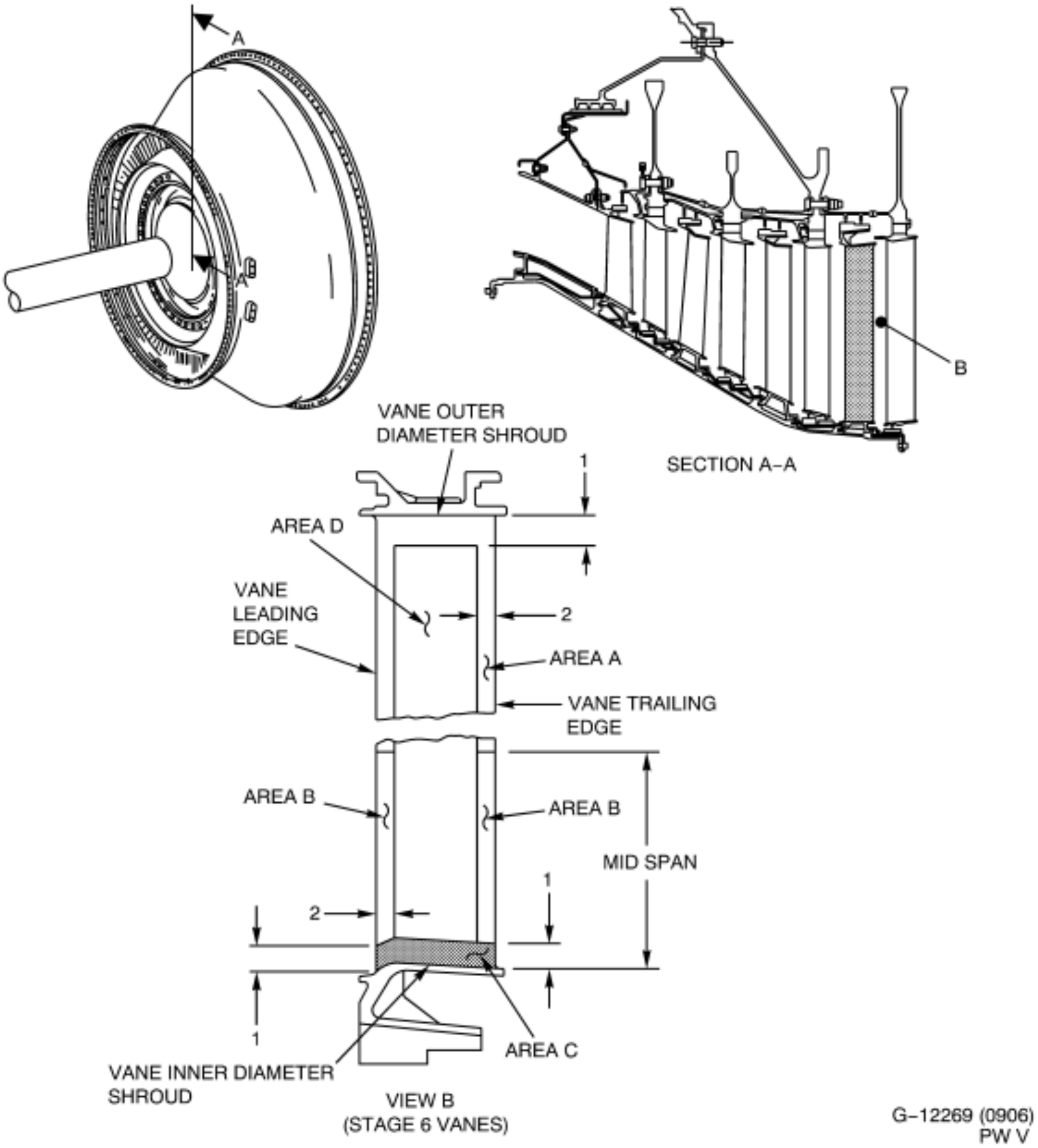
R Stage 3, 4, 5 And 6 Disk Visual Inspection
R Figure 811 (Sheet 2)
R (Task 72-00-53-210-010)


A
A
B
SECTION A−A
BLADE OUTER DIAMETER SHROUD
AREA C
1
1
AREA B
AREA B
2
2
AREA D
AREA A
AREA A
MID SPAN
2
2
BLADE TRAILING EDGE
1
1
VIEW B
BLADE INNER DIAMETER SHROUD
G−12268 (0906)
PW V

R 1. 0.600 Inch (15.240 mm)
R 2. 0.100 Inch (2.540 mm)

R Stage 6 Blade Surface Damage Inspection
R Figure 812
R (Task 72−00−53−210−010)

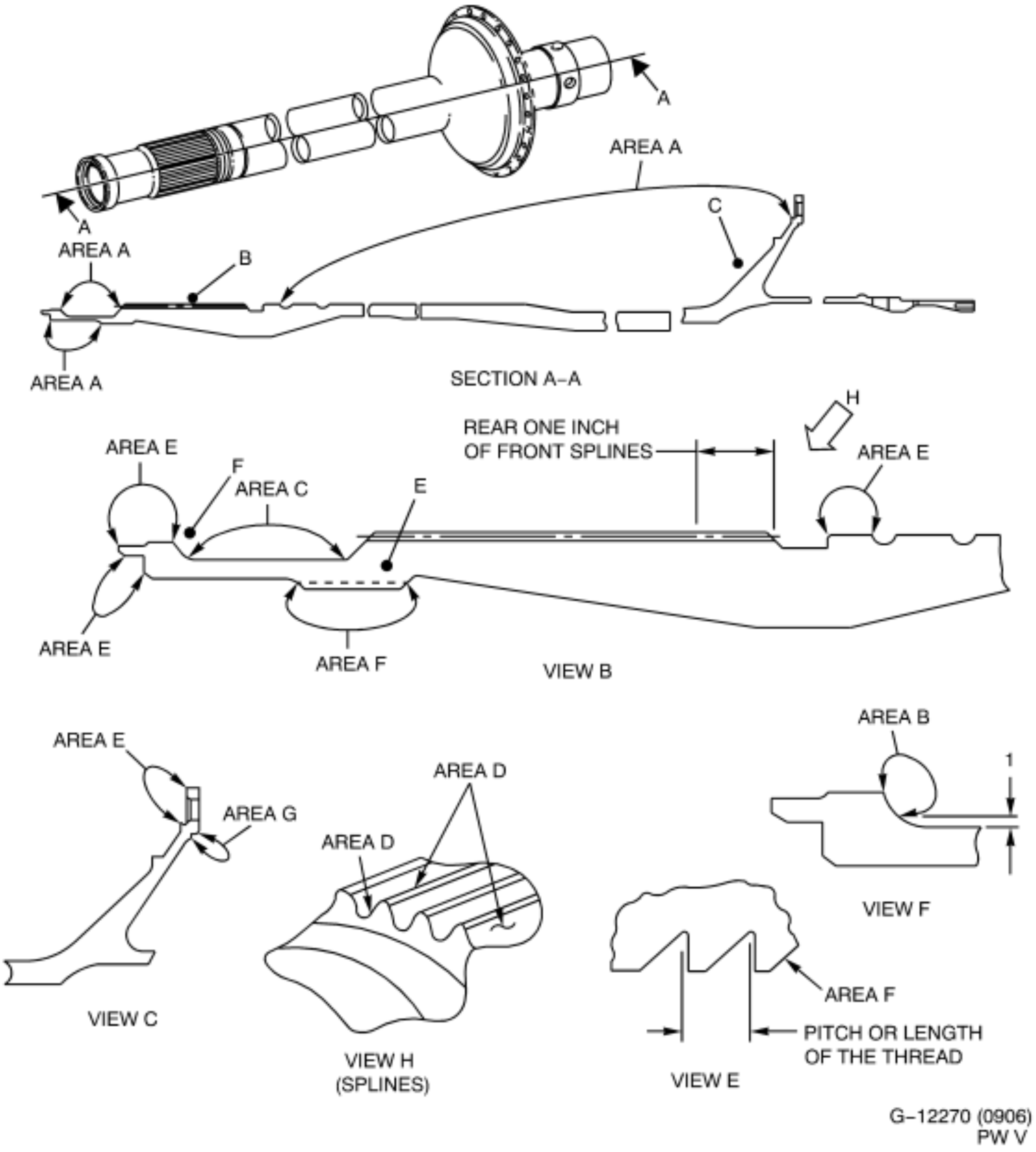
R ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−10


A
A
B
SECTION A−A
VANE OUTER DIAMETER SHROUD
1
AREA D
VANE LEADING EDGE
2
AREA A
VANE TRAILING EDGE
AREA B
AREA B
MID SPAN
1
2
1
VANE INNER DIAMETER SHROUD
AREA C
VIEW B (STAGE 6 VANES)
G−12269 (0906)
PW V

R 1. 0.500 Inch (12.700 mm)
R 2. 0.100 Inch (2.540 mm)

R Stage 6 Vane Airfoil Surface Damage Inspection
R Figure 813
R (Task 72−00−53−210−010)

R ENGINE GENERAL – LOW PRESSURE TURBINE (LPT) – INSPECTION/CHECK-10


A
A
AREA A
AREA A
B
C
AREA A
SECTION A-A
H
REAR ONE INCH
OF FRONT SPLINES
AREA E
F
AREA C
E
AREA E
AREA E
AREA F
VIEW B
AREA E
AREA G
AREA D
AREA D
AREA B
1
VIEW F
AREA F
PITCH OR LENGTH
OF THE THREAD
VIEW C
VIEW H
(SPLINES)
VIEW E
G-12270 (0906)
PW V

R LPT Shaft Inspection
R Figure 814
R (Task 72-00-53-210-010)

ENGINE GENERAL - LOW PRESSURE TURBINE (LPT) - REPAIR-01

Task 72-00-53-300-001:

1. Stop Drill Repair Turbine Case Front Inner Rail Cracks

NOTE: This repair can be used to repair radial cracks in the smooth section and slots of the turbine case front inner rail with a radial length of 0.300 - 0.425 inch (7.6 - 10.8 mm).

NOTE: Optional, you can stop drill repair cracks in the front inner rail after the low pressure turbine is disassembled. Refer to 72-53-17, Repair-23 Task 72-53-17-300-023.

A. Prerequisites

(1) Remove the low pressure turbine from the engine. Refer
R to 72-00-53, Removal-01 (Task 72-00-53-020-001),
R Removal-02 (Task 72-00-53-020-001-002), or remove the low pressure turbine and the turbine exhaust case from the engine. Refer to 72-00-53, Removal-08 (Task 72-00-53-020-002-001) or Removal-09 (Task 72-00-53-020-002-002).

B. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P05-212	Wire, Welding (AMS 5679)
P05-151	Wire, Welding (AMS 5837)
P05-213	Wire (AMS 5687)

C. Procedure

See Figure 901 and Figure 902.

Subtask 72-00-53-350-051:

(1) Locate any 0.058 - 0.068 inch (1.47 - 1.73 mm) diameter stop drill holes that were not plugged. These holes must be re-operated as specified in the following procedure.

CAUTION: WEAR EYE PROTECTION WHEN YOU GRIND THE HARDFACE.

CAUTION: HARDFACE COATING CAN CHIP IF THE FOLLOWING GRINDING PROCEDURE IS NOT USED

(2) Grind to remove all of the hardface from Area X. See Figure 902 (Sheet 1). Use a manually guided rotating abrasive wheel. Keep parent metal removal to a minimum.

NOTE: All stop drill holes must be at the same radial location as the cooling air holes.

Subtask 72-00-53-350-052:

CAUTION: THE TURBINE CASE CAN BE SLIGHTLY OUT OF ROUND. LOCATE THE CENTER OF THE STOP DRILL HOLES 0.091 - 0.121 INCH (2.31 - 3.07 mm) INWARD FROM THE ID OF THE TURBINE CASE WALL AS SPECIFIED IN FIGURE 901 (SHEET 2).

(3) Drill a 0.085 - 0.095 inch (2.16 - 2.41 mm) diameter hole radially in line with the crack. Maintain at least 0.200 inch (50.80 mm) distance from an existing cooling air hole. See Figure 901.

NOTE: If the projected radial growth of a crack does not intersect an existing cooling air hole, but is within 0.200 inch (50.80 mm) of an existing cooling air hole, a stop drill hole must be installed as close as possible to the existing cooling air hole. See Figure 901 (Sheet 1).

Subtask 72-00-53-350-053:

(4) Cut a pin of 0.084 inch (2.134 mm) diameter Wire P05-213 to a length of 0.450 - 0.500 inch (11.43 - 12.70 mm).

(5) Lightly peen to slightly ovalize one end of the wire to approximately 0.095 - 0.100 inch (2.413 - 2.540 mm).

NOTE: Ovalizing one end of the wire will help in installing the wire by providing an interference fit between the wire pin and the hole to be plugged.

(6) In the following step, you can not tack weld near a crack that is stop drilled. Plug and tack weld the cooling hole closest to the stop drilled hole. After you plug one cooling hole for each stop drilled hole a total of (43) 0.085 - 0.095 inch (2.16 - 2.41 mm) diameter holes must remain open.

CAUTION: DO NOT FORCE THE WIRE PIN INTO THE HOLE WITH EXCESSIVE FORCE OR YOU CAN PUSH THE PIN INTO THE NEXT COMPARTMENT.

(7) Install the end of the wire pin that is not deformed into the hole to be plugged, from the front side of the case rail. Use a drift or punch to install the wire pin flush with the blended surface on the front side of the case rail.

Subtask 72-00-53-310-004:

R (8) Tack weld the wire pin. Refer to PWA 16 (Task
R 70-42-01-310-004). Use Welding Wire P05-151 or P05-212. See 70-42-03, Standard Practices Manual. Tack weld only in the area shown in Figure 902 (Sheet 2).

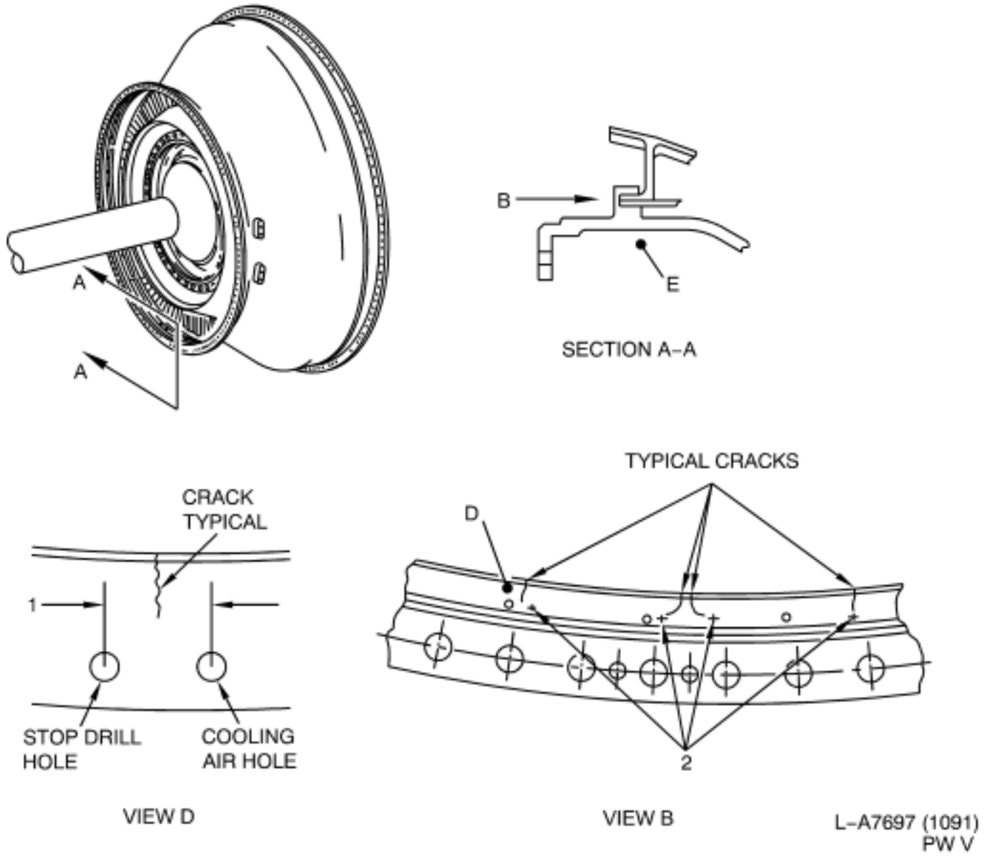
NOTE: Stress-relief is not required.

Subtask 72-00-53-350-054:

CAUTION: IF GRINDING OF THE TACK WELD IS REQUIRED, DO DO NOT REMOVE ALL OF THE TACK WELD. MAKE SURE THAT THE WIRE PIN IS PROPERLY HELD IN THE HOLE AFTER ANY GRINDING OF THE TACK WELD IS PERFORMED.

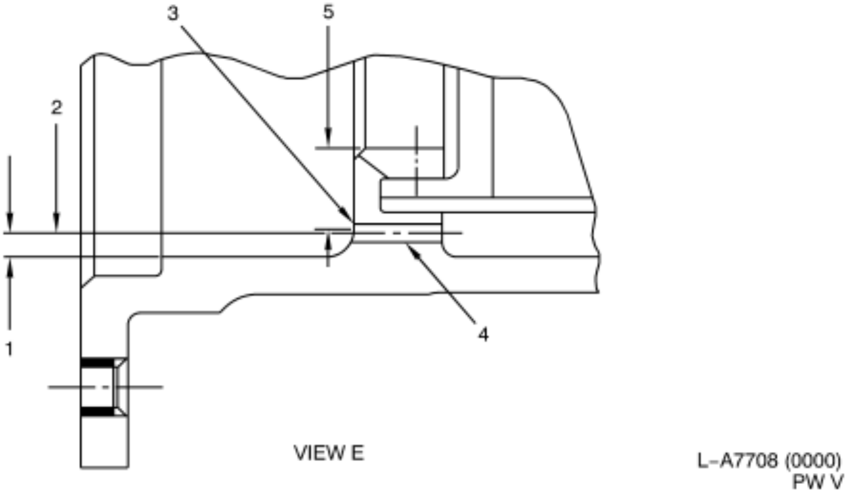
(9) Grind the tack weld as required to make sure that the height of the weld is flush with or below the hardface surface.

NOTE: You do not have to replace the hardface in the in the repaired area.


A
A
B
E
SECTION A−A
CRACK TYPICAL
1
STOP DRILL HOLE
COOLING AIR HOLE
VIEW D
TYPICAL CRACKS
D
2
VIEW B
L−A7697 (1091)
PW V

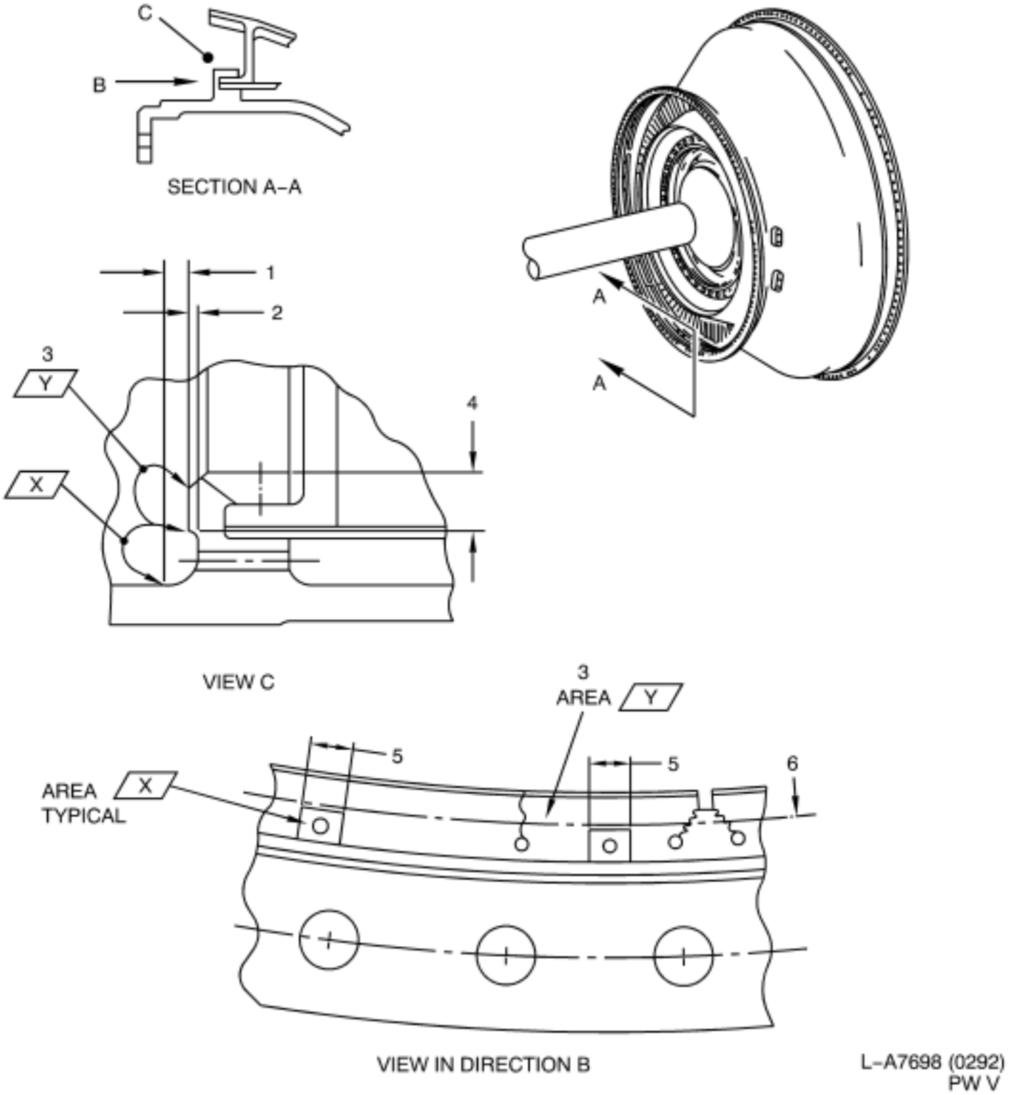
1. 0.275 Inch (6.985 mm) Minimum Distance Between The Center Of The Stop Drill Hole To The Center Of The Cooling Air Hole Or Adjacent Stop Drill Hole.
2. Locate The Center Of Stop Drill Hole Radially Outward From The End Of The Crack And 0.091 − 0.121 Inch (2.31 − 3.07 mm) Inward From The ID Of The Turbine Case Wall.

Front Inner Rail Crack Stop Drill Repair
Figure 901 (Sheet 1)
(Task 72−00−53−300−001)



1. 0.096 - 0.116 Inch (2.44 - 2.95 mm). The Centerline Of The Stop Drill Hole And Maximum Outward Limit On Cracks Is The Same.
2. 39.560 Inch (1004.82 mm) Diameter, Reference
3. Break-edge Of Hole 0.003 - 0.015 Inch (0.08 - 0.38 mm) All Around
4. 0.058 - 0.68 Inch (1.473 - 1.727 mm) Diameter.
5. 0.300 - 0.425 Inch (7.6 - 10.8 mm) Radial Length Of Crack Required To Be Repaired By Stop Drill

Front Inner Rail Crack Stop Drill Repair
Figure 901 (Sheet 2)
(Task 72-00-53-300-001)

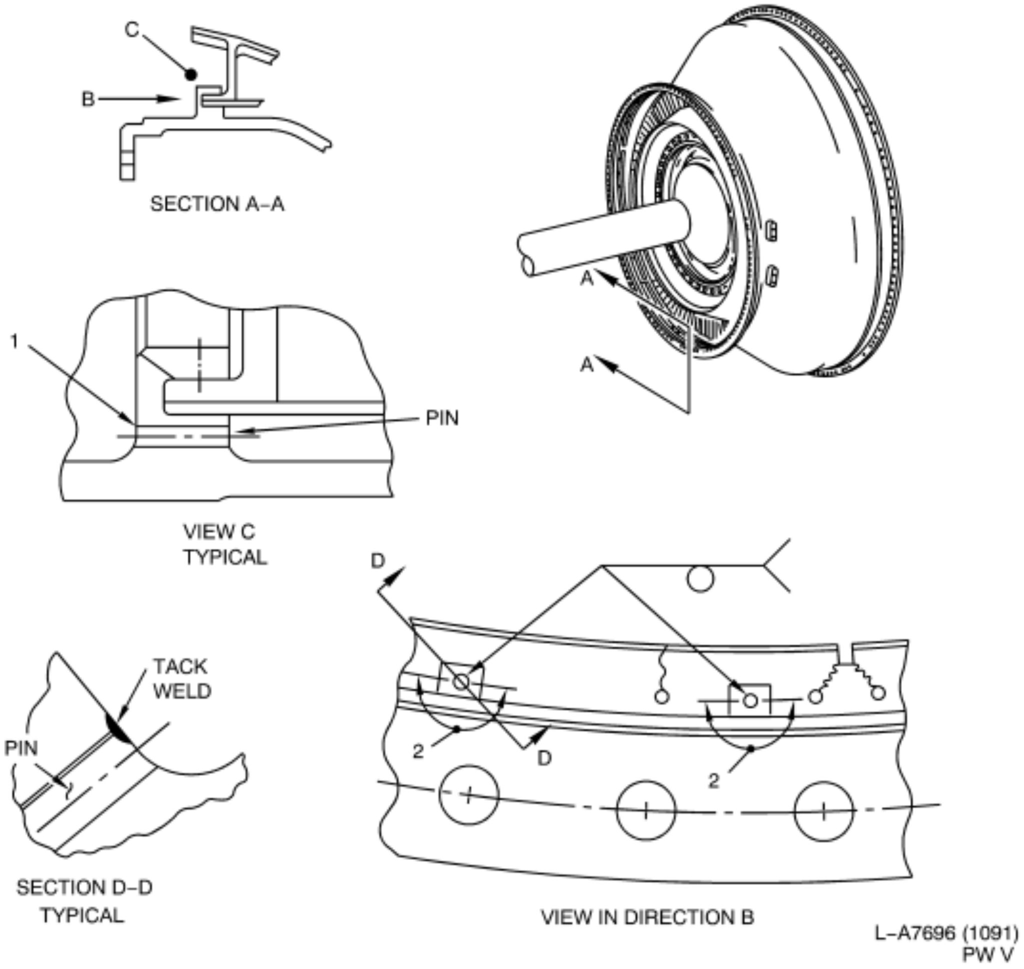

C
B
SECTION A-A
A
A
1
2
3
Y
X
4
VIEW C
3
AREA Y
AREA X
TYPICAL
5
5
6
VIEW IN DIRECTION B
L-A7698 (0292)
PW V

Plug Installation
Figure 902 (Sheet 1)
(Task 72-00-53-300-001)

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REPAIR−01

1. 0.140 Inch (3.556 mm) Minimum
2. 0.005 − 0.010 Inch (0.127 − 0.254 mm) Blend Depth
3. No Blending Allowed In Area Y
4. 0.220 Inch (5.588 mm) Minimum
5. 0.350 Inch (8.890 mm) Maximum Width Of The Blended Area X Typical. The Blend Must Be Centered About The Hole To Be Plugged.
6. 39.200 Inch (995.680 mm) Diameter, Reference, Clearance Envelope Of Area Y, All Around.

Key to Figure 902 (Sheet 1)


C
B
SECTION A−A
A
A
1
PIN
VIEW C
TYPICAL
D
TACK
WELD
PIN
SECTION D−D
TYPICAL
2
D
2
VIEW IN DIRECTION B
L−A7696 (1091)
PW V

1. Wire Pin Must Be Flush To The Blended Surface
2. No Welding Allowed Within This 180° Arc Area Around The Hole To Be Welded, Perpendicular To The Radial Line From The Centerline Of The Case To The Center Of The Hole.

Plug Installation
Figure 902 (Sheet 2)
(Task 72−00−53−300−001)

ENGINE GENERAL − LOW PRESSURE TURBINE (LPT) − REPAIR−02

Task 72−00−53−300−002:

1. In Situ Featherseal Replacement For Assembled LPT Module − 3rd Stage LPT Outer Transition Duct Assembly

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P05−151	Wire, Welding (AMS 5837)

Repair Details

PART NAME	QUANTITY	PARTS CATALOGUE REFERENCE SECTION/FIGURE/ITEM
Seal	AR	72−53−00/3/160

B. Procedure
See Figure 901.

Subtask 72−00−53−110−041−001:

(1) Clean the repair area by SPOP 209. Refer to the Standard Practices Manual, PN 585005, Section 70−21−00.

Subtask 72−00−53−300−001:

(2) Locally blend to remove the coating approximately 0.100 inch (2.540 mm) around the end of the slot to allow reweld after repair.

(3) Locally rout to open the end of the featherseal slot on the two adjacent outer transition ducts.

(a) Use a hand blending tool with a small burr to open the end of the featherseal slot enough to expose the damaged featherseal inside or a missing seal, and allow a new featherseal to be installed.

(b) Remove the damaged featherseal, as necessary.

(c) Install the replacement featherseal (PN 50N551 Typical).

1 It is permissible to shorten the replacement seal by 0.250 inch (6.350 mm) maximum, to prevent welding the seal to the duct.

Subtask 72−00−53−110−040−001:

(4) Wipe the weld area before welding by SPOP 208. Refer to the Standard Practices Manual, PN 585005, Section 70−21−00.

Subtask 72−00−53−310−004−001:

CAUTION: DO NOT WELD THE FETHERSEAL. PUSH THE FEATHERSEAL TO THE REAR OF THE SLOT TO KEEP IT FROM BEING WELDED.

(5) Weld the routed end of the featherseal slot by fusion welding (manual gas tungsten−arc) by PWA 16. See Standard Practices Manual, PN 585005, Section 70−42−01. Use Welding Wire P05−151. Use minimum weld bead necessary to trap the featherseal in the slot.

NOTE: It is not necessary to fill the entire routed end of the featherseal slot.

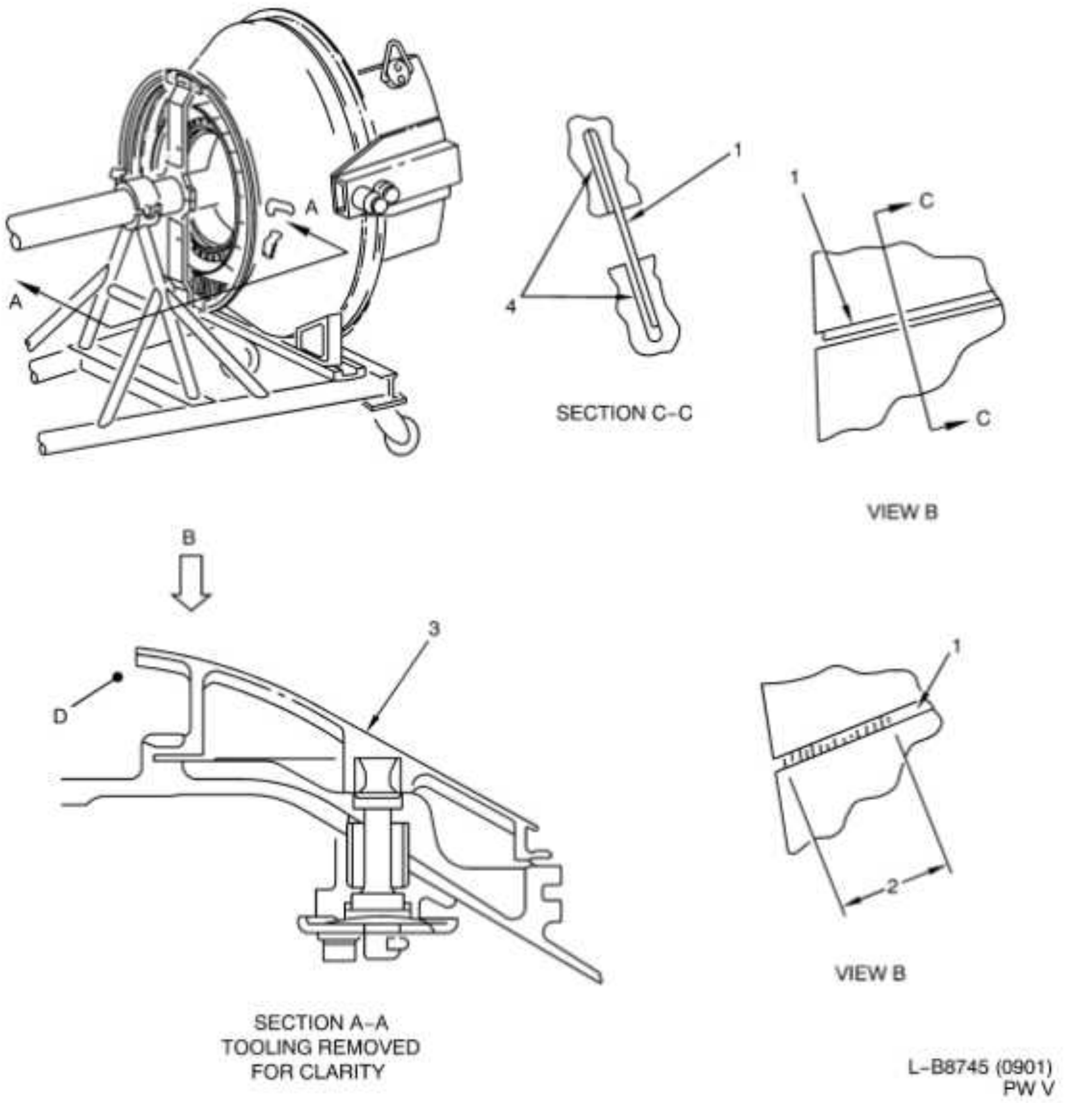
Subtask 72−00−53−220−062:

(6) Visually examine the repair area as follows.

(a) No cracks are permitted.

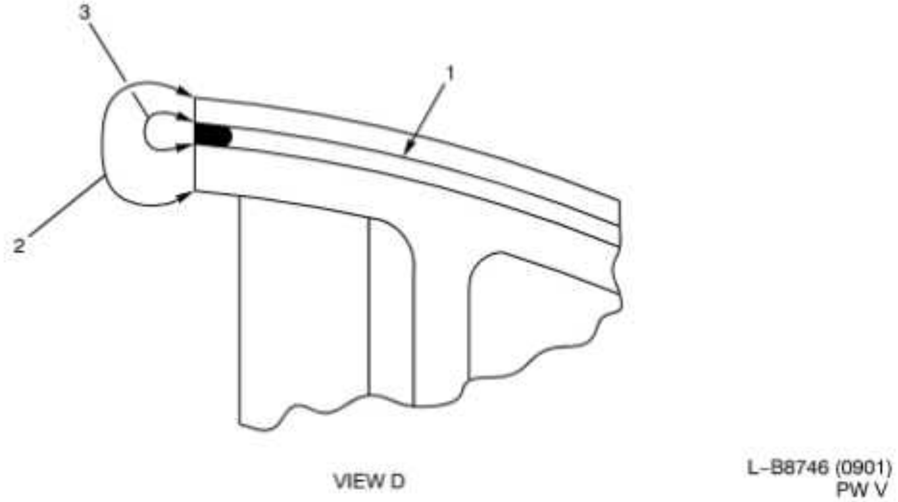
(b) It is permissible to have no coating or incomplete coating in 0.500 inch (12.700 mm) of the repair area.

(c) The featherseal must not be welded.


A
A
1
4
SECTION C-C
1
C
C
VIEW B
B
3
D
SECTION A-A
TOOLING REMOVED
FOR CLARITY
1
2
VIEW B
L-B8745 (0901)
PW V

1. Seal
2. Damaged Or Missing Seal
3. Stage 3 (Outer) Duct Segment (Typical)
4. Feather Seal Slot (Adjacent Ducts)

Stage 3 Duct Segment Seals (In Situ Replacement)
Figure 901 (Sheet 1)
(Task 72−00−53−300−002)



1. Featherseal Slot. Remove And Replace Damaged Seal. See Text.
2. Remove Coating In This Area. See Text.
3. Grind This Area To Featherseal Slot, Both Sides. See Text.

Stage 3 Duct Segment Seals (In Situ Replacement)
Figure 901 (Sheet 2)
(Task 72−00−53−300−002)

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72−00−54	ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−03 • 72−00−54−050−001: Remove The (PT4.95) Average Pressure And Temperature Probes
72−00−54	ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−04 • 72−00−54−050−002−A: Remove The EGT (TT4.95) Thermocouple Cable − For Engines Without The Revised TT4.95 Cable And PT4.95 Sensing Manifold For Increased Engine Core Clearance (Pre SB PW4ENG 72−134) • 72−00−54−050−002−B: Remove The EGT (TT4.95) Thermocouple Cable − For Engines With The Revised TT4.95 Cable And PT4.95 Sensing Manifold For Increased Engine Core Clearance (Post SB PW4ENG 72−134)
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72−00−54	ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−07 • 72−00−54−050−005: Remove EGT (TT4.95) Thermocouple Housing
72−00−54	ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−08 • 72−00−54−020−002: Remove No. 4 Bearing And Seals
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72−00−54	ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−02 • 72−00−54−420−003: Install External Plumbing After Turbine Exhaust Case Installation • 72−00−54−420−004: Install External Plumbing After Turbine Exhaust Case Installation
72−00−54	ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−03 • 72−00−54−450−001: Install The (PT4.95) Average Pressure And Temperature Probes
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72−00−54	ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−09 - 72−00−54−450−006−A: Install EEC Thermocouple And Airframe Cable (W6) − For Engines Without The Revised EEC Thermocouple And Airframe Cable (W6) And Wiring Harness Support Tube For Increased Engine Core Clearance - 72−00−54−450−006−B: Install EEC Thermocouple And Airframe Cable (W6) − For Engines With Revised EEC Thermocouple And Airframe Cable (W6) And Wiring Harness Support Tube For Increased Engine Core Clearance (Post
72−00−54	ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−10 - 72−00−54−450−007: Install EGT (TT4.95) Thermocouple Junction Box
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	- 72−00−54−110−001: Clean Coke From The Turbine Exhaust Case, Pressure And Scavenge Tubes
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72−00−54	ENGINE GENERAL − TURBINE EXHAUST CASE − INSPECTION/CHECK−04 - 72−00−54−210−002: Inspect Exhaust Gas Average Pressure (And Thermocouple Housing) PT4.95 Probe
72−00−54	ENGINE GENERAL − TURBINE EXHAUST CASE − INSPECTION/CHECK−05 - 72−00−54−210−003: Visually Inspect EGT (TT4.95) Thermocouple
72−00−54	ENGINE GENERAL − TURBINE EXHAUST CASE − INSPECTION/CHECK−06 - 72−00−54−210−004: Inspect EGT (TT4.95) Box And Cable
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72−00−54	ENGINE GENERAL − TURBINE EXHAUST CASE − TESTING−01 - 72−00−54−750−001: Test EGT (TT4.95) Thermocouple
72−00−54	ENGINE GENERAL − TURBINE EXHAUST CASE − TESTING−02 - 72−00−54−750−002: Test EGT (TT4.95) Box And Cable

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ENGINE GENERAL - TURBINE EXHAUST CASE - REMOVAL-01

Task 72-00-54-020-001:

1. Remove Turbine Exhaust Case

NOTE: See Figure 301 for part/assembly removal sequence.

A. Equipment And Materials Required

Standard Tools:
.190-32 Jackscrews, Eight Necessary By Text

Special Tools:

PWA 3755	Pump, Hydraulic (Optional To PWA 29389)
PWA 25758	Pedestal
PWA 26157	Pedestal, Engine Support (Optional To PWA 87359)
PWA 28374	Guide
PWA 28657	Sling, Strongback
PWA 29389	Pump, Hydraulic
PWA 75284	Puller, Knocker
PWA 75995	Support
PWA 76154	Adapter (2 Necessary)
PWA 85062	Saddle, Support
PWA 85305	Pins, Aligning (2 Necessary)
PWA 85307	Puller, Jackscrew
PWA 85431	Puller Hydraulic
PWA 85432	Puller, Hydraulic
PWA 85434	Puller, Jackscrew (Optional To PWA 87053)
PWA 85452	Eye, Lifting (Optional To PWA 28657)
PWA 85583	Fixture, Support
PWA 85850	Guide
PWA 86438	Adapter
PWA 87053	Puller, Jackscrew
PWA 87359	Pedestal, Engine Support
PWA 102178	Support, Rear (Optional To PWA 75995 And PWA 85696)

B. Procedure

(1) Disconnect/remove nacelle parts for access to turbine exhaust case per 71-00-54, Removal-01 (Task 71-00-54-020-XXX).

(2) Disconnect/remove external parts for access to exhaust case per Removal-02 (Task 72-00-54-020-003).

(3) Install PWA 85062 Saddle to PWA 87359 or PWA 26157 Pedestal (adjustable). Secure saddle to pedestal with ball-lock pin. See Figure 302.

ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−01

(4) Position saddle and pedestal under diffuser case at 6 o'clock location just forward of Flange M.

(5) Attach PWA 28657 Sling, two PWA 76154 Adapters and hoist to spools on exhaust case at 3 and 9 o'clock.

NOTE: See following step for optional procedure using lifting eye for handling turbine exhaust case.

(6) If applicable, position PWA 85452 Lifting Eye to turbine exhaust case. Align attachment block details to bushing holes in case rails at 2 and 10 o'clock. Install pins through bushings and blocks. Secure pins with safety clips. See Figure 302.

(7) Adjust pedestal at diffuser case, 6 o'clock location, to support engine.

(8) Raise rear of engine and remove two pedestals from exhaust case location; then lower engine to level position, resting on pedestal at diffuser case. Do not remove sling or eye.

(9) If not previously accomplished, remove bolts (303/6) securing No. 4 bearing shield (303/5) to turbine exhaust case (rear inner flange) (303/1). Remove shield. Remove No. 4 bearing heat shield (303/4). See Figure 303.

(10) If not previously accomplished remove No. 4 bearing cover (303/3).

(a) For No. 4 bearing cover (303/3) that has six small threaded holes (Pre SB PW4ENG 72−385), install the PWA 85307 Jackscrew Puller to the rear inner bolt hole flange (Flange T1) of the exhaust case and attach with two bolts, washers and nut details. Install the small plate of the puller to the six threaded holes in the cover and attach with six knurled screw details. Turn the jackscrew to disengage the cover from the exhaust case. Remove the puller and the cover from the exhaust case. Remove the cover from the puller. Discard the packing (303/2).

(b) For cover that has eight jackscrew holes (Post SB PW4ENG 72−385), install and evenly tighten eight 0.190−32 Jackscrews to remove the cover. Discard the packing (303/2).

(11) Remove No. 4 bearing scavenge tube (inner) (304/6). See Figure 304.

(a) Remove key washer (304/5) and bolt (304/4) securing No. 4 bearing oil scavenge (inner) tube (304/6), bracket, to exhaust case inner flange at 6 o'clock position.

(b) Remove key washers (304/2) and bolts (304/3) securing No. 4 bearing oil scavenge tube (304/6) to exhaust case inner flange at 7:30 o'clock location. Remove scavenge tube. Discard packing (304/1).

(12) Remove No. 4 bearing retaining plate (304/8).

(a) Remove bolts (304/10) and key washers (304/9) securing retaining plate to front compressor drive turbine shaft (304/11). Discard key washers.

CAUTION: USE CARE WHEN ACTUATING PULLER PWA 75284. DAMAGE TO EXHAUST CASE MAY RESULT BY SUDDEN REARWARD MOVEMENT OF PULLER WHEN NO. 4 BEARING RETAINING PLATE IS RELEASED FROM ENGINE.

(b) Rotate knurled nut detail of PWA 75284 Knocker Puller to retract jaws. Install puller onto retaining plate with jaws in line with slots in retaining plate wall. Tighten knurled nut to secure jaws in retaining plate. Using slide hammer, remove retaining plate from shaft. Remove puller.

(c) Discard packing (304/2).

(13) For removing exhaust case assembly using PWA 75995 Support and PWA 86438 Adapter, proceed as follows: See Figure 305.

NOTE: See following step for removing exhaust case assembly using optional PWA 102178 Support.

(a) Align boltholes and insert PWA 75995 Support through turbine exhaust case and into ID of front compressor drive turbine shaft (305/6). Secure support flange to turbine shaft with eight screws (305/5).

(b) Slide PWA 28374 Guide larger diameter first over PWA 75995 Support and seat against bearing inner race.

(c) Align boltholes and slide hub PWA 86438 Adapter hub forward into inner flange of turbine exhaust case. Secure flange to case with screws (305/2).

(d) Position PWA 25758 Pedestal under spool of PWA 75995 Support and adjust accordingly.

(14) For removing exhaust case assembly using PWA 102178 Support, proceed as follows: See Figure 305.

(a) Align boltholes and insert shaft (305/3) through turbine exhaust case and into ID of front compressor drive turbine shaft (305/6). Secure shaft flange to turbine shaft with eight screws (305/1).

(b) Slide PWA 85850 Guide, larger diameter first, over PWA 102178 Support and seat against bearing inner race.

(c) Align boltholes and slide hub (305/4) forward into inner flange of turbine exhaust case. Secure hub flange to case with five screws (305/2).

(15) Position 12 to 16 brass shims equally spaced over 90 − 100 degree arc. Place shims just to rear of knife−edge seal between 6th stage blade outer shrouds and 6th stage air sealing ring segments.

(16) Adjust sling and hoist attached to spools on exhaust case to support case when separating it from low pressure turbine.

(17) Remove Flange P bolts, nuts and brackets securing turbine exhaust case to turbine case. Refer to 72−00−54 Removal−20 (Task 72−00−54−020−005).

(18) Install two PWA 85306 Aligning Pins, 180 degrees apart, in Flange P.

(a) Locate smaller .190−32 threaded bolthole in exhaust case and secure plate to rear of exhaust case using detail screw.

(b) Insert two aligning pins through boltholes in turbine case flange and thread into tapped holes in plate.

(19) Using twelve 0.190-32 jackscrews, remove turbine exhaust case from snap diameter of low pressure turbine case.

(20) Move turbine exhaust case rearward approximately 12 inches (306.8 mm).

(21) Install PWA 85583 Fixture to rear flange of turbine rear case. See Figure 306.

(a) Center flange segment (306/5) to rear flange of turbine rear case (306/7) at 12 o'clock location. Secure flange segment to case with six bolts (306/6).

(b) Loosen two jamnuts (306/4). Adjust nut (306/1) to support ID of 6th stage LPT disk (306/3) to maintain proper positioning of low pressure turbine rotor.

(22) If installed, remove PWA 25748 Pedestal from PWA 75995 Support.

(23) Slide turbine exhaust case rearward off of the support.

(24) Remove the adapter or hub detail from the exhaust case rear inner flange.

CAUTION: WHEN REMOVING TURBINE EXHAUST CASE AND POSITIONING IT ONTO PALLET, CARE MUST BE TAKEN NOT TO DAMAGE FRONT END SEAL RING.

(25) Provide suitable support on pallet to protect front end seal. Lower turbine exhaust case, rear end down, onto pallet.

(26) Remove adapters, sling and two brackets at 3 and 9 o'clock locations on turbine exhaust case. Remove alignment pins from turbine rear case flange.

(27) Remove tool details from the turbine rear shaft.

CAUTION: MAKE SURE THAT NO. 4 BEARING INNER AND OUTER RACES ARE KEPT TOGETHER.

(28) Remove No. 4 bearing (rear) seal spacer (307/5) and inner race (308/6) from front compressor drive turbine shaft (307/1) using PWA 85431 Puller. See Figure 307.

(a) Remove jaw retaining ring from puller and slide three jaws outward.

(b) Position puller on end of front compressor drive turbine shaft. Secure inner locating ring to turbine shaft with three detail screws.

(c) Slide three jaws inward behind puller lip of No. 4 bearing (rear) seal spacer (307/5). Install retaining ring over jaws and seat on lugs of jaws.

(d) Attach PWA 29389 or PWA 3755 Hydraulic Pump to hydraulic cylinder on puller.

(e) Actuate pump to remove inner race and spacer from turbine shaft.

(f) Disconnect hydraulic pump. Remove retaining ring and slide jaws outward. Remove bolts securing locating ring to turbine shaft. Remove puller from engine.

(g) Remove bearing inner race and spacer from turbine shaft and store parts in suitable container.

(29) Remove No. 4 bearing (front) seal spacer (307/3) and No. 4 bearing (carbon) face seal (307/4) using PWA 85434 or PWA 87053 Puller.

(a) Rotate outer plate to centralize three puller legs between arms of inner plate. Slide three puller legs inward.

(b) Position puller on end of front compressor drive turbine shaft. Secure inner plate to turbine shaft with three detail screws.

(c) Slide three puller legs outward to engage puller lip in ID of No. 4 bearing seal spacer. It may be necessary to turn jackscrew to align puller lip on jaws with puller groove in spacer. Rotate outer plate detail to align puller legs with three arms of inner plate detail to secure puller.

(d) Turn center jackscrew to remove seal and spacer.

(e) Rotate outer plate to centralize three puller legs between arms of inner plate. Loosen screws and slide jaws inward. Remove screws securing inner plate to turbine shaft and remove puller from shaft.

(f) Remove (carbon) face seal and seal spacer from turbine shaft and store parts in suitable containers.

(30) Remove 6th stage LPT airseal (307/2) from LPT (rear hub) (307/1) using PWA 85432 Puller.

(a) Remove jaw retaining ring from puller and slide four jaws outward.

(b) Position puller on end of front compressor drive turbine shaft. Secure inner locating ring to turbine shaft with two detail screws.

(c) Slide four jaws inward, engaging puller legs in four holes in side of airseal. Install retaining ring over jaws and seal on lugs of jaws.

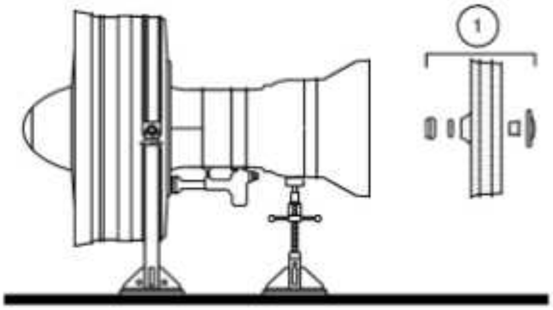
(d) Attach PWA 29389 or PWA 3755 Hydraulic Pump to hydraulic cylinder on puller.

(e) Actuate pump to remove airseal from turbine shaft.

(f) Disconnect hydraulic pump. Remove retaining ring and slide jaws outward. Remove bolts securing locating ring to turbine shaft. Remove puller from engine.

(g) Remove airseal from turbine shaft and store in suitable container.

ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−01

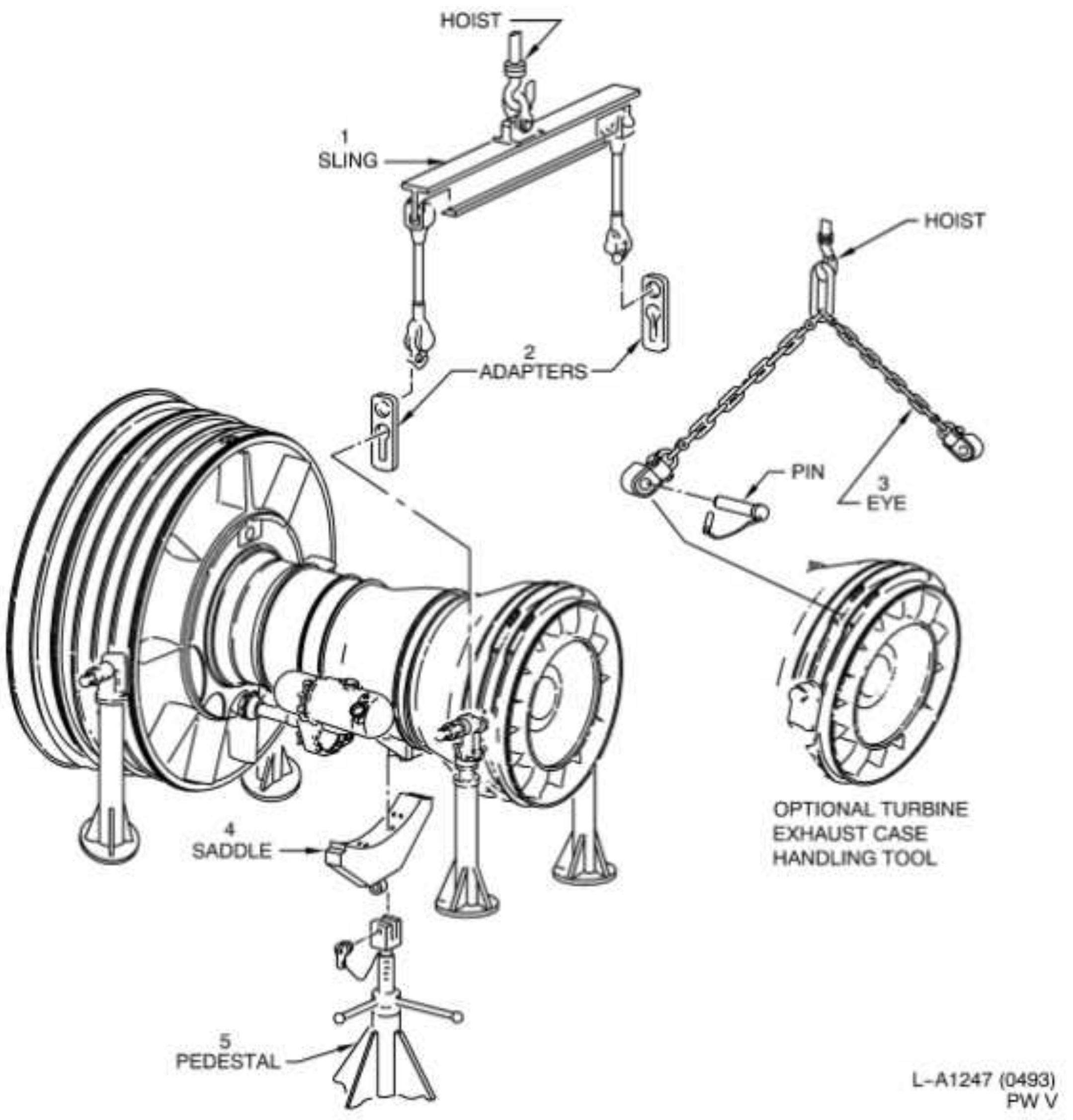


1. REMOVE TURBINE EXHAUST CASE.

L−A0259 (0000)
PW V

Procedure Sequence
Figure 301
(Task 72−00−54−020−001)

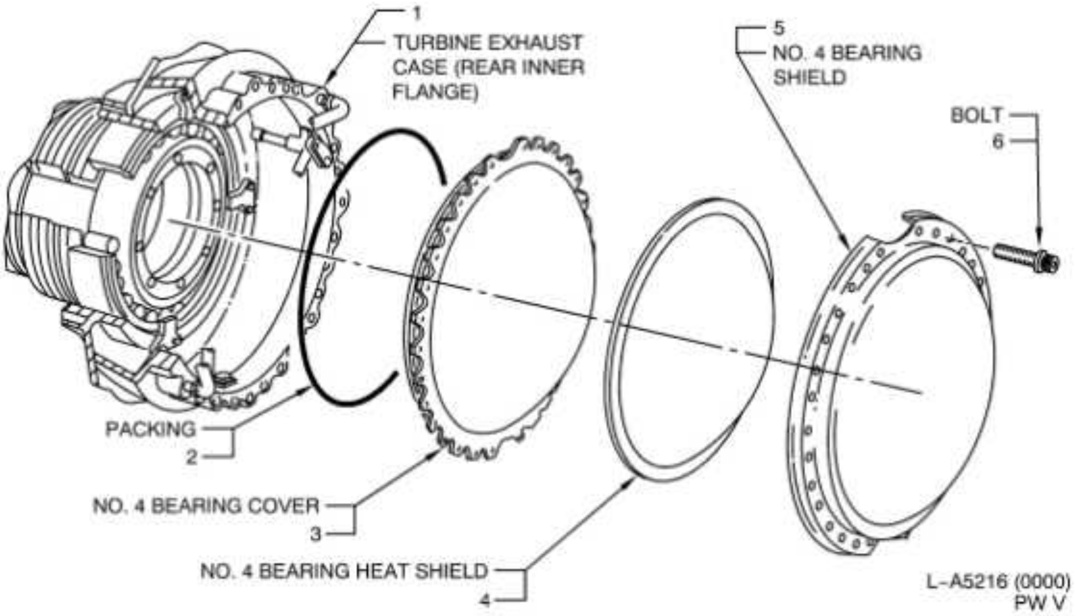
ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−01


HOIST
1
SLING
2
ADAPTERS
HOIST
PIN
3
EYE
OPTIONAL TURBINE
EXHAUST CASE
HANDLING TOOL
4
SADDLE
5
PEDESTAL
L-A1247 (0493)
PW V

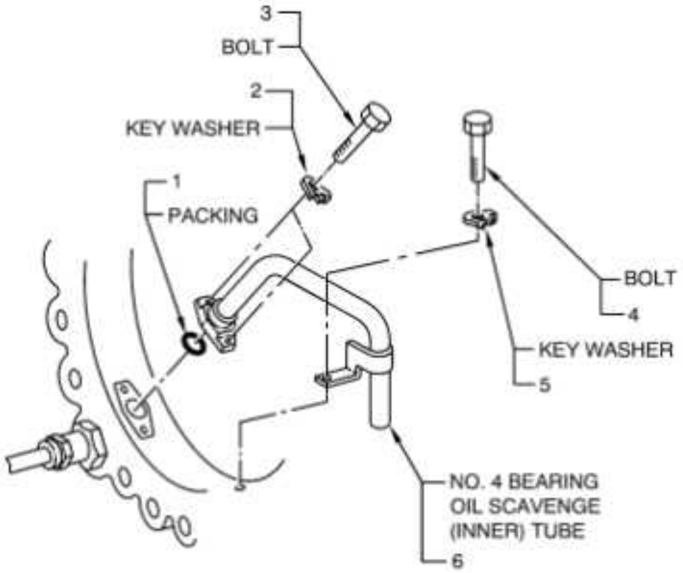
1. PWA 28657 Sling
2. PWA 76154 Adapter (Two Required)
3. PWA 85452 Eye, Lifting.
4. PWA 85062 Saddle, Support.
5. PWA 26157 Or PWA 87359 Pedestal

Turbine Exhaust Case Removal
Figure 302
(Task 72−00−54−020−001)

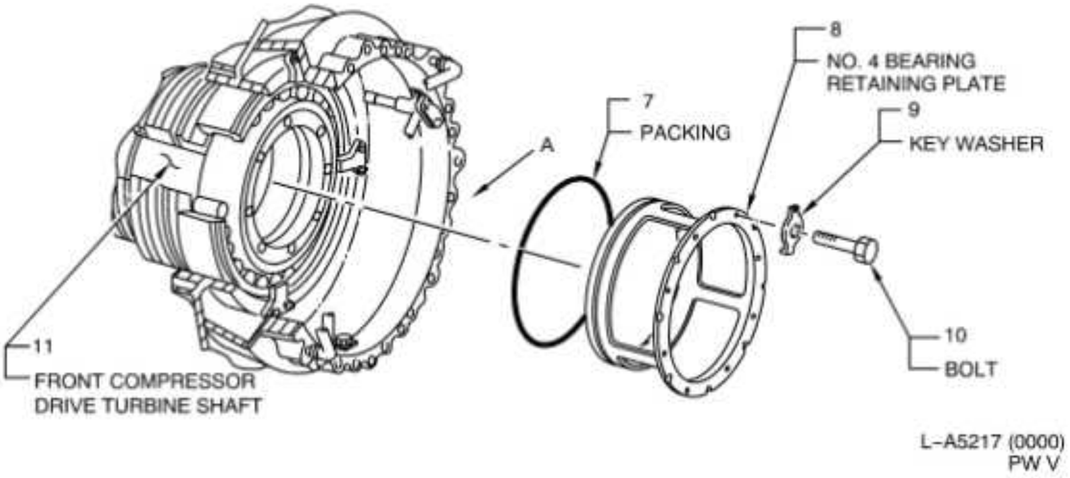
ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−01


1
TURBINE EXHAUST CASE (REAR INNER FLANGE)
5
NO. 4 BEARING SHIELD
BOLT
6
PACKING
2
NO. 4 BEARING COVER
3
NO. 4 BEARING HEAT SHIELD
4
L−A5216 (0000)
PW V

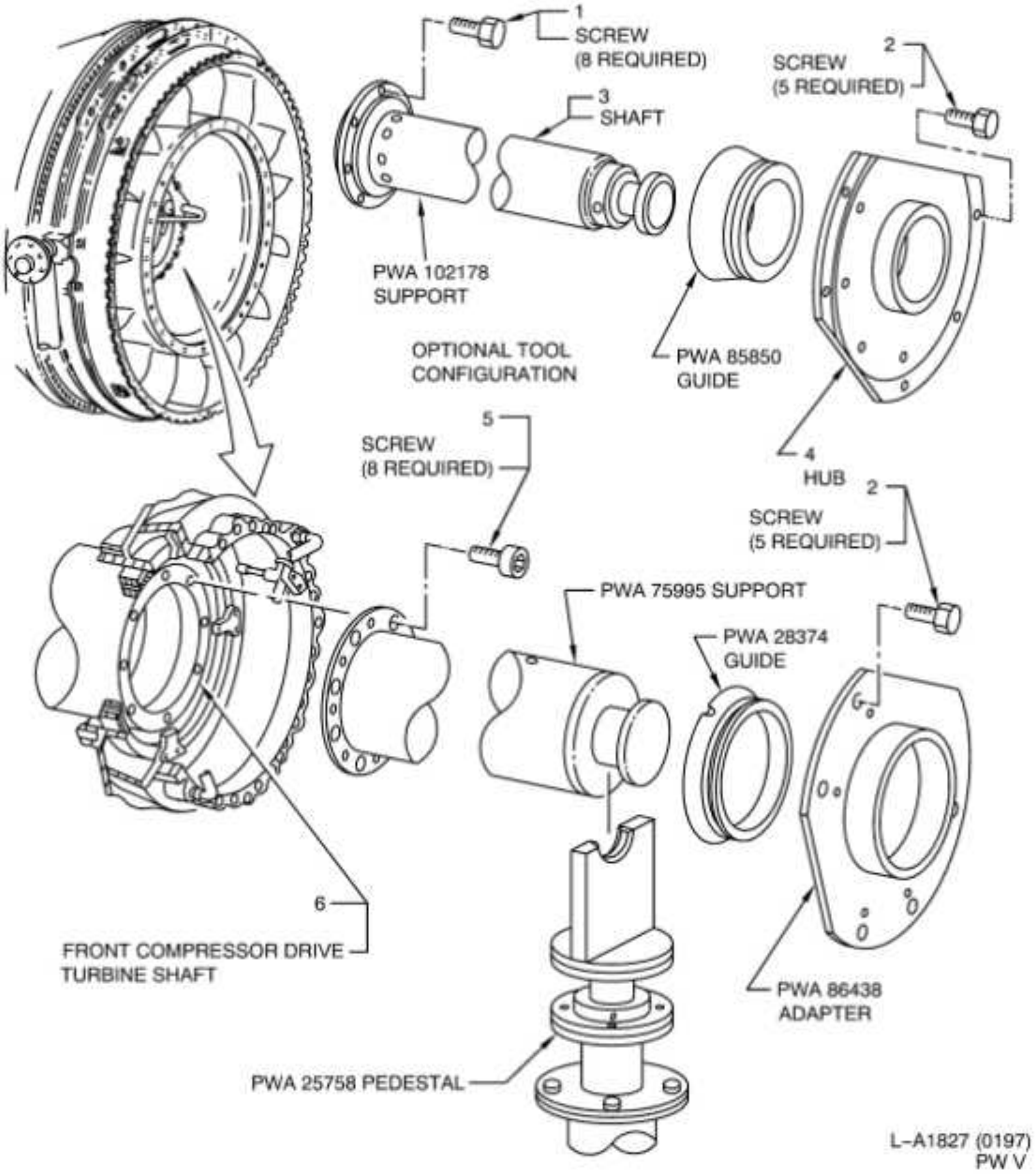
Turbine Exhaust Case Removal
Figure 303
(Task 72−00−54−020−001)


3
BOLT
2
KEY WASHER
1
PACKING
BOLT
4
KEY WASHER
5
NO. 4 BEARING OIL SCAVENGE (INNER) TUBE
6

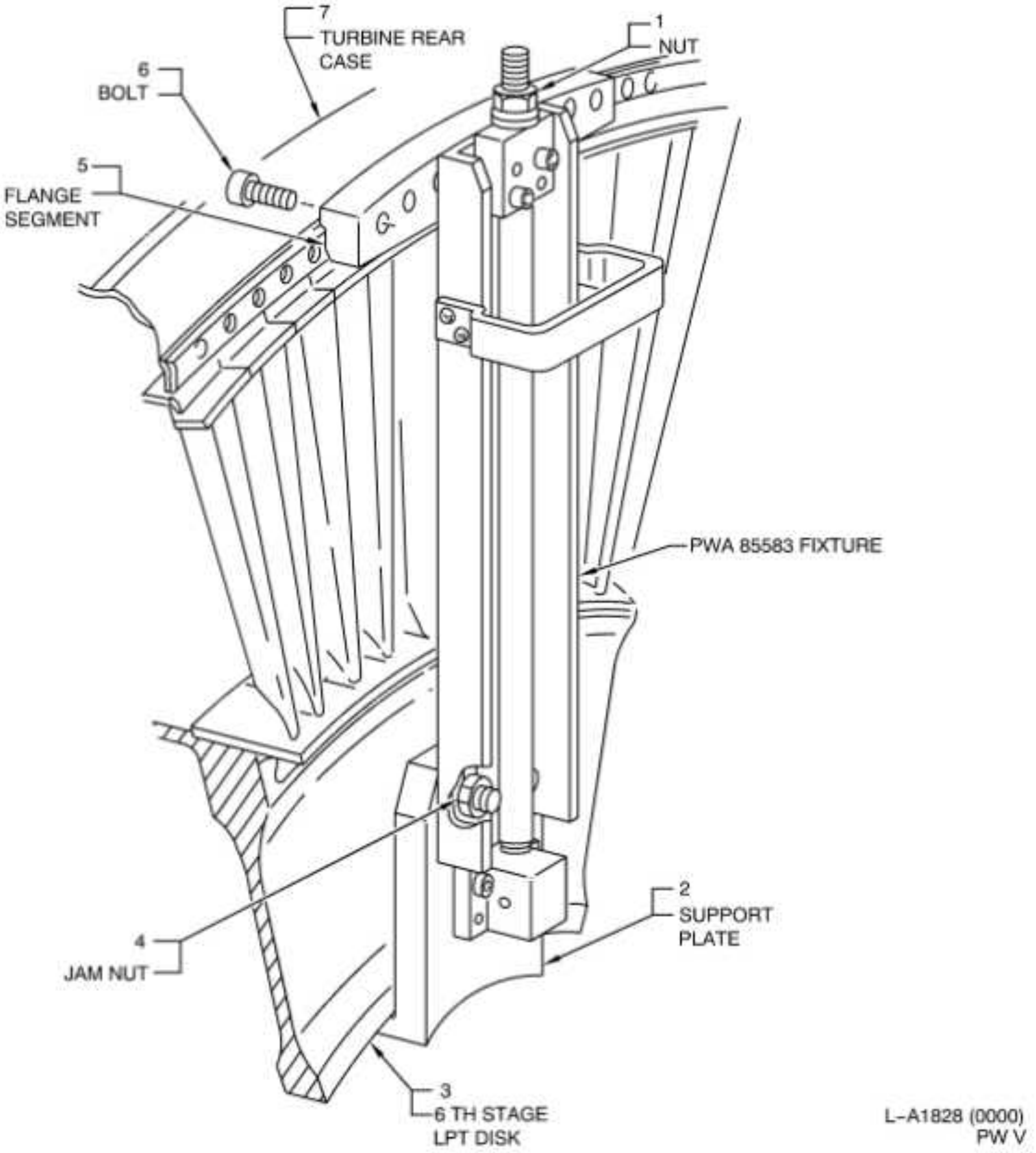
VIEW IN DIRECTION A


8
NO. 4 BEARING RETAINING PLATE
7
PACKING
9
KEY WASHER
A
11
FRONT COMPRESSOR DRIVE TURBINE SHAFT
10
BOLT
L−A5217 (0000)
PW V

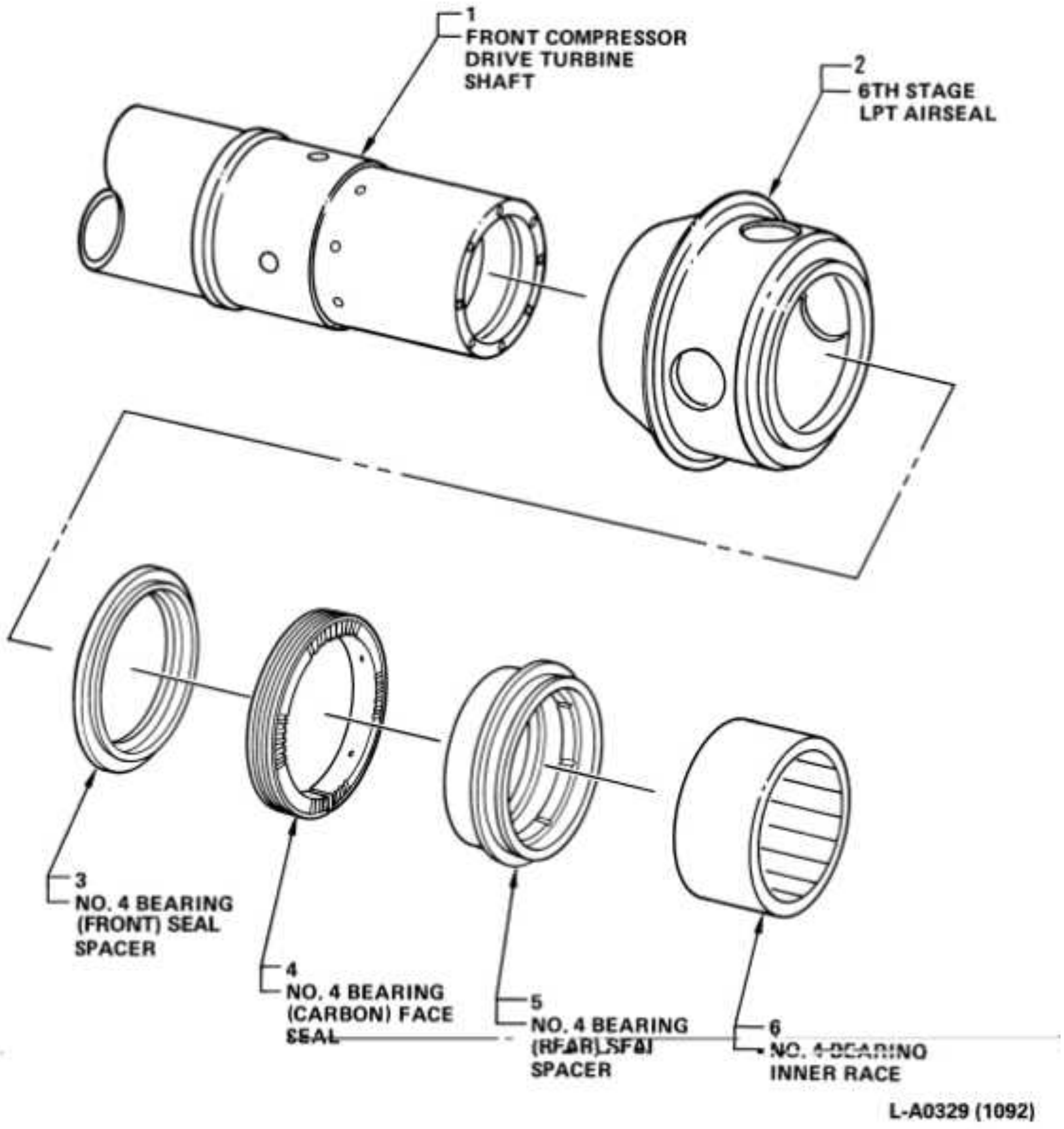
Turbine Exhaust Case Removal
Figure 304
(Task 72−00−54−020−001)


1
SCREW
(8 REQUIRED)
2
SCREW
(5 REQUIRED)
3
SHAFT
PWA 102178
SUPPORT
OPTIONAL TOOL
CONFIGURATION
PWA 85850
GUIDE
4
HUB
5
SCREW
(8 REQUIRED)
2
SCREW
(5 REQUIRED)
PWA 75995 SUPPORT
PWA 28374
GUIDE
6
FRONT COMPRESSOR DRIVE
TURBINE SHAFT
PWA 86438
ADAPTER
PWA 25758 PEDESTAL
L-A1827 (0197)
PW V

Turbine Exhaust Case Removal
Figure 305
(Task 72−00−54−020−001)


7
TURBINE REAR CASE
1
NUT
6
BOLT
5
FLANGE SEGMENT
PWA 85583 FIXTURE
2
SUPPORT PLATE
4
JAM NUT
3
6 TH STAGE LPT DISK
L−A1828 (0000)
PW V

LPT Rotor Support Fixture Installation
Figure 306
(Task 72−00−54−020−001)


1
FRONT COMPRESSOR DRIVE TURBINE SHAFT
2
6TH STAGE LPT AIRSEAL
3
NO. 4 BEARING (FRONT) SEAL SPACER
4
NO. 4 BEARING (CARBON) FACE SEAL
5
NO. 4 BEARING (REAR) SEAL SPACER
6
NO. 4 BEARING INNER RACE
L-A0329 (1092)

Turbine Exhaust Case Removal
Figure 307
(Task 72−00−54−020−001)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-54-020-003:

1. Remove External Plumbing Prior To Turbine Exhaust Case Removal

A. Equipment And Materials Required - None

B. Procedure
See Figures 301, 302, 303, 304 and 305.

(1) (Pre SB PW4ENG 79-76) Remove No. 4 bearing oil pressure tube assembly (LP16) as follows. See Figure 301.

(a) Remove the clamps securing spray shield to front tube connection and if equipped a bracket, forward of Flange M at approximately 10 o'clock position. Remove the shield from the engine. Remove lockwire and disconnect tube nut from coupling.

(b) Remove hose clamp securing spray shield to rear tube connection on exhaust case at approximately 10:30 o'clock position. Remove shield from engine. Remove lockwire and disconnect tube nut from strainer housing.

(c) Remove bolts, spacer, nuts, and clamps securing tube to brackets and adjacent scavenge tube. Remove tube from engine.

(d) Remove lockwire and No. 4 bearing strainer element from strainer housing. Discard packing.

(e) Remove lockwire and disconnect strainer housing from exhaust case internal tube nut at approximately 10:30 o'clock position.

(f) Install protective closures.

(2) (Post SB PW4ENG 79-76) Remove No. 4 bearing oil pressure tube assemblies (LP47) and (LP48) which replace (LP16) as follows. See Figure 305.

(a) Remove clamps and the tube spray shields at the (LP48) tube to the strainer housing connection, at the (LP47) tube to the (LP48) tube connection and at the (LP47) tube to the (LP15) tube connection. See Views G, CA and LA.

(b) Remove clamps, bolts and nuts as shown in Views M, N, B1, P, R and F.

(c) Remove the (LP48) tube from the strainer housing and the (LP47) tube. See Views G and CA.

(d) Remove the element housing from the tube nut at approximately the 7 o'clock position. See View G.

(e) Remove the No. 4 bearing strainer element from the element housing. See View G.

(f) Remove and discard packing from the groove in the strainer element. See View G.

(g) Remove bolts and clamps. See Views U, T, and S.

(h) Remove the coupling nut that attaches (LP15) tube to the (LP47) tube. See View LA.

(3) (Pre SB PW4ENG 79-76) Remove No. 3 bearing oil vent tube assembly (LD02) as follows. See Figure 301.

(a) Remove lockwire and disconnect tube coupling from tube nut forward of Flange N at approximately 8 o'clock position.

(b) Remove lockwire and disconnect tube nut from adapter on exhaust case at approximately 7 o'clock position.

(c) Between Flanges N and P, remove the bolt, nut, and clamp that secures the tube to the adjacent PT4.95 tube assembly.

(d) Remove the bolt, nut, and clamp at approximately the 7:30 o'clock position on the exhaust case that secures the tube to the adjacent PT4.95 tube assembly (Post SB PW4ENG 72-134).

(e) Remove bolts, nuts and clamps securing tube to Flanges N and P brackets. Remove tube from engine and install protective closures.

(4) (Pre SB PW4ENG 79-76) Remove the (rear) EEC PT4.95 pressure tube assembly (AS02) as follows. See Figure 301.

(a) Remove lockwire and disconnect tube nut from tee rearward of Flange P at approximately 6 o'clock position (Pre SB PW4ENG 72-134).

(b) Remove the lockwire and disconnect the tube nut from the tube coupling at the rear of Flange P at approximately the 7 o'clock position (Post SB PW4ENG 72−134).

(c) Remove bolt, nut, and clamp securing tube to Flange P bracket at approximately 7 o'clock position (Pre SB PW4ENG 72−134).

(d) Remove lockwire and disconnect tube nut from tube coupling rearward of Flange N at approximately 8 o'clock position. Remove tube from engine and install protective closures.

(5) (Post SB PW4ENG 79−76) Remove the (rear) No. 3 bearing oil vent tube assembly (LD02) and the (rear) EEC PT4.95 pressure tube assembly (AS02) as follows. See Figure 305.

(a) Remove clamps, nut and bolts from the (AS27) tube, the (LD02) tube, the (AS02) tube and the (LP48) tube. See Views H, I, J, K and L,

(b) Remove the bolt that attaches the (AS02) tube to the bracket. See View G.

(c) Remove the (AS02) tube from the (AS03) and (AS27) tubes. See (Sheet 1).

(d) Remove the (LD02) tube from the (LD01) tube and to the turbine exhaust case. See (Sheet 1).

(6) (Pre SB PW4ENG 79−75) Remove (rear) No. 4 bearing oil scavenge tube assembly (LR06) as follows. See Figure 301.

(a) Remove bolt, nut and clamp securing spray shield to Flange M bracket at approximately 7 o'clock position. Remove hose clamp from forward end of spray shield and remove shield from engine. Remove lockwire and disconnect tube nut from tube coupling.

(b) Remove lockwire and disconnect tube elbow from exhaust case internal tube nut at approximately 10 o'clock position.

(c) Remove bolts, nuts and clamps securing tube to Flanges N and P brackets. Remove tube from engine and install protective closures.

(d) Remove bolts, nuts and clamp bracket attached to Flange N bracket at approximately 7 o'clock position.

(7) (Post SB PW4ENG 79−75 and Pre SB PW4ENG 79−76 only) Remove (rear) No. 4 bearing scavenge tube assembly (LR06) as follows. See Figure 301.

(a) Remove hose clamp securing the tube shield to the bracket inboard side of Flange M at approximately 7 o'clock position. Remove the lockwire and disconnect the (LR05) hose and tube assembly nut from the (LR06) tube coupling.

(b) Remove lockwire and disconnect tube elbow from exhaust case internal tube nut at approximately 10 o'clock position.

(c) Remove bolts, nuts and clamps securing tube to Flanges N and P brackets. Remove tube from engine and install protective closures.

(d) Remove bolts, nuts and clamp bracket attached to Flanges M and N brackets at approximately 7 o'clock position.

(8) (Post SB PW4ENG 79−76) Remove (rear) No. 4 bearing scavenge tube assemblies (LR21) and (LR22) which replace (LR06) as follows. See Figure 305.

(a) Remove clamps and the tube spray shields at the (LR21) tube to (LR22) tube connection and at the (LR05) tube to the (LR21) tube connection. See Views E and DE.

(b) Remove clamps on the (LR22). See Views A, B, C and D.

(c) Remove the (LR22) tube from the (LR21) tube and the port for the internal tube on the turbine exhaust case. See Views E and AP.

(d) Remove clamps, nuts and bolts that secure (LR21) tube. See Views F, O, Q and R.

(e) Remove the (LR21) tube from the (LR05) tube. See View DE.

(9) (Pre SB PW4ENG 79−75) Remove (front) No. 4 bearing oil scavenge tube assembly (LR05) as follows. See Figure 302.

(a) Remove bolts, nuts and clamps securing tube to main oil filter tube at approximately 6 o'clock position.

NOTE: Catch oil in container with a capacity of approximately 5 U.S. gallons (19 liters).

(b) Remove bolts securing tube to main oil pump and remove tube from engine.

(c) Remove and discard packing. Install protective closures.

(d) Remove the six loop clamp grommet halves (Post SB PW4ENG 79−46) from the tube.

(10) (Post SB PW4ENG 79−75) Remove (front) No. 4 bearing oil scavenge hose and tube assembly (LR05) as follows. See Figure 302.

(a) Remove the bolts, nuts and clamps that attach the hose and tube assembly to the loop clamp bracket on the TCC manifold bridge bracket and the loop clamp bracket assembly on the fluid pressure dampener or fluid pressure adapter.

NOTE: Catch oil in container with a capacity of approximately 5 U.S. gallons (19 liters).

(b) Remove lockwire from the tube nut to the main oil pump connection. Remove bolts securing tube to main oil pump and remove tube from engine.

(c) Remove and discard packing. Install protective closures.

(d) Remove the bolts that secure the loop clamp bracket to the TCC manifold bridge bracket. Remove the loop clamp bracket.

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH
R CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND
R INSTALL A TUBE WITH A FLEX SEGMENT WITH THE
R SAME PRECAUTION USED FOR A TUBE WITHOUT A
R FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A
R TUBE TO HELP WITH THE INSTALLATION OR REMOVAL
R OF THE TUBE OR AN ATTACHED COMPONENT. IF A
R FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE
R A KINK IN THE EXTERNAL WIRE BRAID AND IN THE
R INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND
R LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(11) (Pre SB PW4ENG 79−75) Remove main filter oil tube assembly (LP01) as follows. See Figure 302.

NOTE: Ensure oil has been previously drained from main oil filter housing.

(a) Remove bolts securing tube to front of main oil filter housing.

(b) Remove bolts and bracket securing tube to top of main oil pump.

NOTE: Catch oil in container with a capacity of approximately 5 U.S. gallons (19 liters) at lower end of tube.

(c) Remove bolt, nut and clamp securing tube to diffuser case bracket at approximately 7 o'clock position.

(d) Remove bolts, nuts and clamps securing tube to gearbox brackets at approximately 8 o'clock position and remove tube from engine.

(e) Remove the six (clip−on) loop clamp grommet halves from the tube (Post SB PW4ENG 79−36 only).

(f) Remove and discard packings. Install protective closures.

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH
R CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND
R INSTALL A TUBE WITH A FLEX SEGMENT WITH THE
R SAME PRECAUTION USED FOR A TUBE WITHOUT A
R FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A
R TUBE TO HELP WITH THE INSTALLATION OR REMOVAL
R OF THE TUBE OR AN ATTACHED COMPONENT. IF A

R FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE
R A KINK IN THE EXTERNAL WIRE BRAID AND IN THE
R INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND
R LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(12) (Post SB PW4ENG 79-75) Remove the fluid pressure dampener or the fluid pressure adapter assembly (Post SB PW4ENG 79-86) and the main oil filter hose and tube assembly (LP01) as follows. See Figure 302.

NOTE: Ensure oil has been previously drained from main oil filter housing.

(a) Remove bolts securing the hose and tube assembly to the front of the main oil filter housing.

(b) Remove bolts and bracket that hold the hose and tube assembly to the top of the fluid pressure dampener or adapter.

NOTE: Catch oil in container with a capacity of approximately 5 U.S. gallons (19 liters) at lower end of tube.

(c) Remove bolt, nut and clamp securing tube to diffuser case bracket at approximately 7 o'clock position.

(d) Remove bolts, nuts and clamps securing tube to gearbox brackets at approximately 8 o'clock position and remove tube from engine.

(e) Remove the bolts and nuts that hold the loop clamp bracket to the fluid pressure dampener or adapter. Remove the bracket.

(f) Remove the bolts that hold the fluid pressure dampener or adapter to the top of the main oil pump. Remove the fluid pressure dampener or adapter from the main oil pump.

(g) Remove and discard packings. Install protective closures.

(13) Remove LPT case cooling (TCC) manifold assemblies (AC01) through (AC14) as follows. See Figure 303.

(a) Remove bolts securing all manifold ends (upper and lower) to manifold (collector).

(b) Remove the upper and lower cover assemblies from the rear (No. 7) of the manifold (collector) (Post SB PW4ENG 75-53).

(c) Remove bolts, nuts and bracket securing cooling air manifold support brackets to brackets at Flange N.

(d) Remove the bolts, nuts, spacers and clamps that attach the rear mounts of the cooling manifolds to brackets on Flange P (Pre SB PW4ENG 75-50).

(e) Remove the bolts, nuts and clamps that attach the rear mounts of the cooling manifolds to brackets on Flange P (Post SB PW4ENG 75-50).

(f) Rotate lower manifolds to disengage manifold (collector) and remove manifolds from engine.

(g) Rotate upper manifolds to disengage manifold (collector) and remove manifolds from engine. Install protective closures.

(14) Remove LPT case cooling manifold (collector) as follows.

(a) Remove bolts securing manifold (collector) to support bracket and LPT cooling valve flange.

(b) Remove bolts and clamps securing front bracket on manifold (collector) to Flange N bracket.

(c) Remove bolts and nuts securing rear of manifold (collector) to Flange P brackets.

(d) Remove manifold (collector) and install protective closures.

(15) Remove (lower right) turbine cooling tube assembly (AP02) as follows. See Figure 304.

(a) Remove lockwire, bolts and bracket securing cooling tube rear flange to HPT case at approximately 4 o'clock position.

(b) Remove bolts and nuts securing cooling tube front flange to air shutoff valve on HPC case.

(c) Remove bolts, nuts and clamp securing tube to Flange M bracket and remove tube from engine.

(d) Remove and discard the gaskets. Install protective closures.

(16) Remove (lower right) turbine blade cooling tube assembly (AP37) as follows.

(a) Remove lockwire, bolts and bracket securing tube flange to diffuser case at approximately 5 o'clock position.

(b) Remove bolt, nut, and clamp securing fuel manifold to bracket. Remove bracket.

(c) Remove bolts and bracket securing tube flange to air shutoff valve on HPC case.

(d) Remove bolts, nuts and clamps securing tube to diffuser case brackets.

(e) (Pre SB PW4ENG 72-572 or SB PW4ENG 72-537 or Post SB PW4ENG 72-627) Remove the tube from the engine. Remove and discard the gaskets. Remove the metering plate and tube locks. Install the protective closures.

(f) (Post PW4ENG 72-572 and Pre SB PW4ENG 72-627 or Post SB PW4ENG 72-537 and Pre SB PW4ENG 72-627) Remove the tube from the engine. Remove and discard the gaskets. Remove the ring spacer and tube locks. Install the protective closures.

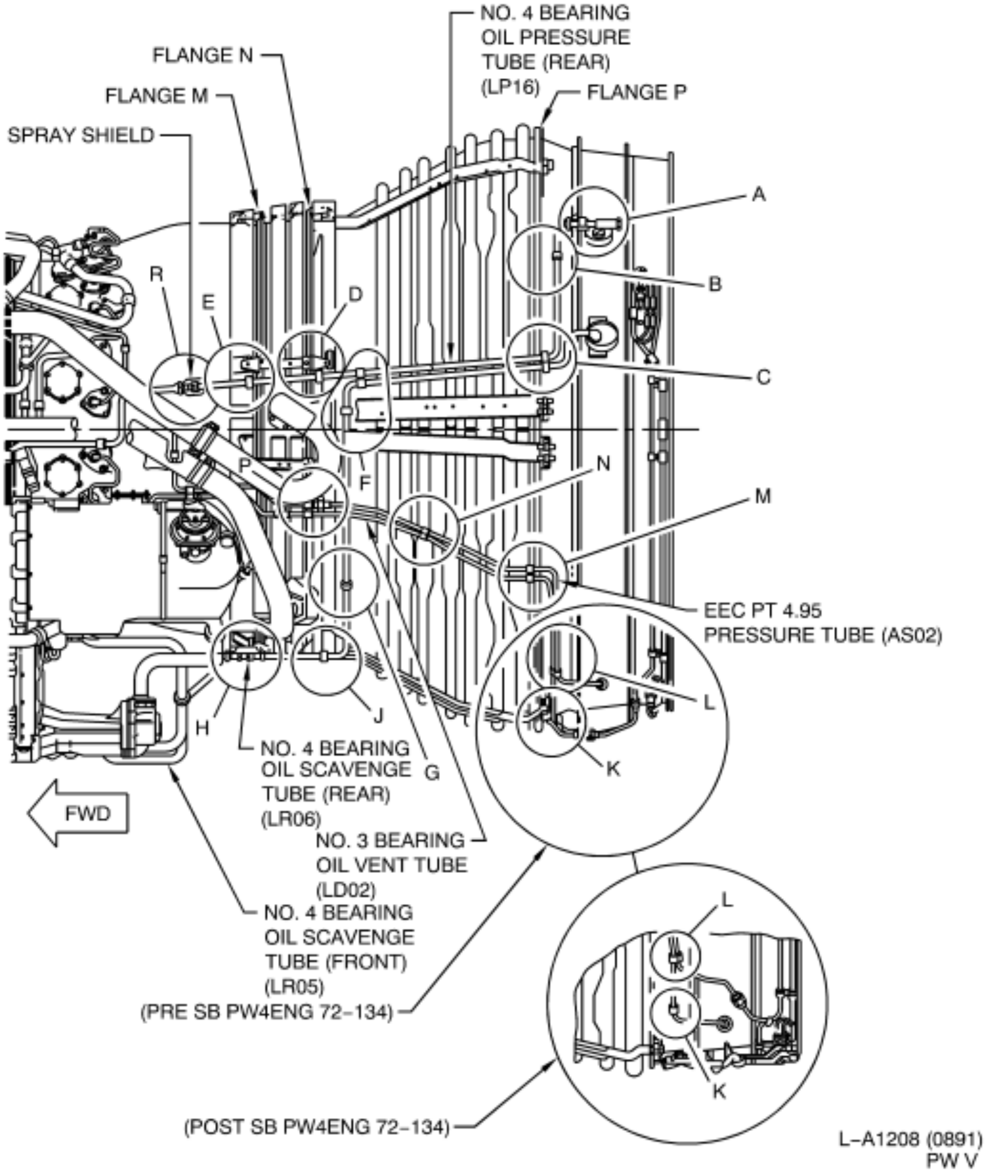
(17) Remove (lower front) turbine case cooling (TCC) HPT manifold assembly (AC25) as follows.

(a) Remove bolt securing manifold end to HPT manifold (collector).

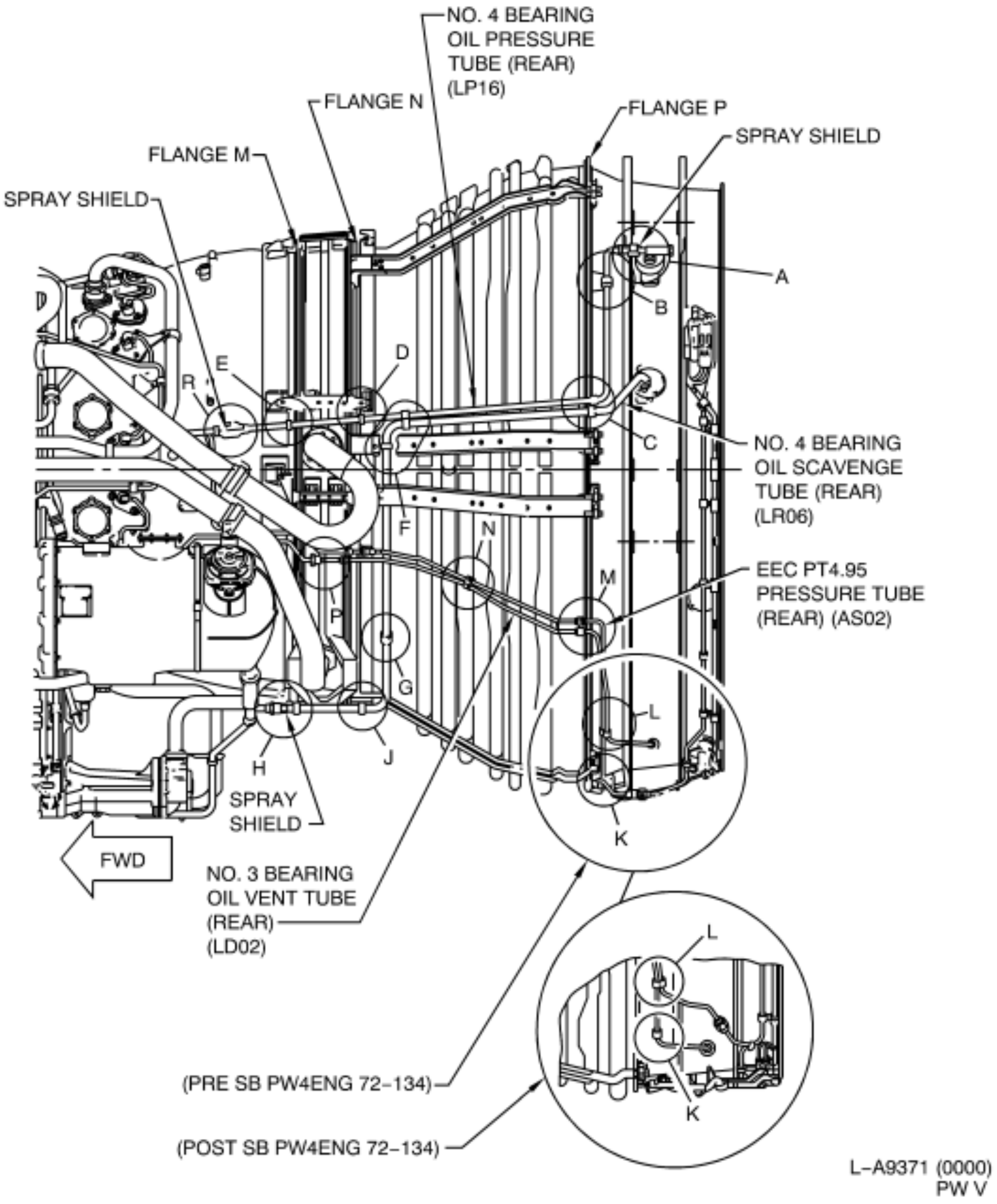
(b) Remove bolts and nuts securing manifold clamps to brackets attached to Flange M brackets at approximately 4, 7 and 9 o'clock positions.

(c) Remove bolts and nuts securing manifold loop clamp brackets to Flange M brackets at approximately 4, 7 and 9 o'clock positions.

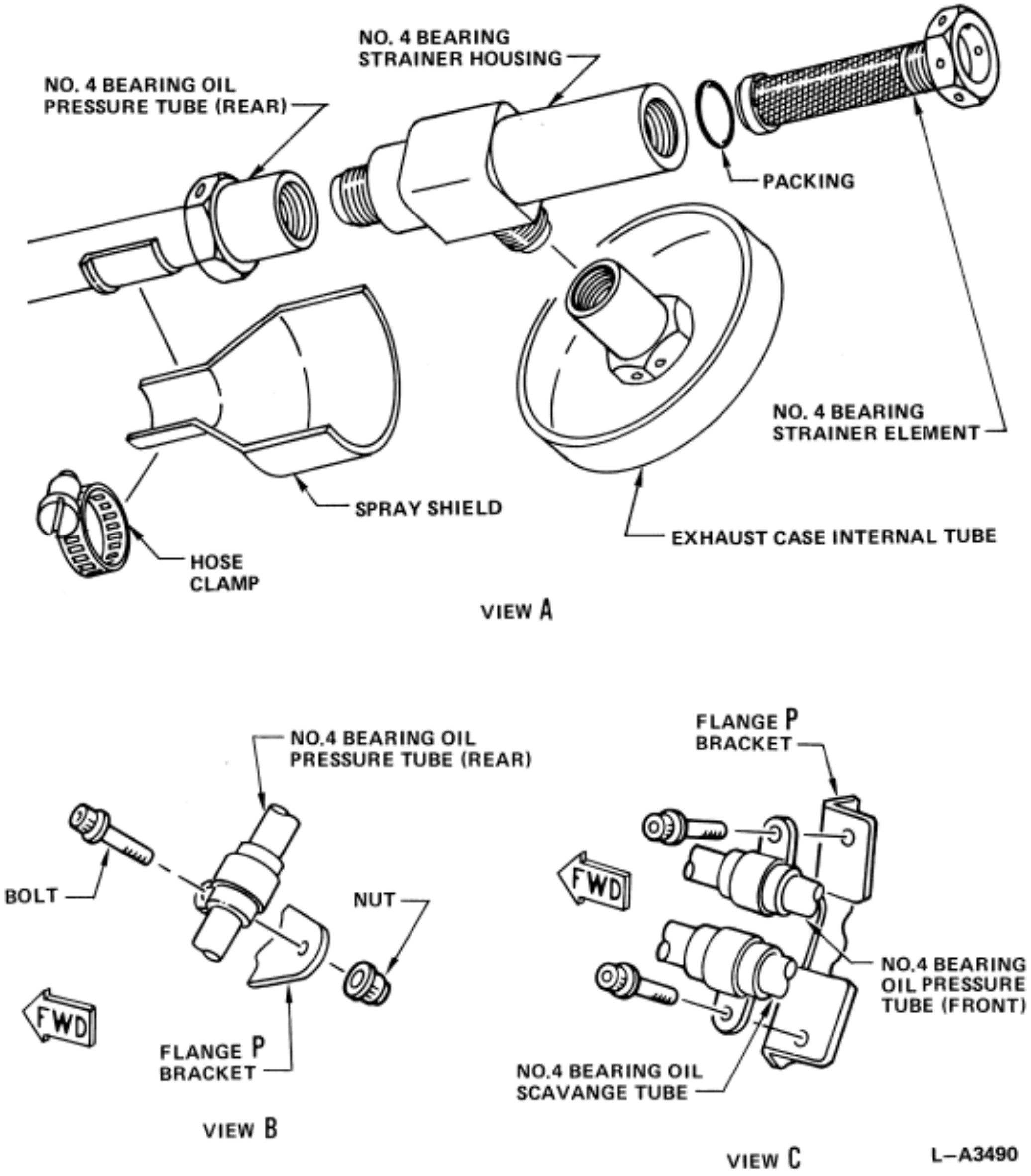
(d) Rotate and lower manifold to disengage collector and remove from engine. Install protective closures.


NO. 4 BEARING OIL PRESSURE TUBE (REAR) (LP16)
FLANGE N
FLANGE M
FLANGE P
SPRAY SHIELD
A
B
C
R
E
D
P
F
N
M
EEC PT 4.95 PRESSURE TUBE (AS02)
L
K
H
J
G
NO. 4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
FWD
NO. 3 BEARING OIL VENT TUBE (LD02)
NO. 4 BEARING OIL SCAVENGE TUBE (FRONT) (LR05)
(PRE SB PW4ENG 72-134)
L
K
(POST SB PW4ENG 72-134)
L-A1208 (0891)
PW V

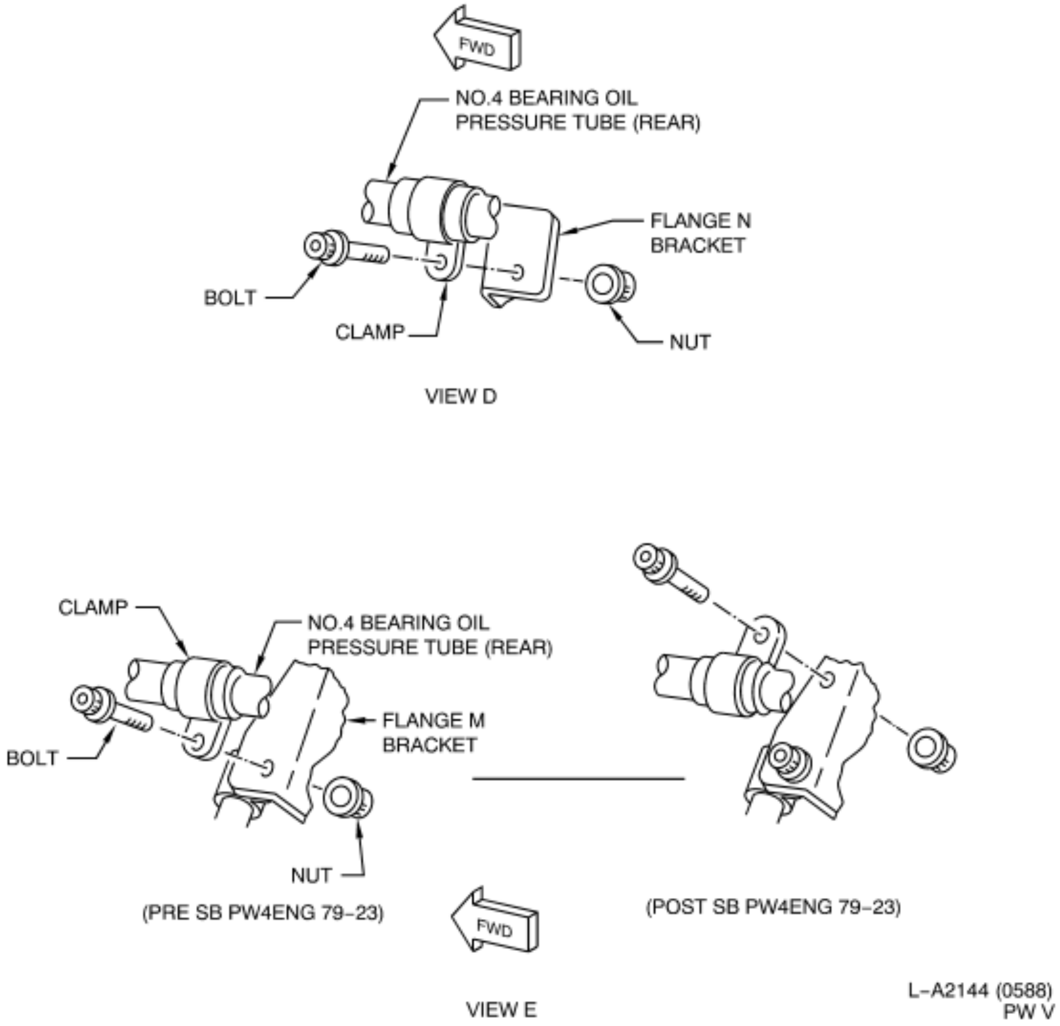
Turbine Exhaust Case External Plumbing
Figure 301 (Sheet 1)
(Task 72-00-54-020-003)


NO. 4 BEARING OIL PRESSURE TUBE (REAR) (LP16)
FLANGE N
FLANGE P
SPRAY SHIELD
FLANGE M
SPRAY SHIELD
A
B
D
E
R
C
NO. 4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
F
N
M
EEC PT4.95 PRESSURE TUBE (REAR) (AS02)
P
G
L
H
J
SPRAY SHIELD
K
FWD
NO. 3 BEARING OIL VENT TUBE (REAR) (LD02)
L
K
(PRE SB PW4ENG 72-134)
(POST SB PW4ENG 72-134)
L-A9371 (0000)
PW V

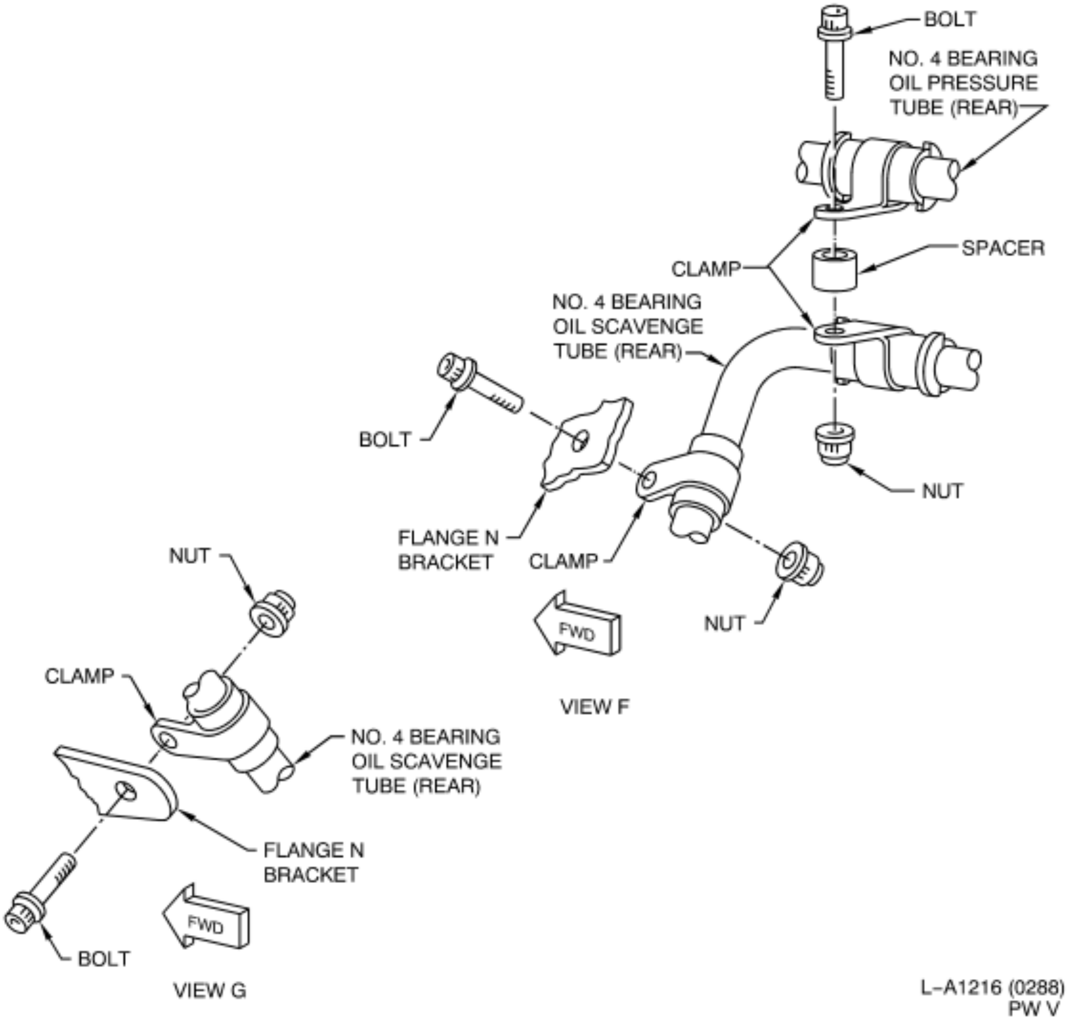
Turbine Exhaust Case External Plumbing
(Engines With SB PW4ENG 75-53)
Figure 301 (Sheet 2)
(Task 72-00-54-020-003)


NO. 4 BEARING STRAINER HOUSING
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
PACKING
NO. 4 BEARING STRAINER ELEMENT
SPRAY SHIELD
EXHAUST CASE INTERNAL TUBE
HOSE CLAMP
VIEW A
NO.4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NUT
FWD
FLANGE P BRACKET
VIEW B
FLANGE P BRACKET
FWD
NO.4 BEARING OIL PRESSURE TUBE (FRONT)
NO.4 BEARING OIL SCAVANGE TUBE
VIEW C
L-A3490

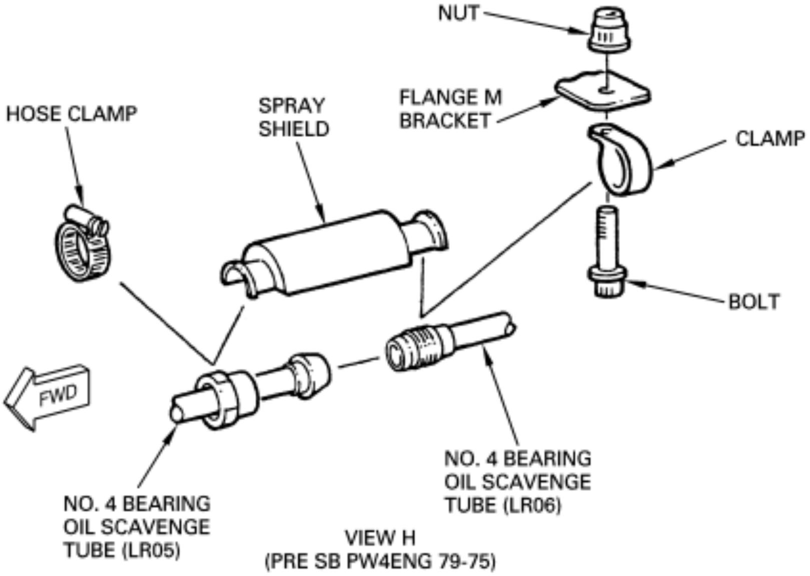
Turbine Exhaust Case External Plumbing
Figure 301 (Sheet 3)
(Task 72-00-54-020-003)


FWD
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE N BRACKET
BOLT
CLAMP
NUT
VIEW D
CLAMP
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE M BRACKET
BOLT
NUT
(PRE SB PW4ENG 79-23)
FWD
(POST SB PW4ENG 79-23)
VIEW E
L-A2144 (0588)
PW V

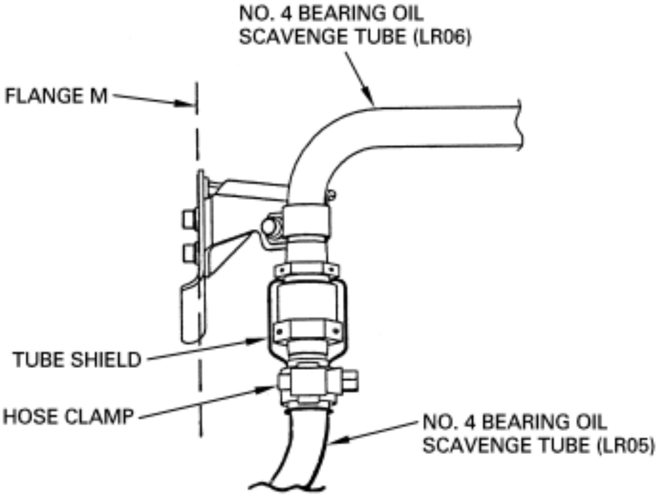
Turbine Exhaust Case External Plumbing
Figure 301 (Sheet 4)
(Task 72-00-54-020-003)


BOLT
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
SPACER
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
BOLT
NUT
FLANGE N BRACKET
CLAMP
NUT
FWD
VIEW F
NUT
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
FLANGE N BRACKET
BOLT
FWD
VIEW G
L-A1216 (0288)
PW V

Turbine Exhaust Case External Plumbing
Figure 301 (Sheet 5)
(Task 72-00-54-020-003)

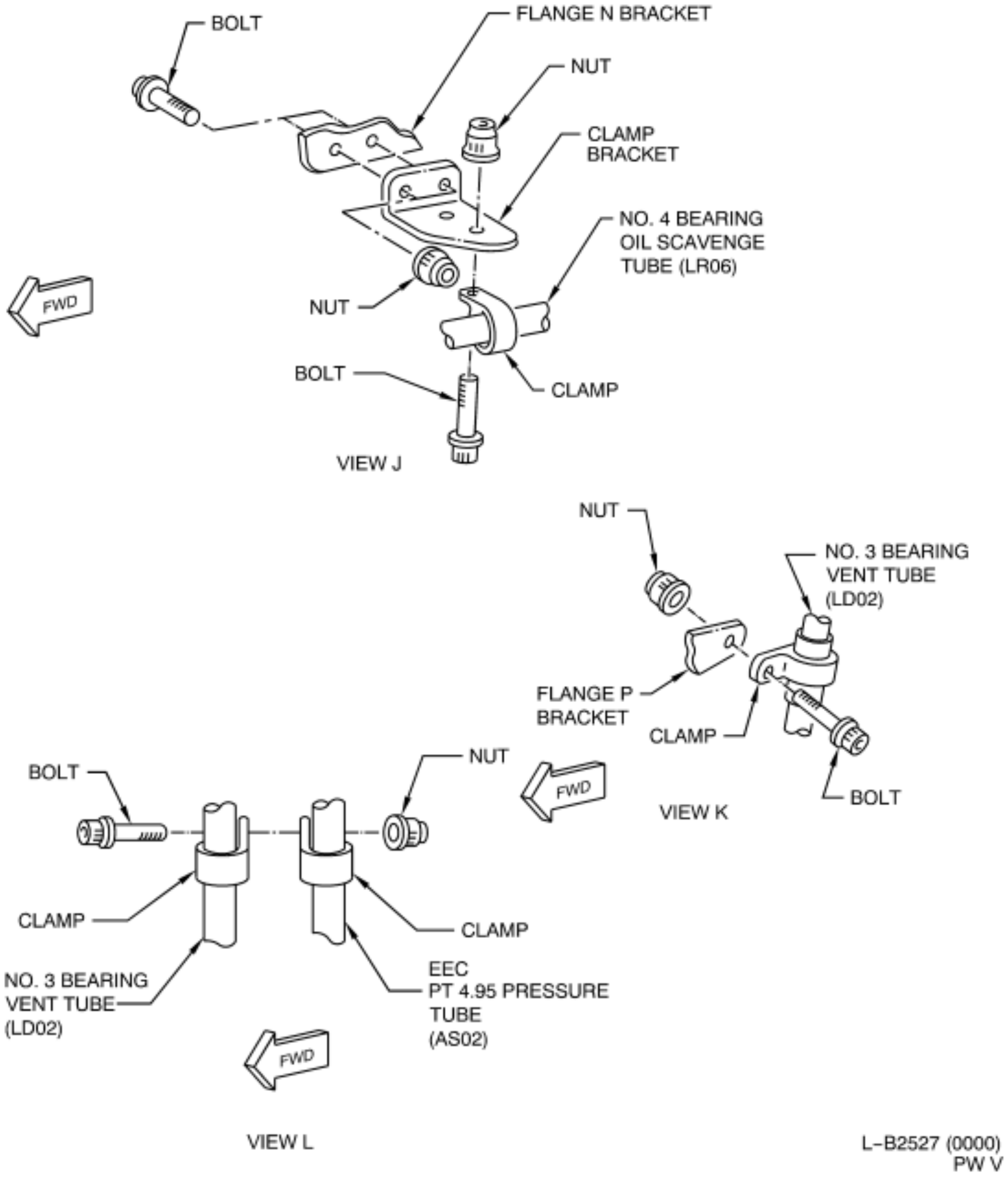

NUT
HOSE CLAMP
SPRAY SHIELD
FLANGE M BRACKET
CLAMP
BOLT
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)

VIEW H
(PRE SB PW4ENG 79-75)

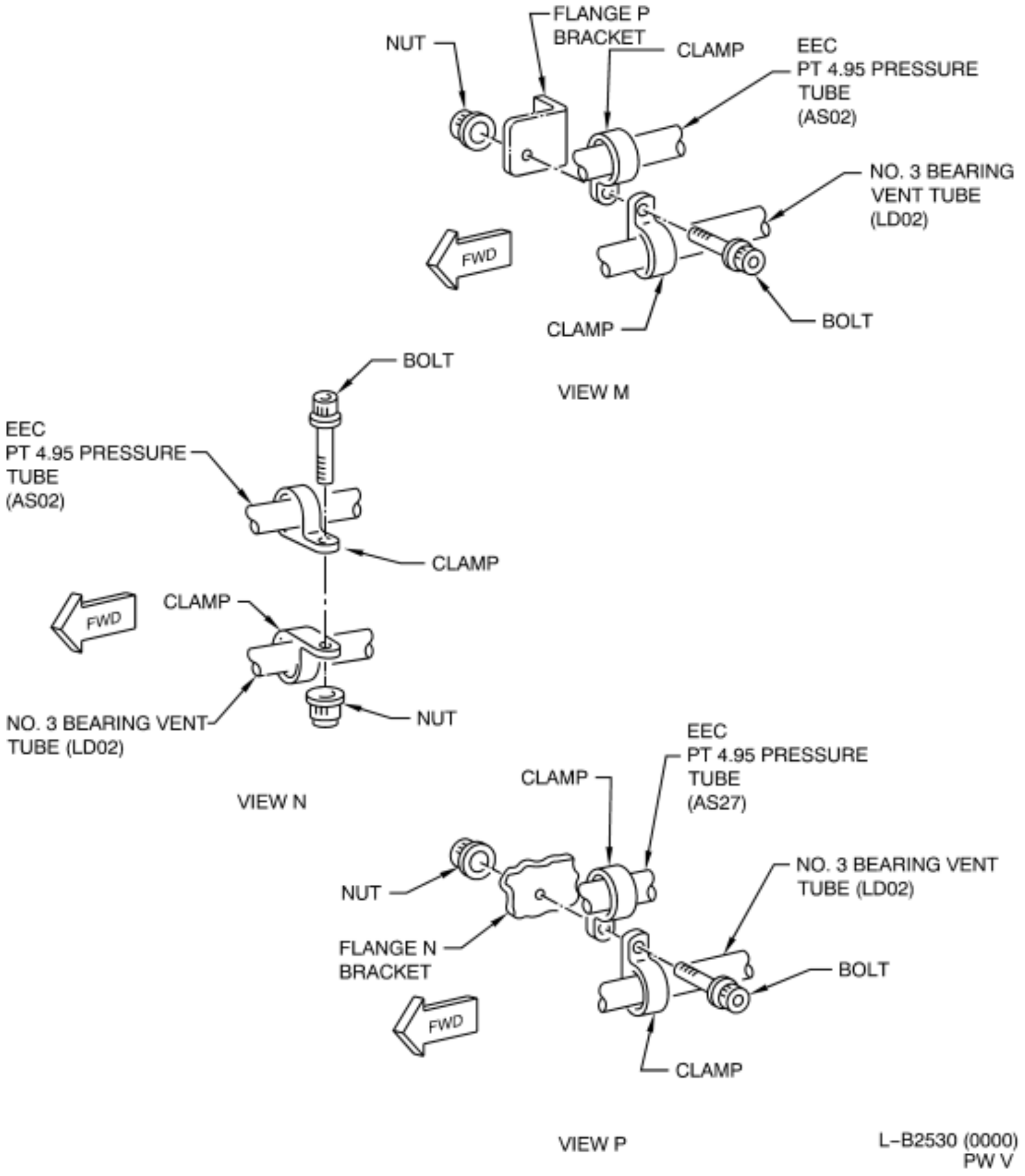

NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
FLANGE M
TUBE SHIELD
HOSE CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
L-B2526 (0000)

VIEW H
(POST SB PW4ENG 79-75)

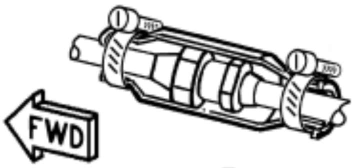
Turbine Exhaust Case External Plumbing
Figure 301 (Sheet 6)
(Task 72−00−54−020−003)


BOLT
FLANGE N BRACKET
NUT
CLAMP BRACKET
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
FWD
NUT
BOLT
CLAMP
VIEW J
NUT
NO. 3 BEARING VENT TUBE (LD02)
FLANGE P BRACKET
CLAMP
BOLT
FWD
VIEW K
BOLT
NUT
CLAMP
CLAMP
NO. 3 BEARING VENT TUBE (LD02)
EEC PT 4.95 PRESSURE TUBE (AS02)
FWD
VIEW L
L−B2527 (0000)
PW V

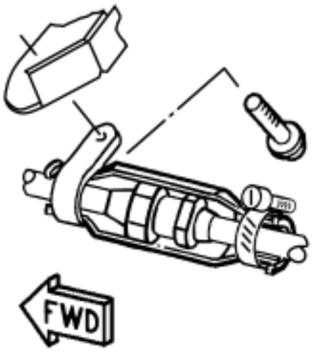
Turbine Exhaust Case External Plumbing
Figure 301 (Sheet 7)
(Task 72−00−54−020−003)


NUT
FLANGE P
BRACKET
CLAMP
EEC
PT 4.95 PRESSURE
TUBE
(AS02)
NO. 3 BEARING
VENT TUBE
(LD02)
FWD
CLAMP
BOLT
VIEW M
BOLT
EEC
PT 4.95 PRESSURE
TUBE
(AS02)
CLAMP
FWD
CLAMP
NO. 3 BEARING VENT
TUBE (LD02)
NUT
VIEW N
EEC
PT 4.95 PRESSURE
TUBE
(AS27)
CLAMP
NO. 3 BEARING VENT
TUBE (LD02)
NUT
FLANGE N
BRACKET
BOLT
FWD
CLAMP
VIEW P
L−B2530 (0000)
PW V

Turbine Exhaust Case External Plumbing
Figure 301 (Sheet 8)
(Task 72−00−54−020−003)



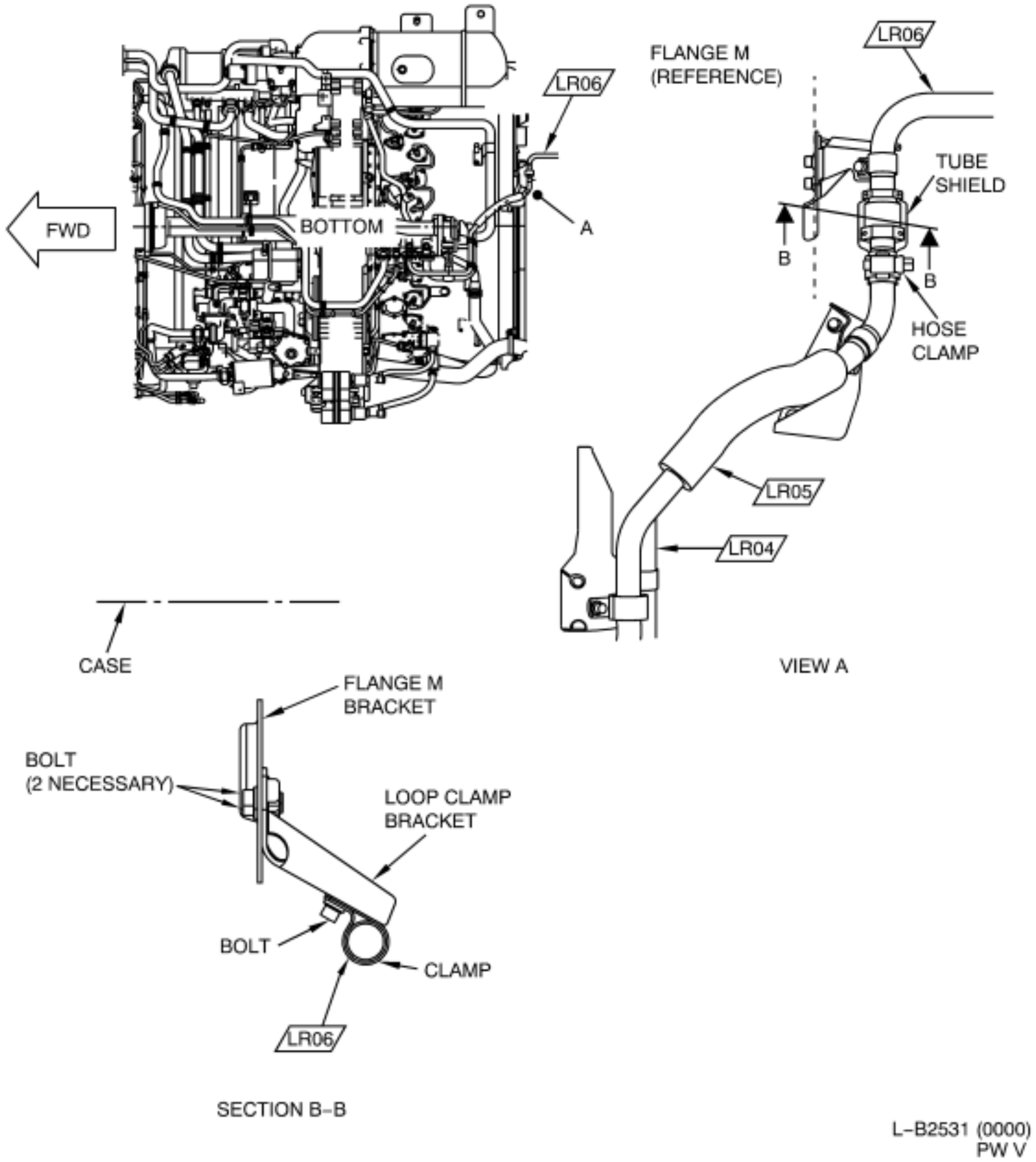
VIEW R
(PRE SB PW4ENG 79-54)



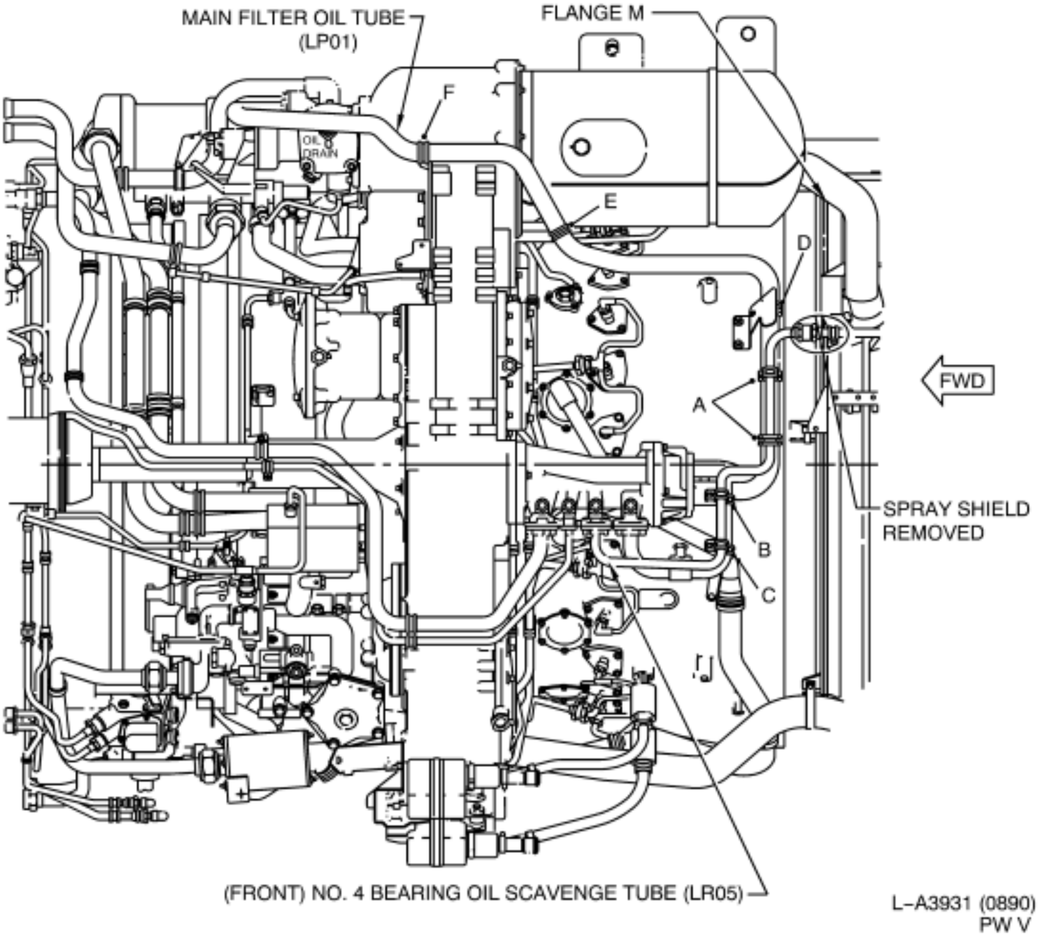
VIEW R
(POST SB PW4ENG 79-54)

L-A6825 (0000)

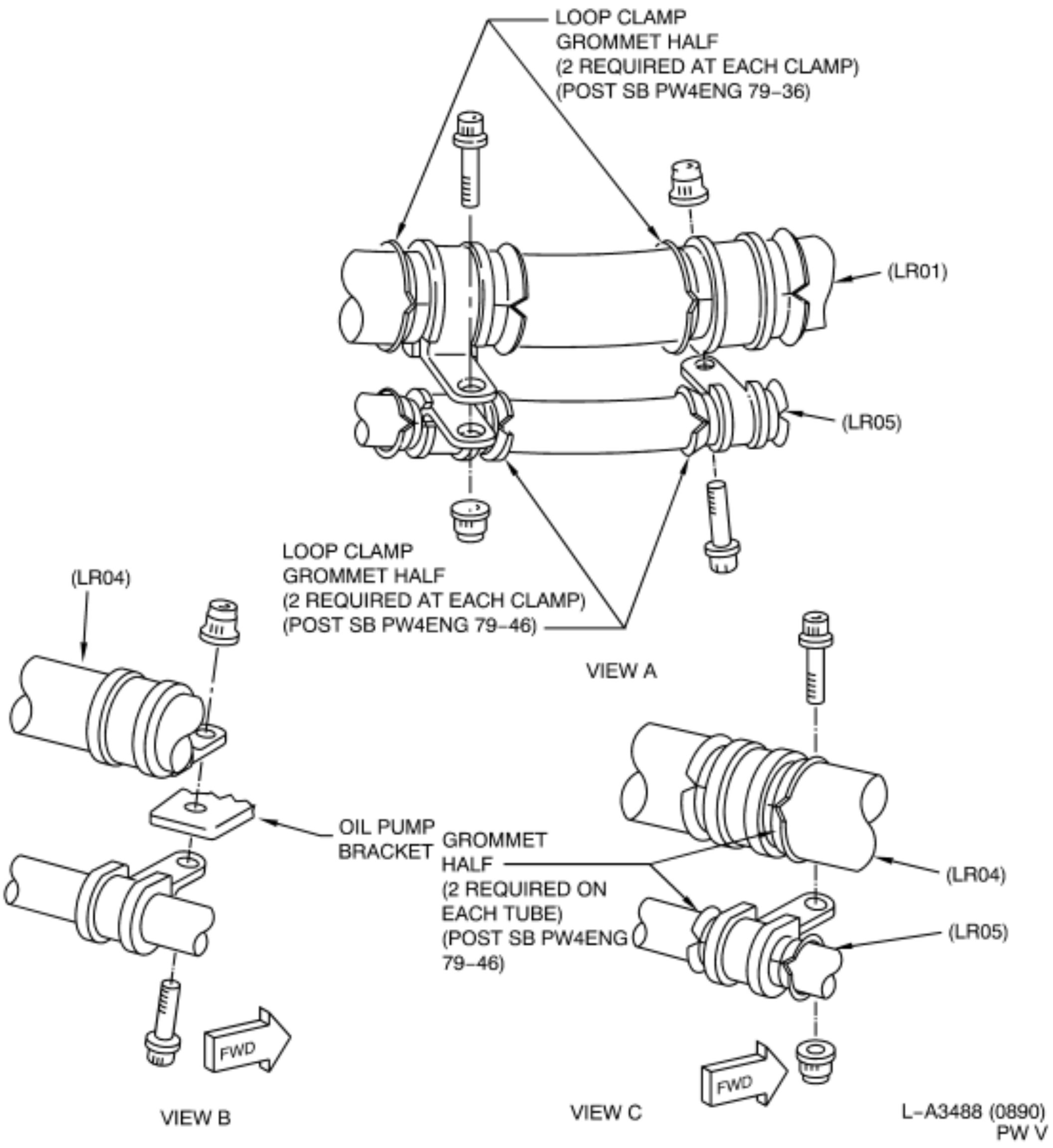
Turbine Exhaust Case External Plumbing
Figure 301 (Sheet 9)
(Task 72−00−54−020−003)


FWD
BOTTOM
LR06
A
FLANGE M
(REFERENCE)
LR06
TUBE
SHIELD
B
B
HOSE
CLAMP
LR05
LR04
CASE
VIEW A
FLANGE M
BRACKET
BOLT
(2 NECESSARY)
LOOP CLAMP
BRACKET
BOLT
CLAMP
LR06
SECTION B-B
L-B2531 (0000)
PW V

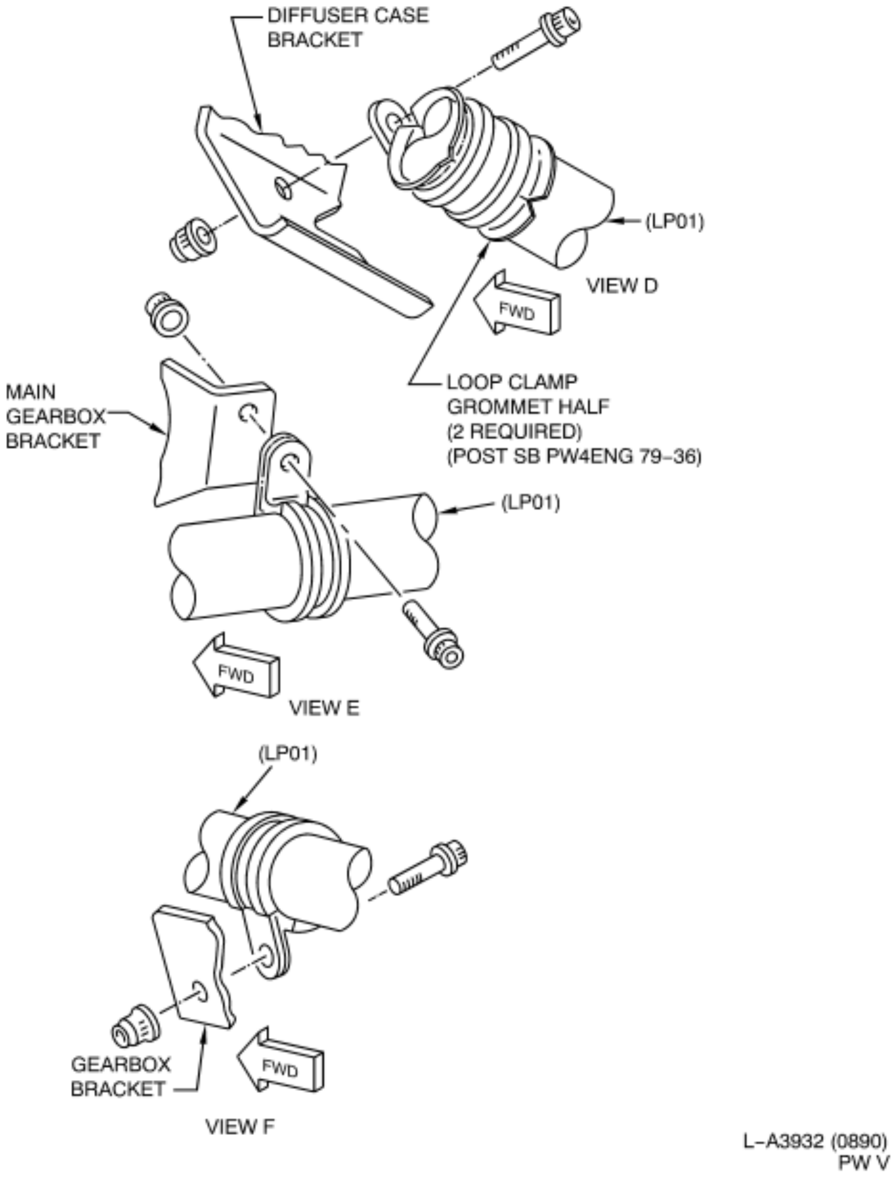
Turbine Exhaust Case External Plumbing (Post SB PW4ENG 79-75)
Figure 301 (Sheet 10)
(Task 72-00-54-020-003)


MAIN FILTER OIL TUBE
(LP01)
FLANGE M
F
OIL DRAIN
E
D
FWD
A
SPRAY SHIELD
REMOVED
B
C
(FRONT) NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
L-A3931 (0890)
PW V

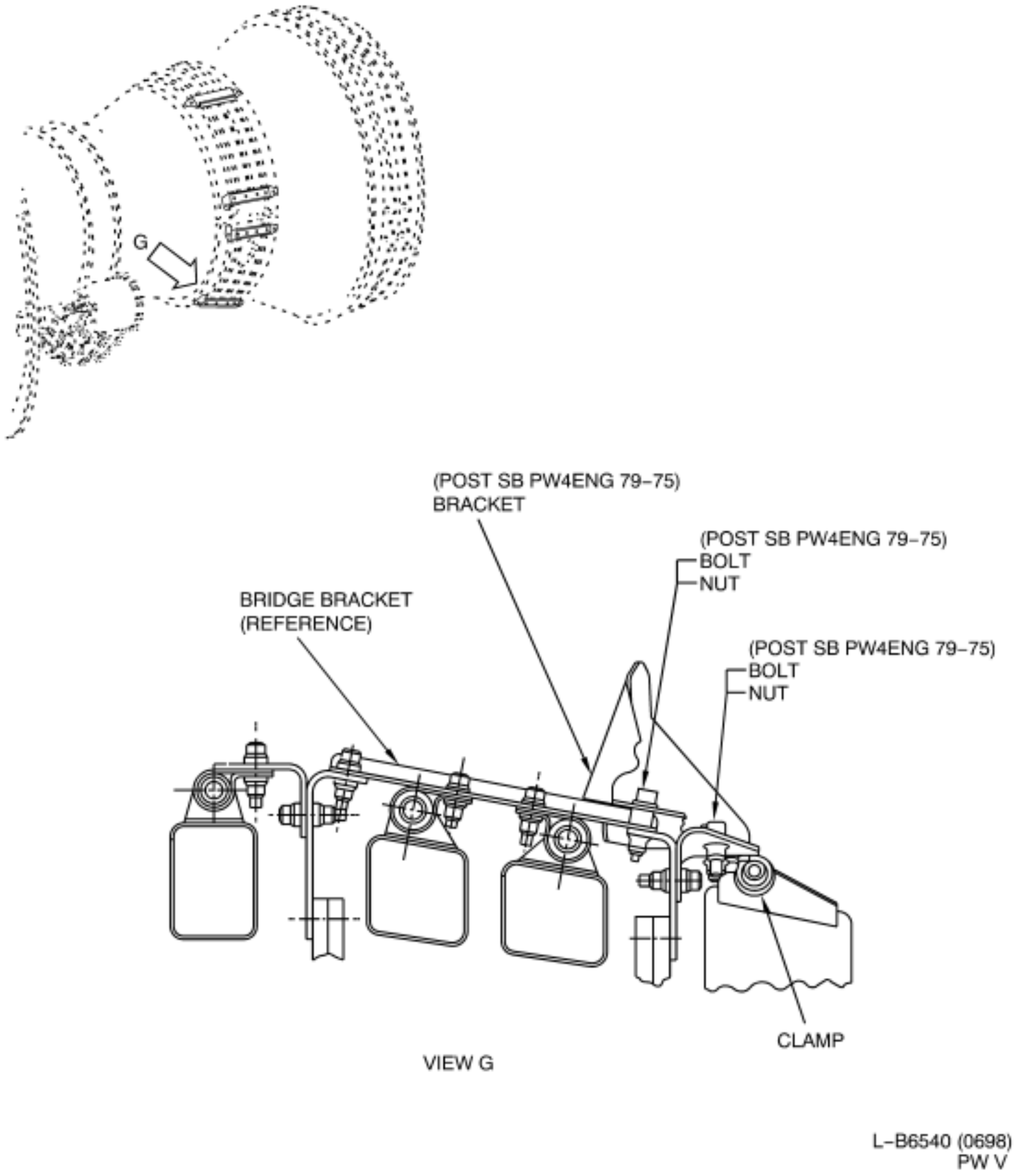
Bottom External Plumbing
Figure 302 (Sheet 1)
(Task 72-00-54-020-003)


LOOP CLAMP
GROMMET HALF
(2 REQUIRED AT EACH CLAMP)
(POST SB PW4ENG 79-36)
(LR01)
(LR05)
LOOP CLAMP
GROMMET HALF
(2 REQUIRED AT EACH CLAMP)
(POST SB PW4ENG 79-46)
VIEW A
(LR04)
OIL PUMP
BRACKET
GROMMET
HALF
(2 REQUIRED ON
EACH TUBE)
(POST SB PW4ENG
79-46)
(LR04)
(LR05)
FWD
FWD
VIEW B
VIEW C
L-A3488 (0890)
PW V

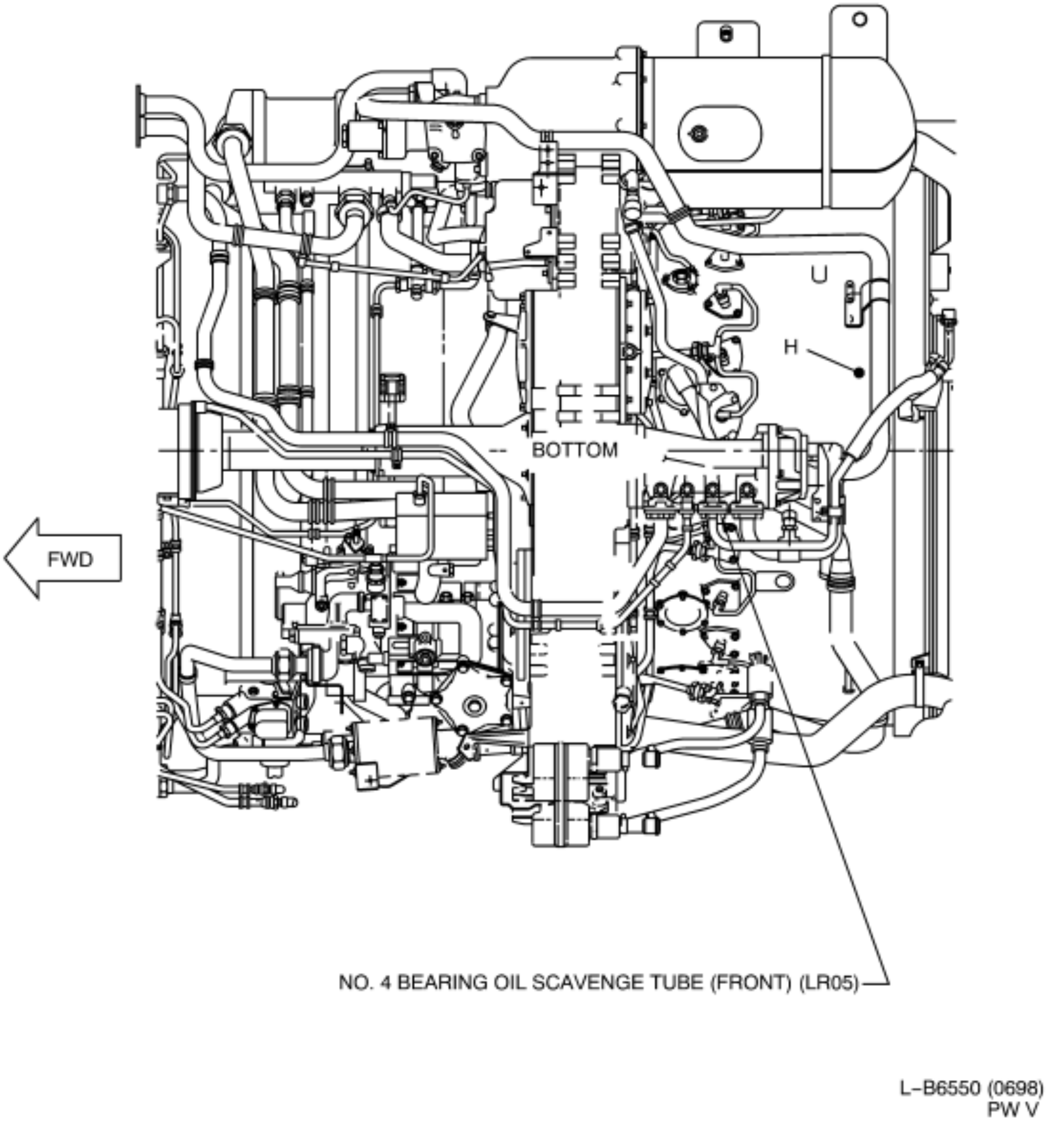
Bottom External Plumbing (Pre SB PW4ENG 79-75)
Figure 302 (Sheet 2)
(Task 72-00-54-020-003)


DIFFUSER CASE BRACKET
(LP01)
VIEW D
FWD
LOOP CLAMP GROMMET HALF (2 REQUIRED) (POST SB PW4ENG 79−36)
MAIN GEARBOX BRACKET
(LP01)
FWD
VIEW E
(LP01)
GEARBOX BRACKET
FWD
VIEW F
L−A3932 (0890)
PW V

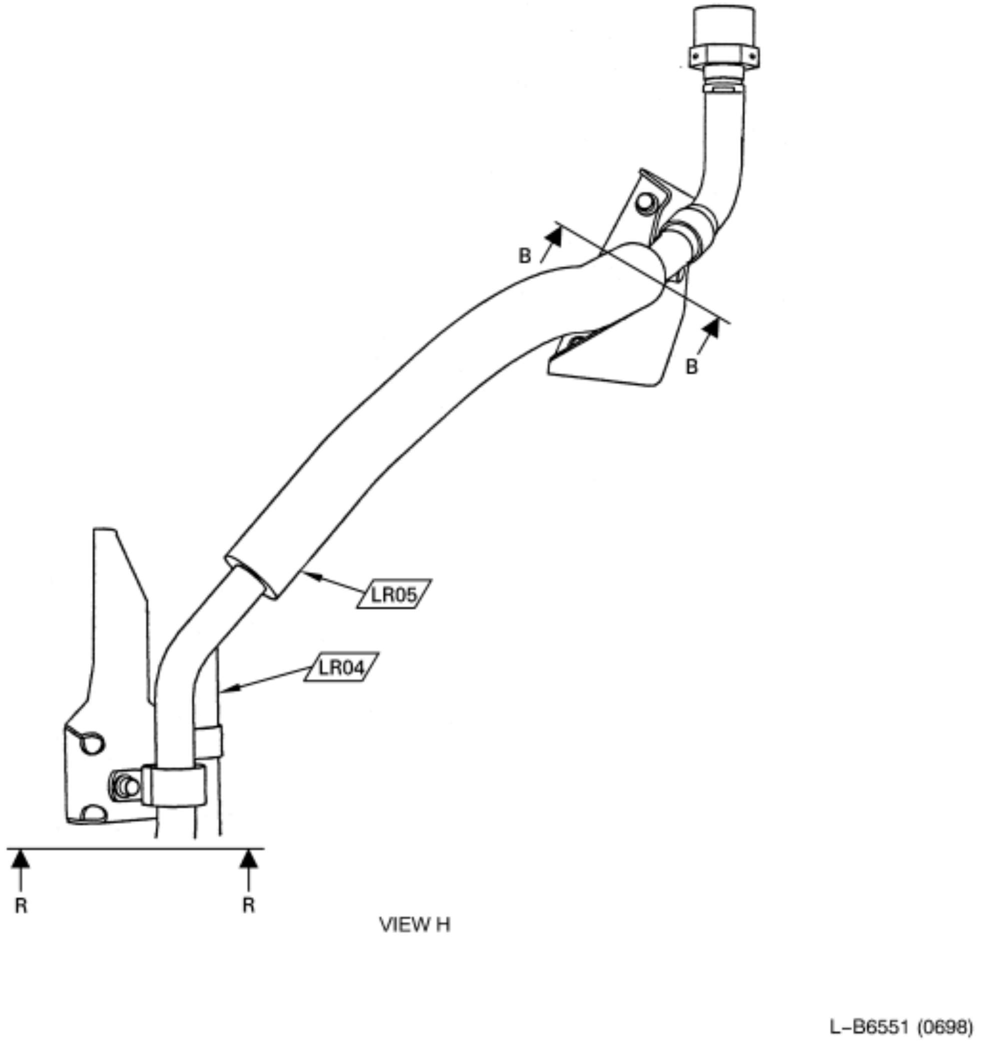
Bottom External Plumbing (Pre SB PW4ENG 79−75)
Figure 302 (Sheet 3)
(Task 72−00−54−020−003)


G
(POST SB PW4ENG 79-75)
BRACKET
(POST SB PW4ENG 79-75)
BOLT
NUT
BRIDGE BRACKET
(REFERENCE)
(POST SB PW4ENG 79-75)
BOLT
NUT
CLAMP
VIEW G
L-B6540 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 4)
(Task 72-00-54-020-003)

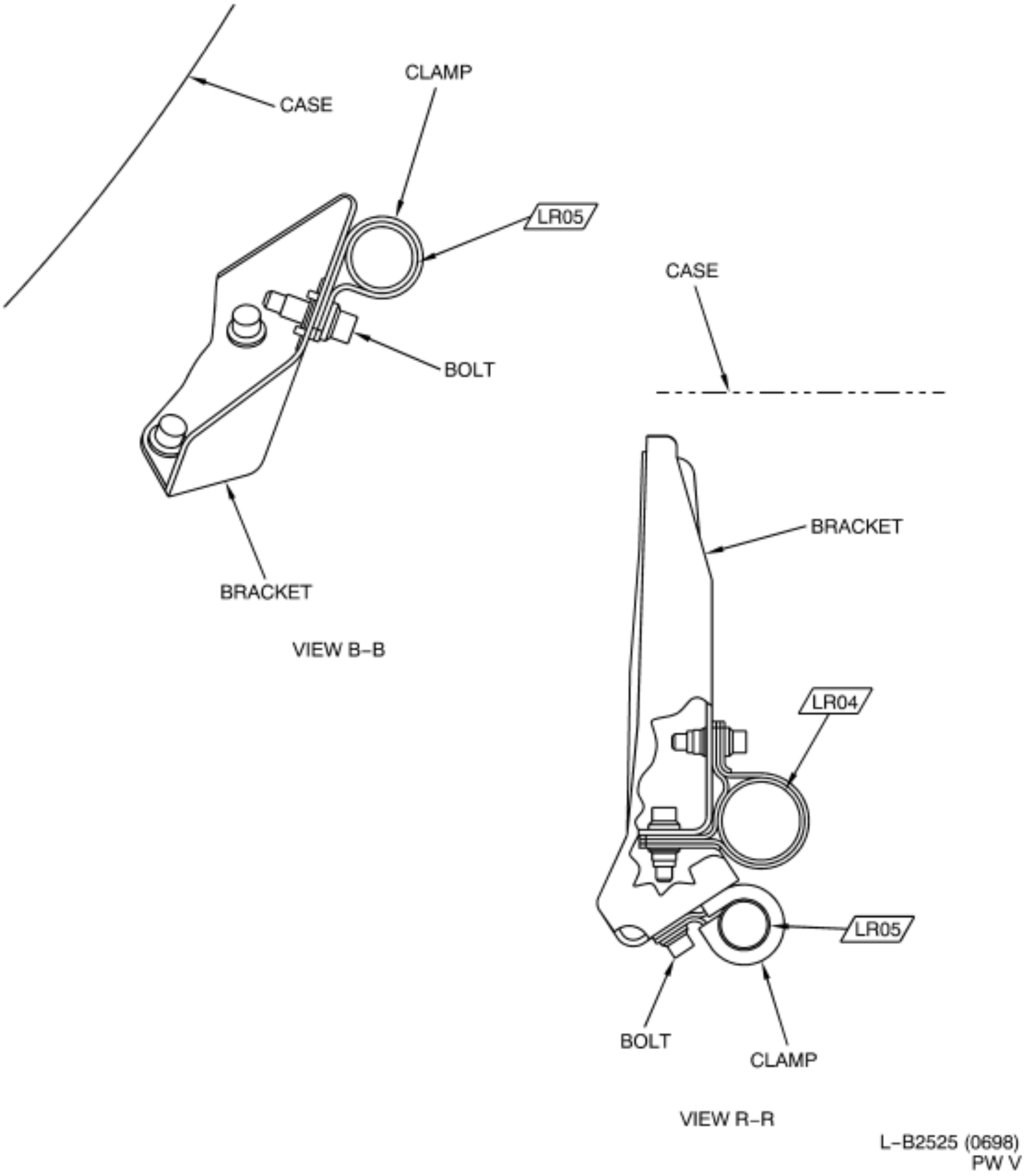

U
H
BOTTOM
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (FRONT) (LR05)
L-B6550 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 5)
(Task 72-00-54-020-003)

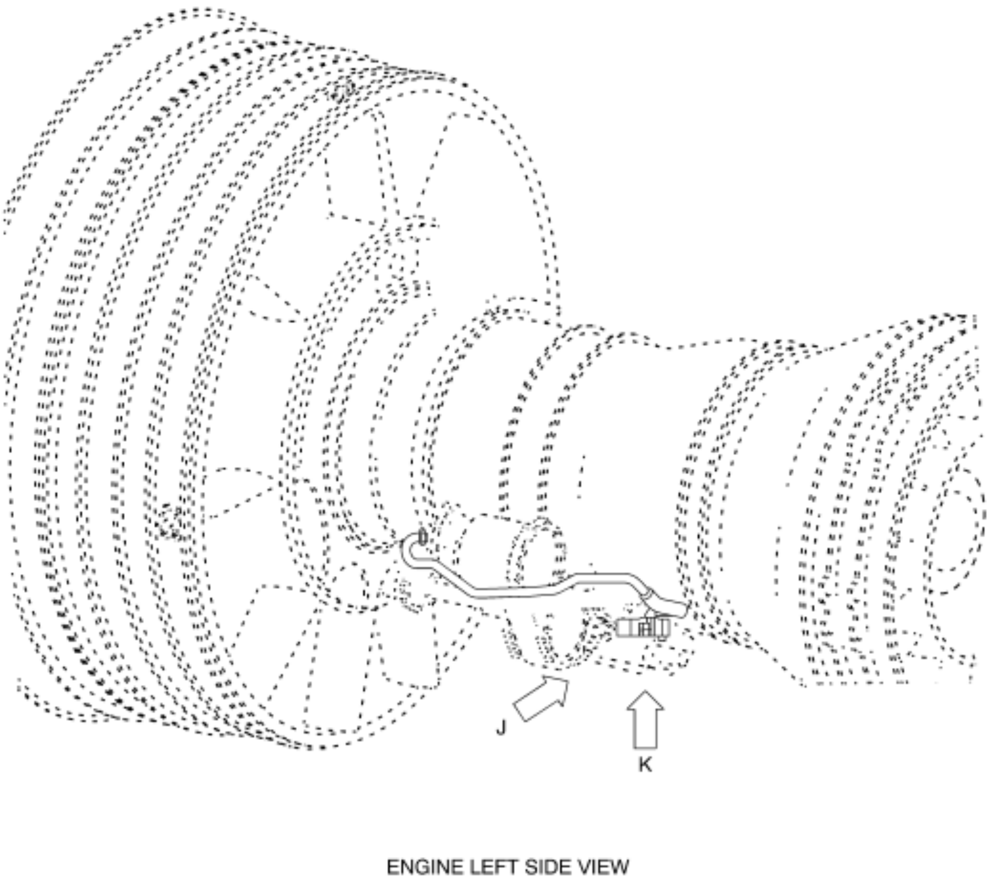

B
B
LR05
LR04
R
R
VIEW H
L-B6551 (0698)

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 6)
(Task 72-00-54-020-003)

ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−02

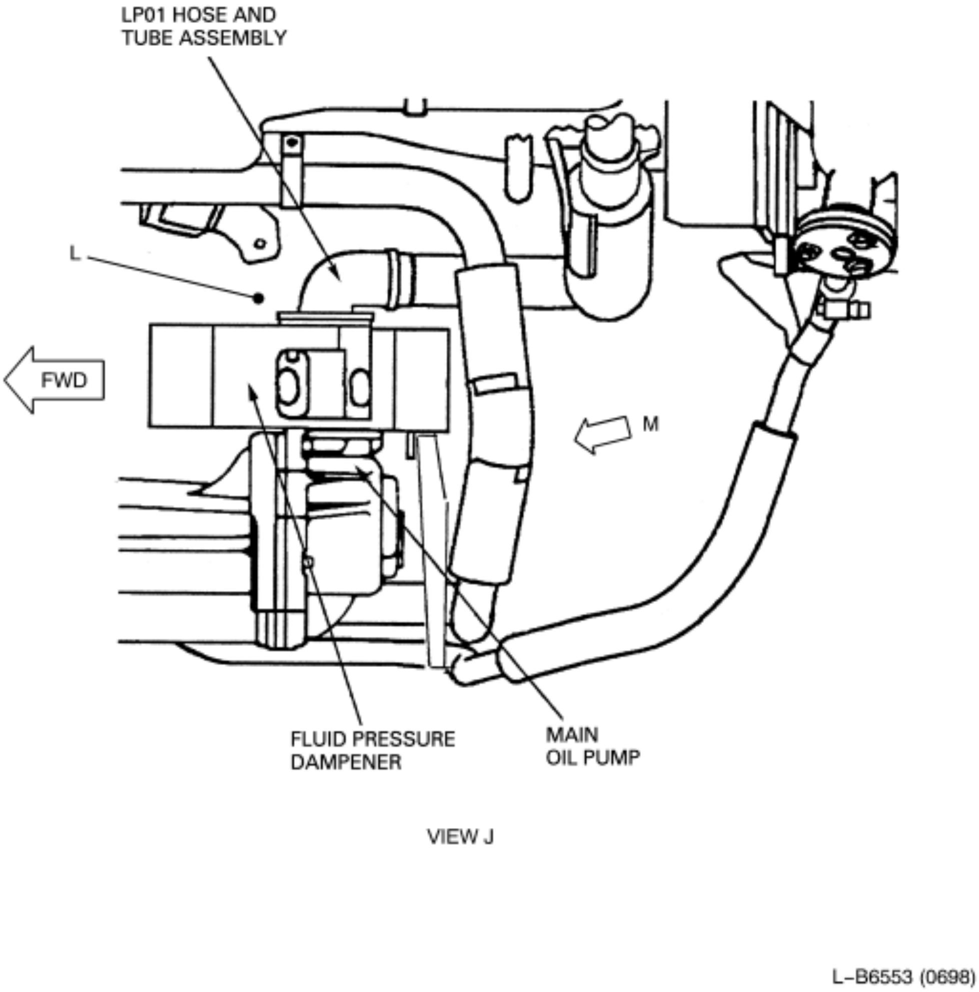

CASE
CLAMP
LR05
BOLT
BRACKET
VIEW B−B
CASE
BRACKET
LR04
LR05
BOLT
CLAMP
VIEW R−R
L−B2525 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 302 (Sheet 7)
(Task 72−00−54−020−003)

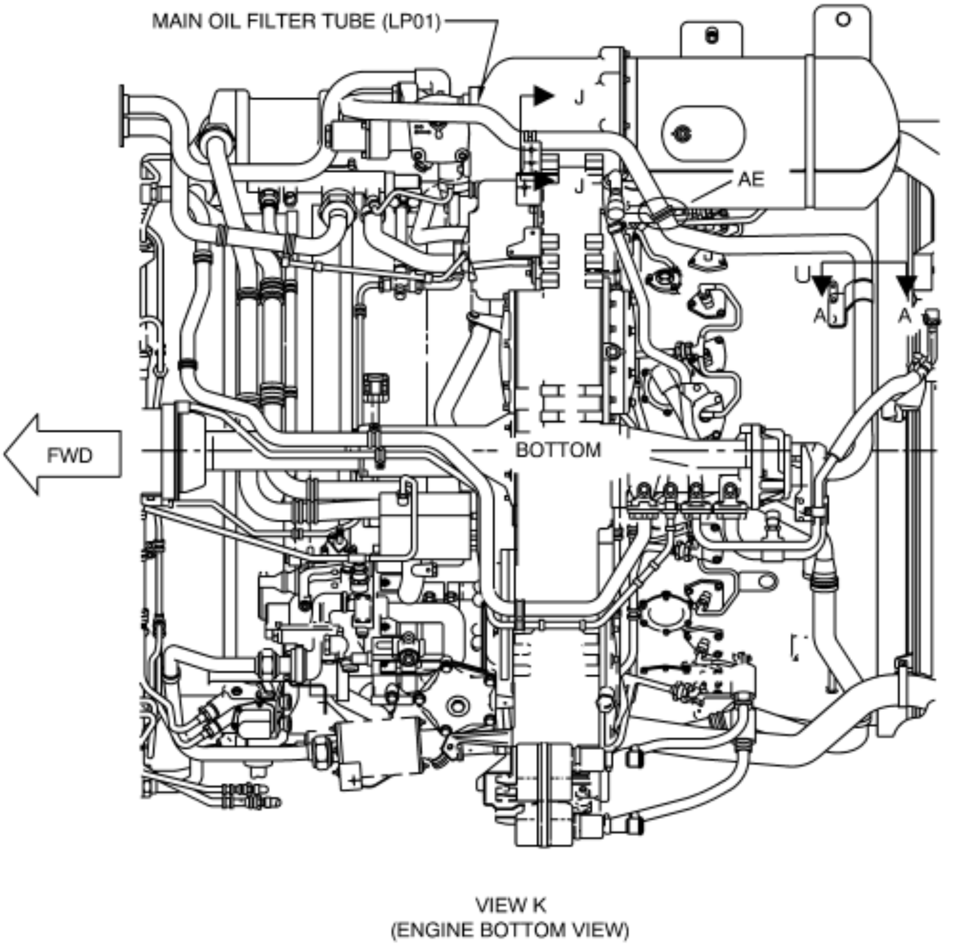


L−B6552 (0698)
PW V

Bottom External Plumbing (Post SB
PW4ENG 79−75) (Pre SB PW4ENG 79−86)
Figure 302 (Sheet 8)
(Task 72−00−54−020−003)

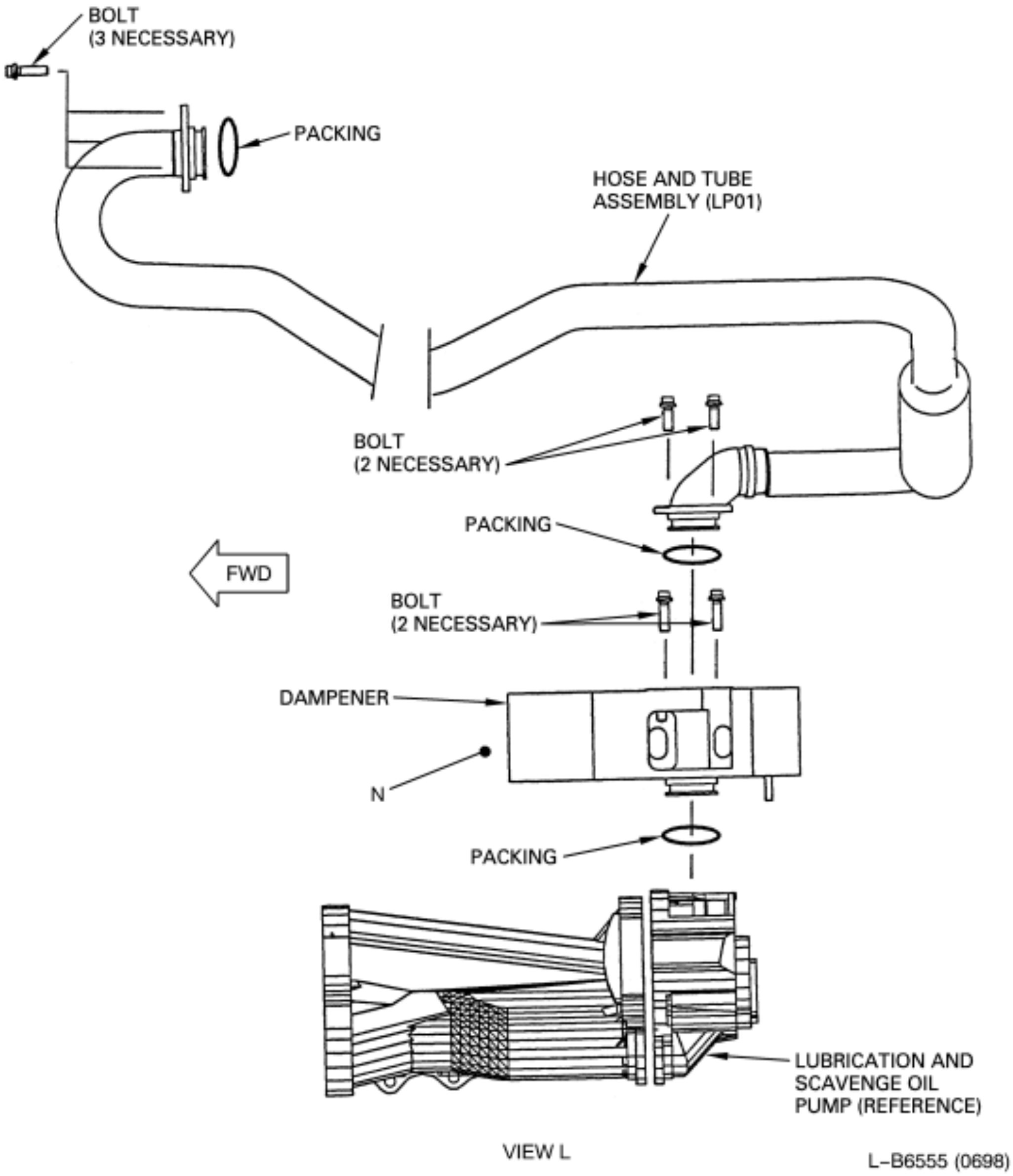

LP01 HOSE AND TUBE ASSEMBLY
L
FWD
M
FLUID PRESSURE DAMPENER
MAIN OIL PUMP
VIEW J
L-B6553 (0698)

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 9)
(Task 72-00-54-020-003)

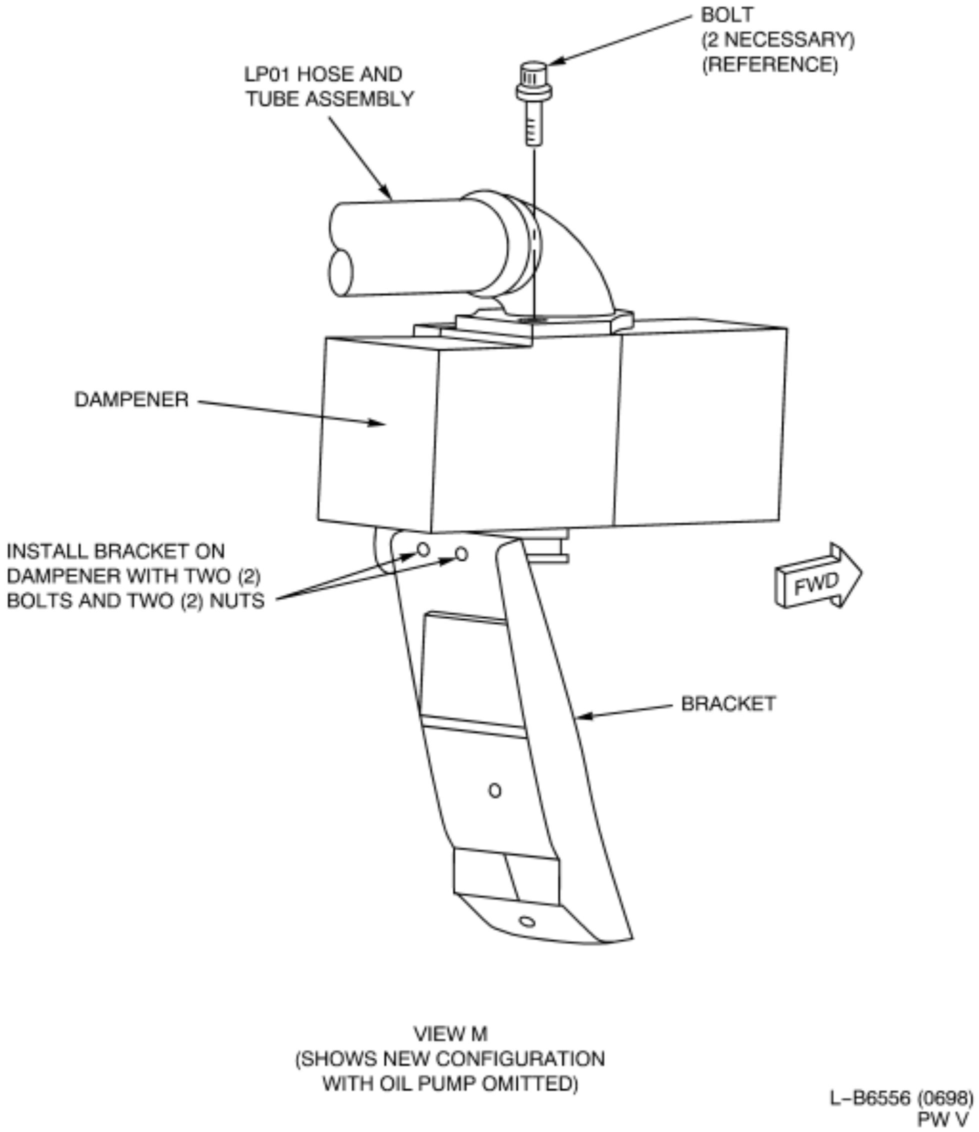

MAIN OIL FILTER TUBE (LP01)
J
J
AE
U
A
A
FWD
BOTTOM
VIEW K
(ENGINE BOTTOM VIEW)

L-B6554 (0698)
PW V

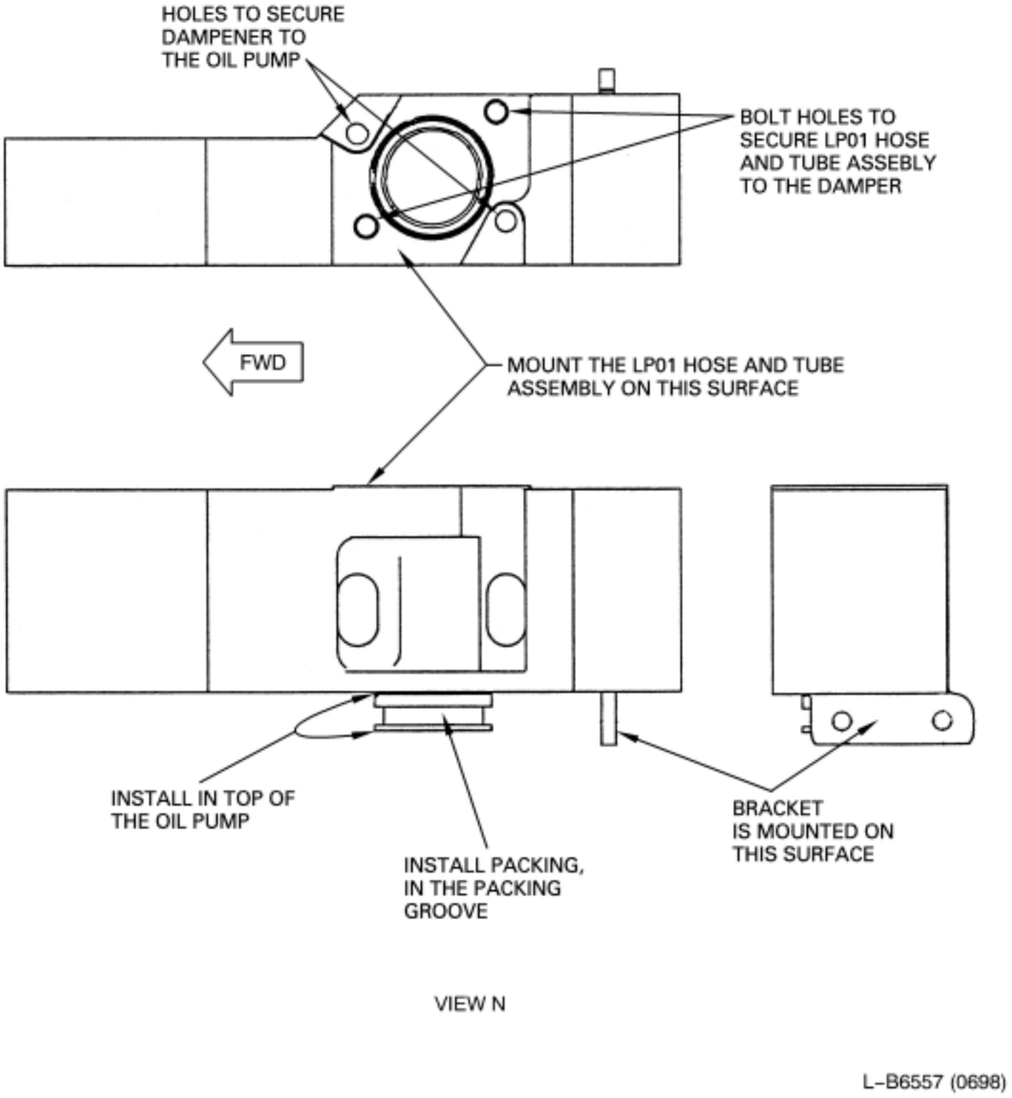
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 10)
(Task 72-00-54-020-003)


BOLT
(3 NECESSARY)
PACKING
HOSE AND TUBE
ASSEMBLY (LP01)
BOLT
(2 NECESSARY)
PACKING
FWD
BOLT
(2 NECESSARY)
DAMPENER
N
PACKING
LUBRICATION AND
SCAVENGE OIL
PUMP (REFERENCE)
VIEW L
L-B6555 (0698)

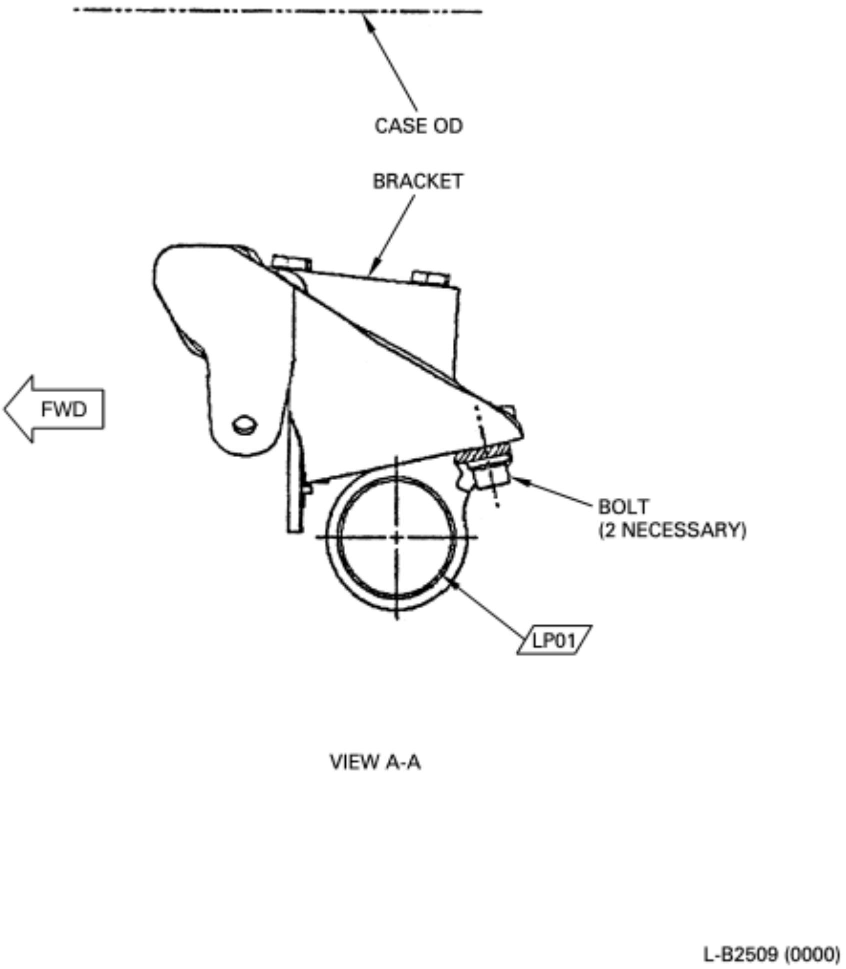
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 11)
(Task 72-00-54-020-003)


BOLT
(2 NECESSARY)
(REFERENCE)
LP01 HOSE AND
TUBE ASSEMBLY
DAMPENER
INSTALL BRACKET ON
DAMPENER WITH TWO (2)
BOLTS AND TWO (2) NUTS
FWD
BRACKET
VIEW M
(SHOWS NEW CONFIGURATION
WITH OIL PUMP OMITTED)
L-B6556 (0698)
PW V

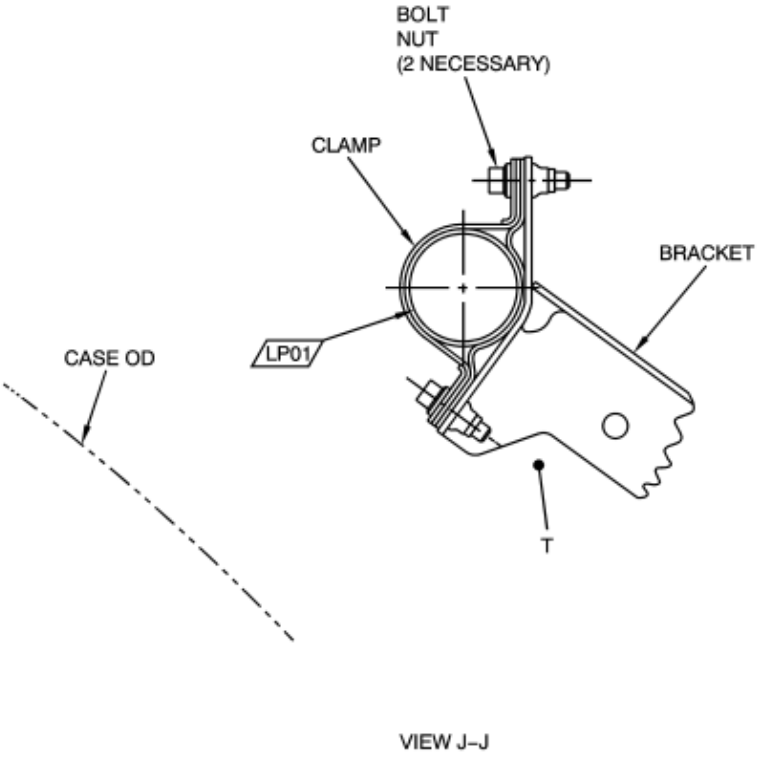
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 12)
(Task 72-00-54-020-003)


HOLES TO SECURE DAMPENER TO THE OIL PUMP
BOLT HOLES TO SECURE LP01 HOSE AND TUBE ASSEBLY TO THE DAMPER
FWD
MOUNT THE LP01 HOSE AND TUBE ASSEMBLY ON THIS SURFACE
INSTALL IN TOP OF THE OIL PUMP
INSTALL PACKING, IN THE PACKING GROOVE
BRACKET IS MOUNTED ON THIS SURFACE
VIEW N
L-B6557 (0698)

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 13)
(Task 72-00-54-020-003)

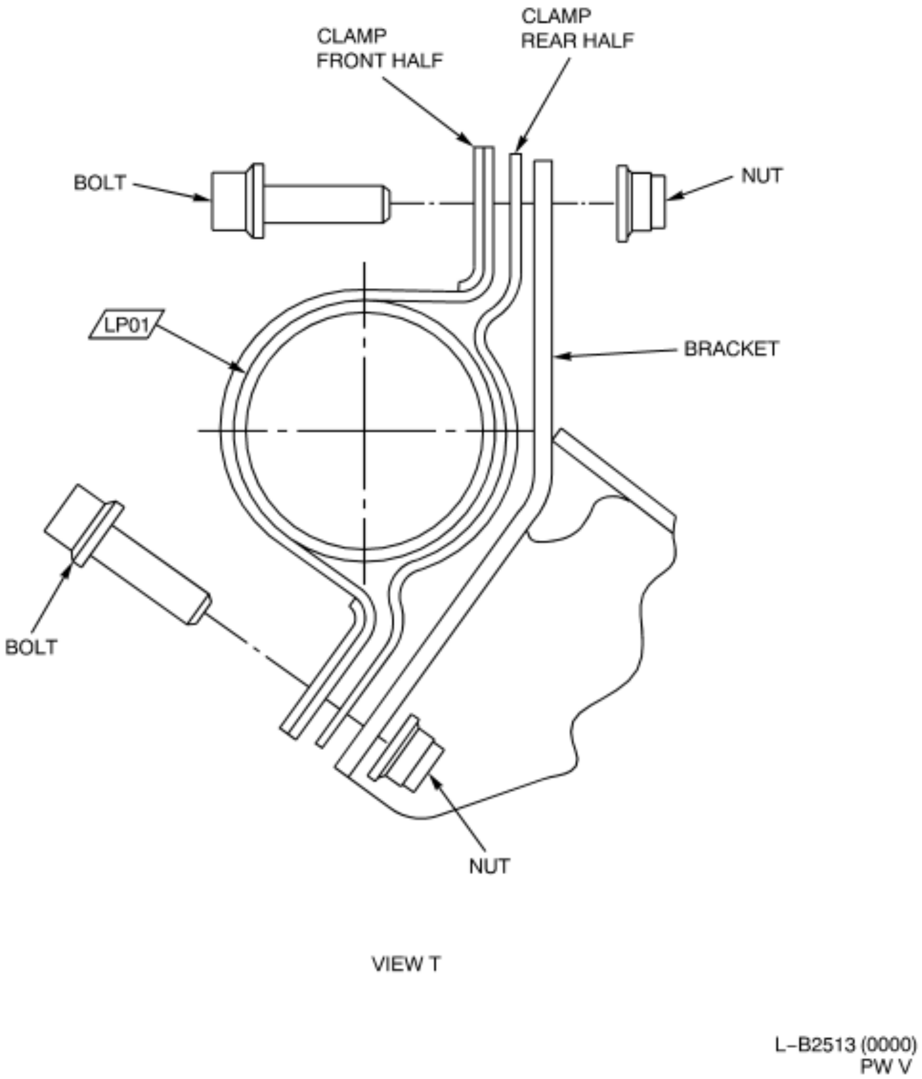

CASE OD
BRACKET
FWD
BOLT
(2 NECESSARY)
LP01
VIEW A-A
L-B2509 (0000)

Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 302 (Sheet 14)
(Task 72−00−54−020−003)

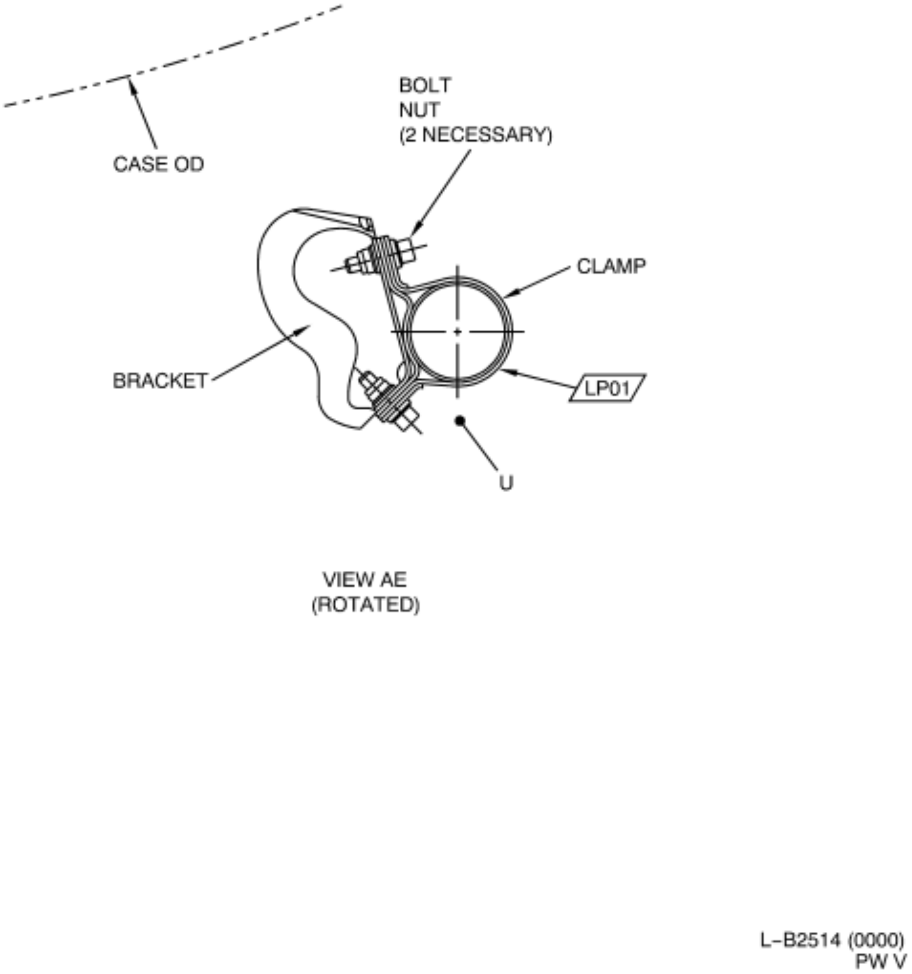

BOLT
NUT
(2 NECESSARY)
CLAMP
BRACKET
CASE OD
LP01
T
VIEW J-J

L-B2512 (0000)
PW V

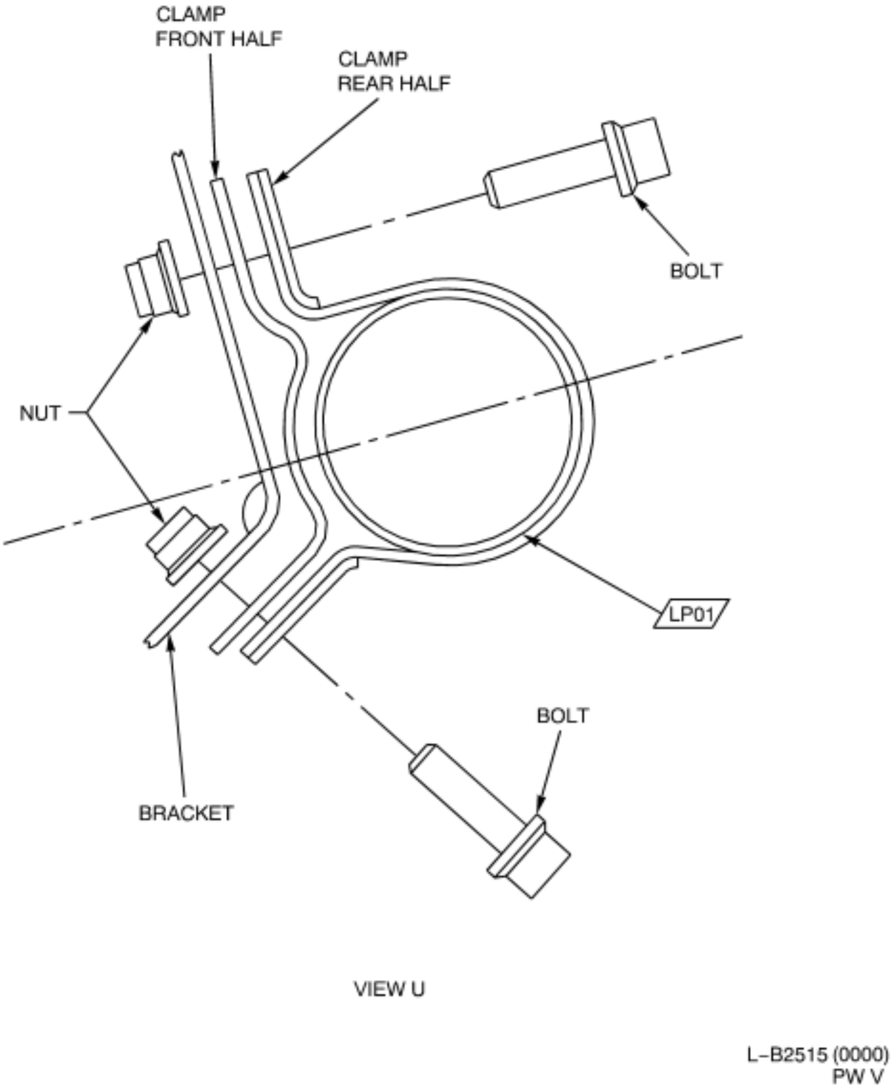
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 15)
(Task 72-00-54-020-003)


CLAMP
FRONT HALF
CLAMP
REAR HALF
BOLT
NUT
LP01
BRACKET
BOLT
NUT
VIEW T
L-B2513 (0000)
PW V

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 16)
(Task 72-00-54-020-003)

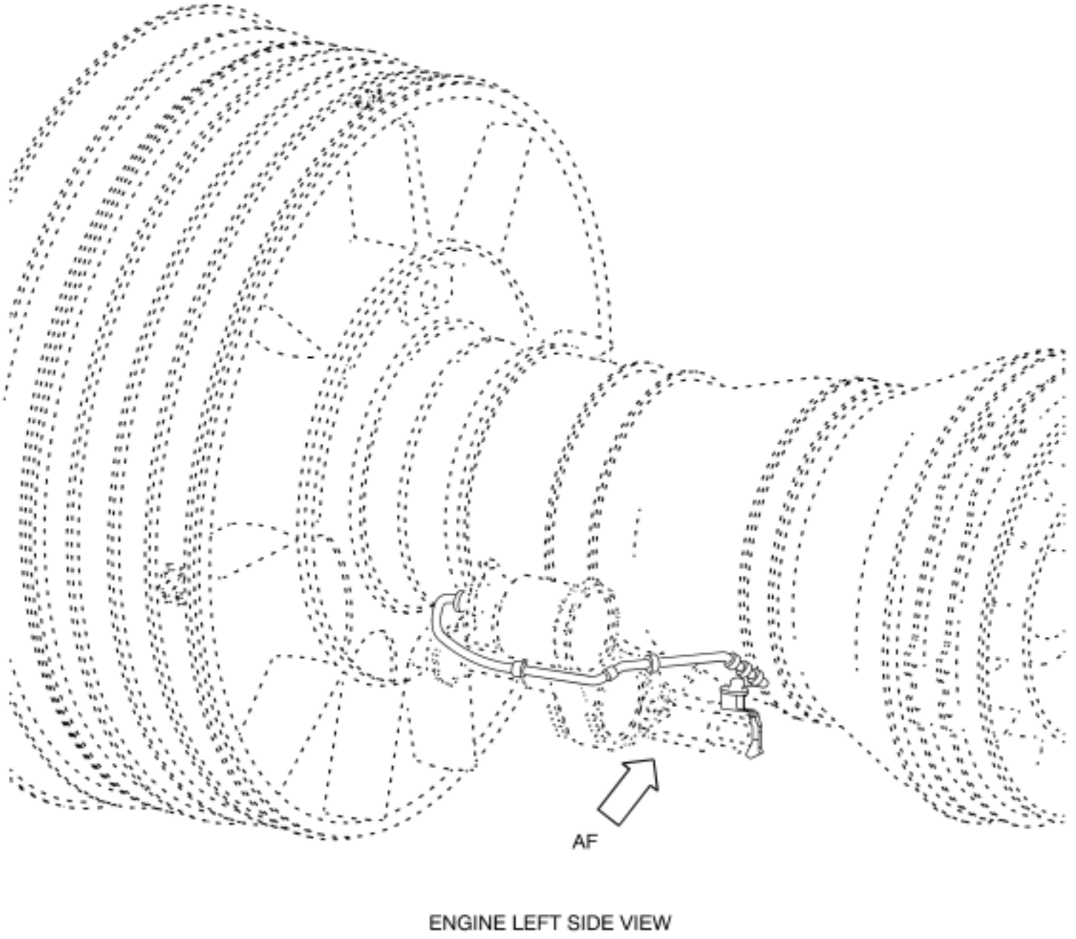

BOLT
NUT
(2 NECESSARY)
CASE OD
CLAMP
BRACKET
LP01
U
VIEW AE
(ROTATED)
L-B2514 (0000)
PW V

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 17)
(Task 72-00-54-020-003)


CLAMP
FRONT HALF
CLAMP
REAR HALF
BOLT
NUT
LP01
BOLT
BRACKET
VIEW U
L-B2515 (0000)
PW V

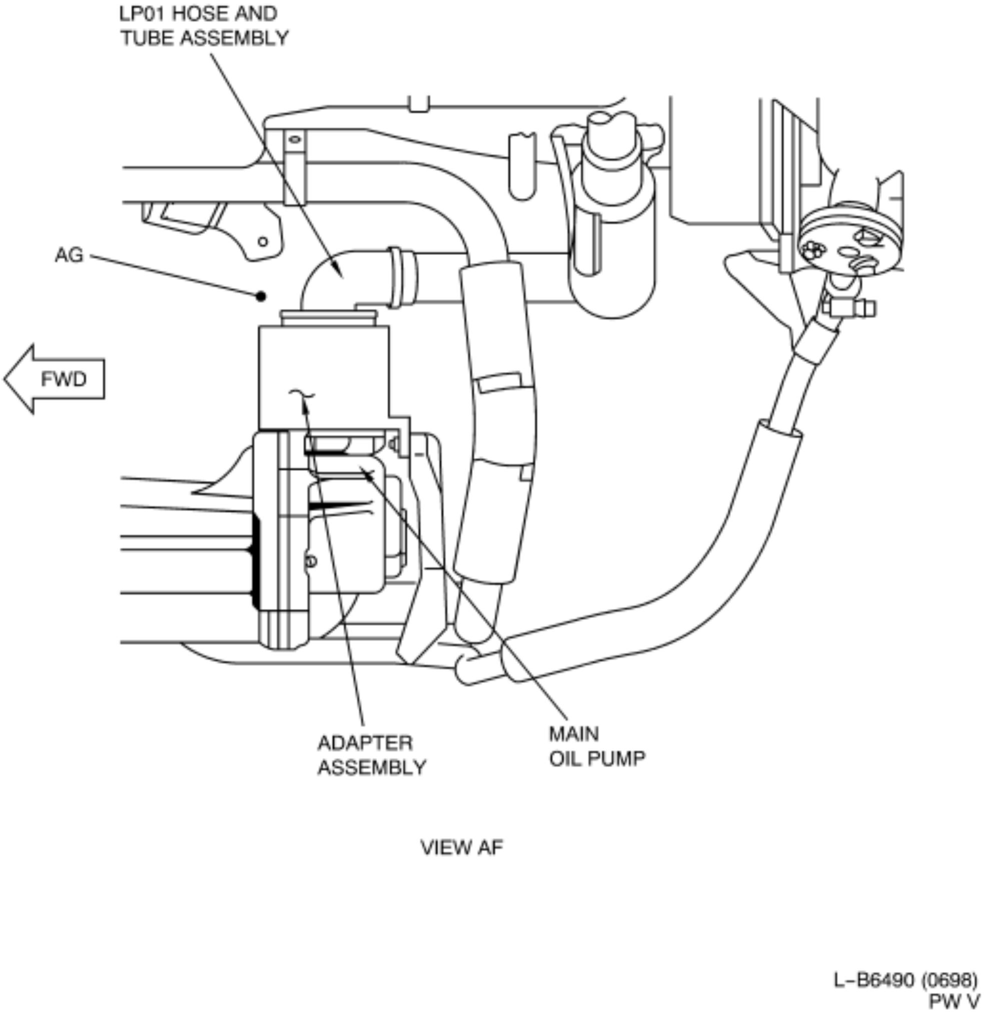
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 18)
(Task 72-00-54-020-003)

ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−02

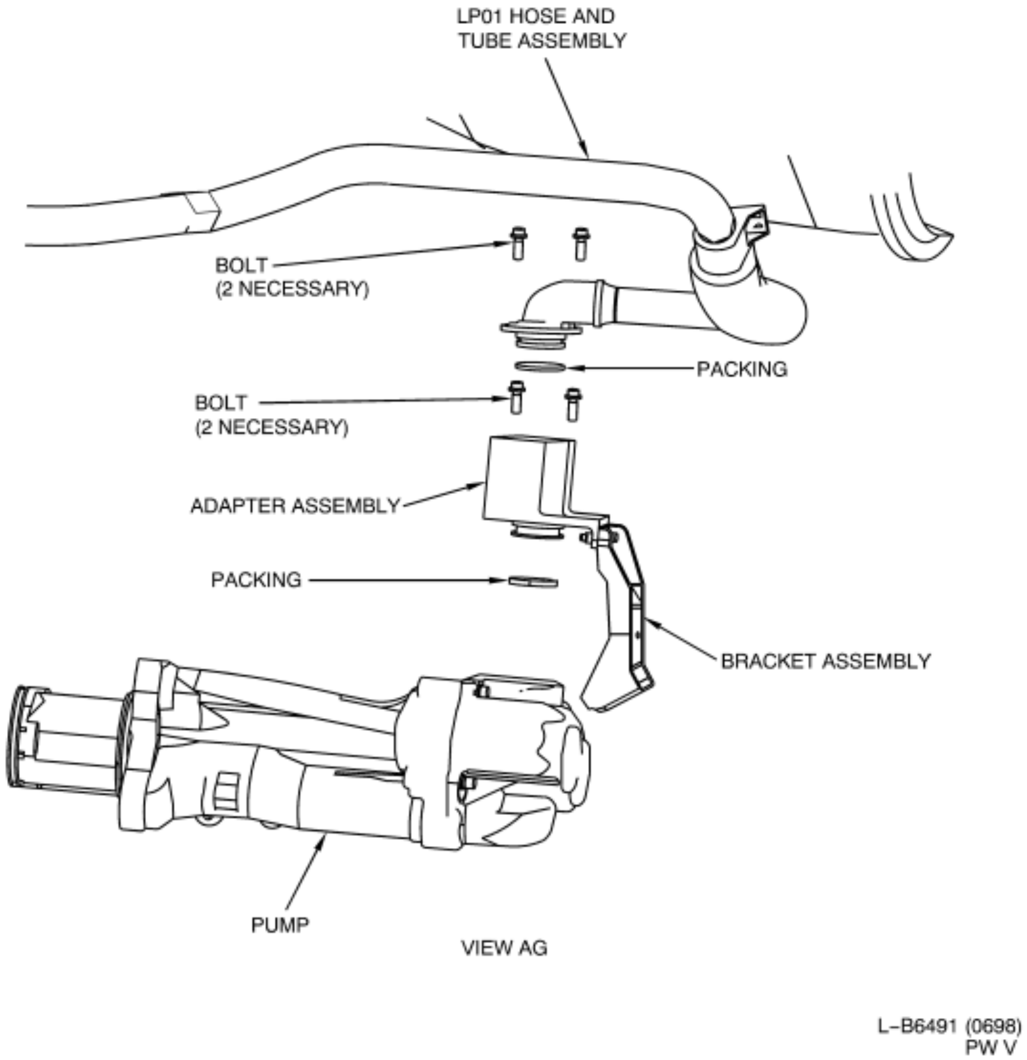

AF
ENGINE LEFT SIDE VIEW

L−B6489 (0698)
PW V

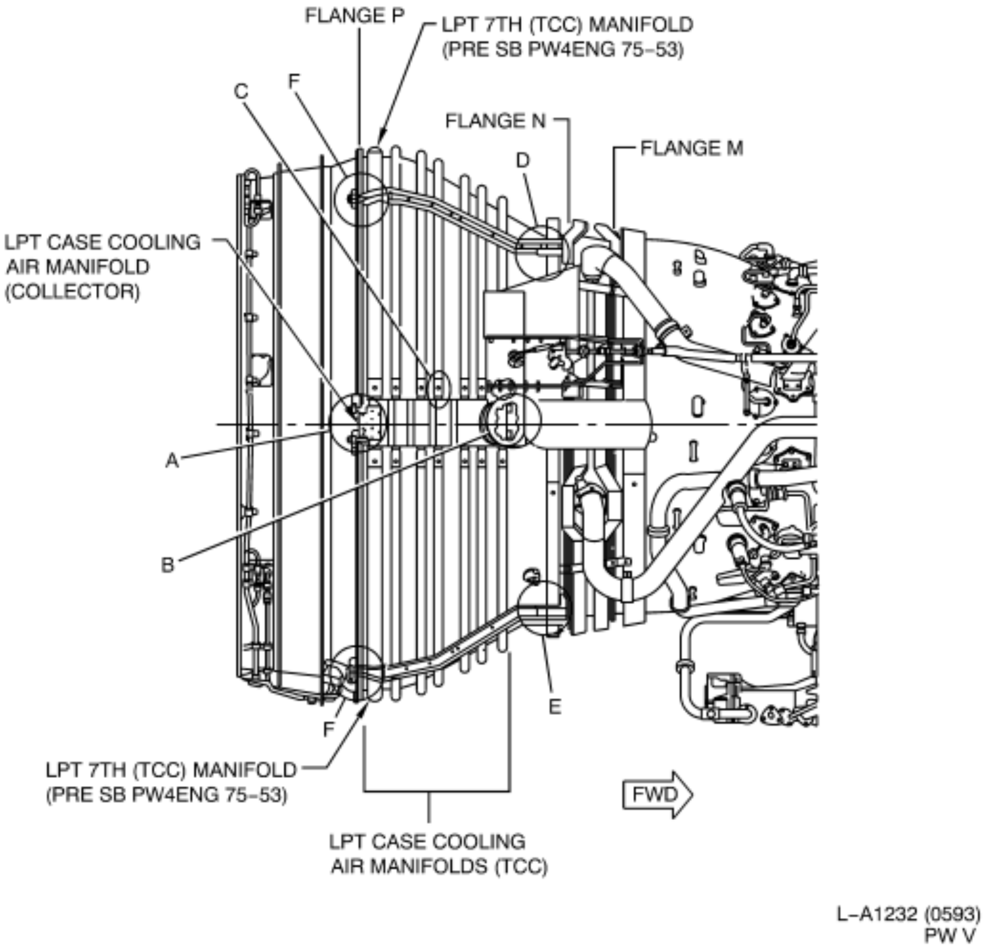
Bottom External Plumbing (Post SB PW4ENG 79−86)
Figure 302 (Sheet 19)
(Task 72−00−54−020−003)


LP01 HOSE AND
TUBE ASSEMBLY
AG
FWD
ADAPTER
ASSEMBLY
MAIN
OIL PUMP
VIEW AF
L-B6490 (0698)
PW V

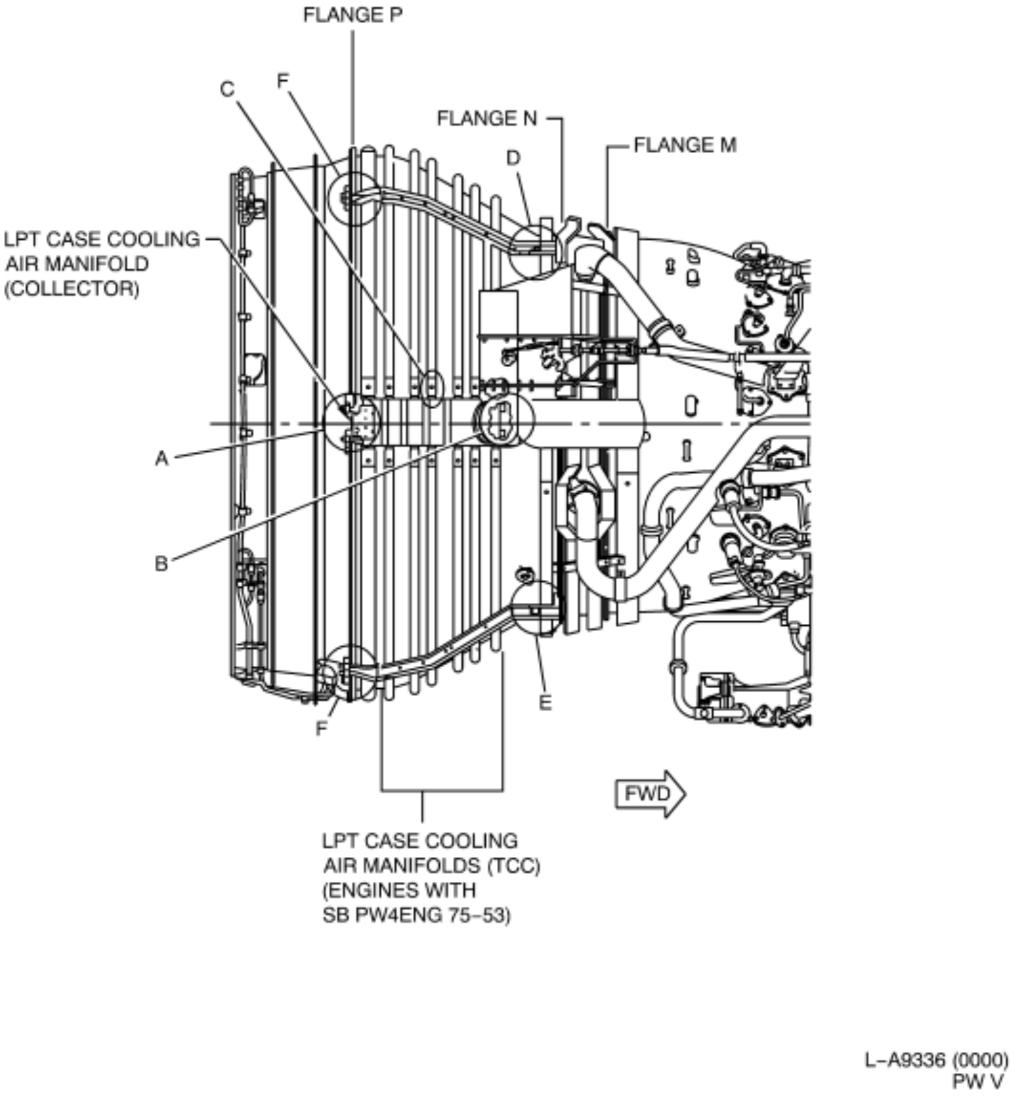
Bottom External Plumbing (Post SB PW4ENG 79-86)
Figure 302 (Sheet 20)
(Task 72-00-54-020-003)


LP01 HOSE AND
TUBE ASSEMBLY
BOLT
(2 NECESSARY)
PACKING
BOLT
(2 NECESSARY)
ADAPTER ASSEMBLY
PACKING
BRACKET ASSEMBLY
PUMP
VIEW AG
L-B6491 (0698)
PW V

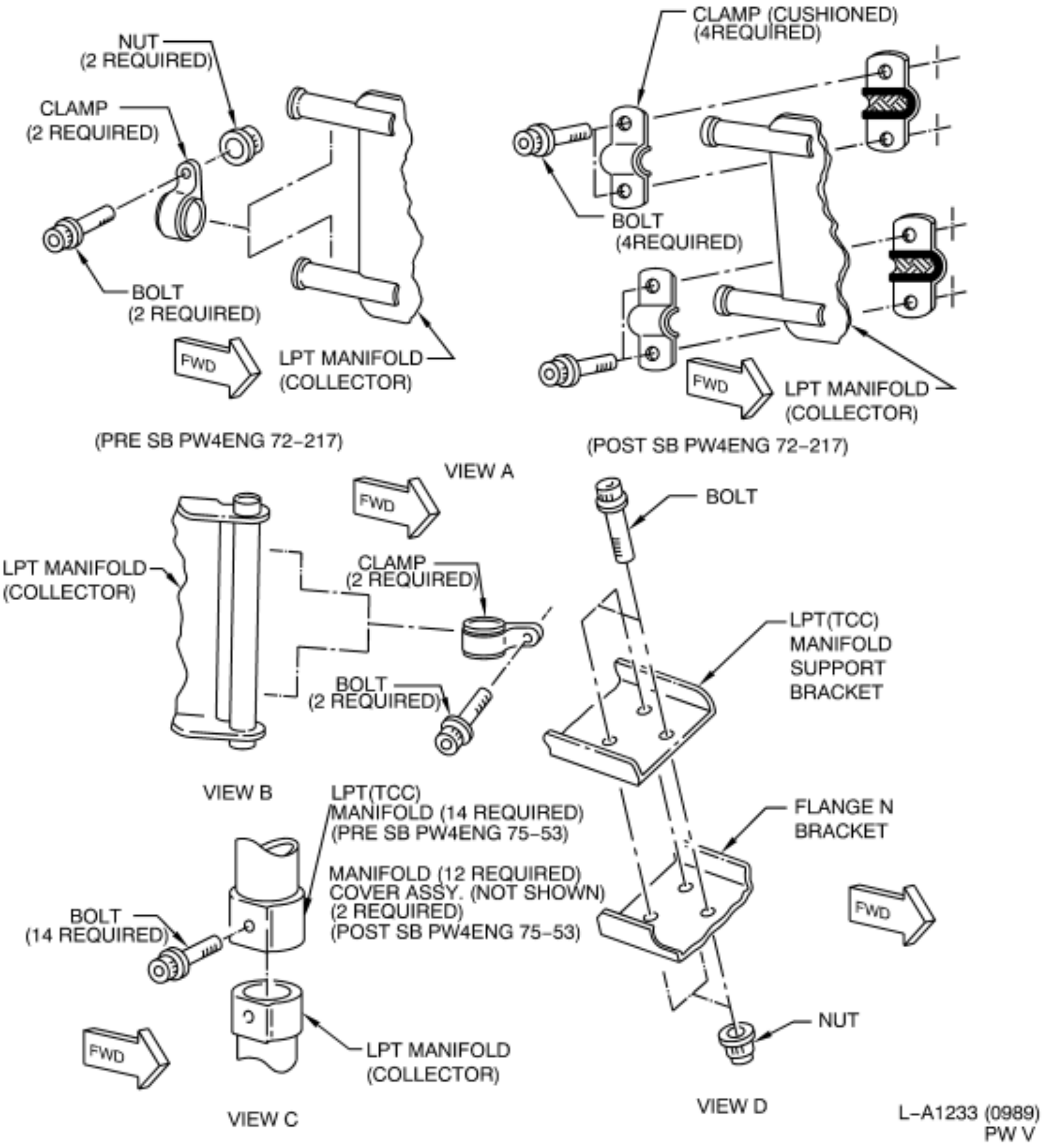
Bottom External Plumbing (Post SB PW4ENG 79-86)
Figure 302 (Sheet 21)
(Task 72-00-54-020-003)


FLANGE P
LPT 7TH (TCC) MANIFOLD
(PRE SB PW4ENG 75-53)
C
F
FLANGE N
D
FLANGE M
LPT CASE COOLING
AIR MANIFOLD
(COLLECTOR)
A
B
E
F
LPT 7TH (TCC) MANIFOLD
(PRE SB PW4ENG 75-53)
FWD
LPT CASE COOLING
AIR MANIFOLDS (TCC)
L-A1232 (0593)
PW V

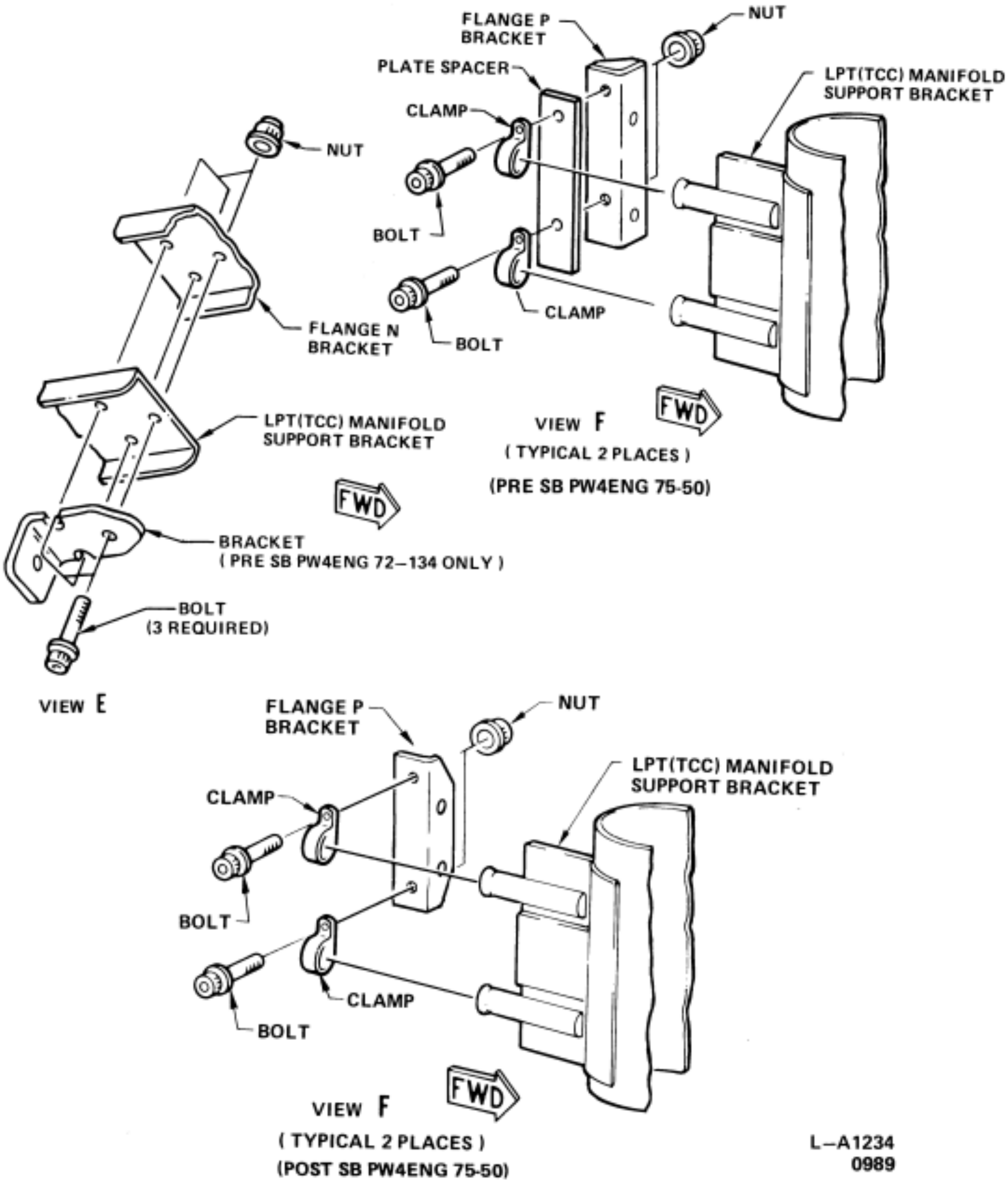
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 303 (Sheet 1)
(Task 72-00-54-020-003)


FLANGE P
C
F
FLANGE N
D
FLANGE M
LPT CASE COOLING AIR MANIFOLD (COLLECTOR)
A
B
F
E
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC) (ENGINES WITH SB PW4ENG 75−53)
L−A9336 (0000)
PW V

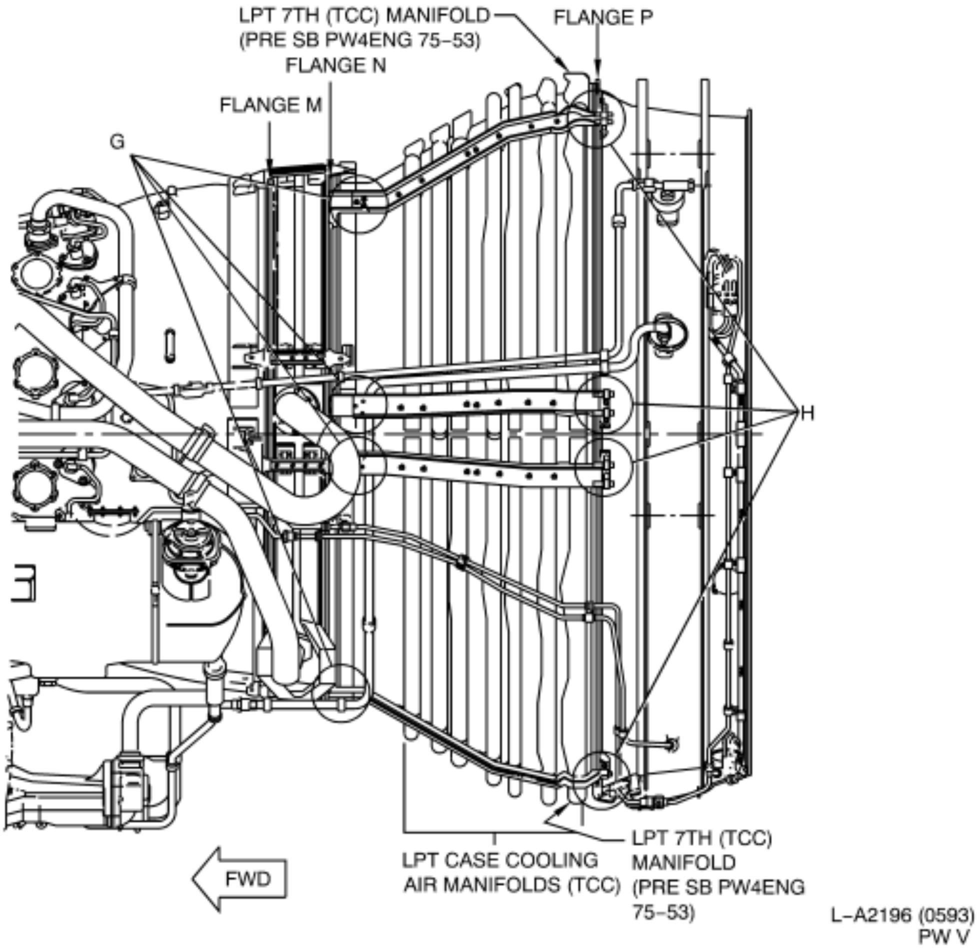
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 303 (Sheet 2)
(Task 72−00−54−020−003)


NUT
(2 REQUIRED)
CLAMP
(2 REQUIRED)
BOLT
(2 REQUIRED)
FWD
LPT MANIFOLD
(COLLECTOR)
(PRE SB PW4ENG 72-217)
CLAMP (CUSHIONED)
(4REQUIRED)
BOLT
(4REQUIRED)
FWD
LPT MANIFOLD
(COLLECTOR)
(POST SB PW4ENG 72-217)
VIEW A
FWD
LPT MANIFOLD
(COLLECTOR)
CLAMP
(2 REQUIRED)
BOLT
(2 REQUIRED)
VIEW B
BOLT
LPT(TCC)
MANIFOLD
SUPPORT
BRACKET
FLANGE N
BRACKET
FWD
NUT
VIEW D
LPT(TCC)
MANIFOLD (14 REQUIRED)
(PRE SB PW4ENG 75-53)
MANIFOLD (12 REQUIRED)
COVER ASSY. (NOT SHOWN)
(2 REQUIRED)
(POST SB PW4ENG 75-53)
BOLT
(14 REQUIRED)
FWD
LPT MANIFOLD
(COLLECTOR)
VIEW C
L-A1233 (0989)
PW V

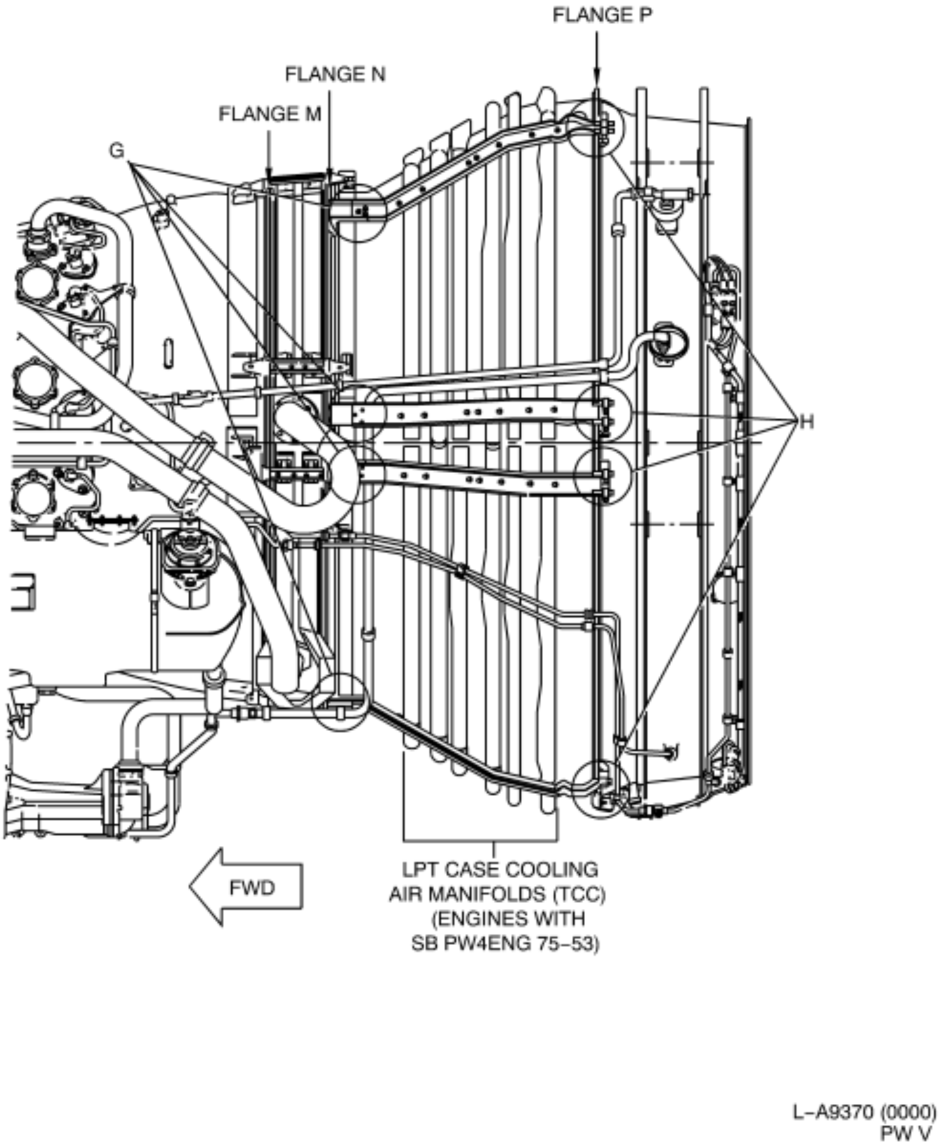
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 303 (Sheet 3)
(Task 72-00-54-020-003)


FLANGE P BRACKET
NUT
PLATE SPACER
LPT(TCC) MANIFOLD SUPPORT BRACKET
CLAMP
NUT
BOLT
FLANGE N BRACKET
CLAMP
BOLT
LPT(TCC) MANIFOLD SUPPORT BRACKET
VIEW F
FWD
(TYPICAL 2 PLACES)
(PRE SB PW4ENG 75-50)
FWD
BRACKET
(PRE SB PW4ENG 72−134 ONLY)
BOLT
(3 REQUIRED)
VIEW E
FLANGE P BRACKET
NUT
LPT(TCC) MANIFOLD SUPPORT BRACKET
CLAMP
BOLT
CLAMP
BOLT
VIEW F
FWD
(TYPICAL 2 PLACES)
(POST SB PW4ENG 75-50)
L−A1234
0989

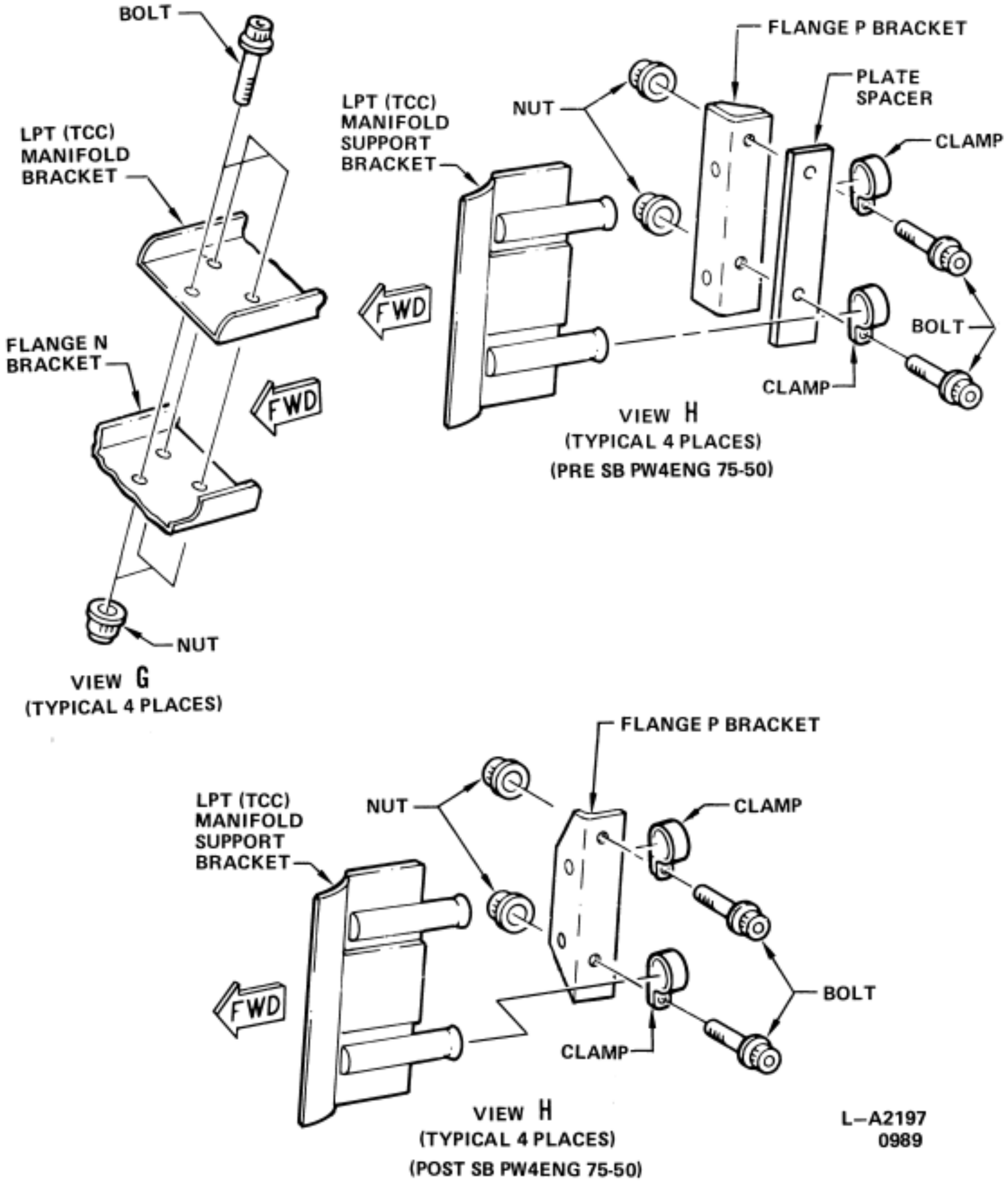
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 303 (Sheet 4)
(Task 72−00−54−020−003)


LPT 7TH (TCC) MANIFOLD
(PRE SB PW4ENG 75−53)
FLANGE P
FLANGE N
FLANGE M
G
H
FWD
LPT CASE COOLING
AIR MANIFOLDS (TCC)
LPT 7TH (TCC)
MANIFOLD
(PRE SB PW4ENG
75−53)
L−A2196 (0593)
PW V

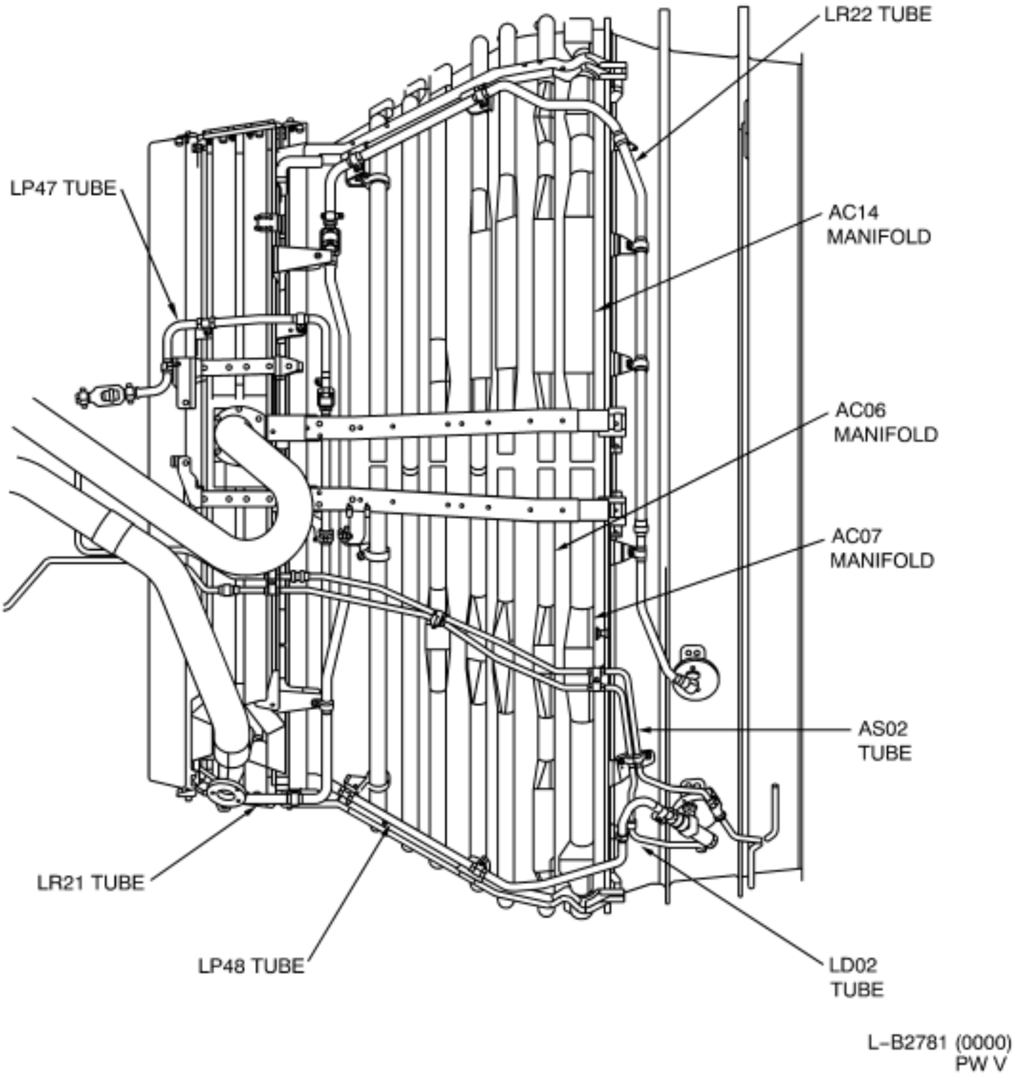
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 303 (Sheet 5)
(Task 72−00−54−020−003)


FLANGE P
FLANGE N
FLANGE M
G
H
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC) (ENGINES WITH SB PW4ENG 75-53)
L-A9370 (0000)
PW V

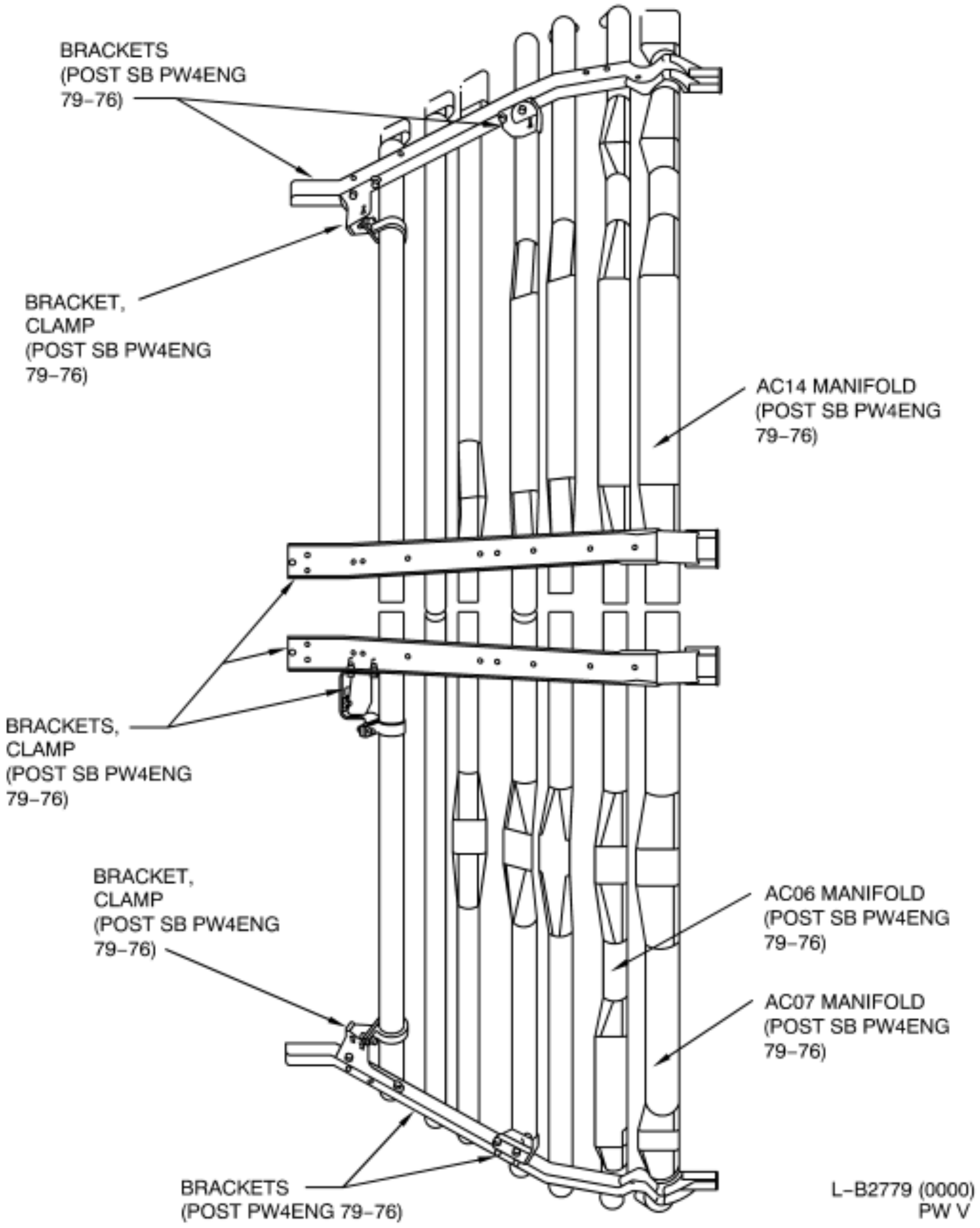
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 303 (Sheet 6)
(Task 72-00-54-020-003)


BOLT
LPT (TCC) MANIFOLD BRACKET
FLANGE N BRACKET
NUT
FWD
FWD
VIEW G
(TYPICAL 4 PLACES)
LPT (TCC) MANIFOLD SUPPORT BRACKET
NUT
FLANGE P BRACKET
PLATE SPACER
CLAMP
BOLT
CLAMP
FWD
VIEW H
(TYPICAL 4 PLACES)
(PRE SB PW4ENG 75-50)
FLANGE P BRACKET
LPT (TCC) MANIFOLD SUPPORT BRACKET
NUT
CLAMP
BOLT
CLAMP
FWD
VIEW H
(TYPICAL 4 PLACES)
(POST SB PW4ENG 75-50)
L-A2197
0989

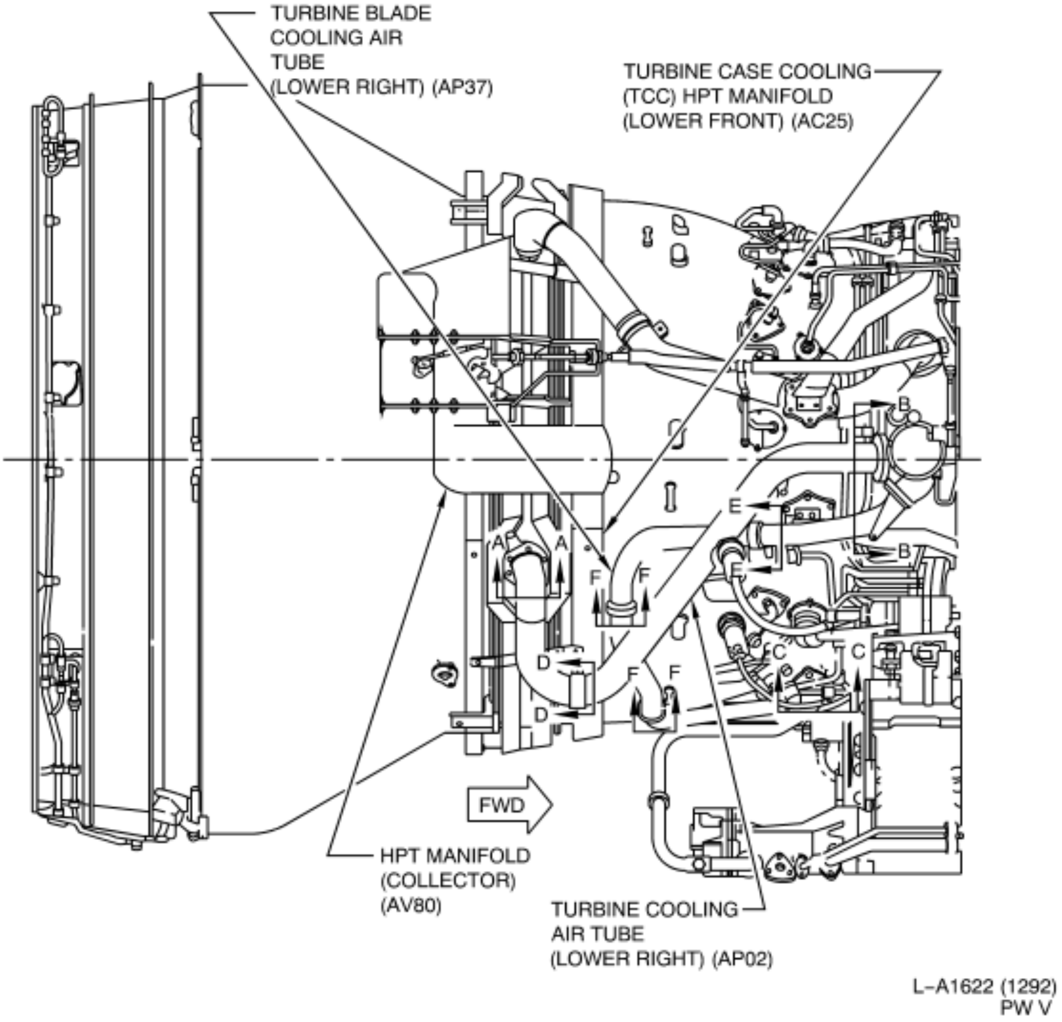
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 303 (Sheet 7)
(Task 72-00-54-020-003)


LR22 TUBE
LP47 TUBE
AC14 MANIFOLD
AC06 MANIFOLD
AC07 MANIFOLD
AS02 TUBE
LR21 TUBE
LP48 TUBE
LD02 TUBE
L-B2781 (0000)
PW V

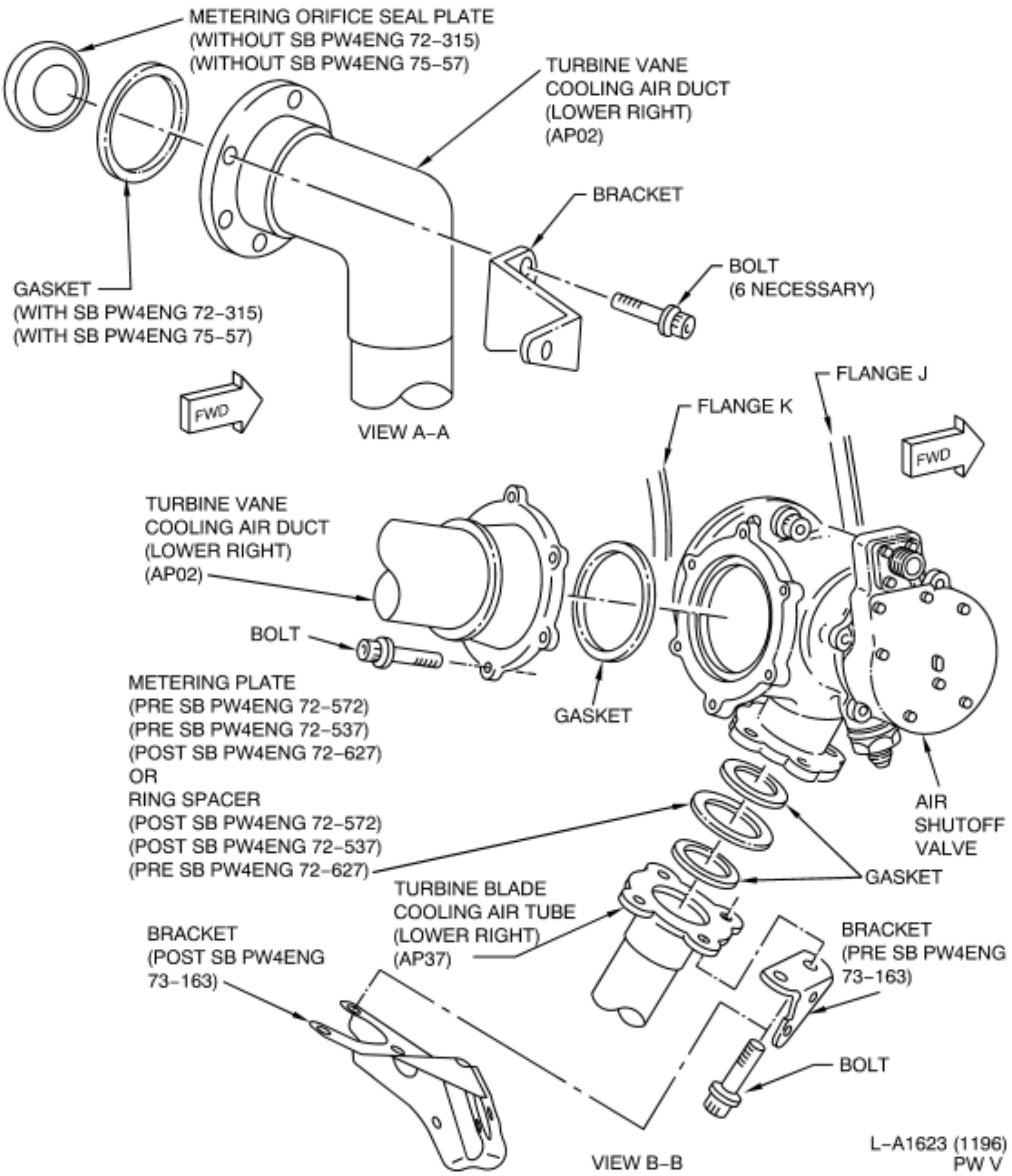
LPT Turbine Case Cooling Manifolds Clipping (Post SB PW4ENG 79-76)
Figure 303 (Sheet 8)
(Task 72-00-54-020-003)


BRACKETS
(POST SB PW4ENG
79-76)
BRACKET,
CLAMP
(POST SB PW4ENG
79-76)
AC14 MANIFOLD
(POST SB PW4ENG
79-76)
BRACKETS,
CLAMP
(POST SB PW4ENG
79-76)
BRACKET,
CLAMP
(POST SB PW4ENG
79-76)
AC06 MANIFOLD
(POST SB PW4ENG
79-76)
AC07 MANIFOLD
(POST SB PW4ENG
79-76)
BRACKETS
(POST PW4ENG 79-76)
L-B2779 (0000)
PW V

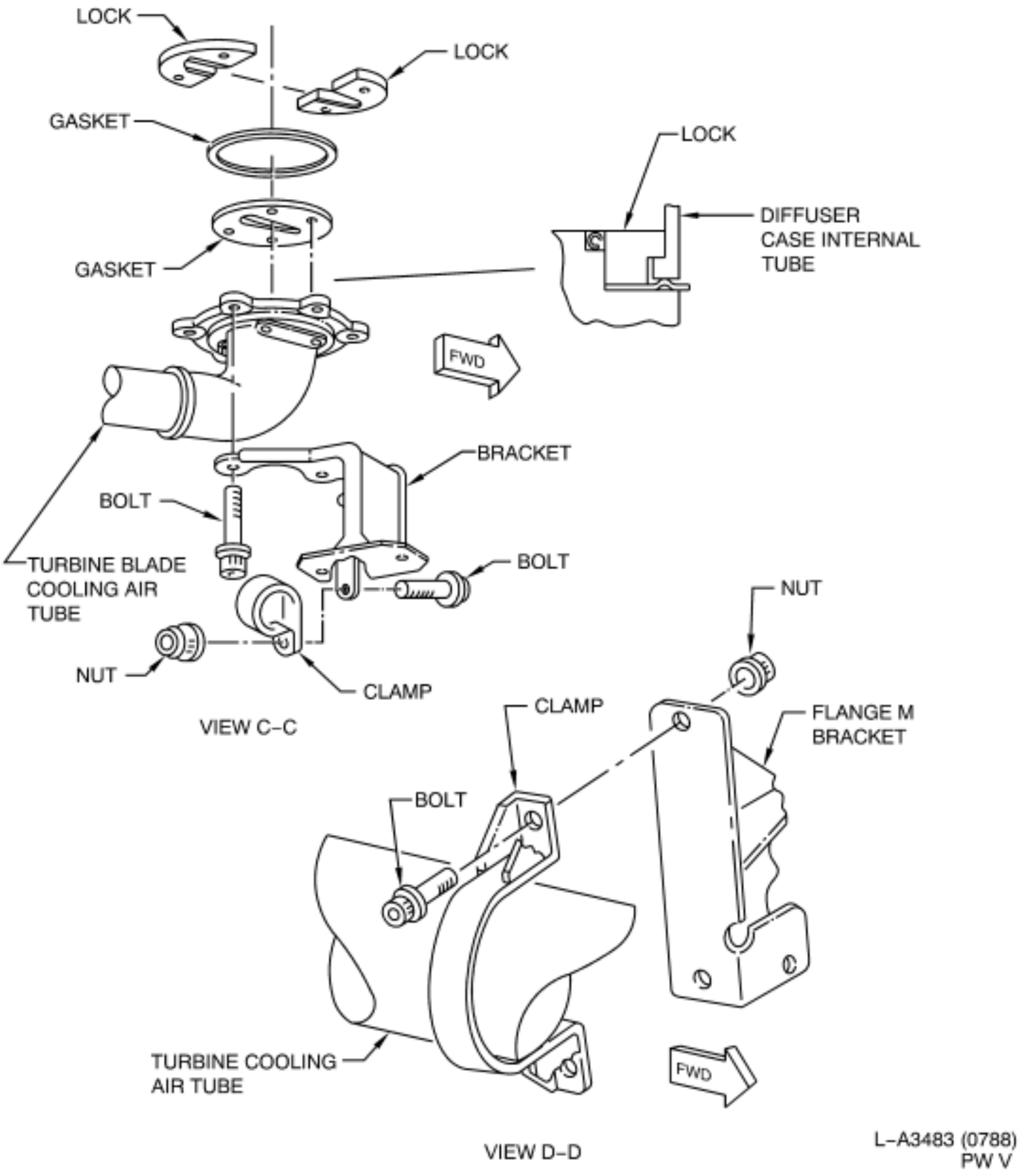
LPT Turbine Case Cooling Manifolds Clipping (Post SB PW4ENG 79-76)
Figure 303 (Sheet 9)
(Task 72-00-54-020-003)


TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT) (AP37)
TURBINE CASE COOLING (TCC) HPT MANIFOLD (LOWER FRONT) (AC25)
A
A
B
B
C
C
D
D
E
E
F
F
F
F
FWD
HPT MANIFOLD (COLLECTOR) (AV80)
TURBINE COOLING AIR TUBE (LOWER RIGHT) (AP02)
L-A1622 (1292)
PW V

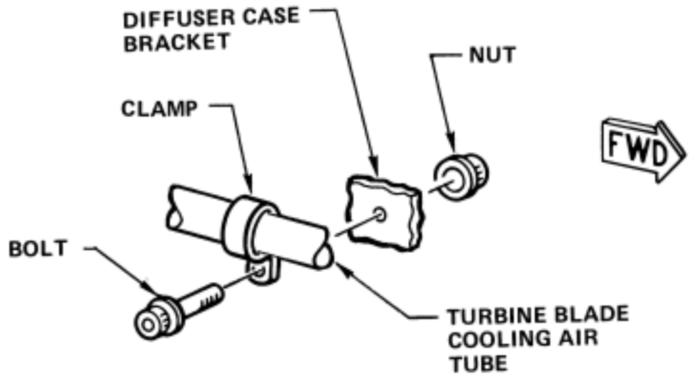
High Pressure Turbine Cooling Air Manifolds
Figure 304 (Sheet 1)
(Task 72-00-54-020-003)


METERING ORIFICE SEAL PLATE
(WITHOUT SB PW4ENG 72-315)
(WITHOUT SB PW4ENG 75-57)
TURBINE VANE COOLING AIR DUCT (LOWER RIGHT) (AP02)
BRACKET
BOLT (6 NECESSARY)
GASKET (WITH SB PW4ENG 72-315) (WITH SB PW4ENG 75-57)
FWD
VIEW A-A
FLANGE J
FLANGE K
FWD
TURBINE VANE COOLING AIR DUCT (LOWER RIGHT) (AP02)
BOLT
METERING PLATE
(PRE SB PW4ENG 72-572)
(PRE SB PW4ENG 72-537)
(POST SB PW4ENG 72-627)
OR
RING SPACER
(POST SB PW4ENG 72-572)
(POST SB PW4ENG 72-537)
(PRE SB PW4ENG 72-627)
GASKET
AIR SHUTOFF VALVE
GASKET
TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT) (AP37)
BRACKET (POST SB PW4ENG 73-163)
BRACKET (PRE SB PW4ENG 73-163)
BOLT
VIEW B-B
L-A1623 (1196)
PW V

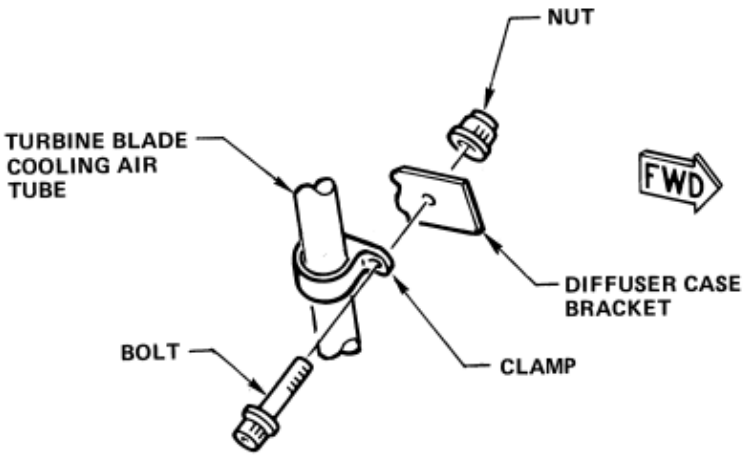
High Pressure Turbine Cooling Air Manifolds
Figure 304 (Sheet 2)
(Task 72-00-54-020-003)


LOCK
LOCK
GASKET
LOCK
DIFFUSER CASE INTERNAL TUBE
GASKET
FWD
BRACKET
BOLT
TURBINE BLADE COOLING AIR TUBE
BOLT
NUT
NUT
CLAMP
VIEW C−C
CLAMP
FLANGE M BRACKET
BOLT
TURBINE COOLING AIR TUBE
FWD
VIEW D−D
L−A3483 (0788)
PW V

High Pressure Turbine Cooling Air Manifolds
Figure 304 (Sheet 3)
(Task 72−00−54−020−003)


DIFFUSER CASE BRACKET
NUT
CLAMP
FWD
BOLT
TURBINE BLADE COOLING AIR TUBE

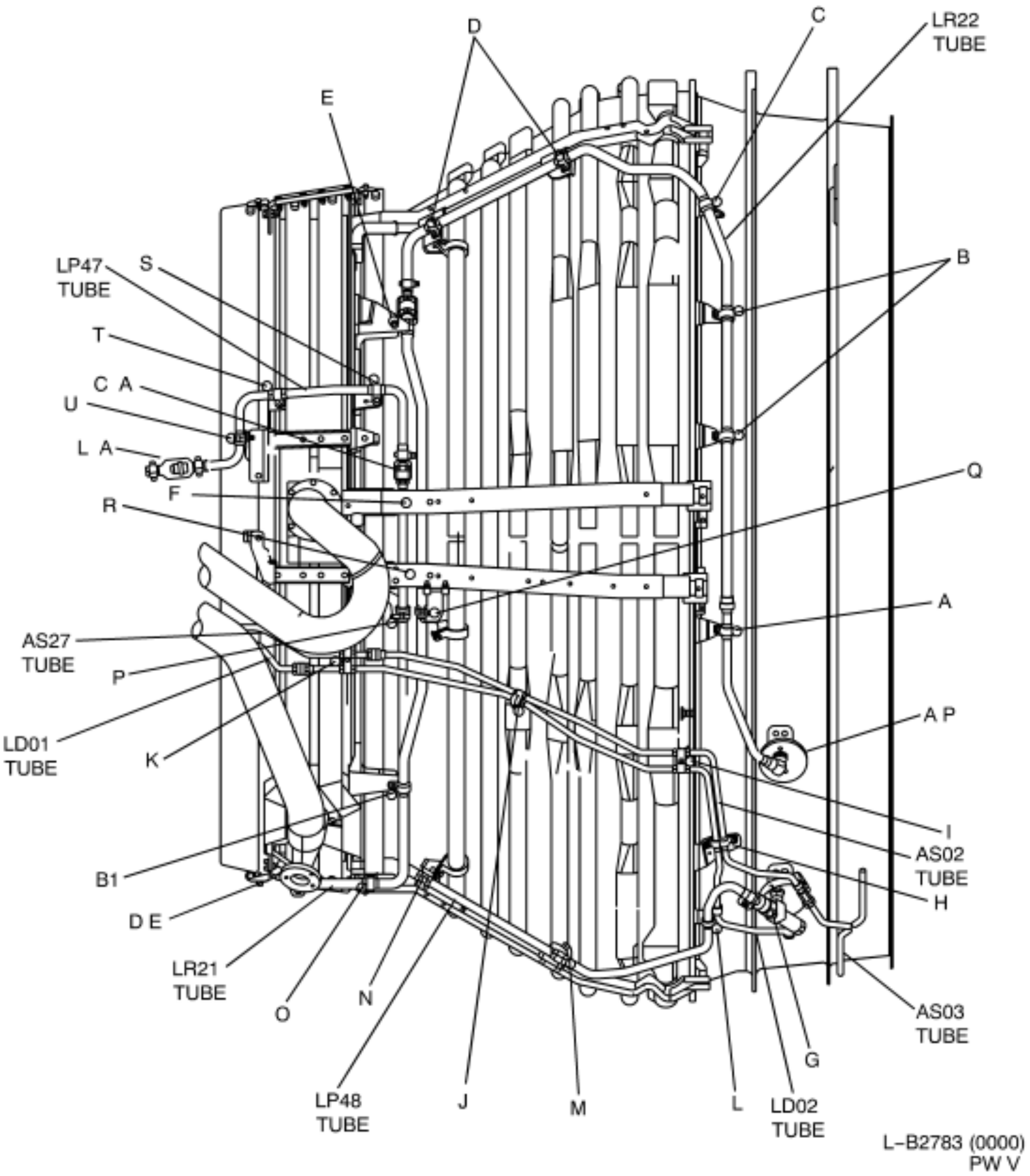
VIEW E-E


NUT
TURBINE BLADE COOLING AIR TUBE
FWD
DIFFUSER CASE BRACKET
BOLT
CLAMP

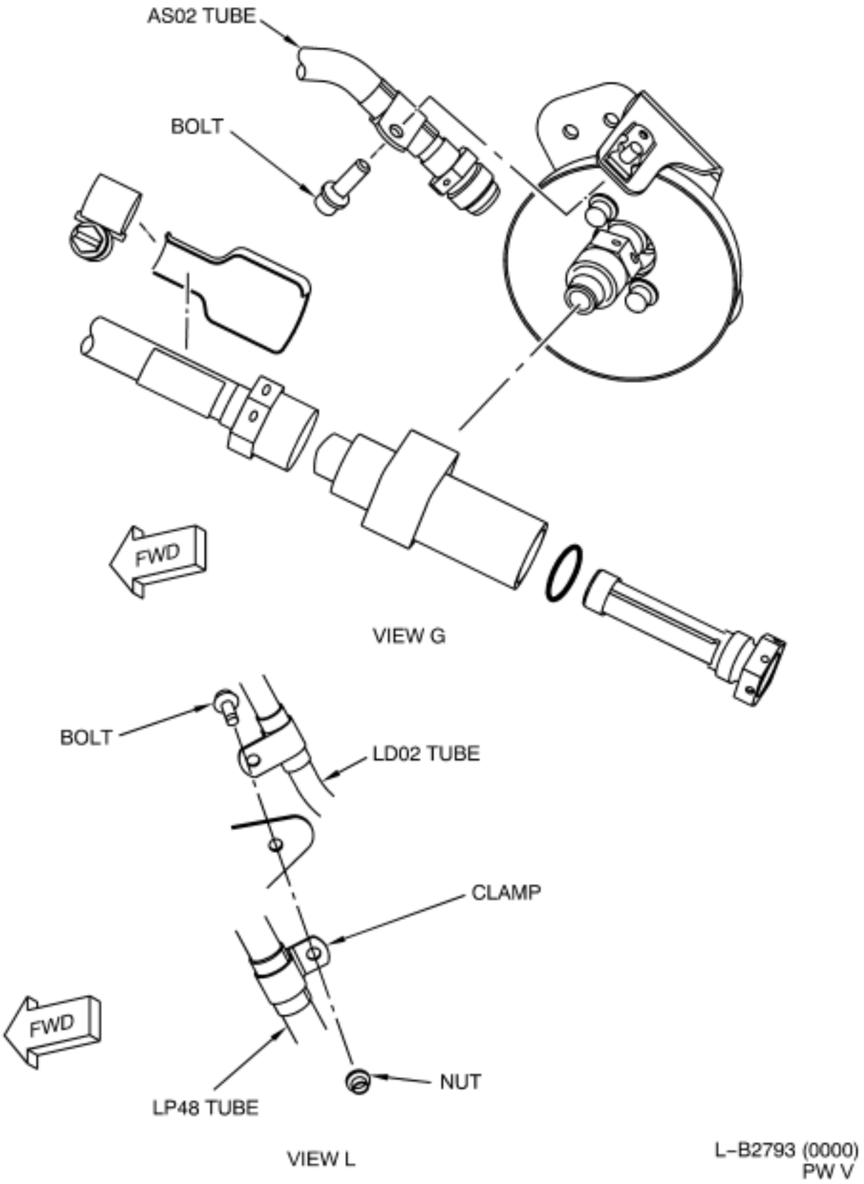
VIEW F-F
(2 LOCATIONS)

L-A1635

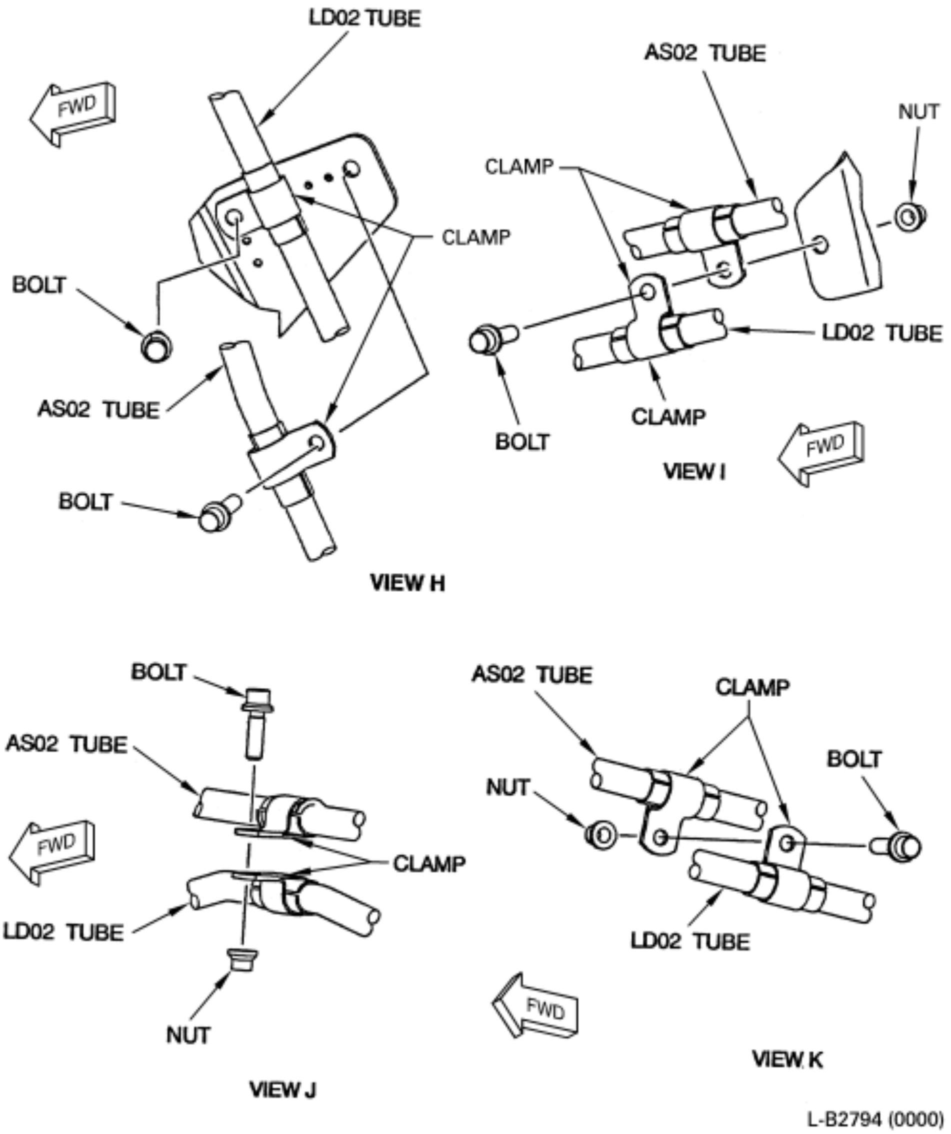
High Pressure Turbine Cooling Air Manifolds
Figure 304 (Sheet 4)
(Task 72-00-54-020-003)


D
C
LR22
TUBE
E
B
LP47
TUBE
S
T
C A
U
L A
F
R
Q
A
AS27
TUBE
P
LD01
TUBE
K
A P
I
AS02
TUBE
H
B1
D E
LR21
TUBE
O
N
AS03
TUBE
G
LP48
TUBE
J
M
L
LD02
TUBE
L-B2783 (0000)
PW V

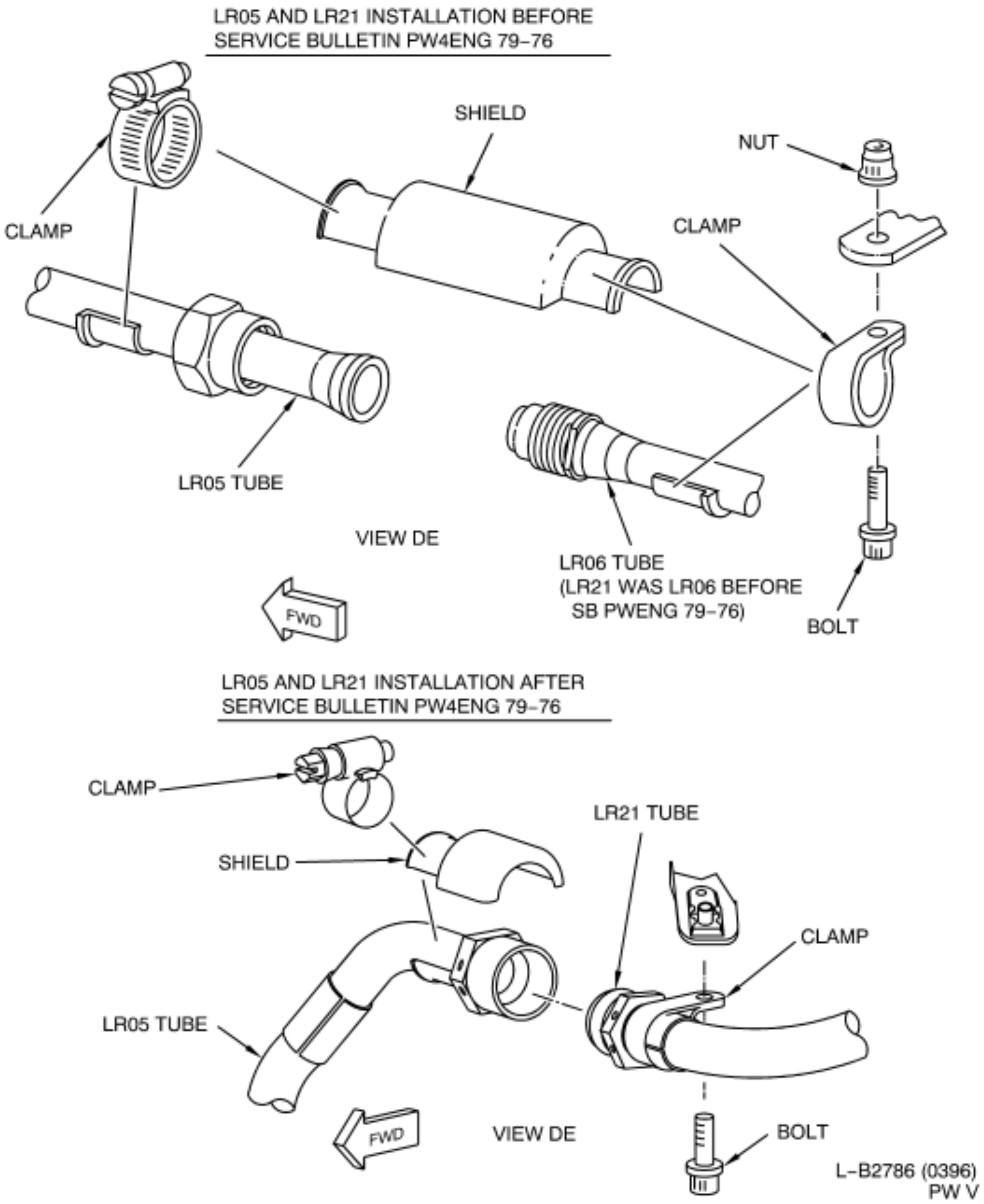
External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 305 (Sheet 1)
(Task 72-00-54-020-003)


AS02 TUBE
BOLT
FWD
VIEW G
BOLT
LD02 TUBE
CLAMP
FWD
NUT
LP48 TUBE
VIEW L
L-B2793 (0000)
PW V

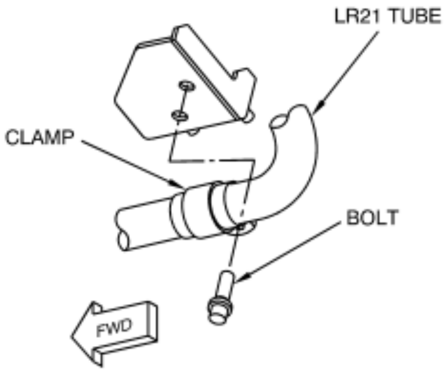
External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 305 (Sheet 2)
(Task 72-00-54-020-003)


LD02 TUBE
FWD
AS02 TUBE
NUT
CLAMP
CLAMP
BOLT
LD02 TUBE
AS02 TUBE
BOLT
CLAMP
BOLT
FWD
VIEW I
BOLT
VIEW H
BOLT
AS02 TUBE
CLAMP
AS02 TUBE
BOLT
NUT
FWD
CLAMP
LD02 TUBE
LD02 TUBE
NUT
FWD
VIEW K
VIEW J
L-B2794 (0000)

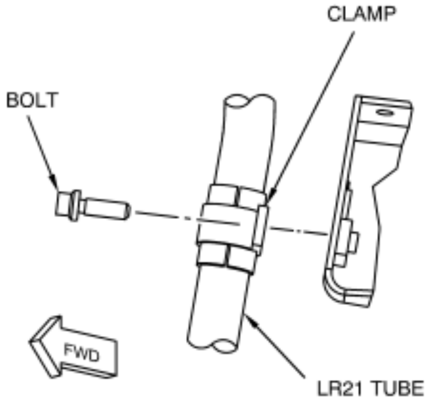
External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 305 (Sheet 3)
(Task 72-00-54-020-003)


LR05 AND LR21 INSTALLATION BEFORE SERVICE BULLETIN PW4ENG 79−76
SHIELD
NUT
CLAMP
CLAMP
LR05 TUBE
VIEW DE
FWD
LR06 TUBE (LR21 WAS LR06 BEFORE SB PWENG 79−76)
BOLT
LR05 AND LR21 INSTALLATION AFTER SERVICE BULLETIN PW4ENG 79−76
CLAMP
SHIELD
LR21 TUBE
CLAMP
LR05 TUBE
FWD
VIEW DE
BOLT
L−B2786 (0396)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 305 (Sheet 4)
(Task 72−00−54−020−003)


LR21 TUBE
CLAMP
BOLT
FWD

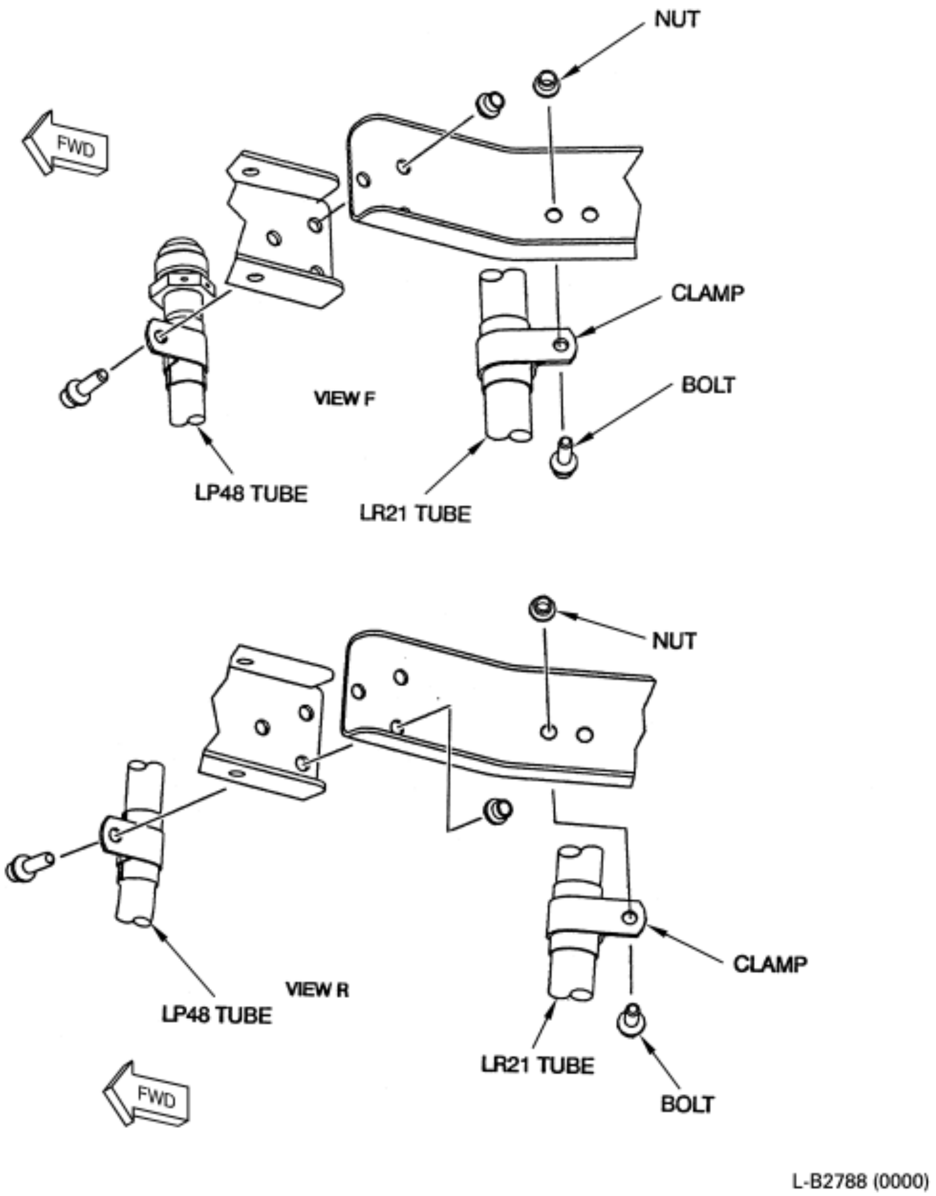
VIEW O


CLAMP
BOLT
FWD
LR21 TUBE

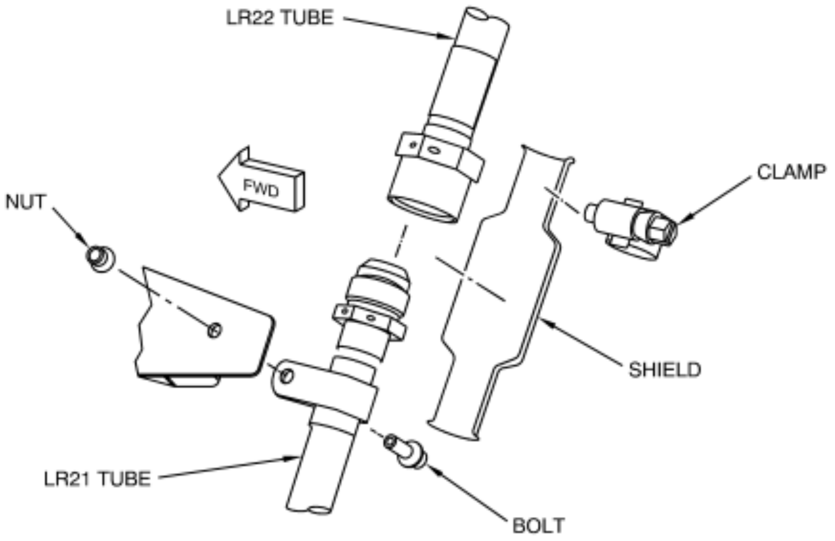
VIEW Q

L−B2787 (0000)
PW V

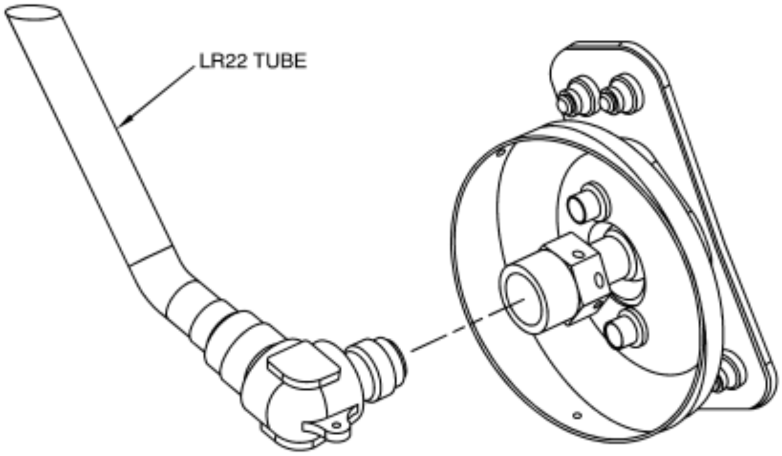
External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 305 (Sheet 5)
(Task 72−00−54−020−003)


NUT
FWD
CLAMP
BOLT
VIEW F
LP48 TUBE
LR21 TUBE
NUT
CLAMP
VIEW R
LP48 TUBE
LR21 TUBE
BOLT
FWD
L-B2788 (0000)

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 305 (Sheet 6)
(Task 72-00-54-020-003)


LR22 TUBE
CLAMP
FWD
NUT
SHIELD
LR21 TUBE
BOLT

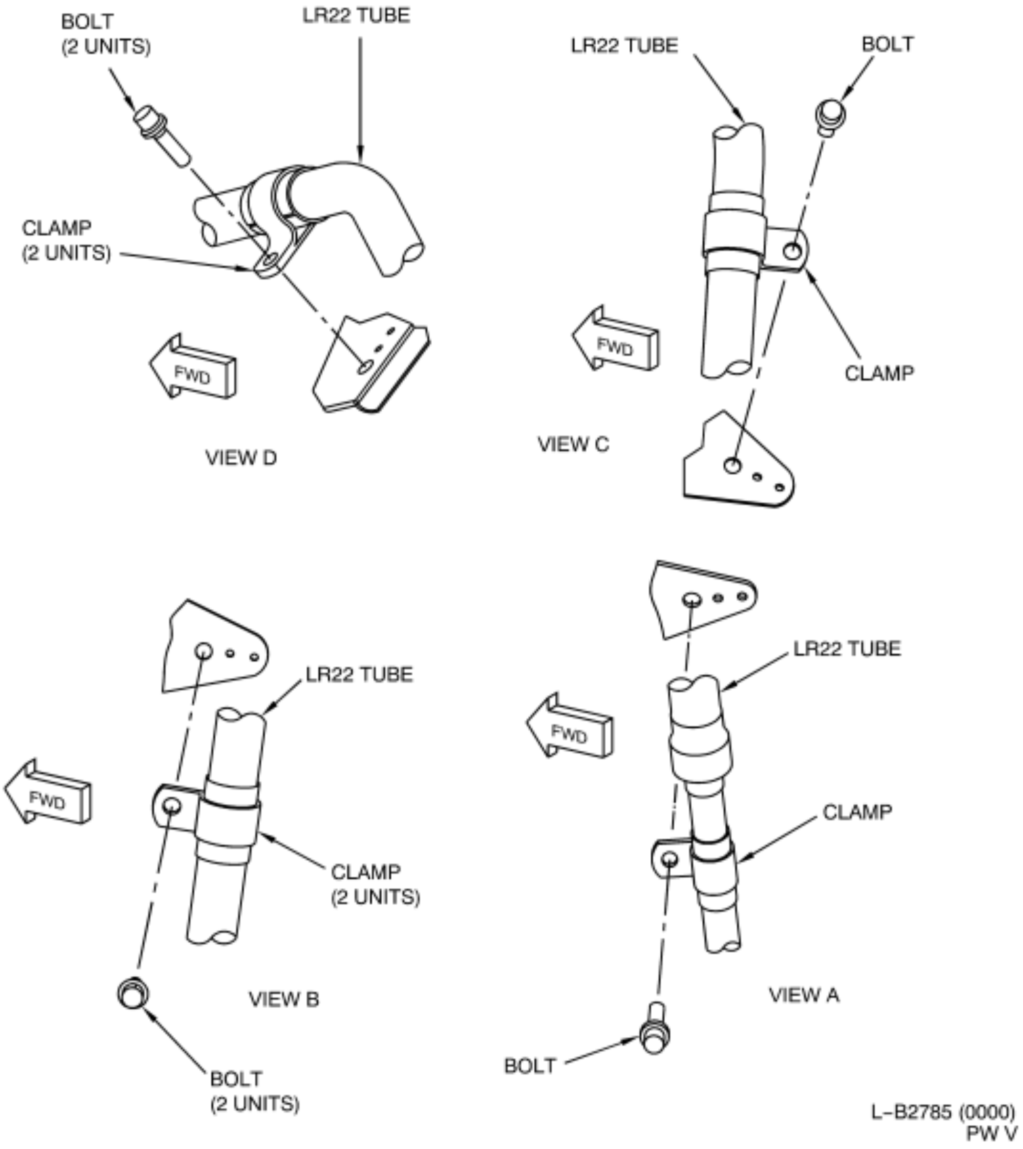
VIEW E



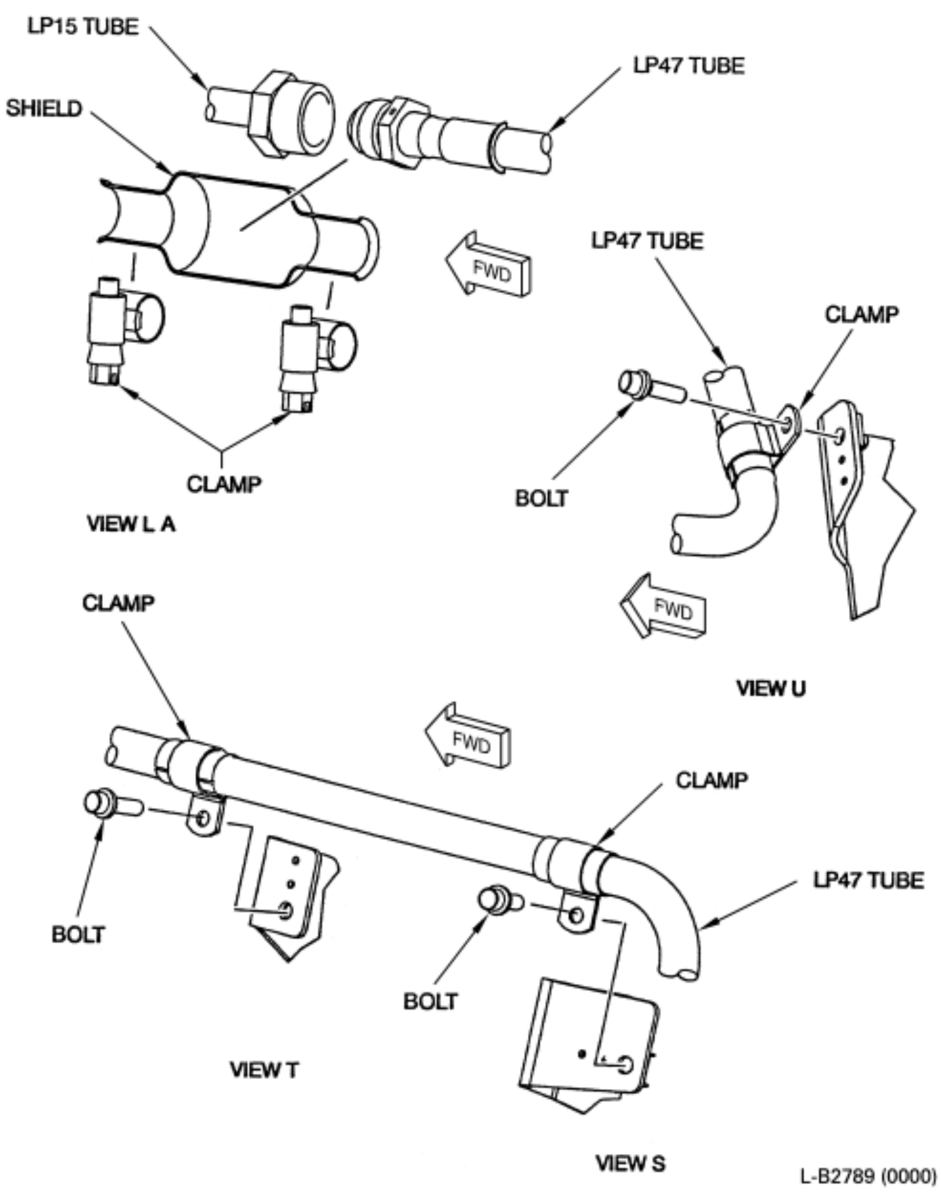
VIEW A P

L-B2784 (0000)
PW V

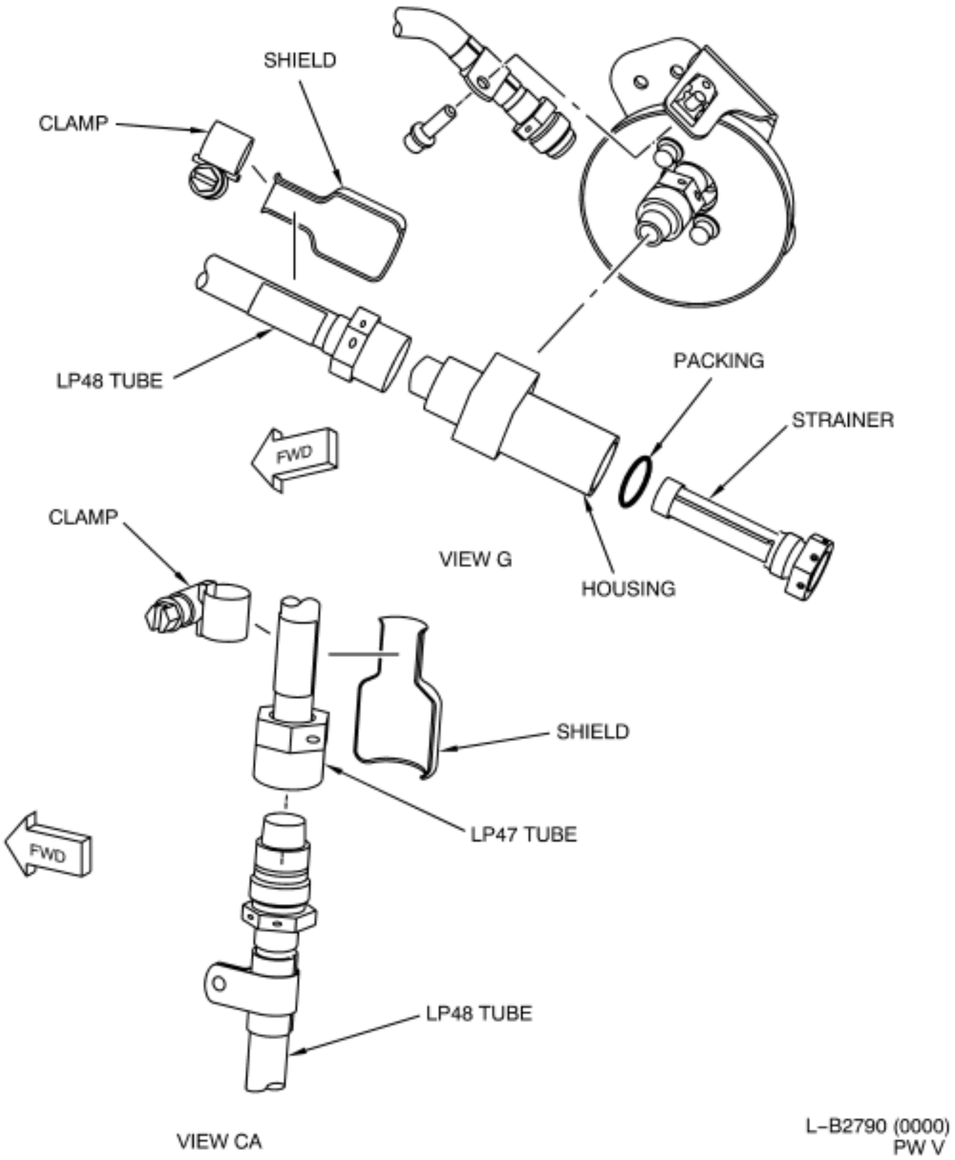
External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 305 (Sheet 7)
(Task 72-00-54-020-003)


BOLT
(2 UNITS)
LR22 TUBE
CLAMP
(2 UNITS)
FWD
VIEW D
LR22 TUBE
BOLT
FWD
CLAMP
VIEW C
LR22 TUBE
FWD
CLAMP
(2 UNITS)
VIEW B
BOLT
(2 UNITS)
LR22 TUBE
FWD
CLAMP
VIEW A
BOLT
L−B2785 (0000)
PW V

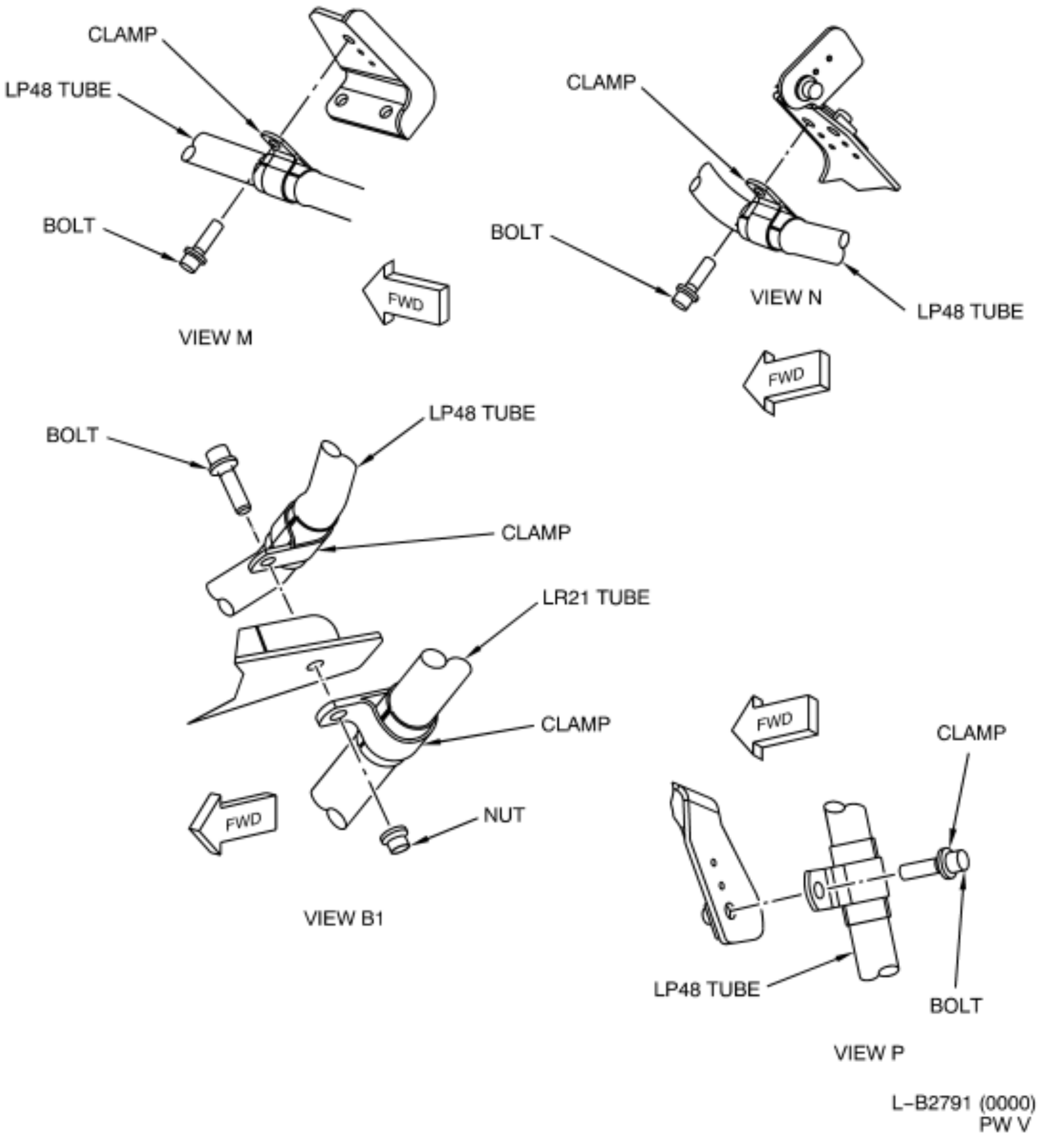
External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 305 (Sheet 8)
(Task 72−00−54−020−003)


LP15 TUBE
SHIELD
LP47 TUBE
FWD
CLAMP
VIEW L A
LP47 TUBE
CLAMP
BOLT
FWD
VIEW U
CLAMP
FWD
CLAMP
LP47 TUBE
BOLT
BOLT
VIEW T
VIEW S
L-B2789 (0000)

External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 305 (Sheet 9)
(Task 72−00−54−020−003)


SHIELD
CLAMP
LP48 TUBE
FWD
PACKING
STRAINER
CLAMP
VIEW G
HOUSING
SHIELD
LP47 TUBE
FWD
LP48 TUBE
VIEW CA
L−B2790 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 305 (Sheet 10)
(Task 72−00−54−020−003)


CLAMP
LP48 TUBE
BOLT
FWD
VIEW M
CLAMP
BOLT
VIEW N
LP48 TUBE
FWD
LP48 TUBE
BOLT
CLAMP
LR21 TUBE
CLAMP
FWD
NUT
VIEW B1
FWD
CLAMP
LP48 TUBE
BOLT
VIEW P
L-B2791 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 305 (Sheet 11)
(Task 72-00-54-020-003)

Task 72−00−54−020−004:

1. Remove External Plumbing Prior To Turbine Exhaust Case Removal

A. Equipment And Materials Required − None

B. Procedure
See Figure 301, Figure 302, Figure 303, Figure 304 and Figure 305.

(1) (Pre SB PW4ENG 79−76) Remove No. 4 bearing oil pressure tube assembly (LP16) as follows. See Figure 301.

(a) Remove the clamps that attach the spray shield to the front tube connection and bracket, forward of Flange M at approximately the 10 o'clock position. Remove the shield from the engine. Remove lockwire and disconnect the tube nut from the coupling.

(b) Remove the hose clamp that attaches the spray shield to the rear tube connection on the exhaust case at approximately the 10:30 o'clock position. Remove the shield from the engine. Remove lockwire and disconnect the tube nut from the strainer housing.

(c) Remove the bolts, spacer, nuts, and clamps that attach the tube to the brackets and adjacent scavenge tube. Remove the tube from the engine.

(d) Remove the lockwire and the No. 4 bearing strainer element from the strainer housing. Discard the packing.

(e) Remove the lockwire and disconnect the strainer housing from the exhaust case internal tube nut at approximately the 10:30 o'clock position.

(f) Install protective closures.

(2) (Post SB PW4ENG 79−76) Remove No. 4 bearing oil pressure tube assemblies (LP47) and (LP48) which replace (LP16) as follows. See Figure 305.

(a) Remove clamps and the tube spray shields at the (LP48) tube to the strainer housing connection, at the (LP47) tube to the (LP48) tube connection and at the (LP47) tube to the (LP15) tube connection. See Views G, CA and LA.

(b) Remove clamps, bolts and nuts as shown in Views M, N, B1, P, R and F.

(c) Remove the (LP48) tube from the strainer housing and the (LP47) tube. See Views G and CA.

(d) Remove the element housing from the tube nut at approximately the 7 o'clock position. See View G.

(e) Remove the No. 4 bearing strainer element from the element housing. See View G.

(f) Remove and discard packing from the groove in the strainer element. See View G.

(g) Remove bolts and clamps. See Views U, T, and S.

(h) Remove the coupling nut that attaches (LP15) tube to the (LP47) tube. See View LA.

(3) (Pre SB PW4ENG 79−76) Remove No. 3 bearing oil vent tube assembly (LD02) as follows.

(a) Remove the lockwire and disconnect the tube coupling from the tube nut forward of Flange N at approximately the 8 o'clock position.

(b) Remove the lockwire and disconnect the tube nut from the adapter on the exhaust case at approximately the 7 o'clock position.

(c) Between Flanges N and P, remove the bolt, nut, and clamp that attaches the tube to the adjacent PT4.95 tube assembly.

(d) Remove the bolt, nut, and clamp at approximately the 7:30 o'clock position on the exhaust case that attaches the tube to the adjacent PT4.95 tube assembly.

(e) Remove the bolts, nuts and clamps that attach the tube to the Flanges N and P brackets. Remove the tube from the engine and install protective closures.

(4) (Pre SB PW4ENG 79-76) Remove the (rear) EEC PT4.95 tube assembly (AS02) as follows.

(a) Remove the lockwire and disconnect the tube nut from the tube coupling at the rear of Flange P at approximately the 7 o'clock position.

(b) Remove the lockwire and disconnect the tube nut from the tube coupling rearward of Flange N at approximately the 8 o'clock position. Remove the tube from the engine and install protective closures.

(5) (Post SB PW4ENG 79-76) Remove the (rear) No. 3 bearing oil vent tube assembly (LD02) and the (rear) EEC PT4.95 pressure tube assembly (AS02) as follows. See Figure 305.

(a) Remove clamps, nut and bolts from the (AS27) tube, the (LD02) tube, the (AS02) tube and the (LP48) tube. See Views H, I, J, K and L,

(b) Remove the bolt that attaches the (AS02) tube to the bracket. See View G.

(c) Remove the (AS02) tube from the (AS03) and (AS27) tubes. See (Sheet 1).

(d) Remove the (LD02) tube from the (LD01) tube and to the turbine exhaust case. See (Sheet 1).

(6) (Pre SB PW4ENG 79-75) Remove the (rear) No. 4 bearing oil scavenge tube assembly (LR06) as follows. See Figure 301.

(a) Remove the bolt, nut and clamp that attaches the spray shield to the Flange M bracket at approximately the 7 o'clock position. Remove the hose clamp from the forward end of the spray shield and remove the shield from the engine. Remove the lockwire and disconnect the tube nut from the tube coupling.

(b) Remove the lockwire and disconnect the tube elbow from the exhaust case internal tube nut at approximately the 10 o'clock position.

(c) Remove the bolts, nuts and clamps that attach the tube to the Flanges N and P brackets. Remove the tube from the engine and install protective closures.

(d) Remove the bolts, nuts and clamp bracket attached to the Flange N bracket at approximately the 7 o'clock position.

(7) (Post SB PW4ENG 79-75 and Pre SB PW4ENG 79-76 only) Remove (rear) No. 4 bearing scavenge tube assembly (LR06) as follows. See Figure 301.

(a) Remove hose clamp securing the tube shield to the bracket inboard side of Flange M at approximately 7 o'clock position. Remove the lockwire and disconnect the (LR05) hose and tube assembly nut from the (LR06) tube coupling.

(b) Remove lockwire and disconnect tube elbow from exhaust case internal tube nut at approximately 10 o'clock position.

(c) Remove bolts, nuts and clamps securing tube to Flanges N and P brackets. Remove tube from engine and install protective closures.

(d) Remove bolts, nuts and clamp bracket attached to Flanges M and N brackets at approximately 7 o'clock position.

(8) (Post SB PW4ENG 79-76) Remove (rear) No. 4 bearing scavenge tube assemblies (LR21) and (LR22) which replace (LR06) as follows. See Figure 305.

(a) Remove clamps and the tube spray shields at the (LR21) tube to (LR22) tube connection and at the (LR05) tube to the (LR21) tube connection. See Views E and DE.

(b) Remove clamps on the (LR22). See Views A, B, C and D.

(c) Remove the (LR22) tube from the (LR21) tube and the port for the internal tube on the turbine exhaust case. See Views E and AP.

(d) Remove clamps, nuts and bolts that secure (LR21) tube. See Views F, O, Q and R.

(e) Remove the (LR21) tube from the (LR05) tube. See View DE.

(9) (Pre SB PW4ENG 79−75) Remove the (front) No. 4 bearing oil scavenge tube assembly (LR05) as follows. See Figure 302.

(a) Remove the bolts, nuts and clamps that attach the tube to the main oil filter tube at approximately the 6 o'clock position.

NOTE: Catch oil in container with a capacity of approximately 5 U.S. gallons (19 liters).

(b) Remove the bolts that attach the tube to the main oil pump and remove the tube from the engine.

(c) Remove and discard the packing. Install protective closures.

(d) Remove the six loop clamp grommet halves from the tube.

(10) (Post SB PW4ENG 79−75) Remove (front) No. 4 bearing oil scavenge hose and tube assembly (LR05) as follows. See Figure 302.

(a) Remove the bolts, nuts and clamps that attach the hose and tube assembly to the loop clamp bracket on the TCC manifold bridge bracket and the loop clamp bracket assembly on the fluid pressure dampener or adapter.

NOTE: Catch oil in container with a capacity of approximately 5 U.S. gallons (19 liters).

(b) Remove lockwire from the tube nut to the main oil pump connection. Remove bolts securing tube to main oil pump and remove tube from engine.

(c) Remove and discard packing. Install protective closures.

(d) Remove the bolts that secure the loop clamp bracket to the TCC manifold bridge bracket. Remove the loop clamp bracket.

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH
R CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND
R INSTALL A TUBE WITH A FLEX SEGMENT WITH THE
R SAME PRECAUTION USED FOR A TUBE WITHOUT A
R FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A
R TUBE TO HELP WITH THE INSTALLATION OR REMOVAL
R OF THE TUBE OR AN ATTACHED COMPONENT. IF A
R FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE
R A KINK IN THE EXTERNAL WIRE BRAID AND IN THE
R INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND
R LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(11) (Pre SB PW4ENG 79−75) Remove main filter oil tube assembly (LP01) as follows. See Figure 302.

NOTE: Make sure all the oil has been drained from the main oil filter housing.

(a) Remove bolts that attach the tube to the front of the main oil filter housing.

(b) Remove the bolts and bracket that attach the tube to the top of the main oil pump.

NOTE: Catch oil in container with a capacity of approximately 5 U.S. gallons (19 liters) at the lower end of tube.

(c) Remove the bolt, nut and clamp that attach the tube to the diffuser case bracket at approximately the 7 o'clock position.

(d) Remove the bolts, nuts and clamps that attach the tube to the gearbox brackets at approximately the 8 o'clock position and remove tube from engine.

(e) Remove the six (clip−on) loop clamp grommet halves from the tube.

(f) Remove and discard packings. Install protective closures.

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH
R CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND
R INSTALL A TUBE WITH A FLEX SEGMENT WITH THE
R SAME PRECAUTION USED FOR A TUBE WITHOUT A
R FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A
R TUBE TO HELP WITH THE INSTALLATION OR REMOVAL
R OF THE TUBE OR AN ATTACHED COMPONENT. IF A
R FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE
R A KINK IN THE EXTERNAL WIRE BRAID AND IN THE
R INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND
R LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(12) (Post SB PW4ENG 79-75) Remove the fluid pressure dampener or the fluid pressure adapter assembly (Post SB PW4ENG 79-86) and the main oil filter hose and tube assembly (LP01) as follows. See Figure 302.

NOTE: Ensure oil has been previously drained from main oil filter housing.

(a) Remove bolts securing the hose and tube assembly to the front of the main oil filter housing.

(b) Remove the bolts and bracket that hold the hose and tube assembly to the top of the fluid pressure dampener or adapter.

NOTE: Catch oil in container with a capacity of approximately 5 U.S. gallons (19 liters) at lower end of tube.

(c) Remove bolt, nut and clamp securing tube to diffuser case bracket at approximately 7 o'clock position.

(d) Remove bolts, nuts and clamps securing tube to gearbox brackets at approximately 8 o'clock position and remove tube from engine.

(e) Remove the bolts and nuts that hold the loop clamp bracket to the fluid pressure dampener or adapter. Remove the bracket.

(f) Remove the bolts that hold the fluid pressure dampener or adapter to the top of the main oil pump. Remove the fluid pressure dampener or adapter from the main oil pump.

(g) Remove and discard packings. Install protective closures.

(13) Remove the LPT case cooling (TCC) manifold assemblies (AC01) through (AC14) as follows.

(a) Remove bolts that attach all the manifold ends (upper and lower) to the manifold (collector).

(b) Remove the bolts, nuts and bracket that attach the cooling air manifold support brackets to the brackets on Flange N.

(c) Remove the bolts, nuts and clamps that attach the rear mounts of the cooling manifolds to the brackets on Flange P.

(d) Move the lower LPT cooling air manifolds around the LPT case to disengage the manifolds from the collector and remove the manifolds from the engine.

(e) Move the upper LPT cooling air manifolds around the LPT case to disengage the manifolds from the collector and remove the manifolds from the engine. Install protective closures.

(14) Remove LPT case cooling manifold (collector) as follows.

(a) Remove the bolts that attach the collector to the support bracket and the LPT cooling valve flange.

(b) Remove the bolts and clamps that attach the front bracket on the collector to the Flange N bracket.

(c) Remove the bolts and nuts that attach the rear of the collector to the Flange P brackets.

(d) Remove the collector from the engine and install protective closures.

(15) Remove the (lower right) turbine vane cooling air duct (AP02) as follows.

(a) Remove the lockwire and bolts that attach the turbine vane cooling air duct rear flange to the HPT case at approximately the 4 o'clock position.

(b) Remove the bolts and nuts that attach the cooling air duct front flange to the turbine vane and blade cooling air valve on the HPC case.

(c) Remove the bolts, nuts and clamp that attach the duct to the Flange M bracket and remove the duct from the engine.

(d) Remove and discard the gaskets. Install protective closures.

(16) Remove the (lower right) turbine blade cooling tube assembly (AP37) as follows.

(a) Remove the lockwire, bolts and bracket that attach the tube flange to the diffuser case at approximately the 5 o'clock position.

(b) Remove the bolt, nut, and clamp that attaches the fuel manifold to the bracket. Remove the bracket.

(c) Remove the bolts and bracket that attach the tube flange to the turbine vane and blade cooling valve on the HPC case.

(d) Remove the bolts, nuts and clamps that attach the tube to the diffuser case brackets.

(e) (Pre SB PW4ENG 72-537 or Post SB PW4ENG 72-627) Remove the tube from the engine. Remove and discard the gaskets. Remove the metering plate and tube locks. Install the protective closures.

(f) (Post SB PW4ENG 72-537 and Pre SB PW4ENG 72-627) Remove the tube from the engine. Remove and discard the gaskets. Remove the ring spacer and tube locks. Install the protective closures.

(17) Remove the (lower front) turbine case cooling (TCC) HPT manifold assembly (AC25) as follows.

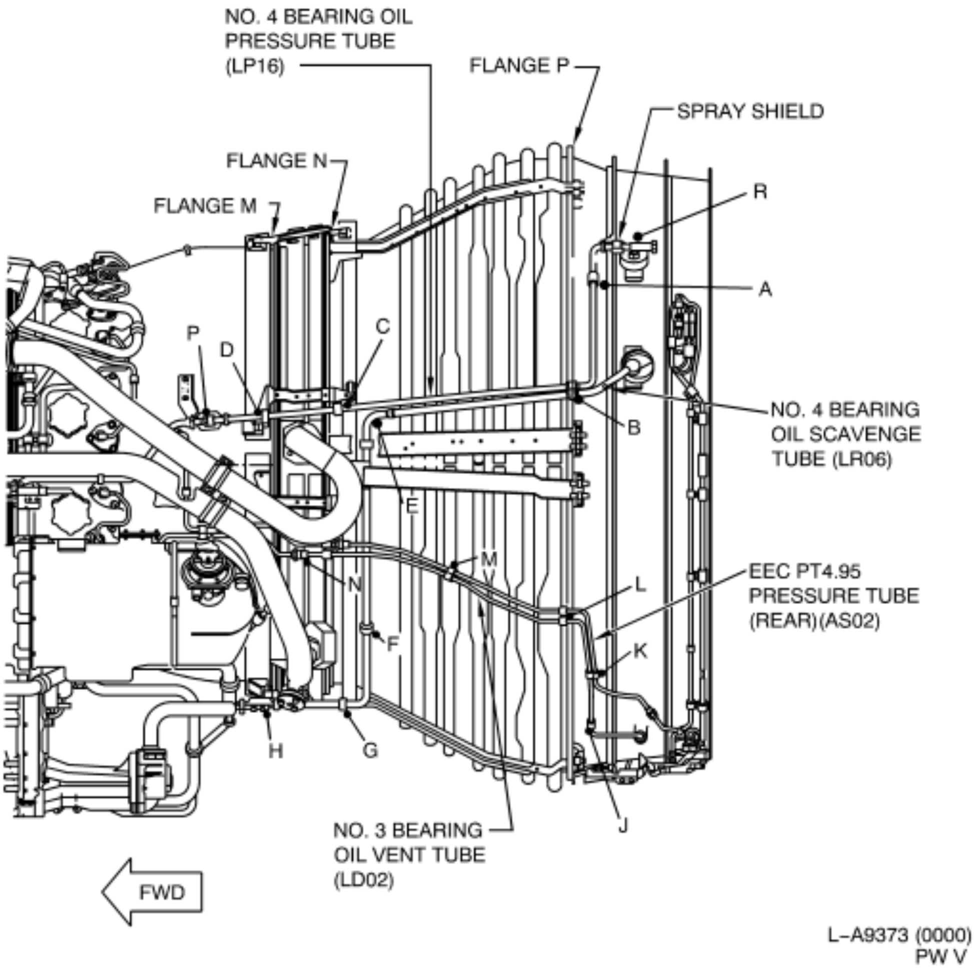
(a) Remove the bolt that attaches the manifold end to the HPT collector.

(b) Remove the bolts and nuts that attach the manifold clamps to the brackets attached to the Flange M brackets at approximately the 4, 7 and 9 o'clock positions.

(c) Remove the bolts and nuts that attach the manifold loop clamp brackets to the Flange M brackets at approximately the 4, 7 and 9 o'clock positions.

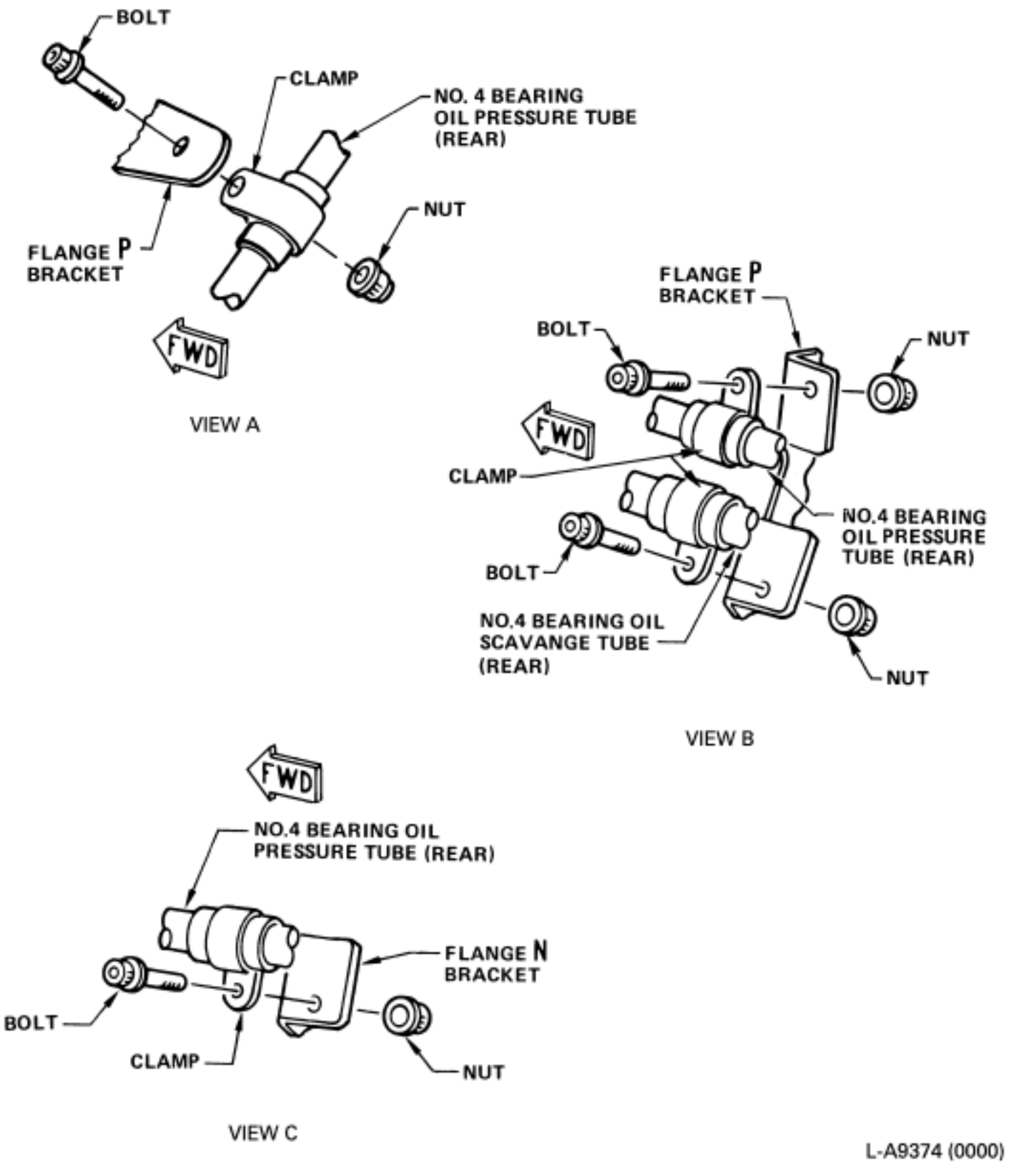
(d) Turn and lower the manifold to disengage it from the HPT collector and remove the manifold from the engine. Install protective closures.

ENGINE GENERAL - TURBINE EXHAUST CASE - REMOVAL-02

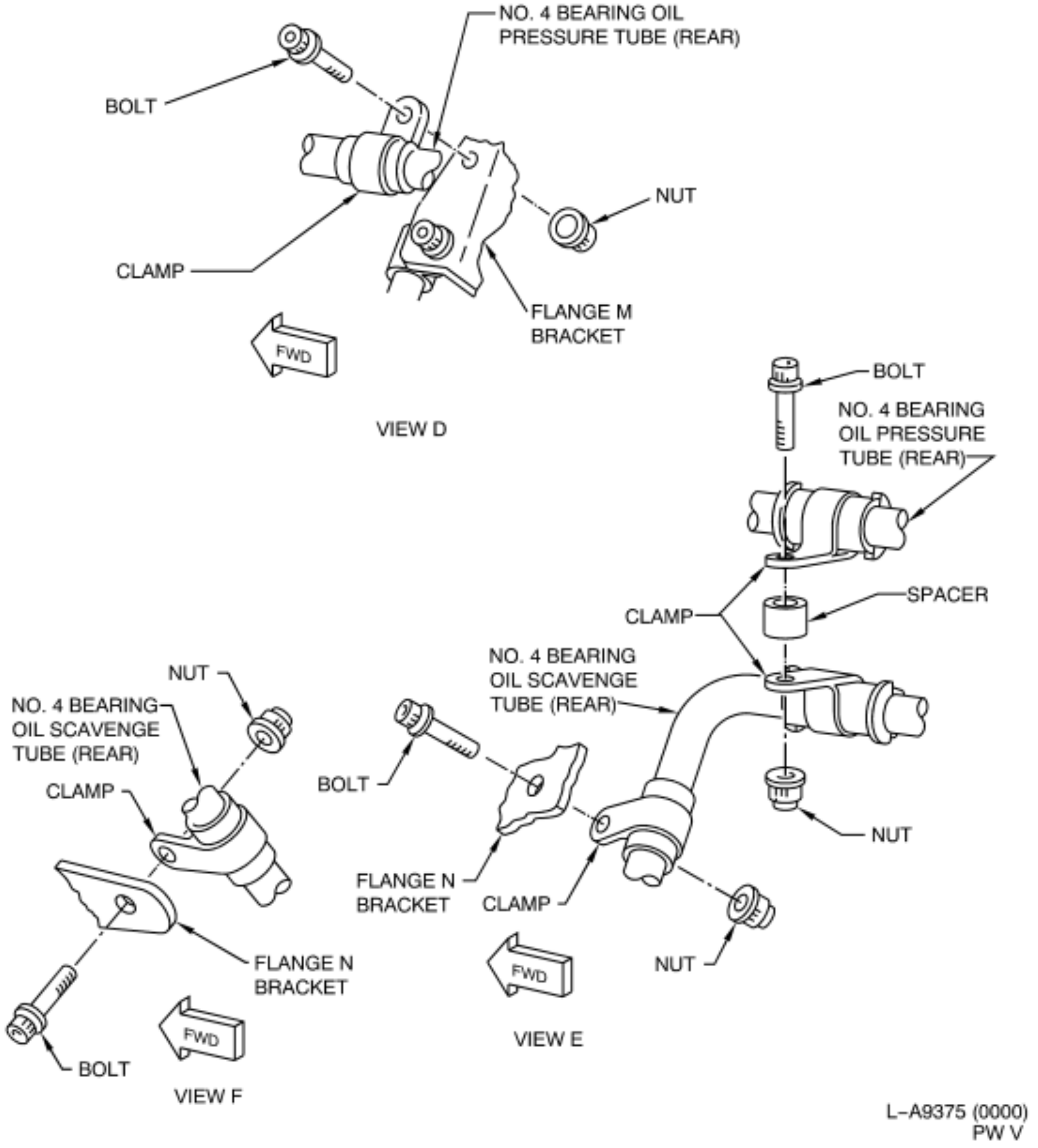

NO. 4 BEARING OIL PRESSURE TUBE (LP16)
FLANGE P
SPRAY SHIELD
FLANGE N
R
FLANGE M
A
P
C
D
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
B
E
M
EEC PT4.95 PRESSURE TUBE (REAR)(AS02)
N
L
F
K
H
G
J
NO. 3 BEARING OIL VENT TUBE (LD02)
FWD
L-A9373 (0000)
PW V

Turbine Exhaust Case External Plumbing
Figure 301 (Sheet 1)
(Task 72-00-54-020-004)

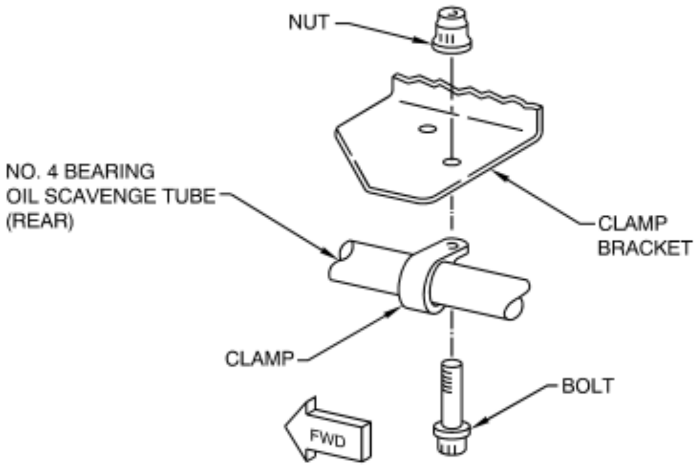
R
R


BOLT
CLAMP
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
NUT
FLANGE P BRACKET
FWD
VIEW A
FLANGE P BRACKET
BOLT
NUT
FWD
CLAMP
NO.4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NO.4 BEARING OIL SCAVANGE TUBE (REAR)
NUT
VIEW B
FWD
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE N BRACKET
BOLT
CLAMP
NUT
VIEW C
L-A9374 (0000)

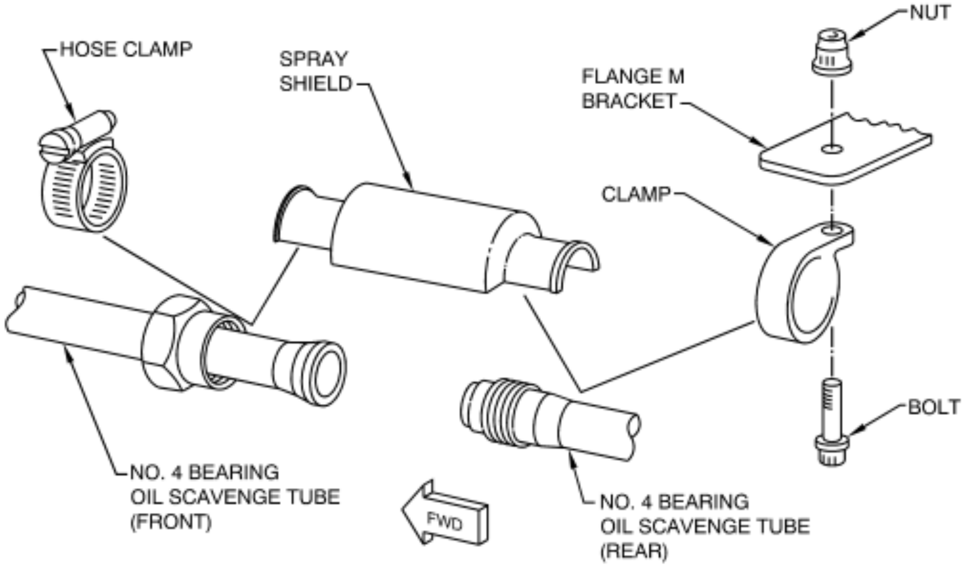
Turbine Exhaust Case External Plumbing
Figure 301 (Sheet 2)
(Task 72−00−54−020−004)


NO. 4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NUT
CLAMP
FLANGE M BRACKET
FWD
VIEW D
BOLT
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
SPACER
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
NUT
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP
BOLT
NUT
FLANGE N BRACKET
CLAMP
NUT
FLANGE N BRACKET
FWD
FWD
VIEW E
BOLT
VIEW F
L–A9375 (0000)
PW V

Turbine Exhaust Case External Plumbing
Figure 301 (Sheet 3)
(Task 72–00–54–020–004)


NUT
NO. 4 BEARING
OIL SCAVENGE TUBE
(REAR)
CLAMP
BRACKET
CLAMP
BOLT
FWD

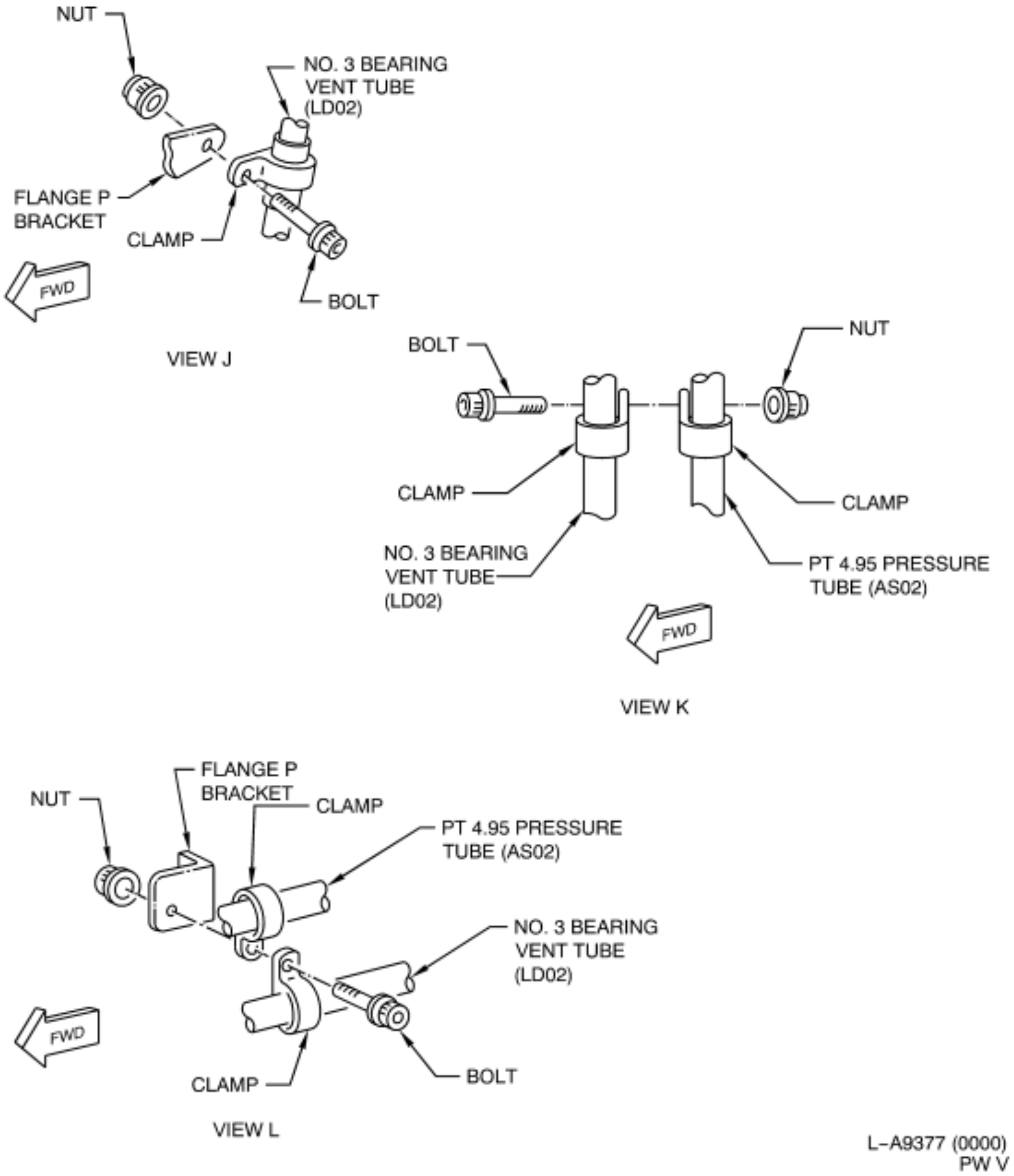
VIEW G


NUT
HOSE CLAMP
SPRAY
SHIELD
FLANGE M
BRACKET
CLAMP
BOLT
NO. 4 BEARING
OIL SCAVENGE TUBE
(FRONT)
FWD
NO. 4 BEARING
OIL SCAVENGE TUBE
(REAR)

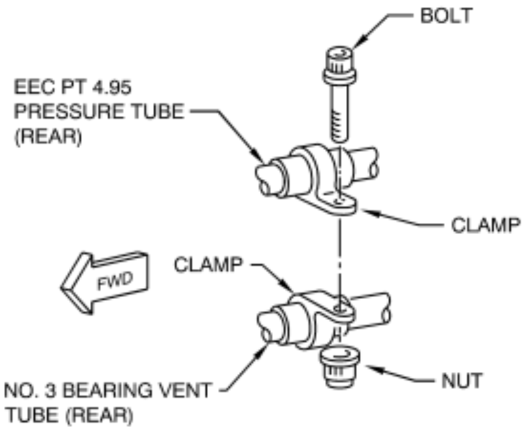
VIEW H

L-A9376 (0000)
PW V

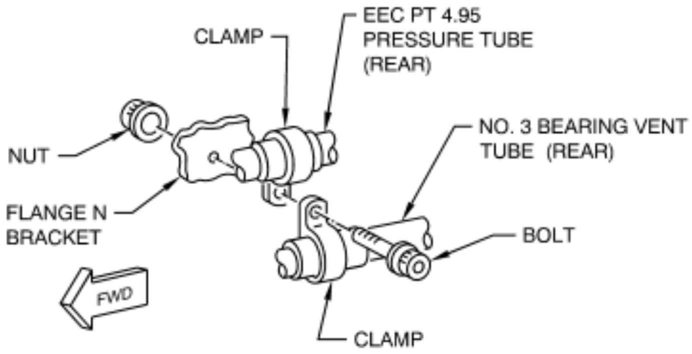
Turbine Exhaust Case External Plumbing
Figure 301 (Sheet 4)
(Task 72-00-54-020-004)


NUT
NO. 3 BEARING VENT TUBE (LD02)
FLANGE P BRACKET
CLAMP
FWD
BOLT
VIEW J
BOLT
NUT
CLAMP
NO. 3 BEARING VENT TUBE (LD02)
CLAMP
PT 4.95 PRESSURE TUBE (AS02)
FWD
VIEW K
FLANGE P BRACKET
NUT
CLAMP
PT 4.95 PRESSURE TUBE (AS02)
NO. 3 BEARING VENT TUBE (LD02)
FWD
CLAMP
BOLT
VIEW L
L-A9377 (0000)
PW V

Turbine Exhaust Case External Plumbing
Figure 301 (Sheet 5)
(Task 72-00-54-020-004)


BOLT
EEC PT 4.95
PRESSURE TUBE
(REAR)
CLAMP
FWD
CLAMP
NUT
NO. 3 BEARING VENT
TUBE (REAR)

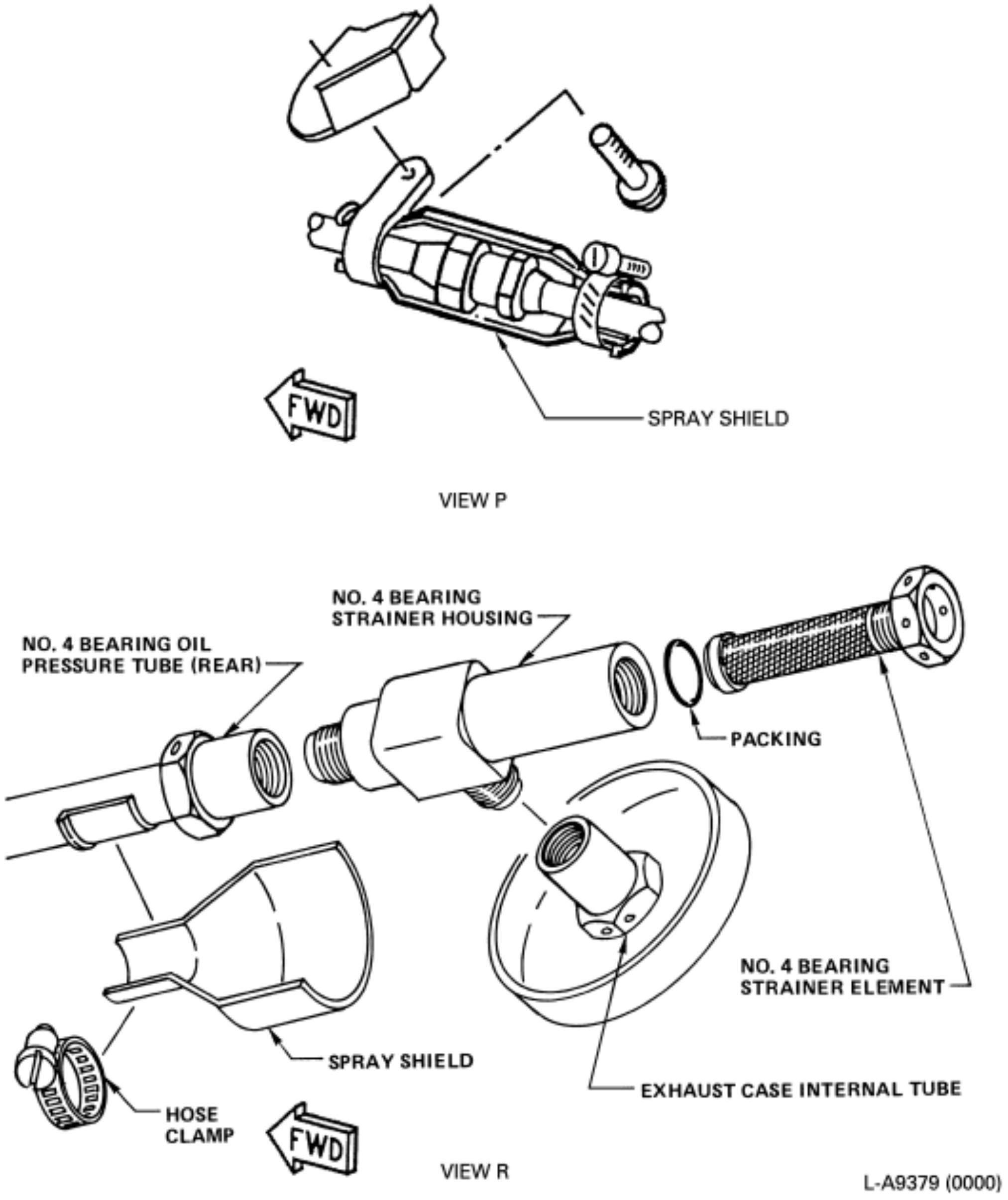
VIEW M


EEC PT 4.95
PRESSURE TUBE
(REAR)
CLAMP
NUT
NO. 3 BEARING VENT
TUBE (REAR)
FLANGE N
BRACKET
BOLT
FWD
CLAMP

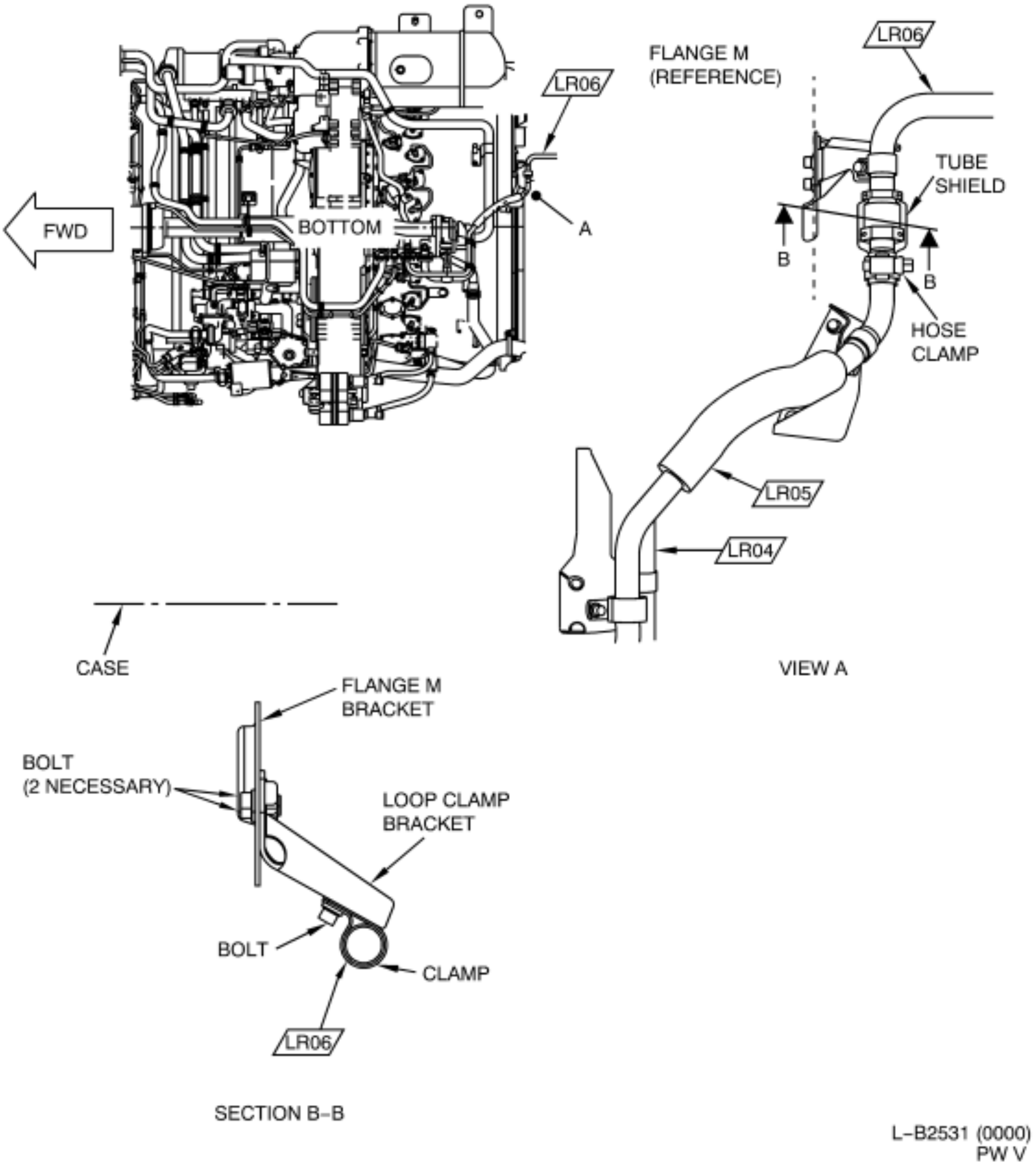
VIEW N

L−A9378 (0000)
PW V

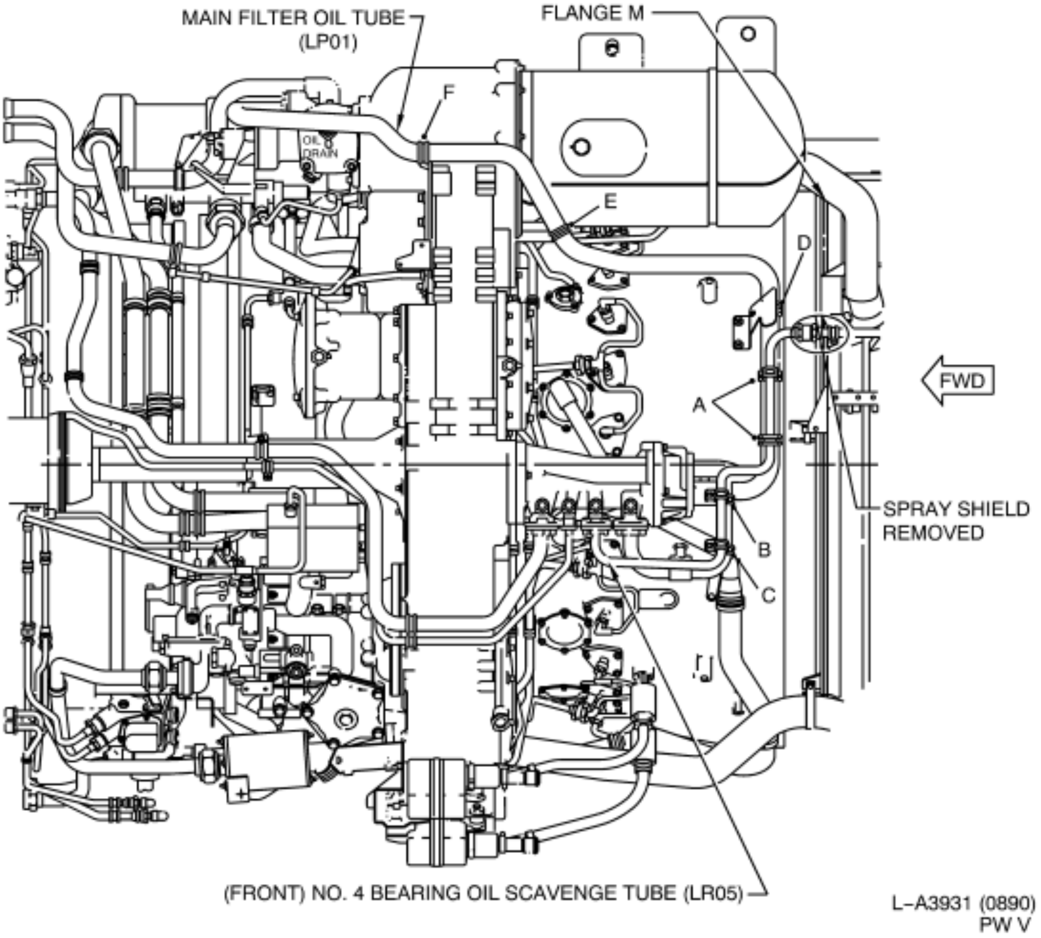
Turbine Exhaust Case External Plumbing
Figure 301 (Sheet 6)
(Task 72−00−54−020−004)


SPRAY SHIELD
FWD
VIEW P
NO. 4 BEARING STRAINER HOUSING
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
PACKING
NO. 4 BEARING STRAINER ELEMENT
SPRAY SHIELD
EXHAUST CASE INTERNAL TUBE
HOSE CLAMP
FWD
VIEW R
L-A9379 (0000)

Turbine Exhaust Case External Plumbing
Figure 301 (Sheet 7)
(Task 72−00−54−020−004)

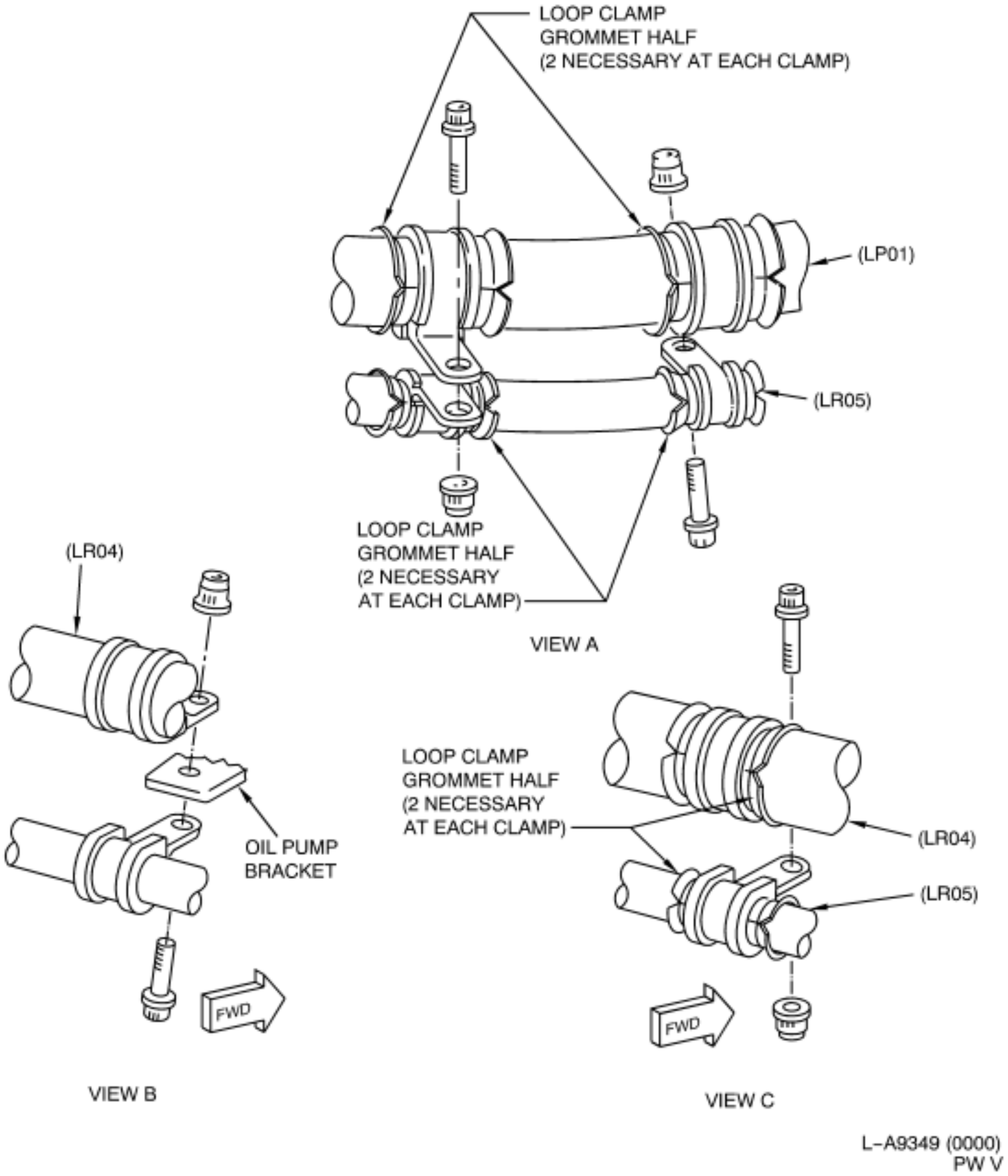

FWD
BOTTOM
LR06
A
FLANGE M
(REFERENCE)
LR06
TUBE
SHIELD
B
B
HOSE
CLAMP
LR05
LR04
CASE
VIEW A
FLANGE M
BRACKET
BOLT
(2 NECESSARY)
LOOP CLAMP
BRACKET
BOLT
CLAMP
LR06
SECTION B-B
L-B2531 (0000)
PW V

Turbine Exhaust Case External Plumbing (Post SB PW4ENG 79-75)
Figure 301 (Sheet 8)
(Task 72-00-54-020-004)

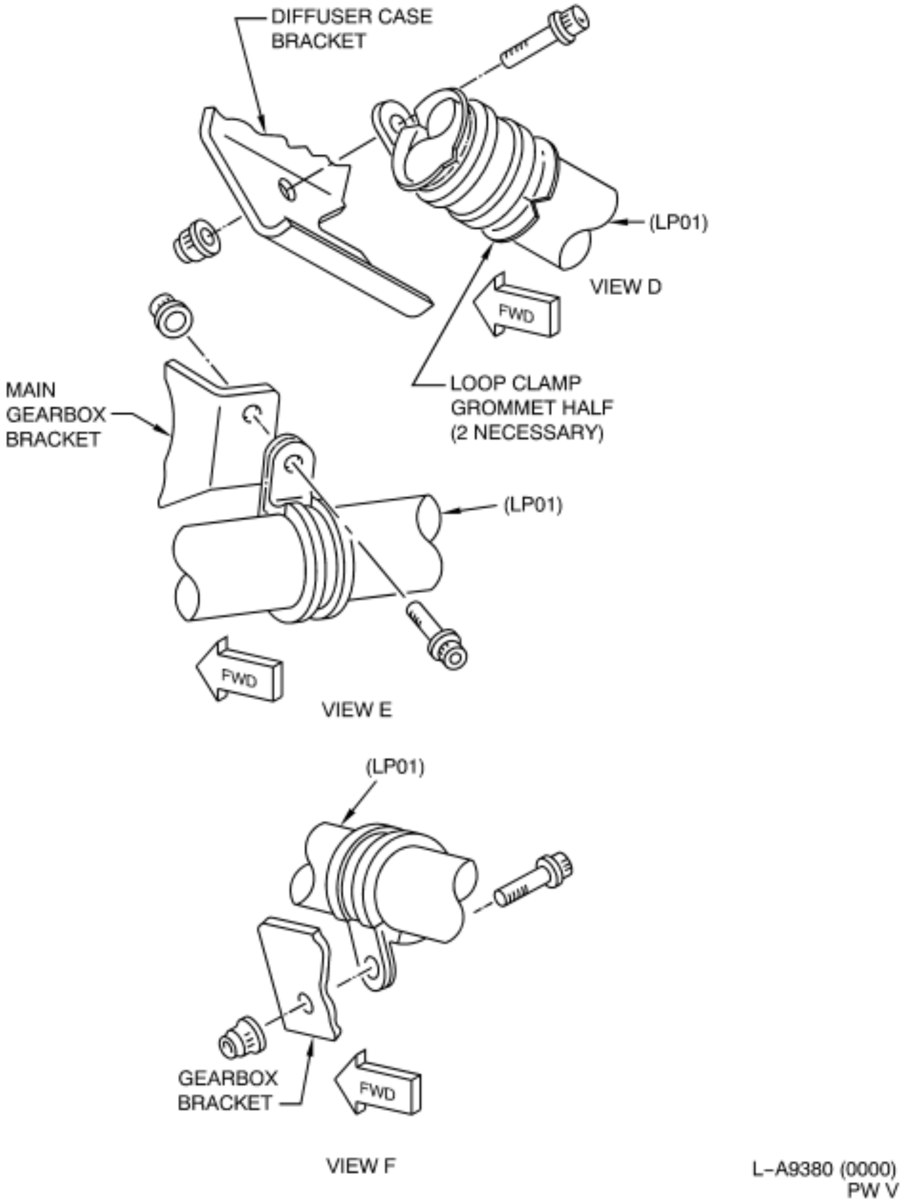

MAIN FILTER OIL TUBE
(LP01)
FLANGE M
F
OIL DRAIN
E
D
FWD
A
SPRAY SHIELD
REMOVED
B
C
(FRONT) NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
L-A3931 (0890)
PW V

Bottom External Plumbing
Figure 302 (Sheet 1)
(Task 72-00-54-020-004)

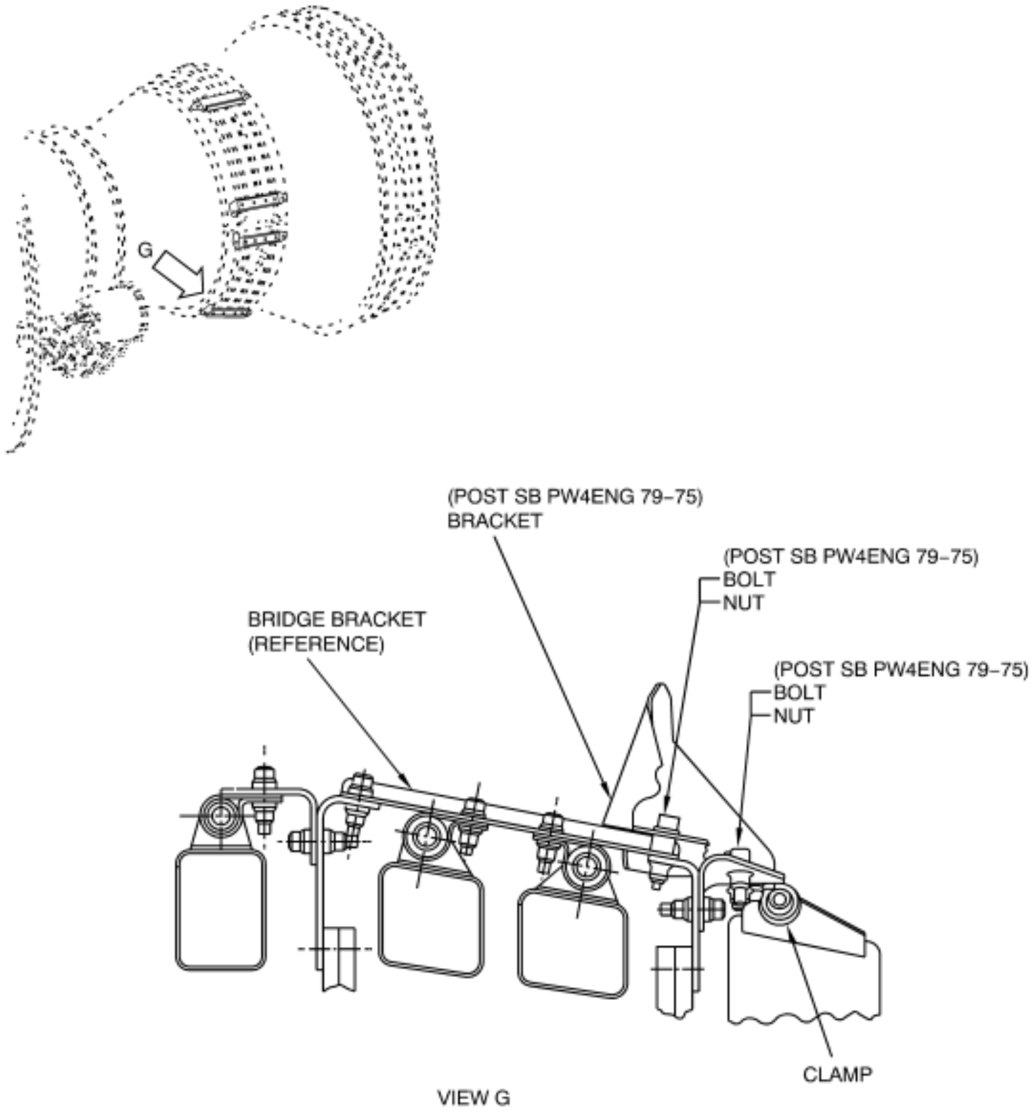
R
R


LOOP CLAMP
GROMMET HALF
(2 NECESSARY AT EACH CLAMP)
(LP01)
(LR05)
LOOP CLAMP
GROMMET HALF
(2 NECESSARY
AT EACH CLAMP)
VIEW A
(LR04)
OIL PUMP
BRACKET
FWD
VIEW B
LOOP CLAMP
GROMMET HALF
(2 NECESSARY
AT EACH CLAMP)
(LR04)
(LR05)
FWD
VIEW C
L-A9349 (0000)
PW V

Bottom External Plumbing (Pre SB PW4ENG 79-75)
Figure 302 (Sheet 2)
(Task 72-00-54-020-004)

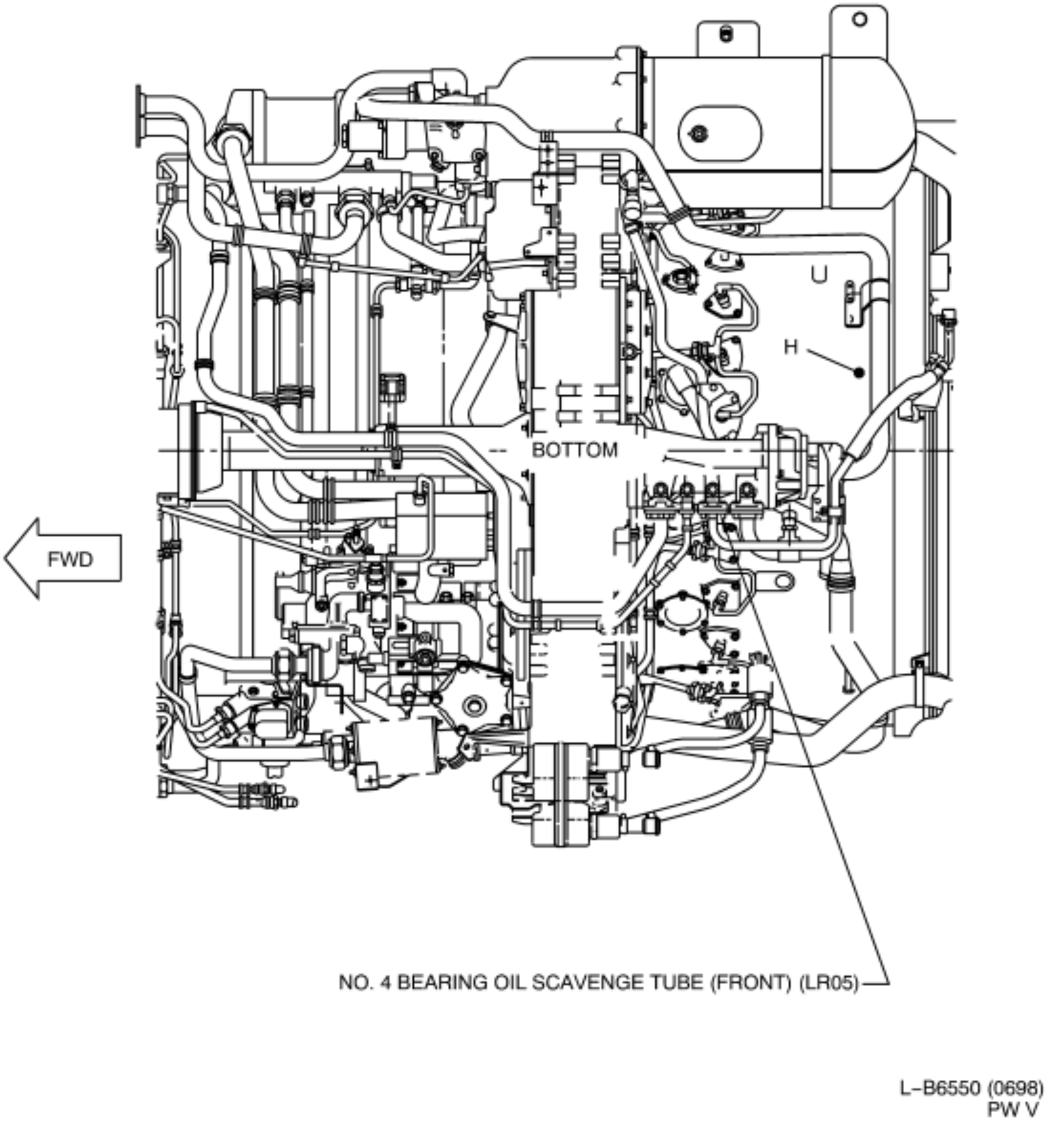

DIFFUSER CASE BRACKET
(LP01)
VIEW D
FWD
LOOP CLAMP GROMMET HALF (2 NECESSARY)
MAIN GEARBOX BRACKET
(LP01)
FWD
VIEW E
(LP01)
GEARBOX BRACKET
FWD
VIEW F
L−A9380 (0000)
PW V

Bottom External Plumbing (Pre SB PW4ENG 79−75)
Figure 302 (Sheet 3)
(Task 72−00−54−020−004)

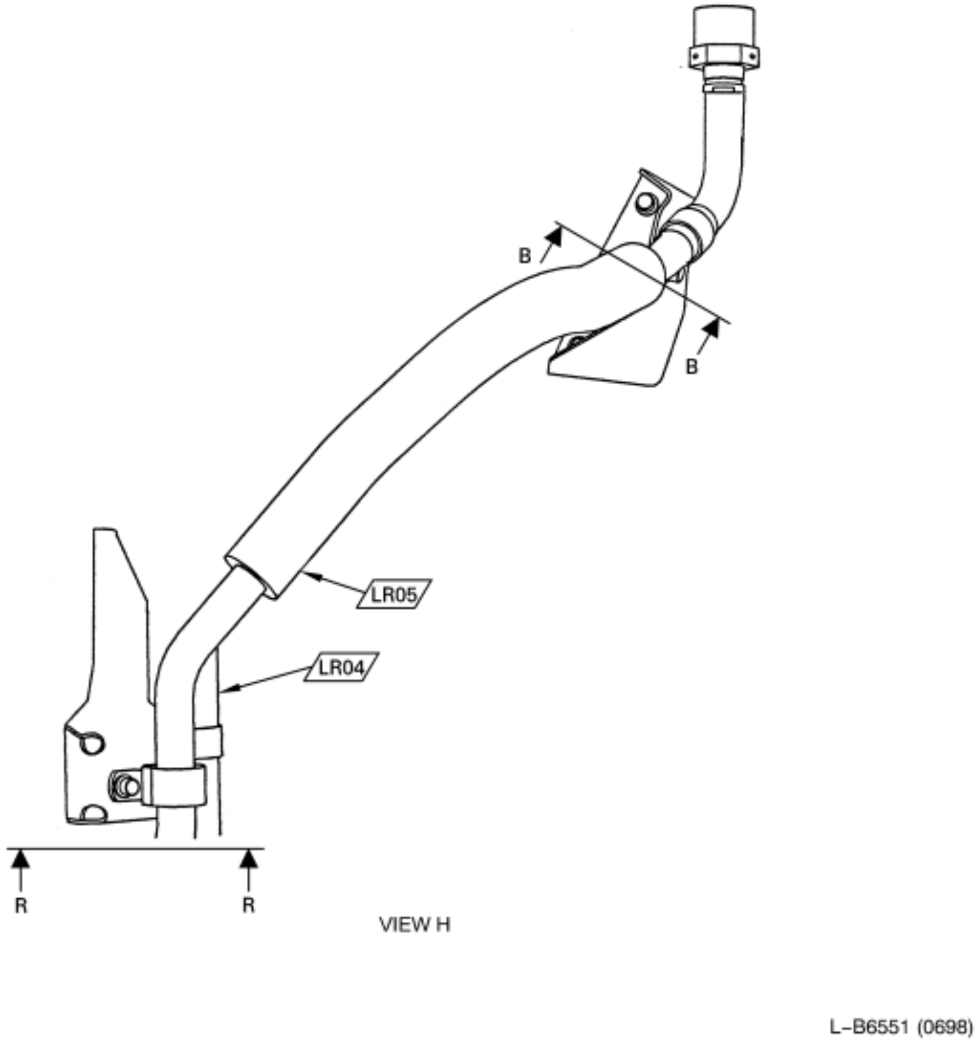

G
(POST SB PW4ENG 79-75)
BRACKET
(POST SB PW4ENG 79-75)
BOLT
NUT
BRIDGE BRACKET
(REFERENCE)
(POST SB PW4ENG 79-75)
BOLT
NUT
CLAMP
VIEW G

L-B6540 (0698)
PW V

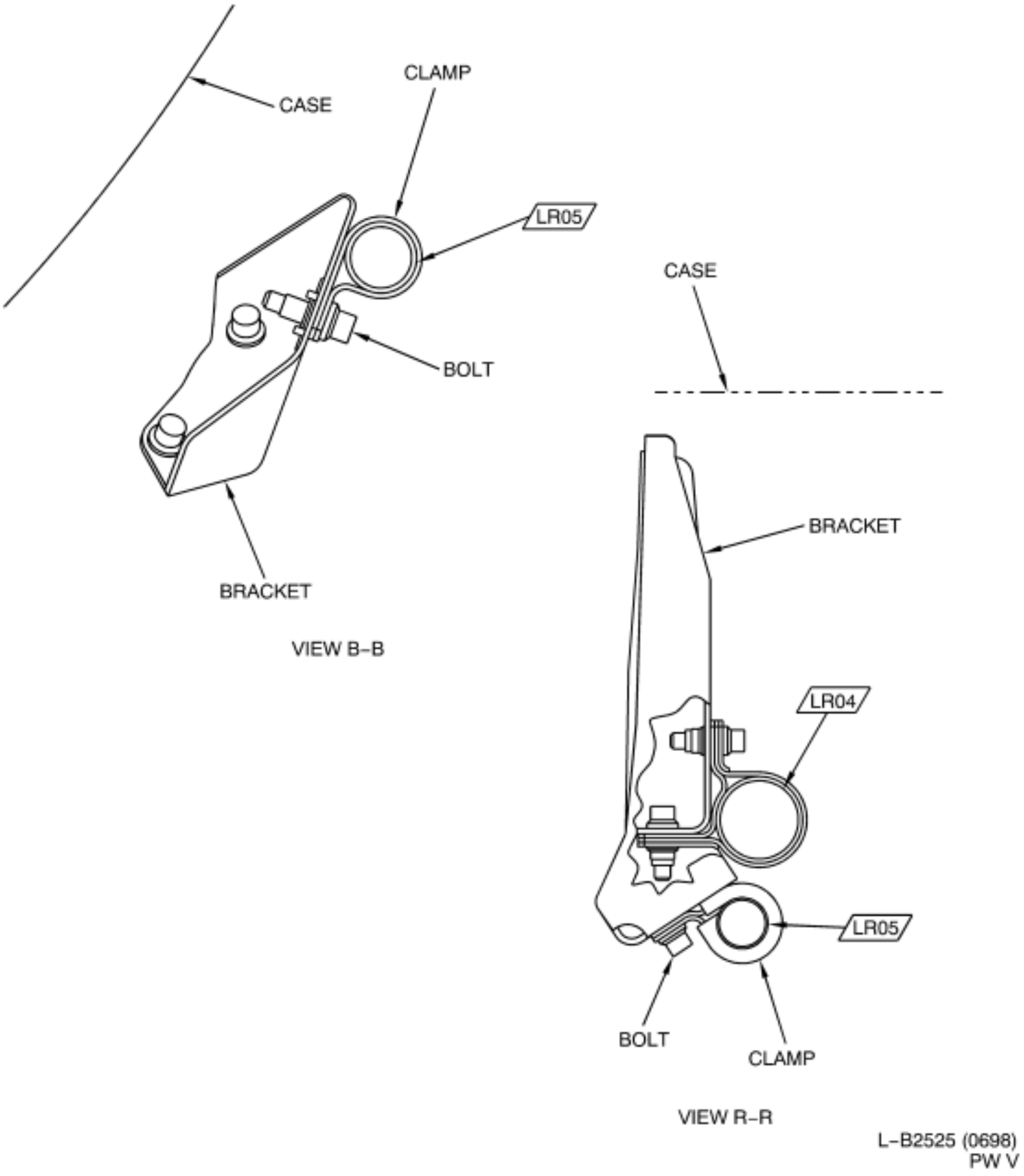
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 4)
(Task 72-00-54-020-004)


U
H
BOTTOM
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (FRONT) (LR05)
L-B6550 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 5)
(Task 72-00-54-020-004)

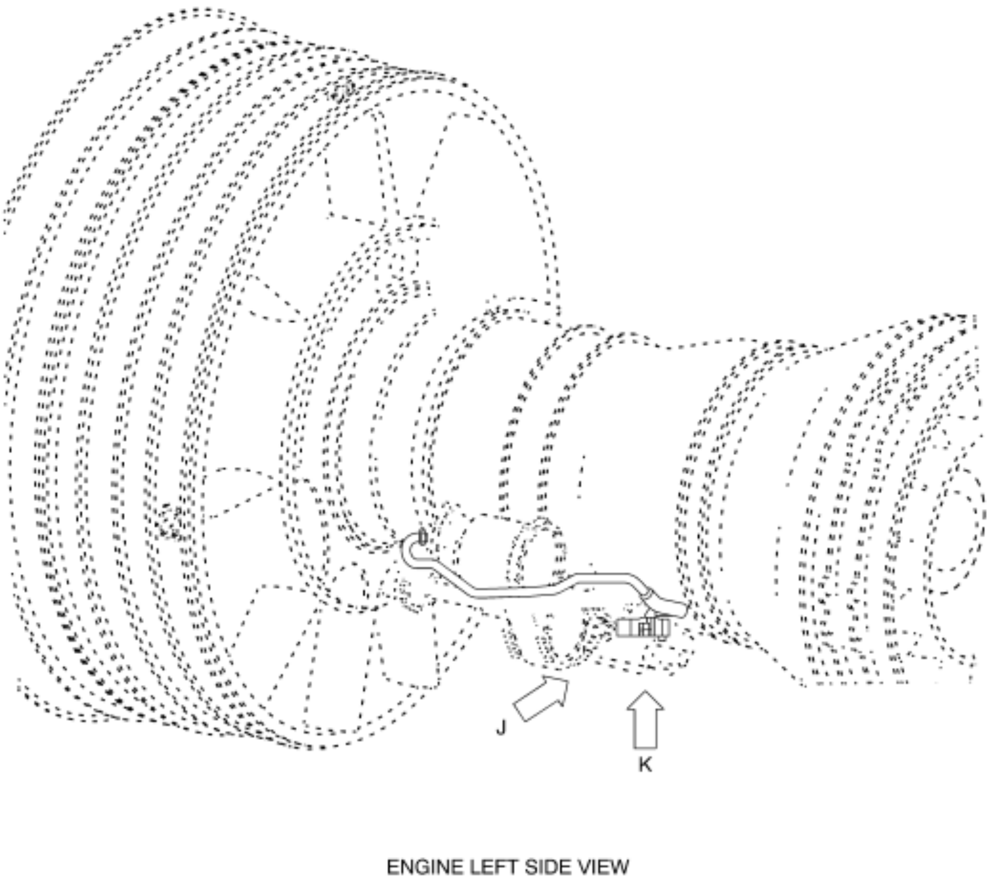

B
B
LR05
LR04
R
R
VIEW H
L−B6551 (0698)

Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 302 (Sheet 6)
(Task 72−00−54−020−004)


CLAMP
CASE
LR05
BOLT
BRACKET
VIEW B-B
CASE
BRACKET
LR04
LR05
BOLT
CLAMP
VIEW R-R
L-B2525 (0698)
PW V

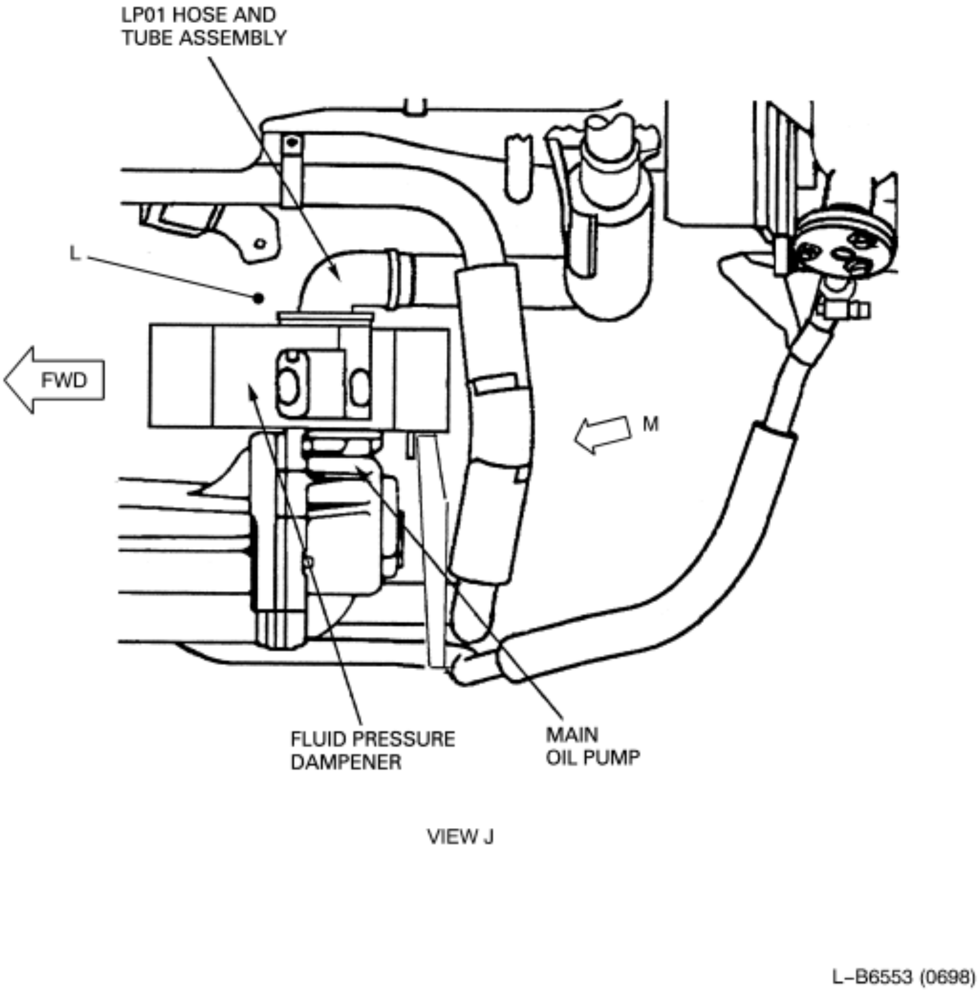
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 7)
(Task 72-00-54-020-004)

R
R

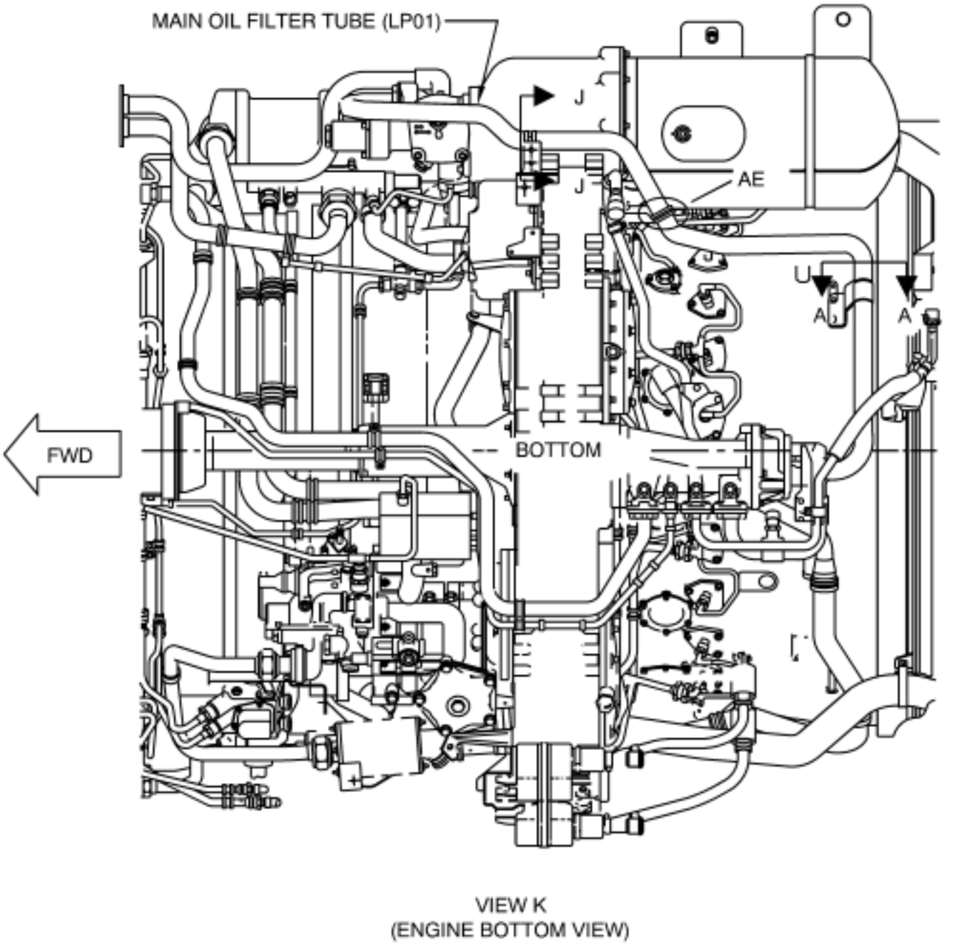


L-B6552 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79-75) (Pre SB PW4ENG 79-86)
Figure 302 (Sheet 8)
(Task 72-00-54-020-004)

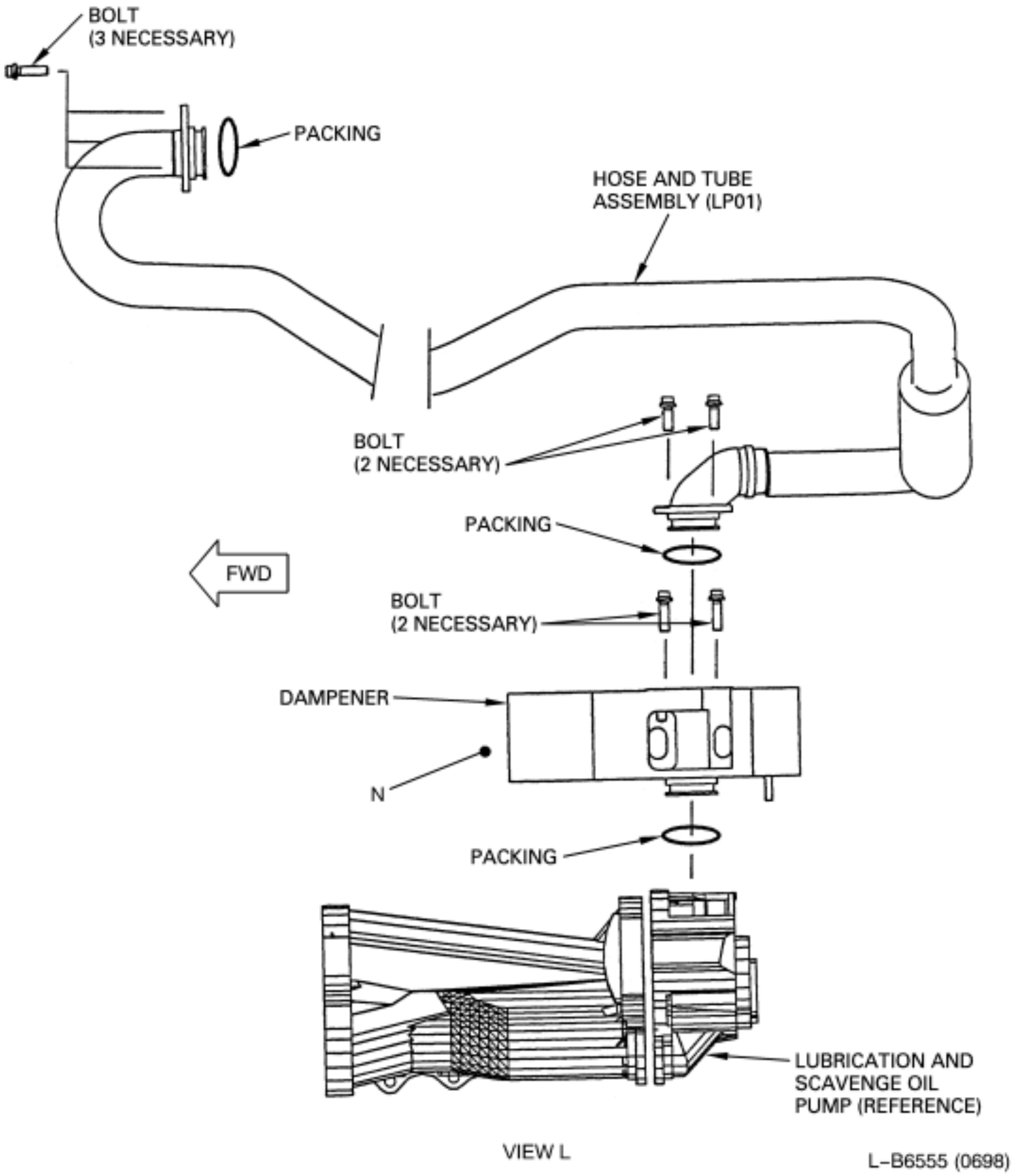

LP01 HOSE AND
TUBE ASSEMBLY
L
FWD
M
FLUID PRESSURE
DAMPENER
MAIN
OIL PUMP
VIEW J
L−B6553 (0698)

Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 302 (Sheet 9)
(Task 72−00−54−020−004)

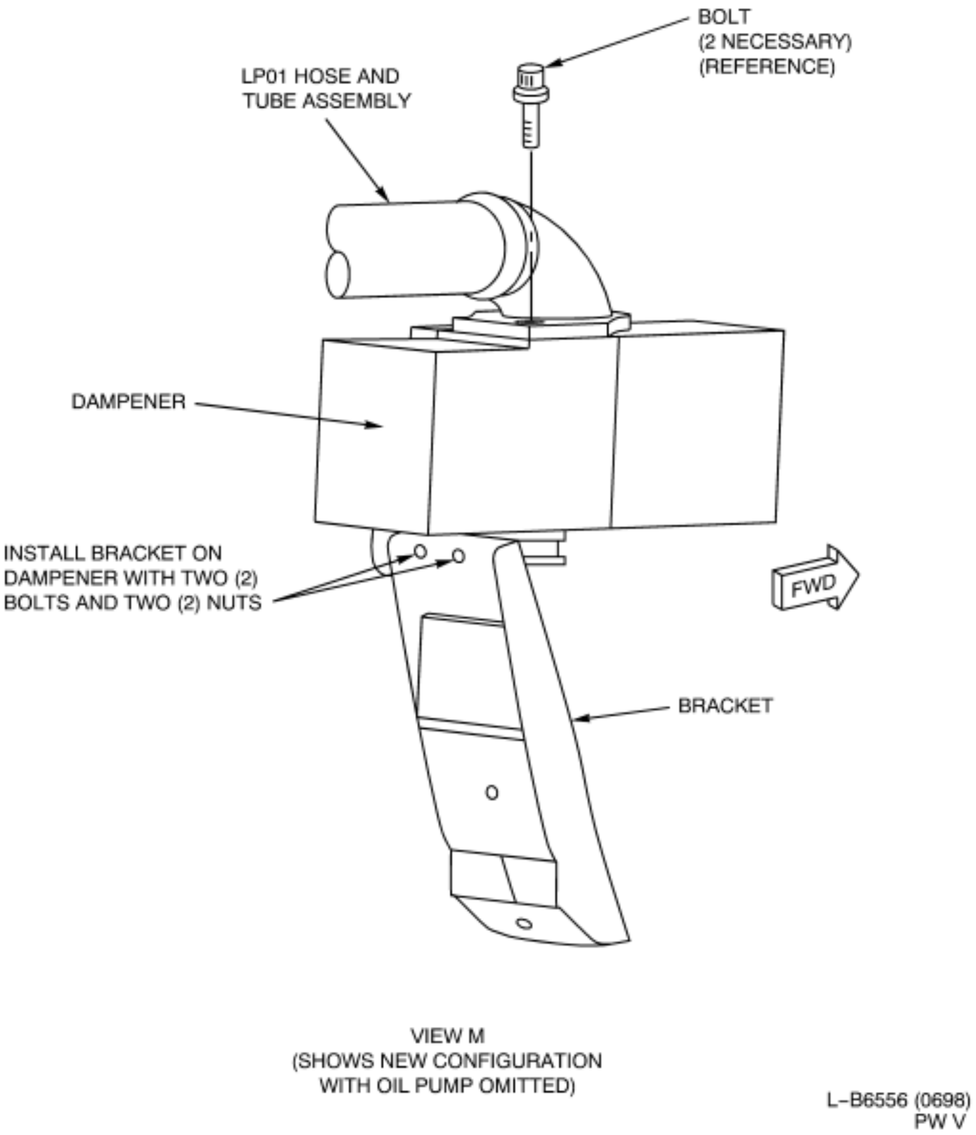

MAIN OIL FILTER TUBE (LP01)
J
J
AE
U
A
A
FWD
BOTTOM
VIEW K
(ENGINE BOTTOM VIEW)

L-B6554 (0698)
PW V

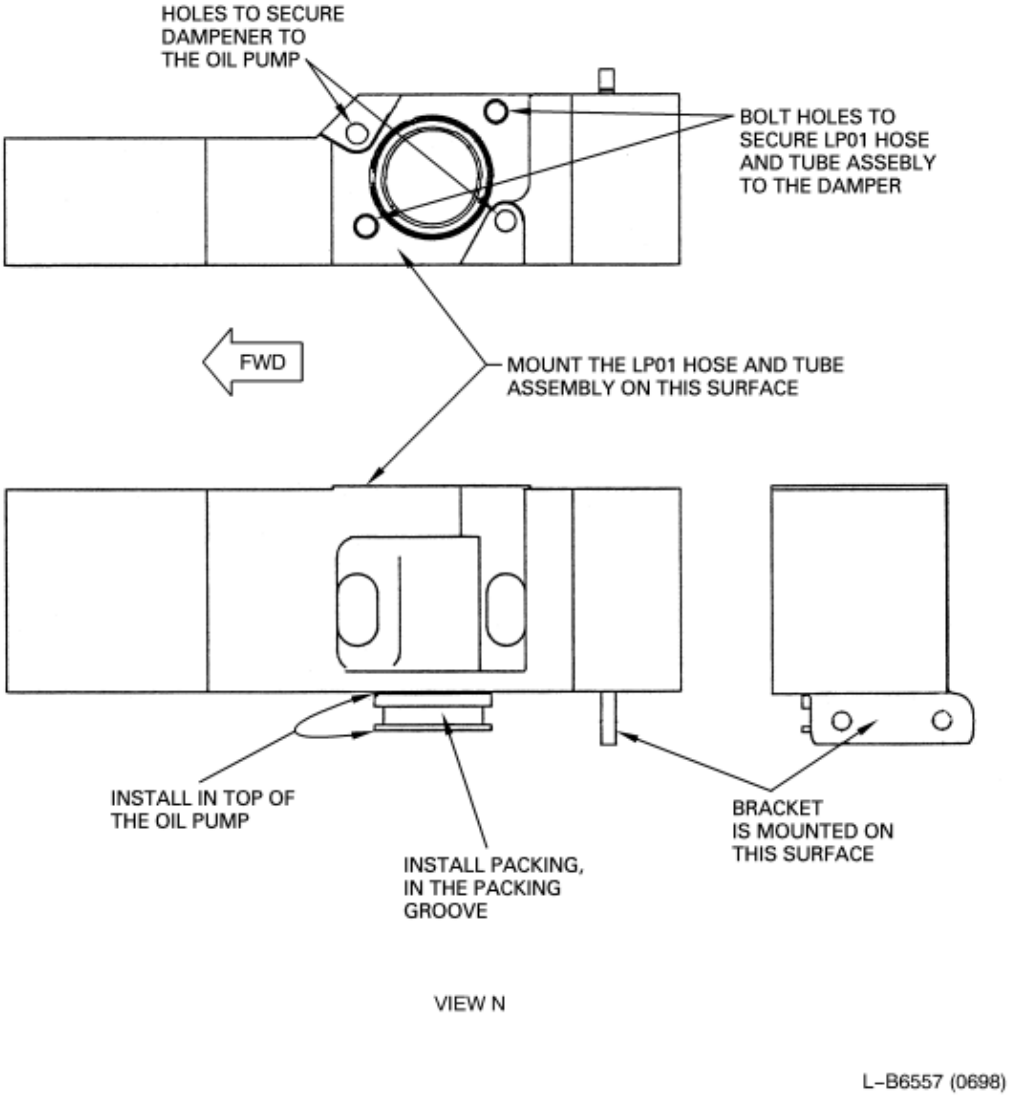
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 10)
(Task 72-00-54-020-004)


BOLT
(3 NECESSARY)
PACKING
HOSE AND TUBE
ASSEMBLY (LP01)
BOLT
(2 NECESSARY)
PACKING
FWD
BOLT
(2 NECESSARY)
DAMPENER
N
PACKING
LUBRICATION AND
SCAVENGE OIL
PUMP (REFERENCE)
VIEW L
L-B6555 (0698)

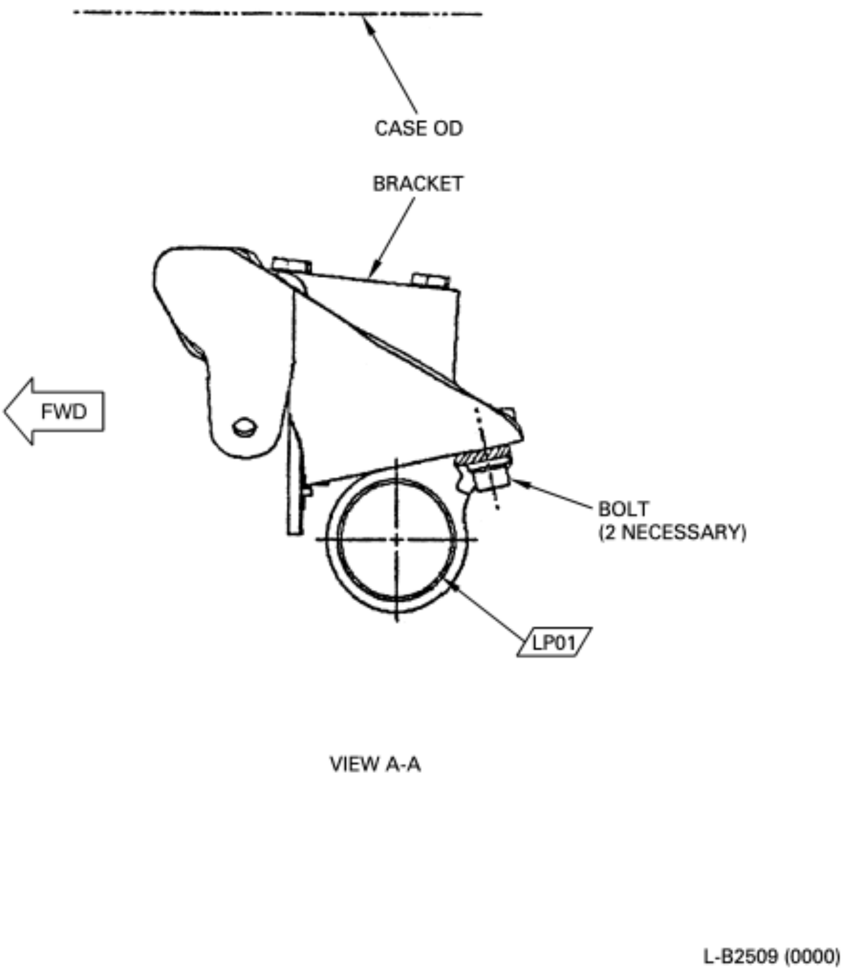
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 11)
(Task 72-00-54-020-004)


BOLT
(2 NECESSARY)
(REFERENCE)
LP01 HOSE AND
TUBE ASSEMBLY
DAMPENER
INSTALL BRACKET ON
DAMPENER WITH TWO (2)
BOLTS AND TWO (2) NUTS
FWD
BRACKET
VIEW M
(SHOWS NEW CONFIGURATION
WITH OIL PUMP OMITTED)
L-B6556 (0698)
PW V

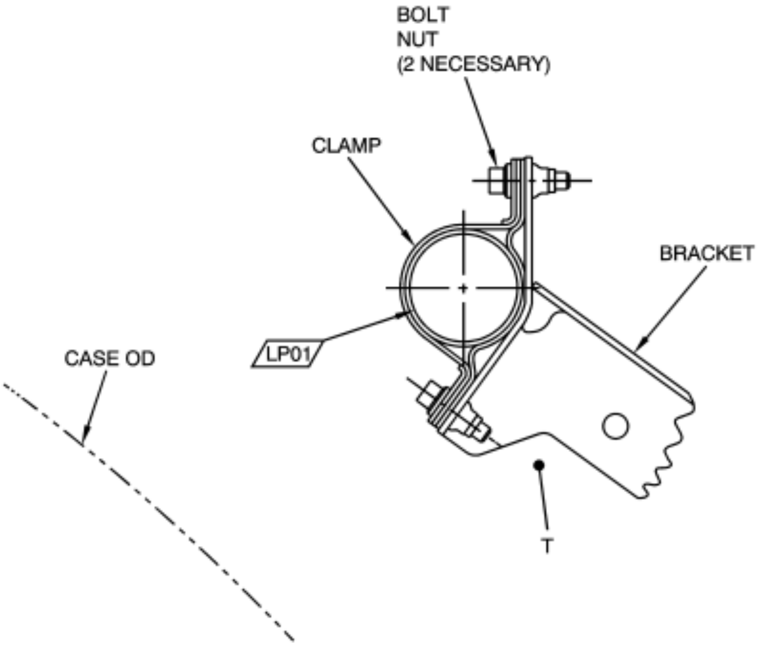
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 12)
(Task 72-00-54-020-004)


HOLES TO SECURE DAMPENER TO THE OIL PUMP
BOLT HOLES TO SECURE LP01 HOSE AND TUBE ASSEBLY TO THE DAMPER
FWD
MOUNT THE LP01 HOSE AND TUBE ASSEMBLY ON THIS SURFACE
INSTALL IN TOP OF THE OIL PUMP
INSTALL PACKING, IN THE PACKING GROOVE
BRACKET IS MOUNTED ON THIS SURFACE
VIEW N
L-B6557 (0698)

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 13)
(Task 72-00-54-020-004)


CASE OD
BRACKET
FWD
BOLT
(2 NECESSARY)
LP01
VIEW A-A
L-B2509 (0000)

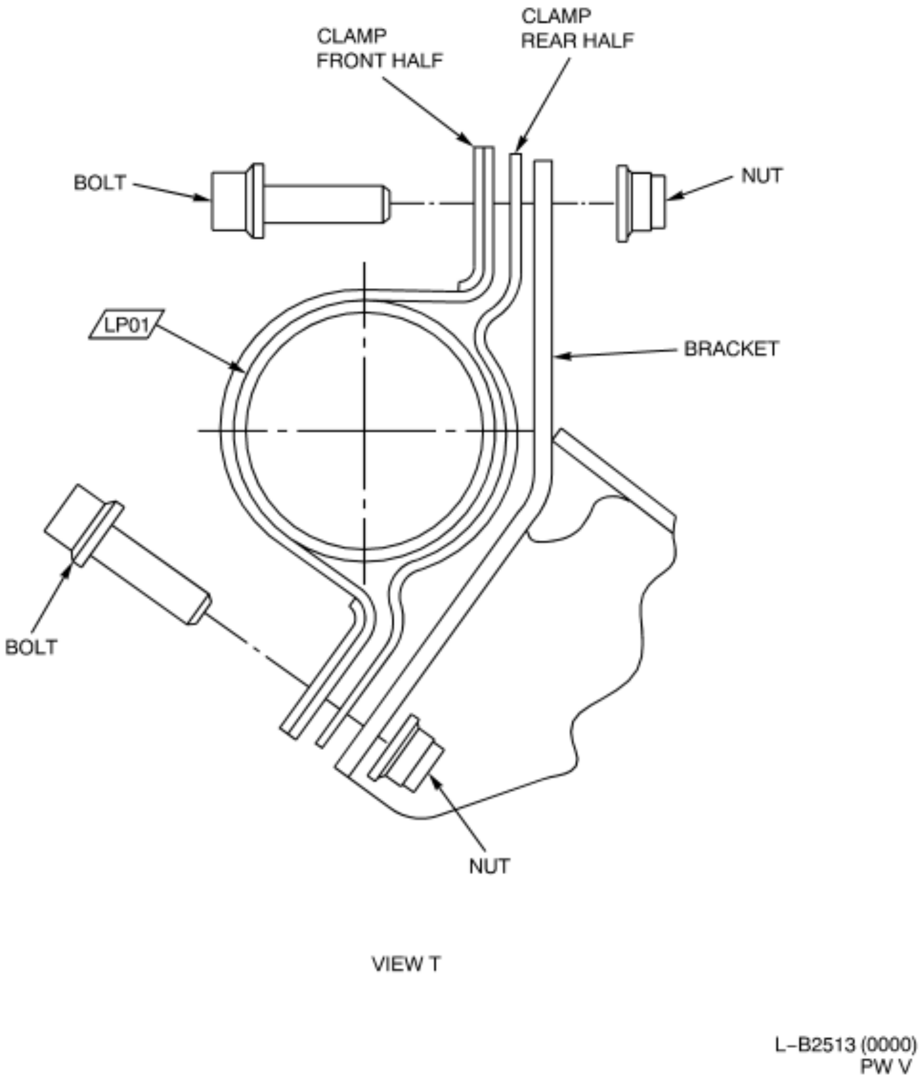
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 14)
(Task 72-00-54-020-004)


BOLT
NUT
(2 NECESSARY)
CLAMP
BRACKET
CASE OD
LP01
T

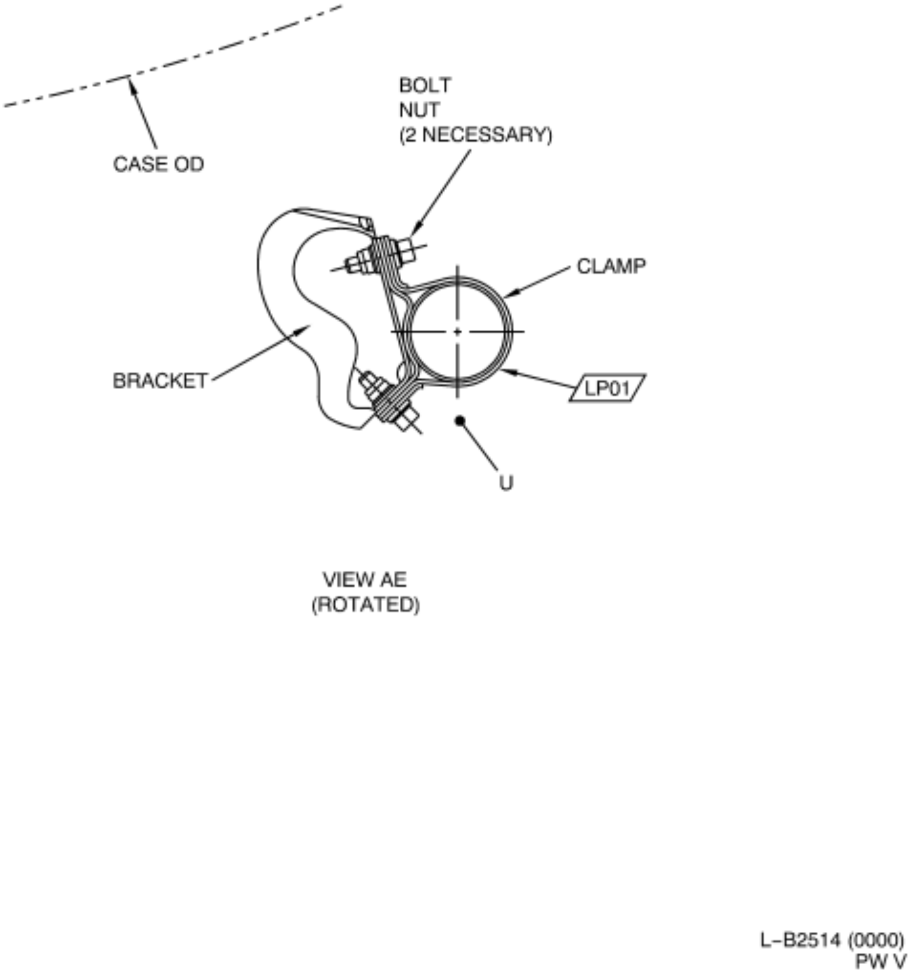
VIEW J-J

L-B2512 (0000)
PW V

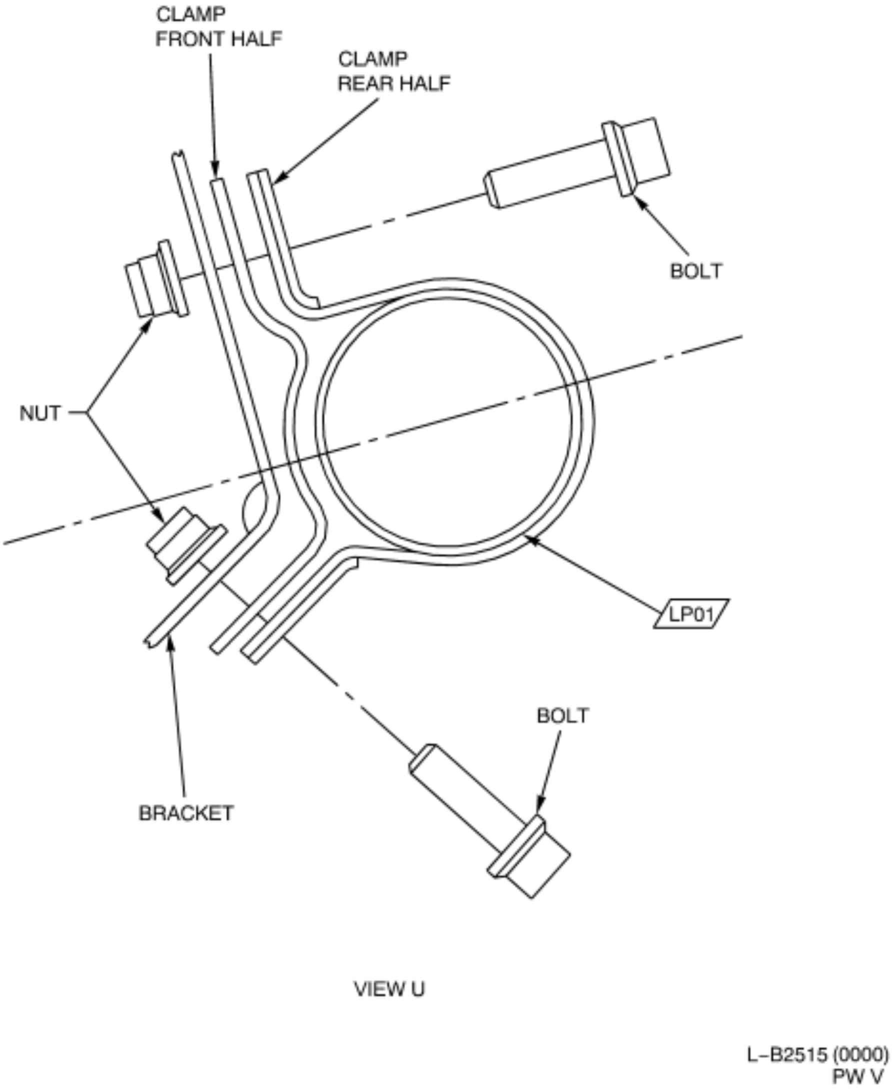
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 15)
(Task 72-00-54-020-004)


CLAMP FRONT HALF
CLAMP REAR HALF
BOLT
NUT
LP01
BRACKET
BOLT
NUT
VIEW T
L-B2513 (0000)
PW V

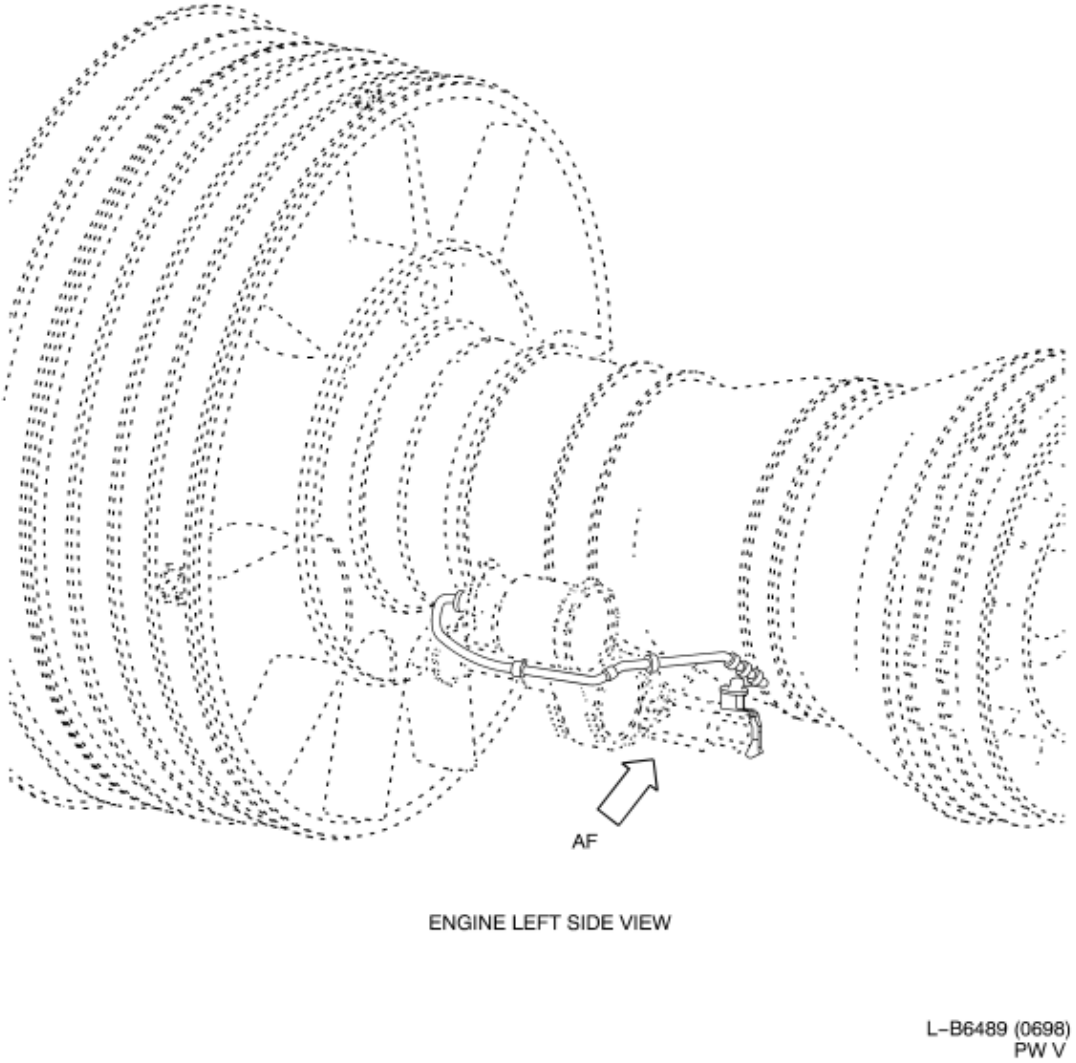
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 16)
(Task 72-00-54-020-004)


BOLT
NUT
(2 NECESSARY)
CASE OD
CLAMP
BRACKET
LP01
U
VIEW AE
(ROTATED)
L-B2514 (0000)
PW V

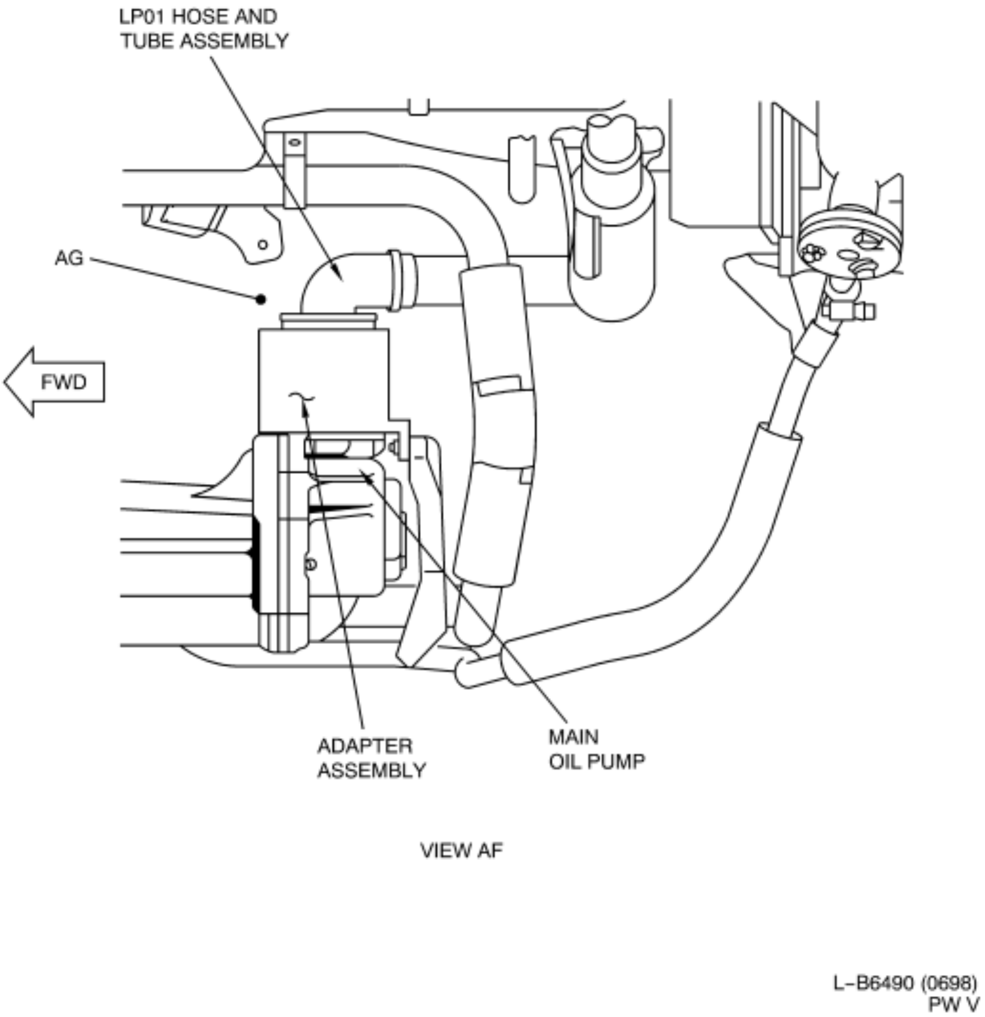
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 17)
(Task 72-00-54-020-004)


CLAMP
FRONT HALF
CLAMP
REAR HALF
BOLT
NUT
LP01
BOLT
BRACKET
VIEW U
L−B2515 (0000)
PW V

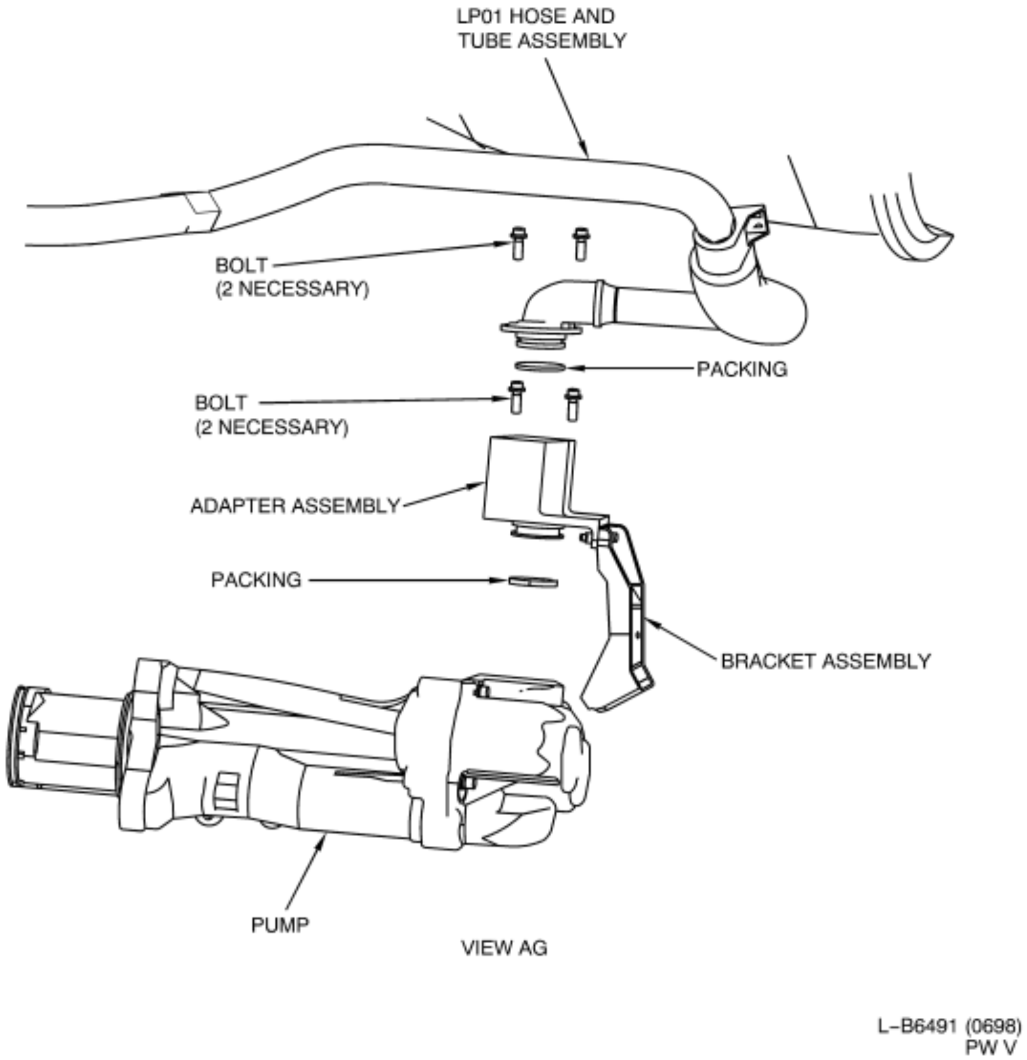
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 302 (Sheet 18)
(Task 72−00−54−020−004)


AF
ENGINE LEFT SIDE VIEW
L-B6489 (0698)
PW V

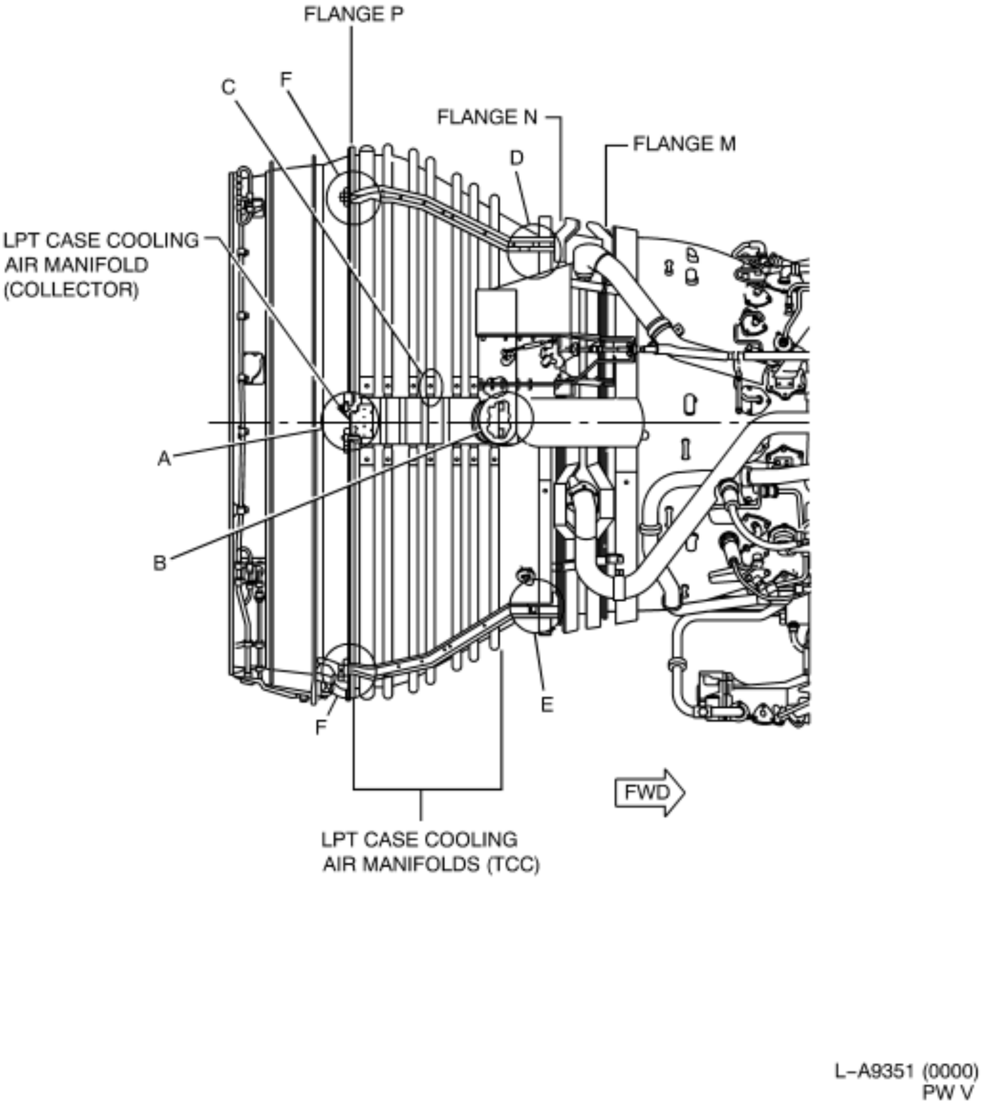
Bottom External Plumbing (Post SB PW4ENG 79-86)
Figure 302 (Sheet 19)
(Task 72-00-54-020-004)


LP01 HOSE AND
TUBE ASSEMBLY
AG
FWD
ADAPTER
ASSEMBLY
MAIN
OIL PUMP
VIEW AF
L-B6490 (0698)
PW V

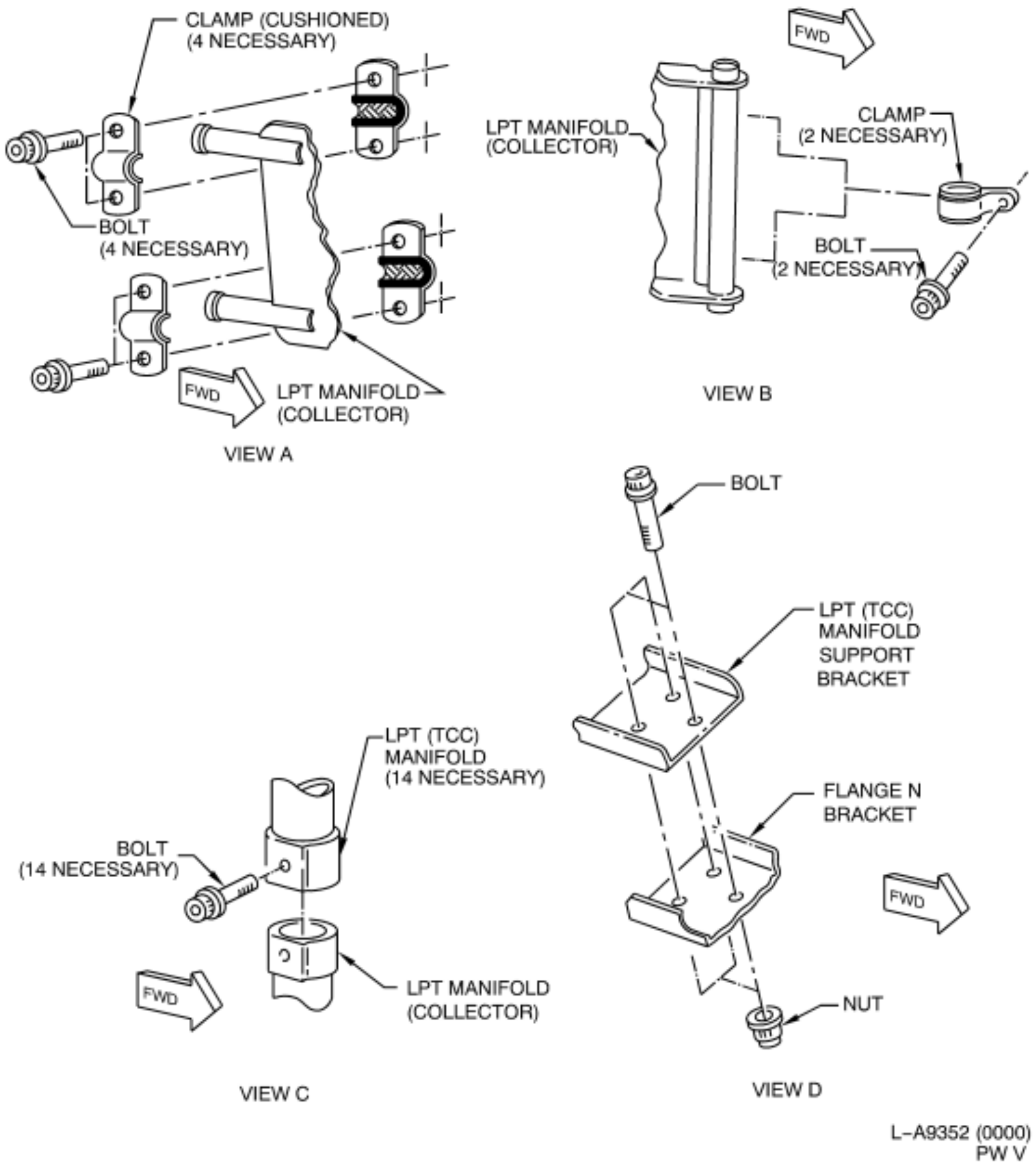
Bottom External Plumbing (Post SB PW4ENG 79-86)
Figure 302 (Sheet 20)
(Task 72-00-54-020-004)


LP01 HOSE AND TUBE ASSEMBLY
BOLT (2 NECESSARY)
PACKING
BOLT (2 NECESSARY)
ADAPTER ASSEMBLY
PACKING
BRACKET ASSEMBLY
PUMP
VIEW AG
L-B6491 (0698)
PW V

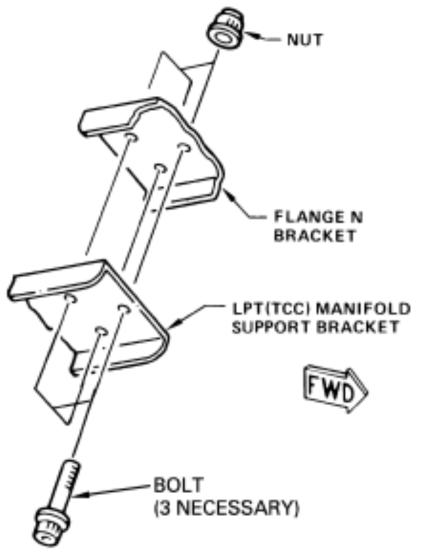
Bottom External Plumbing (Post SB PW4ENG 79-86)
Figure 302 (Sheet 21)
(Task 72-00-54-020-004)


FLANGE P
C
F
FLANGE N
FLANGE M
D
LPT CASE COOLING AIR MANIFOLD (COLLECTOR)
A
B
E
F
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC)
L−A9351 (0000)
PW V

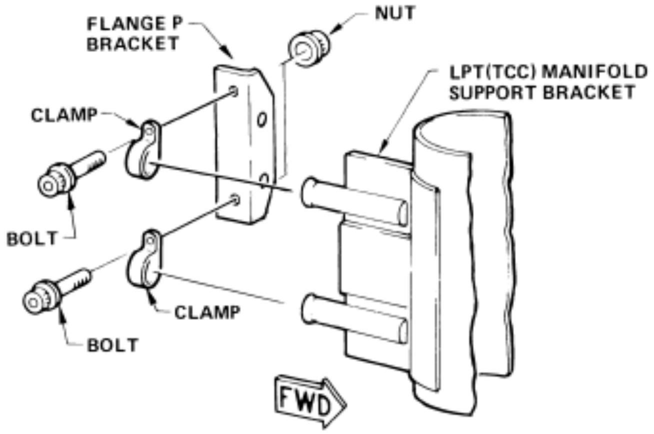
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 303 (Sheet 1)
(Task 72−00−54−020−004)


CLAMP (CUSHIONED)
(4 NECESSARY)
BOLT
(4 NECESSARY)
FWD
LPT MANIFOLD
(COLLECTOR)
VIEW A
FWD
LPT MANIFOLD
(COLLECTOR)
CLAMP
(2 NECESSARY)
BOLT
(2 NECESSARY)
VIEW B
BOLT
LPT (TCC)
MANIFOLD
SUPPORT
BRACKET
FLANGE N
BRACKET
FWD
NUT
VIEW D
LPT (TCC)
MANIFOLD
(14 NECESSARY)
BOLT
(14 NECESSARY)
FWD
LPT MANIFOLD
(COLLECTOR)
VIEW C
L-A9352 (0000)
PW V

Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 303 (Sheet 2)
(Task 72-00-54-020-004)


NUT
FLANGE N BRACKET
LPT(TCC) MANIFOLD SUPPORT BRACKET
FWD
BOLT (3 NECESSARY)

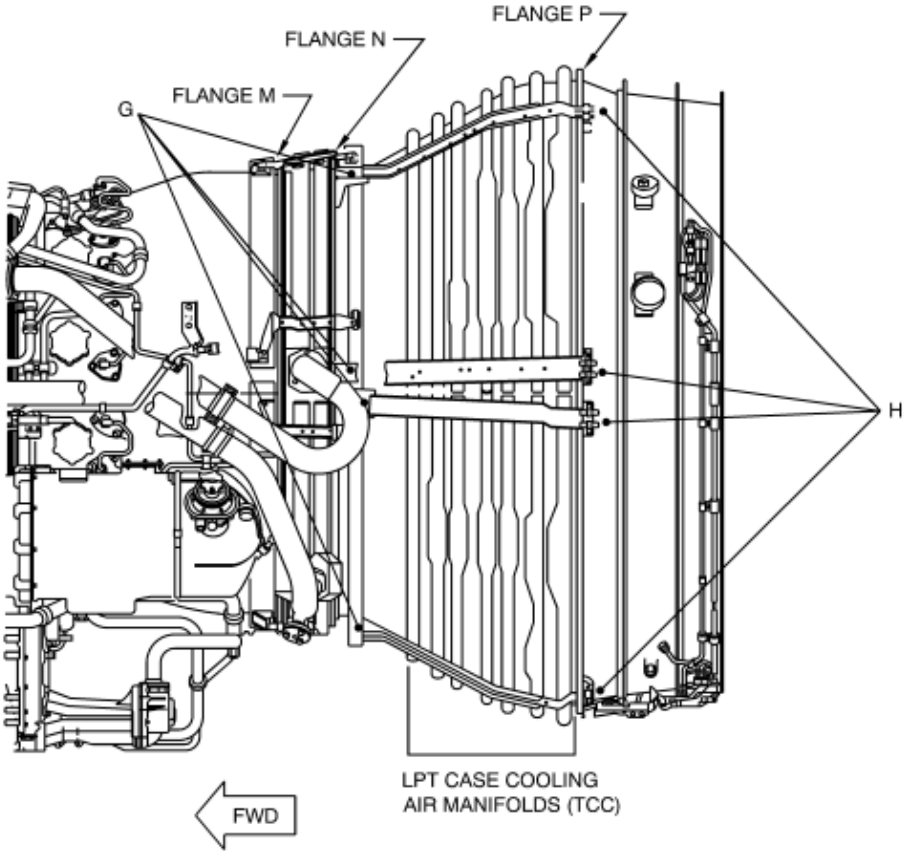
VIEW E


FLANGE P BRACKET
NUT
LPT(TCC) MANIFOLD SUPPORT BRACKET
CLAMP
BOLT
CLAMP
BOLT
FWD

VIEW F
(TYPICAL 2 PLACES)

L-A9353 (0000)

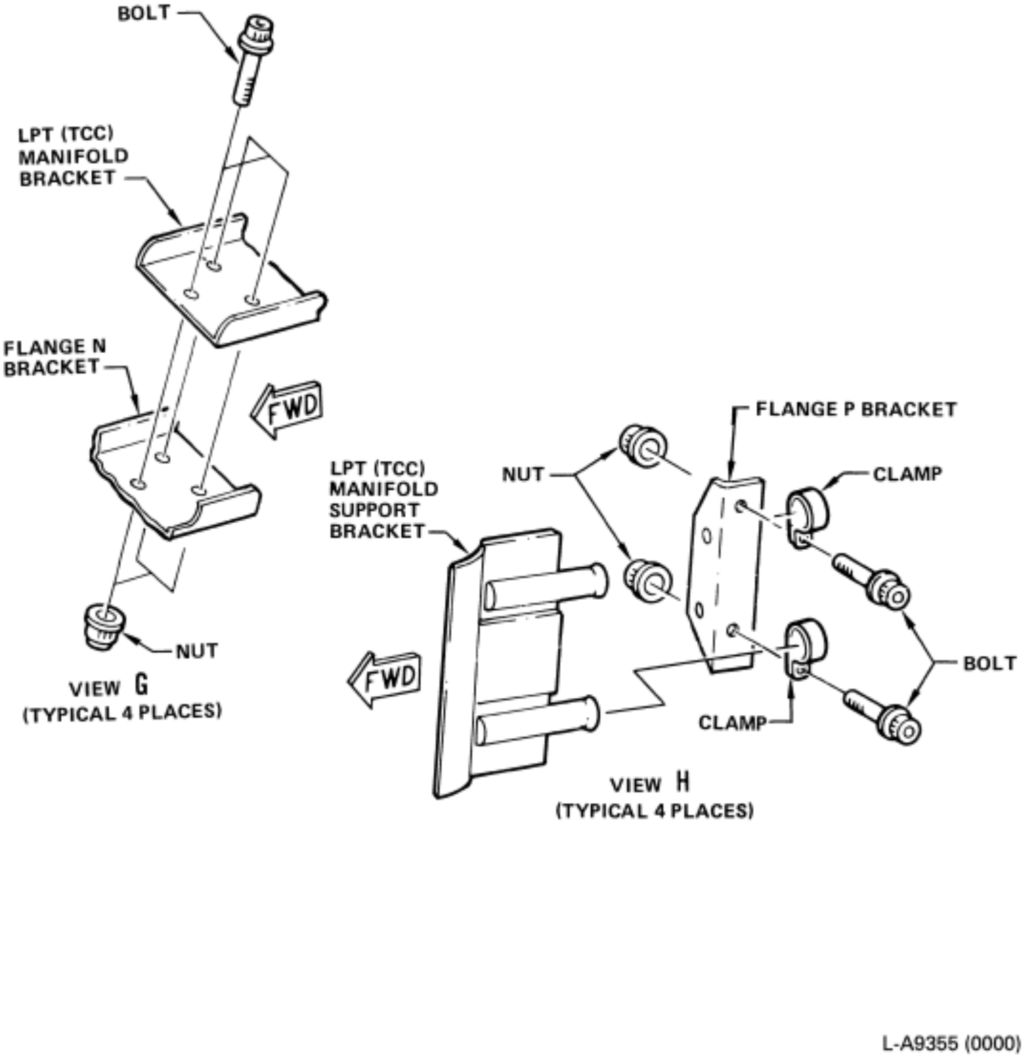
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 303 (Sheet 3)
(Task 72−00−54−020−004)


FLANGE P
FLANGE N
FLANGE M
G
H
LPT CASE COOLING AIR MANIFOLDS (TCC)
FWD

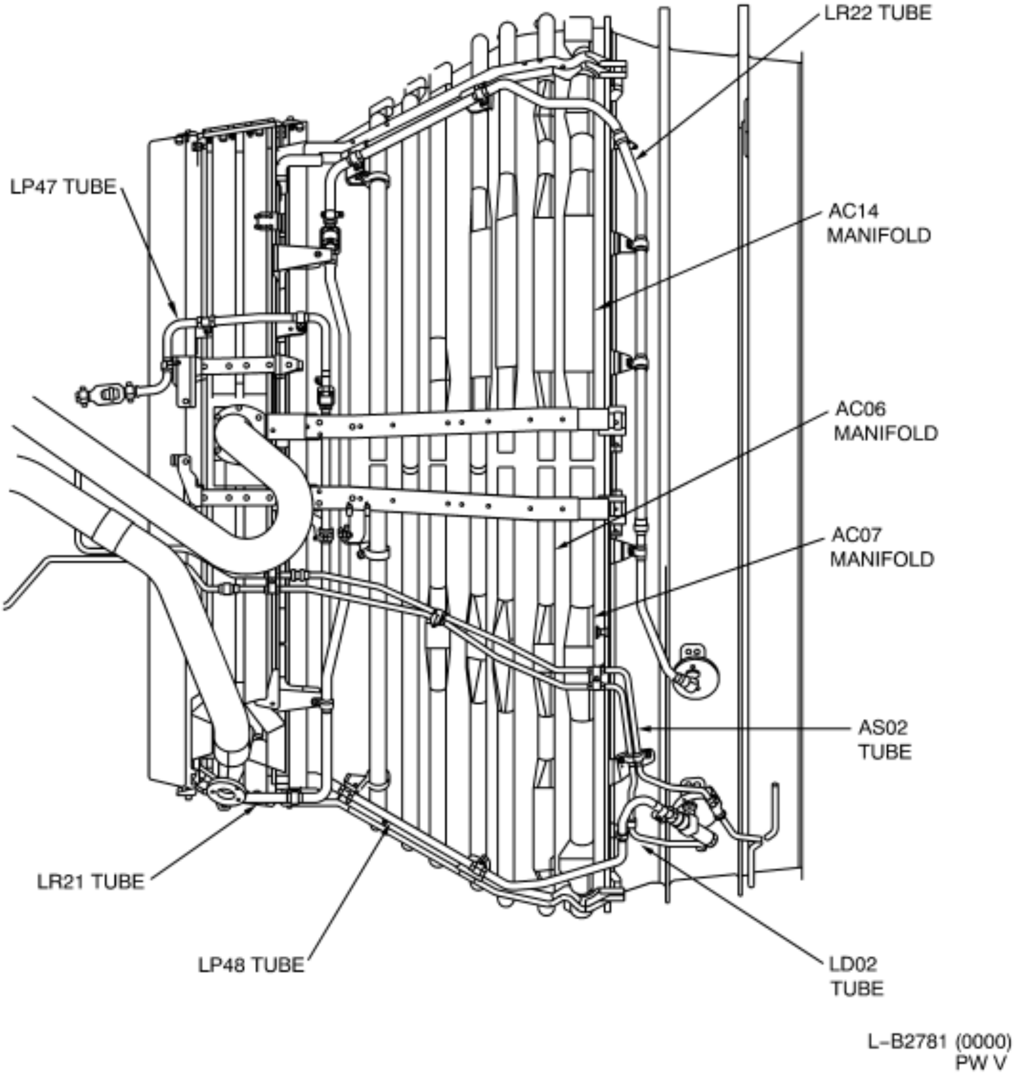
L-A9381 (0000)
PW V

Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 303 (Sheet 4)
(Task 72-00-54-020-004)

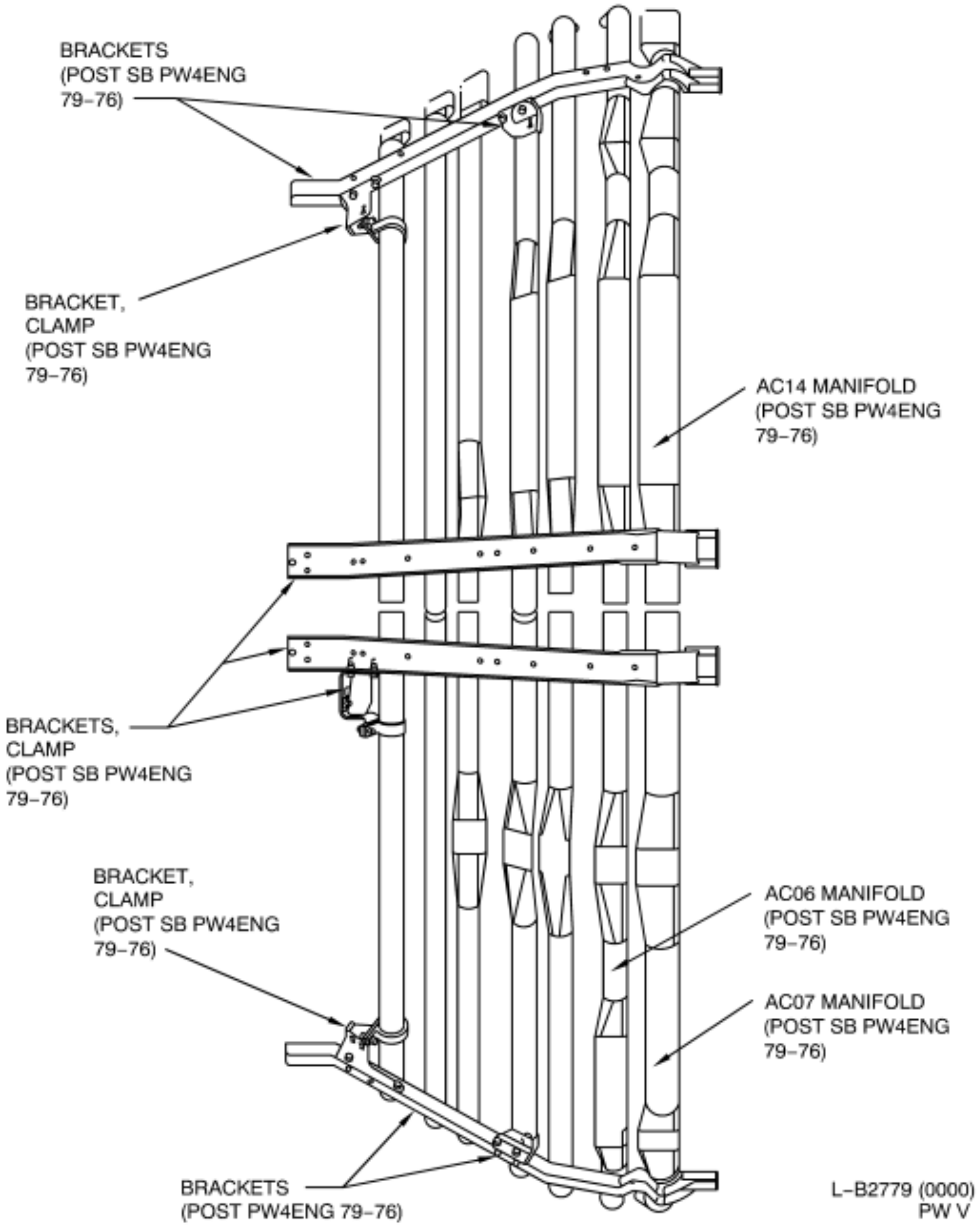
R
R


BOLT
LPT (TCC) MANIFOLD BRACKET
FLANGE N BRACKET
FWD
NUT
VIEW G
(TYPICAL 4 PLACES)
FLANGE P BRACKET
NUT
CLAMP
LPT (TCC) MANIFOLD SUPPORT BRACKET
BOLT
FWD
CLAMP
VIEW H
(TYPICAL 4 PLACES)
L-A9355 (0000)

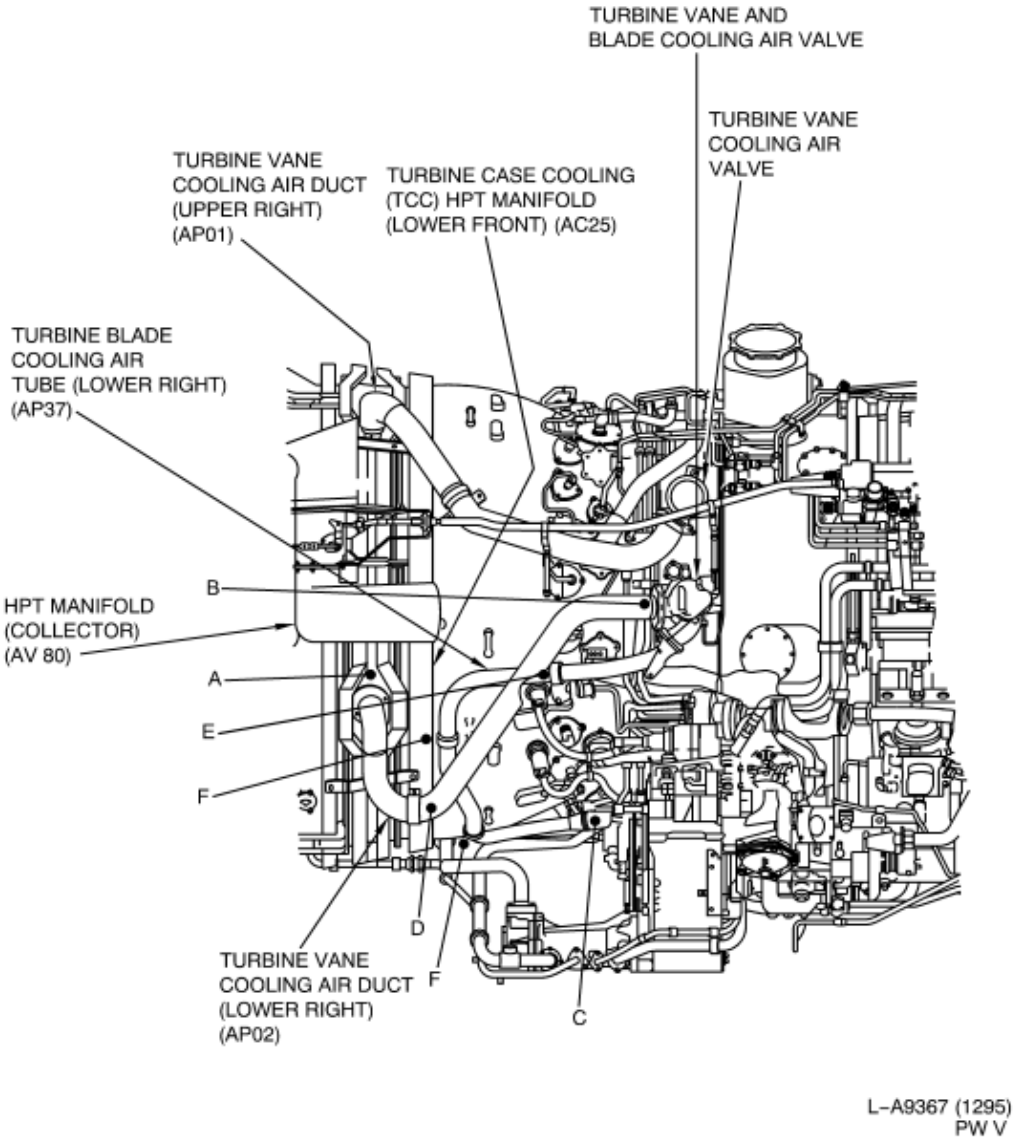
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 303 (Sheet 5)
(Task 72-00-54-020-004)


LR22 TUBE
LP47 TUBE
AC14 MANIFOLD
AC06 MANIFOLD
AC07 MANIFOLD
AS02 TUBE
LR21 TUBE
LP48 TUBE
LD02 TUBE
L-B2781 (0000)
PW V

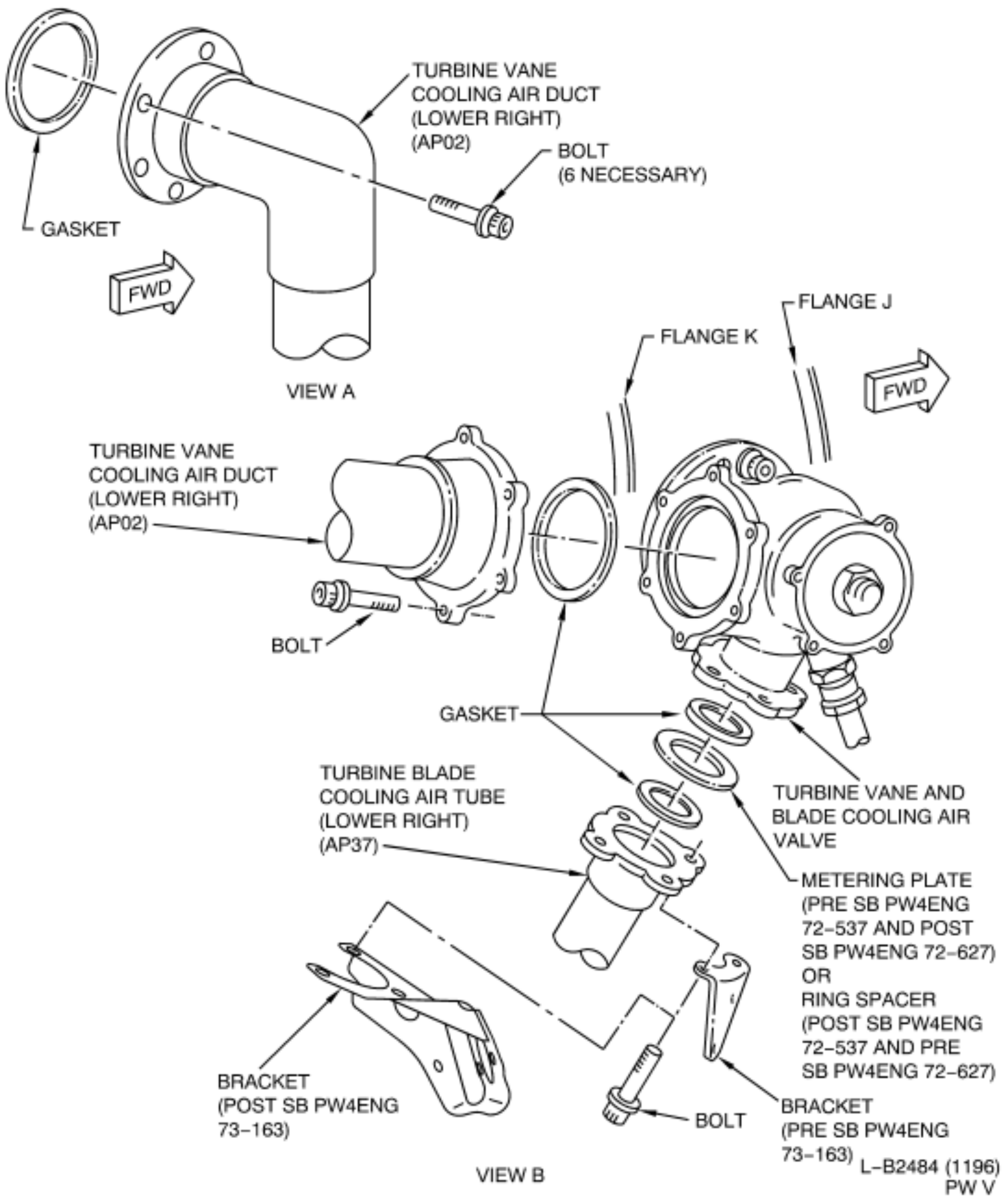
LPT Turbine Case Cooling Manifolds Clipping (Post SB PW4ENG 79-76)
Figure 303 (Sheet 6)
(Task 72-00-54-020-004)


BRACKETS
(POST SB PW4ENG
79-76)
BRACKET,
CLAMP
(POST SB PW4ENG
79-76)
AC14 MANIFOLD
(POST SB PW4ENG
79-76)
BRACKETS,
CLAMP
(POST SB PW4ENG
79-76)
BRACKET,
CLAMP
(POST SB PW4ENG
79-76)
AC06 MANIFOLD
(POST SB PW4ENG
79-76)
AC07 MANIFOLD
(POST SB PW4ENG
79-76)
BRACKETS
(POST PW4ENG 79-76)
L-B2779 (0000)
PW V

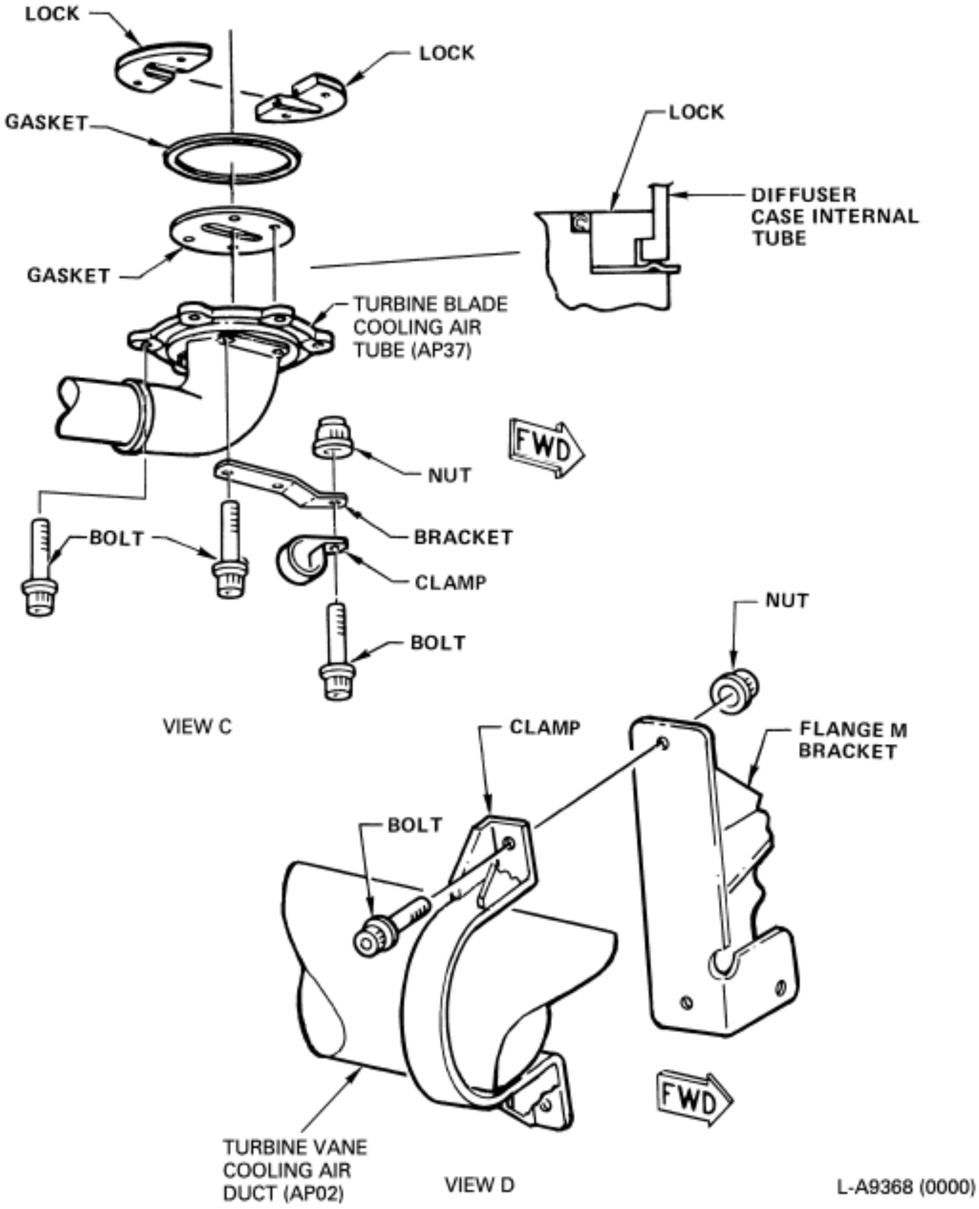
LPT Turbine Case Cooling Manifolds Clipping (Post SB PW4ENG 79-76)
Figure 303 (Sheet 7)
(Task 72-00-54-020-004)


TURBINE VANE AND
BLADE COOLING AIR VALVE
TURBINE VANE
COOLING AIR
VALVE
TURBINE VANE
COOLING AIR DUCT
(UPPER RIGHT)
(AP01)
TURBINE CASE COOLING
(TCC) HPT MANIFOLD
(LOWER FRONT) (AC25)
TURBINE BLADE
COOLING AIR
TUBE (LOWER RIGHT)
(AP37)
B
HPT MANIFOLD
(COLLECTOR)
(AV 80)
A
E
F
D
TURBINE VANE
COOLING AIR DUCT
(LOWER RIGHT)
(AP02)
F
C
L-A9367 (1295)
PW V

High Pressure Turbine Cooling Air Manifolds
Figure 304 (Sheet 1)
(Task 72-00-54-020-004)

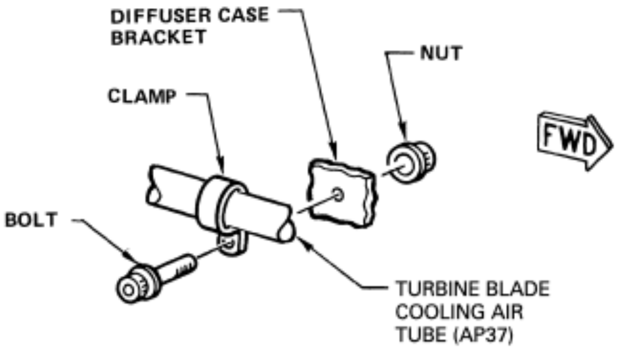

TURBINE VANE COOLING AIR DUCT (LOWER RIGHT) (AP02)
BOLT (6 NECESSARY)
GASKET
FWD
VIEW A
FLANGE J
FLANGE K
FWD
TURBINE VANE COOLING AIR DUCT (LOWER RIGHT) (AP02)
BOLT
GASKET
TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT) (AP37)
TURBINE VANE AND BLADE COOLING AIR VALVE
METERING PLATE (PRE SB PW4ENG 72-537 AND POST SB PW4ENG 72-627) OR RING SPACER (POST SB PW4ENG 72-537 AND PRE SB PW4ENG 72-627)
BRACKET (POST SB PW4ENG 73-163)
BOLT
BRACKET (PRE SB PW4ENG 73-163)
VIEW B
L-B2484 (1196)
PW V

High Pressure Turbine Cooling Air Manifolds
Figure 304 (Sheet 2)
(Task 72-00-54-020-004)

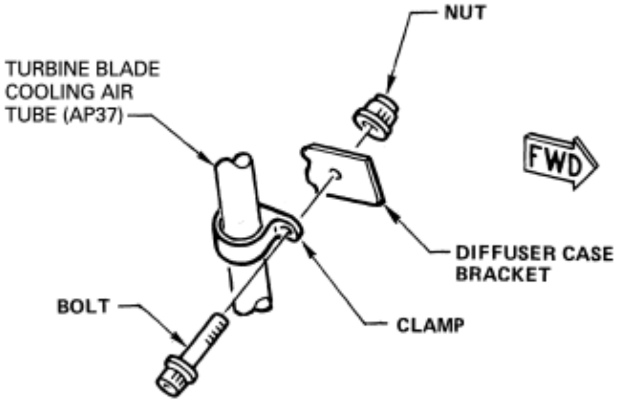

LOCK
LOCK
GASKET
LOCK
DIFFUSER CASE INTERNAL TUBE
GASKET
TURBINE BLADE COOLING AIR TUBE (AP37)
NUT
FWD
BOLT
BRACKET
CLAMP
BOLT
NUT
VIEW C
CLAMP
FLANGE M BRACKET
BOLT
FWD
TURBINE VANE COOLING AIR DUCT (AP02)
VIEW D
L-A9368 (0000)

High Pressure Turbine Cooling Air Manifolds
Figure 304 (Sheet 3)
(Task 72-00-54-020-004)

R
R


DIFFUSER CASE BRACKET
NUT
CLAMP
FWD
BOLT
TURBINE BLADE COOLING AIR TUBE (AP37)

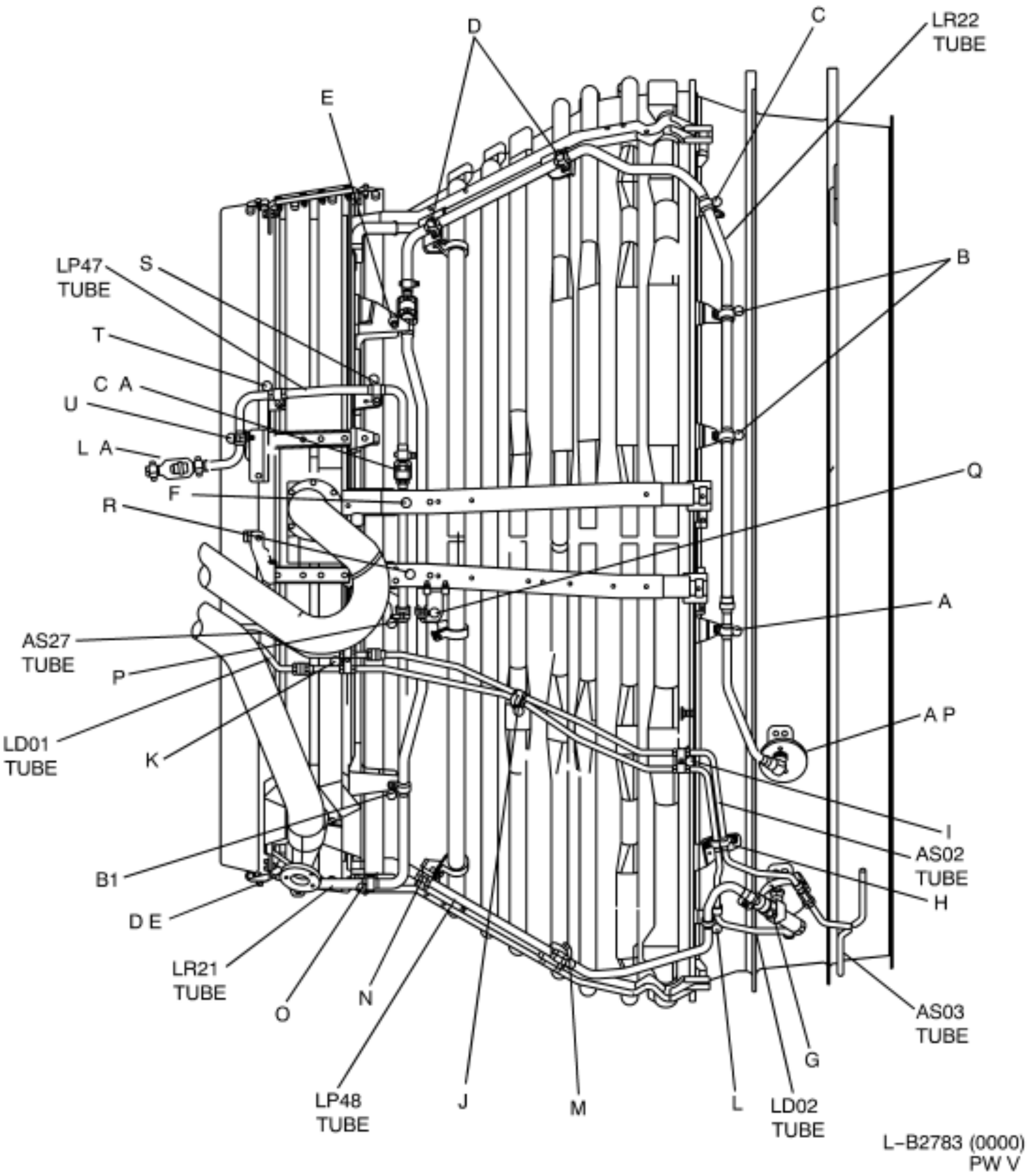
VIEW E


NUT
TURBINE BLADE COOLING AIR TUBE (AP37)
FWD
DIFFUSER CASE BRACKET
BOLT
CLAMP

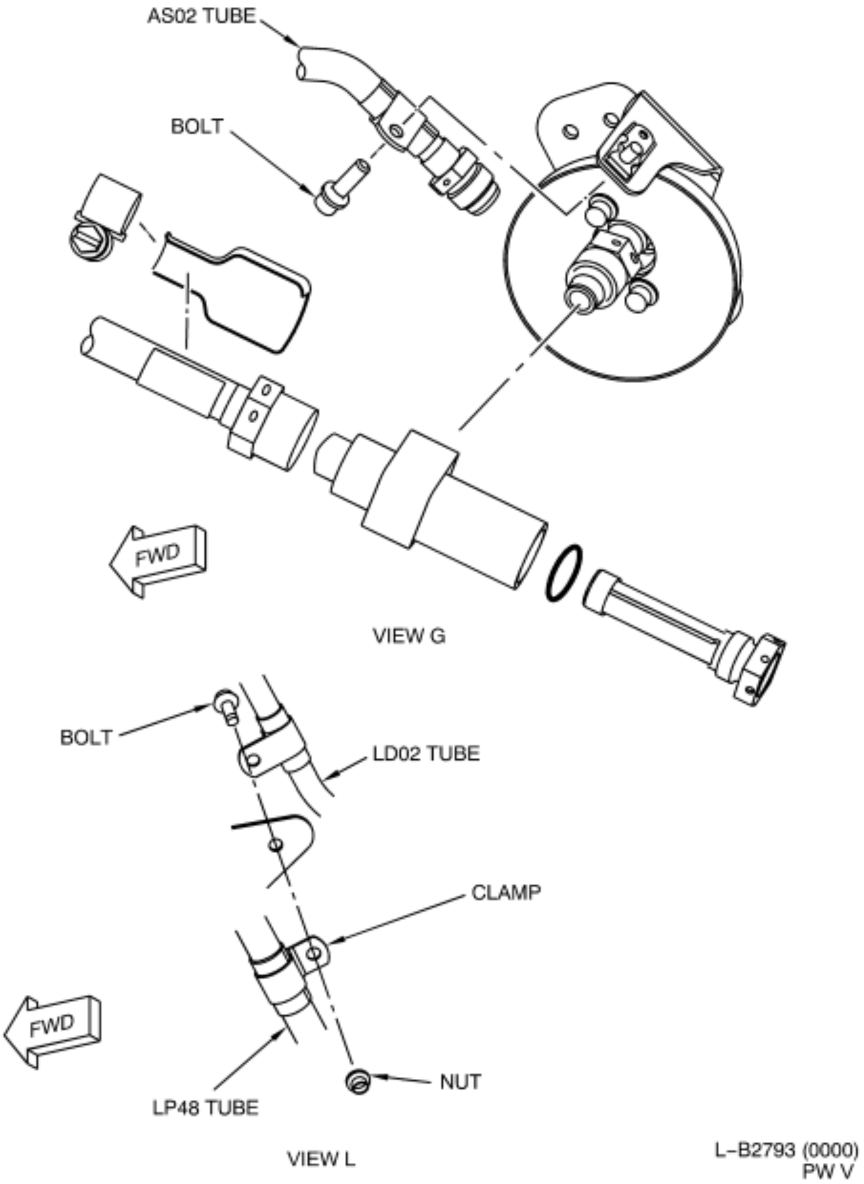
VIEW F
(2 PLACES)

L-A9369 (0000)

High Pressure Turbine Cooling Air Manifolds
Figure 304 (Sheet 4)
(Task 72-00-54-020-004)

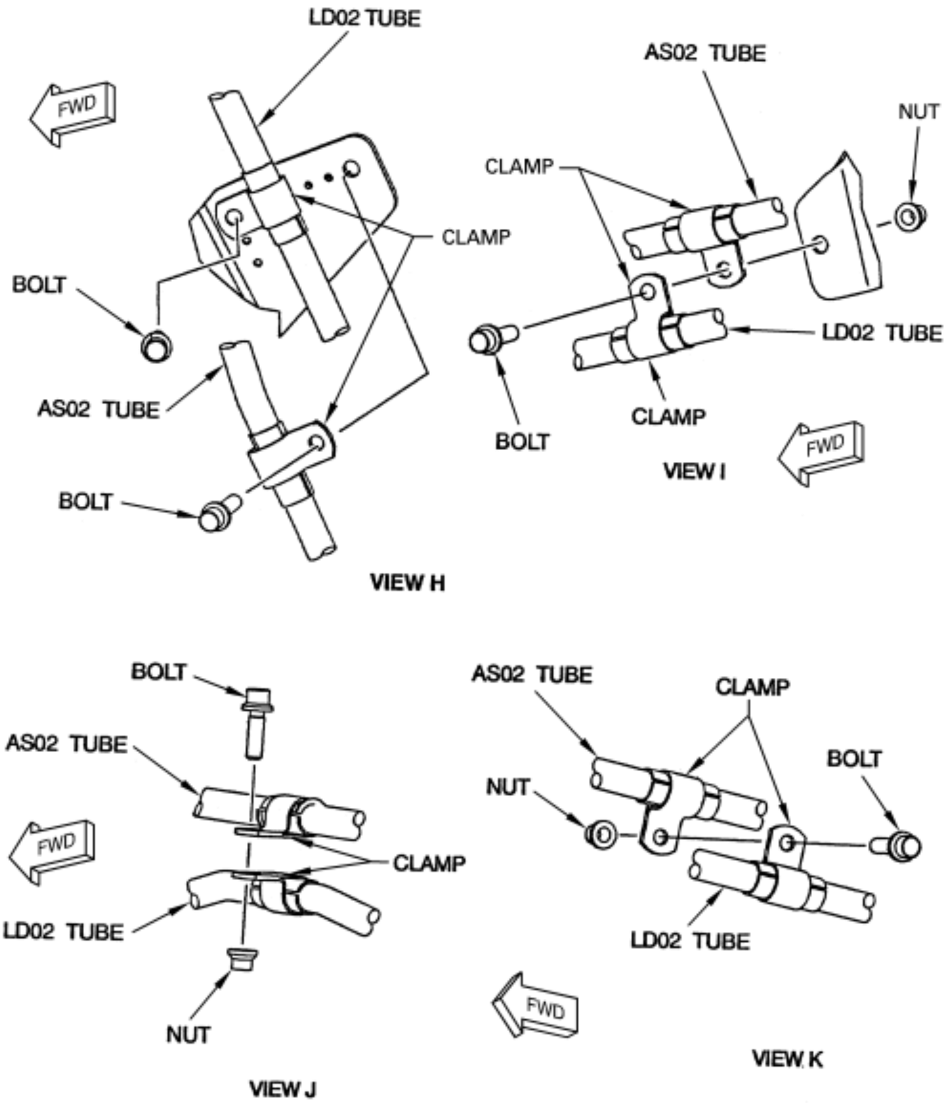

D
C
LR22 TUBE
E
B
LP47 TUBE
S
T
C A
U
L A
F
R
Q
A
AS27 TUBE
P
LD01 TUBE
K
A P
I
AS02 TUBE
H
B1
D E
LR21 TUBE
O
N
AS03 TUBE
G
LP48 TUBE
J
M
L
LD02 TUBE
L-B2783 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 305 (Sheet 1)
(Task 72-00-54-020-004)


AS02 TUBE
BOLT
FWD
VIEW G
BOLT
LD02 TUBE
CLAMP
FWD
NUT
LP48 TUBE
VIEW L
L-B2793 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 305 (Sheet 2)
(Task 72-00-54-020-004)

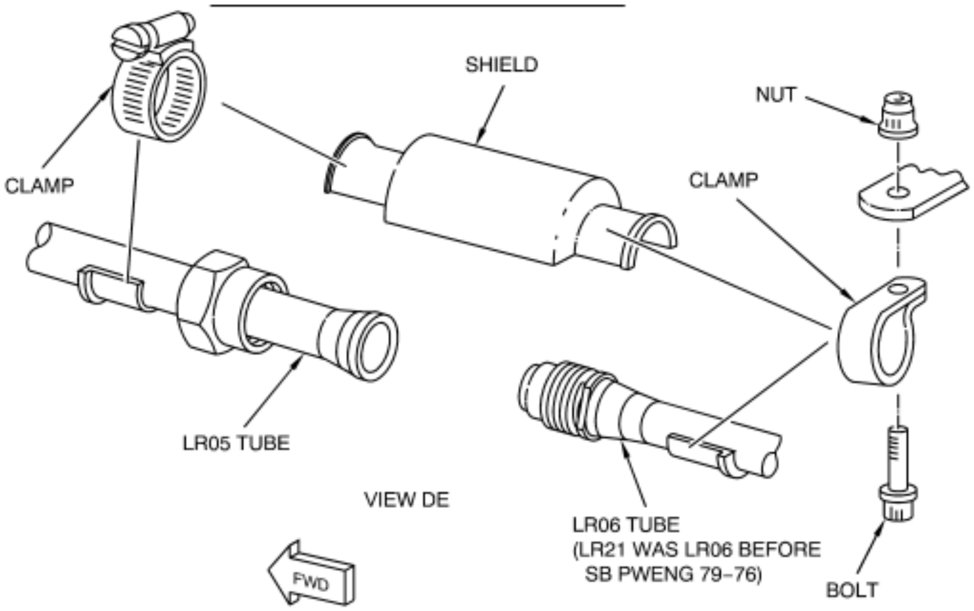
R
R


LD02 TUBE
FWD
CLAMP
BOLT
AS02 TUBE
BOLT
VIEW H
AS02 TUBE
NUT
CLAMP
LD02 TUBE
BOLT
CLAMP
FWD
VIEW I
BOLT
AS02 TUBE
FWD
CLAMP
LD02 TUBE
NUT
VIEW J
AS02 TUBE
CLAMP
NUT
BOLT
LD02 TUBE
FWD
VIEW K

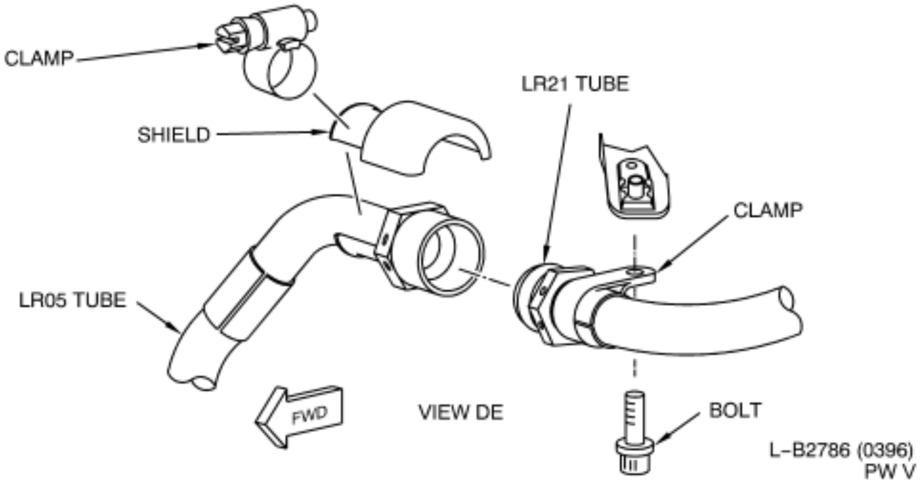
L-B2794 (0000)

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 305 (Sheet 3)
(Task 72-00-54-020-004)

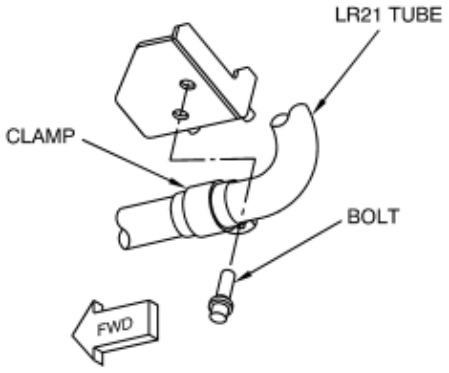
LR05 AND LR21 INSTALLATION BEFORE SERVICE BULLETIN PW4ENG 79-76


SHIELD
NUT
CLAMP
CLAMP
LR05 TUBE
VIEW DE
LR06 TUBE
(LR21 WAS LR06 BEFORE
SB PWENG 79-76)
FWD
BOLT

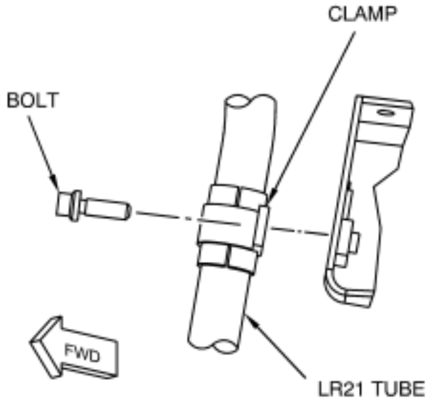
LR05 AND LR21 INSTALLATION AFTER SERVICE BULLETIN PW4ENG 79-76


CLAMP
LR21 TUBE
SHIELD
CLAMP
LR05 TUBE
FWD
VIEW DE
BOLT
L-B2786 (0396)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 305 (Sheet 4)
(Task 72−00−54−020−004)


LR21 TUBE
CLAMP
BOLT
FWD

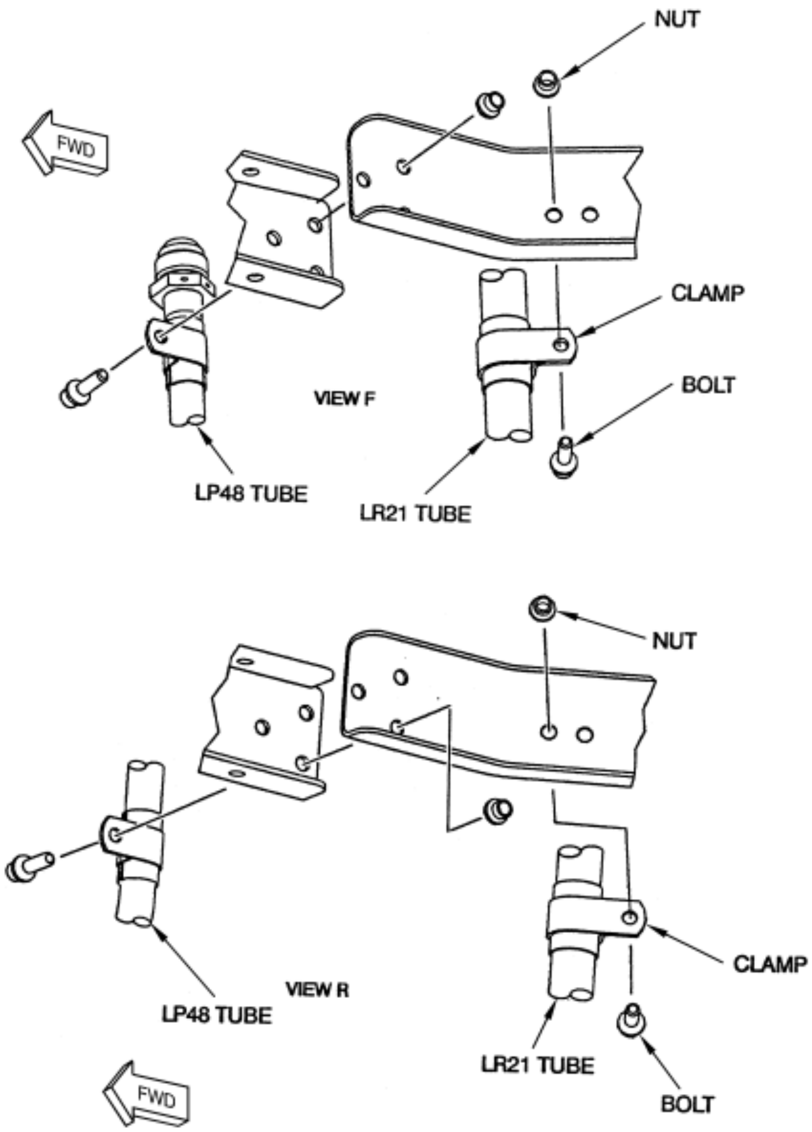
VIEW O


CLAMP
BOLT
FWD
LR21 TUBE

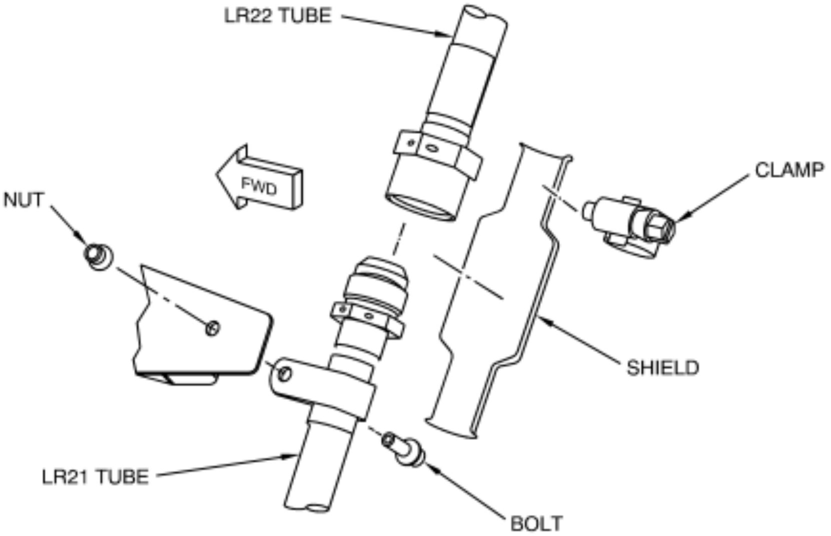
VIEW Q

L-B2787 (0000)
PW V

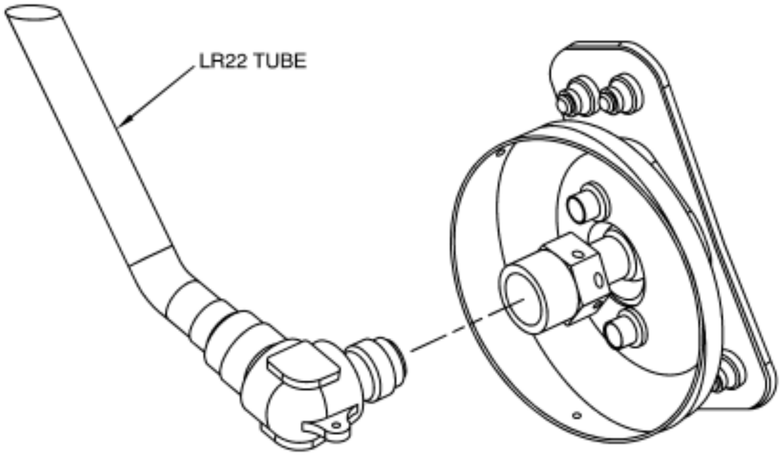
External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 305 (Sheet 5)
(Task 72-00-54-020-004)


NUT
FWD
CLAMP
BOLT
VIEW F
LP48 TUBE
LR21 TUBE
NUT
CLAMP
VIEW R
LP48 TUBE
LR21 TUBE
BOLT
FWD
L-B2788 (0000)

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 305 (Sheet 6)
(Task 72-00-54-020-004)


LR22 TUBE
CLAMP
FWD
NUT
SHIELD
LR21 TUBE
BOLT

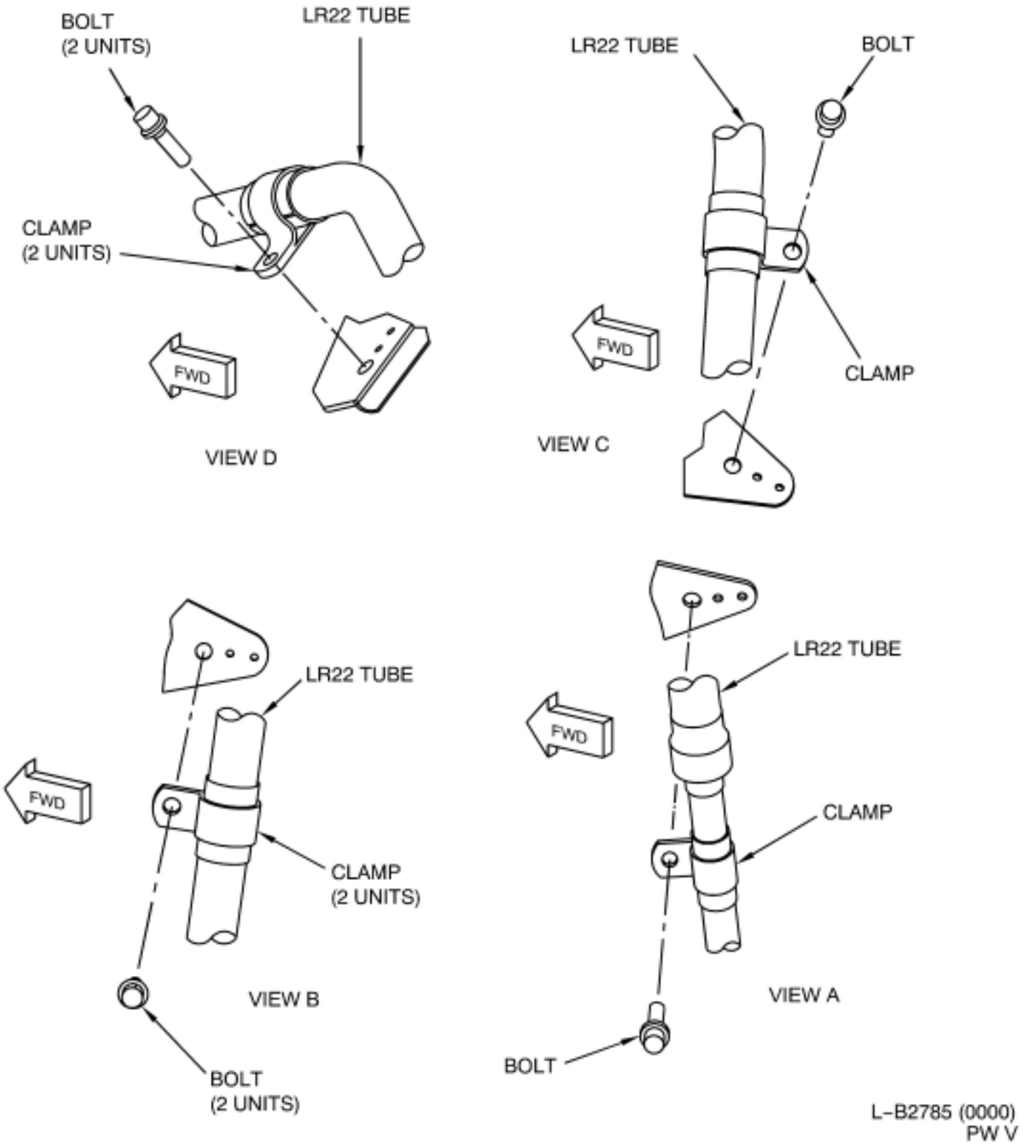
VIEW E



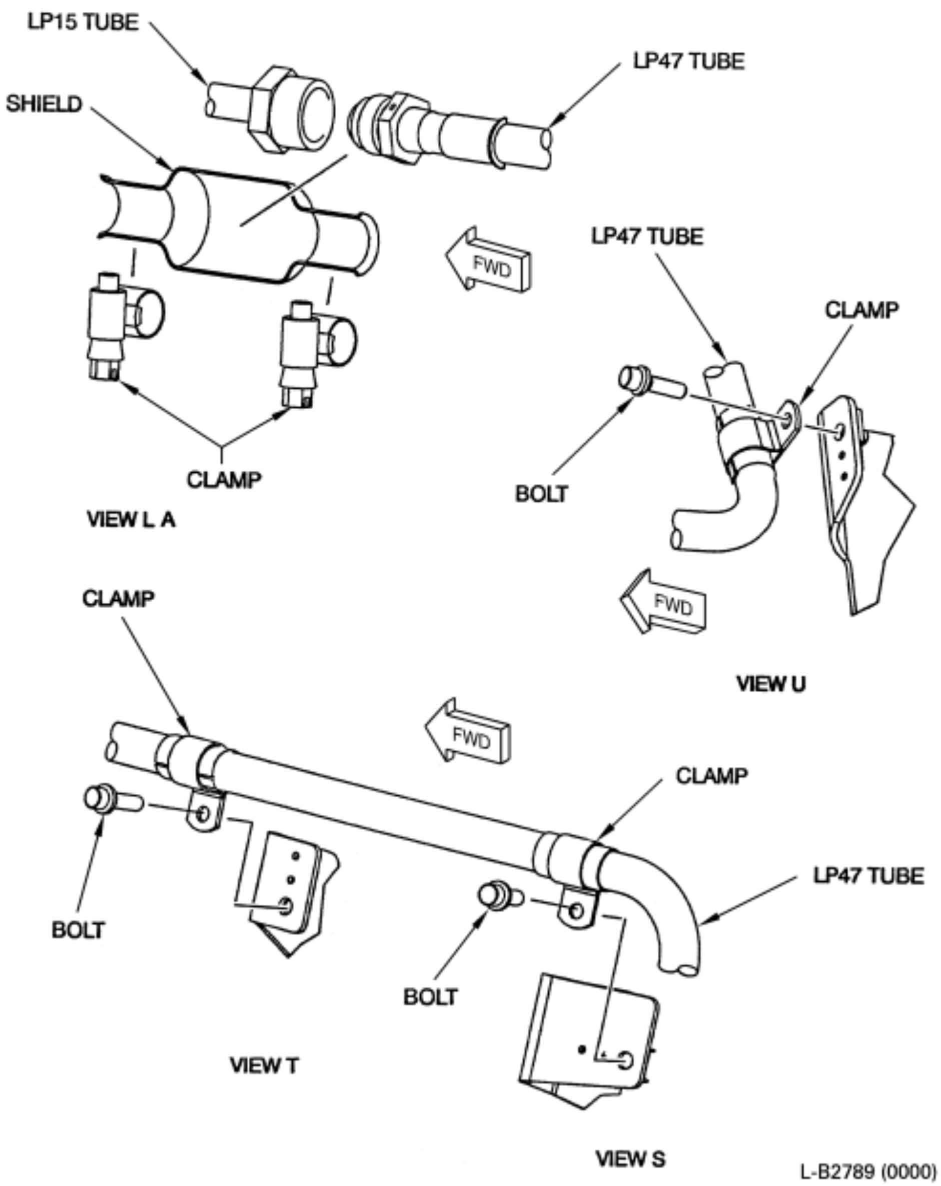
VIEW A P

L-B2784 (0000)
PW V

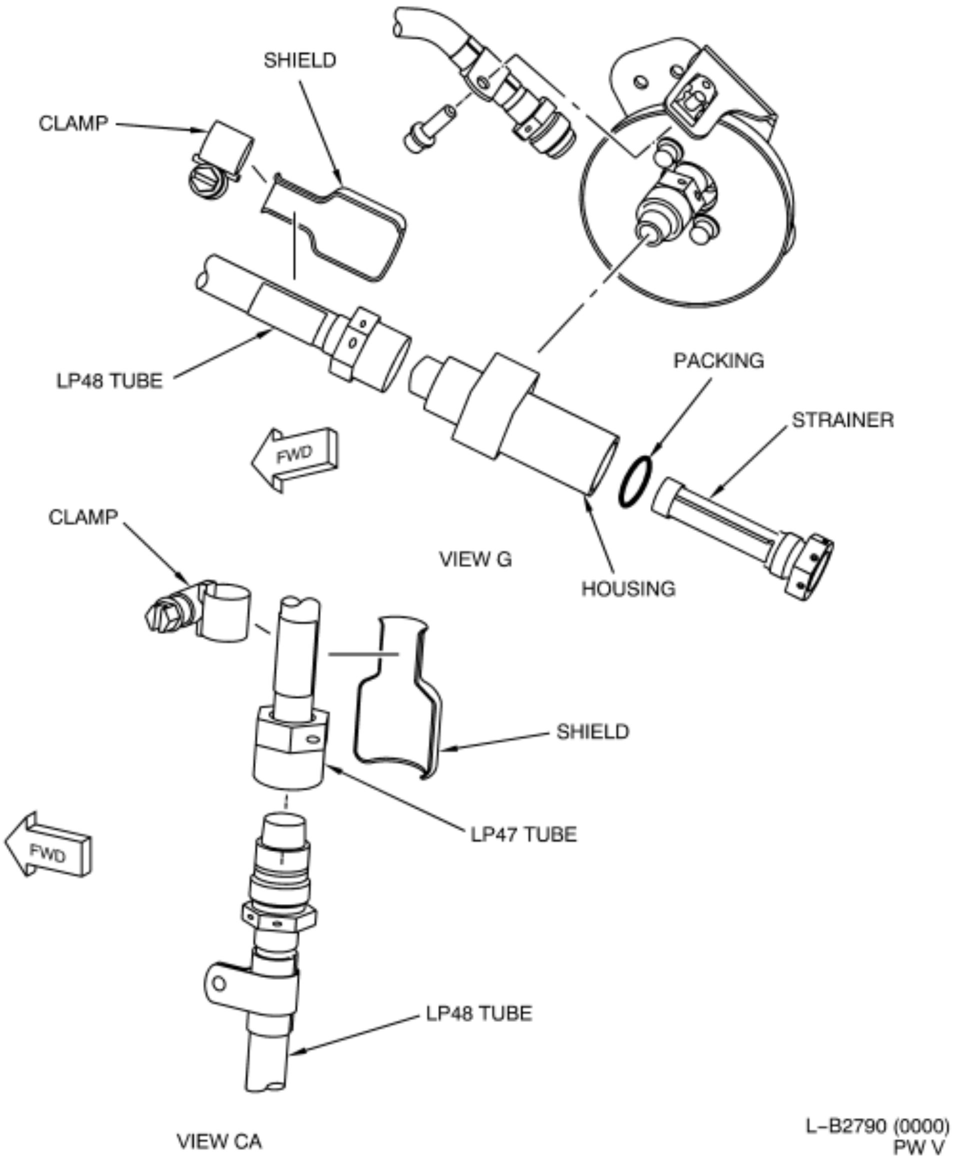
External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 305 (Sheet 7)
(Task 72-00-54-020-004)


BOLT
(2 UNITS)
LR22 TUBE
CLAMP
(2 UNITS)
FWD
VIEW D
LR22 TUBE
BOLT
FWD
CLAMP
VIEW C
LR22 TUBE
FWD
CLAMP
(2 UNITS)
VIEW B
BOLT
(2 UNITS)
LR22 TUBE
FWD
CLAMP
VIEW A
BOLT
L-B2785 (0000)
PW V

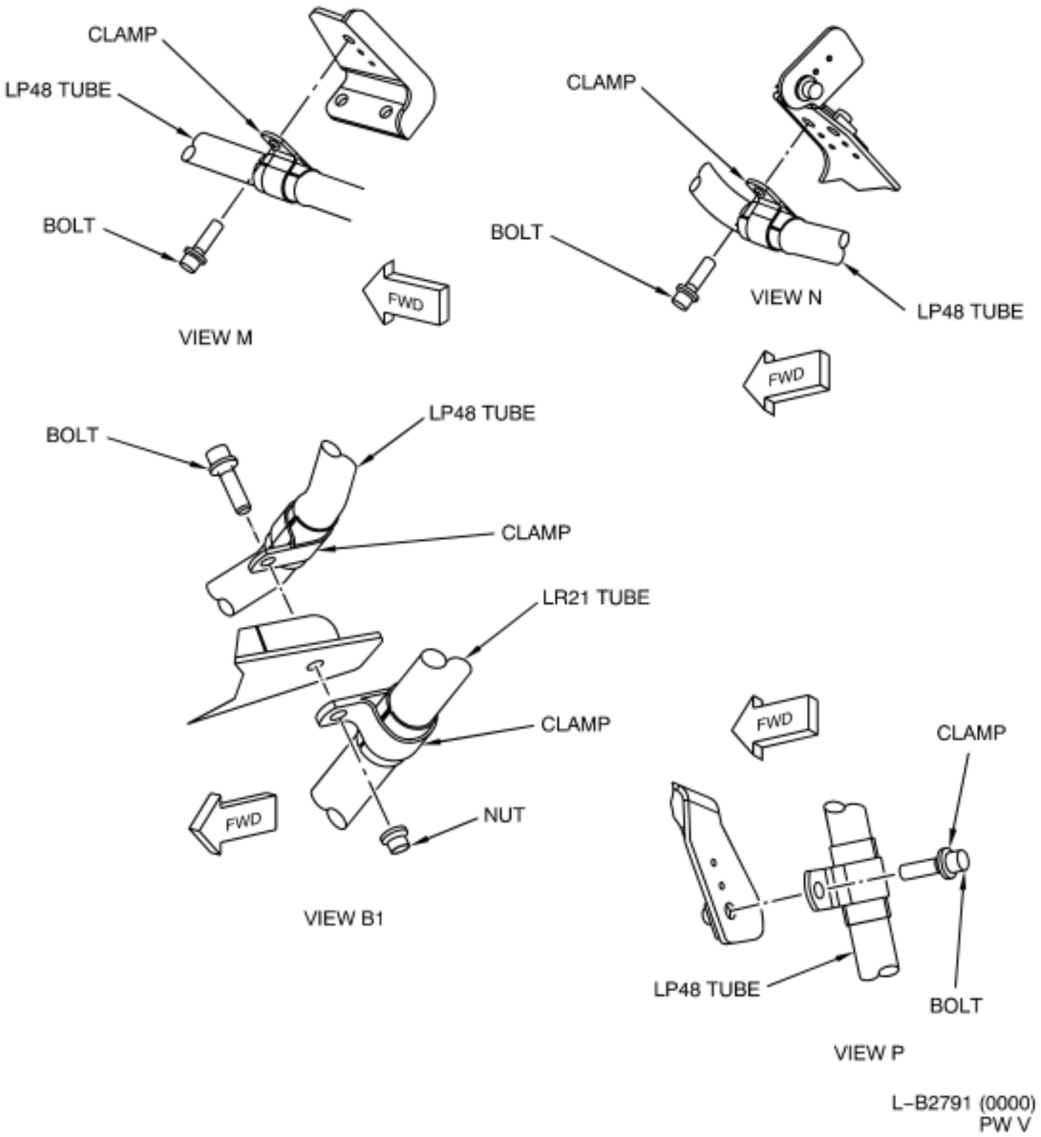
External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 305 (Sheet 8)
(Task 72-00-54-020-004)


LP15 TUBE
SHIELD
LP47 TUBE
FWD
LP47 TUBE
CLAMP
CLAMP
BOLT
VIEW L A
CLAMP
FWD
VIEW U
FWD
CLAMP
LP47 TUBE
BOLT
BOLT
VIEW T
VIEW S
L-B2789 (0000)

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 305 (Sheet 9)
(Task 72-00-54-020-004)


SHIELD
CLAMP
LP48 TUBE
FWD
PACKING
STRAINER
CLAMP
VIEW G
HOUSING
SHIELD
LP47 TUBE
FWD
LP48 TUBE
VIEW CA
L-B2790 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 305 (Sheet 10)
(Task 72-00-54-020-004)


CLAMP
LP48 TUBE
BOLT
FWD
VIEW M
CLAMP
BOLT
VIEW N
LP48 TUBE
FWD
BOLT
LP48 TUBE
CLAMP
LR21 TUBE
CLAMP
FWD
NUT
VIEW B1
FWD
CLAMP
LP48 TUBE
BOLT
VIEW P
L-B2791 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 305 (Sheet 11)
(Task 72-00-54-020-004)

Previous Pageblock Return to Previous Menu Next Pageblock

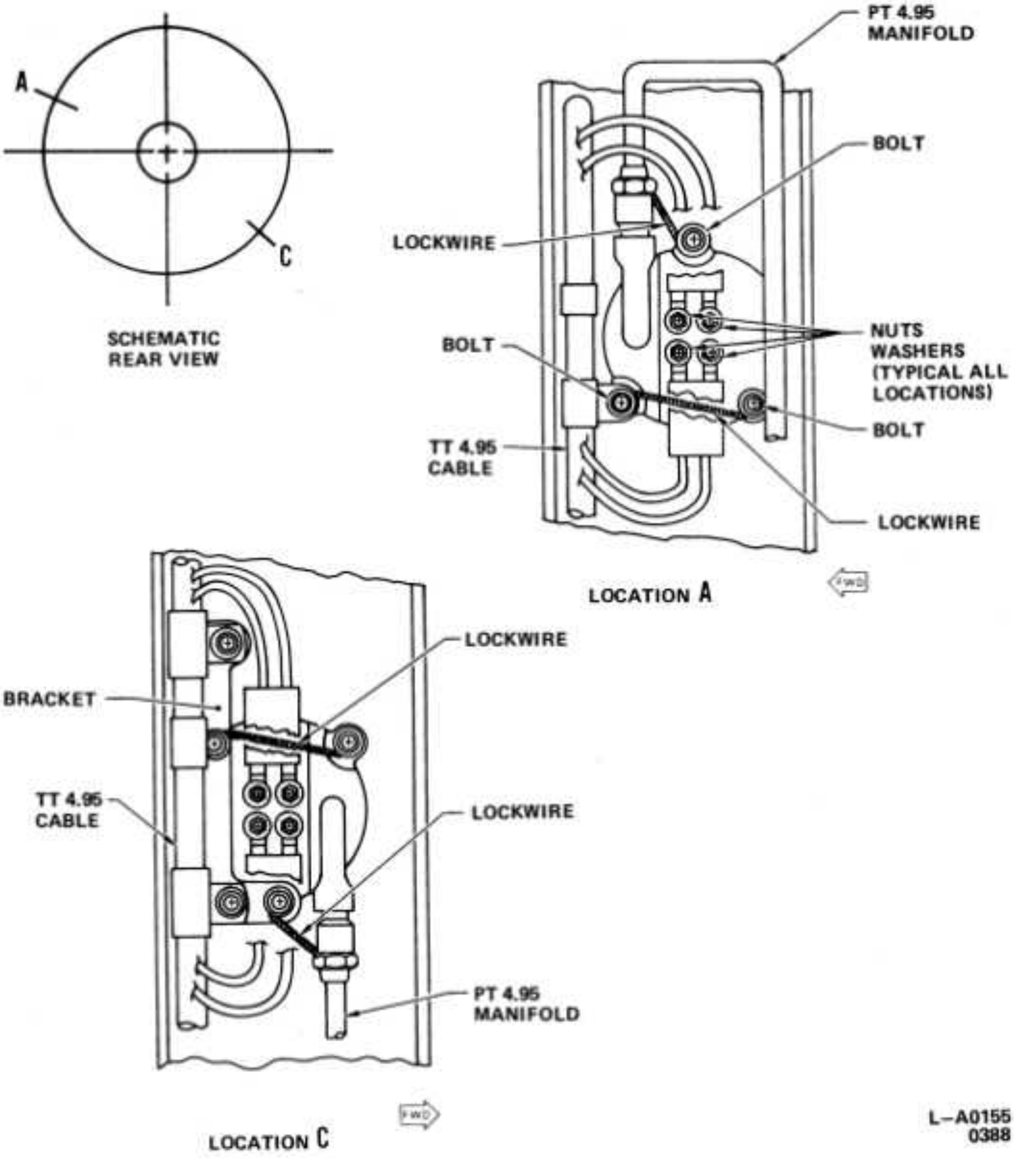
ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−03

Task 72−00−54−050−001:

1. Remove The (PT4.95) Average Pressure And Temperature Probes
    - A. Equipment And Materials Required − None
    - B. Procedure

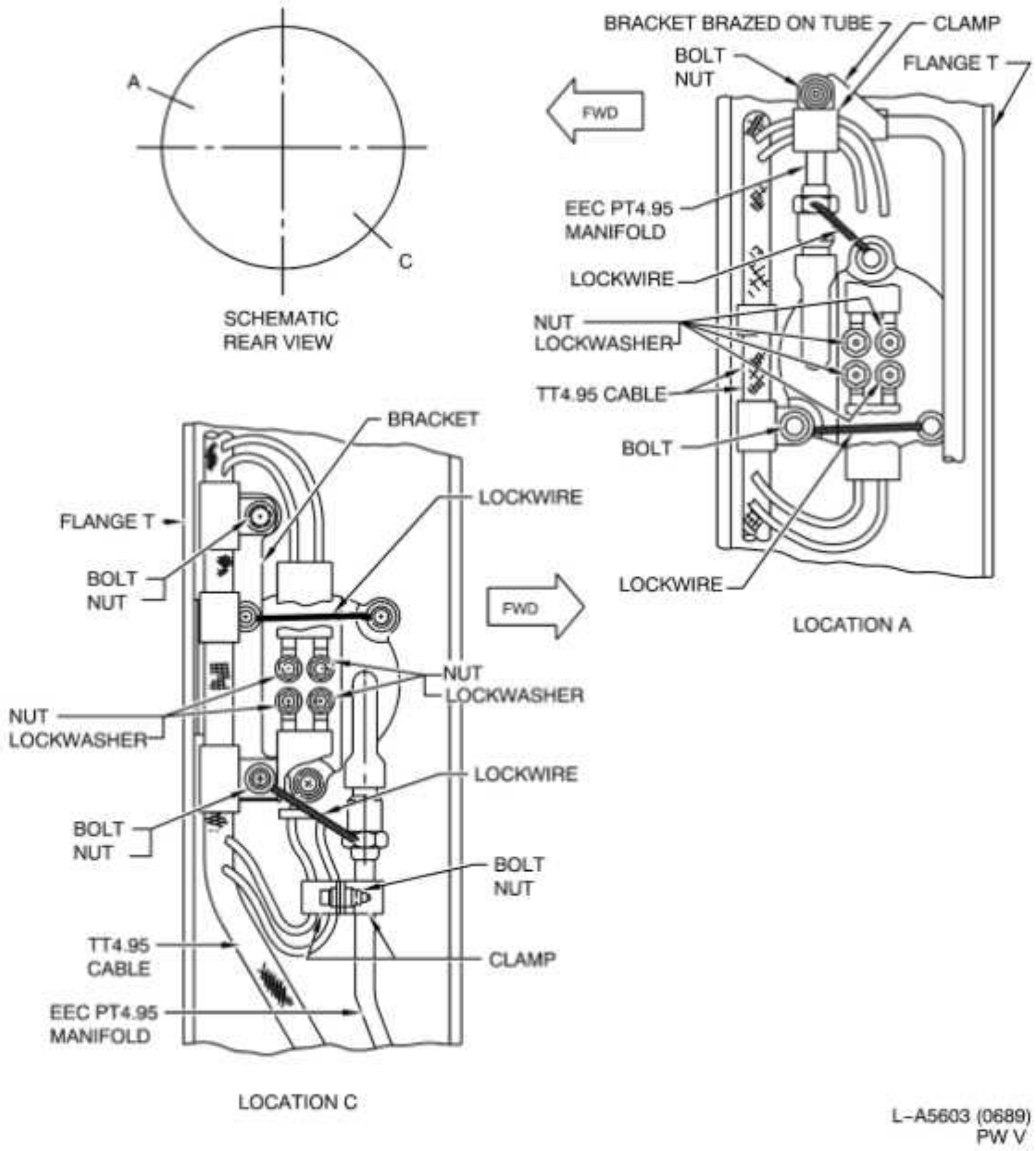
      See Figure 301.
        - (1) Remove each (PT4.95) average pressure and temperature probe from the exhaust case as follows.
            - (a) Remove the four nuts, lockwashers, and TT4.95 cable ends from the probe studs.
            - (b) Remove the lockwire and disconnect the EEC PT4.95 manifold (AS33) or tube (AS34) from the probe.
            - (c) Remove the lockwire and the two bolts that attach the TT4.95 thermocouple to the probe. Remove the thermocouple. Remove the remaining bolt and the probe.

              NOTE: Remove the adjacent PT4.95 manifold and TT4.95 cable clamp bolts as necessary for the probe removal.
            - (d) Install the covers.


A
C
SCHEMATIC REAR VIEW
PT 4.95 MANIFOLD
BOLT
LOCKWIRE
NUTS
WASHERS
(TYPICAL ALL LOCATIONS)
BOLT
BOLT
TT 4.95 CABLE
LOCKWIRE
LOCATION A
FWD
LOCKWIRE
BRACKET
TT 4.95 CABLE
LOCKWIRE
PT 4.95 MANIFOLD
LOCATION C
FWD
L-A0155
0388

Average Pressure And Temperature Probes
(Pre SB PW4ENG 72-134)
Figure 301 (Sheet 1)
(Task 72-00-54-050-001)

ENGINE GENERAL - TURBINE EXHAUST CASE - REMOVAL-03


A
C
SCHEMATIC
REAR VIEW
FWD
BRACKET BRAZED ON TUBE
CLAMP
BOLT
NUT
FLANGE T
EEC PT4.95
MANIFOLD
LOCKWIRE
NUT
LOCKWASHER
TT4.95 CABLE
BOLT
LOCKWIRE
LOCATION A
BRACKET
FLANGE T
LOCKWIRE
BOLT
NUT
FWD
NUT
LOCKWASHER
NUT
LOCKWASHER
LOCKWIRE
BOLT
NUT
BOLT
NUT
TT4.95
CABLE
CLAMP
EEC PT4.95
MANIFOLD
LOCATION C
L-A5603 (0689)
PW V

Average Pressure And Temperature Probes
(Post SB PW4ENG 72-134)
Figure 301 (Sheet 2)
(Task 72-00-54-050-001)

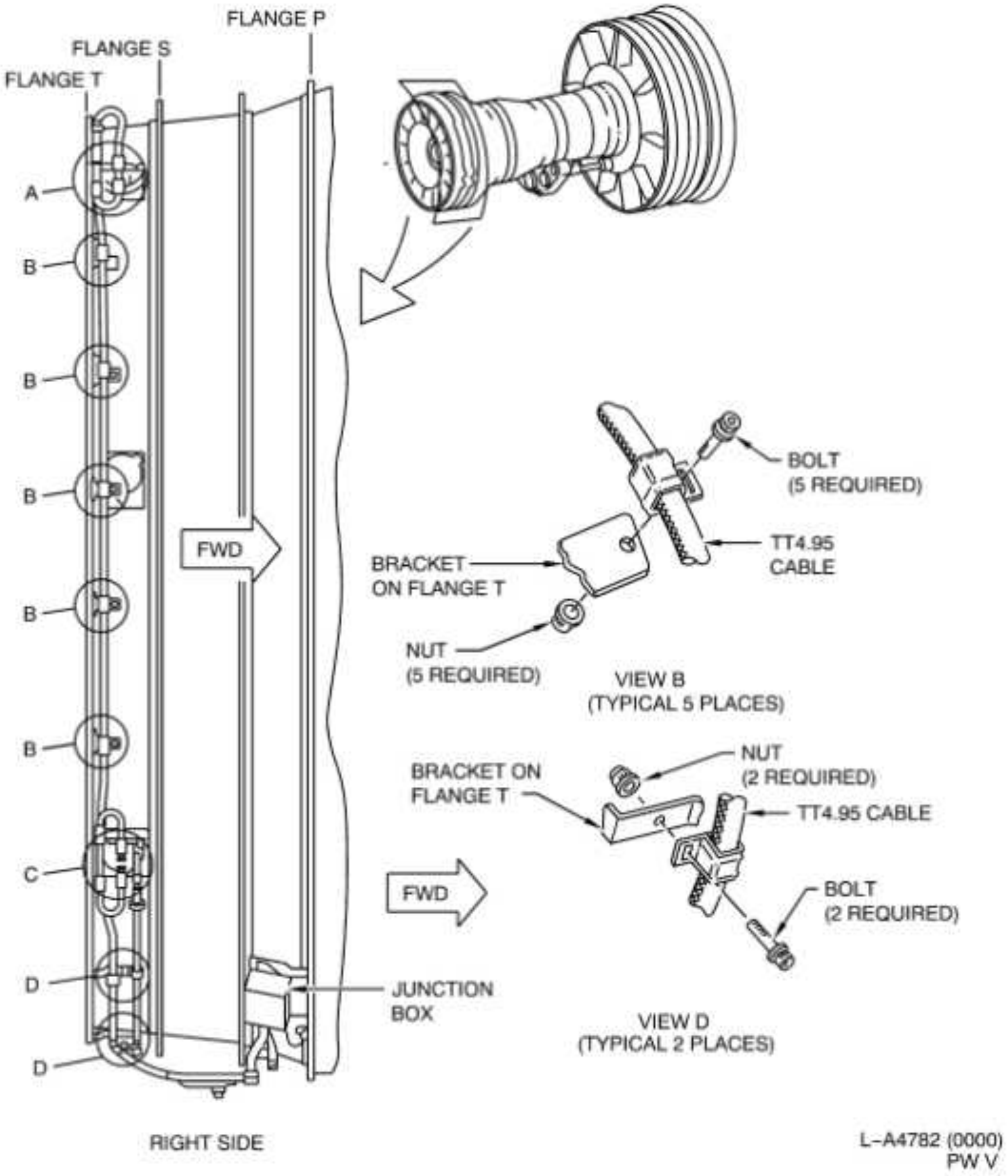
ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−04

Task 72−00−54−050−002−A:

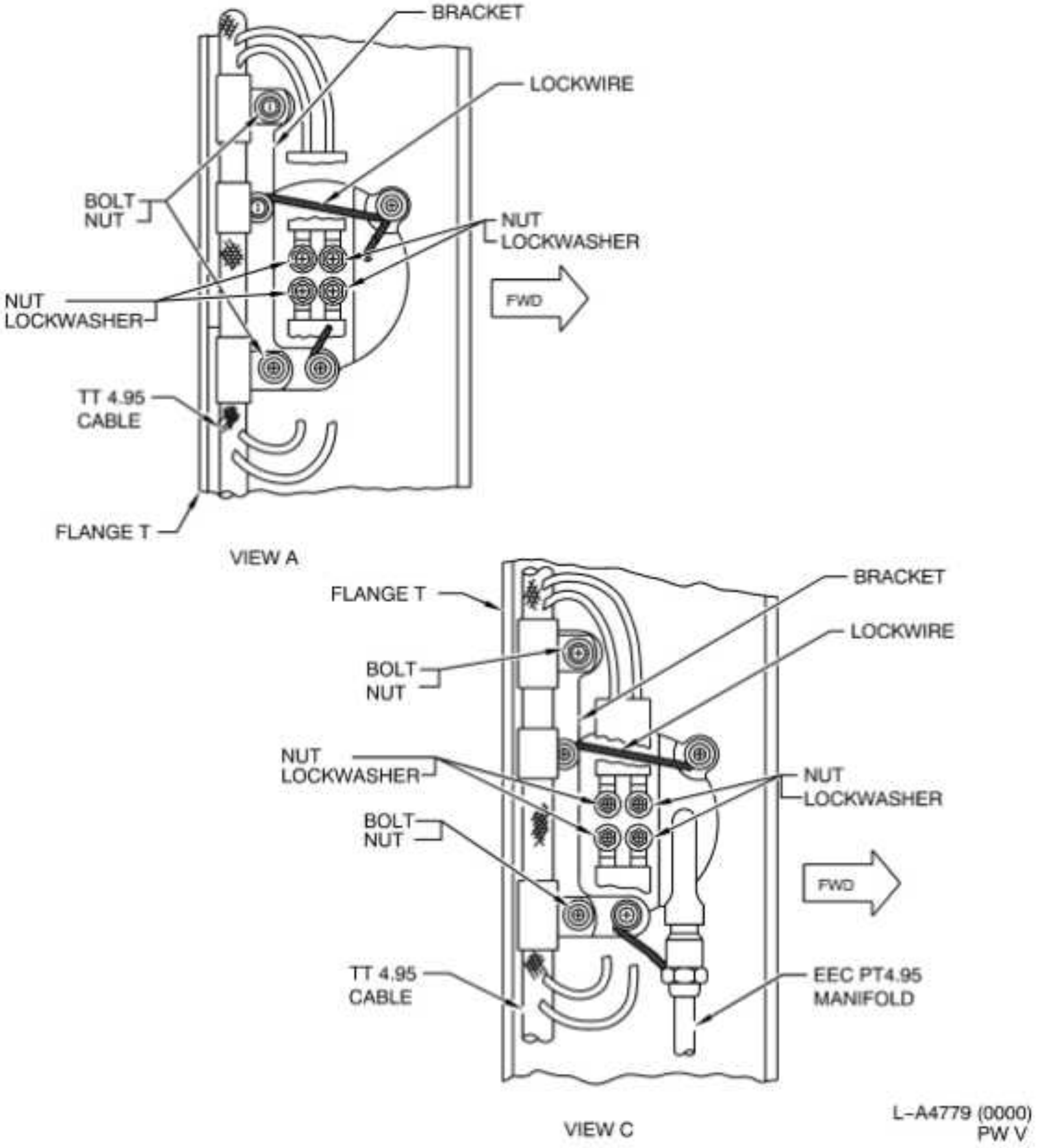
1. Remove The EGT (TT4.95) Thermocouple Cable − For Engines Without The Revised TT4.95 Cable And PT4.95 Sensing Manifold For Increased Engine Core Clearance (Pre SB PW4ENG 72−134)
   A. Equipment And Materials Required − None
   B. Procedure − Right Side
      See Figures 301 and 302.
      (1) Remove the four nuts and lockwashers that attach the cable leads to the thermocouple terminal studs. Remove the cable leads from the studs. Install the lockwashers and nuts on the studs. Do this step at the two thermocouple locations. See Views A and C.
      (2) Remove the lockwire and four screws that attach the cover and ground terminal to the junction box. Remove the cover. See Figure 302.
      (3) Remove the two screws that attach the upper and lower clamp halves and the left and right thermocouple cable leads to the junction box. Remove the clamp halves.
      (4) Remove the nuts that attach the W6 cable leads and the right thermocouple cable leads to the junction box terminal studs. Remove the leads from the studs. Install the nuts on the studs.
      (5) Remove the four bolts that attach the inner front bracket and inner rear bracket to the outer support bracket at approximately the 7 o'clock position on the exhaust case. Remove the inner brackets from the engine. See View J.
      (6) Remove the four bolts securing the front and rear ends of the outer support bracket to the brackets on Flanges P and T. Remove the outer support bracket.
      (7) Remove the bolts and nuts that attach the cable clamps to the brackets on Flange T. Remove the cable from the engine.

         NOTE: The more information on the maintenance of the thermocouple cable assembly, see EGT (TT4.95) Thermocouple Box And Cable Component Maintenance Manual, 77−21−04 (Harco Laboratories).

   C. Procedure − Left Side
      See Figures 301 and 302.
      (1) Remove the four nuts and lockwashers that attach the cable leads to the thermocouple terminal studs. Remove the cable leads from the studs. Install the lockwashers and nuts on the studs. Do this step at the two thermocouple locations. See Views E and I.
      (2) Remove the lockwire and four screws that attach the cover and ground terminal to the junction box. Remove the cover. See Figure 302.

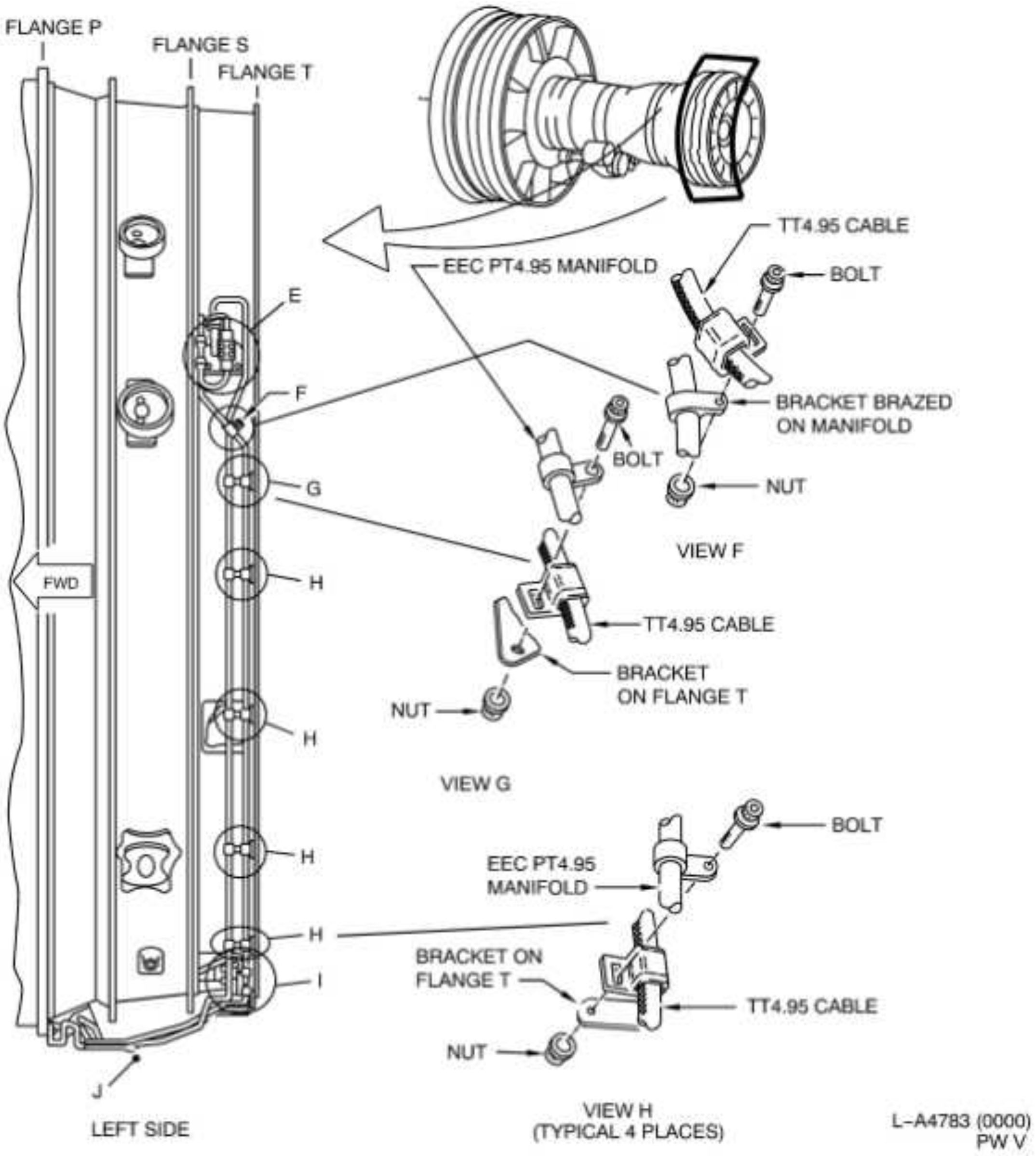

FLANGE P
FLANGE S
FLANGE T
A
B
B
B
B
B
C
D
D
FWD
FWD
BOLT
(5 REQUIRED)
TT4.95
CABLE
BRACKET
ON FLANGE T
NUT
(5 REQUIRED)
VIEW B
(TYPICAL 5 PLACES)
BRACKET ON
FLANGE T
NUT
(2 REQUIRED)
TT4.95 CABLE
BOLT
(2 REQUIRED)
JUNCTION
BOX
VIEW D
(TYPICAL 2 PLACES)
RIGHT SIDE
L−A4782 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Assembly
(Pre SB PW4ENG 72−134)
Figure 301 (Sheet 1)
(Task 72−00−54−050−002−A)

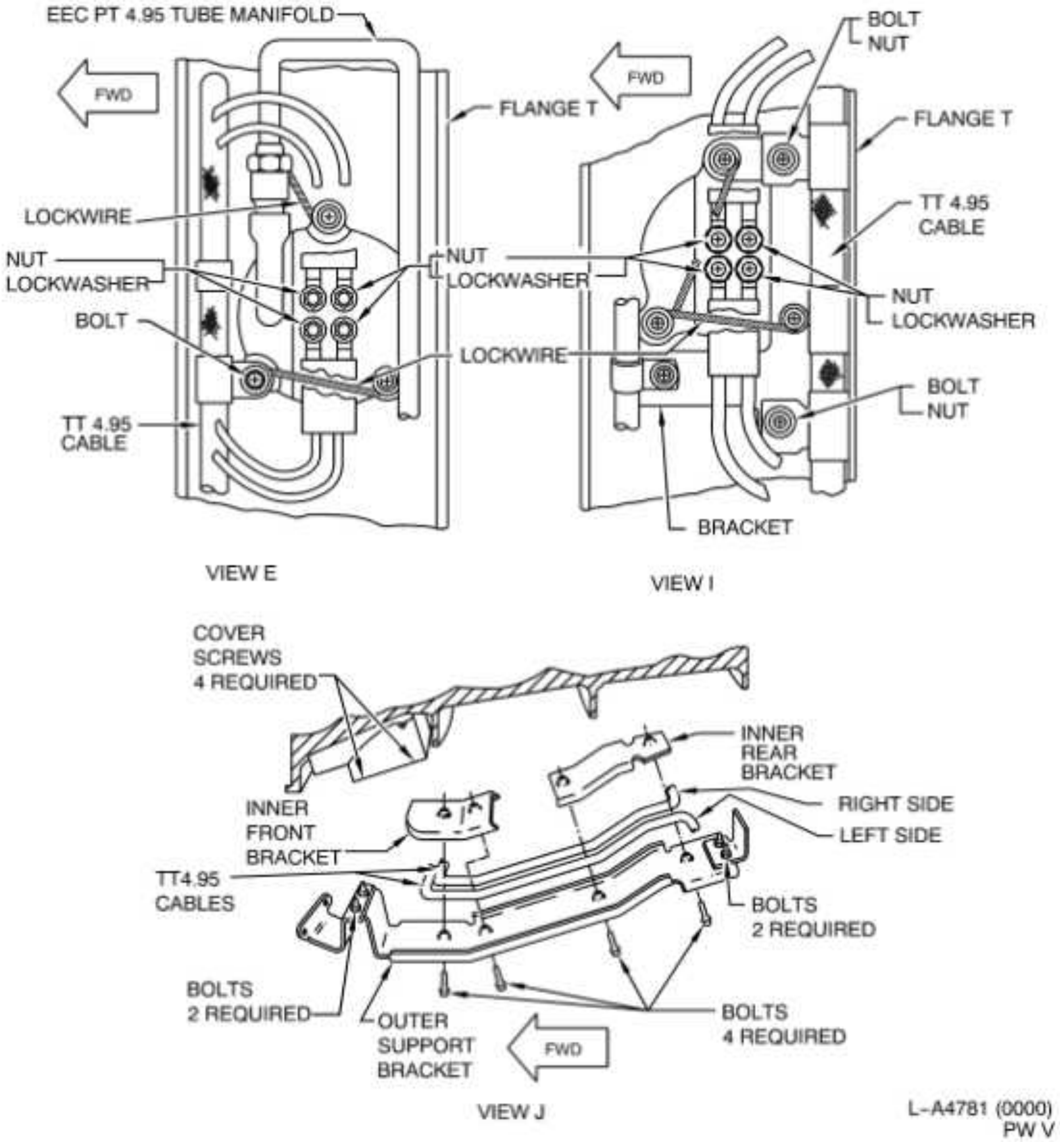

BRACKET
LOCKWIRE
BOLT
NUT
NUT
LOCKWASHER
NUT
LOCKWASHER
FWD
TT 4.95
CABLE
FLANGE T
VIEW A
FLANGE T
BRACKET
LOCKWIRE
BOLT
NUT
NUT
LOCKWASHER
NUT
LOCKWASHER
BOLT
NUT
FWD
TT 4.95
CABLE
EEC PT4.95
MANIFOLD
VIEW C
L−A4779 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Assembly
(Pre SB PW4ENG 72−134)
Figure 301 (Sheet 2)
(Task 72−00−54−050−002−A)

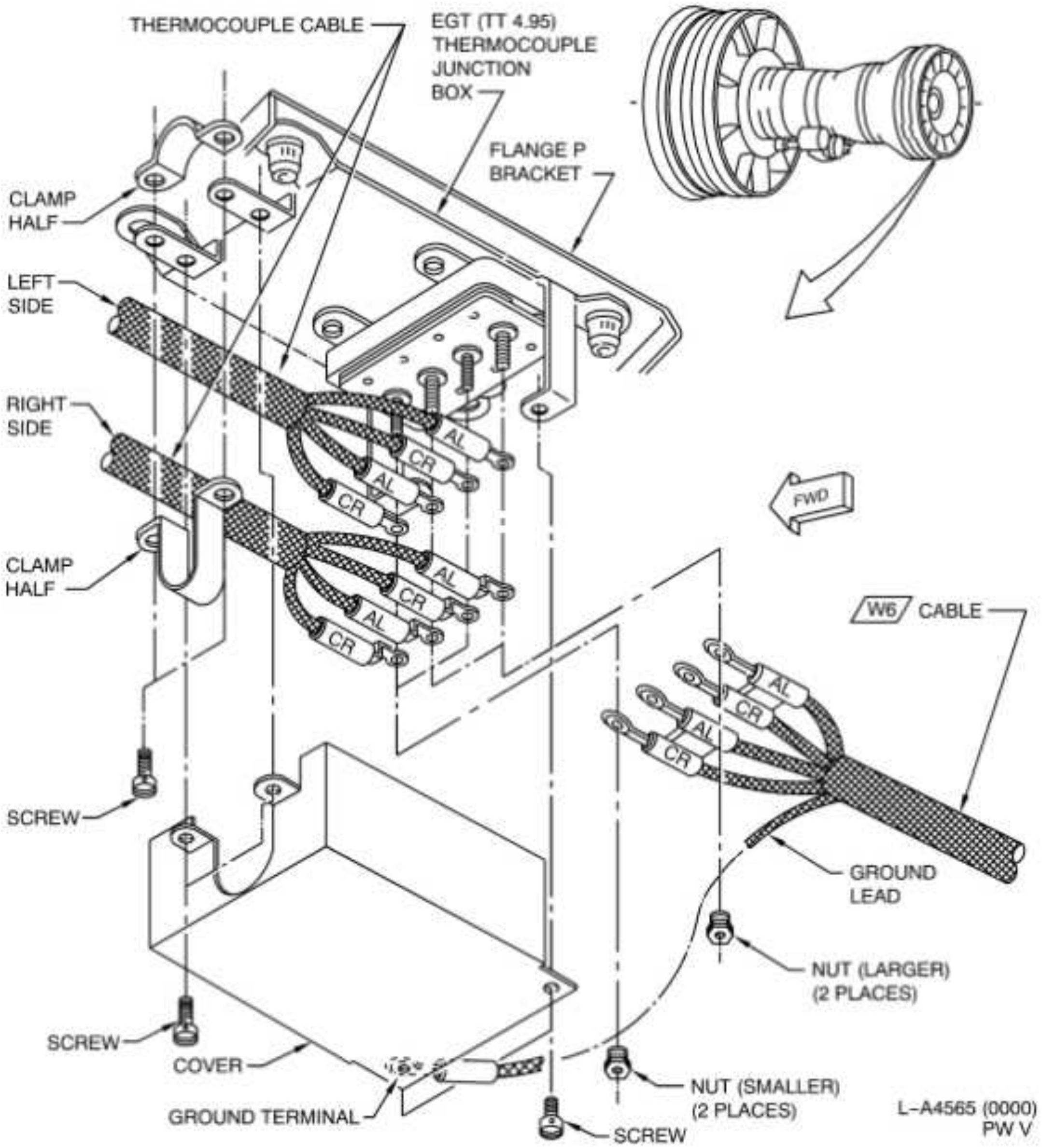
ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−04


FLANGE P
FLANGE S
FLANGE T
E
F
G
H
H
H
H
I
J
FWD
LEFT SIDE
TT4.95 CABLE
BOLT
EEC PT4.95 MANIFOLD
BRACKET BRAZED ON MANIFOLD
BOLT
NUT
VIEW F
TT4.95 CABLE
BRACKET ON FLANGE T
NUT
VIEW G
BOLT
EEC PT4.95 MANIFOLD
BRACKET ON FLANGE T
TT4.95 CABLE
NUT
VIEW H (TYPICAL 4 PLACES)
L−A4783 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Assembly
(Pre SB PW4ENG 72−134)
Figure 301 (Sheet 3)
(Task 72−00−54−050−002−A)


EEC PT 4.95 TUBE MANIFOLD
FWD
FLANGE T
LOCKWIRE
NUT
LOCKWASHER
BOLT
NUT
LOCKWASHER
LOCKWIRE
TT 4.95
CABLE
VIEW E
FWD
BOLT
NUT
FLANGE T
TT 4.95
CABLE
NUT
LOCKWASHER
BOLT
NUT
BRACKET
VIEW I
COVER
SCREWS
4 REQUIRED
INNER
REAR
BRACKET
RIGHT SIDE
LEFT SIDE
INNER
FRONT
BRACKET
TT4.95
CABLES
BOLTS
2 REQUIRED
BOLTS
2 REQUIRED
OUTER
SUPPORT
BRACKET
FWD
BOLTS
4 REQUIRED
VIEW J
L-A4781 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Assembly
(Pre SB PW4ENG 72−134)
Figure 301 (Sheet 4)
(Task 72−00−54−050−002−A)


THERMOCOUPLE CABLE
EGT (TT 4.95) THERMOCOUPLE JUNCTION BOX
FLANGE P BRACKET
CLAMP HALF
LEFT SIDE
RIGHT SIDE
AL
CR
AL
CR
AL
CR
AL
CR
FWD
CLAMP HALF
W6 CABLE
AL
CR
AL
CR
GROUND LEAD
SCREW
NUT (LARGER) (2 PLACES)
SCREW
COVER
GROUND TERMINAL
NUT (SMALLER) (2 PLACES)
SCREW
L−A4565 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Junction Box
(Pre SB PW4ENG 72−134)
Figure 302
(Task 72−00−54−050−002−A)

(3) Remove the two screws that attach the upper and lower clamp halves and the left and right thermocouple cables to the junction box. Remove the clamp halves.
(4) Remove the nuts that attach the W6 cable leads and the right and left thermocouple cable leads to the junction box terminal studs. Remove the leads from the studs. Install the nuts on the studs.
(5) Remove the four bolts that attach the inner front bracket and inner rear bracket to the outer support bracket at approximately the 7 o'clock position on the exhaust case. Remove the inner brackets from the engine. See View J.
(6) Remove the four bolts securing the front and rear ends of the outer support bracket to the brackets on Flanges P and T. Remove the outer support bracket.
(7) Remove the bolts and nuts that attach the cable clamps to all brackets and adjacent PT4.95 manifold clamps.
(8) Remove the lockwire and bolt that attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position. See View E. Remove the cable from the engine.

NOTE: For more information on the maintenance of the thermocouple cable assembly, see EGT (TT4.95) Thermocouple Box And Cable Component Maintenance Manual, 77−21−04 (Harco Laboratories).

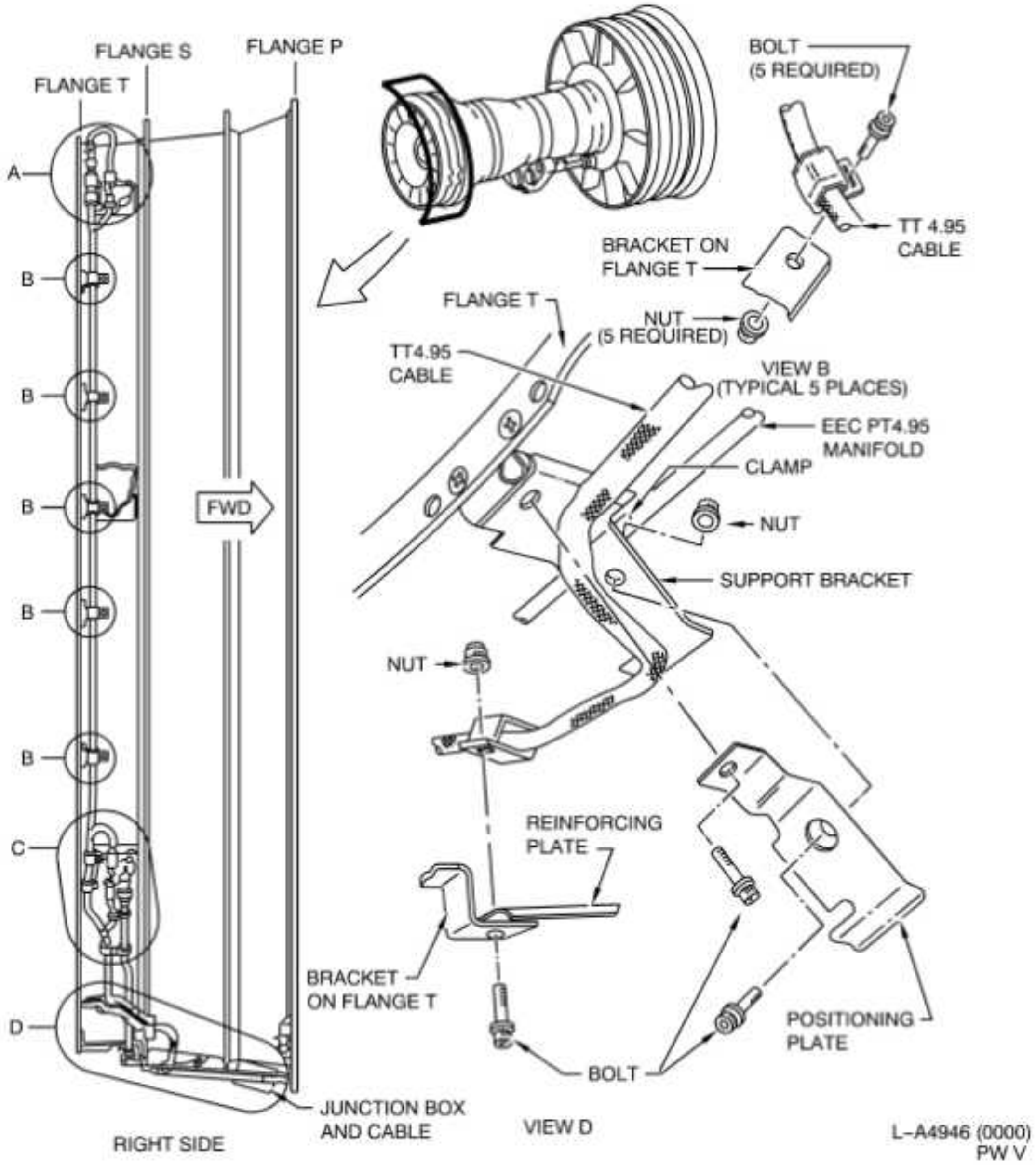
Task 72-00−54−050−002−B:

2. Remove The EGT (TT4.95) Thermocouple Cable − For Engines With The Revised TT4.95 Cable And PT4.95 Sensing Manifold For Increased Engine Core Clearance (Post SB PW4ENG 72−134)

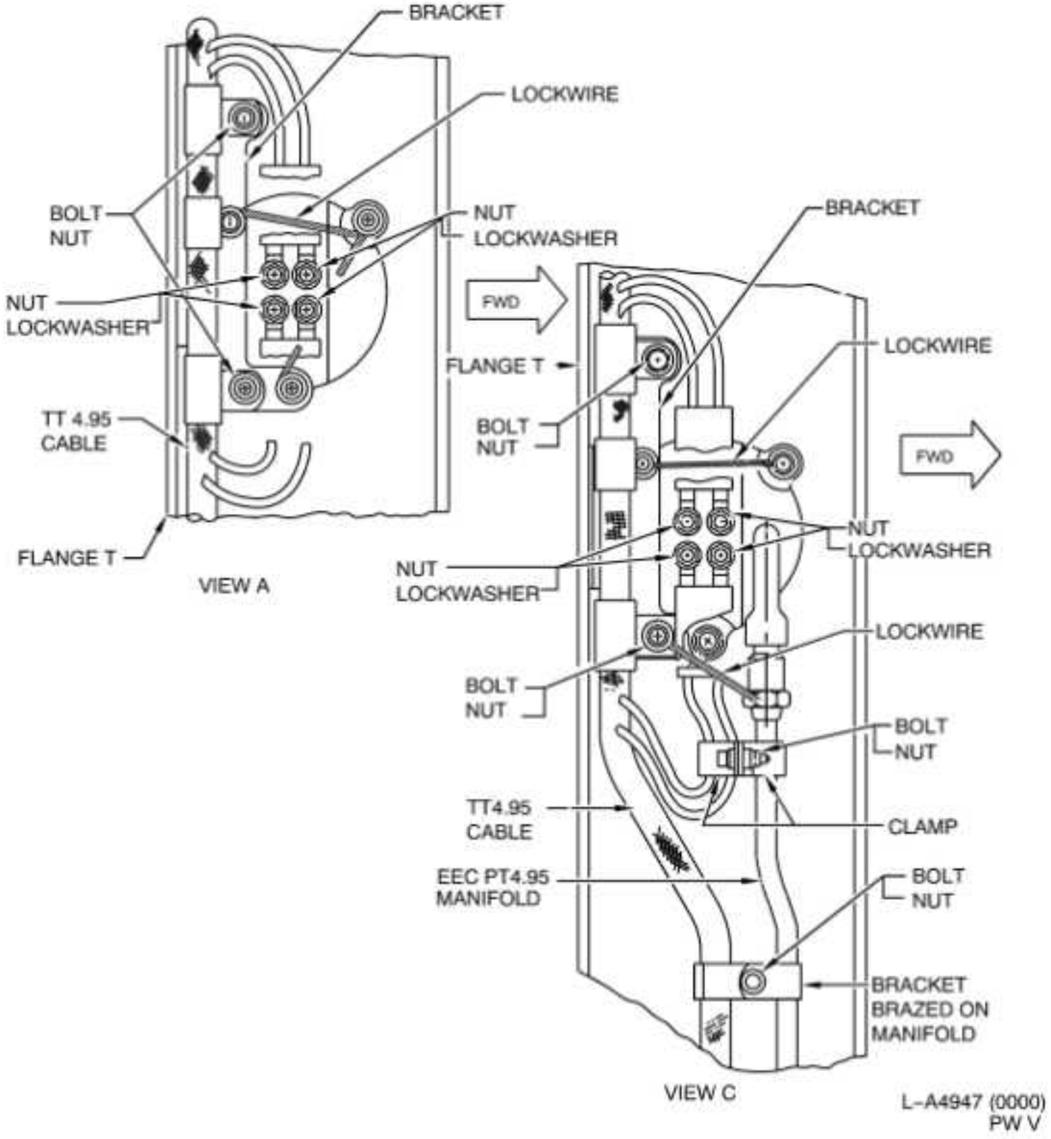
A. Equipment And Materials Required − None

B. Procedure − Right Side
See Figures 303 and 304.

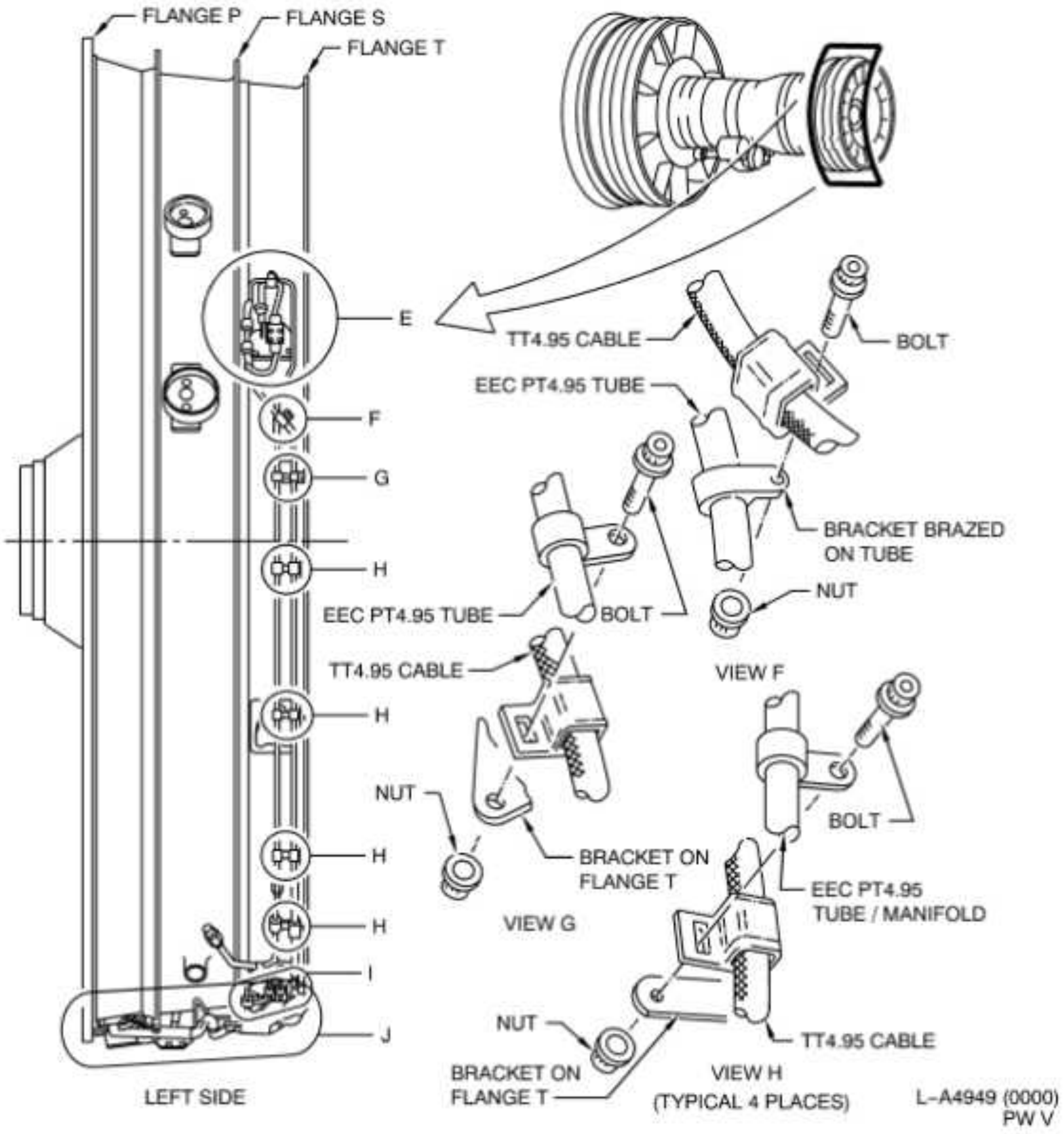
(1) Remove the four nuts and lockwashers that attach the cable leads to the thermocouple terminal studs. Remove the cable leads from the studs. Install the lockwashers and nuts on the studs. Do this step at the two thermocouple locations. See Views A and C.
(2) Remove the nut, bolt and clamps that attach the bottom two leads to the EEC PT4.95 manifold (AS33) at the 4:30 o'clock thermocouple. See View C.
(3) Remove the lockwire and four screws that attach the cover and ground terminal to the junction box. Remove the cover. See Figure 303.
(4) Remove the two screws that attach the upper and lower clamp halves and the left and right thermocouple cables to the junction box. Remove the clamp halves.


FLANGE S
FLANGE P
FLANGE T
A
B
B
B
B
B
C
D
FWD
RIGHT SIDE
JUNCTION BOX AND CABLE
BOLT (5 REQUIRED)
TT 4.95 CABLE
BRACKET ON FLANGE T
NUT (5 REQUIRED)
FLANGE T
TT4.95 CABLE
VIEW B (TYPICAL 5 PLACES)
EEC PT4.95 MANIFOLD
CLAMP
NUT
SUPPORT BRACKET
NUT
REINFORCING PLATE
BRACKET ON FLANGE T
BOLT
POSITIONING PLATE
VIEW D
L-A4946 (0000) PW V

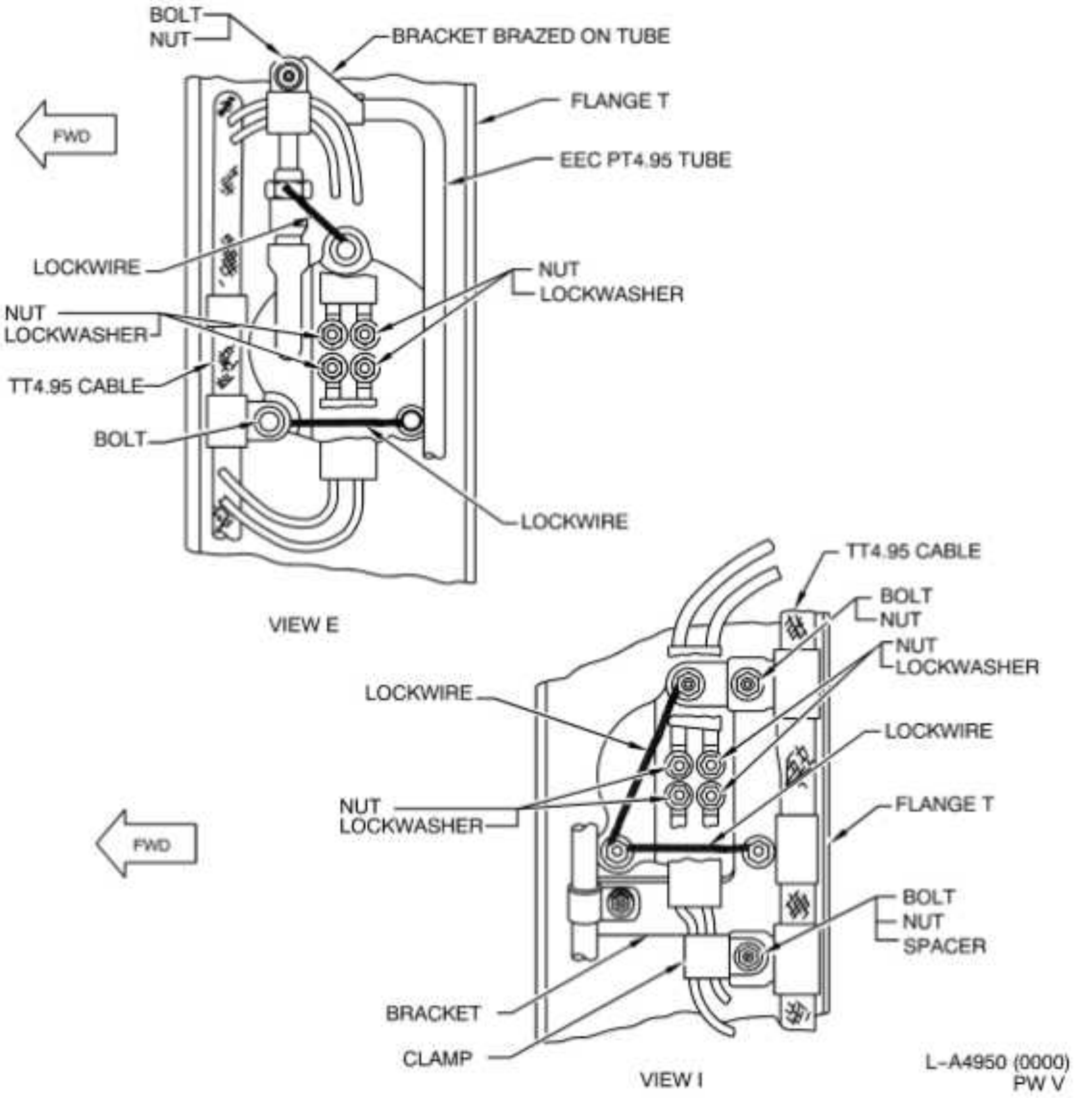
EGT (TT4.95) Thermocouple Cable Assembly
(Post SB PW4ENG 72−134)
Figure 303 (Sheet 1)
(Task 72−00−54−050−002−B)


BRACKET
LOCKWIRE
BOLT
NUT
NUT
LOCKWASHER
NUT
LOCKWASHER
TT 4.95
CABLE
FLANGE T
VIEW A
FWD
FLANGE T
BRACKET
LOCKWIRE
BOLT
NUT
FWD
NUT
LOCKWASHER
NUT
LOCKWASHER
LOCKWIRE
BOLT
NUT
BOLT
NUT
TT4.95
CABLE
CLAMP
EEC PT4.95
MANIFOLD
BOLT
NUT
BRACKET
BRAZED ON
MANIFOLD
VIEW C
L-A4947 (0000)
PW V

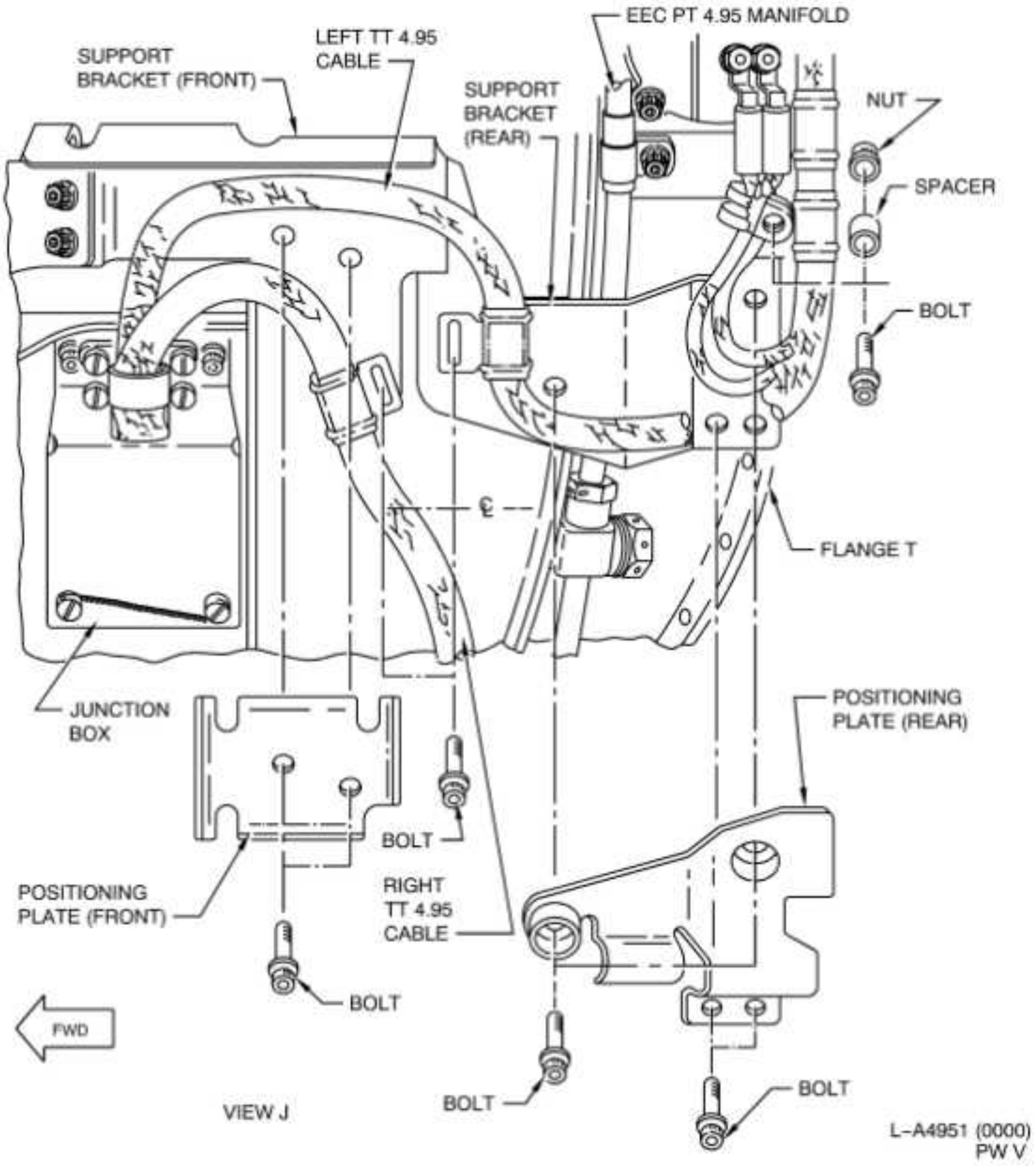
EGT (TT4.95) Thermocouple Cable Assembly
(Post SB PW4ENG 72-134)
Figure 303 (Sheet 2)
(Task 72-00-54-050-002-B)


FLANGE P
FLANGE S
FLANGE T
E
F
G
H
H
H
H
I
J
LEFT SIDE
TT4.95 CABLE
BOLT
EEC PT4.95 TUBE
BRACKET BRAZED ON TUBE
NUT
VIEW F
EEC PT4.95 TUBE
BOLT
TT4.95 CABLE
NUT
BRACKET ON FLANGE T
VIEW G
BOLT
EEC PT4.95 TUBE / MANIFOLD
NUT
TT4.95 CABLE
BRACKET ON FLANGE T
VIEW H
(TYPICAL 4 PLACES)
L-A4949 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Assembly
(Post SB PW4ENG 72-134)
Figure 303 (Sheet 3)
(Task 72-00-54-050-002-B)

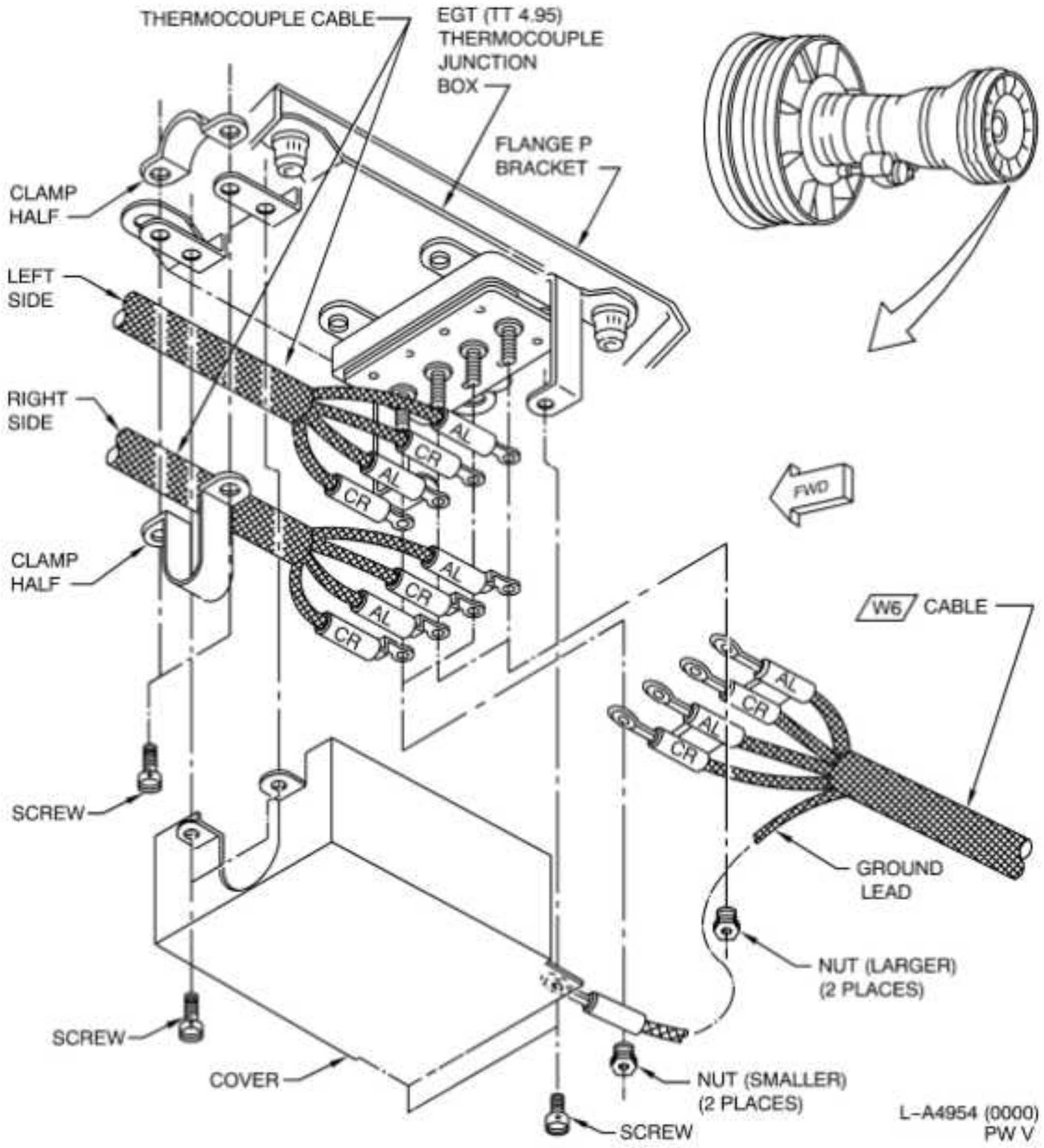

BOLT
NUT
BRACKET BRAZED ON TUBE
FLANGE T
FWD
EEC PT4.95 TUBE
LOCKWIRE
NUT
LOCKWASHER
NUT
LOCKWASHER
TT4.95 CABLE
BOLT
LOCKWIRE
VIEW E
TT4.95 CABLE
BOLT
NUT
NUT
LOCKWASHER
LOCKWIRE
LOCKWIRE
NUT
LOCKWASHER
FWD
FLANGE T
BOLT
NUT
SPACER
BRACKET
CLAMP
VIEW I
L-A4950 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Assembly
(Post SB PW4ENG 72-134)
Figure 303 (Sheet 4)
(Task 72-00-54-050-002-B)


EEC PT 4.95 MANIFOLD
LEFT TT 4.95 CABLE
SUPPORT BRACKET (FRONT)
SUPPORT BRACKET (REAR)
NUT
SPACER
BOLT
FLANGE T
JUNCTION BOX
POSITIONING PLATE (REAR)
BOLT
RIGHT TT 4.95 CABLE
POSITIONING PLATE (FRONT)
BOLT
FWD
VIEW J
BOLT
BOLT
L-A4951 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Assembly
(Post SB PW4ENG 72−134)
Figure 303 (Sheet 5)
(Task 72−00−54−050−002−B)

ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−04


THERMOCOUPLE CABLE
EGT (TT 4.95) THERMOCOUPLE JUNCTION BOX
FLANGE P BRACKET
CLAMP HALF
LEFT SIDE
RIGHT SIDE
CLAMP HALF
AL
CR
AL
CR
AL
CR
AL
CR
FWD
W6 CABLE
AL
CR
AL
CR
SCREW
GROUND LEAD
NUT (LARGER) (2 PLACES)
SCREW
COVER
NUT (SMALLER) (2 PLACES)
SCREW
L−A4954 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Junction Box
(Post SB PW4ENG 72−134)
Figure 304
(Task 72−00−54−050−002−B)

(5) Remove the nuts that attach the W6 cable leads and the right thermocouple cable leads to the junction box terminal studs. Remove the leads from the studs. Install the nuts on the studs.
(6) Remove the bolts that attach the front positioning plate to the front support bracket. Remove the positioning plate. See View J.
(7) Remove the bolts and nut that attach the positioning plate to the support bracket at approximately the 5 o'clock position. Remove the positioning plate. See View D.
(8) Remove the bolts and nuts that attach the cable clamps to all the remaining brackets. Remove the cable from the engine.

NOTE: For more information on the maintenance of the thermocouple cable assembly, see EGT (TT4.95) Thermocouple Box And Cable Component Maintenance Manual, 77-21-04 (Harco Laboratories).

C. Procedure - Left Side
See Figures 303 and 304.
(1) Remove the four nuts and lockwashers that attach the cable leads to the thermocouple terminal studs. Remove the cable leads from the studs. Install the lockwashers and nuts on the studs. Do this step at the two thermocouple locations. See Views E and I.
(2) Remove the nut, bolt and clamp that attach the top two leads to the bracket on the EEC PT4.95 tube (AS34) at the 10 o'clock thermocouple. See View E.
(3) Remove the nut, bolt, spacer and clamp that attach the bottom two leads to the bracket at the 7 o'clock thermocouple. See View I.
(4) Remove the lockwire and four screws that attach the cover and ground terminal to the junction box. Remove the cover. See Figure 304.
(5) Remove the two screws that attach the upper and lower clamp halves and the left and right thermocouple cables to the junction box. Remove the clamp halves.
(6) Remove the nuts that attach the W6 cable leads and the right and left thermocouple cable leads to the junction box terminal studs. Remove the leads from the studs. Install the nuts on the studs.
(7) Remove the bolts that attach the front positioning plate to the front support bracket. Remove the positioning plate. See View J.
(8) Remove the bolts that attach the rear positioning plate to the rear support bracket. Remove the positioning plate. See View J.

(9) Remove the bolts and nuts that attach the cable clamps to all brackets and adjacent PT4.95 tube/manifold clamps.

(10) Remove the lockwire and bolt that attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position. See View E. Remove the cable from the engine.

NOTE: For more information on the maintenance of the thermocouple cable assembly, see EGT (TT4.95) Thermocouple Box And Cable Component Maintenance Manual, 77-21-04 (Harco Laboratories).

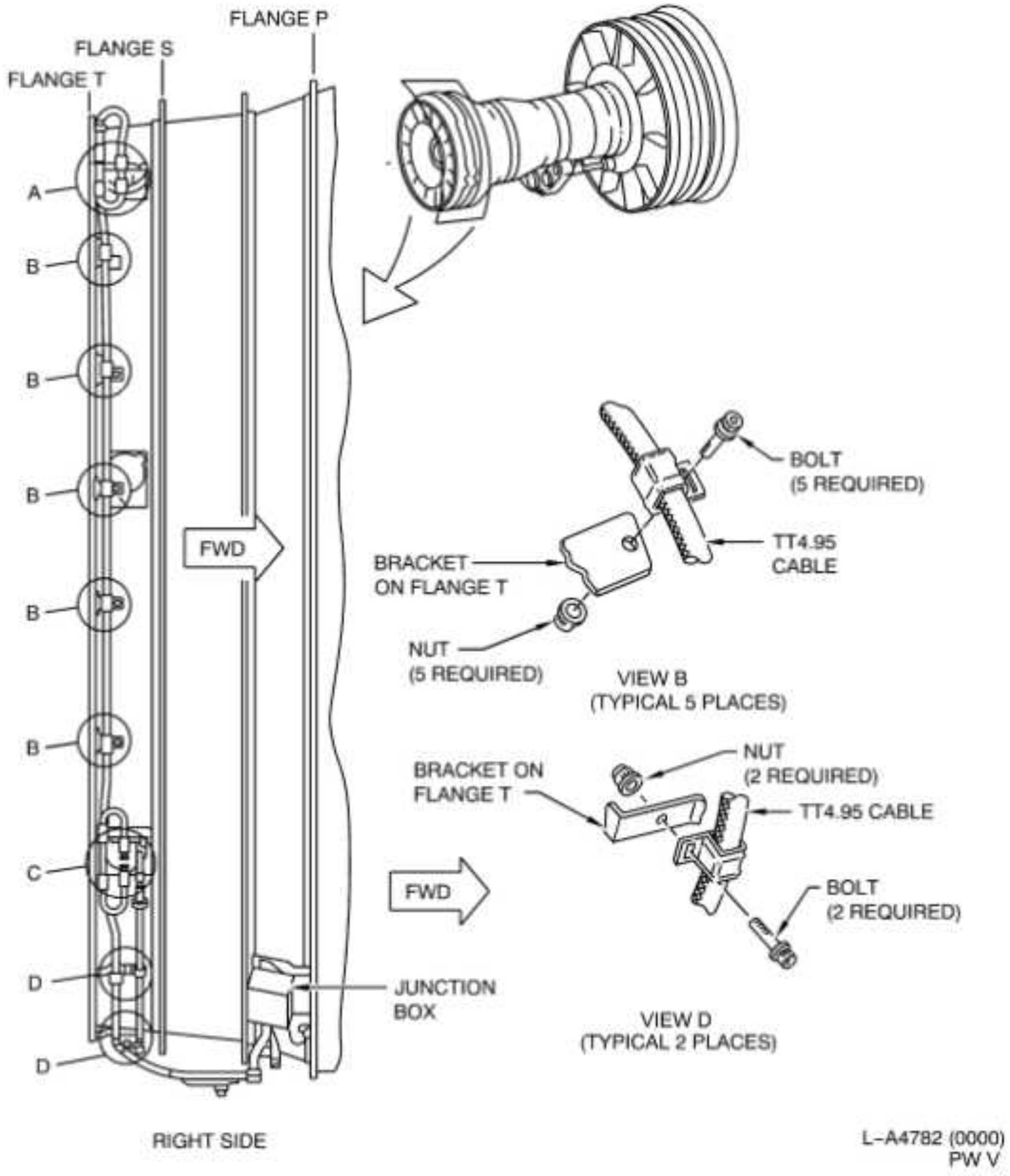
Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - TURBINE EXHAUST CASE - REMOVAL-05

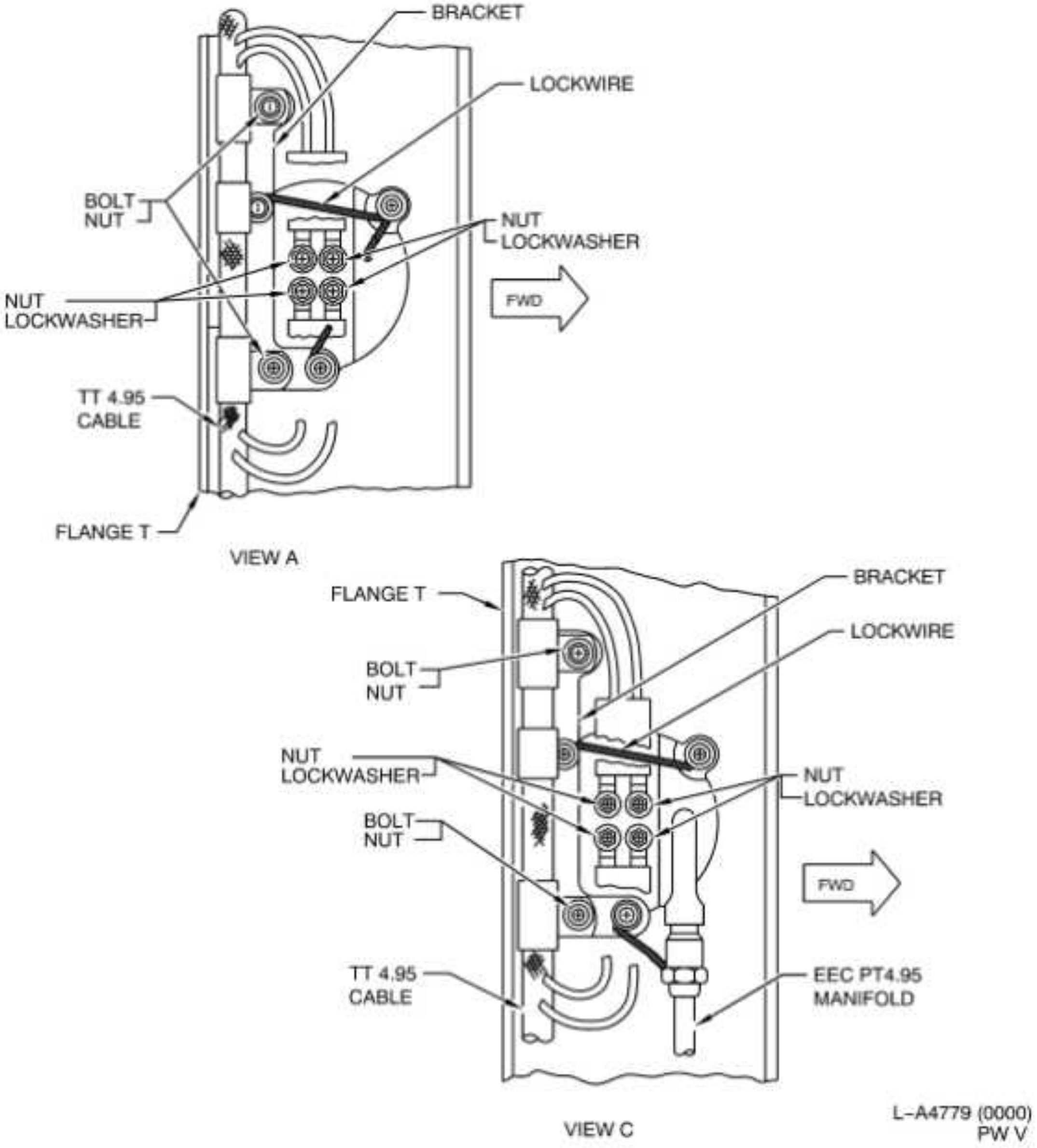
Task 72-00-54-050-003-A:

1. Remove The EGT (TT4.95) Box And Cable Assembly - For Engines Without The Revised TT4.95 Cable And PT4.95 Sensing Manifold For Increased Engine Core Clearance (Pre SB PW4ENG 72-134)
   A. Equipment And Materials Required - None
   B. Procedure
      See Figures 301 and 302.
      (1) Remove the four nuts and lockwashers that attach the cable leads to the thermocouple terminal studs. Remove the cable leads from the studs. Install the lockwashers and nuts on the studs. Do this step at the four thermocouple locations. See Views A, C, E, And I.
      (2) Remove the lockwire and four screws that attach the cover and ground terminal to the junction box. Remove the cover. See Figure 302.
      (3) Remove the nuts that attach the W6 cable leads to the junction box terminal studs. Remove the W6 cable leads from the studs. Install the nuts, cover, and screws handtight only.
      (4) Remove the four bolts that attach the inner front bracket and inner rear bracket to the outer support bracket at approximately the 7 o'clock position on the exhaust case. Remove the inner brackets from the engine. See View J.
      (5) Remove the four bolts securing the front and rear ends of the outer support bracket to the brackets on Flanges P and T. Remove the outer support bracket.
      (6) Remove the lockwire and bolt that attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position. See View E.
      (7) Remove the bolts and nuts that attach the cable clamps to all brackets and to adjacent PT4.95 manifold (AS03) clamps.
      (8) Remove the nuts that attach the box and cable assembly to the bracket on Flange P. Remove the box and cable assembly from the engine.

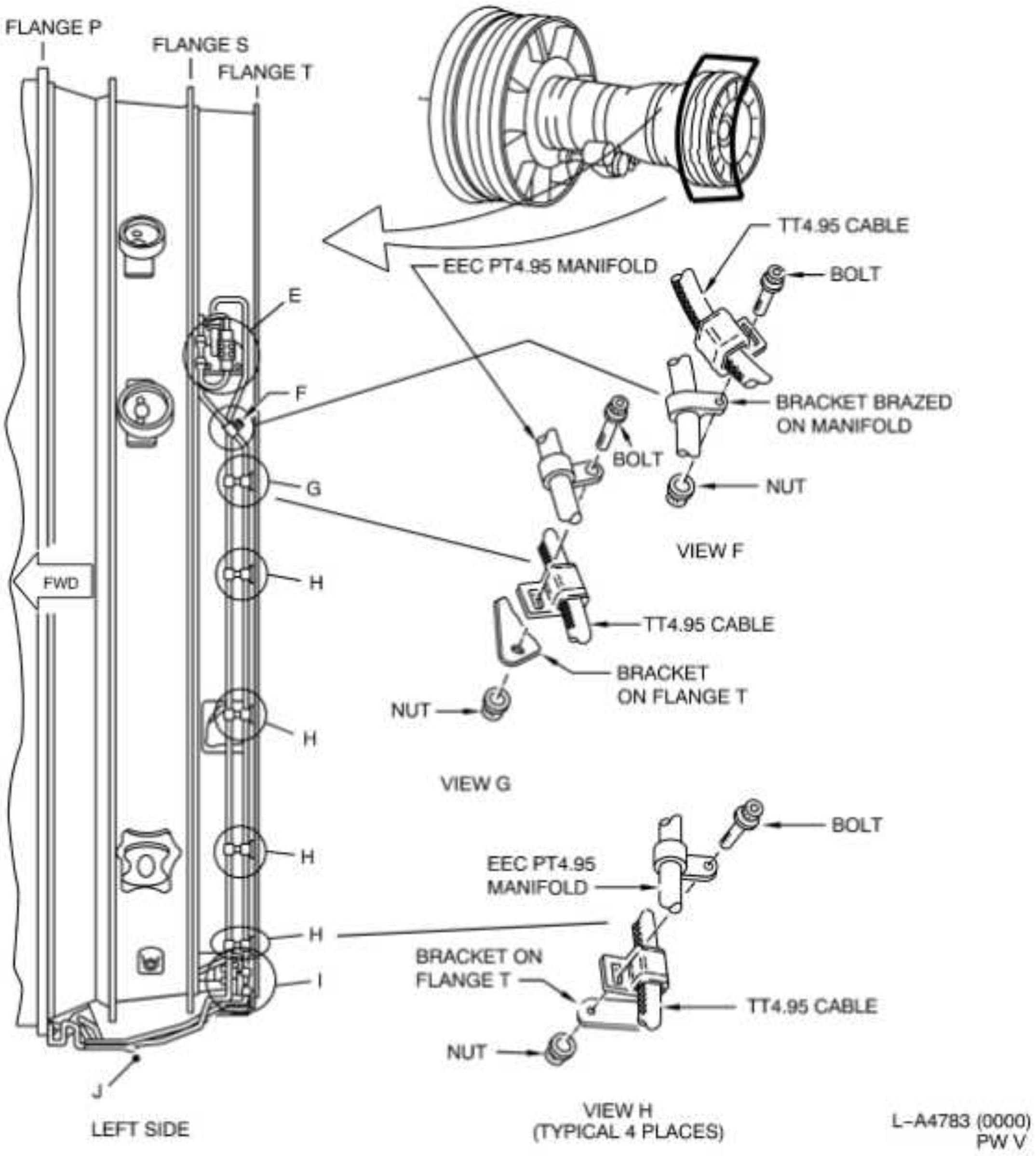
NOTE: For more information on the maintenance of the box and cable assembly, see EGT (TT4.95) Thermocouple Box And Cable Component Maintenance Manual, 77-21-04 (Harco Laboratories).


FLANGE P
FLANGE S
FLANGE T
A
B
B
B
B
B
C
D
D
FWD
FWD
BOLT
(5 REQUIRED)
TT4.95
CABLE
BRACKET
ON FLANGE T
NUT
(5 REQUIRED)
VIEW B
(TYPICAL 5 PLACES)
BRACKET ON
FLANGE T
NUT
(2 REQUIRED)
TT4.95 CABLE
BOLT
(2 REQUIRED)
JUNCTION
BOX
VIEW D
(TYPICAL 2 PLACES)
RIGHT SIDE
L−A4782 (0000)
PW V

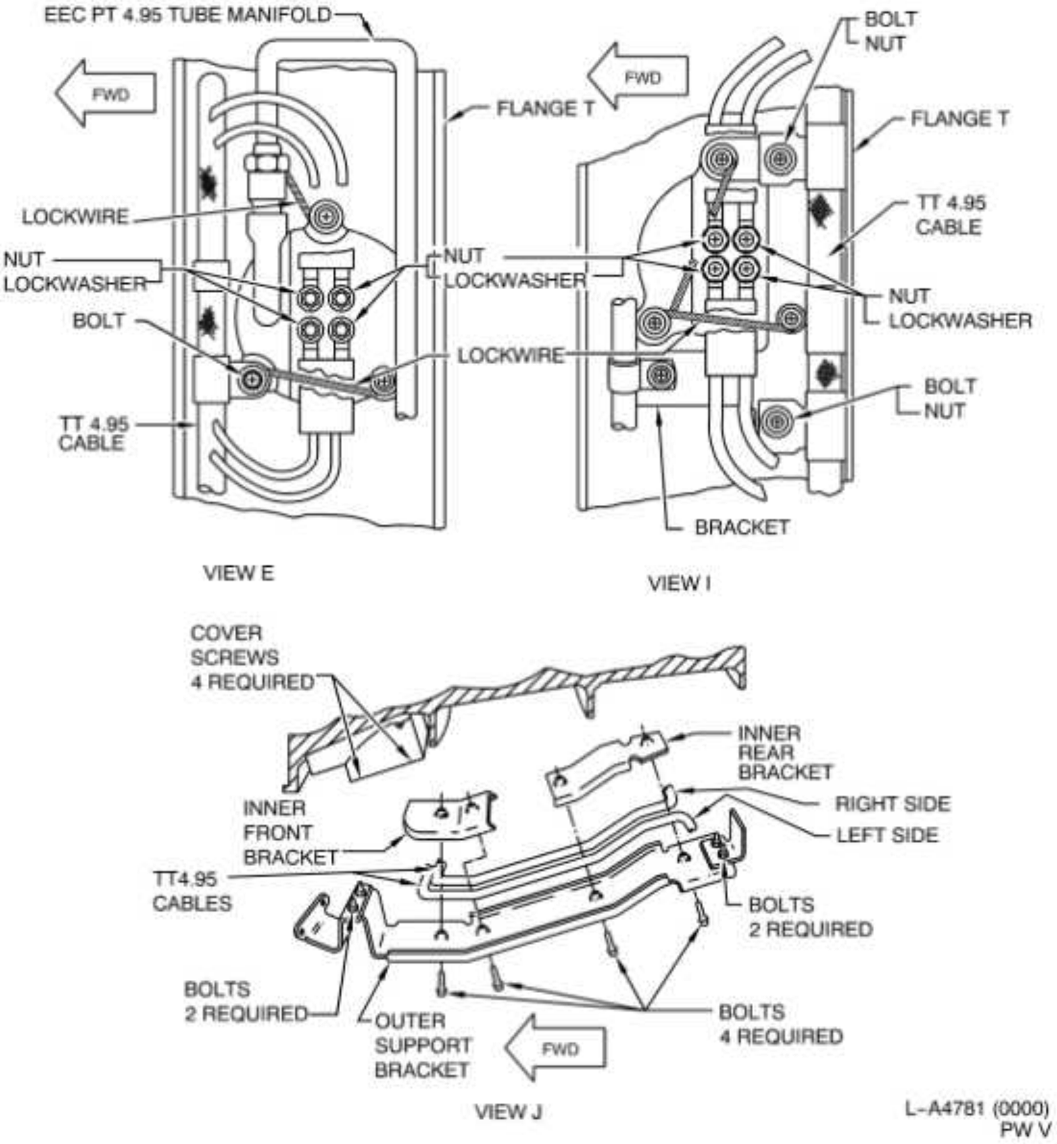
EGT (TT4.95) Box And Cable Assembly
(Pre SB PW4ENG 72−134)
Figure 301 (Sheet 1)
(Task 72−00−54−050−003−A)


BRACKET
LOCKWIRE
BOLT
NUT
NUT
LOCKWASHER
NUT
LOCKWASHER
FWD
TT 4.95
CABLE
FLANGE T
VIEW A
FLANGE T
BRACKET
LOCKWIRE
BOLT
NUT
NUT
LOCKWASHER
BOLT
NUT
NUT
LOCKWASHER
FWD
TT 4.95
CABLE
EEC PT4.95
MANIFOLD
VIEW C
L−A4779 (0000)
PW V

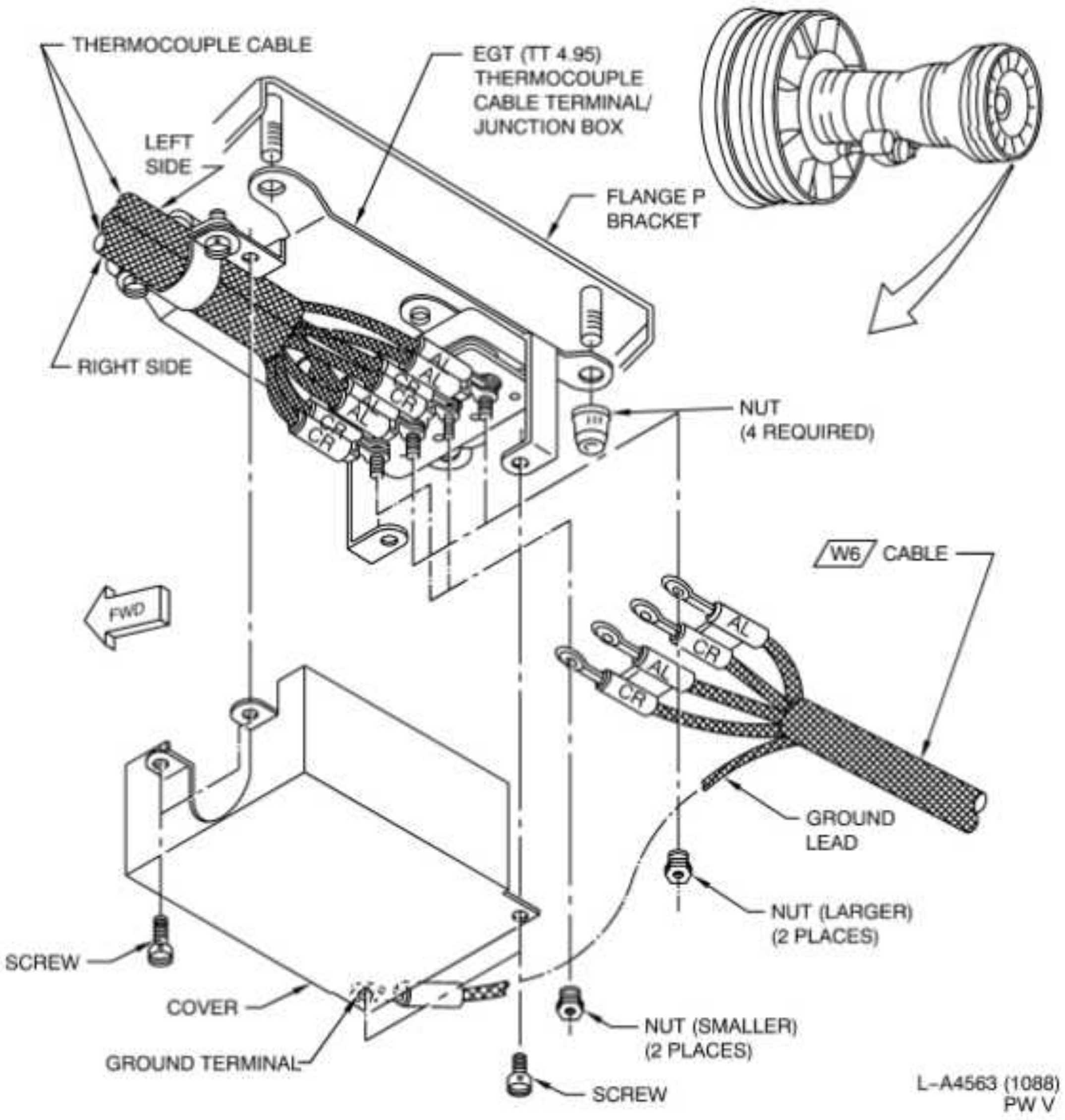
EGT (TT4.95) Box And Cable Assembly
(Pre SB PW4ENG 72−134)
Figure 301 (Sheet 2)
(Task 72−00−54−050−003−A)


FLANGE P
FLANGE S
FLANGE T
E
F
G
H
H
H
H
I
J
FWD
LEFT SIDE
TT4.95 CABLE
BOLT
EEC PT4.95 MANIFOLD
BRACKET BRAZED ON MANIFOLD
BOLT
NUT
VIEW F
TT4.95 CABLE
BRACKET ON FLANGE T
NUT
VIEW G
BOLT
EEC PT4.95 MANIFOLD
BRACKET ON FLANGE T
TT4.95 CABLE
NUT
VIEW H (TYPICAL 4 PLACES)
L−A4783 (0000)
PW V

EGT (TT4.95) Box And Cable Assembly
(Pre SB PW4ENG 72−134)
Figure 301 (Sheet 3)
(Task 72−00−54−050−003−A)


EEC PT 4.95 TUBE MANIFOLD
FWD
FLANGE T
LOCKWIRE
NUT
LOCKWASHER
BOLT
NUT
LOCKWASHER
LOCKWIRE
TT 4.95 CABLE
VIEW E
FWD
BOLT
NUT
FLANGE T
TT 4.95 CABLE
NUT
LOCKWASHER
BOLT
NUT
BRACKET
VIEW I
COVER SCREWS 4 REQUIRED
INNER REAR BRACKET
RIGHT SIDE
LEFT SIDE
INNER FRONT BRACKET
TT4.95 CABLES
BOLTS 2 REQUIRED
BOLTS 2 REQUIRED
OUTER SUPPORT BRACKET
FWD
BOLTS 4 REQUIRED
VIEW J
L-A4781 (0000)
PW V

EGT (TT4.95) Box And Cable Assembly
(Pre SB PW4ENG 72−134)
Figure 301 (Sheet 4)
(Task 72−00−54−050−003−A)

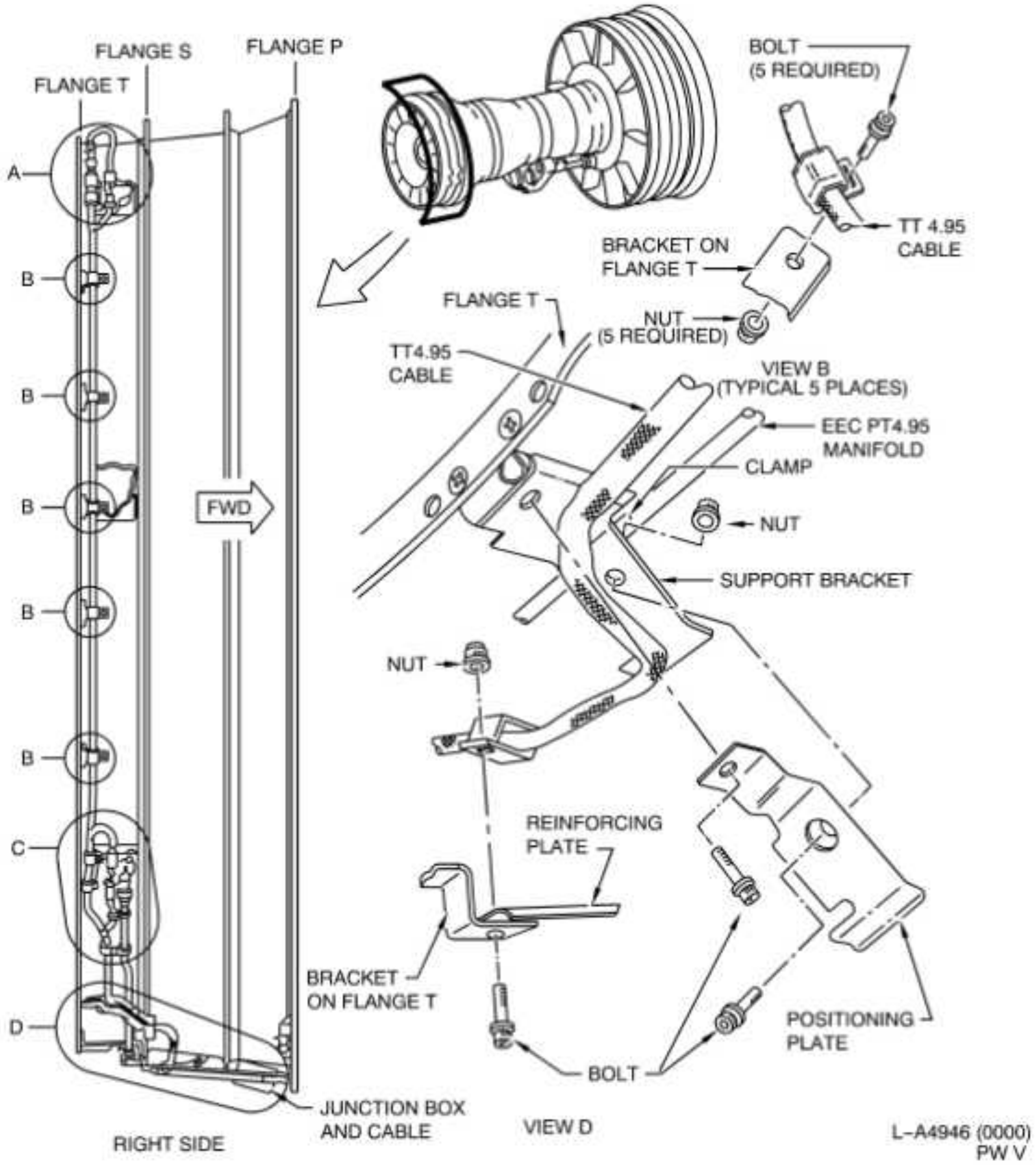

THERMOCOUPLE CABLE
EGT (TT 4.95) THERMOCOUPLE CABLE TERMINAL/ JUNCTION BOX
LEFT SIDE
FLANGE P BRACKET
RIGHT SIDE
AL
CR
NUT (4 REQUIRED)
W6 CABLE
FWD
GROUND LEAD
NUT (LARGER) (2 PLACES)
SCREW
COVER
GROUND TERMINAL
NUT (SMALLER) (2 PLACES)
SCREW
L−A4563 (1088)
PW V

EGT (TT4.95) Thermocouple Cable Junction Box
(Pre SB PW4ENG 72−134)
Figure 302
(Task 72−00−54−050−003−A)

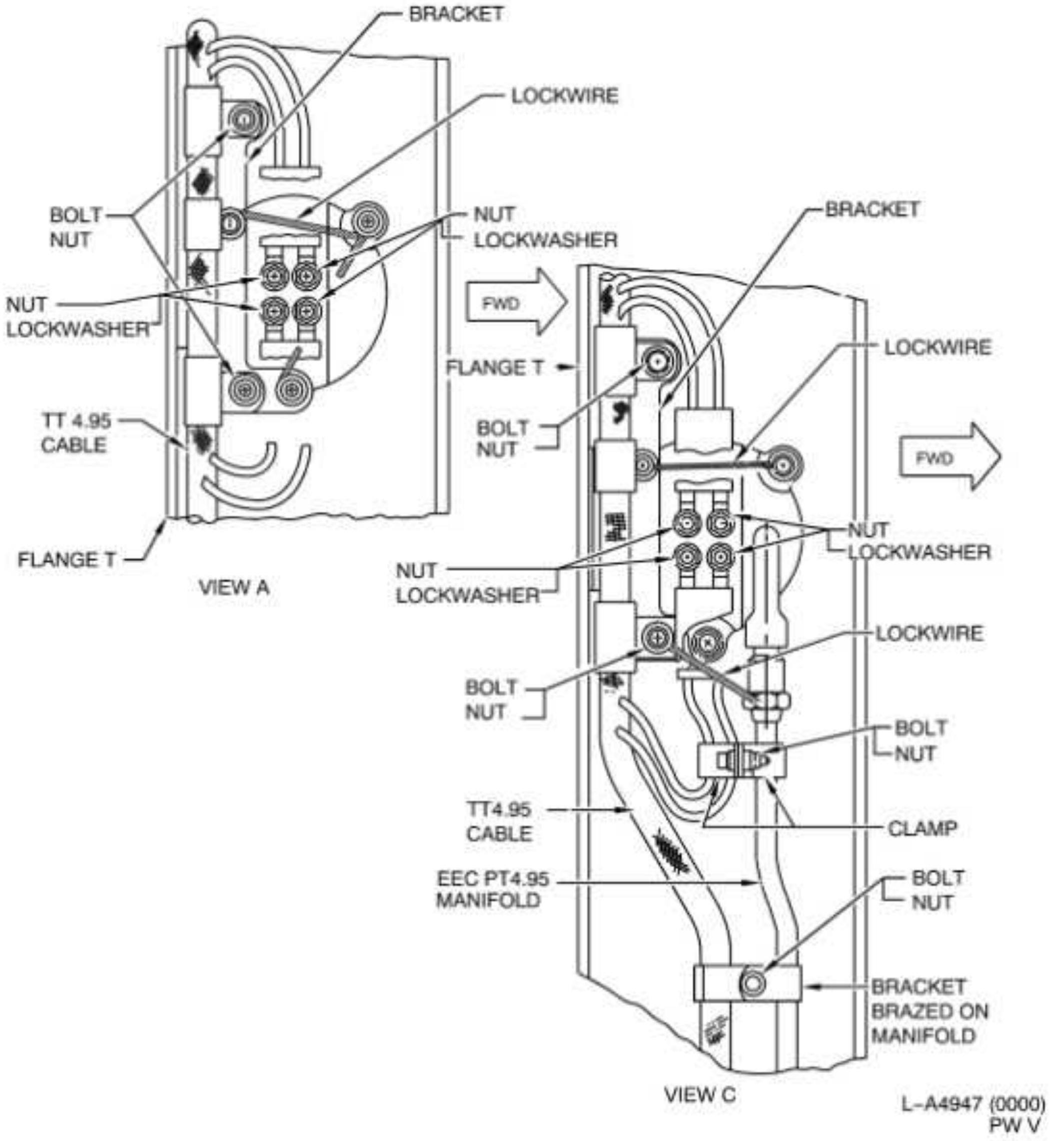
ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−05

Task 72−00−54−050−003−B:

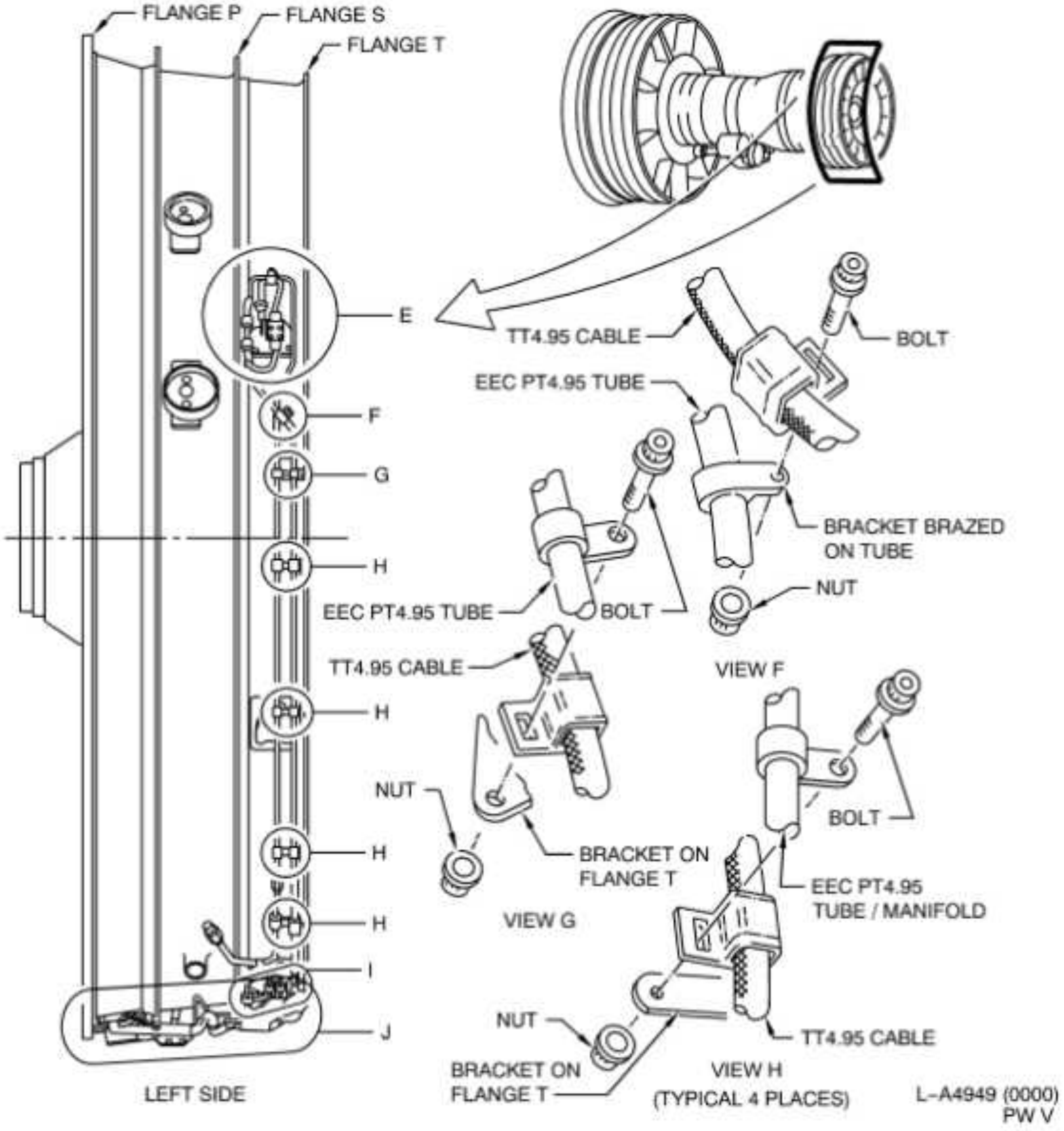
2. Remove The EGT (TT4.95) Box And Cable Assembly − For Engines With The Revised TT4.95 Cable And PT4.95 Sensing Manifold For Increased Engine Core Clearance (Post SB PW4ENG 72−134)
   A. Equipment And Materials Required − None
   B. Procedure
      See Figures 303 and 304.
      (1) Remove the four nuts and lockwashers that attach the cable leads to the thermocouple terminal studs. Remove the cable leads from the studs. Install the lockwashers and nuts on the studs. Do this step at the four thermocouple locations. See Views A, C, E, And I.
      (2) Remove the nut, bolt and clamps that attach the bottom two leads to the EEC PT4.95 manifold (AS33) at the 4:30 o'clock thermocouple. See View C.
      (3) Remove the nut, bolt, and clamp that attach the top two leads to the bracket on the EEC PT4.95 tube (AS34) at the 10 o'clock thermocouple. See View E.
      (4) Remove the nut, bolt, spacer and clamp that attach the bottom two leads to the bracket at the 7 o'clock thermocouple. See View I.
      (5) Remove the lockwire and four screws that attach the cover to the junction box. Remove the cover. See Figure 304.
      (6) Remove the nuts that attach the W6 cable leads to the junction box terminal studs. Remove the W6 cable leads from the studs. Install the nuts, cover, and screws handtight only.
      (7) Remove the bolts and nut that attach the positioning plate to the support bracket at approximately the 5 o'clock position. Remove the positioning plate. See View D.
      (8) Remove the bolts that attach the front positioning plate to the front support bracket. Remove the positioning plate. See View J.
      (9) Remove the bolts that attach the rear positioning plate to the rear support bracket. Remove the positioning plate. See View J.
      (10) Remove the lockwire and bolt that attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position. See View E.
      (11) Remove the bolts and nuts that attach the cable clamps to all brackets and adjacent PT4.95 tube/manifold clamps.


FLANGE S
FLANGE P
FLANGE T
A
B
B
B
B
B
C
D
FWD
RIGHT SIDE
JUNCTION BOX AND CABLE
BOLT (5 REQUIRED)
TT 4.95 CABLE
BRACKET ON FLANGE T
NUT (5 REQUIRED)
FLANGE T
TT4.95 CABLE
VIEW B (TYPICAL 5 PLACES)
EEC PT4.95 MANIFOLD
CLAMP
NUT
SUPPORT BRACKET
NUT
REINFORCING PLATE
BRACKET ON FLANGE T
POSITIONING PLATE
BOLT
VIEW D
L−A4946 (0000)
PW V

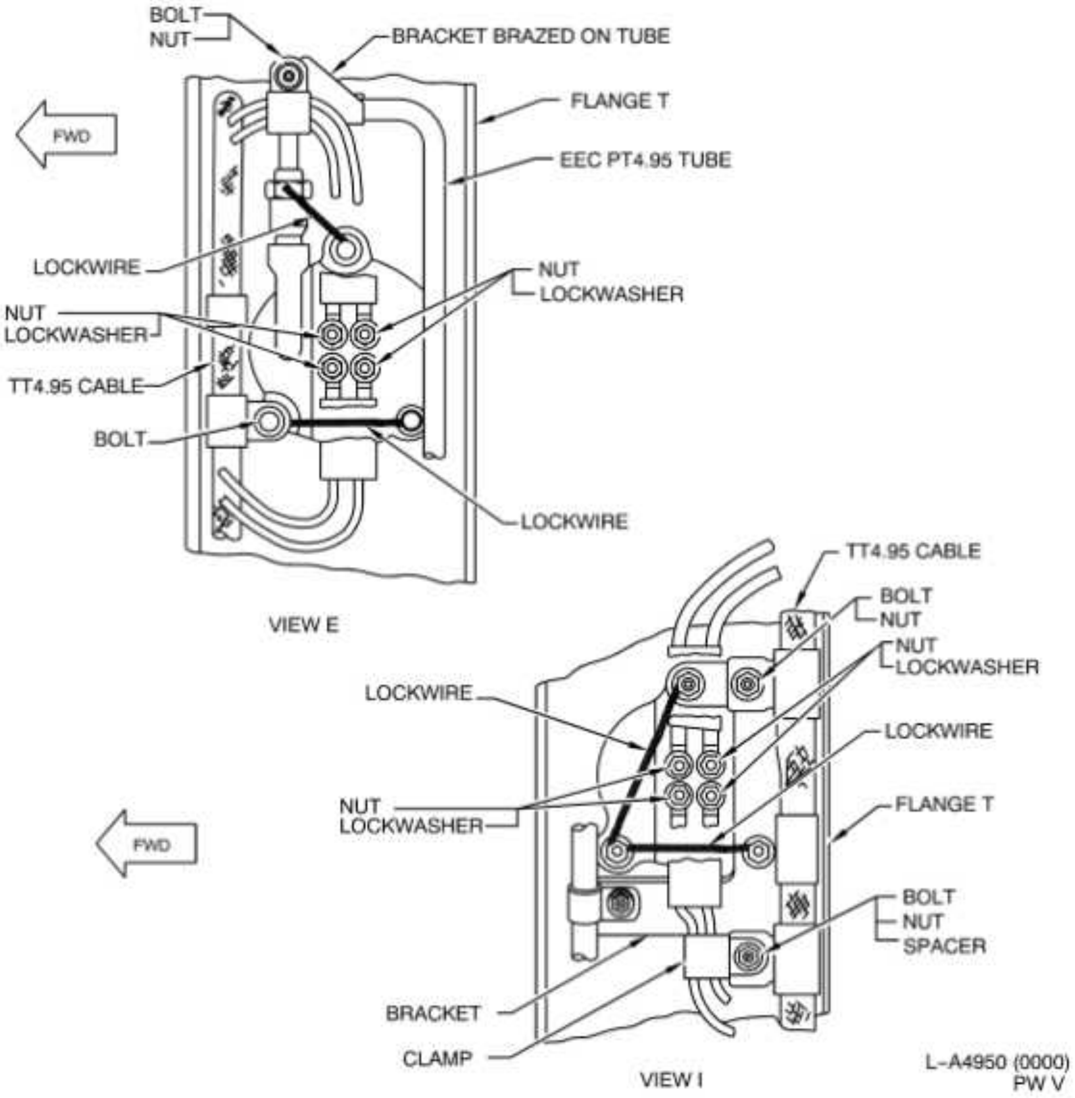
EGT (TT4.95) Box And Cable Assembly
(Post SB PW4ENG 72−134)
Figure 303 (Sheet 1)
(Task 72−00−54−050−003−B)


BRACKET
LOCKWIRE
BOLT
NUT
NUT
LOCKWASHER
NUT
LOCKWASHER
TT 4.95
CABLE
FLANGE T
VIEW A
FWD
FLANGE T
BRACKET
LOCKWIRE
BOLT
NUT
FWD
NUT
LOCKWASHER
NUT
LOCKWASHER
LOCKWIRE
BOLT
NUT
BOLT
NUT
CLAMP
TT4.95
CABLE
EEC PT4.95
MANIFOLD
BOLT
NUT
BRACKET
BRAZED ON
MANIFOLD
VIEW C
L-A4947 (0000)
PW V

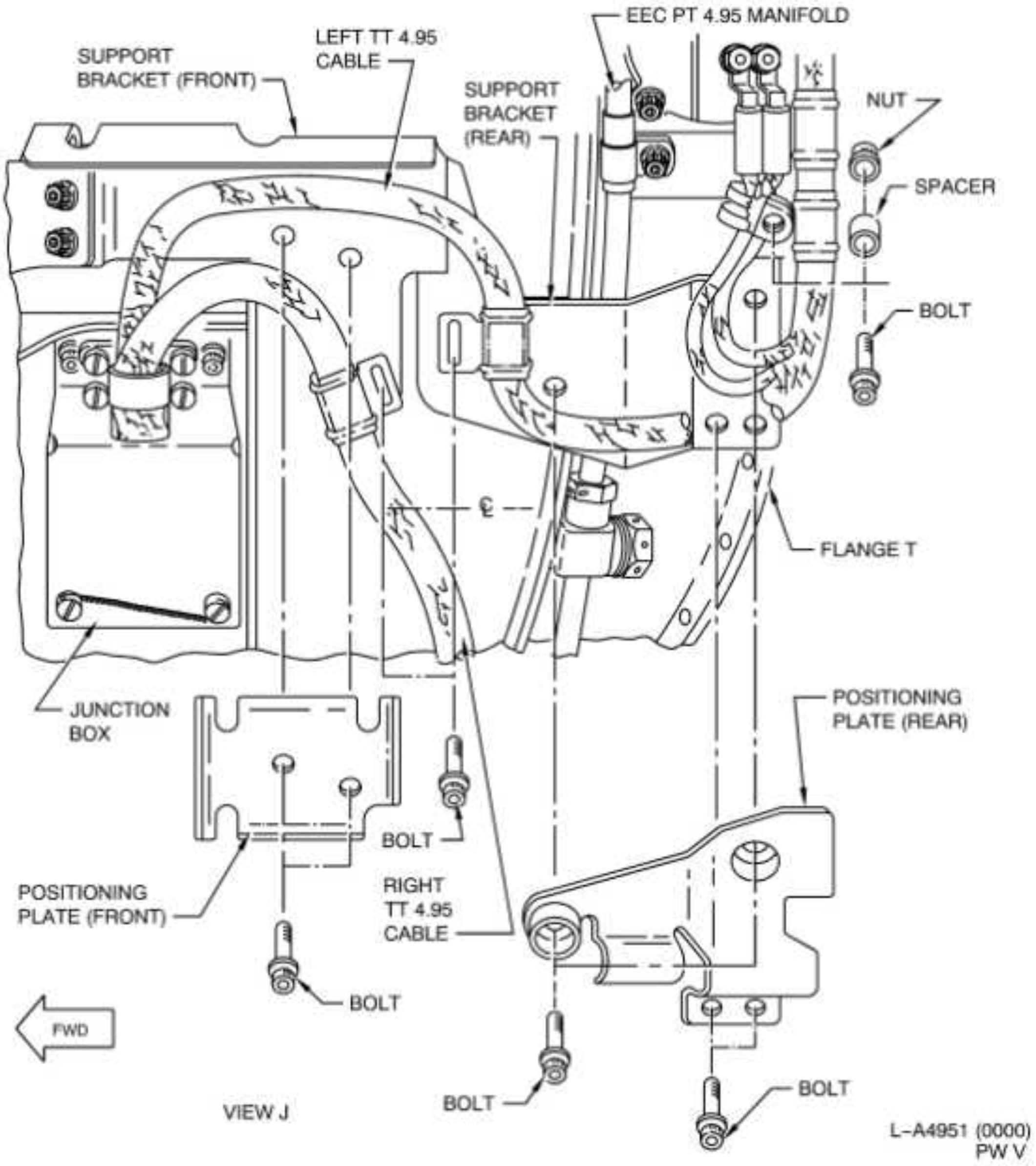
EGT (TT4.95) Box And Cable Assembly
(Post SB PW4ENG 72-134)
Figure 303 (Sheet 2)
(Task 72-00-54-050-003-B)


FLANGE P
FLANGE S
FLANGE T
E
F
G
H
H
H
H
I
J
LEFT SIDE
TT4.95 CABLE
BOLT
EEC PT4.95 TUBE
BRACKET BRAZED ON TUBE
NUT
VIEW F
EEC PT4.95 TUBE
BOLT
TT4.95 CABLE
NUT
BRACKET ON FLANGE T
VIEW G
BOLT
EEC PT4.95 TUBE / MANIFOLD
NUT
TT4.95 CABLE
BRACKET ON FLANGE T
VIEW H
(TYPICAL 4 PLACES)
L-A4949 (0000)
PW V

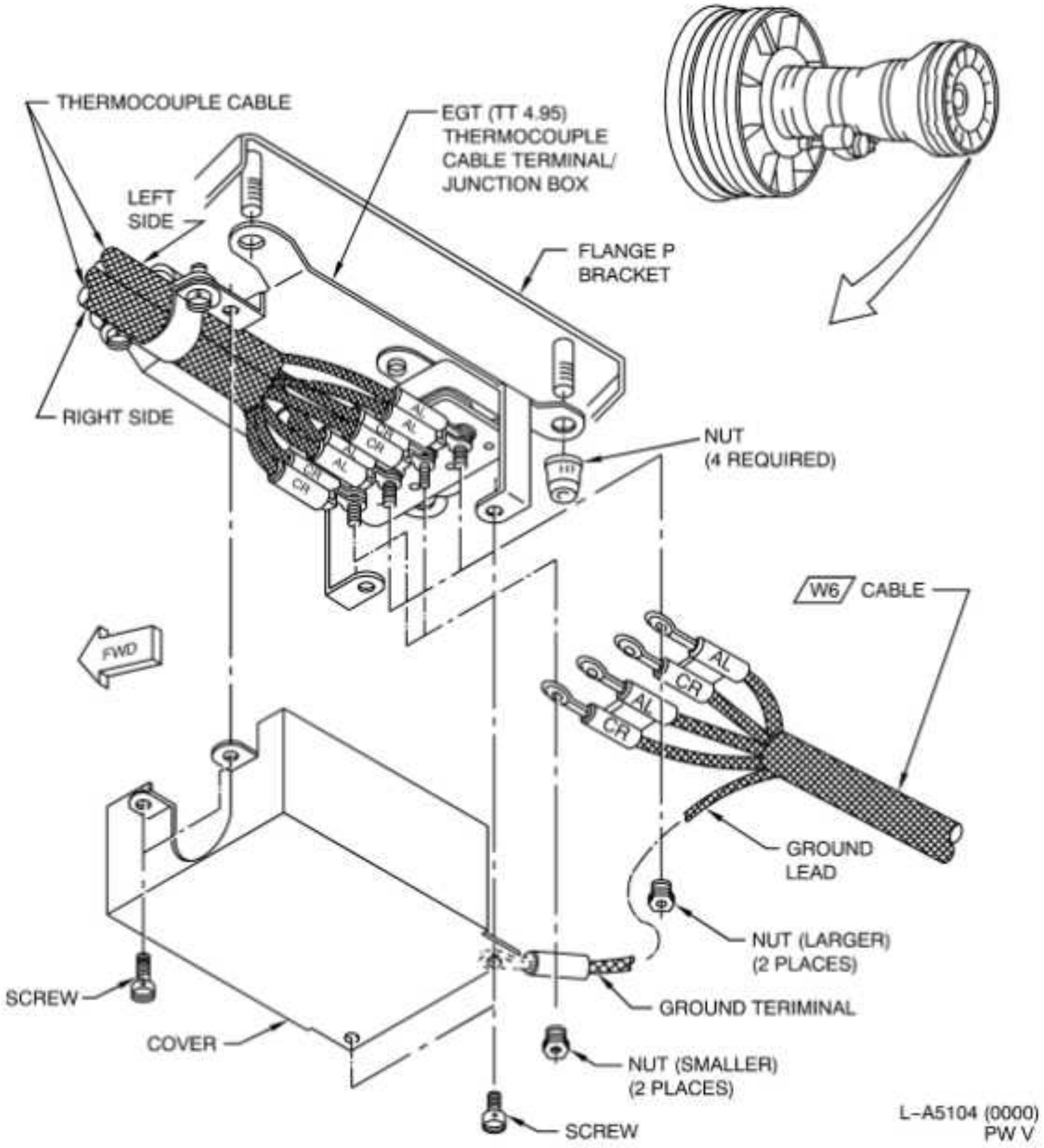
EGT (TT4.95) Box And Cable Assembly
(Post SB PW4ENG 72-134)
Figure 303 (Sheet 3)
(Task 72-00-54-050-003-B)


BOLT
NUT
BRACKET BRAZED ON TUBE
FWD
FLANGE T
EEC PT4.95 TUBE
LOCKWIRE
NUT
LOCKWASHER
NUT
LOCKWASHER
TT4.95 CABLE
BOLT
LOCKWIRE
VIEW E
TT4.95 CABLE
BOLT
NUT
NUT
LOCKWASHER
LOCKWIRE
LOCKWIRE
FLANGE T
FWD
NUT
LOCKWASHER
BOLT
NUT
SPACER
BRACKET
CLAMP
VIEW I
L-A4950 (0000)
PW V

EGT (TT4.95) Box And Cable Assembly
(Post SB PW4ENG 72-134)
Figure 303 (Sheet 4)
(Task 72-00-54-050-003-B)


EEC PT 4.95 MANIFOLD
LEFT TT 4.95 CABLE
SUPPORT BRACKET (FRONT)
SUPPORT BRACKET (REAR)
NUT
SPACER
BOLT
℄
FLANGE T
JUNCTION BOX
POSITIONING PLATE (REAR)
BOLT
RIGHT TT 4.95 CABLE
POSITIONING PLATE (FRONT)
BOLT
FWD
VIEW J
BOLT
BOLT
L−A4951 (0000)
PW V

EGT (TT4.95) Box And Cable Assembly
(Post SB PW4ENG 72−134)
Figure 303 (Sheet 5)
(Task 72−00−54−050−003−B)


THERMOCOUPLE CABLE
EGT (TT 4.95) THERMOCOUPLE CABLE TERMINAL/ JUNCTION BOX
LEFT SIDE
FLANGE P BRACKET
RIGHT SIDE
AL
AL
CR
AL
CR
NUT (4 REQUIRED)
W6 CABLE
FWD
AL
CR
AL
CR
GROUND LEAD
NUT (LARGER) (2 PLACES)
SCREW
GROUND TERIMINAL
COVER
NUT (SMALLER) (2 PLACES)
SCREW
L-A5104 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Junction Box
(Post SB PW4ENG 72-134)
Figure 304
(Task 72-00-54-050-003-B)

(12) Remove the nuts that attach the box and cable assembly to the bracket on Flange P. Remove the box and cable assembly from the engine.

NOTE: For more information on the maintenance of the thermocouple cable assembly, see EGT (TT4.95) Thermocouple Box And Cable Component Maintenance Manual, 77−21−04, (Harco Laboratories).

Previous Pageblock Return to Previous Menu Next Pageblock

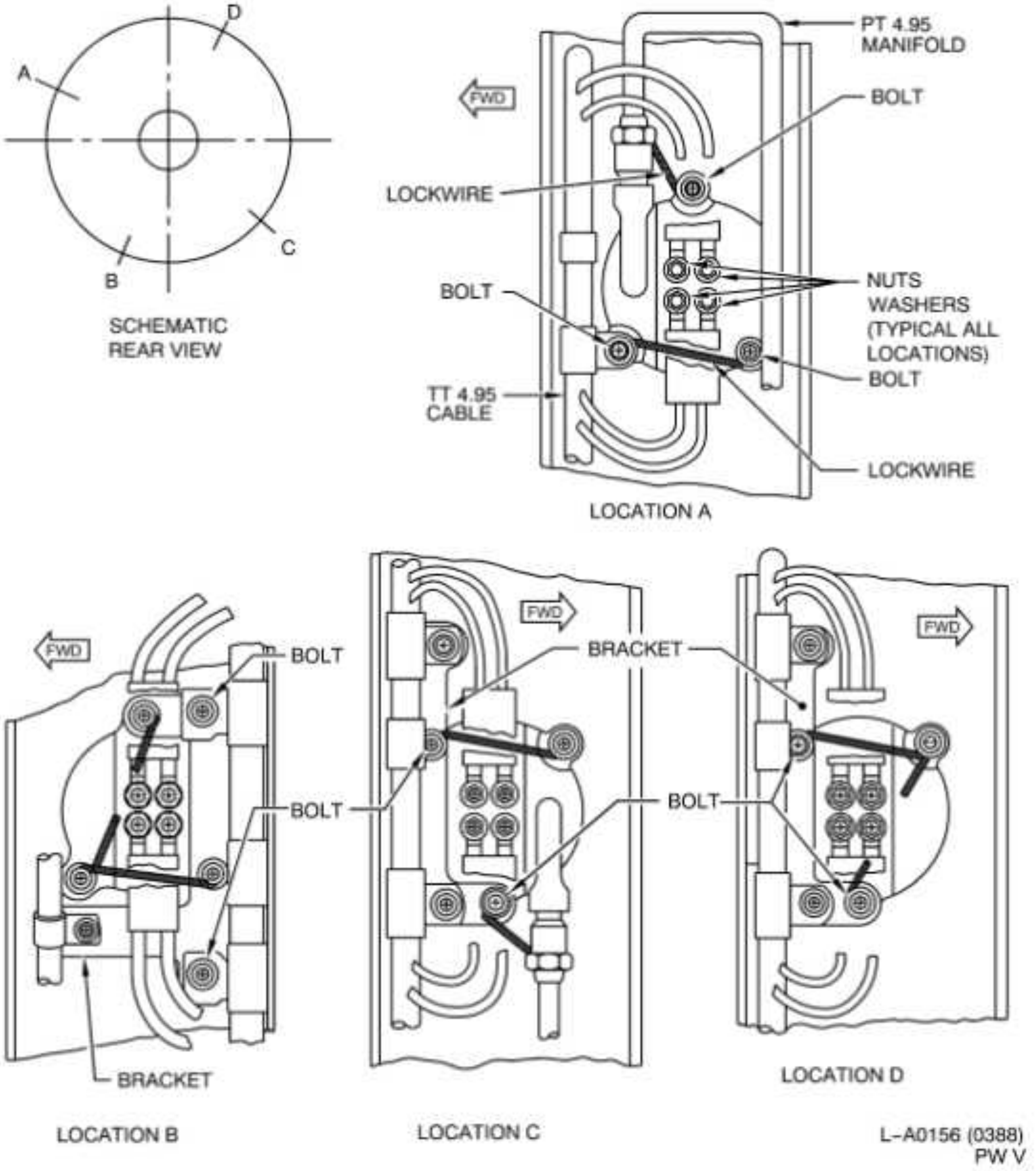
ENGINE GENERAL - TURBINE EXHAUST CASE - REMOVAL-06

Task 72-00-54-050-004-A:

1. Remove Exhaust Gas Temperature Thermocouples, TT4.95 - For Engines Without The Revised TT4.95 Cable And PT4.95 Sensing Manifold For Increased Engine Core Clearance (Pre SB PW4ENG 72-134)
    - A. Equipment And Materials Required - None
    - B. Procedure

      See Figure 301.
        - (1) Remove four nuts and washers securing cable to thermocouple connections. Remove cable ends from thermocouple.
        - (2) Remove thermocouple at Location A (10 o'clock position) as follows.
            - (a) Remove lockwire and disconnect EEC PT4.95 manifold (AS03) from pressure probe. Loosen clamp bolts attaching manifold to Flange T brackets as required to gain clearance for thermocouple removal.
            - (b) Remove lockwire and two bolts securing thermocouple to housing and exhaust case. Remove thermocouple.
        - (3) Remove thermocouple at Location B (7 o'clock position) as follows.
            - (a) Remove bolt and nut securing EEC PT4.95 manifold (AS03) to bracket.
            - (b) Remove lockwire and two bolts securing thermocouple and bracket to housing and exhaust case. Move bracket rearward and remove thermocouple.
        - (4) Remove thermocouple from Locations C and D (4 o'clock and 1 o'clock position) as follows.
            - (a) Remove lockwire and two bolts (each location) securing thermocouple and bracket to housing and exhaust case. Move bracket rearward and remove thermocouple.
        - (5) Install protective closures.

          NOTE: For additional information concerning detailed maintenance of this component see EGT (TT4.95) Thermocouple Probes Component Maintenance Manual, 77-21-05 (PW Manual PN 50A451).


D
A
C
B
SCHEMATIC REAR VIEW
FWD
PT 4.95 MANIFOLD
BOLT
LOCKWIRE
NUTS WASHERS (TYPICAL ALL LOCATIONS)
BOLT
BOLT
TT 4.95 CABLE
LOCKWIRE
LOCATION A
FWD
BOLT
BOLT
BRACKET
LOCATION B
FWD
BRACKET
BOLT
LOCATION C
FWD
LOCATION D
L-A0156 (0388)
PW V

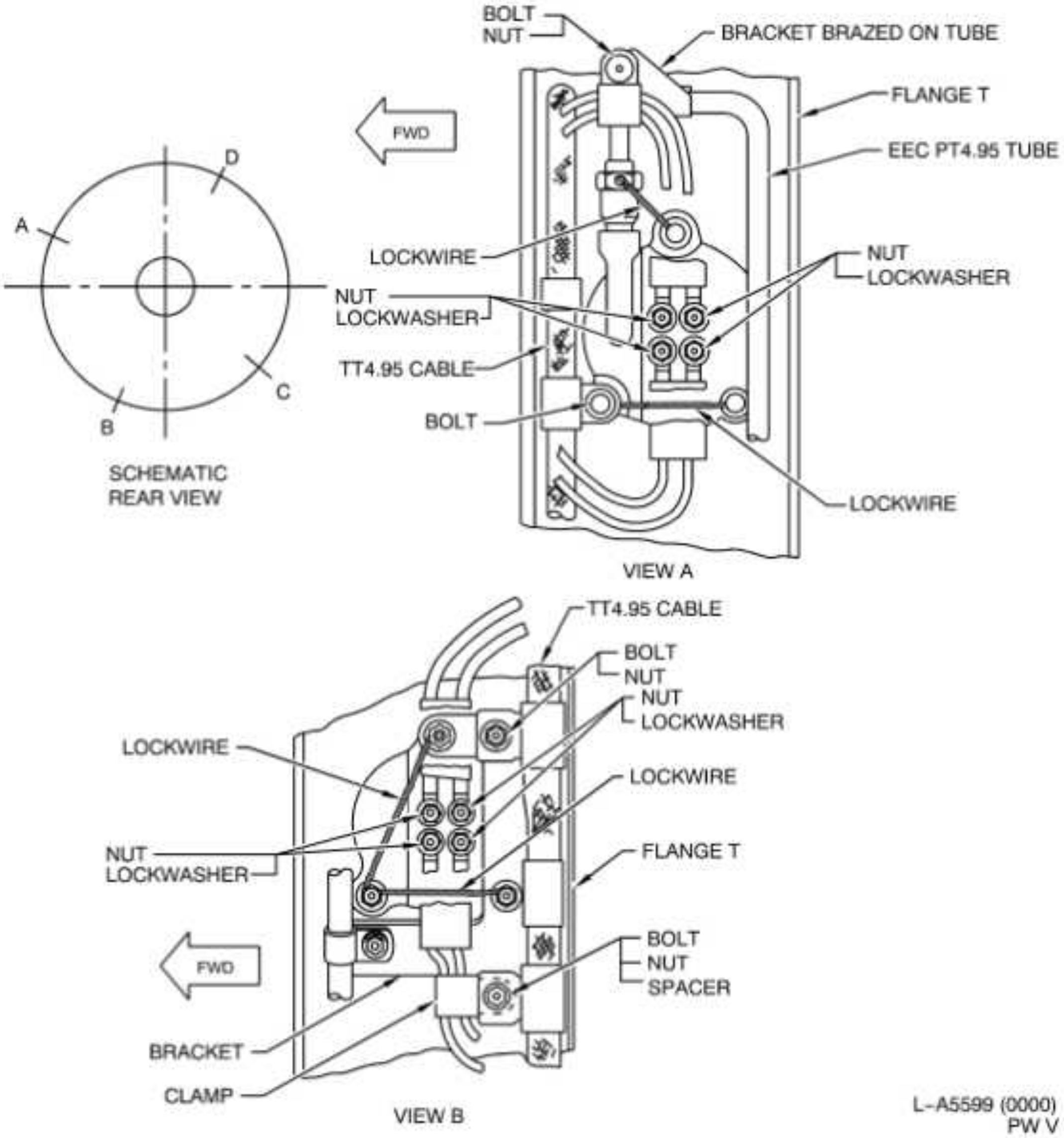
Exhaust Gas Temperature Thermocouple
(Pre SB PW4ENG 72-134)
Figure 301
(Task 72-00-54-050-004-A)

ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−06

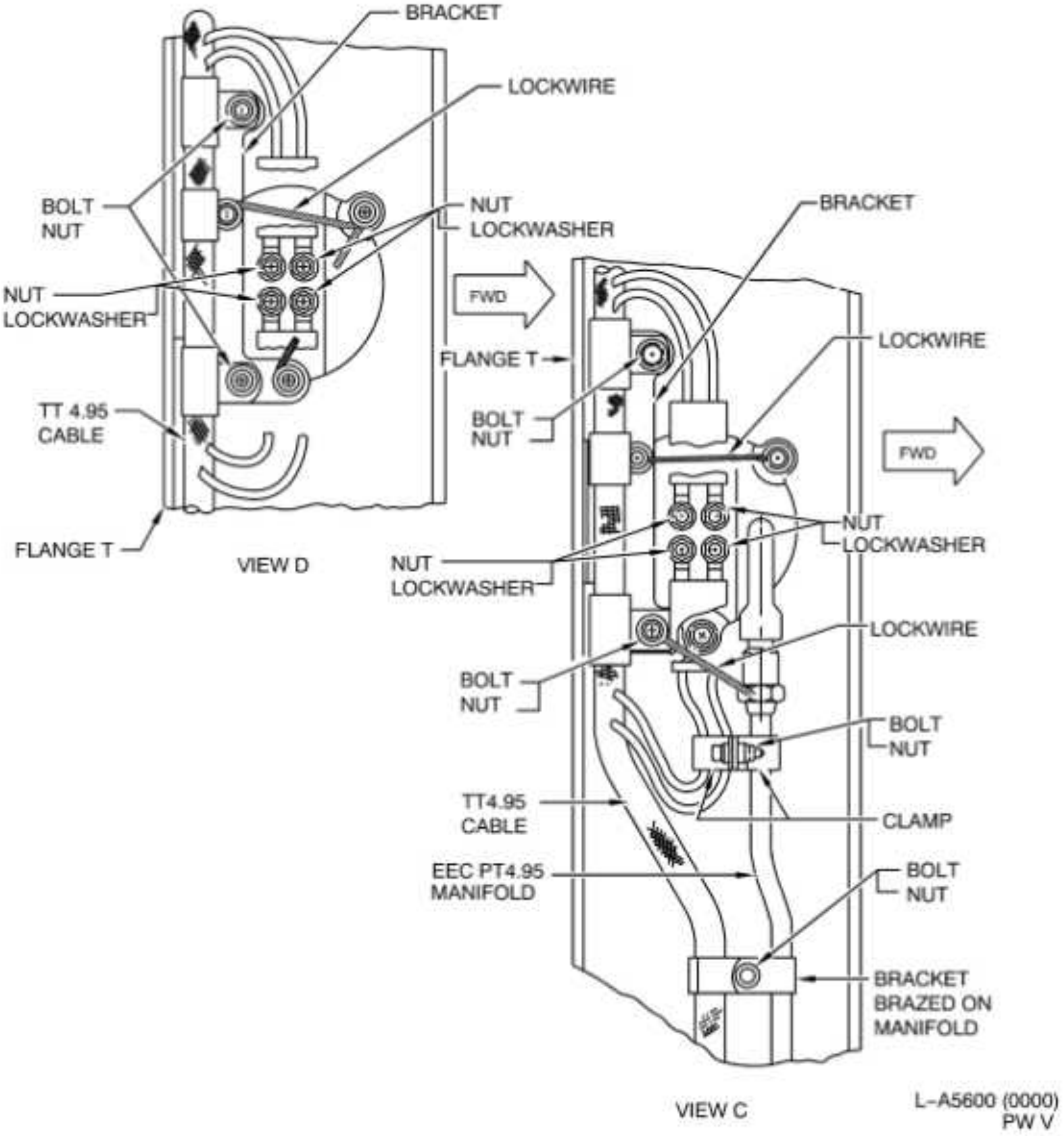
Task 72−00−54−050−004−B:

2. Remove Exhaust Gas Temperature Thermocouples, TT4.95 − For Engines With The Revised TT4.95 Cable And PT4.95 Sensing Manifold For Increased Engine Core Clearance (Post SB PW4ENG 72−134)
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figure 302.
     - (1) Remove four nuts and washers that attach the thermocouple wires to the thermocouple connections. Remove the thermocouple connectors from thermocouple.
     - (2) Remove the thermocouple at Location A (10 o'clock position) as follows.
       - (a) Remove the bolt and nut from the clamp on the thermocouple wires and the brazed on bracket on the EEC PT4.95 tube (AS34). Remove the lockwire and disconnect the EEC PT4.95 tube (AS34) from the pressure probe. Loosen the clamp bolts that attach the manifold to brackets on Flange T as necessary to get clearance for the thermocouple removal.
       - (b) Remove the lockwire and the two bolts that attach the thermocouple to the housing and exhaust case. Remove the thermocouple.
     - (3) Remove the thermocouple at Location B (7 o'clock position) as follows.
       - (a) Remove the bolt and nut that attach the EEC PT4.95 manifold (AS33) to the bracket on Flange T.
       - (b) Remove the bolt, nut and spacer from the clamp on the thermocouple wires. Remove the lockwire and the two bolts that attach the thermocouple and bracket to the housing and exhaust case. Move the bracket rearward and remove the thermocouple.
     - (4) Remove the thermocouple from Location C (4 o'clock position) as follows.
       - (a) Remove the bolt and nut from the clamps on the thermocouple wires and the EEC PT4.95 manifold (AS33). Remove the lockwire and disconnect the EEC PT4.95 manifold (AS33) from the pressure probe.
       - (b) Remove the lockwire and the two bolts that attach the thermocouple and bracket to the housing and exhaust case. Move the bracket rearward and remove the thermocouple.
     - (5) Remove the thermocouple at Location D (1 o'clock position) as follows.
       - (a) Remove the lockwire and the bolts that attach the thermocouple and bracket to the housing and exhaust case. Move the bracket rearward and remove the thermocouple.


BOLT
NUT
BRACKET BRAZED ON TUBE
FLANGE T
EEC PT4.95 TUBE
FWD
D
A
C
B
SCHEMATIC
REAR VIEW
LOCKWIRE
NUT
LOCKWASHER
NUT
LOCKWASHER
TT4.95 CABLE
BOLT
LOCKWIRE
VIEW A
TT4.95 CABLE
BOLT
NUT
NUT
LOCKWASHER
LOCKWIRE
LOCKWIRE
NUT
LOCKWASHER
FLANGE T
FWD
BOLT
NUT
SPACER
BRACKET
CLAMP
VIEW B
L-A5599 (0000)
PW V

Exhaust Gas Temperature Thermocouple
(Post SB PW4ENG 72-134)
Figure 302 (Sheet 1)
(Task 72-00-54-050-004-B)


BRACKET
LOCKWIRE
BOLT
NUT
NUT
LOCKWASHER
NUT
LOCKWASHER
TT 4.95
CABLE
FLANGE T
VIEW D
FWD
BRACKET
FLANGE T
LOCKWIRE
BOLT
NUT
FWD
NUT
LOCKWASHER
NUT
LOCKWASHER
LOCKWIRE
BOLT
NUT
BOLT
NUT
TT4.95
CABLE
CLAMP
EEC PT4.95
MANIFOLD
BOLT
NUT
BRACKET
BRAZED ON
MANIFOLD
VIEW C
L-A5600 (0000)
PW V

Exhaust Gas Temperature Thermocouple
(Post SB PW4ENG 72-134)
Figure 302 (Sheet 2)
(Task 72-00-54-050-004-B)

(6) Install protection covers.

NOTE: For additional information concerning detailed maintenance of this component see EGT (TT4.95) Thermocouple Probes Component Maintenance Manual, 77−21−05 (PW Manual PN 50A451).

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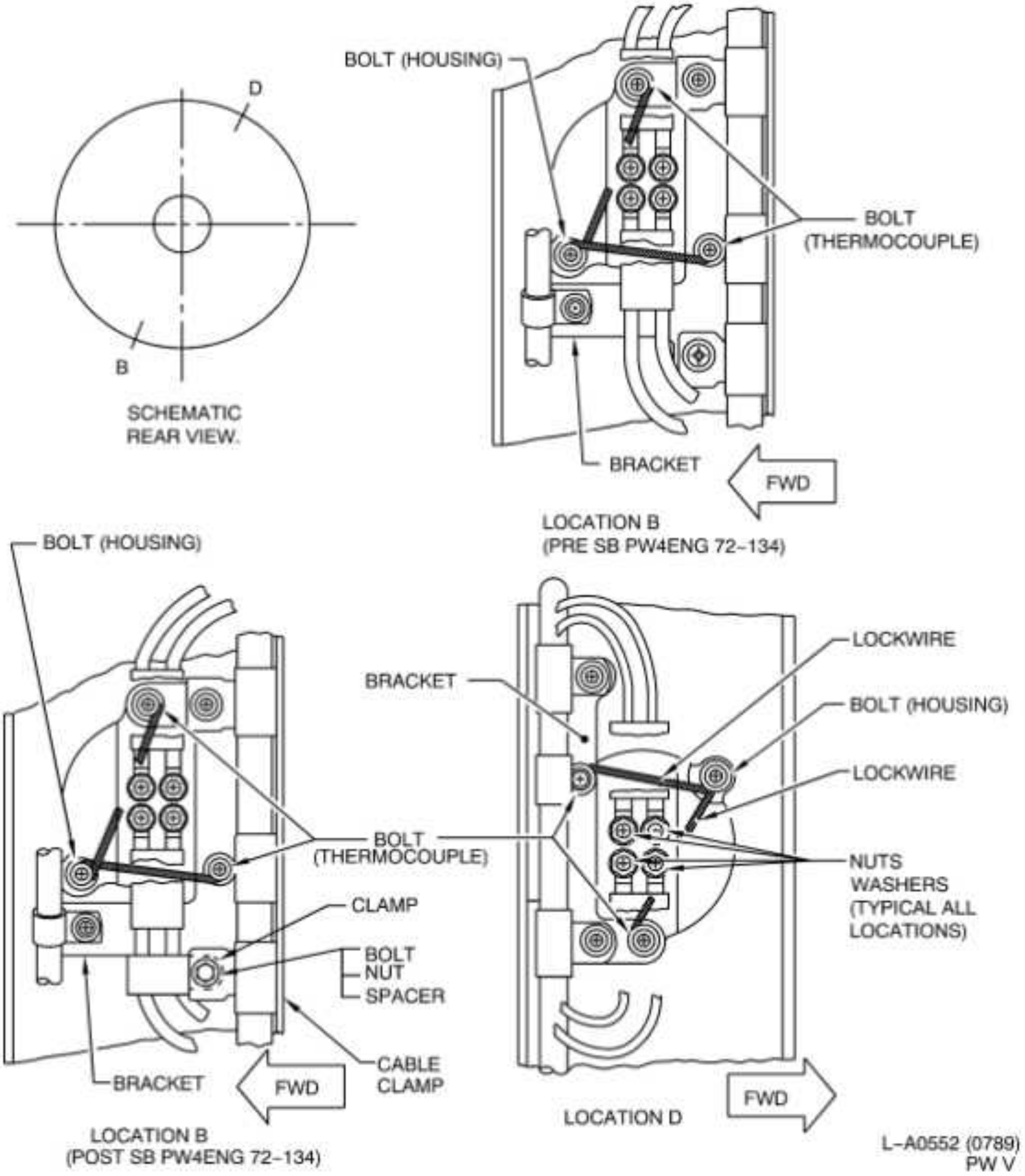
ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−07

Task 72−00−54−050−005:

1. Remove EGT (TT4.95) Thermocouple Housing
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figure 301.
     - (1) Remove nuts and washers securing cable ends to thermocouple connections. Remove cable ends from thermocouple.
     - (2) Remove lockwire and two bolts securing thermocouple to boss on case. At Location B only, remove bolt and nut securing EEC PT4.95 manifold (AS33) to bracket.
     - (3) At Location B remove the bolt, nut and spacer from the clamp on the thermocouple wires (Post SB PW4ENG 72−134).
     - (4) Remove remaining bolt securing EGT (TT4.95) thermo− couple housing to exhaust case boss.
     - (5) Move bracket to rear and remove EGT thermocouple probe. Remove housing from case.
     - (6) Install protective closures.


D
B
SCHEMATIC
REAR VIEW.
BOLT (HOUSING)
BOLT
(THERMOCOUPLE)
BRACKET
FWD
LOCATION B
(PRE SB PW4ENG 72-134)
BOLT (HOUSING)
BRACKET
LOCKWIRE
BOLT (HOUSING)
LOCKWIRE
BOLT
(THERMOCOUPLE)
NUTS
WASHERS
(TYPICAL ALL
LOCATIONS)
CLAMP
BOLT
NUT
SPACER
CABLE
CLAMP
BRACKET
FWD
LOCATION B
(POST SB PW4ENG 72-134)
LOCATION D
FWD
L-A0552 (0789)
PW V

EGT (TT4.95) Thermocouple Housing
Figure 301
(Task 72−00−54−050−005)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - TURBINE EXHAUST CASE - REMOVAL-08

Task 72-00-54-020-002:

1. Remove No. 4 Bearing And Seals

NOTE: See Figure 301 for part/assembly removal sequence.

A. Equipment And Materials Required

Standard Tools:
.190-32 Jackscrews, Eight Required Per Text

Special Tools:

PWA 3755	Pump, Hydraulic (Optional To PWA 29389)
PWA 29389	Pump, Hydraulic
PWA 75284	Puller, Knocker
PWA 85307	Puller, Jackscrew
PWA 85431	Puller, Hydraulic
PWA 85432	Puller, Hydraulic
PWA 85434	Puller, Jackscrew (Optional to PWA 87053)
PWA 85446	Puller, Jackscrew
PWA 87053	Puller

B. Procedure

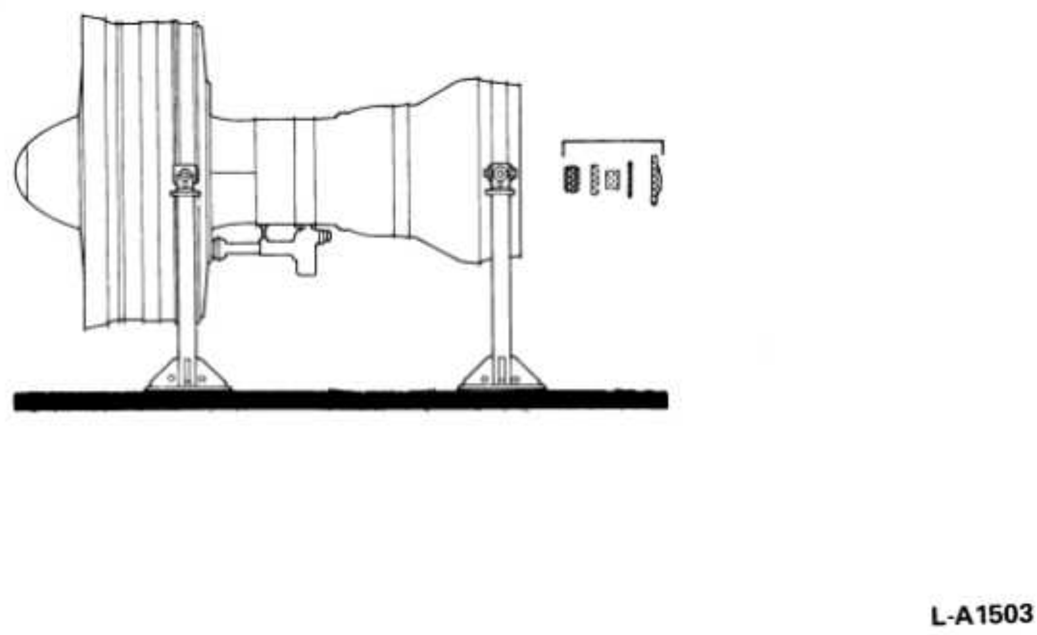
(1) Remove bolts (302/6) securing No. 4 bearing shield (302/5) to turbine exhaust case (rear inner flange) (302/1). Remove shield. Remove No. 4 bearing heat shield (302/4). See Figure 302.

(2) Remove No. 4 bearing cover (302/3).

  (a) For No. 4 bearing cover (302/3) that has six small threaded holes (Pre SB PW4ENG 72-385), install the PWA 85307 Jackscrew Puller to the rear inner bolt hole flange (Flange T1) of the exhaust case and attach with two bolts, washers and nut details. Install the small plate of the puller to the six threaded holes in the cover and attach with six knurled screw details. Turn the jackscrew to disengage the cover from the exhaust case. Remove the puller and the cover from the exhaust case. Remove the cover from the puller. Discard the packing (302/2).

  (b) For cover that has eight jackscrew holes (Post SB PW4ENG 72-385), install and evenly tighten eight 0.190-32 Jackscrews to remove the cover. Discard the packing (302/2).

(3) Remove No. 4 bearing (oil) nozzle and No. 4 bearing packing transfer tube from boss in exhaust case (No. 4 bearing compartment) at 1:30 o'clock position. See Figure 303.



Procedure Sequence
Figure 301
(Task 72-00-54-020-002)

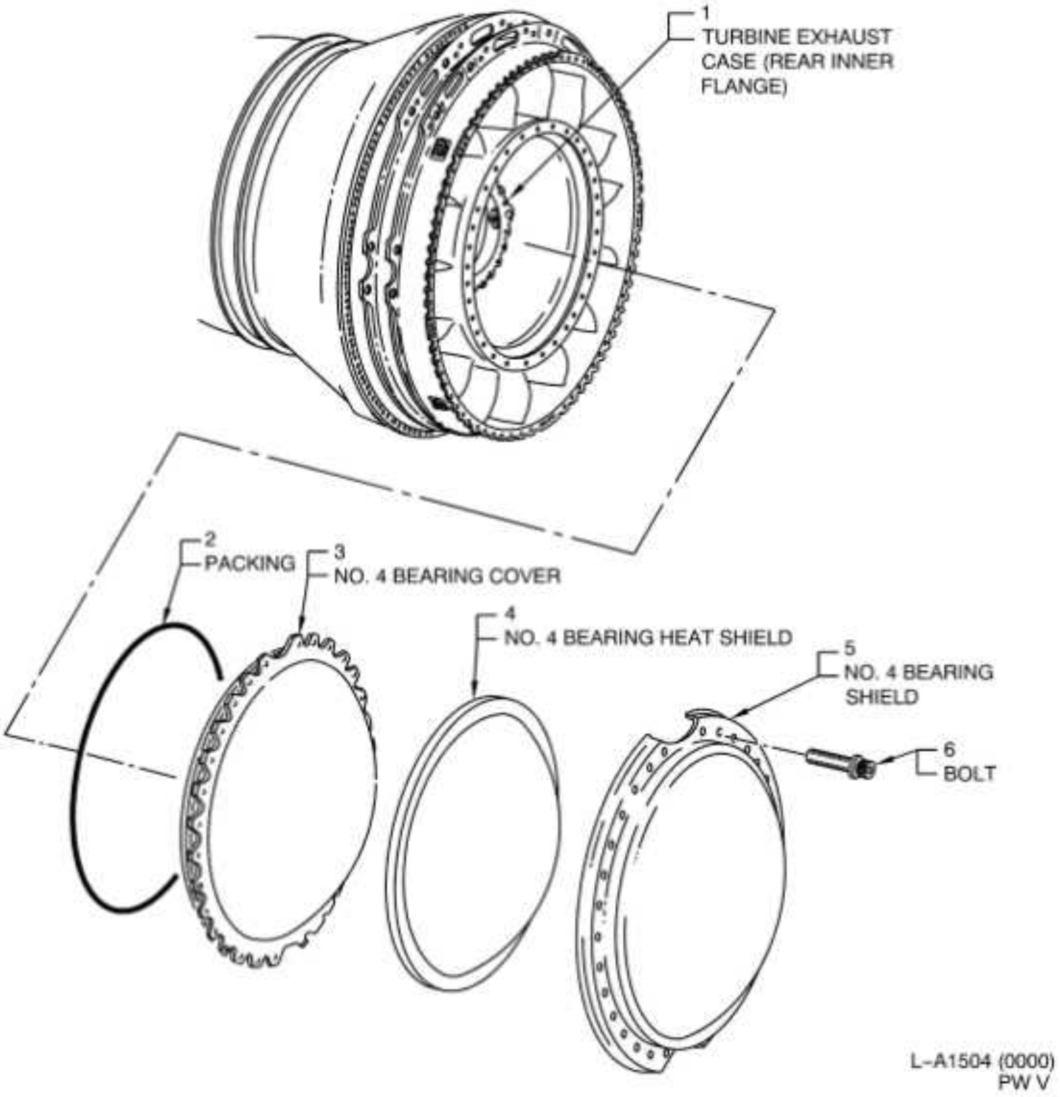
(a) Remove bolts (303/7) and key washers (303/6) and (303/8) securing No. 4 bearing packing transfer tube (303/5) to No. 4 bearing nozzle (303/3). Remove tube.

(b) Remove bolts (303/1) and key washers (303/2) and (303/4) securing No. 4 bearing nozzle (303/3) to exhaust case. Remove nozzle.

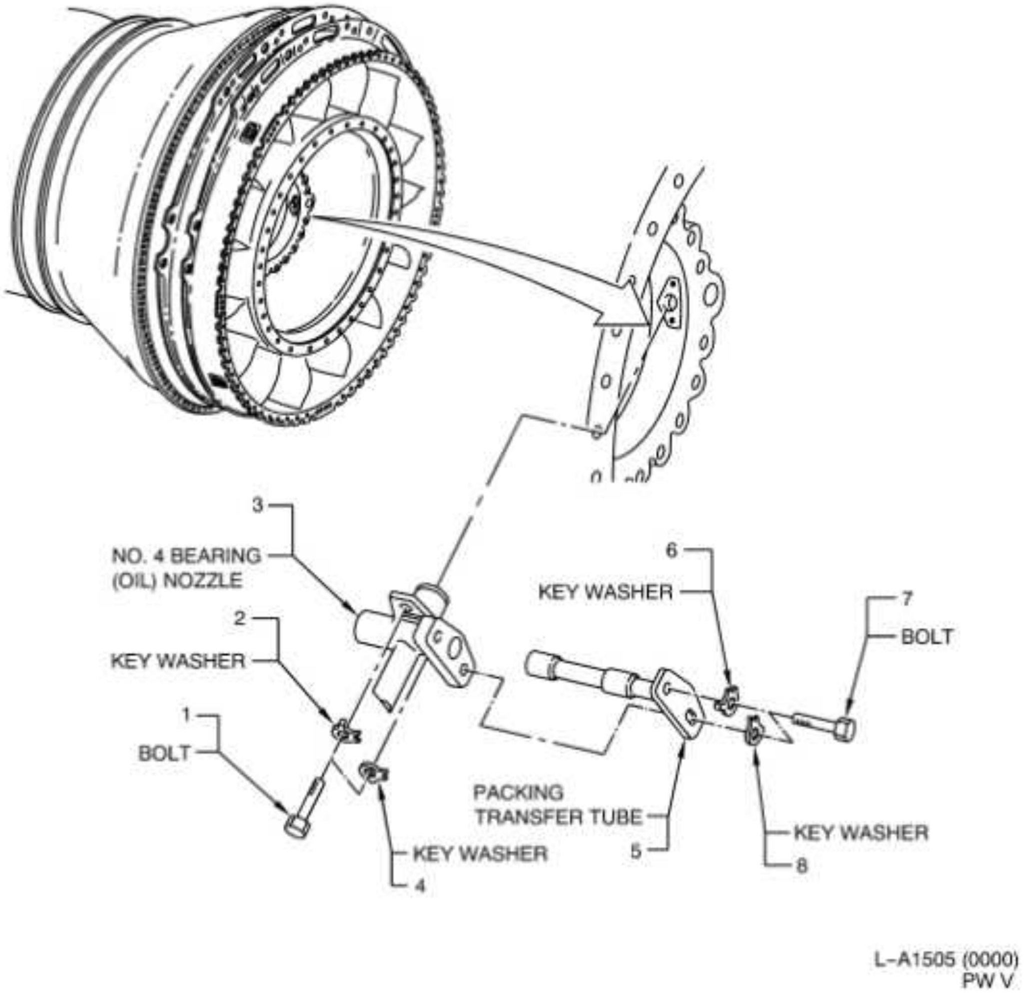
(4) Remove No. 4 bearing oil scavenge (inner) tube (304/4). See Figure 304.

(a) Remove key washer (304/2) and bolt (304/3) securing scavenge tube bracket to exhaust case inner flange at 6 o'clock position.

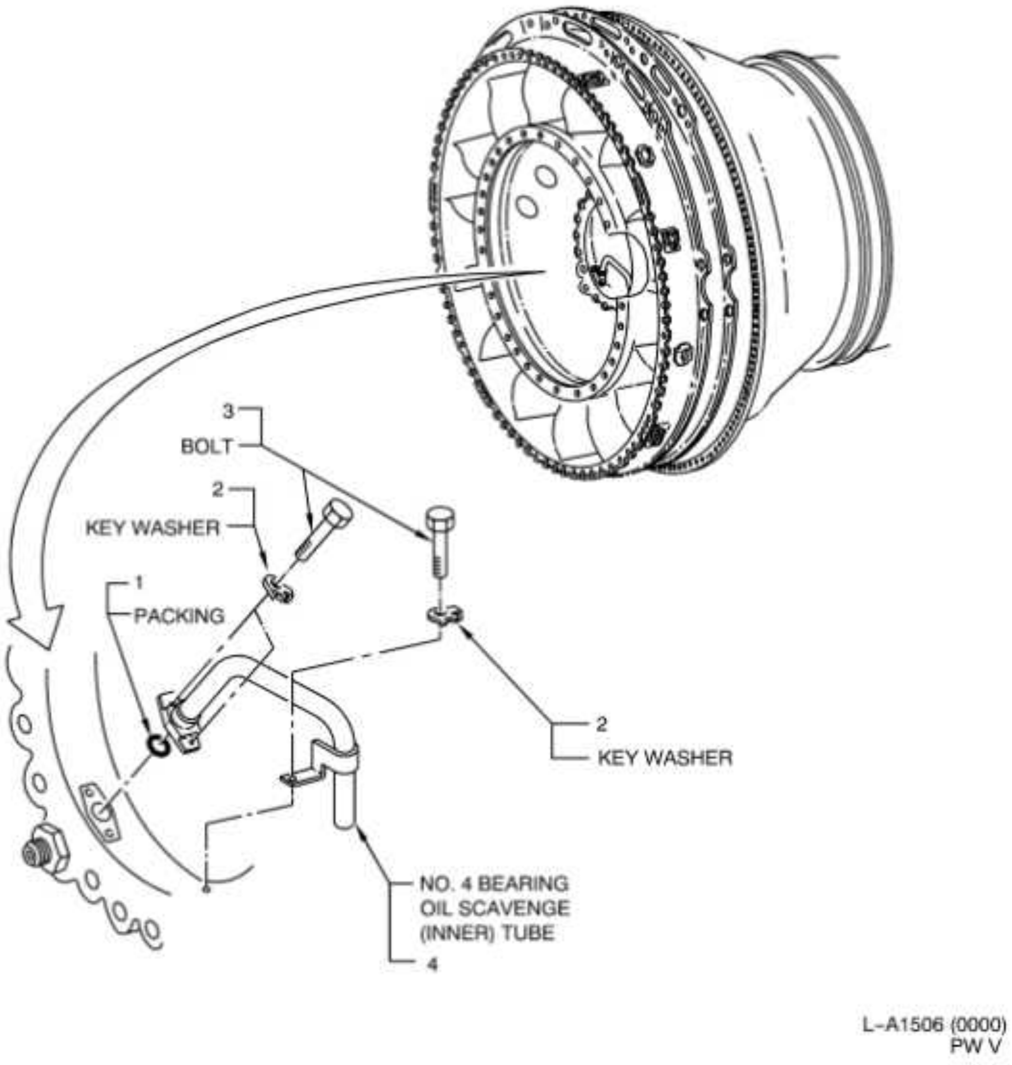
(b) Remove key washers (304/2) and bolts (304/3) securing scavenge tube to exhaust case inner flange at 7:30 o'clock location. Remove scavenge tube. Discard packing (304/1).


1
TURBINE EXHAUST CASE (REAR INNER FLANGE)
2
PACKING
3
NO. 4 BEARING COVER
4
NO. 4 BEARING HEAT SHIELD
5
NO. 4 BEARING SHIELD
6
BOLT
L-A1504 (0000)
PW V

No. 4 Bearing And Seals Removal
Figure 302
(Task 72−00−54−020−002)


3
NO. 4 BEARING (OIL) NOZZLE
2
KEY WASHER
1
BOLT
6
KEY WASHER
7
BOLT
PACKING TRANSFER TUBE
5
KEY WASHER
4
KEY WASHER
8
L-A1505 (0000)
PW V

No. 4 Bearing (Oil) Nozzle Removal
Figure 303
(Task 72−54−00−020−002)


3
BOLT
2
KEY WASHER
1
PACKING
2
KEY WASHER
NO. 4 BEARING
OIL SCAVENGE
(INNER) TUBE
4
L−A1506 (0000)
PW V

No. 4 Bearing Scavenge Tube Removal
Figure 304
(Task 72−00−54−020−002)

(5) Position 12 to 16 brass shims equally spaced over 90 − 110 degree arc. Place shims just to rear of knife−edge seal between 6th stage blade outer shrouds and 6th stage air sealing ring segments.

(6) Remove No. 4 bearing retaining plate (305/3). See Figure 305.

  (a) Remove bolts (305/5) and key washers (305/4) securing retaining plate to front compressor drive turbine shaft (305/6). Discard key washers.

  CAUTION: USE CARE WHEN ACTUATING PULLER (PWA 75284). DAMAGE TO NO. 4 BEARING OIL SCAVENGE TUBE MAY RESULT BY SUDDEN REARWARD MOVEMENT OF PULLER WHEN NO. 4 BEARING RETAINING PLATE IS RELEASED FROM ENGINE.

  (b) Rotate knurled nut detail of PWA 75284 Knocker Puller to retract jaws. Install puller onto retaining plate with jaws in line with slots in retaining plate wall. Tighten knurled nut to secure jaws in retaining plate. Using slide hammer, remove retaining plate from shaft. Remove puller.

  (c) Discard packing (305/2).

(7) Remove No. 4 bearing outer race and rollers. (306/2) See Figure 306.

  (a) Remove bolts (306/6) and key washers (306/4) and (306/5) securing four No. 4 bearing retaining plates (306/3) to rear face of exhaust case inner flange.

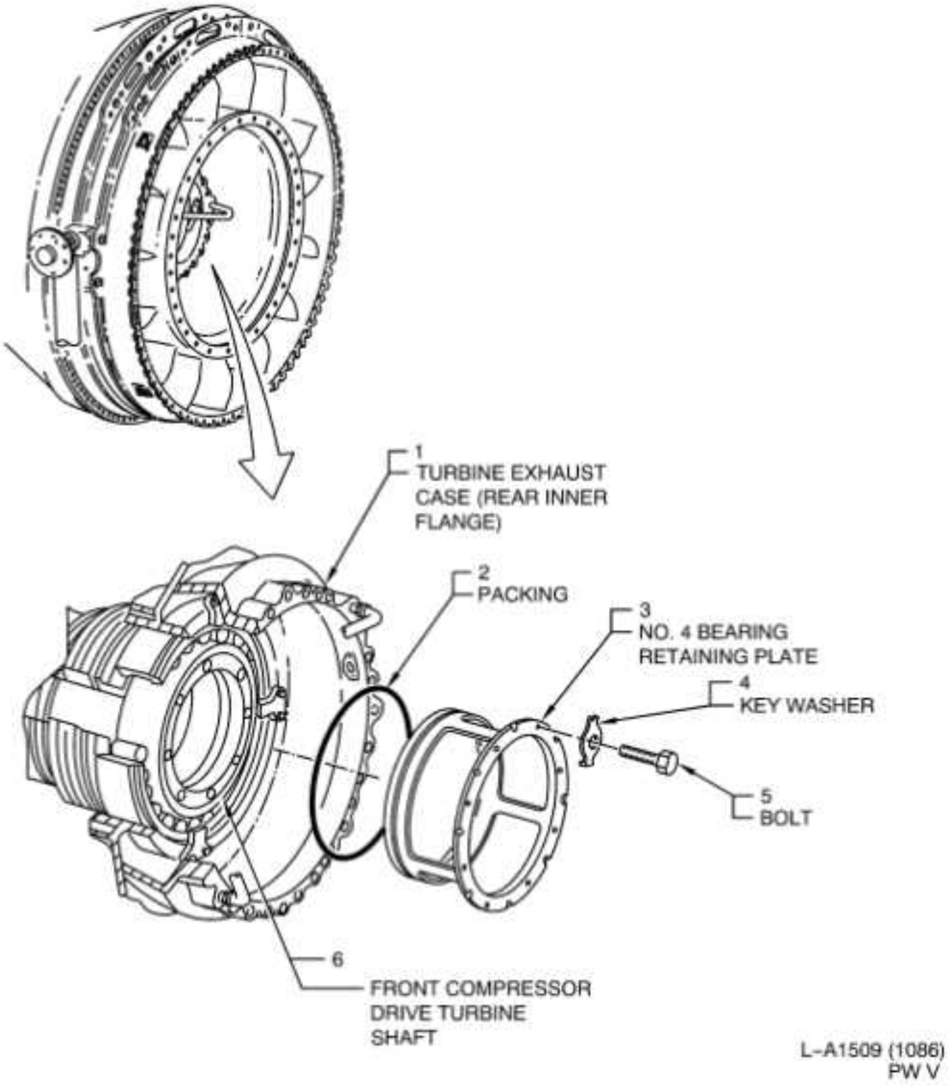
  (b) Position four legs of PWA 85446 Jackscrew Puller into slots in bearing outer race and rotate to secure legs in puller groove of bearing.

  (c) Hold center handle of puller and turn large jacking nut to remove outer race from exhaust case. Remove puller. Remove two seal rings (306/1).

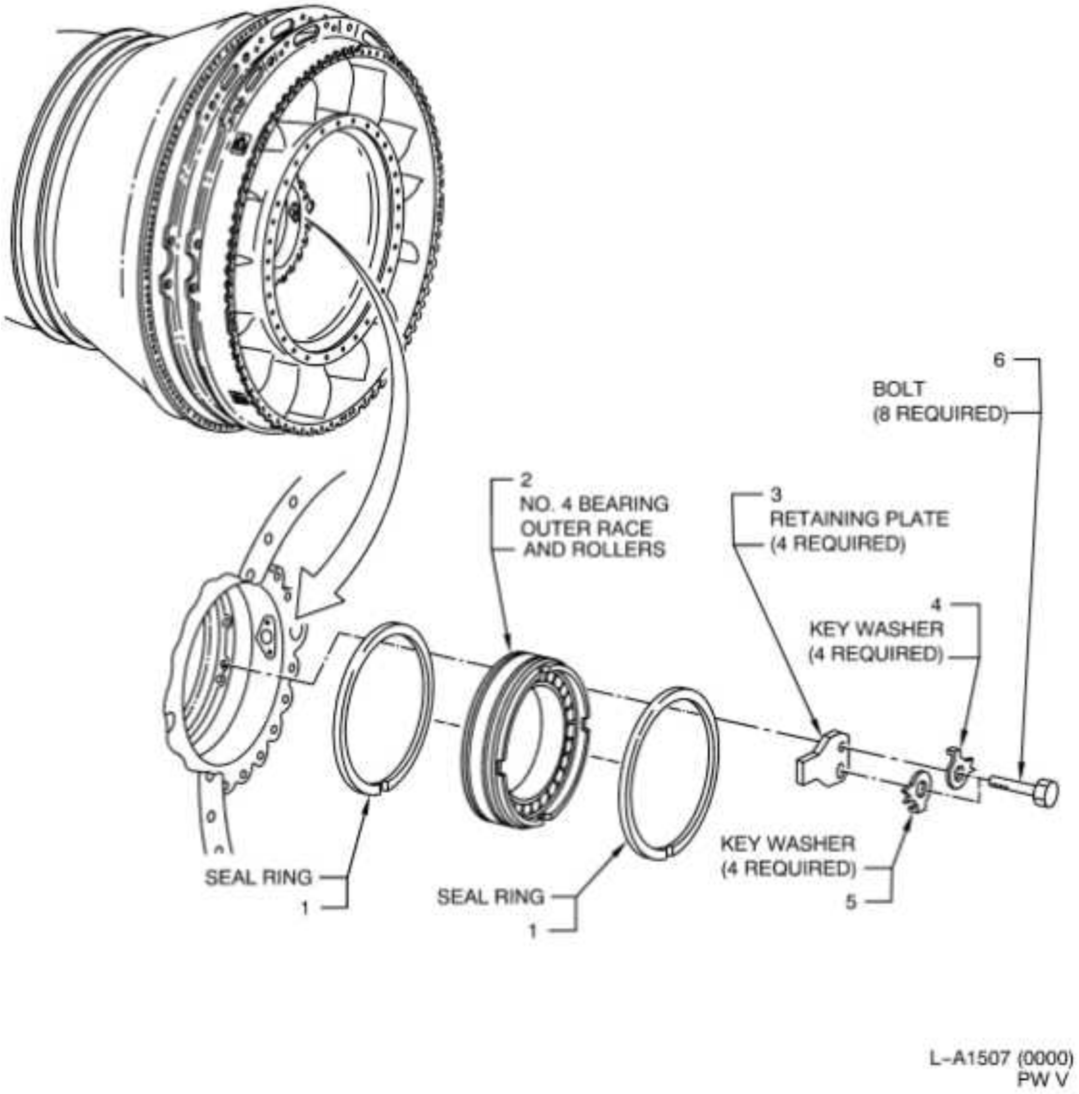
  CAUTION: BEARING INNER RACE IS INSTALLED ON FRONT COMPRESSOR DRIVE TURBINE SHAFT. ENSURE THAT ALL BEARING DETAILS ARE KEPT TOGETHER. MIXING OF BEARING DETAILS MAY CAUSE DAMAGE TO BEARING.

  (d) Place No. 4 bearing outer race and rollers into suitable container.

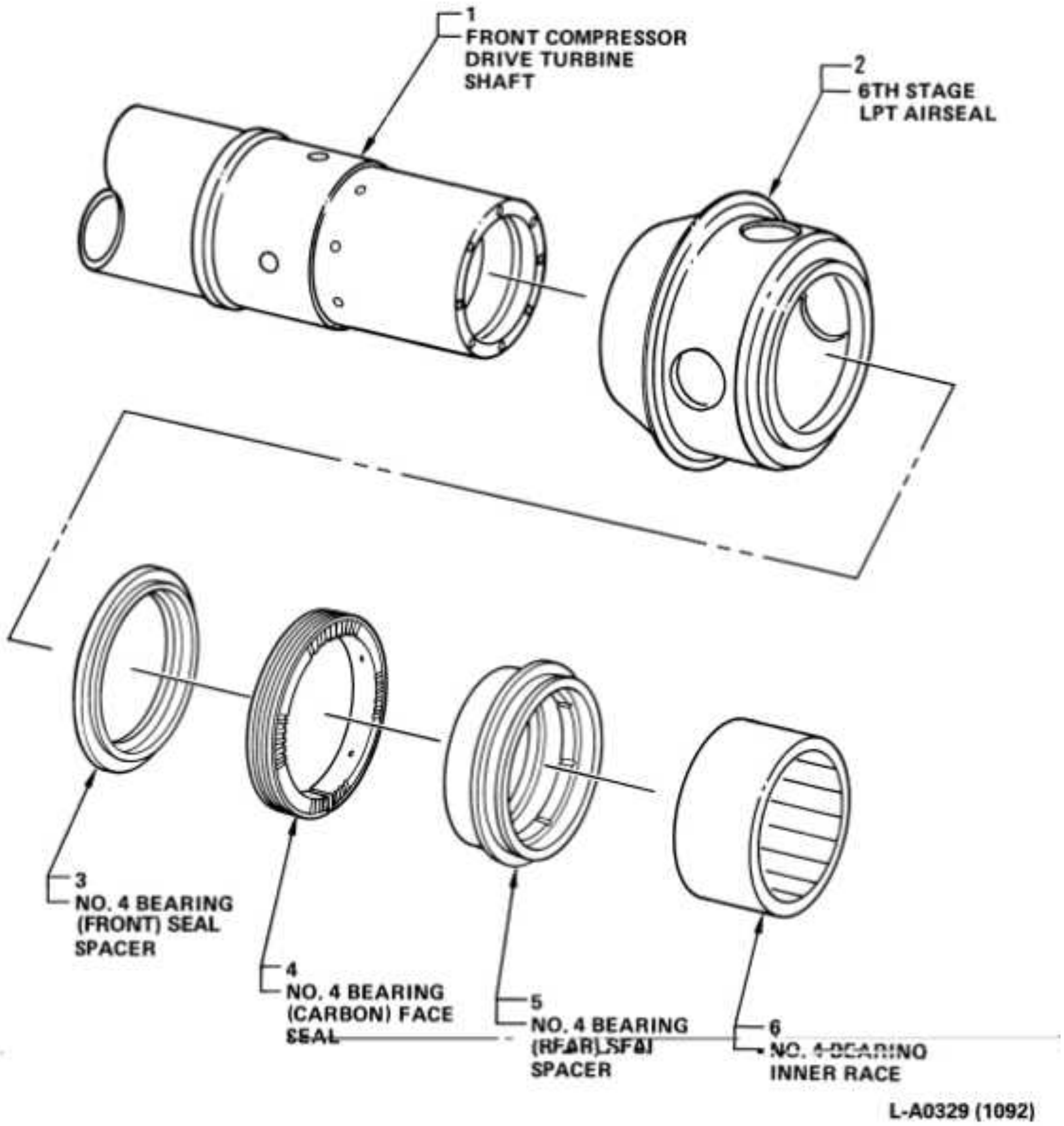
(8) Remove No. 4 bearing (rear) seal spacer (307/5) and inner race (307/6) from front compressor drive turbine shaft (307/1) using PWA 85431 Puller. See Figure 307.


1
TURBINE EXHAUST CASE (REAR INNER FLANGE)
2
PACKING
3
NO. 4 BEARING RETAINING PLATE
4
KEY WASHER
5
BOLT
6
FRONT COMPRESSOR DRIVE TURBINE SHAFT
L-A1509 (1086)
PW V

No. 4 Bearing Retaining Plate Removal
Figure 305
(Task 72−00−54−020−002)


6
BOLT
(8 REQUIRED)
2
NO. 4 BEARING
OUTER RACE
AND ROLLERS
3
RETAINING PLATE
(4 REQUIRED)
4
KEY WASHER
(4 REQUIRED)
KEY WASHER
(4 REQUIRED)
5
SEAL RING
1
SEAL RING
1
L-A1507 (0000)
PW V

No. 4 Bearing Outer Race Removal
Figure 306
(Task 72−00−54−020−002)


1
FRONT COMPRESSOR DRIVE TURBINE SHAFT
2
6TH STAGE LPT AIRSEAL
3
NO. 4 BEARING (FRONT) SEAL SPACER
4
NO. 4 BEARING (CARBON) FACE SEAL
5
NO. 4 BEARING (REAR) SEAL SPACER
6
NO. 4 BEARING INNER RACE
L-A0329 (1092)

No. 4 Bearing And Seals Removal
Figure 307
(Task 72−00−54−020−002)

(a) Remove jaw retaining ring from puller and slide three jaws outward.

(b) Position puller on end of front compressor drive turbine shaft secure inner locating ring to turbine shaft with three detail screws.

(c) Slide three jaws inward behind puller lip of No. 4 bearing (rear) seal spacer (307/5). Install retaining ring over jaws and seat on lugs of jaws.

(d) Attach PWA 3755 or PWA 29389 Hydraulic Pump to hydraulic cylinder on puller.

(e) Actuate pump to remove inner race and spacer turbine shaft.

(f) Disconnect hydraulic pump. Remove retaining ring and slide jaws outward. Remove bolts securing locating ring to turbine shaft. Remove puller from engine.

(g) Remove bearing inner race and spacer from turbine shaft and store parts in suitable container.

(9) Remove No. 4 bearing (front) seal spacer (307/3) and No. 4 bearing (carbon) face seal (307/4) using PWA 85434 or PWA 87053 Puller.

(a) Rotate outer plate to centralize three puller legs between arms of inner plate. Slide three puller legs inward.

(b) Position puller on end of front compressor drive turbine shaft. Secure inner plate to turbine shaft with three detail screws.

(c) Slide three puller legs outward to engage puller lip in ID of No. 4 bearing seal spacer. It may be necessary to turn jackscrew to align puller lip on jaws with puller groove in spacer. Rotate outer plate detail to align puller legs with three arms of inner plate detail to secure puller.

(d) Turn center jackscrew to remove seal and spacer.

(e) Rotate outer plate to centralize three puller legs between arms of inner plate. Loosen screws and slide jaws inward. Remove screws securing inner plate to turbine shaft and remove puller from shaft.

(f) Remove (carbon) face seal and seal spacer from turbine shaft and store parts in suitable containers.

(10) Remove 6th stage LPT airseal (307/2) from front compresser drive turbine shaft (307/1) using PWA 85432 Puller.

(a) Remove jaw retaining ring from puller and slide four jaws outward.

(b) Position puller on end of front compressor drive turbine shaft. Secure inner locating ring to turbine shaft with two detail screws.
(c) Slide four jaws inward, engaging puller legs in four holes in side of airseal. Install retaining ring over jaws and seat on lugs of jaws.
(d) Attach PWA 3755 or PWA 29389 Hydraulic Pump to hydraulic cylinder on puller.
(e) Actuate pump to remove airseal from turbine shaft.
(f) Disconnect hydraulic pump. Remove retaining ring and slide jaws outward. Remove bolts securing locating ring to turbine shaft. Remove puller from engine.
(g) Remove airseal from turbine shaft and store in suitable container.

ENGINE GENERAL - TURBINE EXHAUST CASE - REMOVAL-09

Task 72-00-54-050-006-A:

1. Remove EEC Thermocouple And Airframe Cable (W6) - For Engines Without The Revised EEC Thermocouple And Airframe Cable (W6) And Wiring Harness Support Tube For Increased Engine Core Clearance (Pre SB PW4ENG 72-134)

NOTE: This procedure provides for removal of EEC thermocouple and airframe cable (W6) and cable tube (support).

A. Equipment And Materials Required - None

B. Procedure
See Figure 301 and Figure 302.

(1) Before disconnecting cable leads, tag each lead and terminal stud to facilitate proper reinstallation.

CAUTION: AVOID TWISTING OR SEVERE BENDING OF CABLE AT ANY TIME DURING REMOVAL OR DAMAGE TO CABLE MAY RESULT.

(2) Remove lockwire and four screws securing cover and ground lead to EGT (TT4.95) box and cable assembly junction box located at 5:30 o'clock position on turbine exhaust case. Remove cover. See Figure 302.

(3) Remove four nuts and disconnect cable leads from junction box. Reinstall nuts on terminal studs.

NOTE: Chromel nut and terminal stud diameters are smaller than those of alumel nuts and terminal studs.

(4) Remove four nuts and disconnect cable leads from TT3 thermocouple located at approximately 3 o'clock position on diffuser case. Reinstall nuts on terminal studs. See View H.

NOTE: Chromel nut and terminal stud diameters are smaller than those of alumel nuts and terminal studs.

(5) Disconnect W6P12 cable connector from W5J12 cable connector located on Flange K at 3:30 o'clock position. Install protective closures on each cable connector.

(6) Remove nuts, bolts, and spacers securing cable clamps to brackets and to clamps brazed on cable tube (support). Remove cable.

(7) Remove bolt, nut, and spacer securing cable tube (support) to bracket on LPT cooling air manifold support at 5 o'clock position. See View C.

(8) Remove bolt and nut securing cable tube (support) to bracket on rear flange of (lower right) turbine vane cooling air tube (AP02) at 3:30 o'clock position. See View F.

(9) Remove nut, bolt, and spacer securing lower rear end of cable tube (support) to bracket located on Flange P at approximately 5 o'clock position. Remove cable tube (support).

Task 72−00−54−050−006−B:

2. Remove EEC Thermocouple And Airframe Cable (W6) − For Engines With Revised EEC Thermocouple And Airframe Cable (W6) And Wiring Harness Support Tube For Increased Engine Core Clearance (Post SB PW4ENG 72−134)

A. Equipment And Materials Required − None

B. Procedure
See Figures 303, 304 and 305.

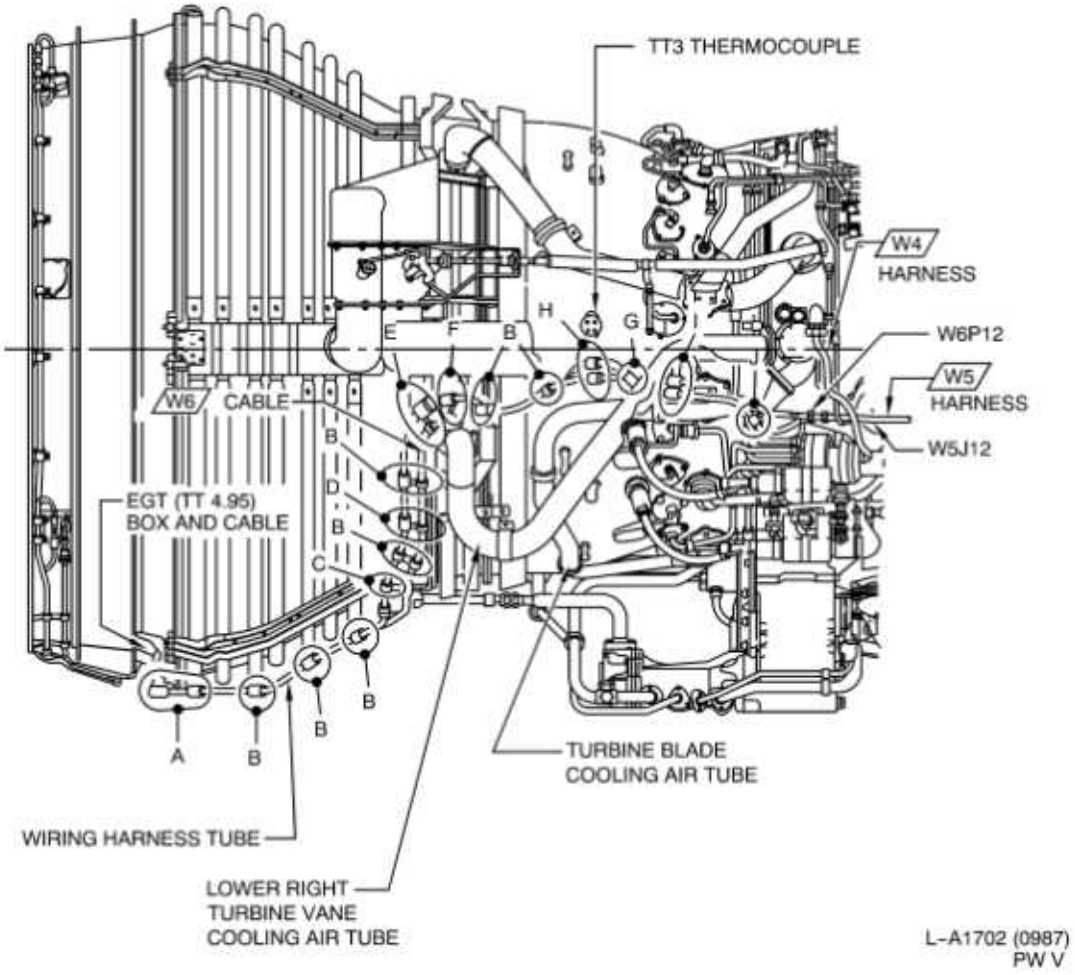
(1) Before you disconnect the cable wires (leads), tag each wire (lead) and terminal stud to help with the correct installation.

CAUTION: DO NOT TWIST OR BEND THE CABLE BADLY DURING REMOVAL, OR DAMAGE TO THE CABLE CAN OCCUR.

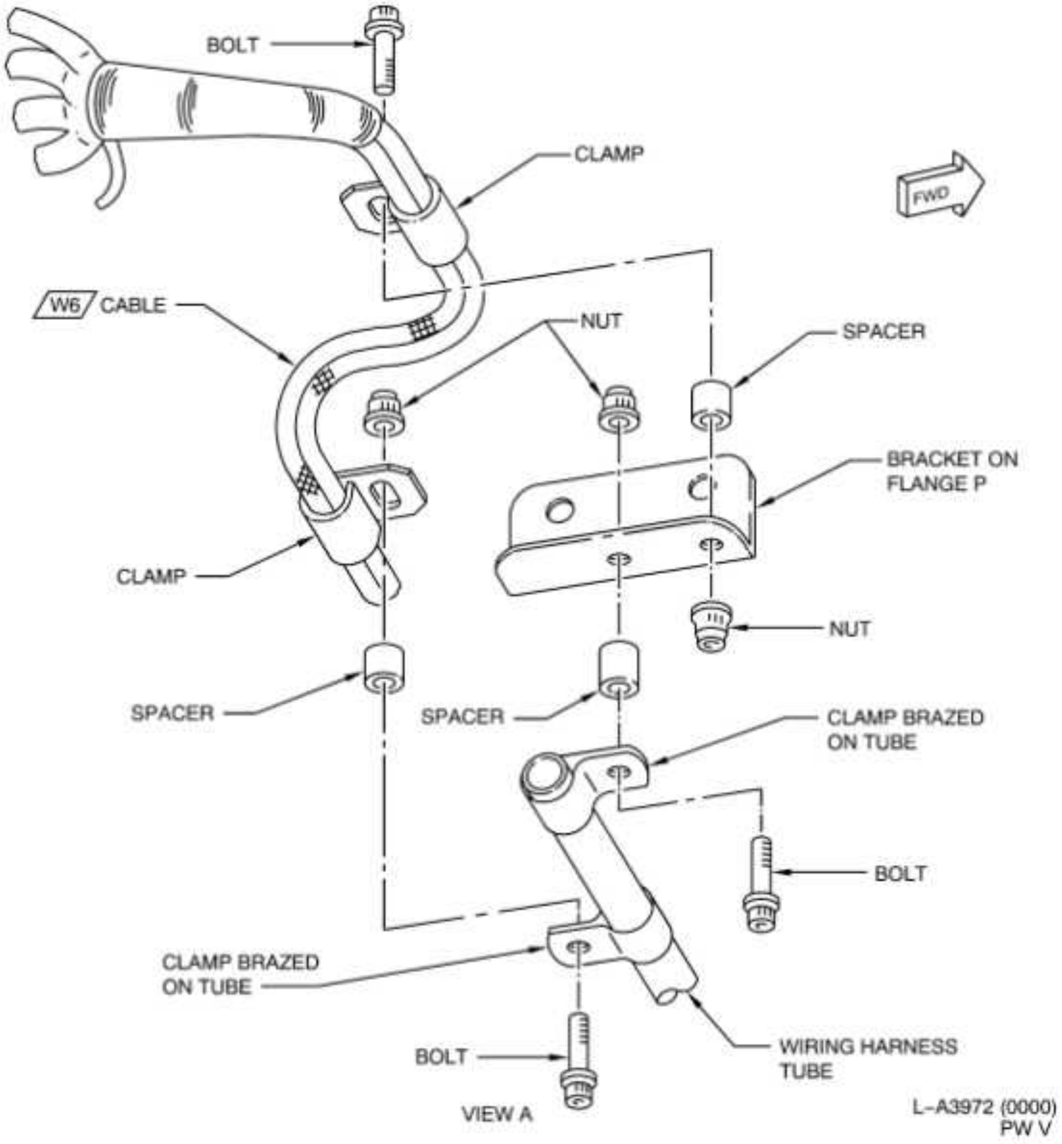
(2) Remove the lockwire and the four screws that attach the cover and the ground wire (lead) of the EGT (TT4.95) box and cable assembly to the junction box at the 5:30 o'clock position on the turbine exhaust case. Remove the cover. See Figure 305.

(3) Remove the four nuts and disconnect the cable wires (leads) from the terminal studs on the junction box. Install the nuts back onto the terminal studs.

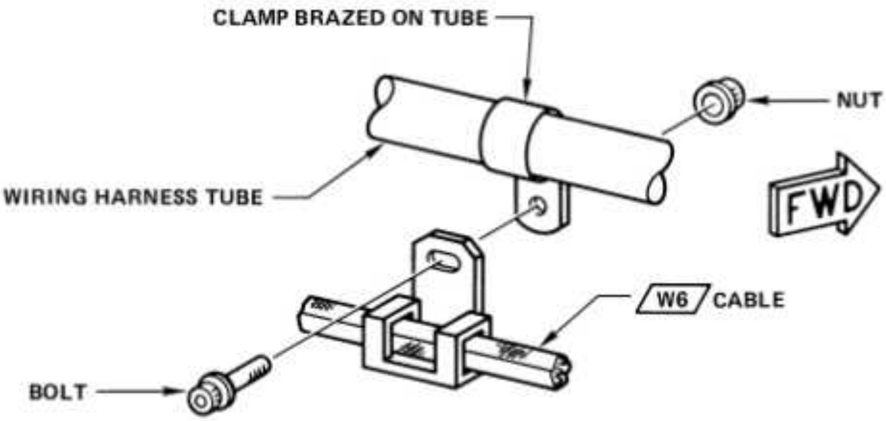
NOTE: The diameter of the chromel nuts and terminal studs is smaller than the diameter of the alumel nuts and terminal studs.


TT3 THERMOCOUPLE
W4
HARNESS
W6P12
W5
HARNESS
W5J12
W6
CABLE
H
G
E
F
B
B
D
B
C
EGT (TT 4.95)
BOX AND CABLE
A
B
B
B
TURBINE BLADE
COOLING AIR TUBE
WIRING HARNESS TUBE
LOWER RIGHT
TURBINE VANE
COOLING AIR TUBE
L-A1702 (0987)
PW V

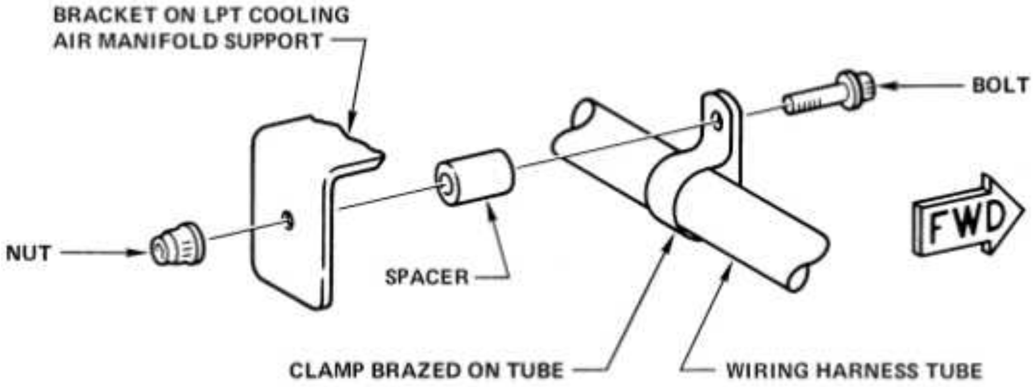
EEC Thermocouple And Airframe Cable (W6)
Figure 301 (Sheet 1)
(Task 72−00−54−050−006−A)


BOLT
CLAMP
FWD
W6 CABLE
NUT
SPACER
BRACKET ON FLANGE P
CLAMP
NUT
SPACER
SPACER
CLAMP BRAZED ON TUBE
BOLT
CLAMP BRAZED ON TUBE
WIRING HARNESS TUBE
BOLT
VIEW A
L-A3972 (0000)
PW V

EEC Thermocouple And Airframe Cable (W6)
Figure 301 (Sheet 2)
(Task 72−00−54−050−006−A)


CLAMP BRAZED ON TUBE
NUT
WIRING HARNESS TUBE
FWD
W6 CABLE
BOLT

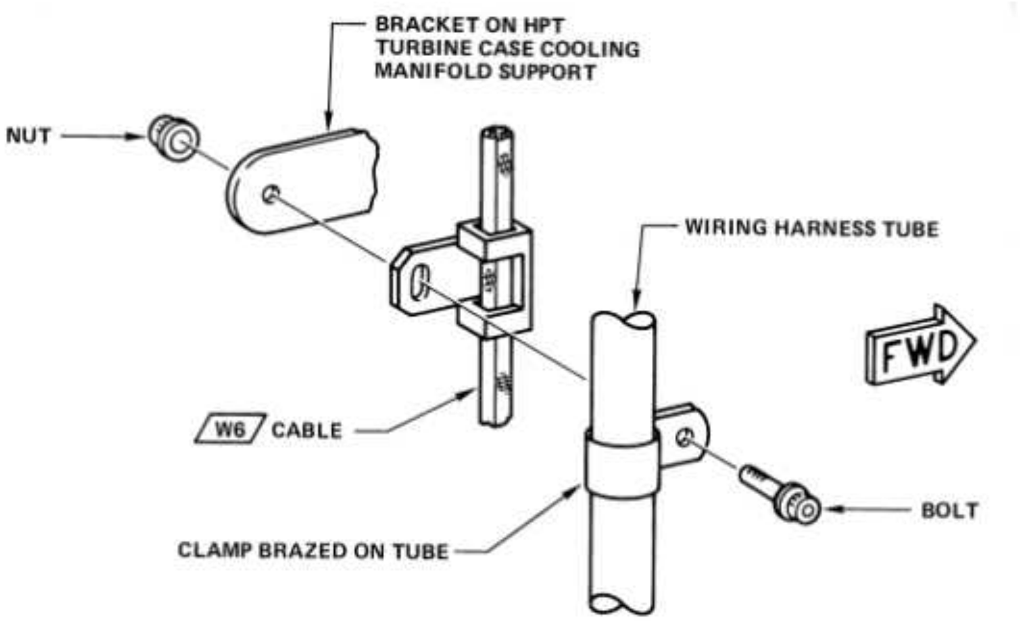
VIEW B
(TYPICAL 7 PLACES)


BRACKET ON LPT COOLING AIR MANIFOLD SUPPORT
BOLT
FWD
NUT
SPACER
CLAMP BRAZED ON TUBE
WIRING HARNESS TUBE

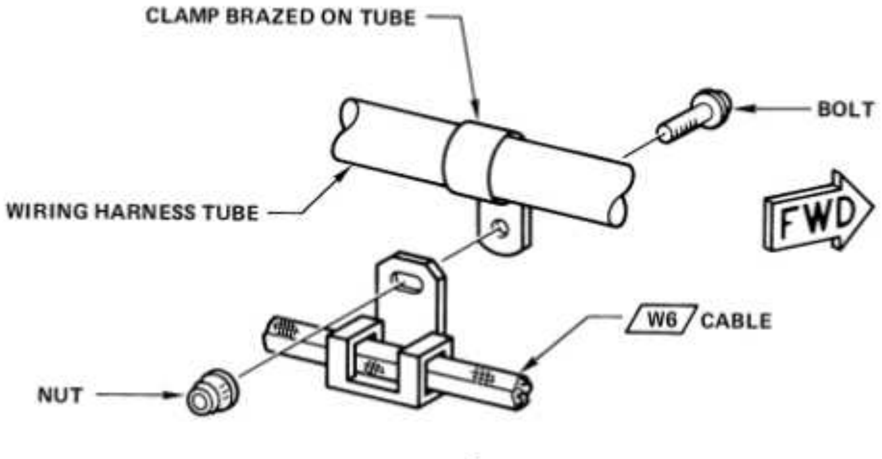
VIEW C

L−A3973

EEC Thermocouple And Airframe Cable (W6)
Figure 301 (Sheet 3)
(Task 72−00−54−050−006−A)


BRACKET ON HPT TURBINE CASE COOLING MANIFOLD SUPPORT
NUT
WIRING HARNESS TUBE
FWD
W6
CABLE
BOLT
CLAMP BRAZED ON TUBE

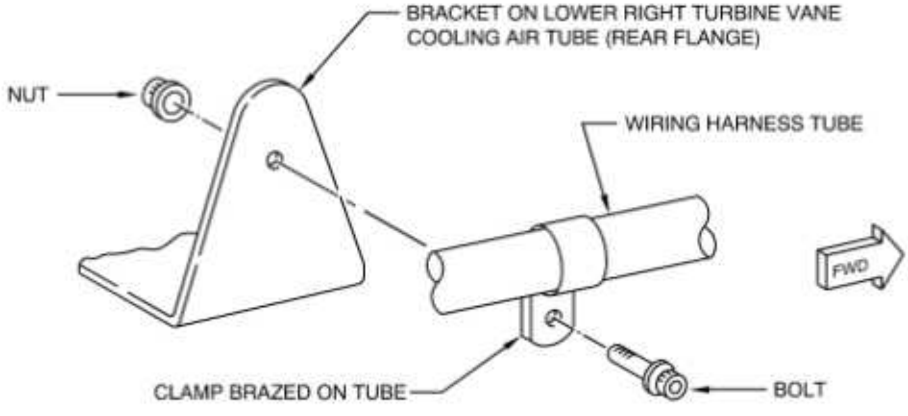
VIEW D


CLAMP BRAZED ON TUBE
BOLT
WIRING HARNESS TUBE
FWD
W6
CABLE
NUT

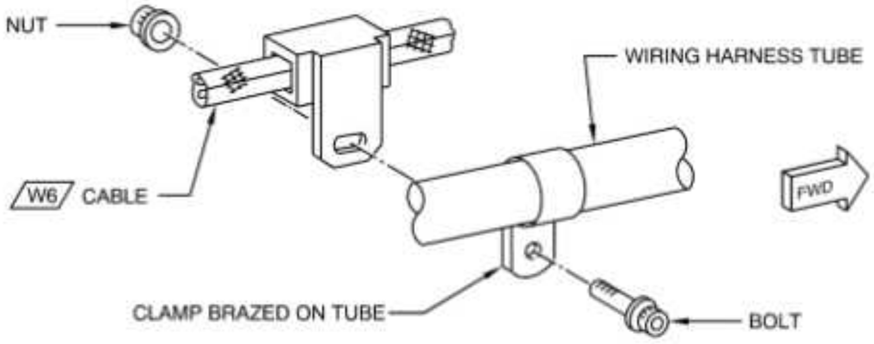
VIEW E

L-A3974

EEC Thermocouple And Airframe Cable (W6)
Figure 301 (Sheet 4)
(Task 72-00-54-050-006-A)


BRACKET ON LOWER RIGHT TURBINE VANE COOLING AIR TUBE (REAR FLANGE)
NUT
WIRING HARNESS TUBE
FWD
CLAMP BRAZED ON TUBE
BOLT

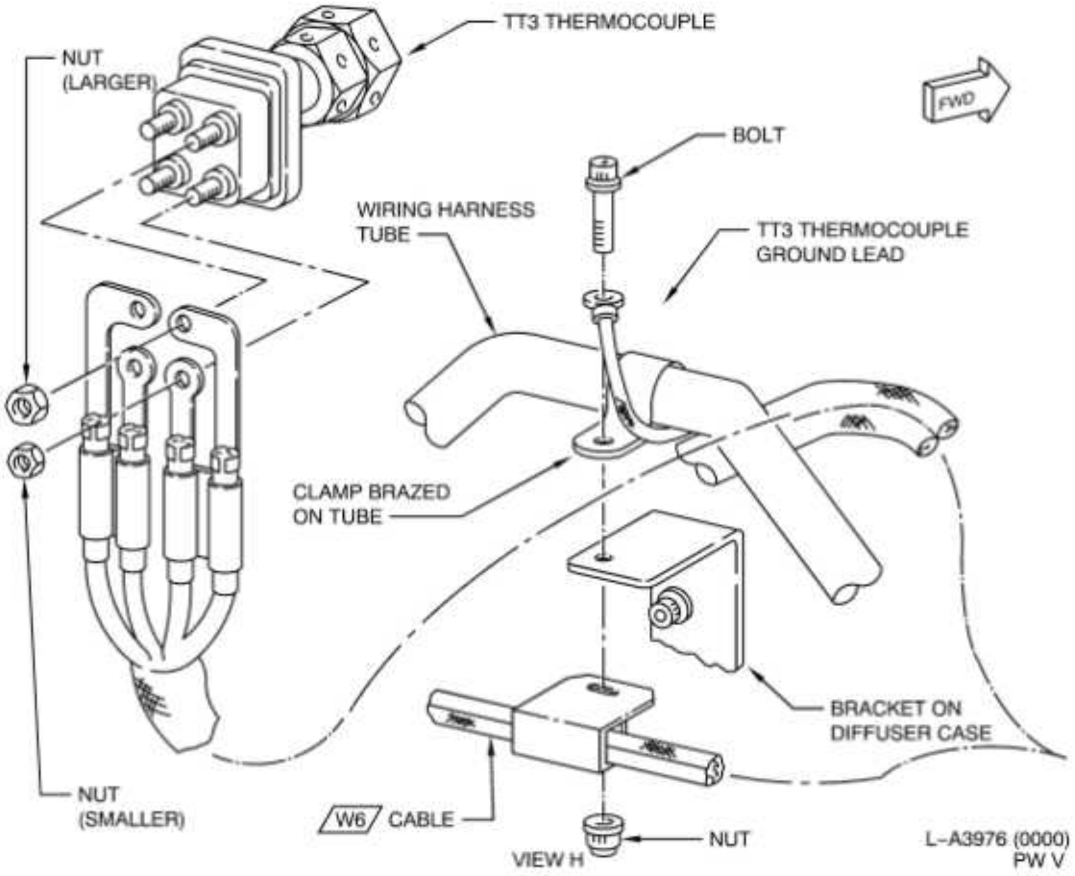
VIEW F


NUT
WIRING HARNESS TUBE
FWD
W6 CABLE
CLAMP BRAZED ON TUBE
BOLT

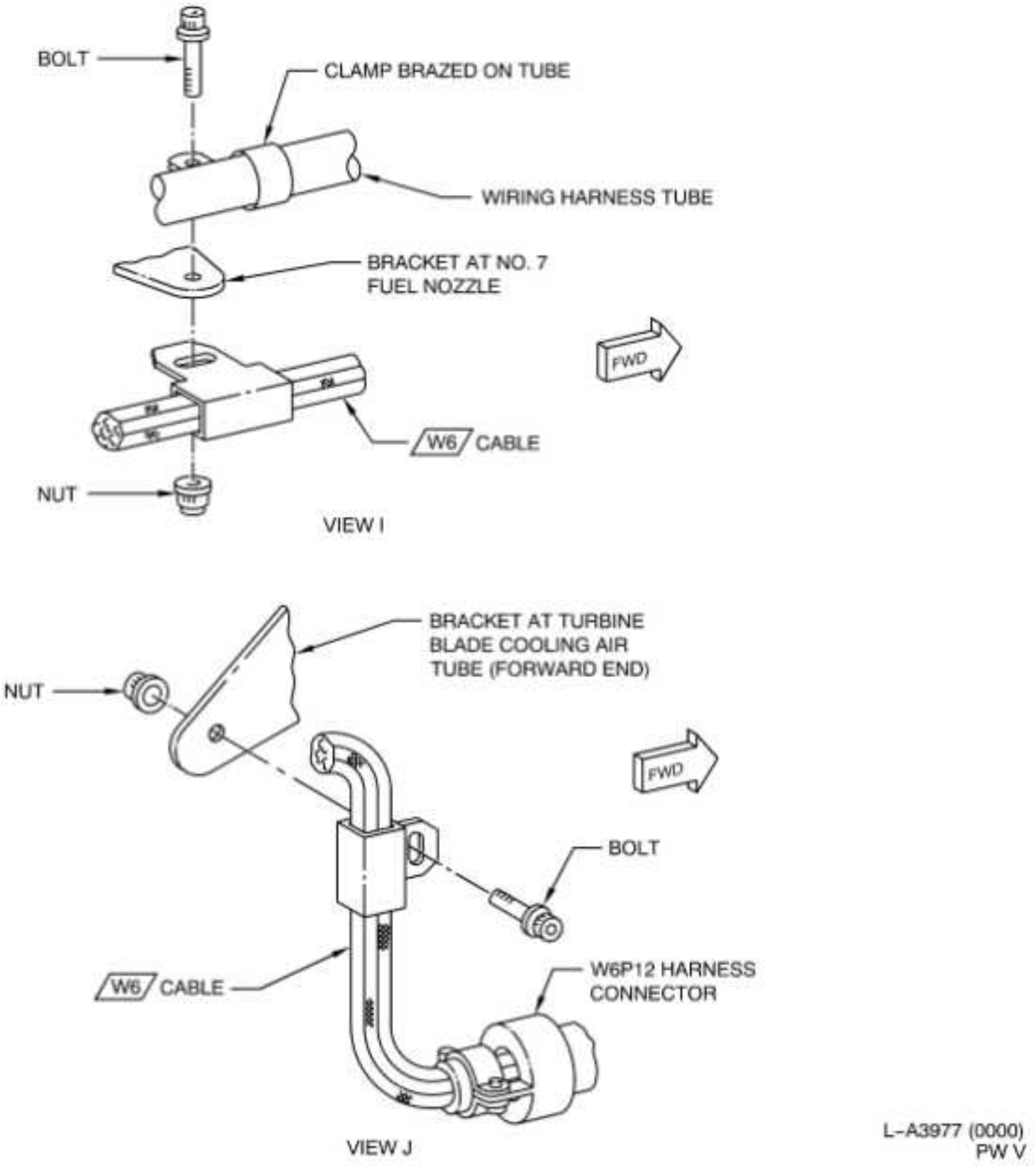
VIEW G

L-A3975 (0000)
PW V

EEC Thermocouple And Airframe Cable (W6)
Figure 301 (Sheet 5)
(Task 72-00-54-050-006-A)

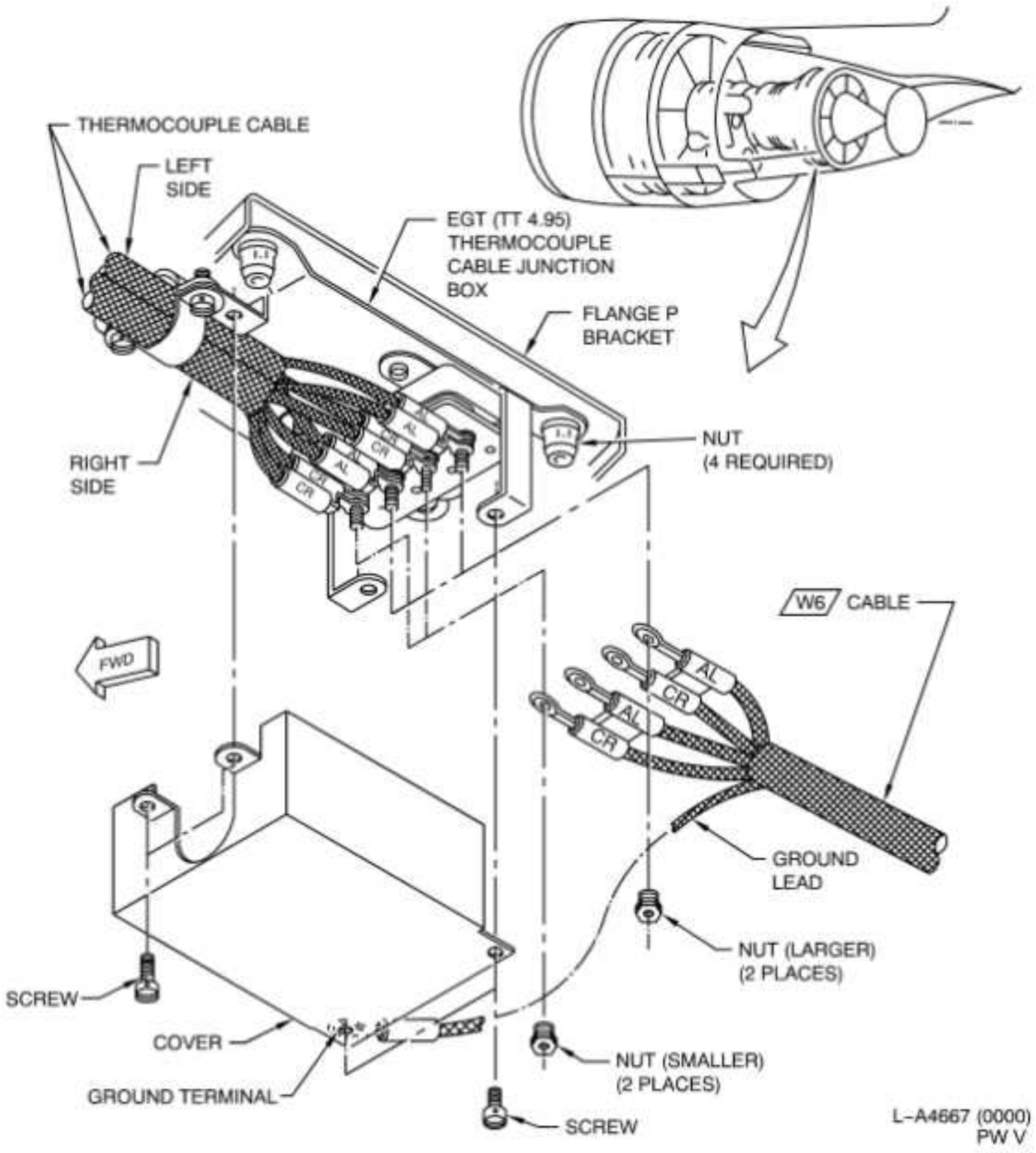

TT3 THERMOCOUPLE
NUT (LARGER)
BOLT
FWD
WIRING HARNESS TUBE
TT3 THERMOCOUPLE GROUND LEAD
CLAMP BRAZED ON TUBE
BRACKET ON DIFFUSER CASE
NUT (SMALLER)
W6 CABLE
NUT
VIEW H
L-A3976 (0000)
PW V

EEC Thermocouple And Airframe Cable (W6)
Figure 301 (Sheet 6)
(Task 72−00−54−050−006−A)


BOLT
CLAMP BRAZED ON TUBE
WIRING HARNESS TUBE
BRACKET AT NO. 7 FUEL NOZZLE
FWD
W6 CABLE
NUT
VIEW I
BRACKET AT TURBINE BLADE COOLING AIR TUBE (FORWARD END)
NUT
FWD
BOLT
W6 CABLE
W6P12 HARNESS CONNECTOR
VIEW J
L−A3977 (0000)
PW V

EEC Thermocouple And Airframe Cable (W6)
Figure 301 (Sheet 7)
(Task 72−00−54−050−006−A)

ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−09


THERMOCOUPLE CABLE
LEFT SIDE
EGT (TT 4.95) THERMOCOUPLE CABLE JUNCTION BOX
FLANGE P BRACKET
NUT (4 REQUIRED)
RIGHT SIDE
AL
CR
FWD
W6 CABLE
GROUND LEAD
NUT (LARGER) (2 PLACES)
SCREW
COVER
GROUND TERMINAL
NUT (SMALLER) (2 PLACES)
SCREW
L-A4667 (0000)
PW V

EGT (TT4.95) Thermocouple Junction Box And Cable
Figure 302
(Task 72−00−54−050−006−A)

(4) Remove the four nuts and disconnect the cable wires (leads) from the TT3 thermocouple on the diffuser case at approximately the 3 o'clock position. Install the nuts back onto the terminal studs. See View M for pre SB PW4ENG 73−163 configuration. See View T for post SB PW4ENG 73−163 configuration.

NOTE: The diameter of the chromel nuts and terminal studs is smaller than the diameter of the alumel nuts and terminal studs.

(5) Disconnect the W6P12 cable connector from the W5J12 cable connector.

(a) (Pre SB PW4ENG 73−163) Connectors are on a bracket outboard of Flange K at the 3 o'clock position.

(b) (Post SB PW4ENG 73−163) Connectors are on the TCA tube flange bracket on the turbine blade cooling air tube (lower right) (AP37) flange at the 3 o'clock position.

1 (Post SB PW4ENG 73−192) Loosen clamp that attaches the cooling hose to the cooling shield around the W6P12 connector. Remove cooling hose from the cooling shield. See Figure 304 (Sheet 15).

NOTE: Pre SB PW4ENG 73−192 engines do not have W5/W6 wiring harness connector cooling.

2 (Post SB PW4ENG 73−192) Loosen and remove the clamp attaching the two halves of the cooling shield around the W6P12 connector. Remove the shields and clamp from the connector.

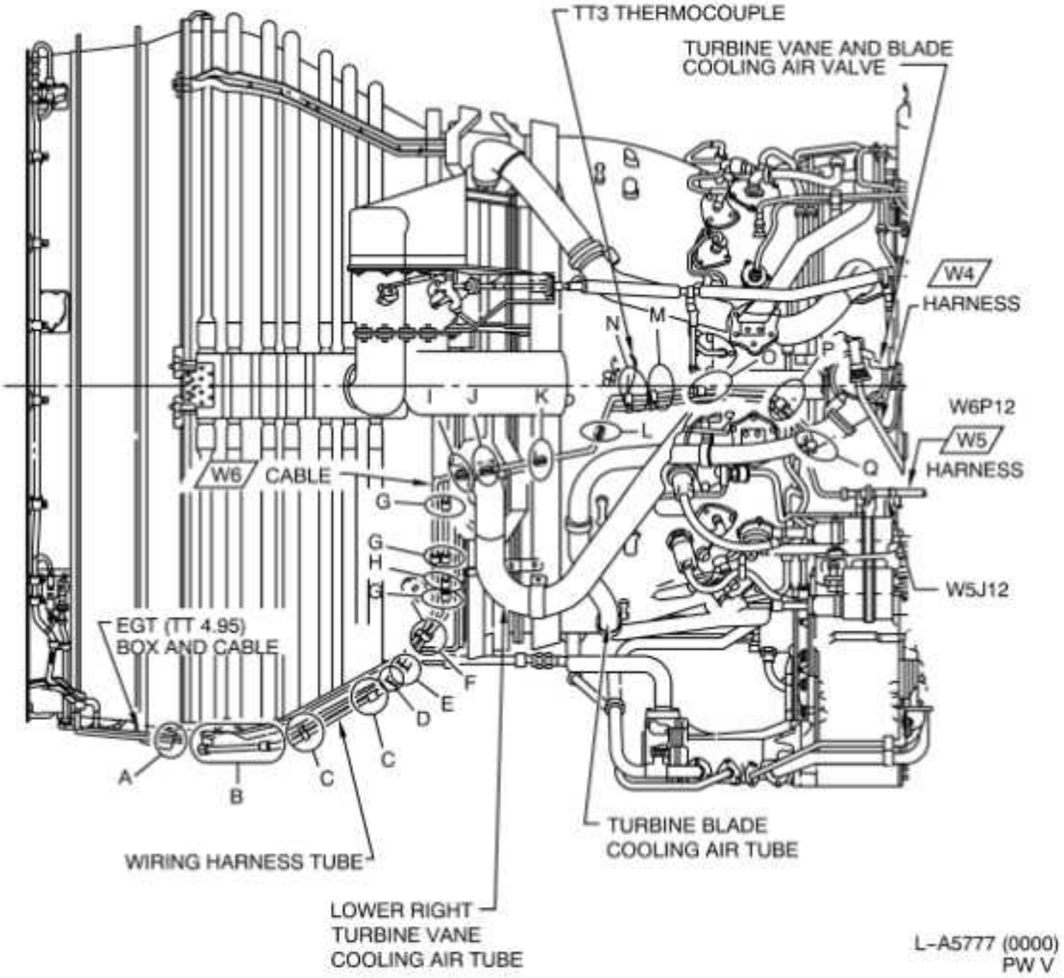
(6) Remove the nuts, bolts, and cable clamps that attach the cable to brackets on Flange P. See Views A and B.

(7) Remove the nuts, bolts, and cable clamps from brackets and from clamps brazed on the cable tube (support). Remove cable.

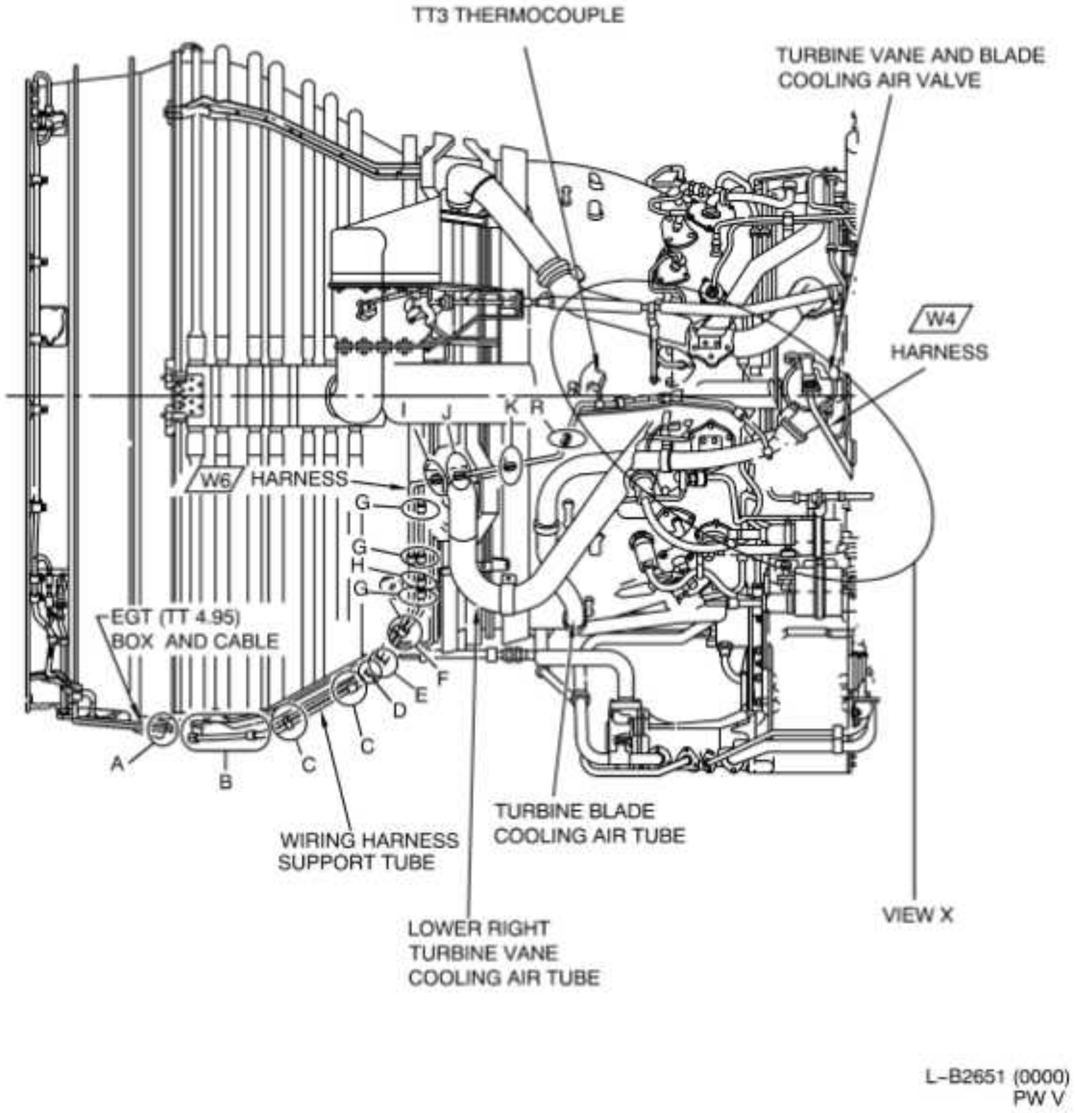
(8) Remove the nut, bolt, and clamp that attach the cable tube (support) to a bracket on the turbine cooling air support at approximately the 5 o'clock position. See View D.

(9) Remove the nut, bolt, and clamp that attach the cable tube (support) to a bracket on the high turbine cooling air manifold support at approximately the 4 o'clock position. See View H.

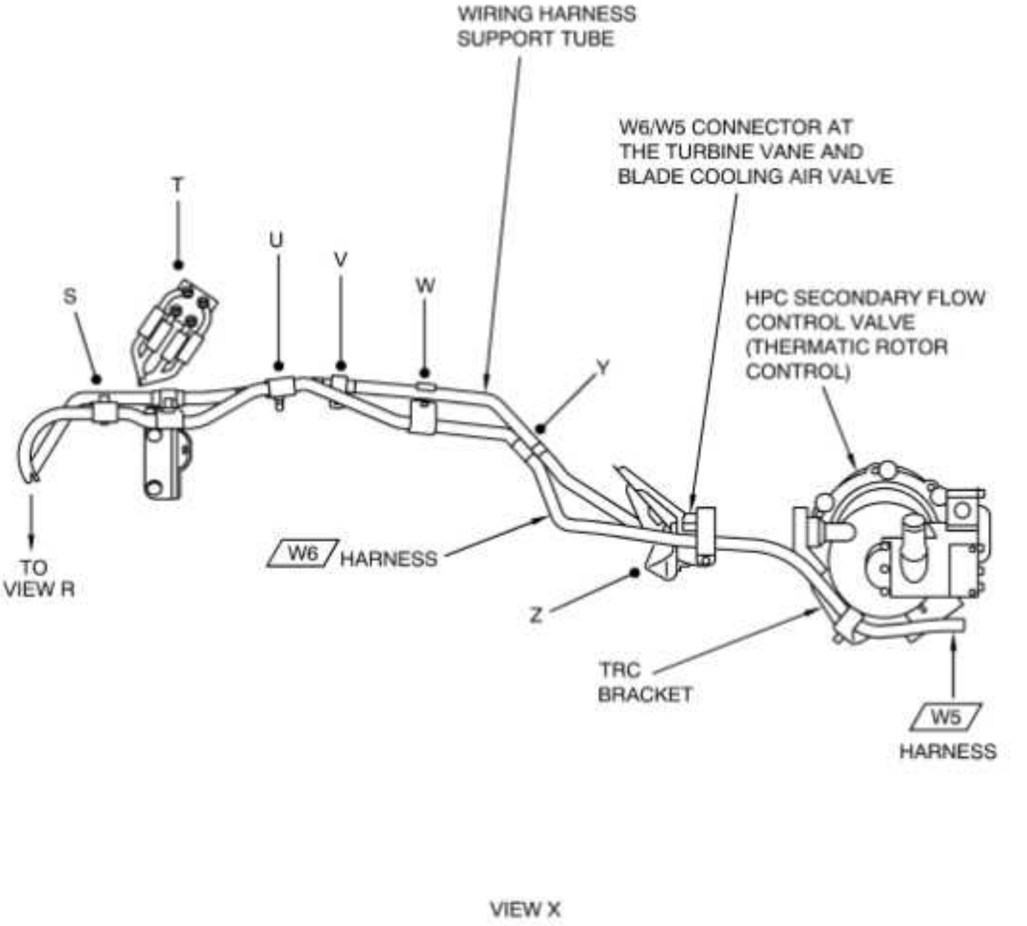
(10) Remove the nut, bolt, and clamp that attach the cable tube (support) to a bracket on the (lower right) turbine vane cooling air tube (AP02) at approximately the 3:30 o'clock position. Remove the cable tube (support). See View J.


TT3 THERMOCOUPLE
TURBINE VANE AND BLADE COOLING AIR VALVE
W4
HARNESS
W6P12
W5
HARNESS
W5J12
N
M
O
P
I
J
K
L
Q
W6
CABLE
G
G
H
G
EGT (TT 4.95) BOX AND CABLE
F
E
D
C
A
B
C
WIRING HARNESS TUBE
TURBINE BLADE COOLING AIR TUBE
LOWER RIGHT TURBINE VANE COOLING AIR TUBE
L−A5777 (0000)
PW V

EEC Thermocouple And Airframe Cable (W6) (Pre SB PW4ENG 73−163)
Figure 303 (Sheet 1)
(Task 72−00−54−050−006−B)

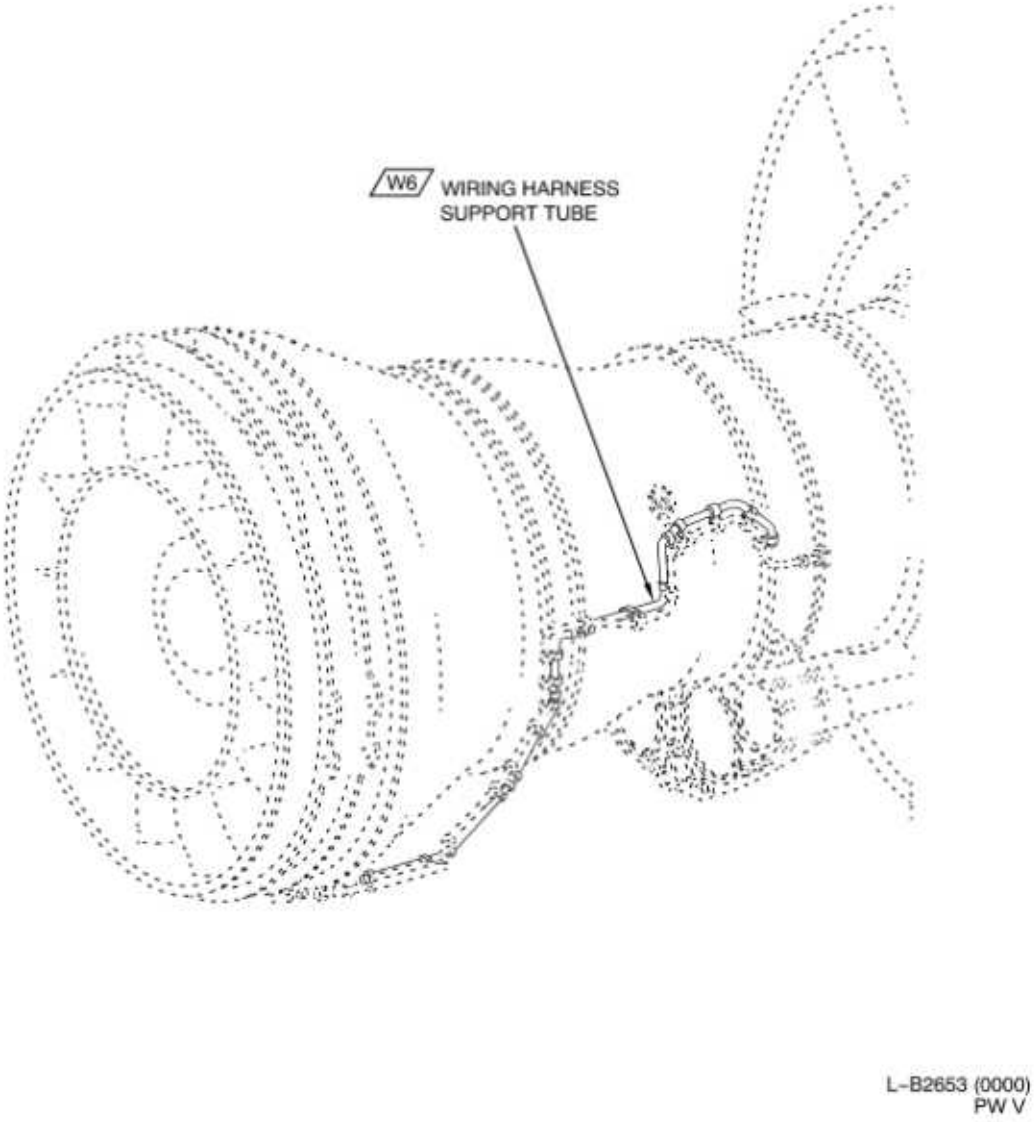

TT3 THERMOCOUPLE
TURBINE VANE AND BLADE COOLING AIR VALVE
W4
HARNESS
I
J
K
R
W6
HARNESS
G
G
H
G
EGT (TT 4.95) BOX AND CABLE
F
E
D
C
C
B
A
WIRING HARNESS SUPPORT TUBE
TURBINE BLADE COOLING AIR TUBE
LOWER RIGHT TURBINE VANE COOLING AIR TUBE
VIEW X
L−B2651 (0000)
PW V

EEC Thermocouple And Airframe Cable (W6) (Post SB PW4ENG 73−163)
Figure 303 (Sheet 2)
(Task 72−00−54−050−006−B)

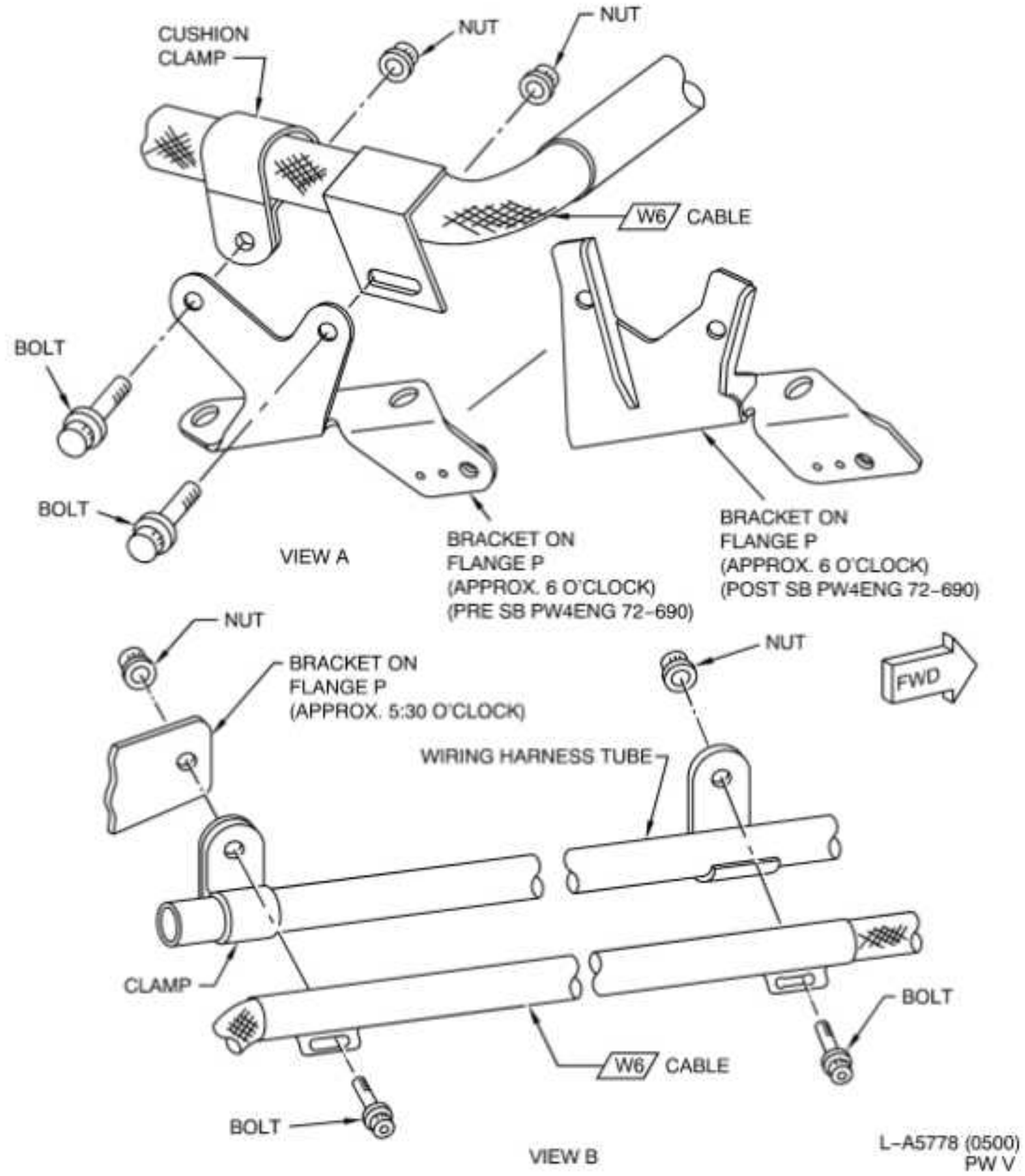

WIRING HARNESS SUPPORT TUBE
W6/W5 CONNECTOR AT THE TURBINE VANE AND BLADE COOLING AIR VALVE
T
U
V
W
S
HPC SECONDARY FLOW CONTROL VALVE (THERMATIC ROTOR CONTROL)
Y
TO VIEW R
W6 HARNESS
Z
TRC BRACKET
W5 HARNESS
VIEW X

L−B2716 (0201)
PW V

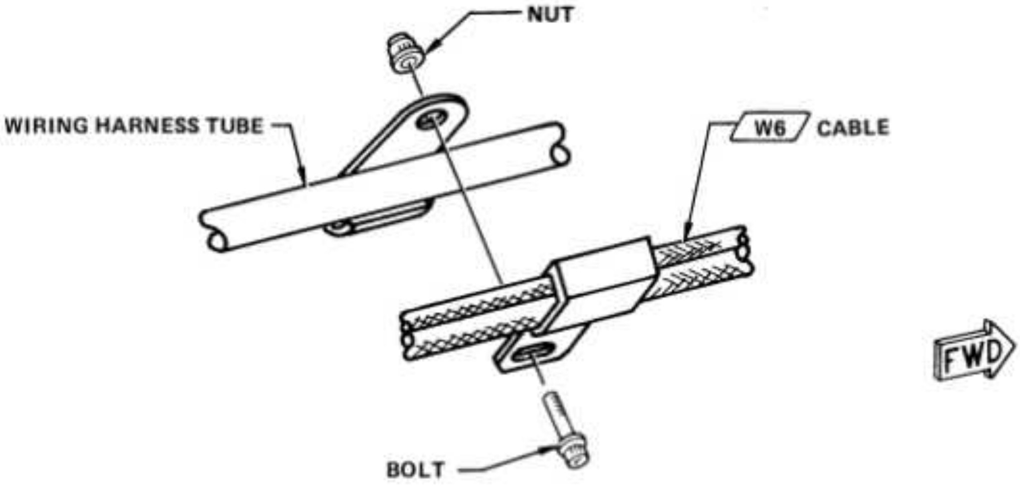
EEC Thermocouple And Airframe Cable (W6) (Post SB PW4ENG 73−163)
Figure 303 (Sheet 3)
(Task 72−00−54−050−006−B)


W6
WIRING HARNESS SUPPORT TUBE
L−B2653 (0000)
PW V

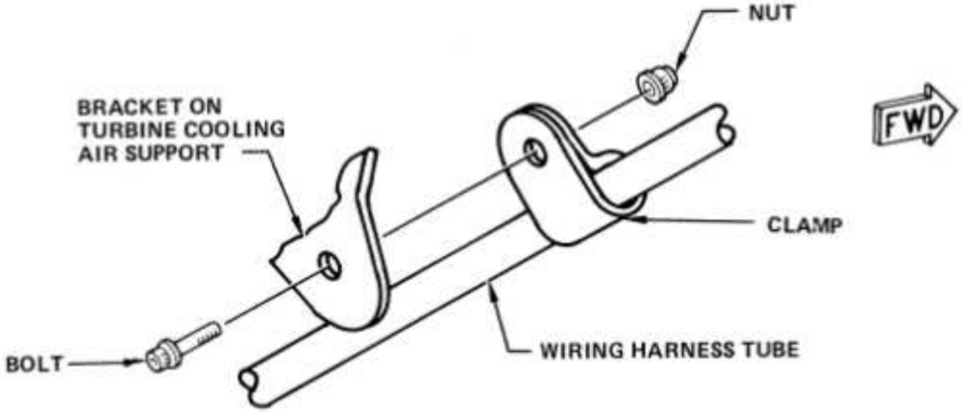
Location Of The W6 Harness Support Tube (Post SB PW4ENG 73−163)
Figure 303 (Sheet 4)
(Task 72−00−54−050−006−B)


CUSHION CLAMP
NUT
NUT
W6 CABLE
BOLT
BOLT
VIEW A
BRACKET ON FLANGE P (APPROX. 6 O'CLOCK) (PRE SB PW4ENG 72-690)
BRACKET ON FLANGE P (APPROX. 6 O'CLOCK) (POST SB PW4ENG 72-690)
NUT
BRACKET ON FLANGE P (APPROX. 5:30 O'CLOCK)
NUT
FWD
WIRING HARNESS TUBE
CLAMP
BOLT
W6 CABLE
BOLT
VIEW B
L-A5778 (0500)
PW V

EEC Thermocouple And Airframe Cable
(W6) (Pre And Post SB PW4ENG 73−163)
Figure 304 (Sheet 1)
(Task 72−00−54−050−006−B)


NUT
WIRING HARNESS TUBE
W6 CABLE
FWD
BOLT

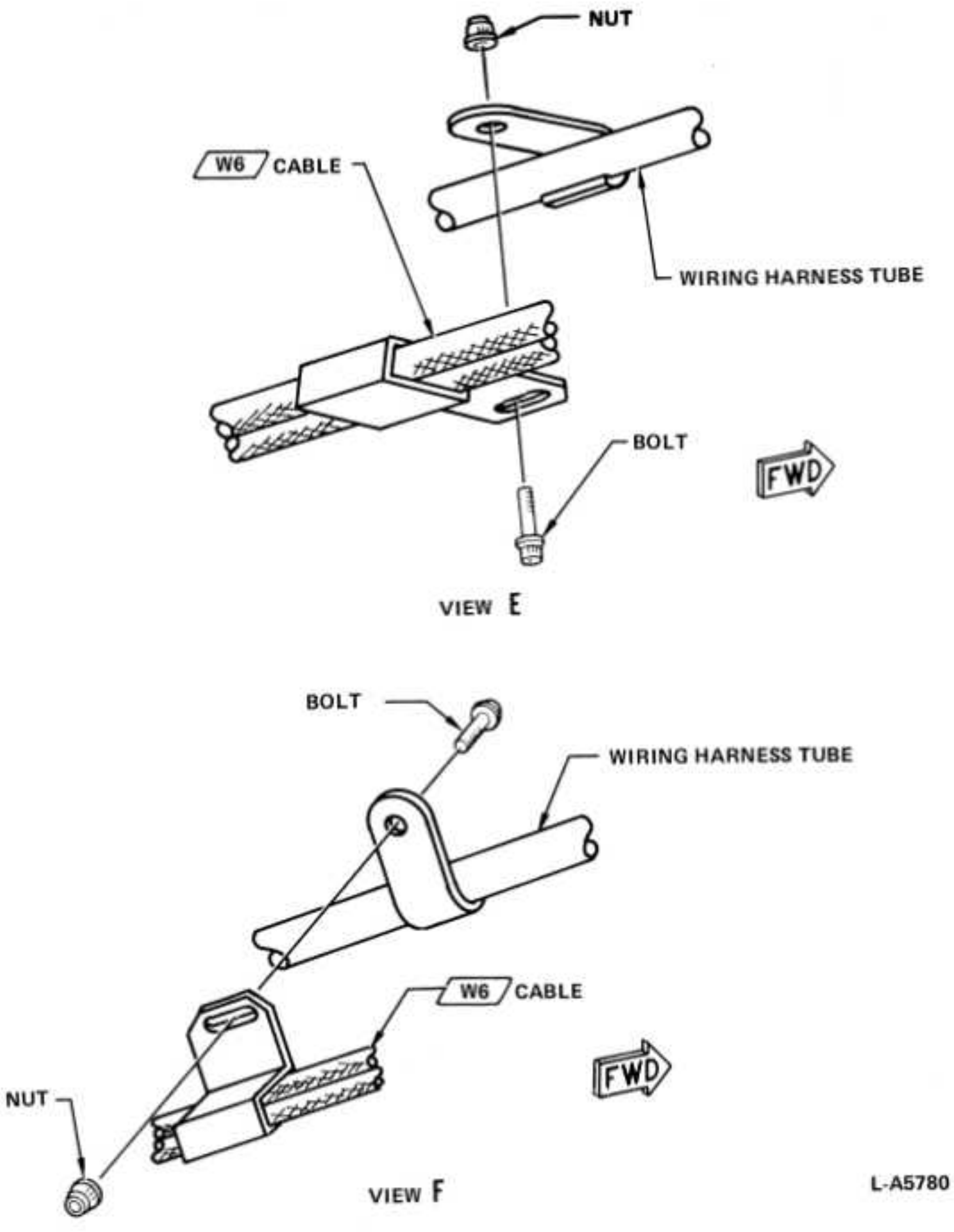
VIEW C


NUT
BRACKET ON TURBINE COOLING AIR SUPPORT
FWD
CLAMP
BOLT
WIRING HARNESS TUBE

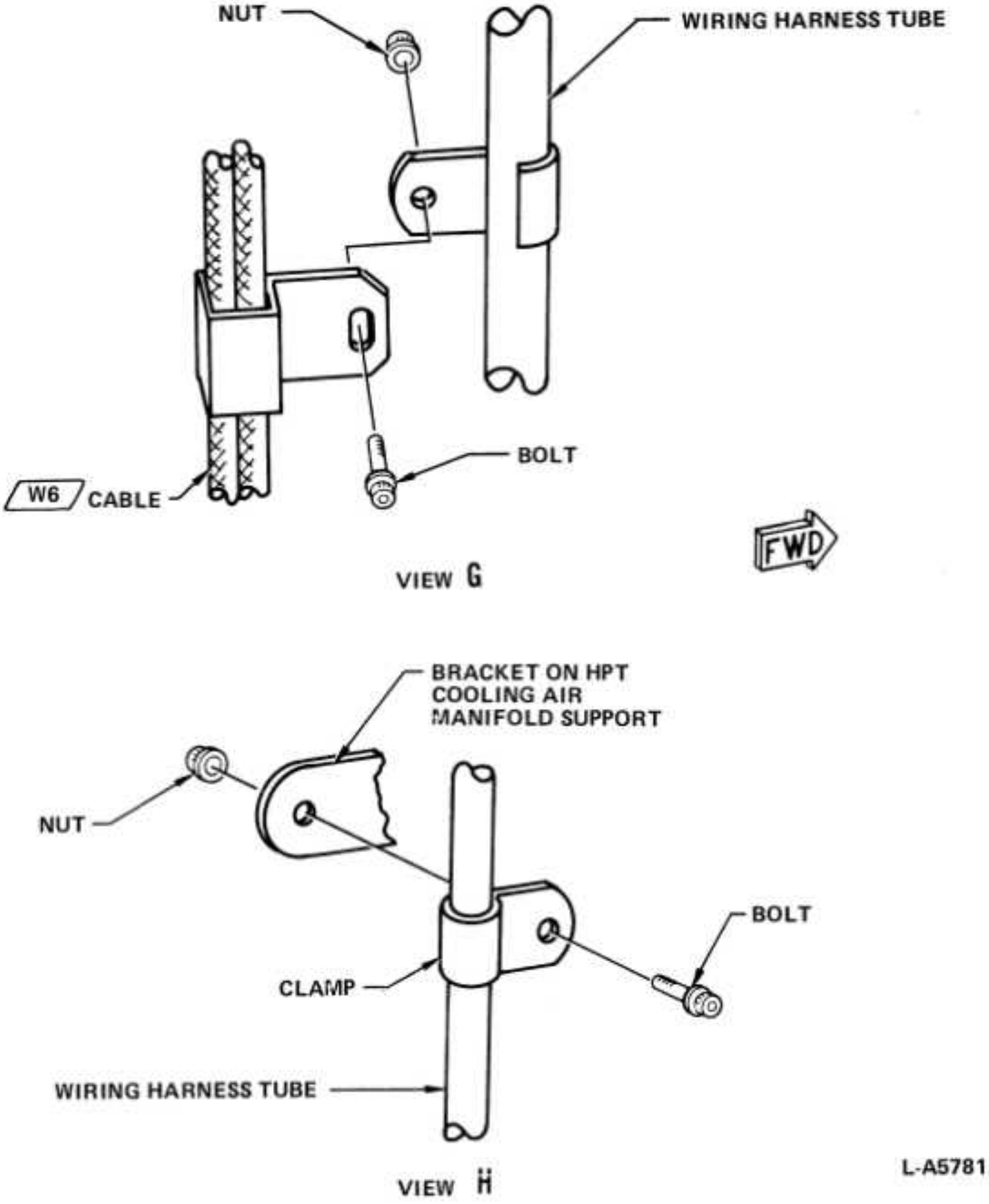
VIEW D

L-A5779

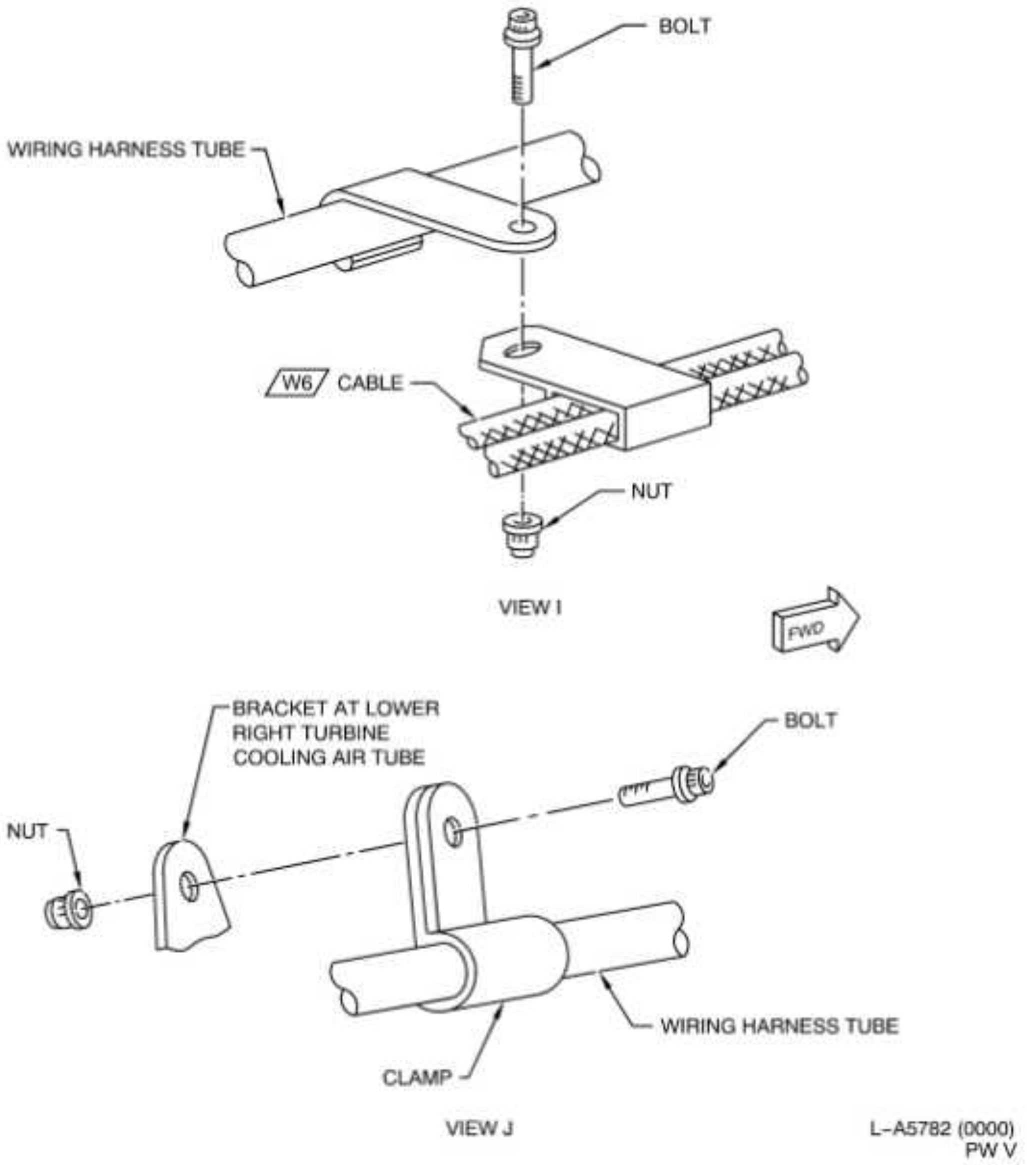
EEC Thermocouple And Airframe Cable
(W6) (Pre And Post SB PW4ENG 73−163)
Figure 304 (Sheet 2)
(Task 72−00−54−050−006−B)


NUT
W6 CABLE
WIRING HARNESS TUBE
BOLT
FWD
VIEW E
BOLT
WIRING HARNESS TUBE
W6 CABLE
NUT
FWD
VIEW F
L-A5780

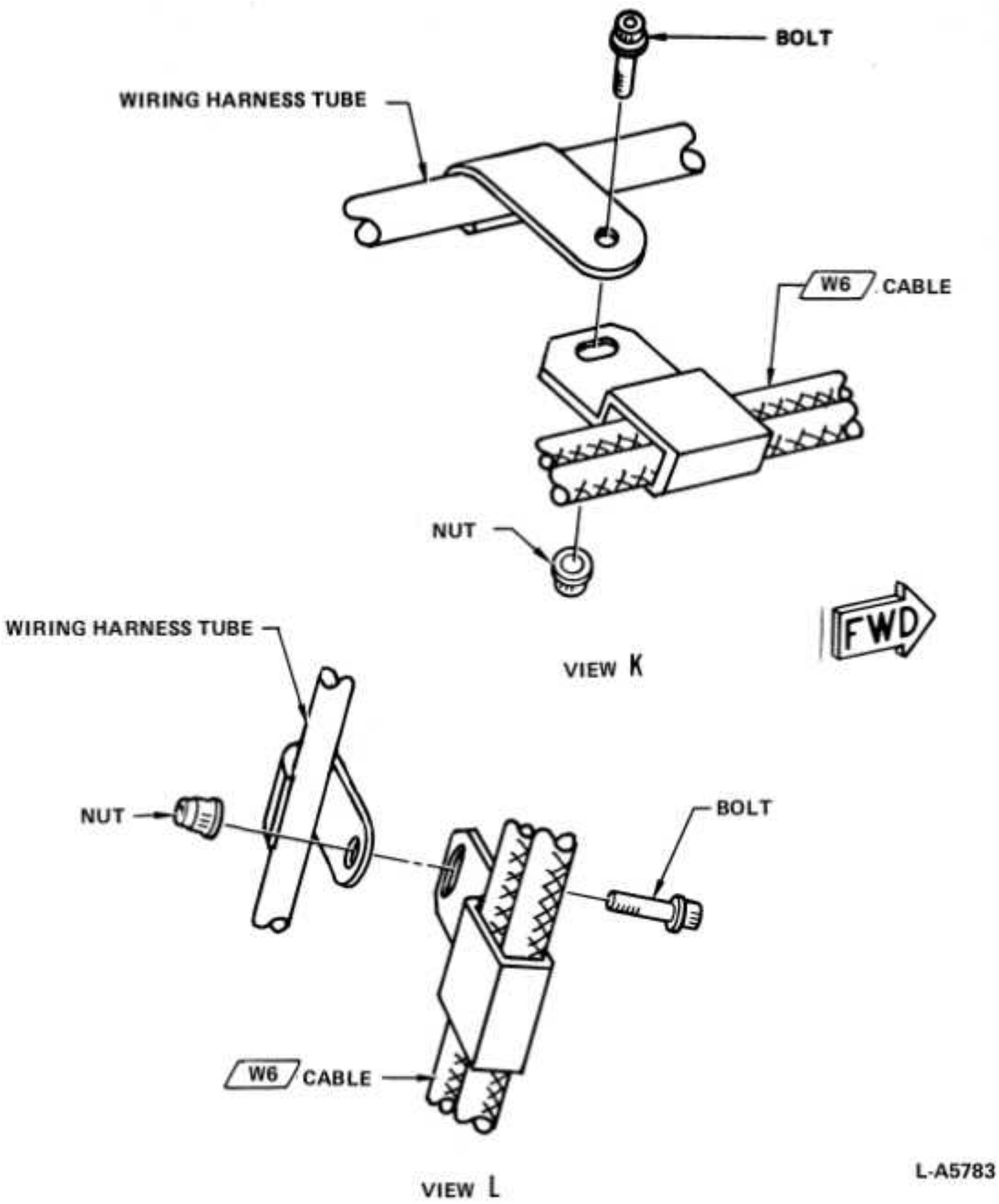
EEC Thermocouple And Airframe Cable
(W6) (Pre And Post SB PW4ENG 73−163)
Figure 304 (Sheet 3)
(Task 72−00−54−050−006−B)


NUT
WIRING HARNESS TUBE
BOLT
W6
CABLE
FWD
VIEW G
BRACKET ON HPT COOLING AIR MANIFOLD SUPPORT
NUT
BOLT
CLAMP
WIRING HARNESS TUBE
L-A5781
VIEW H

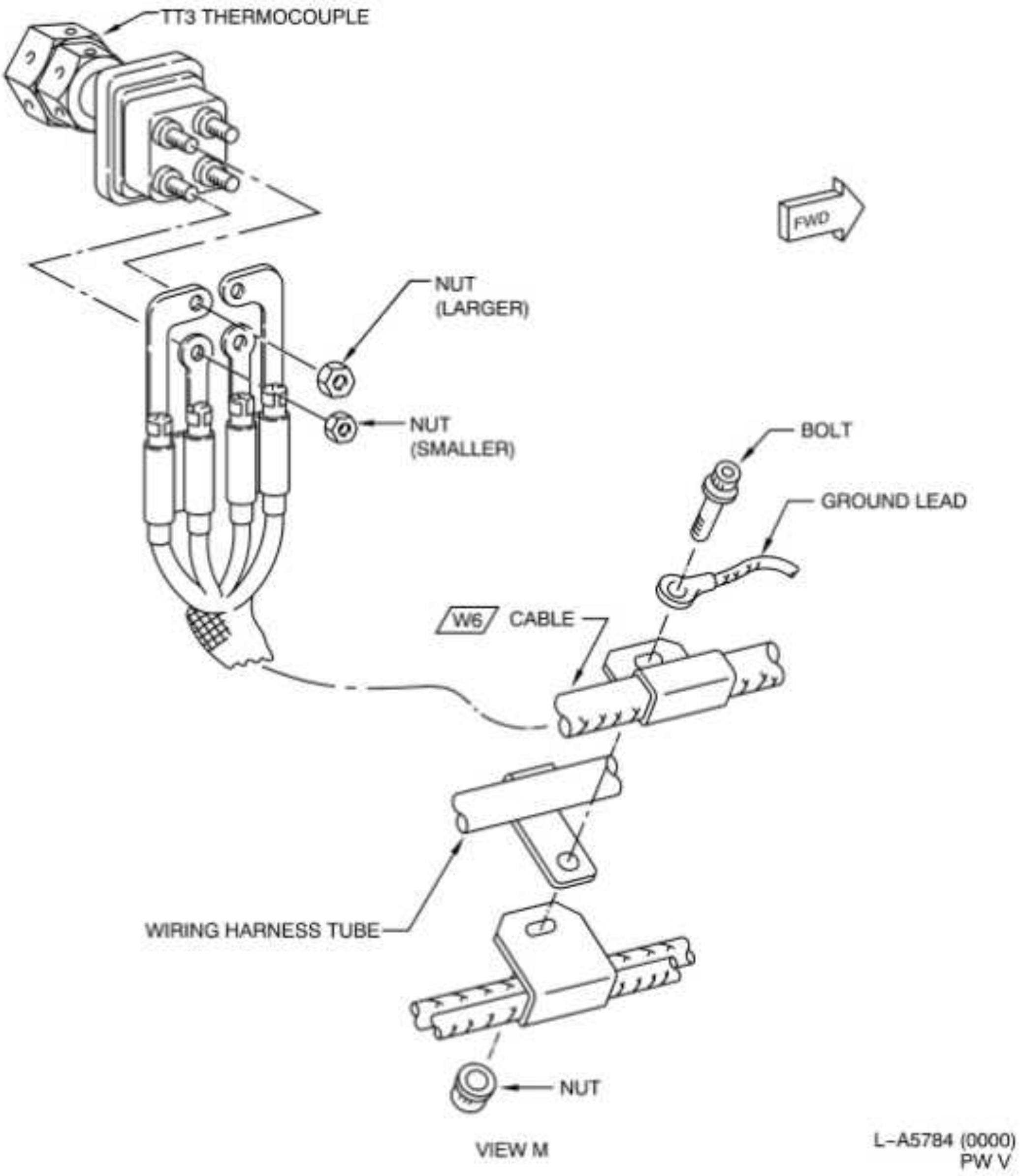
EEC Thermocouple And Airframe Cable
(W6) (Pre And Post SB PW4ENG 73-163)
Figure 304 (Sheet 4)
(Task 72-00-54-050-006-B)


BOLT
WIRING HARNESS TUBE
W6 CABLE
NUT
VIEW I
FWD
BRACKET AT LOWER RIGHT TURBINE COOLING AIR TUBE
BOLT
NUT
WIRING HARNESS TUBE
CLAMP
VIEW J
L−A5782 (0000)
PW V

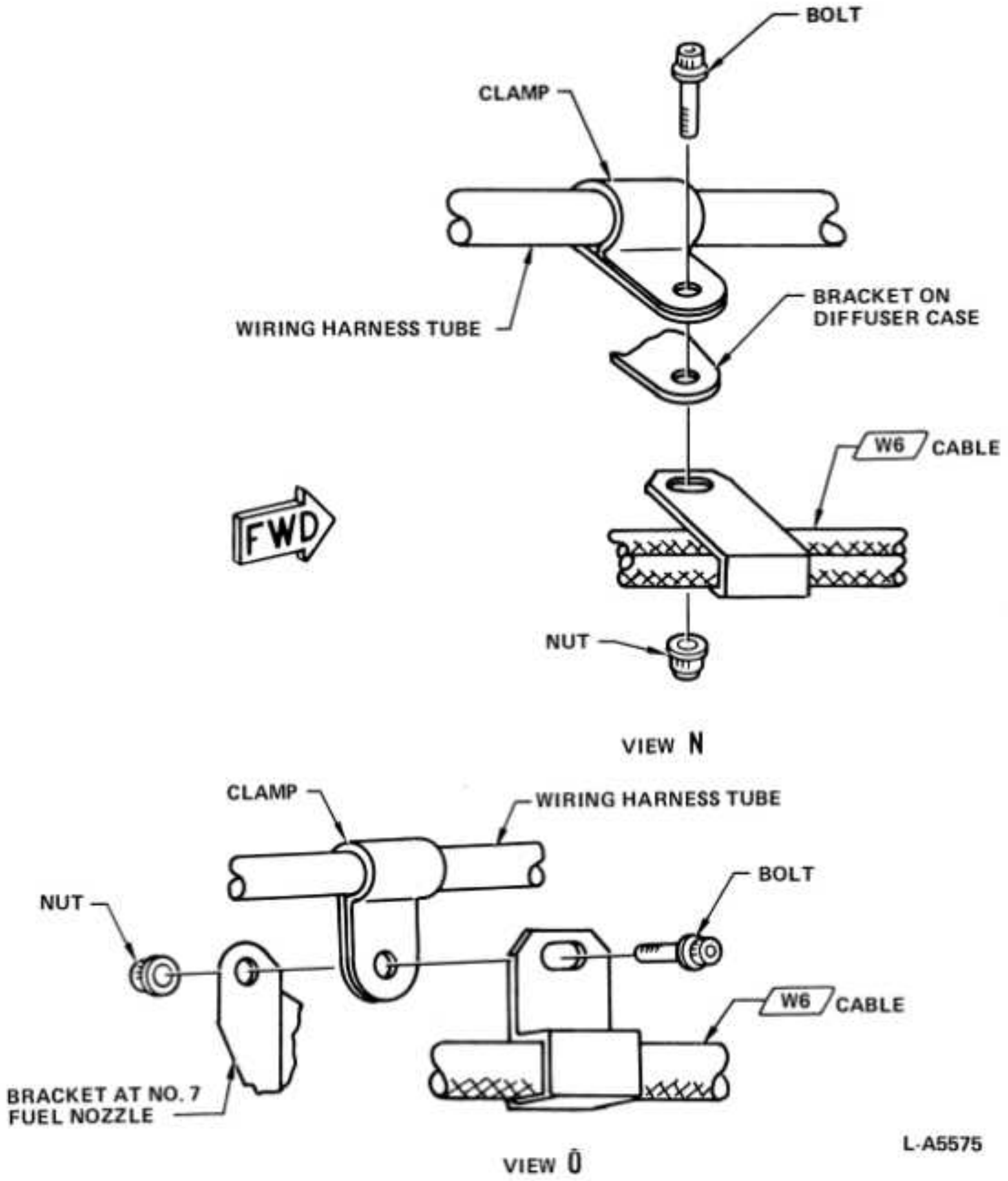
EEC Thermocouple And Airframe Cable
(W6) (Pre And Post SB PW4ENG 73−163)
Figure 304 (Sheet 5)
(Task 72−00−54−050−006−B)


BOLT
WIRING HARNESS TUBE
W6 CABLE
NUT
VIEW K
FWD
WIRING HARNESS TUBE
NUT
BOLT
W6 CABLE
VIEW L
L-A5783

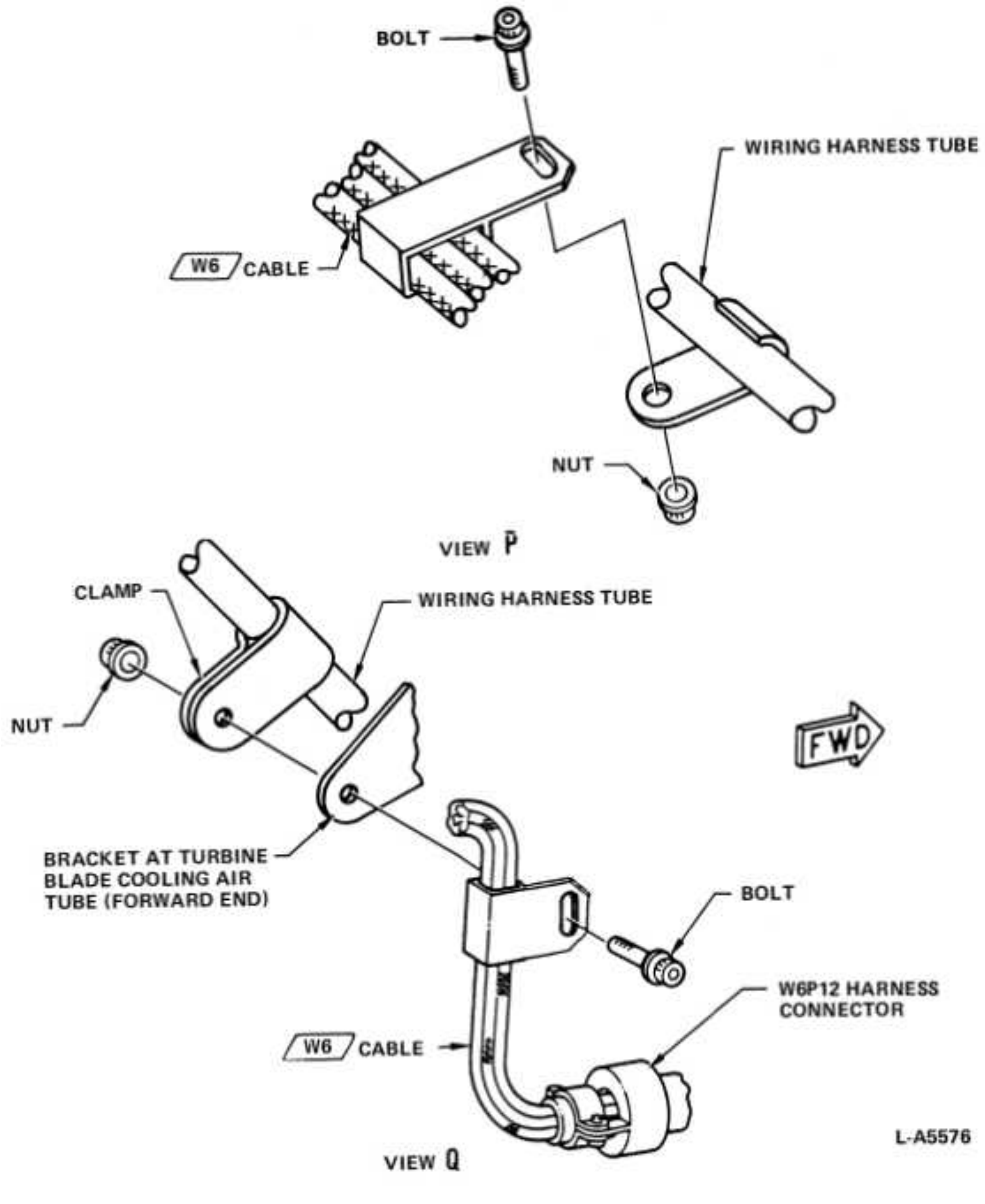
EEC Thermocouple And Airframe Cable
(W6) (Pre And Post SB PW4ENG 73-163)
Figure 304 (Sheet 6)
(Task 72-00-54-050-006-B)


TT3 THERMOCOUPLE
FWD
NUT (LARGER)
NUT (SMALLER)
BOLT
GROUND LEAD
W6 CABLE
WIRING HARNESS TUBE
NUT
VIEW M
L−A5784 (0000)
PW V

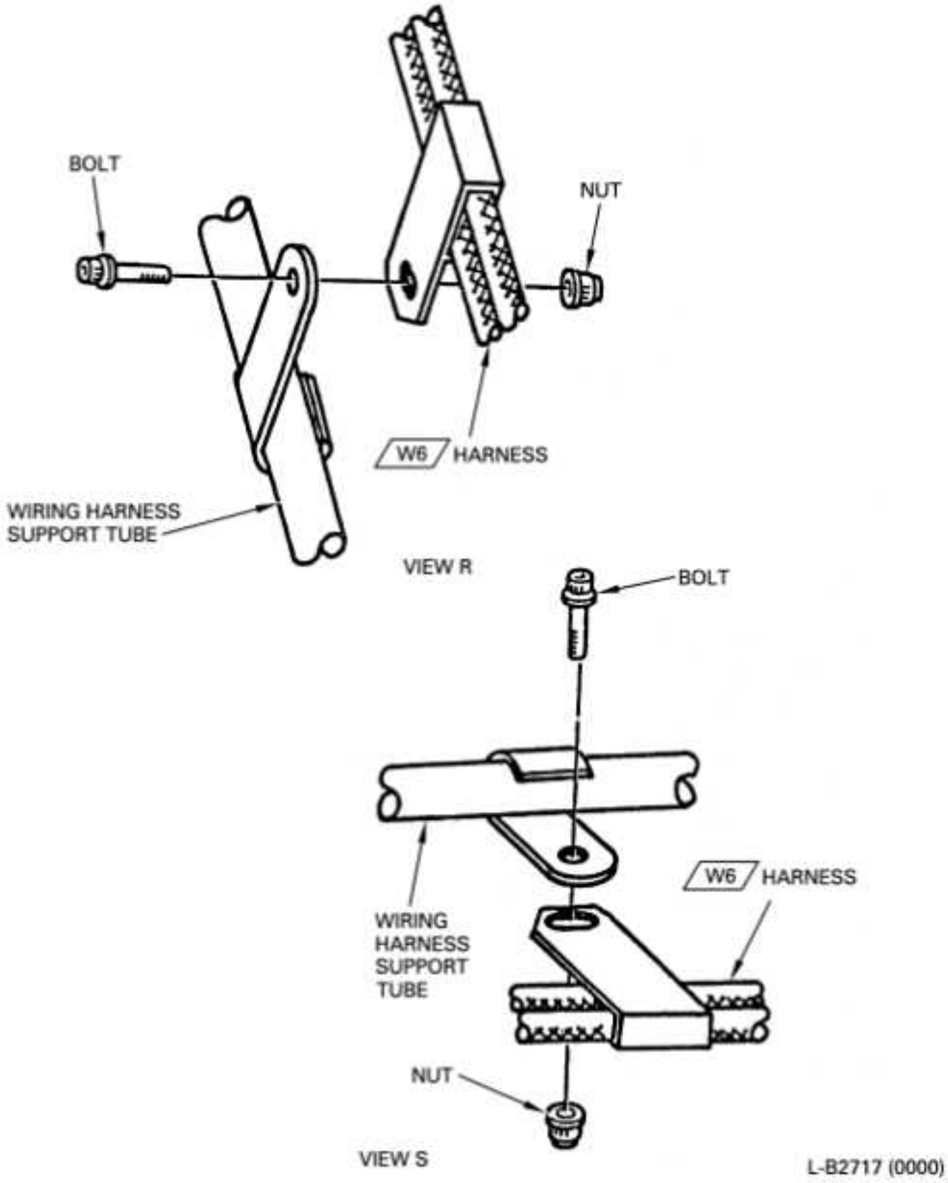
EEC Thermocouple And Airframe Cable (W6) (Pre SB PW4ENG 73−163)
Figure 304 (Sheet 7)
(Task 72−00−54−050−006−B)


BOLT
CLAMP
WIRING HARNESS TUBE
BRACKET ON
DIFFUSER CASE
W6
CABLE
FWD
NUT
VIEW N
CLAMP
WIRING HARNESS TUBE
NUT
BOLT
W6
CABLE
BRACKET AT NO. 7
FUEL NOZZLE
L-A5575
VIEW O

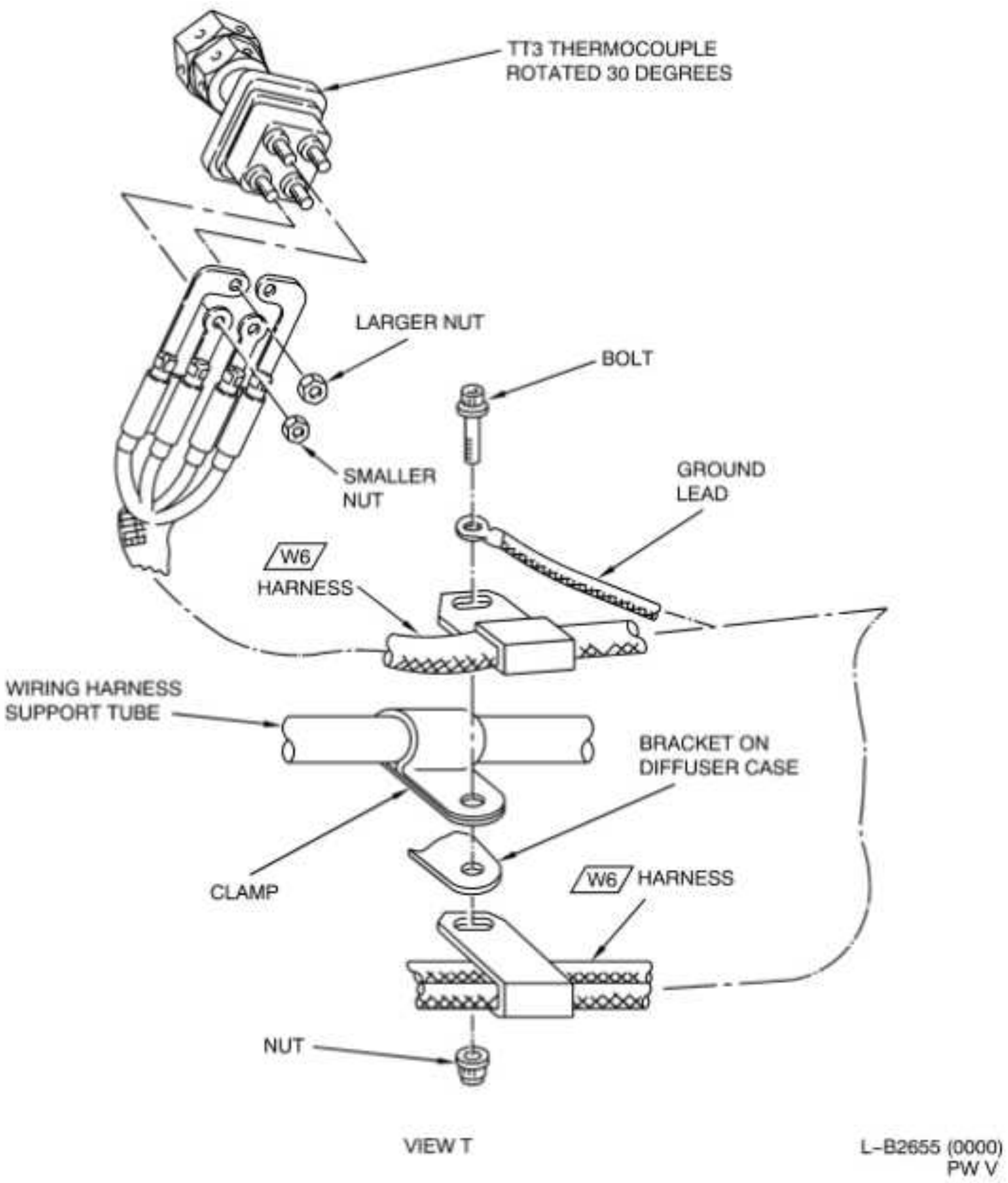
EEC Thermocouple And Airframe Cable (W6) (Pre SB PW4ENG 73-163)
Figure 304 (Sheet 8)
(Task 72-00-54-050-006-B)


BOLT
WIRING HARNESS TUBE
W6 CABLE
NUT
VIEW P
CLAMP
WIRING HARNESS TUBE
NUT
FWD
BRACKET AT TURBINE BLADE COOLING AIR TUBE (FORWARD END)
BOLT
W6P12 HARNESS CONNECTOR
W6 CABLE
L-A5576
VIEW Q

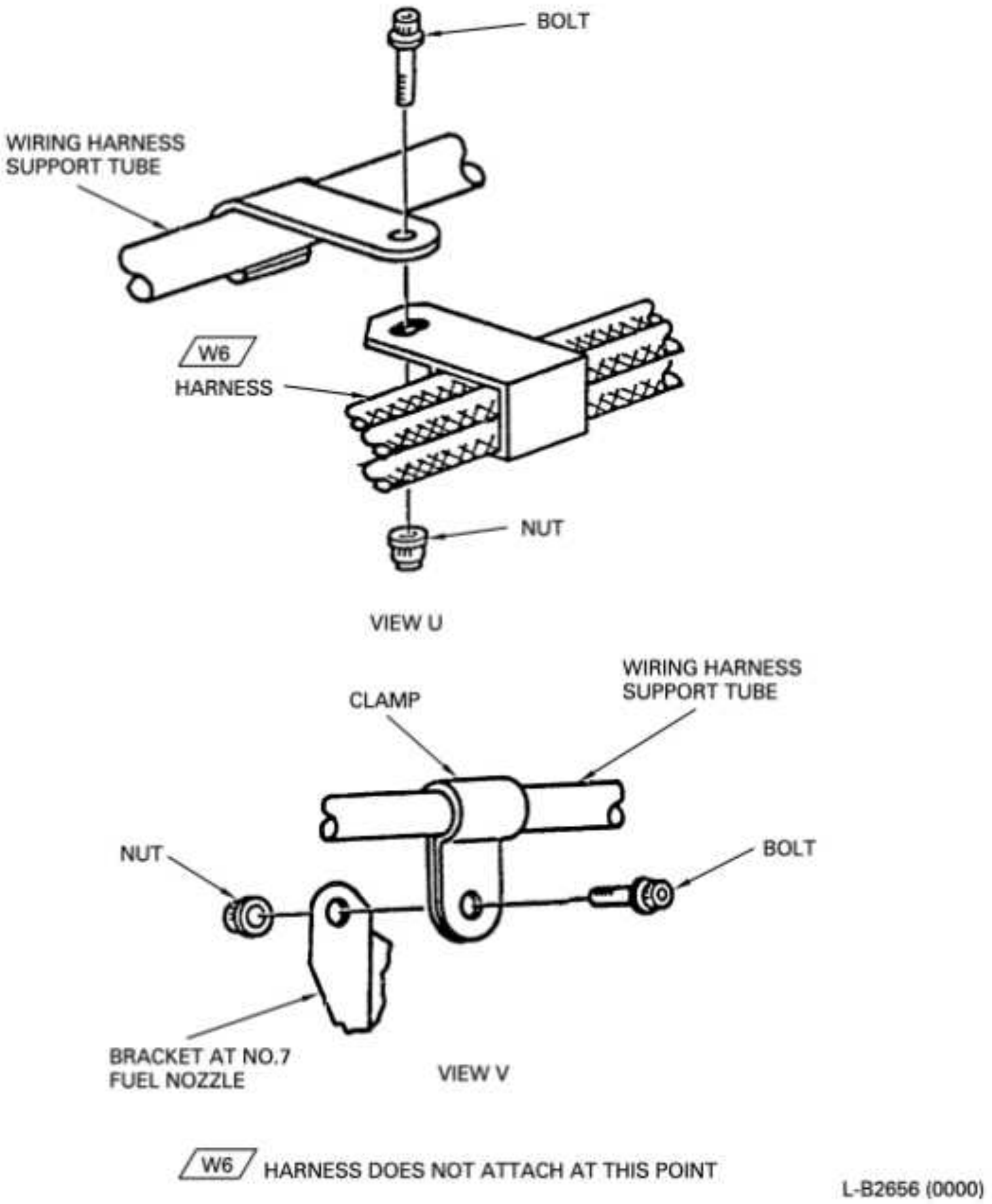
EEC Thermocouple And Airframe Cable (W6) (Pre SB PW4ENG 73−163)
Figure 304 (Sheet 9)
(Task 72−00−54−050−006−B)


BOLT
NUT
W6 HARNESS
WIRING HARNESS SUPPORT TUBE
VIEW R
BOLT
W6 HARNESS
WIRING HARNESS SUPPORT TUBE
NUT
VIEW S
L-B2717 (0000)

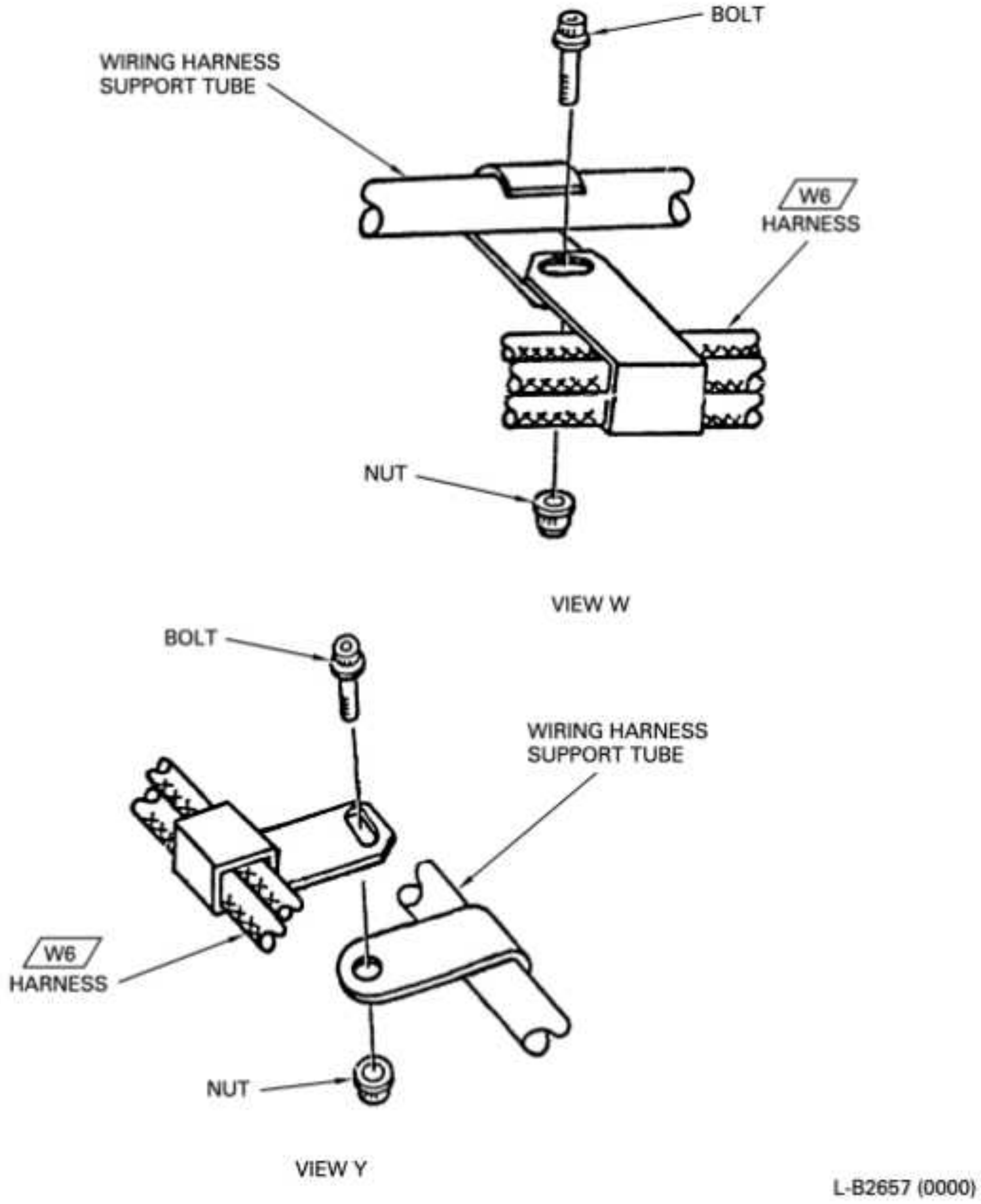
EEC Thermocouple And Airframe Cable (W6) (Post SB PW4ENG 73–163)
Figure 304 (Sheet 10)
(Task 72–00–54–050–006–B)


TT3 THERMOCOUPLE ROTATED 30 DEGREES
LARGER NUT
BOLT
SMALLER NUT
GROUND LEAD
W6
HARNESS
WIRING HARNESS SUPPORT TUBE
BRACKET ON DIFFUSER CASE
CLAMP
W6
HARNESS
NUT
VIEW T
L−B2655 (0000)
PW V

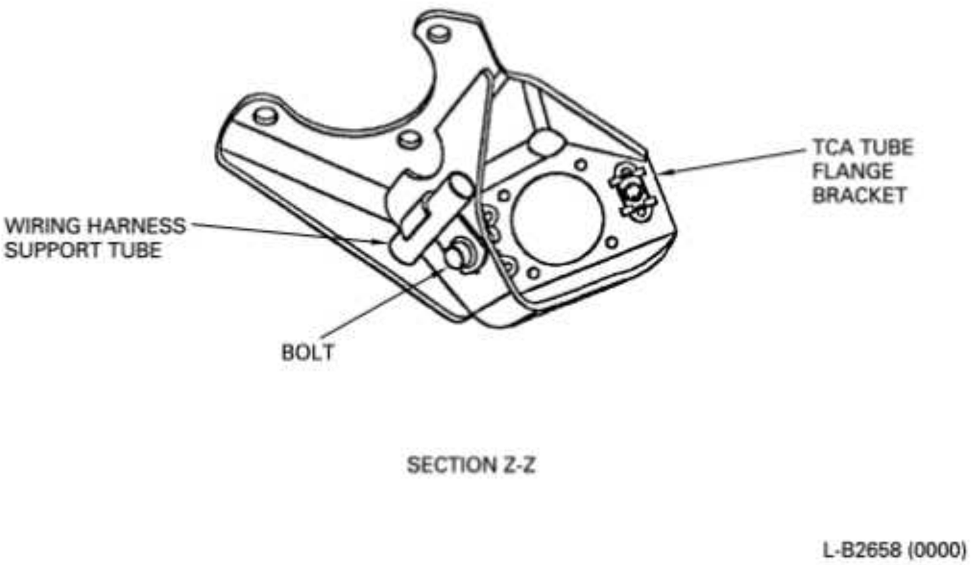
EEC Thermocouple And Airframe Cable (W6) (Post SB PW4ENG 73−163)
Figure 304 (Sheet 11)
(Task 72−00−54−050−006−B)


BOLT
WIRING HARNESS SUPPORT TUBE
W6
HARNESS
NUT
VIEW U
CLAMP
WIRING HARNESS SUPPORT TUBE
NUT
BOLT
BRACKET AT NO.7 FUEL NOZZLE
VIEW V
W6 HARNESS DOES NOT ATTACH AT THIS POINT
L-B2656 (0000)

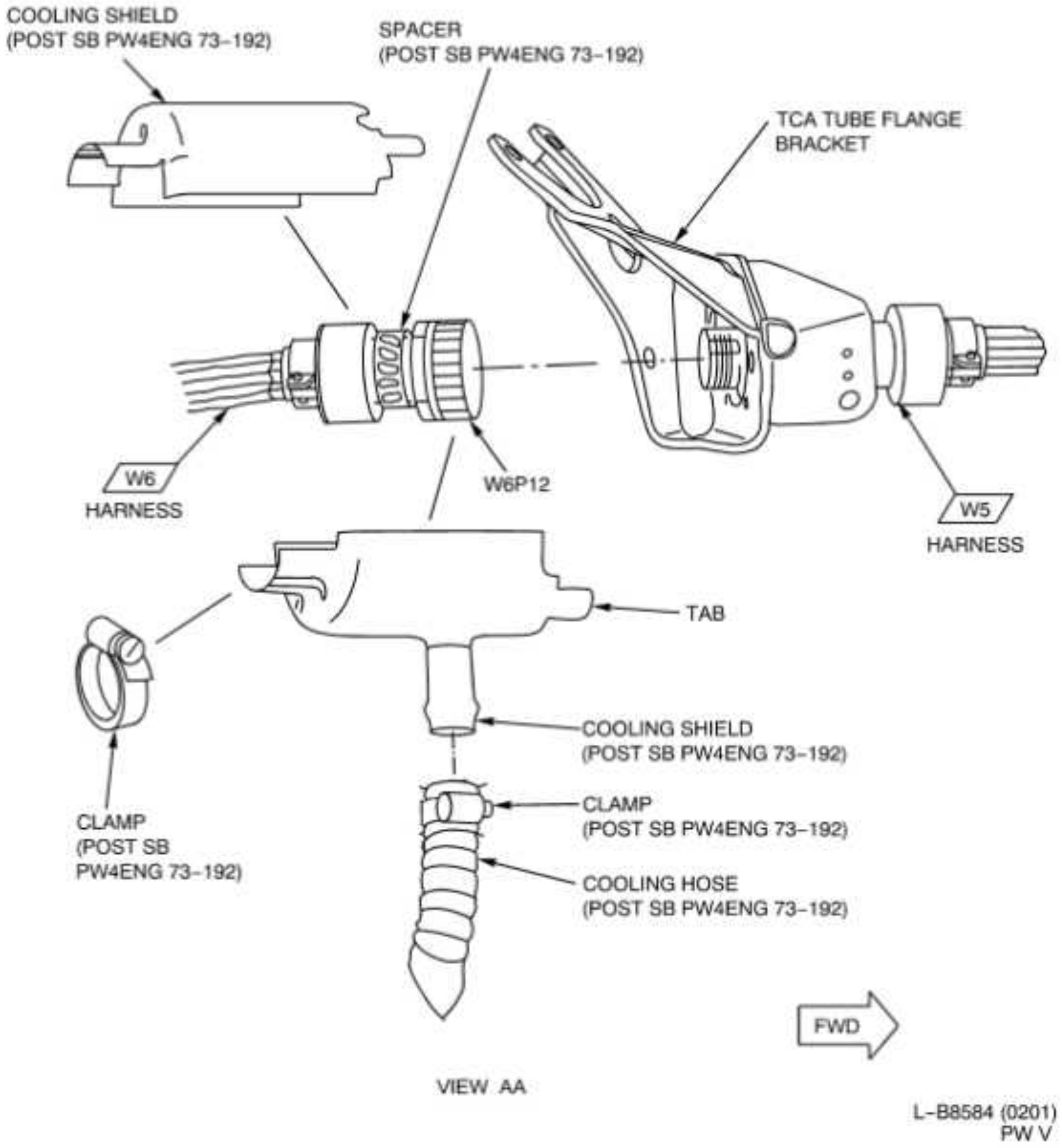
EEC Thermocouple And Airframe Cable (W6) (Post SB PW4ENG 73−163)
Figure 304 (Sheet 12)
(Task 72−00−54−050−006−B)


BOLT
WIRING HARNESS SUPPORT TUBE
W6 HARNESS
NUT
VIEW W
BOLT
WIRING HARNESS SUPPORT TUBE
W6 HARNESS
NUT
VIEW Y
L-B2657 (0000)

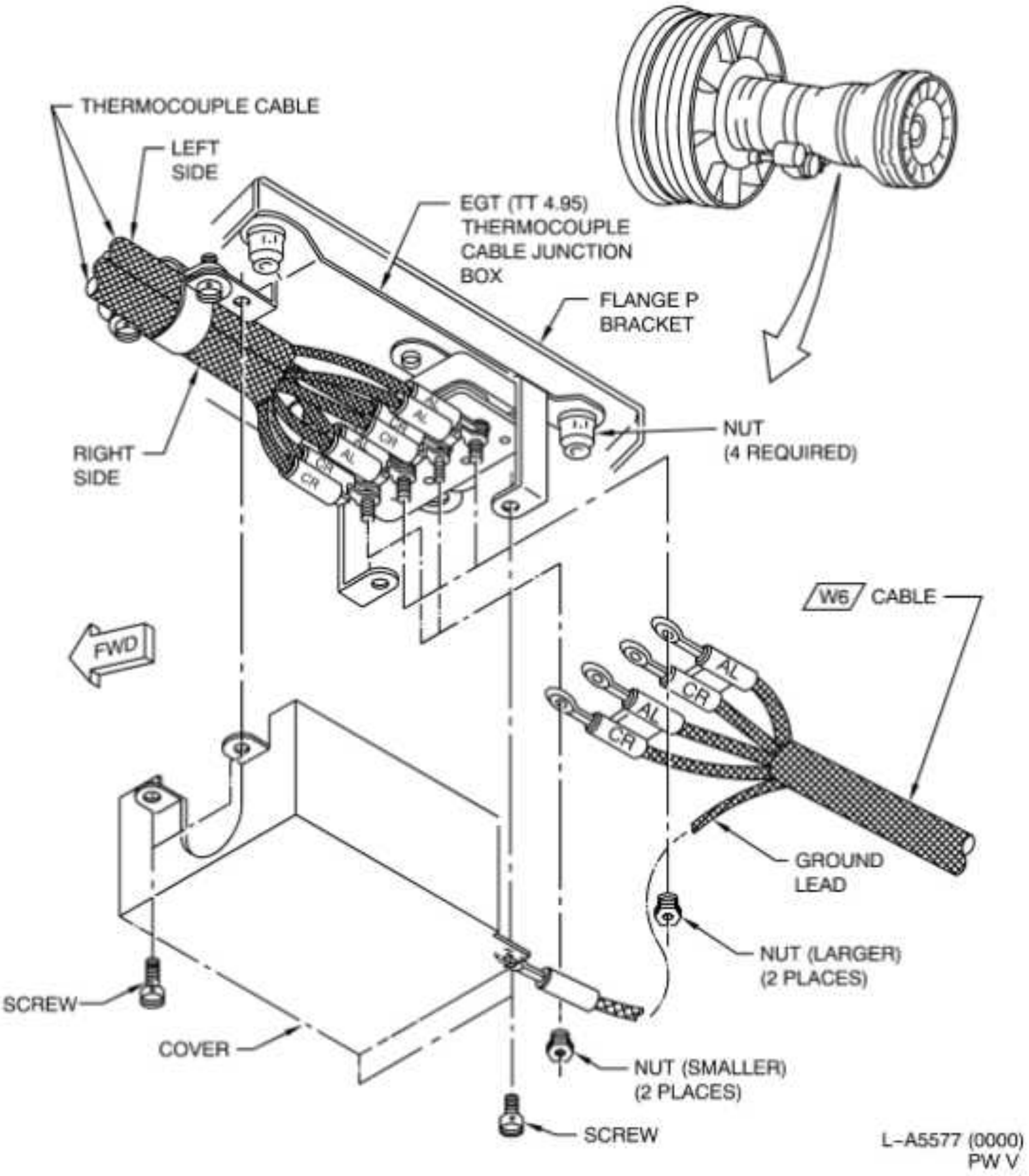
EEC Thermocouple And Airframe Cable (W6) (Post SB PW4ENG 73−163)
Figure 304 (Sheet 13)
(Task 72−00−54−050−006−B)


TCA TUBE FLANGE BRACKET
WIRING HARNESS SUPPORT TUBE
BOLT
SECTION Z-Z
L-B2658 (0000)

EEC Thermocouple And Airframe Cable (W6) (Post SB PW4ENG 73−163)
Figure 304 (Sheet 14)
(Task 72−00−54−050−006−B)


COOLING SHIELD
(POST SB PW4ENG 73-192)
SPACER
(POST SB PW4ENG 73-192)
TCA TUBE FLANGE
BRACKET
W6
HARNESS
W6P12
W5
HARNESS
TAB
COOLING SHIELD
(POST SB PW4ENG 73-192)
CLAMP
(POST SB
PW4ENG 73-192)
CLAMP
(POST SB PW4ENG 73-192)
COOLING HOSE
(POST SB PW4ENG 73-192)
FWD
VIEW AA
L-B8584 (0201)
PW V

EEC Thermocouple And Airframe Cable (W6) (Post SB PW4ENG 73−163)
Figure 304 (Sheet 15)
(Task 72−00−54−050−006−B)


THERMOCOUPLE CABLE
LEFT SIDE
EGT (TT 4.95) THERMOCOUPLE CABLE JUNCTION BOX
FLANGE P BRACKET
NUT (4 REQUIRED)
RIGHT SIDE
AL
CR
FWD
W6 CABLE
GROUND LEAD
NUT (LARGER) (2 PLACES)
SCREW
COVER
NUT (SMALLER) (2 PLACES)
SCREW
L−A5577 (0000)
PW V

EEC Thermocouple And Airframe Cable
(W6) (Pre And Post SB PW4ENG 73−163)
Figure 305
(Task 72−00−54−050−006−B)

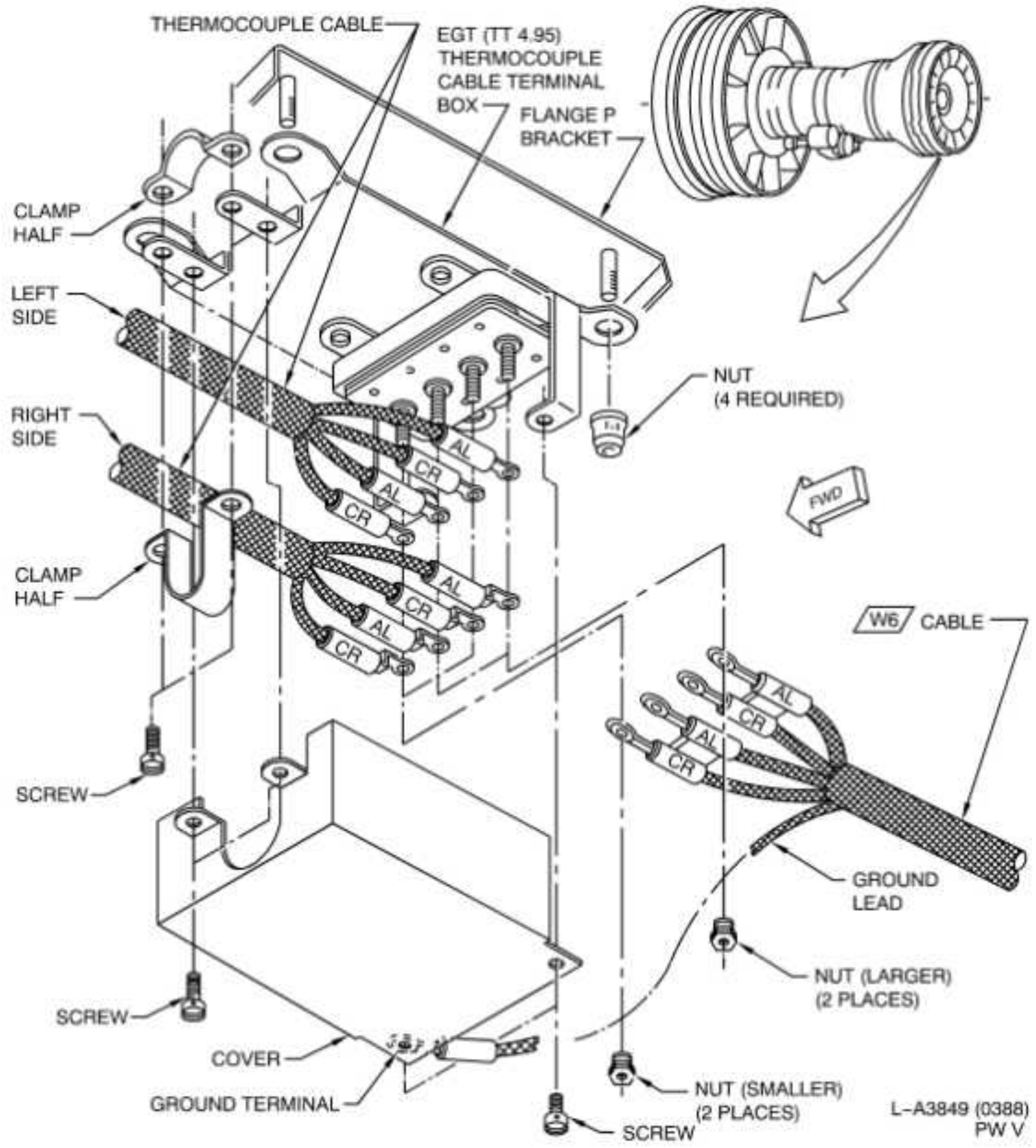
Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−10

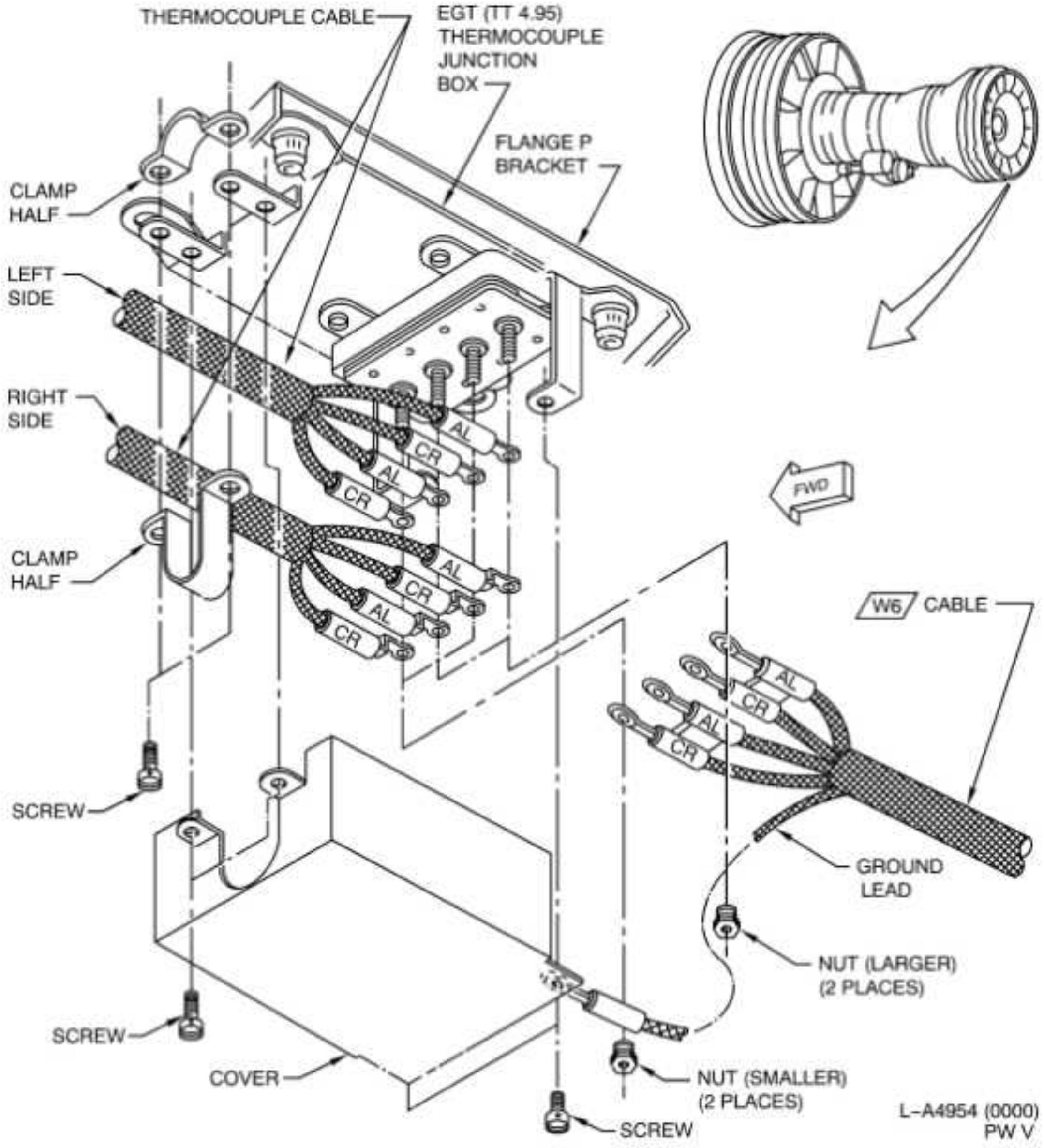
Task 72−00−54−050−007:

1. Remove EGT (TT4.95) Thermocouple Junction Box
    A. Equipment And Material Required − None
    B. Procedure
        See Figure 301.
        (1) Before disconnecting electrical leads, tag each lead and stud to facilitate proper reinstallation.
        (2) Remove lockwire and four screws securing cover and ground lead to junction box. Remove cover.
        (3) Remove two screws securing upper and lower clamp halves and thermocouple cable to junction box. Remove clamp halves.
        (4) Remove nuts and disconnect W6 cable and thermocouple cable leads from junction box studs. Reinstall nuts on studs.
        (5) Remove four nuts securing junction box to bracket on Flange P. Remove junction box from engine.

NOTE: For additional information concerning detailed maintenance of box and cable assembly, see EGT (TT4.95) Thermocouple Box And Cable Component Maintenance Manual, 77−21−04 (Harco Laboratories).


THERMOCOUPLE CABLE
EGT (TT 4.95) THERMOCOUPLE CABLE TERMINAL BOX
FLANGE P BRACKET
CLAMP HALF
LEFT SIDE
RIGHT SIDE
AL
CR
AL
CR
AL
CR
AL
CR
CLAMP HALF
NUT (4 REQUIRED)
FWD
W6 CABLE
AL
CR
AL
CR
SCREW
GROUND LEAD
NUT (LARGER) (2 PLACES)
SCREW
COVER
GROUND TERMINAL
NUT (SMALLER) (2 PLACES)
SCREW
L−A3849 (0388)
PW V

EGT (TT4.95) Thermocouple Junction Box − For Engines Without The Revised (TT4.95) Cable For Increased Engine Core Clearance (Pre SB PW4ENG 72−134)
Figure 301
(Task 72−00−54−050−007)


THERMOCOUPLE CABLE
EGT (TT 4.95) THERMOCOUPLE JUNCTION BOX
FLANGE P BRACKET
CLAMP HALF
LEFT SIDE
RIGHT SIDE
AL
CR
AL
CR
CLAMP HALF
FWD
AL
CR
AL
CR
W6 CABLE
AL
CR
AL
CR
SCREW
GROUND LEAD
NUT (LARGER) (2 PLACES)
SCREW
COVER
NUT (SMALLER) (2 PLACES)
SCREW
L−A4954 (0000)
PW V

EGT (TT4.95) Thermocouple Junction Box − For Engines With
The Revised (TT4.95) Cable For Increased Engine Core
Clearance (Post SB PW4ENG 72−134)
Figure 302
(Task 72−00−54−050−007)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - TURBINE EXHAUST CASE - REMOVAL-20

Task 72-00-54-020-005:

1. Remove The Flange P Brackets And Hardware

   A. Equipment And Materials Necessary - None

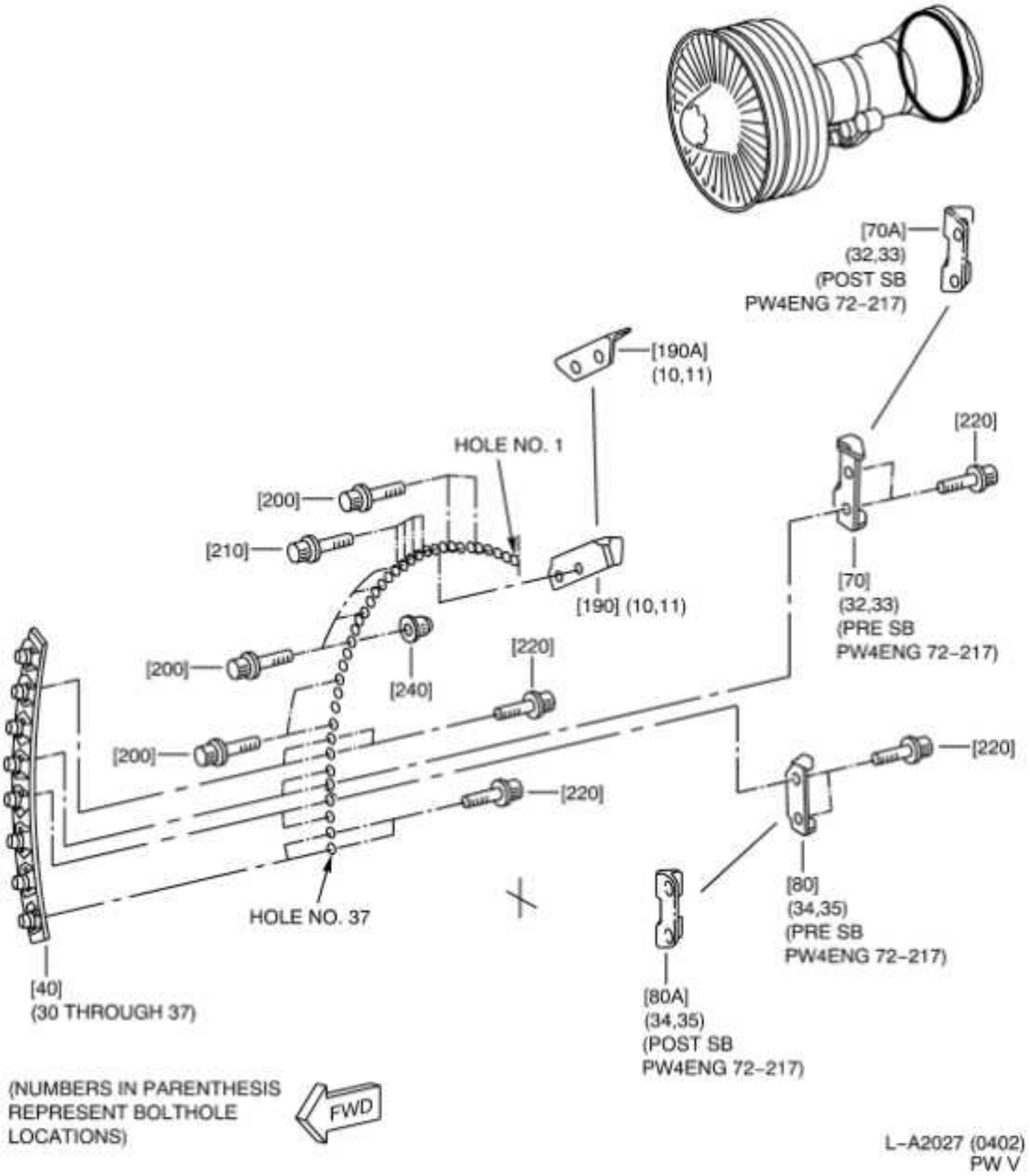
   B. Procedure

      (1) Remove the Flange P brackets as follows. See Figure 301.

         (a) Tag and identify the flange P hardware for the correct bolthole locations.

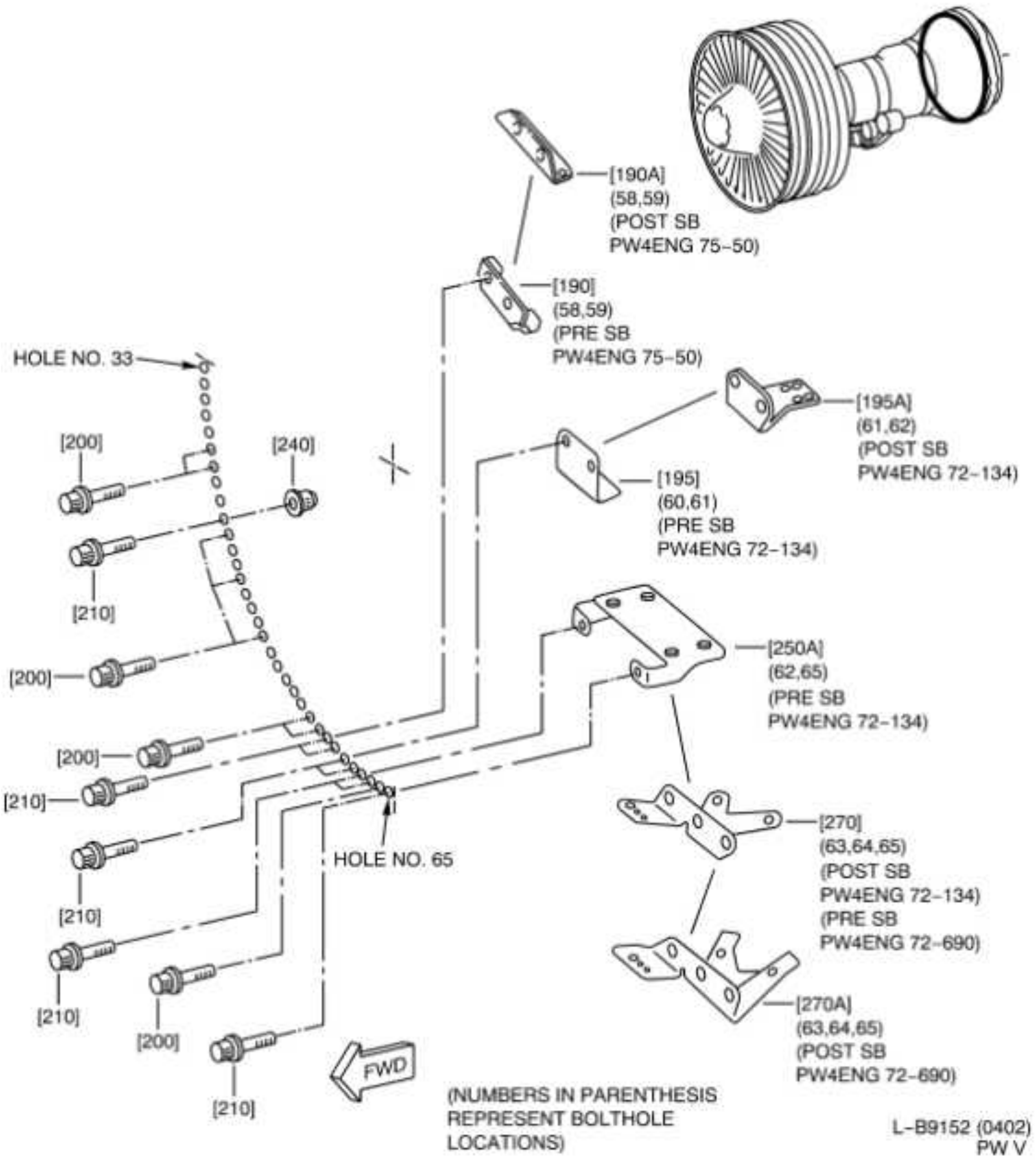
            NOTE: All the part item numbers in the figures are the same as the item numbers in the IPC.

         (b) Remove the nuts and bolts, which attach the brackets at Flange P.

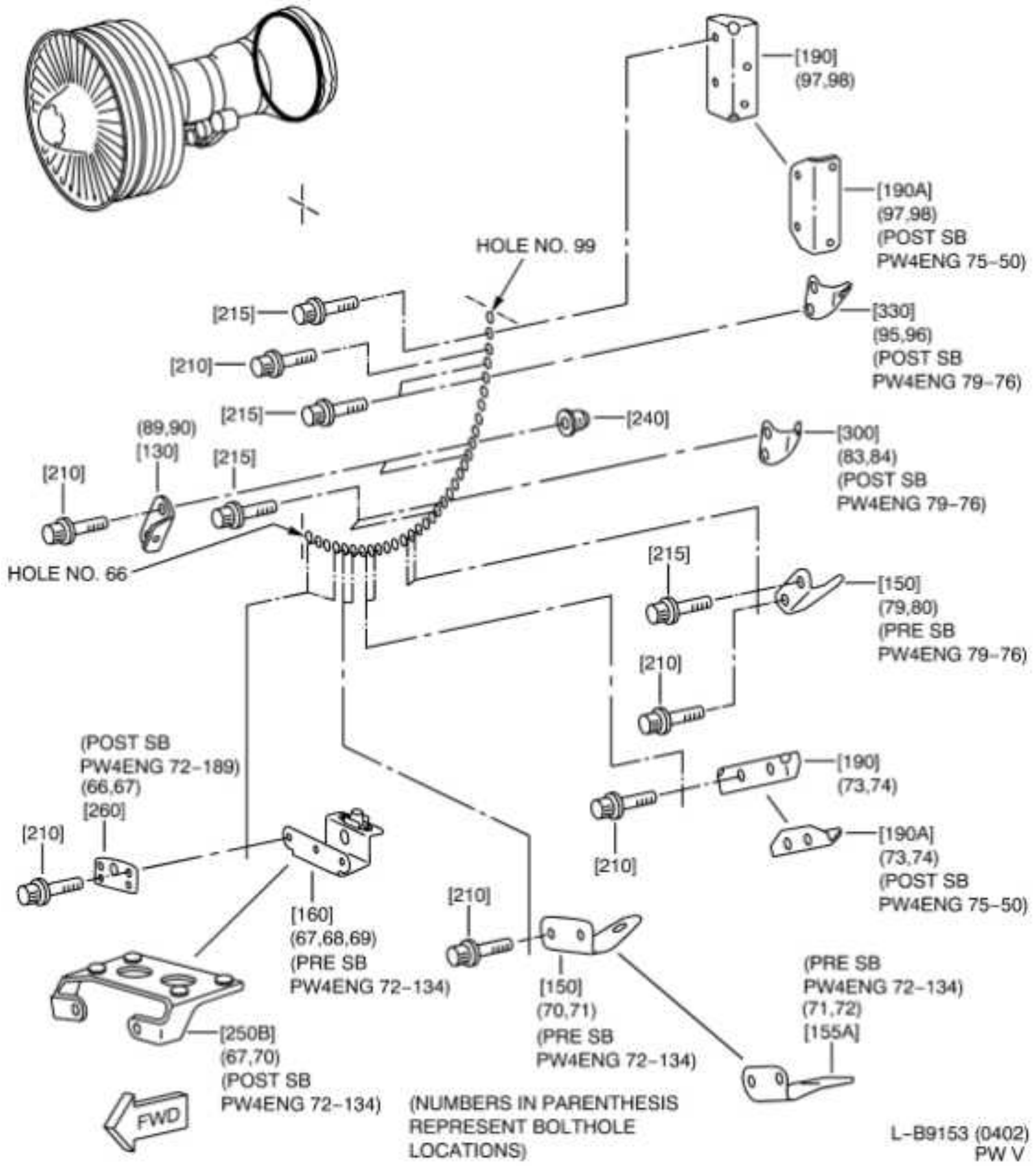

[70A]
(32,33)
(POST SB
PW4ENG 72-217)
[190A]
(10,11)
HOLE NO. 1
[220]
[200]
[210]
[190] (10,11)
[70]
(32,33)
(PRE SB
PW4ENG 72-217)
[220]
[200]
[240]
[200]
[220]
[220]
HOLE NO. 37
[80]
(34,35)
(PRE SB
PW4ENG 72-217)
[40]
(30 THROUGH 37)
[80A]
(34,35)
(POST SB
PW4ENG 72-217)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-A2027 (0402)
PW V

The Flange P Brackets And Hardware
Figure 301 (Sheet 1)
(Task 72−00−54−020−005)

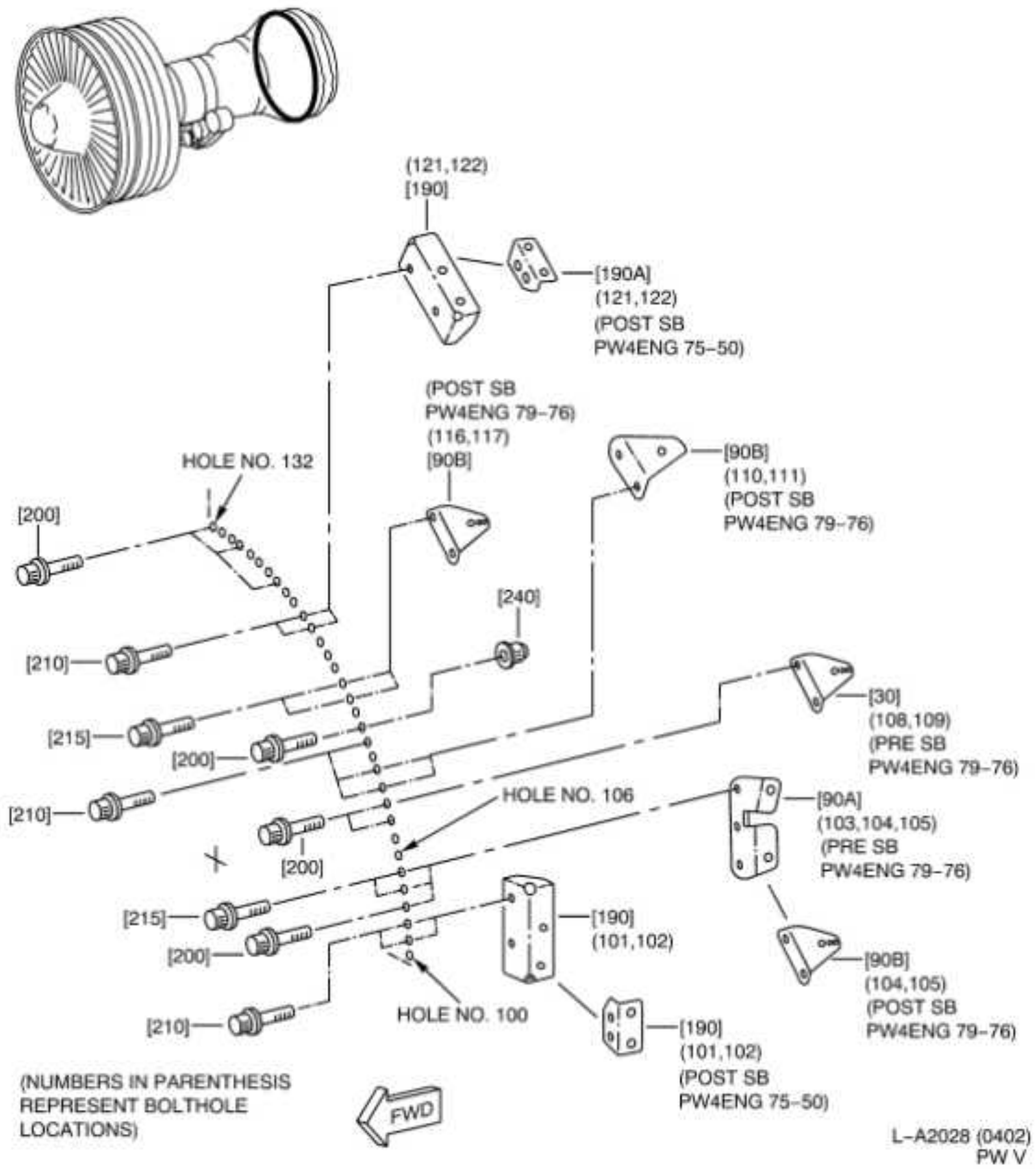
ENGINE GENERAL − TURBINE EXHAUST CASE − REMOVAL−20


[190A]
(58,59)
(POST SB
PW4ENG 75-50)
[190]
(58,59)
(PRE SB
PW4ENG 75-50)
HOLE NO. 33
[195A]
(61,62)
(POST SB
PW4ENG 72-134)
[200]
[240]
[195]
(60,61)
(PRE SB
PW4ENG 72-134)
[210]
[200]
[250A]
(62,65)
(PRE SB
PW4ENG 72-134)
[200]
[210]
[270]
(63,64,65)
(POST SB
PW4ENG 72-134)
(PRE SB
PW4ENG 72-690)
HOLE NO. 65
[210]
[210]
[200]
[270A]
(63,64,65)
(POST SB
PW4ENG 72-690)
FWD
[210]
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L-B9152 (0402)
PW V

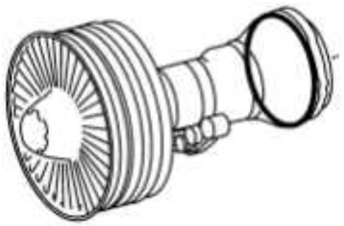
The Flange P Brackets And Hardware
Figure 301 (Sheet 2)
(Task 72−00−54−020−005)

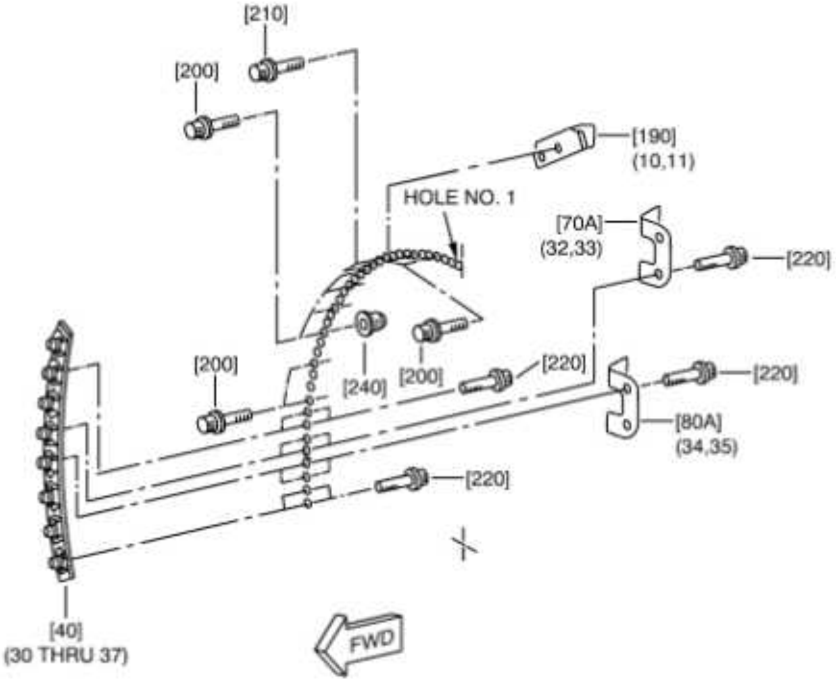

[190]
(97,98)
[190A]
(97,98)
(POST SB
PW4ENG 75-50)
HOLE NO. 99
[215]
[330]
(95,96)
(POST SB
PW4ENG 79-76)
[210]
[215]
[240]
(89,90)
[130]
[300]
(83,84)
(POST SB
PW4ENG 79-76)
[210]
[215]
HOLE NO. 66
[215]
[150]
(79,80)
(PRE SB
PW4ENG 79-76)
[210]
(POST SB
PW4ENG 72-189)
(66,67)
[260]
[190]
(73,74)
[210]
[210]
[190A]
(73,74)
(POST SB
PW4ENG 75-50)
[160]
(67,68,69)
(PRE SB
PW4ENG 72-134)
[210]
[150]
(70,71)
(PRE SB
PW4ENG 72-134)
(PRE SB
PW4ENG 72-134)
(71,72)
[155A]
[250B]
(67,70)
(POST SB
PW4ENG 72-134)
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L-B9153 (0402)
PW V

The Flange P Brackets And Hardware
Figure 301 (Sheet 3)
(Task 72−00−54−020−005)


(121,122)
[190]
[190A]
(121,122)
(POST SB
PW4ENG 75-50)
(POST SB
PW4ENG 79-76)
(116,117)
[90B]
HOLE NO. 132
[200]
[90B]
(110,111)
(POST SB
PW4ENG 79-76)
[240]
[210]
[215]
[200]
[30]
(108,109)
(PRE SB
PW4ENG 79-76)
[210]
HOLE NO. 106
[90A]
(103,104,105)
(PRE SB
PW4ENG 79-76)
[200]
[215]
[190]
(101,102)
[200]
[90B]
(104,105)
(POST SB
PW4ENG 79-76)
[210]
HOLE NO. 100
[190]
(101,102)
(POST SB
PW4ENG 75-50)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-A2028 (0402)
PW V

The Flange P Brackets And Hardware
Figure 301 (Sheet 4)
(Task 72−00−54−020−005)

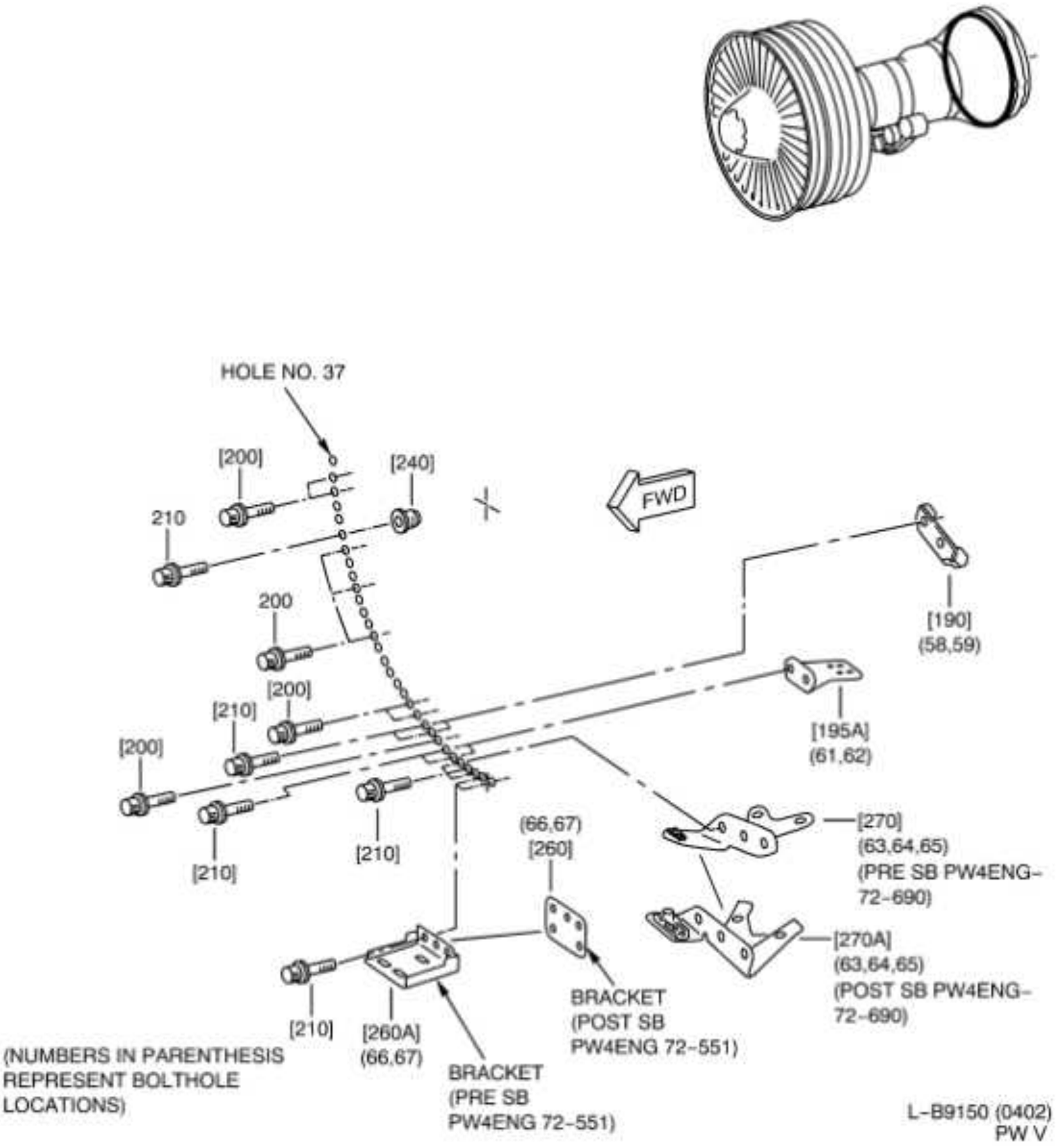



[210]
[200]
[190]
(10,11)
HOLE NO. 1
[70A]
(32,33)
[220]
[200]
[240]
[200]
[220]
[220]
[80A]
(34,35)
[220]
[40]
(30 THRU 37)
FWD

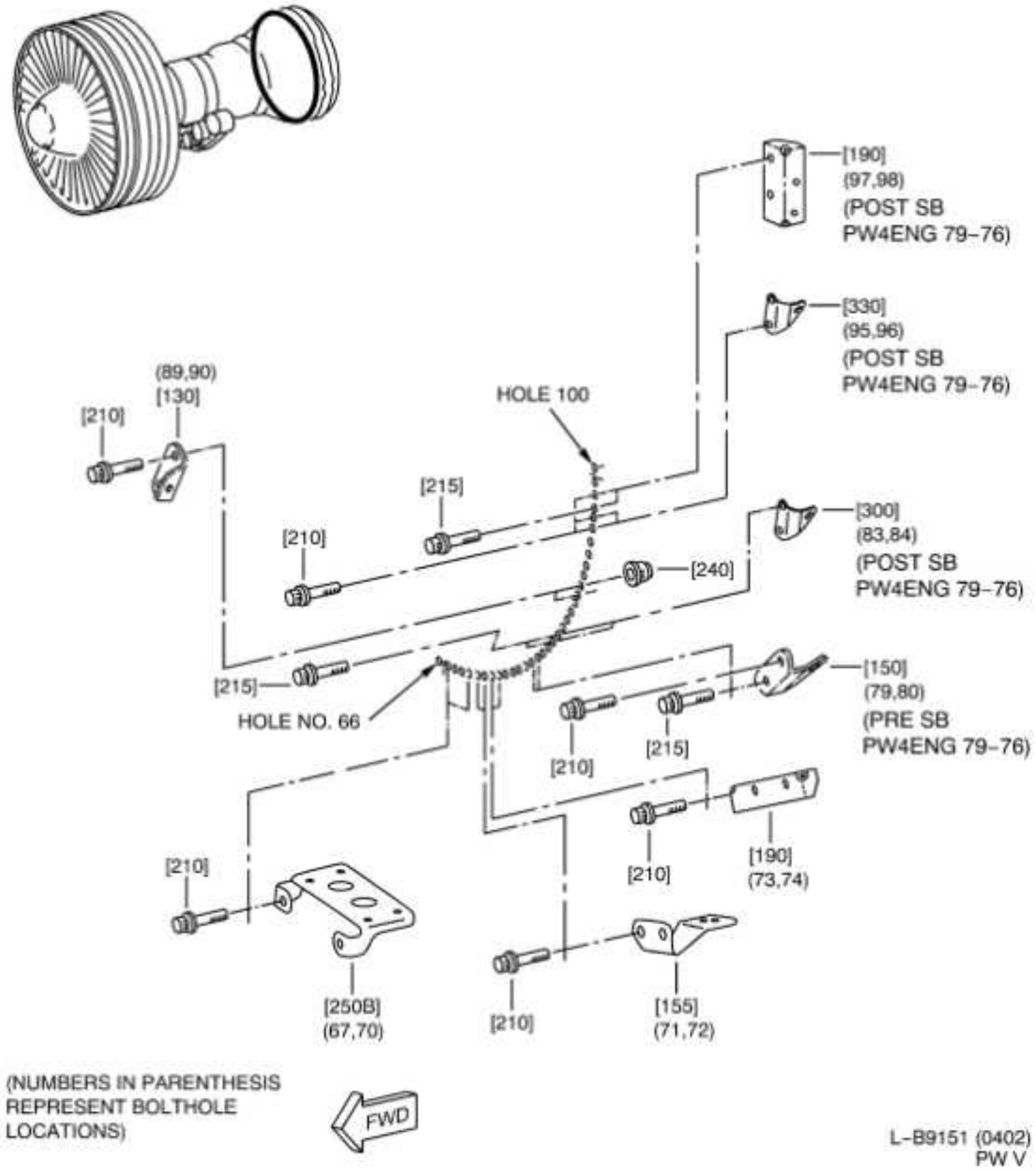
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

L−A9325 (0402)
PW V

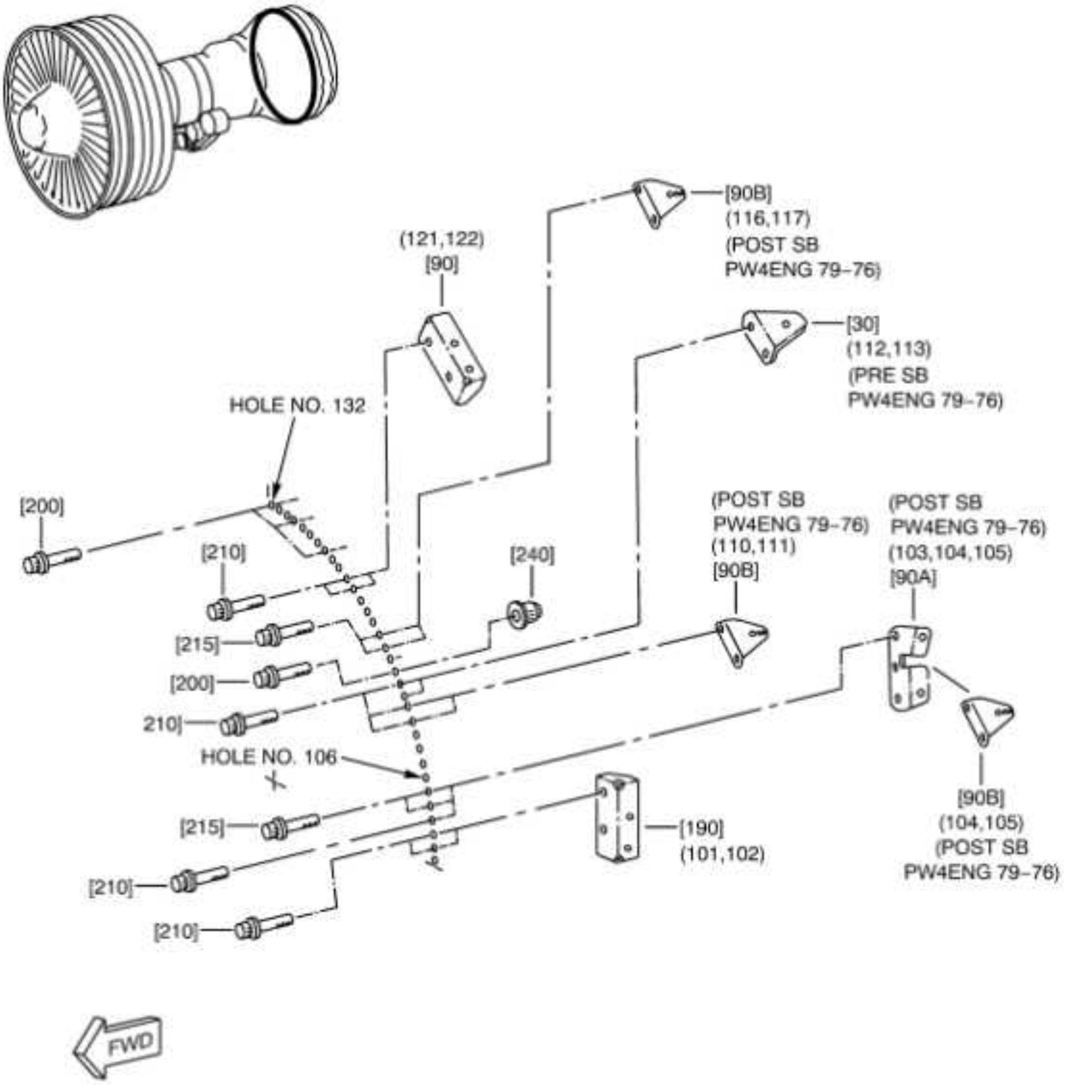
The Flange P Brackets And Hardware
Figure 301 (Sheet 5)
(Task 72−00−54−020−005)


HOLE NO. 37
[200]
[240]
210
FWD
200
[190]
(58,59)
[200]
[210]
[195A]
(61,62)
[200]
[210]
[210]
(66,67)
[260]
[270]
(63,64,65)
(PRE SB PW4ENG-72-690)
[270A]
(63,64,65)
(POST SB PW4ENG-72-690)
BRACKET
(POST SB PW4ENG 72-551)
[210]
[260A]
(66,67)
BRACKET
(PRE SB PW4ENG 72-551)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L-B9150 (0402)
PW V

The Flange P Brackets And Hardware
Figure 301 (Sheet 6)
(Task 72−00−54−020−005)


[190]
(97,98)
(POST SB
PW4ENG 79-76)
[330]
(95,96)
(POST SB
PW4ENG 79-76)
(89,90)
[130]
[210]
HOLE 100
[215]
[210]
[240]
[300]
(83,84)
(POST SB
PW4ENG 79-76)
[215]
HOLE NO. 66
[150]
(79,80)
(PRE SB
PW4ENG 79-76)
[210]
[215]
[210]
[210]
[190]
(73,74)
[250B]
(67,70)
[210]
[155]
(71,72)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-B9151 (0402)
PW V

The Flange P Brackets And Hardware
Figure 301 (Sheet 7)
(Task 72−00−54−020−005)


[90B]
(116,117)
(POST SB
PW4ENG 79-76)
(121,122)
[90]
[30]
(112,113)
(PRE SB
PW4ENG 79-76)
HOLE NO. 132
[200]
[210]
[240]
(POST SB
PW4ENG 79-76)
(110,111)
[90B]
(POST SB
PW4ENG 79-76)
(103,104,105)
[90A]
[215]
[200]
210]
HOLE NO. 106
[215]
[190]
(101,102)
[90B]
(104,105)
(POST SB
PW4ENG 79-76)
[210]
[210]
FWD

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

L-A9326 (0402)
PW V

The Flange P Brackets And Hardware
Figure 301 (Sheet 8)
(Task 72−00−54−020−005)

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Task 72-00-54-420-001:

1. Install Turbine Exhaust Case

NOTE: See Figure 401 for part/assembly installation sequence.

A. Prerequisites

(1) See 72-00-54, Inspection/Check-01 Task 72-00-54-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:

	PWA 25040	Bracket, Support (Optional To PWA 85195 Bracket For Engines With Exhaust Nozzle Removed)
	PWA 25041	Bracket, Support (Optional To PWA 85195 Bracket For Engines With Exhaust Nozzle Removed)
	PWA 25757	Pedestal, Fixed
	PWA 25758	Pedestal, Adjustable
	PWA 25926	Adapter
	PWA 28374	Guide
	PWA 28414	Bracket, Support (Optional To PWA 85195 For Engine Horizontal Support)
	PWA 28657	Sling, Strongback
	PWA 29243	Bracket, Support (2 Necessary) (Optional To PWA 85195 Brackets For Engine Horizontal Support)
	PWA 75995	Support
	PWA 76154	Adapter (2 Necessary)
	PWA 85195	Bracket, Support (2 Necessary)
	PWA 85305	Pins, Aligning (2 Necessary)
	PWA 85452	Eye, Lifting (Optional To PWA 28657)
R R	PWA 85453	Drift, Install (Optional to PWA 106326)
	PWA 85850	Guide, Piloting (Optional To PWA 28374)
	PWA 86438	Adapter
	PWA 102178	Support Rear (Optional To PWA 75995 And PWA 85696)
R R	PWA 106326	Drift, Install (No. 4 Bearing Inner Race, Seals, And Spacers)

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72−54−00/4/90
Packing	1	72−54−00/5/90
Key Washer	8	72−54−00/4/110

C. Procedure

(1) Ensure that No. 4 bearing (carbon) face seal gap dimensional requirement (Reference 829) is met.

(2) (Reference 1003) Install No. 4 bearing inner race, face seal (carbon) and seal spacers (front) and (rear). See Figure 402 and Figure 403.

NOTE: All parts must be within ± 10°F (± 5.6°C) when making all measurements.

(a) Stack 6th stage airseal (402/2), No. 4 bearing seal spacers (front) (402/3) and rear (402/5) and No. 4 bearing inner race (402/6) on bench. Ensure that zero clearance is maintained between mating faces. Measure overall stacking dimension and record as Dimension N.

(b) Measure dimension from 6th stage airseal shoulder Face P, to rear face of front compressor drive turbine shaft (402/1). Record as Dimension R.

(c) Dimension N − Dimension R must equal 0.005 − 0.020 inch (0.13 − 0.51 mm).

(d) Position 6th stage LPT airseal (403/2) on front compressor drive turbine shaft (403/1). Seat airseal onto shoulder of rear hub using PWA 85453
R or PWA 106326 Drift and mallet.

(e) Install No. 4 bearing (front) seal spacer (403/3), (carbon) face seal (403/4) and (rear) seal spacer (403/5) onto front compressor drive turbine shaft (403/1). Seat parts using PWA 85453 or PWA 106326 Drift and mallet. R

(f) Heat the No. 4 bearing inner race (403/5). See Standard Practices Manual, PN 585005.

(g) Install the heated No. 4 bearing inner race onto front compressor drive turbine shaft (403/1). Using PWA 85453 or PWA 106326 Drift and mallet, seat inner race and previously installed spacers. R

(h) Measure Dimension S from rear face of No. 4 bearing inner race to rear face of front compressor drive turbine shaft (402/1). See Figure 402.

(i) Dimension S must equal Dimension N - Dimension R plus 0.000 or minus 0.001 inch (plus 0.000 or minus 0.025 mm).

(j) If Dimension S is not within limits, remove bearing inner race, spacers and seals from turbine shaft and repeat steps (d) through (i).

(3) Install PWA 85195 Support Bracket, PWA 29243 Support Bracket, PWA 25040 Support Bracket and PWA 25041 Support Bracket or PWA 28414 Support Bracket to turbine exhaust case at 3 and 9 o'clock locations.

NOTE: PWA 29243 Support Bracket or PWA 28414 Support Bracket may be used in place of PWA 85195 Support Bracket for horizontal support only.

NOTE: PWA 25040 Support Bracket and PWA 25041 Support Bracket may be used in place of PWA 85195 Support Bracket on engines with exhaust nozzle removed.

(a) Position brackets between case rails and align holes.

NOTE: If applicable, install PWA 25040 Bracket at 3 o'clock and PWA 25041 Bracket at 9 o'clock positions.

(b) For PWA 85195 Bracket or PWA 25040 Bracket and PWA 25041 Bracket, install pin from rear through flange and bracket. Secure pin with safety pin as necessary.

(c) For other brackets, insert pin through flanges and bracket and install bushings through flanges and into bracket. Secure pins with nuts.

(4) Attach hoist to PWA 28657 Sling. Using two PWA 76154 Adapters attach sling to spools of brackets on case. Raise case from pallet and trunnion to horizontal position.

NOTE: See following step for optional procedure using lifting eye for handling turbine exhaust case.

(5) If applicable, position PWA 85452 Eye to turbine exhaust case. Align attachment block details to bushing holes in case rails at 2 and 10 o'clock. Install pins through bushings and blocks. Secure pins with safety clips.

(6) Install two PWA 85305 Aligning Pins, 180 degrees apart, in Flange P.

(a) Remove two aligning pins from plate detail.

(b) Locate smaller .190−32 threaded bolt hole in turbine rear case and secure plate to front side of turbine rear case using detail screw.

(c) Insert two aligning pins through bolt holes in turbine case flange and thread into tapped holes in plate.

(7) For installing exhaust case assembly using PWA 75995 Support and PWA 85696 Adapter, proceed as follows: See Figure 404.

NOTE: See following step for installing exhaust case assembly using optional PWA 102178 Support.

(a) Align boltholes and insert flanged end of PWA 75995 Support into ID of front compressor drive turbine) shaft (404/6). Secure flange to turbine shaft with eight screws (404/5).

(b) Slide PWA 28374 Guide, larger diameter first, over PWA 75995 Support and seat against bearing inner race.

(c) Align boltholes and install PWA 86438 Adapter onto PWA 75995 Support and into inner flange of turbine exhaust case. Secure flange to case with five screws (404/2).

(8) For installing exhaust case assembly using PWA 102178 Support, proceed as follows: See Figure 404.

(a) Align boltholes and insert flanged end of shaft (404/3) into ID of front compressor drive turbine shaft (404/6). Secure flange to turbine shaft with eight screws (404/1).

NOTE: Lifting eye may be threaded into hole near end of shaft detail to aid in removal of shaft.

(b) Slide PWA 85850 Guide, larger diameter first, over PWA 102178 Support and seat against bearing inner race.

(c) Align boltholes and install hub (404/4) into inner flange of turbine exhaust case. Secure hub flange to case with five screws (404/2).

(9) Move exhaust case into position at rear of turbine rear case. Adjust hoist as required and slide hub (404/4) or PWA 86438 Adapter as applicable onto shaft or PWA 75995 Support as applicable.

(10) If installing exhaust case using PWA 75995 Support, position PWA 25758 Pedestal under spool at end of support and adjust accordingly.

(11) Remove PWA 85583 Fixture from low pressure turbine. See Figure 405.

(a) Loosen jamnuts (405/4) and nut (405/1) as required to lower support plate (405/2) from 6th stage LPT disk (405/3).

(b) Remove bolts (405/6) securing flange segment (405/5) to turbine rear case (405/7). Remove fixture.

(12) Slide exhaust case forward, mating bearing rollers on exhaust case with inner race on turbine shaft. Seat exhaust case front flange against turbine exhaust case rear flange.

(13) Install several bolts and nuts equally spaced and evenly tighten nuts to seat snap diameter. Remove aligning pins.

(14) Remove brass shims supporting low pressure turbine rotor. Shims are between 6th stage blade outer shrouds and 6th stage air sealing ring segments.

(15) Install Flange P bolts, brackets and nuts as follows. Refer to 72−00−54, Installation−20 Task 72−00−54−450−005.

(16) Install engine pedestal supports at turbine exhaust case. See Figure 406.

  (a) Raise rear of engine and remove saddle and pedestal from front of Flange M. If applicable remove PWA 25758 Pedestal from rear of engine.

  (b) Install PWA 25757 Pedestal and PWA 25926 Adapter and PWA 25758 Pedestal beneath brackets located at 3 and 9 o'clock locations on turbine exhaust case.

  (c) Lower rear of engine until brackets seat on pedestals.

(17) Remove hoist, sling and adapters from turbine exhaust case.

(18) Remove tool details from exhaust case rear flange and turbine rear shaft.

NOTE: Lifting eye may be threaded into hole near end of shaft detail to aid in removal of shaft.

(19) Lubricate new packing (407/2) with Engine Oil P03−001 and install packing into groove in front diameter of No. 4 bearing retaining plate (407/3). Align boltholes and install retaining plate into rear inner diameter of front compressor drive turbine shaft (407/11). Secure retaining plate using bolts (407/5) lubricated with Engine Oil P03−001 and key washers (407/4). Torque bolts to 75 − 85 lb−in. (8.474 − 9.604 N.m). Bend tabs of key washers. See Figure 407.

CAUTION: YOU MUST APPLY ENGINE OIL FULLY TO THE COVER PACKING OR YOU WILL CUT THE PACKING DURING INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN−FLIGHT SHUTDOWN.

CAUTION: INSTALL THE COVER INTO POSITION USING FOUR WORK BOLTS EQUALLY SPACED AROUND THE COVER. TIGHTEN THE BOLTS EQUALLY IN SMALL INCREMENTS TO PULL THE COVER INTO POSITION EQUALLY. MONITOR THE ENGAGEMENT OF THE COVER TO MAKE SURE THAT THE PACKING IS NOT CUT DURING INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN−FLIGHT SHUTDOWN.

(20) Install the No. 4 bearing cover as follows:

(a) Apply Engine Oil P03−001 fully to the new packing (407/10).

(b) Install the new packing into the groove at the rear flange of the No. 4 bearing cover (407/9).

(c) Install the cover into the rear inner flange of the exhaust case (407/1).

(d) Install 4 work bolts equally spaced around the cover.

(e) Tighten the bolts equally in small increments to pull the cover into position equally.

(f) Monitor the engagement of the cover to make sure the packing is not cut.

(g) Remove the work bolts.

(21) Position No. 4 bearing heat shield (407/8) into recess in No. 4 bearing shield (407/7). Align bolt holes and install shield over previously installed No. 4 bearing cover (407/9) at rear inner flange of exhaust case. Secure shield with bolts, lubricated with Engine Oil P03−001. Use 30 bolts (407/6) for covers with 30 boltholes (Pre SB PW4ENG 72−456), or 16 bolts for covers with 16 boltholes (Post SB PW4ENG 72−456). Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

D. Postrequisites

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−01

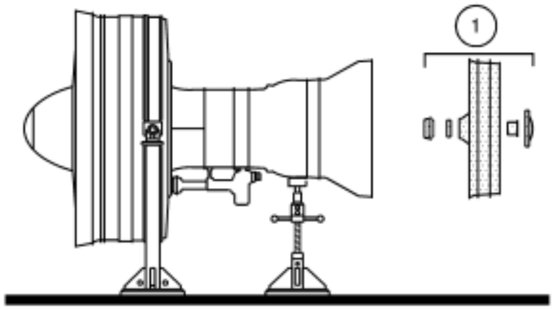
(1) Do a No. 4 bearing compartment vacuum check. Refer to 71−00−00, Testing−12 Task 71−00−00−720−003.

(2) Connect/install external parts to complete installation of turbine exhaust case per 72−00−54, Installation−02 Task 72−00−54−420−003.

(3) Install nacelle parts necessary to complete installation of turbine exhaust case per 71−00−54, Installation−01 Task 71−00−54−450−001.

(4) Test engine per Repair Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.

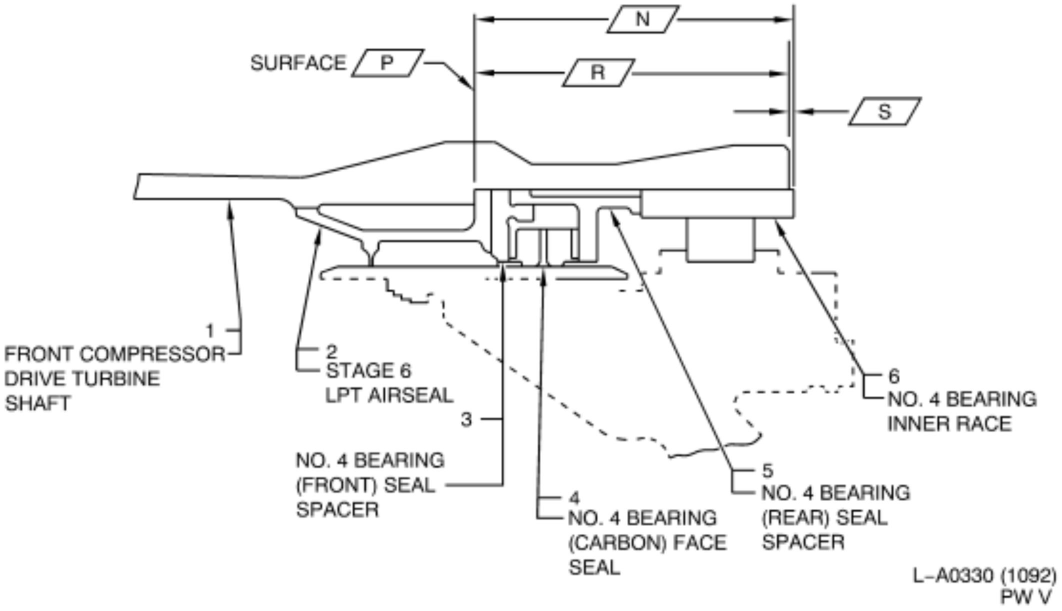
ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−01



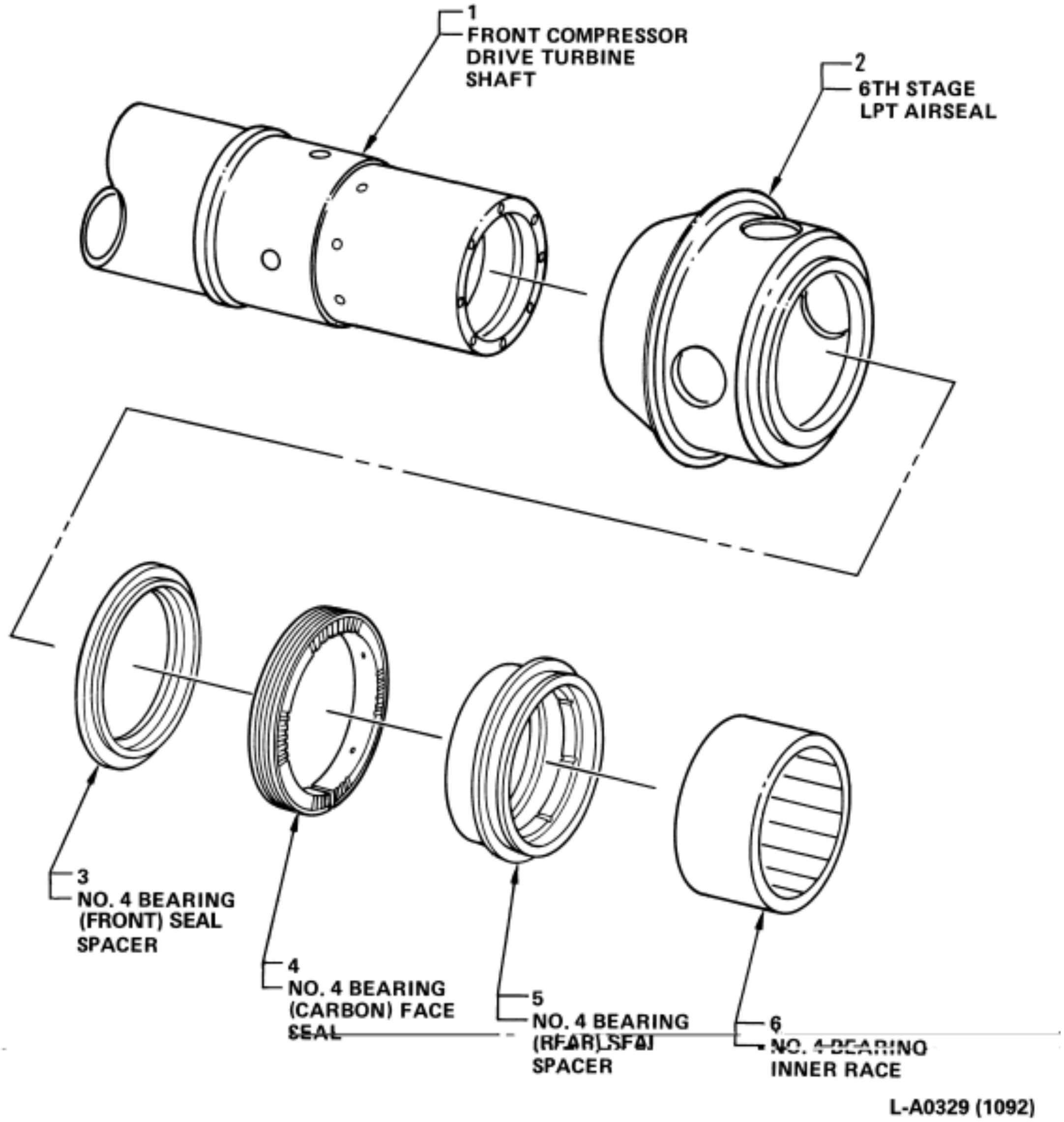
1. INSTALL TURBINE EXHAUST CASE.

L−A0262 (0000)
PW V

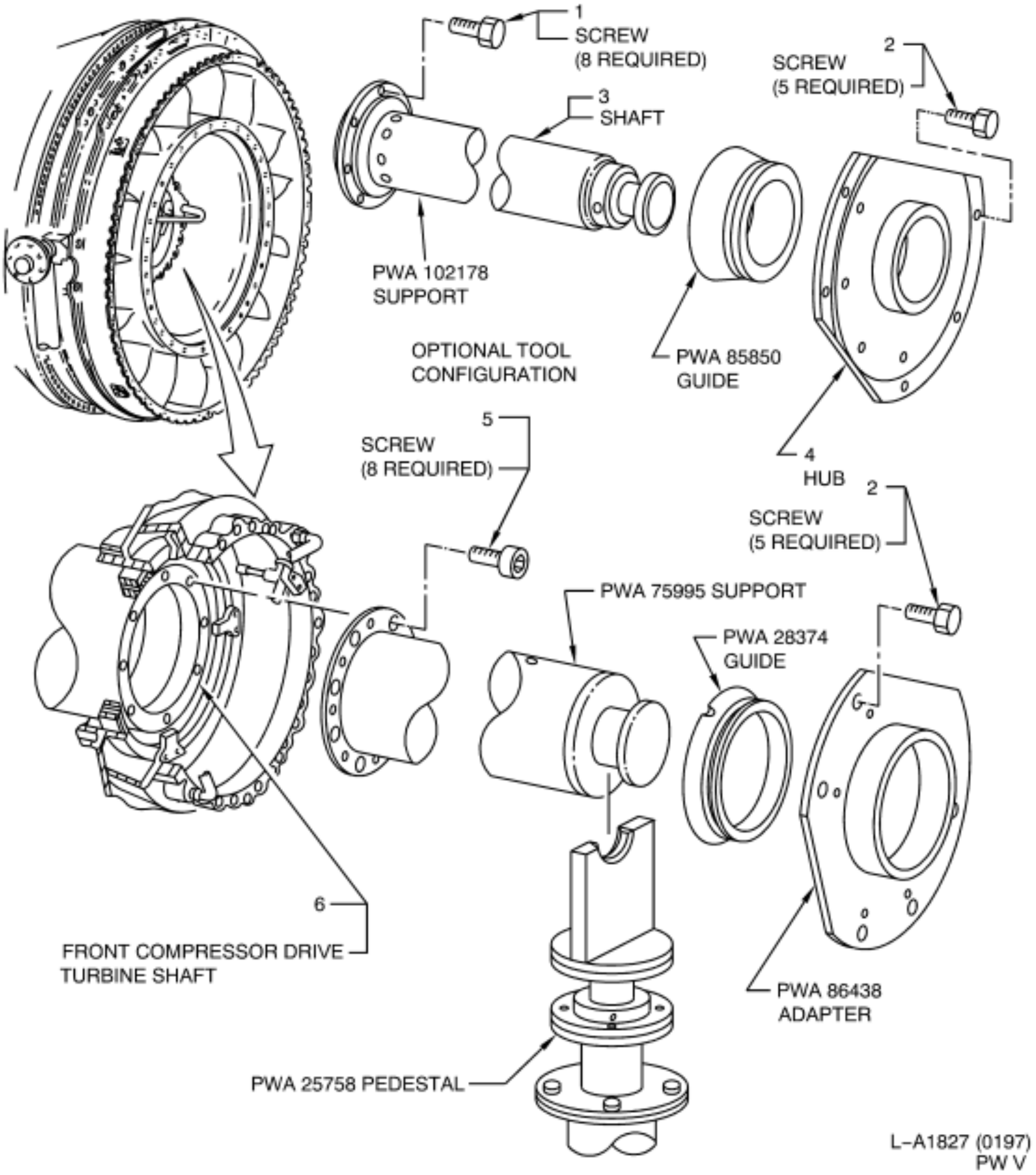
Procedure Sequence
Figure 401
(Task 72−00−54−420−001)


N
SURFACE P
R
S
1 FRONT COMPRESSOR DRIVE TURBINE SHAFT
2 STAGE 6 LPT AIRSEAL
3 NO. 4 BEARING (FRONT) SEAL SPACER
4 NO. 4 BEARING (CARBON) FACE SEAL
5 NO. 4 BEARING (REAR) SEAL SPACER
6 NO. 4 BEARING INNER RACE
L−A0330 (1092)
PW V

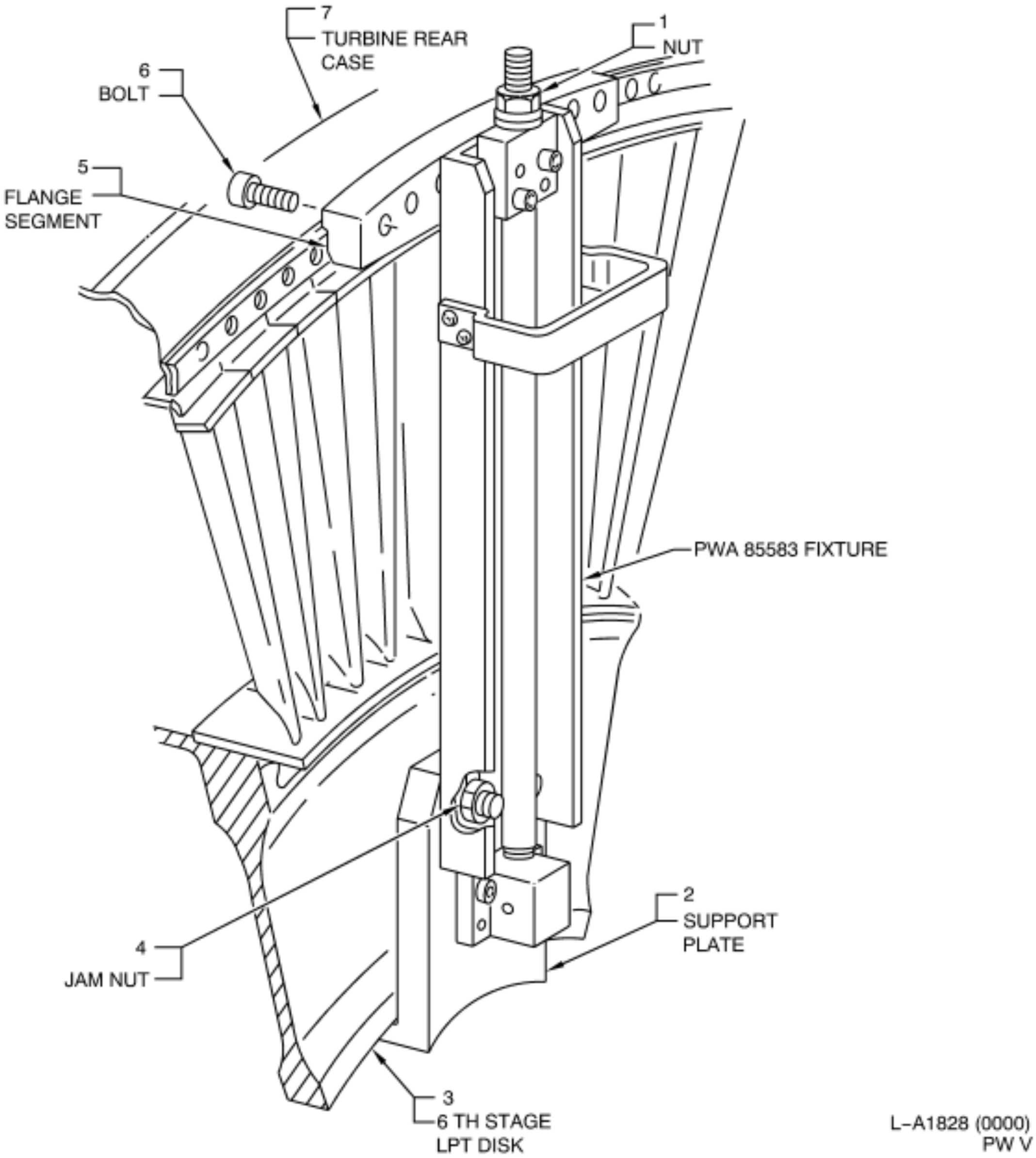
Turbine Exhaust Case Seating Check
Figure 402
(Task 72−00−54−420−001)


1
FRONT COMPRESSOR DRIVE TURBINE SHAFT
2
6TH STAGE LPT AIRSEAL
3
NO. 4 BEARING (FRONT) SEAL SPACER
4
NO. 4 BEARING (CARBON) FACE SEAL
5
NO. 4 BEARING (REAR) SEAL SPACER
6
NO. 4 BEARING INNER RACE
L-A0329 (1092)

Turbine Exhaust Case Installation
Figure 403
(Task 72−00−54−420−001)

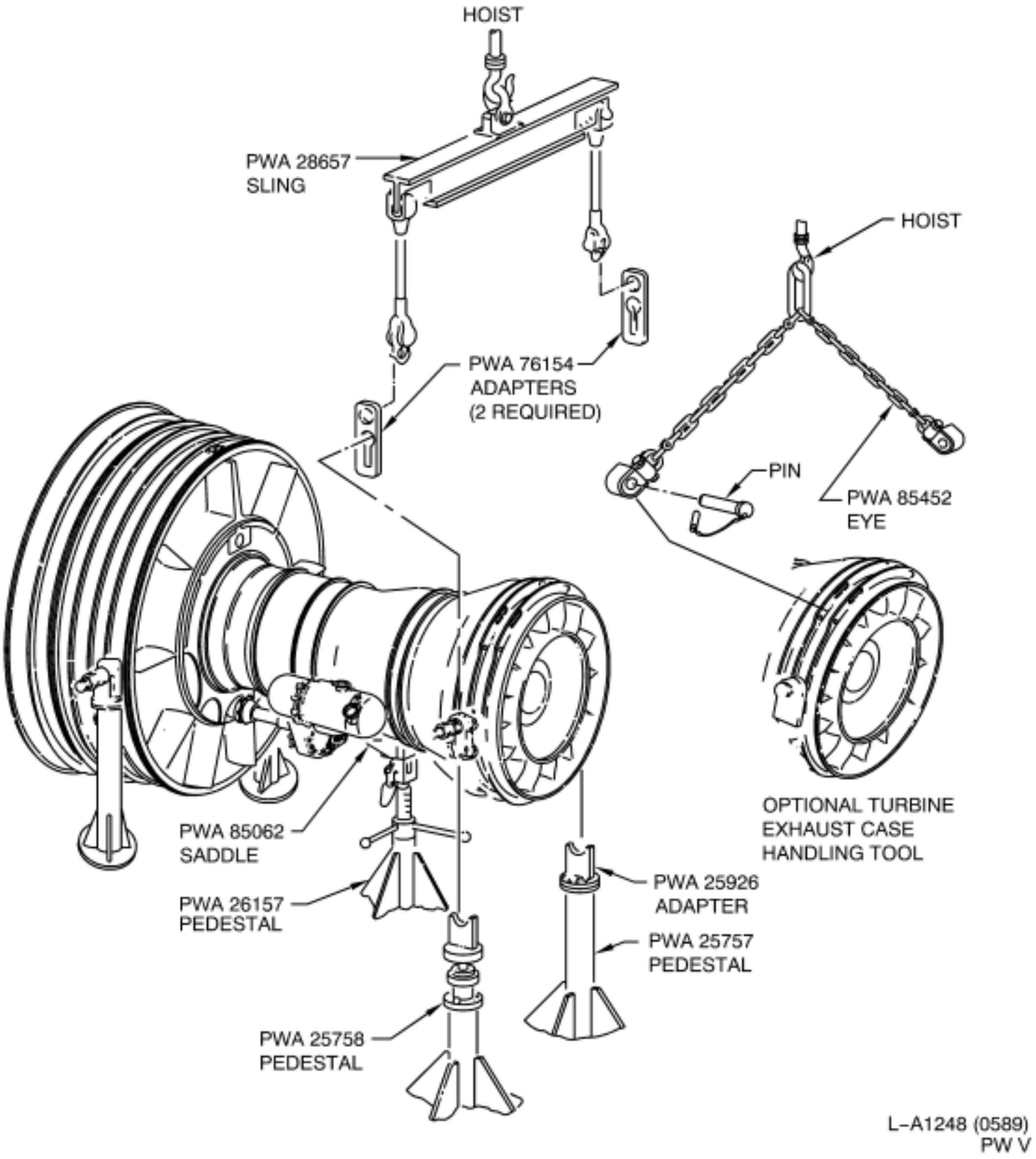

1
SCREW
(8 REQUIRED)
2
SCREW
(5 REQUIRED)
3
SHAFT
PWA 102178
SUPPORT
OPTIONAL TOOL
CONFIGURATION
PWA 85850
GUIDE
4
HUB
5
SCREW
(8 REQUIRED)
2
SCREW
(5 REQUIRED)
PWA 75995 SUPPORT
PWA 28374
GUIDE
6
FRONT COMPRESSOR DRIVE
TURBINE SHAFT
PWA 86438
ADAPTER
PWA 25758 PEDESTAL
L-A1827 (0197)
PW V

Turbine Exhaust Case Installation
Figure 404
(Task 72-00-54-420-001)

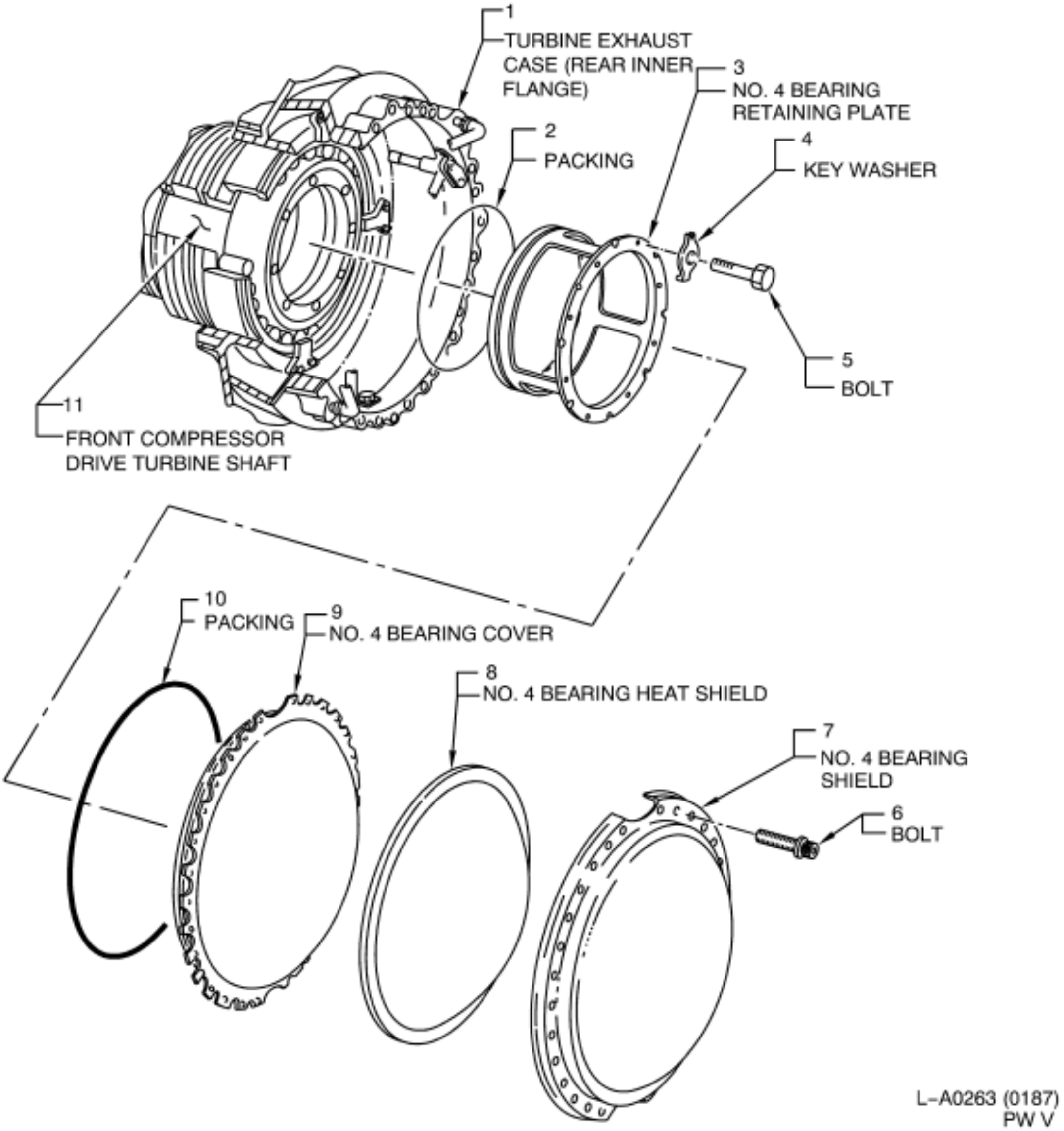

7
TURBINE REAR CASE
1
NUT
6
BOLT
5
FLANGE SEGMENT
PWA 85583 FIXTURE
2
SUPPORT PLATE
4
JAM NUT
3
6 TH STAGE LPT DISK
L−A1828 (0000)
PW V

LPT Rotor Support Fixture Removal
Figure 405
(Task 72−00−54−420−001)

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−01


HOIST
PWA 28657 SLING
HOIST
PWA 76154 ADAPTERS (2 REQUIRED)
PIN
PWA 85452 EYE
OPTIONAL TURBINE EXHAUST CASE HANDLING TOOL
PWA 85062 SADDLE
PWA 26157 PEDESTAL
PWA 25926 ADAPTER
PWA 25757 PEDESTAL
PWA 25758 PEDESTAL
L−A1248 (0589)
PW V

Turbine Exhaust Case Installation
Figure 406
(Task 72−00−54−420−001)


1
TURBINE EXHAUST CASE (REAR INNER FLANGE)
2
PACKING
3
NO. 4 BEARING RETAINING PLATE
4
KEY WASHER
5
BOLT
11
FRONT COMPRESSOR DRIVE TURBINE SHAFT
10
PACKING
9
NO. 4 BEARING COVER
8
NO. 4 BEARING HEAT SHIELD
7
NO. 4 BEARING SHIELD
6
BOLT
L–A0263 (0187)
PW V

Turbine Exhaust Case Installation
Figure 407
(Task 72–00–54–420–001)

ENGINE GENERAL - TURBINE EXHAUST CASE - INSTALLATION-02

Task 72-00-54-420-003:

1. Install External Plumbing After Turbine Exhaust Case Installation

A. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-059	Wax, Paraffin (PMC 9552)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
R	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	75-24-00/2/95
Gasket	1	75-26-00/1/190
Gasket	1	75-26-00/1/200
Gasket	2	75-26-00/1/210
Packing	2	79-21-00/7/1
Packing	1	79-21-00/12/190
Packing	1	79-22-00/4/1
Seal Plate	1	75-24-00/2/90
Gasket	1	75-24-00/2/90C

B. Procedure
See Figure 401, Figure 402, Figure 403, Figure 404 and Figure 405.

(1) Install (lower front) turbine case cooling (TCC) HPT manifold assembly (AC25) as follows.

(a) Raise and rotate manifold to engage manifold (collector) and install bolt, threads lubricated with Engine Oil P03-001, handtight only.

(b) Install HPT manifold loop clamp brackets to forward side of Flange M brackets at approximately 4, 7 and 9 o'clock positions, angled forward, with bolts, threads lubricated with Engine Oil P03-001, and nuts. Torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts securing manifold to manifold loop clamp brackets. Torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Torque bolt securing manifold to manifold (collector) to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(2) Install the (lower right) turbine blade cooling tube assembly (AP37) as follows. See Figure 401.

CAUTION: INSTALL LOCK PLATES WITH SLOT GROOVE OUTWARD AND PIN (IF EQUIPPED) INWARD. ENSURE LOCK PLATES ENGAGE INTERNAL TUBE LIP FLANGE AS SHOWN IN FIGURE 401.

(a) Remove protective closures. Install gasket, with raised sealing surface visible, to elbow end of tube, aligning tube slot and four bolt holes. Secure in place with Paraffin Wax P05-059. Install ring gasket to elbow groove with Paraffin Wax P05-059. Install locks to engage diffuser case internal tube lip and with pin inward (if equipped). Secure the locks in place with Paraffin Wax P05-059.

(b) (Reference 2261) Hold the tube locks outward against the tube lip. Measure and be sure the end of the internal tube is 0.000 - 0.020 inch (0.000 - 0.508 mm) above the tube locks. If the measurement is not within this limit, install the locks again and be sure you engage the internal tube lip properly. See Figure 401 (Sheet 3).

(c) (Pre SB PW4ENG 72-57 or SB PW4ENG 72-537 or Post SB PW4ENG 72-627) Install the gasket and metering plate in the four hole air shutoff valve flanged end of the tube and hold in place with Paraffin Wax P05-059.

(d) (Post PW4ENG 72−572 and Pre SB PW4ENG 72−627 or Post SB PW4ENG 72−537 and Pre SB PW4ENG 72−627) Install the gasket and ring spacer in the four hole air shutoff valve flanged end of the tube and hold in place with Paraffin Wax P05−059.

(e) Install gasket to lower flanged opening of air shutoff valve and secure in place with Paraffin Wax P05−059.

(f) Secure elbow end of tube (gaskets in place) and bracket to diffuser case pad at approximately 5 o'clock position with bolts, threads lubricated with Engine Oil P03−001, handtight only.

(g) Secure opposite end of tube (gasket and metering plate in place) to air shutoff valve with bolts, threads lubricated with Engine Oil P03−001, handtight only.

(h) Install clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts to diffuser case brackets at three locations. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(i) Torque all bolts at each end of tube to 85 − 95 lb−in. (9.604 − 10.734 N.m), then retorque to required limit without loosening until required torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts at the diffuser case pad.

(j) Install clamp, bolt, threads lubricated with Engine Oil P03−001, and nut securing fuel manifold to bracket attached to tube flange at diffuser case. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(3) Install (lower right) turbine cooling tube assembly (AP02) as follows.

(a) Remove protective closures.

(b) Secure new gasket in place to valve flange at approximately 3 o'clock position with Paraffin Wax P05−059.

(c) Secure new gasket in place to pad at approximately 4 o'clock position on HPT case with Paraffin Wax P05−059.

(d) Install tube and bracket to HPT case pad and secure with bolts, threads lubricated with Engine Oil P03−001, handtight only.

(e) Secure forward end of tube to air shutoff valve with bolts, threads lubricated with Engine Oil P03−001.

(f) Install tube clamp over tube at Flange M bracket and secure with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque clamp bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(g) Torque bolts securing tube to air shutoff valve to 85 − 95 lb−in. (9.604 − 10.735 N.m), then retorque to required limit without loosening until required torque is maintained.

(h) Torque bolts securing tube to HPT case to 180 − 200 lb−in. (20.337 − 22.597 N.m), then retorque to required limit without loosening until required torque is maintained. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(4) Install LPT case cooling manifold (collector) as follows. See Figure 402.

(a) Remove protective closures and secure rear of manifold (collector) to Flange P brackets, at approximately 3 o'clock position, with clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts handtight only.

(b) Secure front of manifold (collector) to Flange N bracket with clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts handtight only.

(c) Install bolts, threads lubricated with Engine Oil P03−001, and nuts securing manifold (collector) to support bracket and LPT cooling air valve flange, handtight only.

(d) Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque bolts securing manifold (collector) to LPT cooling air valve to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(5) Install LPT case cooling manifold (TCC) assemblies (AC01) through (AC14) as follows.

(a) Remove protective closures and position upper manifolds over top of LPT case and rotate to engage manifold (collector) at approximately 3 o'clock position.

(b) Position lower manifolds under LPT case and rotate to engage manifold (collector) at approximately 3 o'clock position.

1 Install clamps to the rear mounts of the top half and lower half of the cooling air manifolds. Attach the manifolds to Flange P brackets with bolts, threads lubricated with Engine Oil P03-001, spacers and nuts tightened by hand (Pre SB PW4ENG 75-50).

2 Install clamps to the rear mounts of the top half and lower half of the cooling air manifolds. Attach the manifolds to Flange P brackets with bolts, threads lubricated with Engine Oil P03-001, and nuts tightened by hand (Post SB PW4ENG 75-50).

(c) Install the cover assemblies on the upper and lower rear tubes (No. 7) of the manifold (collector) (Post SB PW4ENG 75-53).

(d) Install bolts, threads lubricated with Engine Oil P03-001, bracket and nuts securing upper and lower manifold support brackets to Flange N brackets handtight only.

(e) Install bolts, threads lubricated with Engine Oil P03-001, securing upper and lower manifolds to manifold (collector) and torque to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(f) Install bolts, threads lubricated with Engine Oil P03-001 to attach the cover assemblies to the manifold (collector). Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m) (Post SB PW4ENG 75-53).

R
R

(g) Torque all bolts securing manifolds at Flanges N and P to 36 - 40 lb-in. (4.067 - 4.519 N.m).

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE ETERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(6) (Pre SB PW4ENG 79-75) Install main filter oil tube assembly (LP01) as follows. See Figure 403.

(a) Remove protective closures and install packings lubricated with Engine Oil P03-001, to packing groove at each end of tube.

(b) Secure tube to forward side of main oil filter housing, with bolts, threads lubricated with Engine Oil P03-001, handtight only.

(c) Secure tube to top of main oil pump with loop clamp bracket angled rearward and bolts, threads
R lubricated with Antiseize Paste P06-054, handtight
R only. Wipe off unwanted paste.

(d) Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts securing tube to gearbox brackets at approximately 8 o'clock position. Torque clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Install the two (clip-on) loop clamp grommet halves to the tube at the diffuser case bracket clamp location (Post SB PW4ENG 79-36 only).

(f) Install the clamp that attaches the tube to the diffuser case bracket. Install the bolt, lubricated with Engine Oil P03-001, and nut. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(g) Torque bolts securing tube to main oil filter housing to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(h) Torque bolts securing tube and bracket to top of oil pump to 62 − 72 lb−in. (7.005 − 8.135 N.m).

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE ETERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(7) (Post SB PW4ENG 79−75) Install the fluid pressure dampener or install the fluid pressure adapter assembly (Post SB PW4ENG 79−86) and the main oil filter hose and tube assembly (LP01) as follows. See Figure 403.

(a) Remove the protective closures and install the packing lubricated with Engine Oil P03−001, to packing groove on the dampener or adapter.

(b) Install the dampener to the top of the main oil pump and secure with bolts, threads lubricated with Engine Oil P03−003, to a handtight condition only.

(c) Remove protective closures and install packing lubricated with Engine Oil P03−003, to packing groove at each end of oil tube assembly (LP01).

(d) Install one end of tube (LP01) to the forward side of the main oil filter housing with bolts, threads lubricated with Engine Oil P03−003, handtight only.

(e) Install the other end of tube (LP01) to the dampener or adapter, threads lubricated with Engine Oil P03−003, to a handtight condition only.

(f) Install bolts, threads lubricated with Engine Oil P03−003, nuts and clamps securing tube to gearbox brackets, handtight only.

(g) Install bolts, threads lubricated with Engine Oil P03−003, on the tube (LP01) which attaches to the diffuser case bracket.

(h) Torque all the clamp bolts to 32 - 36 lb-in. (3.616 - 4.067 N.m).

(i) Torque the bolts that hold the dampener or adapter to top of the main oil pump to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(j) Torque the bolts securing the tube (LP01) to the main oil filter housing to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(k) Torque the bolts that hold the tube (LP01) to the dampener or adapter to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(l) Torque the bolts securing the tube (LP01) to the diffuser case bracket to 65 - 75 lb-in. (7.344 - 8.474 N.m).

(8) (Post SB PW4ENG 79-75) Install the loop clamp bracket assembly on the fluid pressure dampener or adapter as follows. See Figure 403.

(a) Secure bracket assembly to the dampener or adapter with bolts and nuts to a handtight condition only.

(b) Torque the bolts to 32 - 36 lb-in. (3.616 - 4.067 N.m).

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE ETERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(9) (Pre SB PW4ENG 79-75) Install (front) No. 4 bearing scavenge tube assembly (LR05) as follows. See Figure 403.

(a) Remove protective closures and install packing lubricated with Engine Oil P03-001, to groove at flanged end of tube. Lubricate threads on tube coupling with Antiseize Paste P06-054. Wipe off unwanted paste.

(b) Install tube to oil pump port with bolts, threads lubricated with Antiseize Paste P06-054, handtight only. Wipe off unwanted paste.

(c) Install the four (clip-on) loop clamp grommet halves to the main filter oil tube at the two clamp locations (Post SB PW4ENG 79-36 only).

(d) Install the four (clip-on) loop clamp grommet halves to the (LR05) tube at the two clamp locations adjacent to the (LP01) tube grommet halves (Post SB PW4ENG 79-46 only).

(e) Install the two clamps, bolts, lubricated with Engine Oil P03-001, and nuts that attach the tube to the main oil filter tube at the two locations.

(f) Install clamp, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to bracket attached to main oil pump and No. 3 bearing oil scavenge manifold.

(g) Install the two (clip-on) loop clamp grommet halves to the (LR05) tube and two to the (LR04) tube adjacent to the oil pump. Install the clamps, bolts, lubricated with Engine Oil P03-001, and nut (Post SB PW4ENG 79-46 only).

(h) Torque all the clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(i) Torque bolts securing tube to pump to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(10) (Post SB PW4ENG 79-75) Install (front) No. 4 bearing oil scavenge tube assembly (LR05) as follows. See Figure 403.

(a) Remove protective closures and install packing lubricated with Engine Oil P03-001, to flanged end of tube.

R (b) Lubricate threads on tube nut with Antiseize Paste P06−054, wipe off unwanted paste, and install tube to rear scavenge tube at Flange M and to port on main oil pump with bolts, threads lubricated with Antiseize Paste P06−054, handtight only. Wipe off unwanted paste.

(c) Install the loop clamp bracket on the TCC manifold bridge bracket and secure with the clamp bolts, lubricated with Engine Oil P03−001, and nuts. Torque the clamp bolts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(d) Torque bolts securing tube flange to main oil pump to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(e) Torque tube nut to 475 − 525 lb−in. (53.668 − 59.317 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(f) Secure the hose and tube assembly to the loop clamp bracket on the TCC manifold bridge bracket and the loop clamp bracket assembly on the fluid pressure dampener or adapter with clamps and bolts, lubricated with Engine Oil P03−001. Torque the bolts to 27 − 30 lb−in. (3.051 − 3.390 N.m).

(11) (Pre SB PW4ENG 79−76) Install (rear) EEC PT4.95 tube assembly (AS02) as follows. See Figure 404.

CAUTION: DO NOT USED LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF EEC CAN RESULT.

(a) Remove protective closures from the tube fittings.

(b) Secure the tube nut to a tee at approximately the 6 o'clock position and rearward of Flange P (Pre SB PW4ENG 72−134).

(c) Secure the tube nut to the tube coupling at approximately the 7 o'clock position and rearward of Flange P (Post SB PW4ENG 72−134).

(d) Secure the tube nut to the tube coupling at approximately the 8 o'clock position and rearward of Flange N.

(e) Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts securing tube to Flanges N and P brackets. Torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(f) Torque tube nuts (both ends) to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(12) (Pre SB PW4ENG 79-76) Install (rear) No. 3 bearing oil vent tube assembly (LD02) as follows. See Figure 404.

(a) Remove protective closures and secure tube,
R threads on each end lubricated with Antiseize
R Paste P06-054, to adapter on exhaust case at
approximately 7 o'clock position, and to tube nut
forward of Flange N at approximately 8 o'clock
R position, handtight only. Wipe off unwanted paste

(b) Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts securing tube to Flanges N and P brackets, handtight only.

(c) Lubricate the threads of the bolt with Engine Oil P03-001. Secure tube to the adjacent PT4.95 tube assembly with clamps, bolt, and nut at approximately the 7:30 o'clock position and rearward of Flange P (Post SB PW4ENG 72-134).

(d) Install clamps, bolt, threads lubricated with Engine Oil P03-001, and nut securing tube to adjacent PT4.95 tube assembly between Flanges N and P. Torque all clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque tube nuts (both ends) to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(13) (Post SB PW4ENG 79-76) Install the (rear) EEC PT4.95 tube assembly (AS02) and the (rear) No. 3 bearing oil vent tube assembly (LD02) as follows. See Figure 405.

(a) Attach the (LD02) tube to the (LD01) and the turbine exhaust case, handtight only. See Figure 405 (Sheet 1).

(b) Attach the (AS02) tube to the (AS03) and (AS27) tubes, handtight only. See Figure 405 (Sheet 1).

(c) Install bolt to attach the (AS02) tube to the bracket handtight only. See Figure 405 (Sheet 2), View G.

(d) Install the clamp on the (LD02) tube and the clamp on the (LP48) tube and secure with nut and bolt, handtight only. See Figure 405 (Sheet 2), View L.

(e) Install the clamp on the (AS02) and (LD02) tubes and secure with a bolt, handtight only. See Figure 405 (Sheet 3), View H.

(f) Install clamp on the (AS02) and (LD02) tubes and secure with nut and bolt, handtight only. See Figure 405 (Sheet 3), View I.

(g) Install clamps on the (AS02) and (LD02) tubes and secure with nut and bolt, handtight only. See Figure 405 (Sheet 3), View J.

(h) Install clamp on (AS27) and (LD02) tubes and secure with nut and bolt, handtight only. See Figure 405 (Sheet 3), View K.

(i) Torque the (AS02) tube to the (AS03) tube and the (AS27) tube to 200 − 225 lb−in. (22.497 − 25.422 N.m).

(j) Torque the (LD02) tube to the internal tube and the (LD01) tube to 200 − 225 lb−in. (22.497 − 25.422 N.m).

(k) Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(14) (Pre SB PW4ENG 79−75) Install (rear) No. 4 bearing scavenge tube assembly (LR06) as follows.

(a) Remove protective closures and secure tube, elbow
R and nut threads lubricated with Antiseize Paste
R P06−054, to exhaust case internal tube nut at
approximately 10 o'clock position, and to tube
coupling forward of Flange M at approximately 7
R o'clock position, handtight only. Wipe off
R unwanted paste.

(b) Install clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts securing tube to Flanges N and P brackets. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Torque tube nut at exhaust case connection to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(d) Torque tube nut at Flange N connection to 475 − 525 lb−in. (53.668 − 59.317 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(e) (Reference 2151) Position spray shield to inboard side of Flange N connection and secure forward end of shield with hose clamp. Torque hose clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(f) Secure clamp to rear end of shield and Flange M bracket with bolt, threads lubricated with Engine Oil P03−001, and nut. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(15) (Post SB PW4ENG 79−75 and Pre SB PW4ENG 79−76 only) Install (rear) No. 4 bearing scavenge tube assembly (LR06) as follows. See Figure 404.

(a) Install rear scavenge tube, elbow and nut threads
R lubricated with Antiseize Paste P06−054, to exhaust case internal tube nut at approximately 10 o'clock position, and to the tube (LR05) coupling forward of Flange M at approximately 7 o'clock
R position, handtight only. Wipe off unwanted
R paste.

(b) Install loop clamp bracket on Flange M bracket at approximately 7 o'clock with bolts lubricated with Engine Oil P03−001, handtight only. Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Secure tube to loop clamp bracket on Flange M bracket with one clamp and bolt, lubricated with Engine Oil P03−001, handtight only. Torque clamp bolt to 27 − 30 lb−in. (4.067 − 4.519 N.m).

(d) Install clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts securing tube to Flanges N and P brackets. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque tube nut at exhaust case connection to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(f) Torque tube nut at Flange N connection to 475 − 525 lb−in. (53.668 − 59.317 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(g) Position tube shield to inboard side of Flange M connection and secure forward end of shield with hose clamp. Torque hose clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(16) (Post SB PW4ENG 79−76) Install (rear) No. 4 bearing scavenge tube assemblies (LR21) and (LR22) which replace (LR06) as follows.

(a) Attach the (LR21) tube to the (LR05) tube handtight only. See Figure 405 (Sheet 4), View DE.

(b) Install clamps and secure with nuts and bolts, handtight only. See Figure 405 (Sheet 5), Views O and Q and (Sheet 6), Views F and R.

(c) Attach the (LR22) tube to the (LR21) tube and the port for the internal tube on the turbine exhaust case, handtight only. Lubricate the threads that are on the internal tube with Engine Oil P03−001. See Figure 405 (Sheet 7), Views E and AP.

(d) Install clamps on the (LR22) tube and secure with bolts, handtight only. See Figure 405 (Sheet 8), Views A, B, C and D.

(e) Torque the (LR21) tube to the (LR05) tube to 475 − 525 lb−in. (56.668 − 59.317 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(f) Torque the (LR21) tube to the (LR22) tube to 475 - 525 lb-in. (56.668 - 59.317 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(g) Torque the internal tube nut to the (LR22) tube to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(17) (Post SB PW4ENG 79-76) Install the shields for the No. 4 bearing oil scavenge lines as follows.

(a) Install shield at the (LR05) tube to the (LR21) tube connection. Secure shield with clamp or bolt as applicable. See Figure 405 (Sheet 4), View DE.

(b) Install shield at the (LR21) tube to the (LR22) tube connection. Secure shield with clamp or bolt as applicable. See Figure 405 (Sheet 7), View E.

(c) Torque the clamps to 15 - 18 lb-in. (1.695 - 2.034N.m).

(d) Torque the nut and bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(18) Install No. 4 bearing strainer housing and strainer.

(a) Remove protective closures and install packing, lubricated with Engine Oil P03-001, to groove in strainer. Lubricate threads with Engine Oil P03-001, and install strainer to strainer housing, handtight only.

(b) Install strainer housing, threads lubricated with Engine Oil P03-001, to exhaust case internal tube nut at approximately 10:30 o'clock position, handtight only.

(19) (Pre SB PW4ENG 79-76) Install (rear) No. 4 bearing oil pressure tube assembly (LP16). See Figure 404.

(a) Remove protective closures. Secure tube, threads lubricated with Engine Oil P03-001, at each end, to last chance strainer housing on exhaust case, and to tube nut forward of Flange M at approximately 10 o'clock position, handtight only.

(b) Install clamps, bolts, threads lubricated with Engine Oil P03−001, spacer, and nuts to securing tube to brackets at Flanges M, N, and P and to adjacent scavenge tube. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Torque tube nuts at each end of tube to 450 − 500 lb−in. (50.843 − 56.492 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(d) Torque exhaust case internal tube nut to last chance strainer to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(e) Torque the strainer element to 150 − 170 lb−in. (16.948 − 19.207 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(f) (Reference 2151) (Pre SB PW4ENG 79−54) Install spray shields to inboard side of front and rear connections and secure with hose clamps. Torque hose clamps to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(g) (Reference 2151) (Post SB PW4ENG 79−54) Install the spray shield to the inboard side of the pressure tube connection forward of Flange M. Secure the forward end of the shield to the bracket on the diffuser case with a clamp, bolt lubricated with Engine Oil P03−001. Torque the clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). Secure the rear of the shield with a hose clamp and torque to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(20) (Post SB PW4ENG 79−76) Install (rear) No. 4 bearing oil pressure tube assemblies (LP47) and (LP48) which replace (LP16) as follows. Also install the No. 4 bearing strainer element as follows.

(a) Attach the coupling nut on the (LP15) tube to the (LP47) tube, handtight only. See Figure 405 (Sheet 9), View LA.

(b) Install clamps and secure with bolts. See Figure 405 (Sheet 9), Views U, T and S.

(c) Install packing, lubricated with Engine Oil P03−001 to the groove in the No. 4 bearing strainer element. See Figure 405 (Sheet 10), View G.

(d) Install the No. 4 bearing strainer element into the No. 4 bearing strainer element housing, handtight only. Lubricate threads with Engine Oil P03−001. See Figure 405 (Sheet 10), View G.

(e) Install the element housing, lubricated with Engine Oil P03−001, on to the tube nut at approximately the 7 o'clock position, handtight only. See Figure 405 (Sheet 10), View G.

(f) Attach the (LP48) tube to the strainer housing and the (LP47) tube, handtight only. See Figure 405 (Sheet 10), Views G and CA.

(g) Install clamps and secure with bolts and nuts as necessary. See Figure 405 (Sheet 11), Views M, N, B1 and P, and (Sheet 12), Views R and F.

(h) Torque the strainer to the strainer housing to 150 − 170 lb−in. (16.948 − 19.207 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(i) Torque the internal tube nut to the strainer housing to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrul P05−292.

(j) Torque the (LP48) tube to the strainer housing to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(k) Torque the (LP48) tube to the (LP47) tube to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(l) Torque the (LP15) tube to the (LP47) tube to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(m) Torque all the installed clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

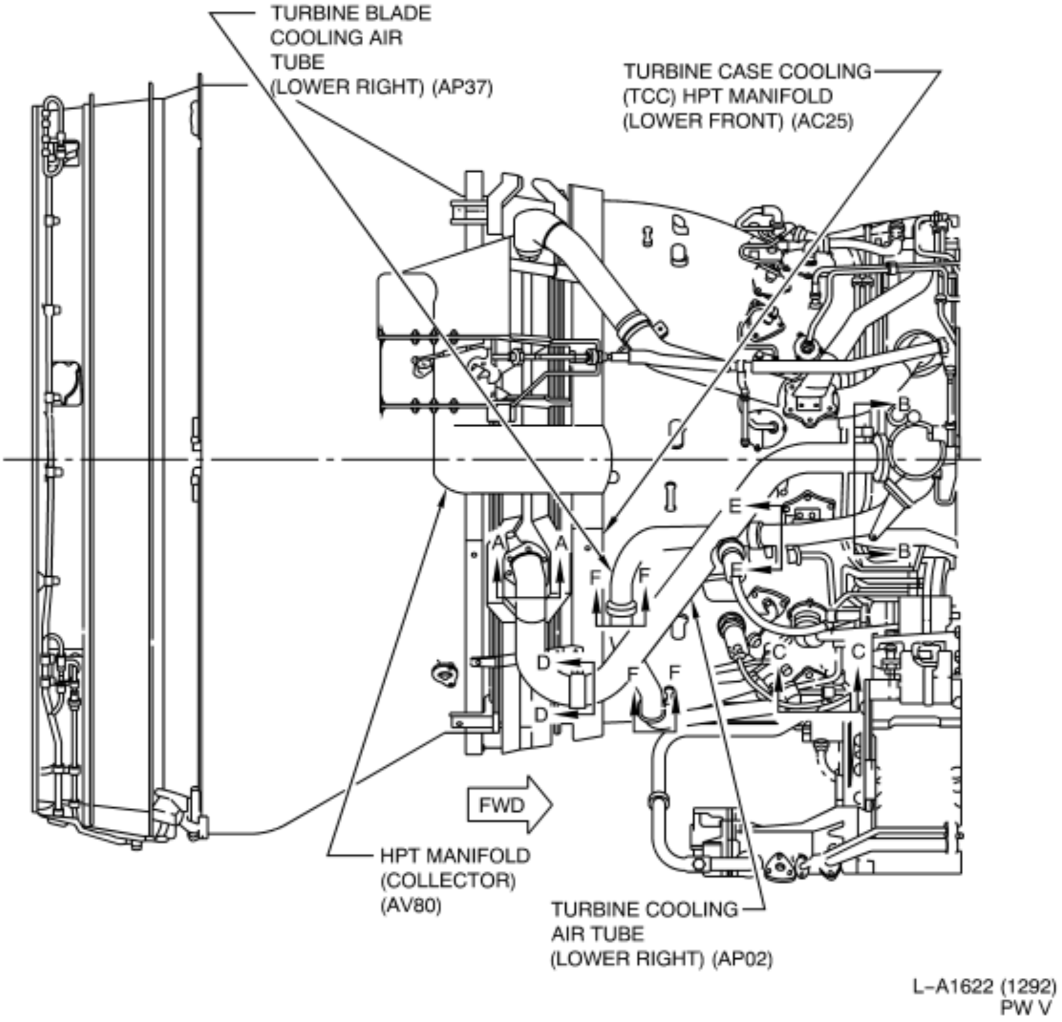
(21) (Post SB PW4ENG 79−76) Install the shields for the No. 4 bearing oil pressure lines as follows.

(a) Install shield at the (LP47) tube to the (LP15) tube connection. Secure shield with clamps. See Figure 405 (Sheet 9), View LA.

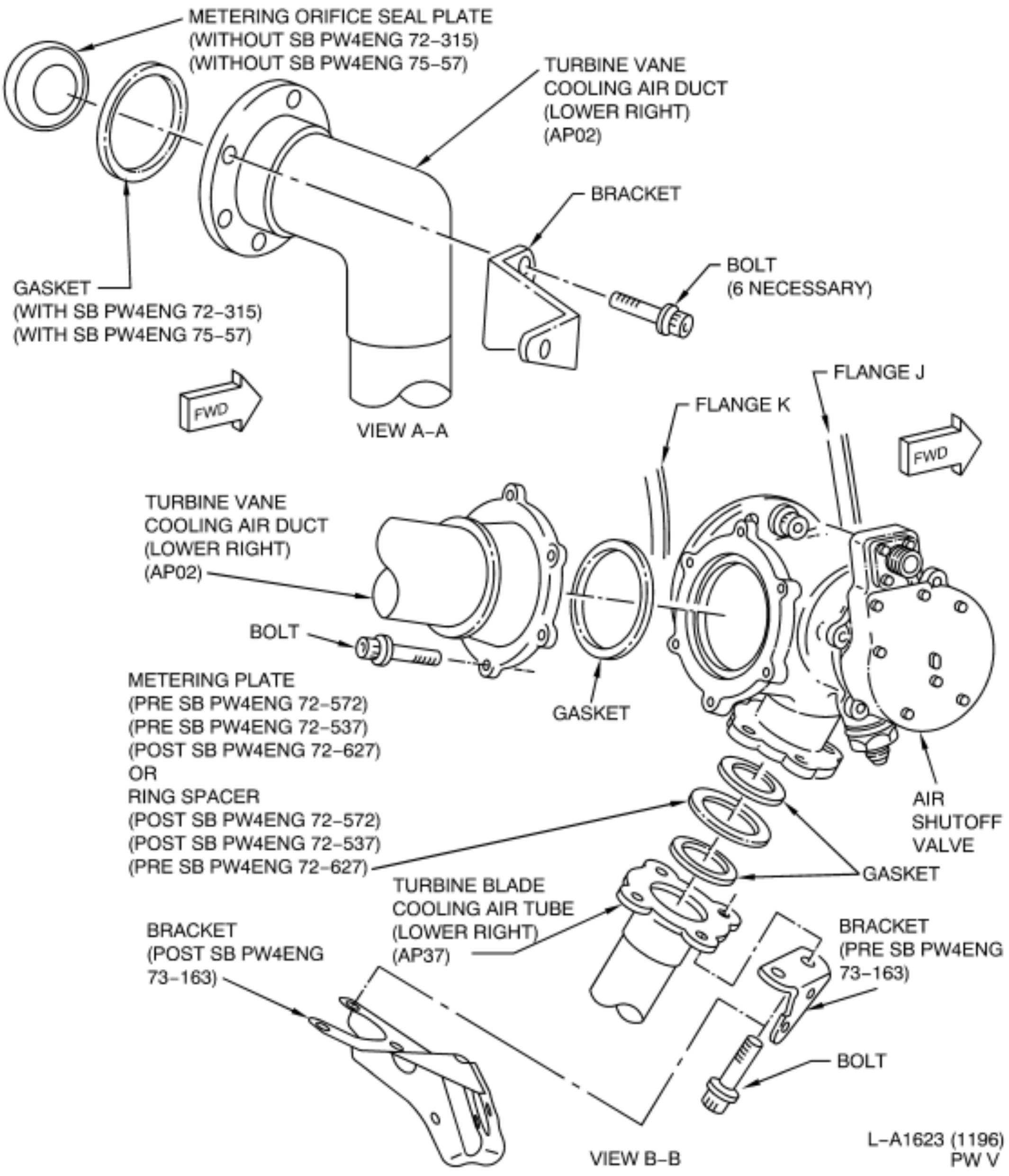
(b) Install shield at the (LP47) tube to the (LP48) tube connection. Secure shield with clamps. See Figure 405 (Sheet 10), View CA.

(c) Install shield at the (LP48) tube to the strainer housing connection. Secure shield with clamps. See Figure 405 (Sheet 10), View G.

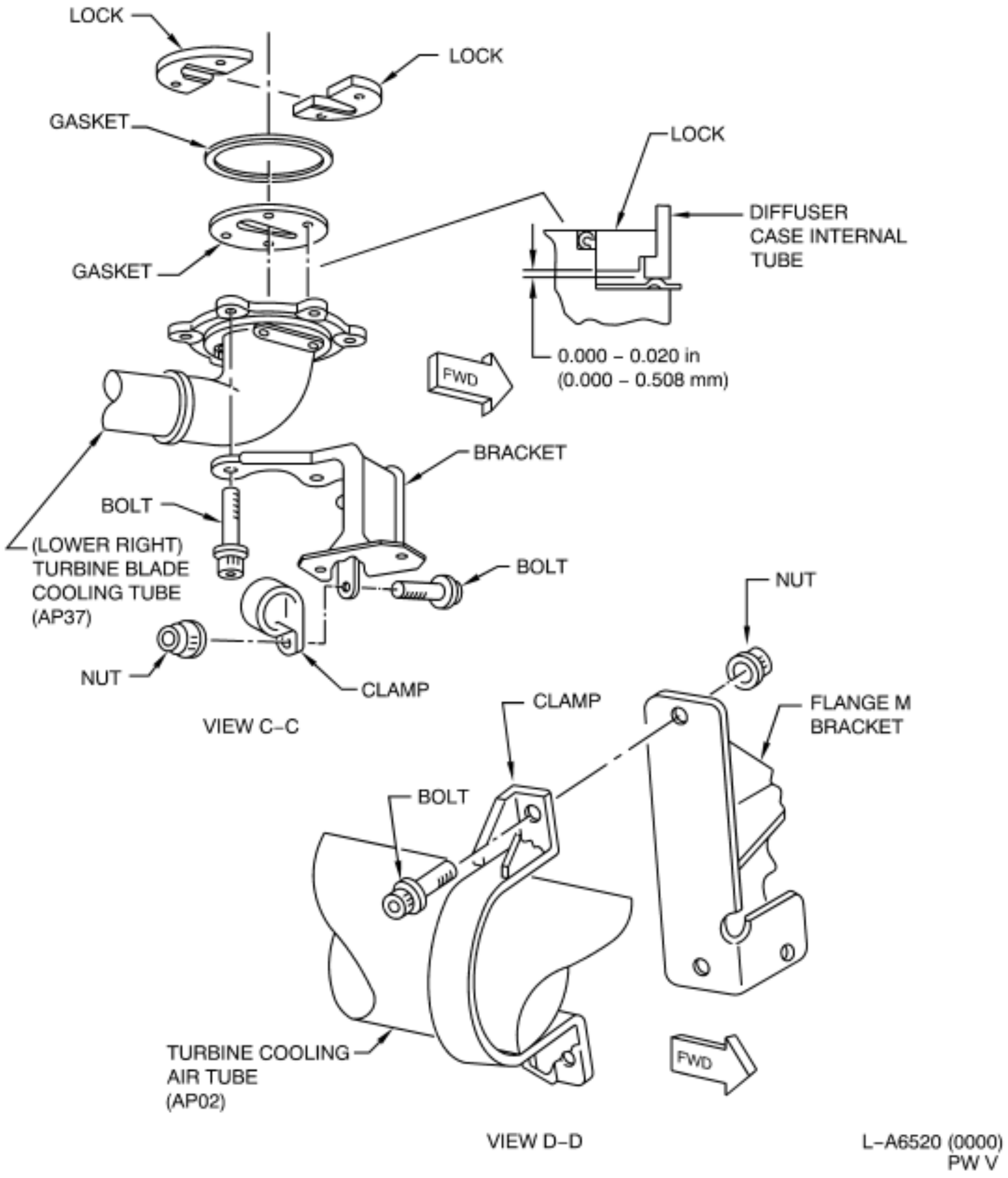
(d) Torque all clamps to 15 − 18 lb−in. (1.695 − 2.034 N.m).


TURBINE BLADE
COOLING AIR
TUBE
(LOWER RIGHT) (AP37)
TURBINE CASE COOLING
(TCC) HPT MANIFOLD
(LOWER FRONT) (AC25)
A
A
F
F
B
E
B
E
C
C
D
D
F
F
FWD
HPT MANIFOLD
(COLLECTOR)
(AV80)
TURBINE COOLING
AIR TUBE
(LOWER RIGHT) (AP02)
L−A1622 (1292)
PW V

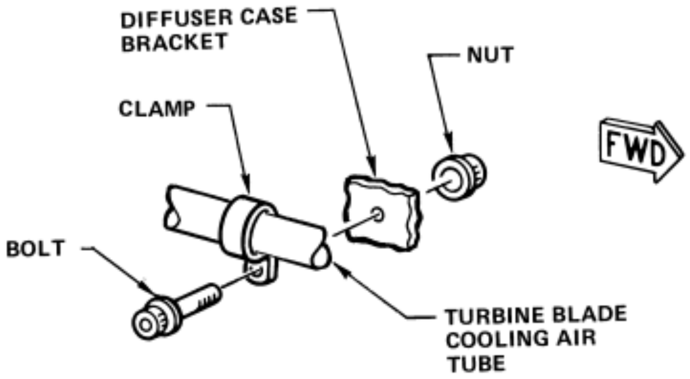
High Pressure Turbine Cooling Air Manifolds
Figure 401 (Sheet 1)
(Task 72−00−54−420−003)


METERING ORIFICE SEAL PLATE
(WITHOUT SB PW4ENG 72-315)
(WITHOUT SB PW4ENG 75-57)
TURBINE VANE COOLING AIR DUCT (LOWER RIGHT) (AP02)
BRACKET
BOLT (6 NECESSARY)
GASKET
(WITH SB PW4ENG 72-315)
(WITH SB PW4ENG 75-57)
FWD
VIEW A-A
FLANGE J
FLANGE K
FWD
TURBINE VANE COOLING AIR DUCT (LOWER RIGHT) (AP02)
BOLT
GASKET
METERING PLATE
(PRE SB PW4ENG 72-572)
(PRE SB PW4ENG 72-537)
(POST SB PW4ENG 72-627)
OR
RING SPACER
(POST SB PW4ENG 72-572)
(POST SB PW4ENG 72-537)
(PRE SB PW4ENG 72-627)
AIR SHUTOFF VALVE
GASKET
TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT) (AP37)
BRACKET (POST SB PW4ENG 73-163)
BRACKET (PRE SB PW4ENG 73-163)
BOLT
VIEW B-B
L-A1623 (1196)
PW V

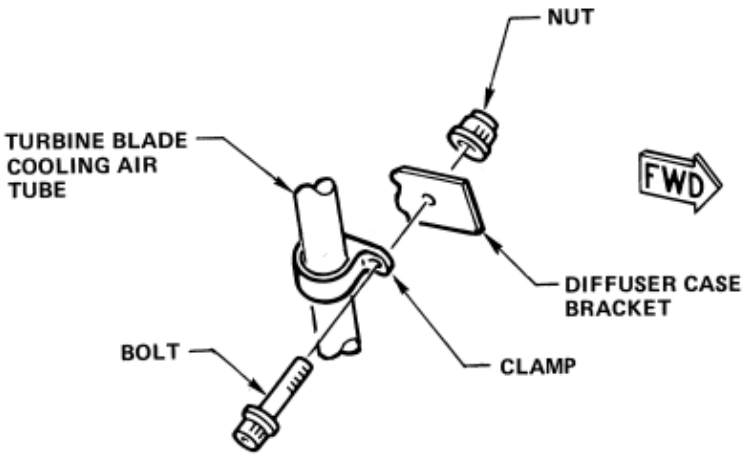
High Pressure Turbine Cooling Air Manifolds
Figure 401 (Sheet 2)
(Task 72-00-54-420-003)


LOCK
LOCK
GASKET
LOCK
DIFFUSER CASE INTERNAL TUBE
GASKET
FWD
0.000 – 0.020 in
(0.000 – 0.508 mm)
BRACKET
BOLT
(LOWER RIGHT) TURBINE BLADE COOLING TUBE (AP37)
BOLT
NUT
NUT
CLAMP
VIEW C–C
CLAMP
FLANGE M BRACKET
BOLT
TURBINE COOLING AIR TUBE (AP02)
FWD
VIEW D–D
L–A6520 (0000)
PW V

High Pressure Turbine Cooling Air Manifolds
Figure 401 (Sheet 3)
(Task 72−00−54−420−003)


DIFFUSER CASE BRACKET
NUT
CLAMP
FWD
BOLT
TURBINE BLADE COOLING AIR TUBE

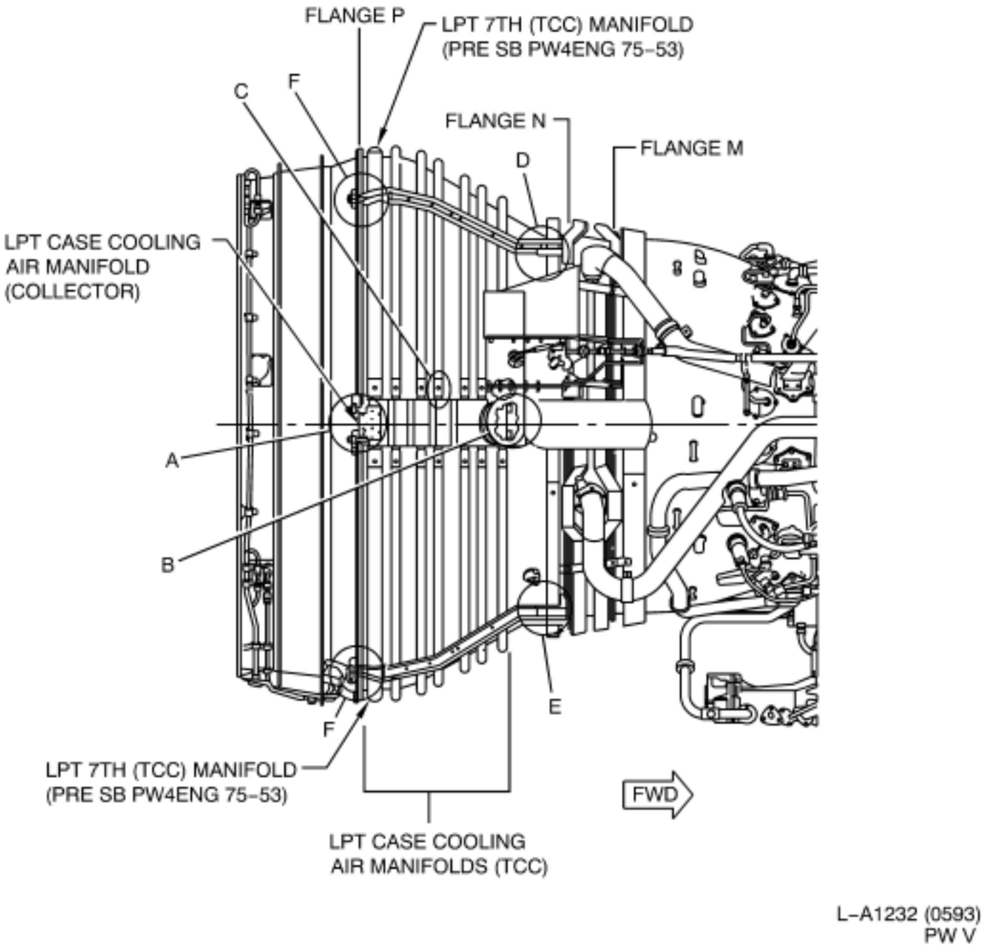
VIEW E-E


NUT
TURBINE BLADE COOLING AIR TUBE
FWD
DIFFUSER CASE BRACKET
BOLT
CLAMP

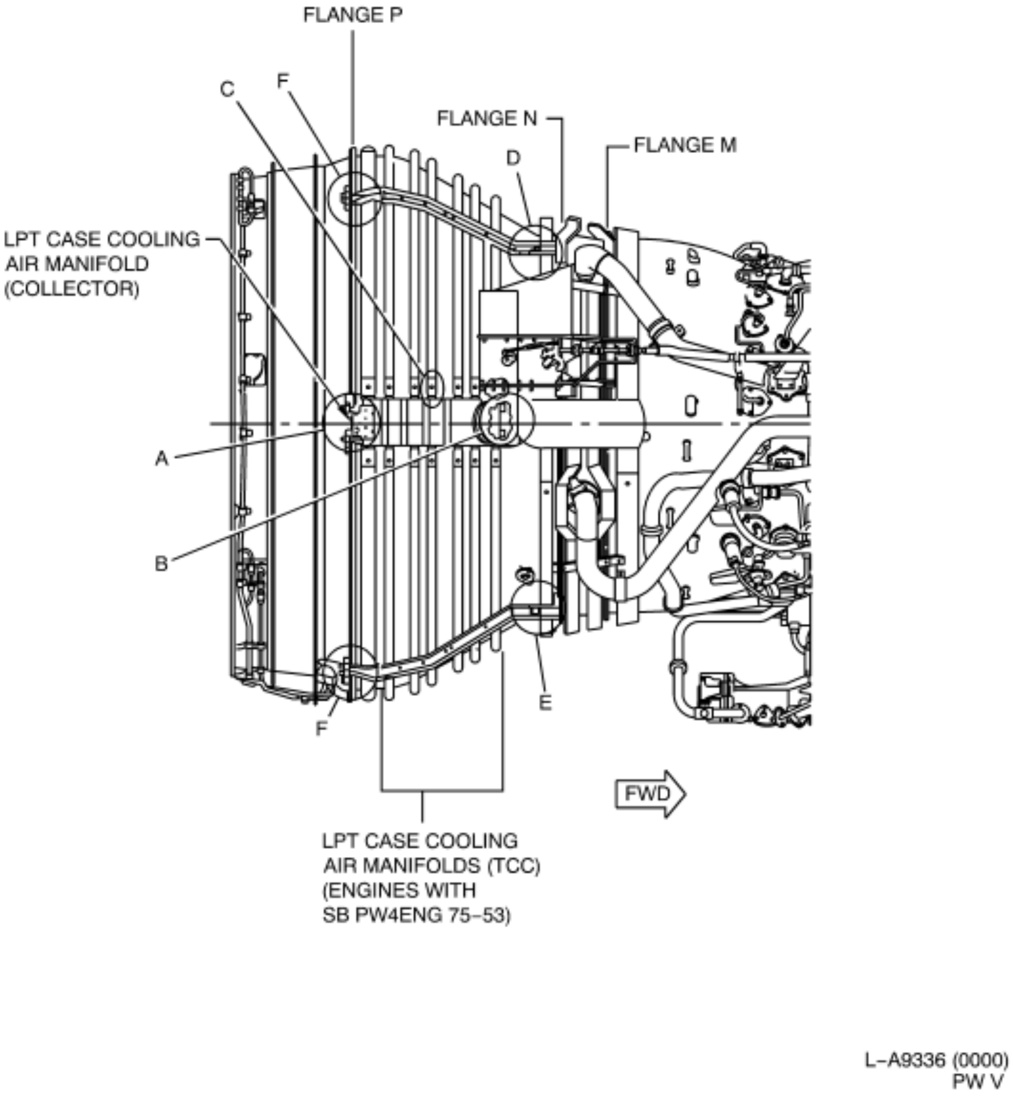
VIEW F-F
(2 LOCATIONS)

L-A1635

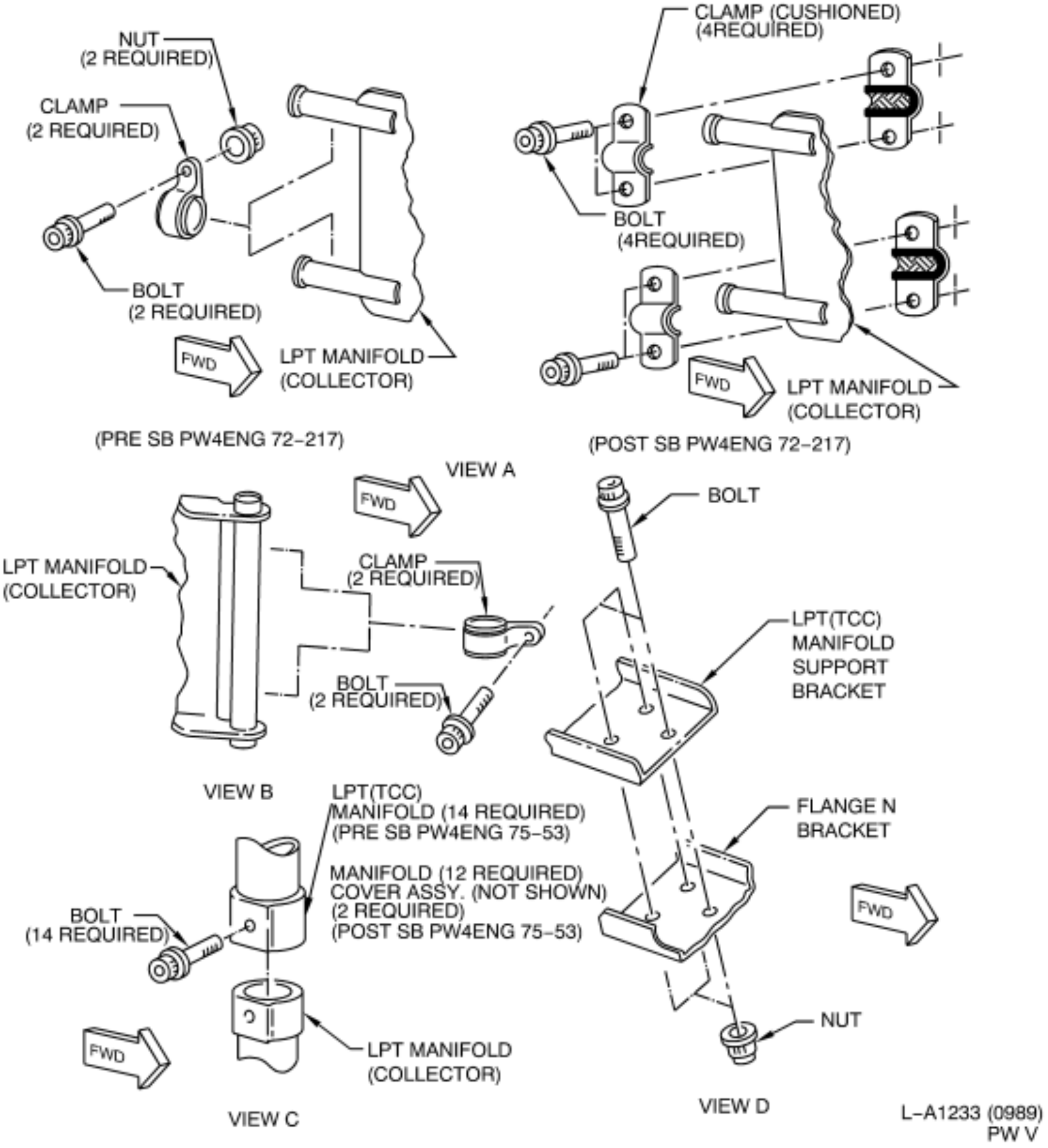
High Pressure Turbine Cooling Air Manifolds
Figure 401 (Sheet 4)
(Task 72-00-54-420-003)


FLANGE P
LPT 7TH (TCC) MANIFOLD (PRE SB PW4ENG 75-53)
C
F
FLANGE N
D
FLANGE M
LPT CASE COOLING AIR MANIFOLD (COLLECTOR)
A
B
E
F
LPT 7TH (TCC) MANIFOLD (PRE SB PW4ENG 75-53)
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC)
L-A1232 (0593)
PW V

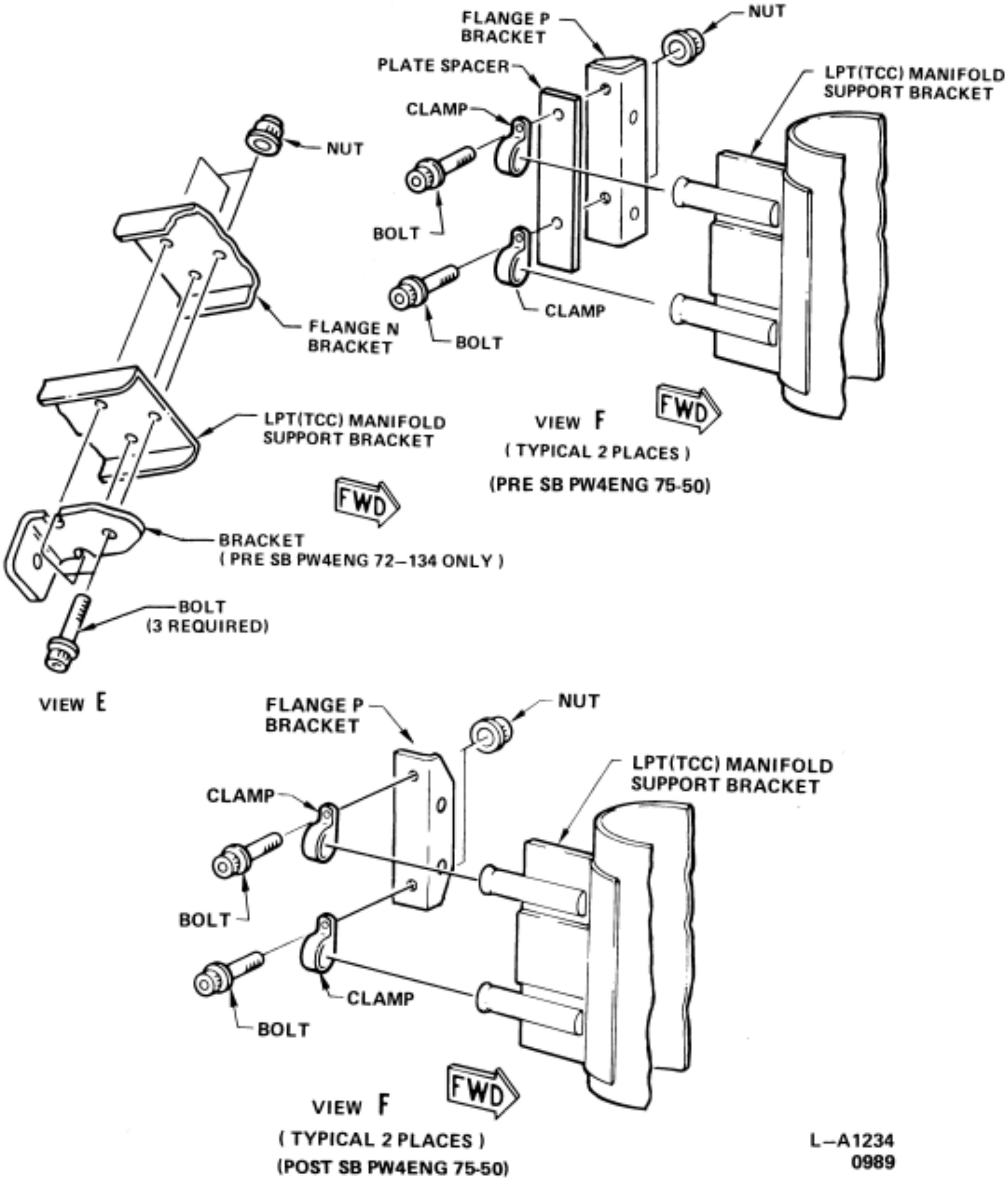
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 402 (Sheet 1)
(Task 72−00−54−420−003)


FLANGE P
C
F
FLANGE N
D
FLANGE M
LPT CASE COOLING AIR MANIFOLD (COLLECTOR)
A
B
F
E
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC) (ENGINES WITH SB PW4ENG 75−53)
L−A9336 (0000)
PW V

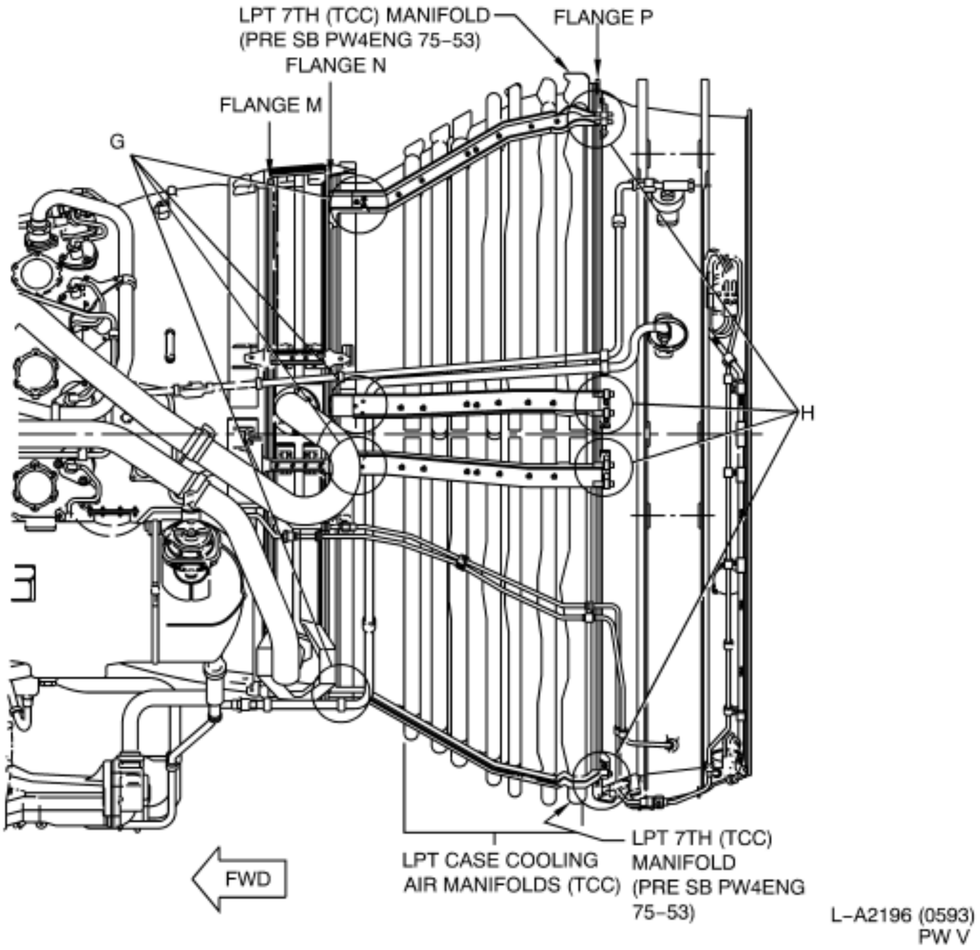
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 402 (Sheet 2)
(Task 72−00−54−420−003)


NUT
(2 REQUIRED)
CLAMP
(2 REQUIRED)
BOLT
(2 REQUIRED)
FWD
LPT MANIFOLD
(COLLECTOR)
(PRE SB PW4ENG 72-217)
CLAMP (CUSHIONED)
(4REQUIRED)
BOLT
(4REQUIRED)
FWD
LPT MANIFOLD
(COLLECTOR)
(POST SB PW4ENG 72-217)
VIEW A
FWD
LPT MANIFOLD
(COLLECTOR)
CLAMP
(2 REQUIRED)
BOLT
(2 REQUIRED)
VIEW B
BOLT
LPT(TCC)
MANIFOLD
SUPPORT
BRACKET
FLANGE N
BRACKET
FWD
NUT
VIEW D
LPT(TCC)
MANIFOLD (14 REQUIRED)
(PRE SB PW4ENG 75-53)
MANIFOLD (12 REQUIRED)
COVER ASSY. (NOT SHOWN)
(2 REQUIRED)
(POST SB PW4ENG 75-53)
BOLT
(14 REQUIRED)
FWD
LPT MANIFOLD
(COLLECTOR)
VIEW C
L-A1233 (0989)
PW V

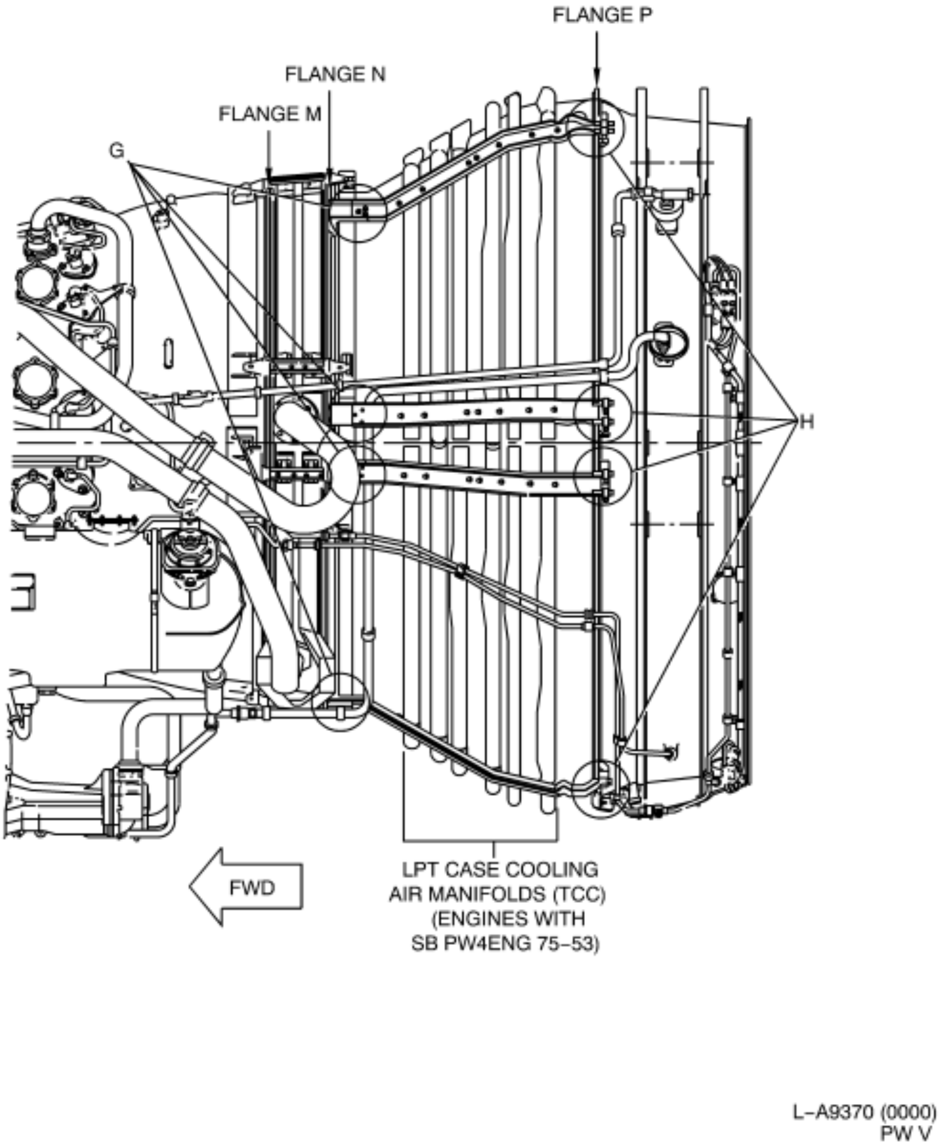
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 402 (Sheet 3)
(Task 72-00-54-420-003)


FLANGE P BRACKET
NUT
PLATE SPACER
LPT(TCC) MANIFOLD SUPPORT BRACKET
CLAMP
NUT
BOLT
FLANGE N BRACKET
CLAMP
BOLT
LPT(TCC) MANIFOLD SUPPORT BRACKET
VIEW F
FWD
(TYPICAL 2 PLACES)
(PRE SB PW4ENG 75-50)
FWD
BRACKET
(PRE SB PW4ENG 72−134 ONLY)
BOLT
(3 REQUIRED)
VIEW E
FLANGE P BRACKET
NUT
LPT(TCC) MANIFOLD SUPPORT BRACKET
CLAMP
BOLT
CLAMP
BOLT
VIEW F
FWD
(TYPICAL 2 PLACES)
(POST SB PW4ENG 75-50)
L−A1234
0989

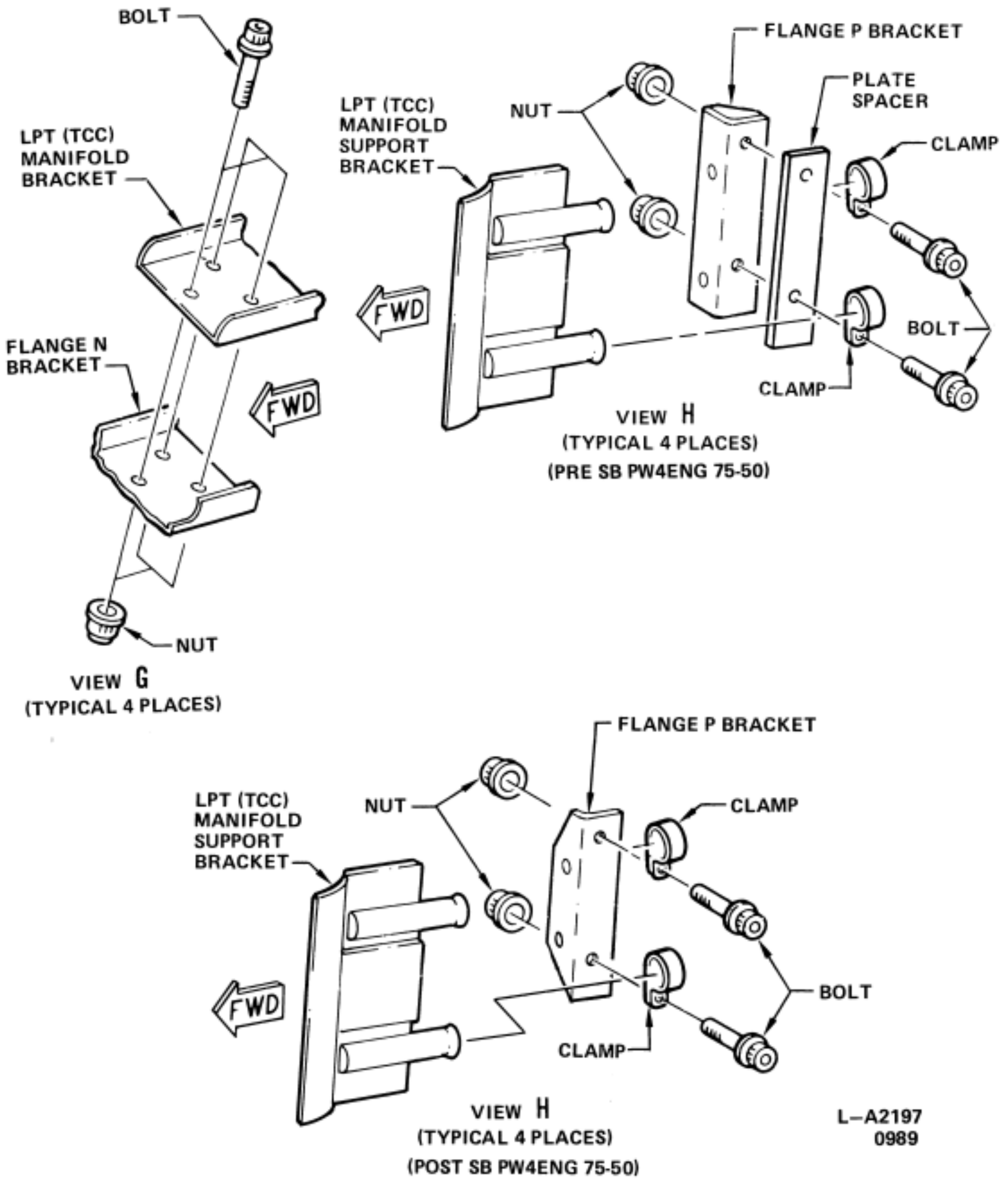
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 402 (Sheet 4)
(Task 72−00−54−420−003)


LPT 7TH (TCC) MANIFOLD
(PRE SB PW4ENG 75−53)
FLANGE P
FLANGE N
FLANGE M
G
H
FWD
LPT CASE COOLING
AIR MANIFOLDS (TCC)
LPT 7TH (TCC)
MANIFOLD
(PRE SB PW4ENG
75−53)
L−A2196 (0593)
PW V

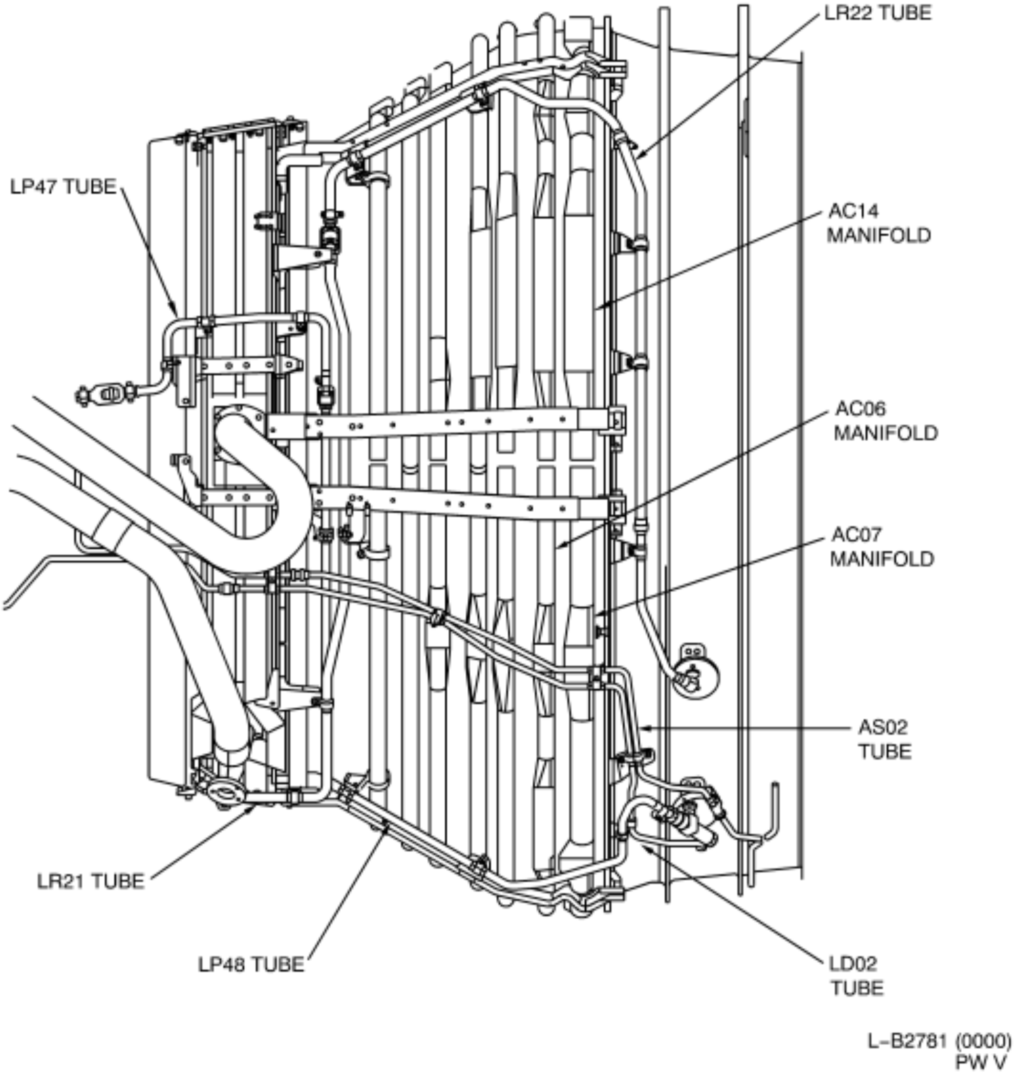
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 402 (Sheet 5)
(Task 72−00−54−420−003)


FLANGE P
FLANGE N
FLANGE M
G
H
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC) (ENGINES WITH SB PW4ENG 75−53)
L−A9370 (0000)
PW V

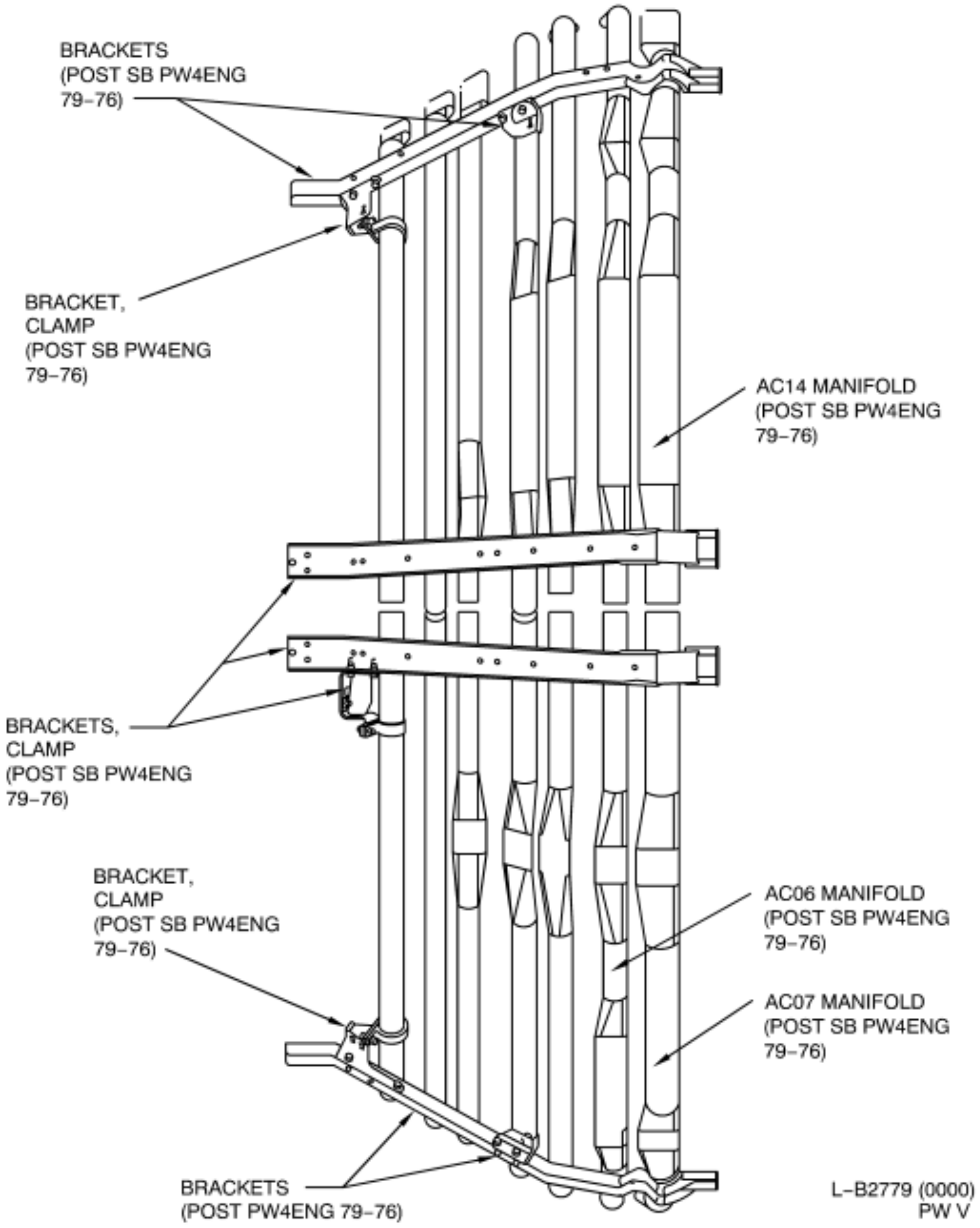
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 402 (Sheet 6)
(Task 72−00−54−420−003)


BOLT
LPT (TCC) MANIFOLD BRACKET
FLANGE N BRACKET
FWD
NUT
VIEW G
(TYPICAL 4 PLACES)
LPT (TCC) MANIFOLD SUPPORT BRACKET
NUT
FLANGE P BRACKET
PLATE SPACER
CLAMP
FWD
BOLT
CLAMP
VIEW H
(TYPICAL 4 PLACES)
(PRE SB PW4ENG 75-50)
LPT (TCC) MANIFOLD SUPPORT BRACKET
NUT
FLANGE P BRACKET
CLAMP
FWD
BOLT
CLAMP
VIEW H
(TYPICAL 4 PLACES)
(POST SB PW4ENG 75-50)
L–A2197
0989

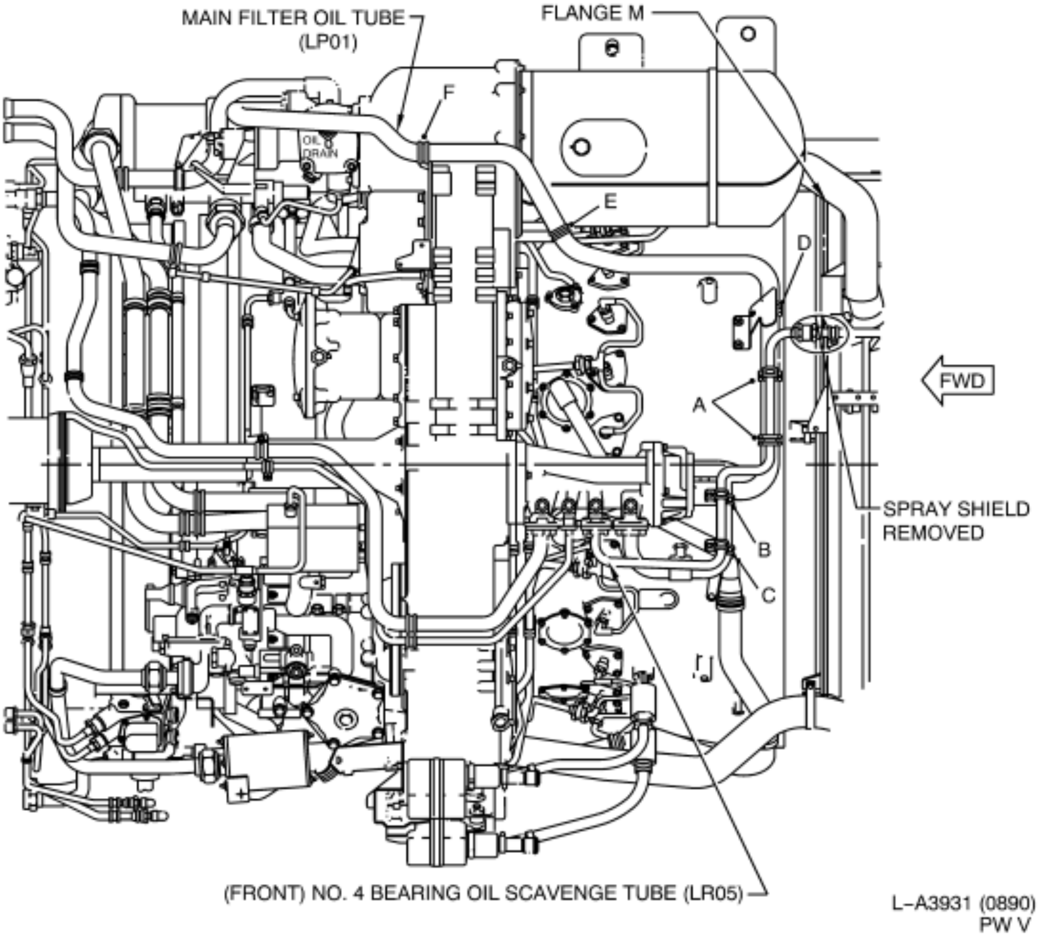
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 402 (Sheet 7)
(Task 72–00–54–420–003)


LR22 TUBE
LP47 TUBE
AC14 MANIFOLD
AC06 MANIFOLD
AC07 MANIFOLD
AS02 TUBE
LR21 TUBE
LP48 TUBE
LD02 TUBE
L-B2781 (0000)
PW V

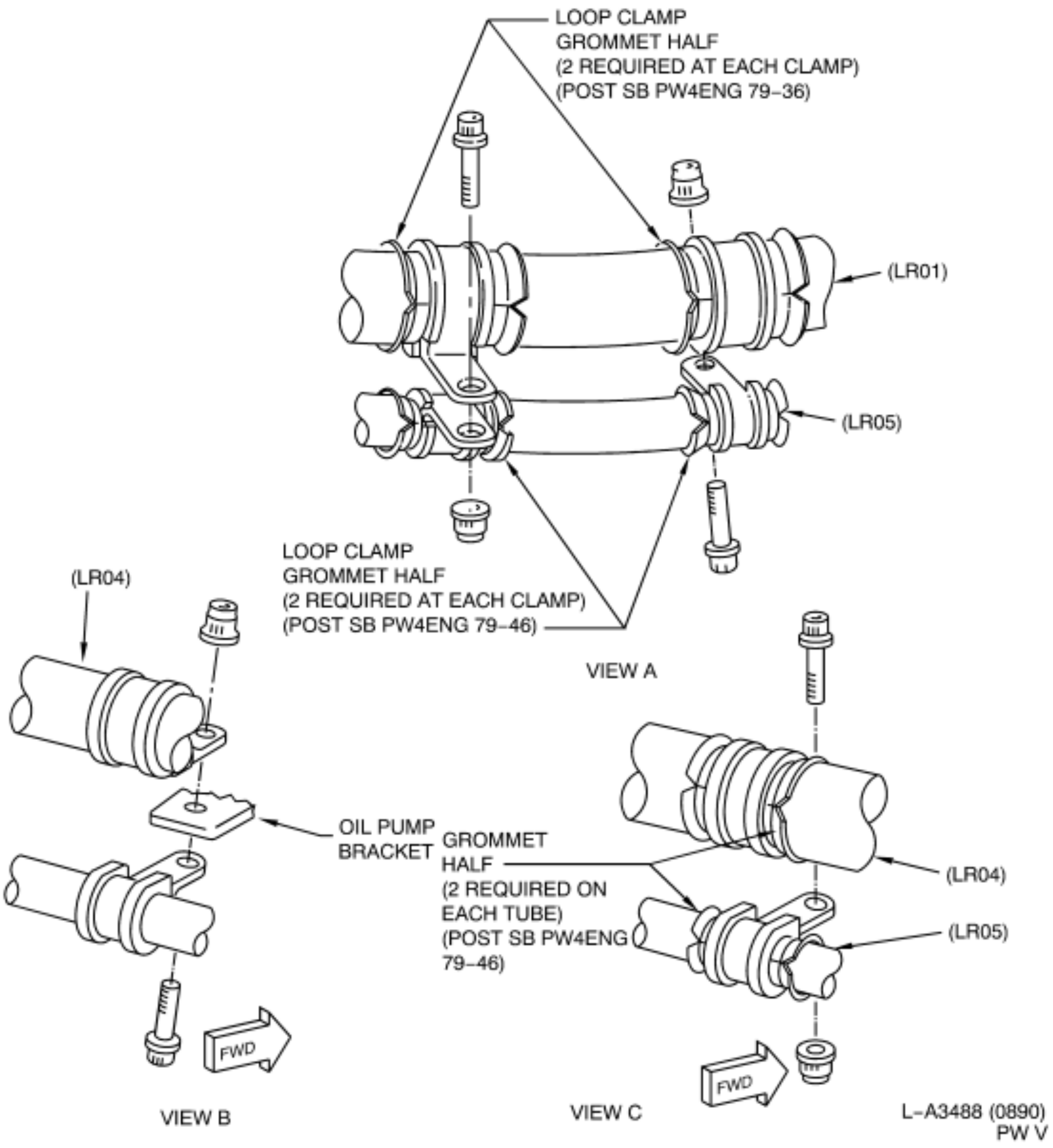
LPT Turbine Case Cooling Manifolds Clipping (Post SB PW4ENG 79-76)
Figure 402 (Sheet 8)
(Task 72-00-54-420-003)


BRACKETS
(POST SB PW4ENG
79-76)
BRACKET,
CLAMP
(POST SB PW4ENG
79-76)
AC14 MANIFOLD
(POST SB PW4ENG
79-76)
BRACKETS,
CLAMP
(POST SB PW4ENG
79-76)
BRACKET,
CLAMP
(POST SB PW4ENG
79-76)
AC06 MANIFOLD
(POST SB PW4ENG
79-76)
AC07 MANIFOLD
(POST SB PW4ENG
79-76)
BRACKETS
(POST PW4ENG 79-76)
L-B2779 (0000)
PW V

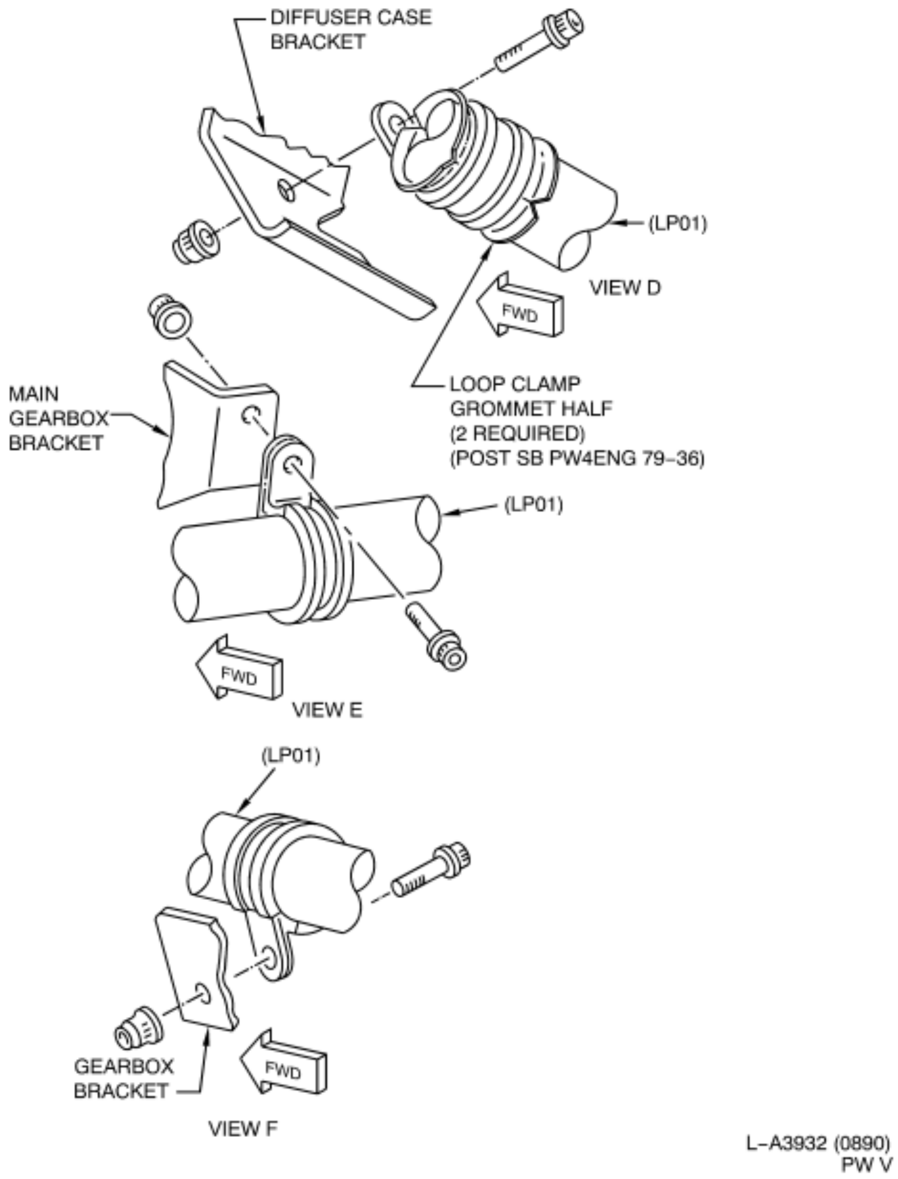
LPT Turbine Case Cooling Manifolds Clipping (Post SB PW4ENG 79-76)
Figure 402 (Sheet 9)
(Task 72-00-54-420-003)


MAIN FILTER OIL TUBE (LP01)
FLANGE M
F
OIL DRAIN
E
D
FWD
A
SPRAY SHIELD REMOVED
B
C
(FRONT) NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
L−A3931 (0890)
PW V

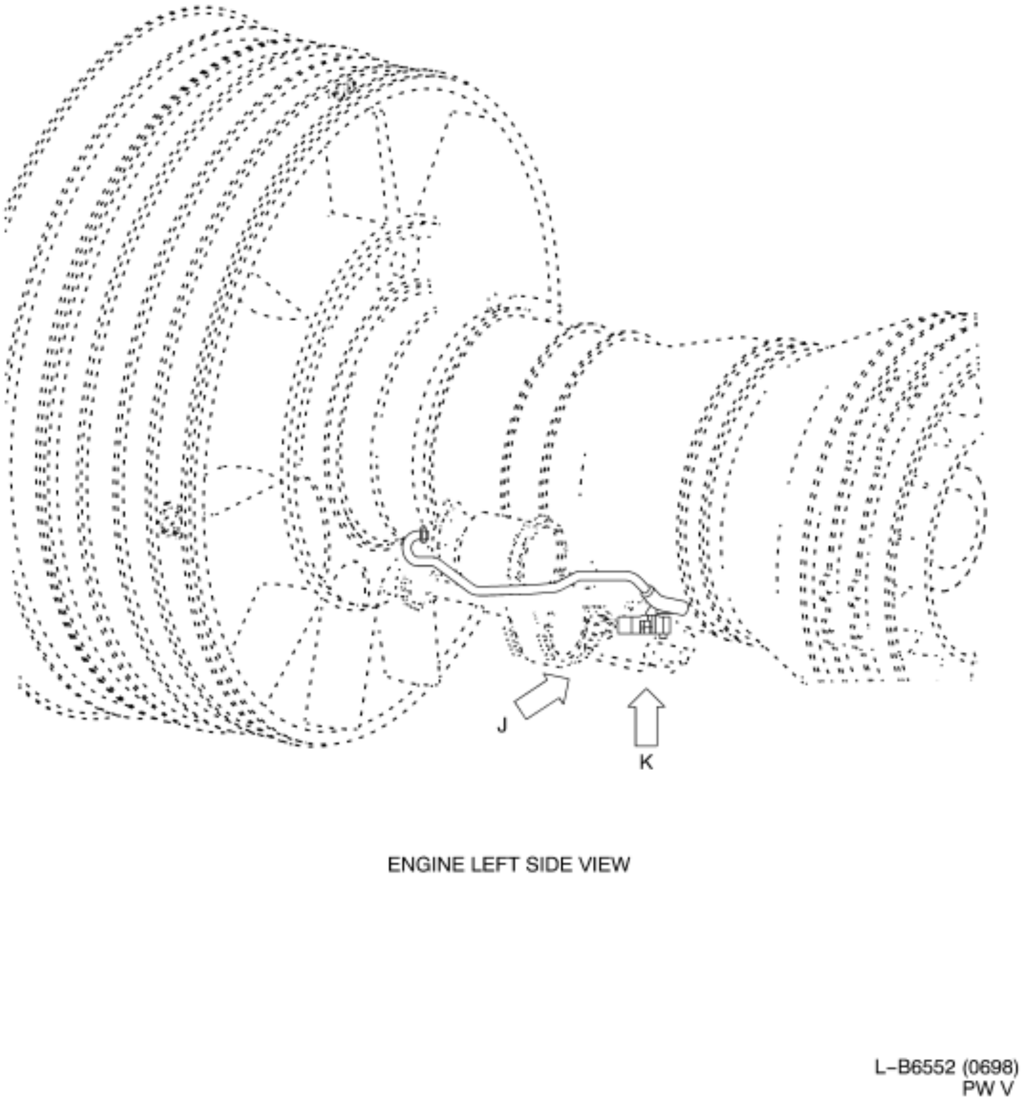
Bottom External Plumbing
Figure 403 (Sheet 1)
(Task 72−00−54−420−003)


LOOP CLAMP
GROMMET HALF
(2 REQUIRED AT EACH CLAMP)
(POST SB PW4ENG 79-36)
(LR01)
(LR05)
LOOP CLAMP
GROMMET HALF
(2 REQUIRED AT EACH CLAMP)
(POST SB PW4ENG 79-46)
VIEW A
(LR04)
OIL PUMP
BRACKET
GROMMET
HALF
(2 REQUIRED ON
EACH TUBE)
(POST SB PW4ENG
79-46)
(LR04)
(LR05)
FWD
VIEW B
FWD
VIEW C
L-A3488 (0890)
PW V

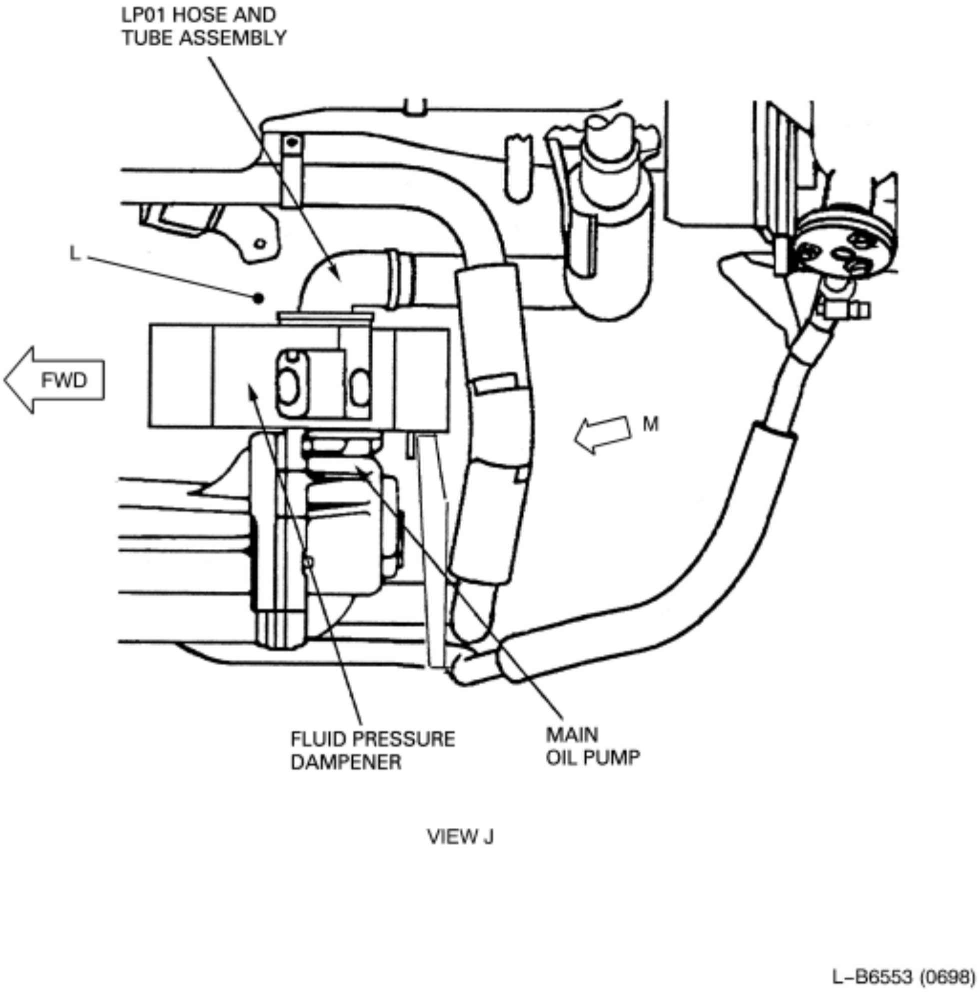
Bottom External Plumbing (Pre SB PW4ENG 79-75)
Figure 403 (Sheet 2)
(Task 72-00-54-420-003)


DIFFUSER CASE BRACKET
(LP01)
VIEW D
FWD
LOOP CLAMP GROMMET HALF (2 REQUIRED) (POST SB PW4ENG 79−36)
MAIN GEARBOX BRACKET
(LP01)
FWD
VIEW E
(LP01)
GEARBOX BRACKET
FWD
VIEW F
L−A3932 (0890)
PW V

Bottom External Plumbing (Pre SB PW4ENG 79−75)
Figure 403 (Sheet 3)
(Task 72−00−54−420−003)

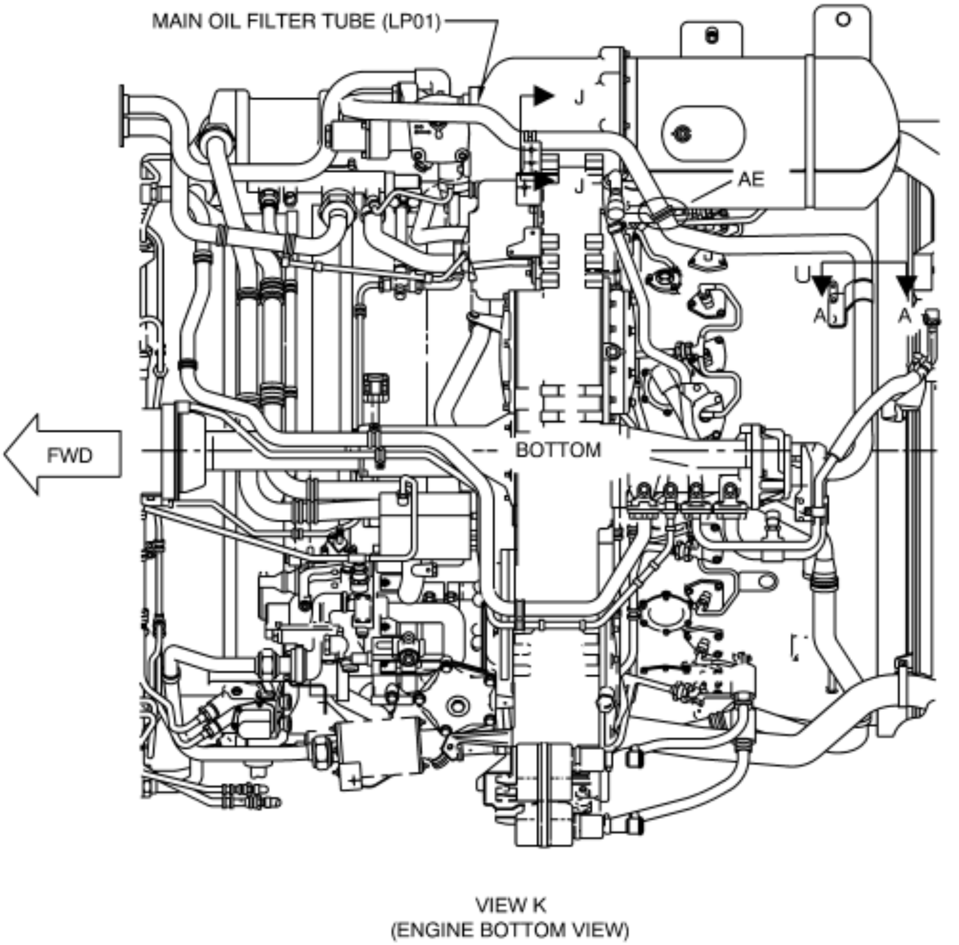

J
K
ENGINE LEFT SIDE VIEW
L-B6552 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79-75) (Pre SB PW4ENG 79-86)
Figure 403 (Sheet 4)
(Task 72-00-54-420-003)


LP01 HOSE AND TUBE ASSEMBLY
L
FWD
M
FLUID PRESSURE DAMPENER
MAIN OIL PUMP
VIEW J
L−B6553 (0698)

Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 5)
(Task 72−00−54−420−003)

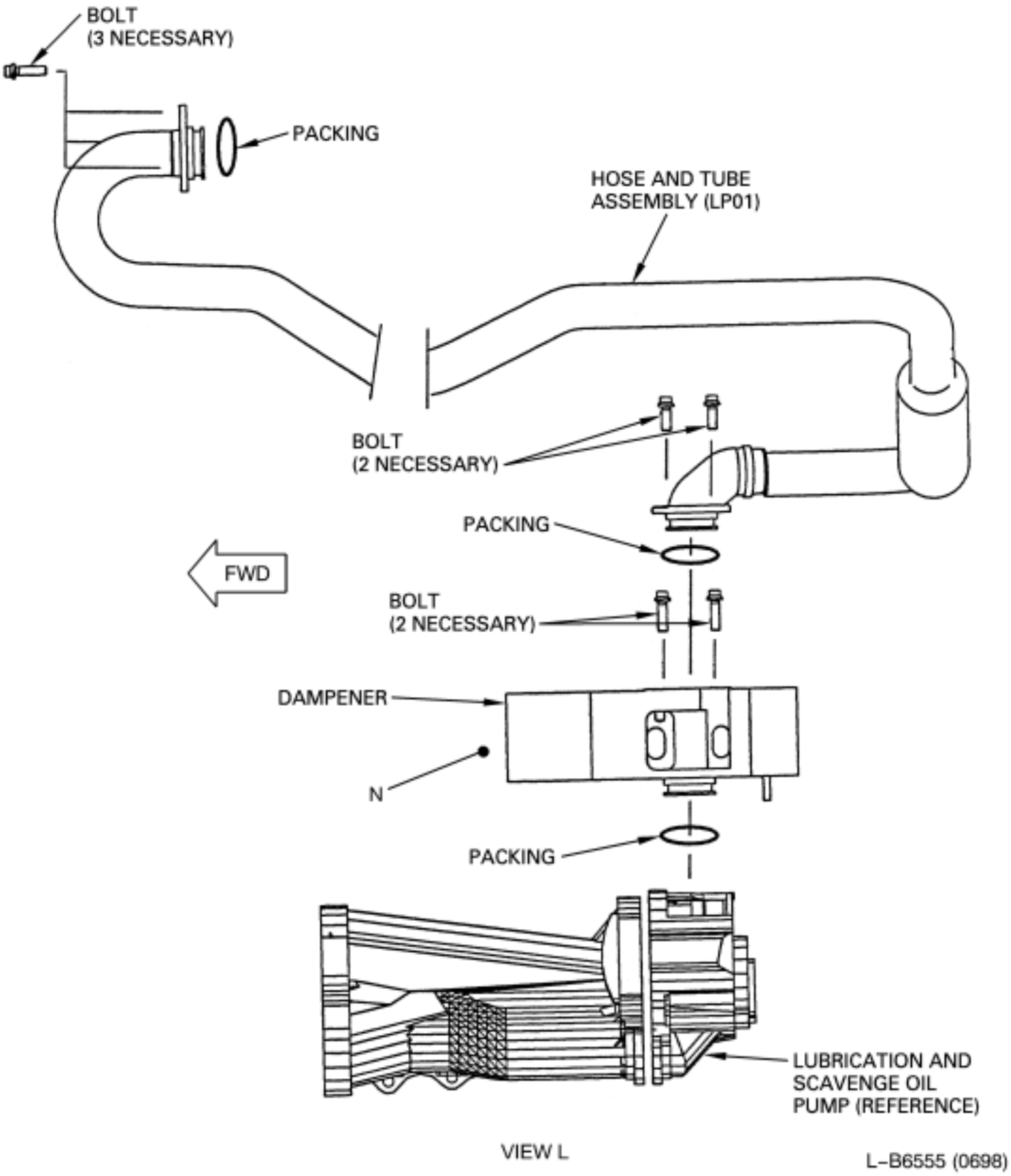
ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−02


MAIN OIL FILTER TUBE (LP01)
J
J
AE
U
A
A
FWD
BOTTOM
VIEW K
(ENGINE BOTTOM VIEW)

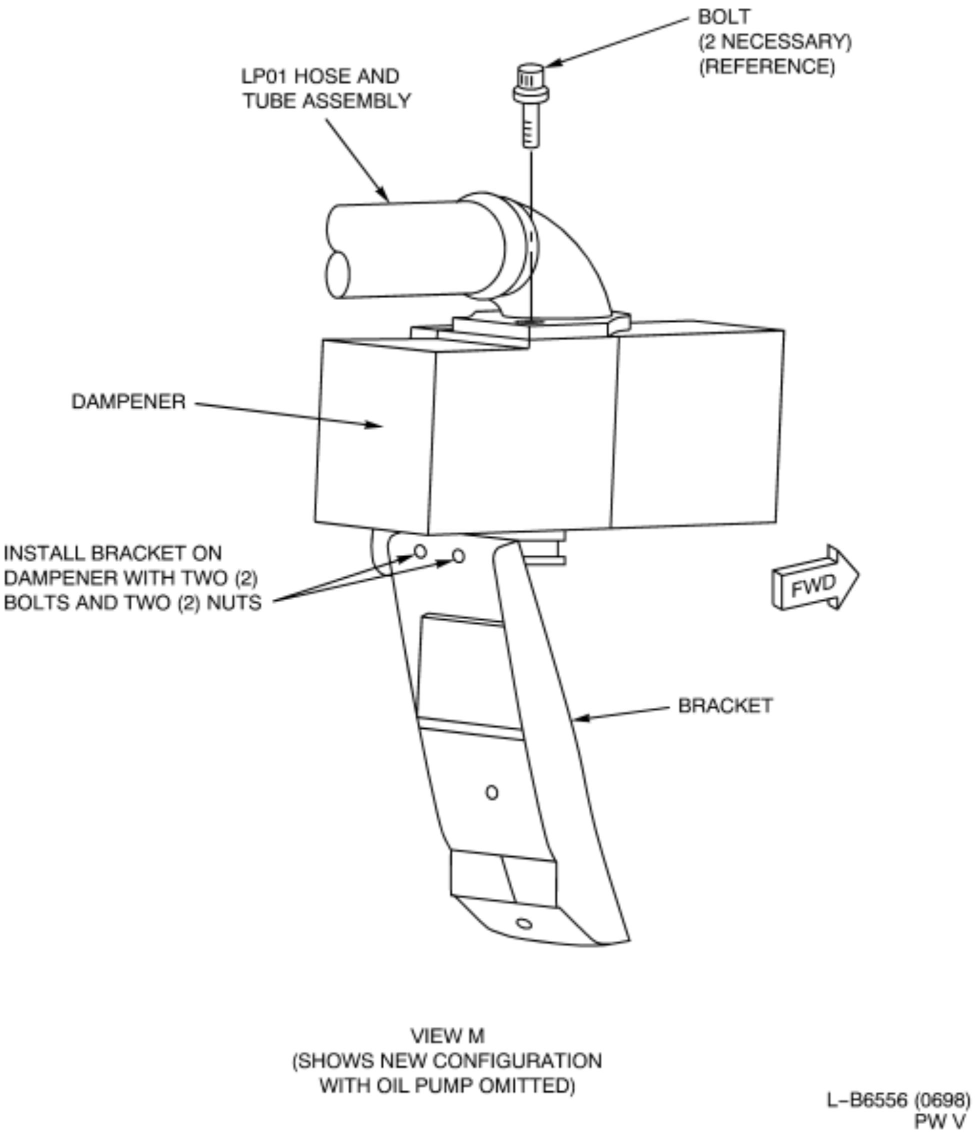
L−B6554 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 6)
(Task 72−00−54−420−003)

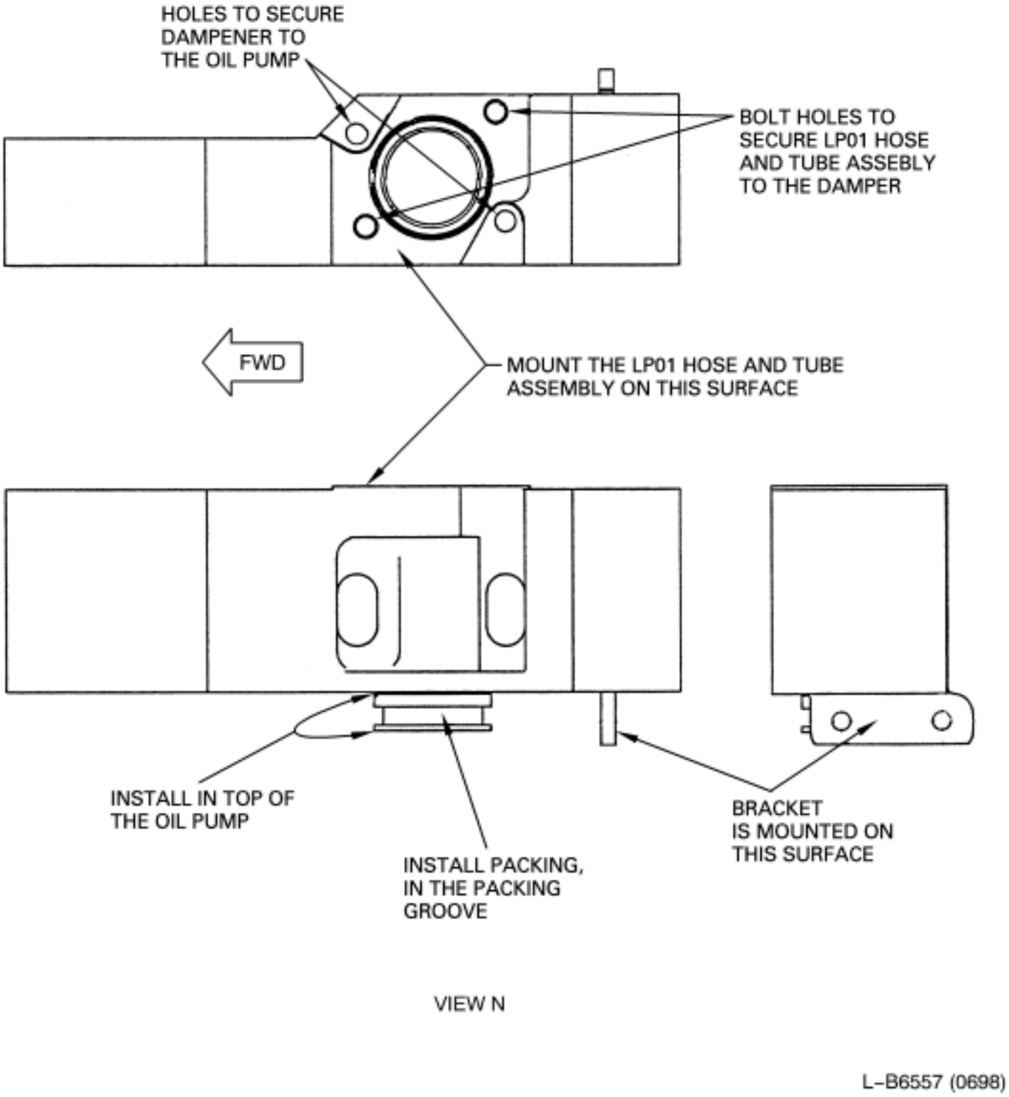
ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−02


BOLT
(3 NECESSARY)
PACKING
HOSE AND TUBE
ASSEMBLY (LP01)
BOLT
(2 NECESSARY)
PACKING
FWD
BOLT
(2 NECESSARY)
DAMPENER
N
PACKING
LUBRICATION AND
SCAVENGE OIL
PUMP (REFERENCE)
VIEW L
L−B6555 (0698)

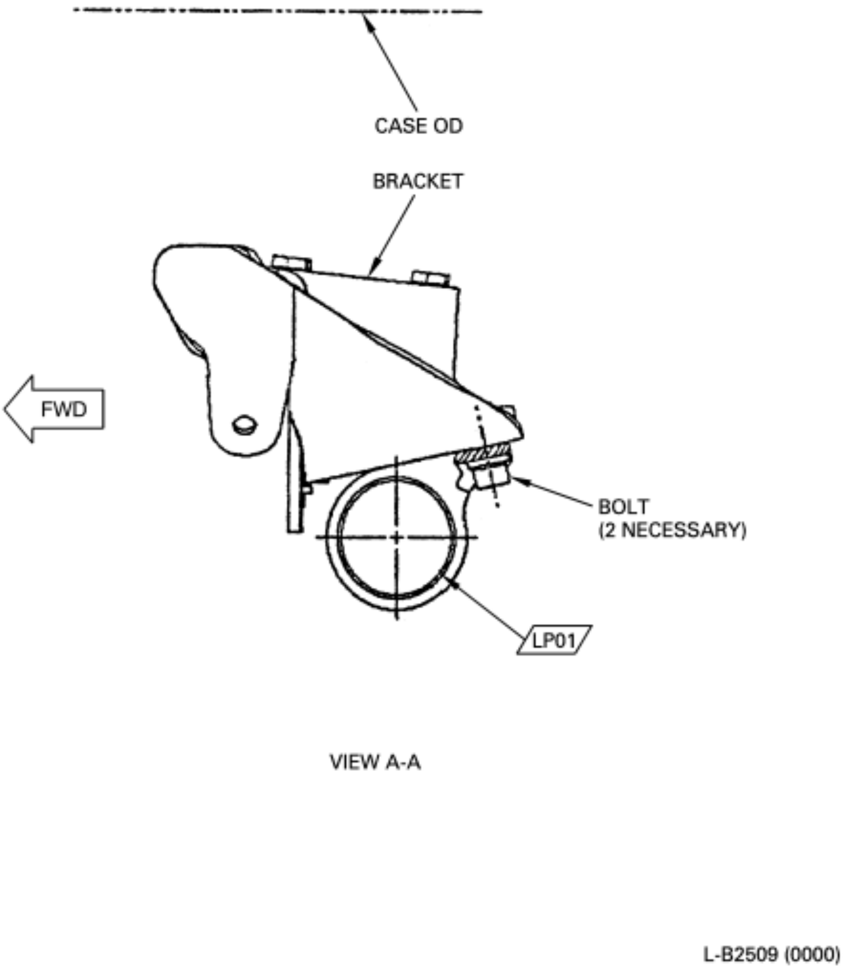
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 7)
(Task 72−00−54−420−003)


BOLT
(2 NECESSARY)
(REFERENCE)
LP01 HOSE AND
TUBE ASSEMBLY
DAMPENER
INSTALL BRACKET ON
DAMPENER WITH TWO (2)
BOLTS AND TWO (2) NUTS
FWD
BRACKET
VIEW M
(SHOWS NEW CONFIGURATION
WITH OIL PUMP OMITTED)
L−B6556 (0698)
PW V

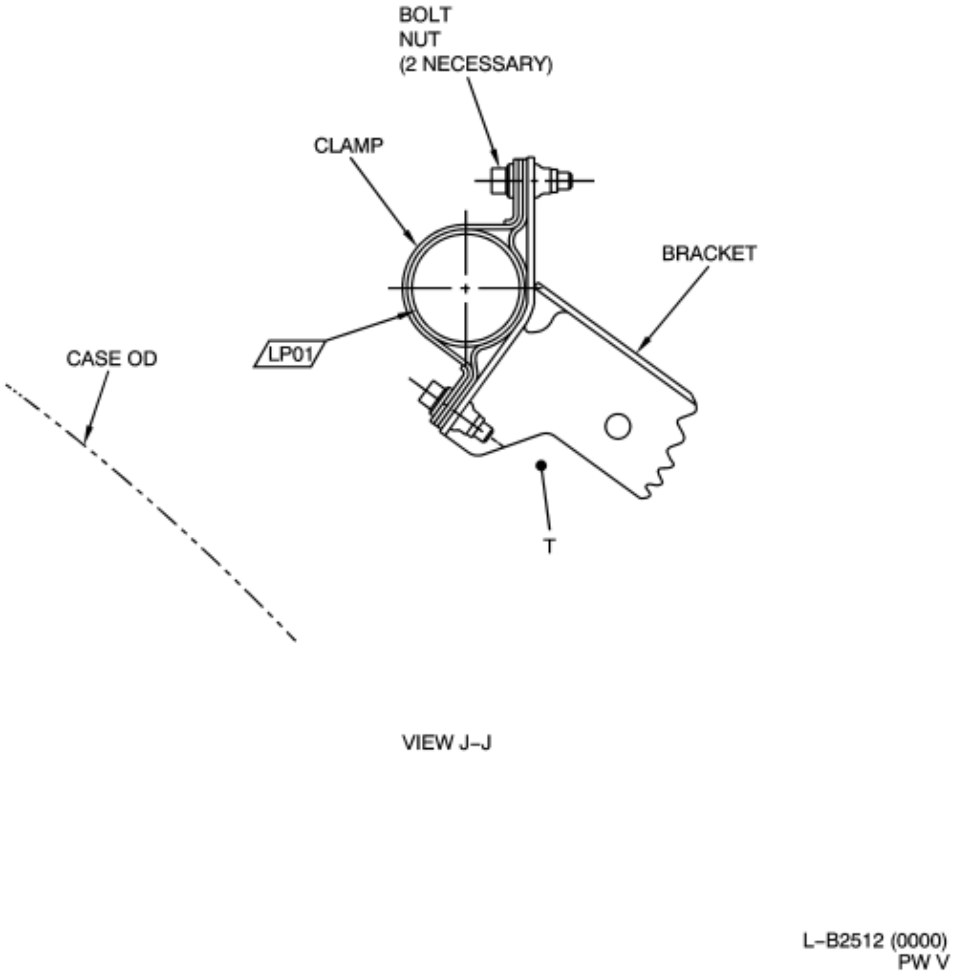
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 8)
(Task 72−00−54−420−003)


HOLES TO SECURE DAMPENER TO THE OIL PUMP
BOLT HOLES TO SECURE LP01 HOSE AND TUBE ASSEBLY TO THE DAMPER
FWD
MOUNT THE LP01 HOSE AND TUBE ASSEMBLY ON THIS SURFACE
INSTALL IN TOP OF THE OIL PUMP
INSTALL PACKING, IN THE PACKING GROOVE
BRACKET IS MOUNTED ON THIS SURFACE
VIEW N
L-B6557 (0698)

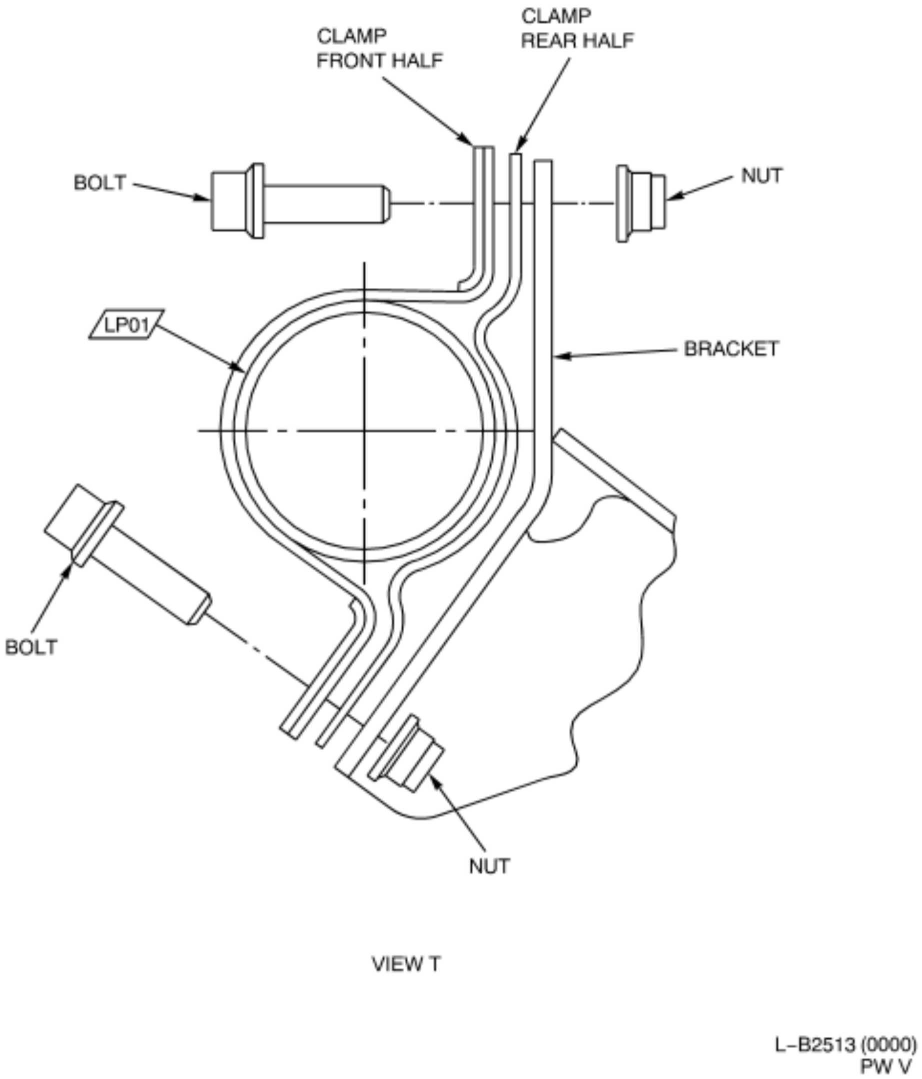
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 403 (Sheet 9)
(Task 72-00-54-420-003)


CASE OD
BRACKET
FWD
BOLT
(2 NECESSARY)
LP01
VIEW A-A
L-B2509 (0000)

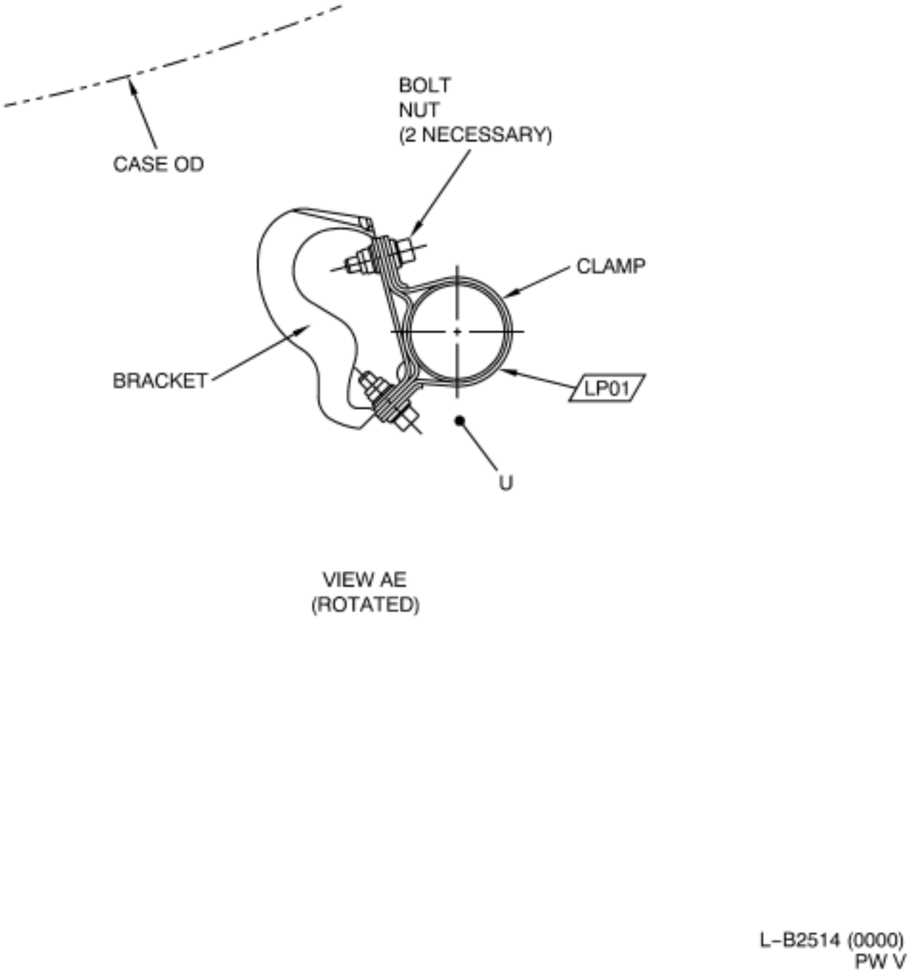
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 10)
(Task 72−00−54−420−003)


BOLT
NUT
(2 NECESSARY)
CLAMP
BRACKET
CASE OD
LP01
T
VIEW J−J
L−B2512 (0000)
PW V

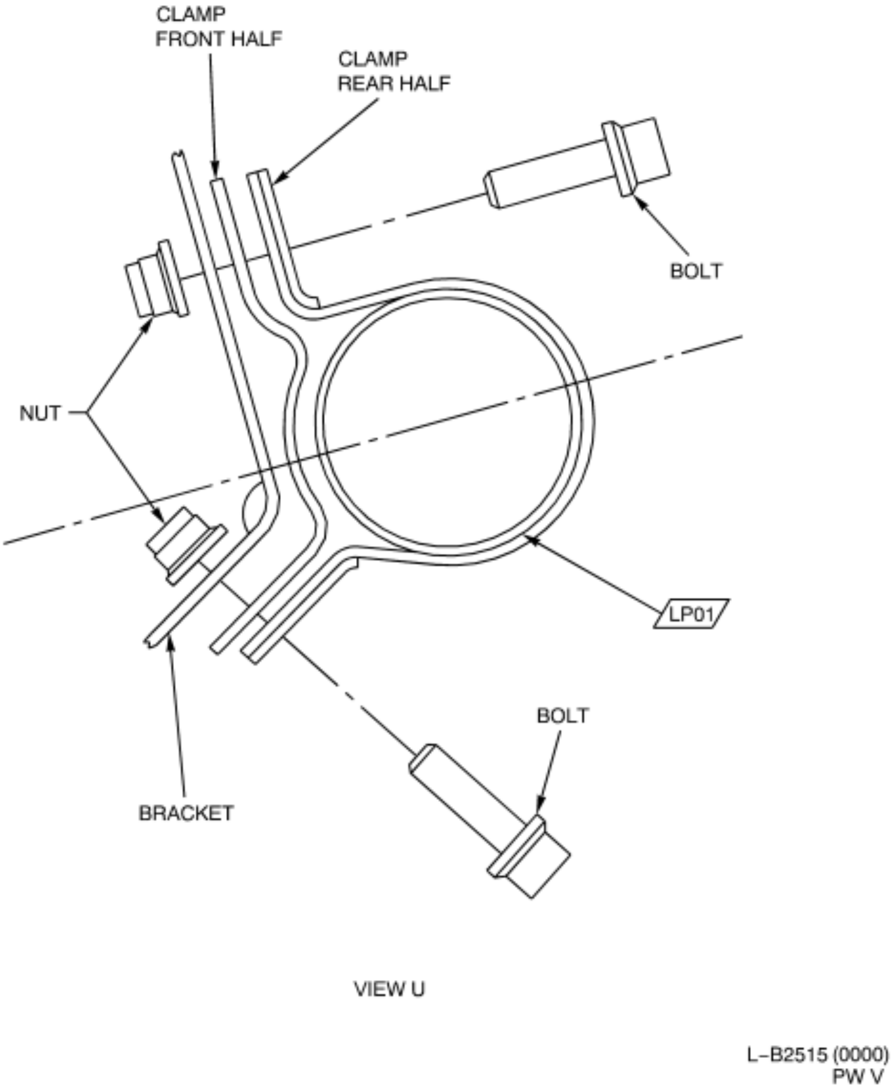
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 11)
(Task 72−00−54−420−003)


CLAMP FRONT HALF
CLAMP REAR HALF
BOLT
NUT
LP01
BRACKET
BOLT
NUT
VIEW T
L−B2513 (0000)
PW V

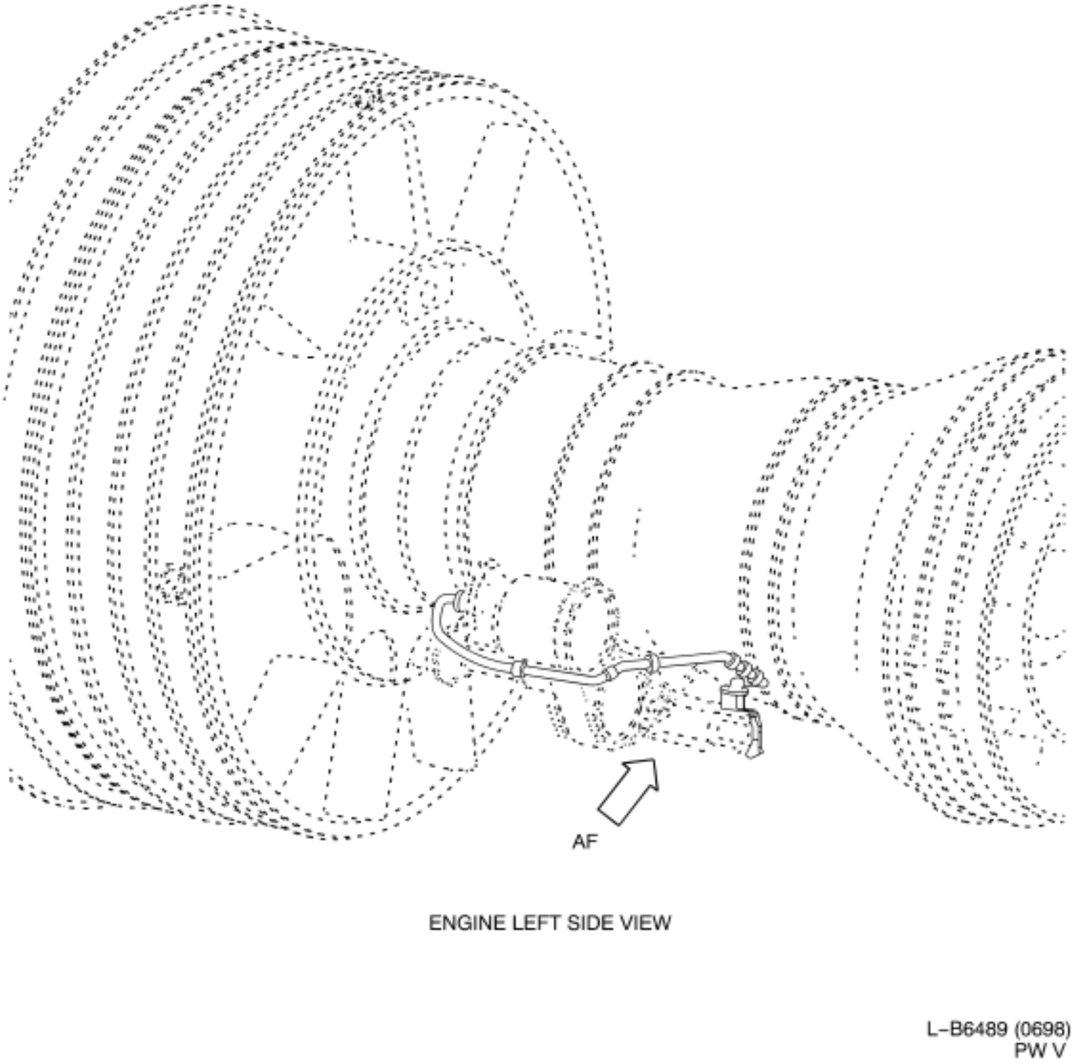
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 12)
(Task 72−00−54−420−003)


BOLT
NUT
(2 NECESSARY)
CASE OD
CLAMP
BRACKET
LP01
U
VIEW AE
(ROTATED)
L−B2514 (0000)
PW V

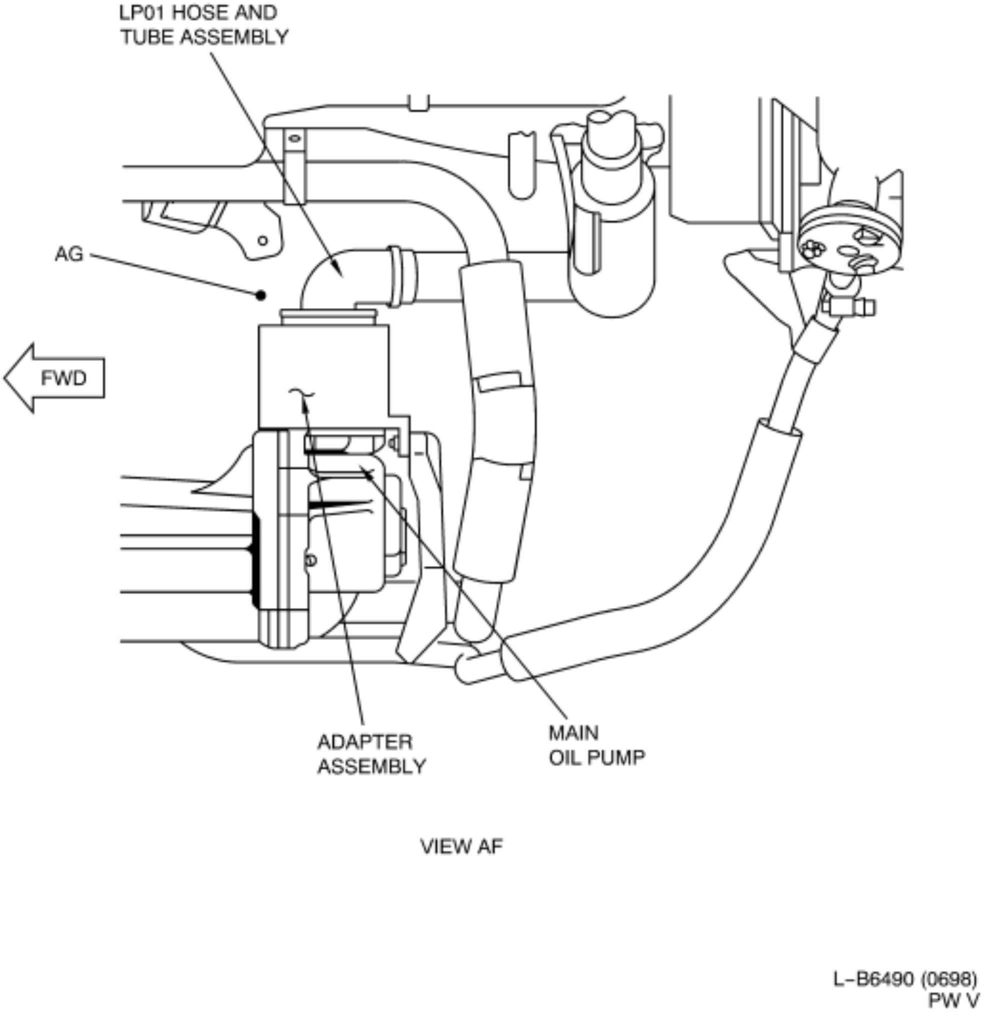
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 13)
(Task 72−00−54−420−003)


CLAMP
FRONT HALF
CLAMP
REAR HALF
BOLT
NUT
LP01
BOLT
BRACKET
VIEW U
L−B2515 (0000)
PW V

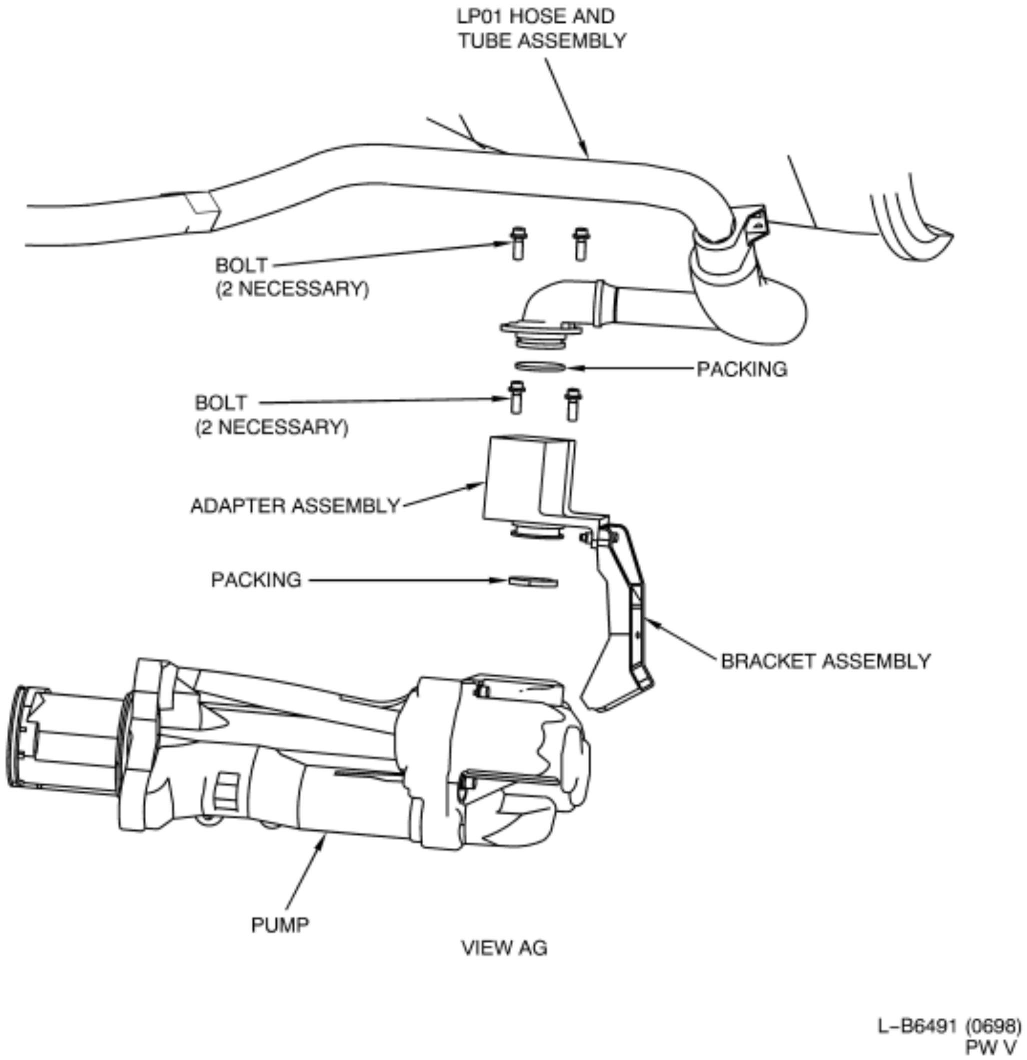
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 14)
(Task 72−00−54−420−003)


AF
ENGINE LEFT SIDE VIEW
L−B6489 (0698)
PW V

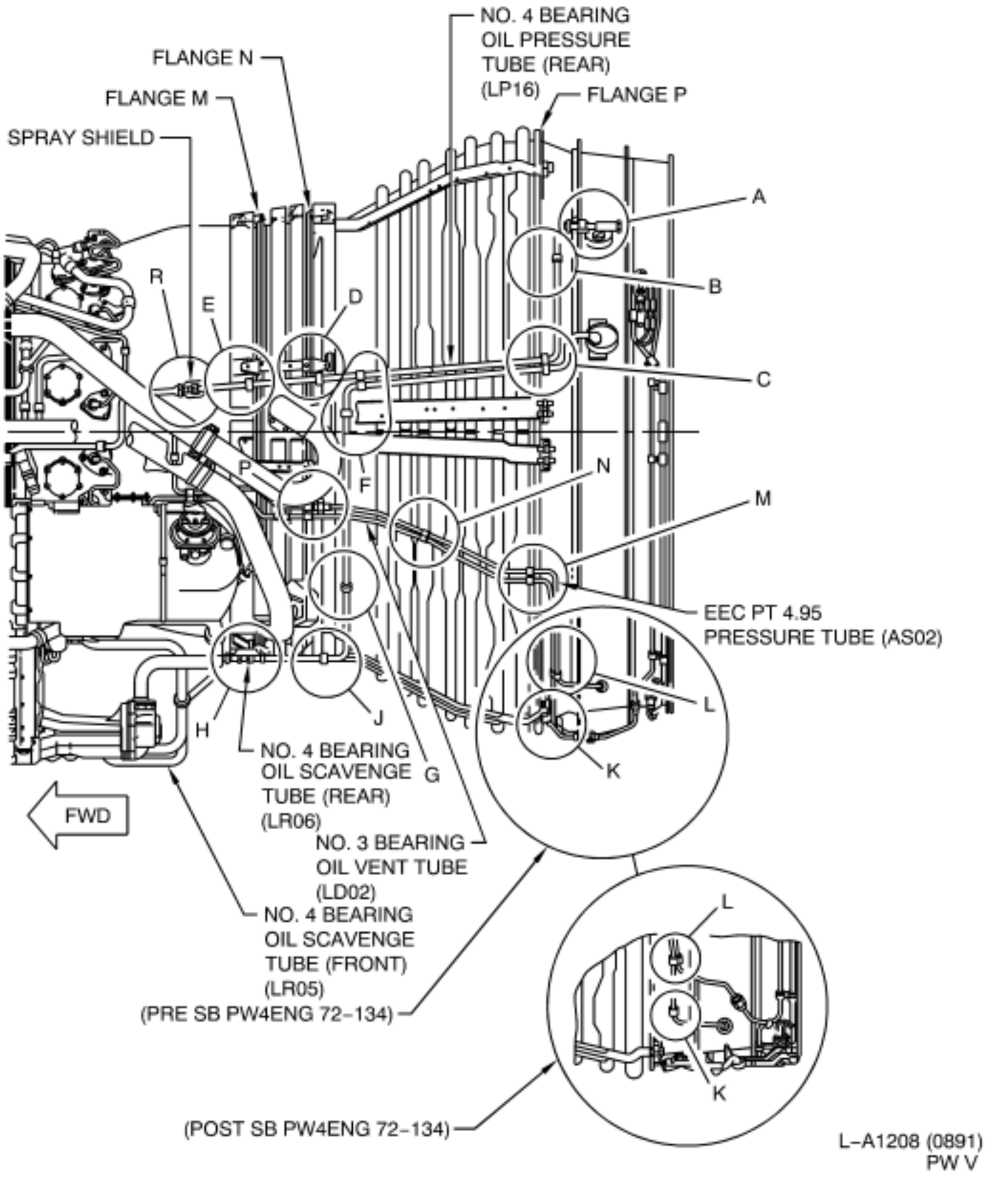
Bottom External Plumbing (Post SB PW4ENG 79−86)
Figure 403 (Sheet 15)
(Task 72−00−54−420−003)


LP01 HOSE AND
TUBE ASSEMBLY
AG
FWD
ADAPTER
ASSEMBLY
MAIN
OIL PUMP
VIEW AF
L−B6490 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79−86)
Figure 403 (Sheet 16)
(Task 72−00−54−420−003)

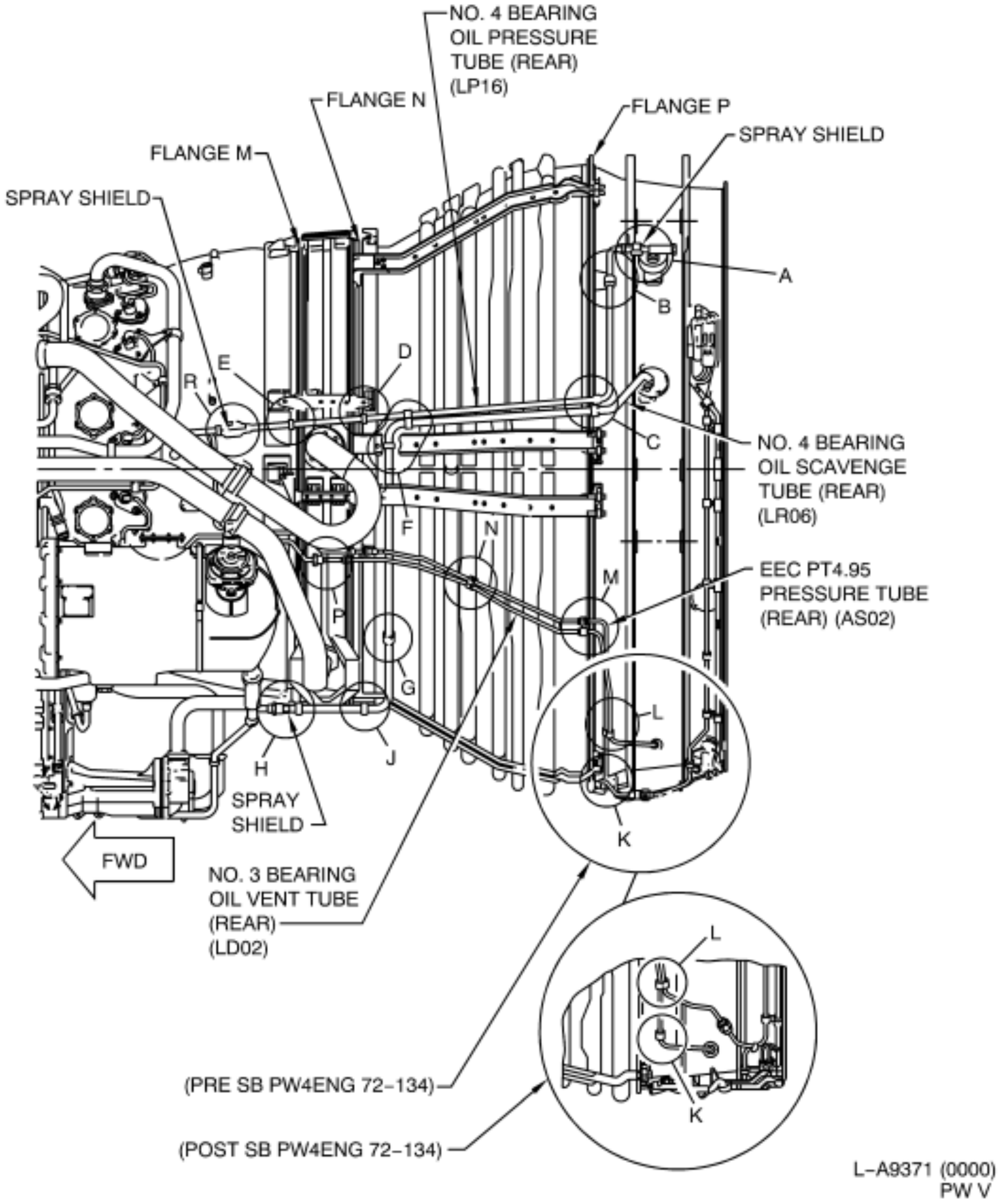

LP01 HOSE AND TUBE ASSEMBLY
BOLT (2 NECESSARY)
PACKING
BOLT (2 NECESSARY)
ADAPTER ASSEMBLY
PACKING
BRACKET ASSEMBLY
PUMP
VIEW AG
L-B6491 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79−86)
Figure 403 (Sheet 17)
(Task 72−00−54−420−003)

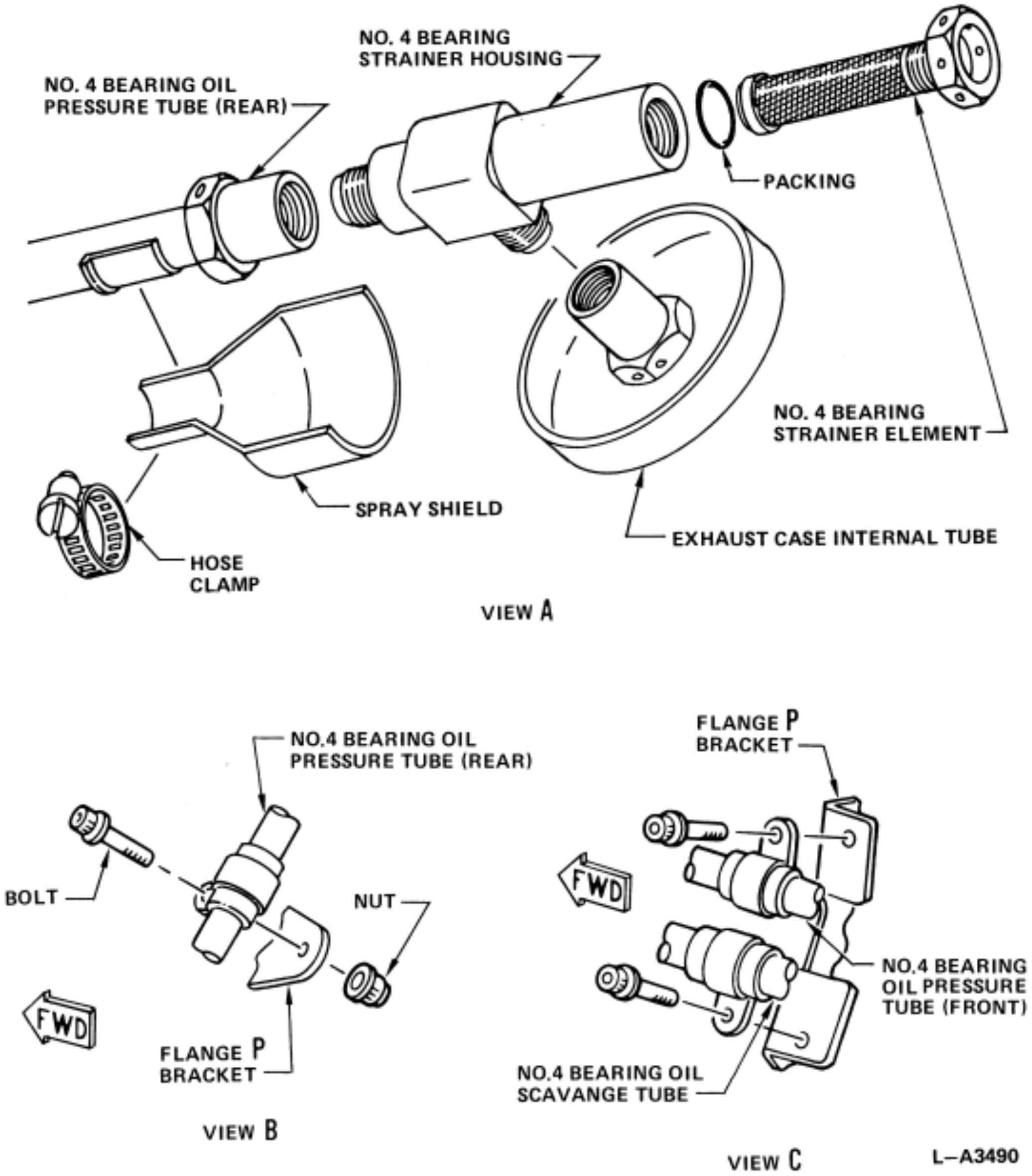

NO. 4 BEARING OIL PRESSURE TUBE (REAR) (LP16)
FLANGE N
FLANGE P
FLANGE M
SPRAY SHIELD
A
R
E
D
B
C
P
F
N
M
EEC PT 4.95 PRESSURE TUBE (AS02)
L
K
H
J
NO. 4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
G
FWD
NO. 3 BEARING OIL VENT TUBE (LD02)
NO. 4 BEARING OIL SCAVENGE TUBE (FRONT) (LR05)
(PRE SB PW4ENG 72−134)
L
K
(POST SB PW4ENG 72−134)
L−A1208 (0891)
PW V

Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 1)
(Task 72−00−54−420−003)

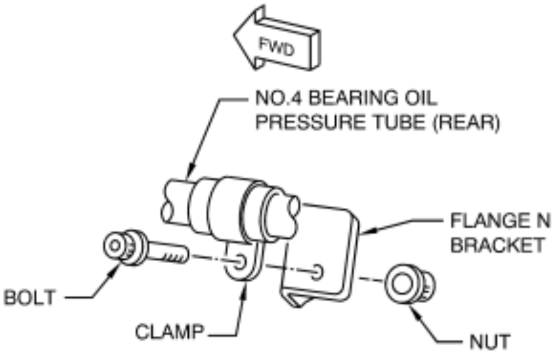
ENGINE GENERAL - TURBINE EXHAUST CASE - INSTALLATION-02


NO. 4 BEARING OIL PRESSURE TUBE (REAR) (LP16)
FLANGE N
FLANGE P
SPRAY SHIELD
FLANGE M
SPRAY SHIELD
A
B
E
D
R
C
NO. 4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
F
N
M
EEC PT4.95 PRESSURE TUBE (REAR) (AS02)
P
G
L
H
J
SPRAY SHIELD
K
FWD
NO. 3 BEARING OIL VENT TUBE (REAR) (LD02)
L
K
(PRE SB PW4ENG 72-134)
(POST SB PW4ENG 72-134)
L-A9371 (0000)
PW V

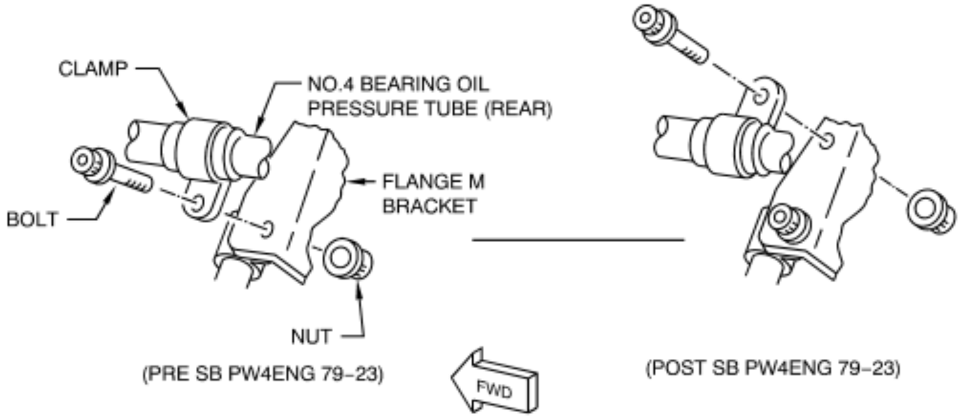
Turbine Exhaust Case External Plumbing
(Engines With SB PW4ENG 75-53)
Figure 404 (Sheet 2)
(Task 72-00-54-420-003)


NO. 4 BEARING STRAINER HOUSING
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
PACKING
NO. 4 BEARING STRAINER ELEMENT
SPRAY SHIELD
EXHAUST CASE INTERNAL TUBE
HOSE CLAMP
VIEW A
NO.4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NUT
FWD
FLANGE P BRACKET
VIEW B
FLANGE P BRACKET
FWD
NO.4 BEARING OIL PRESSURE TUBE (FRONT)
NO.4 BEARING OIL SCAVANGE TUBE
VIEW C
L−A3490

Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 3)
(Task 72−00−54−420−003)


FWD
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE N BRACKET
BOLT
CLAMP
NUT

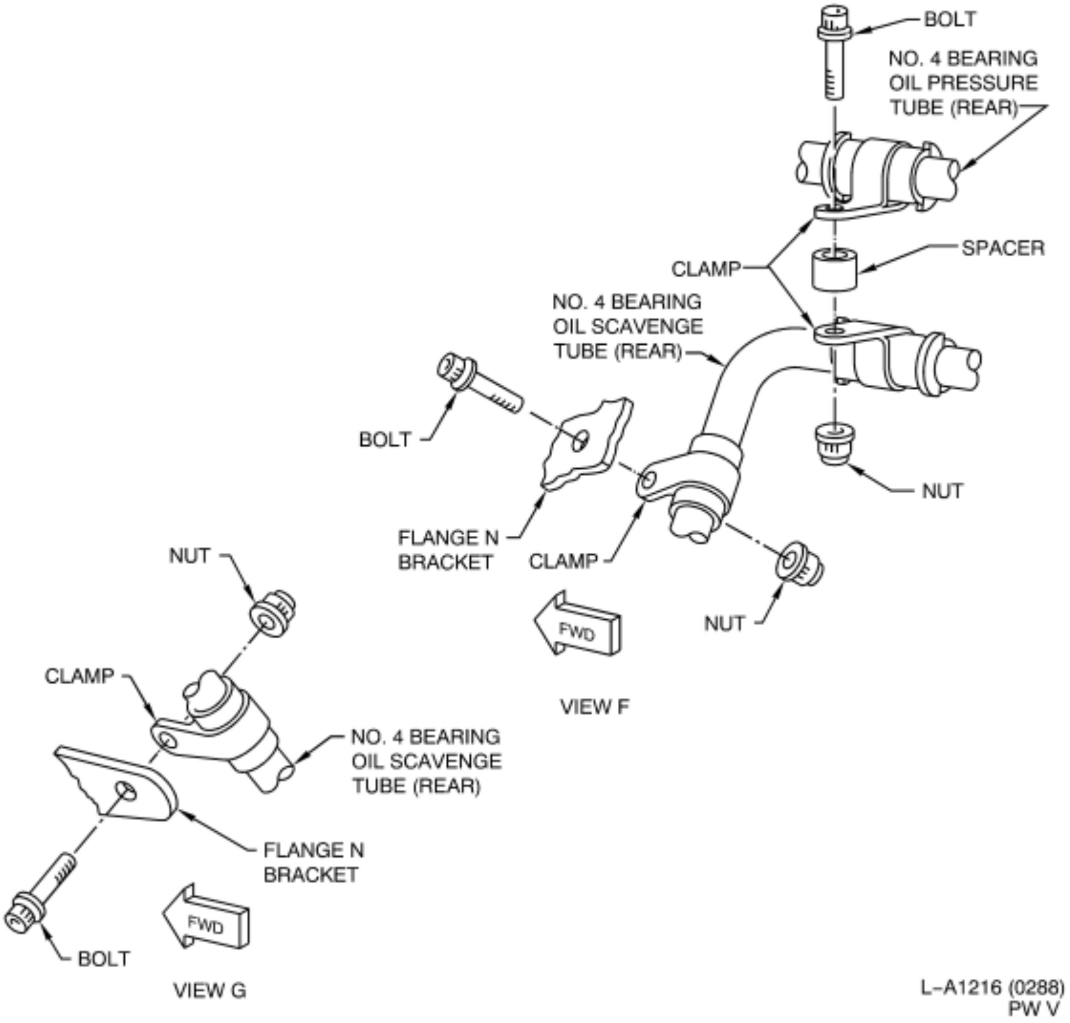
VIEW D


CLAMP
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE M BRACKET
BOLT
NUT
(PRE SB PW4ENG 79-23)
FWD
(POST SB PW4ENG 79-23)

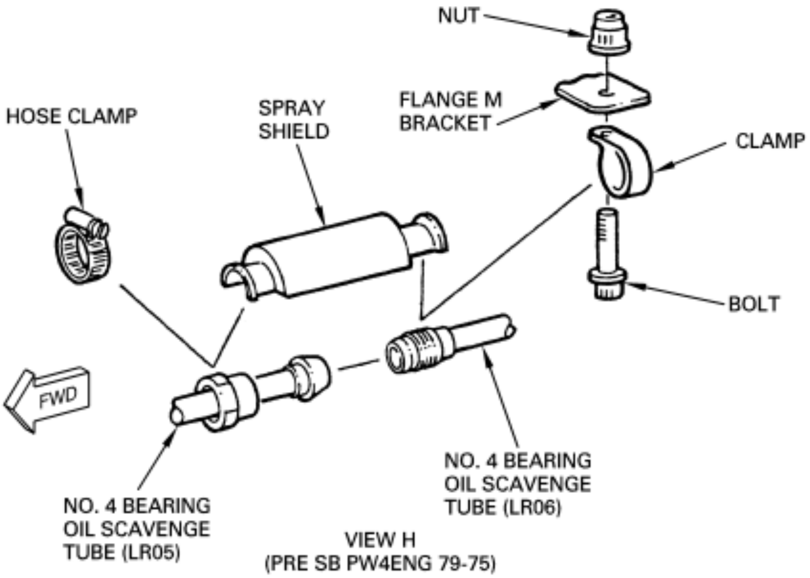
VIEW E

L-A2144 (0588)
PW V

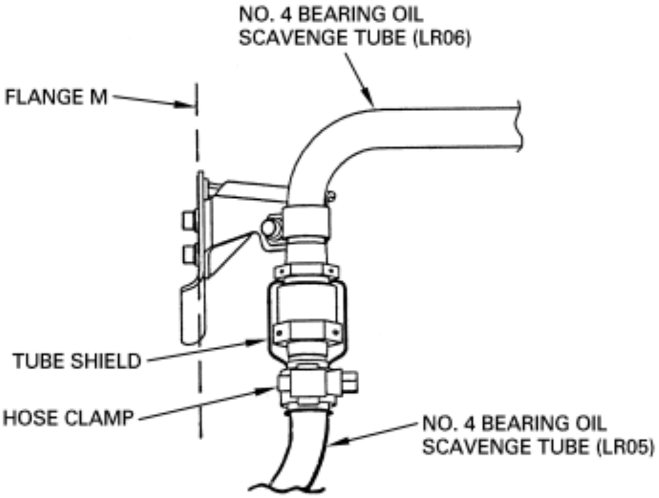
Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 4)
(Task 72-00-54-420-003)


BOLT
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
SPACER
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
BOLT
NUT
FLANGE N BRACKET
CLAMP
NUT
FWD
VIEW F
NUT
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
FLANGE N BRACKET
BOLT
FWD
VIEW G
L-A1216 (0288)
PW V

Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 5)
(Task 72-00-54-420-003)


NUT
HOSE CLAMP
SPRAY SHIELD
FLANGE M BRACKET
CLAMP
BOLT
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)

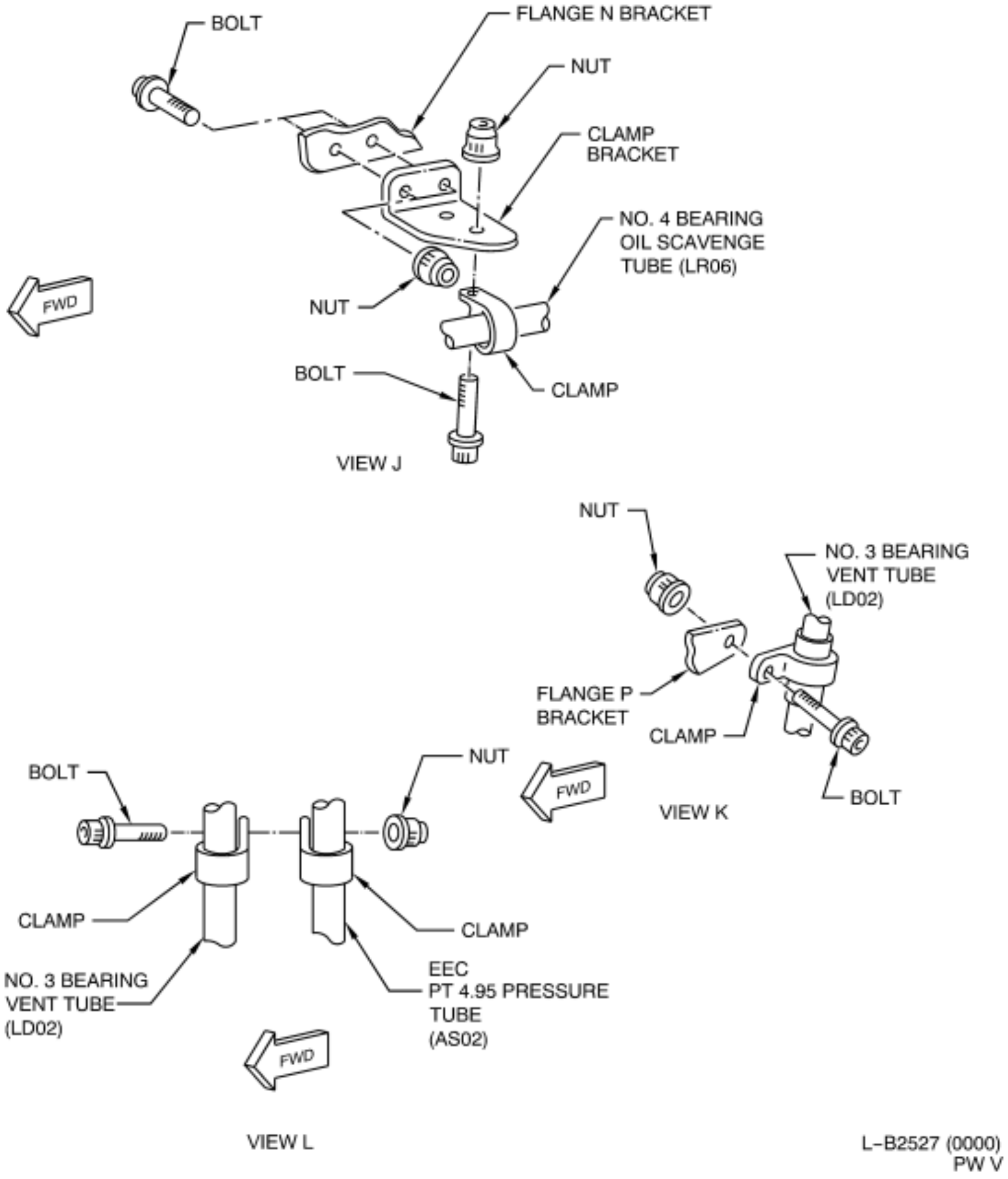
VIEW H
(PRE SB PW4ENG 79-75)


NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
FLANGE M
TUBE SHIELD
HOSE CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)

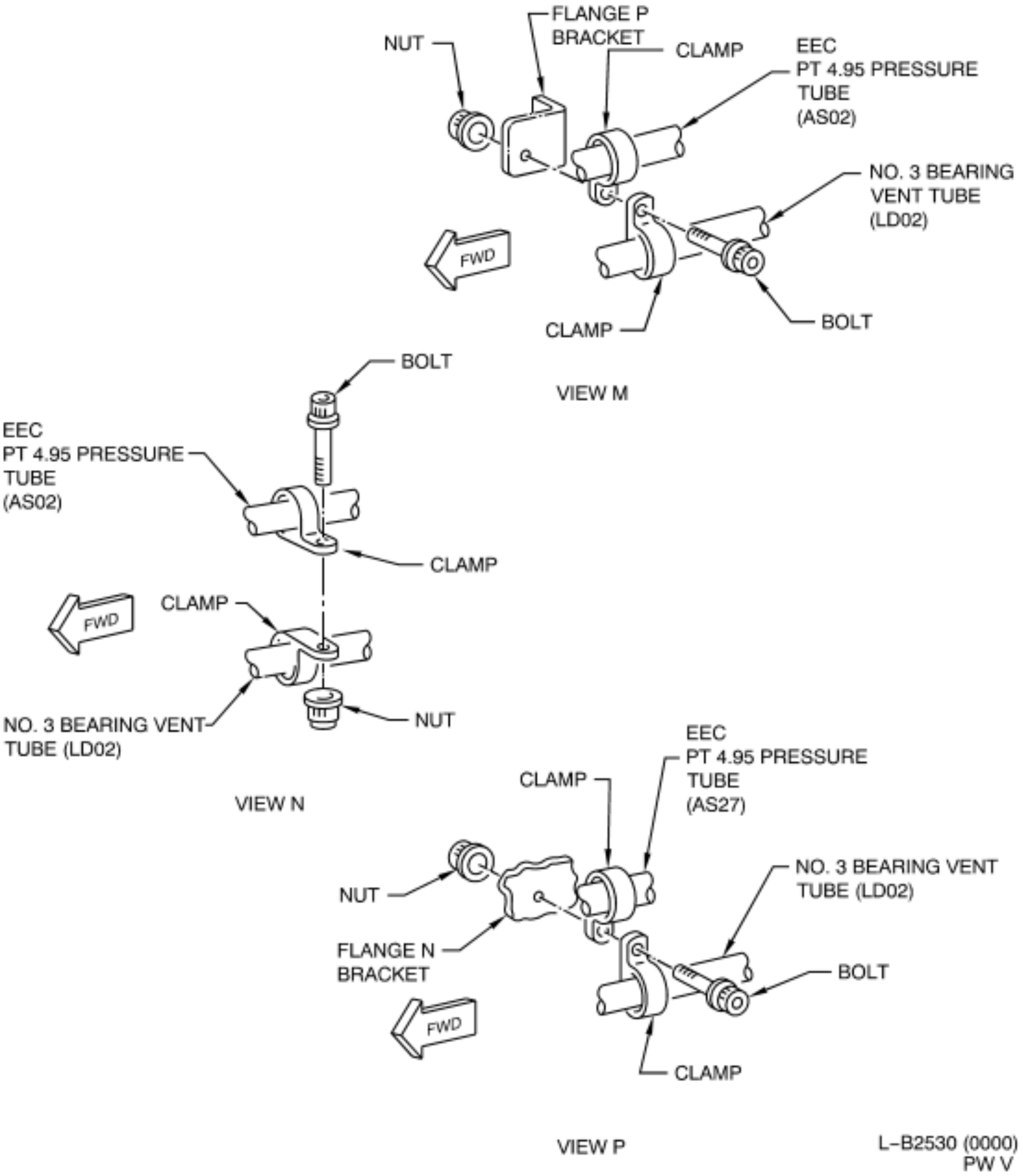
VIEW H
(POST SB PW4ENG 79-75)

L-B2526 (0000)

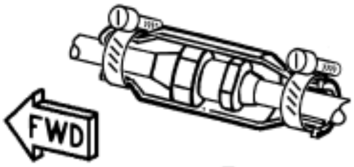
Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 6)
(Task 72−00−54−420−003)


BOLT
FLANGE N BRACKET
NUT
CLAMP BRACKET
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
FWD
NUT
BOLT
CLAMP
VIEW J
NUT
NO. 3 BEARING VENT TUBE (LD02)
FLANGE P BRACKET
CLAMP
BOLT
FWD
VIEW K
BOLT
NUT
CLAMP
CLAMP
NO. 3 BEARING VENT TUBE (LD02)
EEC PT 4.95 PRESSURE TUBE (AS02)
FWD
VIEW L
L−B2527 (0000)
PW V

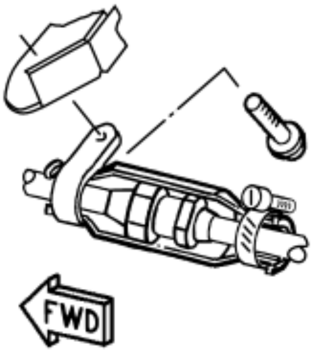
Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 7)
(Task 72−00−54−420−003)


NUT
FLANGE P BRACKET
CLAMP
EEC PT 4.95 PRESSURE TUBE (AS02)
NO. 3 BEARING VENT TUBE (LD02)
FWD
BOLT
CLAMP
VIEW M
BOLT
EEC PT 4.95 PRESSURE TUBE (AS02)
CLAMP
CLAMP
FWD
NO. 3 BEARING VENT TUBE (LD02)
NUT
VIEW N
EEC PT 4.95 PRESSURE TUBE (AS27)
CLAMP
NUT
NO. 3 BEARING VENT TUBE (LD02)
FLANGE N BRACKET
BOLT
FWD
CLAMP
VIEW P
L−B2530 (0000)
PW V

Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 8)
(Task 72−00−54−420−003)



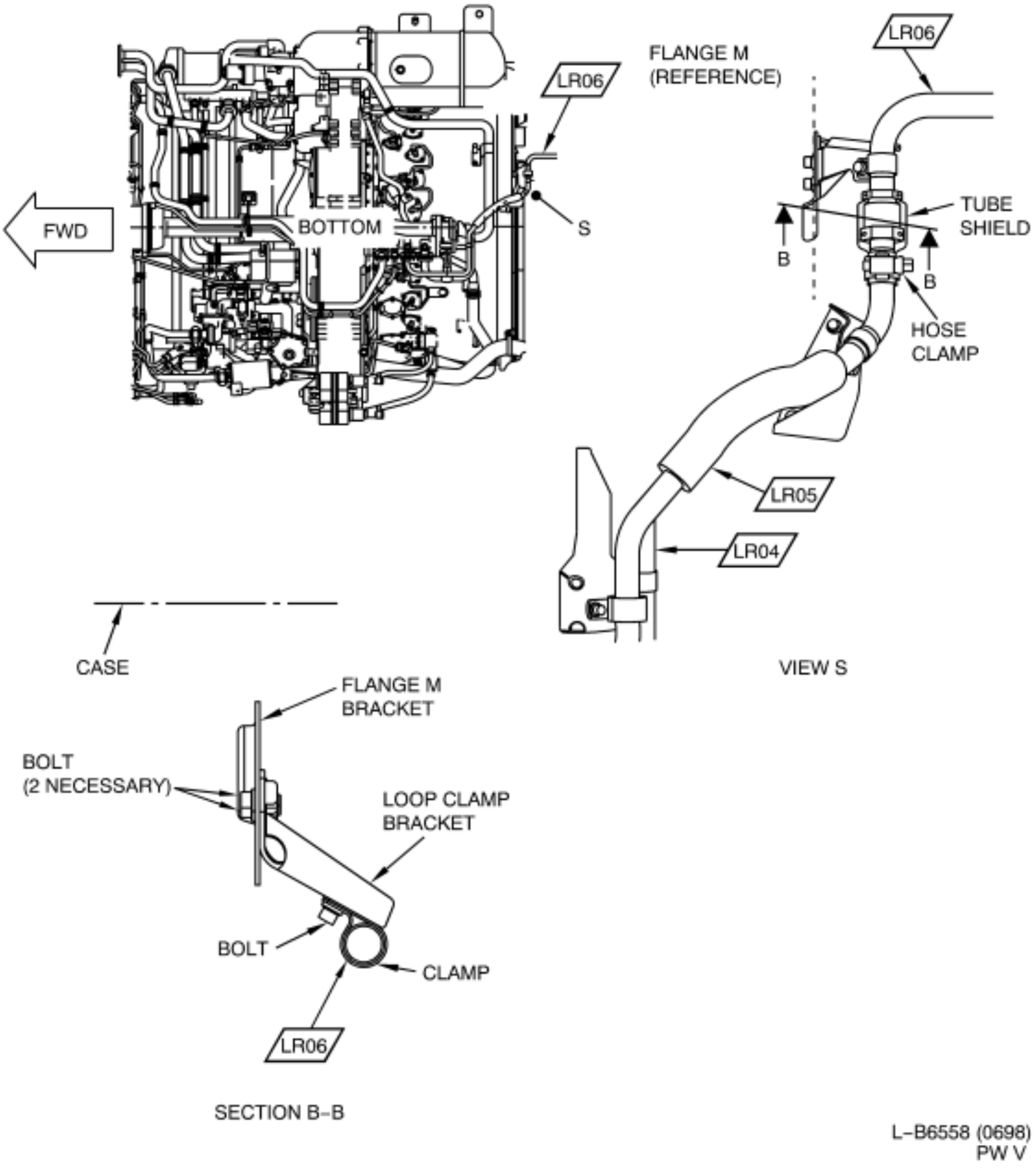
VIEW R
(PRE SB PW4ENG 79-54)



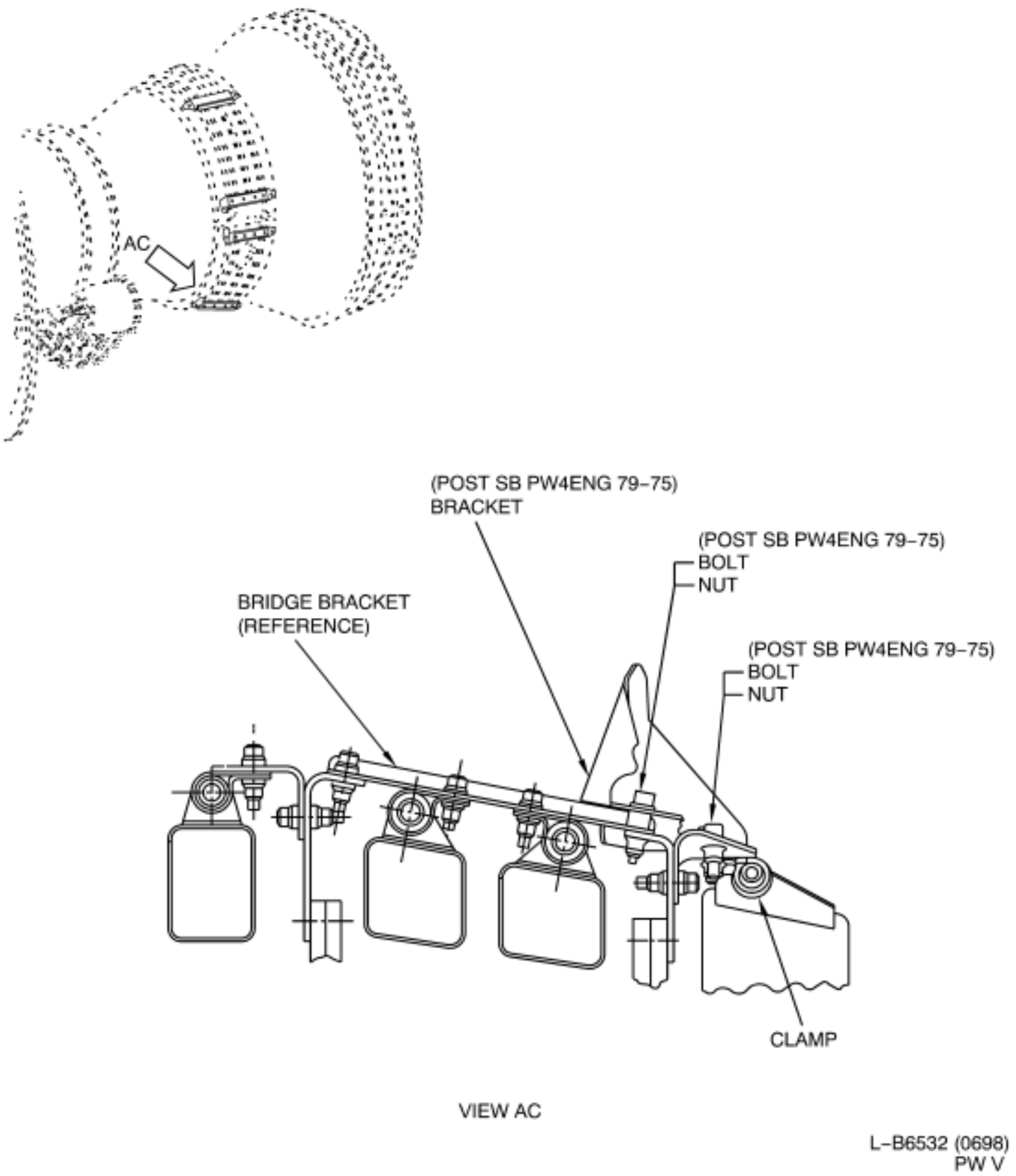
VIEW R
(POST SB PW4ENG 79-54)

L-A6825 (0000)

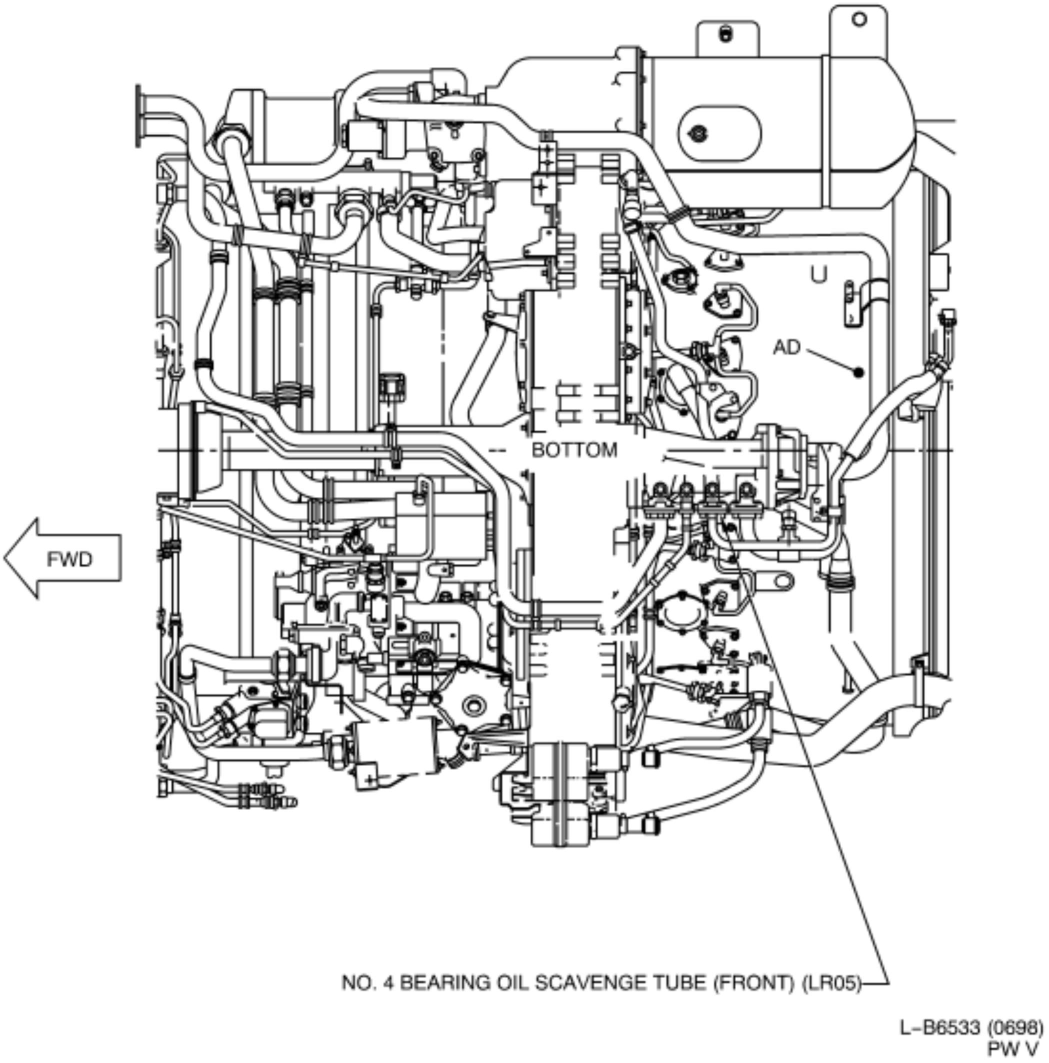
Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 9)
(Task 72−00−54−420−003)


FLANGE M
(REFERENCE)
LR06
LR06
FWD
BOTTOM
S
TUBE
SHIELD
B
B
HOSE
CLAMP
LR05
LR04
CASE
VIEW S
FLANGE M
BRACKET
BOLT
(2 NECESSARY)
LOOP CLAMP
BRACKET
BOLT
CLAMP
LR06
SECTION B−B
L−B6558 (0698)
PW V

Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 10)
(Task 72−00−54−420−003)

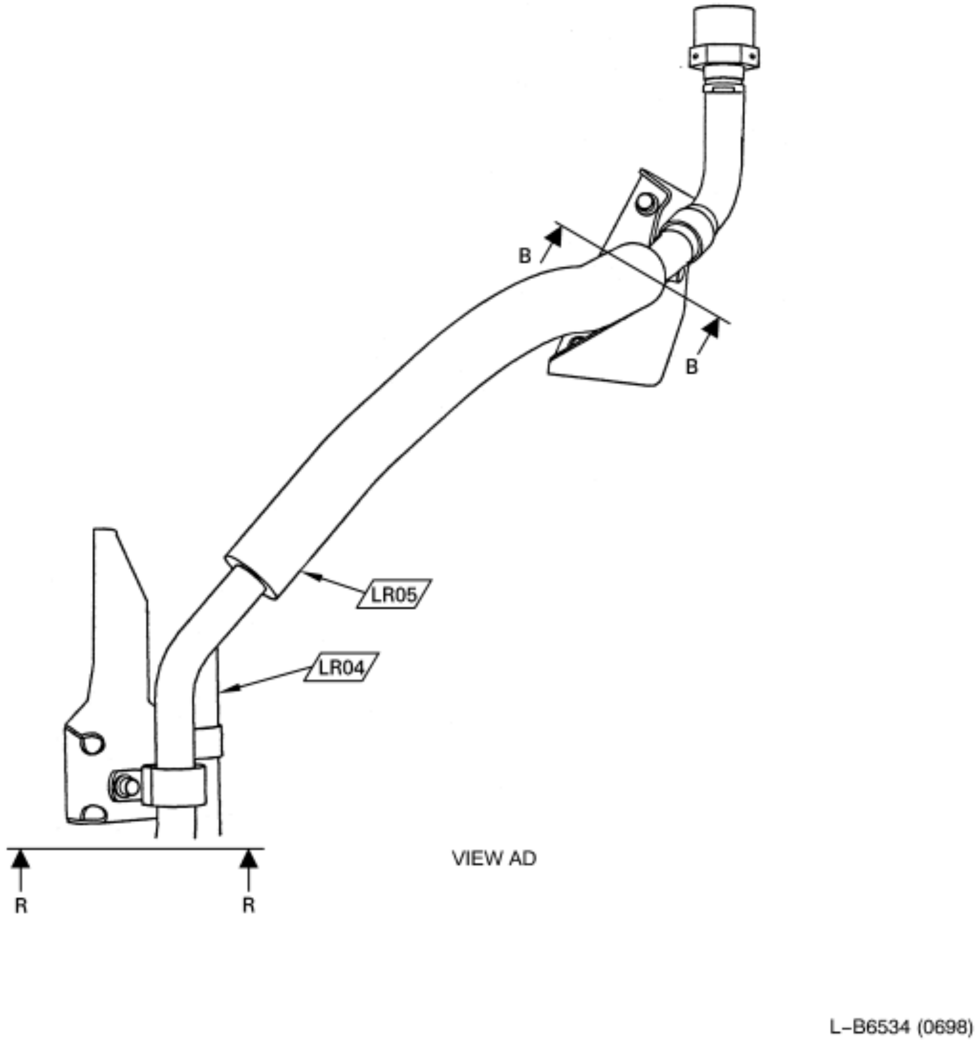

AC
(POST SB PW4ENG 79−75)
BRACKET
(POST SB PW4ENG 79−75)
BOLT
NUT
BRIDGE BRACKET
(REFERENCE)
(POST SB PW4ENG 79−75)
BOLT
NUT
CLAMP
VIEW AC
L−B6532 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 404 (Sheet 11)
(Task 72−00−54−420−003)

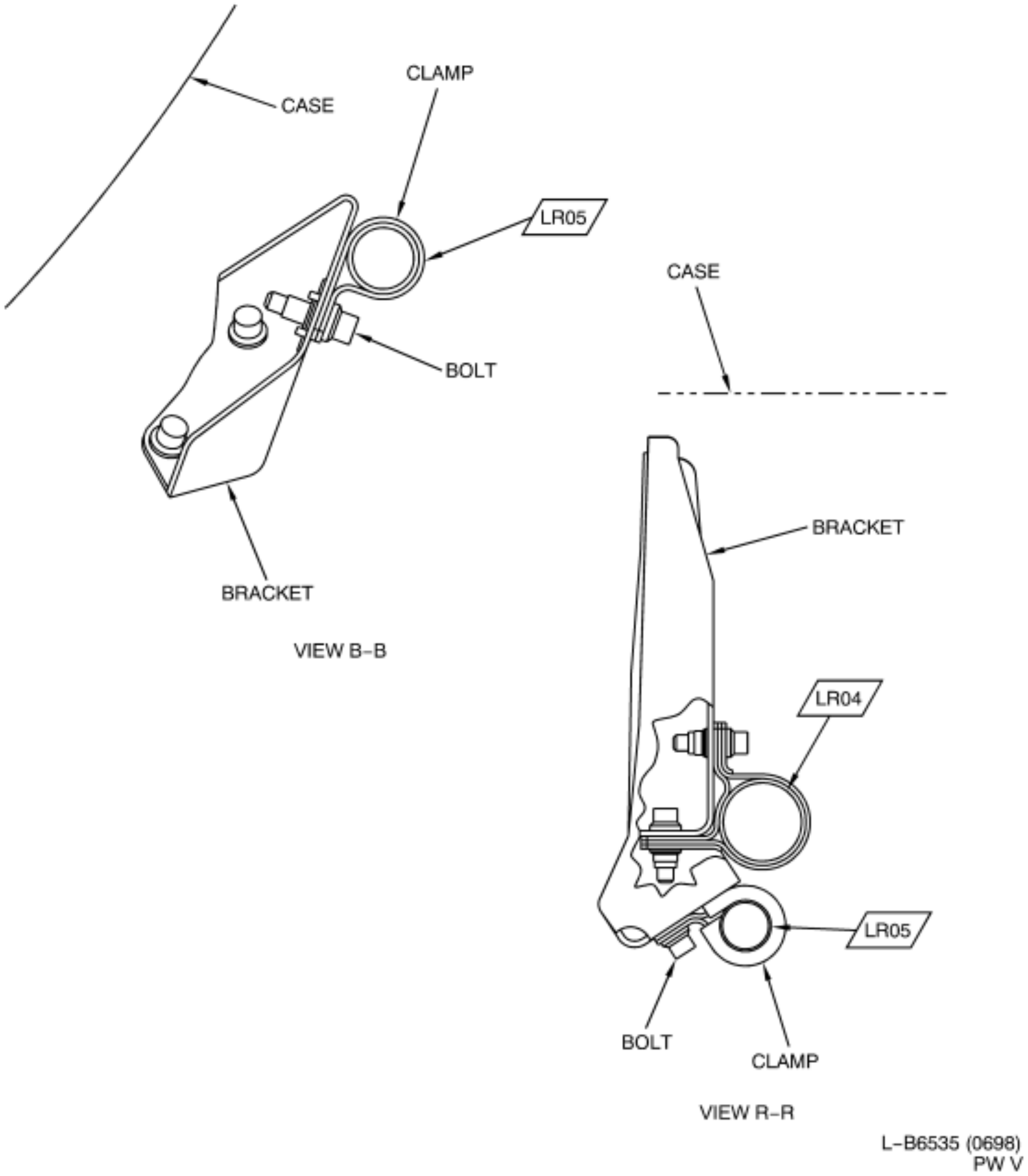

U
AD
BOTTOM
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (FRONT) (LR05)
L−B6533 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 404 (Sheet 12)
(Task 72−00−54−420−003)

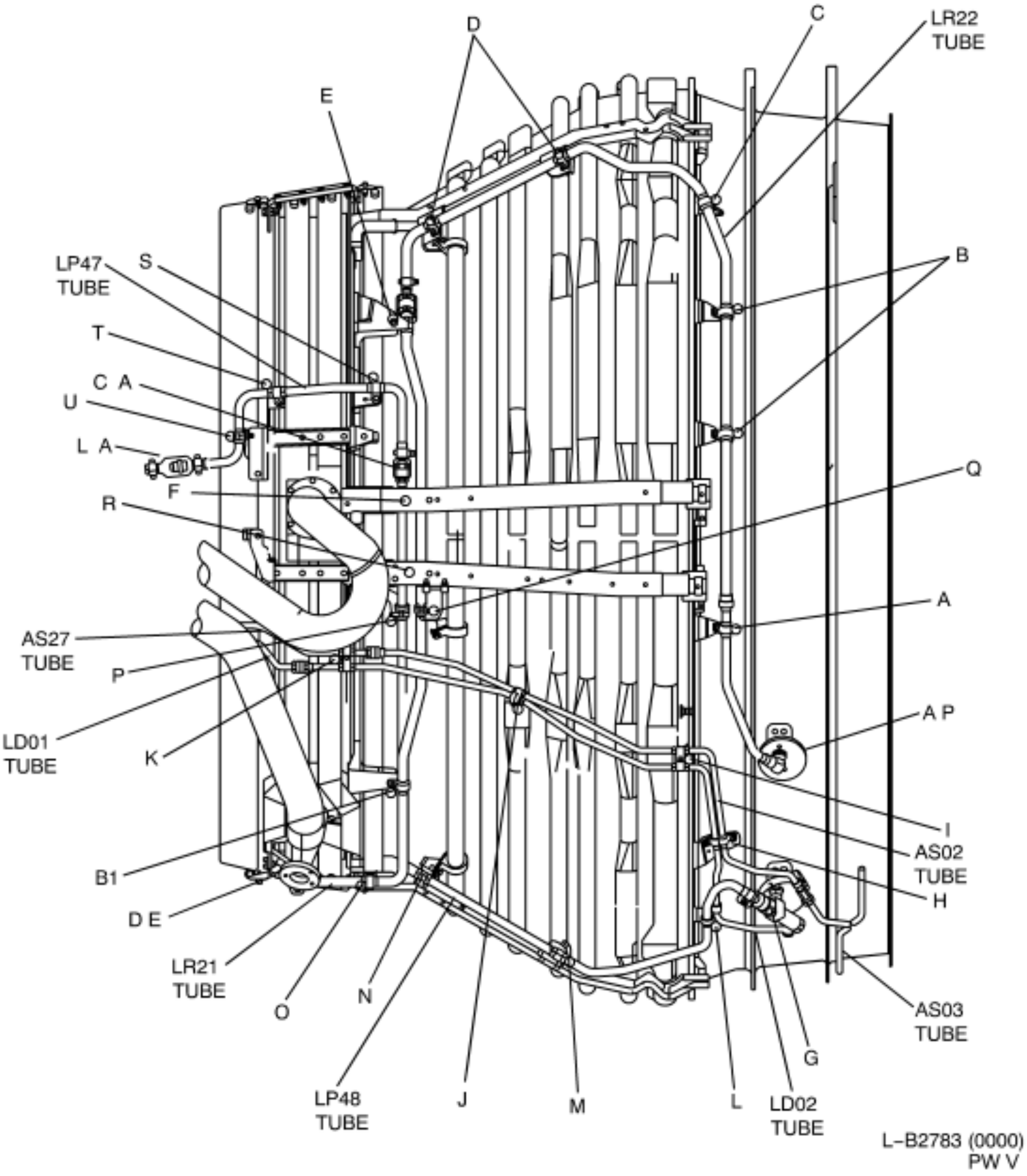
ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−02


B
B
LR05
LR04
VIEW AD
R
R
L−B6534 (0698)

Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 404 (Sheet 13)
(Task 72−00−54−420−003)

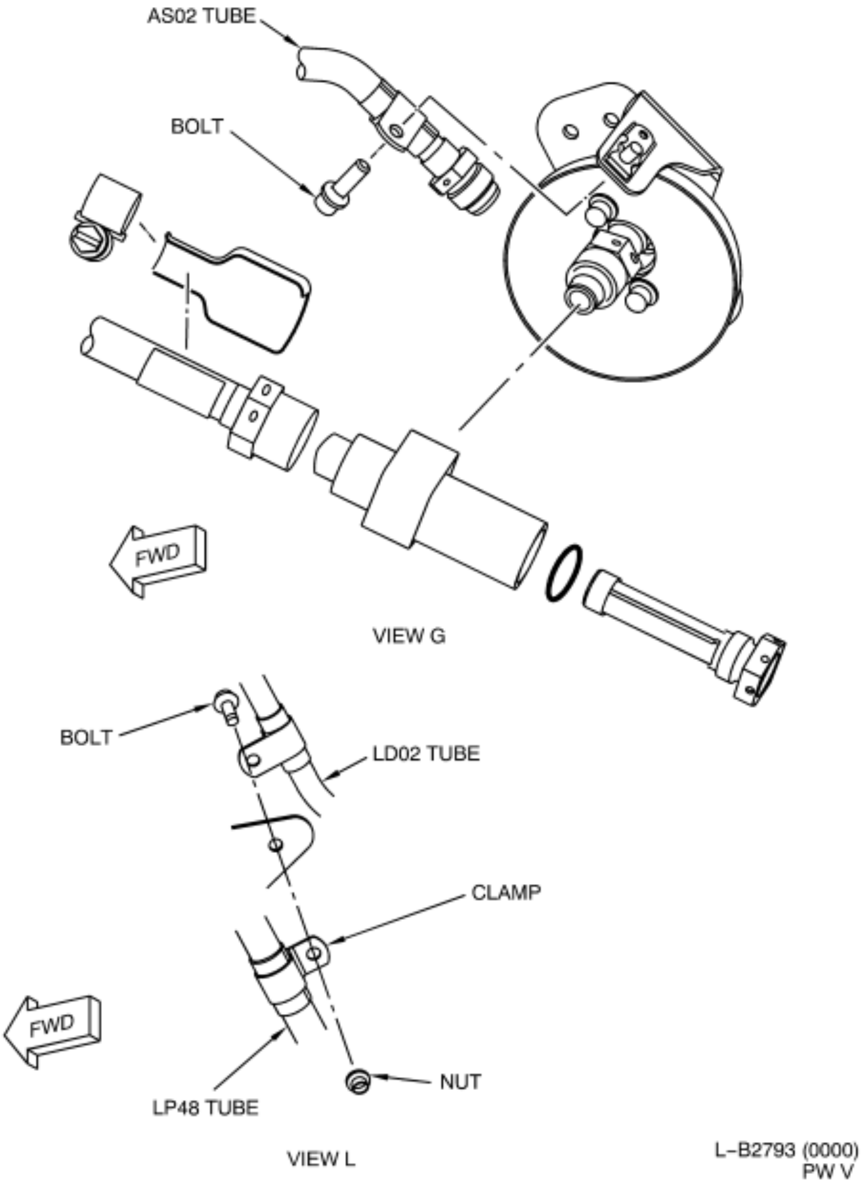

CASE
CLAMP
LR05
BOLT
BRACKET
VIEW B−B
CASE
BRACKET
LR04
LR05
BOLT
CLAMP
VIEW R−R
L−B6535 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 404 (Sheet 14)
(Task 72−00−54−420−003)

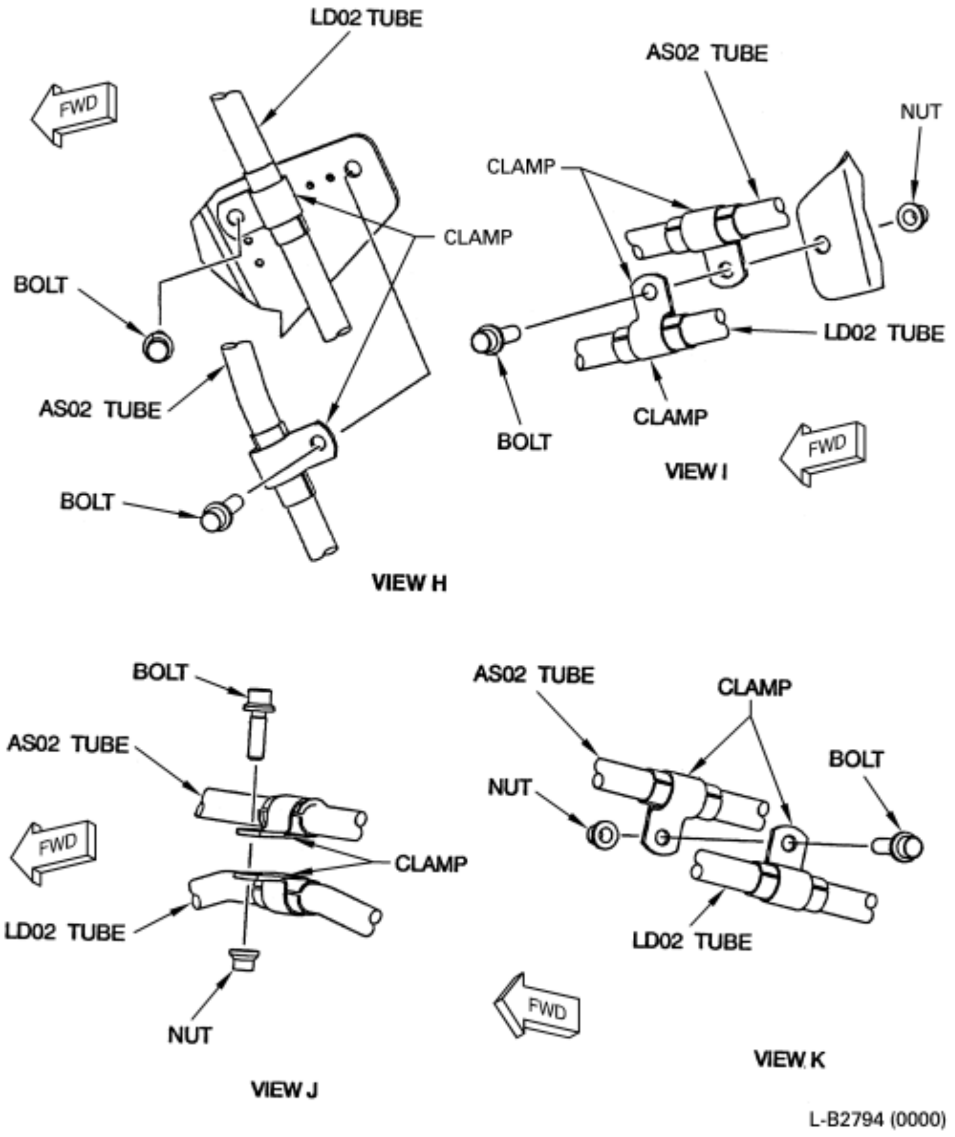

D
C
LR22 TUBE
E
B
LP47 TUBE
S
T
C A
U
L A
F
Q
R
A
AS27 TUBE
P
A P
LD01 TUBE
K
I
AS02 TUBE
H
B1
D E
LR21 TUBE
O
N
AS03 TUBE
G
LP48 TUBE
J
M
L
LD02 TUBE
L−B2783 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 405 (Sheet 1)
(Task 72−00−54−420−003)

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−02

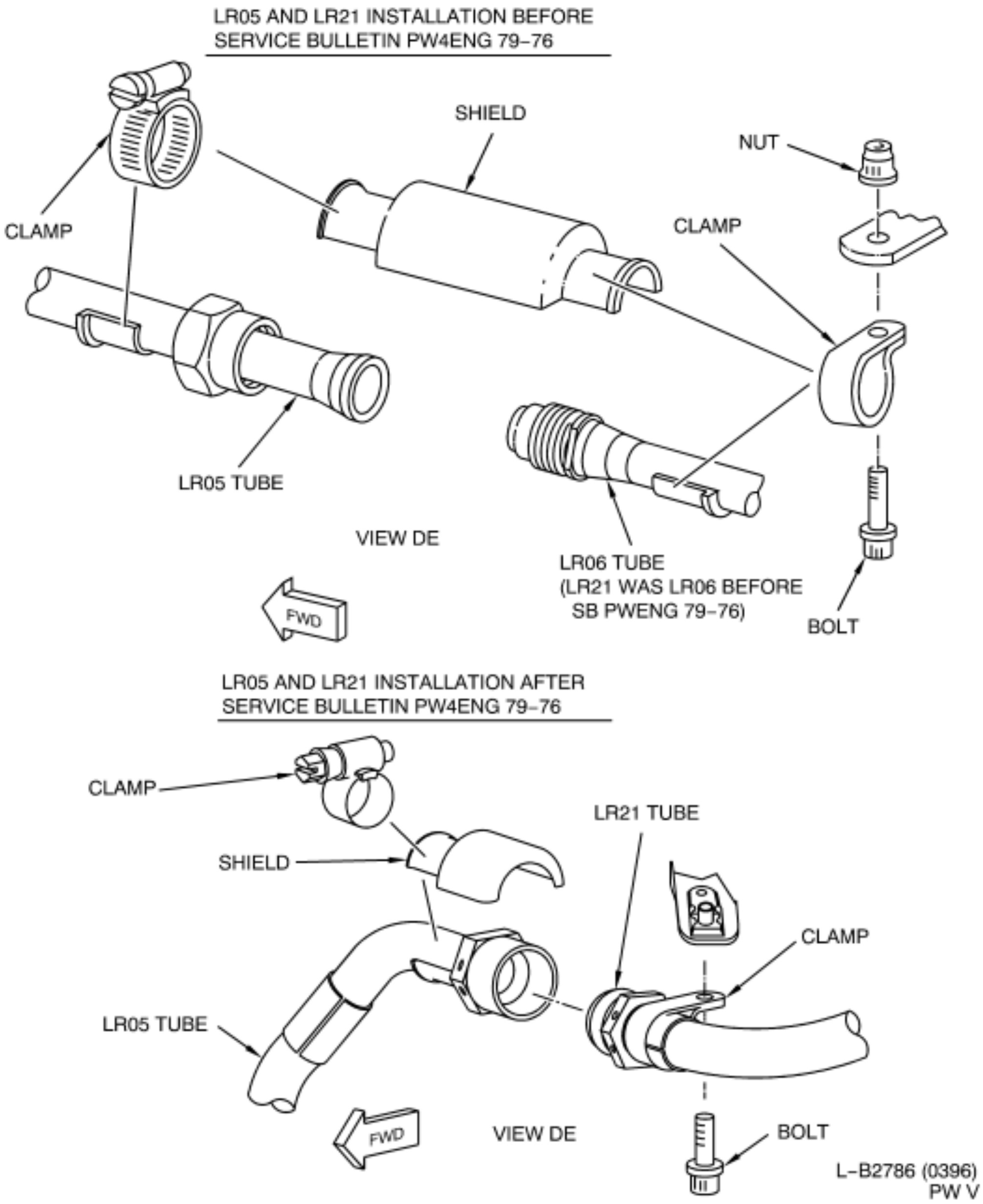

AS02 TUBE
BOLT
FWD
VIEW G
BOLT
LD02 TUBE
CLAMP
FWD
NUT
LP48 TUBE
VIEW L
L−B2793 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 405 (Sheet 2)
(Task 72−00−54−420−003)

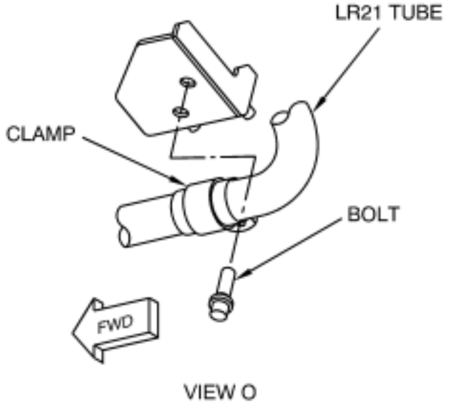

LD02 TUBE
FWD
CLAMP
BOLT
AS02 TUBE
BOLT
VIEW H
AS02 TUBE
NUT
CLAMP
LD02 TUBE
BOLT
CLAMP
FWD
VIEW I
BOLT
AS02 TUBE
FWD
CLAMP
LD02 TUBE
NUT
VIEW J
AS02 TUBE
CLAMP
BOLT
NUT
LD02 TUBE
FWD
VIEW K
L-B2794 (0000)

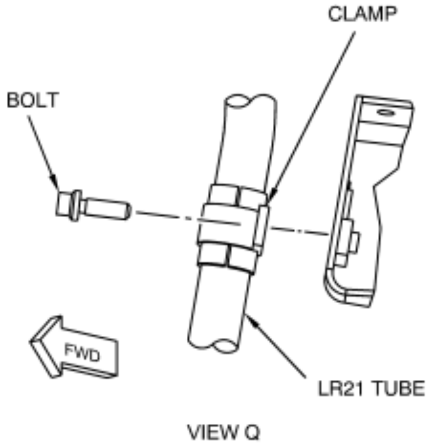
External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 405 (Sheet 3)
(Task 72−00−54−420−003)

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−02


LR05 AND LR21 INSTALLATION BEFORE SERVICE BULLETIN PW4ENG 79−76
SHIELD
NUT
CLAMP
CLAMP
LR05 TUBE
VIEW DE
LR06 TUBE (LR21 WAS LR06 BEFORE SB PWENG 79−76)
BOLT
FWD
LR05 AND LR21 INSTALLATION AFTER SERVICE BULLETIN PW4ENG 79−76
CLAMP
SHIELD
LR21 TUBE
CLAMP
LR05 TUBE
FWD
VIEW DE
BOLT
L−B2786 (0396)
PW V

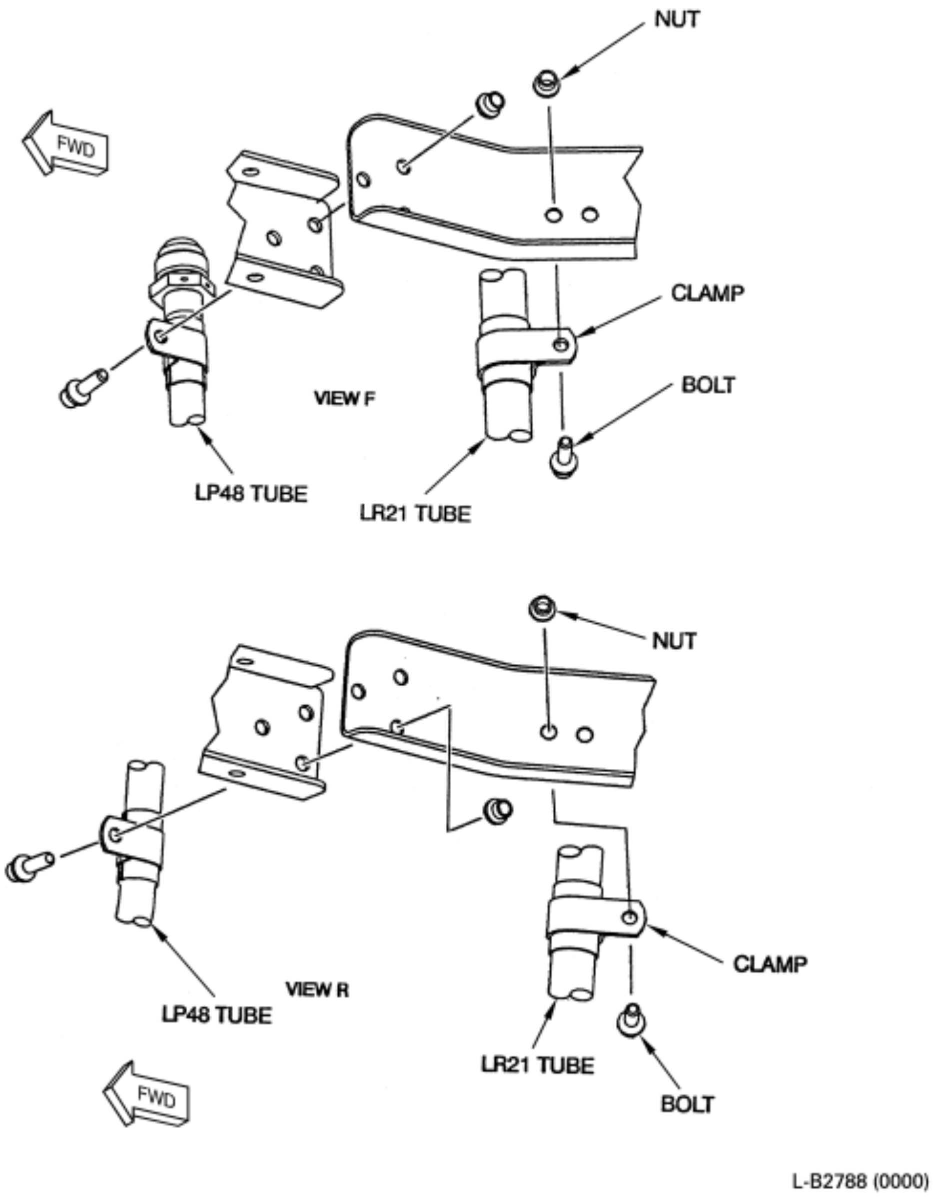
External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 405 (Sheet 4)
(Task 72−00−54−420−003)


LR21 TUBE
CLAMP
BOLT
FWD
VIEW O

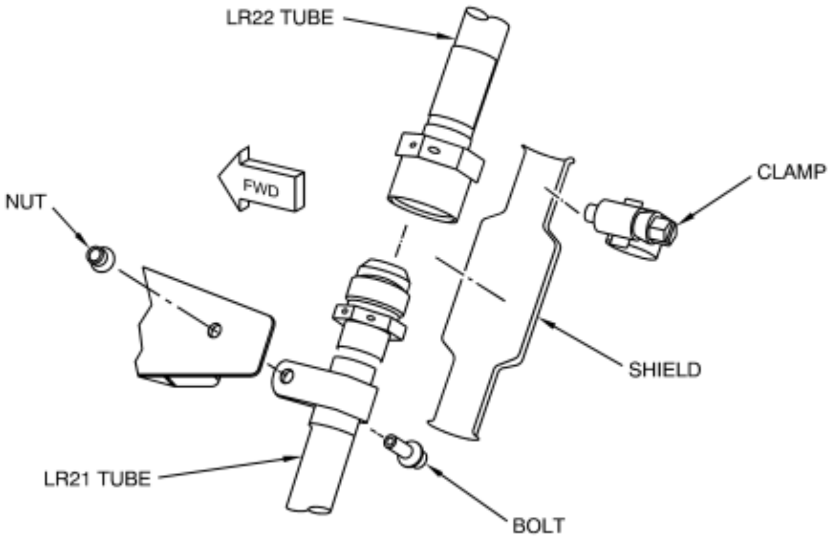

CLAMP
BOLT
FWD
LR21 TUBE
VIEW Q

L−B2787 (0000)
PW V

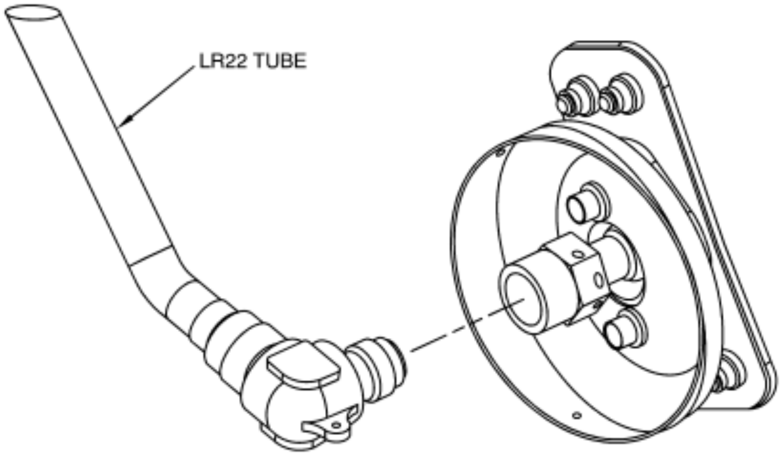
External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 405 (Sheet 5)
(Task 72−00−54−420−003)


NUT
FWD
CLAMP
BOLT
VIEW F
LP48 TUBE
LR21 TUBE
NUT
VIEW R
CLAMP
LP48 TUBE
LR21 TUBE
BOLT
FWD
L-B2788 (0000)

External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 405 (Sheet 6)
(Task 72−00−54−420−003)


LR22 TUBE
CLAMP
FWD
NUT
SHIELD
LR21 TUBE
BOLT

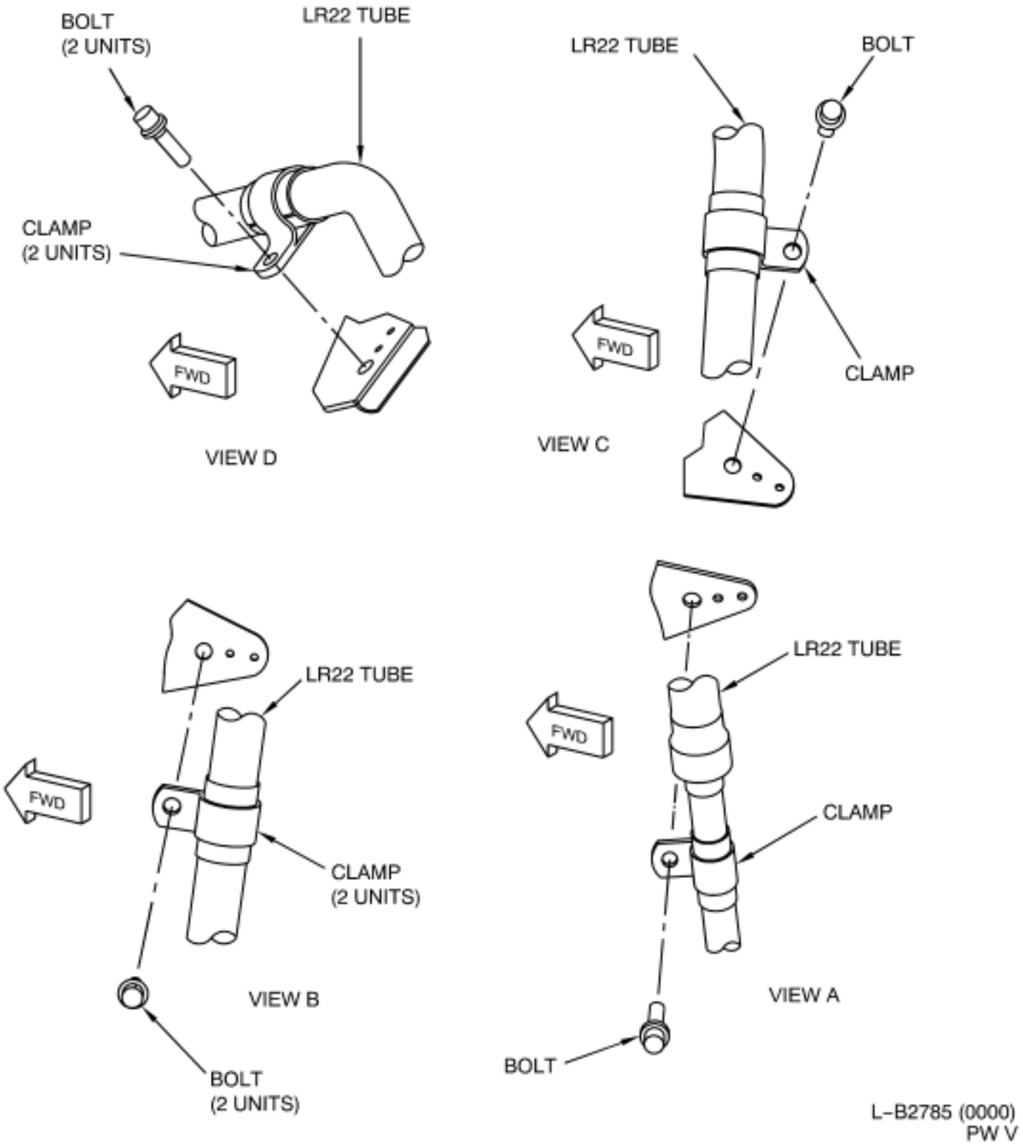
VIEW E



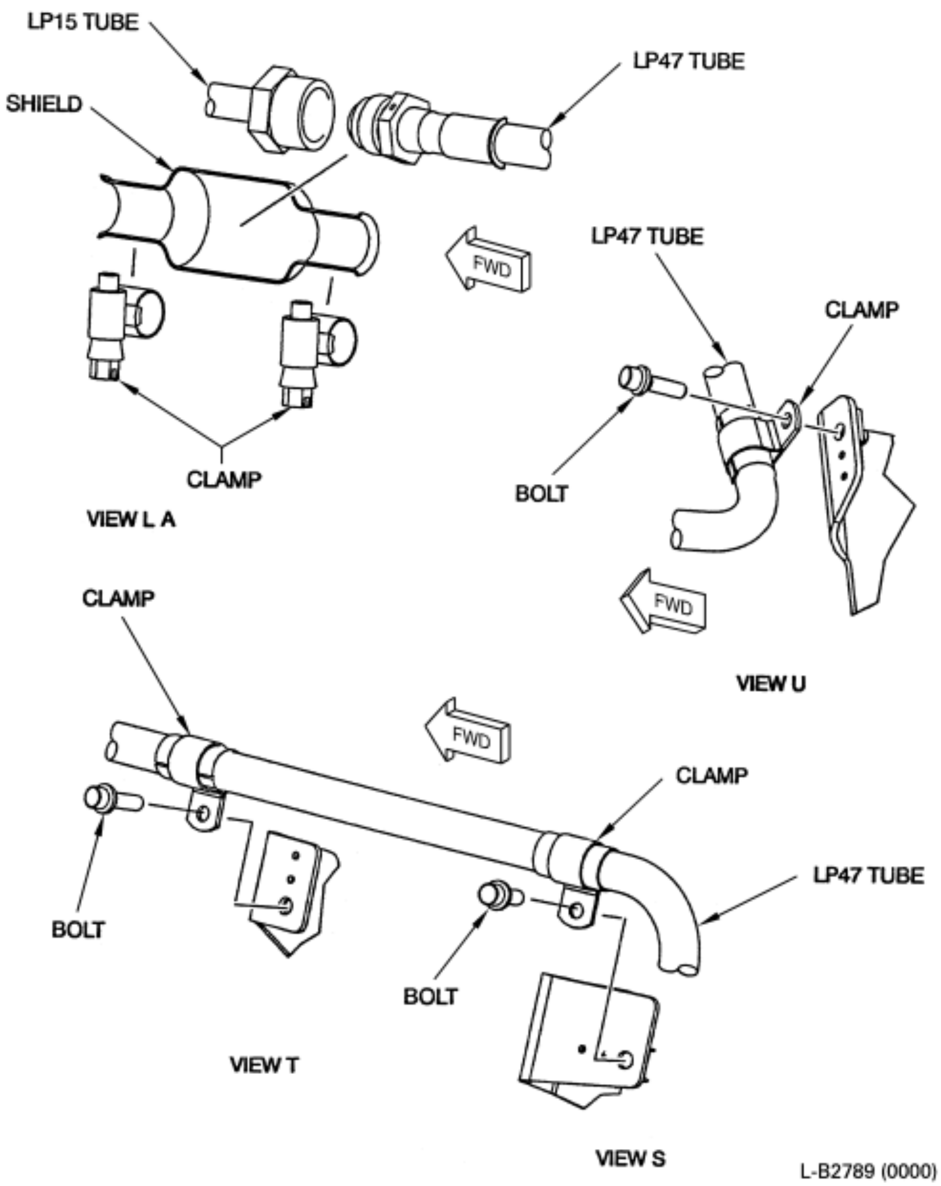
VIEW A P

L-B2784 (0000)
PW V

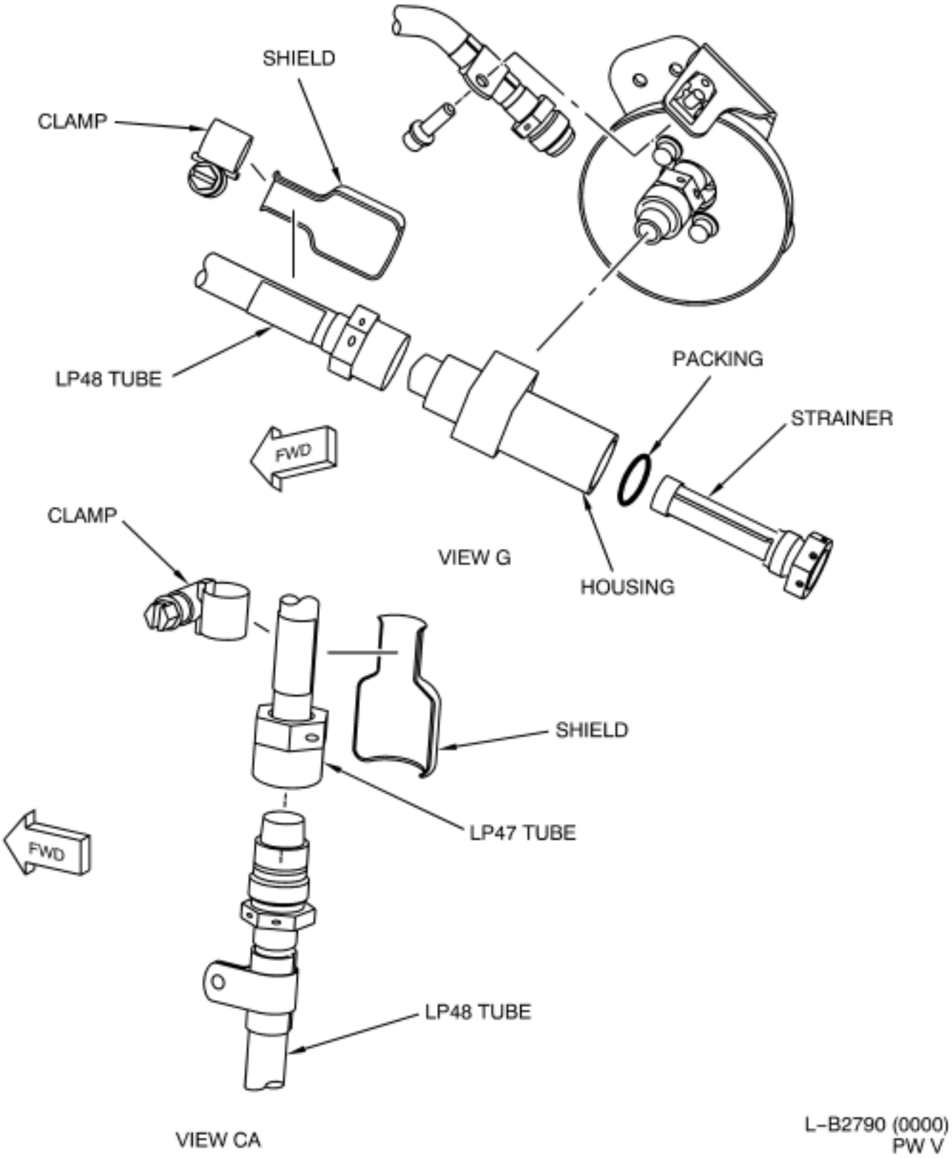
External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 7)
(Task 72-00-54-420-003)


BOLT
(2 UNITS)
LR22 TUBE
CLAMP
(2 UNITS)
FWD
VIEW D
LR22 TUBE
BOLT
FWD
CLAMP
VIEW C
LR22 TUBE
FWD
CLAMP
(2 UNITS)
VIEW B
BOLT
(2 UNITS)
LR22 TUBE
FWD
CLAMP
VIEW A
BOLT
L−B2785 (0000)
PW V

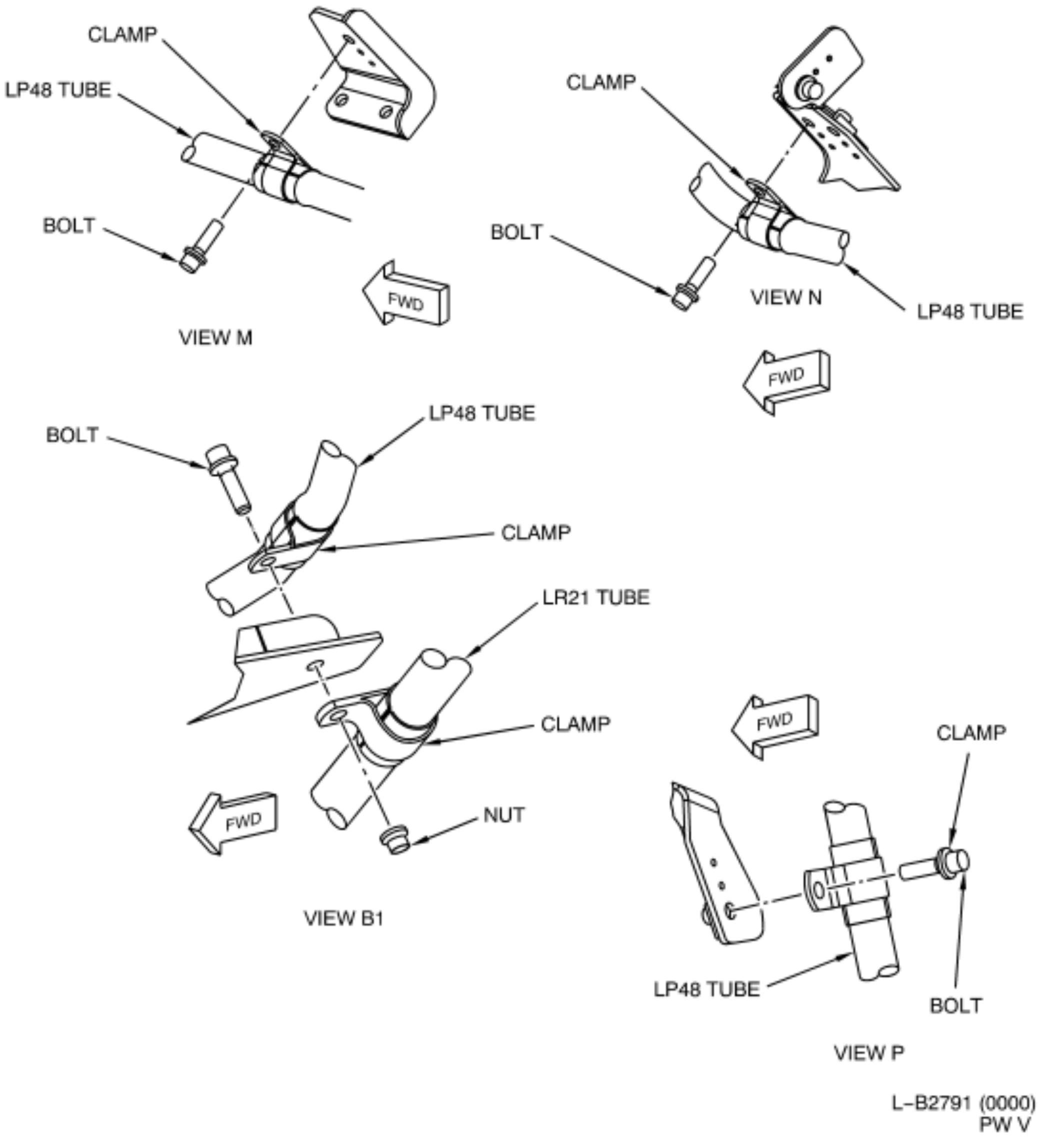
External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 405 (Sheet 8)
(Task 72−00−54−420−003)


LP15 TUBE
SHIELD
LP47 TUBE
FWD
LP47 TUBE
CLAMP
CLAMP
VIEW L A
BOLT
FWD
VIEW U
CLAMP
FWD
CLAMP
LP47 TUBE
BOLT
BOLT
VIEW T
VIEW S
L-B2789 (0000)

External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 405 (Sheet 9)
(Task 72−00−54−420−003)


SHIELD
CLAMP
LP48 TUBE
FWD
PACKING
STRAINER
CLAMP
VIEW G
HOUSING
SHIELD
LP47 TUBE
FWD
LP48 TUBE
VIEW CA
L−B2790 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 405 (Sheet 10)
(Task 72−00−54−420−003)


CLAMP
LP48 TUBE
BOLT
FWD
VIEW M
CLAMP
BOLT
VIEW N
LP48 TUBE
FWD
BOLT
LP48 TUBE
CLAMP
LR21 TUBE
CLAMP
NUT
FWD
VIEW B1
FWD
CLAMP
LP48 TUBE
BOLT
VIEW P
L-B2791 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 11)
(Task 72-00-54-420-003)

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−02

Task 72−00−54−420−004:

1. Install External Plumbing After Turbine Exhaust Case Installation

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03−001	Oil, Engine (PWA 521B)
	P05−059	Wax, Paraffin (PMC 9552)
	P05−289	Lockwire (AS3214−02)
	P05−291	Cable, Safety (Optional)
R	P05−292	Ferrule, Safety Cable (Optional)
	P06−021	Compound, Antigalling (PWA 550)
R	P06−054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	75−24−00/2/95
Gasket	1	75−26−00/1/190
Gasket	1	75−26−00/1/200
Gasket	2	75−26−00/1/210
Packing	2	79−21−00/7/1
Packing	1	79−21−00/12/190
Packing	1	79−22−00/4/1
Gasket	1	75−24−00/2/90C

B. Procedure
See Figure 401, Figure 402, Figure 403, Figure 404 and Figure 405.

(1) Install the (lower front) turbine case cooling (TCC) HPT manifold assembly (AC25) as follows.

(a) Lift and turn the manifold to engage the manifold (collector) and install a bolt, threads lubricated with Engine Oil P03−001, handtight only.

(b) Install the HPT manifold loop clamp brackets to the forward ward side of the Flange M brackets at approximately the 4, 7 and 9 o'clock positions, angled forward, with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Install clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts that attach the manifold to the manifold loop clamp brackets. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Torque the bolt that attaches the manifold to the manifold (collector) to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(2) Install the (lower right) turbine blade cooling tube assembly (AP37) as follows.

CAUTION: INSTALL THE LOCK PLATES WITH THE SLOT GROOVE OUTWARD AND PIN (IF EQUIPPED) INWARD. MAKE SURE THE LOCK PLATES ENGAGE THE INTERNAL TUBE LIP FLANGE AS SHOWN IN FIGURE 401.

(a) Remove the protective closures. Install the gasket, with the raised sealing surface visible, to the elbow end of the tube, align the tube slot and four bolt holes. Attach in position with Paraffin Wax P05−059. Install ring gasket to elbow groove with Paraffin Wax P05−059. Install the locks to engage the diffuser case internal tube lip with pin inward (if equipped). Hold the locks in position with Paraffin Wax P05−059.

(b) (Reference 2261) Hold the tube locks outward against the tube lip. Measure and make sure the end of the internal tube is 0.000 − 0.020 inch (0.000 − 0.508 mm) above the tube locks. If the measurement is not in this limit, install the locks again and make sure you engage the internal tube lip correctly. See Figure 401.

(c) Install the gasket and metering plate to the turbine vane and blade cooling air valve flanged end of tube. Hold in position with Paraffin Wax P05-059. Install the gasket to the lower flanged port of the turbine vane and blade cooling air valve and hold in position with Paraffin Wax P05-059.

(d) Attach the elbow end of the tube (gaskets in position) and the bracket to the diffuser case pad at approximately the 5 o'clock position with bolts, threads lubricated with Engine Oil P03-001, handtight only.

(e) (Pre SB PW4ENG 72-537 or Post SB PW4ENG 72-627) Attach the opposite end of the tube (gaskets and metering plate in position) to the turbine vane and blade cooling air valve with bolts, threads lubricated with Engine Oil P03-001, handtight only.

(f) (Post SB PW4ENG 72-537 and Pre SB PW4ENG 72-627) Attach the opposite end of the tube (gaskets and ring spacer in position) to the turbine vane and blade cooling air valve with bolts, threads lubricated with Engine Oil P03-001, handtight only.

(g) Install the clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts to the diffuser case brackets at three locations. Torque the clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(h) Torque all the bolts at each end of tube to 85 - 95 lb-in. (9.604 - 10.734 N.m), then torque the bolts again until the torque is kept. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts at the diffuser case pad.

(i) Install the clamp, bolt, threads lubricated with Engine Oil P03-001, and nut that attaches the fuel manifold to the bracket installed to the tube flange at the diffuser case. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(3) Install the (lower right) turbine vane cooling air duct (AP02) as follows.

(a) Remove the protective closures.

(b) Attach a new gasket in position to the valve flange at approximately the 3 o'clock position with Paraffin Wax P05−059.

(c) Install a new gasket in position to the pad at approximately the 4 o'clock position on the HPT case with Paraffin Wax P05−059.

(d) Install the duct to the HPT case pad and attach with bolts, threads lubricated with Engine Oil P03−001, handtight only.

(e) Attach the forward end of the duct to the turbine vane and blade cooling air valve with bolts, threads lubricated with Engine Oil P03−001.

(f) Install the clamp over the duct at the Flange M bracket and attach with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the clamp bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(g) Torque the bolts that attach the duct to the turbine vane and blade cooling air valve to 85 − 95 lb−in. (9.604 − 10.735 N.m), then torque the bolts again until the same torque is kept.

(h) Torque the bolts that attach the duct to the HPT case to 180 − 200 lb−in. (20.337 − 22.597 N.m), then torque the bolts again to the same limit until the torque is kept. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(4) Install the LPT case cooling manifold (collector) as follows. See Figure 402.

(a) Remove the protective closures and attach the rear of the manifold (collector) to the Flange P brackets, at approximately the 3 o'clock position, with clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts handtight only.

(b) Install the front of the manifold (collector) to the Flange N bracket with clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts handtight only.

(c) Install the bolts, threads lubricated with Engine Oil P03−001, and nuts to attach the manifold (collector) to the support bracket and the LPT cooling air valve flange, handtight only.

(d) Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque the bolts that attach the manifold (collector) to the LPT cooling air valve to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(5) Install the LPT case cooling manifold (TCC) assemblies (AC01) through (AC14) as follows.

(a) Remove the protective closures and install the upper manifolds over the top of the LPT case and downward to engage the manifold (collector) at approximately the 3 o'clock position.

(b) Install the lower manifolds under the LPT case and upward to engage the manifold (collector) at approximately the 3 o'clock position.

1 Install clamps to the rear mounts of the top half and lower half of the cooling air manifolds. Attach the manifolds to the Flange P brackets with bolts, threads lubricated with Engine Oil P03−001, and nuts tightened by hand.

(c) Install bolts, threads lubricated with Engine Oil P03−001, bracket and nuts to attach the upper and lower manifold support brackets to the Flange N brackets handtight only.

(d) Install bolts, threads lubricated with Engine Oil P03−001, to attach the upper and lower manifolds to the manifold (collector) and torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque all the bolts that attach the manifolds at Flanges N and P to 36 − 40 lb−in. (4.067 − 4.519 N.m).

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A

TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(6) (Pre SB PW4ENG 79-75) Install main filter oil tube assembly (LP01) as follows. See Figure 403.

(a) Remove the protective closures and install the packings lubricated with Engine Oil P03-001, to the packing groove at each end of the tube.

(b) Attach the tube to the forward side of the main oil filter housing, with bolts, threads lubricated with Engine Oil P03-001, handtight only.

(c) Attach the tube to the top of the main oil pump with loop clamp bracket angled rearward and bolts,
R threads lubricated with Antiseize Paste P06-054,
R handtight only. Wipe off unwanted paste.

(d) Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts to attach the tube to the gearbox brackets at approximately the 8 o'clock position . Torque the clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

NOTE: The bracket at the deoiler outlet port on the rear of the gearbox must be aligned and the clamp bolt and nut left handtight. You must torque the clamp bolt when the deoiler outlet tube is installed.

(e) Install the two (clip-on) loop clamp grommet halves to the tube at the diffuser case bracket clamp location.

(f) Install the clamp that attaches the tube to the diffuser case bracket. Install the bolt, lubricated with Engine Oil P03-001, and nut. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(g) Torque the bolts that attach the tube to the main oil filter housing to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(h) Torque the bolts that attach the tube and bracket to the top of the oil pump to 62 − 72 lb−in. (7.005 − 8.135 N.m).

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(7) (Post SB PW4ENG 79−75) Install the fluid pressure dampener or install the fluid pressure adapter assembly (Post SB PW4ENG 79−86) and the main oil filter hose and tube assembly (LPO1) as follows. See Figure 403.

(a) Remove the protective closures and install packing lubricated with Engine Oil P03−001, to packing groove on the dampener or adapter.

(b) Install the dampener or adapter to the top of the main oil pump and hold with bolts, threads lubricated with Engine Oil P03−001, to a handtight condition only.

(c) Remove protective closures and install packing lubricated with Engine Oil P03−001, to packing groove at each end of oil tube assembly (LP01).

(d) Install one end of tube (LP01) to the forward side of the main oil filter housing with bolts, threads lubricated with Engine Oil P03−001, handtight only.

(e) Install the other end of tube (LP01) to the dampener or adapter, threads lubricated with Engine Oil P03−001, to a handtight condition only.

(f) Install bolts, threads lubricated with Engine Oil P03−001, nuts and clamps securing tube to gearbox brackets, handtight only.

(g) Install bolts, threads lubricated with Engine Oil P03−001, on the tube (LP01) which attaches to the diffuser case bracket.

(h) Torque all the clamp bolts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(i) Torque the bolts that hold the dampener or adapter to top of the main oil pump to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(j) Torque the bolts securing the tube (LP01) to the main oil filter housing to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(k) Torque the bolts that hold the tube (LP01) to the dampener or adapter to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(l) Torque the bolts securing the tube (LP01) to the diffuser case bracket to 65 − 75 lb−in. (7.344 − 8.474 N.m).

(8) (Post SB PW4ENG 79−75) Install the loop clamp bracket assembly on the fluid pressure dampener or adapter as follows. See Figure 403.

(a) Attach the bracket assembly to the dampener or adapter with bolts and nuts to a handtight condition only.

(b) Torque the bolts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(9) (Pre SB PW4ENG 79−75) Install the (front) No. 4 bearing scavenge tube assembly (LR05) as follows.

(a) Remove the protective closures and install the packing lubricated with Engine Oil P03-001, to the groove at the flanged end of tube. Lubricate the
R threads on the tube coupling with Antiseize Paste
R P06-054. Wipe off unwanted paste.

(b) Install the tube to the oil pump port with bolts,
R threads lubricated with Antiseize Paste P06-054,
R handtight only. Wipe off unwanted paste.

(c) Install the four (clip-on) loop clamp grommet halves to the main filter oil tube (LP01) at the two clamp locations.

(d) Install the four (clip-on) loop clamp grommet halves to the (LR05) tube at the two clamp locations adjacent to the (LP01) tube grommet halves.

(e) Install the two clamps, bolts, lubricated with Engine Oil P03-001, and nuts that attach the tube to the main oil filter tube at the two locations.

(f) Install the clamp, bolt, threads lubricated with Engine Oil P03-001, and nut to attach the tube to the bracket attached to the main oil pump and the No. 3 bearing oil scavenge manifold.

(g) Install the two (clip-on) loop clamps grommet halves to the (LR05) tube and two to the (LR04) tube adjacent to the oil pump. Install the clamps, bolts, lubricated with Engine Oil P03-001, and nut.

(h) Torque all the clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(i) Torque the bolts that attach the tube to the pump to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(10) (Post SB PW4ENG 79-75) Install (front) No. 4 bearing oil scavenge tube assembly (LR05) as follows. See Figure 404.

(a) Remove protective closures and install packing lubricated with Engine Oil P03-001, to flanged end of tube.

R R (b) Lubricate threads on tube nut with Antiseize Paste P06-054, wipe off unwanted paste, and install tube to rear scavenge tube at Flange M and to port on main oil pump with bolts, threads lubricated with R R Antiseize Paste P06-054, handtight only. Wipe off unwanted paste.

(c) Install the loop clamp bracket on the TCC manifold bridge bracket and secure with the clamp bolts, lubricated with Engine Oil P03-001, and nuts. Torque the clamp bolts to 32 - 36 lb-in. (3.616 - 4.067 N.m).

(d) Torque bolts securing tube flange to main oil pump to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(e) Torque tube nut to 475 - 525 lb-in. (53.668 - 59.317 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(f) Attach the hose and tube assembly to the loop clamp bracket on the TCC manifold bridge bracket and the loop clamp bracket assembly on the fluid pressure dampener or adapter with clamps and bolts, lubricated with Engine Oil P03-001. Torque the bolts to 27 - 30 lb-in. (3.051 - 3.390 N.m).

(11) (Pre SB PW4ENG 79-76) Install the (rear) EEC PT4.95 tube assembly (AS02) as follows.

CAUTION: DO NOT APPLY LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF EEC CAN RESULT.

(a) Remove protective closures from the tube fittings.

(b) Install the tube nut to the tube coupling at approximately the 7 o'clock position and rearward of Flange P.

(c) Attach the tube nut to the tube coupling at approximately the 8 o'clock position and rearward of Flange N.

(d) Install the clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts to attach the tube to the Flanges N and P brackets. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque the tube nuts (both ends) to 270 - 300 lb-in.(30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(12) (Pre SB PW4ENG 79-76) Install (rear) No. 3 bearing oil vent tube assembly (LD02) as follows.

(a) Remove the protective closures and install the tube, threads on each end lubricated with
R Antiseize Paste P06-054, wipe off unwanted
R paste, to the adapter on the exhaust case at approximately the 7 o'clock position, and to the tube nut forward of Flange N at approximately the 8 o'clock position, handtight only.

(b) Install the clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts to attach the tube to the Flanges N and P brackets, handtight only.

(c) Lubricate the threads of the bolt with Engine Oil P03-001. Attach the tube to the adjacent PT4.95 tube assembly (AS02) with clamps, bolt, and nut at approximately the 7:30 o'clock position and rearward of Flange P.

(d) Install clamps, bolt, threads lubricated with Engine Oil P03-001, and nut to attach the tube to the adjacent PT4.95 tube assembly (AS02) between Flanges N and P. Torque all the clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque the tube nuts (both ends) to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(13) (Post SB PW4ENG 79-76) Install the (rear) EEC PT4.95 tube assembly (AS02) and the (rear) No. 3 bearing oil vent tube assembly (LD02) as follows. See Figure 405.

(a) Attach the (LD02) tube to the (LD01) and the turbine exhaust case, handtight only. See Figure 405 (Sheet 1).

(b) Attach the (AS02) tube to the (AS03) and (AS27) tubes, handtight only. See Figure 405 (Sheet 1).

(c) Install bolt to attach the (AS02) tube to the bracket handtight only. See Figure 405 (Sheet 2), View G.

(d) Install the clamp on the (LD02) tube and the clamp on the (LP48) tube and secure with nut and bolt, handtight only. See Figure 405 (Sheet 2), View L.

(e) Install the clamp on the (AS02) and (LD02) tubes and secure with a bolt, handtight only. See Figure 405 (Sheet 3), View H.

(f) Install clamp on the (AS02) and (LD02) tubes and secure with nut and bolt, handtight only. See Figure 405 (Sheet 3), View I.

(g) Install clamps on the (AS02) and (LD02) tubes and secure with nut and bolt, handtight only. See Figure 405 (Sheet 3), View J.

(h) Install clamp on (AS27) and (LD02) tubes and secure with nut and bolt, handtight only. See Figure 405 (Sheet 3), View K.

(i) Torque the (AS02) tube to the (AS03) tube and the (AS27) tube to 200 − 225 lb−in. (22.497 − 25.422 N.m).

(j) Torque the (LD02) tube to the internal tube and the (LD01) tube to 200 − 225 lb−in. (22.497 − 25.422 N.m).

(k) Torque all clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(14) (Pre SB PW4ENG 79−75) Install the (rear) No. 4 bearing scavenge tube assembly (LR06) as follows. See Figure 404.

(a) Remove the protective closures and attach the tube, elbow and nut threads lubricated with
R Antiseize Paste P06−054, wipe off unwanted
R paste, to the exhaust case internal tube nut at approximately the 10 o'clock position, and to the tube coupling forward of Flange M at approximately the 7 o'clock position, handtight only.

(b) Install the clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts to attach the tube to the Flanges N and P brackets. Torque the clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Torque the tube nut at the exhaust case connection to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(d) Torque the tube nut at the Flange N connection to 475 - 525 lb-in. (53.668 - 59.317 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(e) (Reference 2151) Install the spray shield to the inboard side of the Flange N connection and attach the forward end of the shield with a hose clamp. Torque the hose clamp to 15 - 18 lb-in. (1.695 - 2.034 N.m).

(f) Install a clamp to the rear end of the shield and the Flange M bracket with a bolt, threads lubricated with Engine Oil P03-001, and nut. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(15) (Post SB PW4ENG 79-75 and Pre SB PW4ENG 79-76 only) Install (rear) No. 4 bearing scavenge tube assembly (LR06) as follows. See Figure 404.

(a) Install rear scavenge tube, elbow and nut threads
R lubricated with Antiseize Paste P06-054, wipe off
R unwanted paste, to the exhaust case internal tube
nut at approximately 10 o'clock position, and to the tube (LR05) coupling forward of Flange M at approximately 7 o'clock position, handtight only.

(b) Install loop clamp bracket on Flange M bracket at approximately 7 o'clock with bolts lubricated with Engine Oil P03-001, handtight only. Torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Secure tube to loop clamp bracket on Flange M bracket with one clamp and bolt, lubricated with Engine Oil P03-001, handtight only. Torque clamp bolt to 27 - 30 lb-in. (4.067 - 4.519 N.m).

(d) Install clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts securing tube to Flanges N and P brackets. Torque clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque tube nut at exhaust case connection to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install theLockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(f) Torque tube nut at Flange N connection to 475 − 525 lb−in. (53.668 − 59.317 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(g) Position tube shield to inboard side of Flange M connection and secure forward end of shield with hose clamp. Torque hose clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(16) (Post SB PW4ENG 79−76) Install (rear) No. 4 bearing scavenge tube assemblies (LR21) and (LR22) which replace (LR06) as follows.

(a) Attach the (LR21) tube to the (LR05) tube handtight only. See Figure 405 (Sheet 4), View DE.

(b) Install clamps and secure with nuts and bolts, handtight only. See Figure 405 (Sheet 5), Views O and Q and (Sheet 6), Views F and R.

(c) Attach the (LR22) tube to the (LR21) tube and the port for the internal tube on the turbine exhaust case, handtight only. Lubricate the threads that are on the internal tube with Engine Oil P03−001. See Figure 405 (Sheet 7), Views E and AP.

(d) Install clamps on the (LR22) tube and secure with bolts, handtight only. See Figure 405 (Sheet 8), Views A, B, C and D.

(e) Torque the (LR21) tube to the (LR05) tube to 475 − 525 lb−in. (56.668 − 59.317 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

R
R

(f) Torque the (LR21) tube to the (LR22) tube to 475 − 525 lb−in. (56.668 − 59.317 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(g) Torque the internal tube nut to the (LR22) tube to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(17) (Post SB PW4ENG 79−76) Install the shields for the No. 4 bearing oil scavenge lines as follows.

(a) Install shield at the (LR05) tube to the (LR21) tube connection. Secure shield with clamp or bolt as applicable. See Figure 405 (Sheet 4), View DE.

(b) Install shield at the (LR21) tube to the (LR22) tube connection. Secure shield with clamp or bolt as applicable. See Figure 405 (Sheet 7), View E.

(c) Torque the clamps to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(d) Torque the nut and bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(18) Install the No. 4 bearing oil pressure housing and strainer as follows.

(a) Remove the protective closures. Install a packing, lubricated with Engine Oil P03−001, to the groove in the strainer. Lubricate the threads with Engine Oil P03−001, and install the strainer to the strainer housing, handtight only.

(b) Install the strainer housing, threads lubricated with Engine Oil P03−001, to the exhaust case internal tube nut at approximately the 10:30 o'clock position, handtight only.

(19) (Pre SB PW4ENG 79−76) Install (rear) No. 4 bearing oil pressure tube assembly (LP16) as follows.

(a) Remove the protective closures. Install the tube, threads lubricated with Engine Oil P03−001, at both ends, to the last chance strainer housing on the exhaust case, and to the tube nut forward of Flange M at approximately the 10 o'clock position, handtight only.

(b) Install clamps, bolts, threads lubricated with Engine Oil P03−001, spacer, and nuts to attach the tube to the brackets at Flanges M, N, P and to the adjacent scavenge tube. Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Torque the tube nuts at both ends of the tube to 450 − 500 lb−in. (50.843 − 56.492 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the tube nuts.

(d) Torque the exhaust case internal tube nut to the last chance strainer to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the tube nut.

(e) Torque the strainer element to 150 − 170 lb−in. (16.948 − 19.207 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(f) (Reference 2151) Install the spray shield to the inboard side of the pressure tube connection forward of Flange M. Attach the forward end of the shield to the bracket on the diffuser case with a clamp and bolt, threads lubricated with Engine Oil P03−001. Torque the clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). Attach the rear of the spray shield with a hose clamp. Torque the clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(20) (Post SB PW4ENG 79−76) Install (rear) No. 4 bearing oil pressure tube assemblies (LP47) and (LP48) which replace (LP16) as follows. Also install the No. 4 bearing strainer element as follows.

(a) Attach the coupling nut on the (LP15) tube to the (LP47) tube, handtight only. See Figure 405 (Sheet 9), View LA.

(b) Install clamps and secure with bolts. See Figure 405 (Sheet 9), Views U, T and S.

(c) Install packing, lubricated with Engine Oil P03−001 to the groove in the No. 4 bearing strainer element. See Figure 405 (Sheet 10), View G.

(d) Install the No. 4 bearing strainer element into the No. 4 bearing strainer element housing, handtight only. Lubricate threads with Engine Oil P03−001. See Figure 405 (Sheet 10), View G.

(e) Install the element housing, lubricated with Engine Oil P03−001, on to the tube nut at approximately the 7 o'clock position, handtight only. See Figure 405 (Sheet 10), View G.

(f) Attach the (LP48) tube to the strainer housing and the (LP47) tube, handtight only. See Figure 405 (Sheet 10), Views G and CA.

(g) Install clamps and secure with bolts and nuts as necessary. See Figure 405 (Sheet 11), Views M, N, B1 and P and (Sheet 12), Views R and F.

(h) Torque the strainer to the strainer housing to 150 − 170 lb−in. (16.948 − 19.207 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(i) Torque the internal tube nut to the strainer housing to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(j) Torque the (LP48) tube to the strainer housing to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(k) Torque the (LP48) tube to the (LP47) tube to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(l) Torque the (LP15) tube to the (LP47) tube to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(m) Torque all the installed clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

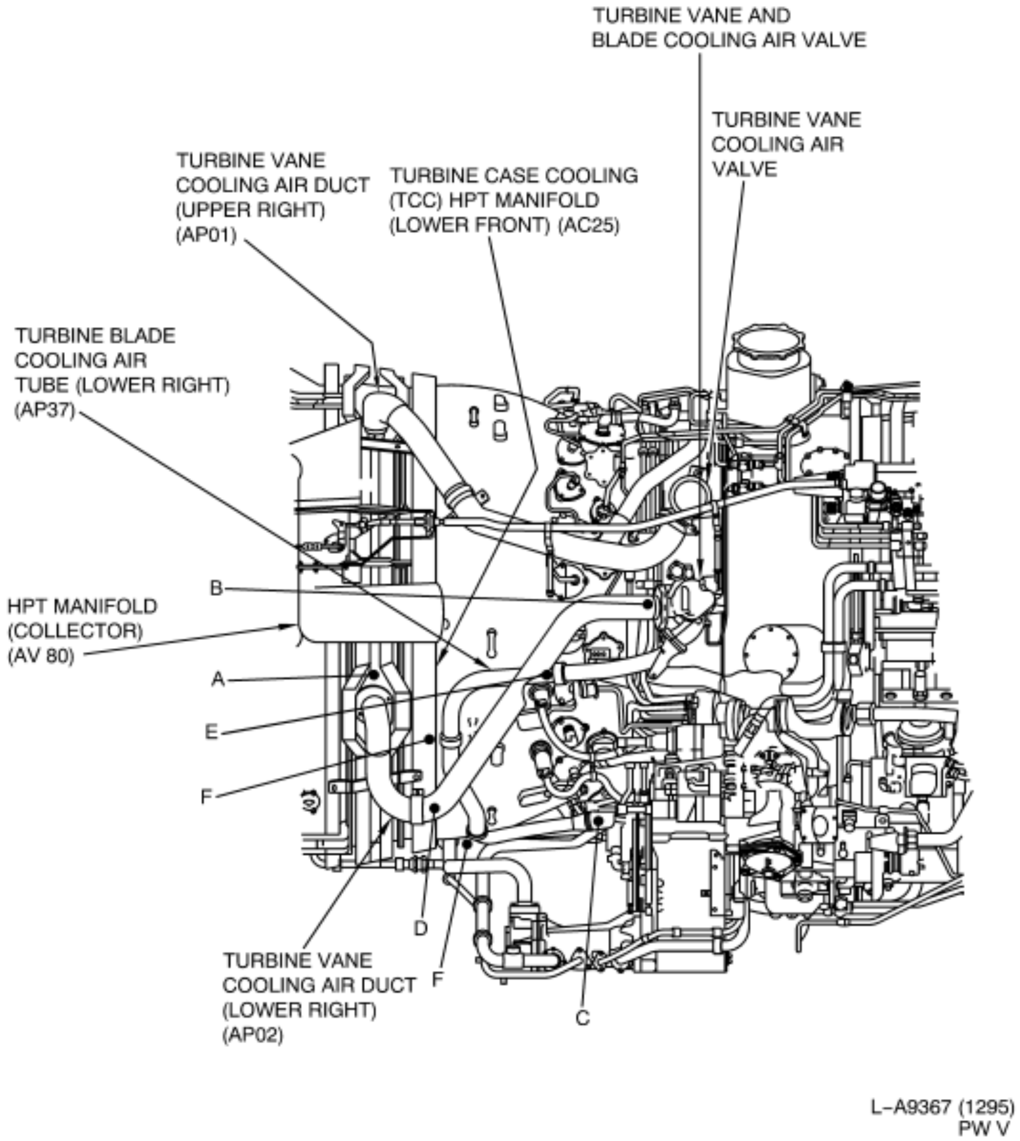
(21) (Post SB PW4ENG 79−76) Install the shields for the No. 4 bearing oil pressure lines as follows.

(a) Install shield at the (LP47) tube to the (LP15) tube connection. Secure shield with clamps. See Figure 405 (Sheet 9), View LA.

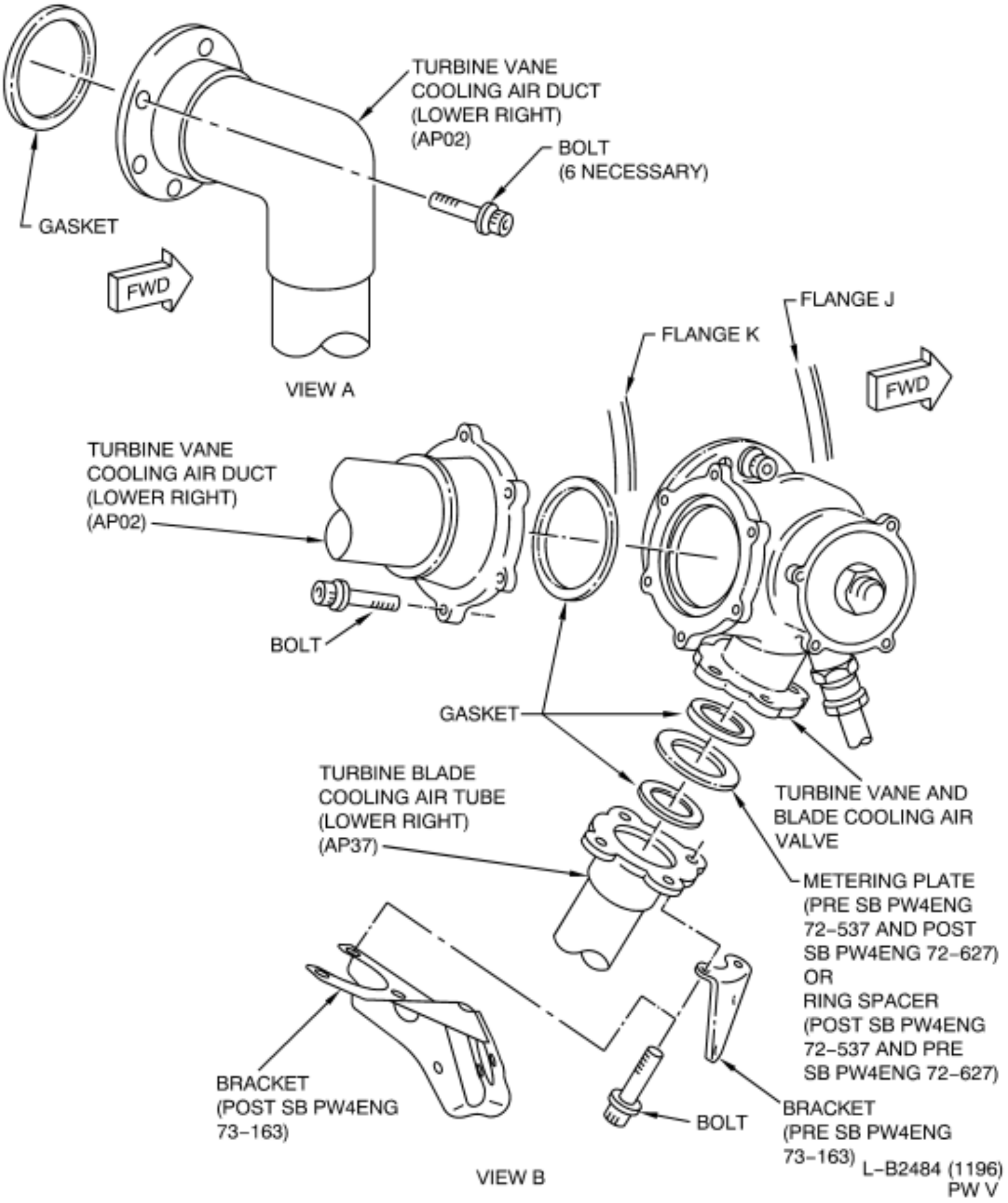
(b) Install shield at the (LP47) tube to the (LP48) tube connection. Secure shield with clamps. See Figure 405 (Sheet 10), View CA.

(c) Install shield at the (LP48) tube to the strainer housing connection. Secure shield with clamps. See Figure 405 (Sheet 10), View G.

(d) Torque all clamps to 15 − 18 lb−in. (1.695 − 2.034 N.m).

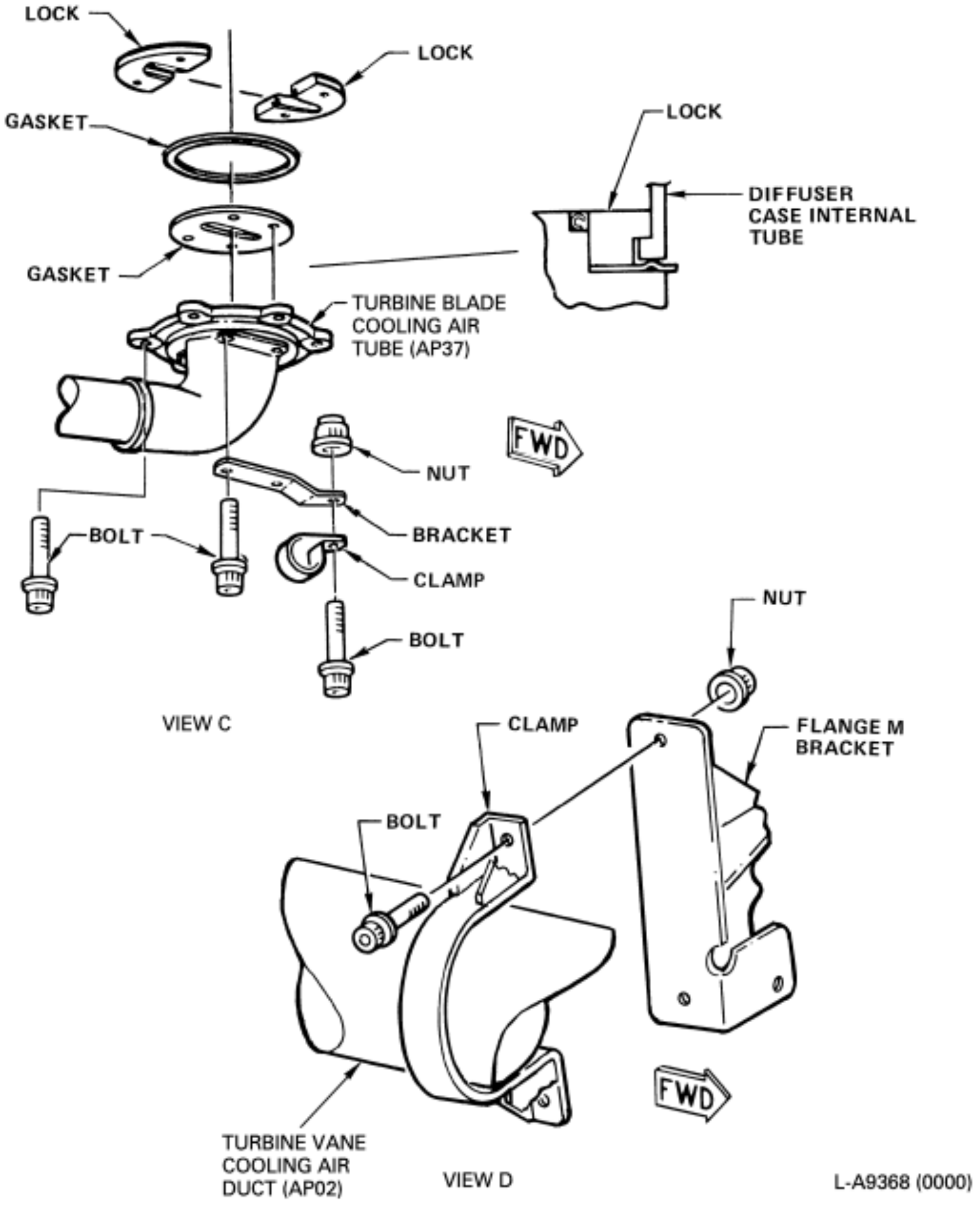

TURBINE VANE AND BLADE COOLING AIR VALVE
TURBINE VANE COOLING AIR VALVE
TURBINE VANE COOLING AIR DUCT (UPPER RIGHT) (AP01)
TURBINE CASE COOLING (TCC) HPT MANIFOLD (LOWER FRONT) (AC25)
TURBINE BLADE COOLING AIR TUBE (LOWER RIGHT) (AP37)
B
HPT MANIFOLD (COLLECTOR) (AV 80)
A
E
F
D
TURBINE VANE COOLING AIR DUCT (LOWER RIGHT) (AP02)
F
C
L−A9367 (1295)
PW V

High Pressure Turbine Cooling Air Manifolds
Figure 401 (Sheet 1)
(Task 72−00−54−420−004)

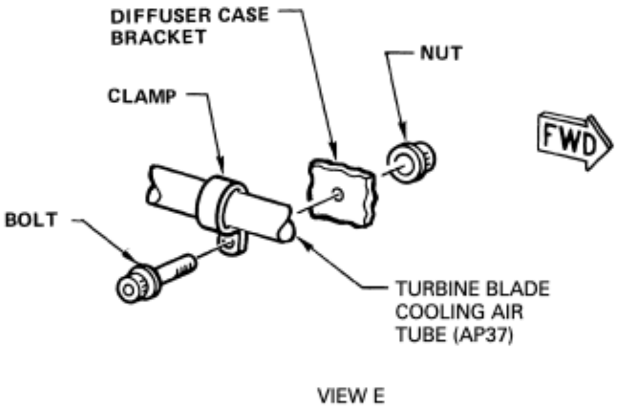

TURBINE VANE
COOLING AIR DUCT
(LOWER RIGHT)
(AP02)
BOLT
(6 NECESSARY)
GASKET
FWD
VIEW A
FLANGE J
FLANGE K
FWD
TURBINE VANE
COOLING AIR DUCT
(LOWER RIGHT)
(AP02)
BOLT
GASKET
TURBINE BLADE
COOLING AIR TUBE
(LOWER RIGHT)
(AP37)
TURBINE VANE AND
BLADE COOLING AIR
VALVE
METERING PLATE
(PRE SB PW4ENG
72−537 AND POST
SB PW4ENG 72−627)
OR
RING SPACER
(POST SB PW4ENG
72−537 AND PRE
SB PW4ENG 72−627)
BRACKET
(POST SB PW4ENG
73−163)
BOLT
BRACKET
(PRE SB PW4ENG
73−163)
VIEW B
L−B2484 (1196)
PW V

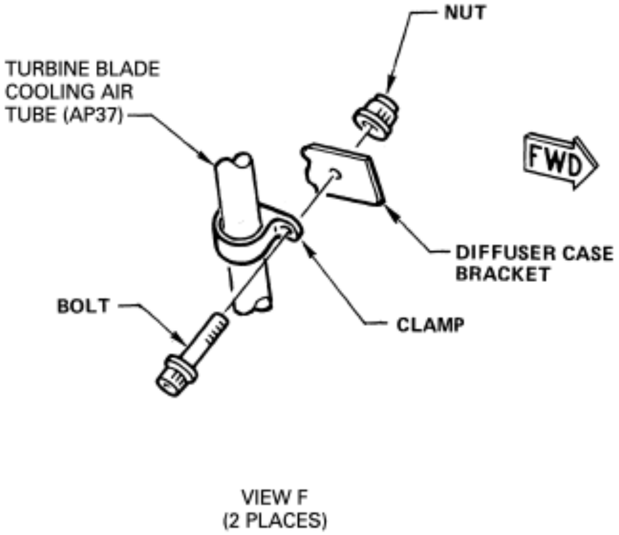
High Pressure Turbine Cooling Air Manifolds
Figure 401 (Sheet 2)
(Task 72−00−54−420−004)

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−02


LOCK
LOCK
GASKET
LOCK
DIFFUSER CASE INTERNAL TUBE
GASKET
TURBINE BLADE COOLING AIR TUBE (AP37)
FWD
NUT
BOLT
BRACKET
CLAMP
BOLT
NUT
VIEW C
CLAMP
FLANGE M BRACKET
BOLT
FWD
TURBINE VANE COOLING AIR DUCT (AP02)
VIEW D
L-A9368 (0000)

High Pressure Turbine Cooling Air Manifolds
Figure 401 (Sheet 3)
(Task 72−00−54−420−004)

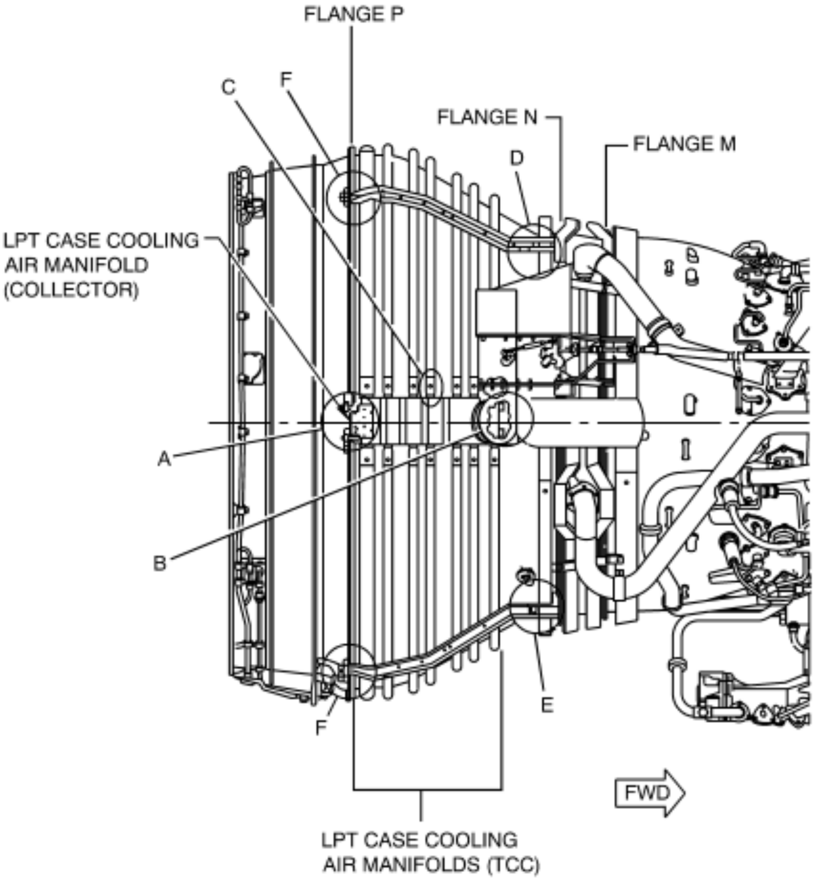

DIFFUSER CASE BRACKET
NUT
CLAMP
FWD
BOLT
TURBINE BLADE COOLING AIR TUBE (AP37)
VIEW E


NUT
TURBINE BLADE COOLING AIR TUBE (AP37)
FWD
DIFFUSER CASE BRACKET
BOLT
CLAMP
VIEW F
(2 PLACES)

L-A9369 (0000)

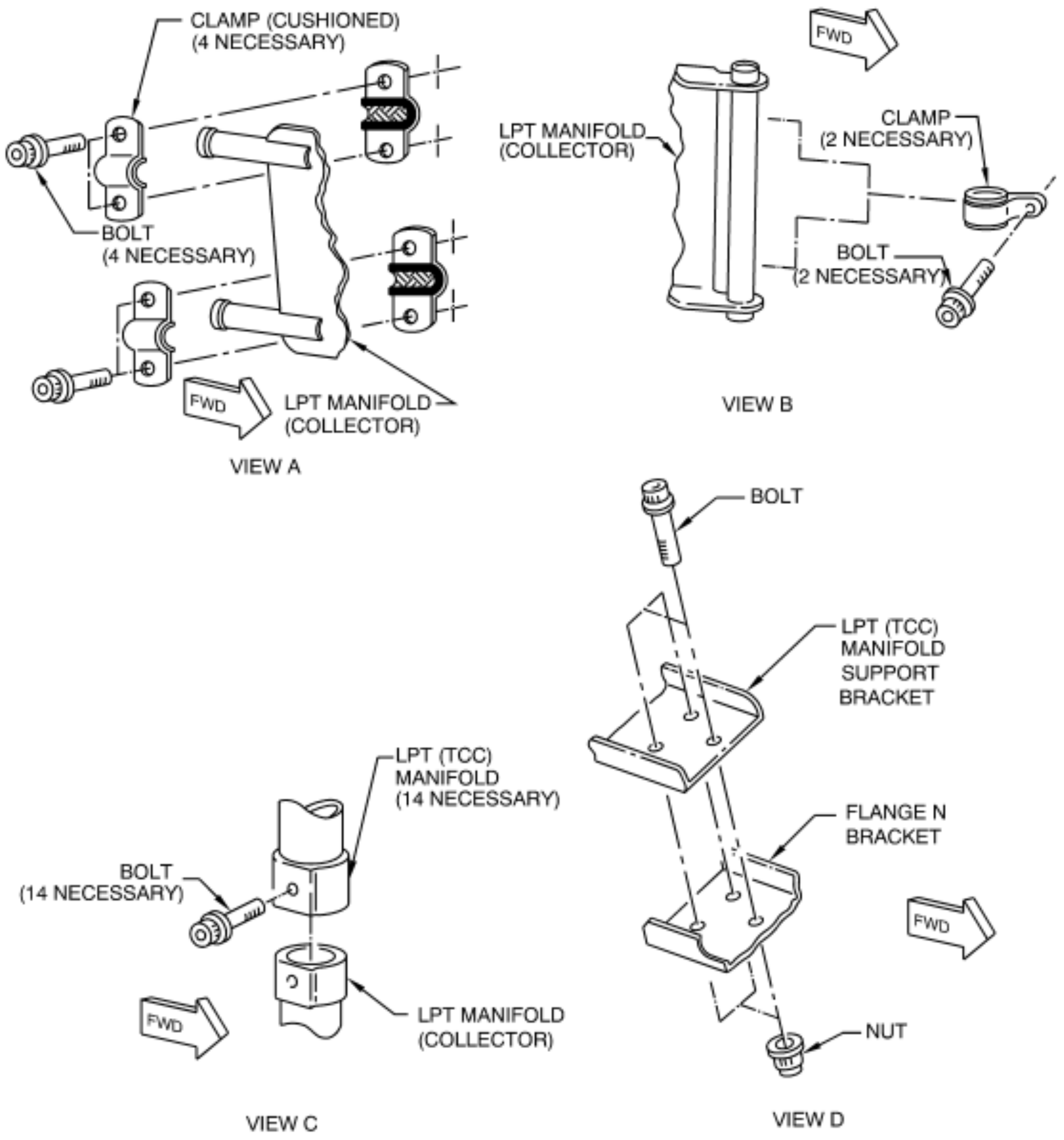
High Pressure Turbine Cooling Air Manifolds
Figure 401 (Sheet 4)
(Task 72−00−54−420−004)

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−02


FLANGE P
C
F
FLANGE N
FLANGE M
D
LPT CASE COOLING AIR MANIFOLD (COLLECTOR)
A
B
E
F
FWD
LPT CASE COOLING AIR MANIFOLDS (TCC)

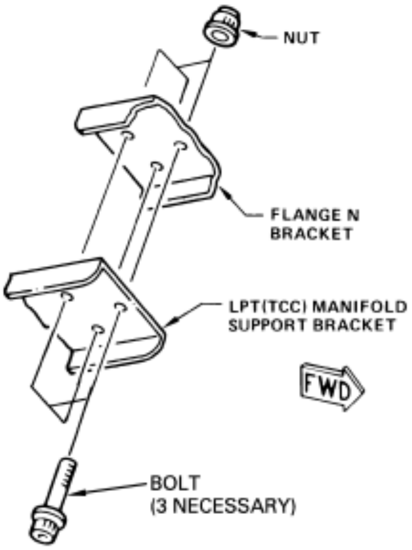
L−A9351 (0000)
PW V

Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 402 (Sheet 1)
(Task 72−00−54−420−004)

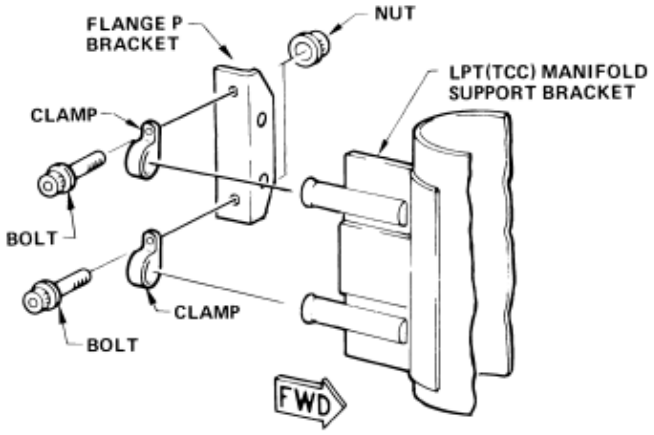

CLAMP (CUSHIONED)
(4 NECESSARY)
BOLT
(4 NECESSARY)
FWD
LPT MANIFOLD
(COLLECTOR)
VIEW A
FWD
LPT MANIFOLD
(COLLECTOR)
CLAMP
(2 NECESSARY)
BOLT
(2 NECESSARY)
VIEW B
BOLT
LPT (TCC)
MANIFOLD
SUPPORT
BRACKET
FLANGE N
BRACKET
FWD
NUT
VIEW D
LPT (TCC)
MANIFOLD
(14 NECESSARY)
BOLT
(14 NECESSARY)
FWD
LPT MANIFOLD
(COLLECTOR)
VIEW C

L−A9352 (0000)
PW V

Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 402 (Sheet 2)
(Task 72−00−54−420−004)


NUT
FLANGE N BRACKET
LPT(TCC) MANIFOLD SUPPORT BRACKET
FWD
BOLT (3 NECESSARY)

VIEW E

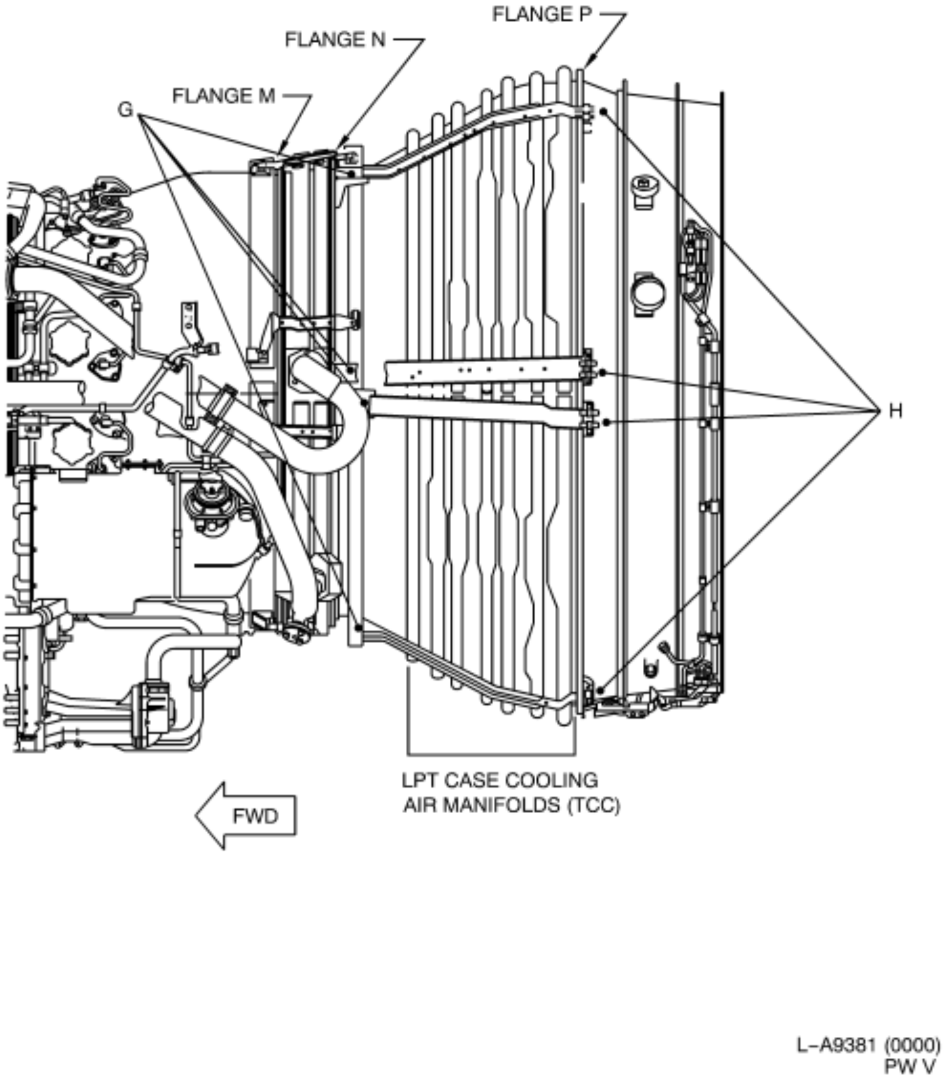

FLANGE P BRACKET
NUT
LPT(TCC) MANIFOLD SUPPORT BRACKET
CLAMP
BOLT
CLAMP
BOLT
FWD

VIEW F
(TYPICAL 2 PLACES)

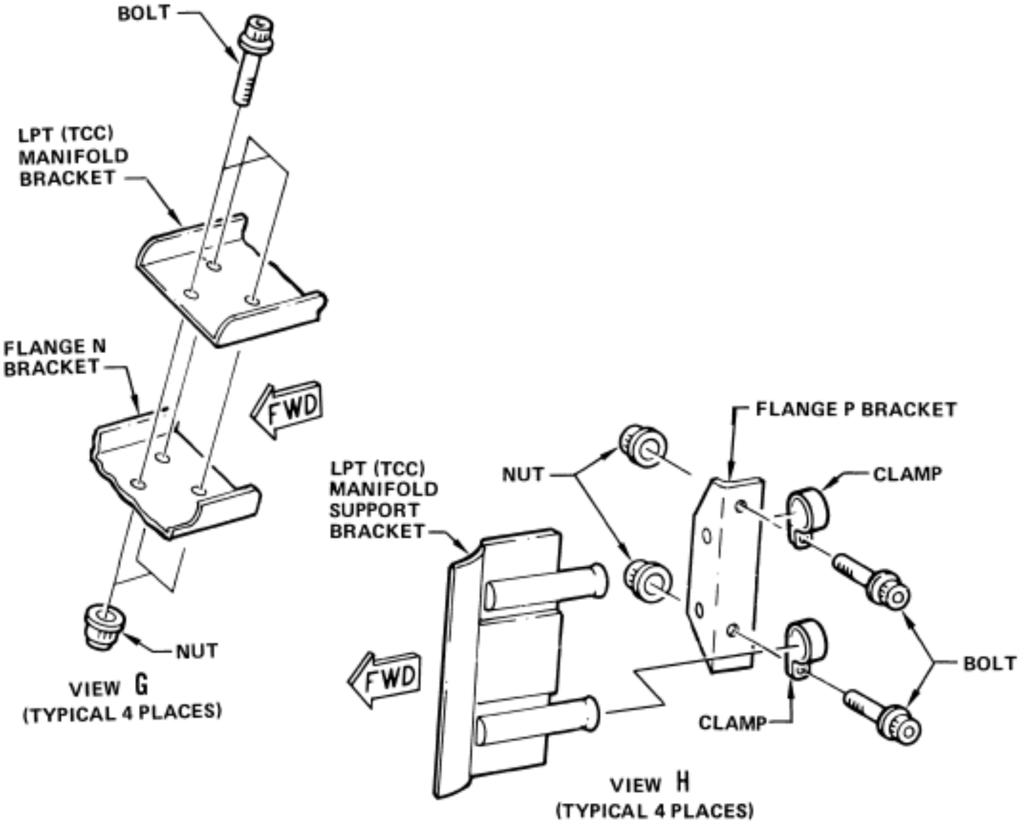
L-A9353 (0000)

Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 402 (Sheet 3)
(Task 72−00−54−420−004)

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−02


FLANGE P
FLANGE N
FLANGE M
G
H
LPT CASE COOLING
AIR MANIFOLDS (TCC)
FWD
L−A9381 (0000)
PW V

Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 402 (Sheet 4)
(Task 72−00−54−420−004)

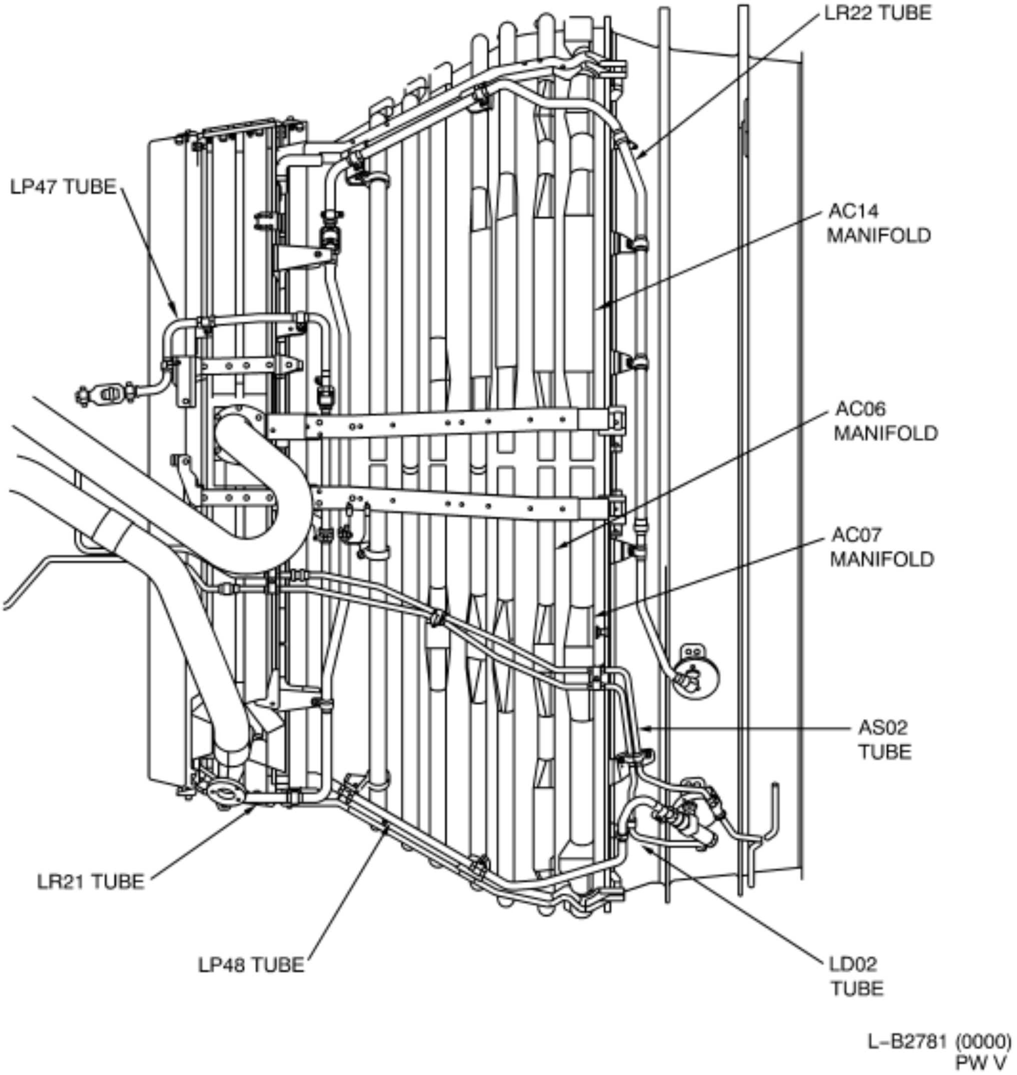

BOLT
LPT (TCC) MANIFOLD BRACKET
FLANGE N BRACKET
FWD
NUT
LPT (TCC) MANIFOLD SUPPORT BRACKET
NUT
FLANGE P BRACKET
CLAMP
BOLT
CLAMP
FWD

VIEW G
(TYPICAL 4 PLACES)

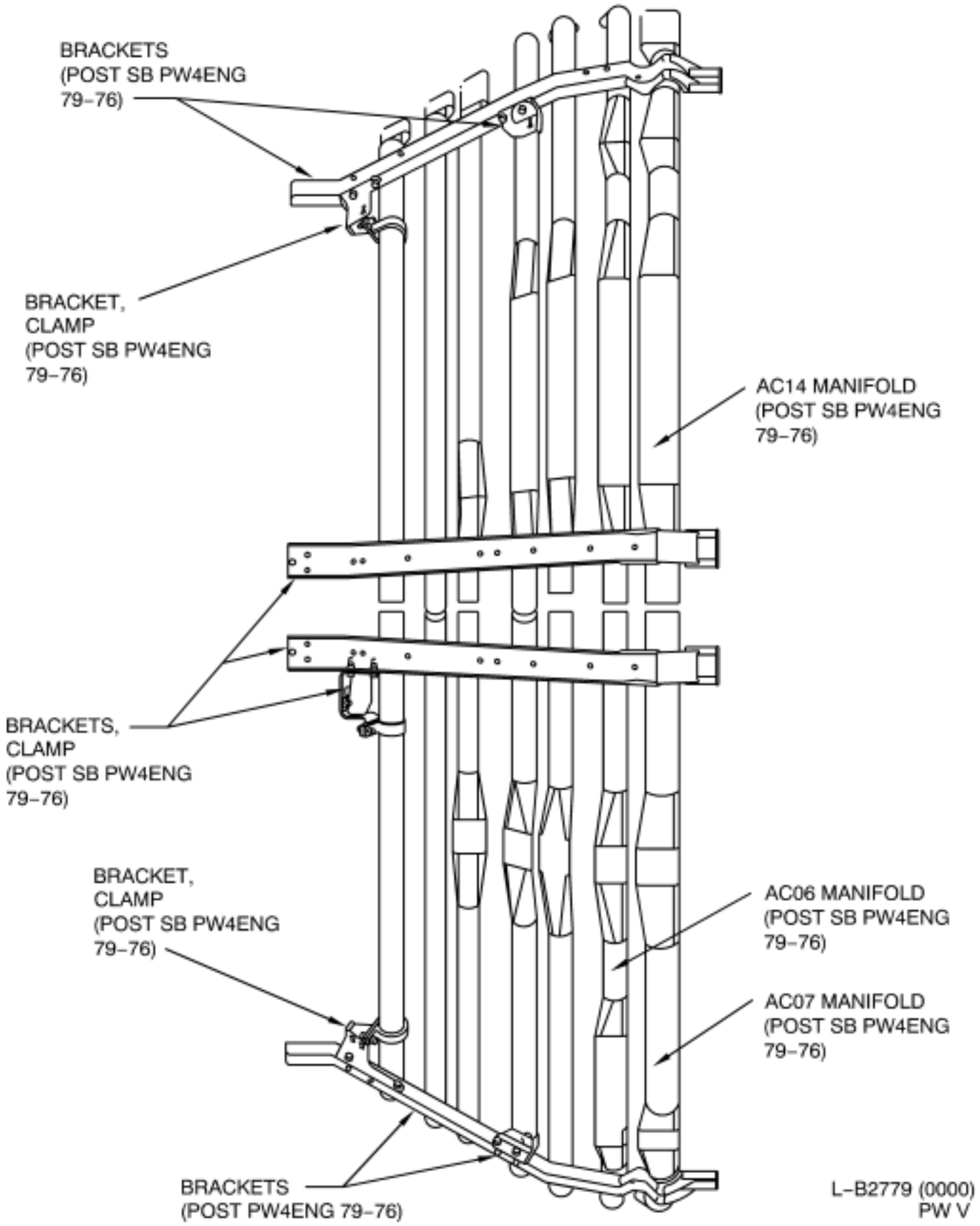
VIEW H
(TYPICAL 4 PLACES)

L-A9355 (0000)

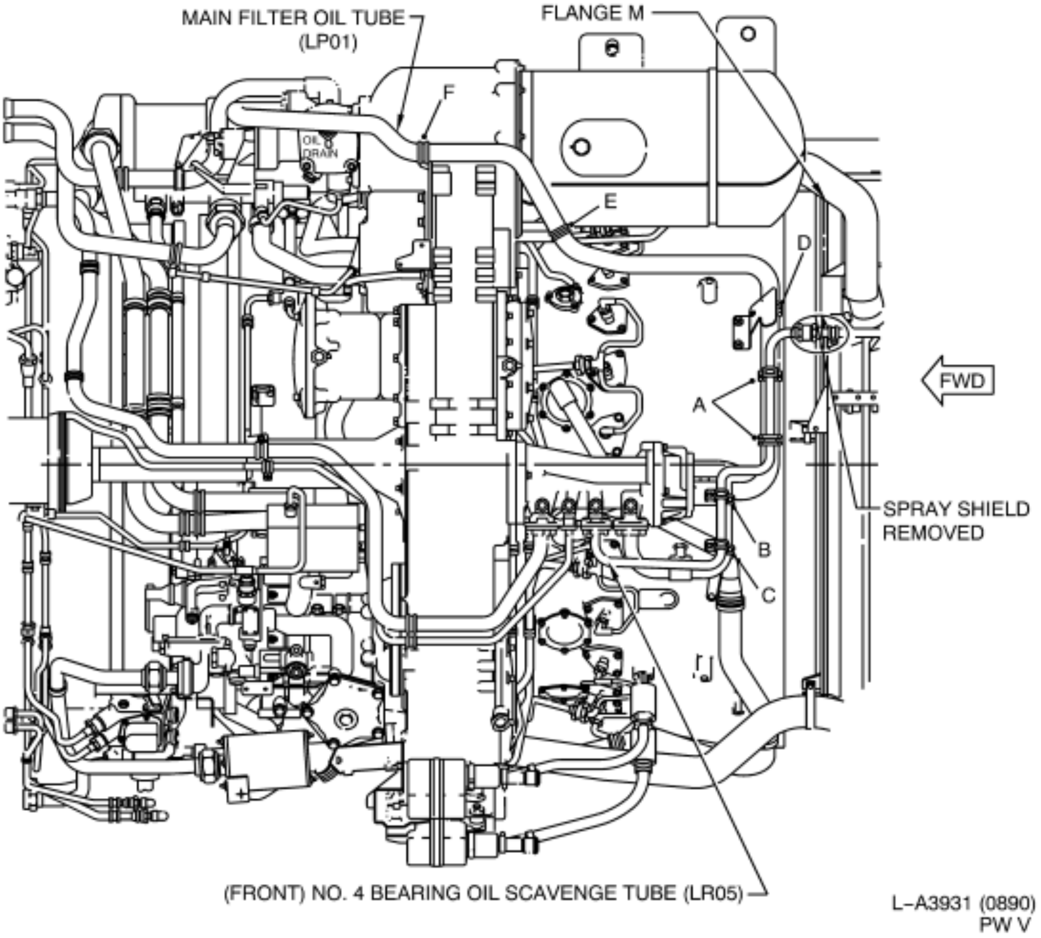
Low Pressure Turbine Cooling Air (TCC) Manifolds
Figure 402 (Sheet 5)
(Task 72−00−54−420−004)


LR22 TUBE
LP47 TUBE
AC14 MANIFOLD
AC06 MANIFOLD
AC07 MANIFOLD
AS02 TUBE
LR21 TUBE
LP48 TUBE
LD02 TUBE
L-B2781 (0000)
PW V

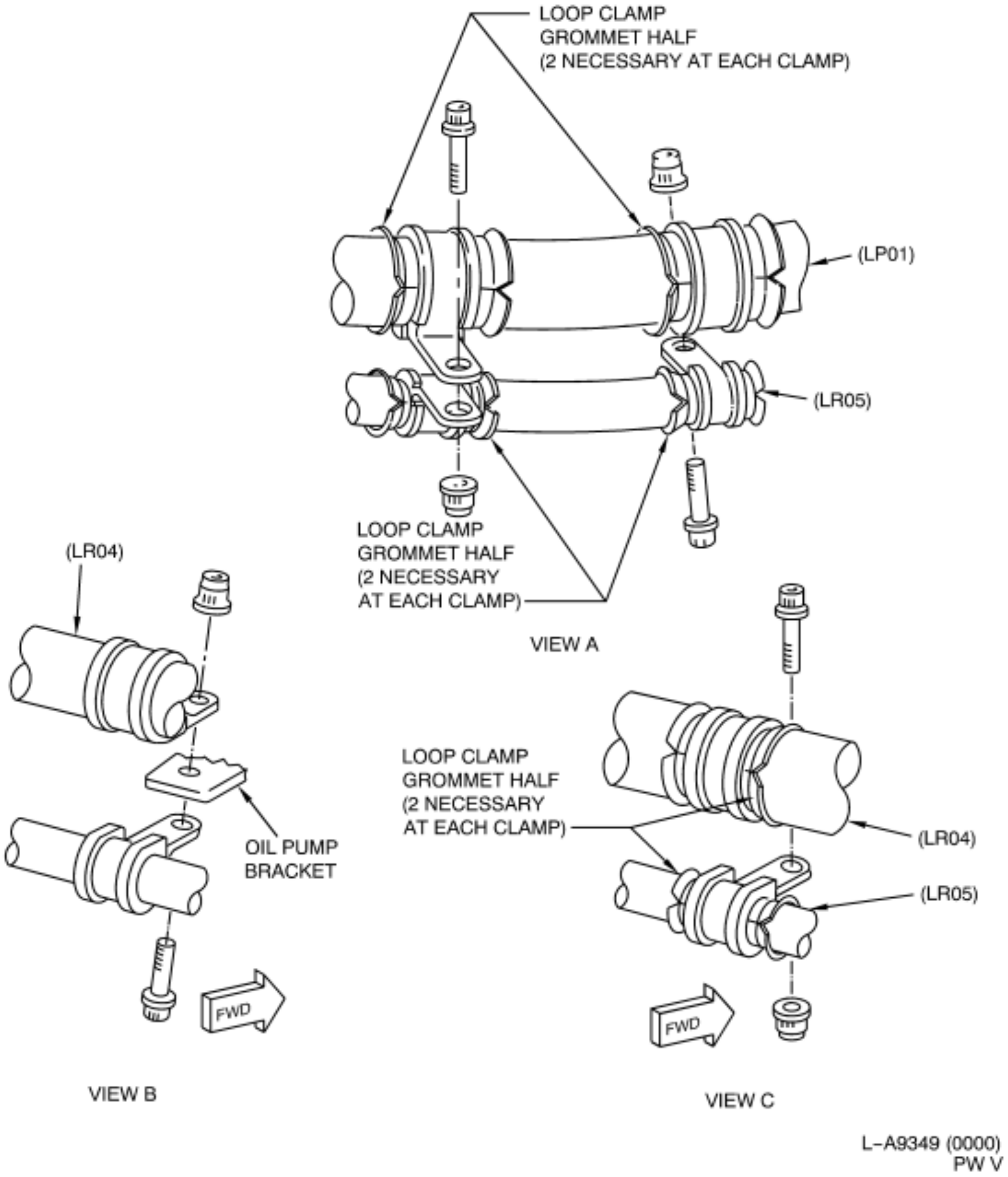
LPT Turbine Case Cooling Manifolds Clipping (Post SB PW4ENG 79-76)
Figure 402 (Sheet 6)
(Task 72-00-54-420-004)


BRACKETS
(POST SB PW4ENG
79-76)
BRACKET,
CLAMP
(POST SB PW4ENG
79-76)
AC14 MANIFOLD
(POST SB PW4ENG
79-76)
BRACKETS,
CLAMP
(POST SB PW4ENG
79-76)
BRACKET,
CLAMP
(POST SB PW4ENG
79-76)
AC06 MANIFOLD
(POST SB PW4ENG
79-76)
AC07 MANIFOLD
(POST SB PW4ENG
79-76)
BRACKETS
(POST PW4ENG 79-76)
L-B2779 (0000)
PW V

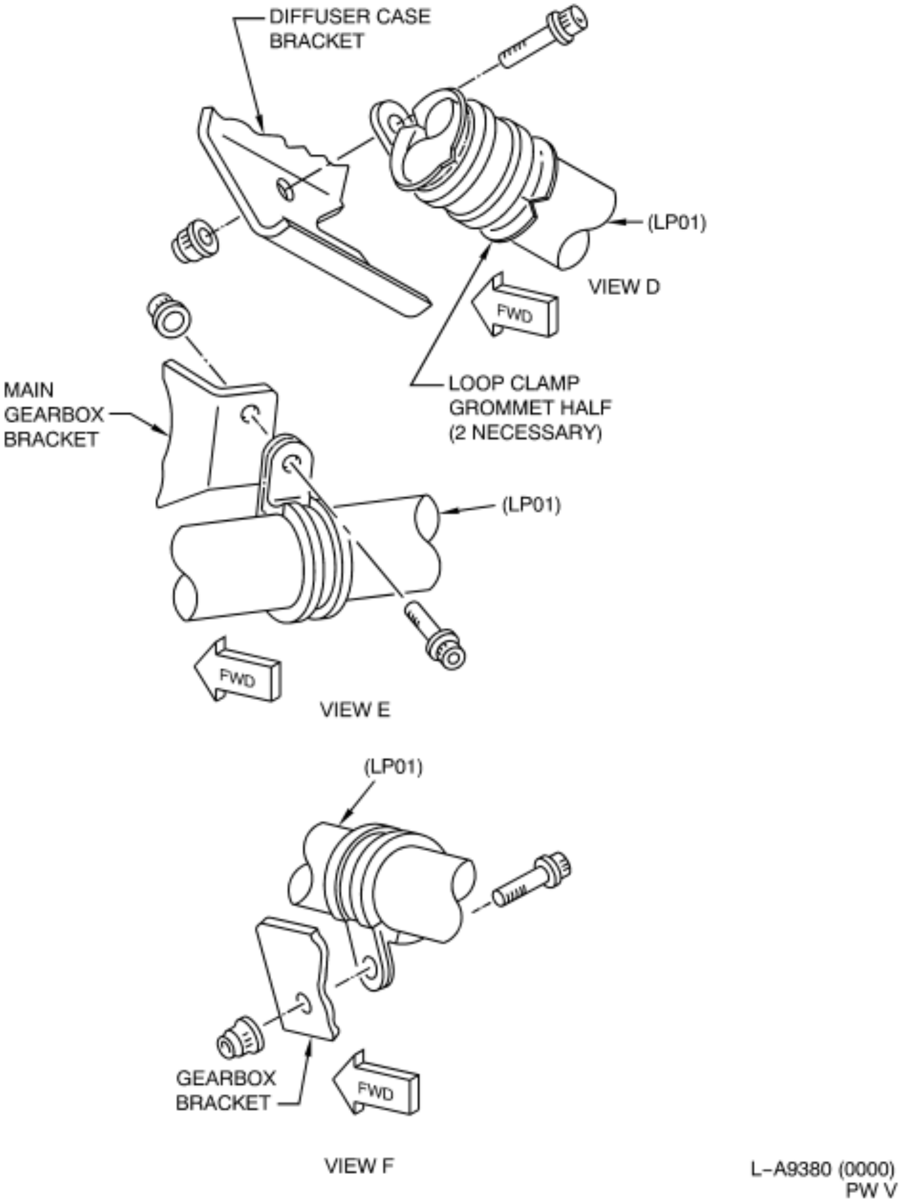
LPT Turbine Case Cooling Manifolds Clipping (Post SB PW4ENG 79-76)
Figure 402 (Sheet 7)
(Task 72-00-54-420-004)


MAIN FILTER OIL TUBE
(LP01)
FLANGE M
F
OIL
DRAIN
E
D
FWD
A
SPRAY SHIELD
REMOVED
B
C
(FRONT) NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
L−A3931 (0890)
PW V

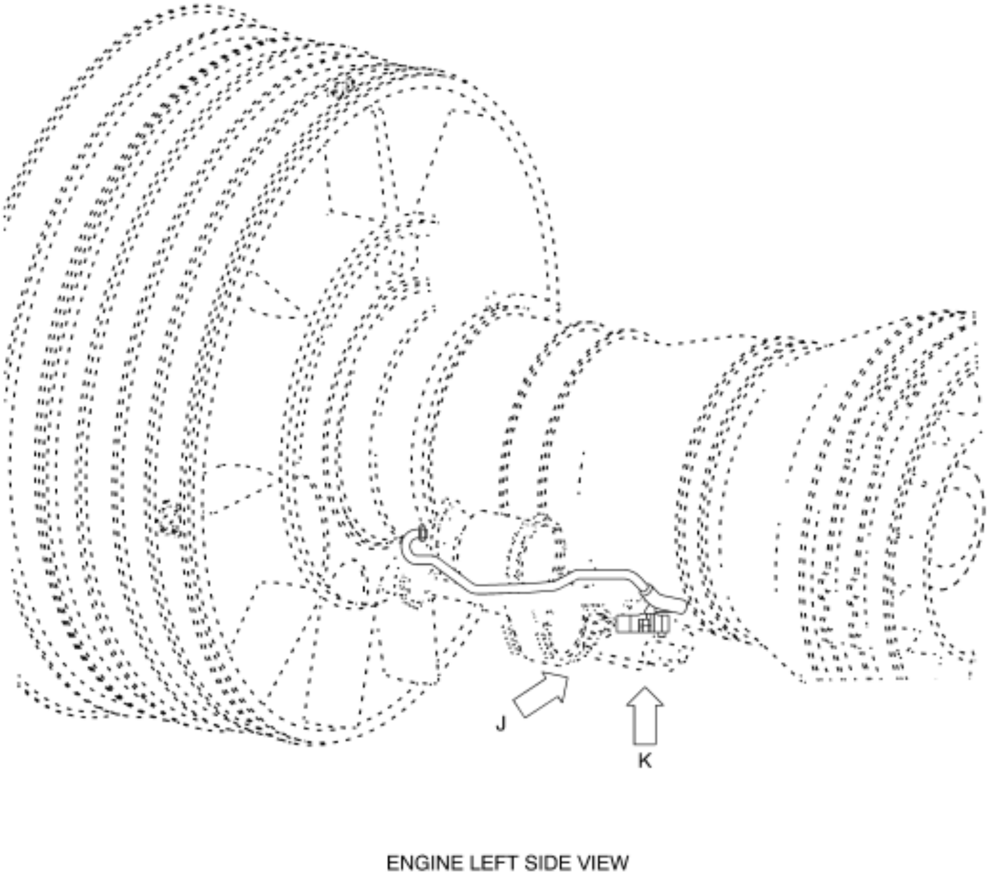
Bottom External Plumbing
Figure 403 (Sheet 1)
(Task 72−00−54−420−004)


LOOP CLAMP
GROMMET HALF
(2 NECESSARY AT EACH CLAMP)
(LP01)
(LR05)
LOOP CLAMP
GROMMET HALF
(2 NECESSARY
AT EACH CLAMP)
VIEW A
(LR04)
OIL PUMP
BRACKET
FWD
VIEW B
LOOP CLAMP
GROMMET HALF
(2 NECESSARY
AT EACH CLAMP)
(LR04)
(LR05)
FWD
VIEW C
L-A9349 (0000)
PW V

Bottom External Plumbing (Pre SB PW4ENG 79-75)
Figure 403 (Sheet 2)
(Task 72-00-54-420-004)

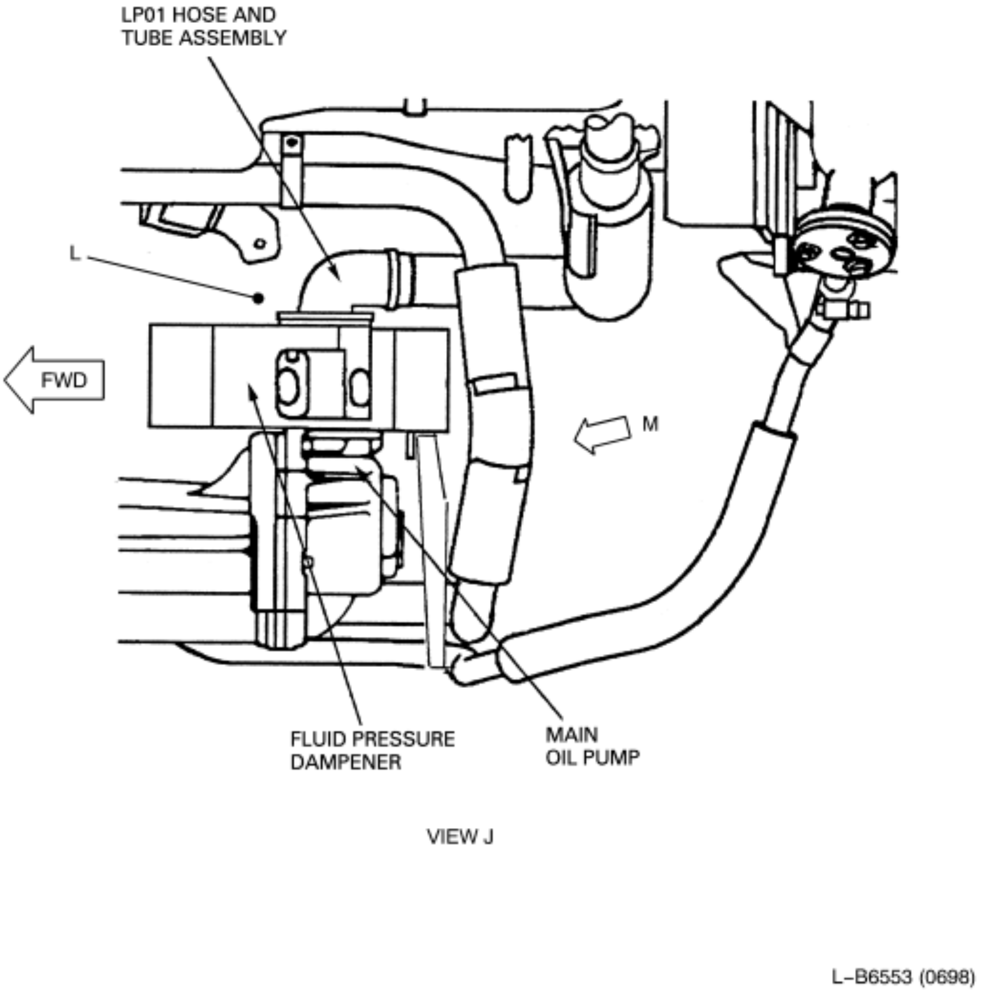

DIFFUSER CASE BRACKET
(LP01)
VIEW D
FWD
LOOP CLAMP GROMMET HALF (2 NECESSARY)
MAIN GEARBOX BRACKET
(LP01)
FWD
VIEW E
(LP01)
GEARBOX BRACKET
FWD
VIEW F
L-A9380 (0000)
PW V

Bottom External Plumbing (Pre SB PW4ENG 79-75)
Figure 403 (Sheet 3)
(Task 72-00-54-420-004)


J
K
ENGINE LEFT SIDE VIEW

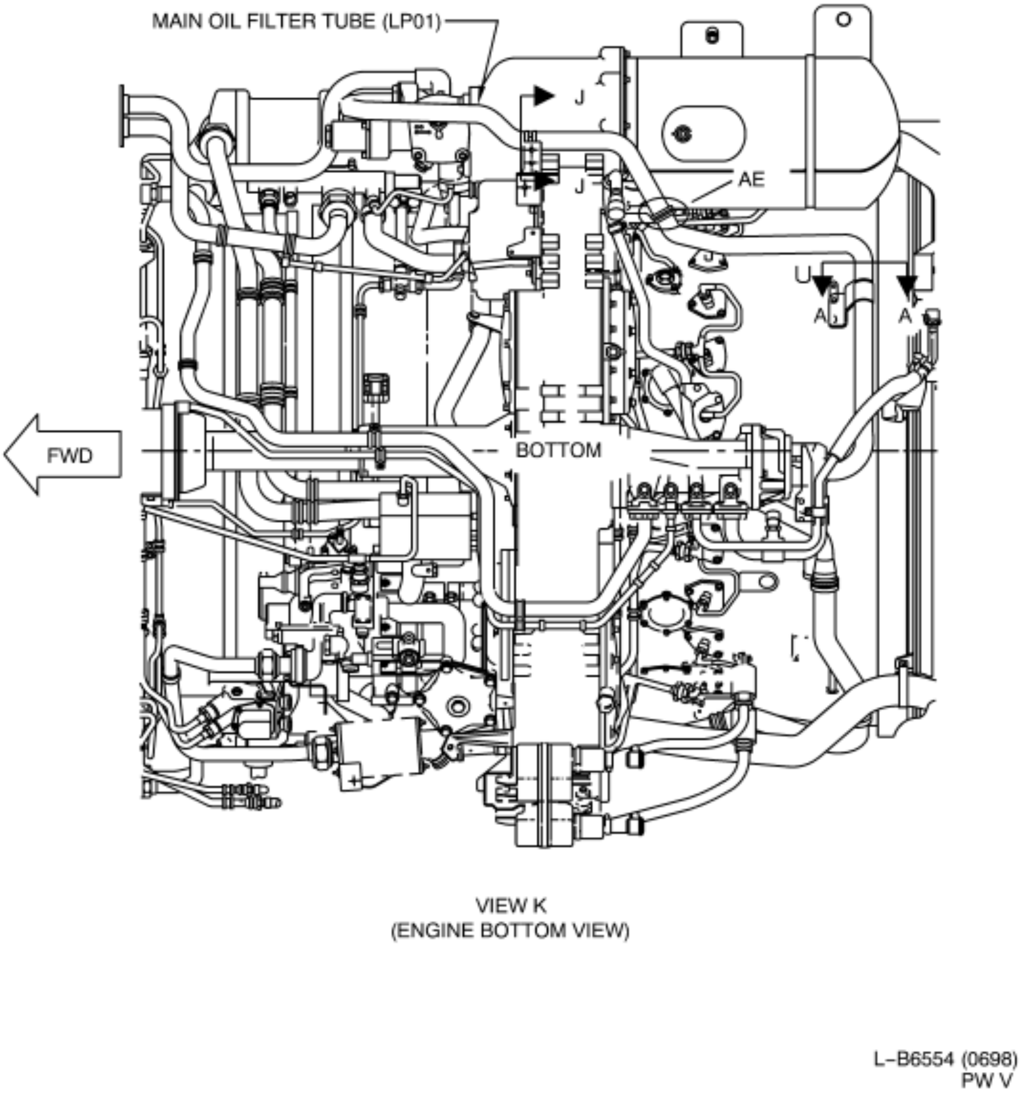
L−B6552 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79−75) (Pre SB PW4ENG 79−86)
Figure 403 (Sheet 4)
(Task 72−00−54−420−004)

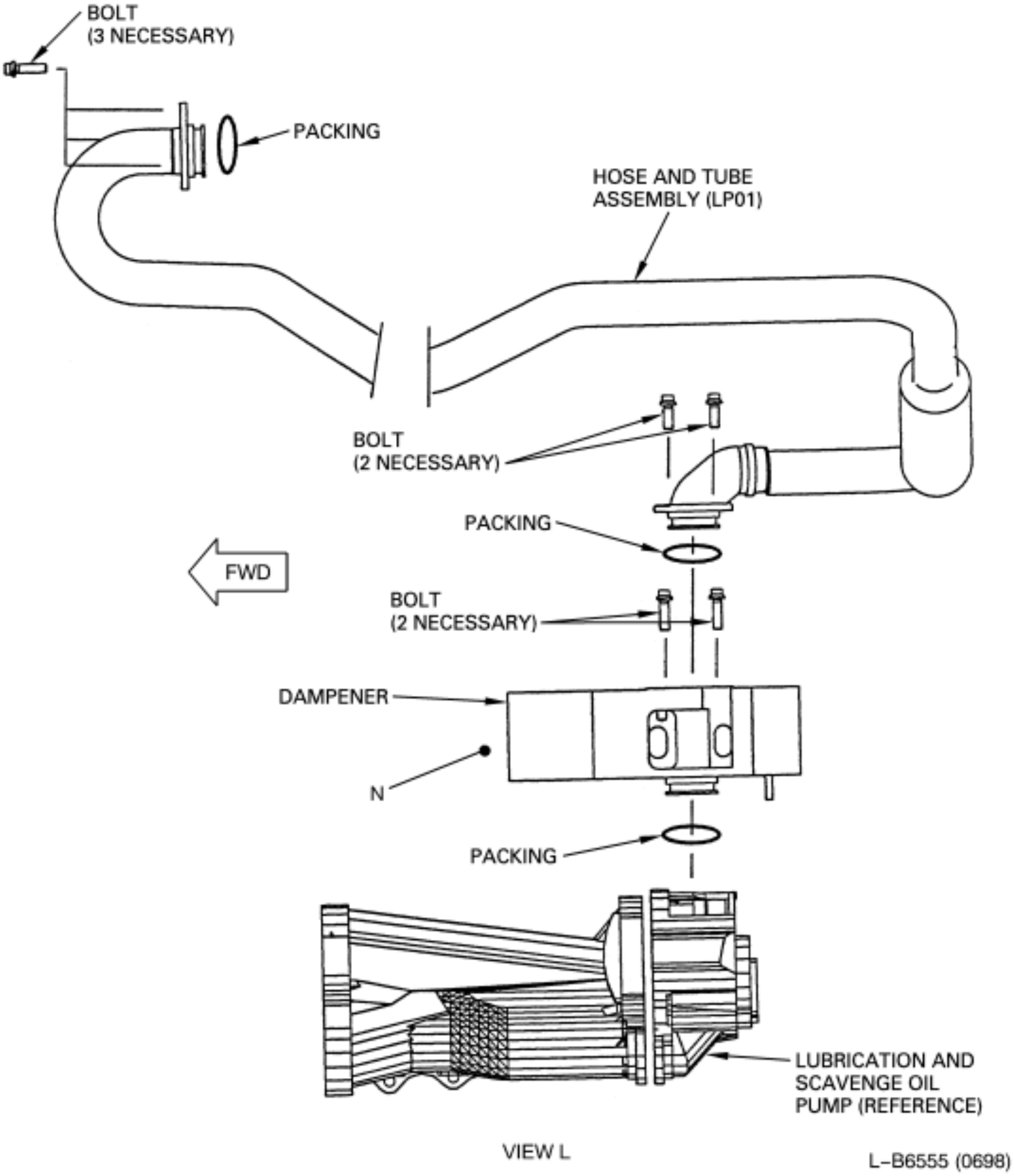

LP01 HOSE AND TUBE ASSEMBLY
L
FWD
M
FLUID PRESSURE DAMPENER
MAIN OIL PUMP
VIEW J
L−B6553 (0698)

Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 5)
(Task 72−00−54−420−004)

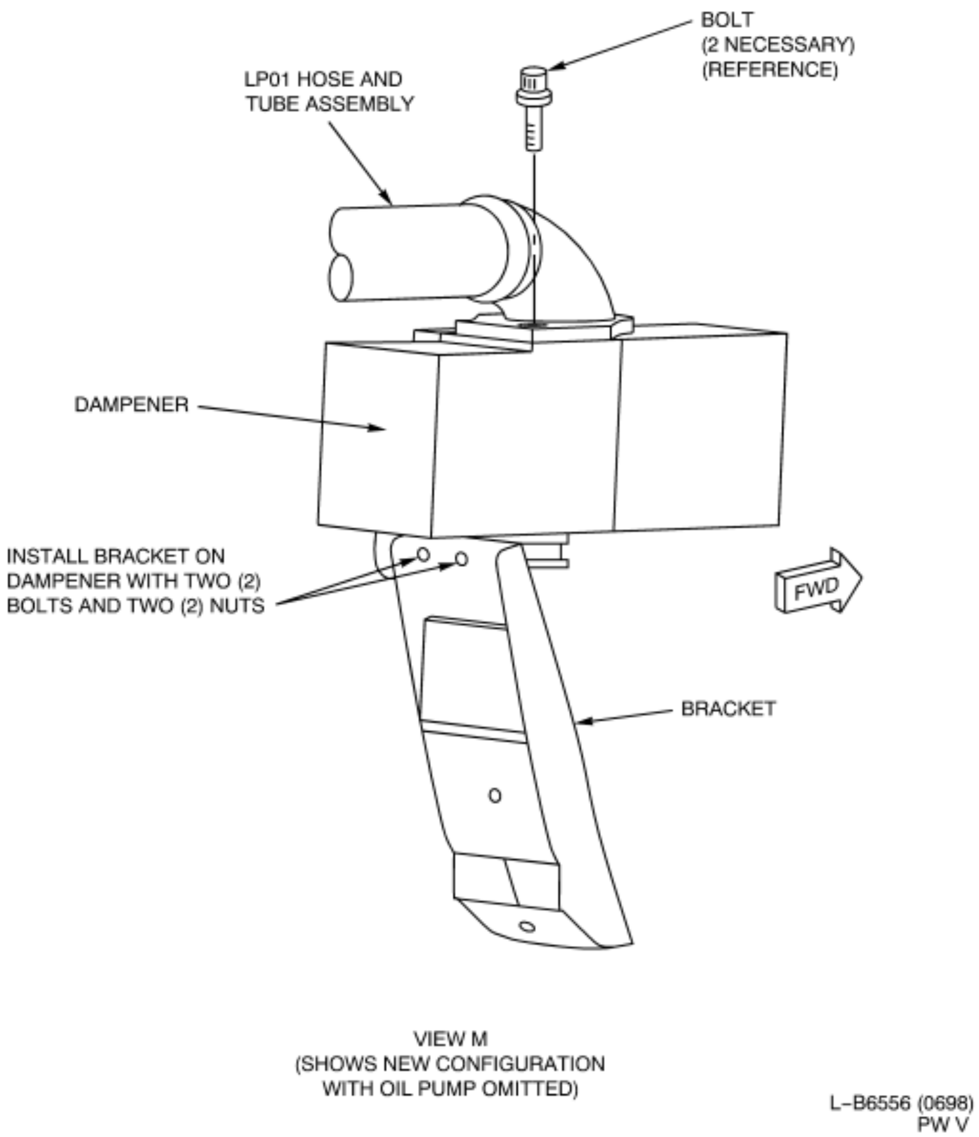
ENGINE GENERAL - TURBINE EXHAUST CASE - INSTALLATION-02


MAIN OIL FILTER TUBE (LP01)
J
J
AE
U
A
A
FWD
BOTTOM
VIEW K
(ENGINE BOTTOM VIEW)
L-B6554 (0698)
PW V

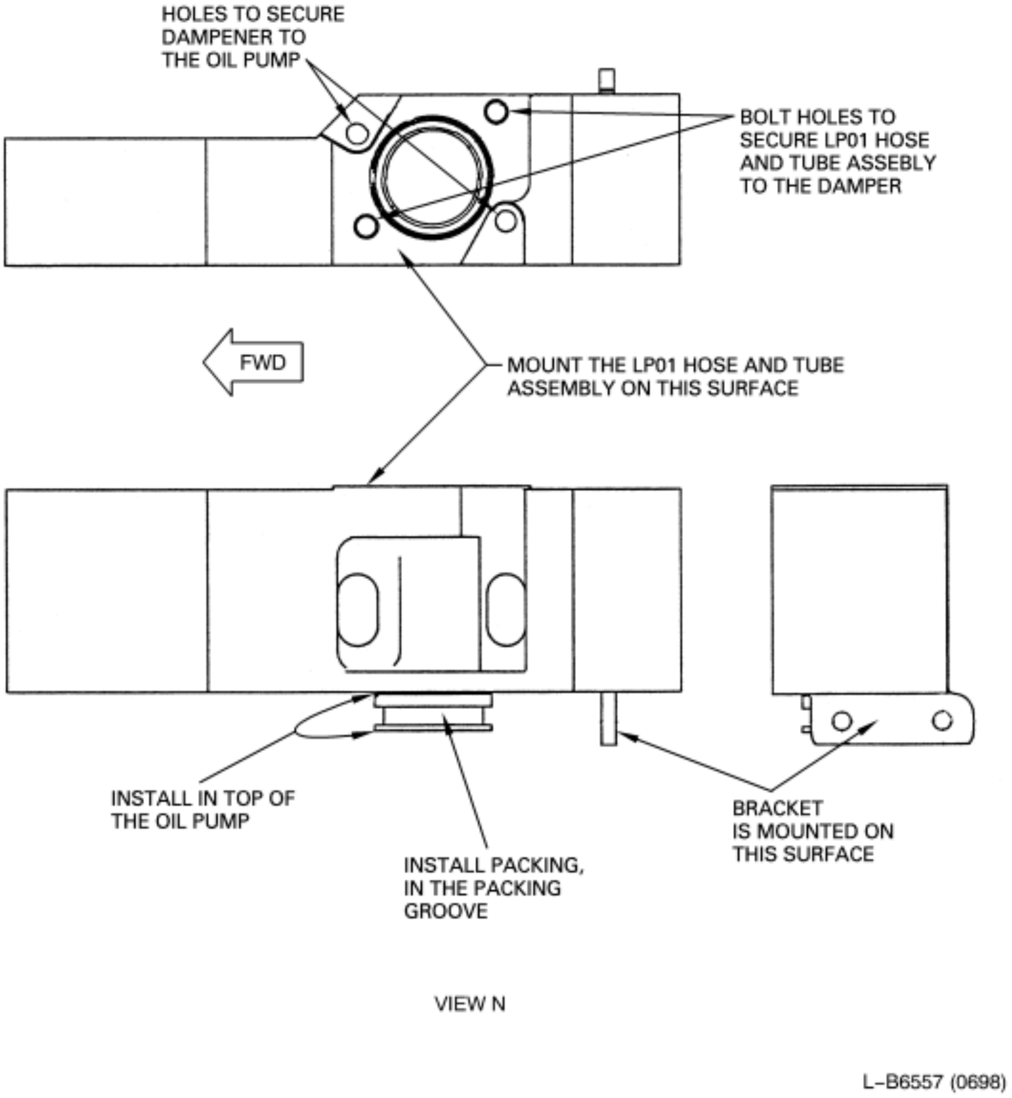
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 403 (Sheet 6)
(Task 72-00-54-420-004)


BOLT
(3 NECESSARY)
PACKING
HOSE AND TUBE
ASSEMBLY (LP01)
BOLT
(2 NECESSARY)
PACKING
FWD
BOLT
(2 NECESSARY)
DAMPENER
N
PACKING
LUBRICATION AND
SCAVENGE OIL
PUMP (REFERENCE)
VIEW L
L−B6555 (0698)

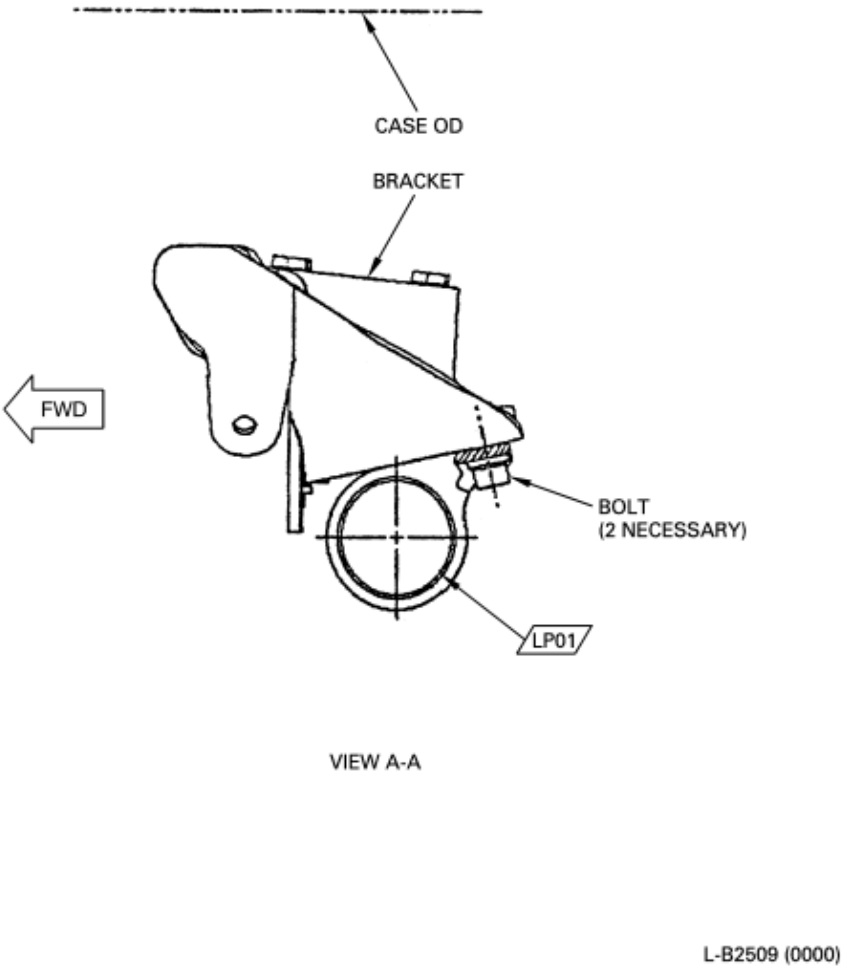
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 7)
(Task 72−00−54−420−004)


BOLT
(2 NECESSARY)
(REFERENCE)
LP01 HOSE AND
TUBE ASSEMBLY
DAMPENER
INSTALL BRACKET ON
DAMPENER WITH TWO (2)
BOLTS AND TWO (2) NUTS
FWD
BRACKET
VIEW M
(SHOWS NEW CONFIGURATION
WITH OIL PUMP OMITTED)
L-B6556 (0698)
PW V

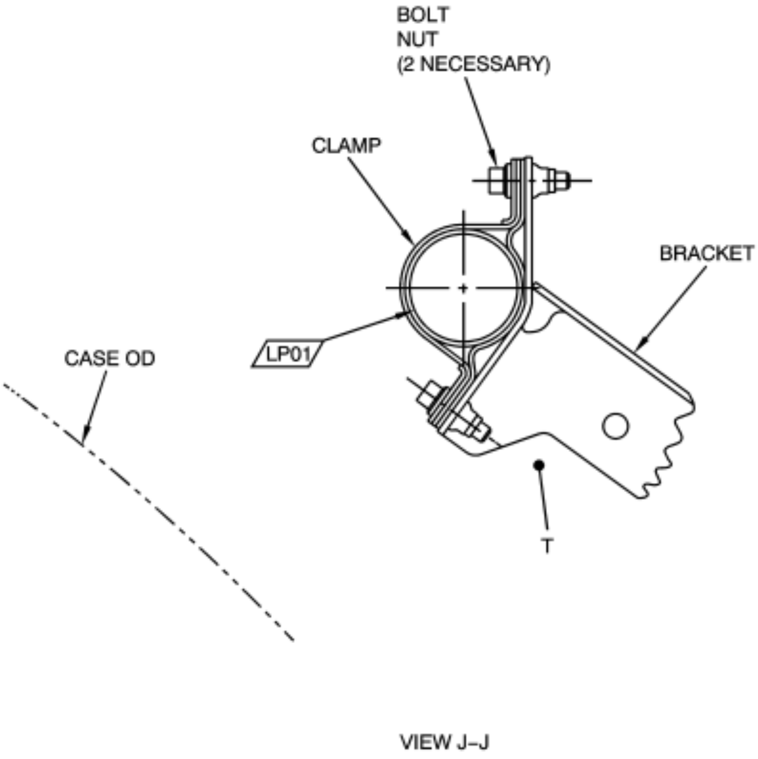
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 403 (Sheet 8)
(Task 72-00-54-420-004)


HOLES TO SECURE DAMPENER TO THE OIL PUMP
BOLT HOLES TO SECURE LP01 HOSE AND TUBE ASSEBLY TO THE DAMPER
FWD
MOUNT THE LP01 HOSE AND TUBE ASSEMBLY ON THIS SURFACE
INSTALL IN TOP OF THE OIL PUMP
INSTALL PACKING, IN THE PACKING GROOVE
BRACKET IS MOUNTED ON THIS SURFACE
VIEW N
L-B6557 (0698)

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 403 (Sheet 9)
(Task 72-00-54-420-004)

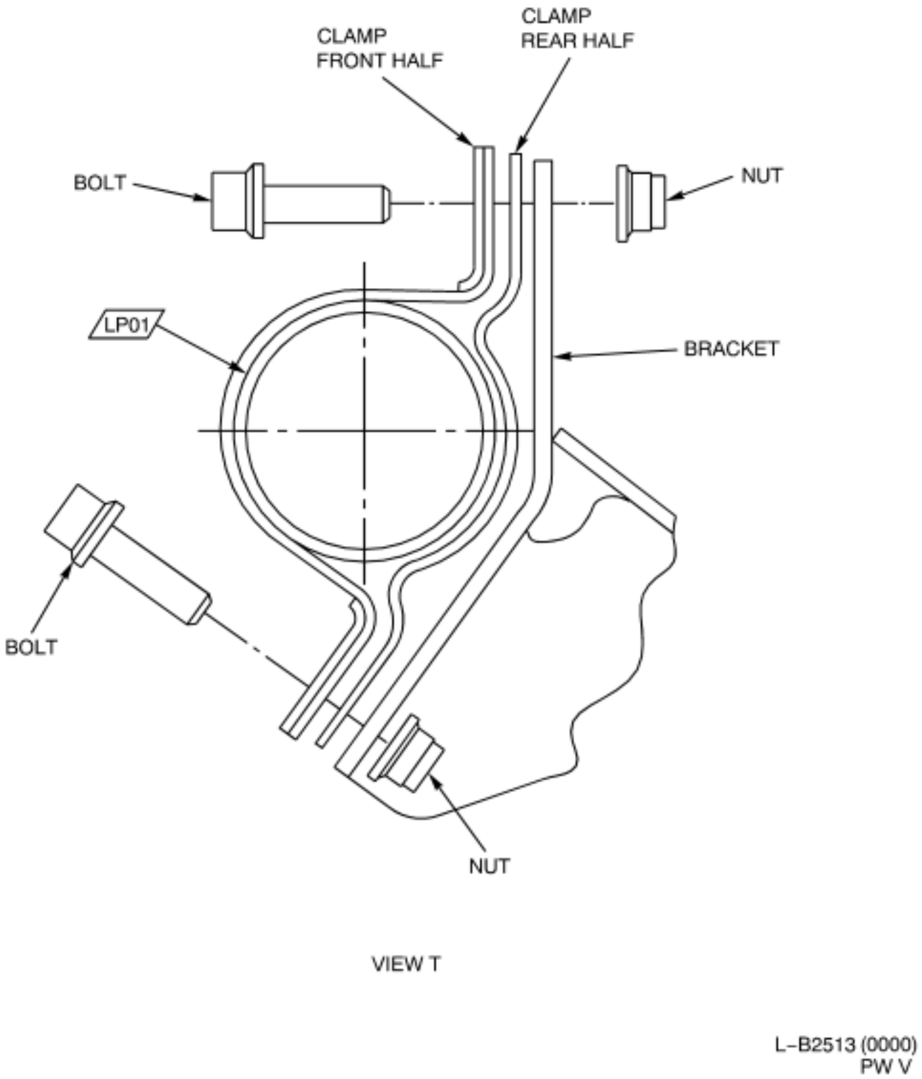

CASE OD
BRACKET
FWD
BOLT
(2 NECESSARY)
LP01
VIEW A-A
L-B2509 (0000)

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 403 (Sheet 10)
(Task 72-00-54-420-004)

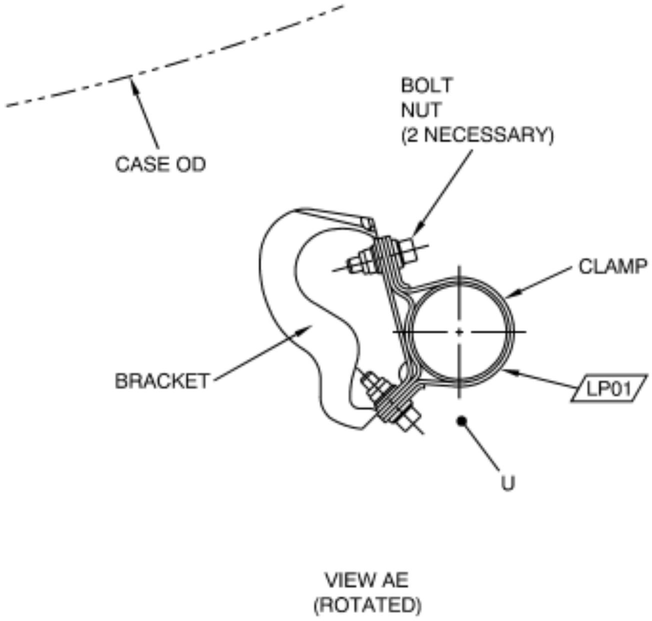

BOLT
NUT
(2 NECESSARY)
CLAMP
BRACKET
LP01
CASE OD
T
VIEW J−J

L−B2512 (0000)
PW V

Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 11)
(Task 72−00−54−420−004)

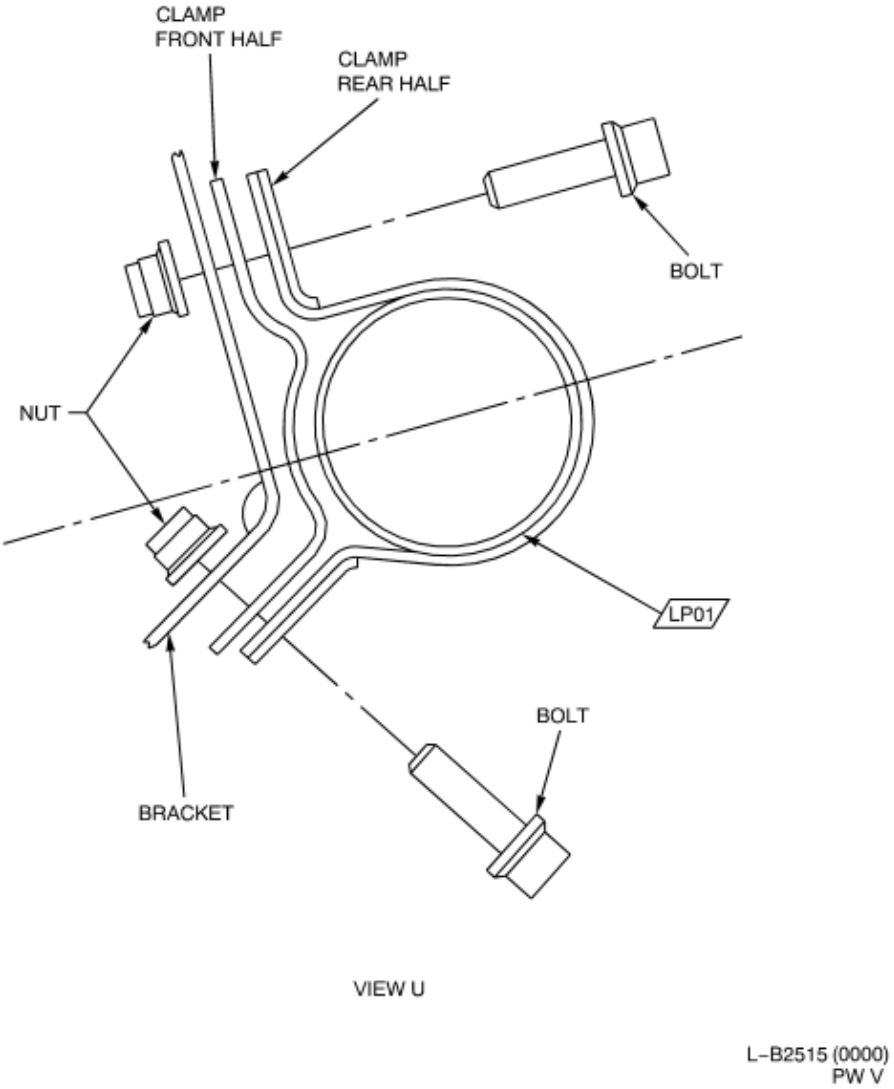

CLAMP
FRONT HALF
CLAMP
REAR HALF
BOLT
NUT
LP01
BRACKET
BOLT
NUT
VIEW T
L−B2513 (0000)
PW V

Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 12)
(Task 72−00−54−420−004)

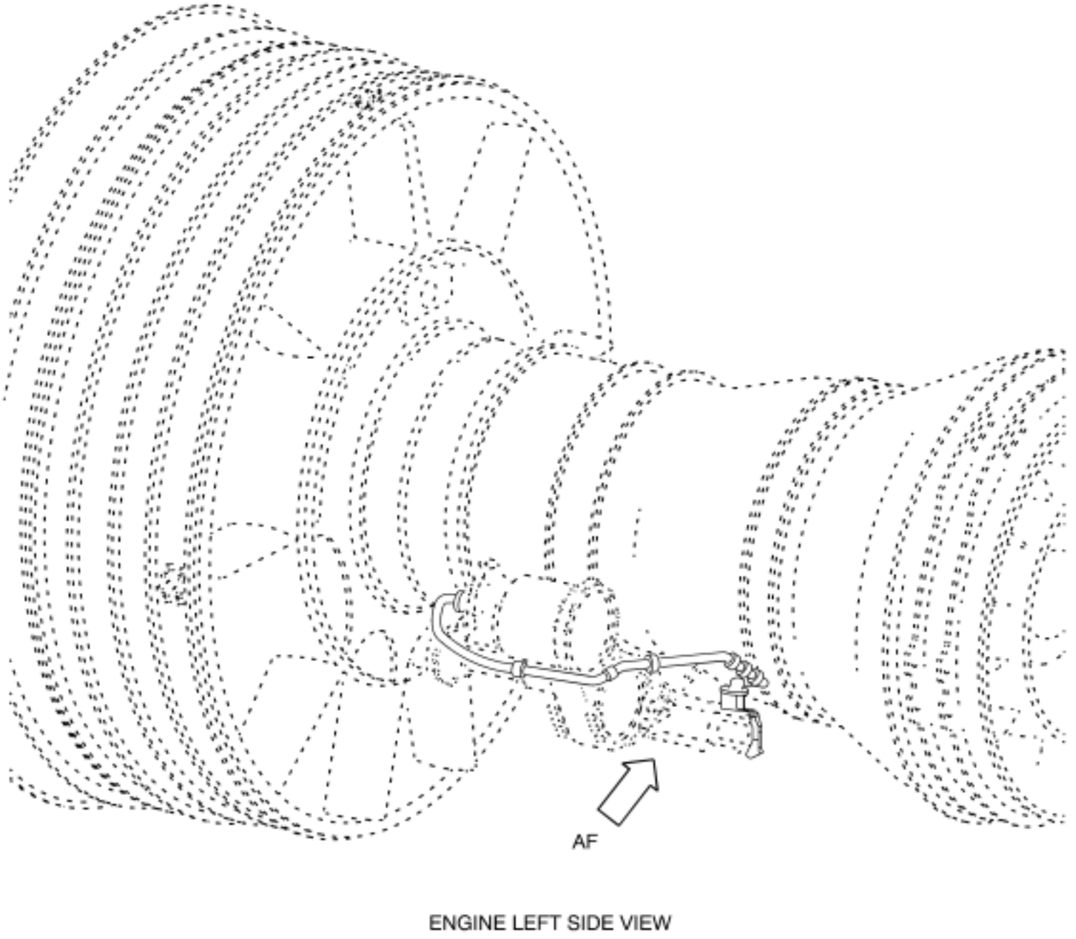

CASE OD
BOLT
NUT
(2 NECESSARY)
CLAMP
BRACKET
LP01
U
VIEW AE
(ROTATED)

L−B2514 (0000)
PW V

Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 13)
(Task 72−00−54−420−004)

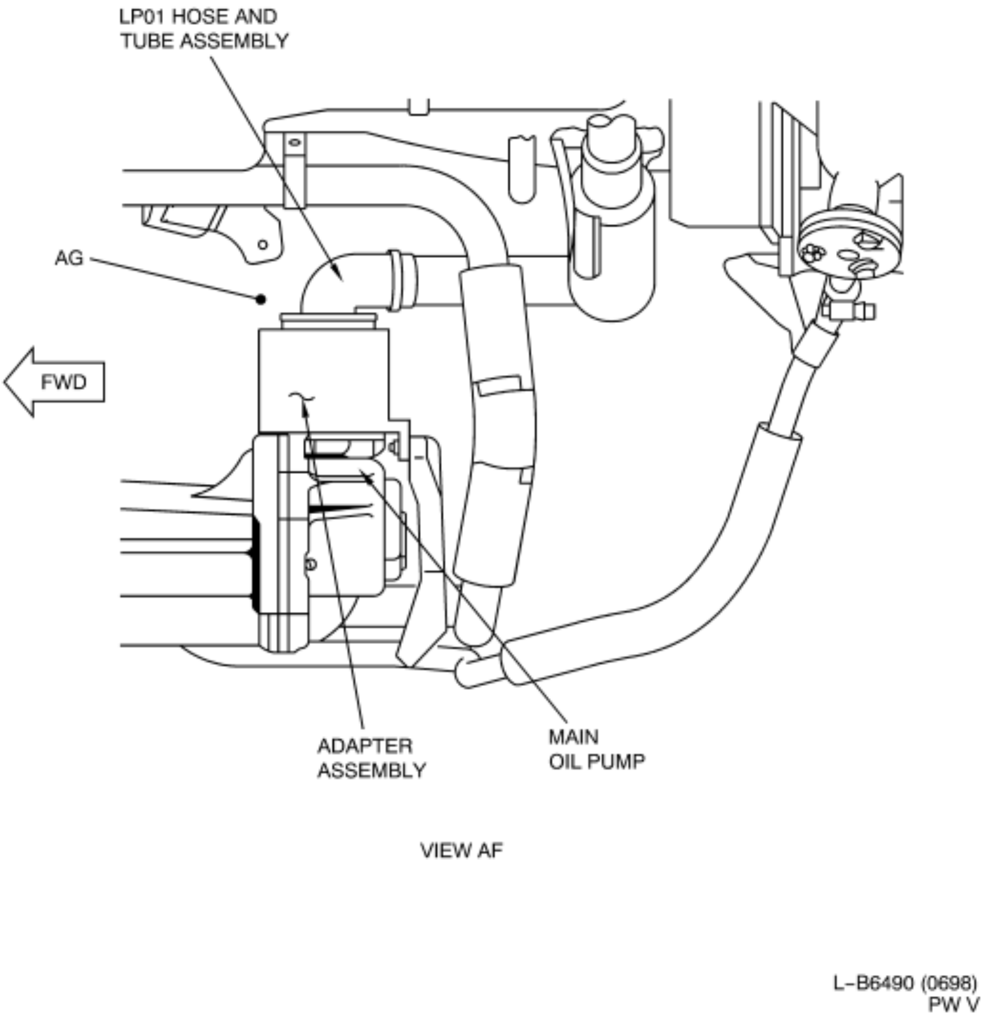

CLAMP FRONT HALF
CLAMP REAR HALF
BOLT
NUT
LP01
BOLT
BRACKET
VIEW U
L-B2515 (0000)
PW V

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 403 (Sheet 14)
(Task 72-00-54-420-004)



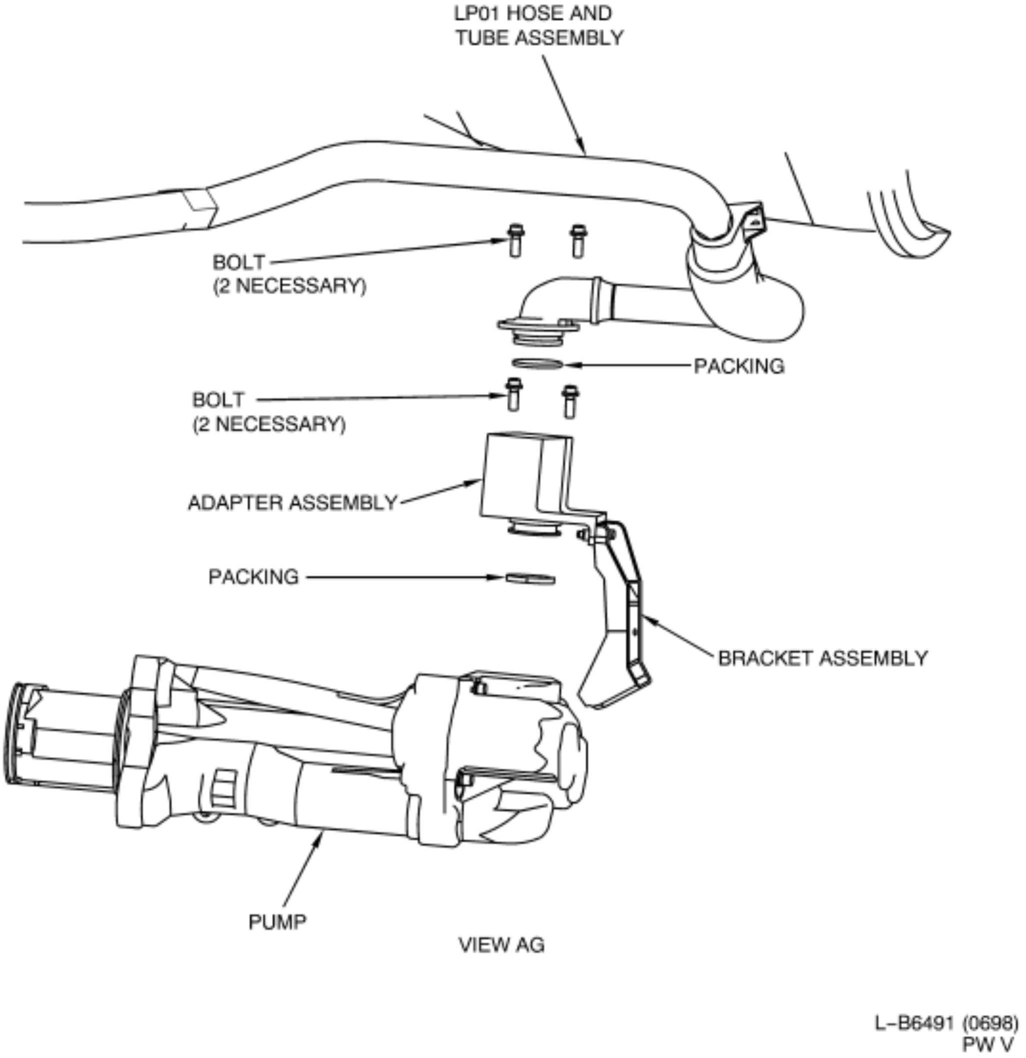
L−B6489 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79−86)
Figure 403 (Sheet 15)
(Task 72−00−54−420−004)


LP01 HOSE AND
TUBE ASSEMBLY
AG
FWD
ADAPTER
ASSEMBLY
MAIN
OIL PUMP
VIEW AF
L-B6490 (0698)
PW V

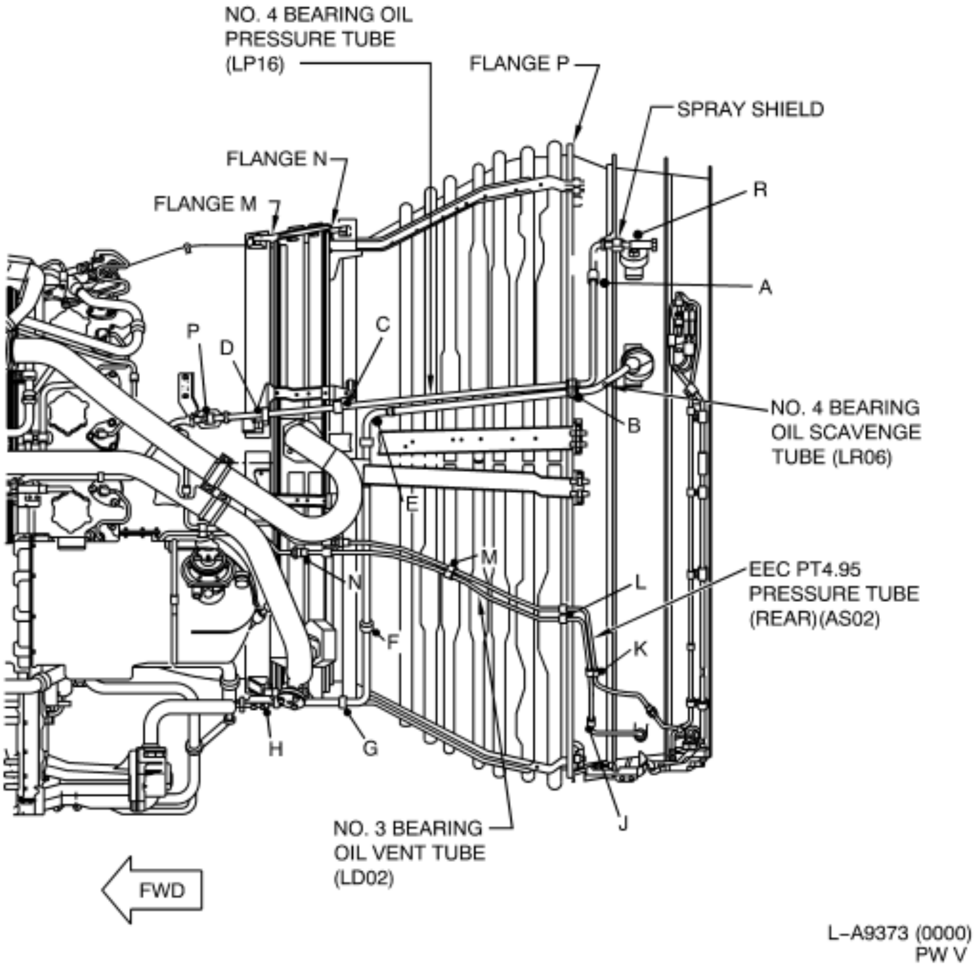
Bottom External Plumbing (Post SB PW4ENG 79-86)
Figure 403 (Sheet 16)
(Task 72-00-54-420-004)

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−02

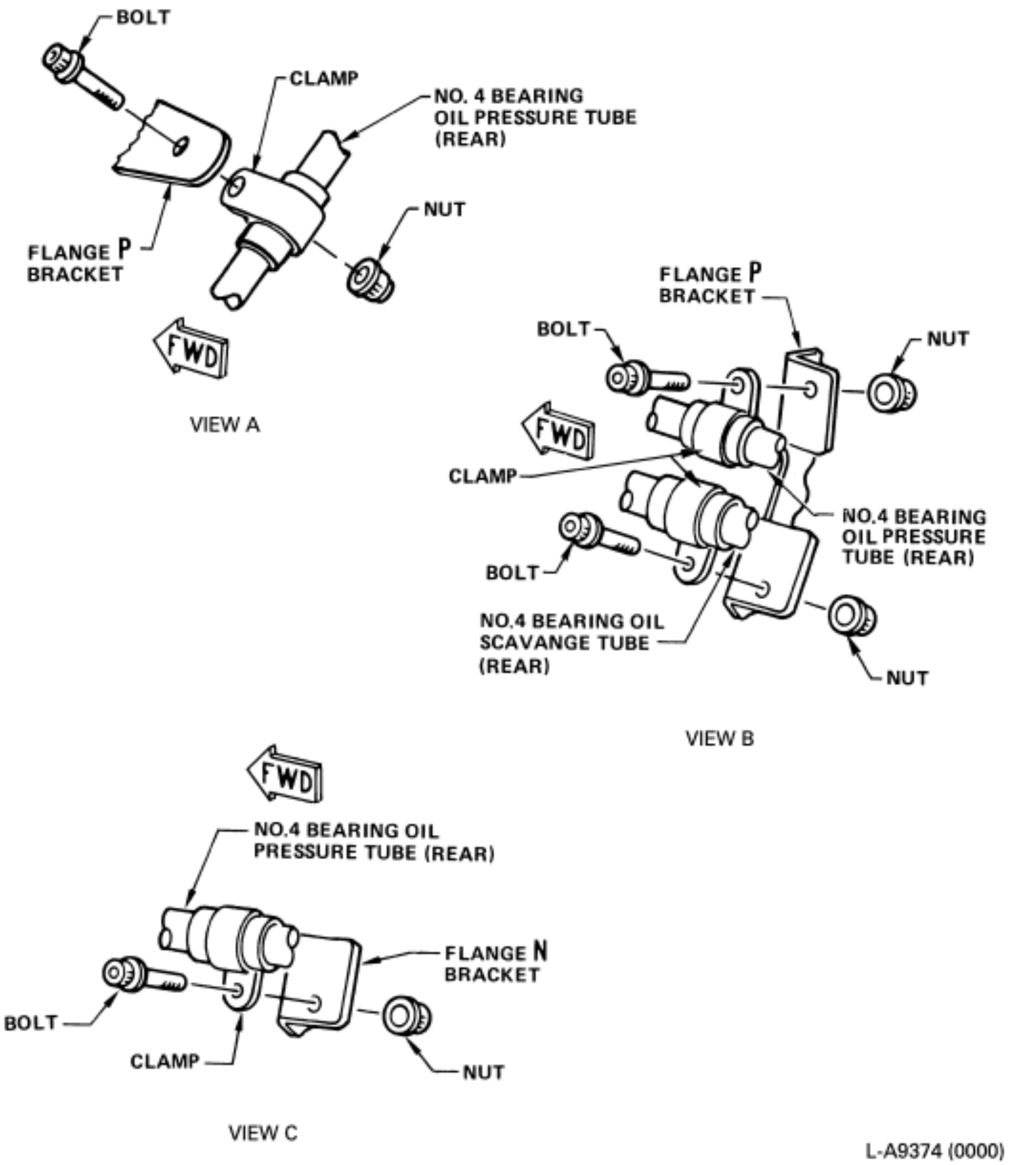

LP01 HOSE AND TUBE ASSEMBLY
BOLT (2 NECESSARY)
PACKING
BOLT (2 NECESSARY)
ADAPTER ASSEMBLY
PACKING
BRACKET ASSEMBLY
PUMP
VIEW AG
L−B6491 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79−86)
Figure 403 (Sheet 17)
(Task 72−00−54−420−004)

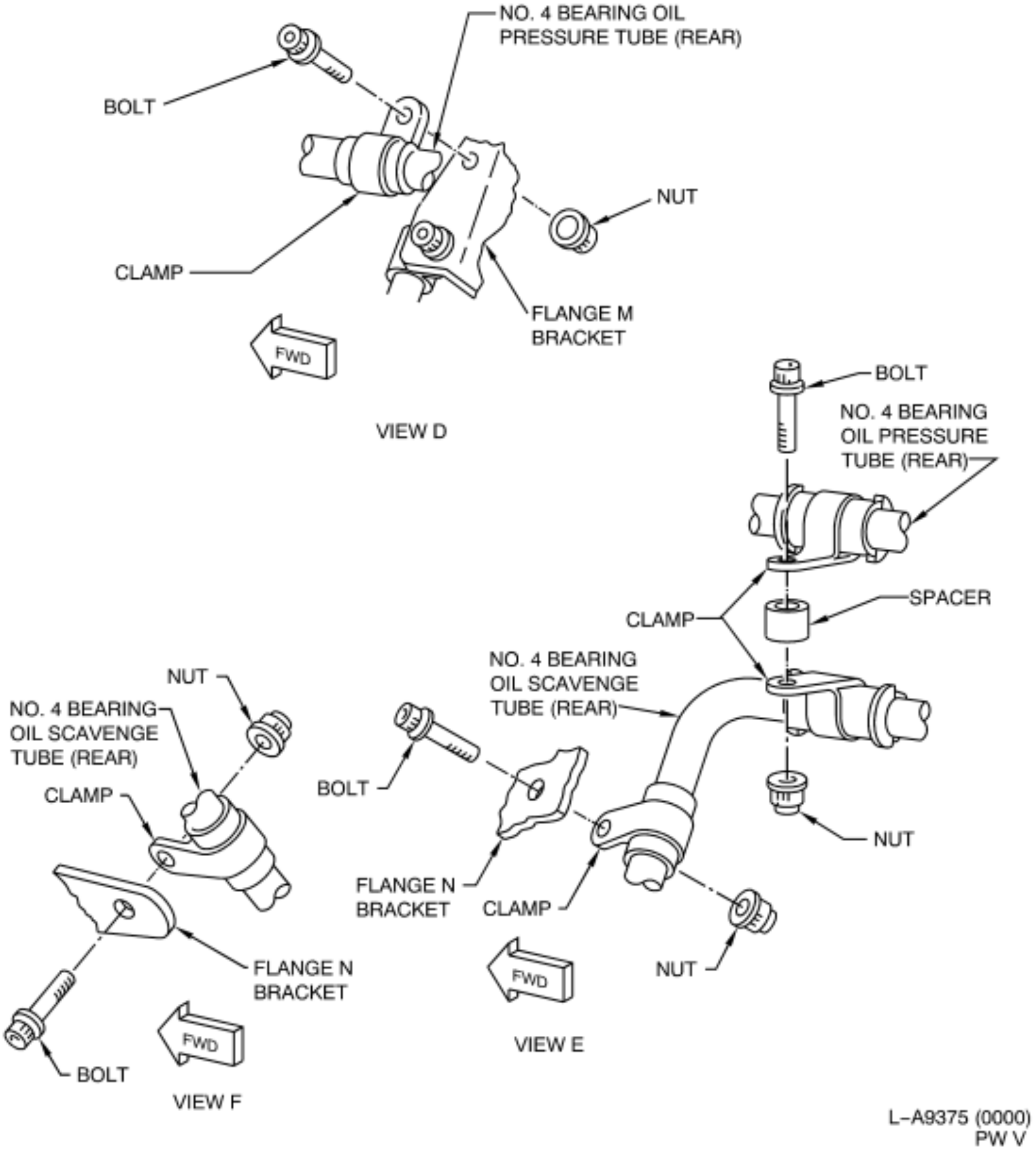
ENGINE GENERAL - TURBINE EXHAUST CASE - INSTALLATION-02


NO. 4 BEARING OIL PRESSURE TUBE (LP16)
FLANGE P
SPRAY SHIELD
FLANGE N
R
FLANGE M
A
P
D
C
B
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
E
M
N
L
EEC PT4.95 PRESSURE TUBE (REAR)(AS02)
F
K
H
G
J
NO. 3 BEARING OIL VENT TUBE (LD02)
FWD
L-A9373 (0000)
PW V

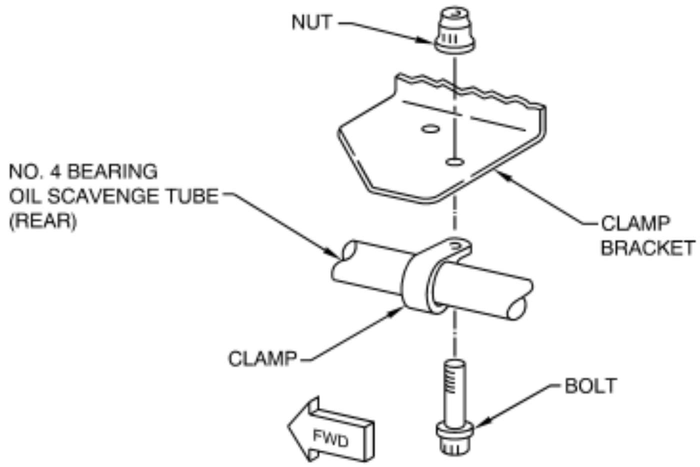
Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 1)
(Task 72-00-54-420-004)


BOLT
CLAMP
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
NUT
FLANGE P BRACKET
FWD
VIEW A
FLANGE P BRACKET
BOLT
NUT
FWD
CLAMP
NO.4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NO.4 BEARING OIL SCAVANGE TUBE (REAR)
NUT
VIEW B
FWD
NO.4 BEARING OIL PRESSURE TUBE (REAR)
FLANGE N BRACKET
BOLT
CLAMP
NUT
VIEW C
L-A9374 (0000)

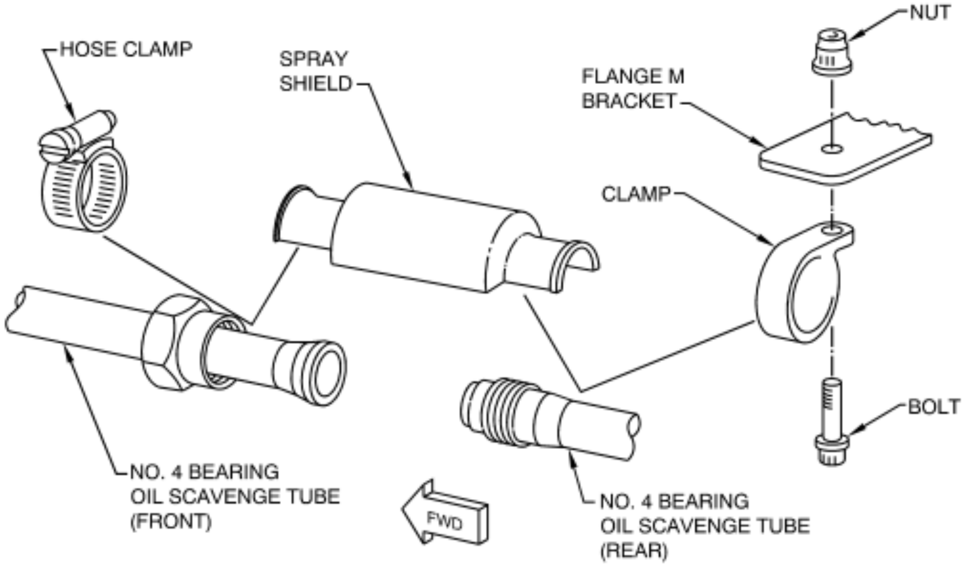
Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 2)
(Task 72−00−54−420−004)


NO. 4 BEARING OIL PRESSURE TUBE (REAR)
BOLT
NUT
CLAMP
FLANGE M BRACKET
FWD
VIEW D
BOLT
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
SPACER
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
NUT
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP
BOLT
NUT
FLANGE N BRACKET
CLAMP
FLANGE N BRACKET
NUT
FWD
VIEW E
BOLT
FWD
VIEW F
L-A9375 (0000)
PW V

Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 3)
(Task 72-00-54-420-004)


NUT
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)
CLAMP BRACKET
CLAMP
BOLT
FWD

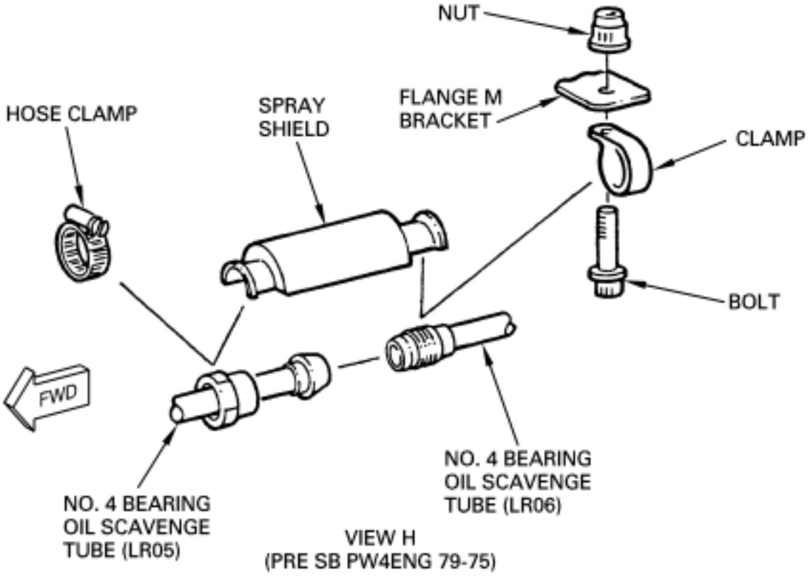
VIEW G


HOSE CLAMP
SPRAY SHIELD
FLANGE M BRACKET
NUT
CLAMP
BOLT
NO. 4 BEARING OIL SCAVENGE TUBE (FRONT)
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (REAR)

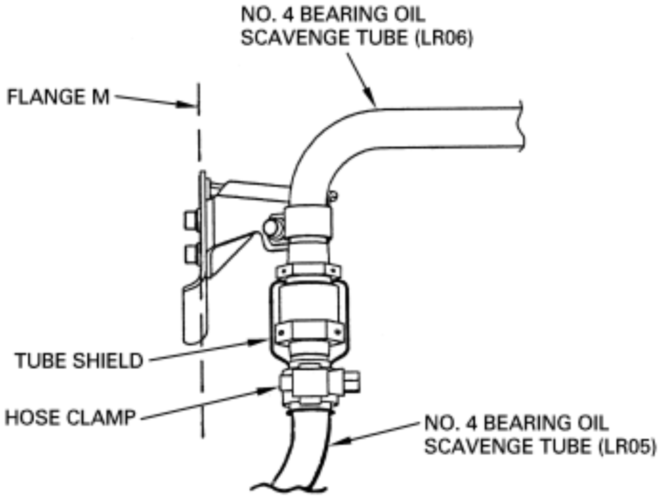
VIEW H

L-A9376 (0000)
PW V

Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 4)
(Task 72-00-54-420-004)


NUT
HOSE CLAMP
SPRAY SHIELD
FLANGE M BRACKET
CLAMP
BOLT
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)

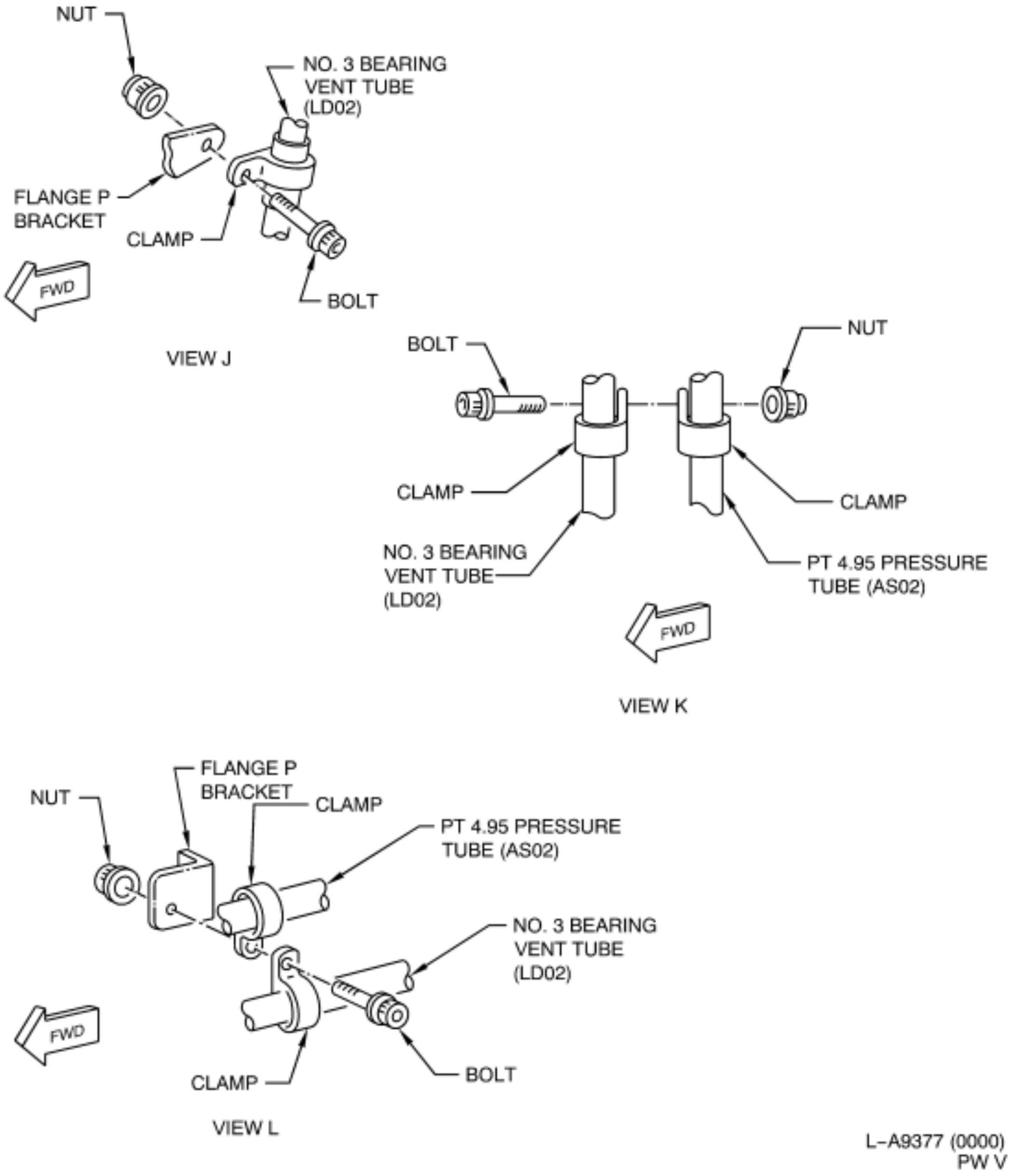
VIEW H
(PRE SB PW4ENG 79-75)


NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
FLANGE M
TUBE SHIELD
HOSE CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)

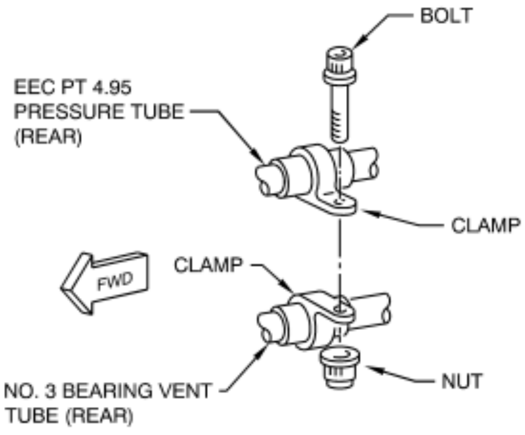
VIEW H
(POST SB PW4ENG 79-75)

L-B2526 (0000)

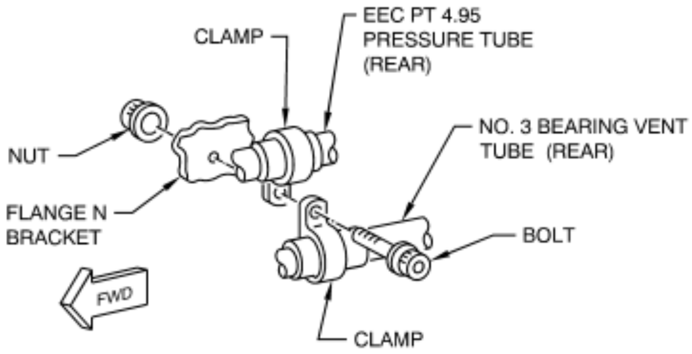
Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 5)
(Task 72−00−54−420−004)


NUT
NO. 3 BEARING VENT TUBE (LD02)
FLANGE P BRACKET
CLAMP
BOLT
FWD
VIEW J
BOLT
NUT
CLAMP
CLAMP
NO. 3 BEARING VENT TUBE (LD02)
PT 4.95 PRESSURE TUBE (AS02)
FWD
VIEW K
FLANGE P BRACKET
NUT
CLAMP
PT 4.95 PRESSURE TUBE (AS02)
NO. 3 BEARING VENT TUBE (LD02)
FWD
CLAMP
BOLT
VIEW L
L-A9377 (0000)
PW V

Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 6)
(Task 72-00-54-420-004)


BOLT
EEC PT 4.95
PRESSURE TUBE
(REAR)
CLAMP
FWD
CLAMP
NUT
NO. 3 BEARING VENT
TUBE (REAR)

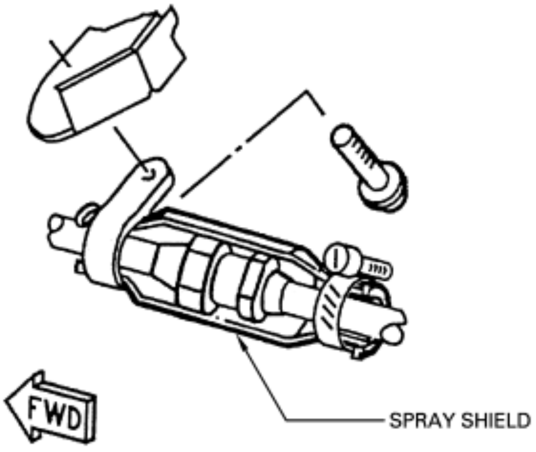
VIEW M


EEC PT 4.95
PRESSURE TUBE
(REAR)
CLAMP
NO. 3 BEARING VENT
TUBE (REAR)
NUT
FLANGE N
BRACKET
BOLT
FWD
CLAMP

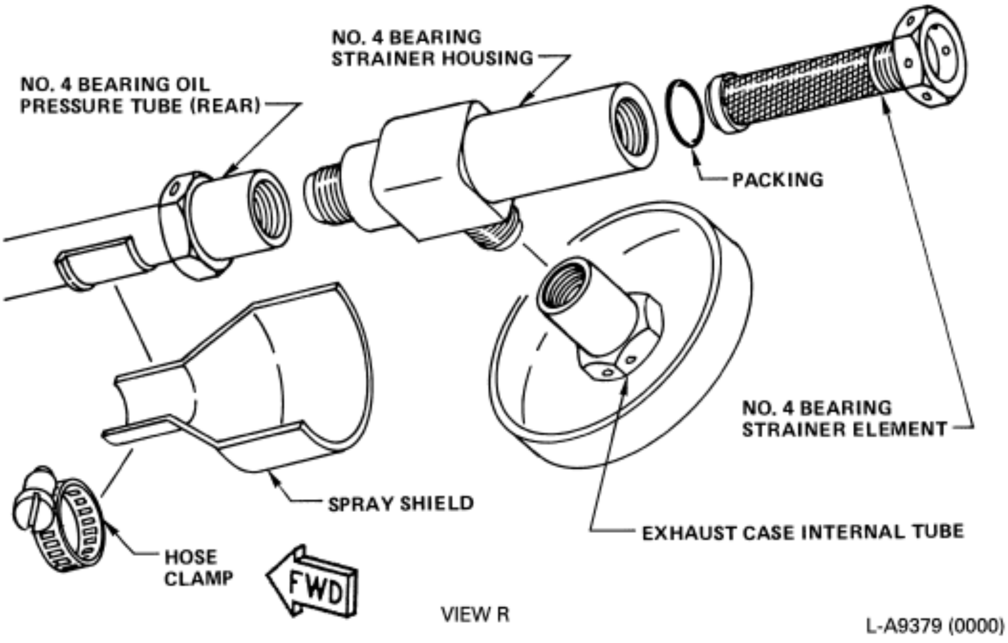
VIEW N

L-A9378 (0000)
PW V

Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 7)
(Task 72-00-54-420-004)

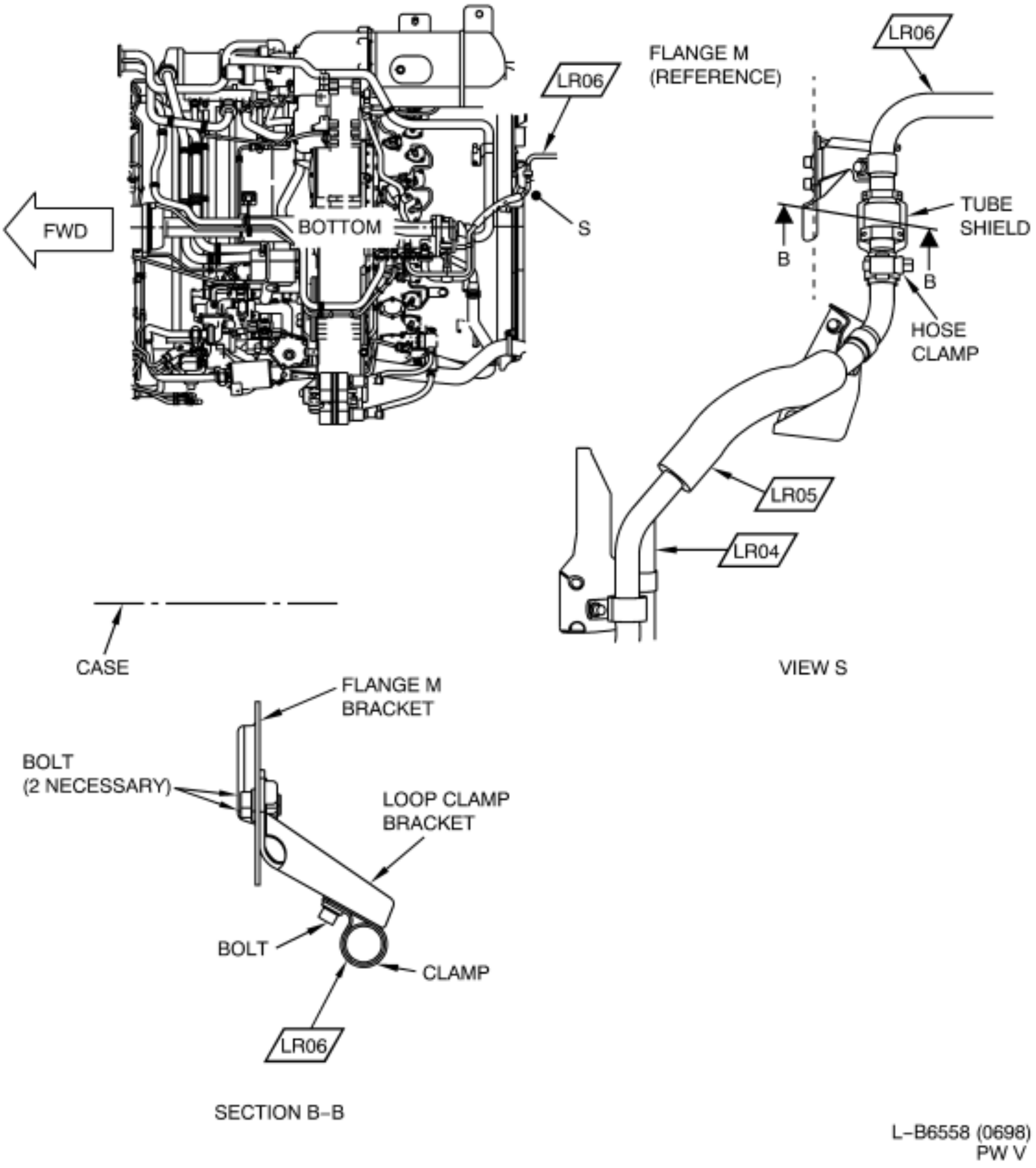

SPRAY SHIELD
FWD

VIEW P

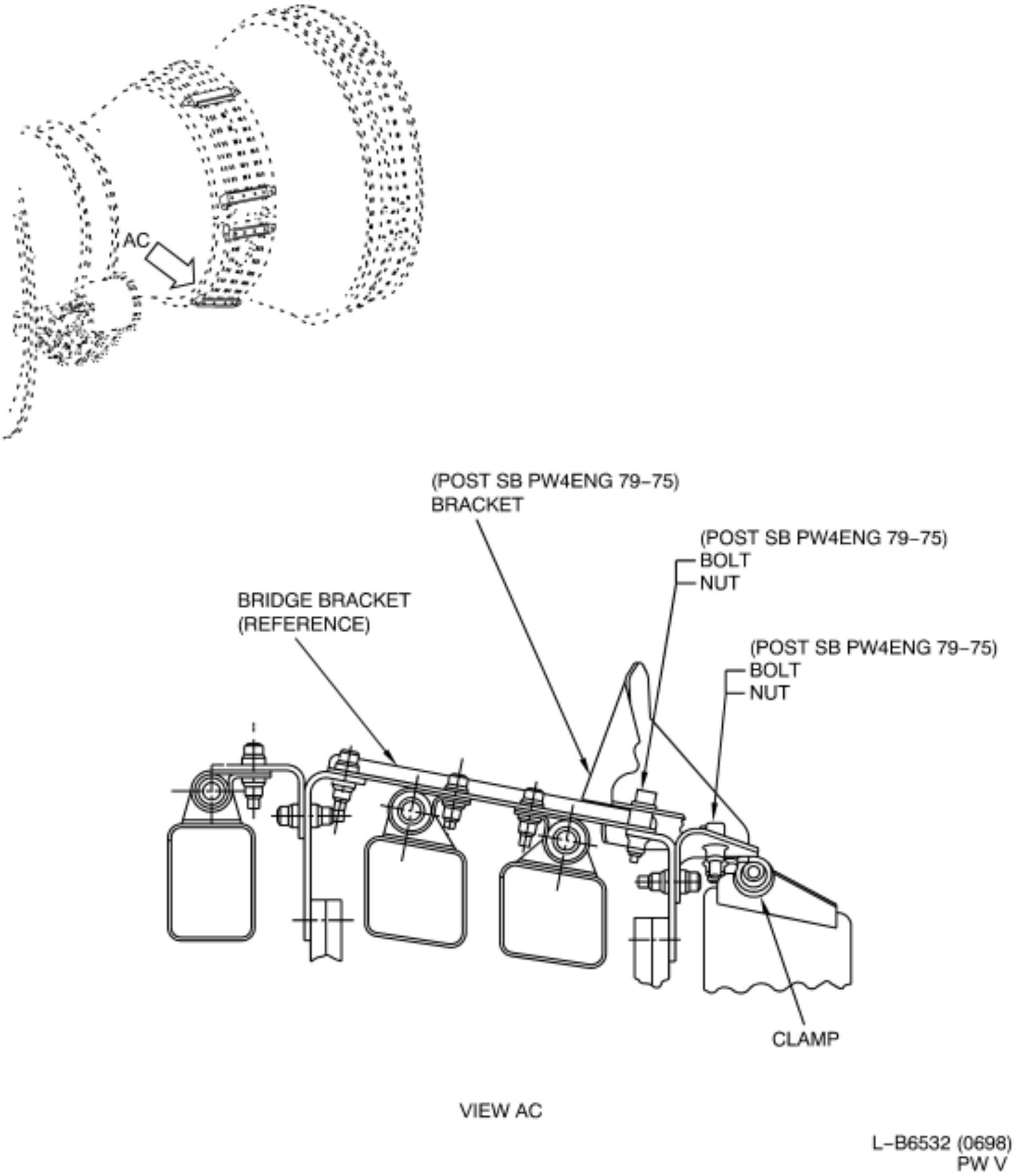

NO. 4 BEARING STRAINER HOUSING
NO. 4 BEARING OIL PRESSURE TUBE (REAR)
PACKING
NO. 4 BEARING STRAINER ELEMENT
SPRAY SHIELD
EXHAUST CASE INTERNAL TUBE
HOSE CLAMP
FWD
L-A9379 (0000)

VIEW R

Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 8)
(Task 72−00−54−420−004)

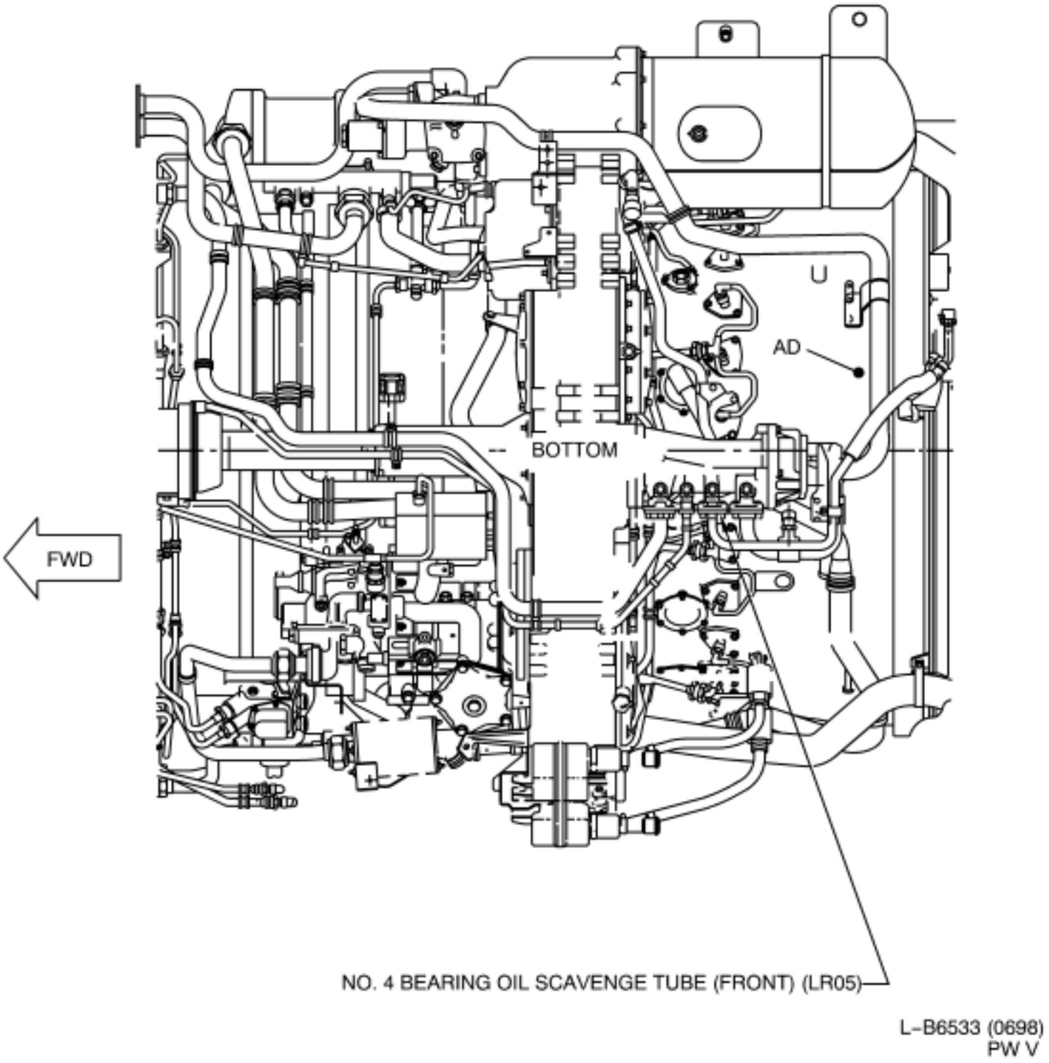

LR06
FLANGE M
(REFERENCE)
LR06
FWD
BOTTOM
S
TUBE
SHIELD
B
B
HOSE
CLAMP
LR05
LR04
CASE
VIEW S
FLANGE M
BRACKET
BOLT
(2 NECESSARY)
LOOP CLAMP
BRACKET
BOLT
CLAMP
LR06
SECTION B-B
L-B6558 (0698)
PW V

Turbine Exhaust Case External Plumbing
Figure 404 (Sheet 9)
(Task 72−00−54−420−004)

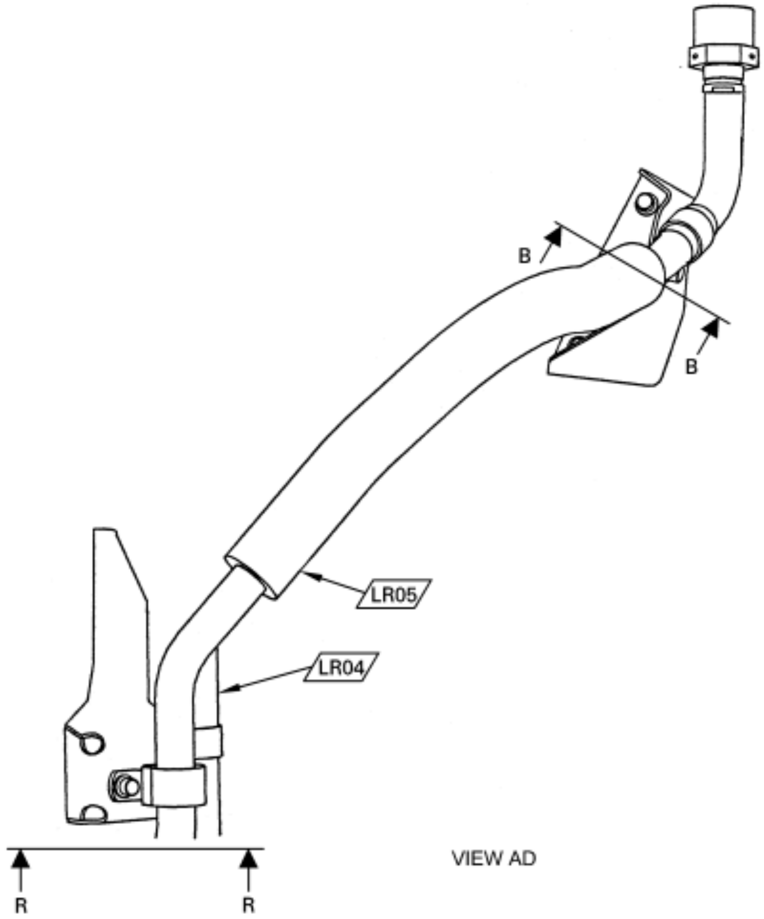

AC
(POST SB PW4ENG 79-75)
BRACKET
(POST SB PW4ENG 79-75)
BOLT
NUT
BRIDGE BRACKET
(REFERENCE)
(POST SB PW4ENG 79-75)
BOLT
NUT
CLAMP
VIEW AC
L-B6532 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 404 (Sheet 10)
(Task 72-00-54-420-004)

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−02

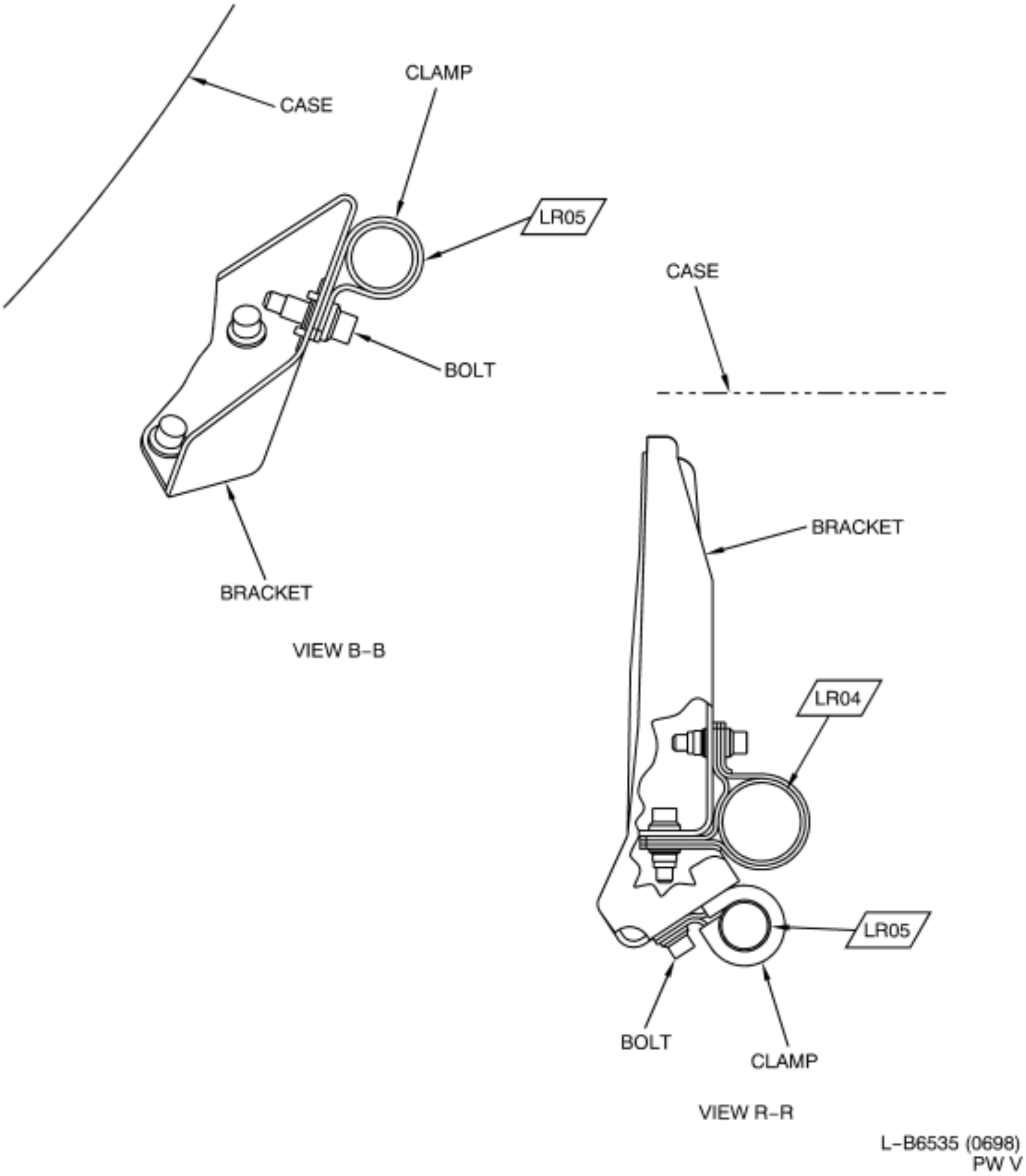

U
AD
BOTTOM
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (FRONT) (LR05)
L−B6533 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 404 (Sheet 11)
(Task 72−00−54−420−004)

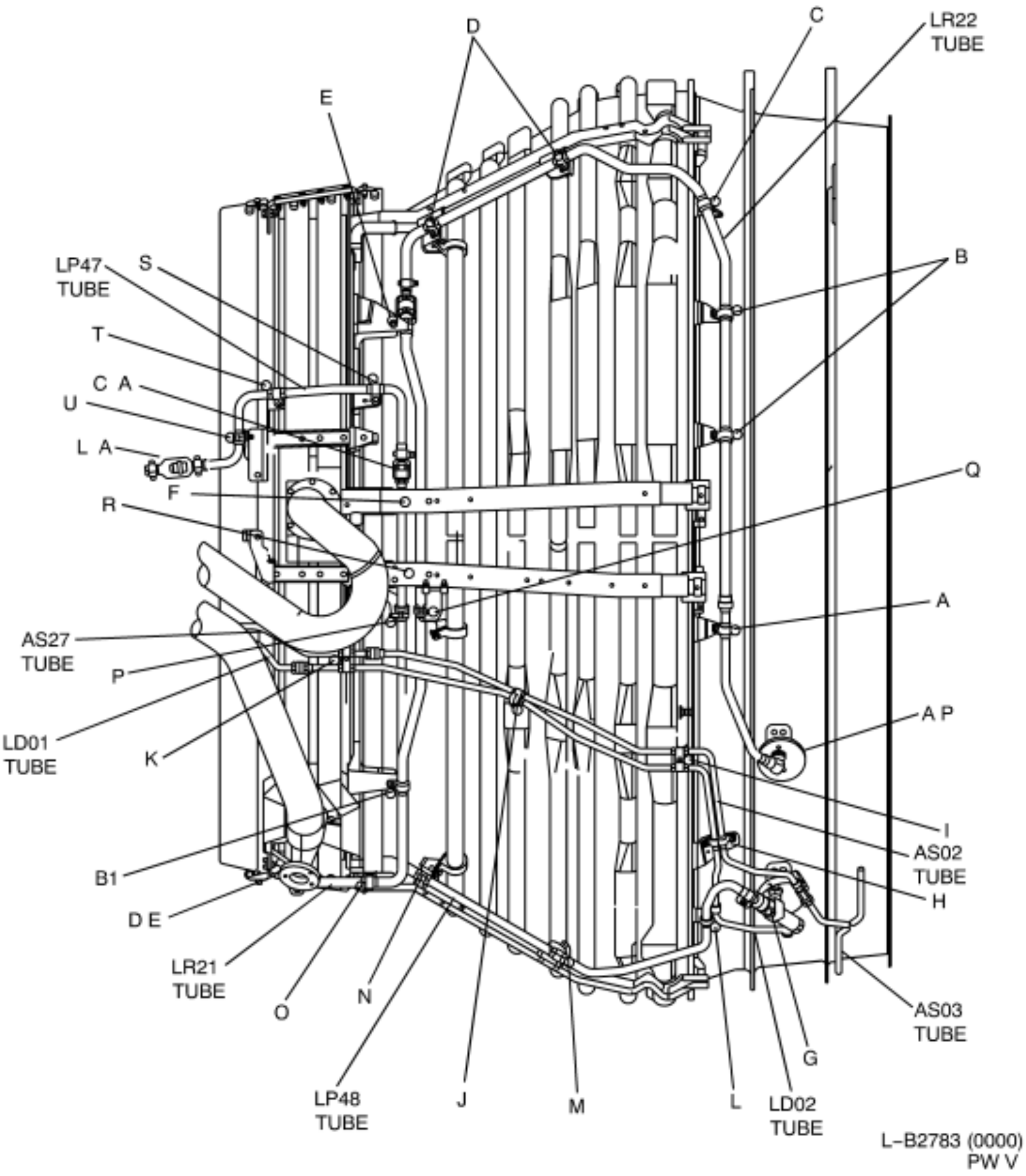


L−B6534 (0698)

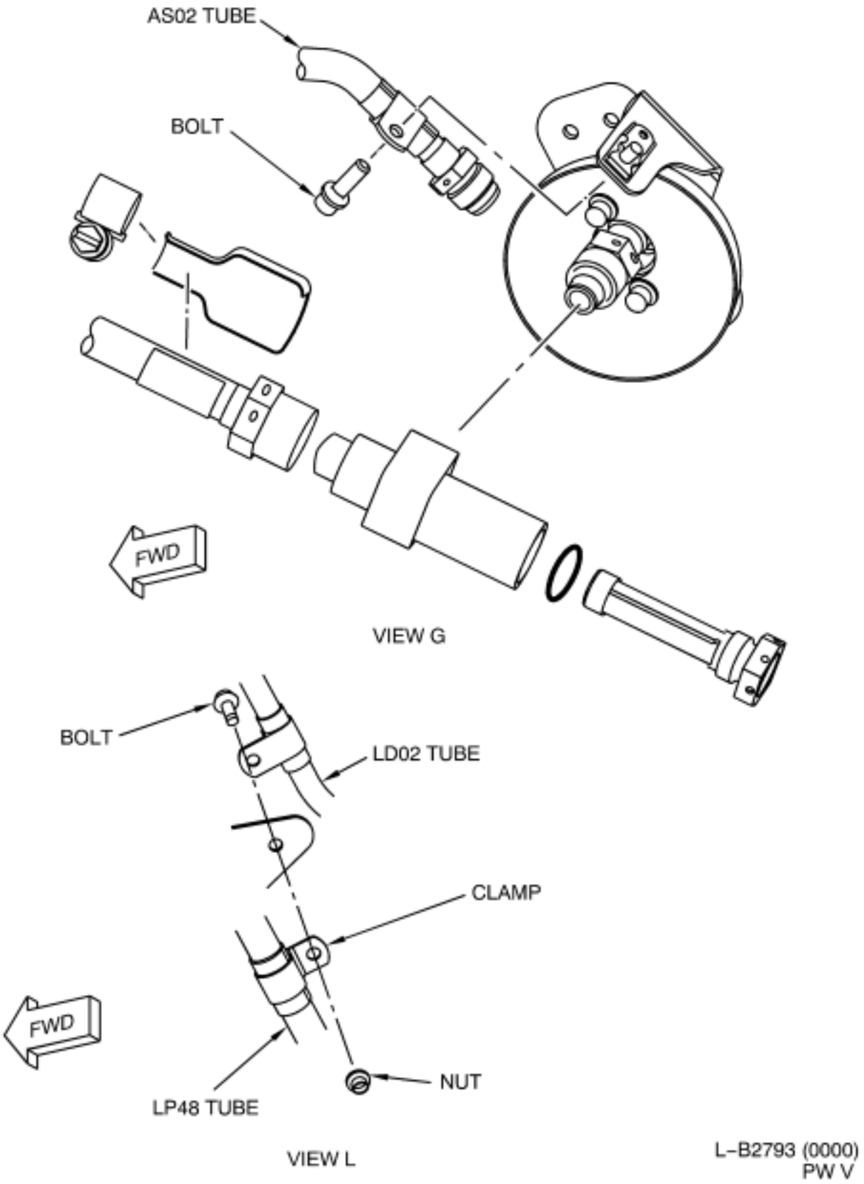
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 404 (Sheet 12)
(Task 72−00−54−420−004)


CASE
CLAMP
LR05
BOLT
BRACKET
VIEW B−B
CASE
BRACKET
LR04
LR05
BOLT
CLAMP
VIEW R−R
L−B6535 (0698)
PW V

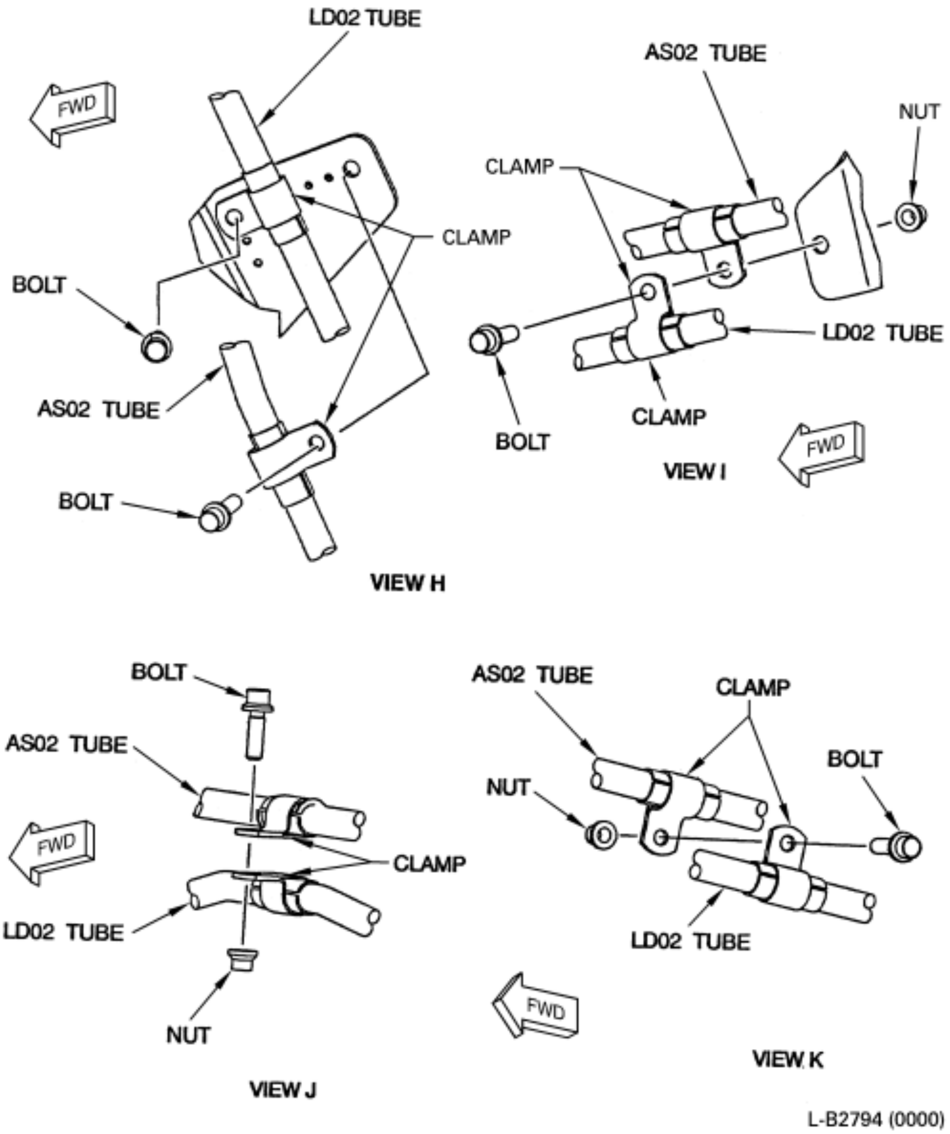
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 404 (Sheet 13)
(Task 72−00−54−420−004)


D
C
LR22 TUBE
E
B
LP47 TUBE
S
T
C A
U
L A
F
R
Q
A
AS27 TUBE
P
LD01 TUBE
K
A P
I
AS02 TUBE
H
B1
D E
LR21 TUBE
O
N
AS03 TUBE
G
LP48 TUBE
J
M
L
LD02 TUBE
L−B2783 (0000)
PW V

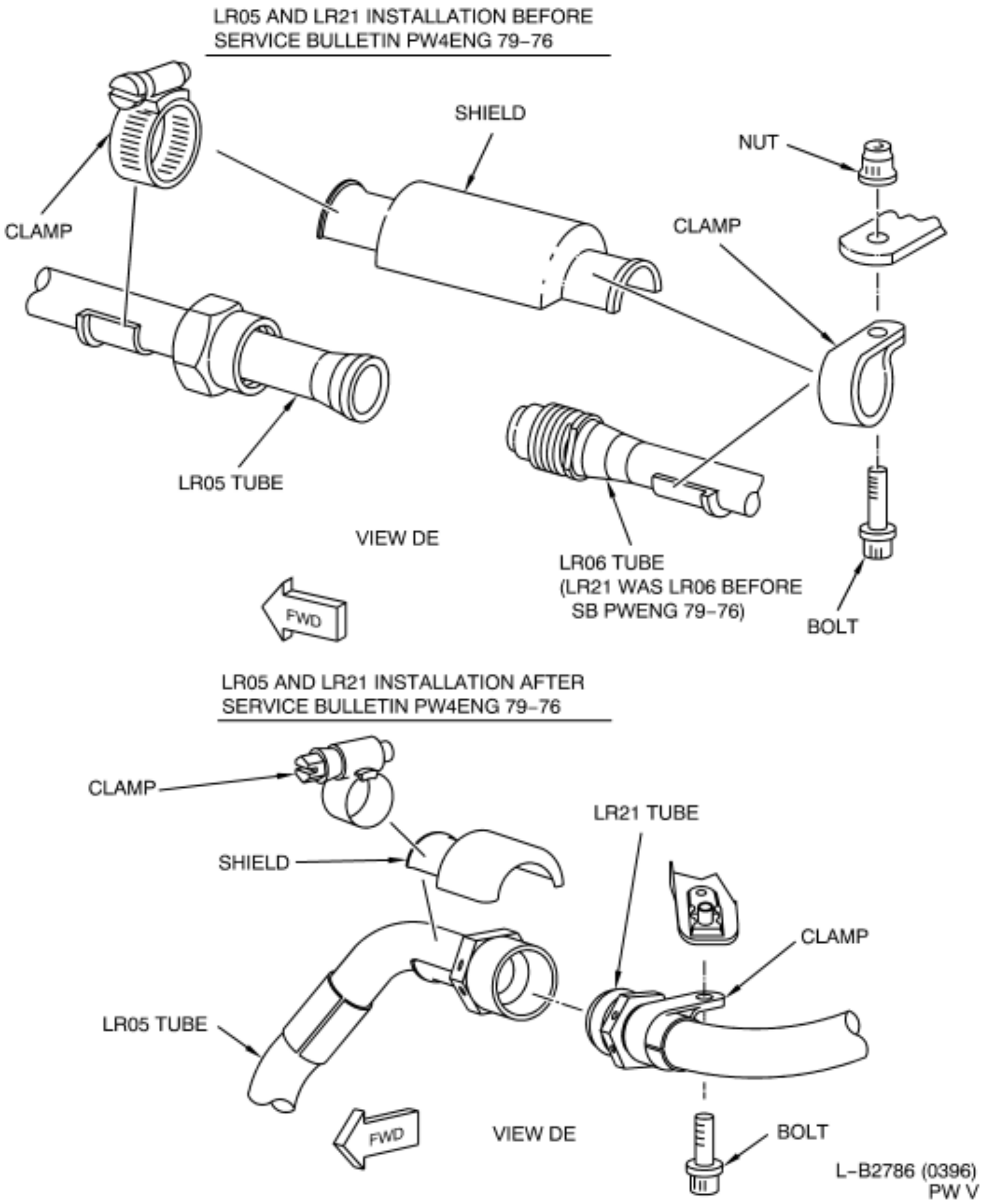
External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 405 (Sheet 1)
(Task 72−00−54−420−004)


AS02 TUBE
BOLT
FWD
VIEW G
BOLT
LD02 TUBE
CLAMP
FWD
NUT
LP48 TUBE
VIEW L
L−B2793 (0000)
PW V

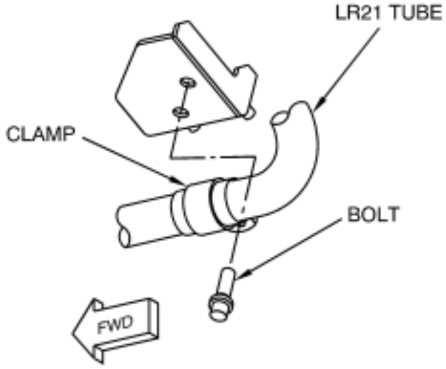
External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 405 (Sheet 2)
(Task 72−00−54−420−004)


FWD
LD02 TUBE
AS02 TUBE
NUT
CLAMP
CLAMP
BOLT
LD02 TUBE
AS02 TUBE
BOLT
CLAMP
BOLT
VIEW I
FWD
BOLT
VIEW H
BOLT
AS02 TUBE
AS02 TUBE
CLAMP
FWD
NUT
BOLT
CLAMP
LD02 TUBE
LD02 TUBE
NUT
FWD
VIEW K
VIEW J
L-B2794 (0000)

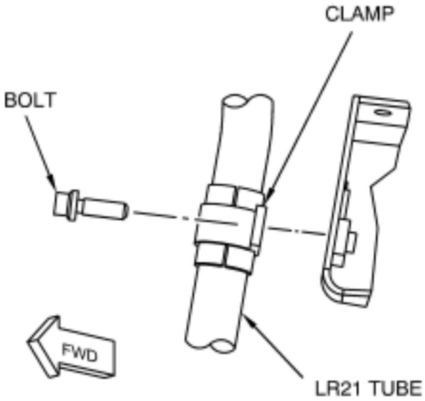
External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 3)
(Task 72-00-54-420-004)


LR05 AND LR21 INSTALLATION BEFORE SERVICE BULLETIN PW4ENG 79-76
CLAMP
SHIELD
NUT
CLAMP
LR05 TUBE
VIEW DE
FWD
LR06 TUBE (LR21 WAS LR06 BEFORE SB PWENG 79-76)
BOLT
LR05 AND LR21 INSTALLATION AFTER SERVICE BULLETIN PW4ENG 79-76
CLAMP
SHIELD
LR21 TUBE
CLAMP
LR05 TUBE
FWD
VIEW DE
BOLT
L-B2786 (0396)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 4)
(Task 72-00-54-420-004)


LR21 TUBE
CLAMP
BOLT
FWD

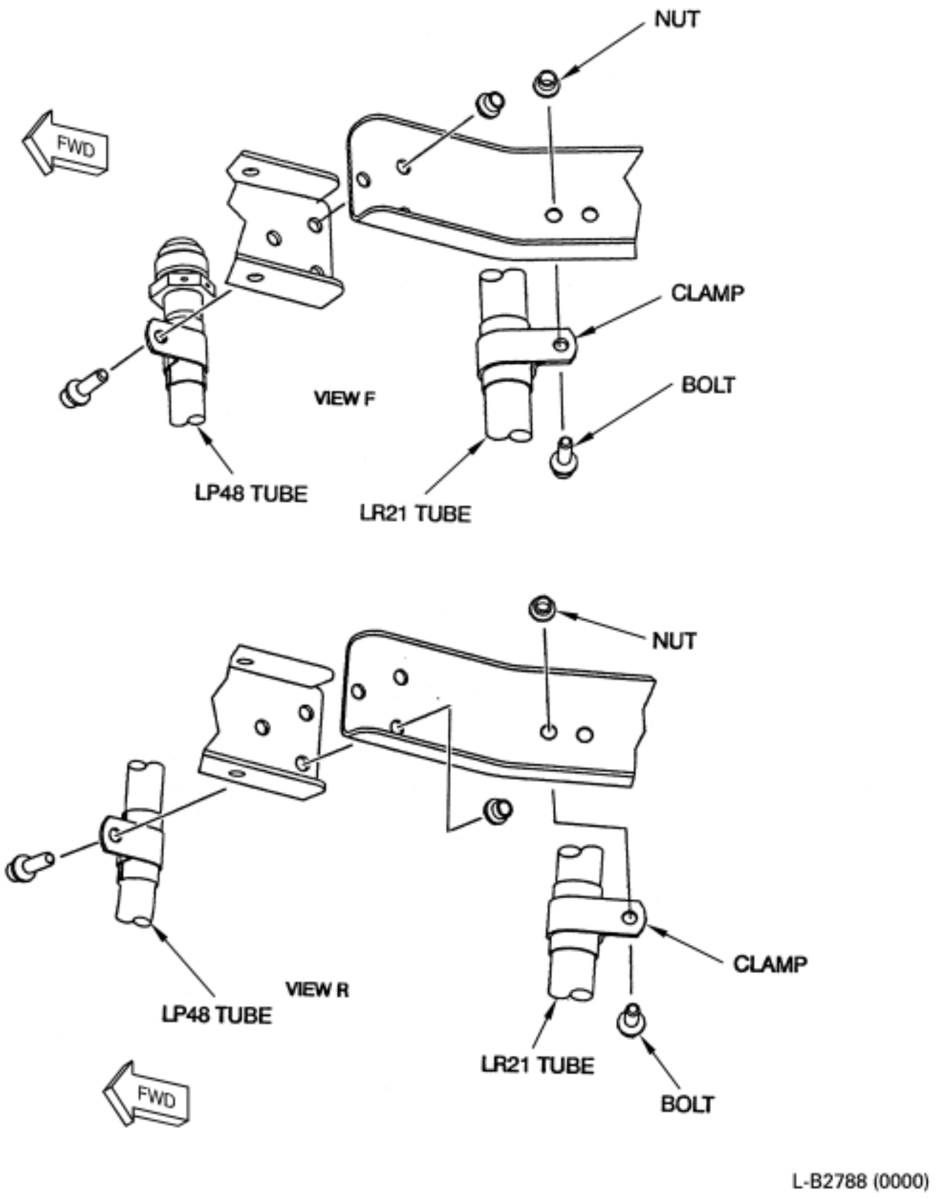
VIEW O


CLAMP
BOLT
FWD
LR21 TUBE

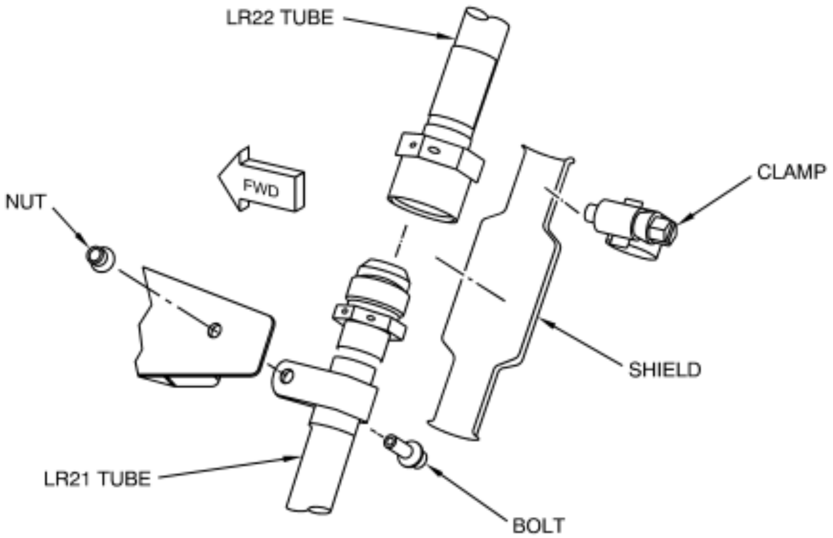
VIEW Q

L−B2787 (0000)
PW V

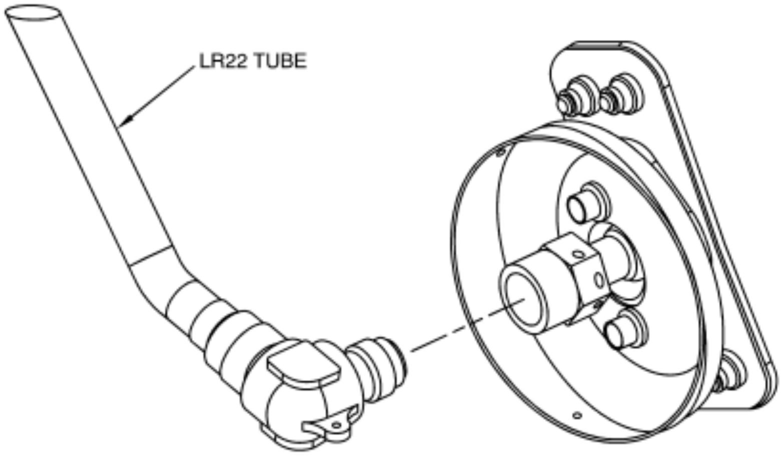
External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 405 (Sheet 5)
(Task 72−00−54−420−004)


NUT
FWD
CLAMP
BOLT
VIEW F
LP48 TUBE
LR21 TUBE
NUT
CLAMP
VIEW R
LP48 TUBE
LR21 TUBE
BOLT
FWD
L-B2788 (0000)

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 6)
(Task 72-00-54-420-004)


LR22 TUBE
FWD
CLAMP
NUT
SHIELD
LR21 TUBE
BOLT

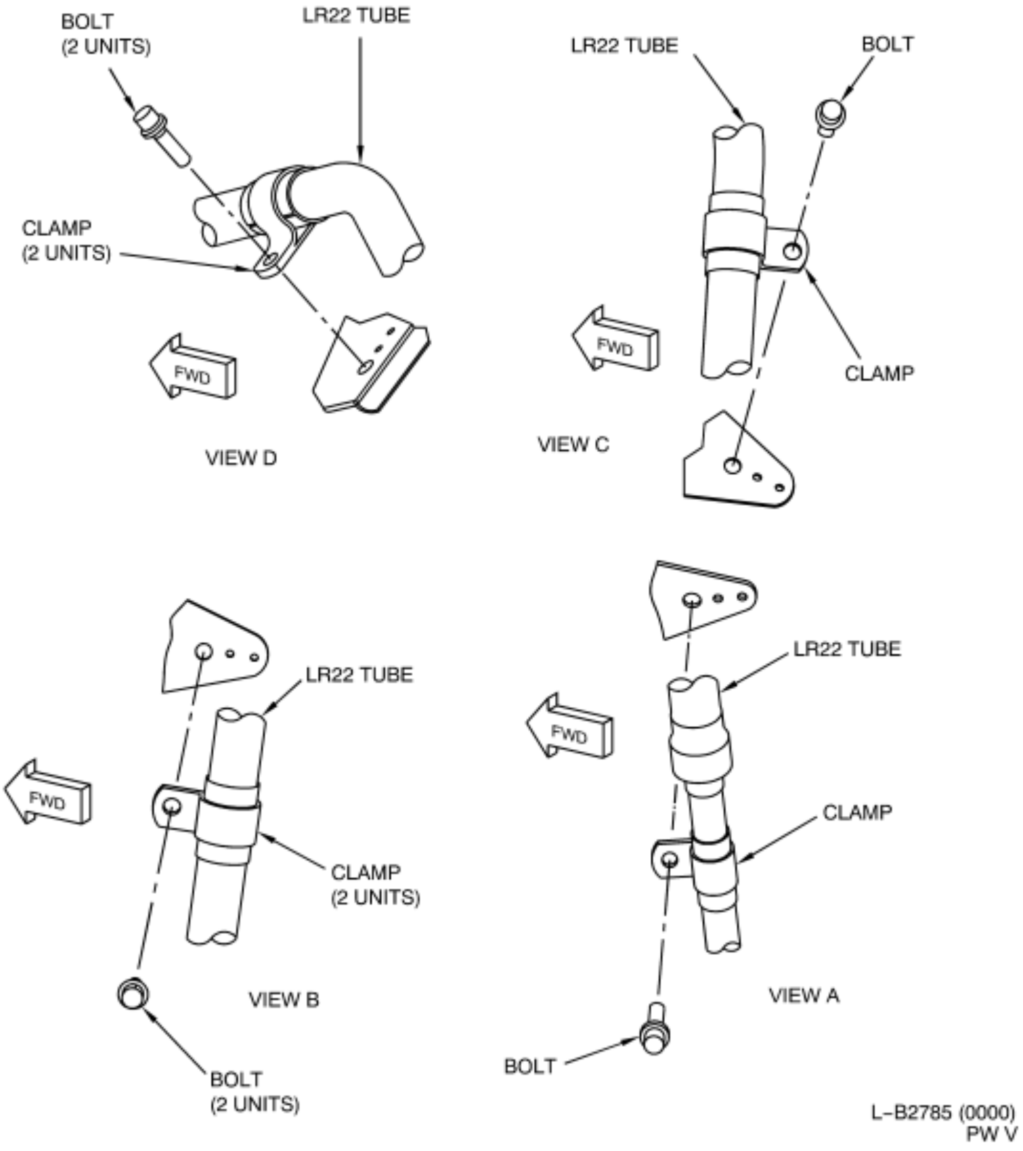
VIEW E


LR22 TUBE

VIEW A P

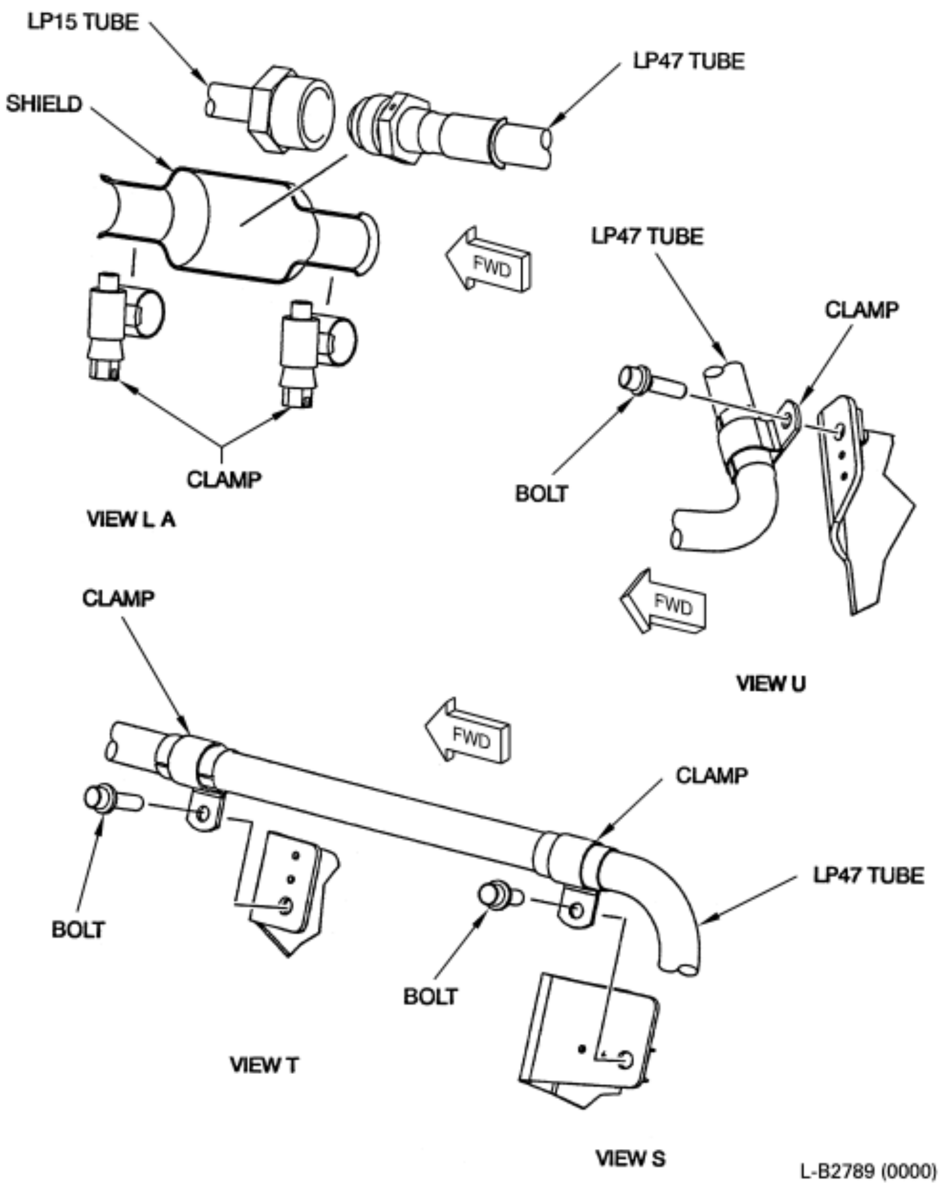
L-B2784 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 7)
(Task 72-00-54-420-004)

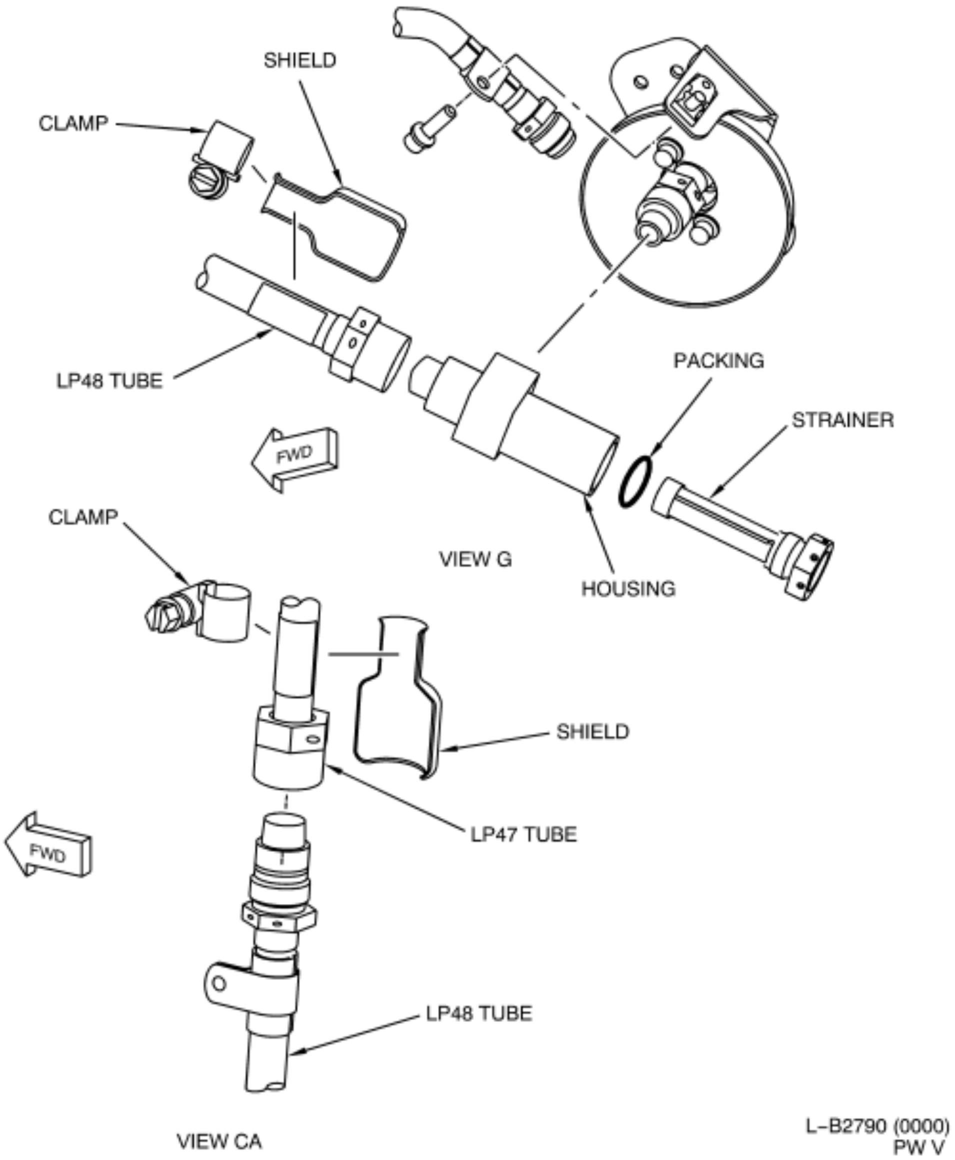

BOLT
(2 UNITS)
LR22 TUBE
CLAMP
(2 UNITS)
FWD
VIEW D
LR22 TUBE
BOLT
CLAMP
FWD
VIEW C
LR22 TUBE
FWD
CLAMP
(2 UNITS)
VIEW B
BOLT
(2 UNITS)
LR22 TUBE
FWD
CLAMP
VIEW A
BOLT
L-B2785 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 8)
(Task 72-00-54-420-004)

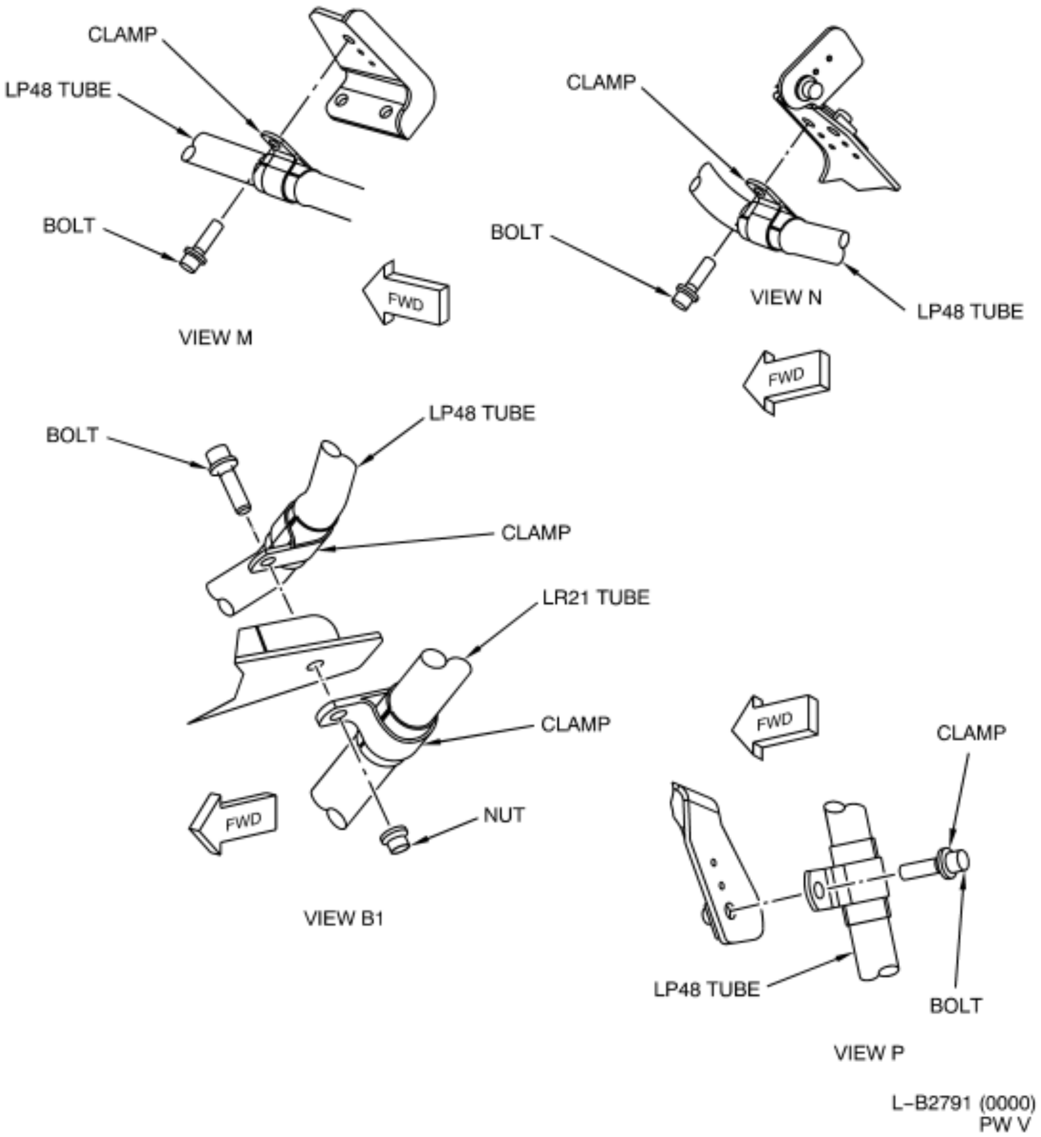
ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−02


LP15 TUBE
SHIELD
LP47 TUBE
FWD
LP47 TUBE
CLAMP
CLAMP
BOLT
VIEW L A
FWD
VIEW U
CLAMP
FWD
CLAMP
LP47 TUBE
BOLT
BOLT
VIEW T
VIEW S
L-B2789 (0000)

External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 405 (Sheet 9)
(Task 72−00−54−420−004)


SHIELD
CLAMP
LP48 TUBE
FWD
PACKING
STRAINER
CLAMP
VIEW G
HOUSING
SHIELD
LP47 TUBE
FWD
LP48 TUBE
VIEW CA
L-B2790 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79-76)
Figure 405 (Sheet 10)
(Task 72-00-54-420-004)


CLAMP
LP48 TUBE
BOLT
FWD
VIEW M
CLAMP
BOLT
VIEW N
LP48 TUBE
FWD
LP48 TUBE
BOLT
CLAMP
LR21 TUBE
CLAMP
FWD
NUT
VIEW B1
FWD
CLAMP
LP48 TUBE
BOLT
VIEW P
L−B2791 (0000)
PW V

External Plumbing Clipping Views (Post SB PW4ENG 79−76)
Figure 405 (Sheet 11)
(Task 72−00−54−420−004)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - TURBINE EXHAUST CASE - INSTALLATION-03

Task 72-00-54-450-001:

1. Install The (PT4.95) Average Pressure And Temperature Probes
   A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

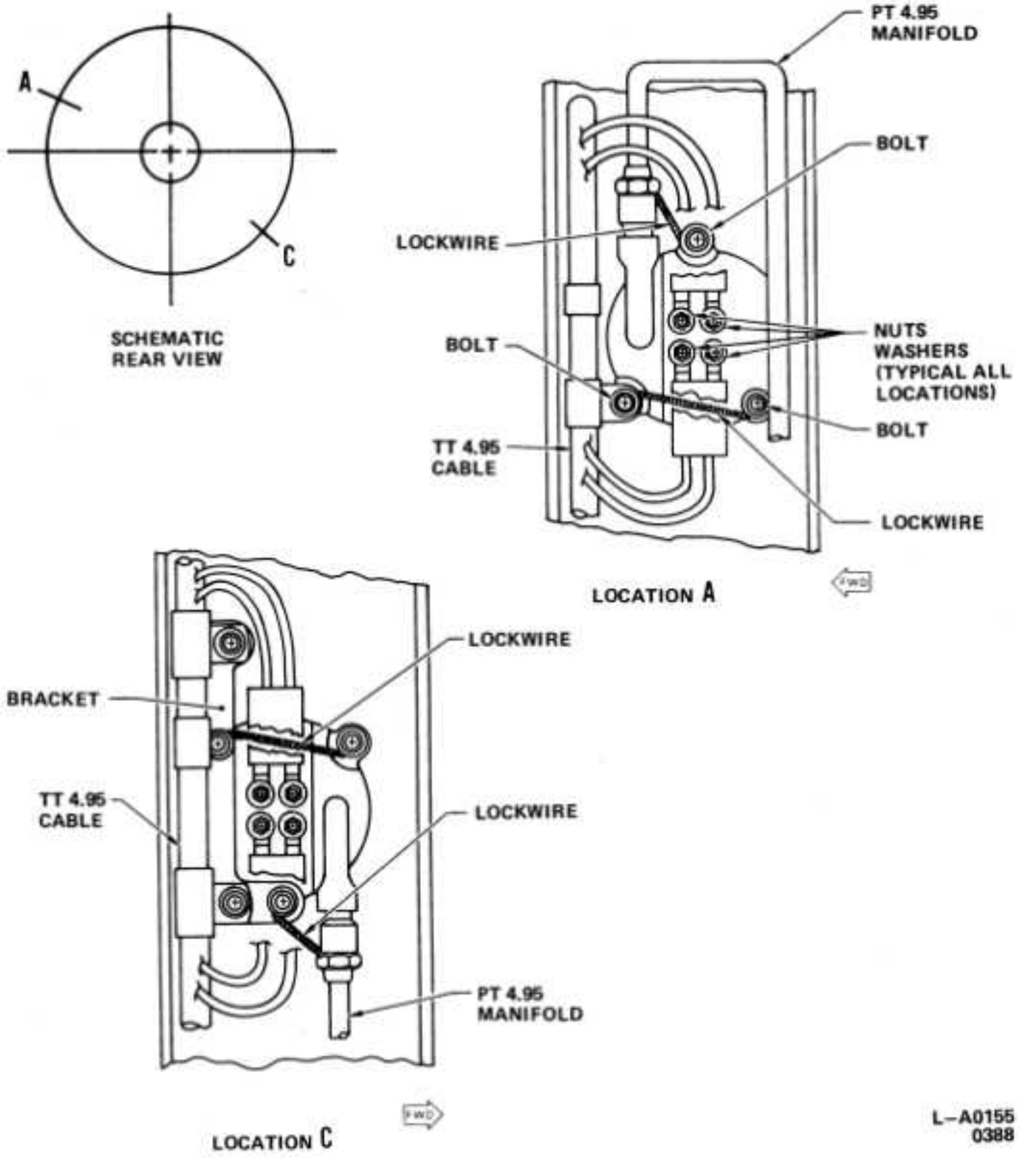
Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-023	Silver Goop (PWA 36001)

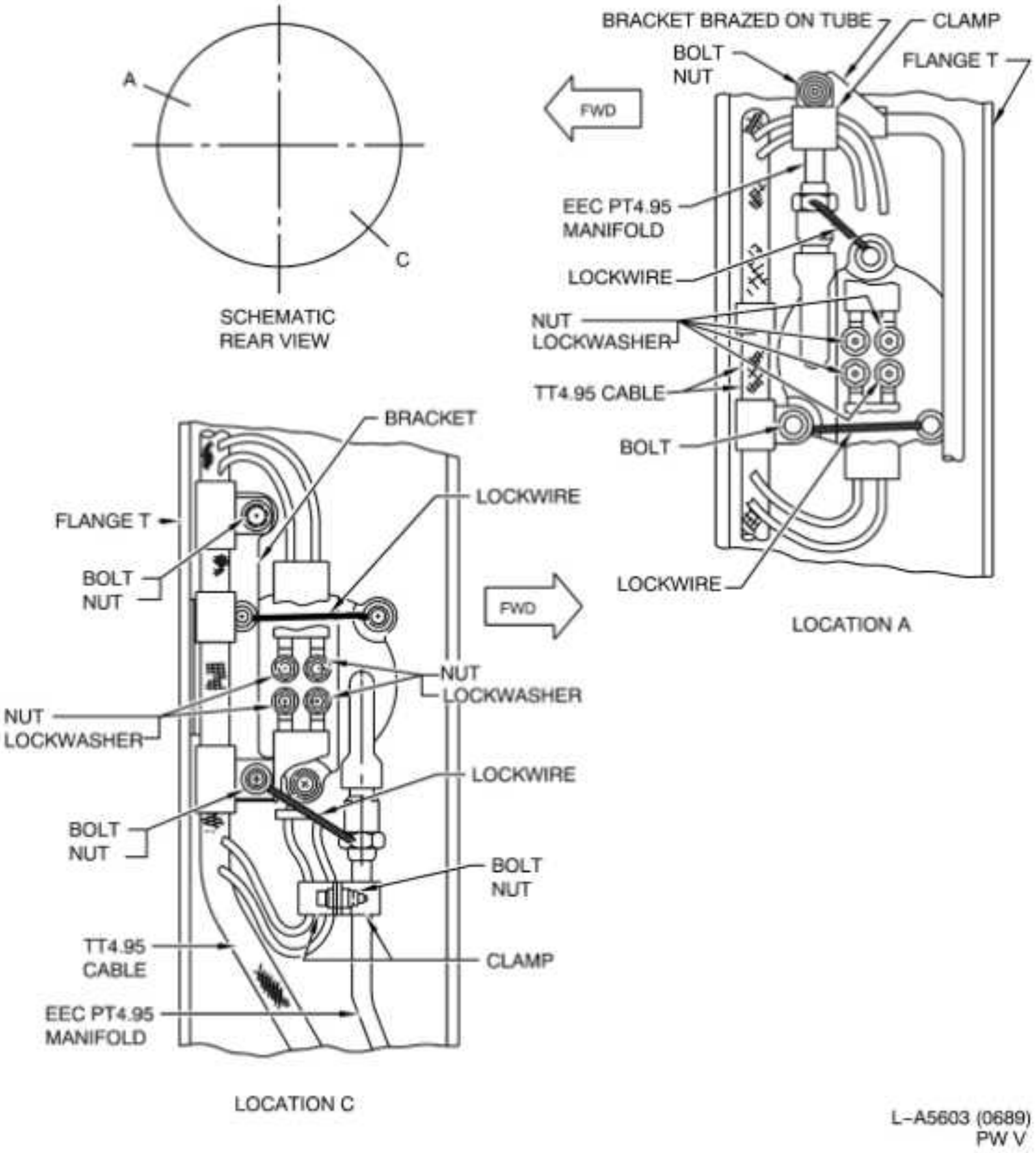
B. Procedure
See Figure 401.
(1) Remove the covers.
(2) Install each (PT4.95) average pressure and temperature probe to the exhaust case as follows.
  (a) Move the EEC PT4.95 manifold and TT4.95 cable away from the opening and install the probe.
  (b) Install the TT4.95 thermocouple into the probe and align the boltholes.
  (c) Align the TT4.95 cable with the boltholes and install the three bolts lubricated with Silver Goop (P06-023).
  (d) Torque the bolts to 54 - 60 lb-in. (6.101 - 6.779 N.m). Install the Lockwire (P05-289) or Safety Cable (P05-291) and Safety Cable Ferrule (P05-292) to the two bolts away from the tube adapter.

CAUTION: DO NOT LUBRICATE THE EEC SENSING TUBES OR ADAPTERS. CONTAMINATION OF THE EEC CAN RESULT.

  (e) Tighten and torque the EEC PT4.95 manifold (AS33) or (AS34) nut to 135 - 150 lb-in. (15.253 - 16.948 N.m). Install the Lockwire (P05-289) or Safety Cable (P05-291) and Safety Cable Ferrule (P05-292) to the adjacent bolt.


A
C
SCHEMATIC REAR VIEW
PT 4.95 MANIFOLD
BOLT
LOCKWIRE
NUTS
WASHERS
(TYPICAL ALL LOCATIONS)
BOLT
BOLT
TT 4.95 CABLE
LOCKWIRE
LOCATION A
FWD
LOCKWIRE
BRACKET
TT 4.95 CABLE
LOCKWIRE
PT 4.95 MANIFOLD
LOCATION C
FWD
L−A0155
0388

Average Pressure And Temperature Probes
(Pre SB PW4ENG 72−134)
Figure 401 (Sheet 1)
(Task 72−00−54−450−003)


A
C
SCHEMATIC
REAR VIEW
FWD
BRACKET BRAZED ON TUBE
CLAMP
BOLT
NUT
FLANGE T
EEC PT4.95
MANIFOLD
LOCKWIRE
NUT
LOCKWASHER
TT4.95 CABLE
BOLT
LOCKWIRE
LOCATION A
BRACKET
LOCKWIRE
FLANGE T
BOLT
NUT
FWD
NUT
LOCKWASHER
NUT
LOCKWASHER
LOCKWIRE
BOLT
NUT
BOLT
NUT
TT4.95
CABLE
CLAMP
EEC PT4.95
MANIFOLD
LOCATION C
L−A5603 (0689)
PW V

Average Pressure And Temperature Probes
(Post SB PW4ENG 72−134)
Figure 401 (Sheet 2)
(Task 72−00−54−450−003)

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−03

CAUTION: USE THE TORQUE LIMITS FOR THE THERMOCOUPLE NUTS. TOO MUCH TORQUE CAN RESULT IN DAMAGE TO THE THERMOCOUPLE.

(f) Attach the cable ends to the thermocouple studs with the lockwashers and nuts. Torque the (larger) alumel nuts to 10 − 15 lb−in. (1.130 − 1.695 N.m). Torque the (smaller) chromel nuts to 8 − 12 lb−in. (0.904 − 1.356 N.m).

(g) Install the clamp bolts, lubricated with Engine Oil (P03−001), and nuts that attach the adjacent TT4.95 cable and PT4.95 manifold clamps. Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

C. Postrequisites

(1) Test the engine per the Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).

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ENGINE GENERAL - TURBINE EXHAUST CASE - INSTALLATION-04

Task 72-00-54-450-002-A:

1. Install The EGT (TT4.95) Thermocouple Cable - For Engines Without The Revised TT4.95 Cable And PT4.95 Sensing Manifold For Increased Engine Core Clearance (Pre SB PW4ENG 72-134)

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lockwire, MS9226-03		

B. Procedure - Right Side
See Figure 401 and Figure 402.

(1) Remove the nuts and lockwashers from the thermocouple terminal studs at the 1:00 and 4:30 o'clock positions. Install the thermocouple cable leads to the thermocouple studs. Install the lockwashers and nuts (stepped washer face next to the lockwasher) handtight only.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(2) Remove the nuts from the junction box terminal studs. Connect the thermocouple cable leads and the W6 cable leads to the studs. Install the nuts. (Reference 2273) Torque the alumel (larger) nuts to 18 - 22 lb-in. (2.034 - 2.486 N.m). (Reference 2273) Torque the chromel (smaller) nuts to 15 - 18 lb-in. (1.695 - 2.034 N.m). See Figure 402.

(3) Install the clamp halves around the cables at the junction box. Attach the clamp halves to the ears on the junction box with screws, threads lubricated with Engine Oil P03-001. Torque the screws to 16 - 22 lb-in. (1.808 - 2.486 N.m).

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−04

(4) (Reference 2273) Install the cover on the junction box. Put the W6 cable ground lead terminal below the front corner of the cover attach the cover and ground terminal with four screws, threads lubricated with Engine Oil P03−001. Torque the screws to 16 − 22 lb−in. (1.808 − 2.486 N.m). Install lockwire.

(5) Install the cable clamps to the brackets adjacent to the two thermocouples. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Views A and C.

(6) Install the cable clamps to the brackets on Flange T at seven locations. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Views B and D.

(7) Install the outer support bracket to the brackets on Flanges P and T. Attach the bracket with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View J.

(8) Install the front and rear inner brackets over the cables and to the outer support bracket. Attach the brackets with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(9) Align the thermocouple cable leads attached to the studs on the thermocouple so they are parallel to one another. Torque the nuts at each thermocouple as follows:

(a) (Reference 2273) Torque the alumel connections (larger studs) to 18 − 22 lb−in. (2.034 − 2.486 N.m).

(b) (Reference 2273) Torque the chromel connections (smaller studs) to 15 − 18 lb−in. (1.695 − 2.034 N.m).

NOTE: After the nuts are torqued, make sure that the cable leads DO NOT contact the adjacent bolt heads or lockwire.

C. Procedure − Left Side
See Figure 401 and Figure 402.

(1) Remove the nuts and lockwashers from the thermocouple terminal studs at the 10 and 7 o'clock positions. Install the thermocouple cable leads to the thermocouple studs. Install the lockwashers and nuts (stepped washer face next to the lockwasher) handtight only.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(2) Remove the nuts from the junction box terminal studs. Connect the thermocouple cable leads and the W6 cable leads to the studs. Install the nuts. (Reference 2273) Torque the alumel (larger) nuts to 18 − 22 lb−in. (2.034 − 2.486 N.m). (Reference 2273) Torque the chromel (smaller) nuts to 15 − 18 lb−in. (1.695 − 2.034 N.m). See Figure 402.

(3) Install the clamp halves around the cables at the junction box. Attach the clamp halves to the ears on the junction box with screws, threads lubricated with Engine Oil P03−001. Torque the screws to 16 − 22 lb−in. (1.808 − 2.486 N.m).

(4) (Reference 2273) Install the cover on the junction box. Put the W6 cable ground lead terminal below the front corner of the cover. Attach the cover and ground terminal with four screws, threads lubricated with Engine Oil P03−001. Torque the screws to 16 − 22 lb−in. (1.808 − 2.486 N.m). Install lockwire.

(5) Attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position with a bolt, threads lubricated with Engine Oil P03−001. Torque the bolt to 75 − 85 lb−in. (8.474 − 9.604 N.m). Install lockwire See View E.

(6) Install the cable clamps to the bracket adjacent to the thermocouple at the 7 o'clock position. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View I.

(7) Install the cable clamps and the EEC PT4.95 manifold clamps to the brackets on Flange T. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Views G and H.

(8) Install the cable clamp to the bracket brazed on the EEC PT4.95 manifold. Attach the clamp with bolt, threads lubricated with Engine Oil P03−001 and nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View F.

(9) Install the outer support bracket to the brackets on Flanges P and T. Attach the bracket with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View J.

(10) Install the front and rear inner brackets over the cables and to the outer support bracket. Attach the brackets with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(11) Align the thermocouple cable leads attached to the studs on the thermocouple so they are parallel to one another. Torque the nuts at each thermocouple as follows:

(a) (Reference 2273) Torque the alumel connections (larger studs) to 18 − 22 lb−in. (2.034 − 2.486 N.m).

(b) (Reference 2273) Torque the chromel connections (smaller) studs to 15 − 18 lb−in. (1.695 − 2.034 N.m).

NOTE: After the nuts are torqued, make sure that the cable leads DO NOT contact the adjacent bolt heads or lockwire.

D. Postrequisites

(1) Test engine per Test Reference Table. See 71−00−00, Adjustment/Test−00.

Task 72−00−54−450−002−B:

2. Install The EGT (TT4.95) Thermocouple Cable − For Engines With The Revised TT4.95 Cable And PT4.95 Sensing Manifold For Increased Engine Core Clearance (Post SB PW4ENG 72−134)

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)

Expendable Parts:

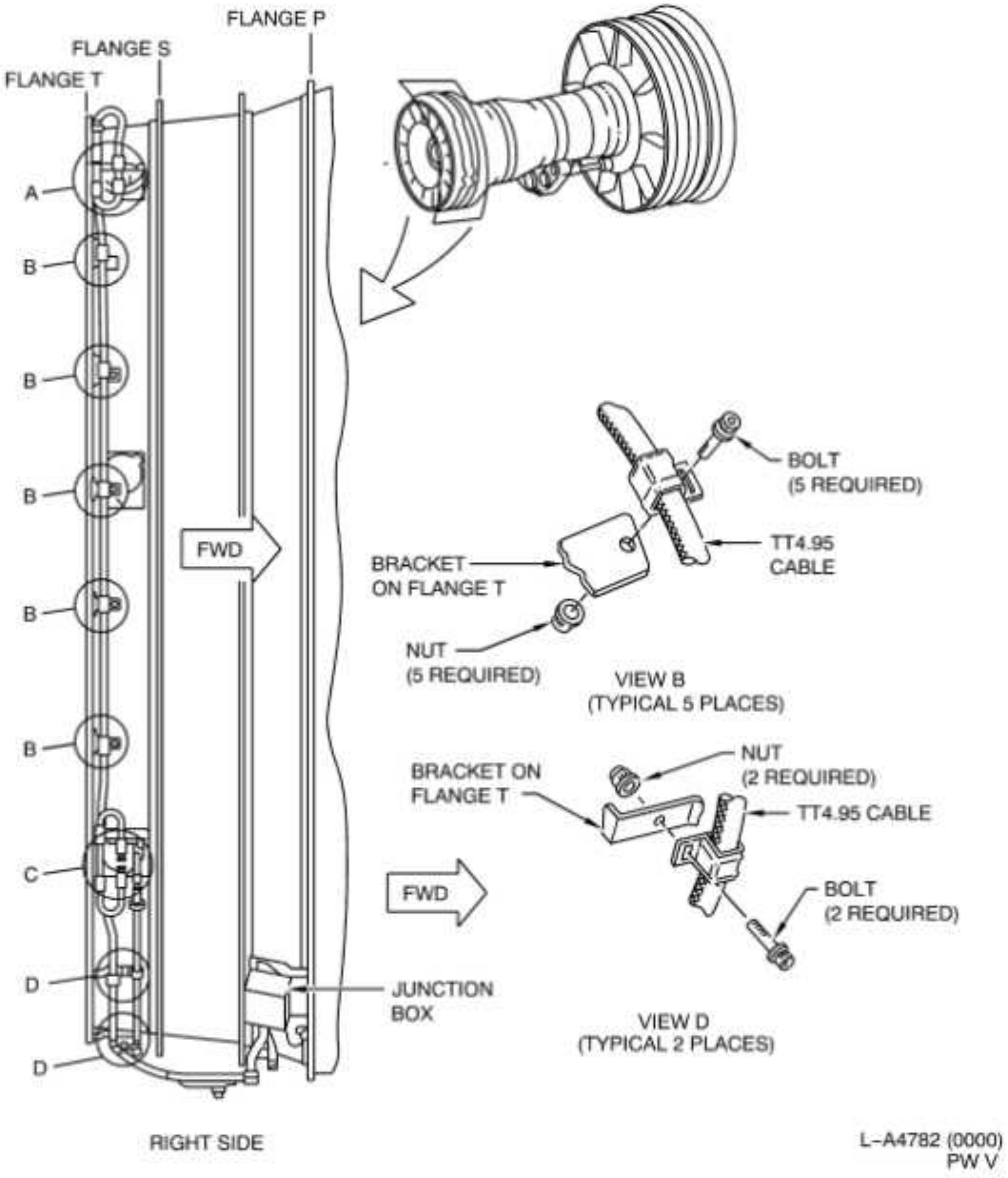
PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lockwire, MS9226−03		

B. Procedure − Right Side
See Figure 403 and Figure 404.

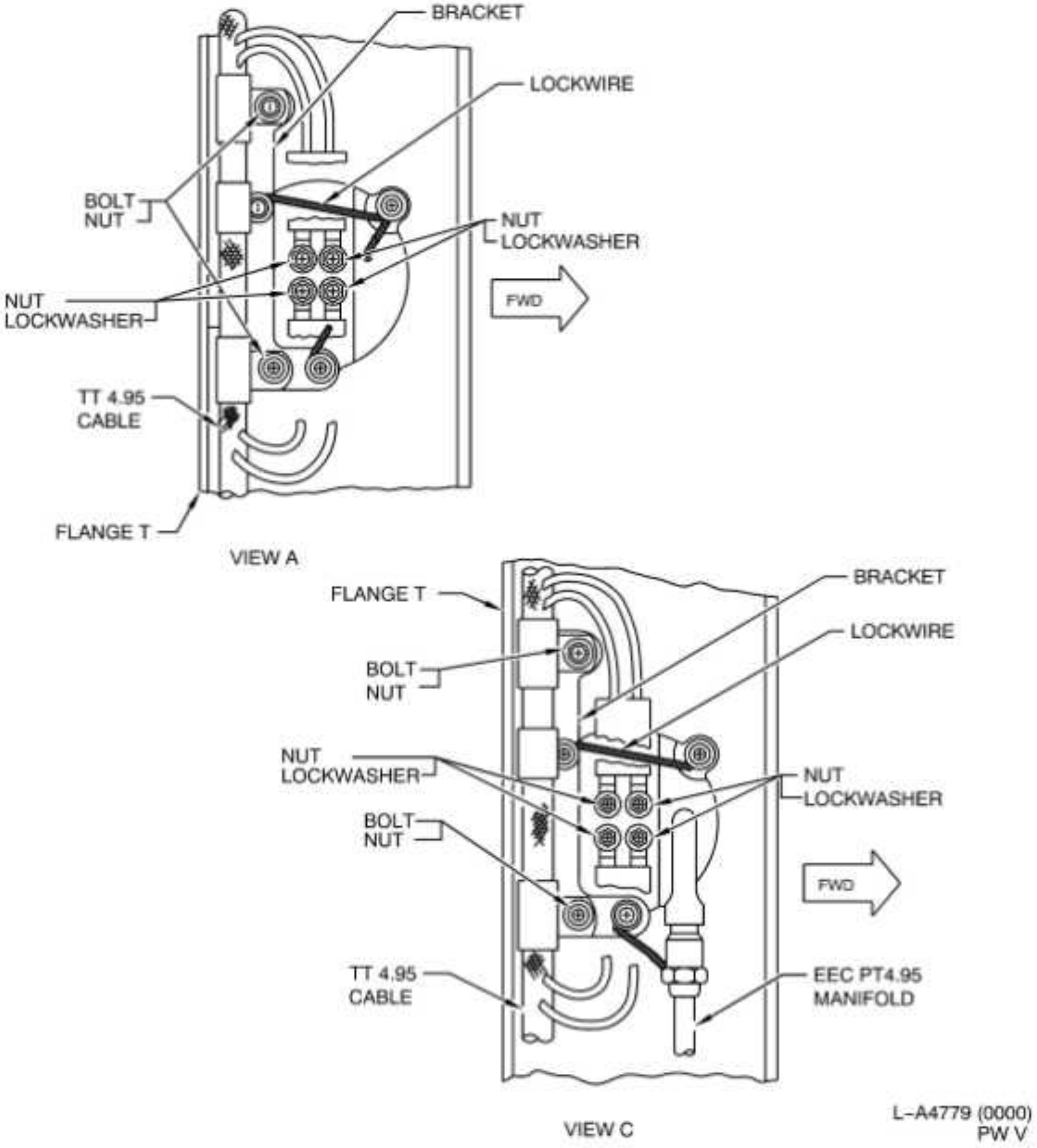
(1) Remove the nuts and lockwashers from the thermocouple terminal studs at the 1:00 and 4:30 o'clock positions. Install the thermocouple cable leads to the thermocouple studs. Install the lockwashers and nuts (stepped washer face next to the lockwasher) handtight only.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

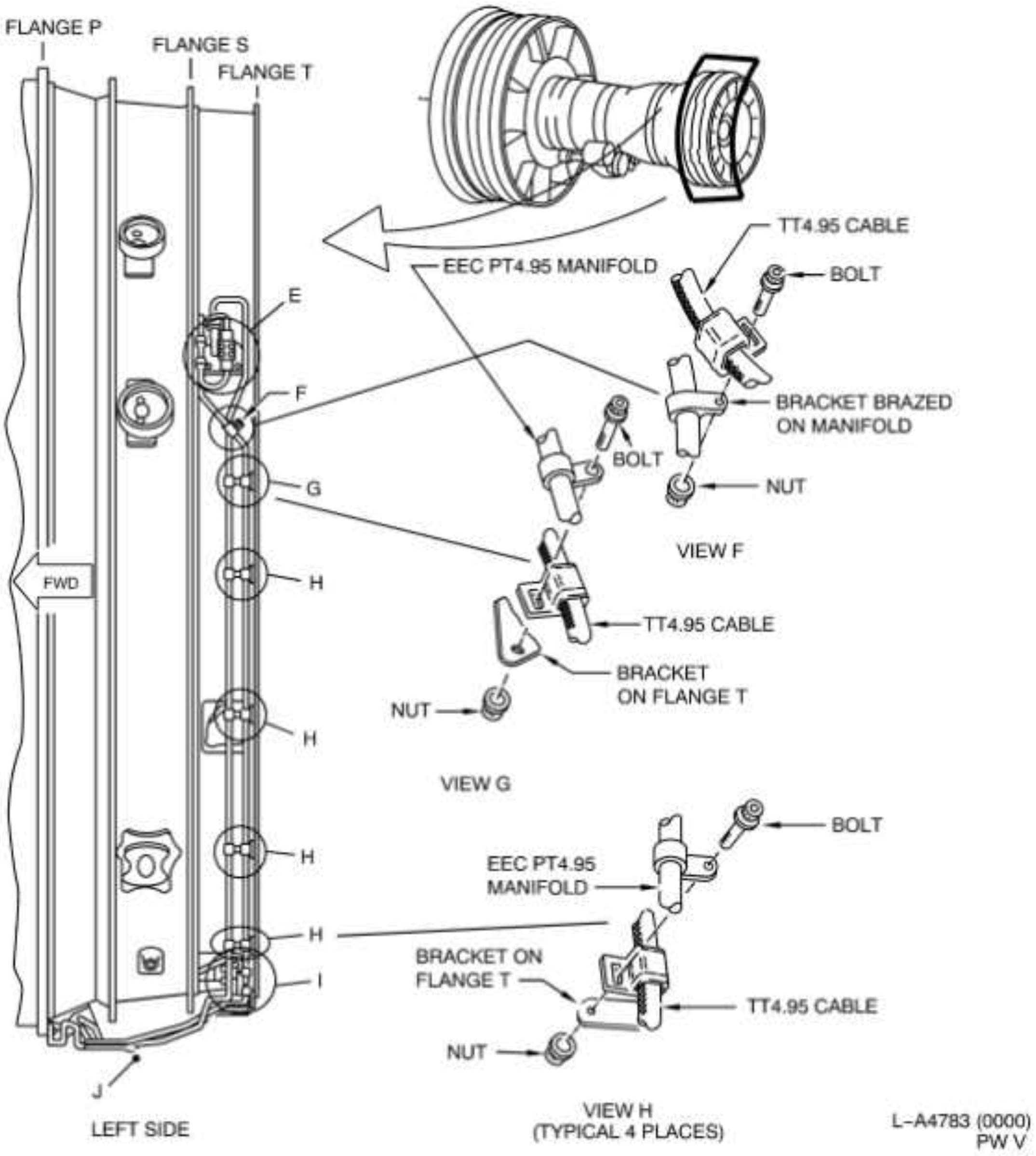
(2) Remove the nuts from the junction box terminal studs. Connect the thermocouple cable leads and the W6 cable leads to the studs. Install the nuts. (Reference 2273) Torque the alumel (larger) nuts to 18 − 22 lb−in. (2.034 − 2.486 N.m). (Reference 2273) Torque the chromel (smaller) nuts to 15 − 18 lb−in. (1.695 − 2.034 N.m). See Figure 404.


FLANGE P
FLANGE S
FLANGE T
A
B
B
B
B
B
C
D
D
FWD
RIGHT SIDE
BOLT
(5 REQUIRED)
TT4.95
CABLE
BRACKET
ON FLANGE T
NUT
(5 REQUIRED)
VIEW B
(TYPICAL 5 PLACES)
BRACKET ON
FLANGE T
NUT
(2 REQUIRED)
TT4.95 CABLE
FWD
BOLT
(2 REQUIRED)
JUNCTION
BOX
VIEW D
(TYPICAL 2 PLACES)
L−A4782 (0000)
PW V

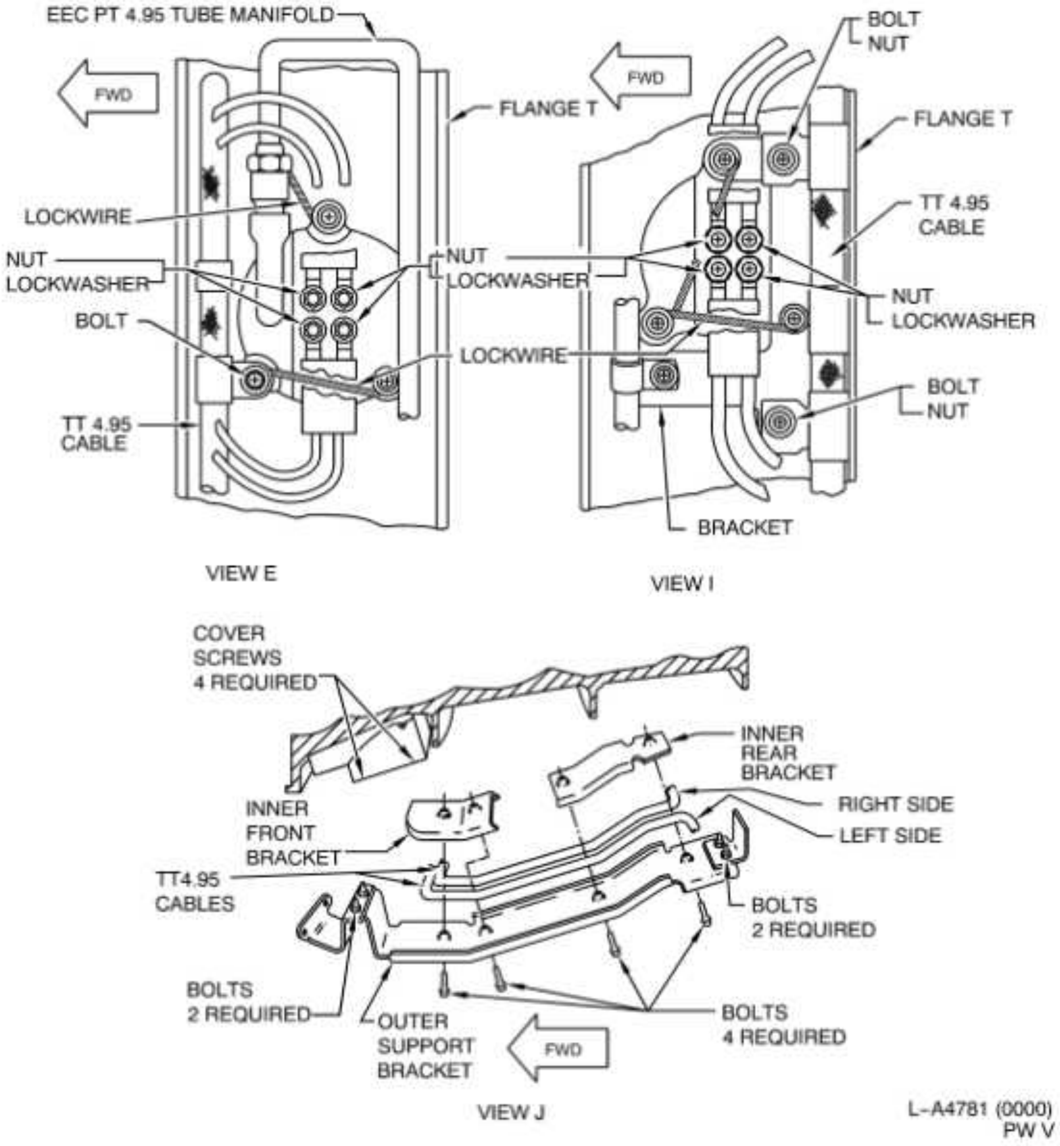
EGT (TT4.95) Thermocouple Cable Assembly (Pre SB PW4ENG 72−134)
Figure 401 (Sheet 1)
(Task 72−00−54−450−002−A)


BRACKET
LOCKWIRE
BOLT
NUT
NUT
LOCKWASHER
NUT
LOCKWASHER
FWD
TT 4.95
CABLE
FLANGE T
VIEW A
FLANGE T
BRACKET
LOCKWIRE
BOLT
NUT
NUT
LOCKWASHER
NUT
LOCKWASHER
BOLT
NUT
FWD
TT 4.95
CABLE
EEC PT4.95
MANIFOLD
VIEW C
L-A4779 (0000)
PW V

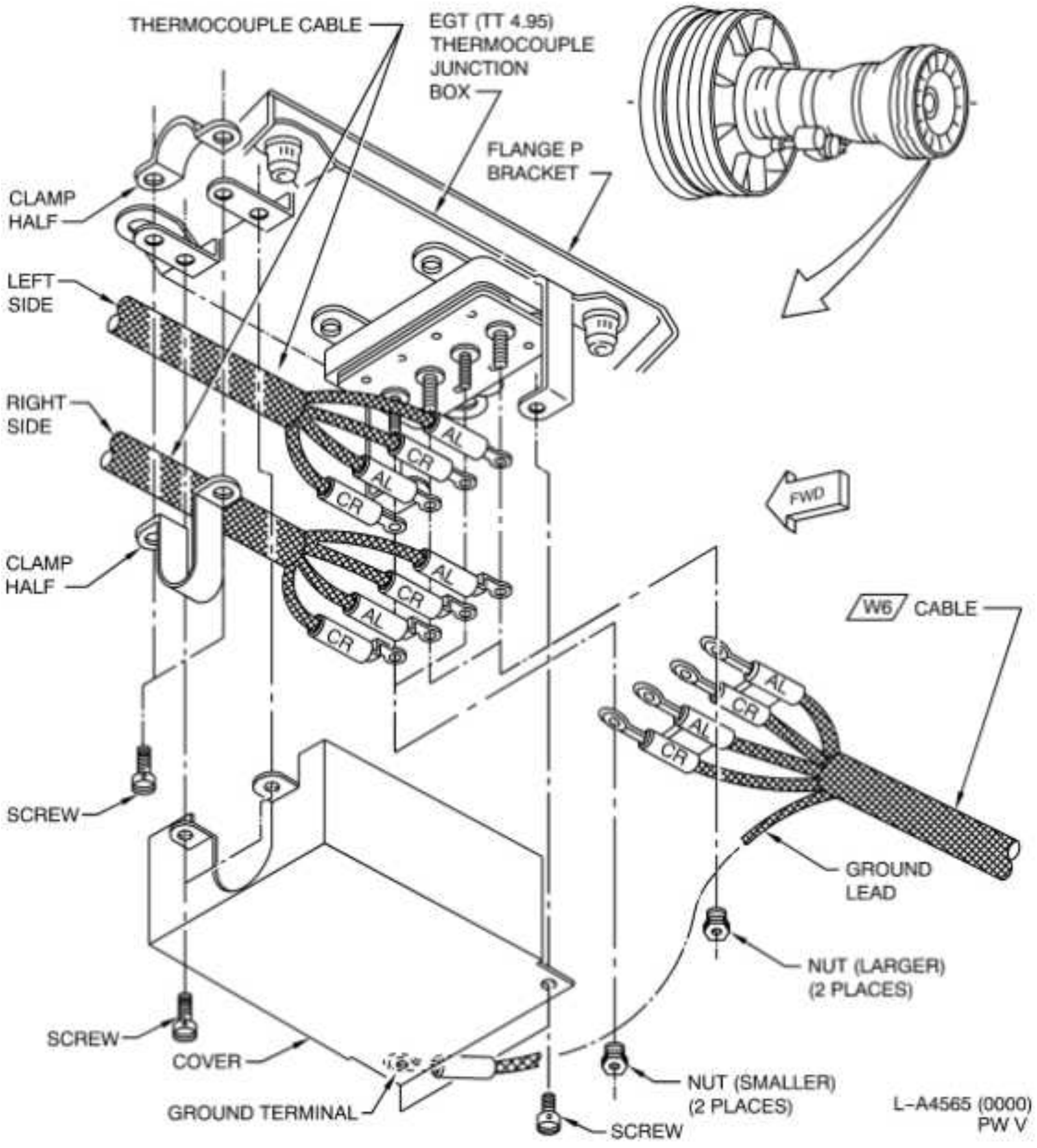
EGT (TT4.95) Thermocouple Cable Assembly (Pre SB PW4ENG 72-134)
Figure 401 (Sheet 2)
(Task 72-00-54-450-002-A)


FLANGE P
FLANGE S
FLANGE T
E
F
G
H
H
H
H
I
J
FWD
LEFT SIDE
TT4.95 CABLE
BOLT
EEC PT4.95 MANIFOLD
BRACKET BRAZED ON MANIFOLD
BOLT
NUT
VIEW F
TT4.95 CABLE
BRACKET ON FLANGE T
NUT
VIEW G
BOLT
EEC PT4.95 MANIFOLD
BRACKET ON FLANGE T
TT4.95 CABLE
NUT
VIEW H (TYPICAL 4 PLACES)
L−A4783 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Assembly (Pre SB PW4ENG 72−134)
Figure 401 (Sheet 3)
(Task 72−00−54−450−002−A)


EEC PT 4.95 TUBE MANIFOLD
FWD
FLANGE T
LOCKWIRE
NUT
LOCKWASHER
BOLT
NUT
LOCKWASHER
LOCKWIRE
TT 4.95
CABLE
VIEW E
FWD
BOLT
NUT
FLANGE T
TT 4.95
CABLE
NUT
LOCKWASHER
BOLT
NUT
BRACKET
VIEW I
COVER
SCREWS
4 REQUIRED
INNER
REAR
BRACKET
RIGHT SIDE
LEFT SIDE
INNER
FRONT
BRACKET
TT4.95
CABLES
BOLTS
2 REQUIRED
BOLTS
2 REQUIRED
OUTER
SUPPORT
BRACKET
FWD
BOLTS
4 REQUIRED
VIEW J
L-A4781 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Assembly (Pre SB PW4ENG 72−134)
Figure 401 (Sheet 4)
(Task 72−00−54−450−002−A)


THERMOCOUPLE CABLE
EGT (TT 4.95) THERMOCOUPLE JUNCTION BOX
FLANGE P BRACKET
CLAMP HALF
LEFT SIDE
RIGHT SIDE
CLAMP HALF
AL
CR
AL
CR
AL
CR
AL
CR
FWD
W6 CABLE
AL
CR
AL
CR
GROUND LEAD
NUT (LARGER) (2 PLACES)
SCREW
SCREW
COVER
GROUND TERMINAL
NUT (SMALLER) (2 PLACES)
SCREW
L−A4565 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Junction Box (Pre SB PW4ENG 72−134)
Figure 402
(Task 72−00−54−450−002−A)

(3) Install the clamp halves around the cables at the junction box. Attach the clamp halves to the ears on the junction box with screws, threads lubricated with Engine Oil P03−001. Torque the screws to 16 − 22 lb−in. (1.808 − 2.486 N.m).

(4) (Reference 2273) Install the cover on the junction box. Put the W6 cable ground lead terminal below the rear corner of the cover. Attach the cover and ground terminal with four screws, threads lubricated with Engine Oil P03−001. Torque the screws to 16 − 22 lb−in. (1.808 − 2.486 N.m). Install lockwire.

(5) Install the cable clamps to the brackets adjacent to the two thermocouples. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Views A and C.

(6) Install the cable clamps to the brackets on Flange T at five locations. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View B.

(7) Install the cable clamp to the bracket brazed on the EEC PT4.95 manifold at the 4:30 o'clock position. Attach clamp with bolt, threads lubricated with Engine Oil P03−001 and a nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View C.

(8) Make a loop in the thermocouple cable adjacent to the junction box. Attach the cable clamp, nearest to the loop, to the front support bracket with a bolt, threads lubricated with Engine Oil P03−001. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View J.

(9) Install the front positioning plate on the two cables with the spacers, inboard, between the cables. Attach the plate to the front support bracket with two bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View J.

NOTE: The cables installed below the positioning plate will be compressed by the plate when torquing the bolts.

(10) Install the positioning plate on the thermocouple cable at approximately the 5 o'clock position. Install the cable to the left of the inner spacer and to the right of the outer spacer on the plate. Attach the positioning plate and the clamp on the EEC PT4.95 manifold to the support bracket with two bolts, threads lubricated with Engine Oil P03−001, and a nut. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View D.

NOTE: The cable installed below the positioning plate will be compressed by the plate when torquing the bolts.

(11) Install the cable clamp to the inboard side of the reinforcing plate at the 5:30 o'clock position. Attach the clamp to the plate with a bolt, threads lubricated with Engine Oil P03−001, and a nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View D.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(12) Align the thermocouple cable leads attached to the studs on the thermocouples so they are parallel to one another. Torque the nuts at each thermocouple as follows:

(a) (Reference 2273) Torque the alumel connections (larger studs) to 18 − 22 lb−in. (2.034 − 2.486 N.m).

(b) (Reference 2273) Torque the chromel connections (smaller studs) to 15 − 18 lb−in. (1.695 − 2.034 N.m).

NOTE: After the nuts are torqued, make sure that the cable leads DO NOT CONTACT the adjacent bolt heads or lockwire.

(13) Clamp the bottom two thermocouple leads at the 4:30 o'clock thermocouple to the EEC PT4.95 manifold, 1/2 inch (12.700 mm) from the manifold nut. Attach the leads with two clamps, bolt, threads lubricated with Engine Oil P03−001, and a nut. Torque the nut to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View C.

C. Procedure − Left Side
See Figure 403 and Figure 404.

(1) Remove the nuts and lockwashers from the thermocouple terminal studs at the 10 and 7 o'clock positions. Install the thermocouple cable leads to the thermocouple studs. Install the lockwashers and nuts (stepped washer face next to the lockwasher) handtight only.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(2) Remove the nuts from the junction box terminal studs. Connect the thermocouple cable leads and the W6 cable leads to the studs. Install the nuts. (Reference 2273) Torque the alumel (larger) nuts to 18 − 22 lb−in. (2.034 − 2.486 N.m). (Reference 2273) Torque the chromel (smaller) nuts to 15 − 18 lb−in. (1.695 − 2.034 N.m). See Figure 404.

(3) Install the clamp halves around the cables at the junction box. Attach the clamp halves to the ears on the junction box with screws, threads lubricated with Engine Oil P03−001. Torque the screws to 16 − 22 lb−in. (1.808 − 2.486 N.m).

(4) (Reference 2273) Install the cover on the junction box. Put the W6 cable ground lead terminal below the rear corner of the cover. Attach the cover and ground terminal with four screws, threads lubricated with Engine Oil P03−001. Torque the screws to 16 − 22 lb−in. (1.808 − 2.486 N.m). Install lockwire.

(5) Attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position with a bolt, threads lubricated with Engine Oil Engine Oil P03−001. Torque the bolt to 75 − 85 lb−in. (8.474 − 9.604 N.m). Install lockwire. See View E.

(6) Clamp the top two thermocouple leads at the 10 o'clock thermocouple to the bracket brazed on the EEC PT4.95 tube. Attach the clamp with bolt, threads lubricated with Engine Oil P03−001, and a nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View E.

(7) Install the cable clamps, and a clamp on the bottom two thermocouple leads, to the bracket adjacent to the thermocouple at the 7 o'clock position. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, nuts and spacer. Install the spacer between the lead clamp and the cable clamp. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View I.

(8) Install the cable clamps and the EEC PT4.95 tube/manifold clamps to the brackets on Flange T. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Views G and H.

(9) Install the cable clamp to the bracket brazed on the EEC PT4.95 tube. Attach the clamp with bolt, threads lubricated with Engine Oil P03−001 and nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View F.

(10) Make a loop in the thermocouple cable adjacent to the 7 o'clock thermocouple. Attach the cable clamp, nearest to the loop, to the rear support bracket with a bolt, threads lubricated with Engine Oil P03−001. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View J.

(11) Install the rear positioning plate with the rear spacer inside the cable/thermocouple lead loop and the front spacer inside the cable adjacent to the cable clamp. Attach the positioning plate to the rear support bracket with four bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View J.

(12) Install the front positioning plate on the two cables with the spacers, inboard, between the cables. Attach the plate to the front support bracket with two bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View J.

NOTE: The cables installed below the positioning plate will be compressed by the plate when torquing the bolts.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(13) Align the thermocouple cable leads attached to the studs on the thermocouples so they are parallel to one another. Torque the nuts at each thermocouple as follows:

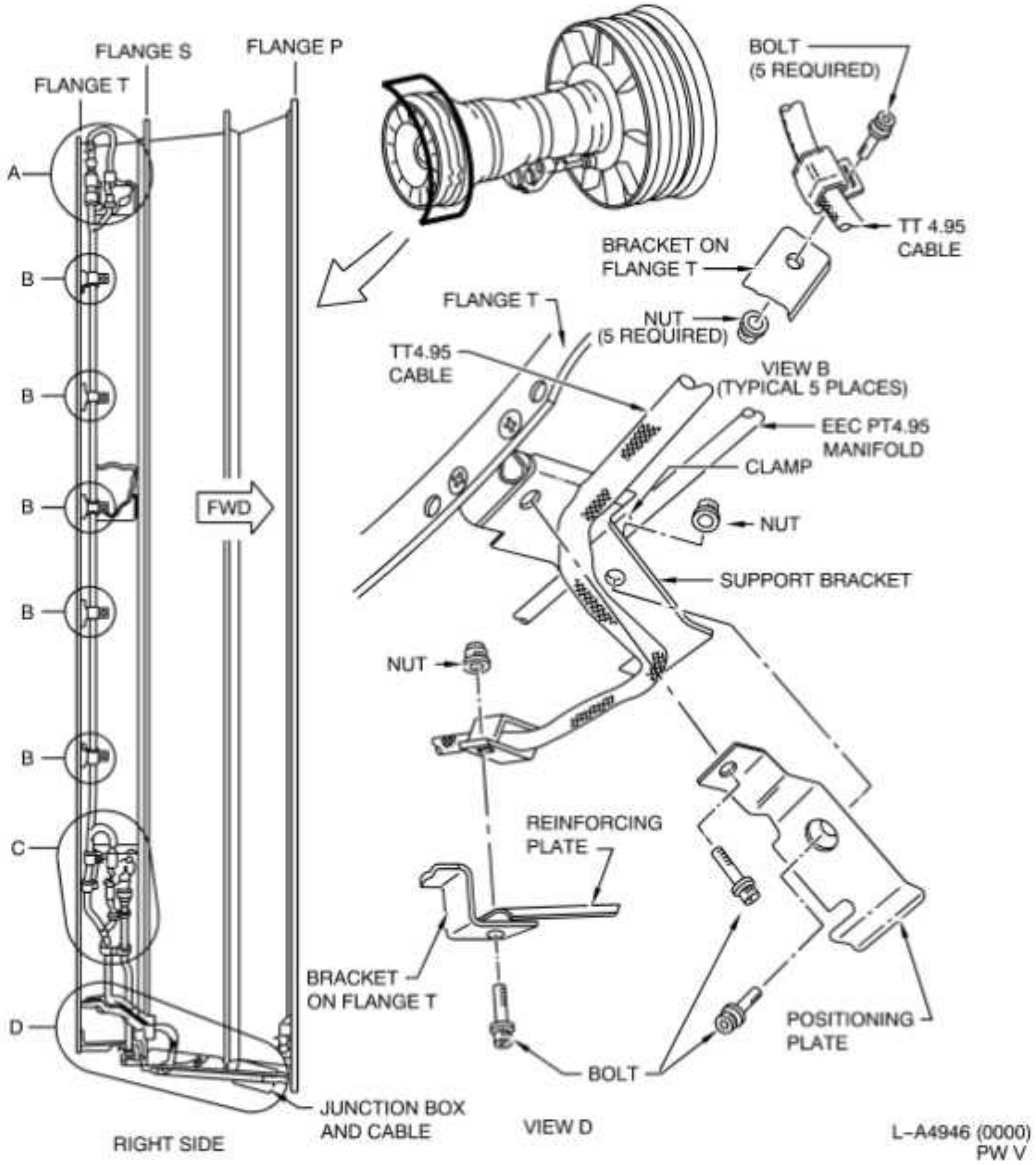
(a) (Reference 2273) Torque the alumel connections (larger studs) to 18 − 22 lb−in. (2.034 − 2.486 N.m).

(b) (Reference 2273) Torque the chromel connections (smaller studs) to 15 − 18 lb−in. (1.695 − 2.034 N.m).

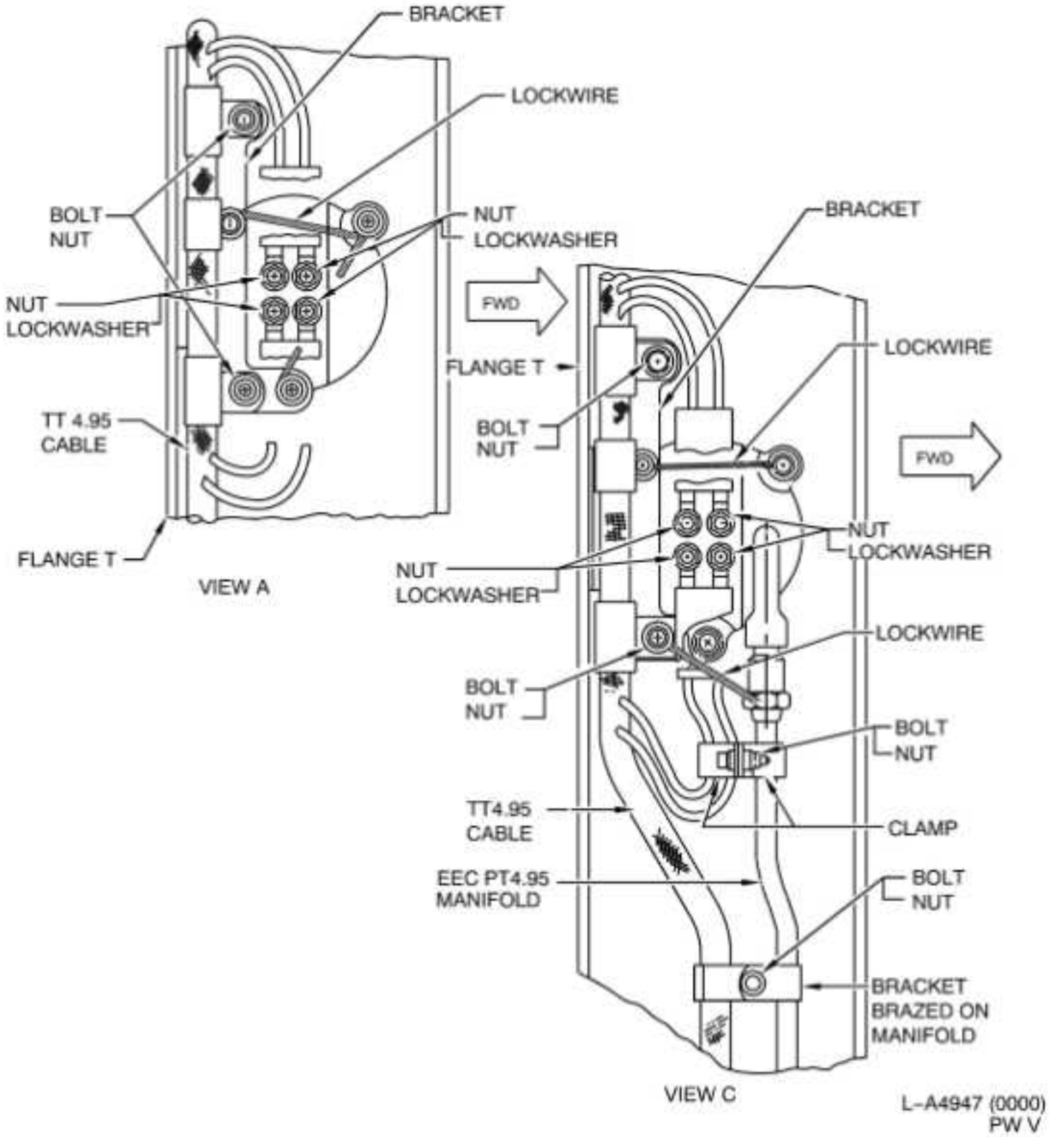
NOTE: After the nuts are torqued, make sure that the cable leads DO NOT CONTACT the adjacent bolt heads or lockwire.

D. Postrequisites

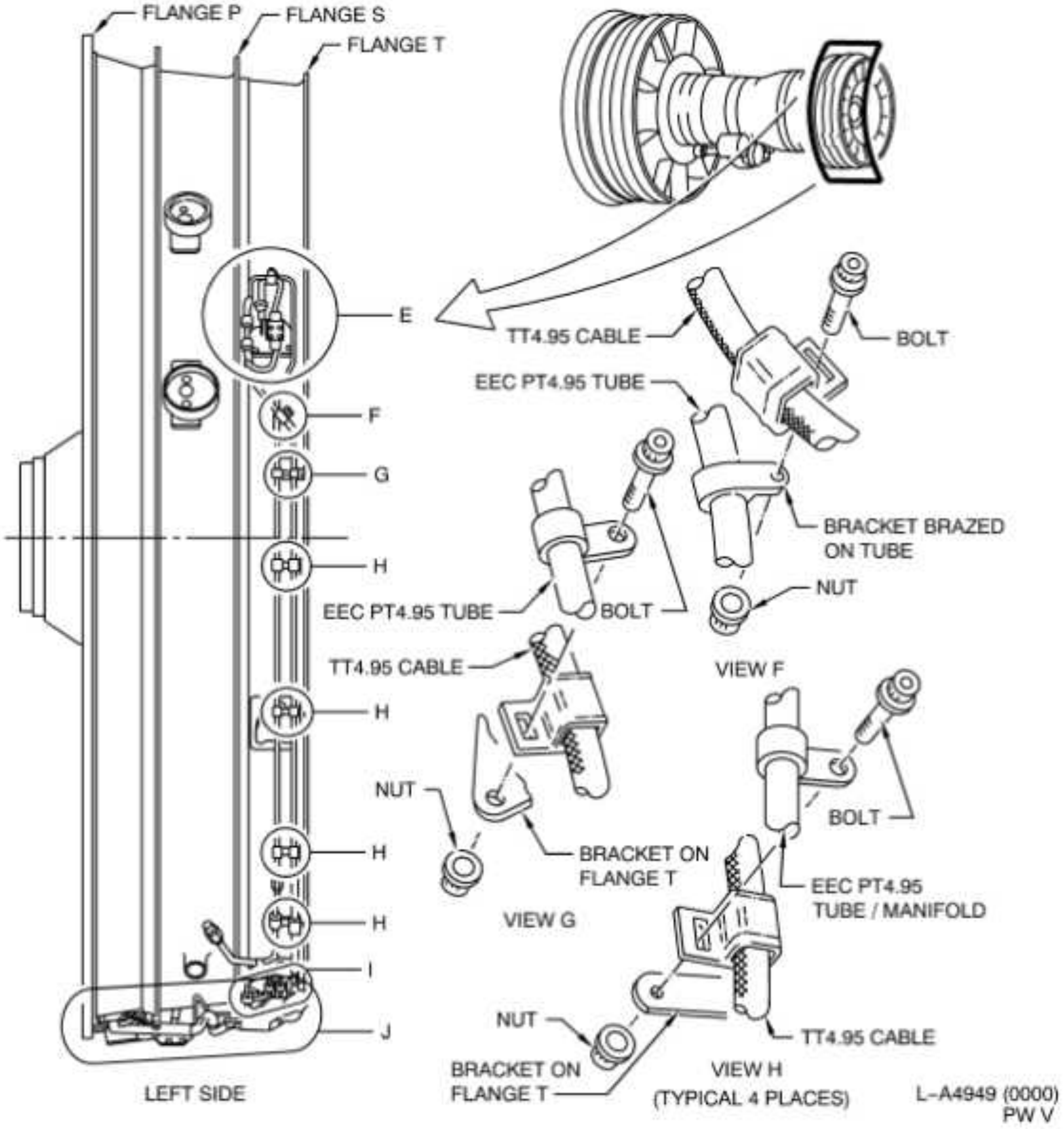
(1) Test engine per Test Reference Table. See 71−00−00, Adjustment/Test−00.


FLANGE S
FLANGE P
FLANGE T
A
B
B
B
B
B
C
D
FWD
RIGHT SIDE
JUNCTION BOX AND CABLE
BOLT (5 REQUIRED)
TT 4.95 CABLE
BRACKET ON FLANGE T
NUT (5 REQUIRED)
FLANGE T
TT4.95 CABLE
VIEW B (TYPICAL 5 PLACES)
EEC PT4.95 MANIFOLD
CLAMP
NUT
SUPPORT BRACKET
NUT
REINFORCING PLATE
BRACKET ON FLANGE T
POSITIONING PLATE
BOLT
VIEW D
L-A4946 (0000)
PW V

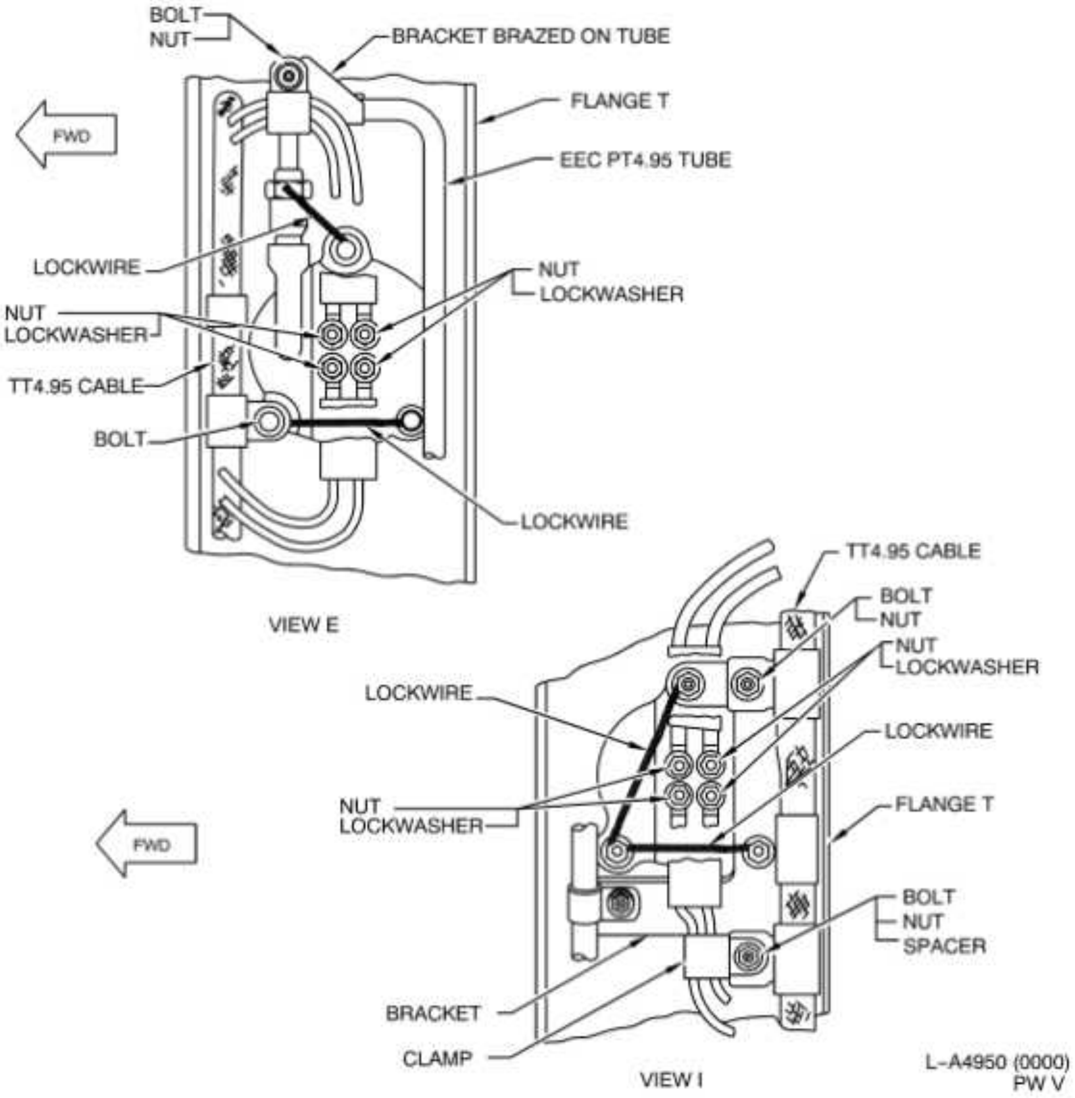
EGT (TT4.95) Thermocouple Cable Assembly (Post SB PW4ENG 72−134)
Figure 403 (Sheet 1)
(Task 72−00−54−450−002−B)


BRACKET
LOCKWIRE
BOLT
NUT
NUT
LOCKWASHER
NUT
LOCKWASHER
TT 4.95
CABLE
FLANGE T
VIEW A
FWD
FLANGE T
BOLT
NUT
BRACKET
LOCKWIRE
FWD
NUT
LOCKWASHER
NUT
LOCKWASHER
LOCKWIRE
BOLT
NUT
BOLT
NUT
CLAMP
TT4.95
CABLE
EEC PT4.95
MANIFOLD
BOLT
NUT
BRACKET
BRAZED ON
MANIFOLD
VIEW C
L−A4947 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Assembly (Post SB PW4ENG 72−134)
Figure 403 (Sheet 2)
(Task 72−00−54−450−002−B)

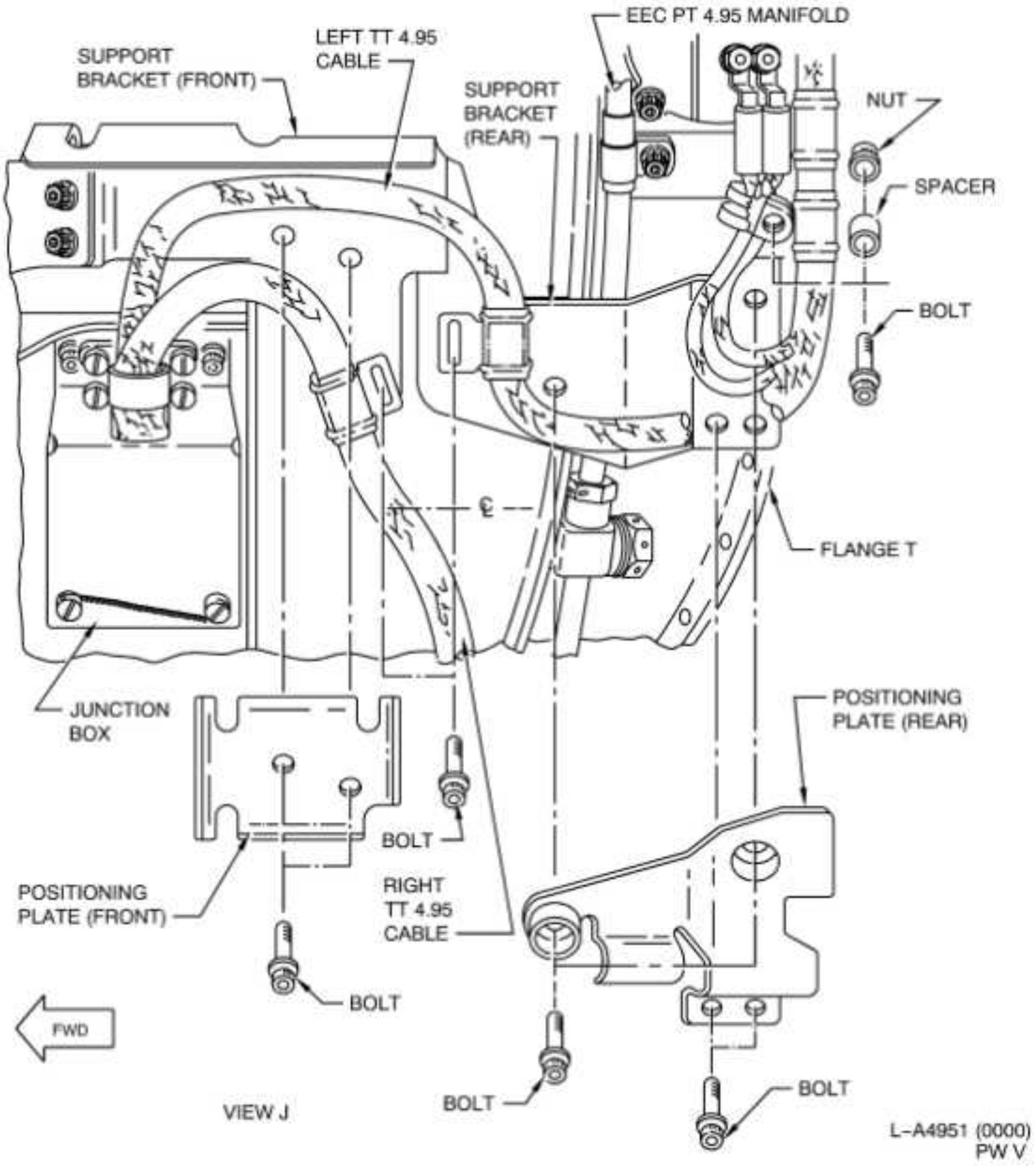

FLANGE P
FLANGE S
FLANGE T
E
F
G
H
H
H
H
I
J
LEFT SIDE
TT4.95 CABLE
BOLT
EEC PT4.95 TUBE
BRACKET BRAZED ON TUBE
NUT
VIEW F
EEC PT4.95 TUBE
BOLT
TT4.95 CABLE
NUT
BRACKET ON FLANGE T
VIEW G
BOLT
EEC PT4.95 TUBE / MANIFOLD
NUT
TT4.95 CABLE
BRACKET ON FLANGE T
VIEW H
(TYPICAL 4 PLACES)
L−A4949 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Assembly (Post SB PW4ENG 72−134)
Figure 403 (Sheet 3)
(Task 72−00−54−450−002−B)

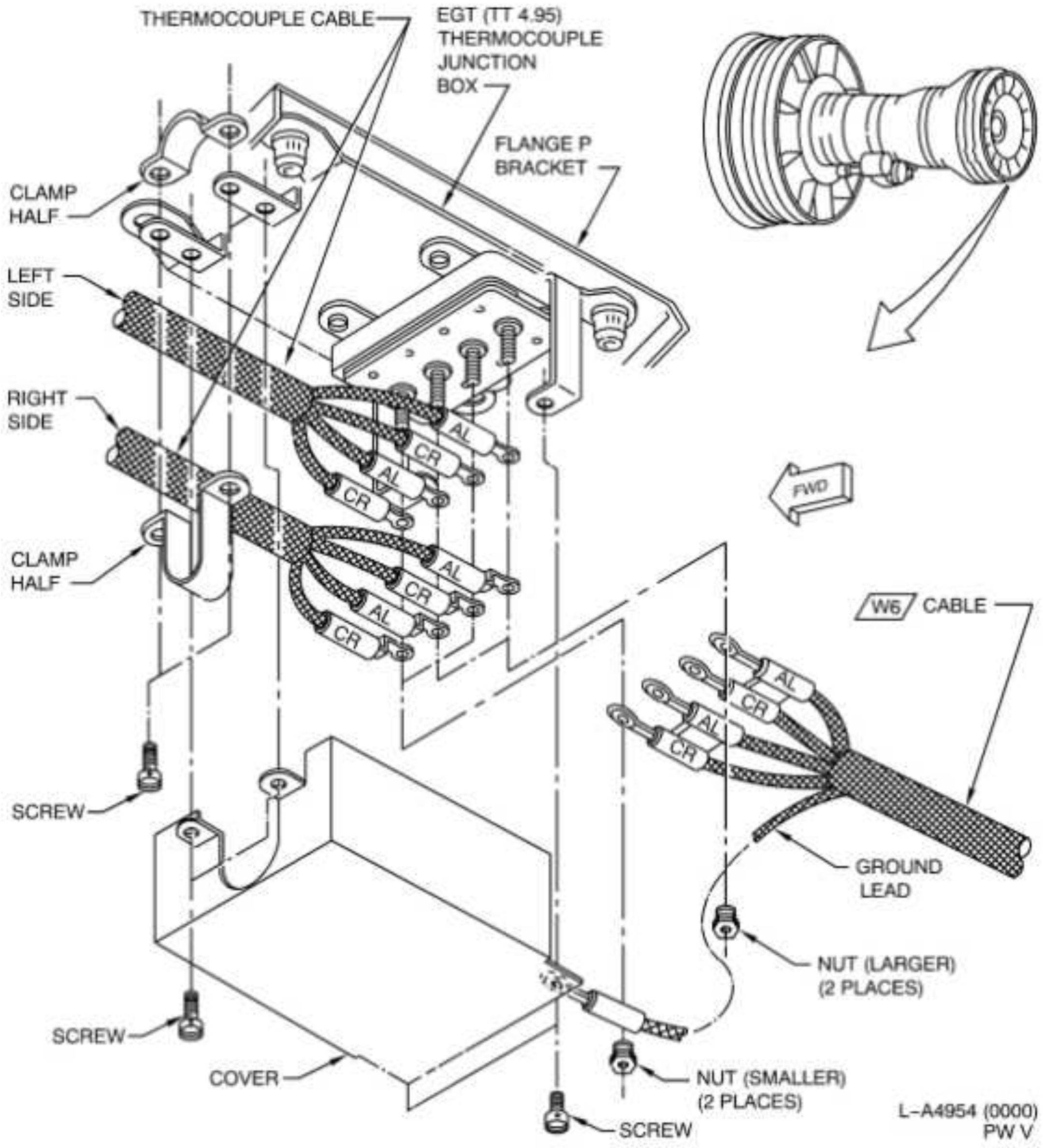

BOLT
NUT
BRACKET BRAZED ON TUBE
FWD
FLANGE T
EEC PT4.95 TUBE
LOCKWIRE
NUT
LOCKWASHER
NUT
LOCKWASHER
TT4.95 CABLE
BOLT
LOCKWIRE
VIEW E
TT4.95 CABLE
BOLT
NUT
NUT
LOCKWASHER
LOCKWIRE
LOCKWIRE
FWD
NUT
LOCKWASHER
FLANGE T
BOLT
NUT
SPACER
BRACKET
CLAMP
VIEW I
L-A4950 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Assembly (Post SB PW4ENG 72−134)
Figure 403 (Sheet 4)
(Task 72−00−54−450−002−B)

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−04


EEC PT 4.95 MANIFOLD
LEFT TT 4.95 CABLE
SUPPORT BRACKET (FRONT)
SUPPORT BRACKET (REAR)
NUT
SPACER
BOLT
FLANGE T
POSITIONING PLATE (REAR)
JUNCTION BOX
BOLT
RIGHT TT 4.95 CABLE
POSITIONING PLATE (FRONT)
BOLT
FWD
VIEW J
BOLT
BOLT
L−A4951 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Assembly (Post SB PW4ENG 72−134)
Figure 403 (Sheet 5)
(Task 72−00−54−450−002−B)


THERMOCOUPLE CABLE
EGT (TT 4.95) THERMOCOUPLE JUNCTION BOX
FLANGE P BRACKET
CLAMP HALF
LEFT SIDE
RIGHT SIDE
CLAMP HALF
AL
CR
AL
CR
AL
CR
AL
CR
FWD
W6 CABLE
AL
CR
AL
CR
GROUND LEAD
NUT (LARGER) (2 PLACES)
SCREW
SCREW
COVER
NUT (SMALLER) (2 PLACES)
SCREW
L−A4954 (0000)
PW V

EGT (TT4.95) Thermocouple Cable Junction Box (Post SB PW4ENG 72−134)
Figure 404
(Task 72−00−54−450−002−B)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-54-450-003-A:

1. Install The EGT (TT4.95) Box And Cable Assembly - For Engines Without The Revised TT4.95 Cable And PT4.95 Sensing Manifold For Increased Engine Core Clearance (Pre SB PW4ENG 72-134)

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lockwire, MS9226-03		

B. Procedure
See Figure 401 and Figure 402.

(1) Install the box and cable assembly to the bracket on Flange P. Lubricate the threads on the bracket studs with Engine Oil P03-001, and attach the junction box to the bracket with nuts. Torque the nuts to 32 - 36 lb-in. (3.616 - 4.067 N.m).

(2) Remove the nuts and lockwashers from the thermocouple terminal studs at the four thermocouple locations. Install the thermocouple cable leads to the thermocouple studs. Install the lockwashers and nuts (stepped washer face next to the lockwasher) handtight only. See Views A, C, E, and I.

(3) Remove the lockwire and four screws that attach the cover to the junction box. Remove the cover. See Figure 402.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(4) Remove the nuts from the junction box terminal studs. Connect the W6 cable leads to the studs. Install the nuts. (Reference 2273) Torque the alumel (larger) nuts to 18 - 22 lb-in. (2.034 - 2.486 N.m). (Reference 2273) Torque the chromel (smaller) nuts to 15 - 18 lb-in. (1.695 - 2.034 N.m).

(5) (Reference 2273) Install the cover on the junction box. Put the W6 cable ground lead terminal below the front corner of the cover. Attach the cover and ground terminal with four screws, threads lubricated with Engine Oil P03−001. Torque the screws to 16 − 22 lb−in. (1.808 − 2.486 N.m). Install lockwire.

(6) Attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position with a bolt, threads lubricated with Engine Oil P03−001. Torque the bolt to 75 − 85 lb−in. (8.474 − 9.604 N.m). Install lockwire. See View E.

(7) Install the cable clamps to the brackets adjacent to the thermocouples. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Views A, C, and I.

(8) Install the cable clamps and the EEC PT4.95 manifold (AS03)clamps to the brackets on Flange T. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Views G and H.

(9) Install the cable clamp to the bracket brazed on the EEC PT4.95 manifold. Attach the clamp with bolt, threads lubricated with Engine Oil P03−001 and nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View F.

(10) Install the cable clamps to the brackets on Flange T at seven locations. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Views B and D.

(11) Install the outer support bracket to the brackets on Flanges P and T at the 7 o'clock position. Attach the bracket with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View J.

(12) Install the front and rear inner brackets over the cables and to the outer support bracket. Attach the brackets with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(13) Align the thermocouple cable leads attached to the studs on the thermocouple so they are parallel to one another. Torque the nuts at each thermocouple as follows:

(a) (Reference 2273) Torque the alumel connections (larger studs) to 18 − 22 lb−in. (2.034 − 2.486 N.m).

(b) (Reference 2273) Torque the chromel connections (smaller studs) to 15 − 18 lb−in. (1.695 − 2.034 N.m).

NOTE: After the nuts are torqued, make sure that the cable leads DO NOT CONTACT the adjacent bolt heads or lockwire.

C. Postrequisites

(1) Test engine per Test Reference Table. See 71−00−00, Adjustment/Test−00.

Task 72−00−54−450−003−B:

2. Install The EGT (TT4.95) Box And Cable Assembly − For Engines With The Revised TT4.95 Cable And PT4.95 Sensing Manifold For Increased Engine Core Clearance (Post SB PW4ENG 72−134)

A. Equipment And Materials Necessary

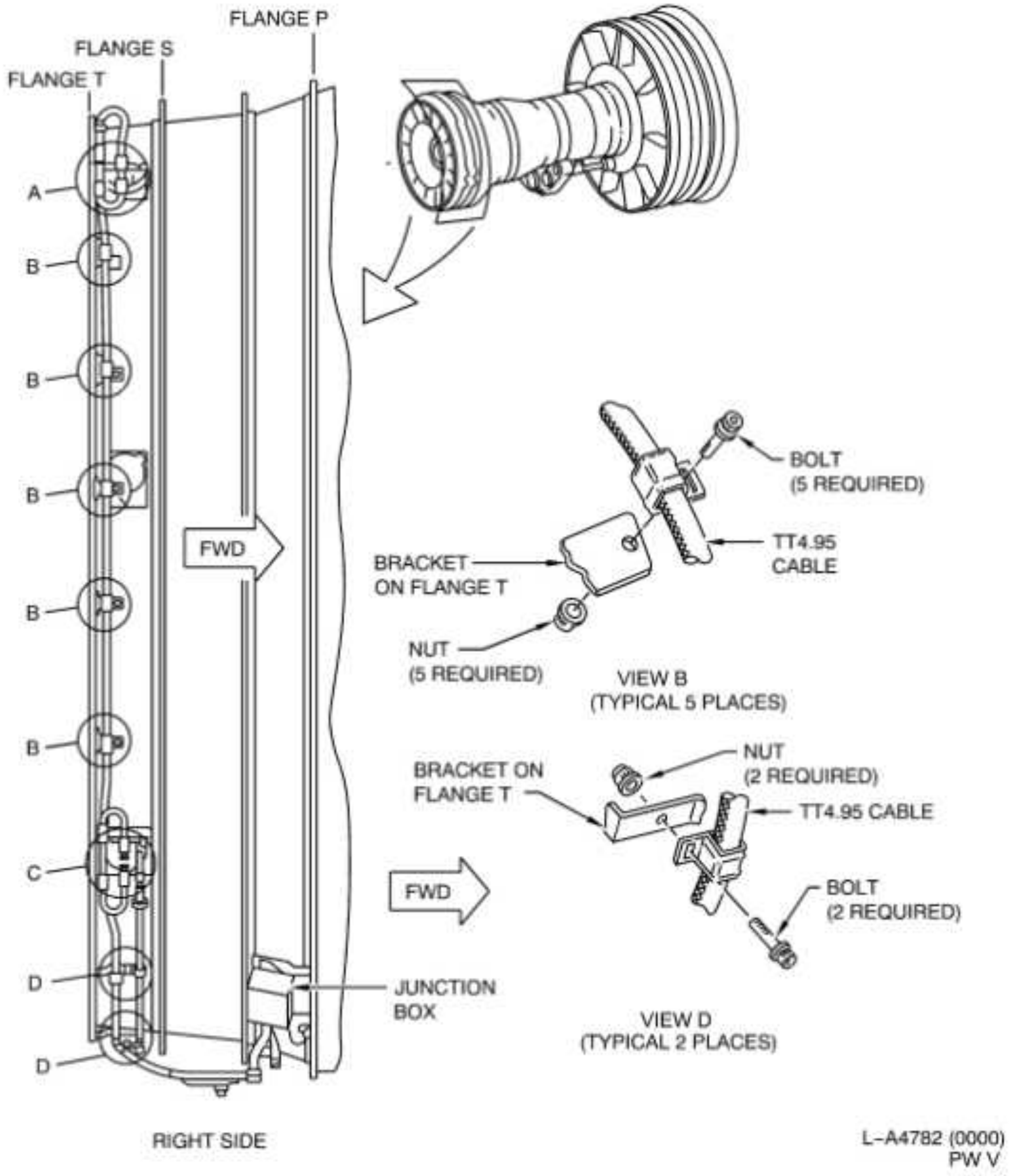
Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)

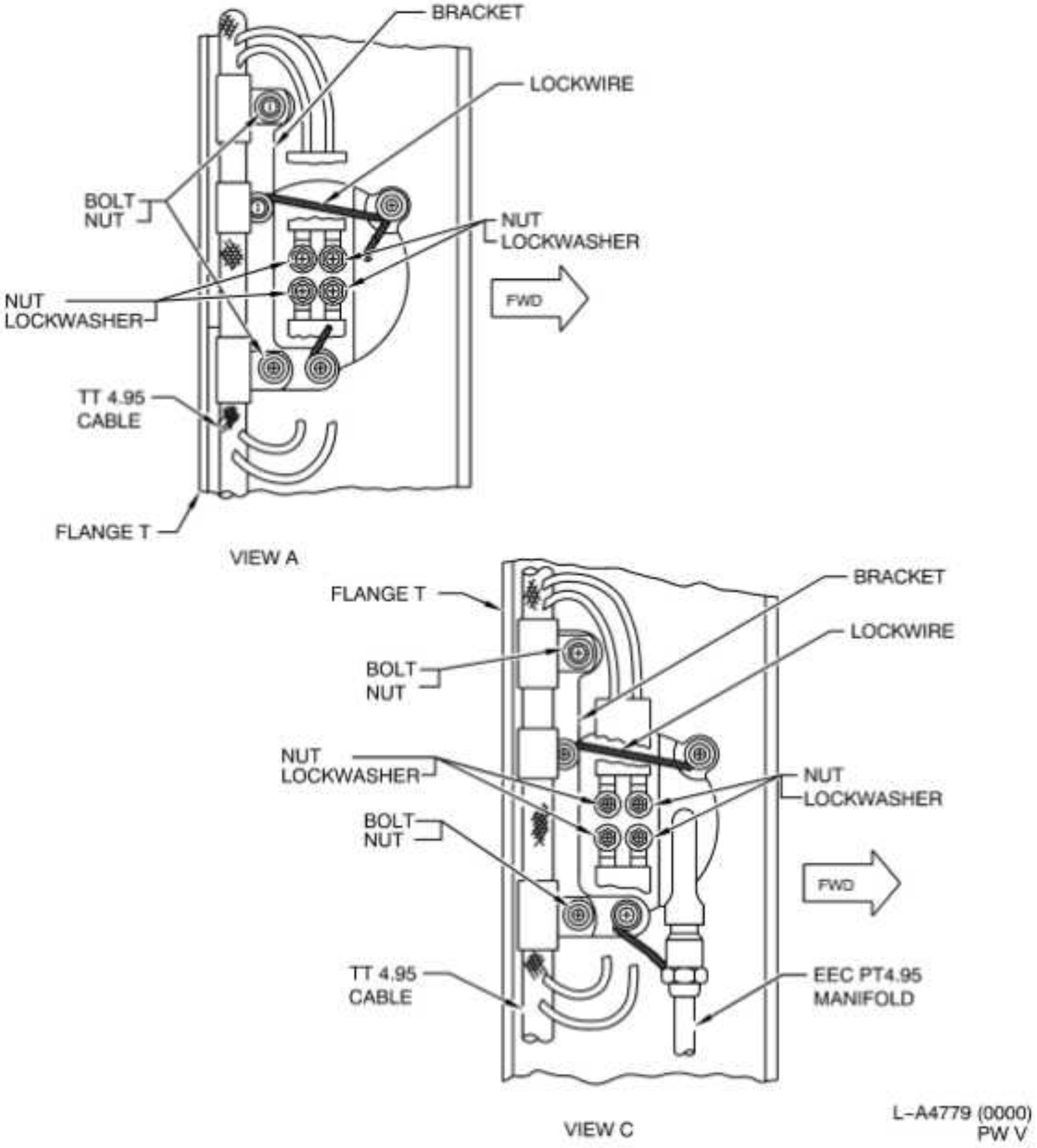
Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lockwire, MS9226−03		

B. Procedure
See Figure 403 and Figure 404.

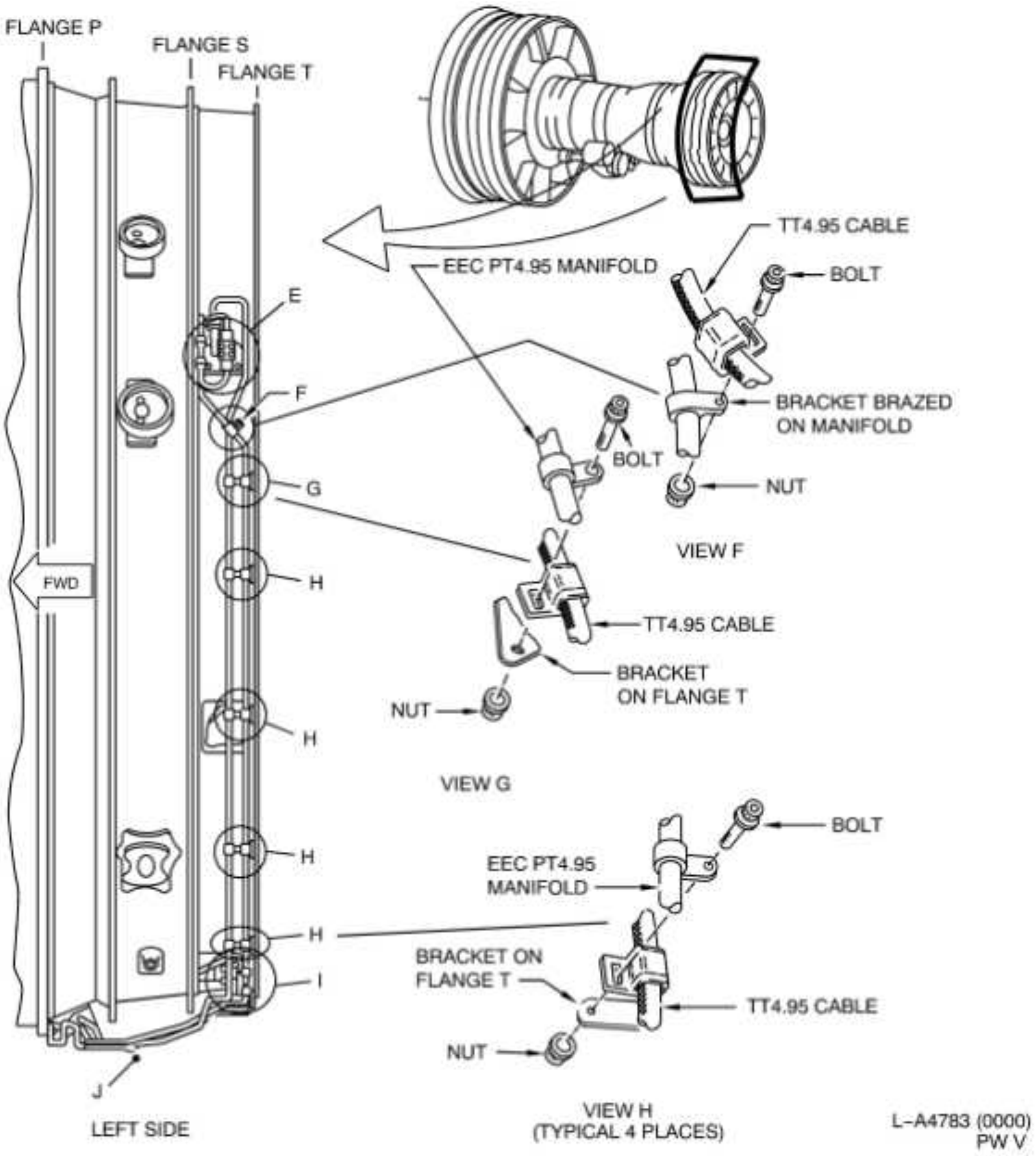

FLANGE P
FLANGE S
FLANGE T
A
B
B
B
B
B
C
D
D
FWD
FWD
JUNCTION BOX
RIGHT SIDE
BOLT (5 REQUIRED)
TT4.95 CABLE
BRACKET ON FLANGE T
NUT (5 REQUIRED)
VIEW B (TYPICAL 5 PLACES)
BRACKET ON FLANGE T
NUT (2 REQUIRED)
TT4.95 CABLE
BOLT (2 REQUIRED)
VIEW D (TYPICAL 2 PLACES)
L−A4782 (0000)
PW V

EGT (TT4.95) Box And Cable Assembly (Pre SB PW4ENG 72−134)
Figure 401 (Sheet 1)
(Task 72−00−54−450−003−A)

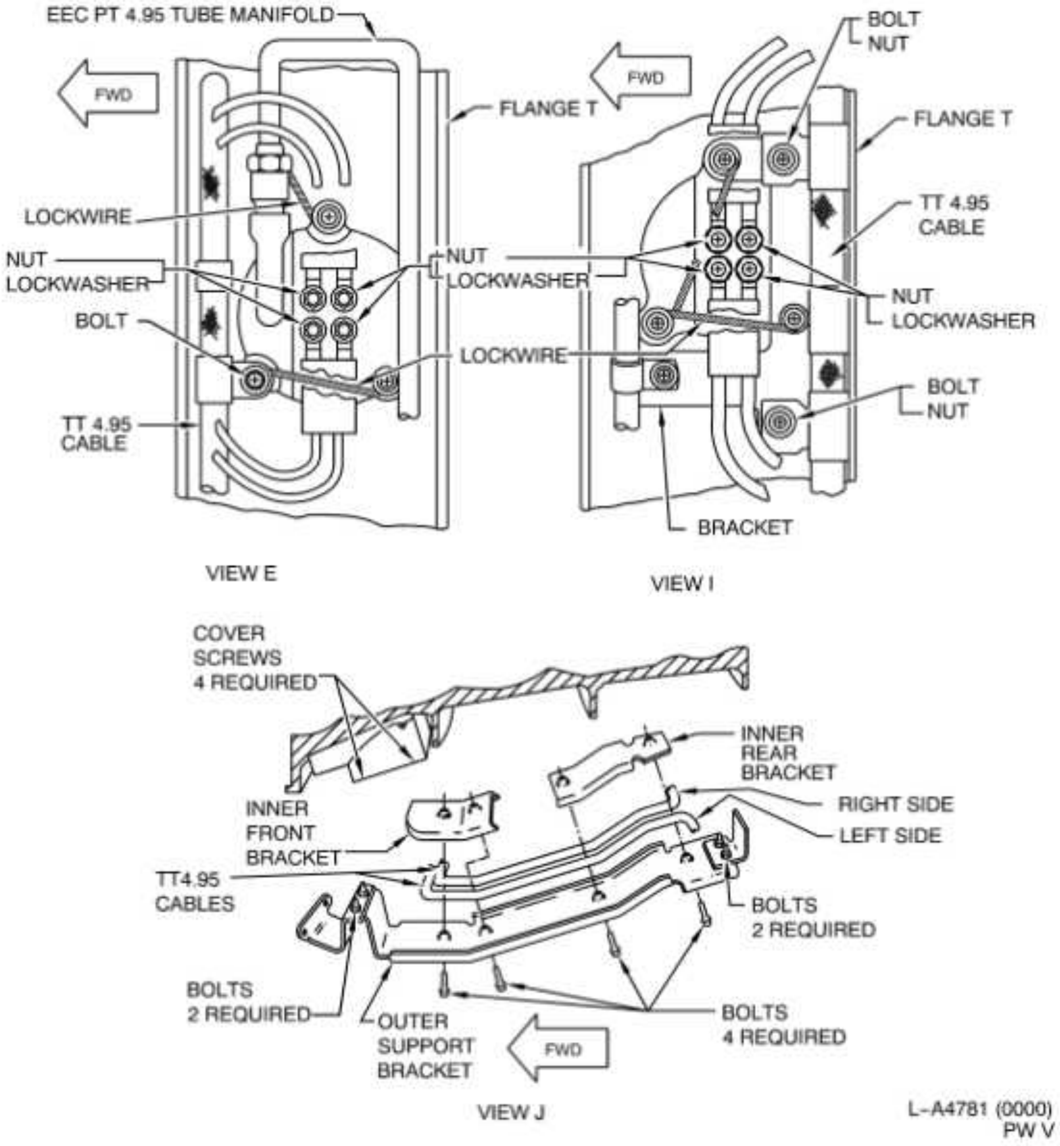

BRACKET
LOCKWIRE
BOLT
NUT
NUT
LOCKWASHER
NUT
LOCKWASHER
FWD
TT 4.95
CABLE
FLANGE T
VIEW A
FLANGE T
BRACKET
LOCKWIRE
BOLT
NUT
NUT
LOCKWASHER
NUT
LOCKWASHER
BOLT
NUT
FWD
TT 4.95
CABLE
EEC PT4.95
MANIFOLD
VIEW C
L−A4779 (0000)
PW V

EGT (TT4.95) Box And Cable Assembly (Pre SB PW4ENG 72−134)
Figure 401 (Sheet 2)
(Task 72−00−54−450−003−A)

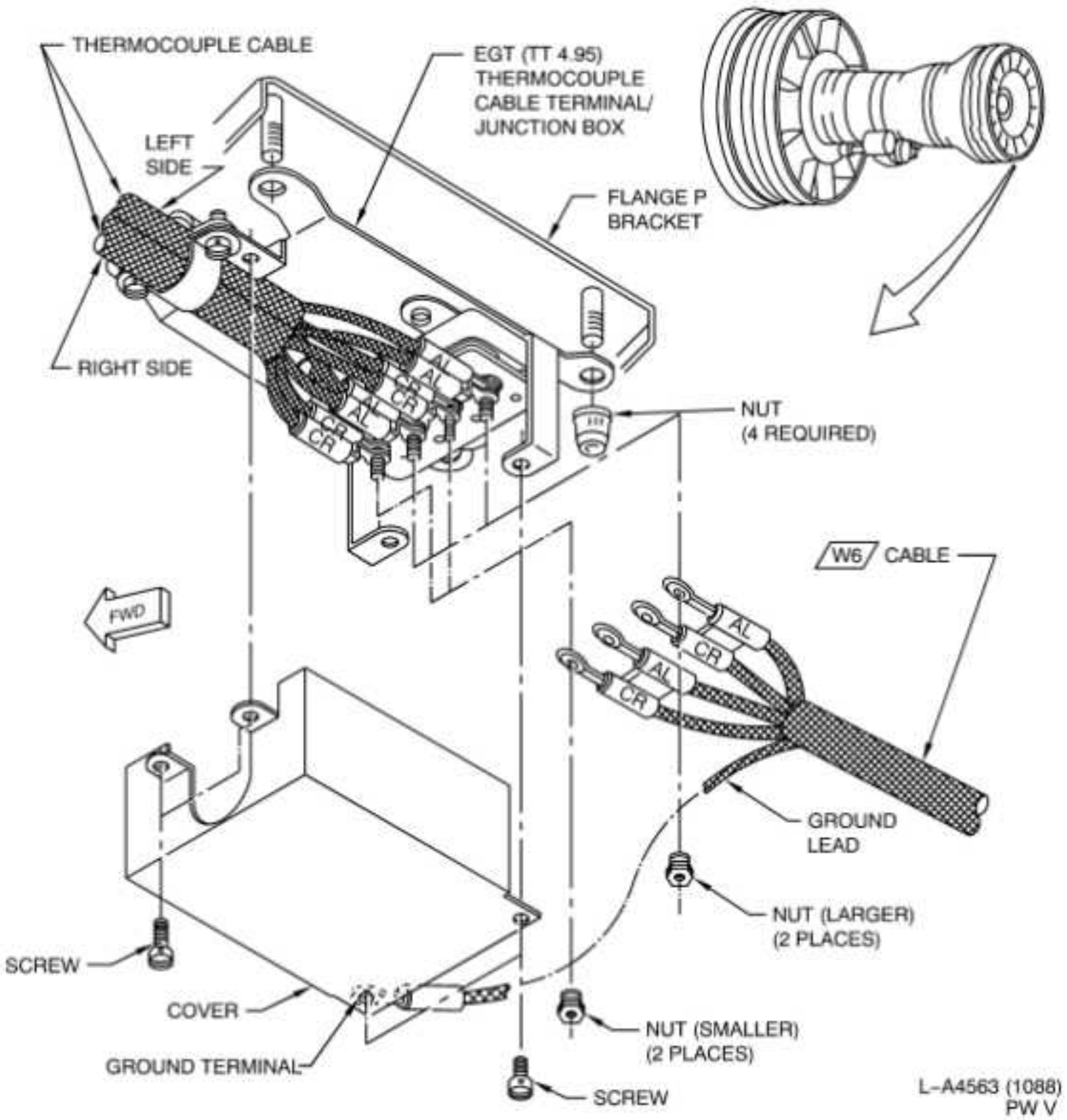
ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−05


FLANGE P
FLANGE S
FLANGE T
E
F
G
H
H
H
H
I
J
FWD
LEFT SIDE
TT4.95 CABLE
BOLT
EEC PT4.95 MANIFOLD
BRACKET BRAZED ON MANIFOLD
BOLT
NUT
VIEW F
TT4.95 CABLE
BRACKET ON FLANGE T
NUT
VIEW G
BOLT
EEC PT4.95 MANIFOLD
BRACKET ON FLANGE T
TT4.95 CABLE
NUT
VIEW H (TYPICAL 4 PLACES)
L−A4783 (0000)
PW V

EGT (TT4.95) Box And Cable Assembly (Pre SB PW4ENG 72−134)
Figure 401 (Sheet 3)
(Task 72−00−54−450−003−A)


EEC PT 4.95 TUBE MANIFOLD
FWD
FLANGE T
LOCKWIRE
NUT
LOCKWASHER
BOLT
NUT
LOCKWASHER
LOCKWIRE
TT 4.95
CABLE
VIEW E
FWD
BOLT
NUT
FLANGE T
TT 4.95
CABLE
NUT
LOCKWASHER
BOLT
NUT
BRACKET
VIEW I
COVER
SCREWS
4 REQUIRED
INNER
REAR
BRACKET
RIGHT SIDE
LEFT SIDE
INNER
FRONT
BRACKET
TT4.95
CABLES
BOLTS
2 REQUIRED
BOLTS
2 REQUIRED
OUTER
SUPPORT
BRACKET
FWD
BOLTS
4 REQUIRED
VIEW J
L-A4781 (0000)
PW V

EGT (TT4.95) Box And Cable Assembly (Pre SB PW4ENG 72−134)
Figure 401 (Sheet 4)
(Task 72−00−54−450−003−A)


THERMOCOUPLE CABLE
EGT (TT 4.95) THERMOCOUPLE CABLE TERMINAL/ JUNCTION BOX
LEFT SIDE
FLANGE P BRACKET
RIGHT SIDE
AL
CR
NUT (4 REQUIRED)
W6 CABLE
FWD
GROUND LEAD
NUT (LARGER) (2 PLACES)
SCREW
COVER
NUT (SMALLER) (2 PLACES)
GROUND TERMINAL
SCREW
L−A4563 (1088)
PW V

EGT (TT4.95) Thermocouple Cable Junction Box (Pre SB PW4ENG 72−134)
Figure 402
(Task 72−00−54−450−003−A)

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−05

(1) Install the box and cable assembly to the bracket on Flange P. Lubricate the threads on the bracket studs with Engine Oil P03−001, and attach the junction box to the bracket with nuts. Torque the nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(2) Remove the nuts and lockwashers from the thermocouple terminal studs at the four thermocouple locations. Install the thermocouple cable leads to the thermocouple studs. Install the lockwashers and nuts (stepped washer face next to the lockwasher) handtight only. See Views A, C, E, and I.

(3) Remove the lockwire and four screws that attach the cover to the junction box. Remove the cover. See Figure 404.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(4) Remove the nuts from the junction box terminal studs. Connect the W6 cable leads to the studs. Install the nuts. (Reference 2273) Torque the alumel (larger) nuts to 18 − 22 lb−in. (2.034 − 2.486 N.m). (Reference 2273) Torque the chromel (smaller) nuts to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(5) (Reference 2273) Install the cover on the junction box. Put the W6 cable ground lead terminal below the rear corner of the cover. Attach the cover and ground terminal with four screws, threads lubricated with Engine Oil P03−001. Torque the screws to 16 − 22 lb−in. (1.808 − 2.486 N.m). Install lockwire.

(6) Attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position with a bolt, threads lubricated with Engine Oil P03−001. Torque the bolt to 75 − 85 lb−in. (8.474 − 9.604 N.m). Install lockwire. See View E.

(7) Clamp the top two thermocouple leads at the 10 o'clock thermocouple to the bracket brazed on the EEC PT4.95 tube (AS34). Attach the clamp with bolt, threads lubricated with Engine Oil P03−001, and a nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View E.

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−05

(8) Install the cable clamps to the brackets adjacent to the thermocouples. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Views A and C.

(9) Install the cable clamps and the EEC PT4.95 tube/manifold clamps to the brackets on Flange T at five locations. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Views G and H.

(10) Install the cable clamps to the brackets on Flange T at five locations. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View B.

(11) Install the cable clamp to the bracket brazed on the EEC PT4.95 manifold at the 4:30 o'clock position. Attach the clamp with bolt, threads lubricated with Engine Oil P03−001, and a nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View C.

(12) Clamp the bottom two thermocouple leads at the 4:30 o'clock thermocouple to the EEC PT4.95 manifold, 1/2 inch (12.700 mm) from the manifold nut. Attach the leads with two clamps, bolt, threads lubricated with Engine Oil P03−001, and a nut. Torque the nut to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View C.

(13) Install the cable clamp to the bracket brazed on the EEC PT4.95 tube. Attach the clamp with bolt, threads lubricated with Engine Oil P03−001 and nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View F.

(14) Install the cable clamps, and a clamp on the bottom two thermocouple leads, to the bracket adjacent to the thermocouple at the 7 o'clock position. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, nuts and spacer. Install the spacer between the lead clamp and the cable clamp. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View I.

(15) Make a loop in the thermocouple cable adjacent to the 7 o'clock thermocouple. Attach the cable clamp, nearest to the loop, to the rear support bracket with a bolt, threads lubricated with Engine Oil P03−001. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View J.

(16) Install the rear positioning plate with the rear spacer inside the cable/thermocouple lead loop and the front spacer inside the cable adjacent to the cable clamp. Attach the positioning plate to the rear support bracket with four bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View J.

(17) Make a loop in the thermocouple cable adjacent to the junction box. Attach the cable clamp, nearest to the loop, to the front support bracket with a bolt, threads lubricated with Engine Oil P03−001. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View J.

(18) Install the front positioning plate on the two cables with the spacers, inboard, between the cables. Attach the plate to the front support bracket with two bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View J.

NOTE: The cables installed below the positioning plate will be compressed by the plate when torquing the bolts.

(19) Install the positioning plate on the thermocouple cable at approximately the 5 o'clock position. Install the cable to the left of the inner spacer and to the right of the outer spacer on the plate. Attach the positioning plate and the clamp on the EEC PT4.95 manifold to the support bracket with two bolts, threads lubricated with Engine Oil P03−001, and a nut. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View D.

NOTE: The cable installed below the positioning plate will be compressed by the plate when torquing the bolts.

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−05

(20) Install the cable clamp to the inboard side of the reinforcing plate at the 5:30 o'clock position. Attach the clamp to the plate with a bolt, threads lubricated with Engine Oil P03−001, and a nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View D.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(21) Align the thermocouple cable leads attached to the studs on the thermocouples so they are parallel to one another. Torque the nuts at each thermocouple as follows:

(a) (Reference 2273) Torque the alumel connections (larger studs) to 18 − 22 lb−in. (2.034 − 2.486 N.m).

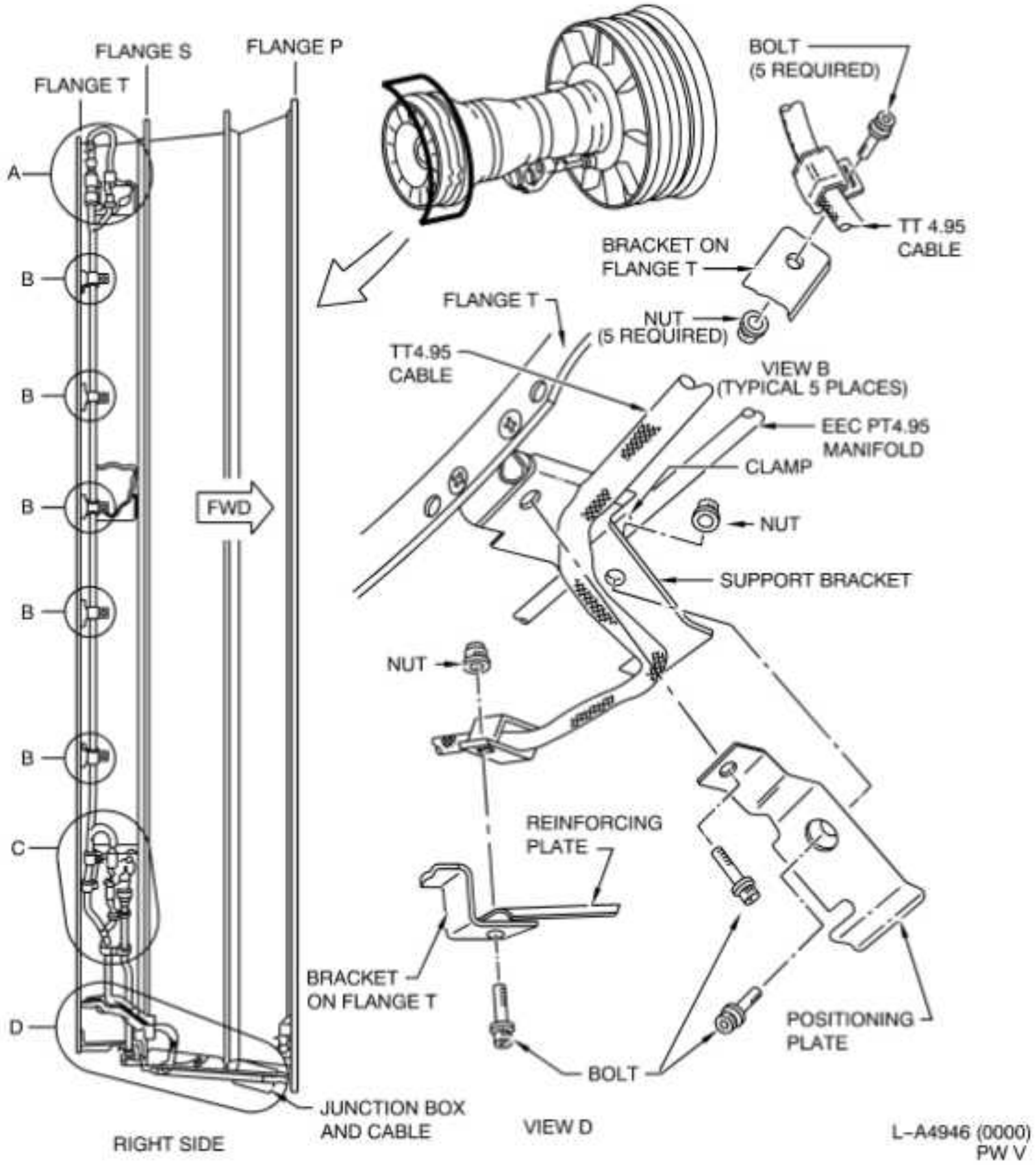
(b) (Reference 2273) Torque the chromel connections (smaller studs) to 15 − 18 lb−in. (1.695 − 2.034 N.m).

NOTE: After the nuts are torqued, make sure that the cable leads DO NOT CONTACT the adjacent bolt heads or lockwire.

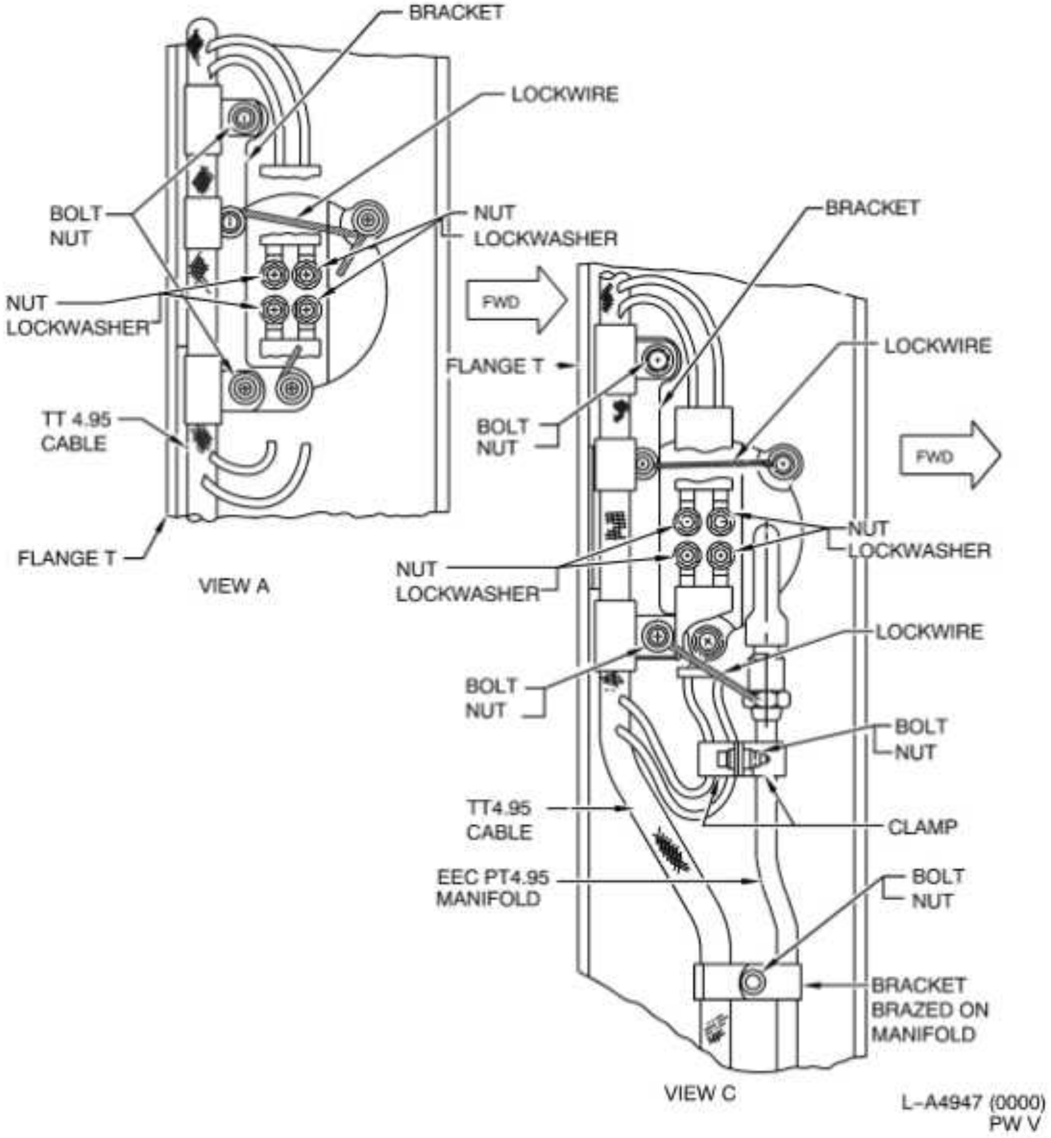
C. Postrequisites

(1) Test engine per Test Reference Table. See 71−00−00, Adjustment/Test−00.

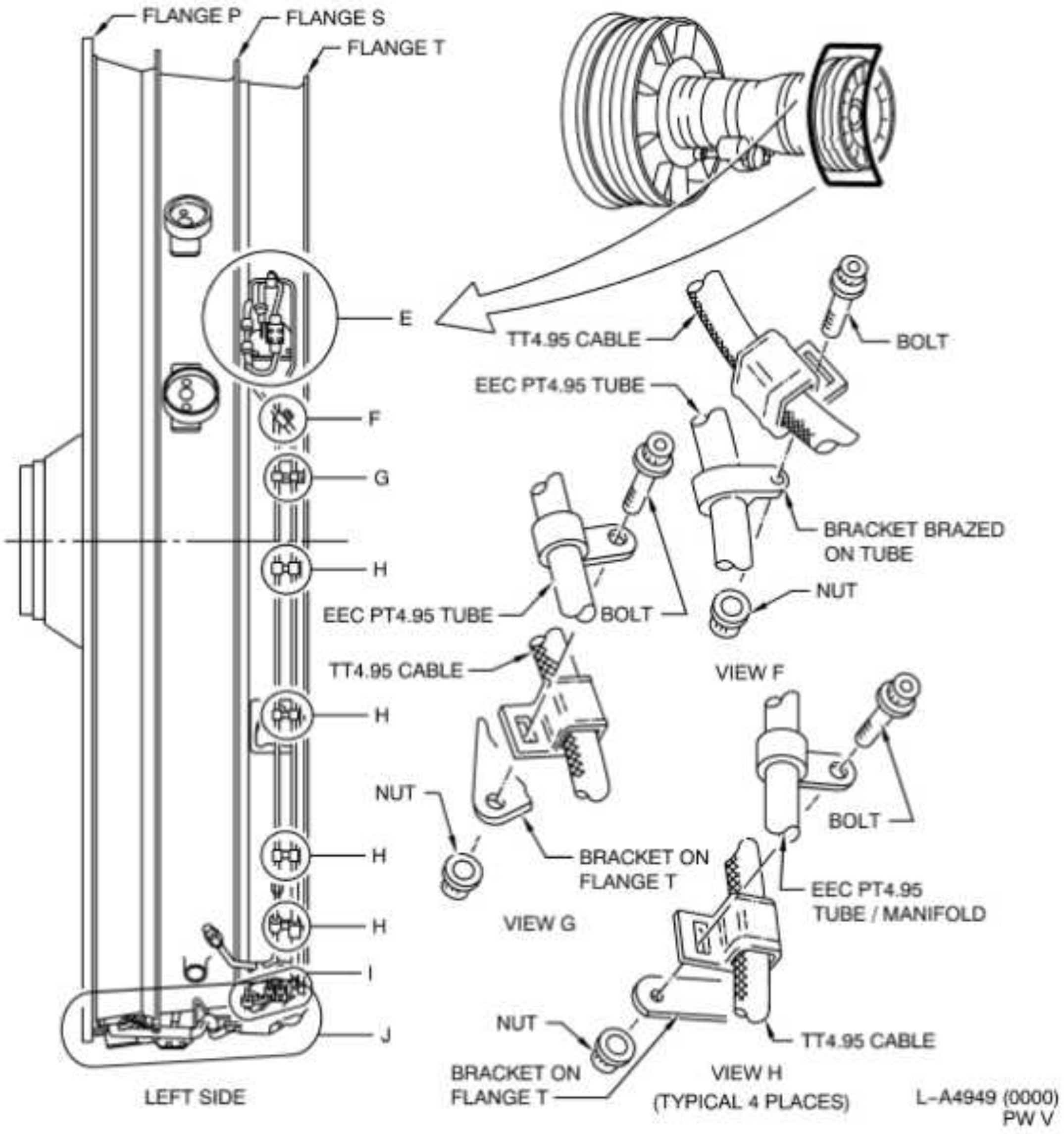
ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−05


FLANGE S
FLANGE P
FLANGE T
A
B
B
B
B
B
C
D
FWD
RIGHT SIDE
JUNCTION BOX AND CABLE
BOLT (5 REQUIRED)
TT 4.95 CABLE
BRACKET ON FLANGE T
FLANGE T
NUT (5 REQUIRED)
TT4.95 CABLE
VIEW B (TYPICAL 5 PLACES)
EEC PT4.95 MANIFOLD
CLAMP
NUT
SUPPORT BRACKET
NUT
REINFORCING PLATE
BRACKET ON FLANGE T
POSITIONING PLATE
BOLT
VIEW D
L−A4946 (0000)
PW V

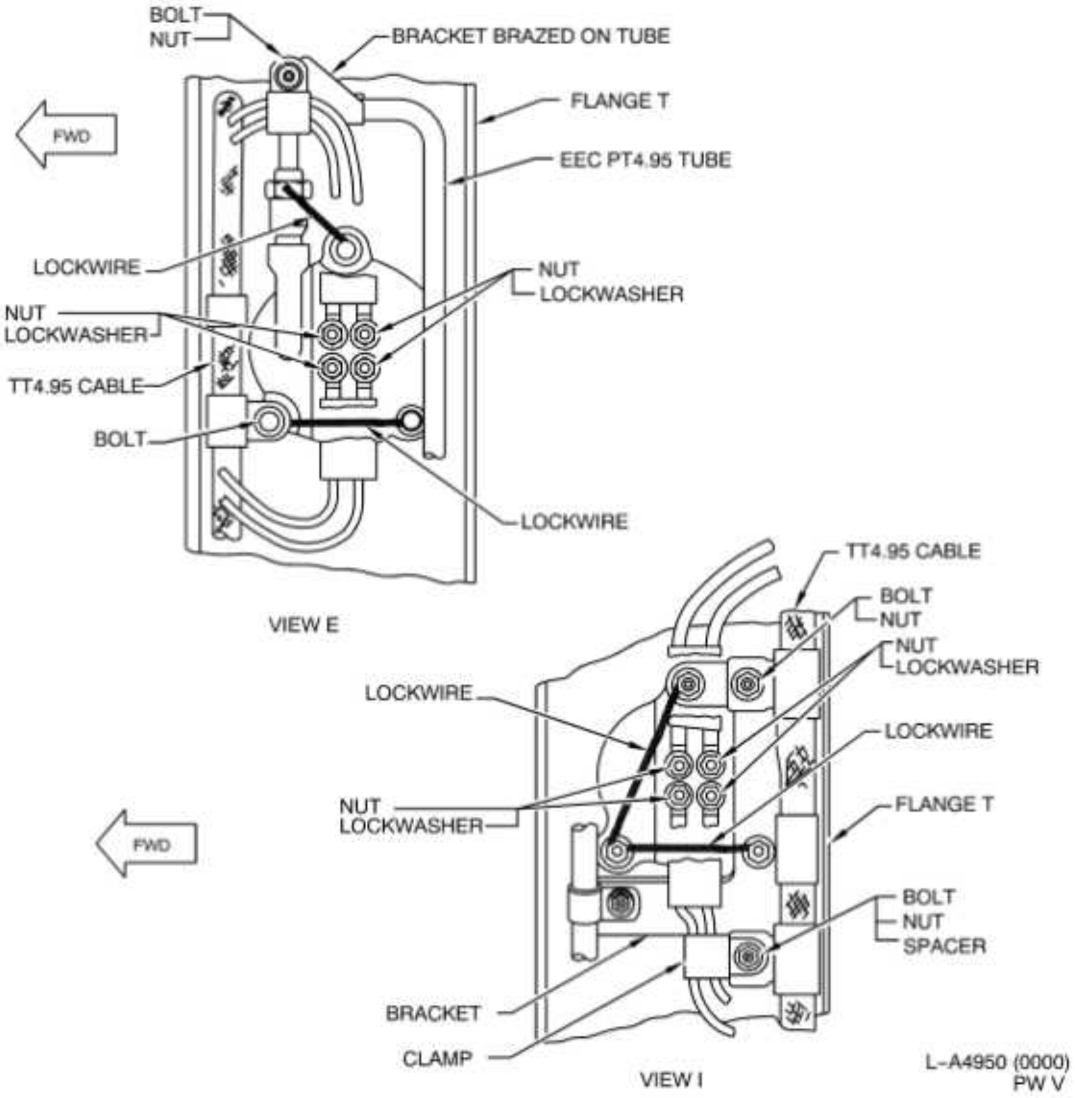
EGT (TT4.95) Box And Cable Assembly (Post SB PW4ENG 72−134)
Figure 403 (Sheet 1)
(Task 72−00−54−450−003−B)


BRACKET
LOCKWIRE
BOLT
NUT
NUT
LOCKWASHER
NUT
LOCKWASHER
TT 4.95
CABLE
FLANGE T
VIEW A
FWD
FLANGE T
BRACKET
LOCKWIRE
BOLT
NUT
FWD
NUT
LOCKWASHER
NUT
LOCKWASHER
LOCKWIRE
BOLT
NUT
BOLT
NUT
CLAMP
TT4.95
CABLE
EEC PT4.95
MANIFOLD
BOLT
NUT
BRACKET
BRAZED ON
MANIFOLD
VIEW C
L-A4947 (0000)
PW V

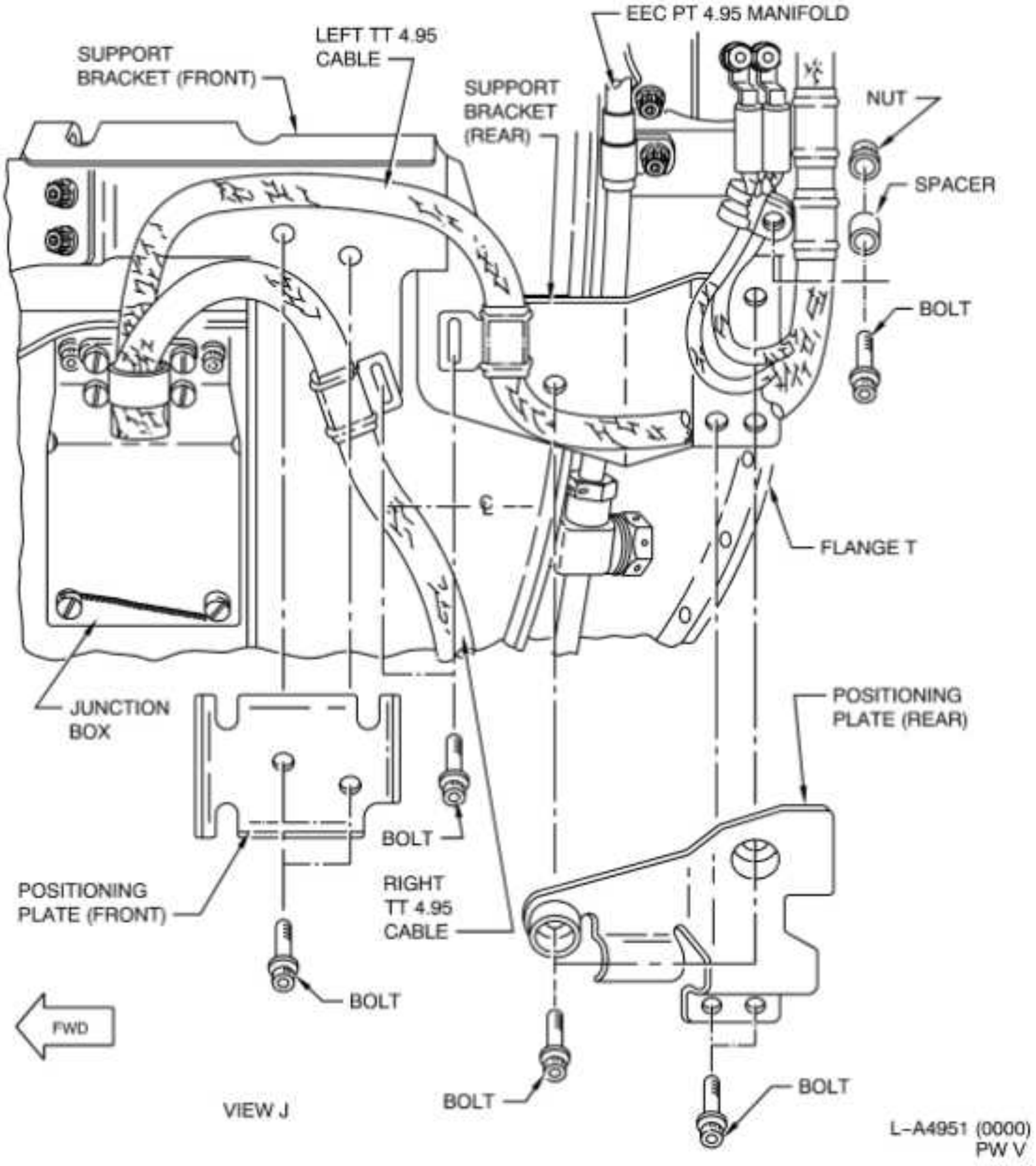
EGT (TT4.95) Box And Cable Assembly (Post SB PW4ENG 72-134)
Figure 403 (Sheet 2)
(Task 72-00-54-450-003-B)


FLANGE P
FLANGE S
FLANGE T
E
F
G
H
H
H
H
I
J
LEFT SIDE
TT4.95 CABLE
BOLT
EEC PT4.95 TUBE
BRACKET BRAZED ON TUBE
NUT
EEC PT4.95 TUBE
BOLT
VIEW F
TT4.95 CABLE
NUT
BRACKET ON FLANGE T
VIEW G
BOLT
EEC PT4.95 TUBE / MANIFOLD
NUT
BRACKET ON FLANGE T
TT4.95 CABLE
VIEW H
(TYPICAL 4 PLACES)
L−A4949 (0000)
PW V

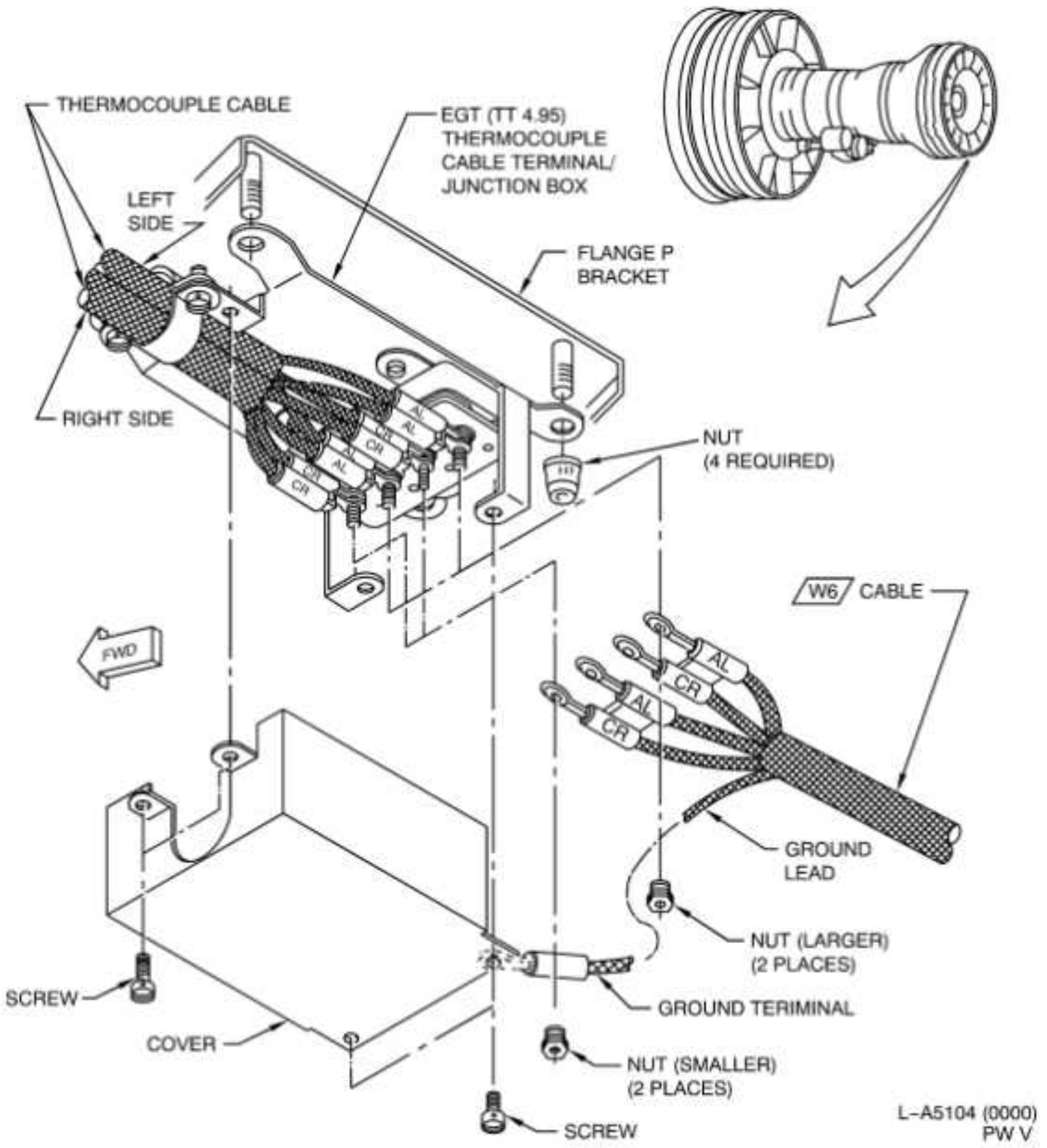
EGT (TT4.95) Box And Cable Assembly (Post SB PW4ENG 72−134)
Figure 403 (Sheet 3)
(Task 72−00−54−450−003−B)


BOLT
NUT
BRACKET BRAZED ON TUBE
FWD
FLANGE T
EEC PT4.95 TUBE
LOCKWIRE
NUT
LOCKWASHER
NUT
LOCKWASHER
TT4.95 CABLE
BOLT
LOCKWIRE
VIEW E
TT4.95 CABLE
BOLT
NUT
NUT
LOCKWASHER
LOCKWIRE
LOCKWIRE
FWD
NUT
LOCKWASHER
FLANGE T
BOLT
NUT
SPACER
BRACKET
CLAMP
VIEW I
L-A4950 (0000)
PW V

EGT (TT4.95) Box And Cable Assembly (Post SB PW4ENG 72−134)
Figure 403 (Sheet 4)
(Task 72−00−54−450−003−B)


EEC PT 4.95 MANIFOLD
LEFT TT 4.95 CABLE
SUPPORT BRACKET (FRONT)
SUPPORT BRACKET (REAR)
NUT
SPACER
BOLT
FLANGE T
℄
JUNCTION BOX
POSITIONING PLATE (REAR)
BOLT
RIGHT TT 4.95 CABLE
POSITIONING PLATE (FRONT)
BOLT
FWD
VIEW J
BOLT
BOLT
L−A4951 (0000)
PW V

EGT (TT4.95) Box And Cable Assembly (Post SB PW4ENG 72−134)
Figure 403 (Sheet 5)
(Task 72−00−54−450−003−B)


THERMOCOUPLE CABLE
EGT (TT 4.95) THERMOCOUPLE CABLE TERMINAL/ JUNCTION BOX
LEFT SIDE
FLANGE P BRACKET
RIGHT SIDE
NUT (4 REQUIRED)
W6 CABLE
FWD
AL
CR
GROUND LEAD
NUT (LARGER) (2 PLACES)
GROUND TERIMINAL
SCREW
COVER
NUT (SMALLER) (2 PLACES)
SCREW
L-A5104 (0000) PW V

EGT (TT4.95) Thermocouple Cable Junction Box (Post SB PW4ENG 72−134)
Figure 404
(Task 72−00−54−450−003−B)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - TURBINE EXHAUST CASE - INSTALLATION-06

Task 72-00-54-450-004-A:

1. Install Exhaust Gas Temperature Thermocouples TT4.95 - For Engines Without The Revised TT4.95 Cable And PT4.95 Sensing Manifold For Increased Engine Core Clearance (Pre SB PW4ENG 72-134)

   A. Equipment And Materials Required

      Standard Tools:
      Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

      Consumable Material:

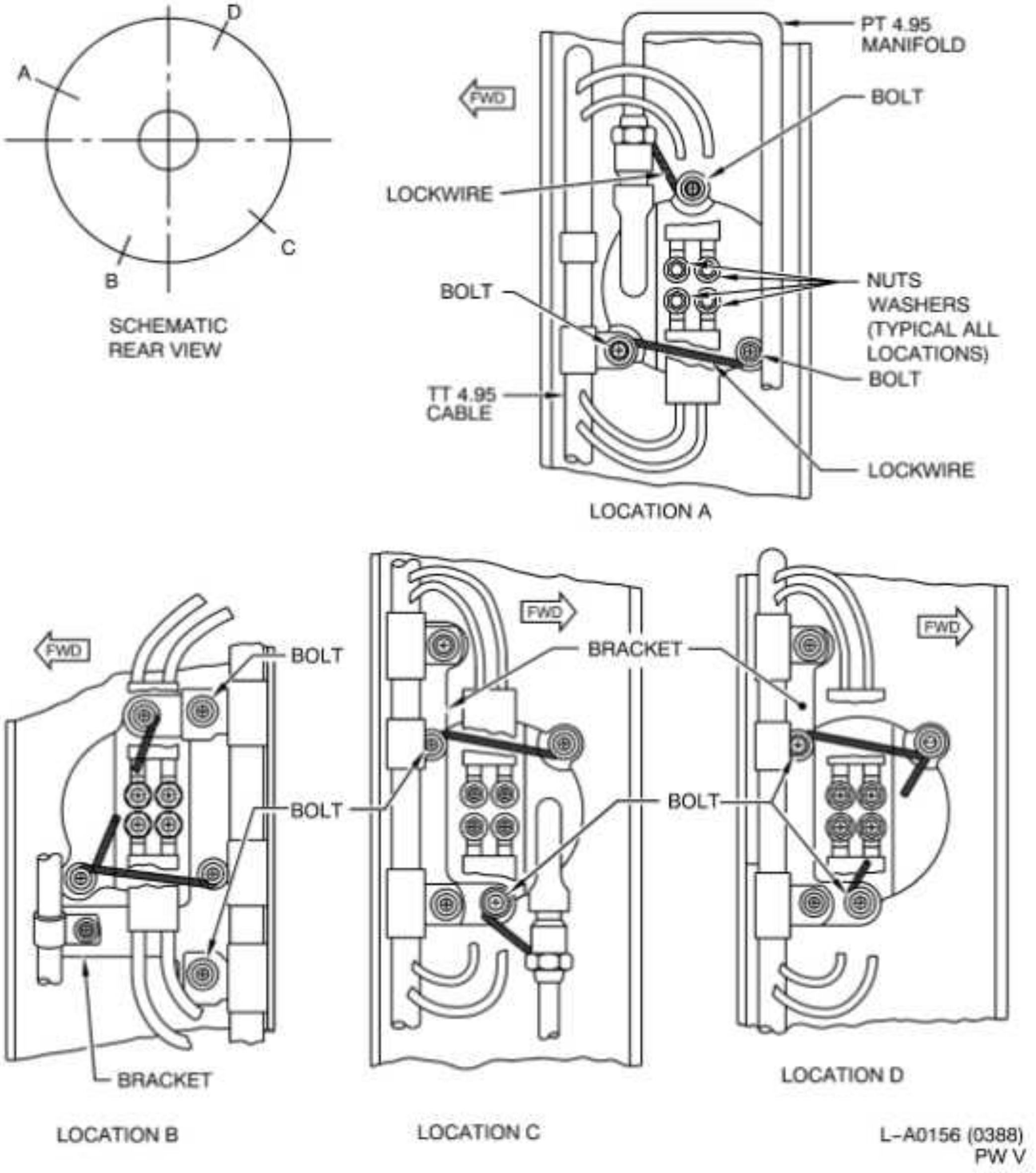
Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-023	Silver Goop (PWA 36001)

   B. Procedure
      See Figure 401.
      (1) Remove protective closures.
      (2) Install thermocouple at Location A (10 o'clock position) as follows.
         (a) Insert thermocouple into housing and case aligning boltholes. Secure in place with bolts, threads lubricated with Silver Goop (P06-023). Torque bolts to 54 - 60 lb-in. (6.101 - 6.779 N.m). Install the Lockwire (P05-289) or Safety Cable (P05-291) and Safety Cable Ferrule (P05-292).

            CAUTION: DO NOT USE LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF EEC CAN RESULT

         (b) Install PT4.95 manifold (AS03) nut to probe adapter. Torque the nut to 135 - 150 lb-in. (15.253 - 16.948 N.m). Install the Lockwire (P05-289) or Safety Cable (P05-291) and Safety Cable Ferrule (P05-292).
         (c) Torque clamp bolts loosened as required to 36 - 40 lb-in. (4.067 - 4.519 N.m).
      (3) Install thermocouple at Location B (7 o'clock position) as follows.

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−06


D
A
C
B
SCHEMATIC REAR VIEW
FWD
PT 4.95 MANIFOLD
BOLT
LOCKWIRE
NUTS
WASHERS
(TYPICAL ALL LOCATIONS)
BOLT
BOLT
TT 4.95 CABLE
LOCKWIRE
LOCATION A
FWD
BOLT
BOLT
BRACKET
LOCATION B
FWD
BRACKET
BOLT
LOCATION C
FWD
LOCATION D
L−A0156 (0388)
PW V

Exhaust Gas Temperature Thermocouple
(Pre SB PW4ENG 72−134)
Figure 401
(Task 72−00−54−450−004−A)

(a) Insert thermocouple into housing and case aligning boltholes. Align bracket and secure with two bolts, threads lubricated with Silver Goop (P06−023). Torque bolts to 54 − 60 lb−in. (6.101 − 6.779 N.m). Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292).

(b) Install bolt, threads lubricated with Engine Oil (P03−001), and nut securing PT4.95 manifold (AS03) clamp to bracket. Torque clamp bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(4) Install thermocouple at Locations C and D (4 and 1 o'clock position) as follows.

(a) Insert thermocouple(s) into housing and case aligning boltholes. Align bracket and secure with bolts, threads lubricated with Silver Goop (P06−023). Torque bolts to 54 − 60 lb−in. (6.101 − 6.779 N.m). Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292).

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(5) Connect thermocouple cable leads to thermocouples. Secure with washers and nuts and torque as follows:

(a) Torque alumel connections (larger studs) to 10 − 15 lb−in. (1.130 − 1.695 N.m).

(b) Torque chromel connections (smaller studs) to 8 − 12 lb−in. (0.904 − 1.356 N.m).

C. Postrequisites

(1) Test engine per Repair Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).

Task 72−00−54−450−004−B:

2. Install Exhaust Gas Temperature Thermocouples TT4.95 − For Engines With The Revised TT4.95 Cable And PT4.95 Sensing Manifold For Increased Engine Core Clearance (Post SB PW4ENG 72−134)

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−06

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

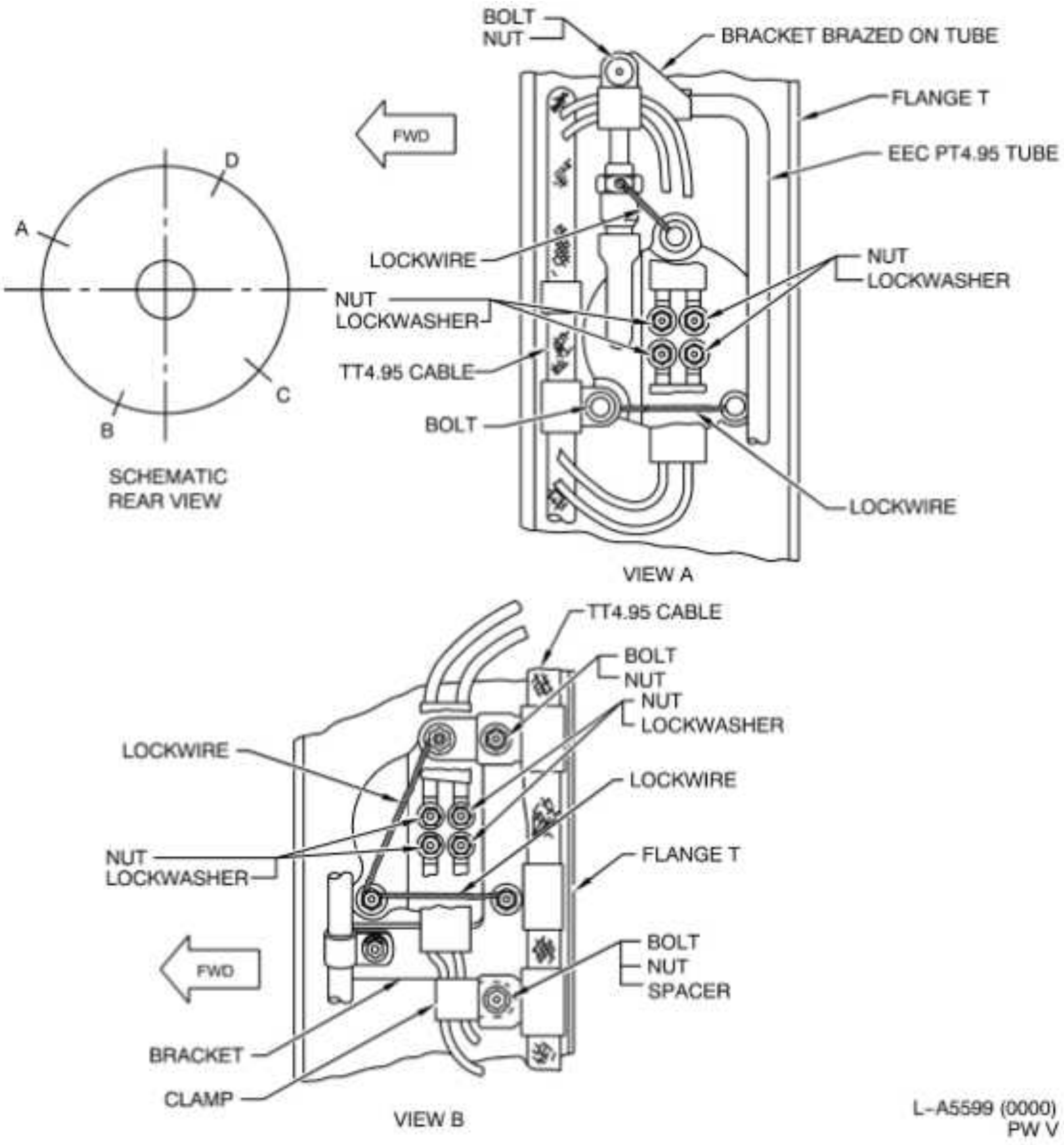
Consumable Material:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−289	Lockwire (AS3214−02)
P05−291	Cable, Safety (Optional)
P05−292	Ferrule, Safety Cable (Optional)
P06−023	Silver Goop (PWA 36001)

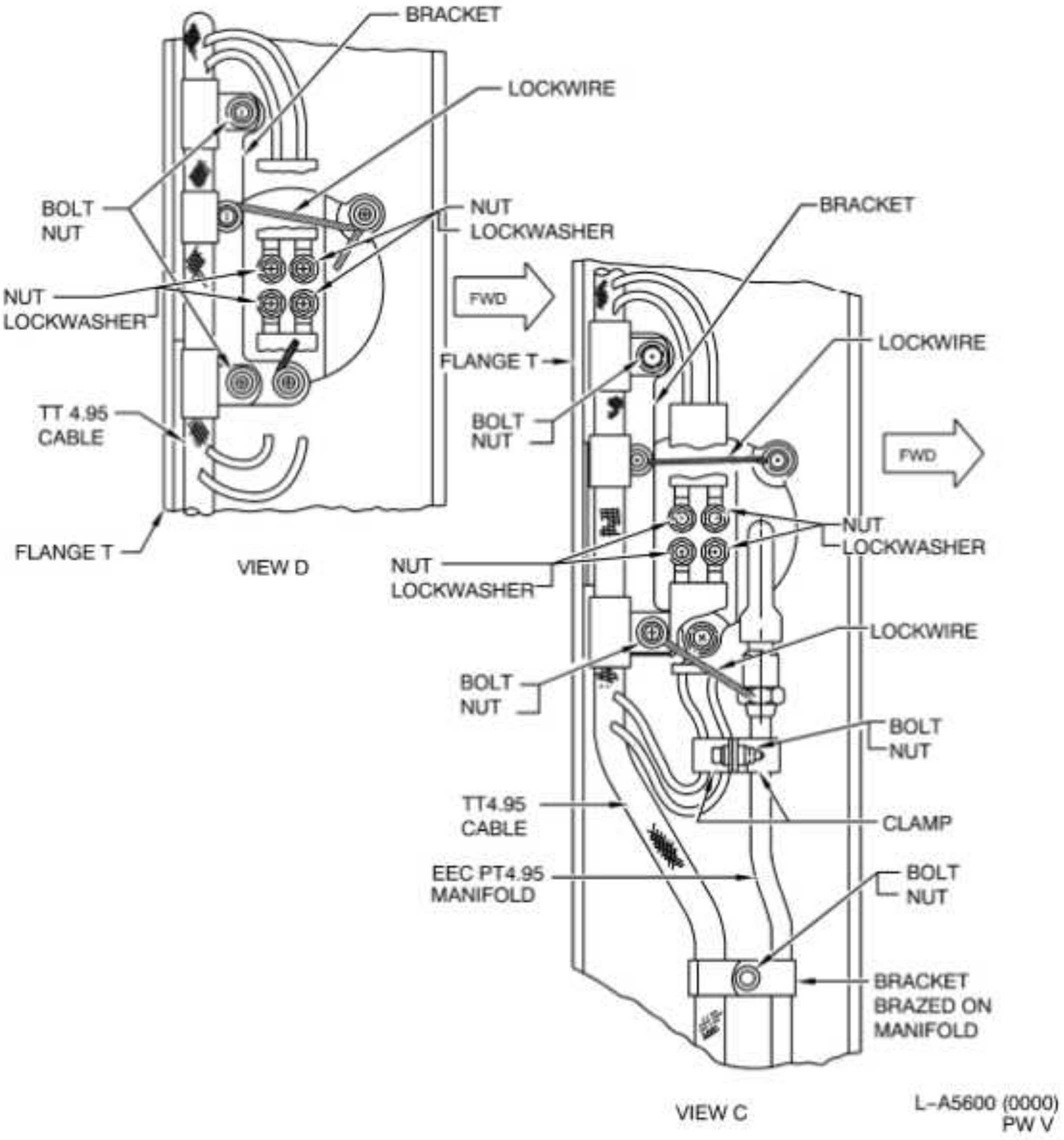
B. Procedure
See Figure 402.
(1) Remove the protection covers.
(2) Install thermocouple at Location A (10 o'clock position) as follows.
  (a) Install the thermocouple into the housing and case, and align the bolt holes. Install bolts, threads lubricated with Silver Goop (P06−023). Torque the bolts to 54 − 60 lb−in. (6.101 − 6.779 N.m). Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292).

  CAUTION: DO NOT USED LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF EEC CAN RESULT.

  (b) Install the PT4.95 tube (AS34) nut to probe adapter. Torque the nut to 135 − 150 lb−in. (15.253 − 16.948 N.m). Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292).
  (c) Torque the clamp bolts that were loosened to 36 − 40 lb−in. (4.067 − 4.519 N.m).
  (d) Install the thermocouple wires to the bracket (brazed) on the PT4.95 tube (AS34) with a clamp, bolt, threads lubricated with Engine Oil (P03−001) and a nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).
(3) Install the thermocouple at Location B (7 o'clock position) as follows.


BOLT
NUT
BRACKET BRAZED ON TUBE
FWD
FLANGE T
EEC PT4.95 TUBE
D
A
LOCKWIRE
NUT
LOCKWASHER
NUT
LOCKWASHER
TT4.95 CABLE
C
B
BOLT
SCHEMATIC
REAR VIEW
LOCKWIRE
VIEW A
TT4.95 CABLE
BOLT
NUT
NUT
LOCKWASHER
LOCKWIRE
LOCKWIRE
NUT
LOCKWASHER
FLANGE T
BOLT
NUT
SPACER
FWD
BRACKET
CLAMP
VIEW B
L-A5599 (0000)
PW V

Exhaust Gas Temperature Thermocouple
(Post SB PW4ENG 72−134)
Figure 402 (Sheet 1)
(Task 72−00−54−450−004−B)


BRACKET
LOCKWIRE
BOLT
NUT
NUT
LOCKWASHER
NUT
LOCKWASHER
TT 4.95
CABLE
FLANGE T
VIEW D
FWD
FLANGE T
BRACKET
LOCKWIRE
BOLT
NUT
FWD
NUT
LOCKWASHER
NUT
LOCKWASHER
LOCKWIRE
BOLT
NUT
BOLT
NUT
CLAMP
TT4.95
CABLE
EEC PT4.95
MANIFOLD
BOLT
NUT
BRACKET
BRAZED ON
MANIFOLD
VIEW C
L−A5600 (0000)
PW V

Exhaust Gas Temperature Thermocouple
(Post SB PW4ENG 72−134)
Figure 402 (Sheet 2)
(Task 72−00−54−450−004−B)

(a) Install the thermocouple into the housing and case, and align the bolt holes. Align the bracket and install two bolts, threads lubricated with Silver Goop (P06−023). Torque the bolts to 54 − 60 lb−in. (6.101 − 6.779 N.m). Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292).

(b) Attach the PT4.95 manifold (AS33) clamp to the bracket with a bolt, threads lubricated with Engine Oil (P03−001), and nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Install the thermocouple wires to the bracket with a clamp (next to bracket), spacer (between clamp and cable clamp), bolt, threads lubricated with Engine Oil (P03−001), and nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(4) Install the thermocouple at Location C (4 o'clock position) as follows.

(a) Install the thermocouple into the housing and case, and align the bolt holes. Align the bracket and install bolts, threads lubricated with Silver Goop (P06−023). Torque the bolts to 54 − 60 lb−in. (6.101 − 6.779 N.m). Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292).

CAUTION: DO NOT USE LUBRICANTS ON EEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF EEC CAN RESULT.

(b) Install the PT4.95 manifold (AS33) nut to the probe adapter. Torque the nut to 135 − 150 lb−in. (15.253 − 16.948 N.m). Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292).

(c) Install the thermocouple wires to the clamp on the PT4.95 manifold (AS33) with a clamp, bolt, threads lubricated with Engine Oil (P03−001) and nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(5) Install the thermocouple at Location D (1 o'clock position) as follows.

(a) Install the thermocouple into the housing and case, and align the bolt holes. Align the bracket and attach with bolts, threads lubricated with Silver Goop (P06−023). Torque the bolts to 54 − 60 lb−in. (6.101 − 6.779 N.m). Install the Lockwire (P05−289) or Safety Cable (P05−291) and Safety Cable Ferrule (P05−292).

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−06

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(6) Attach the thermocouple wire connectors to the thermocouple studs. Install the washers and nuts to the studs and torque the thermocouple nuts.
  (a) Torque the alumel connections (larger studs) to 10 − 15 lb−in. (1.130 − 1.695 N.m).
  (b) Torque the chromel connections (smaller studs) to 8 − 12 lb−in. (0.904 − 1.356 N.m).

C. Postrequisites
  (1) Use the Repair Test Reference Table and do a test of the engine. See 71−00−00, Adjustment/Test−00.

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ENGINE GENERAL - TURBINE EXHAUST CASE - INSTALLATION-07

Task 72-00-54-450-005:

1. Install EGT (TT4.95) Thermocouple Housing

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

ITEM NO.	DESIGNATION
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-023	Silver Goop (PWA 36001)

B. Procedure

See Figure 401.

(1) Remove protective closures.

(2) Install EGT (TT4.95) thermocouple housing to exhaust case bosses aligning boltholes. Install one bolt (in forward hole), threads lubricated with Silver Goop (P06-023), handtight only.

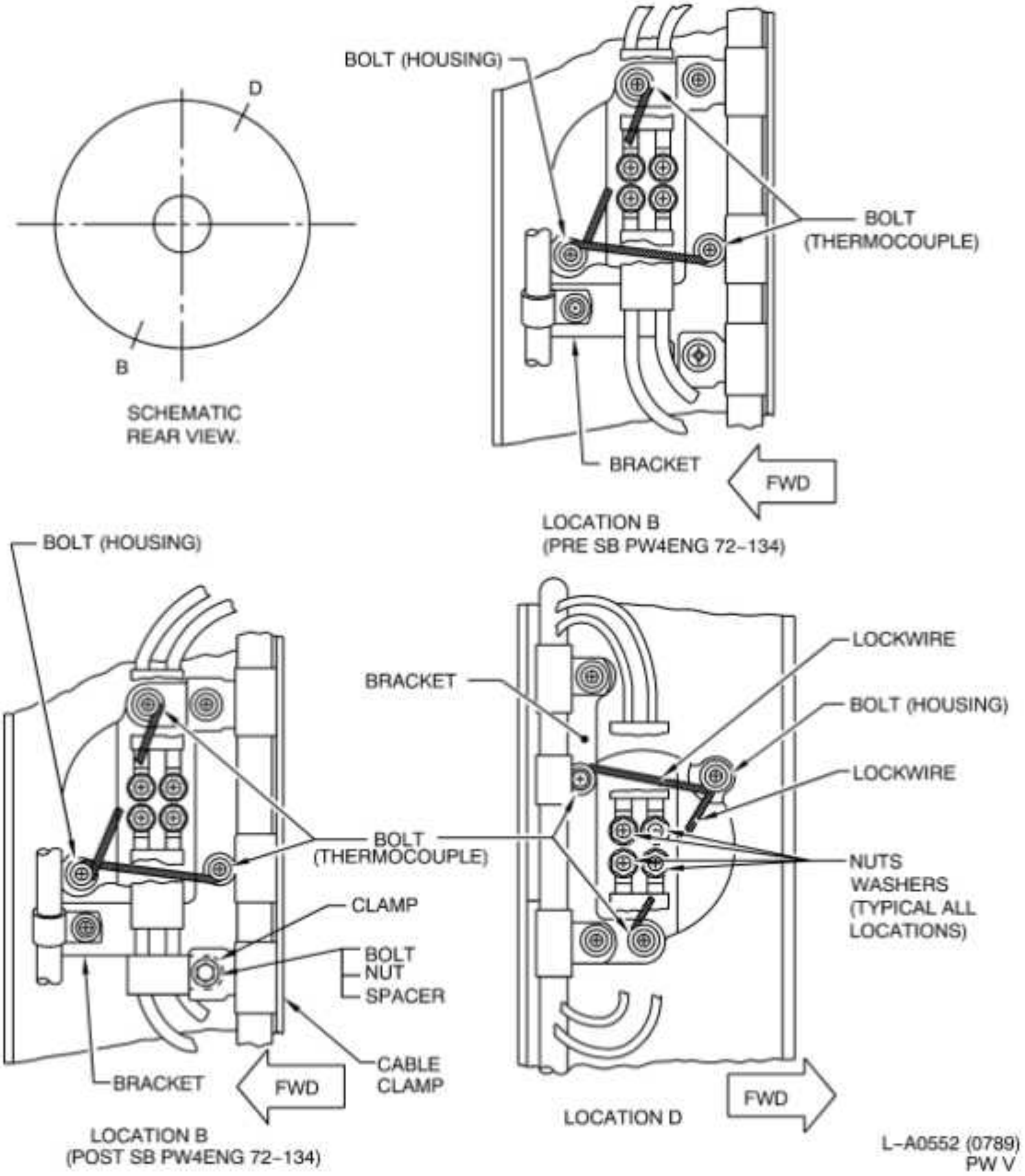
(3) Install EGT (TT4.95) thermocouple probe into housing aligning rearward boltholes). Position harness bracket over probe holes and install two bolts, threads lubricated with Silver Goop (P06-023), handtight only.

(4) Torque all bolts to 54 - 60 lb-in. (6.101 - 6.779 N.m). Install the Lockwire (P05-289) or Safety Cable (P05-291) and Safety Cable Ferrule (P05-292).

(5) At Location B only, secure EEC PT4.95 manifold (AS33) clamp with bolt, threads lubricated with Engine Oil (P03-001), and nut. Torque bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(6) Connect thermocouple cable leads to thermocouple probe and secure with washers and nuts. Torque nuts as follows:
   (a) Torque alumel connections (larger studs) to 10 - 15 lb-in. (1.130 - 1.695 N.m).
   (b) Torque chromel connections (smaller studs) to 8 - 12 lb-in. (0.904 - 1.356 N.m).


BOLT (HOUSING)
D
B
SCHEMATIC REAR VIEW.
BOLT (THERMOCOUPLE)
BRACKET
FWD
LOCATION B (PRE SB PW4ENG 72-134)
BOLT (HOUSING)
BRACKET
BOLT (THERMOCOUPLE)
CLAMP
BOLT
NUT
SPACER
CABLE CLAMP
BRACKET
FWD
LOCATION B (POST SB PW4ENG 72-134)
LOCKWIRE
BOLT (HOUSING)
LOCKWIRE
NUTS
WASHERS
(TYPICAL ALL LOCATIONS)
FWD
LOCATION D
L-A0552 (0789)
PW V

EGT (TT4.95) Thermocouple Housing
Figure 401
(Task 72−00−54−450−005)

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−07

(7) At Location B install the thermocouple wires to the bracket with a clamp (next to bracket), spacer (between clamp and cable clamp), bolt, threads lubricated with Engine Oil (P03−001) and nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m) (Post SB PW4ENG 72−134).

C. Postrequisites

(1) Test engine per Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).

Task 72-00-54-420-002:

1. Install No. 4 Bearing And Seals

NOTE: See Figure 401 for part/assembly installation sequence.

A. Prerequisites

(1) See 72-00-54, Inspection/Check-01 Task 72-00-54-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:

R	PWA 85453	Drift, Install (Optional to PWA 106326)
R	PWA 106326	Drift, Install (No. 4 Bearing Inner Race, Seals, And Spacers)

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	4	72-54-00/4/60
Key Washer	4	72-54-00/4/70
Key Washer	3	72-54-00/5/20
Key Washer	2	72-54-00/5/60
Key Washer	2	72-54-00/5/70
Key Washer	8	72-54-00/4/110
Packing	1	72-54-00/4/90
Packing	1	72-54-00/5/1
Packing	1	72-54-00/5/90

C. Procedure

(1) Ensure that No. 4 bearing (carbon) face seal gap dimensional requirement (Reference 829) is met.

CAUTION: MAKE SURE THE NO. 4 BEARING FACE SEAL, FRONT SEAL SPACER AND REAR SEAL SPACER ARE INSTALLED CORRECTLY. INCORRECTLY ASSEMBLED PARTS CAN CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN−FLIGHT SHUTDOWN.

(2) (Reference 1003) Install No. 4 bearing inner race, face seal (carbon) and seal spacers (front) and (rear). See Figure 402 and Figure 403.

NOTE: All parts must be within ±10°F (±5.6°C) when making all measurements.

(a) Stack 6th stage LPT airseal (402/2), No. 4 bearing seal spacers (front) (402/3) and rear (402/5) and No. 4 bearing inner race (402/6) on bench. Ensure that zero clearance is maintained between mating faces. Measure overall stacking dimension and record as Dimension N.

(b) Measure dimension from 6th stage airseal shoulder Face P, to rear face of front compressor drive turbine shaft (402/1). Record as Dimension R.

(c) Dimension N − Dimension R must equal 0.005 − 0.020 inch (0.13 − 0.51 mm).

(d) Position 6th stage LPT airseal (403/2) on front compressor drive turbine shaft (403/1). Seat airseal onto shoulder of rear hub using PWA 85453 or PWA 106326 Drift and mallet. R

(e) Install No. 4 bearing (front) seal spacer (403/3), large OD end forward, onto the front compressor drive turbine shaft (403/1). Seat the seal spacer to the last installed 6th stage LPT airseal (403/2) with the PWA 85453 or PWA 106326 Drift and a mallet. R R

CAUTION: HANDLE THE NO. 4 BEARING (CARBON) FACE SEAL WITH CARE AS THIS SEAL CAN EASILY BE DAMAGED.

(f) Carefully install the No. 4 bearing (carbon) face seal (403/4) onto the rear face of the last installed No. 4 bearing (front) air seal spacer. The gap of the No. 4 bearing (carbon) face seal must be at the 12:00 o'clock position.

(g) Install the No. 4 bearing (rear) seal spacer (403/5), smaller OD rearward, onto the turbine shaft. Engage the No. 4 bearing (rear) seal spacer to the last installed No. 4 bearing (front) seal spacer on the turbine shaft with the R PWA 85453 or PWA 106326 Drift and a mallet.

(h) Heat the No. 4 bearing inner race (403/6). See Standard Practices Manual, PN 585005.

(i) Install the heated No. 4 bearing inner race onto front compressor drive turbine shaft (403/1). R Using PWA 85453 or PWA 106326 Drift and mallet, seat inner race and previously installed spacers.

(j) Measure Dimension S from rear face of No. 4 bearing inner race to rear face of front compressor drive turbine shaft (402/1). See Figure 402.

(k) Dimension S must equal Dimension N - Dimension R plus 0.000 or minus 0.001 inch (plus 0.000 or minus 0.025 mm).

(l) If Dimension S is not within limits, remove bearing inner race, spacers and seals from turbine shaft and repeat steps (d) through (i).

(3) Lubricate new packing (405/2) with Engine Oil P03-001, and install packing into groove in front diameter of No. 4 bearing retaining plate (404/3). Align boltholes and install retaining plate into rear inner diameter of front compressor drive turbine shaft (404/6). Secure retaining plate using bolts (404/5) lubricated with Engine Oil P03-001, and key washers (404/4). Torque bolts to 75 - 85 lb-in. (8.474 - 9.604 N.m). Bend tabs of key washers. See Figure 404.

(4) Install No. 4 bearing outer race and rollers.

CAUTION: BEARING INNER RACE IS INSTALLED ON FRONT COMPRESSOR DRIVESHAFT. ENSURE THAT ALL BEARING DETAILS ARE KEPT TOGETHER. MIXING OF BEARING DETAILS MAY CAUSE DAMAGE TO BEARING.

(a) Remove No. 4 bearing outer race and rollers from container.

(b) Install two seal rings (405/1) into grooves in OD of bearing outer race. See Figure 405. Position the seal ring gaps within Area E, 180 degrees from the No. 4 bearing (oil) nozzle, as shown in Figure 406.

(c) Align four slots in rear face of bearing outer race with slots in exhaust case inner flange rear face and install bearing outer race with rollers into No. 4 bearing support flange in exhaust case.

(d) Secure outer race using four retaining plates (405/3) (chamfered side out), eight bolts (405/6) lubricated with Engine Oil P03−001 and key washers (405/4) and (405/5). Use key washer PN MS9582−10 at round bolthole locations. Use key washer PN MS9581−10 at elongated bolthole locations.

(e) (Reference 90) Make sure that the clearance between the retaining plate and the grooves in the bearing outer race is in the limit specified in Index 2.

(f) With retaining plate gaps within limits given in previous step, torque bolt to 75 −85 lb−in. (8.474 − 9.604 N.m). Recheck gap per previous step.

(g) Bend tabs of washers to secure bolts.

(5) Remove brass shims supporting low pressure turbine rotor. Shims are between 6th stage blade outer shrouds and 6th stage air sealing ring segments.

(6) Install No. 4 bearing oil scavenge tube (407/4). See Figure 407.

(a) Install new packing (407/1) in groove in recess in exhaust case rear inner diameter.

(b) Align boltholes in flange of No. 4 bearing oil scavenge tube (407/4) with boltholes in recessed pad in exhaust case rear inner diameter. Align bolthole in detail tube bracket with bolthole in exhaust case rear inner diameter. Secure tube using three bolts (407/3) and key washers (407/2). Torque bolts to 32 − 36 lb−in. (3.616 − 4.067 N.m). Bend tabs of key washers.

(7) Install No. 4 bearing oil nozzle and No. 4 bearing packing transfer tube. See Figure 408.

(a) Position No. 4 bearing nozzle into port in pad on exhaust case rear inner diameter. Secure nozzle using two bolts (408/1), lubricated with Engine Oil P03−001, and two washers (408/2) and (408/3).

(b) Install No. 4 bearing packing transfer tube (408/5) through port in nozzle (408/3) and into port in exhaust case rear flange. Secure transfer tube using two bolts (408/7) lubricated with Engine Oil P03−001, and washers (408/6) and (408/8). Torque bolts (408/1) securing nozzle to exhaust case and bolts (408/7) securing transfer tube to nozzle to 75 − 85 lb−in. (8.474 − 9.604 N.m). Bend tabs of washers (408/2), (408/4), (408/6) and (408/8).

CAUTION: YOU MUST APPLY ENGINE OIL FULLY TO THE COVER PACKING OR YOU WILL CUT THE PACKING DURING INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN−FLIGHT SHUTDOWN.

CAUTION: INSTALL THE COVER INTO POSITION USING FOUR WORK BOLTS EQUALLY SPACED AROUND THE COVER. TIGHTEN THE BOLTS EQUALLY IN SMALL INCREMENTS TO PULL THE COVER INTO POSITION EQUALLY. MONITOR THE ENGAGEMENT OF THE COVER TO MAKE SURE THAT THE PACKING IS NOT CUT DURING INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN−FLIGHT SHUTDOWN.

(8) Install the No. 4 bearing cover as follows: See Figure 409.

(a) Apply Engine Oil P03−001 fully to the new packing (409/2).

(b) Install the new packing into the groove at the rear flange of the No. 4 bearing cover (409/3).

(c) Install the cover into the rear inner flange of the exhaust case (409/1).

(d) Install 4 work bolts equally spaced around the cover.

(e) Tighten the bolts equally in small increments to pull the cover into position equally.

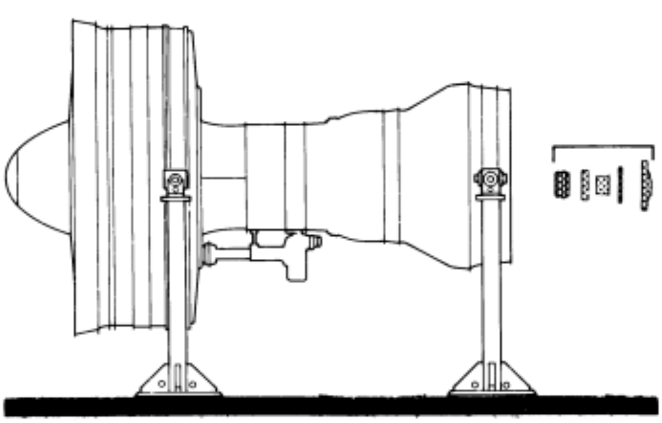
(f) Monitor the engagement of the cover to make sure the packing is not cut.

(g) Remove the work bolts.

(9) Position No. 4 bearing heat shield (409/4) into recess in No. 4 bearing shield (409/5). Align bolt holes and install shield over previously installed No. 4 bearing cover (409/3) at rear inner flange of exhaust case. Secure the shield with bolts, lubricated with Engine Oil P03−001. Use 30 bolts (409/6) for covers with 30 boltholes (Pre SB PW4ENG 72−456), or 16 bolts for covers with 16 boltholes (Post SB PW4ENG 72−456). Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

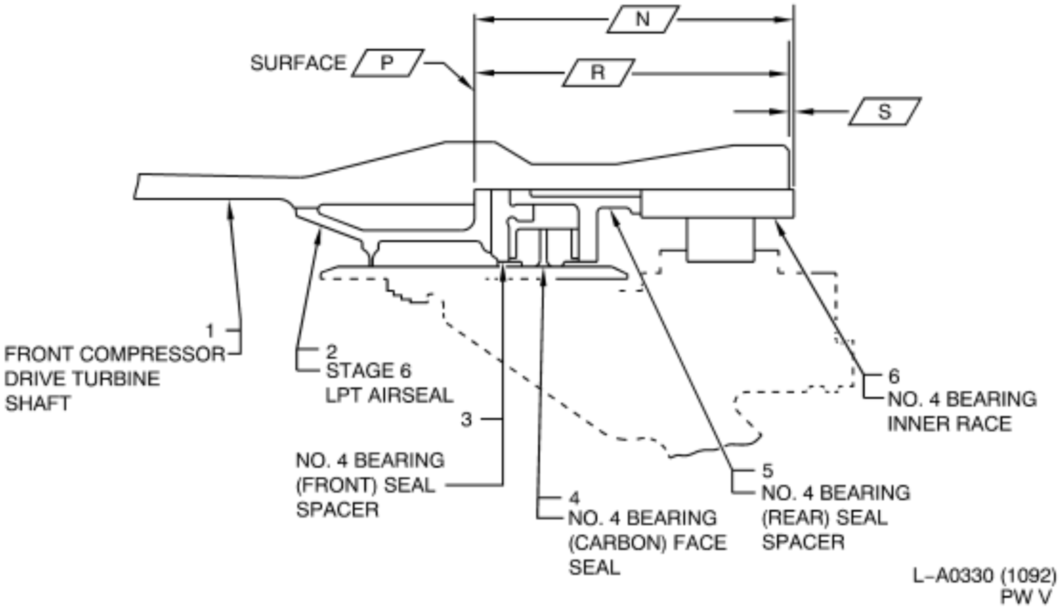
D. Postrequisites

(1) Test engine per Repair Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.

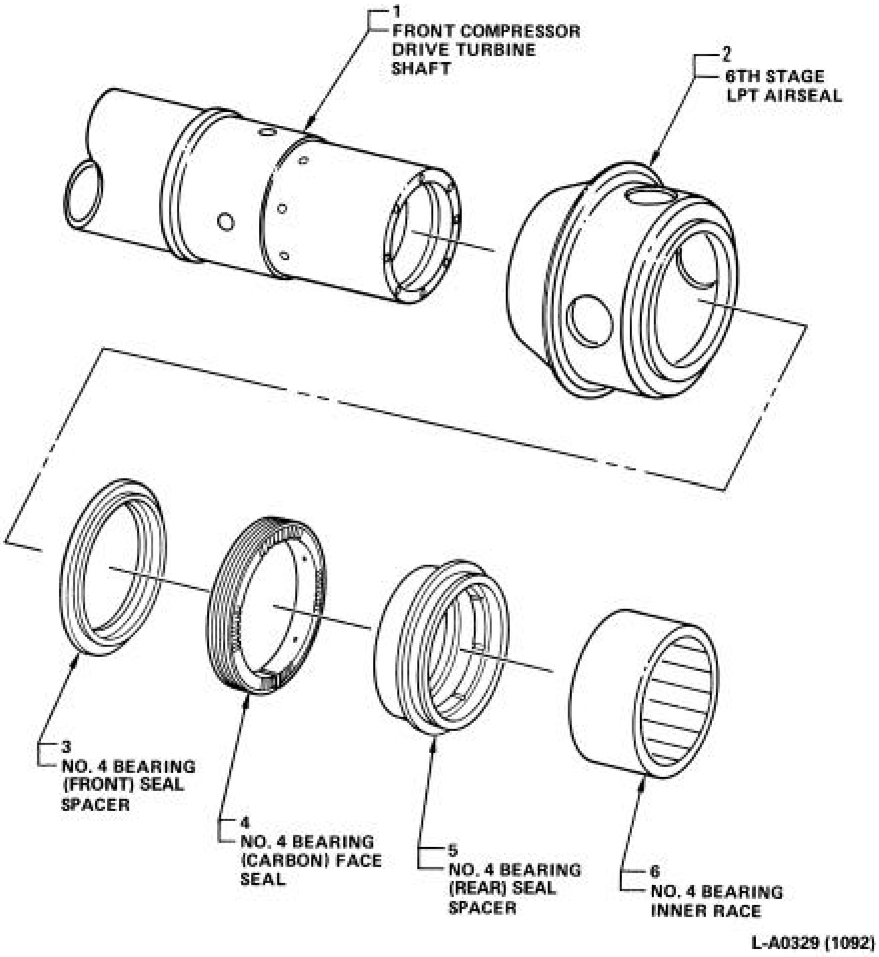


L-A1503

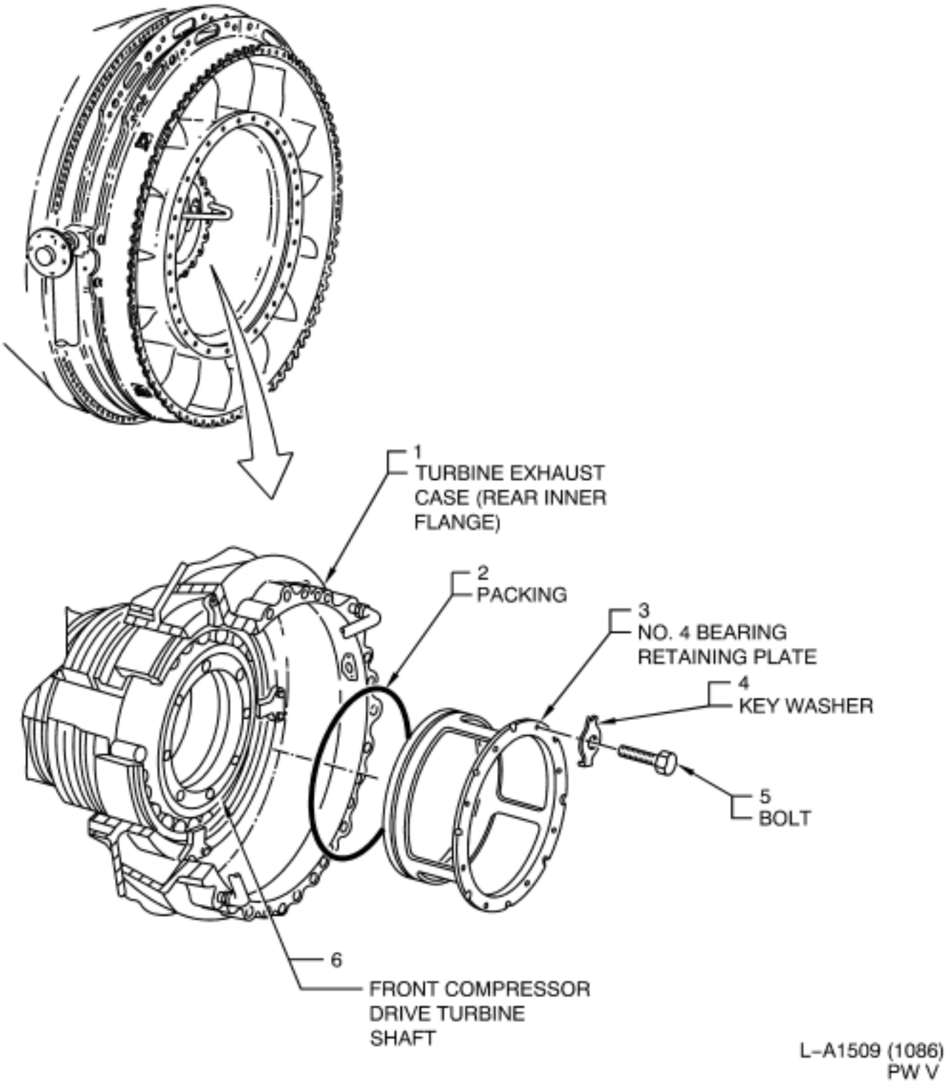
R Procedure Sequence
Figure 401
(Task 72−00−54−420−002)


N
SURFACE P
R
S
1
FRONT COMPRESSOR DRIVE TURBINE SHAFT
2
STAGE 6 LPT AIRSEAL
3
NO. 4 BEARING (FRONT) SEAL SPACER
4
NO. 4 BEARING (CARBON) FACE SEAL
5
NO. 4 BEARING (REAR) SEAL SPACER
6
NO. 4 BEARING INNER RACE
L−A0330 (1092)
PW V

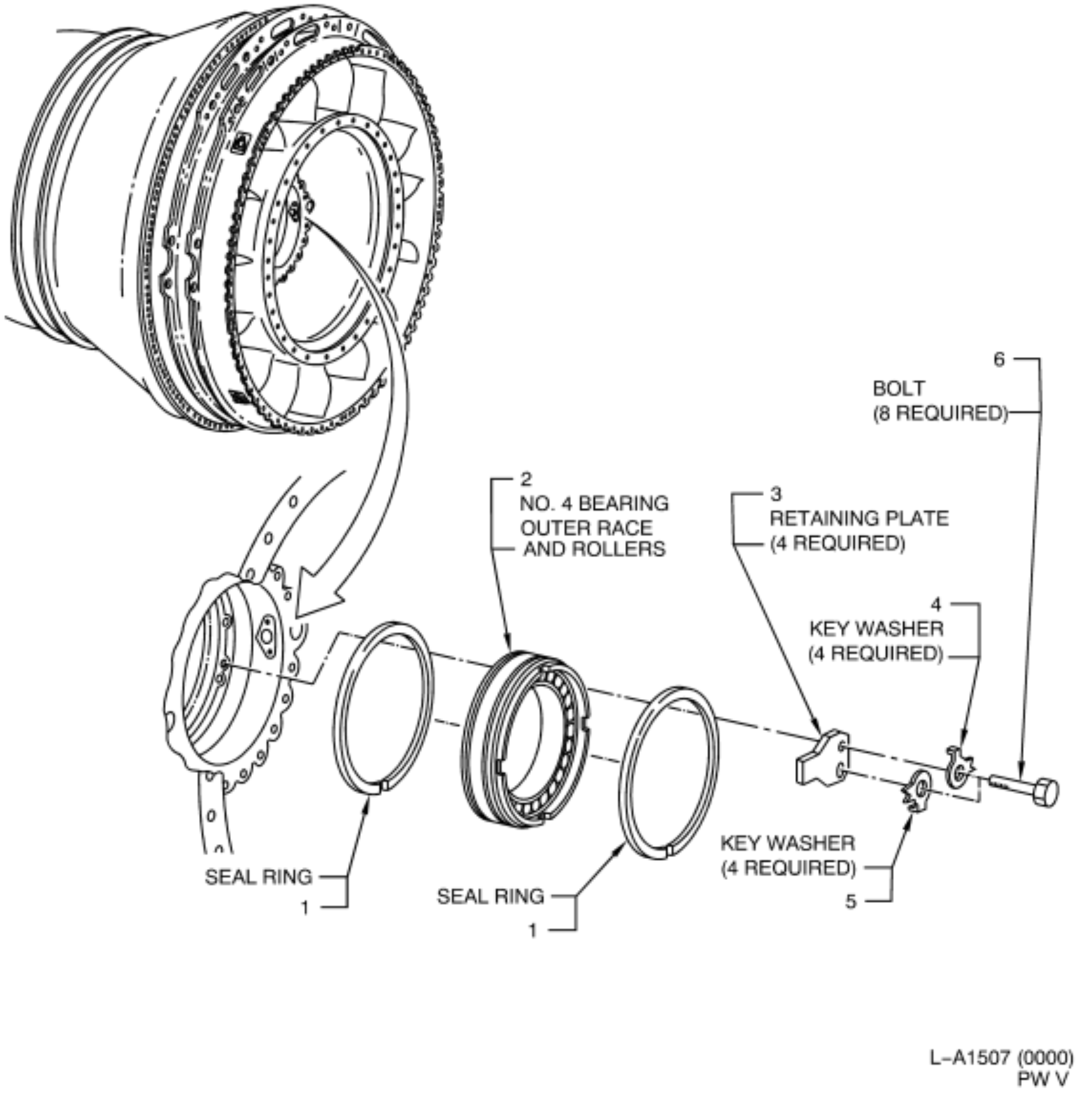
Turbine Exhaust Case Seating Check
Figure 402
(Task 72−00−54−420−002)


1
FRONT COMPRESSOR DRIVE TURBINE SHAFT
2
6TH STAGE LPT AIRSEAL
3
NO. 4 BEARING (FRONT) SEAL SPACER
4
NO. 4 BEARING (CARBON) FACE SEAL
5
NO. 4 BEARING (REAR) SEAL SPACER
6
NO. 4 BEARING INNER RACE
L-A0329 (1092)

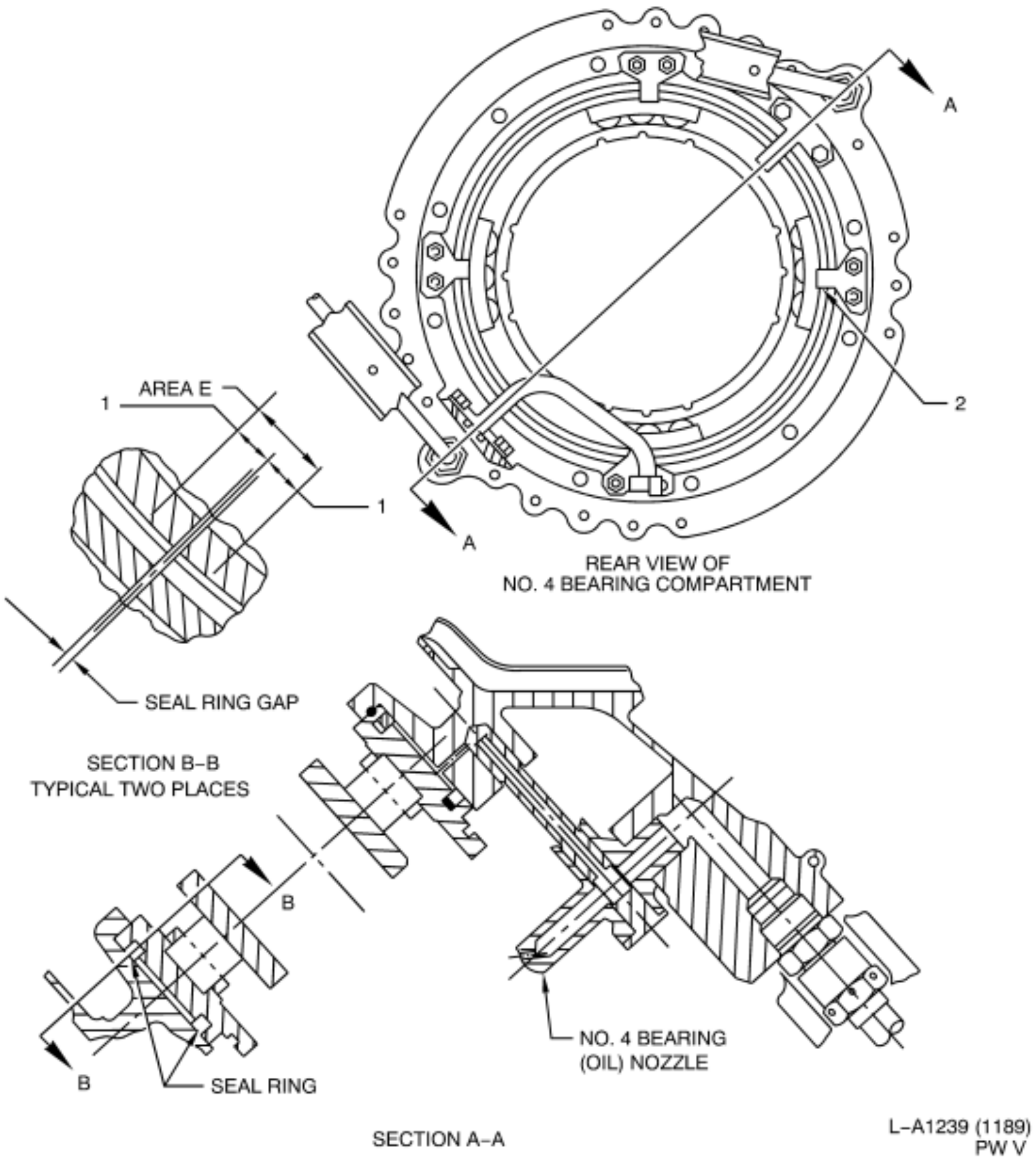
No. 4 Bearing And Seals Installation
Figure 403
(Task 72-00-54-420-002)


1
TURBINE EXHAUST CASE (REAR INNER FLANGE)
2
PACKING
3
NO. 4 BEARING RETAINING PLATE
4
KEY WASHER
5
BOLT
6
FRONT COMPRESSOR DRIVE TURBINE SHAFT
L−A1509 (1086)
PW V

No. 4 Bearing Retaining Plate Installation
Figure 404
(Task 72−00−54−420−002)


6
BOLT
(8 REQUIRED)
2
NO. 4 BEARING
OUTER RACE
AND ROLLERS
3
RETAINING PLATE
(4 REQUIRED)
4
KEY WASHER
(4 REQUIRED)
KEY WASHER
(4 REQUIRED)
5
SEAL RING
1
SEAL RING
1
L−A1507 (0000)
PW V

No. 4 Bearing Outer Race Installation
Figure 405
(Task 72−00−54−420−002)

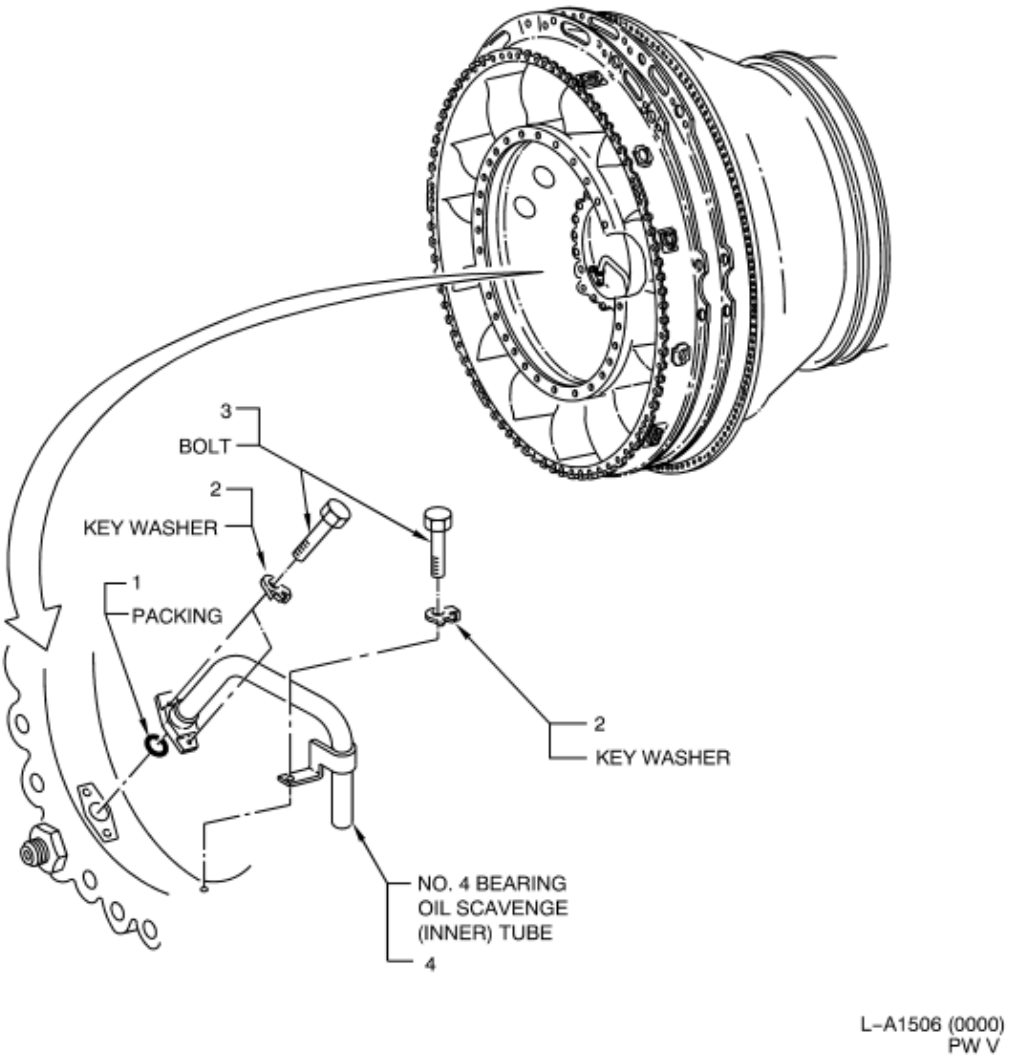

A
2
AREA E
1
1
A
REAR VIEW OF
NO. 4 BEARING COMPARTMENT
SEAL RING GAP
SECTION B−B
TYPICAL TWO PLACES
B
B
SEAL RING
NO. 4 BEARING
(OIL) NOZZLE
SECTION A−A
L−A1239 (1189)
PW V

No. 4 Bearing Outer Race Installation
Figure 406
(Task 72−00−54−420−002)

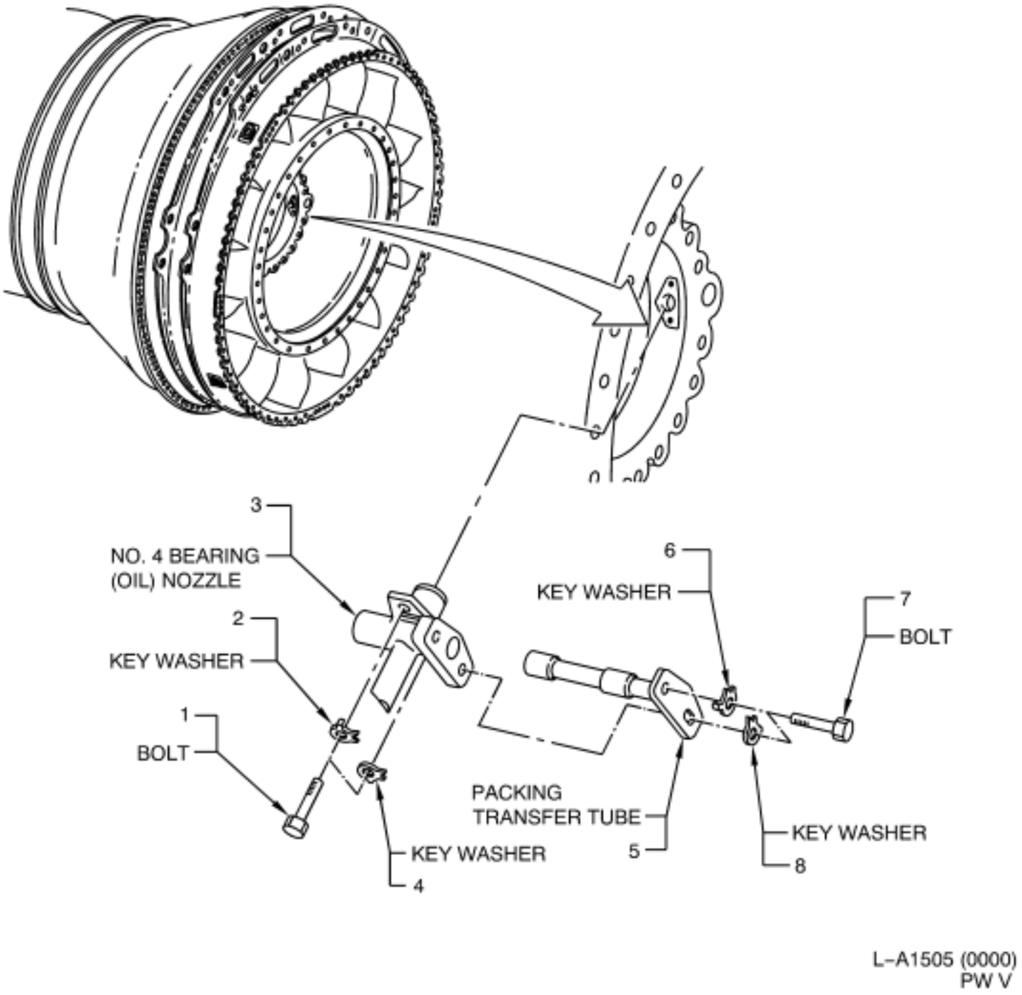
ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−08

1. 0.500 Inch (12.700 mm) Maximum
2. 0.010 − 0.050 Inch (0.254 − 1.270 mm), Four Locations

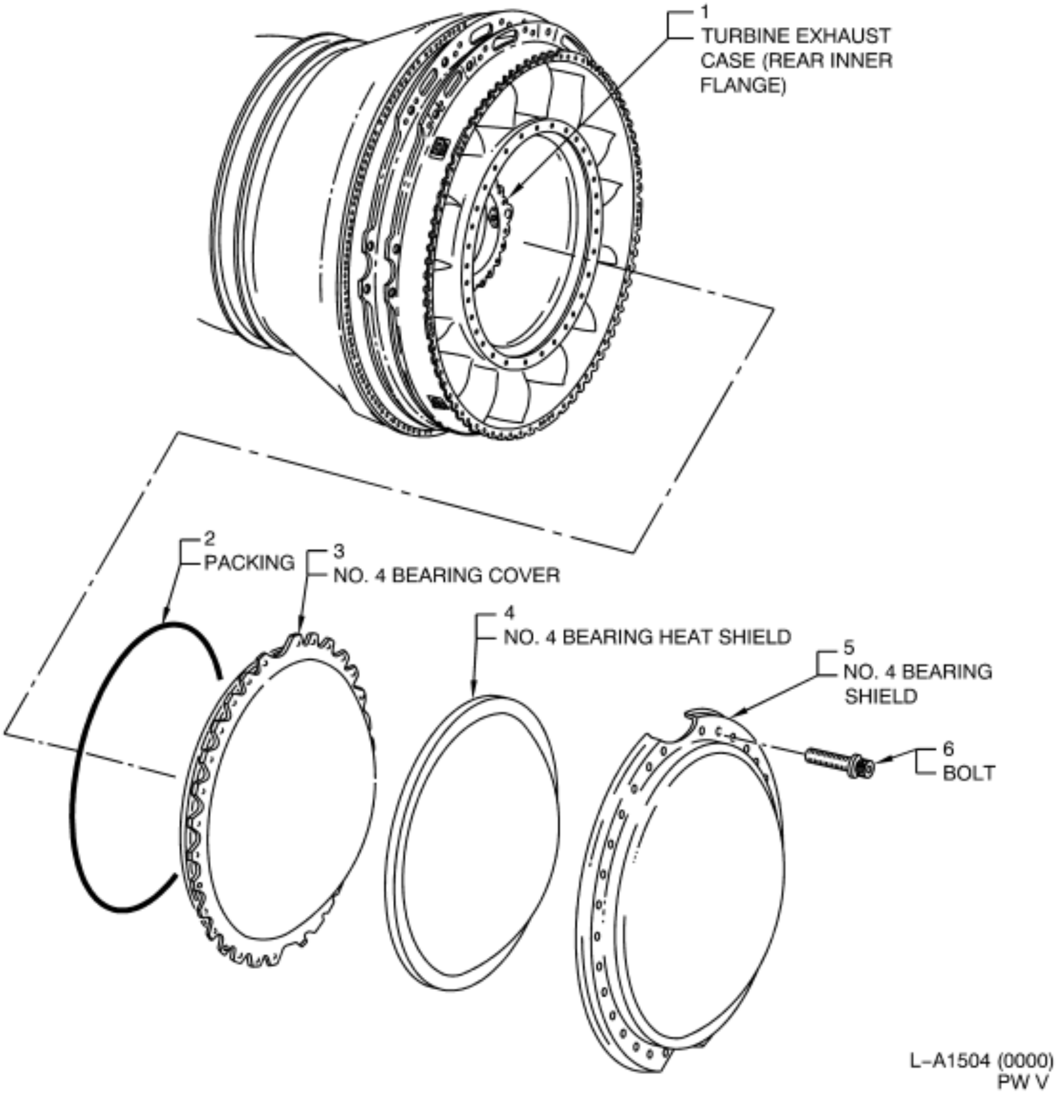
Key to Figure 406


3
BOLT
2
KEY WASHER
1
PACKING
2
KEY WASHER
NO. 4 BEARING
OIL SCAVENGE
(INNER) TUBE
4
L−A1506 (0000)
PW V

No. 4 Bearing Scavenge Tube Installation
Figure 407
(Task 72−00−54−420−002)


3
NO. 4 BEARING (OIL) NOZZLE
2
KEY WASHER
1
BOLT
KEY WASHER
4
6
KEY WASHER
7
BOLT
PACKING TRANSFER TUBE
5
KEY WASHER
8
L−A1505 (0000)
PW V

No. 4 Bearing (Oil) Nozzle Installation
Figure 408
(Task 72−00−54−420−002)


1
TURBINE EXHAUST CASE (REAR INNER FLANGE)
2
PACKING
3
NO. 4 BEARING COVER
4
NO. 4 BEARING HEAT SHIELD
5
NO. 4 BEARING SHIELD
6
BOLT
L−A1504 (0000)
PW V

No. 4 Bearing Cover And Shield Installation
Figure 409
(Task 72−00−54−420−002)

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ENGINE GENERAL - TURBINE EXHAUST CASE - INSTALLATION-09

Task 72-00-54-450-006-A:

1. Install EEC Thermocouple And Airframe Cable (W6) - For Engines Without The Revised EEC Thermocouple And Airframe Cable (W6) And Wiring Harness Support Tube For Increased Engine Core Clearance (Pre SB PW4ENG 72-134)

NOTE: This procedure provides for installation of cable tube (support) and EEC thermocouple and airframe cable (W6).

A. Equipment And Materials Necessary

Standard Tools:
Glenair TG-70 Strap Wrench Or
Glenair TG-69 Soft Jawed Pliers

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lockwire, MS9226-03		

B. Procedure
See Figure 401 and Figure 402.

(1) Install cable tube (support).

(a) Position tube to engine with brazed clamp at shorter straight end of tube against upper face of bracket at No. 7 fuel nozzle. Position other end of tube to outer face of bracket located on Flange P, at 5 o'clock position. See Views A and I.

(b) Secure brazed clamp on tube to bracket at No. 7 fuel nozzle, temporarily, with bolt, threads lubricated with Engine Oil P03-001, (bolthead up next to clamp on tube) and nut fingertight. See View I.

NOTE: Bolt securing brazed clamp to bracket at No. 7 fuel nozzle will be torqued in a later step.

(c) Secure brazed clamp on other end of tube to lower hole on outer face of bracket on Flange P with spacer between tube clamp and bracket. Install bolt, threads lubricated with Engine Oil P03−001, (head outboard next to clamp on tube) and nut. Tighten and torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View A.

(d) Secure clamp brazed on tube to bracket on rear flange of lower right turbine vane cooling air tube, at 3:30 o'clock position, with bolt, threads lubricated with Engine Oil P03−001, (head outboard next to clamp on tube) and nut. Tighten and torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View F.

(e) Secure clamp brazed on tube to bracket on LPT cooling air manifold support, at 5 o'clock position, with bolt, threads lubricated with Engine Oil P03−001, (head forward next to clamp), spacer, and nut. Tighten and torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View C.

CAUTION: SEE 72−00−00, INSTALLATION−00 FOR GENERAL INSTALLATION REQUIREMENTS FOR ELECTRICAL CABLES, LEADS AND CABLES.

CAUTION: AVOID TWISTING OR SEVERE BENDING OF WIRING HARNESSES AT ANY TIME DURING INSTALLATION OR DAMAGE TO CABLES MAY RESULT.

(2) Install EEC thermocouple and airframe cable (W6).

(a) Connect the W6P12 harness connector to the W5J12 harness receptacle attached to a large fuel manifold support bracket on Flange K at the 3:00 o'clock position as follows.

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:

- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal). This procedure will make sure the contacts are sufficiently engaged and the connector is tight.
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(b) Route cable upward and rearward over bracket secured at turbine blade cooling air tube flange on valve located at 3 o'clock position. Route cable inboard of lower right turbine cooling air tube.

(c) Secure second clamp on cable to lower face of bracket securing cable tube to bracket at No. 7 fuel nozzle. Remove nut from bolt and position cable clamp over bolt. Reinstall nut fingertight. See View I.

(d) Secure first clamp on cable to outer face of bracket at turbine blade cooling air tube flange with bolt, threads lubricated with Engine Oil P03−001, (bolthead outboard next to clamp) and nut fingertight. See View J.

(e) Secure third clamp on cable to brazed clamp on tube with bolt, threads lubricated with Engine Oil P03−001, (bolthead outboard next to tube clamp) and nut fingertight. See View G.

(f) Secure fourth clamp on cable to lower face of bracket on diffuser case. Position TT3 thermocouple ground lead on top of brazed tube clamp. Install bolt, threads lubricated with Engine Oil P03−001, (bolthead next to ground lead) and nut fingertight. See View H.

(g) Remove nuts from TT3 thermocouple terminal studs. Connect thermocouple leads to terminal studs and secure with nuts (round collar end inboard). Align leads so they are parallel to one another.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(h) Torque nuts as follows:

1 (Reference 2273) Torque the alumel nuts (larger terminal studs) to 18 − 22 lb−in. (2.034 − 2.486 N.m).

2 (Reference 2273) Torque the chromel nuts (smaller terminal studs) to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(i) Secure fifth, sixth, and eighth clamps on cable to brazed clamps on tube with bolts, threads lubricated with Engine Oil P03−001, (boltheads next to cable clamps) and nuts fingertight. See View B.

(j) Secure seventh cable clamp to brazed tube clamp with bolt, threads lubricated with Engine Oil P03−001, (bolthead inboard next to tube clamp) and nut fingertight. See View E.

(k) Secure ninth cable clamp and brazed tube clamp to outer face of bracket on HPT turbine case cooling air manifold support with bolt, threads lubricated with Engine Oil P03−001, (bolthead outboard next to tube clamp) and nut fingertight. See View D.

(l) Secure tenth, eleventh, twelfth, and thirteenth cable clamps to brazed tube clamps with bolts, threads lubricated with Engine Oil P03−001, (bolthead outboard next to cable clamp) and nuts fingertight. See View B.

(m) Secure fourteenth clamp to inboard side of brazed tube clamp with spacer between cable clamp and tube clamp. Install bolt, threads lubricated with Engine Oil P03−001, (bolthead outboard next to tube clamp) and nut fingertight. See View A.

(n) Secure last cable clamp to inner face of bracket on Flange P, at 5 o'clock position, with spacer between cable clamp and bracket. Install bolt, threads lubricated with Engine Oil P03−001, (bolthead inboard next to cable clamp) and nut fingertight. See View A.

(o) Tighten and torque all previously installed bolts and/or nuts securing cable clamps to brackets, or brazed tube clamps to 36 − 40 lb−in. (4.067 − 4.519 N.m).

CAUTION: DO NOT ATTACH THE GROUND WIRE TO THE TERMINAL STUDS.

(p) Remove nuts from EGT (TT4.95) box and cable assembly junction box located at 5:30 o'clock position on exhaust case. Connect cable leads to terminal studs and secure with nuts. Align leads so they are parallel to one another.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(q) Torque nuts as follows:

1 (Reference 2273) Torque alumel nuts (larger terminal stud) to 18 − 22 lb−in. (2.034 − 2.486 N.m).

2 (Reference 2273) Torque chromel nuts (smaller terminal studs) to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(r) (Reference 2273) Install cover on junction box. Install ground lead terminal under front corner of cover. Secure cover and ground terminal with four screws. Tighten and torque screws to 16 − 22 lb−in. (1.808 − 2.486 N.m) and lockwire.

NOTE: Lockwire cover screw to clamp screw at cable end of junction box. Do not lockwire screws across cable.

Task 72−00−54−450−006−B:

2. Install EEC Thermocouple And Airframe Cable (W6) − For Engines With Revised EEC Thermocouple And Airframe Cable (W6) And Wiring Harness Support Tube For Increased Engine Core Clearance (Post SB PW4ENG 72−134)

A. Equipment And Materials Necessary

Standard Tools:
Glenair TG−70 Strap Wrench or
Glenair TG−69 Soft Jawed Pliers

Consumable Materials:

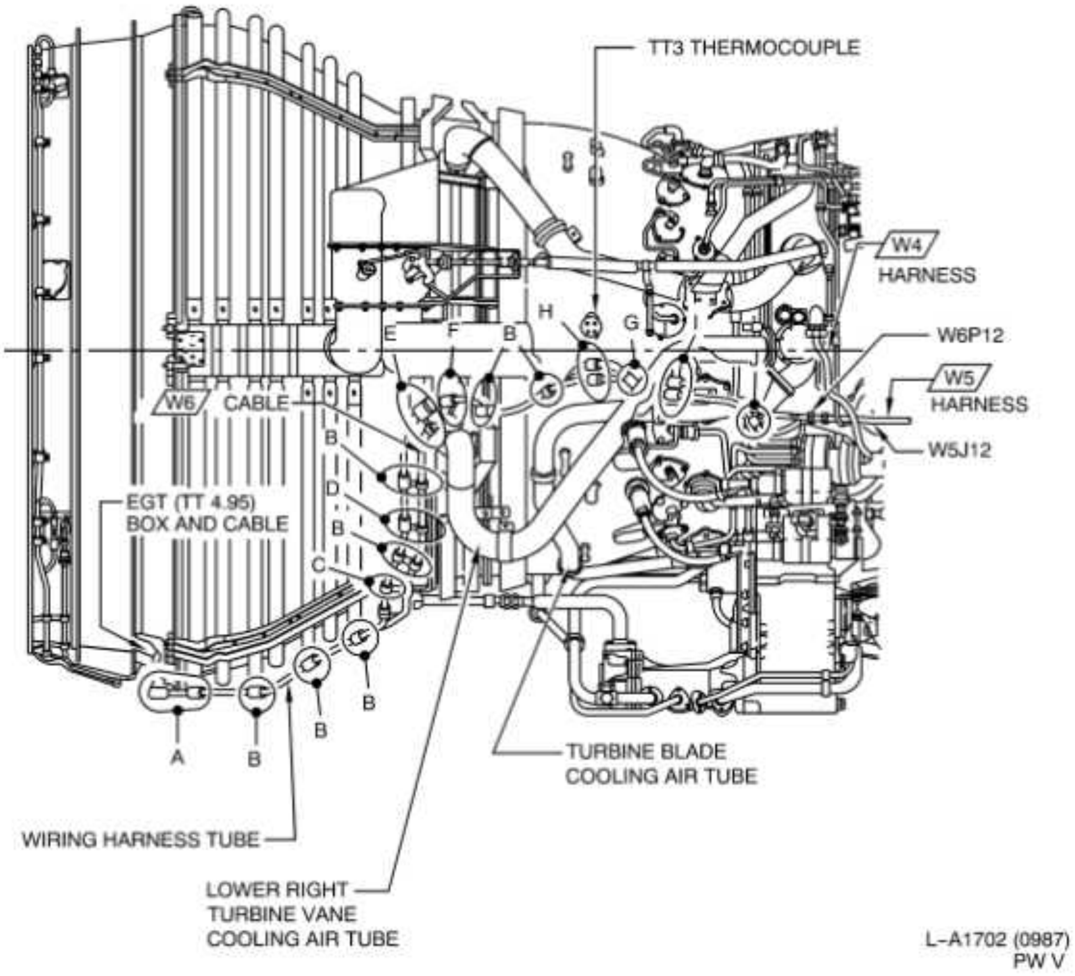
Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P11−009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

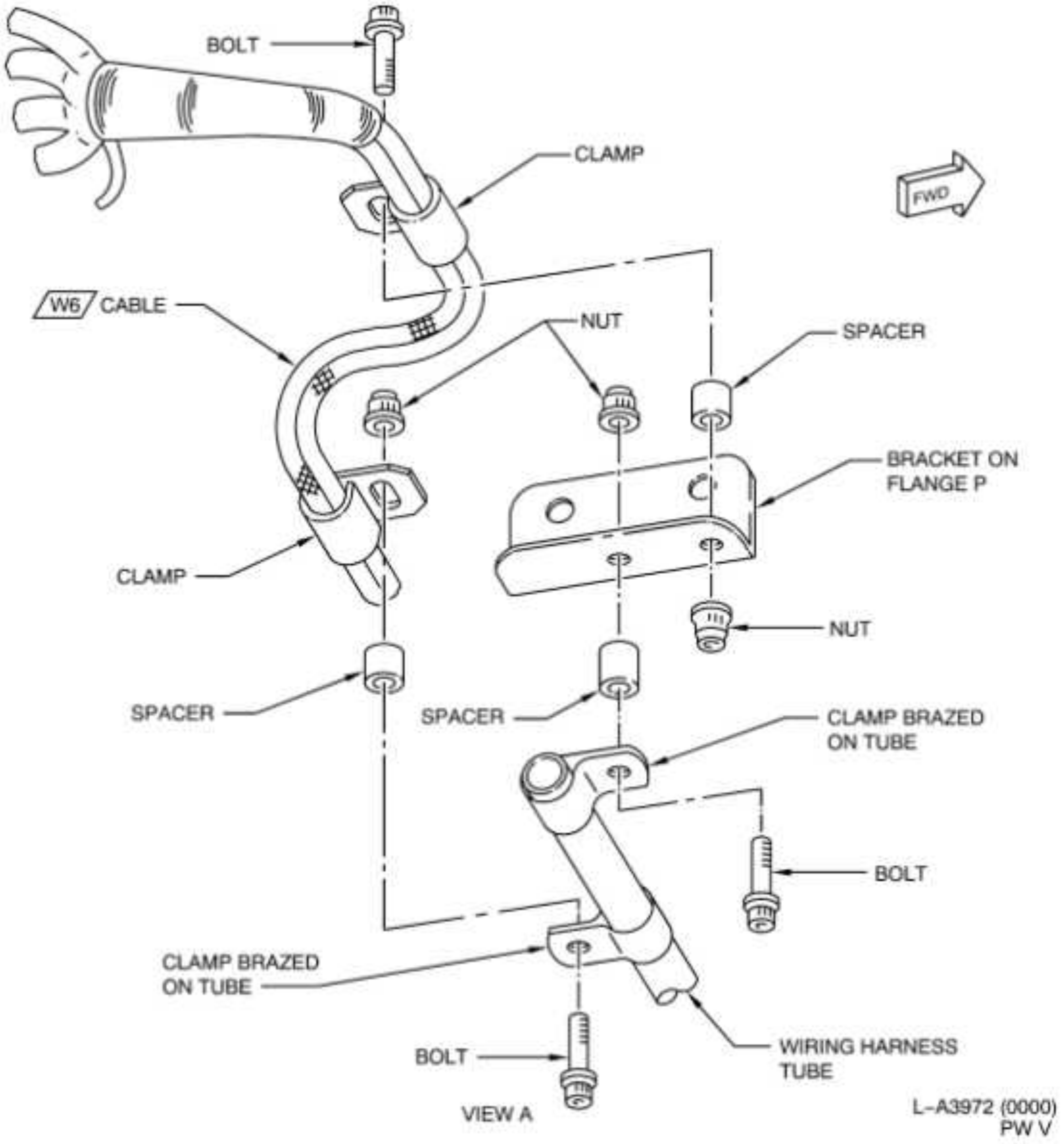
PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lockwire, MS9226−04		

B. Procedure
See Figures 403, 404 and 405.

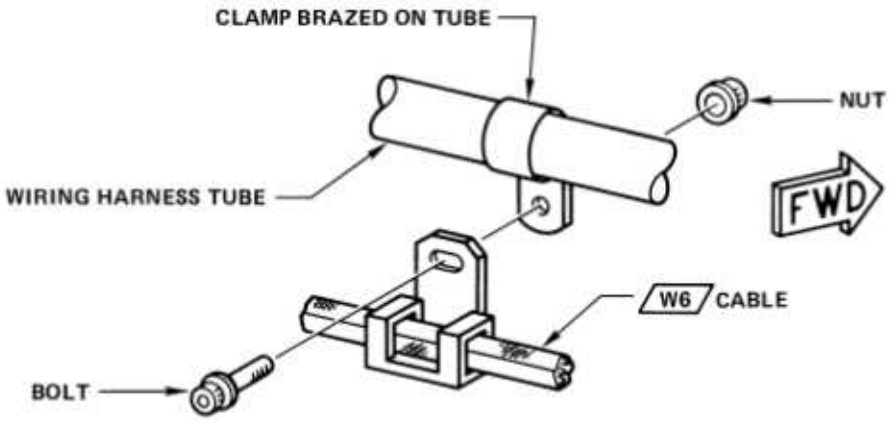
(1) Install the cable tube (support).


TT3 THERMOCOUPLE
W4
HARNESS
W6P12
W5
HARNESS
W5J12
H
G
E
F
B
W6
CABLE
B
D
B
C
EGT (TT 4.95)
BOX AND CABLE
A
B
B
B
TURBINE BLADE
COOLING AIR TUBE
WIRING HARNESS TUBE
LOWER RIGHT
TURBINE VANE
COOLING AIR TUBE
L-A1702 (0987)
PW V

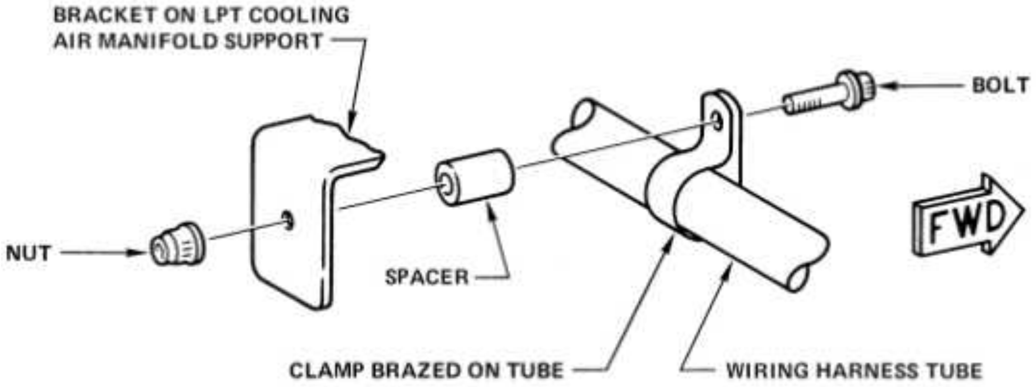
EEC Thermocouple And Airframe Cable (W6)
Figure 401 (Sheet 1)
(Task 72−00−54−450−006−A)


BOLT
CLAMP
FWD
W6 CABLE
NUT
SPACER
BRACKET ON FLANGE P
CLAMP
NUT
SPACER
SPACER
CLAMP BRAZED ON TUBE
BOLT
CLAMP BRAZED ON TUBE
WIRING HARNESS TUBE
BOLT
VIEW A
L-A3972 (0000)
PW V

EEC Thermocouple And Airframe Cable (W6)
Figure 401 (Sheet 2)
(Task 72−00−54−450−006−A)


CLAMP BRAZED ON TUBE
NUT
WIRING HARNESS TUBE
FWD
W6 CABLE
BOLT

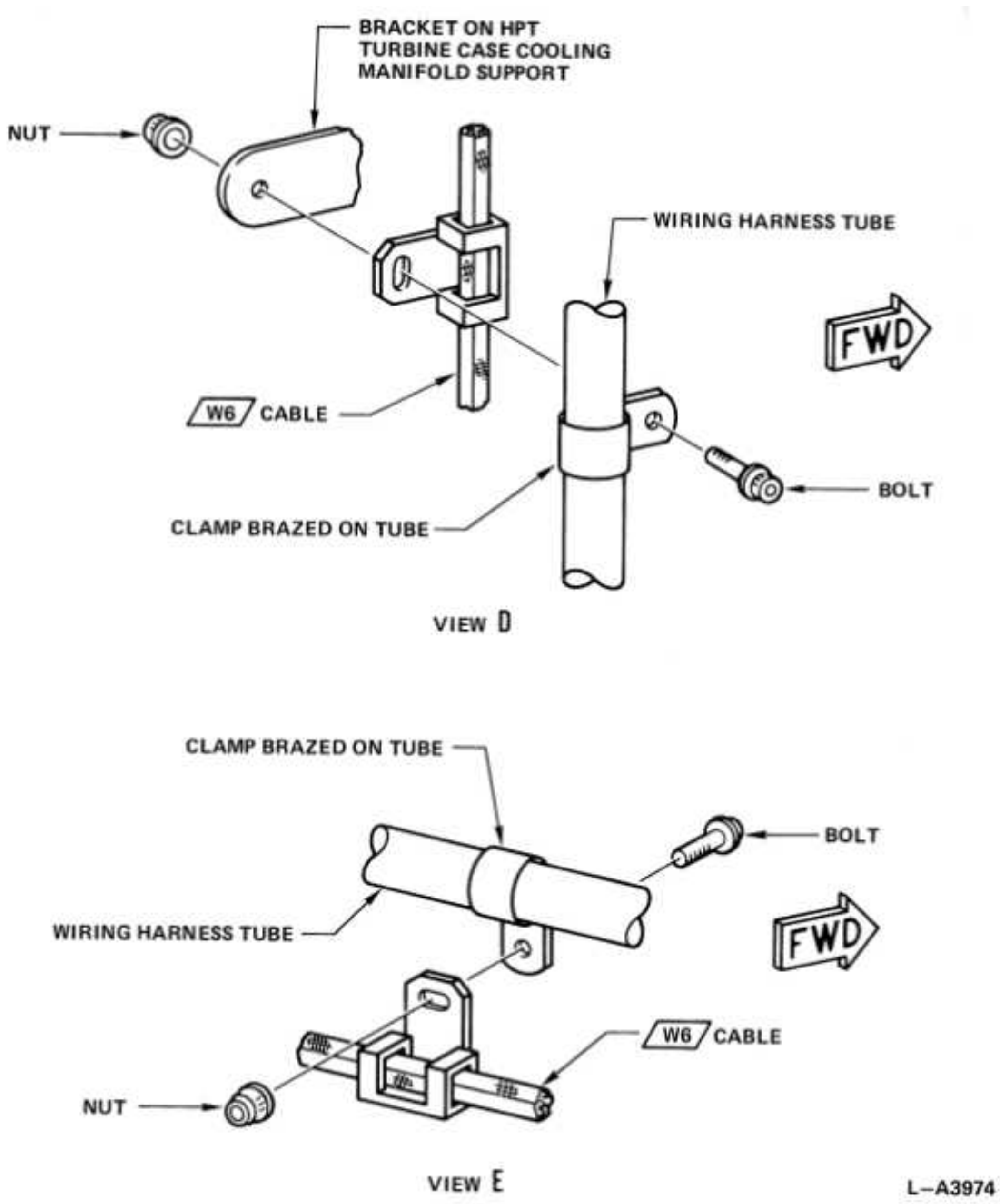
VIEW B
(TYPICAL 7 PLACES)


BRACKET ON LPT COOLING AIR MANIFOLD SUPPORT
BOLT
FWD
NUT
SPACER
CLAMP BRAZED ON TUBE
WIRING HARNESS TUBE

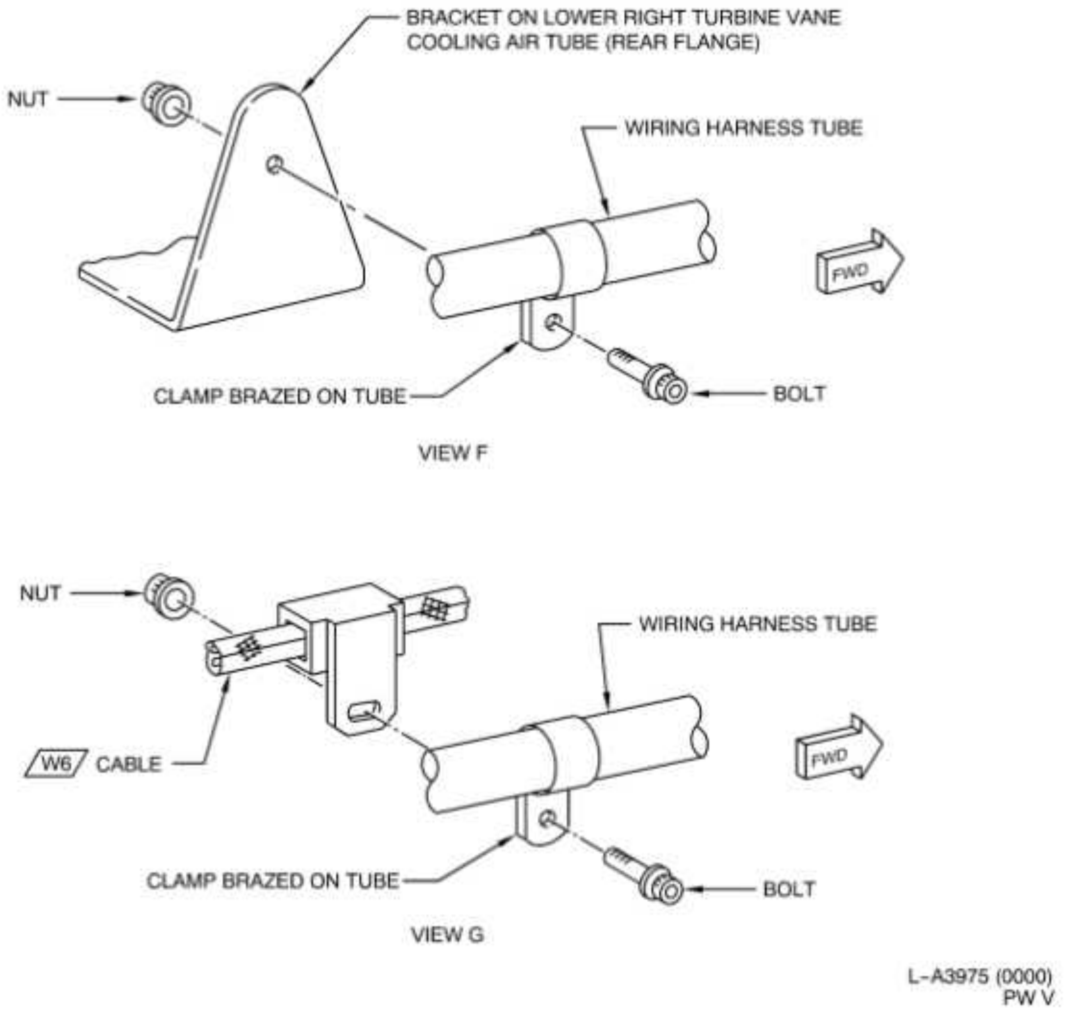
VIEW C

L−A3973

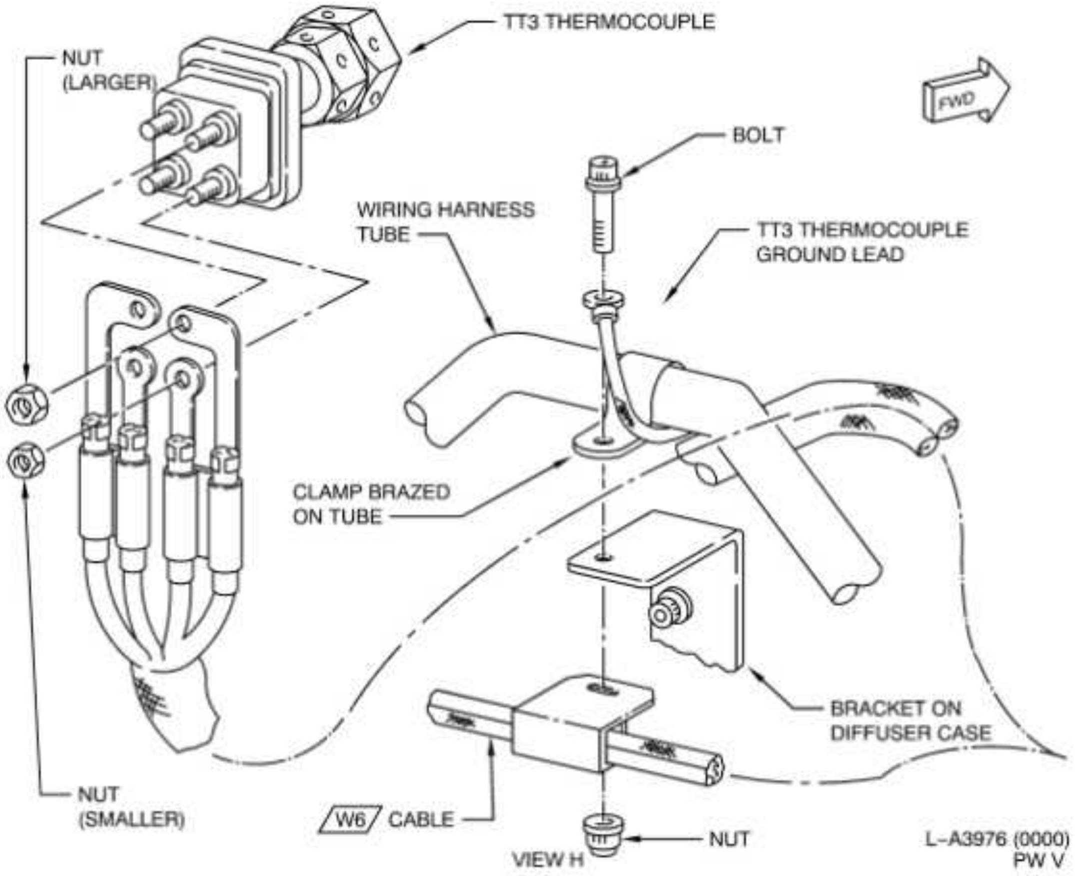
EEC Thermocouple And Airframe Cable (W6)
Figure 401 (Sheet 3)
(Task 72−00−54−450−006−A)


BRACKET ON HPT TURBINE CASE COOLING MANIFOLD SUPPORT
NUT
WIRING HARNESS TUBE
FWD
W6 CABLE
BOLT
CLAMP BRAZED ON TUBE
VIEW D
CLAMP BRAZED ON TUBE
BOLT
WIRING HARNESS TUBE
FWD
W6 CABLE
NUT
VIEW E
L-A3974

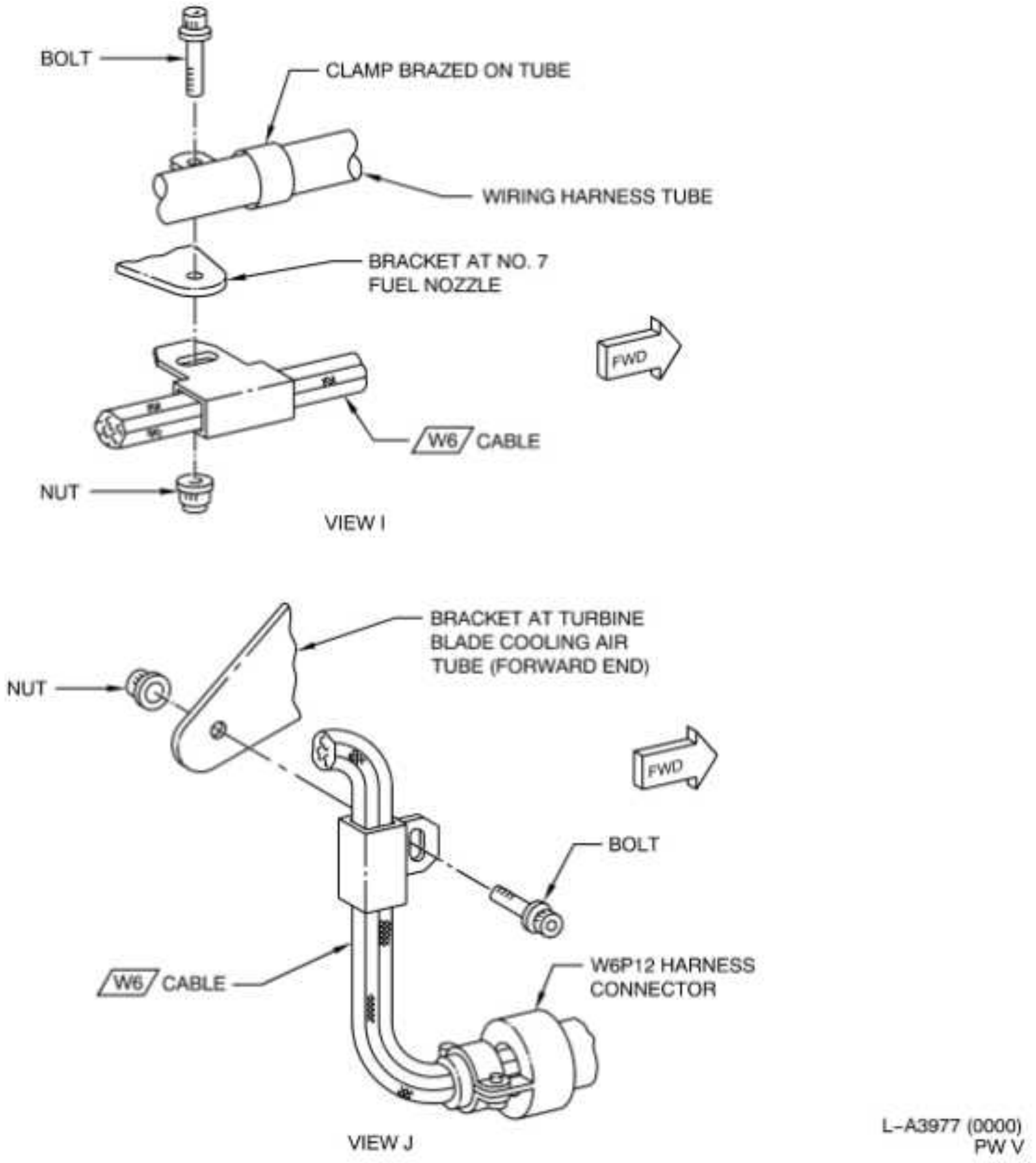
EEC Thermocouple And Airframe Cable (W6)
Figure 401 (Sheet 4)
(Task 72-00-54-450-006-A)


BRACKET ON LOWER RIGHT TURBINE VANE COOLING AIR TUBE (REAR FLANGE)
NUT
WIRING HARNESS TUBE
FWD
CLAMP BRAZED ON TUBE
BOLT
VIEW F
NUT
WIRING HARNESS TUBE
W6
CABLE
FWD
CLAMP BRAZED ON TUBE
BOLT
VIEW G
L-A3975 (0000)
PW V

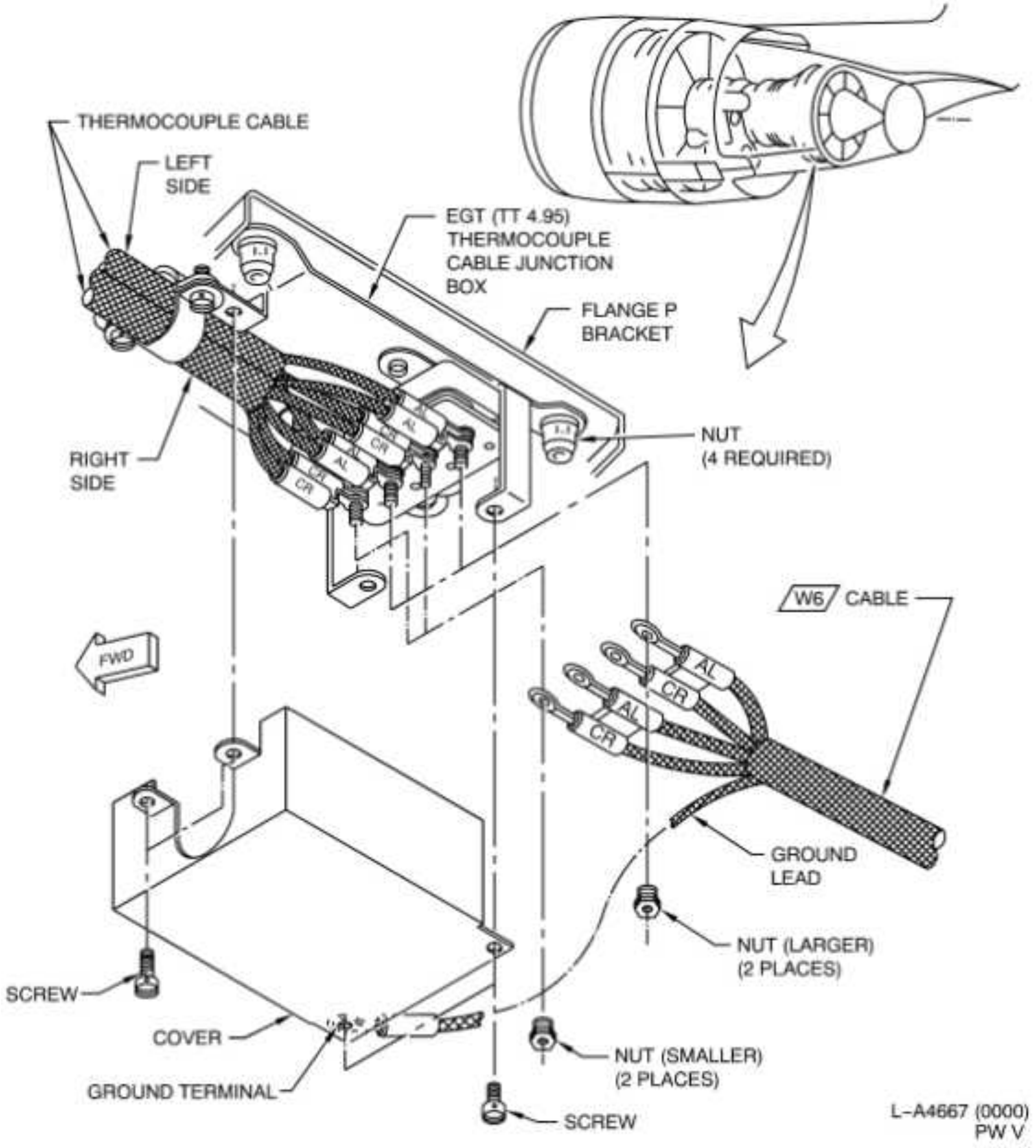
EEC Thermocouple And Airframe Cable (W6)
Figure 401 (Sheet 5)
(Task 72−00−54−450−006−A)


TT3 THERMOCOUPLE
NUT (LARGER)
FWD
BOLT
WIRING HARNESS TUBE
TT3 THERMOCOUPLE GROUND LEAD
CLAMP BRAZED ON TUBE
BRACKET ON DIFFUSER CASE
NUT (SMALLER)
W6 CABLE
NUT
VIEW H
L−A3976 (0000)
PW V

EEC Thermocouple And Airframe Cable (W6)
Figure 401 (Sheet 6)
(Task 72−00−54−450−006−A)


BOLT
CLAMP BRAZED ON TUBE
WIRING HARNESS TUBE
BRACKET AT NO. 7 FUEL NOZZLE
FWD
W6 CABLE
NUT
VIEW I
BRACKET AT TURBINE BLADE COOLING AIR TUBE (FORWARD END)
NUT
FWD
BOLT
W6 CABLE
W6P12 HARNESS CONNECTOR
VIEW J
L-A3977 (0000)
PW V

EEC Thermocouple And Airframe Cable (W6)
Figure 401 (Sheet 7)
(Task 72-00-54-450-006-A)


THERMOCOUPLE CABLE
LEFT SIDE
EGT (TT 4.95) THERMOCOUPLE CABLE JUNCTION BOX
FLANGE P BRACKET
NUT (4 REQUIRED)
RIGHT SIDE
AL
CR
W6 CABLE
FWD
GROUND LEAD
NUT (LARGER) (2 PLACES)
SCREW
COVER
GROUND TERMINAL
NUT (SMALLER) (2 PLACES)
SCREW
L-A4667 (0000)
PW V

EGT (TT4.95) Thermocouple Junction Box And Cable
Figure 402
(Task 72-00-54-450-006-A)

(a) Place the tube to the engine with the longer straight end of the tube to the bottom side of the bracket on Flange P at approximately the 5:30 o'clock position. Place the other end of the tube under the bracket attached to the turbine blade cooling air tube (forward end). See Figure 404, Views B and Q for pre SB PW4ENG 73−163 configuration. See Figure 404, View B and Section Z−Z for post SB PW4ENG 73−163 configuration.

(b) Attach the tube to a bracket on the lower right turbine cooling air tube on the high turbine with a clamp, bolt, and nut. Lubricate the threads of the bolt with Engine Oil P03−001. Tighten the nut by hand. See View J.

(c) Attach the tube to a bracket on the high turbine cooling air manifold support at approximately the 4:30 o'clock position with a clamp, bolt, and nut. Lubricate the threads of the bolt with Engine Oil P03−001. Tighten the nut by hand. See View H.

(d) Attach the tube to a bracket on the low turbine cooling air manifold support at approximately the 5 o'clock position with a clamp, bolt, and nut. Lubricate the threads of the bolt with Engine Oil P03−001. Tighten the nut by hand. See View D.

NOTE: Bolts that attach the cable tube (support) to the brackets will be torqued in a later step.

CAUTION: SEE 72−00−00, INSTALLATION−00 FOR GENERAL INSTALLATION THAT IS NECESSARY FOR ELECTRICAL CABLES AND CABLE WIRES.

CAUTION: DO NOT TWIST OR BEND THE CABLE BADLY DURING INSTALLATION, OR DAMAGE TO THE CABLE CAN OCCUR.

(2) Install the EEC thermocouple and airframe cable (W6).

CAUTION: EXAMINE THE CABLE CONNECTORS AND THE MATING RECEPTACLES FOR BENT PINS AND CONTAMINATION. CAREFULLY MAKE STRAIGHT ANY BENT PIN AND CLEAN AS REQUIRED.

(a) (Pre SB PW4ENG 73−163) Connect the W6P12 cable connector to the W5J12 cable receptacle attached to a large fuel manifold support bracket on Flange K at the 3:30 o'clock position.

(b) (Post SB PW4ENG 73−163) Connect the W6P12 cable connector to the W5J12 cable receptacle attached to the TCA tube flange bracket on the turbine blade cooling air tube (lower right) (AP37) flange at the 3 o'clock position.

(c) Make the harness connector/harness receptacle connector as follows.

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is handtight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the

connector coupling nut. Use sufficient force to be sure:

- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal). This procedure will make sure the contacts are sufficiently engaged and the connector is tight.
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(d) (Post SB PW4ENG−73−192) Install cooling shields around W6 harness connector as follows. See Figure 404 (Sheet 14):

NOTE: Pre SB PW4ENG 73−192 engines do not have W5/W6 wiring harness connector cooling.

1 Position the cooling shields around the W6 harness connector W6P12 and slide the cooling shield tabs into TCA tube flange bracket. Make sure the shield with the hose fitting is on the bottom.

2 Install the clamps around the cooling shields. Torque the hose clamps to 10 − 15 lb−in. (1.130 − 1.695 N.m).

3 Install the cooling hose and clamp onto the bottom cooling shield fitting. Torque the hose clamps to 10 − 15 lb−in. (1.130 − 1.695 N.m).

(e) Place (route) the cable up and rearward above a bracket attached to the forward end of the turbine blade cooling air tube flange on a valve at the 3 o'clock position. Place the cable inboard of the forward end of the lower right turbine cooling air tube.

(f) Place the first cable clamp to the outboard side of the bracket on the turbine blade cooling air tube flange. Place the cable tube (support) with a clamp to the inboard side of the bracket. Attach the clamps to the bracket with a bolt, threads lubricated with Engine Oil P03−001 and a nut tightened by hand. See View Q (pre SB PW4ENG 73−163) or Section Z−Z (post SB PW4ENG 73−163).

(g) Place the second cable clamp to the top of the first attached (brazed) tube clamp. Attach the cable clamp to the tube clamp with a bolt, threads lubricated with Engine Oil P03−001 and a nut tightened by hand. See View P (pre SB PW4ENG 73−163) or View V (post SB PW4ENG 73−163).

(h) Place the cable tube (support) with a clamp to the outboard side of the bracket at the No. 7 fuel nozzle. Place the third cable clamp to the clamp on the tube. Attach the clamps to the bracket with a bolt, lubricated with Engine Oil P03−001 and a nut tightened by hand. See View O (pre SB PW4ENG 73−163) or View U (post SB PW4ENG 73−163).

(i) Place the fourth cable clamp to the top side of the second attached (brazed) tube clamp. Place the ground wire (lead) of the cable to the top of the fourth cable clamp. Place the fifth cable clamp to the bottom side of the tube clamp. Attach the ground wire and cable clamps to the tube clamp with a bolt, lubricated with Engine Oil P03−001 and a nut tightened by hand. See View M (pre SB PW4ENG 73−163) or View T (post SB PW4ENG 73−163).

NOTE: The fourth cable clamp is attached to the cable (lead) which has attached the TT3 thermocouple wire (leads).

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(j) Remove the nuts from the TT3 thermocouple terminal studs. Connect the thermocouple wires (leads) to the terminal studs and install the nuts (round end of the nut inboard). Align the wires (leads) so they are parallel to each other. Torque the nuts as follows:

1 (Reference 2273) Torque the alumel nuts (larger terminal studs) to 18 – 22 lb–in. (2.034 – 2.486 N.m).

2 (Reference 2273) Torque the chromel nuts (smaller terminal studs) to 15 – 18 lb–in. (1.695 – 2.034 N.m).

(k) Place the cable tube (support) with a clamp to the top side of the bracket on the diffuser case at the 3 o'clock position. Place the sixth cable clamp to the bottom side of the bracket. Attach the clamps to the bracket with a bolt, threads lubricated with Engine Oil P03–001 and a nut tightened by hand. See View N (pre SB PW4ENG 73–163) or View S (post SB PW4ENG 73–163).

(l) Place the seventh cable clamp to the forward side of the third attached (brazed) tube clamp. Attach the clamps together with a bolt, threads lubricated with Engine Oil P03–001 and a nut tightened by hand. See View L (pre SB PW4ENG 73–163) or View R (post SB PW4ENG 73–163).

(m) Place the eighth cable clamp to the bottom side of the fourth attached (brazed) tube clamp. Attach the clamps together with a bolt, threads lubricated with Engine Oil P03–001 and a nut tightened by hand. See View K.

(n) Place the ninth cable clamp to the bottom side of the fifth attached (brazed) tube clamp. Attach the clamps together with a bolt, threads lubricated with Engine Oil P03–001 and a nut tightened by hand. See View I.

(o) Place (route) the cable down along the cable tube (support). Place the following cable clamps to the outboard side of the following attached (brazed) tube clamps:

1 Place the tenth cable clamp to the sixth clamp of the tube.

2 Place the eleventh cable clamp to the seventh clamp of the tube.

3 Place the twelfth cable clamp to the eighth clamp of the tube.

4 Attach the cable clamps to the tube clamps with bolts, lubricated with Engine Oil P03−001 and nuts tightened by hand. See View G.

(p) Place the thirteenth cable clamp to the rear side of the ninth attached (brazed) tube clamp. Attach clamps together with a bolt, lubricated with Engine Oil P03−001 and a nut tightened by hand. See View F.

(q) Place the fourteenth cable clamp to the bottom side of the tenth attached (brazed) tube clamp. Attach clamps together with a bolt, lubricated with Engine Oil P03−001 and a nut tightened by hand. See View E.

(r) Place (route) the cable rearward along the cable tube (support). Place the following cable clamps to the bottom side of the following attached (brazed) clamps of the cable tube (support):

1 Place the fifteenth cable clamp to the eleventh clamp of the tube.

2 Place the sixteenth cable clamp to the twelfth clamp of the tube.

3 Attach the cable clamps to the tube clamps with bolts, lubricated with Engine Oil P03−001 and nuts tightened by hand. See View C.

(s) Place the slotted hole in the bracket (ear) on the tube part of the cable to the bottom side of the thirteenth attached (brazed) tube clamp. Attach clamps together with a bolt, lubricated with Engine Oil P03−001 and a nut tightened by hand. See View B.

(t) Place the end of the cable tube (support) with a clamp to the bottom side of the bracket on Flange P at approximately the 5:30 o'clock position. Place the remaining slotted hole in the bracket (ear) of the tube part at the end of the cable to the bottom side of the tube clamp. Attach clamps to bracket with a bolt, lubricated with Engine Oil P03−001 and a nut tightened by hand. See View B.

(u) Place the seventeenth (last) cable clamp to the top side of the bracket on Flange P at approximately the 6 o'clock position. Attach the clamp to the bracket with a bolt, lubricated with Engine Oil P03−001 and a nut tightened by hand. See View A.

(v) Install a clamp on the cable and place the clamp with the cable to the top side of the same bracket on Flange P. Attach the clamp to the bracket with a bolt, lubricated with Engine Oil P03−001 and a nut tightened by hand. See View A.

(w) Tighten and torque all of the last installed bolts and/or nuts attached to the cable and the cable tube (support) to brackets, or attached (brazed) tube clamps to 36 − 40 lb−in. (4.067 − 4.519 N.m).

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(x) Remove the nuts from the terminal studs of the EGT (TT4.95) junction box at the 5:30 o'clock position. Connect the cable wires (leads) to the terminal studs and attach with the nuts. Align the wires (leads) so they ae parallel to each other. See Figure 405.

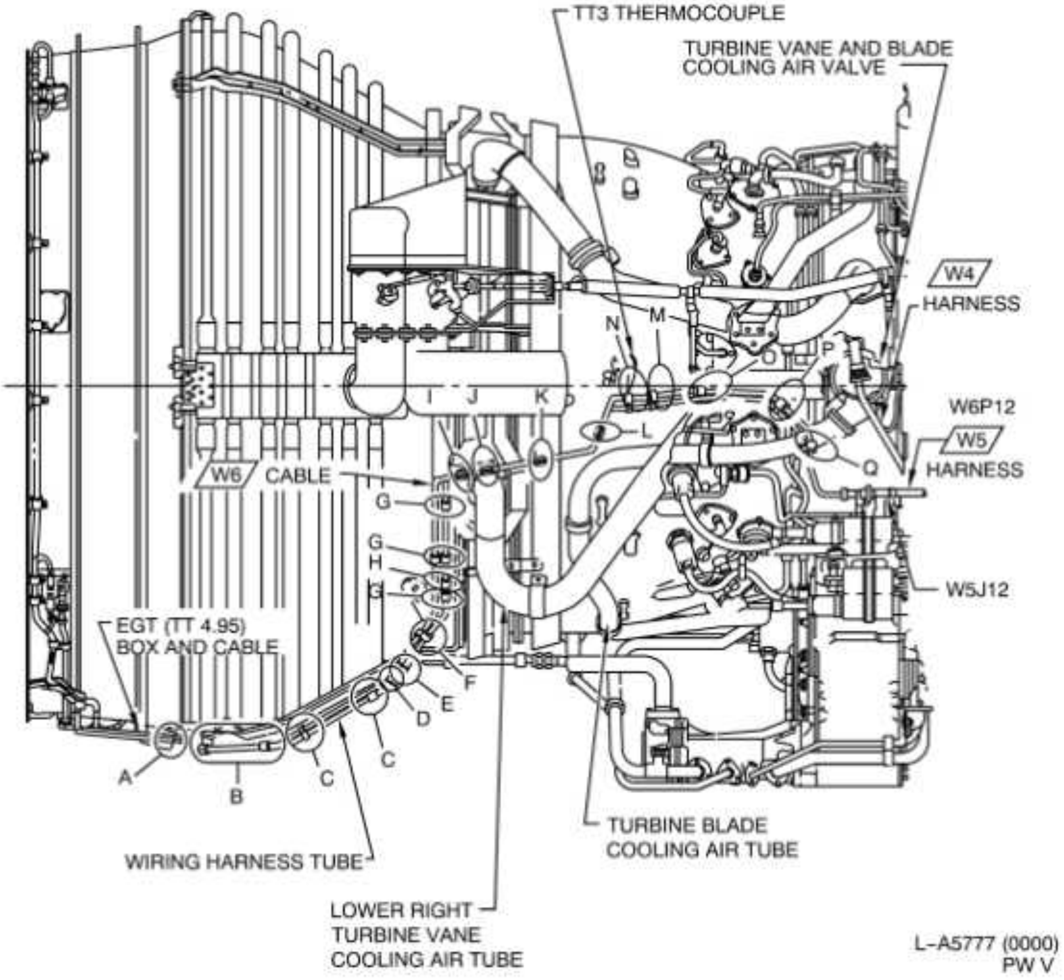
NOTE: Do not attach the ground wire to the terminal studs. Torque the nuts as follows:

1 (Reference 2273) Torque the alumel nuts (large terminal stud) to 18 − 22 lb−in. (2.034 − 2.486 N.m).

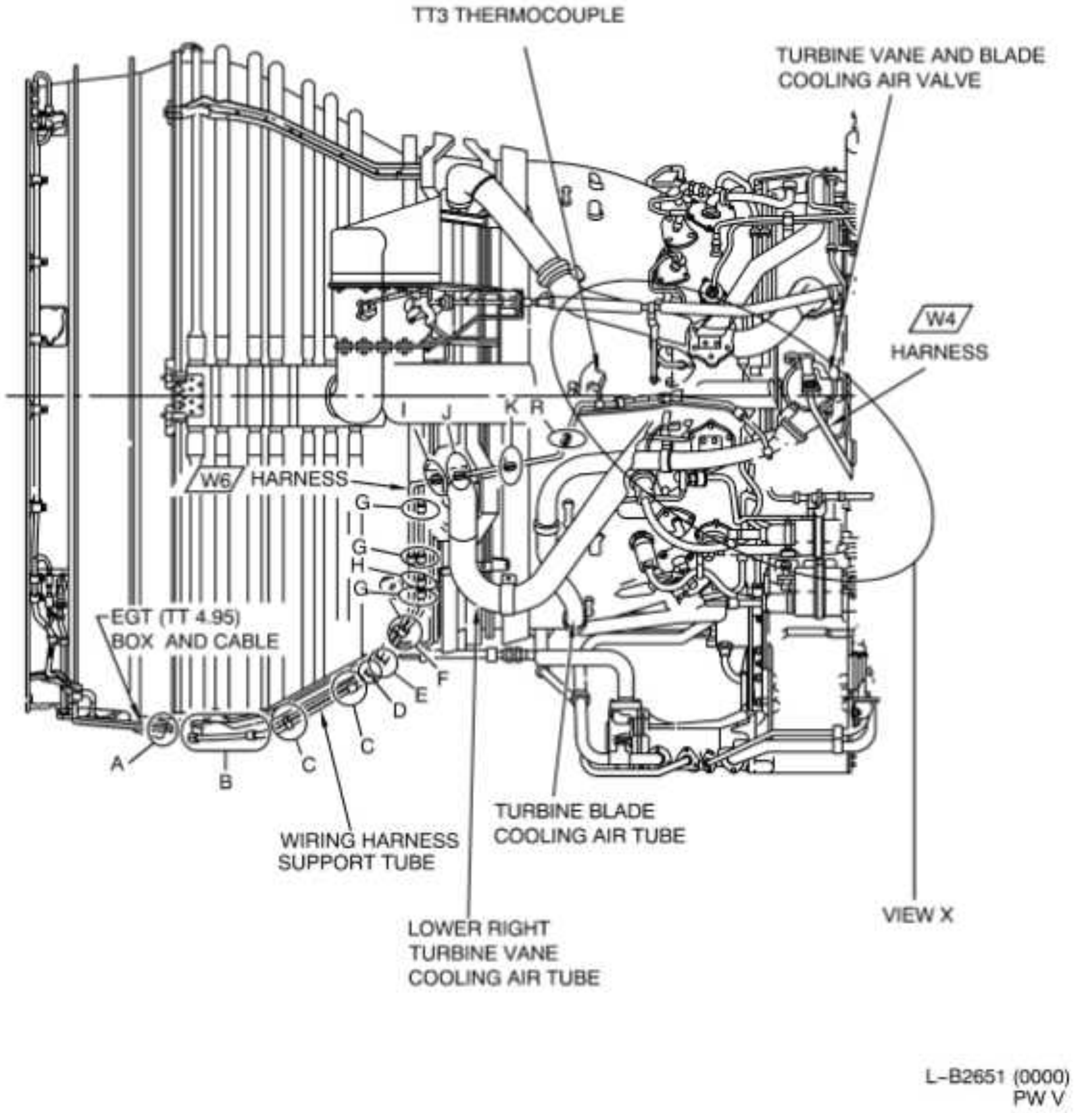
2 (Reference 2273) Torque the chromel nuts (small terminal stud) to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(y) (Reference 2273) Install the cover on the junction box and attach with three screws. Place the ground wire (lead) to the rear right side of the cover (viewed from the rear) and attach with a screw. Tighten and torque the screws to 16 − 22 lb−in. (1.808 − 2.486 N.m). Lockwire the screws.

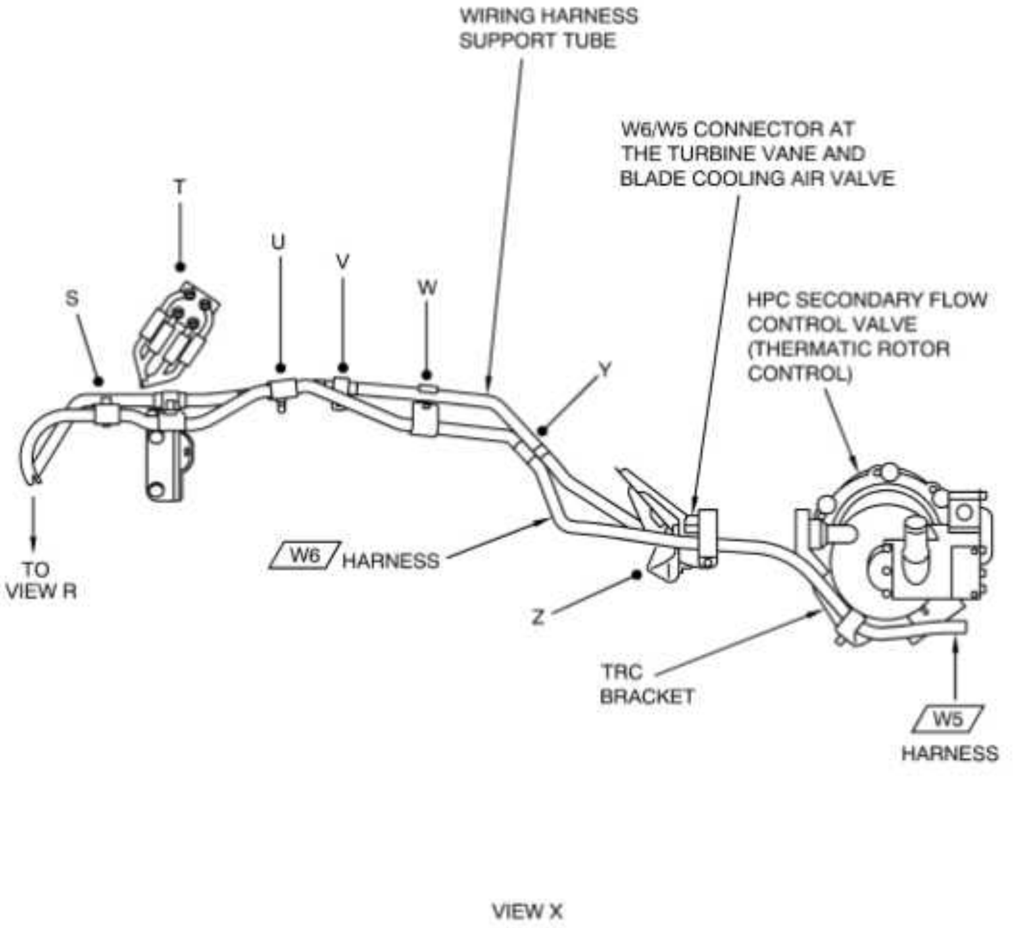
NOTE: Lockwire the cover screws to the clamp screw at the cable end of the junction box. Do not lockwire the screws across the cable.


TT3 THERMOCOUPLE
TURBINE VANE AND BLADE COOLING AIR VALVE
W4 HARNESS
W6P12
W5 HARNESS
W5J12
W6 CABLE
N
M
O
P
I
J
K
L
Q
G
G
H
G
F
E
D
C
C
B
A
EGT (TT 4.95) BOX AND CABLE
WIRING HARNESS TUBE
TURBINE BLADE COOLING AIR TUBE
LOWER RIGHT TURBINE VANE COOLING AIR TUBE
L−A5777 (0000)
PW V

EEC Thermocouple And Airframe Cable (W6) (Pre SB PW4ENG 73−163)
Figure 403 (Sheet 1)
(Task 72−00−54−450−006−B)

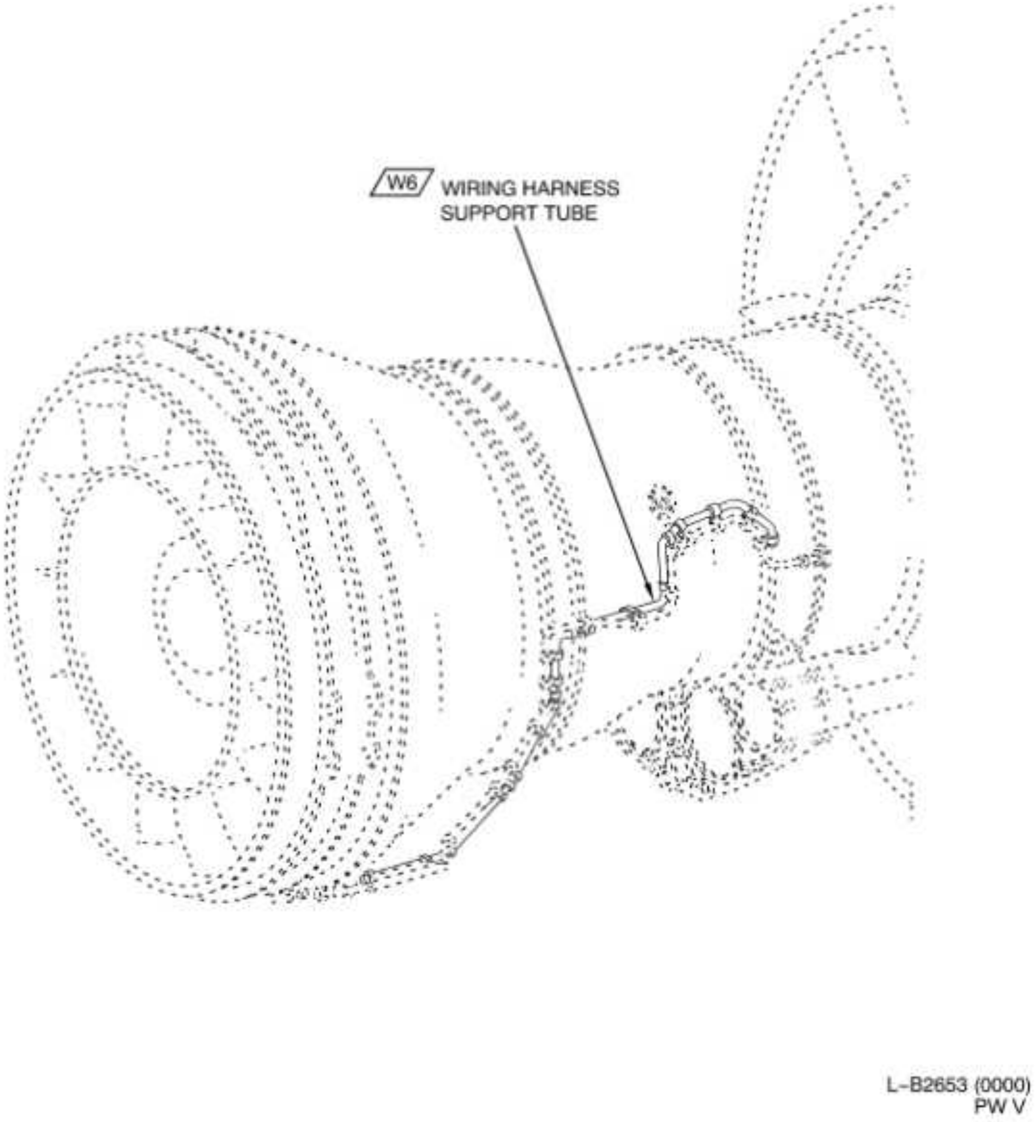

TT3 THERMOCOUPLE
TURBINE VANE AND BLADE COOLING AIR VALVE
W4
HARNESS
W6
HARNESS
I
J
K
R
G
G
H
G
F
E
D
C
C
B
A
EGT (TT 4.95) BOX AND CABLE
WIRING HARNESS SUPPORT TUBE
TURBINE BLADE COOLING AIR TUBE
LOWER RIGHT TURBINE VANE COOLING AIR TUBE
VIEW X
L−B2651 (0000)
PW V

EEC Thermocouple And Airframe Cable (W6) (Post SB PW4ENG 73−163)
Figure 403 (Sheet 2)
(Task 72−00−54−450−006−B)

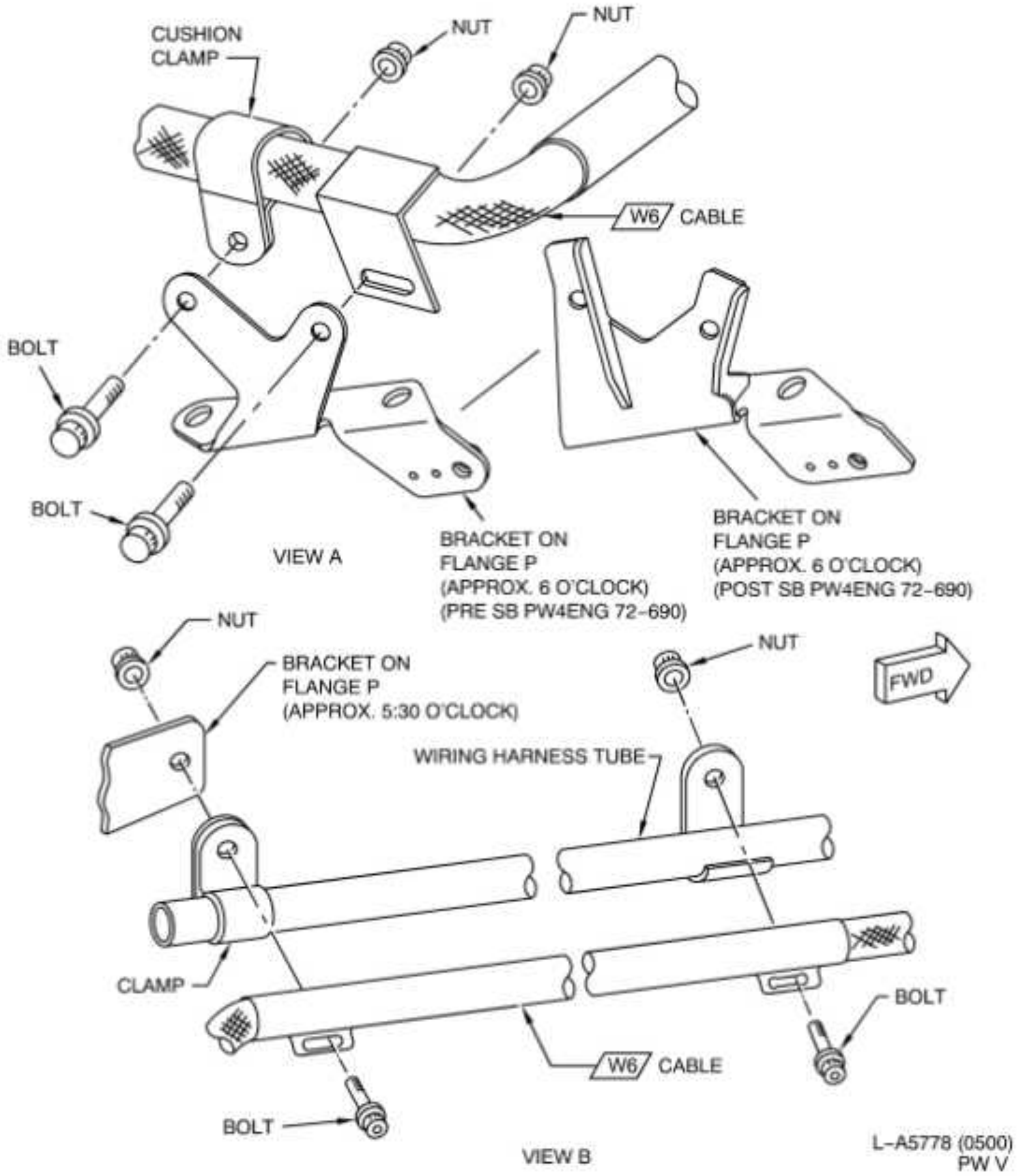

WIRING HARNESS SUPPORT TUBE
W6/W5 CONNECTOR AT THE TURBINE VANE AND BLADE COOLING AIR VALVE
T
U
V
W
S
HPC SECONDARY FLOW CONTROL VALVE (THERMATIC ROTOR CONTROL)
Y
W6 HARNESS
TO VIEW R
Z
TRC BRACKET
W5 HARNESS
VIEW X

L−B2716 (0201)
PW V

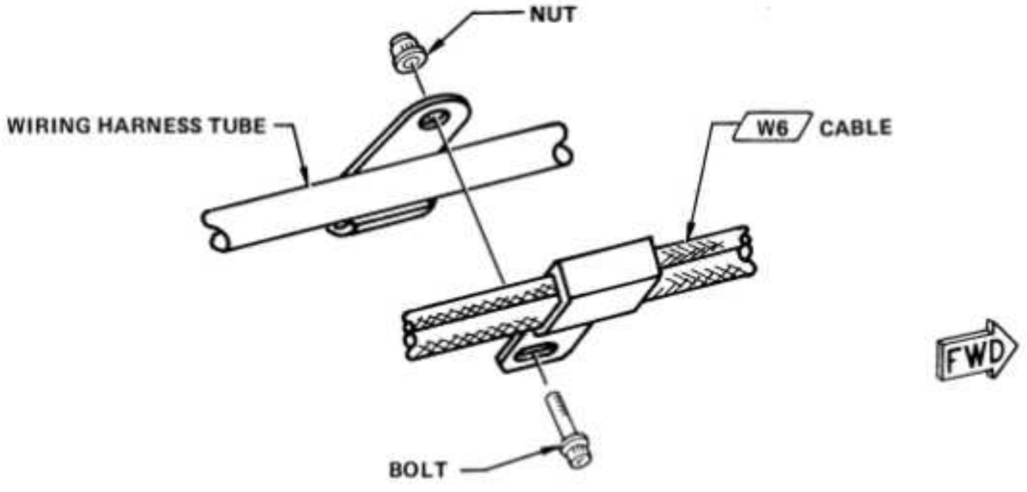
EEC Thermocouple And Airframe Cable (W6) (Post SB PW4ENG 73−163)
Figure 403 (Sheet 3)
(Task 72−00−54−450−006−B)


W6 WIRING HARNESS SUPPORT TUBE
L−B2653 (0000)
PW V

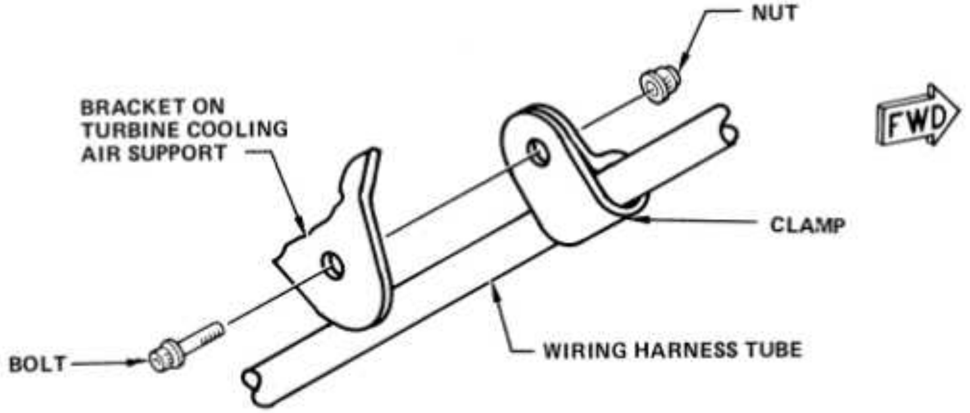
Location Of The W6 Harness Support Tube (Post SB PW4ENG 73−163)
Figure 403 (Sheet 4)
(Task 72−00−54−450−006−B)


CUSHION CLAMP
NUT
NUT
W6 CABLE
BOLT
BOLT
VIEW A
BRACKET ON FLANGE P (APPROX. 6 O'CLOCK) (PRE SB PW4ENG 72-690)
BRACKET ON FLANGE P (APPROX. 6 O'CLOCK) (POST SB PW4ENG 72-690)
NUT
BRACKET ON FLANGE P (APPROX. 5:30 O'CLOCK)
NUT
FWD
WIRING HARNESS TUBE
CLAMP
W6 CABLE
BOLT
BOLT
VIEW B
L-A5778 (0500)
PW V

EEC Thermocouple And Airframe Cable
(W6) (Pre And Post SB PW4ENG 73−163)
Figure 404 (Sheet 1)
(Task 72−00−54−450−006−B)


NUT
WIRING HARNESS TUBE
W6 CABLE
FWD
BOLT

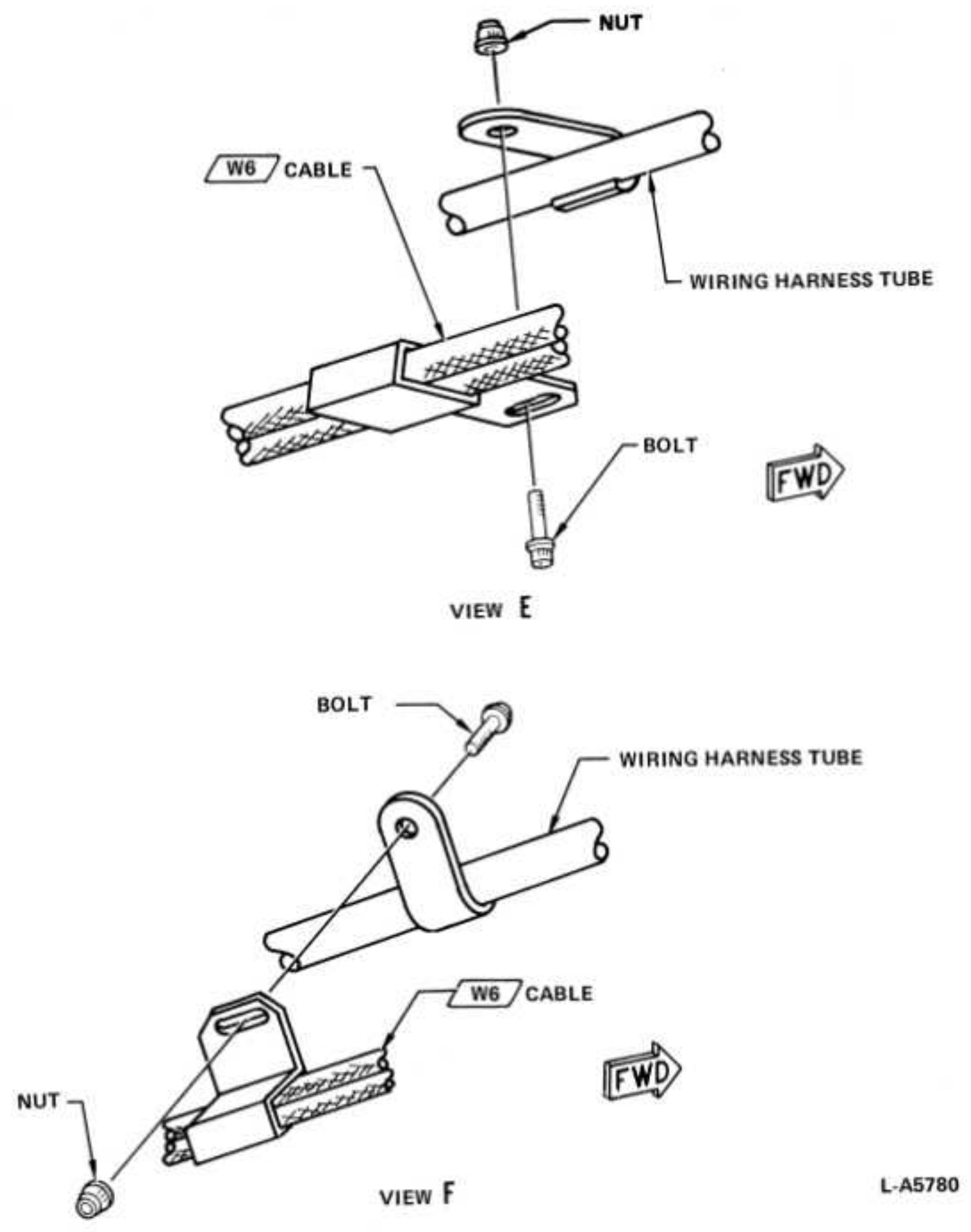
VIEW C


NUT
BRACKET ON TURBINE COOLING AIR SUPPORT
FWD
CLAMP
BOLT
WIRING HARNESS TUBE

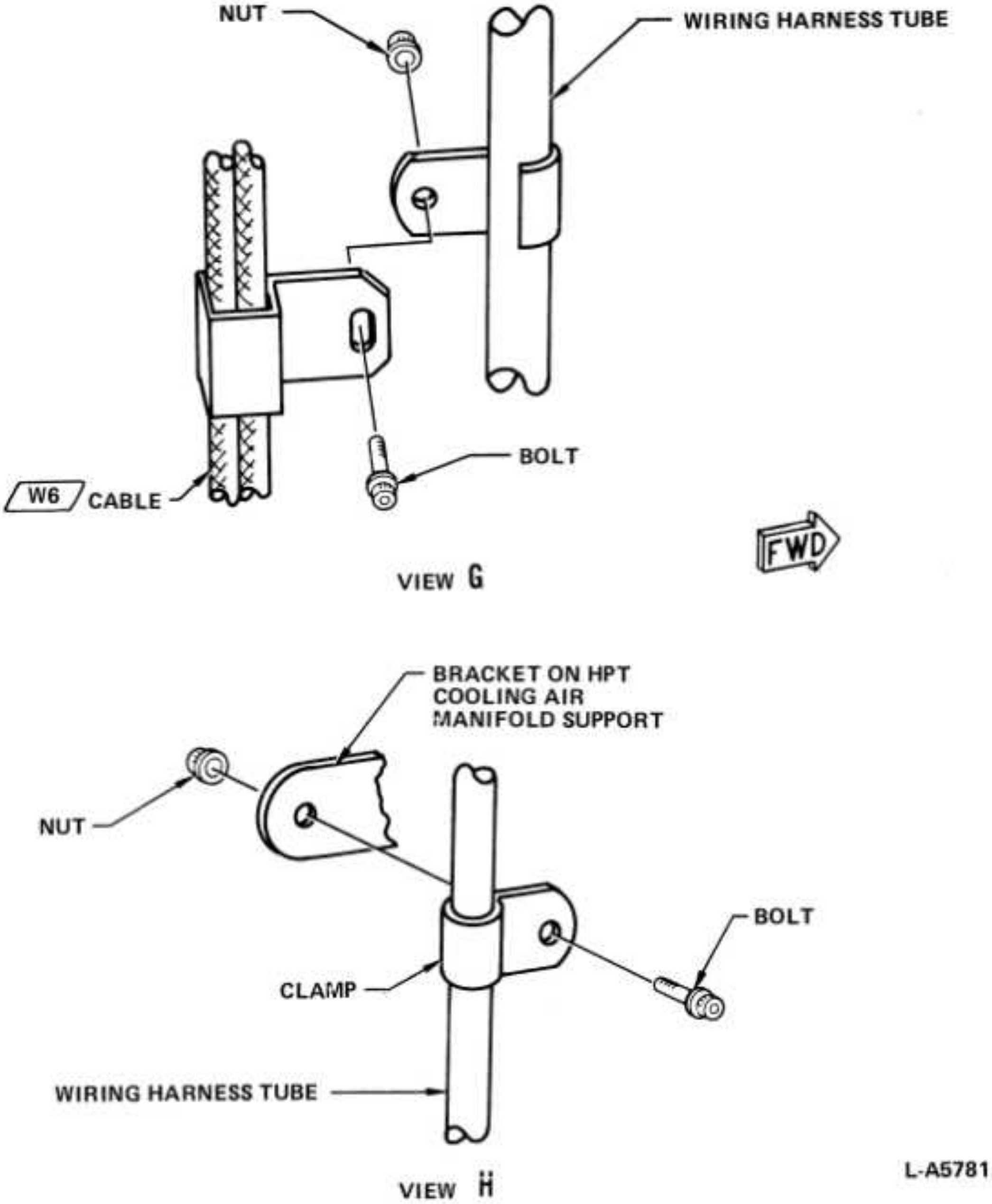
VIEW D

L-A5779

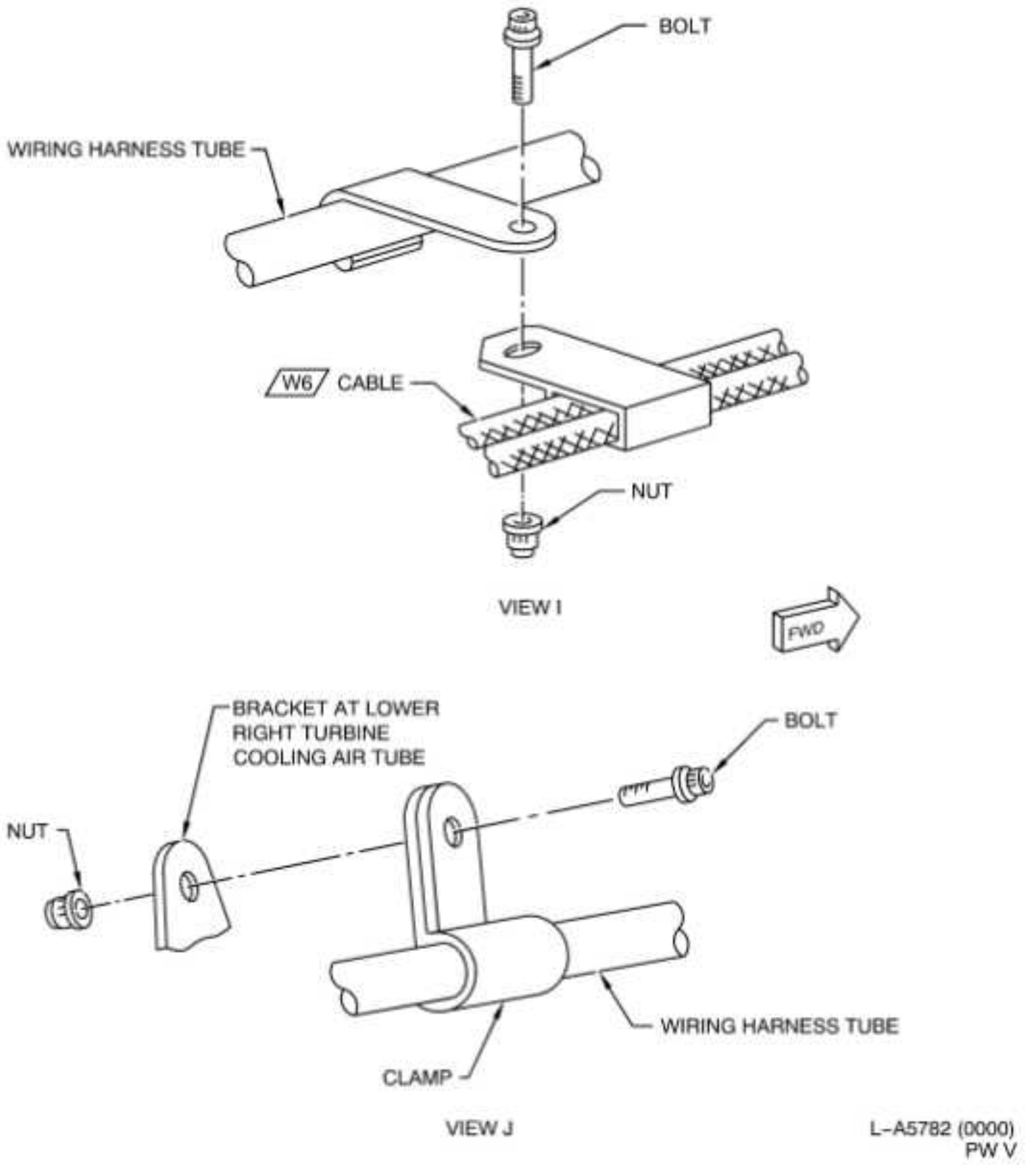
EEC Thermocouple And Airframe Cable
(W6) (Pre And Post SB PW4ENG 73−163)
Figure 404 (Sheet 2)
(Task 72−00−54−450−006−B)


NUT
W6 CABLE
WIRING HARNESS TUBE
BOLT
FWD
VIEW E
BOLT
WIRING HARNESS TUBE
W6 CABLE
FWD
NUT
VIEW F
L-A5780

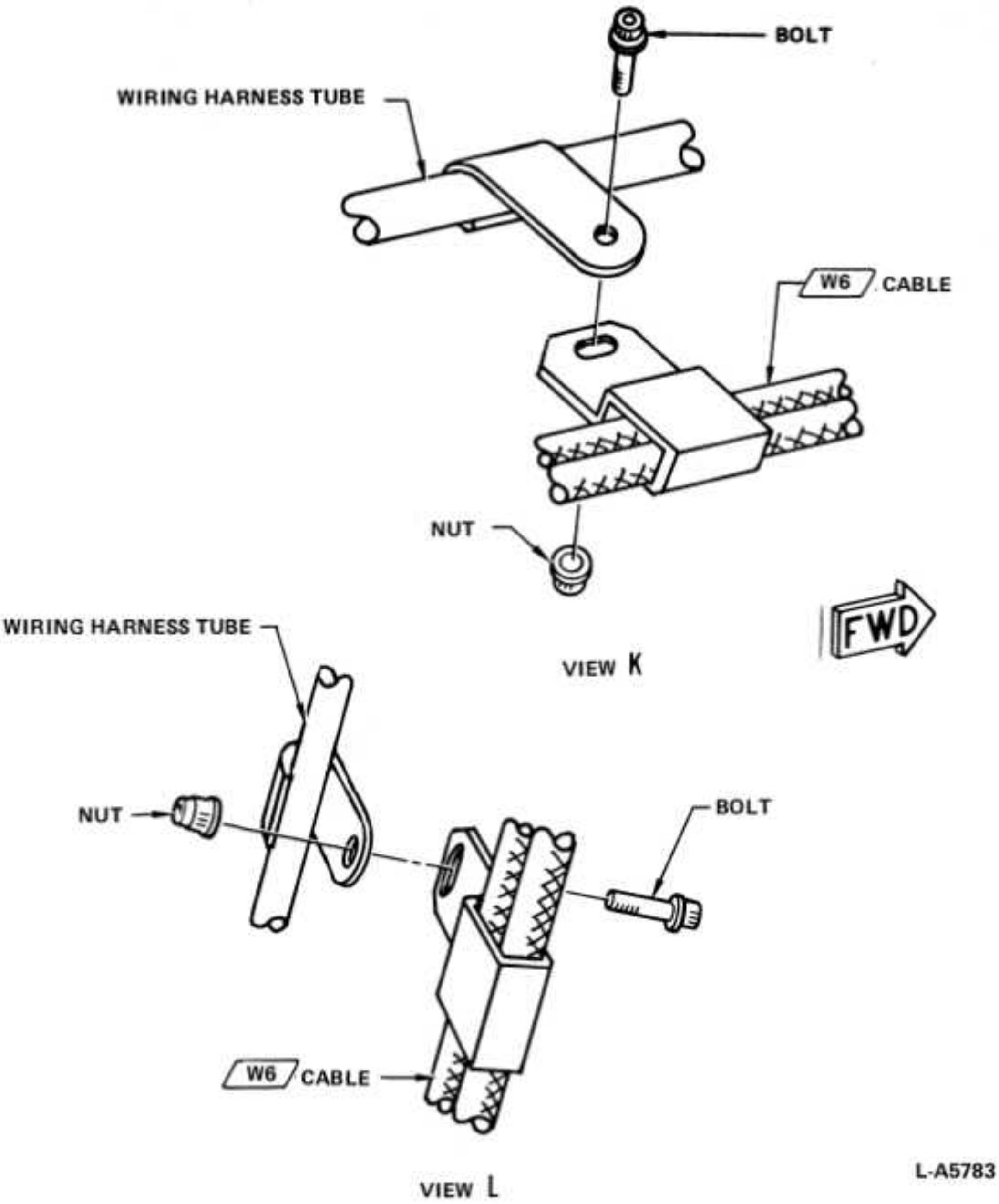
EEC Thermocouple And Airframe Cable
(W6) (Pre And Post SB PW4ENG 73-163)
Figure 404 (Sheet 3)
(Task 72-00-54-450-006-B)


NUT
WIRING HARNESS TUBE
W6
CABLE
BOLT
FWD
VIEW G
BRACKET ON HPT COOLING AIR MANIFOLD SUPPORT
NUT
BOLT
CLAMP
WIRING HARNESS TUBE
L-A5781
VIEW H

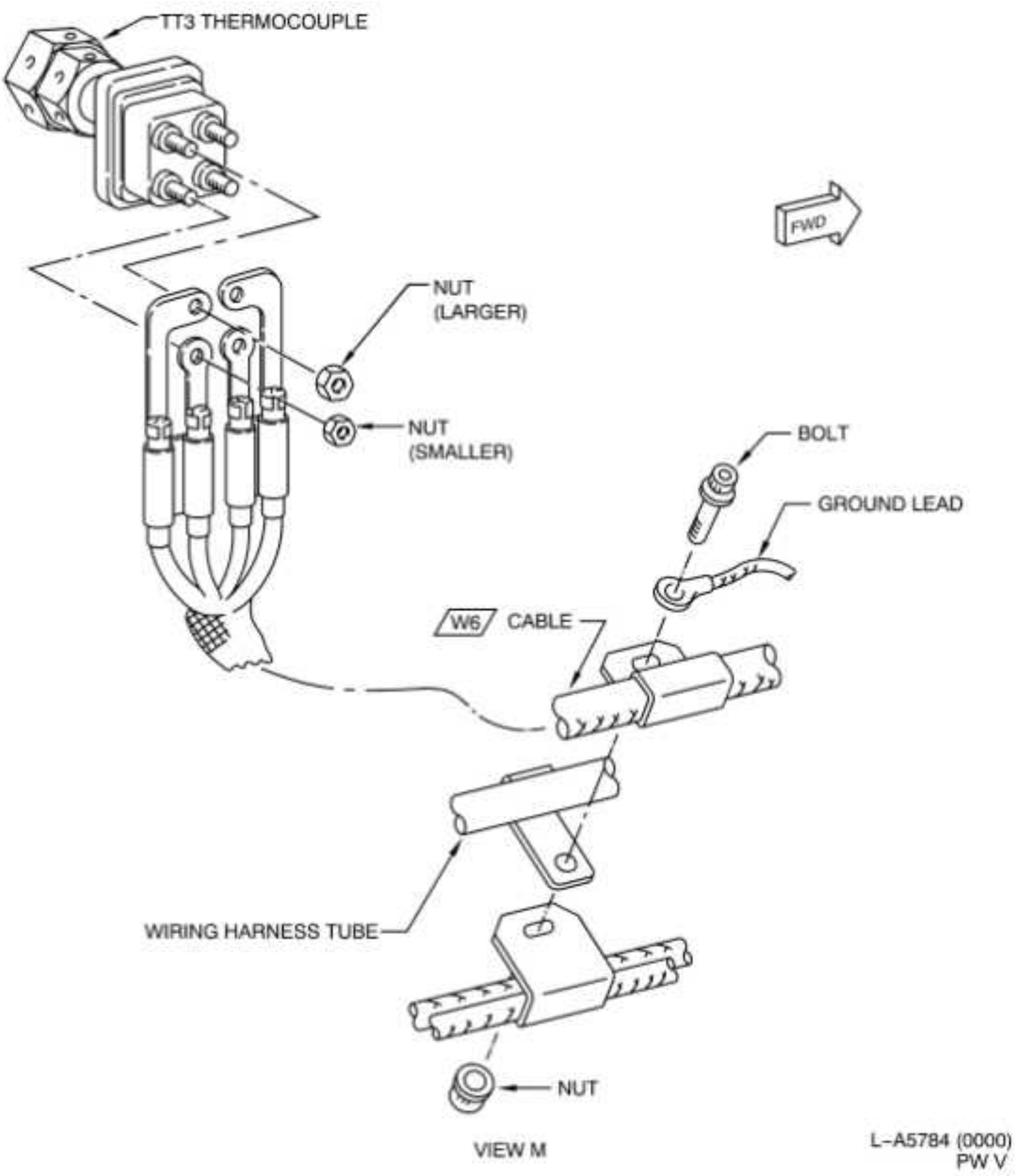
EEC Thermocouple And Airframe Cable
(W6) (Pre And Post SB PW4ENG 73-163)
Figure 404 (Sheet 4)
(Task 72-00-54-450-006-B)


BOLT
WIRING HARNESS TUBE
W6 CABLE
NUT
VIEW I
FWD
BRACKET AT LOWER RIGHT TURBINE COOLING AIR TUBE
BOLT
NUT
WIRING HARNESS TUBE
CLAMP
VIEW J
L−A5782 (0000)
PW V

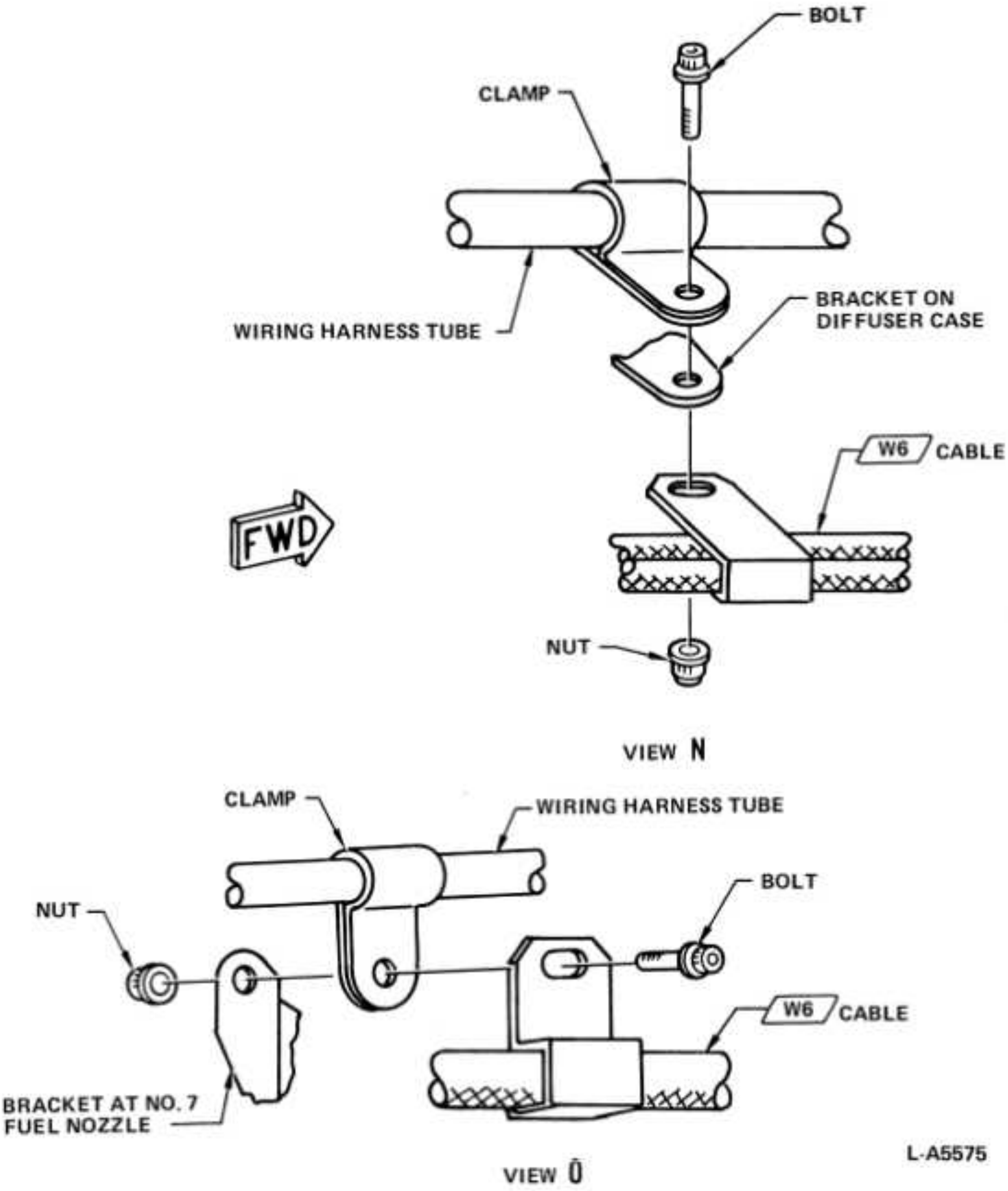
EEC Thermocouple And Airframe Cable
(W6) (Pre And Post SB PW4ENG 73−163)
Figure 404 (Sheet 5)
(Task 72−00−54−450−006−B)


BOLT
WIRING HARNESS TUBE
W6 CABLE
NUT
FWD
VIEW K
WIRING HARNESS TUBE
NUT
BOLT
W6 CABLE
VIEW L
L-A5783

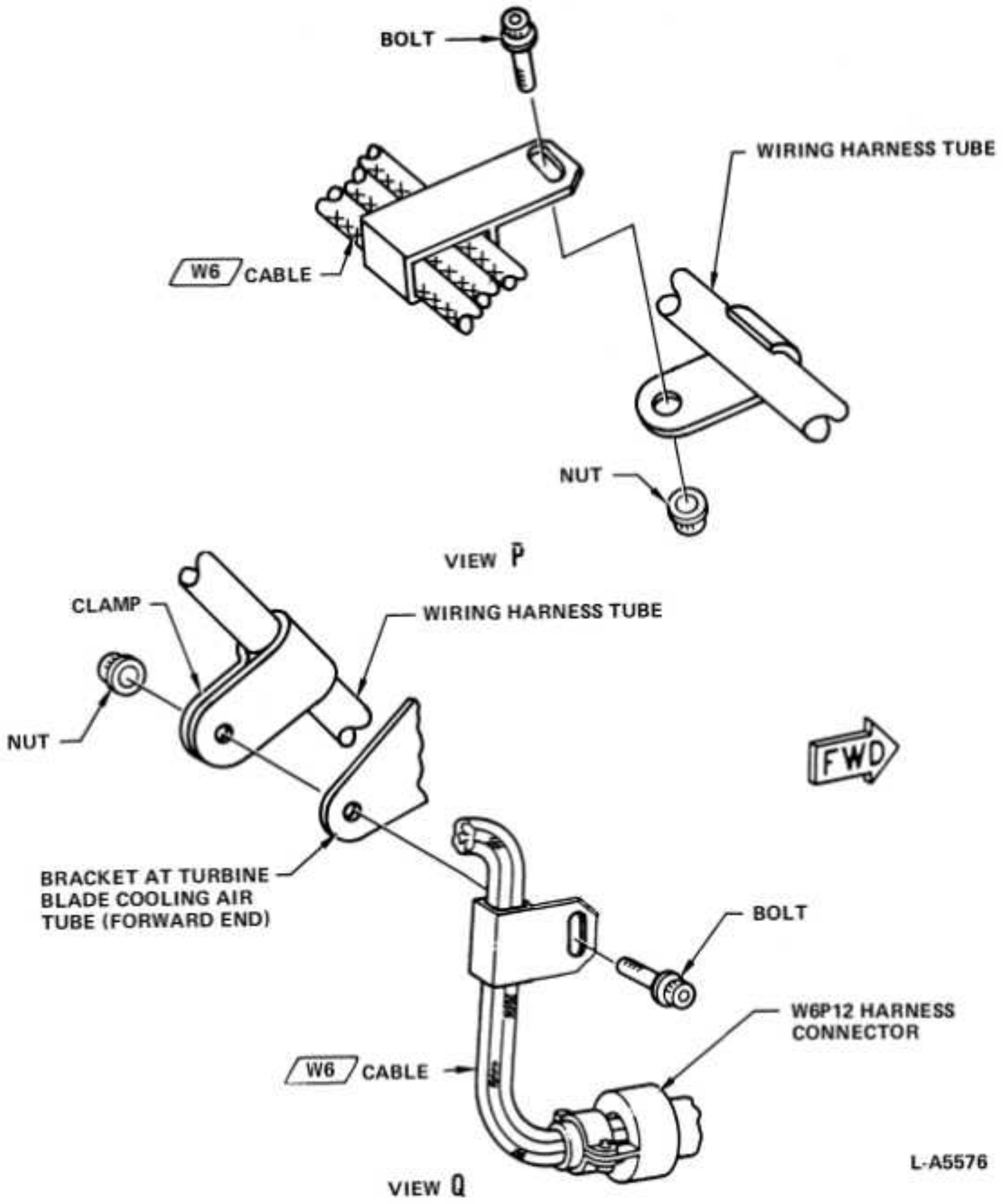
EEC Thermocouple And Airframe Cable
(W6) (Pre And Post SB PW4ENG 73−163)
Figure 404 (Sheet 6)
(Task 72−00−54−450−006−B)


TT3 THERMOCOUPLE
FWD
NUT
(LARGER)
NUT
(SMALLER)
BOLT
GROUND LEAD
W6 CABLE
WIRING HARNESS TUBE
NUT
VIEW M
L-A5784 (0000)
PW V

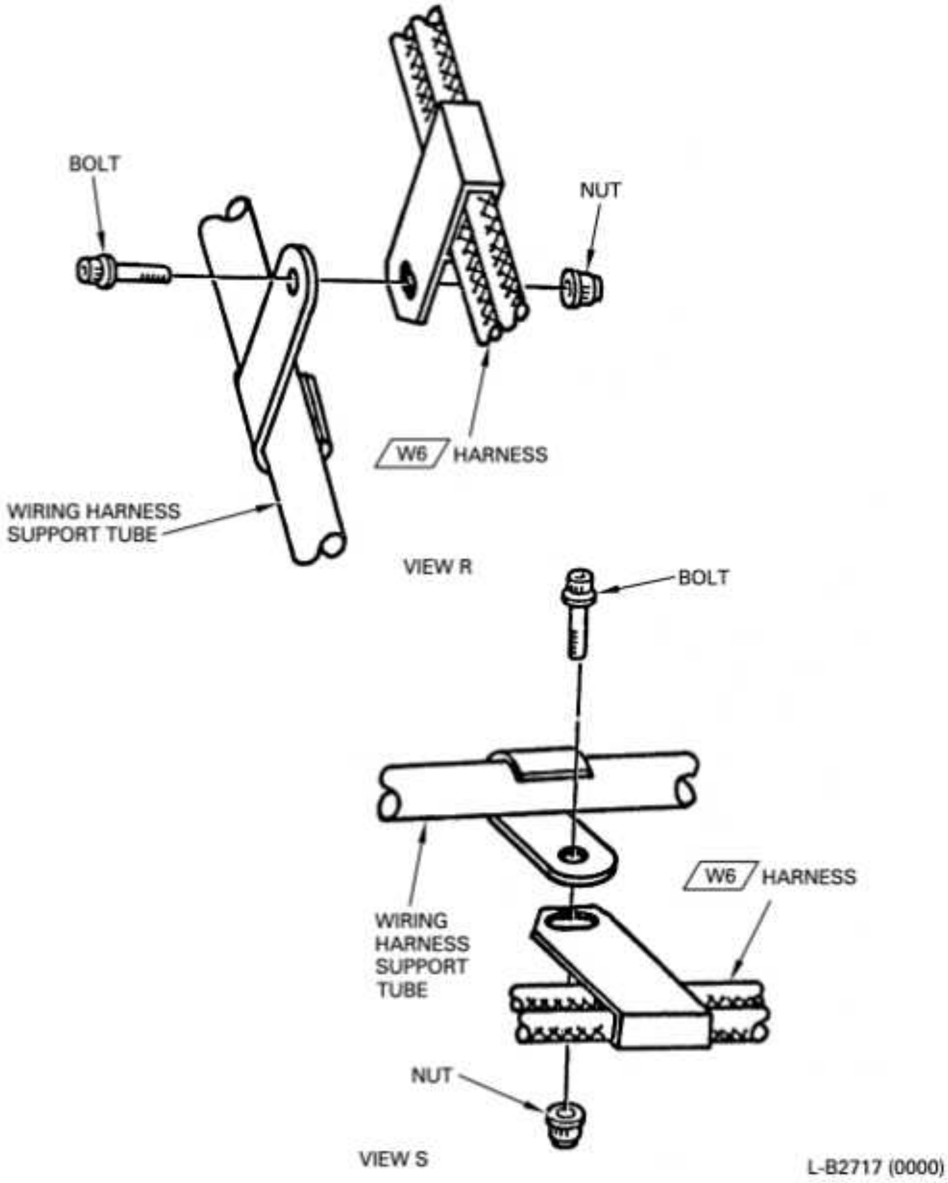
EEC Thermocouple And Airframe Cable (W6) (Pre SB PW4ENG 73-163)
Figure 404 (Sheet 7)
(Task 72-00-54-450-006-B)


BOLT
CLAMP
WIRING HARNESS TUBE
BRACKET ON DIFFUSER CASE
W6 CABLE
FWD
NUT
VIEW N
CLAMP
WIRING HARNESS TUBE
BOLT
NUT
W6 CABLE
BRACKET AT NO. 7 FUEL NOZZLE
L-A5575
VIEW O

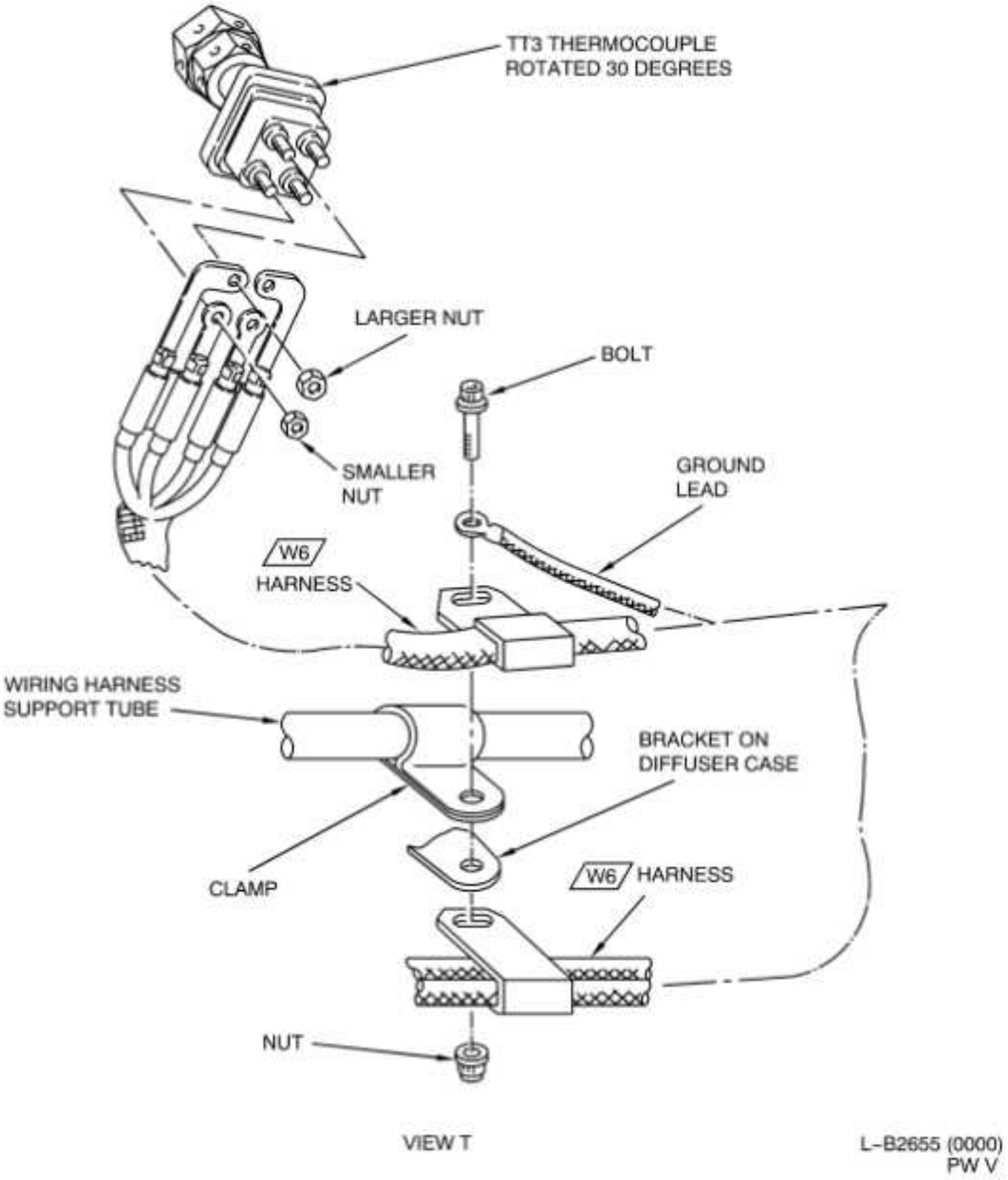
EEC Thermocouple And Airframe Cable (W6) (Pre SB PW4ENG 73−163)
Figure 404 (Sheet 8)
(Task 72−00−54−450−006−B)


BOLT
WIRING HARNESS TUBE
W6 CABLE
NUT
VIEW P
CLAMP
WIRING HARNESS TUBE
NUT
FWD
BRACKET AT TURBINE BLADE COOLING AIR TUBE (FORWARD END)
BOLT
W6P12 HARNESS CONNECTOR
W6 CABLE
L-A5576
VIEW Q

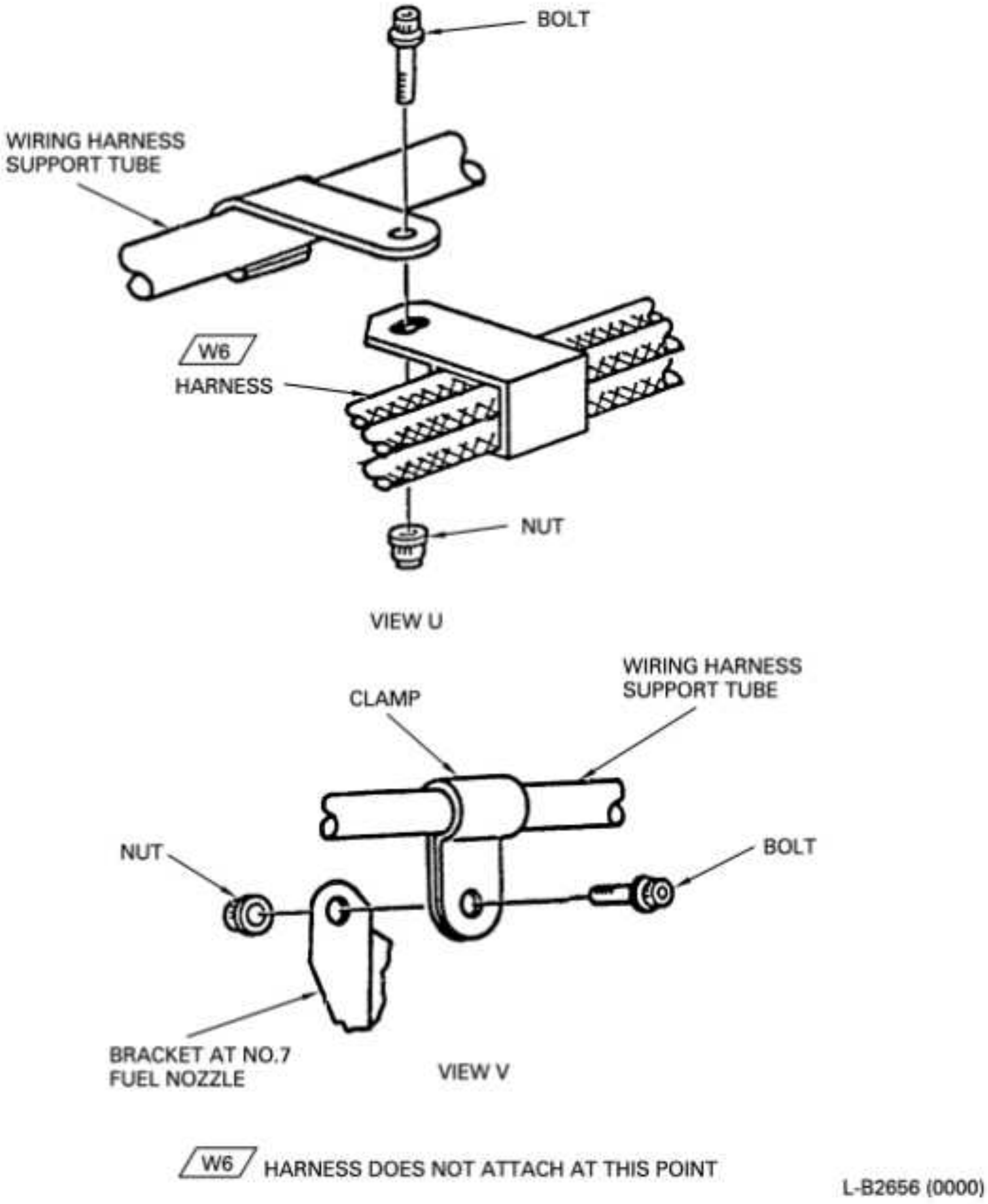
EEC Thermocouple And Airframe Cable (W6) (Pre SB PW4ENG 73−163)
Figure 404 (Sheet 9)
(Task 72−00−54−450−006−B)


BOLT
NUT
W6 HARNESS
WIRING HARNESS SUPPORT TUBE
VIEW R
BOLT
W6 HARNESS
WIRING HARNESS SUPPORT TUBE
NUT
VIEW S
L-B2717 (0000)

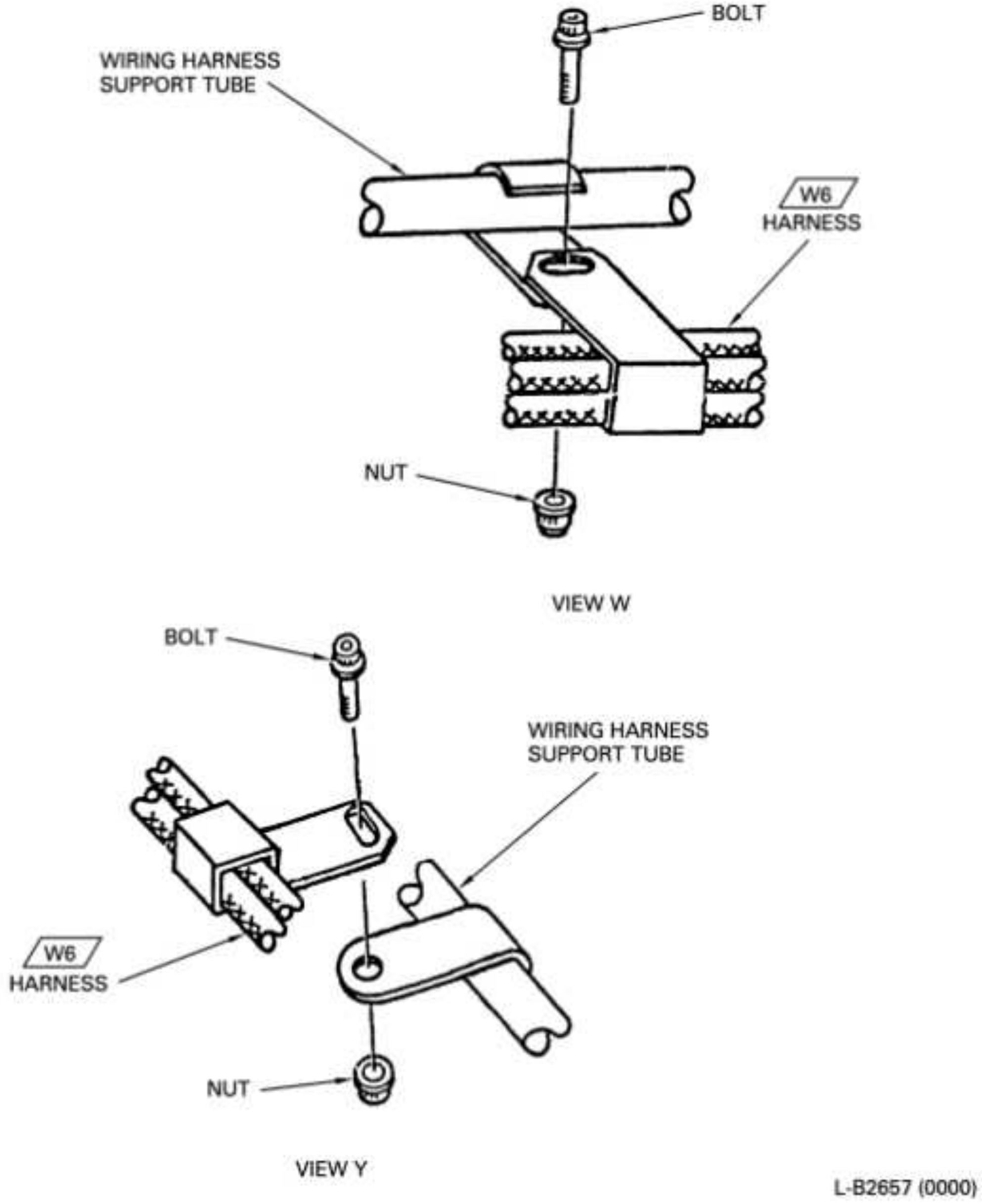
EEC Thermocouple And Airframe Cable (W6) (Post SB PW4ENG 73−163)
Figure 404 (Sheet 10)
(Task 72−00−54−450−006−B)


TT3 THERMOCOUPLE
ROTATED 30 DEGREES
LARGER NUT
BOLT
SMALLER
NUT
GROUND
LEAD
W6
HARNESS
WIRING HARNESS
SUPPORT TUBE
BRACKET ON
DIFFUSER CASE
CLAMP
W6
HARNESS
NUT
VIEW T
L−B2655 (0000)
PW V

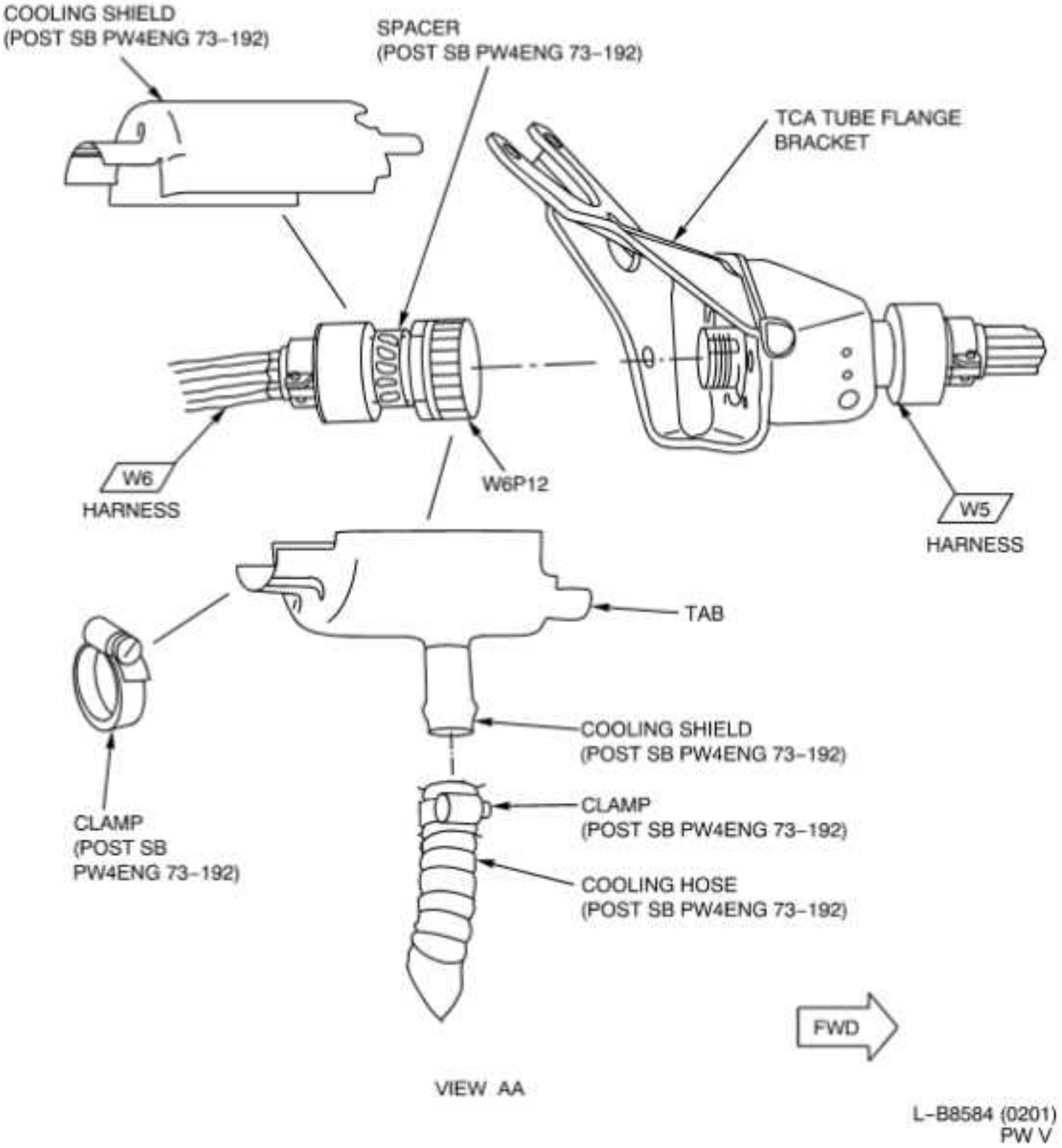
EEC Thermocouple And Airframe Cable (W6) (Post SB PW4ENG 73−163)
Figure 404 (Sheet 11)
(Task 72−00−54−450−006−B)


BOLT
WIRING HARNESS SUPPORT TUBE
W6
HARNESS
NUT
VIEW U
CLAMP
WIRING HARNESS SUPPORT TUBE
NUT
BOLT
BRACKET AT NO.7 FUEL NOZZLE
VIEW V
W6 HARNESS DOES NOT ATTACH AT THIS POINT
L-B2656 (0000)

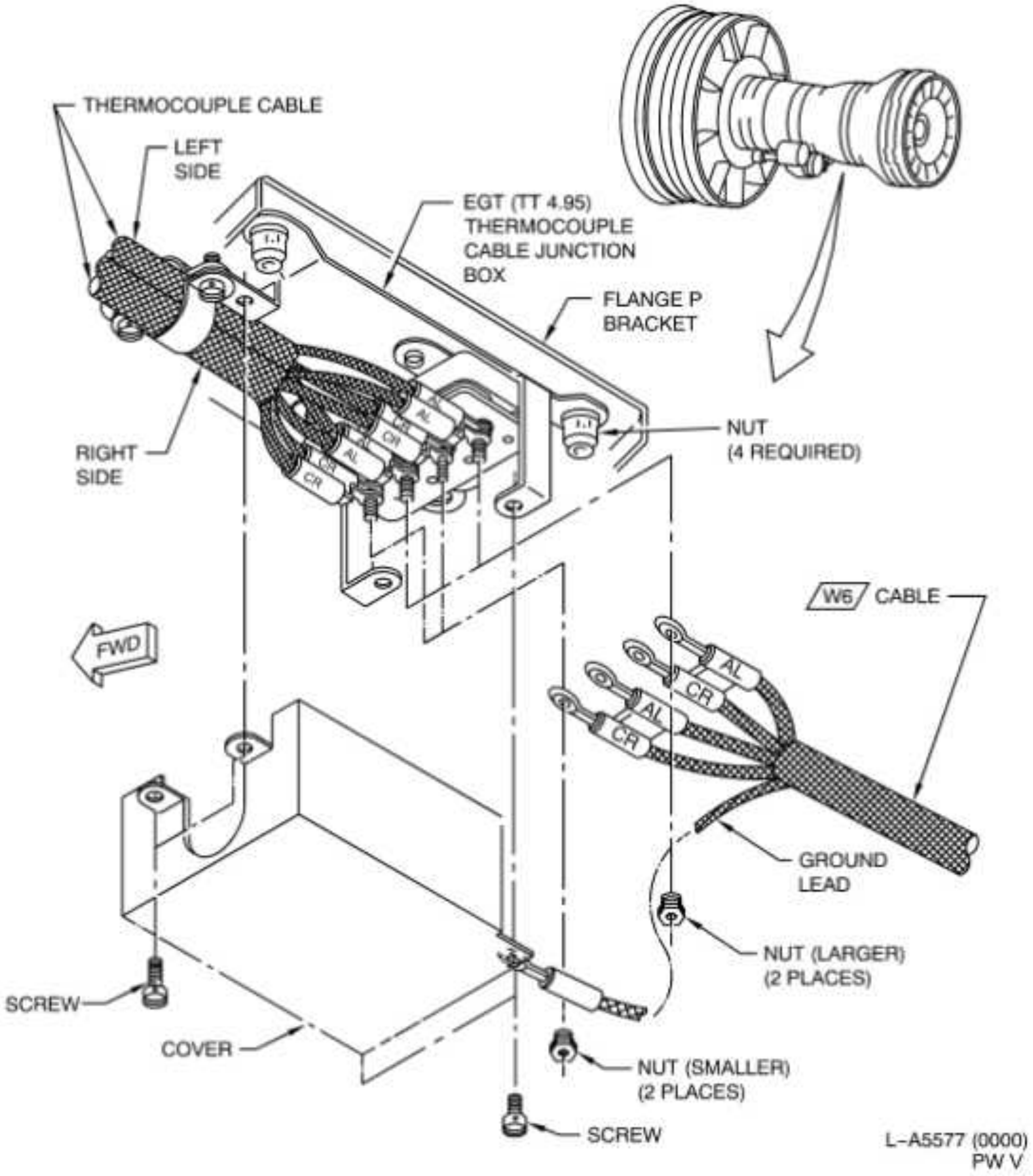
EEC Thermocouple And Airframe Cable (W6) (Post SB PW4ENG 73−163)
Figure 404 (Sheet 12)
(Task 72−00−54−450−006−B)


BOLT
WIRING HARNESS SUPPORT TUBE
W6 HARNESS
NUT
VIEW W
BOLT
WIRING HARNESS SUPPORT TUBE
W6 HARNESS
NUT
VIEW Y
L-B2657 (0000)

EEC Thermocouple And Airframe Cable (W6) (Post SB PW4ENG 73−163)
Figure 404 (Sheet 13)
(Task 72−00−54−450−006−B)


COOLING SHIELD
(POST SB PW4ENG 73-192)
SPACER
(POST SB PW4ENG 73-192)
TCA TUBE FLANGE
BRACKET
W6
HARNESS
W6P12
W5
HARNESS
TAB
COOLING SHIELD
(POST SB PW4ENG 73-192)
CLAMP
(POST SB PW4ENG 73-192)
CLAMP
(POST SB
PW4ENG 73-192)
COOLING HOSE
(POST SB PW4ENG 73-192)
FWD
VIEW AA
L-B8584 (0201)
PW V

EEC Thermocouple And Airframe Cable (W6) (Post SB PW4ENG 73−163)
Figure 404 (Sheet 14)
(Task 72−00−54−450−006−B)


THERMOCOUPLE CABLE
LEFT SIDE
EGT (TT 4.95) THERMOCOUPLE CABLE JUNCTION BOX
FLANGE P BRACKET
NUT (4 REQUIRED)
RIGHT SIDE
AL
CR
FWD
W6 CABLE
GROUND LEAD
NUT (LARGER) (2 PLACES)
SCREW
COVER
NUT (SMALLER) (2 PLACES)
SCREW
L−A5577 (0000)
PW V

EEC Thermocouple And Airframe Cable
(W6) (Pre And Post SB PW4ENG 73−163)
Figure 405
(Task 72−00−54−450−006−B)

ENGINE GENERAL - TURBINE EXHAUST CASE - INSTALLATION-10

Task 72-00-54-450-007:

1. Install EGT (TT4.95) Thermocouple Junction Box

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lockwire, MS9226-03		

B. Procedure
See Figure 401.

(1) Install junction box on Flange P bracket. Lubricate threads of bracket studs with Engine Oil P03-001, and secure junction box to bracket with nuts. Torque nuts to 32 - 36 lb-in. (3.616 - 4.067 N.m).

CAUTION: DO NOT ATTACH THE GROUND WIRE TO THE TERMINAL STUD.

(2) Remove nuts from junction box studs. Connect and secure thermocouple cables and W6 cable leads to studs with nuts. Align leads so they are parallel to one another.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(3) Torque junction box stud nuts as follows:

(a) (Reference 2273) Torque alumel connections (larger stud) to 18 - 22 lb-in. (2.034 - 2.486 N.m).

(b) (Reference 2273) Torque chromel connections (smaller stud) to 15 - 18 lb-in. (1.695 - 2.034 N.m).

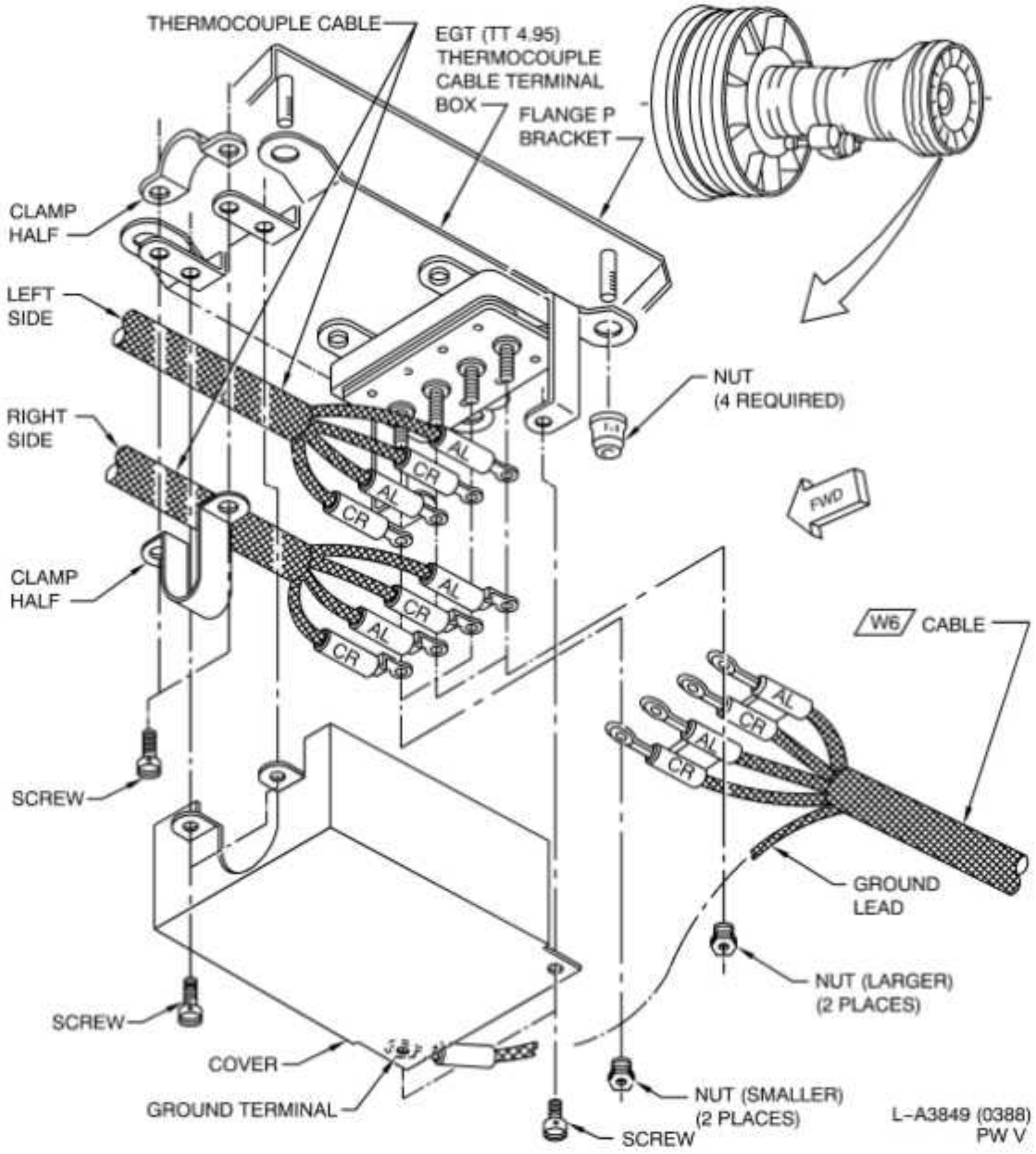
(4) Place clamp halves around cables and secure with two screws, threads lubricated with Engine Oil P03-001. Torque screws to 16 - 22 lb-in. (1.808 - 2.486 N.m).

ENGINE GENERAL − TURBINE EXHAUST CASE − INSTALLATION−10

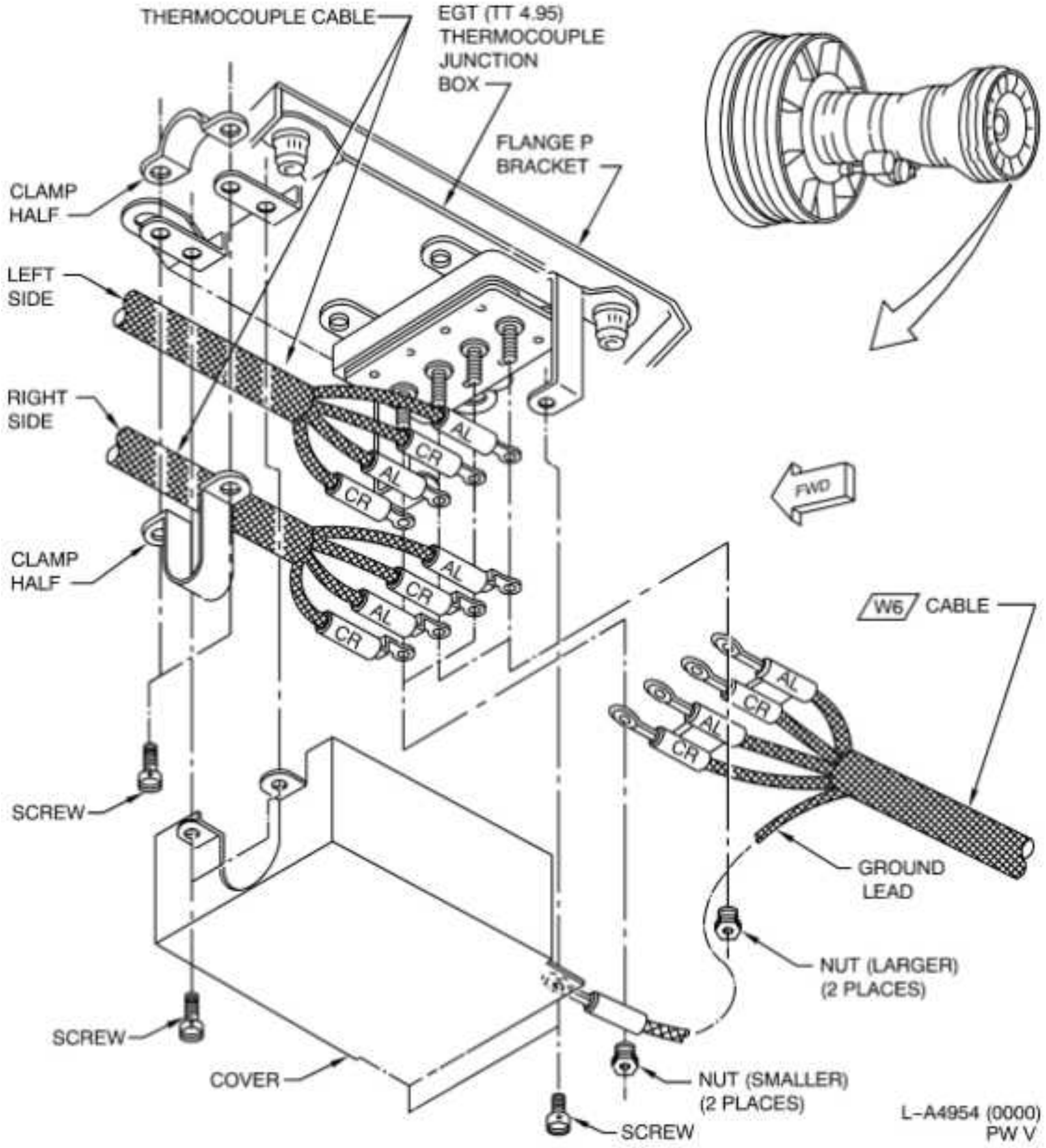
(5) (Reference 2273) For engines without the revised TT4.95 cable and PT4.95 sensing manifold for increased engine core clearance (Pre SB PW4ENG 72−134), install cover on junction box. Install ground lead terminal under front corner of cover. Secure cover and ground terminal with four screws. Torque screws to 16 − 22 lb−in. (1.808 − 2.486 N.m) and lockwire. See Figure 401 (Sheet 1).

NOTE: Do not lockwire clamp half screws together. Lockwire clamp half screws to cover screws.

(6) (Reference 2273) For engines with the revised TT4.95 cable and PT4.95 sensing manifold for increased engine core clearance (Post SB PW4ENG 72−134), install cover on junction box. Install ground lead terminal under rear corner of cover. Secure cover and ground terminal with four screws. Torque screws to 16 − 22 lb−in. (1.808 − 2.486 N.m) and lockwire. See Figure 401 (Sheet 2).


THERMOCOUPLE CABLE
EGT (TT 4.95) THERMOCOUPLE CABLE TERMINAL BOX
FLANGE P BRACKET
CLAMP HALF
LEFT SIDE
RIGHT SIDE
CLAMP HALF
AL
CR
AL
CR
AL
CR
AL
CR
NUT (4 REQUIRED)
FWD
W6 CABLE
AL
CR
AL
CR
SCREW
GROUND LEAD
NUT (LARGER) (2 PLACES)
SCREW
COVER
GROUND TERMINAL
NUT (SMALLER) (2 PLACES)
SCREW
L−A3849 (0388)
PW V

EGT (TT4.95) Thermocouple Junction Box − For Engines Without The Revised (TT4.95) Cable For Increased Engine Core Clearance (Pre SB PW4ENG 72−134)
Figure 401 (Sheet 1)
(Task 72−00−54−450−007)


THERMOCOUPLE CABLE
EGT (TT 4.95) THERMOCOUPLE JUNCTION BOX
FLANGE P BRACKET
CLAMP HALF
LEFT SIDE
RIGHT SIDE
AL
CR
CLAMP HALF
FWD
W6 CABLE
SCREW
GROUND LEAD
NUT (LARGER) (2 PLACES)
SCREW
COVER
NUT (SMALLER) (2 PLACES)
SCREW
L−A4954 (0000)
PW V

EGT (TT4.95) Thermcouple Junction Box − For Engines
With The Revised (TT4.95) Cable For Increased
Engine Core Clearance (Post SB PW4ENG 72−134)
Figure 401 (Sheet 2)
(Task 72−00−54−450−007)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - TURBINE EXHAUST CASE - INSTALLATION-20

Task 72-00-54-420-005:

1. Install The Flange P Brackets And Hardware

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03-001	Engine Oil (PWA 521B)

B. Procedure

(1) Install the Flange P hardware as follows. See Figure 401 and Figure 402.

NOTE: There are 132 boltholes in Flange P. Top dead center is between the first and last boltholes (between bolthole 132 and bolthole 1). Bolthole numbers go clockwise (viewed from the rear).

(a) Apply Engine Oil P03-001 to the bolts.

(b) Install the bolts and brackets to Flange P and attach with nuts handtight only.

NOTE: Remove the work bolts and replace them with the engine bolts one at a time to keep the case seated.

NOTE: Numbers in parenthesis in the figure are the bolthole locations of the brackets.

(c) (Reference 978) Torque the Flange P bolts as follows.

1 Nuts must be tightened simultaneously in sets of two groups. Sets consist of groups number (1,2), (3,4), (5,6), (7,8), (9,10),(11,12) (13,14) and (15,16). See tourque sequence specified in reference figure.

NOTE: Fourteen of the 16 groups consist of eight bolts each. The remaining two groups consist of ten bolts each. See reference figure.

2 Tighten all sets of bolt groups described in previous step to initial torque of 75 − 100 lbf−in (8.474 − 11.298 N.m).

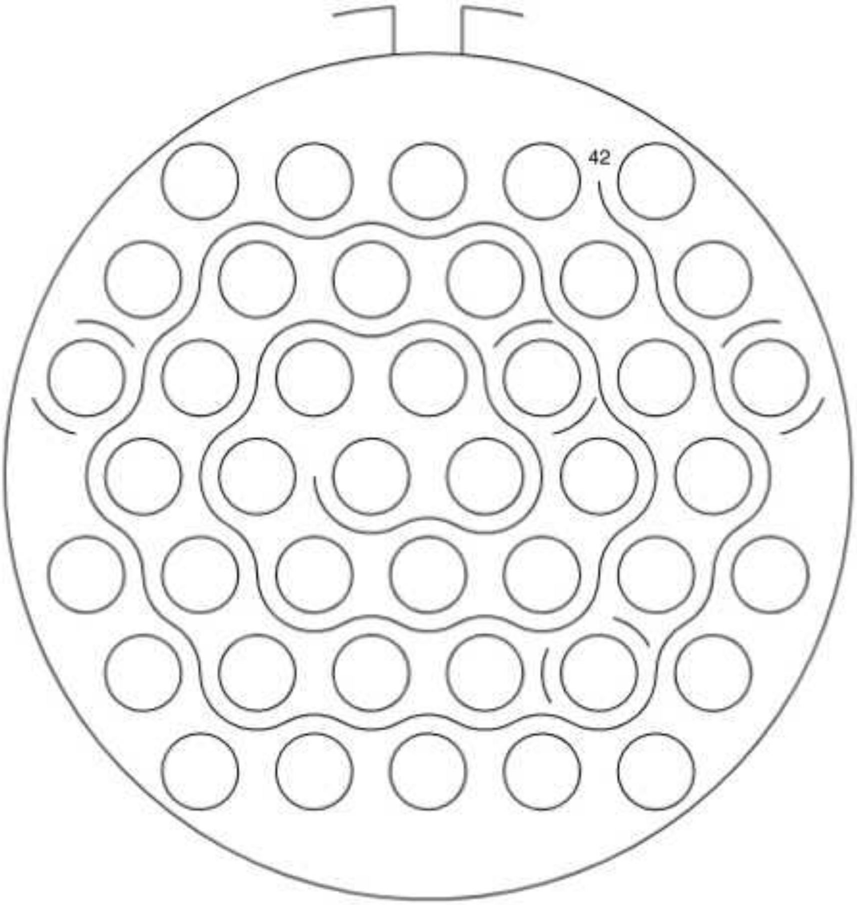
3 Tighten all set of bolt groups described in previous step to final torque of 180 − 200 lbf−in (20.337 − 22.597 N.m).

(2) Remove any tags or markings on the brackets or flange.

(3) Examine the assembly for foreign objects, damage, and correct assembly.

THE VIEW OF THE CONNECTOR IS MADE LARGER FOR IDENTIFICATION OF THE CONTACT LOCATIONS

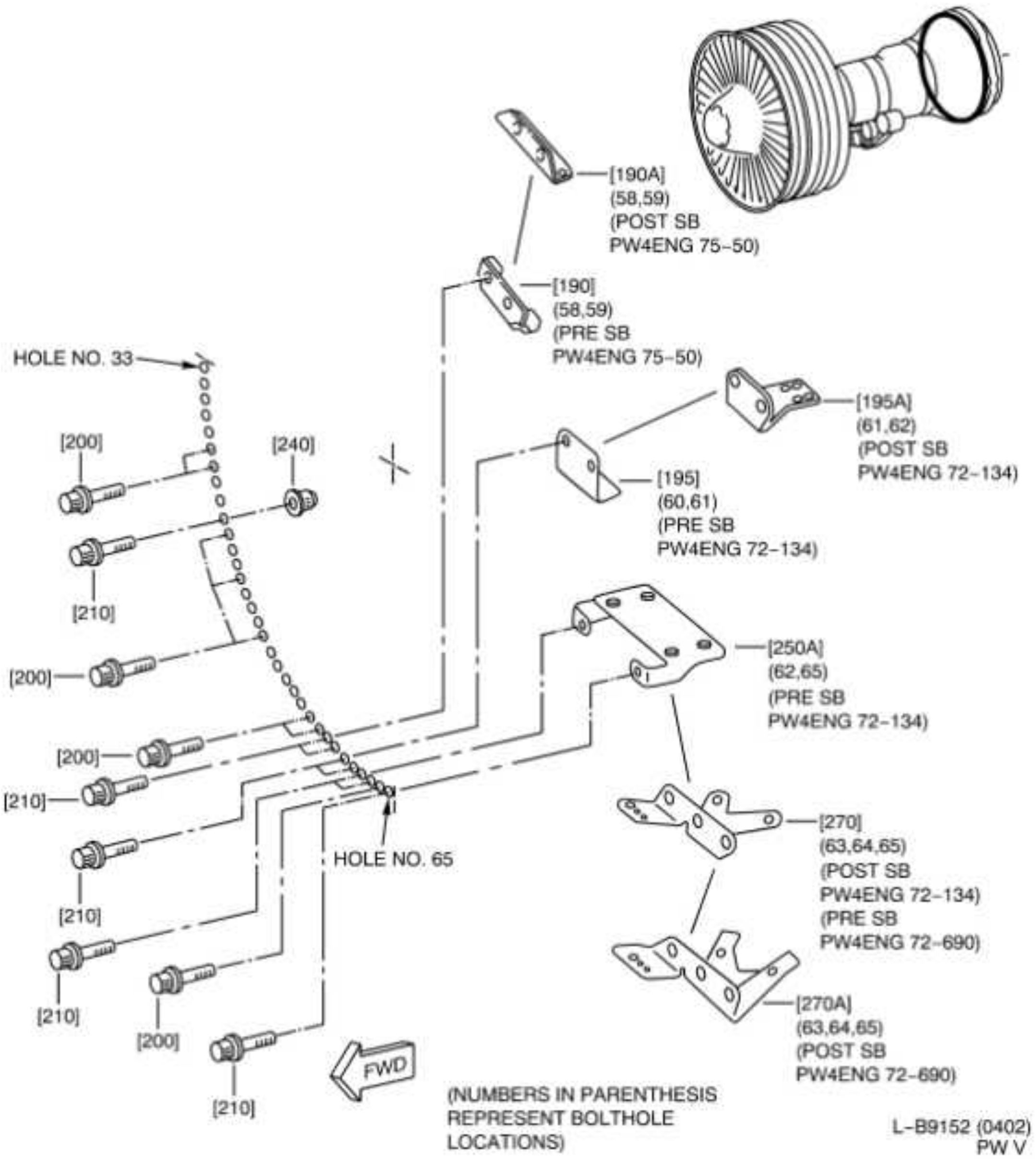
FRONT FACE OF SOCKET INSERT IS SHOWN, REAR FACE OF SOCKET INSERT IS OPPOSITE



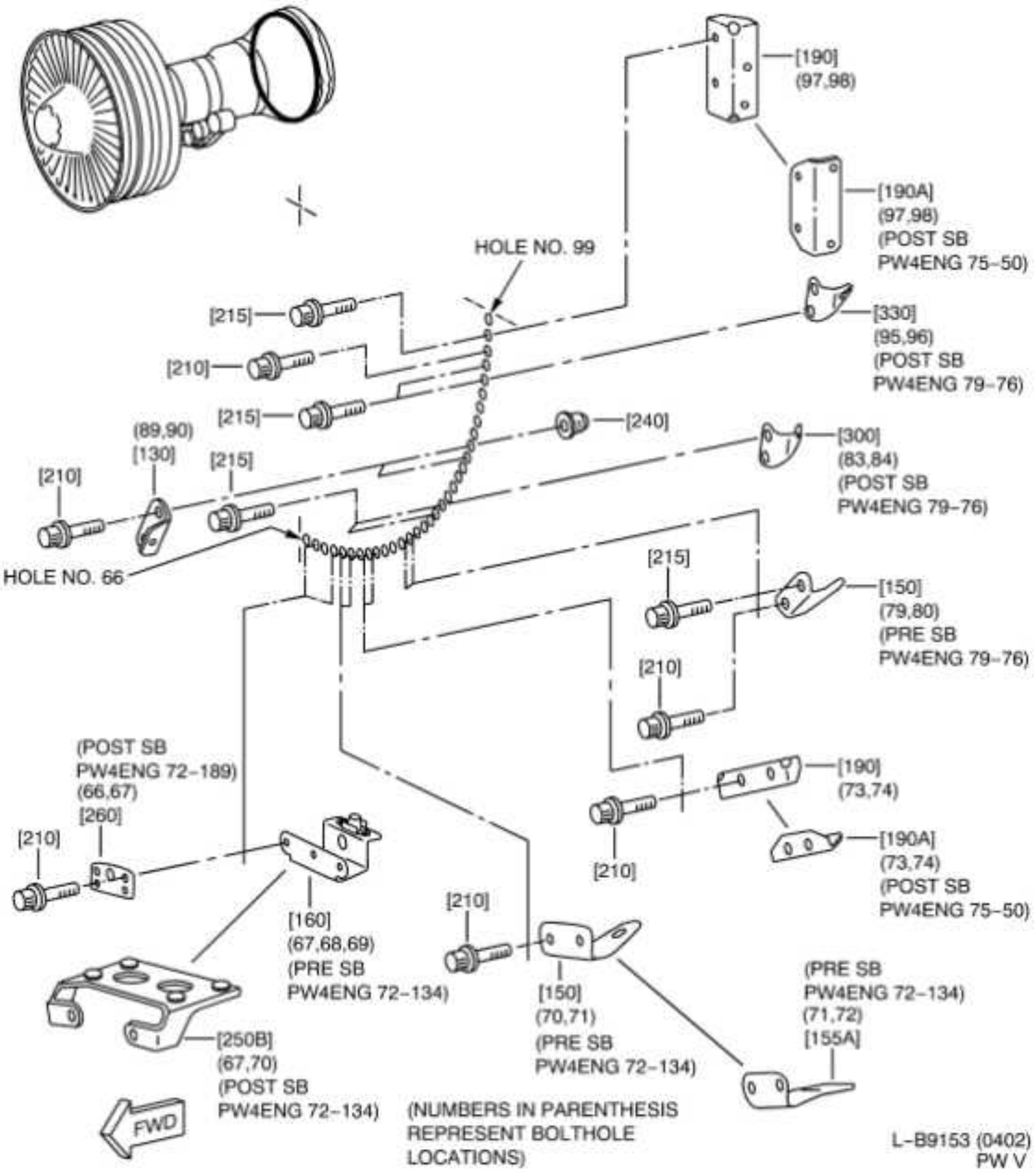
CONTACT ARRANGEMENT	28 – 42
NUMBER OF CONTACTS	42
SIZE OF CONTACTS	NO. 16

G – 02027 (0000)
PW V

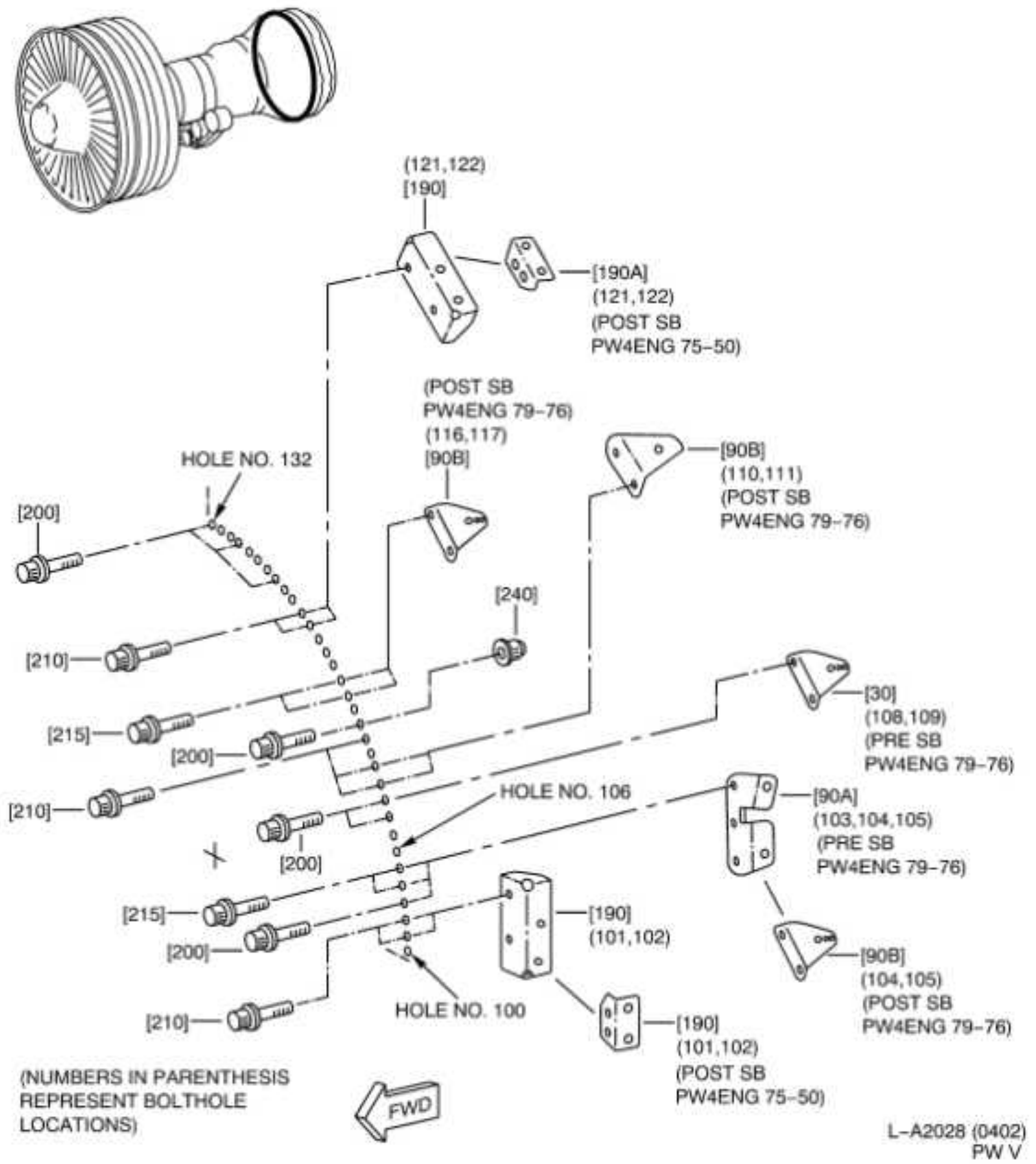
The Flange P Brackets And Hardware
Figure 401 (Sheet 1)
(Task 72−00−54−420−005)


[190A]
(58,59)
(POST SB
PW4ENG 75-50)
[190]
(58,59)
(PRE SB
PW4ENG 75-50)
HOLE NO. 33
[195A]
(61,62)
(POST SB
PW4ENG 72-134)
[200]
[240]
[195]
(60,61)
(PRE SB
PW4ENG 72-134)
[210]
[200]
[250A]
(62,65)
(PRE SB
PW4ENG 72-134)
[200]
[210]
[270]
(63,64,65)
(POST SB
PW4ENG 72-134)
(PRE SB
PW4ENG 72-690)
HOLE NO. 65
[210]
[210]
[200]
[270A]
(63,64,65)
(POST SB
PW4ENG 72-690)
FWD
[210]
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L-B9152 (0402)
PW V

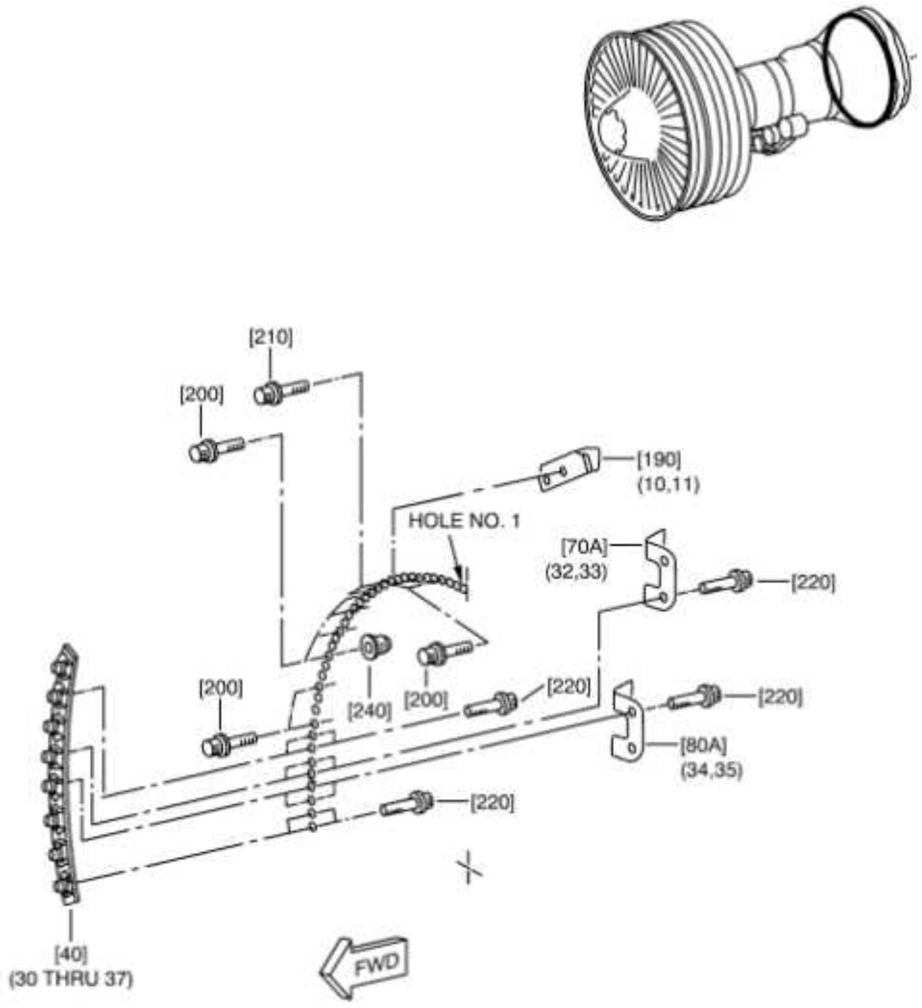
The Flange P Brackets And Hardware
Figure 401 (Sheet 2)
(Task 72−00−54−420−005)


[190]
(97,98)
[190A]
(97,98)
(POST SB PW4ENG 75-50)
HOLE NO. 99
[215]
[210]
[330]
(95,96)
(POST SB PW4ENG 79-76)
[215]
[240]
(89,90)
[130]
[210]
[215]
[300]
(83,84)
(POST SB PW4ENG 79-76)
HOLE NO. 66
[215]
[150]
(79,80)
(PRE SB PW4ENG 79-76)
[210]
(POST SB PW4ENG 72-189)
(66,67)
[260]
[210]
[190]
(73,74)
[210]
[190A]
(73,74)
(POST SB PW4ENG 75-50)
[160]
(67,68,69)
(PRE SB PW4ENG 72-134)
[210]
[150]
(70,71)
(PRE SB PW4ENG 72-134)
(PRE SB PW4ENG 72-134)
(71,72)
[155A]
[250B]
(67,70)
(POST SB PW4ENG 72-134)
FWD
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L-B9153 (0402)
PW V

The Flange P Brackets And Hardware
Figure 401 (Sheet 3)
(Task 72−00−54−420−005)


(121,122)
[190]
[190A]
(121,122)
(POST SB
PW4ENG 75-50)
(POST SB
PW4ENG 79-76)
(116,117)
[90B]
HOLE NO. 132
[90B]
(110,111)
(POST SB
PW4ENG 79-76)
[200]
[210]
[240]
[215]
[200]
[30]
(108,109)
(PRE SB
PW4ENG 79-76)
[210]
HOLE NO. 106
[90A]
(103,104,105)
(PRE SB
PW4ENG 79-76)
[200]
[215]
[190]
(101,102)
[200]
[90B]
(104,105)
(POST SB
PW4ENG 79-76)
[210]
HOLE NO. 100
[190]
(101,102)
(POST SB
PW4ENG 75-50)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-A2028 (0402)
PW V

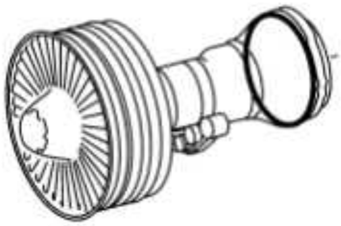
The Flange P Brackets And Hardware
Figure 401 (Sheet 4)
(Task 72−00−54−420−005)

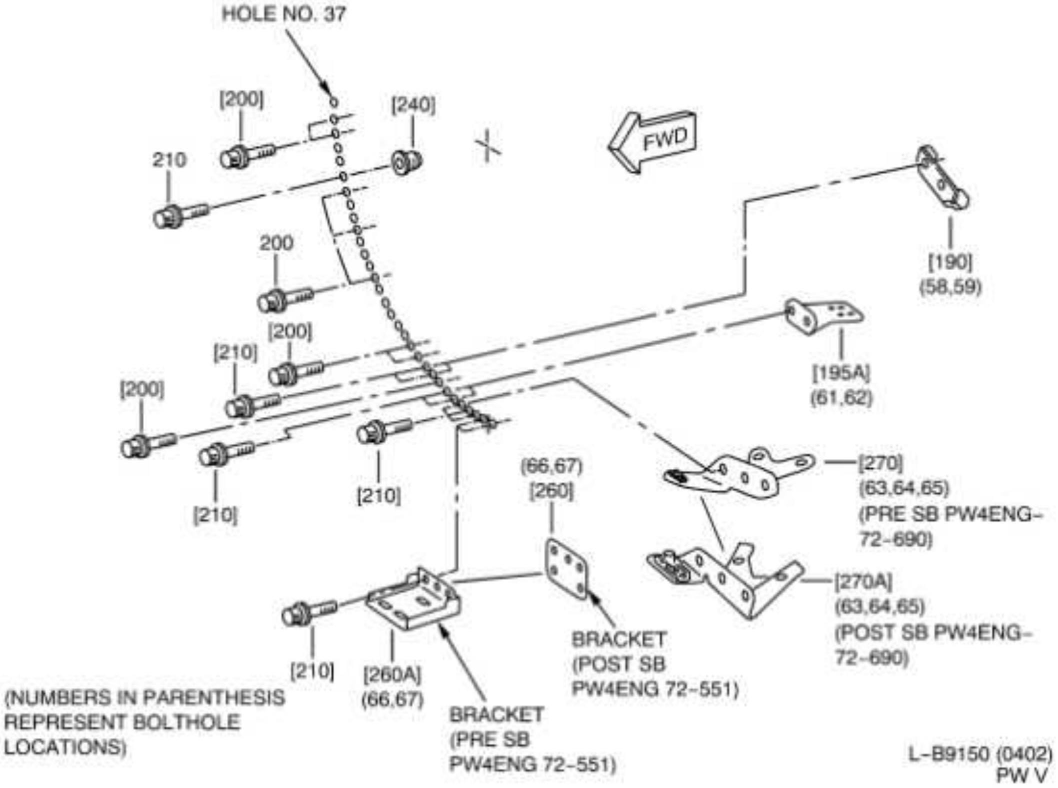

[210]
[200]
[190]
(10,11)
HOLE NO. 1
[70A]
(32,33)
[220]
[200]
[240]
[200]
[220]
[220]
[80A]
(34,35)
[220]
[40]
(30 THRU 37)
FWD

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

L−A9325 (0402)
PW V

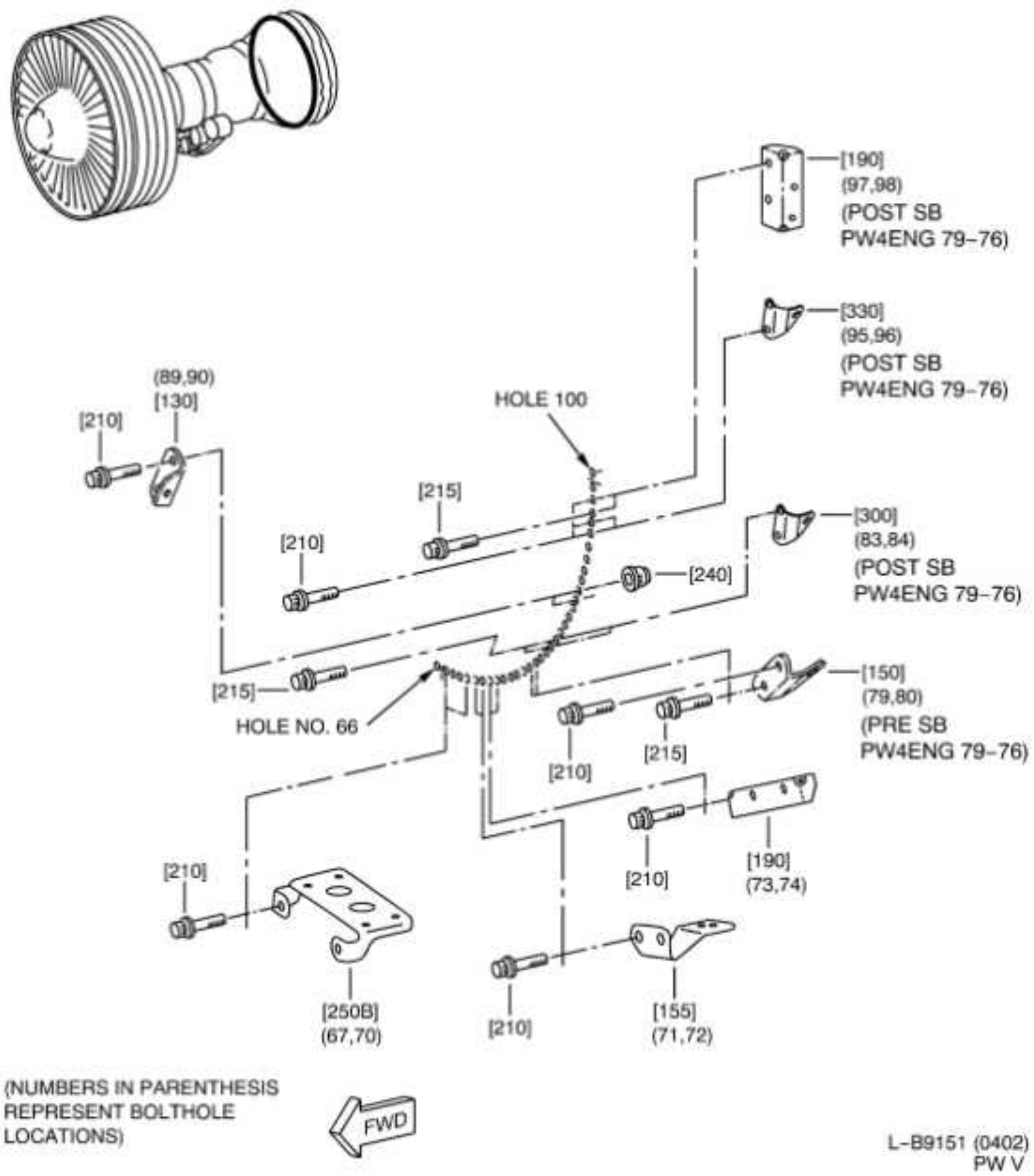
The Flange P Brackets And Hardware
Figure 401 (Sheet 5)
(Task 72−00−54−420−005)




HOLE NO. 37
[200]
[240]
210
FWD
200
[190]
(58,59)
[200]
[210]
[200]
[195A]
(61,62)
[210]
[210]
(66,67)
[260]
[270]
(63,64,65)
(PRE SB PW4ENG-72-690)
[270A]
(63,64,65)
(POST SB PW4ENG-72-690)
[210]
[260A]
(66,67)
BRACKET (POST SB PW4ENG 72-551)
BRACKET (PRE SB PW4ENG 72-551)
L-B9150 (0402)
PW V

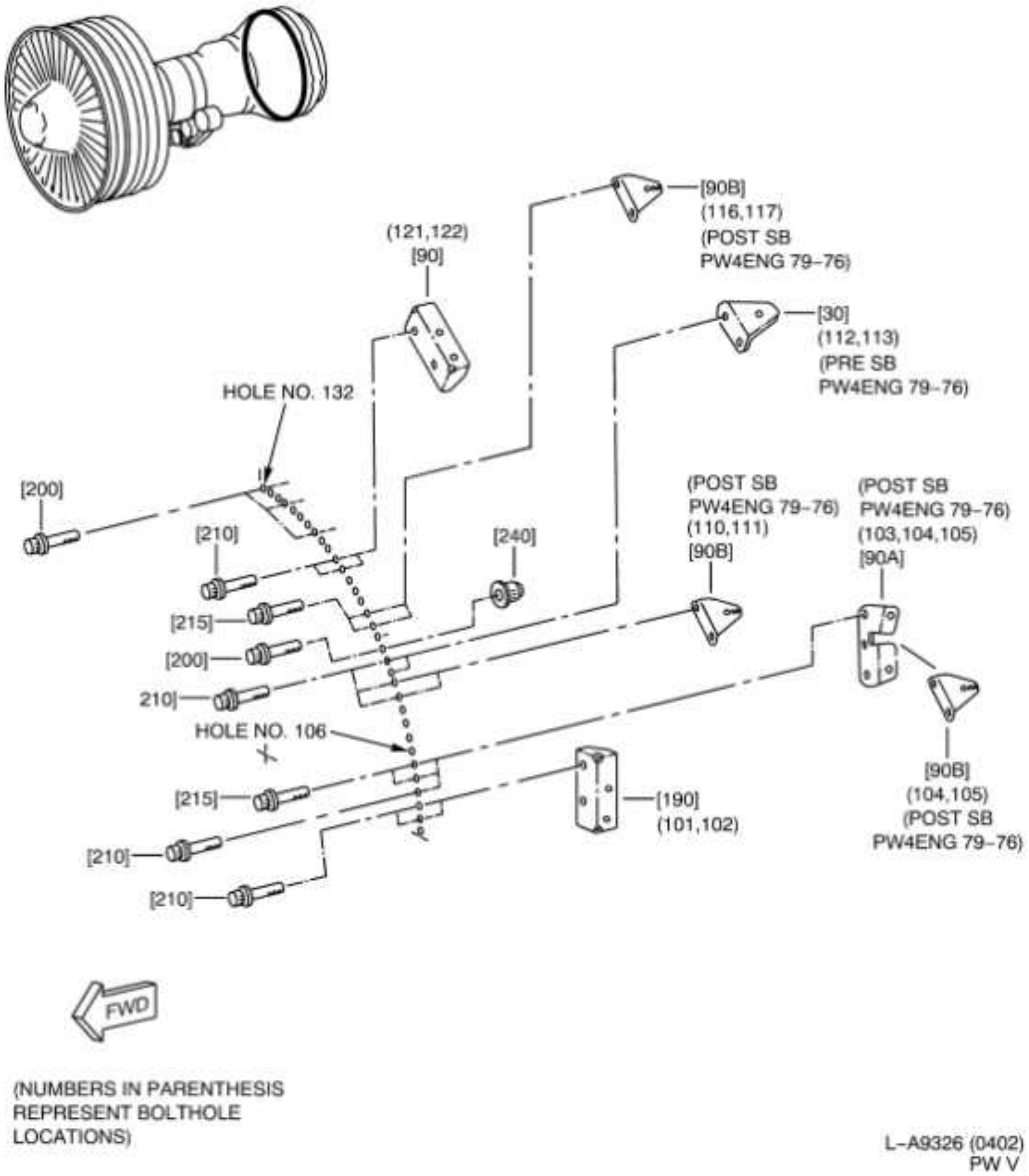
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

The Flange P Brackets And Hardware
Figure 401 (Sheet 6)
(Task 72−00−54−420−005)

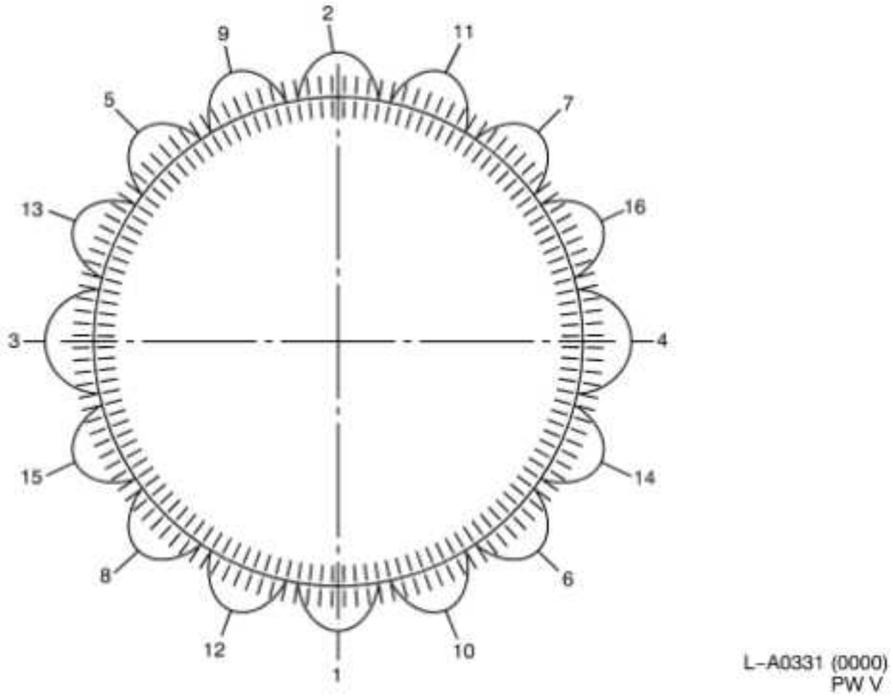

[190]
(97,98)
(POST SB
PW4ENG 79-76)
[330]
(95,96)
(POST SB
PW4ENG 79-76)
(89,90)
[130]
[210]
HOLE 100
[215]
[210]
[240]
[300]
(83,84)
(POST SB
PW4ENG 79-76)
[215]
HOLE NO. 66
[150]
(79,80)
(PRE SB
PW4ENG 79-76)
[210]
[215]
[210]
[210]
[190]
(73,74)
[250B]
(67,70)
[210]
[155]
(71,72)
FWD
L-B9151 (0402)
PW V

(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

The Flange P Brackets And Hardware
Figure 401 (Sheet 7)
(Task 72−00−54−420−005)


[90B]
(116,117)
(POST SB
PW4ENG 79-76)
(121,122)
[90]
[30]
(112,113)
(PRE SB
PW4ENG 79-76)
HOLE NO. 132
[200]
[210]
[240]
[215]
[200]
210]
(POST SB
PW4ENG 79-76)
(110,111)
[90B]
(POST SB
PW4ENG 79-76)
(103,104,105)
[90A]
HOLE NO. 106
[215]
[190]
(101,102)
[210]
[210]
[90B]
(104,105)
(POST SB
PW4ENG 79-76)
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L-A9326 (0402)
PW V

The Flange P Brackets And Hardware
Figure 401 (Sheet 8)
(Task 72−00−54−420−005)


2
9
11
5
7
13
16
3
4
15
14
8
6
12
10
1
L−A0331 (0000)
PW V

Flange P Bolt Torquing Sequence Diagram
Figure 402
(Task 72−00−54−420−005)

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ENGINE GENERAL - TURBINE EXHAUST CASE - CLEANING-01

Task 72-00-54-160-001:

1. Clean EGT (TT4.95) Thermocouple

A. Equipment And Materials Required

Standard Tools:

Name	Manufacturer
Stiff Bristle Brush Nonmetallic (Tampico)	Stanley Home Products 116 Pleasant St. Easthampton, MA 01027

Consumable Materials:

Item No.	Designation
P05-005	Cloth, Cotton Lint Free

B. Procedure

See Figure 601.

(1) Perform cleaning operations as necessary exercising caution to prevent mechanical damage.

WARNING: CLEANING SOLVENT IS FLAMMABLE. USE IN WELL VENTILATED AREA. AVOID CONTACT WITH SKIN.

CAUTION: INSULATION MATERIAL USED WITHIN THERMOCOUPLE PROBE WILL READILY ABSORB LIQUIDS. SINCE OPERATION OF THERMOCOUPLE MAY BE ADVERSELY AFFECTED BY PRESENCE OF LIQUIDS IN INSULATION, IT IS IMPORTANT THAT LIQUID SOLVENTS ARE NOT USED IN ANY WAY THAT WOULD PERMIT SOLVENT ENTRY INTO PROBE PAST TERMINAL STUDS.

(2) Clean thermocouple head.

(a) Remove foreign deposits from head using brush and clean Lint Free Cotton Cloth (P05-005) and the SPOP 208 Wipe Method (Task 70-21-00-110-040).

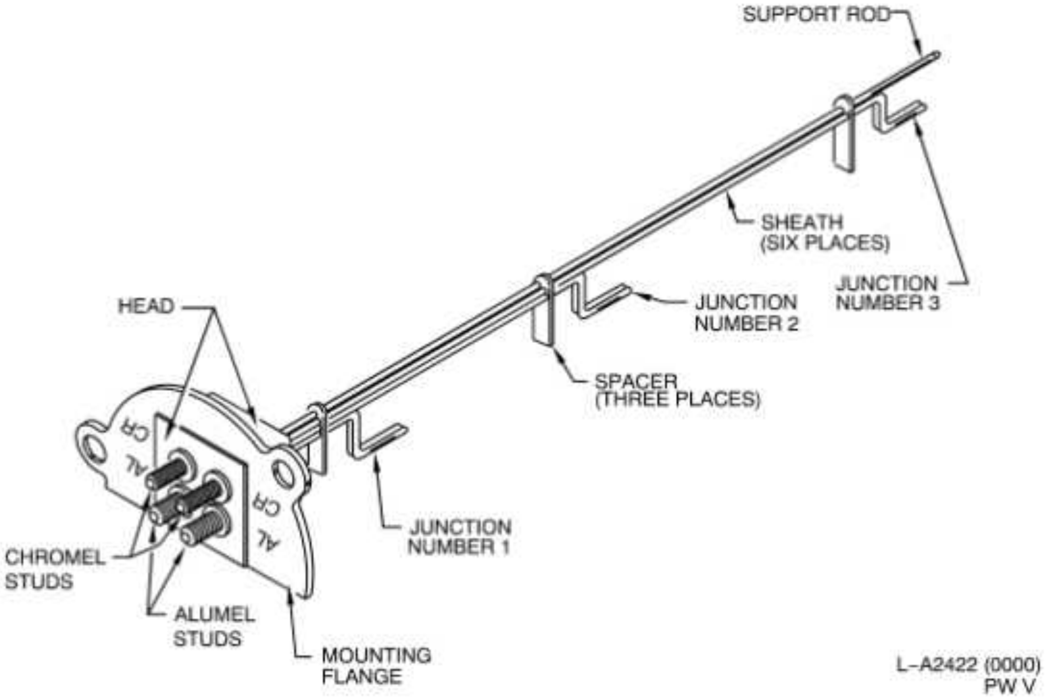
(b) Dry with clean dry compressed air.

NOTE: Compressed air shall be maintained at 30 psig (206.8 kPa) maximum discharge pressure.

(3) Clean thermocouple sheath.

(a) Remove loose carbon deposits from thermocouple sheath by directing air at approximately 100 psig (689.5 kPa) through an air nozzle.

ENGINE GENERAL - TURBINE EXHAUST CASE - CLEANING-01


SUPPORT ROD
SHEATH (SIX PLACES)
JUNCTION NUMBER 3
JUNCTION NUMBER 2
HEAD
SPACER (THREE PLACES)
CR
AL
CR
AL
JUNCTION NUMBER 1
CHROMEL STUDS
ALUMEL STUDS
MOUNTING FLANGE
L-A2422 (0000)
PW V

Thermocouple (TT4.95)
Figure 601
(Task 72-00-54-160-001)

(b) To remove hardened carbon deposits from thermocouple sheath, use stiff bristle brush (nonmetallic) and the SPOP 208 Wipe Method (Task 70−21−00−110−040).
(c) Clean sheath by wiping surfaces with clean Lint Free Cotton Cloth (P05−005) and the SPOP 208 Wipe Method (Task 70−21−00−110−040).
(d) Dry with clean dry compressed air.

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ENGINE GENERAL - TURBINE EXHAUST CASE - CLEANING-02

Task 72-00-54-160-002:

1. Clean EGT (TT4.95) Box And Cable
   - A. Equipment And Materials Required - None
   - B. Procedure
     - (1) Clean external surfaces by wiping with cloth slightly dampened by SPOP 208 Wipe Method (Task 70-21-00-110-040).

       CAUTION: DO NOT LEAVE FOREIGN MATERIAL ON TERMINALS.

     - (2) If necessary, clean thermocouple harness and lead alumel and chromel terminal lugs using stainless steel brush or stainless steel pad (without soap).

       CAUTION: IMBEDDED STAINLESS STEEL PARTICLES MAY ADVERSELY AFFECT ACCURACY OF LOW LEVEL MILLI-VOLT EGT SIGNALS, THEREFORE, ENSURE THAT ALL FOREIGN MATERIAL IS REMOVED FROM TERMINALS.

     - (3) Remove residue using clean compressed air at 30 psig (206.8 kPa) maximum discharge pressure.

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ENGINE GENERAL - TURBINE EXHAUST CASE - CLEANING-03

Task 72-00-54-110-001:

1. Clean Coke From The Turbine Exhaust Case, Pressure And Scavenge Tubes

A. Prerequisites

(1) Remove the No. 4 bearing and seals per 72-00-54, Removal-08 (Task 72-00-54-020-002).

B. Equipment And Materials Required

Standard Tools:

Name	Manufacturer
Hand Suction Gun #6Y831	Grainger - Office K4138 33 Knightsbridge Parkway Lincolnshire, Il. 60069-3639
Air Powered Degreasing/ Cleaning Spray Gun #4Z668	
Rubber Plugs	Local Purchase

Consumable Materials:

Item No.	Designation
P05-005	Cloth, Cotton Lint Free
P05-294	Tape, Solvent Resistant

C. Procedure

(1) Remove the No. 4 bearing (oil) pressure tube (601/7). See Figure 601.

(a) Remove the lockwire (601/12) that secure the heat shields to the tube.

(b) Separate and remove the heat shields (601/8) and (601/11) from the tube.

(c) Remove the lockwire and the bolts (601/6) that secure the No. 4 bearing tube guide (601/5) to the turbine exhaust case.

(d) Disconnect the nut that secures the tube (601/7) to the adapter (601/10) in the inner rear flange of the turbine exhaust case.

(e) Remove the thrust wire (601/2) that secures the nut (601/1) to the tube (601/7). Remove the nut.

(f) Remove the lockwire and the bolts (601/3) that secure the No. 4 bearing pressure tube shield (601/4) to the turbine exhaust case at the 10:30 o'clock position as viewed from the rear.

(g) Move the tube (601/7) radially inward and remove the tube from the turbine exhaust case.

(h) Remove the adapter (601/10) and the packing (601/9). Discard the packing.

(2) Remove the No. 4 bearing scavenge (inner) tube (602/4).

See Figure 602.

(a) Remove the key washer (602/2) and the bolt (602/3) that secures the scavenge tube bracket to the turbine exhaust case inner flange at the 6 o'clock position.

(b) Remove the key washers (602/2) and the bolts (602/3) that secure the scavenge tube to the turbine exhaust case inner flange at the 7:30 o'clock position. Remove the scavenge tube. Discard the packing (602/1).

(3) Seal the No. 4 bearing compartment. See Figure 603.

(a) Seal the No. 4 bearing compartment gap with Solvent Resistant Tape (P05−294) or a rubber preformed packing.

NOTE: This will prevent the alkaline gel cleaning solution from spraying back onto the operator.

(b) Seal the No. 4 bearing inner seal area with a Cotton Lint Free Cloth (P05−005). Make sure the cloth is between the outer diameter of the LPT shaft and the inner diameter of the seal land.

(c) Seal the inner diameter of the LPT shaft with an elastic cover. Place the cover over the outer diameter of the LPT shaft,

(d) Use a plastic sheet to cover over the entire rear side of the turbine exhaust case.

NOTE: This will prevent any spray back of the alkaline gel cleaning solution from the turbine exhaust case.

(4) Clean the No. 4 bearing compartment. See Figure 604.

WARNING: ALKALINE GEL WILL CAUSE BURNS TO EXPOSED SKIN. COVER EXPOSED SKIN. SEE MATERIAL SAFETY DATA SHEETS FOR MORE INFORMATION.

(a) Apply SPOP 2 alkaline gel with a Air Powered Degreasing/Spray Gun, #4Z668.

1 Apply the alkaline gel into the two (2) holes at the 6 o'clock position for 45 − 60 seconds each.

NOTE: Do not over fill the cavity. The intent is to coat the interior surface with the gel.

2 Seal the two (2) holes with rubber plugs.

3 Apply the alkaline gel into the other nine (9) holes for 45 − 60 seconds each. Do not plug the holes.

4 Allow the alkaline gel to soak for 45 − 60 minutes.

5 Repeat steps 1, 2 and 3.

6 Allow the alkaline gel to soak for 4 − 24 hours.

(b) Drain the SPOP 2 alkaline gel.

1 Remove the two (2) plugs at the 6 o'clock position.

2 Collect the alkaline gel in a bucket.

3 Siphon the gel that remains with the Hand Suction Gun, #6Y831.

4 Flush fully the No. 4 bearing compartment with hot water 170° − 180°F (76.7° − 82.2°C) pressure spray until clear water runs out.

NOTE: The Air Powered Degreaser/Spray Gun, #4Z668, may be used for the hot water spray flush.

5 Siphon the water from the compartment and empty it into a bucket.

NOTE: The flush process can use up to five (5) gallons of hot water to insure the compartment is fully cleaned.

CAUTION: MAKE SURE THE ALKALINE GEL IS FULLY FLUSHED FROM THE COMPARTMENT.

6 If the final flush water feels slippery when compared to tap water, some alkaline gel cleaner remains. Repeat the flush process until the water does not have a slippery feel.

(5) Clean the pressure and the scavenge tubes. Refer to SPOP 2.

NOTE: For an optional method to clean the pressure and the scavenge tubes, refer to SPOP 201, 203 or 209.

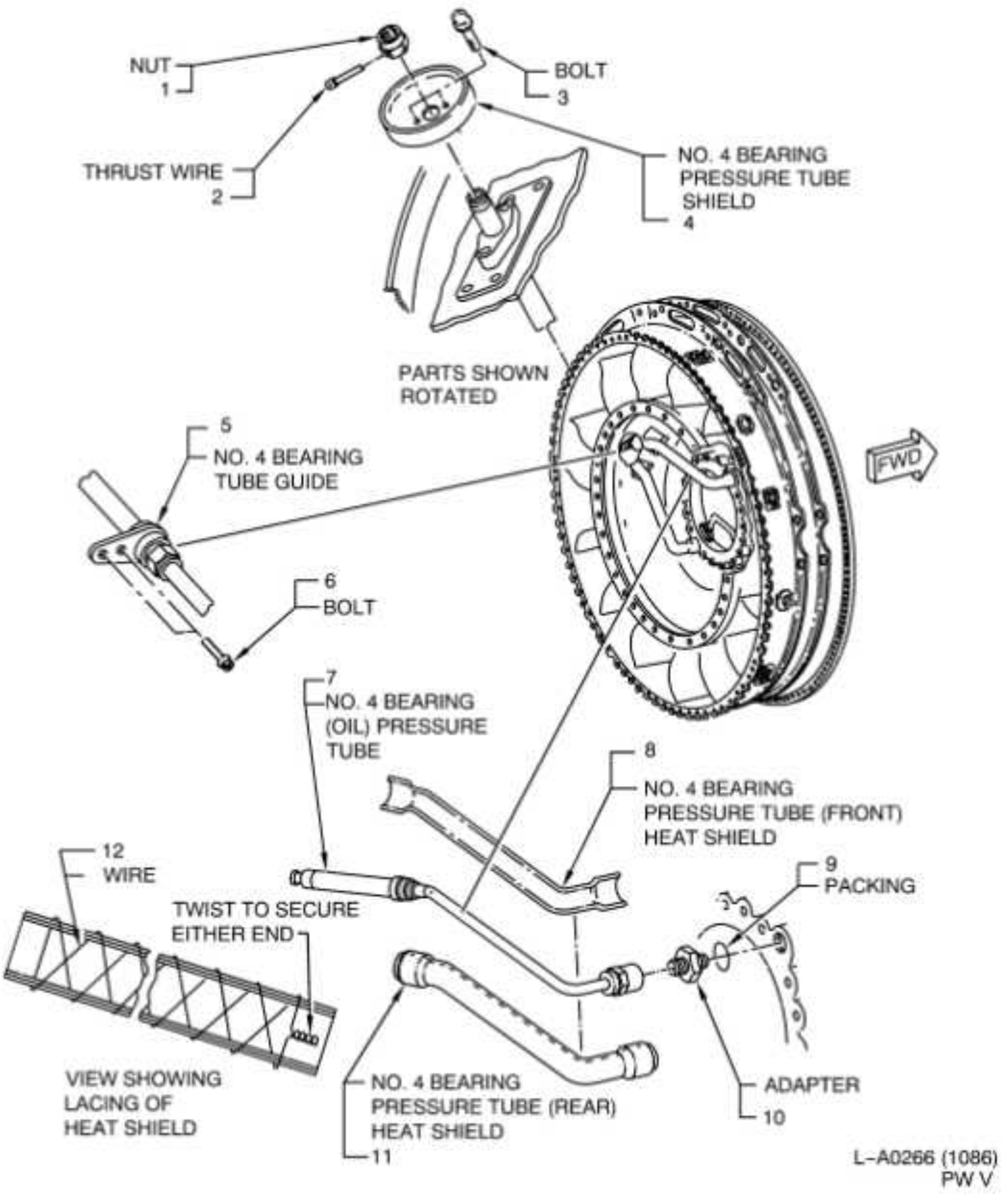
(a) Clean and flush the tubes as specified in step (4).

(6) Fully dry the No. 4 bearing compartment and the pressure and the scavenge tubes with filtered compressed air.

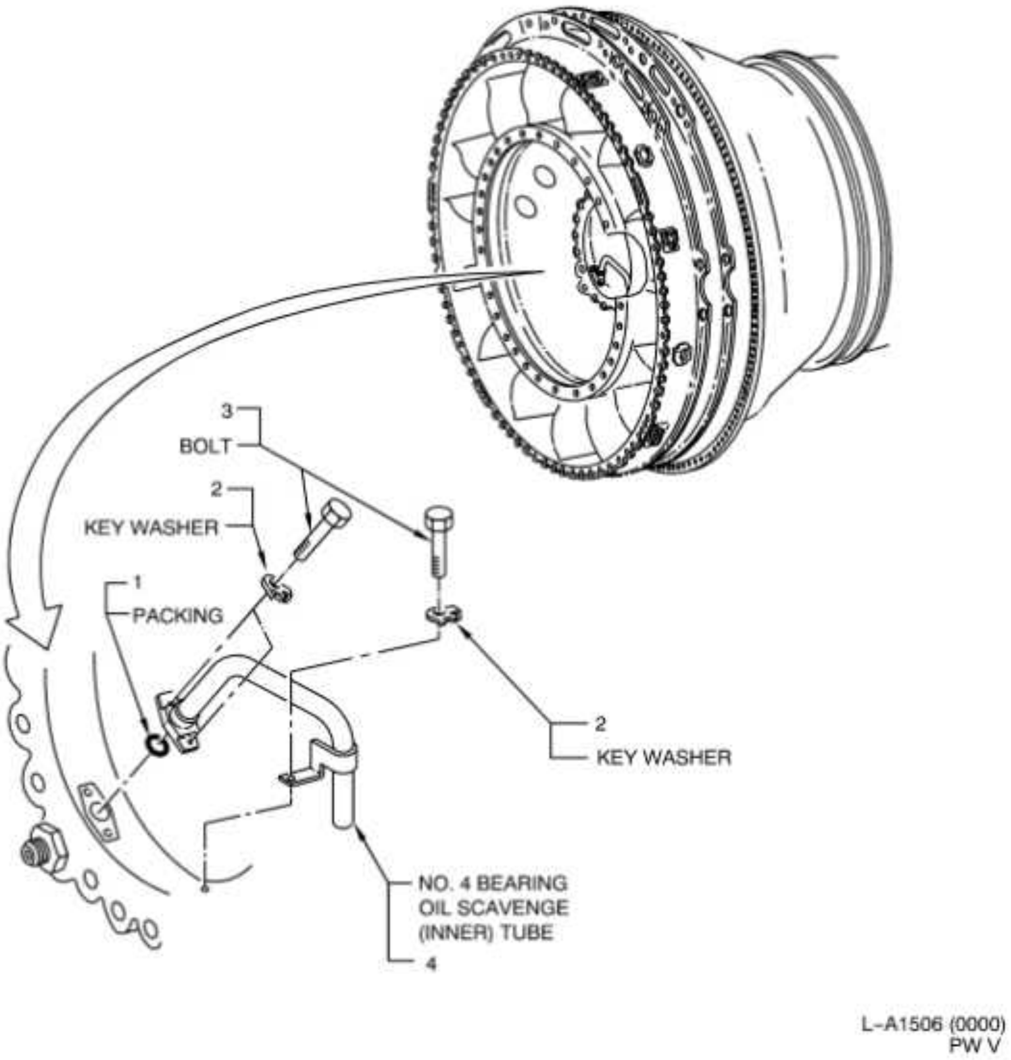
(7) Remove all rubber seals, tape, cloth and cover from the LPT shaft.

(8) Carefully flush any cleaner that remains from the LPT ares. Fully dry the area with air and a lint free cotton cloth.

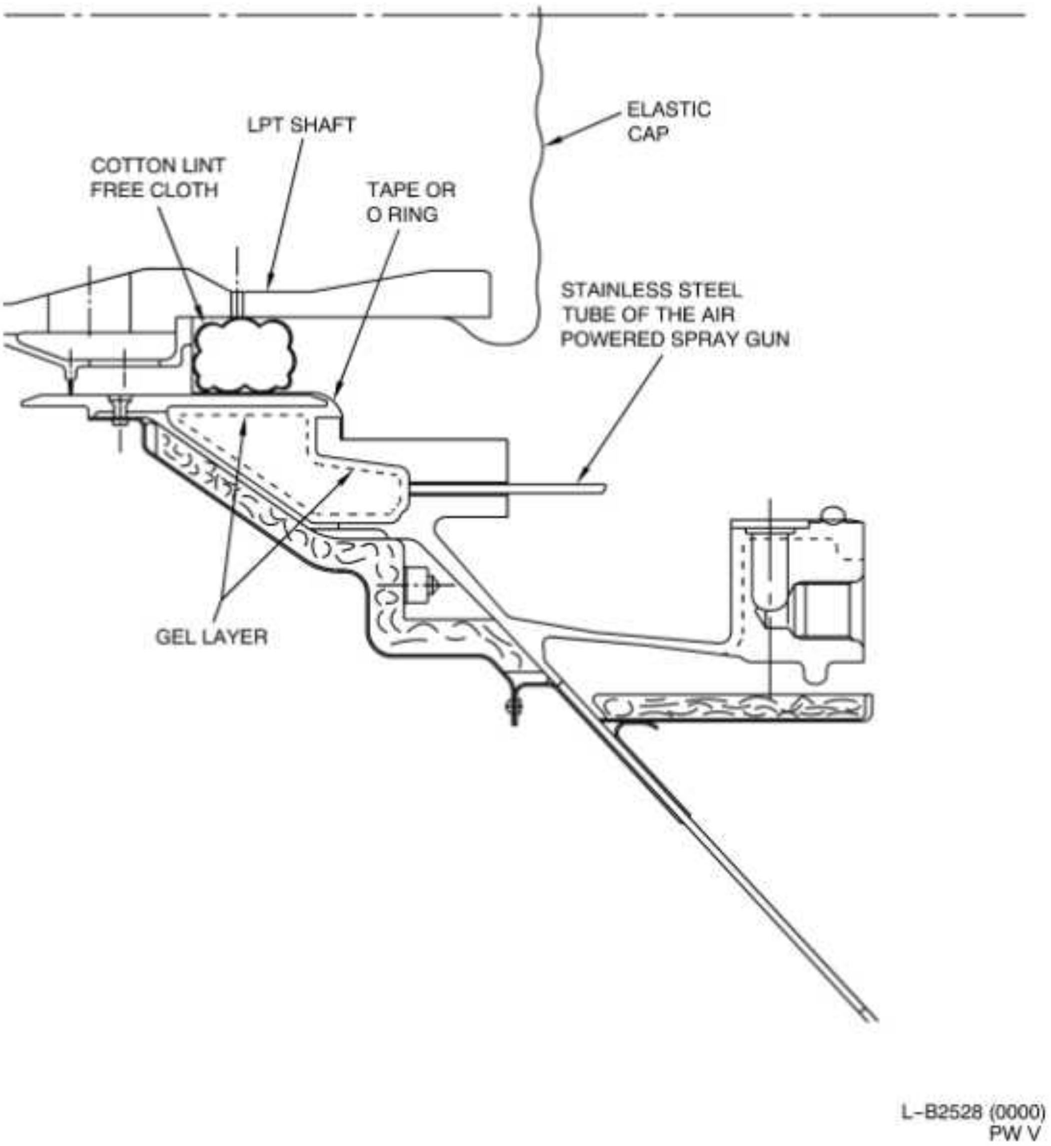
(9) Repeat steps (3) thru (8) if any coking remains.


NUT
1
BOLT
3
THRUST WIRE
2
NO. 4 BEARING
PRESSURE TUBE
SHIELD
4
PARTS SHOWN
ROTATED
5
NO. 4 BEARING
TUBE GUIDE
FWD
6
BOLT
7
NO. 4 BEARING
(OIL) PRESSURE
TUBE
8
NO. 4 BEARING
PRESSURE TUBE (FRONT)
HEAT SHIELD
12
WIRE
TWIST TO SECURE
EITHER END
9
PACKING
VIEW SHOWING
LACING OF
HEAT SHIELD
NO. 4 BEARING
PRESSURE TUBE (REAR)
HEAT SHIELD
11
ADAPTER
10
L−A0266 (1086)
PW V

No. 4 Bearing Pressure Tube Removal
Figure 601
(Task 72−00−54−110−001)

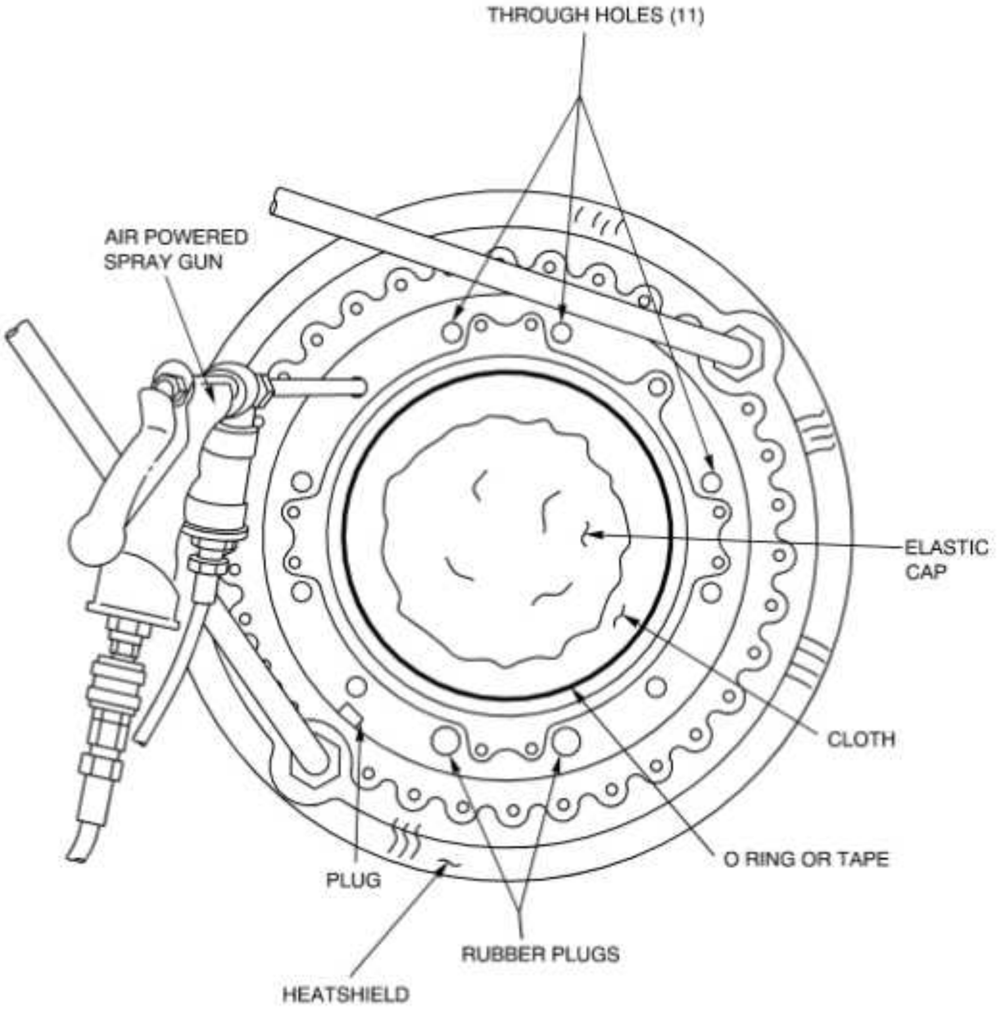

3
BOLT
2
KEY WASHER
1
PACKING
2
KEY WASHER
NO. 4 BEARING
OIL SCAVENGE
(INNER) TUBE
4
L-A1506 (0000)
PW V

No. 4 Bearing Scavenge Tube Removal
Figure 602
(Task 72−00−54−110−001)


ELASTIC CAP
LPT SHAFT
COTTON LINT FREE CLOTH
TAPE OR O RING
STAINLESS STEEL TUBE OF THE AIR POWERED SPRAY GUN
GEL LAYER
L−B2528 (0000)
PW V

No. 4 Bearing Front Cavity Cleaning
Figure 603
(Task 72−00−54−110−001)

ENGINE GENERAL − TURBINE EXHAUST CASE − CLEANING−03


THROUGH HOLES (11)
AIR POWERED SPRAY GUN
ELASTIC CAP
CLOTH
O RING OR TAPE
PLUG
RUBBER PLUGS
HEATSHIELD

L−B2529 (0000)
PW V

No. 4 Bearing Front Cavity Cleaning
Figure 604
(Task 72−00−54−110−001)

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ENGINE GENERAL − TURBINE EXHAUST CASE − INSPECTION/CHECK−01

Task 72−00−54−990−001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (−) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (−) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
819	B	Front Compressor Drive Turbine (LPT) Shaft (72−53−80) Stage 6 LPT Airseal (72−53−85) (See Figure 801)				
		Shaft	6.8595 (174.232)	6.8605 (174.256)		
		Airseal	6.857 (174.168)	6.859 (174.218)	.0005T (0.013T)	.0035T (0.088T)
820	B	Front Compressor Drive Turbine (LPT) Shaft (72−53−80) Stage 6 LPT Airseal (72−53−85) (See Figure 801)				
		Shaft	6.4999 (165.0975)	6.5005 (165.1127)		
		Airseal	6.497 (165.024)	6.499 (165.074)	.0009T (0.023T)	.0035T (0.088T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
821	B	Front Compressor Drive Turbine (LPT) Shaft (72−53−80) No. 4 Bearing Seal Spacer (72−54−80) (See Figure 801)				
		Shaft	6.4999 (165.0975)	6.5005 (165.1127)		
		Spacer	6.510 (165.35)	6.530 (165.86)	.0095 (0.24)	.0301 (0.76)
822	B	Front Compressor Drive Turbine (LPT) Shaft (72−53−80) No. 4 Bearing Seal (Rear) Spacer (72−54−82) (See Figure 801)				
		Shaft	6.4999 (165.0975)	6.5005 (165.1127)		
		Spacer	6.5005 (165.1127)	6.5011 (165.1279)	.0000 (0.000)	.0012 (0.030)
823	B	No. 4 Bearing Seal (Rear) Spacer (72−54−82) No. 4 Bearing Seal (Front) Spacer (72−54−80) (See Figure 801)				
		Rear Spacer	6.7945 (172.581)	6.7955 (172.605)		
		Front Spacer	6.7975 (172.657)	6.7985 (172.681)	.0020 (0.051)	.0040 (0.101)
824	A	Front Compressor Drive Turbine (LPT) Shaft (72−53−80) No. 4 Bearing (72−54−14) (See Figure 801)				
		Shaft	6.4999 (165.0975)	6.5005 (165.1127)		
		Bearing	6.4982 (165.0543)	6.4990 (165.0746)	.0009T (0.023T)	.0023T (0.058T)
825	B	No. 4 Bearing (Inner Race) Retaining Plate (72−53−84) Front Compressor Drive Turbine (LPT) Shaft (72−53−80) (See Figure 801)				
		Plate	5.502 (139.751)	5.504 (139.801)		
		Shaft	5.498 (139.650)	5.502 (139.750)	.000T (0.000T)	.006T (0.152T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
826	B	Rear Turbine (LPT) Case Assembly (72−53−17) Turbine Exhaust Case Assembly (72−54−01) (See Figure 802)				
		Turbine Case	57.560 (1462.024)	57.564 (1462.125)		
		Exhaust Case	57.552 (1461.821)	57.560 (1462.024)	.064* (1.626)*	.012T (0.30T)
829	A	Gap, No. 4 Bearing (Carbon) Face Seal Ring (72−54−81) (See Figure 801)				
		Gap			.020 (0.51)	.030 (0.76)
		Seal Ring Installed In Ring Gage 8.160 (207.264) Diameter (Ring Gage)				
		Gap			.017 (0.43)	.033 (0.84)
		Seal Ring Installed In Turbine Exhaust Case Assembly 8.159 (207.239) 8.161 (207.289) Diameter (Case)				
841	B	No. 4 Bearing Cover Assembly (72−54−83) Turbine Exhaust Case Assembly (72−54−01) (See Figure 801)				
		Cover	10.876 (276.251)	10.878 (276.301)		
		Case	10.880 (276.352)	10.884 (276.453)	.002 (0.051)	.008 (0.202)
842	B	No. 4 Bearing (Inner Race) Retaining Plate (72−53−84) Front Compressor Drive Turbine (LPT) Shaft (72−53−80) (See Figure 801)				
		Plate	5.444 (138.278)	5.446 (138.328)		
		Shaft	5.448 (138.380)	5.452 (138.480)	.002 (0.051)	.008 (0.203)
843	A	Stage 6 LPT Airseal (72−53−85) Turbine Exhaust Case Assembly (72−54−01) (See Figure 801)				
		Airseal	8.118 (206.198)	8.122 (206.298)		
		Case	8.159 (207.239)	8.161 (207.289)	.037 (0.940)	.055* (1.400)*

G. Special Torques

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
978	A	Perimeter Bolts And Nuts At P-Flange (See Figure 803) See 72-00-54, Installation-01 (Task 72-00-54-420-001)				
2151	A	Hose/Tube Clamp Screws See 72-00-54, Installation-02 (Task 72-00-54-420-003)				
2157	A	Electrical Connector See 72-00-54, Installation-09 (Task 72-00-54-450-006-A00) And (Task 72-00-54-450-006-B00)				
2273	A	Terminal Box Nut (Alumel) Terminal Box Nut (Chromel) See 72-00-54, Installation-04 (Task 72-00-54-450-002-A00) And (Task 72-00-54-450-002-B00) See 72-00-54, Installation-05 (Task 72-00-54-450-003-A00) And (Task 72-00-54-450-003-B00) See 72-00-54, Installation-10 (Task 72-00-54-450-007)				

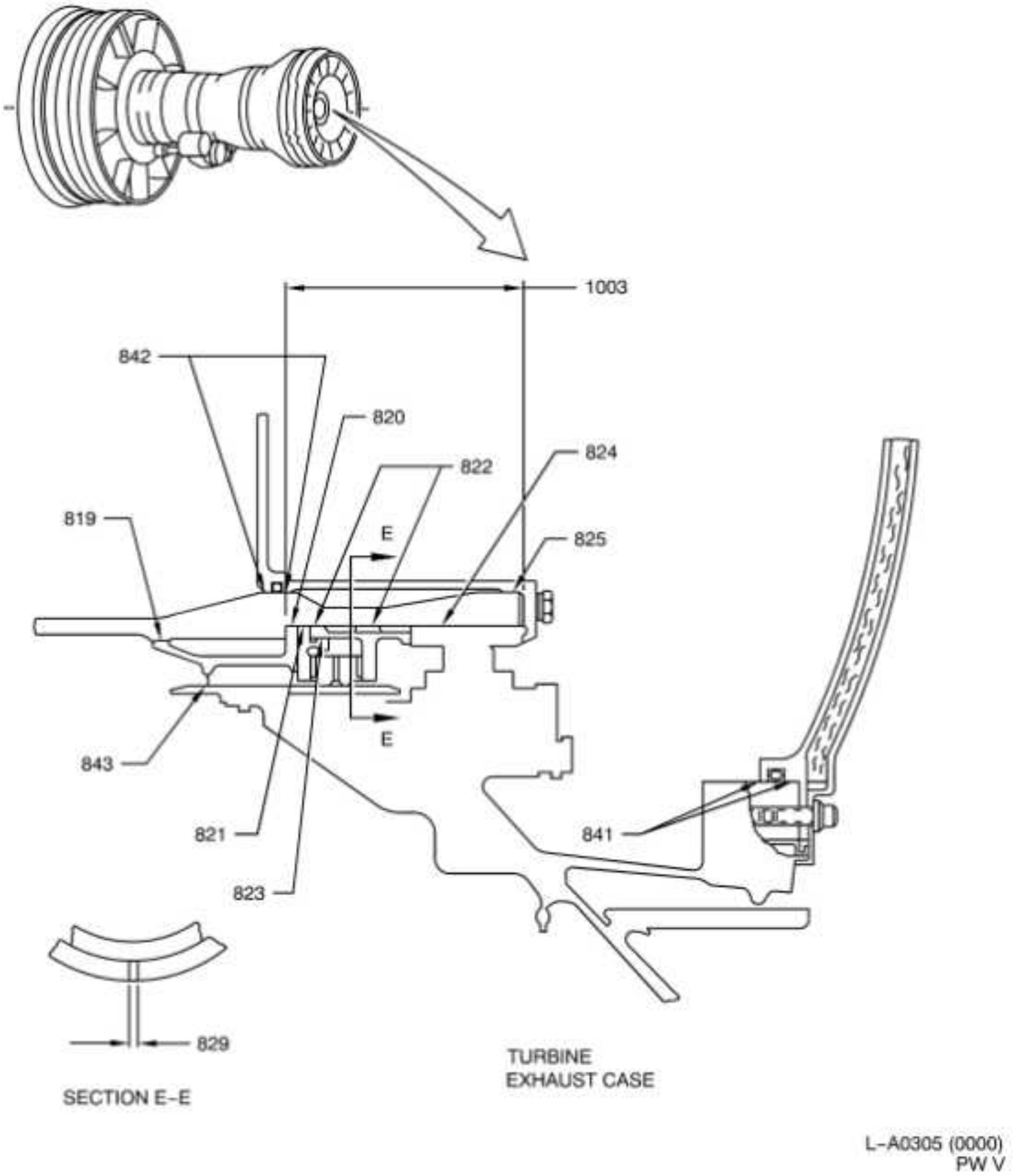
H. Special Assembly Procedure

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
90	A	Gap, No. 4 Bearing (Outer Race) Retaining Plate To No. 4 Roller Bearing (See Figure 804) See 72-00-54, Installation-08 (Task 72-00-54-420-001)				

ENGINE GENERAL − TURBINE EXHAUST CASE − INSPECTION/CHECK−01

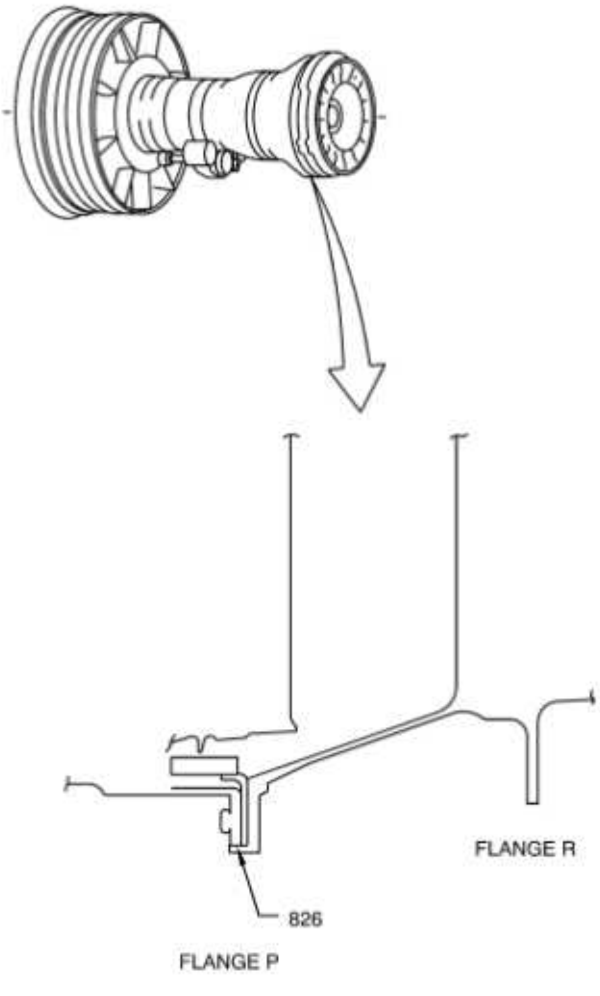
Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1003	A	Bottoming Procedure − Stage 6 LPT Airseal And No. 4 Bearing Seal Spacers On Front Compressor Drive Turbine (LPT) Shaft (See Figure 801) See 72−00−54, Installation−01 (Task 72−00−54−420−001) See 72−00−54, Installation−08 (Task 72−00−54−420−002)				
2261	A	Procedure For Assembling Diffuser Case Tube Locks See 72−00−54, Installation−02 (Task 72−00−54−420−003)				

ENGINE GENERAL − TURBINE EXHAUST CASE − INSPECTION/CHECK−01

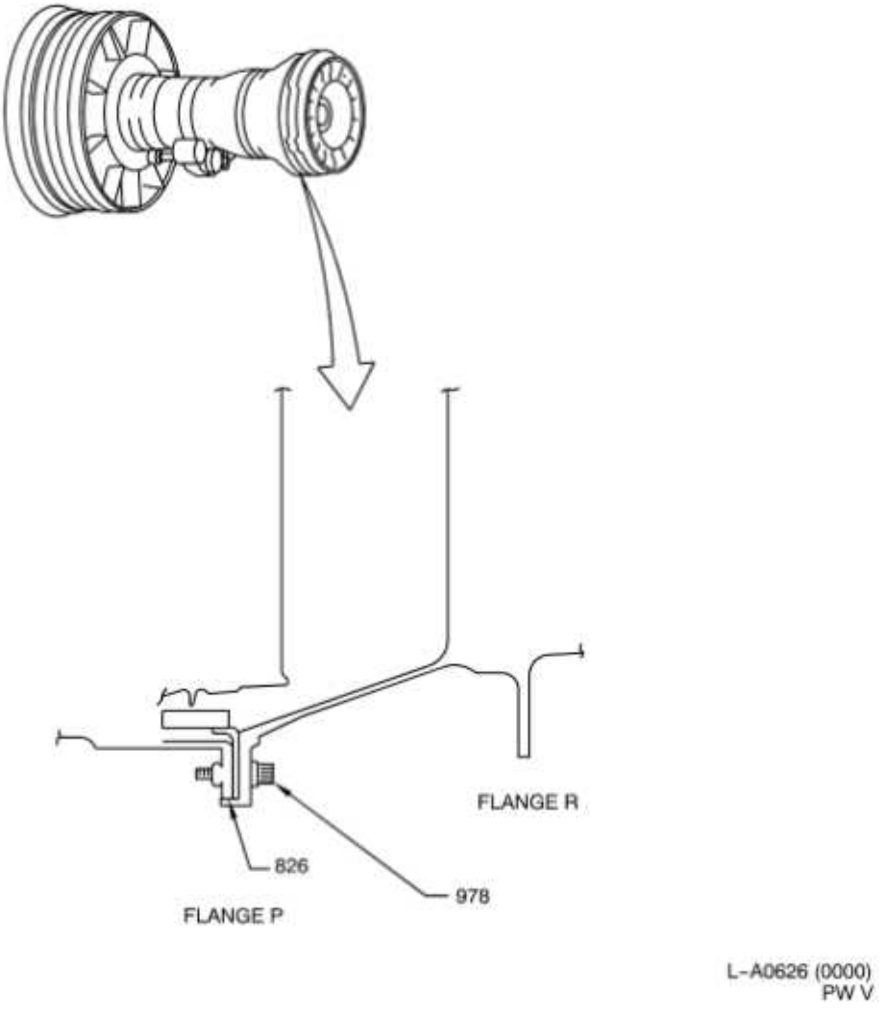

1003
842
820
822
824
819
E
825
E
843
841
821
823
829
SECTION E-E
TURBINE EXHAUST CASE
L-A0305 (0000)
PW V

Turbine Exhaust Case Assembly
Figure 801
(Task 72−00−54−990−001)

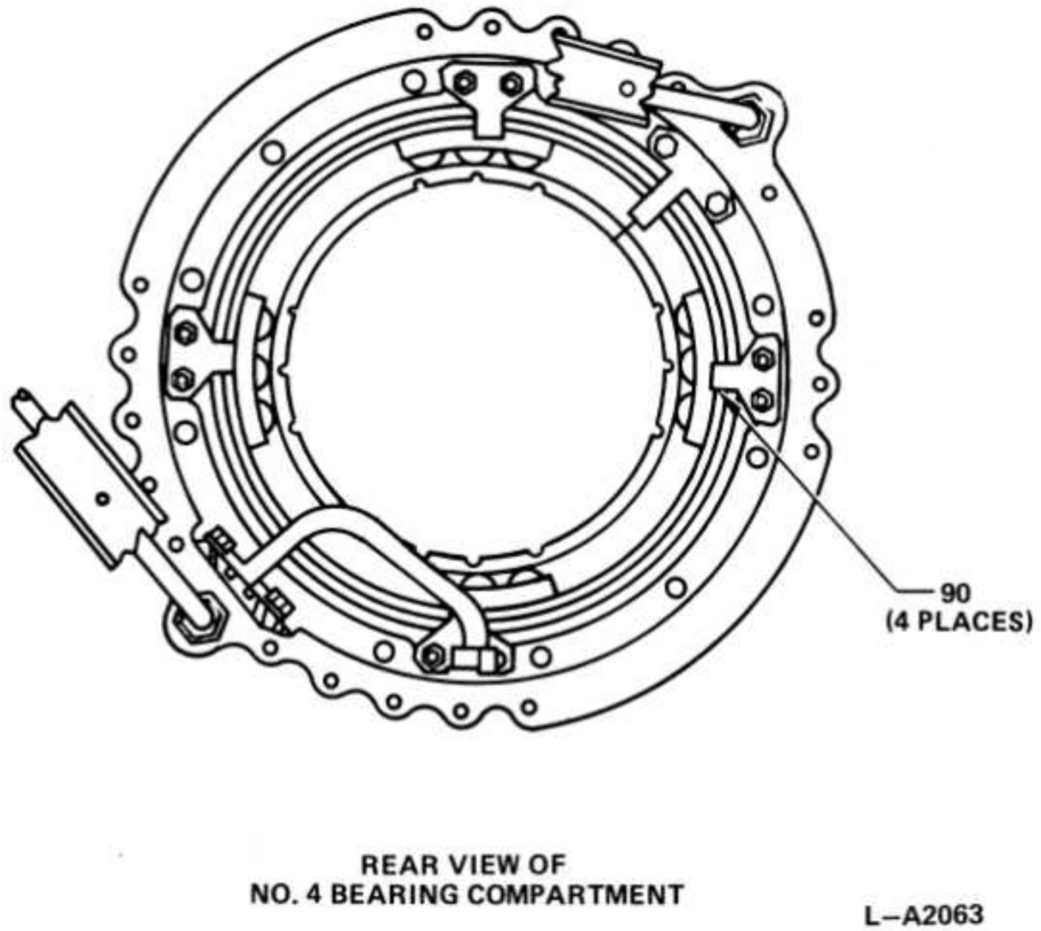
ENGINE GENERAL − TURBINE EXHAUST CASE − INSPECTION/CHECK−01


FLANGE R
826
FLANGE P
L-A0289 (0000)
PW V

Turbine Exhaust Case Assembly
Figure 802
(Task 72−00−54−990−001)


FLANGE R
826
978
FLANGE P
L-A0626 (0000)
PW V

Turbine Exhaust Case Assembly
Figure 803
(Task 72−00−54−990−001)


90
(4 PLACES)
REAR VIEW OF
NO. 4 BEARING COMPARTMENT
L−A2063

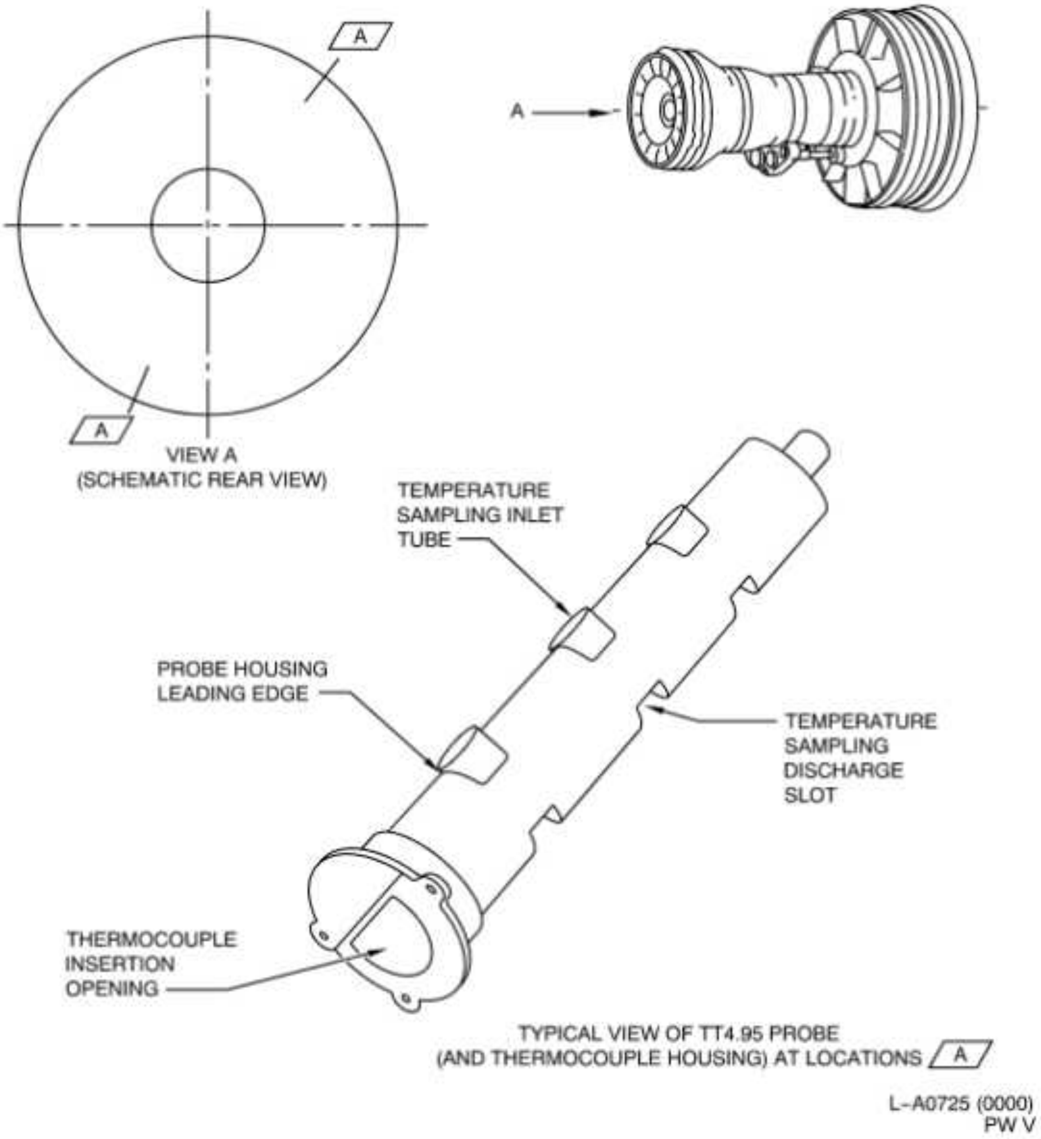
Turbine Exhaust Case Assembly
Figure 804
(Task 72−00−54−990−001)

Previous Pageblock Return to Previous Menu Next Pageblock

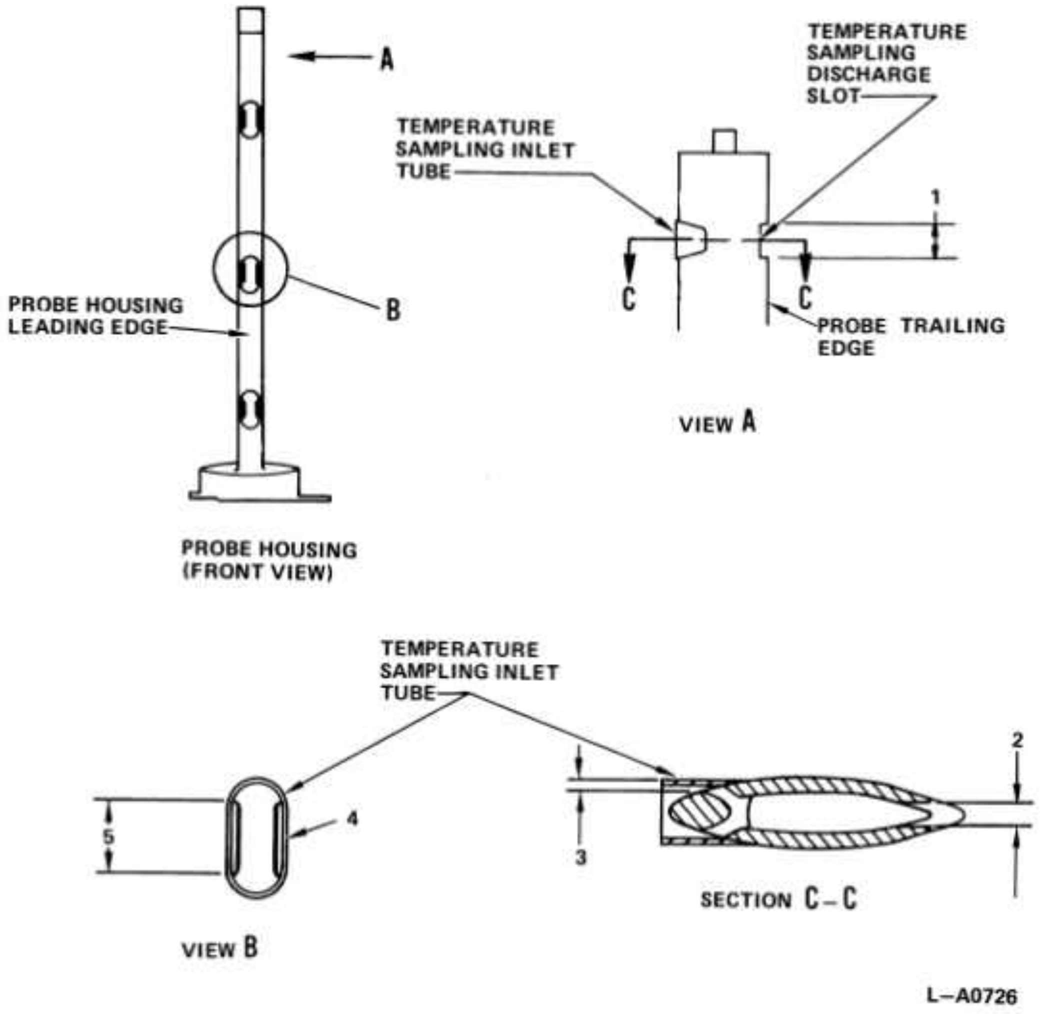
ENGINE GENERAL − TURBINE EXHAUST CASE − INSPECTION/CHECK−03

Task 72−00−54−210−001:

1. Inspect EGT (TT4.95) Thermocouple Housing
   A. Prerequisites
      (1) Remove EGT (TT4.95) Thermocouple Housing per Removal−07 (Task 72−00−54−050−005).
   B. Equipment And Materials Required − None
   C. Visual Inspection
      See Figures 801 and 802.
      (1) Inspect probe housing for nicks, dents cracks and deformation. See Figure 801.
         (a) Nicks and dents are acceptable.
         (b) Deformation due to heat is acceptable provided assembly into engine or thermocouple installation is not affected.
         (c) Cracked probe housings should be rejected.
      (2) Inspect three temperature sampling tubes and six slots on leading edge or probe casting for obstructions to flowpath. Line of sight flowpath to probe slots on leading edge of housing should be maintained.
      (3) Three temperature sampling discharge slots on probe housing, trailing edge should be open to minimum width and length shown in Figure 802 (Indexes 2 and 1) as viewed from the rear.
      (4) The temperature sensing slots on probe leading edge and surrounded by inlet tubes must be open to minimum width and length shown in Figure 802 (Indexes 3 and 5) as viewed from the front.
   D. Postrequisites
      (1) Install EGT (TT4.95) Thermocouple Housing per Installation−07 (Task 72−00−54−450−005).


A
A
A
VIEW A
(SCHEMATIC REAR VIEW)
TEMPERATURE SAMPLING INLET TUBE
PROBE HOUSING LEADING EDGE
TEMPERATURE SAMPLING DISCHARGE SLOT
THERMOCOUPLE INSERTION OPENING
TYPICAL VIEW OF TT4.95 PROBE (AND THERMOCOUPLE HOUSING) AT LOCATIONS A
L-A0725 (0000)
PW V

EGT (TT4.95) Thermocouple Housing
Figure 801
(Task 72−00−54−210−001)


A
TEMPERATURE SAMPLING DISCHARGE SLOT
TEMPERATURE SAMPLING INLET TUBE
1
C
C
PROBE HOUSING LEADING EDGE
B
PROBE TRAILING EDGE
VIEW A
PROBE HOUSING (FRONT VIEW)
TEMPERATURE SAMPLING INLET TUBE
2
5
4
3
SECTION C–C
VIEW B
L–A0726

1. 0.700 Inch (17.780 mm) Minimum Slot Length
2. 0.160 Inch (4.064 mm) Minimum Slot Width
3. 0.050 Inch (1.270 mm) Minimum Slot Width
4. 80 Percent Of Slot Should Be Visible If Viewed From The Front
5. 0.350 Inch (8.890 mm) Minimum Open Slot Length

EGT (TT4.95) Thermocouple Housing
Figure 802
(Task 72−00−54−210−001)

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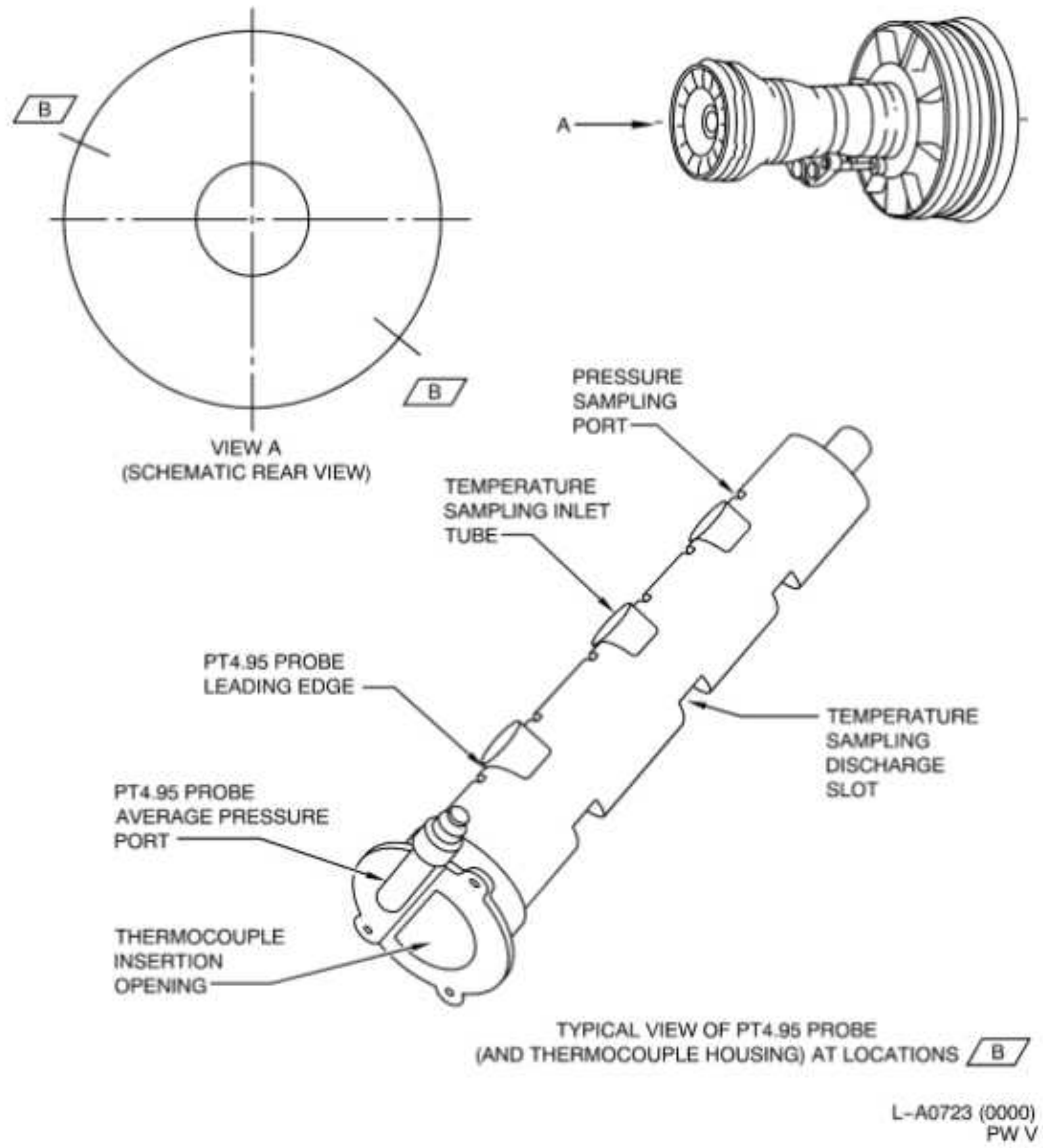
ENGINE GENERAL − TURBINE EXHAUST CASE − INSPECTION/CHECK−04

Task 72−00−54−210−002:

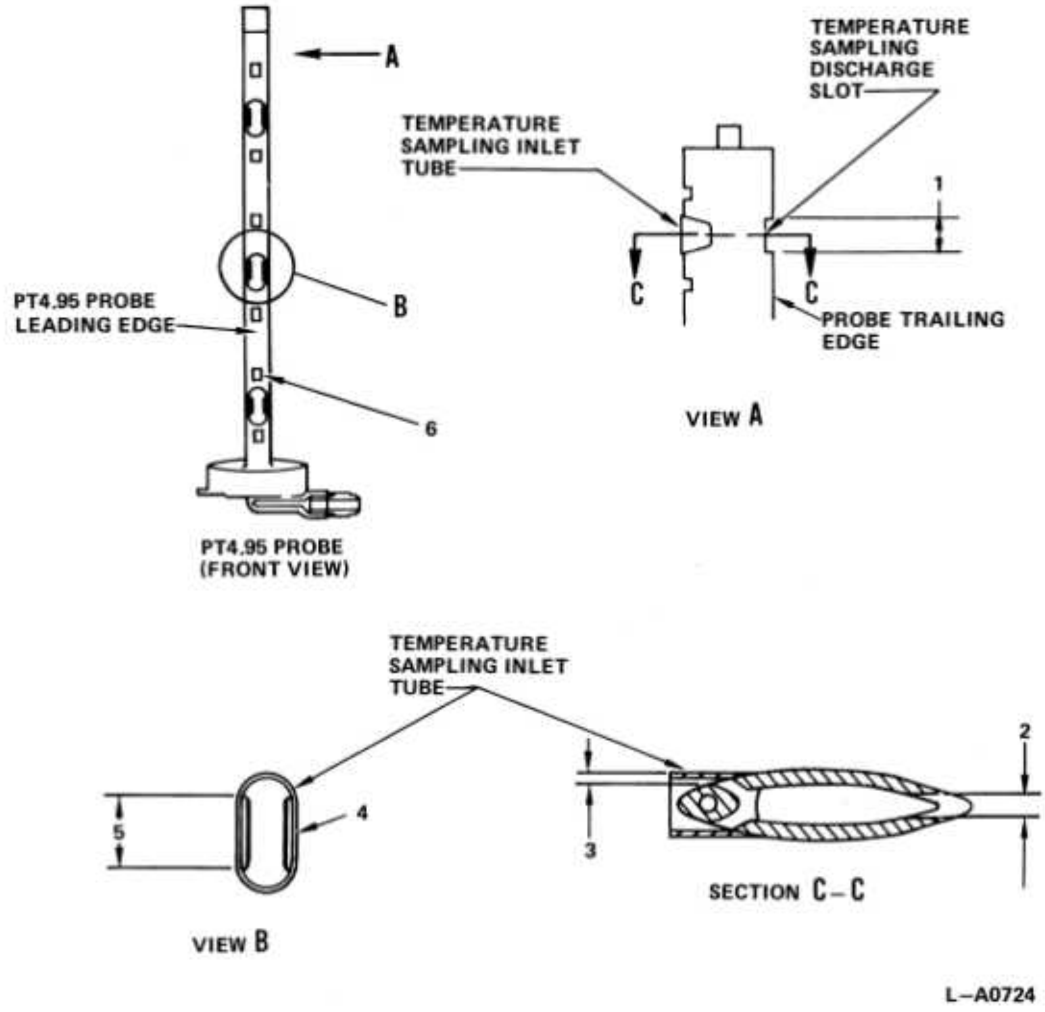
1. Inspect Exhaust Gas Average Pressure (And Thermocouple Housing) PT4.95 Probe
   - A. Prerequisites
     - (1) Remove Exhaust Gas Average Pressure (and thermocouple housing) PT4.95 Probe per Removal−03 (Task 72−00−54−050−001).
   - B. Equipment And Materials Required − None
   - C. Visual Inspection

     See Figures 801 and 802.
     - (1) Inspect probe for nicks, dents, cracks and deformation. See Figure 801.
       - (a) Nicks and dents are acceptable.
       - (b) Deformation due to heat is acceptable provided that assembly into the engine and thermocouple installation is not affected.
       - (c) Cracked probes should be rejected.
     - (2) Inspect probe pressure port for thread damage. Repair thread as required.
     - (3) Inspect temperature sampling tubes and slots in leading edge of probe casting for obstructions to flowpath. Line of sight flowpath to probe slots on leading edge of probe should be maintained.
     - (4) Six pressure sampling ports on leading edge of probes must be open to minimum of Figure 802 (Index 6). It is permissible to use a 0.030 inch (0.762 mm) diameter hand−held drill to unplug holes, or clean per Cleaning−XX.
     - (5) The temperature sensing slots on probe leading edge and surrounded by an inlet tube must be open to minimum width and length shown in Figure 802 (Indexes 3 and 5) as viewed from the front.
     - (6) Three temperature sampling discharge slots on probe trailing edge should be open to minimum width and length shown in Figure 802 (Indexes 2 and 1) as viewed from the rear.
   - D. Postrequisites
     - (1) Install Exhaust Gas Average Pressure (and thermocouple housing) PT4.95 Probe per Installation−03 (Task 72−00−54−450−001).

ENGINE GENERAL − TURBINE EXHAUST CASE − INSPECTION/CHECK−04


B
B
A
VIEW A
(SCHEMATIC REAR VIEW)
PRESSURE SAMPLING PORT
TEMPERATURE SAMPLING INLET TUBE
PT4.95 PROBE LEADING EDGE
TEMPERATURE SAMPLING DISCHARGE SLOT
PT4.95 PROBE AVERAGE PRESSURE PORT
THERMOCOUPLE INSERTION OPENING
TYPICAL VIEW OF PT4.95 PROBE (AND THERMOCOUPLE HOUSING) AT LOCATIONS B
L-A0723 (0000)
PW V

Exhaust Gas Average Pressure (And
Thermocouple Housing) PT4.95 Probe
Figure 801
(Task 72−00−54−210−002)


A
TEMPERATURE SAMPLING DISCHARGE SLOT
TEMPERATURE SAMPLING INLET TUBE
1
C
C
PROBE TRAILING EDGE
PT4.95 PROBE LEADING EDGE
B
6
VIEW A
PT4.95 PROBE (FRONT VIEW)
TEMPERATURE SAMPLING INLET TUBE
2
5
4
3
SECTION C−C
VIEW B
L−A0724

1. 0.700 Inch (17.780 mm) Minimum Slot Length
2. 0.160 Inch (4.064 mm) Minimum Slot Width
3. 0.050 Inch (1.270 mm) Minimum Slot Width
4. 80 Percent Of Slot Should Be Visible If Viewed From the Front
5. 0.350 Inch (8.890 mm) Minimum Open Slot Length
6. Pressure Sampling Port. Open To 0.030 Inch (0.762 mm) Minimum Diameter.

Exhaust Gas Average Pressure (And
Thermocouple Housing) PT4.95 Probe
Figure 802
(Task 72−00−54−210−002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − TURBINE EXHAUST CASE − INSPECTION/CHECK−05

Task 72−00−54−210−003:

1. Visually Inspect EGT (TT4.95) Thermocouple
    - A. Equipment And Materials Required − None
    - B. Procedure
        - (1) Inspect exposed surfaces of thermocouple for cracks.
        - (2) Reject thermocouples with cracks.

          NOTE: Minor nicks are not cause for rejection.

        - (3) Inspect terminals for looseness or thread damage.
    - C. Postrequisite Procedures
        - (1) Check continuity and electrical insulation resistance per Testing−01 (Task 72−00−54−750−001).

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ENGINE GENERAL - TURBINE EXHAUST CASE - INSPECTION/CHECK-06

Task 72-00-54-210-004:

1. Inspect EGT (TT4.95) Box And Cable
    A. Equipment And Materials Required - None
    B. Procedure
        (1) Check EGT box and cable for evidence of damage to steel braid and to terminals.
        (2) Defective or rejected EGT box and cable fall into two basic categories.
            (a) Damaged or frayed braid.
            (b) Damaged or broken terminals and/or brackets.

NOTE: Replace left or right thermocouple cable, as required.

    C. Postrequisite Procedures
        (1) Check continuity and electrical insulation resistance per Testing-02 (Task 72-00-54-750-002).

Task 72-00-54-200-001:

1. No. 4 Bearing Compartment Vacuum Check

A. Equipment And Materials Required

Standard Tools:
CTE 6075 Vacuum Cart
Bergen Mechanical Crimper (Optional) Model M303, M305 Or M307

Special Tools:
PWA 85843 Adapter
PWA 85978 Plug, Vacuum Check

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
R	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	79-21-00/12/230

B. Procedure

See Figure 801.

(1) Disconnect and loosen the (LR06) No. 4 bearing oil scavenge tube assembly.

(a) Remove the bolt, nut and clamp which holds the spray shield to Flange M bracket at approximately the 7 o'clock position. Remove the hose clamp from the forward end of the spray shield and remove the shield from the engine. Remove the lockwire and disconnect the tube nut from the tube coupling.

(b) Remove the lockwire and disconnect the tube elbow from the exhaust case internal tube nut approximately the 10 o'clock position.

(c) Remove the bolts, nuts and clamps which hold the tube to the Flanges N and P brackets. Close the tube openings for protection.

(d) Remove the bolt, spacer, nut and clamp which holds the tube to the adjacent scavenge tube.

(2) Install PWA 85843 Adapter into the tube coupling nut.

(3) Remove the No. 4 bearing strainer housing.

(a) Remove the hose clamp which holds the spray shield to the rear tube connection on the exhaust case at approximately the 10:30 o'clock position. Remove the shield from the engine. Remove the lockwire and disconnect the tube nut from the strainer housing.

(b) Remove the lockwire and disconnect the strainer housing from the exhaust case internal tube nut at approximately the 10:30 o'clock position.

(c) Close the tube openings for protection.

(4) Install PWA 85978 Plug into the tube coupling nut.

(5) Attach the vacuum hose and the pressure line to the CTE 6075 Vacuum Cart.

(6) Set the vacuum cart pressure at PAMB minus 10 psi (69 kPa), or PAMB minus 20 inches (508 mm) HG. At sea level this is 5.0 psia (34.5 kPa absolute). Find the airflow leakage rate into the No. 4 bearing compartment. The maximum airflow leakage is 10 PPH (4.54 kg per hour).

NOTE: During the vacuum test, and except as specified in this procedure, all the oil supply tubes, breather tubes, and scavenge tubes must be installed. During the vacuum test gearbox covers for the integrated drive generator and both hydraulic pump pads must be installed.

(7) Remove PWA 85843 Adapter from the coupling nut. Close the tube openings with standard shop fittings.

(8) Install the No. 4 bearing strainer housing.

(a) Install the strainer housing, threads lubricated with Engine Oil P03−001, to the exhaust case internal tube nut at approximately the 10:30 o'clock position, tighten by hand.

(b) Install the (LP16) No. 4 bearing oil pressure tube assembly to the strainer housing. Install the tube, threads lubricated with Engine Oil P03−001, to the strainer housing on the exhaust case, tighten by hand.

(9) Connect and clamp the (LR06) No. 4 bearing oil scavenge tube assembly.

(a) Remove protection and install tube elbow with
R nut threads lubricated with Antiseize Paste
R P06−054, to the exhaust case internal tube nut at
approximately the 10 o'clock position, and to the
tube coupling forward of Flange M at approximately
R the 7 o'clock position, tighten by hand. Remove
R unwanted paste.

(b) Install the clamps, bolts, threads lubricated with Engine Oil P03−001, and nuts which hold the tube to Flanges N and P brackets. Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Install the clamp, bolt, threads lubricated with Engine Oil P03−001, spacer, and nuts to hold the (LR06) tube to the adjacent (LP16) No. 4 bearing oil pressure tube assembly.

(d) Torque the tube nut at the exhaust case connection to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(e) Torque the tube nut at Flange N connection to 475 − 525 lb−in. (53.668 − 59.317 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

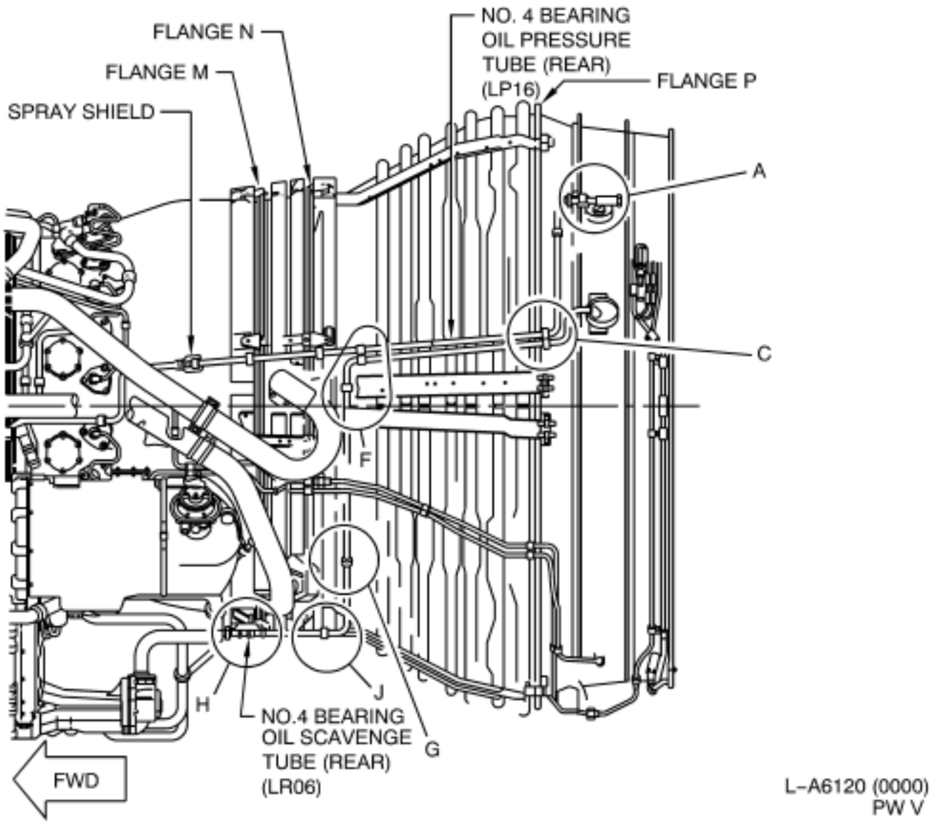
(f) (Reference 2151) Install the spray shield to the inboard side of Flange N connection and attach the forward end of the shield with a hose clamp. Torque hose clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(g) Secure the clamp to the rear end of the shield and Flange M bracket with a bolt, threads lubricated with Engine Oil P03−001, and nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

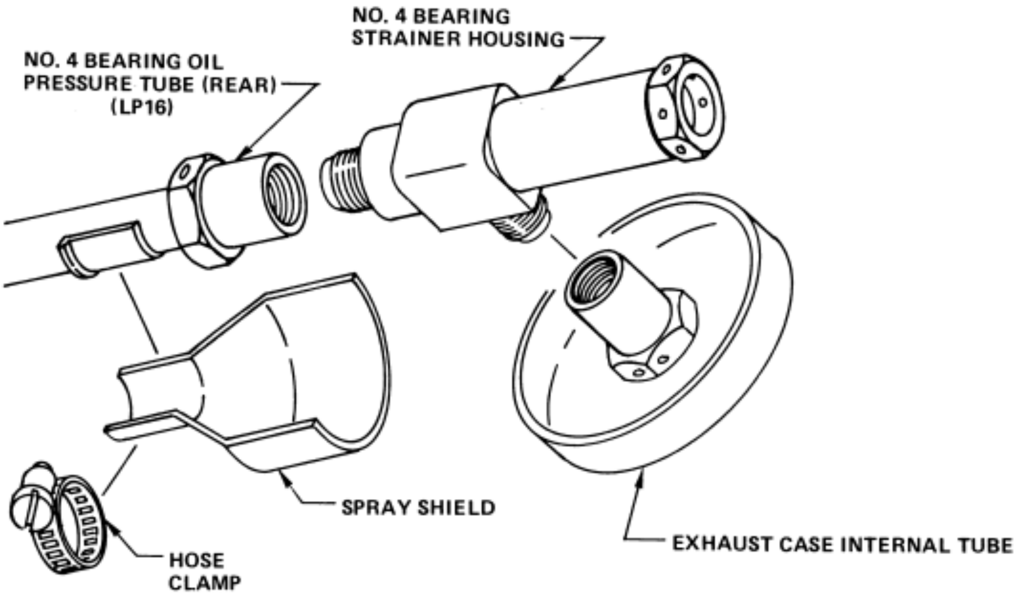
(10) Torque the (LP16) No. 4 bearing oil pressure tube nut to the strainer housing. Torque the tube nut to 450 − 500 lb−in. (50.843 − 56.492 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(11) Torque the exhaust case internal tube nut to the last chance strainer housing to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

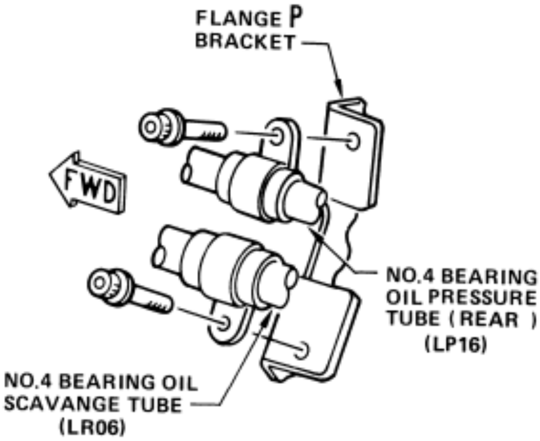
(12) (Reference 2151) Install the spray shields to the inboard side of the front and rear connections and attach with hose clamps. Torque the hose clamps to 15 − 18 lb−in. (1.695 − 2.034 N.m).


FLANGE N
FLANGE M
SPRAY SHIELD
NO. 4 BEARING OIL PRESSURE TUBE (REAR) (LP16)
FLANGE P
A
C
F
H
J
G
NO.4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
FWD
L−A6120 (0000)
PW V

No. 4 Bearing Compartment Vacuum Test
Figure 801 (Sheet 1)
(Task 72−00−54−200−001)


NO. 4 BEARING STRAINER HOUSING
NO. 4 BEARING OIL PRESSURE TUBE (REAR) (LP16)
SPRAY SHIELD
HOSE CLAMP
EXHAUST CASE INTERNAL TUBE

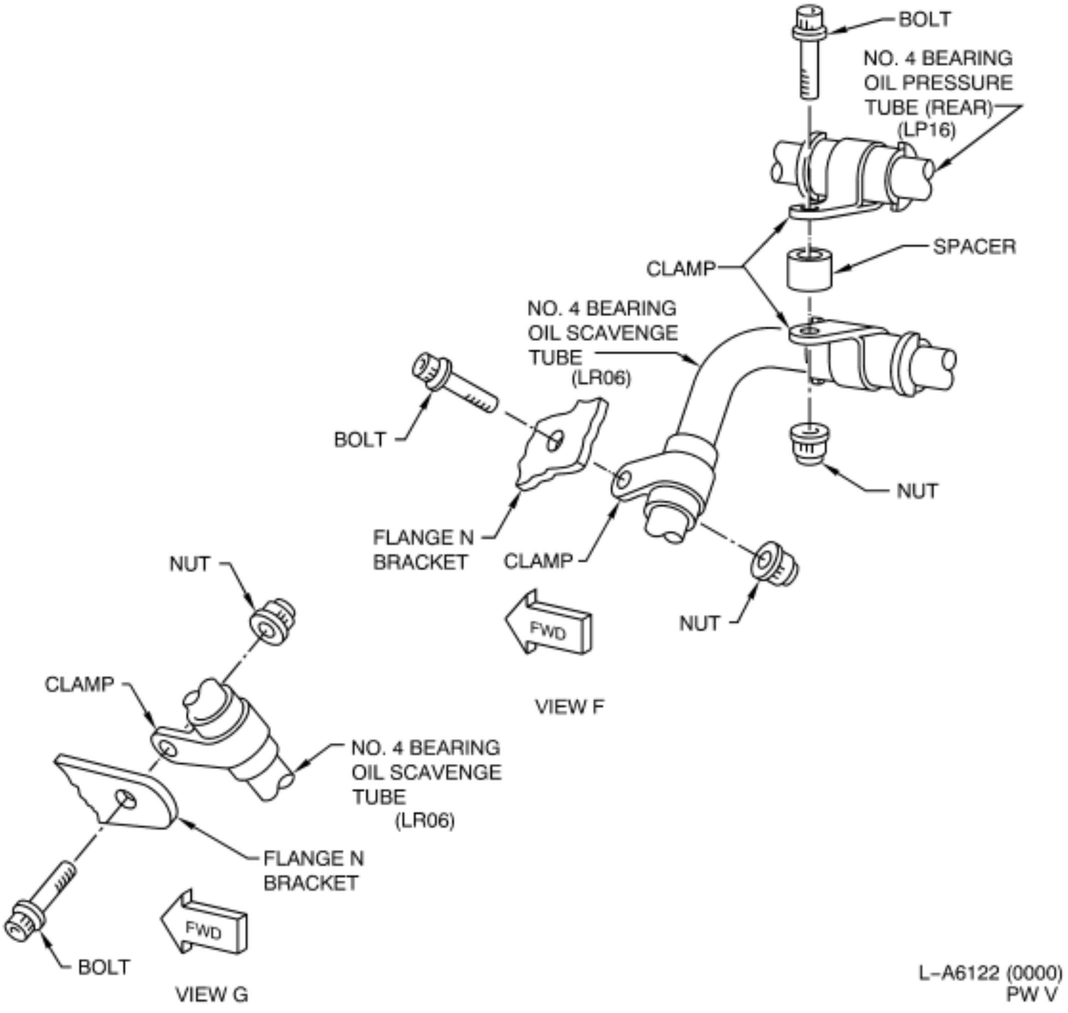
VIEW A


FLANGE P BRACKET
FWD
NO.4 BEARING OIL PRESSURE TUBE (REAR) (LP16)
NO.4 BEARING OIL SCAVANGE TUBE (LR06)

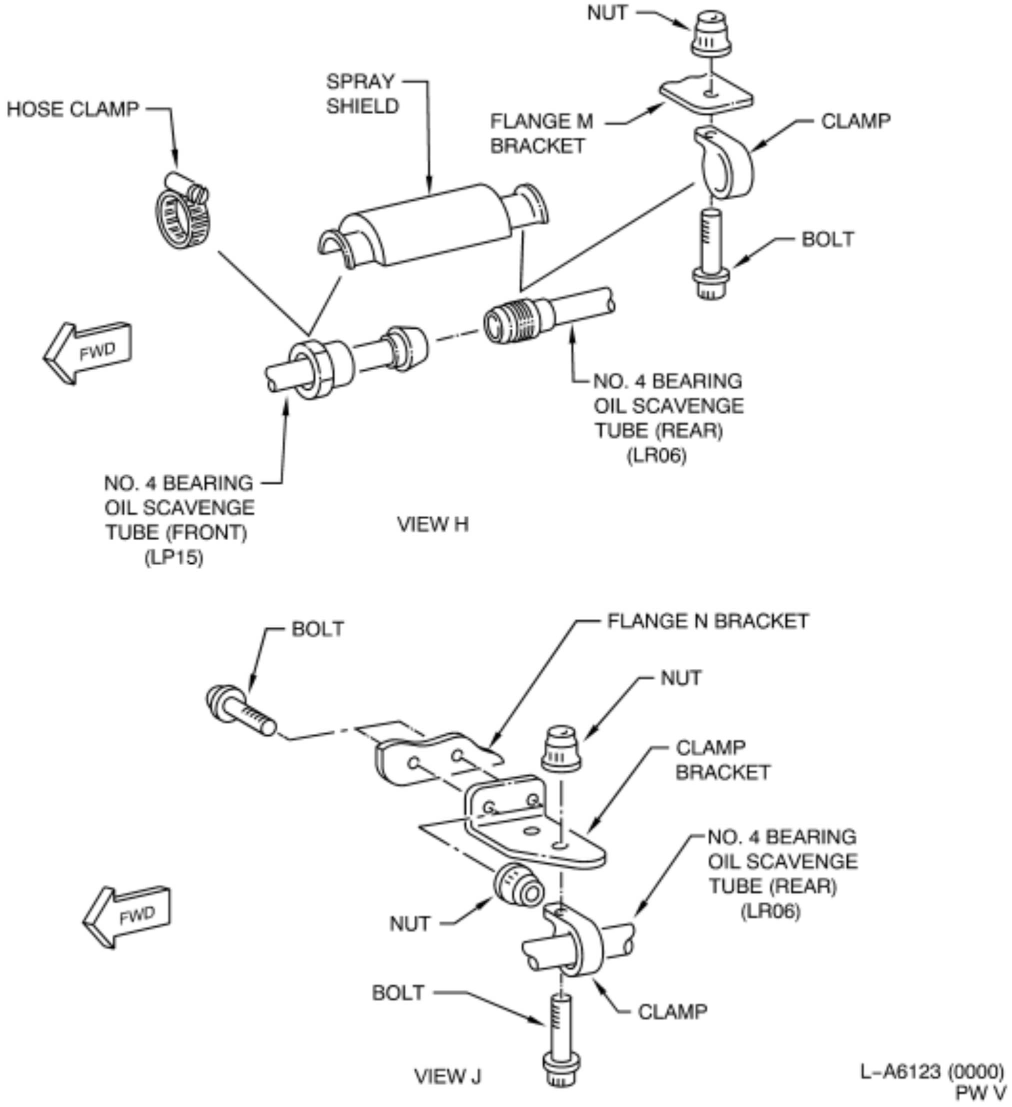
VIEW C

L-A6121

No. 4 Bearing Compartment Vacuum Test
Figure 801 (Sheet 2)
(Task 72-00-54-200-001)


BOLT
NO. 4 BEARING OIL PRESSURE TUBE (REAR) (LP16)
SPACER
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
BOLT
NUT
FLANGE N BRACKET
CLAMP
NUT
FWD
VIEW F
NUT
CLAMP
NO. 4 BEARING OIL SCAVENGE TUBE (LR06)
FLANGE N BRACKET
FWD
BOLT
VIEW G
L−A6122 (0000)
PW V

No. 4 Bearing Compartment Vacuum Test
Figure 801 (Sheet 3)
(Task 72−00−54−200−001)


NUT
SPRAY SHIELD
HOSE CLAMP
FLANGE M BRACKET
CLAMP
BOLT
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
NO. 4 BEARING OIL SCAVENGE TUBE (FRONT) (LP15)
VIEW H
BOLT
FLANGE N BRACKET
NUT
CLAMP BRACKET
NO. 4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
FWD
NUT
BOLT
CLAMP
VIEW J
L-A6123 (0000)
PW V

No. 4 Bearing Compartment Vacuum Test
Figure 801 (Sheet 4)
(Task 72-00-54-200-001)

ENGINE GENERAL − TURBINE EXHAUST CASE − INSPECTION/CHECK−08

Task 72−00−54−210−005:

1. Visually Inspect Turbine Exhaust Case, Pressure And Scavenge Tubes

   A. Equipment And Materials Required − None

   B. Procedure

      (1) Check the turbine exhaust case, the pressure tube and the scavenge tube for coking.

      (2) Excessive coking must be removed. Refer to 72−00−54 Cleaning−03, Clean Coke From The Turbine Exhaust Case, Pressure And Scavenge Tubes (Task 72−00−54−110−001).

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ENGINE GENERAL - TURBINE EXHAUST CASE - TESTING-01

Task 72-00-54-750-001:

1. Test EGT (TT4.95) Thermocouple
   A. Equipment And Materials Required

      Standard Tools:

Name	Manufacturer
Electronic Multimeter Model 2795	Simpson Electric Co. American Gage & Machine Co. (Katy Industries Inc.), 853 Dundee Avenue Elgin, IL 60120

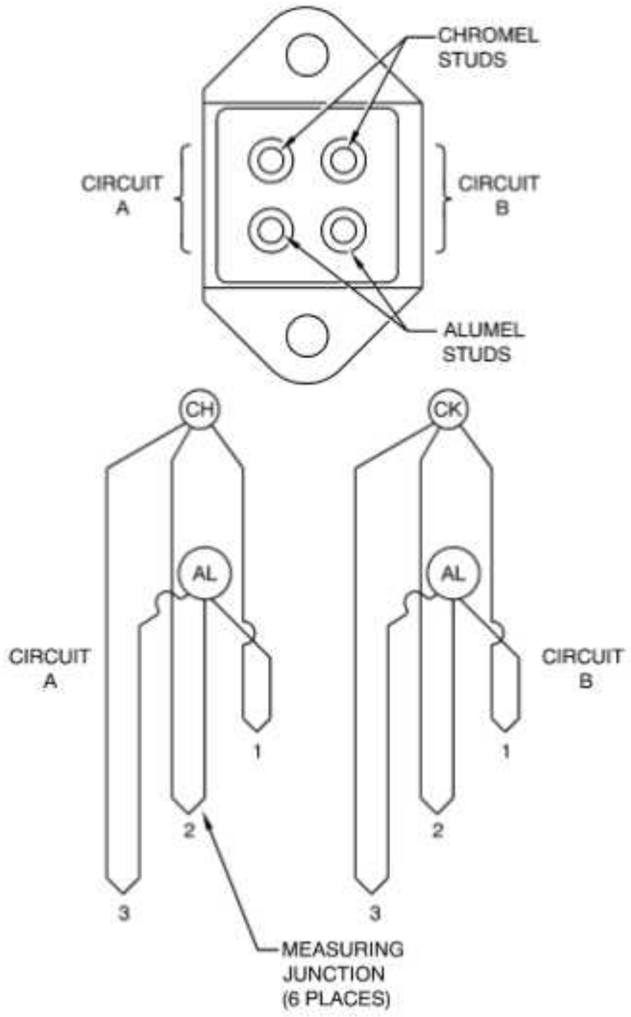
   B. Procedure
      (1) Continuity and insulation resistance test. See Figure 1301.

         NOTE: Before performing any of the following tests, be sure that thermocouple has been satisfactorily cleaned per Cleaning-01 (Task 72-00-54-160-001).

         (a) Apply heat at junctions of thermocouples with heat source.
         (b) Check for continuity by using low voltage ohmmeter at terminal posts. Deflection of needle on low voltage ohmmeter shows continuity in thermocouple circuits.
         (c) Using low voltage ohmmeter, check insulation resistance between both chromel and alumel terminals and body of thermocouple for minimum of 25 seconds for each measurement. Resistance must be at least 50,000 ohms. If resistance is within limits thermocouples shall be returned to service.

            NOTE: Low voltage ohmmeter utilizing less than 40 volts (DC) and maintained at accuracy of five percent shall be used for determining insulation resistance.

      (2) Defective or rejected thermocouples fall into three basic categories.
         (a) No continuity in circuit.
         (b) Shorted circuit.
         (c) Low insulating resistance.
      (3) Check for secondary junctions
         (a) Apply heat gun to head of thermocouple to 600° - 700°F (316° - 371°C).


CHROMEL STUDS
CIRCUIT A
CIRCUIT B
ALUMEL STUDS
CH
CK
AL
AL
CIRCUIT A
CIRCUIT B
1
2
3
1
2
3
MEASURING JUNCTION (6 PLACES)

L-A2423 (0000)
PW V

Test Schematic
Figure 1301
(Task 72-00-54-750-001)

(b) Check for deflection of milli−voltmeter at each set of studs. Milli−voltmeter should not deflect.

ENGINE GENERAL - TURBINE EXHAUST CASE - TESTING-02

Task 72-00-54-750-002:

1. Test EGT (TT4.95) Box And Cable

A. Equipment And Materials Necessary

Standard Tools:

Name	Manufacturer
Electronic Multimeter Model 2795	Simpson Electric Co. American Gage & Machine Co. (Katy Industries Inc.) 853 Dundee Avenue Elgin, IL 60120

B. Procedure
See Figure 1301 and Figure 1302.

(1) General

(a) Validity of electrical tests made in field may depend upon limitations inherent in common ohmmeter. This instrument is not dependable for determining exact wire resistances of thermocouple box and cable. It may, however, be used to detect gross failures such as open or intermittent circuits, and metal-to-metal short circuits. Also, approximate insulation resistance may be checked if certain precautions are observed. Ohmmeter used in following tests must be of good quality and in good condition; i.e. free from "stickiness" of meter needle, with pinjacks firm, test leads sound, and dry cells in condition to permit full scale deflectoin for all positions of range switch.

(2) Prepare cable for test.

(a) Tag all thermocouple cable leads to ensure proper reinstallation.

NOTE: Nut and stud diameters of alumel terminals are larger than those of chromel terminals.

(b) Remove nuts and lockwashers from probe stud terminals and remove cable leads.

(c) Remove bolts attaching junction box cover to junction box and remove covers.

(d) Disconnect averaging circuit leads from junction box terminals (Circuit A and Circuit B). Each circuit has two pair of leads and shields. Separate each pair in each circuit and label.

(3) Continuity check.

(a) Set ohmmeter range switch to range which has center scale value of approximately 10 ohms.

NOTE: Broken wires which come into contact intermittently due to flexing will cause needle to fluctuate. False intermittent indications will result if ohmmeter prods are not in firm contact with clean terminals; also, if ohmmeter prods, leads, or jack are defective.

(b) Perform continuity check per referenced schematic.

(c) Reject any assembly for discontinuity.

(4) Check insulation resistance.

(a) Using low voltage ohmmeter, check insulation for short circuits, excessive leakage, and internal insulation chafing discrepancies. Check proper operation of instrument by touching test prods together and noting needle deflection to read zero ohms.

NOTE: Low voltage ohmmeter utilizing less than 40 volts (DC) and maintained at accuracy of five percent shall be used for determining insulation resistance.

(b) Place one prod in contact with cable steel braid covering and other prod in contact, respectively, with junction box studs as follows. See Figure 1301.

1 Alumel, T/C 3 and TC/4, Circuit A

2 Alumel, T/C 2 and T/C 1, Circuit A

3 Chromel, T/C 5 and T/C 4, Circuit A

4 Chromel, T/C 2 and T/C 1, Cirucit A

(c) Repeat step (b) for Circuit B.

(d) Read ohmmeter. If resistance recorded is below 50,000 ohm, proceed as follows: If full−scale deflection (zero ohms) is recorded and no terminals are in accidental contact, reject part. If larger (but not full−scale) deflection is recorded, presence of carbon or excessive moisture may be indicated. Carbon yields fairly steady reading. Moisture tends to produce readings which waver or drift after 5 − 30 seconds. If presence of moisture is indicated, bake cable at 220° − 250°F (104° − 121°C) for one hour and recheck.

NOTE: False drift may be due to variations in applied voltage. To check for false drift, place prods in contact with each other for ten seconds. Readings must not wander from full−scale deflection.

(e) Perform resistance check of insulation between conductors using low voltage ohmmeter. Place one prod on alumel Circuit A output stud and other prod on chromel Circuit A output stud. If resistance recorded is below 50,000 ohms, reject part.

(f) Repeat step (e) for Ciucuit B.

(5) Short circuit check.

(a) Set ohmmeter range switch to range which has center scale value of approximately 10 ohms.

(b) Place prods respectively as described in paragraphs (4)(b), (c), (e), and (f). Flex cable gently along entire length of conductors under test and observe instrument needle. If any deflection results (unless caused by accidental contact between other terminals of cable), reject part.

(6) Defective or rejected thermocouple box and cable falls into three basic categories.

(a) No continuity in circuit.

(b) Shorted cirucuit.

(c) Low insulation resistance.

(7) Restore to pretest configuration.

(a) Connect averaging circuit leads to thermocouple junction box terminals.

1 (Reference 2273) Torque chromel (smaller) nuts on terminals to 15 − 18 lb−in. (1.695 − 2.034 N.m).

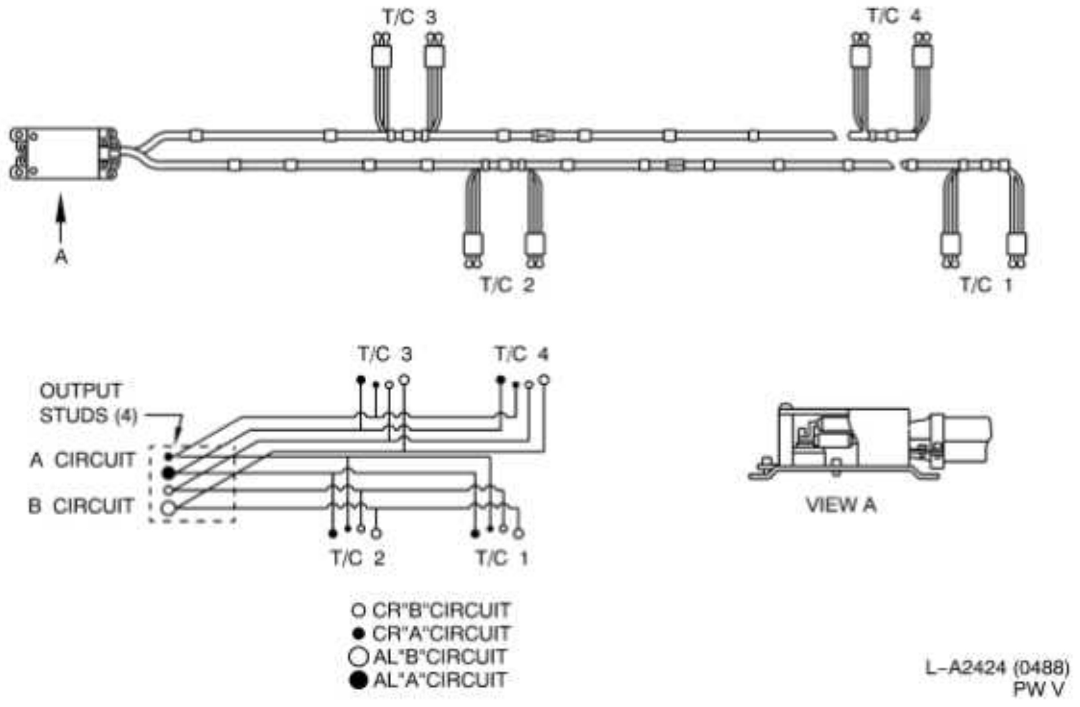
2 (Reference 2273) Torque alumel (larger) nuts on terminals to 18 − 22 lb−in. (2.034 − 2.486 N.m).

(b) Position junction box cover on junction box, install attaching bolts and lockwire.

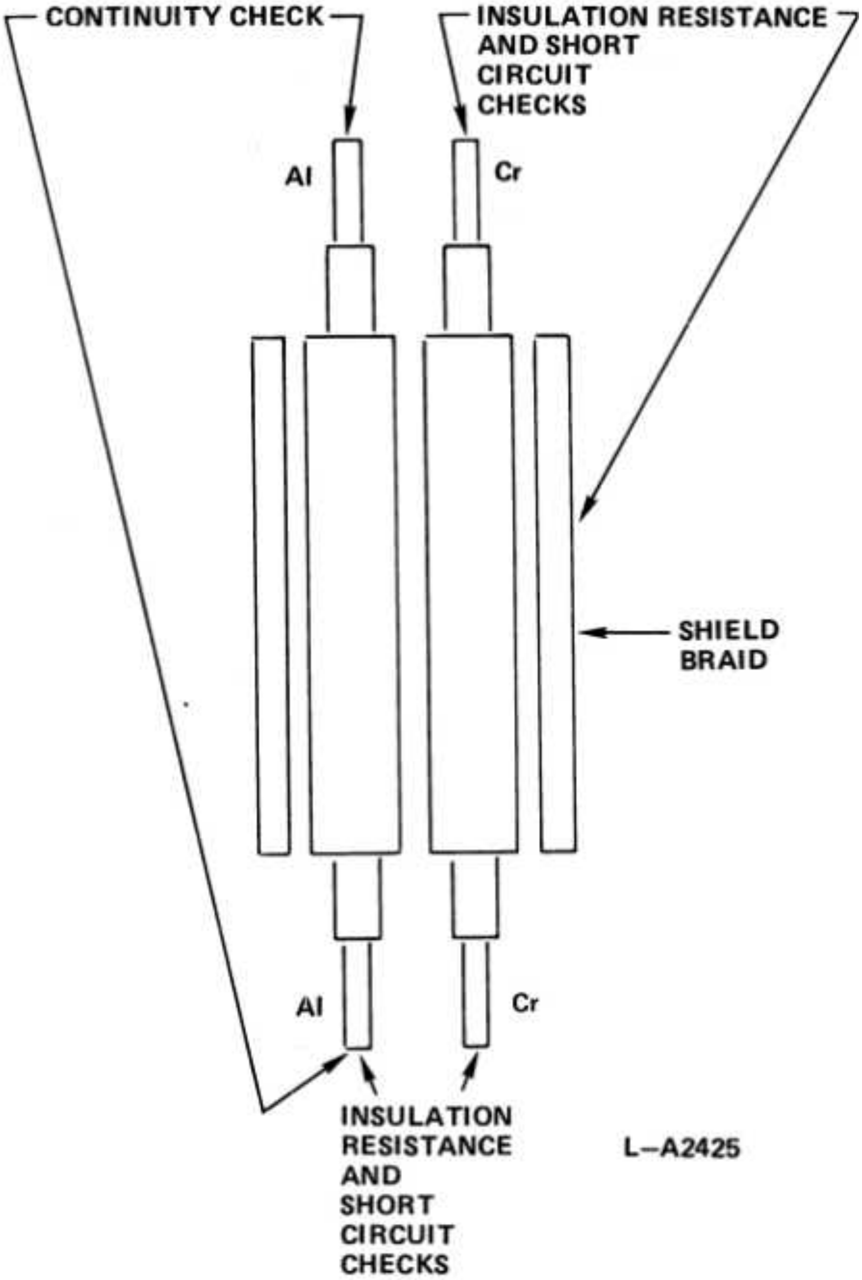
(c) Position termocouple cable leads on probe stud terminals, install lockwashers and nuts.

1 (Reference 2273) Torque chromel (smaller) nuts on terminals to 15 − 18 lb−in. (1.695 − 2.034 N.m).

2 (Reference 2273) Torque alumel (larger) nuts on terminals to 18 − 22 lb−in. (2.034 − 2.486 N.m).


T/C 3
T/C 4
A
T/C 2
T/C 1
OUTPUT STUDS (4)
A CIRCUIT
B CIRCUIT
T/C 3
T/C 4
T/C 2
T/C 1
VIEW A
○ CR"B"CIRCUIT
● CR"A"CIRCUIT
○ AL"B"CIRCUIT
● AL"A"CIRCUIT
L−A2424 (0488)
PW V

Test Schematic
Figure 1301
(Task 72−00−54−750−002)


CONTINUITY CHECK
INSULATION RESISTANCE AND SHORT CIRCUIT CHECKS
Al
Cr
SHIELD BRAID
Al
Cr
INSULATION RESISTANCE AND SHORT CIRCUIT CHECKS
L-A2425

EGT (TT4.95) Box And Cable - Test
Figure 1302
(Task 72-00-54-750-002)

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ENGINE GENERAL - MAIN GEARBOX - REMOVAL-01

Task 72-00-61-020-001:

1. Remove Main Gearbox

A. Prerequisites

(1) Remove fuel pump and fuel metering unit (package) per Removal-05 (Task 72-00-61-050-003).

(2) Remove exciter-to-igniter plug cable (upper plug-upper box), per 72-00-41, Removal-04 (Task 72-00-41-050-001).

(3) Remove exciter-to-igniter plug cable (lower plug-lower box), per 72-00-41, Removal-05 (Task 72-00-41-050-002).

(4) Remove ignition exciters per Removal-03 (Task 72-00-61-050-001) and Removal-04 (Task 72-00-61-050-002).

(5) Disconnect EEC core engine wiring harnesses W3, W4 and W5 from main gearbox, per Removal-34 (Task 72-00-61-050-015).

(6) Disconnect/remove external parts for access to main gearbox per Removal-02 (Task 72-00-61-020-002).

(7) Remove the No. 3 bearing breather and restrictor valve. See Removal-39 (Task 72-00-61-050-019).

(8) Remove the magnetic chip detector assemblies from the oil tank and main gearbox. Refer to Removal-36 (Task 72-00-61-050-017).

B. Equipment And Materials Necessary

Special Tools:

PWA 80611	Jack, Hydraulic
PWA 85123	Fixture (Optional to PWA 86056 Fixture)
PWA 86056	Fixture

NOTE: Hydraulic Jack (PWA 24667) may be used in place of (PWA 80611) if adapted to fit Fixture (PWA 85123).

C. Procedure
See Figures 301, Figure 302, and Figure 303.

(1) Remove lockwire and bolts (301/2) securing gearbox driveshaft (front) housing brackets (302/1) and (302/2) to high pressure compressor.

ENGINE GENERAL − MAIN GEARBOX − REMOVAL−01

CAUTION: USE OF SCREWDRIVER, OR SIMILAR TOOL, TO SEPARATE HOUSING FROM GEARBOX MAY RESULT IN DAMAGE TO SEALING SURFACES.

(2) Remove bolts (302/10), nuts (302/15), and washers (302/11) and (302/16) securing gearbox driveshaft (front) housing (302/3) to angle gearbox (302/17). Move housing (302/3) rearward. Discard packing (302/13). See Figure 302.

(3) Remove retaining ring (302/14) securing gearbox driveshaft (302/12) to gearbox drive coupling (302/18). Slide driveshaft rearward into main gearbox.

(4) Align boltholes and position PWA 86056 or PWA 85123 Fixture to lifting pad of PWA 80611 Hydraulic Jack. Secure fixture to jack with three detail screws. See Figure 301.

(5) Position jack under engine and raise jack to position four post details of fixture to four ground handling points of gearbox. Secure post−details to gearbox with four detail bolts (301/1).

(6) Remove cotter pin (302/4), nut (302/5), and bolt (302/7) securing support link (302/6) to gearbox driveshaft housing (302/8).

(7) Remove cotter pin (303/11), nut (303/15), pin (303/14), bolt (303/10), washer (303/12) and spacer (303/13) that attach the support link (303/8) to lugs on upper wall of left and right sides of gearbox. Discard the washers (303/12). Remove the jack and gearbox. See Figure 303.

(8) If necessary, remove the support links (303/8) from the engine as follows.

(a) Remove cotter pin (303/7), nut (303/1), pin (303/2), bolt (303/6), washer (303/5), and spacer (303/4) that attach the support link (303/8) to the gearbox support clevis (303/3) on each side of the engine.

(b) Remove the support links. Discard the washers (303/5).

ENGINE GENERAL − MAIN GEARBOX − REMOVAL−01

(9) Temporarily secure the spherical bearings (303/9) in the support links (303/8) for the gearbox and the support link (302/6) for the gearbox driveshaft housing.

CAUTION: CARE SHOULD BE TAKEN NOT TO DAMAGE SPLINES ON FRONT AND REAR ENDS OF DRIVESHAFT.

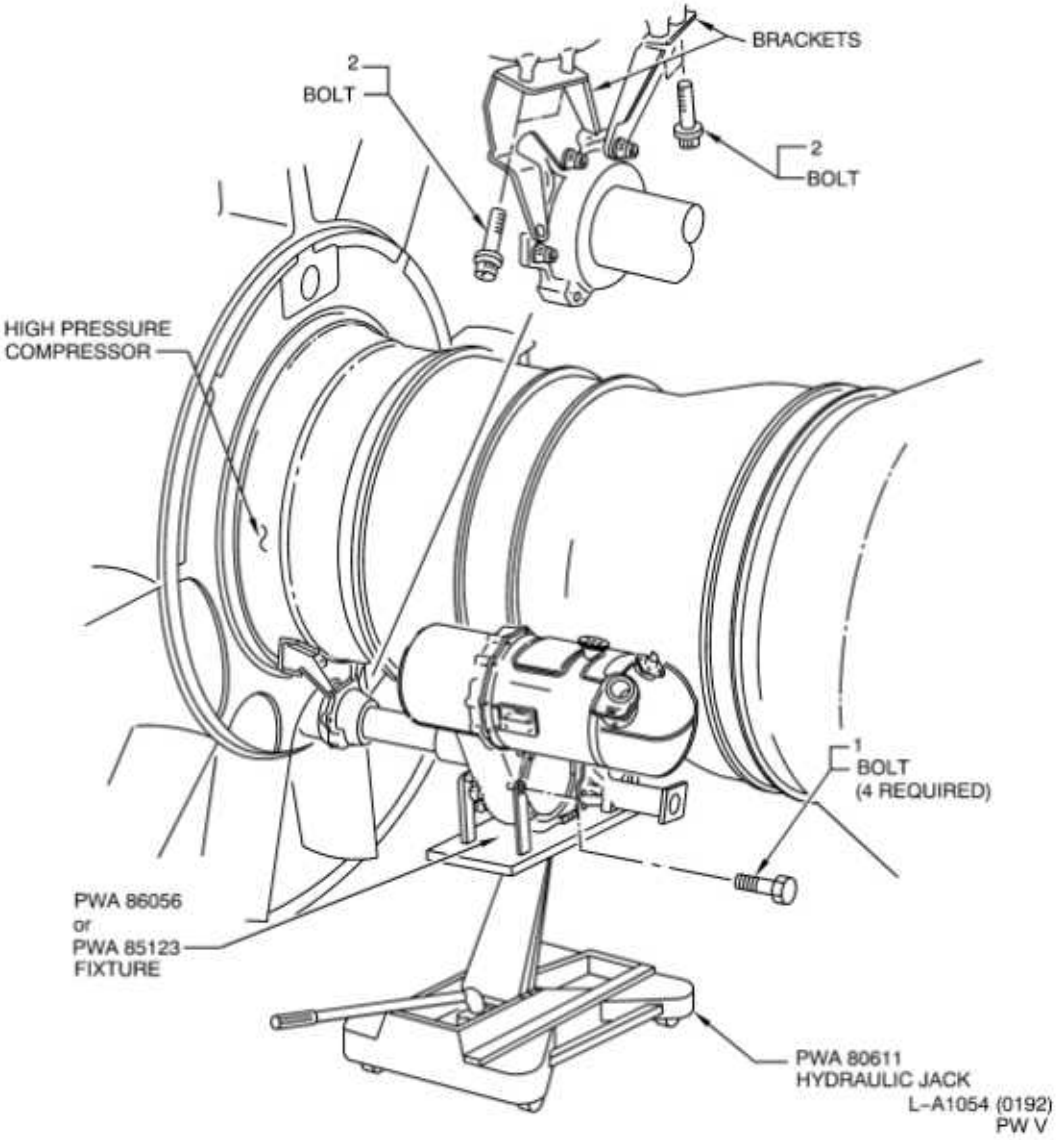
(10) Withdraw gearbox driveshaft (302/12) and driveshaft (front) housing (302/3). Discard packing (302/9).

(11) Position nylon sling through boltholes in gearbox support lugs on upper left and right sides of gearbox housing and attach to hoist. Load hoist.

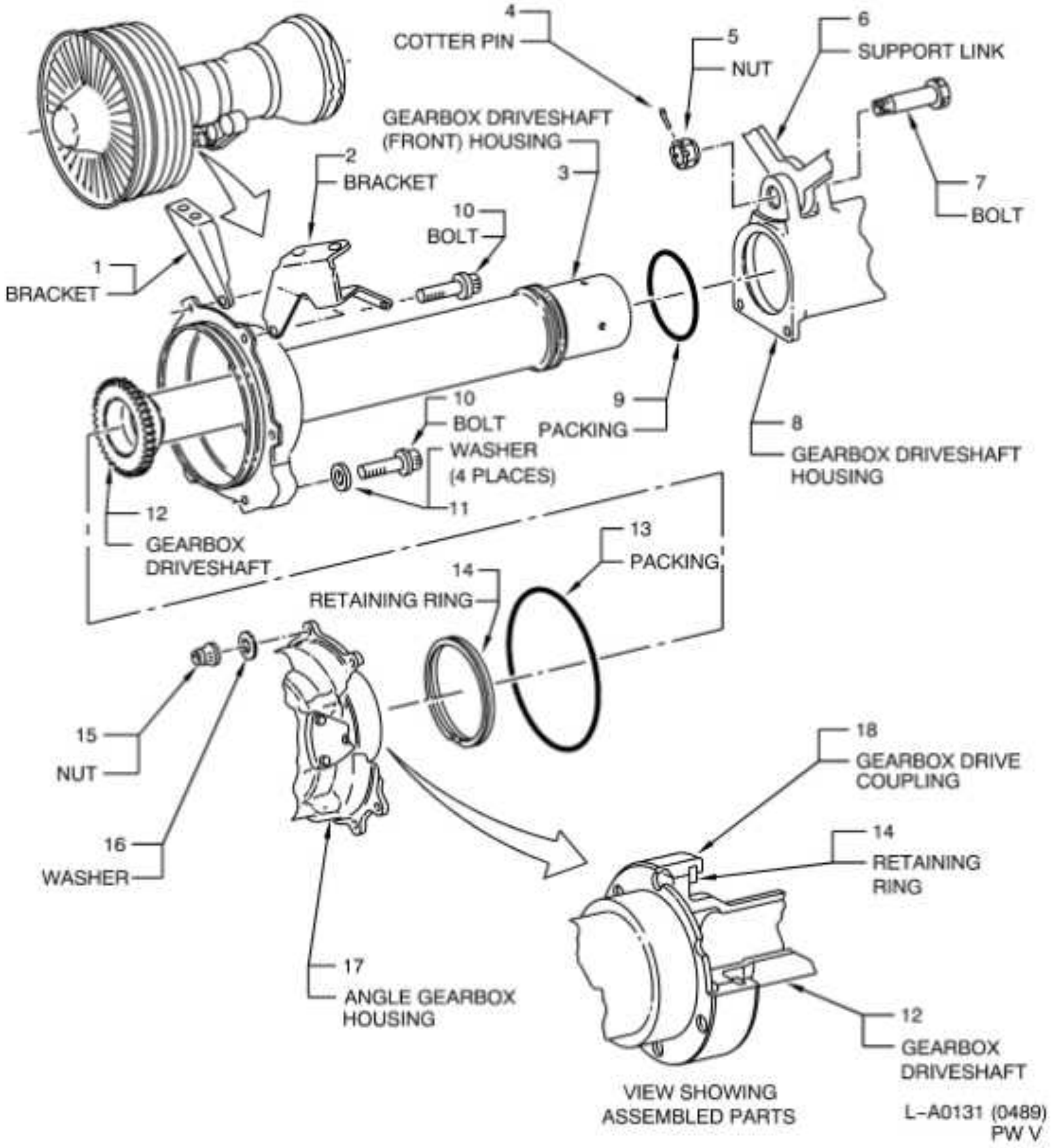
(12) Remove bolts securing gearbox to gearbox handling fixture. Remove gearbox from fixture.

(13) Lift and move main gearbox to pallet. Remove hoist and sling.

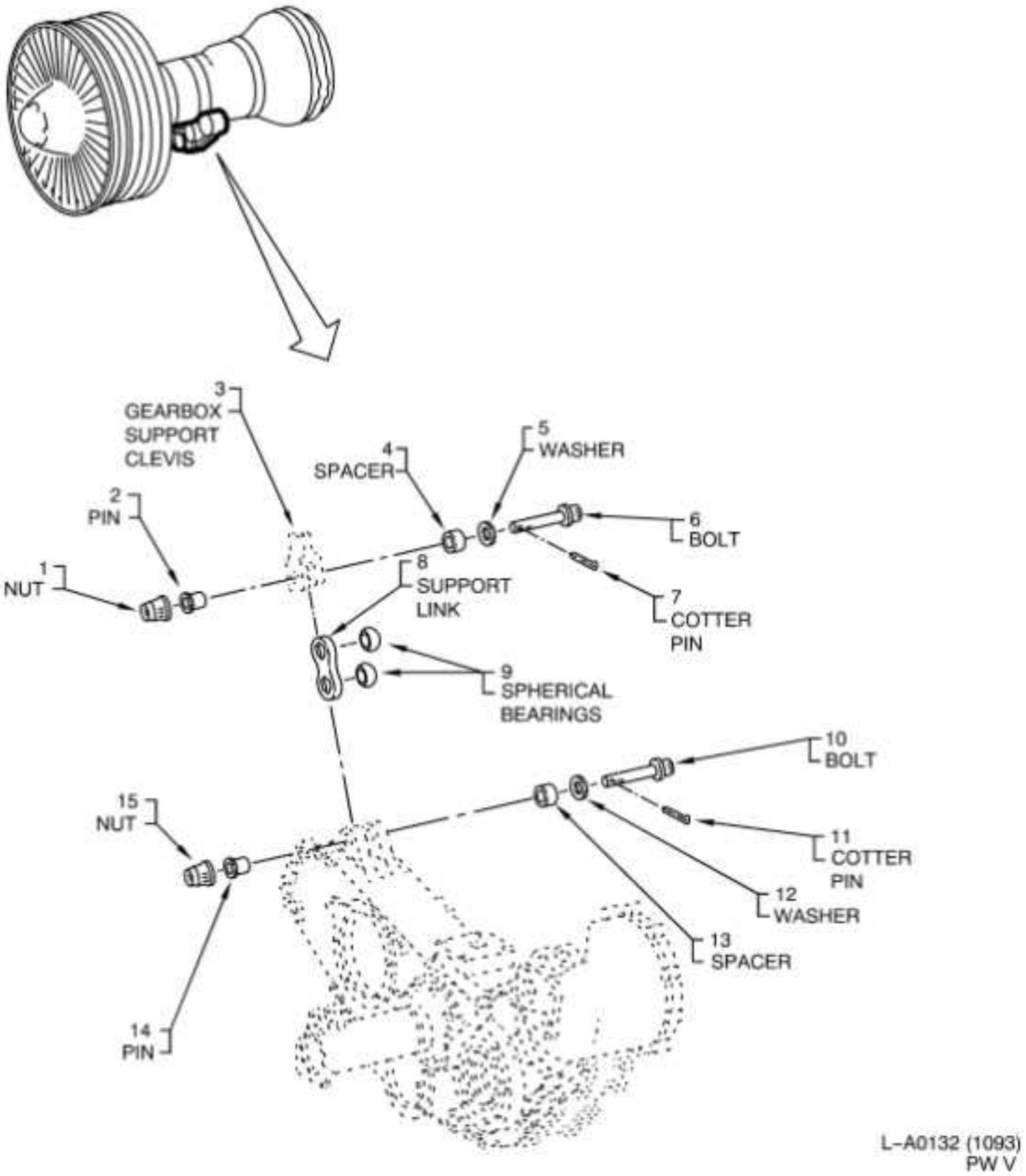
(14) Install protective covers over gearbox driveshaft housing and opening in angle gearbox.


BRACKETS
2
BOLT
2
BOLT
HIGH PRESSURE COMPRESSOR
1
BOLT
(4 REQUIRED)
PWA 86056
or
PWA 85123
FIXTURE
PWA 80611
HYDRAULIC JACK
L−A1054 (0192)
PW V

Main Gearbox Removal
Figure 301
(Task 72−00−61−020−001)


4
COTTER PIN
5
NUT
6
SUPPORT LINK
GEARBOX DRIVESHAFT
(FRONT) HOUSING
3
2
BRACKET
10
BOLT
7
BOLT
1
BRACKET
9
PACKING
8
GEARBOX DRIVESHAFT
HOUSING
10
BOLT
WASHER
(4 PLACES)
11
12
GEARBOX
DRIVESHAFT
13
PACKING
14
RETAINING RING
15
NUT
16
WASHER
17
ANGLE GEARBOX
HOUSING
18
GEARBOX DRIVE
COUPLING
14
RETAINING
RING
12
GEARBOX
DRIVESHAFT
VIEW SHOWING
ASSEMBLED PARTS
L−A0131 (0489)
PW V

Main Gearbox Removal
Figure 302
(Task 72−00−61−020−001)


3
GEARBOX SUPPORT CLEVIS
4
SPACER
5
WASHER
2
PIN
6
BOLT
1
NUT
8
SUPPORT LINK
7
COTTER PIN
9
SPHERICAL BEARINGS
10
BOLT
15
NUT
11
COTTER PIN
12
WASHER
13
SPACER
14
PIN
L−A0132 (1093)
PW V

Main Gearbox Removal
Figure 303
(Task 72−00−61−020−001)

ENGINE GENERAL − MAIN GEARBOX − REMOVAL−02

Task 72−00−61−020−002:

1. Remove The Main Gearbox Plumbing Prior To The Main Gearbox Removal

A. Equipment And Materials Required − None

B. Procedure

(1) (Post SB PW4ENG 72−491) Remove the deoiler idler bearing pressure line (LP35) as follows. See Figure 301.

(a) Remove the spray shield from the tee fitting in the No. 4 bearing oil pressure tube assembly (LP15).

(b) Remove the clamps that attach the line to the overboard breather pad bracket and the oil tank mount flange bracket.

(c) Loosen the line nuts at the tee fitting and the deoiler (idler) spur gear assembly in the gearbox.

(d) Carefully remove the line and install the protective closures.

(2) Remove the No. 1, 1.5, and 2 bearing oil scavenge tube assembly (LR03) as follows. See Figure 302.

(a) Remove the lockwire. Disconnect the tube nut at 7 o'clock position adjacent to Flange E.

(b) Remove the three bolts that attach the rear of the tube to the main oil pump.

(c) Remove the bolts, nuts, and clamps that attach the tube to the HPC case bracket and the gearbox brackets.

(d) Remove the tube. Discard the packing.

(e) (Post SB PW4ENG 79−58), Remove the strainer element from the flanged−end of the tube.

(f) Install protection covers to the tube ends.

(3) Remove angle gearbox oil scavenge tube assembly (LR01) as follows.

(a) Remove the four bolts that attach the tube to the angle gearbox and the main oil pump.

(b) Remove the bolts, nuts, and clamps that attach the tube to the gearbox brackets.

(c) Remove the tube. Discard the packings. Install the covers.

(4) (Pre SB PW4ENG 79-75) Remove the (front) No. 4 bearing oil scavenge tube assembly (LR05) (if not done before) as follows. See Figure 302.

(a) Remove the bolt, nut, and clamps that attach the spray shield to the tube connection at 7 o'clock position adjacent to Flange M. Remove spray shield.

(b) Remove the lockwire. Disconnect the tube nut at the same connection.

(c) Remove the three bolts that attach the tube to main oil pump.

(d) Remove the bolts, nuts, and clamps that attach the tube to the adjacent oil tubes and the oil pump bracket.

(e) Remove the tube. Discard the packings. Remove the six (clip-on) loop clamp grommet halves (Post SB PW4ENG 79-46 only). Install the protection covers.

(5) (Post SB PW4ENG 79-75) Remove (front) No. 4 bearing oil scavenge hose and tube assembly (LR05) as follows. See Figure 302.

(a) Remove the bolts, nuts and clamps that attach the hose and tube assembly to the loop clamp bracket on the TCC manifold bridge bracket and the loop clamp bracket assembly on the fluid pressure dampener or adapter.

NOTE: Catch oil in container with a capacity of approximately 5 U.S. gallons (19 liters).

(b) Remove lockwire from the tube nut to the main oil pump connection. Remove bolts securing tube to main oil pump and remove tube from engine.

(c) Remove and discard packing. Install protective closures.

(d) Remove the bolts that secure the loop clamp bracket to the TCC manifold bridge bracket. Remove the loop clamp bracket.

(6) (Pre SB PW4ENG 79-75) Remove the No. 3 bearing oil scavenge manifold assembly (LR04) as follows. See Figure 302.

(a) Remove the lockwire. Disconnect the diffuser case internal tube nut from the manifold elbow at 6 o'clock position.

(b) Remove the three bolts that attach the manifold to main oil pump.

(c) Remove the tube. Discard the packing. Remove the two (clip-on) loop clamp grommet halves (Post SB PW4ENG 79-46 only). Install the protection covers.

(d) Remove the tube. Discard the packing. Remove the two (clip-on) loop clamp grommet halves (Post SB PW4ENG 79-46 and Pre SB PW4ENG 79-75 only). Install the protection covers.

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH
R CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND
R INSTALL A TUBE WITH A FLEX SEGMENT WITH THE
R SAME PRECAUTION USED FOR A TUBE WITHOUT A
R FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A
R TUBE TO HELP WITH THE INSTALLATION OR REMOVAL
R OF THE TUBE OR AN ATTACHED COMPONENT. IF A
R FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE
R A KINK IN THE EXTERNAL WIRE BRAID AND IN THE
R INNER TUBE AND LEAKS OR TUBE RUPTURE CAN BE
R THE RESULT.

(7) (Pre SB PW4ENG 79-75) Remove the main filter oil tube assembly (LP01) (if not done before) as follows. See Figure 302 (Sheets 1 through 7).

(a) Remove the bolts that attach the tube to the main oil filter housing and the main oil pump. Remove the bracket from the tube flange at the oil pump connection.

(b) Remove the bolts, nuts, and clamps that attach the tube to the gearbox brackets and the diffuser case bracket.

(c) Remove the tube. Discard the packings. Remove the six (clip-on) loop clamp grommet halves (Post SB PW4ENG 79-36 only). Install the covers.

(d) Remove the bolt, nut, and clamp that attach the tube to the fuel/oil cooler rear mount bracket (Pre SB PW4ENG 72-211 only).

(e) Remove the two bolts, nut, and two clamps that attach the tube to the fuel/oil cooler rear mount bracket and to the adjacent No. 3 bearing oil pressure manifold (Post SB PW4ENG 72-211 only).

(f) (Post SB PW4ENG 79-52), Remove the bolt, nut and clamp that attaches the tube to a bracket on the flange of the secondary flow control valve.

(g) Remove the tube. Discard the packing. Install the covers.

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(8) (Post SB PW4ENG 79-75) Remove main oil filter hose and tube assembly (LP01) (if not done before) and the fluid pressure dampener or the fluid pressure adapter assembly (Post SB PW4ENG 79-86) as follows. See Figure 302.

(a) Remove bolts securing tube to front of main oil filter housing.

(b) Remove the bolts that hold the tube to top of the fluid pressure dampener or adapter.

(c) Remove bolt, nut and clamp securing tube to diffuser case bracket at approximately 7 o'clock position.

(d) Remove bolts, nuts and clamps securing tube to gearbox brackets and remove tube from engine.

(e) Remove the bolts that hold the fluid pressure dampener or adapter to the top of the main oil pump.

(f) Remove the bolts and nuts that hold the loop clamp bracket to the fluid pressure dampener or adapter. Remove the bracket.

(g) Remove the dampener or adapter from the engine.

(h) Discard packings from the hose and tube assembly and the filter.

(9) Remove the air cooler inlet oil tube assembly (LP02) as follows.

(a) Remove the three bolts that attach the rear of the tube to the top of the oil filter housing.

(b) Remove the three bolts that attach the front of the tube to the air oil cooler.

(c) Remove the tube. Discard the packings. Install the covers.

(10) Disconnect and disengage the (lower) No. 1 and 2 bearing breather tube assembly (LB02) as follows.

(a) Remove the bolt, nut, and clamp that attach the tube to the Flange H bracket at 8:30 o'clock position.

(b) Remove the bolt, nut and clamp that attaches the No. 1 and 2 bearing breather tube (lower) (LB02) to the inboard oil cooler bracket (Post SB PW4ENG 79−33).

(c) Remove the three bolts and bracket that attach the tube to the front of the gearbox.

(d) Disengage the tube from the gearbox and temporarily attach the tube away from the gearbox with some lockwire.

(e) Discard the packings. Install the covers.

(11) Disconnect and disengage the No. 3 bearing breather tube assembly (LB04) as follows.

(a) Remove the lockwire. Disconnect the tube nut from the tube coupling at 9:30 o'clock position adjacent to Flange K.

(b) (Pre SB PW4ENG 75-95), Remove the three bolts that attach the tube to the front of the main gearbox.

(c) (Post SB PW4ENG 75-95 and Pre SB PW4ENG 75-144) Remove the three bolts that attach the tube to No. 3 bearing breather restrictor valve that is located on the front of the main gearbox.

(d) Remove the bolt and clamp that attach to the tube to the bracket attached to the fuel/oil cooler rear support (Pre SB PW4ENG 72-211 only).

(e) Remove the bolt, nut, and clamp that attach the tube to the bracket attached to the HPC air valve (Post SB PW4ENG 72-211 only).

(f) Disengage the tube from the front of the main gearbox. Temporarily attach the tube away from the gearbox with some lockwire. Discard the packing. Install the covers.

(12) (Post SB PW4ENG 75-95 and Pre SB PW4ENG 75-144) Remove the No. 3 bearing breather valve air supply tube (AP39) from the engine as follows. See Figure 304.

(a) Remove the lockwire from the tube nut that is attached to the No. 3 bearing breather and restrictor valve on the front right side of the main gearbox. Disconnect the tube nut from the valve.

(b) Remove the lockwire from the tube nut that is attached to the No. 3 bearing cooler air tube (AP34) located approximately at the 4 o'clock position on the high compressor case. Disconnect the tube nut from the cooler air tube (AP34).

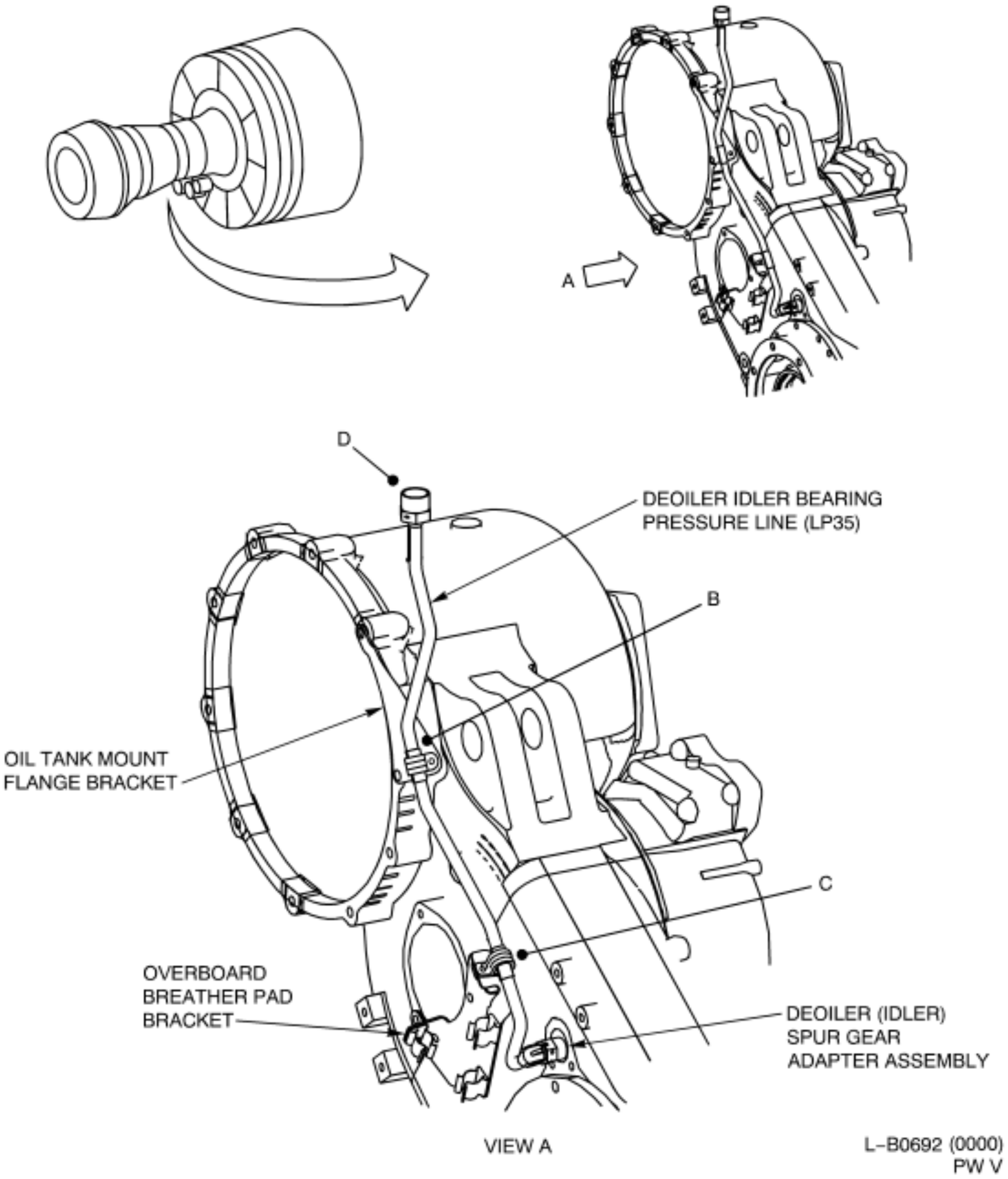
(c) Remove the bolt, nut and clamp that attaches the tube to the clamp on the oil cooler outlet fuel tube (FM11).

(d) Remove the bolt and clamp that attaches the tube to a bracket on the gearbox driveshaft housing, support link mount on the high compressor.

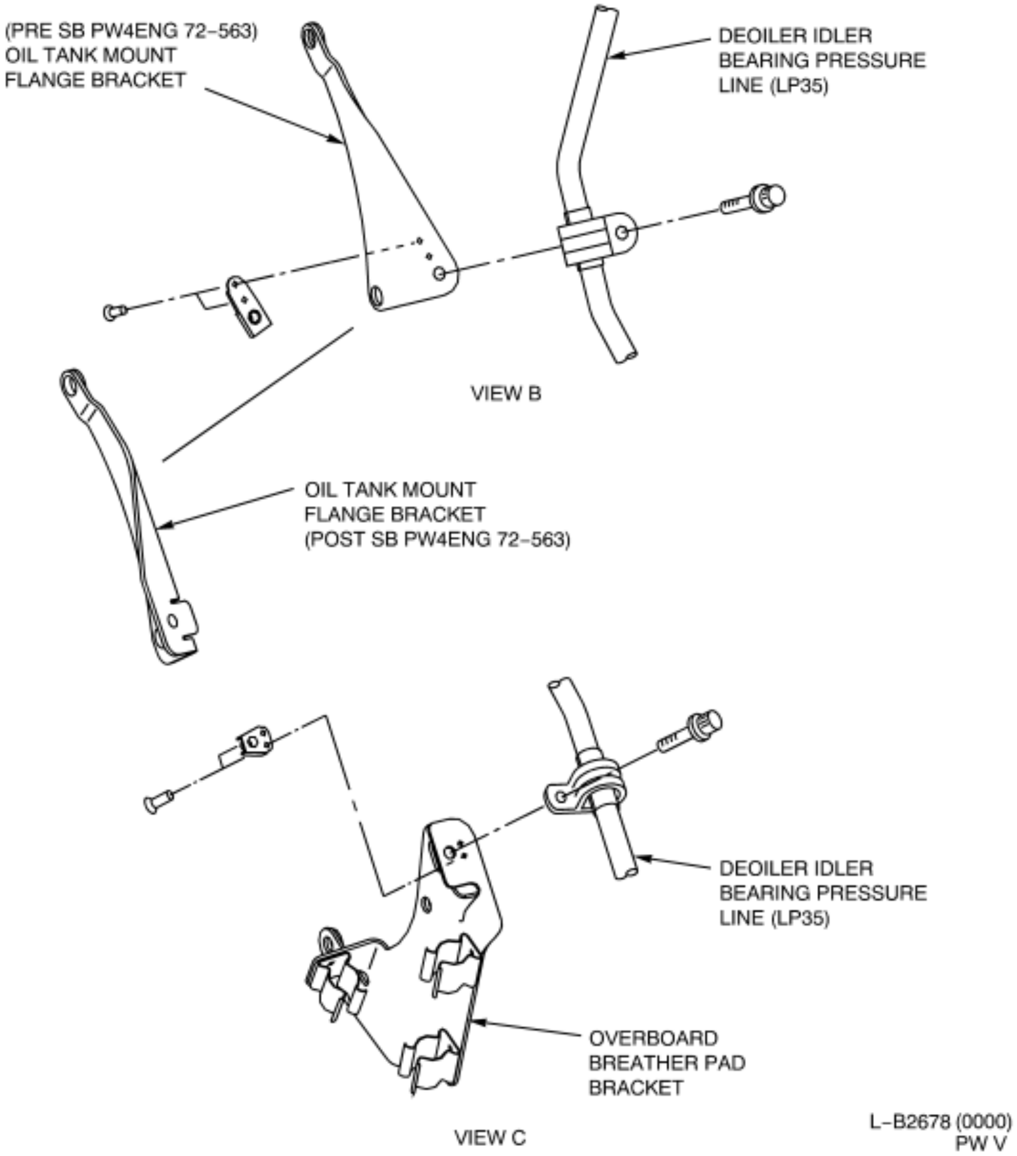
(e) Remove the bolt and clamp from the bracket that is attached to the tube flange of the air vent diffuser seal tube (AP21).

(f) Remove the tube from the engine and install protection covers to the tube openings.

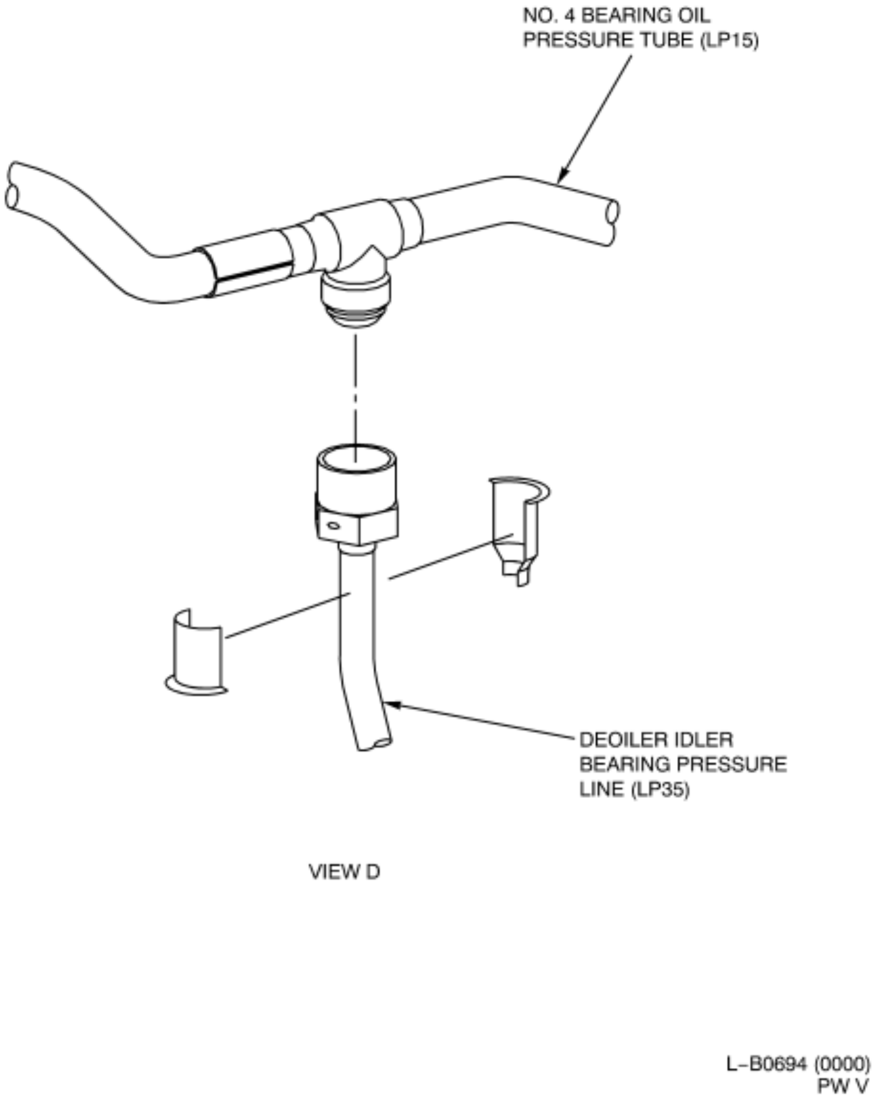
(13) Remove the bolt that attaches the ground cable to the oil tank flange. Install the bolt again and tighten by hand. If diffuser case removal is planned, remove the lockwire and the bolt that attaches the ground cable to the case. Install the bolt again and tighten by hand.


A
D
DEOILER IDLER BEARING
PRESSURE LINE (LP35)
B
OIL TANK MOUNT
FLANGE BRACKET
C
OVERBOARD
BREATHER PAD
BRACKET
DEOILER (IDLER)
SPUR GEAR
ADAPTER ASSEMBLY
VIEW A
L-B0692 (0000)
PW V

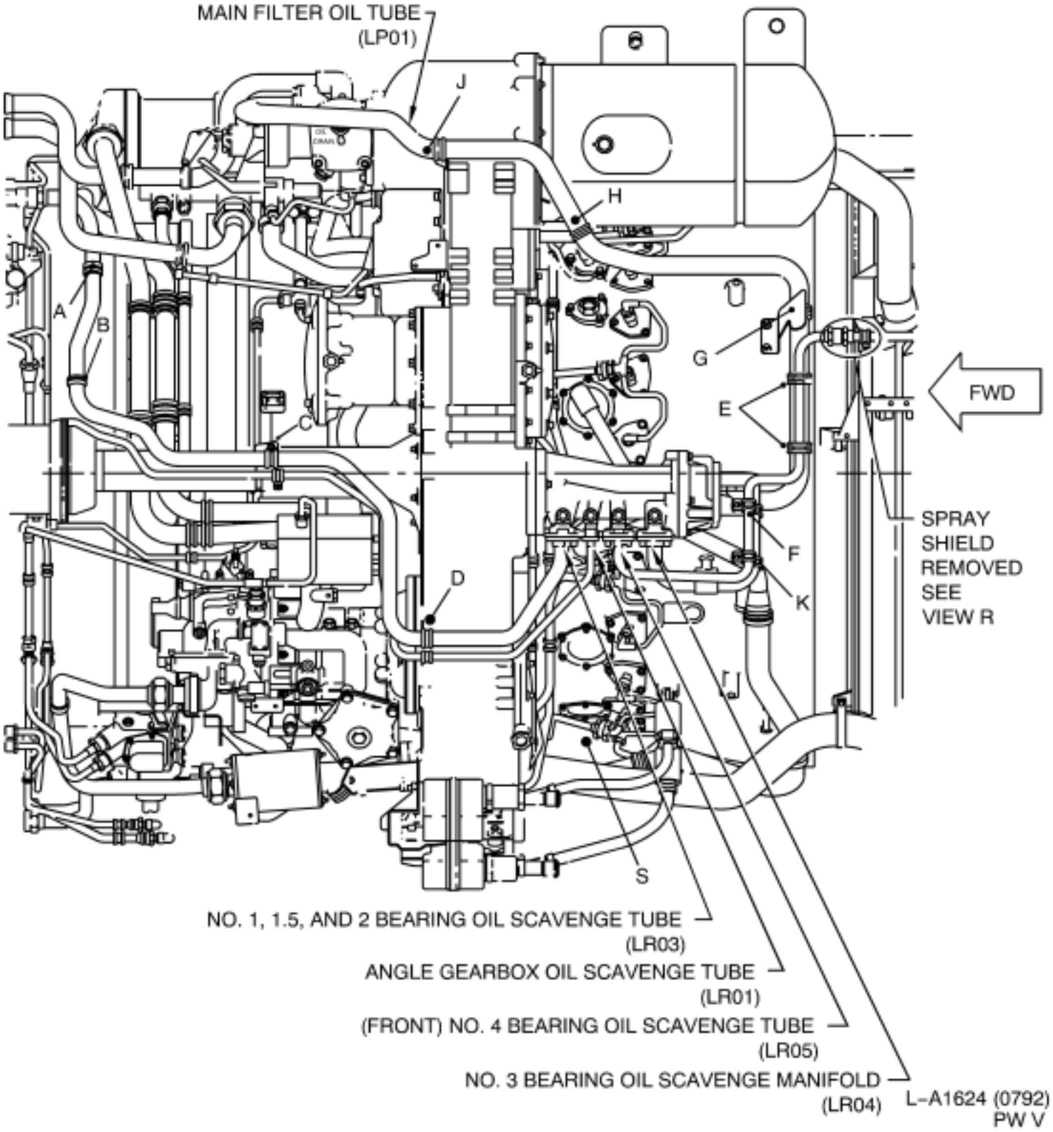
Main Gearbox Plumbing
Figure 301 (Sheet 1)
(Task 72-00-61-020-002)


(PRE SB PW4ENG 72-563)
OIL TANK MOUNT
FLANGE BRACKET
DEOILER IDLER
BEARING PRESSURE
LINE (LP35)
VIEW B
OIL TANK MOUNT
FLANGE BRACKET
(POST SB PW4ENG 72-563)
DEOILER IDLER
BEARING PRESSURE
LINE (LP35)
OVERBOARD
BREATHER PAD
BRACKET
VIEW C
L-B2678 (0000)
PW V

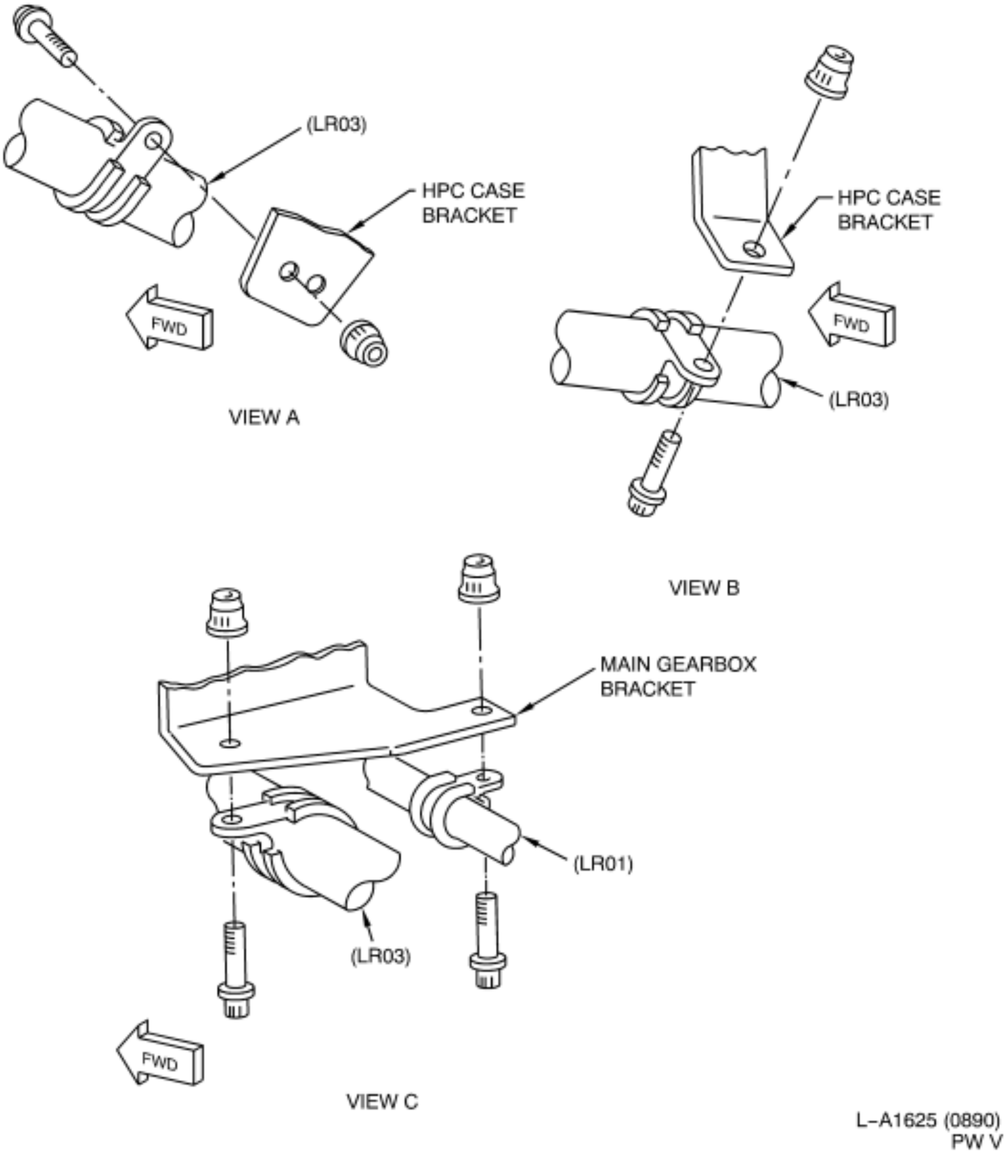
Main Gearbox Plumbing
Figure 301 (Sheet 2)
(Task 72-00-61-020-002)


NO. 4 BEARING OIL PRESSURE TUBE (LP15)
DEOILER IDLER BEARING PRESSURE LINE (LP35)
VIEW D
L-B0694 (0000)
PW V

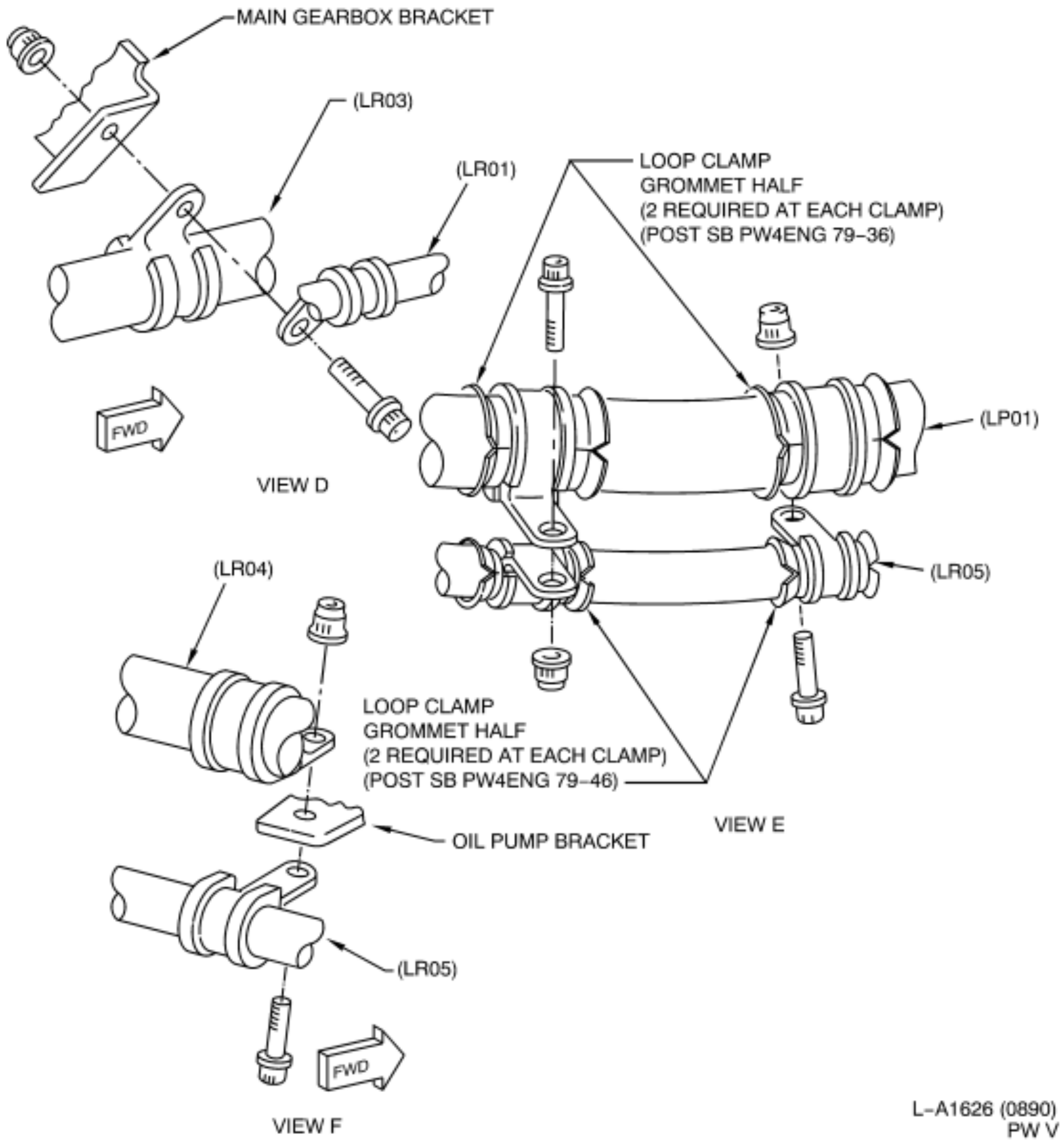
Main Gearbox Plumbing
Figure 301 (Sheet 3)
(Task 72-00-61-020-002)


MAIN FILTER OIL TUBE
(LP01)
J
H
OIL DRAIN
A
B
C
G
E
FWD
D
F
K
SPRAY
SHIELD
REMOVED
SEE
VIEW R
S
NO. 1, 1.5, AND 2 BEARING OIL SCAVENGE TUBE
(LR03)
ANGLE GEARBOX OIL SCAVENGE TUBE
(LR01)
(FRONT) NO. 4 BEARING OIL SCAVENGE TUBE
(LR05)
NO. 3 BEARING OIL SCAVENGE MANIFOLD
(LR04)
L-A1624 (0792)
PW V

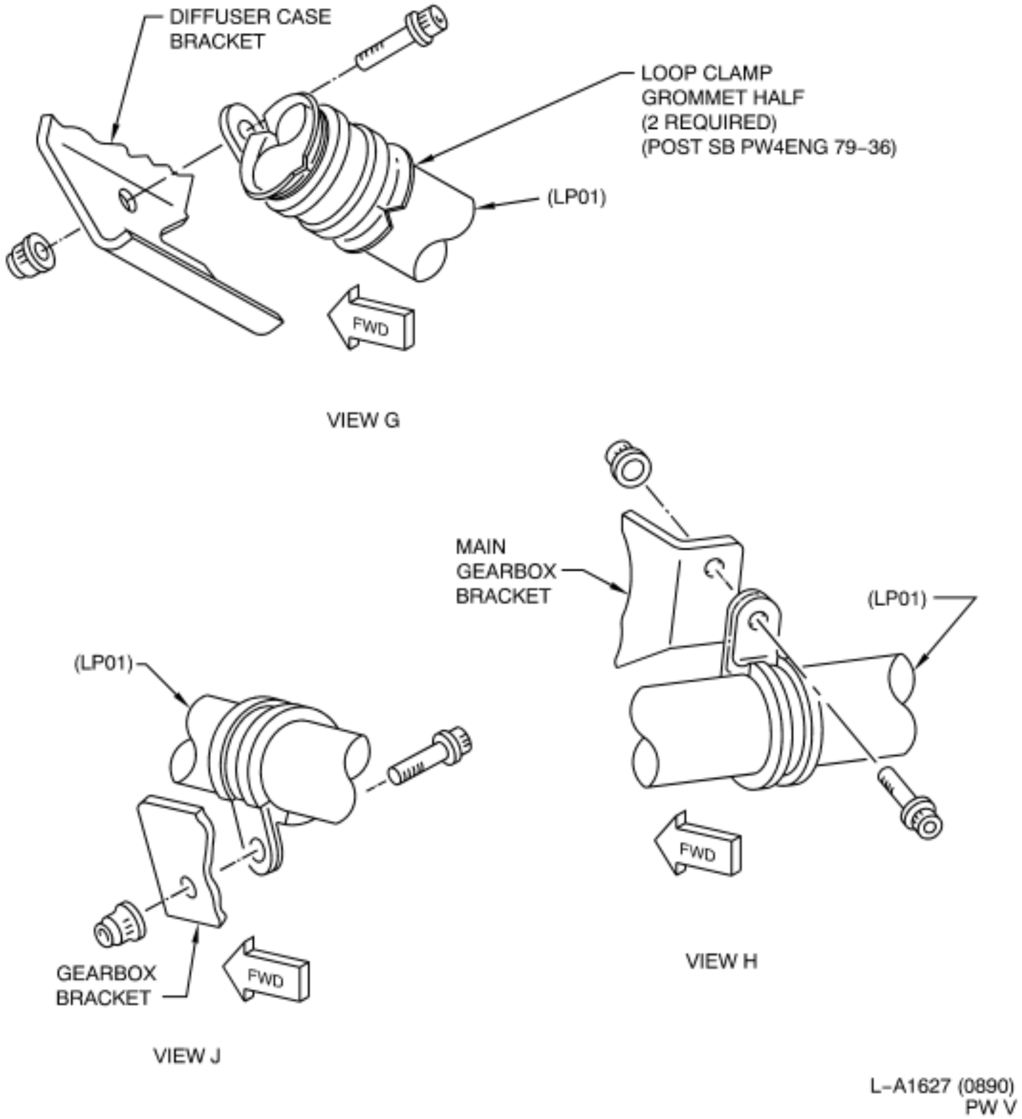
Main Gearbox Plumbing (Pre SB PW4ENG 79-75)
Figure 302 (Sheet 1)
(Task 72-00-61-020-002)


(LR03)
HPC CASE
BRACKET
FWD
VIEW A
HPC CASE
BRACKET
FWD
(LR03)
VIEW B
MAIN GEARBOX
BRACKET
(LR01)
(LR03)
FWD
VIEW C
L−A1625 (0890)
PW V

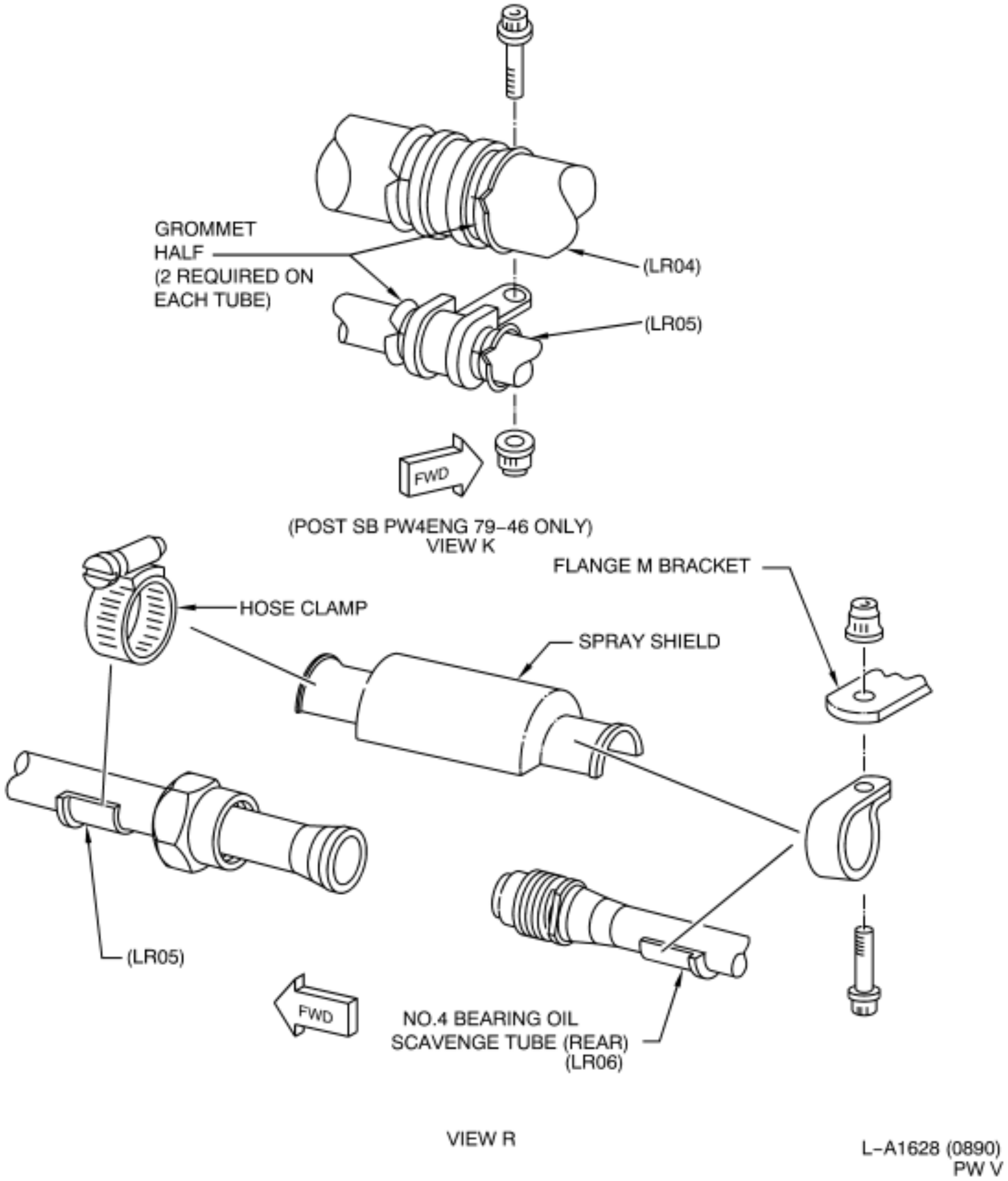
Main Gearbox Plumbing
Figure 302 (Sheet 2)
(Task 72−00−61−020−002)


MAIN GEARBOX BRACKET
(LR03)
(LR01)
LOOP CLAMP
GROMMET HALF
(2 REQUIRED AT EACH CLAMP)
(POST SB PW4ENG 79-36)
(LP01)
FWD
VIEW D
(LR04)
(LR05)
LOOP CLAMP
GROMMET HALF
(2 REQUIRED AT EACH CLAMP)
(POST SB PW4ENG 79-46)
OIL PUMP BRACKET
VIEW E
(LR05)
FWD
VIEW F
L-A1626 (0890)
PW V

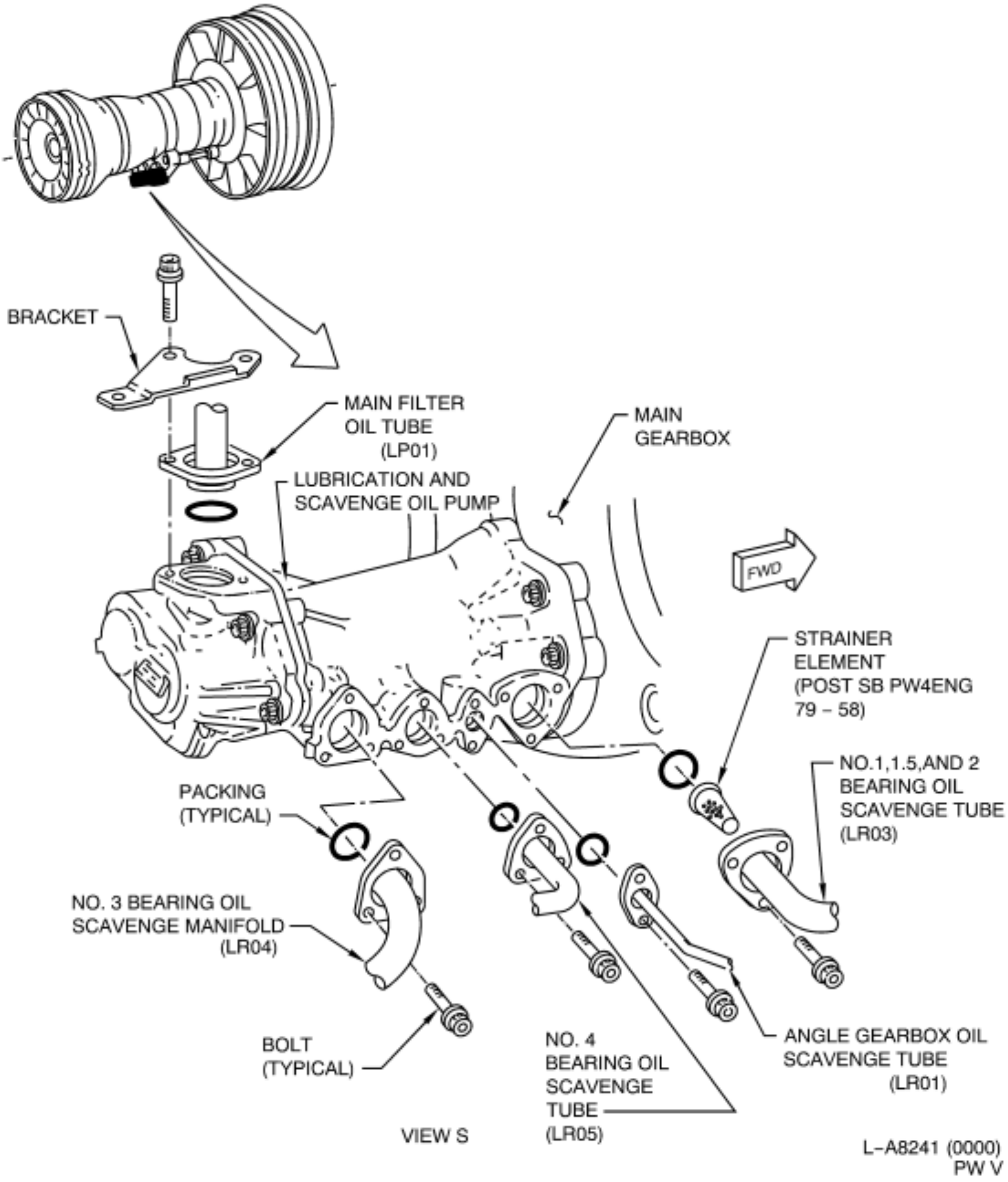
Main Gearbox Plumbing (Pre SB PW4ENG 79-75)
Figure 302 (Sheet 3)
(Task 72-00-61-020-002)


DIFFUSER CASE BRACKET
LOOP CLAMP GROMMET HALF (2 REQUIRED) (POST SB PW4ENG 79-36)
(LP01)
FWD
VIEW G
MAIN GEARBOX BRACKET
(LP01)
FWD
VIEW H
(LP01)
GEARBOX BRACKET
FWD
VIEW J
L-A1627 (0890)
PW V

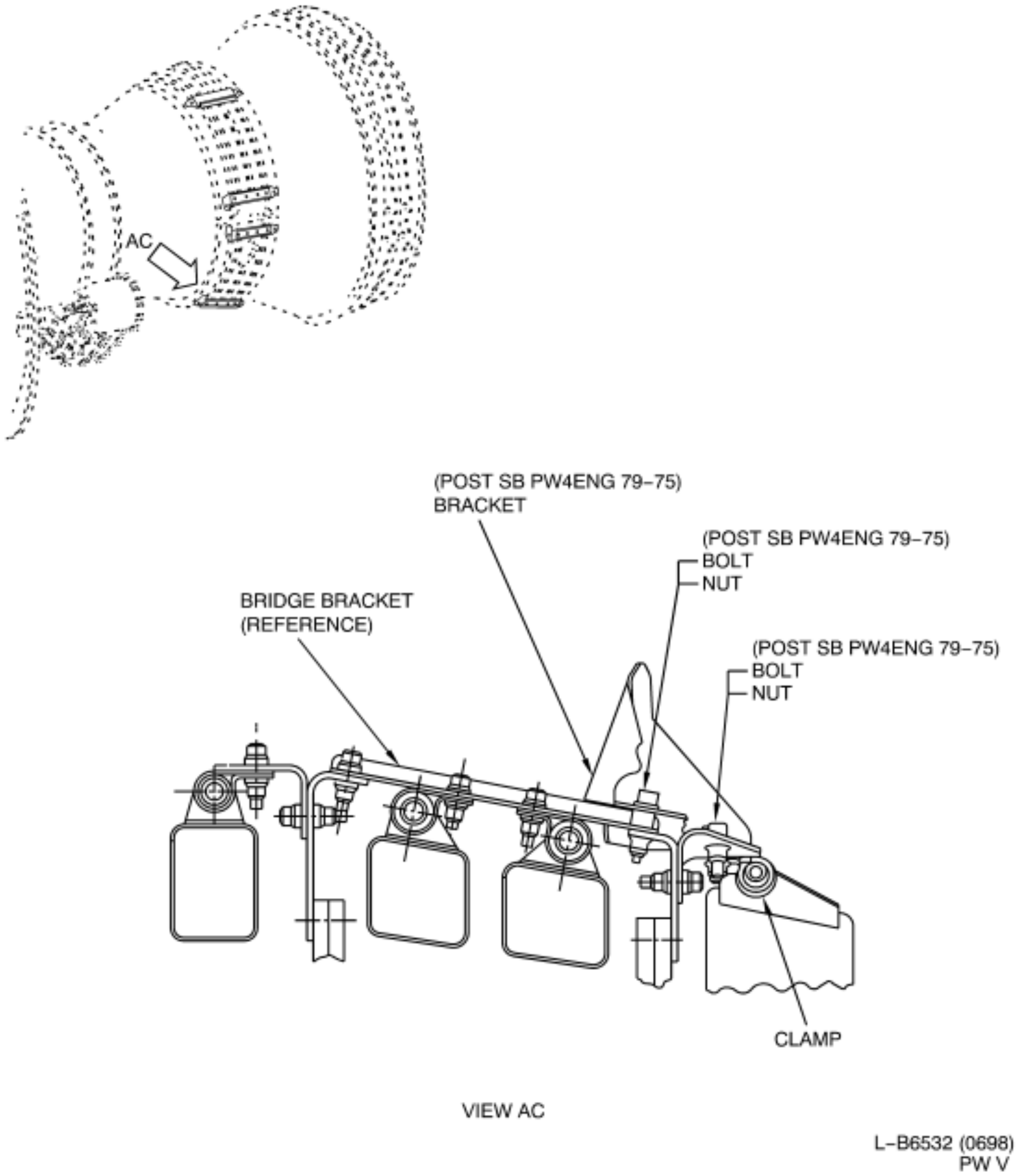
Main Gearbox Plumbing (Pre SB PW4ENG 79−75)
Figure 302 (Sheet 4)
(Task 72−00−61−020−002)


GROMMET
HALF
(2 REQUIRED ON
EACH TUBE)
(LR04)
(LR05)
FWD
(POST SB PW4ENG 79−46 ONLY)
VIEW K
FLANGE M BRACKET
HOSE CLAMP
SPRAY SHIELD
(LR05)
FWD
NO.4 BEARING OIL
SCAVENGE TUBE (REAR)
(LR06)
VIEW R
L−A1628 (0890)
PW V

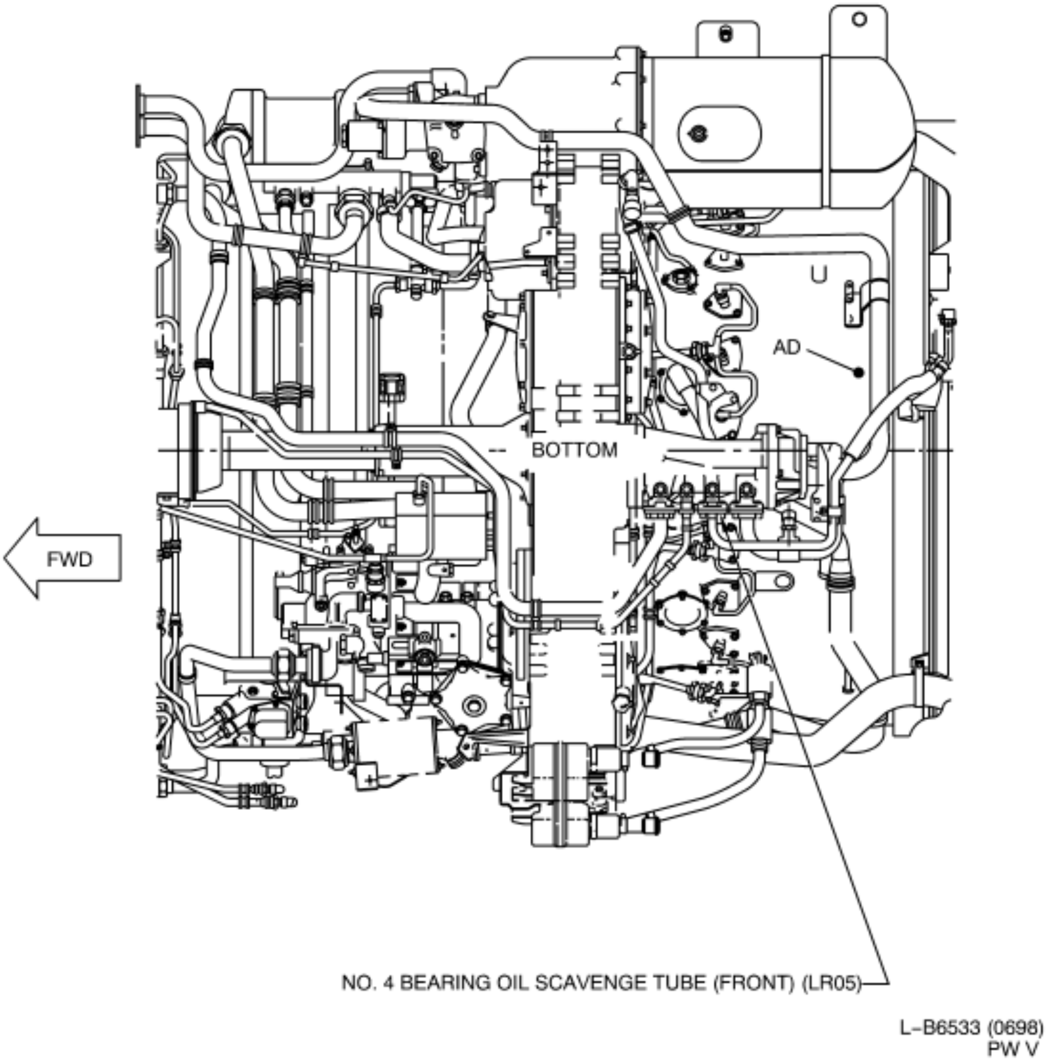
Main Gearbox Plumbing (Pre SB PW4ENG 79−75)
Figure 302 (Sheet 5)
(Task 72−00−61−020−002)


BRACKET
MAIN FILTER OIL TUBE (LP01)
MAIN GEARBOX
LUBRICATION AND SCAVENGE OIL PUMP
FWD
STRAINER ELEMENT (POST SB PW4ENG 79 - 58)
NO.1,1.5,AND 2 BEARING OIL SCAVENGE TUBE (LR03)
PACKING (TYPICAL)
NO. 3 BEARING OIL SCAVENGE MANIFOLD (LR04)
BOLT (TYPICAL)
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
ANGLE GEARBOX OIL SCAVENGE TUBE (LR01)
VIEW S
L-A8241 (0000)
PW V

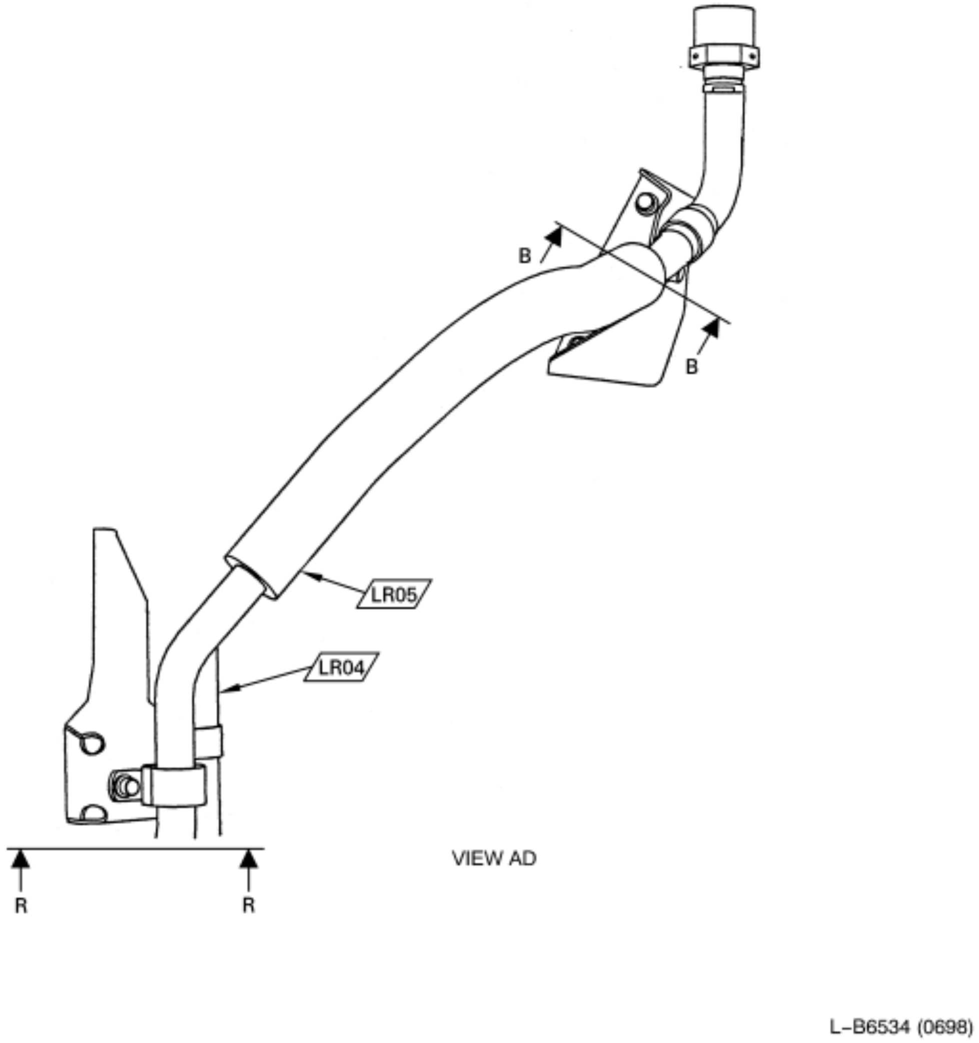
Main Gearbox Plumbing
Figure 302 (Sheet 6)
(Task 72-00-61-020-002)


AC
(POST SB PW4ENG 79-75)
BRACKET
(POST SB PW4ENG 79-75)
BOLT
NUT
BRIDGE BRACKET
(REFERENCE)
(POST SB PW4ENG 79-75)
BOLT
NUT
CLAMP
VIEW AC
L-B6532 (0698)
PW V

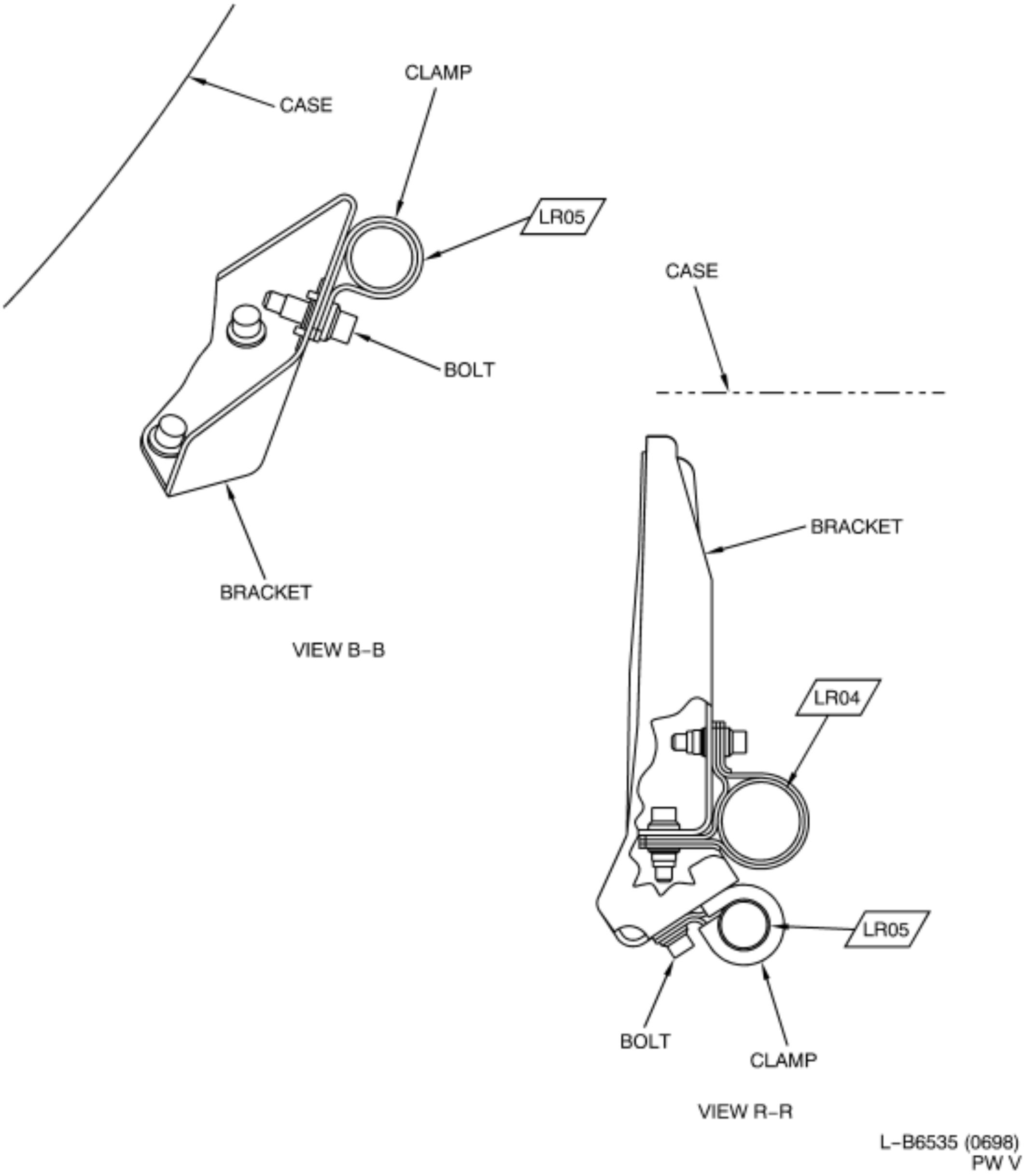
Main Gearbox Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 7)
(Task 72-00-61-020-002)


U
AD
BOTTOM
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (FRONT) (LR05)
L-B6533 (0698)
PW V

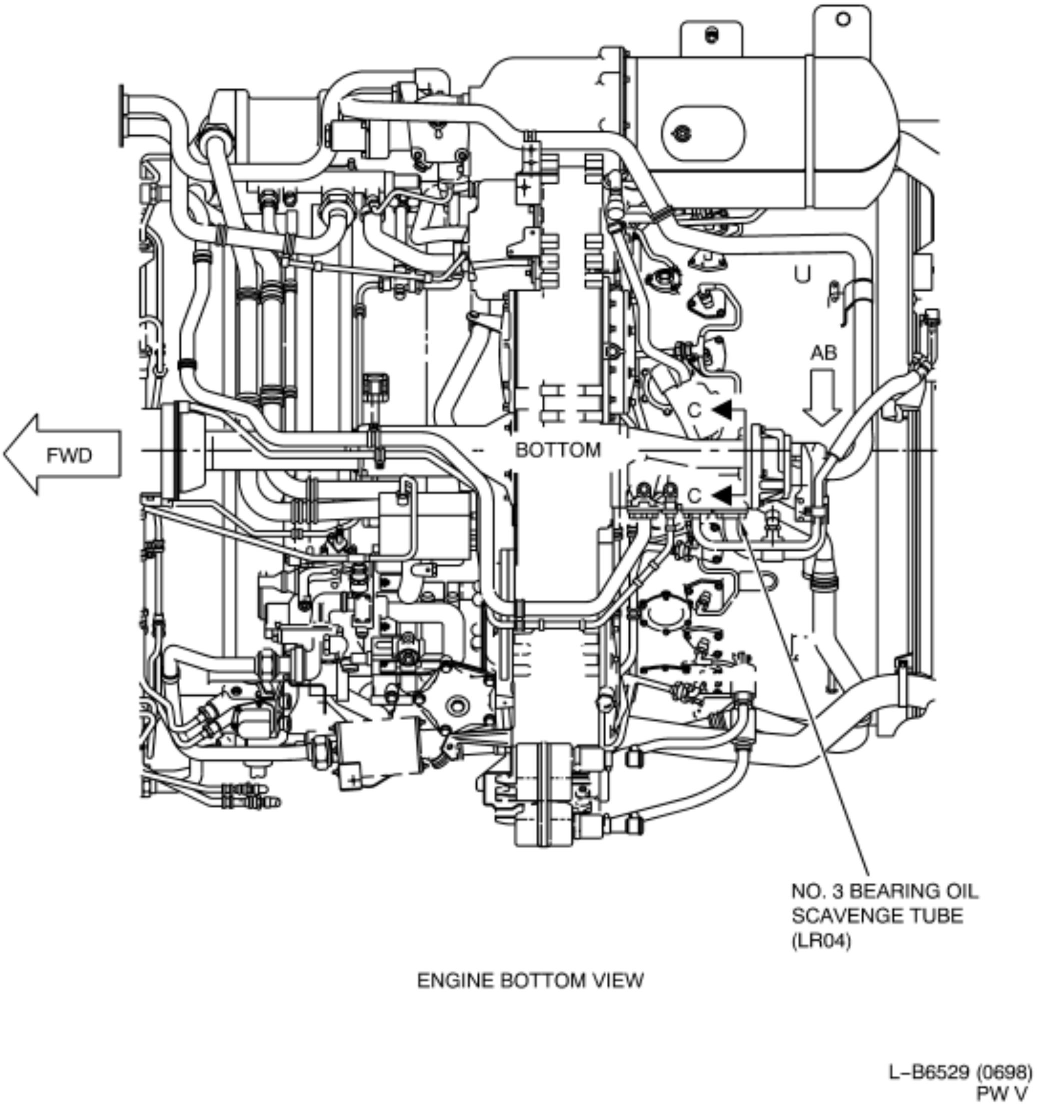
Main Gearbox Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 8)
(Task 72-00-61-020-002)


B
B
LR05
LR04
R
R
VIEW AD
L-B6534 (0698)

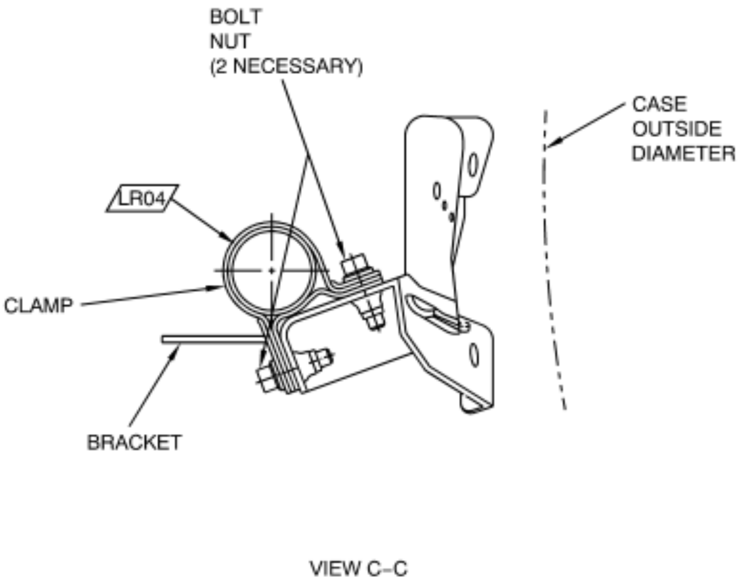
Main Gearbox Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 9)
(Task 72-00-61-020-002)


CASE
CLAMP
LR05
BOLT
BRACKET
VIEW B−B
CASE
BRACKET
LR04
LR05
BOLT
CLAMP
VIEW R−R
L−B6535 (0698)
PW V

Main Gearbox Plumbing (Post SB PW4ENG 79−75)
Figure 302 (Sheet 10)
(Task 72−00−61−020−002)

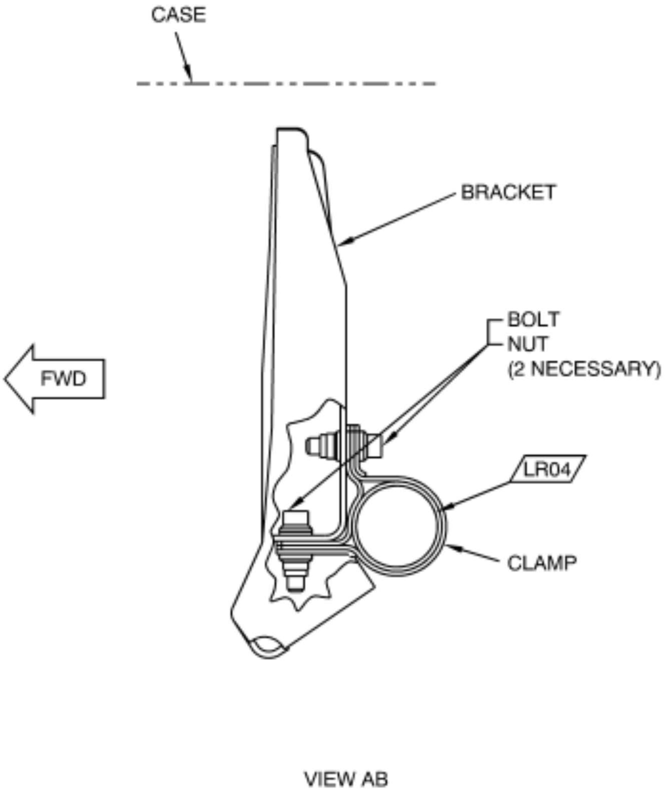

FWD
BOTTOM
U
AB
C
C
NO. 3 BEARING OIL SCAVENGE TUBE (LR04)
ENGINE BOTTOM VIEW
L-B6529 (0698)
PW V

Main Gearbox Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 11)
(Task 72-00-61-020-002)


BOLT
NUT
(2 NECESSARY)
CASE
OUTSIDE
DIAMETER
LR04
CLAMP
BRACKET
VIEW C-C

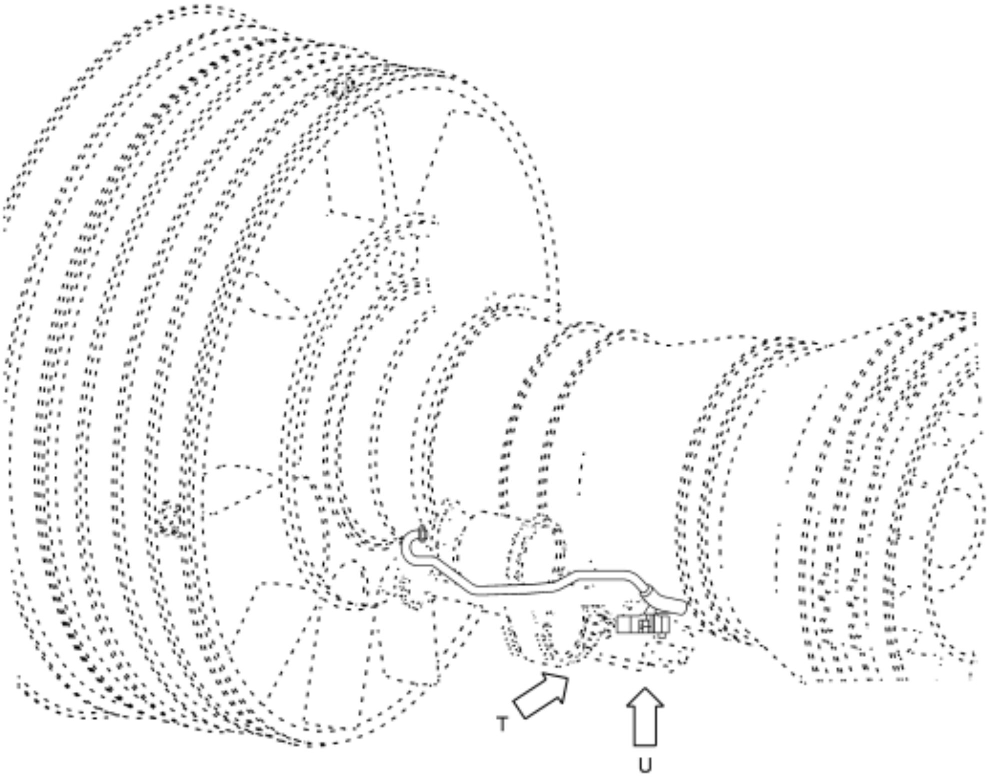
L-B6530 (0698)
PW V

Main Gearbox Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 12)
(Task 72-00-61-020-002)


CASE
BRACKET
BOLT
NUT
(2 NECESSARY)
FWD
LR04
CLAMP
VIEW AB

L-B6531 (0698)
PW V

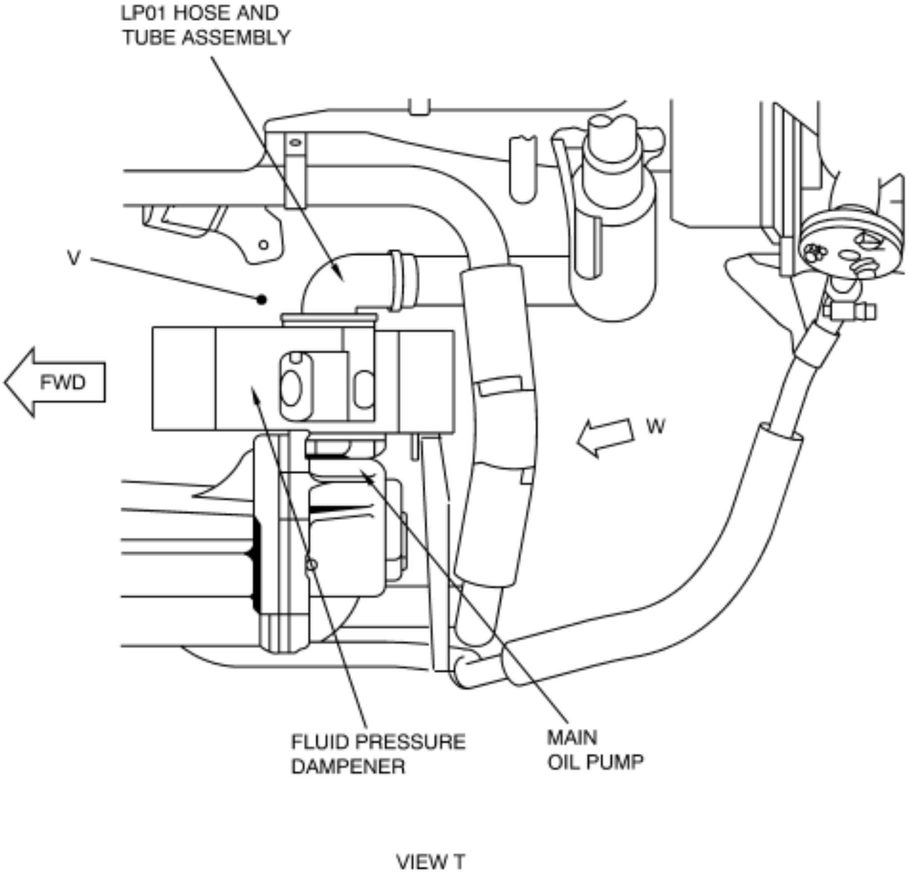
Main Gearbox Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 13)
(Task 72-00-61-020-002)



ENGINE LEFT SIDE VIEW

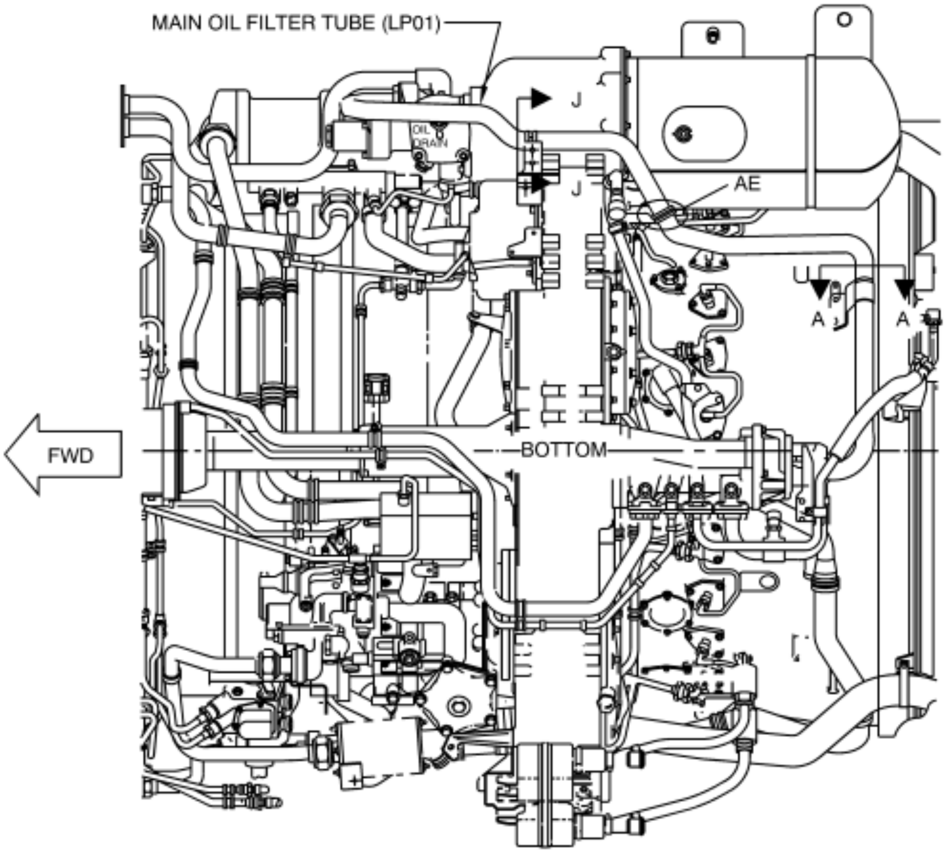
L-B6519 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79-75) (Pre SB PW4ENG 79-86)
Figure 302 (Sheet 14)
(Task 72-00-61-020-002)


LP01 HOSE AND TUBE ASSEMBLY
V
FWD
W
FLUID PRESSURE DAMPENER
MAIN OIL PUMP
VIEW T

L-B6520 (0698)
PW V

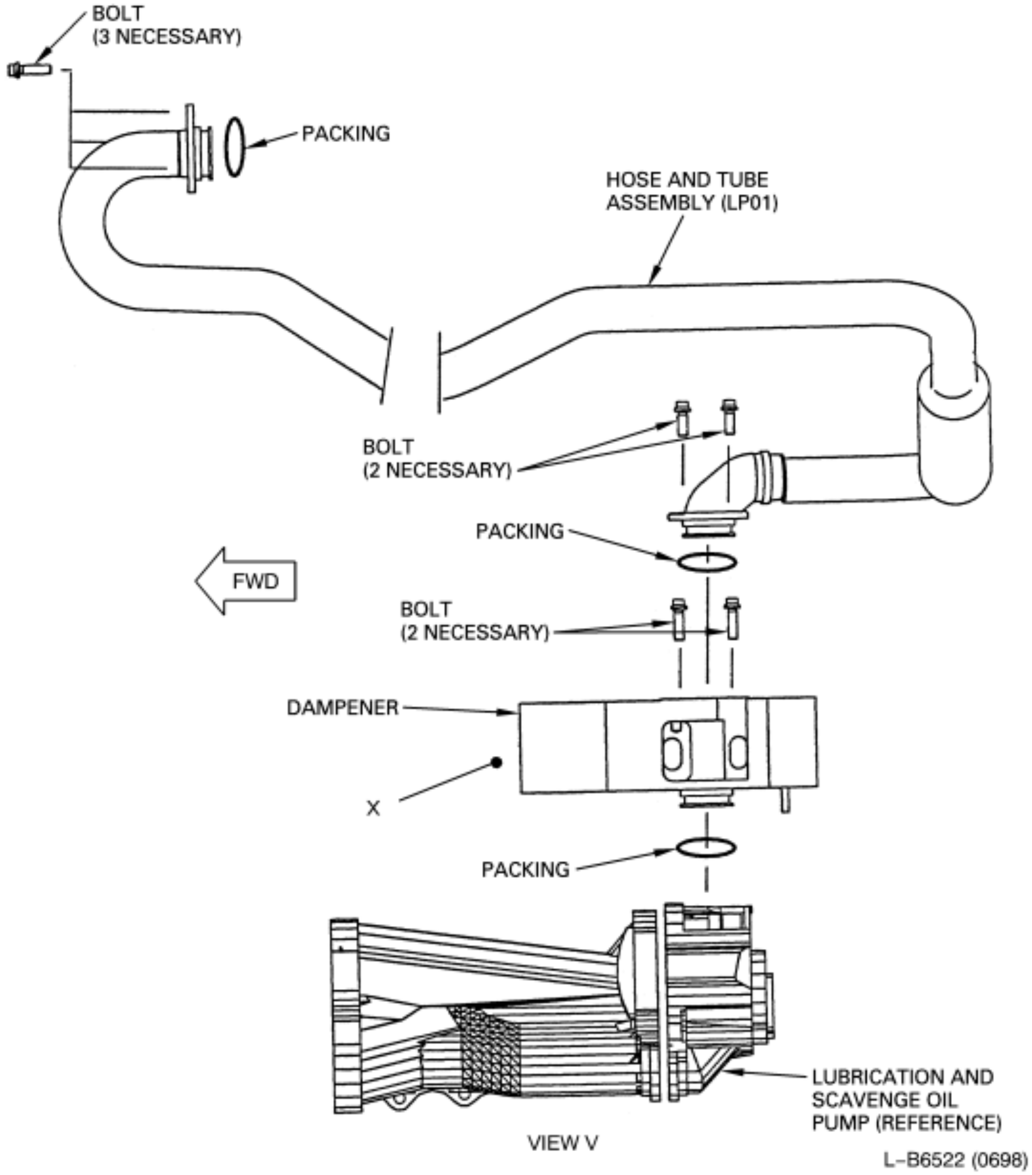
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 15)
(Task 72-00-61-020-002)


MAIN OIL FILTER TUBE (LP01)
J
J
OIL DRAIN
AE
U
A
A
FWD
BOTTOM

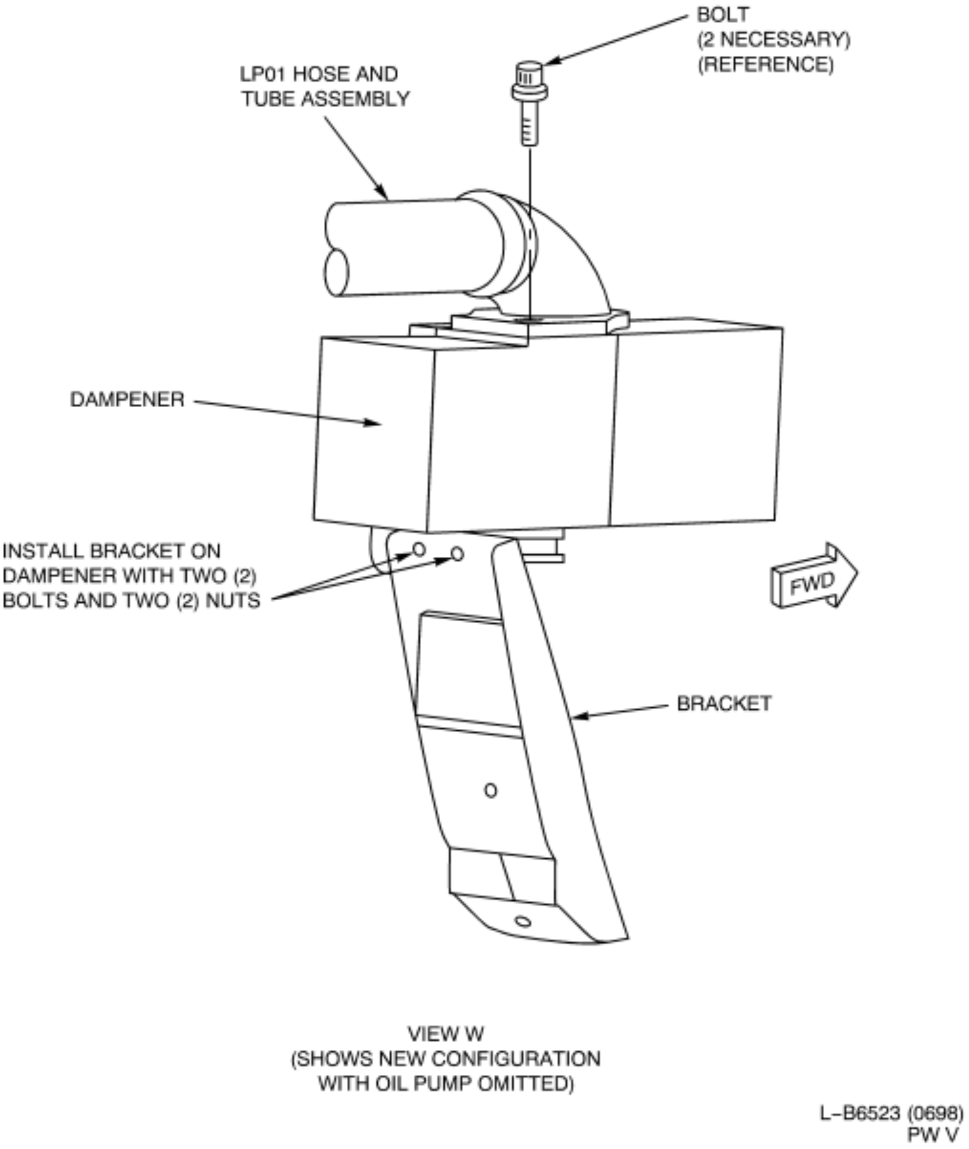
VIEW U
(ENGINE BOTTOM VIEW)

L-B6521 (0698)
PW V

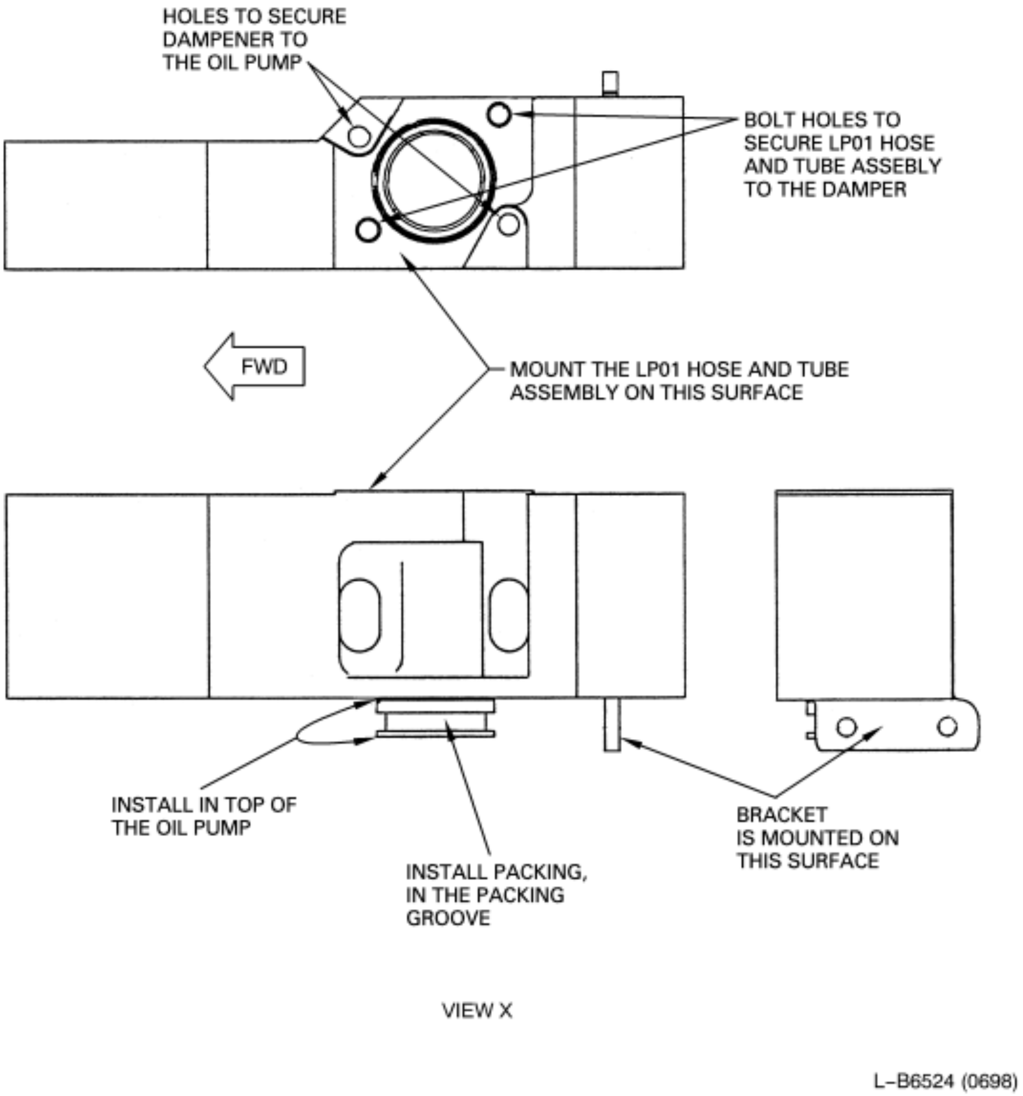
Main Gearbox Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 16)
(Task 72-00-61-020-002)


BOLT
(3 NECESSARY)
PACKING
HOSE AND TUBE
ASSEMBLY (LP01)
BOLT
(2 NECESSARY)
PACKING
FWD
BOLT
(2 NECESSARY)
DAMPENER
X
PACKING
LUBRICATION AND
SCAVENGE OIL
PUMP (REFERENCE)
VIEW V
L-B6522 (0698)

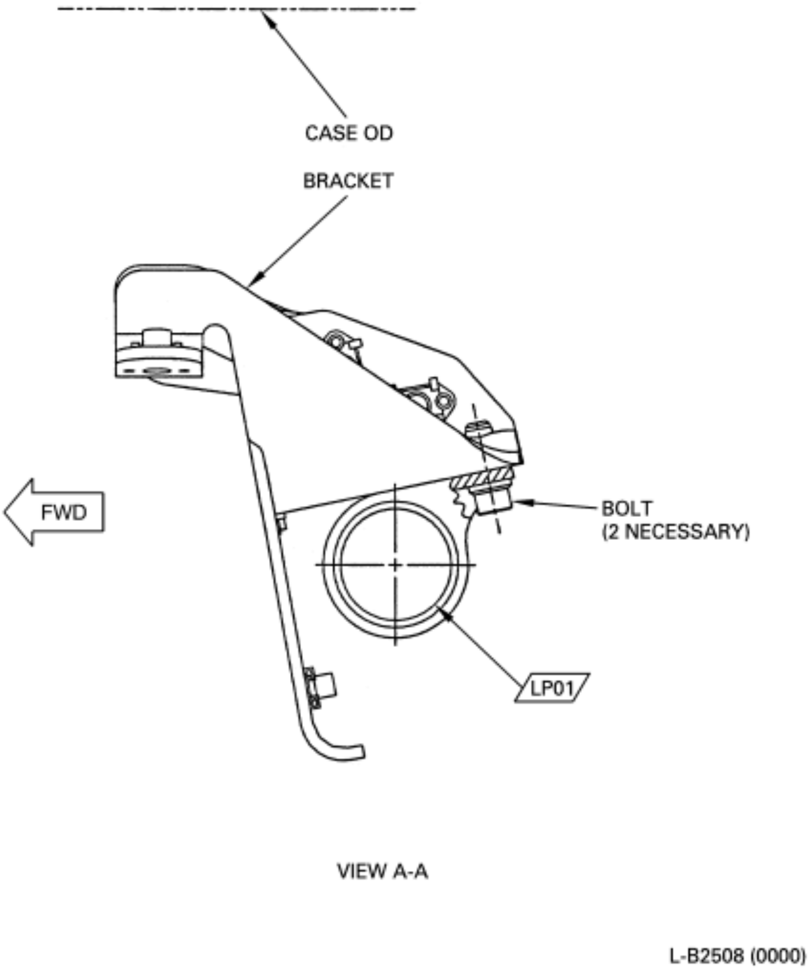
Main Gearbox Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 17)
(Task 72-00-61-020-002)


BOLT
(2 NECESSARY)
(REFERENCE)
LP01 HOSE AND
TUBE ASSEMBLY
DAMPENER
INSTALL BRACKET ON
DAMPENER WITH TWO (2)
BOLTS AND TWO (2) NUTS
FWD
BRACKET
VIEW W
(SHOWS NEW CONFIGURATION
WITH OIL PUMP OMITTED)
L-B6523 (0698)
PW V

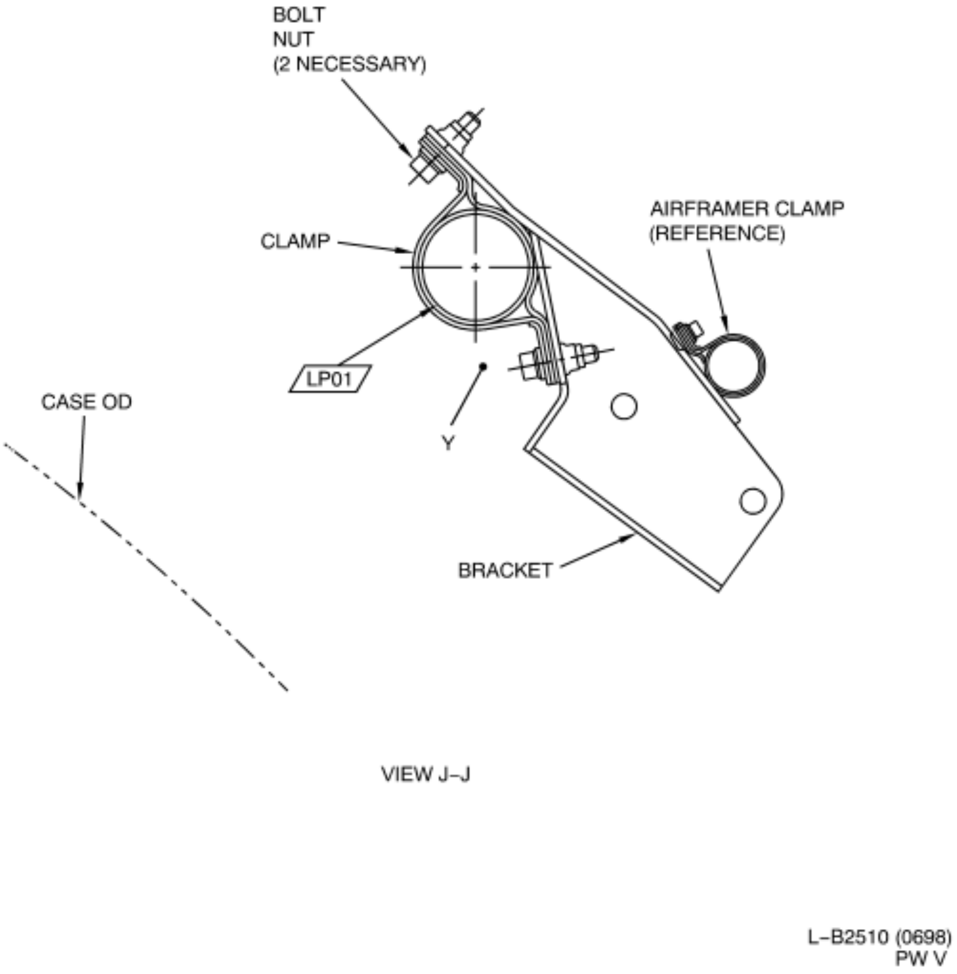
Main Gearbox Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 18)
(Task 72-00-61-020-002)


HOLES TO SECURE DAMPENER TO THE OIL PUMP
BOLT HOLES TO SECURE LP01 HOSE AND TUBE ASSEBLY TO THE DAMPER
FWD
MOUNT THE LP01 HOSE AND TUBE ASSEMBLY ON THIS SURFACE
INSTALL IN TOP OF THE OIL PUMP
INSTALL PACKING, IN THE PACKING GROOVE
BRACKET IS MOUNTED ON THIS SURFACE
VIEW X
L-B6524 (0698)

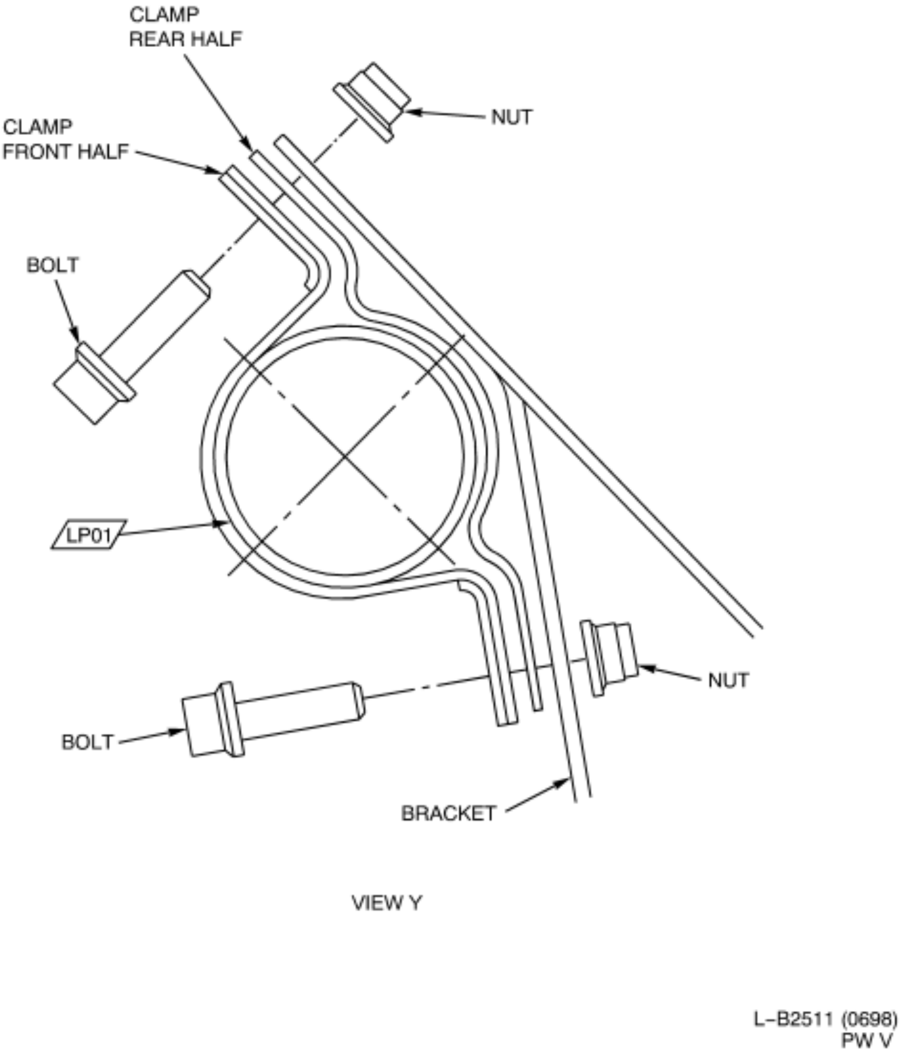
Main Gearbox Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 19)
(Task 72-00-61-020-002)


CASE OD
BRACKET
FWD
BOLT
(2 NECESSARY)
LP01
VIEW A-A
L-B2508 (0000)

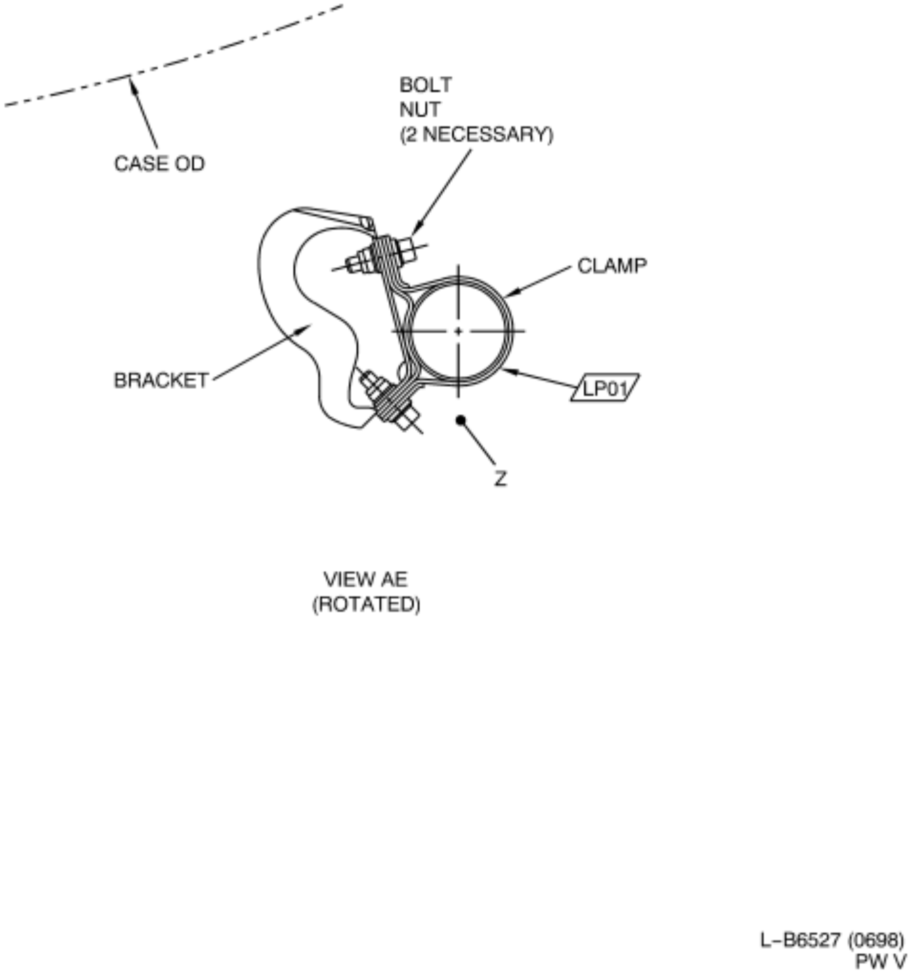
Main Gearbox Plumbing (Post SB PW4ENG 79−75)
Figure 302 (Sheet 20)
(Task 72-00-61-020-002)


BOLT
NUT
(2 NECESSARY)
AIRFRAMER CLAMP
(REFERENCE)
CLAMP
LP01
CASE OD
Y
BRACKET
VIEW J-J
L-B2510 (0698)
PW V

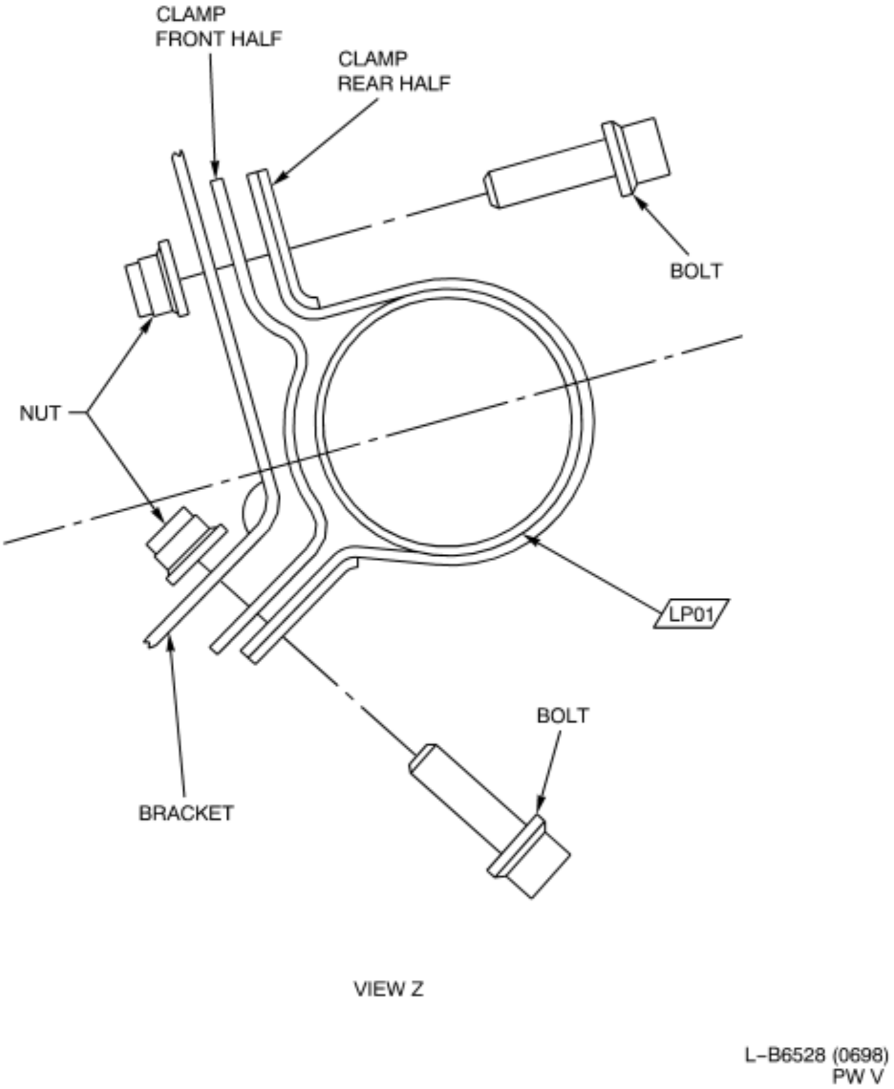
Main Gearbox Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 21)
(Task 72-00-61-020-002)


CLAMP
REAR HALF
NUT
CLAMP
FRONT HALF
BOLT
LP01
NUT
BOLT
BRACKET
VIEW Y
L-B2511 (0698)
PW V

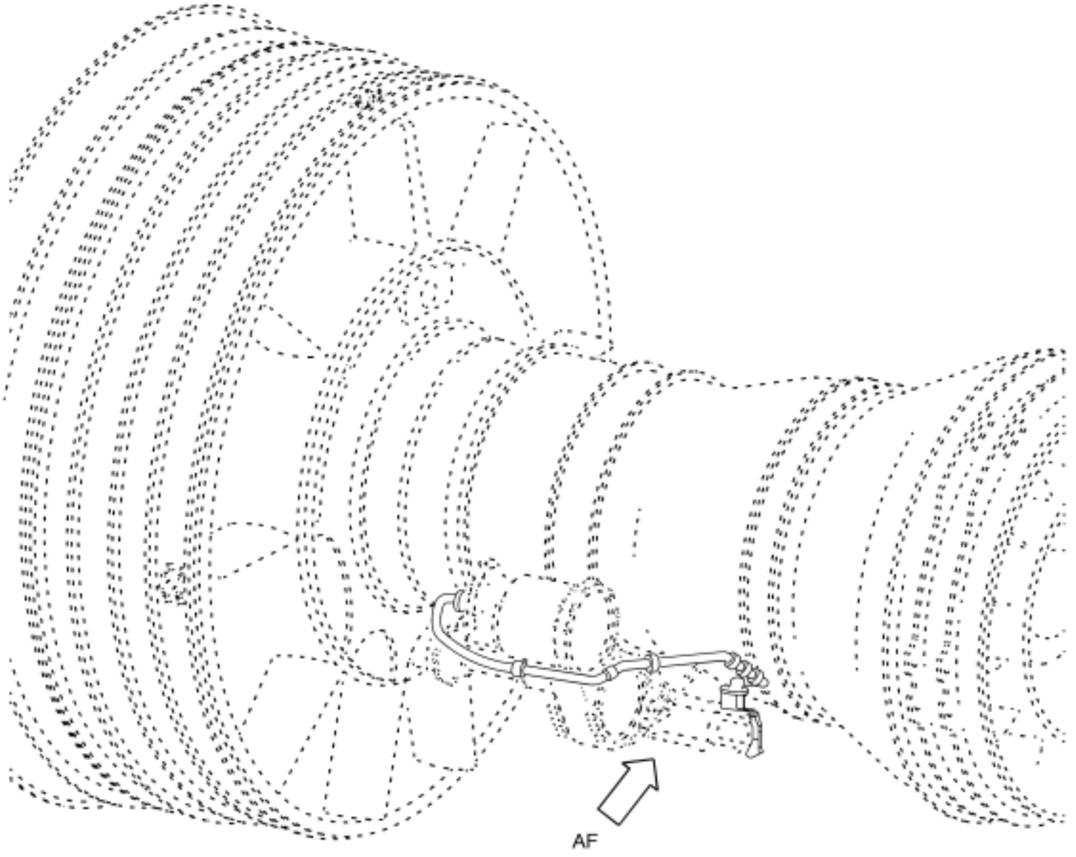
Main Gearbox Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 22)
(Task 72-00-61-020-002)


CASE OD
BOLT
NUT
(2 NECESSARY)
CLAMP
BRACKET
LP01
Z
VIEW AE
(ROTATED)
L−B6527 (0698)
PW V

Main Gearbox Plumbing (Post SB PW4ENG 79−75)
Figure 302 (Sheet 23)
(Task 72−00−61−020−002)


CLAMP
FRONT HALF
CLAMP
REAR HALF
BOLT
NUT
LP01
BOLT
BRACKET
VIEW Z
L-B6528 (0698)
PW V

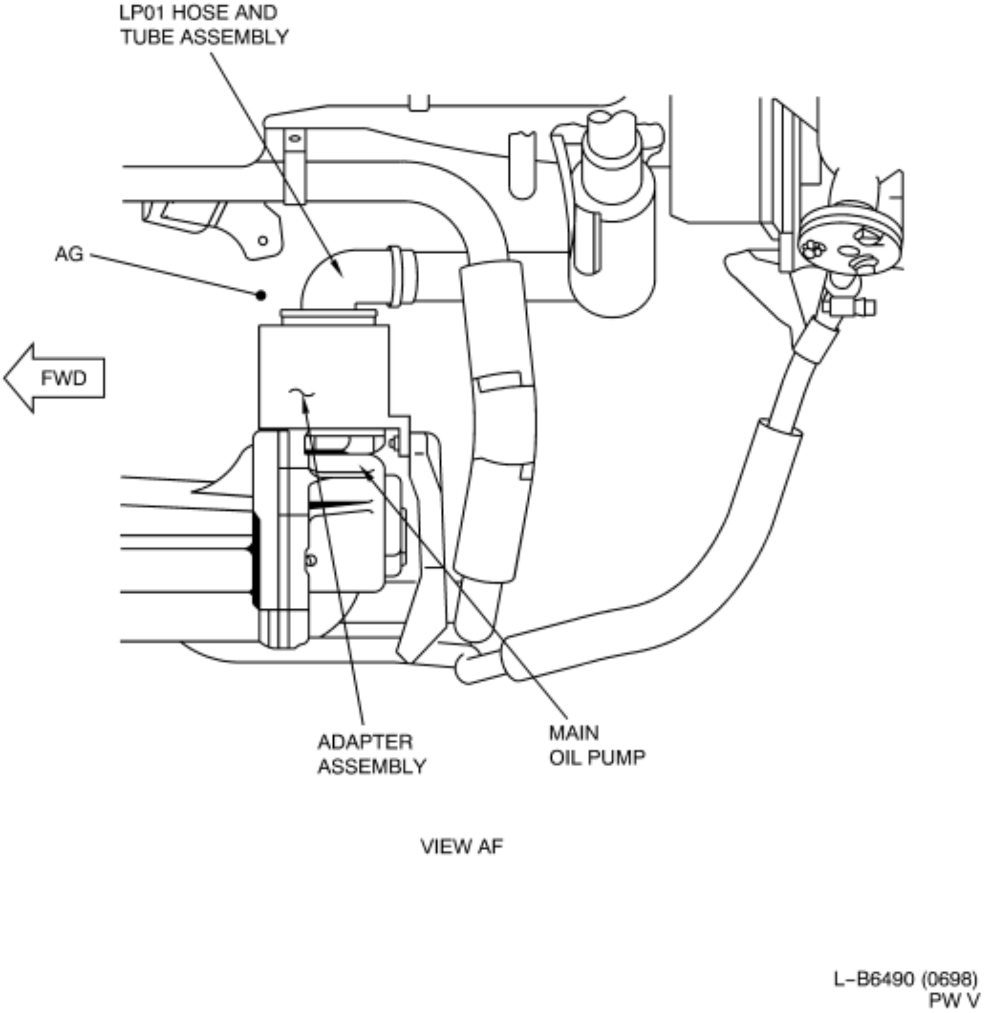
Main Gearbox Plumbing (Post SB PW4ENG 79-75)
Figure 302 (Sheet 24)
(Task 72-00-61-020-002)



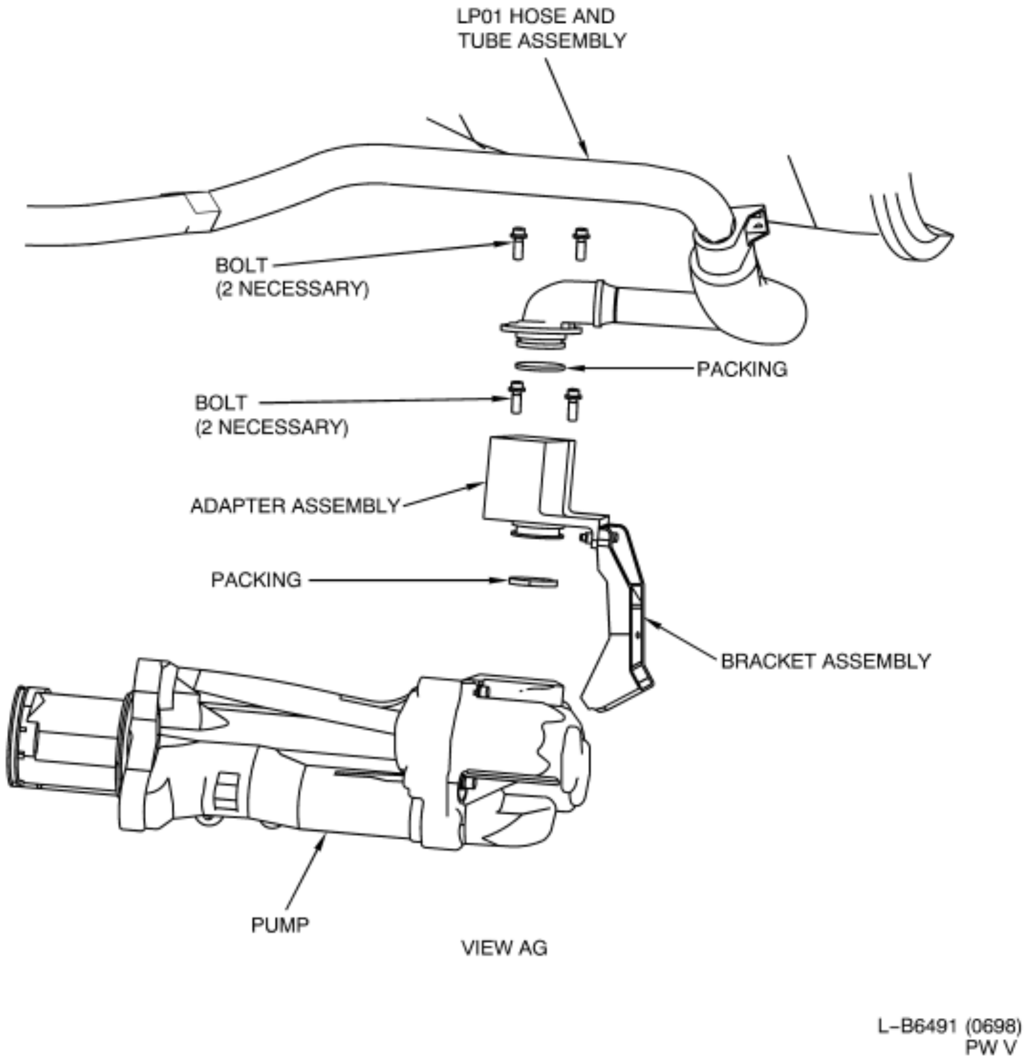
ENGINE LEFT SIDE VIEW

L-B6489 (0698)
PW V

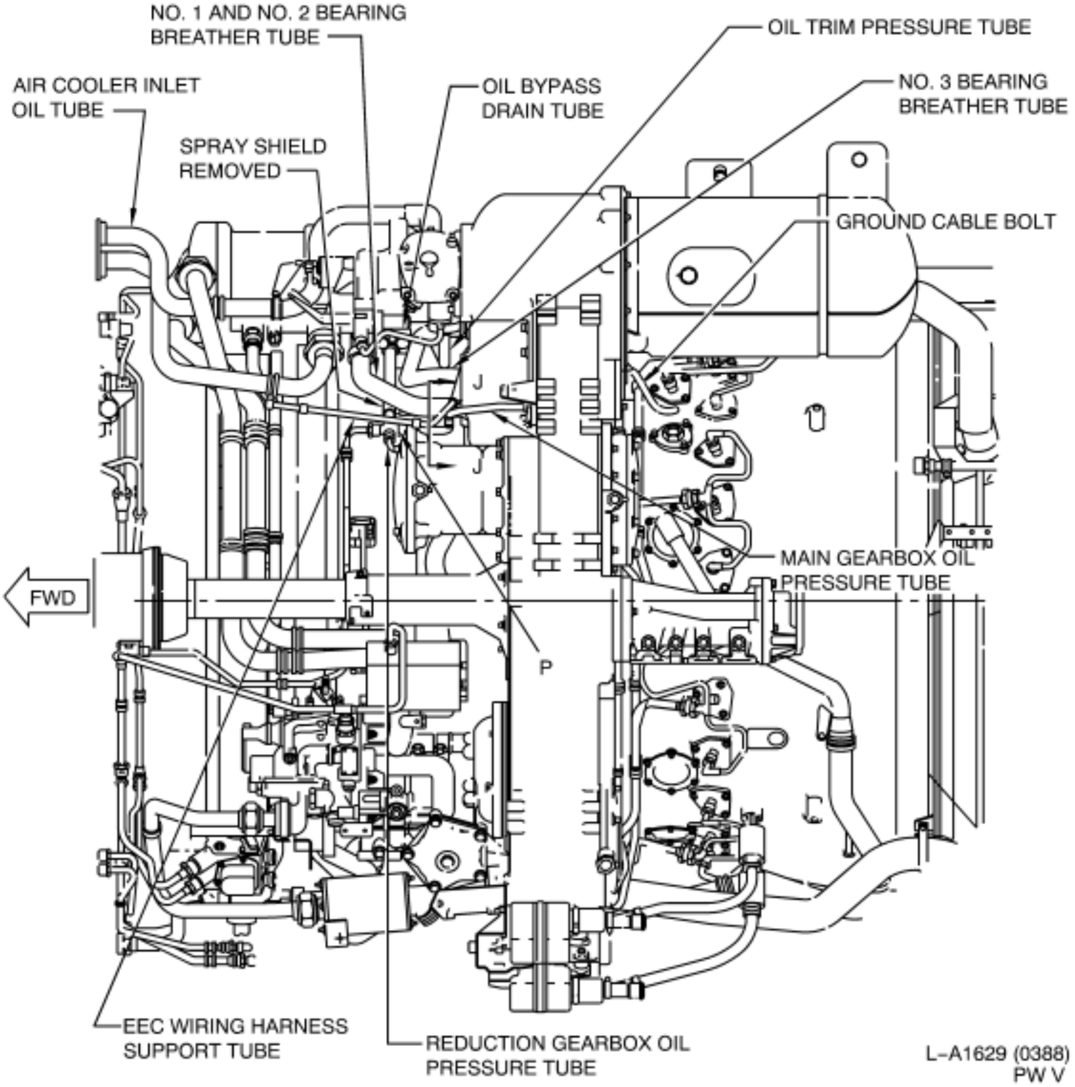
Main Gearbox Plumbing (Post SB PW4ENG 79-86)
Figure 302 (Sheet 25)
(Task 72-00-61-020-002)


LP01 HOSE AND
TUBE ASSEMBLY
AG
FWD
ADAPTER
ASSEMBLY
MAIN
OIL PUMP
VIEW AF
L-B6490 (0698)
PW V

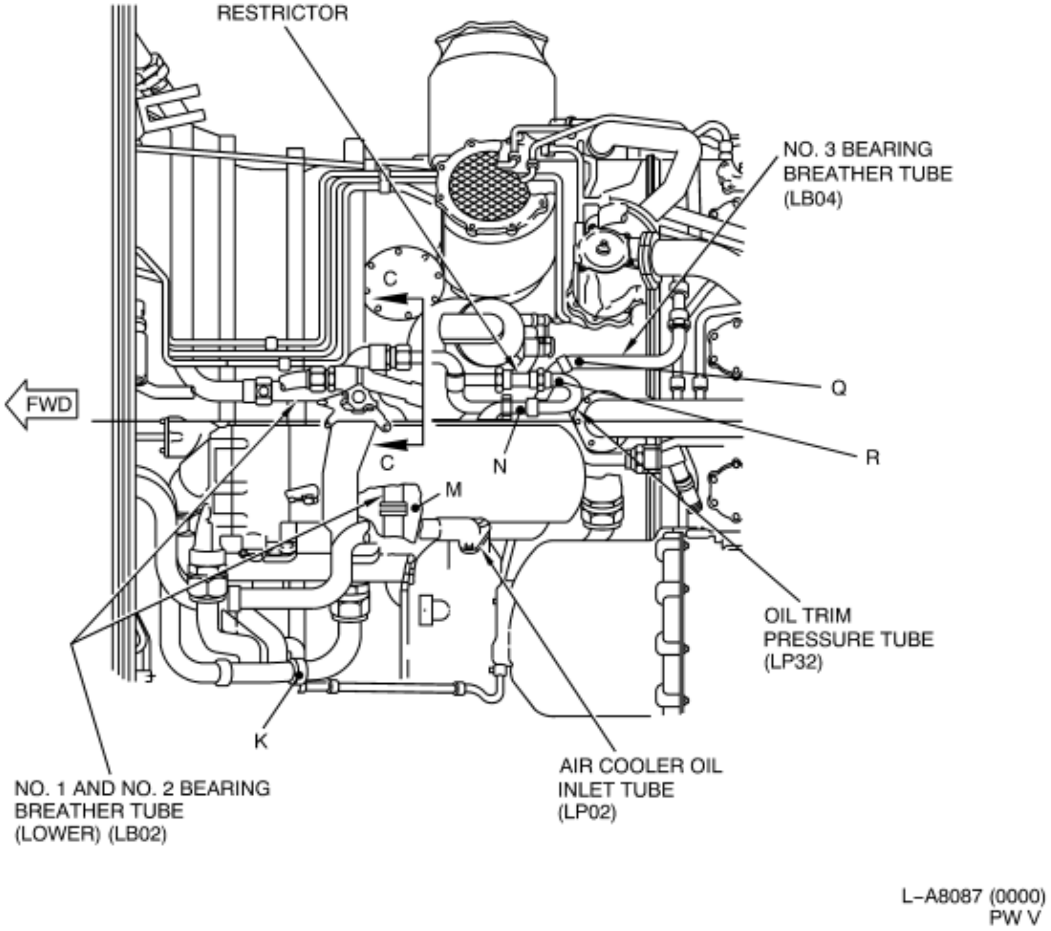
Main Gearbox Plumbing (Post SB PW4ENG 79-86)
Figure 302 (Sheet 26)
(Task 72-00-61-020-002)


LP01 HOSE AND
TUBE ASSEMBLY
BOLT
(2 NECESSARY)
PACKING
BOLT
(2 NECESSARY)
ADAPTER ASSEMBLY
PACKING
BRACKET ASSEMBLY
PUMP
VIEW AG
L-B6491 (0698)
PW V

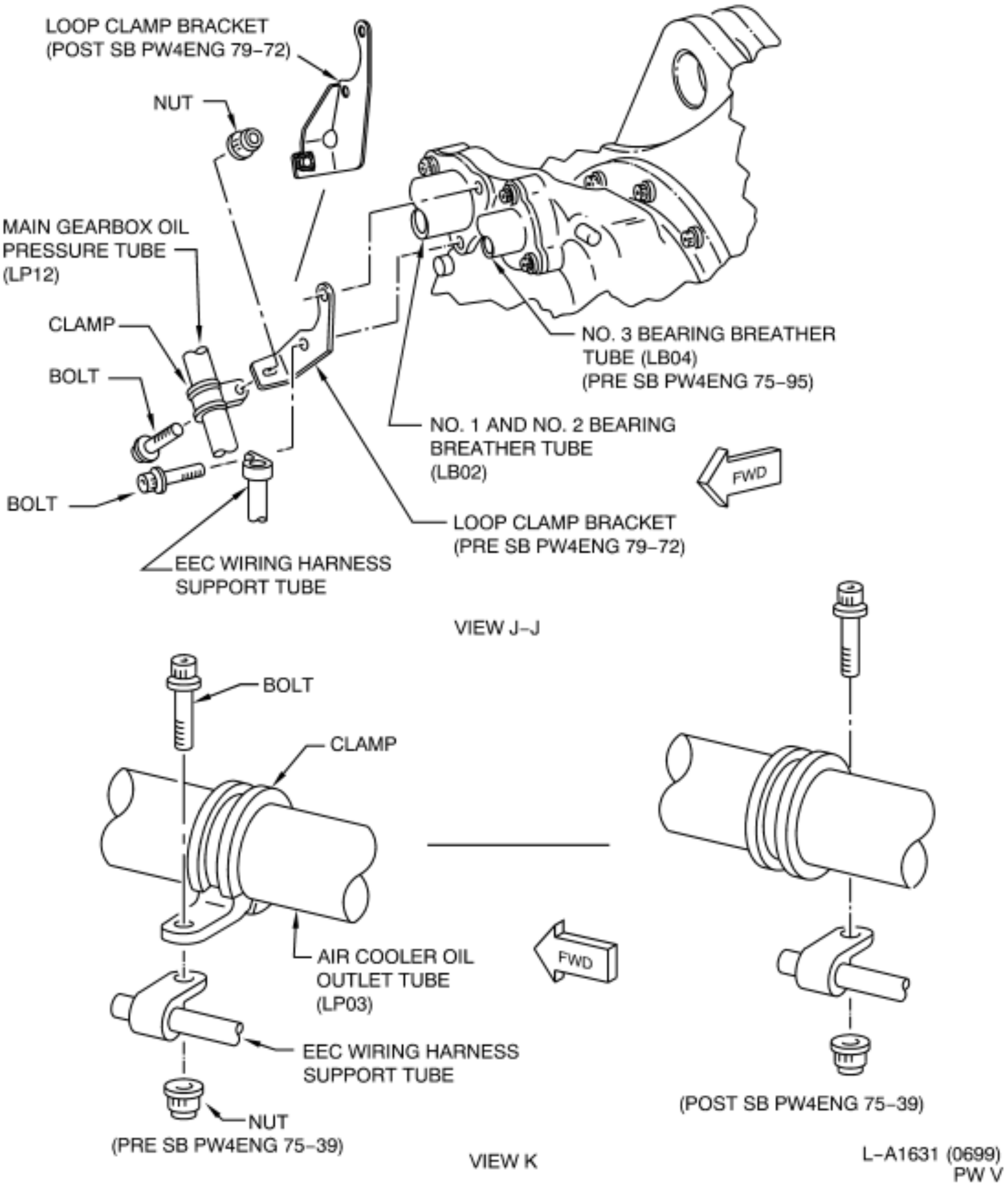
Main Gearbox Plumbing (Post SB PW4ENG 79-86)
Figure 302 (Sheet 27)
(Task 72-00-61-020-002)


NO. 1 AND NO. 2 BEARING BREATHER TUBE
OIL TRIM PRESSURE TUBE
AIR COOLER INLET OIL TUBE
OIL BYPASS DRAIN TUBE
NO. 3 BEARING BREATHER TUBE
SPRAY SHIELD REMOVED
GROUND CABLE BOLT
J
J
MAIN GEARBOX OIL PRESSURE TUBE
FWD
P
EEC WIRING HARNESS SUPPORT TUBE
REDUCTION GEARBOX OIL PRESSURE TUBE
L-A1629 (0388)
PW V

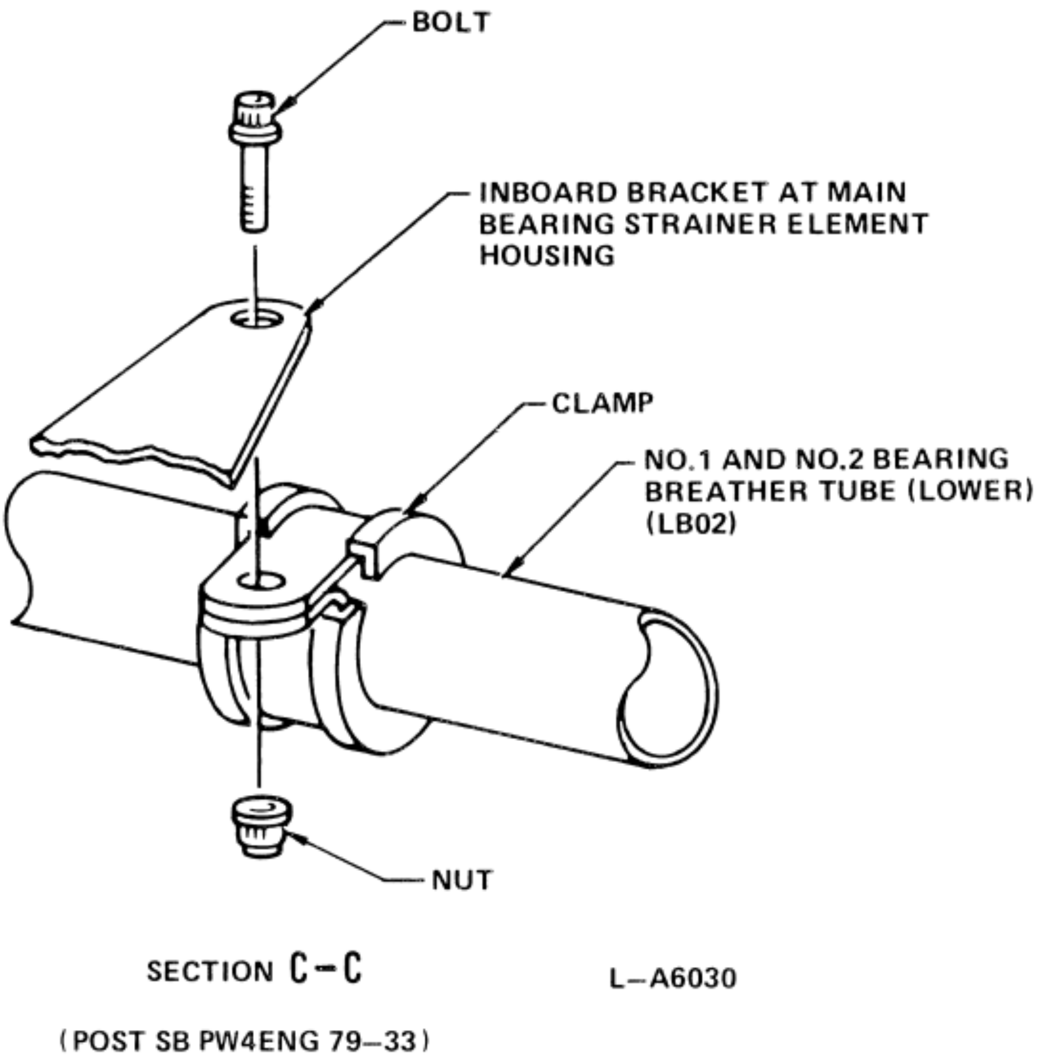
Main Gearbox Plumbing
Figure 303 (Sheet 1)
(Task 72-00-61-020-002)


RESTRICTOR
NO. 3 BEARING BREATHER TUBE (LB04)
C
FWD
Q
R
C
N
M
OIL TRIM PRESSURE TUBE (LP32)
K
AIR COOLER OIL INLET TUBE (LP02)
NO. 1 AND NO. 2 BEARING BREATHER TUBE (LOWER) (LB02)
L-A8087 (0000)
PW V

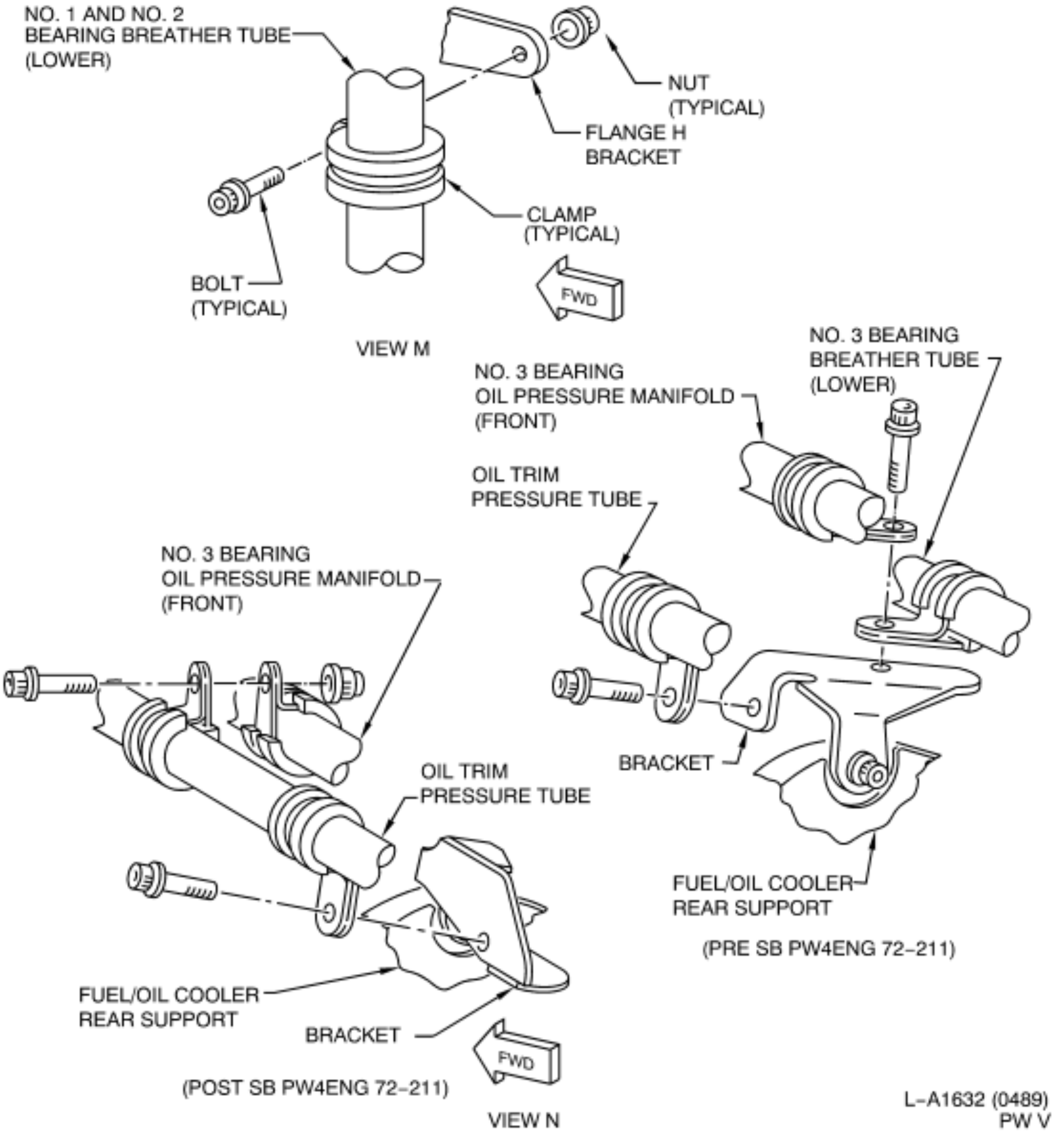
Main Gearbox Plumbing
Figure 303 (Sheet 2)
(Task 72-00-61-020-002)


LOOP CLAMP BRACKET
(POST SB PW4ENG 79-72)
NUT
MAIN GEARBOX OIL
PRESSURE TUBE
(LP12)
CLAMP
BOLT
BOLT
EEC WIRING HARNESS
SUPPORT TUBE
NO. 3 BEARING BREATHER
TUBE (LB04)
(PRE SB PW4ENG 75-95)
NO. 1 AND NO. 2 BEARING
BREATHER TUBE
(LB02)
FWD
LOOP CLAMP BRACKET
(PRE SB PW4ENG 79-72)
VIEW J-J
BOLT
CLAMP
AIR COOLER OIL
OUTLET TUBE
(LP03)
FWD
EEC WIRING HARNESS
SUPPORT TUBE
NUT
(PRE SB PW4ENG 75-39)
VIEW K
(POST SB PW4ENG 75-39)
L-A1631 (0699)
PW V

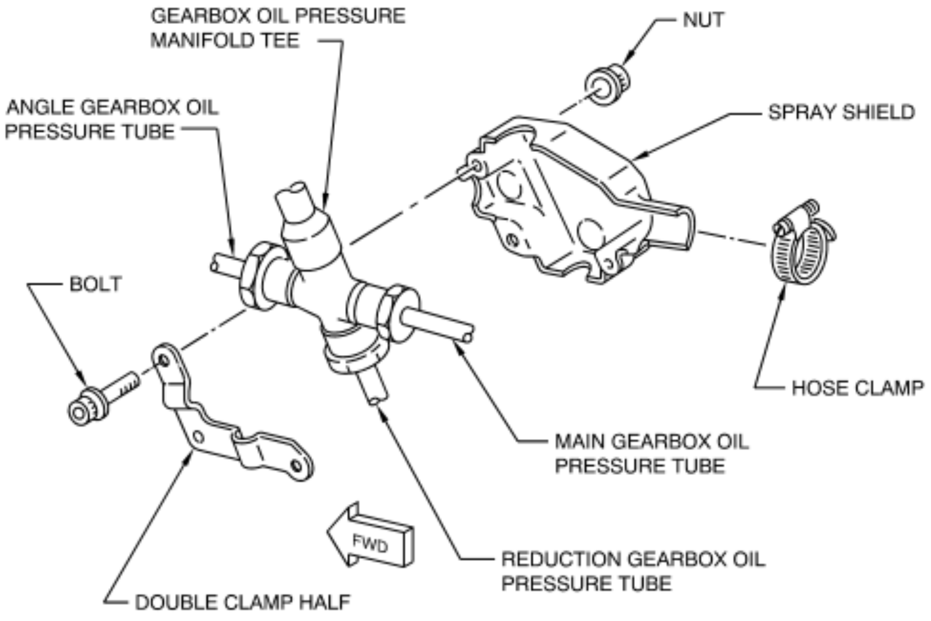
Main Gearbox Plumbing
Figure 303 (Sheet 3)
(Task 72-00-61-020-002)


BOLT
INBOARD BRACKET AT MAIN BEARING STRAINER ELEMENT HOUSING
CLAMP
NO.1 AND NO.2 BEARING BREATHER TUBE (LOWER) (LB02)
NUT
SECTION C-C
L-A6030
(POST SB PW4ENG 79-33)

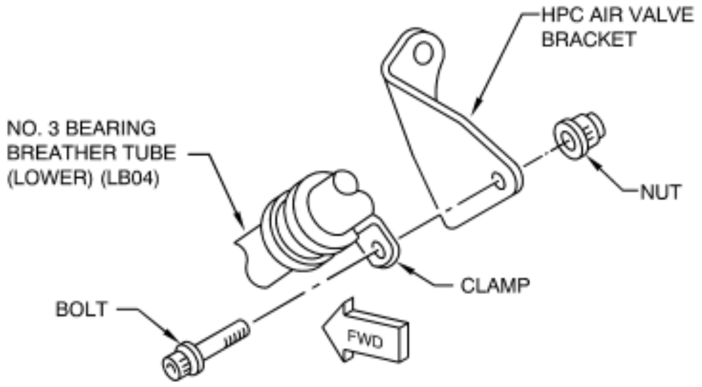
Main Gearbox Plumbing
Figure 303 (Sheet 4)
(Task 72-00-61-020-002)


NO. 1 AND NO. 2
BEARING BREATHER TUBE
(LOWER)
NUT
(TYPICAL)
FLANGE H
BRACKET
CLAMP
(TYPICAL)
BOLT
(TYPICAL)
FWD
VIEW M
NO. 3 BEARING
BREATHER TUBE
(LOWER)
NO. 3 BEARING
OIL PRESSURE MANIFOLD
(FRONT)
OIL TRIM
PRESSURE TUBE
NO. 3 BEARING
OIL PRESSURE MANIFOLD
(FRONT)
BRACKET
OIL TRIM
PRESSURE TUBE
FUEL/OIL COOLER
REAR SUPPORT
(PRE SB PW4ENG 72−211)
FUEL/OIL COOLER
REAR SUPPORT
BRACKET
FWD
(POST SB PW4ENG 72−211)
VIEW N
L−A1632 (0489)
PW V

Main Gearbox Plumbing
Figure 303 (Sheet 5)
(Task 72−00−61−020−002)


GEARBOX OIL PRESSURE MANIFOLD TEE
NUT
ANGLE GEARBOX OIL PRESSURE TUBE
SPRAY SHIELD
BOLT
HOSE CLAMP
MAIN GEARBOX OIL PRESSURE TUBE
FWD
REDUCTION GEARBOX OIL PRESSURE TUBE
DOUBLE CLAMP HALF

VIEW P

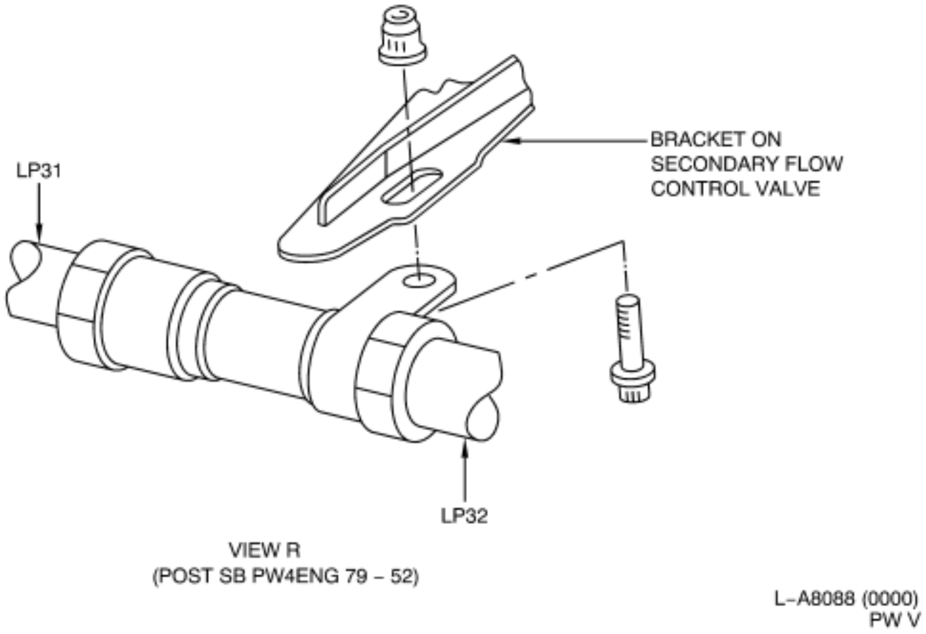

HPC AIR VALVE BRACKET
NO. 3 BEARING BREATHER TUBE (LOWER) (LB04)
NUT
CLAMP
BOLT
FWD

(POST SB PW4ENG 72-211)

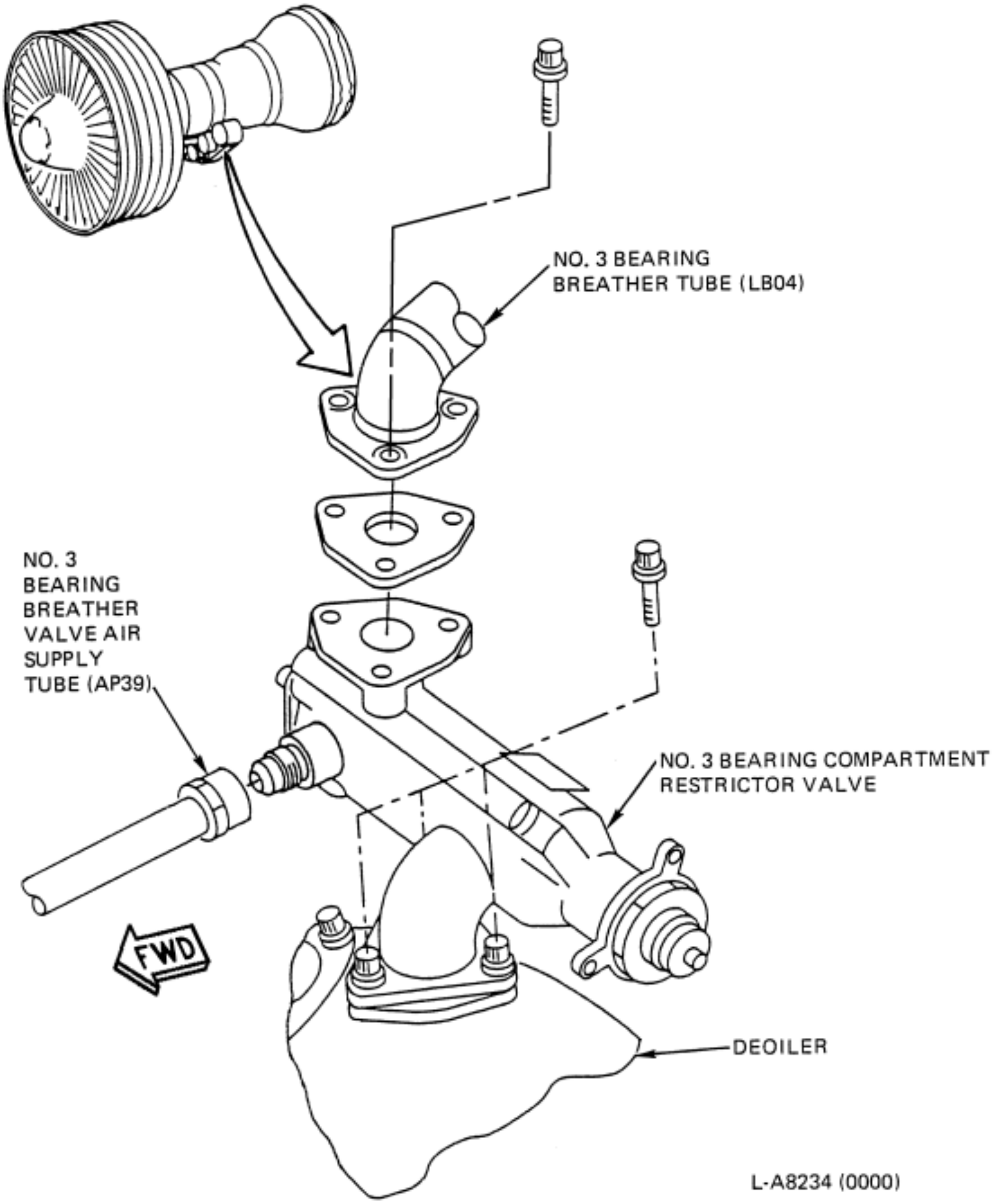
VIEW Q

L-A1633 (0489)
PW V

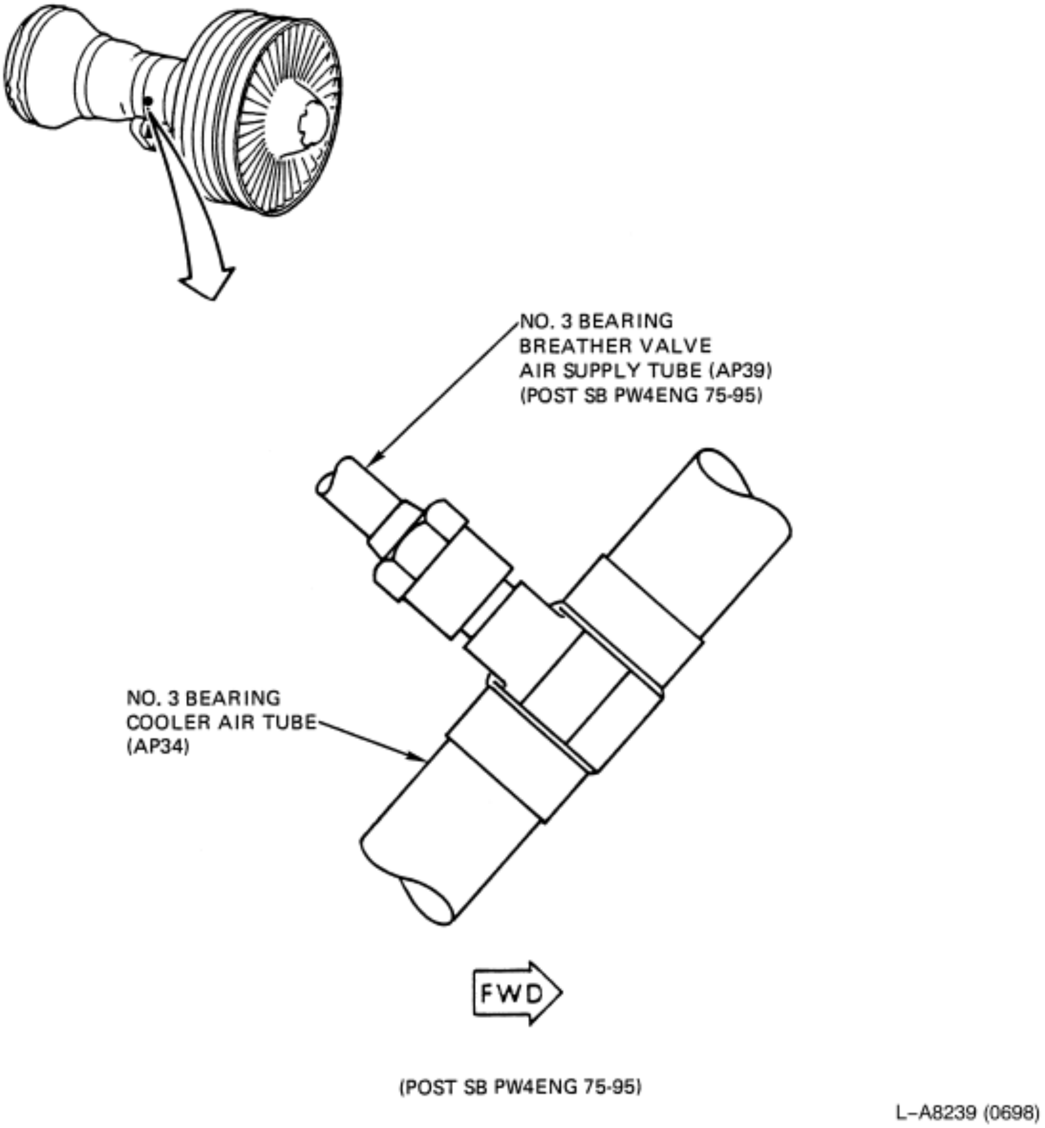
Main Gearbox Plumbing
Figure 303 (Sheet 6)
(Task 72-00-61-020-002)


BRACKET ON
SECONDARY FLOW
CONTROL VALVE
LP31
LP32
VIEW R
(POST SB PW4ENG 79 − 52)
L−A8088 (0000)
PW V

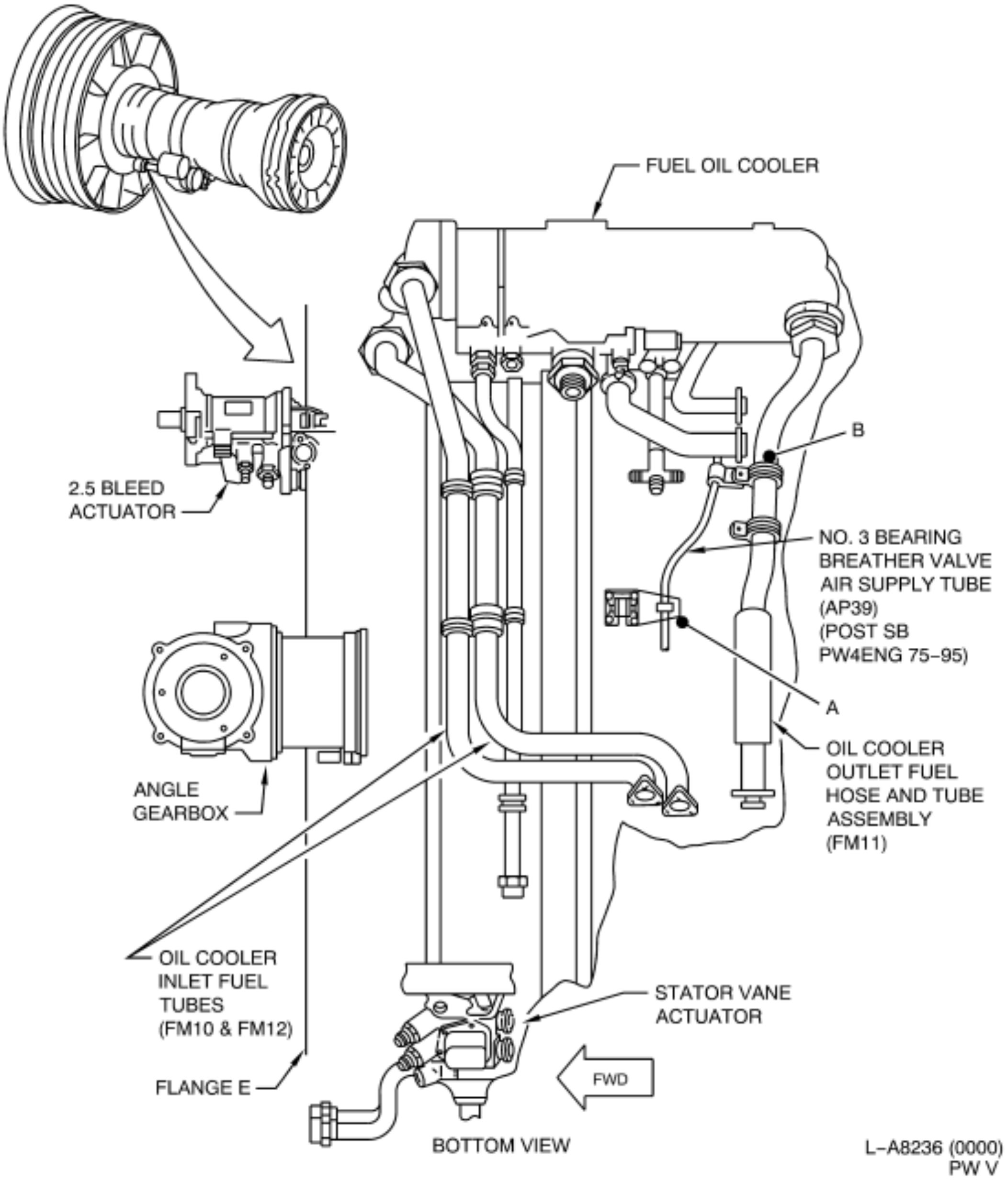
Main Gearbox Plumbing
Figure 303 (Sheet 7)
(Task 72−00−61−020−002)


NO. 3 BEARING BREATHER TUBE (LB04)
NO. 3 BEARING BREATHER VALVE AIR SUPPLY TUBE (AP39)
NO. 3 BEARING COMPARTMENT RESTRICTOR VALVE
FWD
DEOILER
L-A8234 (0000)

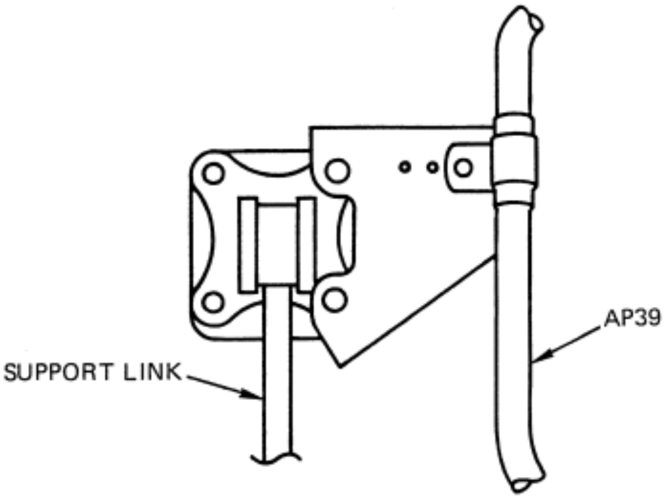
Main Gearbox Plumbing (Post SB PW4ENG 75-95)
Figure 304 (Sheet 1)
(Task 72-00-61-020-002)


NO. 3 BEARING
BREATHER VALVE
AIR SUPPLY TUBE (AP39)
(POST SB PW4ENG 75-95)
NO. 3 BEARING
COOLER AIR TUBE
(AP34)
FWD
(POST SB PW4ENG 75-95)
L-A8239 (0698)

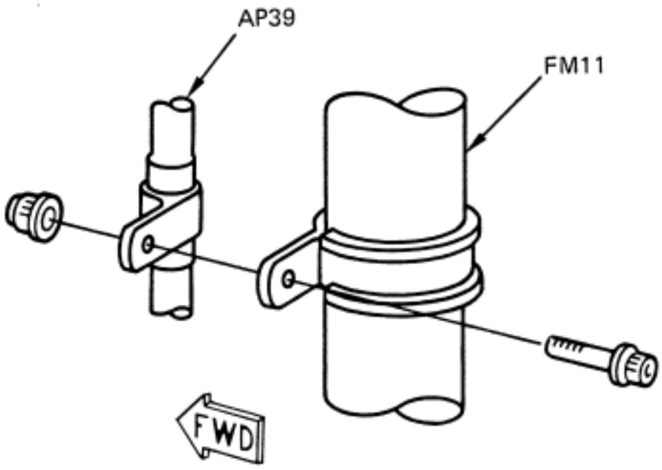
Main Gearbox Plumbing (Post SB PW4ENG 75-95)
Figure 304 (Sheet 2)
(Task 72-00-61-020-002)


FUEL OIL COOLER
B
2.5 BLEED ACTUATOR
NO. 3 BEARING BREATHER VALVE AIR SUPPLY TUBE (AP39) (POST SB PW4ENG 75-95)
A
ANGLE GEARBOX
OIL COOLER OUTLET FUEL HOSE AND TUBE ASSEMBLY (FM11)
OIL COOLER INLET FUEL TUBES (FM10 & FM12)
STATOR VANE ACTUATOR
FLANGE E
FWD
BOTTOM VIEW
L-A8236 (0000)
PW V

Main Gearbox Plumbing (Post SB PW4ENG 75-95)
Figure 304 (Sheet 3)
(Task 72-00-61-020-002)



(POST SB PW4ENG 75-95)
VIEW A

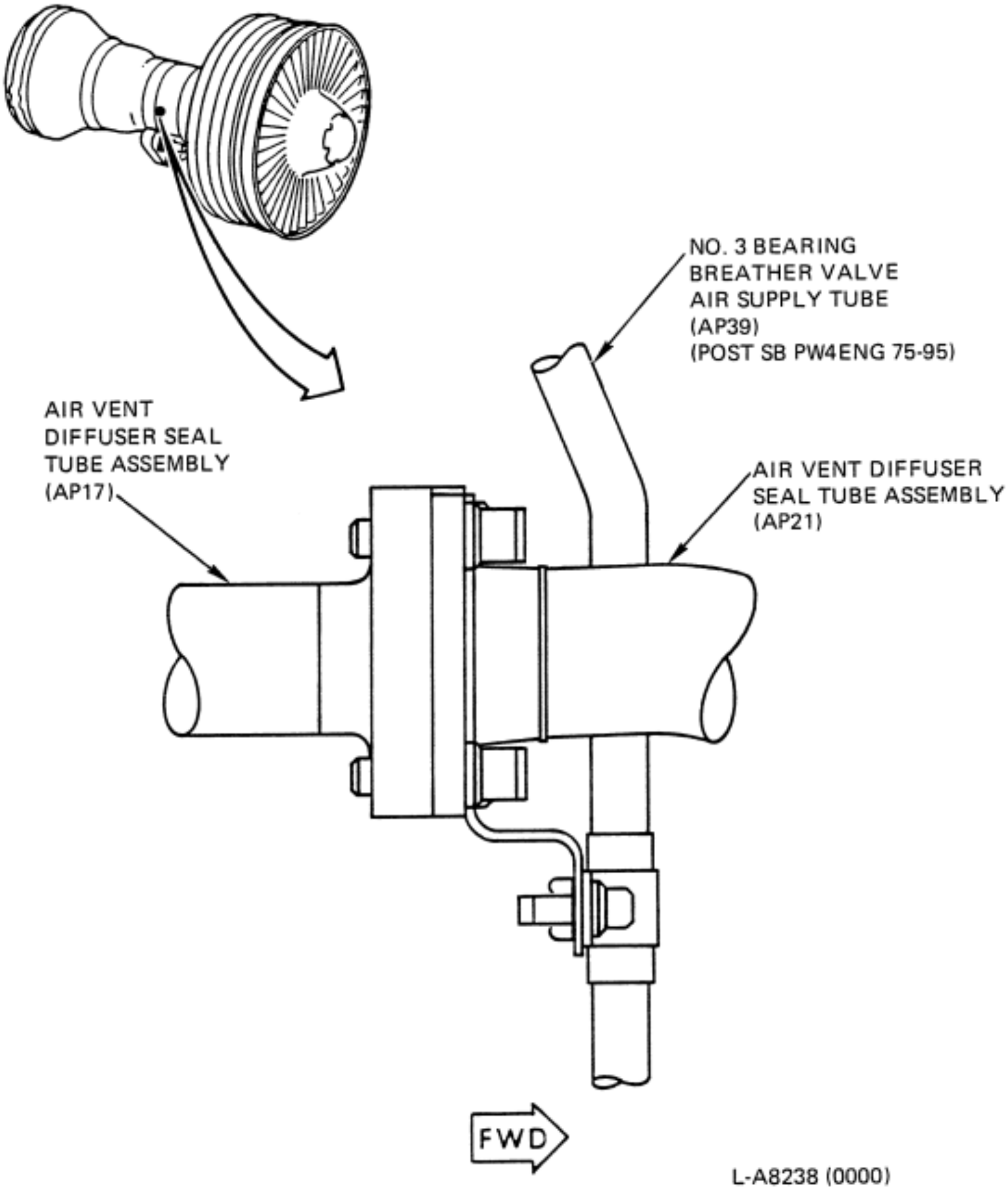


(POST SB PW4ENG 75-95)
VIEW B

L-A8237 (0000)

Main Gearbox Plumbing (Post SB PW4ENG 75-95)
Figure 304 (Sheet 4)
(Task 72-00-61-020-002)

R
R


NO. 3 BEARING BREATHER VALVE AIR SUPPLY TUBE (AP39) (POST SB PW4ENG 75-95)
AIR VENT DIFFUSER SEAL TUBE ASSEMBLY (AP17)
AIR VENT DIFFUSER SEAL TUBE ASSEMBLY (AP21)
FWD
L-A8238 (0000)

Main Gearbox Plumbing (Post SB PW4ENG 75-95)
Figure 304 (Sheet 5)
(Task 72-00-61-020-002)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-61-050-001:

1. Remove Ignition Exciter (Lower Exciter)
   A. Equipment And Materials Required - None
   B. Procedure
      See Figures 301 and 302.

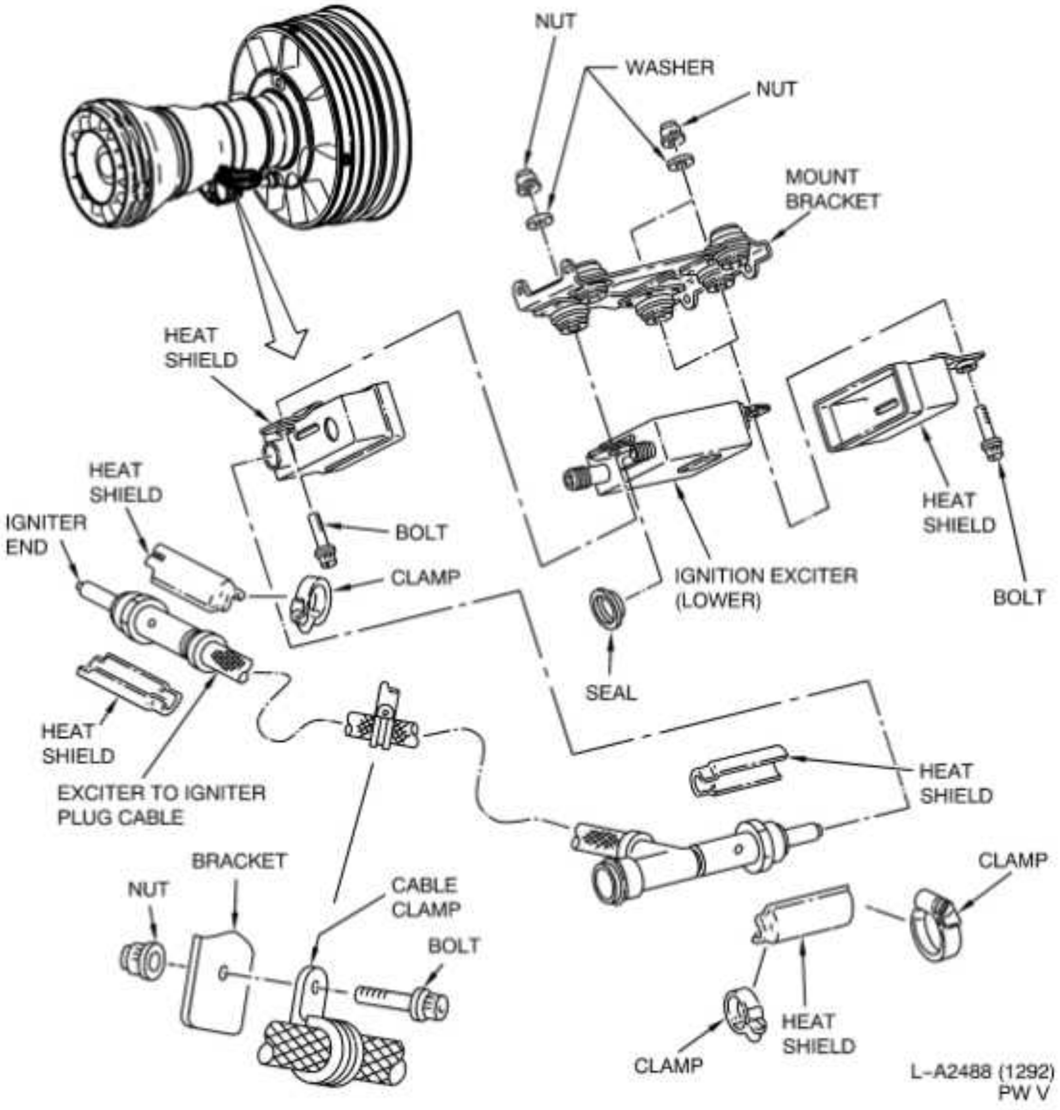
WARNING: IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH. IGNITION SWITCH MUST BE IN THE OFF POSITION BEFORE REMOVAL OF ANY IGNITION COMPONENTS. ALLOW SEVERAL MINUTES TO ELAPSE BETWEEN OPERATION OF THE IGNITION SYSTEM AND THE REMOVAL OF COMPONENTS. UPON DETACHING THE CABLE FROM THE IGNITER PLUG, DISCHARGE THE CURRENT BY GROUNDING THE CABLE TERMINAL TO ENSURE COMPLETE DISSIPATION OF ENERGY FROM THE SYSTEM. FAILURE TO FOLLOW THIS PROCEDURE COULD RESULT IN SEVERE INJURY TO PERSONNEL.

(1) Remove the bolt and nut that attaches a clamp on the lower igniter cable to a bracket located between the upper and lower igniter cables.
(2) Loosen the clamp that attaches the heat shield segments at the igniter plug end of the cable. Remove heat shields from cable.
(3) Loosen the clamps that attaches the heat shield segments at the exciter end of the cable. Remove heat shields from cable.
(4) Loosen the cable coupling nut from the lower exciter at the inboard connector. The coupling nut should only be loose sufficiently to permit free movement of the cable, not removal of the cable.

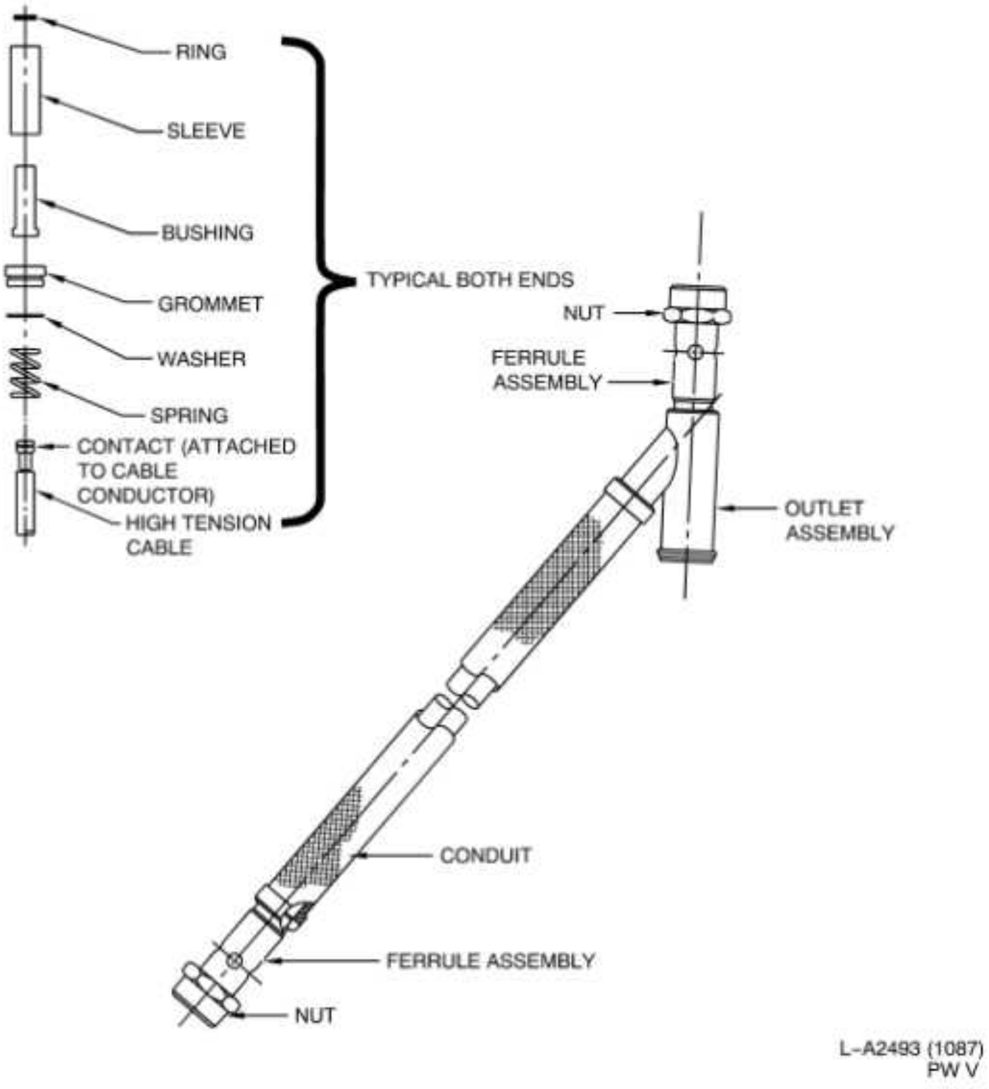
CAUTION: REMOVE THE CABLE ENDS (LEADS) FROM THE IGNITER PLUG AND THE IGNITION EXCITER BY PULLING THE CABLE CONNECTORS IN A STRAIGHT LINE MOVEMENT. IF LATERAL FORCE IS PERMITTED, THE CABLE END CAN BE DAMAGED.

WARNING: FOR MORE PROTECTION FROM A DANGEROUS ELECTRICAL CHARGE DISCONNECT THE COUPLING NUT FROM THE IGNITION PLUG AND TOUCH THE CABLE END TO THE IGNITER PLUG BODY SHIELD.

(5) Disconnect the cable coupling nut from the igniter plug and touch the cable end against the igniter plug casing (body) to decrease to zero any remaining electrical charge. Remove the heat shield clamp from cable.


NUT
WASHER
NUT
MOUNT BRACKET
HEAT SHIELD
HEAT SHIELD
IGNITER END
BOLT
CLAMP
IGNITION EXCITER (LOWER)
HEAT SHIELD
BOLT
SEAL
HEAT SHIELD
EXCITER TO IGNITER PLUG CABLE
HEAT SHIELD
BRACKET
NUT
CABLE CLAMP
BOLT
CLAMP
HEAT SHIELD
CLAMP
L-A2488 (1292)
PW V

Ignition Exciter (Lower)
Figure 301
(Task 72−00−61−050−001)


RING
SLEEVE
BUSHING
GROMMET
WASHER
SPRING
CONTACT (ATTACHED TO CABLE CONDUCTOR)
HIGH TENSION CABLE
TYPICAL BOTH ENDS
NUT
FERRULE ASSEMBLY
OUTLET ASSEMBLY
CONDUIT
FERRULE ASSEMBLY
NUT
L-A2493 (1087)
PW V

Exciter−To−Igniter Plug Cable
Figure 302
(Task 72−00−61−050−001)

ENGINE GENERAL − MAIN GEARBOX − REMOVAL−03

(6) Disconnect igniter cable from lower exciter at inboard connector. Remove heat shield clamps from cable.
(7) Remove three bolts, washers, and nuts securing exciter to mount bracket and remove exciter, entrapped in heat shields from engine.
(8) Remove grommets from exciter−to−igniter plug cable ends and discard.
(9) Remove heat shields from exciter.
(10) Remove seal from exciter input (smaller) connector. Discard seal and install protective closures.

NOTE: Additional information concerning detailed maintenance of this component may be found in Ignition Exciter Component Maintenance Manual, 74−11−04 (Bendix Aerospace).

ENGINE GENERAL - MAIN GEARBOX - REMOVAL-04

Task 72-00-61-050-002:

1. Remove Ignition Exciter (Upper Exciter)

   A. Equipment And Materials Necessary - None

   B. Procedure
   See Figure 301 and Figure 302.

   WARNING: IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH. IGNITION SWITCH MUST BE IN THE OFF POSITION BEFORE REMOVAL OF ANY IGNITION COMPONENTS. ALLOW SEVERAL MINUTES TO ELAPSE BETWEEN OPERATION OF THE IGNITION SYSTEM AND THE REMOVAL OF COMPONENTS. UPON DETACHING THE CABLE FROM THE IGNITER PLUG, DISCHARGE THE CURRENT BY GROUNDING THE CABLE TERMINAL TO ENSURE COMPLETE DISSIPATION OF ENERGY FROM THE SYSTEM. FAILURE TO FOLLOW THIS PROCEDURE COULD RESULT IN SEVERE INJURY TO PERSONNEL.

   (1) Remove the bolt and nut that attaches a clamp on the upper igniter cable to a bracket located between the upper and lower igniter cables.

   (2) Loosen the clamp that attaches the heat shield segments at the igniter plug end of the cable. Remove heat shields from cable.

   (3) (Post SB PW4ENG 73-192) Loosen the clamps that attach the cooling hoses to the heat shield at the exciter end of the cable. Remove cooling hoses from heat shield.

   NOTE: Pre SB PW4ENG 73-192 engines do not have W5/W6 wiring harness connector cooling.

   (4) Loosen the clamps that attaches the heat shield segments at the exciter end of the cable. Remove heat shields from cable.

   (5) Loosen the cable coupling nut from the upper exciter at the outboard connector. The coupling nut should only be loose sufficiently to permit free movement of the cable, not removal of the cable.

   WARNING: FOR MORE PROTECTION FROM A DANGEROUS ELECTRICAL CHARGE DISCONNECT THE COUPLING NUT

FROM THE IGNITION PLUG AND TOUCH THE CABLE END TO THE IGNITER PLUG BODY SHIELD.

CAUTION: REMOVE THE CABLE ENDS (LEADS) FROM THE IGNITER PLUG AND THE IGNITION EXCITER BY PULLING THE CABLE CONNECTORS IN A STRAIGHT LINE MOVEMENT. IF LATERAL FORCE IS PERMITTED, THE CABLE END CAN BE DAMAGED.

(6) Disconnect the cable coupling nut from the igniter plug and touch the cable end against the igniter plug casing (body) to decrease to zero any remaining electrical charge. Remove the heat shield clamp from cable.

(7) Disconnect igniter cable from upper exciter at outboard, connector. Remove heat shield clamps from cable.

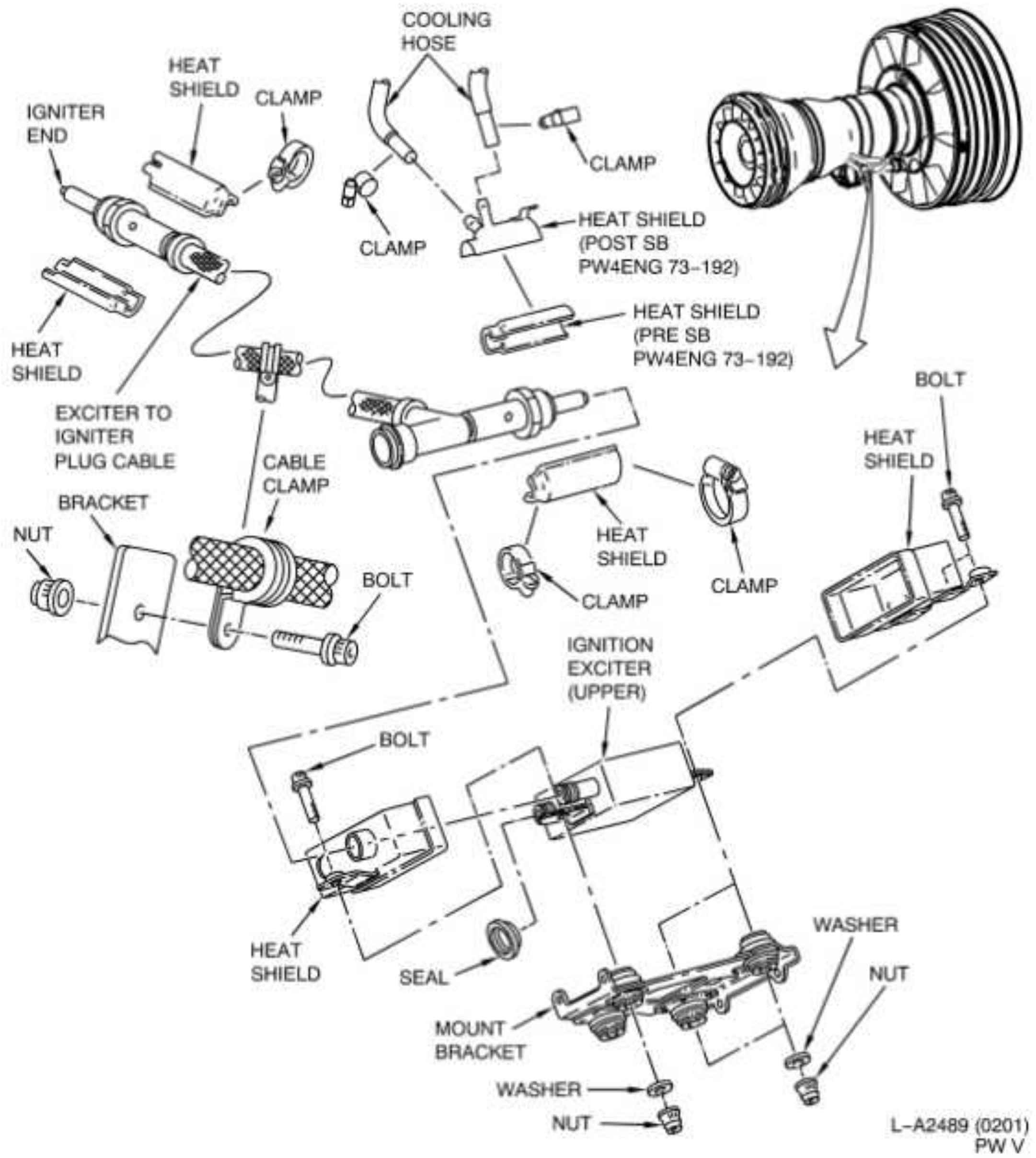
(8) Remove three bolts, washers, and nuts securing exciter to mount bracket and remove exciter, entrapped in heat shields, from engine.

(9) Remove grommets from exciter−to−igniter plug cable ends and discard.

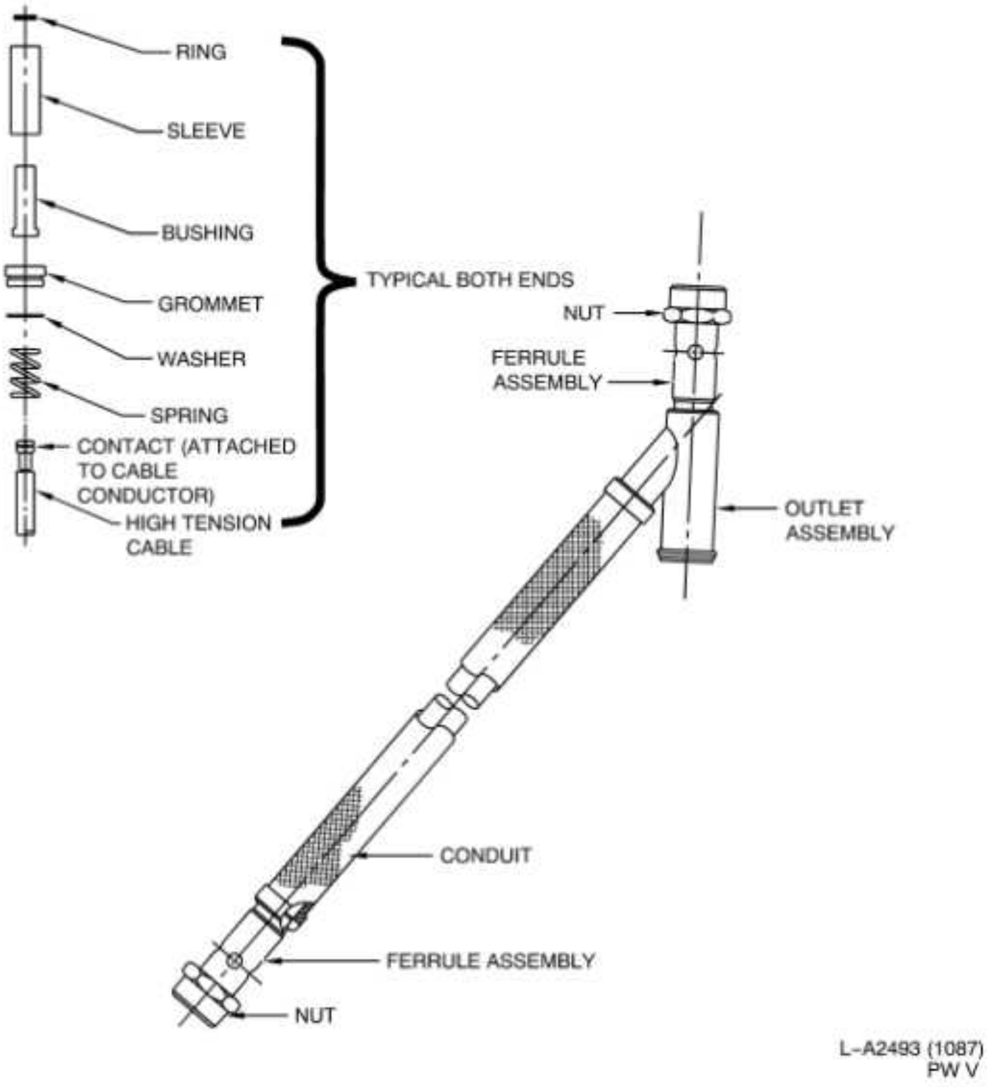
(10) Remove heat shields from exciter.

(11) Remove seal from exciter input (smaller) connector. Discard seal and install protective closures.

NOTE: Additional information concerning detailed maintenance of this component may be found in Ignition Exciter Component Maintenance Manual, 74−11−04 (Bendix Aerospace).


COOLING HOSE
HEAT SHIELD
CLAMP
IGNITER END
CLAMP
CLAMP
HEAT SHIELD (POST SB PW4ENG 73−192)
HEAT SHIELD (PRE SB PW4ENG 73−192)
HEAT SHIELD
EXCITER TO IGNITER PLUG CABLE
BOLT
HEAT SHIELD
CABLE CLAMP
BRACKET
NUT
HEAT SHIELD
BOLT
CLAMP
CLAMP
IGNITION EXCITER (UPPER)
BOLT
HEAT SHIELD
SEAL
WASHER
NUT
MOUNT BRACKET
WASHER
NUT
L−A2489 (0201)
PW V

Ignition Exciter (Upper)
Figure 301
(Task 72−00−61−050−002)


RING
SLEEVE
BUSHING
GROMMET
WASHER
SPRING
CONTACT (ATTACHED TO CABLE CONDUCTOR)
HIGH TENSION CABLE
TYPICAL BOTH ENDS
NUT
FERRULE ASSEMBLY
OUTLET ASSEMBLY
CONDUIT
FERRULE ASSEMBLY
NUT
L-A2493 (1087)
PW V

Exciter−to−Igniter Plug Cable
Figure 302
(Task 72−00−61−050−002)

ENGINE GENERAL - MAIN GEARBOX - REMOVAL-05

Task 72-00-61-050-003:

1. Remove Fuel Pump And Fuel Metering Unit (Package)

A. Prerequisites

(1) Remove fuel bypass valve per 72-00-61, Removal-08 (Task 72-00-61-050-005).

B. Equipment And Materials Necessary

Special Tools:
PWA 85862 Adapter, Torque
PWA 85989 Fixture, Handling (Optional)
PWA 86461 Adapter, Torque

C. Procedure
See Figure 301, Figure 302 and Figure 303.

R CAUTION: BE CAREFUL WHEN YOU HANDLE, REMOVE OR INSTALL ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTIONS USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(1) Disconnect W4P2 and W5P1 harness connectors from fuel metering unit. Install protective closures.

(2) Remove lockwire and disconnect fuel distribution valve supply tube assembly (FM09) from adapter on fuel metering unit and from adapter on fuel flowmeter.

(3) Remove bolts, nut, and clamps securing tube to HPC case bracket and airframe cooler oil outlet tube. Remove tube from engine. Discard packings and retainers.

(4) (Pre SB PW4ENG 73-84), Disconnect W5P8 connector from fuel temperature probe located at top, outer side of fuel pump filter housing.

(5) (Post SB PW4ENG 73-84), Remove the harness connector from the thermocouple probe as follows.

(a) Remove the nuts that attach the W5 wiring harness to the studs on the thermocouple.

(b) Remove the bolt, clamp, and ground strap that are attached to the bracket on the fuel pump filter housing.

(c) Remove the wiring harness terminals from the thermocouple studs.

(d) Install protection covers.

(6) For engines not equipped with flexible oil cooler outlet fuel hose and tube assembly (FM11) (Pre SB PW4ENG 73-35), remove lockwire and disconnect the tube assembly from rearward inboard adapter on fuel pump. Remove three bolts securing threaded adapter to pump. Slide adapter out of pump port and down tube as far as possible.

(7) For engines equipped with flexible oil cooler outlet fuel hose and tube assembly (FM11) (Post SB PW4ENG 73-35), remove three bolts securing hose and tube assembly to rearward inboard port on fuel pump. Disengage hose and tube assembly flange from pump and discard packing.

(8) Remove bolts securing oil cooler inlet fuel tube (FM10) flange to fuel pump pad just forward of outlet fuel tube.

(9) For ease of removal, install the PWA 85989 Handling Fixture to the fuel pump. Attach it with the two detail bolts and the handscrew.

(10) Using PWA 85862 Torque Adapter, loosen and remove antirotation bolt from hole in base flange of fuel pump at approximately 7 o'clock position.

CAUTION: DO NOT ALLOW WEIGHT OF FUEL PUMP AND FUEL METERING UNIT PACKAGE TO BE TRANSMITTED TO PUMP SPLINES DURING REMOVAL OR DAMAGE TO SPLINES MAY RESULT.

(11) Use PWA 86461 Torque Adapter to loosen the bolt at the 1 o'clock position and PWA 85862 Torque Adapter to loosen the remaining bolts securing fuel pump to gearbox drive until captured washers are clear of flange. Rotate pump clockwise (viewed from front) to

disengage flange holes from bolts and oil cooler inlet fuel tube flange from pump.

(12) Move fuel pump and fuel metering unit forward to disengage drive spline and bolts. Lower package from engine.

(13) Remove packings from groove on drive spline and flange of fuel pump. Remove package from fixture (if used).

(14) Remove and discard packing from groove at flanged end of inlet tube.

(15) For engines not equipped with flexible oil cooler outlet fuel hose and tube assembly (Pre SB PW4ENG 73-35), comply with the following.

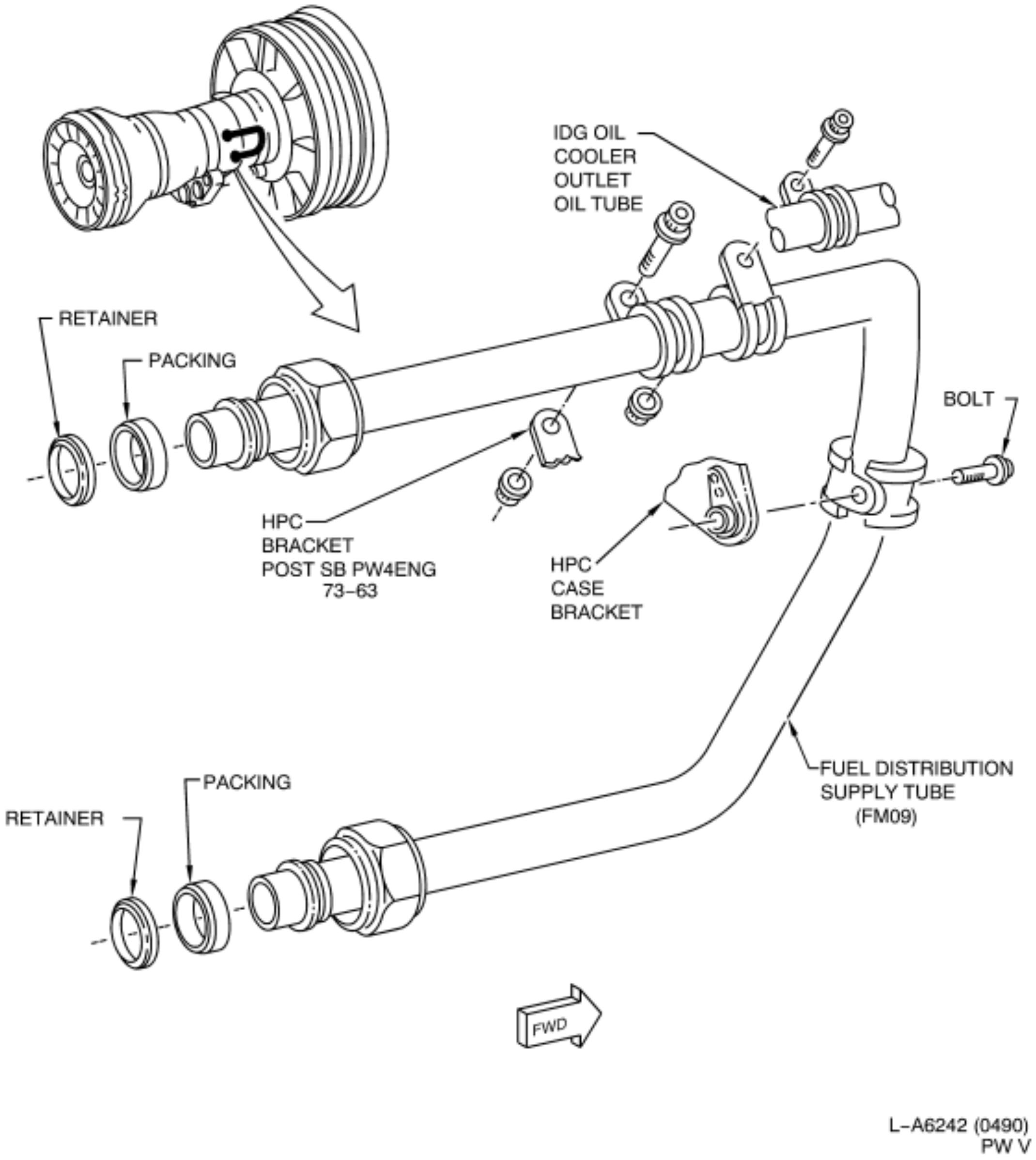
(a) Remove adapter from oil cooler outlet fuel tube. Remove and discard packing from adapter.

(b) Remove packing and retainer from oil cooler outlet tube. Uncrimp key washer and remove coupling nut, ferrule, and key washer. Discard packing, retainer, and key washer.

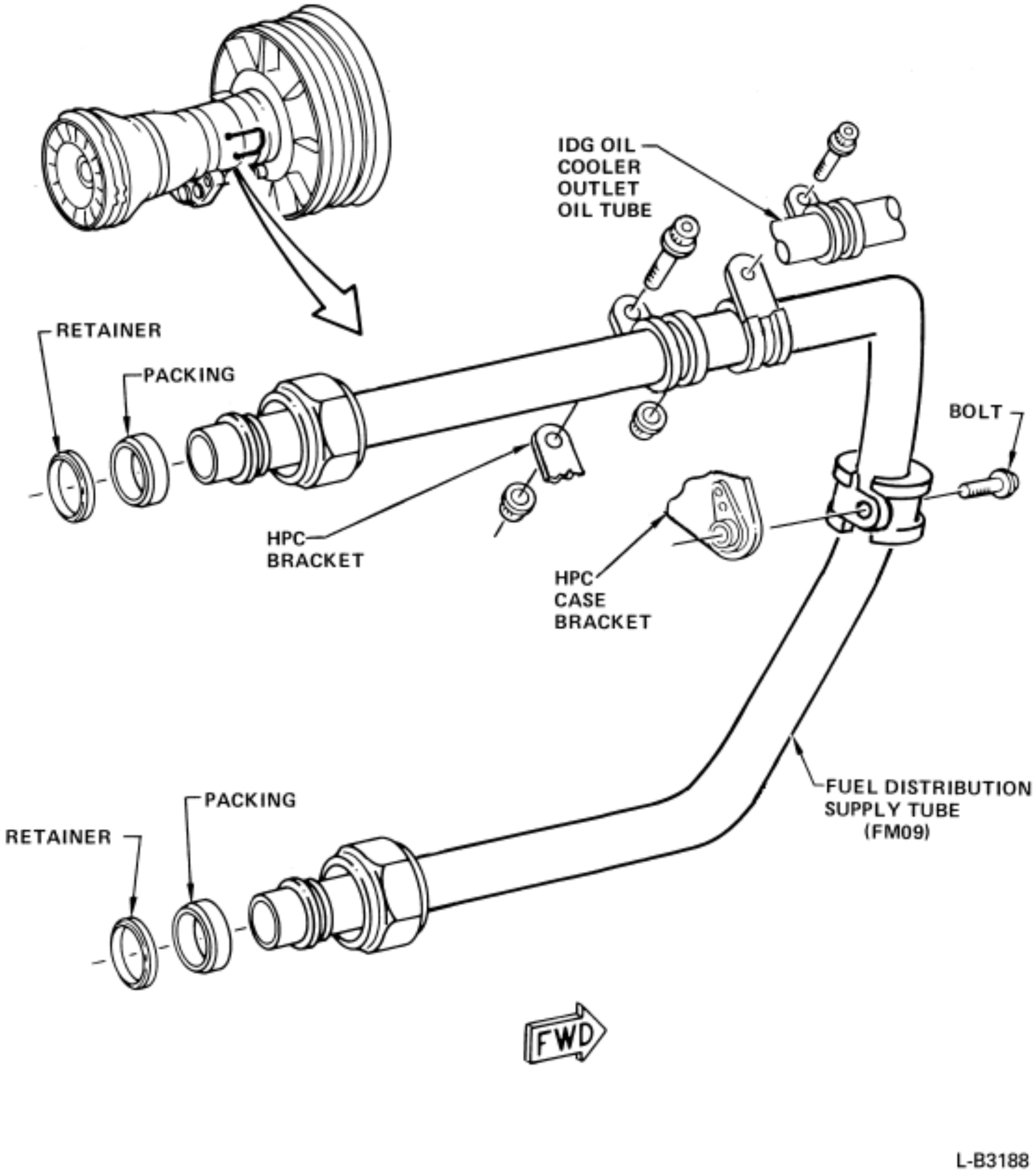
(16) Install protective closures to all openings.

NOTE: For additional information concerning detailed maintenance of fuel metering unit see Fuel Metering Unit Component Maintenance Manual, 73-21-38 (Hamilton Standard Division).

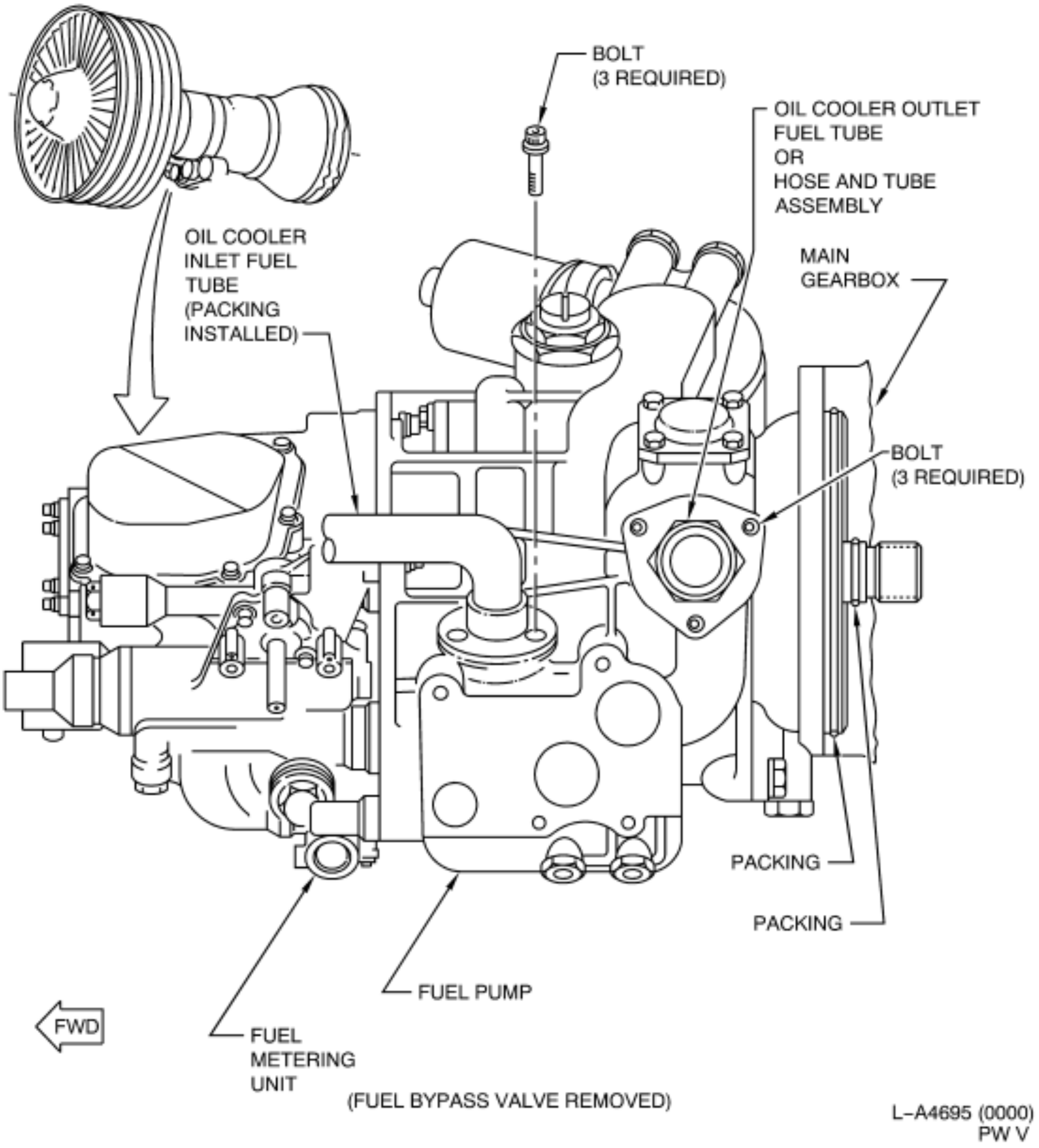
NOTE: For additional information concerning detailed maintenance of fuel pump see Fuel Pump Component Maintenance Manual, 73-11-04 (TRW).


IDG OIL
COOLER
OUTLET
OIL TUBE
RETAINER
PACKING
BOLT
HPC
BRACKET
POST SB PW4ENG
73−63
HPC
CASE
BRACKET
FUEL DISTRIBUTION
SUPPLY TUBE
(FM09)
PACKING
RETAINER
FWD
L−A6242 (0490)
PW V

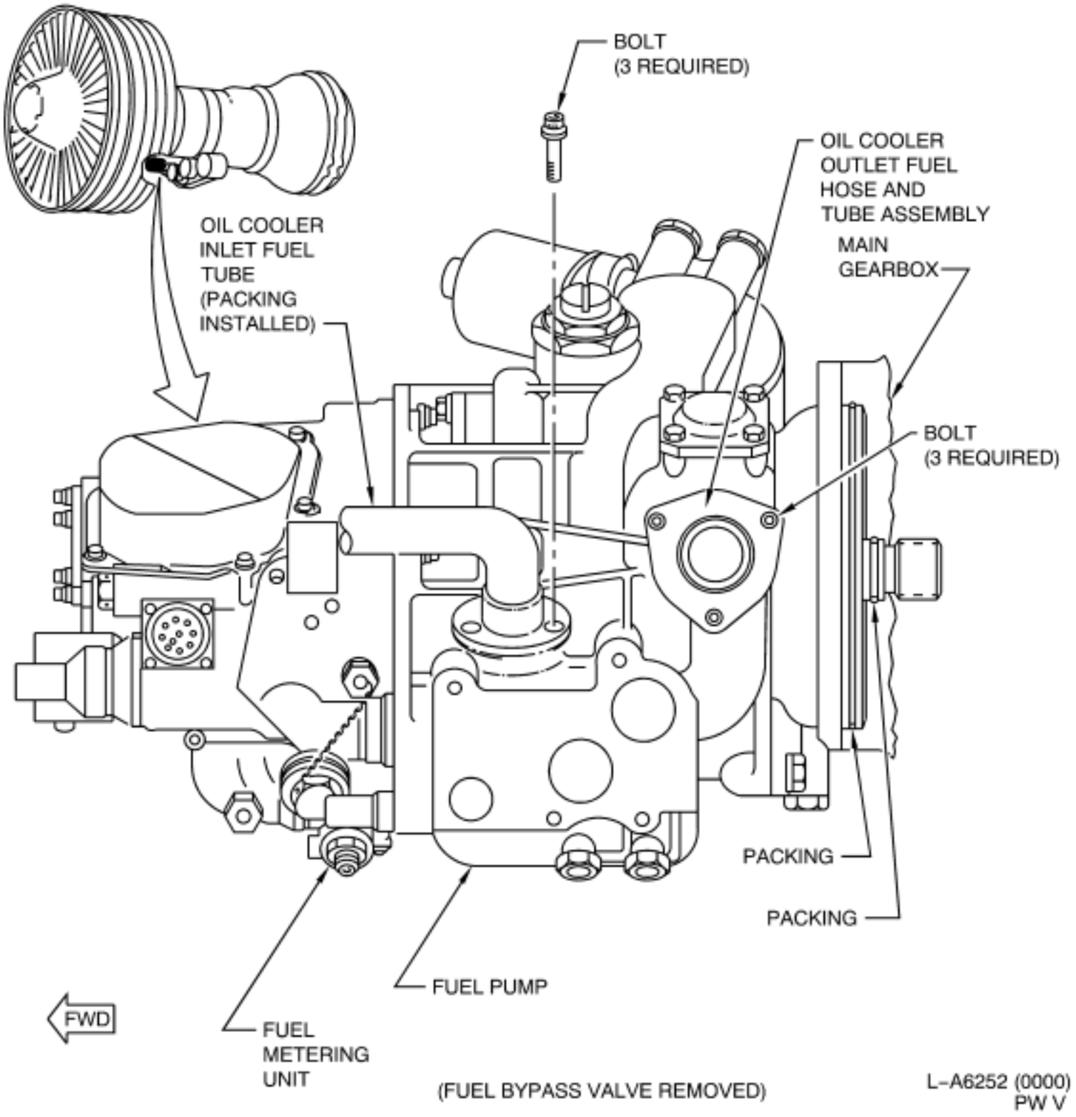
Fuel Distribution Valve Supply Tube
Figure 301 (Sheet 1)
(Task 72−00−61−050−003)


IDG OIL COOLER OUTLET OIL TUBE
RETAINER
PACKING
BOLT
HPC BRACKET
HPC CASE BRACKET
FUEL DISTRIBUTION SUPPLY TUBE (FM09)
PACKING
RETAINER
FWD
L-B3188

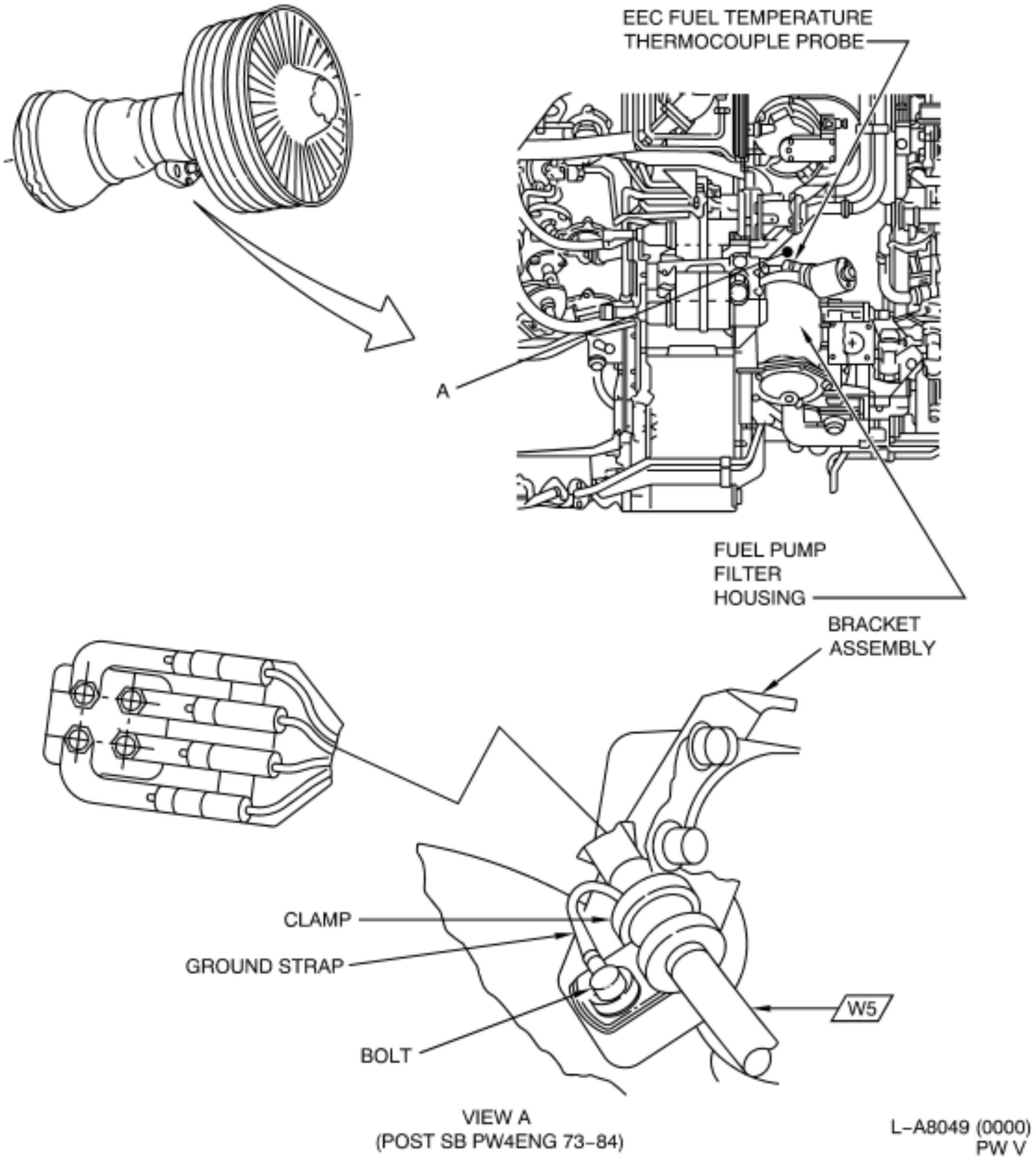
Fuel Distribution Valve Supply Tube
Figure 301 (Sheet 2)
(Task 72−00−61−050−003)


BOLT
(3 REQUIRED)
OIL COOLER OUTLET
FUEL TUBE
OR
HOSE AND TUBE
ASSEMBLY
OIL COOLER
INLET FUEL
TUBE
(PACKING
INSTALLED)
MAIN
GEARBOX
BOLT
(3 REQUIRED)
PACKING
PACKING
FUEL PUMP
FWD
FUEL
METERING
UNIT
(FUEL BYPASS VALVE REMOVED)
L−A4695 (0000)
PW V

Fuel Pump And Metering Unit Package Without
Integral Actuator − Pre SB PW4ENG 73−81
Figure 302 (Sheet 1)
(Task 72−00−61−050−003)


BOLT
(3 REQUIRED)
OIL COOLER
OUTLET FUEL
HOSE AND
TUBE ASSEMBLY
MAIN
GEARBOX
OIL COOLER
INLET FUEL
TUBE
(PACKING
INSTALLED)
BOLT
(3 REQUIRED)
PACKING
PACKING
FUEL PUMP
FWD
FUEL
METERING
UNIT
(FUEL BYPASS VALVE REMOVED)
L-A6252 (0000)
PW V

Fuel Pump And Metering Unit Package With
Integral Actuator - Post SB PW4ENG 73-81
Figure 302 (Sheet 2)
(Task 72-00-61-050-003)


EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
A
FUEL PUMP FILTER HOUSING
BRACKET ASSEMBLY
CLAMP
GROUND STRAP
W5
BOLT
VIEW A
(POST SB PW4ENG 73-84)
L-A8049 (0000)
PW V

Wiring Harness Terminals For Studded EEC Fuel Thermocouple Probe
Figure 303
(Task 72−00−61−050−003)

Previous Pageblock   Return to Previous Menu   Next Pageblock

Task 72-00-61-050-016:

1. Remove Fuel Metering Unit

A. Equipment And Materials Necessary

Consumable Materials:

	Item No.	Designation
R	P03-001	Lubricant, Aircraft Turbine Engine
R		(Synthetic Base) (PWA 521B)
R	P06-053	Lubricant, Sealing Ring (PWA 36500)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing (TRW)	1	73-12-00/2/60

Lockwire, MS20995C32 (TRW) or AS3214-02

B. Procedure
See Figure 301, Figure 302, and Figure 303.

NOTE: This procedure is for removal of the fuel metering unit from the fuel pump while fuel pump remains on engine. For removal of fuel pump and fuel metering unit as a package, see 72-00-61 Removal-05.

(1) Drain residual fuel from fuel metering unit by removing lockwire and plug from port (FP3) adjacent to fuel filter on fuel pump. Discard packing.

NOTE: Be prepared to catch fuel in container with a minimum capacity of 5 U.S. gallons (19 liters).

R (2) Use a new packing, lubricated with Aircraft Turbine
R Engine Lubricant P03-001 or Sealing Ring Lubricant
R P06-053, install a plug. Torque the plug to 45 - 55
R lb-in. (5.084 - 6.214 N.m). Lockwire the plug.

(3) Remove lockwire from compressor stator cylinder hydraulic manifold assembly (CP01) and disconnect manifold from fuel metering unit adapter, from stator vane actuator manifold tee, and from fuel bypass valve adapter. Remove manifold from engine.

R (4) Disconnect W4P2 and W5P1 harness connectors from fuel metering unit. Install protective closures.

(5) Remove lockwire and disconnect valve supply tube assembly (FM09) from adapter on fuel metering unit and adapter on fuel flowmeter.

(6) Remove bolts, nut, and clamps securing flow divider valve supply tube assembly to HPC case bracket and airframe cooler oil outlet tube. Remove tube from engine. Discard retainers and packings.

(7) Remove nuts and washers securing fuel metering unit to fuel pump. Remove fuel metering unit from pump.

(8) Remove the transfer tubes from the fuel pump as follows:

  (a) Remove and discard the packings from the fuel pump transfer tubes.

  (b) Remove the retainers that hold the transfer tubes in the fuel pump.

  (c) Remove the transfer tubes from the fuel pump and remove and discard the packings from the inner grooves of the transfer tubes.

(9) Install protective closures.

(10) If new fuel metering unit is to be installed comply with the following.

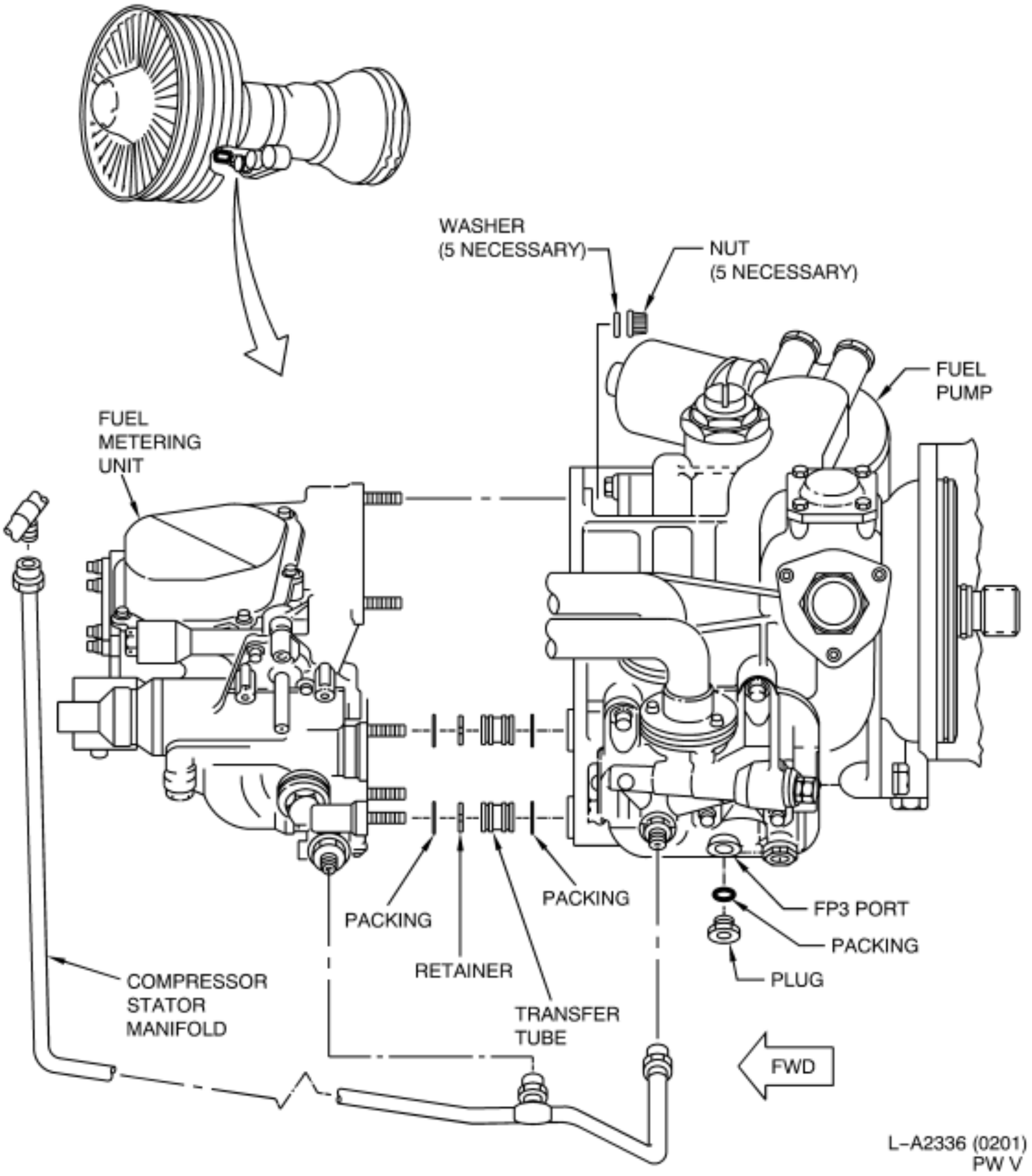
  (a) Remove threaded adapter from port on inboard side of fuel metering unit and discard packing.

  (b) Remove bolts and bracket securing adapter to outboard fuel supply port on fuel metering unit and remove adapter. Discard packing.

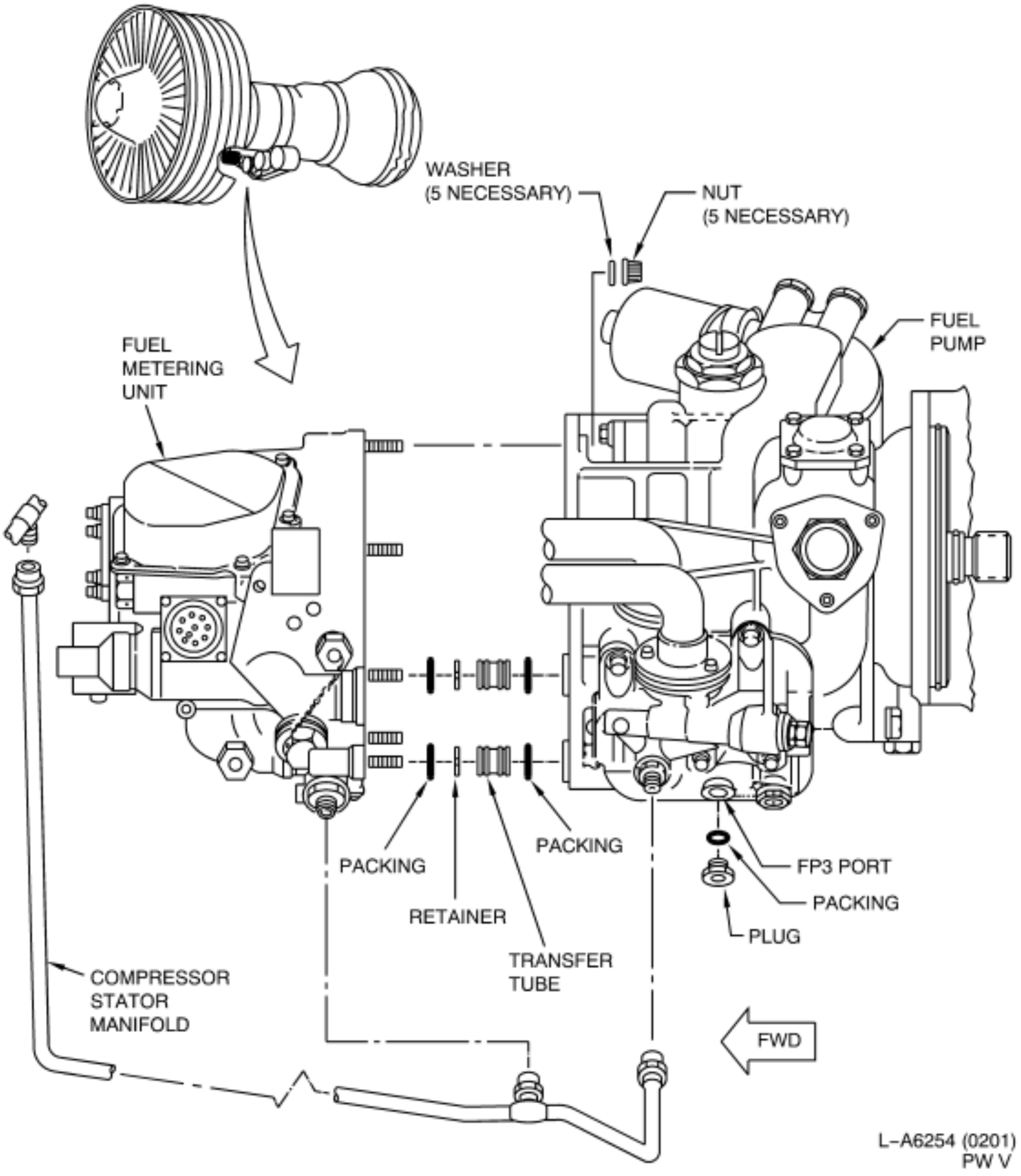
  NOTE: For additional information concerning detailed maintenance of this component, see Fuel Metering Unit Component Maintenance Manual, 73−21−38 (Hamilton Standard Division).

C. Postrequisites

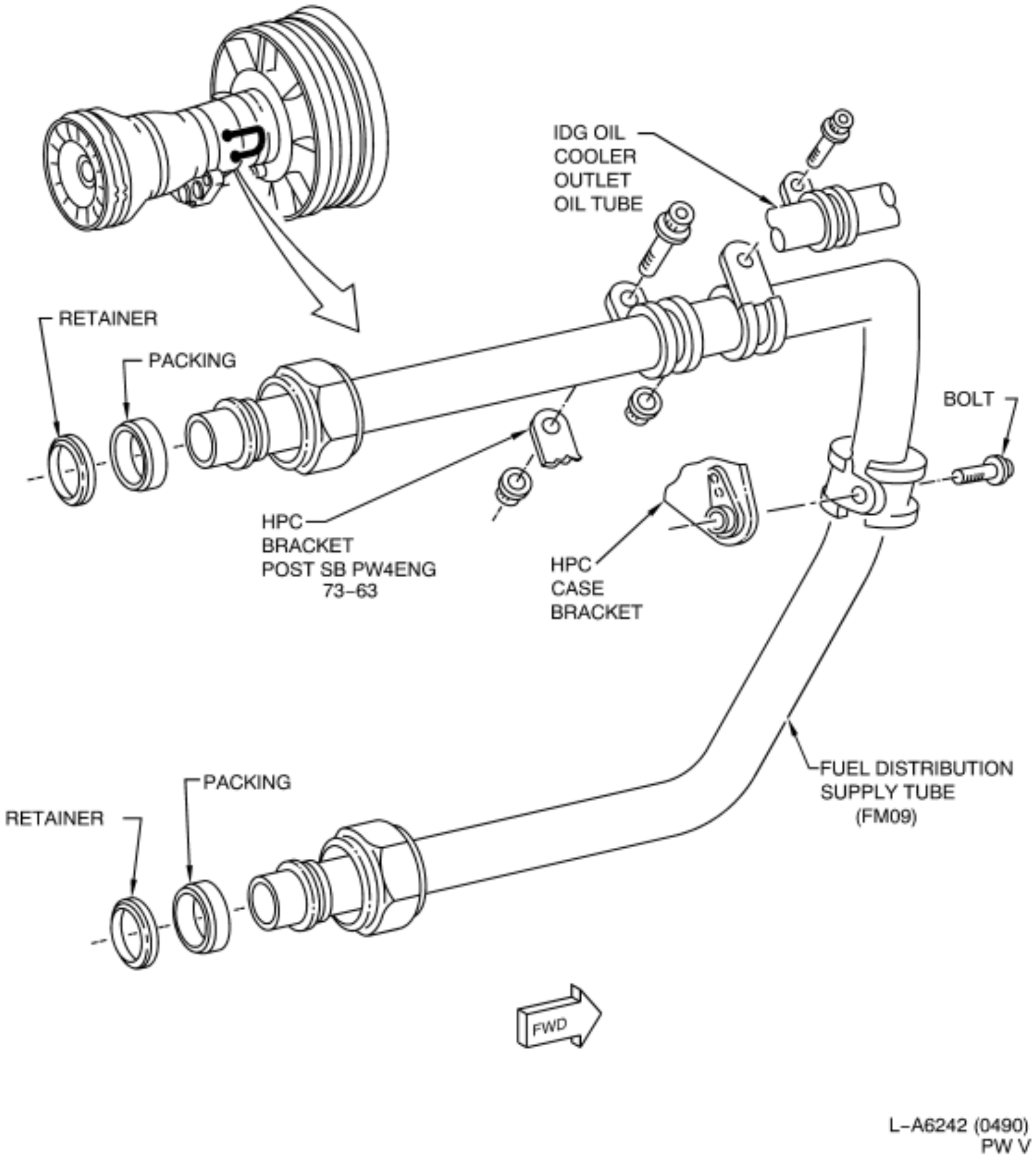
(1) If fuel metering unit will not be installed on engine within 24 hours, it must be preserved. See Fuel Metering Unit Component Maintenance Manual, 73−21−38 (Hamilton Standard Division).


WASHER
(5 NECESSARY)
NUT
(5 NECESSARY)
FUEL
PUMP
FUEL
METERING
UNIT
PACKING
PACKING
RETAINER
TRANSFER
TUBE
FP3 PORT
PACKING
PLUG
COMPRESSOR
STATOR
MANIFOLD
FWD
L−A2336 (0201)
PW V

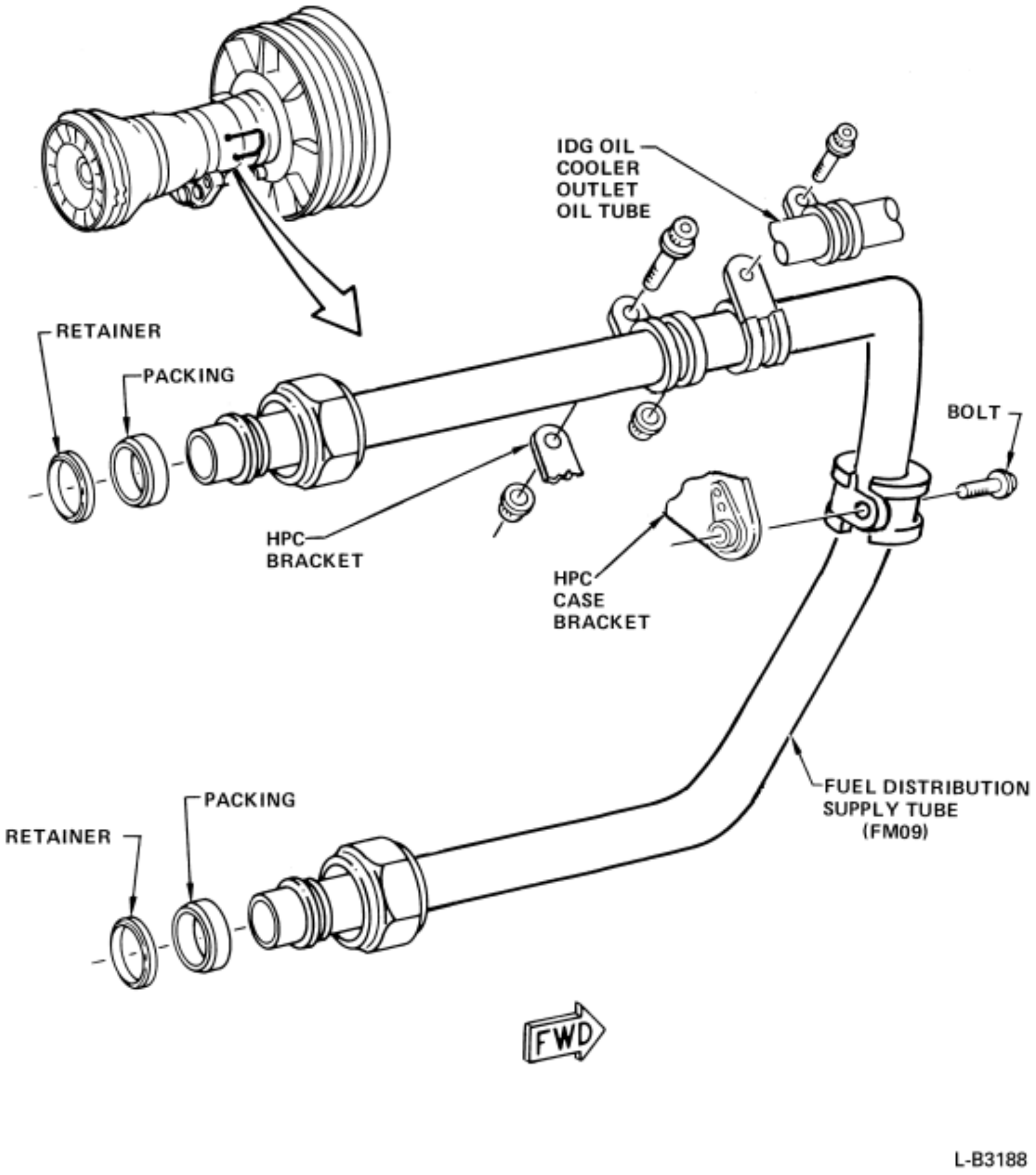
Fuel Metering Unit Without Integral Actuator − Pre SB PW4ENG 73−81
Figure 301 (Sheet 1)
(Task 72−00−61−050−016)


WASHER
(5 NECESSARY)
NUT
(5 NECESSARY)
FUEL
PUMP
FUEL
METERING
UNIT
PACKING
PACKING
FP3 PORT
PACKING
PLUG
RETAINER
TRANSFER
TUBE
COMPRESSOR
STATOR
MANIFOLD
FWD
L-A6254 (0201)
PW V

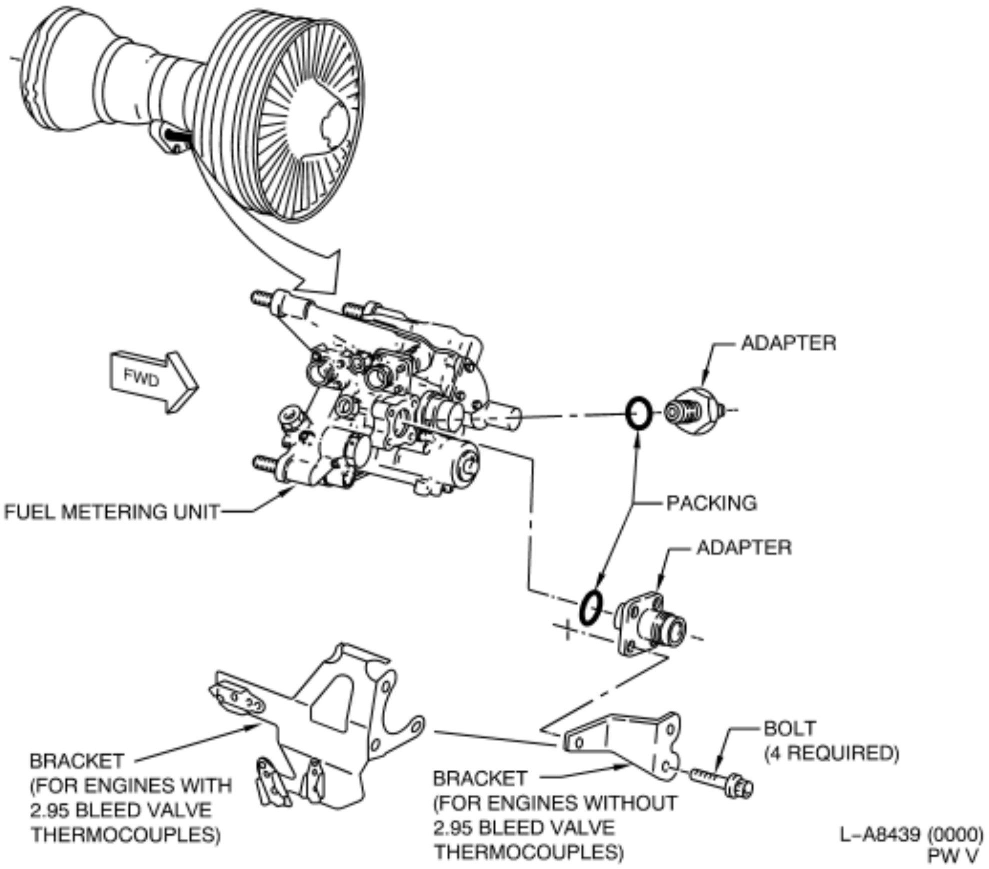
Fuel Metering Unit With Integral Actuator - Post SB PW4ENG 73-81
Figure 301 (Sheet 2)
(Task 72-00-61-050-016)


IDG OIL
COOLER
OUTLET
OIL TUBE
RETAINER
PACKING
BOLT
HPC
BRACKET
POST SB PW4ENG
73-63
HPC
CASE
BRACKET
FUEL DISTRIBUTION
SUPPLY TUBE
(FM09)
PACKING
RETAINER
FWD
L-A6242 (0490)
PW V

Fuel Distribution Valve Supply Tube
Figure 302 (Sheet 1)
(Task 72-00-61-050-016)


IDG OIL COOLER OUTLET OIL TUBE
RETAINER
PACKING
BOLT
HPC BRACKET
HPC CASE BRACKET
FUEL DISTRIBUTION SUPPLY TUBE (FM09)
PACKING
RETAINER
FWD
L-B3188

Fuel Distribution Valve Supply Tube
Figure 302 (Sheet 2)
(Task 72−00−61−050−016)


ADAPTER
FWD
PACKING
ADAPTER
FUEL METERING UNIT
BOLT
(4 REQUIRED)
BRACKET
(FOR ENGINES WITH
2.95 BLEED VALVE
THERMOCOUPLES)
BRACKET
(FOR ENGINES WITHOUT
2.95 BLEED VALVE
THERMOCOUPLES)
L−A8439 (0000)
PW V

Fuel Metering Unit
Figure 303
(Task 72−00−61−050−016)

ENGINE GENERAL - MAIN GEARBOX - REMOVAL-07

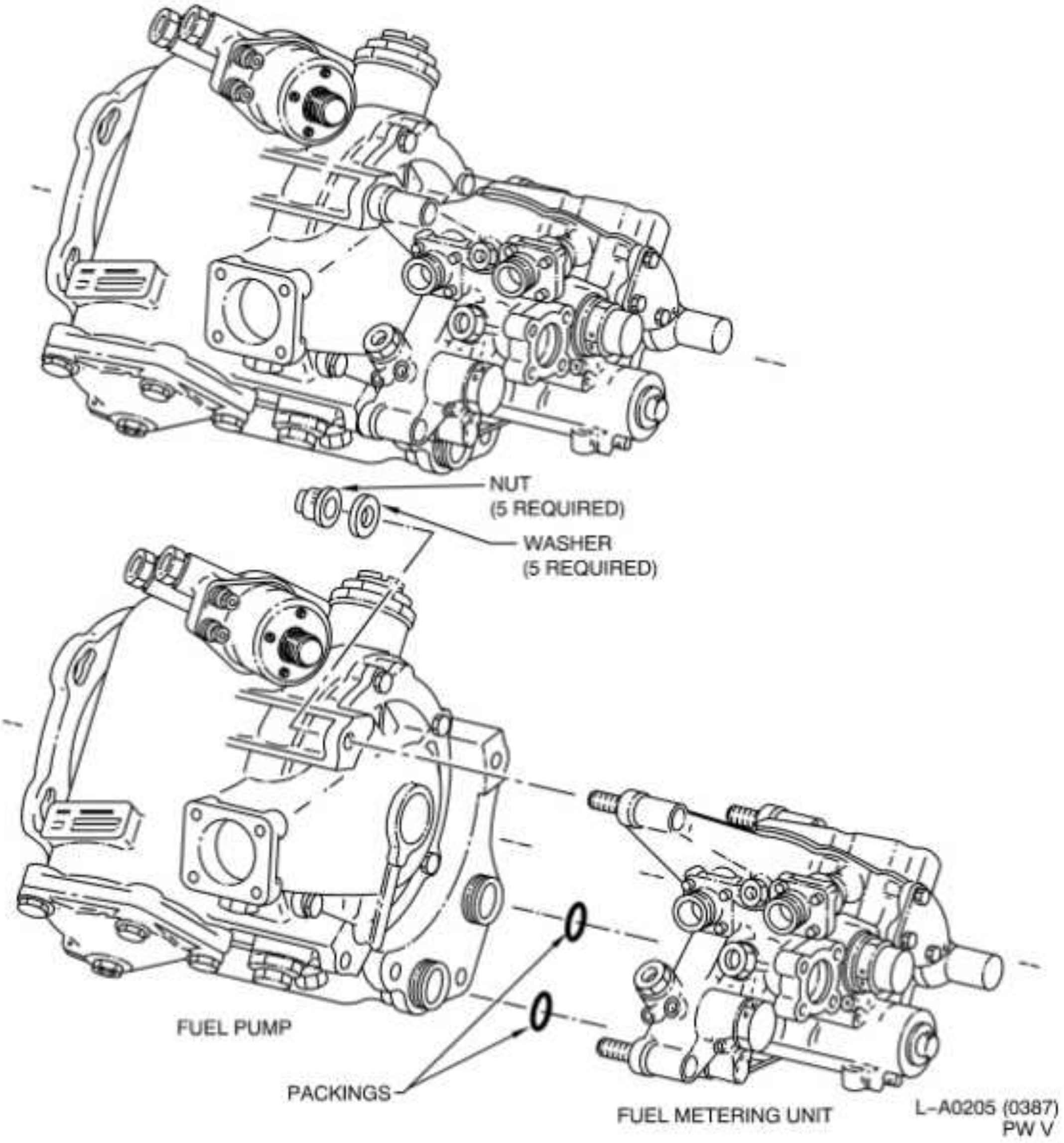
Task 72-00-61-050-004:

1. Remove Fuel Pump From Fuel Metering Unit (On Bench)
   - A. Prerequisites
     - (1) Remove fuel pump and fuel metering unit package per 72-00-61, Removal-05 (Task 72-00-61-050-003).
   - B. Equipment And Materials Required - None
   - C. Procedure

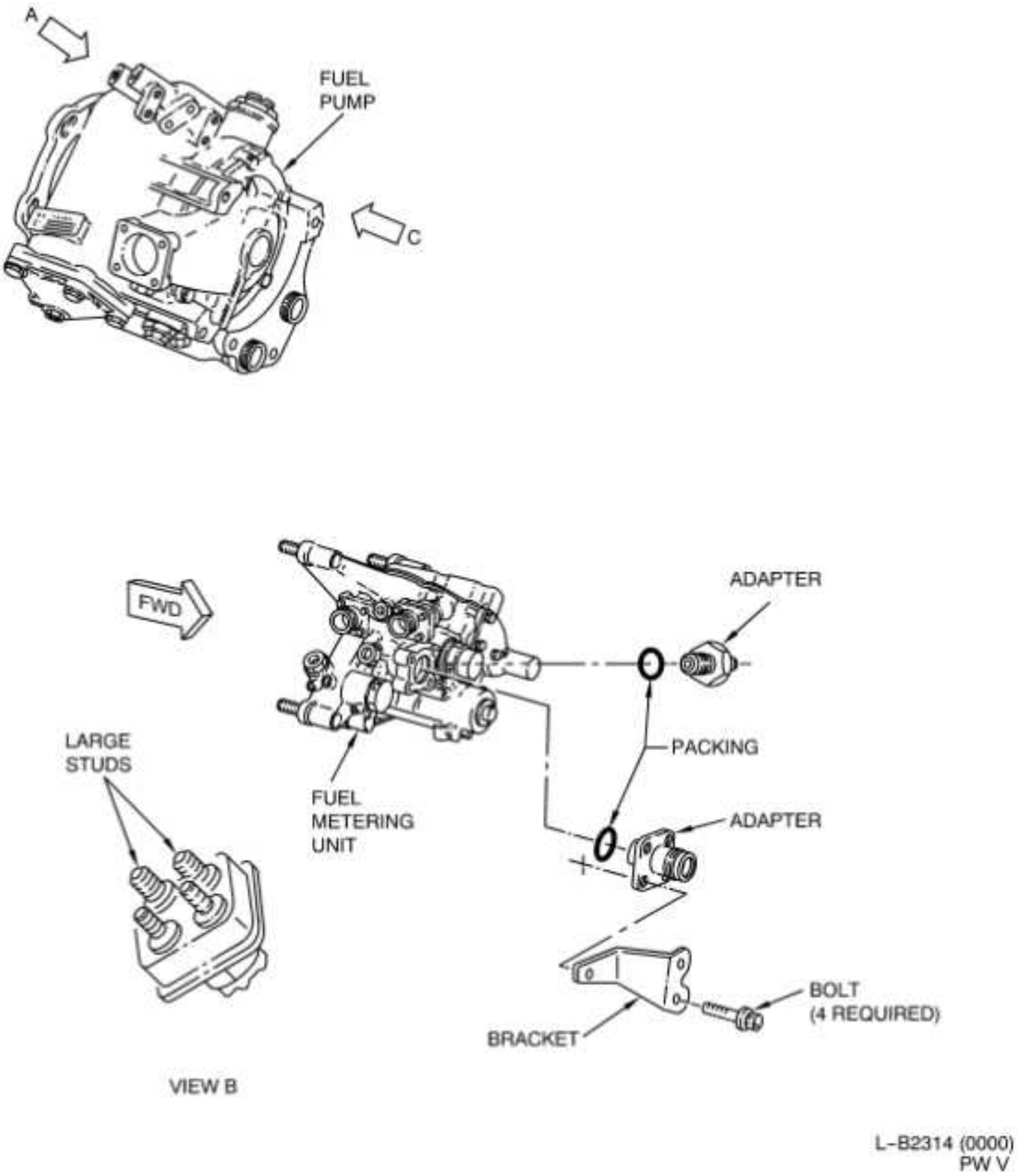
     See Figure 301.
     - (1) Remove nuts and washers securing fuel pump to fuel metering unit. Separate fuel pump from fuel metering unit. Discard packings.

       NOTE: For additional information concerning detailed maintenance of these components see Fuel Metering Unit Component Maintenance Manual, 73-21-38, (Hamilton Standard Division) and Fuel Pump Component Maintenance Manual 73-11-04, (TRW).

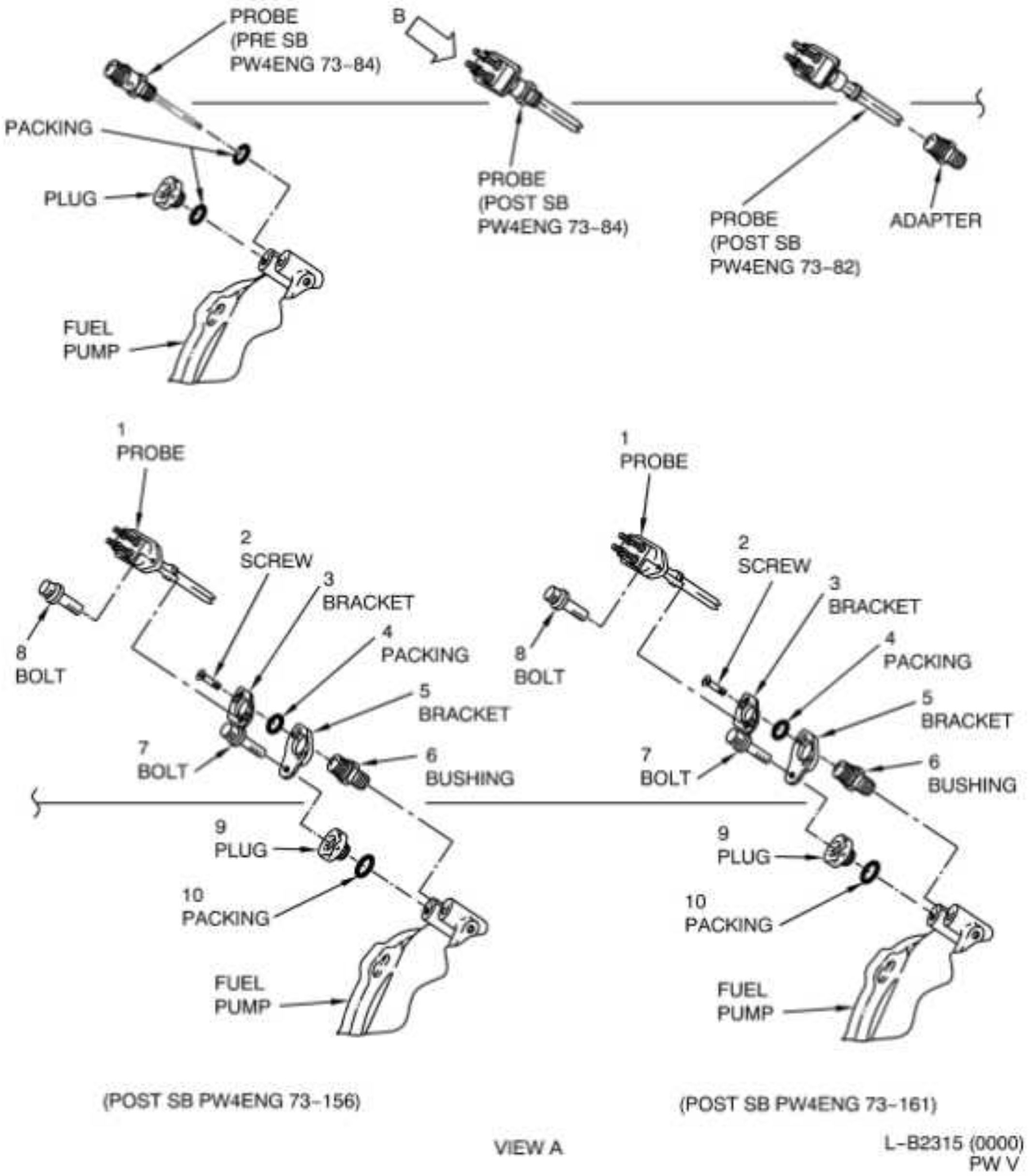
     - (2) If new fuel pump is to be replaced comply with the following.
       - (a) Remove bolts and washers securing fuel pump filter differential pressure switch located on upper right front of fuel filter. Remove switch and bracket and discard packings.
       - (b) (Pre SB PW4ENG 73-156 and SB PW4ENG 73-161) Remove the fuel temperature thermocouple probe from the fuel pump.
         - 1 Remove lockwire and fuel temperature thermocouple probe from port on upper right side of fuel filter. Discard packing.
         - 2 Remove lockwire and plug from port adjacent to fuel temperature port on fuel pump filter. Discard packing
       - (c) (Post SB PW4ENG 73-156 and SB PW4ENG 73-161) Remove the fuel temperature thermocouple probe from the fuel pump.
         - 1 Remove the lockwire and the two (2) bolts (301/8) that hold the fuel temperature thermocouple probe (301/1) to the bracket assembly (301/3 and 301/5). Remove the probe. Discard the packing (301/4).
         - 2 Remove the two (2) screws (301/2) that hold bracket (301/3) to bracket (301/5).
         - 3 Remove lockwire and bolt (301/7) from plug (301/9) that holds bracket (301/5) to the bushing (301/6) in the fuel pump.
         - 4 Remove the bushing (301/6) and bracket (301/5) from the fuel pump.


NUT
(5 REQUIRED)
WASHER
(5 REQUIRED)
FUEL PUMP
PACKINGS
FUEL METERING UNIT
L−A0205 (0387)
PW V

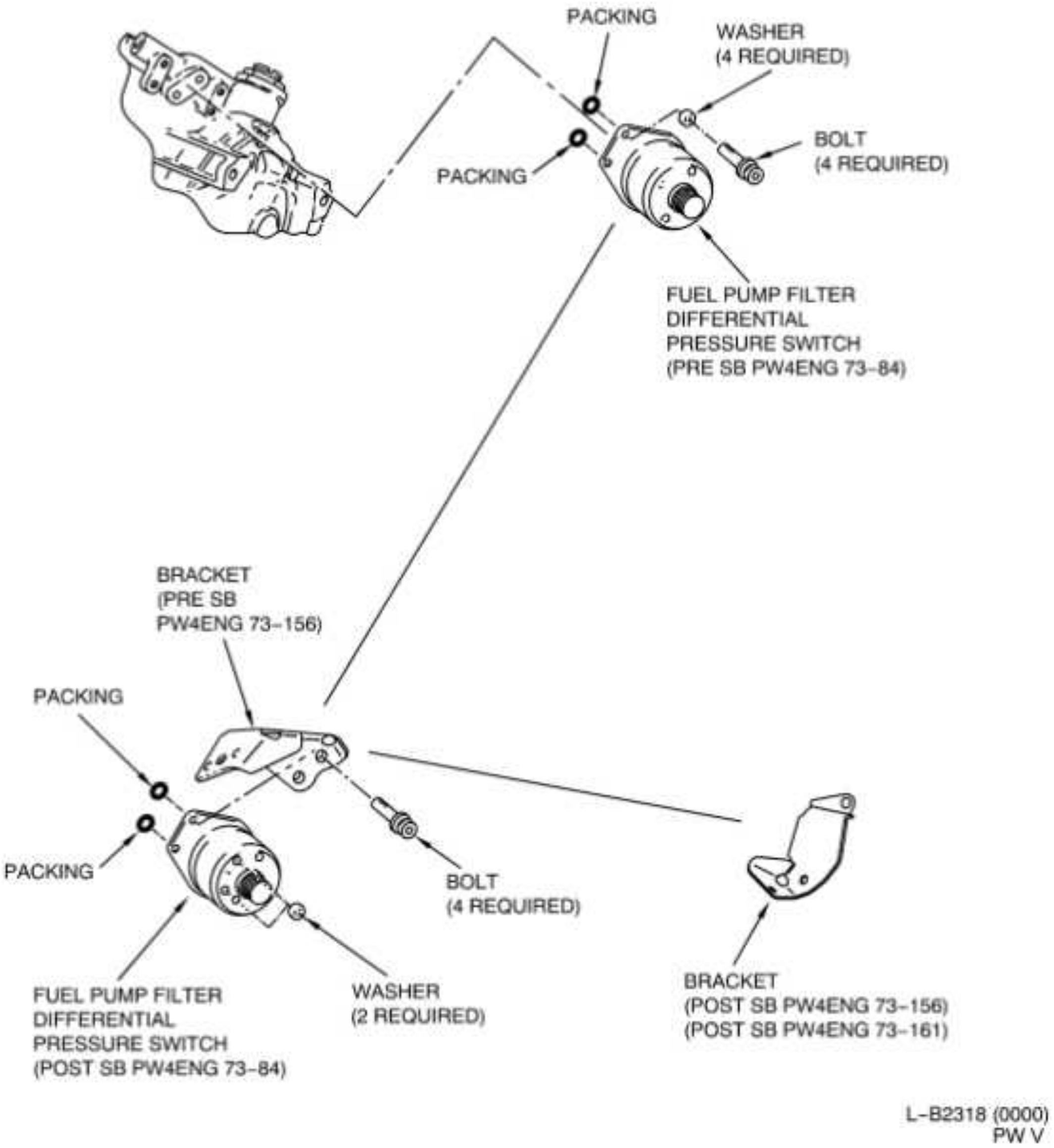
Fuel Pump And Fuel Metering Unit
Figure 301 (Sheet 1)
(Task 72−00−61−050−004)


A
FUEL PUMP
C
FWD
ADAPTER
PACKING
ADAPTER
LARGE STUDS
FUEL METERING UNIT
BOLT (4 REQUIRED)
BRACKET
VIEW B
L−B2314 (0000)
PW V

Fuel Pump And Fuel Metering Unit
Figure 301 (Sheet 2)
(Task 72−00−61−050−004)


PROBE
(PRE SB
PW4ENG 73-84)
B
PACKING
PLUG
FUEL
PUMP
PROBE
(POST SB
PW4ENG 73-84)
PROBE
(POST SB
PW4ENG 73-82)
ADAPTER
1
PROBE
2
SCREW
3
BRACKET
4
PACKING
5
BRACKET
6
BUSHING
7
BOLT
8
BOLT
9
PLUG
10
PACKING
FUEL
PUMP
(POST SB PW4ENG 73-156)
(POST SB PW4ENG 73-161)
VIEW A
L-B2315 (0000)
PW V

Fuel Pump And Fuel Metering Unit
Figure 301 (Sheet 3)
(Task 72−00−61−050−004)


PACKING
WASHER (4 REQUIRED)
BOLT (4 REQUIRED)
PACKING
FUEL PUMP FILTER DIFFERENTIAL PRESSURE SWITCH (PRE SB PW4ENG 73-84)
BRACKET (PRE SB PW4ENG 73-156)
PACKING
PACKING
BOLT (4 REQUIRED)
FUEL PUMP FILTER DIFFERENTIAL PRESSURE SWITCH (POST SB PW4ENG 73-84)
WASHER (2 REQUIRED)
BRACKET (POST SB PW4ENG 73-156) (POST SB PW4ENG 73-161)
L-B2318 (0000)
PW V

Fuel Pump And Fuel Metering Unit
Figure 301 (Sheet 4)
(Task 72−00−61−050−004)

5 Remove the lockwire and plug (301/9) from the fuel pump. Discard the packing (301/10).

(3) If new fuel metering unit is to be installed comply with the following.

(a) Remove threaded adapter from port on inboard side of fuel metering unit and discard packing.

(b) Remove bolts and bracket securing adapter to outboard fuel supply port on fuel metering unit and remove adapter. Discard packing.

(4) Install protective closures to fuel pump and fuel metering unit.

D. Postrequisites

CAUTION: FUEL METERING UNITS WHICH WILL NOT BE INSTALLED ON ENGINES WITHIN 24 HOURS AFTER REMOVAL MUST BE PRESERVED TO PREVENT INTERNAL CORROSION.

NOTE: For Preservation of the fuel metering unit, see the Fuel Metering Unit Component Maintenance Manual, 73−21−38 or 73−21−64 (Hamilton Standard Division).

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ENGINE GENERAL - MAIN GEARBOX - REMOVAL-08

Task 72-00-61-050-005:

1. Remove Fuel Bypass Valve

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P06-002	Lubricant

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Packing (TRW)	1	PN M25988/1-906		

Lockwire, MS20995C32 (TRW) or AS3214-02

B. Procedure

See Figure 301.

(1) Drain residual fuel from fuel pump by removing lockwire and plug from base of pump forward and opposite side of fuel filter (gear discharge port FP3). Discard packing.

NOTE: Be prepared to catch fuel in container with a minimum capacity of 5 U.S. gallons (19 liters).

(2) Using new packing lubricated with Lubricant (P06-002), reinstall plug. Torque plug to 45 - 55 lb-in. (5.084 - 6.214 N.m) and secure with lockwire.

(3) Remove lockwire and disconnect compressor stator cylinder manifold assembly (CP01) from adapter on fuel bypass valve, fuel metering unit, and manifold. Remove manifold from engine.

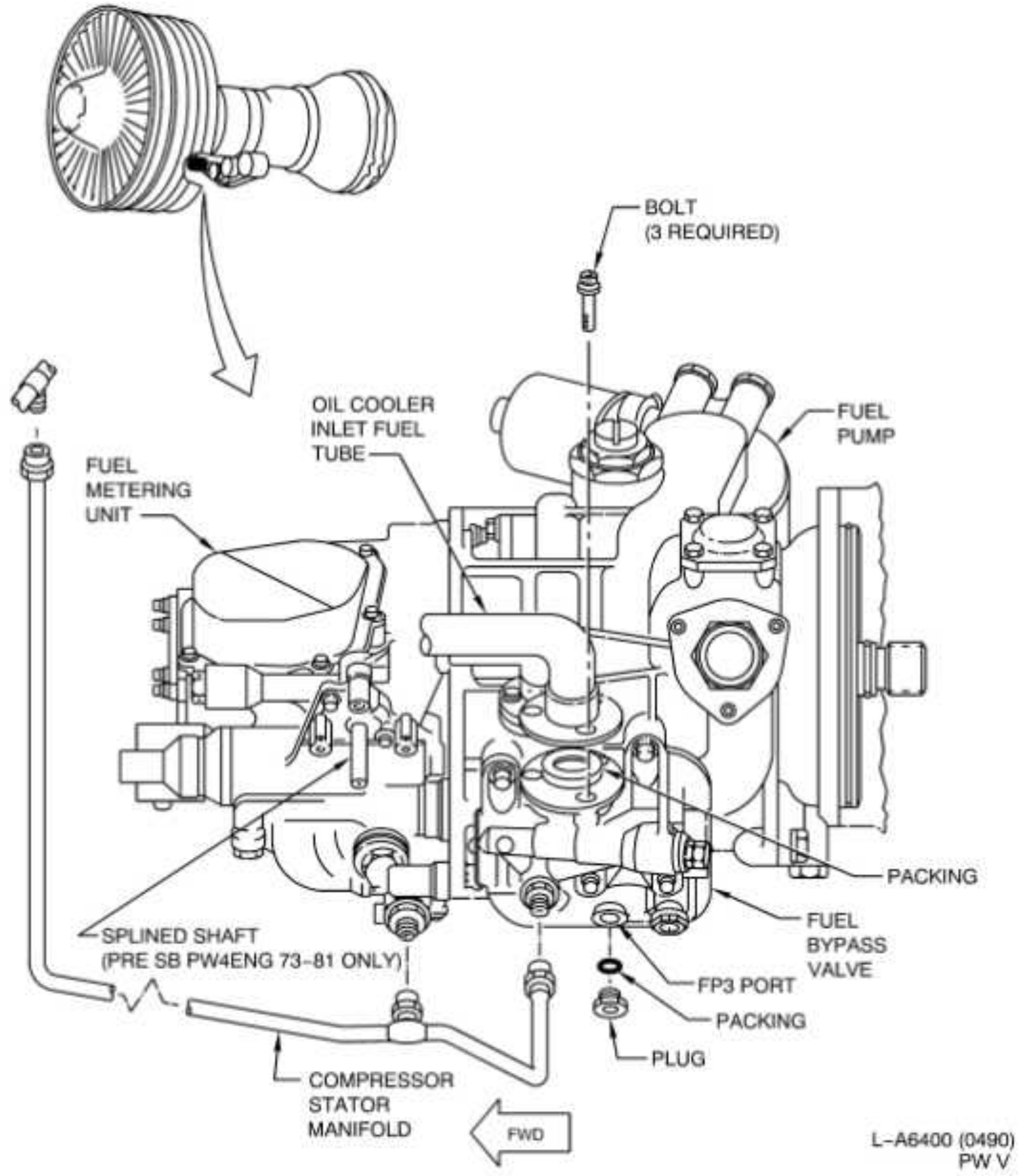
(4) Remove three bolts securing oil cooler inlet fuel tube assembly to top of fuel bypass valve.

(5) Remove four bolts securing fuel bypass valve to fuel pump and remove valve from pump. Discard packings.

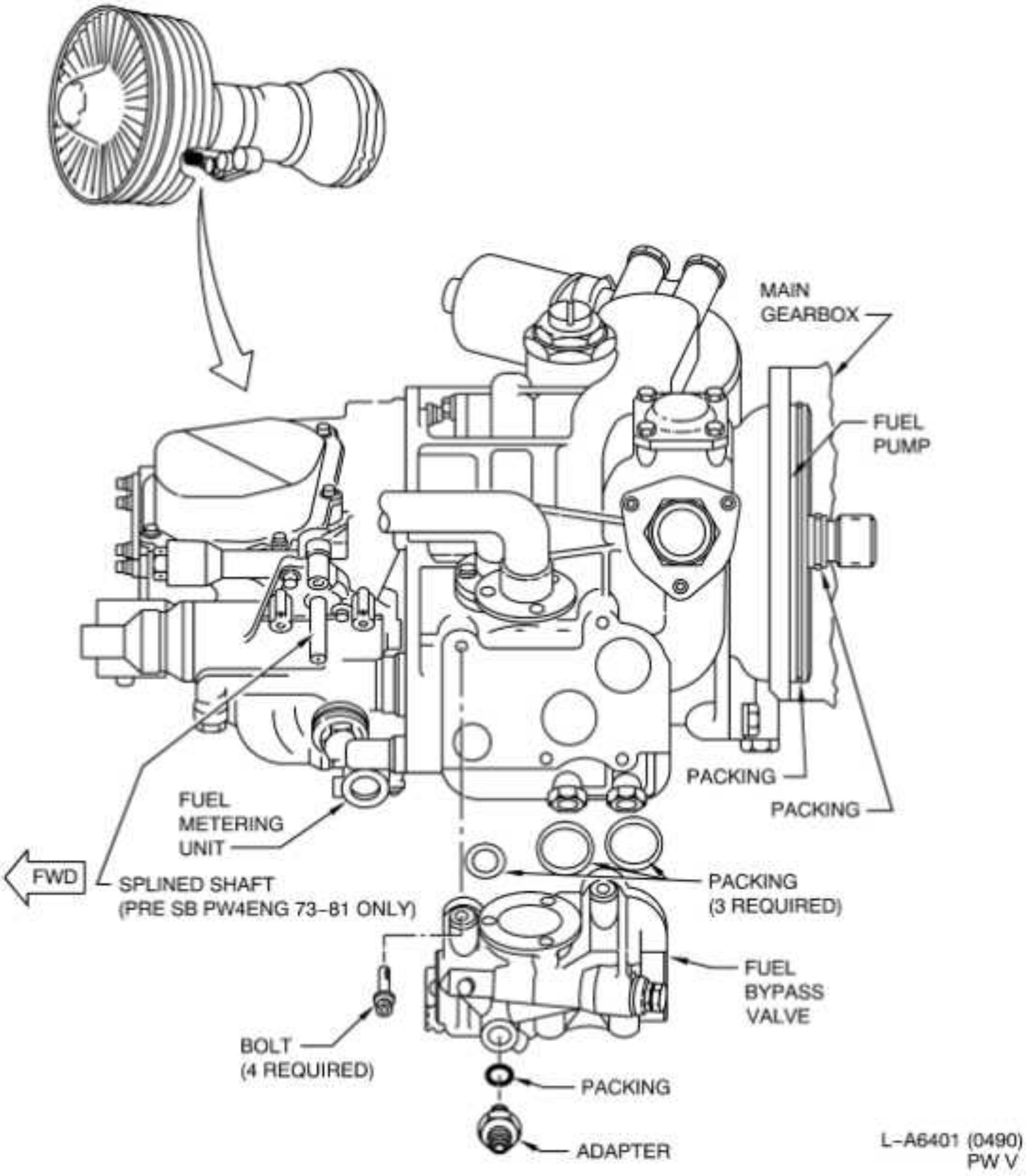
(6) Remove packing from flange of oil cooler inlet fuel tube assembly.

(7) If fuel bypass valve is to be replaced, comply with the following:

(a) Remove adapter from pressure port on fuel bypass valve and discard packing.


BOLT
(3 REQUIRED)
OIL COOLER
INLET FUEL
TUBE
FUEL
PUMP
FUEL
METERING
UNIT
PACKING
SPLINED SHAFT
(PRE SB PW4ENG 73-81 ONLY)
FUEL
BYPASS
VALVE
FP3 PORT
PACKING
PLUG
COMPRESSOR
STATOR
MANIFOLD
FWD
L-A6400 (0490)
PW V

Fuel Bypass Valve
Figure 301 (Sheet 1)
(Task 72-00-61-050-005)


MAIN GEARBOX
FUEL PUMP
PACKING
PACKING
FUEL METERING UNIT
FWD
SPLINED SHAFT (PRE SB PW4ENG 73-81 ONLY)
PACKING (3 REQUIRED)
FUEL BYPASS VALVE
BOLT (4 REQUIRED)
PACKING
ADAPTER
L-A6401 (0490)
PW V

Fuel Bypass Valve
Figure 301 (Sheet 2)
(Task 72−00−61−050−005)

(8) Install protective closures.

NOTE: For additional information concerning detailed maintenance of this component, see Fuel Bypass Valve Component Maintenance Manual, 73−21−58 (Hamilton Standard).

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-61-050-006:

1. Remove EEC Alternator Stator (Pre SB PW4ENG 72-375)

A. Equipment And Materials Necessary

Special Tools:
PWA 85749 Adapter, Torque

B. Procedure

See Figure 301.

(1) Using PWA 85749 Torque Adapter, disconnect W3P1 and W5P6 harness connectors from EEC alternator stator cables at bracket on lower left side of gearbox.

(2) Remove bolts (301/4) and (301/5) and plate (301/4) securing EEC stator cables to bracket.

(3) Remove clamp and bolt (301/1) securing cable to bracket below alternator. Remove cables from spring clips (301/2) and (301/3).

(4) Remove the alternator stator as follows.

(a) (Pre SB PW4ENG 75-59) Remove the three bolts and washer (301/9) securing the alternator stator (301/8) and heat shield (301/7) to gearbox.

(b) (Post SB PW4ENG 75-59) Remove the three bolts securing the stator (301/8) to gearbox.

(5) Remove stator and if equipped a heat shield from the gearbox

(6) Discard packing (301/6).

(7) Install protective closures.

NOTE: For additional information concerning detailed maintenance of this component see EEC Alternator Component Maintenance Manual, 73-21-55 (Bendix).

NOTE: See Removal-10 Task 72-00-61-050-007 for removal of EEC alternator rotor, if required.

Task 72-00-61-050-006-A:

2. Remove EEC Alternator Stator (Post SB PW4ENG 72-375)

A. Equipment And Materials Necessary

Special Tools:
PWA 85749 Adapter, Torque

B. Procedure
See Figures 302, Figure 303 and Figure 304.

(1) (Post SB PW4ENG 72-491) Remove the deoiler idler bearing pressure line (LP35) as follows.

(a) Remove the spray shield from the tee fitting in the No. 4 bearing oil pressure tube assembly (LP15).

(b) Remove the clamps that attach the line to the overboard breather pad bracket and the oil tank mount flange bracket.

(c) Loosen the line nuts at the tee fitting and the deoiler (idler) spur gear assembly in the gearbox.

(d) Carefully remove the line and install the protective closures.

(2) Remove the deoiler outlet tube assembly (LB05) as follows.

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES
R WHICH CONTAIN A FLEX DESIGN SEGMENT.
R REMOVE AND INSTALL A TUBE WITH A FLEX
R SEGMENT WITH THE SAME PRECAUTION USED
R FOR A TUBE WITHOUT A FLEX SEGMENT. DO
R NOT BEND THE FLEXHOSE OF A TUBE TO HELP
R WITH THE INSTALLATION OR REMOVAL OF THE
R TUBE OR AN ATTACHED COMPONENT. IF A FLEX
R SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE
R A KINK IN THE EXTERNAL WIRE BRAID AND IN
R THE INNER POLYTETRAFLUOROETHYLENE (PTFE)
R TUBE AND LEAKS OR TUBE RUPTURE CAN BE
R THE RESULT.

(a) Remove clamp bolt that holds the main filter oil tube (LP01) to the deoiler outlet tube flange bracket.

(b) Remove the three bolts that hold the deoiler outlet tube to the gearbox at the overboard breather pad.

(c) Remove the clamps that attach the tube to the bracket at Flanges M and N.

(d) Carefully remove the tube and install the protective closures.

(3) Using PWA 85749 Torque Adapter, disconnect W3P1 and W5P6 harness connectors from EEC alternator stator cables at bracket on lower left side of gearbox.

(4) Remove two bolts securing stator cable connectors, retaining plate, to bracket. Remove retaining plate.

(5) Remove both cable connectors from bracket.

(6) Remove cables from spring clips at brackets on rear face of gearbox.

(7) Remove three bolts that attach the alternator stator to the gearbox.

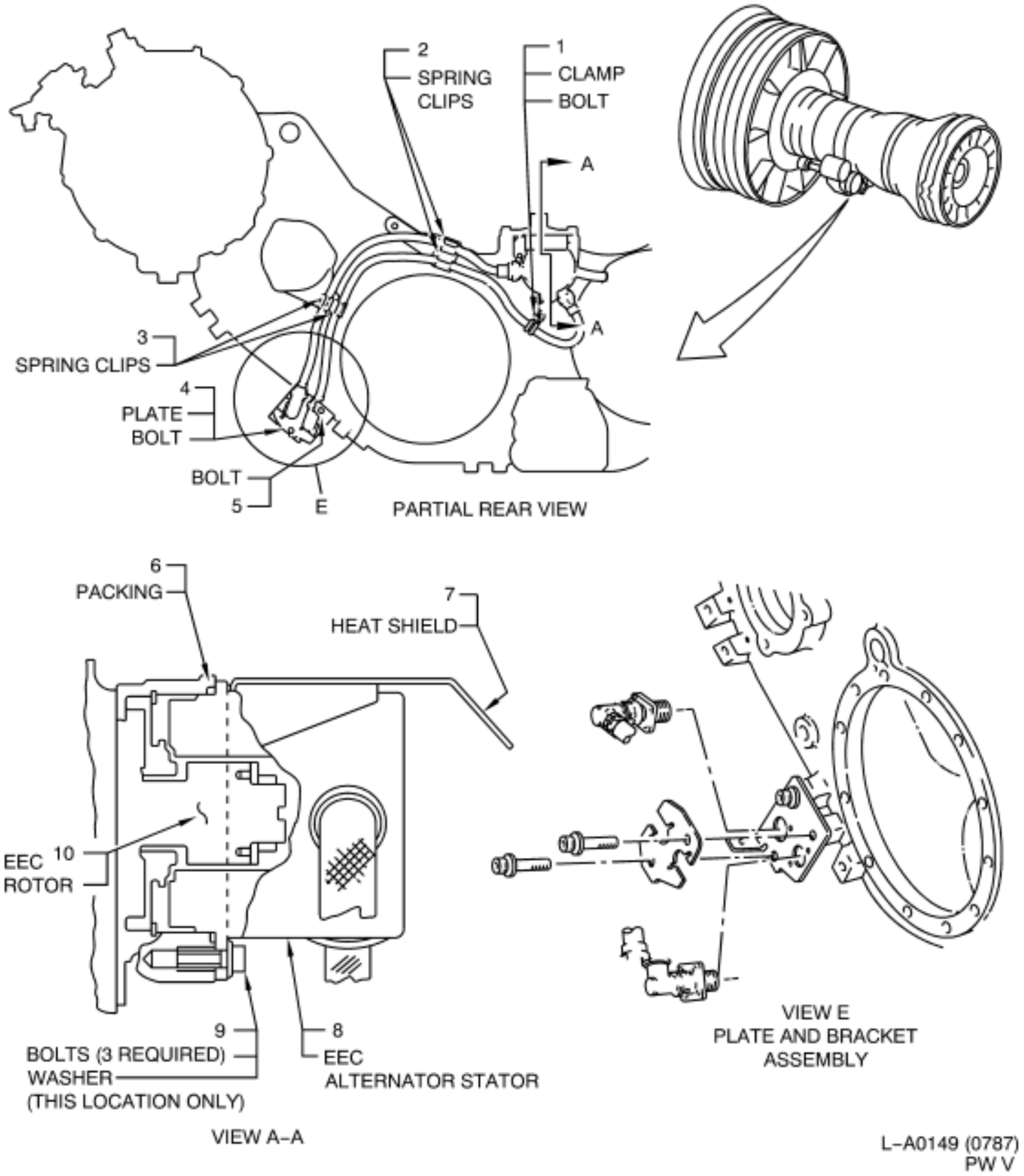
(8) Carefully remove the stator from the gearbox.

(9) Discard the packing.

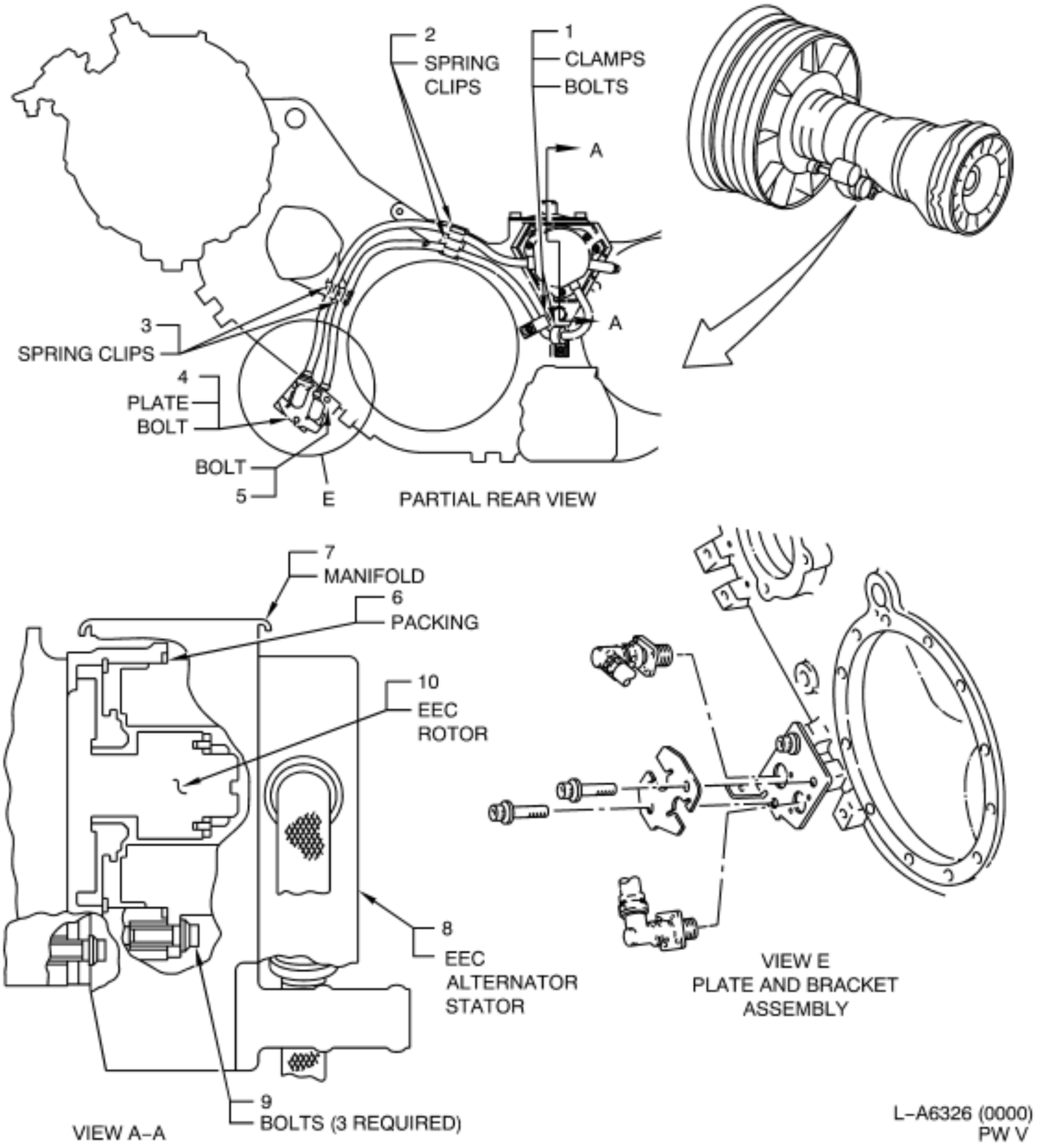
(10) Install protective closures.

NOTE: For additional information concerning detailed maintenance of this component see EEC Alternator Component Maintenance Manual, 73-21-80 (Airsearch, Allied-Signal).

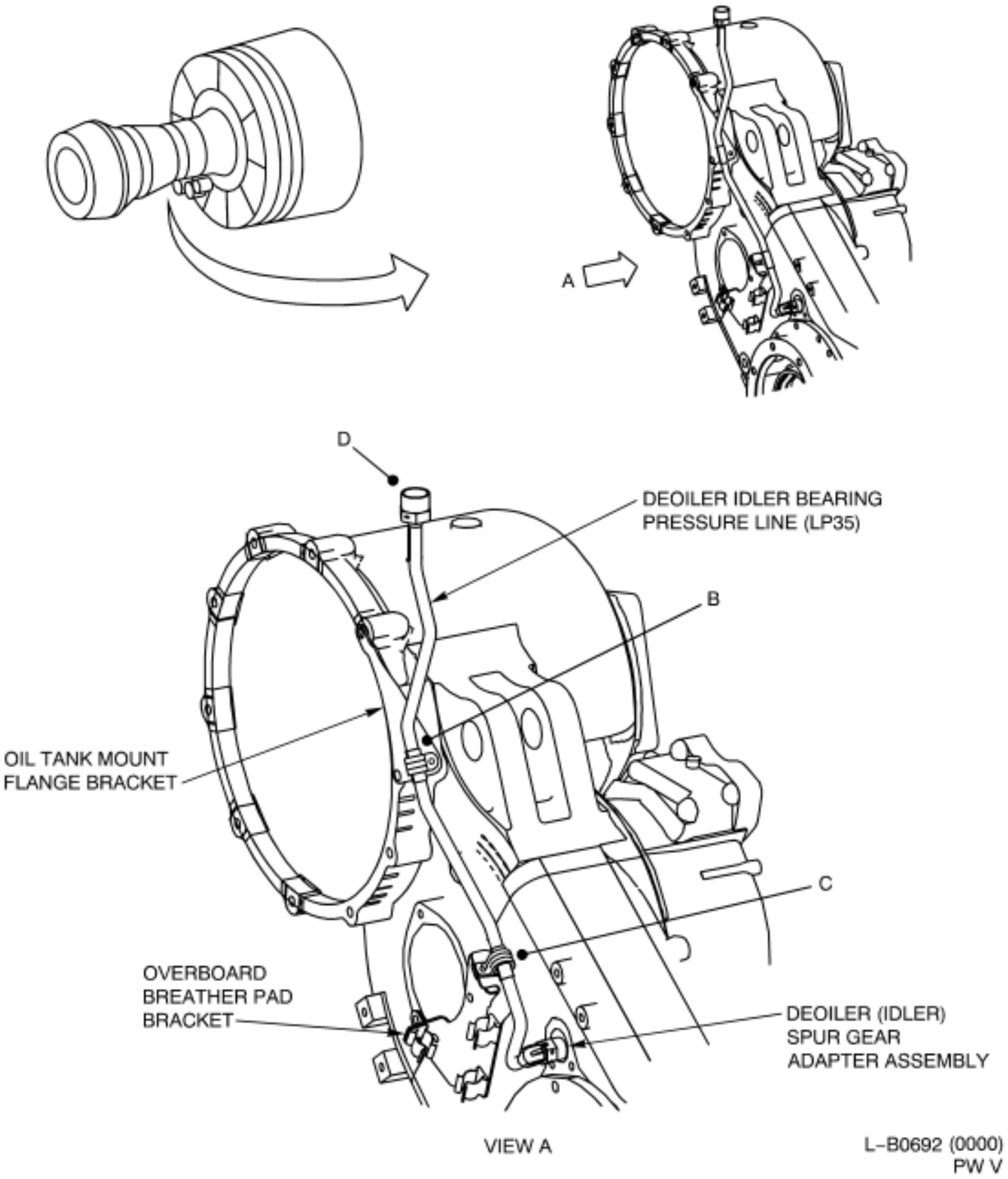
NOTE: See Removal-10 (Task 72-00-61-050-007-A) for removal of EEC Alternator Rotor (Post SB PW4ENG 72-375), if required.


2
SPRING
CLIPS
1
CLAMP
BOLT
A
A
3
SPRING CLIPS
4
PLATE
BOLT
BOLT
5
E
PARTIAL REAR VIEW
6
PACKING
7
HEAT SHIELD
EEC 10
ROTOR
9
BOLTS (3 REQUIRED)
WASHER
(THIS LOCATION ONLY)
8
EEC
ALTERNATOR STATOR
VIEW A-A
VIEW E
PLATE AND BRACKET
ASSEMBLY
L-A0149 (0787)
PW V

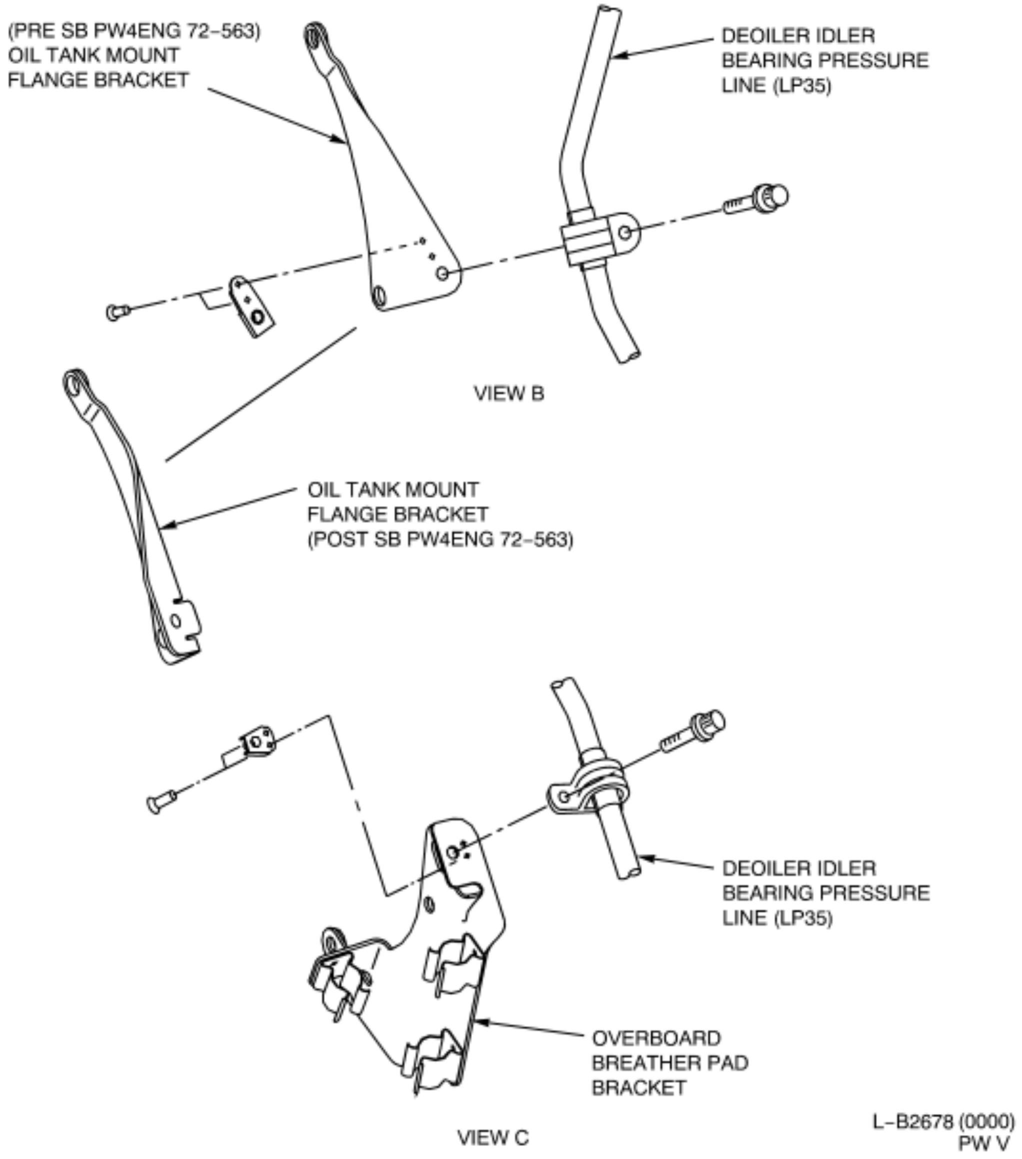
EEC Alternator Stator (Pre SB PW4ENG 75-59)
Figure 301 (Sheet 1)
(Task 72-00-61-050-006-A)


2
SPRING CLIPS
1
CLAMPS
BOLTS
A
A
3
SPRING CLIPS
4
PLATE
BOLT
BOLT
5
E
PARTIAL REAR VIEW
7
MANIFOLD
6
PACKING
10
EEC ROTOR
8
EEC ALTERNATOR STATOR
VIEW E
PLATE AND BRACKET ASSEMBLY
9
BOLTS (3 REQUIRED)
VIEW A-A
L-A6326 (0000)
PW V

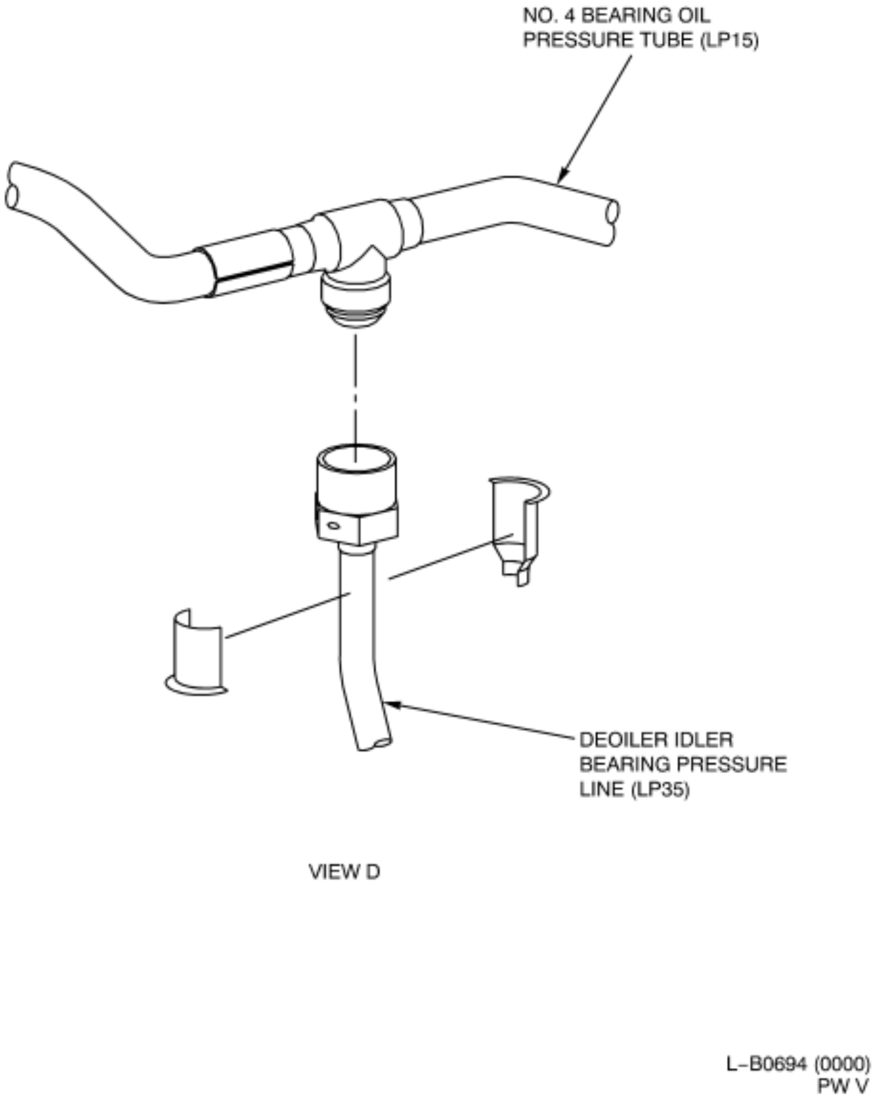
EEC Alternator Stator (Post SB PW4ENG 75-59)
Figure 301 (Sheet 2)
(Task 72-00-61-050-006-A)


A
D
DEOILER IDLER BEARING PRESSURE LINE (LP35)
B
OIL TANK MOUNT FLANGE BRACKET
C
OVERBOARD BREATHER PAD BRACKET
DEOILER (IDLER) SPUR GEAR ADAPTER ASSEMBLY
VIEW A
L-B0692 (0000)
PW V

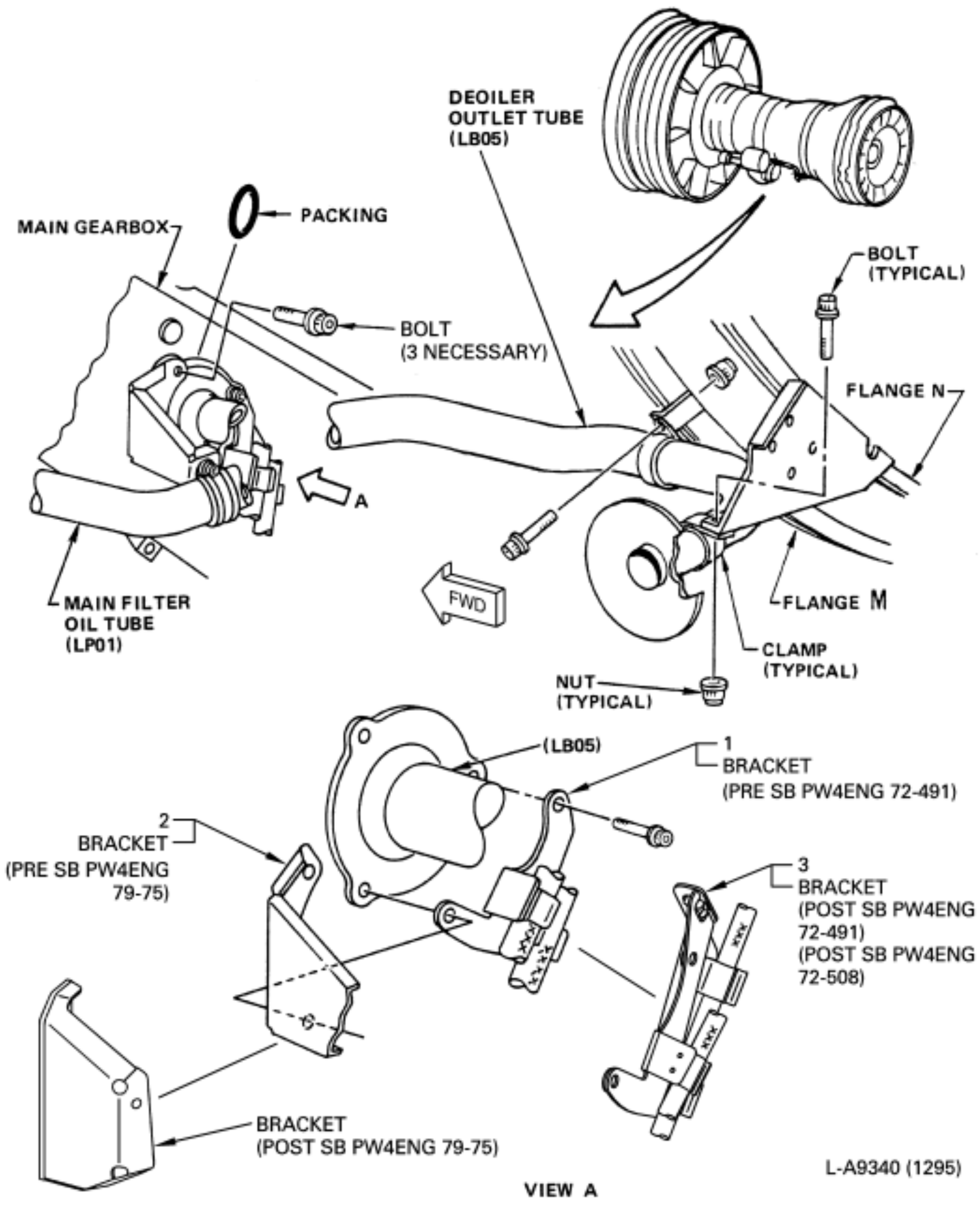
Deoiler Idler Bearing Pressure Line
Figure 302 (Sheet 1)
(Task 72-00-61-050-006-A)


(PRE SB PW4ENG 72−563)
OIL TANK MOUNT
FLANGE BRACKET
DEOILER IDLER
BEARING PRESSURE
LINE (LP35)
VIEW B
OIL TANK MOUNT
FLANGE BRACKET
(POST SB PW4ENG 72−563)
DEOILER IDLER
BEARING PRESSURE
LINE (LP35)
OVERBOARD
BREATHER PAD
BRACKET
VIEW C
L−B2678 (0000)
PW V

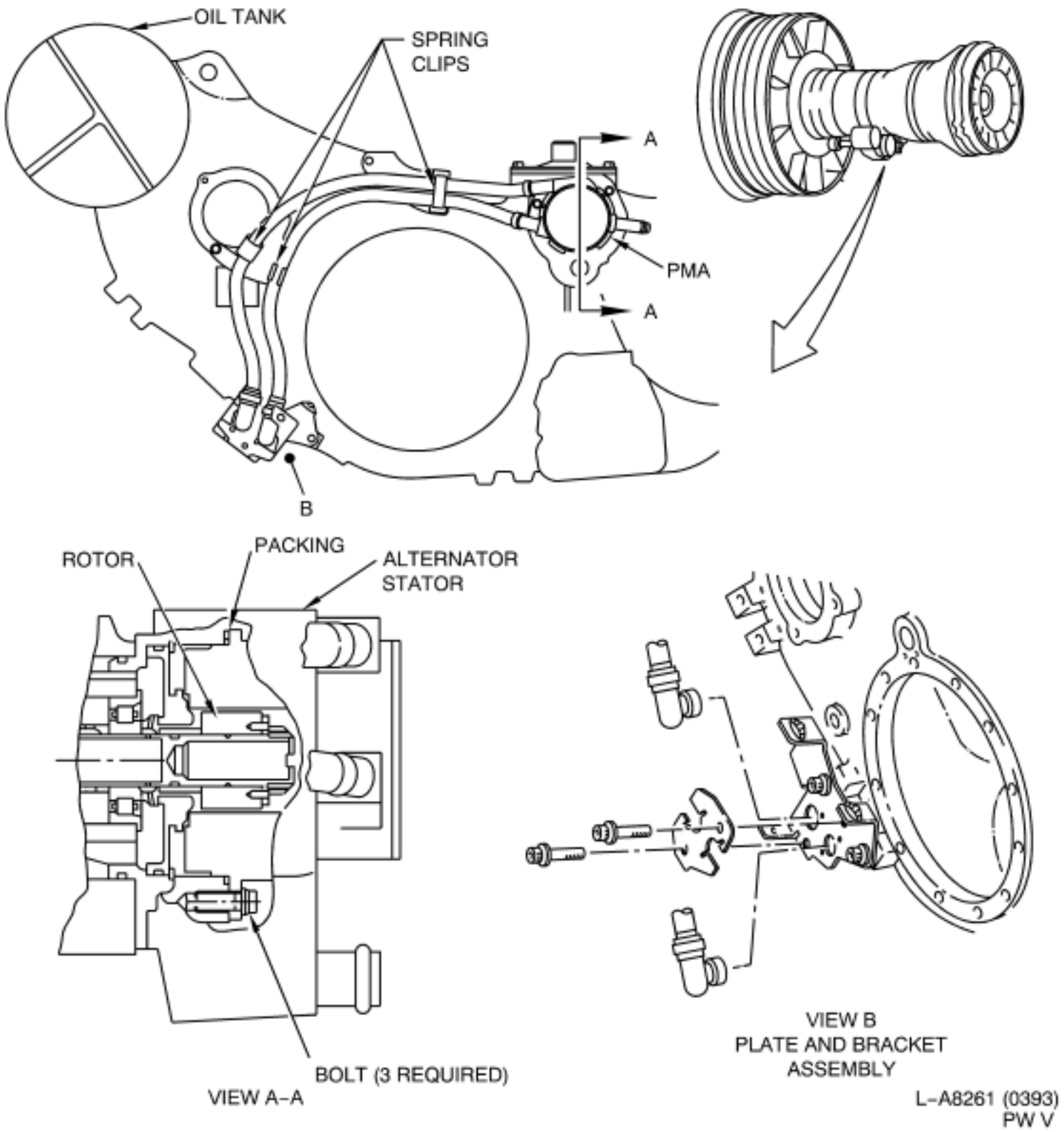
Deoiler Idler Bearing Pressure Line
Figure 302 (Sheet 2)
(Task 72−00−61−050−006−A)


NO. 4 BEARING OIL PRESSURE TUBE (LP15)
DEOILER IDLER BEARING PRESSURE LINE (LP35)
VIEW D
L−B0694 (0000)
PW V

Deoiler Idler Bearing Pressure Line
Figure 302 (Sheet 3)
(Task 72−00−61−050−006−A)


DEOILER OUTLET TUBE (LB05)
PACKING
MAIN GEARBOX
BOLT (TYPICAL)
BOLT (3 NECESSARY)
FLANGE N
A
MAIN FILTER OIL TUBE (LP01)
FWD
FLANGE M
CLAMP (TYPICAL)
NUT (TYPICAL)
(LB05)
1 BRACKET (PRE SB PW4ENG 72-491)
2 BRACKET (PRE SB PW4ENG 79-75)
3 BRACKET (POST SB PW4ENG 72-491) (POST SB PW4ENG 72-508)
BRACKET (POST SB PW4ENG 79-75)
L-A9340 (1295)
VIEW A

Deoiler Outlet Tube
Figure 303
(Task 72-00-61-050-006-A)


OIL TANK
SPRING CLIPS
A
PMA
A
B
ROTOR
PACKING
ALTERNATOR STATOR
BOLT (3 REQUIRED)
VIEW A−A
VIEW B
PLATE AND BRACKET ASSEMBLY
L−A8261 (0393)
PW V

EEC Alternator (N2 Transducer) Stator
Figure 304
(Task 72−00−61−050−006−A)

ENGINE GENERAL - MAIN GEARBOX - REMOVAL-10

Task 72-00-61-050-007:

1. Remove EEC Alternator Rotor (Pre SB PW4ENG 72-375)
   A. Prerequisites
      (1) Remove EEC alternator stator (Pre SB PW4ENG 72-375). See Removal-09 (Task 72-00-61-050-006).
   B. Equipment And Materials Required

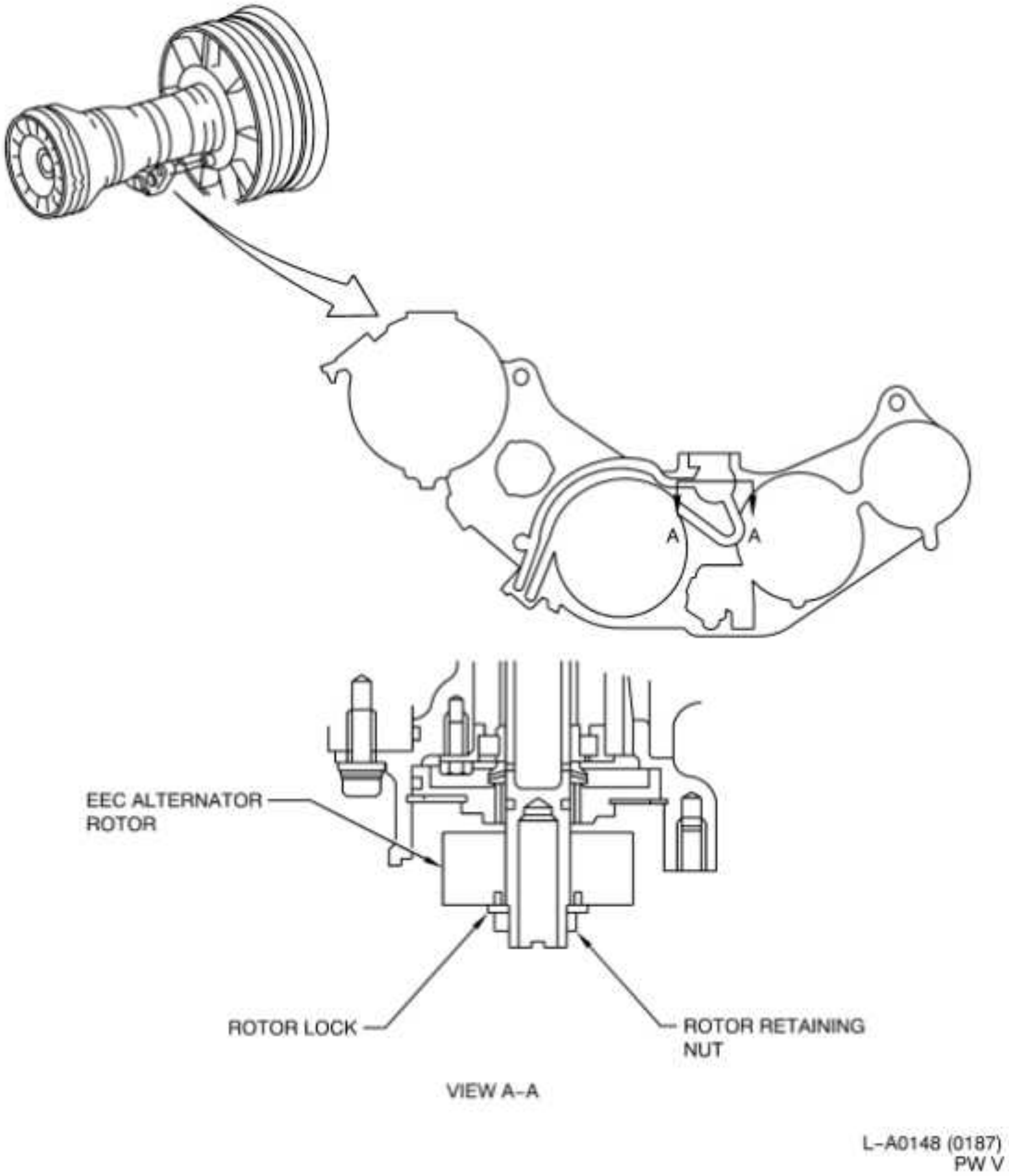
      Special Tools:
      PWA 85238 Wrench (Optional to PWA 86603)
      PWA 86603 Adapter
      PWA 85931 Puller

   C. Procedure
      See Figures 301 and 302.
      (1) Using PWA 85238 Wrench or PWA 86603 Adapter, loosen the rotor retaining nut as follows:
         (a) Loosen both jamnuts (302/3) and retract wrench detail (302/4) from body of wrench.
         (b) Insert handle (302/6) lug end facing outward, over mating lug of wrench detail (302/4).
         (c) Align boltholes and position wrench body (302/2) over EEC gearshaft and onto gearshaft housing (302/1) pad.
         (d) Engage lugs of wrench detail with mating slots in gearshaft. Secure body (302/2) with three detail screws (302/5).
         (e) Seat wrench detail (302/4) firmly on gearshaft and secure with jamnuts (302/3).
         (f) Engage lugs of handle (302/6) with mating lugs in nut (302/7). Rotate handle to loosen nut.

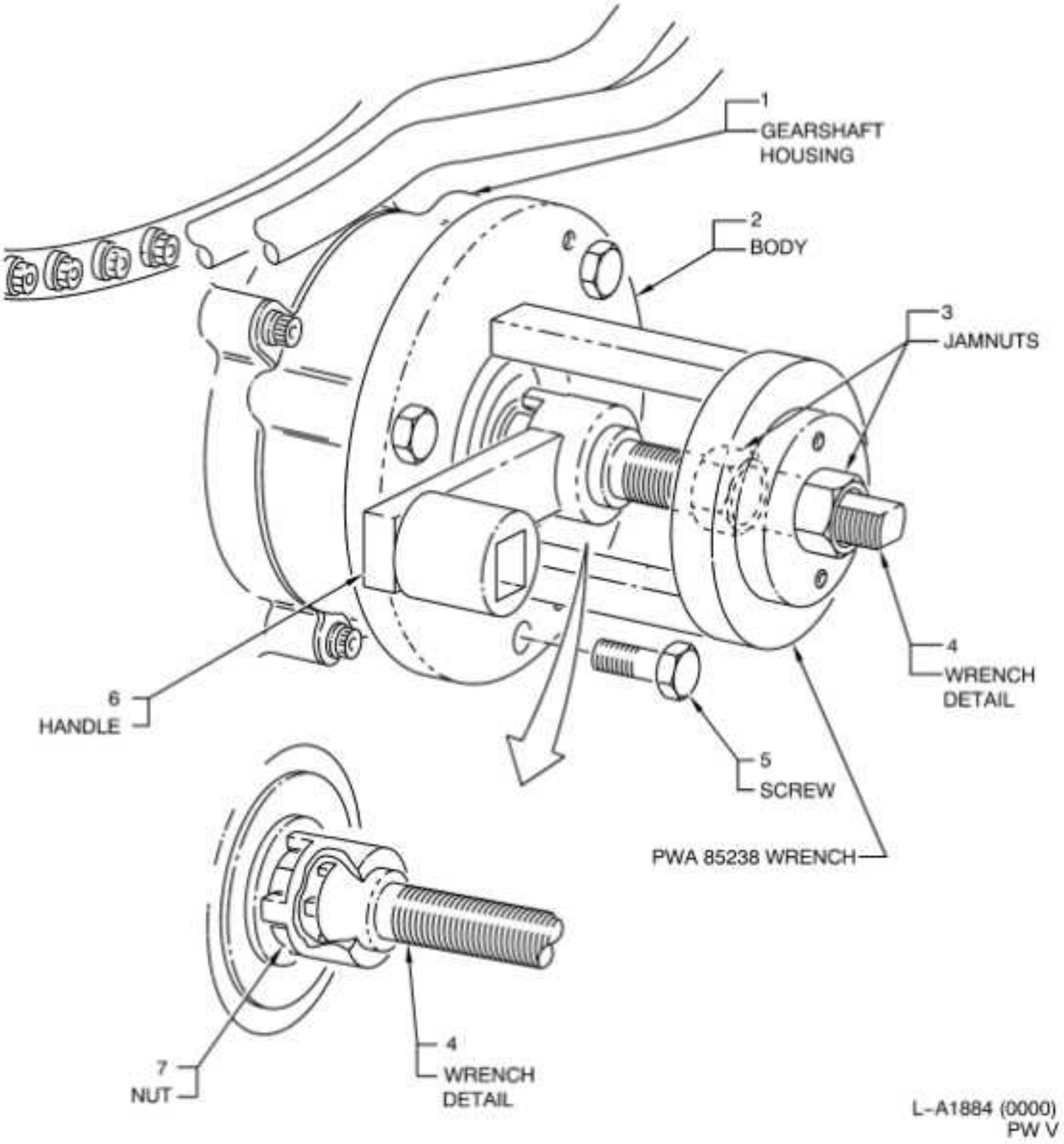
            NOTE: This must be done in several steps because handle movement is restricted and handle must be removed from nut and repositioned.

         (g) Remove cap screws securing wrench to gearbox and remove wrench.
      (2) Remove locknut (302/7) securing EEC alternator rotor to gearshaft.
      (3) Remove the rotor lock.
      (4) With PWA 85931 Puller, remove the rotor from gearshaft.
      (5) Install protective closures.

         NOTE: For additional information concerning detailed maintenance of this component see EEC Alternator Component Maintenance Manual, 73-21-55 (Bendix).


A
A
EEC ALTERNATOR ROTOR
ROTOR LOCK
ROTOR RETAINING NUT
VIEW A-A
L-A0148 (0187)
PW V

EEC Alternator Rotor
Figure 301
(Task 72-00-61-050-007)


1
GEARSHAFT HOUSING
2
BODY
3
JAMNUTS
4
WRENCH DETAIL
5
SCREW
PWA 85238 WRENCH
6
HANDLE
7
NUT
4
WRENCH DETAIL
L-A1884 (0000)
PW V

Rotor Retaining Nut Removal
Figure 302
(Task 72-00-61-050-007)

ENGINE GENERAL – MAIN GEARBOX – REMOVAL–10

Task 72–00–61–050–007–A:

2. Remove EEC Alternator Rotor (Post SB PW4ENG 72–375)

A. Prerequisites

  (1) Remove EEC alternator stator (Post SB PW4ENG 72–375). See Removal–09 (Task 72–00–61–050–006–A).

B. Equipment And Materials Required

Special Tools:
PWA 86603 Adapter
PWA 86551 Puller

C. Procedure

See Figures 303 and 304.

  (1) Loosen the rotor retaining nut with PWA 86603 Adapter as follows.
    (a) Loosen both jamnuts (303/3). While you hold the body (303/2), loosen the wrench detail (303/4).
    (b) Install the handle (303/6),lug end facing outward, over the mating lug of wrench detail (303/4).
    (c) Align boltholes and position body (303/2) over EEC gearshaft (303/8) and onto the gearshaft housing (303/1) pad.
    (d) Engage lugs of wrench detail with mating slots in gearshaft. Attach the body (303/2) with three detail screws (303/5).
    (e) Seat the wrench detail (303/4) firmly on the gearshaft and tighten the jamnuts (303/3).
    (f) Engage the lugs of handle (303/6) with the mating lugs in the nut (303/7). Turn the handle to loosen the nut using a standard 1/2 inch drive.

      NOTE: This must be done in several steps as the handle movement is limited. The handle must be removed and positioned again to the nut.

    (g) Remove the screws (303/5) that attach the adapter to the gearbox and remove adapter.
  (2) Remove the nut (303/7) that attaches EEC alternator rotor to the gearshaft.
  (3) Remove the rotor (304/5) from the gearshaft (304/6) with a PWA 86551 Puller as follows.
    (a) Retract the hex bolt (304/2) on the rotor puller. Loosen the two socket head screws (304/3) and install the jaws (304/1) in the puller groove on the rotor (304/5).
    (b) Install the ring (304/4) around the jaws (304/1) and against the shoulder of the jaws.
    (c) Tighten the two socket heads screws (304/3)

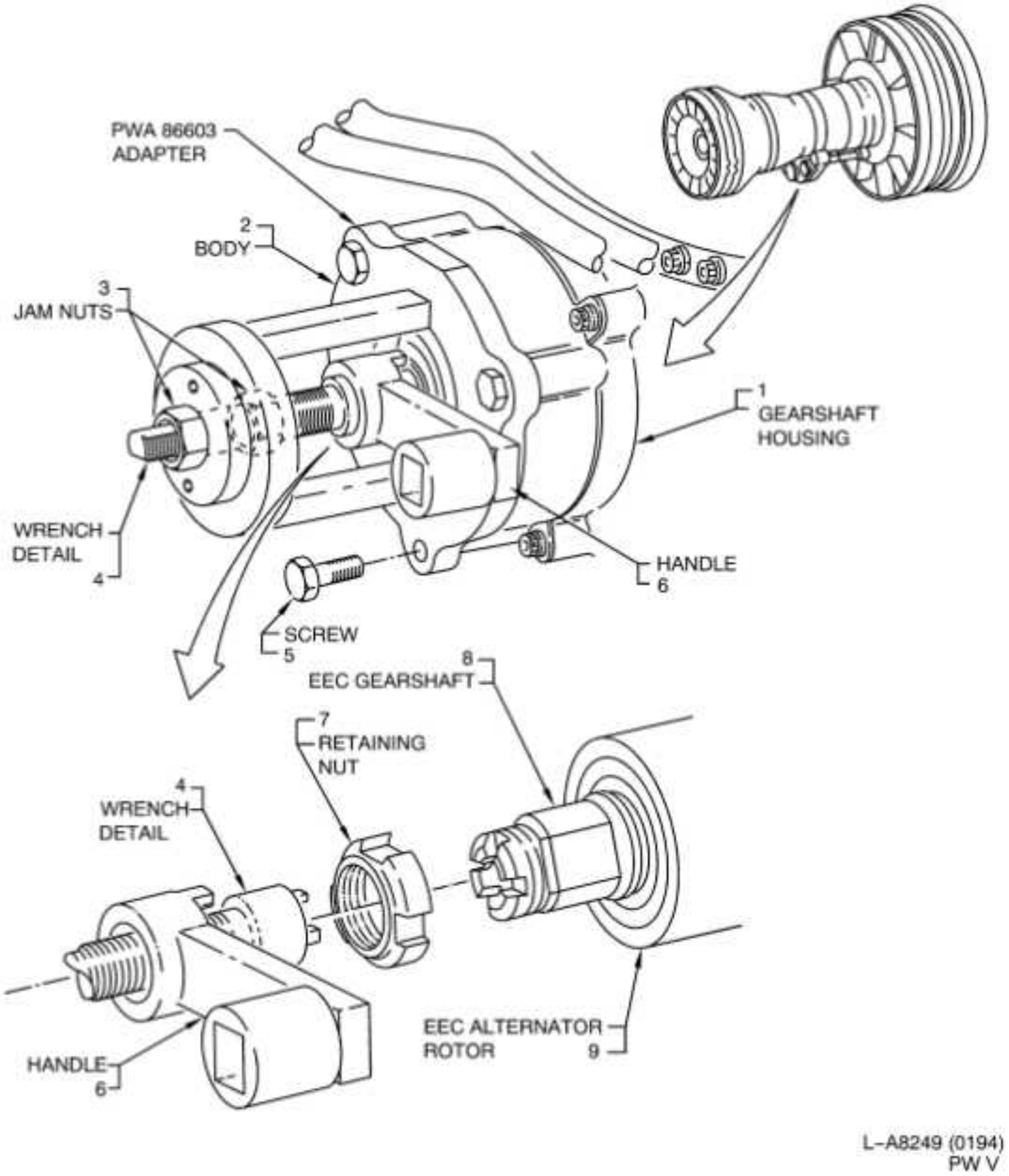
(d) Tighten the hex head bolt (304/2) until the rotor is removed from the gearshaft (304/6) .

NOTE: The puller and rotor can turn when the hex bolt (304/2) is tightened. To prevent the rotor from turning, you can install a rod or punch into one of the holes in the puller jaws and hold while the the hex bolt is tightened.

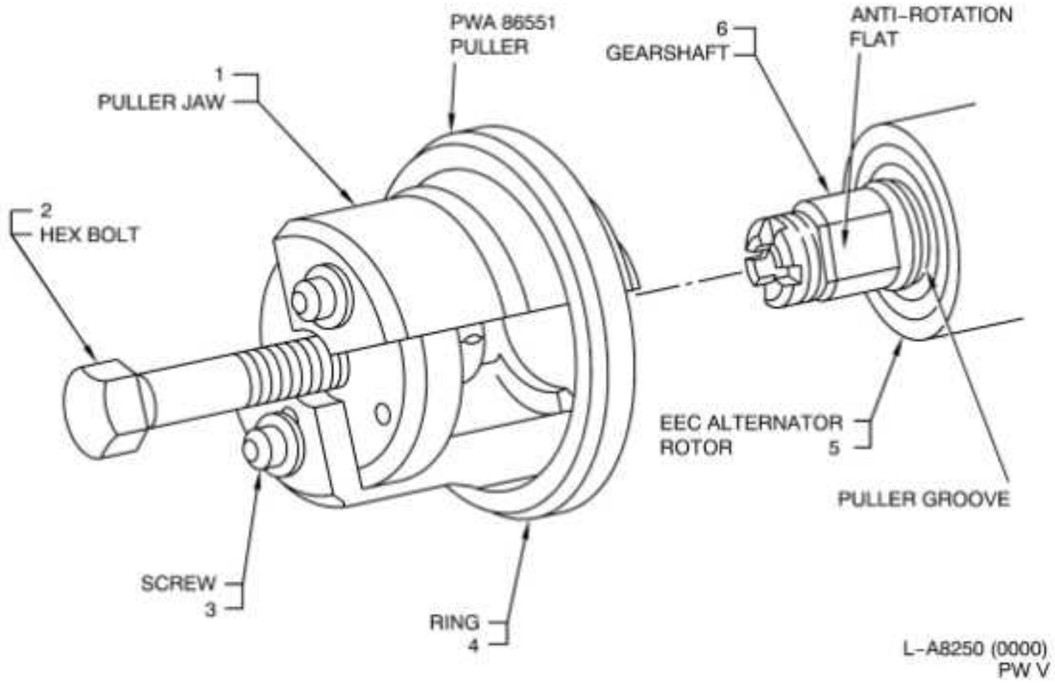
(e) Loosen the hex bolt (304/2) and the two socket head screws (304/3). Remove the ring (304/4) from the puller and remove the puller from the rotor.

(4) Install protective closures.

NOTE: For additional information concerning detailed maintenance of this component see EEC Alternator Component Maintenance Manual, 73−21−80 (Airsearch, Allied−Signal).


PWA 86603 ADAPTER
2 BODY
3 JAM NUTS
1 GEARSHAFT HOUSING
WRENCH DETAIL 4
HANDLE 6
SCREW 5
8 EEC GEARSHAFT
7 RETAINING NUT
4 WRENCH DETAIL
HANDLE 6
EEC ALTERNATOR ROTOR 9
L−A8249 (0194)
PW V

Installation Of PWA 86603 Adapter To Gearbox
Figure 303
(Task 72−00−61−050−007−A)


PWA 86551 PULLER
6 GEARSHAFT
ANTI−ROTATION FLAT
1 PULLER JAW
2 HEX BOLT
EEC ALTERNATOR ROTOR 5
PULLER GROOVE
SCREW 3
RING 4
L−A8250 (0000)
PW V

Installation Of PWA 86551 Puller To Alternator Rotor
Figure 304
(Task 72−00−61−050−007−A)

ENGINE GENERAL - MAIN GEARBOX - REMOVAL-11

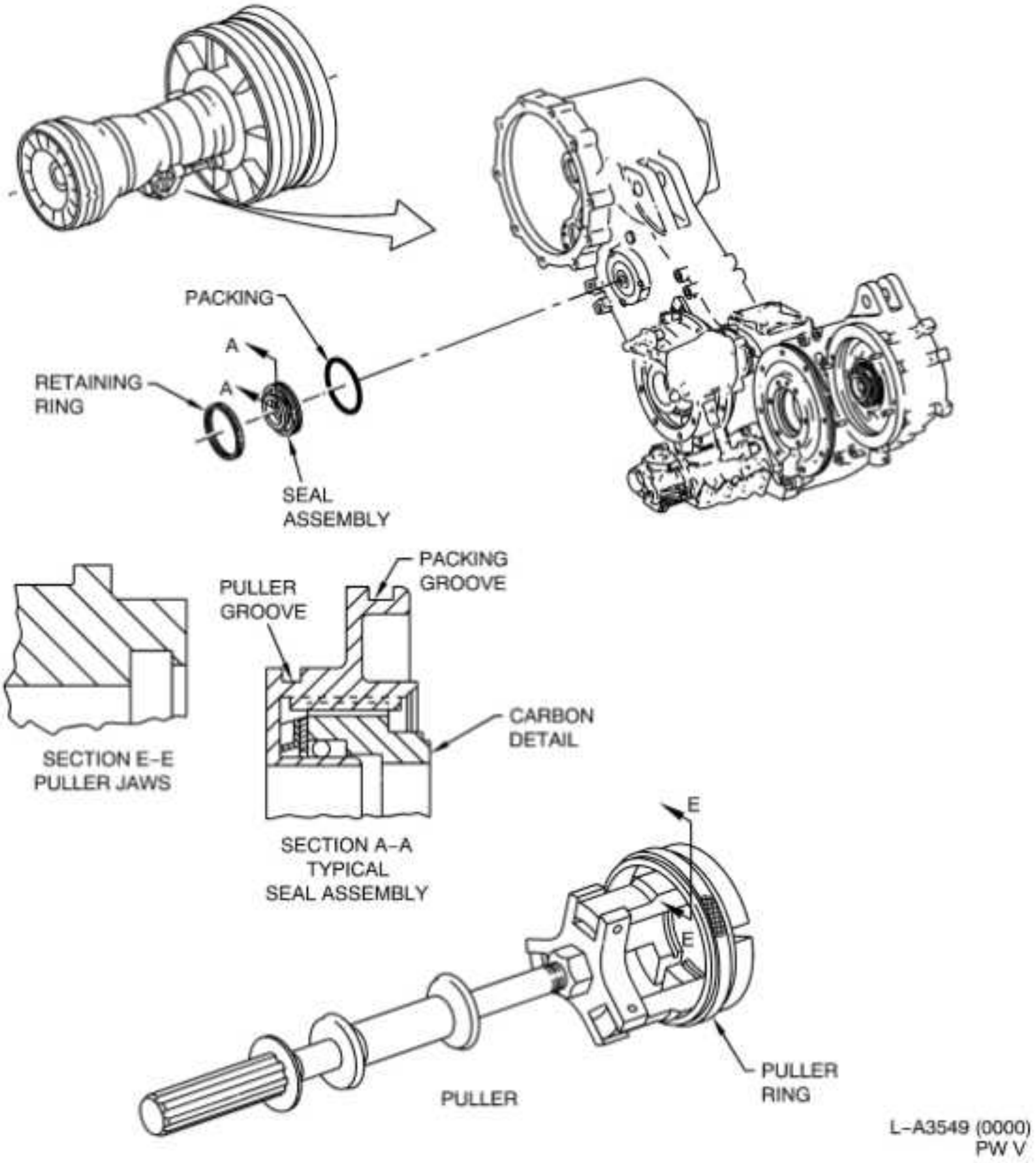
Task 72-00-61-030-002:

1. Remove Deoiler Drive Oil Seal Assembly
   A. Equipment And Materials Required

      Special Tools:
      PWA 85204 Puller (Optional to PWA 88110)
      PWA 88110 Puller

   B. Procedure
      See Figure 301.

      (1) Remove retaining ring securing deoiler oil seal assembly in ejector port on rear of gearbox.
      (2) Install either PWA 88110 or PWA 85204 Puller in oil seal assembly and secure.
         (a) Engage puller jaws in groove of seal assembly.
         (b) Slide down puller ring until jaws are secured in groove.
      (3) Remove oil seal assembly using slide hammer action of puller. Remove puller. Discard packing.
      (4) Install protective closure.


PACKING
A
A
RETAINING RING
SEAL ASSEMBLY
PACKING GROOVE
PULLER GROOVE
CARBON DETAIL
SECTION E−E PULLER JAWS
SECTION A−A TYPICAL SEAL ASSEMBLY
E
E
PULLER
PULLER RING
L−A3549 (0000)
PW V

Deoiler Drive Oil Seal Assembly
Figure 301
(Task 72−00−61−030−002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − MAIN GEARBOX − REMOVAL−12

Task 72−00−61−030−003:

1. Remove Starter Drive Oil Seal Assembly

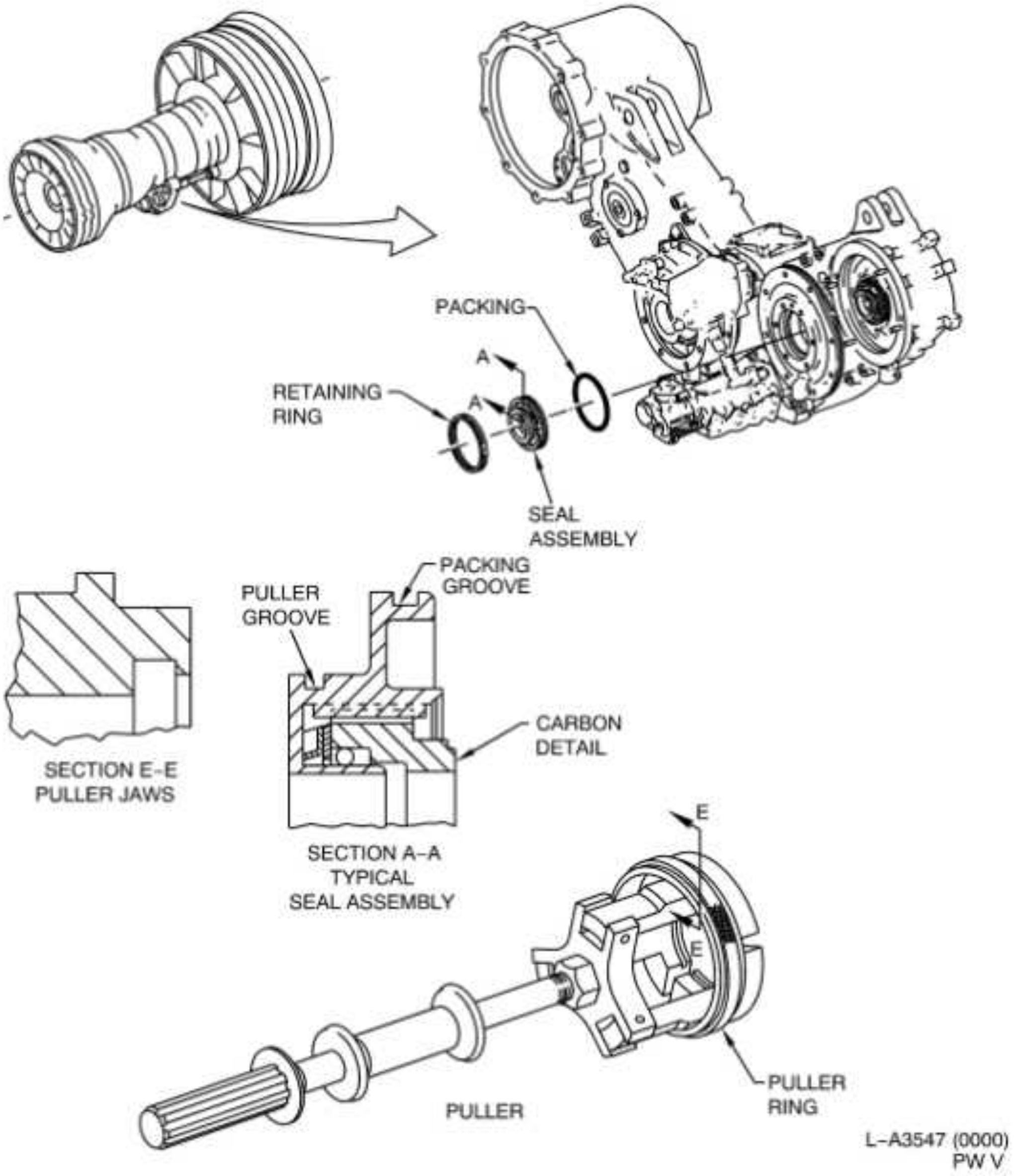
A. Equipment And Materials Required

Special Tools:
PWA 85204 Puller (Optional to PWA 88110)
PWA 88110 Puller

B. Procedure

See Figure 301.

- (1) Remove retaining ring securing starter drive oil seal assembly.
- (2) Install either PWA 88110 or PWA 85204 Puller in seal assembly.
  - (a) Engage puller jaws in groove of seal assembly.
  - (b) Slide down puller ring until jaws are secured in groove.
- (3) Remove oil seal assembly using slide hammer action of puller to overcome resistance of preformed packing. Remove puller. Discard packing.
- (4) Install protective closure.


PACKING
A
A
RETAINING RING
SEAL ASSEMBLY
PACKING GROOVE
PULLER GROOVE
CARBON DETAIL
SECTION E-E PULLER JAWS
SECTION A-A TYPICAL SEAL ASSEMBLY
E
E
PULLER
PULLER RING
L-A3547 (0000)
PW V

Starter Drive Oil Seal Assembly
Figure 301
(Task 72−00−61−030−003)

Previous Pageblock Return to Previous Menu Next Pageblock

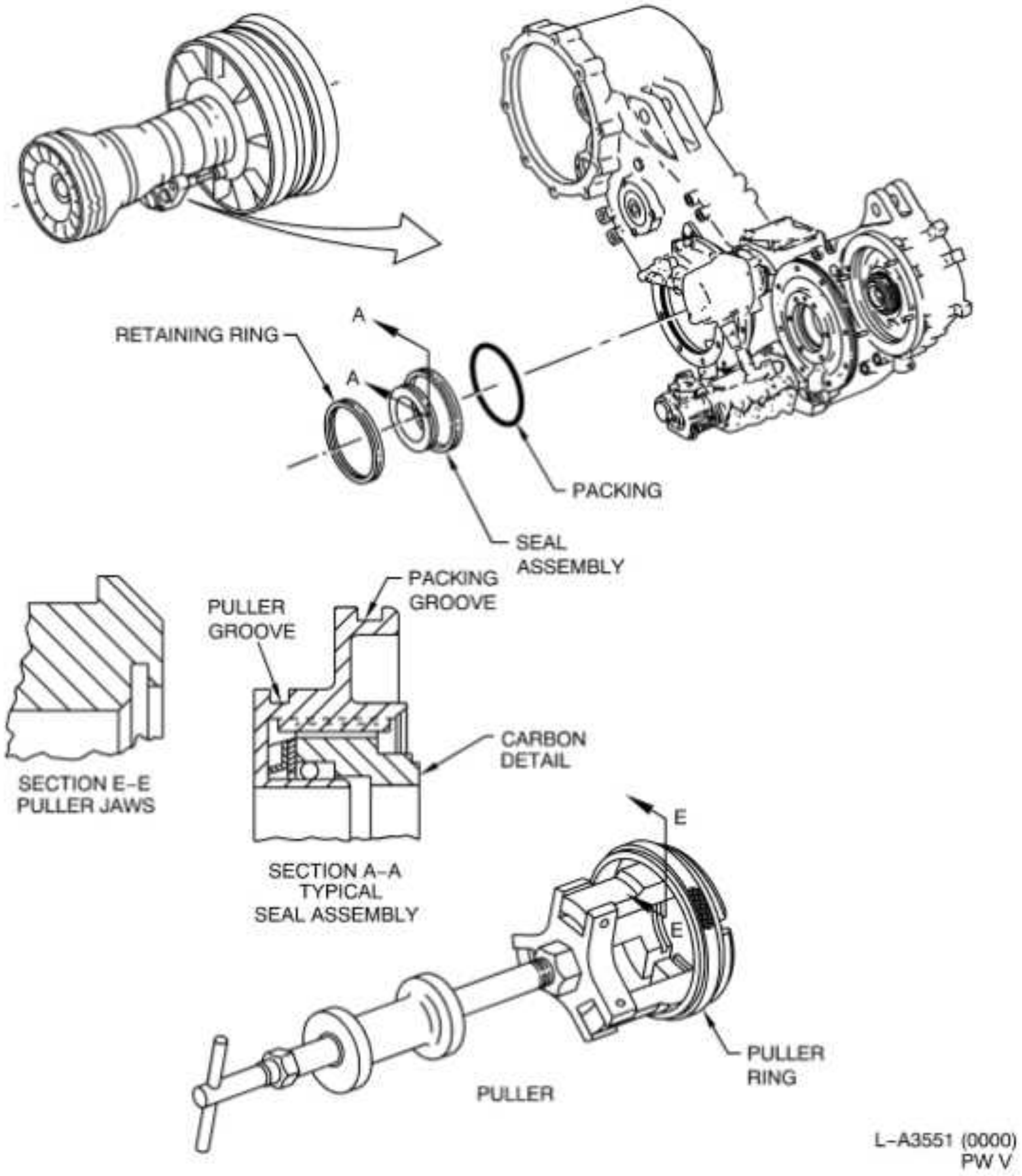
ENGINE GENERAL - MAIN GEARBOX - REMOVAL-13

Task 72-00-61-030-004:

1. Remove Integrated Drive Generator (IDG) Drive Oil Seal Assembly
   A. Equipment And Materials Required

      Special Tools:
      PWA 85203 Puller

   B. Procedure
      See Figure 301.
      (1) Remove retaining ring securing IDG drive oil seal assembly.
      (2) Install PWA 85203 Puller in seal assembly.
         (a) Engage puller jaws in groove of seal assembly.
         (b) Slide puller ring into position over jaws to secure in place.
      (3) Remove oil seal assembly using slide hammer action of puller to overcome resistance of preformed packing. Remove puller. Discard packing.
      (4) Install protective closure.


RETAINING RING
A
A
PACKING
SEAL
ASSEMBLY
PACKING
GROOVE
PULLER
GROOVE
CARBON
DETAIL
SECTION E–E
PULLER JAWS
SECTION A–A
TYPICAL
SEAL ASSEMBLY
E
E
PULLER
RING
PULLER
L–A3551 (0000)
PW V

Integrated Drive Generator (IDG) Drive Oil Seal Assembly
Figure 301
(Task 72−00−61−030−004)

ENGINE GENERAL - MAIN GEARBOX - REMOVAL-14

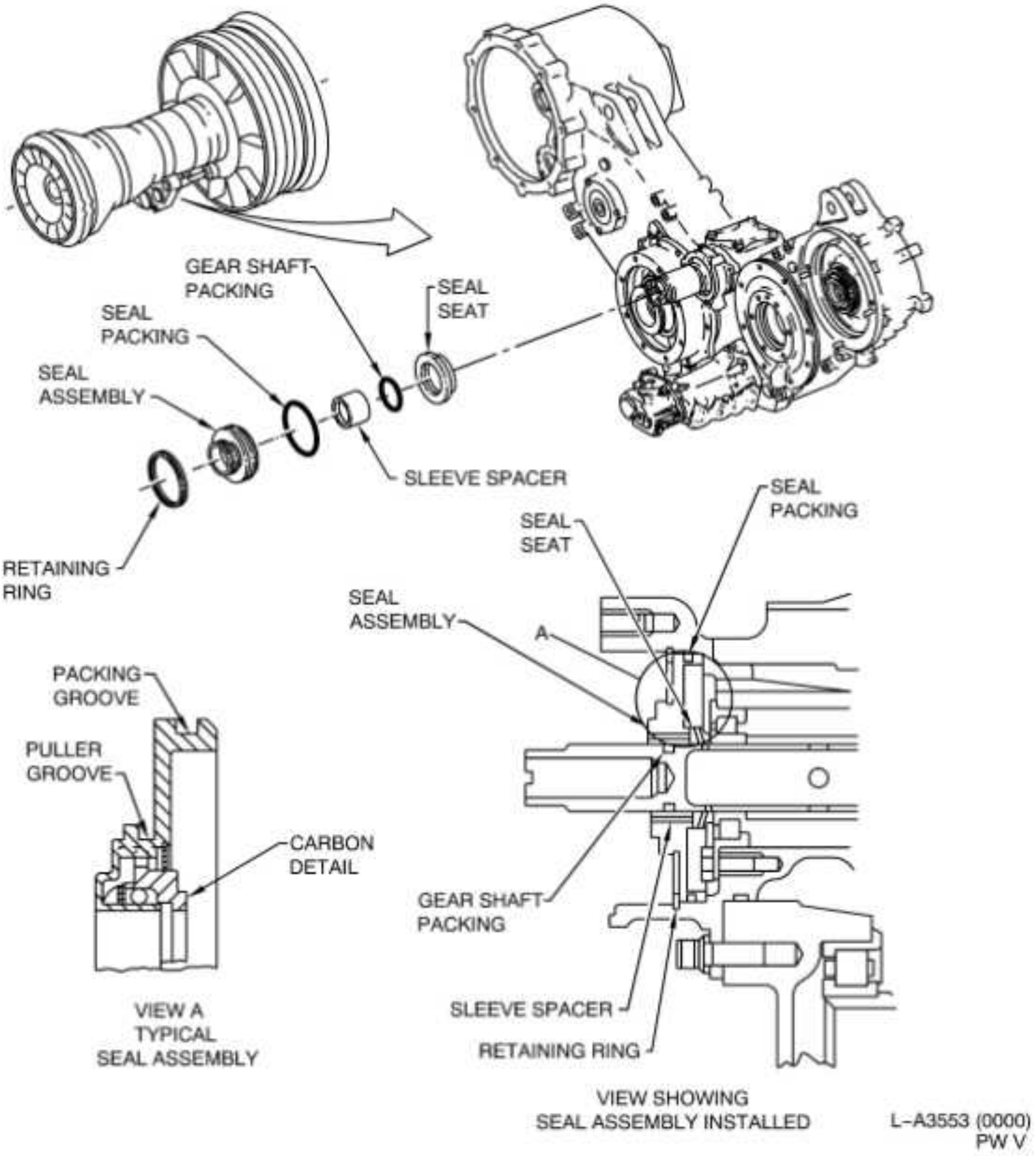
Task 72-00-61-030-005:

1. Remove EEC Alternator Drive Oil Seal Assembly
    - A. Prerequisites
        - (1) Remove EEC alternator stator per 72-00-61, Removal-09 (Task 72-00-61-050-006).
        - (2) Remove EEC alternator rotor per 72-00-61, Removal-10 (Task 72-00-61-050-007).
    - B. Equipment And Materials Required

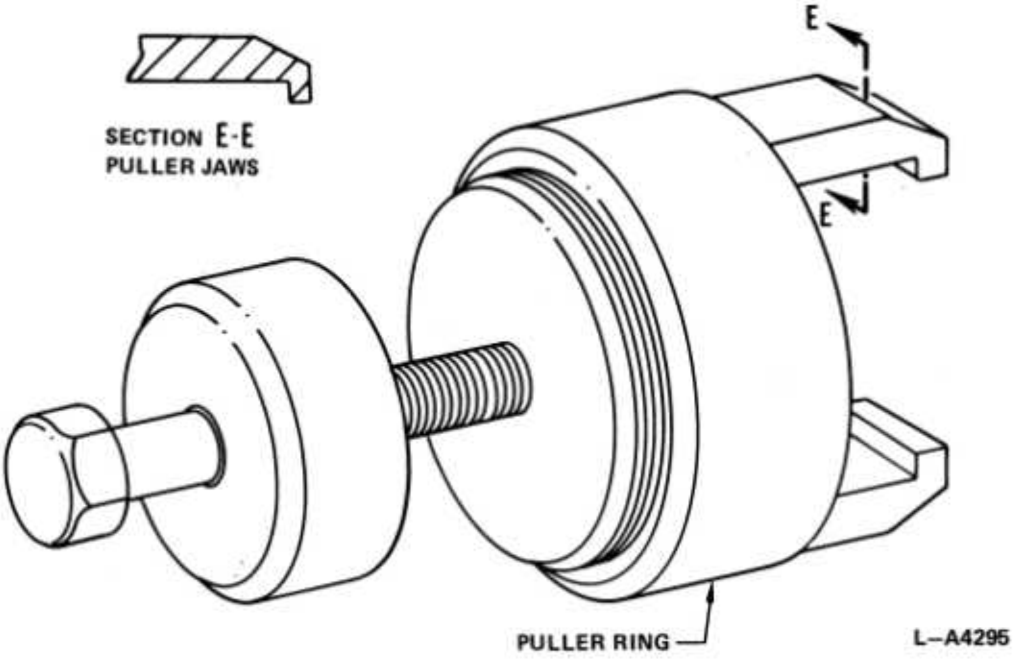
      Special Tools:

      PWA 85723 Puller

    - C. Procedure
      See Figures 301 and 302.
        - (1) Remove retaining ring securing EEC alternator drive oil seal assembly.
        - (2) Install PWA 85723 Puller to seal assembly and secure.
            - (a) Engage puller jaws in groove of seal assembly.
            - (b) Tighten down puller ring until jaws are secured in groove.
        - (3) Remove oil seal assembly using slide hammer action of puller to overcome resistance of preformed packing. Remove puller. Discard packing.
        - (4) If there is the possibility of damage to seal seat, remove sleeve spacer, discard EEC gearshaft packing, and remove seal seat. Examine seal seat for damage.
        - (5) Install protective closure.


GEAR SHAFT PACKING
SEAL SEAT
SEAL PACKING
SEAL ASSEMBLY
SLEEVE SPACER
RETAINING RING
SEAL SEAT
SEAL PACKING
SEAL ASSEMBLY
A
PACKING GROOVE
PULLER GROOVE
CARBON DETAIL
VIEW A TYPICAL SEAL ASSEMBLY
GEAR SHAFT PACKING
SLEEVE SPACER
RETAINING RING
VIEW SHOWING SEAL ASSEMBLY INSTALLED
L-A3553 (0000)
PW V

EEC Alternator Drive Oil Seal Assembly
Figure 301
(Task 72-00-61-030-005)


SECTION E-E
PULLER JAWS
E
E
PULLER RING
L-A4295

Puller
Figure 302
(Task 72-00-61-030-005)

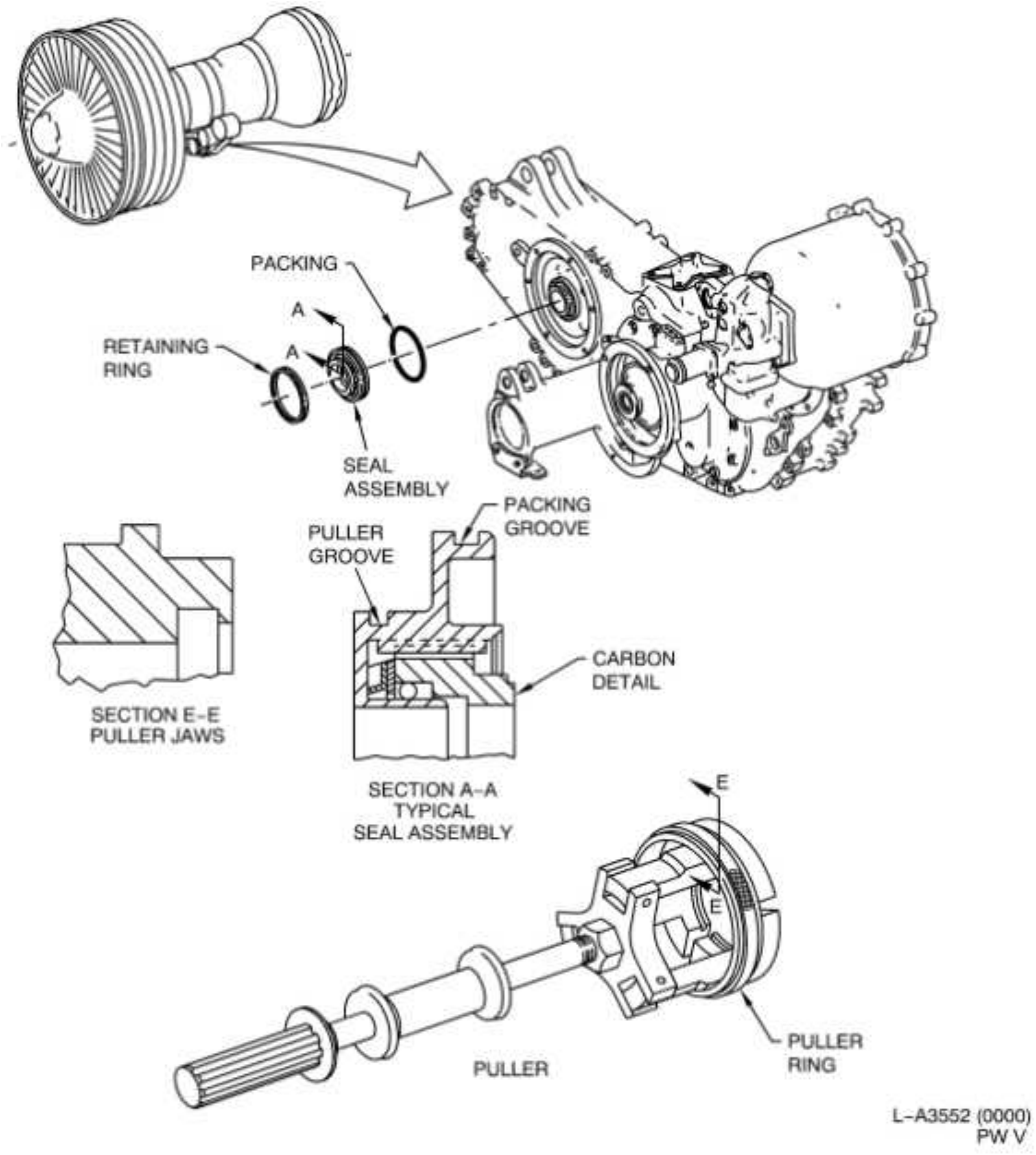
ENGINE GENERAL - MAIN GEARBOX - REMOVAL-15

Task 72-00-61-030-006:

1. Remove Fuel Pump Drive Oil Seal Assembly
   - A. Prerequisites
     - (1) Remove fuel pump and fuel metering unit package per 72-00-61, Removal-05 (Task 72-00-61-050-003).
   - B. Equipment And Materials Required

     Special Tools:
     PWA 85204 Puller (Optional to PWA 88110)
     PWA 88110 Puller

   - C. Procedure
     See Figure 301.
     - (1) Remove retaining ring securing fuel pump drive oil seal assembly to pad on right front side of gearbox.
     - (2) Install either PWA 88110 or PWA 85204 Puller to oil seal assembly and secure.
       - (a) Engage puller jaws in groove of seal assembly.
       - (b) Slide down puller ring until jaws are secured in groove.
     - (3) Remove oil seal assembly using slide hammer action of puller to overcome resistance of preformed packing. Remove puller. Discard packing.
     - (4) Install protective closure.


PACKING
A
A
RETAINING RING
SEAL ASSEMBLY
PACKING GROOVE
PULLER GROOVE
CARBON DETAIL
SECTION E-E PULLER JAWS
SECTION A-A TYPICAL SEAL ASSEMBLY
E
E
PULLER
PULLER RING
L-A3552 (0000)
PW V

Fuel Pump Drive Oil Seal Assembly
Figure 301
(Task 72–00–61–030–006)

Previous Pageblock Return to Previous Menu Next Pageblock

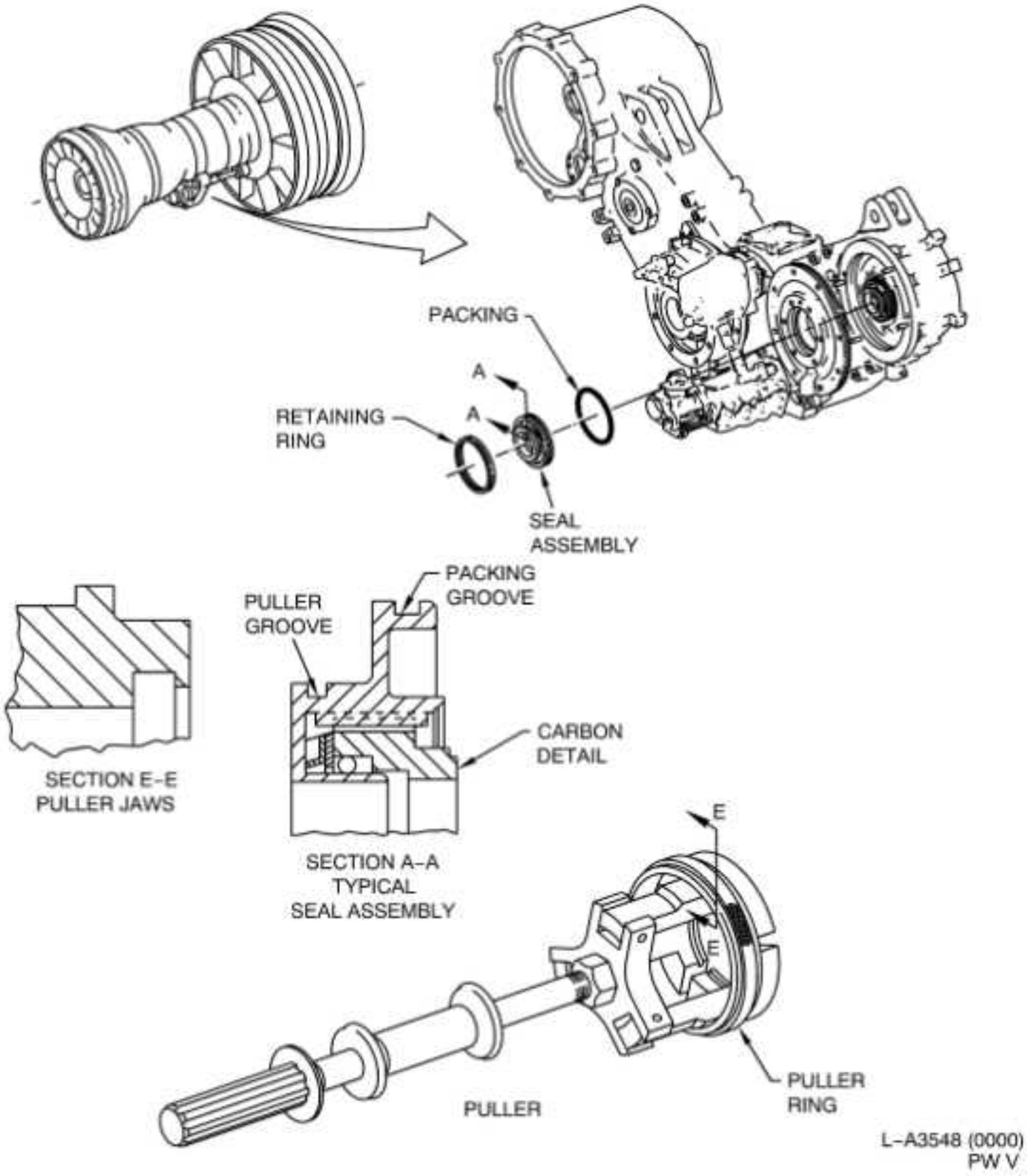
ENGINE GENERAL – MAIN GEARBOX – REMOVAL-16

Task 72-00-61-030-007:

1. Remove Rear Hydraulic Pump Drive Oil Seal Assembly
   A. Equipment And Materials Required

      Special Tools:
      PWA 85204 Puller (Optional to PWA 88110)
      PWA 88110 Puller

   B. Procedure
      See Figure 301.
      (1) Remove retaining ring securing hydraulic pump drive oil seal assembly.
      (2) Install either PWA 88110 or PWA 85204 Puller to oil seal assembly and secure.
         (a) Engage puller jaws in groove of seal assembly.
         (b) Slide down puller ring until jaws are secured in groove.
      (3) Remove oil seal assembly using slide hammer action of puller to overcome resistance of preformed packing. Remove puller. Discard packing.
      (4) Install protective closure.


PACKING
A
A
RETAINING RING
SEAL ASSEMBLY
PACKING GROOVE
PULLER GROOVE
CARBON DETAIL
SECTION E-E
PULLER JAWS
SECTION A-A
TYPICAL
SEAL ASSEMBLY
E
E
PULLER
PULLER RING
L-A3548 (0000)
PW V

Rear Hydraulic Pump Drive Oil Seal Assembly
Figure 301
(Task 72−00−61−030−007)

Previous Pageblock Return to Previous Menu Next Pageblock

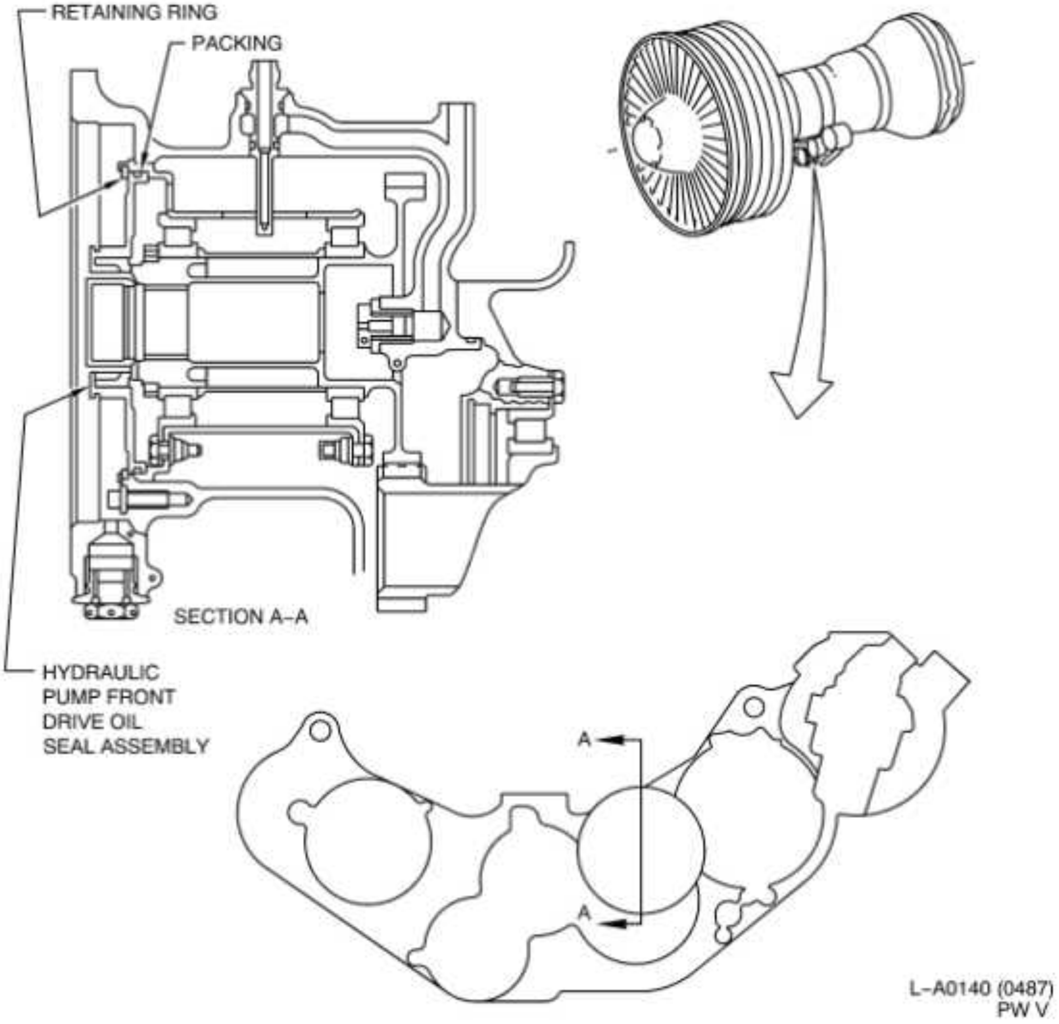
ENGINE GENERAL − MAIN GEARBOX − REMOVAL−17

Task 72−00−61−030−008:

1. Remove Front Hydraulic Pump Drive Oil Seal Assembly
   A. Equipment And Materials Required

      Special Tools:
      PWA 85204 Puller (Optional to PWA 88110)
      PWA 88110 Puller

   B. Procedure
      See Figure 301.
      (1) Remove retaining ring securing hydraulic pump drive oil seal assembly.
      (2) Install either PWA 88110 or PWA 85204 Puller to oil seal assembly and secure.
         (a) Engage puller jaws in groove of seal assembly.
         (b) Slide down puller ring until jaws are secured in groove.
      (3) Remove oil seal assembly using slide hammer action of puller to overcome resistance of preformed packing. Remove puller. Discard packing.
      (4) Install protective closure.


RETAINING RING
PACKING
SECTION A-A
HYDRAULIC PUMP FRONT DRIVE OIL SEAL ASSEMBLY
A
A
L-A0140 (0487)
PW V

Front Hydraulic Pump Drive Oil Seal Assembly
Figure 301
(Task 72-00-61-030-008)

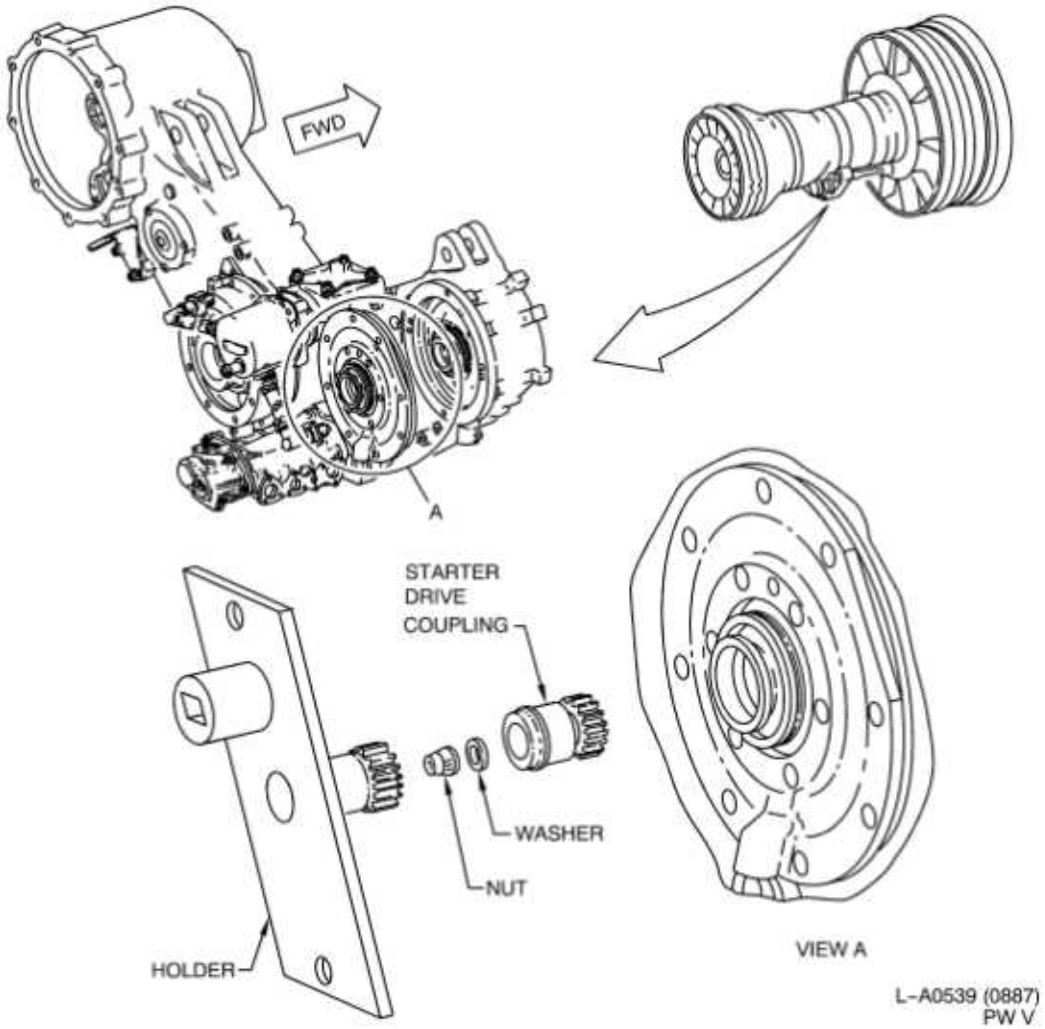
ENGINE GENERAL - MAIN GEARBOX - REMOVAL-18

Task 72-00-61-030-009:

1. Remove Starter Drive Coupling
   - A. Equipment And Materials Required

     Special Tools:
     PWA 26377 Holder
     PWA 85502 Puller

   - B. Procedure
     See Figure 301.
     - (1) Install splined drive of PWA 26377 Holder into starter drive coupling and secure bar with two bolts to starter drive mount pad.
     - (2) Using standard wrench, reach into holder and remove nut which retains starter drive coupling.
     - (3) Remove holder from gearbox.
     - (4) Using PWA 85502 Puller in puller hole in rear ID of coupling (behind splines), remove coupling with steady pull on handle of puller tool. Remove coupling from tool and remove flat washer from coupling ID.


FWD
A
STARTER DRIVE COUPLING
WASHER
NUT
HOLDER
VIEW A
L−A0539 (0887)
PW V

Starter Drive Coupling Removal
Figure 301
(Task 72−00−61−030−009)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − MAIN GEARBOX − REMOVAL−19

Task 72−00−61−030−010:

1. Remove Deoiler

This Procedure Has Been Deleted

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-61-040-001:

1. Remove Main Oil Filter Housing

A. Equipment And Materials Necessary − None

B. Procedure
See Figure 301 through Figure 302.

WARNING: PRESSURE CAN SUDDENLY FORCE OUT HOT OIL ONTO YOU. HOT OIL CAN CAUSE BURNS.

WARNING: BEFORE YOU DRAIN THE OIL FROM THE MAIN OIL FILTER HOUSING, PERMIT PRESSURE TO BLEED FROM THE OIL SYSTEM. WAIT A MINIMUM OF FIVE MINUTES AFTER THE ENGINE STOPS.

(1) Drain the oil from the main oil filter housing assembly (called oil filter housing) (301/1) as follows. See Figure 301 (Sheets 1 and 6).

(a) Prepare to catch the oil in a 5 gallon (19 l) container.

(b) Remove the plug from the cover assembly (301/2).

1 Remove the lockwire from the plug.

2 Hold the insert with a wrench while you remove the plug. Remove the plug.

3 Discard the packing.

(2) Disconnect the air/oil cooler inlet tube assembly (LP02) as follows. See Figure 301 (Sheet 1).

(a) Remove the three bolts that attach the assembly to the "oil-out" hole on top of the oil filter housing.

(b) Discard the packing.

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH
R CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND
R INSTALL A TUBE WITH A FLEX SEGMENT WITH THE
R SAME PRECAUTION USED FOR A TUBE WITHOUT A
R FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A
R TUBE TO HELP WITH THE INSTALLATION OR REMOVAL
R OF THE TUBE OR AN ATTACHED COMPONENT. IF A
R FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE

R A KINK IN THE EXTERNAL WIRE BRAID AND IN THE
R INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND
R LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(3) Remove the main filter oil tube assembly (LP01) as follows. See Figure 301 (Sheet 2) and Figure 301 (Sheet 3).

- (a) Remove the three bolts that attach the assembly to the "oil−in" hole on the front of the oil filter housing.
- (b) Remove the bolts and nuts that attach the tube clamps to the engine.
- (c) Remove the assembly.
- (d) Discard the packings.

(4) Remove the oil cooler bypass valve drain tube assembly (LP20) as follows. See Figure 301 (Sheet 4).

- (a) Remove the bolts that attach the tube to the "servo" hole on the oil filter housing.
- (b) Disconnect the upper end of the tube at the fuel/oil cooler bypass valve.
- (c) Remove the tube.
- (d) Discard the packings and retainer.

(5) Disconnect the oil trim pressure tube assembly (LP32) as follows. See Figure 301 (Sheet 4).

- (a) Remove the lockwire and disconnect the tube nut above the fuel/oil cooler.
- (b) Remove the clamp bolt that attaches the tube to the bracket in back of the fuel/oil cooler.
- (c) Remove the bolts that attach the assembly to the "trim" hole on the oil filter housing.
- (d) Disconnect the assembly from the oil filter housing.
- (e) Discard the packing.

ENGINE GENERAL - MAIN GEARBOX - REMOVAL-20

(6) Disconnect the W3 and W5 wiring harnesses as follows. See Figure 301 (Sheet 4).

   (a) Remove the bolt and nut that attach the wiring harness clamp to the bracket on the oil filter housing.

(7) Remove the oil filter housing (301/1) as follows. See Figure 301 (Sheet 1).

   (a) Remove the bolts and washers that attach the oil filter housing to the front of the gearbox.

   (b) Remove the oil filter housing.

(8) Remove the transfer tubes and, if applicable, the antisiphon tube assembly as follows. See Figure 301 (Sheet 5).

   (a) Remove the transfer tubes and, if applicable, the anti-siphon tube assembly from the holes in the front of the gearbox. Oil filter housings that are (Pre SB PW4ENG 79-43) have three transfer tubes. Oil filter housings that are (Post SB PW4ENG 79-43) have two transfer tubes and an anti-siphon tube assembly.

   (b) Discard the packings.

(9) (Pre SB PW4ENG 72-524) If applicable, remove the details from the MOFH as follows. See Figure 301 (Sheet 6) and Figure 301 (Sheet 7).

   (a) Remove lockwire and pressure relief valve (filter element) (301/19) from port in main oil filter housing (301/3) located just above pressure (regulator) relief valve pad (301/16). Discard packings (301/17 and 301/18).

   (b) Remove inserts (301/1) from ports in face of main oil filter housing. Discard packings (301/2).

   (c) Remove lockwire, plug (301/12) and insert (301/10) from bottom port in main oil strainer cover (301/15). Discard packings (301/9 and 301/11).

(d) Remove four bolts (301/13) and washers (301/14) securing main oil strainer cover (301/15) to main oil filter housing (301/3). Remove cover and filter element (301/4) from housing. Remove filter element. Discard packing (301/8).

(e) Remove spring (301/5) from cover. Remove screw (301/6) securing key washer (301/7) to cover. Remove key washer and discard.

(f) Remove the oil system pressure relief valve (301/16) as follows.

1 Remove the lockwire from the valve.

2 Remove the bolts that attach the bracket and valve to the MOFH.

3 Remove the bracket and valve.

4 Discard the packings.

(10) (Post PW4ENG 72−524 and Pre SB PW4ENG 79−79) If applicable, remove the details from the MOFH as follows. See Figure 301 (Sheet 8) and Figure 301 (Sheet 9).

(a) Remove lockwire and pressure relief valve (filter element) (301/19) from port in main oil filter housing (301/3) located just above pressure (regulator) relief valve pad (301/16). Discard packings (301/17 and 301/18).

(b) Remove inserts (301/1) from ports in face of main oil filter housing. Discard packings (301/2).

(c) Remove lockwire, plug (301/12), and insert (301/10) from bottom port in main oil strainer cover (301/15). Discard packings (301/9 and 301/11).

(d) Remove lockwire, and if necessary, the four nuts (301/29) or (301/30) and the washers (301/14) that secure the main oil strainer cover (301/15) to main oil filter housing (301/3). Remove cover and filter element (301/4) from housing. Remove filter element. Discard packing (301/8).

(e) Remove spring (301/5) from cover. Remove screw (301/6) securing key washer (301/7) to cover. Remove key washer and discard.

(f) Remove the oil system pressure relief valve (301/16) as follows.

1 Remove the lockwire from the valve.

2 Remove the bolts that attach the bracket and valve to the MOFH.

3 Remove the bracket and valve.

4 Discard the packings.

(g) Make a check of the studs installed in the main oil filter housing. If the studs are satisfactory, the cover can be installed again, if the studs are not serviceable, repair the housing by Chapter/Section 72-61-60 in the PW4000 Series CIR, PN 51A357 Manual. See Figure 302.

(11) (Post SB PW4ENG 72-524 and SB PW4ENG 79-79) If applicable, remove the details from the MOFH as follows. See Figure 301 (Sheet 10) and Figure 301 (Sheet 11).

(a) Remove the lockwire and the pressure relief valve (filter element) (301/19) from the port in the main oil filter housing (301/3) located just above the pressure (regulator) relief valve pad (301/16). Discard the packings (301/17 and 301/18).

(b) Remove the inserts (301/1) from the ports in the face of the main oil filter housing. Discard the packings (301/2).

(c) Remove the lockwire, plug (301/12), and insert (301/10) from the bottom port in the main oil strainer cover (301/21). Discard the packings (301/9 and 301/11).

(d) Remove the lockwire, and if necessary, the four nuts (301/29) or (301/30) and the washers (301/14) that secure the main oil strainer cover (301/21) to the main oil filter housing (301/3). Remove the cover and the filter element (301/4) from the housing. Remove the filter element. Discard the packing (301/8).

(e) Remove the spring (301/5) from the cover (301/21). Remove the two screws (301/22) and the two washers (301/20) securing the spring retainer (301/23) to the cover (301/21).

(f) Remove the oil system pressure relief valve (301/16) as follows.

1 Remove the lockwire from the valve.

2 Remove the bolts that attach the bracket and valve to the MOFH.

3 Remove the bracket and valve.

4 Discard the packings.

(g) Make a check of the studs installed in the main oil filter housing. If the studs are satisfactory, the cover can be installed again, if the studs are not serviceable, repair the housing by Chapter/Section 72-61-60 in the PW4000 Series CIR, PN 51A357 Manual. See Figure 302.

(12) (Post SB PW4ENG 72-525) If applicable, remove the details from the MOFH as follows. See Figure 301 (Sheet 12) and Figure 301 (Sheet 13).

(a) Remove lockwire and plug (301/43) from port in main oil filter housing (301/3) located just above pressure (regulator) relief valve pad (301/16). Discard packings (301/17 and 301/18).

(b) Remove inserts (301/1) from ports in face of main oil filter housing. Discard packings (301/2).

(c) Remove lockwire and plug (301/12), from bottom port in main oil strainer cover (301/42). Discard packing (301/11).

(d) Remove four nuts (301/29) and washers (301/14) securing main oil strainer cover (301/42) to main oil filter housing (301/3). Remove cover and filter element (301/39) from housing. Remove filter element. Discard packing (301/8).

(e) Remove retaining ring (301/40) from pressure relief valve (301/41) and remove pressure relief valve from cover (401/42).

CAUTION: PRESSURE RELIEF VALVE IS SPRING LOADED. EXERCISE CARE WHEN REMOVING.

(f) Remove the oil system pressure relief valve (301/16) as follows.

1 Remove the lockwire from the valve.

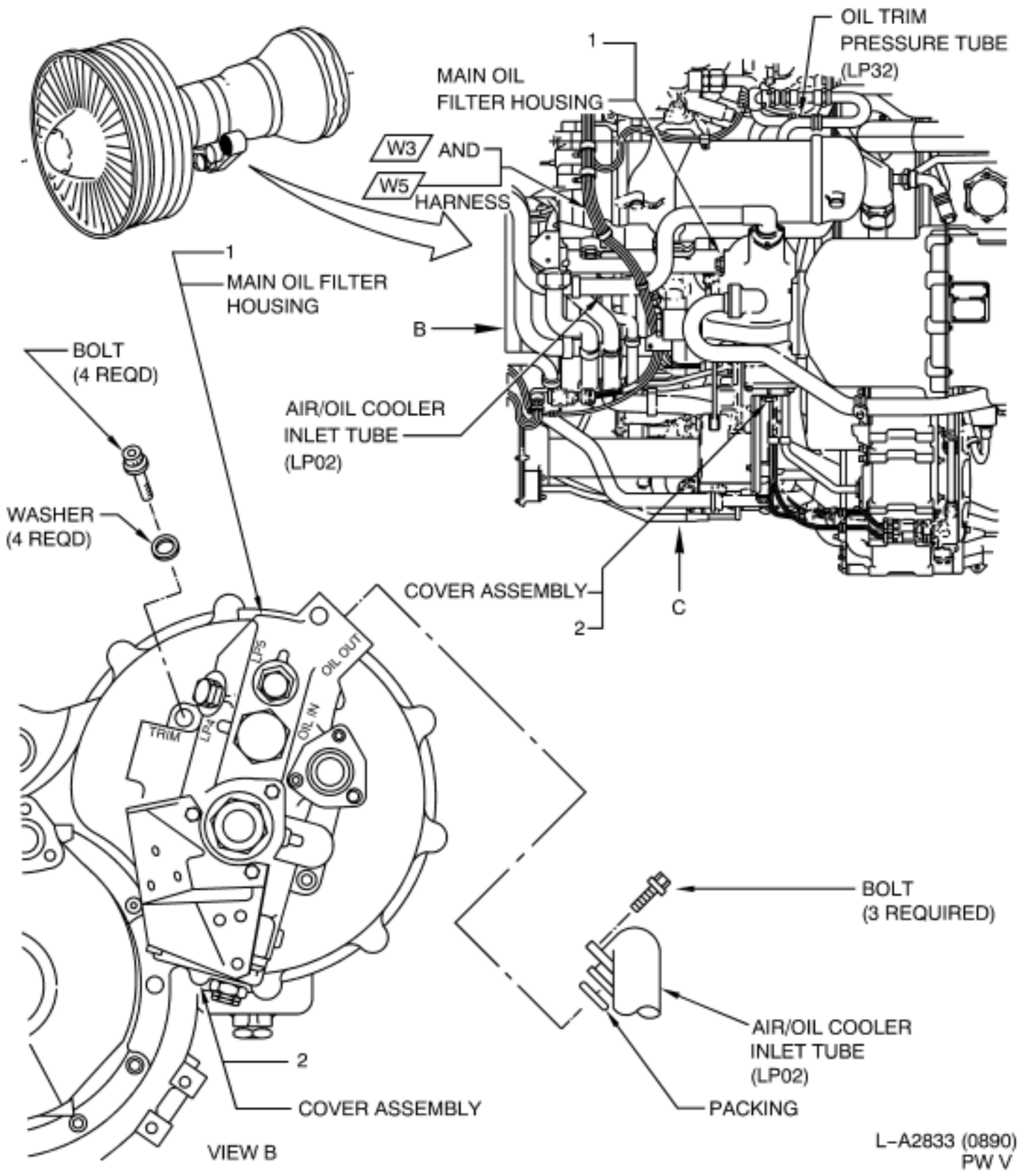
2 Remove the bolts that attach the bracket and valve to the MOFH.

3 Remove the bracket and valve.

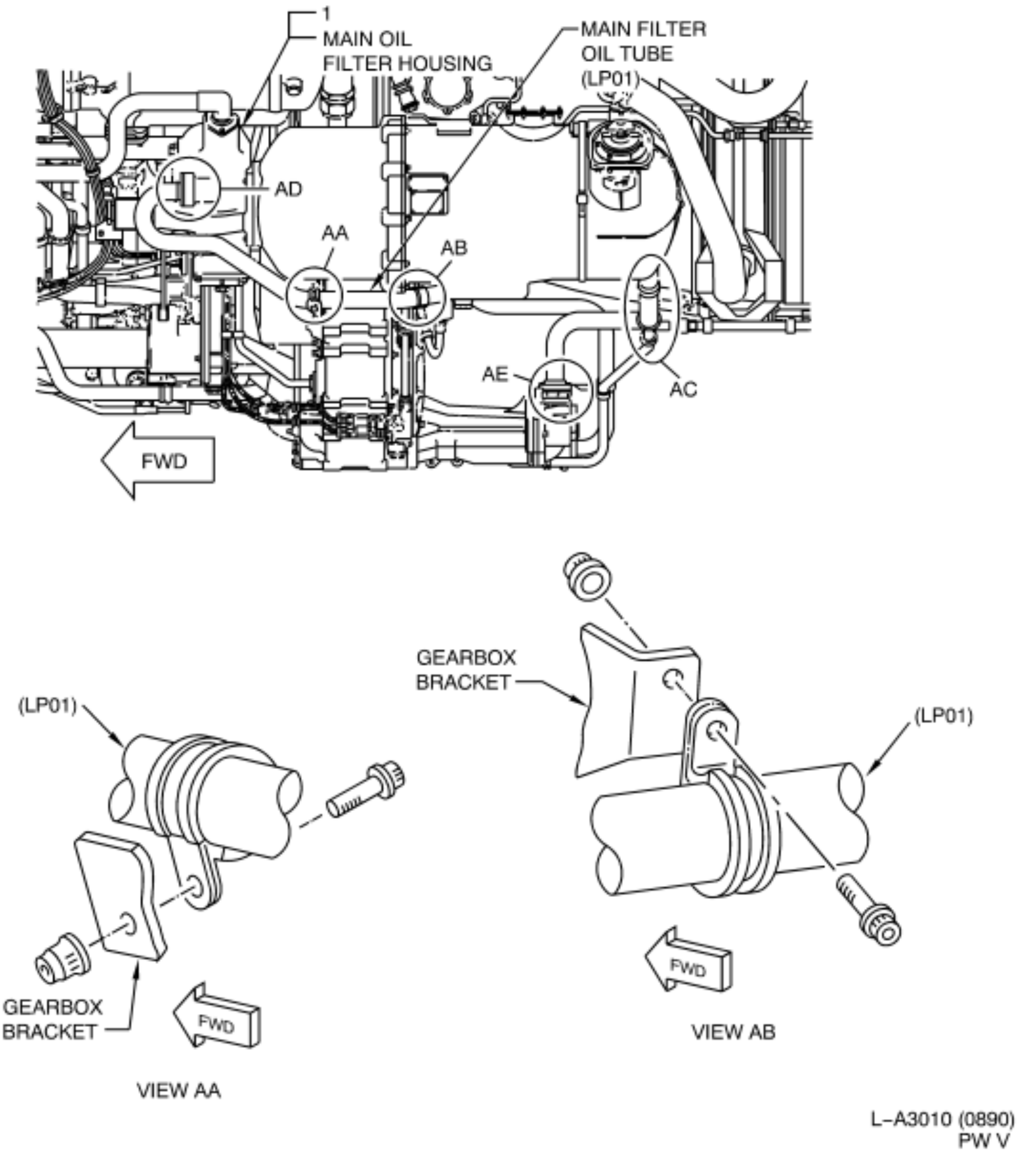
4 Discard the packings.

(g) Make a check of the studs installed in the main oil filter housing. If the studs are satisfactory, the cover can be installed again, if the studs are not serviceable, repair the housing by Chapter/Section 72−61−60 in the PW4000 Series CIR, PN 51A357 Manual. See Figure 302.

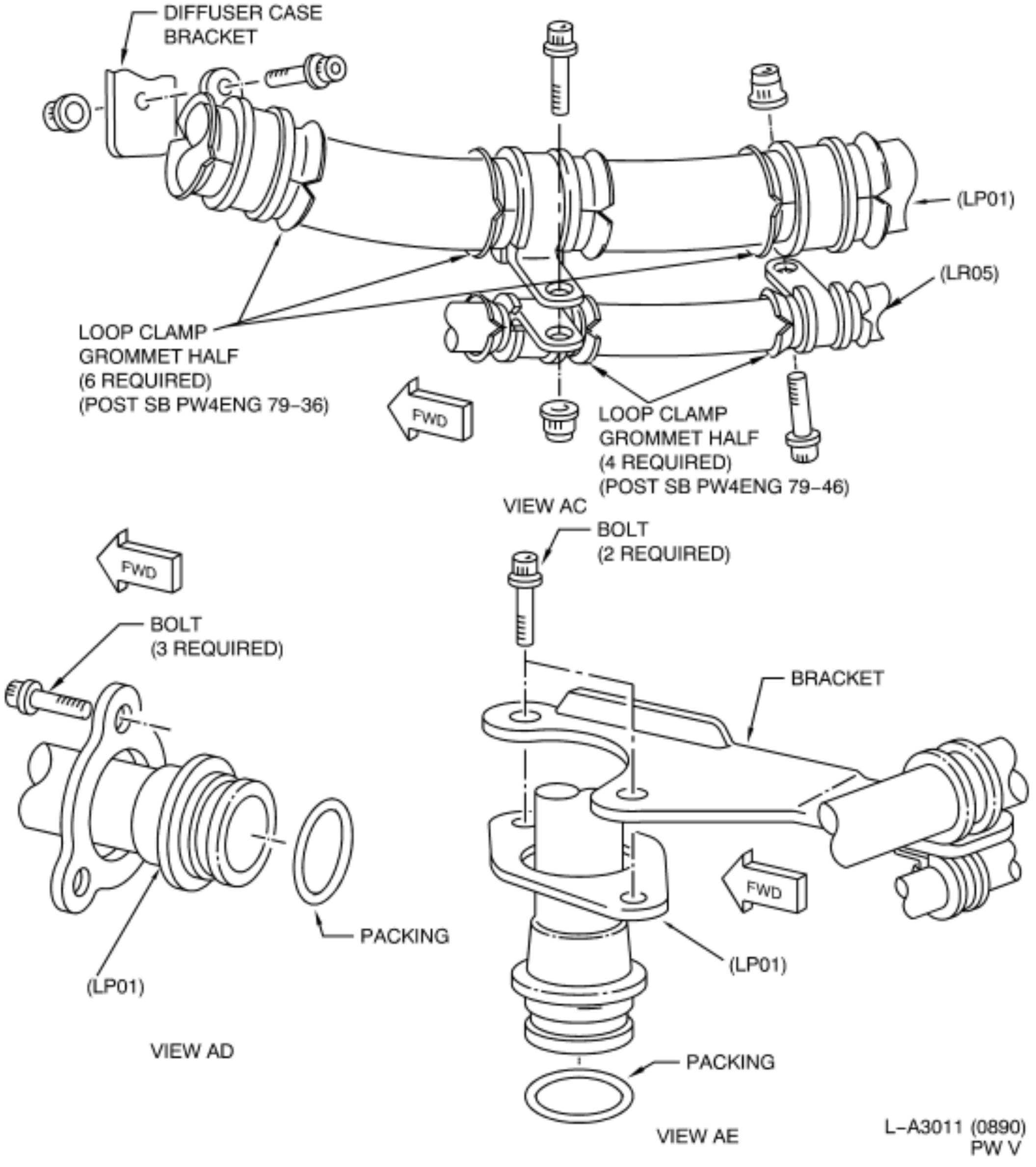
R
R


OIL TRIM
PRESSURE TUBE
(LP32)
1
MAIN OIL
FILTER HOUSING
W3
AND
W5
HARNESS
1
MAIN OIL FILTER
HOUSING
B
BOLT
(4 REQD)
AIR/OIL COOLER
INLET TUBE
(LP02)
WASHER
(4 REQD)
COVER ASSEMBLY
2
C
TRIM
LP4
LP5
OIL OUT
OIL IN
BOLT
(3 REQUIRED)
AIR/OIL COOLER
INLET TUBE
(LP02)
PACKING
2
COVER ASSEMBLY
VIEW B
L−A2833 (0890)
PW V

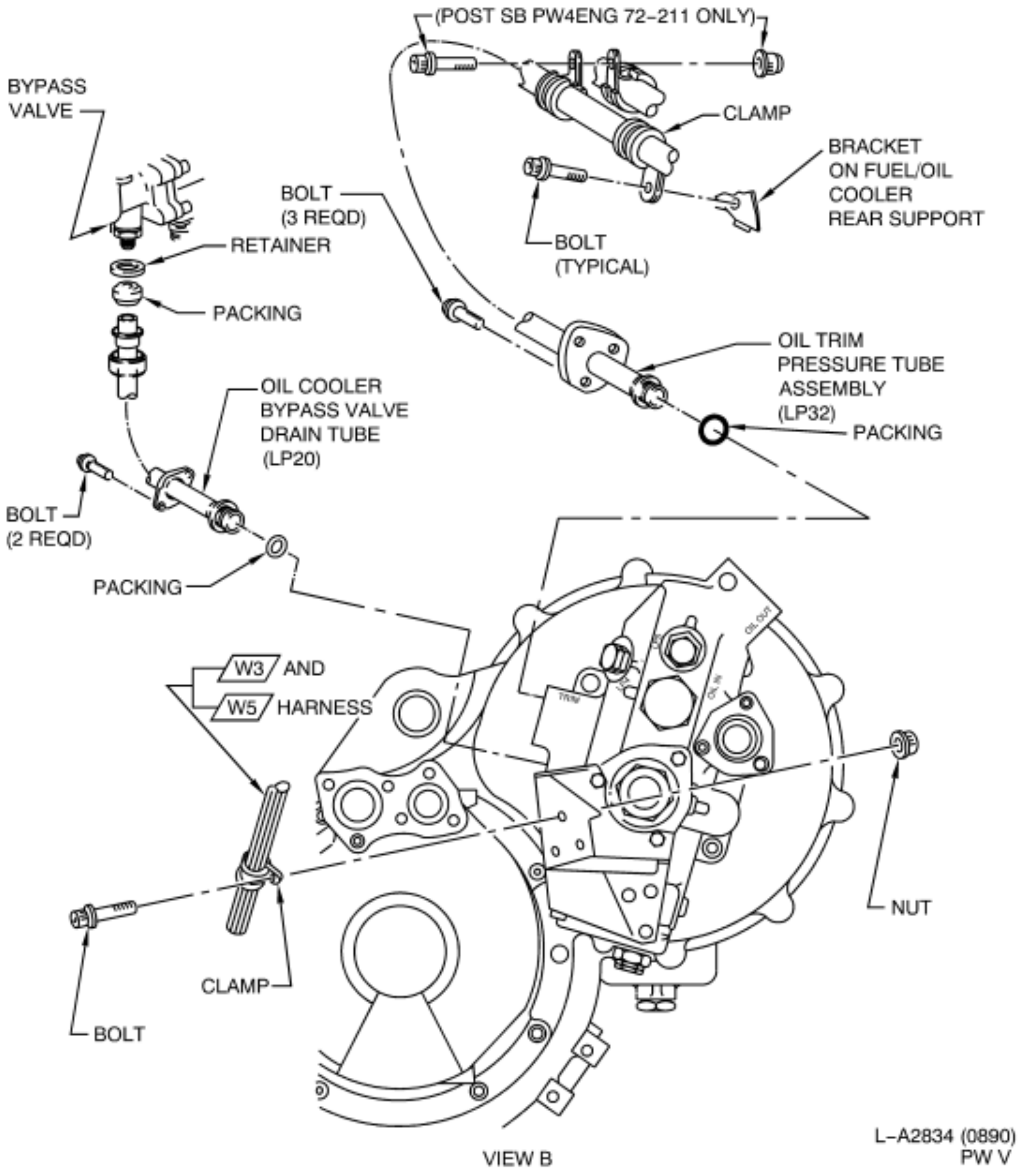
Main Oil Filter Housing Removal
Figure 301 (Sheet 1)
(Task 72−00−61−040−001)


1
MAIN OIL
FILTER HOUSING
MAIN FILTER
OIL TUBE
(LP01)
AD
AA
AB
AE
AC
FWD
GEARBOX
BRACKET
(LP01)
(LP01)
GEARBOX
BRACKET
FWD
FWD
VIEW AA
VIEW AB
L-A3010 (0890)
PW V

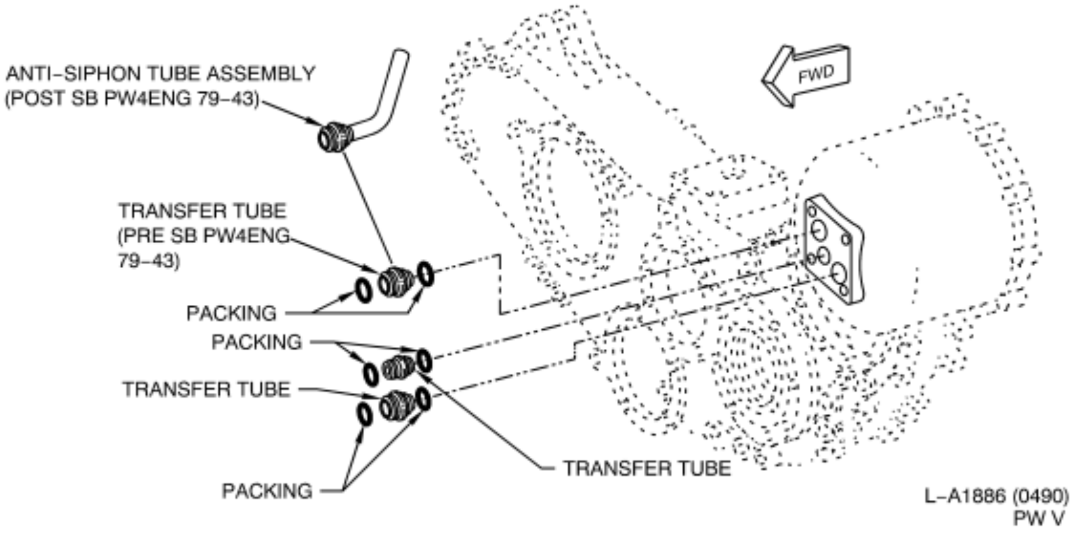
Main Oil Filter Housing Removal
Figure 301 (Sheet 2)
(Task 72-00-61-040-001)


DIFFUSER CASE BRACKET
(LP01)
(LR05)
LOOP CLAMP GROMMET HALF (6 REQUIRED) (POST SB PW4ENG 79−36)
FWD
LOOP CLAMP GROMMET HALF (4 REQUIRED) (POST SB PW4ENG 79−46)
VIEW AC
BOLT (2 REQUIRED)
FWD
BOLT (3 REQUIRED)
BRACKET
FWD
PACKING
(LP01)
(LP01)
VIEW AD
PACKING
VIEW AE
L−A3011 (0890)
PW V

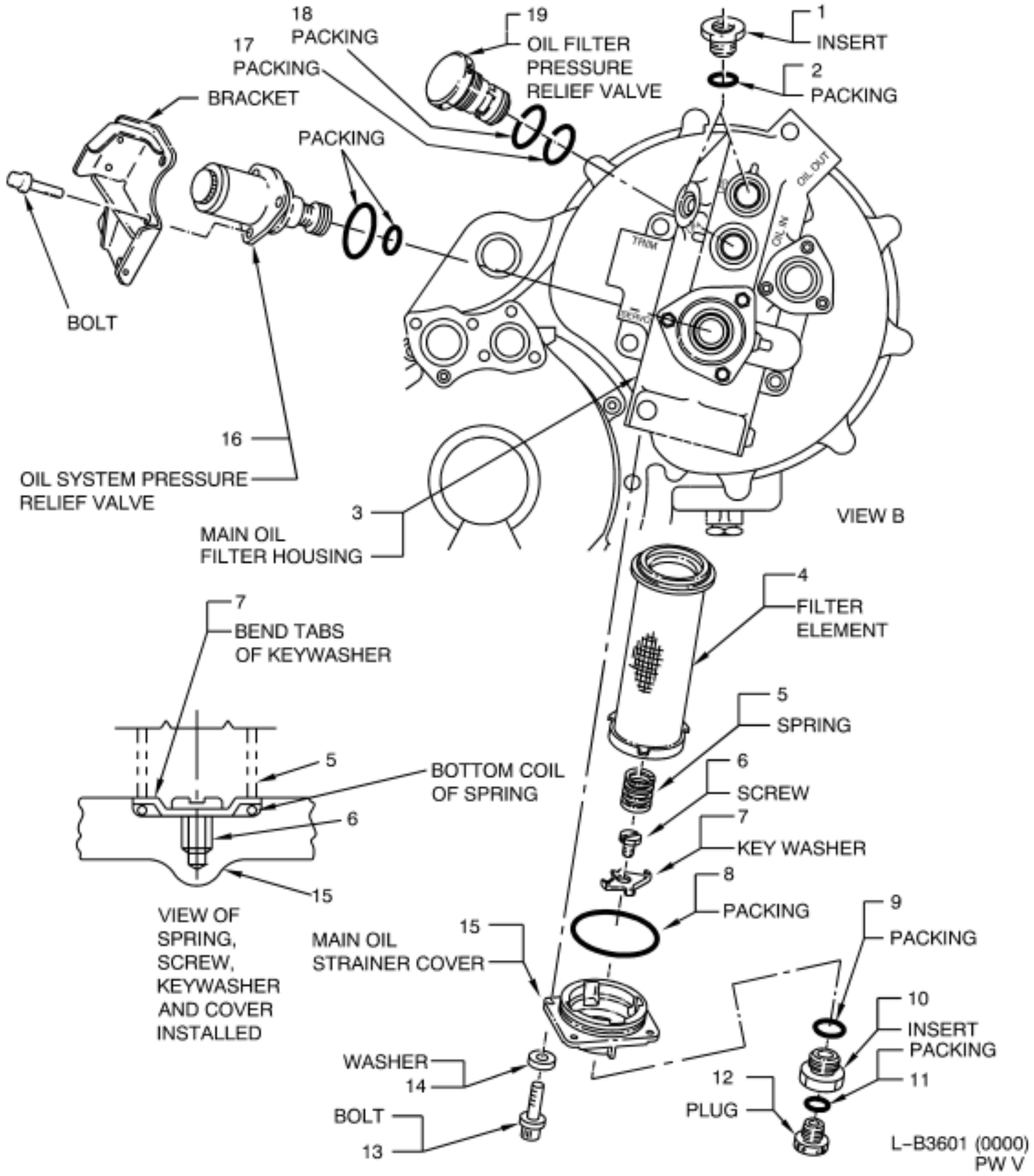
Main Oil Filter Housing Removal
Figure 301 (Sheet 3)
(Task 72−00−61−040−001)


(POST SB PW4ENG 72-211 ONLY)
BYPASS VALVE
CLAMP
BRACKET ON FUEL/OIL COOLER REAR SUPPORT
BOLT (3 REQD)
RETAINER
BOLT (TYPICAL)
PACKING
OIL TRIM PRESSURE TUBE ASSEMBLY (LP32)
PACKING
OIL COOLER BYPASS VALVE DRAIN TUBE (LP20)
BOLT (2 REQD)
PACKING
W3 AND
W5 HARNESS
TRIM
OIL OUT
OIL IN
NUT
CLAMP
BOLT
VIEW B
L-A2834 (0890)
PW V

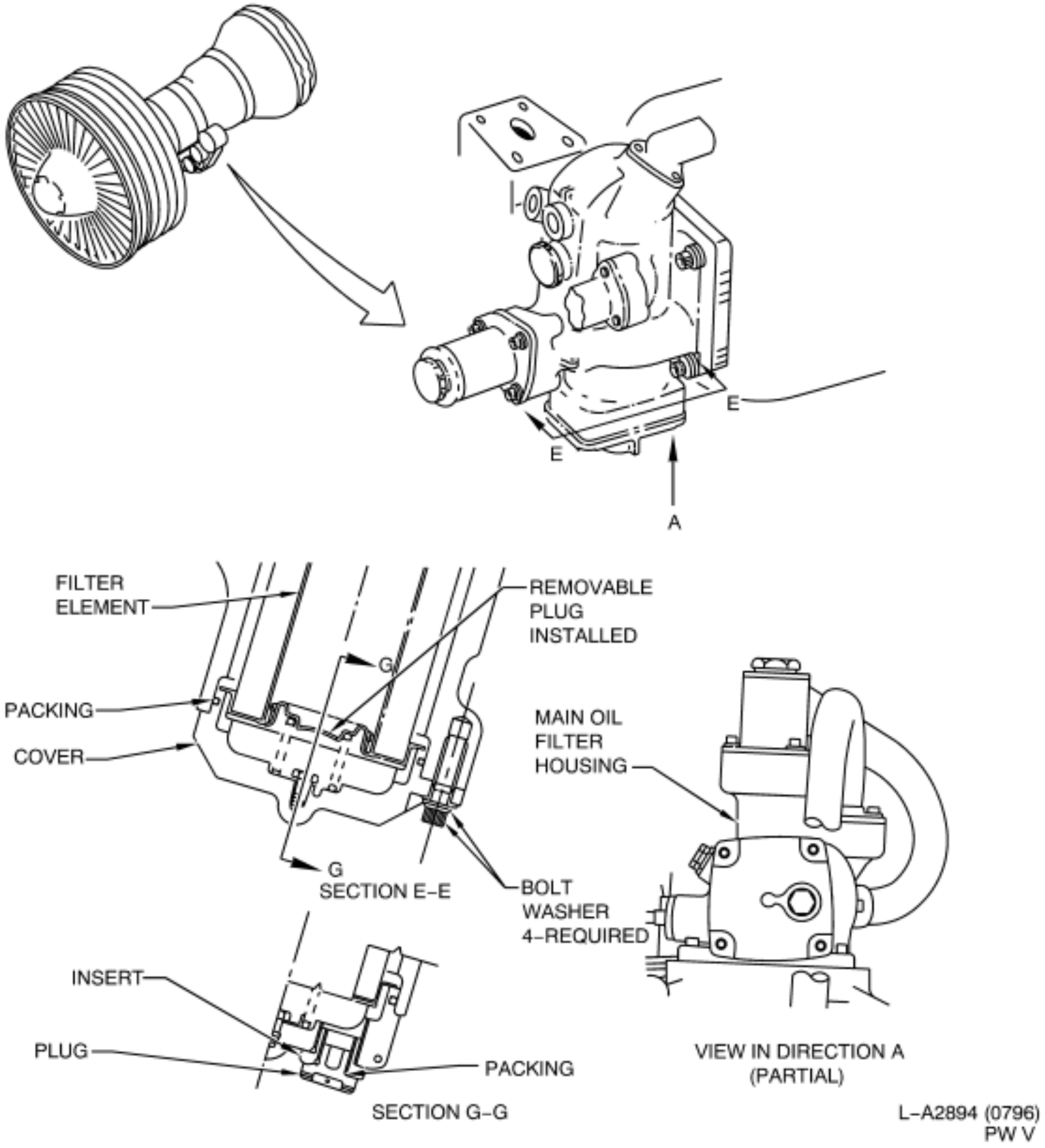
Main Oil Filter Housing Removal
Figure 301 (Sheet 4)
(Task 72-00-61-040-001)


ANTI−SIPHON TUBE ASSEMBLY (POST SB PW4ENG 79−43)
TRANSFER TUBE (PRE SB PW4ENG 79−43)
PACKING
PACKING
TRANSFER TUBE
PACKING
TRANSFER TUBE
FWD
L−A1886 (0490)
PW V

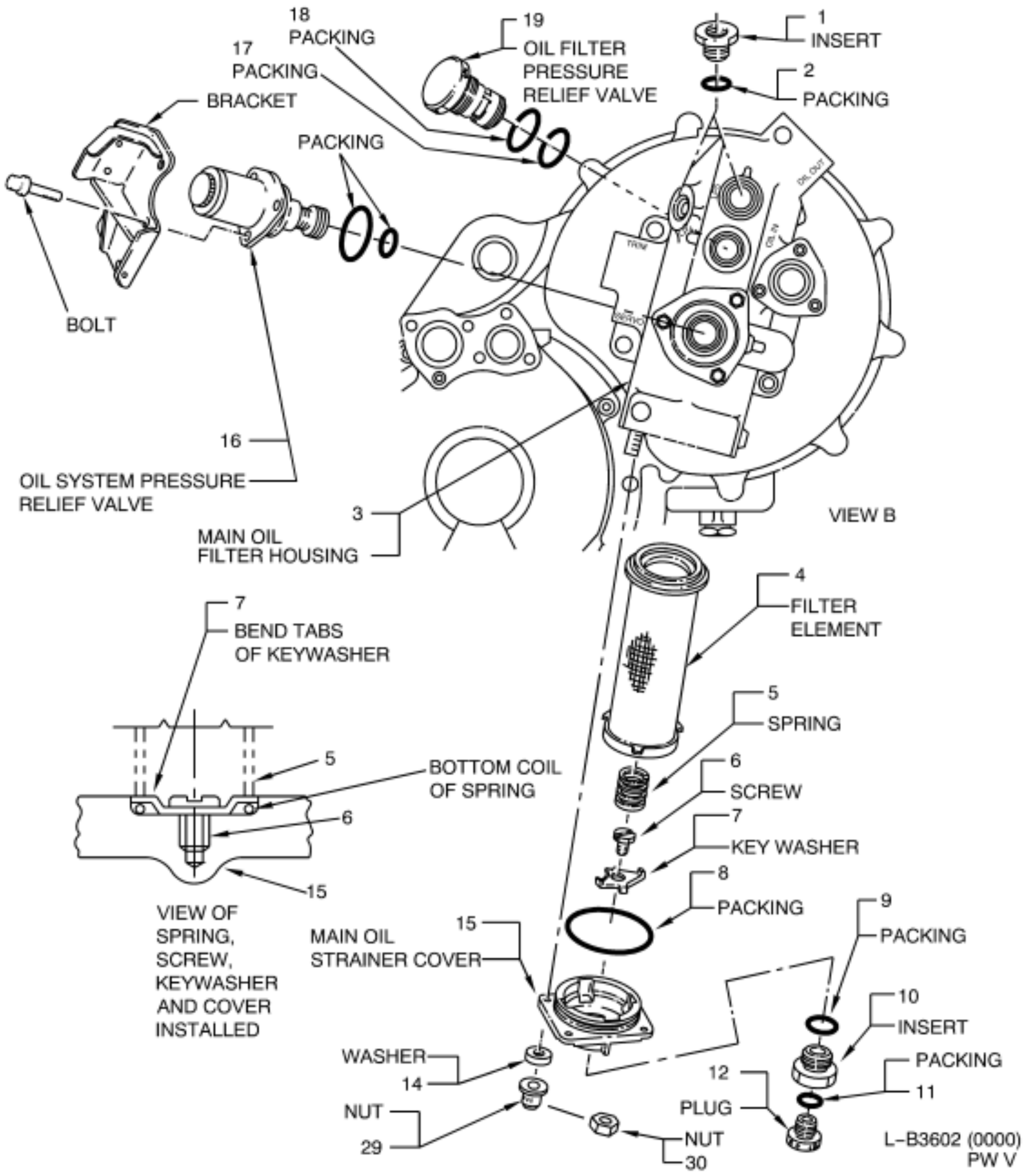
Main Oil Filter Housing Removal
Figure 301 (Sheet 5)
(Task 72−00−61−040−001)


18
PACKING
17
PACKING
19
OIL FILTER
PRESSURE
RELIEF VALVE
1
INSERT
2
PACKING
BRACKET
PACKING
BOLT
TRIM
SERVO
OIL OUT
OIL IN
16
OIL SYSTEM PRESSURE
RELIEF VALVE
3
MAIN OIL
FILTER HOUSING
VIEW B
4
FILTER
ELEMENT
7
BEND TABS
OF KEYWASHER
5
SPRING
6
SCREW
7
KEY WASHER
5
BOTTOM COIL
OF SPRING
6
15
8
PACKING
9
PACKING
VIEW OF
SPRING,
SCREW,
KEYWASHER
AND COVER
INSTALLED
15
MAIN OIL
STRAINER COVER
10
INSERT
PACKING
11
WASHER
14
12
PLUG
BOLT
13
L-B3601 (0000)
PW V

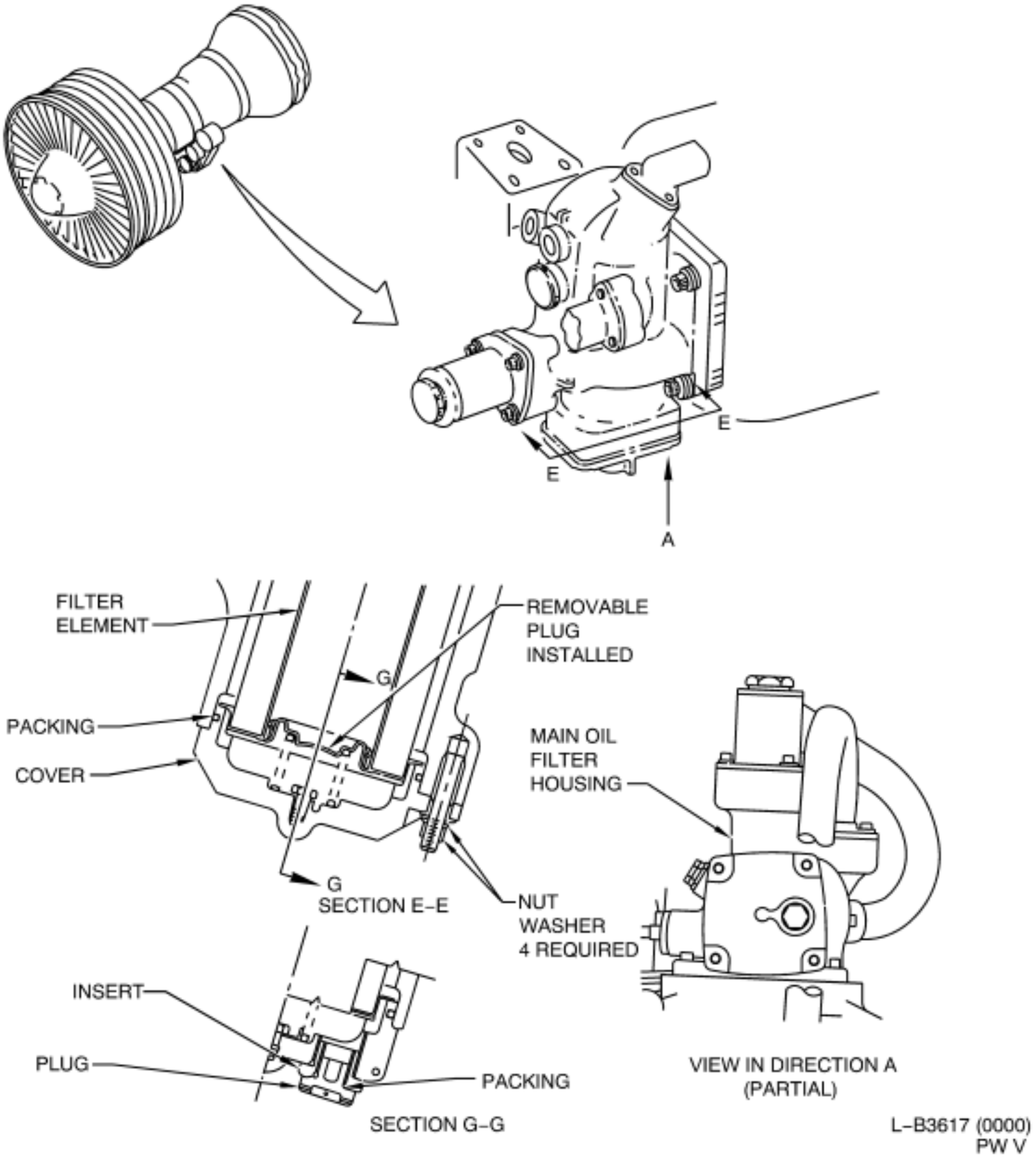
Main Oil Filter Housing Removal (Pre SB PW4ENG 72-524)
Figure 301 (Sheet 6)
(Task 72-00-61-040-001)


E
E
A
FILTER ELEMENT
REMOVABLE PLUG INSTALLED
G
PACKING
COVER
G
SECTION E−E
BOLT
WASHER
4−REQUIRED
MAIN OIL FILTER HOUSING
INSERT
PLUG
PACKING
SECTION G−G
VIEW IN DIRECTION A (PARTIAL)
L−A2894 (0796)
PW V

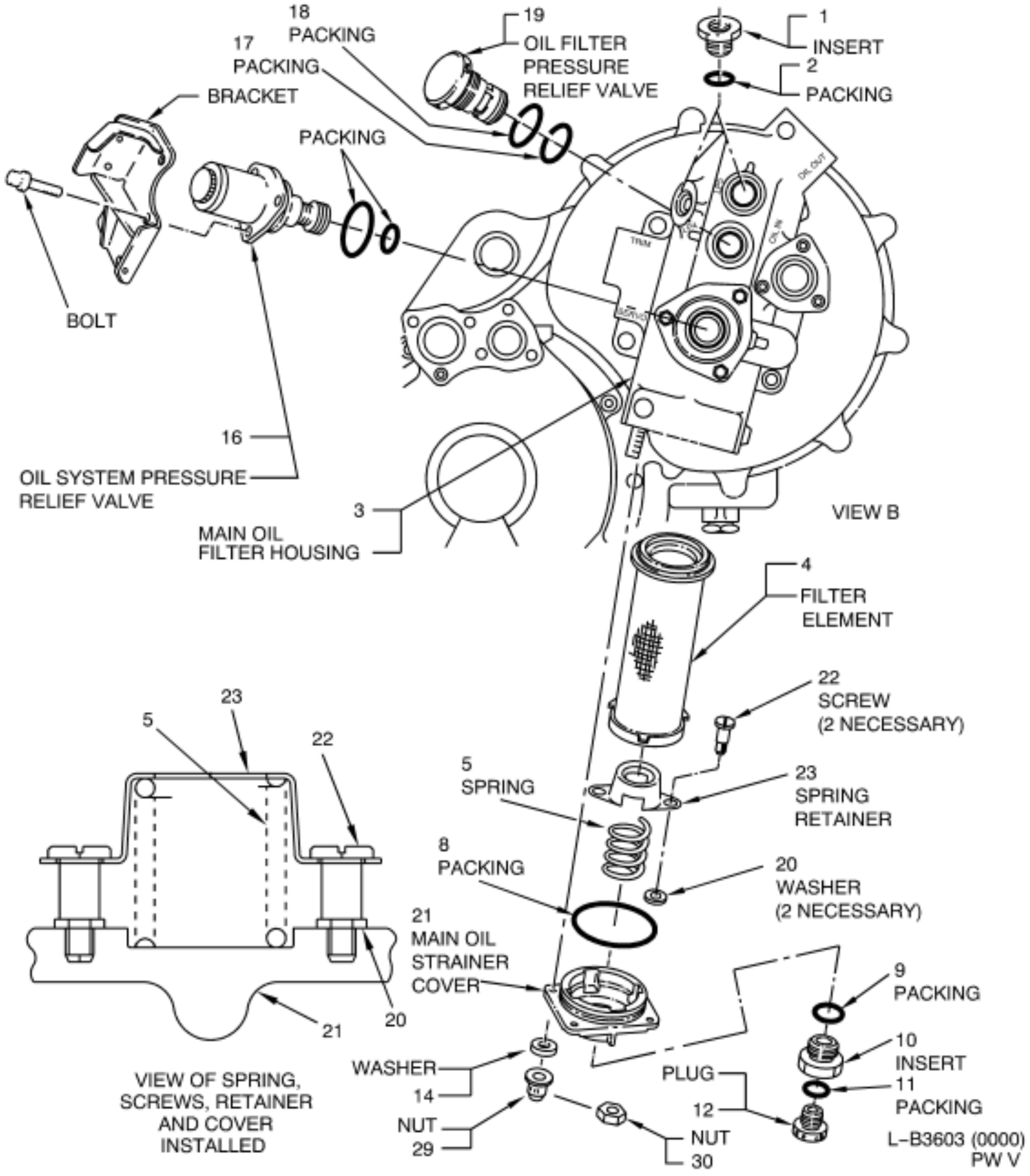
Main Oil Filter Housing Removal (Pre SB PW4ENG 72−524)
Figure 301 (Sheet 7)
(Task 72−00−61−040−001)


18
PACKING
17
PACKING
BRACKET
19
OIL FILTER
PRESSURE
RELIEF VALVE
1
INSERT
2
PACKING
PACKING
BOLT
16
OIL SYSTEM PRESSURE
RELIEF VALVE
3
MAIN OIL
FILTER HOUSING
VIEW B
4
FILTER
ELEMENT
7
BEND TABS
OF KEYWASHER
5
SPRING
5
BOTTOM COIL
OF SPRING
6
SCREW
6
7
KEY WASHER
15
8
PACKING
9
PACKING
VIEW OF
SPRING,
SCREW,
KEYWASHER
AND COVER
INSTALLED
15
MAIN OIL
STRAINER COVER
10
INSERT
WASHER
14
12
PACKING
11
NUT
29
PLUG
NUT
30
L−B3602 (0000)
PW V

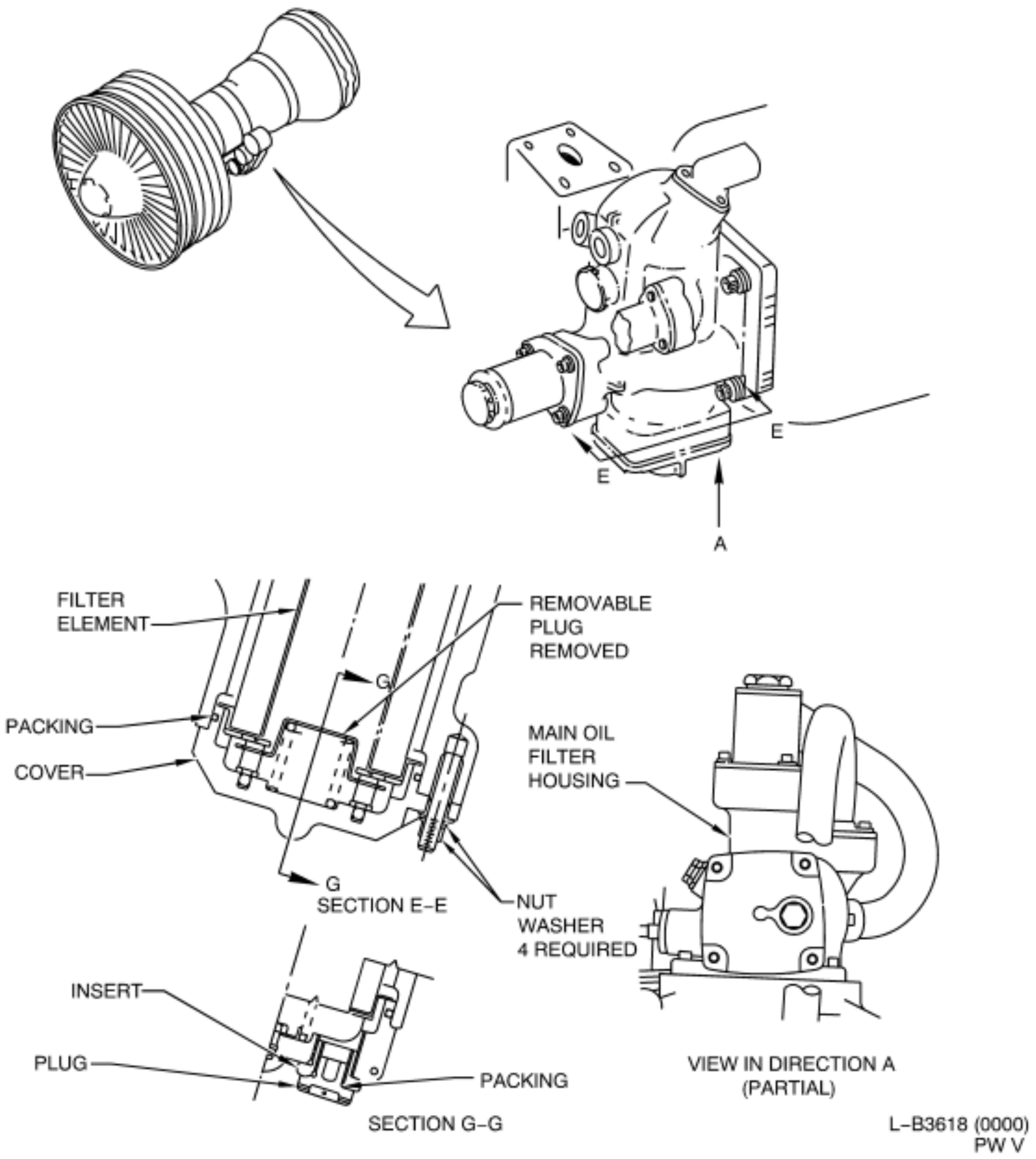
Main Oil Filter Housing Removal (Post SB PW4ENG 72−524 And Pre PW4ENG 79−79)
Figure 301 (Sheet 8)
(Task 72−00−61−040−001)


E
E
A
FILTER ELEMENT
REMOVABLE PLUG INSTALLED
G
PACKING
COVER
MAIN OIL FILTER HOUSING
G
SECTION E-E
NUT
WASHER
4 REQUIRED
INSERT
PLUG
PACKING
SECTION G-G
VIEW IN DIRECTION A (PARTIAL)
L-B3617 (0000)
PW V

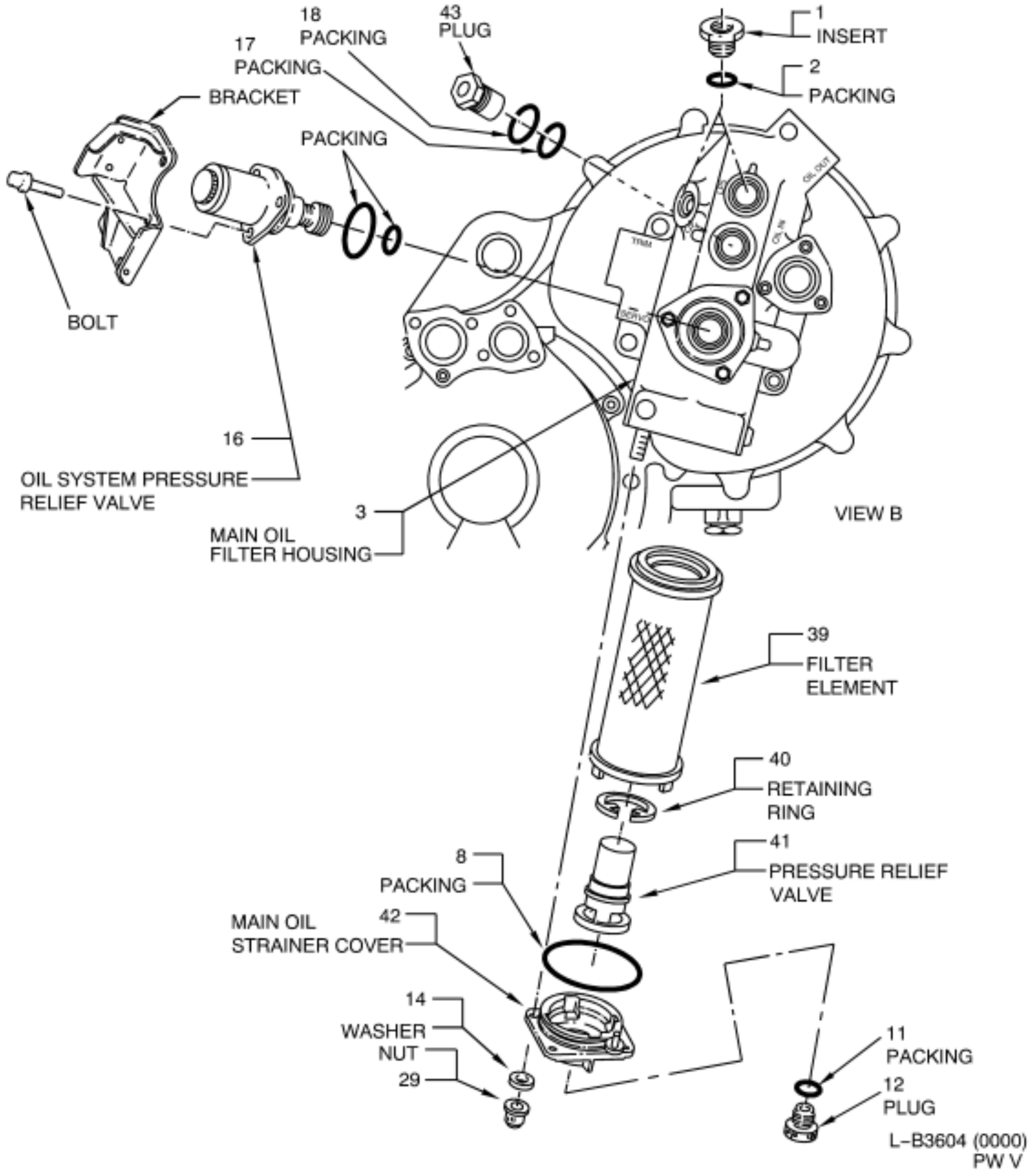
Main Oil Filter Housing Removal (Post SB PW4ENG 72-524 And Pre PW4ENG 79-79)
Figure 301 (Sheet 9)
(Task 72-00-61-040-001)


18
PACKING
17
PACKING
19
OIL FILTER PRESSURE RELIEF VALVE
1
INSERT
2
PACKING
BRACKET
PACKING
BOLT
16
OIL SYSTEM PRESSURE RELIEF VALVE
3
MAIN OIL FILTER HOUSING
VIEW B
4
FILTER ELEMENT
22
SCREW (2 NECESSARY)
23
5
22
5
SPRING
23
SPRING RETAINER
8
PACKING
20
WASHER (2 NECESSARY)
21
MAIN OIL STRAINER COVER
9
PACKING
10
INSERT
11
PACKING
21
20
VIEW OF SPRING, SCREWS, RETAINER AND COVER INSTALLED
WASHER
14
NUT
29
PLUG
12
NUT
30
L-B3603 (0000)
PW V

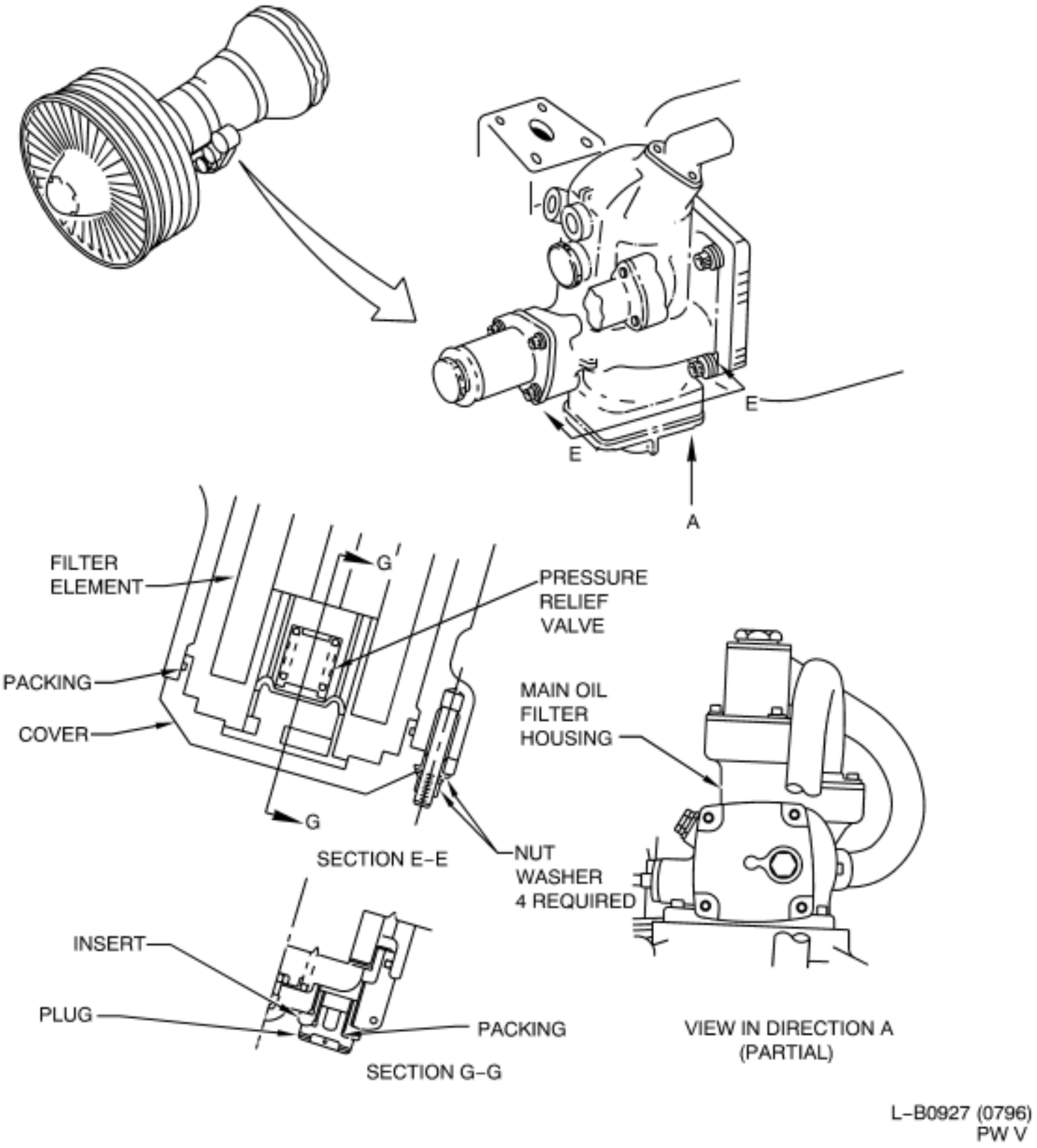
Main Oil Filter Housing Removal (Post SB PW4ENG 72-524 And SB PW4ENG 79-79)
Figure 301 (Sheet 10)
(Task 72-00-61-040-001)


E
E
A
FILTER ELEMENT
REMOVABLE PLUG REMOVED
G
PACKING
COVER
MAIN OIL FILTER HOUSING
G
SECTION E−E
NUT
WASHER
4 REQUIRED
INSERT
PLUG
PACKING
SECTION G−G
VIEW IN DIRECTION A (PARTIAL)
L−B3618 (0000)
PW V

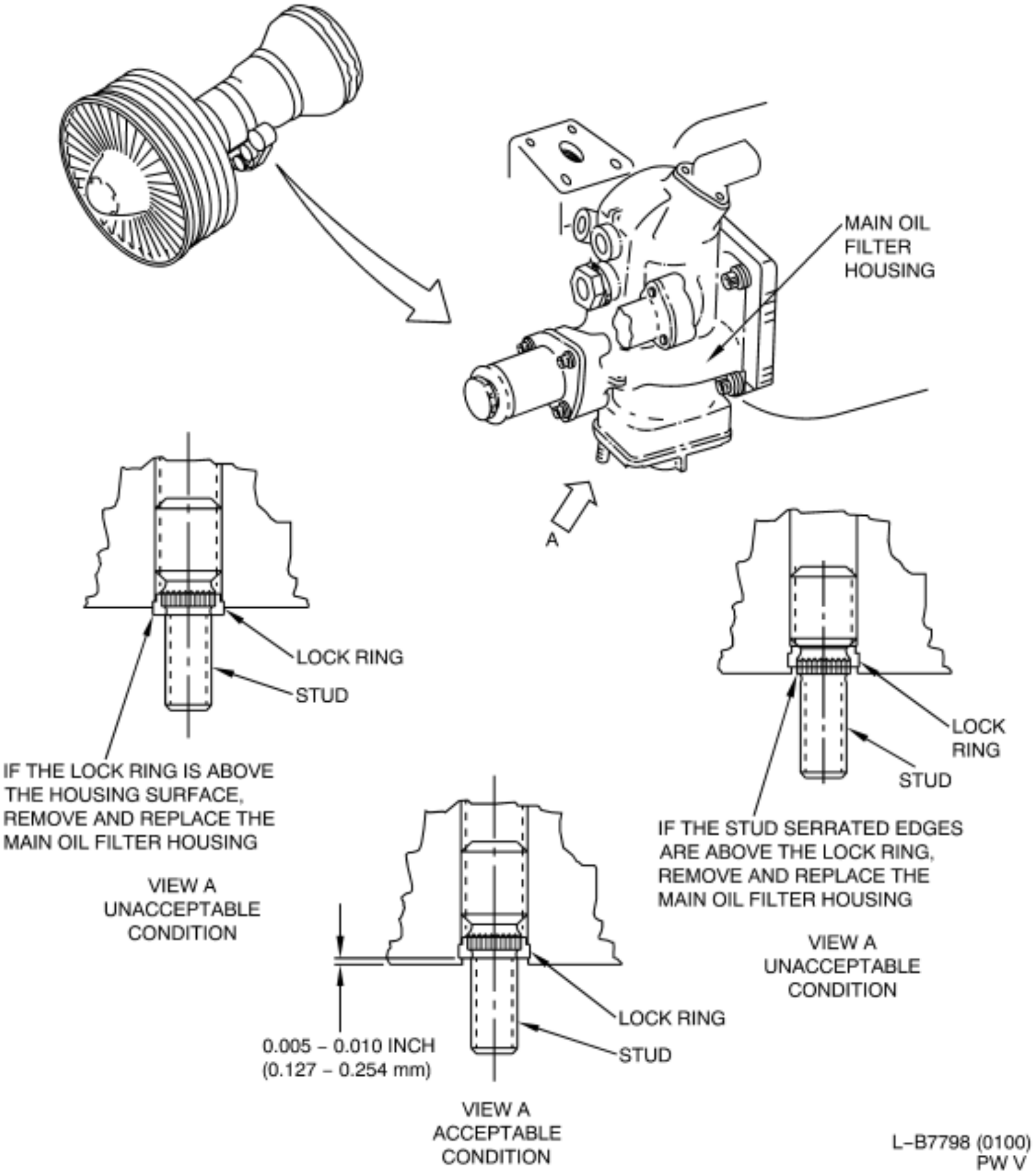
Main Oil Filter Housing Removal (Post SB PW4ENG 72−524 And SB PW4ENG 79−79)
Figure 301 (Sheet 11)
(Task 72−00−61−040−001)


18
PACKING
17
PACKING
43
PLUG
1
INSERT
2
PACKING
BRACKET
PACKING
BOLT
16
OIL SYSTEM PRESSURE
RELIEF VALVE
3
MAIN OIL
FILTER HOUSING
VIEW B
39
FILTER
ELEMENT
40
RETAINING
RING
41
PRESSURE RELIEF
VALVE
8
PACKING
42
MAIN OIL
STRAINER COVER
14
WASHER
NUT
29
11
PACKING
12
PLUG
L-B3604 (0000)
PW V

Main Oil Filter Housing Removal (Post SB PW4ENG 72-525)
Figure 301 (Sheet 12)
(Task 72-00-61-040-001)


E
E
A
FILTER ELEMENT
G
PRESSURE RELIEF VALVE
PACKING
COVER
G
MAIN OIL FILTER HOUSING
SECTION E-E
NUT
WASHER
4 REQUIRED
INSERT
PLUG
PACKING
SECTION G-G
VIEW IN DIRECTION A (PARTIAL)
L-B0927 (0796)
PW V

Main Oil Filter Housing Removal (Post SB PW4ENG 72-525)
Figure 301 (Sheet 13)
(Task 72-00-61-040-001)

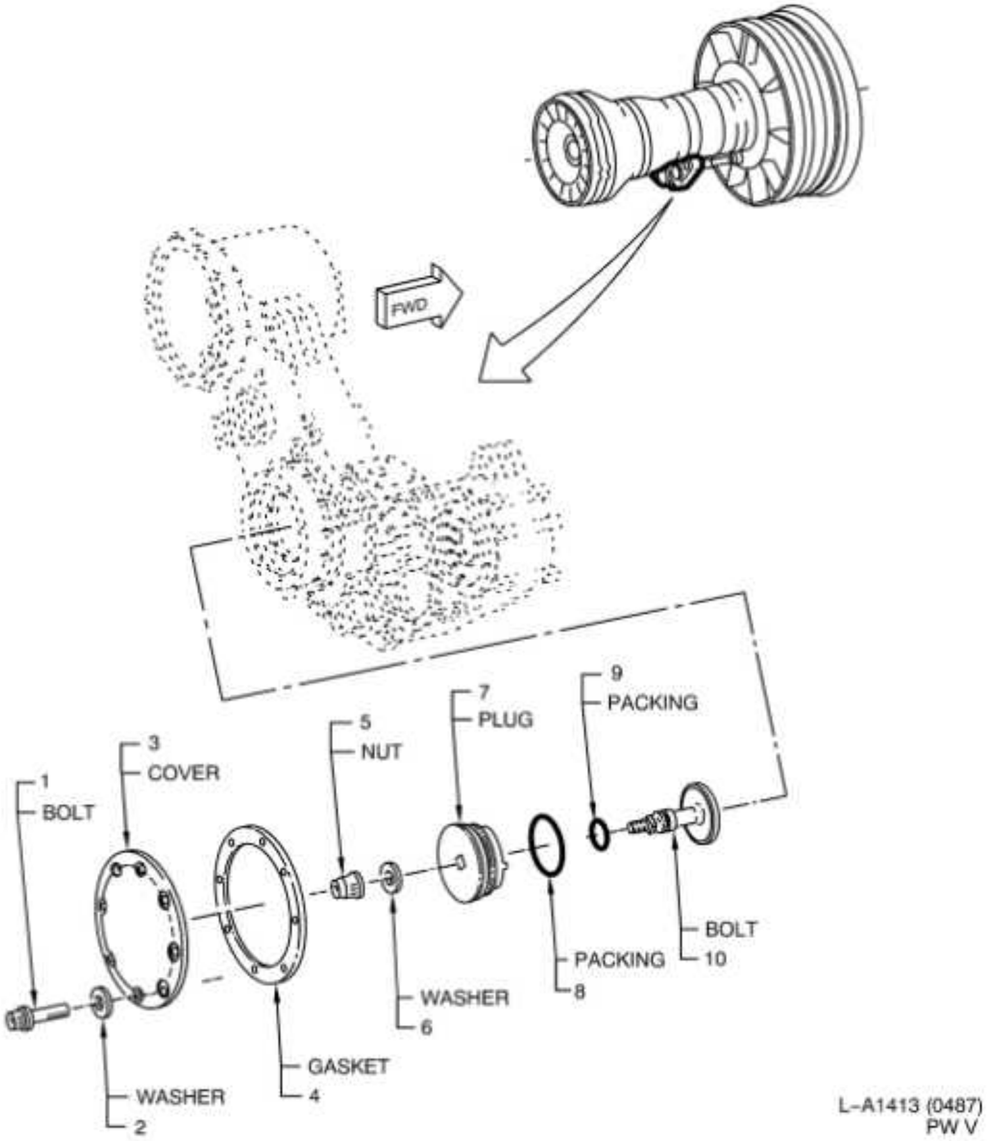

MAIN OIL FILTER HOUSING
A
LOCK RING
STUD
IF THE LOCK RING IS ABOVE THE HOUSING SURFACE, REMOVE AND REPLACE THE MAIN OIL FILTER HOUSING
VIEW A UNACCEPTABLE CONDITION
LOCK RING
STUD
IF THE STUD SERRATED EDGES ARE ABOVE THE LOCK RING, REMOVE AND REPLACE THE MAIN OIL FILTER HOUSING
VIEW A UNACCEPTABLE CONDITION
0.005 - 0.010 INCH (0.127 - 0.254 mm)
LOCK RING
STUD
VIEW A ACCEPTABLE CONDITION
L-B7798 (0100)
PW V

Main Oil Filter Housing Stud Check
Figure 302
(Task 72-00-61-040-001)

ENGINE GENERAL − MAIN GEARBOX − REMOVAL−21

Task 72−00−61−030−011:

1. Remove IDG Drive Gearshaft Plug And Bolt
   A. Equipment And Materials Required − None
   B. Procedure
      See Figure 301.
      (1) For those engines not using an IDG, remove bolts (301/1) and washers (301/2) securing IDG drive pad cover to gearbox. Remove cover (301/3) and gasket (301/4). Remove nut (301/5) and washer (301/6). Remove plug (301/7). Discard packing (301/8). Remove bolt (301/10). Discard packing (301/9).


FWD
1
BOLT
2
WASHER
3
COVER
4
GASKET
5
NUT
6
WASHER
7
PLUG
8
PACKING
9
PACKING
10
BOLT
L−A1413 (0487)
PW V

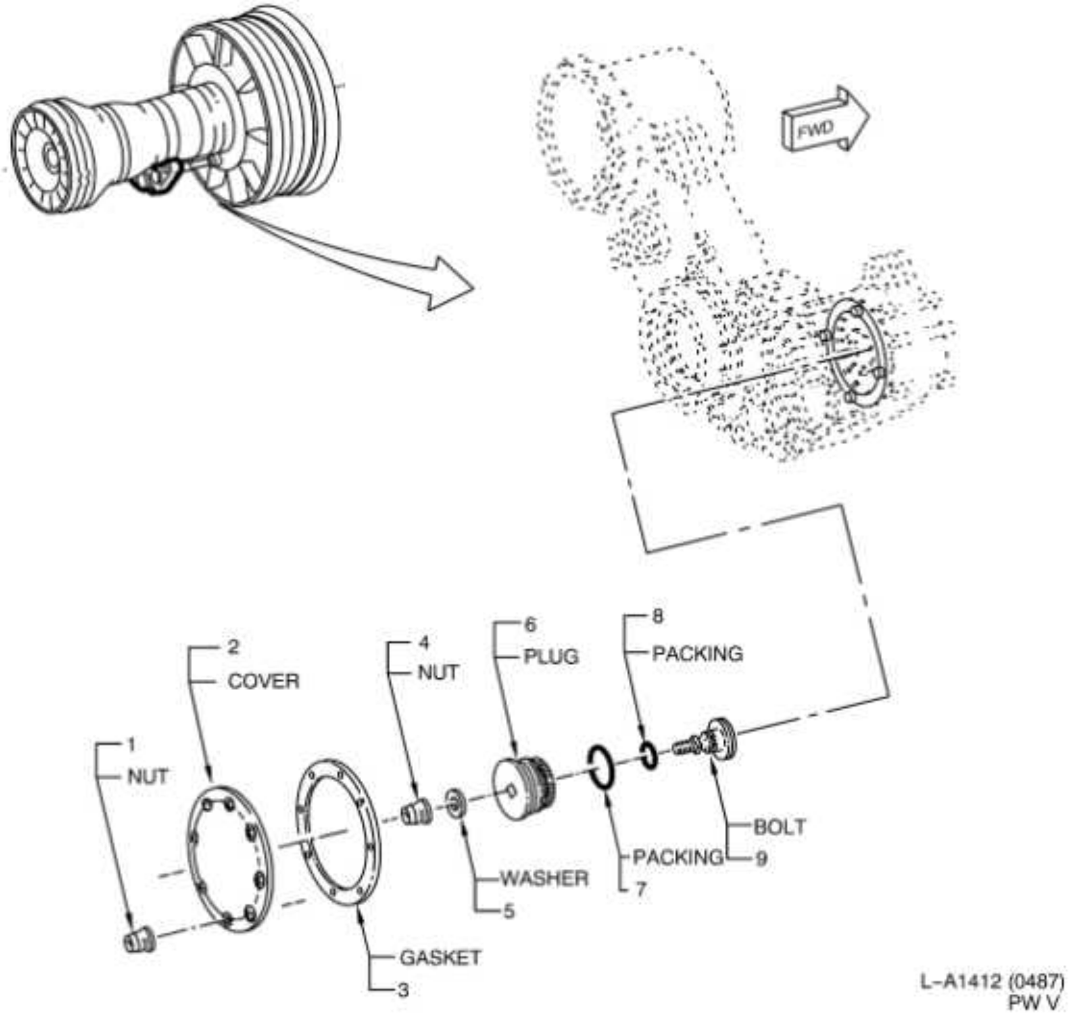
IDG Drive Cover, Plug And Bolt Removal
Figure 301
(Task 72−00−61−030−011)

ENGINE GENERAL − MAIN GEARBOX − REMOVAL−22

Task 72−00−61−030−012:

1. Remove Rear Hydraulic Pump Drive Plug And Bolt
   - A. Equipment And Materials Required − None
   - B. Procedure

     See Figure 301.
     - (1) For those engines not using a rear hydraulic pump, remove nuts (301/1) securing rear hydraulic pump drive pad cover to gearbox. Remove cover (301/2) and gasket (301/3). Remove nut (301/4) and washer (301/5). Remove plug (301/6). Discard packing (301/7). Remove bolt (301/9). Discard packing (301/8).


FWD
1
NUT
2
COVER
3
GASKET
4
NUT
5
WASHER
6
PLUG
7
PACKING
8
PACKING
9
BOLT
L-A1412 (0487)
PW V

Rear Hydraulic Pump Drive Cover, Plug And Bolt Removal
Figure 301
(Task 72-00-61-030-012)

Previous Pageblock Return to Previous Menu Next Pageblock

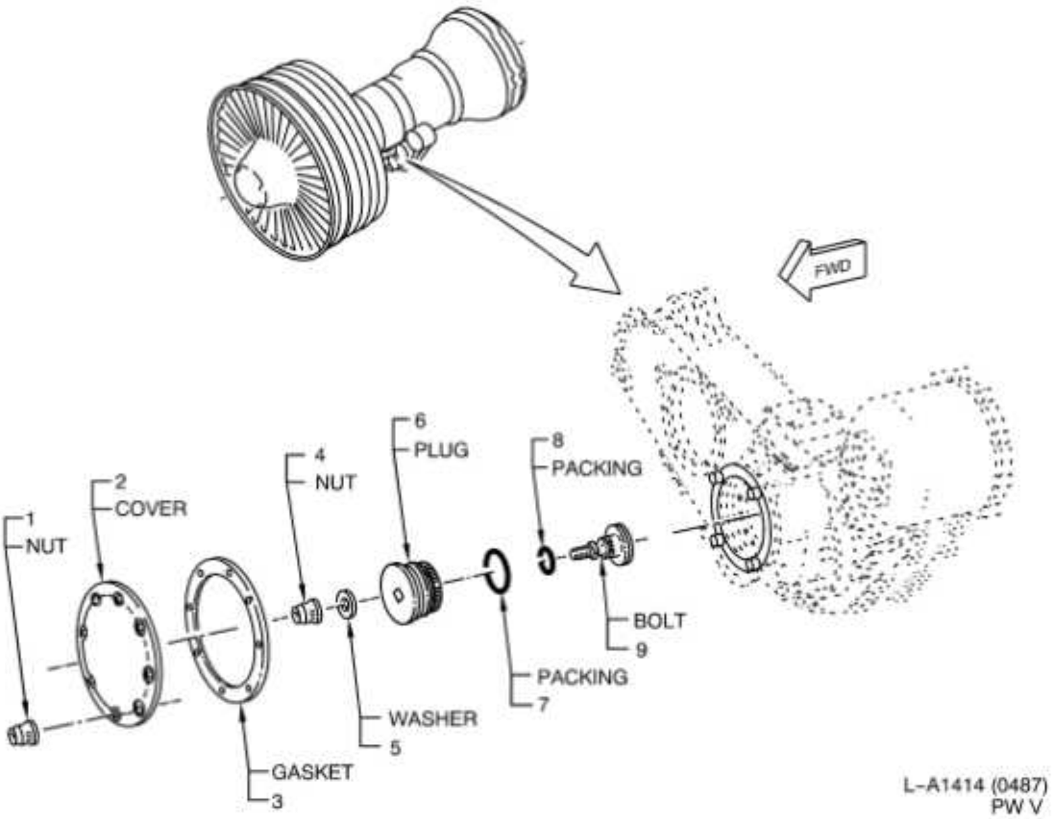
ENGINE GENERAL - MAIN GEARBOX - REMOVAL-23

Task 72-00-61-030-013:

1. Remove Front Hydraulic Pump Drive Gearshaft Plug And Bolt
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 301.

     (1) For those engines not using a front hydraulic pump, remove nuts (301/1) securing front hydraulic pump drive cover to gearbox. Remove cover (301/2) and gasket (301/3). Remove nut (301/4) and washer (301/5). Remove plug (301/6). Discard packing (301/7). Remove bolt (301/9). Discard packing (301/8).


FWD
6
PLUG
8
PACKING
4
NUT
2
COVER
1
NUT
BOLT
9
PACKING
7
WASHER
5
GASKET
3
L−A1414 (0487)
PW V

Front Hydraulic Pump Drive Cover, Plug And Bolt Removal
Figure 301
(Task 72−00−61−030−013)

ENGINE GENERAL - MAIN GEARBOX - REMOVAL-24

Task 72-00-61-060-001:

1. Remove The Fuel Pump Filter
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 301.

     WARNING: DO NOT LET ENGINE FUEL STAY ON YOUR SKIN FOR A LONG TIME. THE FUEL IS POISONOUS AND CAN GO THROUGH YOUR SKIN. PUT A CONTAINER, MINIMUM CAPACITY OF 5 U.S. GALLONS (19 LITERS), IN POSITION AND COLLECT THE DRAINED FUEL.

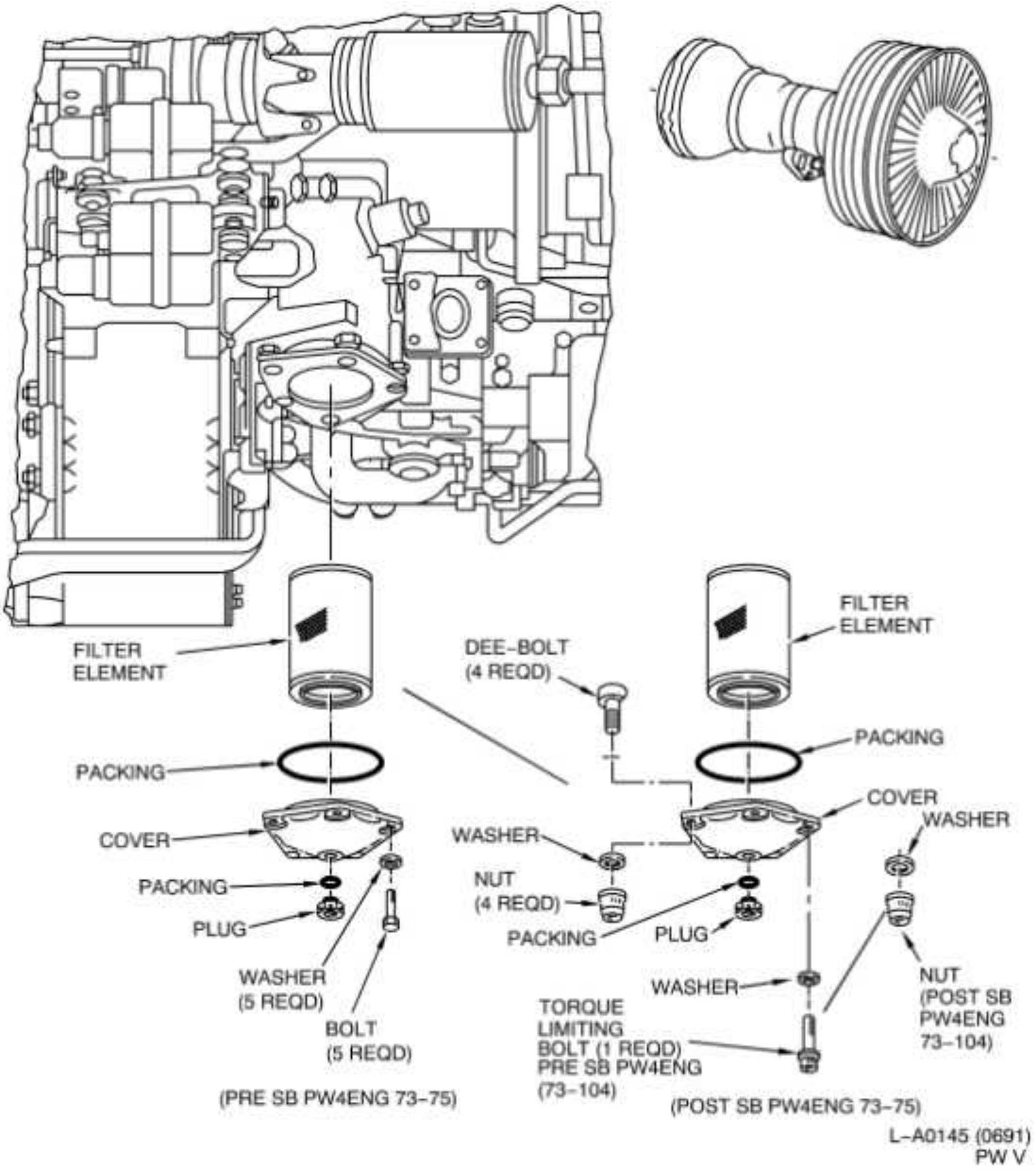
     - (1) Remove the lockwire and plug from the center of the fuel pump filter cover. Let fuel drain. Discard the packing from the plug.
     - (2) For fuel pumps with the five cover bolts, washers, and no nuts (Pre SB PW4ENG 73-75), remove the filter as follows.
       - (a) Remove the bolts and washers. Monitor the torque necessary to remove (back-out) the bolt from each heli-coil self-locking feature. If the torque is less than 6.5 lb-in. (0.73 N.m), you must replace the heli-coil insert. (See Component Maintenance Manual, 73-11-04 for heli-coil replacement).
       - (b) Remove the cover and fuel filter.

         NOTE: Some covers have machined slots in the split surface of the cover. These slots will help remove the cover.

       - (c) Discard the packing from the cover.
       - (d) Examine the filter, the filter cavity, and the filter cover. Be sure that the filter element gaskets are on the filter element and not stuck in the housing cavity or the cover. Remove the gaskets if necessary.
       - (e) Install the protection covers.

     - (3) For fuel pumps with the four cover nuts, washers, dee-bolts, and the torque-limiting bolt (Post SB PW4ENG 73-75) and (Pre SB PW4ENG 73-104), remove the filter as follows.

       CAUTION: WHEN YOU LOOSEN THE TORQUE-LIMITING BOLT, DO NOT PUT UNWANTED FORCE ON THE BOLT HEAD. KEEP THE WRENCH STRAIGHT AND AT 90 DEGREES TO THE BOLT HEAD AND LOOSEN THE BOLT SLOWLY. BOLT HEAD FAILURE CAN RESULT IF YOU DO NOT USE THESE INSTRUCTIONS.


FILTER ELEMENT
PACKING
COVER
PACKING
PLUG
WASHER (5 REQD)
BOLT (5 REQD)
(PRE SB PW4ENG 73−75)
DEE−BOLT (4 REQD)
WASHER
NUT (4 REQD)
PACKING
PLUG
WASHER
TORQUE LIMITING BOLT (1 REQD) PRE SB PW4ENG (73−104)
FILTER ELEMENT
PACKING
COVER
WASHER
NUT (POST SB PW4ENG 73−104)
(POST SB PW4ENG 73−75)
L−A0145 (0691)
PW V

Fuel Pump Filter
Figure 301
(Task 72−00−61−060−001)

(a) Keep the wrench straight and at 90 degrees to the bolt head and slowly loosen and remove the torque−limiting bolt. Monitor the torque necessary to remove (back−out) the bolt from the heli−coil self−locking feature. If this torque is less than 6.5 lb−in. (0.73 N.m), you must replace the heli−coil insert. (See Component Maintenance Manual, 73−11−04 for heli−coil replacement).
(b) Remove the nuts, washers and dee−bolts.
(c) Remove the cover and fuel filter.

NOTE: Some covers have machined slots in the split surface of the cover. These slots will help remove the cover.

(d) Discard the packing from the cover.
(e) Examine the filter, the filter cavity, and the filter cover. Be sure that the filter element gaskets are on the filter element and not stuck in the housing cavity or the cover. Remove the gaskets if necessary.
(f) Install the protection covers.

(4) For fuel pumps with the five cover nuts, washers, and the four dee−bolts (Post SB PW4ENG 73−105), remove the filter as follows.
(a) Remove the nuts, washers and dee−bolts.
(b) Remove the cover and fuel filter.

NOTE: Covers have machined slots in the split surface of the cover. These slots will help remove the cover.

(c) Discard the packing from the cover.
(d) Examine the filter, the filter cavity, and the filter cover. Be sure that the filter element gaskets are on the filter element and not stuck in the housing cavity or the cover. Remove the gaskets if necessary.
(e) Install the protection covers.

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-61-050-009:

1. Remove Fuel Pump Filter Differential Pressure Switch

   A. Equipment And Materials Required - None

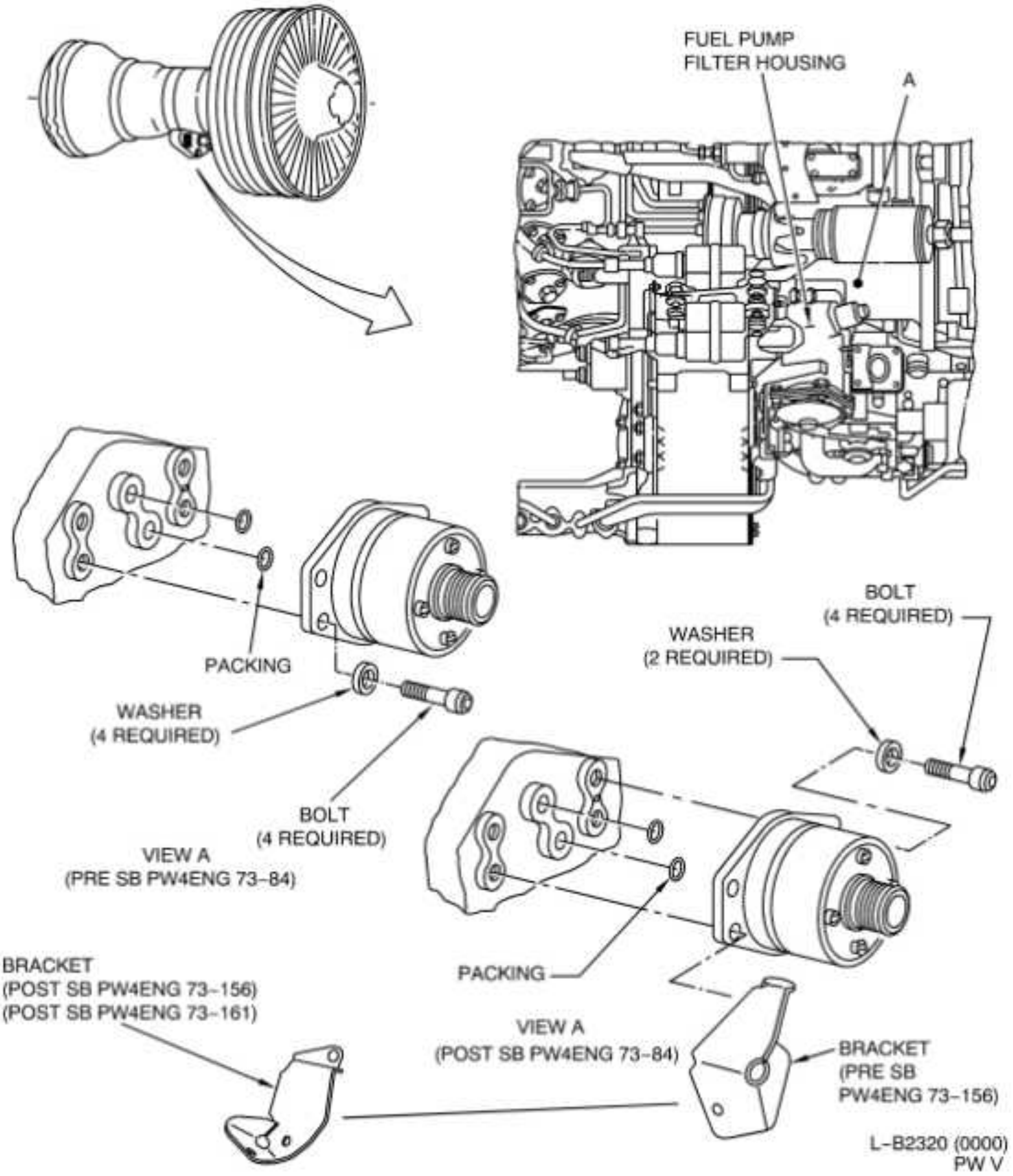
   B. Procedure

      See Figure 301.

      (1) Disconnect electrical connector. Install protective closures.

      (2) Remove bolts and washers securing switch to fuel pump. Remove bracket. Remove switch and discard packings. Install protective closures.

         NOTE: For additional information concerning detailed maintenance of this component see Fuel Pump Filter Differential Pressure Switch Component Maintenance Manual, 73-11-10 (Custom Component Switches).


FUEL PUMP
FILTER HOUSING
A
BOLT
(4 REQUIRED)
WASHER
(2 REQUIRED)
PACKING
WASHER
(4 REQUIRED)
BOLT
(4 REQUIRED)
VIEW A
(PRE SB PW4ENG 73-84)
BRACKET
(POST SB PW4ENG 73-156)
(POST SB PW4ENG 73-161)
PACKING
VIEW A
(POST SB PW4ENG 73-84)
BRACKET
(PRE SB
PW4ENG 73-156)
L-B2320 (0000)
PW V

Fuel Pump Filter Differential
Pressure Switch
Figure 301
(Task 72−00−61−050−009)

ENGINE GENERAL - MAIN GEARBOX - REMOVAL-26

Task 72-00-61-050-010:

1. Remove EEC Fuel Temperature Thermocouple Probe
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 301.
     - (1) (Pre SB PW4ENG 73-84), Remove the EEC fuel temperature thermocouple probe as follows:
       - (a) Disconnect W5P8 harness connector from EEC fuel temperature thermocouple probe located on upper end of fuel pump filter housing.
       - (b) Remove lockwire from probe and remove probe from boss on fuel pump filter housing. Discard packing.

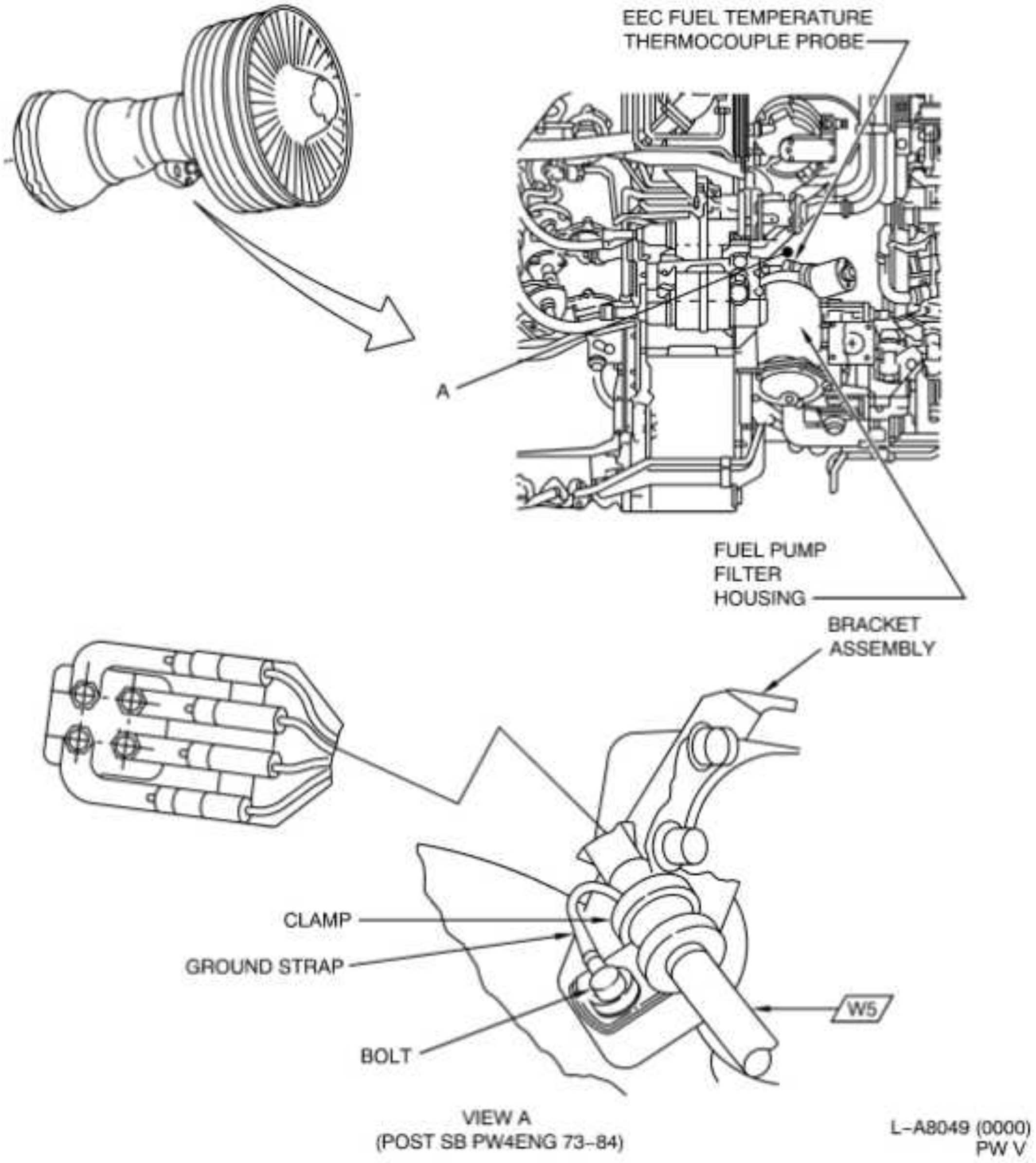
         NOTE: Be prepared to catch fuel in a container with a minimum capacity of 5 U.S. gallons (19 liters).

         For additional information concerning detailed maintenance of this component see EEC Fuel/Oil Temperature Thermocouple Probe Component Maintenance Manual, 73-21-47 (PW Manual PN 50A447).

       - (c) Install protective closure.
     - (2) (Post SB PW4ENG 73-84), Remove the harness connector and the thermocouple probe as follows.
       - (a) Remove the nuts that attach the W5 wiring harness to the studs on the thermocouple.
       - (b) Remove the bolt, clamp, and ground strap that are attached to the bracket on the fuel pump filter housing.
       - (c) Remove the wiring harness terminals from the thermocouple studs.
       - (d) Remove the lockwire from the thermocouple probe nut to the adapter. Remove the thermocouple probe from the housing.

         NOTE: Be prepared to catch fuel in a container with a minimum capacity of 5 U.S. gallons (19 liters).

         For additional information concerning detailed maintenance of this component see EEC Fuel/Oil Temperature Thermocouple Probe Component Maintenance Manual, 73-21-47 (PW Manual PN 50A447).


EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
A
FUEL PUMP FILTER HOUSING
BRACKET ASSEMBLY
CLAMP
GROUND STRAP
W5
BOLT
VIEW A
(POST SB PW4ENG 73-84)
L-A8049 (0000)
PW V

EEC Fuel Temperature Thermocouple Probe
Figure 301
(Task 72-00-61-050-010)

(e) Remove the lockwire from the adapter to the housing. Remove the adapter from the housing and discard the packing.
(f) Install protection covers.

ENGINE GENERAL - MAIN GEARBOX - REMOVAL-27

Task 72-00-61-050-011:

1. Remove EEC Oil Temperature Thermocouple Probe
   A. Equipment And Materials Required - None
   B. Procedure
      See Figure 401.
      (1) (Pre SB PW4ENG 73-84), Remove EEC oil temperature thermocouple probe as follows.
         (a) Disconnect W3P18 harness connector from EEC oil temperature thermocouple probe located on lower, left side of main gearbox front face.
         (b) Remove lockwire from probe and remove probe from boss on gearbox. Discard packing.

            NOTE: Be prepared to catch oil in a container with a minimum capacity of 5 U.S. gallons (19 liters).

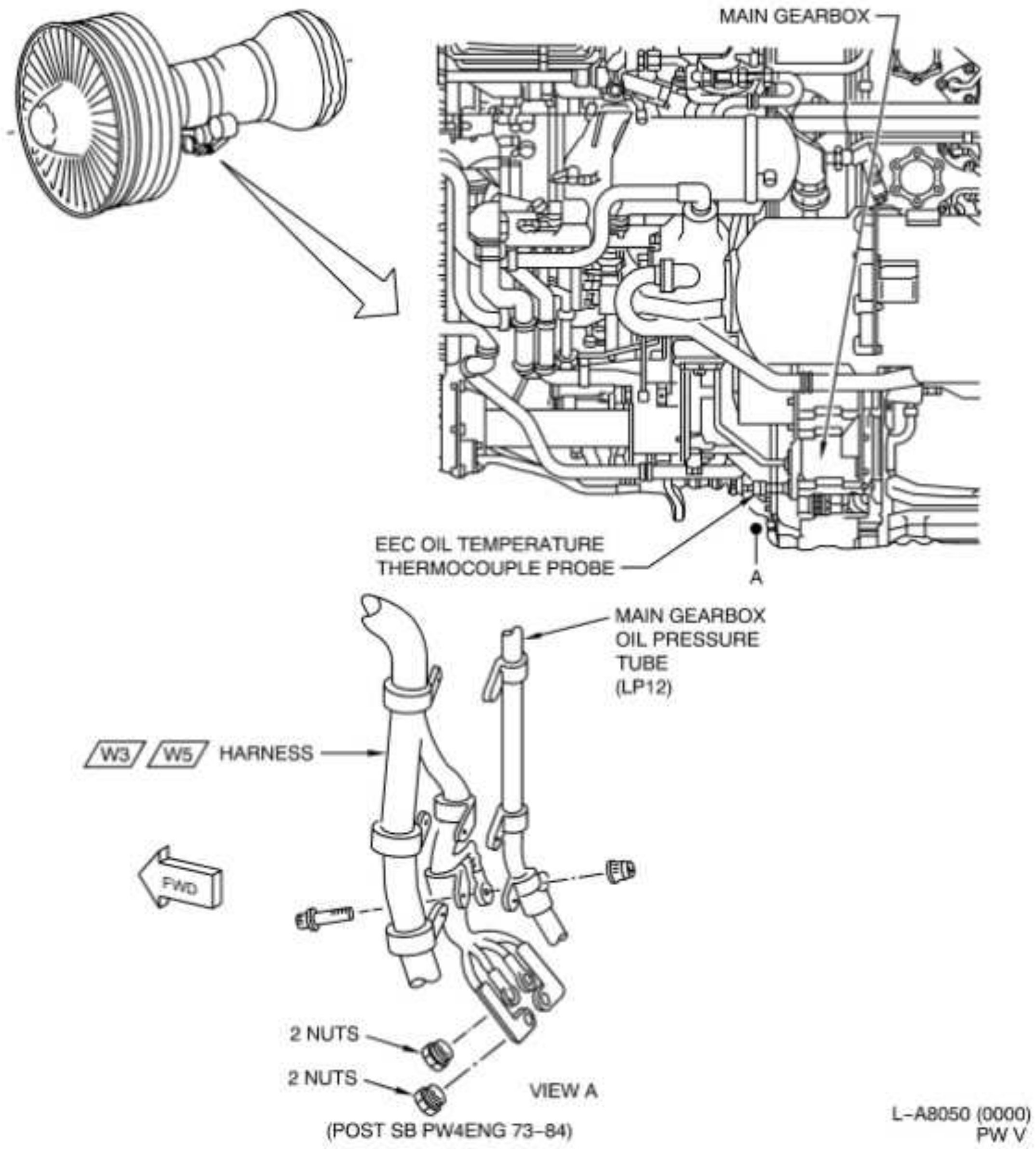
            For additional information concerning detailed maintenance of this component see EEC Fuel/Oil Temperature Thermocouple Probe Component Maintenance Manual, 73-21-47 (PW Manual PN 50A447).

         (c) Install protective closure.
      (2) (Post SB PW4ENG 73-84), Remove the harness connector and the thermocouple probe as follows.
         (a) Remove the nuts that attach the W3 wiring harness to the studs on the thermocouple.
         (b) Remove the bolt, clamp, and ground strap that are attached to the main gearbox pressure tube (LP12).
         (c) Remove the wiring harness terminals from the thermocouple studs.
         (d) Remove the lockwire from the thermocouple probe nut to the adapter. Remove the thermocouple probe from the housing.

            NOTE: Be prepared to catch oil in a container with a minimum capacity of 5 U.S. gallons (19 liters).

            For additional information concerning detailed maintenance of this component see EEC Fuel/Oil Temperature Thermocouple Probe Component Maintenance Manual, 73-21-47 (PW Manual PN 50A447).

         (e) Remove the lockwire from the adapter to the housing. Remove the adapter from the housing and discard packing.


MAIN GEARBOX
EEC OIL TEMPERATURE THERMOCOUPLE PROBE
A
MAIN GEARBOX OIL PRESSURE TUBE (LP12)
W3 W5 HARNESS
FWD
2 NUTS
2 NUTS
VIEW A
(POST SB PW4ENG 73-84)
L-A8050 (0000)
PW V

EEC Oil Temperature Thermocouple Probe −
Studded Terminals
Figure 301
(Task 72−00−61−050−011)

(f) Install protection covers.

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Task 72-00-61-050-012:

1. Remove The Lube Oil Tank Assembly

A. Prerequisites

(1) Remove the (lower left) turbine vane cooling air tube (AP03). Refer to 72-00-52, Removal-07 (Task 72-00-52-050-004).

(2) Remove the magnetic chip detector assembly from the oil tank. Refer to Removal-36 (Task 72-00-61-050-017).

(3) Remove the oil tank sight gage if it is necessary to use the sight gage from this oil tank on another oil tank. Refer to Removal-31 (Task 72-00-61-050-013).

B. Equipment And Materials Necessary

Special Tools:

PWA 88231	Puller, Jackscrew

C. Procedure

(1) Remove the oil tank from the gearbox. See Figure 301.

(a) Remove the bolt (301/2) and engine ground-strap (301/4) from the oil tank. The ground-strap must stay with the engine.

(b) Remove the bolt (301/2) and bracket (301/5) that has the identification plate. The bracket must stay with the gearbox.

(c) Remove the bolt (301/2) that holds the heat shield (301/1) and, if applicable, bracket (Pre SB PW4ENG 79-48) (301/3) and bracket (Post SB PW4ENG 72-491) (301/7).

CAUTION: TO PREVENT DAMAGE TO THE GEARBOX HOUSING, MAKE SURE ALL THE OIL TANK TO GEARBOX ATTACHMENT BOLTS ARE REMOVED BEFORE INSTALLING PWA 88231 PULLER.

(d) Remove the remaining bolts that attach the oil tank to the gearbox.

(e) Use PWA 88231 Puller to carefully remove the oil tank from the gearbox.

(2) Remove packings (302/1), (302/2), (302/3), and (302/4). Discard the packings. See Figure 302.

(3) If it is necessary to use the heat shield from this oil tank on another oil tank, remove the heat shield. See Figure 301.

  (a) Remove the clamp (301/6).

  (b) (Pre SB PW4ENG 72−74) Remove the six (6) bolts (301/8) and nuts (301/11) that attach the cover (301/10) to the flange of the hole at the top of the lube oil tank.

  (c) (Post SB PW4ENG 72−74) Remove the six (6) bolts (301/8) and nuts (301/11) that attach the cover (301/10) and the oil tank heat shield bracket (301/12) to the flange of the hole at the top of the lube oil tank.

  (d) Remove the heat shield (301/1) and, if applicable, bracket (301/3).

(4) Remove the oil tank cap and related parts from this oil tank if it is necessary to use those parts on another oil tank. This procedure is for an oil tank that either has no remote filler or is post SB PW4ENG 79−47. See Figure 303.

  (a) Remove the oil tank cap (303/1):

    1 Lift the handle. Turn the cap counterclockwise. Remove the cap.

    2 Remove the lockwire and bolt (303/4) that hold the oil tank cap lanyard (303/3).

    3 Discard the packing (303/2).

  (b) Remove the filler neck valve (303/5):

    1 Remove the lockwire and remaining bolts (303/4).

    2 Remove the filler neck valve.

    3 Discard the packing (303/6).

4 Examine the packing (303/8) under the valve. If the packing is cut or deteriorated, discard it.

(c) Remove the oil tank sump (303/7).

(5) Remove the oil tank cap and related parts from this oil tank if it is necessary to use those parts on another oil tank. This procedure is for an oil tank that has a remote filler and is pre SB PW4ENG 79−47. See Figure 304.

(a) Remove the oil tank cap (304/1):

1 Lift the handle. Turn the cap counterclockwise. Remove the cap.

2 Remove the bolt (304/4) and nut (304/16) that hold the oil tank cap lanyard (304/5).

3 Discard the packing (304/2).

(b) Remove the filler neck valve (304/3):

1 Remove the lockwire and the remaining bolts (304/4 and 304/7) and nuts (304/16).

2 Remove the filler neck valve.

3 Discard the packing (304/6).

4 Examine the packing (304/17) under the valve. If the packing is cut or deteriorated, discard it.

(c) Remove the oil tank sump (304/8).

(d) Remove the connector (304/9) (remote filler):

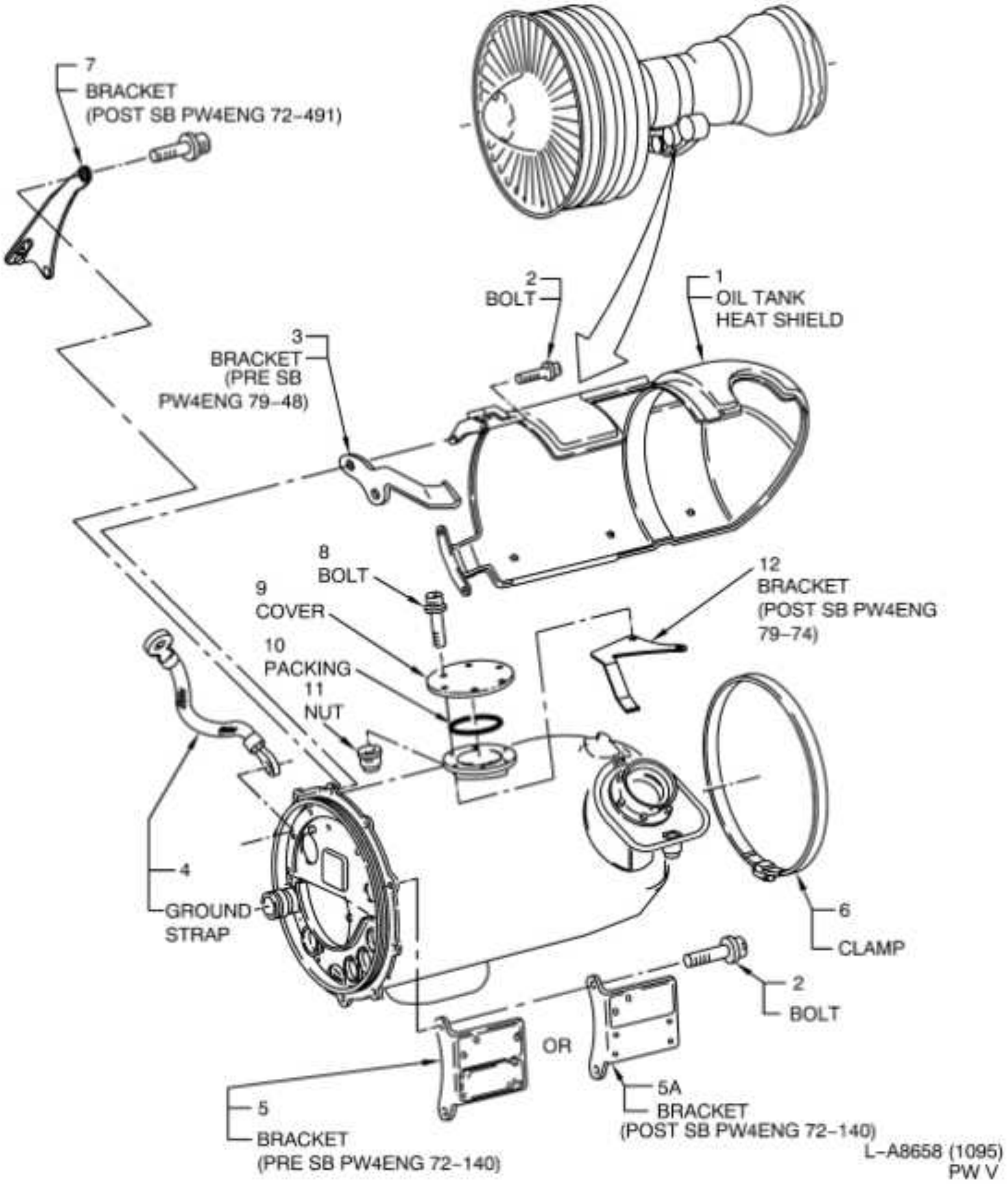
1 Remove the lockwire and bolts (304/12).

2 Remove the connector.

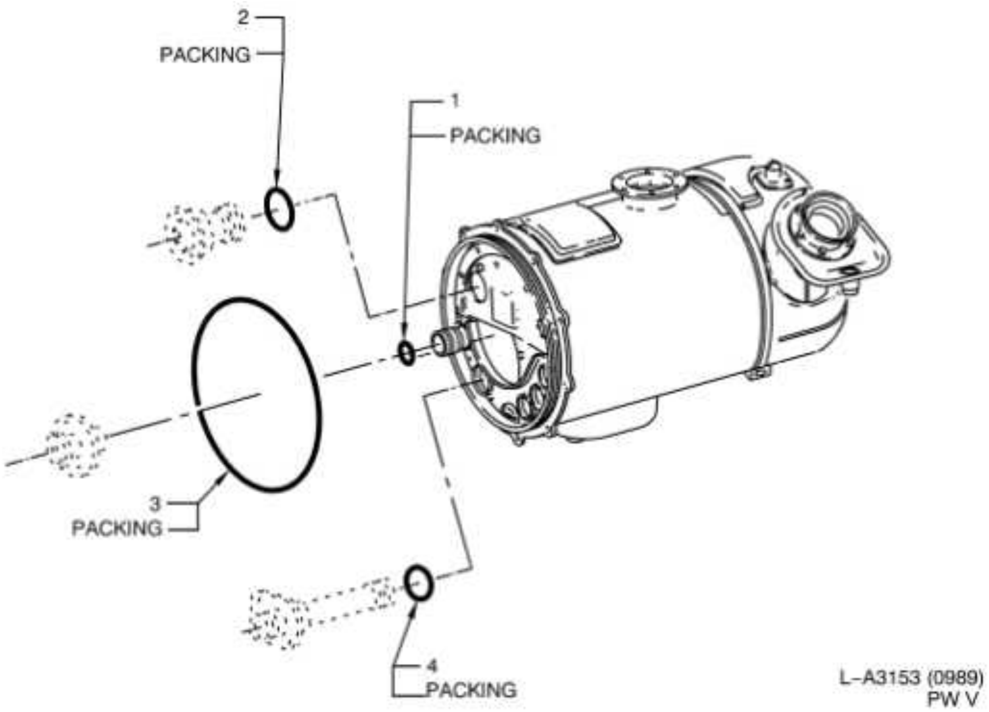
3 Discard the packing (304/13).

4 If applicable, remove the plugs (304/11 and 304/15) and packings (304/10 and 304/14). Discard the packings.

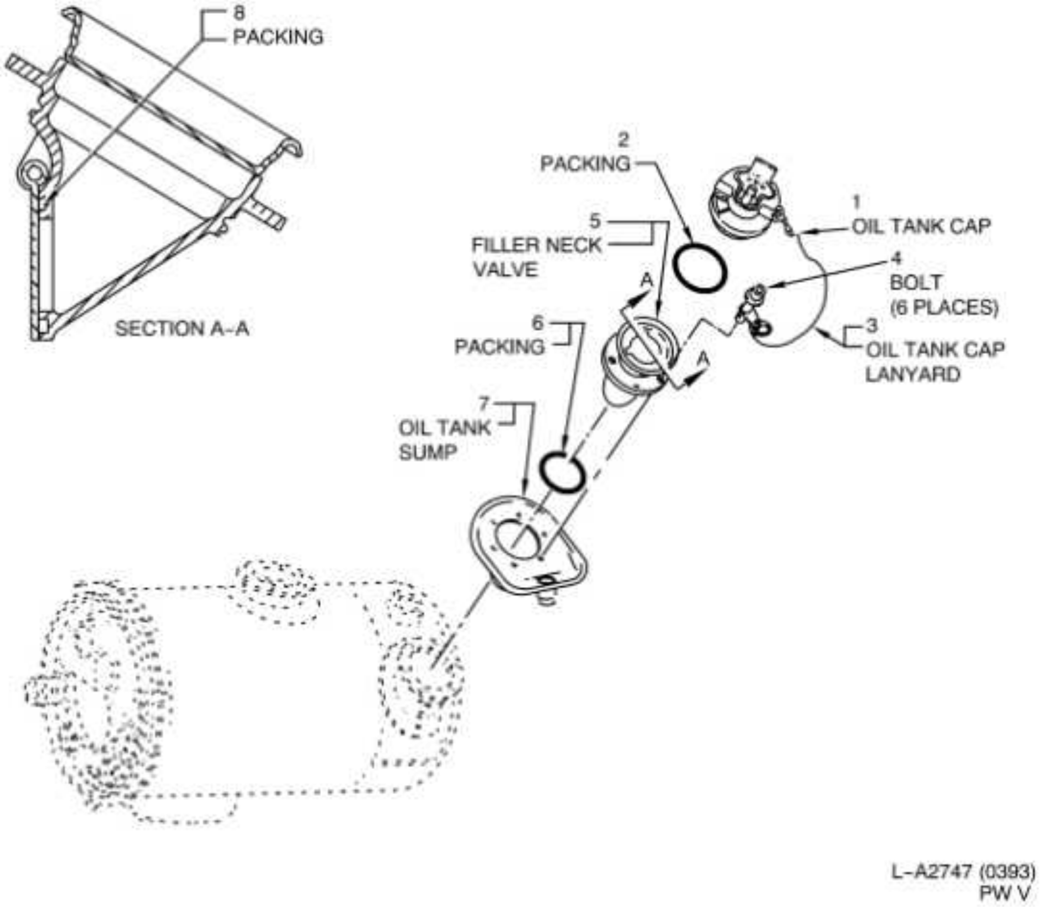
(6) To protect the oil tank holes, install covers.


7
BRACKET
(POST SB PW4ENG 72-491)
2
BOLT
1
OIL TANK
HEAT SHIELD
3
BRACKET
(PRE SB
PW4ENG 79-48)
8
BOLT
9
COVER
10
PACKING
11
NUT
12
BRACKET
(POST SB PW4ENG
79-74)
4
GROUND
STRAP
6
CLAMP
2
BOLT
OR
5A
BRACKET
(POST SB PW4ENG 72-140)
5
BRACKET
(PRE SB PW4ENG 72-140)
L-A8658 (1095)
PW V

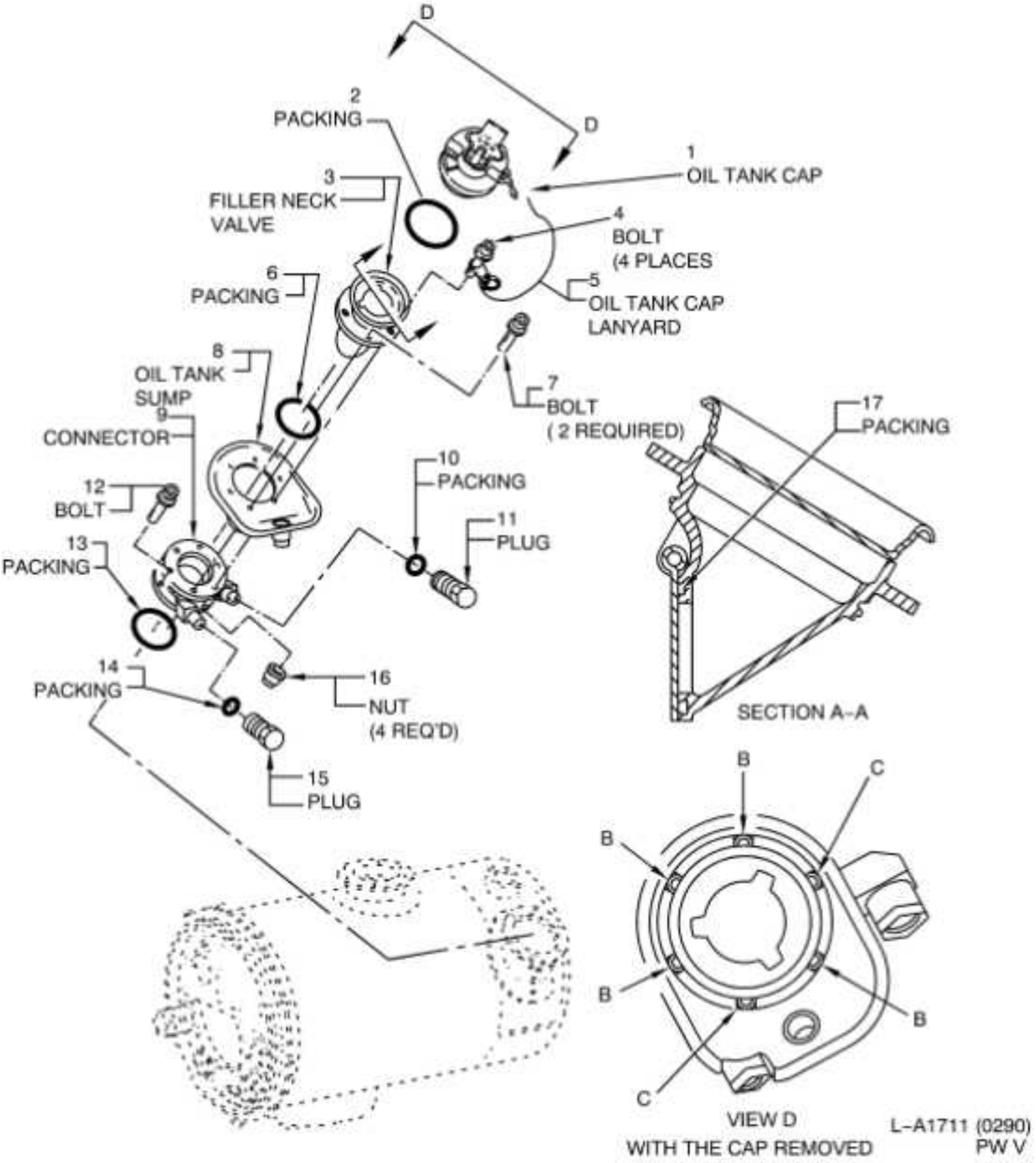
Oil Tank - Gearbox Connections
Figure 301
(Task 72-00-61-050-012)


2
PACKING
1
PACKING
3
PACKING
4
PACKING
L−A3153 (0989)
PW V

Oil Tank And Gearbox Packings
Figure 302
(Task 72−00−61−050−012)


8
PACKING
SECTION A-A
2
PACKING
1
OIL TANK CAP
5
FILLER NECK
VALVE
4
BOLT
(6 PLACES)
A
A
6
PACKING
3
OIL TANK CAP
LANYARD
7
OIL TANK
SUMP
L-A2747 (0393)
PW V

Removal Of The Oil Tank Cap And Related Parts
(No Remote Filler And Post SB PW4ENG 79−47)
Figure 303
(Task 72−00−61−050−012)


D
D
2
PACKING
1
OIL TANK CAP
3
FILLER NECK
VALVE
4
BOLT
(4 PLACES
6
PACKING
5
OIL TANK CAP
LANYARD
8
OIL TANK
SUMP
7
BOLT
(2 REQUIRED)
9
CONNECTOR
17
PACKING
10
PACKING
12
BOLT
11
PLUG
13
PACKING
16
NUT
(4 REQ'D)
14
PACKING
SECTION A-A
15
PLUG
B
C
B
B
B
C
VIEW D
WITH THE CAP REMOVED
L-A1711 (0290)
PW V

Removal Of The Oil Tank Cap And Related Parts (With Remote Filler)
Figure 304
(Task 72−00−61−050−012)

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ENGINE GENERAL - MAIN GEARBOX - REMOVAL-29

Task 72-00-61-030-014:

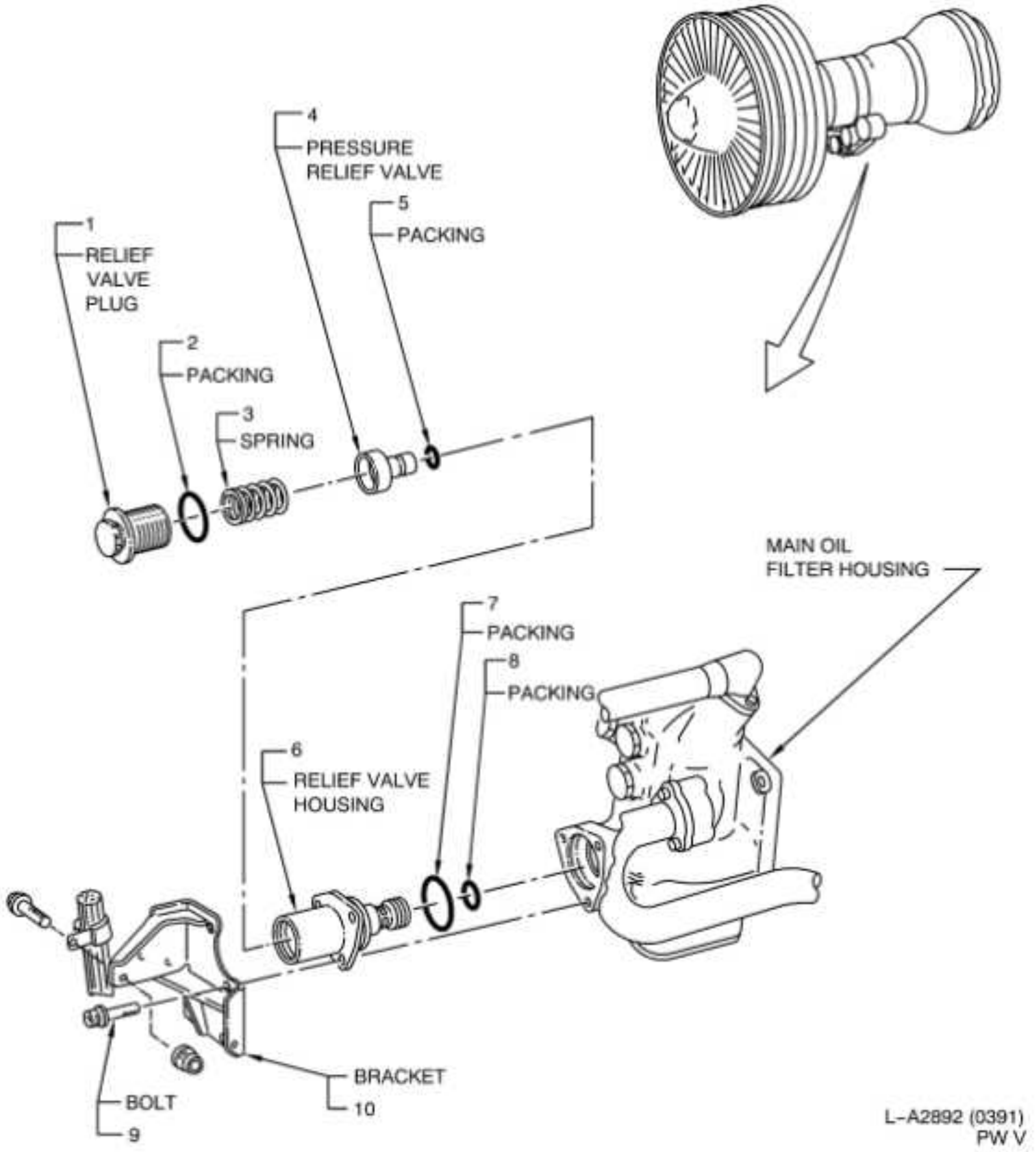
1. Remove Pressure (Regulator) Relief Valve
    A. Equipment And Materials Required - None
    B. Procedure
    See Figure 301.

WARNING: BE VERY CAREFUL WHEN YOU REMOVE THE RELIEF VALVE PLUG. THE PLUG IS SPRING LOADED.

(1) Remove the lockwire from the relief valve plug (301/1).
(2) Remove the relief valve plug (301/1) from the housing (301/6).

NOTE: Catch the oil in a container with a minimum capacity of 5 U.S. gallons (19 liters).

(3) Discard the packing (301/2).
(4) Remove the spring (301/3) and the pressure relief valve (301/4) from the housing (301/6).
(5) Discard the packing (301/5).
(6) If necessary, remove the pressure relief valve housing (301/6) from the main oil filter housing as follows.
    (a) Remove the clamp bolt and nut that attach the harness to the bracket (301/10).
    (b) Remove the three bolts (301/9) that attach the housing (301/6) to the main oil filter housing.
    (c) Remove the bracket (301/10).
    (d) Remove the relief valve housing (301/6).
    (e) Discard the packings (301/7) and (301/8).
    (f) Install the protection covers.


4
PRESSURE RELIEF VALVE
5
PACKING
1
RELIEF VALVE PLUG
2
PACKING
3
SPRING
MAIN OIL FILTER HOUSING
7
PACKING
8
PACKING
6
RELIEF VALVE HOUSING
BRACKET
10
BOLT
9
L-A2892 (0391)
PW V

Pressure (Regulator) Relief Valve
Figure 301
(Task 72-00-61-030-014)

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ENGINE GENERAL - MAIN GEARBOX - REMOVAL-30

Task 72-00-61-030-015:

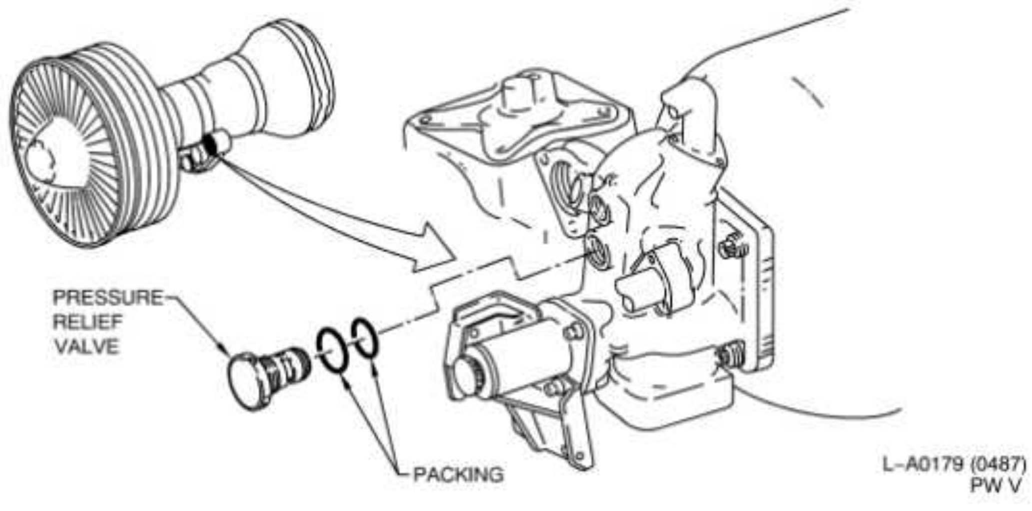
1. Remove Pressure Relief Valve (Filter Element) (Pre SB PW4ENG 72-525)
   A. Equipment And Materials Required - None
   B. Procedure
   See Figure 301.

NOTE: A Dual Element Oil Filter is introduced by SB PW4ENG 72-525 which also replaces the pressure relief valve in the main oil filter housing with a plug. For Post SB PW4ENG 72-525 removal of the pressure relief valve and the replacement plug, see 72-00-61, Removal-20 or 72-61-00, Disassembly-04.

WARNING: A MINIMUM OF FIVE MINUTES SHOULD ELAPSE AFTER ENGINE SHUTDOWN BEFORE REMOVING PRESSURE RELIEF VALVE TO ALLOW TANK PRESSURE TO BLEED OFF.

USE CARE WHEN REMOVING PRESSURE RELIEF VALVE ON A RECENTLY RUN ENGINE. HOT OIL UNDER PRESSURE COULD BE RELEASED TO CASUE SEVERE BURNS ON CONTACT WITH EYES OR SKIN.

(1) Remove lockwire and remove pressure relief valve from main oil filter housing. Discard packings.


PRESSURE RELIEF VALVE
PACKING
L−A0179 (0487)
PW V

Pressure Relief Valve (Filter Element)
(Pre SB PW4ENG 72−525)
Figure 301
(Task 72−00−61−030−015)

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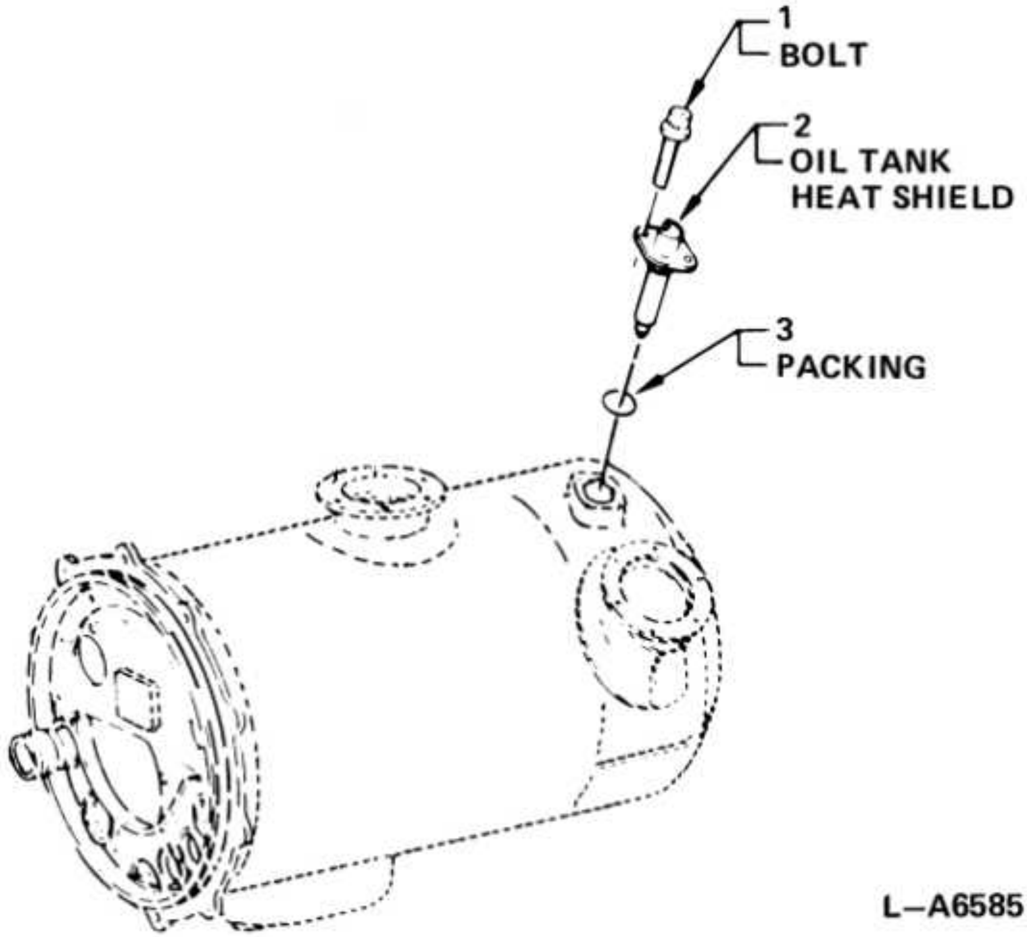
ENGINE GENERAL - MAIN GEARBOX - REMOVAL-31

Task 72-00-61-050-013:

1. Remove The Oil Tank Sight Gage
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 301.
     - (1) Remove the lockwire and bolts (301/1).
     - (2) Remove the oil tank sight gage (301/2).
     - (3) Remove and discard the packing (301/3).
     - (4) Protect the oil tank hole with a cover.


1
BOLT
2
OIL TANK
HEAT SHIELD
3
PACKING
L−A6585

Oil Tank Sight Gage
Figure 301
(Task 72−00−61−050−013)

Task 72-00-61-050-014:

1. Remove Lubrication And Scavenge Oil Pump

A. Prerequisites

(1) Remove the magnetic plug assemblies in the oil tank and main gearbox. Refer to Removal-36 (Task 72-00-61-050-017).

B. Equipment And Materials Necessary

Special Tools:

PWA 86630	Jackscrew Puller (2 are necessary) - Optional to PWA 88774 Jackscrew Puller
PWA 88774	Jackscrew Puller (2 are necessary) - Optional to PWA 86630 Jackscrew Puller

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	79-11-00/2/1
Lockwire, AS3214-02		

C. Procedure
See Figure 301 and Figure 302.

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH
R CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND
R INSTALL A TUBE WITH A FLEX SEGMENT WITH THE
R SAME PRECAUTION USED FOR A TUBE WITHOUT A
R FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A
R TUBE TO HELP WITH THE INSTALLATION OR REMOVAL
R OF THE TUBE OR AN ATTACHED COMPONENT. IF A
R FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE
R A KINK IN THE EXTERNAL WIRE BRAID AND IN THE
R INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND
R LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(1) (Pre SB PW4ENG 79-75) Remove bolts securing bracket and flange of main filter oil tube assembly (LP01) to top rear port on oil pump. Loosen bolts securing clamps to

bracket and swing bracket clear of pump. See Figure 301.

R CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(2) (Post SB PW4ENG 79-75) Loosen the main oil filter hose, tube assembly (LP01) and the fluid pressure dampener or the fluid pressure adapter assembly (Post SB PW4ENG 79-86) as follows. See Figure 302.

(a) Remove the bolts that hold the tube to the top of the fluid pressure dampener or adapter.

(b) Remove bolt, nut and clamp securing tube to diffuser case bracket at approximately 7 o'clock position.

(c) Remove bolts, nuts and clamps securing tube to gearbox brackets.

(d) If applicable, remove the bolts that hold the fluid pressure dampener or adapter to the top of the main oil pump.

(e) If applicable, remove the bolts and nuts that hold the loop clamp bracket to the fluid pressure dampener or adapter. Remove the bracket.

(f) If applicable, remove the dampener or adapter from the pump.

(g) Discard the packings from the hose, tube assembly and the dampener or adapter, as applicable.

(3) Remove bolts securing flanges of the following scavenge tubes starting at right rear of pump and working forward.

(a) No. 3 bearing oil scavenge manifold assembly (LR04).

NOTE: The No. 3 bearing oil scavenge manifold assembly contains a strainer element (Post SB PW4ENG 79−58) at the scavenge pump side of the manifold.

(b) No. 4 bearing oil scavenge tube assembly (LR05).

(c) Angle gearbox oil scavenge tube assembly (LR01).

(d) Main bearing oil scavenge tube assembly (LR03).

(4) Loosen clamps on tubes as necessary to allow flexibility for tube flanges to be disengaged from pump.

(5) Loosen and remove the bolts and washers that attach the oil pump to the pad on the rear face of the gearbox. Disengage the tubes from the oil pump. Install two PWA 88774 Jackscrew Pullers or PWA 86630 Jackscrew Pullers to the holes in the oil pump mount flange that have threads. Turn the jackscrews equally to disengage the pump from the gearbox. Remove the pump from the gearbox. Remove the two transfer tubes and discard the packings. Remove and discard the packings on the pump.

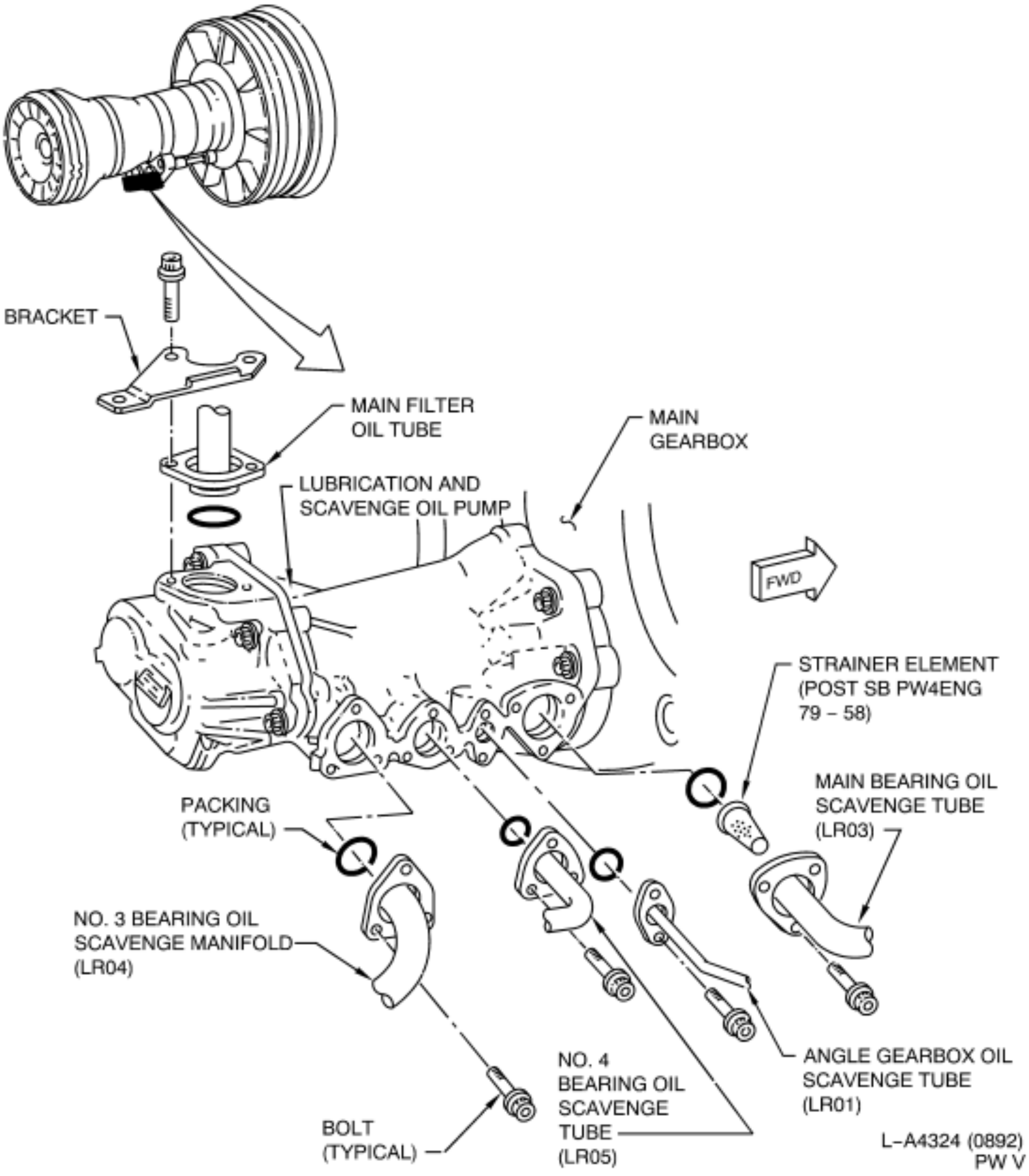
NOTE: If you cannot find the two threaded bolt holes on the oil pump flange, you cannot use the two PWA 86630 Jackscrew Pullers or PWA 88774 Jackscrew Pullers to remove the oil pump. To remove oil pumps without threaded bolt holes, carefully pull on the pump to remove it from the gearbox.

NOTE: To get the the two threaded bolt holes in the oil pump flange, see Sundstrand SB 5008437−79−4.

(6) Remove and discard packings from the five tubes previously disconnected from pump.

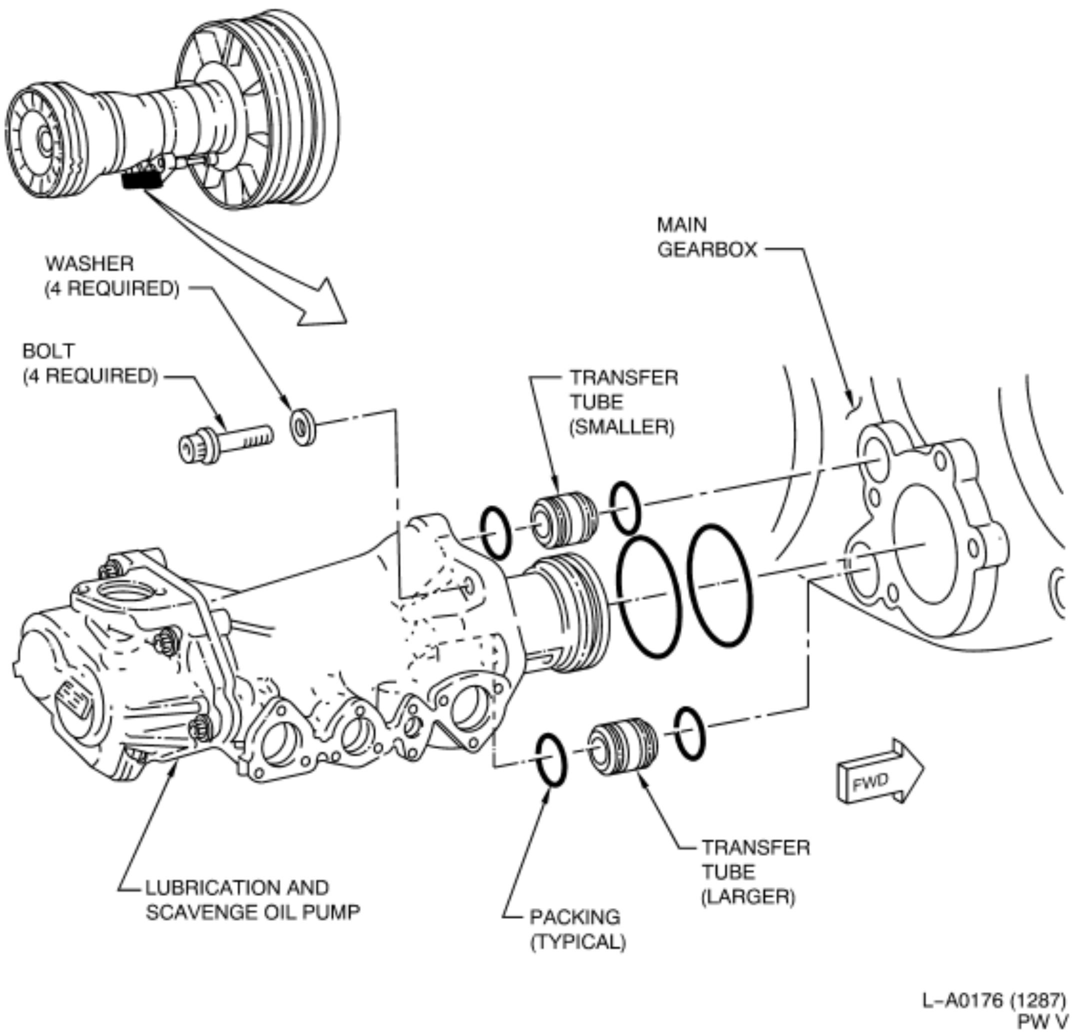
(7) Install the protection covers.

NOTE: For additional information concerning detailed maintenance of this component see Lubrication And Scavenge Oil Pump Component Maintenance Manual, 79−21−10 (Sundstrand Aviation).

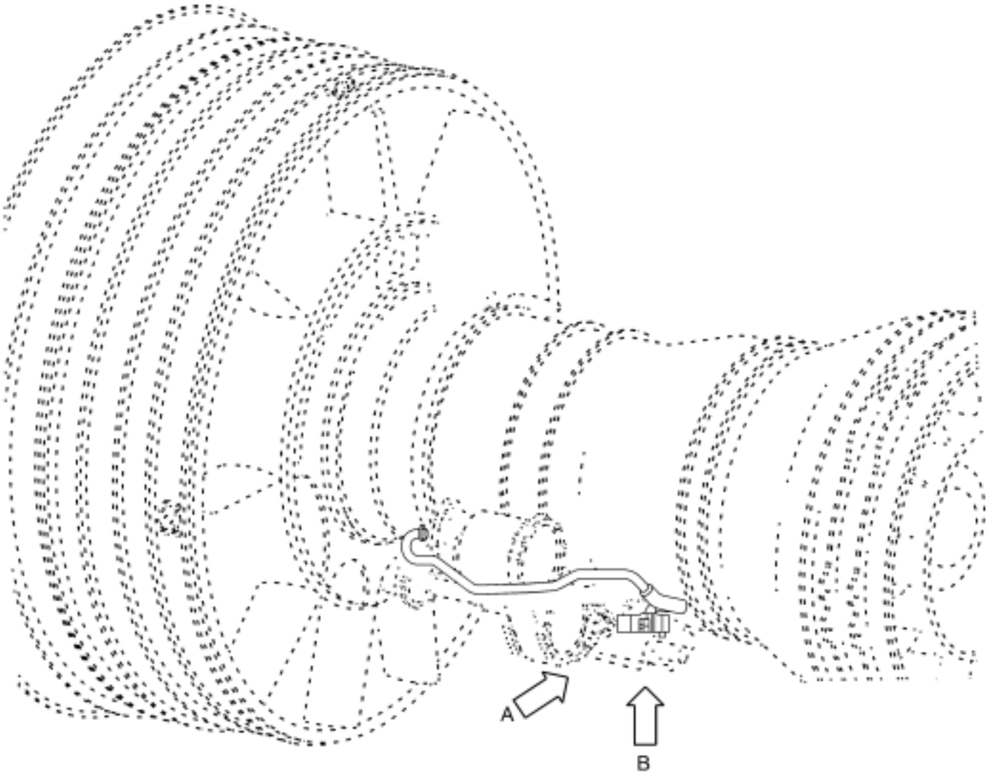

BRACKET
MAIN FILTER OIL TUBE
MAIN GEARBOX
LUBRICATION AND SCAVENGE OIL PUMP
FWD
STRAINER ELEMENT (POST SB PW4ENG 79 - 58)
MAIN BEARING OIL SCAVENGE TUBE (LR03)
PACKING (TYPICAL)
NO. 3 BEARING OIL SCAVENGE MANIFOLD (LR04)
ANGLE GEARBOX OIL SCAVENGE TUBE (LR01)
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
BOLT (TYPICAL)
L-A4324 (0892)
PW V

Lubrication And Scavenge Oil Pump (Pre SB PW4ENG 79-75)
Figure 301 (Sheet 1)
(Task 72-00-61-050-014)

R
R


MAIN GEARBOX
WASHER (4 REQUIRED)
BOLT (4 REQUIRED)
TRANSFER TUBE (SMALLER)
FWD
LUBRICATION AND SCAVENGE OIL PUMP
PACKING (TYPICAL)
TRANSFER TUBE (LARGER)
L-A0176 (1287)
PW V

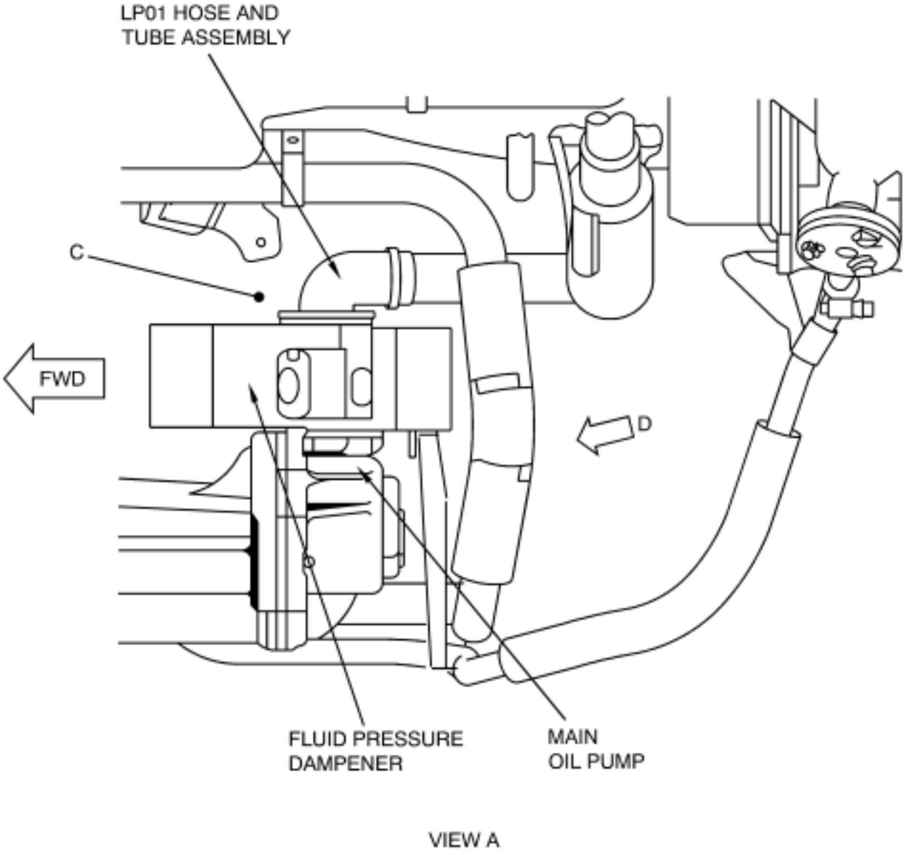
Lubrication And Scavenge Oil Pump
Figure 301 (Sheet 2)
(Task 72-00-61-050-014)



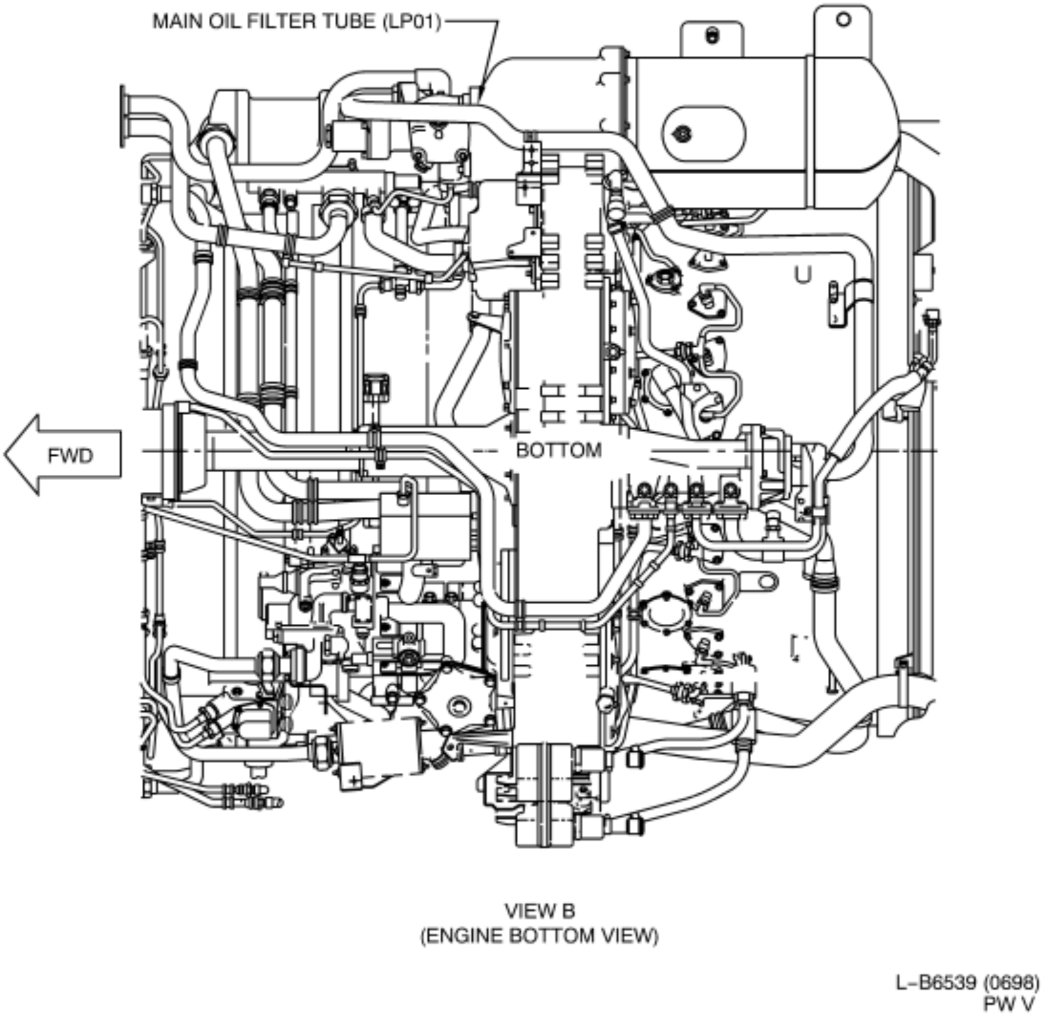
ENGINE LEFT SIDE VIEW

L-B2502 (0000)
PW V

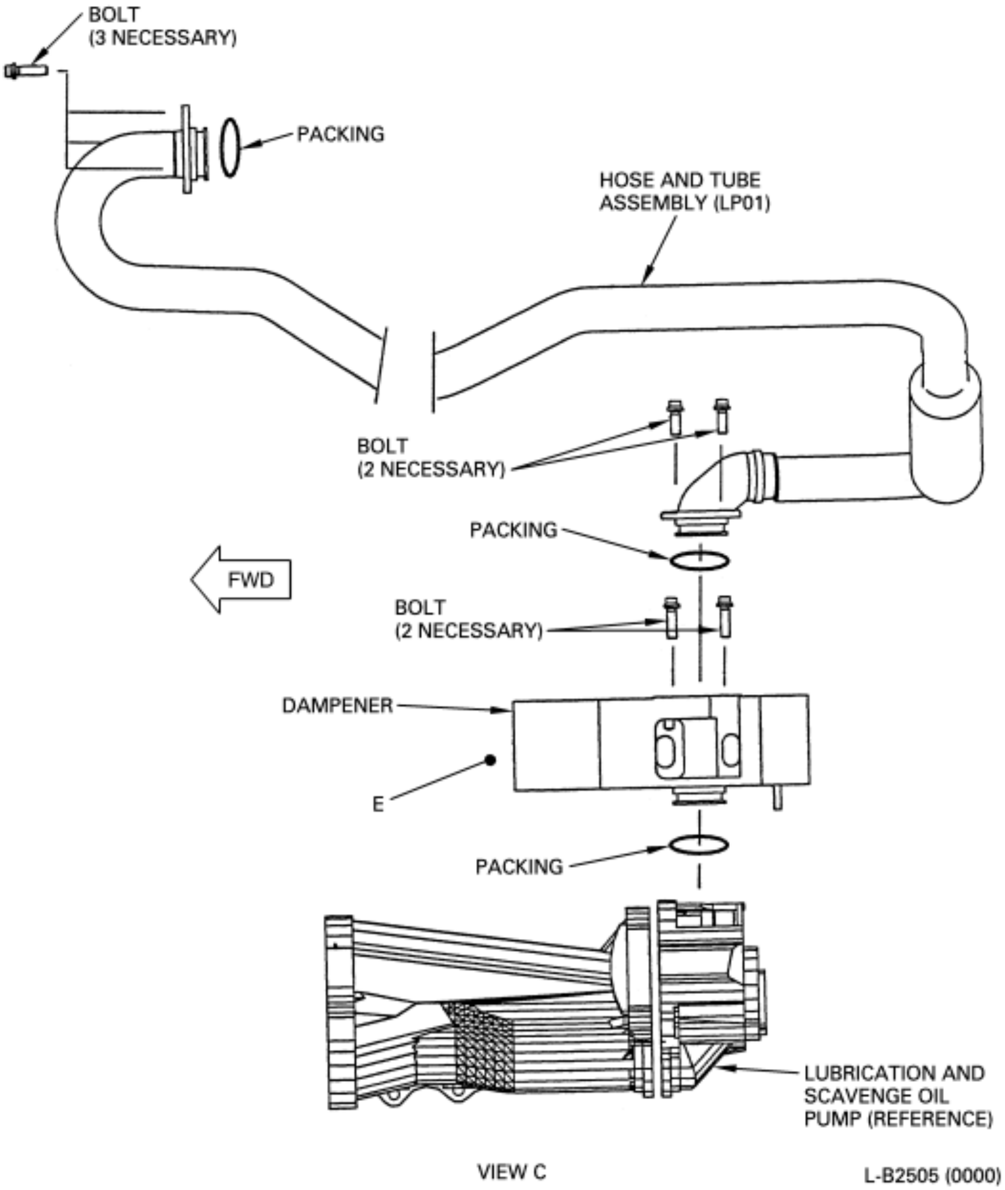
Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79-75)
Figure 302 (Sheet 1)
(Task 72-00-61-050-014)


LP01 HOSE AND TUBE ASSEMBLY
C
FWD
D
FLUID PRESSURE DAMPENER
MAIN OIL PUMP
VIEW A
L-B2503 (0000)
PW V

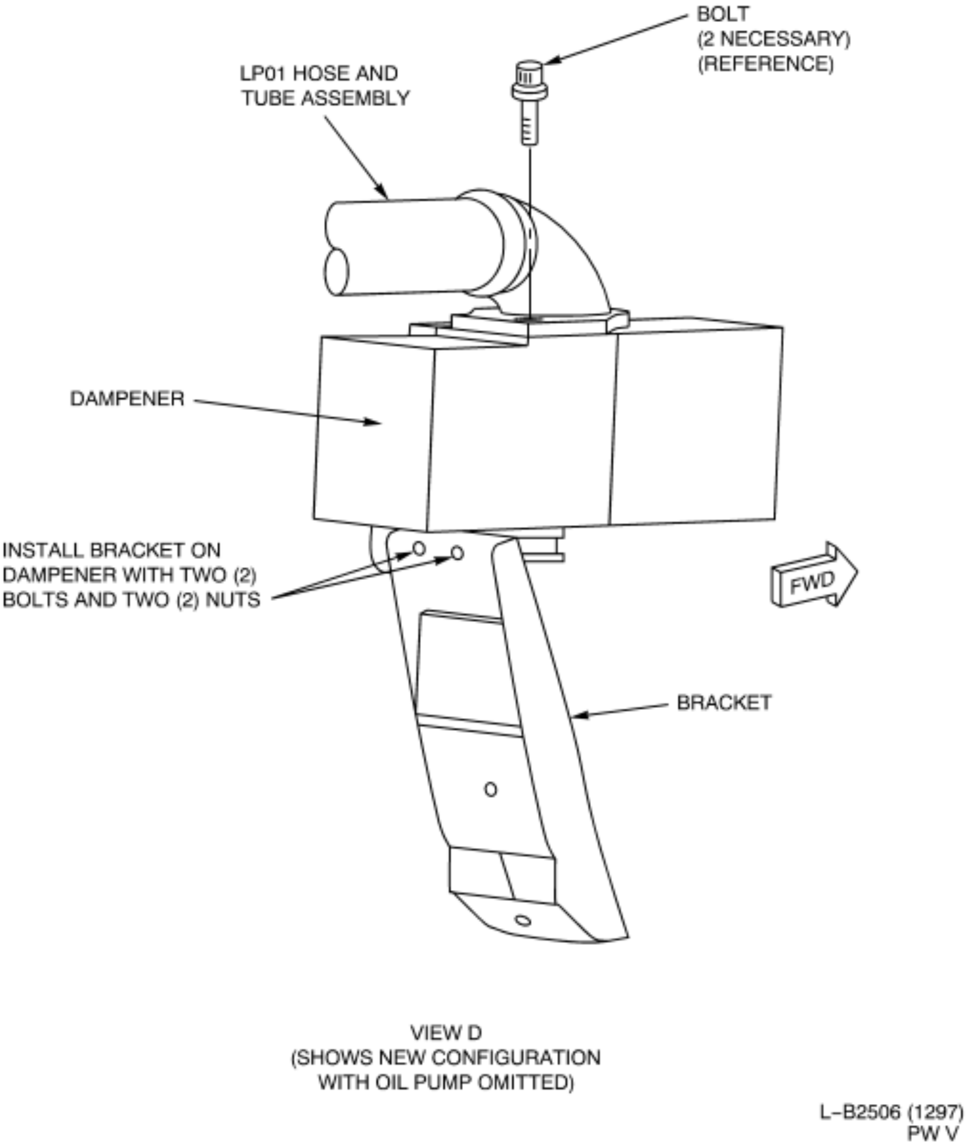
Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79-75)
Figure 302 (Sheet 2)
(Task 72-00-61-050-014)


MAIN OIL FILTER TUBE (LP01)
FWD
BOTTOM
VIEW B
(ENGINE BOTTOM VIEW)
L−B6539 (0698)
PW V

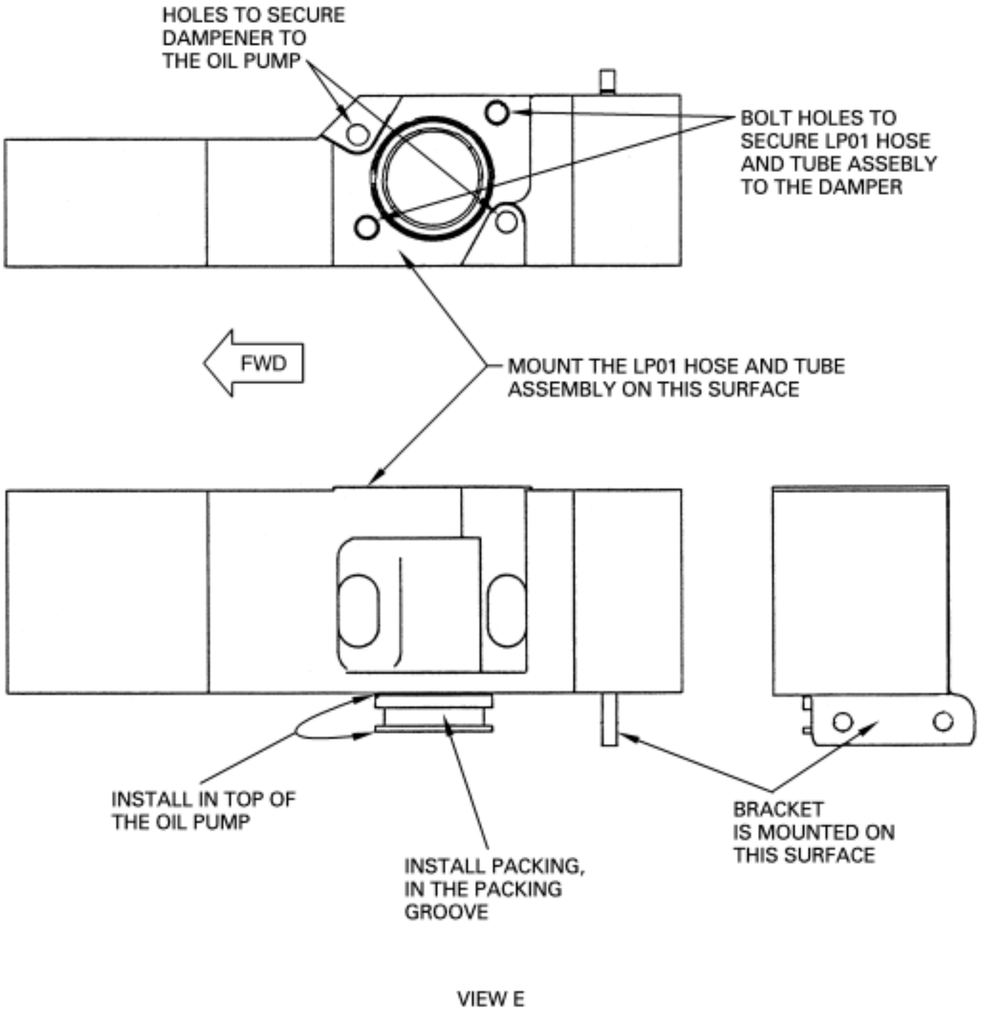
Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79−75)
Figure 302 (Sheet 3)
(Task 72−00−61−050−014)


BOLT
(3 NECESSARY)
PACKING
HOSE AND TUBE
ASSEMBLY (LP01)
BOLT
(2 NECESSARY)
PACKING
FWD
BOLT
(2 NECESSARY)
DAMPENER
E
PACKING
LUBRICATION AND
SCAVENGE OIL
PUMP (REFERENCE)
VIEW C
L-B2505 (0000)

Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79−75)
Figure 302 (Sheet 4)
(Task 72−00−61−050−014)

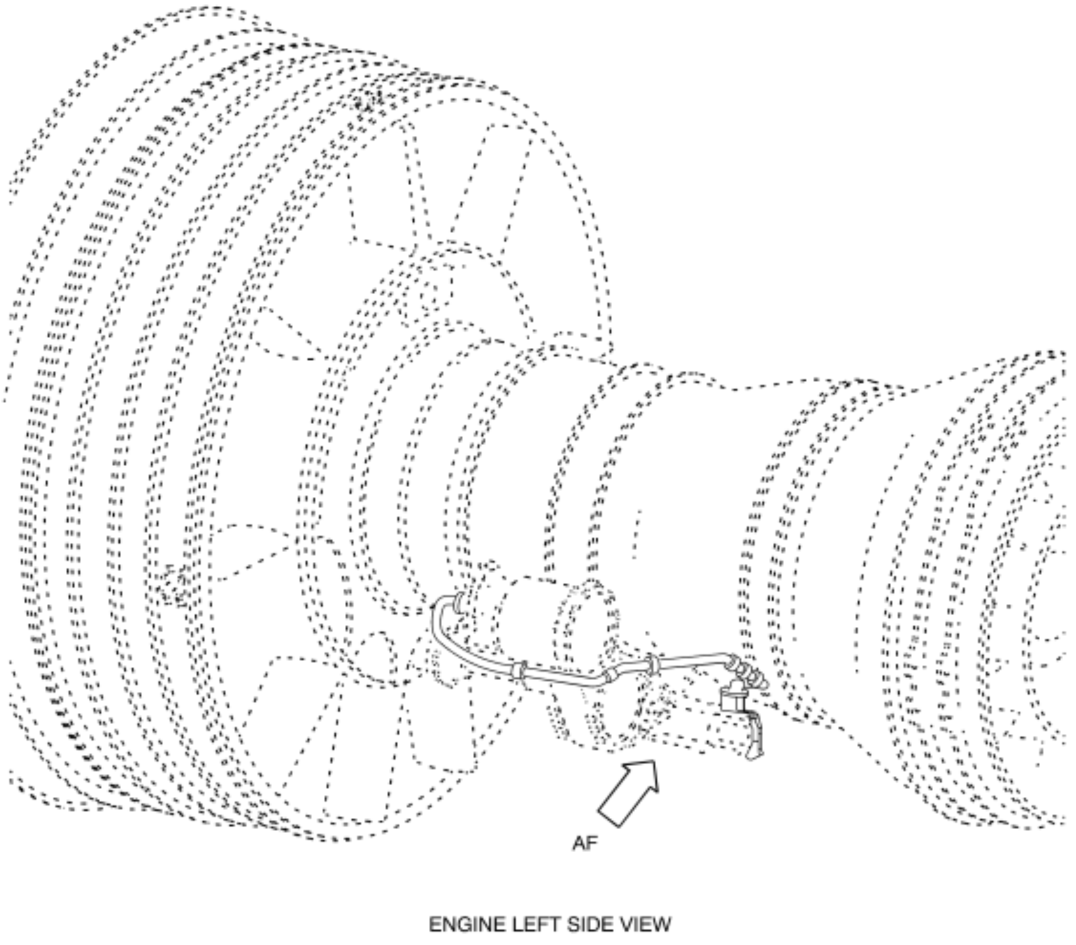

BOLT
(2 NECESSARY)
(REFERENCE)
LP01 HOSE AND
TUBE ASSEMBLY
DAMPENER
INSTALL BRACKET ON
DAMPENER WITH TWO (2)
BOLTS AND TWO (2) NUTS
FWD
BRACKET
VIEW D
(SHOWS NEW CONFIGURATION
WITH OIL PUMP OMITTED)
L-B2506 (1297)
PW V

Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79-75)
Figure 302 (Sheet 5)
(Task 72-00-61-050-014)


HOLES TO SECURE DAMPENER TO THE OIL PUMP
BOLT HOLES TO SECURE LP01 HOSE AND TUBE ASSEBLY TO THE DAMPER
FWD
MOUNT THE LP01 HOSE AND TUBE ASSEMBLY ON THIS SURFACE
INSTALL IN TOP OF THE OIL PUMP
INSTALL PACKING, IN THE PACKING GROOVE
BRACKET IS MOUNTED ON THIS SURFACE
VIEW E

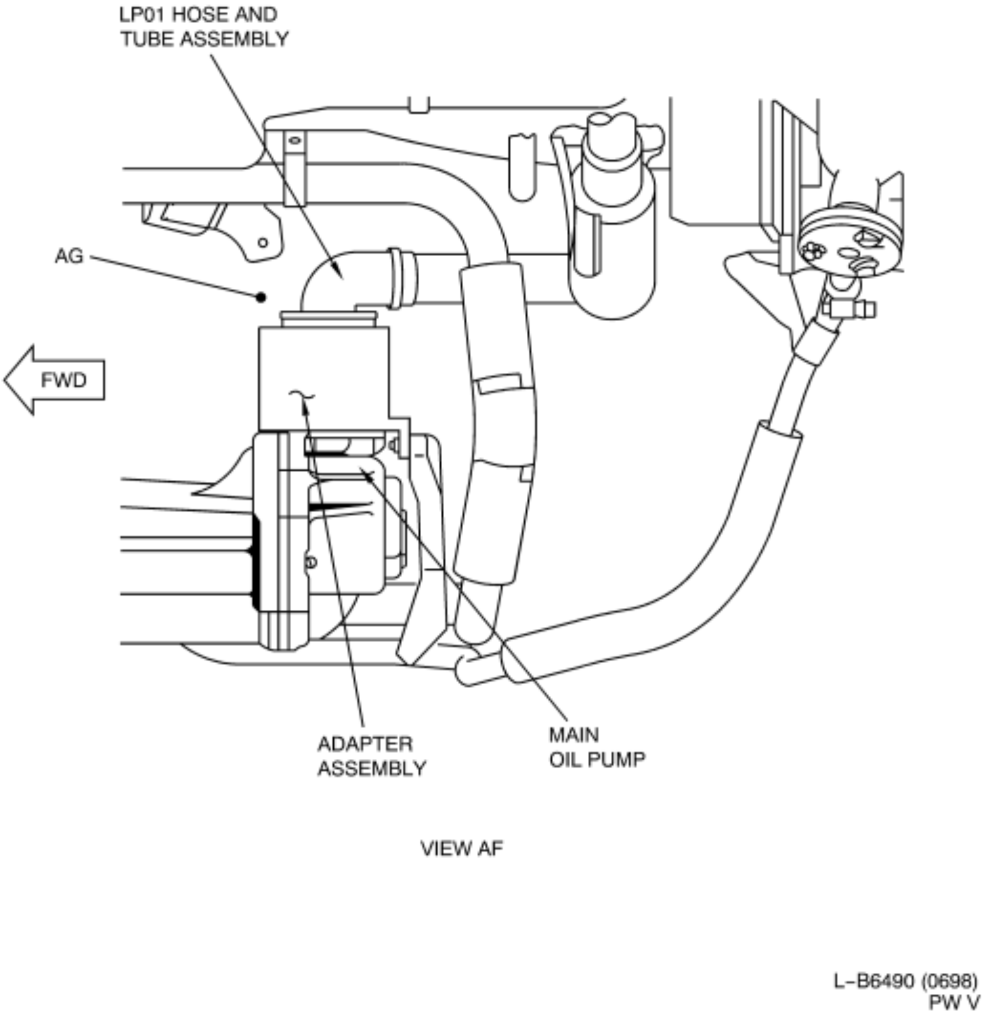
L-B2507 (0000)

Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79-75)
Figure 302 (Sheet 6)
(Task 72-00-61-050-014)

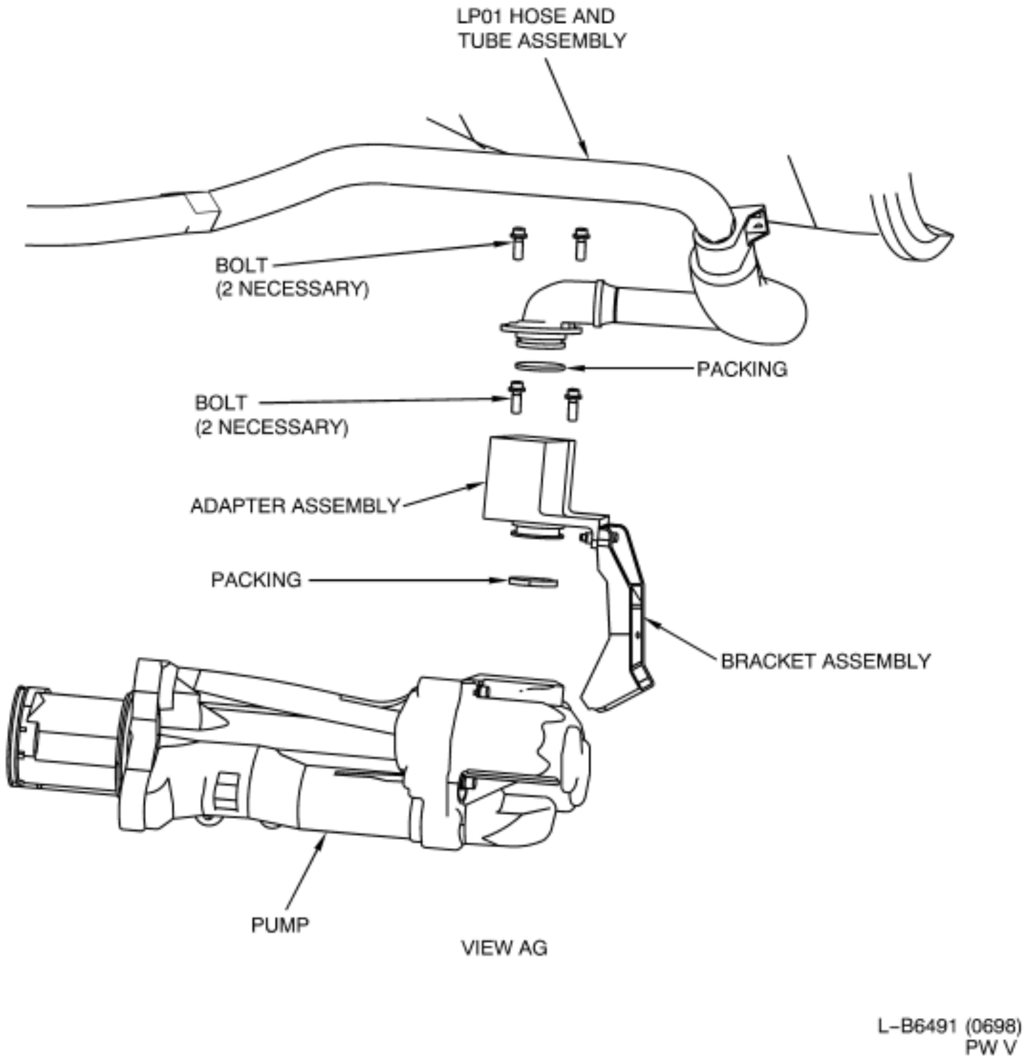


L-B6489 (0698)
PW V

Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79-86)
Figure 302 (Sheet 7)
(Task 72-00-61-050-014)


LP01 HOSE AND TUBE ASSEMBLY
AG
FWD
ADAPTER ASSEMBLY
MAIN OIL PUMP
VIEW AF
L−B6490 (0698)
PW V

Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79−86)
Figure 302 (Sheet 8)
(Task 72−00−61−050−014)


LP01 HOSE AND TUBE ASSEMBLY
BOLT (2 NECESSARY)
PACKING
BOLT (2 NECESSARY)
ADAPTER ASSEMBLY
PACKING
BRACKET ASSEMBLY
PUMP
VIEW AG
L−B6491 (0698)
PW V

Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79−86)
Figure 302 (Sheet 9)
(Task 72−00−61−050−014)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - MAIN GEARBOX - REMOVAL-33

Task 72-00-61-020-003:

1. Remove Main Gearbox

NOTE: See Figure 301 for part/assembly removal sequence.

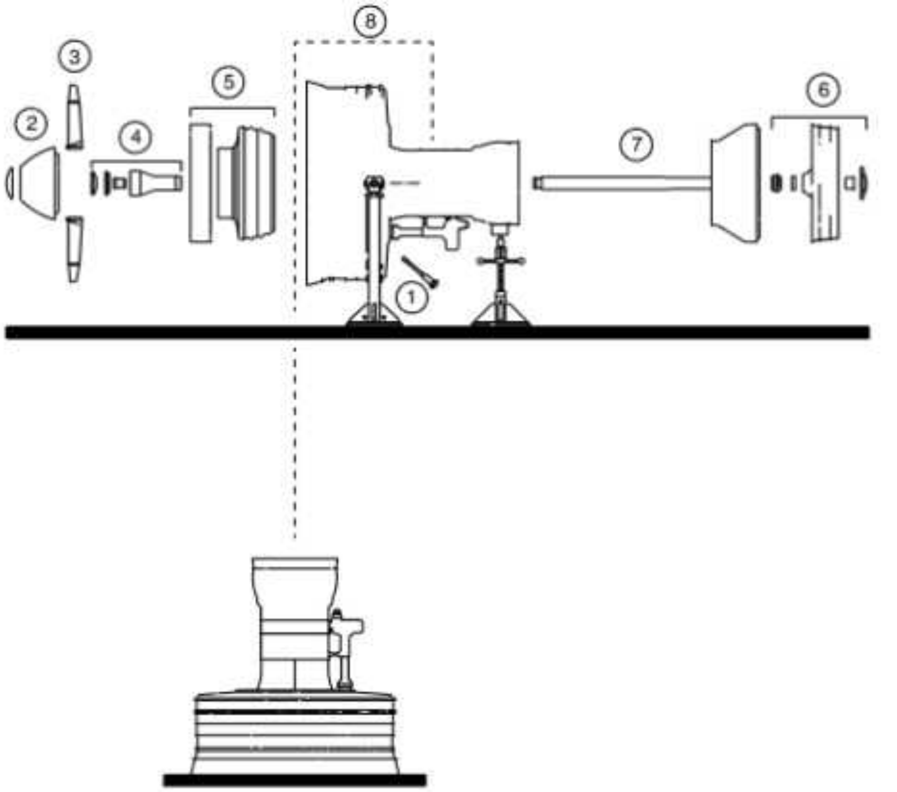
A. Prerequisites
  (1) Remove low pressure compressor per 72-00-31, Removal-01 (Task 72-00-31-020-003).
  (2) Remove turbine exhaust case per 72-00-54, Removal-01 (Task 72-00-54-020-001).
  (3) Remove LPT with shaft per 72-00-53, Removal-01 (Task 72-00-53-020-001).
  (4) Trunnion fan cases through HPT from horizontal to front end down.
  (5) Remove fuel pump and fuel metering unit (package) per Removal-05 (Task 72-00-61-050-003).
  (6) Remove ignition exciters per Removal-03 (Task 72-00-61-050-001) and Removal-04 (Task 72-00-61-050-002).
  (7) Remove the exciter-to-igniter plug cable (upper plug-upper box) per 72-00-41, Removal-04 (Task 72-00-41-050-001).
  (8) Remove the exciter-to-igniter plug cable (lower plug-lower box) per 72-00-41, Removal-05 (Task 72-00-41-050-002).
  (9) Disconnect the W3 and W5 EEC wiring harnesses from the main gearbox per 72-00-61, Removal-34 (Task 72-00-61-050-015).
  (10) Remove the external plumbing per Removal-02 (Task 72-00-61-020-003).

B. Equipment And Materials Required

Special Tools:
PWA 85123 Fixture, Handling (Optional to PWA 86056 Fixture)
PWA 85241 Arm, Lifting
PWA 86056 Fixture, Handling

C. Procedure
See Figures 302 through 304.
  (1) Using hoist and nylon sling, position PWA 86056 or PWA 85123 Handling Fixture (302/3) against main gearbox. Secure to main gearbox at four ground handling points using detail posts and screws (302/4). Remove sling.
  (2) Secure PWA 85241 Lifting Arm (302/1) to handling fixture using four detail screws (302/2). There are three possible attachment positions, depending on the components installed on gearbox.

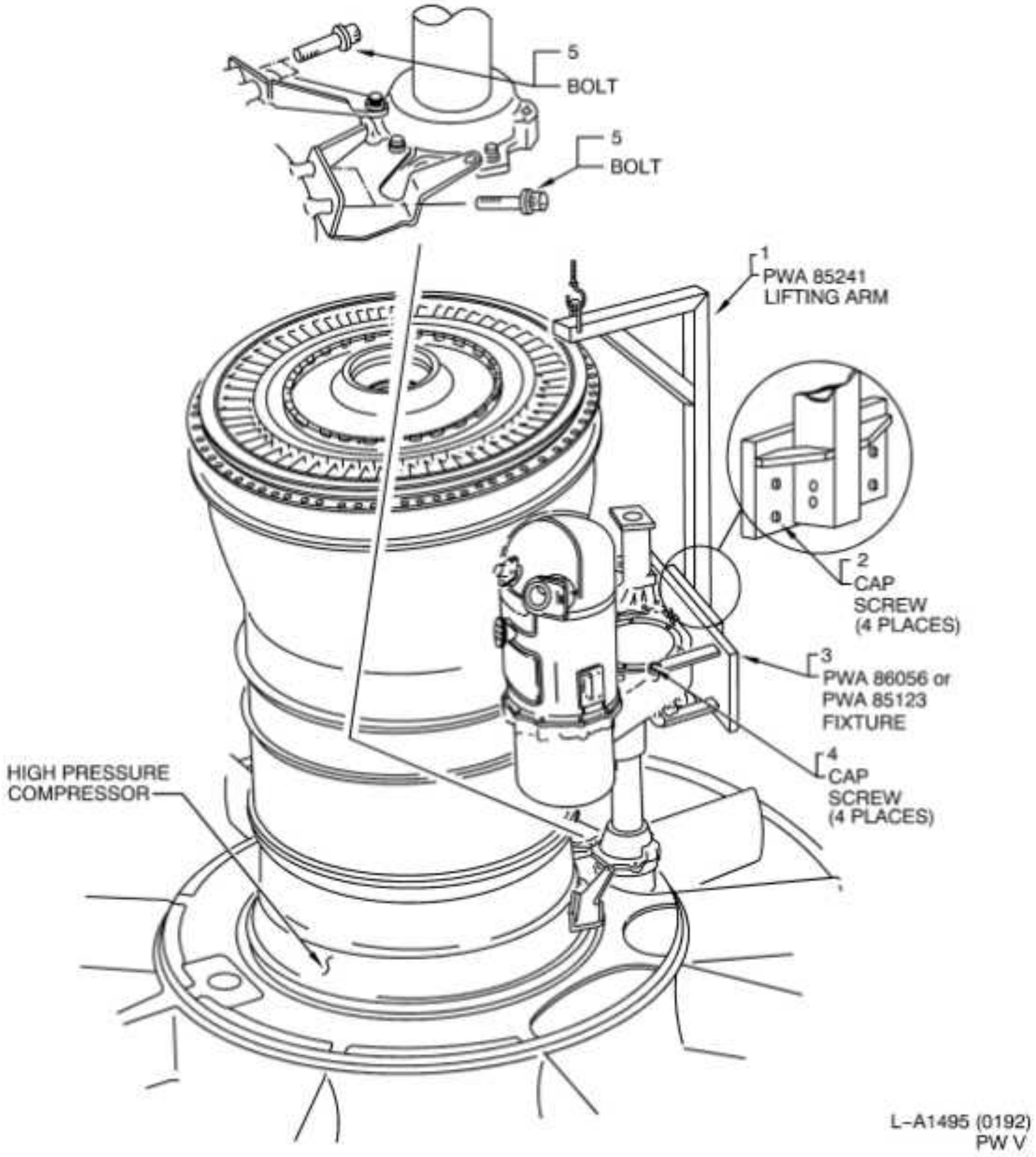
ENGINE GENERAL − MAIN GEARBOX − REMOVAL−33



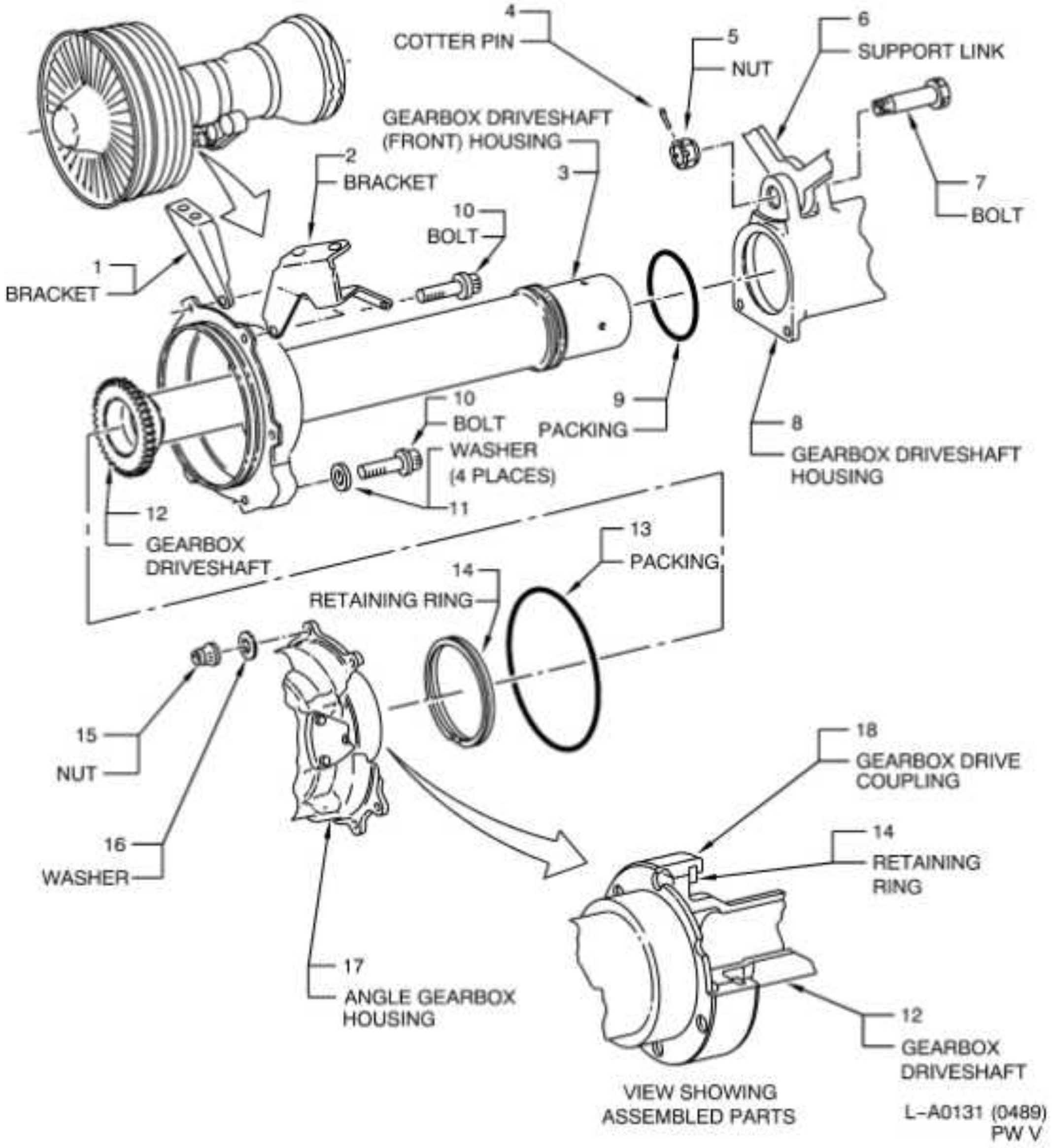
1. REMOVE N1 SPEED SENSOR
2. REMOVE COMPRESSOR INLET CONE
3. REMOVE FIRST STAGE (FAN) BLADES
4. REMOVE FAN/LPT COUPLING ASSEMBLY
5. REMOVE LPC GROUP
6. REMOVE TURBINE EXHAUST CASE GROUP
7. REMOVE LPT GROUP WITH SHAFT
8. TRUNNION FAN CASES THROUGH HPT FROM HORIZONTAL TO FRONT END DOWN

L−A1496 (0786)
PW V

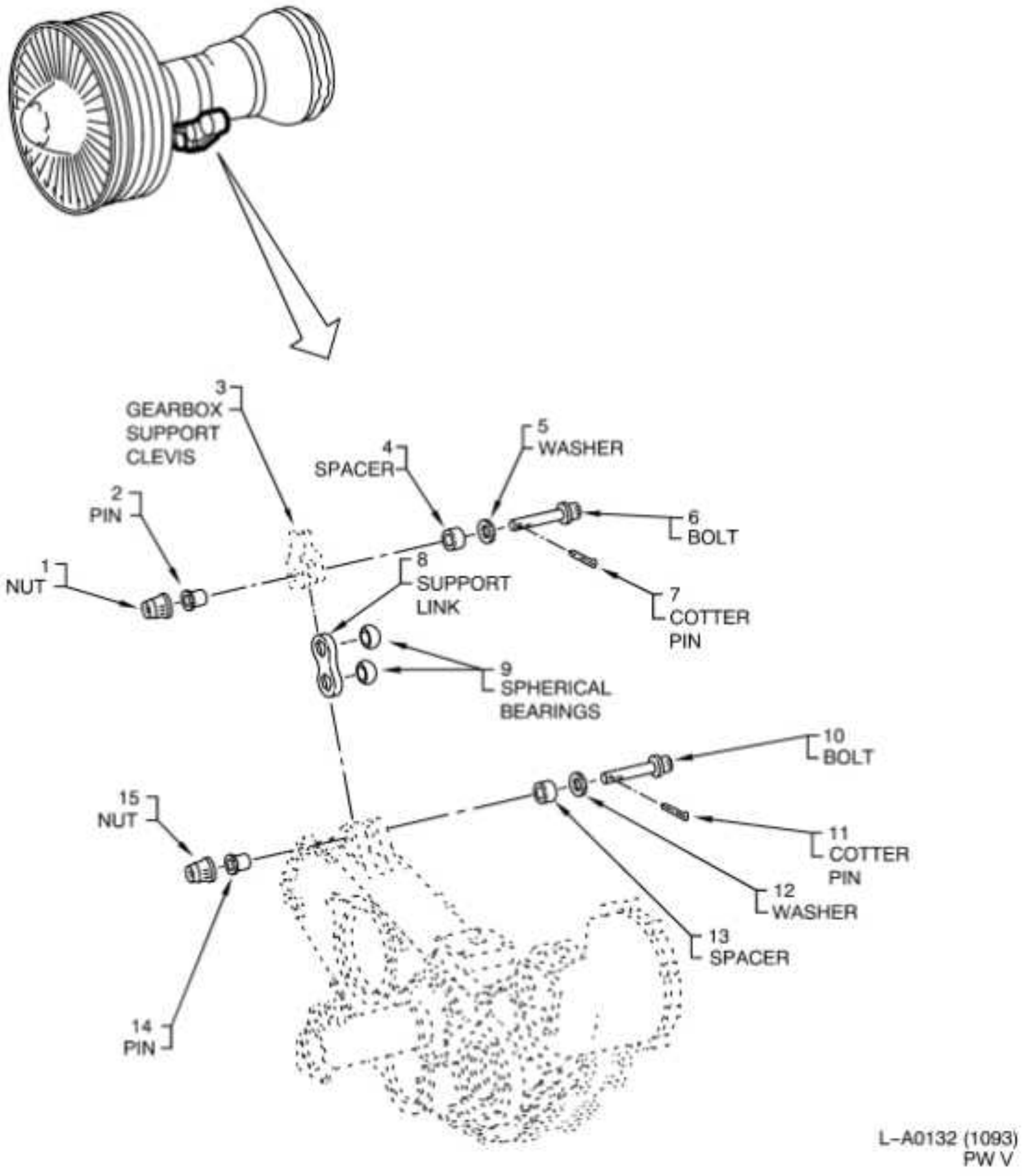
Procedure Sequence
Figure 301
(Task 72−00−61−020−003)


5
BOLT
5
BOLT
1
PWA 85241
LIFTING ARM
2
CAP
SCREW
(4 PLACES)
3
PWA 86056 or
PWA 85123
FIXTURE
4
CAP
SCREW
(4 PLACES)
HIGH PRESSURE
COMPRESSOR
L-A1495 (0192)
PW V

Main Gearbox Removal
Figure 302
(Task 72-00-61-020-003)


4
COTTER PIN
5
NUT
6
SUPPORT LINK
GEARBOX DRIVESHAFT (FRONT) HOUSING
3
2
BRACKET
7
BOLT
10
BOLT
1
BRACKET
10
BOLT
9
PACKING
8
GEARBOX DRIVESHAFT HOUSING
WASHER (4 PLACES)
11
12
GEARBOX DRIVESHAFT
13
PACKING
14
RETAINING RING
15
NUT
16
WASHER
17
ANGLE GEARBOX HOUSING
18
GEARBOX DRIVE COUPLING
14
RETAINING RING
12
GEARBOX DRIVESHAFT
VIEW SHOWING ASSEMBLED PARTS
L-A0131 (0489)
PW V

Main Gearbox Removal
Figure 303
(Task 72-00-61-020-003)


3 GEARBOX SUPPORT CLEVIS
4 SPACER
5 WASHER
2 PIN
6 BOLT
1 NUT
8 SUPPORT LINK
7 COTTER PIN
9 SPHERICAL BEARINGS
10 BOLT
15 NUT
11 COTTER PIN
12 WASHER
13 SPACER
14 PIN
L-A0132 (1093)
PW V

Main Gearbox Removal
Figure 304
(Task 72-00-61-020-003)

CAUTION: USE OF SCREWDRIVER, OR SIMILAR TOOL, TO SEPARATE DRIVESHAFT HOUSING FROM GEARBOX MAY RESULT IN DAMAGE TO SEALING SURFACES.

(3) Remove bolts (302/5) securing gearbox driveshaft (front) housing brackets (303/1) and (301/2) to high pressure compressor.
(4) Remove bolts (303/16), nuts (303/15), and washers (303/11) and (303/16) securing gearbox driveshaft (front) housing (303/3) to angle gearbox housing (303/17). Move housing (303/3) rearward. Temporarily secure driveshaft (front) housing. Discard packing (303/13). See Figure 303.
(5) Remove retaining ring (303/17) securing gearbox driveshaft (303/12) to gearbox drive coupling (303/18). Slide driveshaft rearward into main gearbox. Temporarily secure driveshaft.
(6) Remove cotter pin (303/4), nut (303/5), and bolt (303/7) securing support link (303/6) to gearbox driveshaft housing (303/8).
(7) Remove cotter pin (304/11), nut (304/15), pin (304/14), bolt (304/10), washer (304/12) and spacer (304/13) that attach the support link (304/8) to lugs on upper wall of left and right sides of gearbox. Discard the washers (304/12). Remove the jack and the gearbox. See Figure 304.
(8) If necessary, remove the support links (304/8) from the engine as follows.
    (a) Remove cotter pin (304/7), nut (304/1), pin (304/2), bolt (304/6), washer (304/5), and spacer (304/4) that attach the support link (304/8) to the gearbox support clevis (304/3) on each side of the engine.
    (b) Remove the support links. Discard the washers (304/5).
(9) Temporarily secure the spherical bearings (304/9) in the support links (304/8) for the gearbox and the support link (303/6) for the gearbox driveshaft housing.
(10) Pass sling through eye of lifting arm and, using hoist, lift gearbox away from engine.
(11) Position second nylon sling through boltholes in support lugs on upper left and right sides of gearbox and attach to second hoist.
(12) Remove lifting arm and handling fixture from gearbox.
(13) Move main gearbox to workbench. Remove hoist and sling.

CAUTION: CARE SHOULD BE TAKEN NOT TO DAMAGE SPLINES ON FRONT AND REAR ENDS OF DRIVESHAFT.

(14) Withdraw gearbox driveshaft (303/12) and driveshaft (front) housing (303/13). Discard packing (303/9).
(15) Position nylon sling through gearbox outer support lugs and attach hoist.
(16) Lift gearbox from workbench and lower onto pallet. Remove hoist and sling.
(17) Install protective covers over gearbox driveshaft housing and opening in angle gearbox.

ENGINE GENERAL - MAIN GEARBOX - REMOVAL-34

Task 72-00-61-050-015:

1. Remove The Core Engine EEC Wiring Harnesses W3 And W5 Prior To The Main Gearbox Removal

A. Equipment And Materials Required

Special Tools:
PWA 85749 Torque Adapter, Electronic Harness Connector

B. Procedure
See Figure 301.

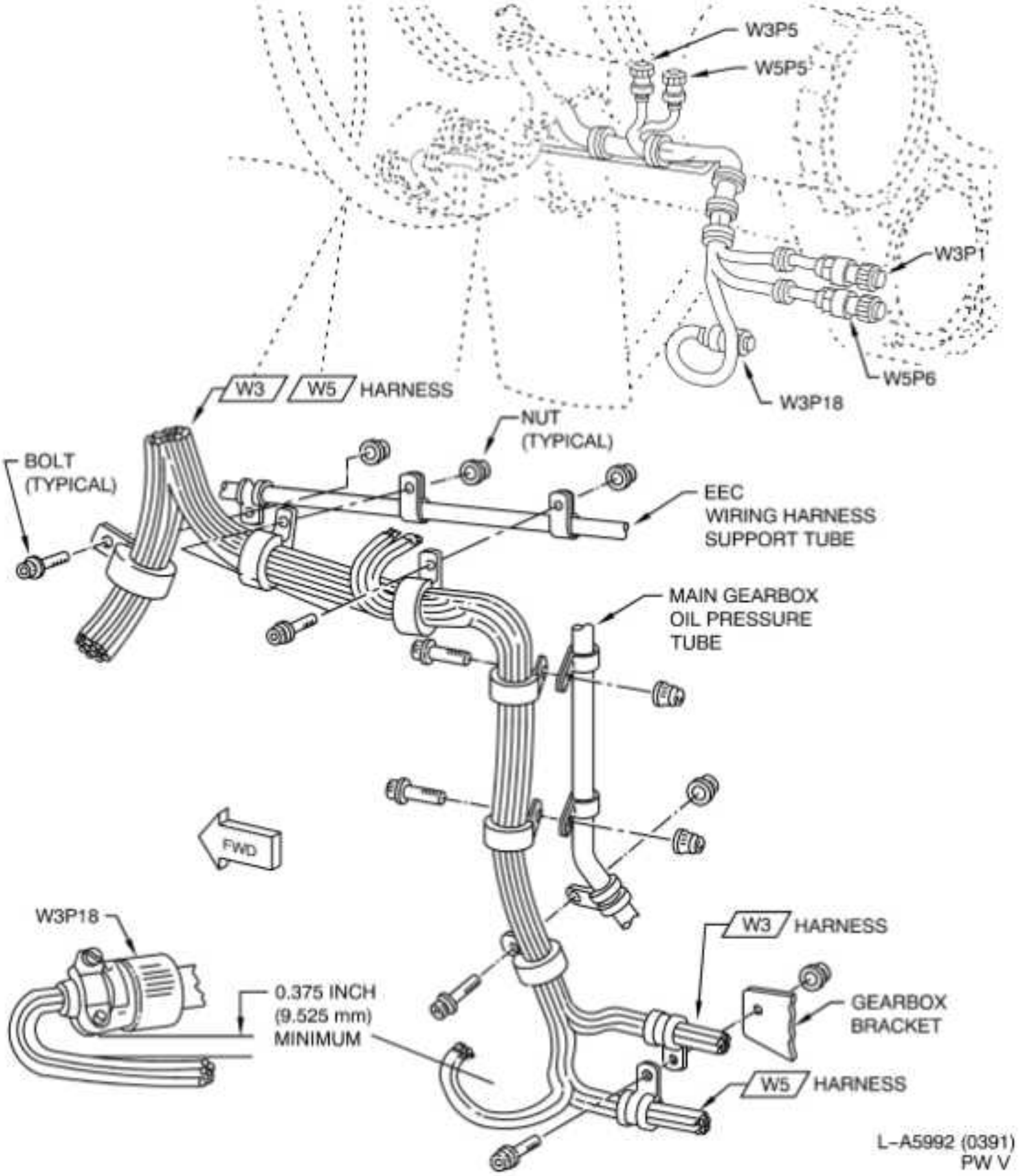
CAUTION: DO NOT TWIST OR BEND THE HARNESS BADLY DURING THE REMOVAL, OR DAMAGE TO THE HARNESS CAN OCCUR.

(1) Disconnect the following harness connectors from the components given below. Install a protective closure on each harness connector and mating receptacle. See Figures 301 for the connector to component locations.

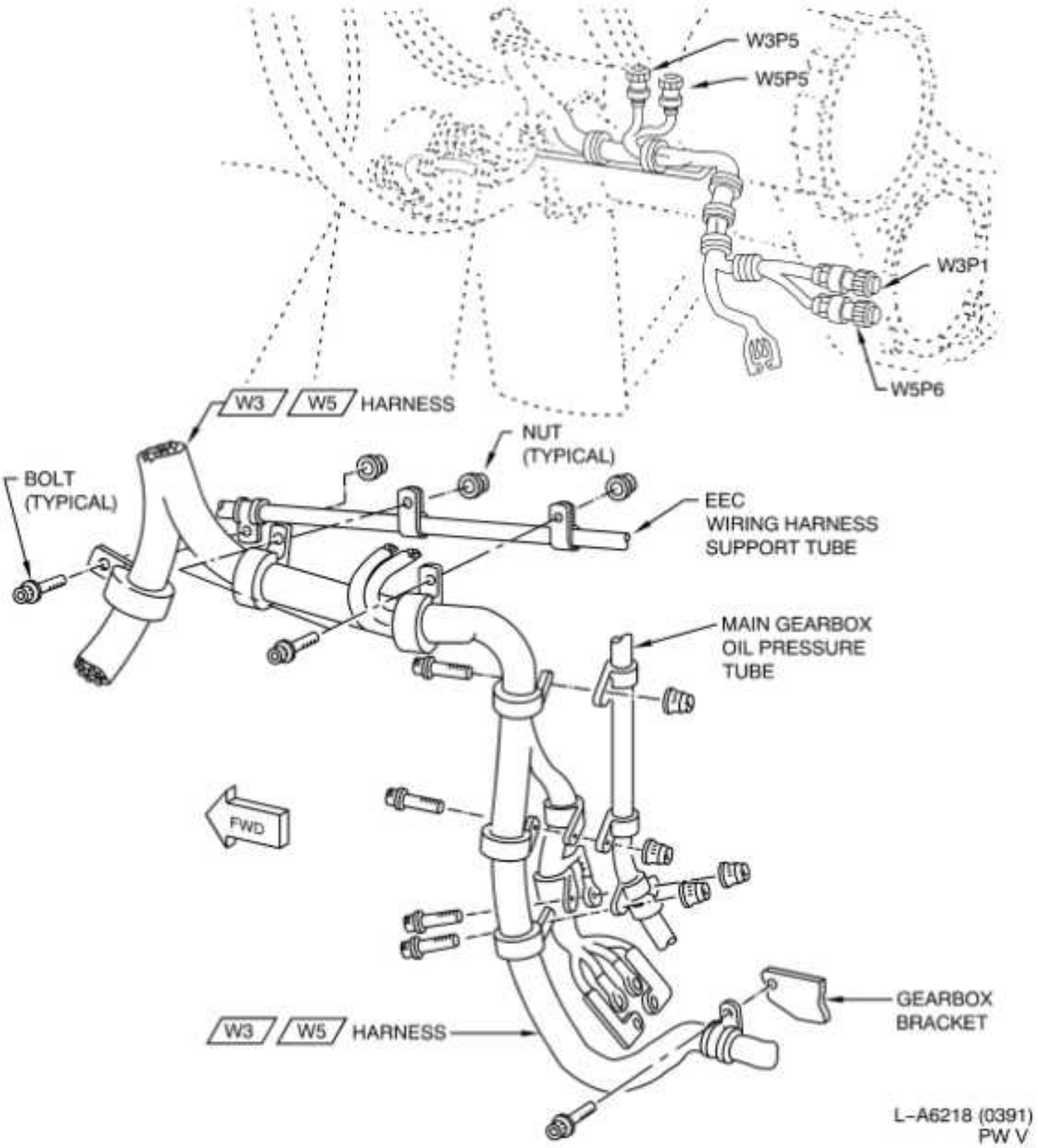
Connector	Component	Location
W3P18	EEC Oil Temperature Thermocouple Probe	Front Of Gearbox 7 O'clock
W3P1	EEC Alternator (Upper Connector)	Bottom Of Gearbox 7 O'clock
W5P6	EEC Alternator (Lower Connector)	Bottom Of Gearbox 7 O'clock

NOTE: Use a PWA 85749 Electronic Harness Connector Torque Adapter to disconnect the W5P6 and W3P1 harness connector.

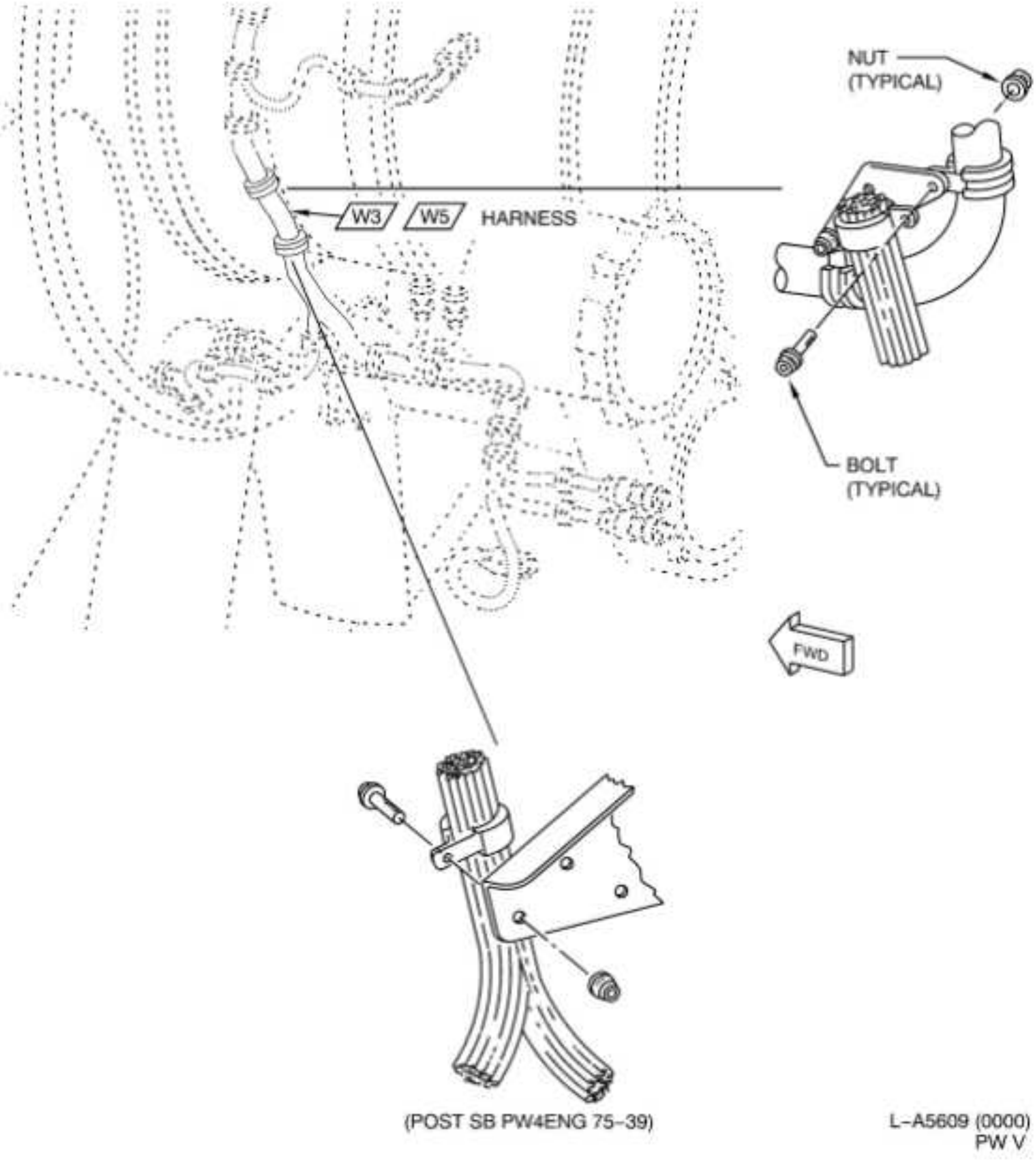
(2) Remove the bolts, nuts, and clamps that attach the W3 and W5 harnesses to brackets, and oil/support tubes. Carefully put harnesses and connectors clear of gearbox to prevent damage when gearbox is removed.


W3P5
W5P5
W3P1
W5P6
W3P18
W3 W5 HARNESS
NUT (TYPICAL)
BOLT (TYPICAL)
EEC WIRING HARNESS SUPPORT TUBE
MAIN GEARBOX OIL PRESSURE TUBE
FWD
W3P18
0.375 INCH (9.525 mm) MINIMUM
W3 HARNESS
GEARBOX BRACKET
W5 HARNESS
L-A5992 (0391)
PW V

Core Engine EEC Wiring Harnesses
(Pre SB PW4ENG 73−84)
Figure 301 (Sheet 1)
(Task 72−00−61−050−015)


W3P5
W5P5
W3P1
W5P6
W3 W5 HARNESS
NUT (TYPICAL)
BOLT (TYPICAL)
EEC WIRING HARNESS SUPPORT TUBE
MAIN GEARBOX OIL PRESSURE TUBE
FWD
GEARBOX BRACKET
W3 W5 HARNESS
L−A6218 (0391)
PW V

Core Engine EEC Wiring Harnesses
(Post SB PW4ENG 73−84)
Figure 301 (Sheet 2)
(Task 72−00−61−050−015)


NUT
(TYPICAL)
W3
W5
HARNESS
BOLT
(TYPICAL)
FWD
(POST SB PW4ENG 75−39)
L−A5609 (0000)
PW V

Core Engine EEC Wiring Harnesses
Figure 301 (Sheet 3)
(Task 72−00−61−050−015)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - MAIN GEARBOX - REMOVAL-35

Task 72-00-61-030-001:

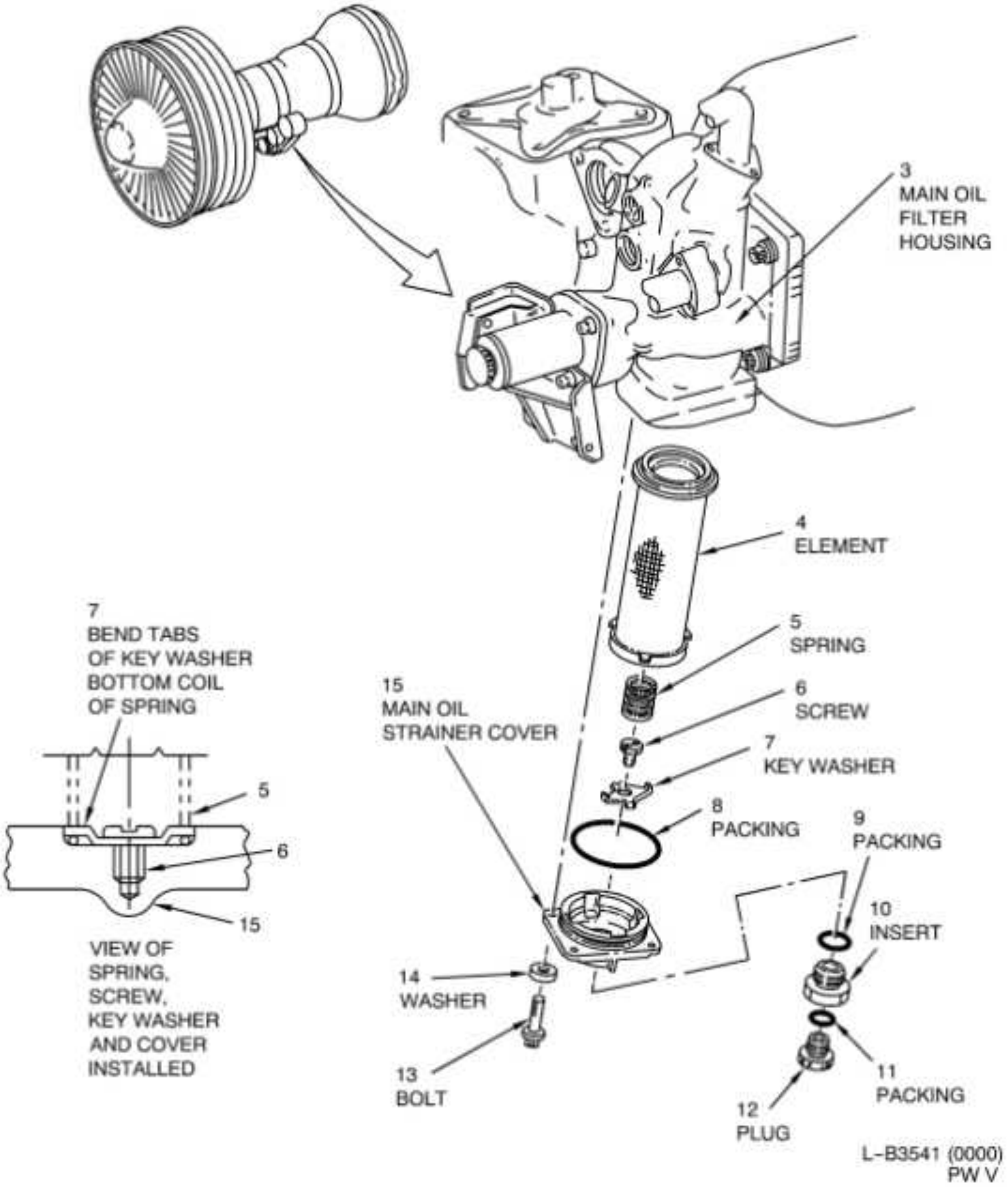
1. Remove Main Oil Filter
   - A. Equipment And Materials Required - None
   - B. Procedure

     See Figure 301.
     - (1) Drain oil from main oil filter housing assembly.
       - (a) Remove lockwire and plug from insert in cover assembly. Hold insert in place with wrench on flats while removing plug. Discard packing.

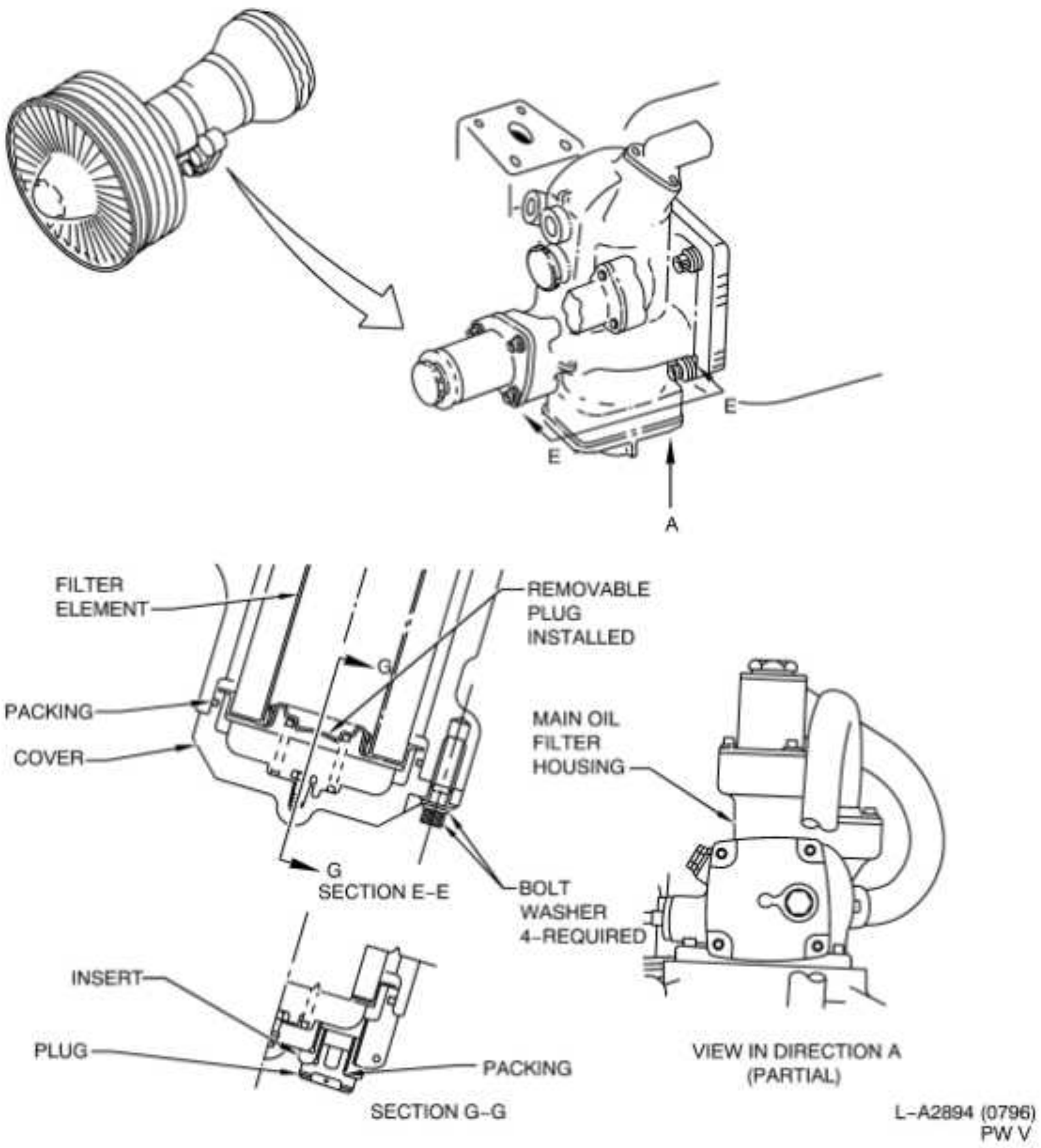
         NOTE: Be prepared to catch oil in a container with a minimum capacity of 5 U.S. gallons (19 liters).

       WARNING: FILTER COVER IS UNDER SPRING PRESSURE. EXERCISE CARE TO PREVENT PERSONAL INJURY DURING DISASSEMBLY.

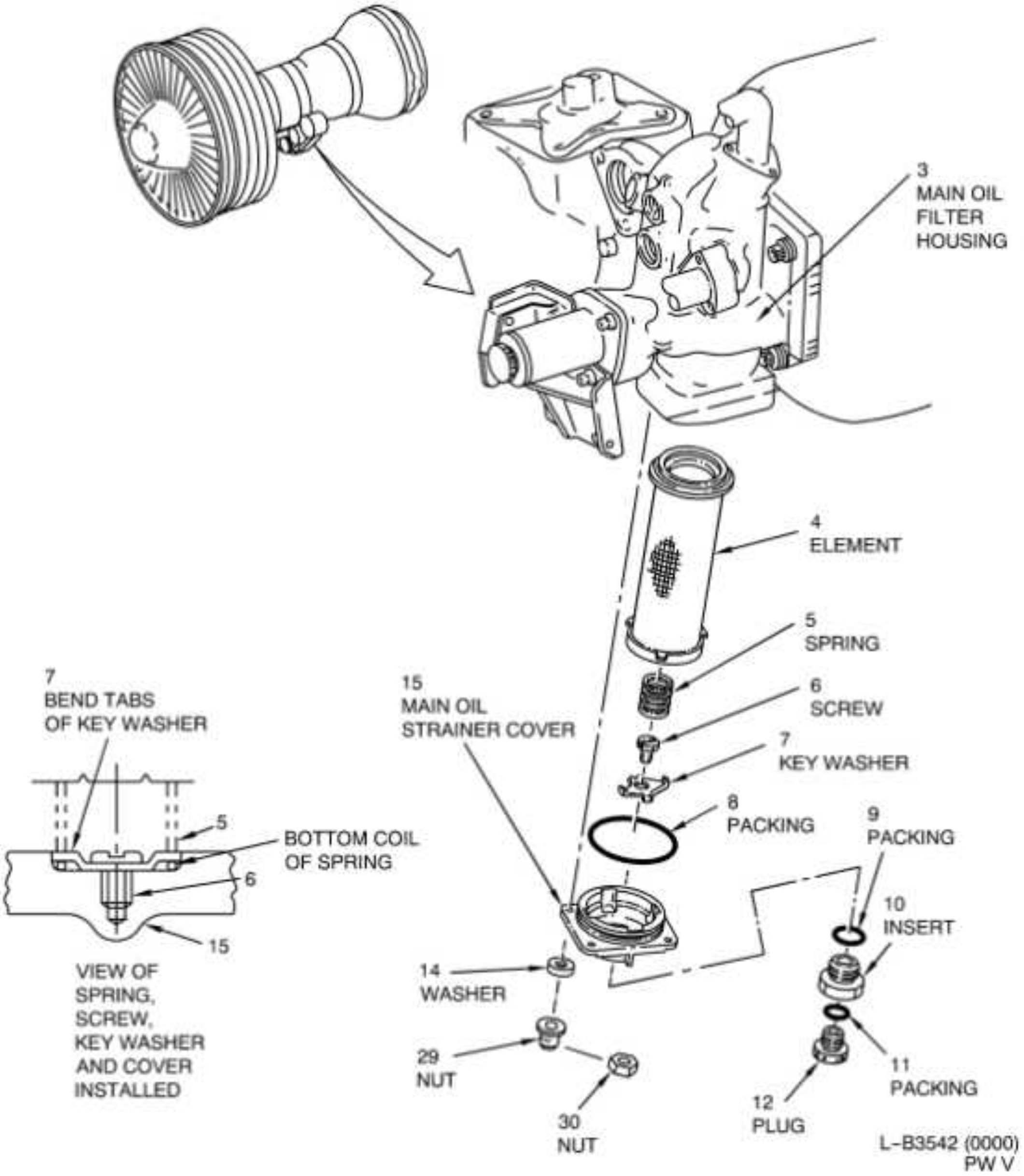
     - (2) (Pre PW4ENG 72-524) Remove the main oil filter element from the main oil filter housing assembly. See Figure 301 (Sheets 1 and 2).
       - (a) Remove lockwire, plug (301/12), and insert (301/10) from bottom port in main oil strainer cover (301/15). Discard packings (301/9 and 301/11).
       - (b) Remove four bolts (301/13) and washers (301/14) securing main oil strainer cover (301/15) to main oil filter housing (301/3). Remove cover and filter element (301/4) from housing. Remove filter element. Discard packing (301/8).
       - (c) Remove spring (301/5) from cover. Remove screw (301/6) securing key washer (301/7) to cover. Remove key washer and discard.
     - (3) (Post PW4ENG 72-524 and Pre SB PW4ENG 79-79) Remove the main oil filter element from the main oil filter housing assembly. See Figure 301 (Sheets 3 and 4).
       - (a) Remove lockwire, plug (301/12), and insert (301/10) from bottom port in main oil strainer cover (301/15). Discard packings (301/9 and 301/11).
       - (b) Remove lockwire, if necessary, the four nuts (301/29) or (301/30) and the washers (301/14) that secure the main oil strainer cover (301/15) to main oil filter housing (301/3). Remove cover and filter element (301/4) from housing. Remove filter element. Discard packing (301/8).
       - (c) Remove spring (301/5) from cover. Remove screw (301/6) securing key washer (301/7) to cover. Remove key washer and discard.


3
MAIN OIL
FILTER
HOUSING
4
ELEMENT
5
SPRING
6
SCREW
7
KEY WASHER
8
PACKING
9
PACKING
10
INSERT
11
PACKING
12
PLUG
13
BOLT
14
WASHER
15
MAIN OIL
STRAINER COVER
7
BEND TABS
OF KEY WASHER
BOTTOM COIL
OF SPRING
5
6
15
VIEW OF
SPRING,
SCREW,
KEY WASHER
AND COVER
INSTALLED
L-B3541 (0000)
PW V

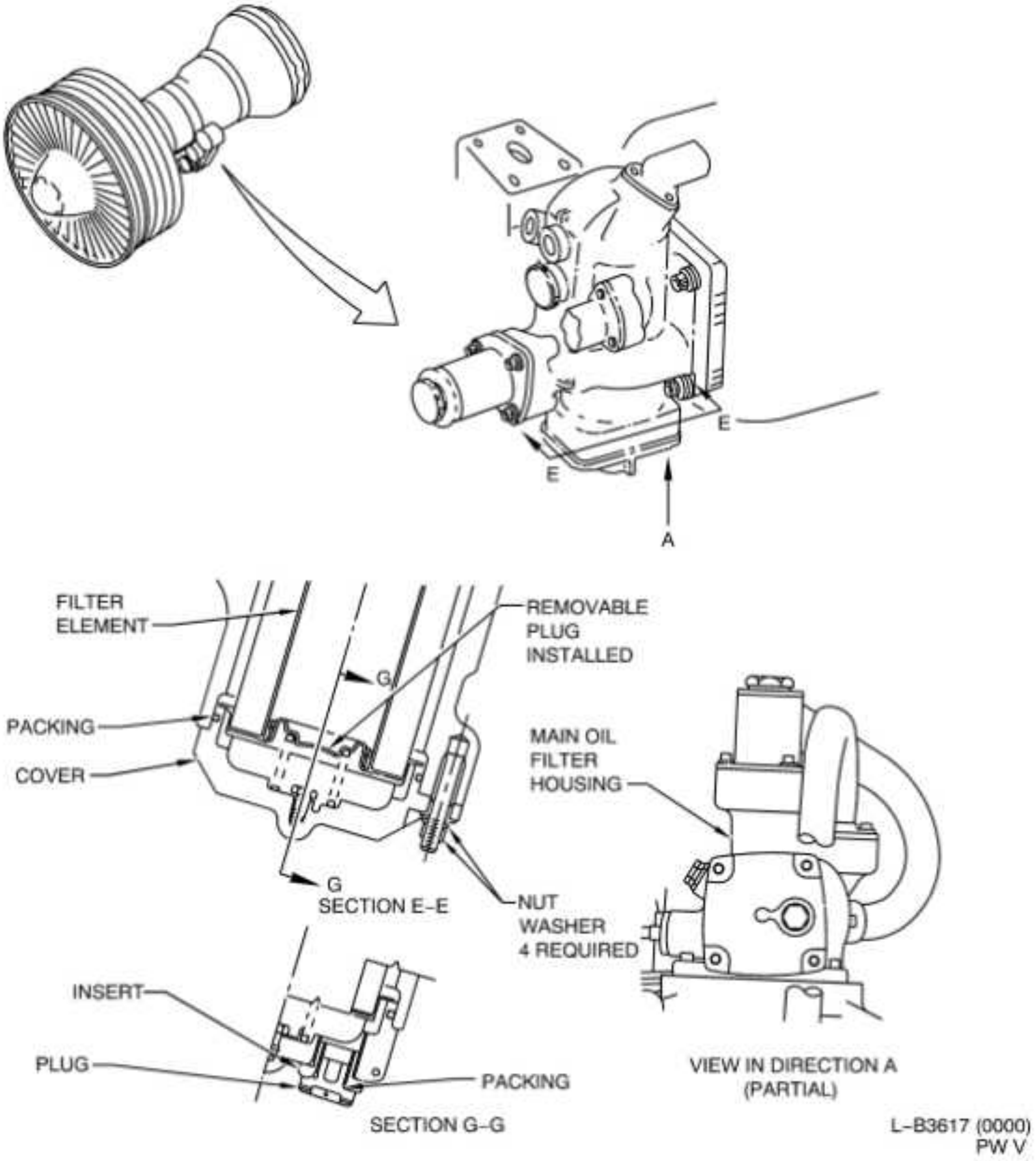
Main Oil Filter Assembly
(Pre SB PW4ENG 72−524)
Figure 301 (Sheet 1)
(Task 72−00−61−030−001)


E
E
A
FILTER ELEMENT
REMOVABLE PLUG INSTALLED
G
PACKING
COVER
G
SECTION E-E
BOLT
WASHER
4-REQUIRED
MAIN OIL FILTER HOUSING
INSERT
PLUG
PACKING
SECTION G-G
VIEW IN DIRECTION A (PARTIAL)
L-A2894 (0796)
PW V

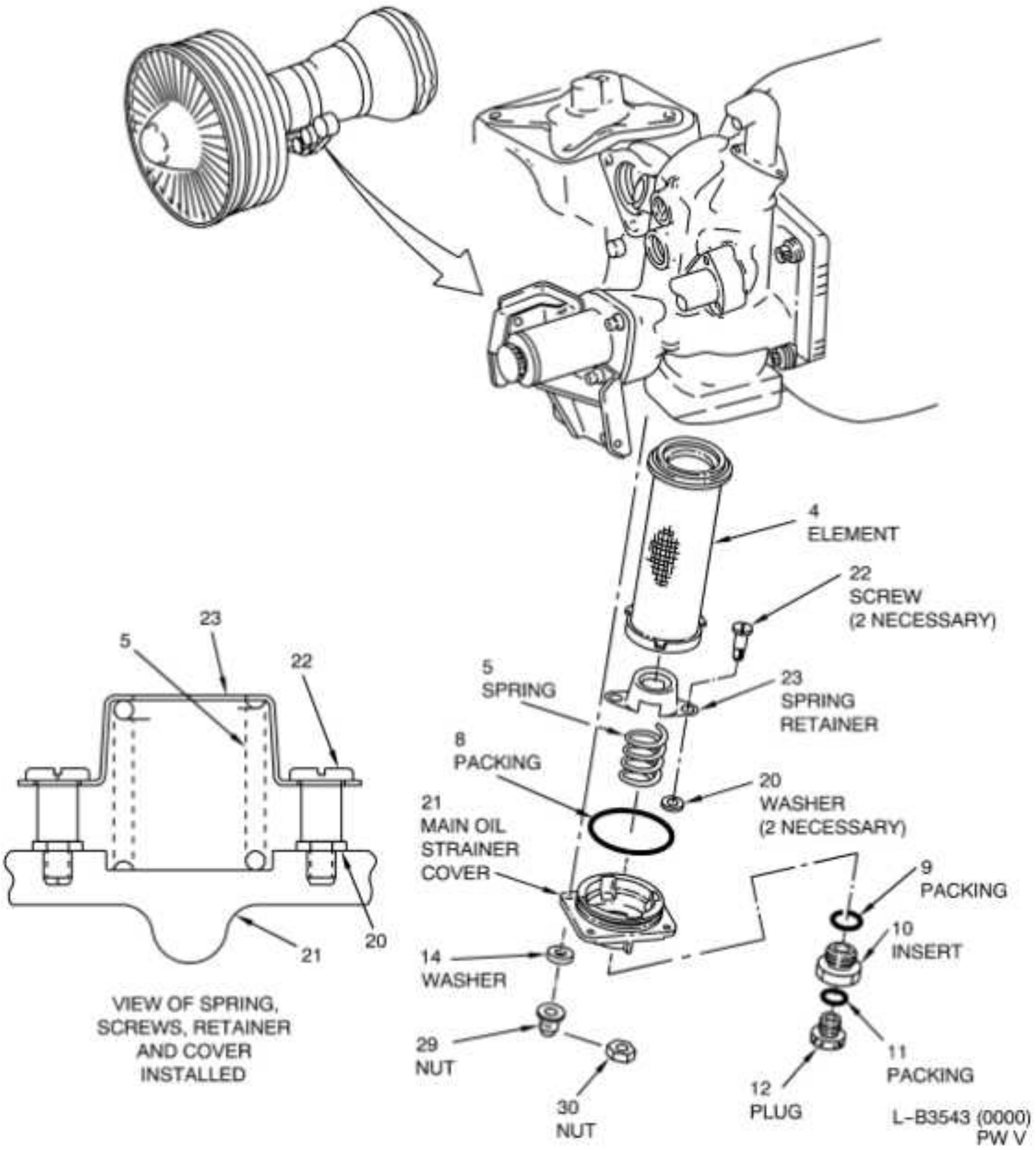
Main Oil Filter Assembly
(Pre SB PW4ENG 72−524)
Figure 301 (Sheet 2)
(Task 72−00−61−030−001)


3
MAIN OIL
FILTER
HOUSING
4
ELEMENT
5
SPRING
6
SCREW
7
KEY WASHER
8
PACKING
9
PACKING
10
INSERT
11
PACKING
12
PLUG
14
WASHER
15
MAIN OIL
STRAINER COVER
29
NUT
30
NUT
7
BEND TABS
OF KEY WASHER
5
BOTTOM COIL
OF SPRING
6
15
VIEW OF
SPRING,
SCREW,
KEY WASHER
AND COVER
INSTALLED
L-B3542 (0000)
PW V

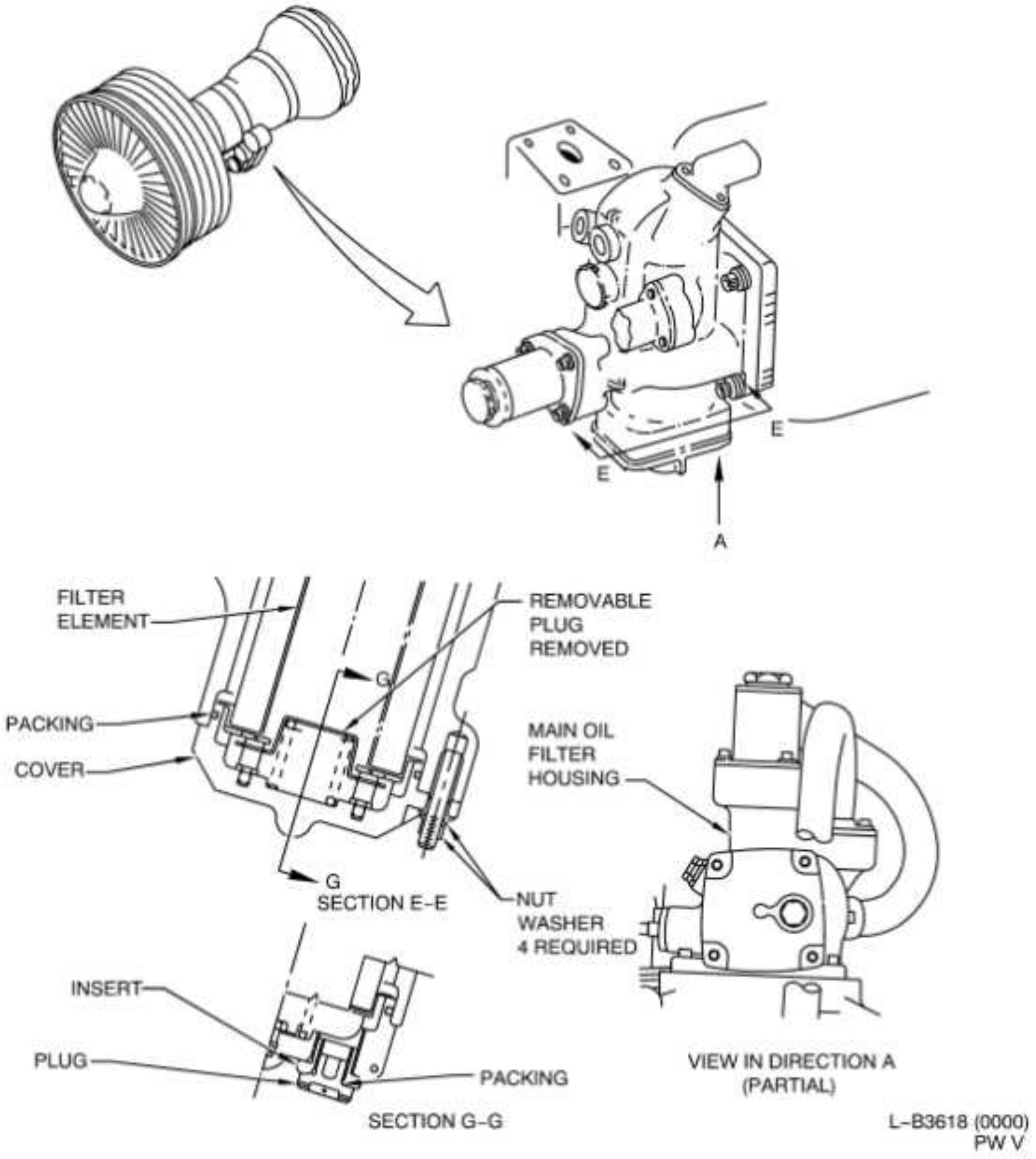
Main Oil Filter Assembly
(Post SB PW4ENG 72−524 And Pre SB PW4ENG 79−79)
Figure 301 (Sheet 3)
(Task 72−00−61−030−001)


E
E
A
FILTER ELEMENT
REMOVABLE PLUG INSTALLED
G
PACKING
COVER
MAIN OIL FILTER HOUSING
G
SECTION E–E
NUT
WASHER
4 REQUIRED
INSERT
PLUG
PACKING
SECTION G–G
VIEW IN DIRECTION A (PARTIAL)
L–B3617 (0000)
PW V

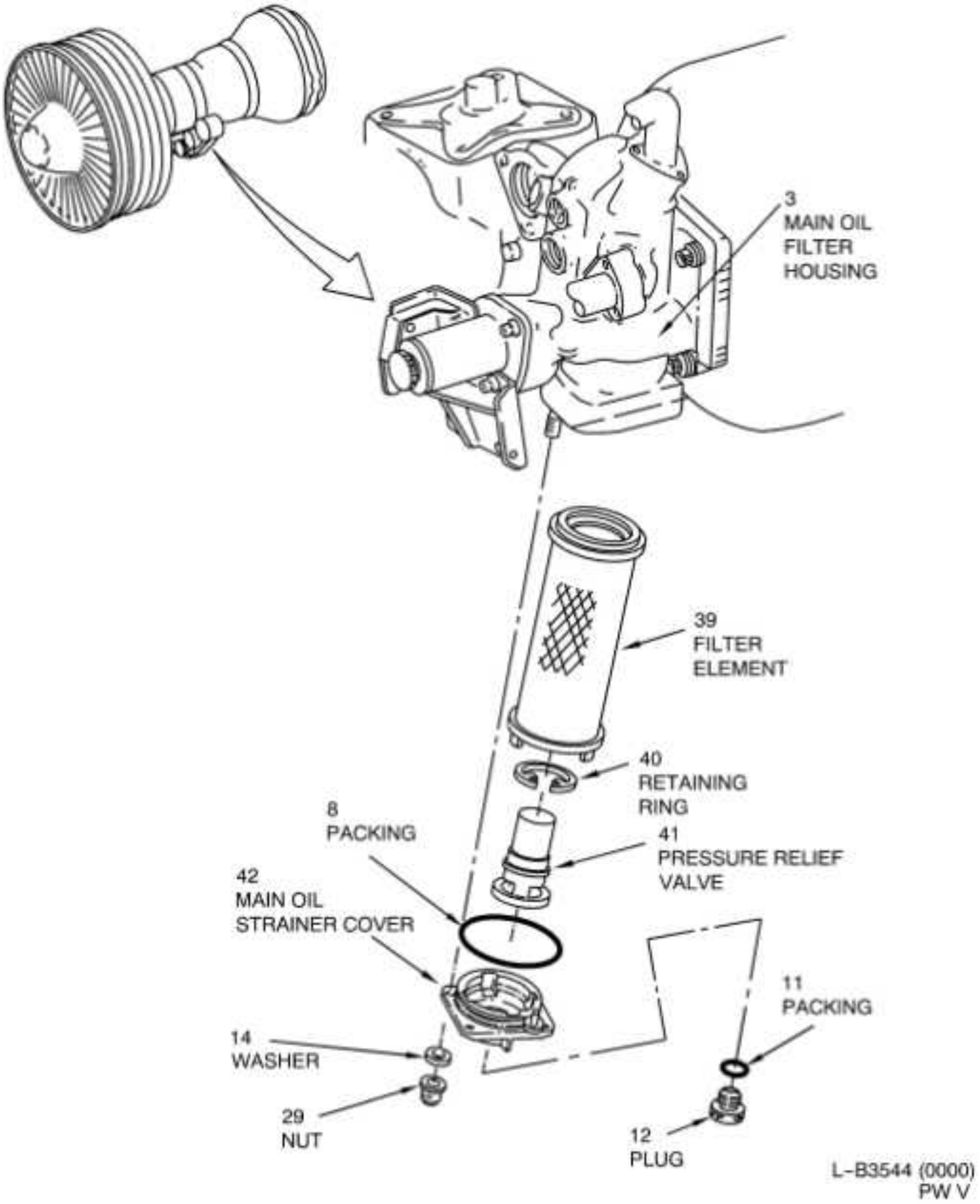
Main Oil Filter Assembly
(Post SB PW4ENG 72−524 And Pre SB PW4ENG 79−79)
Figure 301 (Sheet 4)
(Task 72−00−61−030−001)


4
ELEMENT
22
SCREW
(2 NECESSARY)
23
5
22
5
SPRING
23
SPRING
RETAINER
8
PACKING
20
WASHER
(2 NECESSARY)
21
MAIN OIL
STRAINER
COVER
9
PACKING
10
INSERT
21
20
14
WASHER
VIEW OF SPRING,
SCREWS, RETAINER
AND COVER
INSTALLED
29
NUT
11
PACKING
30
NUT
12
PLUG
L-B3543 (0000)
PW V

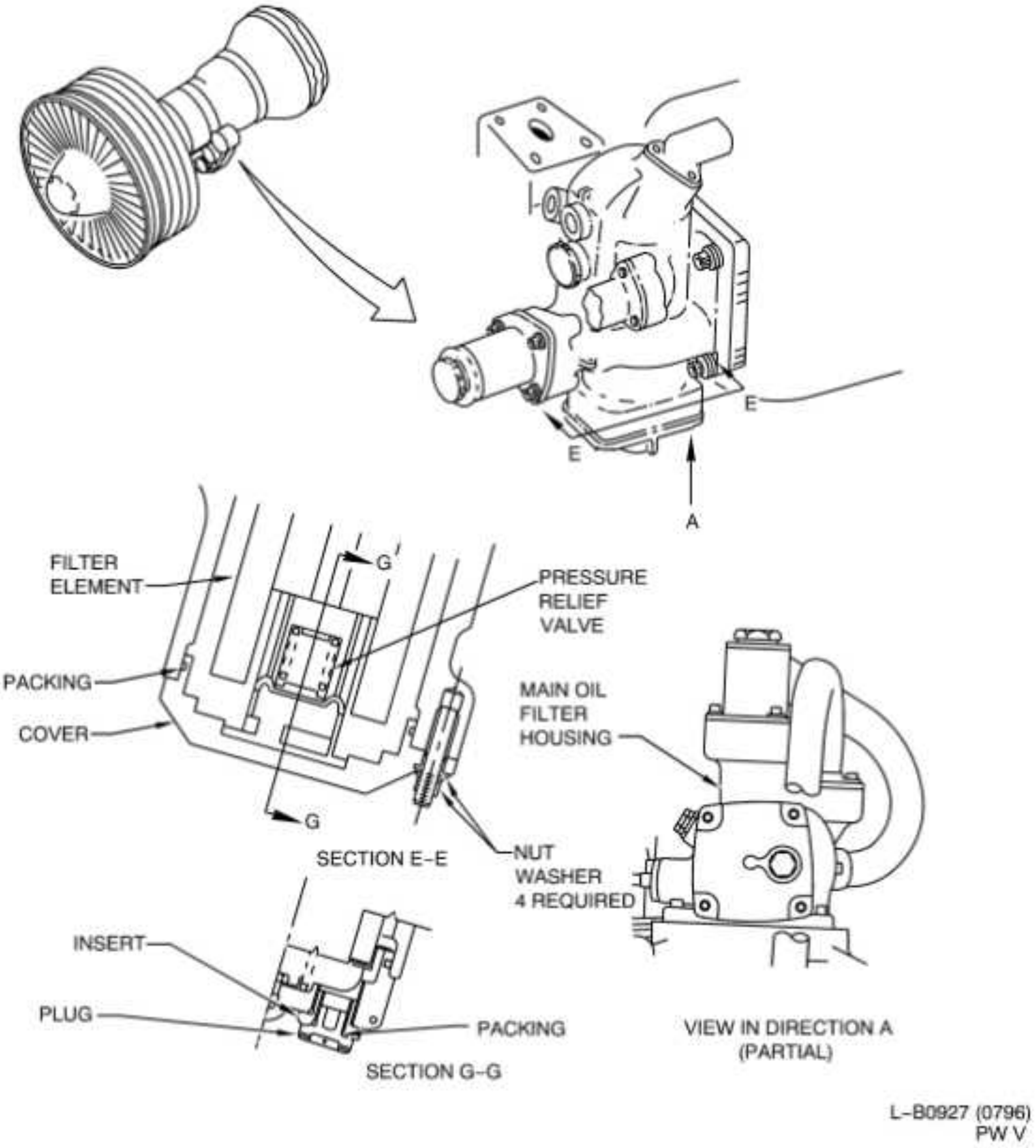
Main Oil Filter Assembly
(Post SB PW4ENG 72−524, SB PW4ENG 79−79 And Pre SB PW4ENG 525)
Figure 301 (Sheet 5)
(Task 72−00−61−030−001)


E
E
A
FILTER ELEMENT
REMOVABLE PLUG REMOVED
G
PACKING
COVER
MAIN OIL FILTER HOUSING
G
SECTION E-E
NUT
WASHER
4 REQUIRED
INSERT
PLUG
PACKING
SECTION G-G
VIEW IN DIRECTION A
(PARTIAL)
L-B3618 (0000)
PW V

Main Oil Filter Assembly
(Post SB PW4ENG 72−524, SB PW4ENG 79−79 And Pre SB PW4ENG 525)
Figure 301 (Sheet 6)
(Task 72−00−61−030−001)


3
MAIN OIL
FILTER
HOUSING
39
FILTER
ELEMENT
40
RETAINING
RING
8
PACKING
41
PRESSURE RELIEF
VALVE
42
MAIN OIL
STRAINER COVER
11
PACKING
14
WASHER
29
NUT
12
PLUG
L−B3544 (0000)
PW V

Main Oil Filter, Housing, Pressure Relief Valve
And Cover Assembly
(Post SB PW4ENG 72−525)
Figure 301 (Sheet 7)
(Task 72−00−61−030−001)


E
E
A
FILTER ELEMENT
G
PRESSURE RELIEF VALVE
PACKING
COVER
MAIN OIL FILTER HOUSING
G
SECTION E−E
NUT
WASHER
4 REQUIRED
INSERT
PLUG
PACKING
SECTION G−G
VIEW IN DIRECTION A (PARTIAL)
L−B0927 (0796)
PW V

Main Oil Filter, Housing, Pressure Relief Valve
And Cover Assembly
(Post SB PW4ENG 72−525)
Figure 301 (Sheet 8)
(Task 72−00−61−030−001)

(4) (Post SB PW4ENG 72−524 and SB PW4ENG 79−79) Remove the main oil filter element from the main oil filter housing assembly. See Figure 301 (Sheets 5 and 6).
  (a) Remove the lockwire, plug (301/12) and insert (301/10) from the bottom port in the main oil strainer cover (301/21). Discard the packings (301/9 and 301/11).
  (b) Remove the lockwire and the four nuts (301/29) or (301/30) and the washers (301/14) that secure the main oil strainer cover (301/21) to the main oil filter housing (301/3). Remove the cover and the filter element (301/4) from the housing. Remove the filter element. Discard the packing (301/8).
  (c) Remove the spring (301/5) from the cover (301/21). Remove the two screws (301/22) and the two washers (301/20) securing the spring retainer (301/23) to the cover (301/21).

(5) (Post SB PW4ENG 72−525) Remove the main oil filter element from the main oil filter housing assembly. See Figure 301 (Sheets 7 and 8).
  (a) Remove lockwire and plug (301/12), from bottom port in main oil strainer cover (301/42). Discard packing (301/11).
  (b) Remove four nuts (301/29) and washers (301/14) securing main oil strainer cover (301/42) to main oil filter housing (301/3). Remove cover and filter element (301/39) from housing. Remove filter element. Discard packing (301/8).
  (c) Remove retaining ring (301/40) from pressure relief valve (301/41) and remove pressure relief valve from cover (301/42).

Task 72-00-61-050-017:

1. Remove The Magnetic Chip Detector Assemblies

A. General

(1) To remove the full magnetic plug assembly, first remove the plug, then remove the valve. To drain the oil tank, it is necessary to remove the full magnetic plug assembly.

B. Equipment And Materials Necessary

Standard Tools

Fluid Drain Collector/Container (capacity 10 US gal.) (38.0 liter)

C. Procedure

CAUTION: INSTALL PROTECTIVE COVERS OVER ALL OPENINGS AS SOON AS POSSIBLE TO PREVENT ENGINE DAMAGE.

CAUTION: DO NOT TRY TO REMOVE THE MAGNETIC CHIP DETECTOR AS AN ASSEMBLY. THE MAGNETIC CHIP DETECTOR PROBE MUST BE REMOVED FROM THE VALVE TO PREVENT DAMAGE TO THE PART.

(1) Remove the magnetic chip detectors from the engine oil tank. See Figure 301.

(a) Remove the PN 50R499 magnetic chip detector from the engine oil tank as follows:

1 Remove the lockwire or safety cable from the valve (301/4).

2 Put a Fluid Drain Collector/Container under the engine oil tank.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

3 Push the magnetic probe (301/5) in and turn it counterclockwise to disengage it from the valve.

4 Remove the probe from the valve.

5 Remove the packing (301/3) from the probe. Discard the packing.

6 Remove the valve from the engine oil tank.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

7 Let the oil drain into the Fluid Drain Collector/Container.

8 Install the magnetic probe into the valve.

9 Remove the packing (301/2) from the small OD end of the valve. Discard the packing.

10 Remove the packing (301/1) from the washer face of the valve. Discard the packing.

11 Remove the probe from the valve again.

(b) Remove the PN 50R485 magnetic chip detector from the engine oil tank as follows:

1 Remove the lockwire or safety cable from the valve (301/7).

2 Put a Fluid Drain Collector/Container under the engine oil tank.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

3 Push the magnetic probe (301/9) in and turn it counterclockwise to disengage it from the valve.

4 Remove the probe from the valve.

5 Remove the packing (301/8) from the probe. Discard the packing.

6 Remove the valve from the engine oil tank.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

7 Let the oil drain into the Fluid Drain Collector/Container.

8 Install the magnetic probe into the valve.

9 Remove the packing (301/6) from the small OD end of the valve. Discard the packing.

10 Remove the packing (301/1) from the washer face of the valve. Discard the packing.

11 Remove the probe from the valve again.

(c) Remove the PN 50R423 (option) magnetic chip detector from the engine oil tank as follows:

1 Remove the lockwire or safety cable from the valve (301/10) or (301/13).

2 Put a Fluid Drain Collector/Container under the engine oil tank.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

3 Push the magnetic probe (301/12) or (301/16) in and turn it counterclockwise to disengage it from the valve.

4 Remove the probe from the valve.

5 Remove the packing (301/11) or (301/15) from the magnetic probe. Discard the packing.

6 Remove the valve from the engine oil tank.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

7 Let the oil drain into the Fluid Drain Collector/Container.

8 If applicable, remove the packing (301/14) from the ID of the valve. Discard the packing.

9 Remove the packing (301/1) from the washer face of the valve. Discard the packing.

(d) Remove the PN 50R374 magnetic chip detector from the engine oil tank as follows:

1 Remove the lockwire or safety cable from the valve (301/17).

2 Put a Fluid Drain Collector/Container under the engine oil tank.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

3 Push the magnetic probe (301/19) in and turn it counterclockwise to disengage it from the valve.

4 Remove the probe from the valve.

5 Remove the packing (301/18) from the magnetic probe. Discard the packing.

6 Remove the valve from the engine oil tank.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

7 Let the oil drain into the Fluid Drain Collector/Container.

8 Remove the packing (301/1) from the washer face of the valve. Discard the packing.

CAUTION: INSTALL PROTECTIVE COVERS OVER ALL OPENINGS AS SOON AS POSSIBLE TO PREVENT ENGINE DAMAGE.

CAUTION: DO NOT TRY TO REMOVE THE MAGNETIC CHIP DETECTOR AS AN ASSEMBLY. THE MAGNETIC CHIP DETECTOR PROBE MUST BE REMOVED FROM THE VALVE TO PREVENT DAMAGE TO THE PART.

(2) Remove the magnetic chip detectors from the lubrication and scavenge oil pump. See Figure 302.

(a) Remove the PN 50R342 magnetic chip detectors from the lubrication and scavenge oil pump as follows:

1 Remove the lockwire or safety cable from the valve (302/2).

2 Put a Fluid Drain Collector/Container under the lubrication and scavenge oil pump.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

3 Push the magnetic probe (302/4) in and turn it counterclockwise to disengage it from the valve.

4 Remove the probe from the valve.

5 Remove the packing (302/3) from the probe. Discard the packing.

6 Remove the valve from the lubrication and scavenge oil pump.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

7 Let the oil drain into the Fluid Drain Collector/Container.

8 Remove the packing (302/1) from the washer face of the valve. Discard the packing.

9 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

(b) Remove the PN 50R348 magnetic chip detectors from the lubrication and scavenge oil pump as follows:

1 Remove the lockwire or safety cable from the valve (302/8).

2 Put a Fluid Drain Collector/Container under the lubrication and scavenge oil pump.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

3 Push the magnetic probe (302/5) in and turn it counterclockwise to disengage it from the valve.

4 Remove the probe from the valve.

5 Remove the packing (302/6) from the probe. Discard the packing.

6 Remove the valve from the lubrication and scavenge oil pump.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

7 Let the oil drain into the Fluid Drain Collector/Container.

8 Remove the packing (302/7) from the ID of the valve. Discard the packing.

9 Remove the packing (302/1) from the washer face of the valve. Discard the packing.

10 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

(c) Remove the PN 50R492 magnetic chip detectors from the lubrication and scavenge oil pump as follows:

1 Remove the lockwire or safety cable from the valve (302/10).

2 Put a Fluid Drain Collector/Container under the lubrication and scavenge oil pump.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

3 Push the magnetic probe (302/12) in and turn it counterclockwise to disengage it from the valves.

4 Remove the probe from the valve.

5 Remove the packing (302/11) from the probe. Discard the packing.

6 Remove the valve from the lubrication and scavenge oil pump.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

7 Let the oil drain into the Fluid Drain Collector/Container.

8 Install the magnetic probe (302/12) into the valve (302/10).

9 Remove the packing (302/9) from the small OD end of the valve. Discard the packings.

10 Remove the packing (302/1) from the washer face of the valve. Discard the packing.

11 Remove the magnetic probe from the valve again.

12 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

(d) Remove the PN 50R491 magnetic chip detectors from the lubrication and scavenge oil pump as follows:

1 Remove the lockwire or safety cable from the valve (302/16).

2 Put a Fluid Drain Collector/Container under the lubrication and scavenge oil pump.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

3 Push the magnetic probe (302/13) in and turn it counterclockwise to disengage it from the valve.

4 Remove the probe from the valve.

5 Remove the packing (302/14) from the probe. Discard the packing.

6 Remove the valve from the lubrication and scavenge oil pump.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

7 Let the oil drain into the Fluid Drain Collector/Container.

8 Remove the packing (302/15) from the ID of the valve. Discard the packing.

9 Remove the packing (302/1) from the washer face of the valve. Discard the packing.

10 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

(e) Remove the PN 50R501 magnetic chip detectors from the lubrication and scavenge oil pump as follows:

1 Remove the lockwire or safety cable from the valve (302/18).

2 Put a Fluid Drain Collector/Container under the lubrication and scavenge oil pump.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

3 Push the magnetic probe (302/20) in and turn it counterclockwise to disengage it from the valves.

4 Remove the probe from the valve.

5 Remove the packing (302/19) from the probe. Discard the packing.

6 Remove the valve from the lubrication and scavenge oil pump.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

7 Let the oil drain into the Fluid Drain Collector/Container.

8 Install the magnetic probe (302/20) into the valve (302/18).

9 Remove the packing (302/17) from the small OD end of the valve. Discard the packings.

10 Remove the packing (302/1) from the washer face of the valve. Discard the packing.

11 Remove the magnetic probe from the valve again.

12 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

CAUTION: INSTALL PROTECTIVE COVERS OVER ALL OPENINGS AS SOON AS POSSIBLE TO PREVENT ENGINE DAMAGE.

CAUTION: DO NOT TRY TO REMOVE THE MAGNETIC CHIP DETECTOR AS AN ASSEMBLY. THE MAGNETIC PROBE MUST BE REMOVED FROM THE VALVE TO PREVENT DAMAGE TO THE PART.

(3) Remove the magnetic chip detector from the center front side of the main gearbox assembly. See Figure 303.

(a) Remove the PN 50R341 magnetic chip detector from the main gearbox assembly as follows:

1 Remove the lockwire or safety cable from the valve (303/2).

2 Put a Fluid Drain Collector/Container under the main gearbox assembly.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

3 Push the magnetic probe (303/4) in and turn it counterclockwise to disengage it from the valve.

4 Remove the probe from the valve.

5 Remove the packing (303/3) from the probe. Discard the packing.

6 Remove the valve from the main gearbox assembly.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

7 Let the oil drain into the Fluid Drain Collector/Container.

8 Remove the packing (303/1) from the washer face of the valve. Discard the packing.

(b) Remove the PN 50R347 magnetic chip detector from the main gearbox assembly:

1 Remove the lockwire or safety cable from the valve (303/5).

2 Put a Fluid Drain Collector/Container under the main gearbox assembly.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

3 Push the magnetic probe (303/8) in and turn it counterclockwise to disengage it from the valve.

4 Remove the probe from the valve.

5 Remove the packing (303/7) from the probe. Discard the packing.

6 Remove the valve from the main gearbox assembly.

a Hold the bushing with a wrench so it does not turn.

b Remove the valve from the bushing.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

7 Let the oil drain into the Fluid Drain Collector/Container.

8 Remove the packing (303/6) from the ID of the valve. Discard the packing.

9 Remove the packing (303/1) from the washer face of the valve. Discard the packing.

(c) Remove the PN 50R485 magnetic chip detector from the main gearbox assembly as follows:

1 Remove the lockwire or safety cable from the valve (303/10).

2 Put a Fluid Drain Collector/Container under the main gearbox assembly.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

3 Push the magnetic probe (303/12) in and turn it counterclockwise to disengage it from the valve.

4 Remove the probe from the valve.

5 Remove the packing (303/11) from the probe. Discard the packing.

6 Remove the valve from the main gearbox assembly as follows:

a Hold the bushing with a wrench so it does not turn.

b Remove the valve from the bushing.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

7 Let the oil drain into the Fluid Drain Collector/Container.

8 Install the magnetic probe into the valve.

9 Remove the packing (303/9) from the small OD end of the valve. Discard the packing.

10 Remove the packing (303/1) from the washer face of the valve. Discard the packing.

11 Remove the probe from the valve again.

(d) Remove the PN 50R484 magnetic chip detector from the center front side of the main gearbox assembly as follows:

1 Remove the lockwire or safety cable from the valve (303/13).

2 Put a Fluid Drain Collector/Container under the center front side of the main gearbox assembly.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

3 Push the magnetic probe (303/16) in and turn it counterclockwise to disengage it from the valve.

4 Remove the probe from the valve.

5 Remove the packing (303/15) from the probe. Discard the packing.

6 Remove the valve from the main gearbox as follows:

a Hold the bushing with a wrench so it does not turn.

b Remove the valve from the bushing.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

7 Let the oil drain into the Fluid Drain Collector/Container.

8 Remove the packing (303/14) from the ID of the valve. Discard the packing.

9 Remove the packing (303/1) from the washer face of the valve. Discard the packing.

(e) Remove the PN 50R499 magnetic chip detector from the center front side of the main gearbox assembly as follows:

1 Remove the lockwire or safety cable from the valve (303/18).

2 Put a Fluid Drain Collector/Container under the main gearbox assembly.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

3 Push the magnetic probe (303/20) in and turn it counterclockwise to disengage it from the valve.

4 Remove the probe from the valve.

5 Remove the packing (303/19) from the probe. Discard the packing.

6 Remove the valve from the main gearbox assembly as follows:

  a Hold the bushing with a wrench so it does not turn.

  b Remove the valve from the bushing.

WARNING: BE CAREFUL WHEN YOU DRAIN OIL FROM A HOT ENGINE. HOT OIL IS DANGEROUS. IF IT TOUCHES YOUR BODY OR EYES, IT WILL BURN BADLY.

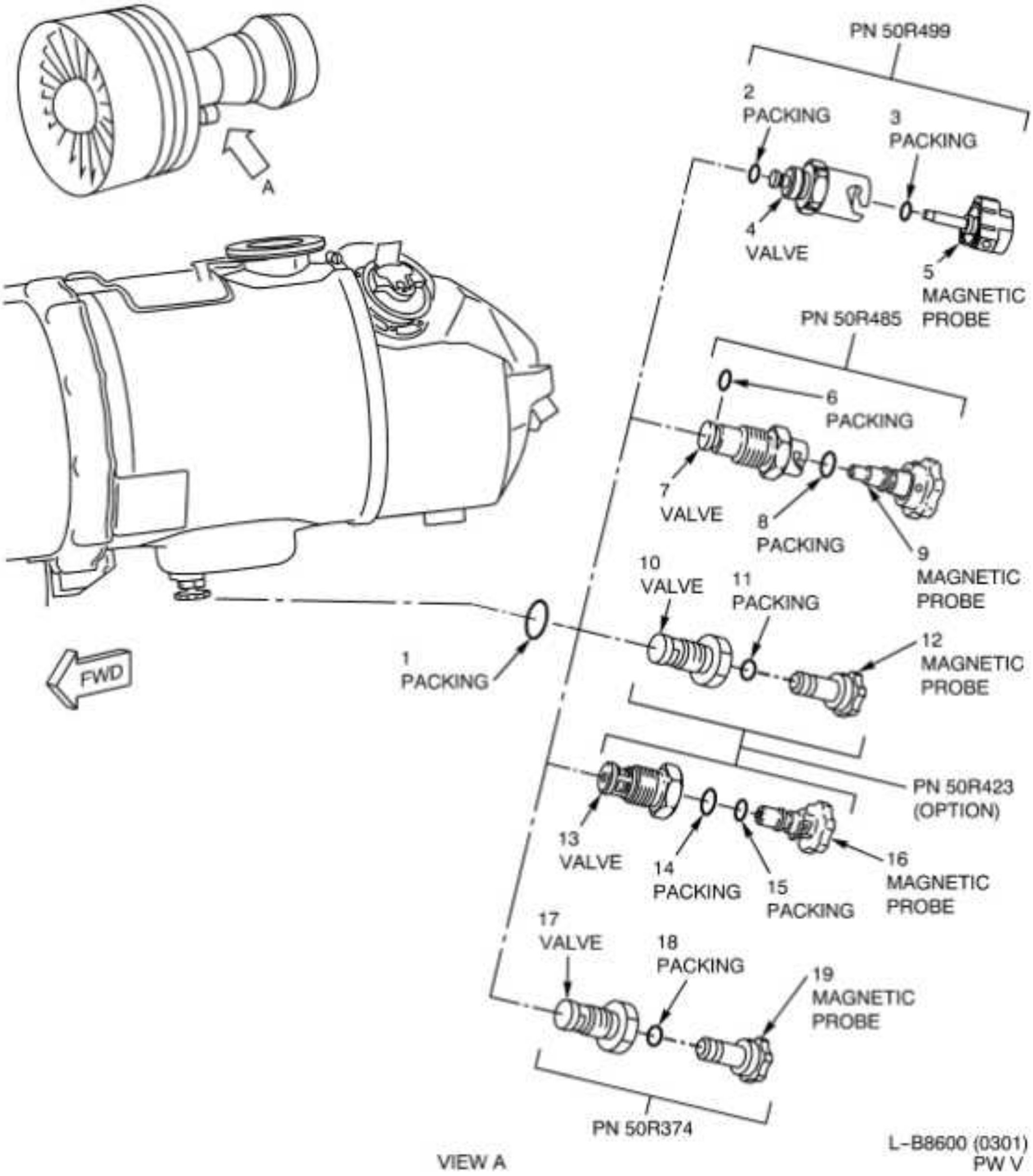
7 Let the oil drain into the Fluid Drain Collector/Container.

8 Install the magnetic probe into the valve.

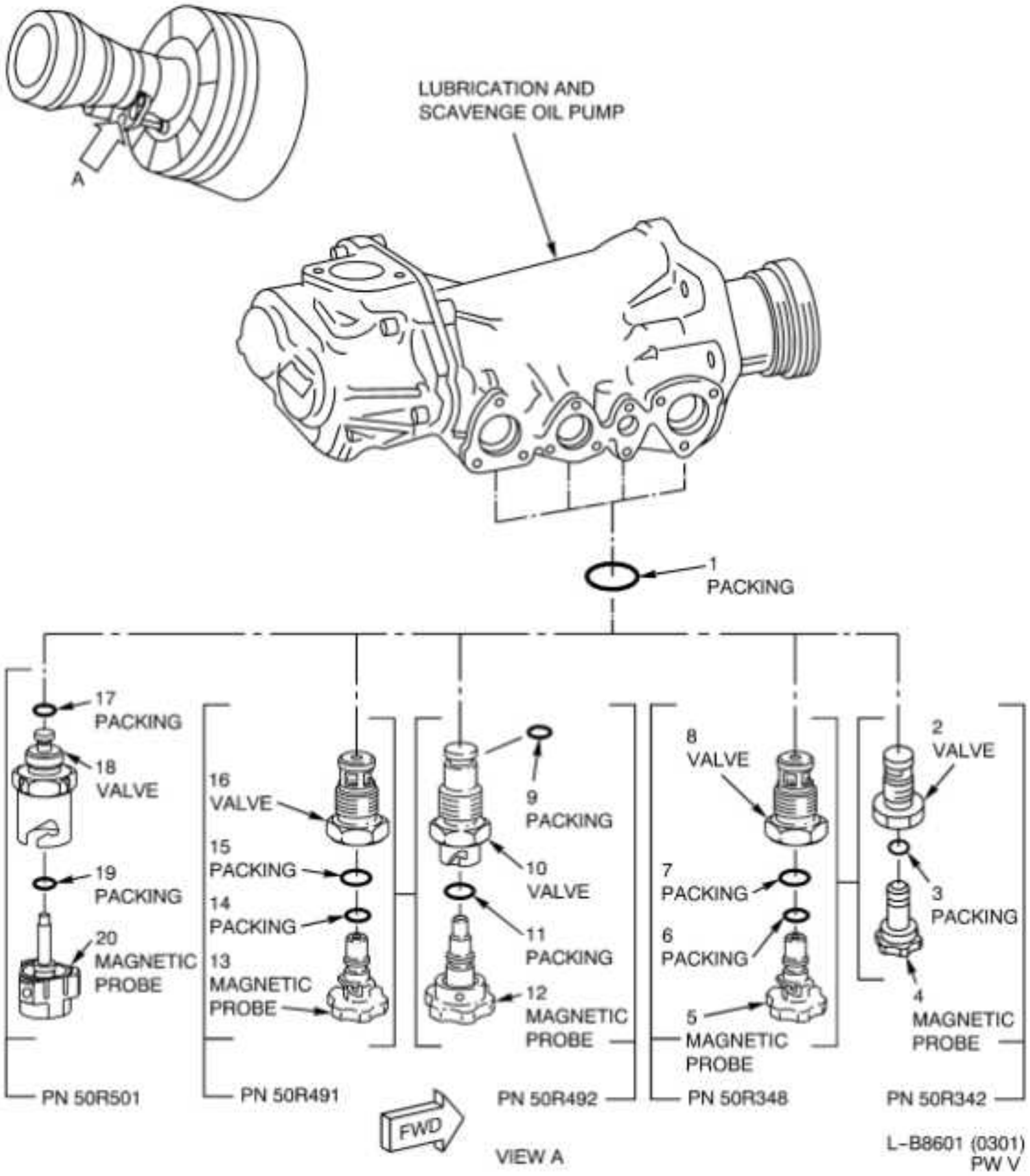
9 Remove the packing (303/17) from the small OD end of the valve. Discard the packing.

10 Remove the packing (303/1) from the washer face of the valve. Discard the packing.

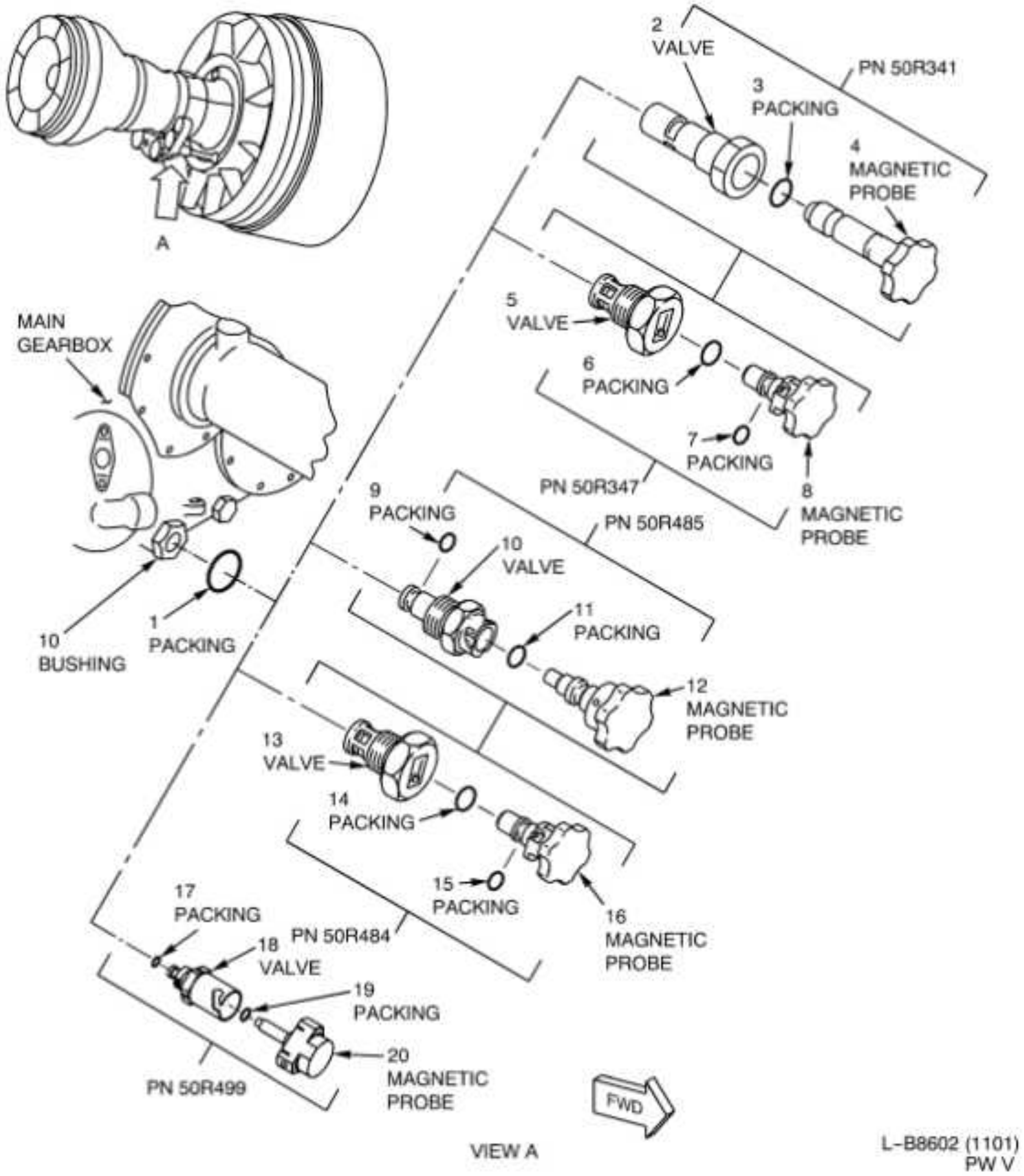
11 Remove the probe from the valve again.


A
PN 50R499
2
PACKING
3
PACKING
4
VALVE
5
MAGNETIC
PROBE
PN 50R485
6
PACKING
7
VALVE
8
PACKING
9
MAGNETIC
PROBE
10
VALVE
11
PACKING
12
MAGNETIC
PROBE
FWD
1
PACKING
PN 50R423
(OPTION)
13
VALVE
14
PACKING
15
PACKING
16
MAGNETIC
PROBE
17
VALVE
18
PACKING
19
MAGNETIC
PROBE
PN 50R374
VIEW A
L-B8600 (0301)
PW V

Main Oil Tank Chip Detectors
Figure 301
(Task 72−00−61−050−017)


A
LUBRICATION AND SCAVENGE OIL PUMP
1 PACKING
17 PACKING
18 VALVE
19 PACKING
20 MAGNETIC PROBE
16 VALVE
15 PACKING
14 PACKING
13 MAGNETIC PROBE
9 PACKING
10 VALVE
11 PACKING
12 MAGNETIC PROBE
8 VALVE
7 PACKING
6 PACKING
5 MAGNETIC PROBE
2 VALVE
3 PACKING
4 MAGNETIC PROBE
PN 50R501
PN 50R491
PN 50R492
PN 50R348
PN 50R342
FWD
VIEW A
L-B8601 (0301)
PW V

Lubrication And Scavenge Oil Pump Chip Detectors
Figure 302
(Task 72−00−61−050−017)


2
VALVE
PN 50R341
3
PACKING
4
MAGNETIC
PROBE
A
5
VALVE
6
PACKING
7
PACKING
8
MAGNETIC
PROBE
PN 50R347
MAIN
GEARBOX
9
PACKING
PN 50R485
10
VALVE
11
PACKING
12
MAGNETIC
PROBE
10
BUSHING
1
PACKING
13
VALVE
14
PACKING
15
PACKING
16
MAGNETIC
PROBE
17
PACKING
18
VALVE
PN 50R484
19
PACKING
20
MAGNETIC
PROBE
PN 50R499
FWD
VIEW A
L-B8602 (1101)
PW V

Main Gearbox Chip Detectors
Figure 303
(Task 72-00-61-050-017)

Previous Pageblock Return to Previous Menu Next Pageblock

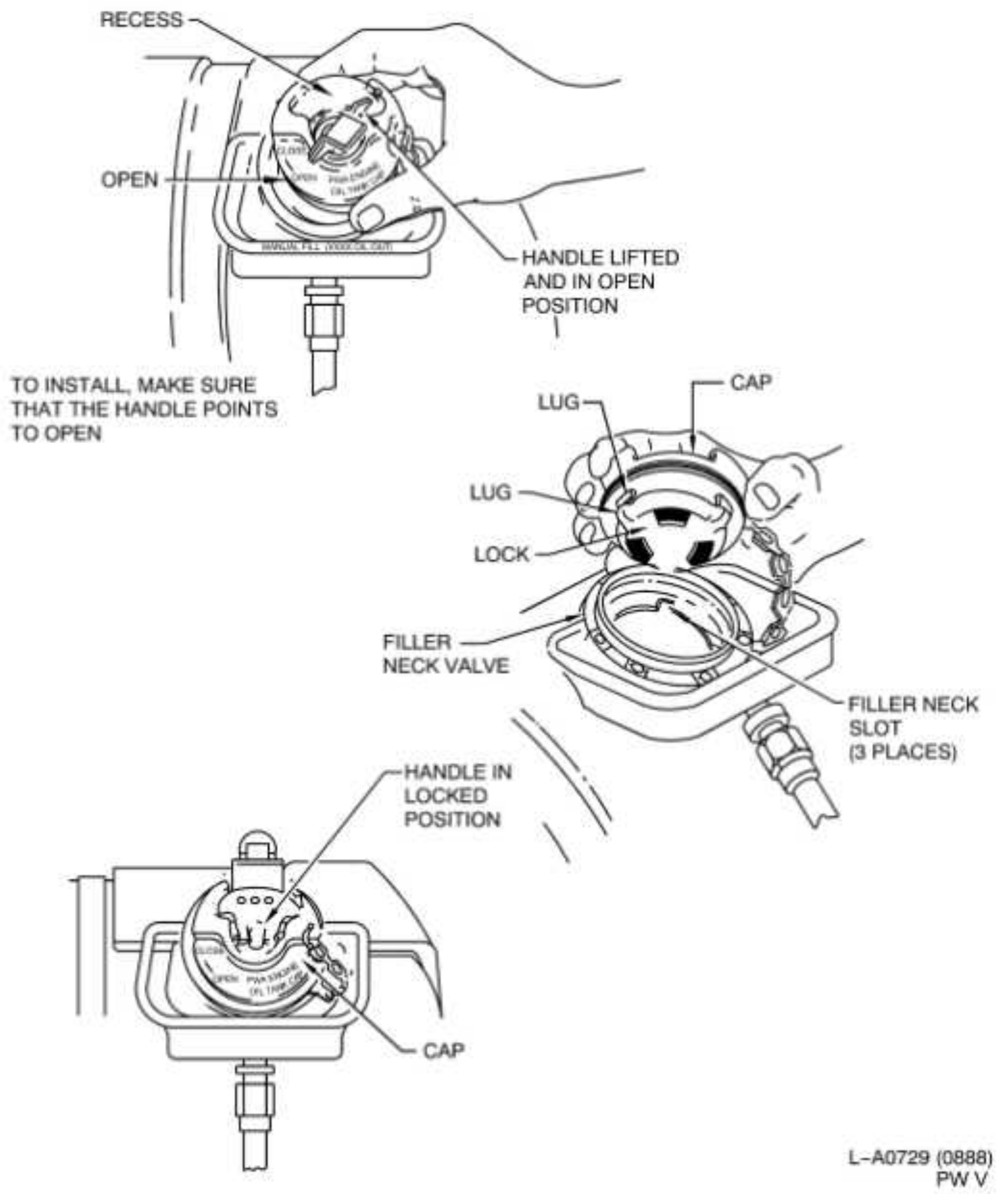
Task 72-00-61-040-002:

1. Remove The Oil Tank Cap

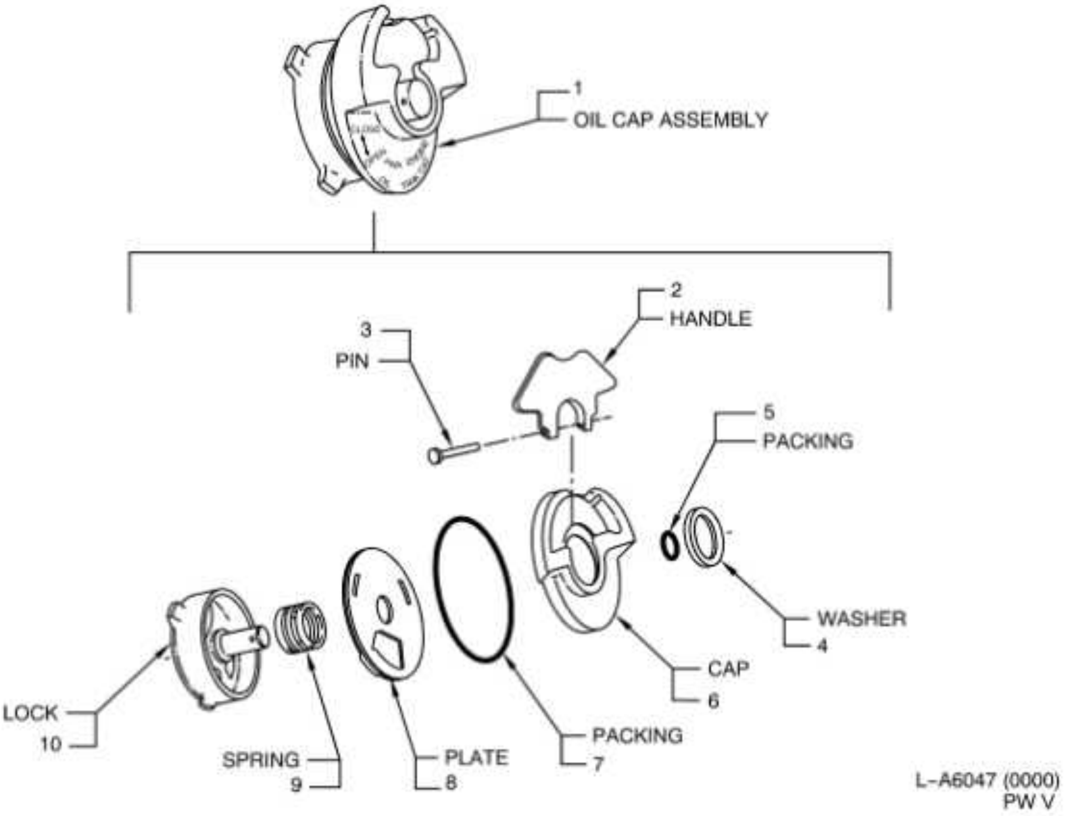
A. Procedure

See Figures 301 and 302.

- (1) Lift the handle of the cap.
- (2) Turn the cap counterclockwise.
- (3) Remove the cap. Examine the packing (302/7). If it is torn, cut, or shows deterioration, remove and discard it.
- (4) If Inspection/Check-05 (Task 72-00-61-200-001) showed that the packing in the cap was defective, remove the packing as follows. See Figure 302.
  - (a) Remove the handle (302/2) as follows:
    - 1 Push the cap (302/2) and lock (302/10) together.
    - 2 While they are pushed together, remove the pin (302/3) with a drift.
    - 3 Remove the handle (302/2).
  - (b) Slowly release the pressure on the cap and lock. The washer (302/4), cap (302/6), spring (302/9), plate (302/8), and lock (302/10) will move apart.
  - (c) Discard the packing (302/5).


RECESS
OPEN
HANDLE LIFTED AND IN OPEN POSITION
TO INSTALL, MAKE SURE THAT THE HANDLE POINTS TO OPEN
CAP
LUG
LUG
LOCK
FILLER NECK VALVE
FILLER NECK SLOT (3 PLACES)
HANDLE IN LOCKED POSITION
CAP
L-A0729 (0888)
PW V

Remove The Oil Tank Cap
Figure 301
(Task 72-00-61-040-002)


1
OIL CAP ASSEMBLY
2
HANDLE
3
PIN
5
PACKING
WASHER
4
CAP
6
LOCK
10
PACKING
7
SPRING
9
PLATE
8
L-A6047 (0000)
PW V

Assemble The Oil Tank Cap
Figure 302
(Task 72-00-61-040-002)

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ENGINE GENERAL - MAIN GEARBOX - REMOVAL-39

Task 72-00-61-050-019:

1. Remove The No. 3 Bearing Breather And Restrictor Valve (Pre SB PW4ENG 75-144)

   A. Procedure
   See Figure 301.

      (1) Remove the No. 3 bearing breather and restrictor valve as follows.

         (a) Remove the lockwire from the tube nut on the No. 3 bearing breather and restrictor valve air supply tube (AP39).

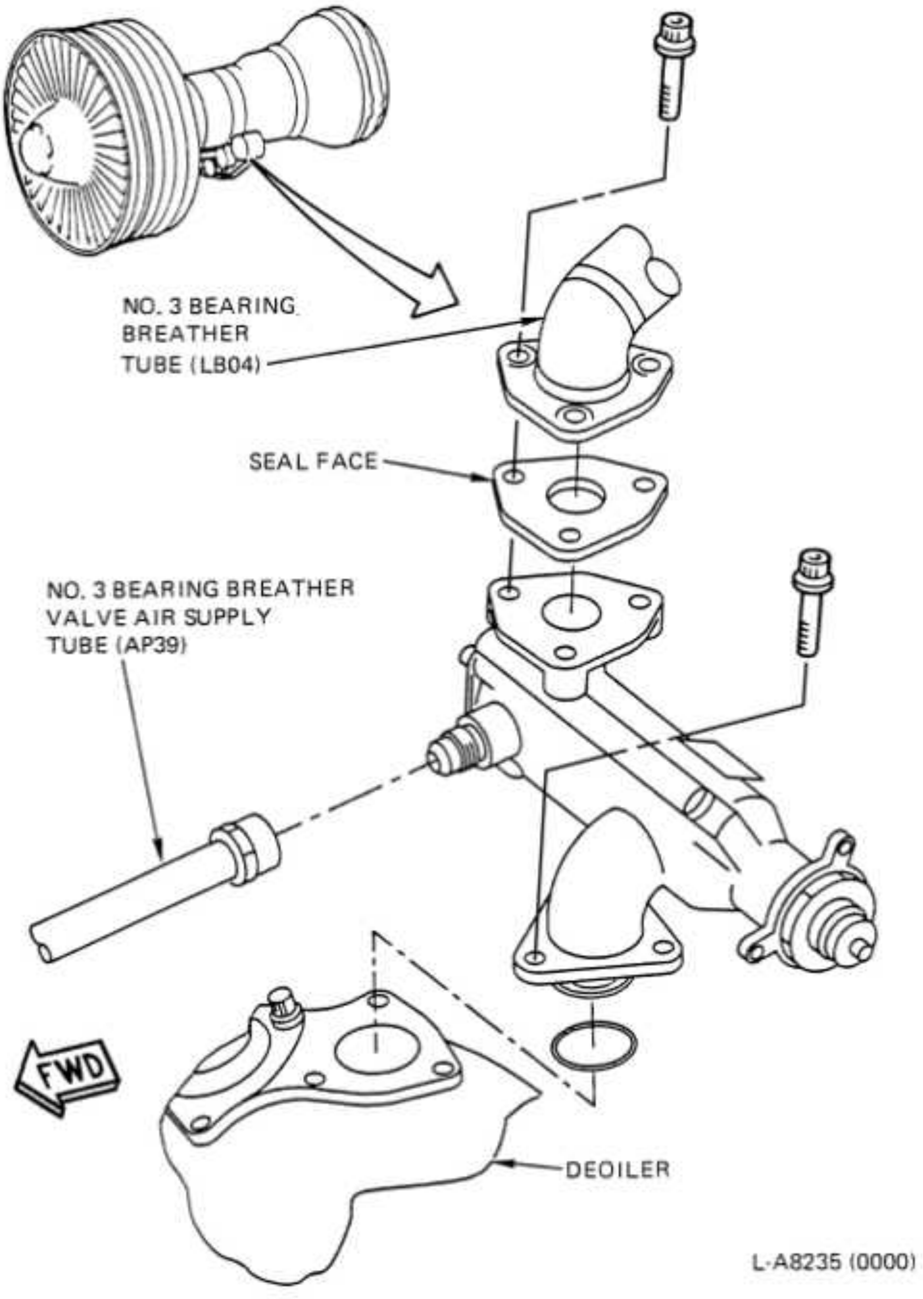
         (b) Disconnect the tube nut from the restrictor valve.

         (c) Remove the three bolts that attach the No. 3 bearing breather tube (LB04) to the restrictor valve. Remove the seal face from between the tube and the valve.

         (d) Remove the three bolts that attach the valve to the deoiler on the gearbox.

         (e) Remove the restrictor valve from the gearbox. Discard the packing from the valve.

         (f) Install protection covers to all openings.


NO. 3 BEARING BREATHER TUBE (LB04)
SEAL FACE
NO. 3 BEARING BREATHER VALVE AIR SUPPLY TUBE (AP39)
FWD
DEOILER
L-A8235 (0000)

No. 3 Bearing Breather And Restrictor Valve
Figure 301
(Task 72−00−61−050−019)

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-01

Task 72-00-61-420-001:

1. Install Main Gearbox

A. Prerequisites

(1) See Inspection/Check-01 (Task 72-00-61-990-001) for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by reference number. For example: (Reference 1234) Torque retaining nut as follows:

B. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 24667	Jack, Hydraulic (Optional to PWA 80611)
PWA 80611	Jack, Hydraulic
PWA 85123	Fixture, Handling (Optional to PWA 86056)
PWA 85768	Puller
PWA 86056	Fixture, Handling

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	1	72-00-61/1/20
Cotter Pin	2	72-00-61/1/100
Cotter Pin	2	72-00-61/1/160
Packing	1	72-62-00/6/20
Packing	1	72-62-00/6/30
Washer	2	72-00-61/1/70
Washer	2	72-00-61/1/130

C. Procedure

(1) Align boltholes and position PWA 86056 or PWA 85123 Fixture to lifting pad of PWA 24667 or PWA 80611 Hydraulic Jack. Secure fixture to jack with three detail screws. See Figure 401.

(2) Position nylon sling through gearbox outer support lugs, located on top left and right sides of gearbox, and attach hoist.

(3) Using hoist, lift gearbox and position over fixture. Lower gearbox and position four post details of adapter to four ground handling points of gearbox. Secure post details to gearbox with four detail bolts (401/1).

(4) Install new packings, lubricated with Engine Oil P03−001, on gearbox driveshaft (front) housing (402/3). See Figure 402.

  (a) Install packing (402/9) in groove on rear of housing.

  (b) Install packing (402/13) in groove on front of housing.

(5) Insert gearbox driveshaft (402/12) and driveshaft (front) housing (402/3) in driveshaft housing (402/8) and telescope rearward, carefully mating driveshaft splines with internal splines on gearbox spline lockring.

(6) If not installed on the engine, install the two support links (403/8) in the gearbox support clevises (403/3) on Flange K. See Figure 403.

  (a) With the support links in position in the clevises, install the spacers (403/4) in the rear holes of the clevises. Install the pins (403/2), flanged ends forward, in the front holes of the clevises.

  (b) Install new washers (403/5) on the bolts (403/6). Install the bolts, heads rearward and threads lubricated with Engine Oil P03−001, in the spacers. Install nuts (403/1) on the bolts.

  (c) Torque the bolts to 290 − 325 lb−in. (32.766 − 36.720 N.m). Install a cotter pin (403/7) in each bolt.

(7) Make sure that spherical bearings (403/9) are installed in support links (403/8) and in the lower end of the (driveshaft housing) support link (402/6). Make sure that the bearings turn freely.

(8) Move jack beneath engine and raise gearbox to align lug on top center of gearbox with mating part on compressor case and align support links (403/8) on engine with lugs on upper right and left sides of gearbox.

(9) Install the gearbox on the support links (403/8) as follows.

(a) Install spacer (403/13) into hole in rear of the clevis on the gearbox. Insert pin (403/14), flanged end toward the front, through clevis on gearbox.

(b) Install a new washer (403/12) on the bolt (403/10). Install the bolt, head rearward and threads lubricated with Engine Oil P03−001, in the clevis. Install a nut (403/15) on the bolt.

(c) Torque the bolt to 290 − 325 lb−in. (32.766 − 36.720 N.m). Secure nut using cotter pin (403/11).

(d) Repeat procedure to secure support link to clevis on right side of gearbox.

(10) Align bolthole in support link (402/6) spherical bearing with boltholes in clevis on gearbox driveshaft housing (402/8). Secure support link using bolt (402/7) and nut (402/5). Torque nut to 515 − 575 lb−in. (58.187 − 64.966 N.m). Secure nut using cotter pin (402/4). See Figure 402.

(11) Position retaining ring (402/14) on forward end of driveshaft (402/12). Move driveshaft forward carefully, mating driveshaft splines with internal splines in gearbox drive coupling (402/18). Install retaining ring (402/14) in coupling in angle gearbox to secure front end of driveshaft.

NOTE: Driveshaft must mate, in front, with angle gearbox drive coupling (402/18) splines and, in rear, with main gearbox drive gearshaft teeth. If splines/teeth are out of alignment, driveshaft will not seat in drive coupling

(402/18). In order to align angle and main gearbox splines/teeth, remove the bolts and washers in the gearbox that attach the cover (manual crank). Remove the cover. Use PWA 85768 Puller. Discard the packing. Rotate main gearbox drive gearshaft by turning the gearshaft. To install the cover, install a new packing, lubricated with Engine Oil P03−001, on the cover. Install the cover. Attach it with washers and bolts. Torque the bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(12) Align boltholes and telescope gearbox driveshaft (front) housing (402/3) forward and seat on rear flange of angle gearbox housing (402/17). Position bracket (402/1) over top right bolthole in driveshaft (front) housing (402/3) and install bolt (402/10). Position bracket (402/2) over top left bolthole in driveshaft (front) housing and install bolt (402/10). Install washers (402/11) onto four remaining bolts (402/10) and install bolts through remaining boltholes in driveshaft (front) housing and angle gearbox housing. Install washers (402/16) and nuts (402/15) to all six bolts. Torque bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(13) Lubricate four bolts (401/2) with Engine Oil P03−001. Install two bolts in each bracket securing driveshaft (front) housing to high pressure compressor. Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(14) Remove gearbox handling fixture bolts (401/1). Lower jack and remove from beneath engine.

(15) Remove three detail screws securing fixture to jack. Remove handling fixture from jack using hoist and sling.

D. Postrequisites

(1) Install the magnetic chip detector assemblies in the oil tank and main gearbox. Refer to Installation−36 (Task 72−00−61−450−017).

(2) Connect/install external parts to complete installation of main gearbox per Installation−02 (Task 72−00−61−420−002).

(3) Install ignition exciters per Installation−03 (Task 72−00−61−450−001) and Installation−04 (Task 72−00−61−450−002).

(4) Install exciter−to−igniter plug cable (lower pluglower box), per 72−00−41, Installation−05 (Task 72−00−41−450−002).

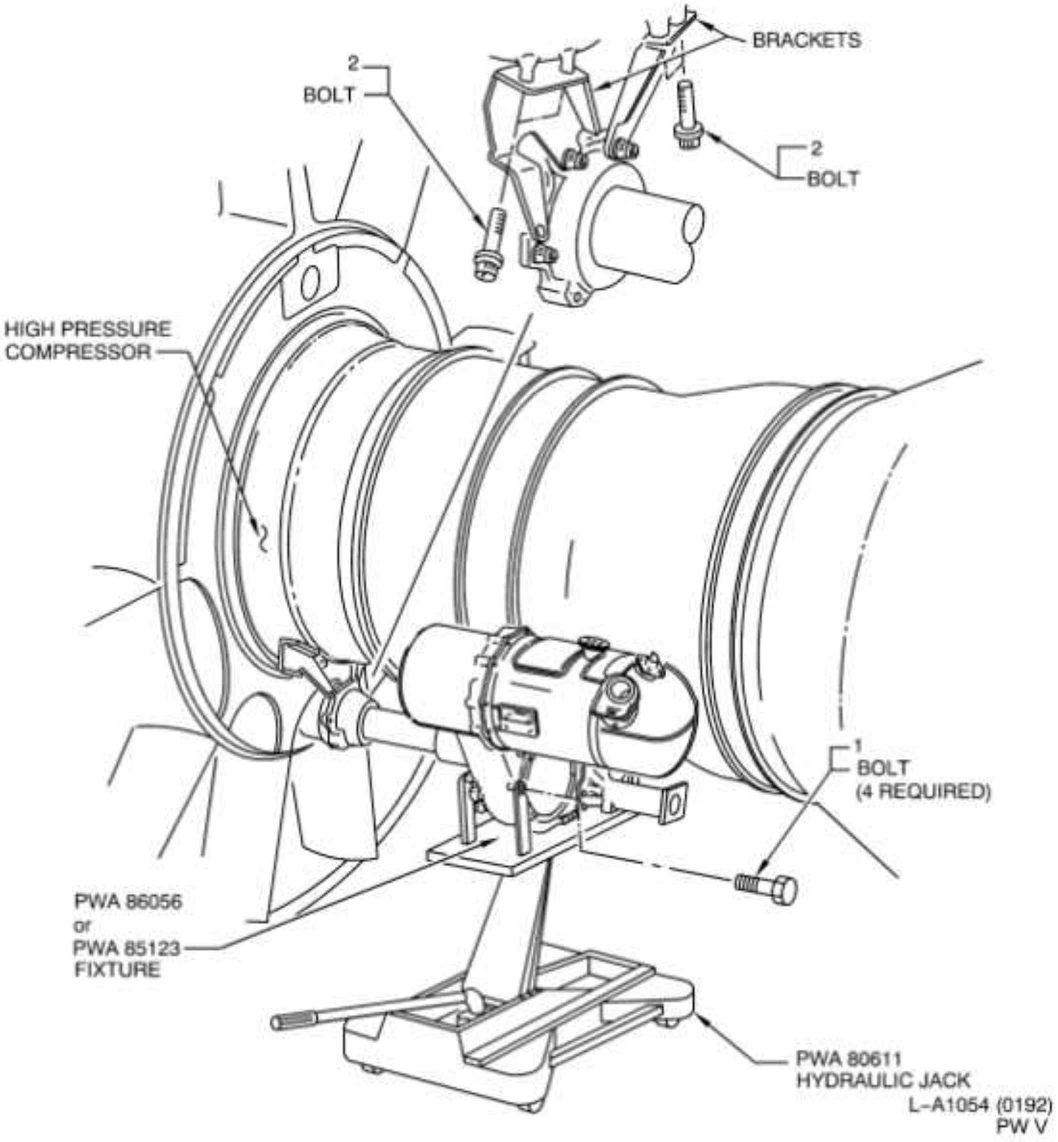
(5) Install exciter−to−igniter plug cable (upper plugupper box), per 72−00−41, Installation−04 (Task 72−00−41−450−001).

(6) Install fuel pump and fuel metering unit (package) per Installation−05 (Task 72−00−61−450−003).

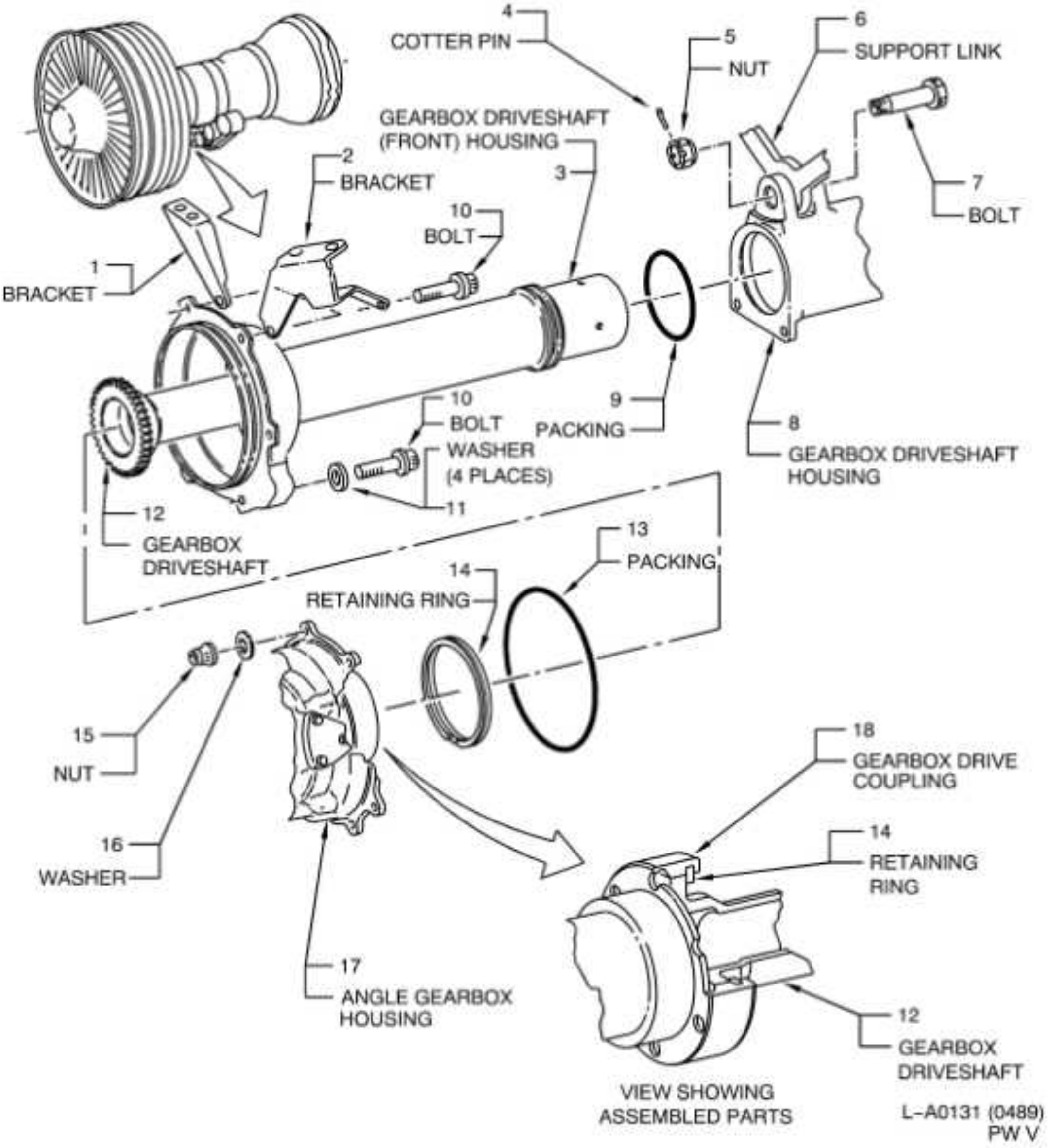
(7) Connect EEC core engine wiring harnesses W3, W4 and W5 to main gearbox per Installation−34 (Task 72−00−61−450−015).

(8) Service engine oil system per 72−00−00, Servicing−03 (Task 72−00−00−610−003).

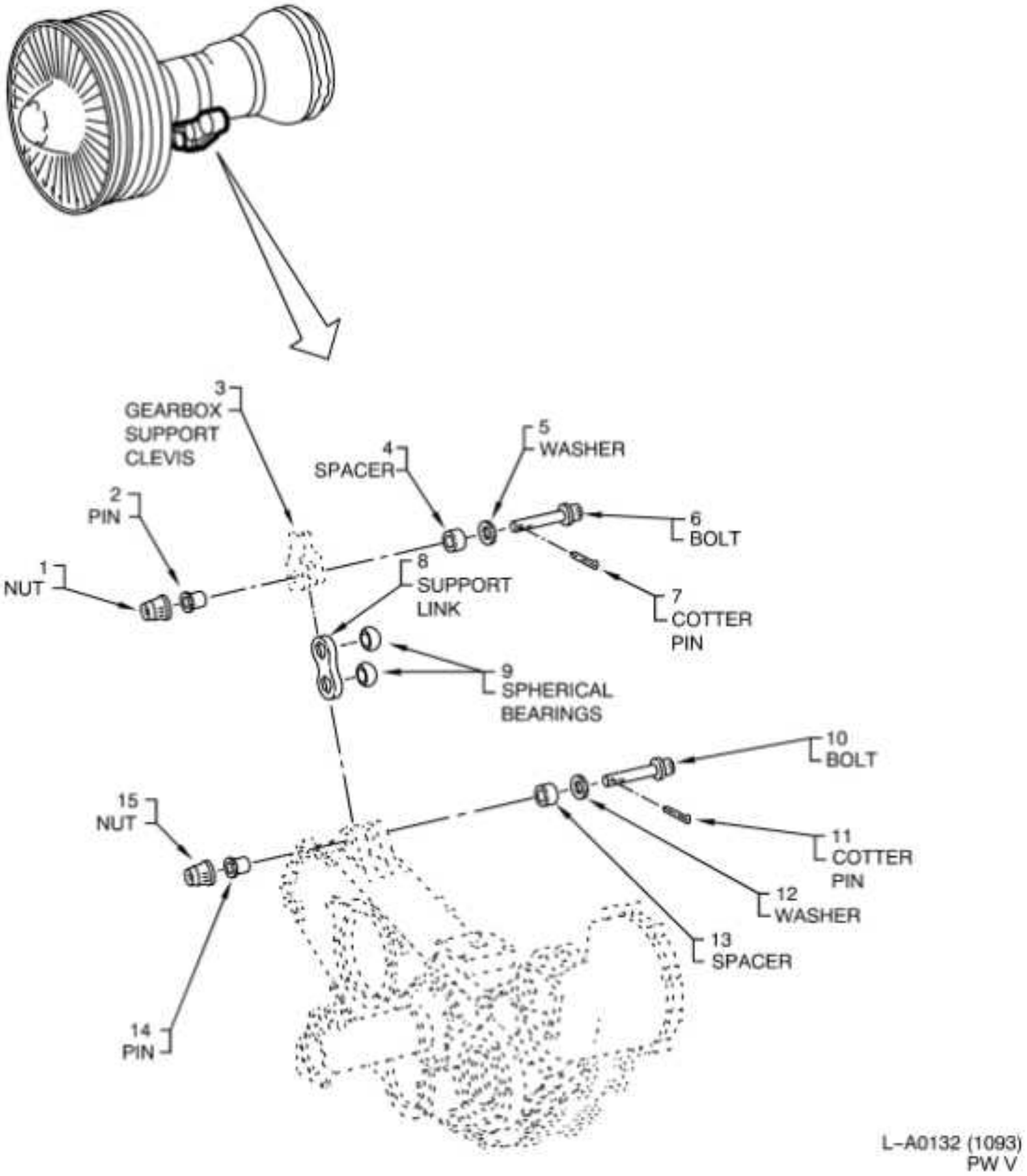
(9) Test engine per Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).


BRACKETS
2
BOLT
2
BOLT
HIGH PRESSURE COMPRESSOR
1
BOLT (4 REQUIRED)
PWA 86056 or PWA 85123 FIXTURE
PWA 80611 HYDRAULIC JACK
L−A1054 (0192)
PW V

Main Gearbox Installation
Figure 401
(Task 72−00−61−420−001)


4
COTTER PIN
5
NUT
6
SUPPORT LINK
GEARBOX DRIVESHAFT (FRONT) HOUSING
3
2
BRACKET
7
BOLT
10
BOLT
1
BRACKET
9
PACKING
10
BOLT
WASHER (4 PLACES)
11
8
GEARBOX DRIVESHAFT HOUSING
12
GEARBOX DRIVESHAFT
13
PACKING
14
RETAINING RING
15
NUT
16
WASHER
18
GEARBOX DRIVE COUPLING
14
RETAINING RING
17
ANGLE GEARBOX HOUSING
12
GEARBOX DRIVESHAFT
VIEW SHOWING ASSEMBLED PARTS
L-A0131 (0489)
PW V

Main Gearbox Installation
Figure 402
(Task 72−00−61−420−001)


3 GEARBOX SUPPORT CLEVIS
5 WASHER
4 SPACER
6 BOLT
2 PIN
8 SUPPORT LINK
1 NUT
7 COTTER PIN
9 SPHERICAL BEARINGS
10 BOLT
15 NUT
11 COTTER PIN
12 WASHER
13 SPACER
14 PIN
L-A0132 (1093)
PW V

Main Gearbox Installation
Figure 403
(Task 72−00−61−420−001)

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ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-02

Task 72-00-61-420-002:

1. Install The Main Gearbox Plumbing After The Main Gearbox Installation

A. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-021	Compound, Antigalling (PWA 550)
P06-036	Compound, Antigallant(PWA 36035)
P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	2	79-21-00/7/1
Packing	2	79-21-00/8/1
Packing	1	79-21-00/8/240
Packing	1	79-21-00/9/1
Packing	1	79-21-00/9/10
Packing	1	79-21-00/13/30
Packing	2	79-22-00/1/1
Packing	1	79-22-00/2/1
Packing	1	79-22-00/3/1
Packing	1	79-22-00/4/1
Packing	1	79-23-00/1/140
Packing	1	79-23-00/2/1
Packing	1	79-23-00/4/1
Retainer	1	79-21-00/9/20
Seal-Face, ST1592-12	1	

B. Procedure
See Figure 401 through 404.

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-02

R CAUTION: BE CAREFUL WHEN YOU HANDLE, REMOVE OR INSTALL
R ALL TUBES WHICH CONTAIN A FLEX DESIGN
R SEGMENT. REMOVE AND INSTALL A TUBE WITH A
R FLEX SEGMENT WITH THE SAME PRECAUTIONS
R USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO
R NOT BEND THE FLEXHOSE OF A TUBE TO HELP
R WITH THE INSTALLATION OR REMOVAL OF AN
R ATTACHED COMPONENT. IF A FLEX SEGMENT IS
R BENT TOO MUCH, THIS CAN CAUSE A KINK IN
R THE EXTERNAL WIRE BRAID AND IN THE INNER
R POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS
R OR TUBE RUPTURE CAN BE THE RESULT.

(1) Install the ground cable as follows. See Figure 401.

(a) If the ground cable was removed from the diffuser case, do as follows.

1 Remove the lockwire and the bottom bolt that attaches the No. 3 bearing oil vent tube lock plate.

2 Install the bolt with the ground cable, angled down and forward. Torque the bolt to 75 - 85 lb-in. (8.474 - 9.604 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolt.

(b) If the ground cable was removed from the gearbox, do as follows.

1 Remove the oil tank flange bolt and install it with the ground cable.

2 Torque the bolt to 180 - 200 lb-in. (20.337 - 22.597 N.m).

(2) (Post SB PW4ENG 75-95 and Pre SB PW4ENG 75-144) Install the No. 3 bearing breather valve, air supply tube (AP39) as follows. See Figure 402.

(a) Remove the protection covers from the tube.

(b) (Pre SB PW4ENG 79-52), Lubricate the threads of the tube nuts tand the back surface of the ferrules with Antigallant Compound P06-036. See Figure 402 (Sheet 6).

(c) (Post SB PW4ENG 79-52), Lubricate the threads of the tube nuts and the back surface of the ferrules with Antigallant Compound P06-021. See Figure 402 (Sheet 7).

(d) Install the tube to the bottom of the high compressor case and connect one end of the tube to the No. 3 bearing breather and restrictor valve on the front right side of the main gearbox. Connect the other end of the tube to a fitting on the No. 3 bearing cooler air tube (AP34) located at the 4 o'clock position on the high compressor case. Tighten the tube nuts by hand.

(e) Install clamps to the tube as follows.

1 With a clamp on the oil cooler outlet fuel tube (FM11), install a clamp on the tube sleeve of the tube (AP39) and attach the clamps together with a bolt, threads lubricated with Engine Oil P03-001 and a nut.

2 Install a clamp to the tube and attach the clamp to a bracket on the gearbox driveshaft housing, support link mount with a bolt, threads lubricated with Engine Oil P03-001.

3 Install a clamp to the tube and attach the clamp to bracket that is located on the air vent diffuser seal tube (AP21) flange. Attach the clamp to the bracket with a bolt, threads lubricated with Engine Oil P03-001.

(f) Torque the clamp bolts/nut to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(g) Torque the tube nut to the No. 3 bearing cooler air tube (AP34) and the tube nut to the No. 3 bearing breather and restrictor valve to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the tube nuts.

(3) (Post SB PW4ENG 75-144), Install cap assembly to the (AP34) manifold assembly as follows:

(a) Apply Antigalling Compound P06−021 to the treads on nut and install cap assembly to the tee of the (AP34) manifold assembly.

(b) Torque the cap assembly to 200 − 225 lb−in. (22.597 − 25.422 N.m). Secure with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the cap assembly.

(4) Connect the (lower) No. 3 bearing breather tube assembly (LB04) as follows.

(a) Remove the cover.

(b) (Pre SB PW4ENG 75−95), Install the packing lubricated with Engine Oil P03−001 to the packing groove on the lower end of the tube.

(c) (Post SB PW4ENG 75−95 and Pre SB PW4ENG 75−144) Install a three hole seal face to the No. 3 bearing breather restrictor valve that is located on the right front side of the gearbox.

(d) Lubricate the tube nut threads with Antigalling Compound P06−021. See Figure 401 (Sheet 11). Connect the tube to the upper tube at 9:30 o'clock position adjacent to Flange K. Tighten by hand.

(e) (Pre SB PW4ENG 75−95), Remove the temporary lockwire and install the flanged end to the outboard port on the front of the gearbox. Install the three bolts, lubricated with Engine Oil P03−001 and tighten by hand.

(f) (Post SB PW4ENG 75−95 and Pre SB PW4ENG 75−144) Install the flanged−end of the tube to the No. 3 bearing breather restrictor valve on the right front side of the main gearbox. Install three bolts, lubricated with Engine Oil P03−001 and tighten by hand.

(g) Install the clamp that attaches the tube to the bracket on the fuel/oil cooler rear support (Pre SB PW4ENG 72−211 only). Attach the clamp with the bolt, lubricated with Engine Oil P03−001. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(h) Install the clamp that attaches the tube to the bracket on the HPC air valve (Post SB PW4ENG 72-211 only). Attach the clamp with the bolt, lubricated with Engine Oil P03-001, and nut. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(i) Torque the three bolts that attach the tube to the gearbox or restrictor valve (Post SB PW4ENG 75-95) to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(j) Torque the tube nut to 675 - 750 lb-in. (76.265 - 84.739 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the tube nut.

(5) Connect the (lower) No. 1 and 2 bearing breather tube assembly (LB02) as follows.

(a) Remove the covers. Install the packing, lubricated with Engine Oil P03-001, to the packing groove at the flanged end of the tube.

(b) Remove the temporary lockwire and install the flanged end to the inboard port on the front of the gearbox. Install the bracket and three bolts, lubricated with Engine Oil P03-001. Tighten the bolts by hand.

(c) Locate the clamp that attaches the tube to the Flange H bracket at 8:30 o'clock position. Attach the clamp with the bolt, lubricated with Engine Oil P03-001, and nut. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Install a clamp to the (lower) breather tube (LB02) and attach the clamp to the inboard oil cooler bracket with a bolt, threads lubricated with Engine Oil P03-001 and a nut. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m). See Section C-C (Post SB PW4ENG 79-33).

(e) Torque the three bolts that attach the tube to the gearbox to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(f) Attach the (lower) tube (LB02) nut to the (middle) tube (LB06) nut above the Fuel/Oil Cooler, at approximately 9 o'clock position. Torque the tube nut to 1150 − 1300 lb−in. (129.993 − 146.880 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the tube nut.

(6) Install the air cooler inlet oil tube assembly (LP02) as follows.

(a) Remove the covers. Install the packings, lubricated with Engine Oil P03−001, to the packing groove at each end of the tube.

(b) Install the tube to the air oil cooler and the top of the main oil filter housing. Install the three bolts, lubricated with Engine Oil P03−001, at each end. Tighten them by hand.

(c) Install the clamp that attaches the tube to the Flange H bracket. Attach the clamp with the bolt, lubricated with Engine Oil P03−001, and nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Torque the three bolts at each end of tube to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(7) Install the oil trim pressure tube assembly (LP32) as follows:

CAUTION: DO THIS PROCEDURE EXACTLY AS FOLLOWS OR TUBE FAILURE CAN RESULT.

CAUTION: YOU MUST USE THE WRENCHING FLATS ON THE MATING PARTS WHEN YOU LOOSEN OR TIGHTEN ANY OR ALL TUBE NUTS. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

(a) Be sure the following parts are loose. If any parts are not loose, be sure and loosen them and then tighten by hand only.

1 Both ends of the No. 3 bearing oil pressure manifold (LP18) located above the oil cooler.

2 Both ends of the oil trim pressure tube (LP31) located between the No. 3 bearing oil pressure manifold (LP18) and the oil metering nipple (restrictor).

3 The tube nut that attaches the No. 3 bearing oil pressure tube (LP19) to the diffuser case located at approximately 9:30 o'clock position.

4 The clamp bolts that attach all the tubes above to the engine brackets or to each other.

(b) (Pre SB PW4ENG 79-52), Lubricate the back surface of the ferrules with Antigallant Compound P06-036 on each end of the tubes that follow. See Figure 402 (Sheet 6).

(c) (Post SB PW4ENG 79-52), Lubricate the back of the ferrule of the N0. 3 bearing manifold (LP18) with Antigallant Compound P06-021. See Figure 402 (Sheet 7).

(d) Lubricate the back surface of ferrule with Antigallant Compound P06-036 on the oil trim pressure tube (LP31). See Figure 402 (Sheet 7).

NOTE: Loosen or remove the tube nuts as necessary to apply the lubricant to the back side of the ferrules. After you apply the lubricant, tighten the tube nuts by hand only.

(e) Remove the protection covers and lubricate the oil trim pressure tube (LP32) nut threads with Antiseize Paste P06-054. Wipe off unwanted paste. Lubricate the back surface of the ferrule with Antigallant Compound P06-036. Install the packing, lubricated with Engine Oil P03-001, to the flanged end of the tube. Install the tube to the main oil filter housing and attach with three bolts lubricated with Engine Oil P03-001. Tighten the bolts by hand. Tighten the tube nut by hand.

(f) (Reference 2016) Be sure that the center of the forward clamp (on the (LP32) oil trim pressure tube) is 2.500 - 3.000 inches (63.500 - 76.200 mm) from the center of the rear clamp (Post SB PW4ENG 72-211 only).

(g) With all the tube nuts above only handtight, torque the clamp bolts and tubes exactly as follows:

1 The clamp bolt that attaches the back to back clamps (LP18) to (LP32) to 36 - 40 lb-in. (4.067 - 4.519 N.m).

2 The clamp bolt(s) that attach the tubes to the oil cooler rear bracket to 36 - 40 lb-in. (4.067 - 4.519 N.m).

3 (Pre SB PW4ENG 79-52), the clamp bolt that attaches the No. 3 bearing oil strainer (LP19) to the Flange K bracket to 36 - 40 lb-in. (4.067 - 4.519 N.m).

4 (Post SB PW4ENG 79-52), the bolts that attach the ferrule end of the No. 3 bearing pressure tube (LP19) to the bracket on Flange K to 36 - 40 lb-in. (4.067 - 4.519 N.m).

5 The three bolts that attach the oil trim pressure tube (LP32) to the main oil filter housing to 85 - 95 lb-in. (9.604 - 10.734 N.m).

CAUTION: YOU MUST USE THE WRENCHING FLATS ON THE MATING PARTS WHEN YOU LOOSEN OR TIGHTEN ANY OR ALL TUBE NUTS. THIS WILL PREVENT ANY TWIST DAMAGE TO THE TUBES.

6 The front tube nut of the (LP18) manifold to strainer housing to 140 - 160 lb-in. (15.818 - 18.078 N.m), then loosen and torque again to the same value.

7 The front tube nut of the oil trim pressure tube (LP31) to the No. 3 bearing oil pressure manifold (LP18) tee to 675 - 750 lb-in. (76.265 - 84.739 N.m).

8 The tube nuts (LP31) and (LP32), that attach the oil tube metering nipple (restrictor) to 675 - 750 lb-in. (76.265 - 84.739 N.m).

9 (Post SB PW4ENG 79-52), Install a clamp to the tube nut end of the oil trim pressure tube (LP32) and attach the clamp to a bracket on the secondary flow control valve flange with a bolt, threads lubricated with Engine Oil P03-001 and a nut.

10 Torque the nut to 36 - 40 (4.067 - 4.519 N.m).

11 The tube nut that attaches the (rear) No. 3 bearing oil pressure tube (LP19) to the diffuser case to 450 - 500 lb-in. (50.843 - 56.492 N.m).

12 (Pre SB PW4ENG 79-52), the manifold nut (LP18) to the No. 3 bearing oil strainer at Flange K to 675 - 750 lb-in. (76.265 - 84.739 N.m).

13 (Post SB PW4ENG 79-52), the two nuts that attach the adapter to the ferrule end of No. 3 bearing pressure tube (LP19) to 36 - 40 lb-in. (4.067 - 4.519 N.m).

14 (Post SB PW4ENG 79-52), the manifold nut (LP18) to the adapter on the No. 3 bearing pressure tube (LP19) at Flange K to 675 - 750 lb-in. (76.265 - 84.739).

(h) Install the lockwire at all necessary locations.

(i) (Pre SB PW4ENG 79-52), Install the spray shield to the inboard side of the rear manifold (LP18) connection at the No. 3 bearing strainer. Attach the shield with the hose clamp.

(j) (Pre SB PW4ENG 79-52), (Reference 2151) Torque the hose clamp to 15 - 18 lb-in. (1.695 - 2.034 N.m).

(k) (Post SB PW4ENG 79-52), Install the spray shield to the inboard side of the rear manifold (LP18) that is attached to the No. 3 bearing pressure tube (LP19). Attach the spray shield with a clamp and a bolt, threads lubricated with Engine Oil P03-001, to a bracket attached to the flange of the cooling air tube on the high compressor. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(8) Install the oil bypass drain tube assembly (LP20) as follows.

(a) Remove the covers. Install the packing, lubricated with Engine Oil P03−001, to the packing groove at the flanged end of the tube. Install the packing, lubricated with Engine Oil P03−001, and retainer to the other end of the tube.

(b) Lubricate the tube nut threads with Antiseize Paste P06−054. Wipe off unwanted paste. Install the tube to the inboard side of the main oil filter housing and to the oil bypass valve.

(c) Install the two bolts, lubricated with Engine Oil P03−001, that attach the tube to the housing. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Torque tube nut to 65 − 70 lb−in. (7.344 − 7.909 N.m), loosen tube nut, then retorque to 65 − 70 lb−in. (7.344 − 7.909 N.m) and install Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the tube nut.

(9) Install the reduction gearbox oil pressure tube assembly (LP13) as follows.

(a) Remove covers. Lubricate the tube nut threads with Antiseize Paste P06−054. Wipe off unwanted paste.

(b) Install the tube to the manifold tee at 7 o'clock position and to the reduction gearbox adapter.

(c) Torque each tube nut to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the tube nuts.

(10) Install the main gearbox oil pressure tube assembly (LP12) as follows.

(a) Remove the covers. Install the packing, lubricated with Engine Oil P03−001, to the packing groove at the flanged end of the tube.

(b) Lubricate the tube nut threads with Antiseize Paste P06−054. Wipe off unwanted paste. Install the tube to the manifold tee at 7 o'clock position and to the main gearbox.

(c) Install the two bolts, lubricated with Engine Oil P03−001, that attach the tube flange to the gearbox.

(d) Install the clamp that attaches the tube to the gearbox bracket. Attach the clamp with the bolt, lubricated with Engine Oil P03−001, and nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque the two bolts at the flanged end of the tube to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Torque the tube nut to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the tube nut.

(g) (Reference 2151) Install the spray shield, clamp half, hose clamp, bolts, lubricated with Engine Oil P03−001, and nuts to the manifold tee. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). Torque the hose clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(11) Install the EEC wiring harness support tube assembly as follows.

(a) Remove the lower bolt that attaches the bracket to the No. 1 and 2 bearing, breather tube flange.

(b) Install the bolt again with the support tube in position.

(c) Install the bolt, lubricated with Engine Oil P03−001, and nut that attach the support tube to the air cooler outlet oil tube clamp. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Torque the bolt that attaches the support tube to the gearbox to 85 − 95 lb−in. (9.604 − 10.734 N.m).

R
R

(12) (Pre SB PW4ENG 79-75) Install the main filter oil tube assembly (LP01) as follows. See Figure 403 (Sheets 1 through 6).

NOTE: If PWA 26157 Pedestal and PWA 85062 Saddle are installed forward of Flange M, see 72-00-54, Installation-02 Task 72-00-54-420-003 for the tube installation after the removal of the pedestal and the saddle.

(a) Remove the covers. Install the packing, lubricated with Engine Oil P03-001, to the packing groove at each end of the tube.

(b) Install the tube to the main oil filter housing. Install the three bolts, lubricated with Engine Oil P03-001. Tighten the bolts by hand.

(c) Install the tube to the main oil pump port. Install the bracket and the two bolts, lubricated with Antiseize Paste P06-054. Wipe off unwanted paste. Tighten the bolts by hand.

(d) Install the six (clip-on) loop clamp grommet halves (Post SB PW4ENG 79-36 only) at the three rearward clamp locations.

(e) Install the three clamps that attach the tube to the gearbox brackets and diffuser case bracket. Attach the clamps with the bolts, lubricated with Engine Oil P03-001, and nuts. Torque the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(f) Torque the bolts that attach the tube to the oil filter housing to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(g) Torque the bolts that attach the tube to the oil pump to 62 - 72 lb-in. (7.005 - 8.135 N.m).

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-02

(13) (Post SB PW4ENG 79-75) Install the fluid pressure dampener or fluid pressure adapter assembly (Post SB PW4ENG 79-86) and install the main oil filter hose and tube assembly (LPO1) as follows. See Figure 403.

NOTE: If PWA 26157 Pedestal and PWA 85062 Saddle are installed forward of Flange M, see 72-00-54, Installation-02 Task 72-00-54-420-003 for the tube installation after the removal of the pedestal and the saddle.

(a) Remove protective closures and install packing lubricated with Engine Oil P03-001, to packing groove on the dampener or adapter.

(b) Install the dampener or adapter to the top of the main oil pump and hold with bolts, threads lubricated with Engine Oil P03-003, to a handtight condition only.

(c) Remove protective closures and install packing lubricated with Engine Oil P03-003, to packing groove at each end of oil tube assembly (LP01).

(d) Install one end of tube (LP01) to the forward side of the main oil filter housing with with bolts, threads lubricated with Engine Oil P03-003, handtight only.

(e) Install the other end of tube (LP01) to the dampener or adapter, threads lubricated with Engine Oil P03-003, to a handtight condition only.

(f) Install bolts, threads lubriated with Engine Oil P03-003, nuts and clamps securing tube to gearbox brackets, handtight only.

(g) Install bolts, threads lubricated with Engine Oil P03-003, on the tube (LP01) which attaches to the diffuser case bracket.

(h) Torque all the clamp bolts to 32 - 36 lb-in. (3.616 - 4.067 N.m).

(i) Torque the bolts that hold the dampener or adapter to the top of the main oil pump to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(j) Torque the bolts securing the tube (LP01) to the main oil filter housing to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(k) Torque the bolts that hold the tube (LP01) to the dampener or adapter to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(l) Torque the bolts securing the tube (LP01) to the diffuser case bracket to 65 - 75 lb-in. (7.344 - 8.474 N.m).

(14) (Post SB PW4ENG 79-75) Install the loop clamp bracket assembly on the fluid pressure dampener or adapter as follows.

(a) Secure bracket assembly to the dampener or adapter with bolts and nuts to a handtight condition only.

(b) Torque the bolts to 32 - 36 lb-in. (3.616 - 4.067 N.m).

(15) (Pre SB PW4ENG 79-75) Install the No. 3 bearing oil scavenge manifold assembly (LR04) as follows. See Figure 403.

(a) Remove the covers. Install the packing, lubricated with Engine Oil P03-001, to the groove at the flanged end of the manifold.

(b) Lubricate the elbow threads with Engine Oil P03-001. Install the manifold to the diffuser case internal tube at 6 o'clock position and to the oil pump.

(c) Install the three bolts, lubricated with Antiseize Paste P06-054, that attach the manifold to the pump. Wipe off unwanted paste.

(d) Install the clamp, bolt, lubricated with Engine Oil P03-001, and nut that attach the manifold to the oil pump bracket. Torque the clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque the bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(f) Hold manifold elbow from turning and torque diffuser case internal tube nut to 650 - 700 lb-in. (73.440 - 79.089 N.m). Secure with Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(g) Install the two loop clamp grommet halves (Post SB PW4ENG 79-46) to the manifold adjacent to the oil pump clamp. Loosen the clamp bolt that attaches the manifold clamp to the oil pump bracket.

NOTE: Torque the clamp bolt again after the installation of the No. 4 bearing oil scavenge tube (LR05).

(16) (Post SB PW4ENG 79-75) Install the No. 3 bearing oil scavenge hose and manifold assembly (LR04) as follows. See Figure 403 (Sheets 18 through 20).

(a) Remove the covers. Install the packing, lubricated with Engine Oil P03-001, to the groove at the flanged end of the manifold.

(b) Lubricate the elbow threads with Engine Oil P03-001. Install the hose and manifold assembly to the diffuser case internal tube nut at 6 o'clock position and to the oil pump.

(c) Install the three bolts, lubricated with Antiseize Paste P06-054, that attach the manifold to the pump. Wipe off unwanted paste.

(d) Install the clamp, bolt, lubricated with Engine Oil P03-001, and nut that attach the manifold to the oil pump bracket. Torque the clamp bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque the bolts securing the manifold flange to the main oil pump to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(f) Hold the manifold elbow from turning and torque diffuser case internal tube nut to 650 - 700 lb-in. (73.440 - 79.089 N.m). Secure with Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(g) Secure the hose and manifold assembly to the fluid pressure dampener or adapter bracket and the fuel injector support bracket with two loop clamps using four nuts and bolts lubricated with Engine Oil P03-001. Torque the bolts to 32 - 36 lb-in. (3.616 - 4.067 N.m).

(h) Loosen the clamp bolt that attaches the manifold clamp to the oil pump bracket.

NOTE: Torque the clamp bolt again after the installation of the No. 4 bearing oil scavenge tube (LR05).

(17) (Pre SB PW4ENG 79-75) Install the (front) No. 4 bearing oil scavenge tube assembly (LR05) as follows.

NOTE: If the PWA 26157 Pedestal and the PWA 85062 Saddle are been installed forward of Flange M, see 72-00-54, Installation-02 (Task 72-00-54-420-003) for the installation of this tube.

(a) Remove the covers. Install the packing lubricated with Engine Oil P03-001, to the packing groove at the flanged end of the tube.

(b) Lubricate the tube nut threads with Antiseize Paste P06-054, wipe off unwanted paste. Install the tube to the oil pump port and to the rear scavenge tube adjacent to Flange M.

(c) Install the three bolts, lubricated with Antiseize Paste P06-054, that attach the tube to the pump. Wipe off unwanted paste. Tighten by hand.

(d) Install the six loop clamp grommet halves (Post SB PW4ENG 79-46). Install clamps that attach the tube (LR05) to the main filter oil tube (LP01), the No. 3 bearing oil scavenge manifold (LR04), and the oil pump bracket. Install the clamp bolts, lubricated with Engine Oil P03-001, and nuts. Torque the clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Torque the bolts that attach the tube to the oil pump to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(f) Torque the tube nut to 475 − 525 lb−in. (53.668 − 59.317 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the tube nut.

(g) Install the spray shield to the inboard side of the connection. Install the clamp, bolt, lubricated with Engine Oil P03−001, and nut that attach the spray shield and tube to the Flange M bracket. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(h) (Reference 2151) Install the hose clamp to the spray shield and torque it to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(18) (Post SB PW4ENG 79−75) Install (front) No. 4 bearing oil scavenge tube assembly (LR05) as follows. See Figure 403 (Sheets 21 through 24).

(a) Remove protective closures and install packing lubricated with Engine Oil P03−001, to flanged end of tube.

(b) Lubricate threads on tube nut with Antiseize Paste P06−054, and install tube to rear scavenge tube at Flange M and to port on main oil pump with bolts, threads lubricated with Antiseize Paste P06−054, handtight only. Wipe off unwanted paste.

(c) Install the loop clamp bracket on the TCC manifold bridge bracket and secure with the clamp bolts, lubricated with Engine Oil P03−001, and nuts. Torque the clamp bolts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(d) Torque bolts securing tube flange to main oil pump to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(e) Torque tube nut to 475 − 525 lb−in. (53.668 − 59.317 N.m) and secure with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the tube nut.

(f) Secure hose and tube assembly to the loop clamp bracket on the TCC manifold bridge bracket and the loop clamp bracket assembly on the fluid pressure dampener or adapter with clamps and bolts, lubricated with Engine Oil P03−001. Torque the bolts to 27 − 30 lb−in. (3.051 − 3.390 N.m).

(19) Install the angle gearbox oil scavenge tube assembly (LR01) as follows.

(a) Remove the covers. Install the packings, lubricated with Engine Oil P03−001, to the packing grooves at each end of the tube.

(b) Install the tube to the angle gearbox port and the main oil pump port.

(c) Attach the tube to the angle gearbox with two bolts, lubricated with Engine Oil P03−001. Tighten the bolts by hand.

(d) Attach the tube to the main oil pump with two bolts, lubricated with Antiseize Paste P06−054. Wipe off unwanted paste. Tighten the bolts by hand.

(e) Install the clamps that attach the tube to the gearbox brackets. Attach the clamps with the bolts, lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(f) Torque the bolts that attach the tube to the angle gearbox to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(g) Torque the bolts that attach the tube to the main oil pump to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(20) Install the No. 1, 1.5, and 2 bearing oil scavenge tube assembly (LR03) as follows.

(a) Remove the covers. Install the packing, lubricated with Engine Oil P03−001, to the flanged end of the tube.

(b) (Post SB PW4ENG 79−58), Install a strainer element into the flanged−end of the tube.

(c) Lubricate the tube nut threads with Engine Oil P03−001. Install the tube to the main oil pump and to the tube adjacent to Flange E at 7 o'clock position.

(d) Install the three bolts, lubricated with Antiseize Paste P06−054, that attach the tube to the pump. Wipe off unwanted paste. Tighten the bolts by hand.

(e) Install the four clamps that attach the tube to the gearbox and HPC case brackets. Attach the clamps with the bolts, lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(f) Torque the bolts that attach the tube to the oil pump to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(g) Torque the tube nut to 1300 − 1400 lb−in. (146.880 − 158.179 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the tube nut. See Figure 403.

(21) (Post SB PW4ENG 72−491) Install the deoiler idler bearing pressure line (LP35) as follows. See Figure 404.

(a) Remove protective closures from the two end nuts.

(b) Position the line to the gearbox and install the nut on the end of the line bent at 90 degrees to the deoiler (idler) spur gear adapter assembly in the gearbox.

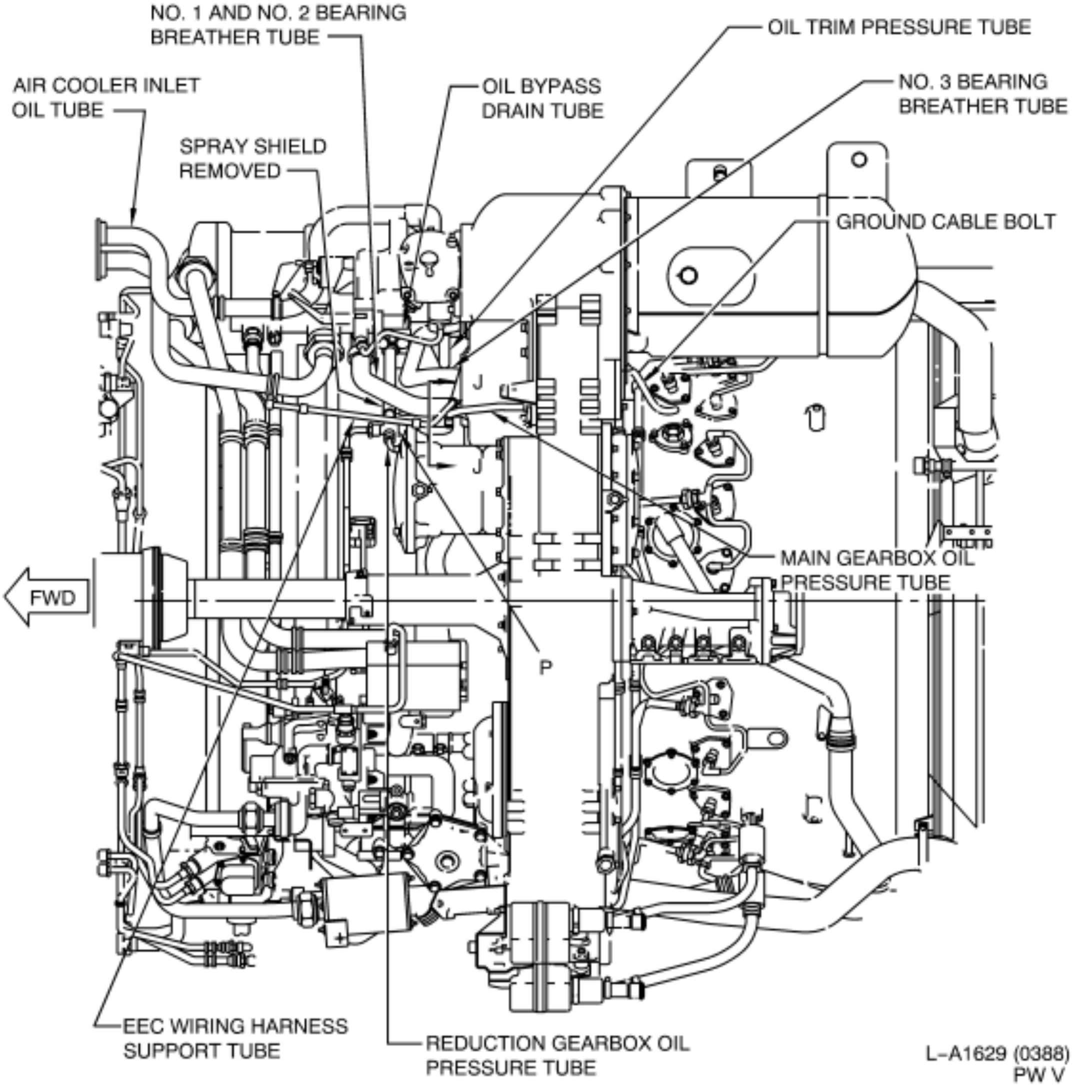
(c) Install the nut on the straight end of the line to the tee fitting in the No. 4 bearing oil pressure tube assembly (LP15).

(d) Torque the nut to the deoiler (idler) spur gear adapter assembly to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nut.

(e) Torque the nut to the tee fitting in the No. 4 bearing oil pressure tube assembly (LP15) to 340 − 375 lb−in. (38.415 − 42.369 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nut.

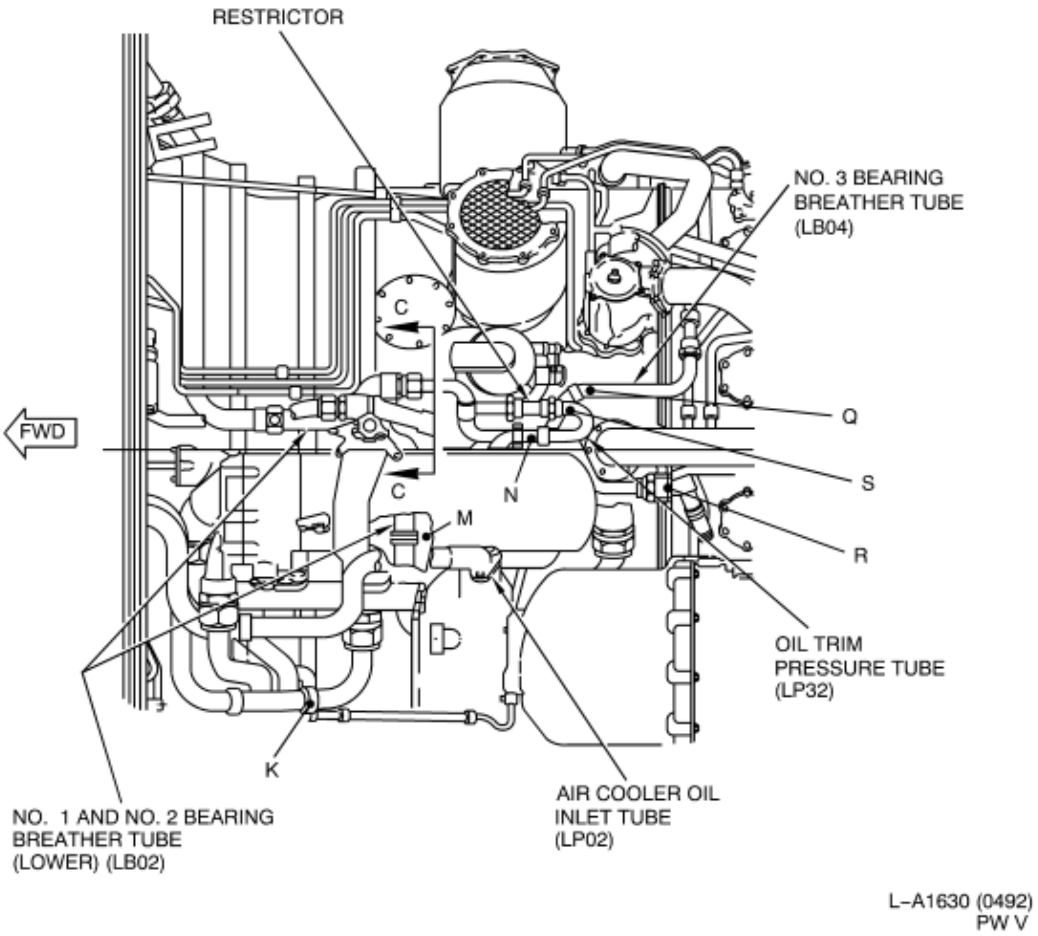
(f) Install clamps and bolts, threads lubricated with Engine Oil P03−001, to hold the line to the oil tank mount flange bracket and to the overboard breather pad bracket. Torque the clamp bolts to 36 − 41 lb−in. (4.067 − 4.519 N.m).

(g) Position the spray shield to the tee fitting connection and attach with the hose clamp. Torque the clamp to 15 − 18 lb−in. (1.695 − 2.034 N.m).

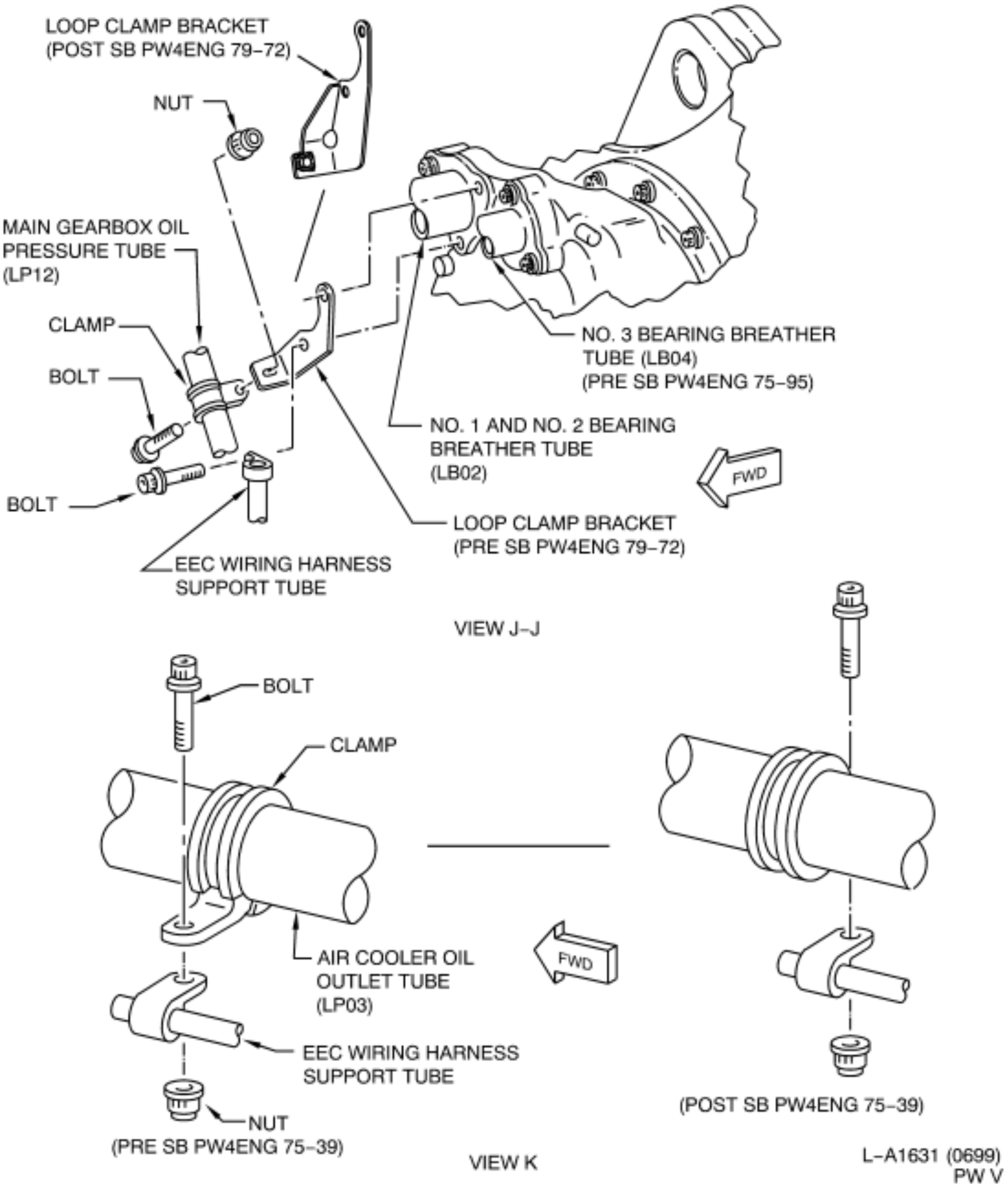

NO. 1 AND NO. 2 BEARING BREATHER TUBE
OIL TRIM PRESSURE TUBE
AIR COOLER INLET OIL TUBE
OIL BYPASS DRAIN TUBE
NO. 3 BEARING BREATHER TUBE
SPRAY SHIELD REMOVED
GROUND CABLE BOLT
J
J
MAIN GEARBOX OIL PRESSURE TUBE
FWD
P
EEC WIRING HARNESS SUPPORT TUBE
REDUCTION GEARBOX OIL PRESSURE TUBE
L-A1629 (0388)
PW V

Main Gearbox Plumbing
Figure 401 (Sheet 1)
(Task 72-00-61-420-002)

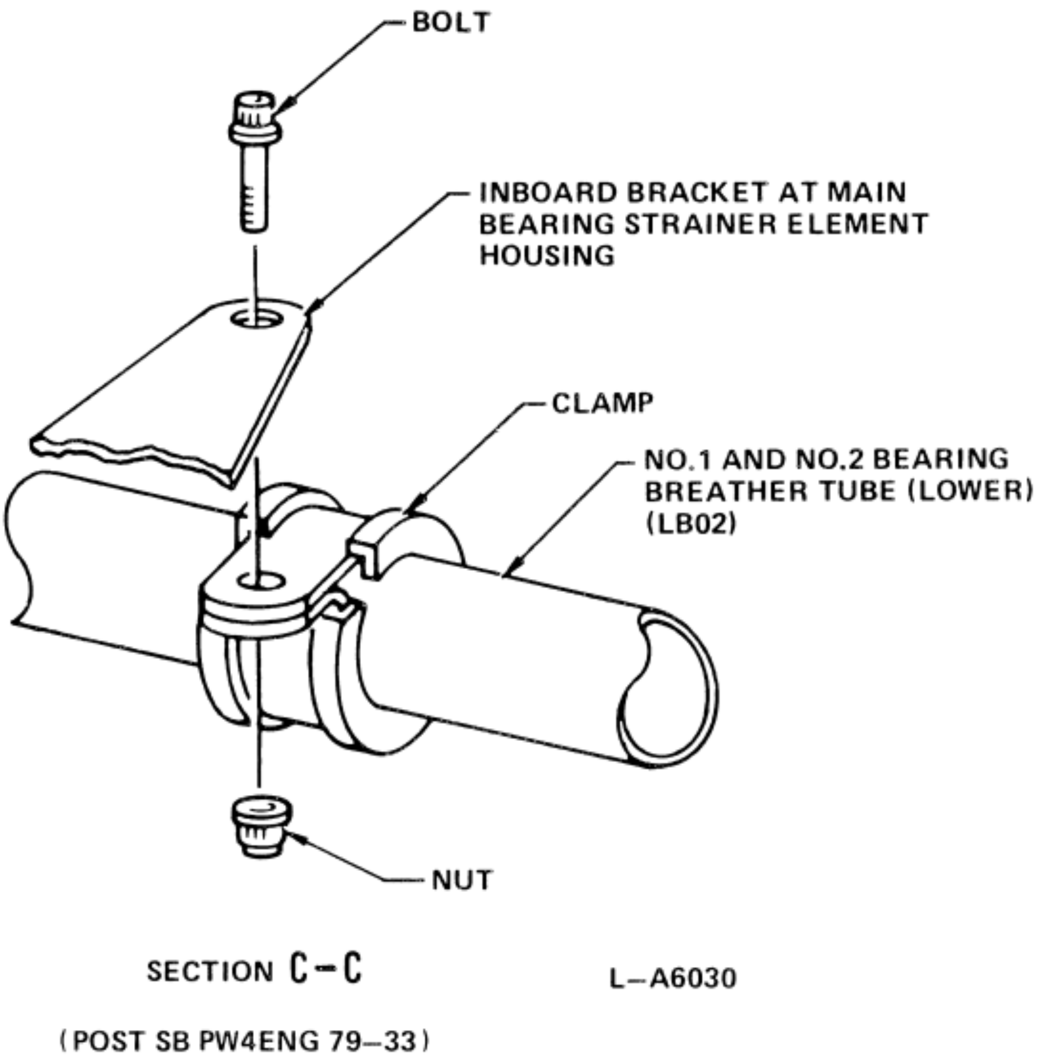
ENGINE GENERAL − MAIN GEARBOX − INSTALLATION−02


RESTRICTOR
NO. 3 BEARING BREATHER TUBE (LB04)
C
FWD
C
N
M
Q
S
R
OIL TRIM PRESSURE TUBE (LP32)
K
AIR COOLER OIL INLET TUBE (LP02)
NO. 1 AND NO. 2 BEARING BREATHER TUBE (LOWER) (LB02)
L−A1630 (0492)
PW V

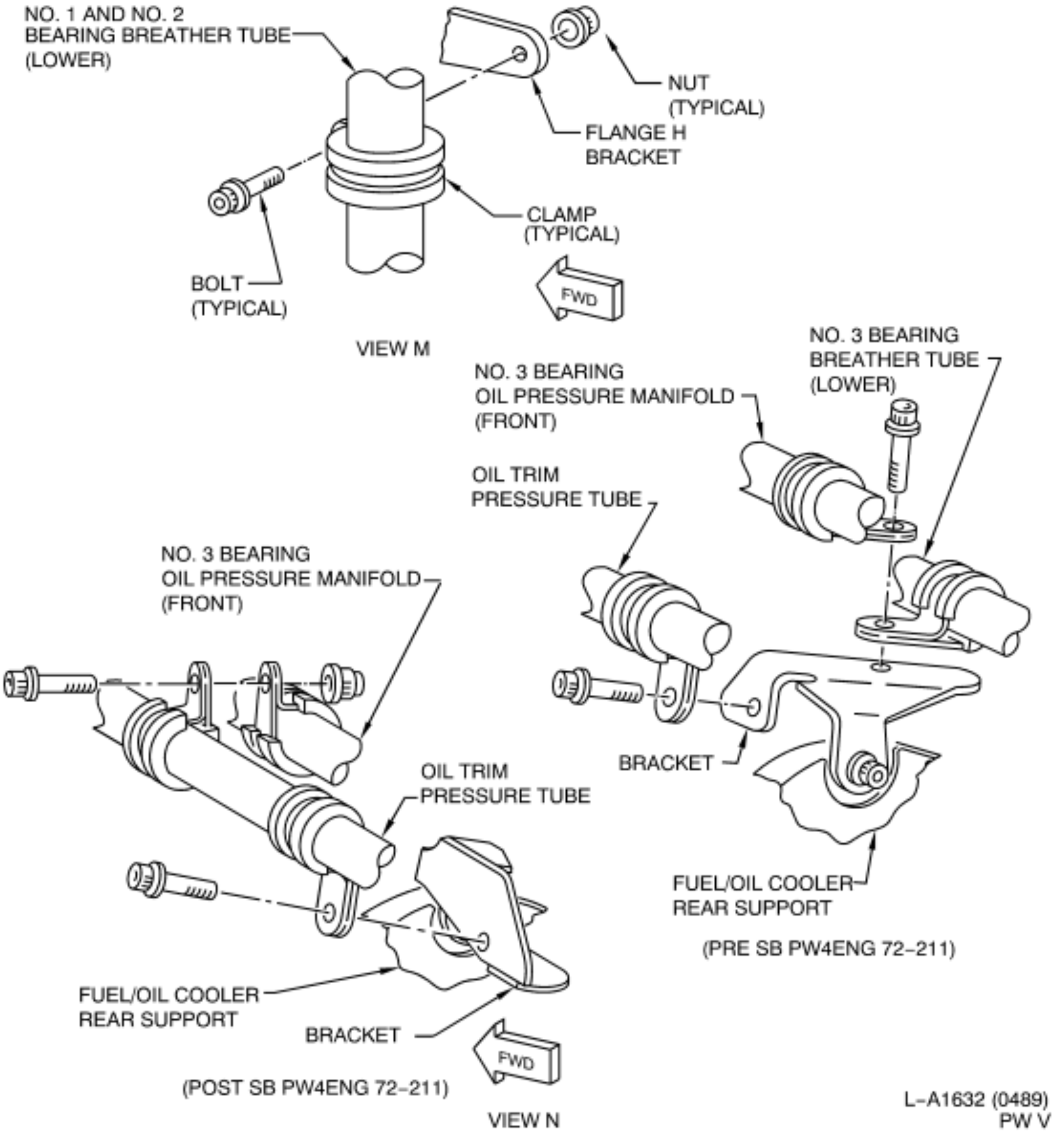
Main Gearbox Plumbing
Figure 401 (Sheet 2)
(Task 72−00−61−420−002)


LOOP CLAMP BRACKET
(POST SB PW4ENG 79-72)
NUT
MAIN GEARBOX OIL
PRESSURE TUBE
(LP12)
CLAMP
BOLT
BOLT
EEC WIRING HARNESS
SUPPORT TUBE
NO. 3 BEARING BREATHER
TUBE (LB04)
(PRE SB PW4ENG 75-95)
NO. 1 AND NO. 2 BEARING
BREATHER TUBE
(LB02)
FWD
LOOP CLAMP BRACKET
(PRE SB PW4ENG 79-72)
VIEW J-J
BOLT
CLAMP
AIR COOLER OIL
OUTLET TUBE
(LP03)
FWD
EEC WIRING HARNESS
SUPPORT TUBE
NUT
(PRE SB PW4ENG 75-39)
VIEW K
(POST SB PW4ENG 75-39)
L-A1631 (0699)
PW V

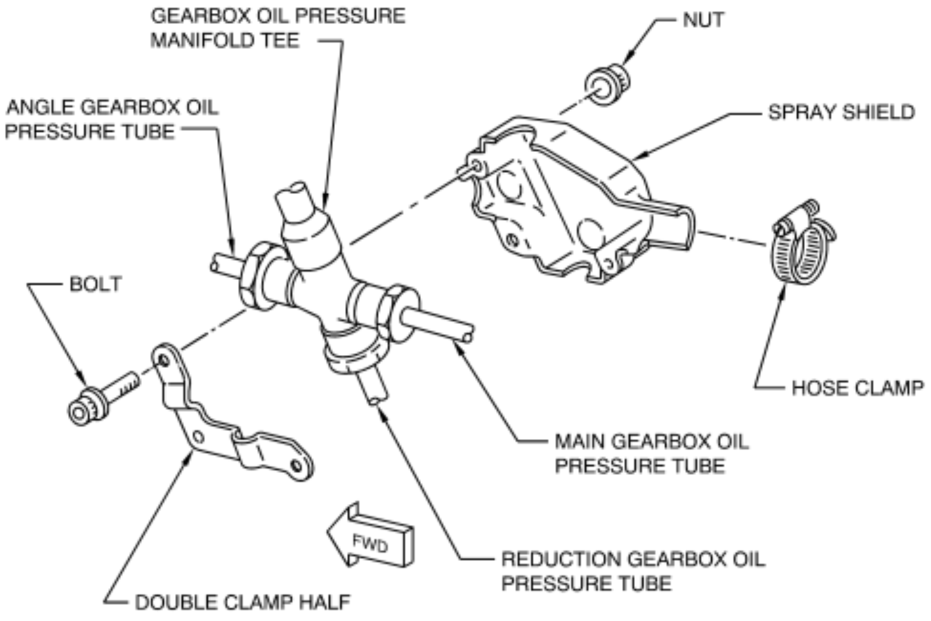
Main Gearbox Plumbing
Figure 401 (Sheet 3)
(Task 72-00-61-420-002)


BOLT
INBOARD BRACKET AT MAIN BEARING STRAINER ELEMENT HOUSING
CLAMP
NO.1 AND NO.2 BEARING BREATHER TUBE (LOWER) (LB02)
NUT
SECTION C-C
L-A6030
(POST SB PW4ENG 79-33)

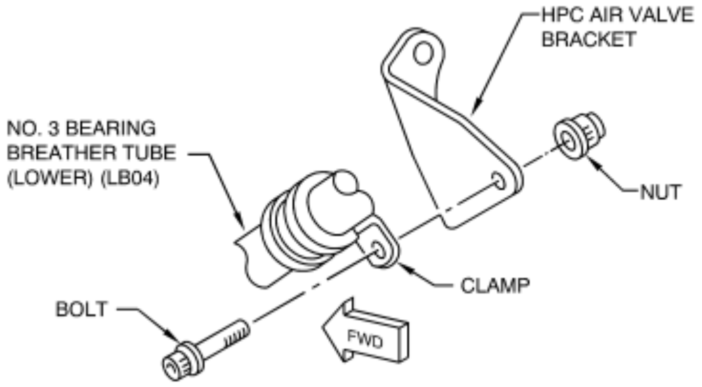
Main Gearbox Plumbing
Figure 401 (Sheet 4)
(Task 72-00-61-420-002)


NO. 1 AND NO. 2
BEARING BREATHER TUBE
(LOWER)
NUT
(TYPICAL)
FLANGE H
BRACKET
CLAMP
(TYPICAL)
BOLT
(TYPICAL)
FWD
VIEW M
NO. 3 BEARING
BREATHER TUBE
(LOWER)
NO. 3 BEARING
OIL PRESSURE MANIFOLD
(FRONT)
OIL TRIM
PRESSURE TUBE
NO. 3 BEARING
OIL PRESSURE MANIFOLD
(FRONT)
BRACKET
OIL TRIM
PRESSURE TUBE
FUEL/OIL COOLER
REAR SUPPORT
(PRE SB PW4ENG 72-211)
FUEL/OIL COOLER
REAR SUPPORT
BRACKET
FWD
(POST SB PW4ENG 72-211)
VIEW N
L-A1632 (0489)
PW V

Main Gearbox Plumbing
Figure 401 (Sheet 5)
(Task 72-00-61-420-002)


GEARBOX OIL PRESSURE MANIFOLD TEE
NUT
ANGLE GEARBOX OIL PRESSURE TUBE
SPRAY SHIELD
BOLT
HOSE CLAMP
MAIN GEARBOX OIL PRESSURE TUBE
FWD
REDUCTION GEARBOX OIL PRESSURE TUBE
DOUBLE CLAMP HALF

VIEW P

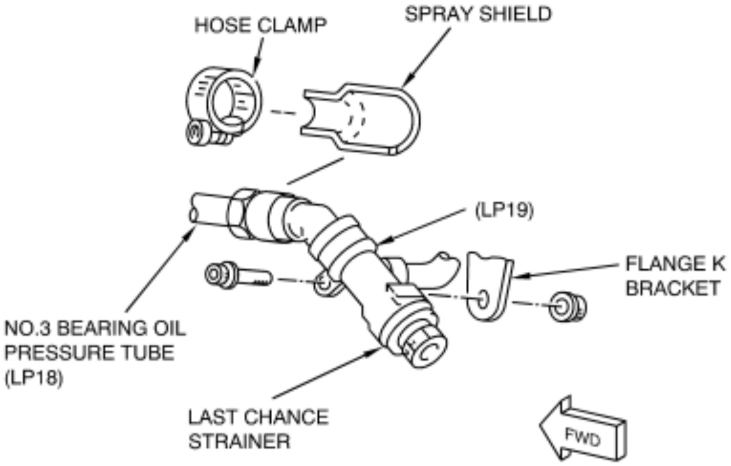

HPC AIR VALVE BRACKET
NO. 3 BEARING BREATHER TUBE (LOWER) (LB04)
NUT
CLAMP
BOLT
FWD

(POST SB PW4ENG 72-211)

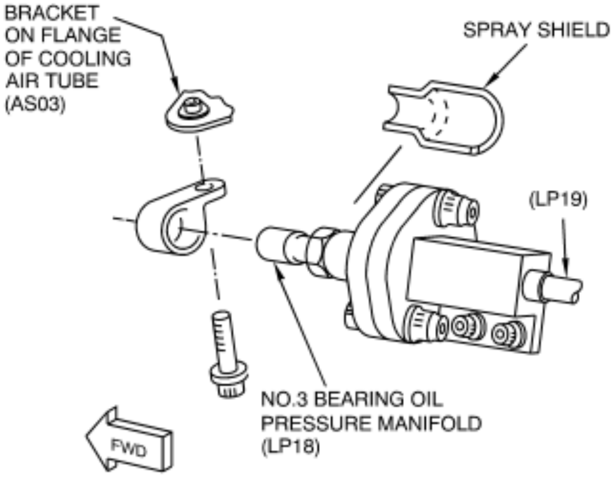
VIEW Q

L-A1633 (0489)
PW V

Main Gearbox Plumbing
Figure 401 (Sheet 6)
(Task 72-00-61-420-002)


HOSE CLAMP
SPRAY SHIELD
(LP19)
FLANGE K
BRACKET
NO.3 BEARING OIL
PRESSURE TUBE
(LP18)
LAST CHANCE
STRAINER
FWD

VIEW R
(PRE SB PW4ENG 79-52)

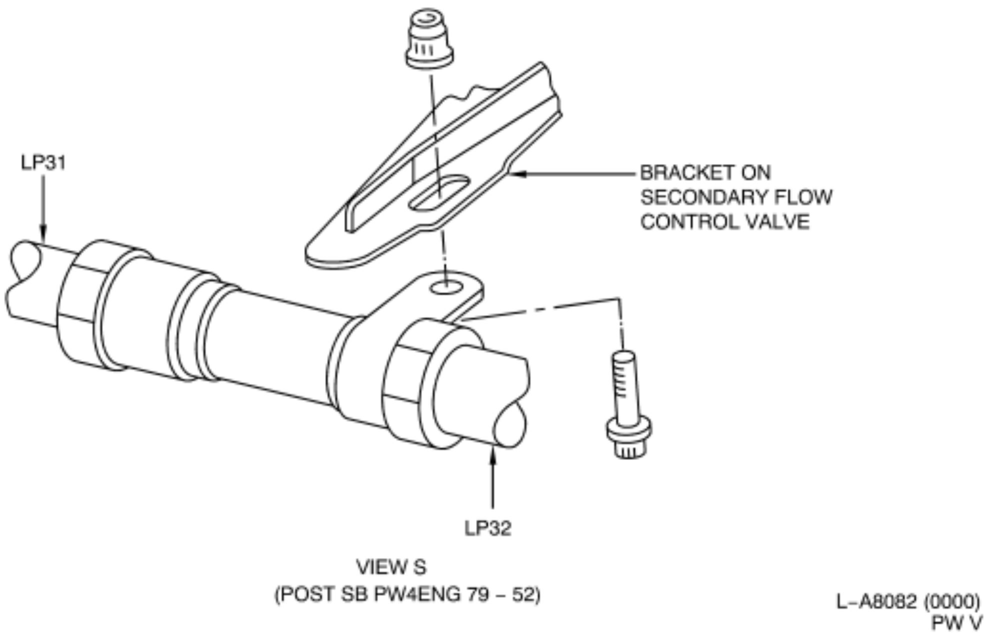

BRACKET
ON FLANGE
OF COOLING
AIR TUBE
(AS03)
SPRAY SHIELD
(LP19)
NO.3 BEARING OIL
PRESSURE MANIFOLD
(LP18)
FWD

VIEW R
(POST SB PW4ENG 79-52)

L-A8058 (0000)
PW V

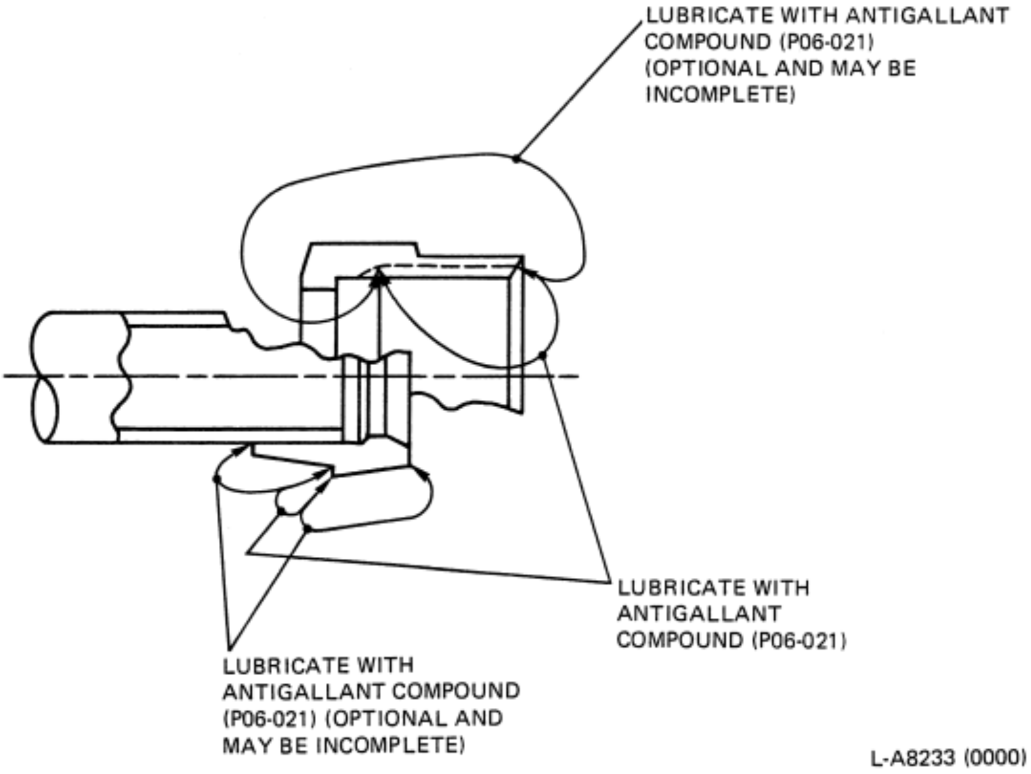
Main Gearbox Plumbing
Figure 401 (Sheet 7)
(Task 72-00-61-420-002)

ENGINE GENERAL − MAIN GEARBOX − INSTALLATION−02

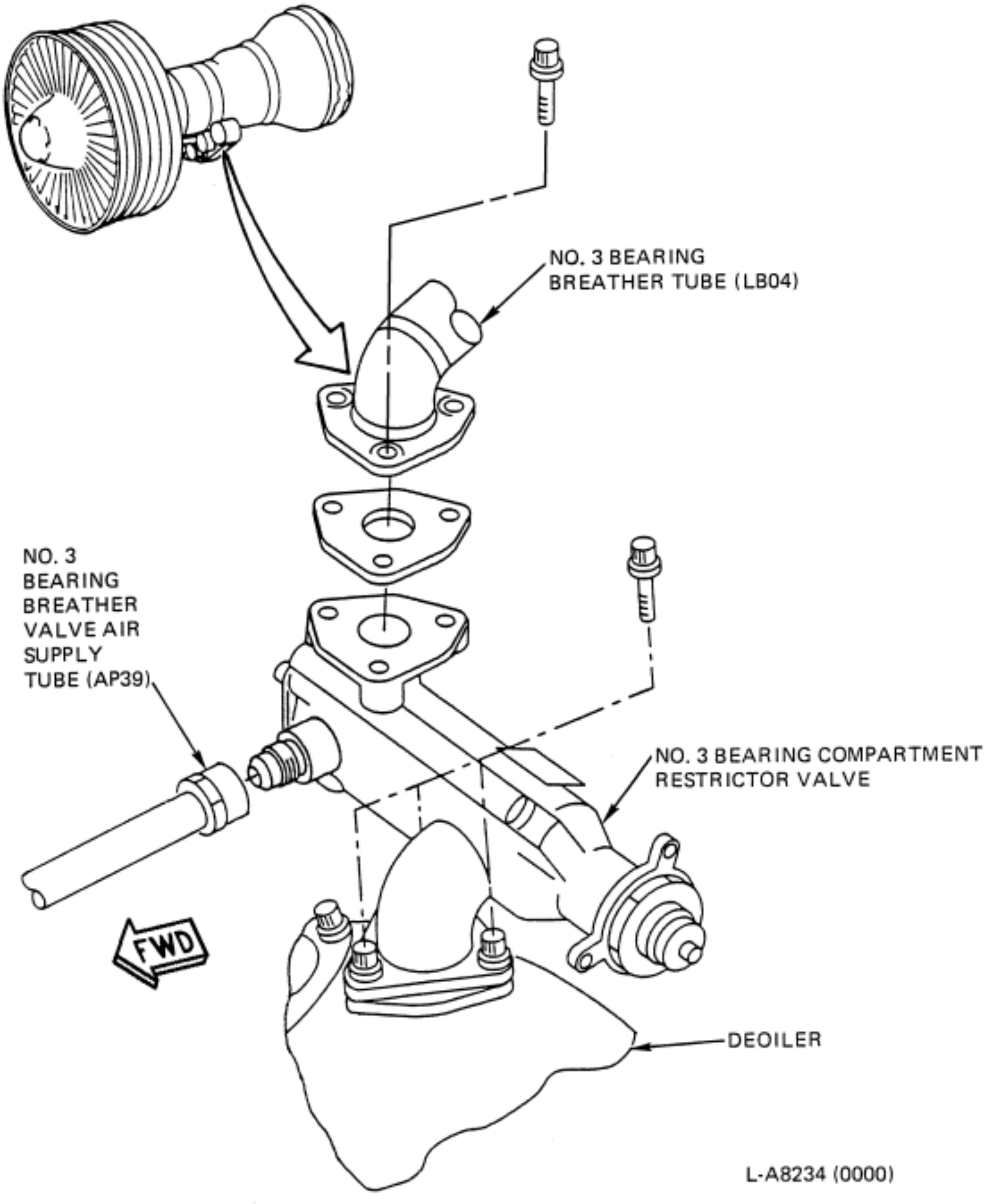

LP31
BRACKET ON
SECONDARY FLOW
CONTROL VALVE
LP32
VIEW S
(POST SB PW4ENG 79 − 52)
L−A8082 (0000)
PW V

Main Gearbox Plumbing
Figure 401 (Sheet 8)
(Task 72−00−61−420−002)

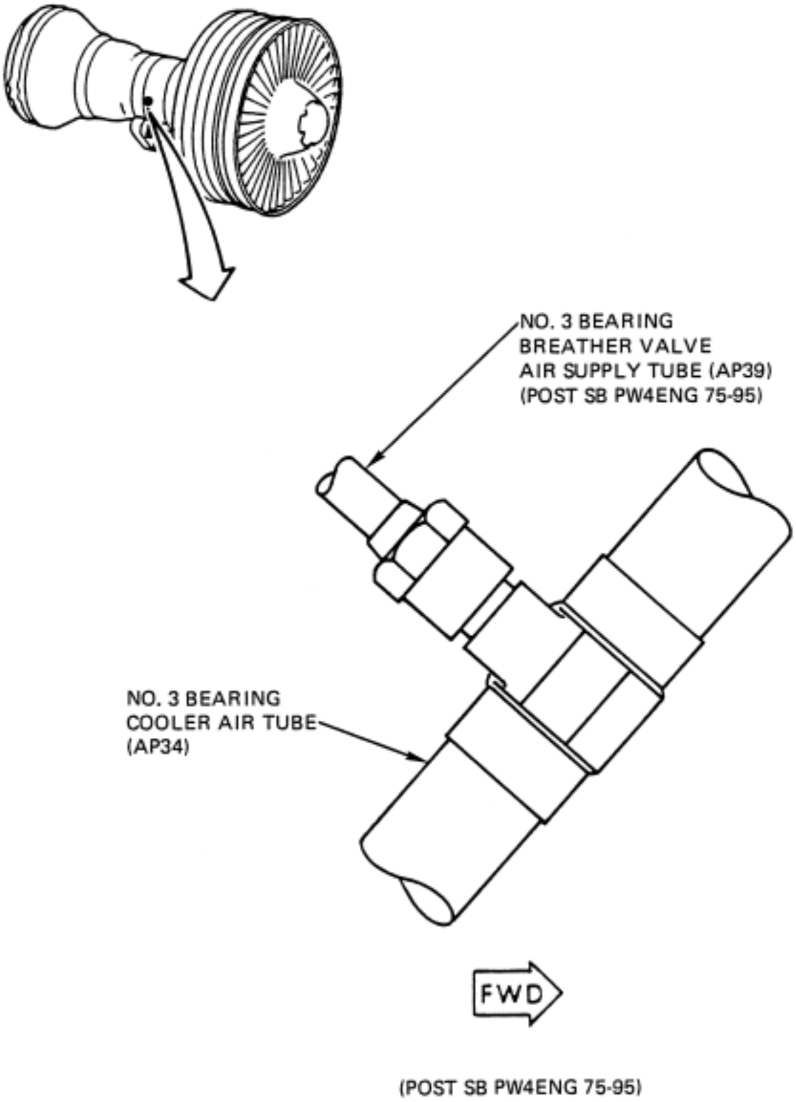
R
R


LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
L-A8233 (0000)

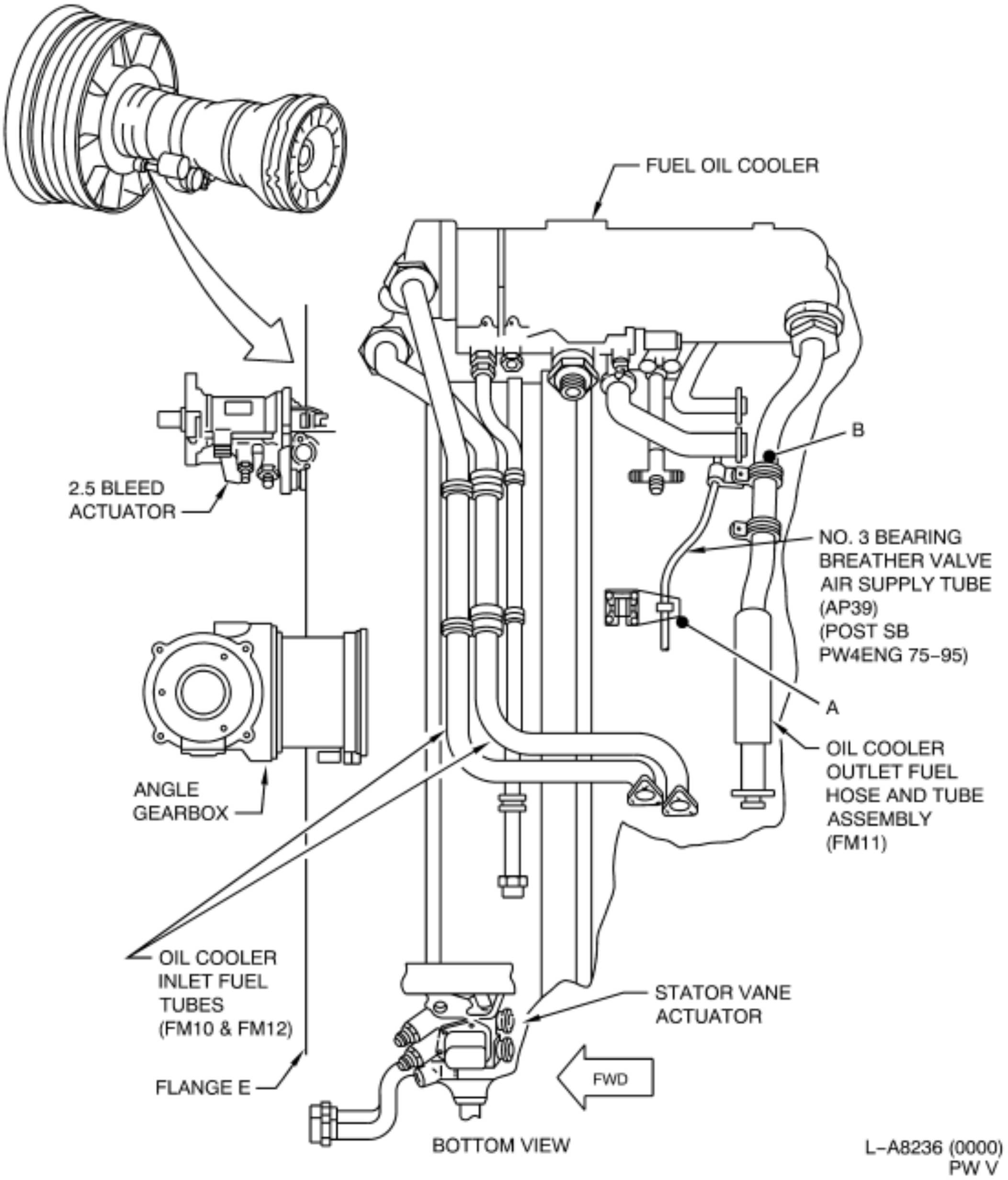
Main Gearbox Plumbing (Application of Antigallant)
Figure 401 (Sheet 9)
(Task 72−00−61−420−002)


NO. 3 BEARING BREATHER TUBE (LB04)
NO. 3 BEARING BREATHER VALVE AIR SUPPLY TUBE (AP39)
NO. 3 BEARING COMPARTMENT RESTRICTOR VALVE
FWD
DEOILER
L-A8234 (0000)

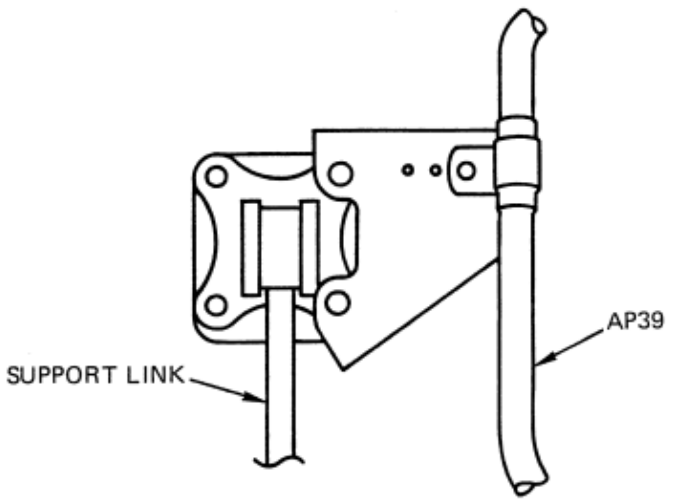
Main Gearbox Plumbing (Post SB PW4ENG 75-95)
Figure 402 (Sheet 1)
(Task 72-00-61-420-002)


NO. 3 BEARING
BREATHER VALVE
AIR SUPPLY TUBE (AP39)
(POST SB PW4ENG 75-95)
NO. 3 BEARING
COOLER AIR TUBE
(AP34)
FWD
(POST SB PW4ENG 75-95)
L-A8239 (0698)

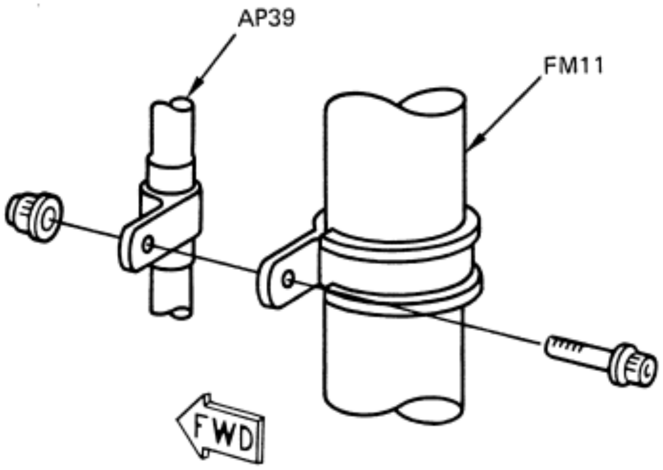
Main Gearbox Plumbing (Post SB PW4ENG 75-95)
Figure 402 (Sheet 2)
(Task 72-00-61-420-002)


FUEL OIL COOLER
B
2.5 BLEED ACTUATOR
NO. 3 BEARING BREATHER VALVE AIR SUPPLY TUBE (AP39) (POST SB PW4ENG 75-95)
A
ANGLE GEARBOX
OIL COOLER OUTLET FUEL HOSE AND TUBE ASSEMBLY (FM11)
OIL COOLER INLET FUEL TUBES (FM10 & FM12)
STATOR VANE ACTUATOR
FLANGE E
FWD
BOTTOM VIEW
L-A8236 (0000)
PW V

Main Gearbox Plumbing (Post SB PW4ENG 75-95)
Figure 402 (Sheet 3)
(Task 72-00-61-420-002)



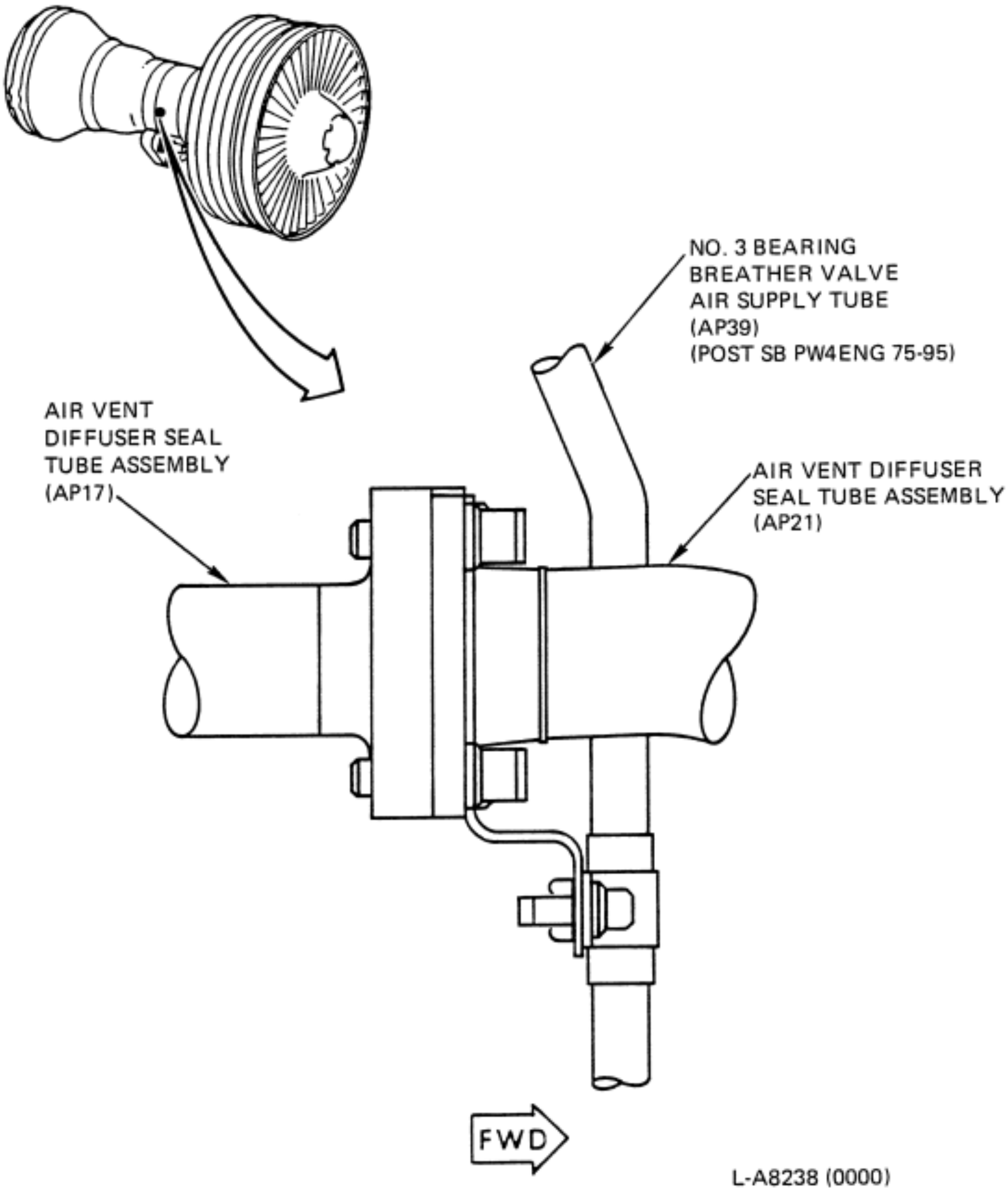
(POST SB PW4ENG 75-95)
VIEW A



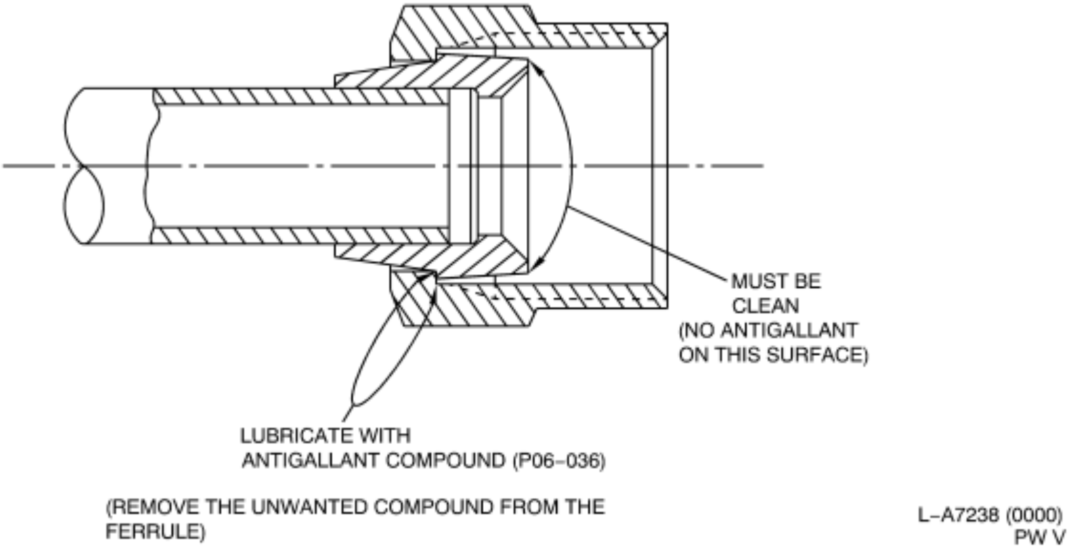
(POST SB PW4ENG 75-95)
VIEW B

L-A8237 (0000)

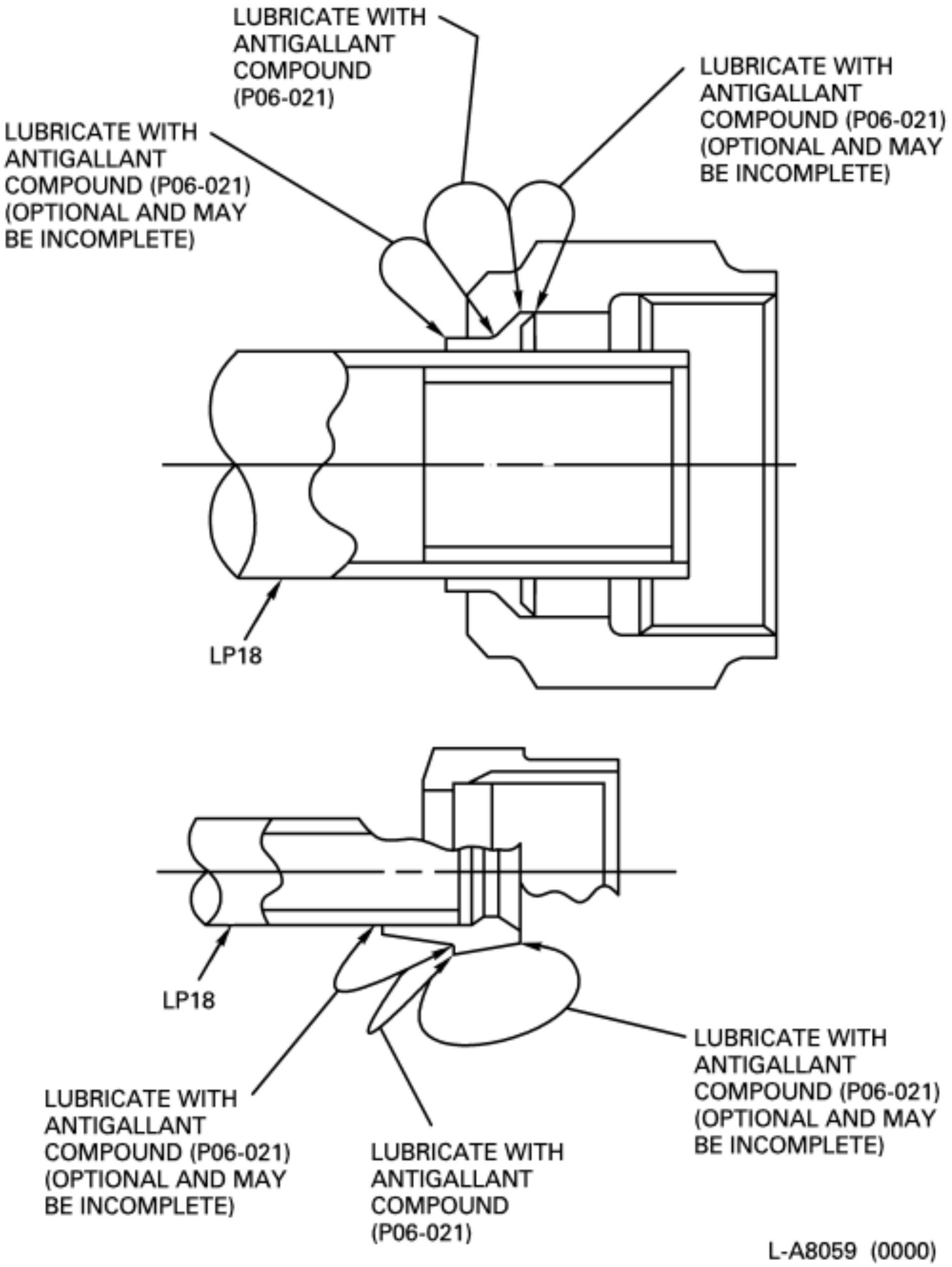
Main Gearbox Plumbing (Post SB PW4ENG 75-95)
Figure 402 (Sheet 4)
(Task 72-00-61-420-002)


NO. 3 BEARING BREATHER VALVE AIR SUPPLY TUBE (AP39) (POST SB PW4ENG 75-95)
AIR VENT DIFFUSER SEAL TUBE ASSEMBLY (AP17)
AIR VENT DIFFUSER SEAL TUBE ASSEMBLY (AP21)
FWD
L-A8238 (0000)

Main Gearbox Plumbing (Post SB PW4ENG 75−95)
Figure 402 (Sheet 5)
(Task 72−00−61−420−002)

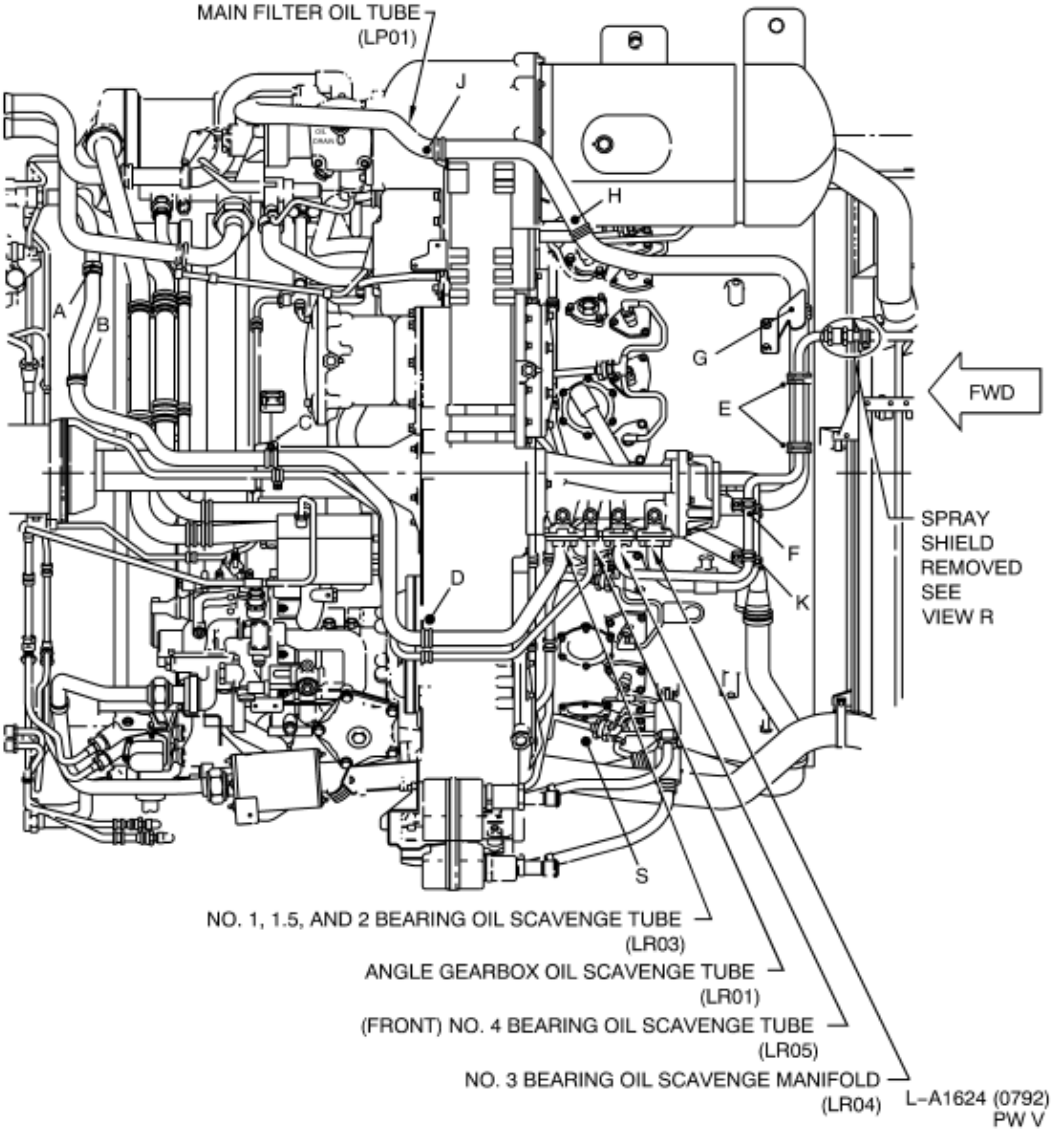

MUST BE CLEAN (NO ANTIGALLANT ON THIS SURFACE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-036)
(REMOVE THE UNWANTED COMPOUND FROM THE FERRULE)
L-A7238 (0000)
PW V

Main Gearbox Plumbing Application Of Antigallant
To Back Of Tube Ferrules (Pre SB PW4ENG 79-52)
Figure 402 (Sheet 6)
(Task 72-00-61-420-002)

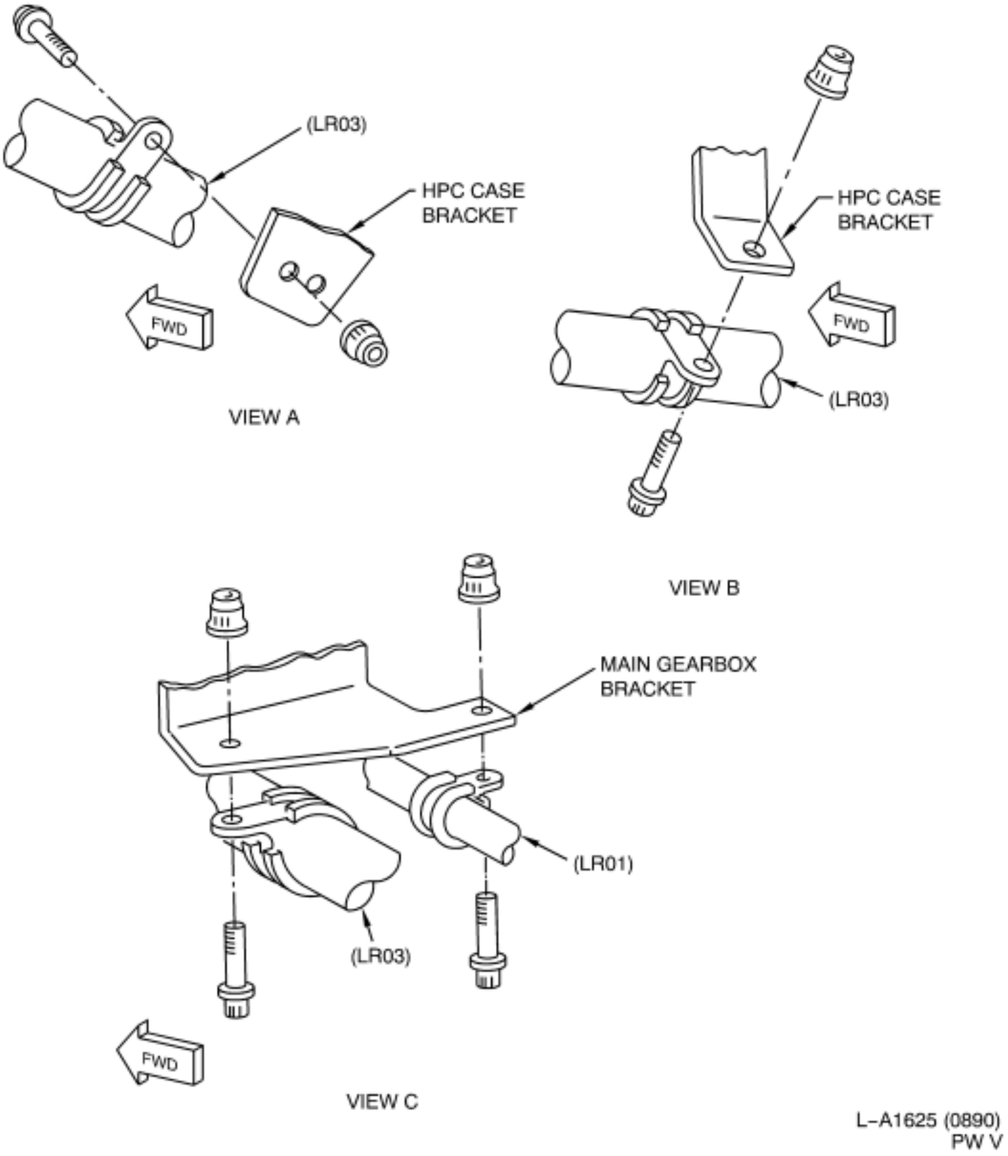

LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LP18
LP18
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021) (OPTIONAL AND MAY BE INCOMPLETE)
LUBRICATE WITH ANTIGALLANT COMPOUND (P06-021)
L-A8059 (0000)

Main Gearbox Plumbing Application Of Antigallant To
Back Of Manifold Ferrules (Post SB PW4ENG 79−52)
Figure 402 (Sheet 7)
(Task 72−00−61−420−002)

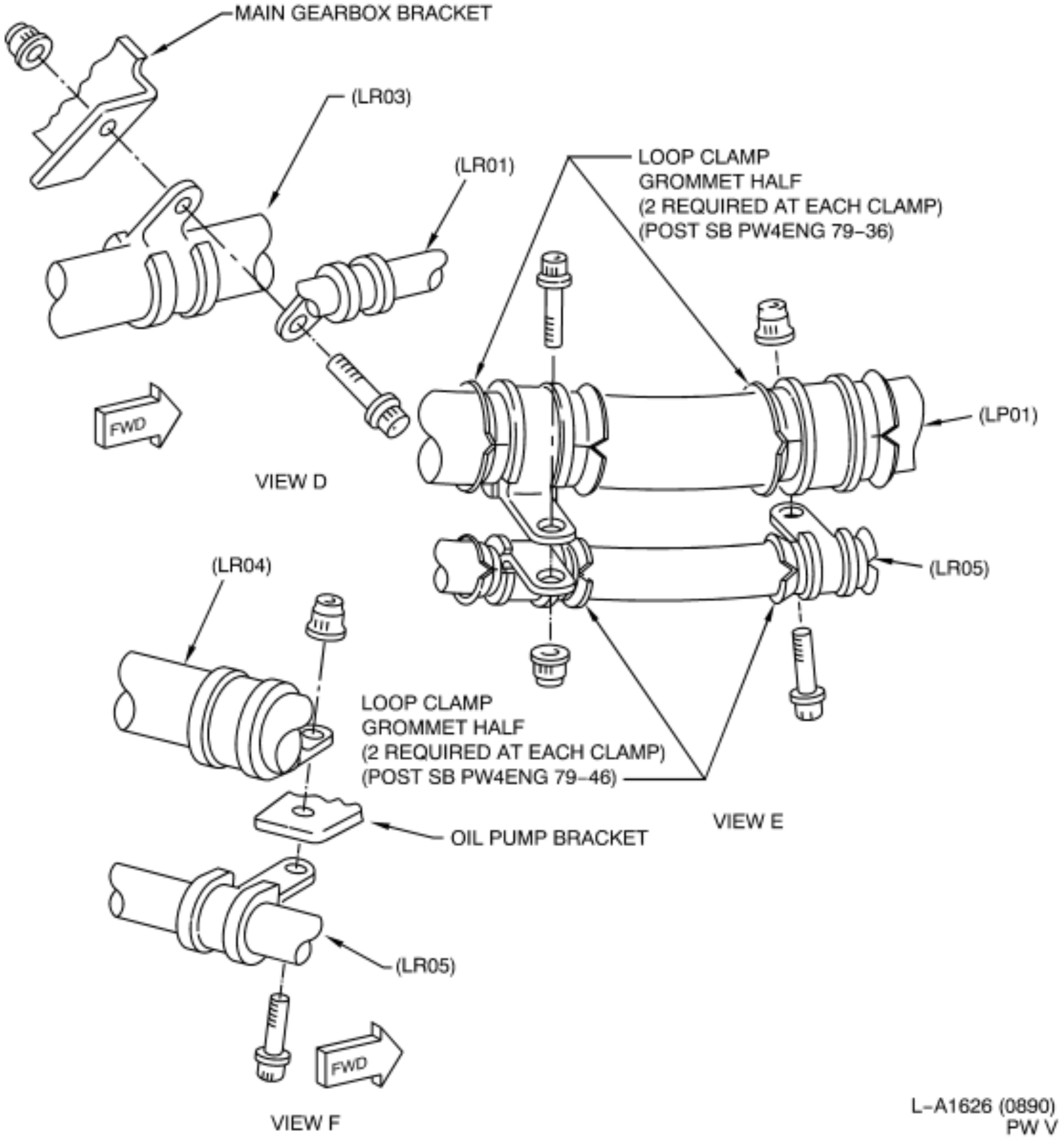
ENGINE GENERAL − MAIN GEARBOX − INSTALLATION−02


MAIN FILTER OIL TUBE (LP01)
J
H
A
B
C
G
E
FWD
F
K
SPRAY SHIELD REMOVED SEE VIEW R
D
S
NO. 1, 1.5, AND 2 BEARING OIL SCAVENGE TUBE (LR03)
ANGLE GEARBOX OIL SCAVENGE TUBE (LR01)
(FRONT) NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
NO. 3 BEARING OIL SCAVENGE MANIFOLD (LR04)
L−A1624 (0792)
PW V

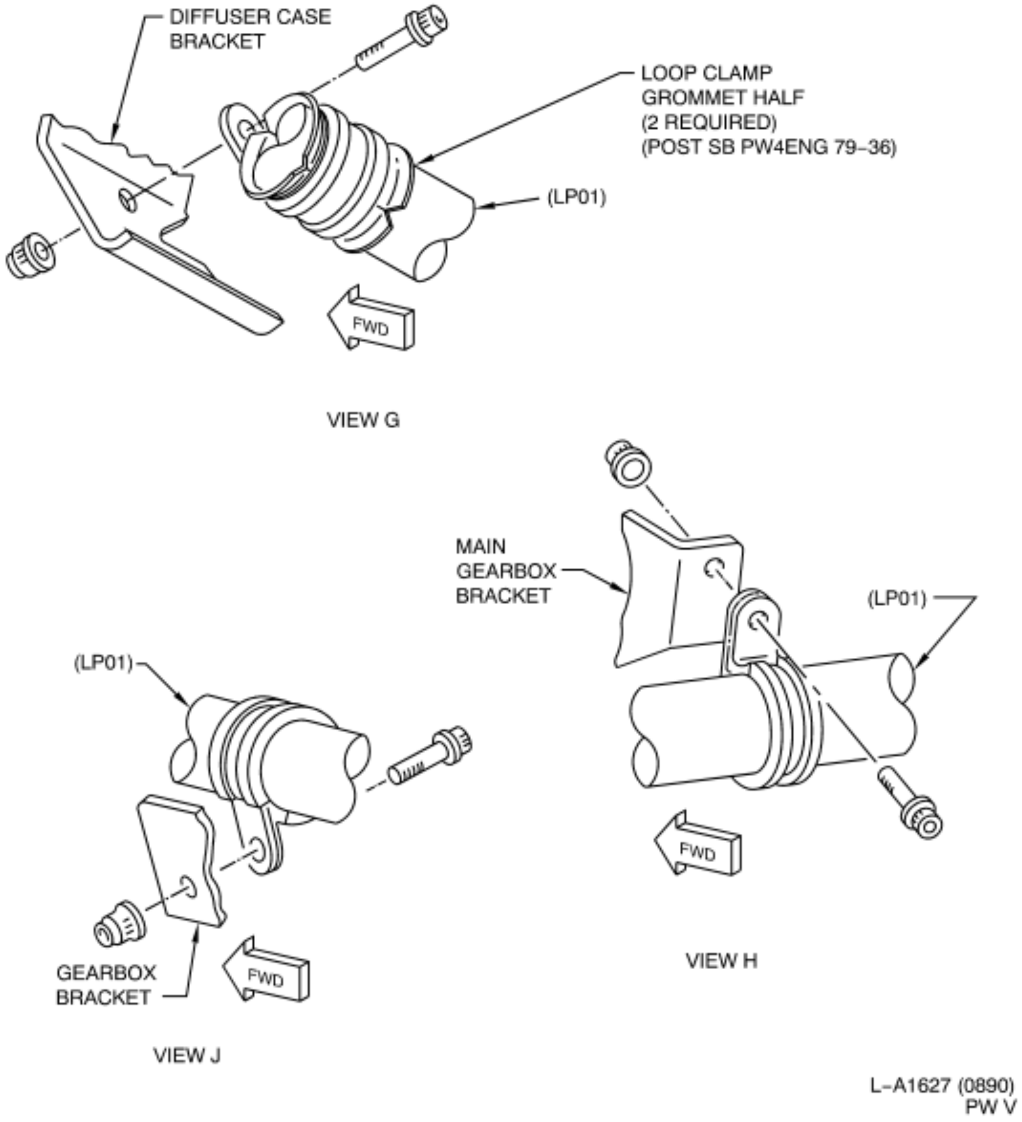
Main Gearbox Plumbing (Pre SB PW4ENG 79−75)
Figure 403 (Sheet 1)
(Task 72−00−61−420−002)


(LR03)
HPC CASE BRACKET
FWD
VIEW A
HPC CASE BRACKET
FWD
(LR03)
VIEW B
MAIN GEARBOX BRACKET
(LR01)
(LR03)
FWD
VIEW C
L−A1625 (0890)
PW V

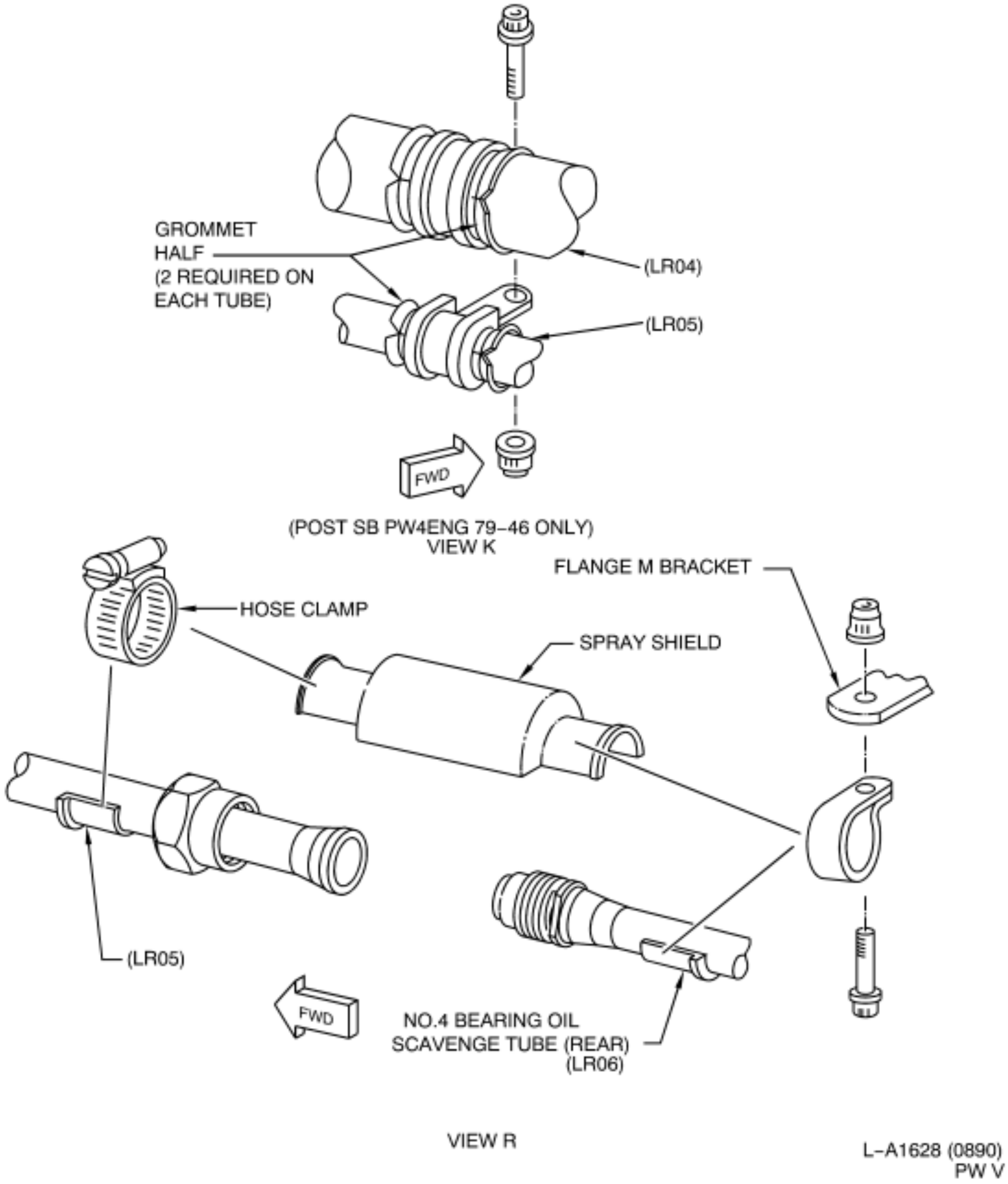
Main Gearbox Plumbing
Figure 403 (Sheet 2)
(Task 72−00−61−420−002)


MAIN GEARBOX BRACKET
(LR03)
(LR01)
LOOP CLAMP
GROMMET HALF
(2 REQUIRED AT EACH CLAMP)
(POST SB PW4ENG 79-36)
FWD
(LP01)
VIEW D
(LR04)
(LR05)
LOOP CLAMP
GROMMET HALF
(2 REQUIRED AT EACH CLAMP)
(POST SB PW4ENG 79-46)
OIL PUMP BRACKET
VIEW E
(LR05)
FWD
VIEW F
L-A1626 (0890)
PW V

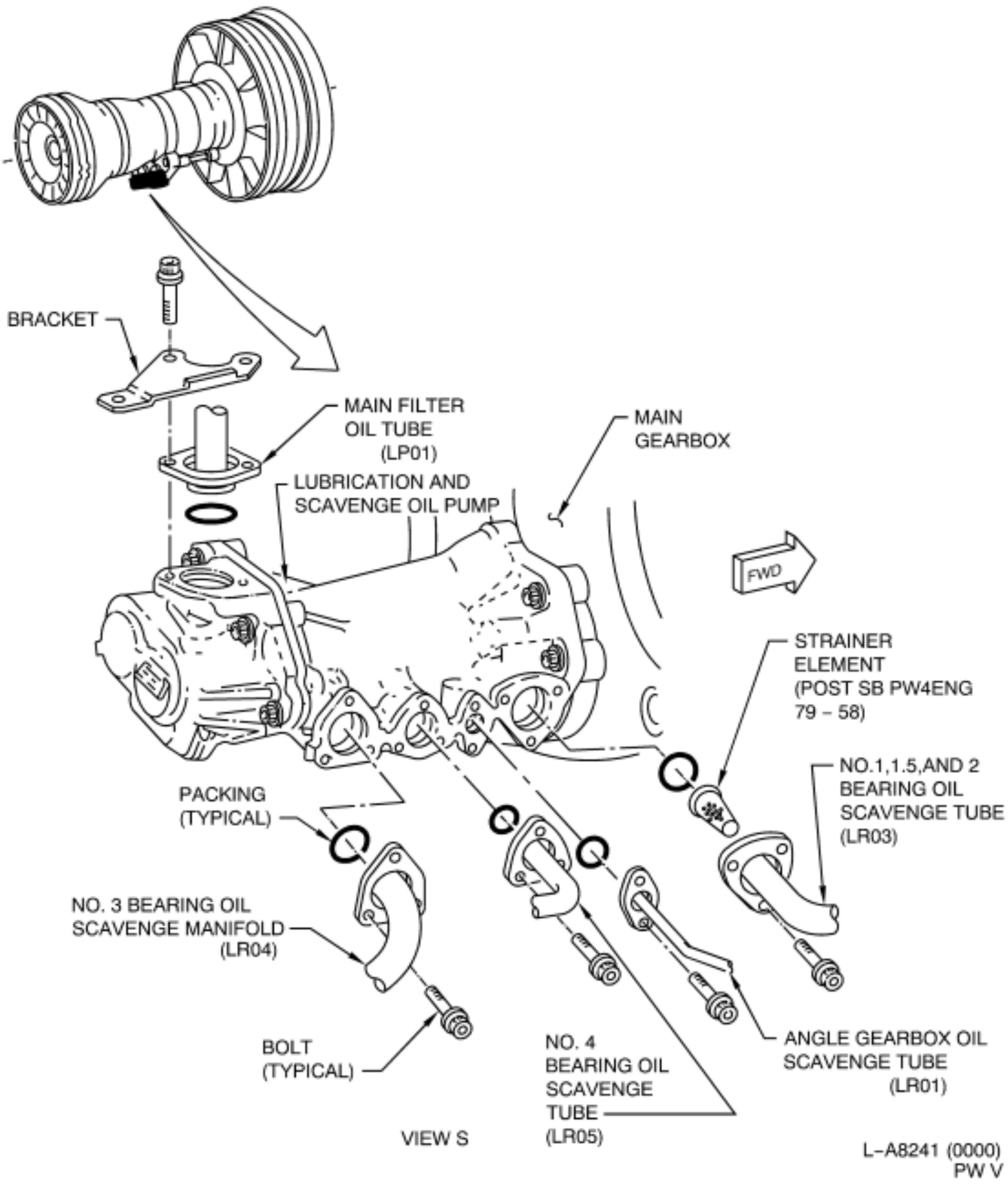
Main Gearbox Plumbing (Pre SB PW4ENG 79-75)
Figure 403 (Sheet 3)
(Task 72-00-61-420-002)


DIFFUSER CASE BRACKET
LOOP CLAMP GROMMET HALF (2 REQUIRED) (POST SB PW4ENG 79-36)
(LP01)
FWD
VIEW G
MAIN GEARBOX BRACKET
(LP01)
(LP01)
FWD
VIEW H
GEARBOX BRACKET
FWD
VIEW J
L-A1627 (0890)
PW V

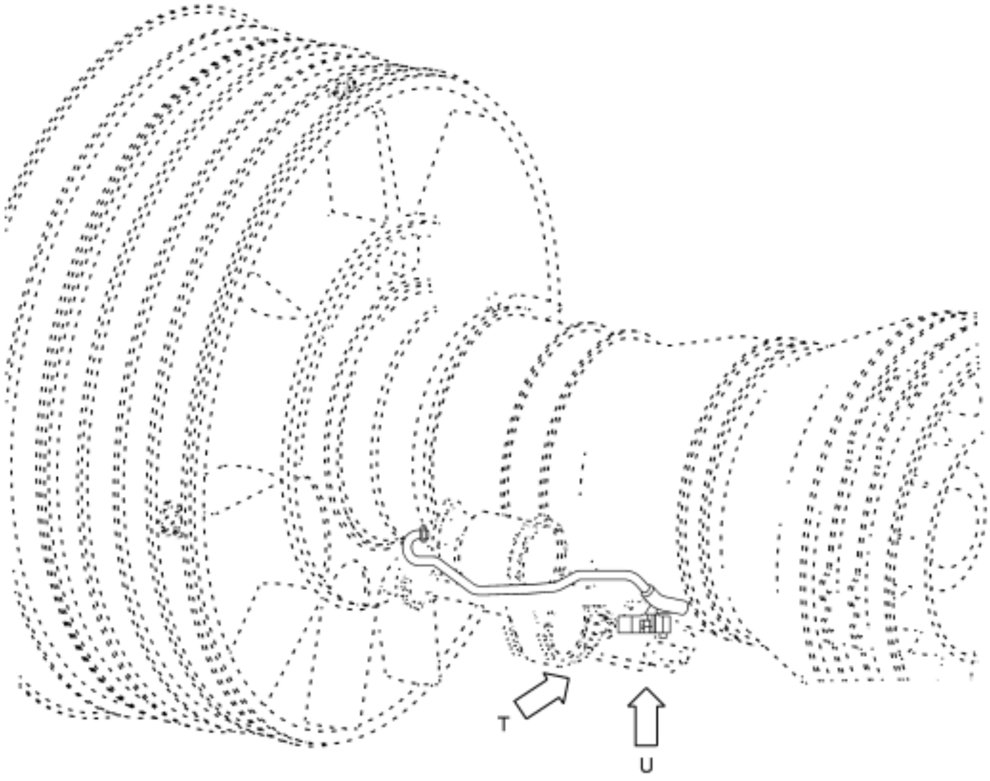
Main Gearbox Plumbing (Pre SB PW4ENG 79-75)
Figure 403 (Sheet 4)
(Task 72-00-61-420-002)


GROMMET HALF (2 REQUIRED ON EACH TUBE)
(LR04)
(LR05)
FWD
(POST SB PW4ENG 79-46 ONLY)
VIEW K
FLANGE M BRACKET
HOSE CLAMP
SPRAY SHIELD
(LR05)
FWD
NO.4 BEARING OIL SCAVENGE TUBE (REAR) (LR06)
VIEW R
L-A1628 (0890)
PW V

Main Gearbox Plumbing (Pre SB PW4ENG 79-75)
Figure 403 (Sheet 5)
(Task 72-00-61-420-002)


BRACKET
MAIN FILTER OIL TUBE (LP01)
LUBRICATION AND SCAVENGE OIL PUMP
MAIN GEARBOX
FWD
STRAINER ELEMENT (POST SB PW4ENG 79 - 58)
NO.1,1.5,AND 2 BEARING OIL SCAVENGE TUBE (LR03)
PACKING (TYPICAL)
NO. 3 BEARING OIL SCAVENGE MANIFOLD (LR04)
BOLT (TYPICAL)
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
ANGLE GEARBOX OIL SCAVENGE TUBE (LR01)
VIEW S
L-A8241 (0000)
PW V

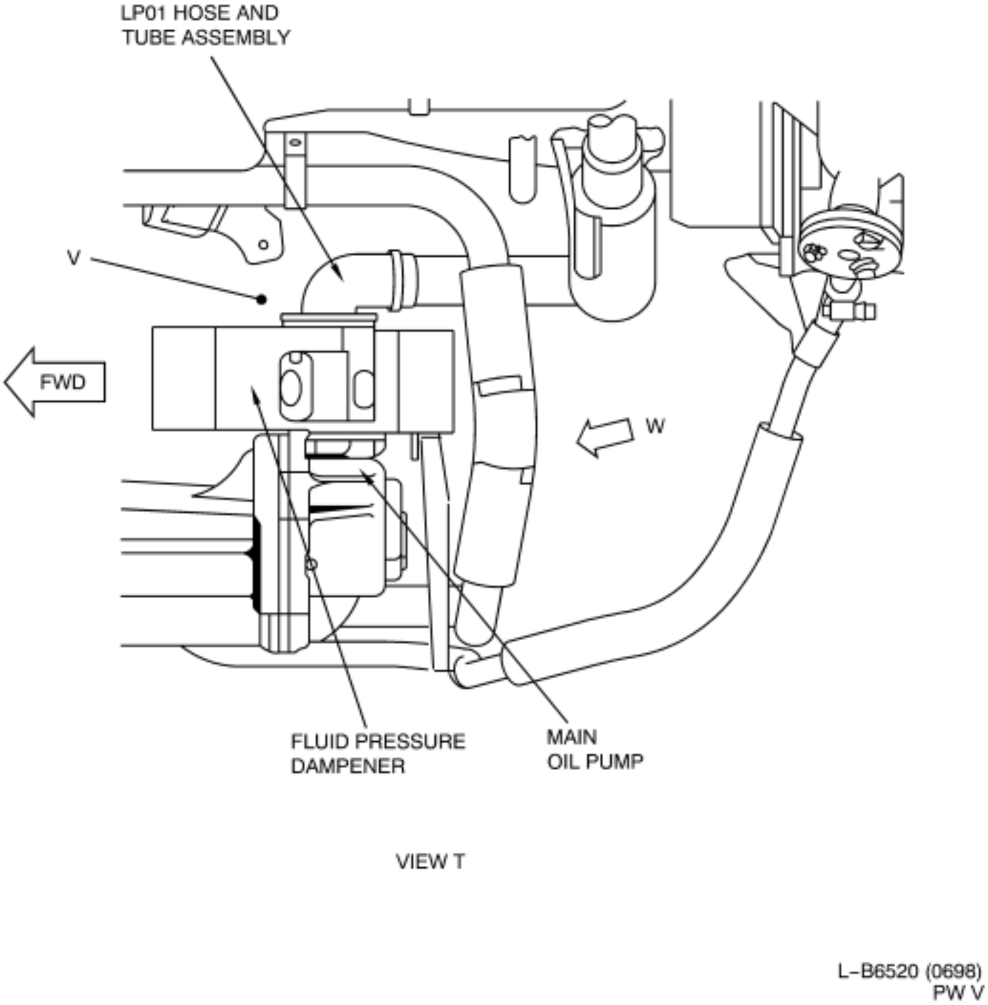
Main Gearbox Plumbing (Pre SB PW4ENG 79-75)
Figure 403 (Sheet 6)
(Task 72-00-61-420-002)



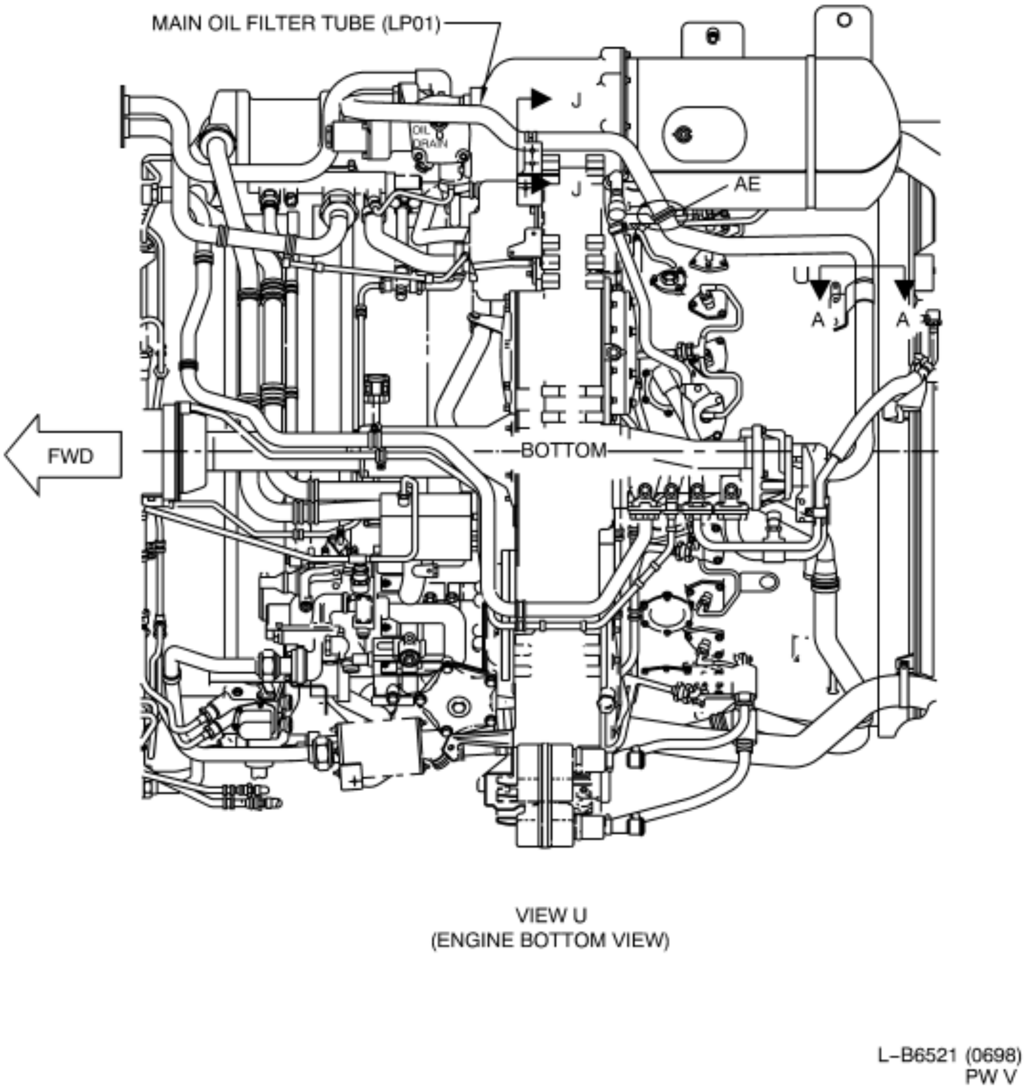
ENGINE LEFT SIDE VIEW

L-B6519 (0698)
PW V

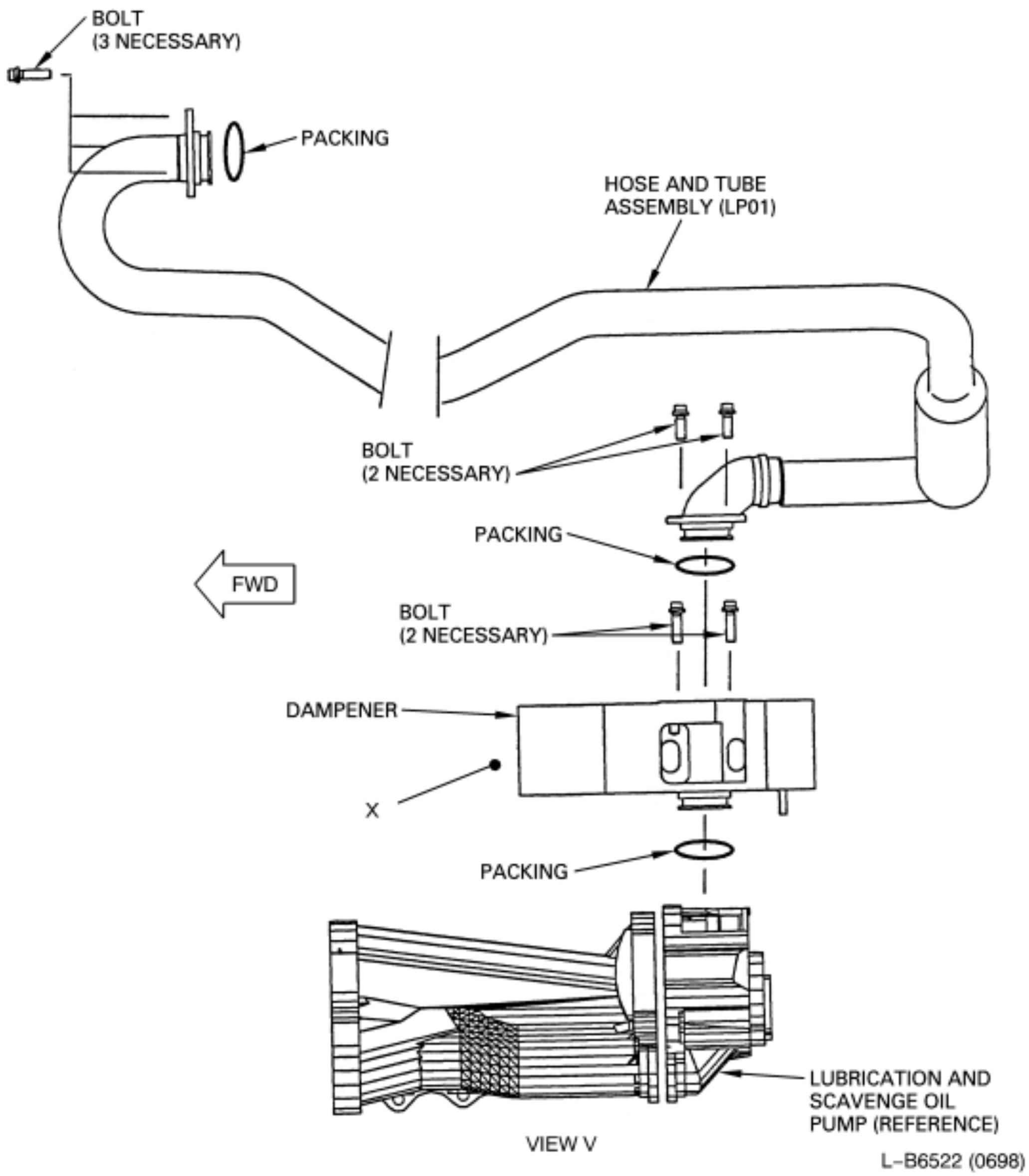
Bottom External Plumbing (Post SB PW4ENG 79-75) (Pre SB PW4ENG 79-86)
Figure 403 (Sheet 7)
(Task 72-00-61-420-002)


LP01 HOSE AND TUBE ASSEMBLY
V
FWD
W
FLUID PRESSURE DAMPENER
MAIN OIL PUMP
VIEW T
L−B6520 (0698)
PW V

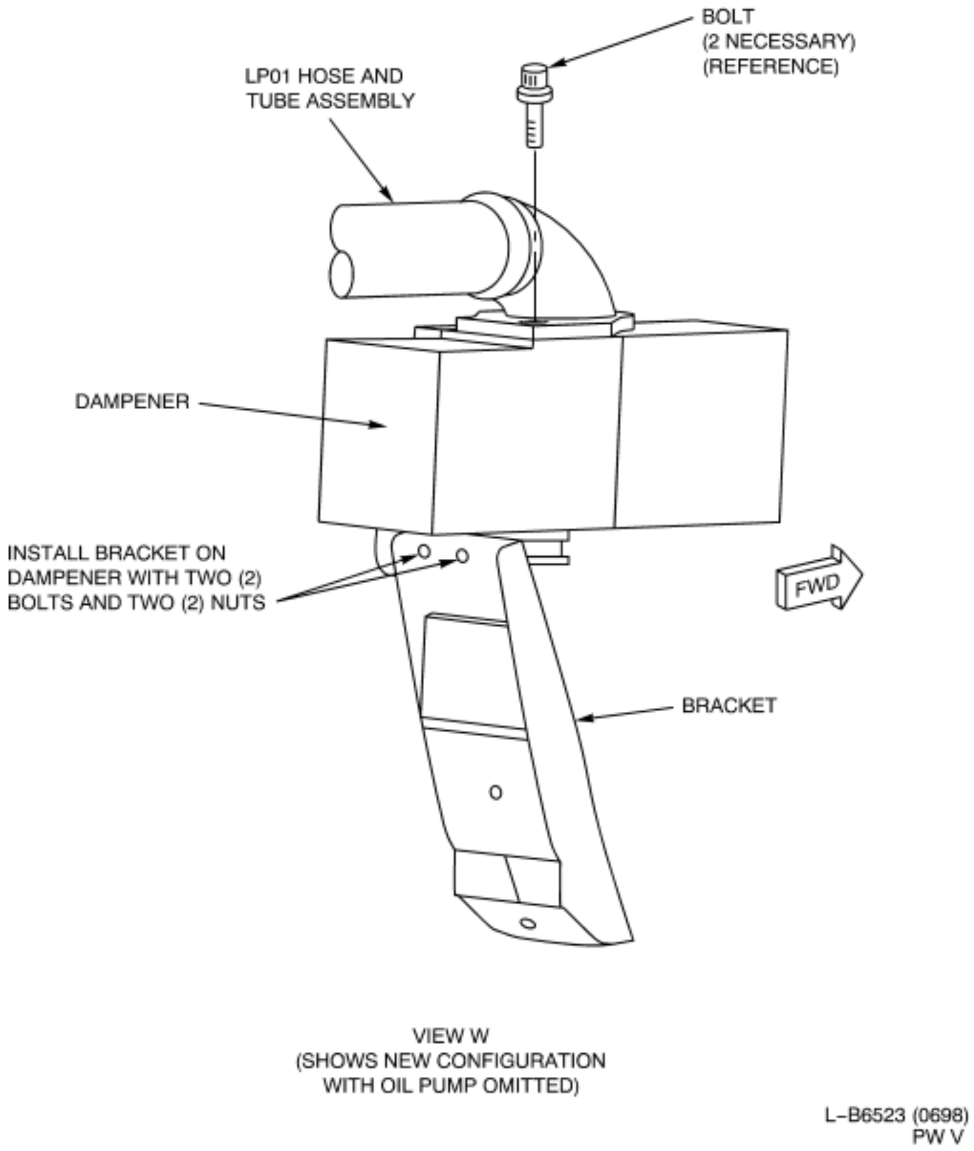
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 8)
(Task 72−00−61−420−002)


MAIN OIL FILTER TUBE (LP01)
J
J
OIL DRAIN
AE
U
A
A
FWD
BOTTOM
VIEW U
(ENGINE BOTTOM VIEW)
L−B6521 (0698)
PW V

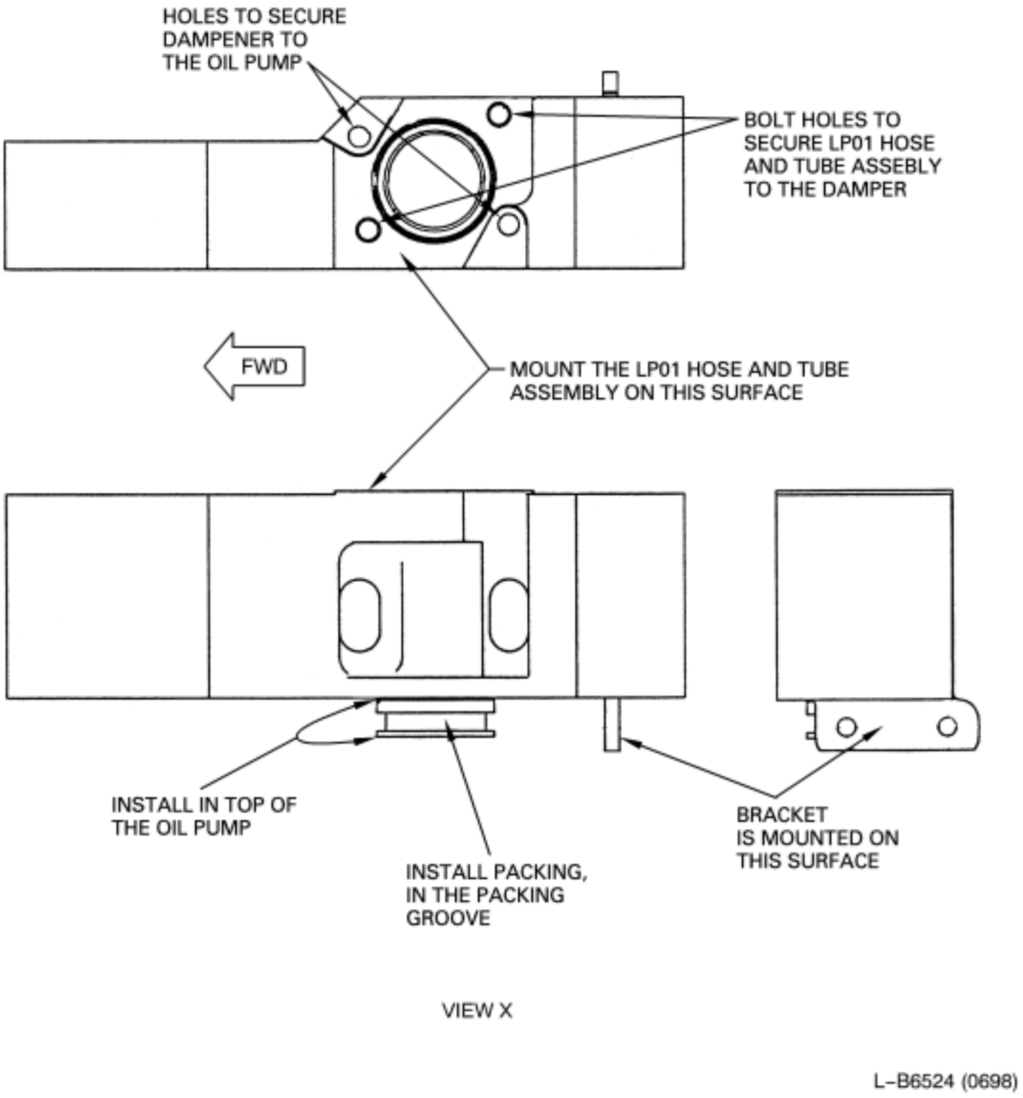
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 9)
(Task 72−00−61−420−002)


BOLT
(3 NECESSARY)
PACKING
HOSE AND TUBE
ASSEMBLY (LP01)
BOLT
(2 NECESSARY)
PACKING
FWD
BOLT
(2 NECESSARY)
DAMPENER
X
PACKING
LUBRICATION AND
SCAVENGE OIL
PUMP (REFERENCE)
VIEW V
L−B6522 (0698)

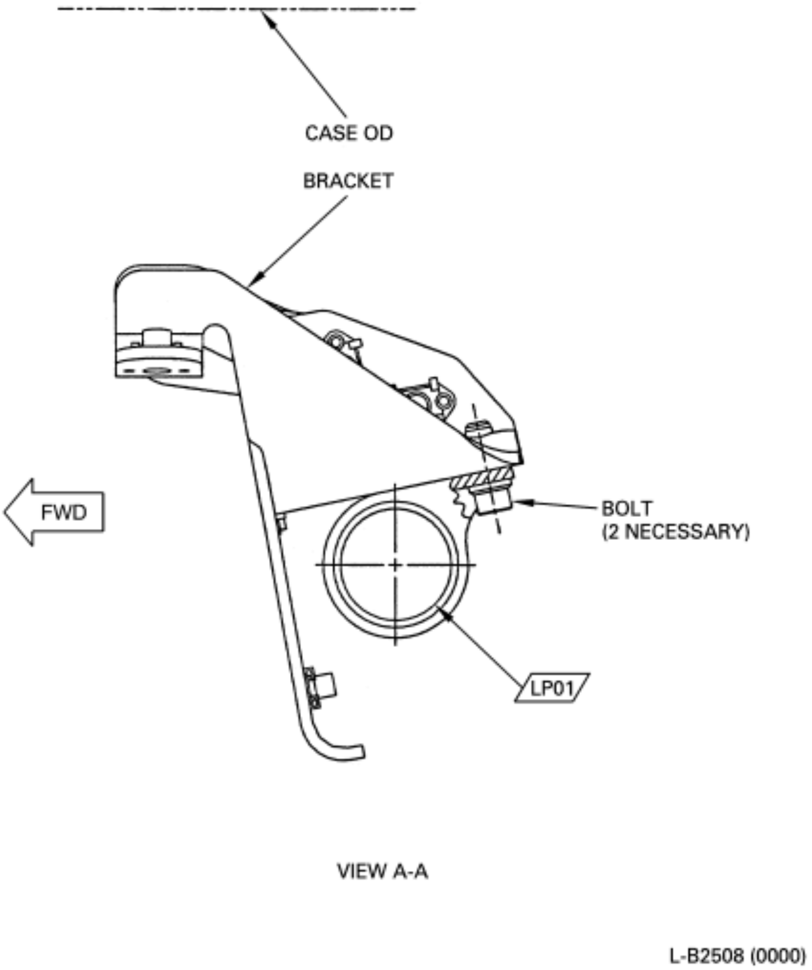
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 10)
(Task 72−00−61−420−002)


BOLT
(2 NECESSARY)
(REFERENCE)
LP01 HOSE AND
TUBE ASSEMBLY
DAMPENER
INSTALL BRACKET ON
DAMPENER WITH TWO (2)
BOLTS AND TWO (2) NUTS
FWD
BRACKET
VIEW W
(SHOWS NEW CONFIGURATION
WITH OIL PUMP OMITTED)
L−B6523 (0698)
PW V

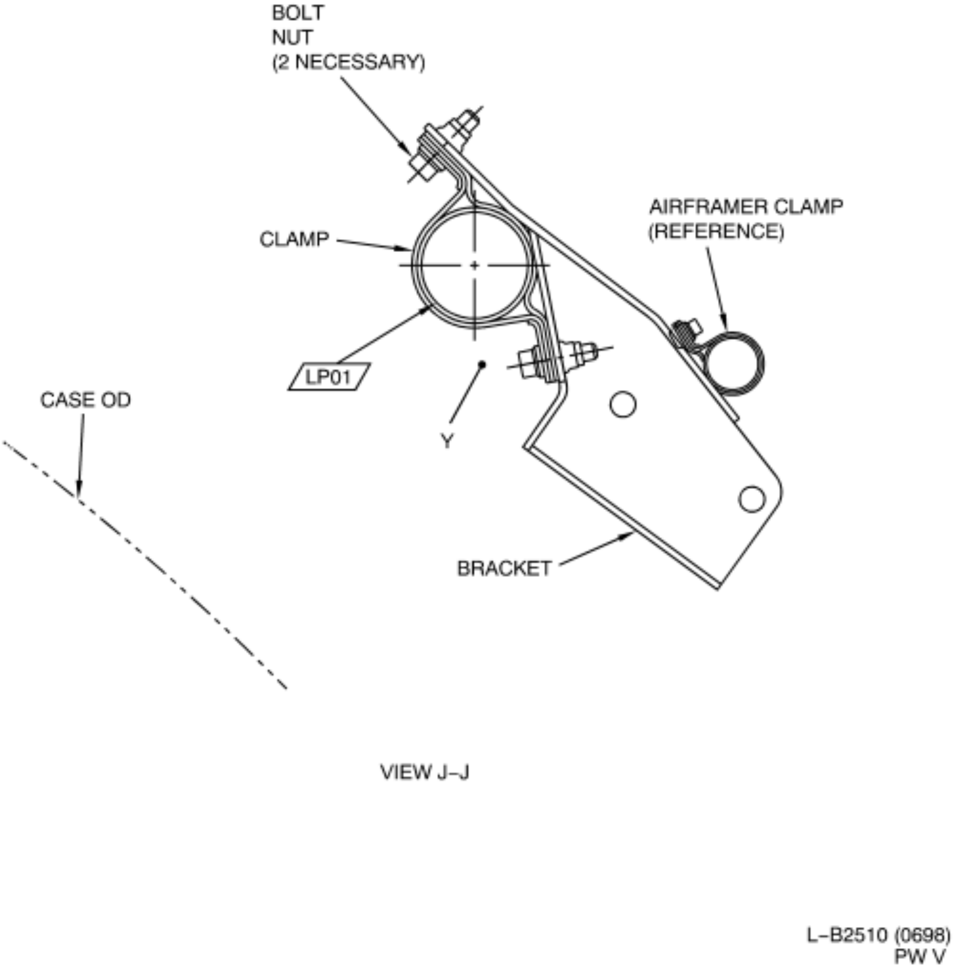
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 11)
(Task 72−00−61−420−002)


HOLES TO SECURE DAMPENER TO THE OIL PUMP
BOLT HOLES TO SECURE LP01 HOSE AND TUBE ASSEBLY TO THE DAMPER
FWD
MOUNT THE LP01 HOSE AND TUBE ASSEMBLY ON THIS SURFACE
INSTALL IN TOP OF THE OIL PUMP
INSTALL PACKING, IN THE PACKING GROOVE
BRACKET IS MOUNTED ON THIS SURFACE
VIEW X
L-B6524 (0698)

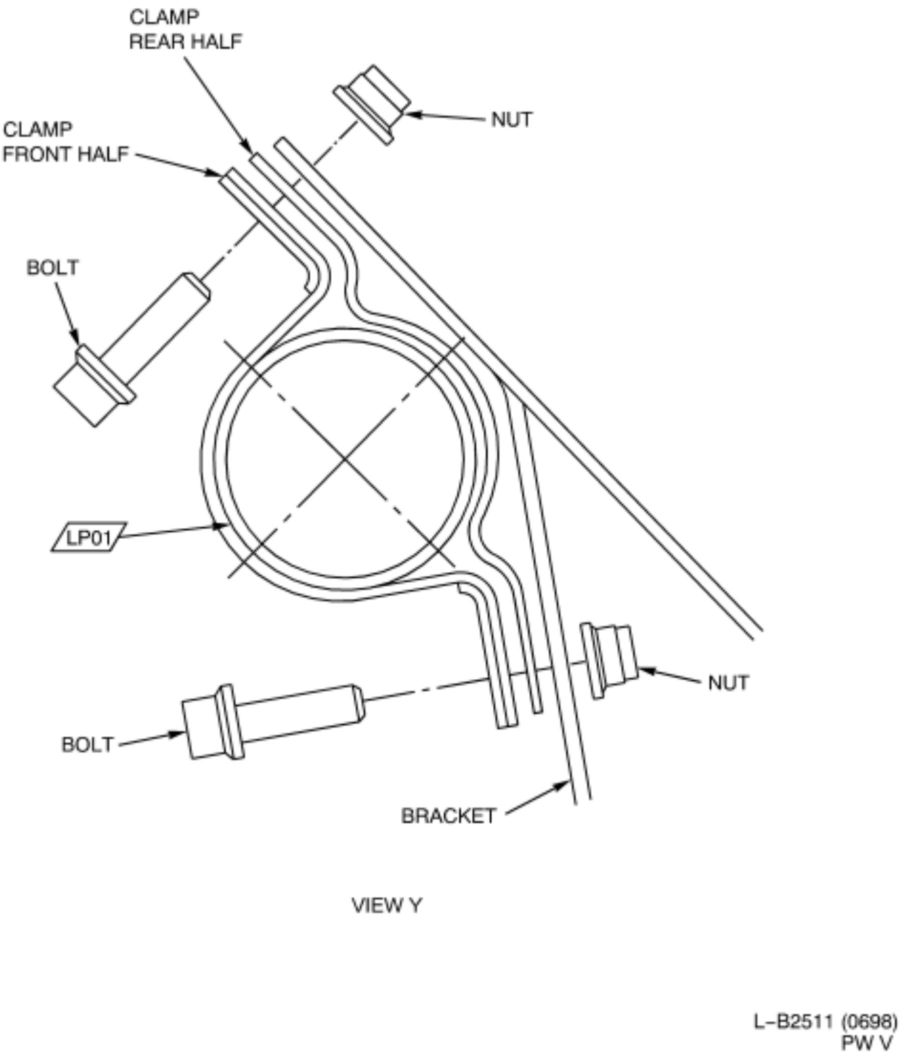
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 403 (Sheet 12)
(Task 72-00-61-420-002)


CASE OD
BRACKET
FWD
BOLT
(2 NECESSARY)
LP01
VIEW A-A
L-B2508 (0000)

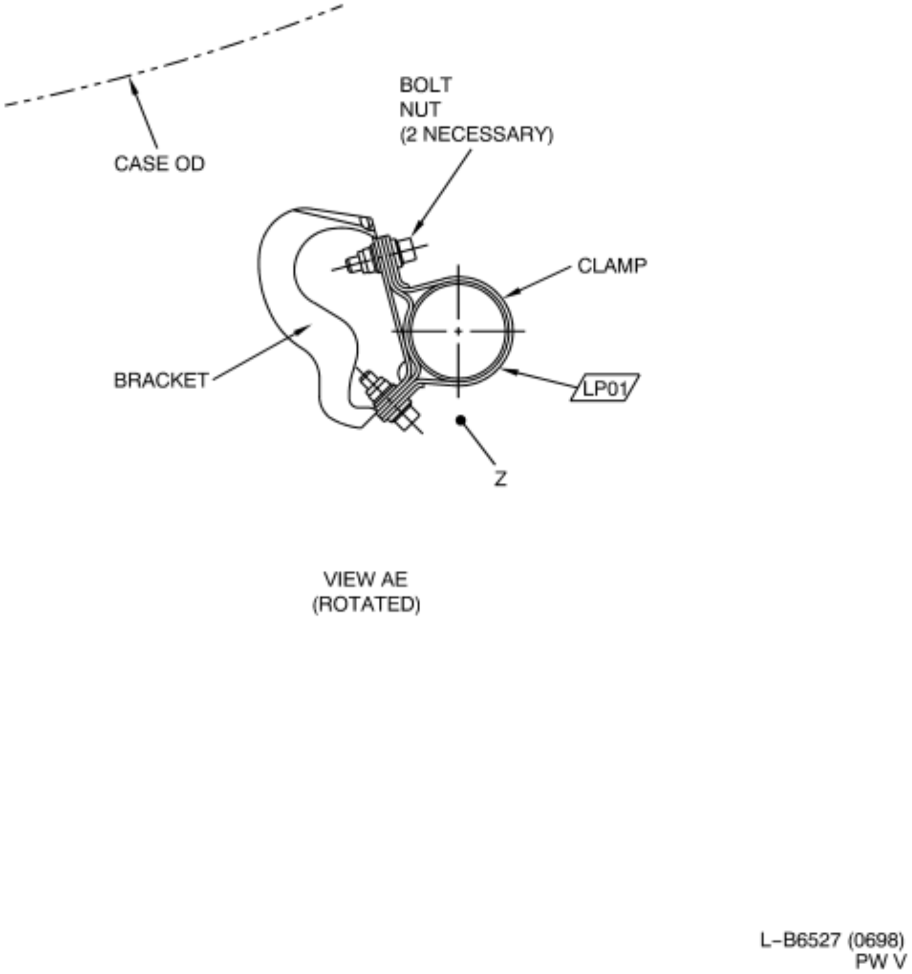
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 403 (Sheet 13)
(Task 72-00-61-420-002)


BOLT
NUT
(2 NECESSARY)
CLAMP
AIRFRAMER CLAMP
(REFERENCE)
LP01
CASE OD
Y
BRACKET
VIEW J-J
L-B2510 (0698)
PW V

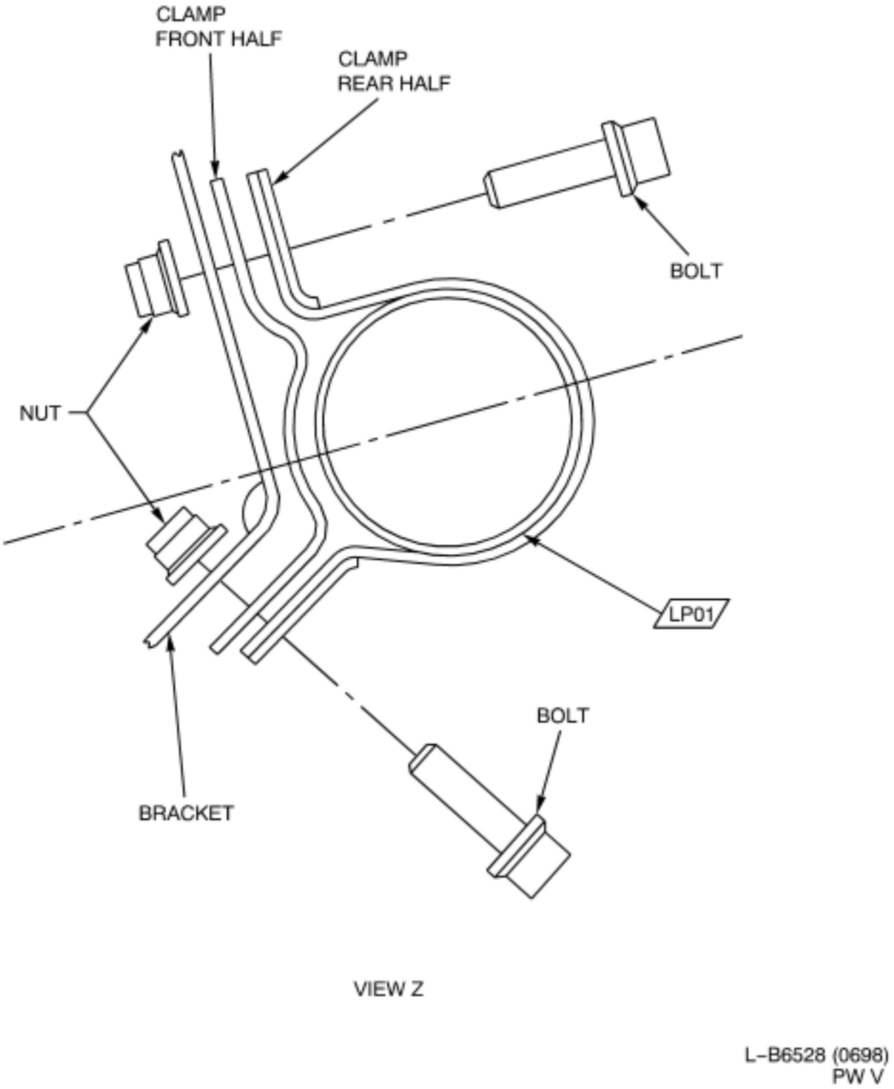
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 403 (Sheet 14)
(Task 72-00-61-420-002)


CLAMP
REAR HALF
NUT
CLAMP
FRONT HALF
BOLT
LP01
NUT
BOLT
BRACKET
VIEW Y
L-B2511 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 403 (Sheet 15)
(Task 72-00-61-420-002)

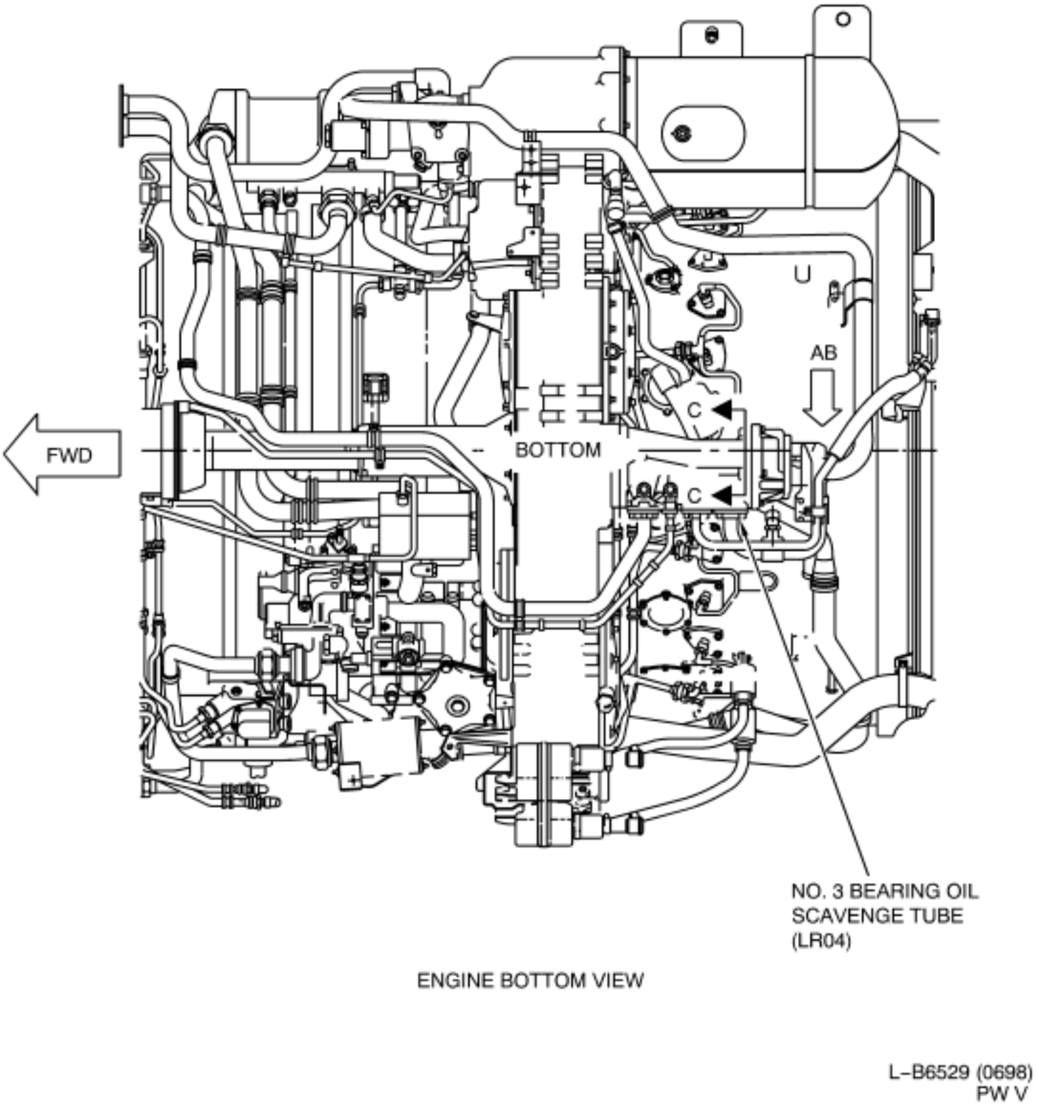

BOLT
NUT
(2 NECESSARY)
CASE OD
CLAMP
BRACKET
LP01
Z
VIEW AE
(ROTATED)
L-B6527 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 403 (Sheet 16)
(Task 72-00-61-420-002)

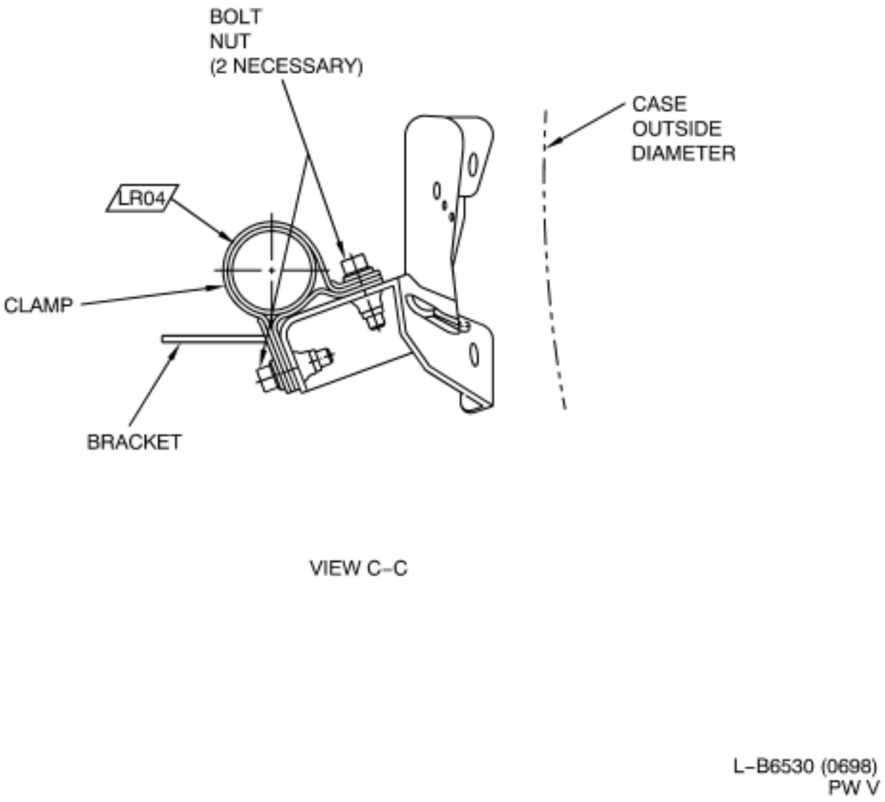

CLAMP FRONT HALF
CLAMP REAR HALF
BOLT
NUT
LP01
BOLT
BRACKET
VIEW Z
L-B6528 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 403 (Sheet 17)
(Task 72-00-61-420-002)

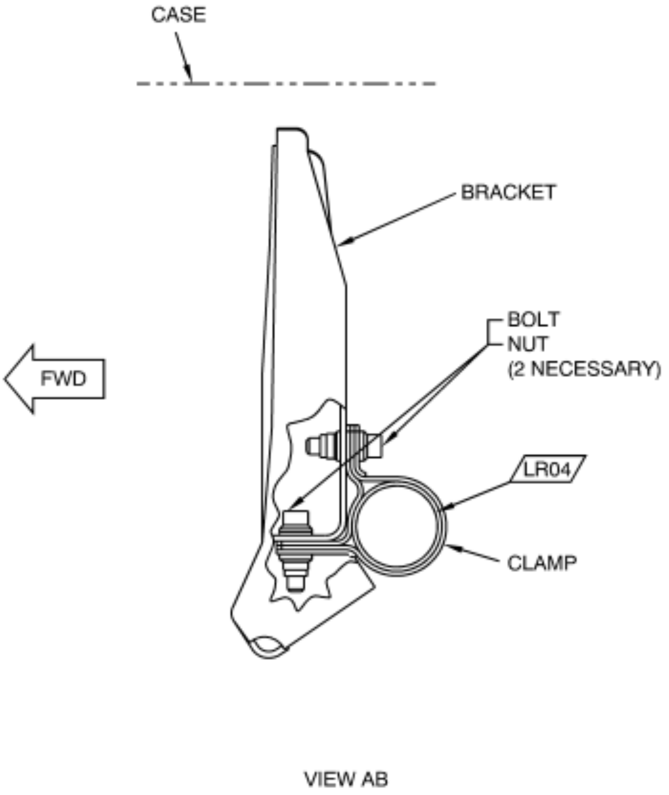
R
R


U
AB
C
C
FWD
BOTTOM
NO. 3 BEARING OIL SCAVENGE TUBE (LR04)
ENGINE BOTTOM VIEW
L-B6529 (0698)
PW V

Bottom External Plumbing Installation Of The No. 3 Bearing Scavenge Hose And Manifold Assembly (Post SB PW4ENG 79-75)
Figure 403 (Sheet 18)
(Task 72-00-61-420-002)

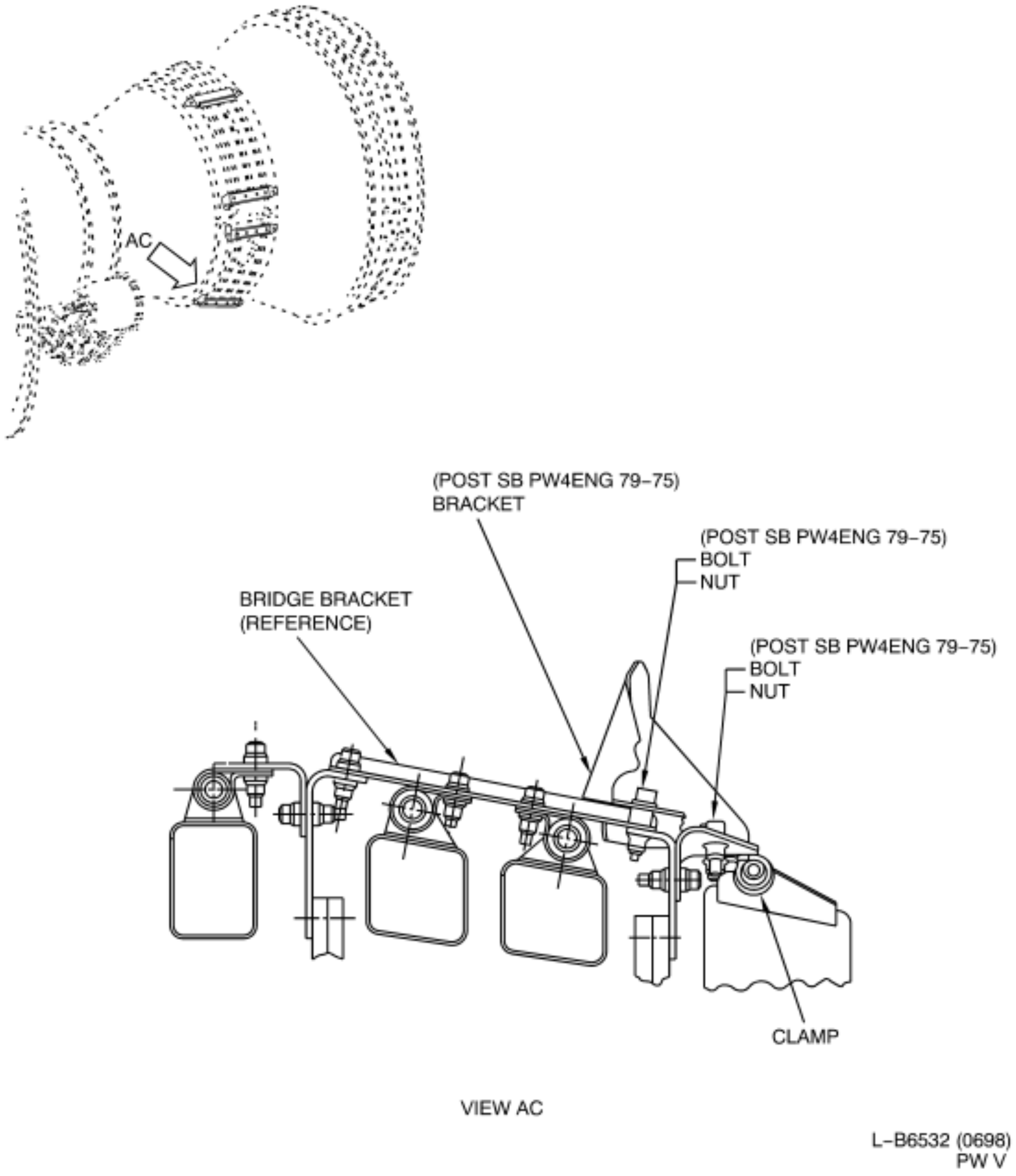

BOLT
NUT
(2 NECESSARY)
CASE
OUTSIDE
DIAMETER
LR04
CLAMP
BRACKET
VIEW C-C
L-B6530 (0698)
PW V

Bottom External Plumbing Installation Of The No. 3 Bearing Scavenge Hose And Manifold Assembly (Post SB PW4ENG 79-75)
Figure 403 (Sheet 19)
(Task 72-00-61-420-002)


CASE
BRACKET
BOLT
NUT
(2 NECESSARY)
FWD
LR04
CLAMP
VIEW AB

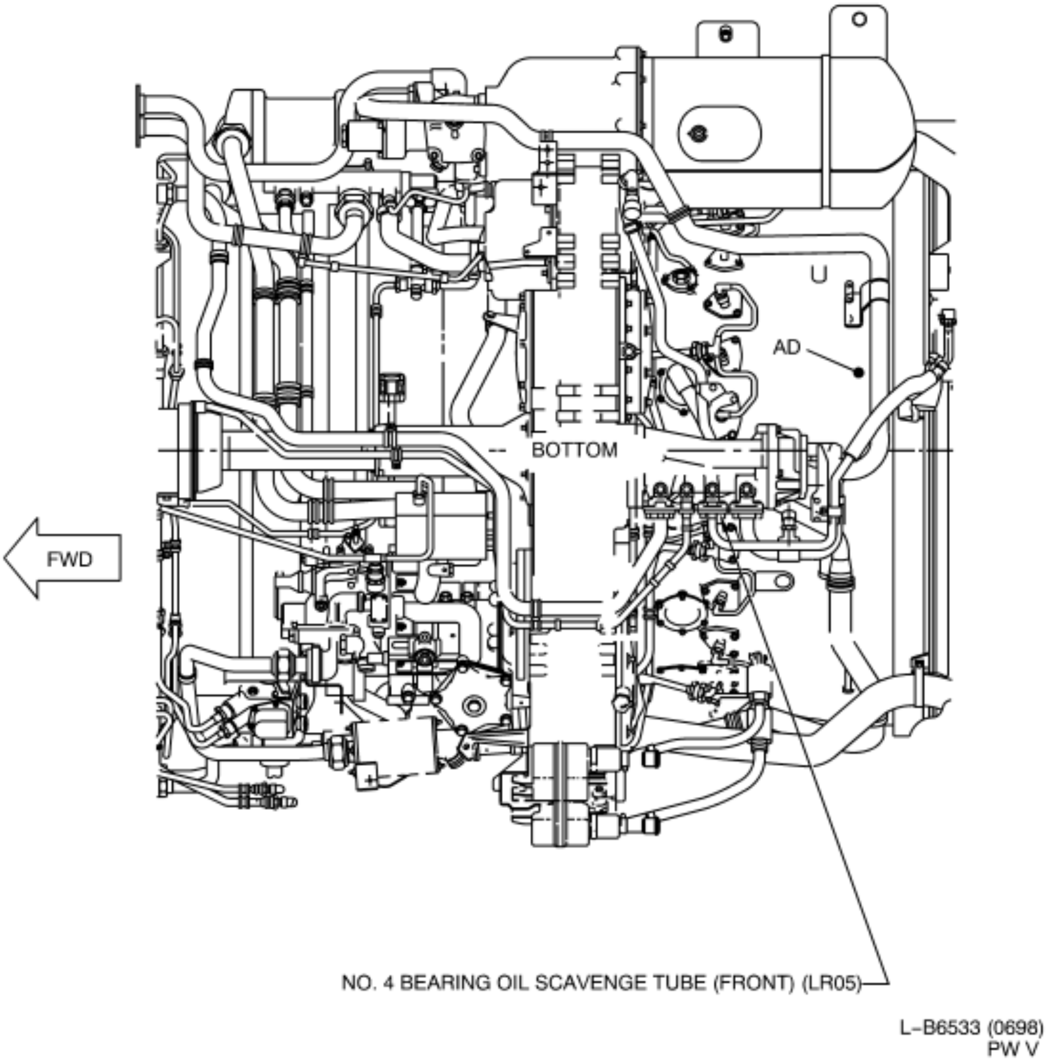
L-B6531 (0698)
PW V

Bottom External Plumbing Installation Of The No. 3 Bearing Scavenge Hose And Manifold Assembly (Post SB PW4ENG 79-75)
Figure 403 (Sheet 20)
(Task 72-00-61-420-002)

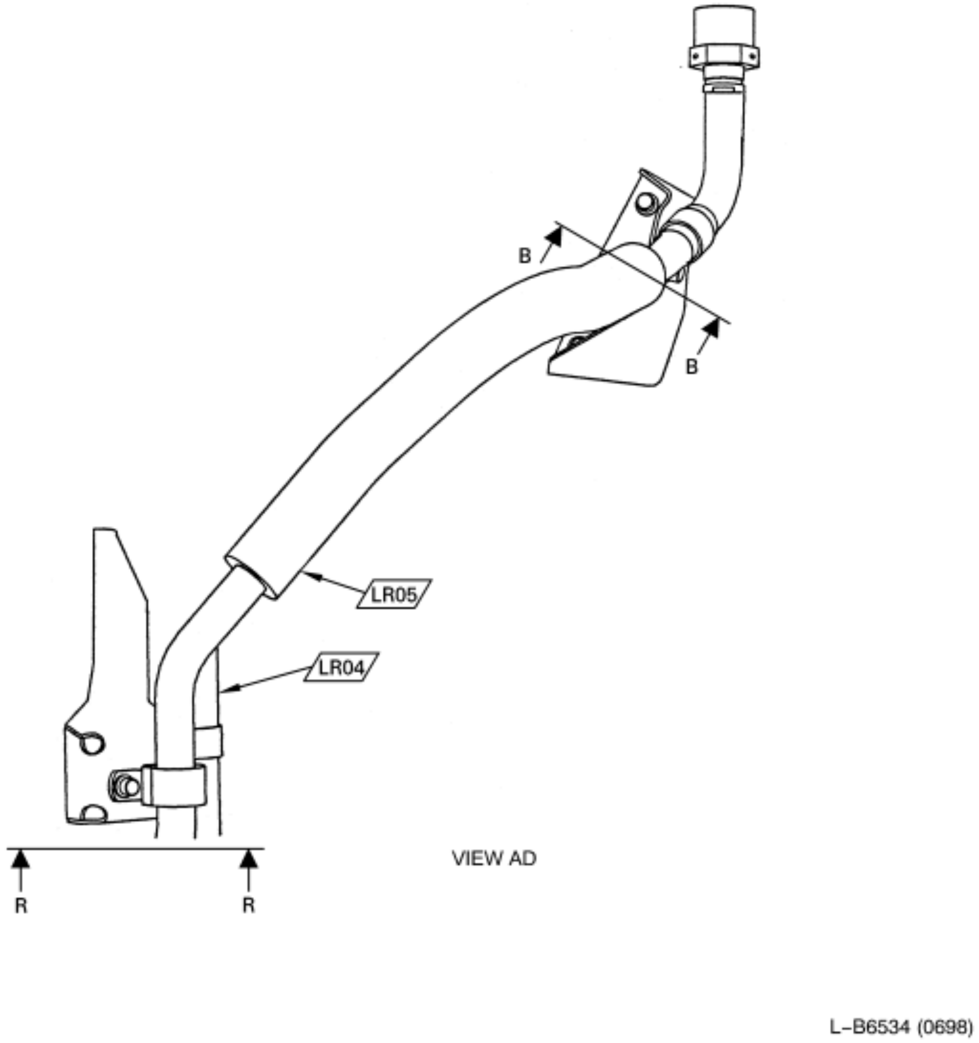

AC
(POST SB PW4ENG 79-75)
BRACKET
(POST SB PW4ENG 79-75)
BOLT
NUT
BRIDGE BRACKET
(REFERENCE)
(POST SB PW4ENG 79-75)
BOLT
NUT
CLAMP
VIEW AC
L-B6532 (0698)
PW V

Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 403 (Sheet 21)
(Task 72-00-61-420-002)

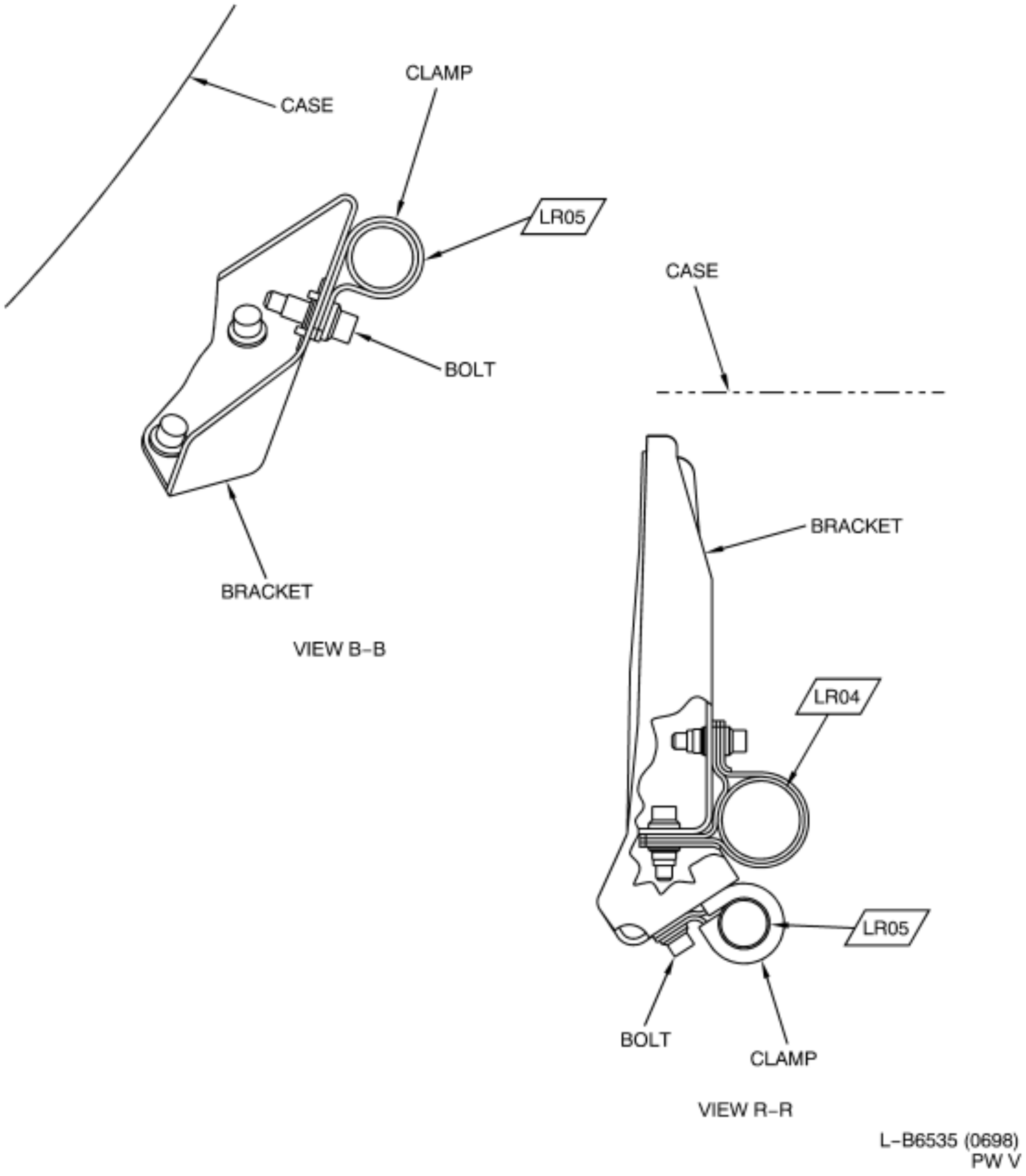
ENGINE GENERAL − MAIN GEARBOX − INSTALLATION−02


U
AD
BOTTOM
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (FRONT) (LR05)
L−B6533 (0698)
PW V

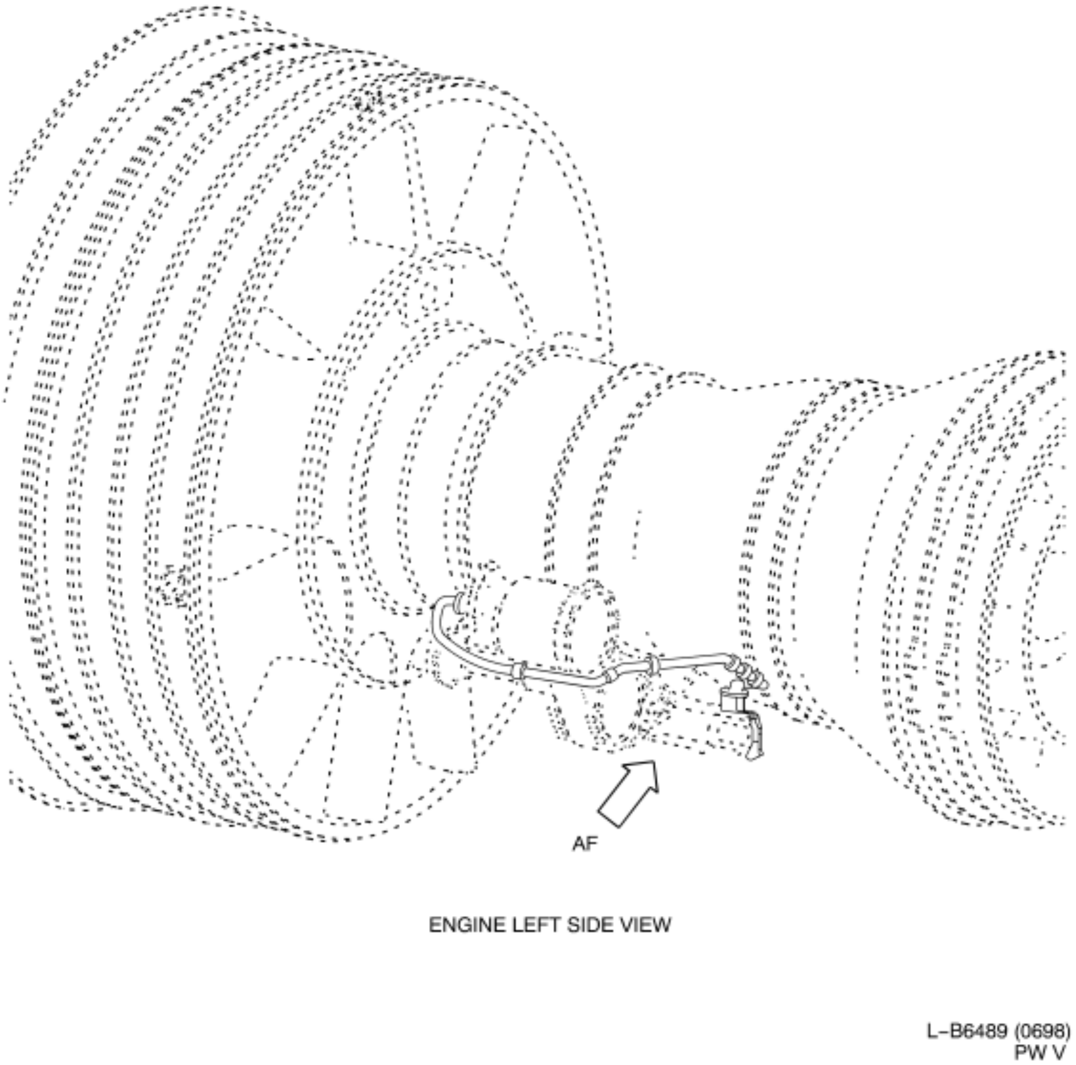
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 22)
(Task 72−00−61−420−002)


B
B
LR05
LR04
R
R
VIEW AD
L-B6534 (0698)

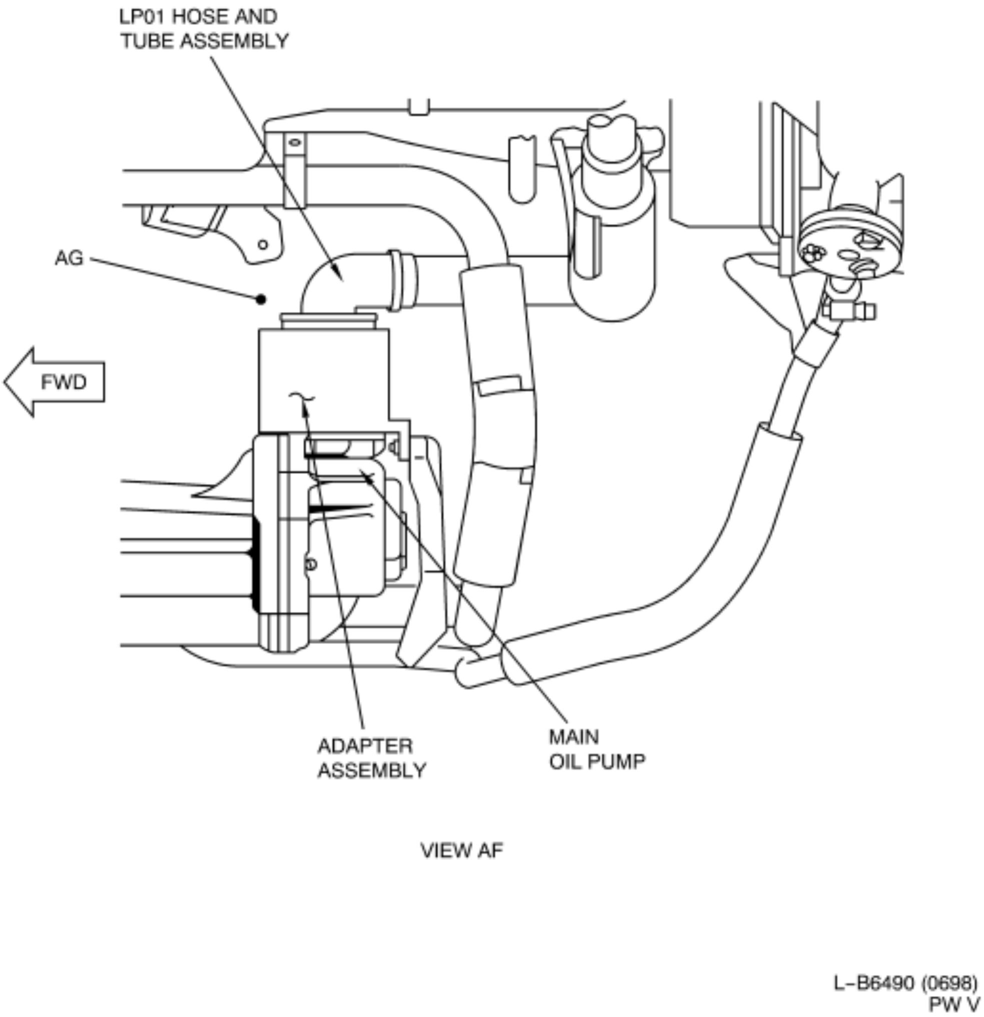
Bottom External Plumbing (Post SB PW4ENG 79-75)
Figure 403 (Sheet 23)
(Task 72-00-61-420-002)


CLAMP
CASE
LR05
BOLT
BRACKET
VIEW B−B
CASE
BRACKET
LR04
LR05
BOLT
CLAMP
VIEW R−R
L−B6535 (0698)
PW V

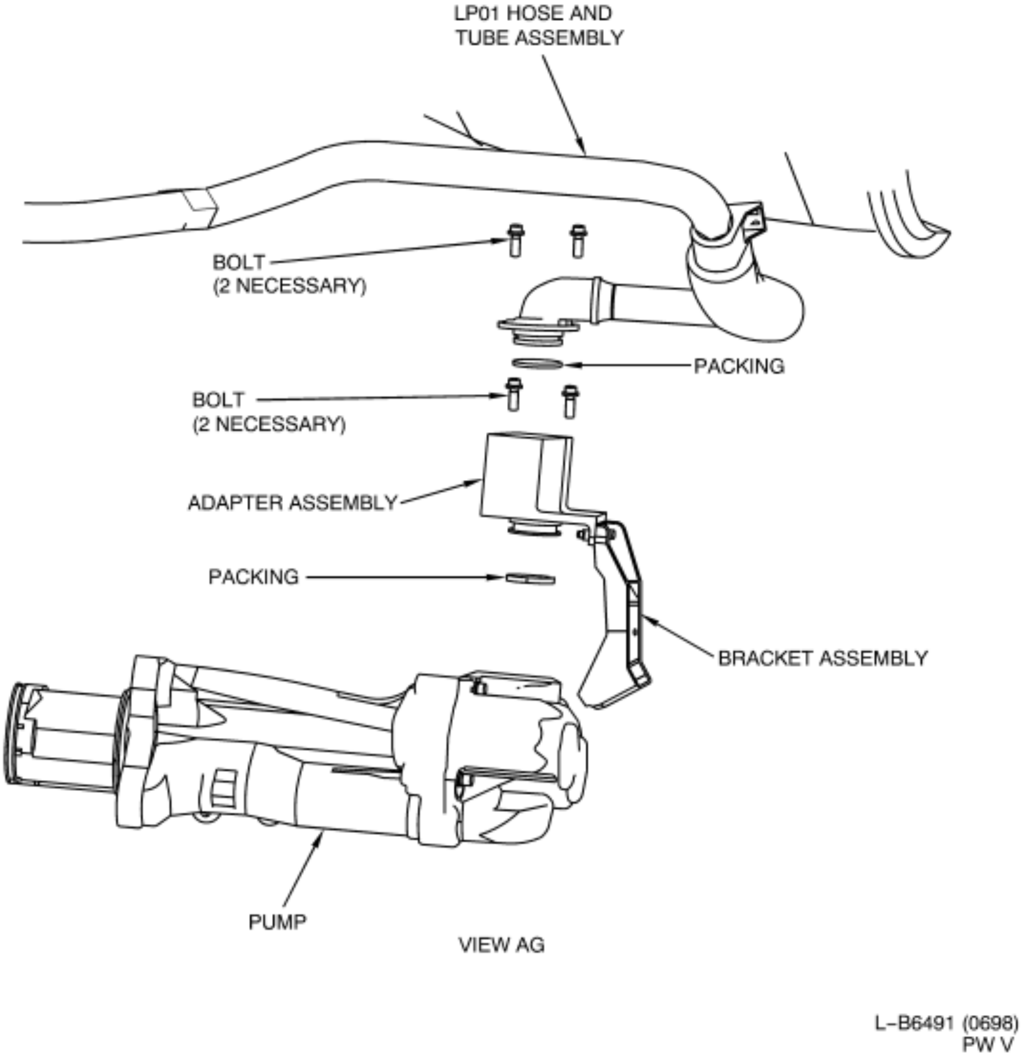
Bottom External Plumbing (Post SB PW4ENG 79−75)
Figure 403 (Sheet 24)
(Task 72−00−61−420−002)


AF
ENGINE LEFT SIDE VIEW
L-B6489 (0698)
PW V

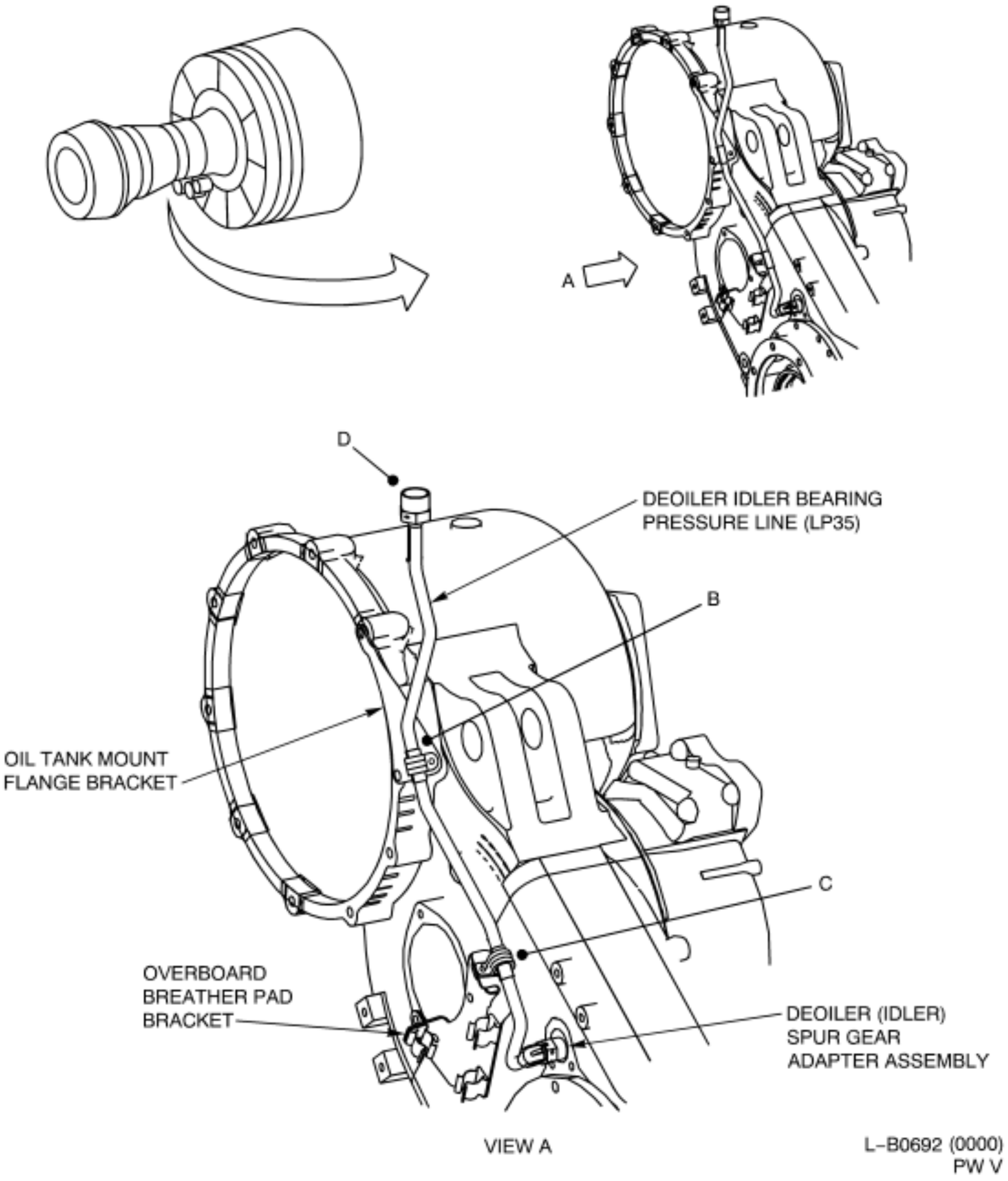
Main Gearbox Plumbing (Post SB PW4ENG 79-86)
Figure 403 (Sheet 25)
(Task 72-00-61-420-002)


LP01 HOSE AND
TUBE ASSEMBLY
AG
FWD
ADAPTER
ASSEMBLY
MAIN
OIL PUMP
VIEW AF
L-B6490 (0698)
PW V

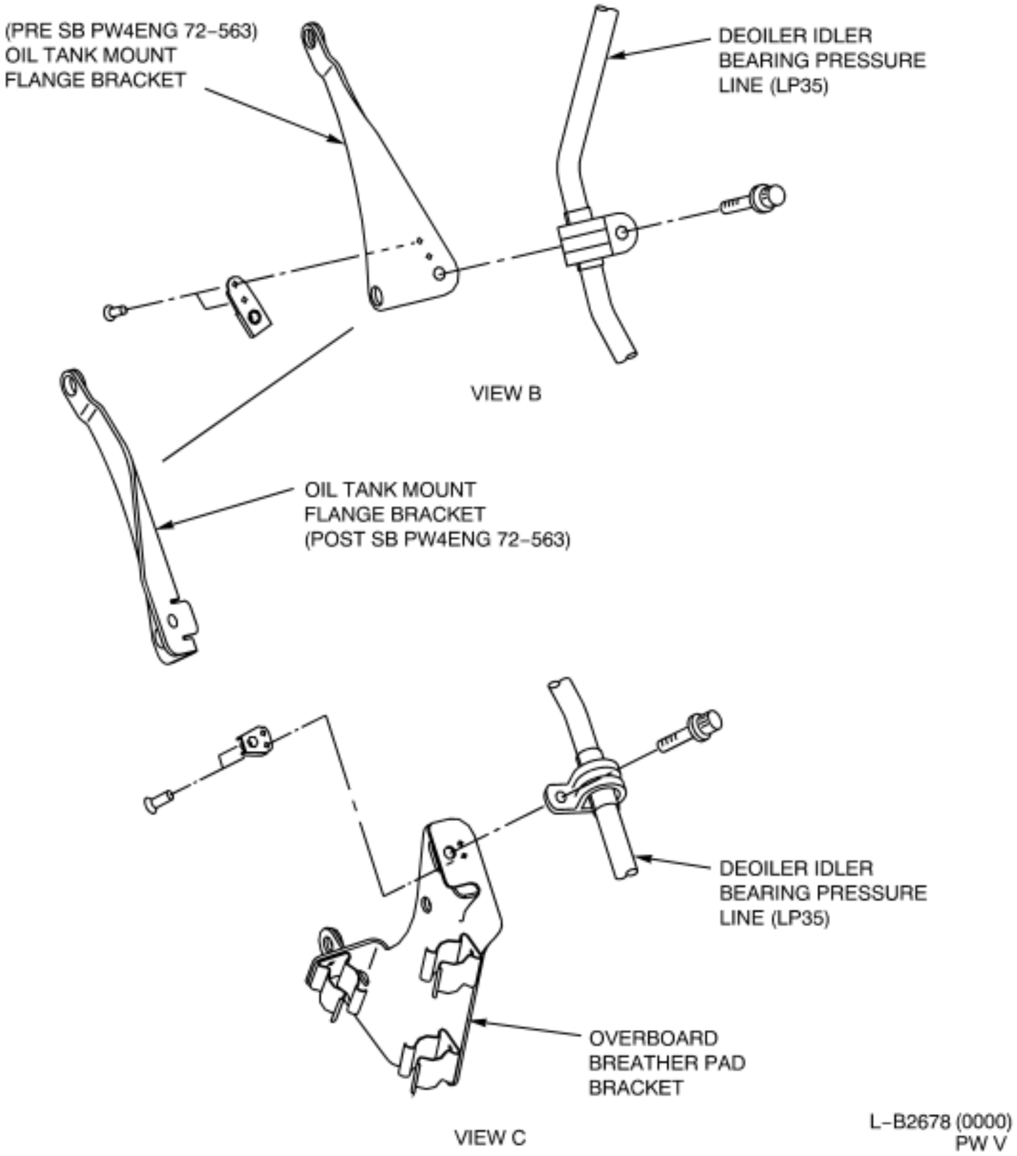
Main Gearbox Plumbing (Post SB PW4ENG 79-86)
Figure 403 (Sheet 26)
(Task 72-00-61-420-002)


LP01 HOSE AND
TUBE ASSEMBLY
BOLT
(2 NECESSARY)
PACKING
BOLT
(2 NECESSARY)
ADAPTER ASSEMBLY
PACKING
BRACKET ASSEMBLY
PUMP
VIEW AG
L-B6491 (0698)
PW V

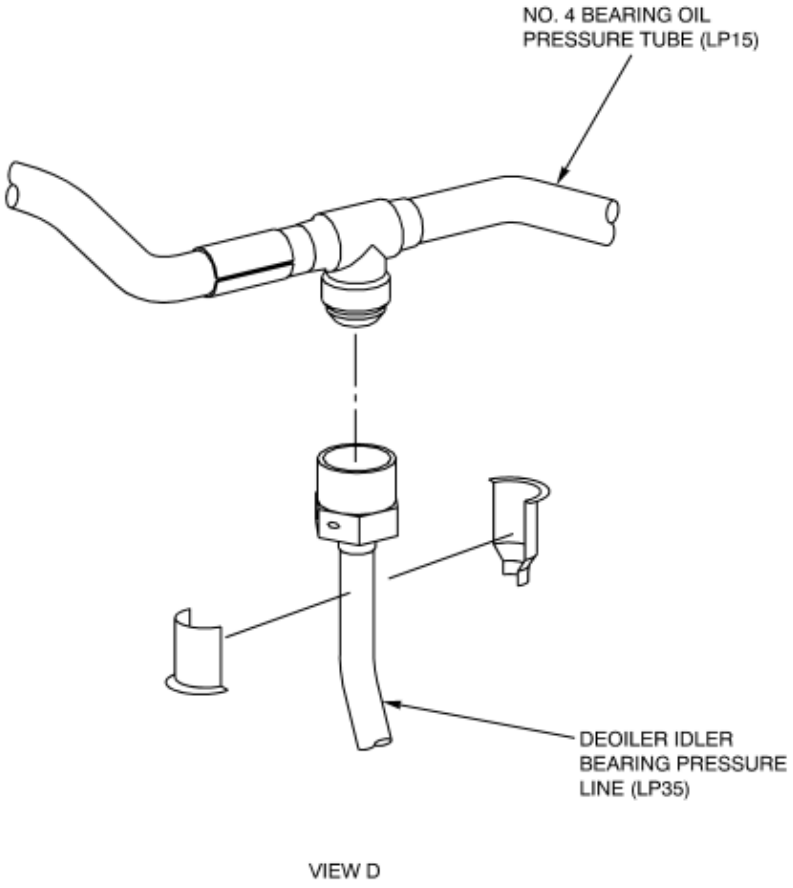
Main Gearbox Plumbing (Post SB PW4ENG 79-86)
Figure 403 (Sheet 27)
(Task 72-00-61-420-002)


A
D
DEOILER IDLER BEARING PRESSURE LINE (LP35)
B
OIL TANK MOUNT FLANGE BRACKET
C
OVERBOARD BREATHER PAD BRACKET
DEOILER (IDLER) SPUR GEAR ADAPTER ASSEMBLY
VIEW A
L−B0692 (0000)
PW V

Deoiler Idler Bearing Pressure Line
Figure 404 (Sheet 1)
(Task 72−00−61−420−002)


(PRE SB PW4ENG 72-563)
OIL TANK MOUNT
FLANGE BRACKET
DEOILER IDLER
BEARING PRESSURE
LINE (LP35)
VIEW B
OIL TANK MOUNT
FLANGE BRACKET
(POST SB PW4ENG 72-563)
DEOILER IDLER
BEARING PRESSURE
LINE (LP35)
OVERBOARD
BREATHER PAD
BRACKET
VIEW C
L-B2678 (0000)
PW V

Deoiler Idler Bearing Pressure Line
Figure 404 (Sheet 2)
(Task 72-00-61-420-002)


NO. 4 BEARING OIL PRESSURE TUBE (LP15)
DEOILER IDLER BEARING PRESSURE LINE (LP35)
VIEW D

L−B0694 (0000)
PW V

Deoiler Idler Bearing Pressure Line
Figure 404 (Sheet 3)
(Task 72−00−61−420−002)

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-03

Task 72-00-61-450-001:

1. Install Ignition Exciter (Lower Exciter)

A. Equipment And Materials Required

Consumable Material:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-005	Cloth, Cotton Lint Free
P06-021	Compound, Antigalling (PWA 550-3)
P06-036	Compound, Antigallant (PWA 36035) (Fel-Pro C-300)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Grommet	1	74-21-00	X	XX
Seal	1	74-11-00	1	55

B. Procedure

See Figure 401 and 402.

(1) Remove protective closures from exciter. Install seal (larger washer OD outboard) on exciter input (smaller) connector.

(2) Align rear exciter heat shield, with largest opening, with largest threaded connector on exciter. Engage front heat shield only far enough to line up mounting holes.

(3) Position ignition exciter, entrapped in heat shields, to mount bracket on right side of gearbox and secure in place with bolts, threads lubricated with Engine Oil (P03-001), washers, and nuts. Torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(4) Check cable contacts for evidence of arcing (discoloration and heavy pitting). Check cable ends for evidence of carbon tracking. Replace cable if either condition is found. See 72-00-41, Removal/Installation-05.

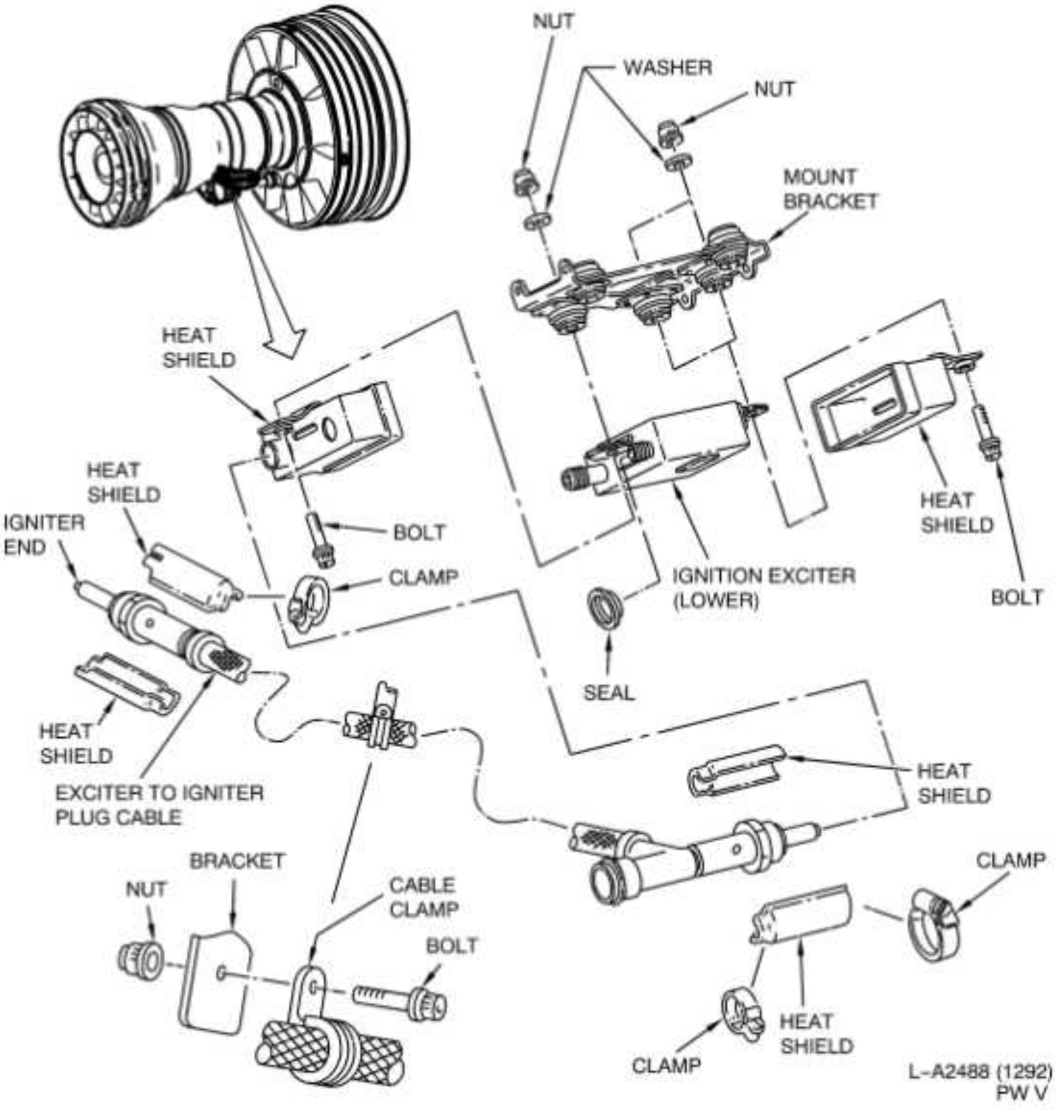
(5) Install new grommets on cable ends as follows:

    (a) Clean new grommets with clean Lint Free Cotton Cloth (P05-005), and the SPOP 208 Wipe Method (Task 70-21-00-110-040).

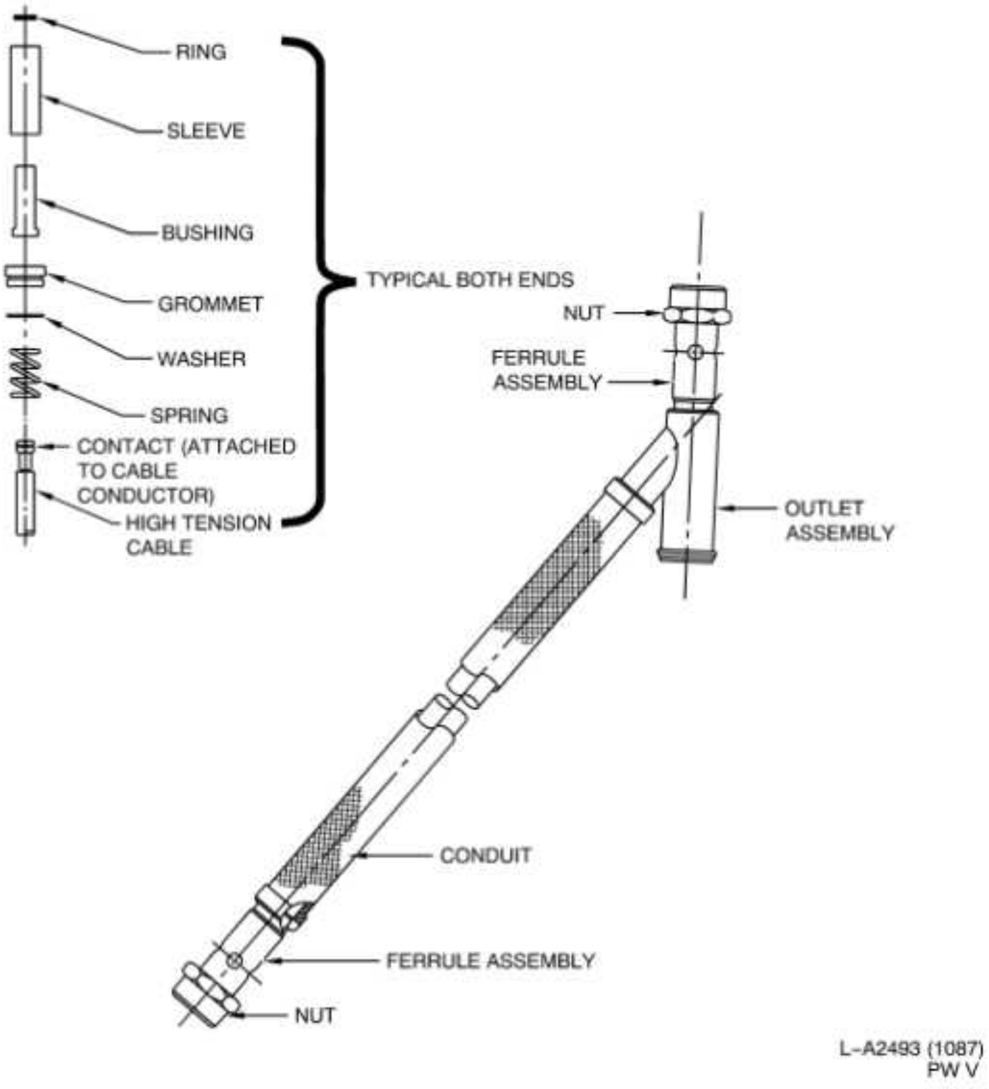
    (b) Slide grommets on cable.

(6) Place two clamps, small clamp first, over exciter end of cable.

(7) Install ignition cable as follows:


NUT
WASHER
NUT
MOUNT BRACKET
HEAT SHIELD
HEAT SHIELD
IGNITER END
BOLT
CLAMP
IGNITION EXCITER (LOWER)
HEAT SHIELD
BOLT
SEAL
HEAT SHIELD
EXCITER TO IGNITER PLUG CABLE
HEAT SHIELD
BRACKET
NUT
CABLE CLAMP
BOLT
CLAMP
HEAT SHIELD
CLAMP
L-A2488 (1292)
PW V

Ignition Exciter (lower)
Figure 401
(Task 72−00−61−450−001)


RING
SLEEVE
BUSHING
GROMMET
WASHER
SPRING
CONTACT (ATTACHED TO CABLE CONDUCTOR)
HIGH TENSION CABLE
TYPICAL BOTH ENDS
NUT
FERRULE ASSEMBLY
OUTLET ASSEMBLY
CONDUIT
FERRULE ASSEMBLY
NUT
L-A2493 (1087)
PW V

Exciter−To−Igniter Plug Cable
Figure 402
(Task 72−00−61−450−001)

CAUTION: INSTALL THE CABLE ENDS (LEADS) TO THE IGNITER PLUG AND THE IGNITION EXCITER BY PUSHING THE CABLE CONNECTORS IN A STRAIGHT LINE MOVEMENT. IF LATERAL FORCE IS PERMITTED, THE CABLE END CAN BE DAMAGED.

(a) Lubricate the threads of the coupling nut at the exciter end of the cable with Antigallant Compound (P06-036) and connect the cable to the output connector on the exciter.

NOTE: When Fel-Pro C300 (PWA 36035) is not available, an alternative of Antigalling Compound (PWA 550-3) can be used.

Do not apply an excessive amount of compound to the cable coupling nut threads.

(b) Lubricate the cable coupling threads, igniter plug end, with Antiseize Compound (P06-009). Connect the cable to the plug.
(c) Torque the cable nuts until they are bottomed on their shoulders. This normally takes 140 - 160 lb-in. (15.818 - 18.078 N.m).

NOTE: Insufficient torque on the cable nut can cause ignition-radiated noise to be picked up by the aircraft radio equipment.

(8) (Reference 2151) Position heat shield segments over exciter end of cable and secure with clamps. Torque clamp screws to 15 - 18 lb-in. (1.695 - 2.034 N.m).
(9) (Reference 2151) Install heat shields at igniter plug. Bend tabs of igniter plug heat shield into groove in boss before securing clamp. Secure with clamp. Torque clamp screw to 15 - 18 lb-in. (1.695 - 2.034 N.m).
(10) Install the cable clamp to the lower cable. Attach the cable clamp to the bracket with a bolt, threads lubricated with Engine Oil (P03-001), and a nut. Torque the nut to 36 - 40 lb-in. (4.067 - 4.519 N.m).
(11) Attach electrical cable. After engaging key to slot, secure connector by handtightening knurled coupling ring until plug is fully engaged in receptacle and coupling ring cannot be further tightened by hand.

C. Postrequisites
(1) Test engine per Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-04

Task 72-00-61-450-002:

1. Install Ignition Exciter (Upper Exciter)

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-005	Cloth, Cotton Lint Free
P06-021	Compound, Antigalling (PWA 550-3)
P06-036	Compound, Antigallant (PWA 36035) (Fel-Pro C-300)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Grommet	1	74-21-00/X/XX
Seal	1	74-11-00/1/55

B. Procedure
See Figure 401 and Figure 402.

(1) Remove protective closures from exciter. Install seal (larger washer OD outboard) on exciter input (smaller) connector.

(2) Align rear exciter heat shield, with largest opening, with largest threaded connector on exciter. Engage front heat shield only far enough to line up mounting holes.

(3) Position ignition exciter, entrapped in heat shields, to mount bracket on right side of gearbox and secure in place with bolts, threads lubricated with Engine Oil P03-001, washers, and nuts. Torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(4) Check cable contacts for evidence of arcing (discoloration and heavy pitting). Check cable ends for evidence of carbon tracking. Replace cable if either condition is found. See 72-00-41, Removal/Installation-04.

(5) Install new grommets on cable ends as follows:

(a) Clean new grommets with clean Lint Free Cotton Cloth P05−005, and the SPOP 208 Wipe Method (Task 70−21−00−110−040).

(b) Slide grommets on cable.

(6) Place two clamps, small clamp first, over exciter end of cable.

(7) Install ignition cable as follows:

CAUTION: INSTALL THE CABLE ENDS (LEADS) TO THE IGNITER PLUG AND THE IGNITION EXCITER BY PUSHING THE CABLE CONNECTORS IN A STRAIGHT LINE MOVEMENT. IF LATERAL FORCE IS PERMITTED, THE CABLE END CAN BE DAMAGED.

(a) Lubricate the threads of the coupling nut at the exciter end of the cable with Antigallant Compound P06−036 and connect the cable to the output connector on the exciter.

NOTE: When Antigalling Compound P06−036 is not available, an alternative of Antigalling Compound P06−021 can be used.

NOTE: Do not apply an excessive amount of compound to the cable coupling nut threads.

(b) Lubricate the cable coupling threads, igniter plug end, with Antiseize Compound P06−009. Connect the cable to the plug.

(c) Torque the cable nuts until they are bottomed on their shoulders. This normally takes 140 − 160 lb−in. (15.818 − 18.078 N.m).

NOTE: Insufficient torque on the cable nut can cause ignition−radiated noise to be picked up by the aircraft radio equipment.

(8) (Reference 2151) (Pre SB PW4ENG 73−192) Position heat shield segments over exciter end of cable and secure with clamps. Torque clamp screws to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(9) (Reference 2151) (Post SB PW4ENG 73−192) Position heat shield segments over exciter end of cable. Make sure the segment half with hose fittings is pointed up. Secure with clamps. Torque clamp screws to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(10) (Post SB PW4ENG 73−192) Install cooling hoses on heat shield fittings and secure with clamps. Torque the hose clamps to 10 − 15 lb−in. (1.130 − 1.695 N.m).

NOTE: Pre SB PW4ENG 73−192 engines do not have W5/W6 wiring harness connector cooling.

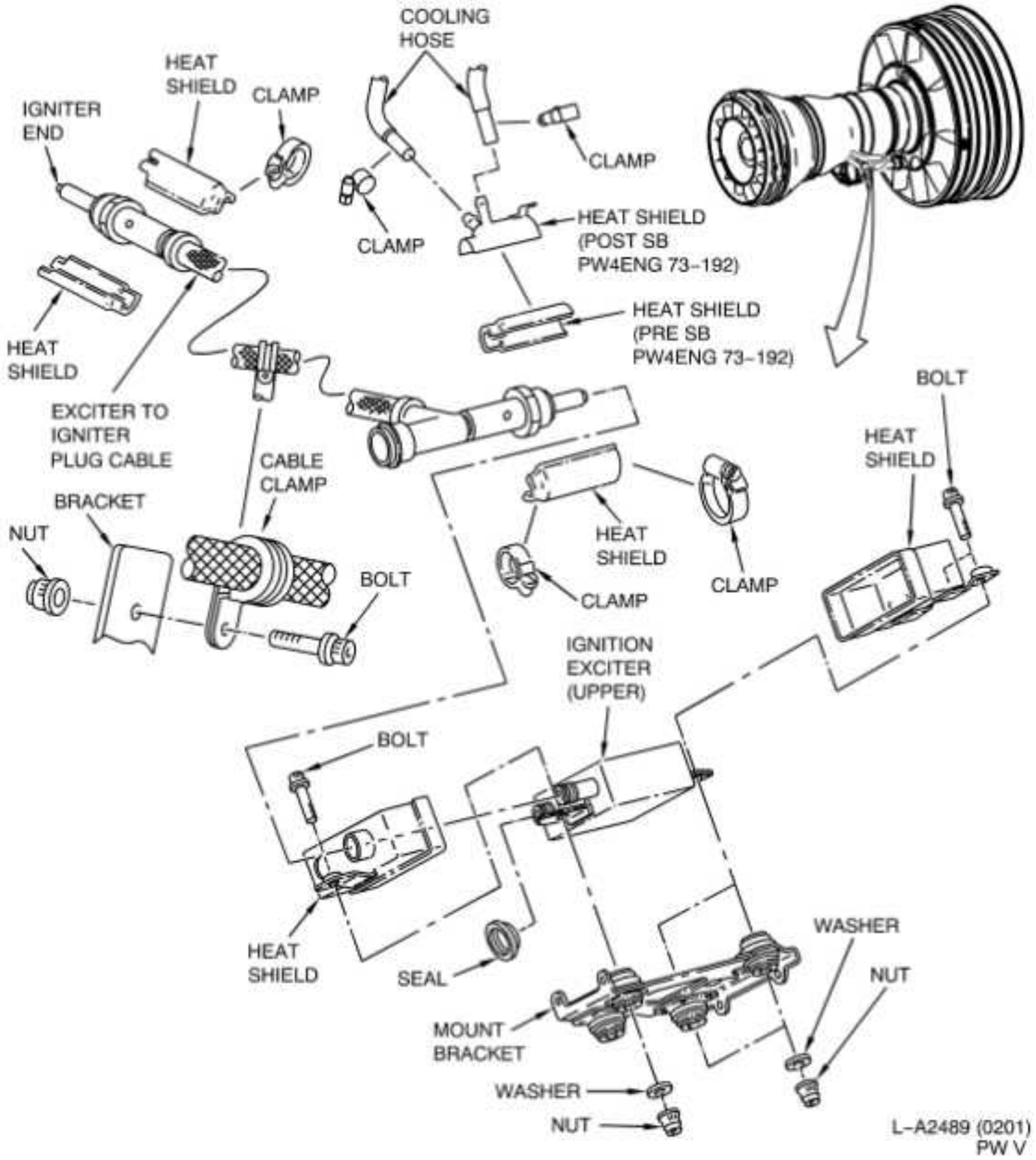
(11) (Reference 2151) Install heat shields at igniter plug. Bend tabs of igniter plug heat shield into groove in boss before securing clamp. Secure with clamp. Torque clamp screw to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(12) Install the cable clamp to the upper cable. Attach the cable clamp to the bracket with a bolt, threads lubricated with Engine Oil P03−001, and a nut. Torque the nut to 36 − 40 lb−in. (4.067 − 4.519 N.m).

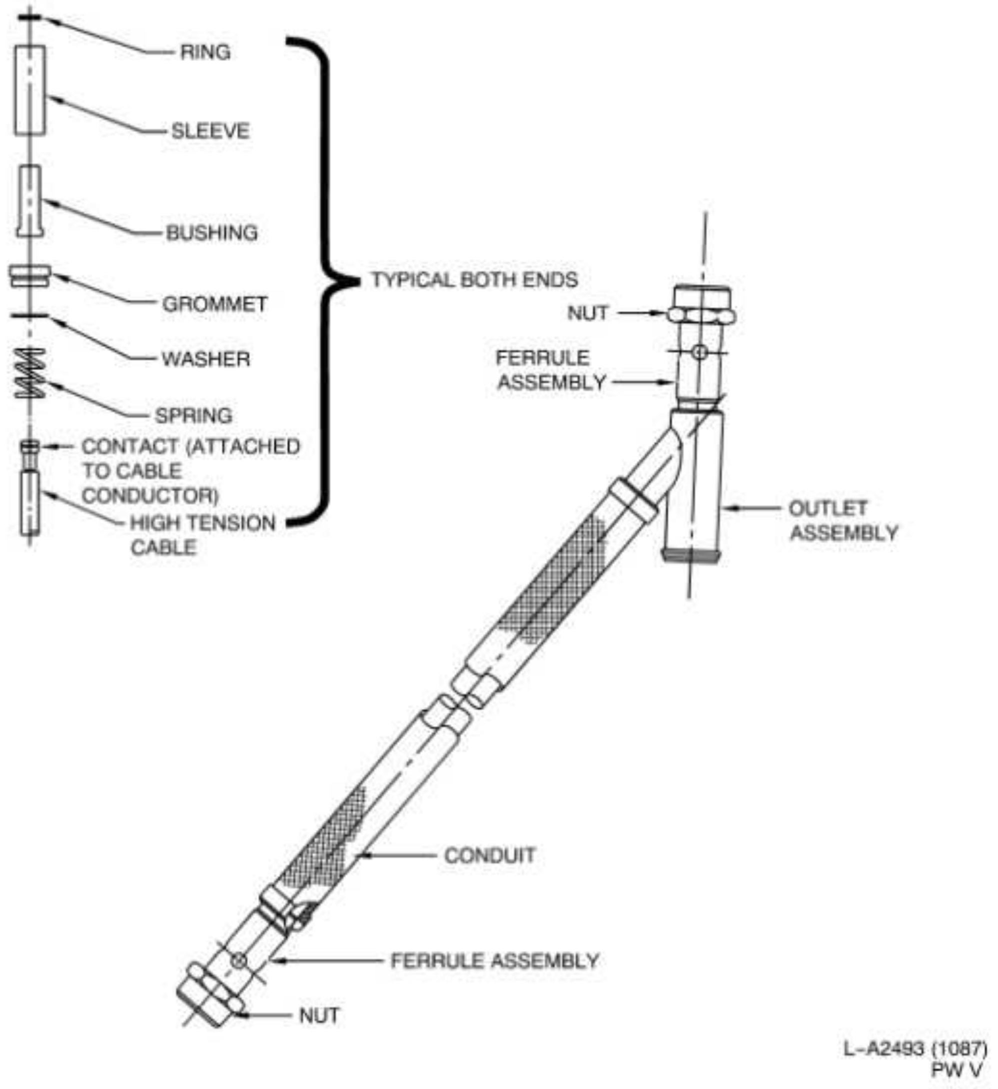
(13) Attach electrical cable. After engaging key to slot, secure connector by handtightening knurled coupling ring until plug is fully engaged in receptacle and coupling ring cannot be further tightened by hand.

C. Postrequisites

(1) Test engine per Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


COOLING HOSE
HEAT SHIELD
CLAMP
IGNITER END
CLAMP
CLAMP
HEAT SHIELD (POST SB PW4ENG 73-192)
HEAT SHIELD (PRE SB PW4ENG 73-192)
HEAT SHIELD
EXCITER TO IGNITER PLUG CABLE
CABLE CLAMP
BRACKET
NUT
BOLT
HEAT SHIELD
CLAMP
CLAMP
BOLT
HEAT SHIELD
IGNITION EXCITER (UPPER)
BOLT
HEAT SHIELD
SEAL
WASHER
NUT
MOUNT BRACKET
WASHER
NUT
L-A2489 (0201)
PW V

Ignition Exciter (Upper)
Figure 401
(Task 72−00−61−450−002)


RING
SLEEVE
BUSHING
GROMMET
WASHER
SPRING
CONTACT (ATTACHED TO CABLE CONDUCTOR)
HIGH TENSION CABLE
TYPICAL BOTH ENDS
NUT
FERRULE ASSEMBLY
OUTLET ASSEMBLY
CONDUIT
FERRULE ASSEMBLY
NUT
L-A2493 (1087)
PW V

Exciter−To−Igniter Plug Cable
Figure 402
(Task 72−00−61−450−002)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-61-450-003:

1. Install Fuel Pump And Fuel Metering Unit (Package)

A. Equipment And Materials Necessary

Standard Tools:

Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 85862	Adapter, Torque
PWA 85989	Fixture, Handling (Optional)
PWA 86461	Adapter, Torque

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
R	P06-053	Lubricant, Sealing Ring (PWA 36500)
R	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	1	73-12-00/3/90
Packing	1	73-12-00/1/60
Packing	1	73-12-00/1/10
Packing	1	73-12-00/1/20
Packing	1	73-12-00/3/1
Packing	2	73-21-00/3/30
Packing	1	73-12-00/3/170
Retainer	1	73-12-00/3/10
Retainer	2	73-21-00/3/40

B. Procedure

See Figure 401, Figure 402 and Figure 403.

CAUTION: BE CAREFUL WHEN YOU HANDLE, REMOVE OR INSTALL ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTIONS USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

CAUTION: ENSURE ALL PROTECTIVE CLOSURES HAVE BEEN REMOVED.

R (1) Lubricate the packings with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 and install to the grooves on the drive shaft and flange of the fuel pump.

R (2) Install a packing, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the (upper) oil cooler inlet fuel tube (FM10) flange groove.

(3) For engines not equipped with flexible oil cooler outlet fuel hose and tube assembly (FM11) (Pre SB PW4ENG 73-35), comply with the following.

NOTE: Items referred to as numbers in parenthesis in text are identified in Figure 403.

R (a) Install a new key washer (403/6) and coupling nut (403/4) to stopnut (403/5), threads lubricated with Engine Oil P03-001 on the oil cooler outlet fuel tube. Install the ferrule (403/3), packing (403/2), lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 and the retainer (403/1) to the tube.

R (b) Install a packing, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the groove in threaded three hole adapter and slip adapter on the oil cooler outlet fuel tube. Slide down the tube as far as possible.

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-05

(4) For engines equipped with flexible oil cooler outlet fuel hose and tube assembly (FM11) (Post SB PW4ENG
R 73-35), install a packing lubricated with Engine Oil
R P03-001 or Sealing Ring Lubricant P06-053 to the hose
R and tube assembly flange groove.

(5) Check to ensure bolts (with trapped washers) are in position on pad on right, forward side of gearbox. Lubricate bolt threads with Antiseize Paste P06-054. Wipe off unwanted paste.

NOTE: Do not install bolt to threaded hole on drive pad at 7 o'clock position.

NOTE: Bolts should be installed until threads are flush with mounting surface.

CAUTION: DO NOT ALLOW WEIGHT OF FUEL PUMP AND METERING UNIT PACKAGE TO BE TRANSMITTED TO PUMP SPLINES DURING INSTALLATION OR DAMAGE TO SPLINES MAY RESULT.

CAUTION: WHILE ROTATING ENTIRE FUEL PUMP AND METERING UNIT PACKAGE DURING INSTALLATION, ALIGN OIL COOLER INLET FUEL TUBE WITH PORT AT TOP INBOARD SIDE OF FUEL PUMP. FAILURE TO DO SO COULD RESULT IN DAMAGE TO PACKING AND/OR FUEL PUMP PORT.

(6) Position and raise the package so that the hole in the pump flange is aligned with the hole in the mounting surface. Move package rearward to engage spline and seat pump flange. Rotate package counterclockwise, aligning inlet tube, and install anti-rotation bolt, threads lubricated with Antiseize Paste P06-054, to 7 o'clock position. Wipe off unwanted paste. Use PWA 86461 Torque Adapter to torque the bolt at the 1 o'clock position and PWA 85862 Torque Adapter to torque the remaining bolts. Torque bolts on pump flange to 225 - 250 lb-in. (25.422 - 28.246 N.m).

NOTE: For ease of installation, install the PWA 85989 Handling Fixture to the fuel pump. Attach it with the two detail bolts and the hand screw.

(7) Remove the handling fixture if used.

(8) For engines not equipped with flexible oil cooler outlet fuel hose and tube assembly (FM11) (Pre SB PW4ENG 73-35), comply with the following.

CAUTION: STOPNUT KEY WASHER TABS MUST BE SECURELY CRIMPER OVER FACE OF STOPNUT FLANGE TO RETAIN KEY WASHER ENGAGEMENT WITH STOPNUT. IMPROPERLY SECURED KEY WASHER MAY ALLOW STOPNUT TO LOOSEN CAUSING FUEL LEAK IN ENGINE NACELLE.

(a) Slide oil cooler outlet fuel tube three hole adapter to rear port of fuel pump. Secure with three bolts, threads lubricated with Engine Oil P03-001. Bolt with lockwire holes to be installed in bottom hole. Torque bolts 85 - 95 lb-in. (9.604 - 10.734 N.m). Lubricate tube nut threads (403/4) with Engine Oil P03-001 and torque to 100 - 110 lb-in. (11.298 - 12.428 N.m), then loosen and retorque nut (403/4) to same value. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 tube nut (403/4) to bottom bolt securing adapter to pump. Handtighten stopnut (403/5) against stop and back of maximum one half turn to align with key washer. Thread engagement between both nuts must be such that No. 60 wire will not pass through 0.063 inch (1.600 mm) diameter holes (both walls) of stopnut. Crimp key washer in slots and over flange of stopnut.

(9) For engines equipped with flexible oil cooler outlet fuel hose and tube assembly (FM11) (Post SB PW4ENG 73-35), install three bolts, threads lubricated with Engine Oil P03-001, securing hose and tube assembly flange to fuel pump port. Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(10) Install three bolts, threads lubricated with Engine Oil P03-001, securing oil cooler inlet fuel tube (FM10) flange to fuel pump port. Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

R (11) Install the packings lubricated with Engine Oil P03-001
R or Sealing Ring Lubricant P06-053 and the retainers
R to the fuel distribution valve supply tube assembly
R (FM09). Install the tube to the adapters, threads
R lubricated with Engine Oil P03-001, on the fuel
R metering unit and to the adapter on the fuel flowmeter.
R Handtighten only.

(12) Install bolts, threads lubricated with Engine Oil P03-001, nut, and clamps securing tube to HPC case bracket and to airframe cooler oil outlet tube. Torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(13) Torque the (FM09) tube nuts to 100 - 110 lb-in. (11.298 - 12.428 N.m). Loosen the tube nuts and torque them again to the same limits. Safety the tube nuts with Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(14) (Reference 2170) Torque tube (FM10) and (FM11) nuts to 150 - 160 lb-in. (16.948 - 18.078 N.m). Torque the tube nuts again to 150 - 160 lb-in. (16.948 - 18.078 N.m) until the torque is kept.

(15) Connect the W4P2 and the W5P1 harness connectors to the fuel metering unit harness receptacles as follows. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make
R straight all the bent pins. If necessary, clean
R the connector and receptacle by SPOP 6 (Task
R 70-21-00-110-900). Refer to Section 70-21-00 in
R the Standard Practices Manual, PN 585005.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG-70 Strap Wrench or the Glenair TG-69 Soft-Jawed Piers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight

- the connector fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(16) (Pre SB PW4ENG 73-84) Connect the W5P8 harness connector to the fuel temperature probe harness receptacles as follows. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make
R straight all the bent pins. If necessary, clean
R the connector and receptacle by SPOP 6 (Task
R 70-21-00-110-900). Refer to Section 70-21-00 in
R the Standard Practices Manual, PN 585005.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG-70 Strap Wrench or the Glenair TG-69 Soft-Jawed Piers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the connector is tight

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(17) (Post SB PW4ENG 73-84), For a thermocouple probe with a studded terminal type receptacle install the wiring harness as follows.

(a) Install the wiring harness terminals to the thermocouple studs and install loosely the nuts to the thermocouple studs.

(b) Install the clamp, ground strap, and bolt loosely to the bracket on the housing.

CAUTION: TO PREVENT DAMAGE TO THE WIRING HARNESS, MAKE SURE THE THERMOCOUPLE STUD BOX DOES NOT TURN WHEN THE COUPLING NUT IS TORQUED.

(c) If necessary to align the thermocouple stud box, remove the lockwire from the thermocouple coupling nut to the adapter and loosen the coupling nut.

(d) Align the thermocouple stud box with the wiring harness connector.

(e) (Reference 2167) Hold the thermocouple stud box and torque the thermocouple probe coupling nut to 95 - 100 lb-in. (10.734 - 11.298 N.m). Do not let the thermocouple studs turn.

CAUTION: DO NOT ALIGN THE THERMOCOUPLE STUD BOX AFTER THE COUPLING NUT IS TORQUED. HOLD THE THERMOCOUPLE STUD BOX AND LOOSEN THE COUPLING NUT AND ALIGN THE THERMOCOUPLE STUD BOX AGAIN.

(f) Make sure the thermocouple stud box is aligned. Do not put too much force on the terminals of the wiring harness.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(g) (Reference 2273) Torque the alumel nuts (larger terminal studs) to 18 - 22 lb-in. (2.034 - 2.486 N.m).

(h) (Reference 2273) Torque the chromel nuts (smaller terminal studs) to 15 - 18 lb-in. (1.695 - 2.034 N.m).

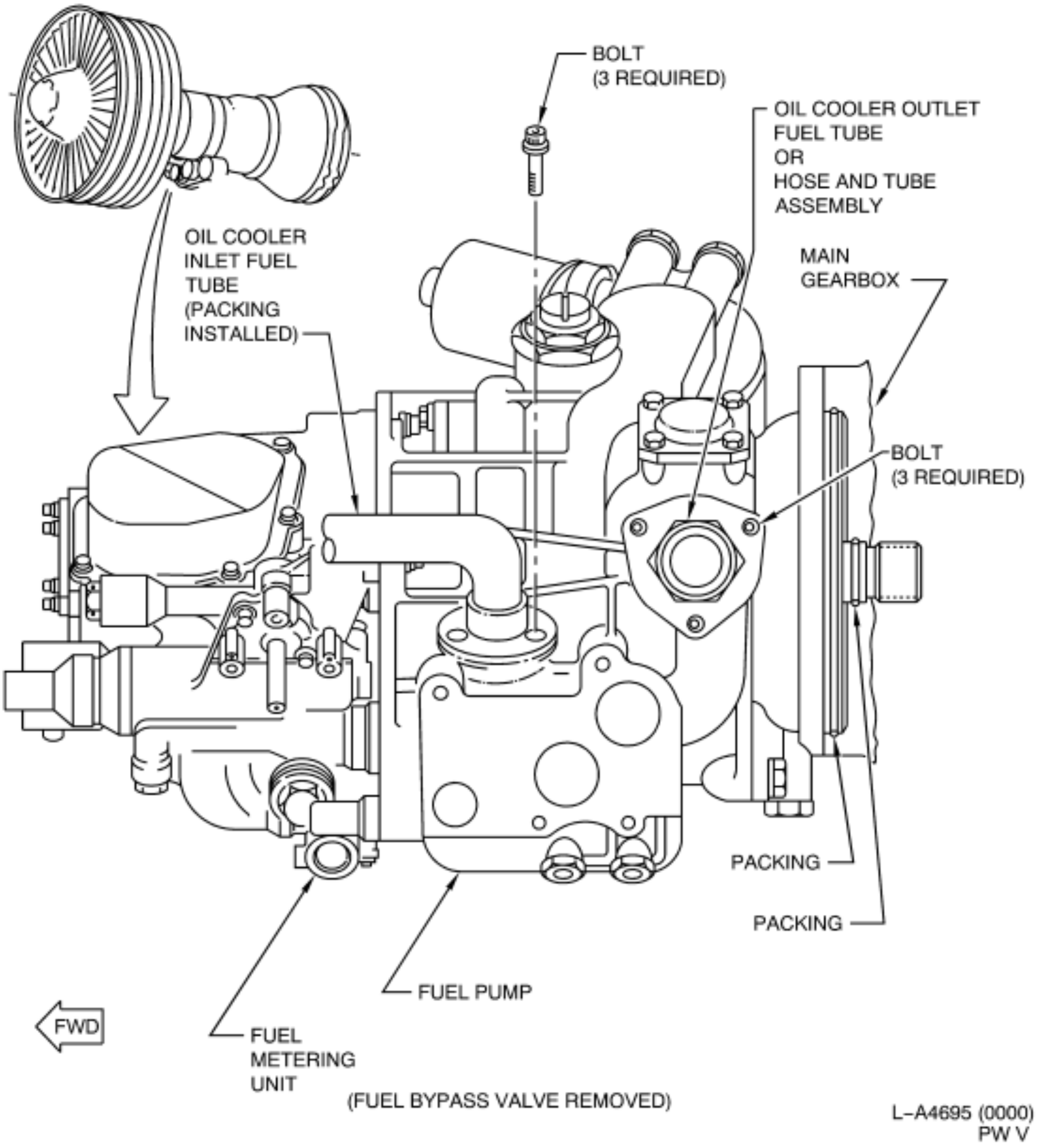
(i) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 from the coupling nut to the adapter.

(j) Torque the bolt that attachs the clamp and ground strap to the bracket on the housing to 36 - 40 lb-in. (4.067 - 4.519 N.m).

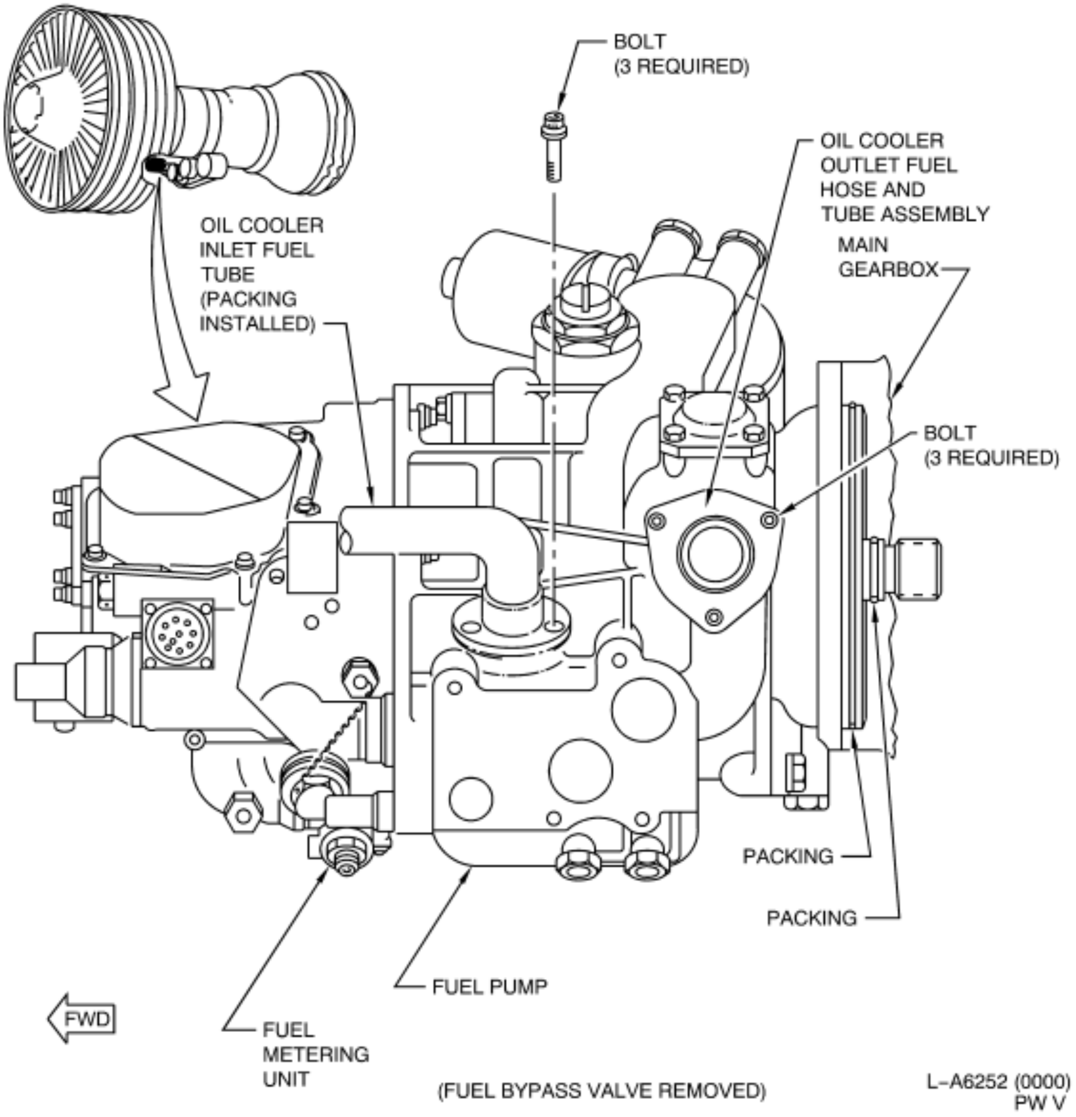
C. Postrequisites

(1) Install fuel bypass valve. See 72-00-61, Installation-08 (Task 72-00-61-450-005).

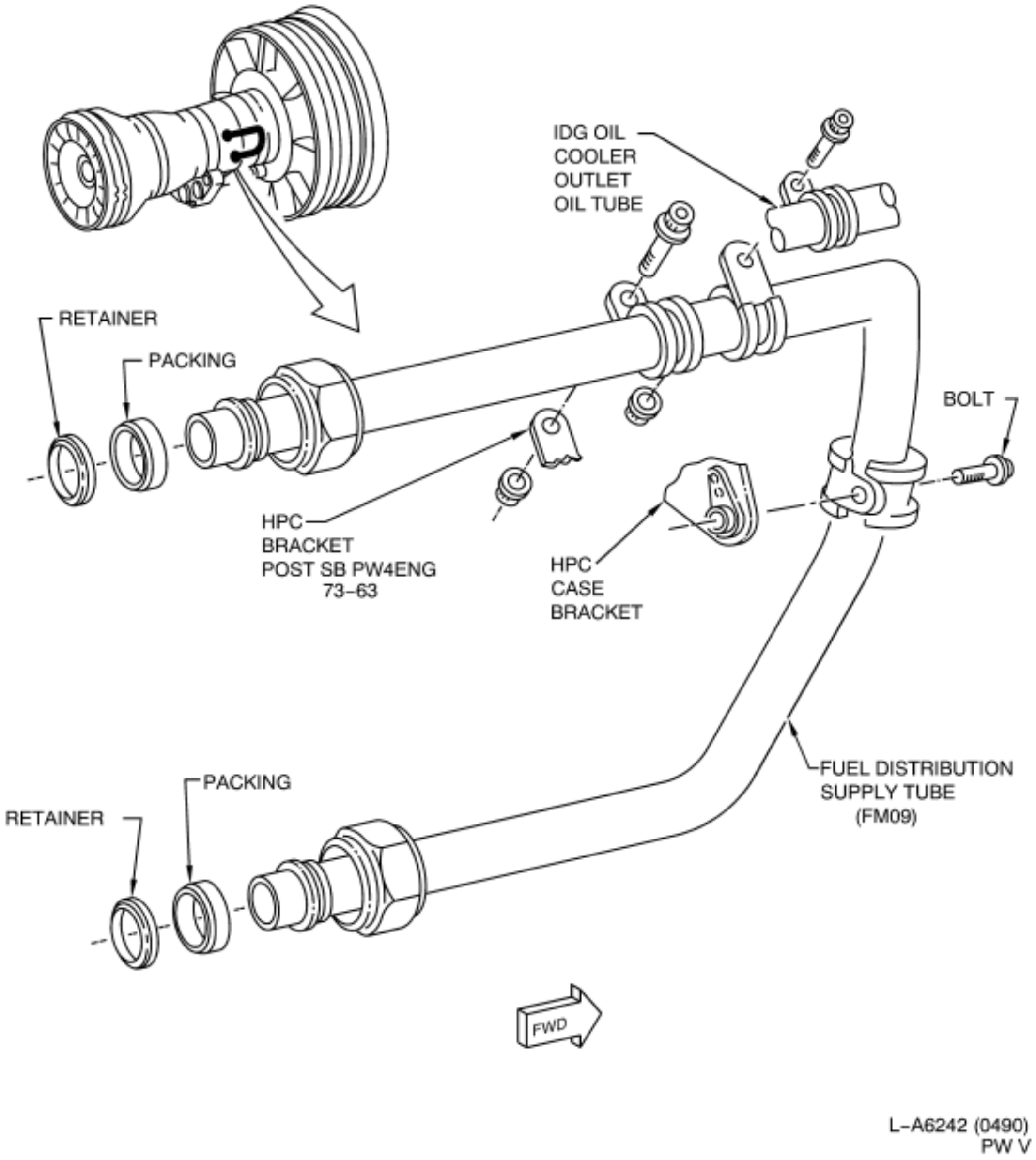
(2) Test engine per Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).


BOLT
(3 REQUIRED)
OIL COOLER OUTLET
FUEL TUBE
OR
HOSE AND TUBE
ASSEMBLY
OIL COOLER
INLET FUEL
TUBE
(PACKING
INSTALLED)
MAIN
GEARBOX
BOLT
(3 REQUIRED)
PACKING
PACKING
FUEL PUMP
FWD
FUEL
METERING
UNIT
(FUEL BYPASS VALVE REMOVED)
L-A4695 (0000)
PW V

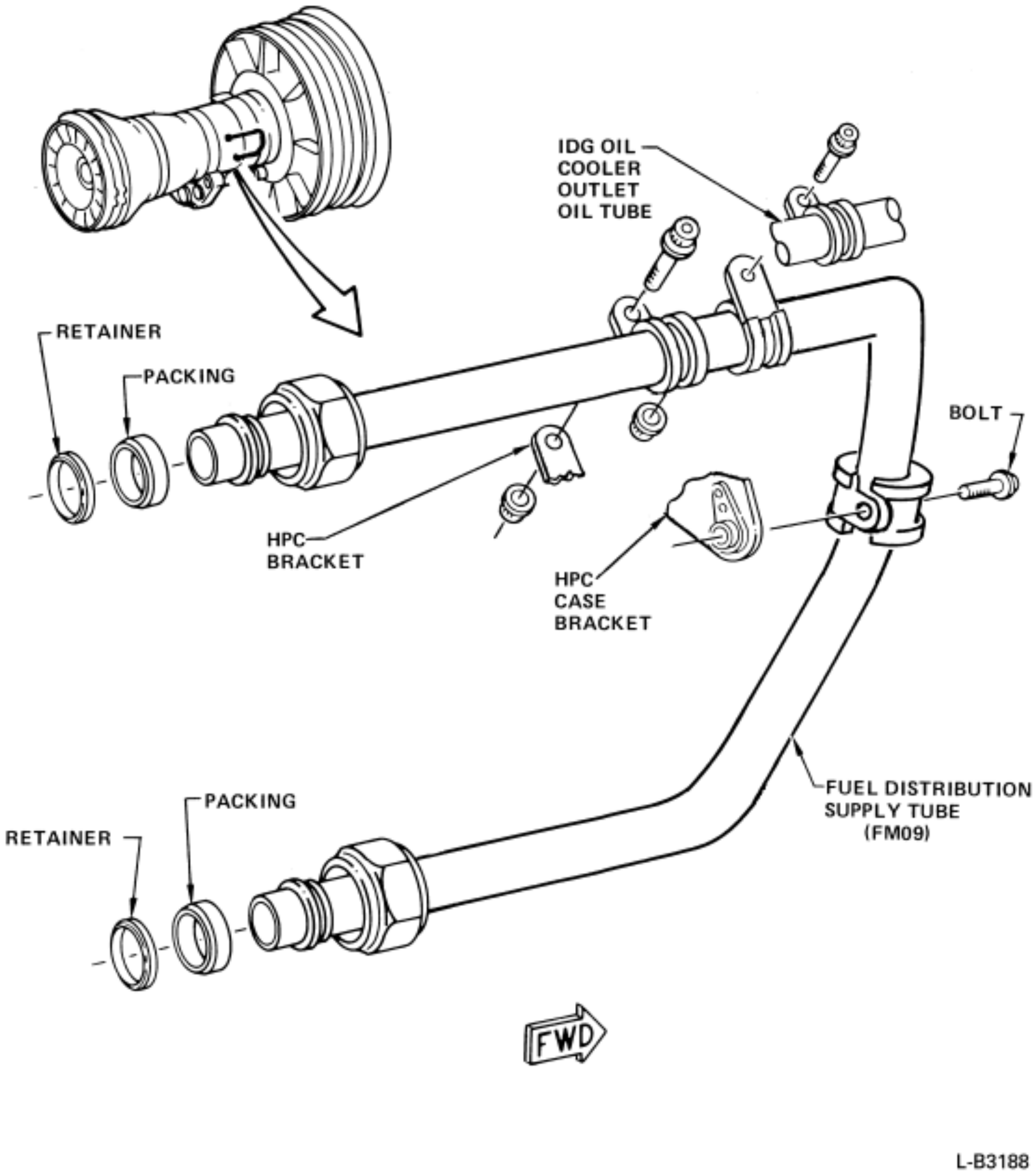
Fuel Pump And Metering Unit Package Without
Integral Actuator - Pre SB PW4ENG 73-81
Figure 401 (Sheet 1)
(Task 72-00-61-450-003)


BOLT
(3 REQUIRED)
OIL COOLER
OUTLET FUEL
HOSE AND
TUBE ASSEMBLY
MAIN
GEARBOX
OIL COOLER
INLET FUEL
TUBE
(PACKING
INSTALLED)
BOLT
(3 REQUIRED)
PACKING
PACKING
FUEL PUMP
FWD
FUEL
METERING
UNIT
(FUEL BYPASS VALVE REMOVED)
L-A6252 (0000)
PW V

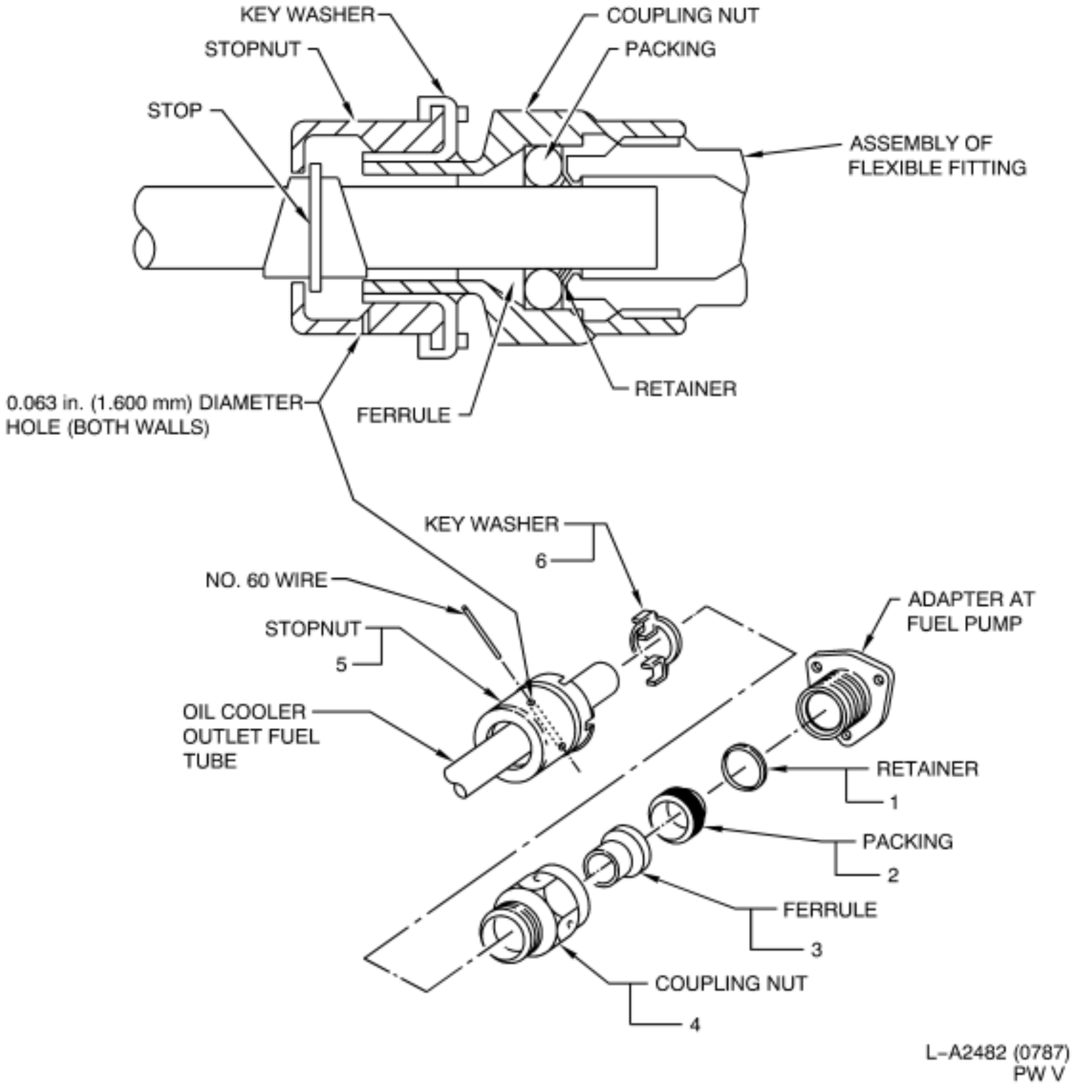
Fuel Pump And Metering Unit Package With
Integral Actuator - Post SB PW4ENG 73-81
Figure 401 (Sheet 2)
(Task 72-00-61-450-003)


IDG OIL COOLER OUTLET OIL TUBE
RETAINER
PACKING
BOLT
HPC BRACKET POST SB PW4ENG 73-63
HPC CASE BRACKET
FUEL DISTRIBUTION SUPPLY TUBE (FM09)
PACKING
RETAINER
FWD
L-A6242 (0490)
PW V

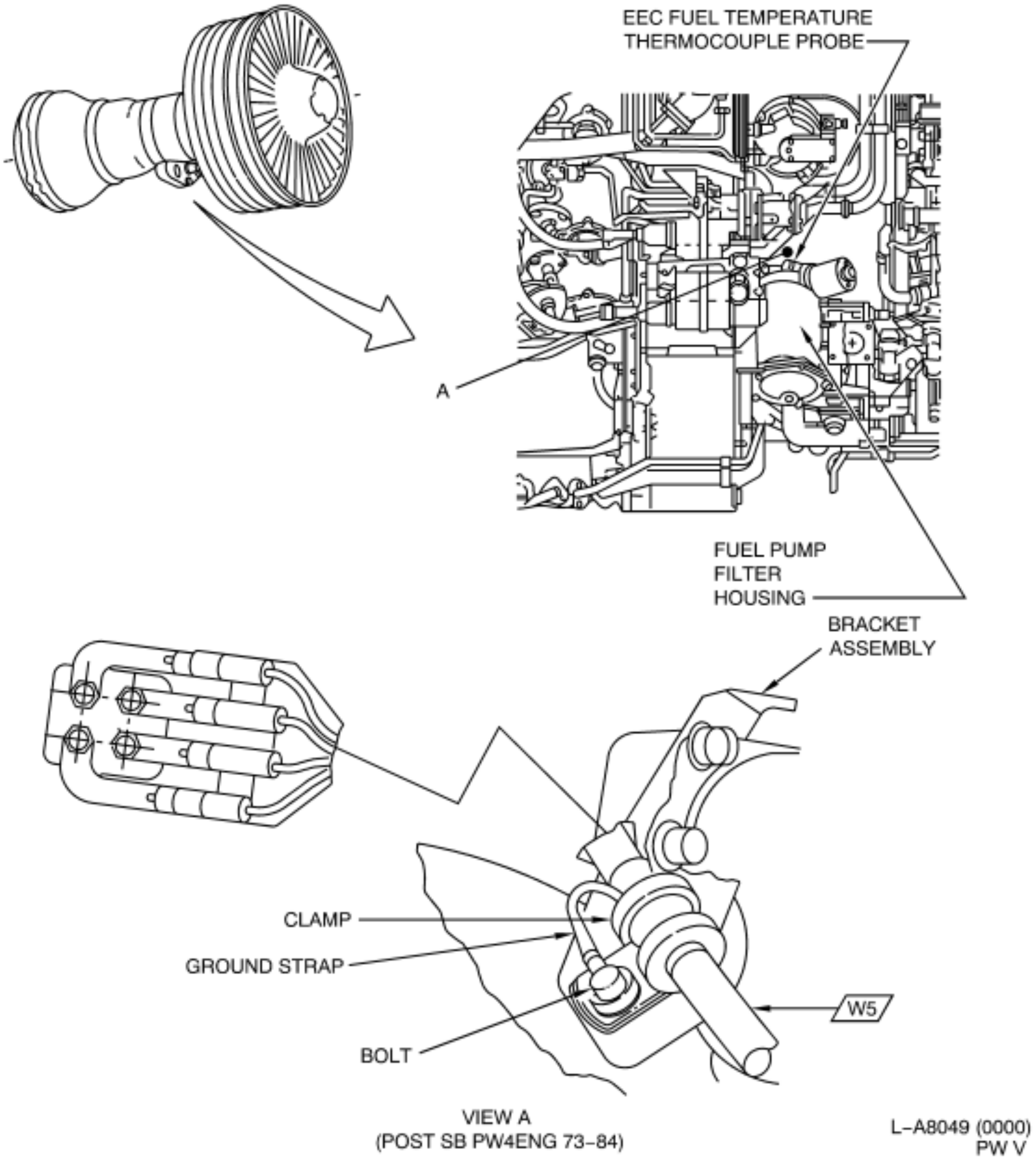
Fuel Distribution Valve Supply Tube
Figure 402 (Sheet 1)
(Task 72-00-61-450-003)


IDG OIL
COOLER
OUTLET
OIL TUBE
RETAINER
PACKING
BOLT
HPC
BRACKET
HPC
CASE
BRACKET
FUEL DISTRIBUTION
SUPPLY TUBE
(FM09)
PACKING
RETAINER
FWD
L-B3188

Fuel Distribution Valve Supply Tube
Figure 402 (Sheet 2)
(Task 72−00−61−450−003)


KEY WASHER
STOPNUT
STOP
COUPLING NUT
PACKING
ASSEMBLY OF FLEXIBLE FITTING
0.063 in. (1.600 mm) DIAMETER HOLE (BOTH WALLS)
FERRULE
RETAINER
KEY WASHER
6
NO. 60 WIRE
STOPNUT
5
OIL COOLER OUTLET FUEL TUBE
ADAPTER AT FUEL PUMP
RETAINER
1
PACKING
2
FERRULE
3
COUPLING NUT
4
L-A2482 (0787)
PW V

Assembly Of Flexible Fitting Key Washer
and Stopnut (Pre SB PW4ENG 73-35)
Figure 403
(Task 72-00-61-450-003)


EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
A
FUEL PUMP FILTER HOUSING
BRACKET ASSEMBLY
CLAMP
GROUND STRAP
W5
BOLT
VIEW A
(POST SB PW4ENG 73−84)
L−A8049 (0000)
PW V

Wiring Harness Terminals For Studded EEC Fuel Thermocouple Probe
Figure 404
(Task 72−00−61−450−003)

Task 72-00-61-450-016:

1. Install Fuel Metering Unit

A. Equipment And Materials Necessary

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
R	P06-053	Lubricant, Sealing Ring (PWA 36500)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	73-21-00/1/80
Packing	1	73-21-00/1/60
Packing	1	73-21-00/1/1
Packing	1	73-21-00/1/10
Packing	1	73-12-00/2/110
Packing	1	73-12-00/2/100
Packing	2	73-21-00/3/30
Retainer	2	73-21-00/3/40

B. Procedure
See Figure 401, Figure 402, and Figure 403.

(1) If new fuel metering unit is being installed, comply with the following:

R (a) Install a new packing lubricated with Engine Oil
R P03-001 or Sealing Ring Lubricant P06-053 to the
R adapter and install the adapter and bracket to
R the fuel supply port on outboard side of metering
unit. Secure with bolts, threads lubricated with
Engine Oil P03-001. Bolt with lockwire holes to
be installed in lower outboard hole. Torque bolts
to 65 - 85 lb-in. (7.344 - 9.604 N.m).

R (b) Install a new packing lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the adapter and install the adapter, threads lubricated with Engine Oil P03-001 to inboard port on the fuel metering unit. Torque adapter to 200 - 225 lb-in. (22.597 - 25.422 N.m).

(2) Install the transfer tubes to the fuel pump as follows:

R (a) Lubricate the two new small packings and the two new large packings with Engine Oil P03-001 or Sealing Ring Lubricant P06-053.

(b) Install two new packings to the two transfer tubes.

(c) Install the transfer tubes, packing side inward, to the fuel pump ports.

(d) Install the retainers to hold the transfer tubes in position in the fuel pump.

(e) Install the two remaining packings to the transfer tubes on fuel pump.

(3) Lubricate threads of fuel metering unit studs with Engine Oil P03-001, and install fuel metering unit to fuel pump over transfer tubes and secure with washers and nuts. Torque nuts to 275 - 300 lb-in. (31.071 - 33.895 N.m).

R (4) Install the packings lubricated with Sealing Ring Lubricant P06-053 or Engine Oil P03-001 and the retainers to the fuel distribution valve supply tube assembly (FM09). Attach the tube to the adapters, threads lubricated with Engine Oil P03-001, on the fuel metering unit and fuel flowmeter. Handtighten only.

(5) Install bolts, threads lubricated with Engine Oil P03-001, nut, and clamps securing tube to HPC case bracket and to airframe cooler oil outlet tube. Torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(6) Torque tube nuts to 100 - 110 lb-in. (11.298 - 12.428 N.m), loosen tube nuts, then retorque to required limit. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to the tube nuts.

NOTE: Tube nut attached to fuel metering unit to be lockwired to bolt securing adapter to fuel metering unit.

(7) Lubricate threads of fuel metering unit adapter with Engine Oil P03-001. Install compressor stator cylinder manifold (CP01) to fuel bypass valve, fuel metering unit, and manifold tee. Torque manifold nut to fuel bypass valve to 200 - 225 lb-in. (22.597 - 25.422 N.m). Torque manifold nut to fuel metering unit to 450 - 500 lb-in. (50.843 - 56.492 N.m). Torque manifold nut to manifold tee to 340 - 375 lb-in. (38.415 - 42.369 N.m). Secure all nuts with Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(8) Connect the W4P2 and the W5P1 harness connectors to the fuel metering unit harness receptacles as follows. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make
R straight the bent pins. If necessary, clean
R the connector and receptacle by SPOP 6 (Task
R 70-21-00-110-900). Refer to Section 70-21-00 in
R the Standard Practices Manual, PN 585005.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND

CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

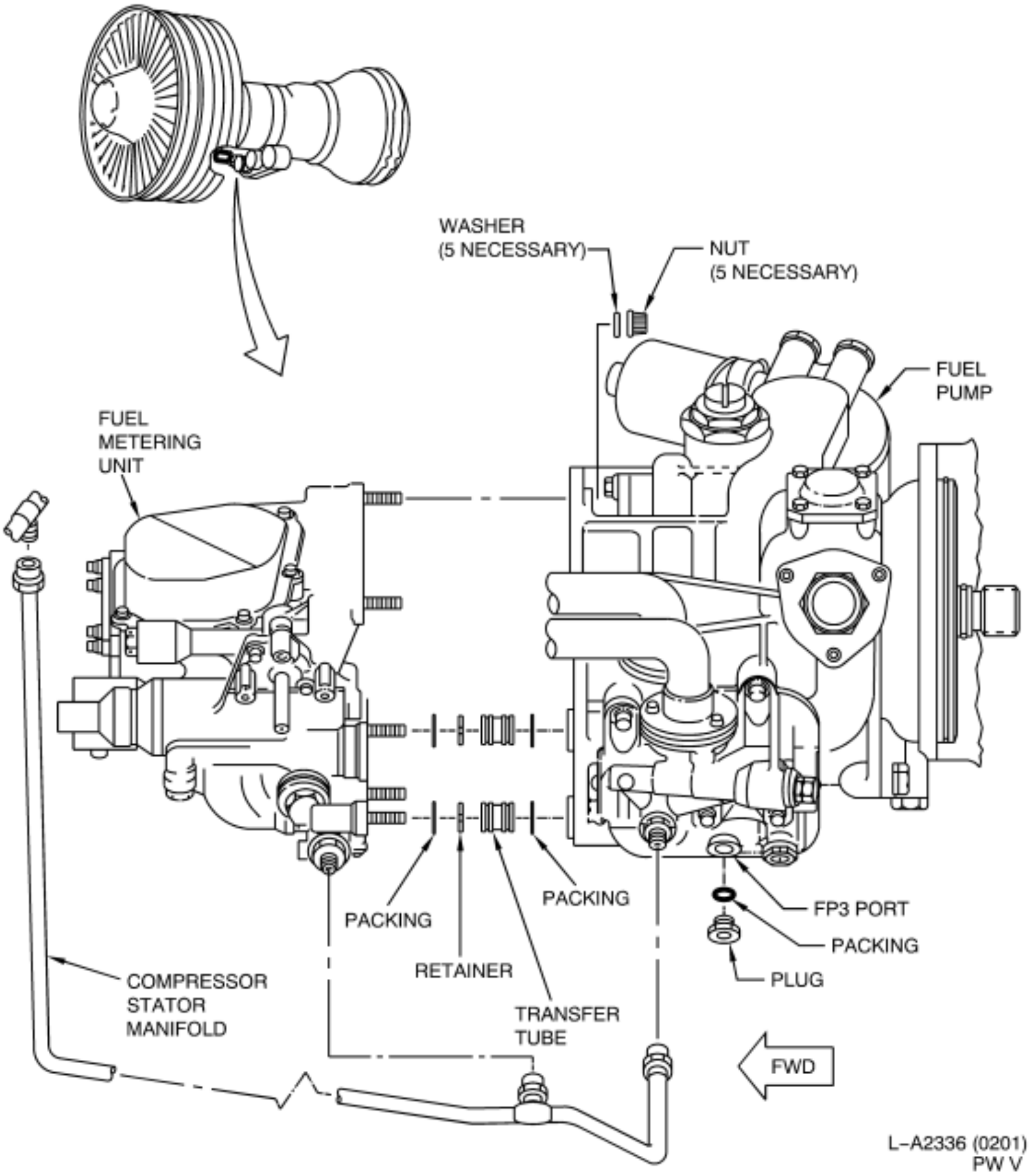
(c) Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

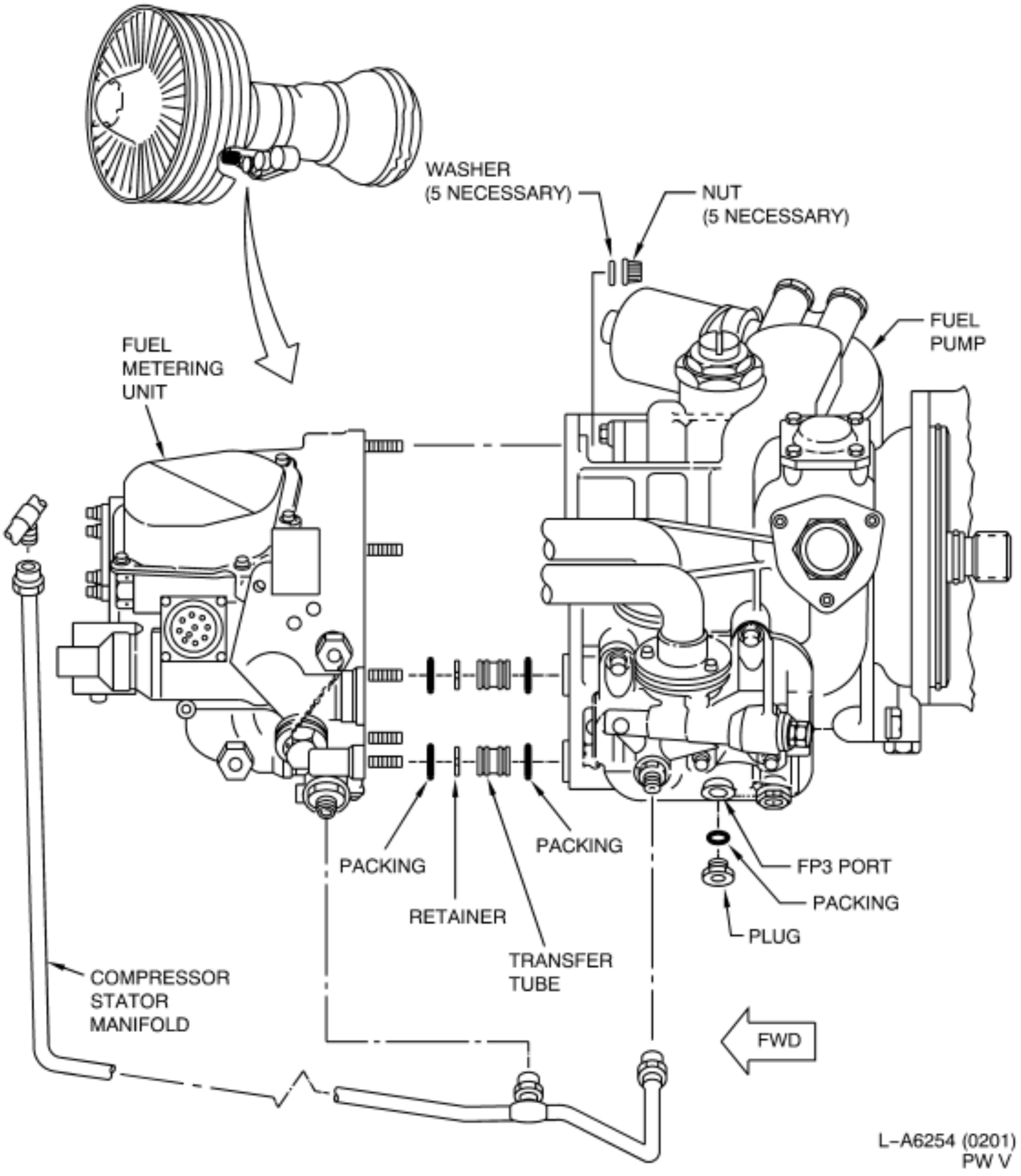
NOTE: See the instructions given with the strap wrench for correct use.

C. Postrequisites

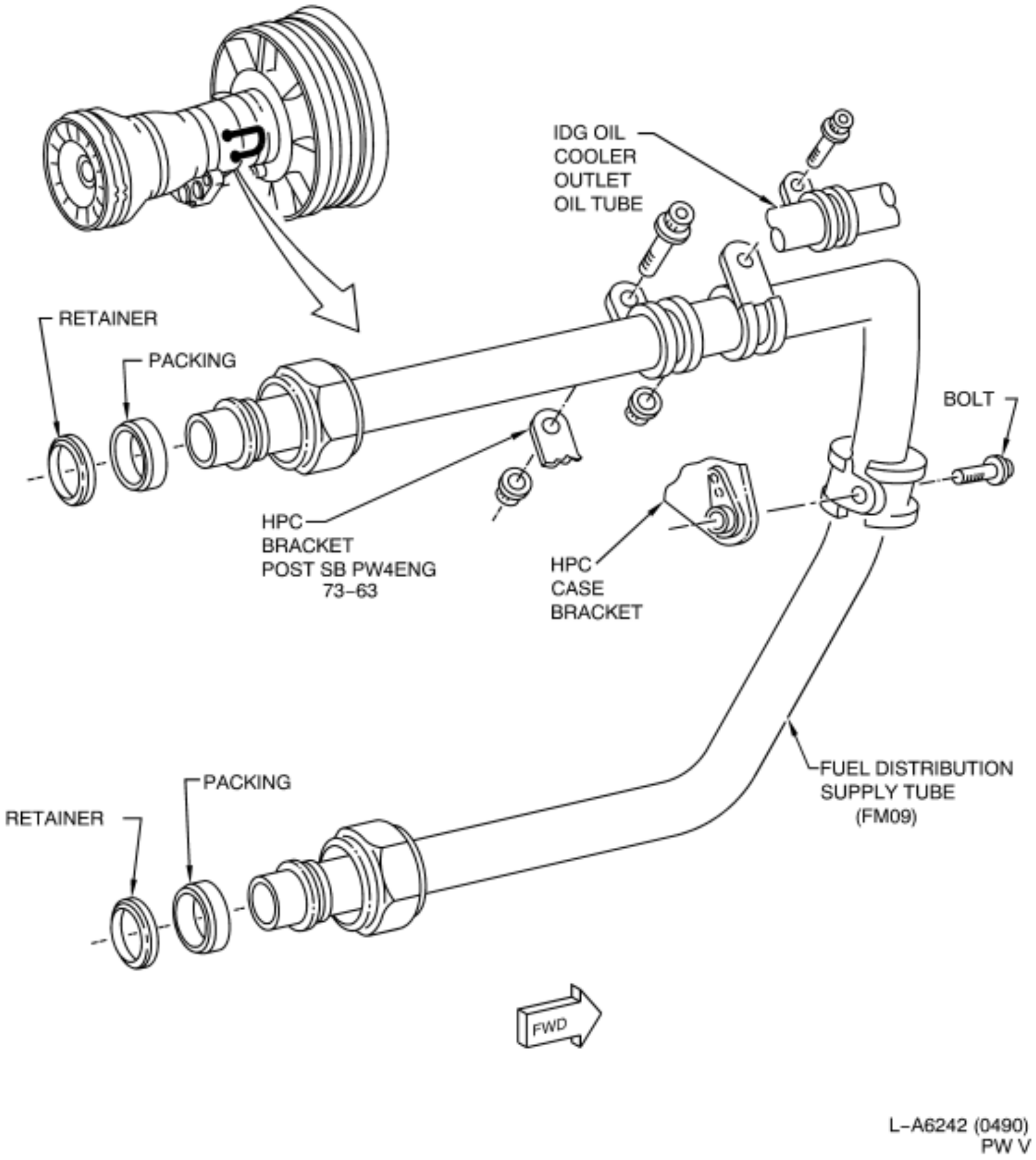
(1) Test engine per Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


WASHER
(5 NECESSARY)
NUT
(5 NECESSARY)
FUEL
PUMP
FUEL
METERING
UNIT
PACKING
PACKING
RETAINER
FP3 PORT
PACKING
PLUG
COMPRESSOR
STATOR
MANIFOLD
TRANSFER
TUBE
FWD
L-A2336 (0201)
PW V

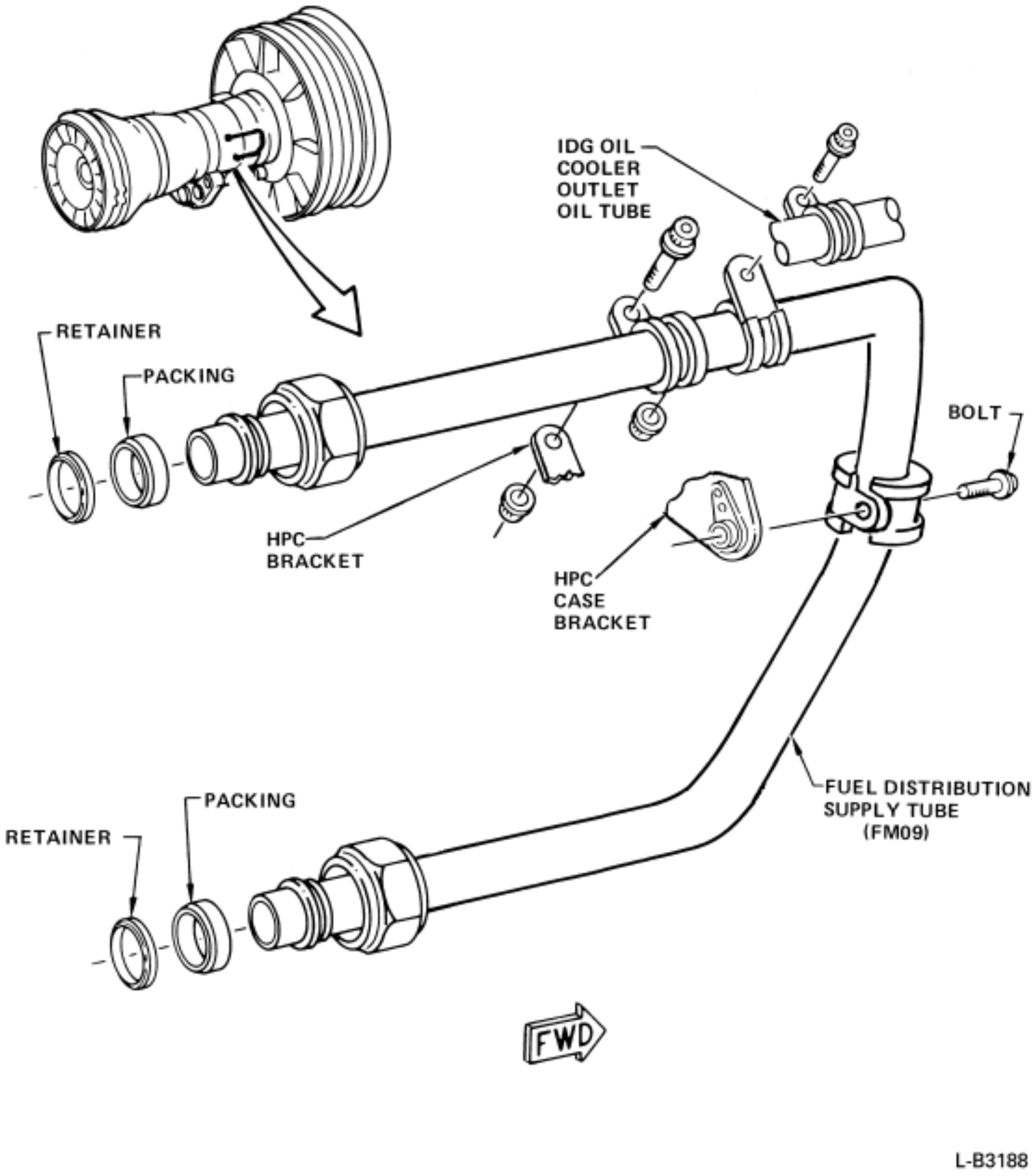
Fuel Metering Unit Without Integral Actuator - Pre SB PW4ENG 73-81
Figure 401 (Sheet 1)
(Task 72-00-61-450-016)


WASHER
(5 NECESSARY)
NUT
(5 NECESSARY)
FUEL
PUMP
FUEL
METERING
UNIT
PACKING
PACKING
FP3 PORT
PACKING
PLUG
RETAINER
TRANSFER
TUBE
COMPRESSOR
STATOR
MANIFOLD
FWD
L-A6254 (0201)
PW V

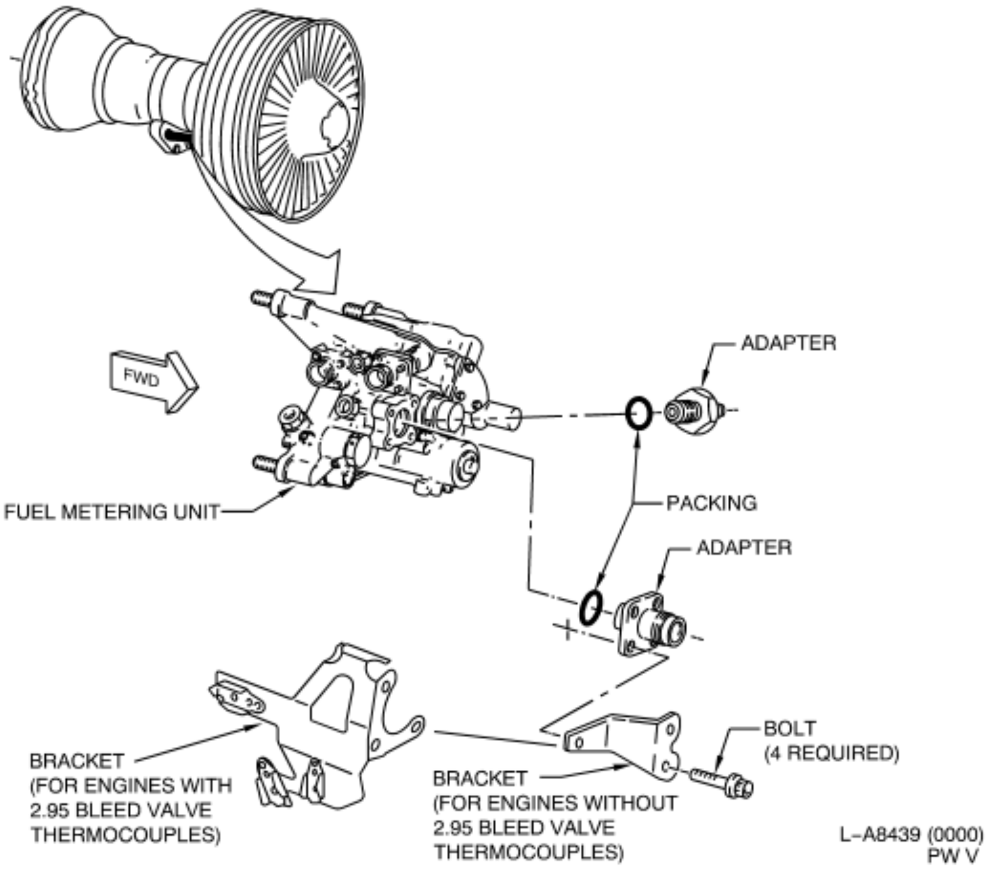
Fuel Metering Unit With Integral Actuator - Post SB PW4ENG 73-81
Figure 401 (Sheet 2)
(Task 72-00-61-450-016)


IDG OIL
COOLER
OUTLET
OIL TUBE
RETAINER
PACKING
BOLT
HPC
BRACKET
POST SB PW4ENG
73−63
HPC
CASE
BRACKET
FUEL DISTRIBUTION
SUPPLY TUBE
(FM09)
PACKING
RETAINER
FWD
L−A6242 (0490)
PW V

Fuel Distribution Valve Supply Tube
Figure 402 (Sheet 1)
(Task 72−00−61−450−016)


IDG OIL
COOLER
OUTLET
OIL TUBE
RETAINER
PACKING
BOLT
HPC
BRACKET
HPC
CASE
BRACKET
FUEL DISTRIBUTION
SUPPLY TUBE
(FM09)
PACKING
RETAINER
FWD
L-B3188

Fuel Distribution Valve Supply Tube
Figure 402 (Sheet 2)
(Task 72−00−61−450−016)


ADAPTER
FWD
PACKING
ADAPTER
FUEL METERING UNIT
BOLT
(4 REQUIRED)
BRACKET
(FOR ENGINES WITH
2.95 BLEED VALVE
THERMOCOUPLES)
BRACKET
(FOR ENGINES WITHOUT
2.95 BLEED VALVE
THERMOCOUPLES)
L−A8439 (0000)
PW V

Fuel Metering Unit
Figure 403
(Task 72−00−61−450−016)

Task 72-00-61-450-004:

1. Install Fuel Pump To Fuel Metering Unit (On Bench)

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
R	P06-053	Lubricant, Sealing Ring (PWA 36500)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	73-21-00/1/10
Packing	1	73-21-00/1/1
Packing	1	73-12-00/1/90
Packing	1	73-23-00/4/1
Packing	2	73-34-00/1/1
Packing	1	73-21-00/1/60
Packing	1	73-21-00/1/80

B. Procedure
See Figure 401.

(1) Remove protective closures from transfer tubes on pump and mating ports on fuel metering unit.

(2) If new fuel pump is being installed comply with the following:

R (a) Lubricate the packings with Engine Oil P03-001 or
R Sealing Ring Lubricant P06-053 and install the
R two packings in raised rectangular pad on the upper front side of fuel filter. Position fuel pump filter differential pressure switch to pad aligning dowel pin and secure with four bolts, threads lubricated with Engine Oil P03-001, and washers. Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

R R R R (b) Install a packing, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the plug and install the plug, threads lubricated with Engine Oil P03-001 to the rear upper port on the right side of the fuel pump filter housing. Torque plug to 110 - 120 lb-in. (12.428 - 13.558 N.m).

(c) For thermocouple probe with a keyway type receptacle (Pre SB PW4ENG 73-84).

R R R 1 Install a packing, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the fuel temperature thermocouple probe. Install probe, threads lubricated with Engine Oil P03-001, to port on fuel pump filter housing, forward and adjacent to previously installed plug. Torque probe to 110 - 120 lb-in. (12.428 - 13.558 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 probe and plug.

(d) For a thermocouple probe with a studed terminal type receptacle (Post SB PW4ENG 73-84).

R R R 1 Install a packing, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the fuel temperature thermocouple probe.

2 Lubricate the threads of the probe with Engine Oil P03-001, and install the probe to boss on the upper end of the fuel pump filter housing. .

a (Reference 2166) Remove the lockwire between the body nut and coupling nut. Loosen the coupling nut from the body nut. Torque the body nut (to the housing) to 95 - 100 lb-in. (10.734 - 11.298 N.m). Install Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 from the body nut to the filter housing.

b Turn the probe so the two larger studs are on the top and to the left as shown in the figure

CAUTION: DO NOT ALIGN THE THERMOCOUPLE STUD BOX AFTER THE COUPLING NUT IS TORQUED.

c (Reference 2167) Torque the coupling to 95 - 100 lb-in. (10.734 - 11.298 N.m). Install Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 from the coupling to the body nut.

(e) (Post SB PW4ENG 73-156 and SB PW4ENG 73-161) Install the fuel temperature thermocouple probe to the fuel pump.

1 Install packing (401/10) onto plug (401/9).

2 Install the plug into the aft port in the fuel pump. Torque the plug to 110 - 120 lb-in. (12.428 - 13.558 N.m).

3 Install bushing (401/6) with bracket (401/5) into the forward port in the fuel pump. Torque the bushing (401/6) to 110 - 120 lb-in. (12.428 - 13.558 N.m).

4 Attach bracket (401/5) to plug (401/9) with bolt (401/7). Torque the bolt to 85 - 95 lb-in. (9.604 - 10.734 N.m).

5 Align the contour and bolt holes in bracket (401/3) with bracket (401/5). Attach the brackets together with two (2) screws (401/2). Torque screws to 36 - 40 lb-in. (4.067 - 4.519 N.m).

6 Install packing (401/4), lubricated with Engine Oil P03-001, onto the thermocouple probe (401/1).

7 Install the thermocouple probe (401/1) into the bracket assembly (401/3 and 401/5).

8 Rotate the thermocouple probe (401/1) so that the smaller diameter terminal studs are close to the harness and seat the thermocouple flange against the bracket assembly.

NOTE: The bolt holes in the brackets and the thermocouple flange are offset so that the thermocouple can only be attached with bolts when correctly oriented.

9 Attach the thermocouple probe to the bracket assembly with two (2) bolts (401/8). Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(3) If new fuel metering unit is being installed comply with the following:

R R R (a) Install a new packing, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the adapter and install the adapter and bracket to the fuel supply port on fuel metering unit. Secure with bolts, threads lubricated with Engine Oil P03-001. Bolt with lockwire holes to be installed in bottom outboard hole. Torque bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m).

NOTE: Bolt with lockwire holes to be used to secure fuel tube nut at installation of package.

R R R R R (b) Install a new packing, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053, to the adapter and install the adapter, threads lubricated with Engine Oil P03-001 to the port on the fuel metering unit. Torque adapter to 200 - 225 lb-in. (22.597 - 25.422 N.m).

R R R (4) Install the packings, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the transfer tubes on the fuel pump.

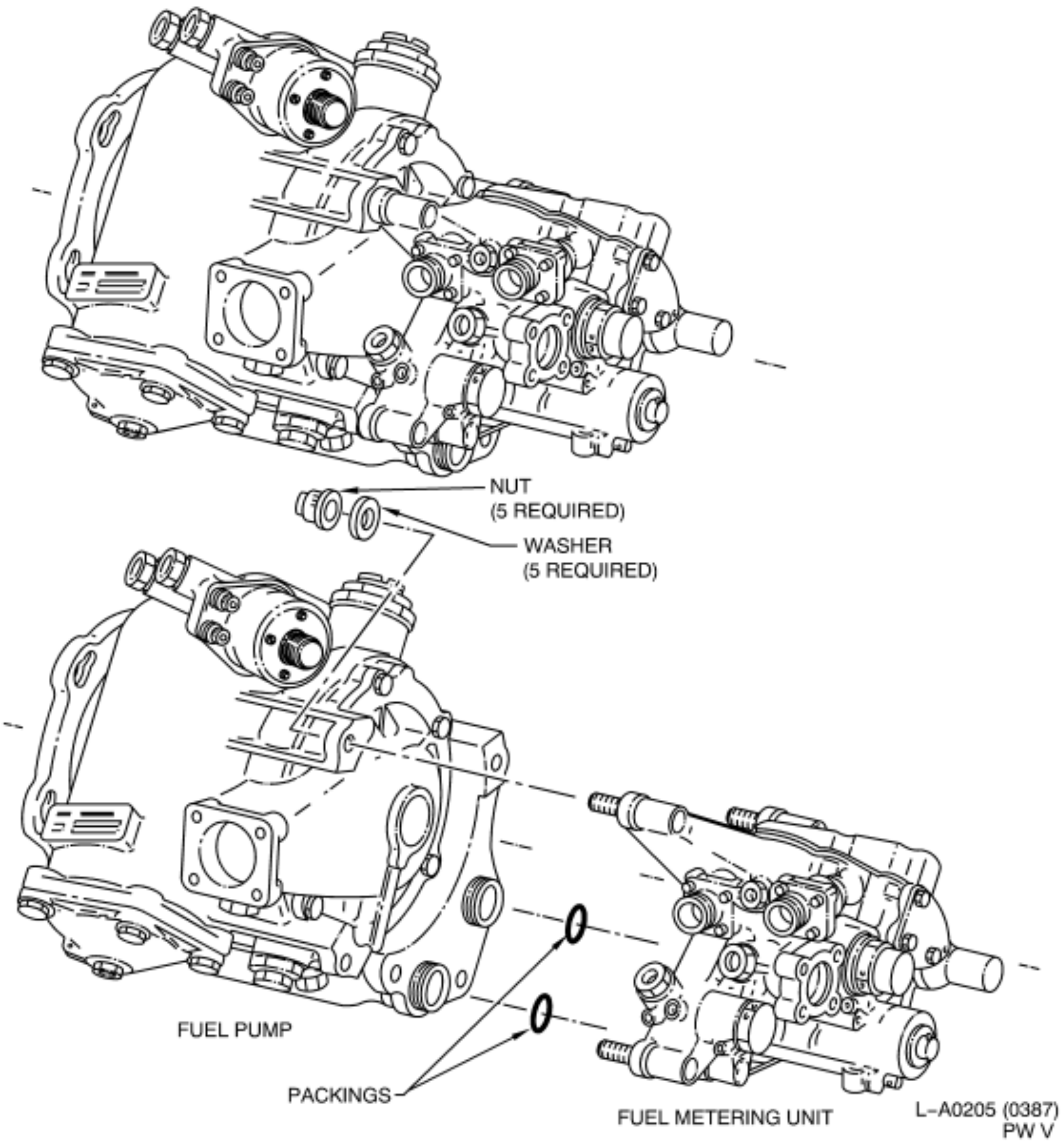
(5) Lubricate threads of studs on fuel metering unit with Engine Oil P03-001, and aligning transfer tubes on pump with ports on metering unit, install pump to fuel metering unit and secure with washers and nuts. Torque nuts to 275 - 300 lb-in. (31.071 - 33.895 N.m).

C. Postrequisites

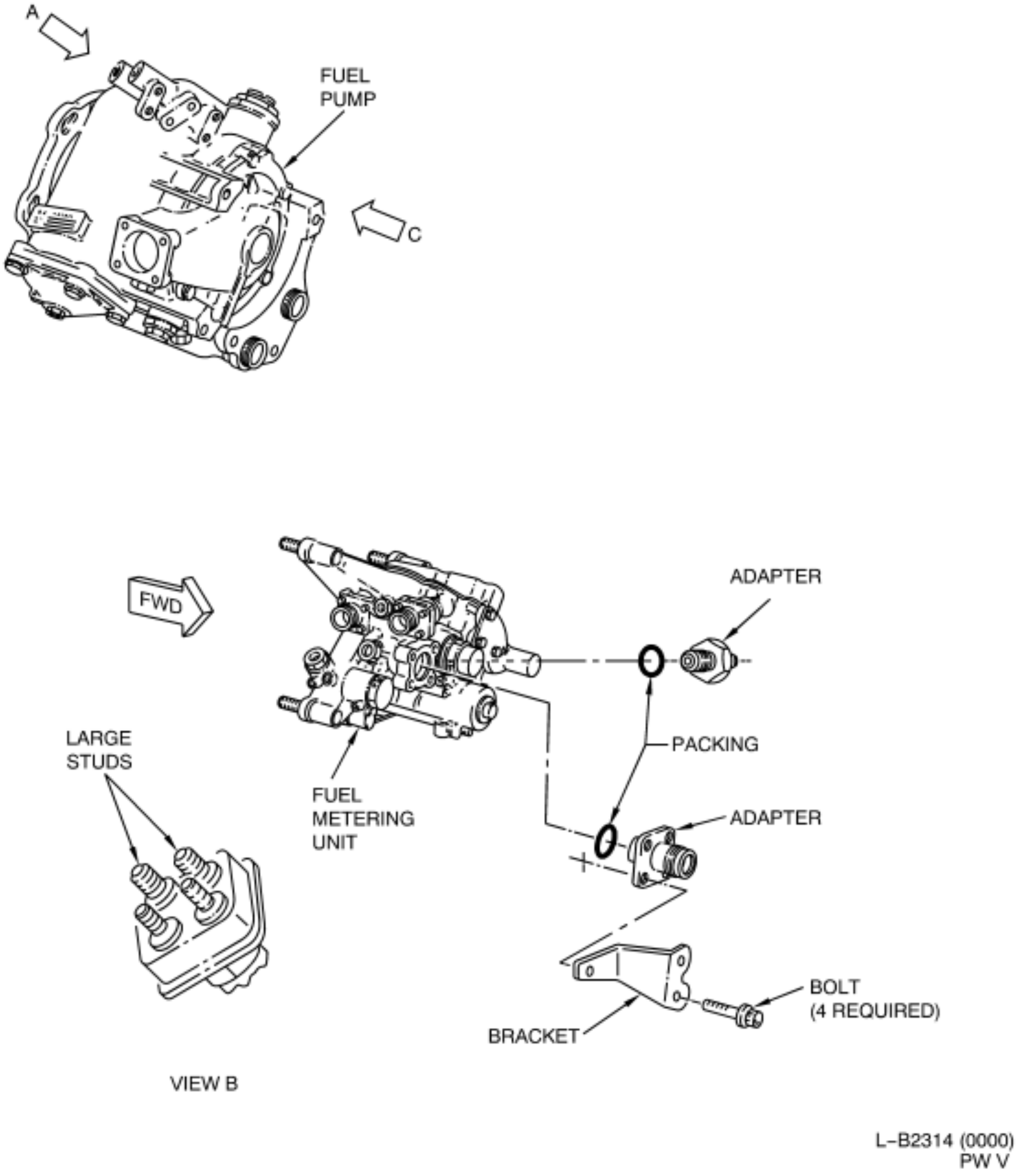
ENGINE GENERAL − MAIN GEARBOX − INSTALLATION−07

(1) Install fuel pump and fuel metering unit package per 72−00−61, Installation−05 Task 72−00−61−450−003.

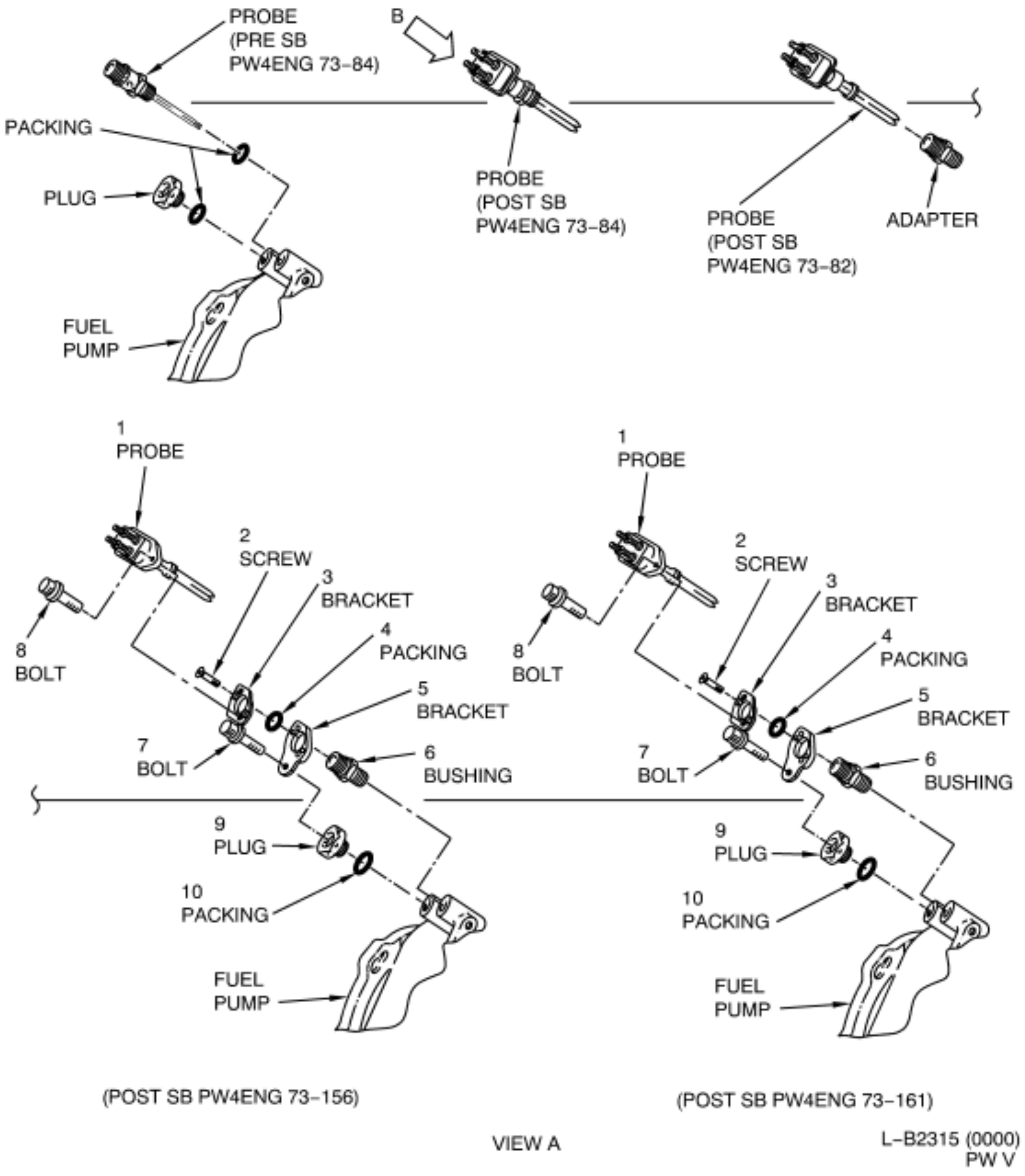
(2) Test engine per Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


NUT
(5 REQUIRED)
WASHER
(5 REQUIRED)
FUEL PUMP
PACKINGS
FUEL METERING UNIT
L-A0205 (0387)
PW V

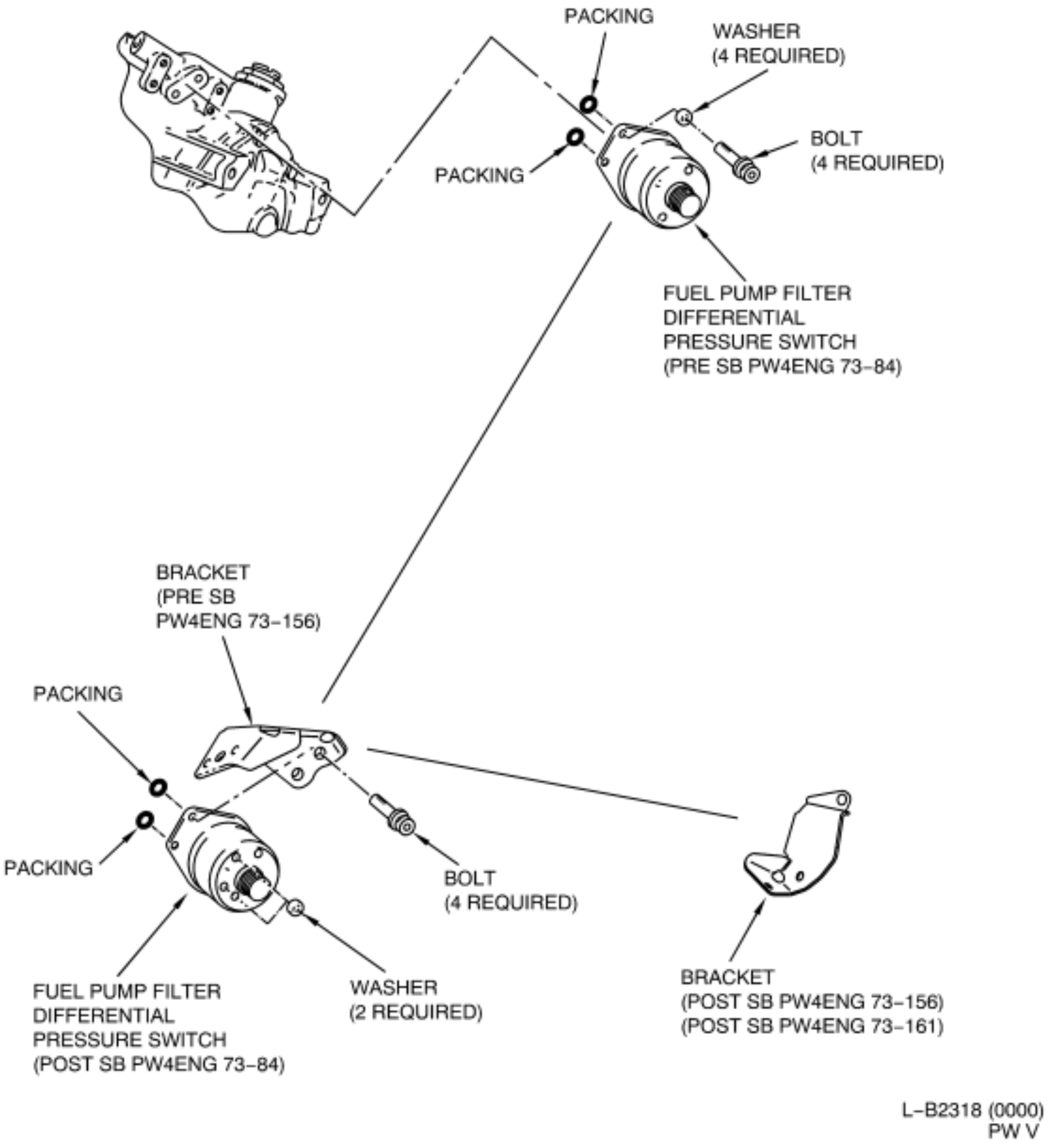
Fuel Pump And Fuel Metering Unit
Figure 401 (Sheet 1)
(Task 72-00-61-450-004)


A
FUEL PUMP
C
FWD
ADAPTER
PACKING
ADAPTER
LARGE STUDS
FUEL METERING UNIT
BRACKET
BOLT (4 REQUIRED)
VIEW B
L-B2314 (0000)
PW V

Fuel Pump And Fuel Metering Unit
Figure 401 (Sheet 2)
(Task 72-00-61-450-004)


PROBE
(PRE SB
PW4ENG 73-84)
B
PACKING
PLUG
FUEL
PUMP
PROBE
(POST SB
PW4ENG 73-84)
PROBE
(POST SB
PW4ENG 73-82)
ADAPTER
1
PROBE
8
BOLT
2
SCREW
3
BRACKET
4
PACKING
5
BRACKET
7
BOLT
6
BUSHING
9
PLUG
10
PACKING
FUEL
PUMP
(POST SB PW4ENG 73-156)
1
PROBE
8
BOLT
2
SCREW
3
BRACKET
4
PACKING
5
BRACKET
7
BOLT
6
BUSHING
9
PLUG
10
PACKING
FUEL
PUMP
(POST SB PW4ENG 73-161)
VIEW A
L-B2315 (0000)
PW V

Fuel Pump And Fuel Metering Unit
Figure 401 (Sheet 3)
(Task 72-00-61-450-004)


PACKING
WASHER
(4 REQUIRED)
BOLT
(4 REQUIRED)
PACKING
FUEL PUMP FILTER
DIFFERENTIAL
PRESSURE SWITCH
(PRE SB PW4ENG 73-84)
BRACKET
(PRE SB
PW4ENG 73-156)
PACKING
PACKING
BOLT
(4 REQUIRED)
FUEL PUMP FILTER
DIFFERENTIAL
PRESSURE SWITCH
(POST SB PW4ENG 73-84)
WASHER
(2 REQUIRED)
BRACKET
(POST SB PW4ENG 73-156)
(POST SB PW4ENG 73-161)
L-B2318 (0000)
PW V

Fuel Pump And Fuel Metering Unit
Figure 401 (Sheet 4)
(Task 72-00-61-450-004)

Task 72−00−61−450−005:

1. Install Fuel Bypass Valve

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03−001	Oil, Engine (PWA 521B)
	P05−289	Lockwire (AS3214−02)
	P05−291	Cable, Safety (Optional)
	P05−292	Ferrule, Safety Cable (Optional)
R	P06−053	Lubricant, Sealing Ring (PWA 36500)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	73−12−00/1/110
Packing	2	73−12−00/1/120
Packing	1	73−12−00/1/160
Packing	1	73−12−00/3/170

B. Procedure
See Figure 401.

(1) Remove protective closures.

(2) If new fuel bypass valve is being installed comply with the following:

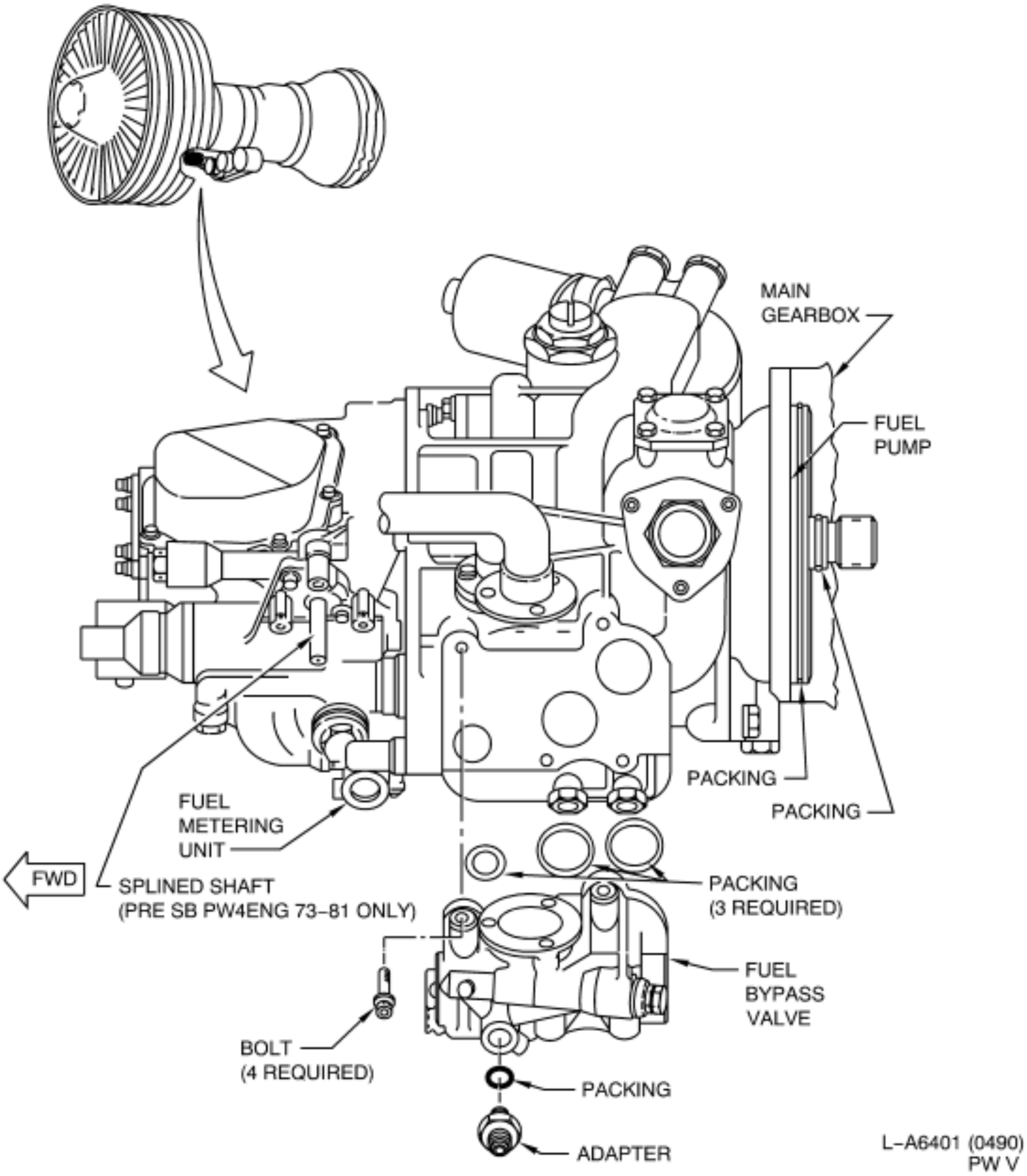
R (a) Install a packing, lubricated with Engine Oil
R P03−001 or Sealing Ring Lubricant P06−053 to
R the adapter and install the adapter, threads
R lubricated with Engine Oil P03−001 to the pressure
R port on the fuel bypass valve. Torque adapter to
110 − 120 lb-in. (12.428 − 13.558 N.m).

R (3) Install a packing, lubricated with Engine Oil P03−001
R or Sealing Ring Lubricant P06−053 to the flange of oil
R cooler inlet fuel tube assembly (FM12).

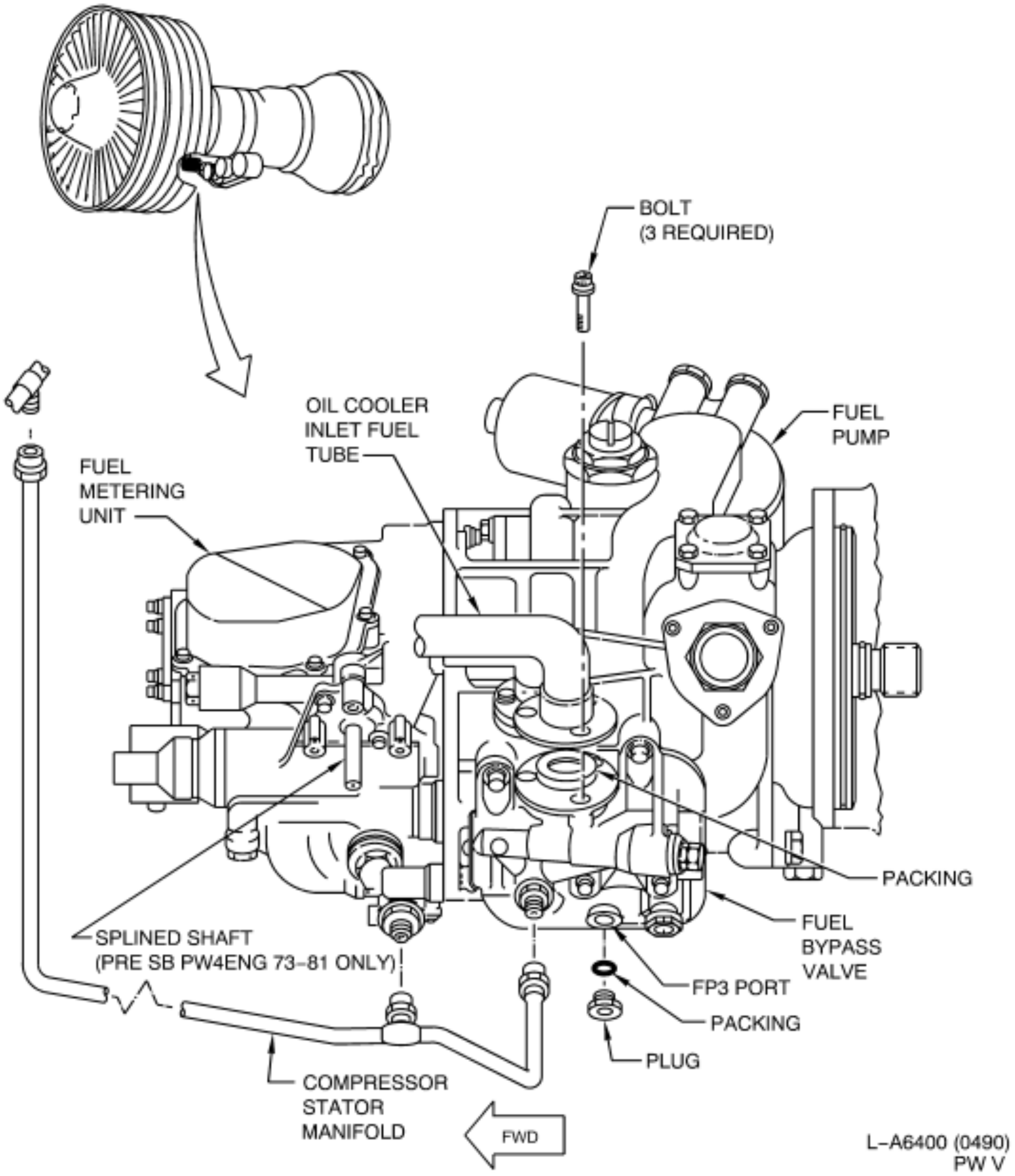
R (4) Install the packings, lubricated with Engine Oil
R P03−001 or Sealing Ring Lubricant P06−053 to recesses
R on the pad on inboard side of the fuel pump. Install fuel bypass valve to fuel pump aligning bolt holes. Secure valve to pump with bolts, threads lubricated with Engine Oil P03−001. Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(5) Position flange of oil cooler inlet fuel tube assembly (FM12), to large opening on fuel bypass valve, (packing previously installed), and secure with bolts, threads lubricated with Engine Oil P03−001. Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(6) Lubricate threads of fuel metering unit adapter with Engine Oil P03−001. Install compressor stator cylinder manifold (CP01) to fuel bypass valve, fuel metering unit, and manifold tee. Torque manifold nut to fuel bypass valve to 200 − 225 lb−in. (22.597 − 25.422 N.m). Torque manifold nut to fuel metering unit to 450 − 500 lb−in. (50.843 − 56.492 N.m). Torque manifold nut to manifold tee to 340 − 375 lb−in. (38.415 − 42.369 N.m). Secure all nuts with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.


MAIN GEARBOX
FUEL PUMP
PACKING
PACKING
FUEL METERING UNIT
FWD
SPLINED SHAFT (PRE SB PW4ENG 73-81 ONLY)
PACKING (3 REQUIRED)
FUEL BYPASS VALVE
BOLT (4 REQUIRED)
PACKING
ADAPTER
L-A6401 (0490)
PW V

Fuel Bypass Valve
Figure 401 (Sheet 1)
(Task 72-00-61-450-005)


BOLT
(3 REQUIRED)
OIL COOLER
INLET FUEL
TUBE
FUEL
PUMP
FUEL
METERING
UNIT
PACKING
FUEL
BYPASS
VALVE
SPLINED SHAFT
(PRE SB PW4ENG 73-81 ONLY)
FP3 PORT
PACKING
PLUG
COMPRESSOR
STATOR
MANIFOLD
FWD
L-A6400 (0490)
PW V

Fuel Bypass Valve
Figure 401 (Sheet 2)
(Task 72-00-61-450-005)

Task 72-00-61-450-006:

1. Install EEC Alternator Stator (Pre SB PW4ENG 72-375)

A. Prerequisites

(1) Install EEC alternator rotor. See Installation-10 Task 72-00-61-450-007.

B. Equipment And Materials Required

Standard Tools:
Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P06-002	Petrolatum White (PMC 9609)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	73-23-00/2/1

C. Procedure

See Figure 401.

(1) Remove protective closures.

(2) Lubricate new packing (401/6) with Petrolatum White P06-002, and install on EEC alternator stator (401/8).

(3) Align boltholes in stator with boltholes on gearbox, and carefully install stator over rotor (401/10).

(4) Secure the stator to the gearbox as follows.

(a) (Pre SB PW4ENG 72-59) Attach stator and heat shield to the gearbox with three bolts (401/9) and one washer, at location shown.

(b) (Post SB PW4ENG 72-59) Attach stator to the gearbox with three bolts (401/9).

(5) Torque bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(6) Do a check of the clearance between the stator and the EEC drive gearshaft housing mount flange. Use a 0.003 inch (0.076 mm) feeler gage. If it is possible to put the gage between the stator and the housing, the stator is not correctly installed. Do a check of the torque of the stator bolts. If the bolts are at the maximum torque and the stator is not correctly installed, remove the stator and install it again. Do the check again.

(7) Insert ends of cable in bracket on lower left side of gearbox.

- (a) With plate spacers facing bracket, secure cable ends with plate and two bolts (401/4) and (401/5).
- (b) Torque bolt (401/5) to 62 - 72 lb-in. (7.005 - 8.135 N.m).
- (c) Lubricate threads of other bolt (401/4) with Engine Oil P03-001. Torque bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(8) Secure cables to spring clips (401/3) and (401/2).

(9) Install clamps (401/1) to lower cable and secure to bracket below alternator with bolts, threads lubricated with Engine Oil P03-001. Torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(10) Connect the W3P1 and the W5P6 harness connectors to the stator cable harness receptacles as follows. For each connector:

- (a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11-009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 strap wrench or the Glenair TG−69 soft−jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

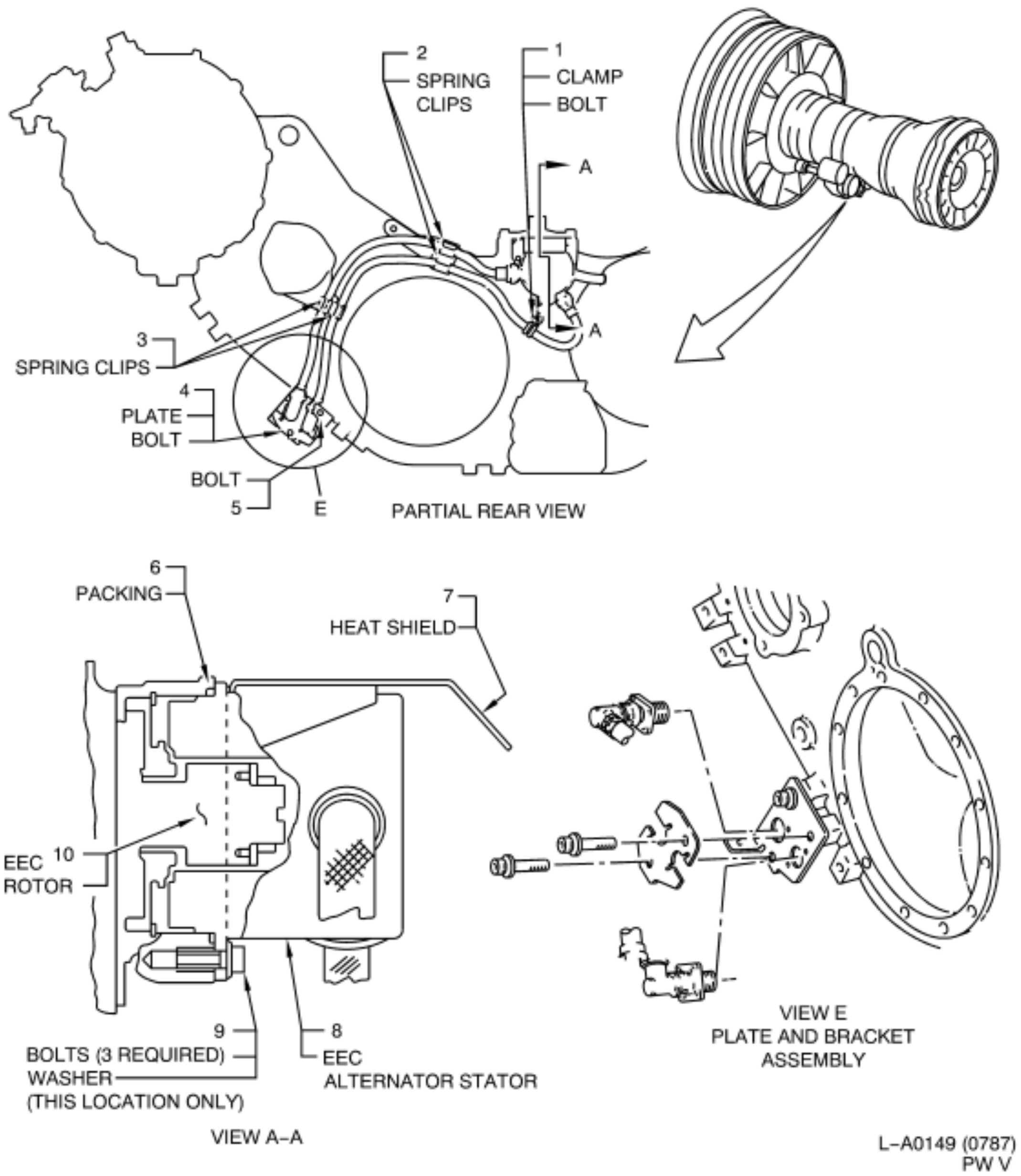
NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

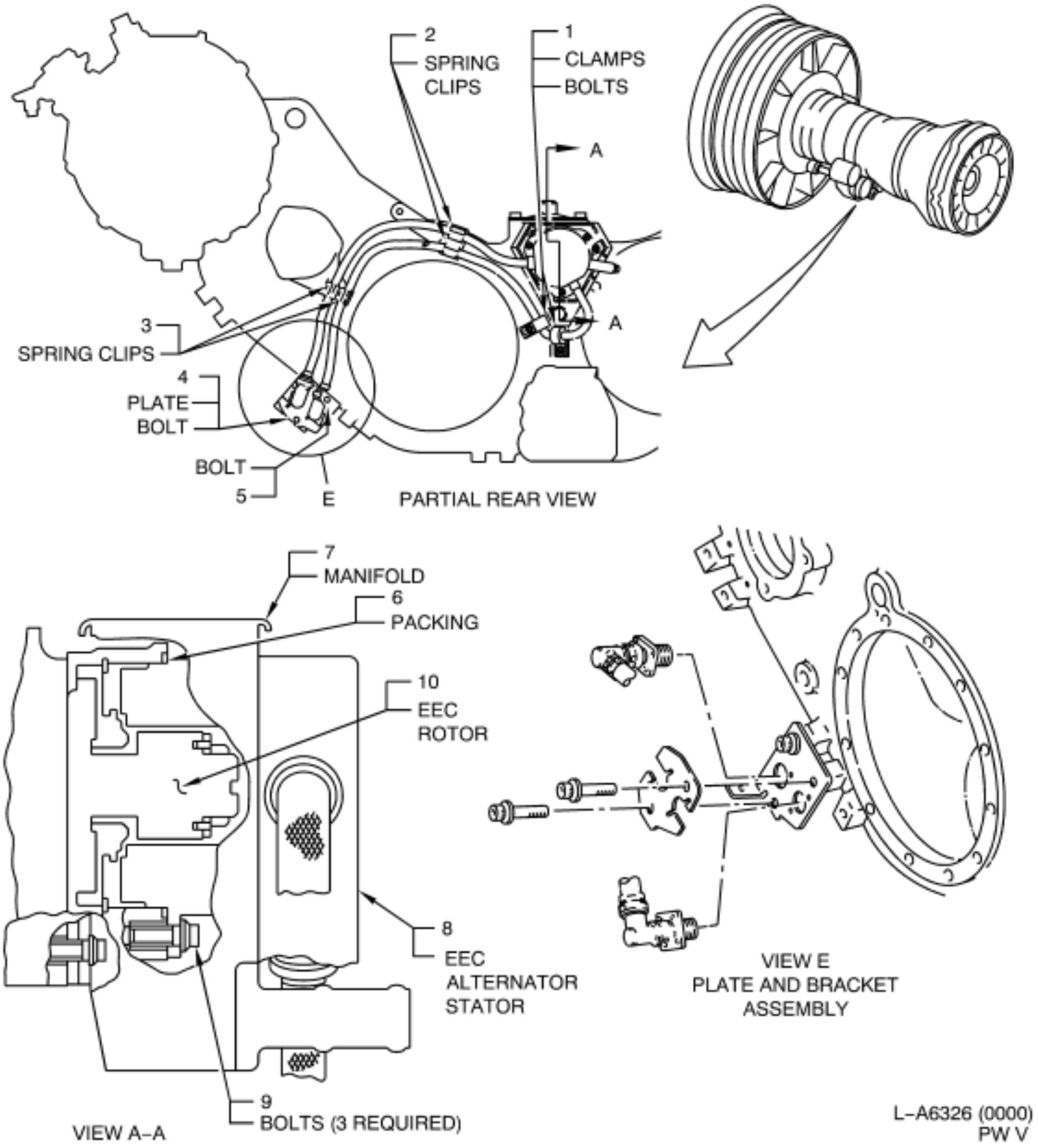
D. Postrequisites

(1) Test engine per Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.

R
R


2
SPRING CLIPS
1
CLAMP
BOLT
A
A
3
SPRING CLIPS
4
PLATE
BOLT
BOLT
5
E
PARTIAL REAR VIEW
6
PACKING
7
HEAT SHIELD
EEC 10
ROTOR
9
BOLTS (3 REQUIRED)
WASHER
(THIS LOCATION ONLY)
8
EEC
ALTERNATOR STATOR
VIEW A−A
VIEW E
PLATE AND BRACKET
ASSEMBLY
L−A0149 (0787)
PW V

EEC Alternator Stator (Pre SB PW4ENG 75−59)
Figure 401 (Sheet 1)
(Task 72−00−61−450−006)


2
SPRING
CLIPS
1
CLAMPS
BOLTS
A
A
3
SPRING CLIPS
4
PLATE
BOLT
BOLT
5
E
PARTIAL REAR VIEW
7
MANIFOLD
6
PACKING
10
EEC
ROTOR
8
EEC
ALTERNATOR
STATOR
9
BOLTS (3 REQUIRED)
VIEW A-A
VIEW E
PLATE AND BRACKET
ASSEMBLY
L-A6326 (0000)
PW V

EEC Alternator Stator (Post SB PW4ENG 75-59)
Figure 401 (Sheet 2)
(Task 72-00-61-450-006)

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-09

Task 72-00-61-450-006-A:

2. Install EEC Alternator Stator (Post SB PW4ENG 72-375)

A. Prerequisites

(1) Install EEC alternator rotor (Post SB PW4ENG 72-375), See Installation-10 (Task 72-00-61-450-007-A).

B. Equipment And Materials Required

Standard Tools:
Glenair TG-70 Strap Wrench
Glenair TG-69 Soft-Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Material:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-002	Petrolatum White (PMC 9609)
P06-021	Compound, Antigalling (PWA 550)
R P06-054	Paste, Anti-Seize (PWA 36246)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	73-23-00/2/1
Packing	1	79-23-00/4/1

C. Procedure
See Figure 402 and Figure 403.

(1) Remove protective closures.

(2) Lubricate new packing with Petrolatum White P06-002, and install on EEC alternator stator.

(3) Align boltholes in stator with boltholes on gearbox, and carefully install stator over rotor.

(4) Attach the stator to the gearbox with three bolts, threads lubricated with Antigalling Compound P06-021, and tighten by hand.

(5) Torque bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(6) Do a check of the clearance between the stator and the EEC drive gearshaft housing mount flange. Use a 0.003 inch (0.076 mm) feeler gage. If it is possible to put the gage between the stator and the housing, the stator is not correctly installed. Do a check of the torque of the stator bolts. If the bolts are at the maximum torque and the stator is not correctly installed, remove the stator and install it again. Do the check again.

(7) Install cable connectors to bracket on lower left side of gearbox as follows.

  (a) With plate spacers facing bracket, install the retaining plate over connector flanges. Attach the retaining plate to the bracket with two bolts.

  (b) Lubricate threads of inboard bolt with Antigalling Compound P06-021. Torque bolt to 62 - 72 lb-in. (7.005 - 8.135 N.m).

  (c) Lubricate threads of outboard bolt with Engine Oil P03-001. Torque bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(8) Attach the cables to spring clips on a bracket on the deoiler outlet flange and to a bracket located above the IDG drive pad.

(9) Connect W5P6 and W3P1 harness connectors to the stator cable harness receptacles as follows. For each connector:

  (a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11-009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG-70 strap wrench or the Glenair TG-69 soft-jawed pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).

This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(10) Install deoiler outlet tube assembly (LB05) as follows. See Figure 403.

(a) Remove protective closures and install packing, lubricated with Engine Oil P03-001, to front flange groove of tube.

(b) Position tube and install to deoiler outlet port on rear of gearbox. Position brackets (403/1), (403/2), (403/3) over flange of tube and install
R three bolts, threads lubricated with Anti-Seize
R Paste P06-054, handtight only. Remove the
R unwanted paste.

(c) Install clamps, bolts, threads lubricated with Engine Oil P03-001, and nuts securing tube to Flanges M and N brackets. Torque clamp bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(d) Torque three bolts securing deoiler outlet tube to gearbox to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(e) Torque clamp bolt securing main filter oil tube to bracket attached to front flange of deoiler outlet tube to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(11) (Post SB PW4ENG 72-491) Install the deoiler idler bearing pressure line (LP35) as follows. See Figure 404.

(a) Remove protective closures from the two end nuts.

(b) Position the line to the gearbox and install the nut on the end of the line bent at 90 degrees to the deoiler (idler) spur gear adapter assembly in the gearbox.

(c) Install the nut on the straight end of the line to the tee fitting in the No. 4 bearing oil pressure tube assembly (LP15).

(d) Torque the nut to the deoiler (idler) spur gear adapter assembly to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 the nut.

(e) Torque the nut to the tee fitting in the No. 4 bearing oil pressure tube assembly (LP15) to 340 - 375 lb-in. (38.415 - 42.369 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 the nut.

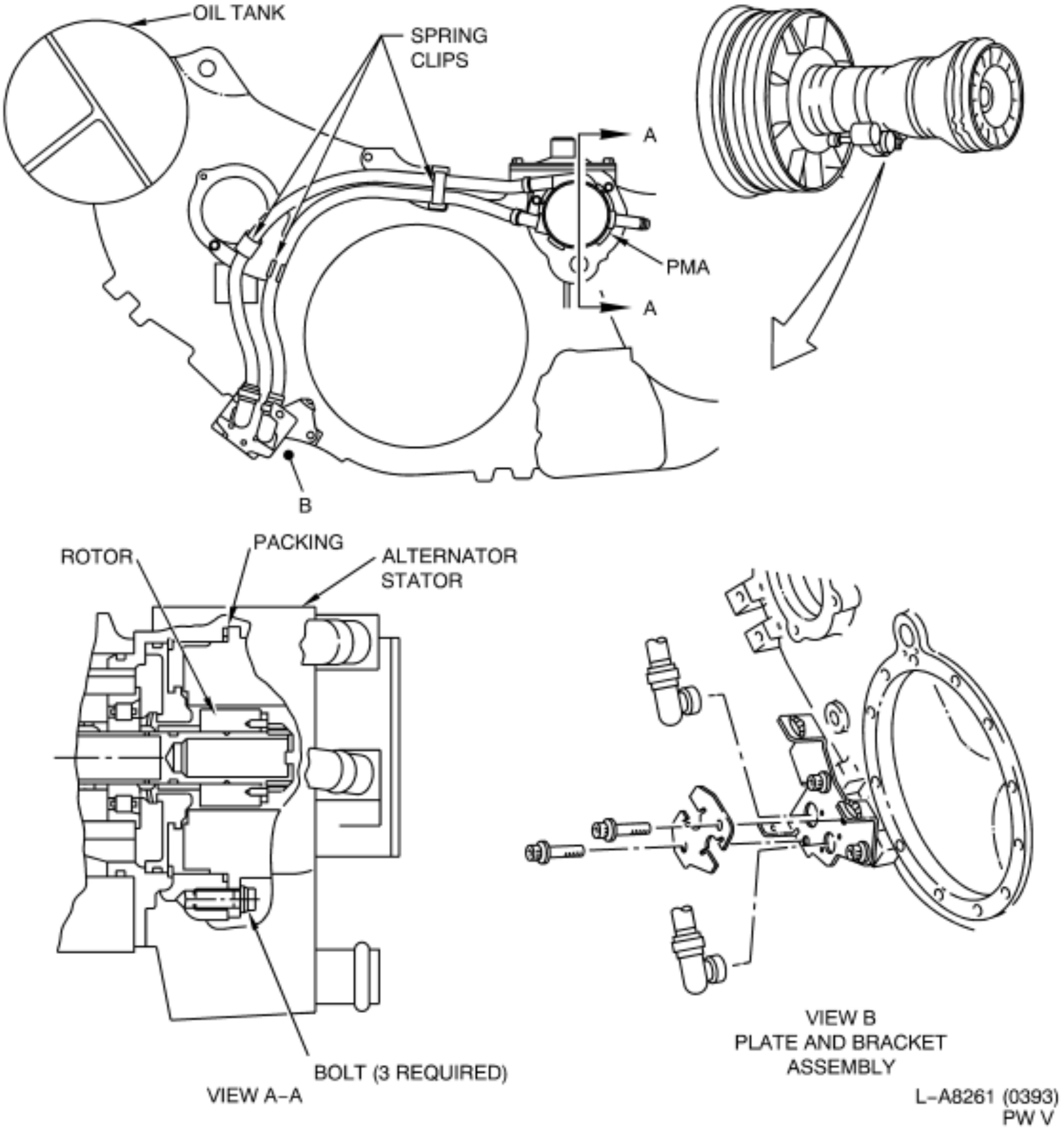
(f) Install clamps and bolts, threads lubricated with Engine Oil P03-001, to hold the line to the oil tank mount flange bracket and to the overboard breather pad bracket. Torque the clamp bolts to 36 - 41 lb-in. (4.067 - 4.519 N.m).

(g) Position the spray shield to the tee fitting connection and attach with the hose clamp. Torque the clamp to 15 - 18 lb-in. (1.695 - 2.034 N.m).

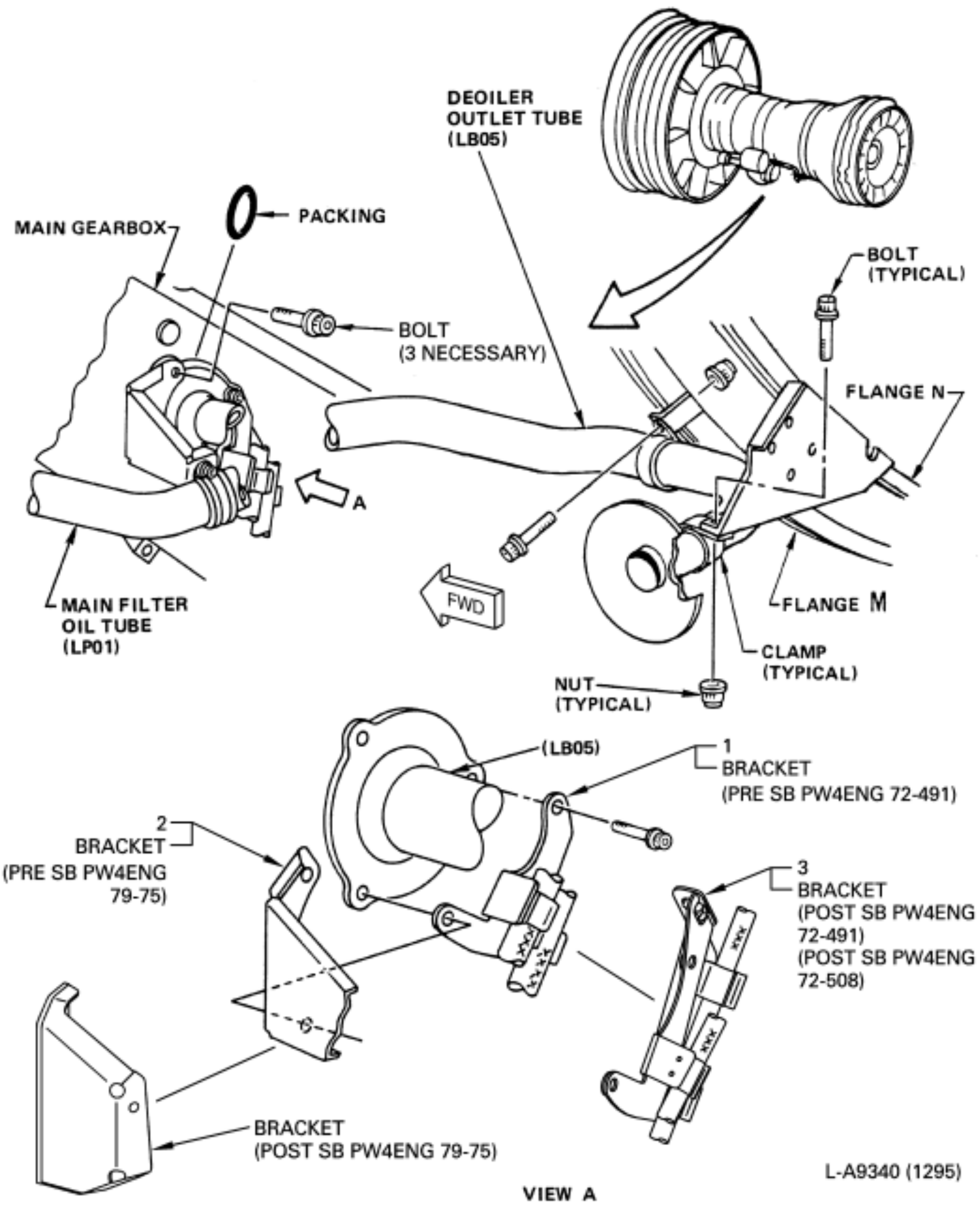
R
R

D. Postrequisites

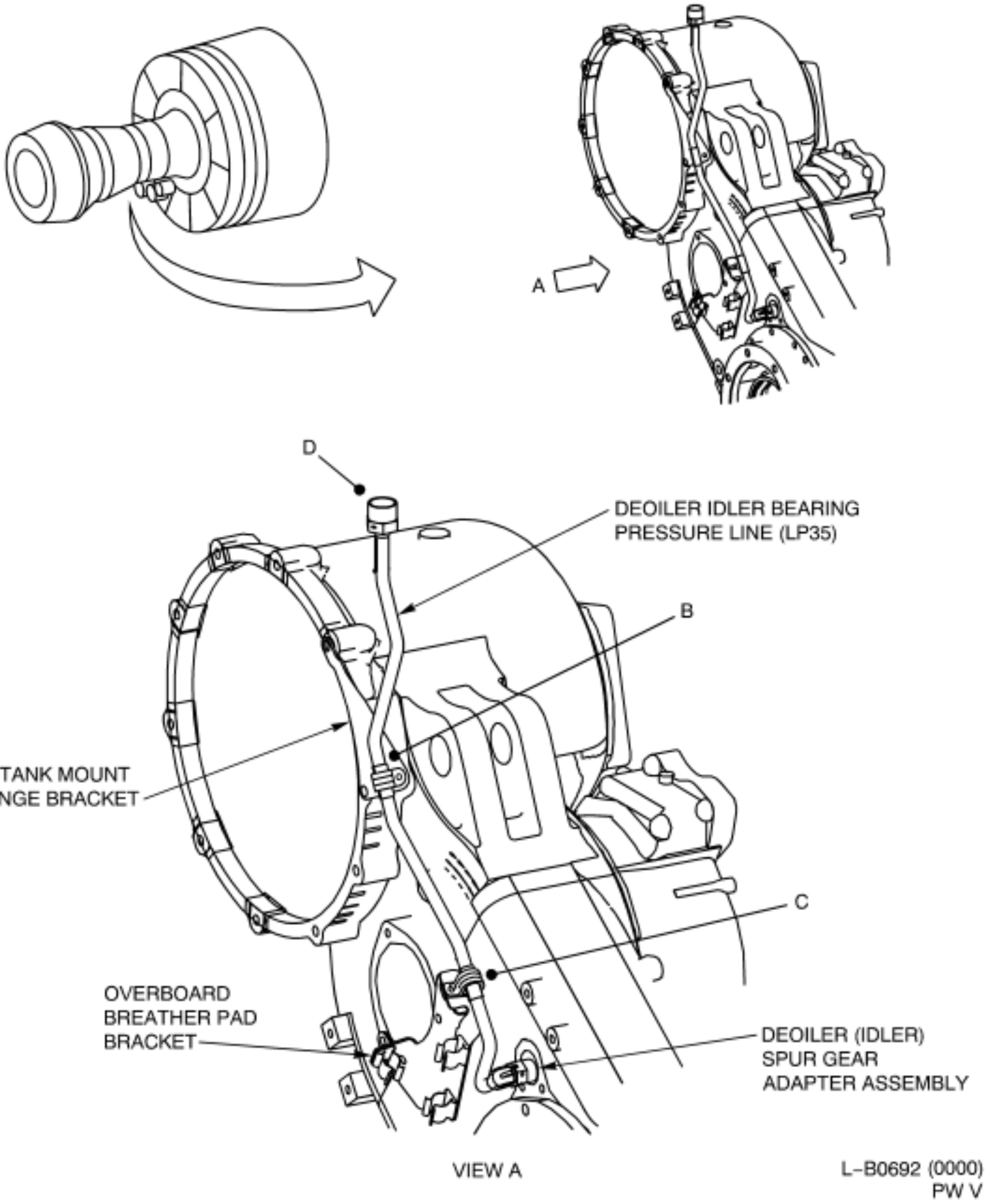
(1) Test engine per Test Reference Table. See 71−00−00, Adjustment/Test−00.


OIL TANK
SPRING CLIPS
A
PMA
A
B
ROTOR
PACKING
ALTERNATOR STATOR
BOLT (3 REQUIRED)
VIEW A−A
VIEW B
PLATE AND BRACKET ASSEMBLY
L−A8261 (0393)
PW V

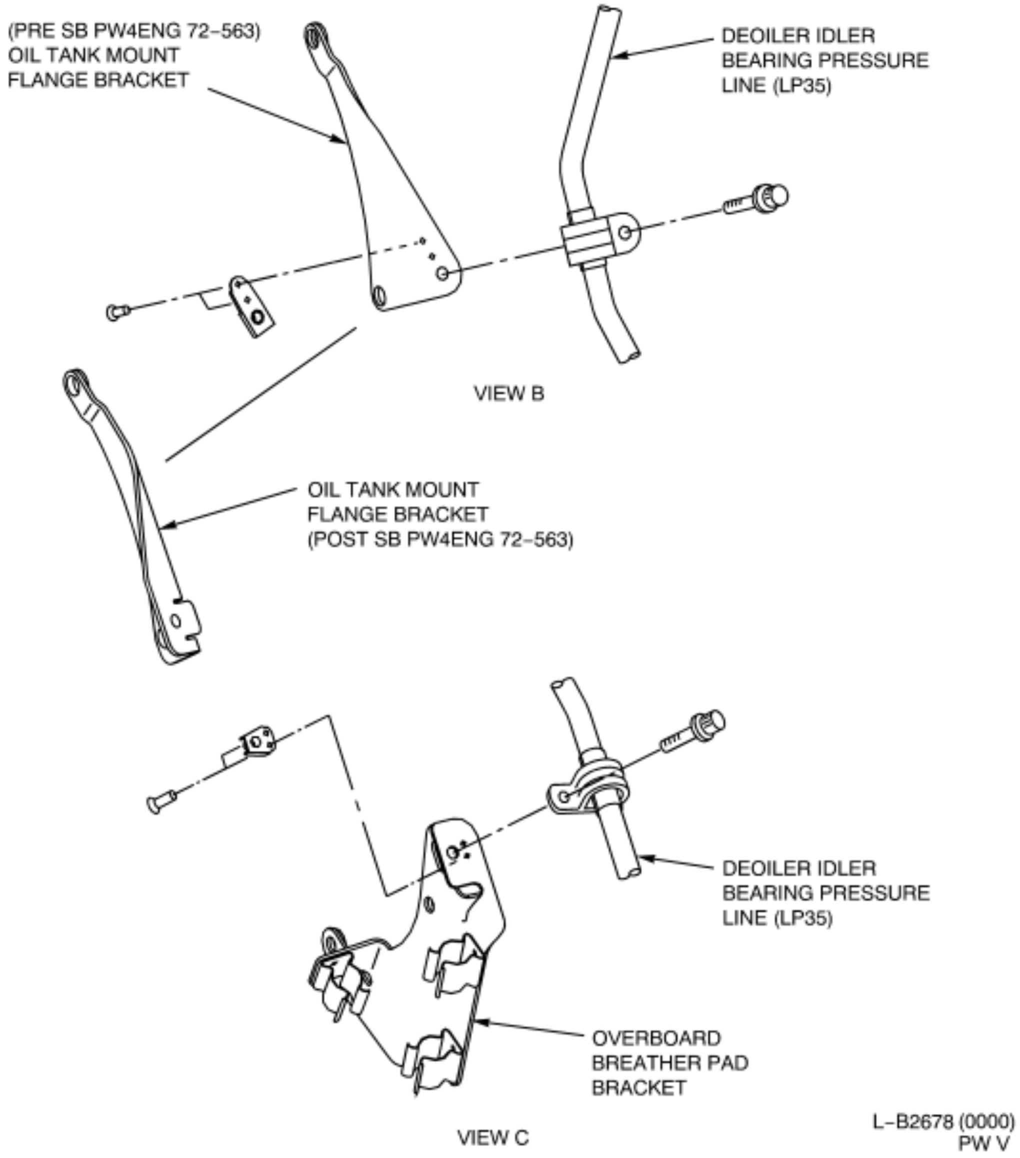
EEC Alternator (N2 Transducer) Stator
Figure 402
(Task 72−00−61−450−006−A)


DEOILER OUTLET TUBE (LB05)
PACKING
MAIN GEARBOX
BOLT (3 NECESSARY)
BOLT (TYPICAL)
FLANGE N
A
MAIN FILTER OIL TUBE (LP01)
FWD
FLANGE M
CLAMP (TYPICAL)
NUT (TYPICAL)
(LB05)
1
BRACKET
(PRE SB PW4ENG 72-491)
2
BRACKET
(PRE SB PW4ENG 79-75)
3
BRACKET
(POST SB PW4ENG 72-491)
(POST SB PW4ENG 72-508)
BRACKET
(POST SB PW4ENG 79-75)
L-A9340 (1295)
VIEW A

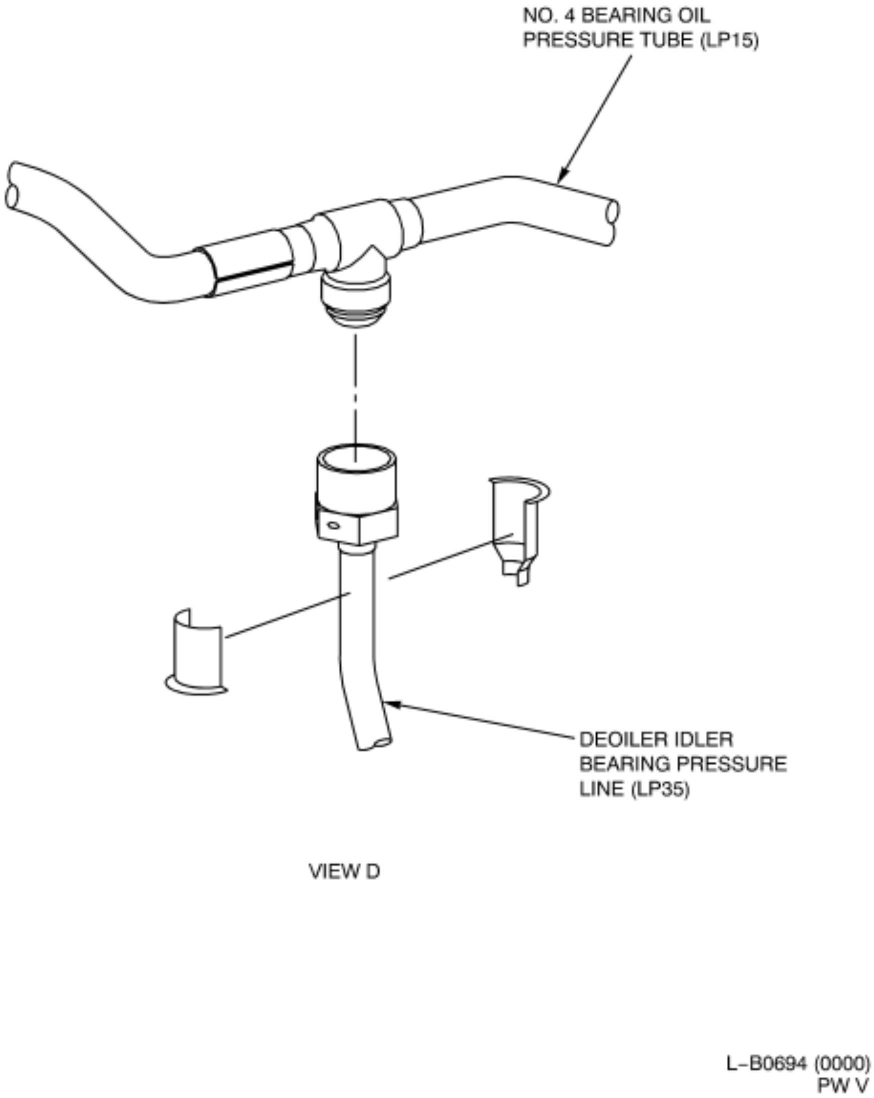
Deoiler Outlet Tube
Figure 403
(Task 72−00−61−450−006−A)


A
D
DEOILER IDLER BEARING PRESSURE LINE (LP35)
B
OIL TANK MOUNT FLANGE BRACKET
C
OVERBOARD BREATHER PAD BRACKET
DEOILER (IDLER) SPUR GEAR ADAPTER ASSEMBLY
VIEW A
L−B0692 (0000)
PW V

Deoiler Idler Bearing Pressure Line
Figure 404 (Sheet 1)
(Task 72−00−61−450−006−A)


(PRE SB PW4ENG 72-563)
OIL TANK MOUNT
FLANGE BRACKET
DEOILER IDLER
BEARING PRESSURE
LINE (LP35)
VIEW B
OIL TANK MOUNT
FLANGE BRACKET
(POST SB PW4ENG 72-563)
DEOILER IDLER
BEARING PRESSURE
LINE (LP35)
OVERBOARD
BREATHER PAD
BRACKET
VIEW C
L-B2678 (0000)
PW V

Deoiler Idler Bearing Pressure Line
Figure 404 (Sheet 2)
(Task 72-00-61-450-006-A)


NO. 4 BEARING OIL PRESSURE TUBE (LP15)
DEOILER IDLER BEARING PRESSURE LINE (LP35)
VIEW D
L−B0694 (0000)
PW V

Deoiler Idler Bearing Pressure Line
Figure 404 (Sheet 3)
(Task 72−00−61−450−006−A)

Task 72-00-61-450-007:

1. Install EEC Alternator Rotor (Pre SB PW4ENG 72-375)

A. Equipment And Materials Required

Special Tools:
PWA 85238 Wrench (Optional to PWA 86603)
PWA 86603 Adapter

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

B. Procedure
See Figure 401.

(1) Remove protective closures.

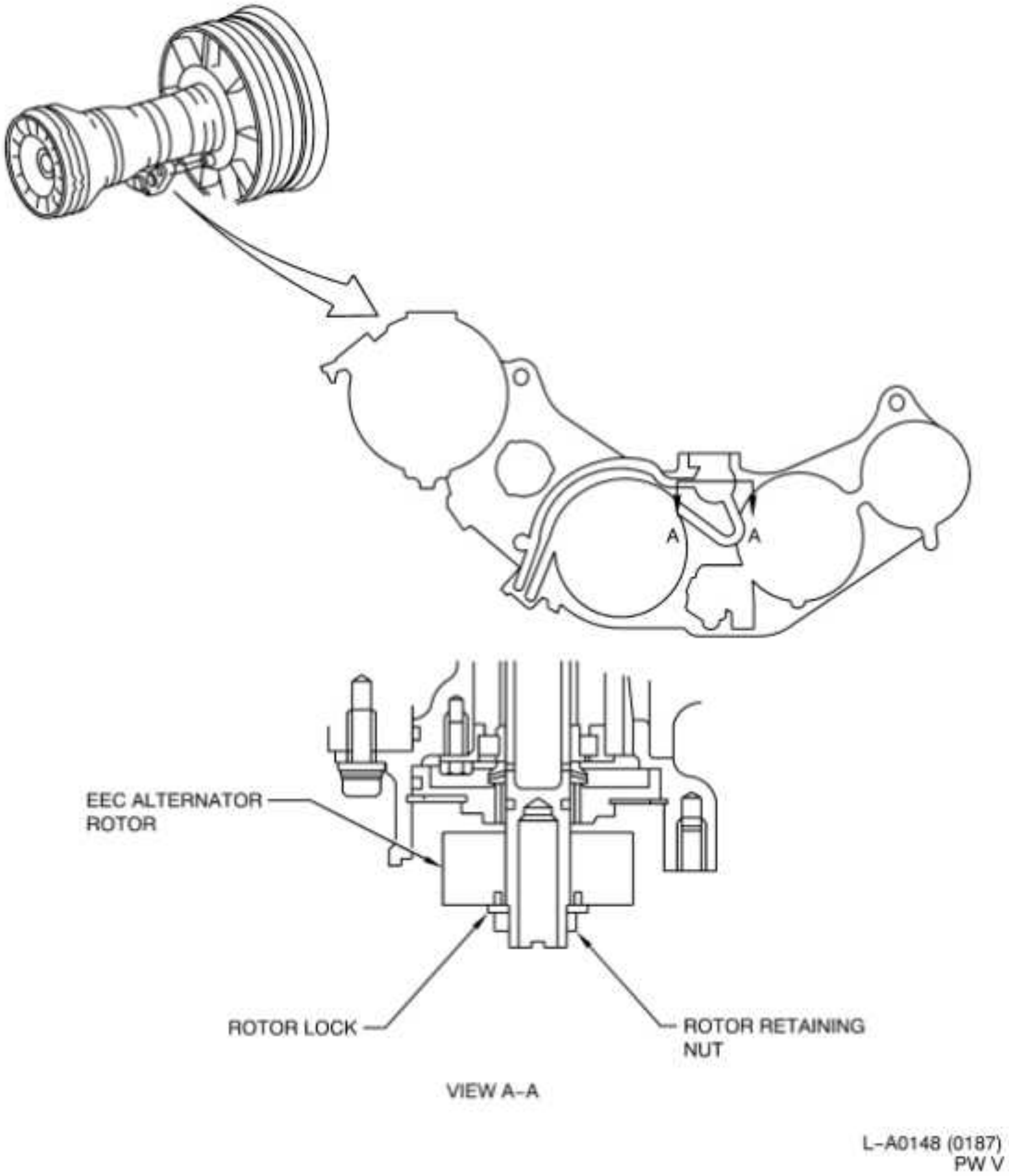
CAUTION: ENSURE ROTOR IS FULLY SEATED ON GEARSHAFT.

(2) Install EEC alternator rotor on gearshaft.

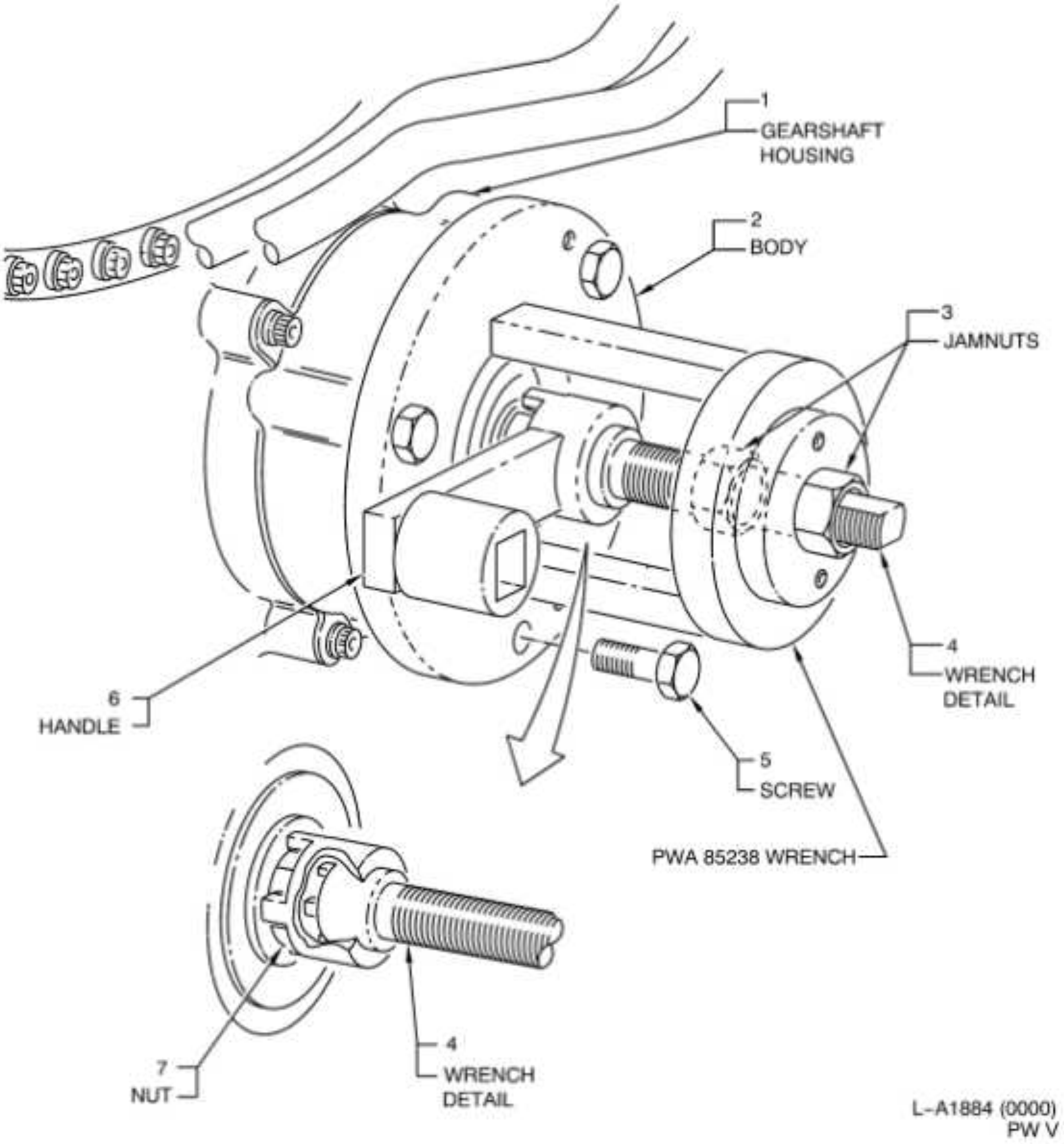
(3) Install EEC alternator rotor lock over gearshaft aligning ID flats on lock with flats on shaft and seat against rotor engaging pins on lock with holes in rotor.

CAUTION: WHEN USING THE FOLLOWING WRENCH OR ADAPTER THE ACTUAL TORQUE WRENCH READING WILL BE LESS THAN THAT STATED BELOW. SEE STANDARD TORQUES, STANDARD PRACTICES MANUAL.

(4) (Reference 570) Lubricate nut with Engine Oil (P03-001), and install nut to gearshaft. Torque nut using either PWA 85238 Wrench or PWA 86603 Adapter. See Figure 402.
  - (a) Loosen both jamnuts (402/3) and retract wrench detail (402/4) from body of wrench.
  - (b) Insert handle (402/6) lug end facing outward, over mating lug of wrench detail (402/4).
  - (c) Align boltholes and position wrench body (402/2) over EEC gearshaft and onto gearshaft housing (402/1) pad.
  - (d) Engage lugs of wrench detail with mating slots in gearshaft. Secure body (402/2) with three detail screws (402/5).
  - (e) Seat wrench detail (402/4) firmly on gearshaft and secure with jamnuts (402/3).
  - (f) Engage lugs of handle (402/6) with mating lugs in nut (402/7).


A
A
EEC ALTERNATOR ROTOR
ROTOR LOCK
ROTOR RETAINING NUT
VIEW A−A
L−A0148 (0187)
PW V

EEC Alternator Rotor
Figure 401
(Task 72−00−61−450−007)


1
GEARSHAFT HOUSING
2
BODY
3
JAMNUTS
4
WRENCH DETAIL
5
SCREW
6
HANDLE
PWA 85238 WRENCH
7
NUT
4
WRENCH DETAIL
L-A1884 (0000)
PW V

Rotor Retaining Nut Installation
Figure 402
(Task 72−00−61−450−007)

(g) Torque nut to 675 - 800 lb-in. (76.265 - 90.388 N.m), loosen to 0 torque, then retorque to required limit.

NOTE: This must be done in several steps because handle movement is restricted and handle must be removed from nut and repositioned.

(h) Remove cap screws securing wrench to gearbox and remove wrench.

C. Postrequisites

(1) Install EEC alternator stator (Pre SB PW4ENG 72-375). See Installation-09 (Task 72-00-61-450-006).

Task 72-00-61-450-007-A:

2. Install EEC Alternator Rotor (Post SB PW4ENG 72-375)

A. Equipment And Materials Required

Special Tools:
PWA 86603 Adapter

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

B. Procedure

See Figure 402.

(1) Remove protective closures.

CAUTION: MAKE SURE THE ROTOR IS FULLY AGAINST (SEATED) THE GEARSHAFT.

DO NOT USE INDUCTION HEATING TO ASSEMBLE THE PMA ROTOR ASSEMBLY. INDUCTION HEATING CAN DAMAGE THE MAGNETIC MATERIAL IN THE ROTOR.

(2) Install the EEC alternator rotor (402/9) on gearshaft (402/8).

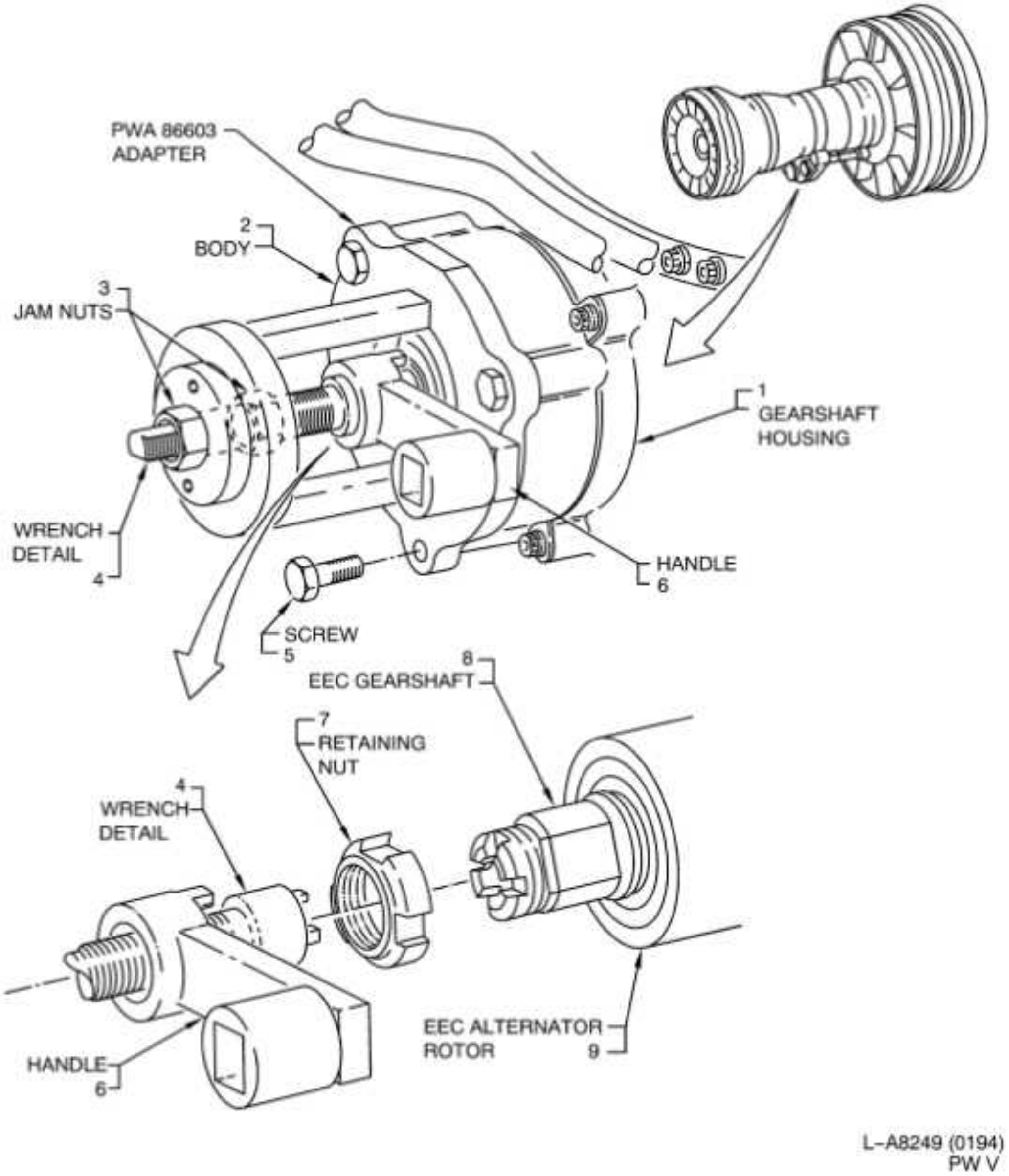
CAUTION: WHEN USING THE FOLLOWING ADAPTER THE ACTUAL TORQUE WRENCH READING WILL BE LESS THAN THAT STATED BELOW. SEE STANDARD TORQUES, STANDARD PRACTICES MANUAL.

(3) (Reference 570) Lubricate the nut with Engine Oil (P03−001), and install the nut to the gearshaft. Torque the nut with PWA 86603 Adapter as follows. See Figure 402.
  (a) Loosen both jamnuts (402/3). While you hold the body (402/2), loosen the wrench detail (402/4).
  (b) Install the handle (402/6), lug end facing outward, over the mating lug of wrench detail (402/4).
  (c) Align boltholes and position body (402/2) over EEC gearshaft (402/8) and onto the gearshaft housing (402/1) pad.
  (d) Engage lugs of wrench detail with mating slots in gearshaft. Attach the body (402/2) with three detail screws (402/5).
  (e) Seat the wrench detail (402/4) firmly on the gearshaft and tighten the jamnuts (402/3).
  (f) Engage the lugs of handle (402/6) with the mating lugs in the nut (402/7).
  (g) Using a standard 1/2 inch drive, torque the nut to 675 − 800 lb−in. (76.265 − 90.388 N.m), loosen to 0 torque, then torque again to 675 − 800 lb−in. (76.265 − 90.388 N.m).

NOTE: This must be done in several steps because the handle movement is limited. The handle must be removed and repositioned to nut.

  (h) Remove the screws (402/5) that attach the adapter to gearbox and remove the adapter.

C. Postrequisites
(1) Install EEC alternator stator (Post SB PW4ENG 72−375). See Installation−09 (Task 72−00−61−450−006−A).


PWA 86603
ADAPTER
2
BODY
3
JAM NUTS
1
GEARSHAFT
HOUSING
WRENCH
DETAIL
4
HANDLE
6
SCREW
5
8
EEC GEARSHAFT
7
RETAINING
NUT
4
WRENCH
DETAIL
EEC ALTERNATOR
ROTOR
9
HANDLE
6
L-A8249 (0194)
PW V

Installation Of PWA 86603 Adapter To Gearbox
Figure 402
(Task 72−00−61−450−007−A)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-11

Task 72-00-61-430-002:

1. Install Deoiler Drive Oil Seal Assembly

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Packing	1	72-61-00	10	190

B. Procedure

See Figure 401.

(1) Remove protective closure.

(2) Lubricate new preformed packing with Engine Oil (P03-001), and position in groove of oil seal assembly.

(3) Lubricate carbon detail of face seal assembly with Engine Oil (P03-001).

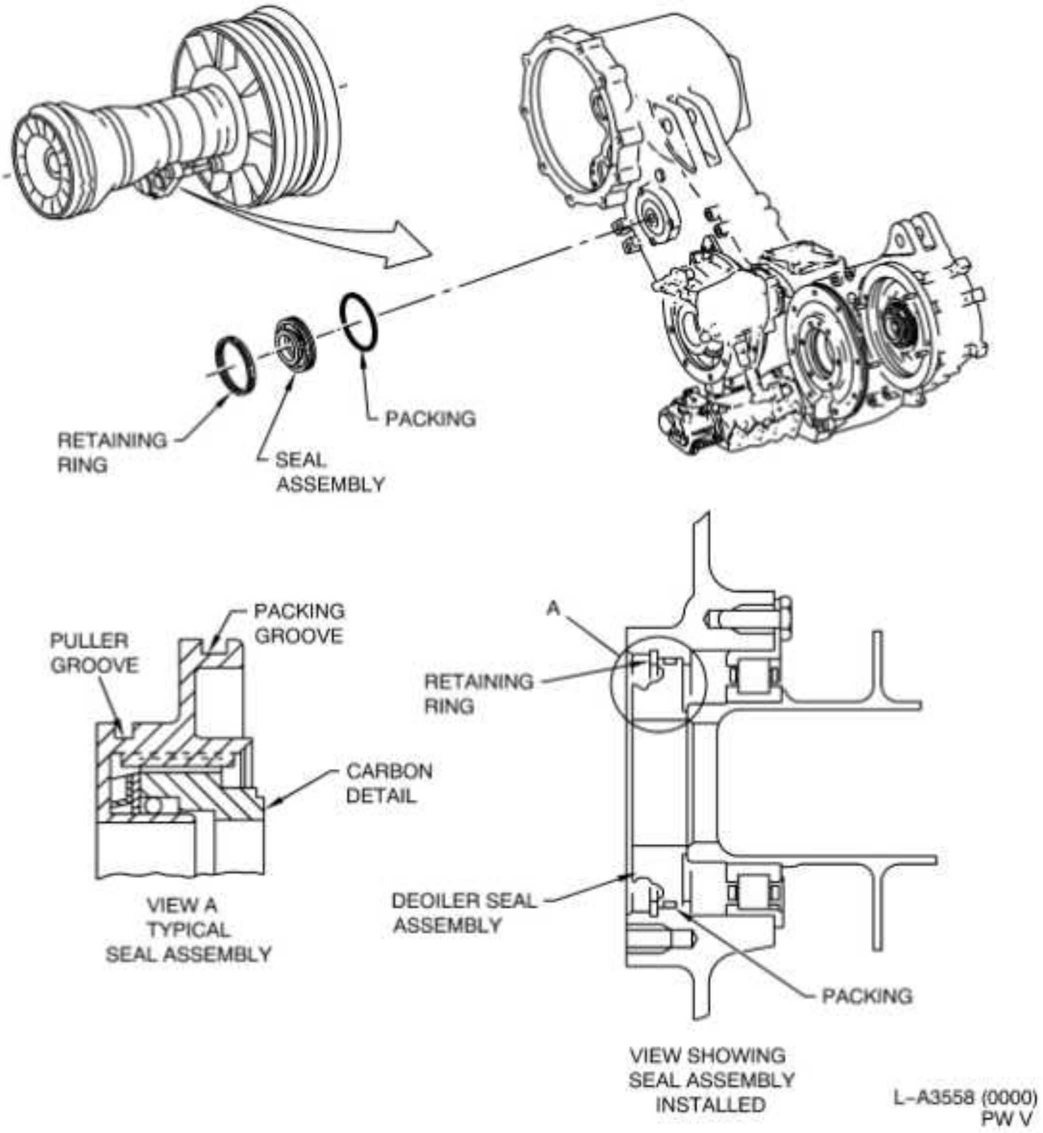
(4) Install oil seal assembly in deoiler ejector port to seat against end of gearshaft.

(5) Install retaining ring in groove in ejector port of gearbox to secure seal assembly in place.

C. Postrequisites

(1) Service oil system per 72-00-00, Servicing-03 (Task 72-00-00-610-003).

(2) Test engine per Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).


RETAINING RING
SEAL ASSEMBLY
PACKING
PULLER GROOVE
PACKING GROOVE
CARBON DETAIL
VIEW A
TYPICAL
SEAL ASSEMBLY
A
RETAINING RING
DEOILER SEAL ASSEMBLY
PACKING
VIEW SHOWING
SEAL ASSEMBLY
INSTALLED
L−A3558 (0000)
PW V

Deoiler Drive Oil Seal Assembly
Figure 401
(Task 72−00−61−430−002)

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-12

Task 72-00-61-430-003:

1. Install Starter Drive Oil Seal Assembly
   A. Equipment And Materials Required

   Consumable Materials:

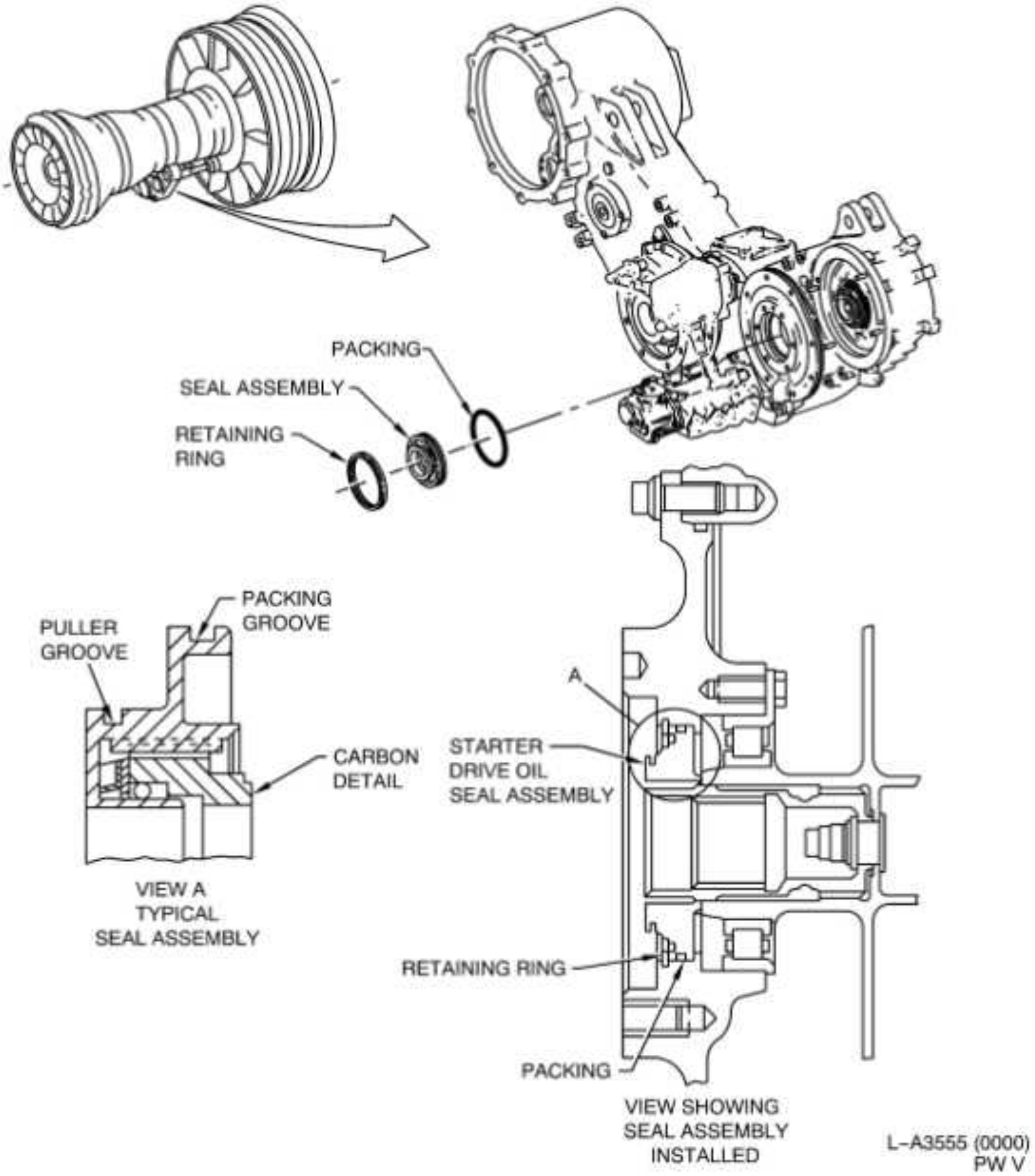
Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

   Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Packing	1	72-61-00	3	9

   B. Procedure
   See Figure 401.
   (1) Remove protective closure.
   (2) Lubricate new preformed packing with Engine Oil (P03-001), and position in groove of starter drive oil seal assembly.
   (3) Lubricate carbon detail of face seal assembly with Engine Oil (P03-001).
   (4) Install oil seal assembly in starter drive pad over end of starter drive coupling to seat against face of gear-shaft. Secure with retaining ring.

   C. Postrequisites
   (1) Service oil system per 72-00-00, Servicing-03 (Task 72-00-00-610-003).
   (2) Test engine per Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).


PACKING
SEAL ASSEMBLY
RETAINING RING
PULLER GROOVE
PACKING GROOVE
CARBON DETAIL
VIEW A TYPICAL SEAL ASSEMBLY
A
STARTER DRIVE OIL SEAL ASSEMBLY
RETAINING RING
PACKING
VIEW SHOWING SEAL ASSEMBLY INSTALLED
L−A3555 (0000)
PW V

Starter Drive Oil Seal Assembly
Figure 401
(Task 72−00−61−430−003)

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-13

Task 72-00-61-430-004:

1. Install Integrated Drive Generator (IDG) Drive Oil Seal Assembly
   A. Equipment And Materials Required

Consumable Materials:

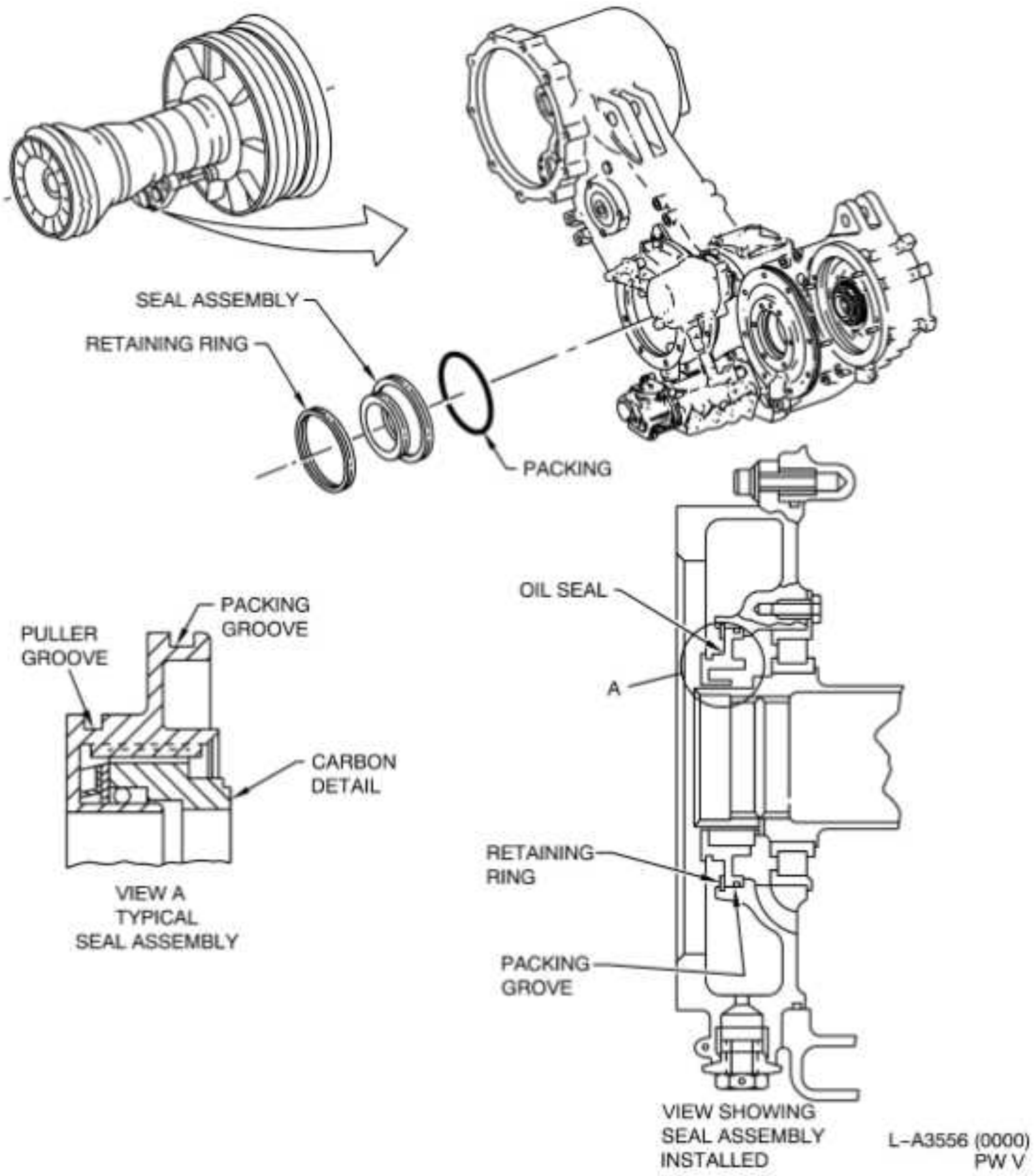
Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Packing	1	72-61-00	13	110

B. Procedure
See Figure 401.
(1) Lubricate new preformed packing with Engine Oil (P03-001), and position in groove of integrated drive generator (IDG) drive oil seal housing assembly.
(2) Lubricate carbon detail of face seal assembly with Engine Oil (P03-001).
(3) Install oil seal housing assembly in IDG pad over end of gearshaft to seat against flange of gear.
(4) Install retaining ring in groove in gearbox housing to secure seal assembly in place.

C. Postrequisites
(1) Service oil system per 72-00-00, Servicing-03 (Task 72-00-00-610-003).
(2) Test engine per Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).


SEAL ASSEMBLY
RETAINING RING
PACKING
PACKING GROOVE
PULLER GROOVE
CARBON DETAIL
VIEW A
TYPICAL
SEAL ASSEMBLY
OIL SEAL
A
RETAINING RING
PACKING GROVE
VIEW SHOWING
SEAL ASSEMBLY
INSTALLED
L-A3556 (0000)
PW V

Integrated Drive Generator Drive Oil Seal Assembly
Figure 401
(Task 72−00−61−430−004)

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-14

Task 72-00-61-430-005:

1. Install EEC Alternator Drive Oil Seal Assembly
   A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

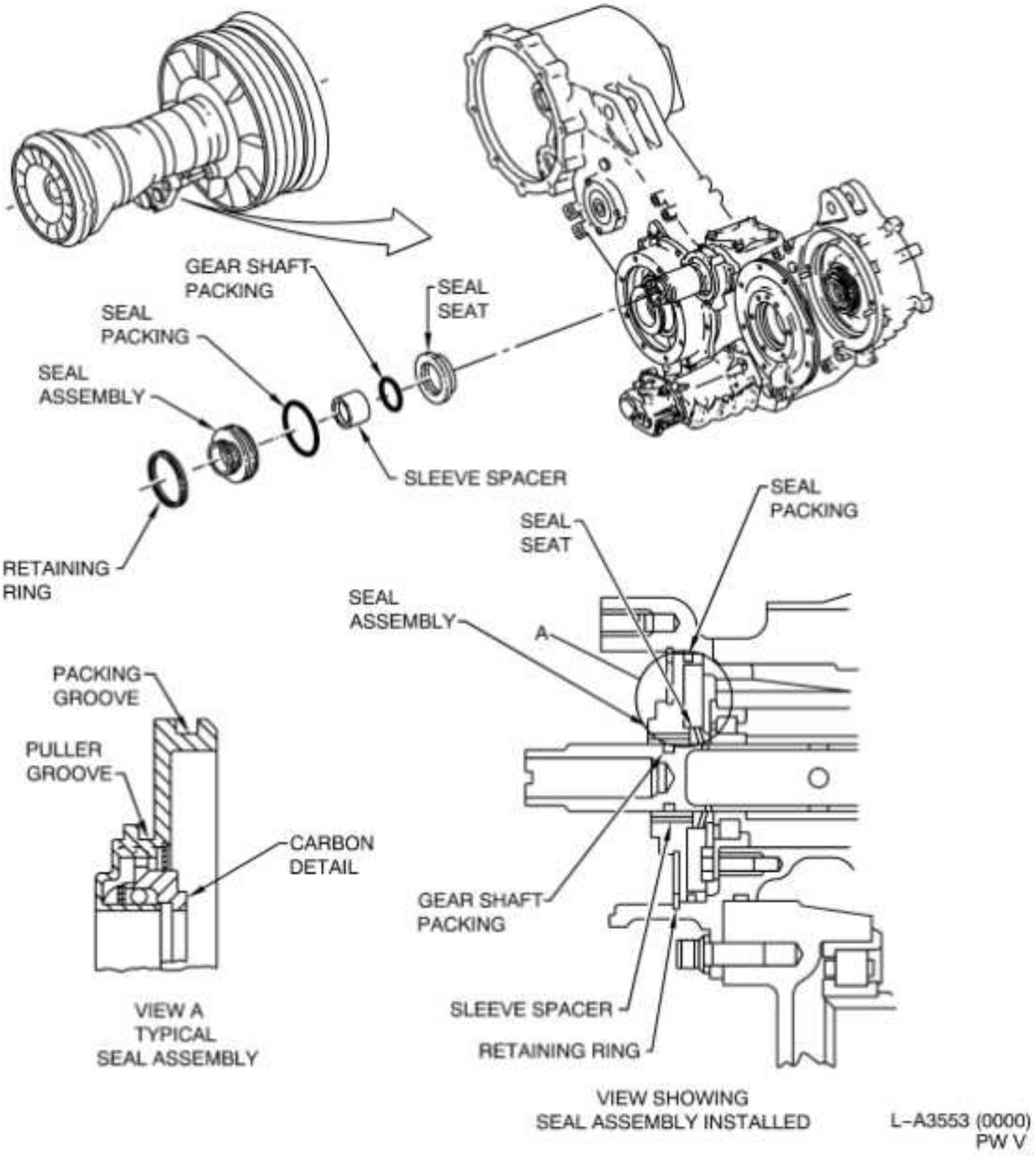
Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Packing	1	72-61-00	4	80
Packing	1	72-61-00	4	140

B. Procedure
See Figure 401.
(1) Remove protective closure from EEC alternator shaft on upper rear face of gearbox.
(2) If required, install seal seat, small OD stepped face inward, over stud (threaded) end of alternator gearshaft. Install Engine Oil (P03-001), lubricated packing to groove in EEC alternator shaft. Install sleeve spacer onto shaft over above installed packing.

(3) Lubricate new preformed packing with Engine Oil (P03-001), and position in groove of alternator drive oil seal assembly.
(4) Lubricate carbon detail of seal assembly with Engine Oil (P03-001).
(5) Install oil seal assembly over stud end of gearshaft to seat against previously installed seal seat.

C. Postrequisites
(1) Install EEC alternator rotor per 72-00-61, Installation-10 (Task 72-00-61-450-007).
(2) Install EEC alternator stator per 72-00-61, Installation-09 (Task 72-00-61-450-006).
(3) Service oil system per 72-00-00, Servicing-03 (Task 72-00-00-610-003).
(4) Test engine per Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).


GEAR SHAFT PACKING
SEAL SEAT
SEAL PACKING
SEAL ASSEMBLY
SLEEVE SPACER
RETAINING RING
SEAL PACKING
SEAL SEAT
SEAL ASSEMBLY
A
PACKING GROOVE
PULLER GROOVE
CARBON DETAIL
VIEW A TYPICAL SEAL ASSEMBLY
GEAR SHAFT PACKING
SLEEVE SPACER
RETAINING RING
VIEW SHOWING SEAL ASSEMBLY INSTALLED
L−A3553 (0000)
PW V

EEC Alternator Drive Oil Seal Assembly
Figure 401
(Task 72−00−61−430−005)

ENGINE GENERAL − MAIN GEARBOX − INSTALLATION−15

Task 72−00−61−430−006:

1. Install Fuel Pump Drive Oil Seal Assembly

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Packing	1	72−61−00	7	170

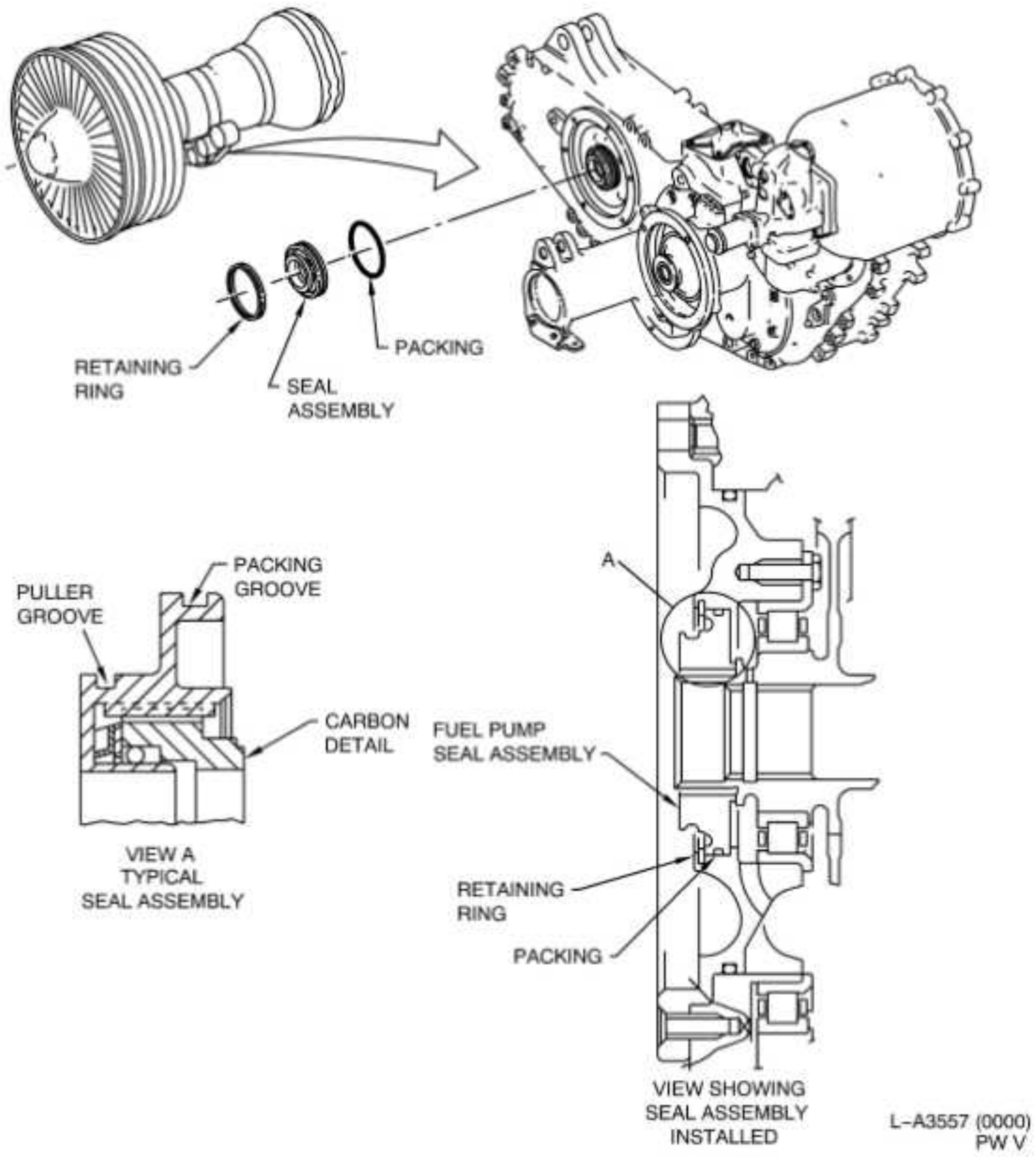
B. Procedure

See Figure 401.

- (1) Lubricate new preformed packing with Engine Oil (P03−001), and position in groove of fuel pump drive oil seal assembly.
- (2) Lubricate carbon detail of face seal assembly with Engine Oil (P03−001).
- (3) Install oil seal assembly into fuel pump drive pad over end of gearshaft to seat against shoulder on drive gear.
- (4) Secure seal assembly with retaining ring installed in groove in gearbox housing.

C. Postrequisites

- (1) Install fuel pump and fuel metering unit package per 72−00−61, Installation−05 (Task 72−00−61−450−003).
- (2) Service oil system per 72−00−00, Servicing−03 (Task 72−00−00−610−003).
- (3) Test engine per Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).


RETAINING RING
SEAL ASSEMBLY
PACKING
PULLER GROOVE
PACKING GROOVE
CARBON DETAIL
VIEW A
TYPICAL
SEAL ASSEMBLY
A
FUEL PUMP SEAL ASSEMBLY
RETAINING RING
PACKING
VIEW SHOWING SEAL ASSEMBLY INSTALLED
L−A3557 (0000)
PW V

Fuel Pump Drive Oil Seal Assembly
Figure 401
(Task 72−00−61−430−006)

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Task 72-00-61-430-007:

1. Install Rear Hydraulic Pump Drive Oil Seal Assembly

A. Equipment And Materials Required

Consumable Materials:

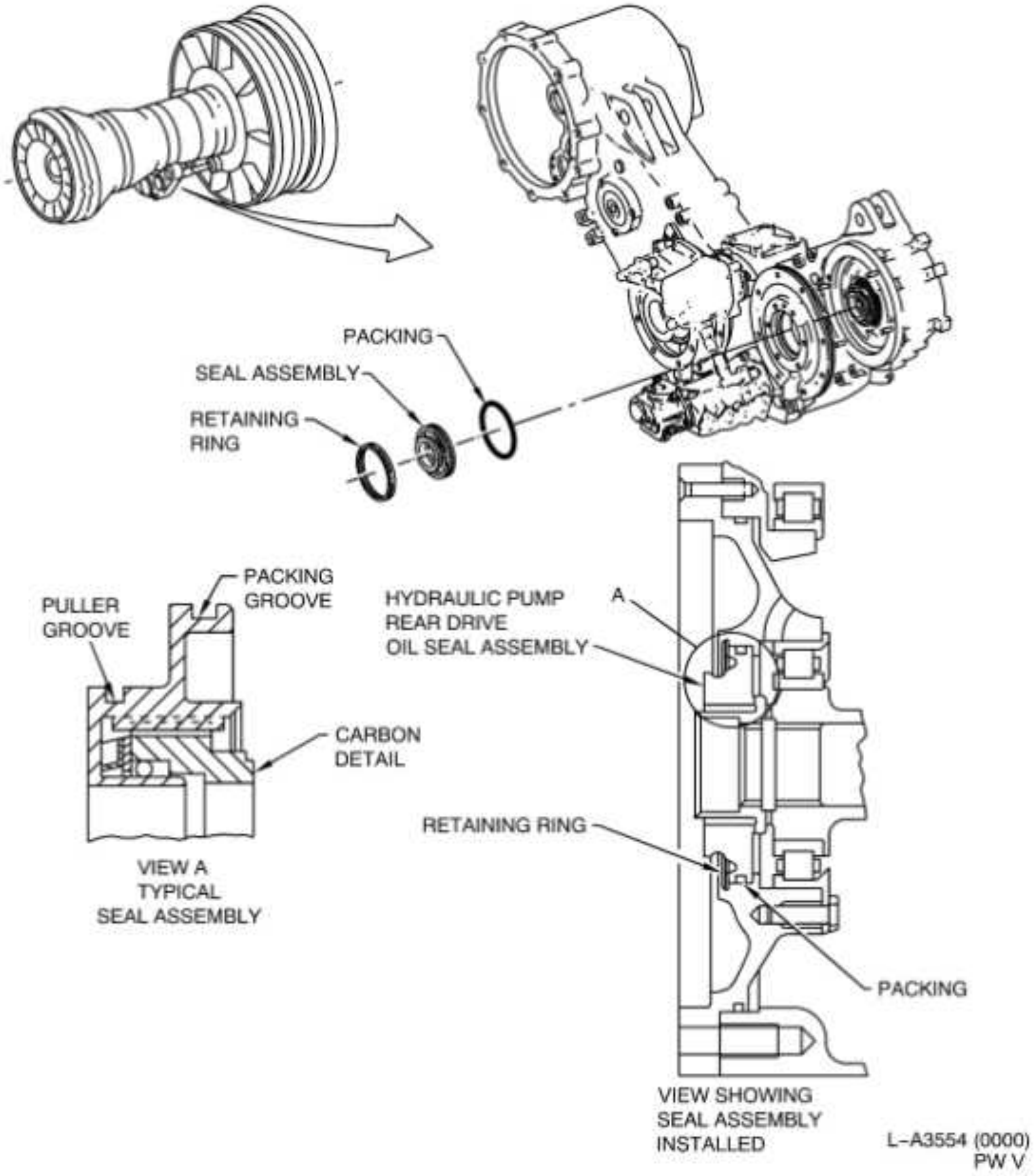
Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Packing	1	72-61-00	2	170

B. Procedure
See Figure 401.
- (1) Remove protective closure.
- (2) Lubricate new preformed packing with Engine Oil (P03-001), and position in groove of hydraulic pump drive oil seal assembly.
- (3) Lubricate carbon detail of face seal assembly with Engine Oil (P03-001).
- (4) Install oil seal assembly in hydraulic pump drive pad located over end of gearshaft to seat against shoulder on gearshaft.
- (5) Secure seal assembly in place with retaining ring.

C. Postrequisites
- (1) Service oil system per 72-00-00, Servicing-03 (Task 72-00-00-610-003).
- (2) Test engine per Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).


PACKING
SEAL ASSEMBLY
RETAINING RING
PACKING GROOVE
PULLER GROOVE
CARBON DETAIL
VIEW A TYPICAL SEAL ASSEMBLY
HYDRAULIC PUMP REAR DRIVE OIL SEAL ASSEMBLY
A
RETAINING RING
PACKING
VIEW SHOWING SEAL ASSEMBLY INSTALLED
L−A3554 (0000)
PW V

Rear Hydraulic Pump Drive Oil Seal Assembly
Figure 401
(Task 72−00−61−430−007)

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ENGINE GENERAL − MAIN GEARBOX − INSTALLATION−17

Task 72−00−61−430−008:

1. Install Front Hydraulic Pump Drive Oil Seal Assembly

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Packing	1	72−61−00	14	230

B. Procedure

See Figure 401.

(1) Remove protective closure.

(2) Lubricate new preformed packing with Enigne Oil (P03−001), and position in groove of hydraulic pump drive oil seal assembly.

(3) Lubricate contact carbon detail of face seal assembly with Engine Oil (P03−001).

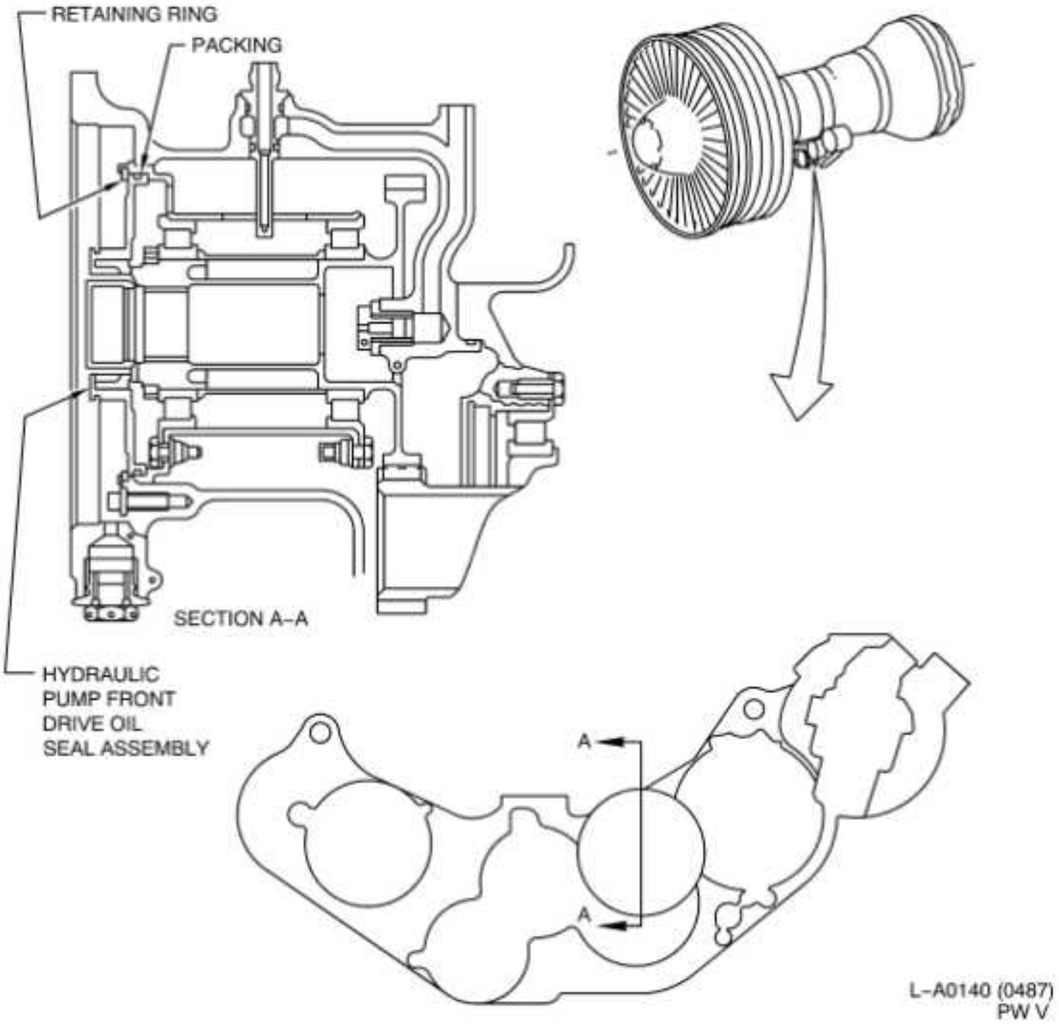
(4) Install oil seal assembly over end of gearshaft to seat against shoulder on gearshaft.

(5) Secure seal assembly with retaining ring.

C. Postrequisites

(1) Service oil system per 72−00−00, Servicing−03 (Task 72−00−00−610−003).

(2) Test engine per Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).


RETAINING RING
PACKING
SECTION A-A
HYDRAULIC PUMP FRONT DRIVE OIL SEAL ASSEMBLY
A
A
L-A0140 (0487)
PW V

Front Hydraulic Pump Drive Oil Seal Assembly
Figure 401
(Task 72-00-61-430-008)

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-18

Task 72-00-61-430-009:

1. Install Starter Drive Coupling

A. Equipment And Materials Necessary

Special Tools:

PWA 26377	Holder

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P06-059	Lubricant, Fluorinated Grease (PWA 36230)

B. Procedure
See Figure 401.

CAUTION: BEFORE YOU APPLY FLUORINATED GREASE LUBRICANT TO THE STARTER DRIVE COUPLING, MAKE SURE THE STARTER DRIVE COUPLING SPLINES AND STARTER DRIVE GEARSHAFT SPLINES ARE CLEAN AND NOT DAMAGED. APPLY FLUORINATED GREASE LUBRICANT TO THE STARTER DRIVE COUPLING SPLINES TO REDUCE WEAR AND INCREASE SERVICE LIFE OF THE PARTS.

(1) Apply Fluorinated Grease Lubricant P06-059 to the ID and OD splines of the starter drive coupling.

(2) Carefully insert coupling into starter drive gearshaft, aligning splines.

(3) Lubricate threads of nut with Engine Oil P03-001. Secure coupling in place with flat washer and nut, fingertight.

(4) Install splined drive of PWA 26377 Holder into starter drive coupling and secure bar with two bolts to starter drive mount pad.

(5) Using standard wrench, reach into holder and torque retaining nut to 290 - 325 lb-in (32.766 - 36.720 N.m).

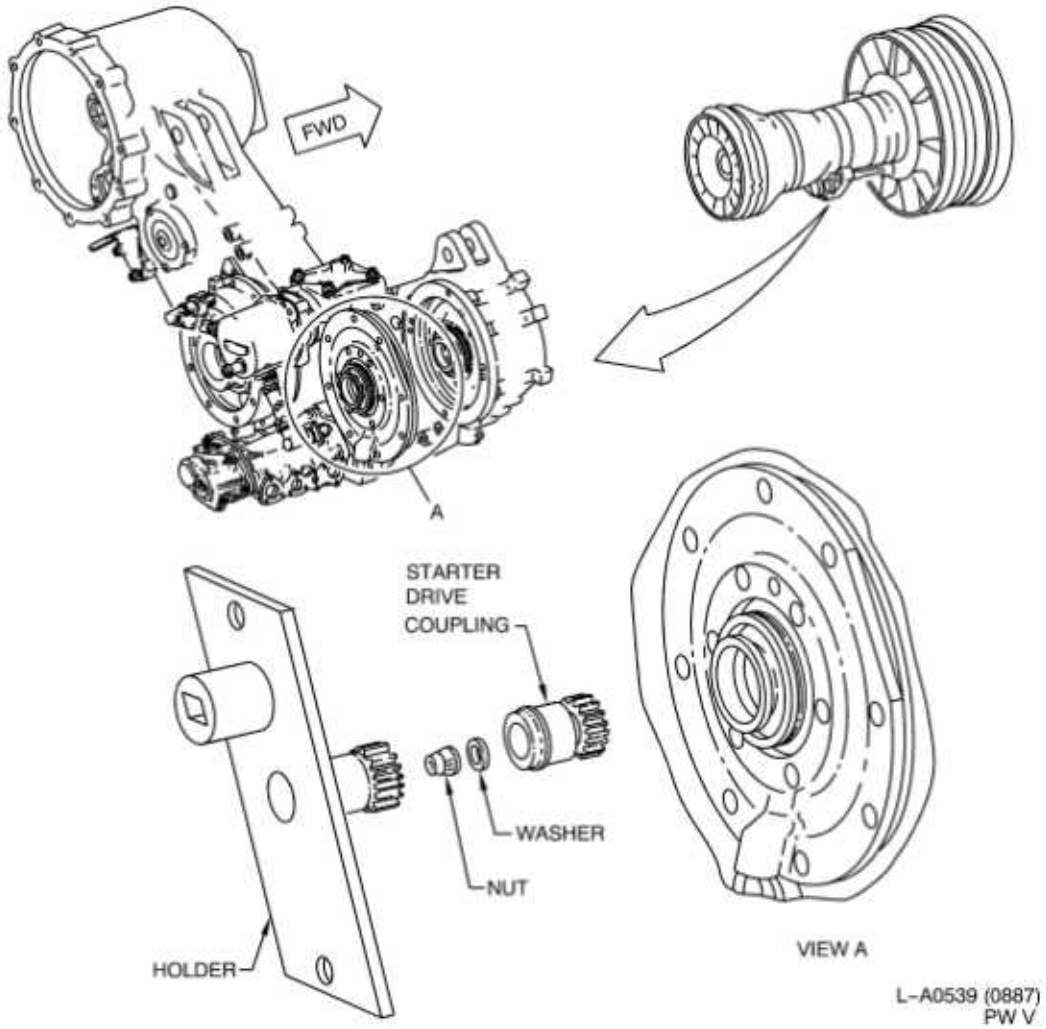
(6) Remove holder from starter drive mount pad.

C. Postrequisites

ENGINE GENERAL – MAIN GEARBOX – INSTALLATION–18

(1) Test engine per Test Reference Table. See 71–00–00, Testing–00 (Task 71–00–00–990–003).

ENGINE GENERAL – MAIN GEARBOX – INSTALLATION–18


FWD
A
STARTER DRIVE COUPLING
WASHER
NUT
HOLDER
VIEW A
L–A0539 (0887)
PW V

Starter Drive Coupling Installation
Figure 401
(Task 72–00–61–430–009)

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-19

Task 72-00-61-430-010:

1. Install Deoiler

This Procedure Has Been Deleted.

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Task 72-00-61-440-001:

1. Install Main Oil Filter Housing

A. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
R	P05-292	Ferrule, Safety Cable (Optional)
	P06-021	Compound, Antigalling (PWA 550)
R	P06-054	Paste, Antiseize (PWA 35246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Filter Element	1	79-21-00/2/140
Filter Element	1	79-21-00/2/140B
Nut, Self-locking	4	79-21-00/2/220A
Packing	4	72-61-00/11/1
Packing	2	72-61-00/11/100
Packing	2	72-61-00/11/20
Packing	1	79-21-00/2/180
Packing	1	79-21-00/2/250
Packing	1	79-21-00/2/30
Packing	1	79-21-00/2/50
Packing	1	79-21-00/2/60
Packing	1	79-21-00/2/230
Packing	2	79-21-00/7/1
Packing	1	79-21-00/8/1
Packing	1	79-21-00/8/124
Packing	1	79-21-00/9/1
Packing	1	79-21-00/9/10
Retainer	1	79-21-00/9/20

B. Procedure

See Figure 401 (Sheet 1), Figure 401 (Sheet 2), Figure 401 (Sheet 3), Figure 401 (Sheet 4), Figure 401 (Sheet 5), Figure 401 (Sheet 6), Figure 401 (Sheet 7), Figure 401 (Sheet 8), Figure 401 (Sheet 9), Figure 401 (Sheet 10), Figure 401 (Sheet 11), Figure 401 (Sheet 12), and Figure 401 (Sheet 13).

(1) (Pre SB PW4ENG 72−524) If applicable, install the details in the main oil filter housing assembly (MOFH) (401/3) as follows. See Figure 401 (Sheet 1), Figure 401 (Sheet 2), and Figure 401 (Sheet 3).

(a) Align bolt hole and position key washer (401/7) in center of cover (401/15) with tab of key washer in mating hole in cover. Secure key washer with screw (401/6), lubricated with Engine Oil P03−001. Torque screw to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(b) Install spring (401/5) on key washer (401/7). Bend tabs of washer out between coils of spring.

(c) Install new packing (401/8), lubricated with Engine Oil P03−001, into groove in OD of main oil strainer cover (401/15).

(d) Install filter element (401/4), into opening in bottom of cover (401/15). Align bolt holes and install cover with filter element into main oil filter housing (401/3).

NOTE: Removable plug must be installed in outboard end of filter element or the filter will not properly filter the oil.

(e) Install the cover (401/15) as follows.

R
R

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: INCORRECT INSTALLATION OF THE COVER CAN CAUSE DAMAGE TO THE PACKING.

CAUTION: DO NOT USE THE COVER RETAINING BOLTS TO PULL THE COVER INTO THE HOUSING. TO DO SO CAN CAUSE DAMAGE TO THE PACKING.

(f) With the cover (401/15) in position on the housing (401/3), carefully push the cover on the housing until the flange of the cover touches the housing.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: BE SURE TO TORQUE THE COVER RETAINING BOLTS TO THE TORQUE SPECIFIED.

(g) Attach the cover (401/15) with four washers (401/14) and bolts (401/13). Torque bolts to 125 − 140 lb−in. (14.123 − 15.818 N.m).

(2) (Post SB PW4ENG 72−524 and Pre SB PW4ENG 79−79) If applicable, install the details in the main oil filter housing assembly (MOFH) (401/3) as follows. See Figure 401 (Sheet 4) and Figure 401 (Sheet 5).

(a) Align bolt hole and position key washer (401/7) in center of cover (401/15) with tab of key washer in mating hole in cover. Secure key washer with screw (401/6), lubricated with Engine Oil P03−001. Torque screw to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(b) Install spring (401/5) on key washer (401/7). Bend tabs of washer out between coils of spring.

(c) Install new packing (401/8), lubricated with Engine Oil P03−001, into groove in OD of main oil strainer cover (401/15).

(d) Install filter element (401/4) into opening in bottom of cover (401/15). Align bolt holes and install cover with filter element into main oil filter housing (401/3).

NOTE: Removable plug must be installed in outboard end of filter element or the filter will not properly filter the oil.

(e) Install the cover (401/15) as follows.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: INCORRECT INSTALLATION OF THE COVER CAN CAUSE DAMAGE TO THE PACKING.

CAUTION: DO NOT USE THE COVER RETAINING NUTS TO PULL THE COVER INTO THE HOUSING. TO DO SO CAN CAUSE DAMAGE TO THE PACKING.

(f) With the cover (401/15) in position over the studs in the housing (401/3), carefully push the cover on the housing until the flange of the cover touches the housing.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: BE SURE TO TORQUE THE COVER RETAINING NUTS TO THE TORQUE SPECIFIED.

(g) Attach the cover (401/15) to the housing.

1 If self−locking nuts are used, attach the cover to the housing with four (4) washers (401/14) and nuts (401/29). Lubricate the threads with Engine Oil P03−001. Torque nuts to 150 − 170 lb−in. (16.948 − 19.207 N.m).

2 If hex nuts with lockwire provisions are used, attach the cover to the housing with four (4) washers (4012/14) and nuts (401/30). Lubricate the threads with Engine Oil P03−001. Torque nuts to 125 − 150 lb−in. (14.123 − 16.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 the nuts.

R
R

(3) (Post SB PW4ENG 72-524 and SB PW4ENG 79-79) If applicable, install the details in the main oil filter housing assembly (MOFH) (401/3) as follows. See Figure 401 (Sheet 6) and Figure 401 (Sheet 7).

(a) Install the spring (401/5) in the spring retainer (401/23).

(b) Install two screws (401/22) through the spring retainer screw holes and then install two washers (401/20) on the ends of the two screws.

(c) Lubricate the threads of the two screws (401/22) with Engine Oil P03-001.

(d) With the spring (401/5) in place in the spring retainer (401/23), thread the two screws (401/22) into the main oil strainer cover (401/21). Torque the two screws to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(e) Install new packing (401/8), lubricated with Engine Oil P03-001, into groove in OD of main oil strainer cover (401/21).

(f) Install filter element (401/4) into opening in bottom of cover (401/21). Align bolt holes and install cover with filter element into main oil filter housing (401/3).

NOTE: Removable plug must be removed from outboard end of filter element or the filter will not properly filter the oil.

(g) Install the cover (401/21) as follows.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN-FLIGHT-SHUTDOWN.

CAUTION: INCORRECT INSTALLATION OF THE COVER CAN CAUSE DAMAGE TO THE PACKING.

CAUTION: DO NOT USE THE COVER RETAINING NUTS TO PULL THE COVER INTO THE HOUSING. TO DO SO CAN CAUSE DAMAGE TO THE PACKING.

(h) With the cover (401/21) in position over the studs in the housing (401/3), carefully push the cover on the housing until the flange of the cover touches the housing.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: BE SURE TO TORQUE THE COVER RETAINING NUTS TO THE TORQUE SPECIFIED.

(i) Attach the cover (401/21) to the housing.

1 If self−locking nuts are used, attach the cover to the housing with four (4) washers (401/14) and nuts (401/29). Lubricate the threads with Engine Oil P03−001. Torque nuts to 150 − 170 lb−in. (16.948 − 19.207 N.m).

2 If hex nuts with lockwire provisions are used, attach the cover to the housing with four (4) washers (401/14) and nuts (401/30). Lubricate the threads with Engine Oil P03−001. Torque nuts to 125 − 150 lb−in. (14.123 − 16.948 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 the nuts.

(4) Install new packing (401/9), lubricated with Engine Oil P03−001, onto insert (401/10).

(5) Install insert, lubricated with Engine Oil P03−001, into opening in bottom of cover (401/15 or 401/21, as appropriate). Torque insert to 200 − 225 lb−in. (22.597 − 25.422 N.m).

(6) Install new packing (401/11), lubricated with Engine Oil P03−001, onto plug (401/12).

(7) Install plug (401/12), lubricated with Engine Oil P03−001, into previously installed insert (401/10). Torque plug to 110 − 120 lb−in. (12.428 − 13.558 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 the plug.

(8) Install packings (401/17) and (401/18), lubricated with Engine Oil P03−001, into grooves in pressure relief valve (filter element) (401/19). Install valve, threads lubricated with Engine Oil P03−001, onto port just above pressure (regulator) relief valve pad (401/16). Torque valve to 525 − 625 lb−in. (959.317 − 70.615 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 the valve.

(9) (Post SB PW4ENG 72−525) If applicable, install the details in the main oil filter housing assembly (MOFH) (401/3) as follows. See Figure 401 (Sheet 8) and Figure 401 (Sheet 9).

(a) Install pressure relief valve (401/41) in center of cover (401/42) and attach with retaining ring (401/40).

(b) Install new packing (401/8), lubricated with Engine Oil P03−001, into groove in OD of main oil strainer cover (401/42).

(c) Remove the protective closure from the end of the filter element (401/39).

(d) Install the filter element (401/39) over the pressure relief valve (401/41) in cover (401/42). Align bolt holes and dowel pin in cover with studs and dowel pin hole in main oil filter housing (401/3), then install cover with filter element into main oil filter housing.

NOTE: Removable plug must be removed from outboard end of filter element or the filter will not properly filter the oil.

(e) Install the cover (401/42) as follows.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN-FLIGHT-SHUTDOWN.

CAUTION: INCORRECT INSTALLATION OF THE COVER CAN CAUSE DAMAGE TO THE PACKING.

CAUTION: DO NOT USE THE COVER RETAINING NUTS TO PULL THE COVER INTO THE HOUSING. TO DO SO CAN CAUSE DAMAGE TO THE PACKING.

(f) With the cover (401/42) in position over the studs and dowel pin hole in the housing, carefully push the cover on the housing until the flange of the cover touches the housing.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN-FLIGHT-SHUTDOWN.

CAUTION: BE SURE TO TORQUE THE COVER RETAINING NUTS TO THE TORQUE SPECIFIED.

(g) Attach the cover (401/42) with four washers (401/14) and nuts (401/29). Torque nuts to 150 - 170 lb-in. (16.948 - 19.207 N.m).

(10) (Post SB PW4ENG 72-525) Install new packing (401/11), lubricated with Engine Oil P03-001, onto plug (401/12).

(11) (Post SB PW4ENG 72-525) Install plug (401/12), lubricated with Engine Oil P03-001, into threaded hole in bottom of cover (401/42). Torque plug to 110 - 120 lb-in. (12.428 - 13.558 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 the plug.

(12) (Post PW4ENG 72-525) Install packings (401/2), lubricated with Engine Oil P03-001, onto two inserts (401/1). Install inserts, lubricated with Engine Oil P03-001, into two upper ports in main oil filter housing (401/3). Torque inserts to 200 - 225 lb-in. (22.597 - 25.422 N.m).

ENGINE GENERAL − MAIN GEARBOX − INSTALLATION−20

(13) (Post PW4ENG 72−525) Install packings (401/17) and (401/18), lubricated with Engine Oil P03−001, into grooves in plug (401/43). Install plug, threads lubricated with Engine Oil P03−001, in port just above pressure (regulator) relief valve pad (1002/16). Torque plug to 525 − 625 lb−in. (59.317 − 70.615 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 the plug.

(14) Install packings (401/2), lubricated with Engine Oil P03−001, onto two inserts (401/1). Install inserts, lubricated with Engine Oil P03−001, into two upper ports (LP4 and LP5) in main oil filter housing (401/3). Torque inserts to 200 − 225 lb−in. (22.597 − 25.422 N.m).

(15) Install the oil system pressure relief valve (401/16) as follows.

- (a) Lubricate two new packings with Engine Oil P03−001.
- (b) Install the packings on the valve.
- (c) Install the valve in the bottom hole on the forward side of the MOFH.
- (d) Put the bracket on the valve.
- (e) Attach the valve and bracket to the MOFH with three bolts.
- (f) Torque the bolts to 125 − 140 lb−in. (14.123 − 15.818 N.m).
- (g) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 in the valve.

(16) Install the transfer tubes as follows. See Figure 401, (Sheet 10).

- (a) For oil filter housings that are pre SB PW4ENG 79−43, apply Engine Oil P03−001 to six packings.
- (b) For oil filter housings that are post SB PW4ENG 79−43, apply Engine Oil P03−001 to four packings.
- (c) Install the packings on the transfer tubes.

(d) Install the tubes in the holes in the front of the gearbox.

(17) For oil filter housings that are post SB PW4ENG 79-43, install the anti-siphon tube assembly as follows. See Figure 401, (Sheet 10).

(a) Find the correct position of the tube assembly as follows.

1 With no packings installed, put the eccentric flange of the tube assembly in the mating counterbore of the oil filter housing.

2 The fit of the oil filter housing and the tube assembly is correct if the tube can not turn much.

3 With the oil filter housing pointed in the installed position, see the position of the tube assembly.

4 Remove the tube assembly.

(b) Apply Engine Oil P03-001 to two packings.

(c) Install the packings on the tube assembly.

(d) Install the tube assembly in the hole in the front of the gearbox in the same position as before.

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER MAIN OIL FILTER HOUSING ASSEMBLY.

CAUTION: INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 79-43 AND TO SB PW4ENG 72-525).

(18) Install the oil filter housing as follows. See Figure 401, (Sheet 1).

(a) Install the oil filter housing over the transfer tubes and, if applicable, the anti-siphon tube assembly.

1 As you install the oil filter housing, turn the anti-siphon tube assembly to be in the same position as before.

R
R

2 The tube assembly must correctly seat in the mating hole of the oil filter housing.

(b) Attach the oil filter housing to the gearbox with four washers and four bolts.

(c) Do a check of the position of the anti−siphon tube assembly. The end of the tube assembly must be approximately 0.25 inch (6.350 mm) from the top of the gearbox housing.

(d) Torque the bolts to 125 − 140 lb−in. (14.123 − 15.818 N.m).

(19) Attach the W3 and W5 wiring harnesses to the bracket on the oil filter housing as follows. See Figure 401 (Sheet 11).

(a) Lubricate the threads of a clamp bolt with Engine Oil P03−001.

(b) With the loop of the clamp up, attach the harnesses to the bracket with the clamp bolt and a nut.

(c) Torque the nut to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(20) Connect the air/oil cooler inlet tube (LP02) as follows. See Figure 401 (Sheet 1).

(a) Lubricate with Engine Oil P03−001.

1 A new packing.

2 Threads of bolts.

(b) Install the packing on the tube.

(c) Install the tube in the "oil−out" hole of the oil filter housing.

(d) Attach the tube to the oil filter housing with the bolts.

(e) Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(21) Connect the oil trim pressure tube assembly (LP32) as follows. See Figure 401 (Sheet 11).

- (a) Lubricate with Antigalling Compound P06−021 the tube nut threads.
- (b) Lubricate with Engine Oil P03−001.
  - 1 A new packing.
  - 2 The threads of a clamp−bolt.
  - 3 The threads of the three other bolts.
- (c) Install the packing on the assembly.
- (d) Install the clamp−bolt in the clamp. Tighten the bolt by hand that attaches to the bracket in back of the fuel/oil cooler.
- (e) Install the assembly in the "trim" hole.
- (f) Attach the assembly to the oil filter housing with three bolts. Tighten the bolts by hand.
- (g) Torque the:
  - 1 Clamp−bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).
  - 2 Other bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).
  - 3 Tube nut to 675 − 750 lb−in. (76.265 − 84.739 N.m).
  - 4 Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(22) Install the oil cooler bypass valve drain tube assembly (LP20) as follows. See Figure 401 (Sheet 11).

- (a) Lubricate with Engine Oil P03−001.
  - 1 Two new packings.
  - 2 The threads of two bolts.
  - 3 The threads of the tube nut.

(b) Install a packing at both ends of the tube.

(c) Install a retainer on the tube at the end with the flange.

(d) Install the tube in the "servo" hole of the oil filter housing.

(e) Attach the tube to the oil filter housing with two bolts. Tighten the bolts by hand.

(f) Attach the tube nut to the oil cooler bypass valve. Tighten the tube by hand.

(g) Torque the:

1 Bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

2 Tube the nut to 65 − 70 lb−in. (7.344 − 7.909 N.m). Loosen the tube nut and torque it again to 65 − 70 lb−in. (7.344 − 7.909 N.m).

(h) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 in the tube nut.

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(23) Install the main filter oil tube (LP01)as follows. See Figure 401 (Sheet 12) and Figure 401 (Sheet 13).

R R (a) Lubricate with Antiseize Paste P06−054. Wipe off unwanted paste.

1 The threads of two bolts (for the rear end of the tube).

(b) Lubricate with Engine Oil P03−001.

1 Two new packings.

2 The threads of eight other bolts.

(c) Install a packing on each end of the tube.

(d) Install one end of the tube in the "oil-in" hole in the oil filter housing.

(e) Install the other end of the tube in the top of the lubrication and scavenge oil pump.

(f) Attach the front end of the tube to the oil filter housing with three bolts. Tighten by hand.

(g) Attach the rear end of the tube and a bracket to the oil pump with two bolts. Tighten by hand.

(h) Attach the tube to brackets on the gearbox with clamp bolts and nuts. Tighten by hand.

(i) Attach the tube to the bracket on the diffuser case with a clamp bolt and nut. Tighten by hand.

(j) Attach the tube to the clamps on the adjacent (LR05) tube just above the oil pump with clamp bolts and nuts. Tighten by hand.

NOTE: Be sure the clip-on loop clamp grommets are on the (LP01) tube at three clamp locations and on the (LR05) tube assembly at two locations (Post SB PW4ENG 79-36 and Post SB PW4ENG 79-46). See clamp views.

(k) Torque:

1 The nuts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

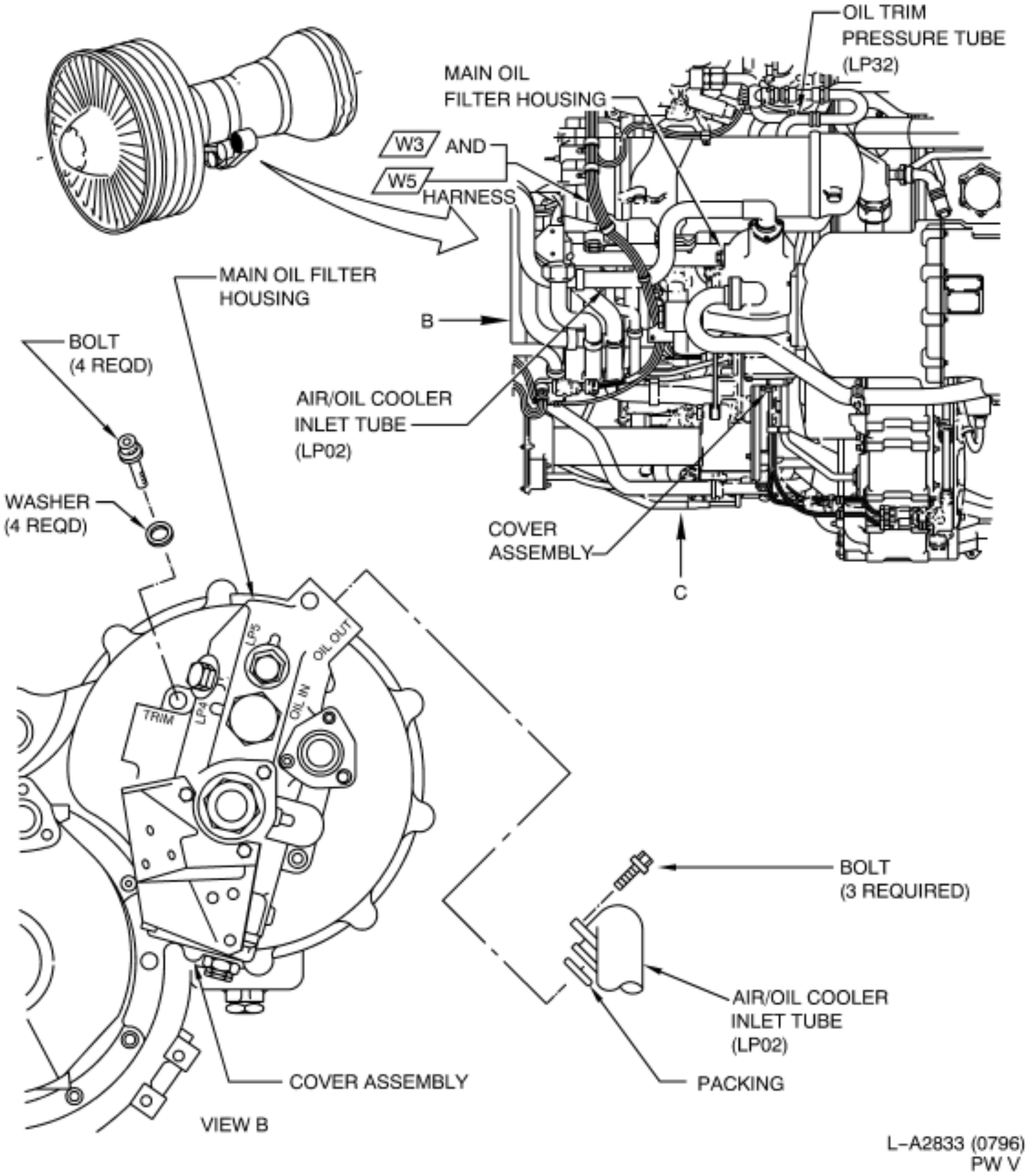
2 The bolts in the oil filter housing to 85 - 95 lb-in. (9.604 - 10.734 N.m).

3 The bolts in the oil pump to 62 - 72 lb-in. (7.005 - 8.135 N.m).

C. Postrequisites

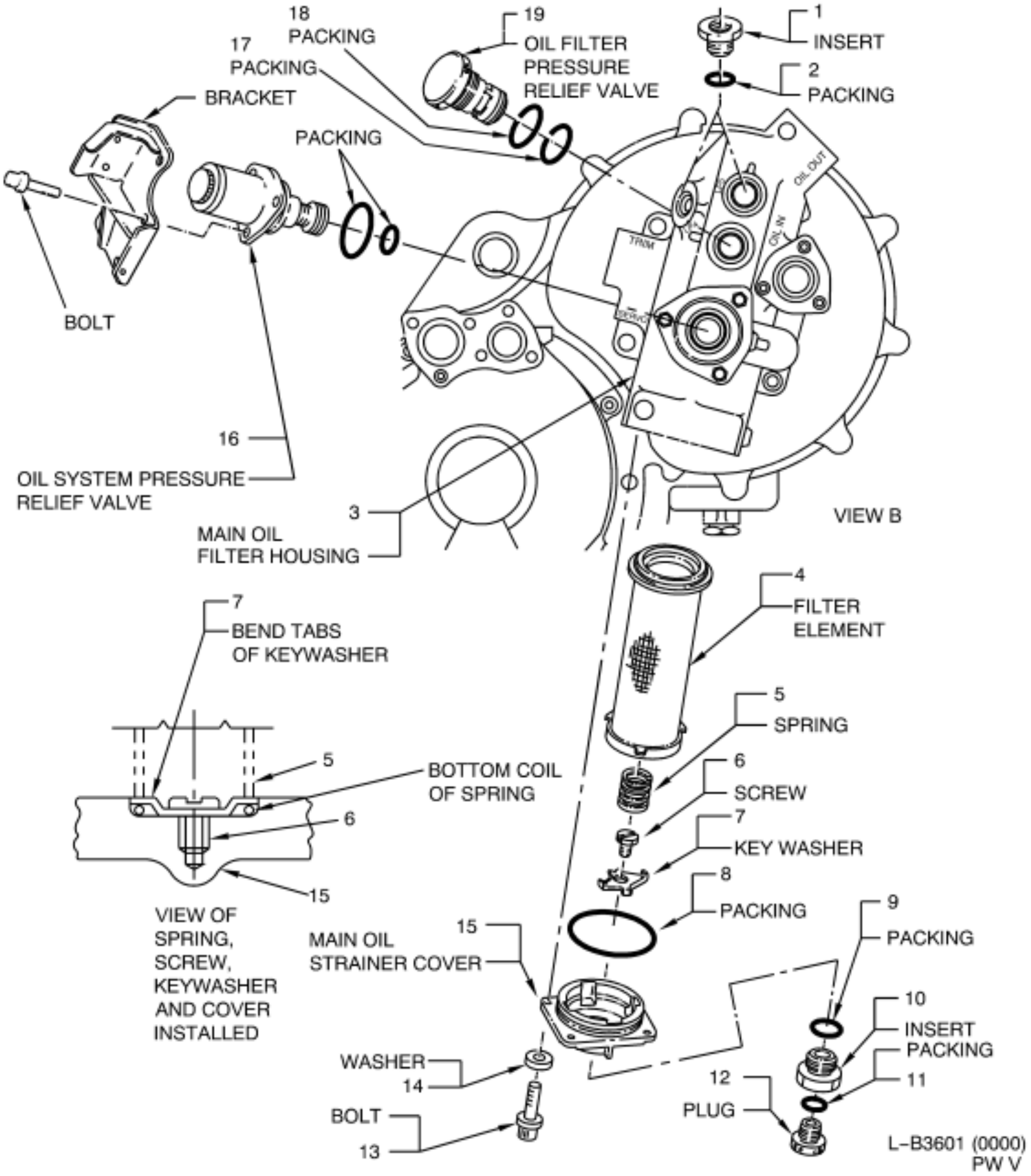
(1) Service the oil system. Refer to 72-00-00, Servicing-03 Task 72-00-00-610-003.

(2) Test the engine. Refer to the Test Reference Table, 71-00-00, Testing-00 Task 71-00-00-990-003.

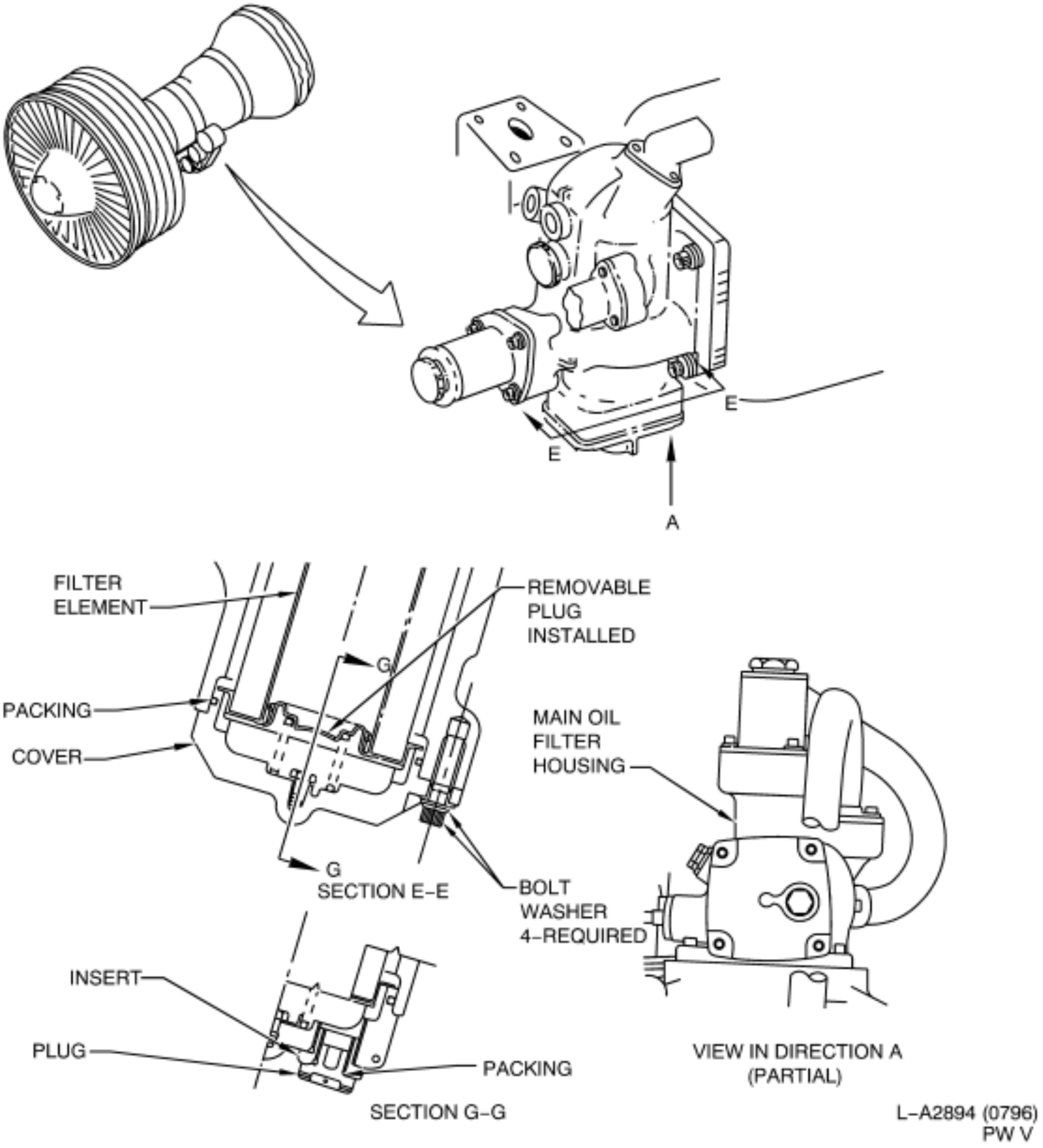

OIL TRIM
PRESSURE TUBE
(LP32)
MAIN OIL
FILTER HOUSING
W3 AND
W5
HARNESS
MAIN OIL FILTER
HOUSING
B
BOLT
(4 REQD)
AIR/OIL COOLER
INLET TUBE
(LP02)
WASHER
(4 REQD)
COVER
ASSEMBLY
C
TRIM
LP4
LP5
OIL OUT
OIL IN
BOLT
(3 REQUIRED)
AIR/OIL COOLER
INLET TUBE
(LP02)
COVER ASSEMBLY
PACKING
VIEW B
L-A2833 (0796)
PW V

Main Oil Filter Housing Installation
Figure 401 (Sheet 1)
(Task 72-00-61-440-001)

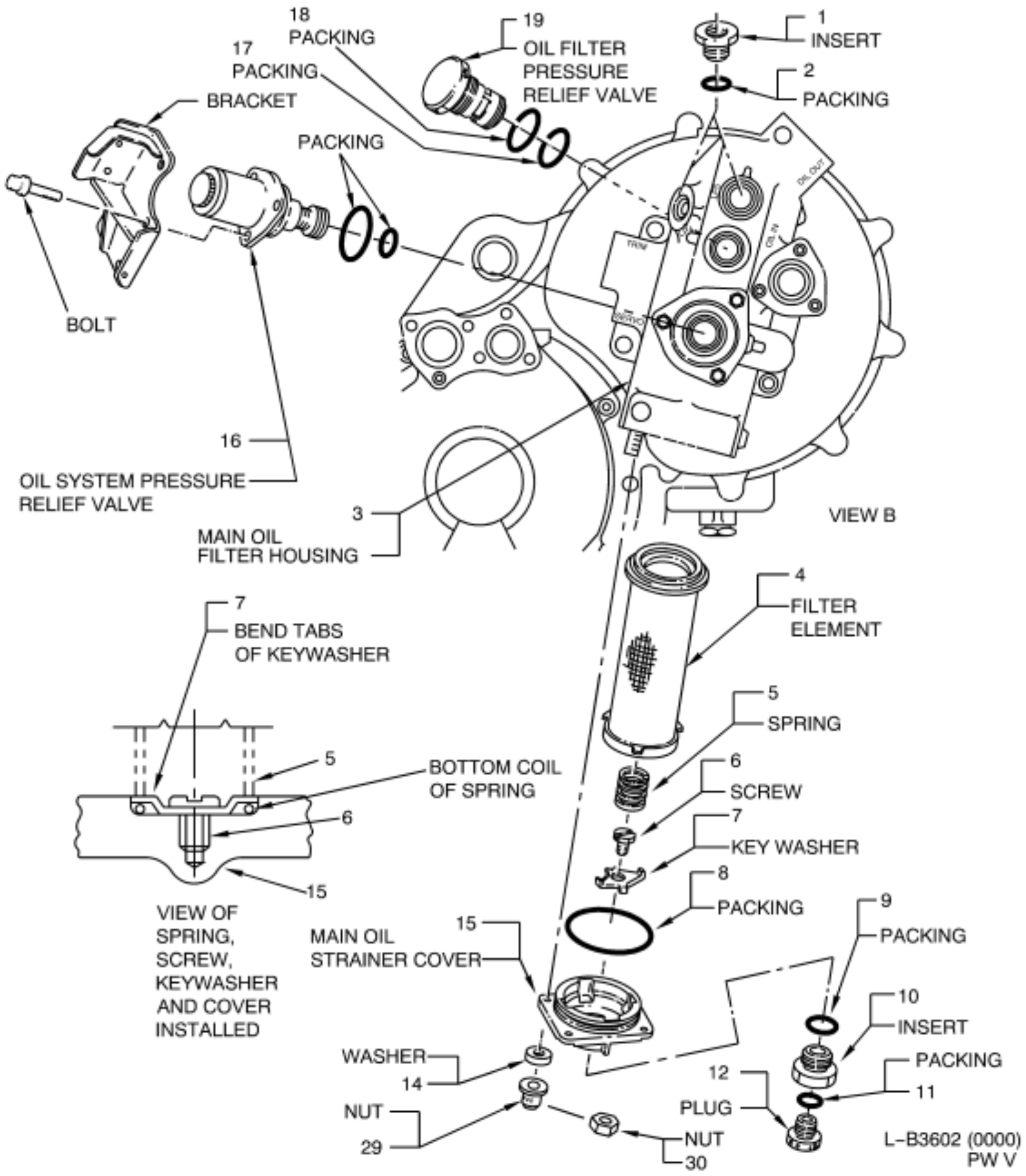
ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-20


18
PACKING
17
PACKING
19
OIL FILTER
PRESSURE
RELIEF VALVE
1
INSERT
2
PACKING
BRACKET
PACKING
BOLT
16
OIL SYSTEM PRESSURE
RELIEF VALVE
3
MAIN OIL
FILTER HOUSING
VIEW B
4
FILTER
ELEMENT
7
BEND TABS
OF KEYWASHER
5
SPRING
BOTTOM COIL
OF SPRING
6
SCREW
7
KEY WASHER
8
PACKING
9
PACKING
5
6
15
VIEW OF
SPRING,
SCREW,
KEYWASHER
AND COVER
INSTALLED
15
MAIN OIL
STRAINER COVER
10
INSERT
PACKING
11
WASHER
14
BOLT
13
12
PLUG
L-B3601 (0000)
PW V

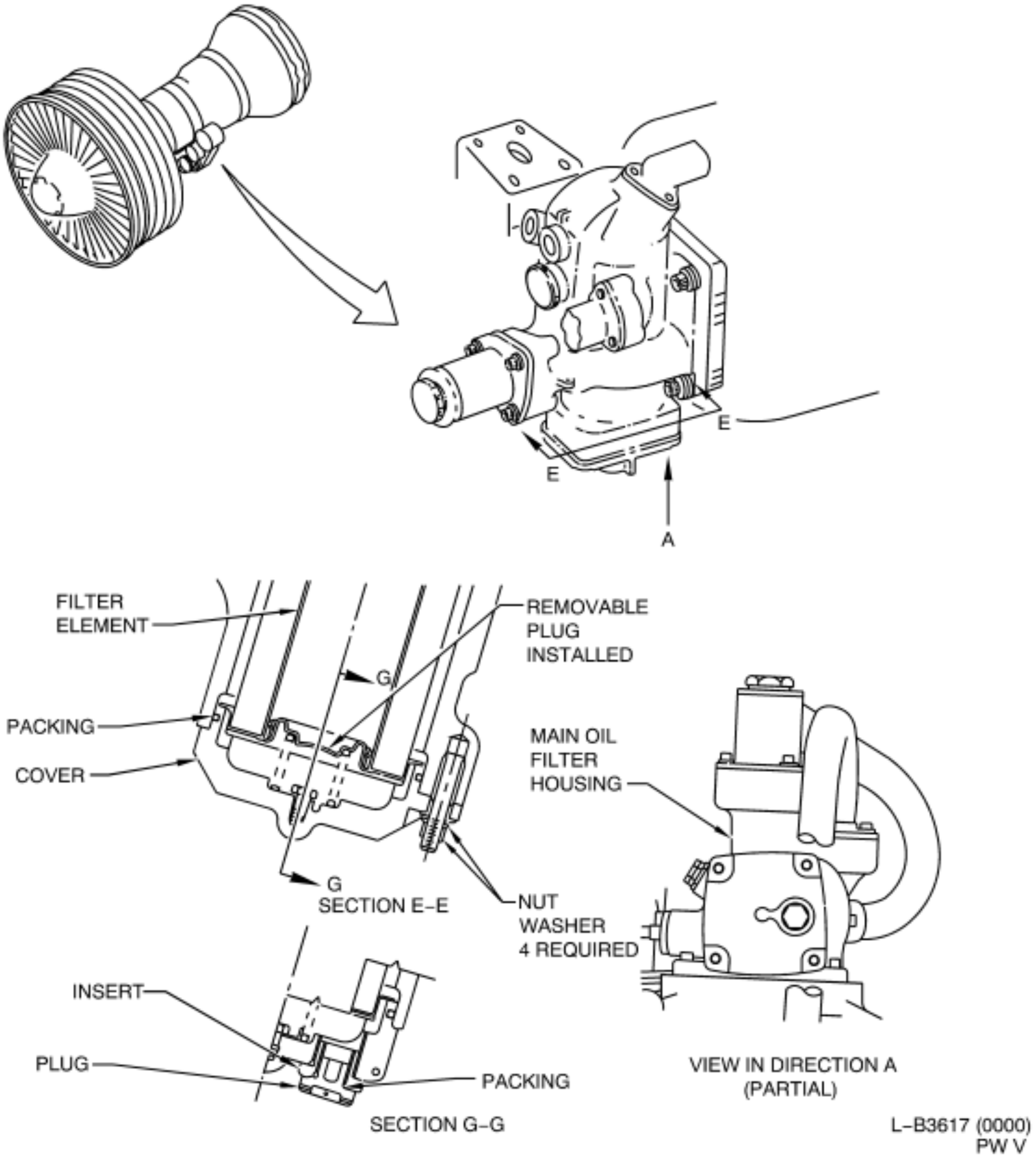
Main Oil Filter Housing (Pre SB PW4ENG 72-524)
Figure 401 (Sheet 2)
(Task 72-00-61-440-001)


E
E
A
FILTER ELEMENT
REMOVABLE PLUG INSTALLED
G
PACKING
COVER
G
SECTION E-E
MAIN OIL FILTER HOUSING
BOLT WASHER 4-REQUIRED
INSERT
PLUG
PACKING
SECTION G-G
VIEW IN DIRECTION A (PARTIAL)
L-A2894 (0796)
PW V

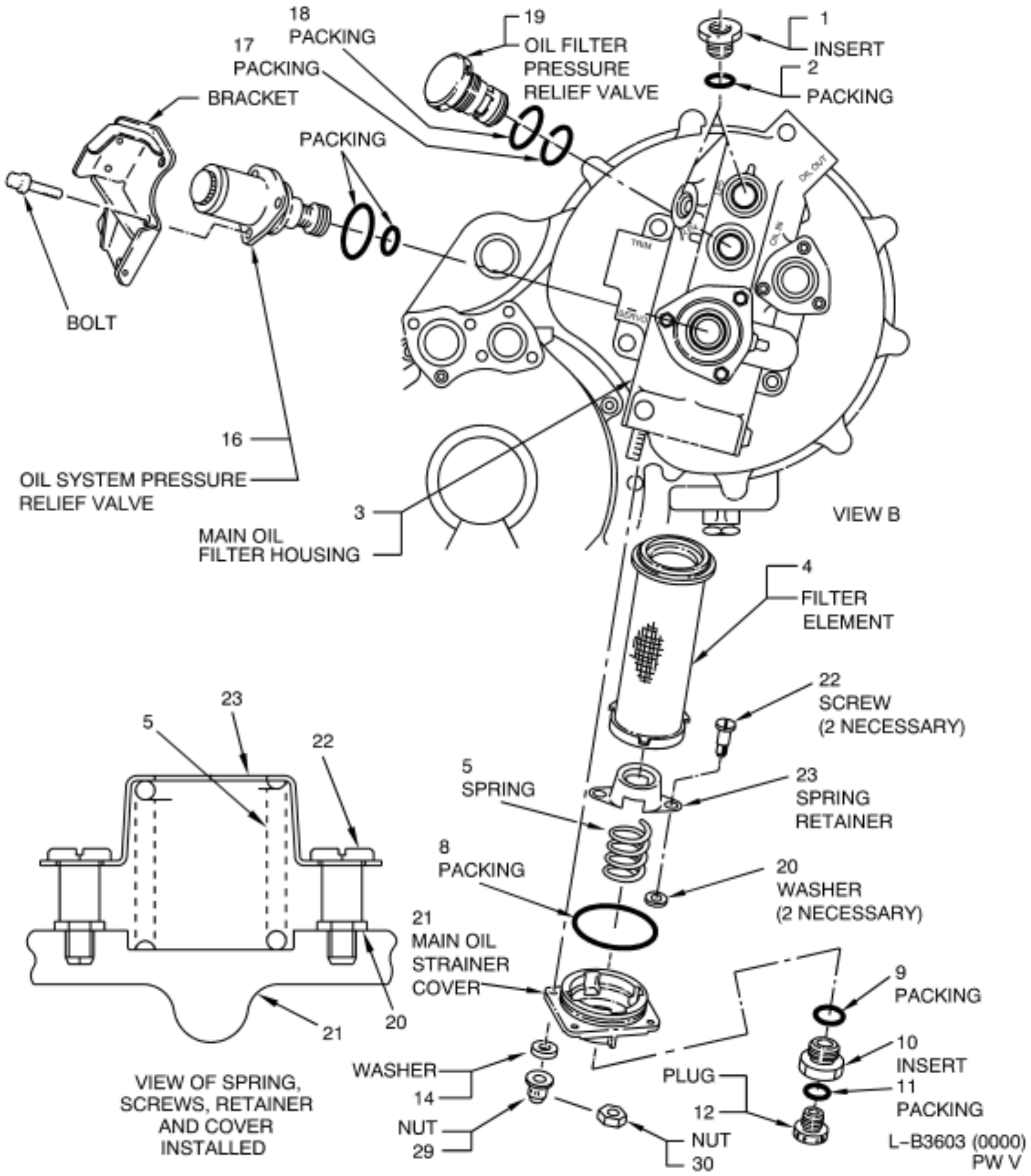
Main Oil Filter Housing (Pre SB PW4ENG 72-524)
Figure 401 (Sheet 3)
(Task 72-00-61-440-001)


18
PACKING
17
PACKING
BRACKET
19
OIL FILTER
PRESSURE
RELIEF VALVE
1
INSERT
2
PACKING
PACKING
OIL OUT
OIL IN
TRIM
SERVO
BOLT
16
OIL SYSTEM PRESSURE
RELIEF VALVE
3
MAIN OIL
FILTER HOUSING
VIEW B
4
FILTER
ELEMENT
7
BEND TABS
OF KEYWASHER
5
SPRING
5
BOTTOM COIL
OF SPRING
6
SCREW
6
7
KEY WASHER
8
PACKING
15
VIEW OF
SPRING,
SCREW,
KEYWASHER
AND COVER
INSTALLED
15
MAIN OIL
STRAINER COVER
9
PACKING
10
INSERT
WASHER
14
PACKING
11
12
PLUG
NUT
29
NUT
30
L-B3602 (0000)
PW V

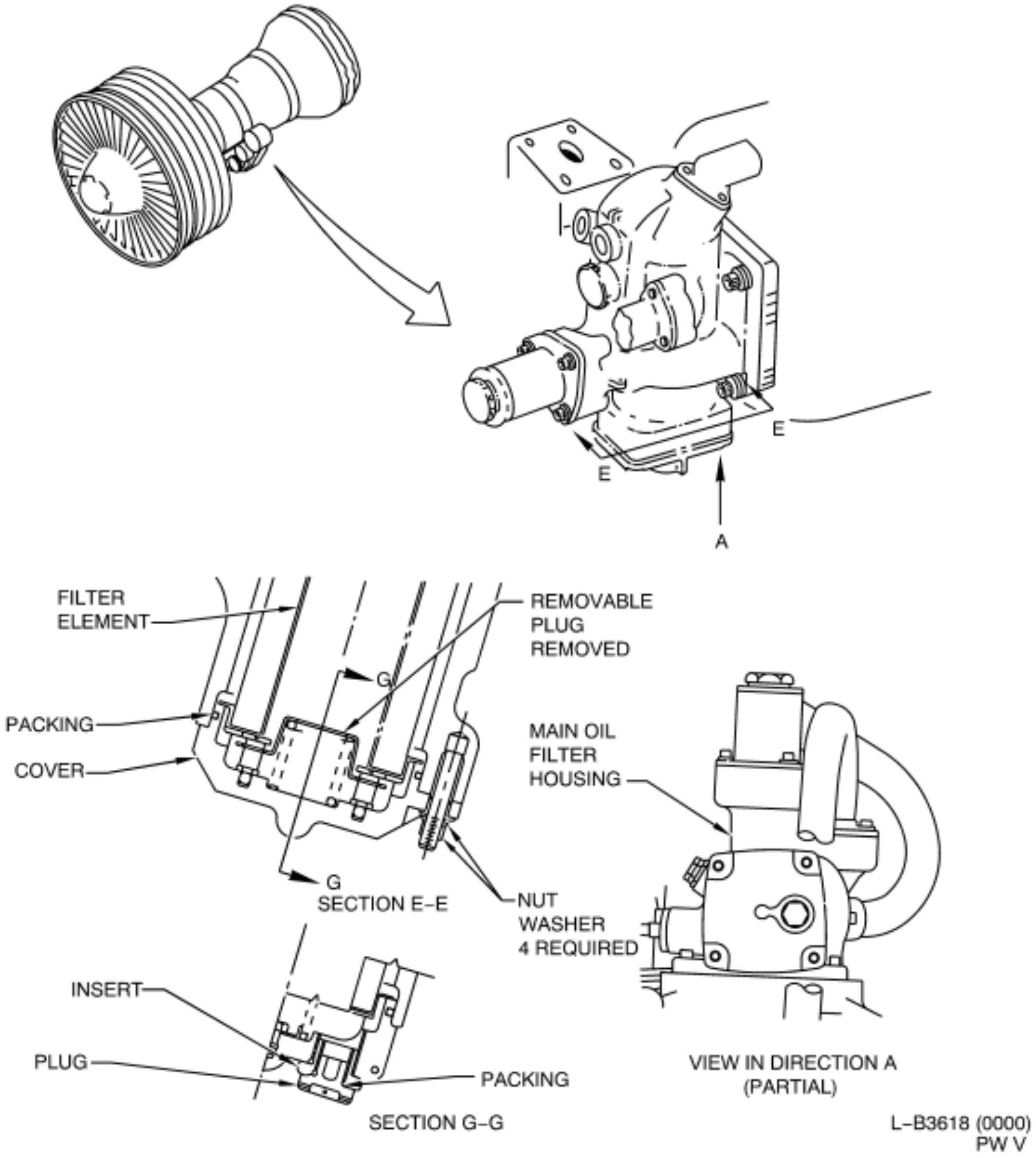
Main Oil Filter Housing (Post SB PW4ENG 72-524 And SB PW4ENG 79-79)
Figure 401 (Sheet 4)
(Task 72-00-61-440-001)


E
E
A
FILTER ELEMENT
REMOVABLE PLUG INSTALLED
G
PACKING
COVER
MAIN OIL FILTER HOUSING
G
SECTION E-E
NUT
WASHER
4 REQUIRED
INSERT
PLUG
PACKING
SECTION G-G
VIEW IN DIRECTION A
(PARTIAL)
L-B3617 (0000)
PW V

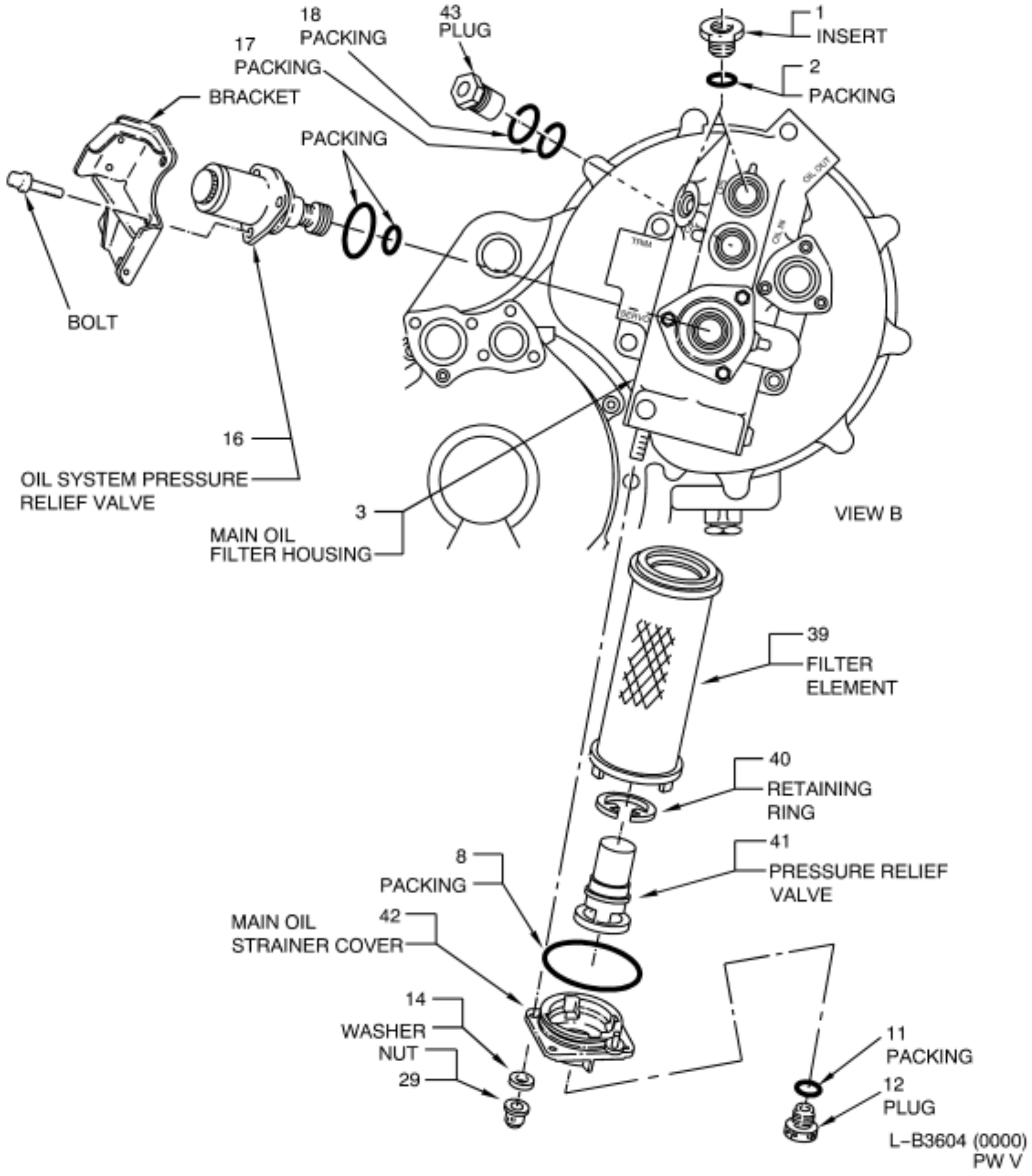
Main Oil Filter Housing (Post SB PW4ENG 72-524 And SB PW4ENG 79-79)
Figure 401 (Sheet 5)
(Task 72-00-61-440-001)


18
PACKING
17
PACKING
BRACKET
19
OIL FILTER
PRESSURE
RELIEF VALVE
1
INSERT
2
PACKING
PACKING
BOLT
16
OIL SYSTEM PRESSURE
RELIEF VALVE
3
MAIN OIL
FILTER HOUSING
VIEW B
4
FILTER
ELEMENT
22
SCREW
(2 NECESSARY)
23
5
22
5
SPRING
23
SPRING
RETAINER
8
PACKING
20
WASHER
(2 NECESSARY)
21
MAIN OIL
STRAINER
COVER
9
PACKING
21
20
WASHER
14
NUT
29
PLUG
12
NUT
30
10
INSERT
11
PACKING
VIEW OF SPRING,
SCREWS, RETAINER
AND COVER
INSTALLED
L-B3603 (0000)
PW V

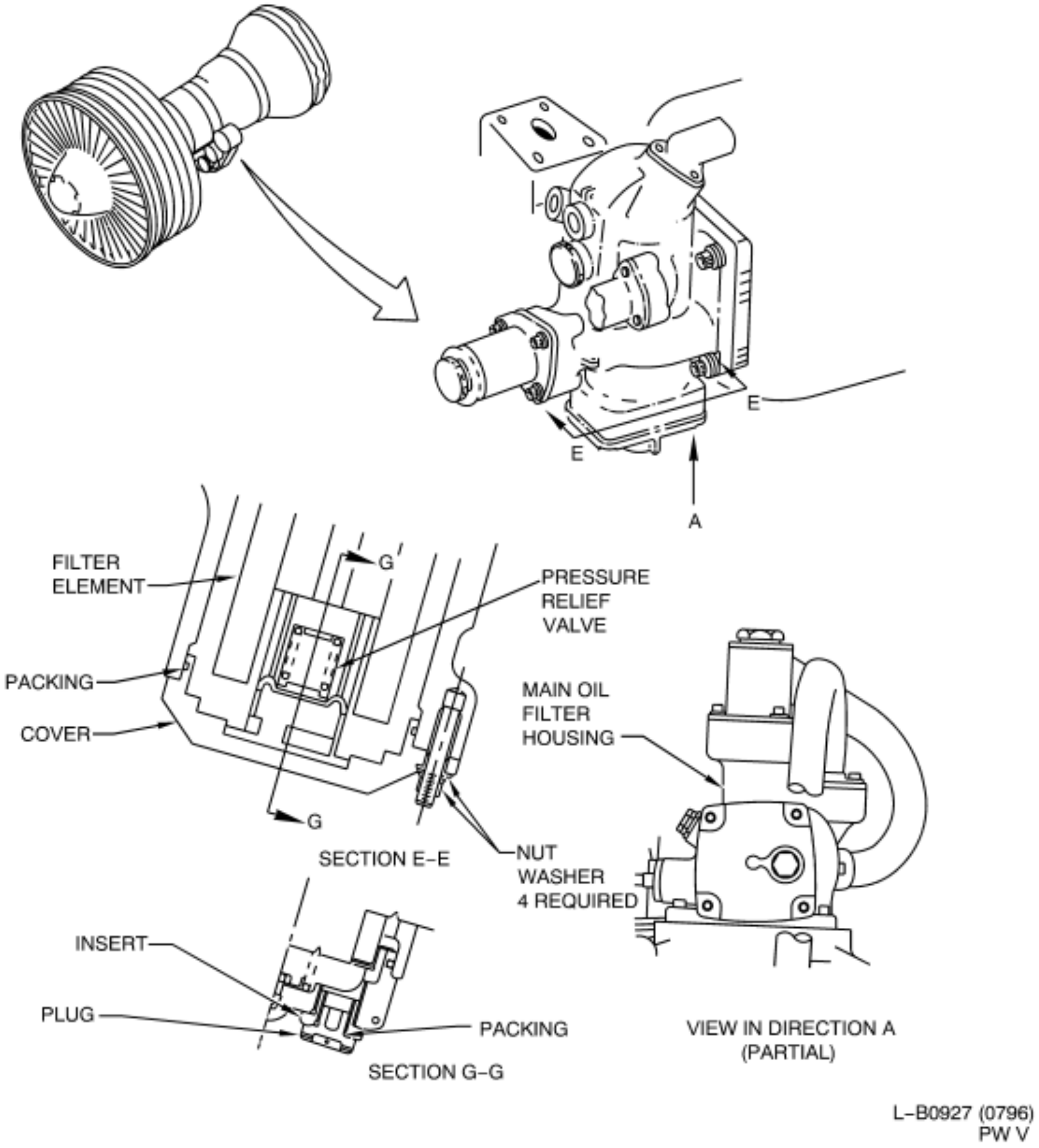
Main Oil Filter Housing (Post SB PW4ENG 72-524 And SB PW4ENG 79-79)
Figure 401 (Sheet 6)
(Task 72-00-61-440-001)


E
E
A
FILTER ELEMENT
REMOVABLE PLUG REMOVED
G
PACKING
COVER
MAIN OIL FILTER HOUSING
G
SECTION E-E
NUT
WASHER
4 REQUIRED
INSERT
PLUG
PACKING
SECTION G-G
VIEW IN DIRECTION A (PARTIAL)
L-B3618 (0000)
PW V

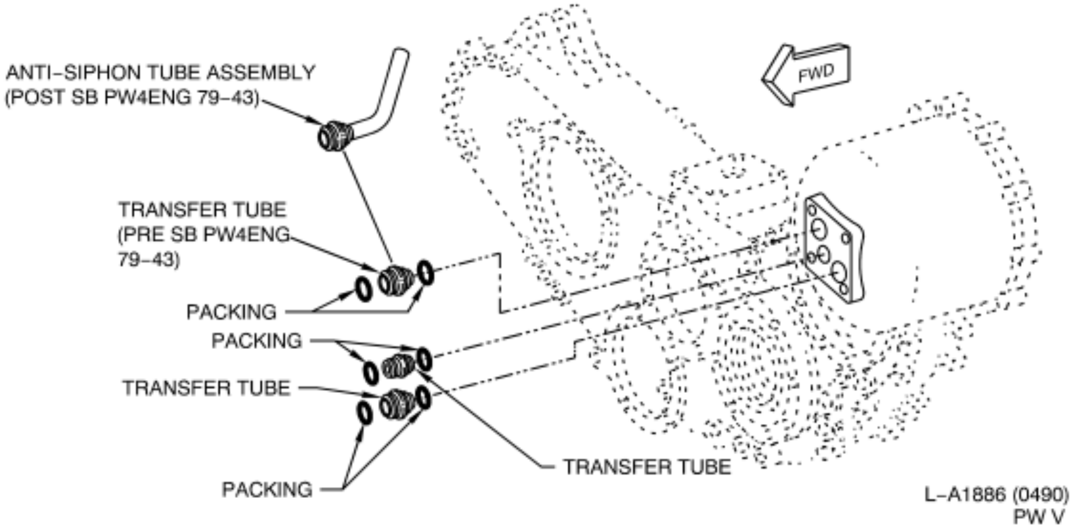
Main Oil Filter Housing (Post SB PW4ENG 72-524 And SB PW4ENG 79-79)
Figure 401 (Sheet 7)
(Task 72-00-61-440-001)


18
PACKING
43
PLUG
1
INSERT
17
PACKING
2
PACKING
BRACKET
PACKING
BOLT
16
OIL SYSTEM PRESSURE
RELIEF VALVE
3
MAIN OIL
FILTER HOUSING
VIEW B
39
FILTER
ELEMENT
40
RETAINING
RING
8
PACKING
41
PRESSURE RELIEF
VALVE
MAIN OIL
STRAINER COVER
42
14
WASHER
NUT
29
11
PACKING
12
PLUG
L-B3604 (0000)
PW V

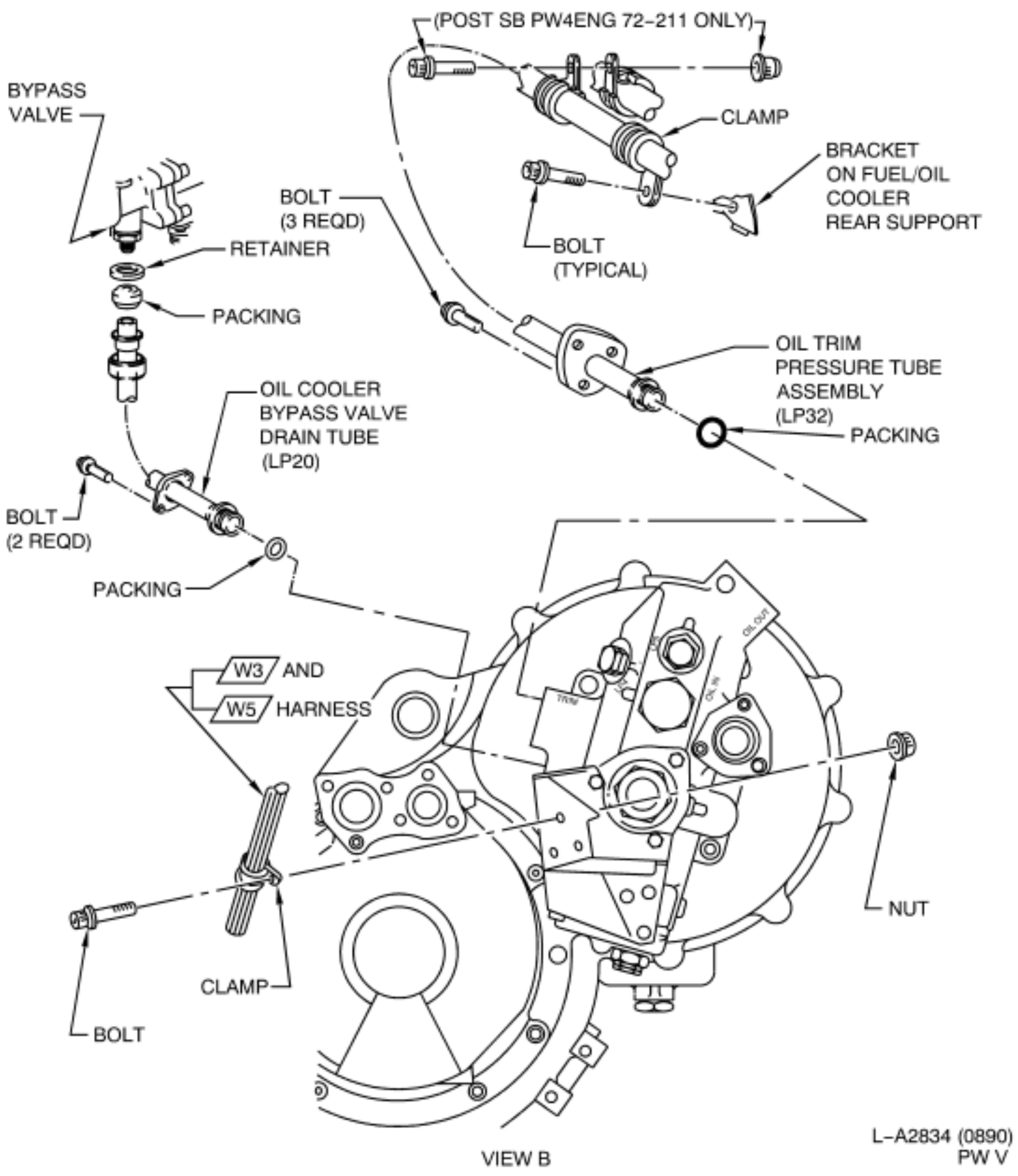
Main Oil Filter Housing (Post SB PW4ENG 72-525
Figure 401 (Sheet 8)
(Task 72-00-61-440-001)


E
E
A
G
FILTER ELEMENT
PRESSURE RELIEF VALVE
PACKING
COVER
MAIN OIL FILTER HOUSING
G
SECTION E-E
NUT
WASHER
4 REQUIRED
INSERT
PLUG
PACKING
SECTION G-G
VIEW IN DIRECTION A
(PARTIAL)
L-B0927 (0796)
PW V

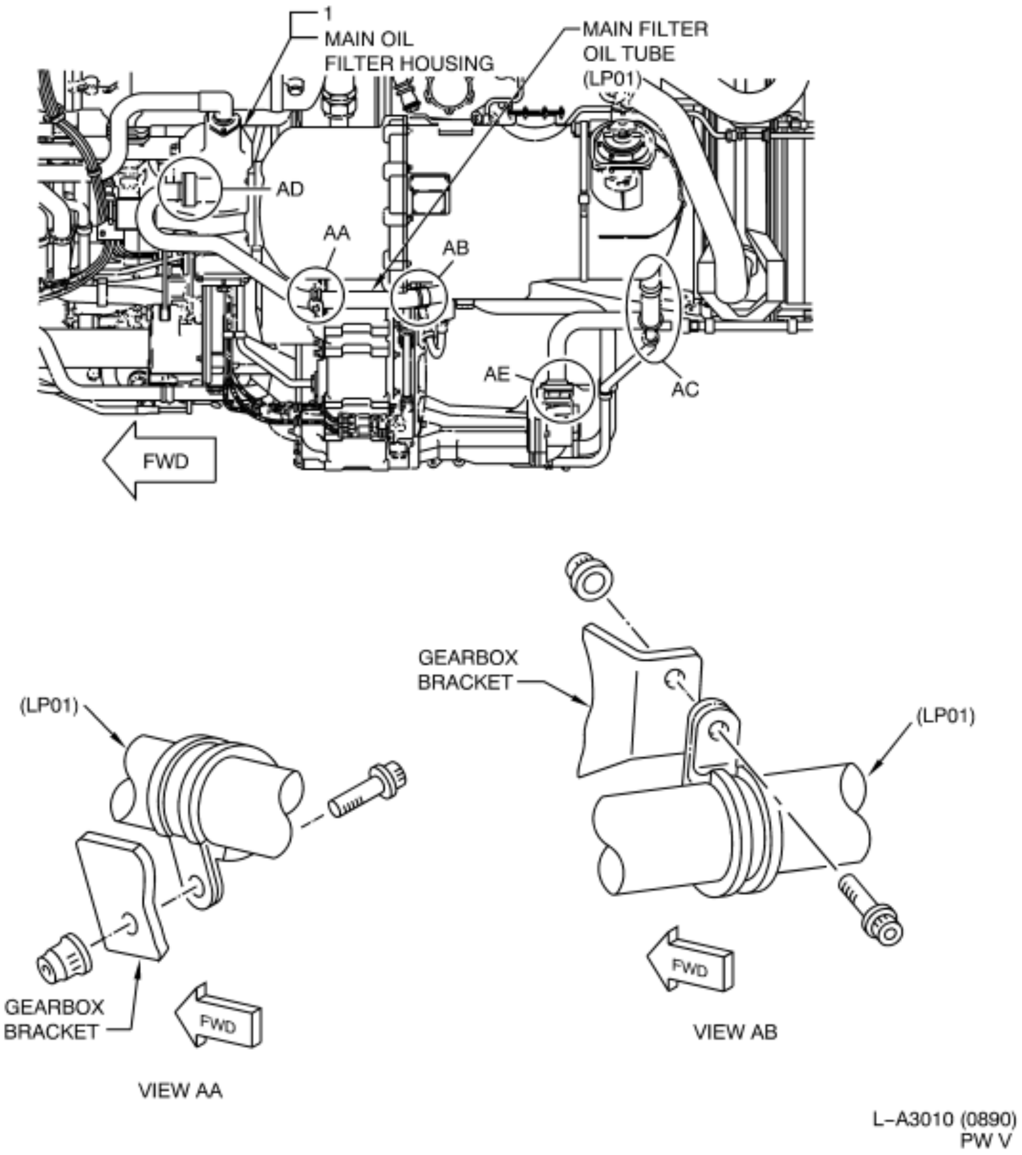
Main Oil Filter Housing (Post SB PW4ENG 72-525
Figure 401 (Sheet 9)
(Task 72-00-61-440-001)


ANTI−SIPHON TUBE ASSEMBLY
(POST SB PW4ENG 79−43)
FWD
TRANSFER TUBE
(PRE SB PW4ENG
79−43)
PACKING
PACKING
TRANSFER TUBE
PACKING
TRANSFER TUBE
L−A1886 (0490)
PW V

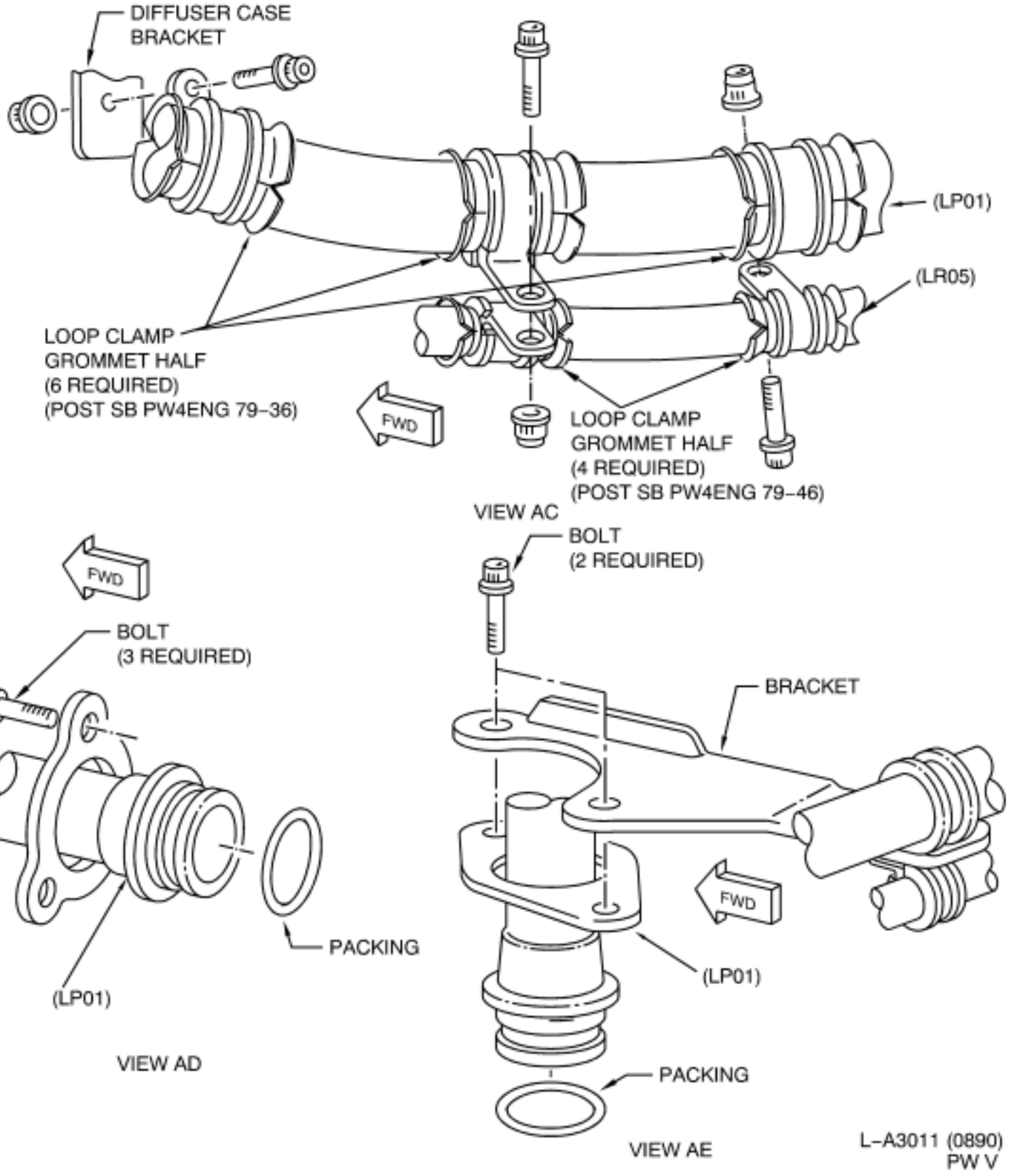
Main Oil Filter Housing Installation
Figure 401 (Sheet 10)
(Task 72−00−61−440−001)


(POST SB PW4ENG 72-211 ONLY)
BYPASS VALVE
CLAMP
BRACKET ON FUEL/OIL COOLER REAR SUPPORT
BOLT (3 REQD)
RETAINER
BOLT (TYPICAL)
PACKING
OIL TRIM PRESSURE TUBE ASSEMBLY (LP32)
PACKING
OIL COOLER BYPASS VALVE DRAIN TUBE (LP20)
BOLT (2 REQD)
PACKING
W3 AND
W5 HARNESS
TRIM
OIL OUT
OIL IN
NUT
CLAMP
BOLT
VIEW B
L-A2834 (0890)
PW V

Main Oil Filter Housing Installation
Figure 401 (Sheet 11)
(Task 72-00-61-440-001)


1
MAIN OIL
FILTER HOUSING
MAIN FILTER
OIL TUBE
(LP01)
AD
AA
AB
AE
AC
FWD
(LP01)
GEARBOX
BRACKET
FWD
VIEW AA
GEARBOX
BRACKET
(LP01)
FWD
VIEW AB
L-A3010 (0890)
PW V

Main Oil Filter Housing Installation
Figure 401 (Sheet 12)
(Task 72-00-61-440-001)


DIFFUSER CASE
BRACKET
(LP01)
(LR05)
LOOP CLAMP
GROMMET HALF
(6 REQUIRED)
(POST SB PW4ENG 79−36)
FWD
LOOP CLAMP
GROMMET HALF
(4 REQUIRED)
(POST SB PW4ENG 79−46)
VIEW AC
FWD
BOLT
(2 REQUIRED)
BOLT
(3 REQUIRED)
BRACKET
FWD
PACKING
(LP01)
(LP01)
VIEW AD
PACKING
VIEW AE
L−A3011 (0890)
PW V

Main Oil Filter Housing Installation
Figure 401 (Sheet 13)
(Task 72−00−61−440−001)

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-21

Task 72-00-61-430-021:

1. Install IDG Drive Gearshaft Plug And Bolt

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Gasket	1	72-61-00	17	160
Packing	1	72-61-00	17	100
Packing	1	72-61-00	17	130

B. Procedure

See Figure 401.

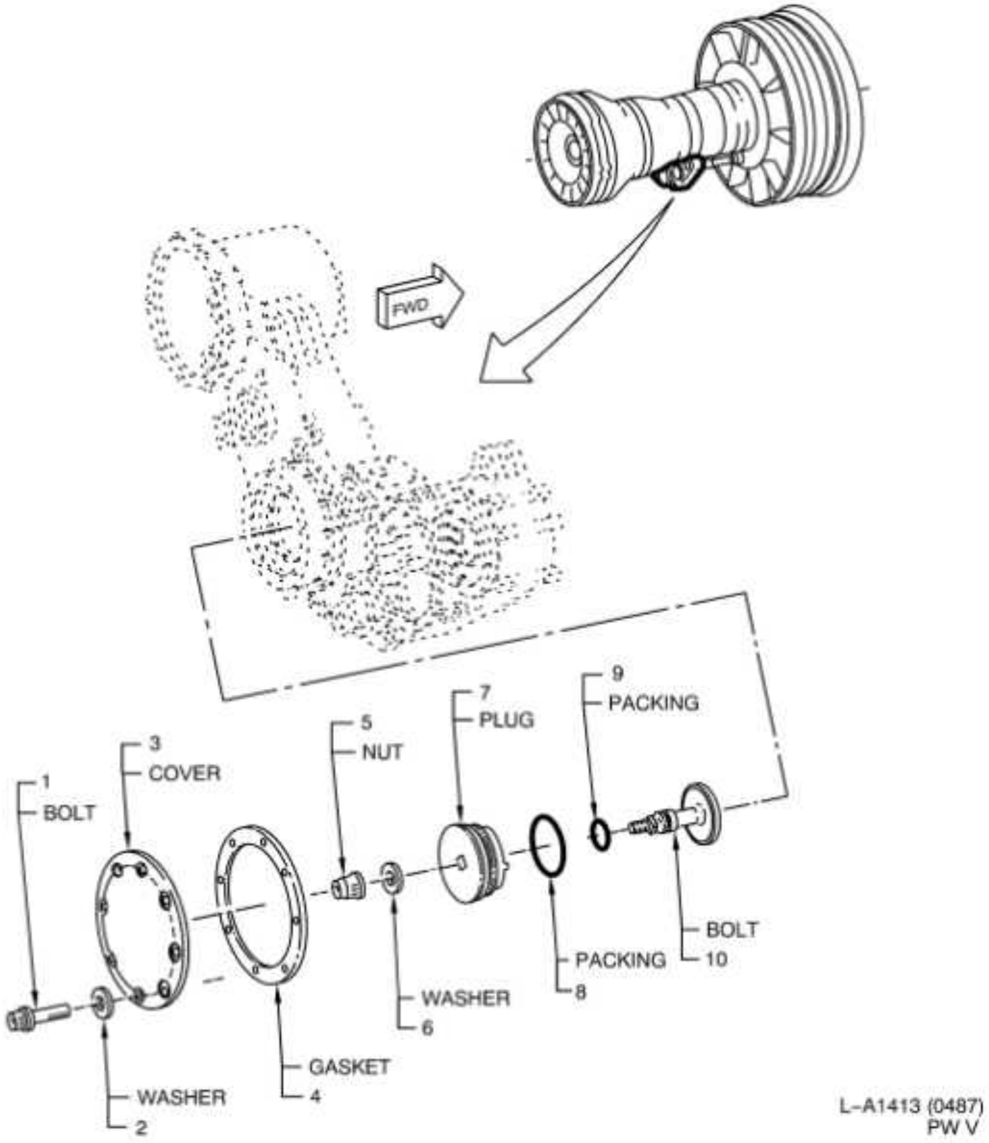
(1) For those engines not utilizing an IDG, install the IDG drive bolt, plug and cover.

  (a) Install packing (401/9), lubricated with Engine Oil (P03-001), in groove of bolt (401/10), lubricated with Engine Oil (P03-001), nearest bolt head. Install bolt and packing assembly in IDG drive gearshaft, seating bolthead in groove in gearshaft internal splines.

  (b) Install packing (401/8), lubricated with Engine Oil (P03-001), in groove of plug (401/7), lubricated with Engine Oil (P03-001). Install plug over bolt, plugging gearshaft opening.

  (c) Install washer (401/6) and nut (401/5), lubricated with Engine Oil (P03-001), over bolt. Torque nut to 85 - 95 lb-in. (9.604 - 10.734 N.m).

  (d) Install gasket (401/4) and cover (401/3) and secure with eight washers (401/2) and eight bolts (401/1). Torque bolts to 225 - 250 lb-in. (25.422 - 28.246 N.m).


FWD
1
BOLT
2
WASHER
3
COVER
4
GASKET
5
NUT
6
WASHER
7
PLUG
8
PACKING
9
PACKING
10
BOLT
L−A1413 (0487)
PW V

IDG Drive Bolt, Plug And Cover Installation
Figure 401
(Task 72−00−61−430−021)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-22

Task 72-00-61-430-012:

1. Install Rear Hydraulic Pump Drive Plug And Bolt
   A. Equipment And Materials Required

Consumable Materials:

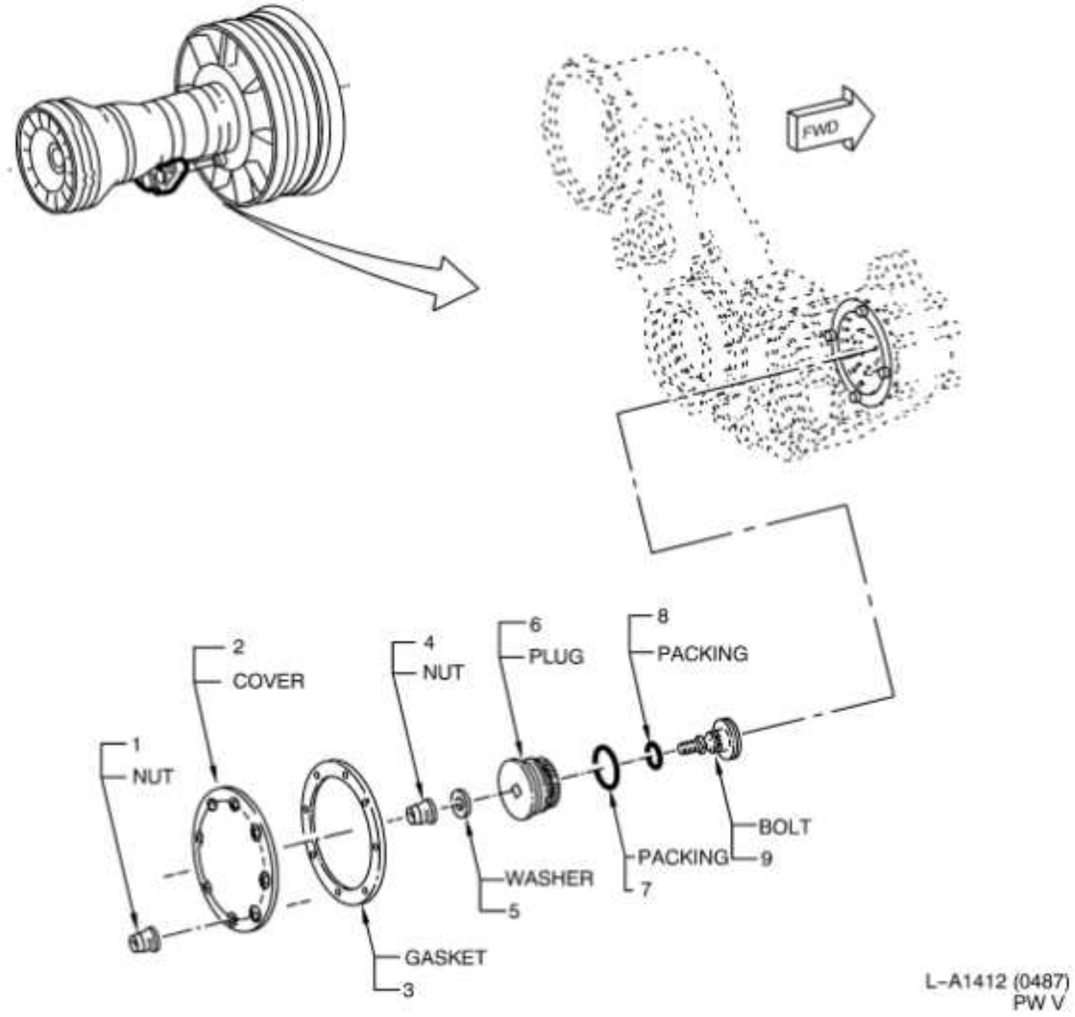
Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Gasket	1	72-61-00	17	60
Packing	1	72-61-00	17	1
Packing	1	72-61-00	17	30

B. Procedure
See Figure 401.

(1) For those engines not utilizing a rear hydraulic pump, install the rear hydraulic pump drive bolt, plug and cover.
  - (a) Install packing (401/8), lubricated with Engine Oil (P03-001), in groove of bolt (401/9), lubricated with Engine Oil (P03-001), nearest bolt head. Install bolt and packing assembly in rear hydraulic pump drive gearshaft, seating bolthead in groove in gearshaft internal splines.
  - (b) Install packing (401/7), lubricated with Engine Oil (P03-001), in groove of plug (401/6), lubricated with Engine Oil (P03-001). Install plug over bolt, plugging gearshaft opening.
  - (c) Install washer (401/5) and nut (401/4), lubricated with Engine Oil (P03-001), over bolt. Torque nut to 36 - 40 lb-in. (4.067 - 4.519 N.m).
  - (d) Install gasket (401/3) and cover (401/2) over studs on drive pad. Secure with four hydraulic pump nuts (401/1) lubricated with Engine Oil (P03-001). Torque nuts to 275 - 300 lb-in. (31.071 - 33.895 N.m).


FWD
2
COVER
4
NUT
6
PLUG
8
PACKING
1
NUT
BOLT
PACKING
9
WASHER
7
5
GASKET
3
L−A1412 (0487)
PW V

Rear Hydraulic Pump Drive Plug,
Bolt And Cover Installation
Figure 401
(Task 72−00−61−430−012)

Task 72-00-61-430-013:

1. Install Front Hydraulic Pump Drive Gearshaft Plug And Bolt

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Gasket	1	72-61-00	17	60
Packing	1	72-61-00	17	1
Packing	1	72-61-00	17	30

B. Procedure

See Figure 401.

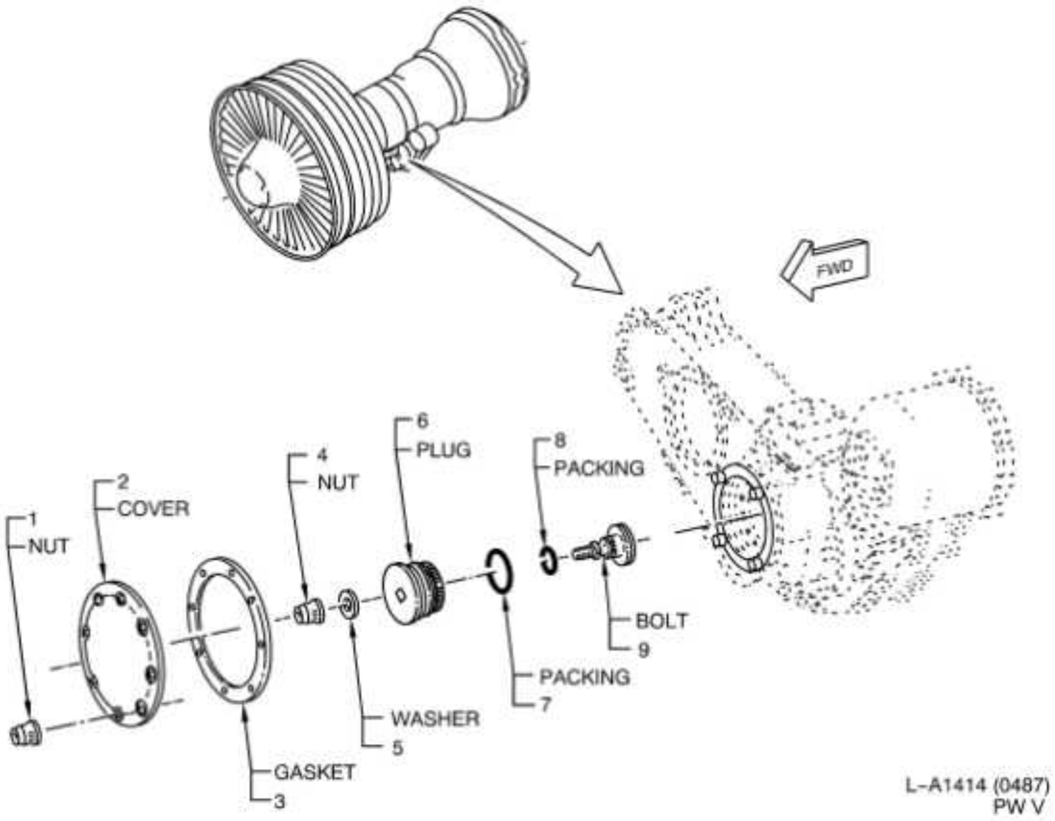
(1) For those engines not utilizing a front hydraulic pump, install the front hydraulic pump drive bolt, plug and cover.

  (a) Install packing (401/8), lubricated with Engine Oil (P03-001), in groove of bolt (401/9), lubricated with Engine Oil (P03-001), nearest bolt head. Install bolt and packing assembly in front hydraulic pump drive gearshaft, seating bolthead in groove in gearshaft internal splines.

  (b) Install packing (401/7), lubricated with Engine Oil (P03-001), in groove of plug (401/6), lubricated with Engine Oil (P03-001). Install plug over bolt, plugging gearshaft opening.

  (c) Install washer (401/5) and nut (401/4), lubricated with Engine Oil (P03-001), over bolt. Torque nut to 36 - 40 lb-in. (4.067 - 4.519 N.m).

  (d) Install gasket (401/3) and cover (401/2) over studs on drive pad. Secure with four hydraulic pump nuts (401/1) lubricated with Engine Oil (P03-001). Torque nuts to 275 - 300 lb-in. (31.071 - 33.895 N.m).


FWD
1
NUT
2
COVER
3
GASKET
4
NUT
5
WASHER
6
PLUG
7
PACKING
8
PACKING
9
BOLT
L−A1414 (0487)
PW V

Front Hydraulic Pump Drive Plug,
Bolt And Cover Installation
Figure 401
(Task 72−00−61−430−013)

Task 72-00-61-460-001:

1. Install Fuel Pump Filter

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-005	Lint Free Cotton Cloth
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
R	P05-292	Ferrule, Safety Cable (Optional)
R R	P06-053	Lubricant, Sealing Ring (PWA 36500)
	P11-004	Solvent, Cleaning (PMC 9010)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Fuel Filter Element	1	73-12-00/2/10
Packing	1	73-12-00/2/20
Packing, (TRW)	1	73-12-00/2/60

B. Procedure
See Figure 401.

CAUTION: REPLACE THE USED FUEL FILTER ELEMENT WITH A NEW FUEL FILTER ELEMENT. DO NOT CLEAN OR USE THE SAME FUEL FILTER ELEMENT AGAIN. INSTALL THE CORRECT FUEL FILTER ELEMENT FOR THE ENGINE MODEL. LOOK AT THE ELEMENT TO FIND THE PART NUMBER AND ENGINE MODEL MARKS. IF THE ELEMENT IS INCORRECT FOR THE ENGINE MODEL, THIS CAN CAUSE CONTAMINATION OF THE FUEL SYSTEM AND UNSATISFACTORY ENGINE OPERATION.

(1) Remove protection covers and clean the cover and filter cavity with a lint free Cotton Cloth P05-005. Examine the heli-coil insert(s). If the insert(s) are not recessed in the housing, you must replace the pump.

CAUTION: IT IS POSSIBLE THAT THE OLD GASKETS FROM THE REMOVED FILTER ELEMENT CAN BE STUCK INSIDE THE FUEL FILTER HOUSING CAVITY OR COVER. BE SURE YOU EXAMINE THE FILTER CAVITY AND COVER. REMOVE THE OLD FILTER GASKETS FROM THE CAVITY AND COVER IF NECESSARY OR DAMAGE TO THE ENGINE CAN RESULT.

(2) Examine the filter housing cavity and the filter cover. Be sure that the old gaskets from the removed filter element are not stuck in the cavity or the cover. Remove the old gaskets if necessary.

R (3) Install a new packing, lubricated with Engine Oil
R P03-001 or Sealing Ring Lubricant P06-053 to the cover.

CAUTION: YOU MUST ADHERE (KEEP) TO THE FOLLOWING TORQUING PROCEDURE TO PREVENT DAMAGE TO THE PACKING AND HELI-COIL INSERTS, AND THE FILTER COVER FROM COCKING (NOT ALIGNED). BE SURE YOU TIGHTEN THE COVER NUTS EVENLY. MONITOR THE COVER INSTALLATION AND BE SURE THE COVER ENGAGES THE HOUSING EVENLY AND FREELY. DO NOT OVERTORQUE THE NUTS OR BOLT.

(4) For fuel pumps with the five cover bolts, washers, and no nuts (Pre SB PW4ENG 73-75), install the filter as follows.

(a) Do not use any lubricant on the threads of bolts. Clean the threads of bolts with a Cleaning Solvent P11-004 and dry before installation of bolts. Install the new filter element onto the filter cover and then into the fuel pump cavity. Attach with the bolts (dry), and washers. Engage evenly the filter cover by tightening evenly the bolts, and monitor the 'Run On' torque required to turn each bolt through the inserts before the last torque. Torque the bolts to 150 - 170 lb-in. (16.948 - 19.207 N.m) plus the torque required to turn the bolts through the heli-coil inserts. If you must replace the coil inserts, but the inserts are not available, you can use alternate bolts (and lockwire) that are in the Illustrated Parts List of the Component Maintenance Manual. Tighten the filter cover by tightening the alternate bolts using the above torquing procedure. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to the bolts.

(5) For fuel pumps with the four nuts, washers, dee-bolts, and the torque-limiting bolt (Post SB PW4ENG 73-75) and (Pre SB PW4ENG 73-104), install the filter as follows.

CAUTION: BE SURE YOU TIGHTEN THE COVER NUTS EVENLY. DO NOT USE THE TORQUE-LIMITING BOLT TO ENGAGE THE COVER TO THE HOUSING. MONITOR THE COVER INSTALLATION AND BE SURE THE COVER ENGAGES THE HOUSING EVENLY AND FREELY. DO NOT OVERTORQUE THE NUTS OR BOLT.

(a) Do not use any lubricant on the threads of bolts. Clean the threads of the bolts with a Cleaning Solvent P11-004 and dry before installation of bolts. Install the new filter element onto the filter cover and then into the fuel pump cavity. Attach with the four dee-bolts, washers, and nuts. Install the torque-limiting bolt and washer. Do not use the torque-limiting bolt to engage the cover to the pump. Engage evenly the filter cover by tightening evenly the nuts. Monitor the 'Run On' torque needed to turn the nuts through the self-locking feature. After the cover is completely engaged, loosen and torque the four nuts (one at a time) to 150 - 170 lb-in. (16.948 - 19.207 N.m) plus the 'Run On' torque. Tighten and torque the torque-limiting bolt to 150 - 170 lb-in. (16.948 - 19.207 N.m) plus the 'Run On' torque.

(6) For fuel pumps with the five nuts, washers, and the four dee-bolts (Post SB PW4ENG 73-104), install the filter as follows.

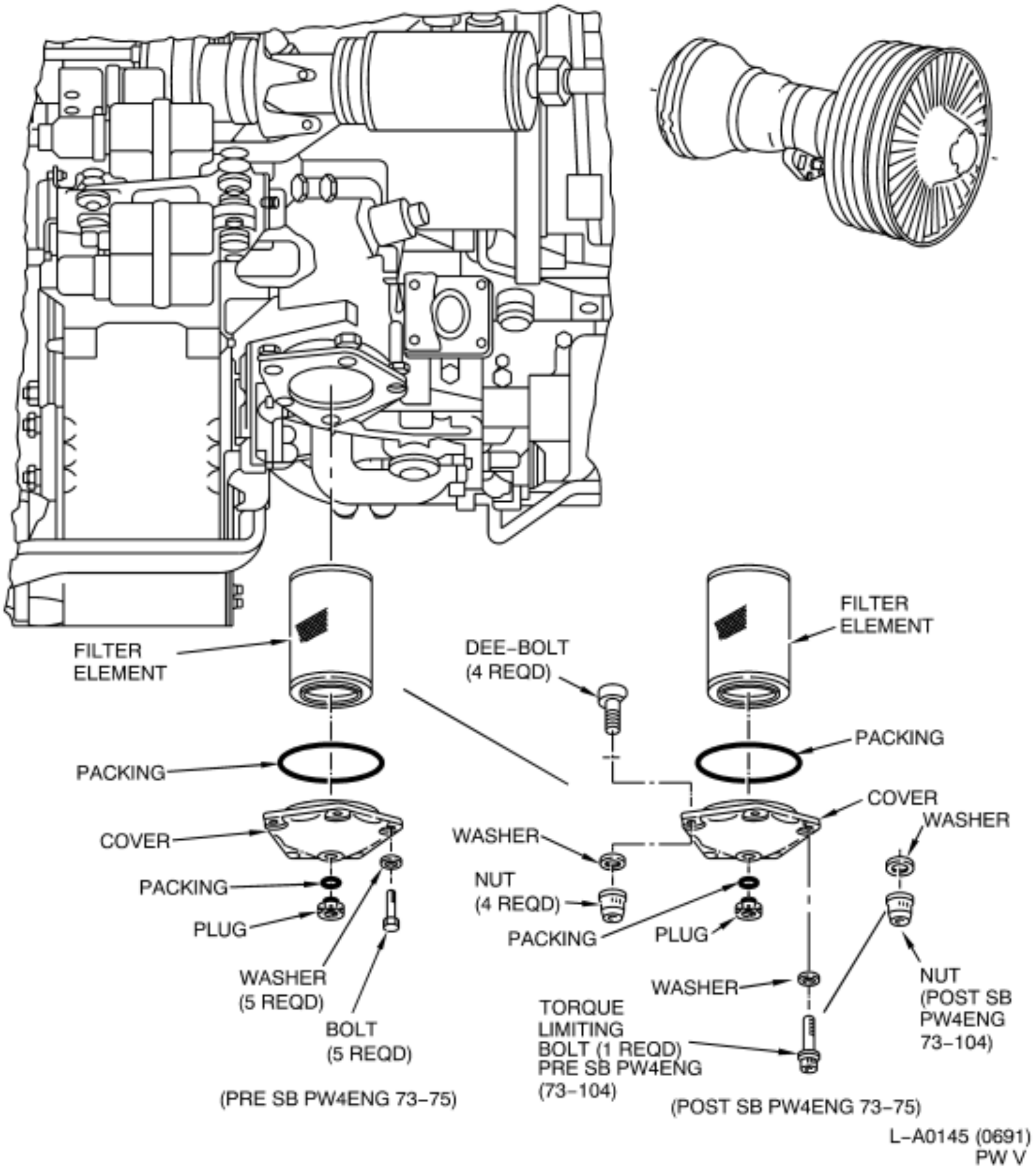
CAUTION: BE SURE YOU TIGHTEN THE COVER NUTS EVENLY TO ENGAGE THE COVER TO THE HOUSING. MONITOR THE COVER INSTALLATION AND BE SURE THE COVER ENGAGES THE HOUSING EVENLY AND FREELY. DO NOT OVERTORQUE THE NUTS.

(a) Do not use any lubricant on the threads of bolts. Clean the threads of the bolts with a Cleaning Solvent P11-004 and dry before installation of bolts. Install the new filter element onto the filter cover and then into the fuel pump cavity. Attach with the four dee-bolts, washers, and nuts. Engage evenly the filter cover by tightening evenly the nuts. Monitor the 'Run On' torque needed to turn the nuts through the self-locking feature. After the cover is completely engaged, loosen and torque the five nuts (one at a time) to 150 - 170 lb-in. (16.948 - 19.207 N.m) plus the 'Run On' torque.

R (7) Install a packing, lubricated with Engine Oil P03-001
R or Sealing Ring Lubricant P06-053 to the plug. Install plug, threads lubricated with Engine Oil P03-001, to center opening on filter cover. Torque plug to 45 - 55 lb-in. (5.084 - 6.214 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 the plug.

C. Postrequisites

(1) Test engine per Test Reference Table. See 71-00-00, Testing-00 Task 71-00-00-990-003.


FILTER ELEMENT
DEE−BOLT (4 REQD)
FILTER ELEMENT
PACKING
PACKING
COVER
COVER
WASHER
WASHER
PACKING
NUT (4 REQD)
PLUG
PACKING
PLUG
WASHER (5 REQD)
BOLT (5 REQD)
WASHER
TORQUE LIMITING BOLT (1 REQD) PRE SB PW4ENG (73−104)
NUT (POST SB PW4ENG 73−104)
(PRE SB PW4ENG 73−75)
(POST SB PW4ENG 73−75)
L−A0145 (0691)
PW V

Fuel Pump Filter
Figure 401
(Task 72−00−61−460−001)

Task 72-00-61-450-009:

1. Install Fuel Pump Filter Differential Pressure Switch

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
R P06-053	Lubricant, Sealing Ring (PWA 36500) R

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	2	73-34-00/1/1

B. Procedure

See Figure 401.

(1) Remove protective closures.

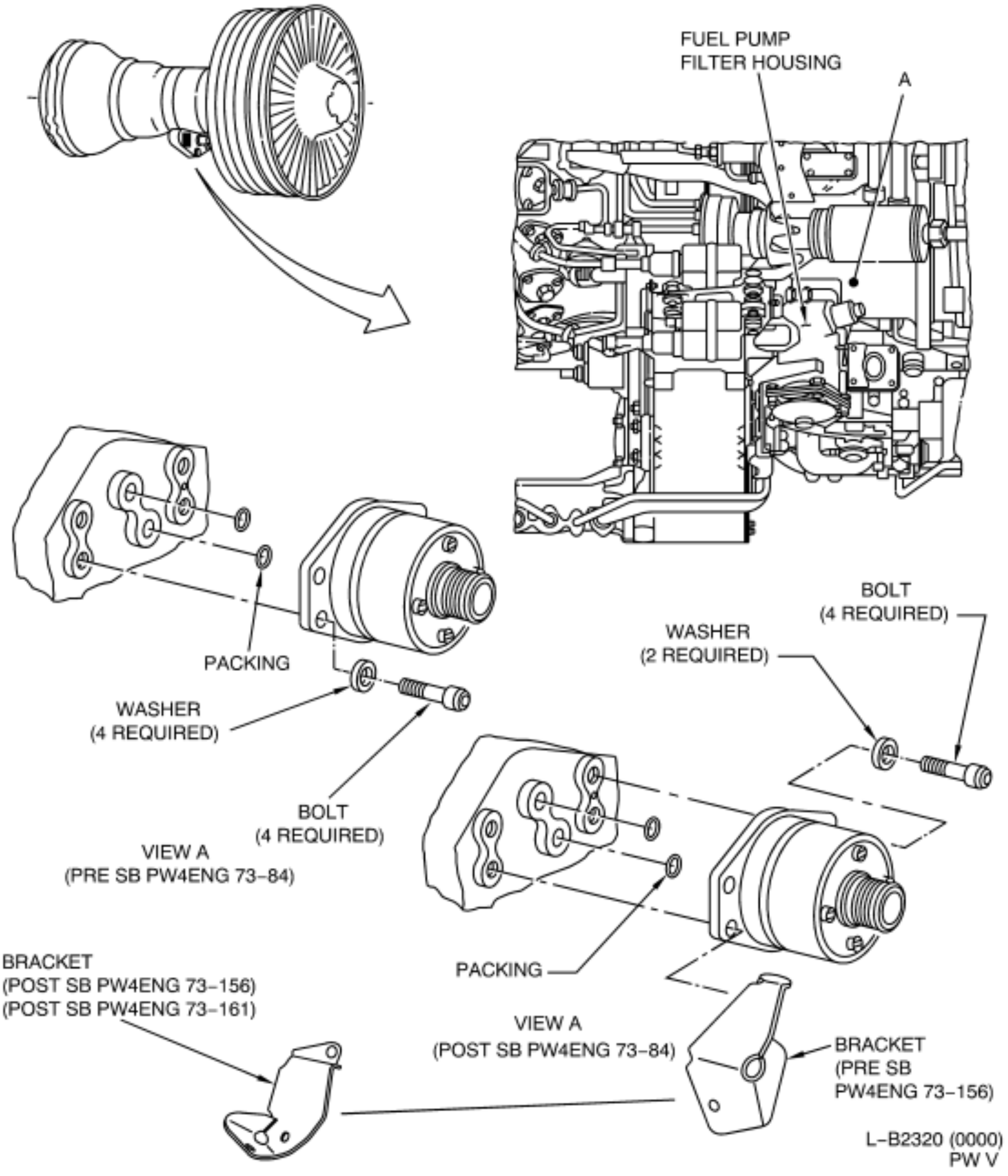
R (2) Use the two new packings lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053. Position the differential pressure switch on the fuel pump and align the dowel pin. R R R

(3) Secure switch and bracket for (Post SB PW4ENG 73-84 engine only) with bolts, threads lubricated with Engine Oil P03-001, and washers. Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(4) Connect electrical connector. Tighten handtight.

C. Postrequisites

(1) Test engine per Test Reference Table. See 71-00-00, Testing-00 Task 71-00-00-990-003.


FUEL PUMP
FILTER HOUSING
A
BOLT
(4 REQUIRED)
WASHER
(2 REQUIRED)
PACKING
WASHER
(4 REQUIRED)
BOLT
(4 REQUIRED)
VIEW A
(PRE SB PW4ENG 73−84)
BRACKET
(POST SB PW4ENG 73−156)
(POST SB PW4ENG 73−161)
PACKING
VIEW A
(POST SB PW4ENG 73−84)
BRACKET
(PRE SB
PW4ENG 73−156)
L−B2320 (0000)
PW V

Fuel Pump Filter Differential Pressure Switch
Figure 401
(Task 72−00−61−450−009)

Task 72-00-61-450-010:

1. Install EEC Fuel Temperature Thermocouple Probe

A. Equipment And Materials Necessary

Standard Tools:

Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
R	P05-292	Ferrule, Safety Cable (Optional)
R	P06-053	Lubricant, Sealing Ring (PWA 36500)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	73-23-00/4/1

B. Procedure
See Figure 401 and Figure 402.

(1) Remove protective closure.

(2) For thermocouple probe with a keyway type receptacle (Pre SB PW4ENG 73-84). Install probe as follows:

R (a) Install a packing lubricated with Engine Oil
R P03-001 or Sealing Ring Lubricant P06-053 to the
R EEC fuel temperature thermocouple probe.

(b) Lubricate threads of probe with Engine Oil P03-001, and install probe to boss on upper end of fuel pump filter housing. Torque probe to 110 - 120 lb-in. (12.428 - 13.558 N.m). Lockwire probe.

(c) Connect the W5P8 harness connector to the probe harness receptacle as follows.

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary,
R carefully make straight all the bent pins. If
R necessary, clean the connector and receptacle
R by SPOP 6 (Task 70-21-00-110-900). Refer to
R Section 70-21-00 in the Standard Practices
R Manual, PN 585005.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG-70 Strap Wrench or the Glenair TG-69 Soft-Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(3) (Post SB PW4ENG 73-84), Install the EEC fuel temperature thermocouple probe and wiring harness connector as follows.

R (a) Install a packing lubricated with Engine Oil
R P03-001 or Sealing Ring Lubricant P06-053 to the
R adapter.

(b) (Reference 2166) remove protection covers and install the concave end of the adapter into the port of the housing. Torque the adapter to 95 - 100 lb-in. (10.734 - 11.298 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 from the adapter to the housing.

(c) Lubricate the threads of the thermocouple probe with Engine Oil P03-001, and install the probe into the adapter in the fuel pump filter housing.

(d) Turn the thermocouple probe to align the thermocouple studs with the terminal on the wiring harness.

NOTE: Do not install the clamp, ground strap, and bolt to the bracket on the housing at this time.

CAUTION: DO NOT LUBRICATE THREADS ON THERMOCOUPLE WIRING HARNESS CONNECTIONS (TERMINAL STUDS). LUBRICATION OF THREADS ON THE THERMOCOUPLE COULD CAUSE MALFUNCTION OF THE THERMOCOUPLE.

(e) Install the wiring harness terminals to the thermocouple studs and install loosely the nuts to the thermocouple studs.

(f) Install the clamp, ground strap, and bolt loosely to the bracket on the housing.

CAUTION: TO PREVENT DAMAGE TO THE WIRING HARNESS, MAKE SURE THE THERMOCOUPLE STUD BOX DOES NOT TURN WHEN THE COUPLING NUT IS TORQUED

(g) (Reference 2167) Hold the thermocouple stud box and torque the thermocouple probe coupling nut to 95 - 100 lb-in. (10.734 - 11.298 N.m). Do not let the thermocouple studs turn.

CAUTION: DO NOT ALIGN THE THERMOCOUPLE STUD BOX AFTER THE COUPLING NUT IS TORQUED. HOLD THE THERMOCOUPLE STUD BOX AND LOOSEN THE COUPLING NUT AND ALIGN THE THERMOCOUPLE STUD BOX AGAIN.

(h) Make sure the thermocouple stud box is aligned. Do not put too much force on the terminals of the wiring harness.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(i) (Reference 2273) Torque the alumel nuts (larger terminal studs) to 18 − 22 lb−in. (2.034 − 2.486 N.m).

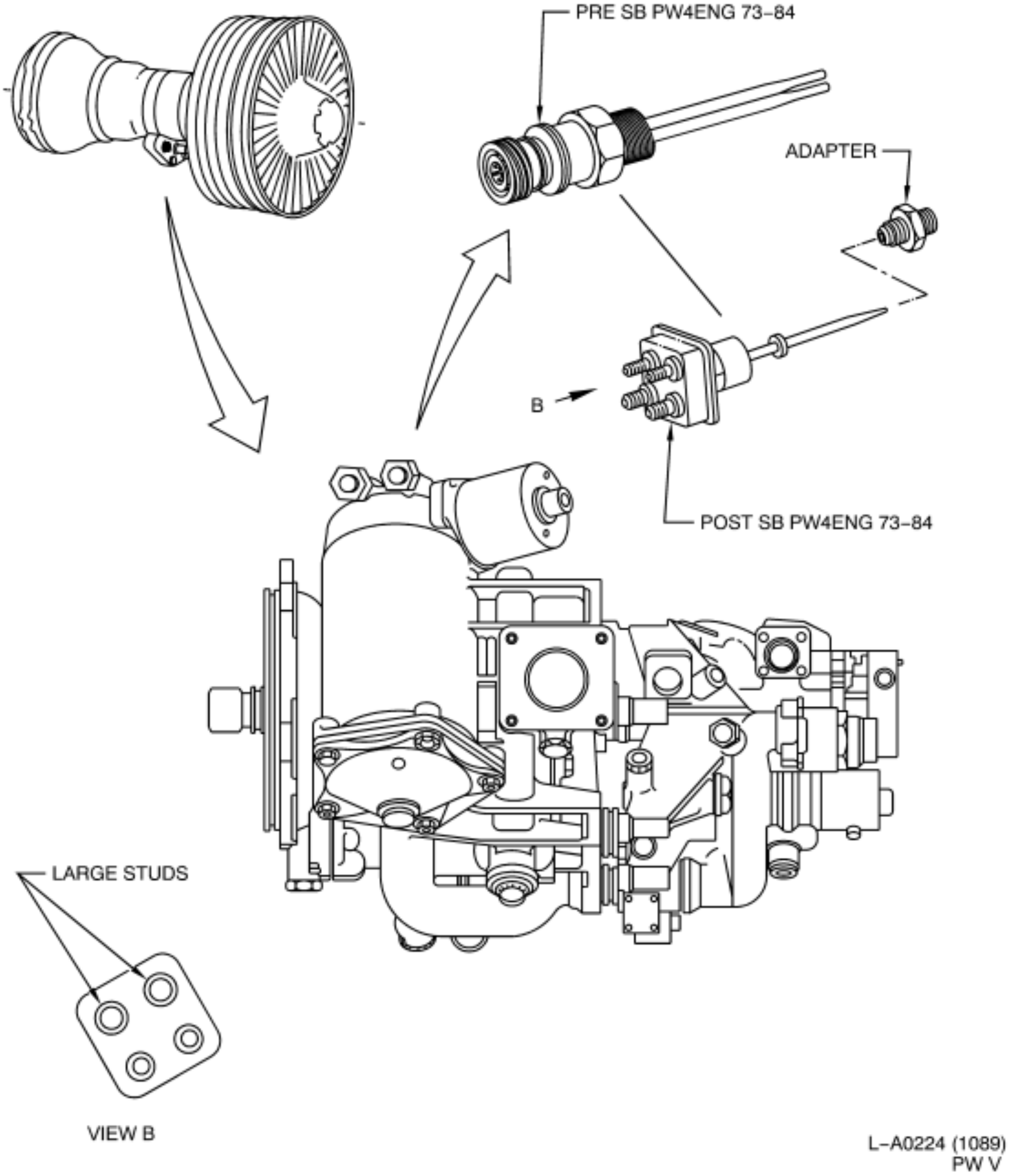
(j) (Reference 2273) Torque the chromel nuts (smaller terminal studs) to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(k) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 from the coupling nut to the adapter.

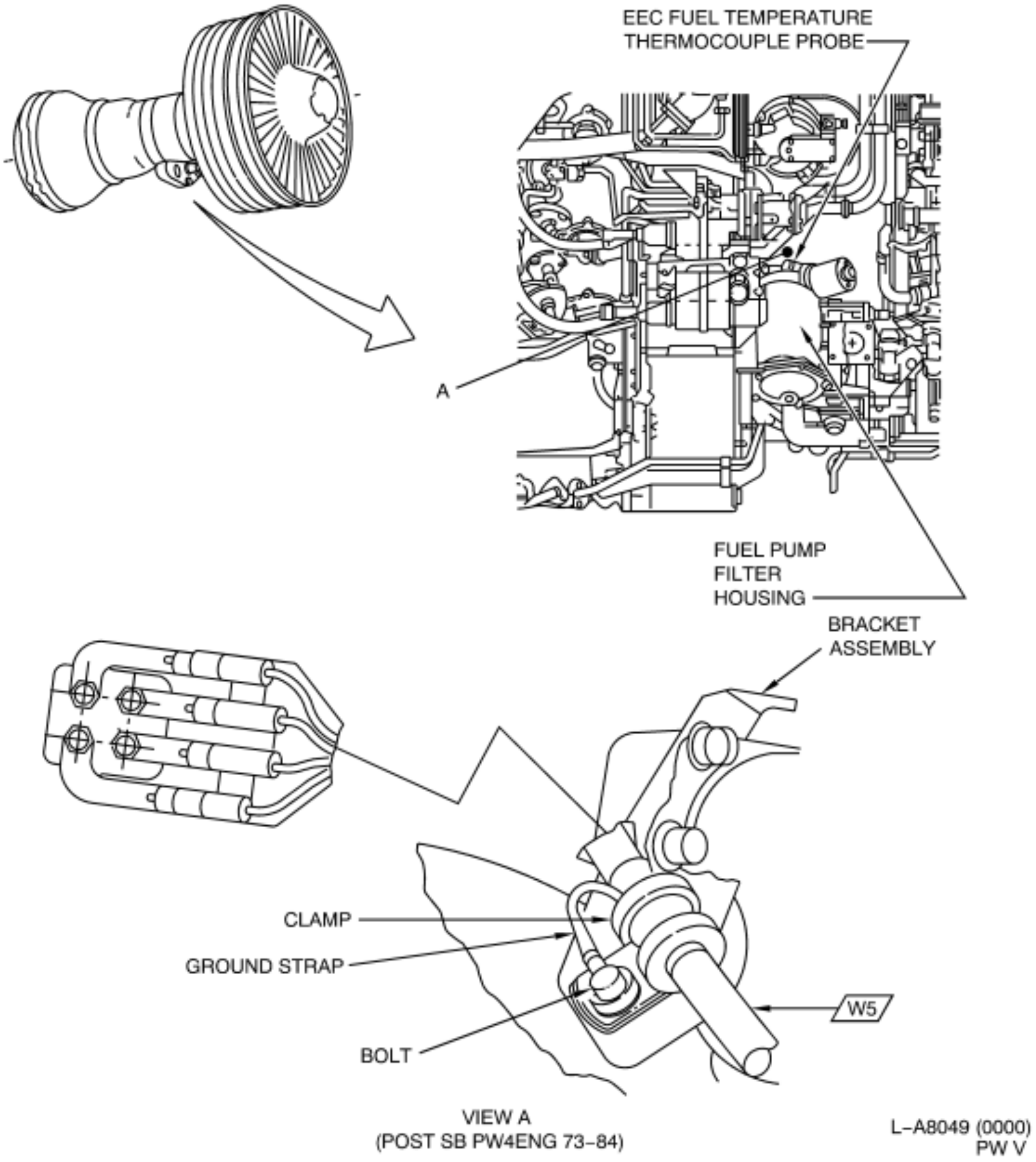
(l) Torque the bolt that attaches the clamp and ground strap to the bracket on the housing to 36 − 40 lb−in. (4.067 − 4.519 N.m).

C. Postrequisites

(1) Test engine per Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).


PRE SB PW4ENG 73−84
ADAPTER
B
POST SB PW4ENG 73−84
LARGE STUDS
VIEW B
L−A0224 (1089)
PW V

EEC Fuel Temperature Thermocouple Probe
Figure 401
(Task 72−00−61−450−010)


EEC FUEL TEMPERATURE THERMOCOUPLE PROBE
A
FUEL PUMP FILTER HOUSING
BRACKET ASSEMBLY
CLAMP
GROUND STRAP
W5
BOLT
VIEW A
(POST SB PW4ENG 73−84)
L−A8049 (0000)
PW V

Wiring Harness for EEC Fuel Temperature Studded Thermocouple Probe
Figure 402
(Task 72−00−61−450−010)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-61-450-011:

1. Install EEC Oil Temperature Thermocouple Probe

A. Equipment And Materials Necessary

Standard Tools:

Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
R	P05-292	Ferrule, Safety Cable (Optional)
R	P06-053	Lubricant, Sealing Ring (PWA 36500)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	73-23-00/4/10

B. Procedure
See Figure 401 and Figure 402.

(1) Remove protective closure.

(2) For thermocouple probe with a keyway type receptacle (Pre SB PW4ENG 73-84). Install probe as follows:

R (a) Install a packing lubricated with Engine Oil
R P03-001 or Sealing Ring Lubricant P06-053 to the
R EEC oil temperature thermocouple probe.

(b) Lubricate threads of probe with Engine Oil P03-001, and install probe to boss located on lower, left side of main gearbox front face. Torque probe to 110 - 120 lb-in. (12.428 - 13.558 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 the probe.

(c) Connect the W3P18 harness connector to the probe harness receptacle as follows:

1 Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary,
R carefully make straight all the bent pins. If
R necessary, clean the connector and receptacle
R by SPOP 6 (Task 70−21−00−110−900). Refer to
R Section 70−21−00 in the Standard Practices
R Manual, PN 585005.

2 Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

3 Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(3) (Post SB PW4ENG 73-84), Install the EEC oil temperature thermocouple probe and wiring harness connector as follows.

R (a) Install a packing lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the adapter.

(b) (Reference 571) remove protection covers and install the concave end of the adapter into the port of the gearbox housing. Torque the adapter to 95 - 100 lb-in. (10.734 - 11.298 N.m). Install lockwire from the adapter to the housing.

(c) Lubricate the threads of the thermocouple probe with Engine Oil P03-001, and install the probe into the adapter in the gearbox housing.

(d) Turn the thermocouple probe to align the thermocouple studs with the terminal on the wiring harness.

NOTE: Do not install the clamp, ground strap, and bolt to the main gearbox pressure tube (LP12) at this time.

(e) Install the wiring harness terminals to the thermocouple studs and install loosely the nuts to the thermocouple studs.

(f) Install the clamp, ground strap, and bolt loosely to the main gearbox pressure tube (LP12).

CAUTION: TO PREVENT DAMAGE TO THE WIRING HARNESS, MAKE SURE THE THERMOCOUPLE STUD BOX DOES NOT TURN WHEN THE COUPLING NUT IS TORQUED.

(g) (Reference 572) Hold the thermocouple stud box and torque the thermocouple probe coupling nut to 95 - 100 lb-in. (10.734 - 11.298 N.m). Do not let the thermocouple studs turn.

CAUTION: DO NOT ALIGN THE THERMOCOUPLE STUD BOX AFTER THE COUPLING NUT IS TORQUED. HOLD THE THERMOCOUPLE STUD BOX AND LOOSEN THE COUPLING NUT AND ALIGN THE THERMOCOUPLE STUD BOX AGAIN.

(h) Make sure the thermocouple stud box is aligned. Do not put too much force on the terminals of the wiring harness.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(i) (Reference 2273) Torque the alumel nuts (larger terminal studs) to 18 - 22 lb-in. (2.034 - 2.486 N.m).

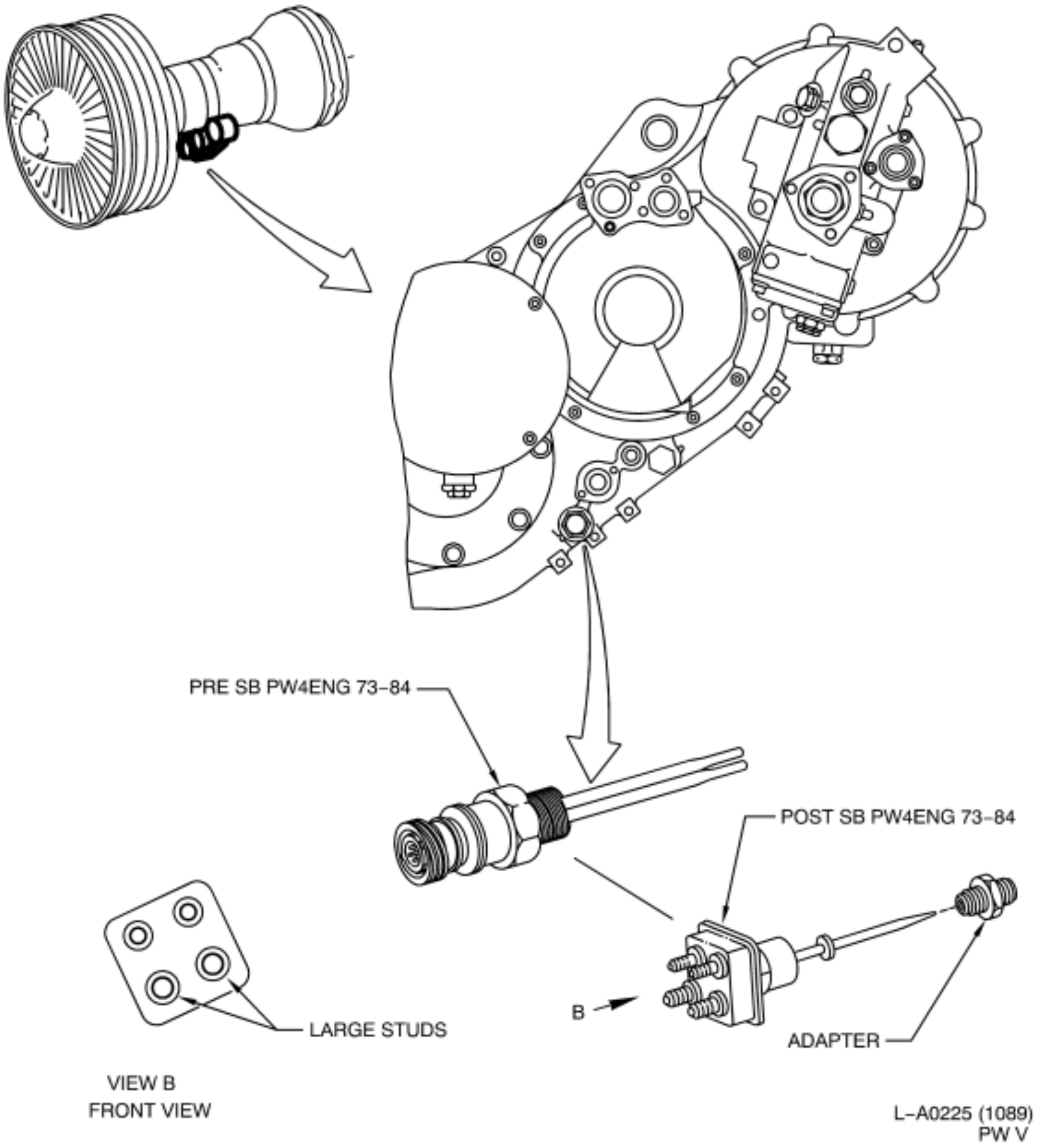
(j) (Reference 2273) Torque the chromel nuts (smaller terminal studs) to 15 - 18 lb-in. (1.695 - 2.034 N.m).

(k) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 from the coupling nut to the adapter.

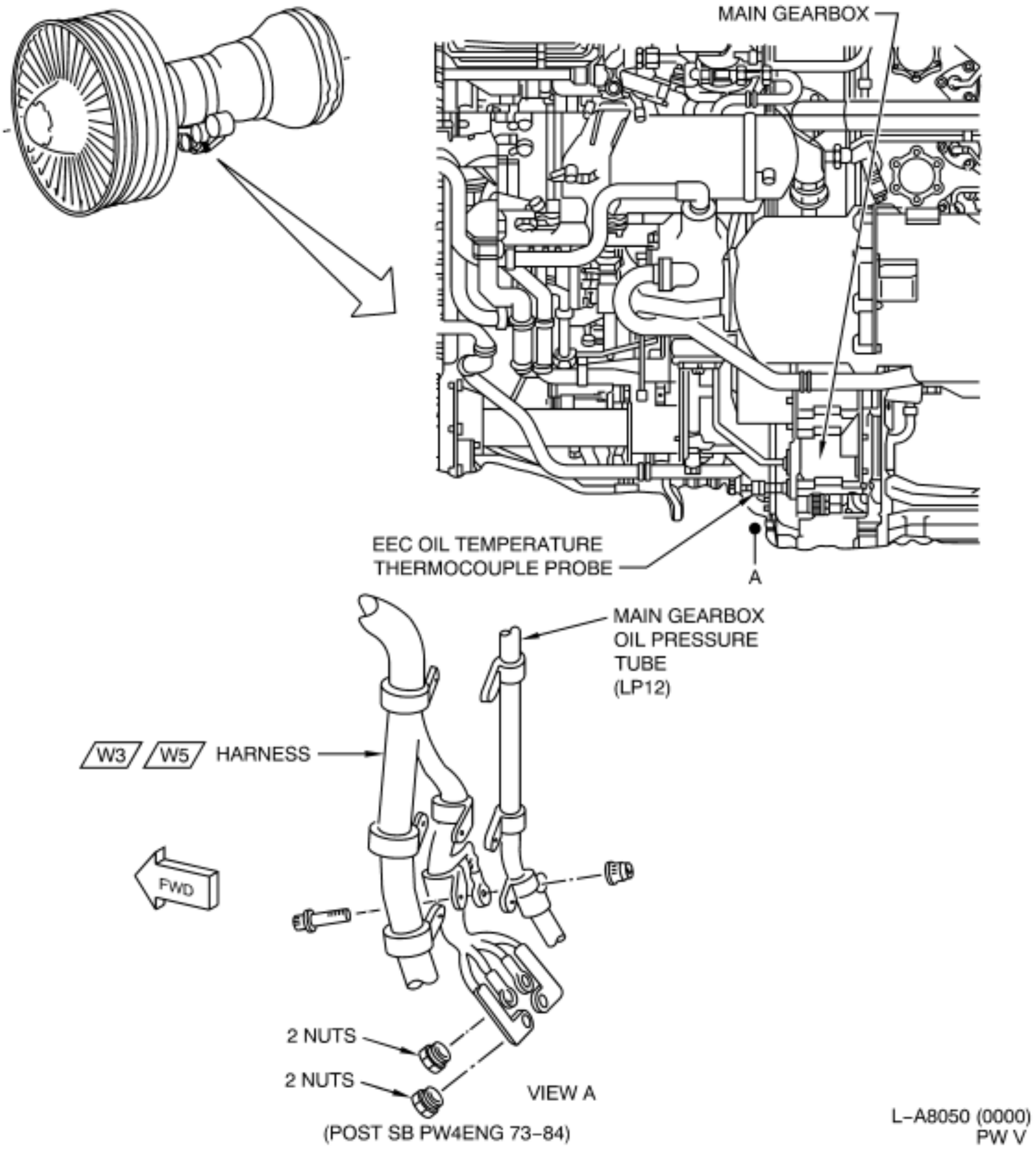
(l) Torque the bolt that attachs the clamp and ground strap to the main gearbox pressure tube to 36 - 40 lb-in. (4.067 - 4.519 N.m).

C. Postrequisites

(1) Test engine per Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).


PRE SB PW4ENG 73−84
POST SB PW4ENG 73−84
LARGE STUDS
B
ADAPTER
VIEW B
FRONT VIEW
L−A0225 (1089)
PW V

EEC Oil Temperature Thermocouple Probe
Figure 401
(Task 72−00−61−450−011)


MAIN GEARBOX
EEC OIL TEMPERATURE THERMOCOUPLE PROBE
A
MAIN GEARBOX OIL PRESSURE TUBE (LP12)
W3
W5
HARNESS
FWD
2 NUTS
2 NUTS
VIEW A
(POST SB PW4ENG 73−84)
L−A8050 (0000)
PW V

EEC Oil Temperature Thermocouple Probe − Studded Terminals
Figure 402
(Task 72−00−61−450−011)

Task 72-00-61-450-012:

1. Install The Lube Oil Tank Assembly

A. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72-61-00/15/1
Packing	1	72-61-00/15/30
Packing	1	79-11-00/1/20
Packing	1	79-11-00/1/40
*Packing	1	79-11-00/2/100
*Packing	1	79-11-00/2/105A
*Packing	1	79-11-00/3/10
*Packing	1	79-11-00/4/1
*Packing	1	79-11-00/4/60
*Packing	1	79-11-00/4/80

*NOTE: These parts are not necessary if you install the same tank you removed.

B. Procedure

(1) Remove the covers that protect the oil tank holes.

(2) If not installed, install the oil tank cap (401/1) and related parts. This procedure is for an oil tank without a remote filler or (Post SB PW4ENG 79-47). See Figure 401.

(a) Align the oil tank sump (401/7) on the oil tank boss.

(b) Install the filler neck valve (401/5):

1 Look under the valve of the filler neck valve. If there is no packing (401/8) there, install one that is lubricated with Engine Oil P03−001.

2 Apply Engine Oil P03−001 to a packing (401/6) and the threads of six bolts (401/4).

3 Put one of the bolts in the hole of the oil tank cap lanyard (401/3).

4 Attach the filler neck valve and the oil tank sump to the oil tank with the six bolts. Torque the bolts to 32 − 36 lb−in. (3.616 − 4.067 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(c) Install the oil tank cap (401/1):

1 Apply Engine Oil P03−001 to a packing (401/2). Install the packing on the oil tank cap.

2 Put the cap in the filler neck valve. Turn the cap clockwise to CLOSE.

(3) If not installed, install the oil tank cap (402/1) and related parts. This procedure is for an oil tank with a remote filler or (Pre SB PW4ENG 79−47). See Figure 402.

(a) Install the connector (remote filler) (402/9):

1 Apply Engine Oil P03−001 to a packing (402/13) and the the threads of four bolts (402/12).

2 Install the packing on the connector.

3 Attach the connector to the oil tank with the four bolts. Torque the bolts to 32 − 36 lb−in. (3.616 − 4.067 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

4 If applicable, install the plugs (402/11 and 402/15):

a Apply Engine Oil P03−001 to two packings (402/10 and 402/14) and the threads of the two plugs.

b Put the packings on the plugs.

c Install the plugs. Torque plug (402/11) to 200 − 225 lb−in. (22.597 − 25.422 N.m). Torque plug (402/15) to 110 − 120 lb−in. (12.428 − 13.558 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(b) Install the filler neck valve (402/3):

1 Align the oil tank sump (402/8) on the connector.

2 Apply Engine Oil P03−001 to a packing (402/6) and the threads of two bolts (402/7) and four bolts (402/4).

3 Install the packing on the filler neck valve.

4 Put one of the bolts in the hole of the oil tank cap lanyard (402/5).

5 Attach the filler neck valve, oil tank sump, and connector to the oil tank with the two long bolts at Locations C.

6 Attach the filler neck valve and oil tank sump to the connector with the four short bolts and nuts (402/16) at Locations B.

7 Torque the short bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

8 Torque the long bolts to 32 − 36 lb−in. (3.616 − 4.067 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(4) Install the oil tank heat shield (403/1) as follows. See Figure 403.

(a) Align the raised seam of the heat shield with the seam on the oil tank.

(b) Apply Engine Oil P03−001 to the clamp screw.

(c) (Reference 2151) Attach the heat shield with the clamp (403/6). Torque the clamp screw to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(5) Install the packings on the gearbox−oil tank mating parts. See Figure 404.

(a) Apply Engine Oil P03−001 to packings (404/2), (404/3), (404/4), and (404/5).

(b) Install packing (404/4) on the front mating flange of the oil tank.

(c) Install packing (404/2) on the oil tank breather tube.

(d) Install packing (404/5) on the gearbox transfer tube.

(e) Install packing (404/3) on the gearbox oil check valve housing.

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER LUBE OIL TANK. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 79−43.

(6) Install the oil tank on the gearbox. See Figure 403.

(a) Apply Engine Oil P03−001 to the threads of bolts (403/2).

(b) Align the offset boltholes on the oil tank and gearbox.

(c) Attach the bracket (Pre SB PW4ENG 79−48) (403/3), heat shield (403/1), bracket (Post SB PW4ENG 72−491) (403/7) and oil tank with five of the bolts.

(d) Attach the bracket (403/5) with the identification plate with two of the bolts.

(e) Attach the oil tank and ground−strap (403/4) to the gearbox at any position with one of the bolts.

(f) Install the remaining bolts.

CAUTION: MAKE SURE THAT THE TUBES IN THE OIL TANK CORRECTLY ENGAGE THE TUBES FROM THE GEARBOX. INCORRECT ENGAGEMENT OF THE TUBES CAN CAUSE AN IN-FLIGHT SHUTDOWN.

(g) Make sure that the oil tank is correctly installed as follows.

1 Look in the hole at the top of the oil tank.

2 With a mirror, do a check to be sure that the tubes inside the oil tank are engaged with the tubes from the main gearbox. Give special attention to the engagement of the breather tube (404/1) with its mating tube.

(h) Torque the bolts to 180 - 200 lb-in. (20.337 - 22.597 N.m).

(i) Install packing (403/10), lubricated with Engine Oil P03-001, onto the groove in cover (403/9) and install the cover to the flange of the hole at the top of the oil tank.

(j) (Pre SB PW4ENG 79-74) Attach the cover (403/10) to the tank flange with six (6) bolts (403/8) and nuts (403/11). Torque nuts to 30 - 35 lb-in. (3.390 - 3.954 N.m).

(k) (Post SB PW4ENG 79-74) Install the oil tank heat shield bracket (403/12) to the bottom of the flange at the top of the oil tank. Attach the cover (403/9) and bracket (403/12) to the tank flange with six (6) bolts (403/8) and nuts (403/11). Torque nuts to 30 - 35 lb-in. (3.390 - 3.954 N.m).

C. Postrequisites

(1) Install the oil tank magnetic chip detector assembly. Refer to Installation-36 (Task 72-00-61-450-017).

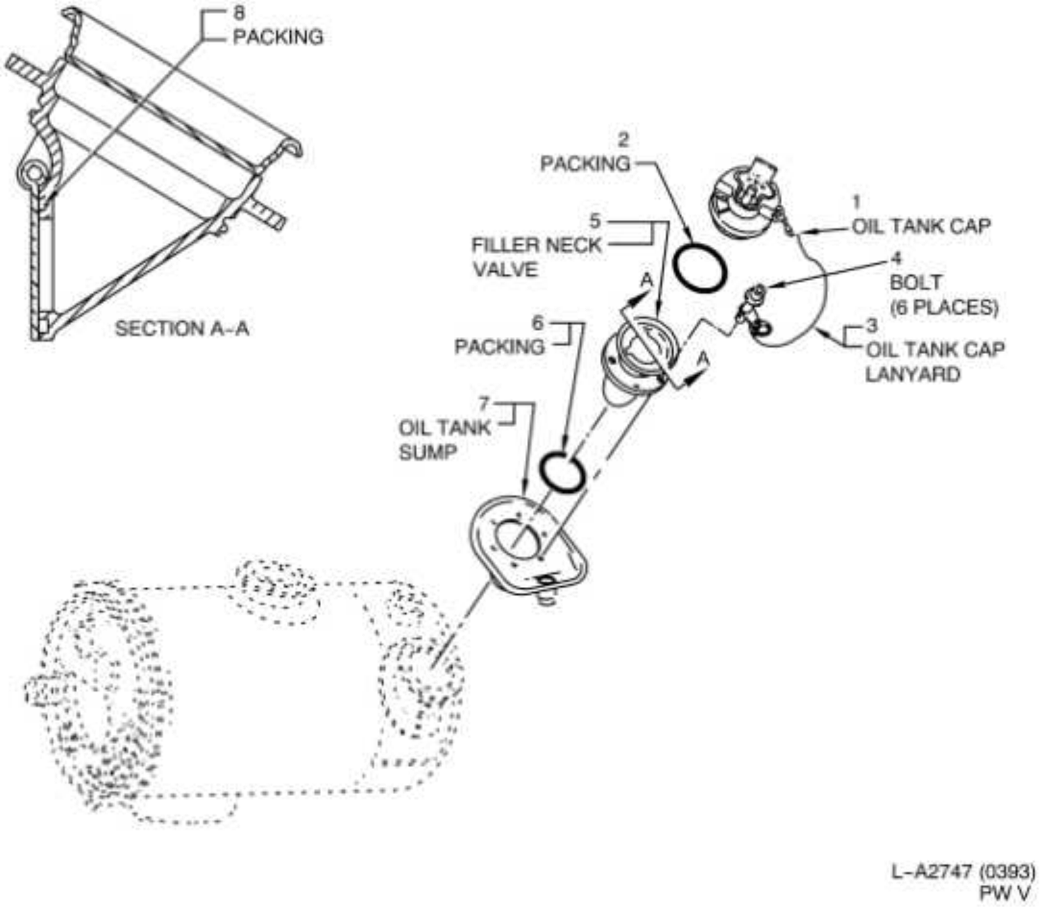
(2) Install the oil tank sight gage. Refer to Installation-31 (Task 72-00-61-450-013).

(3) Install the (lower left) turbine vane cooling air tube (AP03). Refer to 72-00-52, Installation-07 (Task 72-00-52-450-004).

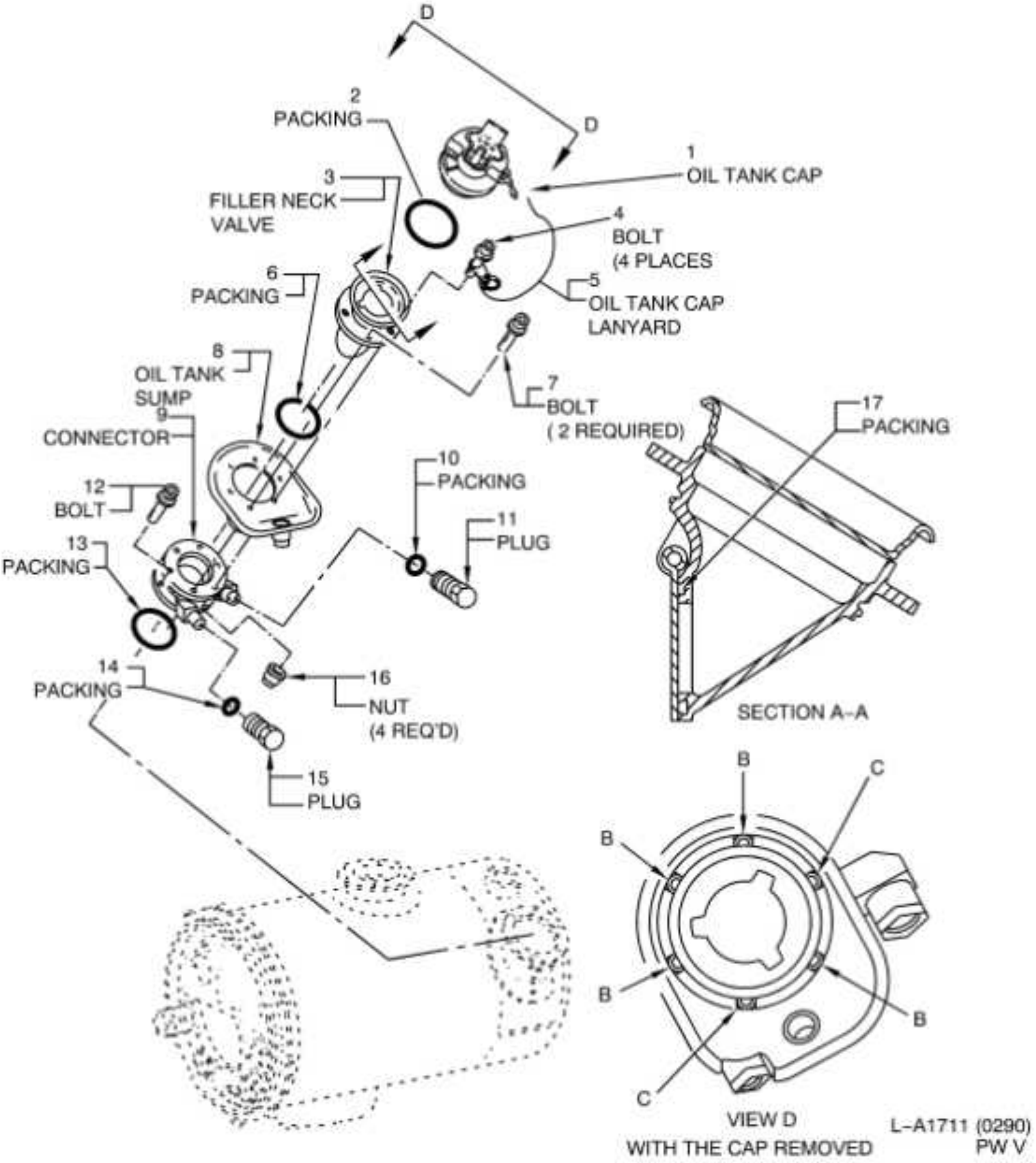
(4) Service the oil system. Refer to 72−00−00, Servicing−03 (Task 72−00−00−610−003).

(5) Test the engine. Use the Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).

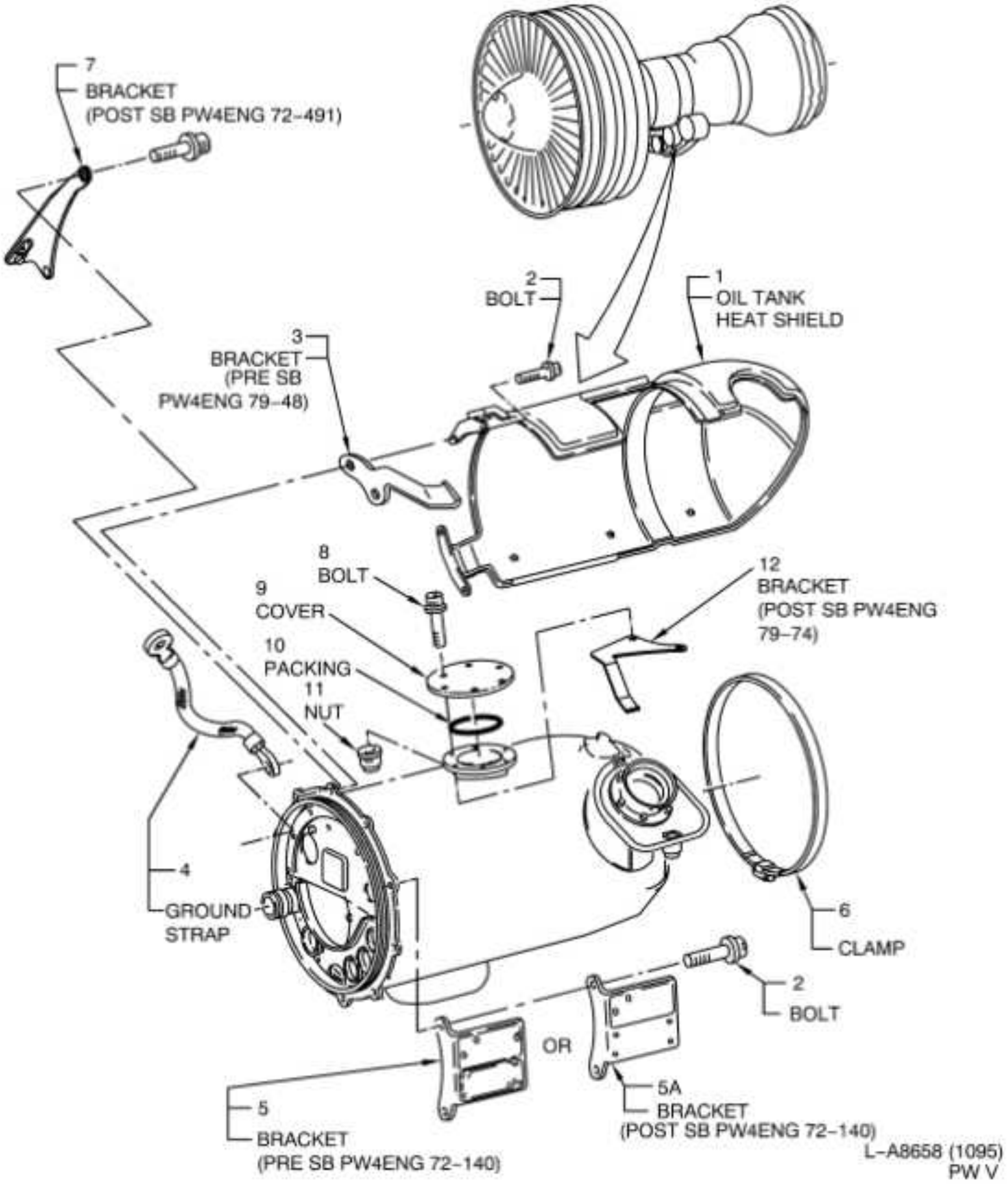
ENGINE GENERAL − MAIN GEARBOX − INSTALLATION−28


8
PACKING
SECTION A-A
2
PACKING
1
OIL TANK CAP
5
FILLER NECK
VALVE
4
BOLT
(6 PLACES)
A
A
6
PACKING
3
OIL TANK CAP
LANYARD
7
OIL TANK
SUMP
L-A2747 (0393)
PW V

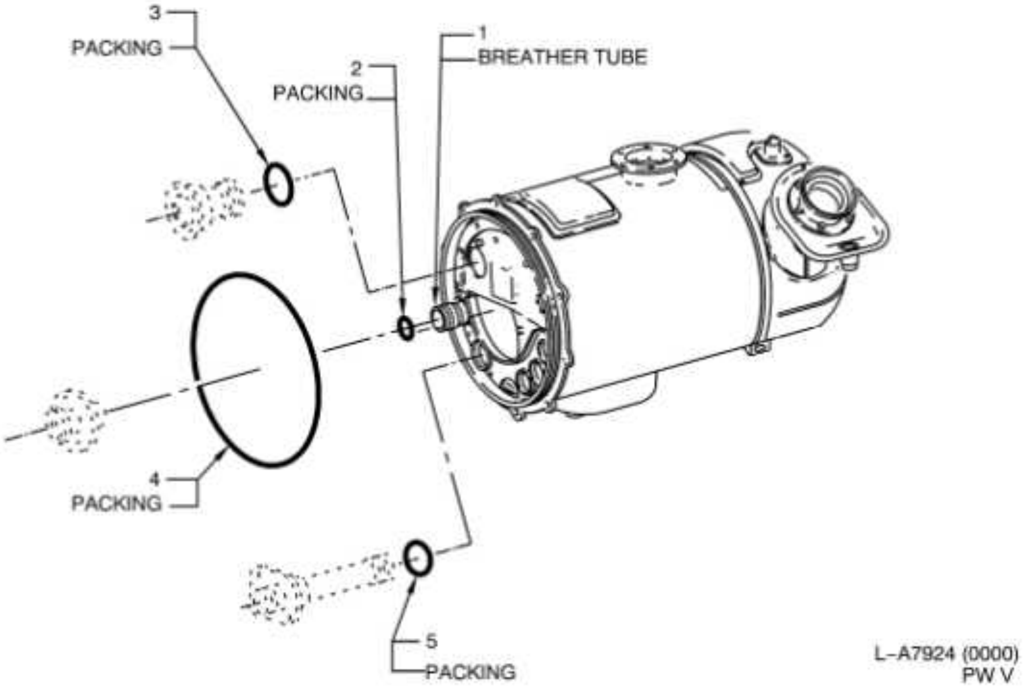
Installation Of The Oil Tank Cap And Related Parts
(Either No Remote Filler Or Post PW4ENG 79−47)
Figure 401
(Task 72−00−61−450−012)


D
D
2
PACKING
3
FILLER NECK
VALVE
1
OIL TANK CAP
4
BOLT
(4 PLACES
6
PACKING
5
OIL TANK CAP
LANYARD
8
OIL TANK
SUMP
7
BOLT
(2 REQUIRED)
9
CONNECTOR
17
PACKING
12
BOLT
10
PACKING
11
PLUG
13
PACKING
14
PACKING
16
NUT
(4 REQ'D)
15
PLUG
SECTION A-A
B
C
B
B
B
C
VIEW D
WITH THE CAP REMOVED
L-A1711 (0290)
PW V

Installation Of The Oil Tank Cap And Related
Parts (Pre SB PW4ENG 79−47, With A Remote Filler)
Figure 402
(Task 72−00−61−450−012)


7
BRACKET
(POST SB PW4ENG 72-491)
2
BOLT
1
OIL TANK
HEAT SHIELD
3
BRACKET
(PRE SB
PW4ENG 79-48)
8
BOLT
9
COVER
10
PACKING
11
NUT
12
BRACKET
(POST SB PW4ENG
79-74)
4
GROUND
STRAP
6
CLAMP
2
BOLT
OR
5A
BRACKET
(POST SB PW4ENG 72-140)
5
BRACKET
(PRE SB PW4ENG 72-140)
L-A8658 (1095)
PW V

Oil Tank − Gearbox Connections
Figure 403
(Task 72−00−61−450−012)


3
PACKING
1
BREATHER TUBE
2
PACKING
4
PACKING
5
PACKING
L−A7924 (0000)
PW V

Oil Tank − Gearbox Packings
Figure 404
(Task 72−00−61−450−012)

Task 72-00-61-430-014:

1. Install Pressure (Regulator) Relief Valve

A. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 Or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
R P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	79-21-00/2/50
Packing	1	79-21-00/2/60
Packing	1	79-21-00/2/80
Packing	1	79-21-00/2/110

B. Procedure

See Figure 401.

(1) Lubricate packings (401/7) and (401/8) with Engine Oil P03-001, and install packings in two grooves on valve housing (401/6).

(2) Install valve housing (401/6) in port on main oil filter housing. Install bracket (401/10) on valve housing. Secure bracket and valve housing to filter housing with three bolts (401/9) lubricated with
R Antiseize Paste P06-054. Wipe off unwanted paste. Torque bolts to 125 - 140 lb-in. (14.123 - 15.818 N.m).

(3) Secure W3 and W5 wiring harnesses to inboard side of bracket with clamp (loop up) (401/5), bolt (head outward) (401/9), lubricated with Engine Oil P03-001 and nut (401/6). Torque bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(4) Install the new packing (401/5), lubricated with Engine Oil P03-001, to the pressure relief valve (401/4).

(5) Install the valve (401/4) to the housing (401/6) with the packing end in first.

(6) Install the new packing (401/2) lubricated with Engine Oil P03-001, to the relief valve plug (401/1).

(7) Install the spring (401/3) to the plug (401/1) and install both into the housing (401/6).

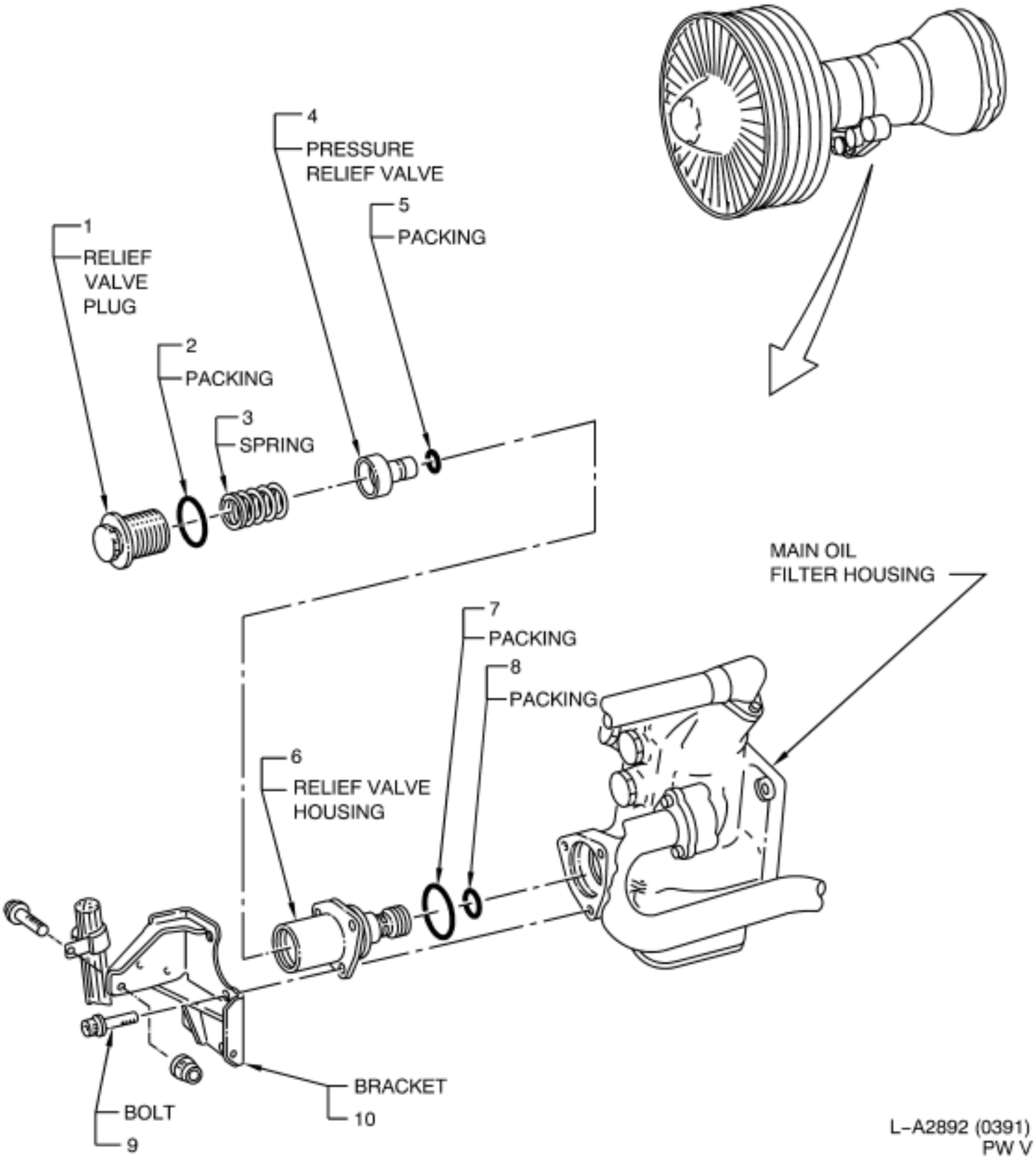
(8) Torque the plug to 650 - 750 lb-in. (73.440 - 84.738 N.m).

(9) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

C. Postrequisites

(1) Service oil system per 72-00-00, Servicing-03 (Task 72-00-00-610-003).

(2) Test engine per Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).


4
PRESSURE RELIEF VALVE
5
PACKING
1
RELIEF VALVE PLUG
2
PACKING
3
SPRING
MAIN OIL FILTER HOUSING
7
PACKING
8
PACKING
6
RELIEF VALVE HOUSING
BRACKET
10
BOLT
9
L-A2892 (0391)
PW V

Pressure (Regulator) Relief Valve
Figure 401
(Task 72-00-61-430-014)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-30

Task 72-00-61-430-015:

1. Install Pressure Relief Valve (Filter Element) (Pre SB PW4ENG 72-525)

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Packing	1	79-21-00	2	20
Packing	1	79-21-00	2	30

B. Procedure

See Figure 401.

NOTE: A dual element oil filter is introduced by SB PW4ENG 72-525 which also replaces the pressure relief valve in the main oil filter housing with a plug. For Post SB PW4ENG 72-525 installation of the pressure relief valve and the replacement plug, see 72-00-61, Install-20 or 72-61-00, Assembly-04.

(1) Install new packings lubricated with Engine Oil (P03-001), in grooves of pressure relief valve.

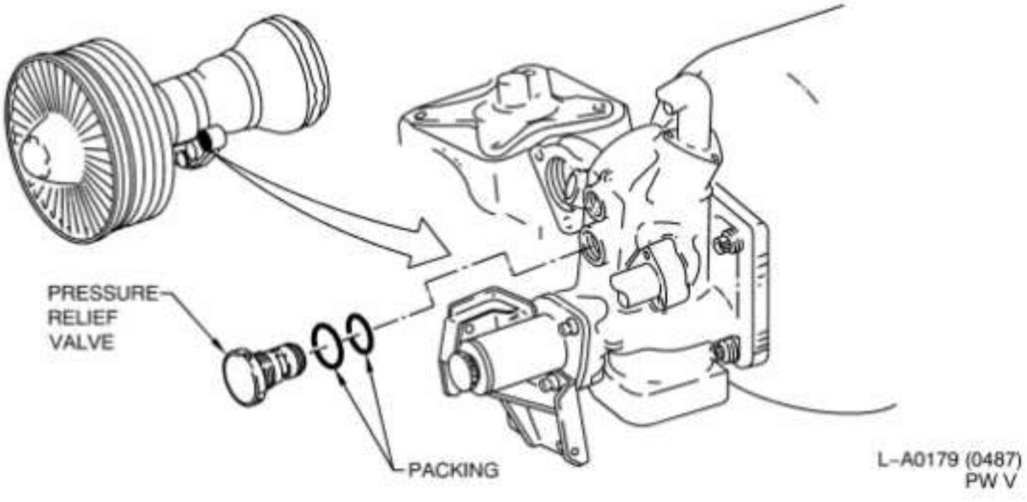
(2) Lubricate threads of valve with Engine Oil (P03-001), and install pressure relief valve in main oil filter housing. Torque valve to 525 - 625 lb-in. (59.317 - 70.616 N.m). Install the Lockwire (P05-289) or Safety Cable (P05-291) and Safety Cable Ferrule (P05-292).

C. Postrequisites

ENGINE GENERAL − MAIN GEARBOX − INSTALLATION−30

(1) Service oil system per 72−00−00, Servicing−03 (Task 72−00−00−610−003).

(2) Test engine per Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).


PRESSURE
RELIEF
VALVE
PACKING
L−A0179 (0487)
PW V

Pressure Relief Valve (Filter Element)
(Pre SB PW4ENG 72−525)
Figure 401
(Task 72−00−61−430−015)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-61-450-013:

1. Install The Oil Tank Sight Gage

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Packing	1	79-11-00	2	60

B. Procedure

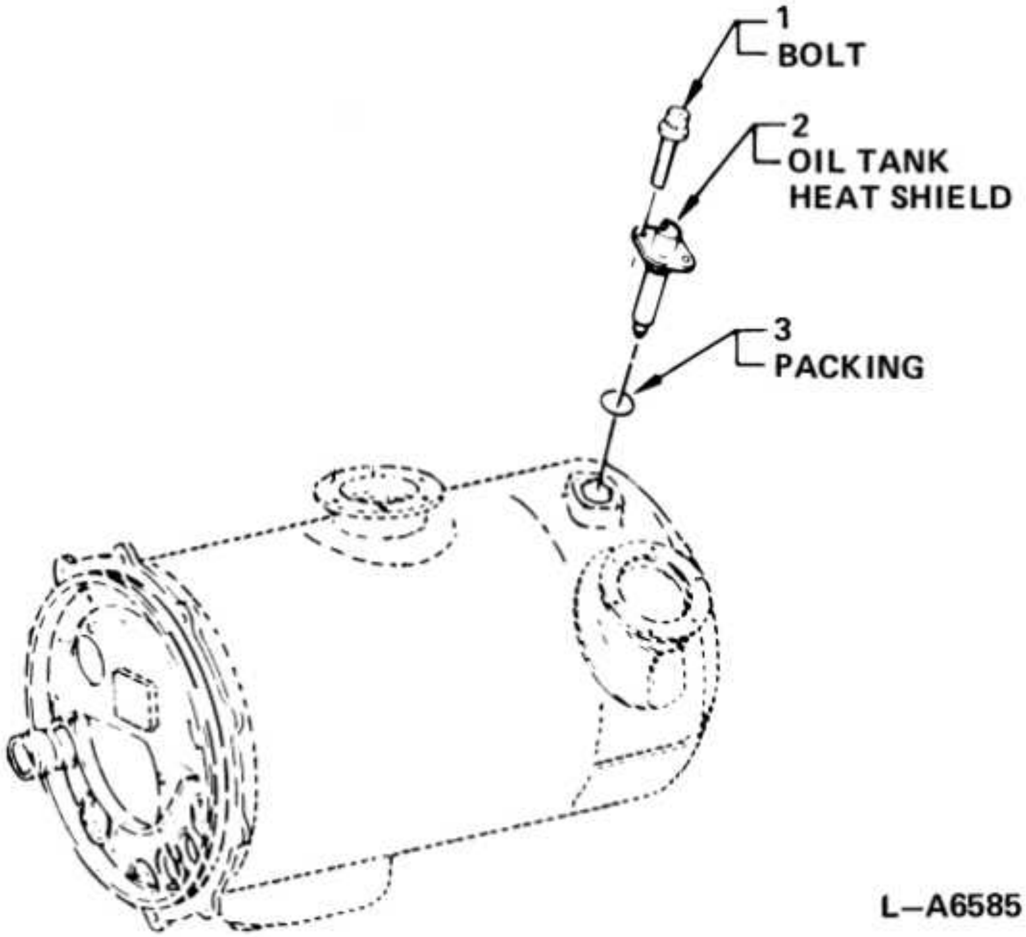
See Figure 401.

(1) Remove the cover from the hole.

(2) Apply Engine Oil (P03-001) to a packing (401/3) and two bolts (401/1).

(3) Install the packing on the sight gage.

(4) Attach the sight gage to the oil tank with the two bolts. Torque bolts to 32 - 36 lb-in. (3.616 - 4.067 N.m). Install the Lockwire (P05-289) or Safety Cable (P05-291) and Safety Cable Ferrule (P05-292).


1
BOLT
2
OIL TANK
HEAT SHIELD
3
PACKING
L−A6585

Oil Tank Sight Gage
Figure 401
(Task 72−00−61−450−013)

Task 72-00-61-450-014:

1. Install Lubrication And Scavenge Oil Pump

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
R P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	2	79-21-00/1/30
Packing	2	79-21-00/1/40
Packing	2	79-21-00/1/60
Packing	1	79-21-00/7/1
Packing	1	79-22-00/3/1
Packing	1	79-22-00/4/1
Packing	1	79-22-00/1/1
Packing	1	79-22-00/2/1

B. Procedure
See Figure 401 and Figure 402.

(1) Lubricate preformed packings with Engine Oil P03-001, and install packings in grooves of ferrules on tubes as follows.

(a) (Pre SB PW4ENG 79-75) Install packing to main filter oil tube assembly (LP01). See Figure 401.

(b) (Post SB PW4ENG 79-75) Install packing to main filter oil tube assembly (LP01) and the fluid pressure dampener or the fluid pressure adapter assembly (Post SB PW4ENG 79-86). See Figure 402.

(c) Install packing to No. 3 bearing oil scavenge manifold assembly (LR04).

(d) Install packing to No. 4 bearing oil scavenge tube assembly (LR05).

(e) Install packing to angle gearbox oil scavenge tube assembly (LR01).

(f) Install packing to main bearing oil scavenge tube assembly (LR03).

1 (Post SB PW4ENG 79-58) Install a strainer element into the No. 1, 1.5 and 2 bearing oil scavenge tube assembly (LR03).

(2) Lubricate preformed packings with Engine Oil P03-001, and install packings to grooves on left transfer tube. Install tube in oil pump.

(3) Lubricate preformed packings with Engine Oil P03-001, and install packings to grooves on right transfer tube. Install tube in oil pump.

(4) Lubricate preformed packings with Engine Oil P03-001, and install packings to groove on oil pump.

(5) Install lubrication and scavenge oil pump to gearbox aligning transfer tubes with their respective ports. Secure oil pump with washers and bolts, threads
R lubricated with Antiseize Paste P06-054. Wipe off
R unwanted paste. Torque bolts to 125 - 140 lb-in. (14.123 - 15.818 N.m).

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(6) (Pre SB PW4ENG 79-75) Attach main filter oil tube assembly (LP01) with packing (previously installed) and bracket to top rear port of oil pump with bolts,
R threads lubricated with Antiseize Paste P06-054. Wipe
R off unwanted paste. Torque bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m). See Figure 401.

(7) (Pre SB PW4ENG 79-75) Tighten and torque clamp bolt on main filter oil tube bracket to 36 - 40 lb-in. (4.067 - 4.519 N.m). See Figure 401.

CAUTION: BE CAREFUL WHEN YOU HANDLE ALL TUBES WHICH CONTAIN A FLEX DESIGN SEGMENT. REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTION USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE INSTALLATION OR REMOVAL OF THE TUBE OR AN ATTACHED COMPONENT. IF A FLEX SEGMENT IS BENT TOO MUCH, THIS CAN CAUSE A KINK IN THE EXTERNAL WIRE BRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND LEAKS OR TUBE RUPTURE CAN BE THE RESULT.

(8) (Post SB PW4ENG 79-75) Attach the fluid pressure dampener or the fluid pressure adapter assembly (Post SB PW4ENG 79-86) and the main oil filter hose and tube assembly (LP01) with packing (previously installed). See Figure 402.

(a) If applicable, install the dampener or adapter to the top of the main oil pump and hold with bolts, threads lubricated with Engine Oil P03-003, to a handtight condition only.

(b) Attach the tube (LP01) to the dampener or adapter, threads lubricated with Engine Oil P03-003, to a handtight condition only.

(c) Install bolts, threads lubricated with Engine Oil P03-003, nuts and clamps securing tube to gearbox brackets, handtight only.

(d) Install bolts, threads lubricated with Engine Oil P03-003, on the tube (LP01) which attaches to the diffuser case bracket.

(e) Torque all the clamp bolts to 32 - 36 lb-in. (3.616 - 4.067 N.m).

(f) Torque the bolts that hold the dampener or adapter to top of the main oil pump to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(g) Torque the bolts that hold the tube (LP01) to the dampener or adapter to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(h) Torque the bolts securing the tube (LP01) to the diffuser case bracket to 65 - 75 lb-in. (7.344 - 8.474 N.m).

(9) (Post SB PW4ENG 79-75) If applicable, install the loop clamp bracket assembly on the fluid pressure dampener or adapter as follows. See Figure 402.

(a) Secure the bracket assembly to the dampener or adapter with bolts and nuts to a handtight condition only.

(b) Torque the bolts to 32 - 36 lb-in. (3.616 - 4.067 N.m)

(10) Starting at right rear of oil pump and working forward, attach four scavenge tubes (with packings previously installed) with bolts, threads lubricated with
R Antiseize Paste P06-054, as follows. Wipe off unwanted
R paste.

(a) Attach No. 3 bearing oil scavenge manifold assembly (LR04).

NOTE: The No. 3 bearing oil scavenge manifold assembly contains a strainer element (Post SB PW4ENG 79-58) on the scavenge pump side of the manifold.

(b) Attach No. 4 bearing oil scavenge tube assembly (LR05).

(c) Attach angle gearbox oil scavenge tube assembly (LR01).

(d) Attach main bearing oil scavenge tube assembly (LR03).

(11) Torque all bolts securing four scavenge tubes to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(12) Torque all clamp bolts loosened to allow disengagement of tubes to 36 - 40 lb-in. (4.067 - 4.519 N.m).

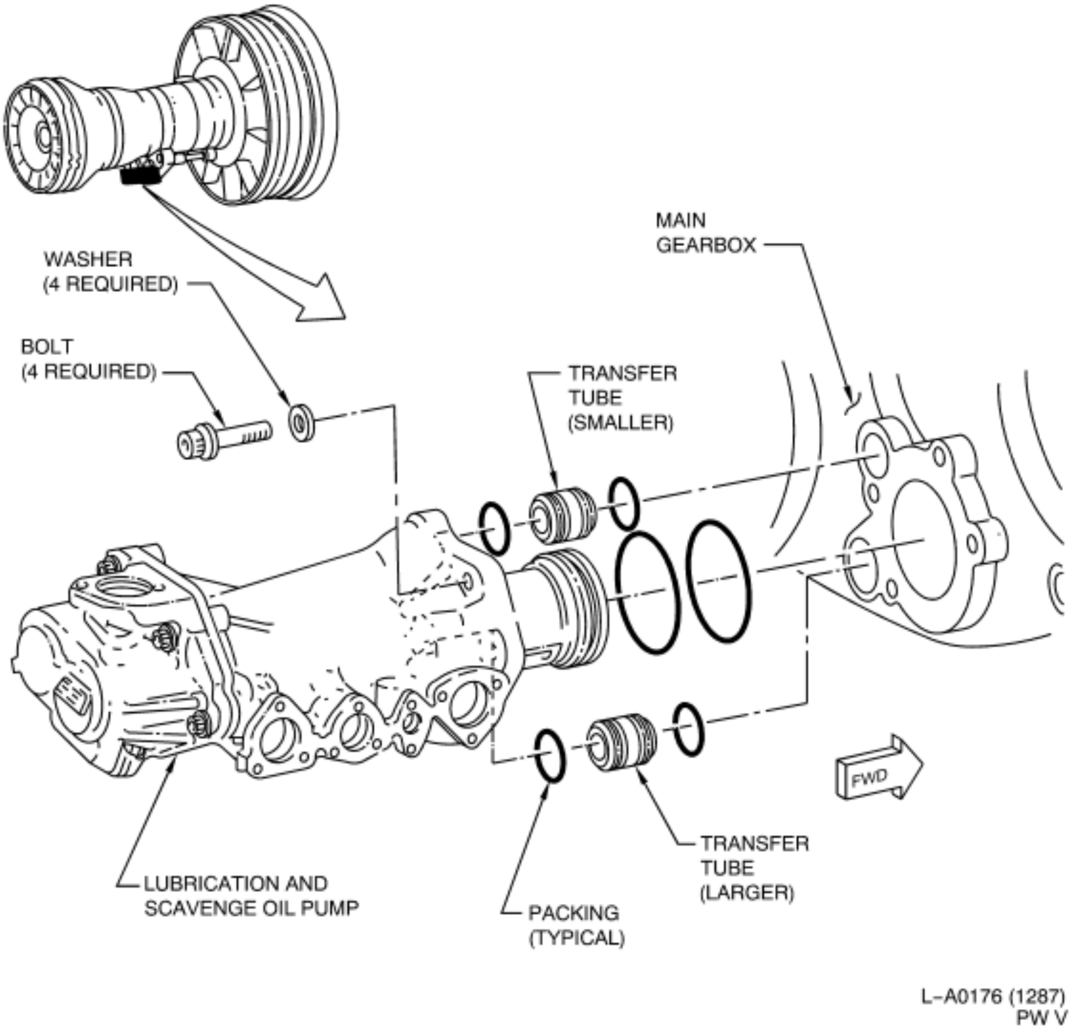
C. Postrequisites

(1) Install the magnetic chip detector assemblies in the oil tank and main gearbox. Refer to Installation-36 (Task 72-00-61-450-017).

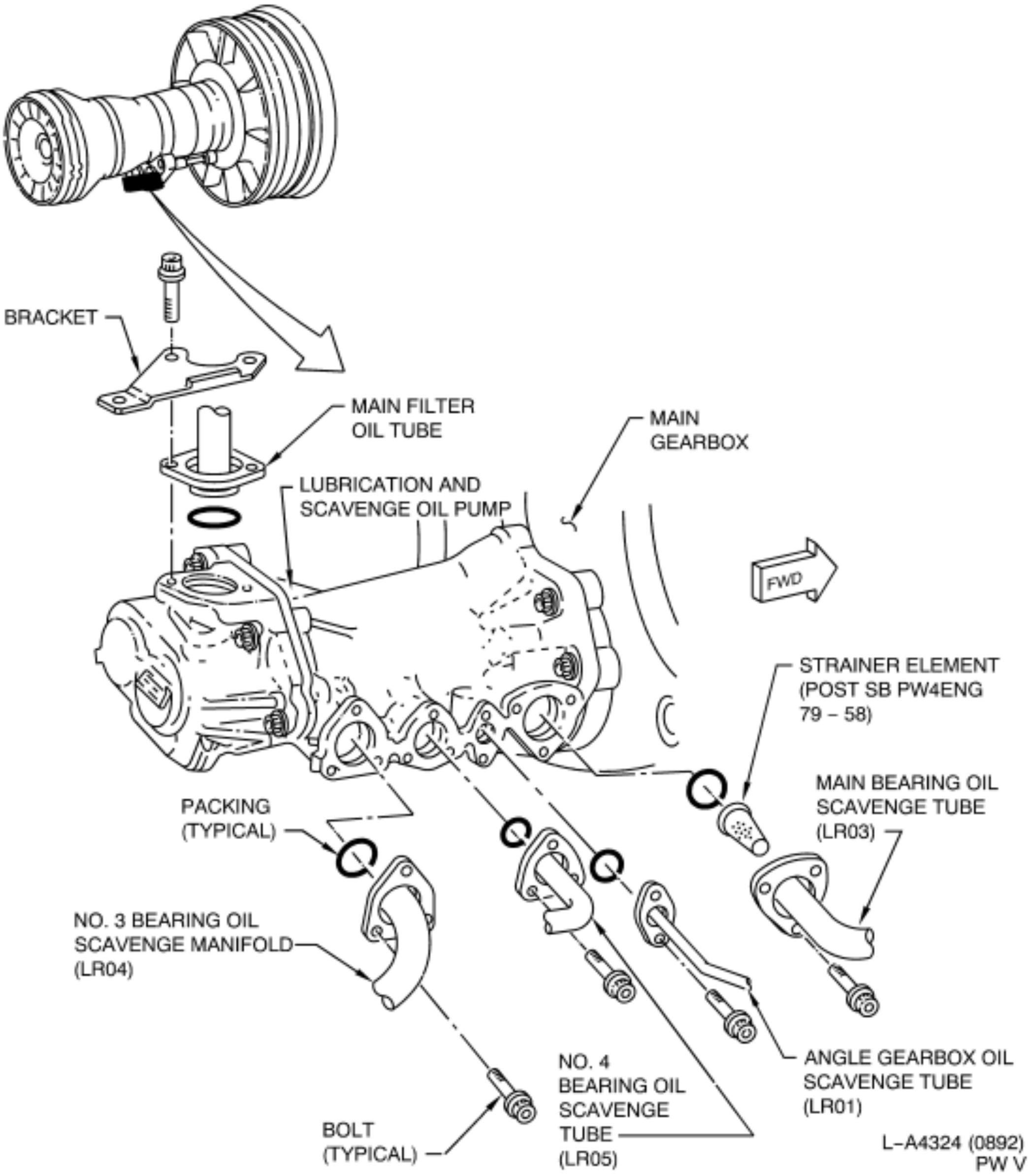
(2) Service oil system per 72-00-00, Servicing-03 (Task 72-00-00-610-003).

ENGINE GENERAL − MAIN GEARBOX − INSTALLATION−32

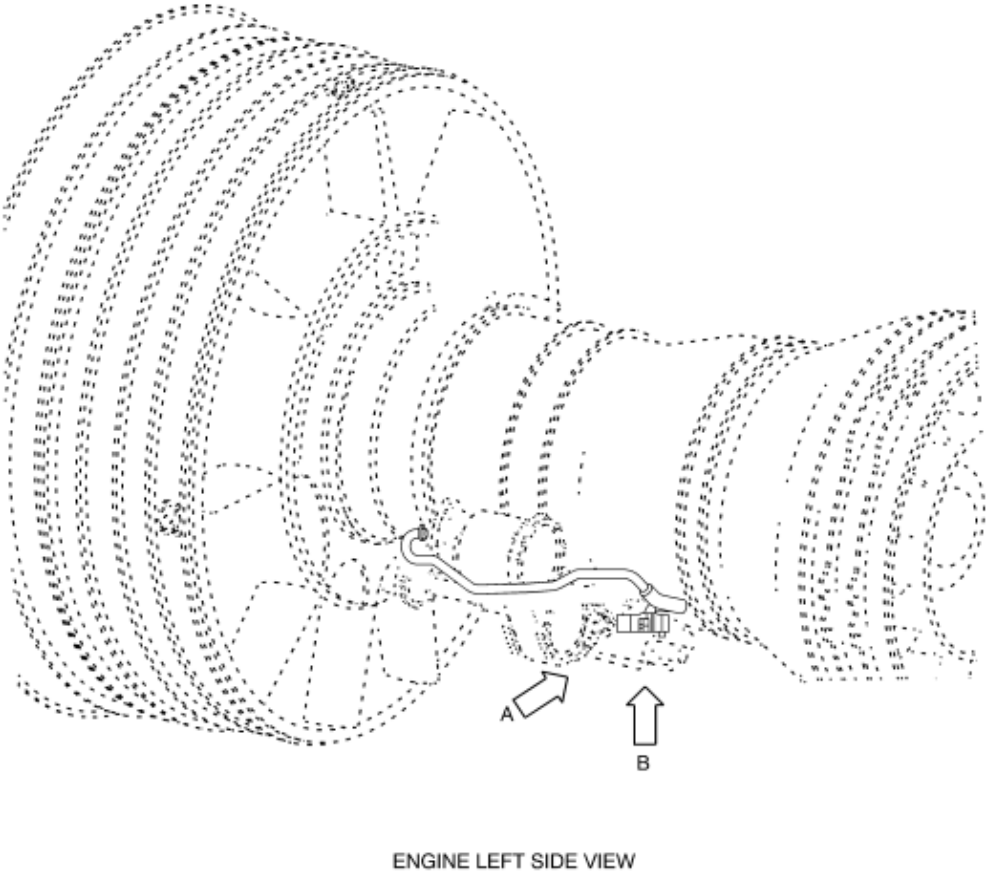
(3) Test engine per Test Reference Table. See 71−00−00, Testing−00 (Task 71−00−00−990−003).


MAIN GEARBOX
WASHER (4 REQUIRED)
BOLT (4 REQUIRED)
TRANSFER TUBE (SMALLER)
FWD
LUBRICATION AND SCAVENGE OIL PUMP
PACKING (TYPICAL)
TRANSFER TUBE (LARGER)
L-A0176 (1287)
PW V

Lubrication And Scavenge Oil Pump
Figure 401 (Sheet 1)
(Task 72-00-61-450-014)

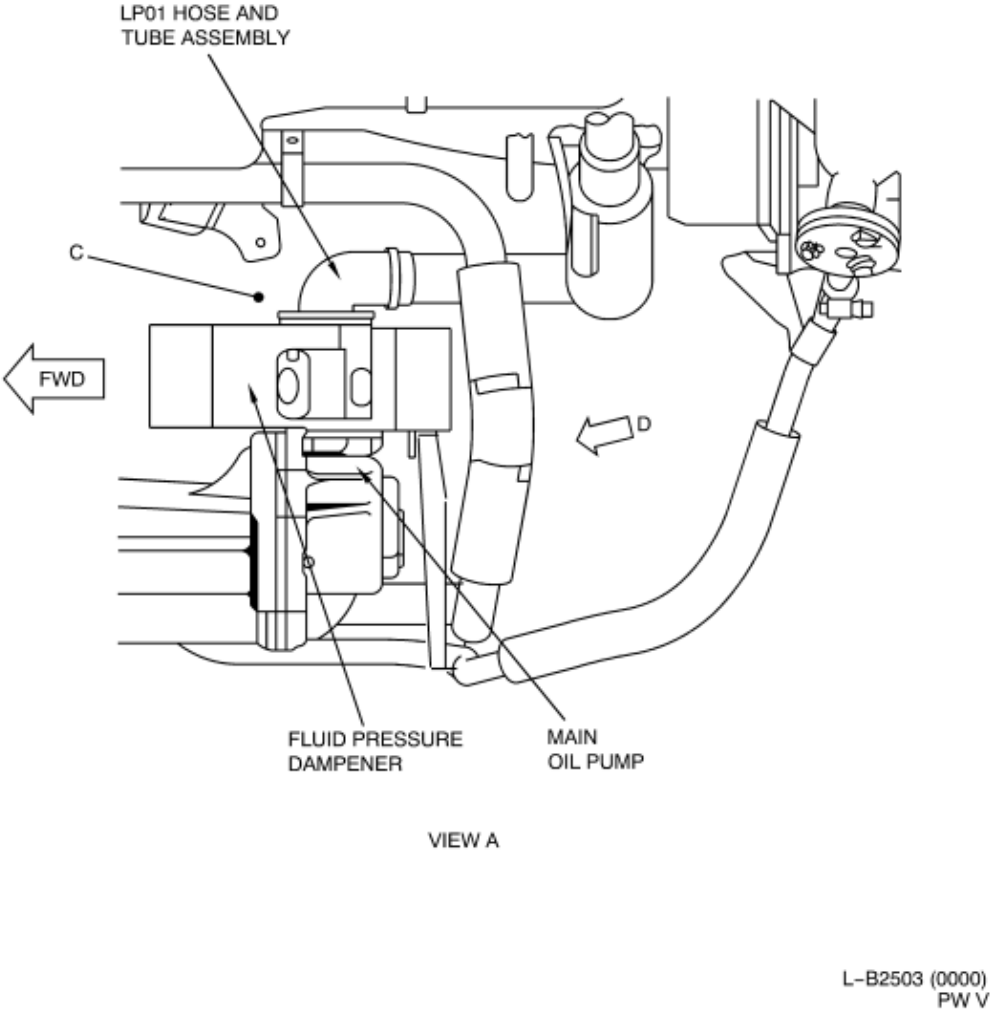

BRACKET
MAIN FILTER OIL TUBE
MAIN GEARBOX
LUBRICATION AND SCAVENGE OIL PUMP
FWD
STRAINER ELEMENT (POST SB PW4ENG 79 - 58)
MAIN BEARING OIL SCAVENGE TUBE (LR03)
PACKING (TYPICAL)
NO. 3 BEARING OIL SCAVENGE MANIFOLD (LR04)
ANGLE GEARBOX OIL SCAVENGE TUBE (LR01)
NO. 4 BEARING OIL SCAVENGE TUBE (LR05)
BOLT (TYPICAL)
L-A4324 (0892)
PW V

Lubrication And Scavenge Oil Pump (Pre SB PW4ENG 79-75)
Figure 401 (Sheet 2)
(Task 72-00-61-450-014)

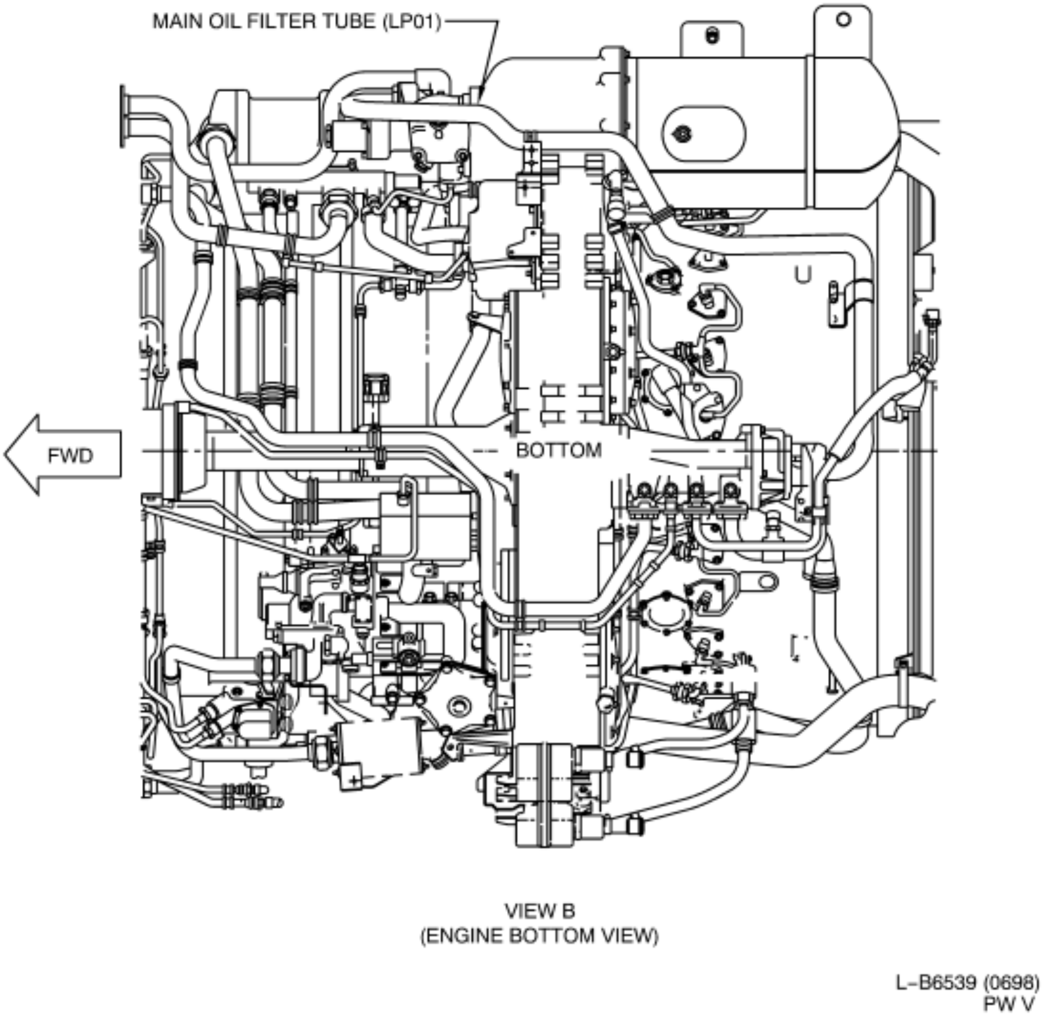


L−B2502 (0000)
PW V

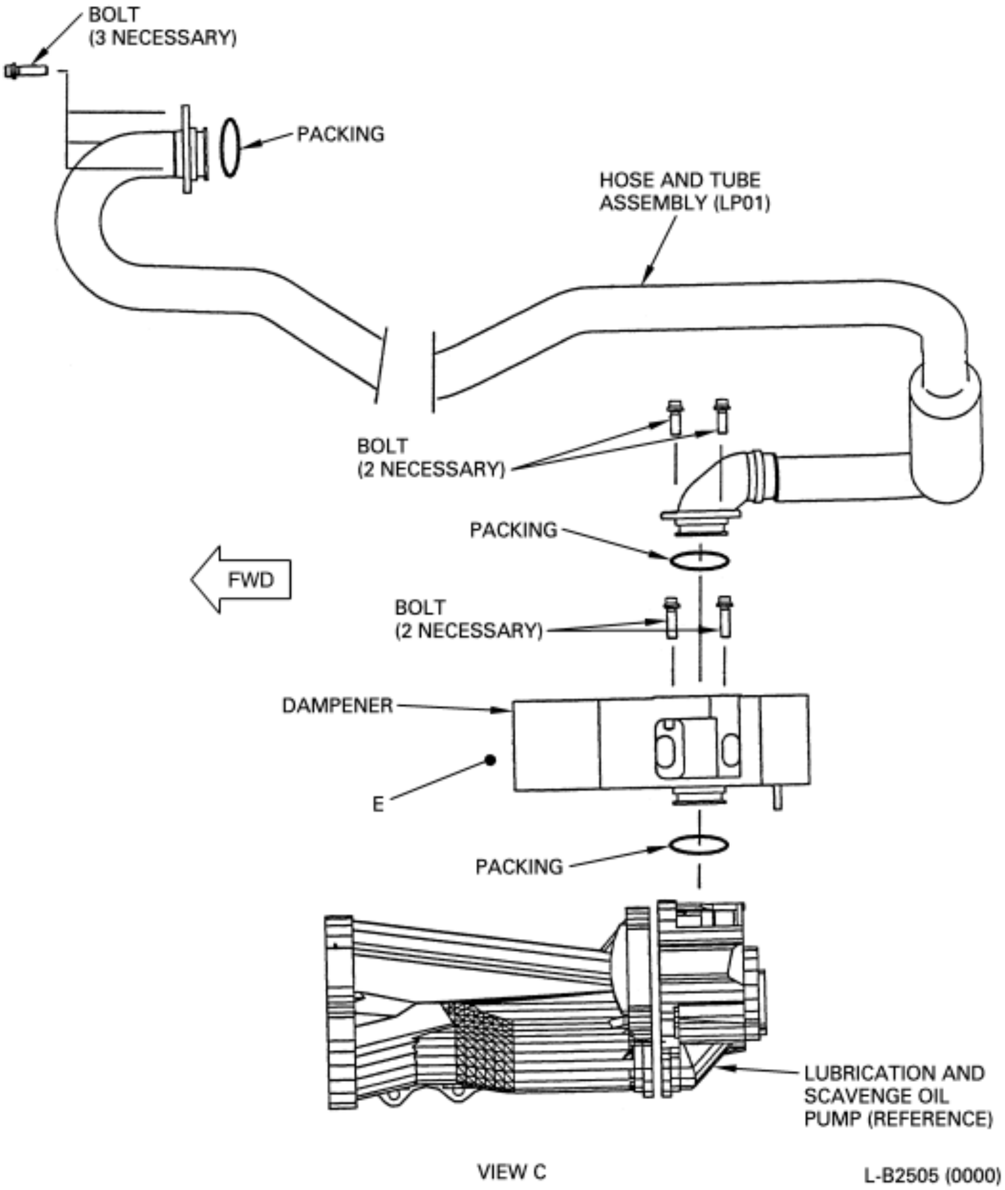
Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79−75)
Figure 402 (Sheet 1)
(Task 72−00−61−450−014)


LP01 HOSE AND TUBE ASSEMBLY
C
FWD
D
FLUID PRESSURE DAMPENER
MAIN OIL PUMP
VIEW A
L-B2503 (0000)
PW V

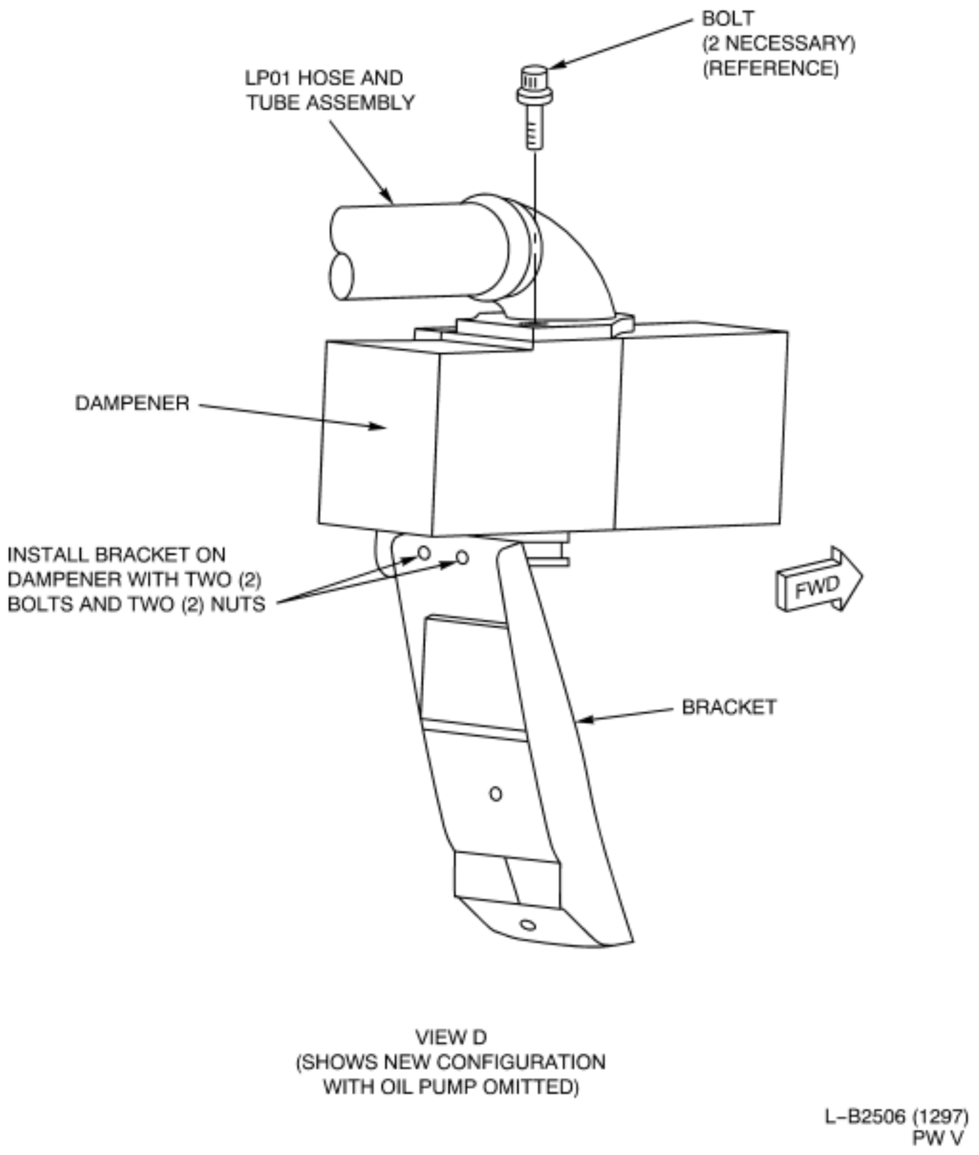
Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79-75)
Figure 402 (Sheet 2)
(Task 72-00-61-450-014)


MAIN OIL FILTER TUBE (LP01)
FWD
BOTTOM
U
VIEW B
(ENGINE BOTTOM VIEW)
L-B6539 (0698)
PW V

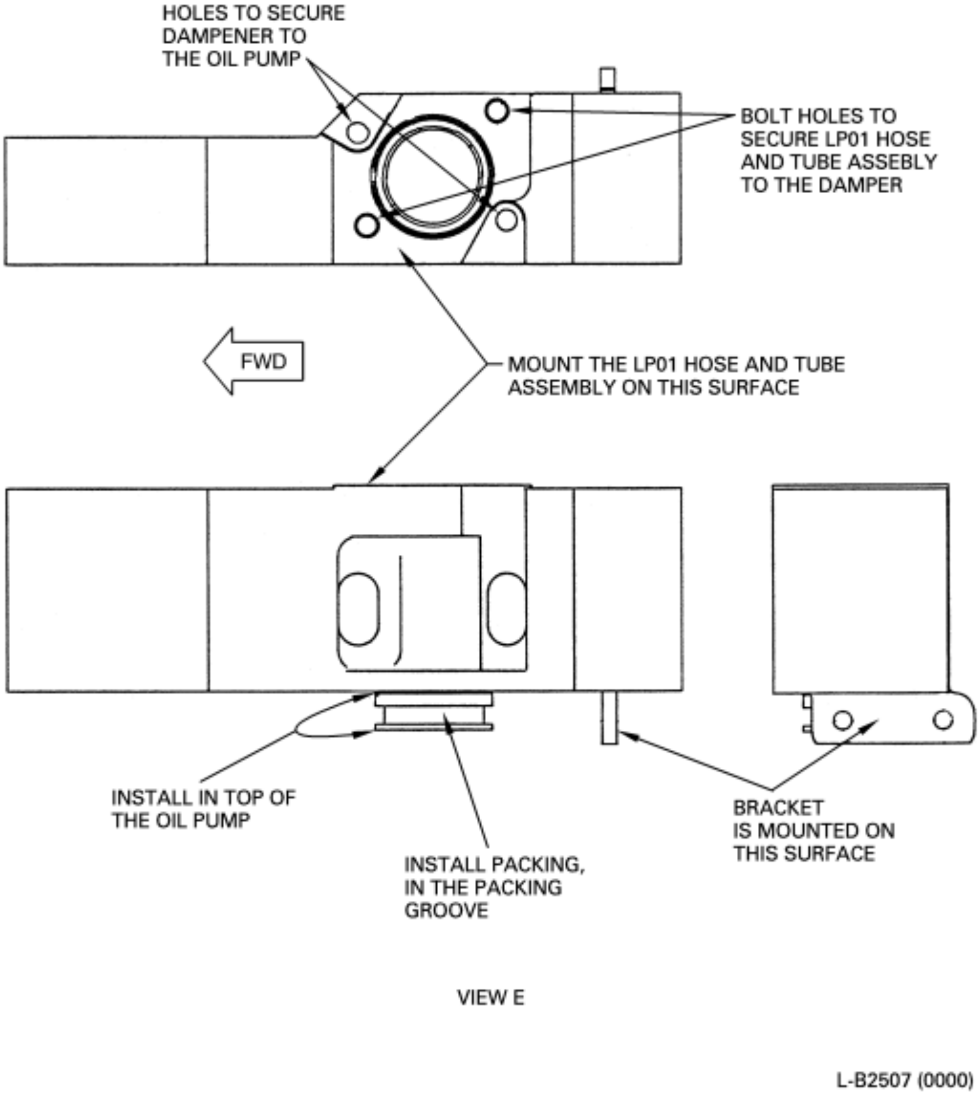
Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79-75)
Figure 402 (Sheet 3)
(Task 72-00-61-450-014)


BOLT
(3 NECESSARY)
PACKING
HOSE AND TUBE
ASSEMBLY (LP01)
BOLT
(2 NECESSARY)
PACKING
FWD
BOLT
(2 NECESSARY)
DAMPENER
E
PACKING
LUBRICATION AND
SCAVENGE OIL
PUMP (REFERENCE)
VIEW C
L-B2505 (0000)

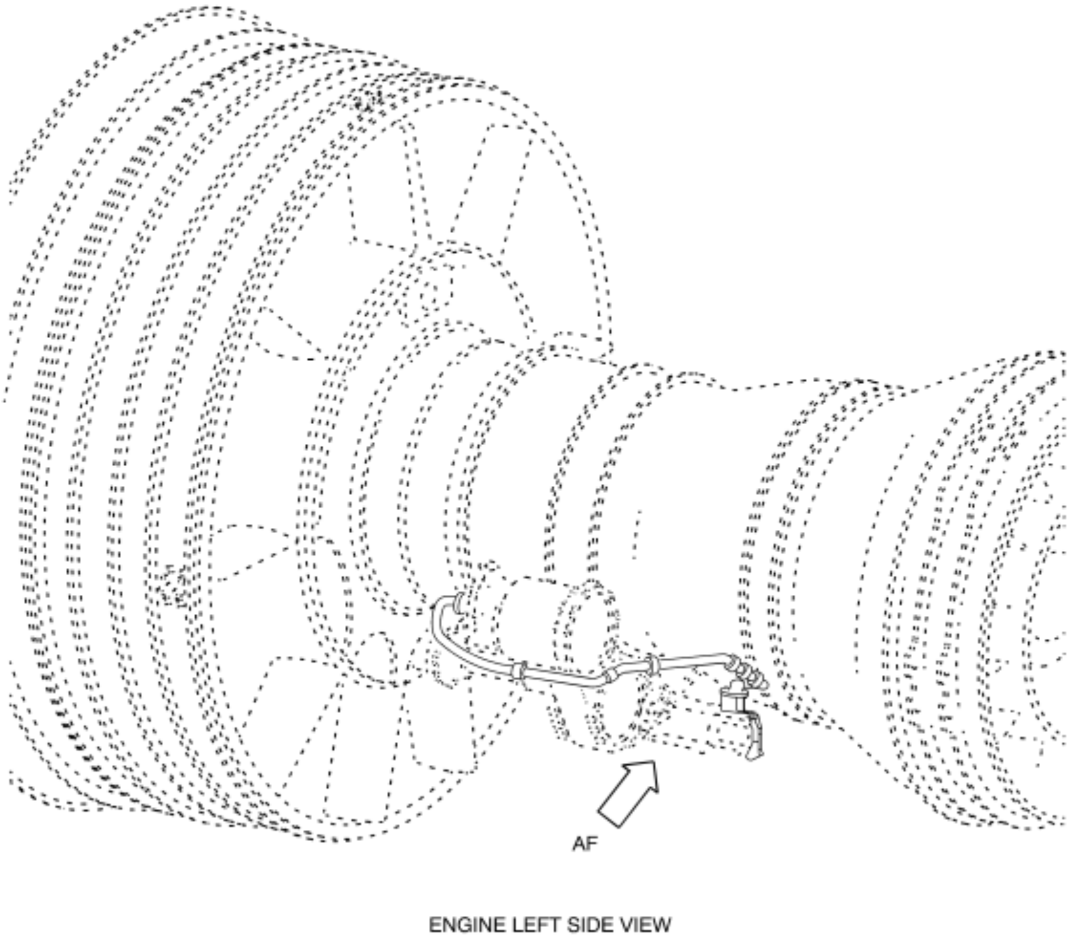
Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79−75)
Figure 402 (Sheet 4)
(Task 72−00−61−450−014)


BOLT
(2 NECESSARY)
(REFERENCE)
LP01 HOSE AND
TUBE ASSEMBLY
DAMPENER
INSTALL BRACKET ON
DAMPENER WITH TWO (2)
BOLTS AND TWO (2) NUTS
FWD
BRACKET
VIEW D
(SHOWS NEW CONFIGURATION
WITH OIL PUMP OMITTED)
L−B2506 (1297)
PW V

Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79−75)
Figure 402 (Sheet 5)
(Task 72−00−61−450−014)

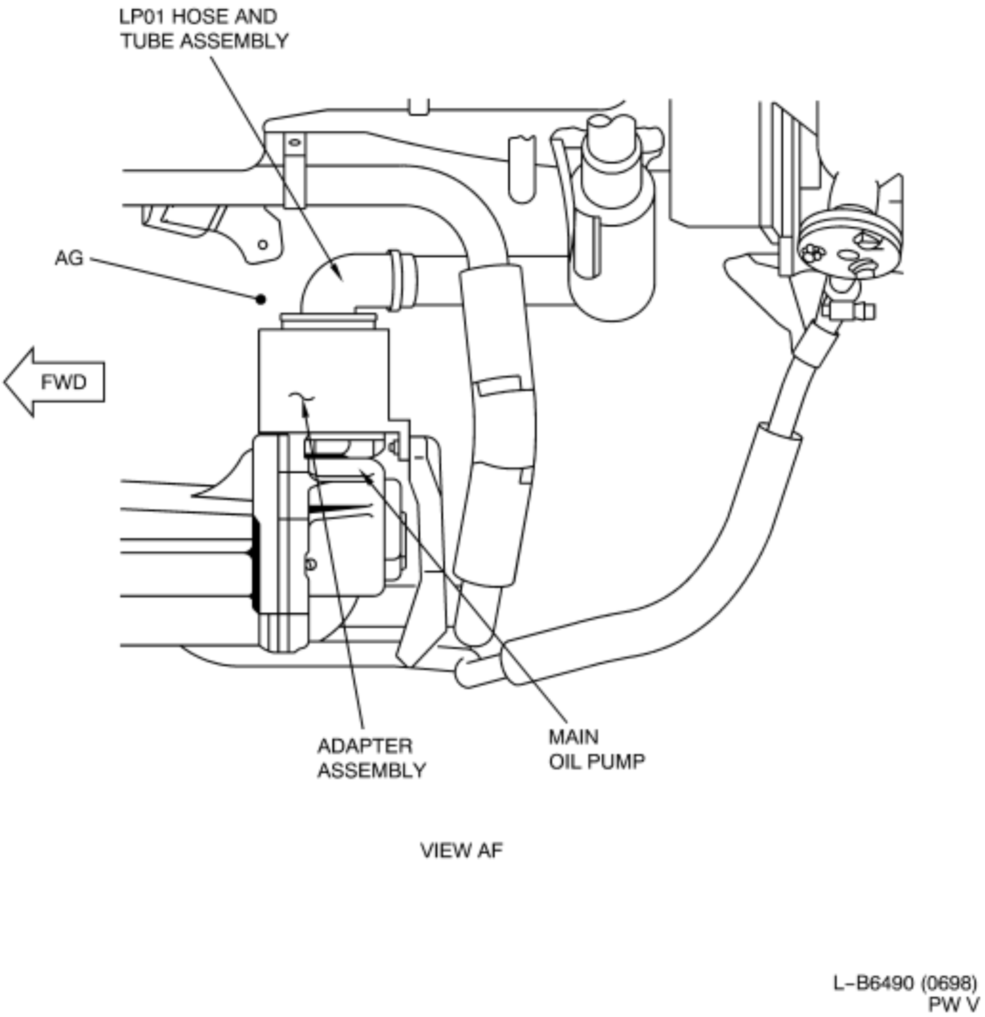

HOLES TO SECURE DAMPENER TO THE OIL PUMP
BOLT HOLES TO SECURE LP01 HOSE AND TUBE ASSEBLY TO THE DAMPER
FWD
MOUNT THE LP01 HOSE AND TUBE ASSEMBLY ON THIS SURFACE
INSTALL IN TOP OF THE OIL PUMP
INSTALL PACKING, IN THE PACKING GROOVE
BRACKET IS MOUNTED ON THIS SURFACE
VIEW E
L-B2507 (0000)

Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79-75)
Figure 402 (Sheet 6)
(Task 72-00-61-450-014)

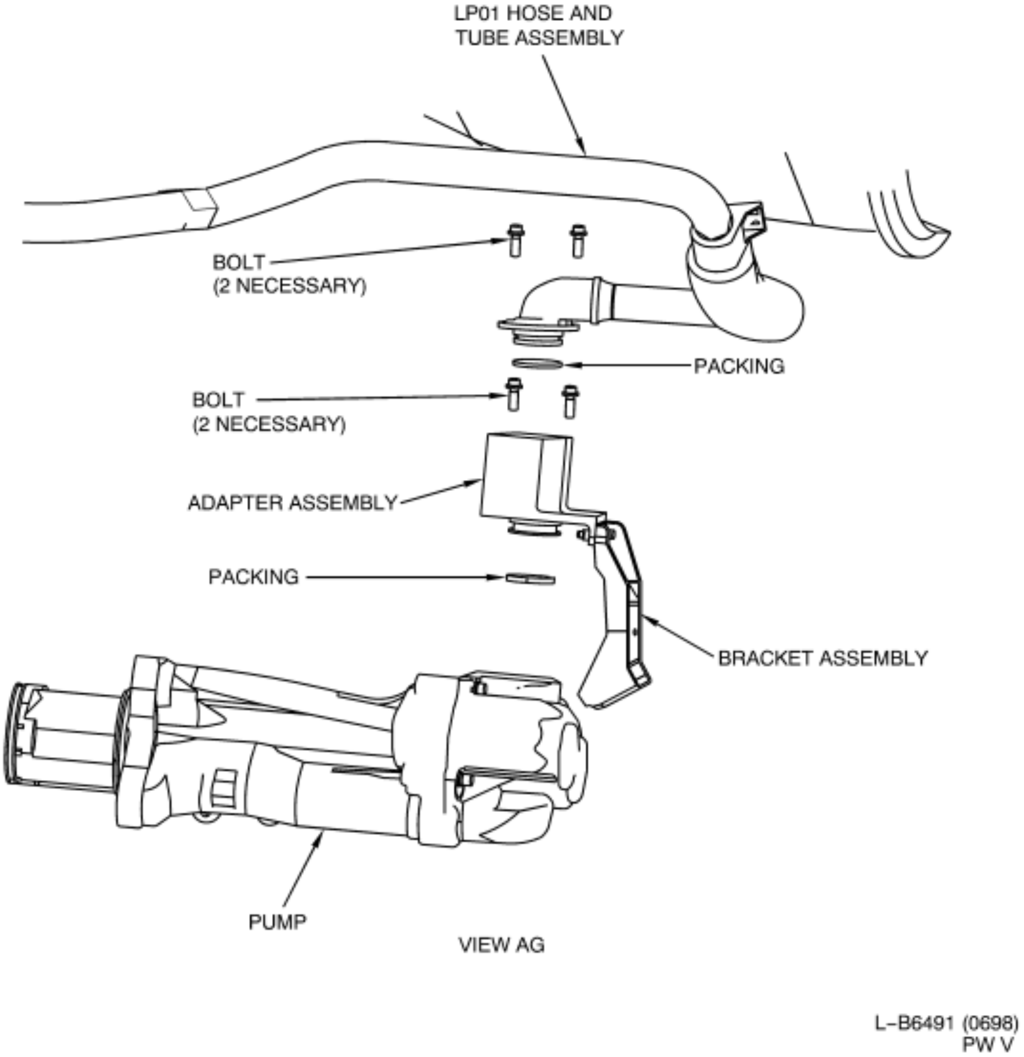


L-B6489 (0698)
PW V

Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79-86)
Figure 402 (Sheet 7)
(Task 72-00-61-450-014)


LP01 HOSE AND TUBE ASSEMBLY
AG
FWD
ADAPTER ASSEMBLY
MAIN OIL PUMP
VIEW AF
L-B6490 (0698)
PW V

Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79-86)
Figure 402 (Sheet 8)
(Task 72-00-61-450-014)


LP01 HOSE AND TUBE ASSEMBLY
BOLT (2 NECESSARY)
PACKING
BOLT (2 NECESSARY)
ADAPTER ASSEMBLY
PACKING
BRACKET ASSEMBLY
PUMP
VIEW AG
L-B6491 (0698)
PW V

Lubrication And Scavenge Oil Pump (Post SB PW4ENG 79-86)
Figure 402 (Sheet 9)
(Task 72-00-61-450-014)

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-33

Task 72-00-61-420-003:

1. Install Main Gearbox

NOTE: See Figure 401 for part/assembly installation sequence.

A. Prerequisites

(1) See Inspection/Check-01 (Task 72-00-61-990-001) for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by reference number. For example: (Reference 1234) Torque retaining nut as follows:

B. Equipment And Materials Required

Special Tools:
PWA 85241 Arm, Lifting
PWA 85123 Fixture, Handling (Optional to PWA 86056)
PWA 85768 Puller
PWA 86056 Fixture, Handling

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

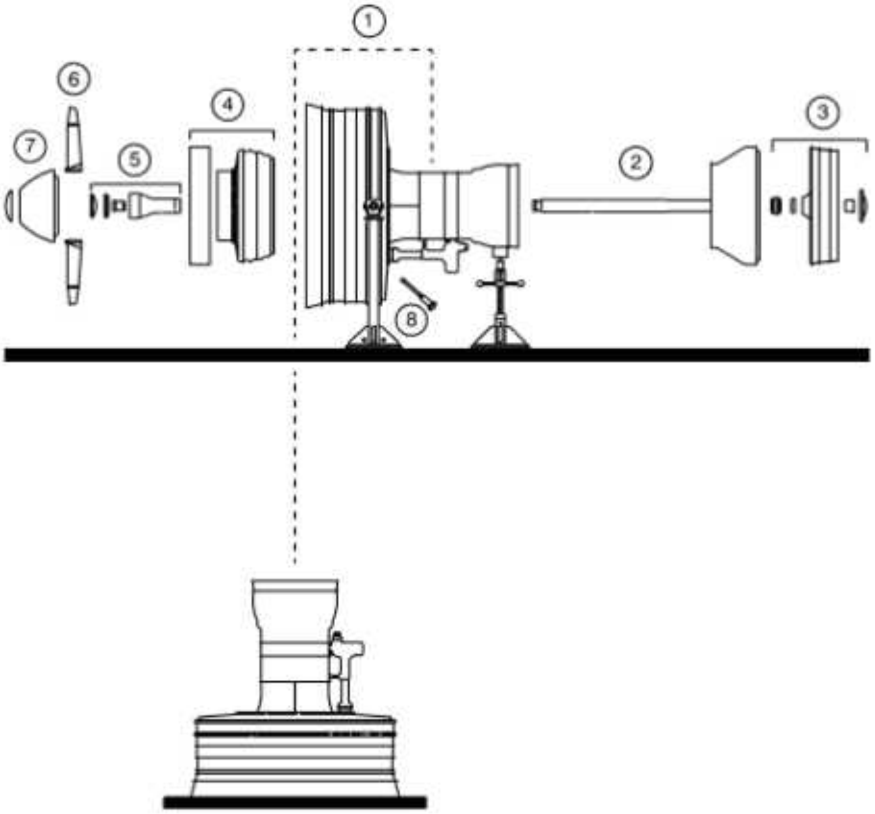
		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Cotter Pin	1	72-00-61	1	20
Cotter Pin	2	72-00-61	1	100
Cotter Pin	2	72-00-61	1	160
Packing	1	72-62-00	6	20
Packing	1	72-62-00	6	30
Washer	2	72-00-61	1	70
Washer	2	72-00-61	1	130

Lockwire, AS3214-02

C. Procedure

(1) Position nylon sling through gearbox outer support lugs, located on top of gearbox on left and right sides and attach hoist.

(2) Place PWA 86056 or PWA 85123 Fixture on workbench.



1. TRUNNION FAN CASES THROUGH HPT FROM HORIZONTAL TO FRONT END DOWN
2. INSTALL LPT GROUP WITH SHAFT
3. INSTALL TURBINE EXHAUST CASE GROUP
4. INSTALL LPC GROUP
5. INSTALL FAN/LPT COUPLING ASSEMBLY
6. INSTALL FIRST STAGE (FAN) BLADES
7. INSTALL COMPRESSOR INLET CONE
8. INSTALL N1 SPEED SENSOR

L−A1497 (0786)
PW V

Procedure Sequence
Figure 401
(Task 72−00−61−420−003)

(3) Using hoist and sling, lift gearbox and position over fixture (402/3). Lower gearbox and position four post details of fixture to four ground handling points of gearbox. Secure post details to gearbox with four detail cap screws (402/4). See Figure 402.

(4) Install new packings, lubricated with Engine Oil (P03−001), on gearbox driveshaft (front) housing (403/3). See Figure 403.
  (a) Install packing (403/9) in groove on rear of housing.
  (b) Install packing (403/13) in groove on front of housing.

(5) Insert gearbox driveshaft (403/12) and driveshaft (front) housing (403/3) in driveshaft housing (403/8) and telescope rearward, carefully mating driveshaft splines with internal splines on gearbox spline lockring.

(6) If not installed on the engine, install the two support links (404/8) in the gearbox support clevises (404/3) on Flange K. See Figure 404.
  (a) With the support links in position in the clevises, install the spacers (404/4) in the rear holes of the clevises. Install the pins (404/2), flanged ends forward, in the front holes of the clevises.
  (b) Install new washers (404/5) on the bolts. Install the bolts (404/6), heads rearward, threads lubricated with Engine Oil (P03−001), in the spacers. Install nuts (404/1) on the bolts.
  (c) Torque the bolts to 290 − 325 lb−in. (32.766 − 36.720 N.m). Install a cotter pin (404/7) in each bolt.

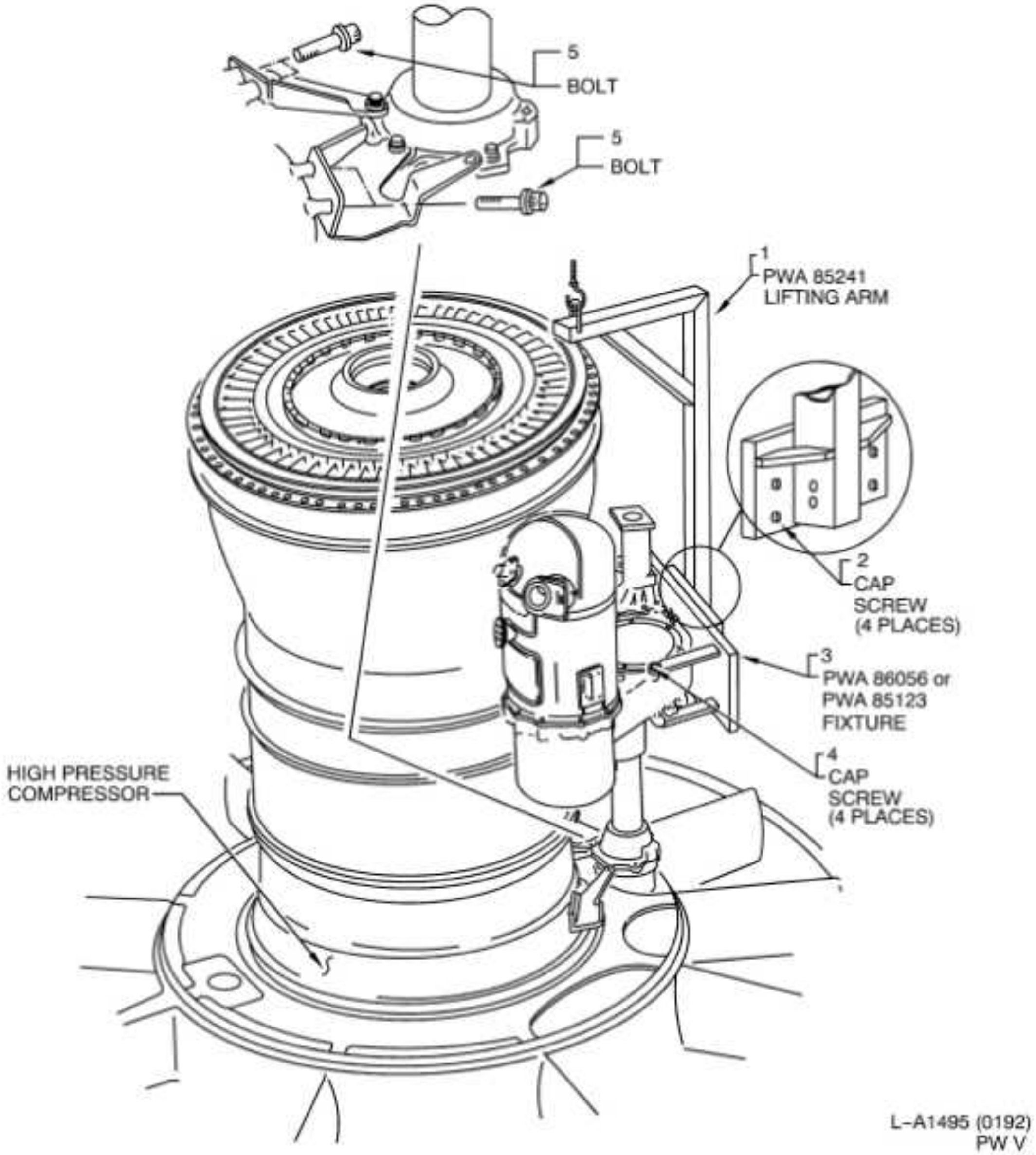
(7) Raise gearbox with sling. Secure PWA 85241 Lifting Arm (402/1) to handling fixture using four detail screws (402/2). There are three possible attachment positions, depending on the components installed on the gearbox.

(8) Pass second nylon sling through eye in lifting arm and secure to second hoist. Transfer load from first hoist to second hoist. Remove first sling and hoist.

(9) Make sure that spherical bearings (404/9) are installed in support links (404/8) and in the lower end of the (driveshaft housing) support link (403/6). Make sure that the bearings turn freely.

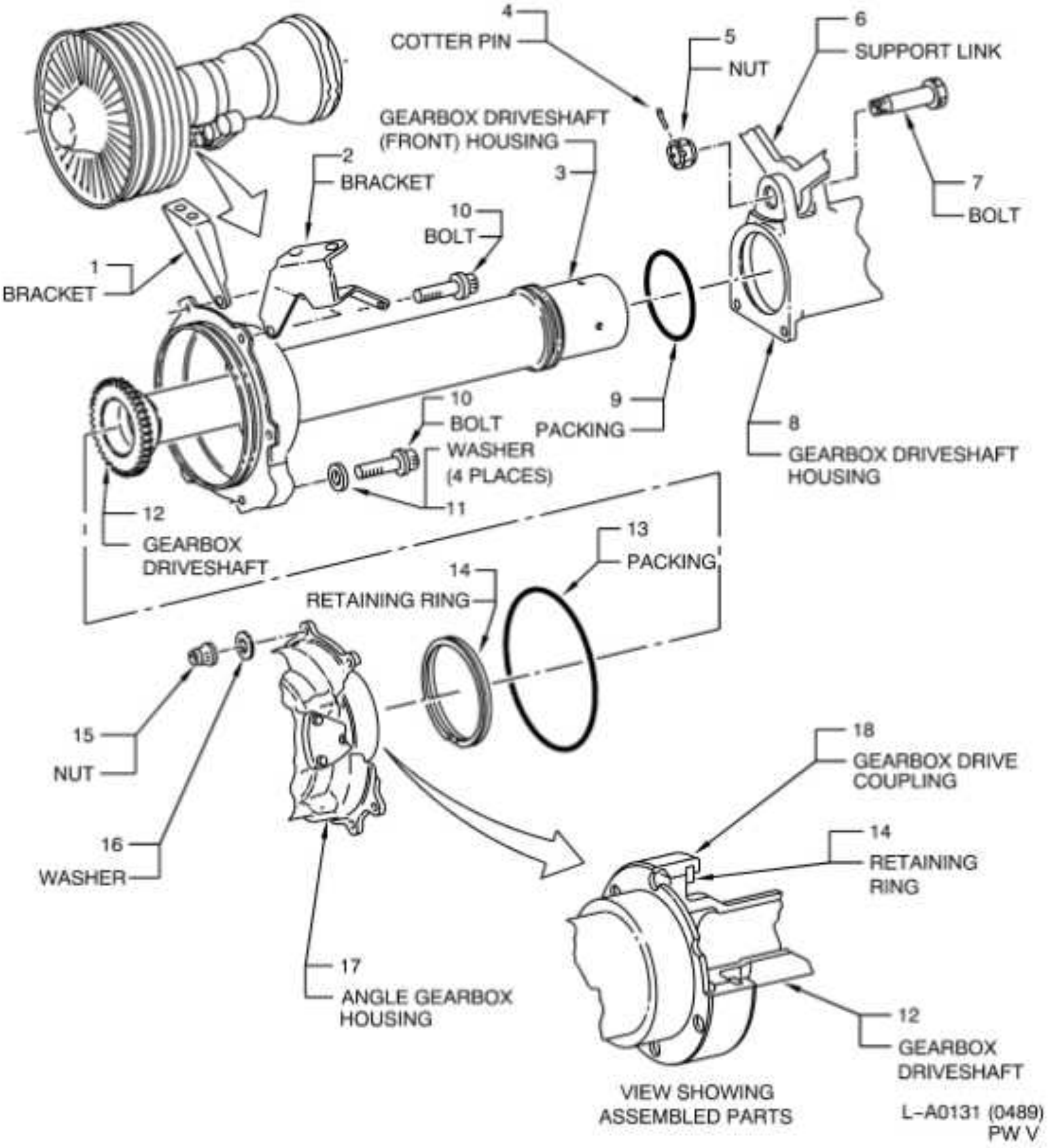
(10) Position gearbox to align lug at top center of gearbox with mating part in compressor case and align support links (404/8) on engine with lugs on upper right and left sides of gearbox.

(11) Install the gearbox on the support links (404/8) as follows.


5
BOLT
5
BOLT
1
PWA 85241
LIFTING ARM
2
CAP
SCREW
(4 PLACES)
3
PWA 86056 or
PWA 85123
FIXTURE
4
CAP
SCREW
(4 PLACES)
HIGH PRESSURE
COMPRESSOR
L−A1495 (0192)
PW V

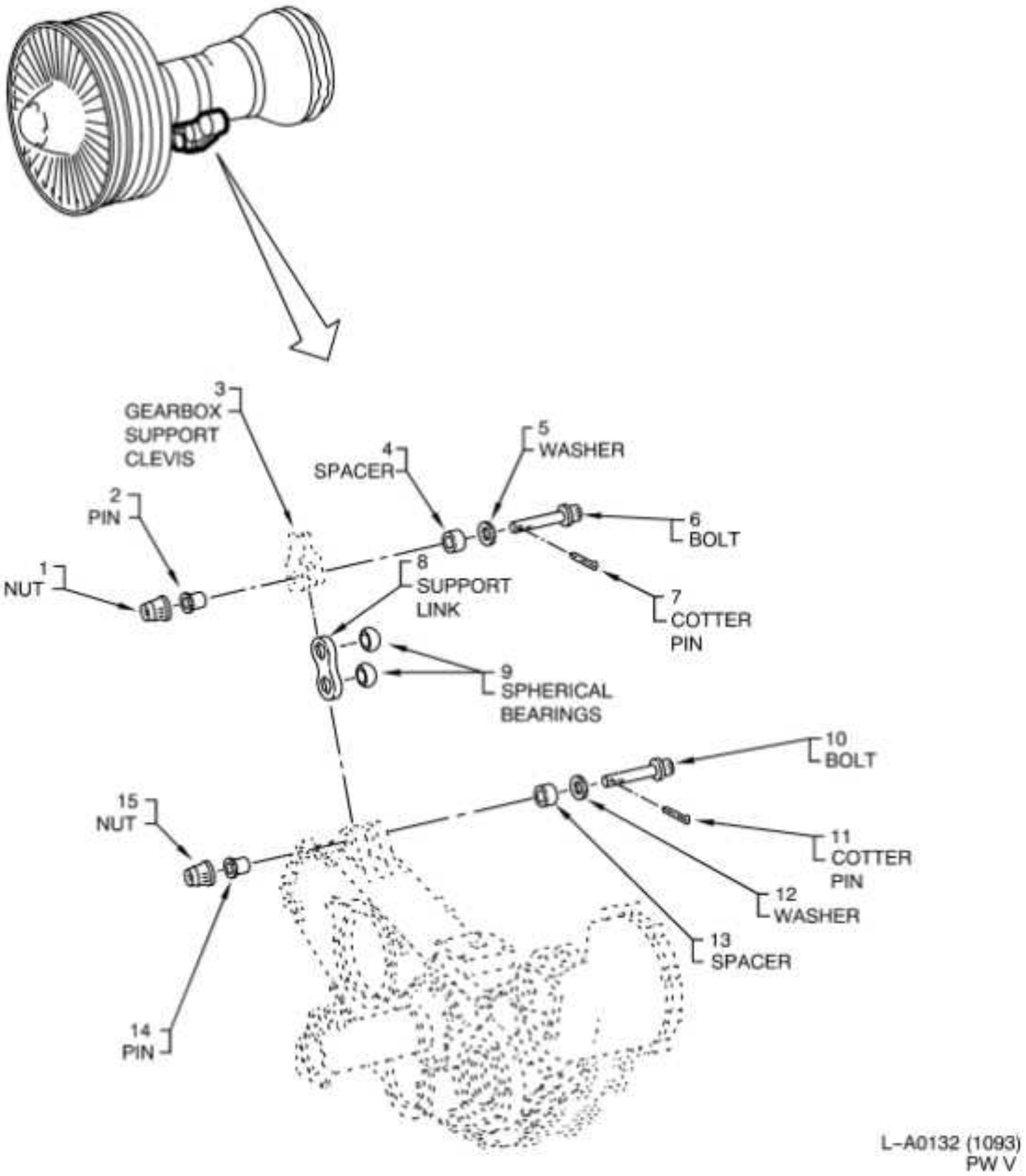
Main Gearbox Installation
Figure 402
(Task 72−00−61−420−003)

ENGINE GENERAL – MAIN GEARBOX – INSTALLATION–33


4
COTTER PIN
5
NUT
6
SUPPORT LINK
GEARBOX DRIVESHAFT (FRONT) HOUSING
3
2
BRACKET
10
BOLT
7
BOLT
1
BRACKET
9
PACKING
10
BOLT
WASHER (4 PLACES)
11
8
GEARBOX DRIVESHAFT HOUSING
12
GEARBOX DRIVESHAFT
13
PACKING
14
RETAINING RING
15
NUT
16
WASHER
17
ANGLE GEARBOX HOUSING
18
GEARBOX DRIVE COUPLING
14
RETAINING RING
12
GEARBOX DRIVESHAFT
VIEW SHOWING ASSEMBLED PARTS
L-A0131 (0489)
PW V

Main Gearbox Installation
Figure 403
(Task 72–00–61–420–003)

ENGINE GENERAL − MAIN GEARBOX − INSTALLATION−33


3 GEARBOX SUPPORT CLEVIS
4 SPACER
5 WASHER
2 PIN
6 BOLT
1 NUT
8 SUPPORT LINK
7 COTTER PIN
9 SPHERICAL BEARINGS
10 BOLT
15 NUT
11 COTTER PIN
12 WASHER
13 SPACER
14 PIN
L−A0132 (1093)
PW V

Main Gearbox Installation
Figure 404
(Task 72−00−61−420−003)

(a) Install spacer (404/13) into hole in rear of the clevis on the gearbox. Insert pin (404/14), flanged end toward the front, through clevis on gearbox.
(b) Install a new washer (404/12) on the bolt (404/10). Install the bolt (404/10), head rearward, threads lubricated with Engine Oil (P03−001), in the clevis. Install a nut (404/15) on the bolt.
(c) Torque the bolt to 290 − 325 lb−in. (32.766 − 36.720 N.m). Secure nut using cotter pin (404/11).
(d) Repeat procedure to secure support link to clevis on right side of gearbox.

(12) Align bolthole in support link (403/6) spherical bearing with boltholes in clevis on gearbox driveshaft housing (403/8). Secure support link using bolt (403/7) and nut (403/5). Torque nut to 515 − 575 lb−in. (58.187 − 64.966 N.m). Secure nut using cotter pin (403/4). See Figure 403.

(13) Position retaining ring (403/14) on forward end of driveshaft (403/12). Move driveshaft forward carefully, mating driveshaft splines with internal splines in gearbox drive coupling (403/18). Install retaining ring (403/14) in coupling in angle gearbox to secure front end of driveshaft.

NOTE: Driveshaft must mate, in front, with angle gearbox drive coupling (403/18) splines and in rear, with main gearbox drive gearshaft splines. If splines are out of alignment, driveshaft will not seat in drive coupling (402/18). In order to align angle and main gearbox splines/teeth, remove the bolts and washers in the gearbox that attach the cover (manual crank). Remove the cover. Use PWA 85768 Puller. Rotate main gearbox drive gearshaft by turning the gearshaft. To install the cover, install a new packing, lubricated with Engine Oil (P03−001) on the cover. Install the cover. Attach it with washers and bolts. Torque the bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(14) Align boltholes and telescope gearbox driveshaft (front) housing (403/3) forward and seat on rear flange of angle gearbox housing (403/17). Position bracket (403/1) over top right bolthole in driveshaft (front) housing (403/3) and install bolt (403/10). Position bracket (403/2) over top left bolthole in driveshaft (front) housing and install bolt (403/10). Install washers (403/11) onto four bolts (403/10) and install

bolts through remaining boltholes in driveshaft (front) housing and angle gearbox housing. Install washers (403/16) and nuts (403/15) to all six bolts. Torque bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(15) Lubricate four bolts (402/5) with Engine Oil (P03-001). Install two bolts in each bracket securing driveshaft (front) housing to high pressure compressor. Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). Install lockwire.

(16) Remove gearbox handling fixture from gearbox.

(17) Remove tool assembly and sling from hoist.

D. Postrequisites

(1) Trunnion engine from front end down to horizontal position per 72-00-00, Special Procedures-XX (Task 72-00-00-410-XXX).

(2) Install LPT with shaft per 72-00-53, Installation-01 (Task 72-00-53-420-001).

(3) Install turbine exhaust case per 72-00-54, Installation-01 (Task 72-00-54-420-001).

(4) Install low pressure compressor per 72-00-31, Installation-01 (Task 72-00-31-420-003).

(5) Connect/install external parts to complete installation of main gearbox per Installation-02 (Task 72-00-61-420-003).

(6) Install ignition exciters per Installation-03 (Task 72-00-61-450-001) and Installation-04 (Task 72-00-61-450-002).

(7) Install fuel pump and fuel metering unit (package) per Installation-05 (Task 72-00-61-450-003).

(8) Service engine oil system per 72-00-00, Servicing-03 (Task 72-00-00-610-003).

(9) Test engine per Test Reference Table. See 71-00-00, Testing-00 (Task 71-00-00-990-003).

Task 72-00-61-450-015:

1. Install The Core Engine EEC Wiring Harnesses W3 And W5 After The Main Gearbox Installation

A. Equipment And Materials Necessary

Standard Tools:

Glenair TG-70 Strap Wrench or
Glenair TG-69 Soft Jawed Pliers

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P11-009	Alcohol, Denatured Ethyl (AMS 3002)

B. Procedure
See Figure 401.

CAUTION: SEE 72-00-00, INSTALLATION-00 FOR THE GENERAL INSTALLATION REQUIREMENTS FOR THE ELECTRICAL HARNESSES, LEADS, AND CABLES.

CAUTION: DO NOT TWIST OR BEND THE HARNESS BADLY DURING THE INSTALLATION, OR DAMAGE TO THE HARNESS CAN OCCUR.

(1) (Pre SB PW4ENG 73-84) Connect the W3P18 harness connector to the mating harness receptacle as follows: See Figure 401.

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11-009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:
- the connector coupling nut is fully tight
- the connector fits tightly against the receptacle (metal to metal).
- This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

(2) (Post SB PW4ENG 73−84), For a thermocouple probe with a studded terminal type receptacle install the wiring harness as follows.

CAUTION: DO NOT LUBRICATE THREADS ON THERMOCOUPLE WIRING HARNESS CONNECTIONS (TERMINAL STUDS). LUBRICATION OF THREADS ON THE THERMOCOUPLE COULD CAUSE MALFUNCTION OF THE THERMOCOUPLE.

(a) Install the wiring harness terminals to the thermocouple studs and install loosely the nuts to the thermocouple studs.

(b) Install the clamp, ground strap, and bolt loosely to the bracket on the housing.

CAUTION: TO PREVENT DAMAGE TO THE WIRING HARNESS, MAKE SURE THE THERMOCOUPLE STUD BOX DOES NOT TURN WHEN THE COUPLING NUT IS TORQUED.

(c) If necessary to align the thermocouple stud box, remove the lockwire from the thermocouple coupling nut to the adapter and loosen the coupling nut.

(d) Align the thermocouple stud box with the wiring harness connector.

(e) (Reference 2167) Hold the thermocouple stud box and torque the thermocouple probe coupling nut to 95 − 100 lb−in. (10.734 − 11.298 N.m). Do not let the thermocouple studs turn.

CAUTION: DO NOT ALIGN THE THERMOCOUPLE STUD BOX AFTER THE COUPLING NUT IS TORQUED. HOLD THE THERMOCOUPLE STUD BOX AND LOOSEN THE COUPLING NUT AND ALIGN THE THERMOCOUPLE STUD BOX AGAIN.

(f) Make sure the thermocouple stud box is aligned. Do not put too much force on the terminals of the wiring harness.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(g) (Reference 2273) Torque the alumel nuts (larger terminal studs) to 18 − 22 lb−in. (2.034 − 2.486 N.m).

(h) (Reference 2273) Torque the chromel nuts (smaller terminal studs) to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(i) Install lockwire from the coupling nut to the adapter.

(j) Torque the bolt that attachs the clamp and ground strap to the bracket on the housing to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(3) Connect the W3 and the W5 harness connectors (given below) to the mating harness receptacles as follows. See Figure 401. For each connector:

(a) Remove the protection covers. Examine the harness connector and the mating receptacle for bent pins and contamination. If necessary, carefully make straight any bent pins. If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol P11−009. Let dry.

(b) Align the connector keyways and engage the connector to the mating receptacle. Tighten the connector coupling nut by hand until you cover the witness (color) band and the connector coupling nut is hand tight.

NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. USE OF THE WRONG ASSEMBLY TOOLS CAN RESULT IN CONNECTOR DAMAGE OR A LOOSE CONNECTOR. A LOOSE CONNECTOR PERMITS VIBRATION AND CAN RESULT IN CONTACT WEAR AND POOR LIGHTNING PROTECTION.

(c) Use the Glenair TG−70 Strap Wrench or the Glenair TG−69 Soft−Jawed Pliers and tighten the connector coupling nut. Use sufficient force to be sure:

− the connector coupling nut is fully tight
− the connector fits tightly against the receptacle (metal to metal).
− This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

NOTE: See the instructions given with the strap wrench for correct use.

Connector	Component	Location
W5P6	EEC Alternator (Lower Connector)	Bottom Of Gearbox 7 O'Clock
W3P1	EEC Alternator (Upper Connector)	Bottom Of Gearbox 7 O'Clock
W3P18	EEC Oil Temperature Thermocouple Probe	Front Of Gearbox 7 O'Clock

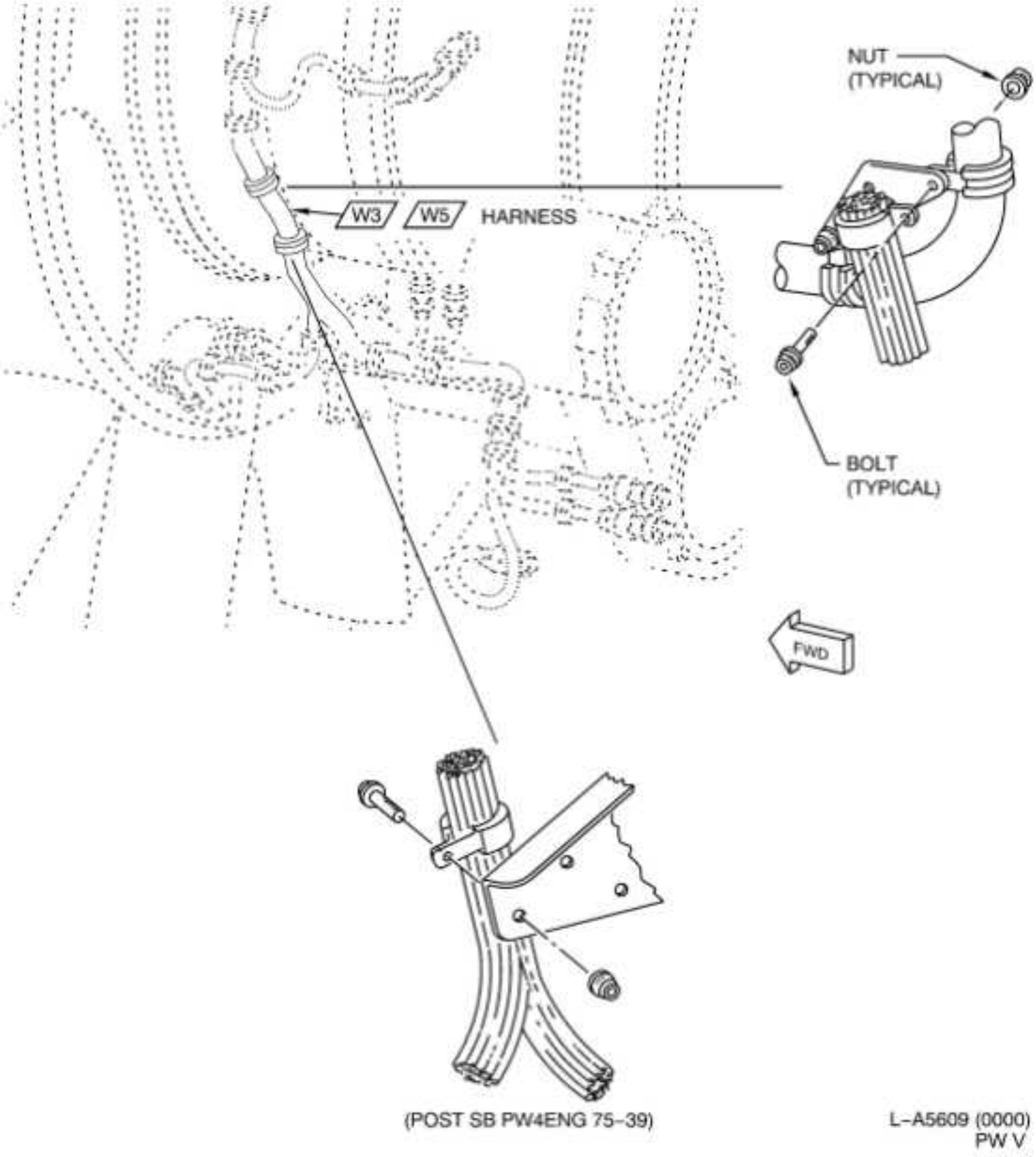
(4) Adjust the harnesses for any necessary clearances as required. Install the clamps at all clamp points. Refer to the figures. Attach the clamps loosely to the

engine with bolts and/or nuts, threads lubricated with Engine Oil P03−001.

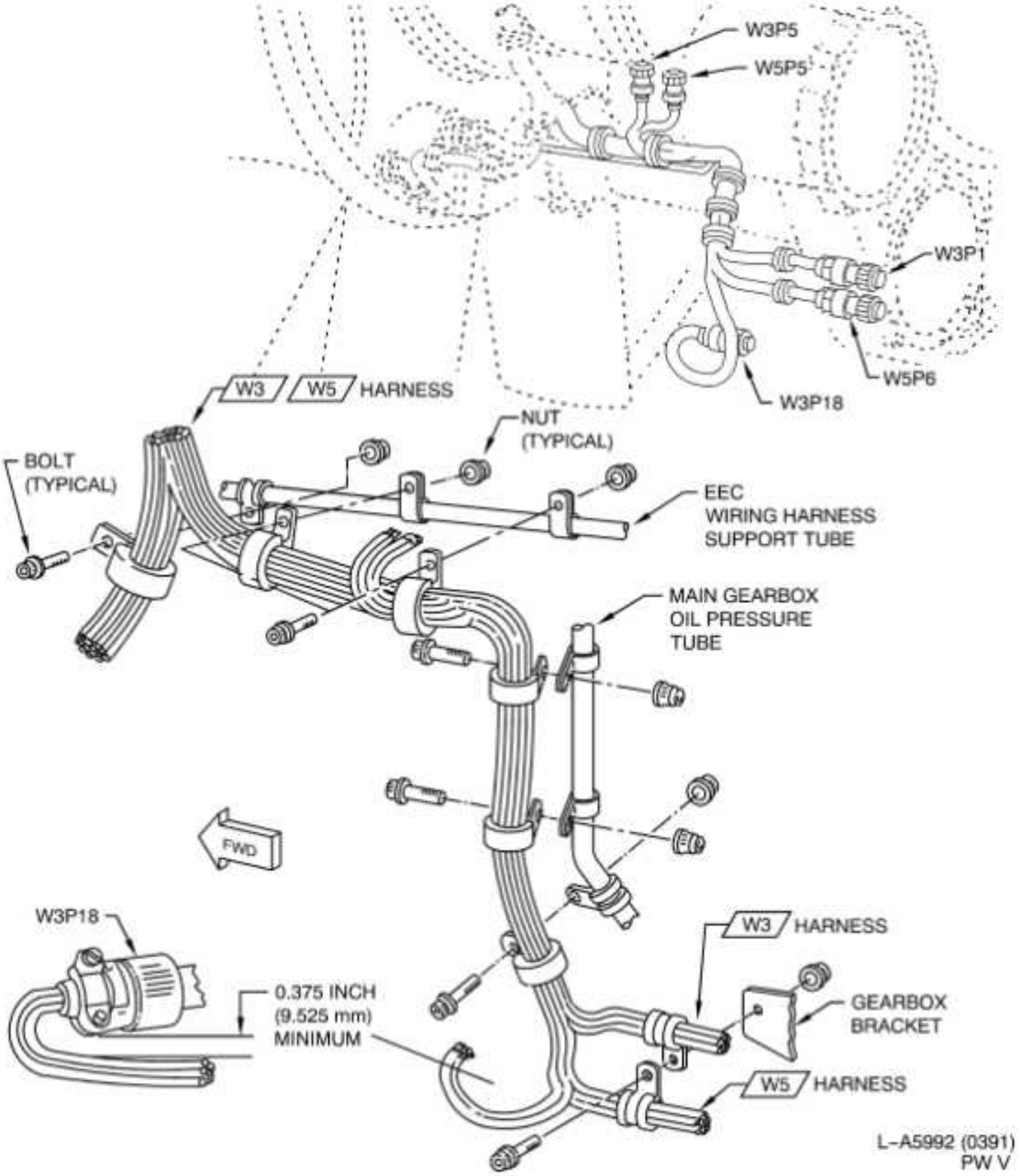
NOTE: Use different clamp sizes on the harnesses to prevent harness movement when tightened. See the Illustrated Parts Catalog for selection of the clamp sizes and part numbers.

(5) Make sure that the harnesses are not tight to the point where sharp bends are caused, and that the harnesses do not touch any engine parts or plumbing. Provide a drip loop on the leads where the wires run downward into the connector.

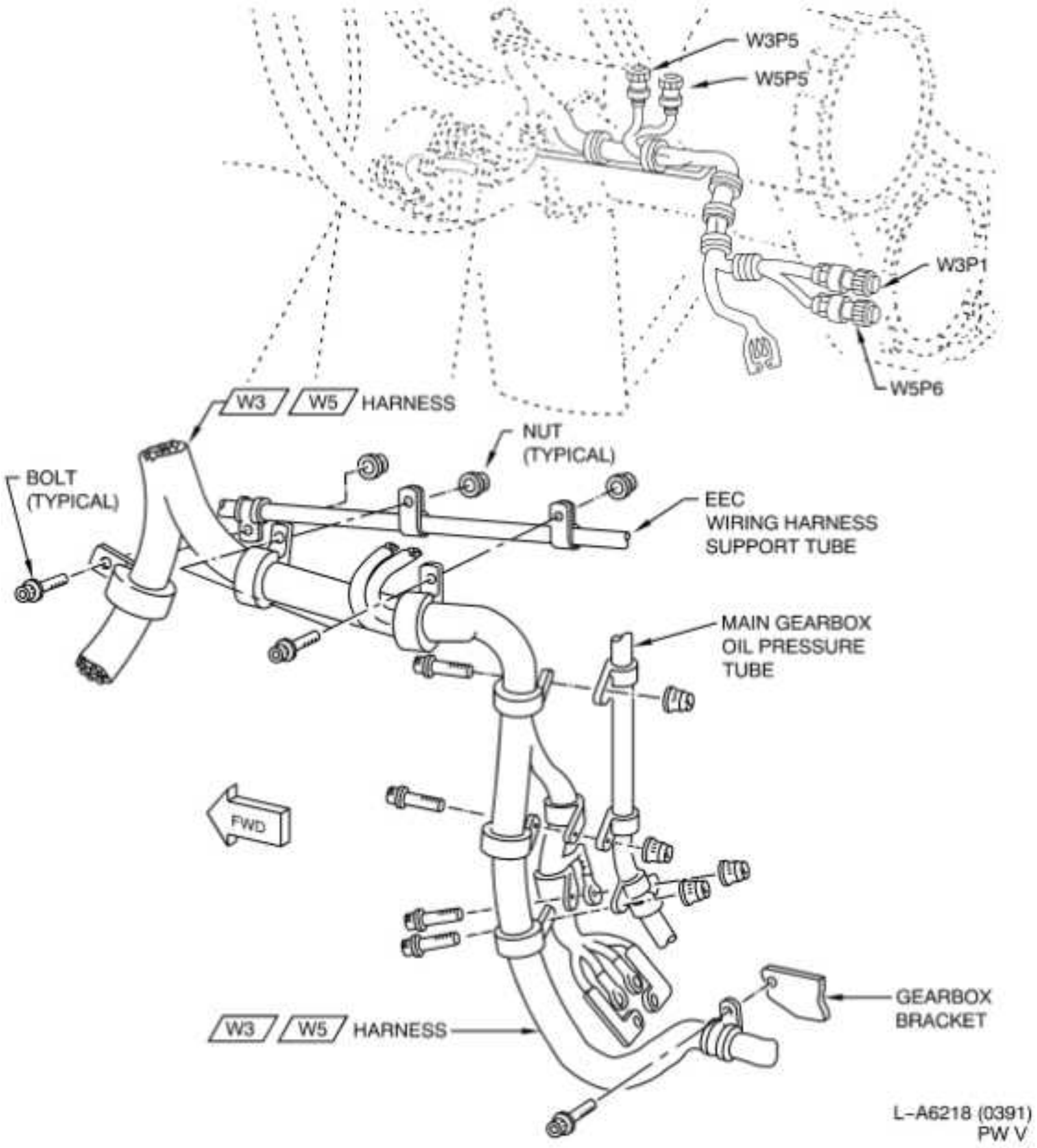
(6) Tighten all the previously installed clamp nuts and/or bolts to a torque of 36 − 40 lb−in. (4.067 − 4.519 N.m).


NUT
(TYPICAL)
W3
W5
HARNESS
BOLT
(TYPICAL)
FWD
(POST SB PW4ENG 75−39)
L−A5609 (0000)
PW V

Core Engine EEC Wiring Harnesses
Figure 401 (Sheet 1)
(Task 72−00−61−450−015)


W3P5
W5P5
W3P1
W5P6
W3P18
W3 W5 HARNESS
NUT (TYPICAL)
BOLT (TYPICAL)
EEC WIRING HARNESS SUPPORT TUBE
MAIN GEARBOX OIL PRESSURE TUBE
FWD
W3P18
0.375 INCH (9.525 mm) MINIMUM
W3 HARNESS
GEARBOX BRACKET
W5 HARNESS
L-A5992 (0391)
PW V

Core Engine EEC Wiring Harnesses (Pre SB PW4ENG 73-84)
Figure 401 (Sheet 2)
(Task 72-00-61-450-015)


W3P5
W5P5
W3P1
W5P6
W3
W5
HARNESS
NUT (TYPICAL)
BOLT (TYPICAL)
EEC WIRING HARNESS SUPPORT TUBE
MAIN GEARBOX OIL PRESSURE TUBE
FWD
W3
W5
HARNESS
GEARBOX BRACKET
L−A6218 (0391)
PW V

Core Engine EEC Wiring Harnesses (Post SB PW4ENG 73−84)
Figure 401 (Sheet 3)
(Task 72−00−61−450−015)

Task 72-00-61-430-001:

1. Install Main Oil Filter

A. Equipment And Materials Required

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
R P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Filter Element	1	79-21-00/2/120
Packing	1	79-21-00/2/160
Packing	1	79-21-00/2/230

B. Procedure
See Figure 401.

(1) (Pre SB PW4ENG 72-524) Install the main oil filter element and cover as follows: See Figure 401 (Sheet 1) and Figure 401 (Sheet 2).

(a) Remove the protective closures and check the oil filter cavity for old seal parts and remove any that are found.

CAUTION: OIL FILTER ELEMENTS HAVE A REMOVABLE PLUG IN THE END CAP WHICH MUST BE IN PLACE BEFORE INSTALLING THE FILTER ELEMENT INTO THE HOUSING OR THE OIL WILL NOT BE FILTERED.

(b) Align the bolt hole and position key washer (401/7) in the center of the cover (401/15) with the tab of the key washer in the mating hole in the cover. Secure the key washer with the screw (401/6), lubricated with Engine Oil P03-001.

Torque screw to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Install the spring (401/5) on the key washer (401/7). Bend the tabs of the washer out between the coils of the spring.

(d) Install a new packing (401/8), lubricated with Engine Oil P03-001, into the groove in OD of the main oil strainer cover (401/15).

(e) Install the filter element (401/4) with the plugged end outward, into the opening in the bottom of the cover (401/15). Align the bolt holes and install the cover with the filter element into the main oil filter housing (401/3).

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN-FLIGHT-SHUTDOWN.

CAUTION: INCORRECT INSTALLATION OF THE COVER CAN CAUSE DAMAGE TO THE PACKING.

CAUTION: DO NOT USE THE COVER RETAINING BOLTS TO PULL THE COVER INTO THE HOUSING. TO DO SO CAN CAUSE DAMAGE TO THE PACKING.

(f) With the cover (401/15) in position on the housing (401/3), carefully push the cover on to the housing until the flange of the cover touches the housing.

NOTE: The drain opening in the cover should be toward the outboard side of the filter housing.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN-FLIGHT-SHUTDOWN.

CAUTION: BE SURE TO TORQUE THE COVER RETAINING BOLTS TO THE TORQUE SPECIFIED.

(g) Attach the cover (401/15) with four washers (401/14) and bolts (401/13). Torque bolts to 125 - 140 lb-in. (14.123 - 15.818 N.m).

(2) (Post SB PW4ENG 72-524 and Pre SB PW4ENG 79-79) Install the main oil filter element and cover as follows: See Figure 401 (Sheet 3) and Figure 401 (Sheet 4).

(a) Remove the protective closures and check the oil filter cavity for old seal parts and remove any that are found.

CAUTION: OIL FILTER ELEMENTS HAVE A REMOVABLE PLUG IN THE END CAP WHICH MUST BE IN PLACE BEFORE INSTALLING THE FILTER ELEMENT INTO THE HOUSING OR THE OIL WILL NOT BE FILTERED.

(b) Align the bolt hole and position the key washer (401/7) in the center of the cover (401/15) with the tab of the key washer in the mating hole in the cover. Secure the key washer with the screw (401/6), lubricated with Engine Oil P03−001. Torque the screw to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Install the spring (401/5) on the key washer (401/7). Bend the tabs of the washer out between the coils of spring.

(d) Install a new packing (401/8), lubricated with Engine Oil P03−001, into the groove in the OD of the main oil strainer cover (401/15).

(e) Install the filter element (401/4) into the opening in the bottom of the cover (401/15). Align the bolt holes and install the cover with the filter element into the main oil filter housing (401/3).

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: INCORRECT INSTALLATION OF THE COVER CAN CAUSE DAMAGE TO THE PACKING.

CAUTION: DO NOT USE THE COVER RETAINING NUTS TO PULL THE COVER INTO THE HOUSING. TO DO SO CAN CAUSE DAMAGE TO THE PACKING.

(f) With the cover (401/15) in position over the studs in the housing (401/3), carefully push the cover on the housing until the flange of the cover touches the housing.

NOTE: The drain opening in the cover should be toward the outboard side of the filter housing.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN-FLIGHT-SHUTDOWN.

CAUTION: BE SURE TO TORQUE THE COVER RETAINING NUTS TO THE TORQUE SPECIFIED.

(g) Attach the cover (401/15) to the housing.

1 If self-locking nuts are used, attach the cover to the housing with four (4) washers (401/14) and nuts (401/29). Lubricate the threads with Engine Oil P03-001. Torque nuts to 150 - 170 lb-in. (16.948 - 19.207 N.m).

2 If hex nuts with lockwire provisions are used, attach the cover to the housing with four (4) washers (401/14) and nuts (401/30). Lubricate the threads with Engine Oil P03-001. Torque nuts to 125 - 150 lb-in. (14.123 - 16.948 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to the nuts.

(3) (Post SB PW4ENG 72-524 and SB PW4ENG 79-79) Install the main oil filter element and cover as follows: See Figure 401 (Sheet 5) and Figure 401 (Sheet 6).

(a) Remove the protective closures and check the oil filter cavity for old seal parts and remove any that are found.

CAUTION: OIL FILTER ELEMENTS HAVE A REMOVABLE PLUG IN THE END CAP WHICH MUST BE REMOVED BEFORE INSTALLING THE FILTER ELEMENT INTO THE HOUSING OR THE OIL WILL NOT BE FILTERED.

(b) Install the spring (401/5) in the spring retainer (401/23).

(c) Install two screws (401/22) through the spring retainer screw holes and then install two washers (401/20) on the ends of the two screws.

(d) Lubricate the threads of the two screws (401/22) with Engine Oil P03−001.

(e) With the spring (401/5) in place in the spring retainer (401/23), thread the two screws (401/22) into the main oil strainer cover (401/21). Torque the two screws to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(f) Install new packing (401/8), lubricated with Engine Oil P03−001, into the groove in the OD of the main oil strainer cover (401/21).

(g) Install the filter element (401/4) into the opening in the bottom of the cover (401/21). Align the bolt holes and install the cover with the filter element into the main oil filter housing (401/3).

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: INCORRECT INSTALLATION OF THE COVER CAN CAUSE DAMAGE TO THE PACKING.

CAUTION: DO NOT USE THE COVER RETAINING NUTS TO PULL THE COVER INTO THE HOUSING. TO DO SO CAN CAUSE DAMAGE TO THE PACKING.

(h) With the cover (401/21) in position over the studs in the housing (401/3), carefully push the cover on the housing until the flange of the cover touches the housing.

NOTE: The drain opening in the cover should be toward the outboard side of the filter housing.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: BE SURE TO TORQUE THE COVER RETAINING NUTS TO THE TORQUE SPECIFIED.

(i) Attach the cover (401/21) to the housing.

1 If self-locking nuts are used, attach the cover to the housing with four (4) washers (401/14) and nuts (401/29). Lubricate the threads with Engine Oil P03-001. Torque nuts to 150 - 170 lb-in. (16.948 - 19.207 N.m).

2 If hex nuts with lockwire provisions are used, attach the cover to the housing with four (4) washers (401/14) and nuts (401/30). Lubricate the threads with Engine Oil P03-001. Torque nuts to 125 - 150 lb-in. (14.123 - 16.948 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to the nuts.

(4) (Post SB PW4ENG 72-525) Install the main oil filter element and cover as follows: See Figure 401 (Sheet 7) and Figure 401 (Sheet 8).

(a) Remove the protective closures and check the oil filter cavity for old seal parts and remove any that are found.

CAUTION: OIL FILTER ELEMENTS HAVE A REMOVABLE PLUG IN THE END CAP WHICH MUST BE REMOVED BEFORE INSTALLING THE FILTER ELEMENT INTO THE HOUSING OR THE OIL WILL NOT BE FILTERED.

(b) Install pressure relief valve (401/41) in center of cover (401/42) and attach with retaining ring (401/40).

(c) Install new packing (401/8), lubricated with Engine Oil P03-001, into groove in OD of main oil strainer cover (401/42).

(d) Remove the protective closure from the end of the filter element (401/39).

(e) Install the filter element (401/39) over the pressure relief valve (401/41) in cover (401/42). Align bolt holes and dowel pin in cover with studs and dowel pin hole in main oil filter housing (401/3), then install cover with filter element into main oil filter housing.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN-FLIGHT-SHUTDOWN.

CAUTION: INCORRECT INSTALLATION OF THE COVER CAN CAUSE DAMAGE TO THE PACKING.

CAUTION: DO NOT USE THE COVER RETAINING NUTS TO PULL THE COVER INTO THE HOUSING. TO DO SO CAN CAUSE DAMAGE TO THE PACKING.

(f) With the cover (401/42) in position over the studs and dowel pin hole in the housing, carefully push the cover on the housing until the flange of the cover touches the housing.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN-FLIGHT-SHUTDOWN.

CAUTION: BE SURE TO TORQUE THE COVER RETAINING NUTS TO THE TORQUE SPECIFIED.

(g) Attach the cover (401/42) with four washers (401/14) and nuts (401/29). Torque nuts to 150 - 170 lb-in. (16.948 - 19.207 N.m).

(5) (Pre SB PW4ENG 72-525) Install new packing (401/9), lubricated with Engine Oil P03-001, onto insert (401/10).

(6) (Pre SB PW4ENG 72-525) Install insert, lubricated with Engine Oil P03-001, into opening in bottom of cover (401/15 or 401/21, as applicable). Torque insert to 200 - 225 lb-in. (22.597 - 25.422 N.m).

(7) (Pre SB PW4ENG 72-525) Install new packing (401/11), lubricated with Engine Oil P03-001, onto plug (401/12).

(8) (Pre SB PW4ENG 72-525) Install plug (401/12), lubricated with Engine Oil P03-001, into previously installed insert (401/10). Torque plug to 110 - 120 lb-in. (12.428 - 13.558 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 the plug.

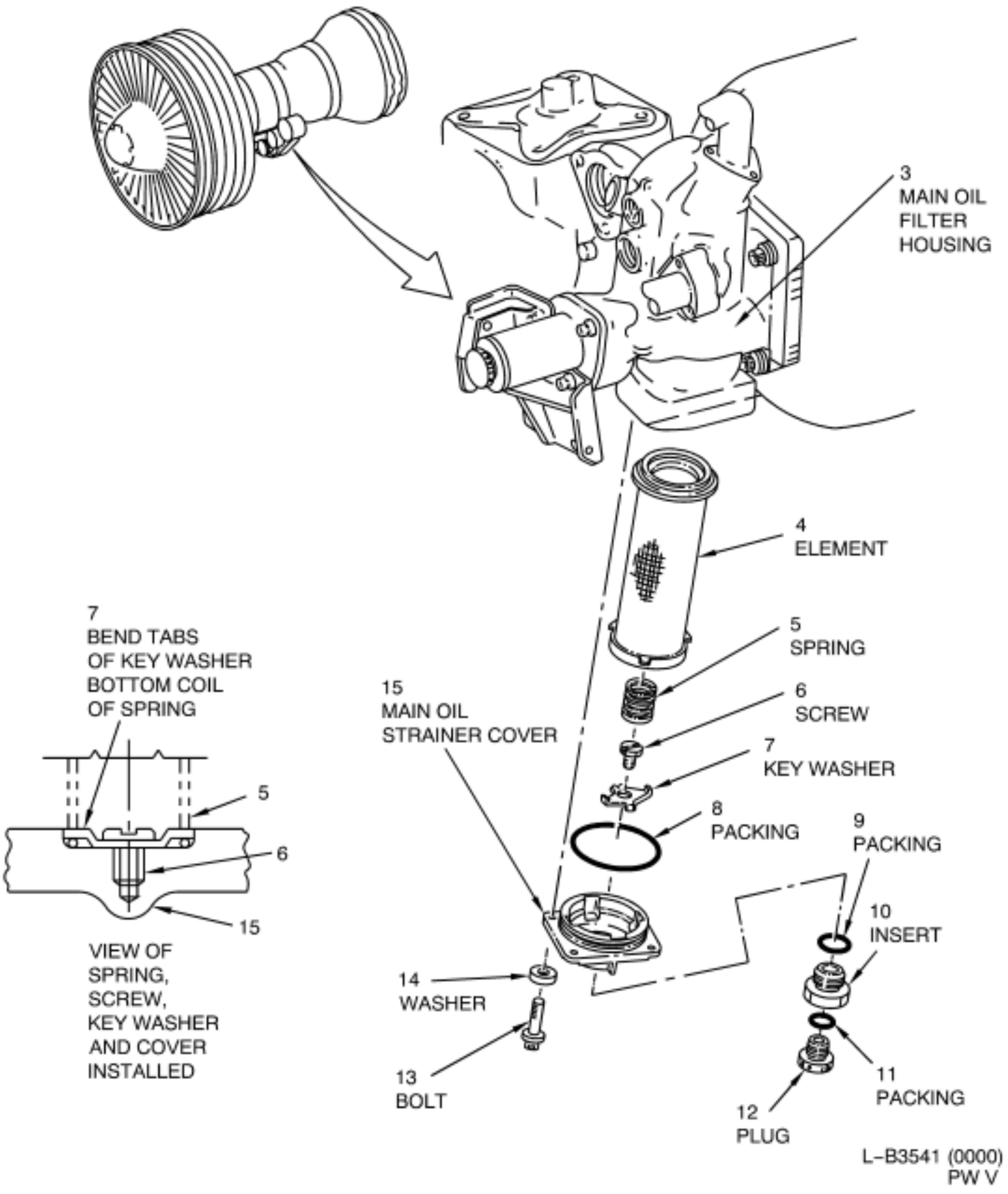
(9) (Post SB PW4ENG 72-525) Install new packing (401/11), lubricated with Engine Oil P03-001, onto plug (401/12). See Figure 401 (Sheet 4).

(10) (Post SB PW4ENG 72−525) Install plug (401/12), lubricated with Engine Oil P03−001, into threaded hole in bottom of cover (401/42). Torque plug to 110 − 120 lb−in. (12.428 − 13.558 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 the plug. See Figure 401 (Sheet 4).

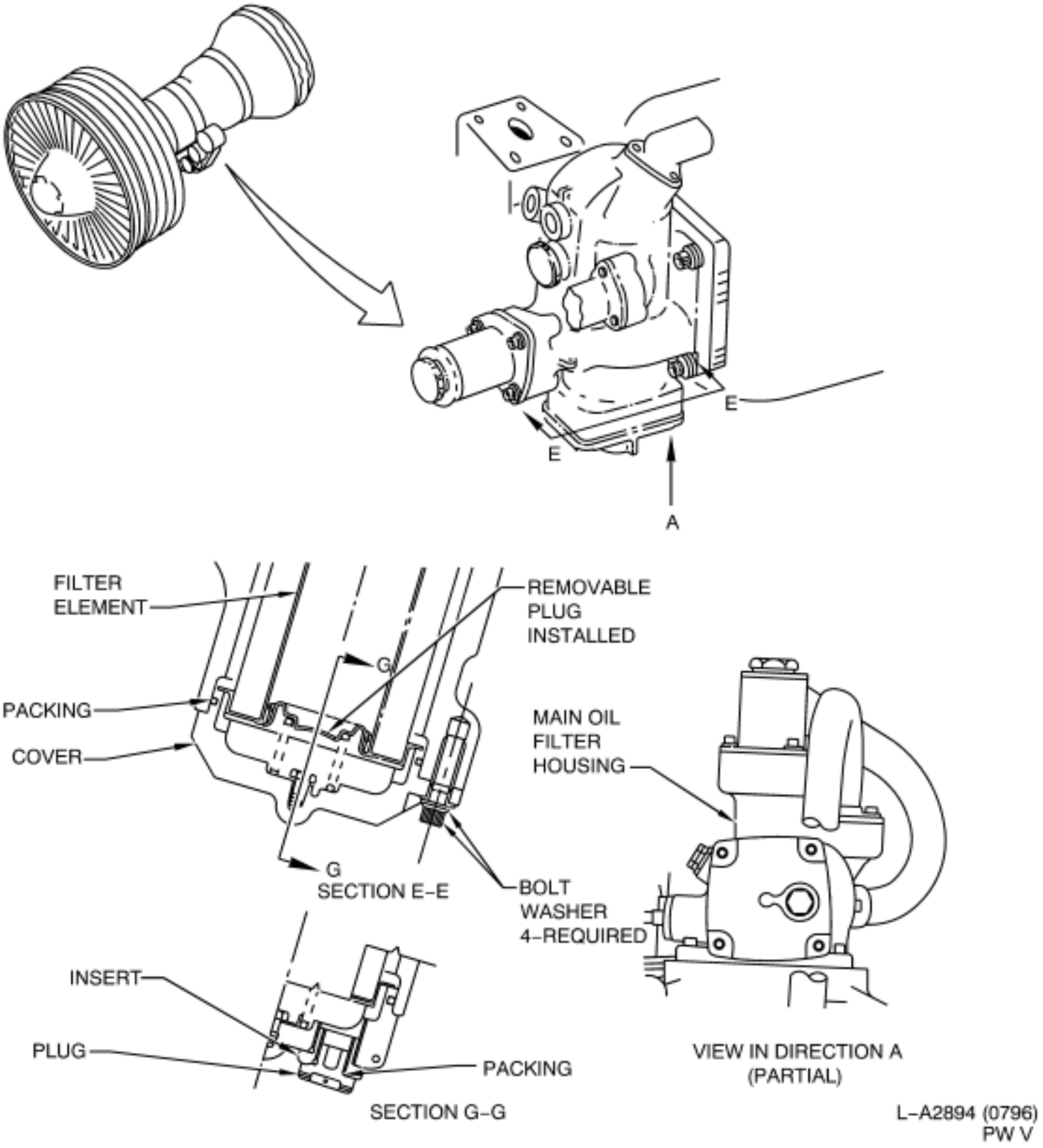
C. Postrequisites

(1) Service oil system per 72−00−00, Servicing−03 Task 72−00−00−610−003.

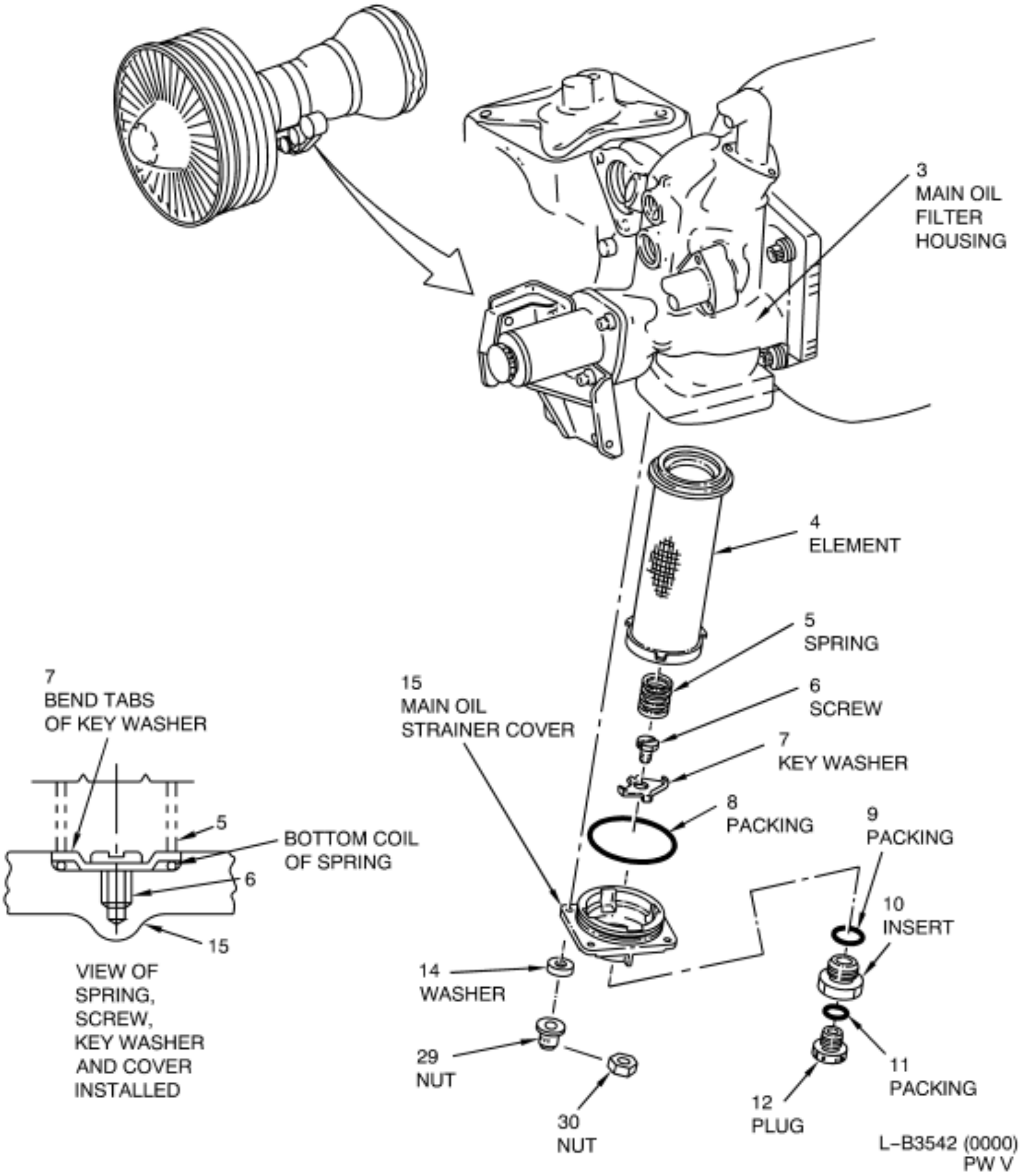
(2) Test engine per Test Reference Table. See 71−00−00, Testing−00 Task 71−00−00−990−003.


3
MAIN OIL
FILTER
HOUSING
4
ELEMENT
5
SPRING
6
SCREW
7
KEY WASHER
8
PACKING
9
PACKING
10
INSERT
11
PACKING
12
PLUG
13
BOLT
14
WASHER
15
MAIN OIL
STRAINER COVER
7
BEND TABS
OF KEY WASHER
BOTTOM COIL
OF SPRING
5
6
15
VIEW OF
SPRING,
SCREW,
KEY WASHER
AND COVER
INSTALLED
L-B3541 (0000)
PW V

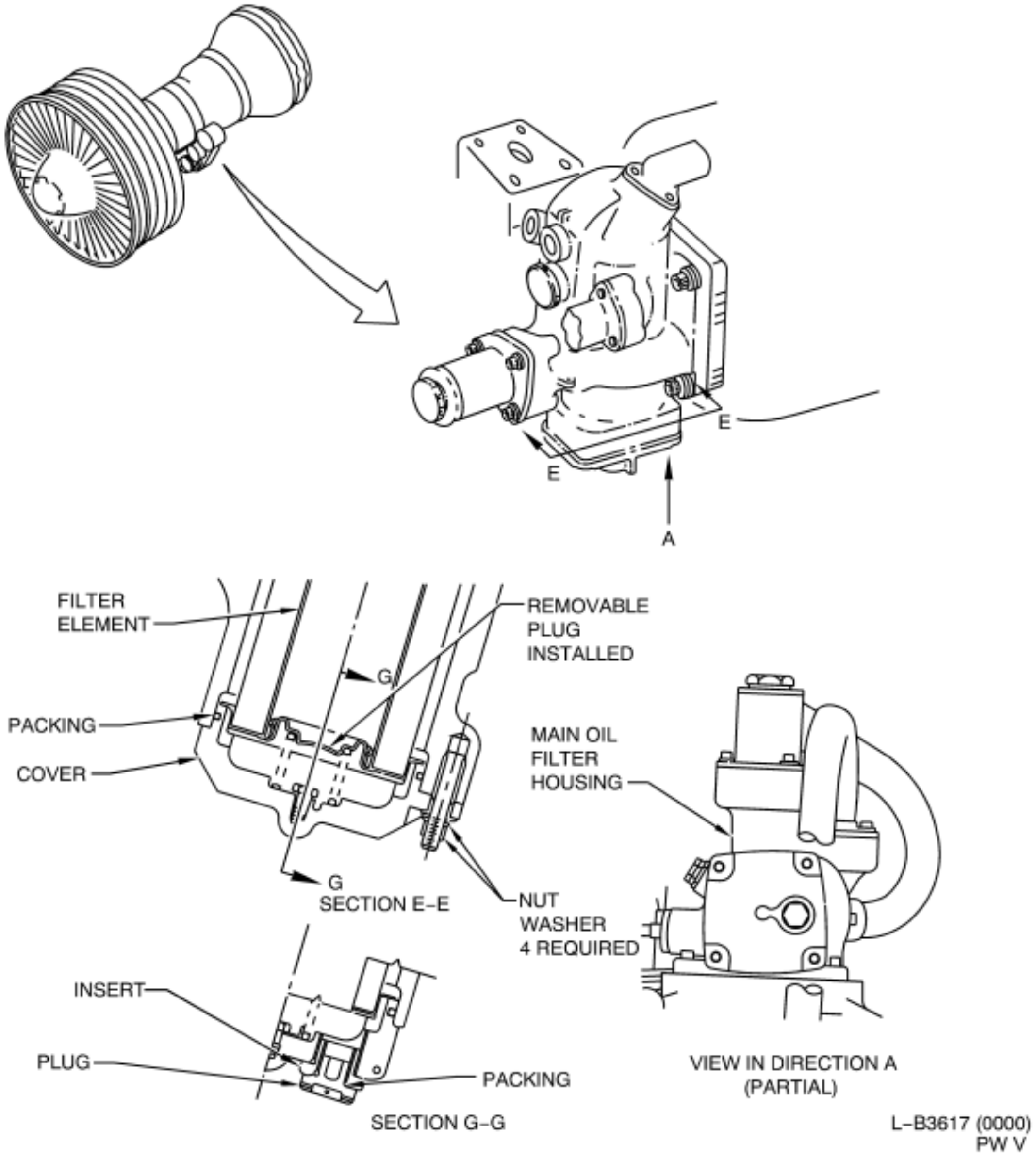
Main Oil Filter Assembly (Pre SB PW4ENG 72-524)
Figure 401 (Sheet 1)
(Task 72-00-61-430-001)


E
E
A
FILTER ELEMENT
REMOVABLE PLUG INSTALLED
G
PACKING
COVER
MAIN OIL FILTER HOUSING
G
SECTION E-E
BOLT
WASHER
4-REQUIRED
INSERT
PLUG
PACKING
SECTION G-G
VIEW IN DIRECTION A (PARTIAL)
L-A2894 (0796)
PW V

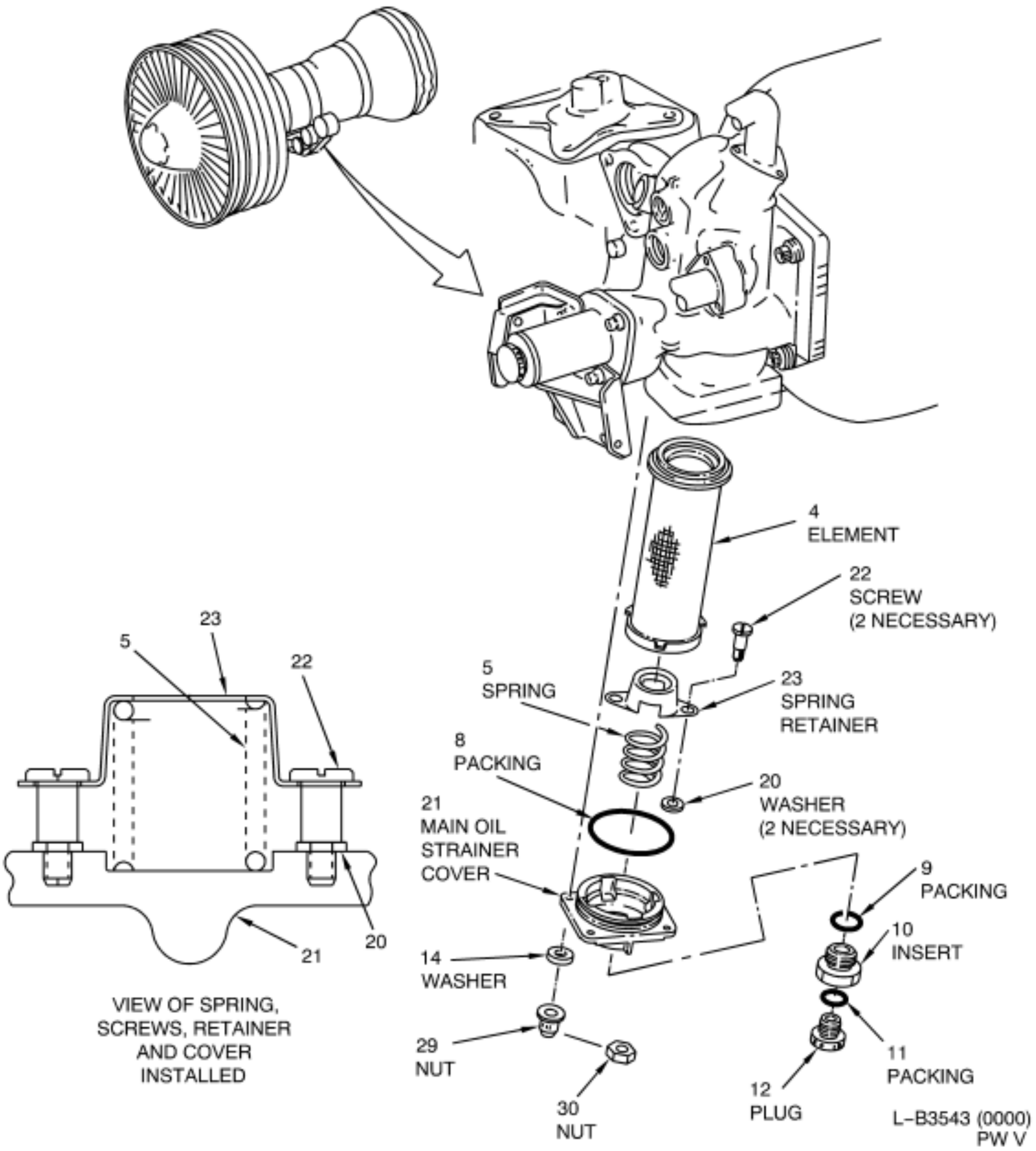
Main Oil Filter Assembly (Pre SB PW4ENG 72-524)
Figure 401 (Sheet 2)
(Task 72-00-61-430-001)


3
MAIN OIL
FILTER
HOUSING
4
ELEMENT
5
SPRING
6
SCREW
7
KEY WASHER
8
PACKING
9
PACKING
10
INSERT
11
PACKING
12
PLUG
7
BEND TABS
OF KEY WASHER
15
MAIN OIL
STRAINER COVER
5
BOTTOM COIL
OF SPRING
6
15
VIEW OF
SPRING,
SCREW,
KEY WASHER
AND COVER
INSTALLED
14
WASHER
29
NUT
30
NUT
L-B3542 (0000)
PW V

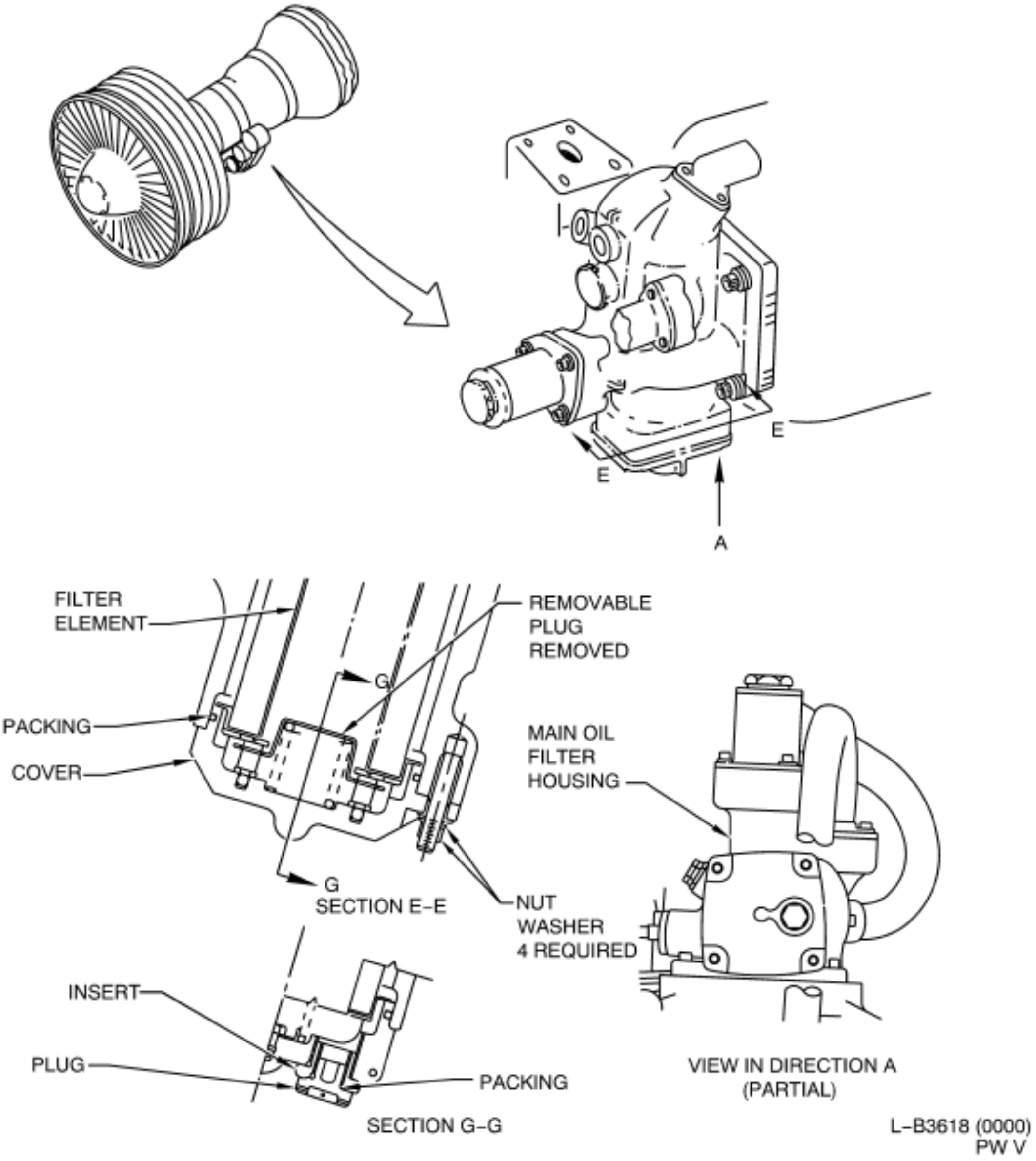
Main Oil Filter Assembly (Post SB PW4ENG 72-524 And Pre SB PW4ENG 79-79)
Figure 401 (Sheet 3)
(Task 72-00-61-430-001)


E
E
A
FILTER ELEMENT
REMOVABLE PLUG INSTALLED
G
PACKING
COVER
MAIN OIL FILTER HOUSING
G
SECTION E-E
NUT
WASHER
4 REQUIRED
INSERT
PLUG
PACKING
SECTION G-G
VIEW IN DIRECTION A
(PARTIAL)
L-B3617 (0000)
PW V

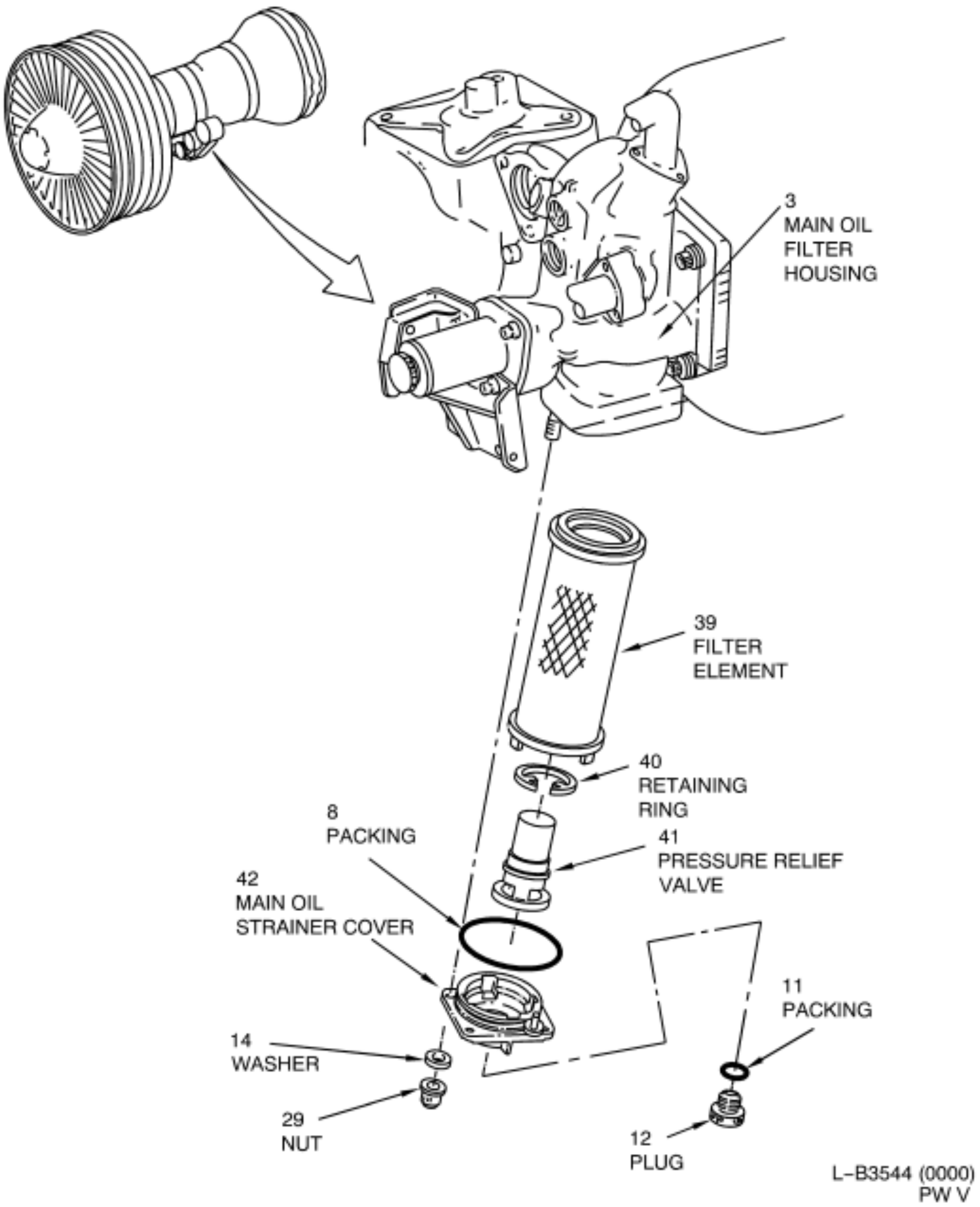
Main Oil Filter Assembly (Post SB PW4ENG 72-524 And Pre SB PW4ENG 79-79)
Figure 401 (Sheet 4)
(Task 72-00-61-430-001)


4
ELEMENT
22
SCREW
(2 NECESSARY)
23
5
22
5
SPRING
23
SPRING
RETAINER
8
PACKING
20
WASHER
(2 NECESSARY)
21
MAIN OIL
STRAINER
COVER
9
PACKING
21
20
10
INSERT
14
WASHER
VIEW OF SPRING,
SCREWS, RETAINER
AND COVER
INSTALLED
29
NUT
11
PACKING
12
PLUG
30
NUT
L-B3543 (0000)
PW V

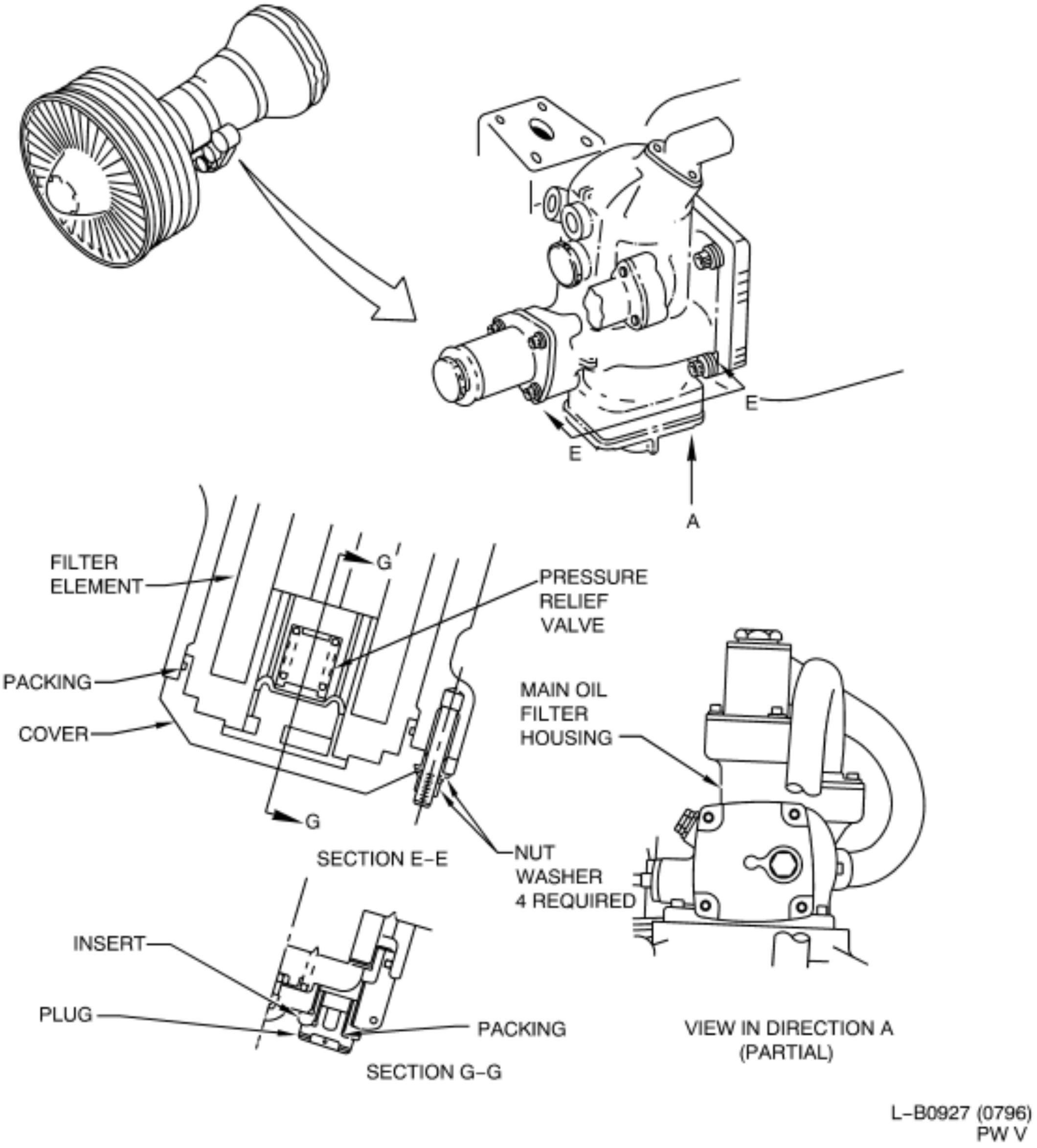
Main Oil Filter Assembly (Post SB PW4ENG 72-524, SB PW4ENG 79-79 And Pre SB PW4ENG 525)
Figure 401 (Sheet 5)
(Task 72-00-61-430-001)


E
E
A
FILTER ELEMENT
REMOVABLE PLUG REMOVED
G
PACKING
COVER
MAIN OIL FILTER HOUSING
G
SECTION E−E
NUT
WASHER
4 REQUIRED
INSERT
PLUG
PACKING
SECTION G−G
VIEW IN DIRECTION A (PARTIAL)
L−B3618 (0000)
PW V

Main Oil Filter Assembly (Post SB PW4ENG 72−524, SB PW4ENG 79−79 And Pre SB PW4ENG 525)
Figure 401 (Sheet 6)
(Task 72−00−61−430−001)


3
MAIN OIL
FILTER
HOUSING
39
FILTER
ELEMENT
40
RETAINING
RING
41
PRESSURE RELIEF
VALVE
8
PACKING
42
MAIN OIL
STRAINER COVER
11
PACKING
14
WASHER
29
NUT
12
PLUG
L−B3544 (0000)
PW V

Main Oil Filter, Housing, Pressure Relief Valve
And Cover Assembly (Post SB PW4ENG 72−525)
Figure 401 (Sheet 7)
(Task 72−00−61−430−001)


E
E
A
FILTER ELEMENT
G
PRESSURE RELIEF VALVE
PACKING
COVER
G
MAIN OIL FILTER HOUSING
SECTION E-E
NUT
WASHER
4 REQUIRED
INSERT
PLUG
PACKING
SECTION G-G
VIEW IN DIRECTION A (PARTIAL)
L-B0927 (0796)
PW V

Main Oil Filter, Housing, Pressure Relief Valve
And Cover Assembly (Post SB PW4ENG 72-525)
Figure 401 (Sheet 8)
(Task 72-00-61-430-001)

Task 72-00-61-450-017:

1. Install The Magnetic Chip Detector Assemblies

A. General

(1) To install a full magnetic plug assembly, first install the valve, then install the plug.

B. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72-61-00/12/270
Packing	AR	72-61-00/12/287
Packing	AR	72-61-00/12/287A
Packing	AR	72-61-00/12/289
Packing	AR	72-61-00/12/292
Packing	AR	72-61-00/12/292A
Packing	AR	72-61-00/12/293
Packing	AR	72-61-00/12/303
Packing	AR	72-61-00/12/306
Packing	1	79-11-00/2/1
Packing	AR	79-11-00/2/14
Packing	AR	79-11-00/2/18
Packing	AR	79-11-00/2/19
Packing	AR	79-11-00/2/23
Packing	AR	79-11-00/2/23A
Packing	AR	79-11-00/2/25
Packing	AR	79-11-00/2/33
Packing	AR	79-11-00/2/35
Packing	4	79-21-00/1/80
Packing	AR	79-21-00/1/97
Packing	AR	79-21-00/1/99
Packing	AR	79-21-00/1/102
Packing	AR	79-21-00/1/103

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
(CONTINUED)		
Packing	AR	79-21-00/1/113
Packing	AR	79-21-00/1/117

C. Installation Of The Magnetic Chip Detectors

CAUTION: REMOVE THE PROTECTIVE COVERS FROM THE OPENINGS AS NECESSARY TO PREVENT ENGINE DAMAGE.

CAUTION: DO NOT TRY TO INSTALL THE CHIP DETECTOR AS AN ASSEMBLY. YOU MUST REMOVE THE MAGNETIC PROBE FROM THE VALVE TO PREVENT DAMAGE TO THE PARTS.

(1) Install the magnetic chip detector to the engine oil tank. See Figure 401.

(a) Install the PN 50R499 magnetic chip detector to the engine oil tank as follows:

1 If necessary, install the magnetic probe (401/15) into the valve (401/4) to get access to the packing grooves.

2 Apply Engine Oil P03-001 to the new packing (401/2).

3 Install the new packing to the small OD end of the valve.

4 Apply Engine Oil P03-001 to the new packing (401/1).

5 Install the new packing to the washer face of the valve.

6 Remove the magnetic probe from the valve.

7 Install the valve into the engine oil tank.

8 Torque the valve to 200 - 225 lb-in. (22.597 - 25.422 N.m).

9 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

10 Apply Engine Oil P03−001 to the new packing (401/3).

11 Install the new packing to the groove on the magnetic probe.

12 Install the magnetic probe into the valve.

13 Push the magnetic probe in and turn it clockwise until it locks.

14 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

(b) Install the PN 50R485 magnetic chip detector to the engine oil tank as follows:

1 If necessary, install the magnetic probe (401/9) into the valve (401/7) to get access to the packing grooves.

2 Apply Engine Oil P03−001 to the new packing (401/6).

3 Install the new packing to the small OD end of the valve.

4 Apply Engine Oil P03−001 to the new packing (401/1).

5 Install the new packing to the washer face of the valve.

6 Remove the magnetic probe from the valve.

7 Install the valve into the engine oil tank.

8 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

9 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

10 Apply Engine Oil P03−001 to the new packing (401/8).

11 Install the new packing to the groove on the magnetic probe.

12 Install the magnetic probe into the valve.

13 Push the magnetic probe in and turn it clockwise until it locks.

14 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

(c) Install the PN 50R423 (option 1) magnetic chip detector to the engine oil tank as follows:

1 Apply Engine Oil P03−001 to the new packing (401/1).

2 Install the new packing to the washer face of the valve (401/10).

3 Install the valve into the engine oil tank.

4 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

5 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

6 Apply Engine Oil P03−001 to the new packing (401/11).

7 Install the new packing to the groove on the magnetic probe (401/12).

8 Install the magnetic probe into the valve.

9 Push the magnetic probe in and turn it clockwise until it locks.

10 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

(d) Install the PN 50R423 (option 2) magnetic chip detector to the engine oil tank as follows:

1 Apply Engine Oil P03−001 to the new packing (401/1).

2 Install the new packing to the washer face of the valve (401/13).

3 Apply Engine Oil P03−001 to the new packing (401/14).

4 Install the new packing to the ID of the valve.

5 Install the valve into the engine oil tank.

6 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

7 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

8 Apply Engine Oil P03−001 to the new packing (401/15).

9 Install the new packing to the groove on the magnetic probe (401/16).

10 Install the magnetic probe into the valve.

11 Push the magnetic probe in and turn it clockwise until it locks.

12 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

(e) Install the PN 50R374 magnetic chip detector to the engine oil tank as follows:

1 Apply Engine Oil P03−001 to the new packing (401/1).

2 Install the new packing to the washer face of the valve (401/17).

3 Install the valve into the engine oil tank.

4 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

5 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

6 Apply Engine Oil P03−001 to the new packing (401/18).

7 Install the new packing to the groove on the magnetic probe (401/19).

8 Install the magnetic probe into the valve.

9 Push the magnetic probe in and turn it clockwise until it locks.

10 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

CAUTION: REMOVE THE PROTECTIVE COVERS FROM THE OPENINGS AS NECESSARY TO PREVENT ENGINE DAMAGE.

CAUTION: DO NOT TRY TO INSTALL THE CHIP DETECTOR AS AN ASSEMBLY. YOU MUST REMOVE THE MAGNETIC PROBE FROM THE VALVE TO PREVENT DAMAGE TO THE PARTS.

(2) Install the four magnetic chip detectors to the lubrication and scavenge oil pump. See Figure 402.

(a) Install the PN 50R342 magnetic chip detector to the lubrication and scavenge oil pump as follows:

1 Apply Engine Oil P03−001 to the new packing (402/1).

2 Install the new packing to the washer face of the valve (402/2).

3 Install the valve into the engine oil tank.

4 Torque the valve to 90 − 100 lb−in. (10.169 − 11.298 N.m).

5 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

6 Apply Engine Oil P03−001 to the new packing (402/3).

7 Install the new packing to the groove on the magnetic probe (402/4).

8 Install the magnetic probe into the valve.

9 Push the magnetic probe in and turn it clockwise until it locks.

10 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

11 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

(b) Install the PN 50R348 magnetic chip detector to the lubrication and scavenge oil pump as follows:

1 Apply Engine Oil P03−001 to the new packing (402/1).

2 Install the new packing to the washer face of the valve (402/8).

3 Apply Engine Oil P03−001 to the new packing (402/7).

4 Install the new packing to the ID of the valve.

5 Install the valve into the lubrication and scavenge oil pump.

6 Torque the valve to 90 − 100 lb−in. (10.169 − 11.298 N.m).

7 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

8 Apply Engine Oil P03−001 to the new packing (402/6).

9 Install the new packing to the groove on the magnetic probe (402/5).

10 Install the magnetic probe into the valve.

11 Push the magnetic probe in and turn it clockwise until it locks.

12 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

13 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

(c) Install the PN 50R492 magnetic chip detector to the lubrication and scavenge oil pump as follows:

1 If necessary, install the magnetic probe (402/2) into the valve (402/10) to get access to the packing grooves.

2 Apply Engine Oil P03−001 to the new packing (402/9).

3 Install the new packing to the small OD end of the valve.

4 Apply Engine Oil P03−001 to the new packing (402/1).

5 Install the new packing to the washer face of the valve.

6 Remove the magnetic probe from the valve.

7 Install the valve into the lubrication and scavenge oil pump.

8 Torque the valve to 90 − 100 lb−in. (10.169 − 11.298 N.m).

9 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

10 Apply Engine Oil P03−001 to the new packing (402/11).

11 Install the new packing to the groove on the magnetic probe.

12 Install the magnetic probe into the valve.

13 Push the magnetic probe in and turn it clockwise until it locks.

14 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

15 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

(d) Install the PN 50R491 magnetic chip detector to the lubrication and scavenge oil pump as follows:

1 Apply Engine Oil P03−001 to the new packing (402/1).

2 Install the new packing to the washer face of the valve (402/16).

3 Apply Engine Oil P03−001 to the new packing (402/15).

4 Install the new packing to the ID of the valve.

5 Install the valve into the lubrication and scavenge oil pump.

6 Torque the valve to 90 − 100 lb−in. (10.169 − 11.298 N.m).

7 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

8 Apply Engine Oil P03−001 to the new packing (402/14).

9 Install the new packing to the groove on the magnetic probe (402/13).

10 Install the magnetic probe into the valve.

11 Push the magnetic probe in and turn it clockwise until it locks.

12 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

13 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

(e) Install the PN 50R501 magnetic chip detector to the engine oil tank as follows:

1 If necessary, install the magnetic probe (402/20) into the valve (402/18) to get access to the packing grooves.

2 Apply Engine Oil P03−001 to the new packing (402/17).

3 Install the new packing to the small OD end of the valve.

4 Apply Engine Oil P03−001 to the new packing (402/1).

5 Install the new packing to the washer face of the valve.

6 Remove the magnetic probe from the valve.

7 Install the valve into the engine oil tank.

8 Torque the valve to 90 − 100 lb−in. (10.169 − 11.298 N.m).

9 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

10 Apply Engine Oil P03−001 to the new packing (402/19).

11 Install the new packing to the groove on the magnetic probe.

12 Install the magnetic probe into the valve.

13 Push the magnetic probe in and turn it clockwise until it locks.

14 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

CAUTION: REMOVE THE PROTECTIVE COVERS FROM THE OPENINGS AS NECESSARY TO PREVENT ENGINE DAMAGE.

CAUTION: DO NOT TRY TO INSTALL THE CHIP DETECTOR AS AN ASSEMBLY. YOU MUST REMOVE THE MAGNETIC PROBE FROM THE VALVE TO PREVENT DAMAGE TO THE PARTS.

(3) Install the magnetic chip detector to the center front side of the main gearbox assembly. See Figure 403.

(a) Install the PN 50R341 magnetic chip detector to the center front side of the main gearbox assembly as follows:

1 Apply Engine Oil P03−001 to the new packing (403/1).

2 Install the new packing to the washer face of the valve (403/2).

3 Install the valve into the center front side of the main gearbox assembly.

4 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

5 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

6 Apply Engine Oil P03−001 to the new packing (403/3).

7 Install the new packing to the groove on the magnetic probe (403/4).

8 Install the magnetic probe into the valve.

9 Push the magnetic probe in and turn it clockwise until it locks.

10 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

(b) Install the PN 50R347 magnetic chip detector to the center front side of the main gearbox assembly as follows:

1 Apply Engine Oil P03−001 to the new packing (403/1).

2 Install the new packing to the washer face of the valve (403/5).

3 Apply Engine Oil P03−001 to the new packing (403/6).

4 Install the new packing to the ID of the valve.

5 Install the valve into the center front side of the main gearbox assembly.

6 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

7 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

8 Apply Engine Oil P03−001 to the new packing (403/7).

9 Install the new packing to the groove on the magnetic probe (403/8).

10 Install the magnetic probe into the valve.

11 Push the magnetic probe in and turn it clockwise until it locks.

12 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

(c) Install the PN 50R485 magnetic chip detector to the center front side of the main gearbox assembly as follows:

1 If necessary, install the magnetic probe (403/12) into the valve (403/10) to get access to the packing grooves.

2 Apply Engine Oil P03−001 to the new packing (403/9).

3 Install the new packing to the small OD end of the valve.

4 Apply Engine Oil P03−001 to the new packing (403/1).

5 Install the new packing to the washer face of the valve.

6 Remove the magnetic probe from the valve.

7 Install the valve into the center front side of the main gearbox assembly.

8 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

9 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

10 Apply Engine Oil P03−001 to the new packing (403/11).

11 Install the new packing to the groove on the magnetic probe.

12 Install the magnetic probe into the valve.

13 Push the magnetic probe in and turn it clockwise until it locks.

14 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

(d) Install the PN 50R484 magnetic chip detector to the center front side of the main gearbox assembly as follows:

1 Apply Engine Oil P03−001 to the new packing (403/1).

2 Install the new packing to the washer face of the valve (403/13).

3 Apply Engine Oil P03−001 to the new packing (403/14).

4 Install the new packing to the ID of the valve.

5 Install the valve into the center front side of the main gearbox assembly.

6 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

7 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

8 Apply Engine Oil P03−001 to the new packing (403/15).

9 Install the new packing to the groove on the magnetic probe (403/16).

10 Install the magnetic probe into the valve.

11 Push the magnetic probe in and turn it clockwise until it locks.

12 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

(e) Install the PN 50R499 magnetic chip detector to the center front side of the main gearbox assembly as follows:

1 If necessary, install the magnetic probe (403/20) into the valve (403/18) to get access to the packing grooves.

2 Apply Engine Oil P03−001 to the new packing (403/17).

3 Install the new packing to the small OD end of the valve.

4 Apply Engine Oil P03−001 to the new packing (403/1).

5 Install the new packing to the washer face of the valve.

6 Remove the magnetic probe from the valve.

7 Install the valve into the center front side of the main gearbox assembly.

8 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

9 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

10 Apply Engine Oil P03−001 to the new packing (403/19).

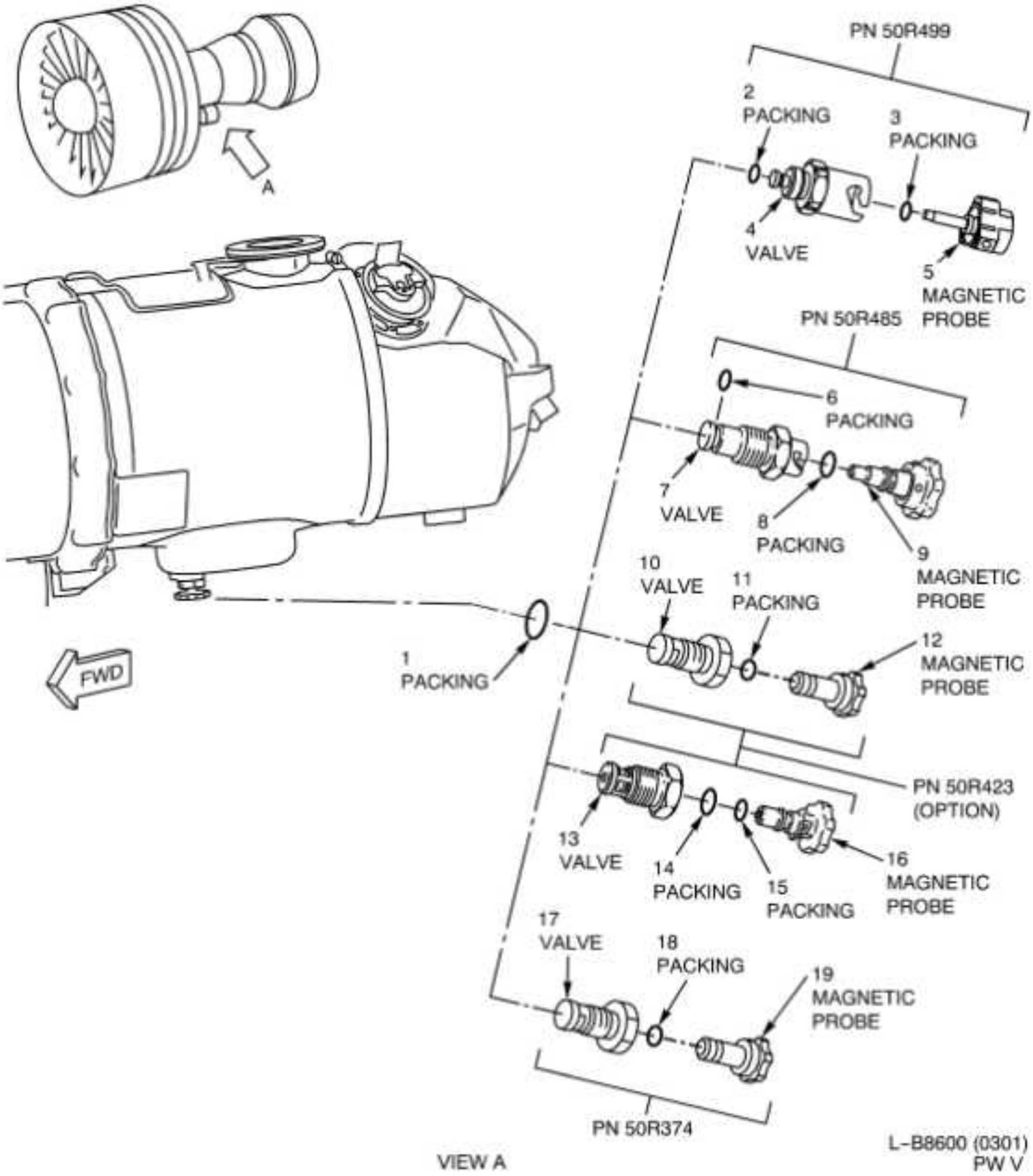
11 Install the new packing to the groove on the magnetic probe.

12 Install the magnetic probe into the valve.

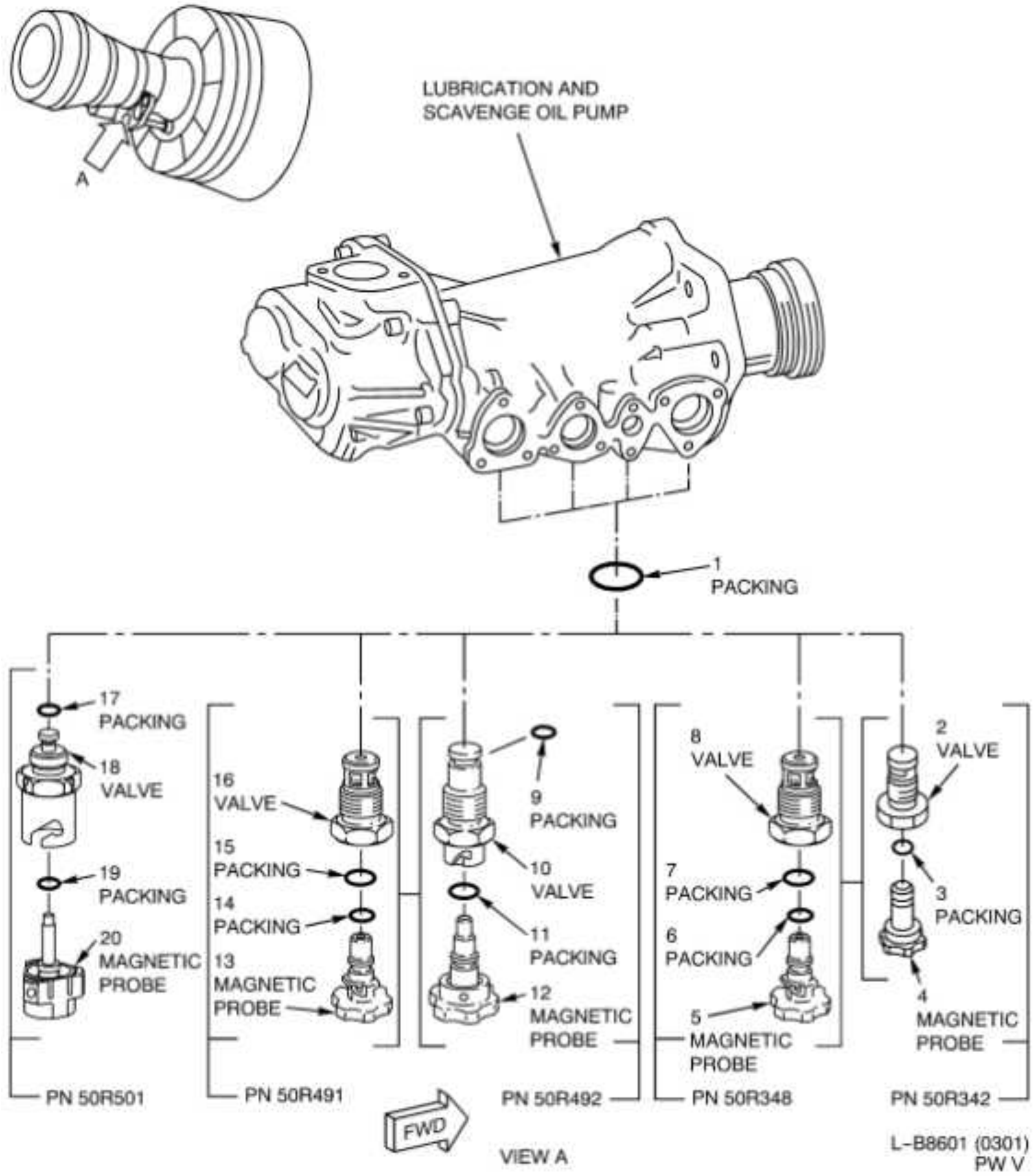
13 Push the magnetic probe in and turn it clockwise until it locks.

14 Pull on the magnetic probe to make sure it is locked.

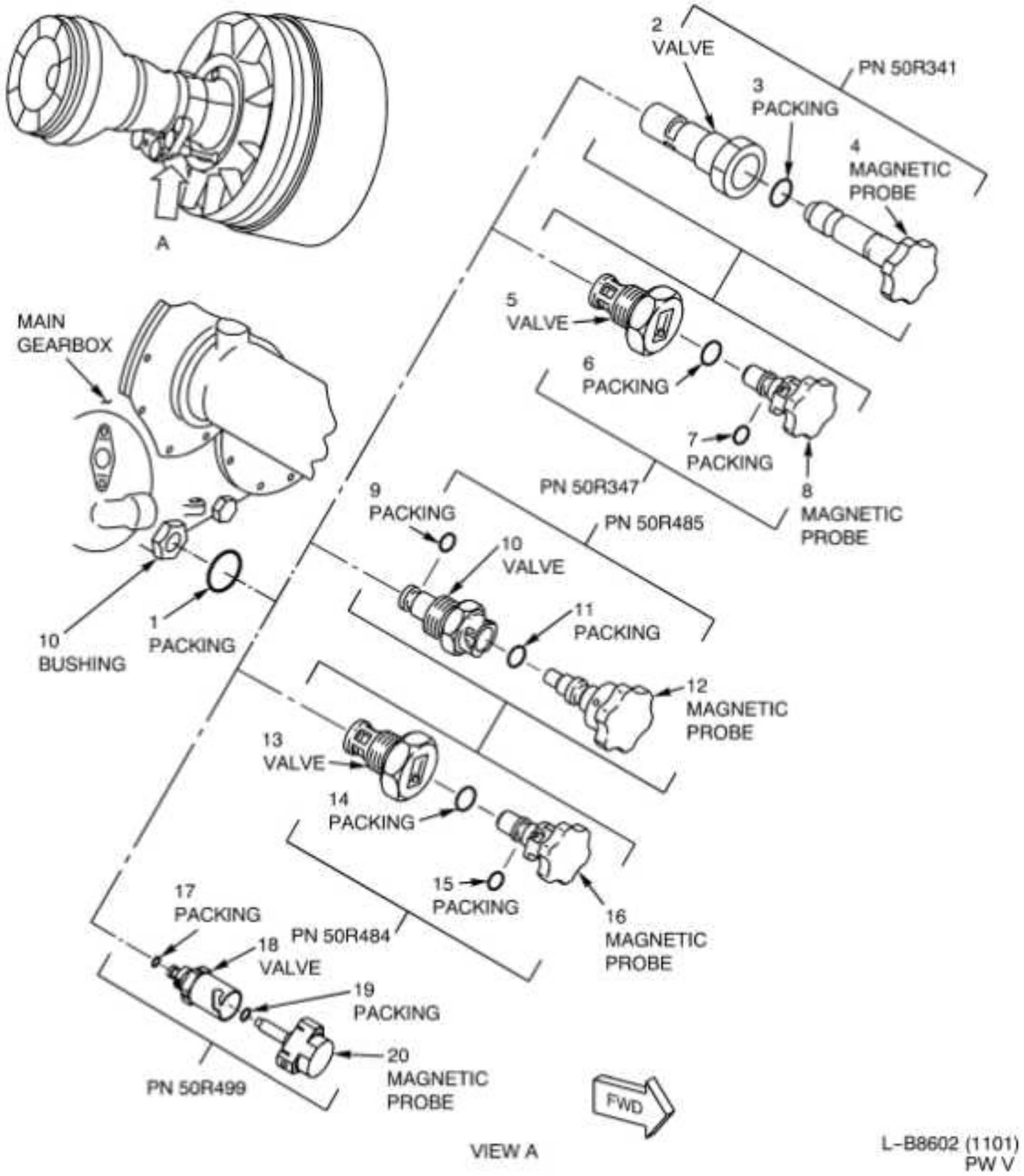
NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.


PN 50R499
2
PACKING
3
PACKING
4
VALVE
5
MAGNETIC
PROBE
A
PN 50R485
6
PACKING
7
VALVE
8
PACKING
9
MAGNETIC
PROBE
10
VALVE
11
PACKING
12
MAGNETIC
PROBE
1
PACKING
FWD
PN 50R423
(OPTION)
13
VALVE
14
PACKING
15
PACKING
16
MAGNETIC
PROBE
17
VALVE
18
PACKING
19
MAGNETIC
PROBE
PN 50R374
VIEW A
L-B8600 (0301)
PW V

Main Oil Tank Chip Detectors
Figure 401
(Task 72−00−61−450−017)


A
LUBRICATION AND SCAVENGE OIL PUMP
1 PACKING
17 PACKING
18 VALVE
19 PACKING
20 MAGNETIC PROBE
16 VALVE
15 PACKING
14 PACKING
13 MAGNETIC PROBE
9 PACKING
10 VALVE
11 PACKING
12 MAGNETIC PROBE
8 VALVE
7 PACKING
6 PACKING
5 MAGNETIC PROBE
2 VALVE
3 PACKING
4 MAGNETIC PROBE
PN 50R501
PN 50R491
PN 50R492
PN 50R348
PN 50R342
FWD
VIEW A
L-B8601 (0301)
PW V

Lubrication And Scavenge Oil Pump Chip Detectors
Figure 402
(Task 72−00−61−450−017)


A
MAIN GEARBOX
10 BUSHING
1 PACKING
2 VALVE
PN 50R341
3 PACKING
4 MAGNETIC PROBE
5 VALVE
6 PACKING
7 PACKING
8 MAGNETIC PROBE
PN 50R347
9 PACKING
PN 50R485
10 VALVE
11 PACKING
12 MAGNETIC PROBE
13 VALVE
14 PACKING
15 PACKING
16 MAGNETIC PROBE
PN 50R484
17 PACKING
18 VALVE
19 PACKING
20 MAGNETIC PROBE
PN 50R499
FWD
VIEW A
L-B8602 (1101)
PW V

Main Gearbox Chip Detectors
Figure 403
(Task 72−00−61−450−017)

ENGINE GENERAL MAIN GEARBOX - INSTALLATION-38

Task 72-00-61-440-002:

1. Install The Oil Tank Cap

   A. Equipment And Materials Required

   Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

   Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Packing	1	79-11-00	3	10
Packing	1	79-11-00	3	20

   B. Procedure

   (1) If the cap is disassembled, assemble it. See Figure 401.

   (a) Apply Engine Oil (P03-001) to a new packing (401/5). Install the packing to the packing groove in the lock (401/10).

   (b) Assemble the lock (401/10), spring (401/9), plate (401/8), cap (401/6), and washer (401/4).

   (c) Put the handle (401/2) in position on the shaft of the lock (401/10) and the cap (401/6). Press together the lock (401/10) and the cap (401/6). While pressed together, put the pin (401/3) through the handle (401/2).

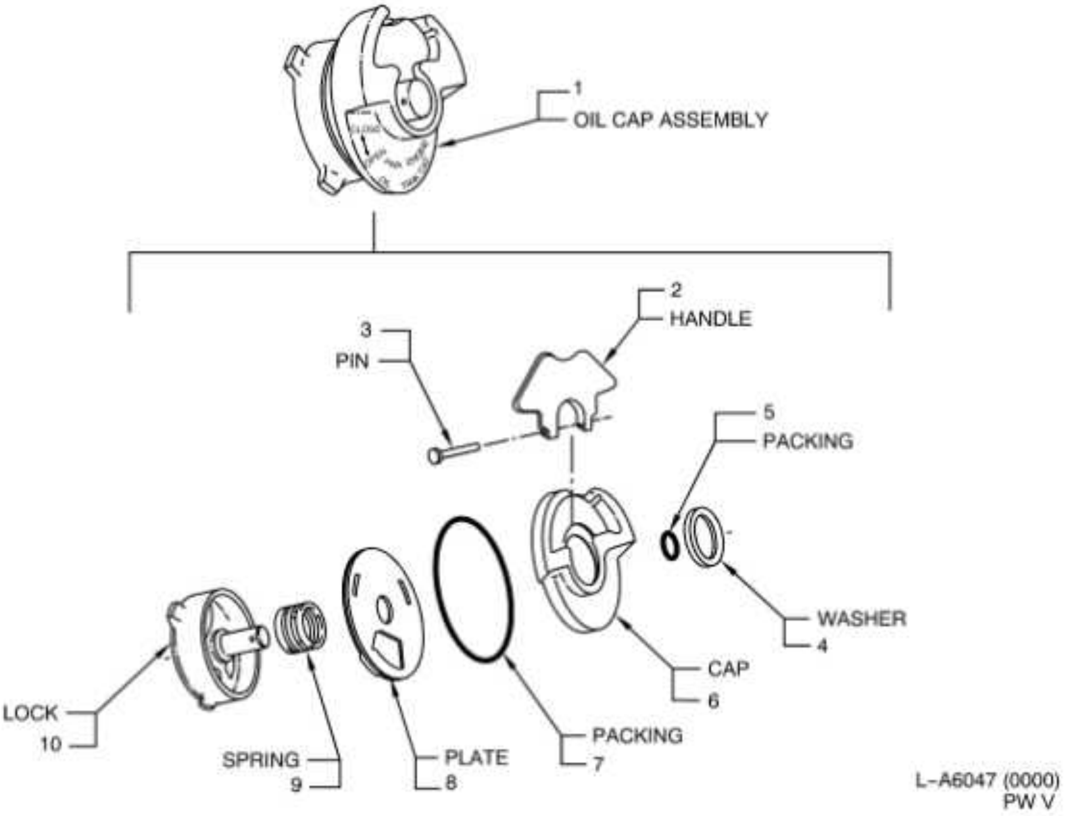
   (2) Install the oil tank cap. See Figure 402.

   (a) If not installed, install a new packing (401/7) lubricated with Engine Oil (P03-001), in the packing groove on the cap.

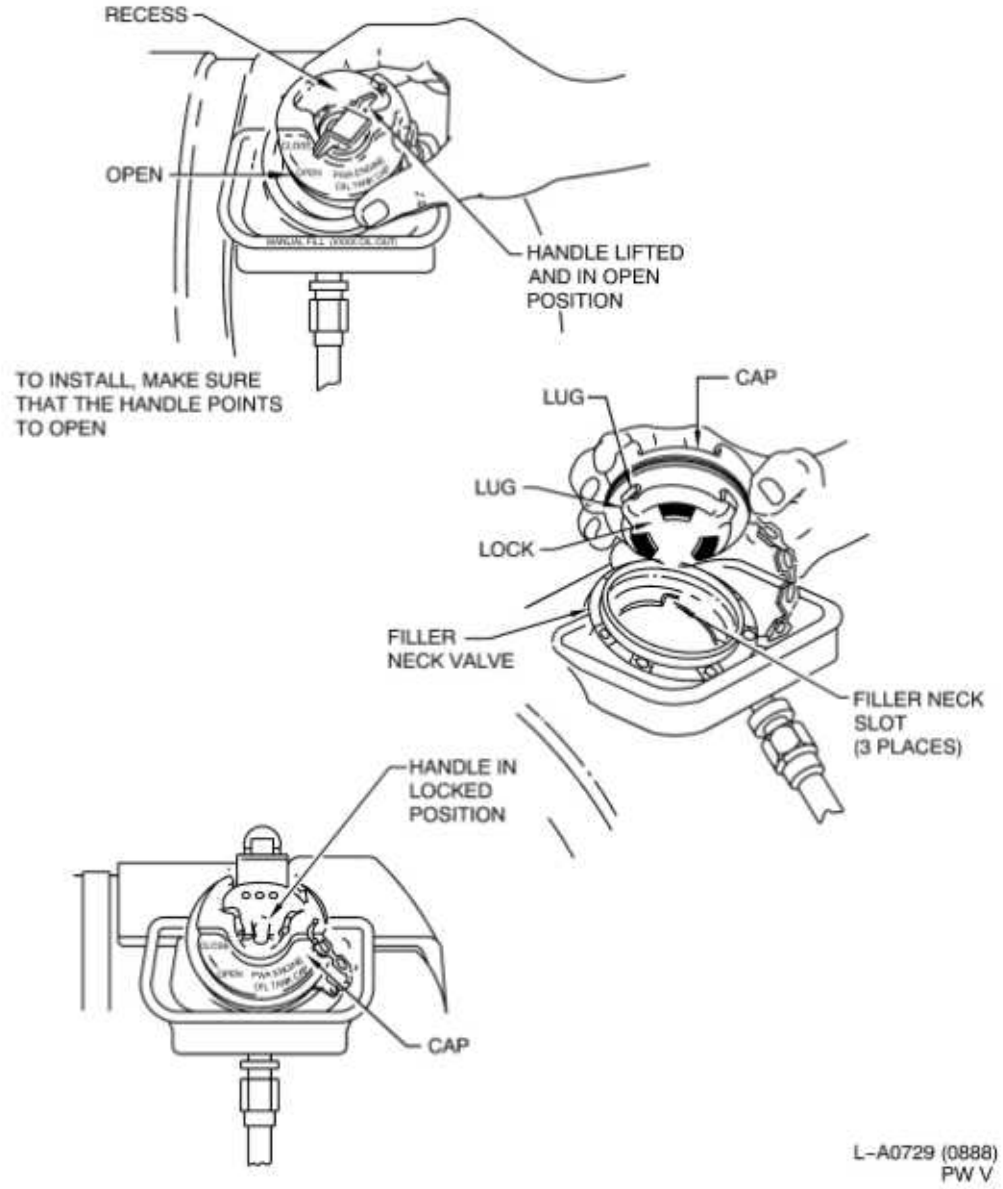
   (b) With the handle at OPEN, align the lugs of the cap with the slots of the filler neck valve.

   (c) Install the cap.

   (d) Push down on the cap while you turn the handle clockwise to CLOSE.


1
OIL CAP ASSEMBLY
2
HANDLE
3
PIN
5
PACKING
WASHER
4
CAP
6
LOCK
10
PACKING
7
SPRING
9
PLATE
8
L−A6047 (0000)
PW V

Assemble The Oil Tank Cap
Figure 401
(Task 72−00−61−440−002)


RECESS
OPEN
HANDLE LIFTED AND IN OPEN POSITION
TO INSTALL, MAKE SURE THAT THE HANDLE POINTS TO OPEN
LUG
CAP
LUG
LOCK
FILLER NECK VALVE
FILLER NECK SLOT (3 PLACES)
HANDLE IN LOCKED POSITION
CAP
L−A0729 (0888)
PW V

Install The Oil Tank Cap
Figure 402
(Task 72−00−61−440−002)

(e) Push the handle in the recess. This locks the cap.

(f) Make sure that the cap is locked.

- 1 Try to pull up on the edge of the cap.
- 2 With your hand, apply pressure to the outer edge of the cap at opposite points.
- 3 The cap must not move.
- 4 If necessary, remove the cap and repeat the procedure.

ENGINE GENERAL - MAIN GEARBOX - INSTALLATION-39

Task 72-00-61-450-019:

1. Install The No. 3 Bearing Breather And Restrictor Valve (Pre SB PW4ENG 75-144)

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P06-021	Compound, Antigalling (PWA 550-3)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing AS3209-213	1	

B. Procedure
See Figure 401.

(1) Install the No. 3 bearing breather and restrictor valve to the deoiler on the gearbox as follows.

(a) Remove the protection covers from the openings.

(b) Lubricate the packing with Engine Oil P03-001 and install the packing to the groove on the elbow of the restrictor valve.

(c) Install the restrictor valve to the three-hole mount pad on the deoiler on the front right side of the gearbox. Attach the valve with bolts, threads lubricated with Engine Oil P03-001 and tighten by hand.

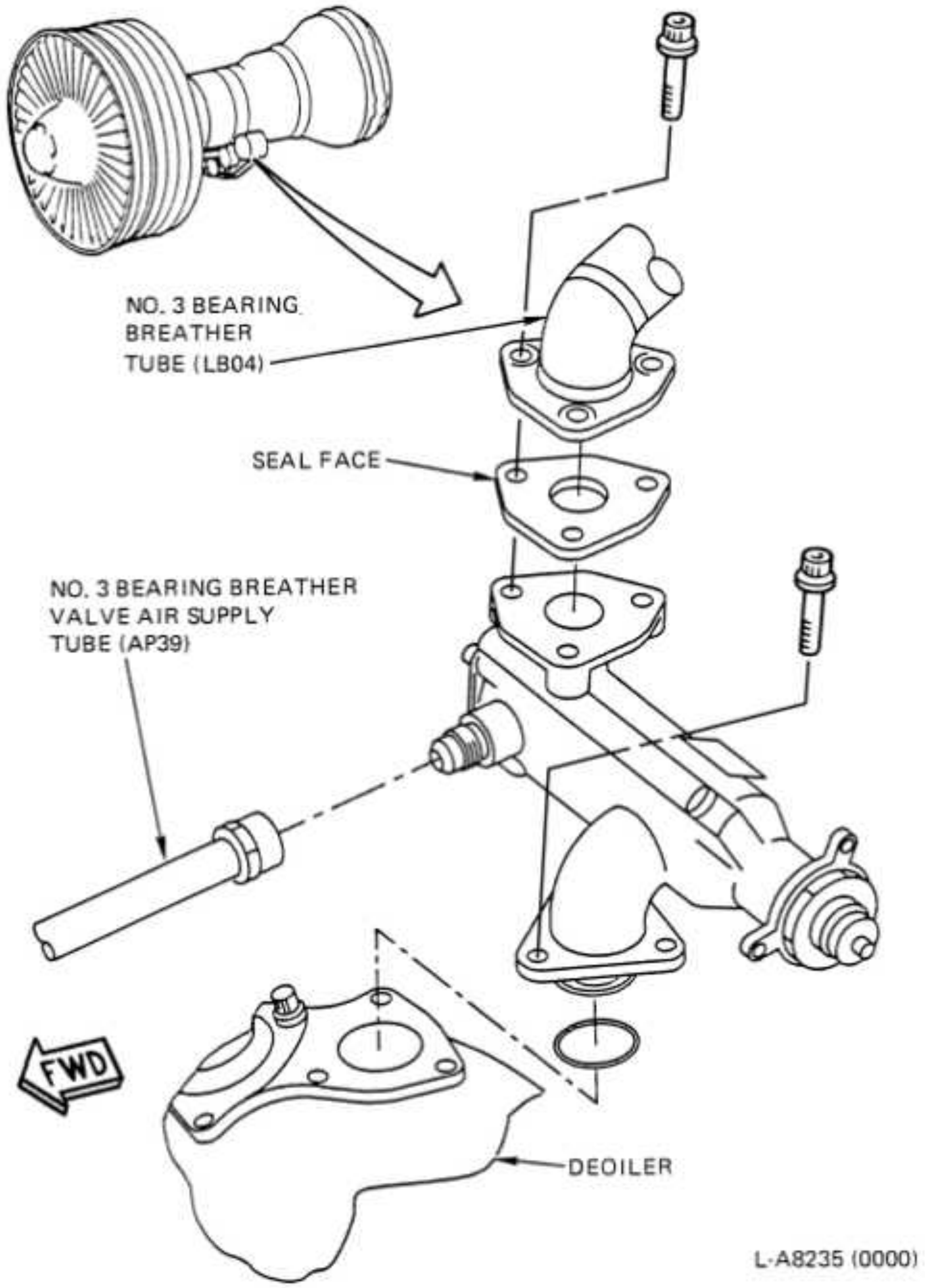
(d) Install the face seal between the upper three holepad on the restrictor valve and the No. 3 bearing breather tube (LB04). Attach the tube to the valve with bolts, threads lubricated with Engine Oil P03-001, and tighten by hand.

(e) Lubricate the tube nut of the No. 3 bearing breather and restrictor valve, air supply tube (AP39) with Antigalling Compound P06-021. Connect the tube to the restrictor valve and tighten by hand.

(f) Torque the bolts that attach the restrictor valve to the deoiler to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(g) Torque the bolts that attach the No. 3 bearing breather tube (LB04) to the restrictor valve to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(h) Torque the tube nut to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install lockwire to the tube nut.


NO. 3 BEARING BREATHER TUBE (LB04)
SEAL FACE
NO. 3 BEARING BREATHER VALVE AIR SUPPLY TUBE (AP39)
FWD
DEOILER
L-A8235 (0000)

No. 3 Bearing And Breather Valve Installation
Figure 401
(Task 72−00−61−450−019)

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ENGINE GENERAL - MAIN GEARBOX - CLEANING-01

Task 72-00-61-160-001:

1. Clean Ignition Exciter Contact Well
   A. Equipment And Materials Required

      Consumable Material:

Item No.	Description
P05-050	Abrasive Rod, Rubberized

   B. Procedure
      (1) Remove dirt, or foreign matter from inside contact well with compressed air.

      NOTE: Compressed air shall be maintained at 30 psig (206.8 kPa) maximum discharge pressure. Dirt on contact surface will cause reduced output or arcing.

      WARNING: USE CLEANING SOLVENT IN WELL-VENTILATED AREA. AVOID CONTACT WITH SKIN.

      (2) Clean ignition exciter outlet contact well with long bristle, nonmetallic brush and the SPOP 208 Wipe Method (Task 70-21-00-110-040). Dry with compressed air. Minor arcing and discoloration of the contact button can be removed by resurfacing the button with Abrasive Rod (P05-050), using a circular movement of the hand. Repeat above cleaning procedure.
      (3) Clean inner ceramic walls using circular felt bob, 1/2 inch (12.7 mm) in diameter and approximately 1 3/4 inches (44.450 mm) long, suitable for use with hand chuck. Use the SPOP 208 Wipe Method (Task 70-21-00-110-040), and clean using circular movement of hand. Dry with compressed air.
      (4) Clean end surface of ceramic at seat of grommet face using short bristle nonmetallic brush and the SPOP 208 Wipe Method (Task 70-21-00-110-040). Dry with compressed air.

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ENGINE GENERAL − MAIN GEARBOX − INSPECTION/CHECK−01

Task 72−00−61−990−001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum - maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (−) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (−) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
786	B	Gearbox Drive Shaft Housing Support Link Bolt (72-61-83) Gearbox Drive Shaft Housing Assembly (72-61-23) (See Figure 801, Sheet 2)				
		Bolt	.6232 (15.8293)	.6237 (15.8419)		
		Housing	.6239 (15.848)	.6249 (15.872)	.0002 (0.006)	.0017 (0.043)
788	B	Gearbox Lug (72-61-68) Spherical Bearing (72-41-91) (See Figure 801, Sheet 2)				
		Lug	.9985 (25.3619)	.9990 (25.3746)		
		Bearing	.9995 (25.3873)	1.000 (25.4000)	.0005 (0.013)	.0015 (0.038)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
832	B	Gearbox Support Link Upper Pin Spacers (OD) (72−61−90) Gearbox Support Clevis (72−41−92) (See Figure 801, Sheet 3)				
		Spacer (OD)	1.124 (28.550)	1.125 (28.575)		
		Clevis	1.126 (28.601)	1.128 (28.651)	.001 (0.026)	.004 (0.101)
833	B	Gearbox Support Link Upper Hollow Pin (72−61−86) To: −Gearbox Support Clevis (72−41−92)/, −Gearbox Support Link Spherical Bearing (ID) (72−61−85)/ −Gearbox Mount Link Upper Pin Spacer (ID) (72−61−98) (See Figure 801, Sheet 3)				
		Pin	.9985 (25.3619)	.9990 (25.3746)		
		−Clevis/ −Bearing/ −Spacer	.9995 (25.3873)	1.0000 (25.4000)	.0005 (0.013)	.0015 (0.038)
834	B	Gearbox Support Link Spherical Bearing (72−61−85) Gearbox Support Link (72−61−84) (See Figure 801, Sheet 3)				
		Spacer	1.4995 (38.088)	1.5005 (38.112)		
		Link	1.5015 (38.139)	1.5025 (38.163)	.001 (0.026)	.003 (0.076)
835	B	Gearbox Support Link Lower Pin Spacers (OD) (72−61−91) Gearbox Housing Lug (72−61−10) (See Figure 801, Sheet 3)				
		Spacers (OD)	1.127 (28.626)	1.128 (28.651)		
		Lug	1.129 (28.677)	1.131 (28.727)	.001 (0.026)	.004 (0.101)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
836	B	Gearbox Support Lower Hollow Pins (72-61-87) To: Gearbox Housing Lug (72-61-10)/ Gearbox Support Link Spherical Bearing (ID) (72-61-85)/ Gearbox Housing Lug Lower Pin Spacer (ID) (72-61-91) (See Figure 801, Sheet 3)				
		Pin	.9985 (25.3619)	.9990 (25.3746)		
		Lug/ Bearing/ Spacer	.9995 (15.3873)	1.0000 (25.4000)	.0000 (0.000)	.0025 (0.064)

G. Spline Data

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
955	B	1. Gearbox Drive Coupling (72-62-13) Internal Spline (See Figure 801, Sheet 1)				
		A. Effective Space Width	.1309 (3.325)	---		
		B. Actual Space Width	---	.1344 (3.414)		
		2. Gearbox Drive Shaft (72-61-80) External Spline (See Figure 801, Sheet 1)				
		A. Effective Tooth Thickness	---	.1274 (3.236)		
		B. Actual Tooth Thickness	.1239 (3.147)	---		
		3. Fit			.0035 (0.089)	---

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
956		1. Gearbox Drive Shaft (72-61-80) Internal Spline (See Figure 801, Sheet 1)				
		A. Effective Space Width	.0979 (2.487)	---		
		B. Actual Space Width	---	.1009 (2.563)		
		2. Gearbox Drive Spur Gearshaft (72-61-22) External Spline (See Figure 801, Sheet 1)				
		A. Effective Tooth Thickness	---	.0944 (2.398)		
		B. Actual Tooth Thickness	.0915 (2.324)	---		
		3. Fit			.0035 (0.089)	---

H. Special Torques

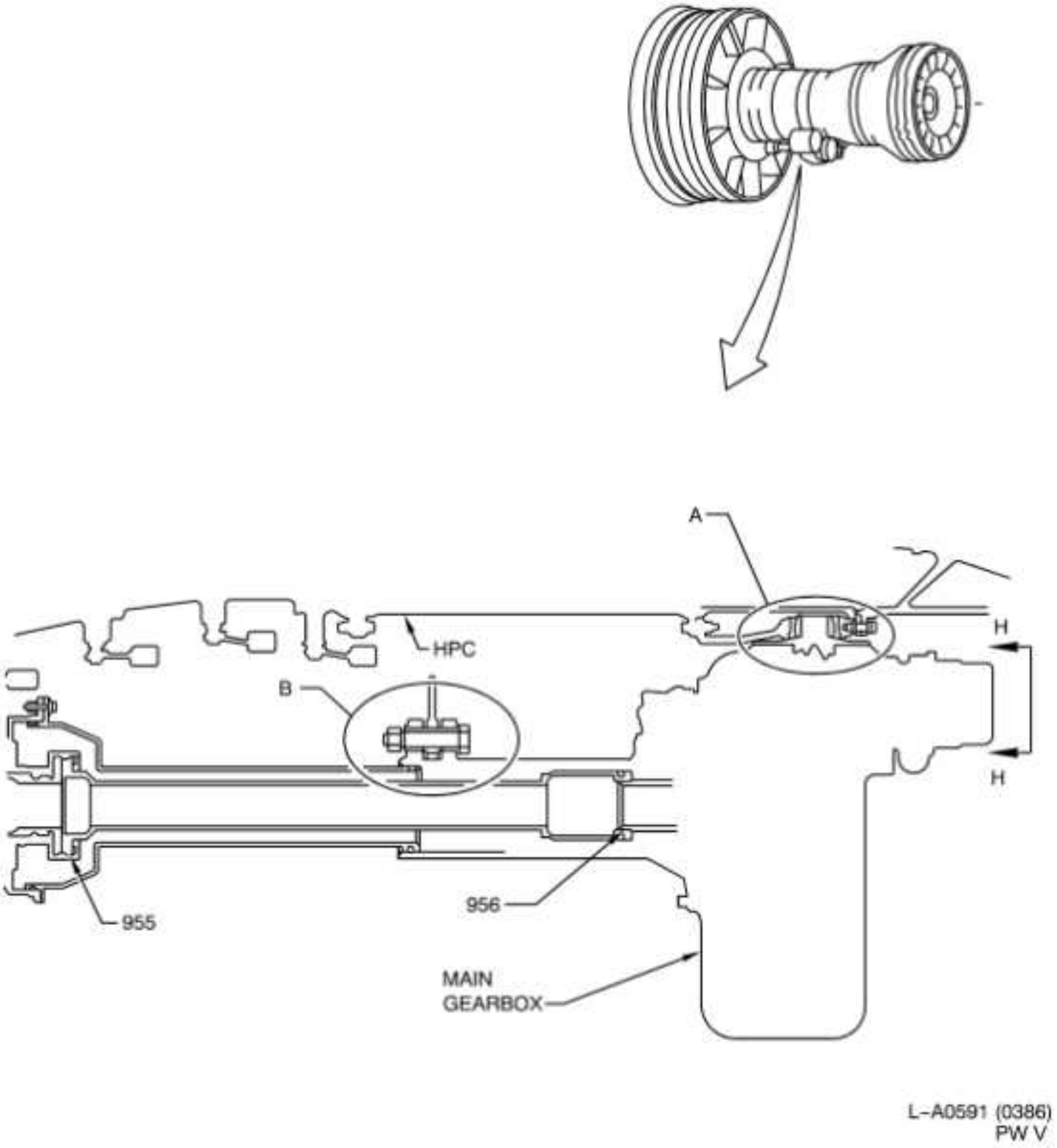
Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
571		Thermocouple Locknut See 72-00-61, Installation-27 Task 72-00-61-450-001 See 72-00-61, Inspection/Check-05 Task 72-00-61-200-001				
572		Thermocouple Nut See 72-00-61, Installation-27 Task 72-00-61-450-001 See 72-00-61, Inspection/Check-05 Task 72-00-61-200-001				

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
2151	A	Hose/Tube Clamp Screws See 72-00-61, Installation-02 Task 72-00-61-420-002 See 72-00-61, Installation-03 Task 72-00-61-450-001 See 72-00-61, Installation-04 Task 72-00-61-450-002				
2155	A	Electrical Connector See 72-00-61, Installation-05 Task 72-00-61-450-003 See 72-00-61, Installation-09 Task 72-00-61-450-006 See 72-00-61, Installation-26 Task 72-00-61-450-010 See 72-00-61, Installation-34 Task 72-00-61-450-015				
2156	A	Electrical Connector See 72-00-61, Installation-09 Task 72-00-61-450-006 See 72-00-61, Installation-34 Task 72-00-61-450-015				
2157	A	Electrical Connector See 72-00-61, Installation-05 Task 72-00-61-450-003 See 72-00-61, Installation-06 Task 72-00-61-450-016 See 72-00-61, Installation-34 Task 72-00-61-450-015				
2166		Thermocouple Locknut See 72-00-61, Installation-07 Task 72-00-61-450-004 See 72-00-61, Installation-26 Task 72-00-61-450-010				
2167		Thermocouple Nut See 72-00-61, Installation-07 Task 72-00-61-450-004 See 72-00-61, Installation-26 Task 72-00-61-450-010				

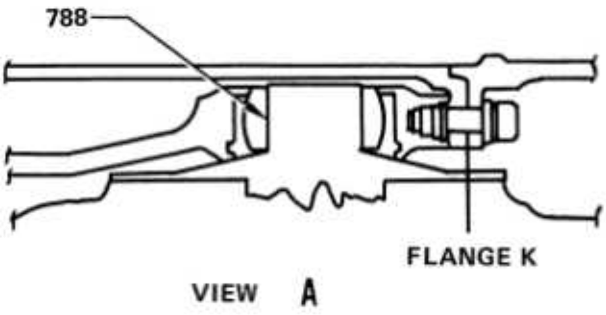
I. Special Assembly Procedures

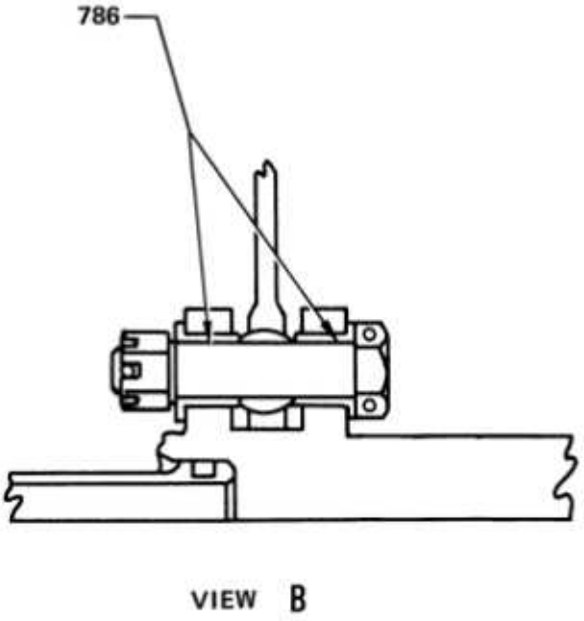
ENGINE GENERAL - MAIN GEARBOX - INSPECTION/CHECK-01

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
2016	A	Procedure For Installing The Oil Trim Pressure Tube Clamping See 72-00-61, Installation-02 Task 72-00-61-420-002				
2170	A	Torque Procedure, Fuel/Oil Cooler Fuel Tube Nuts See 72-00-61, Installation-05 Task 72-00-61-450-003				

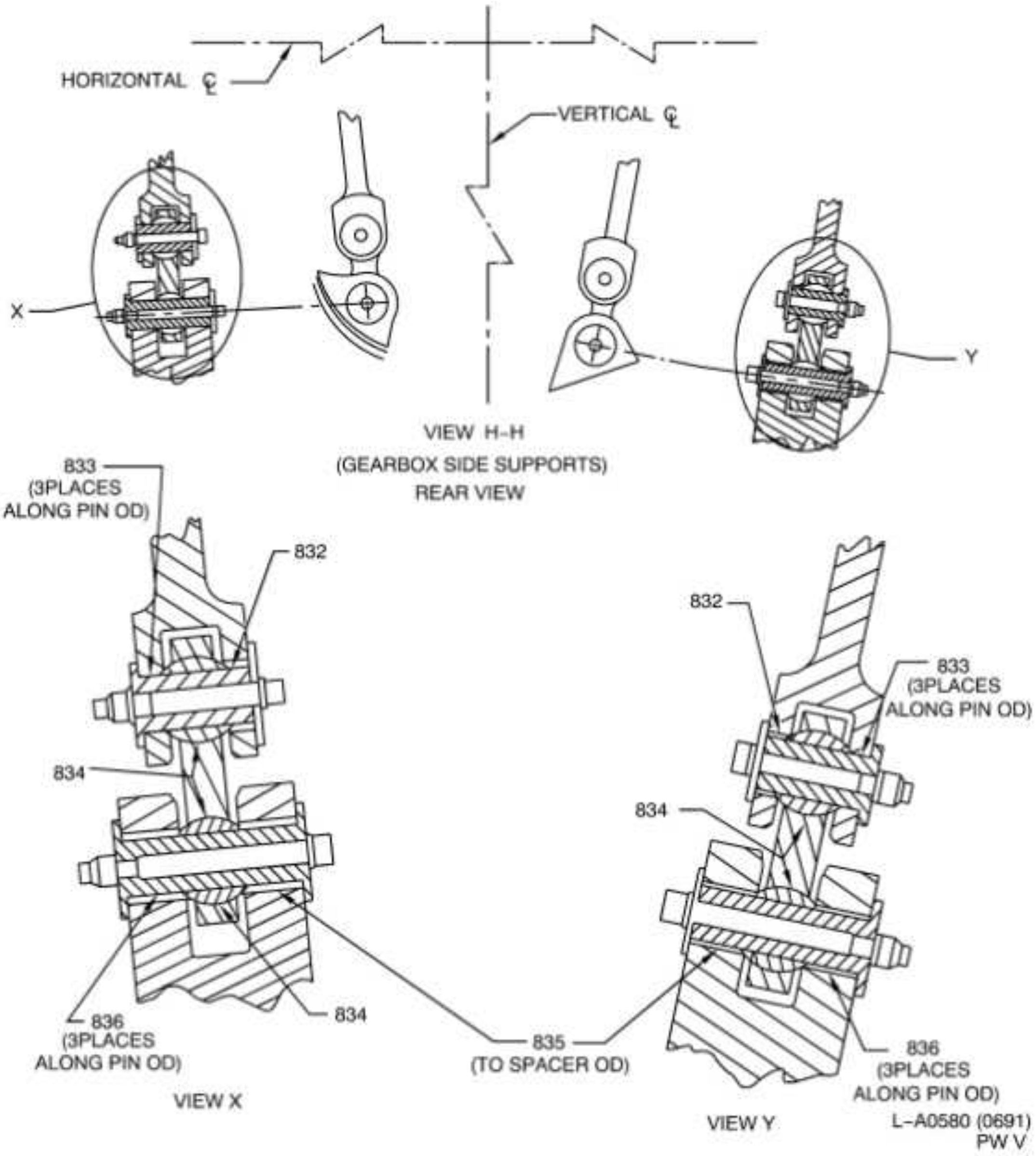

A
HPC
H
B
H
955
956
MAIN
GEARBOX
L−A0591 (0386)
PW V

Main Gearbox
Figure 801 (Sheet 1)
(Task 72−00−61−990−001)


788
FLANGE K
VIEW A


786
VIEW B
L–A0596

Main Gearbox
Figure 801 (Sheet 2)
(Task 72–00–61–990–001)


HORIZONTAL ℄
VERTICAL ℄
X
Y
VIEW H-H
(GEARBOX SIDE SUPPORTS)
REAR VIEW
833
(3PLACES
ALONG PIN OD)
832
834
834
836
(3PLACES
ALONG PIN OD)
835
(TO SPACER OD)
VIEW X
832
833
(3PLACES
ALONG PIN OD)
834
836
(3PLACES
ALONG PIN OD)
VIEW Y
L-A0580 (0691)
PW V

Main Gearbox
Figure 801 (Sheet 3)
(Task 72-00-61-990-001)

ENGINE GENERAL – MAIN GEARBOX – INSPECTION/CHECK-02

Task 72-00-61-210-003:

1. Inspect Fuel Pump Filter
   A. Prerequisites
      (1) Refer to Removal-24 (Task 72-00-61-060-001) to remove the fuel pump filter.
   B. Equipment And Materials Required – None
   C. Procedure

      (1) Remove the paper outer wrap from around the filter to examine the pleated paper element.
      (2) Examine the paper element for signs of damage or for a collection of contamination.
      (3) Replace the used filter element with a new filter element.

      NOTE: Do NOT clean the filter element. Do NOT use the same filter element again.

      (4) If there is damage or a large quantity of contamination in the paper element, examine (in the direction of flow) the filter element in the fuel distribution valve. Refer to 72-00-41, Inspection/Check-05.
   D. Postrequisites
      (1) Refer to Installation-24 (Task 72-00-61-460-001) to install the fuel pump filter.

ENGINE GENERAL - MAIN GEARBOX - INSPECTION/CHECK-03

Task 72-00-61-210-001:

1. Inspect Ignition Exciter

A. Equipment And Materials Required

Standard Tools:
1.000-20UNS-3A Thread Chasing Die

B. Procedure

CAUTION: USE EXTREME CARE NOT TO CAUSE BURRS.

(1) Inspect input connector for bent or damaged pins. Bent pins may be straightened using needlenose pliers. Damaged pins will require exciter replacement.

(2) Inspect output receptacle well for damage or signs of arcing or flashover on contact button. Arcing is identified by pitting or discoloration on contact button. Flashover is identified by carbon tracking. If any of these indications are evident, send exciter to repair facility. Minor discoloration and pitting of contact button and minor carbon tracking can be removed per Cleaning-01 (Task 72-00-61-160-001).

(3) Inspect threads of each outlet. Minor repair to threads can be made by chasing with 1.000-20UNS-3A Thread Chasing Die. If threads are damaged beyond minor repair, exciter must be replaced.

(4) Inspect case for cracks, dents, or abrasions.

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL – MAIN GEARBOX – INSPECTION/CHECK-04

Task 72-00-61-210-002:

1. Inspect The Magnetic Probes

A. Prerequisites

(1) Remove the magnetic probe from the valve. Refer to Removal-36 (Task 72-00-61-050-017).

B. Equipment And Materials Necessary

Special Tools:
PWA 107014 Photo Aide

Consumable Materials:

	Item No.	Designation
R	P11-014	Alcohol, Isopropyl (PMC 9094)
	P11-027	Solvent, Petroleum (PMC 9001)

C. General

CAUTION: DO NOT PERMIT THE MAGNETS ON THE PROBES
R TO TOUCH EACH OTHER OR THEY CAN BECOME
DEMAGNETIZED.

(1) Upon removal of each probe, you must immediately
R identify the position of that probe. See Figure 801.

(2) It is necessary to keep records of all contamination that is on the probes and in the oil filter.

R (3) You must examine the contamination with suitable
magnification. Although it is permitted to use a
R magnifying glass, it is recommended that you use a
R magnifying glass that has 20X magnification.

(4) If the engine or gearbox can not continue in service,
R you must send the debris contamination and/or analysis
of the contamination with the engine or gearbox to the
repair facility.

D. Inspection Procedure
See Figure 802.

R (1) Examine the probes for debris contamination. Use the
R procedure in the paragraph "Magnetic Chip Detector
R Examination Procedure".

(2) If, after you remove the magnetic probe, oil leaks from the valve, replace the valve packing. Refer to Removal-36 (Task 72-00-61-050-017) and Installation-36 (Task 72-00-61-450-017). If the valve still leaks with the new valve packing, replace the valve.

(3) Examine the packing on the probes. If the packing is damaged, replace the packing. Refer to Removal-36 (Task 72-00-61-050-017) and Installation-36 (Task 72-00-61-450-017).

NOTE: The shape of the grip and the quantity of packings can be different from what is shown in the figure.

(4) Before you install the probe, clean the probe with Solvent P11-027, then dry them with a clean cloth. Make sure that you remove all contamination.

(5) Before you install the probe, do the procedure in the
R paragraph "Magnetic Chip Detector Probe Functional
R Check Procedure".

R E. Magnetic Chip Detector Examination Procedure

(1) This procedure gives instructions on how to interpret
R the debris contamination that is on the magnetic probes. Refer to the paragraph "Spectroscopic Analysis" for information on the methods of quantitative analysis and on the composition of the
R debris contamination.

R (2) There are four main types of debris contamination:

R 1 Contamination from the assembly of the
R engine (called build debris or residual debris)
R 2 Fines
R 3 Flakes
R 4 Chips

(3) If there is contamination, make a record of the position of the probes. Examine the probe with
R suitable magnification. Make a record of the quantity
R and type of debris contamination that is there.

R NOTE: The PWA 107014 Photo Aide can be used as an aid
R showing actual photos of conditions which you
R can find during an MCD inspection.

(a) If the probe is covered by a drop of oil, add a few drops of Alcohol P11−014 to the probe tip. The alcohol should help break the surface tension of the oil and allow the oil to flow down the body of the probe. After a few minutes, metallic particles are expected to be observed on the probe tip.

NOTE: This condition where the probe tip is covered by a drop of oil is shown in the PWA 107014 Photo Aide (Condition C). This condition is usually the result of fine metallic particles holding the oil near the collector and is the reason for performing the preceding step whenever these conditions are found.

(4) If there is a question of what type of debris contamination that you see, obey the action that follows the stricter interpretation.

(5) Build debris or residual debris. See Figure 803, Figure 804 (Sheet 1), (Sheet 2), and Figure 807.

NOTE: The PWA 107014 Photo Aide (see Condition A) can be used as an aid showing actual photos of conditions which you can find during an MCD inspection.

(a) Description: Build debris normally collects during the early stages, the first 1000 hours of engine operation after assembly of the engine. Build debris or residual debris can look like strands of curly steel wool, shavings, or burrs.

(b) Source: This is residual material that is accidentally left in or enters the engine at assembly. Build debris or residual debris typically comes from machine operations when the components are made or assembled.

(c) Action: The engine can continue−in−service. Obey the usual magnetic probe inspection interval.

NOTE: "Usual magnetic chip detector probe inspection interval" is the interval that the individual operator has established as part of the approved maintenance program.

1 After 1000 hours of engine operation do an analysis of chips or flakes (these are not specified as build or residual debris).

2 See Table 801 and Table 802 for a list of the composition and location of the various commonly used bearing and gear materials.

(6) Magnetic fines. See Figure 804 (Sheet 1), Figure 804 (Sheet 2), and Figure 807.

(a) Description: These are very small particles. They are less than 0.010 inch (0.254 mm) long and of different widths. They appear as a black or gray sludge or fuzz on the magnetic probe. When the oil on the probe is removed, they appear as dull hairlike slivers. Fines are typical of low−time engines and small amounts are serviceable.

(b) Source: The usual wear of various engine components can cause a small quantity of fines. This is a serviceable condition. Bearing skid and the spinning of parts such as spacers, seal plates, and shaft probes can also cause fines. Bearing skid and spinning make fines at a higher rate than usual wear. This is not a serviceable condition. Service experience shows that only the deoiler idler gear bearing in the main gearbox is subject to bearing skid that can generate fines.

(c) Action: If there are fines on less than 25 percent of the probe tip perimeter (see PWA 107014 Photo Aide (Condition B and Figure 804 (Sheet 2)) the engine can continue in service. Obey the usual magnetic probe inspection interval.

1 If the fines collected on the probe tip make up more than 25 percent of the probe tip's perimeter (see Figure 804 (Sheet 2), also PWA 107014 Photo Aide Condition E shows a non acceptable amount of fines) examine the individual compartment chip collectors for debris.

2 If any individual MCD probe has 100 percent coverage of fines, the engine is not serviceable.

R 3 If there is debris on more than 25 percent of any of the individual probe tip's perimeter (see Figure 804 (Sheet 2), also PWA 107014 Photo Aide shows a non acceptable amount of fines as Condition E) and less than 100 percent surface coverage, then examine the main oil filter element.

(d) If the fines that are on the tip of the magnetic probe are on more than 25 percent of the probe tip's circumference or area, do the steps that follow: R

1 Remove the main oil filter. Refer to 72-00-61, Removal-35 (Task 72-00-61-030-001). Keep the oil that is in the oil filter housing.

2 Flush the filter with Petroleum Solvent P11-027.

3 Strain the solvent through filter paper or clean cloth. Keep the debris contamination for identification. R

4 Install a new main oil filter. Refer to 72-00-61, Installation-35 (Task 72-00-61-430-001).

5 Examine the main oil filter and filter housing oil for metallic debris contamination. If there is metallic debris contamination that is not build debris, or residual debris, and if the quantity is sufficient to make a circle that has a diameter of 0.50 inch (12.700 mm) minimum, the engine is not serviceable. Disassemble the engine and find the source of the debris contamination. R

R 6 If there is metallic debris contamination other than build debris or residual debris in the main oil filter and the filter housing oil, and the debris contamination is not sufficient to make a circle that has a diameter of 0.50 inch (12.700 mm) minimum, do the steps that follow.

a Continue the engine in service. Also, examine the magnetic probes every 25 hours for 200 flight hours.

R b Collect the debris contamination from the probes and do an analysis of the material R within 200 flight hours. If there is debris contamination from bearing or gear material, remove the engine from service, disassemble the engine, and find the source of the material.

R c If the debris contamination is the same or increases in consecutive magnetic probe inspections during the 200 flight hours inspection interval, remove the engine from service. Disassemble the engine to find the R source of the debris contamination.

d If you do not find bearing or gear material, R and if the quantity of debris contamination decreases in consecutive inspections of R the probes during the 200 flight hours inspection interval, return the engine to service.

(7) Chips or flakes. See Figure 805, Figure 806 and Figure 807.

R R R R NOTE: The PWA 107014 Photo Aide (see Conditions D and F) can be used as an aid showing actual photos of conditions which you can find during a MCD inspection.

(a) Description of chips: These are very thick pieces of metal. Usually one surface is a smooth machined surface; the opposite surface is rough and irregular.

(b) Source of chips: Chips from ball and roller bearings are usually smooth and shiny on one side. R This side can show the original honing/grinding process. The opposite side is duller and has a fractured appearance. Chips from gearteeth have one shiny side with machine marks and one side that is smooth and dull.

(c) Description of flakes: Flakes have an irregular shape, but are usually flat and shiny on both sides. You must do an analysis of them to know their source.

(d) Source of flakes: Flakes come from ball bearings, roller bearings, and gearteeth. Flakes from ball and roller bearings are very thin: 0.002 - 0.010 inch (0.051 - 0.254 mm) thick. They usually have an irregular, plate-like shape and have radial cracks. When the flake is cleaned, it is much brighter than other types of debris contamination. Flakes from gearteeth are shiny, long, and thin, and can have an irregular shape. They are usually thicker and not as bright as ball or roller bearing flakes.

(e) Action: If there are five or more flakes or chips on the magnetic probe the engine is not serviceable. Make a spectroscopic analysis of the debris contamination. Refer to Table 801. Disassemble the engine and find the source of the debris contamination.

(f) Combination of chips/flakes, and fines: If a combination of both chips/flakes and fines are collected on the probe, follow the chip/flakes path on Figure 807.

(g) If there are chips or flakes on a probe, but less than five chips or flakes, do the steps that follow:

1. Remove the main oil filter. Refer to 72-00-61, Removal-35 (Task 72-00-61-030-001). Keep the oil that is in the oil filter housing.

2. Flush the filter with Petroleum Solvent P11-027.

3. Strain the solvent through filter paper or clean cloth. Keep the debris contamination for identification.

4. Install a new main oil filter. Refer to 72-00-61, Installation-35 (Task 72-00-61-430-001).

5 Examine the main oil filter and the filter housing oil for debris contamination. If there is metallic debris contamination in the main oil filter and filter housing oil, and the debris contamination is not build debris or residual debris, and the quantity is sufficient to make a circle that has a diameter of 0.50 inch (12.700 mm) minimum, the engine is not serviceable. Disassemble the engine and find the source of the debris contamination.

6 If there is metallic debris contamination in the main oil filter and filter housing oil but it is not build debris or residual debris, and it is not sufficient to cover an area 0.50 inch (12.700 mm) in diameter, do the steps that follow:

- a Continue the engine in service, but do an inspection of the magnetic probes every 25 hours for 200 flight hours.
- b Collect the debris contamination from the magnetic probes and do an analysis of it for bearing or gear material (see Table 801) within 200 flight hours. If there is bearing or gear material, the engine is not serviceable. Disassemble the engine and find the source of the material.
- c If there is no bearing or gear material, and if the quantity of debris contamination decreases in consecutive magnetic probe inspections during the 200 flight hours inspection interval, continue the engine in service.

F. Spectroscopic Analysis Of Chips And Flakes. See Tables 801 and 802.

(1) The objective of this analysis is to obtain a quantitative estimate of the relative concentrations of metallic elements in the chips, a compositional fingerprint that can be compared to elemental profiles of known oil−wetted materials for purposes of R identifying the source of the debris contamination. One of several spectroscopic methods can be used, depending upon the homogeneity and quantity of chips. The methods and advantages/disadvantages of each are listed below:

Spectroscopic Method	Advantages/Disadvantages
Scanning Electron Microscopy/Energy Dispersive X−ray Spectrometry (SEM/EDX)	This technique is particularly useful when the chips appear heterogeneous, since the small diameter of the electron beam allows spatial resolution of areas as small as 0.1 micrometers. Care must be taken when using the technique to sample several areas to avoid the possibility of an unrepresentative analysis.
Inductively Coupled Plasma/Optical Emission Spectrometry (ICP/OES)	This technique is highly accurate and useful when a large quantity (several milligrams) of material is available for analysis. The technique is relatively laborious, however, as the chips must be digested (dissolved) in an acid solution prior to analysis. This method is therefore recommended only when it is desirable to sample a lot of material at one time, or if it is the only equipment available.
Wavelength Dispersive X−ray Fluorescence Spectrometry (WDXRF)	This technique should only be used when a moderate amount of homogeneous material is present on the probe. The advantage of this technique is the great speed with which an analysis can be performed.

Spectroscopic Method	Advantages/Disadvantages
Spark-or Arc-Source Optical Emission Spectrography	This technique is quite laborious, and only semiquantitative. It should only be used when general, non-definitive information is required.

(2) In all of the techniques described above, the best analysis will be obtained when the equipment is calibrated using well-characterized standard materials, similar in composition to the sample. The stability and relative specificity of modern equipment, however, allows some useful information to be gathered with less rigorous calibration. Interpretation of this type of data is difficult, however, and should be carried out only be a trained atomic spectroscopist.

	Bearing Material	
	AMS 6441 AISI 52100 PWA-723 Min - Max (Percent)	AMS 6490 PWA-725 (M-50) PWA-793 (M-50) Min - Max (Percent)
Carbon	0.95 - 1.10	0.77 - 0.85
Manganese	0.25 - 0.45	0.35
Silicon	0.20 - 0.35	0.25
Phosphorous	-- 0.025	-- 0.015
Sulphur	-- 0.025	-- 0.015
Chromium	1.30 - 1.60	3.75 - 4.25
Nickel	-- 0.15	-- 0.15
Molybdenum	-- 0.10	4.00 - 4.50
Copper	-- 0.15	-- 0.10
Vanadium	-- --	0.90 - 1.10
Cobalt	-- --	-- 0.25
Tungsten	-- --	-- 0.25
Iron	Remainder	Remainder

Mineral Composition of Bearing Material -
Table 801

R
R

	Gear Material AMS 6265 Min − Max (Percent)
Carbon	0.07 − 0.13
Manganese	0.40 − 0.70
Silicon	0.20 − 0.35
Phosphorous	−− 0.025
Sulphur	−− 0.025
Chromium	1.00 − 1.40
Nickel	3.00 − 3.50
Molybdenum	0.08 − 0.15
Copper	−− 0.35
Vanadium	−− −−
Cobalt	−− −−
Tungsten	−− −−
Iron	Remainder

Mineral Composition Of Gear Material − Table 801 (Continued)

	BEARINGS		GEARS
Magnetic Probe	M−50	AISI 52100	AMS 6265
No. 1, 1.5, 2 bearing compartments	X	X	X
Angle gearbox	X	X	X
No. 4 bearing compartment	X	X	
No. 3 bearing compartment	X		
Main gearbox	X	X	X
Oil tank	X	X	X

Table 802

R G. Magnetic Chip Detector Probe Functional Check Procedure

CAUTION: DO NOT PERMIT THE MAGNETS ON THE PROBES
R TO TOUCH EACH OTHER OR THEY CAN BECOME
DEMAGNETIZED.

R (1) Use one of the procedures that follow to do a check of
R the magnetic strength of the probe:

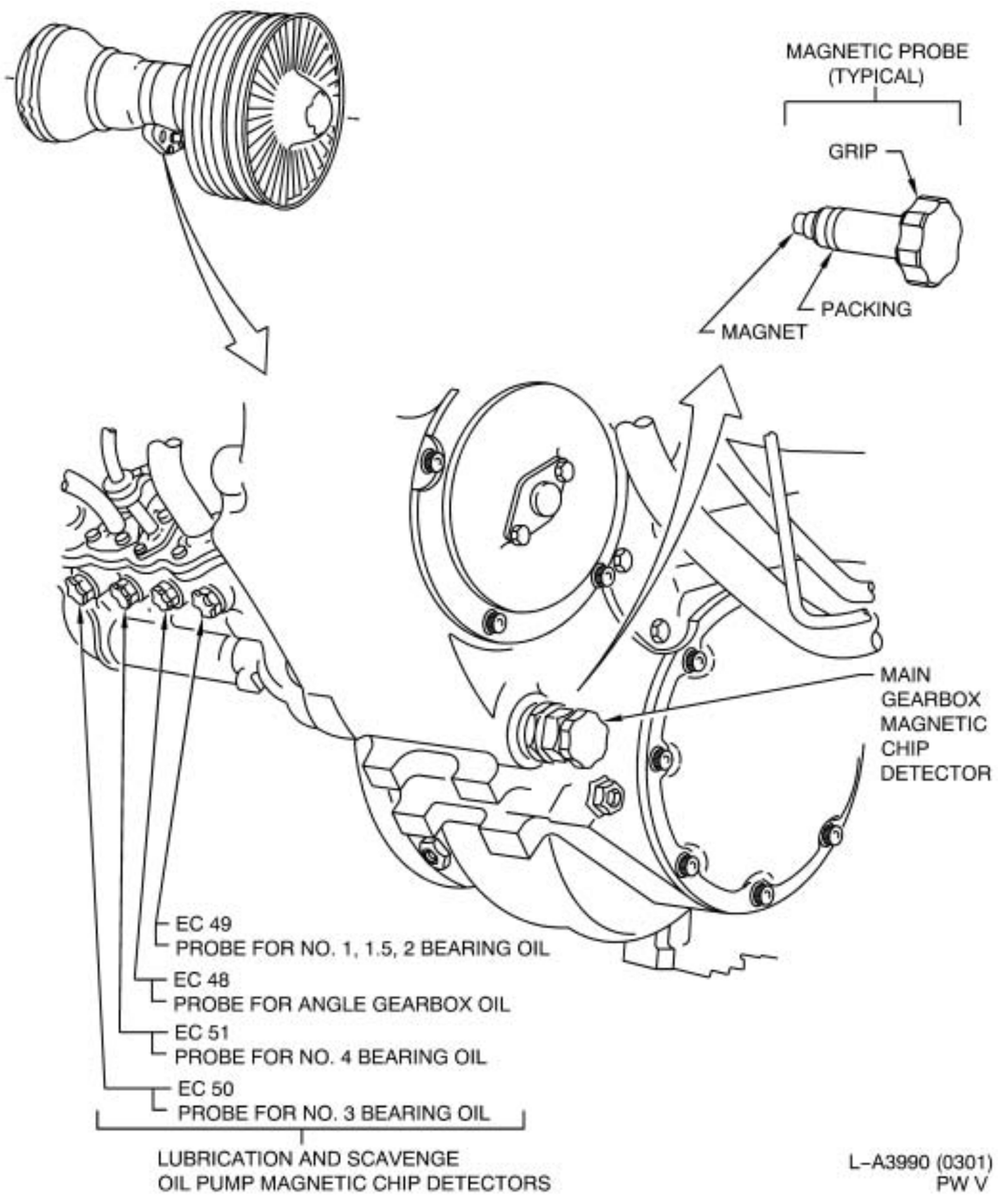
R (a) Preferred method. Have the magnetic probe pick up a 1.00 inch (25.400 mm) diameter carbon steel ball bearing. If the ball bearing is not available, perform the method described in the step that follows.

R (b) Alternate Method. Hang the magnetic probe on a horizontal steel surface so that the magnet has to fully support the weight of the probe.

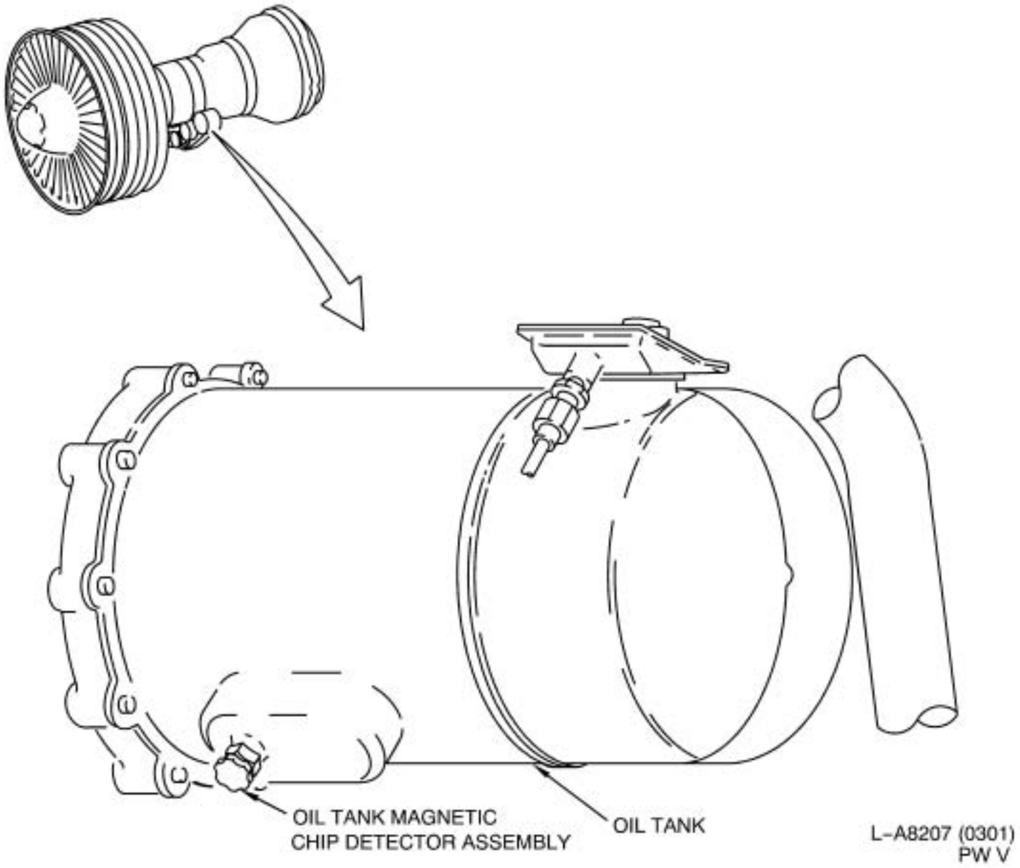
R (c) If the magnetic probes do not operate correctly, replace the magnetic chip detector assembly.

H. Postrequisites

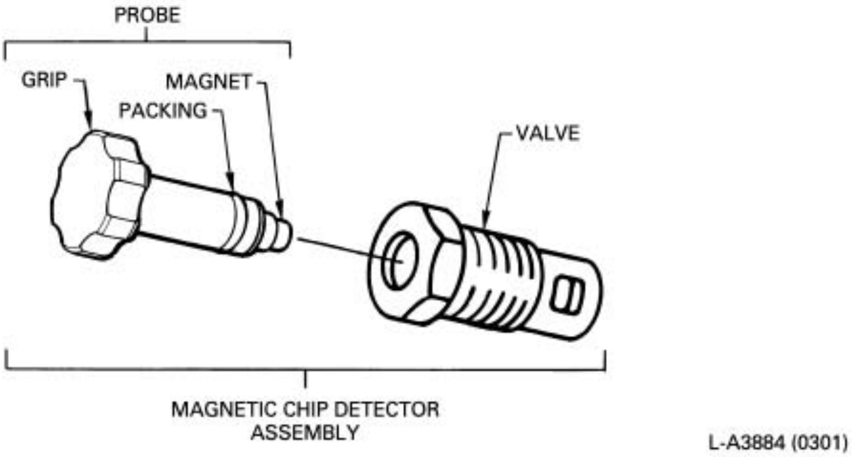
(1) Install the magnetic probe in the valve. Refer to Installation−36 (Task 72−00−61−450−017).


MAGNETIC PROBE
(TYPICAL)
GRIP
PACKING
MAGNET
MAIN
GEARBOX
MAGNETIC
CHIP
DETECTOR
EC 49
PROBE FOR NO. 1, 1.5, 2 BEARING OIL
EC 48
PROBE FOR ANGLE GEARBOX OIL
EC 51
PROBE FOR NO. 4 BEARING OIL
EC 50
PROBE FOR NO. 3 BEARING OIL
LUBRICATION AND SCAVENGE
OIL PUMP MAGNETIC CHIP DETECTORS
L-A3990 (0301)
PW V

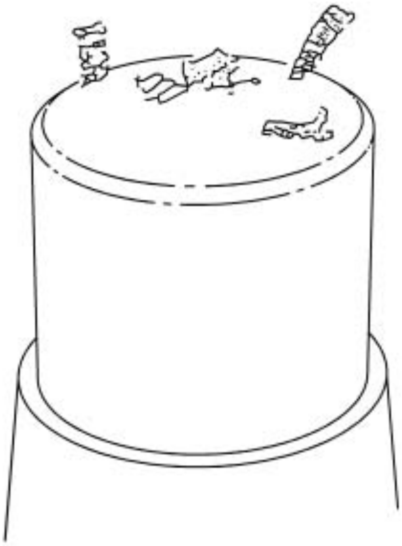
Positions Of The Magnetic probe Assemblies
Figure 801 (Sheet 1)
(Task 72-00-61-210-002)


OIL TANK MAGNETIC
CHIP DETECTOR ASSEMBLY
OIL TANK
L-A8207 (0301)
PW V

Positions Of The Magnetic probe Assemblies
Figure 801 (Sheet 2)
(Task 72-00-61-210-002)

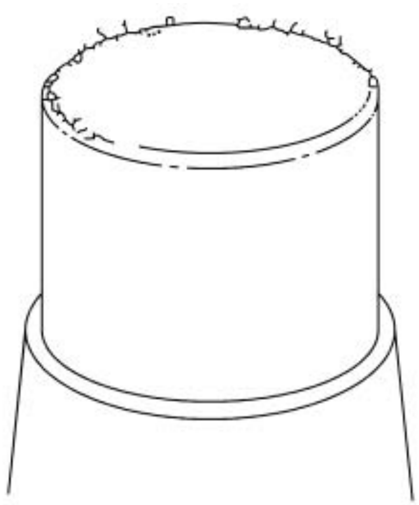

PROBE
GRIP
MAGNET
PACKING
VALVE
MAGNETIC CHIP DETECTOR ASSEMBLY
L-A3884 (0301)

Magnetic probe Assembly
Figure 802
(Task 72-00-61-210-002)



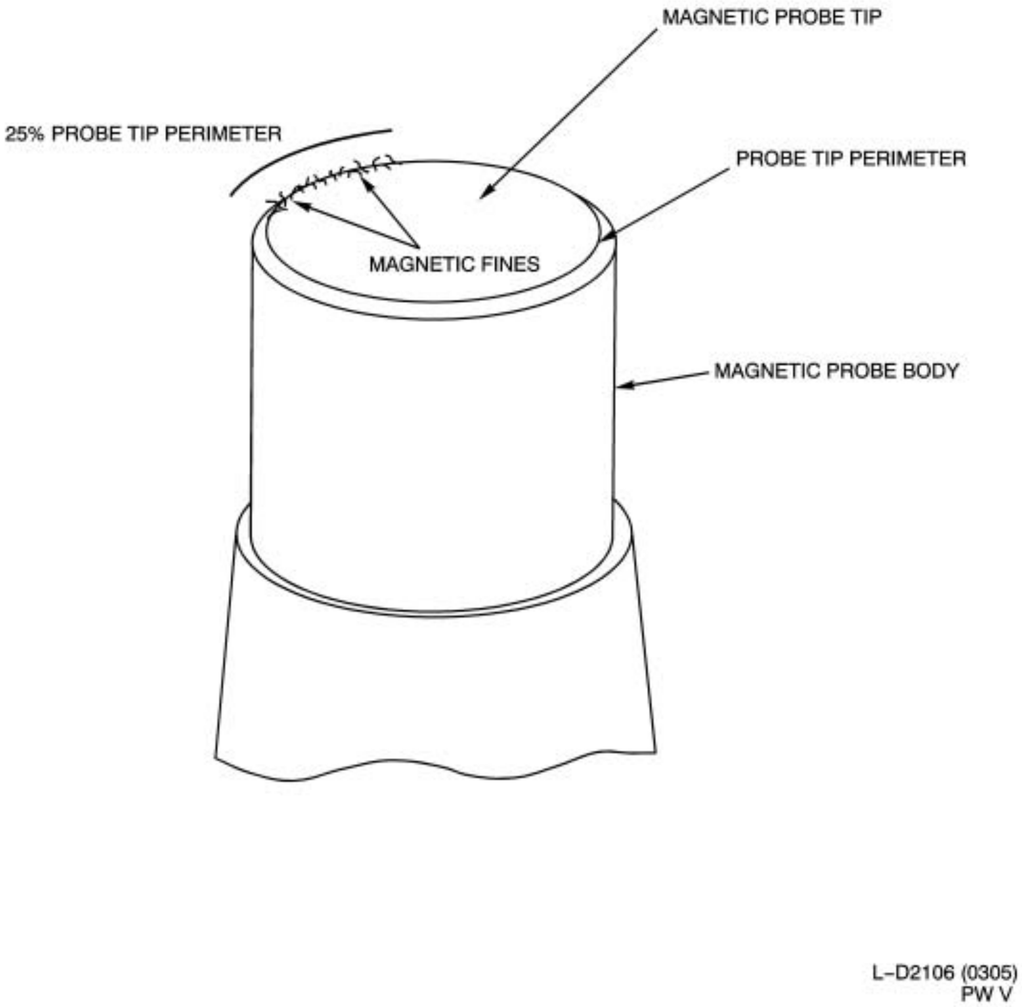
L−A7680 (0000)
PW V

Build Debris
Figure 803
(Task 72−00−61−210−002)

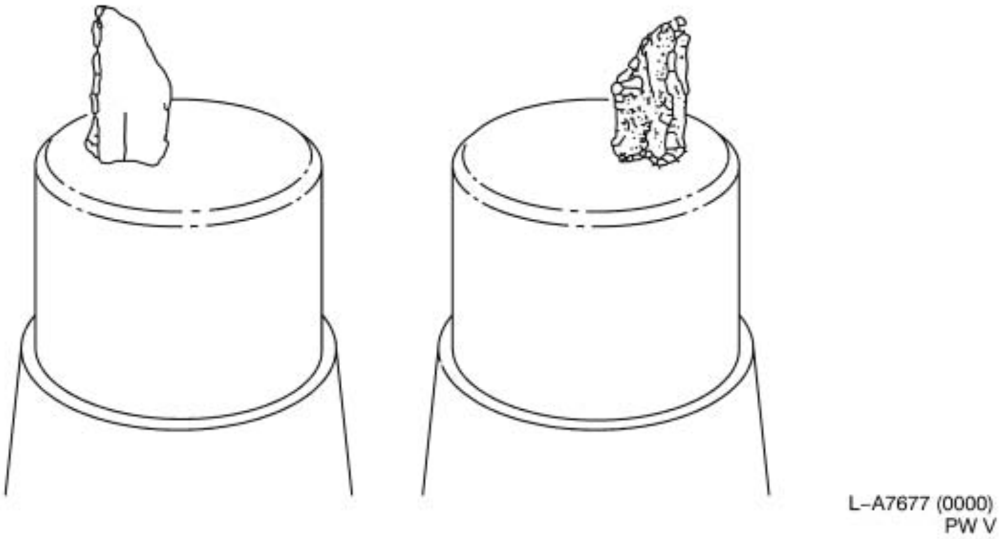


L−A7679 (0000)
PW V

R Magnetic Probe And Examples Of Magnetic Fines
Figure 804 (Sheet 1)
(Task 72−00−61−210−002)

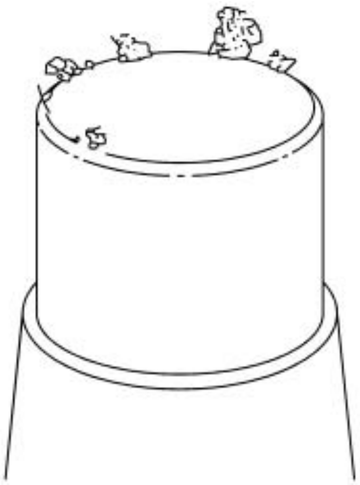

MAGNETIC PROBE TIP
25% PROBE TIP PERIMETER
PROBE TIP PERIMETER
MAGNETIC FINES
MAGNETIC PROBE BODY
L−D2106 (0305)
PW V

R Magnetic Probe And Examples Of Magnetic Fines
Figure 804 (Sheet 2)
(Task 72−00−61−210−002)



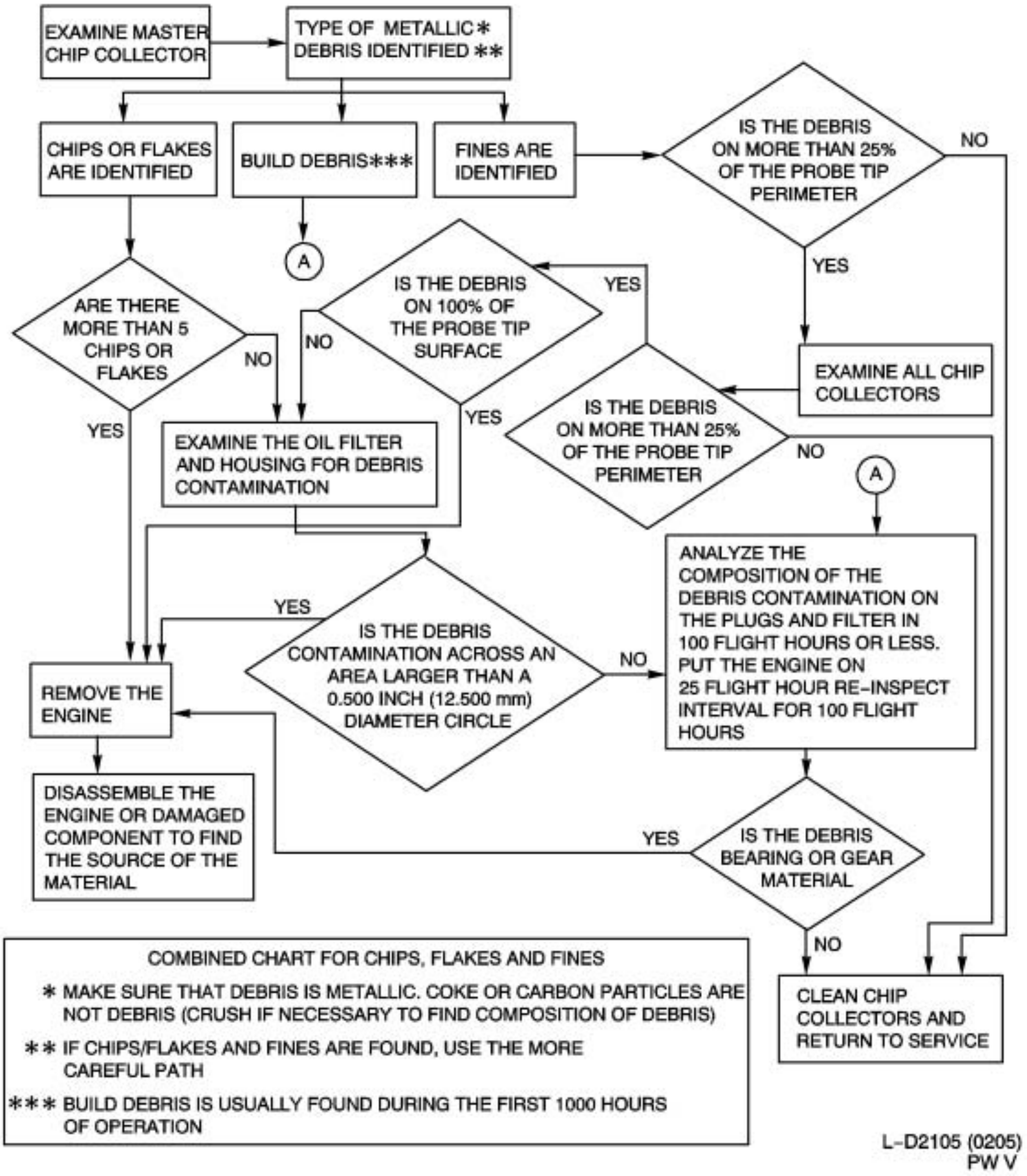
Chips
Figure 805
(Task 72−00−61−210−002)

ENGINE GENERAL − MAIN GEARBOX − INSPECTION/CHECK−04



L−A7678 (0000)
PW V

Metallic Flakes
Figure 806
(Task 72−00−61−210−002)


EXAMINE MASTER CHIP COLLECTOR
TYPE OF METALLIC* DEBRIS IDENTIFIED **
CHIPS OR FLAKES ARE IDENTIFIED
BUILD DEBRIS***
FINES ARE IDENTIFIED
IS THE DEBRIS ON MORE THAN 25% OF THE PROBE TIP PERIMETER
NO
YES
A
ARE THERE MORE THAN 5 CHIPS OR FLAKES
NO
YES
IS THE DEBRIS ON 100% OF THE PROBE TIP SURFACE
NO
YES
YES
EXAMINE ALL CHIP COLLECTORS
IS THE DEBRIS ON MORE THAN 25% OF THE PROBE TIP PERIMETER
NO
A
EXAMINE THE OIL FILTER AND HOUSING FOR DEBRIS CONTAMINATION
ANALYZE THE COMPOSITION OF THE DEBRIS CONTAMINATION ON THE PLUGS AND FILTER IN 100 FLIGHT HOURS OR LESS. PUT THE ENGINE ON 25 FLIGHT HOUR RE-INSPECT INTERVAL FOR 100 FLIGHT HOURS
YES
IS THE DEBRIS CONTAMINATION ACROSS AN AREA LARGER THAN A 0.500 INCH (12.500 mm) DIAMETER CIRCLE
NO
REMOVE THE ENGINE
DISASSEMBLE THE ENGINE OR DAMAGED COMPONENT TO FIND THE SOURCE OF THE MATERIAL
YES
IS THE DEBRIS BEARING OR GEAR MATERIAL
NO
CLEAN CHIP COLLECTORS AND RETURN TO SERVICE
COMBINED CHART FOR CHIPS, FLAKES AND FINES
* MAKE SURE THAT DEBRIS IS METALLIC. COKE OR CARBON PARTICLES ARE NOT DEBRIS (CRUSH IF NECESSARY TO FIND COMPOSITION OF DEBRIS)
** IF CHIPS/FLAKES AND FINES ARE FOUND, USE THE MORE CAREFUL PATH
*** BUILD DEBRIS IS USUALLY FOUND DURING THE FIRST 1000 HOURS OF OPERATION
L-D2105 (0205)
PW V

R Troubleshooting Chart For Magnetic Fines, Chips, And Flakes
Figure 807
(Task 72-00-61-210-002)

ENGINE GENERAL - MAIN GEARBOX - INSPECTION/CHECK-05

Task 72-00-61-200-001:

1. Inspect The Main Gearbox For Oil Leaks, Cracks, And Corrosion

A. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	AR	72-61-00/12/60
Packing	AR	72-61-00/12/240

B. Procedure

WARNING: DO NOT PERMIT ENGINE OIL P03-001 TO TOUCH SKIN OR PAINT FOR A LONG TIME. ENGINE OIL CAN CAUSE DERMATITIS AND SOFTEN PAINT.

(1) Examine the main gearbox, oil pump, and oil tank for oil leaks from the magnetic chip detector assemblies. Refer to Figure 801. If there is a leak, refer to Table 801 for action.

Source Of The Leak	Replace The:
Top of the valve	Probe packing, and, if applicable, the valve packing. Refer to Removal-36 (Task 72-00-61-050-017) and Installation-36 (Task 72-00-61-450-017).
Bottom of the valve	Assembly packing. Refer to Removal-36 (Task 72-00-61-050-017) and Installation-36 (Task 72-00-61-450-017).

Table 801

(2) Examine the drain plugs and thermocouple probe in the main gearbox for leaks. See Figure 802. If there is a leak:

CAUTION: WHEN YOU REMOVE A DRAIN PLUG, HOLD THE BUSHING WITH A WRENCH SO THAT IT DOES NOT TURN.

(a) Remove the plug/probe. Discard the packing. Permit the oil to drain.

(b) Apply Engine Oil P03−001 to a new packing and the threads of the plug/probe.

CAUTION: BE SURE TO INSTALL A PACKING ON THE PLUG/PROBE. IF THERE IS NO PACKING, THE ENGINE CAN LOSE A LARGE QUANTITY OF OIL AND THERE CAN BE AN ENGINE FAILURE.

(c) Put the packing on the plug/probe.

(d) Install the plug/probe in the bushing.

CAUTION: WHEN YOU INSTALL A PLUG/PROBE, HOLD THE BUSHING WITH A WRENCH SO THAT IT DOES NOT TURN.

(e) Torque the plug as shown in Table 802. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

Figure/ Item No.	Torque lb−in. (N.m)
802/1	110 − 120 (12.428 − 13.558)
802/3	150 − 170 (16.948 − 19.207)

Table 802

(f) For (Pre SB PW4ENG 72−84) engines, torque the probe (802/2) to 110 − 120 lb−in. (12.428 − 13.558 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(g) For (Post SB PW4ENG 72−84) engines, torque the probe (802/2A) as follows:

1 (Reference 571) Remove the lockwire between the adapter and coupling nut. Loosen the coupling nut from the adapter. Torque the adapter (to the housing) to 95 - 100 lb-in. (10.734 - 11.298 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 from the adapter to the gearbox lug.

2 Turn the probe so the two larger studs are on the bottom and slightly outward from the engine centerline. See the figure.

3 (Reference 572) Torque the coupling to 95 - 100 lb-in. (10.734 - 11.298 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 from the coupling nut to the adapter.

(3) Examine the oil tank cap for leaks. If there is a leak from the stem of the cap, replace the packing in the cap. Refer to Removal-38 (Task 72-00-61-040-002) and Installation-38 (Task 72-00-61-440-002).

(4) Examine the main gearbox for cracks. A gearbox with cracks cannot continue in service.

(5) Examine the main gearbox housing for corrosion.

CAUTION: USE THE SPOP 208 WIPE METHOD OF THE Standard Practices Manual, PN 585005, TO IMMEDIATELY REMOVE ANY WET OR BAKED ON HYDRAULIC FLUID FROM THE GEARBOX. HYDRAULIC FLUID CAN CORRODE THE ALUMINUM HOUSING OF THE GEARBOX WHEN UNDER ENGINE OPERATING TEMPERATURES.

(a) Corroded areas that are less than 0.050 inch (0.127 mm) deep are permitted.

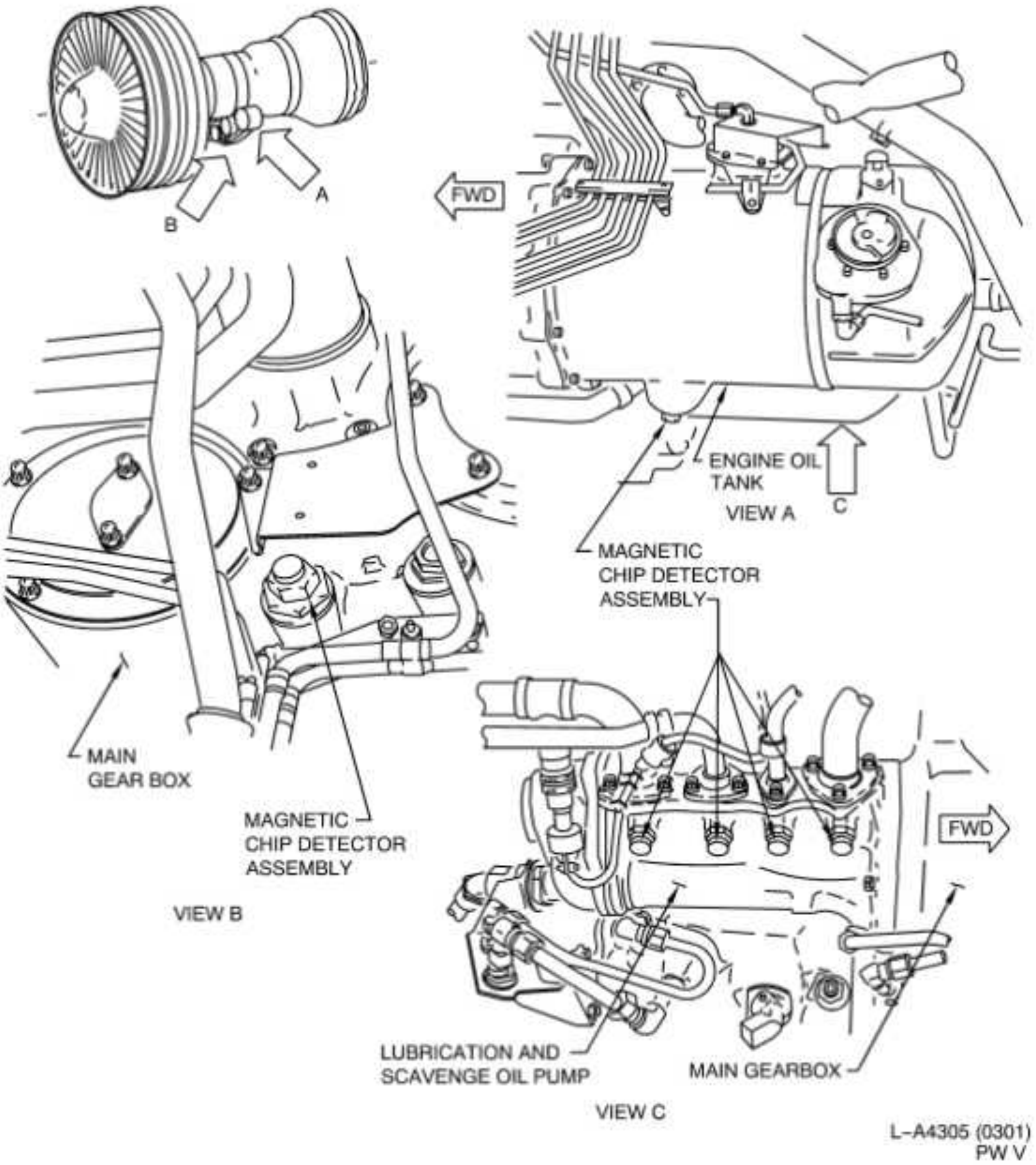
(b) If the depth of a corroded area is equal to, but not more than, 0.050 inch (0.127 mm), and has an area less than 1.00 inch^2 (645 mm^2), and is at least 2.00 inches (50.800 mm) away from other corroded areas, the part may continue in service.

(c) Corrosion that is more than the limits above is not permitted and the part may not continue-in-service.

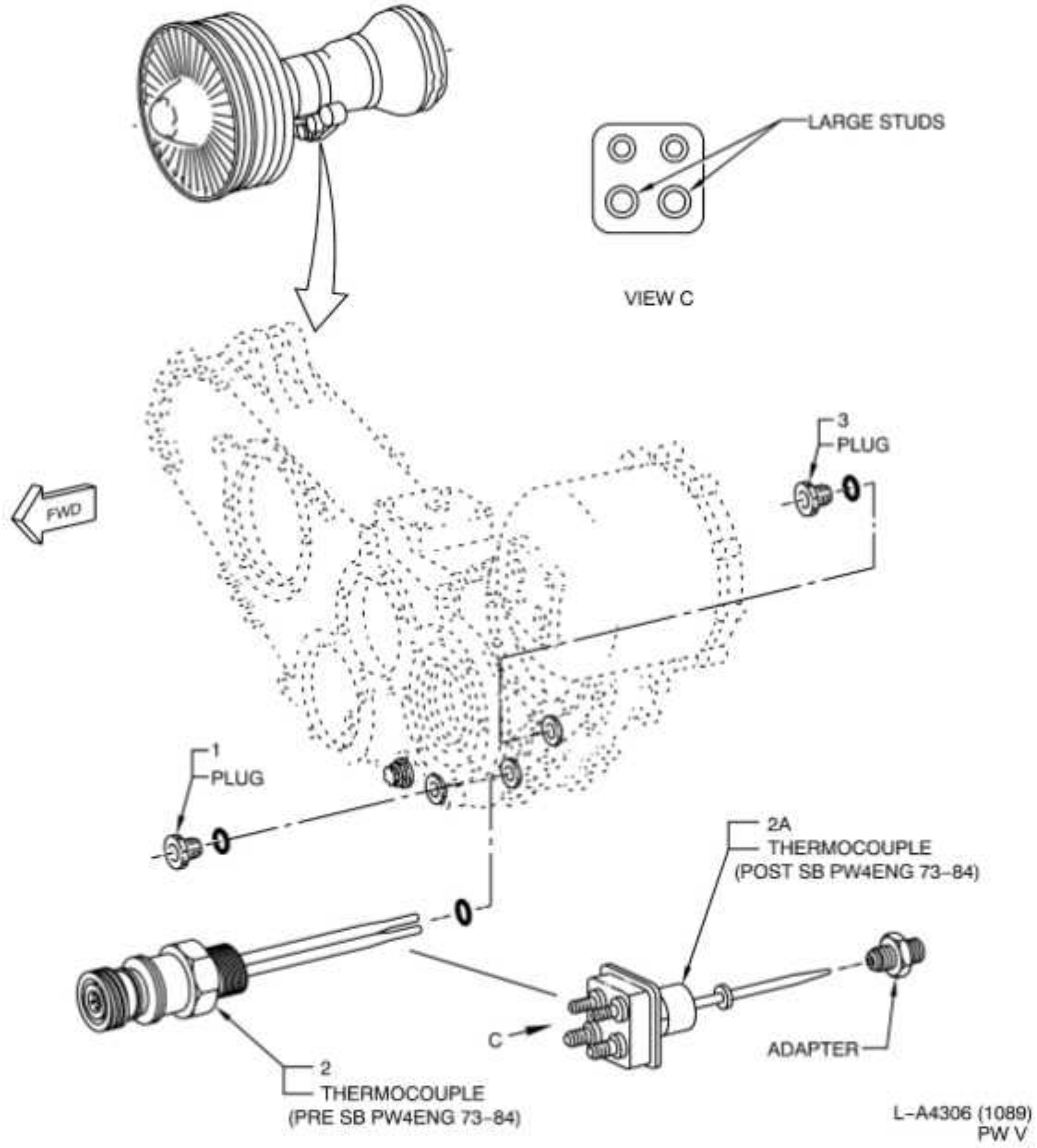
ENGINE GENERAL − MAIN GEARBOX − INSPECTION/CHECK−05

C. Postrequisites

(1) If a plug/probe was removed, service the oil system. Refer to 72−00−00, Servicing−03 (Task 72−00−00−610−003).


B
A
FWD
ENGINE OIL TANK
VIEW A
C
MAGNETIC CHIP DETECTOR ASSEMBLY
MAIN GEAR BOX
MAGNETIC CHIP DETECTOR ASSEMBLY
VIEW B
FWD
LUBRICATION AND SCAVENGE OIL PUMP
MAIN GEARBOX
VIEW C
L-A4305 (0301)
PW V

Location Of The Magnetic Chip Detector Assemblies
Figure 801
(Task 72−00−61−200−001)


LARGE STUDS
VIEW C
FWD
3
PLUG
1
PLUG
2A
THERMOCOUPLE
(POST SB PW4ENG 73-84)
C
ADAPTER
2
THERMOCOUPLE
(PRE SB PW4ENG 73-84)
L-A4306 (1089)
PW V

Location Of The Drain Plugs And Thermocouple Probe
Figure 802
(Task 72-00-61-200-001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL − MAIN GEARBOX − STORAGE−01

Task 72−00−61−530−001:

1. Pack The Main Gearbox

A. Prerequisites

(1) Remove the main gearbox. Refer to 72−00−61, Removal−01 (Task 72−00−61−020−001) or Removal−33 (Task 72−00−61−020−003).

(2) Remove the lubrication and scavenge oil pump. Refer to 72−00−61, Removal−32 (Task 72−00−61−050−014).

(3) Remove the EEC alternator stator. Refer to 72−00−61, Removal−10 (Task 72−00−61−050−007).

(4) Remove the EEC alternator rotor. Refer to 72−00−61, Removal−09 (Task 72−00−61−050−006).

NOTE: Removal of the oil tank is optional. To remove the oil tank, refer to 72−00−61, Removal−28 (Task 72−00−61−050−012).

B. Equipment And Materials Required

Special Tools:
P60041 Shipping Equipment Assembly

C. Procedure

See Figures 1201 and 1202.

(1) If applicable, remove the bolts that attach the cover of the container. Remove the cover.

(2) With a hoist and two slings, lift the detail support of P60041 Shipping Equipment Assembly. Attach the support to the main gearbox clevises with the detail ball lock pins.

(3) With the detail screws, attach the covers to the bores shown in the referenced figure. Install the plugs and and cap where shown.

NOTE: If the oil tank is installed, do not install the cover for that bore.

(4) With the hoist and slings, lift the assembly. Lower the assembly into the detail frame. Attach the support to the detail frame with the detail washers, lockwashers, and screws.

(5) With the detail bolts, attach the cover of the container.

Task 72−00−61−540−001:

2. Unpack The Main Gearbox

A. Equipment And Materials Required − None

B. Procedure

See Figures 1201 and 1202.

(1) Before you remove the bolts that attach the cover of the container, release the pressure inside the container. Use the detail pressure relief valve.

(2) Remove the bolts that attach the cover of the container. Remove the cover.

(3) Remove the eight bolts and washers that attach the detail support to the detail frame of the shipping equipment assembly.

(4) With a hoist and two slings, lift the detail support and main gearbox out of the detail frame. Put the assembly on a pallet.

(5) Remove the detail covers and plugs from the main gearbox.

(6) Remove the three ball lock pins that attach the main gearbox to the detail support. Remove the detail support from the main gearbox.

(7) Attach the detail support to the detail frame. Remove the hoist and slings.

C. Postrequisites

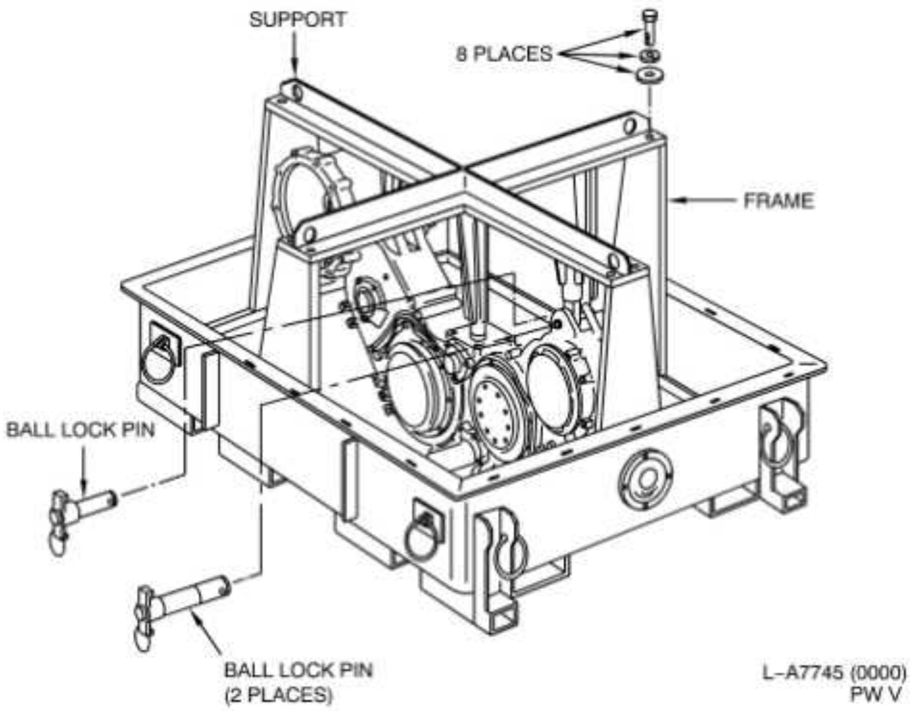
(1) Install the EEC alternator rotor. Refer to 72−00−61, Installation−09 (Task 72−00−61−450−006).

(2) Install the EEC alternator stator. Refer to 72−00−61, Installation−10 (Task 72−00−61−450−007).

(3) Install the lubrication and scavenge oil pump. Refer to 72−00−61, Installation−32 (Task 72−00−61−450−014).

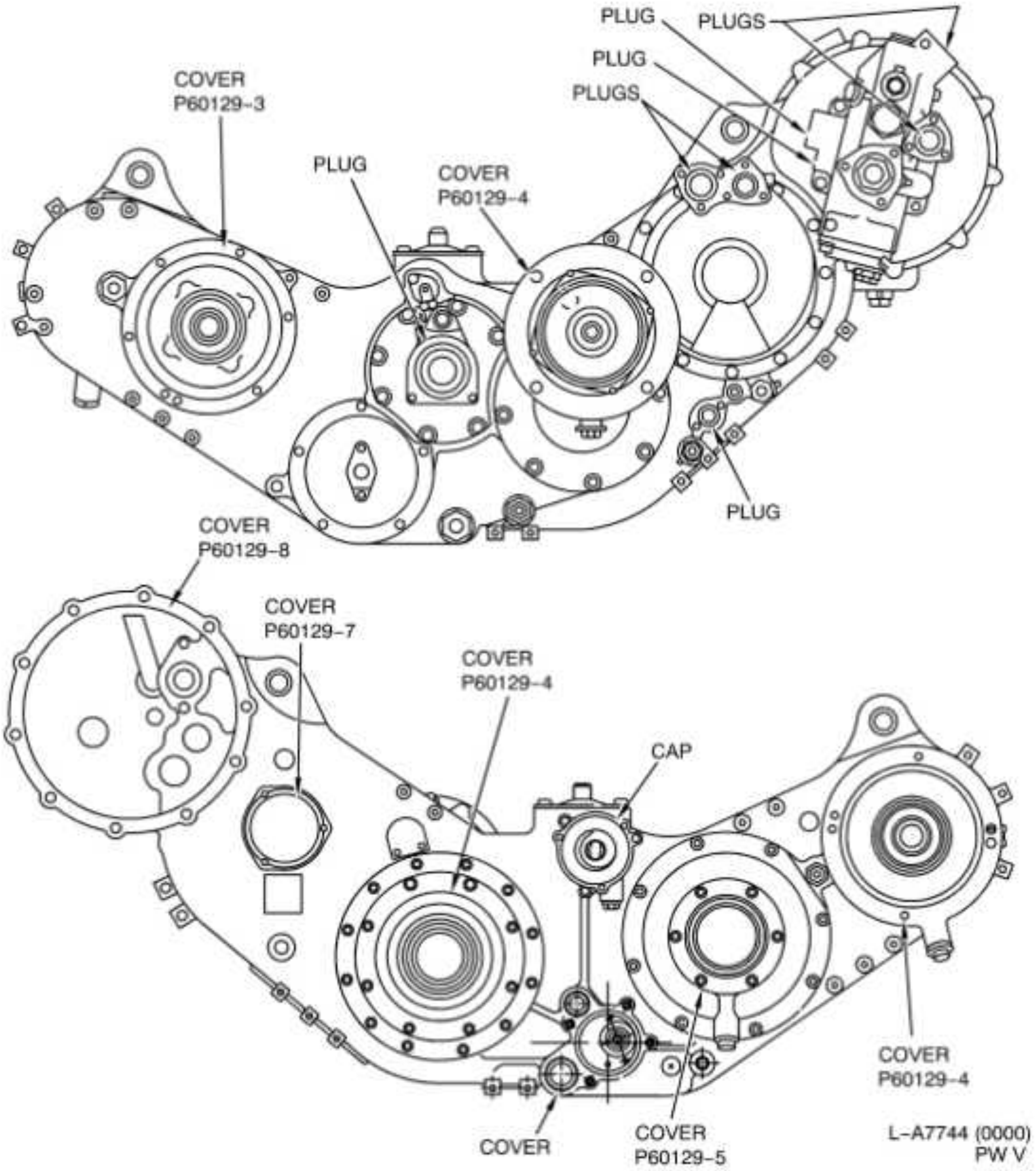
(4) If the oil tank was removed, install the oil tank. Refer to 72−00−61, Installation−28 (Task 72−00−61−450−012).

(5) Install the main gearbox. Refer to 72−00−61, Installation−01 (Task 72−00−61−420−001) or Installation−33 Task 72−00−61−420−003).


SUPPORT
8 PLACES
FRAME
BALL LOCK PIN
BALL LOCK PIN
(2 PLACES)
L−A7745 (0000)
PW V

Pack/Unpack The Main Gearbox
Figure 1201
(Task 72−00−61−530−001)

ENGINE GENERAL − MAIN GEARBOX − STORAGE−01


PLUG
PLUGS
PLUG
PLUGS
COVER
P60129-3
PLUG
COVER
P60129-4
PLUG
COVER
P60129-8
COVER
P60129-7
COVER
P60129-4
CAP
COVER
P60129-4
COVER
COVER
P60129-5
L-A7744 (0000)
PW V

Pack/Unpack The Main Gearbox
Figure 1202
(Task 72−00−61−530−001)

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72−00−62

	LIST OF EFFECTIVE PAGES
	HIGHLIGHTS
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72−00−62	ENGINE GENERAL − ANGLE GEARBOX − REMOVAL−02 • 72−00−62−020−002: Remove The External Plumbing Prior To The Removal Of The Angle Gearbox
72−00−62	ENGINE GENERAL − ANGLE GEARBOX − INSTALLATION−01 • 72−00−62−420−001: Install The Angle Gearbox
72−00−62	ENGINE GENERAL − ANGLE GEARBOX − INSTALLATION−02 • 72−00−62−420−002: Install External Plumbing To Complete Installation Of Angle Gearbox
72−00−62	ENGINE GENERAL − ANGLE GEARBOX − INSPECTION/CHECK−01 • 72−00−62−990−001: Specific Fits And Clearances
72−00−62	ENGINE GENERAL − ANGLE GEARBOX − INSPECTION/CHECK−02 • 72−00−62−210−001: Examine The Angle Gearbox For Cracks, Oil Leaks, And Corrosion

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-00-62-020-001:

1. Remove The Angle Gearbox

A. Prerequisites

(1) Remove the external plumbing before removal of the angle gearbox. See Removal-02 (Task 72-00-62-020-002).

(2) Remove the fan exit liner segment (inner rear) that is at 6 o'clock. Refer to 72-00-33, Removal-16 (Task 72-00-33-040-001).

B. Equipment And Materials Necessary

Special Tools:

PWA 85518	Puller
PWA 87502	Puller, Knocker (Optional To PWA 101035)
PWA 101035	Puller, Jackscrew (Optional To PWA 87502)
PWA 102830	Adapter

C. Procedure

R NOTE: If the angle gearbox is the source of the metal
R in the system and the failure caused any debris
R larger than a flake (such as a geartooth, washer,
R bolt, bearing part, etc.) then all liberated angle
R gearbox debris larger than a flake must be found.
R If there is any debris larger than a flake that
R is not found, then the main gearbox must also be
R removed and disassembled sufficiently until the
R missing debris is found. Refer to Section 72-00-00,
R Inspection/Check-04 (Task 72-00-00-280-054) for the
R definition of a flake.

(1) Disconnect the gearbox driveshaft and the front housing from the angle gearbox as follows. See Figure 301.

(a) Put a 5 gallon (18.9 l) container under the mating faces of the front housing and angle gearbox. Use it to collect oil.

(b) Remove the bolts that connect the brackets on the front housing to the HPC.

(c) Remove the bolts, washers, and nuts that attach the front housing and brackets to the angle gearbox. Remove the clamp bolt and the two brackets.

(d) Use PWA 102830 Adapter to break loose the front and rear packings on the front housing.

(e) Move the front housing to the rear.

(f) Discard the packing on the front housing.

(g) Remove the retaining ring that attaches the gearbox driveshaft to the angle gearbox.

(h) Move the gearbox driveshaft to the rear.

(2) Remove the fan exit case flange assembly (called flange assembly) as follows. See Figure 302.

(a) Cut the sealant that is at the ends of the flange assembly.

(b) Bend the key at each end of the flange assembly.

(c) Remove and discard the keys.

(d) Remove the flange assembly.

(e) Mechanically remove the sealant that is at the ends of the flange assembly. Remove the sealant that is at the trailing edge of strut platforms No. 5 and 6.

(3) Remove the angle gearbox as follows.

(a) Put a 5 gallon (18.9 l) container under the angle gearbox to collect oil.

(b) Remove the plug from the side of the angle gearbox cover assembly. See Figure 303.

1 Remove the bolts, washers, and plug.

2 Discard the packing.

(c) Remove the gearbox driveshaft assembly as follows. See Figure 304.

R
R

1 Remove the retaining ring that keeps the plug (gearbox cover) in the bottom of the angle gearbox.

2 With PWA 85518 Puller, remove the plug (gearbox cover). Discard the packing.

3 Remove the retaining ring that is inside the angle gearbox. It keeps the gearbox driveshaft assembly in place.

4 Remove the gearbox driveshaft assembly.

(d) Remove the angle gearbox with the PWA 101035 Jackscrew Puller (Optional to PWA 87502 Knocker Puller) as follows. See Figure 305 (Sheet 1).

1 Remove the bolt and pin stop from each support bracket. Discard the pin stops.

2 Remove the two arms of the PWA 101035 Jackscrew Puller from the puller detail bar and attach the two arm assemblies into the angle gearbox brackets on the opposite sides of the angle gearbox with the two detail bolts handtightened.

3 Remove the large jackscrew nut and washer which attach the puller detail bar to the main body bracket of the Jackscrew Puller.

4 Put the main body bracket of the PWA 101035 Jackscrew Puller between the 5th and 6th stage strut of the intermediate case and attach the main body bracket of the puller to the inner strut flanges with the four detail hex head cap screws handtight only.

5 Attach the two detail arm assemblies of the jackscrew puller to the outer position of the puller detail bar and handtighten the two detail bolts to lock the arms in place on the puller detail bar.

6 With the PWA 101035 Jackscrew Puller assembly firmly in place, tighten the two detail bolts which attach the two arm assemblies to the two support brackets. Next, tighten the two detail bolts which attach the arm assemblies to the

outer position of the puller detail bar. Next, tighten the four detail hex head cap screws which attach the puller main body bracket to the inner strut flanges. Next, install the washer and large detail jackscrew nut to the puller detail bar and handtighten.

7 (Pre SB PW4ENG 72-438) Remove the lockwire or safety cable and bolts that attach the two support brackets to the intermediate case.

8 (Post SB PW4ENG 72-438) Un-bend the tabs of the key washers. Remove the bolts that attach the two support brackets to the intermediate case. Remove and discard the key washers.

9 Turn the large detail jackscrew nut to disengage the angle gearbox from the intermediate case. Remove the gearbox with the puller from the intermediate case.

10 Lower the angle gearbox. Install it in a stand.

11 Remove the four detail screws that attach the puller to the two strut flanges.

12 Discard the packing that is on the upper OD of the angle gearbox.

13 If necessary, remove the support brackets from the sides of the angle gearbox.

14 Install protective covers.

(e) Remove the angle gearbox with the PWA 87502 Knocker Puller (optional to PWA 101035 Jackscrew Puller) as follows. See Figure 305 (Sheet 2).

1 Remove the bolt and pin stop from each support bracket. Discard the pin stops.

2 Put the jaws of the PWA 87502 Knocker Puller on the brackets on opposite sides of the angle gearbox.

3 Attach the jaws to the angle gearbox support brackets with the detail bolts. Tighten the two detail bolts.

4 (Pre SB PW4ENG 72-438) Remove the lockwire or safety cable and bolts that attach the two support brackets to the intermediate case.

5 (Post SB PW4ENG 72-438) Unbend the tabs of the key washers. Remove the bolts that attach the two support brackets to the intermediate case. Remove and discard the key washers.

6 Quickly pull the slide hammer against the handle many times until you loosen the angle gearbox from the engine. Remove the gearbox with the puller from the intermediate case.

7 Remove the two detail bolts that attach the puller jaws to the two strut flanges. Remove the puller from the angle gearbox.

8 Put the angle gearbox in a stand.

9 Discard the packing that is on the upper OD of the angle gearbox.

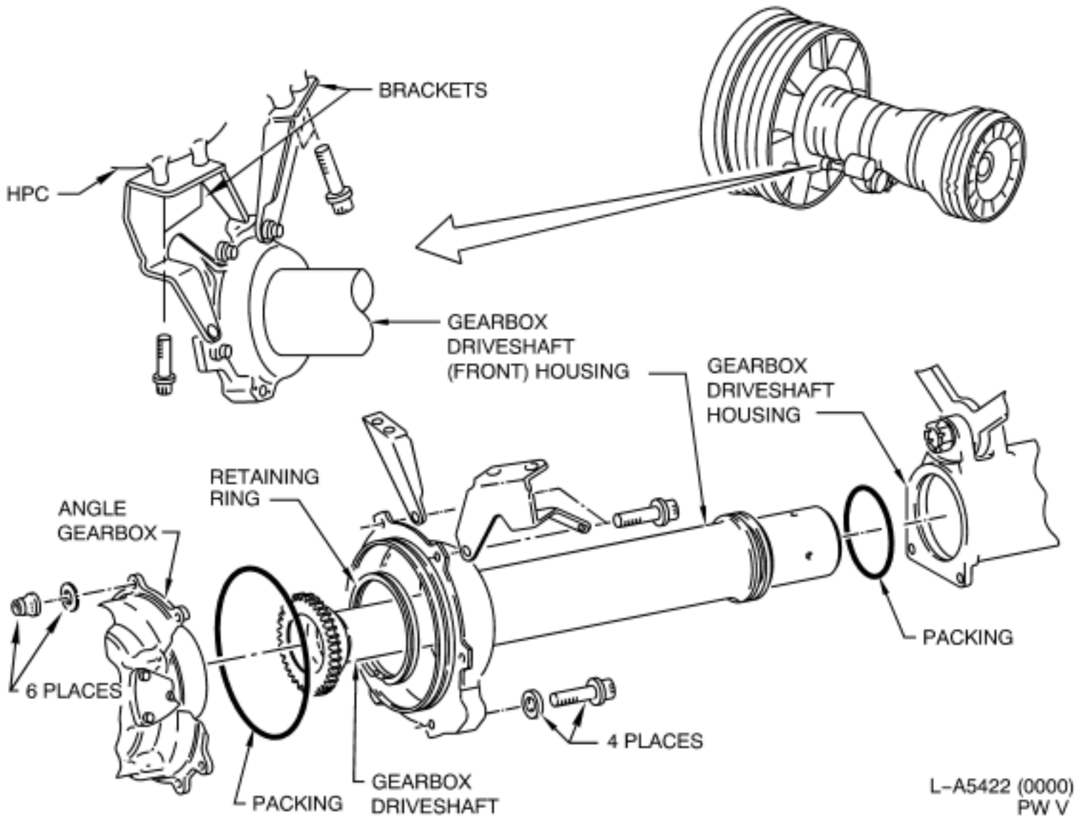
10 If necessary, remove the support bracket at each side of the angle gearbox.

11 Install protective covers.

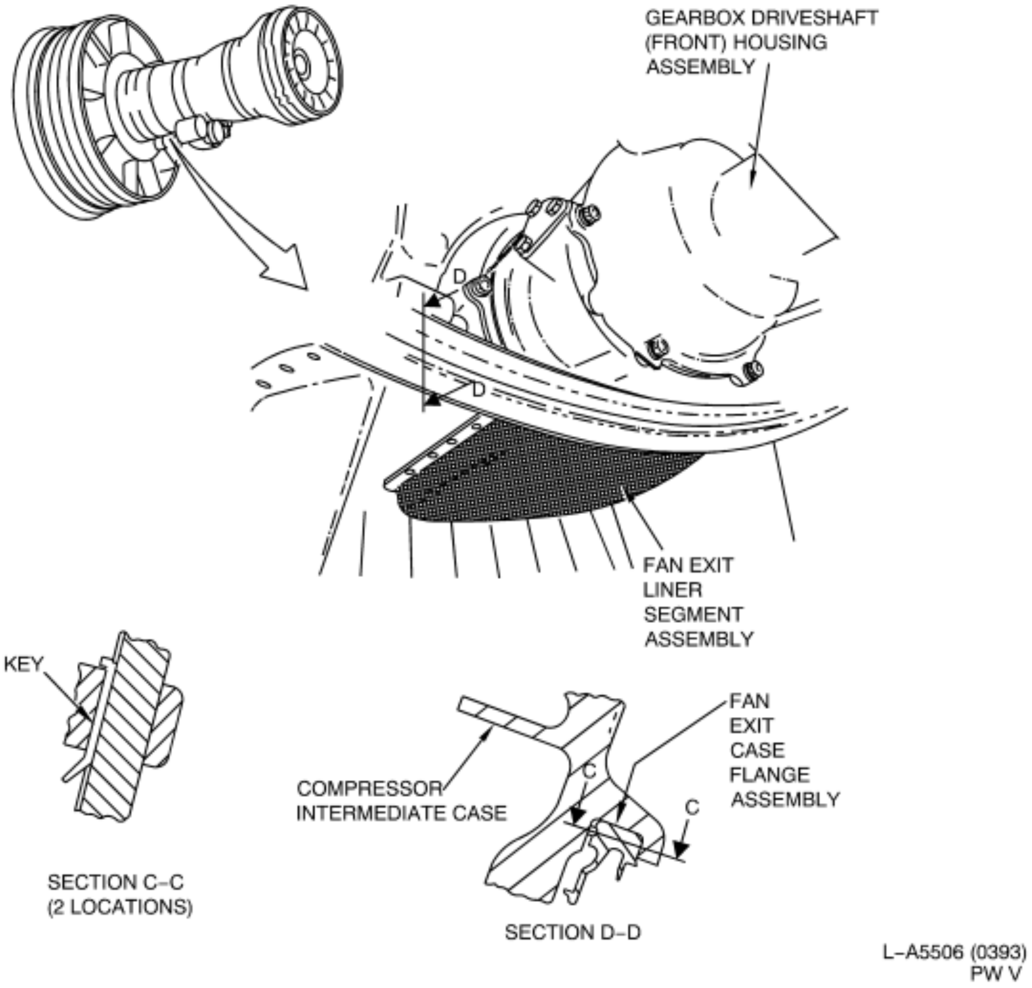
(4) Remove the gearbox driveshaft and front housing from the main gearbox as follows. See Figure 301.

(a) Pull the gearbox driveshaft and the front housing out of the gearbox driveshaft housing assembly (called rear housing).

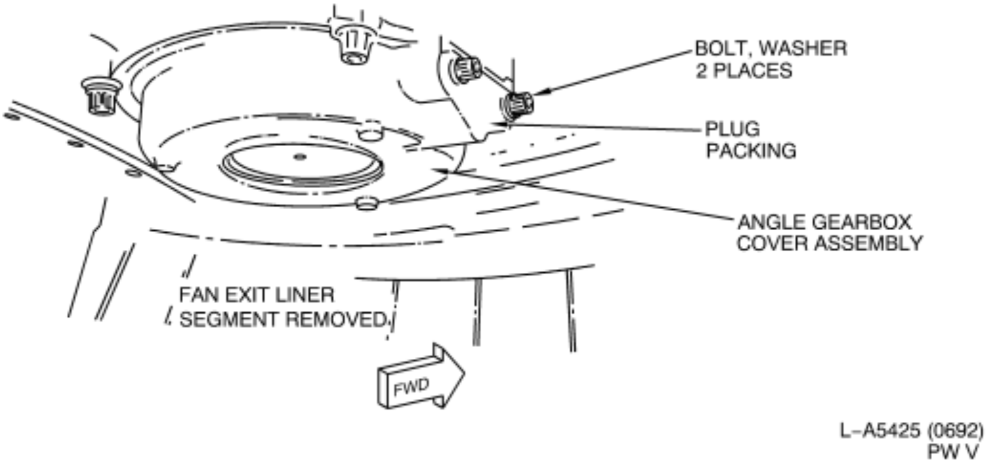
(b) Discard the packing that is on the rear of the front housing.


BRACKETS
HPC
GEARBOX DRIVESHAFT (FRONT) HOUSING
GEARBOX DRIVESHAFT HOUSING
RETAINING RING
ANGLE GEARBOX
6 PLACES
PACKING
4 PLACES
PACKING
GEARBOX DRIVESHAFT
L−A5422 (0000)
PW V

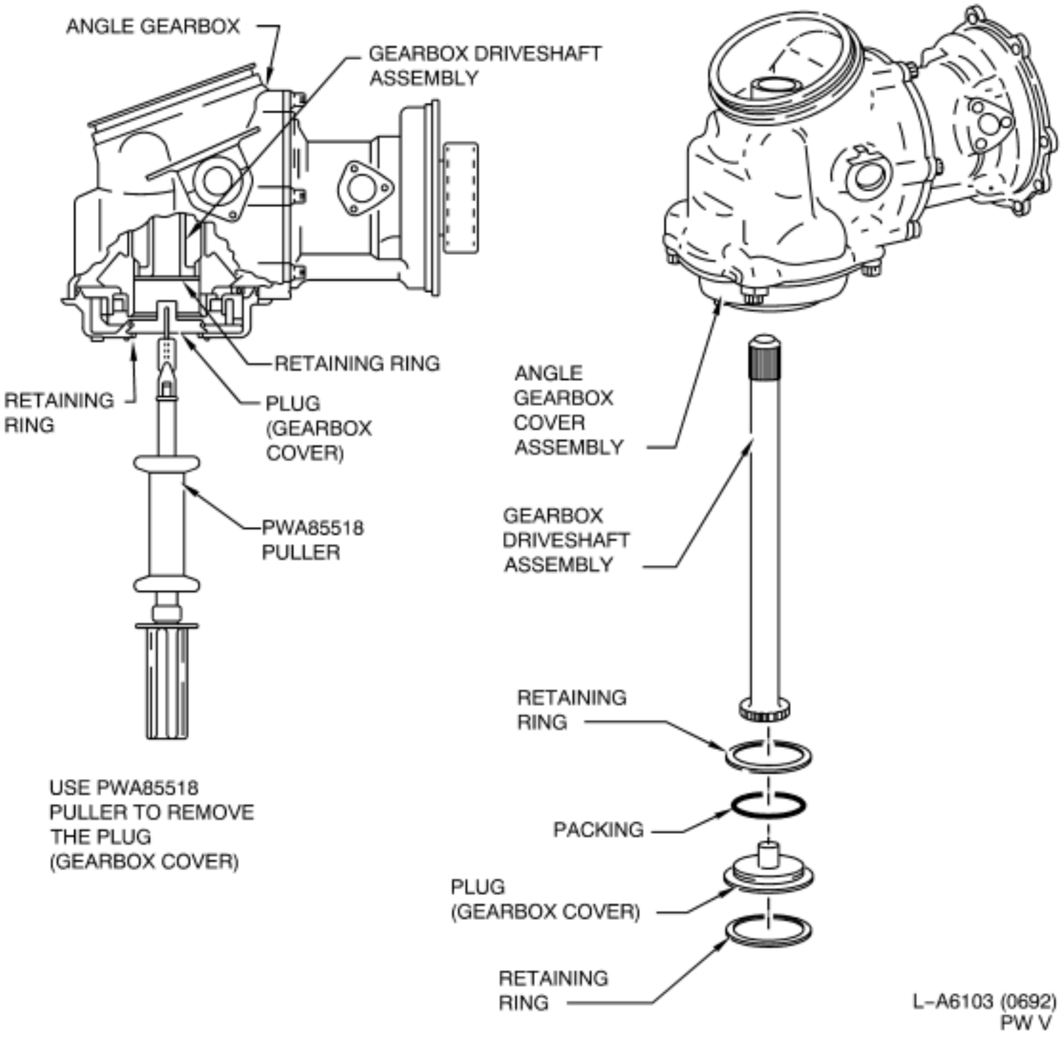
The Gearbox Driveshaft And Front Housing
Figure 301
(Task 72−00−62−020−001)


GEARBOX DRIVESHAFT (FRONT) HOUSING ASSEMBLY
D
D
FAN EXIT LINER SEGMENT ASSEMBLY
KEY
SECTION C−C (2 LOCATIONS)
COMPRESSOR INTERMEDIATE CASE
C
C
FAN EXIT CASE FLANGE ASSEMBLY
SECTION D−D
L−A5506 (0393)
PW V

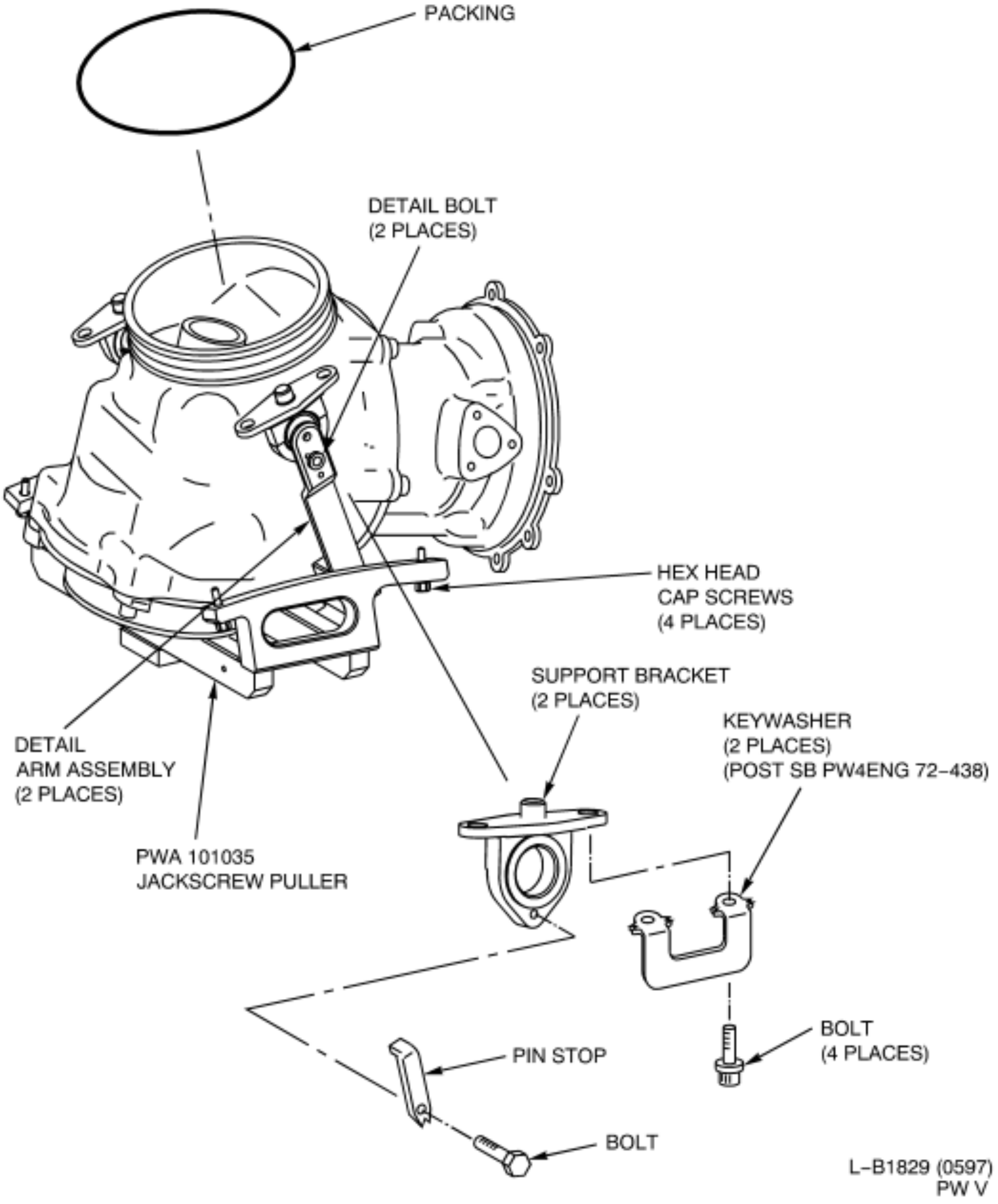
Intermediate Case Parts
Figure 302
(Task 72−00−62−020−001)


BOLT, WASHER
2 PLACES
PLUG
PACKING
ANGLE GEARBOX
COVER ASSEMBLY
FAN EXIT LINER
SEGMENT REMOVED
FWD
L−A5425 (0692)
PW V

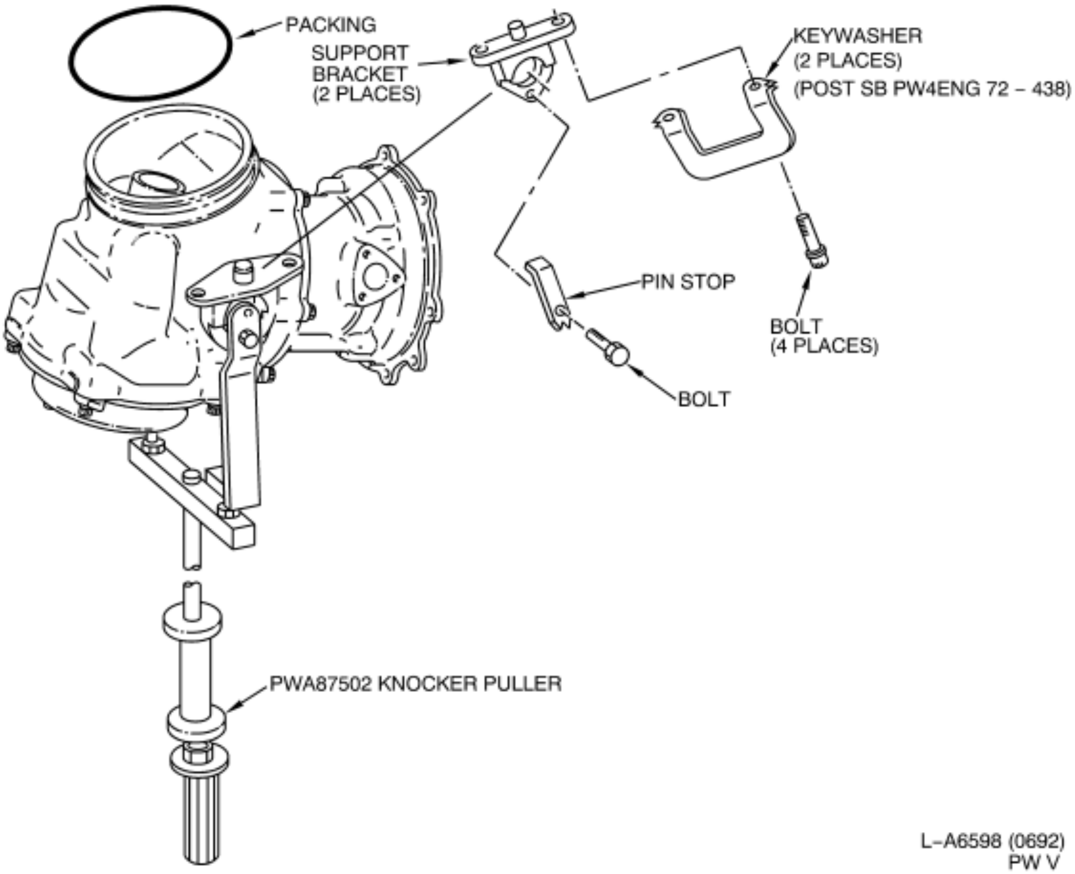
The Angle Gearbox Plug
Figure 303
(Task 72−00−62−020−001)


ANGLE GEARBOX
GEARBOX DRIVESHAFT ASSEMBLY
RETAINING RING
RETAINING RING
PLUG (GEARBOX COVER)
PWA85518 PULLER
USE PWA85518 PULLER TO REMOVE THE PLUG (GEARBOX COVER)
ANGLE GEARBOX COVER ASSEMBLY
GEARBOX DRIVESHAFT ASSEMBLY
RETAINING RING
PACKING
PLUG (GEARBOX COVER)
RETAINING RING
L−A6103 (0692)
PW V

Removal Of The Gearbox Driveshaft Assembly
Figure 304
(Task 72−00−62−020−001)


PACKING
DETAIL BOLT
(2 PLACES)
HEX HEAD
CAP SCREWS
(4 PLACES)
SUPPORT BRACKET
(2 PLACES)
KEYWASHER
(2 PLACES)
(POST SB PW4ENG 72-438)
DETAIL
ARM ASSEMBLY
(2 PLACES)
PWA 101035
JACKSCREW PULLER
PIN STOP
BOLT
(4 PLACES)
BOLT
L-B1829 (0597)
PW V

Removal Of The Angle Gearbox With PWA 101035 Jackscrew Puller
Figure 305 (Sheet 1)
(Task 72-00-62-020-001)


PACKING
SUPPORT BRACKET (2 PLACES)
KEYWASHER (2 PLACES) (POST SB PW4ENG 72 − 438)
PIN STOP
BOLT (4 PLACES)
BOLT
PWA87502 KNOCKER PULLER
L−A6598 (0692)
PW V

Removal Of The Angle Gearbox With PWA 87502 Knocker Puller
Figure 305 (Sheet 2)
(Task 72−00−62−020−001)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - ANGLE GEARBOX - REMOVAL-02

Task 72-00-62-020-002:

1. Remove The External Plumbing Prior To The Removal Of The Angle Gearbox

   A. Equipment And Materials Necessary - None

   B. Procedure
   See Figure 301.

      (1) Put a 5 gallon (19 l) container under the angle gearbox connections to collect oil.

      (2) Disconnect the angle-gearbox oil pressure tube assembly (LP09) as follows.

         (a) Remove the lockwire and disconnect the tube nut from the right side angle gearbox adapter.

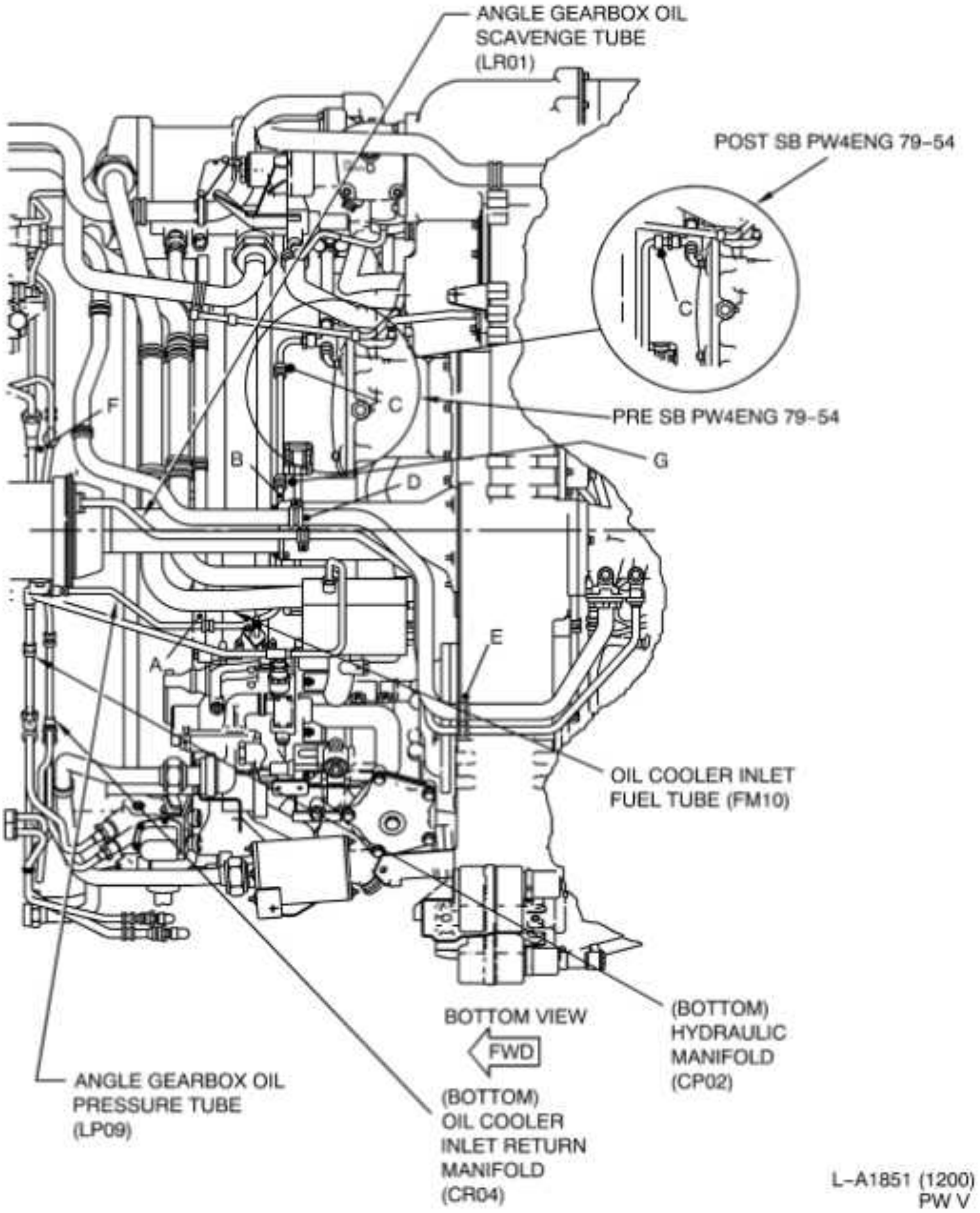
         (b) Remove the bolts and nuts that attach the tube to brackets. Move the tube to permit angle gearbox removal. Install protection covers.

      (3) Remove the angle-gearbox oil scavenge tube assembly (LR01) as follows.

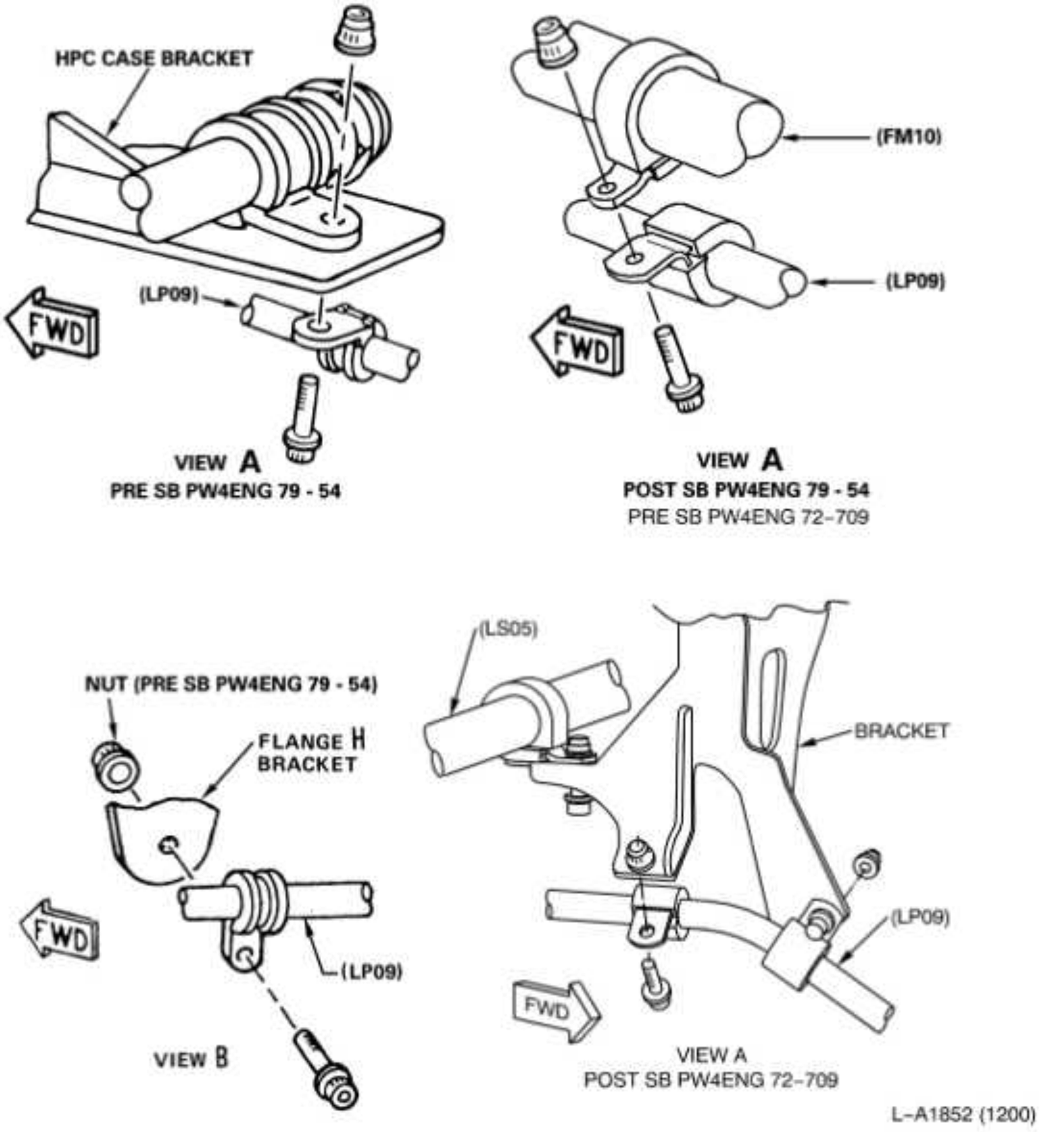
         (a) Remove the bolts that attach the tube to the rear of the angle gearbox and to the right side of the oil pump.

         (b) Remove the bolts, nuts and clamps that attach the tube to the brackets. Move the tube to permit angle gearbox removal. Remove and discard the packings. Install protection covers.

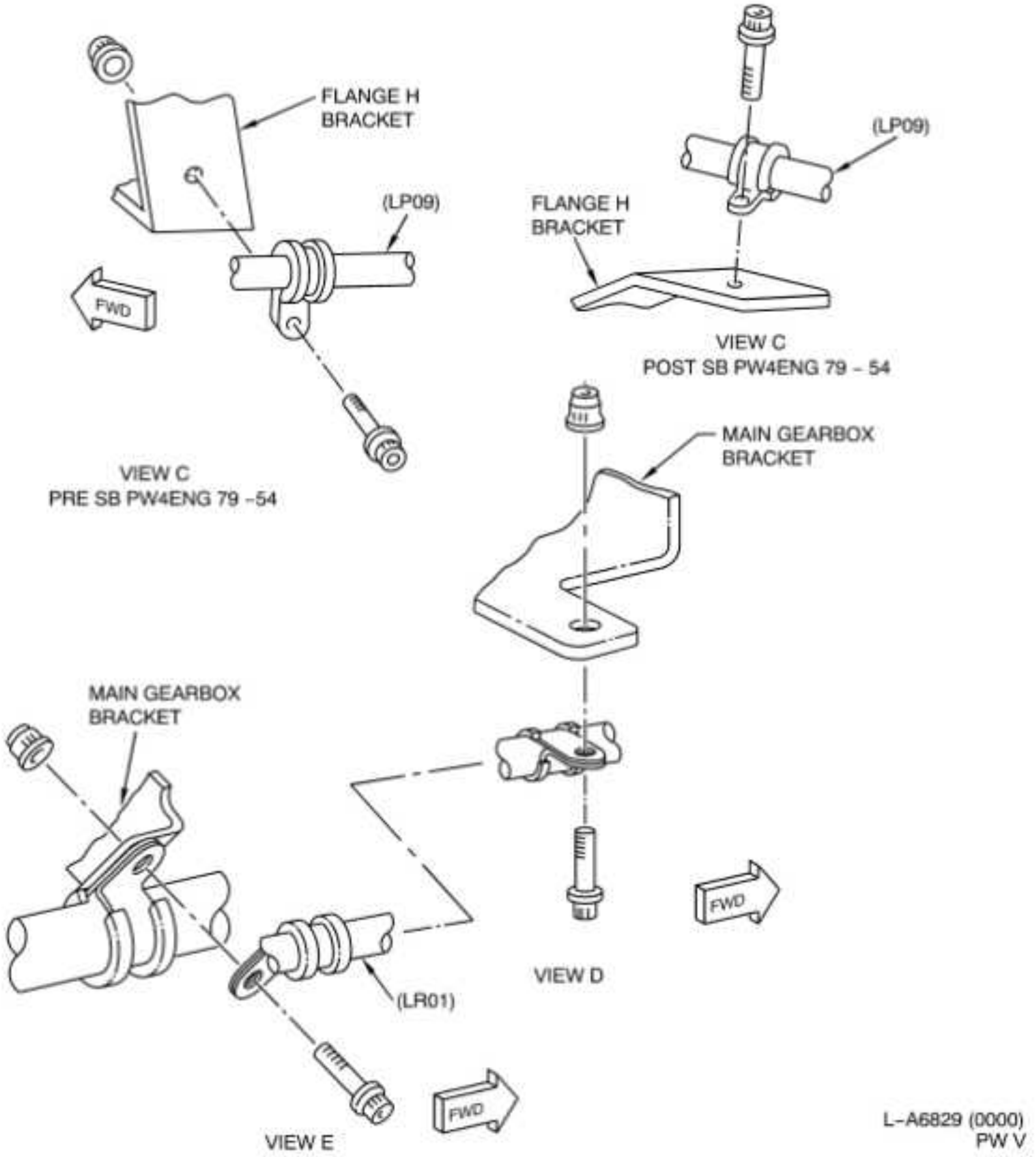
      (4) For Post SB PW4ENG 75-45 engines, remove the two clamp bolts and nuts that attach the (bottom) hydraulic manifold (CP02) and the (bottom) oil cooler inlet return manifold (CR04) to the angle gearbox bracket.


ANGLE GEARBOX OIL SCAVENGE TUBE (LR01)
POST SB PW4ENG 79-54
C
F
C
PRE SB PW4ENG 79-54
B
D
G
E
A
OIL COOLER INLET FUEL TUBE (FM10)
BOTTOM VIEW
FWD
(BOTTOM) HYDRAULIC MANIFOLD (CP02)
ANGLE GEARBOX OIL PRESSURE TUBE (LP09)
(BOTTOM) OIL COOLER INLET RETURN MANIFOLD (CR04)
L-A1851 (1200)
PW V

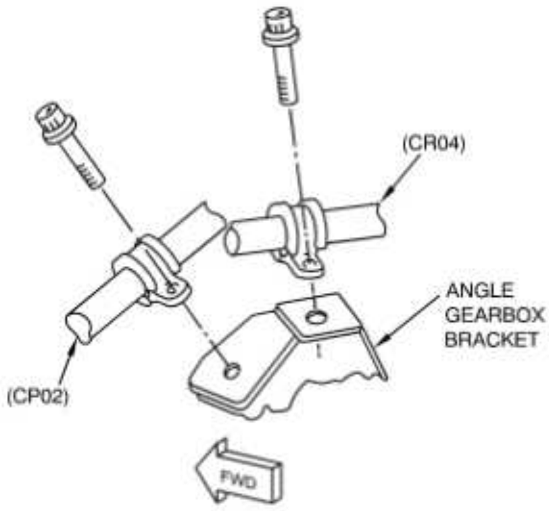
Angle Gearbox Plumbing Removal
Figure 301 (Sheet 1)
(Task 72−00−62−020−002)


HPC CASE BRACKET
(LP09)
FWD
VIEW A
PRE SB PW4ENG 79 - 54
(FM10)
(LP09)
FWD
VIEW A
POST SB PW4ENG 79 - 54
PRE SB PW4ENG 72-709
NUT (PRE SB PW4ENG 79 - 54)
FLANGE H
BRACKET
FWD
(LP09)
VIEW B
(LS05)
BRACKET
(LP09)
FWD
VIEW A
POST SB PW4ENG 72-709
L-A1852 (1200)

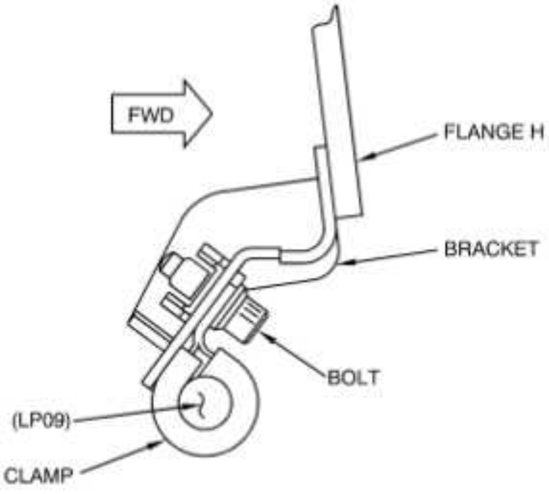
Angle Gearbox Plumbing Removal
Figure 301 (Sheet 2)
(Task 72−00−62−020−002)


FLANGE H BRACKET
(LP09)
FWD
VIEW C
PRE SB PW4ENG 79 -54
(LP09)
FLANGE H BRACKET
VIEW C
POST SB PW4ENG 79 - 54
MAIN GEARBOX BRACKET
MAIN GEARBOX BRACKET
(LR01)
VIEW D
FWD
VIEW E
FWD
L-A6829 (0000)
PW V

Angle Gearbox Plumbing Removal
Figure 301 (Sheet 3)
(Task 72−00−62−020−002)


(CR04)
ANGLE
GEARBOX
BRACKET
(CP02)
FWD

(POST SB PW4ENG 75-45 ONLY)
VIEW F


FWD
FLANGE H
BRACKET
BOLT
(LP09)
CLAMP

VIEW G
POST SB PW4ENG 72-709

L-A6475 (1200)
PW V

Angle Gearbox Plumbing Removal
Figure 301 (Sheet 4)
(Task 72−00−62−020−002)

ENGINE GENERAL - ANGLE GEARBOX - INSTALLATION-01

Task 72-00-62-420-001:

1. Install The Angle Gearbox

A. Prerequisites

(1) See 72-00-62, Inspection/Check-01 (Task 72-00-62-990-001) for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 Or M307

Special Tools:
PWA 85768 Puller
PWA 87514 Gage, Plug
PWA 87552 Crimper, Finish
PWA 87553 Crimper, Prebend

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-038	Cheesecloth, Unsized (Misc. 0018)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
R	P06-054	Paste, Antiseize (PWA 36246)
	P09-027	Sealant, Silicone Rubber (PWA 36003-2)
	P11-005A	Solvent, Methyl Ethyl Ketone (PMC 1820)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key	2	72-34-00/12/30
Key Washer	2	72-34-00/12/110A
Packing	1	72-61-00/8/160
Packing	1	72-62-00/1/1
Packing	1	72-62-00/3/130
Packing	1	72-62-00/3/190
Packing	1	72-62-00/6/20

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
(CONTINUED)		
Packing	1	72−62−00/6/30
Pin Stop	2	72−00−62/1/10

C. Procedure

(1) Install the gearbox driveshaft and gearbox driveshaft (front) housing assembly (called front housing) in the gearbox driveshaft housing assembly (called rear housing) as follows. See Figure 401.

(a) Install the gearbox driveshaft and retaining ring in the front housing.

(b) Lubricate with Engine Oil P03−001 two new packings. Install the packings in the front and rear grooves of the front housing.

(c) Install the front housing in the rear housing. Move the front housing to the rear.

(d) Engage the splines of the gearbox driveshaft with the splines in the main gearbox. Move the gearbox driveshaft to the rear.

(2) Install the angle gearbox as follows. See Figure 402.

(a) Install the angle gearbox in the intermediate case as follows.

1 Attach a new pin stop to each support bracket with bolts, lubricated with Engine Oil P03−001. Tighten the bolts with your fingers.

2 Install the brackets on the pins at the sides of the angle gearbox.

3 Twist the free end of the stop counterclockwise until it touches the ID of the pin.

4 While you hold the pin stops, torque the bolts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

5 Bend the keys on the stops.

R
R

6 Lubricate with Engine Oil P03-001 one packing. Install it on the upper OD of the angle gearbox.

7 Put the angle gearbox in position in the intermediate case.

8 Apply Engine Oil P03-001 to the threads of four bolts.

9 (Pre SB PW4ENG 72-438) Attach the angle gearbox with the bolts through the support brackets. Torque the bolts to 225 - 300 lb-in. (25.422 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

10 (Post SB PW4ENG 72-438) Put the two key washers in the correct position against the support brackets. Attach the angle gearbox with the bolts through the key washers and support brackets. Torque the bolts to 275 - 300 lb-in. (31.071 - 33.895 N.m). Bend the tabs of the key washers against the bolts. Use PWA 87553 Crimper. Then use PWA 87552 Crimper.

(b) Install the gearbox driveshaft assembly as follows.

1 Lubricate with Engine Oil P03-001 the splines of the gearbox driveshaft assembly.

2 Put the gearbox driveshaft assembly in position in the angle gearbox mating the splines.

3 Install the retaining ring to keep the gearbox driveshaft assembly in position.

(c) Do a check of the installation of the gearbox driveshaft retaining ring.

1 Install PWA 87514 Gage in the bore of the bevel gear.

2 If the retaining ring is correctly installed, the detail stop bar will touch the bottom of the bevel gear.

(d) Install the plug (gearbox cover) as follows.

ENGINE GENERAL − ANGLE GEARBOX − INSTALLATION−01

1 Lubricate with Engine Oil P03−001 one packing.

2 Install the packing on the plug (gearbox cover).

3 Install the plug (gearbox cover) in the angle gearbox cover assembly.

4 Install the retaining ring in the angle gearbox cover assembly.

(e) Install the plug in the side of the angle gearbox cover assembly. See Figure 403.

1 Lubricate with Engine Oil P03−001 one packing. Install it on the plug.

2 Attach the plug to the angle gearbox cover assembly with two washers and two bolts,
R threads lubricated with Antiseize Paste
R P06−054. Wipe off unwanted paste. Tighten and torque the bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(3) Install the intermediate case parts as follows. See Figure 404.

(a) Install the fan−exit−case−flange−assembly.

1 Install the fan−exit−case−flange−assembly.

2 (Reference 138) Install a key at each end of the fan−exit−case−flange−assembly in the lugs of the struts of the intermediate case. Use the correct class of key. The class of key is correct if there is no empty space between the key and the intermediate case. Refer to the figure.

3 Bend the keys as shown in the figure.

(b) Apply sealant to the ends of the flange assembly and at the trailing edges of the platforms of struts five and six as follows.

1 Clean Areas K and CH. Use a piece of clean Cheesecloth P05−038 that is moist with Solvent P11−005A.

2 Dry the surfaces fully in air that is at room temperature. There must be no solvent on the surfaces when you apply the sealant.

3 Apply Sealant P09−027 where shown. Cure the sealant in air that is at room temperature and has a relative humidity of 25 percent, minimum.

4 Cure the sealant at the struts for two hours, minimum, before you touch it.

5 Cure the sealant at the ends of the flange assembly for eight hours before engine operation.

(4) Connect the gearbox driveshaft and front housing to the angle gearbox as follows. See Figure 401.

(a) Move the gearbox driveshaft forward. Engage the mating splines of the gearbox driveshaft and angle gearbox.

(b) If the splines do not engage, you must turn the gearshaft in the main gearbox as follows. See Figure 405.

1 Remove the two bolts and washers that attach the cover (manual crank) to the main gearbox.

2 Remove the cover (manual crank) with PWA 85768 Puller. Discard the packing.

3 With a standard wrench, turn the gearshaft that is inside.

4 Engage the mating splines of the gearbox driveshaft and the angle gearbox.

5 Lubricate with Engine Oil P03−001 a new packing. Install it on the cover (manual crank).

R
R
6 Lubricate with Antiseize Paste P06−054 two bolts. Wipe off unwanted paste. Attach the cover (manual crank) to the main gearbox with two washers and the two bolts. Torque the bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

ENGINE GENERAL - ANGLE GEARBOX - INSTALLATION-01

(c) Install the retaining ring in the angle gearbox to keep the gearbox driveshaft in position. See Figure 401.

R R (d) Lubricate with Antiseize Paste P06-054 the threads of six nuts. Wipe off unwanted paste.

(e) Attach the front housing and two brackets to the angle gearbox with two bolts, two washers, and two of the nuts. Tighten the bolts.

(f) Attach the front housing to the angle gearbox at the other locations with four bolts, eight washers, and four of the nuts. Tighten the bolts.

(g) Attach the brackets on the front housing to the HPC.

1 Lubricate with Engine Oil P03-001 the threads of four bolts.

2 Attach the brackets to the HPC with the four bolts. Tighten the bolts.

3 Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(h) Torque the bolts in the front housing to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(5) Attach the main-bearing-scavenge tube to the bracket as follows.

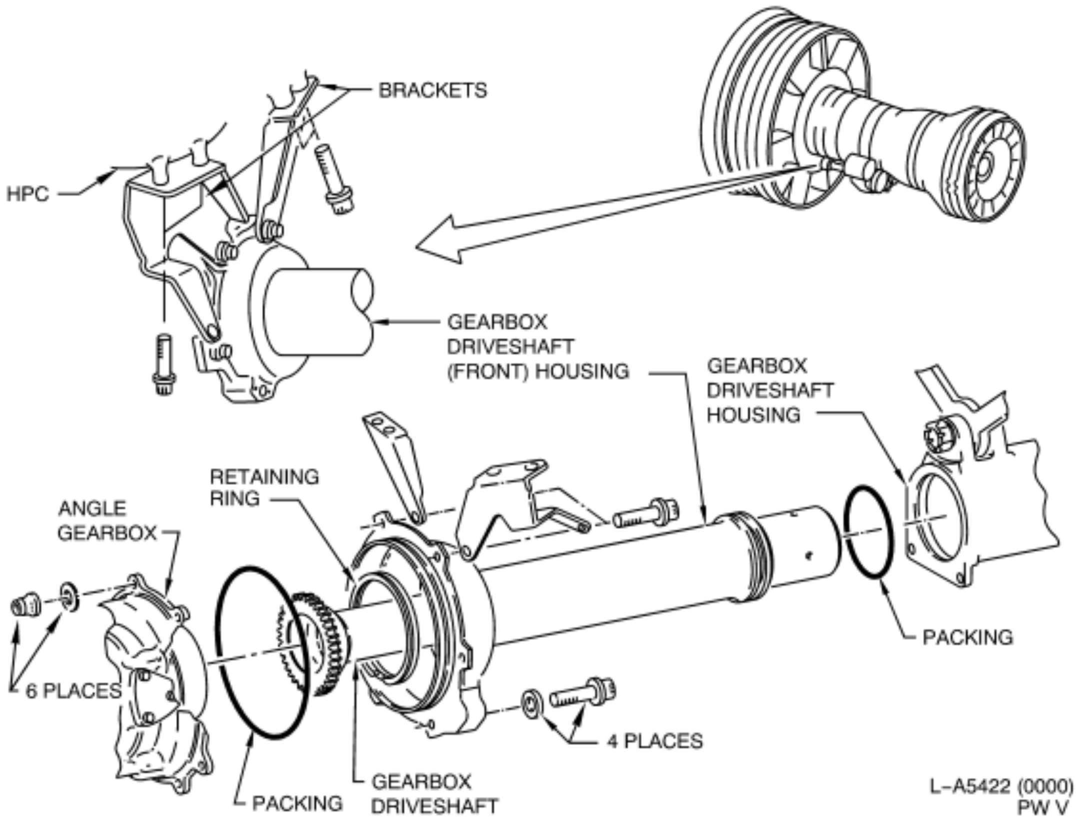
(a) Lubricate with Engine Oil P03-001 the threads of one bolt.

(b) Attach the tube clamp to the front of the bracket on the front housing with the bolt and a nut. Torque the bolt to 36 - 40 lb-in. (4.067 - 4.519 N.m).

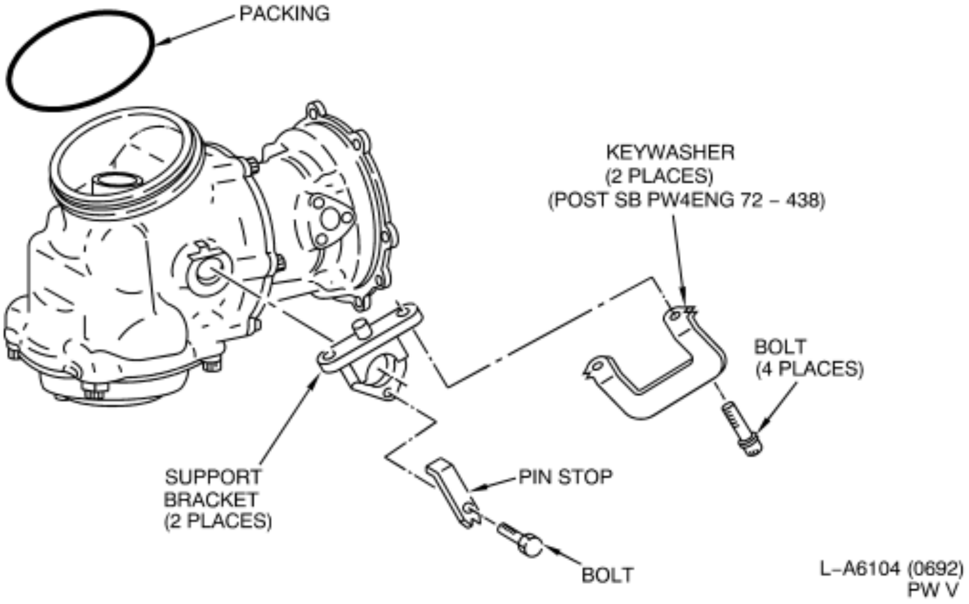
D. Postrequisites

(1) Install the fan exit liner segment (inner rear) that is at 6 o'clock. Refer to 72-00-33, Installation-16 (Task 72-00-33-440-001).

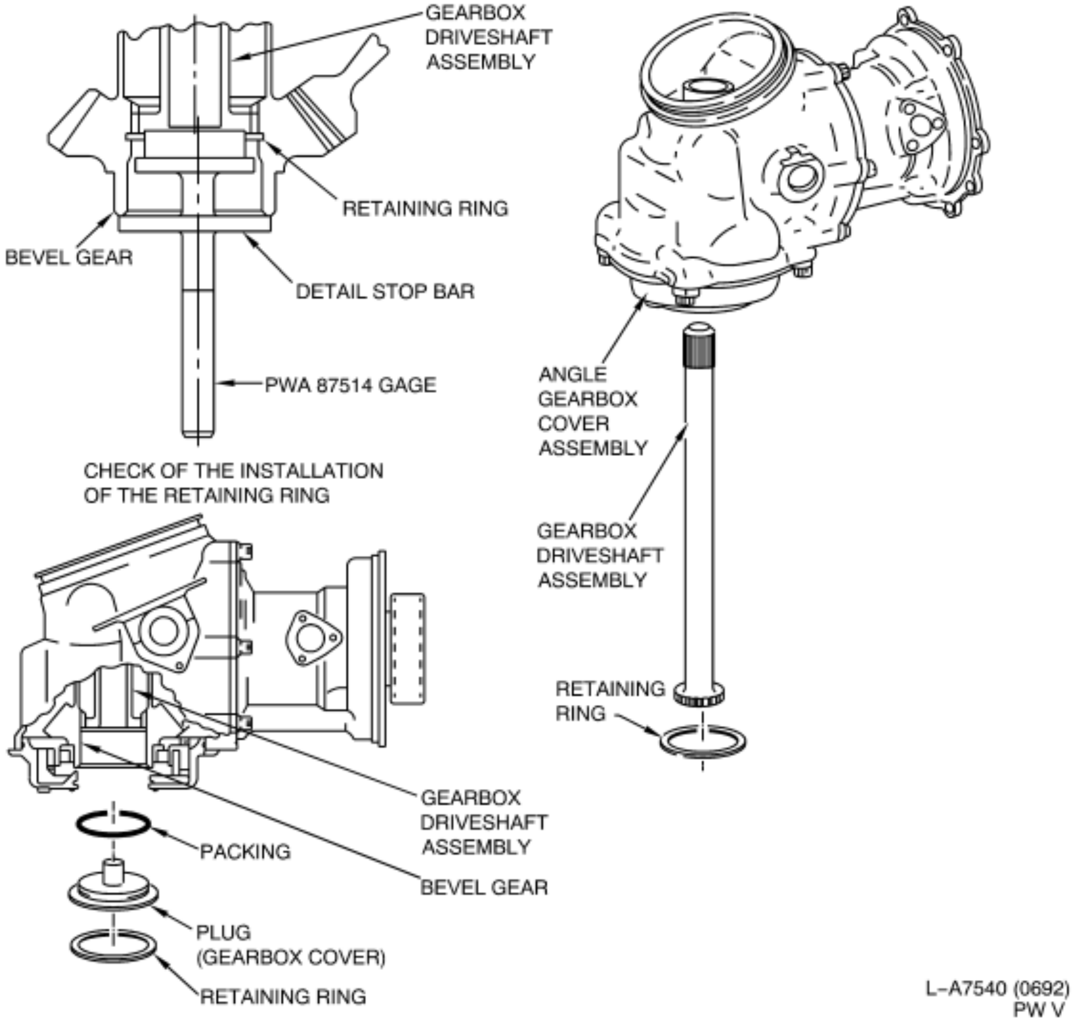
(2) Install the external plumbing to complete the installation of the angle gearbox. See Installation-02 (Task 72-00-62-420-002).


BRACKETS
HPC
GEARBOX DRIVESHAFT (FRONT) HOUSING
GEARBOX DRIVESHAFT HOUSING
RETAINING RING
ANGLE GEARBOX
PACKING
6 PLACES
4 PLACES
PACKING
GEARBOX DRIVESHAFT
L−A5422 (0000)
PW V

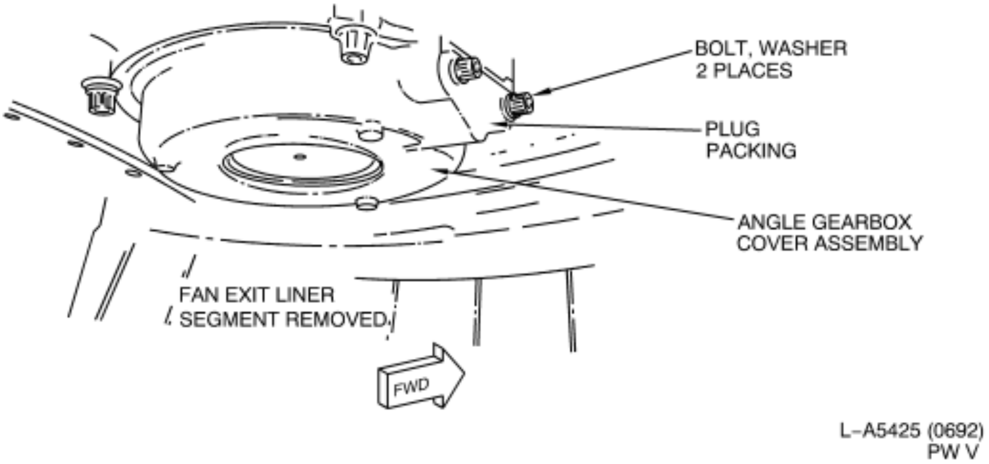
The Gearbox Driveshaft And Front Housing
Figure 401
(Task 72−00−62−420−001)


PACKING
KEYWASHER
(2 PLACES)
(POST SB PW4ENG 72 − 438)
BOLT
(4 PLACES)
SUPPORT
BRACKET
(2 PLACES)
PIN STOP
BOLT
L−A6104 (0692)
PW V

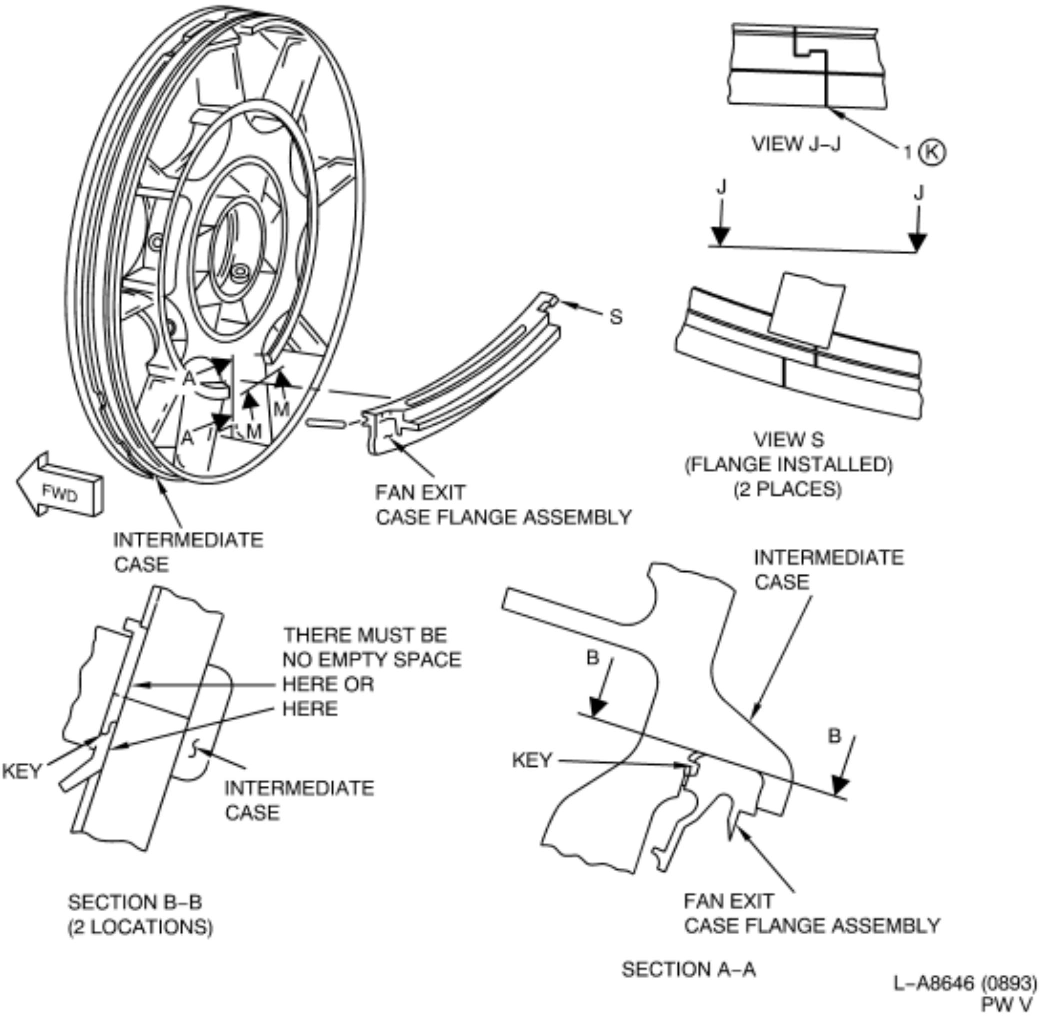
Installation Of The Angle Gearbox
Figure 402 (Sheet 1)
(Task 72−00−62−420−001)


GEARBOX DRIVESHAFT ASSEMBLY
RETAINING RING
BEVEL GEAR
DETAIL STOP BAR
PWA 87514 GAGE
CHECK OF THE INSTALLATION OF THE RETAINING RING
ANGLE GEARBOX COVER ASSEMBLY
GEARBOX DRIVESHAFT ASSEMBLY
RETAINING RING
GEARBOX DRIVESHAFT ASSEMBLY
PACKING
BEVEL GEAR
PLUG (GEARBOX COVER)
RETAINING RING
L-A7540 (0692)
PW V

Installation Of The Angle Gearbox
Figure 402 (Sheet 2)
(Task 72-00-62-420-001)

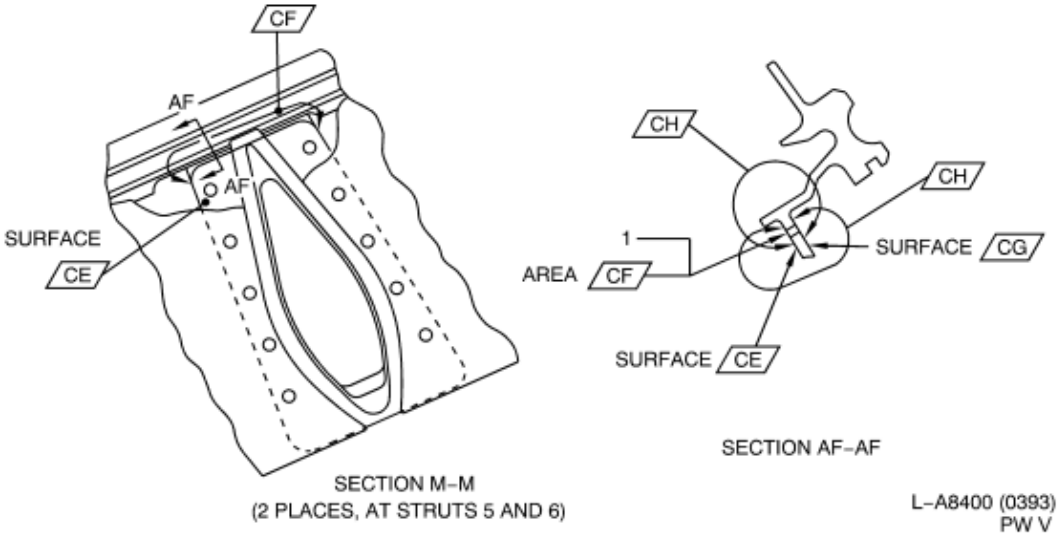

BOLT, WASHER
2 PLACES
PLUG
PACKING
ANGLE GEARBOX
COVER ASSEMBLY
FAN EXIT LINER
SEGMENT REMOVED
FWD
L−A5425 (0692)
PW V

Installation Of The Angle Gearbox Plug
Figure 403
(Task 72−00−62−420−001)


VIEW J−J
1 Ⓚ
J
J
S
VIEW S
(FLANGE INSTALLED)
(2 PLACES)
A
A
M
M
1
FWD
FAN EXIT
CASE FLANGE ASSEMBLY
INTERMEDIATE
CASE
THERE MUST BE
NO EMPTY SPACE
HERE OR
HERE
KEY
INTERMEDIATE
CASE
SECTION B−B
(2 LOCATIONS)
INTERMEDIATE
CASE
B
B
KEY
FAN EXIT
CASE FLANGE ASSEMBLY
SECTION A−A
L−A8646 (0893)
PW V

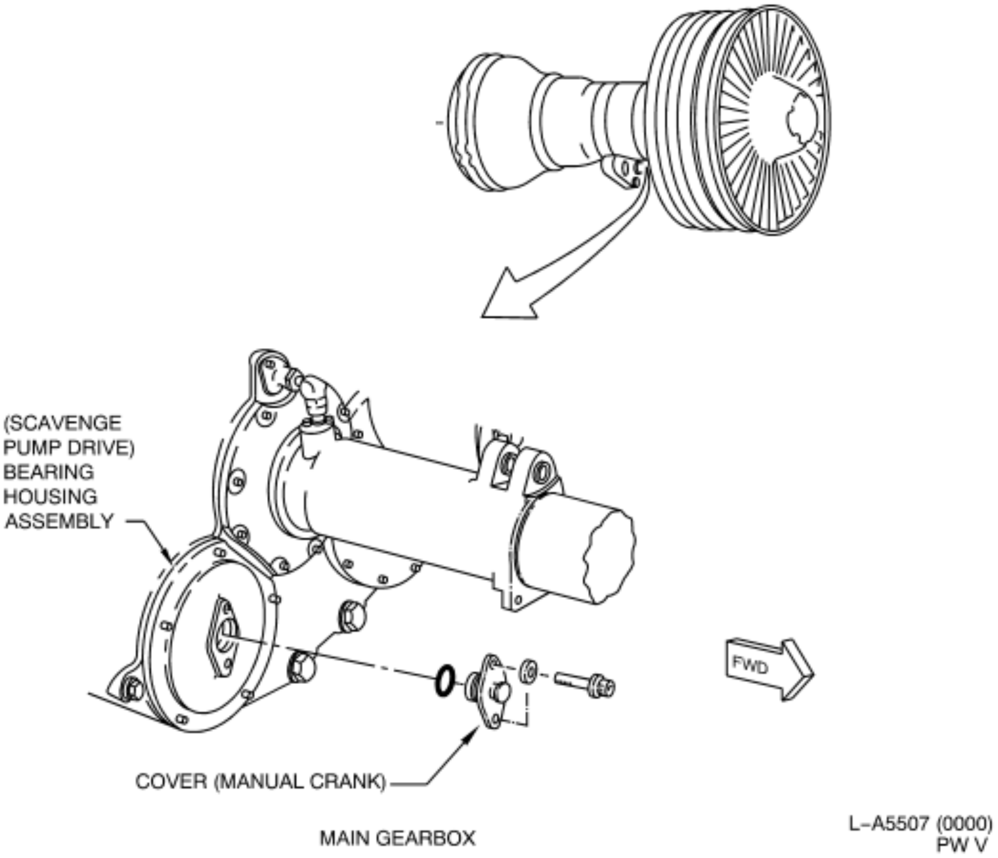
1. Apply Sealant At The Ends Of The Flange Assembly, Two Locations. Fill The Joint Flush To 0.010 Inch (0.254 mm) Above All Surfaces.

Installation Of The Flange
Figure 404 (Sheet 1)
(Task 72−00−62−420−001)


CF
AF
AF
SURFACE
CE
SECTION M−M
(2 PLACES, AT STRUTS 5 AND 6)
CH
CH
1
AREA
CF
SURFACE
CG
SURFACE
CE
SECTION AF−AF
L−A8400 (0393)
PW V

1. Fully Fill Area CF. The Sealant Must Be Flush With, Or Up To 0.020 Inch (0.508 mm) Below, Surface CE. It Is Permitted For The Sealant To Be Above Surface CG. The Height Is Not Important.

Installation Of The Flange
Figure 404 (Sheet 2)
(Task 72−00−62−420−001)


(SCAVENGE PUMP DRIVE) BEARING HOUSING ASSEMBLY
FWD
COVER (MANUAL CRANK)
MAIN GEARBOX
L−A5507 (0000)
PW V

The Cover (Manual Crank)
Figure 405
(Task 72−00−62−420−001)

Task 72-00-62-420-002:

1. Install External Plumbing To Complete Installation Of Angle Gearbox

A. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
R	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	2	79-22-00/1/1

B. Procedure
See Figure 401.

(1) Connect angle-gearbox oil pressure tube assembly (LP09) as follows.

(a) Remove the protection covers. Lubricate the tube
R nut threads with Antiseize Paste P06-054. Wipe
R off unwanted paste. Install the tube nut to the
adapter on the right side of the angle gearbox and
tighten by hand.

(b) Install the clamps, bolts, lubricated with Engine Oil P03-001, and nuts that attach the tube to the brackets. Torque all the clamp bolts that attach the tube to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Torque the tube nut to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(2) Install the angle−gearbox oil scavenge tube assembly (LR01) as follows.

(a) Remove the protection covers. Install the two packings, lubricated with Engine Oil P03−001, to the groove at each end of the tube.

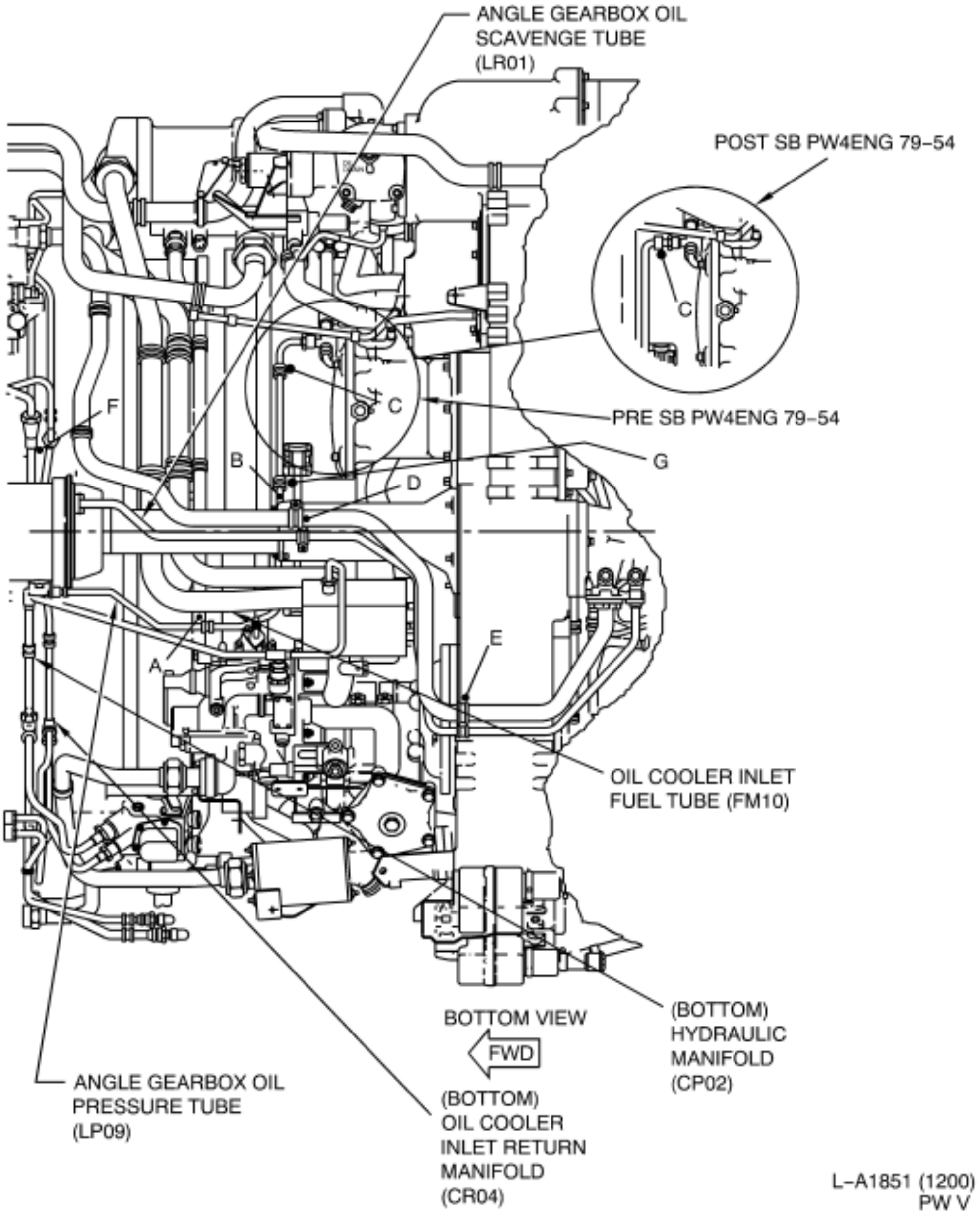
(b) Install the tube to the oil−scavenge pump port and to the port on the rear of the angle gearbox. Attach the front end of the tube with two bolts, lubricated with Engine Oil P03−001. Attach the rear end of the tube with two bolts, lubricated
R with Antiseize Paste P06−054. Wipe off unwanted
R paste.

(c) Install the clamps, bolts, lubricated with Engine Oil P03−001, and nuts that attach the tube to the brackets. Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

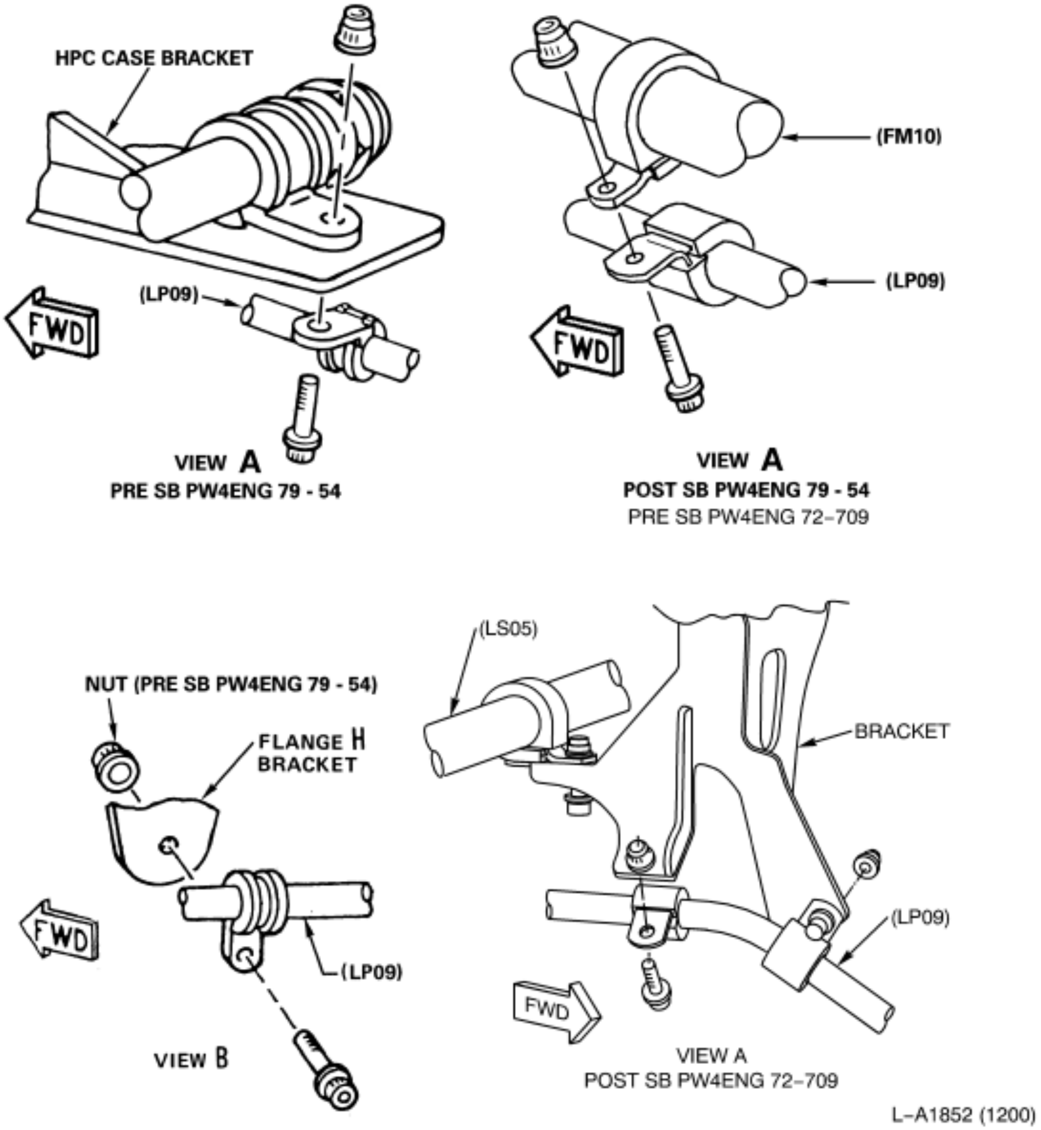
(d) Torque the bolts at the front end of the tube to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(e) Torque the bolts at the rear end of the tube to 62 − 72 lb−in. (7.005 − 8.135 N.m).

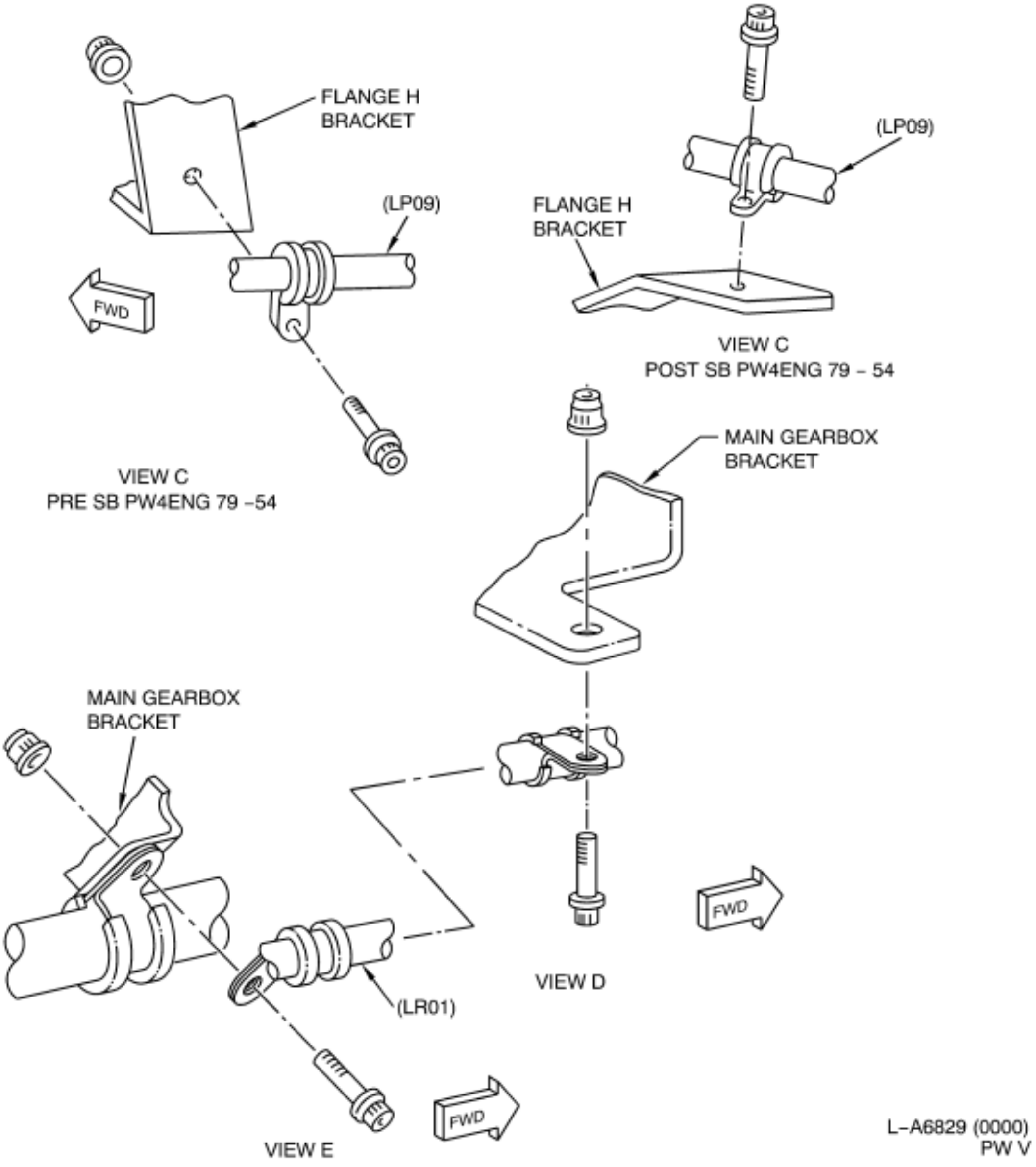
(3) For Post SB PW4ENG 75−45 engines, install the clamps, bolts, threads lubricated with Engine Oil P03−001, and nut that attach the (bottom) hydraulic manifold (CP02) and the oil cooler inlet return manifold (CR04). Torque the clamp bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).


ANGLE GEARBOX OIL SCAVENGE TUBE (LR01)
POST SB PW4ENG 79−54
C
PRE SB PW4ENG 79−54
C
F
B
G
D
E
A
OIL COOLER INLET FUEL TUBE (FM10)
BOTTOM VIEW
FWD
(BOTTOM) HYDRAULIC MANIFOLD (CP02)
ANGLE GEARBOX OIL PRESSURE TUBE (LP09)
(BOTTOM) OIL COOLER INLET RETURN MANIFOLD (CR04)
L−A1851 (1200)
PW V

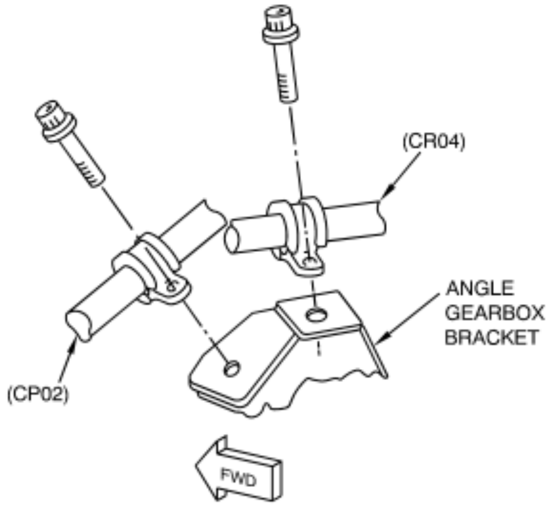
Angle Gearbox Plumbing Installation
Figure 401 (Sheet 1)
(Task 72−00−62−420−002)


HPC CASE BRACKET
(LP09)
FWD
VIEW A
PRE SB PW4ENG 79 - 54
(FM10)
(LP09)
FWD
VIEW A
POST SB PW4ENG 79 - 54
PRE SB PW4ENG 72-709
NUT (PRE SB PW4ENG 79 - 54)
FLANGE H
BRACKET
FWD
(LP09)
VIEW B
(LS05)
BRACKET
(LP09)
FWD
VIEW A
POST SB PW4ENG 72-709
L-A1852 (1200)

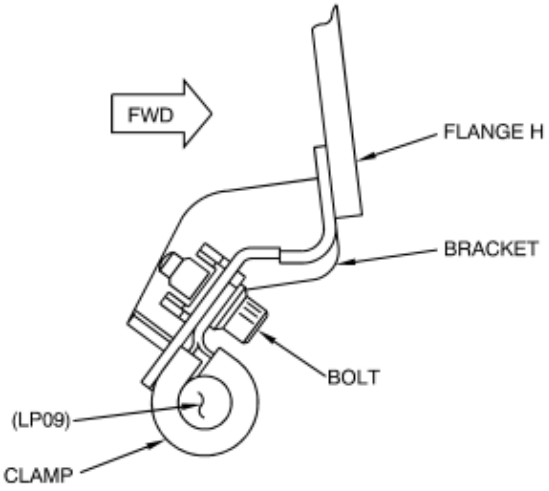
Angle Gearbox Plumbing Installation
Figure 401 (Sheet 2)
(Task 72-00-62-420-002)


FLANGE H BRACKET
(LP09)
FWD
VIEW C
PRE SB PW4ENG 79 –54
(LP09)
FLANGE H BRACKET
VIEW C
POST SB PW4ENG 79 – 54
MAIN GEARBOX BRACKET
MAIN GEARBOX BRACKET
(LR01)
FWD
VIEW D
FWD
VIEW E
L−A6829 (0000)
PW V

Angle Gearbox Plumbing
Figure 401 (Sheet 3)
(Task 72−00−62−420−002)


(CR04)
ANGLE
GEARBOX
BRACKET
(CP02)
FWD

(POST SB PW4ENG 75-45 ONLY)
VIEW F


FWD
FLANGE H
BRACKET
BOLT
(LP09)
CLAMP

VIEW G
POST SB PW4ENG 72-709

L-A6475 (1200)
PW V

Angle Gearbox Plumbing Removal
Figure 401 (Sheet 4)
(Task 72-00-62-420-002)

Previous Pageblock Return to Previous Menu Next Pageblock

ENGINE GENERAL - ANGLE GEARBOX - INSPECTION/CHECK-01

Task 72-00-62-990-001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of

	actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions
- (1) Dimensions are provided in this column for reference only.
- (2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits
- (1) Limits applicable to any combination of new or used parts.
  - (a) This column provides the acceptable (minimum - maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.
  - (b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.
  - (c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1:

Ref. No.	IFR	Description	New Part Reference Dimensions Min	− Max	Limits Min	− Max
1812		Bearing ------	0.508 (12.903)	0.512 (13.005)		
		Support ------	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (−) 0.512 = .005
(13.131) (13.005) (0.126)

.527 (−) .508 = .019
(13.385) (12.903) (0.482)

EXAMPLE 2:

Ref. No.	IFR	Description	New Part Reference Dimensions Min	− Max	Limits Min	− Max
1812		Bearing ------	0.508 (12.903)	0.512 (13.005)		
		Support ------	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk (*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3:

Ref. No.	I F R	Description	New Part Reference Dimensions Min	− Max	Limits Min	− Max
1812		Bearing ------	0.508 (12.903)	0.512 (13.005)		
		Support ------	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

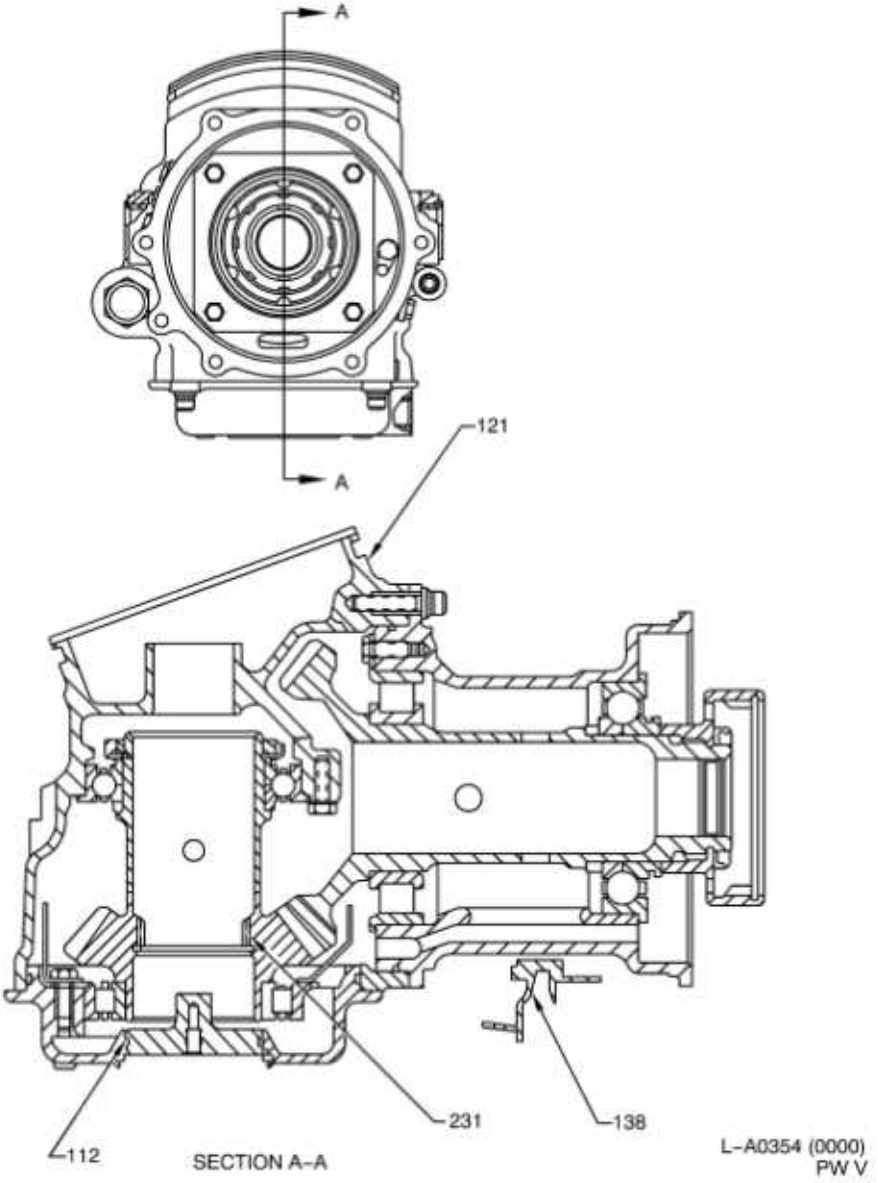
Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
112	B	Plug, Angle Gearbox Cover (72–62–80) Angle Gearbox Cover Assembly (72–62–10) (See Figure 801)				
		Plug –––––––––	2.488 (63.196)	2.490 (63.246)		
		Cover ––––––––	2.492 (63.297)	2.496 (63.398)	.002 (0.051)	.008 (0.203)
121	B	Angle Gearbox Housing Assembly (72–62–01) Compressor Intermediate Case Assembly (72–34–01) (See Figure 801)				
		Housing ––––––	5.998 (152.350)	6.000 (152.400)		
		Case –––––––––	6.001 (152.426)	6.005 (152.527)	.001 (0.026)	.007 (0.177)
122	B	Hollow (Angle Gearbox Mounting) Pin (72–34–51) Bushing (ID), Angle Gearbox Support Bracket (72–34–52) (See Figure 802)				
		Pin –––––––––––	1.0015 (25.4381)	1.0020 (25.4508)		
		Bushing –––––––	1.0025 (25.464)	1.0040 (25.501)	.0005 (0.013)	.0025 (0.063)
141	B	Pin, Hollow (Angle Gearbox Mounting) (72–34–51) Bushing (ID), Angle Gearbox Housing (72–62–01) (See Figure 802)				
			1.0015 (25.4381)	1.0020 (25.4508)		
		Bushing –––––––	.999 (25.375)	1.001 (25.425)	.0005T (0.013T)	.0030T (0.076T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
		G. Spline Data				
231	B	1. Gearbox Bevel Gear Assembly (72-62-02) Internal Spline (See Figure 801)				
		A. Effective Space Width	.0915 (2.324)	---		
		B. Actual Space Width	---	.0946 (2.403)		
		2. Angle Gearbox Driveshaft Assembly (72-34-53) External Spline (See Figure 801)				
		A. Effective Tooth Thickness	---	.0875 (2.222)		
		B. Actual Tooth Thickness	.0845 (2.146)	---		
		3. Fit -------			.004 (0.102)	---
		H. Special Assembly Procedures				
133	A	Installation Of Fan Exit Case Flange Assembly Lower Ring Segment Keys. (Following Installation Of Angle Gearbox To Intermediate Case.) (See Figure 803) See 72-00-62, Installation-01 (Task 72-00-62-420-001)				

ENGINE GENERAL − ANGLE GEARBOX − INSPECTION/CHECK−01

Ref. No.	I F R	Description	New Part Reference Dimensions Min − Max	Limits Min − Max
138	A	Installation Of Fan Exit Case Flange Assembly (Lower Segment) (Install After Angle Gearbox) (See Figure 801) See 72−00−62, Installation−01 (Task 72−00−62−420−001) See 72−34−00, Assembly−01 (Task 72−34−00−420−001)		

ENGINE GENERAL − ANGLE GEARBOX − INSPECTION/CHECK−01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Angle Gearbox
Figure 801
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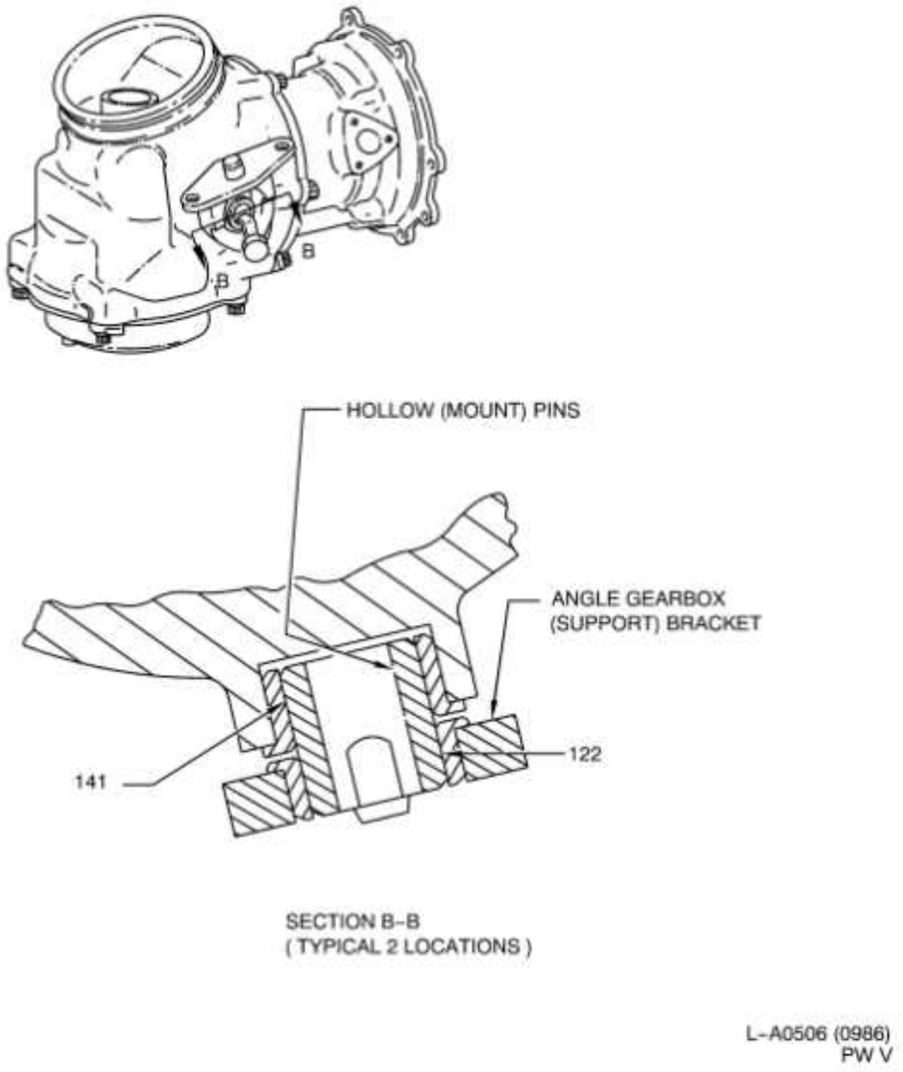
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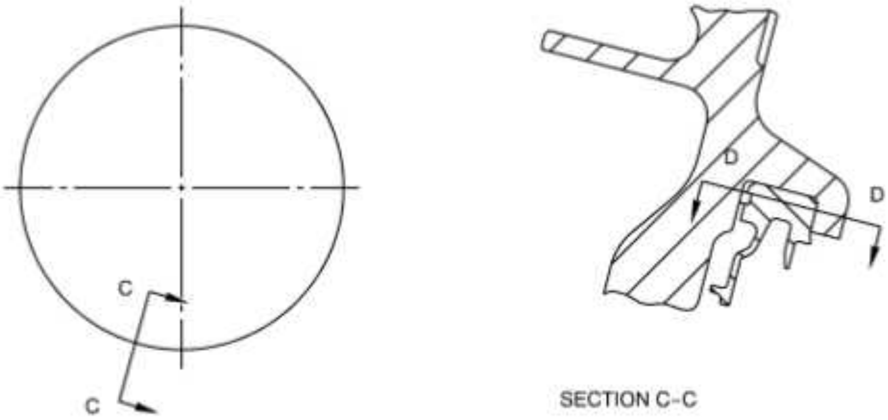

SCHEMATIC REAR VIEW
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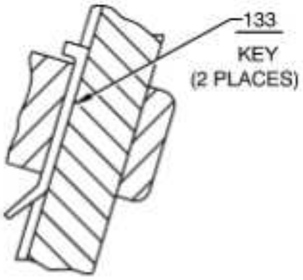

SECTION D-D

L-A1109 (0000)
PW V

Angle Gearbox
Figure 803
(Task 72−00−62−990−001)

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ENGINE GENERAL - ANGLE GEARBOX - INSPECTION/CHECK-02

Task 72-00-62-210-001:

1. Examine The Angle Gearbox For Cracks, Oil Leaks, And Corrosion
   - A. Equipment And Materials Required - None
   - B. Procedure
     - (1) Examine the angle gearbox for cracks, oil leaks, and corrosion. Refer to Table 801.

Examine	Serviceable Limits	Not Serviceable
All surfaces for:		
Cracks		Any quantity
Oil Leaks		Any quantity
Corrosion		
Depth	0.050 or less (0.127)	More than 0.050 (0.127)
Area	Any quantity less than 1.00 inch^2 (645 mm^2)	
Separation	Any quantity 2.000 or more (50.800)	

Table 801

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Tab Separator - Engine General - Low Pressure Compressor (LPC)

List of Effective Pages - Engine General - Low Pressure Compressor (LPC)

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TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 83 DATED MAY 1, 2007

HIGHLIGHTS - ENGINE GENERAL - LOW PRESSURE COMPRESSOR (LPC)

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-00-31 INSTALL-03	401 -402 408	Revised PWA 587 and deleted PWA 36246 and pen marker. (IEN00KP009C, IEN00KP009F)	ALL
72-00-31 INSTALL-04	401 -402 407/ 408	Revised PWA 587 and deleted PWA 36246 and pen marker. (IEN00KP009C, IEN00KP009F)	ALL
72-00-31 INSP/CHK-10	818 832 839 -841 855 861	Revised Table 803, Table 807, serviceable limits and Table 811 LPC stage 1 outer shroud inspection limits. (IEN00KP009C, IEN03KCM06A)	ALL

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CHAPTER 72

ENGINE GENERAL – LOW PRESSURE COMPRESSOR (LPC)

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TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 83 DATED MAY 1, 2007

HIGHLIGHTS - ENGINE GENERAL - LPC/LPT COUPLING

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-00-32 REMOVAL-03	302 305 311/ 312	Added the PWA 101263 Protector in the text and related figure. Renumbered steps. (TDS101263)	ALL
72-00-32 INSTALL-01	409 428	Revised the text to add a step to loosen the PWA 88222 Retainer. Revised the related figure. (CACTUSR7031-Q56541)	ALL

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CHAPTER 72

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The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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	355		SEP 15/02
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	357		SEP 15/02
	358		SEP 15/02
	359		SEP 15/02
	360		SEP 15/02
72−00−34			
72−00−34 REMOVAL−21	301	CONFIG−2 4152−3 4156A−3 4158−3	JUN 15/03
	302		JUN 15/03
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	307		SEP 15/05
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	316		SEP 15/05
	317		JUN 15/03
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72-00-34			
72-00-34	301	ALL	MAR 15/97
REMOVAL-22	302		MAR 15/97
	303		MAR 15/97
	304		MAR 15/97
	305/306		MAR 15/97
72-00-34			
72-00-34	301	CONFIG-1	SEP 15/02
REMOVAL-23		4152 4156A 4158	
	302		SEP 15/02
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	334		SEP 15/02
	335/336		SEP 15/02
72-00-34			
72-00-34	301	CONFIG-2	SEP 15/02
REMOVAL-23		4152-3 4156A-3 4158-3	
	302		SEP 15/02
	303		SEP 15/02
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	321		SEP 15/02
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	324		SEP 15/02
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	326		SEP 15/02
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	328		SEP 15/02
72-00-34			
72-00-34	301	4152-3 4156A-3	SEP 15/96
REMOVAL-24		4158-3	
	302		SEP 15/96
72-00-34			
72-00-34	301	4152-3 4156A-3	SEP 15/96
REMOVAL-25		4158-3	
	302		SEP 15/96
72-00-34			
72-00-34	401	ALL	SEP 15/02
INSTALL-01	402		SEP 15/02
	403		SEP 15/02
	404		SEP 15/02
	405		SEP 15/02
	406		SEP 15/02
	407/408		SEP 15/02
72-00-34			
72-00-34	401	ALL	DEC 15/05
INSTALL-02	402		DEC 15/05
	403		MAR 15/99
	404		MAR 15/99
	405		DEC 15/05
	406		DEC 15/05
	407		DEC 15/01
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	448		JUN 15/01
	449		MAR 15/99
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		456		MAR 15/99
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		460		MAR 15/99
		461		SEP 15/99
		462		SEP 15/99
		463		MAR 15/99
		464		MAR 15/99
72-00-34				
72-00-34		401	ALL	SEP 15/99
INSTALL-03		402		SEP 15/99
		403		SEP 15/99
		404		SEP 15/99
		405		SEP 15/99
		406		SEP 15/99
72-00-34				
72-00-34		401	ALL	DEC 15/05
INSTALL-04		402		DEC 15/05
	R	403		DEC 15/06
	R	404		DEC 15/06
		405		SEP 15/06
		406		SEP 15/06
		407		DEC 15/05
		408		DEC 15/05
72-00-34				
72-00-34		401/402	ALL	JUL 15/89
INSTALL-05				
72-00-34				
72-00-34		401	ALL	JUN 15/93
INSTALL-06		402		JUN 15/93
		403		JUN 15/93
		404		JUN 15/93
		405		JUN 15/93
		406		JUN 15/93
		407/408		OCT 15/92
72-00-34				
72-00-34		401	ALL	SEP 15/06
INSTALL-07		402		SEP 15/06
		403/404		SEP 15/06
72-00-34				
72-00-34		401	ALL	DEC 15/05
INSTALL-08		402		DEC 15/05
		403		DEC 15/05
		404		DEC 15/05
		405		DEC 15/01
		406		DEC 15/01
		407		SEP 15/99
		408		SEP 15/99
72-00-34				
72-00-34		401	ALL	SEP 15/06
INSTALL-09		402		SEP 15/06
		403		SEP 15/06
		404		SEP 15/06
		405		DEC 15/05
		406		DEC 15/05
		407		DEC 15/05
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		414		DEC 15/05
		415		DEC 15/05
		416		DEC 15/05
		417		DEC 15/05
		418		DEC 15/05
72-00-34				

72-00-34		401	ALL	SEP 15/06
	INSTALL-10	402		SEP 15/06
		403		SEP 15/05
		404		SEP 15/05
		405		SEP 15/06
		406		SEP 15/06
		407		SEP 15/06
		408		SEP 15/06
		409		SEP 15/05
		410		SEP 15/05
		411/412		SEP 15/05
72-00-34				
72-00-34		401	ALL	SEP 15/06
	INSTALL-11	402		SEP 15/06
		403		SEP 15/06
		404		SEP 15/06
		405		DEC 15/99
		406		DEC 15/99
		407		DEC 15/99
		408		DEC 15/99
72-00-34				
72-00-34		401	ALL	DEC 15/05
	INSTALL-12	402		DEC 15/05
		403		DEC 15/05
		404		DEC 15/05
		405/406	4152 4156A 4158	JUN 15/05
72-00-34				
72-00-34		401	ALL	DEC 15/05
	INSTALL-13	402		DEC 15/05
		403		DEC 15/05
		404		DEC 15/05
		405		DEC 15/05
		406		DEC 15/05
		407		DEC 15/05
		408		DEC 15/05
72-00-34				
72-00-34		401	ALL	DEC 15/05
	INSTALL-14	402		DEC 15/05
		403		DEC 15/05
		404		DEC 15/05
72-00-34				
72-00-34		401	ALL	DEC 15/05
	INSTALL-15	402	4152 4156A 4158	DEC 15/05
		403/404	4152-3 4156A-3 4158-3	SEP 15/96
72-00-34				
72-00-34		401	ALL	DEC 15/05
	INSTALL-16	402		DEC 15/05
72-00-34				
72-00-34		401	ALL	SEP 15/99
	INSTALL-17	402		SEP 15/99
		403		DEC 15/01
		404		DEC 15/01
		405		DEC 15/01
		406		DEC 15/01
		407		DEC 15/01
		408		DEC 15/01
72-00-34				
72-00-34		401	ALL	JUN 15/02
	INSTALL-18	402		JUN 15/02
		403		JUN 15/02
		404		JUN 15/02
		405		JUN 15/02
		406		JUN 15/02
		407	4152 4156A 4158	JUN 15/02
		408		JUN 15/02
		409		JUN 15/02
		410		JUN 15/02
		411	ALL	JUN 15/02
		412	4152 4156A 4158	JUN 15/02
		413	4152-3 4156A-3 4158-3	JUN 15/02

	414	ALL	JUN 15/02
	415	4152 4156A 4158	JUN 15/02
	416	ALL	JUN 15/02
	417		JUN 15/02
	418	4152 4156A 4158	JUN 15/02
	419		JUN 15/02
	420	4152−3 4156A−3 4158−3	JUN 15/02
	421	4152 4156A 4158	JUN 15/02
	422		JUN 15/02
	423	4152−3 4156A−3 4158−3	JUN 15/02
	424	4152 4156A 4158	JUN 15/02
	425	ALL	JUN 15/02
	426	4152 4156A 4158	JUN 15/02
	427	ALL	JUN 15/02
	428	4152 4156A 4158	JUN 15/02
	429	ALL	JUN 15/02
	430	4152 4156A 4158	JUN 15/02
	431/432	ALL	JUN 15/02
72−00−34			
72−00−34	401	ALL	JUN 15/03
INSTALL−19	402		JUN 15/03
	403		JUN 15/03
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	409		JUN 15/03
	410	4152 4156A 4158	JUN 15/03
	411		JUN 15/03
	412	4152−3 4156A−3 4158−3	JUN 15/03
	413	ALL	JUN 15/03
	414		JUN 15/03
	415		JUN 15/03
	416		JUN 15/03
	417	4152 4156A 4158	JUN 15/03
	418		JUN 15/03
	419	4152−3 4156A−3 4158−3	JUN 15/03
	420	4152 4156A 4158	JUN 15/03
	421		JUN 15/03
	422	4152−3 4156A−3 4158−3	JUN 15/03
	423	ALL	JUN 15/03
	424		JUN 15/03
	425	4152 4156A 4158	JUN 15/03
	426	ALL	JUN 15/03
	427	4152 4156A 4158	MAR 15/04
	428	ALL	MAR 15/04
	429	4152−3 4156A−3 4158−3	MAR 15/04
	430	ALL	MAR 15/04
72−00−34			
72−00−34	401	ALL	SEP 15/02
INSTALL−20	402	4152 4156A 4158	SEP 15/02
	403		SEP 15/02
	404		SEP 15/02
	405		SEP 15/02
	406	4152−3 4156A−3 4158−3	SEP 15/02
	407		SEP 15/02
	408		SEP 15/02
	409		DEC 15/02
	410		DEC 15/02
	411		SEP 15/02
	412		SEP 15/02
	413/414		SEP 15/02
72−00−34			
72−00−34	401	CONFIG−1	SEP 15/06

INSTALL-21		4152 4156A 4158	
	402		SEP 15/06
	403		SEP 15/06
	404		SEP 15/06
	405		SEP 15/02
	406		SEP 15/02
	407		SEP 15/02
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	432		SEP 15/06
	433		MAR 15/01
	434		MAR 15/01
	435		DEC 15/97
	436		DEC 15/97
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	438		DEC 15/97
	439		SEP 15/02
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	472		SEP 15/02

	473		SEP 15/02
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	478		SEP 15/02
	479/480		SEP 15/02
72-00-34			
72-00-34	401	CONFIG-2	SEP 15/06
INSTALL-21		4152-3 4156A-3	
		4158-3	
	402		SEP 15/06
	403		SEP 15/06
	404		SEP 15/06
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	431		SEP 15/06
	432		SEP 15/06
	433		MAR 15/01
	434		MAR 15/01
	435		DEC 15/97
	436		DEC 15/97
	437		DEC 15/97
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	475		SEP 15/02
	476		SEP 15/02
72-00-34			
72-00-34	401	ALL	MAR 15/98
INSTALL-22	402		MAR 15/98
	403		MAR 15/98
	404		MAR 15/98
	405		MAR 15/98
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	407		MAR 15/98
	408		MAR 15/98
72-00-34			
72-00-34	401	CONFIG-1	SEP 15/02
INSTALL-23		4152 4156A 4158	
	402		SEP 15/02
	403		JUN 15/03
	404		JUN 15/03
	405		SEP 15/02
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	409		SEP 15/02
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	411		JUN 15/03
	412		JUN 15/03
	413		SEP 15/02
	414		SEP 15/02
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	425		JUN 15/03
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72-00-34			
72-00-34	401	CONFIG-2	SEP 15/02
INSTALL-23		4152-3 4156A-3	
		4158-3	
	402		SEP 15/02
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	404		SEP 15/02
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REVISION NO. 82 DATED DECEMBER 15, 2006

HIGHLIGHTS - ENGINE GENERAL - INTERMEDIATE CASE

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REVISION NO. 84 DATED SEPTEMBER 1, 2007

HIGHLIGHTS - ENGINE GENERAL - HIGH PRESSURE COMPRESSOR (HPC)

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-00-35 REMOVAL-02	302 -304 307 309	Revised the Special Tools list, text and related figure to add the PWA 106364 Adapter. Revised the text editorially concerning PWA 85368. (TDS106364)	ALL
72-00-35 INSTALL-02	402 -404 408 410	Revised the Special Tools list, text and related figure to add the PWA 106364 Adapter. Revised the text editorially concerning PWA 85368. (TDS106364)	ALL

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REVISION NO. 85 DATED JANUARY 1, 2008

HIGHLIGHTS - ENGINE GENERAL - DIFFUSER AND COMBUSTOR

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-00-41 INSTALL-07	401 -402	Added a caution for thread lubricant and added reference to clean the boss threads. (PSAF07KC464)	ALL

CHAPTER 72

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REVISION NO. 83 DATED MAY 1, 2007

HIGHLIGHTS − ENGINE GENERAL − TURBINE NOZZLE

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72−00−51 INSP/CHK−01	805	Revised Stage 1 HPT cooling duct assembly tolerance limits. (IEN06KC301C)	ALL
72−00−51 INSP/CHK−10	801 −842	Added inspection/check for visual inspection of module assembly and stage 1 vane platform feather seal inspection. (IEN04KC314C, IEN03KCG14A)	ALL

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REVISION NO. 85 DATED JANUARY 1, 2008

HIGHLIGHTS − ENGINE GENERAL − HIGH PRESSURE TURBINE (HPT)

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72−00−52 INSP/CHK−03	801 −811/ 812	Added a new permeability inspection check for internal sulfidation distress. (IEN07KC498)	ALL
72−00−52 INSP/CHK−10	804	Revised to add a new permeability inspection requirement. (IEN07KC498)	ALL

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PW4158, PW4158−3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 83 DATED MAY 1, 2007

HIGHLIGHTS − ENGINE GENERAL − LOW PRESSURE TURBINE (LPT)

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72−00−53 INSP/CHK−02	801/ 802	Revised the full procedure and added reference to Inspection/Check−10. (IEN05KC663)	ALL
72−00−53 INSP/CHK−10	801 −847/ 848	Added inspection/check−10 for visual inspection of module assembly. (IEN05KC663, PSAF05KC663B)	ALL

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Pratt & Whitney
PW4000 SERIES ENGINE MANUAL (PN 50A443)

TO: RECIPIENTS OF PW4152, PW4152−3, PW4156A, PW4156A−3,
PW4158, PW4158−3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 82 DATED DECEMBER 15, 2006

HIGHLIGHTS − ENGINE GENERAL − TURBINE EXHAUST CASE

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REVISION NO. 82 DATED DECEMBER 15, 2006

HIGHLIGHTS − ENGINE GENERAL − MAIN GEARBOX

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ENGINE GENERAL - MAIN GEARBOX

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REVISION NO. 79 DATED MARCH 15, 2006

HIGHLIGHTS - ENGINE GENERAL - ANGLE GEARBOX

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72-00-62 REMOVAL-01	301	Added a NOTE concerning the angle gearbox and main gearbox disassembly requirements. (PSAF05KC733)	ALL

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PW4158, PW4158−3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 70 DATED DECEMBER 15, 2003

HIGHLIGHTS − ENGINE GENERAL − COMMON PARTS

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ENGINE EXTERNAL TUBES - DESCRIPTION/OPERATION-00

Task 72-09-71-990-001:

1. Engine External Tubes

A. General

(1) The PW4000 external tubes are divided into four systems. Each tube has a function number assigned that does not change with part progression as do the tube part numbers. The tube function number is not a part number. The tube function numbers will also appear in the Illustrated Parts Catalog and the Engine Manual sections. You can use the information in this section and the function numbers in the other publications to:

- Cross reference between the different publications
- Positively identify different tubes with a common nomenclature
- Reference the locations of all tubes and systems
- Use as a quick reference to identify a tube function and routing
- Find the installation procedure for each tube.

(2) This section is divided into four systems. (Air, Hydraulic, Fuel, and Lubrication). Each system is divided into subsystems. Each system has a tube schematic and a tube chart. The systems are divided into subsystems as follows:

System	Subsystem (Tube Function Identifier)
Air-	
	Air Actuation System (AA) Air Cooling System (AC) Air Pressurizing System (AP) Air Sense System (AS)
Hydraulic-	
	Hydraulic Control Pressure System (CP) Hydraulic Control Return System (CR)
Fuel-	
	Fuel Main Supply System (FM) Fuel Supply To Injector System (FS)
Lubrication-	
	Lubrication Breather System (LB) Lubrication Drain System (LD) Lubrication Pressure System (LP)

System	Subsystem (Tube Function Identifier)
(CONTINUED)	
	Lubrication Return Scavenge System (LR)
	Lubrication IDG System (LS)

B. Air − Air Actuation System (AA)

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION
(AA01)	HPC Air Valve Signal Tube (right)	72−00−34 INST−02
(AA06)	HPC Air Valve Signal Tube (left)	72−00−34 INST−02
(AA15)	HPC Air Valve Signal Tube (right)	72−00−35 INST−03
(AA16)	HPC Air Valve Signal Tube (left)	72−00−35 INST−03
(AA18)	Air Shutoff Valve Signal Tube	72−00−34 INST−02
(AA19)	Air Shutoff Valve Signal Tube (left)	72−00−35 INST−03
(AA20)	Air Shutoff Valve Signal Tube (upper)	72−00−35 INST−03
(AA21)	Air Shutoff Valve Signal Tube (right)	72−00−35 INST−03
(AA22)	HPC Air Valve And Air Shutoff Valve Supply Tube	72−00−34 INST−02
(AA23)	HPC Air Valve And Bleed Valve Supply Tube	72−00−41 INST−02
(AA24)	HPC Air Valve And Bleed Valve Supply Manifold	72−00−35 INST−03
(AA25)	HPC Air Valve Tube	72−00−34 INST−02
(AA26)	HPC Air Valve And Bleed Valve Supply Manifold	72−00−34 INST−02
(AA27)	(Right) Bleed Valve Supply Tube (lower)	72−00−34 INST−02
(AA28)	(Right) Bleed Valve Supply Tube (upper)	72−00−35 INST−03
(AA29)	(Left) Bleed Valve Supply Tube (lower)	72−00−34 INST−02
(AA30)	(Left) Bleed Valve Supply Tube (upper)	72−00−35 INST−03
(AA32)	Pressure Switch Tube	72−34−00 ASSY−01
(AA34)	Bleed And HPC Air Valve Supply Tube	72−00−41 INST−02
(AA35)	Bleed Valve Supply Tube	72−34−00 ASSY−01
(AA36)	Bleed Valve Supply Tube	72−34−00 ASSY−01
(AA37)	Bleed Valve Supply Tube	72−34−00 ASSY−01

Air Actuation System (AA) Tube Chart
Table 1

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION

NOTE: The words in parenthesis are descriptive and are not part of the nomenclature. The descriptive words are used throughout this manual as needed. See Figure 1.

Air Actuation System (AA) Tube Chart
Table 1 (Continued)

C. Air − Air Cooling System (AC)

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION
(AC01)	Turbine Case Cooling Manifold−LPT	72−00−53 INST−05
(AC02)	Turbine Case Cooling Manifold−LPT	72−00−53 INST−05
(AC03)	Turbine Case Cooling Manifold−LPT	72−00−53 INST−05
(AC04)	Turbine Case Cooling Manifold−LPT	72−00−53 INST−05
(AC05)	Turbine Case Cooling Manifold−LPT	72−00−53 INST−05
(AC06)	Turbine Case Cooling Manifold−LPT	72−00−53 INST−05
(AC07)*	Turbine Case Cooling Manifold−LPT *(Pre SB PW4ENG 75−53)	72−00−53 INST−05
(AC08)	Turbine Case Cooling Manifold−LPT	72−00−53 INST−05
(AC09)	Turbine Case Cooling Manifold−LPT	72−00−53 INST−05
(AC10)	Turbine Case Cooling Manifold−LPT	72−00−53 INST−05
(AC11)	Turbine Case Cooling Manifold−LPT	72−00−53 INST−05
(AC12)	Turbine Case Cooling Manifold−LPT	72−00−53 INST−05
(AC13)	Turbine Case Cooling Manifold−LPT	72−00−53 INST−05
(AC14)*	Turbine Case Cooling Manifold−LPT *(Pre SB PW4ENG 75−53)	72−00−53 INST−05
(AC21)	Turbine Case Cooling Manifold−HPT	72−00−52 INST−06
(AC22)	Turbine Case Cooling Manifold−HPT	72−00−52 INST−06
(AC23)	Turbine Case Cooling Manifold−HPT	72−00−52 INST−06
(AC24)	Turbine Case Cooling Manifold−HPT	72−00−52 INST−06
(AC25)	Turbine Case Cooling Manifold−HPT	72−00−52 INST−06
(AC26)	Turbine Case Cooling Manifold−HPT	72−00−52 INST−06
(AC27)	Turbine Case Cooling Manifold−HPT	72−00−52 INST−06
(AC28)	Turbine Case Cooling Manifold−HPT	72−00−52 INST−06
(AC35)	HPC Valve Cooling Air Tube	72−00−34 INST−02

NOTE: The words in parenthesis are descriptive and are not part of the nomenclature. The descriptive words are used throughout this manual as needed. See Figure 2.

Air Cooling System (AC) Tube Chart
Table 2

D. Air − Air Pressurizing System (AP)

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION
(AP01)	Turbine Vane Cooling Air Tube (upper right)	72−00−52 INST−07
(AP02)	Turbine Vane Cooling Air Tube (lower right)	72−00−52 INST−07
(AP03)	Turbine Vane Cooling Air Tube (lower left)	72−00−52 INST−07
(AP04)	Turbine Vane Cooling Air Tube (upper left)	72−00−52 INST−07
(AP17)	Diffuser Seal Air Vent Tube (lower right)	72−00−41 INST−02
(AP21)	Diffuser Seal Air Vent Tube (upper right)	72−00−41 INST−02
(AP22)	Diffuser Seal Air Vent Tube (left)	72−00−41 INST−02
(AP33)	No. 3 Bearing Cooler Air Tube	72−00−41 INST−02
(AP34)	No. 3 Bearing Cooler Air Tube	72−00−41 INST−02
(AP37)	Turbine Blade Cooling Air Tube (lower)	72−00−54 INST−02
(AP38)	Turbine Blade Cooling Air Tube (upper)	72−00−41 INST−02
(AP39)	No. 3 Bearing Breather Valve Air Supply Tube (Pre SB PW4ENG 75−144)	72−00−61 INST−02

NOTE: The words in parenthesis are descriptive and are not part of the nomenclature. The descriptive words are used throughout this manual as needed. See Figure 3.

Air Pressurizing System (AP) Tube Chart
Table 3

E. Air − Air Sense System (AS)

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION
(AS01)	EEC PT4.95 Tube	72−00−41 INST−02
(AS02)	EEC PT4.95 Tube	72−00−54 INST−02
(AS03)	EEC PT4.95 Manifold	72−54−00 ASSY−01
(AS04)	EEC PT4.95 Tube	72−00−34 INST−02
(AS05)	EEC PT4.95 Tube	72−00−33 INST−02
(AS09)	EEC PB Tube	72−00−41 INST−02
(AS10)	EEC PAMB Hose	72−00−33 INST−02
(AS11)	EEC PT2 Hose	72−00−33 INST−02
(AS12)	EEC PB Hose	72−00−33 INST−02
(AS13)	EEC PT4.95 Hose	72−00−33 INST−02
(AS16)	EEC PT2 Tube	72−00−33 INST−02
(AS17)	EEC PAMB Tube	72−00−33 INST−02
(AS19)	EEC PB Tube	72−00−33 INST−02
(AS20)	EEC PB Tube	72−00−34 INST−02
(AS21)	EEC PAMB Manifold	72−00−33 INST−02
(AS22)	EEC PT2 Manifold	72−00−33 INST−02
(AS23)	EEC PB Manifold	72−00−33 INST−02
(AS24)	EEC PT4.95 Manifold	72−00−33 INST−02
(AS27)	EEC PT4.95 Tube	72−00−52 INST−03
(AS28)	PT2.5 Sensing Manifold	72−00−33 INST−02
(AS29)	PT2.5 Sensing Tube	72−00−34 INST−02
(AS30)	PT2.5 Sensing Tube	72−00−34 INST−02
(AS31)	PT2.5 Sensing Manifold	72−00−34 INST−02
(AS32)	PT2.5 Sensing Hose	72−00−33 INST−02
(AS33)	EEC PT4.95 Manifold	72−54−00 ASSY−01
(AS34)	EEC PT4.95 Tube	72−54−00 ASSY−01
(AS41)	EEC PT4.95 Tube	72−00−34 INST−02

NOTE: The words in parenthesis are descriptive and are not part of the nomenclature. The descriptive words are used throughout this manual as needed. See Figure 4.

Air Sense System (AS) Tube Chart
Table 4

F. Hydraulic − Hydraulic Control Pressure System (CP)

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION
(CP01)	Hydraulic Pressure Manifold	72−00−61 INST−08
(CP02)	Hydraulic Pressure Manifold	72−00−34 INST−02
(CP05)	Hydraulic Pressure Manifold	72−00−34 INST−02
(CP06)	Bleed Valve Cylinder Hydraulic	72−00−34 INST−02

Hydraulic Control Pressure System (CP) Tube Chart
Table 5

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION
(CONTINUED)	Tube	
(CP07)	(Left) Air/Oil Cooler Valve Hydraulic Tube	72−00−34 INST−02
(CP08)	(Left) Air/Oil Cooler Valve Hydraulic Tube	72−00−34 INST−02
(CP09)	(Right) Air/Oil Cooler Valve Hydraulic Tube	72−00−34 INST−02
(CP11)	Hydraulic Pressure Hose	72−00−34 INST−02
(CP12)	Compressor Stator Cylinder Hydraulic Tube	72−00−34 INST−02
(CP13)	(Right) Air/Oil Cooler Valve Hydraulic Tube	72−00−34 INST−02

NOTE: The words in parenthesis are descriptive and are not part of the nomenclature. The descriptive words are used throughout this manual as needed. See Figure 5.

Hydraulic Control Pressure System (CP) Tube Chart
Table 5 (Continued)

G. Hydraulic − Hydraulic Control Return System (CR)

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION
(CR01)	Oil Cooler Inlet Return Manifold (upper)	72−00−34 INST−02
(CR02)	Bleed Valve Cylinder Hydraulic Return Tube	72−00−34 INST−02
(CR03)	Compressor Stator Cylinder Hydraulic Return Tube	72−00−34 INST−02
(CR04)	Oil Cooler Inlet Hydraulic Return Manifold (lower)	72−00−34 INST−02
(CR05)	(Left) Air/Oil Cooler Valve Hydraulic Return Tube	72−00−34 INST−02
(CR08)	(Left) Air/Oil Cooler Valve Hydraulic Return Tube	72−00−34 INST−11
(CR09)	(Left) Air Shutoff Valve Drain Tube	72−00−34 INST−11
(CR10)	(Right) Air Shutoff Valve Drain Tube	72−00−34 INST−09
(CR11)	(Right) Air/Oil Cooler Valve Hydraulic Return Tube	72−00−34 INST−09

Hydraulic Control Return System (CR) Tube Chart
Table 6

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION
(CONTINUED)		
(CR12)	(Right) Air/Oil Cooler Valve Hydraulic Return Tube	72−00−34 INST−02
(CR13)	Hydraulic Return Hose	72−00−41 INST−02

NOTE: The words in parenthesis are descriptive and are not part of the nomenclature. The descriptive words are used throughout this manual as needed. See Figure 6.

Hydraulic Control Return System (CR) Tube Chart
Table 6 (Continued)

H. Fuel − Fuel Main Supply System (FM)

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION
(FM01)	Fuel Supply Tube (1, 2, 3)	72−41−00 ASSY−03
(FM02)	Fuel Supply Tube (4, 5, 6)	72−41−00 ASSY−03
(FM03)	Fuel Supply Tube (7, 8, 9)	72−41−00 ASSY−03
(FM04)	Fuel Supply Tube (10, 11, 12)	72−41−00 ASSY−03
(FM05)	Fuel Supply Tube (13, 14, 15)	72−41−00 ASSY−03
(FM06)	Fuel Supply Tube (16, 17, 18)	72−41−00 ASSY−03
(FM07)	Fuel Supply Tube (19, 20, 21)	72−41−00 ASSY−03
(FM08)	Fuel Supply Tube (22, 23, 24)	72−41−00 ASSY−03
(FM09)	Fuel Distribution Valve Supply Tube	72−00−61 INST−05
(FM10)	Oil Cooler Inlet Fuel Tube	72−00−35 INST−04
(FM11)	Oil Cooler Outlet Fuel Tube	72−00−35 INST−04
(FM12)	Oil Cooler Inlet Fuel Tube	72−00−35 INST−04

NOTE: The words in parenthesis are descriptive and are not part of the nomenclature. The descriptive words are used throughout this manual as needed. See Figure 7.

Fuel Main Supply System (FM) Tube Chart
Table 7

I. Fuel − Fuel Supply To Injector (FS)

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION
(FS01)	Fuel Supply Manifold (1, 2, 3)	72-41-00 ASSY-01
(FS02)	Fuel Supply Manifold (4, 5, 6)	72-41-00 ASSY-01
(FS03)	Fuel Supply Manifold (7, 8, 9)	72-41-00 ASSY-01
(FS04)	Fuel Supply Manifold (10, 11, 12)	72-41-00 ASSY-01
(FS05)	Fuel Supply Manifold (13, 14, 15)	72-41-00 ASSY-01
(FS06)	Fuel Supply Manifold (16, 17, 18)	72-41-00 ASSY-01
(FS07)	Fuel Supply Manifold (19, 20, 21)	72-41-00 ASSY-01
(FS08)	Fuel Supply Manifold (22, 23, 24)	72-41-00 ASSY-01

NOTE: The words in parenthesis are descriptive and are not part of the nomenclature. The descriptive words are used throughout this manual as needed. See Figure 8.

Fuel Supply To Injector System (FS) Tube Chart
Table 8

J. Lubrication - Lubrication Breather System (LB)

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION
(LB01)	(No. 1, 1 1/2, 2) Main Bearing Breather Tube (upper)	72-00-34 INST-02
(LB02)	(No. 1, 1 1/2, 2) Main Bearing Breather Tube (lower)	72-00-61 INST-02
(LB03)	No. 3 Bearing Breather Tube (upper)	72-00-41 INST-02
(LB04)	No. 3 Bearing Breather Tube (lower)	72-00-61 INST-02
(LB06)	(No. 1, 1 1/2, 2) Main Bearing Breather Tube (middle)	72-00-34 INST-02

NOTE: The words in parenthesis are descriptive and are not part of the nomenclature. The descriptive words are used throughout this manual as needed. See Figure 9.

Lubrication Breather System (LB) Tube Chart
Table 9

K. Lubrication − Lubrication Drain System (LD)

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION
(LD01)	No. 3 Bearing Oil Vent Tube (front)	72−00−41 INST−02
(LD02)	No. 3 Bearing Oil Vent Tube (rear)	72−00−54 INST−02

NOTE: The words in parenthesis are descriptive and are not part of the nomenclature. The descriptive words are used throughout this manual as needed. See Figure 10.

Lubrication Drain System (LD) Tube Chart
Table 10

L. Lubrication − Lubrication Pressure System (LP)

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION
(LP01)	Main Filter Oil Tube	72−00−61 INST−02
(LP02)	Air/Oil Cooler Inlet Oil Tube	72−00−61 INST−02
(LP03)	Air/Oil Cooler Outlet Oil Tube	72−00−34 INST−02
(LP05)	(No. 1, 1 1/2, 2) Main Bearing Oil Pressure Tube (rear)	72−00−34 INST−02
(LP07)	(No. 1, 1 1/2, 2) Main Bearing Oil Pressure Manifold (front)	72−00−34 INST−02
(LP08)	Gearbox Oil Pressure Manifold	72−00−34 INST−02
(LP09)	Angle Gearbox Oil Pressure Tube	72−00−34 INST−02
(LP12)	Main Gearbox Oil Pressure Tube	72−00−61 INST−02
(LP13)	Reduction Gearbox Oil Pressure Tube	72−00−61 INST−02
(LP15)	No. 4 Bearing Oil Pressure Tube (front)	72−00−41 INST−02
(LP16)	No. 4 Bearing Oil Pressure Tube (rear)	72−00−54 INST−02
(LP18)	No. 3 Bearing Oil Pressure Manifold (front)	72−00−34 INST−02
(LP19)	No. 3 Bearing Oil Pressure Tube (rear)	72−00−41 INST−02
(LP20)	Oil Cooler Bypass Valve Drain Tube	72−00−61 INST−02
(LP21)	Gearbox Driveshaft Oil Pressure Tube	72−61−00 ASSY−01
(LP31)	Oil Trim Pressure Tube (upper)	72−00−34 INST−02
(LP32)	Oil Trim Pressure Tube (lower)	72−00−61 INST−02

Lubrication Pressure System (LP) Tube Chart
Table 11

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION

NOTE: The words in parenthesis are descriptive and are not part of the nomenclature. The descriptive words are used throughout this manual as needed. See Figure 11.

Lubrication Pressure System (LP) Tube Chart
Table 11 (Continued)

M. Lubrication − Lubrication Return Scavenge System (LR)

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION
(LR01)	Angle Gearbox Oil Scavenge Tube	72−00−61 INST−02
(LR02)	(No. 1, 1 1/2, 2) Main Bearing Oil Scavenge Tube (front)	72−34−00 ASSY−01
(LR03)	(No. 1, 1 1/2, 2) Main Bearing Oil Scavenge Tube (rear)	72−00−61 INST−02
(LR04)	No. 3 Bearing Oil Scavenge Manifold	72−00−61 INST−02
(LR05)	No. 4 Bearing Oil Scavenge Tube (front)	72−00−61 INST−02
(LR06)	No. 4 Bearing Oil Scavenge Tube (rear)	72−00−54 INST−02

NOTE: The words in parenthesis are descriptive and are not part of the nomenclature. The descriptive words are used throughout this manual as needed. See Figure 12.

Lubrication Return Scavenge System (LR) Tube Chart
Table 12

N. Lubrication − IDG Lubrication System (LS)

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION
(LS03)	Airframe Cooler Outlet Oil tube (right)	72−00−34 INST−02
(LS05)	(Fuel/Oil) Cooler Inlet Oil Tube (left)	72−00−34 INST−02
(LS06)	Airframe Cooler Outlet Oil Tube (middle)	72−00−34 INST−02

IDG Lubrication System (LS) Tube Chart
Table 13

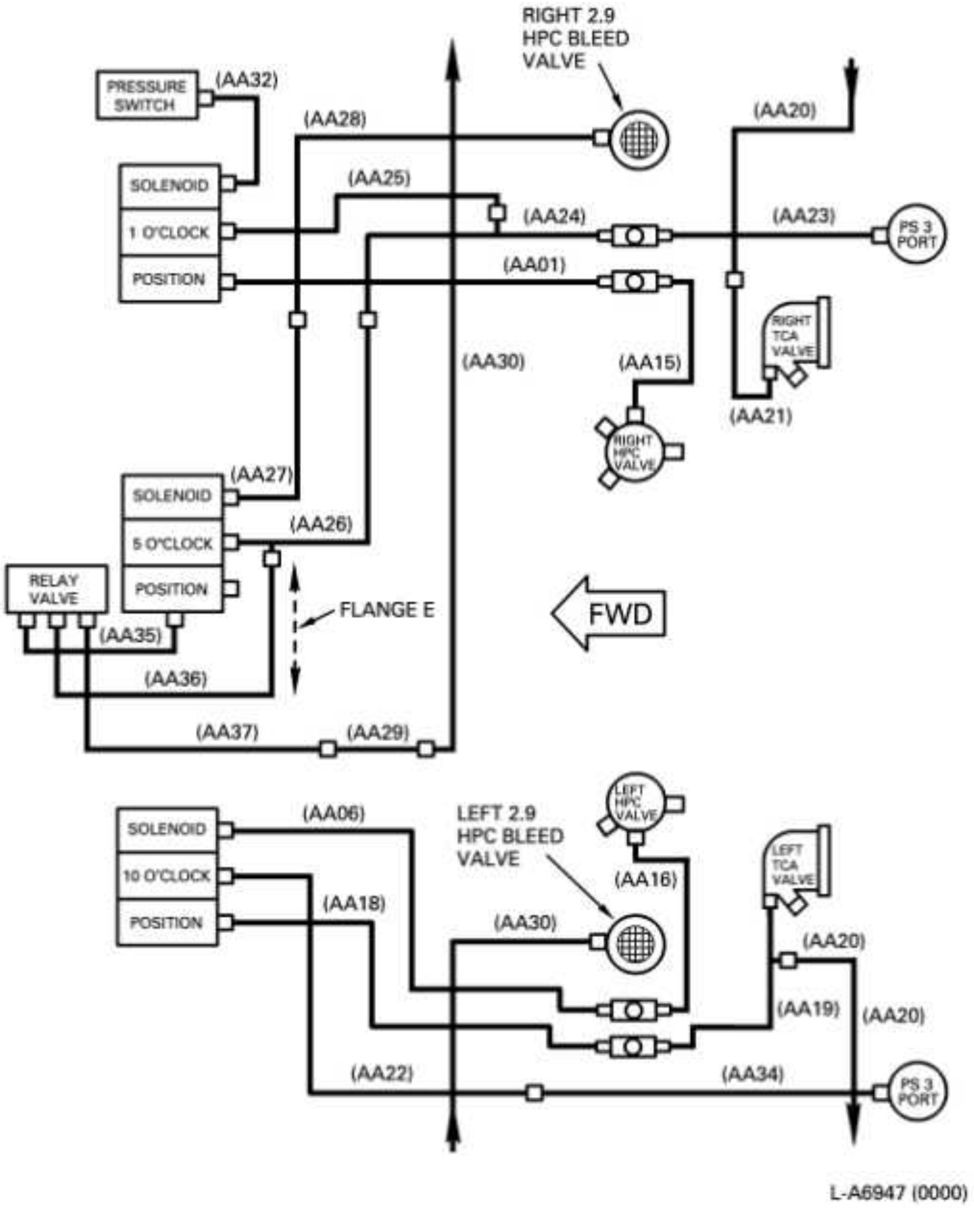
ENGINE EXTERNAL TUBES − DESCRIPTION/OPERATION−00

TUBE FUNCTION NUMBER	TUBE NOMENCLATURE	ENGINE MANUAL INSTALLATION LOCATION

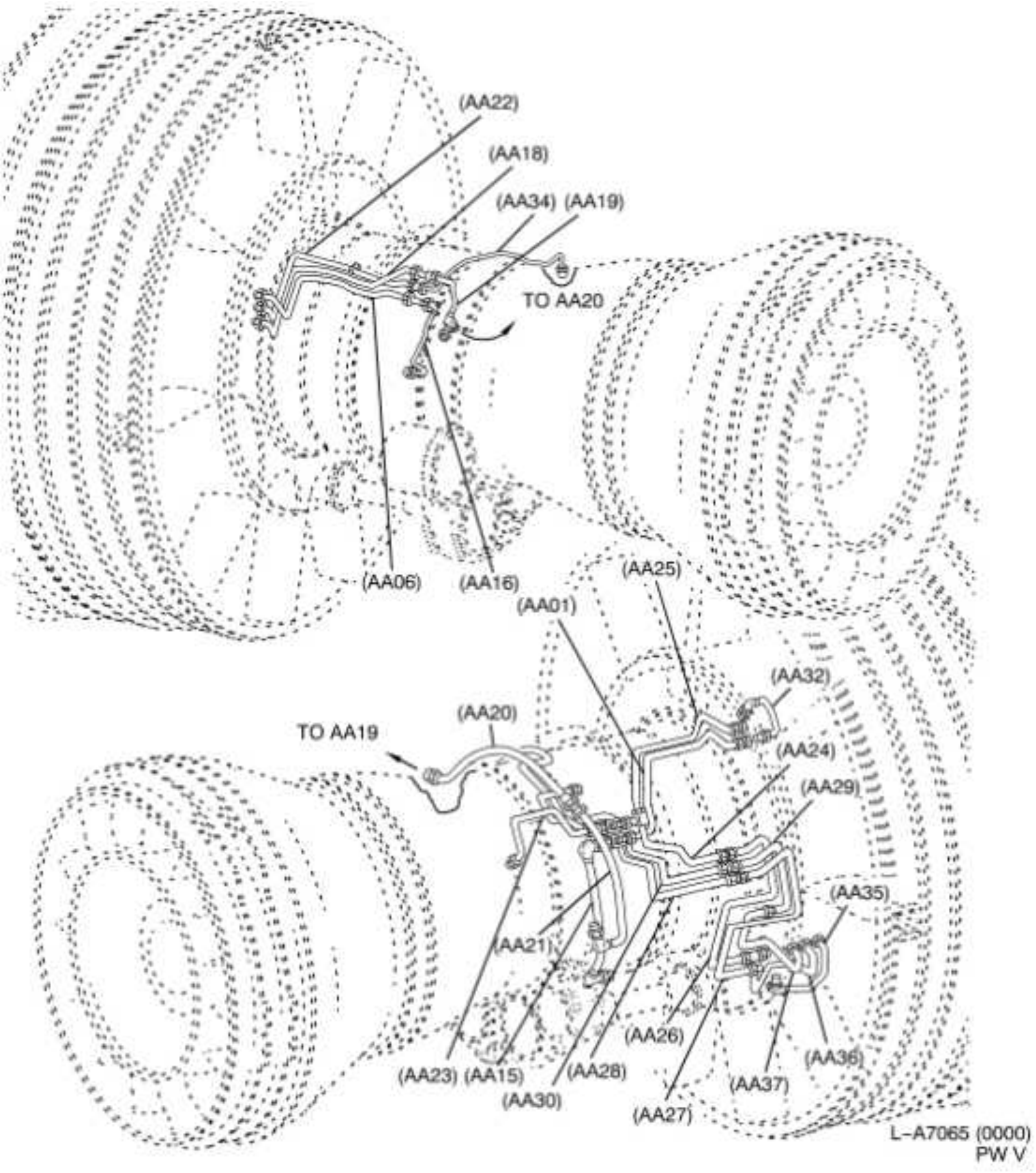
NOTE: The words in parenthesis are descriptive and are not part of the nomenclature. The descriptive words are used throughout this manual as needed. See Figure 13.

IDG Lubrication System (LS) Tube Chart
Table 13 (Continued)

ENGINE EXTERNAL TUBES - DESCRIPTION/OPERATION-00

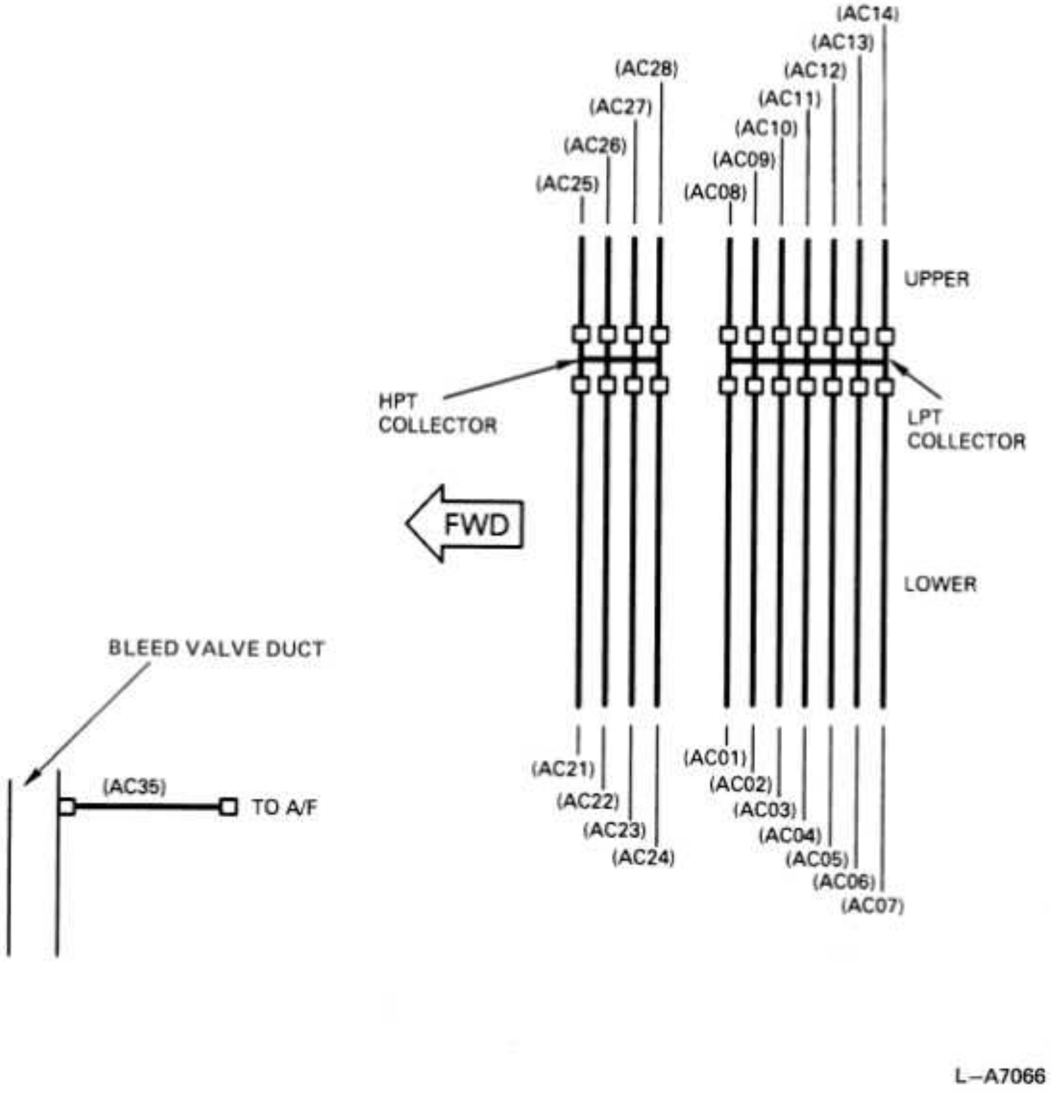

RIGHT 2.9
HPC BLEED
VALVE
PRESSURE SWITCH
(AA32)
(AA28)
(AA20)
SOLENOID
(AA25)
1 O'CLOCK
(AA24)
(AA23)
PS 3 PORT
POSITION
(AA01)
RIGHT TCA VALVE
(AA30)
(AA15)
(AA21)
RIGHT HPC VALVE
(AA27)
SOLENOID
(AA26)
5 O'CLOCK
RELAY VALVE
POSITION
FLANGE E
FWD
(AA35)
(AA36)
(AA37)
(AA29)
SOLENOID
(AA06)
LEFT 2.9
HPC BLEED
VALVE
LEFT HPC VALVE
LEFT TCA VALVE
10 O'CLOCK
(AA18)
(AA16)
POSITION
(AA30)
(AA20)
(AA19)
(AA20)
(AA22)
(AA34)
PS 3 PORT
L-A6947 (0000)

Air Actuation System (AA) (Schematic)
Figure 1 (Sheet 1)
(Task 72-09-71-990-001)

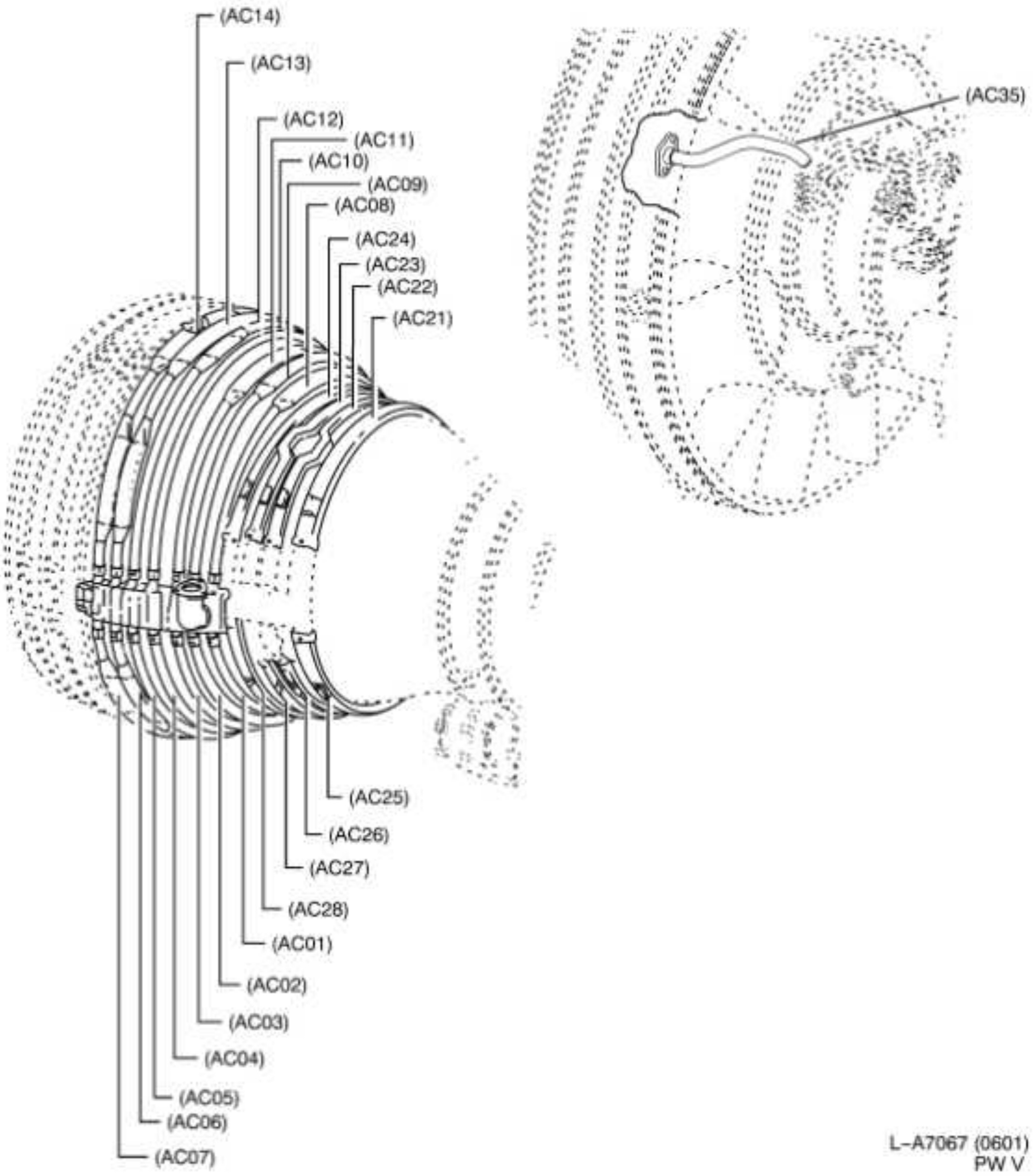

(AA22)
(AA18)
(AA34) (AA19)
TO AA20
(AA06)
(AA16)
(AA25)
(AA01)
(AA32)
(AA20)
TO AA19
(AA24)
(AA29)
(AA35)
(AA21)
(AA26)
(AA36)
(AA23) (AA15)
(AA28)
(AA37)
(AA30)
(AA27)
L-A7065 (0000)
PW V

Air Actuation System (AA) (Tube Locations)
Figure 1 (Sheet 2)
(Task 72−09−71−990−001)

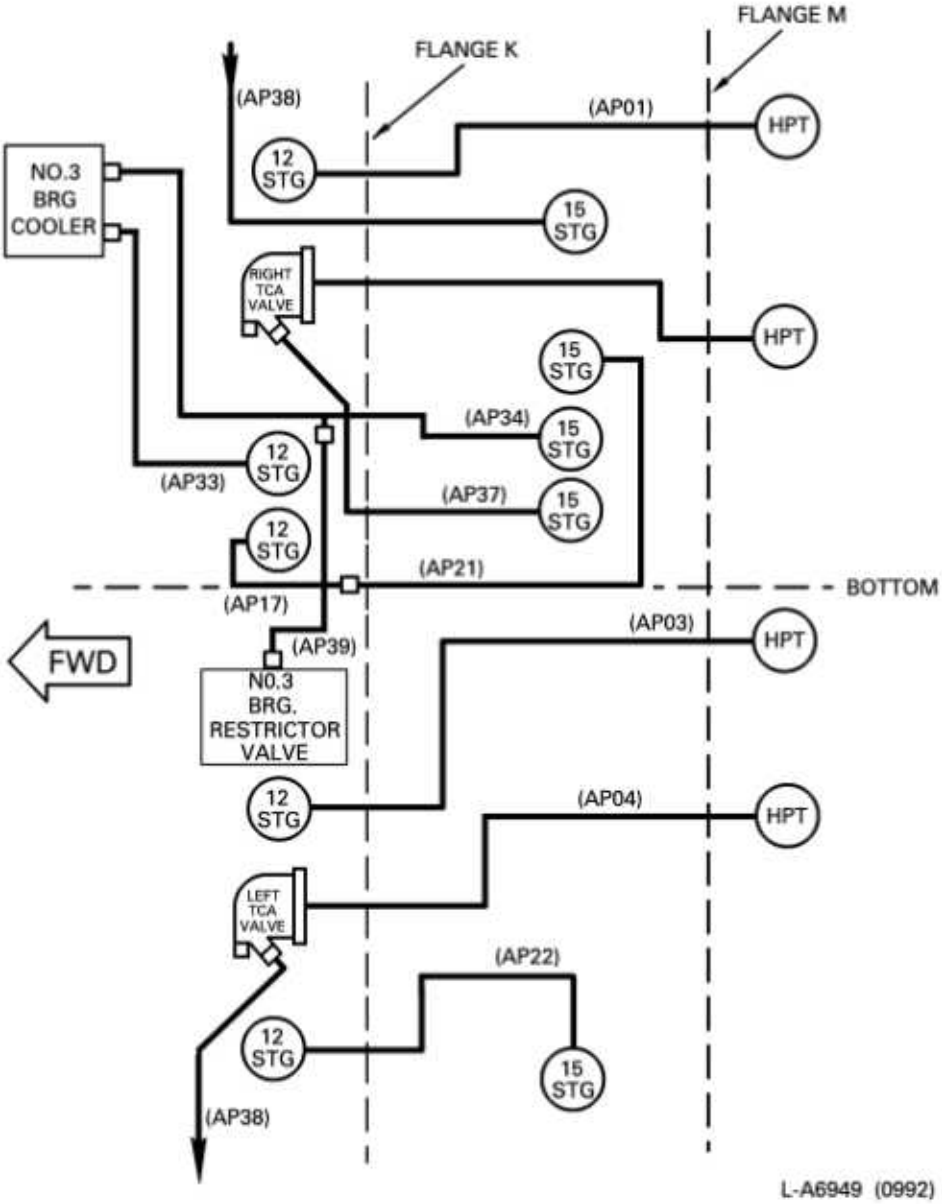
ENGINE EXTERNAL TUBES − DESCRIPTION/OPERATION−00


(AC14)
(AC13)
(AC12)
(AC11)
(AC10)
(AC09)
(AC08)
(AC28)
(AC27)
(AC26)
(AC25)
UPPER
HPT COLLECTOR
LPT COLLECTOR
FWD
LOWER
BLEED VALVE DUCT
(AC35)
TO A/F
(AC21)
(AC22)
(AC23)
(AC24)
(AC01)
(AC02)
(AC03)
(AC04)
(AC05)
(AC06)
(AC07)
L−A7066

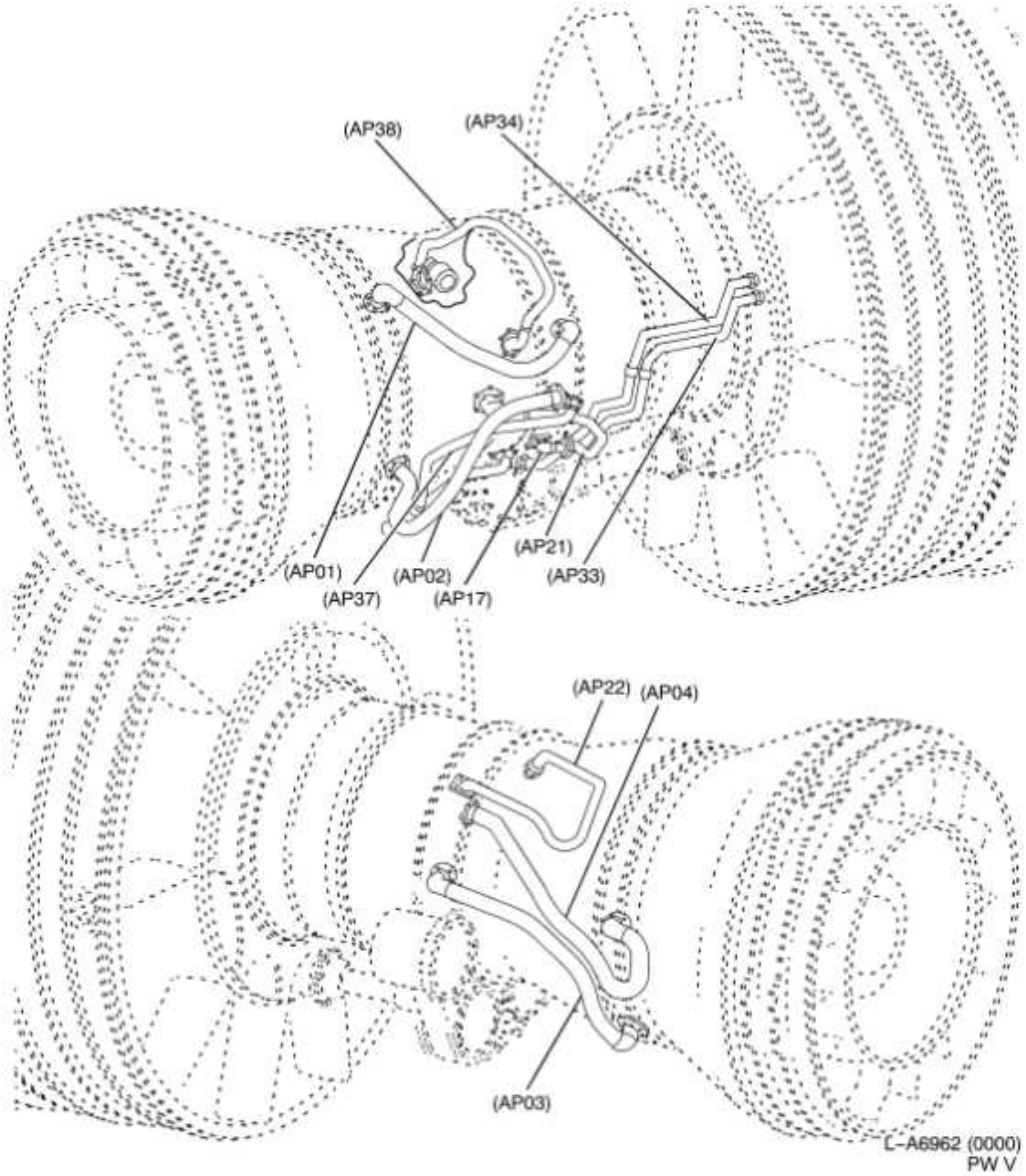
Air Cooling System (AC) (Schematic)
Figure 2 (Sheet 1)
(Task 72−09−71−990−001)


(AC14)
(AC13)
(AC12)
(AC11)
(AC10)
(AC09)
(AC08)
(AC24)
(AC23)
(AC22)
(AC21)
(AC35)
(AC25)
(AC26)
(AC27)
(AC28)
(AC01)
(AC02)
(AC03)
(AC04)
(AC05)
(AC06)
(AC07)
L-A7067 (0601)
PW V

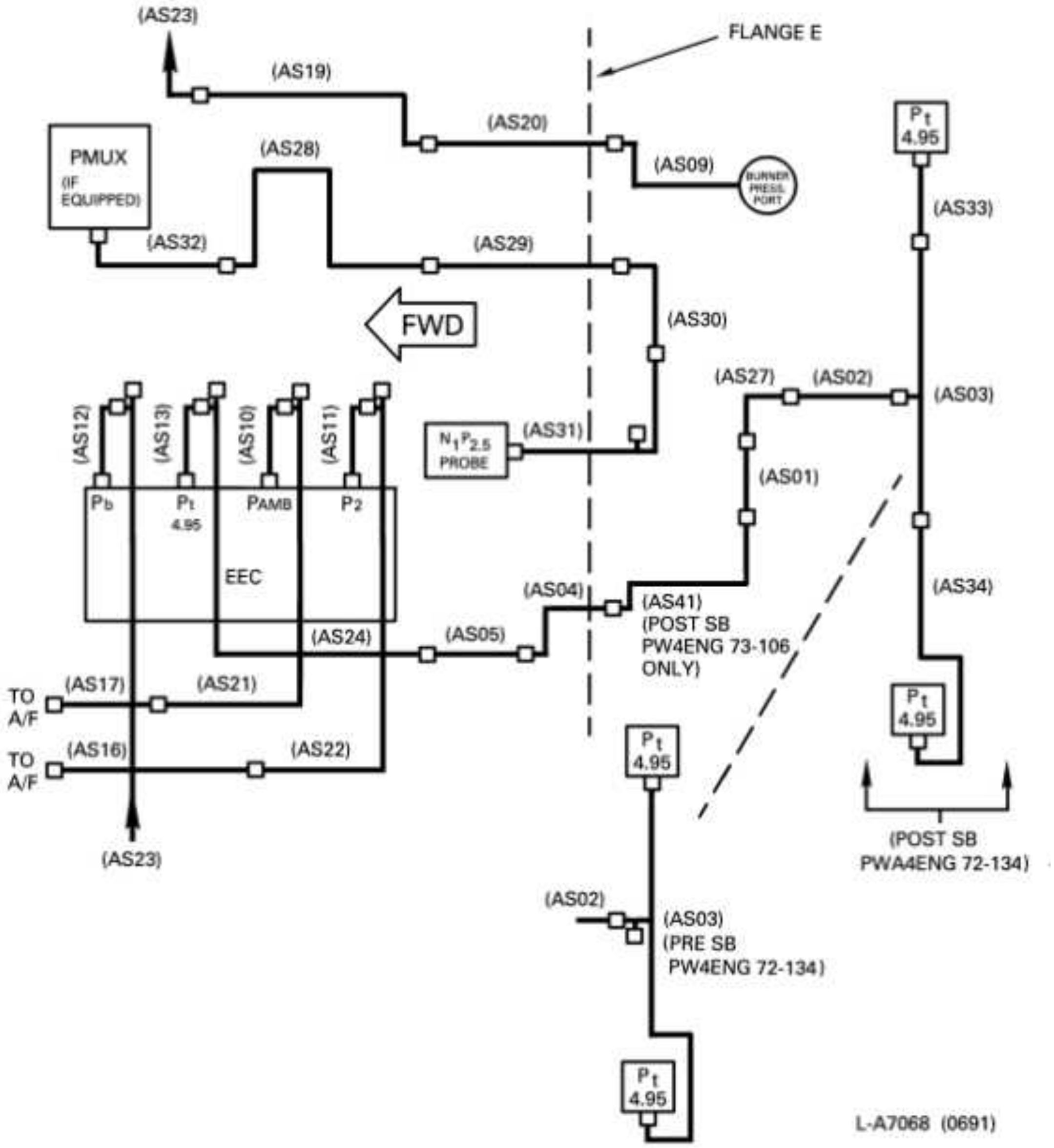
Air Cooling System (AC) (Tube Locations)
Figure 2 (Sheet 2)
(Task 72-09-71-990-001)


FLANGE M
FLANGE K
(AP38)
(AP01)
HPT
12 STG
NO.3 BRG COOLER
15 STG
RIGHT TCA VALVE
HPT
15 STG
(AP34)
15 STG
12 STG
(AP33)
(AP37)
15 STG
12 STG
(AP21)
BOTTOM
(AP17)
(AP03)
HPT
FWD
(AP39)
NO.3 BRG. RESTRICTOR VALVE
12 STG
(AP04)
HPT
LEFT TCA VALVE
(AP22)
12 STG
15 STG
(AP38)
L-A6949 (0992)

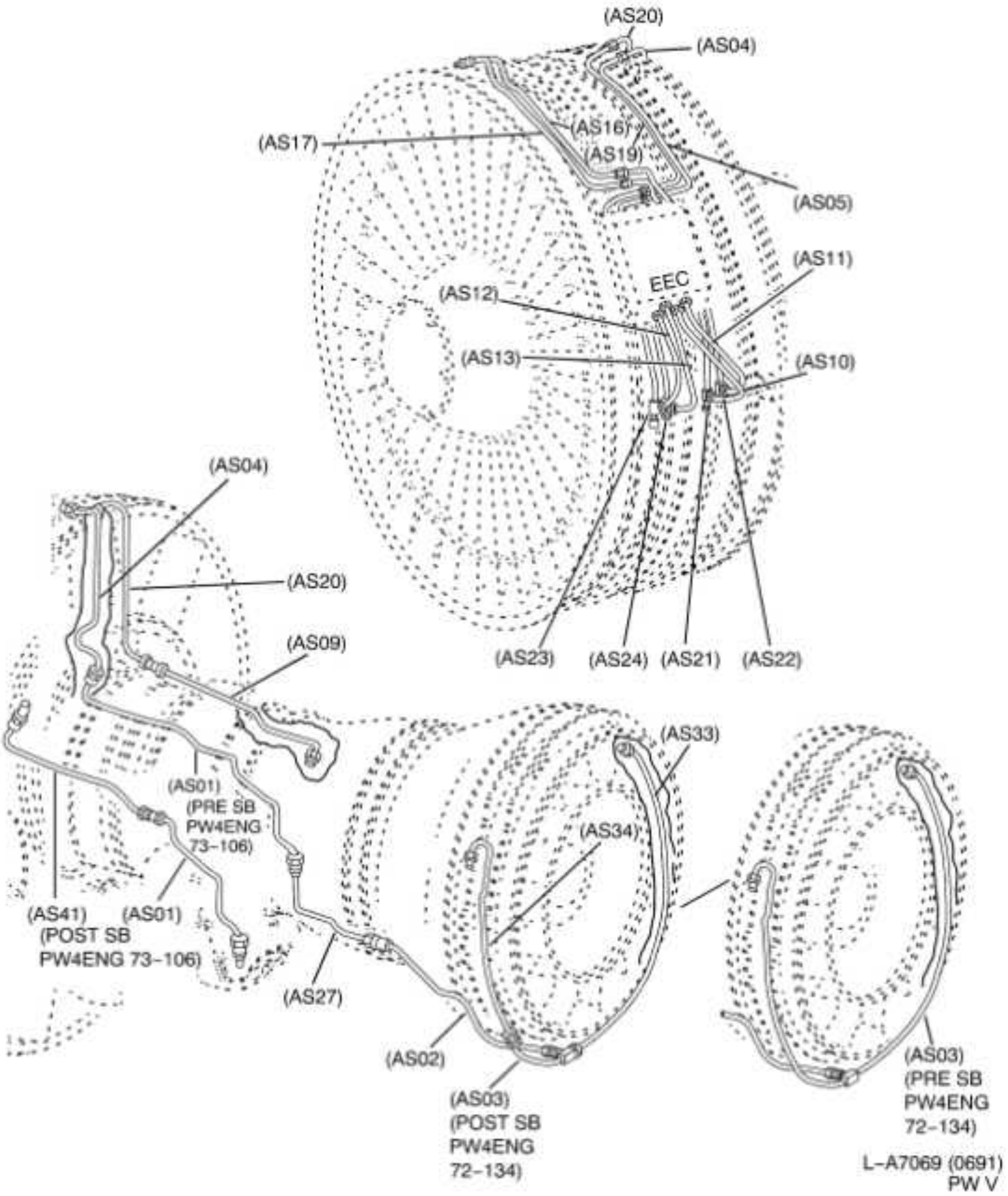
Air Pressurizing System (AP) (Schematic)
Figure 3 (Sheet 1)
(Task 72-09-71-990-001)


(AP38)
(AP34)
(AP01)
(AP37)
(AP02)
(AP17)
(AP21)
(AP33)
(AP22)
(AP04)
(AP03)
L−A6962 (0000)
PW V

Air Pressurizing System (AP) (Tube Locations)
Figure 3 (Sheet 2)
(Task 72−09−71−990−001)

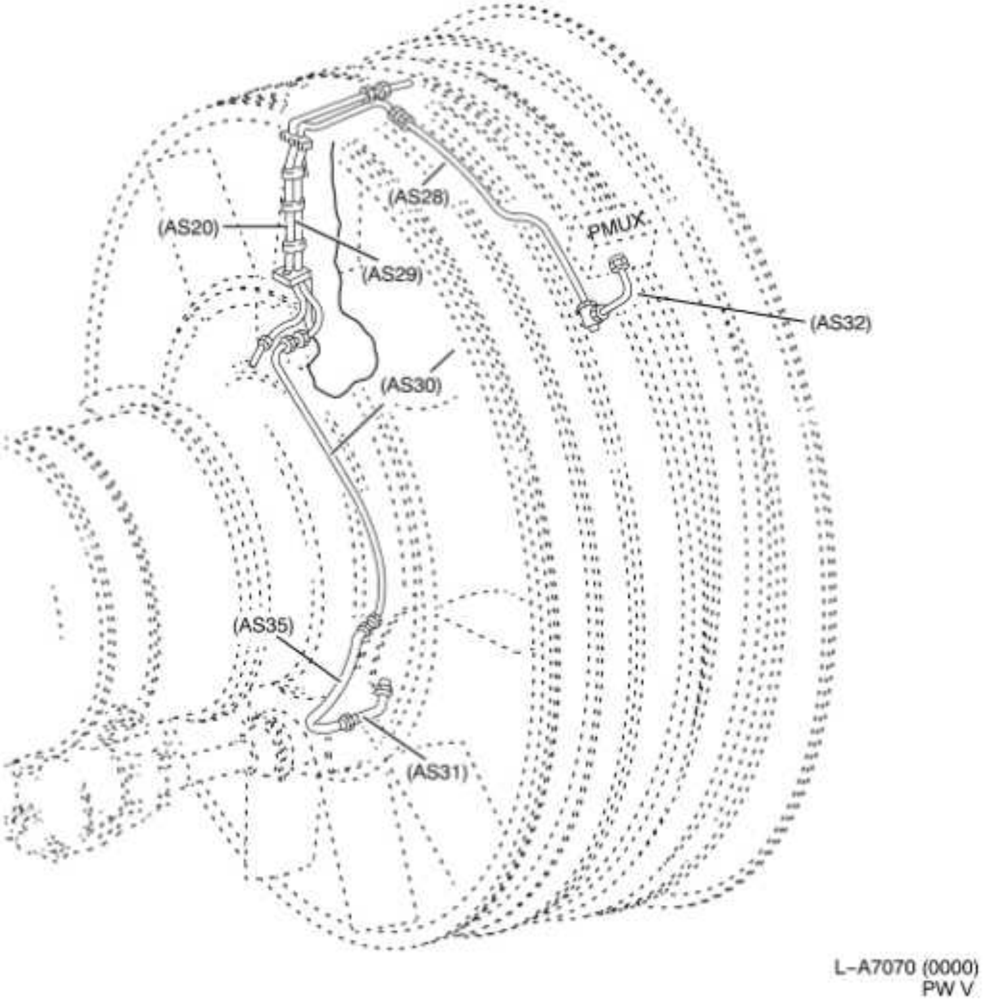

(AS23)
FLANGE E
(AS19)
(AS20)
PMUX (IF EQUIPPED)
(AS28)
(AS09)
BURNER PRESS. PORT
Pt 4.95
(AS33)
(AS32)
(AS29)
FWD
(AS30)
(AS27)
(AS02)
(AS03)
(AS12)
(AS13)
(AS10)
(AS11)
N1P2.5 PROBE
(AS31)
(AS01)
Pb
Pt 4.95
PAMB
P2
EEC
(AS04)
(AS41) (POST SB PW4ENG 73-106 ONLY)
(AS34)
(AS24)
(AS05)
TO A/F
(AS17)
(AS21)
Pt 4.95
TO A/F
(AS16)
(AS22)
Pt 4.95
(AS23)
(POST SB PWA4ENG 72-134)
(AS02)
(AS03) (PRE SB PW4ENG 72-134)
Pt 4.95
L-A7068 (0691)

Air Sense System (AS) (Schematic)
Figure 4 (Sheet 1)
(Task 72−09−71−990−001)

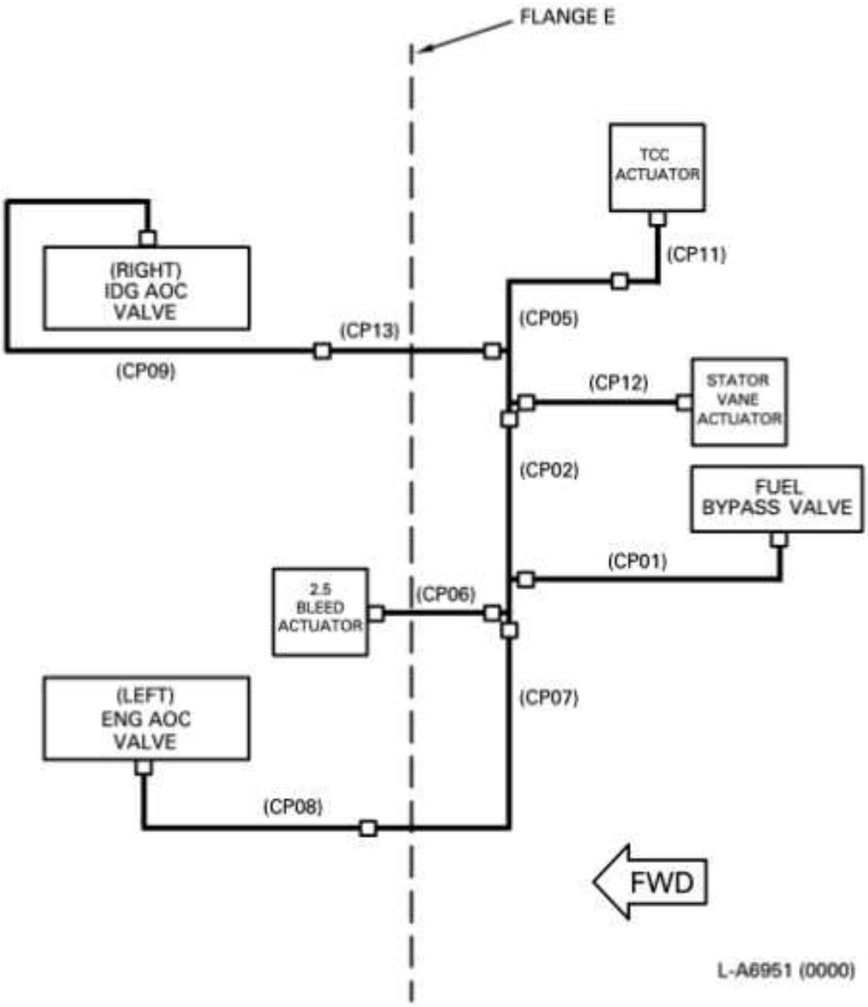

(AS20)
(AS04)
(AS17)
(AS16)
(AS19)
(AS05)
(AS11)
EEC
(AS12)
(AS13)
(AS10)
(AS04)
(AS20)
(AS09)
(AS23)
(AS24)
(AS21)
(AS22)
(AS33)
(AS01)
(PRE SB
PW4ENG
73−106)
(AS34)
(AS41)
(POST SB
PW4ENG 73−106)
(AS01)
(AS27)
(AS02)
(AS03)
(POST SB
PW4ENG
72−134)
(AS03)
(PRE SB
PW4ENG
72−134)
L−A7069 (0691)
PW V

Air Sense System (AS) (Tube Locations)
Figure 4 (Sheet 2)
(Task 72−09−71−990−001)

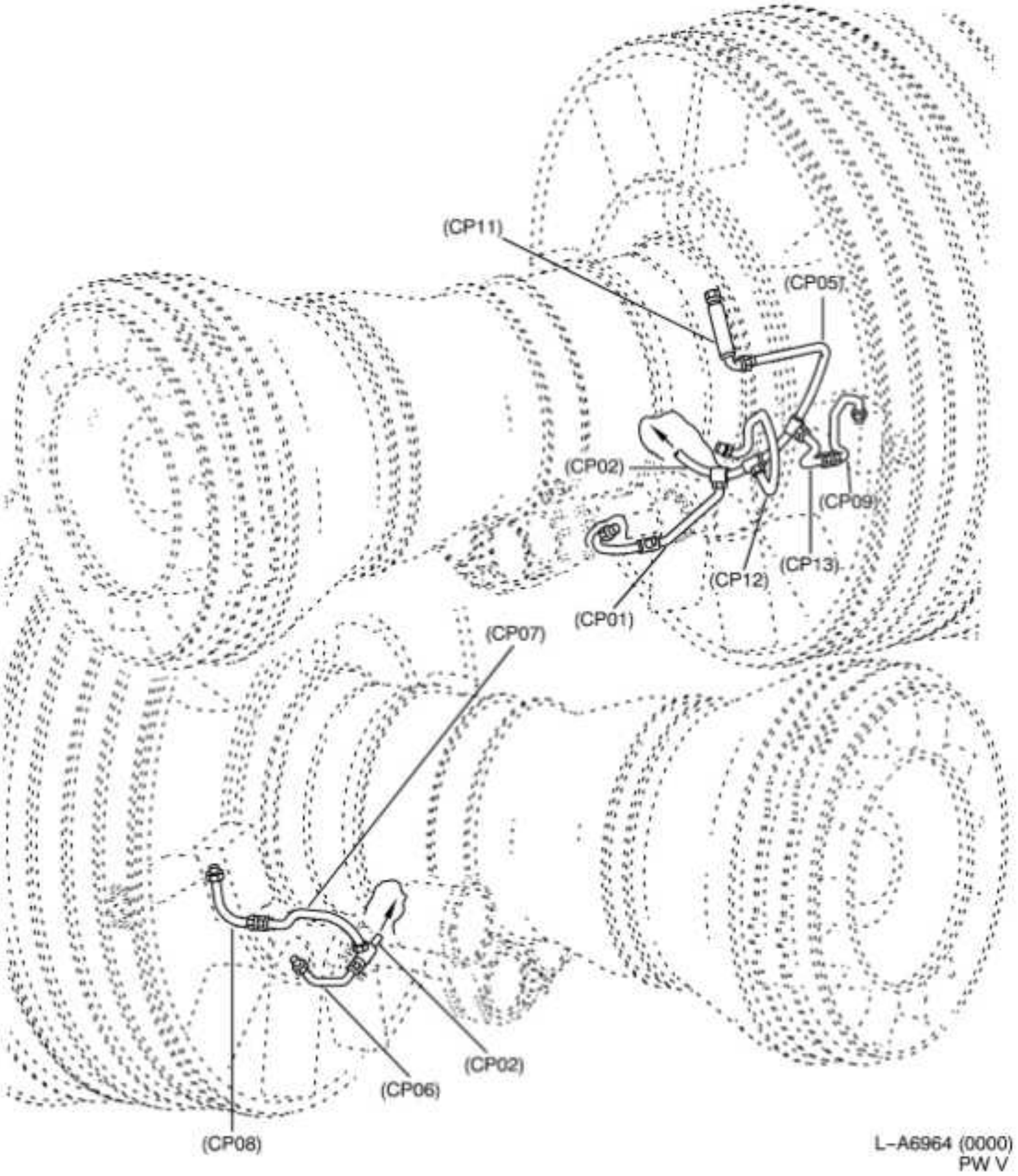
ENGINE EXTERNAL TUBES − DESCRIPTION/OPERATION−00


(AS28)
(AS20)
(AS29)
PMUX
(AS32)
(AS30)
(AS35)
(AS31)
L−A7070 (0000)
PW V

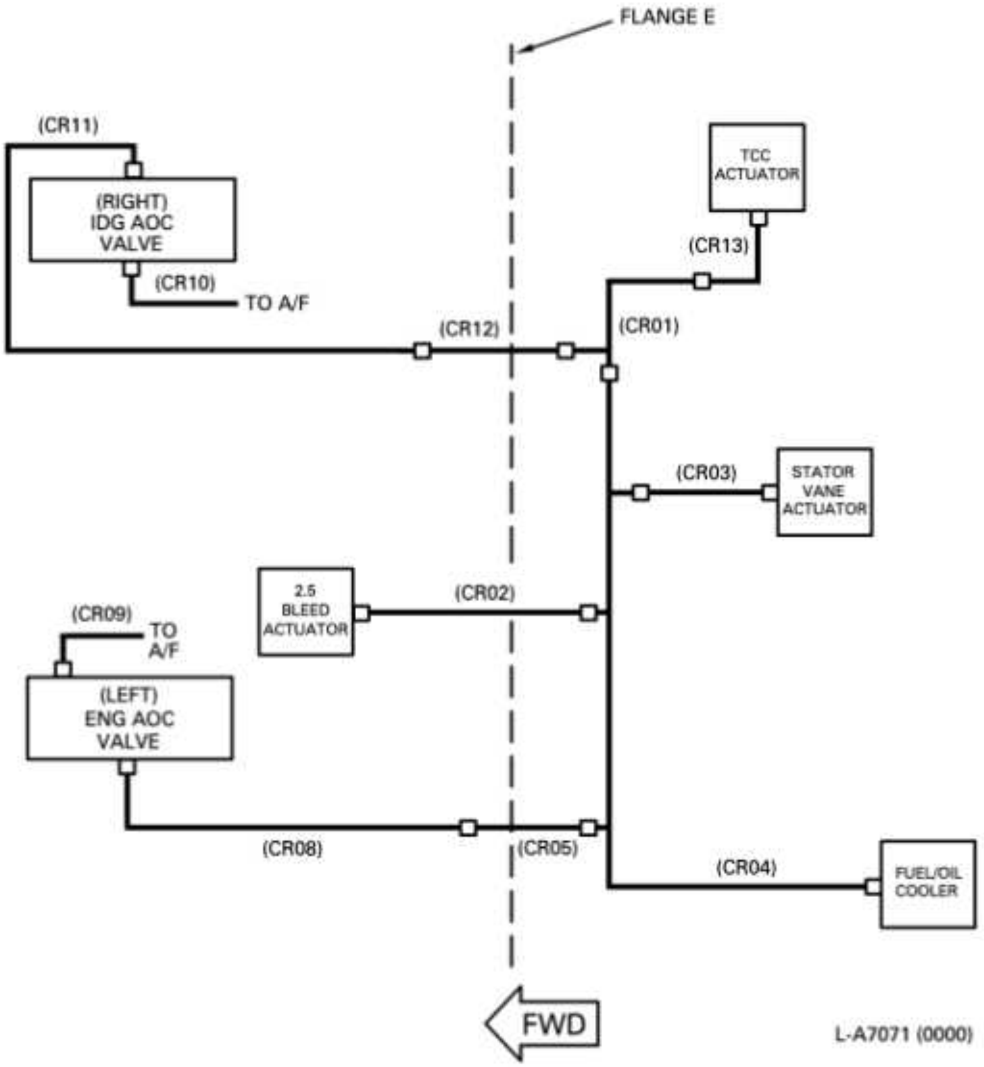
Air Sense System (AS) (Tube Locations)
Figure 4 (Sheet 3)
(Task 72−09−71−990−001)


FLANGE E
TCC ACTUATOR
(CP11)
(RIGHT) IDG AOC VALVE
(CP13)
(CP05)
(CP09)
(CP12)
STATOR VANE ACTUATOR
(CP02)
FUEL BYPASS VALVE
(CP01)
2.5 BLEED ACTUATOR
(CP06)
(LEFT) ENG AOC VALVE
(CP07)
(CP08)
FWD
L-A6951 (0000)

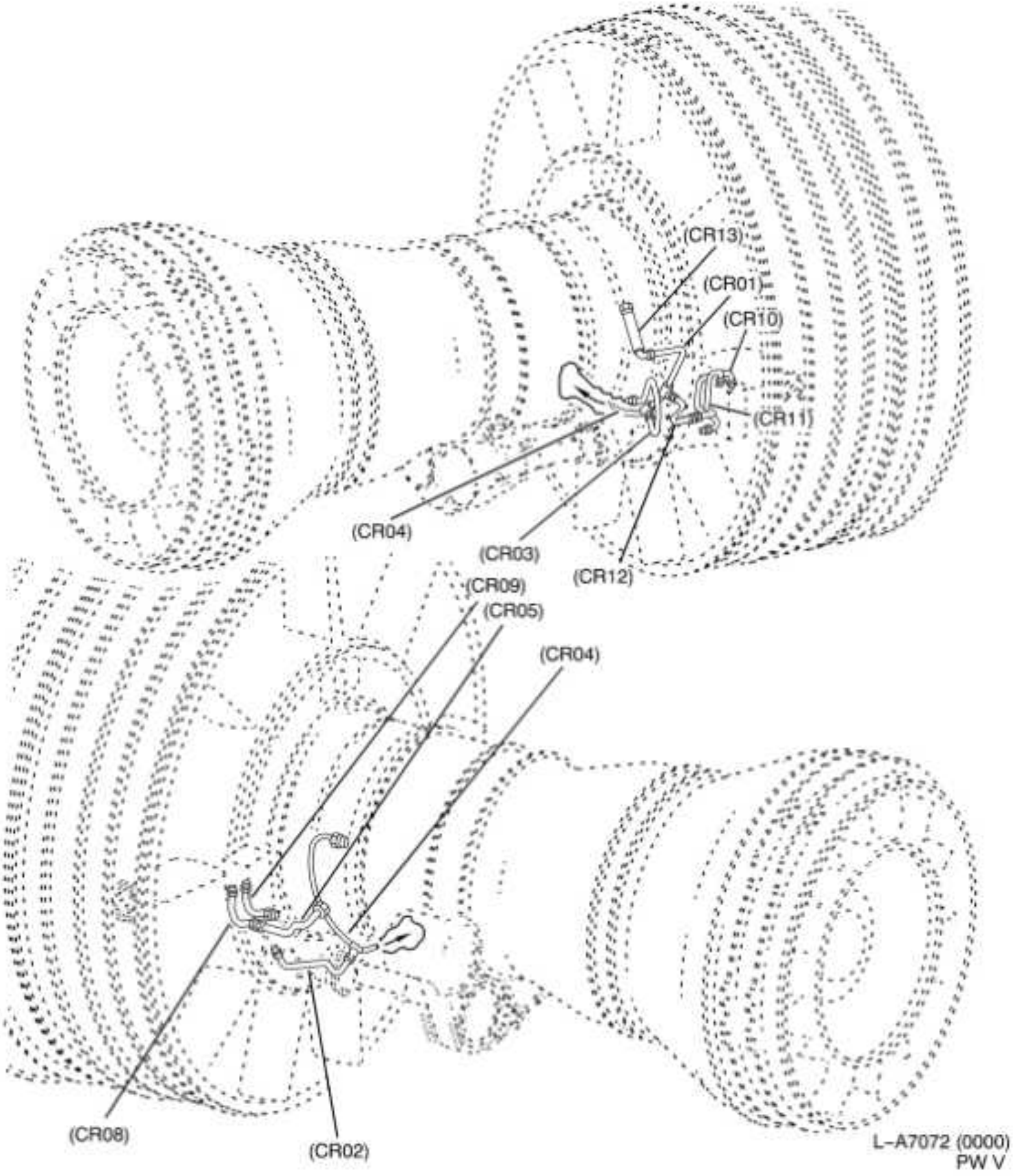
Hydraulic Control Pressure System (CP) (Schematic)
Figure 5 (Sheet 1)
(Task 72-09-71-990-001)


(CP11)
(CP05)
(CP02)
(CP09)
(CP13)
(CP12)
(CP01)
(CP07)
(CP02)
(CP06)
(CP08)
L-A6964 (0000)
PW V

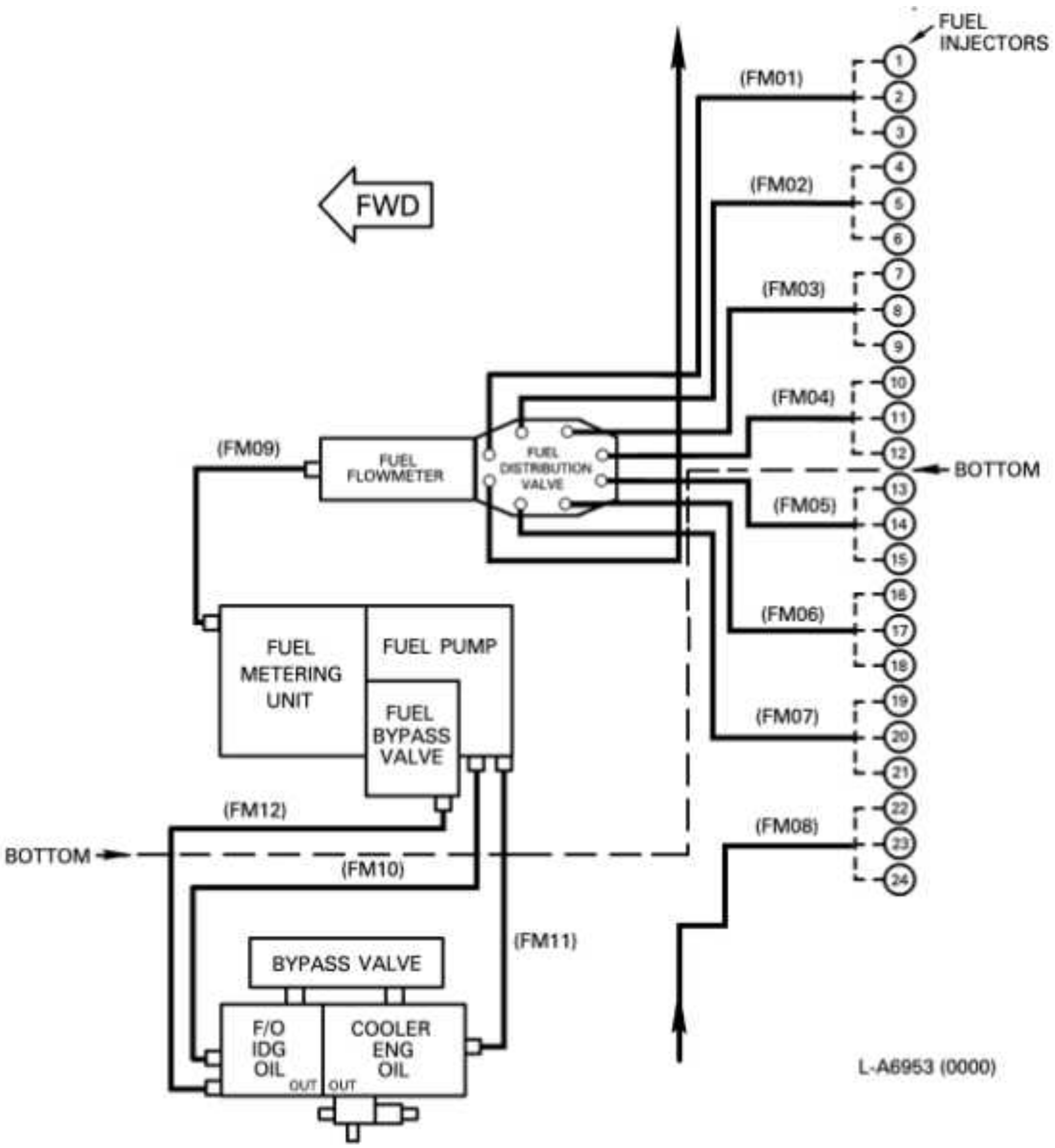
Hydraulic Control Pressure System (CP) (Tube Locations)
Figure 5 (Sheet 2)
(Task 72-09-71-990-001)


FLANGE E
(CR11)
(RIGHT) IDG AOC VALVE
(CR10)
TO A/F
TCC ACTUATOR
(CR13)
(CR12)
(CR01)
(CR03)
STATOR VANE ACTUATOR
2.5 BLEED ACTUATOR
(CR02)
(CR09)
TO A/F
(LEFT) ENG AOC VALVE
(CR08)
(CR05)
(CR04)
FUEL/OIL COOLER
FWD
L-A7071 (0000)

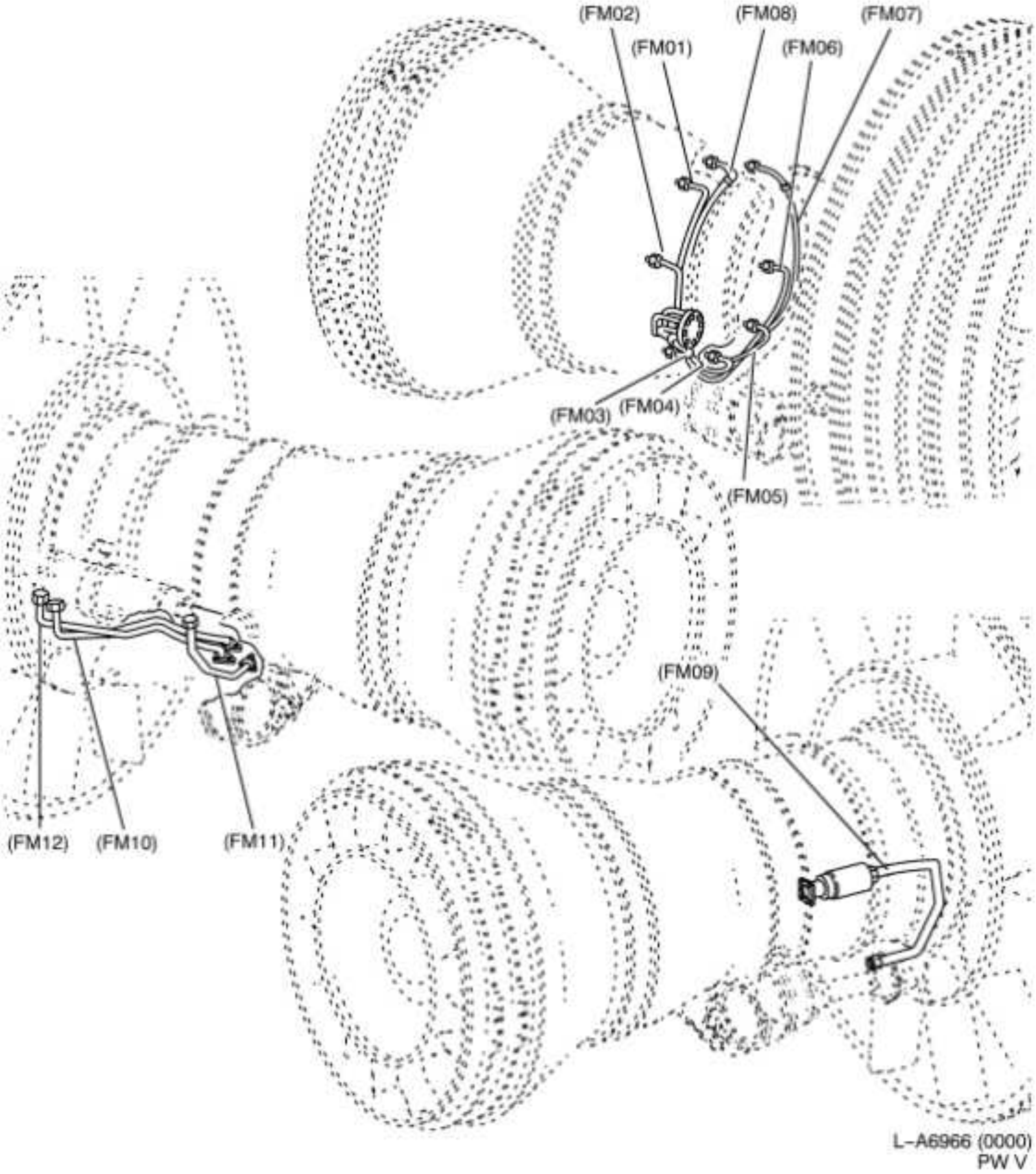
Hydraulic Control Return System (CR) (Schematic)
Figure 6 (Sheet 1)
(Task 72-09-71-990-001)


(CR13)
(CR01)
(CR10)
(CR11)
(CR04)
(CR03)
(CR12)
(CR09)
(CR05)
(CR04)
(CR08)
(CR02)
L−A7072 (0000)
PW V

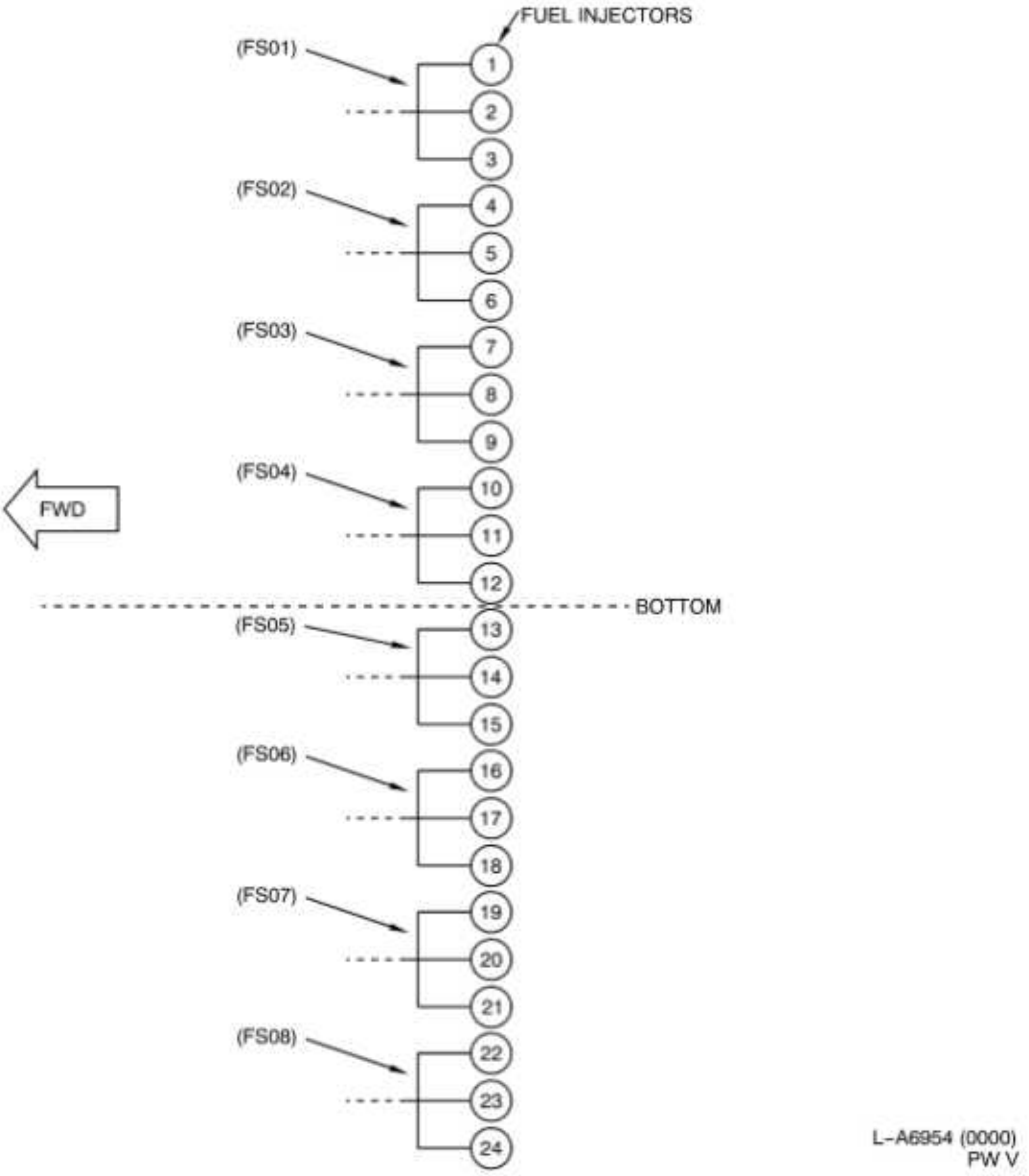
Hydraulic Control Return System (CR) (Tube Locations)
Figure 6 (Sheet 2)
(Task 72−09−71−990−001)


FUEL INJECTORS
FWD
(FM01)
(FM02)
(FM03)
(FM04)
(FM05)
(FM06)
(FM07)
(FM08)
(FM09)
(FM10)
(FM11)
(FM12)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
BOTTOM
BOTTOM
FUEL FLOWMETER
FUEL DISTRIBUTION VALVE
FUEL METERING UNIT
FUEL PUMP
FUEL BYPASS VALVE
BYPASS VALVE
F/O IDG OIL
COOLER ENG OIL
OUT
OUT
L-A6953 (0000)

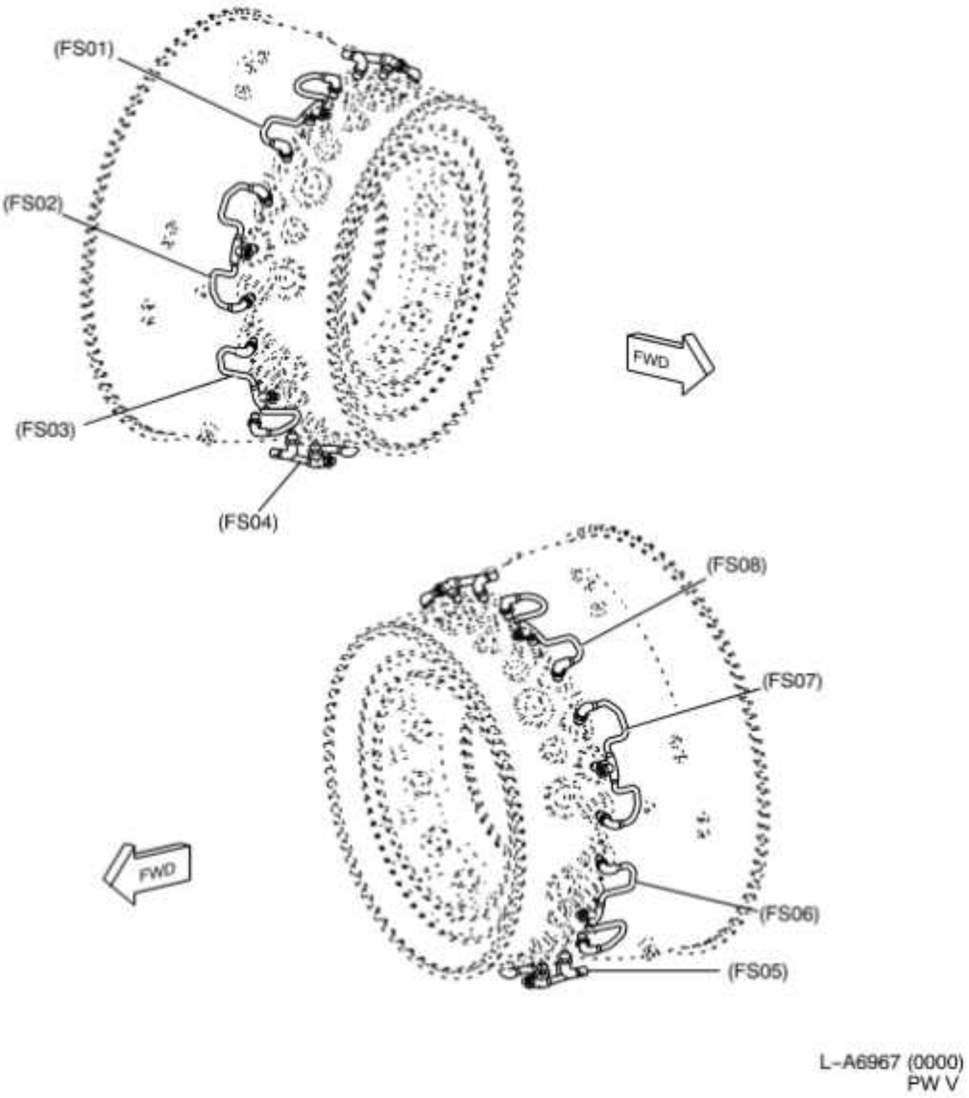
Fuel Main Supply System (FM) (Schematic)
Figure 7 (Sheet 1)
(Task 72-09-71-990-001)


(FM02)
(FM08)
(FM07)
(FM01)
(FM06)
(FM03)
(FM04)
(FM05)
(FM09)
(FM12)
(FM10)
(FM11)
L−A6966 (0000)
PW V

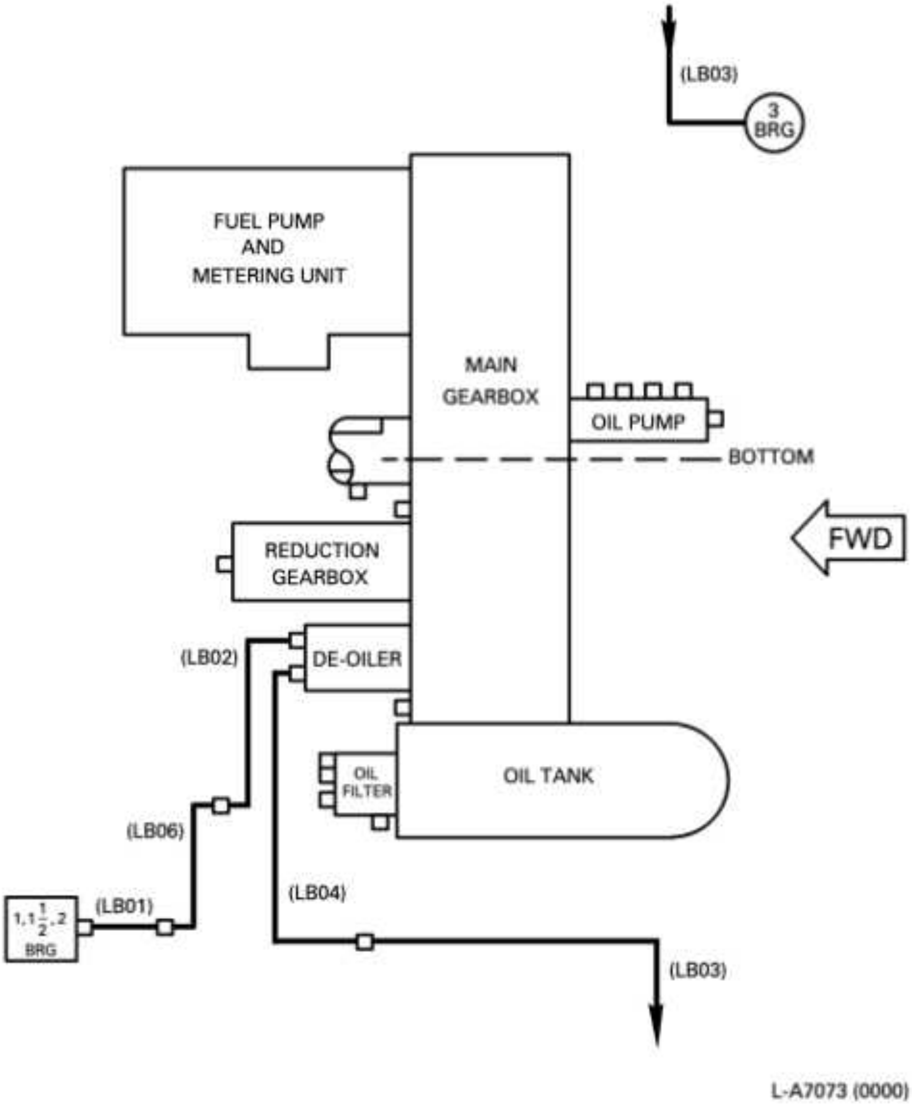
Fuel Main Supply System (FM) (Tube Locations)
Figure 7 (Sheet 2)
(Task 72−09−71−990−001)


FUEL INJECTORS
(FS01)
(FS02)
(FS03)
(FS04)
(FS05)
(FS06)
(FS07)
(FS08)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
FWD
BOTTOM
L−A6954 (0000)
PW V

Fuel Supply To Injector System (FS) (Schematic)
Figure 8 (Sheet 1)
(Task 72−09−71−990−001)

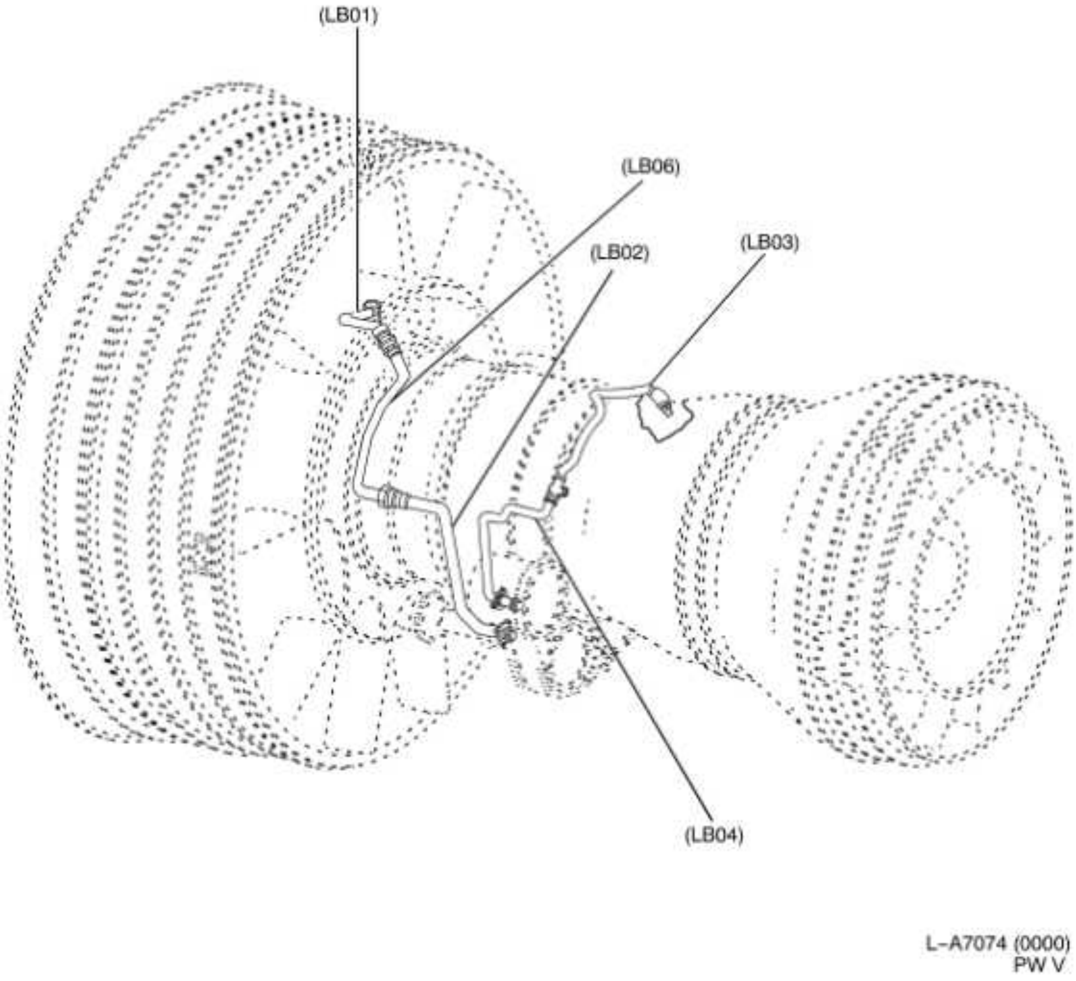

(FS01)
(FS02)
(FS03)
(FS04)
FWD
(FS08)
(FS07)
FWD
(FS06)
(FS05)
L-A6967 (0000)
PW V

Fuel Supply To Injector System (FS) (Tube Locations)
Figure 8 (Sheet 2)
(Task 72−09−71−990−001)

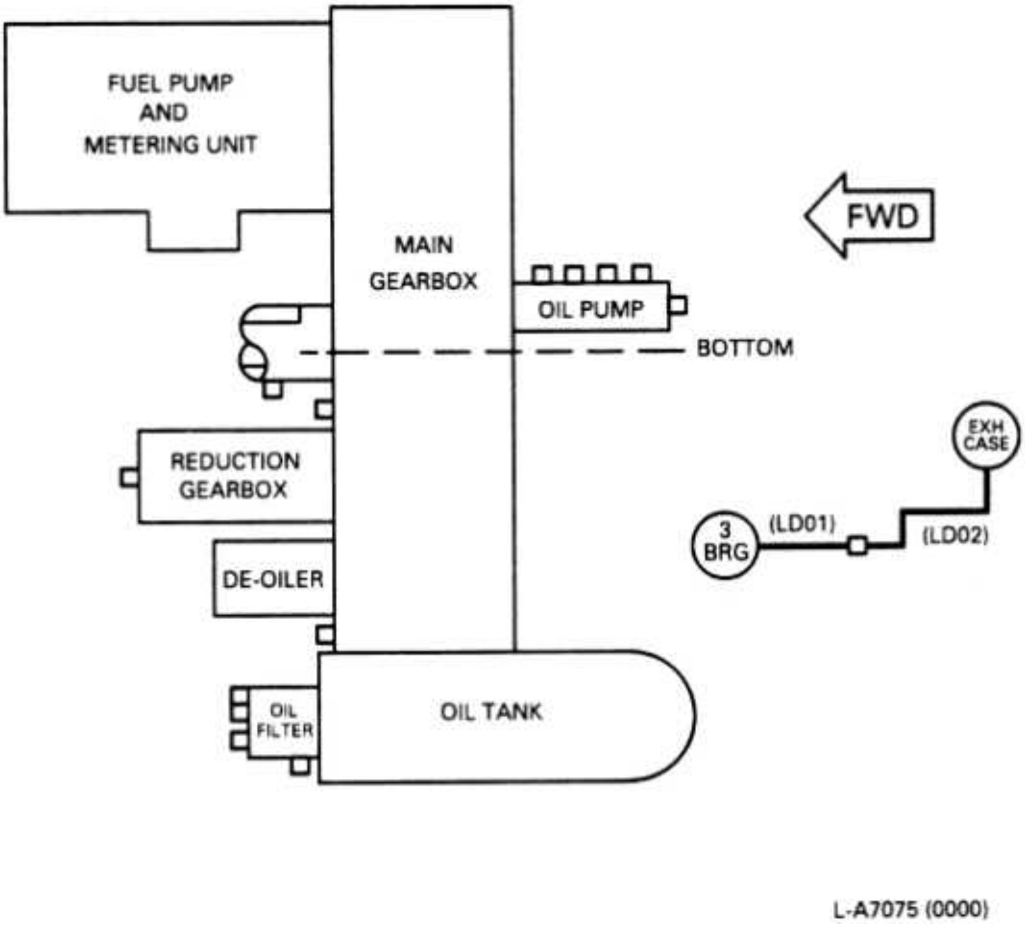

(LB03)
3 BRG
FUEL PUMP AND METERING UNIT
MAIN GEARBOX
OIL PUMP
BOTTOM
FWD
REDUCTION GEARBOX
(LB02)
DE-OILER
OIL FILTER
OIL TANK
(LB06)
(LB04)
1,1½,2 BRG
(LB01)
(LB03)
L-A7073 (0000)

Lubrication Breather System (LB) (Schematic)
Figure 9 (Sheet 1)
(Task 72−09−71−990−001)

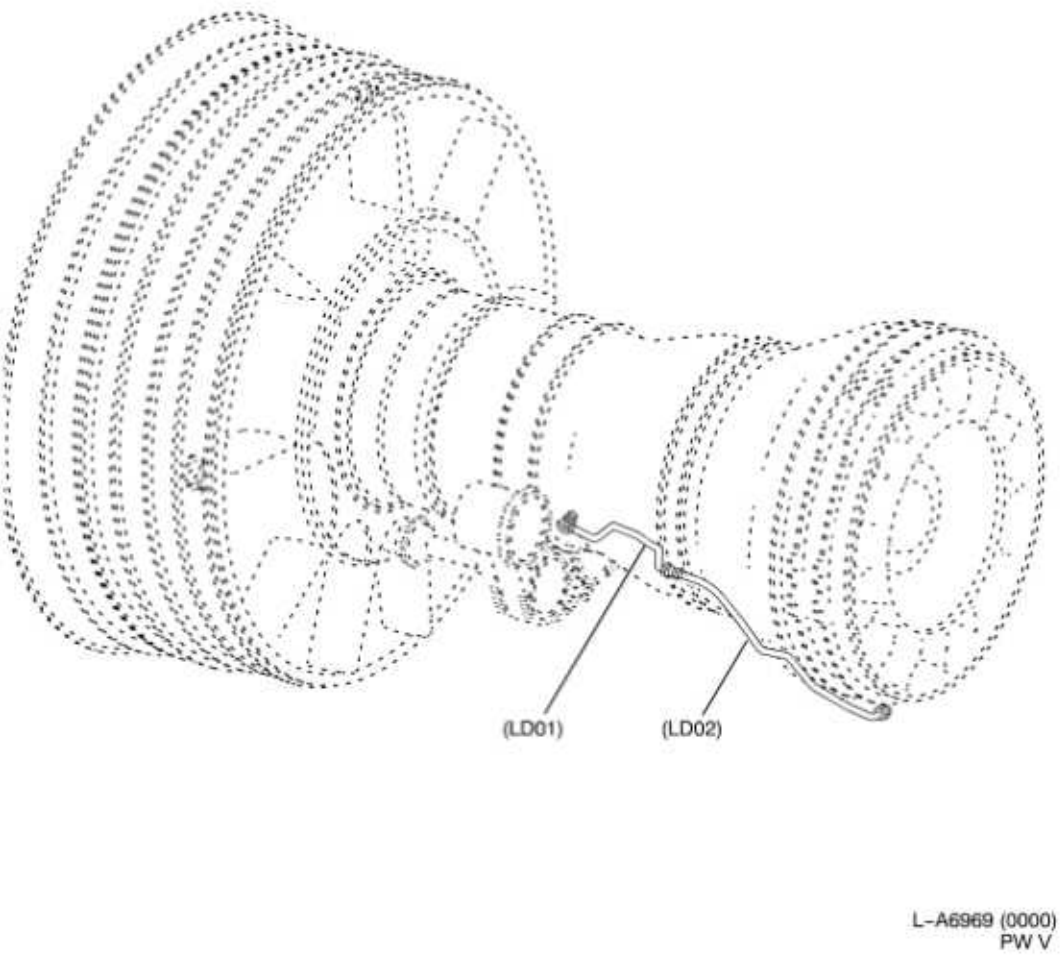
ENGINE EXTERNAL TUBES - DESCRIPTION/OPERATION-00


(LB01)
(LB06)
(LB02)
(LB03)
(LB04)
L-A7074 (0000)
PW V

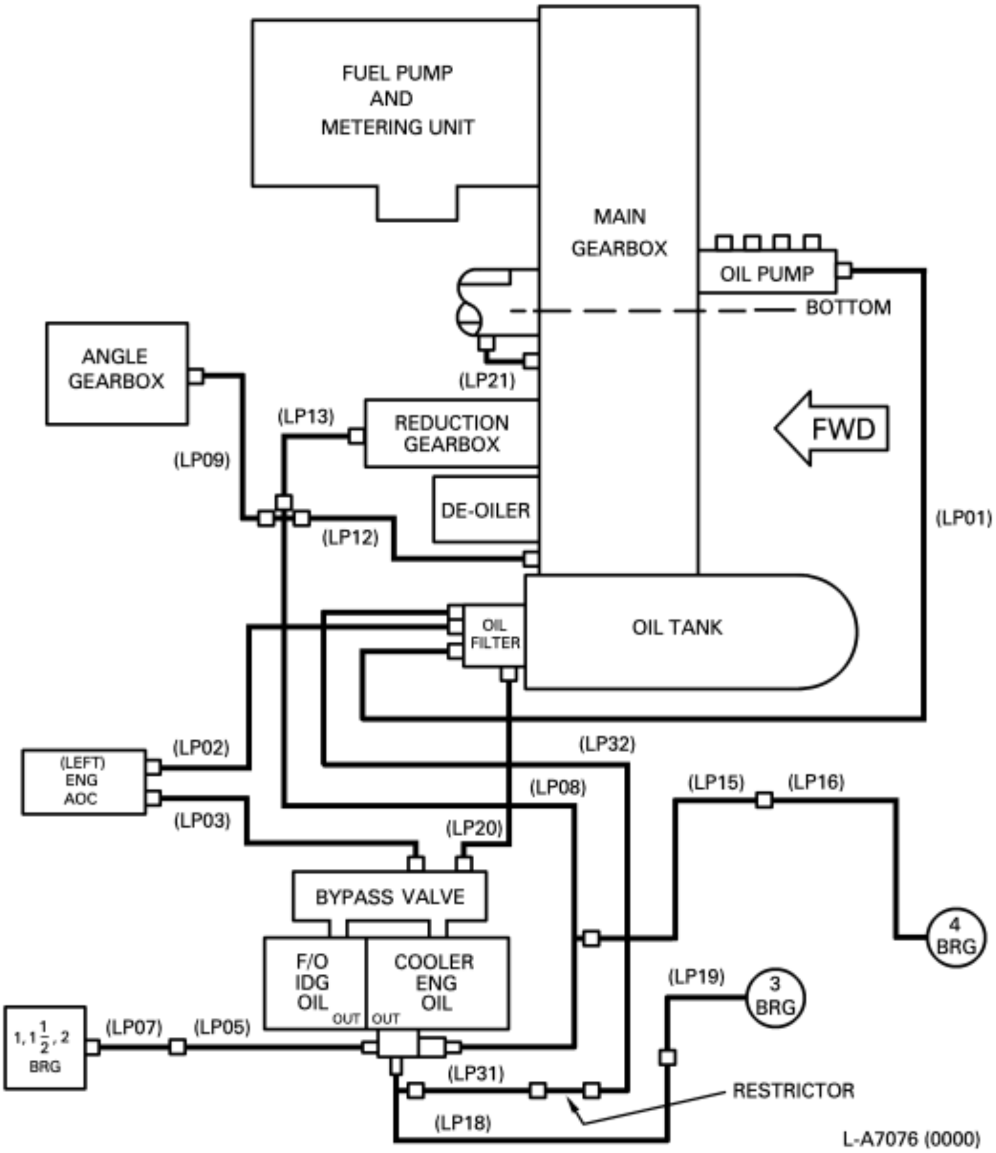
Lubrication Breather System (LB) (Tube Locations)
Figure 9 (Sheet 2)
(Task 72-09-71-990-001)


FUEL PUMP AND METERING UNIT
MAIN GEARBOX
FWD
OIL PUMP
BOTTOM
EXH CASE
REDUCTION GEARBOX
3 BRG
(LD01)
(LD02)
DE-OILER
OIL FILTER
OIL TANK
L-A7075 (0000)

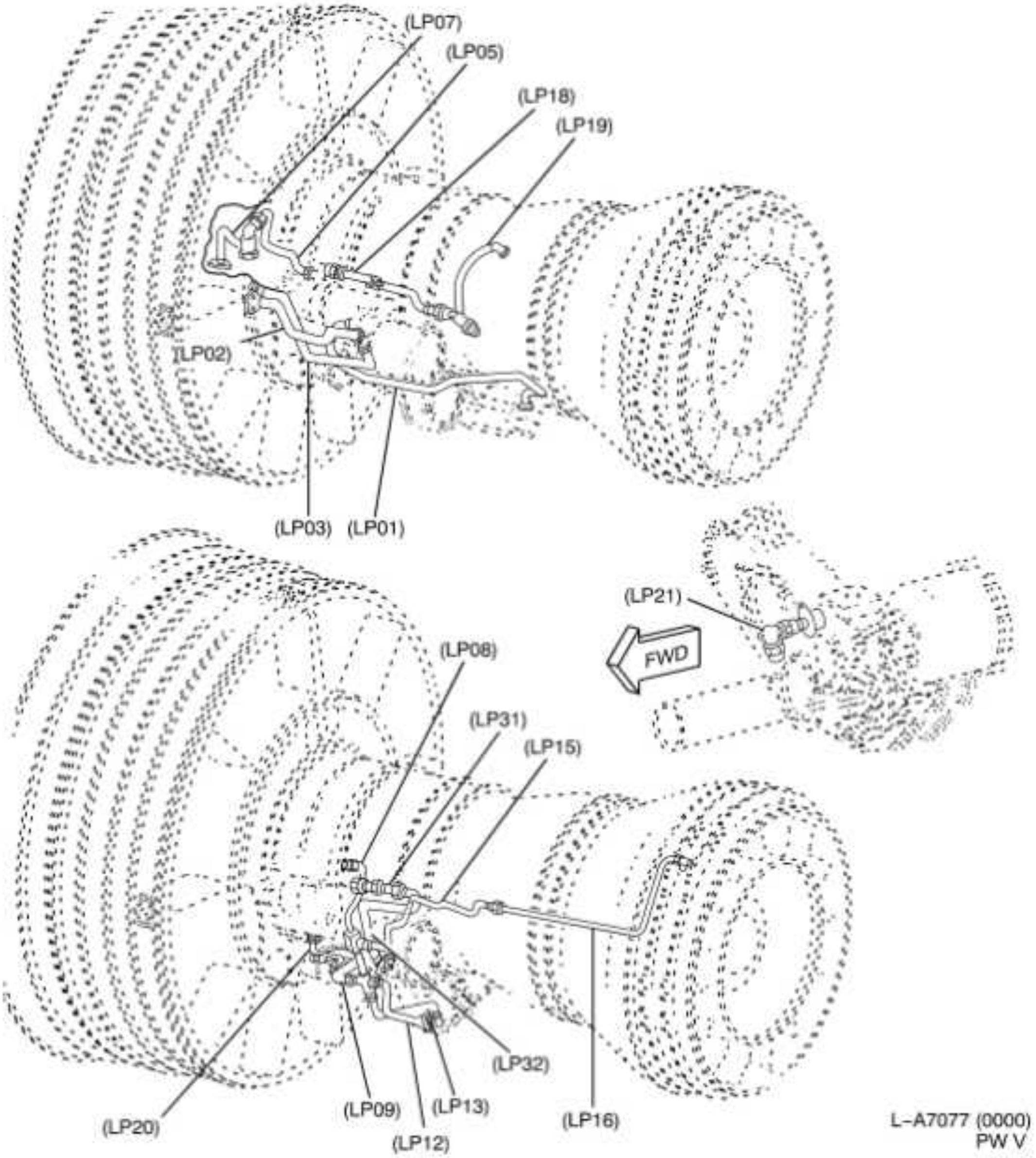
Lubrication Drain System (LD) (Schematic)
Figure 10 (Sheet 1)
(Task 72-09-71-990-001)



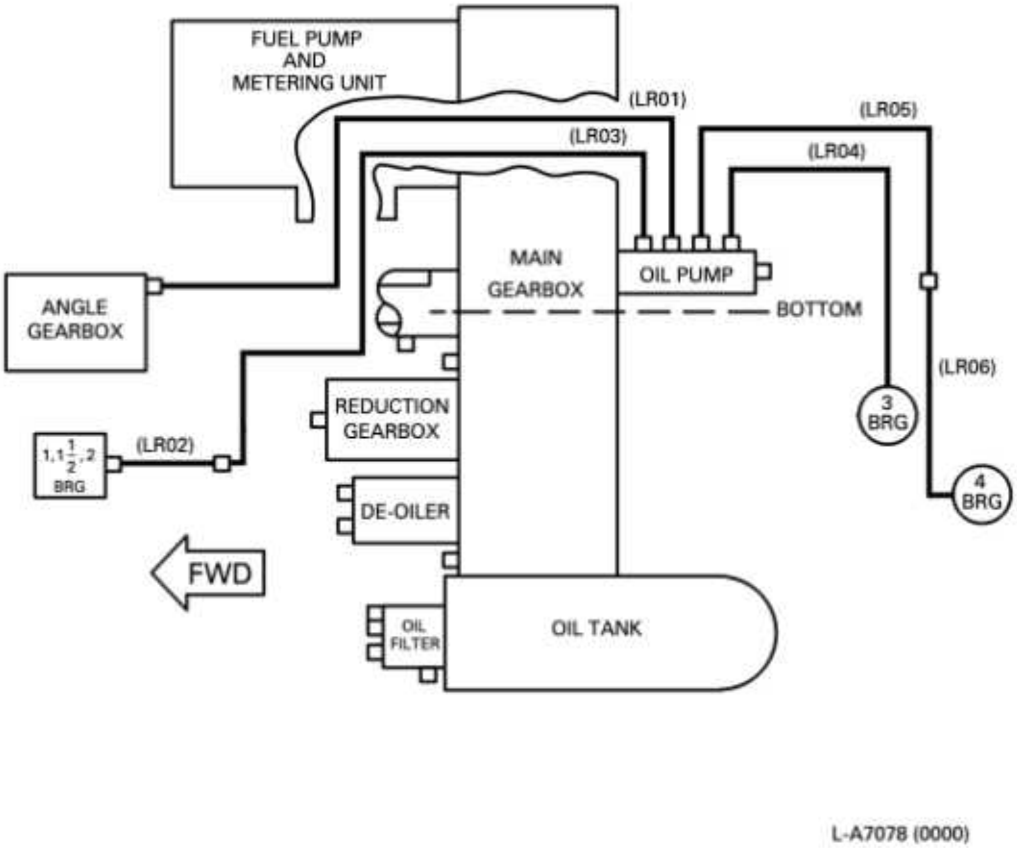
Lubrication Drain System (LD) (Tube Locations)
Figure 10 (Sheet 2)
(Task 72−09−71−990−001)


FUEL PUMP AND METERING UNIT
MAIN GEARBOX
OIL PUMP
BOTTOM
ANGLE GEARBOX
(LP21)
(LP13)
REDUCTION GEARBOX
FWD
(LP09)
DE-OILER
(LP12)
(LP01)
OIL FILTER
OIL TANK
(LP02)
(LP32)
(LEFT) ENG AOC
(LP08)
(LP15)
(LP16)
(LP03)
(LP20)
BYPASS VALVE
4 BRG
F/O IDG OIL
OUT
COOLER ENG OIL
OUT
(LP19)
3 BRG
$1, 1\frac{1}{2}, 2$ BRG
(LP07)
(LP05)
(LP31)
RESTRICTOR
(LP18)
L-A7076 (0000)

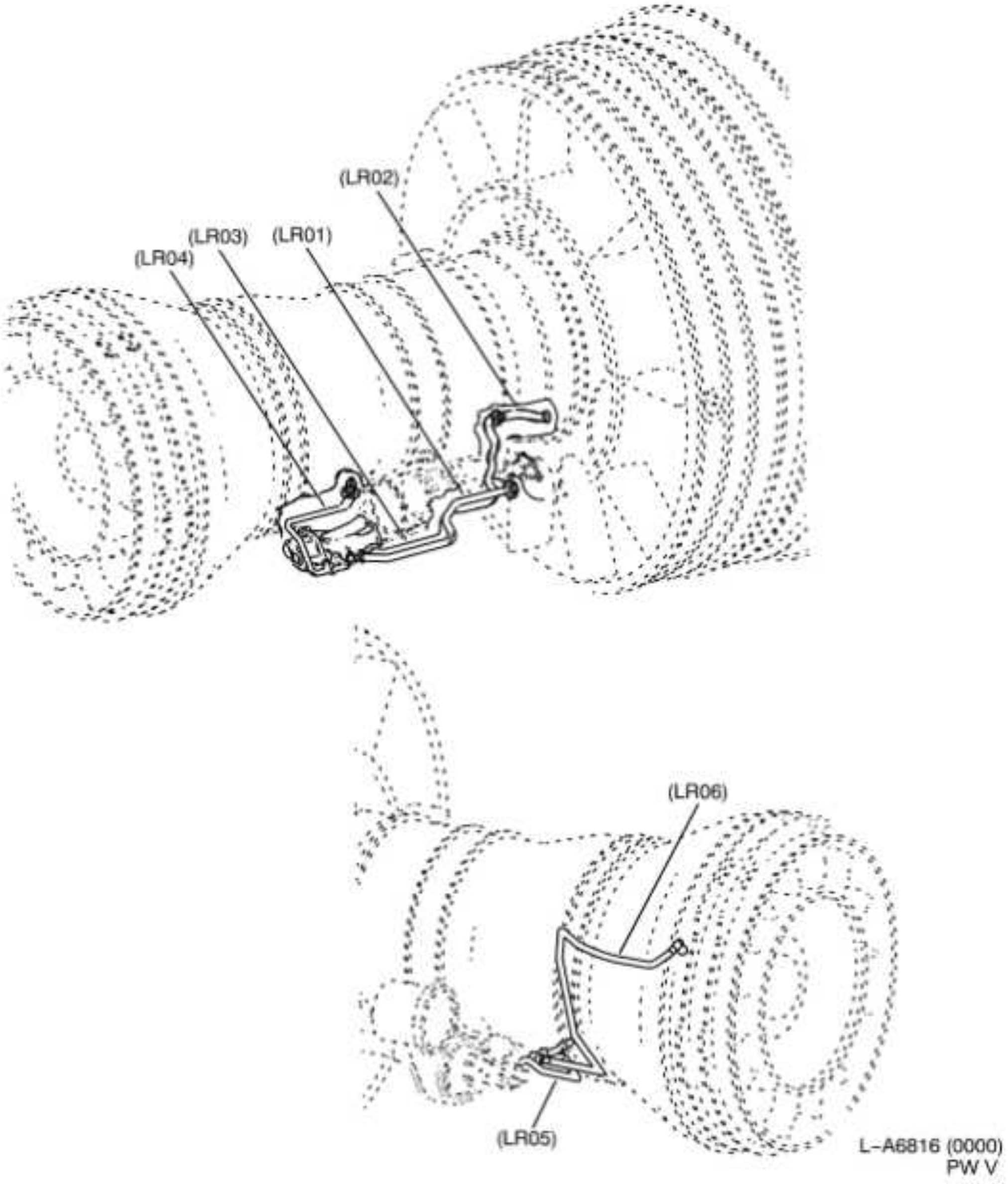
Lubrication Pressure System (LP) (Schematic)
Figure 11 (Sheet 1)
(Task 72−09−71−990−001)


(LP07)
(LP05)
(LP18)
(LP19)
(LP02)
(LP03)
(LP01)
(LP21)
FWD
(LP08)
(LP31)
(LP15)
(LP32)
(LP20)
(LP09)
(LP13)
(LP12)
(LP16)
L-A7077 (0000)
PW V

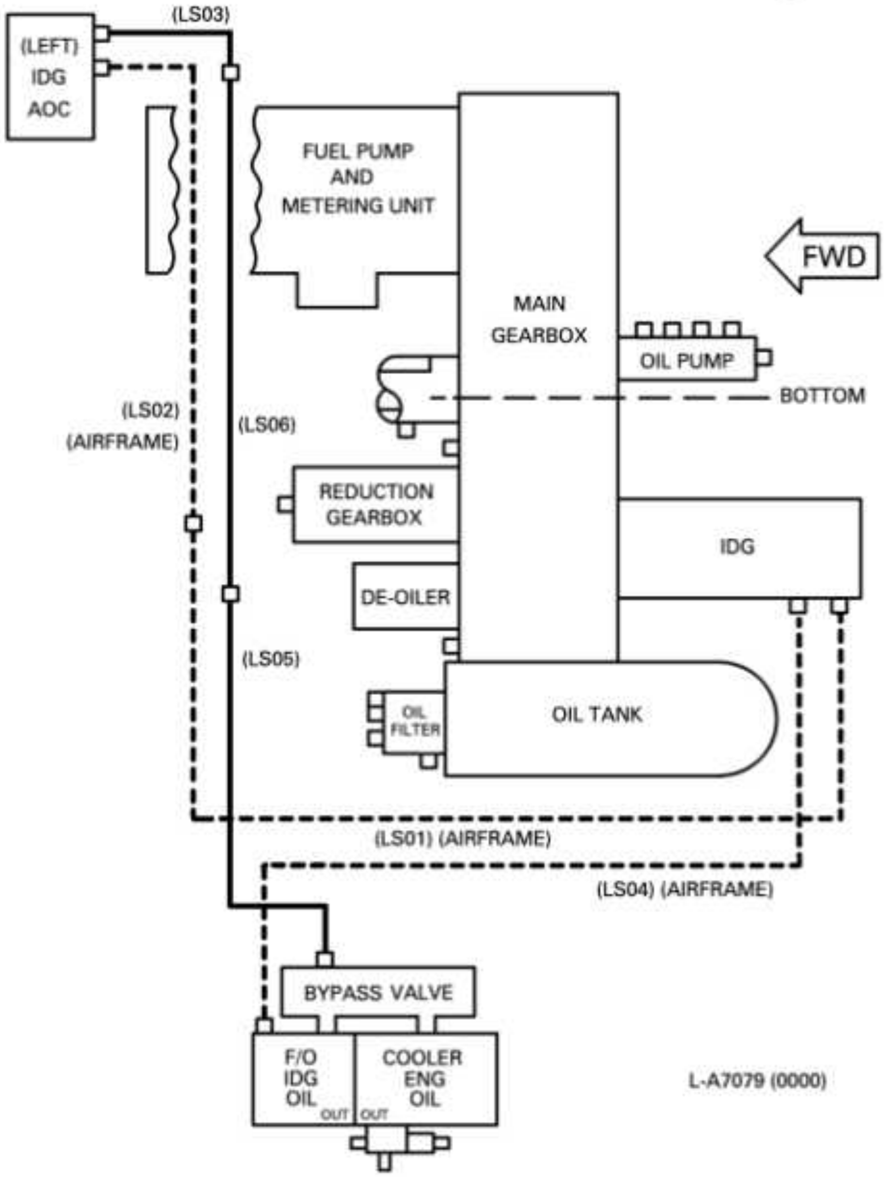
Lubrication Pressure System (LP)
Figure 11 (Sheet 2)
(Task 72-09-71-990-001)


FUEL PUMP AND METERING UNIT
(LR01)
(LR05)
(LR03)
(LR04)
MAIN GEARBOX
OIL PUMP
ANGLE GEARBOX
BOTTOM
(LR06)
3 BRG
REDUCTION GEARBOX
$1, 1\frac{1}{2}, 2$ BRG
(LR02)
4 BRG
DE-OILER
FWD
OIL FILTER
OIL TANK
L-A7078 (0000)

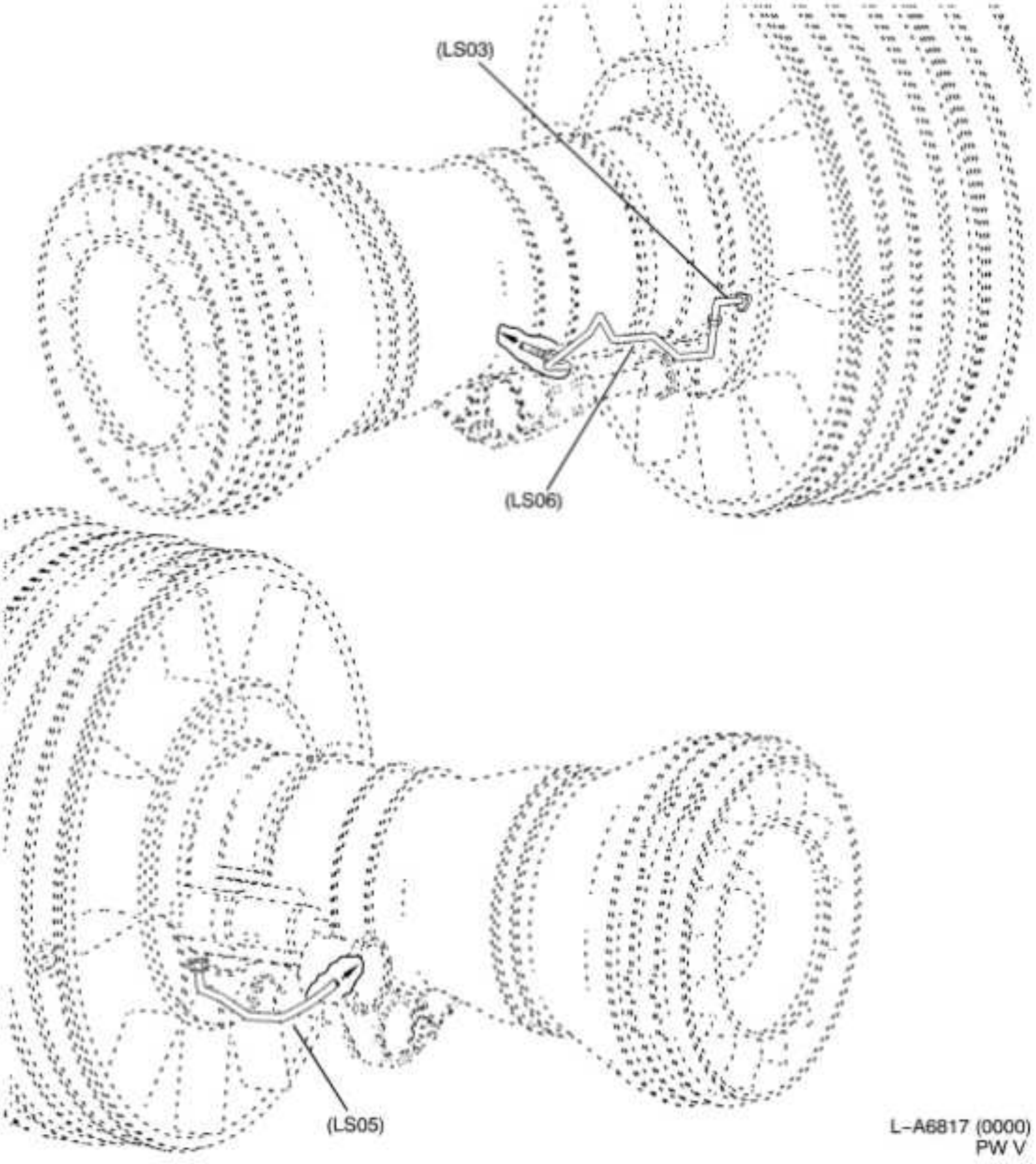
Lubrication Return Scavenge System (LR) (Schematic)
Figure 12 (Sheet 1)
(Task 72-09-71-990-001)


(LR02)
(LR03)
(LR01)
(LR04)
(LR06)
(LR05)
L-A6816 (0000)
PW V

Lubrication Return Scavenge System (LR) (Tube Locations)
Figure 12 (Sheet 2)
(Task 72-09-71-990-001)


(LS03)
(LEFT)
IDG
AOC
FUEL PUMP
AND
METERING UNIT
FWD
MAIN
GEARBOX
OIL PUMP
BOTTOM
(LS02)
(AIRFRAME)
(LS06)
REDUCTION
GEARBOX
IDG
DE-OILER
(LS05)
OIL
FILTER
OIL TANK
(LS01) (AIRFRAME)
(LS04) (AIRFRAME)
BYPASS VALVE
F/O
IDG
OIL
OUT
OUT
COOLER
ENG
OIL
L-A7079 (0000)

IDG Lubrication System (LS) (Schematic)
Figure 13 (Sheet 1)
(Task 72-09-71-990-001)


(LS03)
(LS06)
(LS05)
L−A6817 (0000)
PW V

IDG Lubrication System (LS) (Tube Locations)
Figure 13 (Sheet 2)
(Task 72−09−71−990−001)

ENGINE EXTERNAL TUBES − REPAIR−00

Task 72−09−71−990−004:

1. Repair Part Number Index − Engine External Tubes
   A. Table 901 contains a listing of specific part numbers and the repairs which apply to each part number. Reference Service Bulletins are listed for parts introduced or obtained by Service Bulletins.

PART NUMBER	REPAIR	SERVICE BULLETIN
52T837−01 (Typical)	−01	None

Repair Part Number Index
Table 901

ENGINE EXTERNAL TUBES - REPAIR-01

Task 72-09-71-300-001:

1. Tube Assemblies - Voi-Shan Seal Repair Of Conical Seats

A. Equipment And Materials Required - None

B. Procedure

NOTE: This repair is to correct leakage of conical seats on tube fittings that have small nicks and scratches on the sealing surfaces.

(1) Loosen the tube nut and disconnect the tube.

(2) Make clean (wipe) the conical seat mating surfaces.

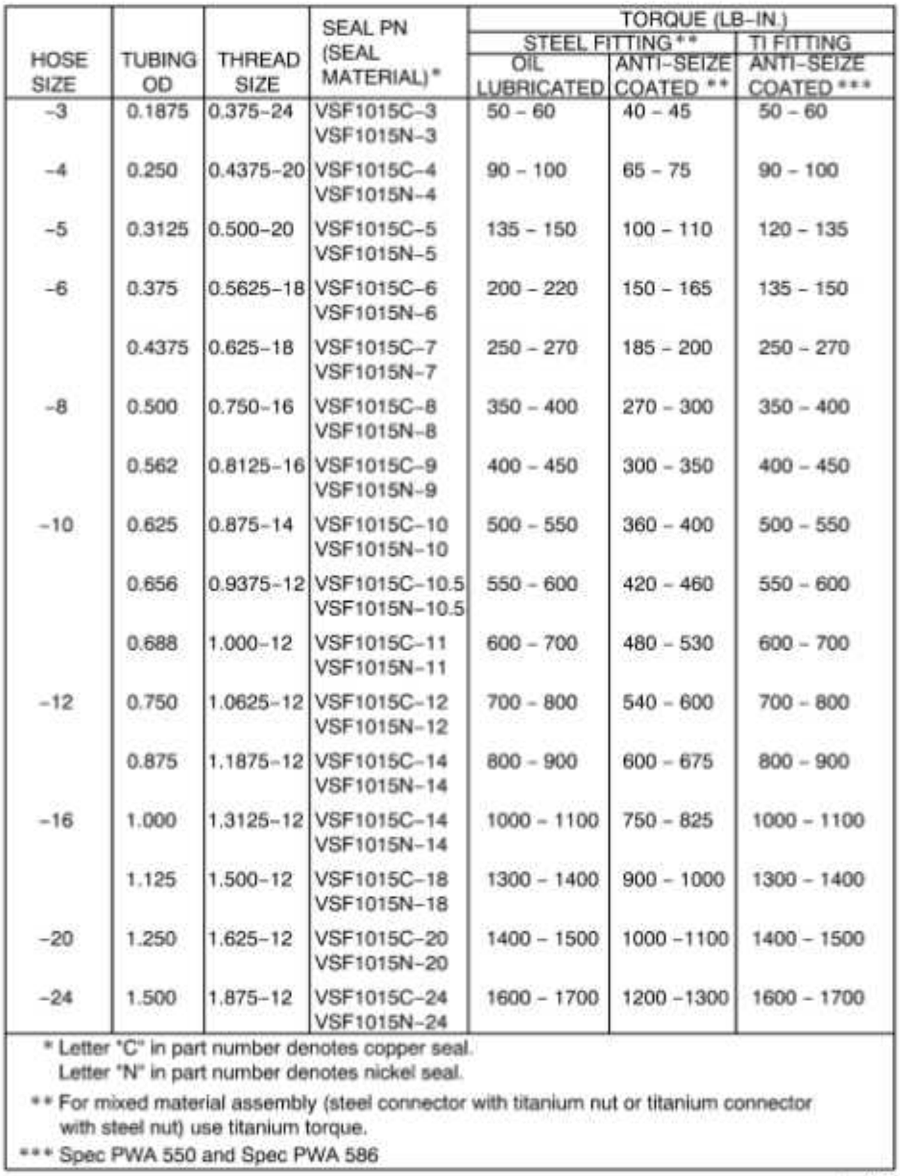
(3) Put the correct part number Voi-Shan seal on the male conical seat. See Table 901 and Table 902 or you can get the catalog from:

Voi-Shan Mfg.
Div. VSI Corp.
Box 512
8463 Higuera St.
Culver City, CA 90230

(4) With the Voi-Shan seal installed connect the tubes.

(5) Torque the tube nut to the correct torque for the tube size. See Table 901 and 902.

ENGINE EXTERNAL TUBES − REPAIR−01



HOSE SIZE	TUBING OD	THREAD SIZE	SEAL PN (SEAL MATERIAL)*	TORQUE (LB–IN.)		
				STEEL FITTING**		TI FITTING
				OIL LUBRICATED	ANTI–SEIZE COATED **	ANTI–SEIZE COATED ***
–3	0.1875	0.375–24	VSF1015C–3 VSF1015N–3	50 – 60	40 – 45	50 – 60
–4	0.250	0.4375–20	VSF1015C–4 VSF1015N–4	90 – 100	65 – 75	90 – 100
–5	0.3125	0.500–20	VSF1015C–5 VSF1015N–5	135 – 150	100 – 110	120 – 135
–6	0.375	0.5625–18	VSF1015C–6 VSF1015N–6	200 – 220	150 – 165	135 – 150
	0.4375	0.625–18	VSF1015C–7 VSF1015N–7	250 – 270	185 – 200	250 – 270
–8	0.500	0.750–16	VSF1015C–8 VSF1015N–8	350 – 400	270 – 300	350 – 400
	0.562	0.8125–16	VSF1015C–9 VSF1015N–9	400 – 450	300 – 350	400 – 450
–10	0.625	0.875–14	VSF1015C–10 VSF1015N–10	500 – 550	360 – 400	500 – 550
	0.656	0.9375–12	VSF1015C–10.5 VSF1015N–10.5	550 – 600	420 – 460	550 – 600
	0.688	1.000–12	VSF1015C–11 VSF1015N–11	600 – 700	480 – 530	600 – 700
–12	0.750	1.0625–12	VSF1015C–12 VSF1015N–12	700 – 800	540 – 600	700 – 800
	0.875	1.1875–12	VSF1015C–14 VSF1015N–14	800 – 900	600 – 675	800 – 900
–16	1.000	1.3125–12	VSF1015C–14 VSF1015N–14	1000 – 1100	750 – 825	1000 – 1100
	1.125	1.500–12	VSF1015C–18 VSF1015N–18	1300 – 1400	900 – 1000	1300 – 1400
–20	1.250	1.625–12	VSF1015C–20 VSF1015N–20	1400 – 1500	1000 –1100	1400 – 1500
–24	1.500	1.875–12	VSF1015C–24 VSF1015N–24	1600 – 1700	1200 –1300	1600 – 1700

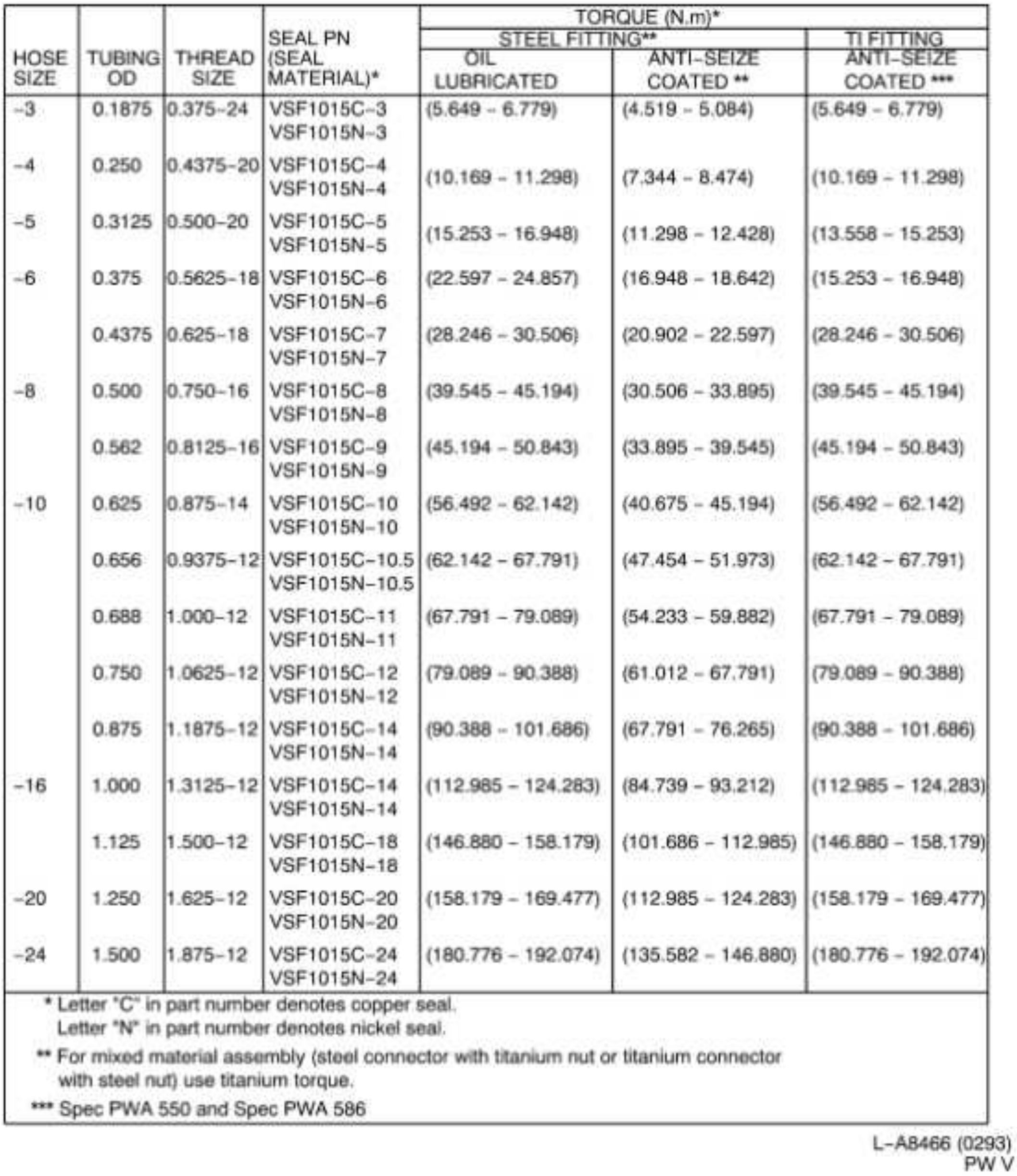
* Letter "C" in part number denotes copper seal.
Letter "N" in part number denotes nickel seal.

** For mixed material assembly (steel connector with titanium nut or titanium connector with steel nut) use titanium torque.

*** Spec PWA 550 and Spec PWA 586

L–A8465 (0293)
PW V

Torque Values (Lb−In.) And Part Numbers For 37 Degrees Cone Seat Connectors With Nickel Gaskets
Table 901



HOSE SIZE	TUBING OD	THREAD SIZE	SEAL PN (SEAL MATERIAL)*	TORQUE (N.m)*		
				STEEL FITTING**		TI FITTING
				OIL LUBRICATED	ANTI-SEIZE COATED **	ANTI-SEIZE COATED ***
-3	0.1875	0.375-24	VSF1015C-3 VSF1015N-3	(5.649 - 6.779)	(4.519 - 5.084)	(5.649 - 6.779)
-4	0.250	0.4375-20	VSF1015C-4 VSF1015N-4	(10.169 - 11.298)	(7.344 - 8.474)	(10.169 - 11.298)
-5	0.3125	0.500-20	VSF1015C-5 VSF1015N-5	(15.253 - 16.948)	(11.298 - 12.428)	(13.558 - 15.253)
-6	0.375	0.5625-18	VSF1015C-6 VSF1015N-6	(22.597 - 24.857)	(16.948 - 18.642)	(15.253 - 16.948)
	0.4375	0.625-18	VSF1015C-7 VSF1015N-7	(28.246 - 30.506)	(20.902 - 22.597)	(28.246 - 30.506)
-8	0.500	0.750-16	VSF1015C-8 VSF1015N-8	(39.545 - 45.194)	(30.506 - 33.895)	(39.545 - 45.194)
	0.562	0.8125-16	VSF1015C-9 VSF1015N-9	(45.194 - 50.843)	(33.895 - 39.545)	(45.194 - 50.843)
-10	0.625	0.875-14	VSF1015C-10 VSF1015N-10	(56.492 - 62.142)	(40.675 - 45.194)	(56.492 - 62.142)
	0.656	0.9375-12	VSF1015C-10.5 VSF1015N-10.5	(62.142 - 67.791)	(47.454 - 51.973)	(62.142 - 67.791)
	0.688	1.000-12	VSF1015C-11 VSF1015N-11	(67.791 - 79.089)	(54.233 - 59.882)	(67.791 - 79.089)
	0.750	1.0625-12	VSF1015C-12 VSF1015N-12	(79.089 - 90.388)	(61.012 - 67.791)	(79.089 - 90.388)
	0.875	1.1875-12	VSF1015C-14 VSF1015N-14	(90.388 - 101.686)	(67.791 - 76.265)	(90.388 - 101.686)
-16	1.000	1.3125-12	VSF1015C-14 VSF1015N-14	(112.985 - 124.283)	(84.739 - 93.212)	(112.985 - 124.283)
	1.125	1.500-12	VSF1015C-18 VSF1015N-18	(146.880 - 158.179)	(101.686 - 112.985)	(146.880 - 158.179)
-20	1.250	1.625-12	VSF1015C-20 VSF1015N-20	(158.179 - 169.477)	(112.985 - 124.283)	(158.179 - 169.477)
-24	1.500	1.875-12	VSF1015C-24 VSF1015N-24	(180.776 - 192.074)	(135.582 - 146.880)	(180.776 - 192.074)

* Letter "C" in part number denotes copper seal.
Letter "N" in part number denotes nickel seal.

** For mixed material assembly (steel connector with titanium nut or titanium connector with steel nut) use titanium torque.

*** Spec PWA 550 and Spec PWA 586

L-A8466 (0293)
PW V

Torque Values (N.m) And Part Numbers For 37 Degrees Cone Seat Connectors With Nickel Gaskets
Table 902

Return to Previous Menu

72−31−00

	LIST OF EFFECTIVE PAGES
	HIGHLIGHTS
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72−31−00	LOW PRESSURE COMPRESSOR (LPC) − HOW TO USE • 72−31−00−990−003: Chapter/Section/Subject Numbering Outline
72−31−00	LOW PRESSURE COMPRESSOR (LPC) − DESCRIPTION AND OPERATION • 72−31−00−990−002: Low Pressure Compressor (LPC)
72−31−00	LOW PRESSURE COMPRESSOR (LPC) − DISASSEMBLY−01 • 72−31−00−030−001: Disassemble Low Pressure Compressor (LPC)
72−31−00	LOW PRESSURE COMPRESSOR (LPC) − DISASSEMBLY−02 • 72−31−00−030−002−001: Disassemble No. 1 Bearing And Seal Assembly (Mechanical Method)
72−31−00	LOW PRESSURE COMPRESSOR (LPC) − DISASSEMBLY−03 • 72−31−00−030−002−002: Disassemble No. 1 Bearing And Seal Assembly (Hydraulic Method)
72−31−00	LOW PRESSURE COMPRESSOR (LPC) − INSPECTION/CHECK−01 • 72−31−00−990−004: General Inspection Requirements − Low Pressure Compressor (LPC)
72−31−00	LOW PRESSURE COMPRESSOR (LPC) − INSPECTION/CHECK−03 • 72−31−00−990−005: Visual Inspection − Low Pressure Compressor (LPC)
72−31−00	LOW PRESSURE COMPRESSOR (LPC) − INSPECTION/CHECK−04 • 72−31−00−990−001: Specific Fits And Clearances
72−31−00	LOW PRESSURE COMPRESSOR (LPC) − INSPECTION/CHECK−05 • 72−31−00−200−005: Functional Check − Vacuum Check No. 1 Bearing Compartment
72−31−00	LOW PRESSURE COMPRESSOR (LPC) − ASSEMBLY−01 • 72−31−00−400−001: Assemble Low Pressure Compressor (LPC)
72−31−00	LOW PRESSURE COMPRESSOR (LPC) − ASSEMBLY−02

	- 72−31−00−400−002−001: Install The No. 1 Bearing And Seal Assembly (Mechanical Method)
72−31−00	LOW PRESSURE COMPRESSOR (LPC) − ASSEMBLY−03 - 72−31−00−400−002−002: Install The No. 1 Bearing And Seal Assembly (Hydraulic Method)
72−31−00	LOW PRESSURE COMPRESSOR (LPC) − STORAGE−01 - 72−31−00−530−001: Pack Low Pressure Compressor (LPC) - 72−31−00−540−001: Unpack Low Pressure Compressor (LPC)
72−31−01	AXIAL COMPRESSOR ROTOR ASSEMBLY − DISASSEMBLY−01 - 72−31−01−040−001: Disassemble The Axial Compressor Rotor Assembly
72−31−01	AXIAL COMPRESSOR ROTOR ASSEMBLY − INSPECTION/CHECK−00 - 72−31−01−990−001: Inspection/Check Part Number Index − Axial Compressor Rotor Assembly
72−31−01	AXIAL COMPRESSOR ROTOR ASSEMBLY − INSPECTION/CHECK−03 - 72−31−01−200−003: Visual Inspection − Axial Compressor Rotor Assembly
72−31−01	AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−01 - 72−31−01−440−001: Assemble Axial Compressor Rotor Assembly (Stage 2)
72−31−01	AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−02 - 72−31−01−440−002: Assemble Axial Compressor Rotor Assembly (Stage 4)
72−31−01	AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−03 - 72−31−01−440−003: Assemble Axial Compressor Rotor Assembly (Stage 3)
72−31−01	AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04 - 72−31−01−440−004: Assemble Axial Compressor Rotor Assembly (Stage 1.6)
72−31−01	AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−05 - 72−31−01−440−005: Assemble Hub To Drum Rotor And Check Runout
72−31−01	AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−06 - 72−31−01−440−006: Balance LPC Rotor (Fan Blades Not Included)
72−31−01	AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−07

	- 72−31−01−440−007: Assemble Fan Blades To Hub
72−31−01	AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−08 - 72−31−01−440−008−A: Balance LPC Rotor (Fan Blades Included) By Fan Blade Set Replacement - 72−31−01−440−008−B: Balance LPC Rotor (Fan Blades Included) By Counterweight Installation
72−31−01	AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−09 - 72−31−01−440−009: Remove Fan Blades And Arbor
72−31−17	NO. 1 BEARING (CARBON) SEAL ASSEMBLY − DISASSEMBLY−01 - 72−31−17−040−001: Disassemble No. 1 Bearing (Carbon) Seal Assembly
72−31−17	NO. 1 BEARING (CARBON) SEAL ASSEMBLY − ASSEMBLY−01 - 72−31−17−440−001: Assemble No. 1 Bearing (Carbon) Seal Assembly
72−31−17	NO. 1 BEARING (CARBON) SEAL ASSEMBLY − TESTING−01 - 72−31−17−720−001: Airflow Check No. 1 Bearing (Carbon) Seal Assembly
72−31−81	COMPRESSOR INLET CONE (REAR) SEGMENT ASSEMBLY − ASSEMBLY−01 - 72−31−81−440−001: Balance Compressor Inlet Cone (Rear) Segment Assembly
72−31−82	STAGE 1 LPC BLADE ASSEMBLY − ASSEMBLY−01 - 72−31−82−440−001: Balance Complete Stage 1 LPC Blade (Fan Blade Set) Assemblies

Previous Pageblock Return to Previous Menu Next Pageblock

LOW PRESSURE COMPRESSOR (LPC) − HOW TO USE

Task 72−31−00−990−003:

1. Chapter/Section/Subject Numbering Outline

See Figure 1.

NOTE: See the tab separated How To Use Manual section located at the beginning of this manual set for information concerning Data Location Guidelines and a complete Chapter/Section/Subject numbering outline for all manual sections.

A. The following is a complete listing of the individual Chapter/Section/Subject numbers and specific nomenclatures which have been assigned to the significant Low Pressure Compressor (LPC) parts.

(1) Numbers which are not assigned are indicated in the list by one of the following terms:

UNASSIGNED − This designation is for numbers intentionally omitted and reserved for possible future use.

NOT USED − This designation is applied to numbers used in other related engine model programs which are not at this time, applicable to the engine models represented by this manual.

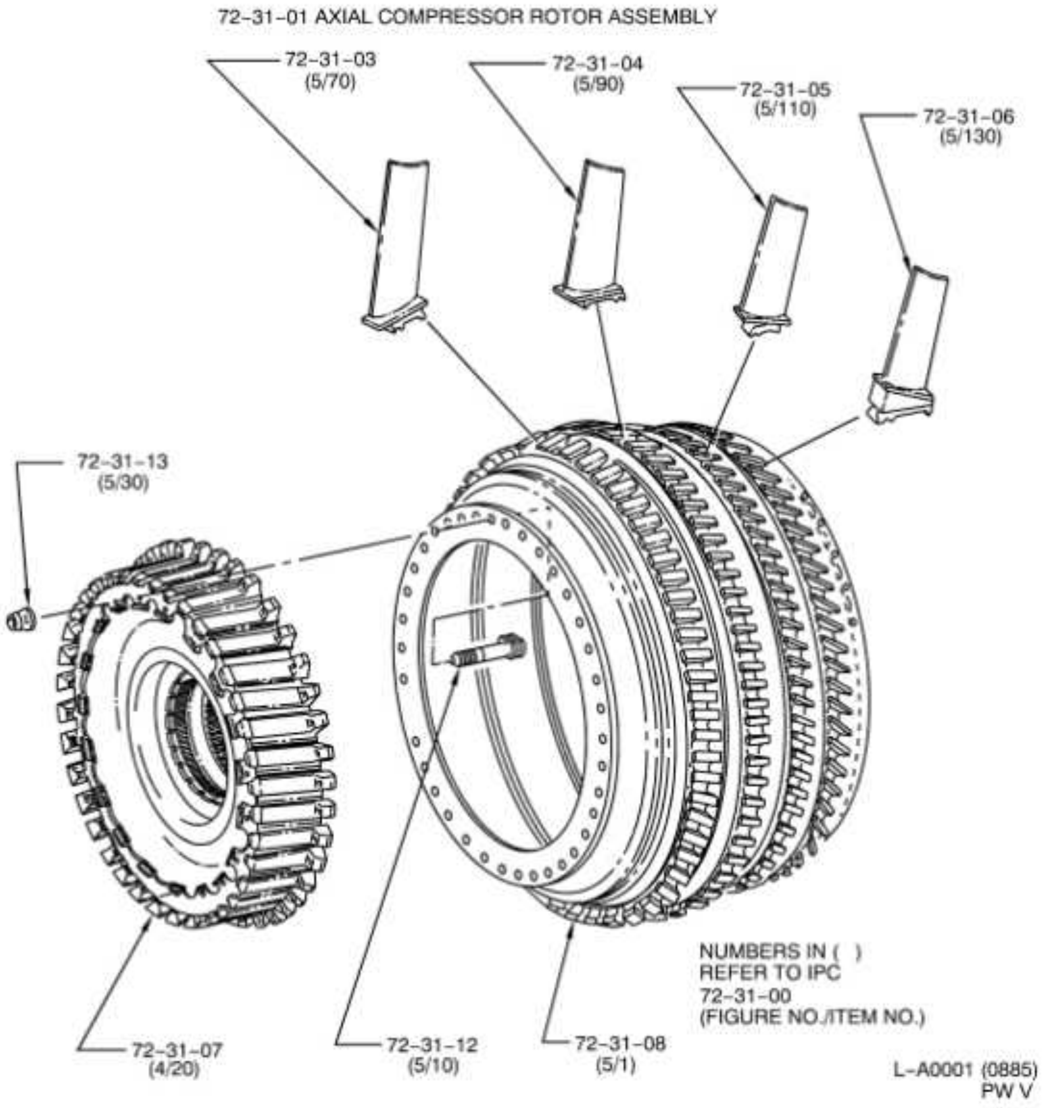
LOW PRESSURE COMPRESSOR (LPC) − HOW TO USE

LOW PRESSURE COMPRESSOR (LPC)	72−31−00
AXIAL COMPRESSOR ROTOR ASSEMBLY	72−31−01
NOT USED	72−31−02
STAGE 1.6 LPC BLADE	72−31−03
STAGE 2 LPC BLADE	72−31−04
STAGE 3 LPC BLADE	72−31−05
STAGE 4 LPC BLADE	72−31−06
FRONT COMPRESSOR HUB ASSEMBLY	72−31−07
DRUM ROTOR DISK ASSEMBLY	72−31−08
LPC STAGE 1 COMPRESSOR STATOR ASSEMBLY	72−31−09
LPC (STAGE 1.6, 2, AND 3) COMPRESSOR STATOR ASSEMBLY	72−31−10
LPC STAGE 4 DUCT	72−31−11
LPC (DRUM TO HUB) TIEROD	72−31−12
LPC TIEROD NUT	72−31−13
NO. 1 BALL BEARING	72−31−14
NO. 1 BEARING (INNER RACE) RETAINING NUT	72−31−15
NO. 1 BEARING SEAL SEAT	72−31−16
NO. 1 BEARING (CARBON) SEAL ASSEMBLY	72−31−17
NO. 1 BEARING FACE SEAL ASSEMBLY	72−31−18
NOT USED	72−31−19 through 72−31−27
NO. 1 BEARING SEAL SUPPORT ASSEMBLY	72−31−28
NOT USED	72−31−29 through 72−31−34

LOW PRESSURE COMPRESSOR (LPC) - HOW TO USE

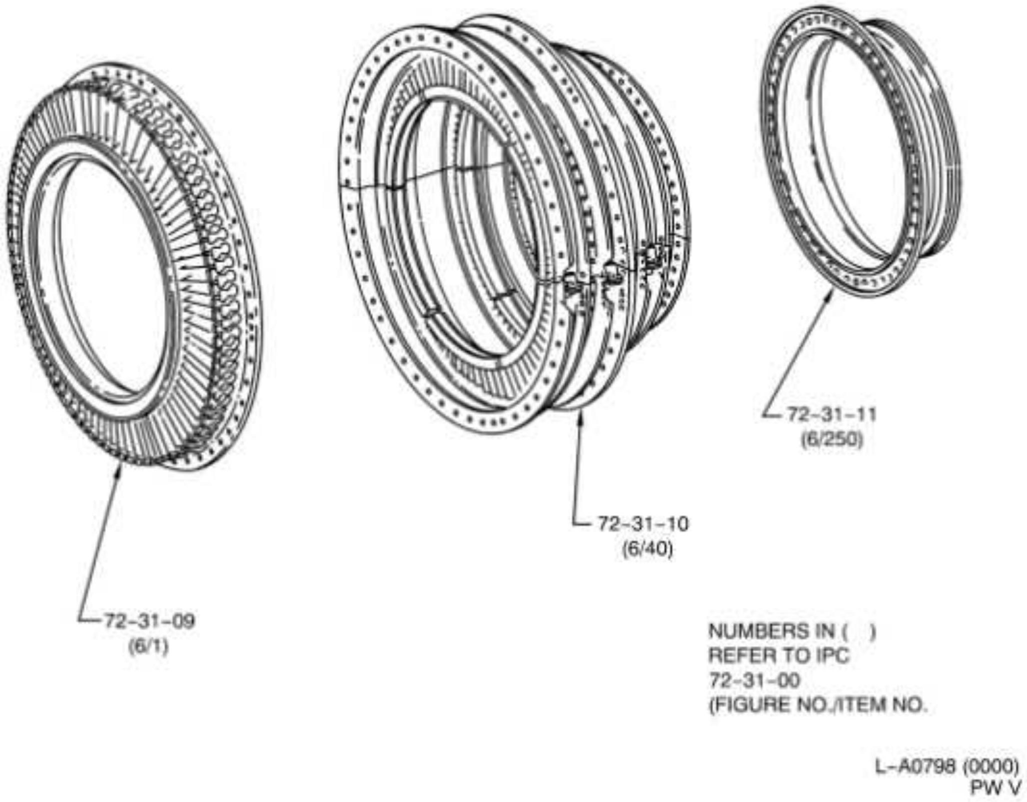
UNASSIGNED	72-31-35 through 72-31-79
COMPRESSOR INLET CONE FRONT SEGMENT	72-31-80
COMPRESSOR INLET CONE (REAR) SEGMENT ASSEMBLY	72-31-81
STAGE 1 LPC BLADE ASSEMBLY	72-31-82
COMPRESSOR BLADE (STAGE 1) LOCK ASSEMBLY	72-31-83
FAN EXIT FAIRING	72-31-84
NOT USED	72-31-85 through 72-31-87
UNASSIGNED	72-31-88 through 72-31-99

LOW PRESSURE COMPRESSOR (LPC) − HOW TO USE


72-31-01 AXIAL COMPRESSOR ROTOR ASSEMBLY
72-31-03 (5/70)
72-31-04 (5/90)
72-31-05 (5/110)
72-31-06 (5/130)
72-31-13 (5/30)
72-31-07 (4/20)
72-31-12 (5/10)
72-31-08 (5/1)
NUMBERS IN ( ) REFER TO IPC 72-31-00 (FIGURE NO./ITEM NO.)
L-A0001 (0885)
PW V

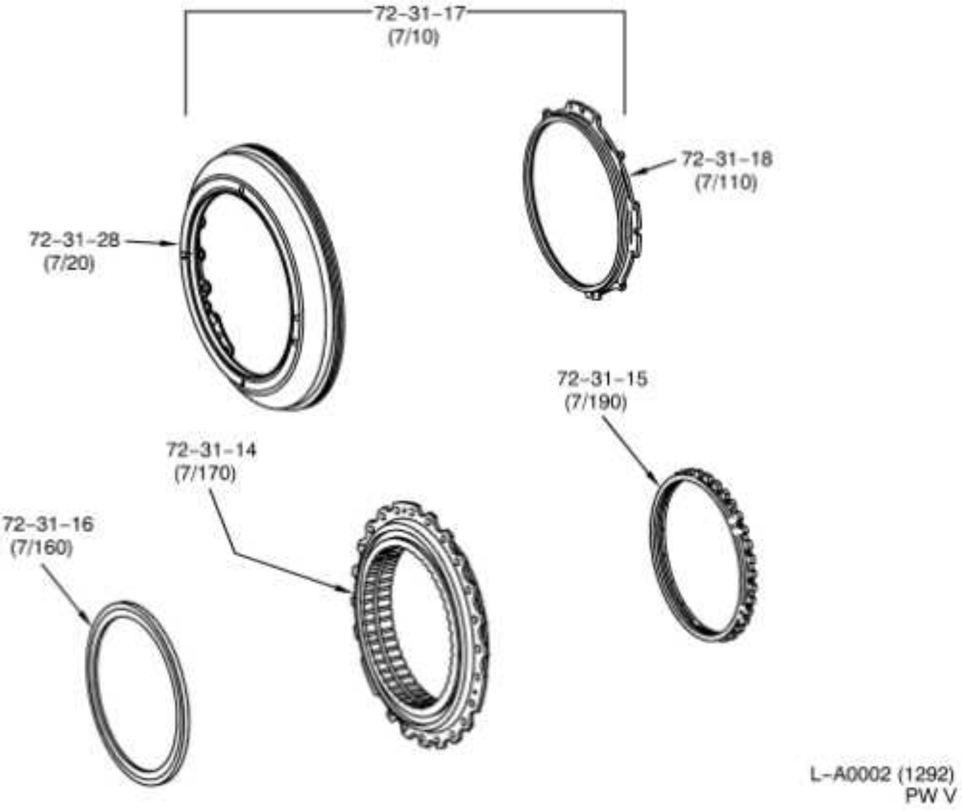
Low Pressure Compressor (LPC)
Figure 1 (Sheet 1)
(Task 72−31−00−990−003)

LOW PRESSURE COMPRESSOR (LPC) − HOW TO USE


72-31-11
(6/250)
72-31-10
(6/40)
72-31-09
(6/1)
NUMBERS IN ( )
REFER TO IPC
72-31-00
(FIGURE NO./ITEM NO.
L-A0798 (0000)
PW V

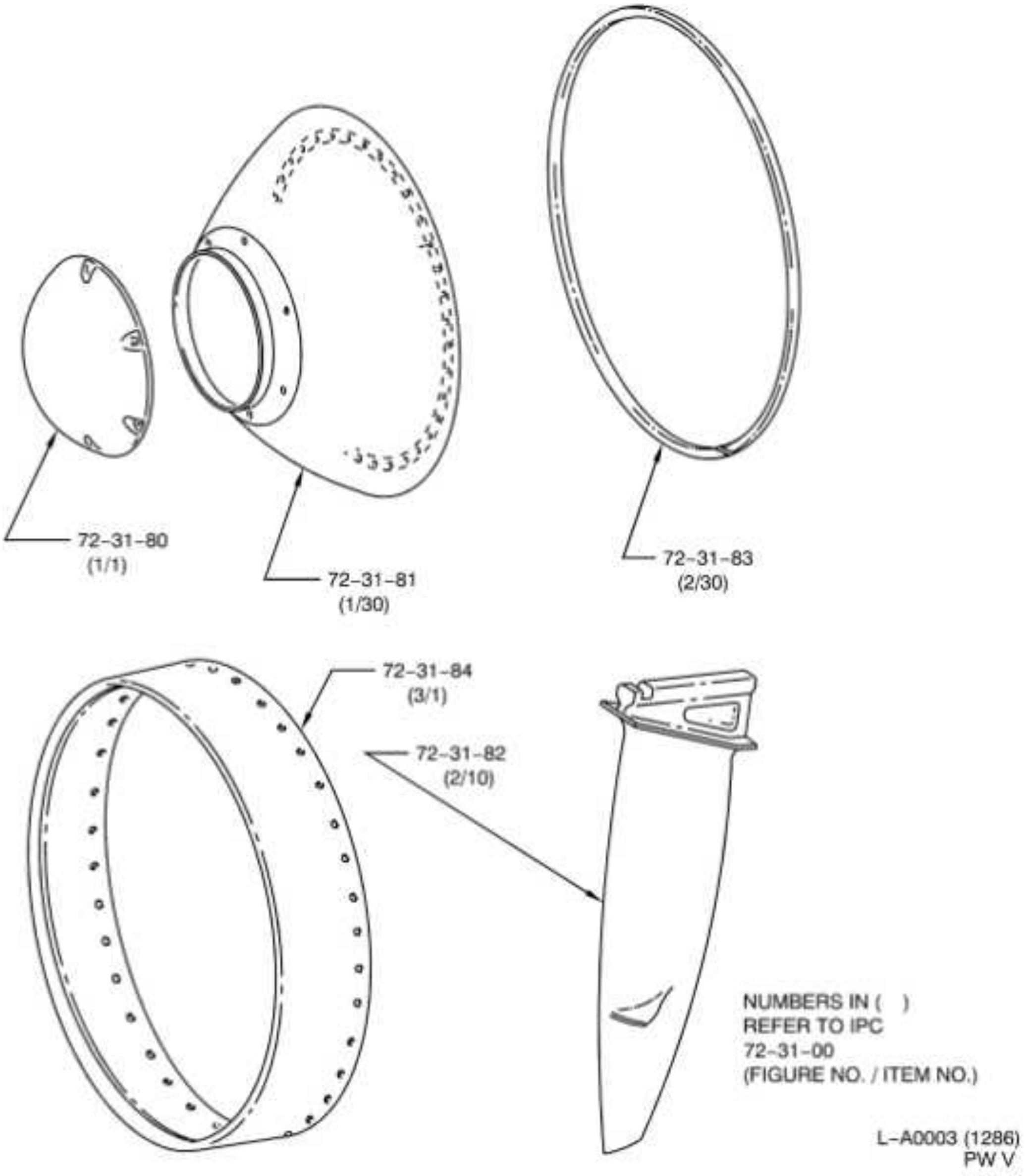
Low Pressure Compressor (LPC)
Figure 1 (Sheet 2)
(Task 72−31−00−990−003)

LOW PRESSURE COMPRESSOR (LPC) − HOW TO USE


72-31-17
(7/10)
72-31-18
(7/110)
72-31-28
(7/20)
72-31-15
(7/190)
72-31-14
(7/170)
72-31-16
(7/160)
L-A0002 (1292)
PW V

Low Pressure Compressor (LPC)
Figure 1 (Sheet 3)
(Task 72−31−00−990−003)

LOW PRESSURE COMPRESSOR (LPC) − HOW TO USE


72-31-80
(1/1)
72-31-81
(1/30)
72-31-83
(2/30)
72-31-84
(3/1)
72-31-82
(2/10)
NUMBERS IN ( )
REFER TO IPC
72-31-00
(FIGURE NO. / ITEM NO.)
L-A0003 (1286)
PW V

Low Pressure Compressor (LPC)
Figure 1 (Sheet 4)
(Task 72−31−00−990−003)

Previous Pageblock Return to Previous Menu Next Pageblock

LOW PRESSURE COMPRESSOR (LPC) - DESCRIPTION AND OPERATION

Task 72-31-00-990-002:

1. Low Pressure Compressor (LPC)

See Figure 1.

A. General

(1) The low pressure compressor (LPC) is a five stage rotor and stator assembly. The LPC consists of a five stage (stages 1, 1.6, 2, 3 and 4) rotor and four stages (stages 1, 1.6, 2 and 3) of stator assemblies. The 4th stage compressor stator is a part of the intermediate case.

B. LPC Rotor

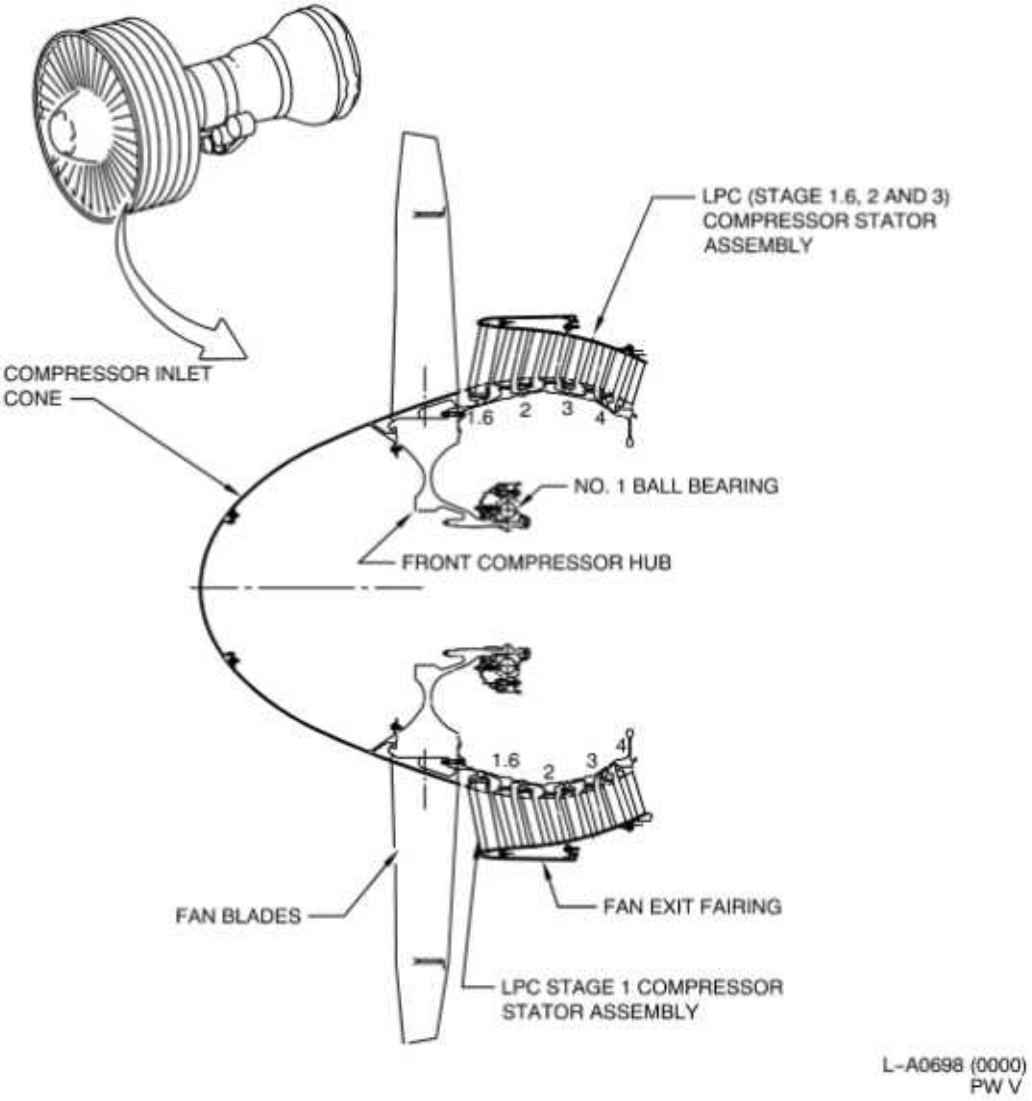
(1) The LPC rotor consists of a titanium hub (stage 1) mechanically attached to a four stage (stages 1.6, 2, 3 and 4) titanium drum rotor. Titanium blades are installed in all five stages. The 1st stage of the rotor, commonly referred to as the fan stage, consists of 38 wide chord blade assemblies which are installed in slots 12 degrees from axial in the front compressor hub. The fan blades are retained at the rear by the drum rotor and at the front by a circumferential blade lock installed in aligned slots in the hub. Each fan blade has a single aft positioned part span shroud for added strength. Fan blades are replaceable in balanced pairs on installed engines. The blades in the remaining four stages of the rotor are installed in axial slots in the drum rotor and are retained by wire blade locks. Four pairs of knife-edge seals are integral to the drum rotor and are in axial alignment with each of the stages 1, 1.6, 2 and 3 stator inner shrouds.

(2) The rotor is driven by the low pressure turbine (LPT). The front compressor hub is splined to a titanium turbine shaft coupling which in turn is splined to the LPT shaft. Structural support for the rotor is provied by the No. 1 ball bearing which is mounted on the front compressor hub.

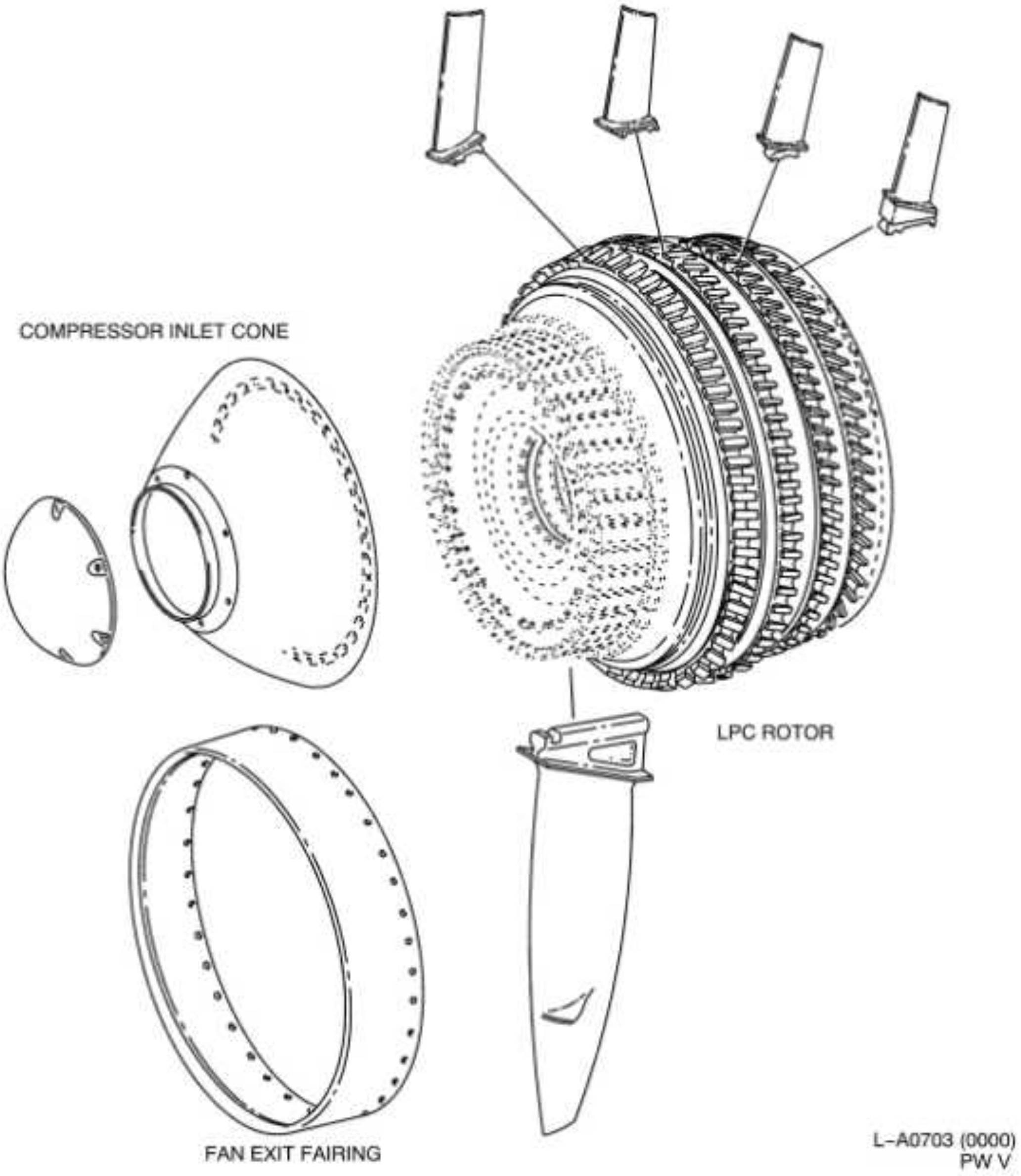
C. LPC Stator

(1) The LPC stator assembly consists of a single stage (stage 1 compressor stator assembly) full hoop aluminum case with titanium stator vanes mechanically attached to a three stage (stage 1.6, 2 and 3 compressor stator assembly) split case aluminum stator assembly with

LOW PRESSURE COMPRESSOR (LPC) − DESCRIPTION AND OPERATION


LPC (STAGE 1.6, 2 AND 3)
COMPRESSOR STATOR
ASSEMBLY
COMPRESSOR INLET
CONE
1.6
2
3
4
NO. 1 BALL BEARING
FRONT COMPRESSOR HUB
1.6
2
3
4
FAN BLADES
FAN EXIT FAIRING
LPC STAGE 1 COMPRESSOR
STATOR ASSEMBLY
L-A0698 (0000)
PW V

Low Pressure Compressor (LPC)
Figure 1 (Sheet 1)
(Task 72−31−00−990−002)


COMPRESSOR INLET CONE
LPC ROTOR
FAN EXIT FAIRING
L−A0703 (0000)
PW V

Low Pressure Compressor (LPC)
Figure 1 (Sheet 2)
(Task 72−31−00−990−002)

titanium vanes installed in all three stages. The stage 1 stator consists of 88 solid vanes and is located immediately aft of the stage 1 LPC blades at the entrance to the primary gaspath. At the inner shroud of the stage 1 stator are a pair of PWA 407 abradable seal lands axially aligned with a pair of knife−edge seals on the drum rotor. The three stage (stages 1.6, 2 and 3) stator assembly also contains solid vanes and incorporates three PWA 407 abradable rubstrips at outer shroud locations in axial alignment with blades (stages 1.6, 2 and 3). At inner shroud locations are three pairs of PWA 407 abradable seal lands in axial alignment with pairs of knife−edge seals on the drum rotor. An aluminum LPC stage 4 duct which incorprates a PWA 407 abradable rubstrip in axial alignment with the stage 4 LPC blades is mechanically attached to the rear outer flange of the LPC compressor stator assembly.

(2) The LPC compressor stator assembly is supported structually by mechanical attachment to the fan exit inner case.

D. Inlet Cone

(1) The compressor inlet cone segment assembly is mounted on the front compressor hub and provides a smooth aerodynamic fairing at the inlet of the LPC. The compressor inlet cone segment assembly consists of an inlet cone front segment which is bolted to an inlet cone (rear) segment assembly which is bolted in turn to the front flange of the front compressor hub. Both inlet cone segments are fabricated from Kevlar fabric impregnated with epoxy resin.

E. Fan Exit Fairing

(1) Surrounding the front half of the stator assembly is a composite (Kevlar coated with polyurethane) fan exit fairing which acts as an aerodynamic splitter separating the primary (main gas generator) airstream from the secondary (fan discharge) airstream.

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LOW PRESSURE COMPRESSOR (LPC) - DISASSEMBLY-01

Task 72-31-00-030-001:

1. Disassemble Low Pressure Compressor (LPC)

A. Prerequisites

(1) Disassemble No. 1 bearing and seal assembly. See Disassembly-02 (Task 72-31-00-030-002-001) or Disassembly-03 (Task 72-31-00-030-002-002).

B. Equipment And Materials Required

Special Tools:

PWA 85086	Arm, Lifting (2 Required)
PWA 85621	Eye, Lifting, Front (For Hub Only) (Optional to PWA 87221)
PWA 85660	Stand, Build/Storage (Optional to PWA 88183)
PWA 86534	Fixture, Lifting
PWA 87221	Eye, Lifting, Front (For Hub Only) (Optional to PWA 88748)
PWA 88183	Stand, Build/Storage
PWA 88748	Adapter, Lift And Turn (For Hub/HPC Rotor)

C. Procedure
See Figure 501.

Subtask 72-31-00-030-051:

(1) Remove the LPC Stage 4 duct as follows. See Figure 502.

(a) With the LPC in Fixture (PWA 85520), remove the nuts, washers, and bolts that attach the LPC Stage 4 duct to the LPC (Stage 1.6, 2 and 3) compressor stator assembly (called compressor stator assembly).

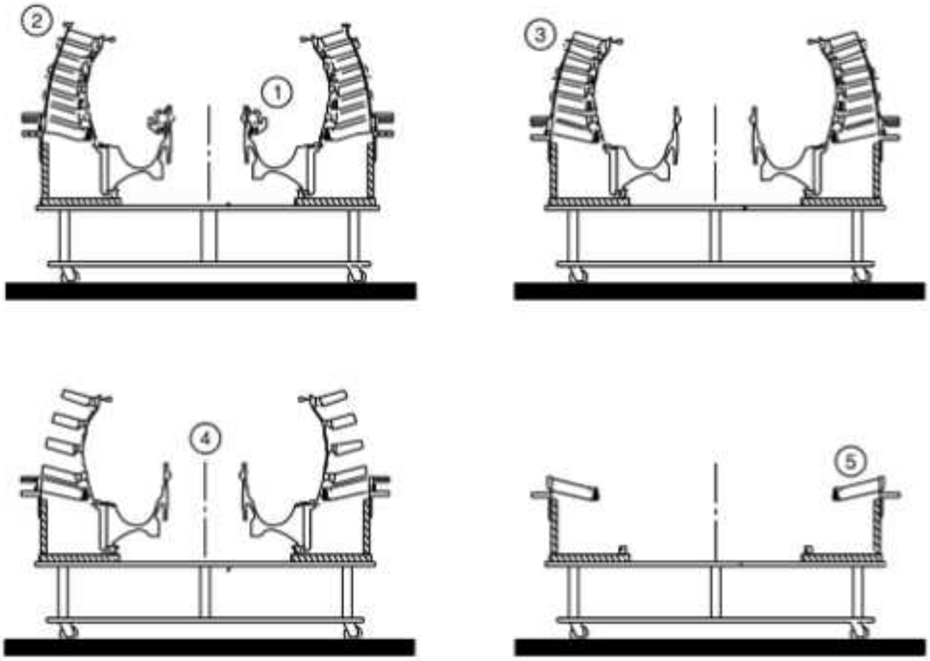
(b) Remove the Stage 4 duct and put it on a rack.

Subtask 72-31-00-030-052:

(2) Remove the compressor stator assembly as follows. See Figures 502 and 503.

(a) Remove the 50 nuts, 100 washers, and 50 bolts that attach the Stage 1 compressor stator assembly (called Stage 1 stator) to the compressor stator assembly.

(b) Remove the 48 nuts, 96 washers, 48 bolts, and brackets that attach both halves of the compressor stator assembly at approximately 3 and 9 o'clock locations. Remove the brackets and stator halves.

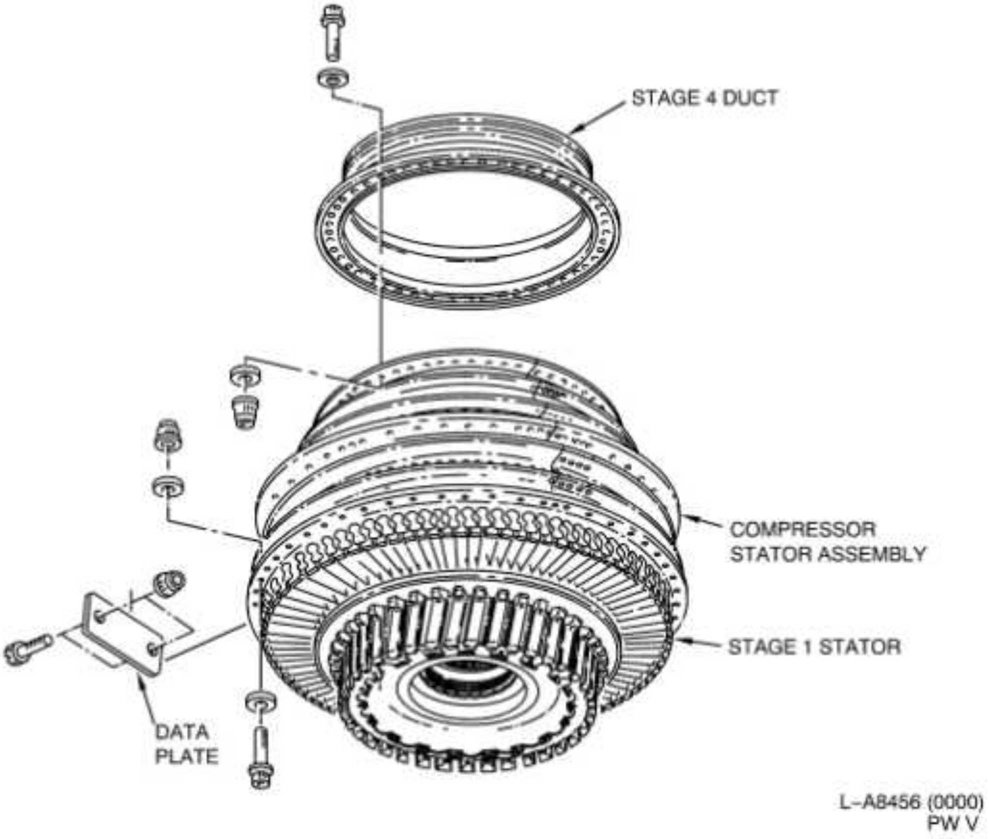


1. REMOVE NO. 1 BEARING AND CARBON SEAL ASSEMBLY.
2. REMOVE LPC STAGE 4 DUCT.
3. REMOVE LPC (STAGE 1.6, 2 AND 3) COMPRESSOR STATOR ASSEMBLY HALVES.
4. REMOVE AXIAL COMPRESSOR ROTOR ASSEMBLY.
5. REMOVE LPC STAGE 1 COMPRESSOR STATOR ASSEMBLY.

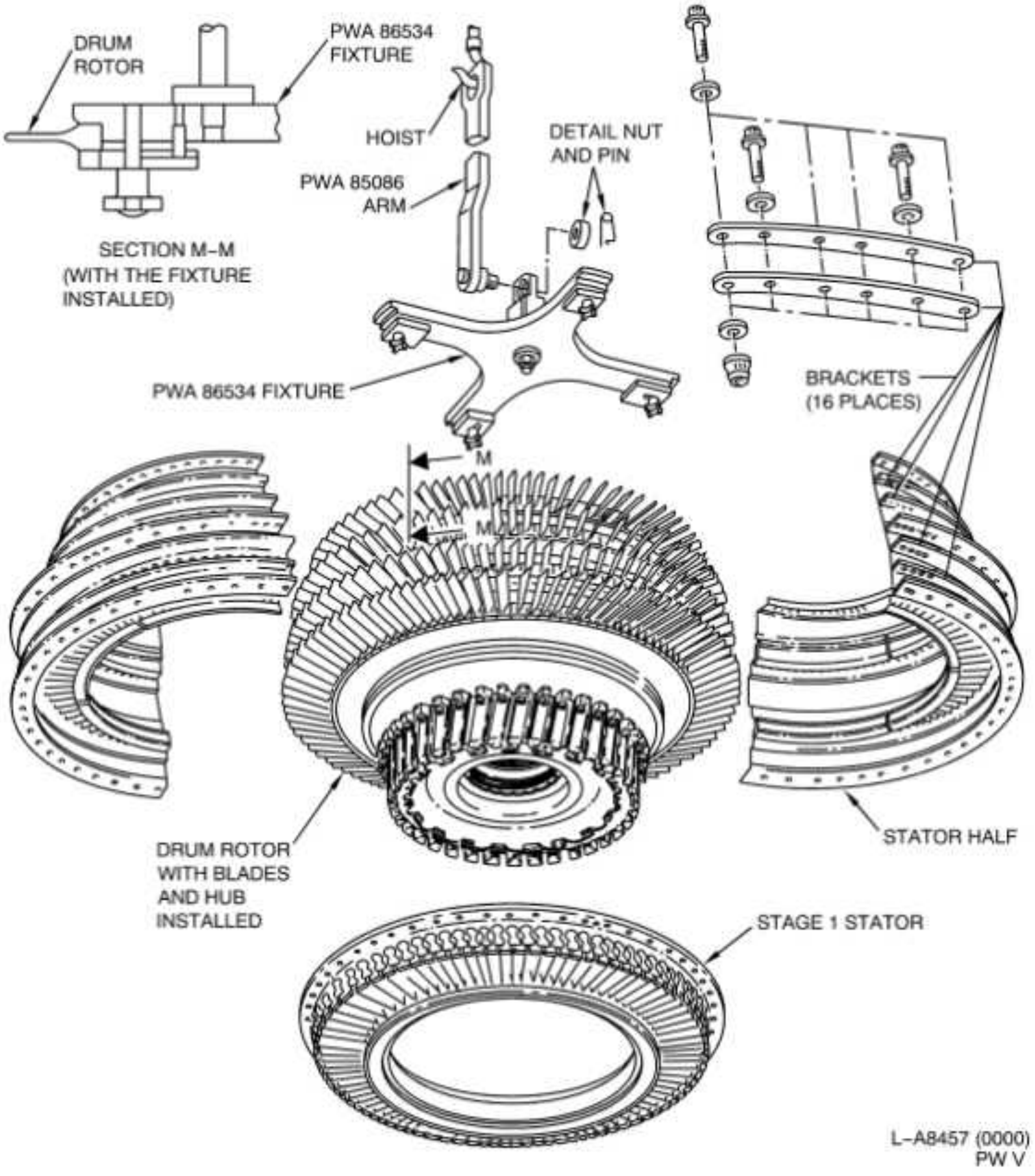
L−A0106 (0000)
PW V

Low Pressure Compressor (LPC) Disassembly
Figure 501
(Task 72−31−00−030−001)

LOW PRESSURE COMPRESSOR (LPC) − DISASSEMBLY−01


STAGE 4 DUCT
COMPRESSOR STATOR ASSEMBLY
STAGE 1 STATOR
DATA PLATE
L−A8456 (0000)
PW V

Low Pressure Compressor (LPC) Disassembly
Figure 502
(Task 72−31−00−030−001)


DRUM ROTOR
PWA 86534 FIXTURE
SECTION M-M (WITH THE FIXTURE INSTALLED)
HOIST
PWA 85086 ARM
DETAIL NUT AND PIN
PWA 86534 FIXTURE
BRACKETS (16 PLACES)
M
M
DRUM ROTOR WITH BLADES AND HUB INSTALLED
STATOR HALF
STAGE 1 STATOR
L-A8457 (0000)
PW V

Low Pressure Compressor (LPC) Disassembly
Figure 503
(Task 72-31-00-030-001)

LOW PRESSURE COMPRESSOR (LPC) − DISASSEMBLY−01

(c) Remove the two nuts and bolts that attach the data plate to the bracket on the upper stator half. Remove the data plate.

Subtask 72−31−00−030−053:

(3) Remove the Stage 1 stator as follows.

(a) Clamp PWA 86534 Fixture to the rear of the axial compressor rotor assembly (called rotor).

(b) Remove the 19 bolts that attach the the rotor to Fixture (PWA 85520).

(c) Attach PWA 85086 Arm to PWA 86534 Fixture with the detail nut and safety pin. With a hoist attached to the arm, raise the rotor from the stand and remove the Stage 1 stator.

(4) Trunnion the rotor as follows. See Figure 504.

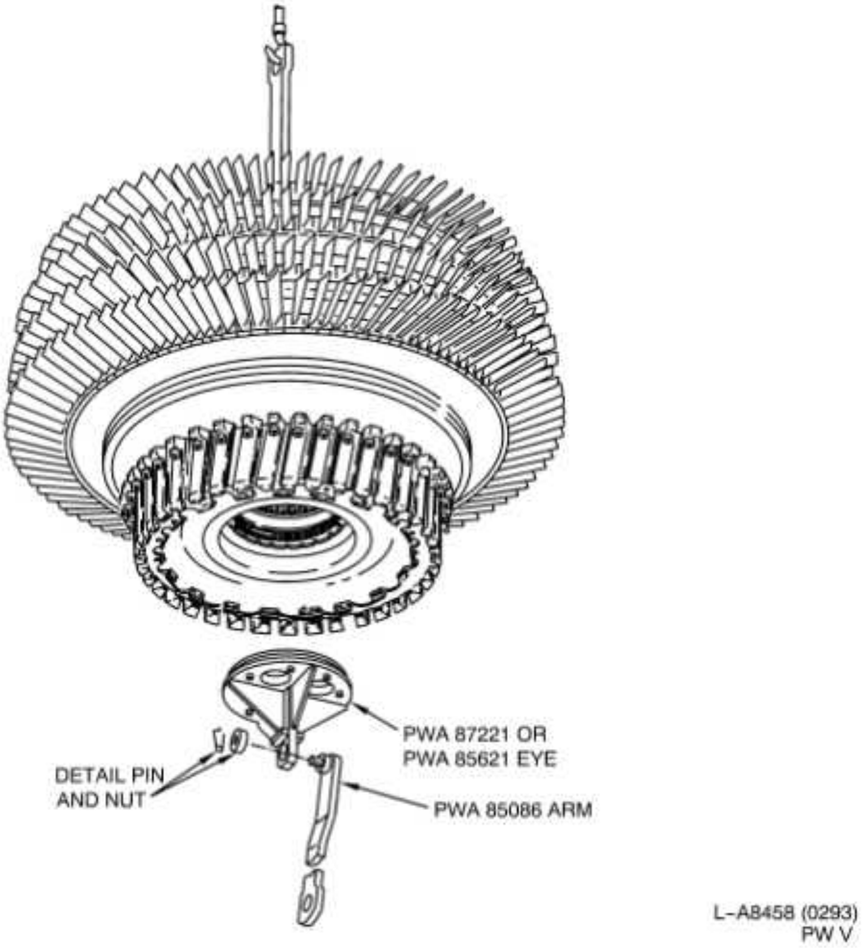
(a) Thread either PWA 87221 or PWA 85621 Eye or PWA 88748 Adapter into the ID of the hub.

(b) Attach PWA 85086 Arm to the eye.

(c) With a hoist through the eye, trunnion the rotor to rear end down. Remove the arm and fixture from the rear and lower the rotor onto PWA 88183 or PWA 85660 Stand.

(5) Remove the arm and eye from the hub.

LOW PRESSURE COMPRESSOR (LPC) − DISASSEMBLY−01


PWA 87221 OR
PWA 85621 EYE
DETAIL PIN
AND NUT
PWA 85086 ARM
L−A8458 (0293)
PW V

Low Pressure Compressor (LPC) Disassembly
Figure 504
(Task 72−31−00−030−001)

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LOW PRESSURE COMPRESSOR (LPC) - DISASSEMBLY-02

Task 72-31-00-030-002-001:

1. Disassemble No. 1 Bearing And Seal Assembly (Mechanical Method)

A. Equipment And Materials Required

Special Tools:
PWA 28657 Sling
PWA 29389 Hydraulic Pump
PWA 29614 Wrench, Mechanical
PWA 29615 Holder
PWA 45419 Multiplier, Pneumatic (Optional to PWA 80651)
PWA 76154 Adapter, Lift And Trunnion (2 Required)
PWA 80651 Multiplier, Pneumatic
PWA 85200 Puller
PWA 85201 Puller
PWA 85520 Fixture, Install And Remove
PWA 85590 Protector, Plastic
PWA 85653 Wrench, Torque
PWA 85791 Adapter, Counter-Torque
PWA 85793 Adapter, Handling

B. Procedure

Subtask 72-31-00-030-054:

(1) Install PWA 85520 Fixture onto axial compressor rotor assembly located in Stand (PWA 88183 or PWA 85660).

(2) Install PWA 85791 Adapter into hub ID and secure with detail nut.

(3) Attach hoist to PWA 28657 Sling with two PWA 76154 Adapters to spools on fixture. Use spools marked for fixture LPC. Trunnion axial compressor rotor assembly to rear end up and place on work area.

(4) Remove sling and adapters from fixture.

(5) Cut flare and drift out rivets securing No. 1 bearing retaining nut to hub assembly.

(6) Position PWA 85793 Adapter onto Adapter (PWA 85791). Position PWA 85653 Wrench over Adapter (PWA 85793) onto No. 1 bearing nut. Position PWA 29614 Wrench over splines of Wrench (PWA 85653). Position PWA 29615 Holder over splines of Adapter (PWA 85793) and onto pins of Wrench (PWA 29614). Install either PWA 45419 or PWA 80651 Multiplier on the mechanical wrench. Using Wrench (PWA 29614) loosen nut. Remove tooling and nut from hub.

(7) Install PWA 85200 Puller to inner race puller groove. Attach PWA 29389 Pump and remove upper half of inner race. Remove tooling and inner race half.

LOW PRESSURE COMPRESSOR (LPC) − DISASSEMBLY−02

(8) Remove three screws securing No. 1 bearing seal assembly to No. 1 bearing outer race flange. Carefully lower seal assembly to rest on hub flange. Remove No. 1 bearing outer race and balls from hub.

(9) Install PWA 85201 Puller to inner race front half (front side). Attach PWA 29389 Pump and remove front half of inner race. Remove tooling and front inner race.

(10) Remove seal seat from hub. Remove No. 1 bearing seal assembly from hub. Install PWA 85590 Protector over hub.

(11) Protect carbon seal, seal seat and bearing using protective wrapper.

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Task 72-31-00-030-002-002:

1. Disassemble No. 1 Bearing And Seal Assembly (Hydraulic Method)

A. Equipment And Materials Required

Special Tools:
PWA 28657 Sling
PWA 28668 Pump
PWA 28669 Cart
PWA 29389 Hydraulic Pump
PWA 29510 Pump (Optional to PWA 28668)
PWA 25000 Wrench, Hydraulic
PWA 76154 Adapter, Lift And Trunnion (2 Required)
PWA 85200 Puller
PWA 85201 Puller
PWA 85520 Fixture, Install And Remove
PWA 85590 Protector, Plastic
PWA 85641 Wrench, Torque
PWA 85791 Adapter, Counter-Torque
PWA 85792 Adapter, Holding

B. Procedure

Subtask 72-31-00-030-055:

(1) Install PWA 85520 Fixture onto axial compressor rotor assembly located in Stand (PWA 88183 or PWA 85660).

(2) Install PWA 85791 Adapter into hub ID and secure with detail nut.

(3) Attach hoist to PWA 28657 Sling with two PWA 76154 Adapters to spools on fixture. Use spools marked for fixture LPC. Trunnion axial compressor rotor assembly to rear end up and place on work area.

(4) Remove sling and adapters from fixture.

(5) Cut flare and drift out rivets securing No. 1 bearing retaining nut to hub assembly.

(6) Install PWA 85792 Adapter onto adapter. Install PWA 85641 Wrench on nut. Remove PWA 25000 Wrench from PWA 28669 Cart and install on wrench and adapter. Using PWA 28668 or PWA 29510 Pump actuate wrench to loosen nut on hub. Remove tooling and nut from hub.

(7) Install PWA 85200 Puller to inner race puller groove. Attach PWA 29389 Pump and remove upper half of inner race. Remove tooling and inner race half.

(8) Remove three screws securing No. 1 bearing seal assembly to No. 1 bearing outer race flange. Carefully lower seal assembly to rest on hub flange. Remove No. 1 bearing outer race and balls from hub.

(9) Install PWA 85201 Puller to inner race front half (front side). Attach PWA 29389 Pump and remove front half of inner race. Remove tooling and front inner race.

(10) Remove seal seat from hub. Remove No. 1 bearing seal assembly from hub. Install PWA 85590 Protector over hub.
(11) Protect carbon seal, seal seat and bearing using protective wrapper.

LOW PRESSURE COMPRESSOR (LPC) - INSPECTION/CHECK-01

Task 72-31-00-990-004:

1. General Inspection Requirements - Low Pressure Compressor (LPC)

   A. Organization Of Individual Part Or Subassembly Inspection Data

      (1) Specific inspection functions for all significant parts/subassemblies are provided in individual Inspection/Check sections. Application of each inspection function is shown in Inspection/Check-00 for part/subassembly. Section designations and function descriptions are as follows.

      (2) Inspection/Check-00 section contains, where applicable:

         (a) Part number(s) for which the inspection data is applicable.

         (b) Service Bulletin numbers applicable to part number(s).

         (c) Inspection/Check numbers, data categories and applicability data.

      (3) Inspection/Check-01, Preinspection Preparation, contains, where applicable:

         (a) General inspection comments, notes, CAUTIONS, etc., which supplement data contained in this section.

         (b) Identification of mechanical disassembly required prior to inspection.

         (c) Identification of any surface treatment or coating removal, or other actions required prior to inspection.

         (d) Identification of part/subassembly cleaning required prior to inspection.

      (4) Inspection/Check-02, Nondestructive Inspection, contains the following nondestructive inspection methods, part/subassembly special attention areas and damage limits (as applicable):

         (a) Fluorescent Penetrant Method

         (b) Eddy Current Method

(c) Magnetic Particle Method

(d) X−ray Method

(e) Ultrasonic Method

(f) Hardness Check

(g) Other − As specified.

(5) Inspection/Check−03, Visual Inspection contains, where applicable:

(a) Visual inspection requirements which can be accomplished with or without magnification or special lighting (as specified).

NOTE: Use of inspection tools may be required as a supplement to visual inspection process.

(b) Allowable blending for visual damage, which may be accomplished within the inspection area.

NOTE: Blending requirement will also be shown in applicable repairs.

(6) Inspection/Check−04, Dimensional Inspection, contains, where applicable:

(a) Dimensional inspection requirements other than visual inspection. The requirements will include applicable fits and clearances, and other dimensional inspections necessary to ensure the part integrity and proper functioning.

(7) Inspection/Check−05, Functional Check Inspection contains, where applicable:

(a) Procedures, limits, and equipment used with any required functional checks (oil flow, air flow, leak, etc.).

(8) Inspection/Check−06, Inspection Postrequisites contains, references to procedures required to return part/subassembly to serviceable condition. References include the following, as required.

(a) Reassembly

(b) Protective coatings, sealants and/or lubricant reapplication

B. Thorough and intelligent part/subassembly inspection is of major importance in achieving efficient engine operation and satisfactory service life. Inspection personnel should be thoroughly familiar with inspection procedures, inspection tooling, limits associated with normal and, where applicable, unusual operating conditions, limits associated with repairs, and with inspection procedures published in Standard Practices Manual.

C. During preliminary inspection of part/subassembly, comparison with mating or adjacent parts may provide indication of source of wear or damage. This procedure may indicate requirement for additional disassembly and inspection.

D. During inspection, records should be kept of deviations beyond serviceable limits to determine: (a) if part/subassembly will be repaired or replaced, and (b) if part is reparable, which repairs are required. Suitable documentation should accompany part/subassembly with results of this determination.

E. Inspection of individual part/subassembly dimensions which are also in Fits and Clearances will include Fits and Clearance Reference Numbers and will show new part/subassembly dimension unless specifically stated otherwise. Inspection Frequency Requirements (IFR) codes (for IFR Code A parts only) are included with Reference Number data. If acceptable dimensional deviations or results of repair affect Fits and Clearances, suitable documentation should accompany part/subassembly to ensure check of fit or clearance at final assembly.

NOTE: Parts/subassemblies which deviate dimensionally from new part/subassembly values may be acceptable provided required fit or clearance is achieved at final assembly.

F. Dimensional inspection requirements will be accompanied by part/subassembly constraint data if such constraint requirements are required during part/subassembly manufacture. Adherence to constraint requirements when inspecting service operated parts/subassemblies should be dictated by experience. It is recommended that parts/subassemblies which do not meet dimensional inspection requirements in free state be constrained and re−measured prior to initiation of any repair or re−use activity.

G. Dimensional inspections of one detail of a subassembly, prior to removal from subassembly, may produce incorrect data due to constraint forces from mating details. If questionable data is obtained, subassembly should be disassembled and inspections repeated.

H. Dimensional inspection limits in inspection text provide continued use (as is) and, if applicable, repair limits. Parts/subassemblies which exceed both limits and nonreparable parts/subassemblies which exceed (as is) limits are unserviceable.

I. Inspections required to verify integrity of repair are contained within repair procedure. Unless otherwise stated, repaired part is expected to meet all inspection requirements contained in inspection text for part/subassembly.

J. Parts/subassemblies which do not require repairs except for those provided in Standard Practices Manual are identified by Chapter/Section/Subject Number 72−31−99 in cleaning table (Cleaning−01) and nondestructive inspection table (Inspection/Check−02). Determination of serviceability for those parts listed in 72−31−99 is limited to cleaning, non−destructive inspection, and the following:

(1) Visually inspect parts/subassemblies for surface defects, deformations, cuts, improper threads or wrenching surfaces, incomplete or missing protective coatings or other damage which will prevent proper functioning and make part/subassembly unserviceable. Unserviceable parts/subassemblies should not be reinstalled. Repair unserviceable parts/subassemblies per Standard Practices Manual, as applicable.

(2) Parts/subassemblies with crack indications to any length or depth detected by listed nondestructive inspection are unserviceable, and should not be reinstalled.

LOW PRESSURE COMPRESSOR (LPC) − INSPECTION/CHECK−01

K. When new part/subassembly is to be installed and it is important that it be identified as to engine number or position in engine, mark it by appropriate method described in Marking of Parts, 70−11, Standard Practices Manual.

L. In order to eliminate confusion and to maintain consistent terminology, various physical conditions which might be encountered during inspection of parts/subassemblies and explanation of unusual causes of such conditions are defined in Physical Inspection, 70−31, Standard Practices Manual.

M. If inspection reveals it necessary to replace fitted spacer, tag spacer to indicate that replacement must be made with spacer of correct classification at assembly.

N. If text refers to superficial or shallow imperfection, following definitions apply:

    (1) A superficial imperfection is defined as a nick, dent, scratch, toolmark, etc., which disrupts the surface but does not appear to penetrate surface roughness texture.

    (2) A shallow imperfection appears to penetrate surface finish texture, but does not have a dark bottom and would not cause a 0.007 inch (.178 mm) radius stylus to hesitate if passed over it.

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LOW PRESSURE COMPRESSOR (LPC) - INSPECTION/CHECK-03

Task 72-31-00-990-005:

1. Visual Inspection - Low Pressure Compressor (LPC)
   A. For inspection requirements applicable to installed (accessible) parts of Low Pressure Compressor (LPC) see 72-00-31, Inspection/Check-03 (Task 72-00-31-990-002).

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LOW PRESSURE COMPRESSOR (LPC) − INSPECTION/CHECK−04

Task 72−31−00−990−001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B, C or D located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.
D	Clearance or fit relates to a component for which you think you would want to replace the used part with a new or restored part (in which the wear or seal surface has been restored to manufactured dimensions at the time of overhaul in order to restore a wear or sealing surface). It is necessary to dimensionally examine this fit unless all of the conditions that follow are met. The used wear or sealing component has been replaced with a new or a used part restored to the manufactures specified dimensions. The mating part(s) have been visually and dimensionally examined as necessary by the applicable PW4000 Series CIR, PN 51A357 sections(s) for the part(s) and meet the permitted wear and dimensional requirements on the surface(s) related to the clearance or fit.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131)	(−)	0.512 (13.005)	=	.005 (0.126)
0.527 (13.385)	(−)	0.508 (12.903)	=	.019 (0.482)

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
440	A	Gap, No. 1 Bearing Seal Ring (72-31-17) (See Figure 803, Sheet 2)				
		NOTE: The following seal ring gap measurement is not a requirement for later teflon seal ring PN 50B209.				
		Gap			.020 (0.51)	.030 (0.76)
		Seal Ring Installed In Ring Gage 14.370 (364.998) Diameter (Ring Gage)				
		Gap			.017 (0.43)	.033 (0.84)
		Seal Ring Installed In Seal Support 14.369 (364.973) 14.371 (365.023) Diameter (Seal Support)				
441	A	Side Clearance, No. 1 Bearing Seal Ring (72-31-17) No. 1 Bearing Face Seal Assembly (72-31-18) (See Figure 803, Sheet 2)				
		NOTE: The following seal ring side clearance measurement is not a requirement for later teflon seal ring PN 50B209.				
		Ring	.121 (3.074)	.124 (3.149)		
		Seal Assembly	.127 (3.226)	.130 (3.302)	.003 (0.077)	.009 (0.228)
442 (1)	B	Front Compressor Hub Assembly (72-31-07) PN 50B221 No. 1 Bearing Seal Seat (72-31-16) (See Figure 803, Sheet 1)				
		Hub	12.8295 (325.870)	12.8305 (325.894)		
		Seat	12.8315 (325.921)	12.8335 (325.970)	.001 (0.026)	.004 (0.102)

LOW PRESSURE COMPRESSOR (LPC) - INSPECTION/CHECK-04

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
442 (2)	B	Front Compressor Hub Assembly (72-31-07) PN 50B321 And 53B021 No. 1 Bearing Seal Seat (72-31-16) (See Figure 803, Sheet 1)				
		Hub	12.8285 (325.844)	12.8305 (325.894)		
		Seat	12.8315 (325.921)	12.8335 (325.970)	.001 (0.026)	.005 (0.127)
443	A	Front Compressor Hub Assembly (72-31-07) No. 1 Ball Bearing (72-31-14) (See Figure 803, Sheet 1)				
		Hub	12.7998 (325.115)	12.8008 (325.140)		
		Bearing	12.7946 (324.9829)	12.7953 (325.0006)	.0062T (0.157T)	.0045T (0.115T)
444	A	No. 1 Bearing Face Seal Assembly (72-31-18) (See Figure 803, Sheet 2)				
		Height Of Step			.075* (1.905)*	.105 (2.67)
761	A	Gap, Compressor Blade (Stage 1) Lock (See Figure 802)				
		Gap			.010 (0.254)	.060 (1.524)
		Blade Lock Installed To Front Compressor Hub Assembly 32.989 (837.921) 32.999 (838.175) Diameter (Retaining Groove)				
762	B	Front Compressor Hub Assembly (72-31-07) Compressor Inlet Cone (Rear) Segment Assembly (72-31-81) (See Figure 802)				
		Hub	27.377 (695.376)	27.383 (695.528)		
		Segment	27.376 (695.350)	27.384 (695.554)	.008T (0.203T)	.032L* (0.813L)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
763	A	No. 1 Ball Bearing (72−31−14) No. 1 Bearing Front Support (72−34−82) (See Figure 802)				
		Bearing	17.6605 (448.5767)	17.6613 (448.5970)		
		Support	17.6589 (448.537)	17.6599 (448.561)	.0006T (0.016T)	.0024T (0.060T)
765	B	Turbine Shaft Coupling Assembly (72−32−01) Front Compressor Hub Assembly (72−31−07) (See Figure 802)				
		Coupling	12.0630 (306.401)	12.0640 (306.425)		
		Hub	12.0610 (306.350)	12.0630 (306.400)	.0002L (0.0051L)	.003T (0.076T)
766	B	Turbine Shaft Coupling Assembly (72−32−01) Front Compressor Hub Assembly (72−31−07) (See Figure 802)				
		Coupling	11.1253 (282.583)	11.1263 (282.608)		
		Hub	11.1195 (282.436)	11.1205 (282.460)	.0068T (0.172T)	.0048T (0.122T)
767	B	Turbine Shaft (Coupling Retaining) Nut (72−32−80) Front Compressor Hub Assembly (72−31−07) (See Figure 802)				
		Nut	12.057 (306.248)	12.060 (306.324)		
		Hub	12.061 (306.350)	12.063 (306.400)	.001 (0.025)	.0062 (0.157)
776	B	LPC (Stage 1.6, 2, 3) Compressor Stator Assembly (72−31−10) Fan Exit Inner Case Assembly (72−33−04) (See Figure 804)				
		Stator	52.403 (1331.036)	52.409 (1331.189)		
		Case	52.397 (1330.884)	52.403 (1331.036)	.013T* (0.330T)*	.000T (0.00T)

LOW PRESSURE COMPRESSOR (LPC) - INSPECTION/CHECK-04

	Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
	777	B	LPC Stage 4 Duct (72-31-11)				
			Fan Exit Inner Case Assembly				
			(Bleed Valve Duct) (72-33-08)				
			(See Figure 804)				
			LPC Duct	46.791	46.801		
				(1188.49)	(1188.75)		
			Case	46.798	46.802	.003T	0.071*
			(Bleed Valve Duct)	(1188.670)	(1188.770)	(0.076T)	(1.803)*
	840	B	No. 1 Bearing Front Support (72-34-82)				
			No. 1 Bearing (Carbon) Seal Assembly (72-31-17)				
			(See Figure 802)				
			Support	20.135	20.139		
				(511.429)	(511.530)		
			Seal	20.131	20.133	.002	.008
				(511.328)	(511.378)	(0.051)	(0.203)
	1580	A	Front Compressor Hub Assembly (72-31-07)				
			Drum Rotor Disk Assembly (72-31-08)				
			(See Figure 801, Sheet 2)				
			Hub	31.339	31.343		
				(796.011)	(796.112)		
			Disk	31.330*	31.338	.013T*	.001T
				(795.782)*	(795.985)	(0.330T)*	(0.025T)
	1581	B	LPC (Drum To Hub) Tierod (72-31-12)				
			Front Compressor Hub Assembly (72-31-07)				
			(See Figure 801, Sheet 2)				
			Tierod	.390	.391		
				(9.906)	(9.931)		
			Hub	.395	.400	.004	.015*
R			See NOTE.	(10.033)	(10.160)	(0.102)	(0.381)*

R NOTE: Four holes maximum can be up to 0.405 inch
R (10.287 mm) if the surface finish is the same as
R that of a new part.

	Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
	1582	B	LPC (Drum To Hub) Tierod (72-31-12)				
			Drum Rotor Disk Assembly (72-31-08)				
			(See Figure 801, Sheet 2)				
			Tierod	.390	.391		
				(9.906)	(9.931)		
			Disk	.395	.400	.004	.015*
				(10.033)	(10.160)	(0.102)	(0.381)*

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1583 (1)	D	Drum Rotor Disk Assembly (72-31-08) LPC Stage 1 Compressor Stator Assembly (72-31-09) (See Figure 801, Sheet 2)				
		Disk (Pre SB PW4ENG 72-36)	37.898 (962.610)	37.902 (962.710)		
		Stator	37.975 (964.56)	37.985 (964.82)	.073 (1.85)	.092* (2.34)*
1583 (2)	D	Drum Rotor Disk Assembly (72-31-08) LPC Stage 1 Compressor Stator Assembly (72-31-09) (See Figure 801, Sheet 2)				
		Disk (Post SB PW4ENG 72-36 And Post SB PW4ENG 72-618)	37.935 (963.55)	37.945 (963.80)		
		Stator	37.975 (964.56)	37.985 (964.82)	.020* (0.508)*	.055* (1.40)*
1584 (1)	D	Drum Rotor Disk Assembly (72-31-08) LPC Stage 1 Compressor Stator Assembly (72-31-09) (See Figure 801, Sheet 2)				
		Disk (Pre SB PW4ENG 72-36)	38.238 (971.246)	38.242 (971.346)		
		Stator	38.315 (973.20)	38.325 (973.46)	.073 (1.85)	.092* (2.34)*
1584 (2)	D	Drum Rotor Disk Assembly (72-31-08) LPC Stage 1 Compressor Stator Assembly (72-31-09) (See Figure 801, Sheet 2)				
		Disk (Post SB PW4ENG 72-36 And Post SB PW4ENG 72-618)	38.275 (972.18)	38.285 (972.44)		
		Stator	38.315 (973.20)	38.325 (973.46)	.020* (0.508)*	.055* (1.40)*
1585 (1)	D	Drum Rotor Disk Assembly (72-31-08) LPC (Stage 1.6, 2, 3) Compressor Stator Assembly (72-31-10) (See Figure 801, Sheet 2)				
		Disk (Pre SB PW4ENG 72-36)	40.086 (1018.185)	40.090 (1018.286)		
		Stator	40.151 (1019.84)	40.161 (1020.09)	.061 (1.55)	.080* (2.03)*

LOW PRESSURE COMPRESSOR (LPC) - INSPECTION/CHECK-04

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1585 (2)	D	Drum Rotor Disk Assembly (72-31-08) LPC (Stage 1.6, 2, 3) Compressor Stator Assembly (72-31-10) (See Figure 801, Sheet 2)				
		Disk (Post SB PW4ENG 72-36 And Post SB PW4ENG 72-618)	40.111 (1018.82)	40.121 (1019.07)		
		Stator	40.151 (1019.84)	40.161 (1020.09)	.020* (0.508)*	.055* (1.40)*
1586 (1)	D	Drum Rotor Disk Assembly (72-31-08) LPC (Stage 1.6, 2, 3) Compressor Stator Assembly (72-31-10) (See Figure 801, Sheet 2)				
		Disk (Pre SB PW4ENG 72-36)	40.378 (1025.602)	40.382 (1025.702)		
		Stator	40.443 (1027.25)	40.453 (1027.51)	.061 (1.55)	.080* (2.03)*
1586 (2)	D	Drum Rotor Disk Assembly (72-31-08) LPC (Stage 1.6, 2, 3) Compressor Stator Assembly (72-31-10) (See Figure 801, Sheet 2)				
		Disk (Post SB PW4ENG 72-36 And Post SB PW4ENG 72-618)	40.403 (1026.24)	40.413 (1026.49)		
		Stator	40.443 (1027.25)	40.453 (1027.51)	.020* (0.508)*	.055* (1.40)*
1587 (1)	D	Drum Rotor Disk Assembly (72-31-08) LPC (Stage 1.6, 2, 3) Compressor Stator Assembly (72-31-10) (See Figure 801, Sheet 2)				
		Disk (Pre SB PW4ENG 72-36)	40.238 (1022.046)	40.242 (1022.146)		
		Stator	40.323 (1024.20)	40.333 (1024.46)	.081 (2.06)	.100* (2.54)*

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1587	D	Drum Rotor Disk Assembly (72-31-08)				
(2)		LPC (Stage 1.6, 2, 3) Compressor				
		Stator Assembly (72-31-10)				
		(See Figure 801, Sheet 2)				
		Disk	40.283	40.293		
		(Post SB	(1023.19)	(1023.44)		
		PW4ENG 72-36 And Post SB PW4ENG 72-618)				
		Stator	40.323	40.333	.020*	.055*
			(1024.20)	(1024.46)	(0.508)*	(1.40)*
1588	D	Drum Rotor Disk Assembly (72-31-08)				
(1)		LPC (Stage 1.6, 2, 3) Compressor				
		Stator Assembly (72-31-10)				
		(See Figure 801, Sheet 2)				
		Disk	40.038	40.042		
		(Pre SB	(1016.966)	(1017.066)		
		PW4ENG 72-36)				
		Stator	40.123	40.133	.081	.100*
			(1019.12)	(1019.38)	(2.06)	(2.54)*
1588	D	Drum Rotor Disk Assembly (72-31-08)				
(2)		LPC (Stage 1.6, 2, 3) Compressor				
		Stator Assembly (72-31-10)				
		(See Figure 801, Sheet 2)				
		Disk	40.083	40.093		
		(Post SB	(1018.11)	(1018.36)		
		PW4ENG 72-36 And Post SB PW4ENG 72-618)				
		Stator	40.123	40.133	.020*	.055*
			(1019.12)	(1019.38)	(0.508)*	(1.40)*
1589	D	Drum Rotor Disk Assembly (72-31-08)				
		LPC (Stage 1.6, 2, 3) Compressor				
		Stator Assembly (72-31-10)				
		(See Figure 801, Sheet 2)				
		Disk	37.875	37.885		
			(962.02)	(962.28)		
		Stator	37.907	37.917	.012*	.047*
			(962.84)	(963.09)	(0.305)*	(1.19)*

LOW PRESSURE COMPRESSOR (LPC) - INSPECTION/CHECK-04

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1590	D	Drum Rotor Disk Assembly (72-31-08) LPC (Stage 1.6, 2, 3) Compressor Stator Assembly (72-31-10) (See Figure 801, Sheet 2)				
		Disk	37.235 (945.77)	37.245 (946.02)		
		Stator	37.267 (946.58)	37.277 (946.84)	.012* (0.305)*	.047* (1.19)*
1591	A	LPC (Stage 1.6, 2, 3) Compressor Stator Assembly (72-31-10) LPC Stage 1 Compressor Stator Assembly (72-31-09) (See Figure 801, Sheet 3)				
		Stator (1.6, 2 and 3)	54.425 (1382.395)	54.431 (1382.547)		
		Stator (1)	54.418 (1382.218)	54.422 (1382.318)	.003T (0.08T)	.030T* (0.762T)*
1593	B	LPC Stage 4 Duct (72-31-11) LPC (Stage 1.6, 2, 3) Compressor Stator Assembly (72-31-10) (See Figure 801, Sheet 3)				
		Duct	46.896 (1191.158)	46.902 (1191.311)		
		Stator	46.889 (1190.981)	46.895 (1191.133)	.013T (0.33T)	.002* (0.051)*
1620	D	LPC (Stage 1.6, 2, 3) Compressor Stator Assembly (72-31-10) Stage 1.6 LPC Blade (72-31-03) (See Figure 801, Sheet 3)				
		Tip Clearance			.060 (1.52)	.112* (2.845)*
1621	D	LPC (Stage 1.6, 2, 3) Compressor Stator Assembly (72-31-10) Stage 2 LPC Blade (72-31-04) (See Figure 801, Sheet 3)				
		Tip Clearance			.059 (1.50)	.115* (2.921)*

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1622	D	LPC (Stage 1.6, 2, 3) Compressor Stator Assembly (72−31−10) Stage 3 LPC Blade (72−31−05) (See Figure 801, Sheet 3) Tip Clearance			.018 (0.46)	.080* (2.032)*
1623	D	LPC Stage 4 Duct (72−31−11) Stage 4 LPC Blade (72−31−06) (See Figure 801, Sheet 3) Tip Clearance			.000 (0.00)	.074* (1.880)*

G. Hub And Drum Rotor Disk Assembly Limits

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1626	A	LPC Stage 1.6 Disk See Chapter 5−10−00, Time Limits (See Figure 801, Sheet 1)				
1627	A	LPC Stage 2 Disk See Chapter 5−10−00, Time Limits (See Figure 801, Sheet 1)				
1628	A	LPC Stage 3 Disk See Chapter 5−10−00, Time Limits (See Figure 801, Sheet 1)				
1629	A	LPC Stage 4 Disk See Chapter 5−10−00, Time Limits (See Figure 801, Sheet 1)				
1630	A	Front Compressor Hub Assembly See Chapter 5−10−00, Time Limits (See Figure 801, Sheet 1)				
1631	A	Drum Rotor Disk Assembly See Chapter 5−10−00, Time Limits (See Figure 801, Sheet 1)				

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
2020	A	Compressor Inlet Cone (Rear), Segment See Chapter 5-10-00, Time Limits (See Figure 802)				

H. Spring Loads

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
470 (1)	A	No. 1 Bearing Seal Compressor Spring, PN 50B049 (72-31-17) (See Figure 803, Sheet 2)				
		At 1.269 Inches (32.233 mm)			.875 lbs (0.40 kg)	1.125 lbs (0.51 Kg)
		.709 Inch (18.009 mm)			4.000 lbs (1.81 kg)	4.250 lbs (1.92 kg)
470 (2)	A	No. 1 Bearing Seal Compressor Spring, PN 50B231 (72-31-17) (See Figure 803, Sheet 2)				
		At 1.240 Inches (31.496 mm)			1.5 lbs (0.68 kg)	1.625 lbs (0.74 kg)
		0.680 Inch (17.272 mm)			6.188 lbs (2.81 kg)	6.438 lbs (2.92 kg)
470 (3)	A	No. 1 Bearing Seal Compressor Spring, PN 50B946 (72-31-17) (See Figure 803, Sheet 2)				
		At 1.269 Inches (32.233 mm)			.938 lbs (0.43 kg)	1.063 lbs (0.48 kg)
		0.709 Inch (18.009 mm)			4.075 lbs (1.85 kg)	4.325 lbs (1.96 kg)

NOTE: In order to prevent buckling, bending, or other damage that could decrease spring load, Pratt & Whitney recommends that springs should be supported by an I.D. mandrel during load measurement.

I. Spline Data

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
950	B	1. Front Compressor Hub Assembly (72-31-07) Internal Spline (See Figure 802)				
		A. Effective Space Width	.0982 (2.494)	---		
		B. Actual Space Width	---	.1023 (2.598)		
		2. Turbine Shaft Coupling Assembly (72-32-01) External Spline (See Figure 802)				
		A. Effective Tooth Thickness	---	.0967 (2.456)		
		B. Actual Tooth Thickness	.0926 (2.352)	---		
		3. Fit			.0015 (0.038)	---

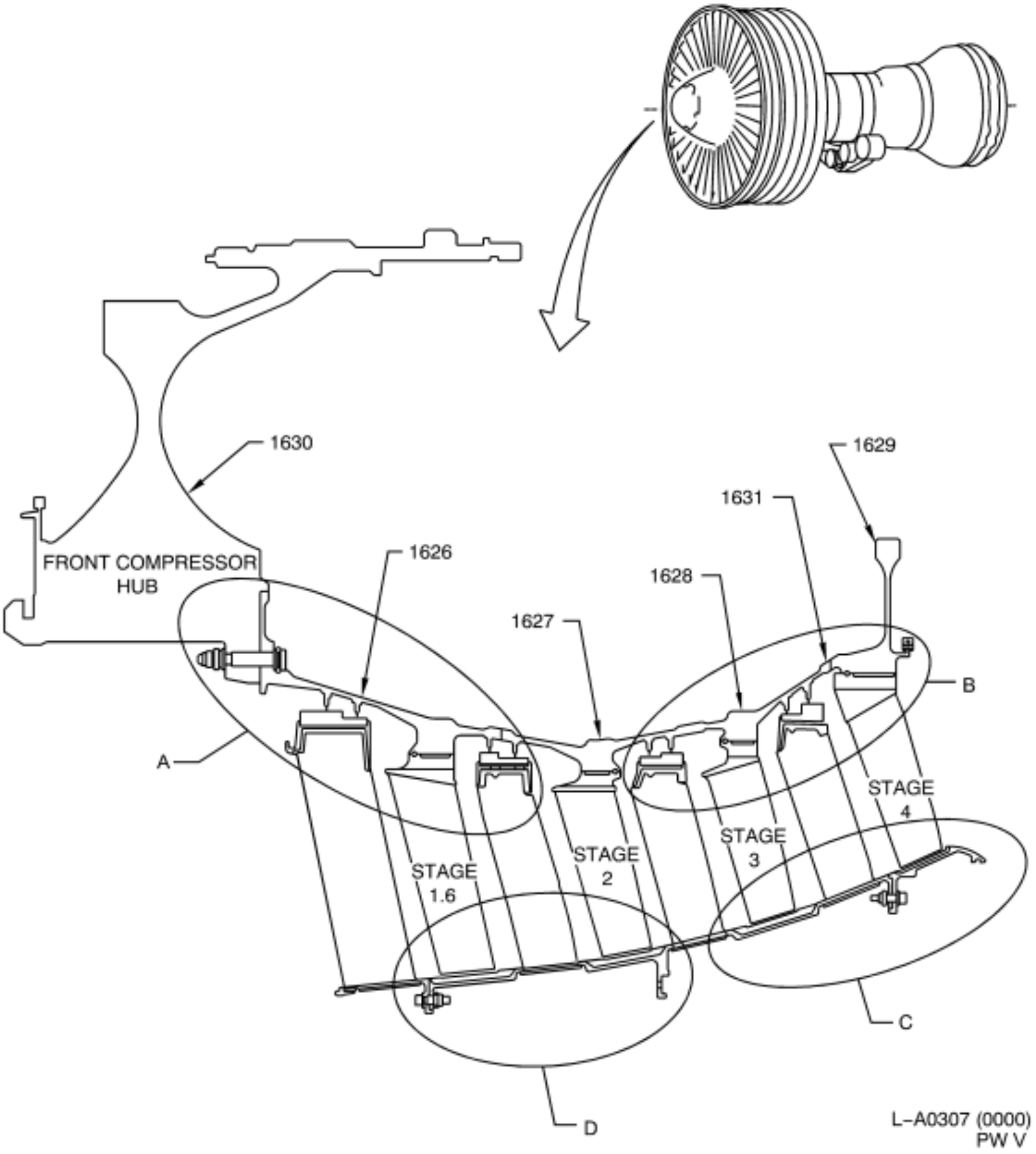
J. Special Torques

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
460	A	No. 1 Bearing (Inner Race) Retaining Nut (See Figure 803, Sheet 1) See 72-31-00, Assembly-01 Task 72-31-00-400-001 See 72-31-00, Assembly-02 R (Task 72-31-00-400-002-001) See 72-31-00, Assembly-03 R (Task 72-31-00-400-002-002)				

LOW PRESSURE COMPRESSOR (LPC) - INSPECTION/CHECK-04

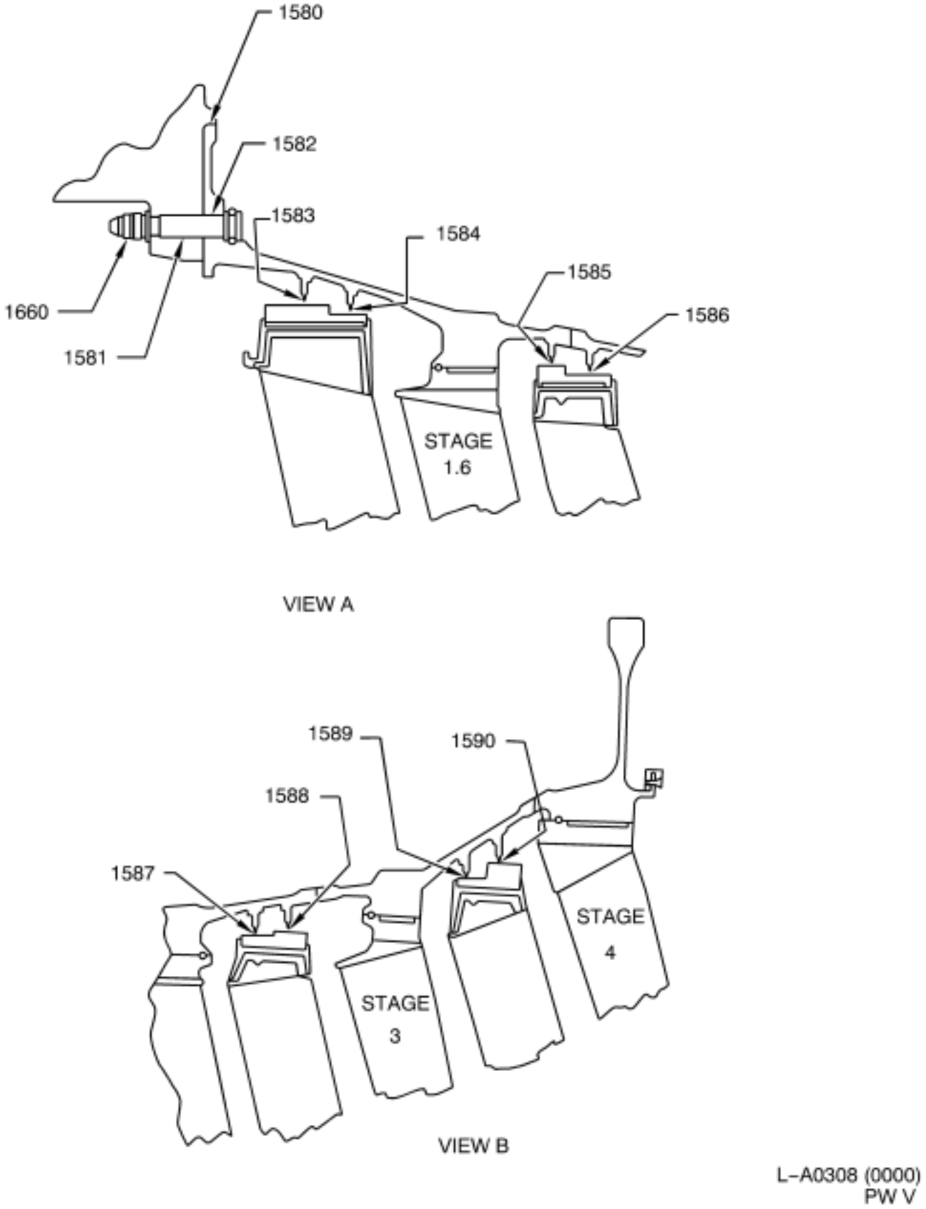
Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1660	A	LPC Tierod Nut Torquing Procedure (See Figure 801, Sheet 2) See 72-31-01, Assembly-05 R (Task 72-31-01-440-005)				

LOW PRESSURE COMPRESSOR (LPC) − INSPECTION/CHECK−04

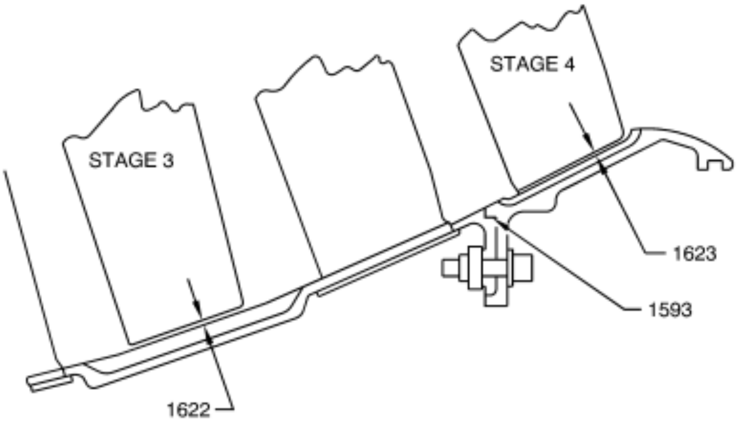

1630
1629
1631
FRONT COMPRESSOR HUB
1626
1628
1627
B
A
STAGE 4
STAGE 3
STAGE 2
STAGE 1.6
C
D
L−A0307 (0000)
PW V

Low Pressure Compressor (LPC)
Figure 801 (Sheet 1)
(Task 72−31−00−990−001)

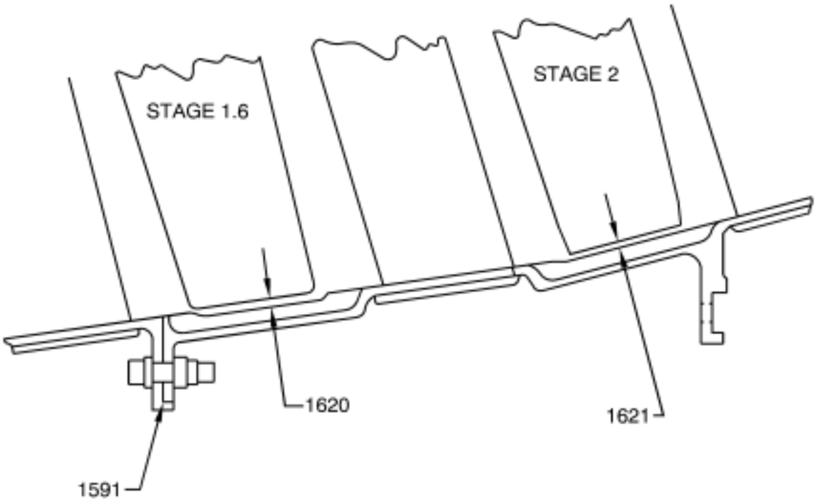
LOW PRESSURE COMPRESSOR (LPC) − INSPECTION/CHECK−04


1580
1582
1583
1584
1585
1586
1660
1581
STAGE 1.6
VIEW A
1589
1590
1588
1587
STAGE 4
STAGE 3
VIEW B
L−A0308 (0000)
PW V

Low Pressure Compressor (LPC)
Figure 801 (Sheet 2)
(Task 72−31−00−990−001)


STAGE 4
STAGE 3
1623
1593
1622

VIEW C

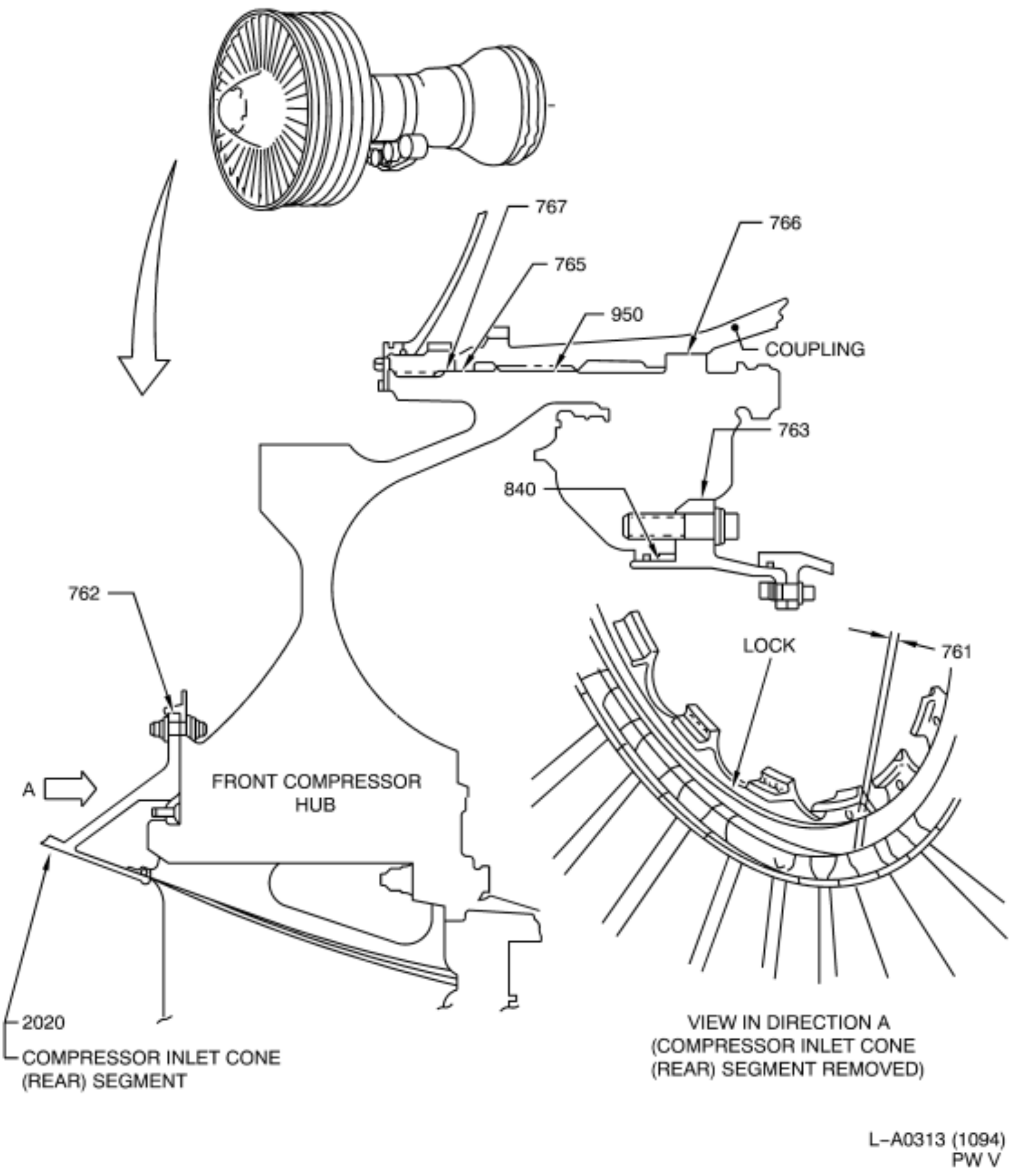

STAGE 2
STAGE 1.6
1620
1621
1591

VIEW D

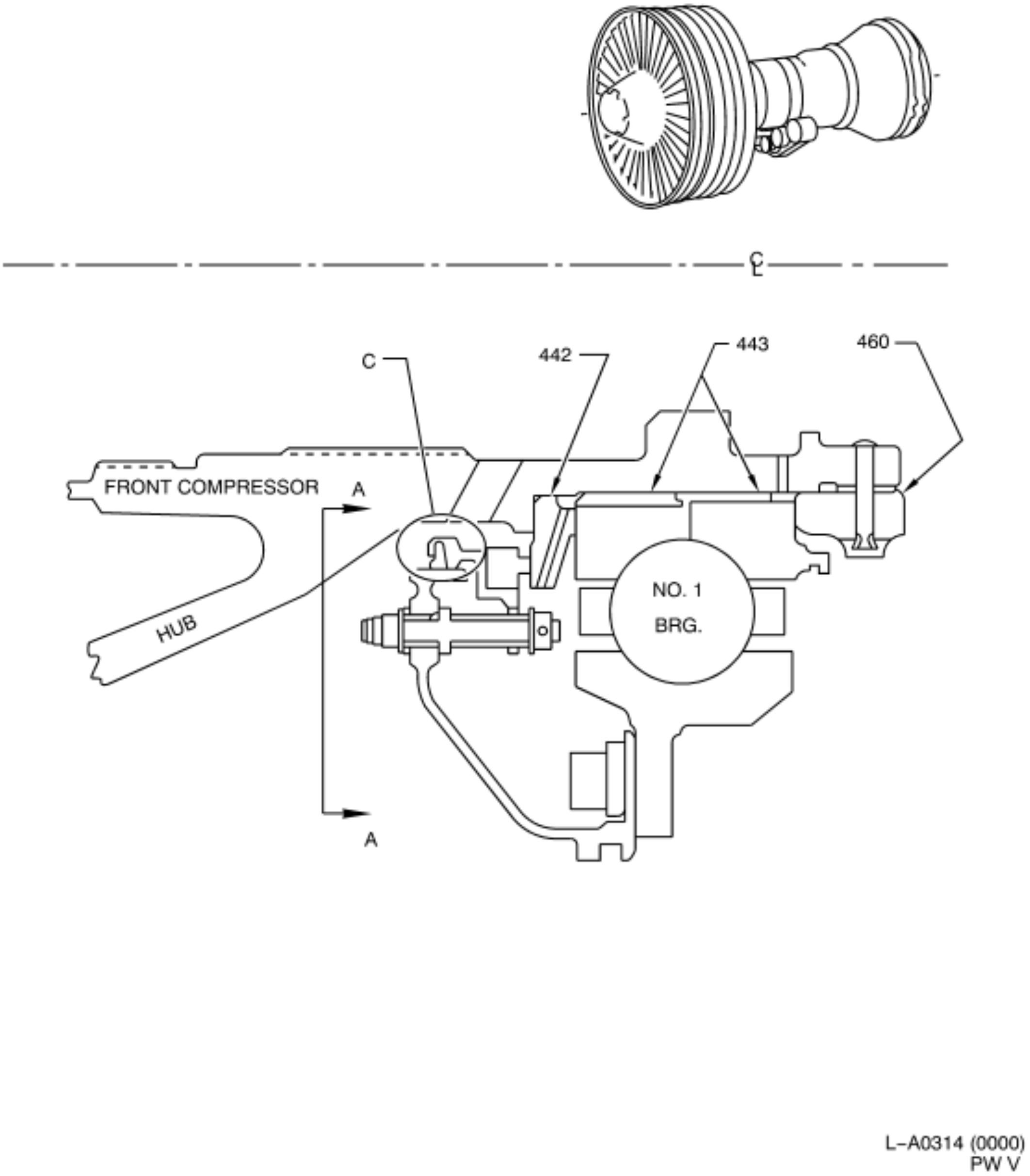
L−A0309 (0986)
PW V

Low Pressure Compressor (LPC)
Figure 801 (Sheet 3)
(Task 72−31−00−990−001)

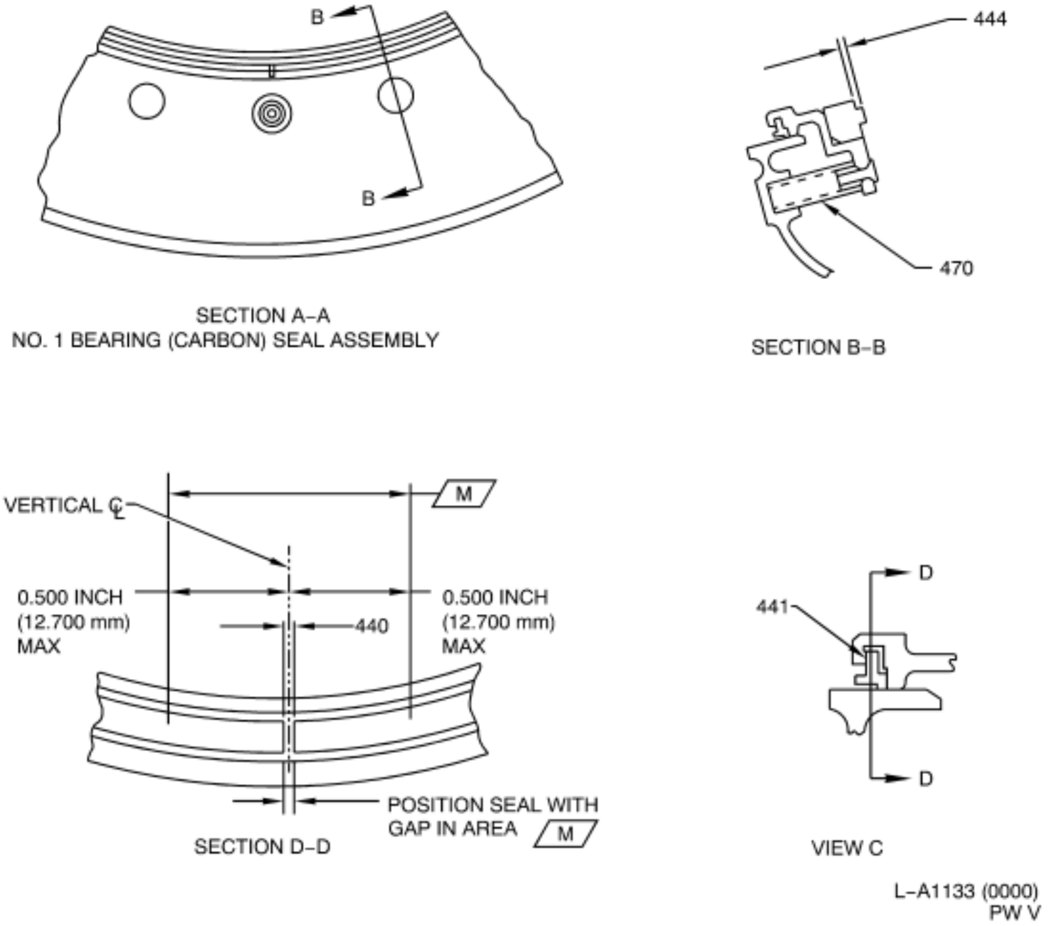
LOW PRESSURE COMPRESSOR (LPC) - INSPECTION/CHECK-04


767
765
766
950
COUPLING
763
840
762
LOCK
761
A
FRONT COMPRESSOR HUB
2020
COMPRESSOR INLET CONE (REAR) SEGMENT
VIEW IN DIRECTION A (COMPRESSOR INLET CONE (REAR) SEGMENT REMOVED)
L-A0313 (1094)
PW V

Low Pressure Compressor (LPC)
Figure 802
(Task 72-31-00-990-001)

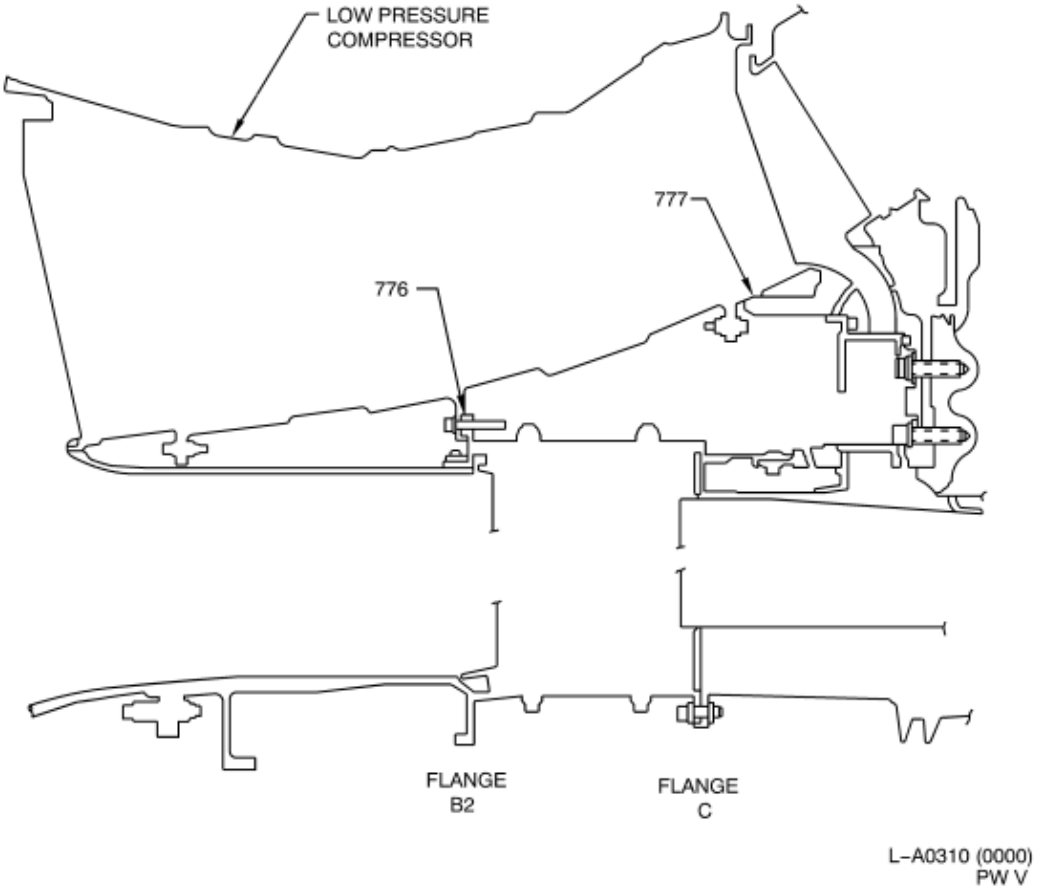

C
L
C
442
443
460
FRONT COMPRESSOR
A
HUB
NO. 1
BRG.
A
L−A0314 (0000)
PW V

Low Pressure Compressor (LPC)
Figure 803 (Sheet 1)
(Task 72−31−00−990−001)


B
B
SECTION A−A
NO. 1 BEARING (CARBON) SEAL ASSEMBLY
444
470
SECTION B−B
VERTICAL ℄
M
0.500 INCH
(12.700 mm)
MAX
440
0.500 INCH
(12.700 mm)
MAX
POSITION SEAL WITH
GAP IN AREA
M
SECTION D−D
D
441
D
VIEW C
L−A1133 (0000)
PW V

Low Pressure Compressor (LPC)
Figure 803 (Sheet 2)
(Task 72−31−00−990−001)

LOW PRESSURE COMPRESSOR (LPC) − INSPECTION/CHECK−04


LOW PRESSURE COMPRESSOR
777
776
FLANGE B2
FLANGE C
L−A0310 (0000)
PW V

Low Pressure Compressor (LPC)
Figure 804
(Task 72−31−00−990−001)

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LOW PRESSURE COMPRESSOR (LPC) - INSPECTION/CHECK-05

Task 72-31-00-200-005:

1. Functional Check - Vacuum Check No. 1 Bearing Compartment

A. Equipment Materials Required

Special Tools:
CTE 6075 Cart, Vacuum
PWA 85478 Adapter, Vacuum Check
PWA 85584 Protector

B. Procedure

See Figure 801.

(1) Ensure that packing is installed in OD groove of seal assembly and in OD groove of adapter.

(2) Attach hoist to eye bolt on PWA 85478 Adapter and lift to position it over hub and No. 1 bearing.

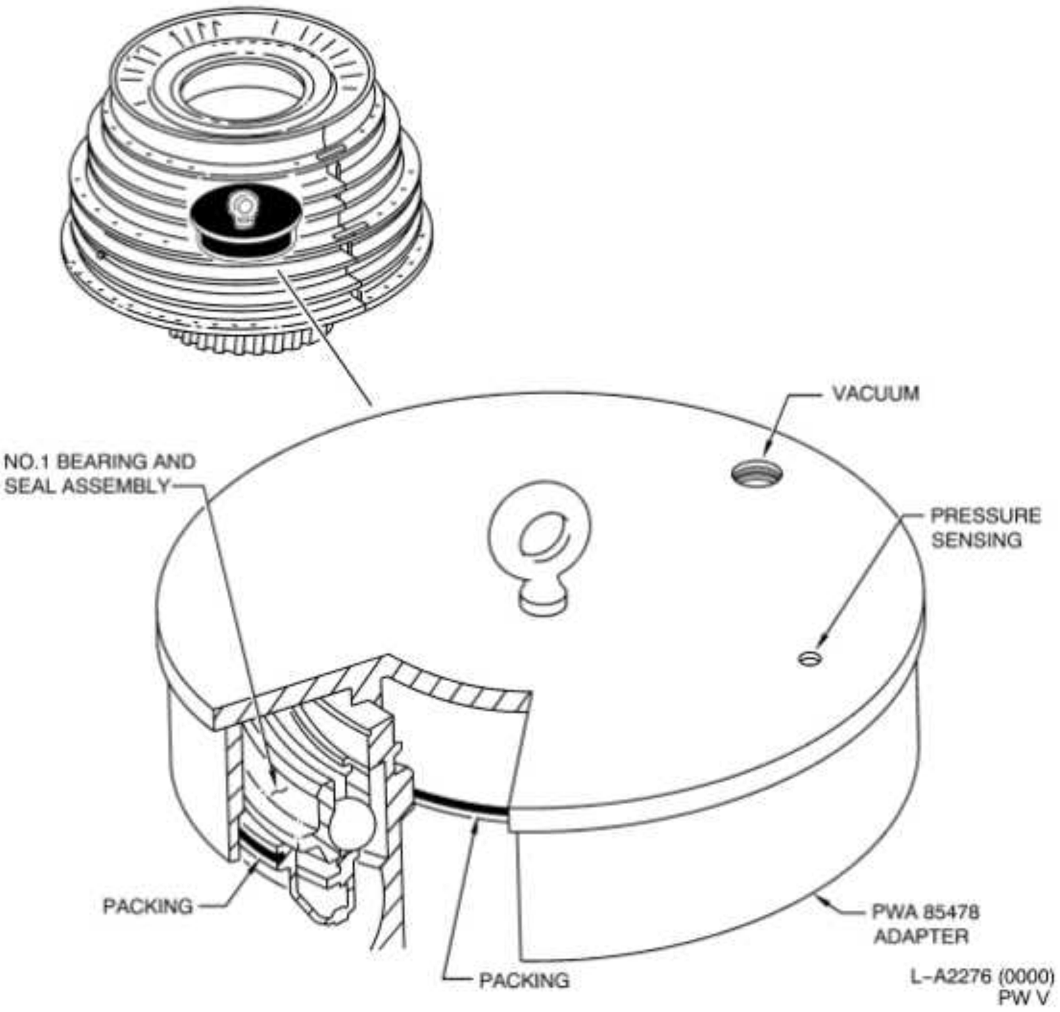
(3) Attach vacuum hose and pressure sense line from CTE 6075 Vacuum Cart and vacuum check No. 1 bearing compartment with the vacuum cart pressure set at PAMB minus 10 psi (69 kPa), or PAMB minus 20 inches (508 mm) HG. At sea level this is 5.0 psia (34.5 kPa absolute).

(a) (Pre SB PW4ENG 72-245) Airflow must not exceed 14 lbs. (6.36 kg) per hour.

(b) (Post SB PW4ENG 72-245) Airflow must not exceed 5 lbs. (2.27 kg) per hour.

(4) Disconnect lines from adapter. Attach hoist to eye bolt on adapter and remove from No. 1 bearing.

(5) Install PWA 85584 Protector over No. 1 bearing assembly.


VACUUM
NO.1 BEARING AND SEAL ASSEMBLY
PRESSURE SENSING
PACKING
PWA 85478 ADAPTER
PACKING
L-A2276 (0000)
PW V

Vacuum Check No. 1 Bearing Compartment
Figure 801
(Task 72-31-00-200-005)

Previous Pageblock Return to Previous Menu Next Pageblock

LOW PRESSURE COMPRESSOR (LPC) - ASSEMBLY-01

Task 72-31-00-400-001:

1. Assemble Low Pressure Compressor (LPC)
   A. Prerequisites
      (1) Assemble axial compressor rotor assembly. See 72-31-01, Assembly-01 (Task 72-31-01-440-001).
      (2) Assemble No. 1 bearing (carbon) seal assembly. See 72-31-17, Assembly-01 (Task 72-31-17-440-001).
      (3) See Inspection/Check-04, (Task 72-31-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.
   B. Equipment And Materials Required

Special Tools:
PWA 28657 Sling
PWA 76154 Adapter, Lift And Trunnion (2 Required)
PWA 85520 Fixture, Install And Remove
PWA 85589 Eye, Lifting
PWA 85660 Stand, Build/Storage
PWA 85791 Adapter, Counter-Torque

Consumable Materials:

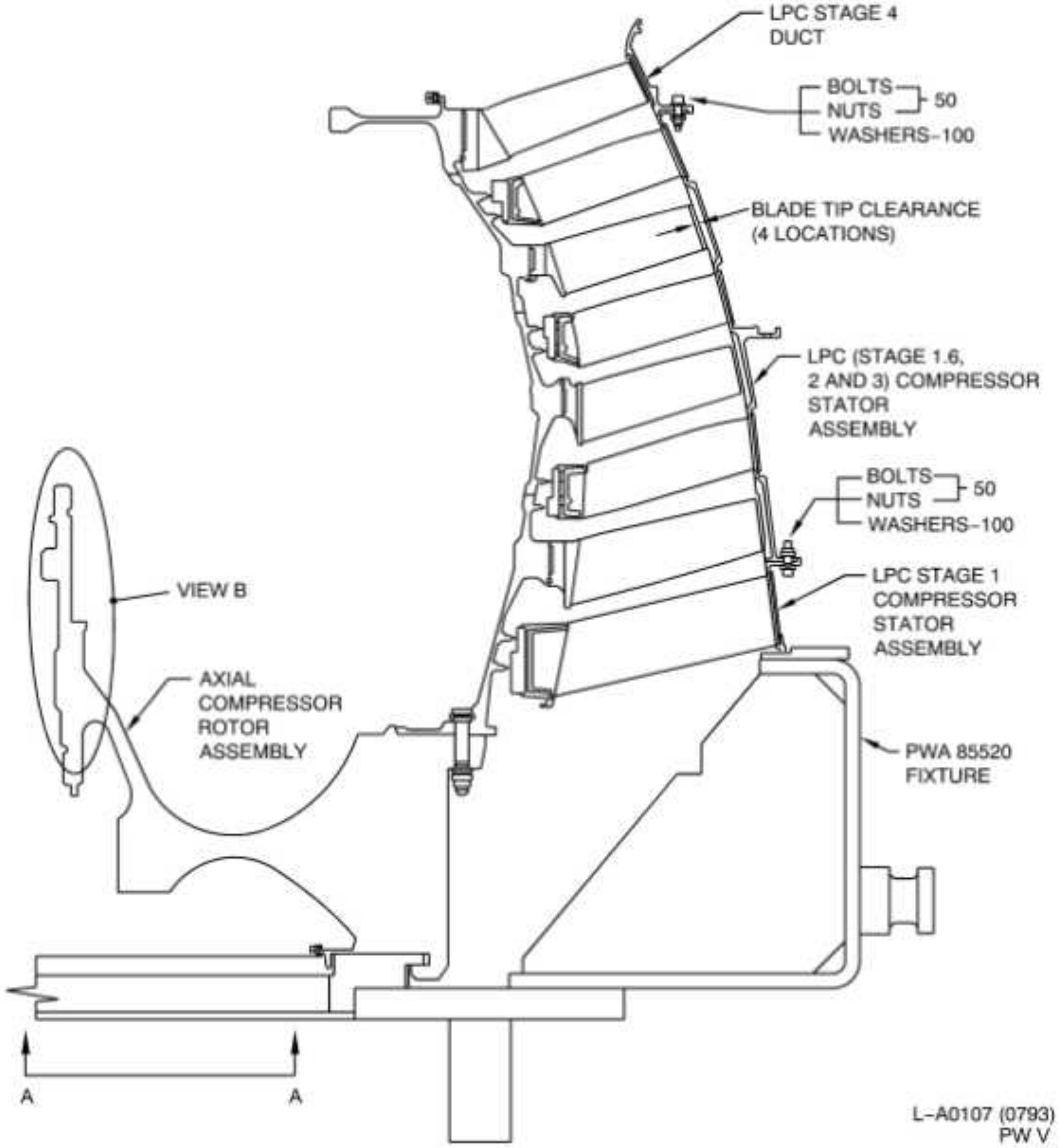
Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P09-014	Sealant, Silicone Rubber (PWA 36003)

   C. Procedure
      See Figure 1001.

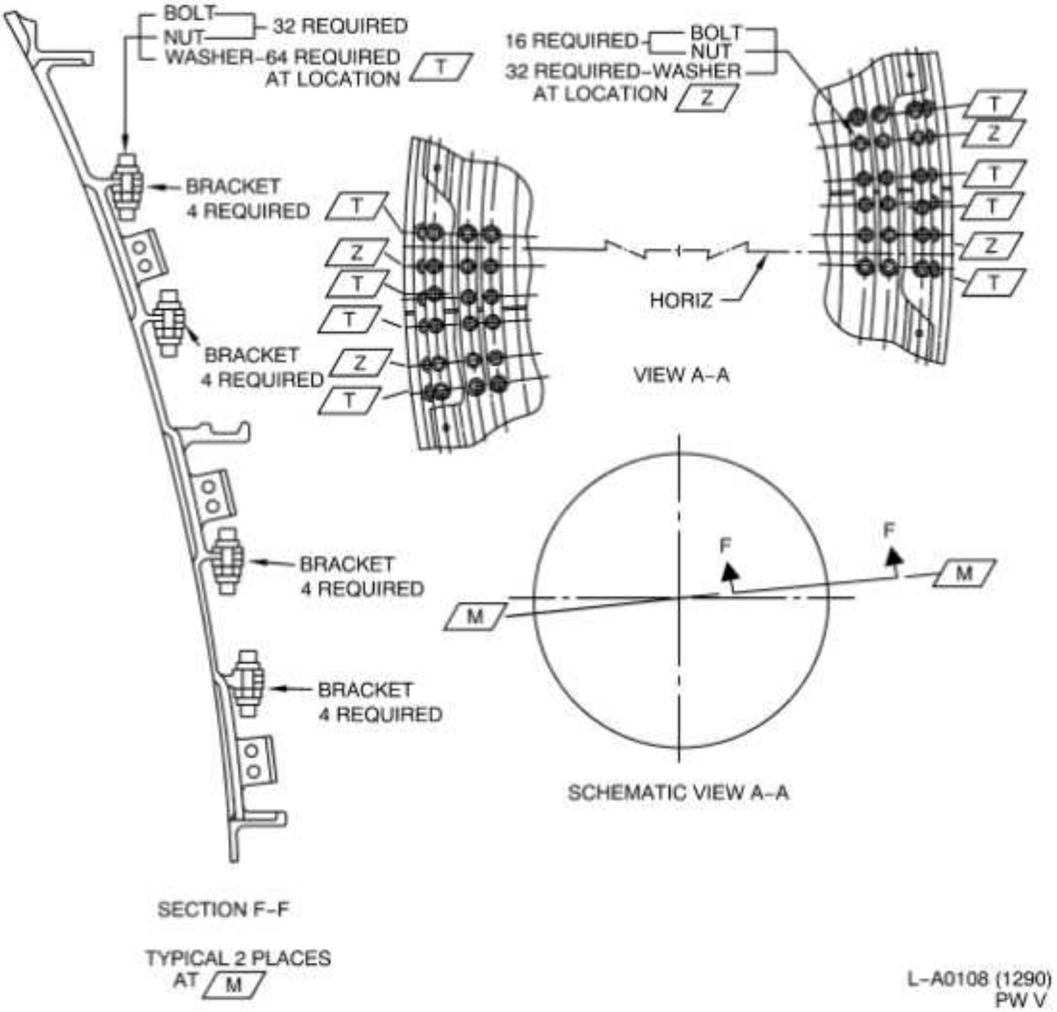
Subtask 72-31-00-430-051:
      (1) Attach PWA 28657 Sling with hoist and two PWA 76154 Adapters to PWA 85520 Fixture and place feet end down on work area.
      (2) Install LPC Stage 1 compressor stator assembly to Fixture (PWA 85520), bolt hole flange up.
      (3) With axial compressor rotor assembly in PWA 85660 Stand, hub end up, install PWA 85791 Adapter into hub ID and secure with detail nut.

NOTE: This adapter is not used until Assembly-02 (Task 72-31-00-400-002-001) and Assembly-03 (Task 72-31-00-400-002-002).

LOW PRESSURE COMPRESSOR (LPC) − ASSEMBLY−01


LPC STAGE 4 DUCT
BOLTS
NUTS
WASHERS-100
50
BLADE TIP CLEARANCE (4 LOCATIONS)
LPC (STAGE 1.6, 2 AND 3) COMPRESSOR STATOR ASSEMBLY
BOLTS
NUTS
WASHERS-100
50
LPC STAGE 1 COMPRESSOR STATOR ASSEMBLY
VIEW B
AXIAL COMPRESSOR ROTOR ASSEMBLY
PWA 85520 FIXTURE
A
A
L-A0107 (0793)
PW V

Low Pressure Compressor (LPC) Assembly
Figure 1001 (Sheet 1)
(Task 72−31−00−400−001)


BOLT
NUT
32 REQUIRED
WASHER-64 REQUIRED
AT LOCATION T
16 REQUIRED
BOLT
NUT
32 REQUIRED-WASHER
AT LOCATION Z
BRACKET
4 REQUIRED
T
Z
T
T
Z
T
T
Z
T
T
Z
T
HORIZ
BRACKET
4 REQUIRED
VIEW A-A
BRACKET
4 REQUIRED
F
F
M
M
BRACKET
4 REQUIRED
SCHEMATIC VIEW A-A
SECTION F-F
TYPICAL 2 PLACES
AT M
L-A0108 (1290)
PW V

Low Pressure Compressor (LPC) Assembly
Figure 1001 (Sheet 2)
(Task 72−31−00−400−001)

(4) With Sling (PWA 28657), hoist and two Adapters (PWA 76154), lift and trunnion Fixture (PWA 85520) to feet end up. Install fixture onto axial compressor rotor assembly and secure fixture to rotor.

(5) Lift and trunnion fixture with rotor assembly and place feet end down on work area. Remove hoist and fixture from rotor.

Subtask 72−31−00−430−052:

(6) Clean mating area of stator halves and seal assemblies by SPOP 208 Wipe Method (Task 70−21−00−110−040). Surfaces shall be thoroughly dried in air for 15 minutes.

(7) Apply Silicone Rubber (P09−014) on Surfaces AG and AH for Distance AD. Silicone rubber must not protrude into air flowpath after installing seal assembly. See Figure 1002.

(8) Apply a thin bead of Silicone Rubber (P09−014) on seal assembly Surface AF (typically three places) for Distance AE. See Figure 1002.

(9) Install seal assembly until Surface AF contacts stator case OD. Assemble before silicone rubber cures. See Figure 1002.

Subtask 72−31−00−430−063:

(10) (References 1620, 1621, 1622, and 1623) Do a check of the blade tip clearances. Do this check before you assemble the axial compressor rotor assembly to the LPC (Stage 1.6, 2 and 3) compressor stator assembly. See Figure 1001.

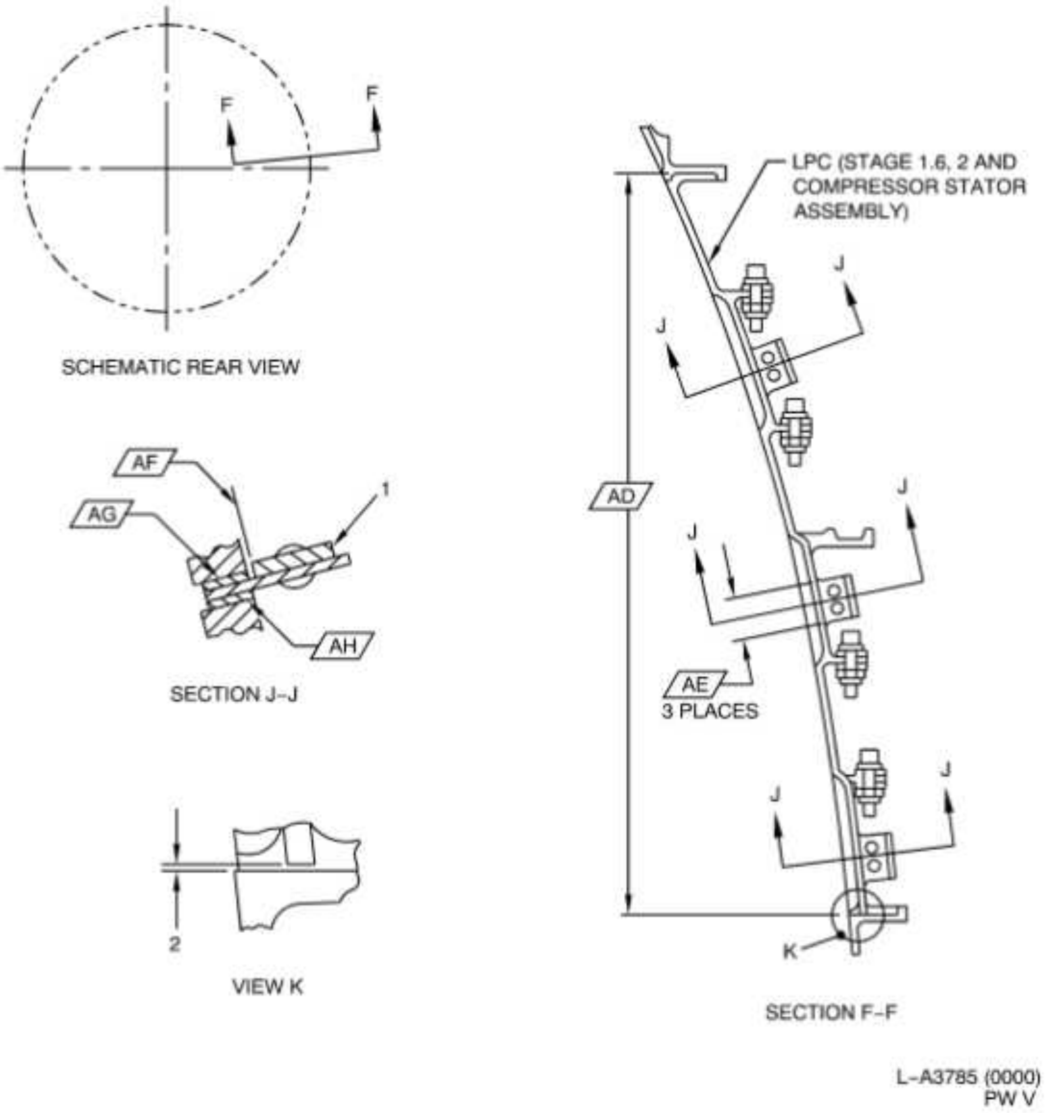
NOTE: It is not necessary to do a check of blade tip clearances if all of the items that follow apply: 1) The blades are installed in the rotor and are the same blades that were installed at the previous installation 2) The blades have been inspected and show no signs of FOD, cracks, or erosion 3) The outer airseals are either serviceable or have been repaired.

(a) Measure the OD of the axial compressor rotor assembly at the Stage 1.6, 2, 3, and 4 blades.

(b) Measure the ID of the LPC (Stage 1.6, 2 and 3) compressor stator assembly at each of the outer airseals.

(c) Measure the ID of the Stage 4 duct at the outer airseal.

(d) Use the above measurements to calculate the tip clearances for the four stages of blade.


F
F
SCHEMATIC REAR VIEW
AF
AG
1
AH
SECTION J-J
2
VIEW K
LPC (STAGE 1.6, 2 AND COMPRESSOR STATOR ASSEMBLY)
J
J
AD
J
J
AE
3 PLACES
J
J
K
SECTION F-F
L-A3785 (0000)
PW V

1. Seal Assembly, PN 50B210 (2 Required)
2. 0.000 - 0.010 Inch (0.000 - 0.254 mm)

Sealant Application
Figure 1002
(Task 72-31-01-400-002)

(e) The tip clearances must be in the limits specified in Inspection/Check-04 (Task 72-31-00-990-001).

Subtask 72-31-00-430-064:

(11) Attach PWA 85589 Lifting Eye to LPC (Stage 1.6, 2 and 3) compressor stator assembly halves and install to axial compressor rotor assembly larger OD down mating with LPC Stage 1 compressor stator assembly. Install 48 bolts, threads lubricated with Engine Oil (P03-001), 96 washers, 16 brackets and 48 nuts to secure stator halves. Tighten and torque nuts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(12) Remove excess sealant. Cure in ambient air of 25 percent minimum relative humidity for 24 hours prior to engine run.

(13) Align holes in Stage 1 stator flange with holes in compressor stator flange and install 50 bolts, threads lubricated with Engine Oil (P03-001), 100 washers and 50 nuts. With bolt heads down, tighten and torque nuts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

Subtask 72-31-00-430-053:

CAUTION: THE FOLLOWING 4TH STAGE DUCTS AND STAGE 4 LPC BLADES MUST BE ASSEMBLED IN SETS ONLY OR BLADE, RUBSTRIP AND SHROUD DAMAGE MAY OCCUR.

- PN 50B227 4TH STAGE DUCT MUST BE ASSEMBLED WITH PN 51B404 STAGE 4 LPC BLADE.

- PN 50B023 4TH STAGE DUCT CAN BE ASSEMBLED WITH PN 51B104 OR PN 51B404 STAGE 4 LPC BLADES.

THE ABOVE SETS ARE INTERCHANGEABLE WITH PN 54B016 OR PN 56B916 OR PN 56B016 OR PN 56B116 LPC COMPRESSOR STATOR ASSEMBLIES.

(14) Install 4th stage duct to previously installed stators. Align bolt holes and install 50 bolts, threads lubricated with Engine Oil (P03-001), 100 washers and 50 nuts. With bolts heads up, tighten and torque nuts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(15) Install data plate to bracket on stator half. Secure with two screws, threads lubricated with Engine Oil (P03-001), and nuts. Tighten and torque nuts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

D. Postrequisites

(1) Install the No. 1 bearing and seal assembly. See Assembly-02 (Task 72-31-00-400-002) or Assembly-03 (Task 72-31-00-400-003).

LOW PRESSURE COMPRESSOR (LPC) - ASSEMBLY-02

Task 72-31-00-400-002-001:

1. Install The No. 1 Bearing And Seal Assembly (Mechanical Method)

A. Prerequisites

(1) Assemble the low pressure compressor (LPC). See 72-31-00, Assembly-01 Task 72-31-00-400-001.

B. Equipment And Materials Required

Special Tools:

PWA 26523	Riveter (Optional to PWA 86338)
PWA 29614	Wrench, Mechanical
PWA 29615	Holder
PWA 45419	Multiplier, Pneumatic (Optional to PWA 80651)
PWA 80651	Multiplier, Pneumatic
PWA 85178	Gage, Assembly
PWA 85186	Drift
PWA 85524	Ring, Alignment
PWA 85584	Protector, Plastic
PWA 85653	Wrench, Torque
PWA 85654	Adapter, Handling
PWA 85793	Adapter, Handling
PWA 86338	Riveter

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-045	Pen, Marker (PMC 4092)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Rivet	2	72-31-00/7/200

C. Procedure

NOTE: The LPC is rear end up in PWA 85520 Fixture. PWA 85791 Adapter is installed in the ID of the front compressor hub assembly (called hub).

Subtask 72−31−00−430−054:

(1) (Reference 460) Measure Dimension F as follows (Method 1). See Figure 1001.

NOTE: To measure Dimension F, use either this method or Method 2.

(a) Install the No. 1 bearing seal seat (called seal seat), the bearing inner races, and the No. 1 bearing (inner race) retaining nut (called nut), lubricated with Engine Oil P03−001, on PWA 85178 Gage. The diametral empty space between the gage and the stacked parts must be 0.001 − 0.005 inch (0.026 − 0.127 mm).

(b) Install PWA 85654 Adapter on the gage. Install PWA 85653 Wrench in the nut. Install PWA 29614 Wrench on PWA 85653 Wrench. Install PWA 29615 Holder. Tighten and torque the nut to 33,600 − 37,200 lb−in. (3796.289 − 4203.035 N.m). There must be zero clearance between all mating parts.

R (c) Put the detail−8 bar and dial indicator of the gage on top of the nut. Move the dial indicator off the detail−16 flush pin to set the indicator on zero.

(d) Move the dial indicator on the flush pin. Read the measurement (Dimension M). Write the measurement. Do this measurement at several positions. Calculate the average value of Dimension M. Add this value to the basic gage size
R stamped on the detail−8 bar (Dimension X). Call this sum Dimension F.

$$F = X + \text{average } M$$

(e) Remove the engine parts from the gage.

(2) (Reference 460) Measure Dimension F as follows (Method 2).

NOTE: To measure Dimension F, use either this method or Method 1.

(a) Measure the thickness of each of the parts that follow. Do the measurements at four positions that are at the same distance from each other. Write the measurements.

1 The seal seat (Dimension K)

2 The inner races (Dimensions N and P)

3 The nut (Dimension Q).

(b) Add together the maximum thicknesses from each part. Call this sum Dimension F.

F = maximum K + maximum N + maximum P + maximum Q

(3) (Reference 460) Measure Dimension B as follows. See Figure 1002.

(a) Measure the dimension from the rear (top) face of the fan hub to the shoulder of the hub. Use the detail−8 bar, detail−21 flush pin, and detail dial indicator of PWA 85178 Gage. Call this Dimension Y.

NOTE: It is permitted to use standard shop equipment to measure Dimension B.

(b) Add Dimension Y to the basic gage size stamped on the detail−8 bar (Dimension X) if the flush pin is below the top of the bar. Subtract Dimension Y from Dimension X if the flush pin is above the top of the bar. Call this Dimension B.

B = X + Y   OR   B = X − Y

NOTE: This equation does not apply if you do not use the gage.

Subtask 72−31−00−430−055:

(4) Install the No. 1 bearing (carbon) seal assembly on the hub as follows. See Figure 1003.

Subtask 72−31−00−430−056:

(5) Install the seal seat on the hub. The flat face marked FRONT must be face down.

Subtask 72−31−00−430−057:

(6) Install the No. 1 ball bearing on the hub as follows.

(a) Heat the inner races. Refer to Standard Practices Manual, PN 585005.

(b) With correct gloves on your hands, remove the front half of the inner race (without the puller groove). Install the inner race on the hub. Use PWA 85186 Drift.

(c) Install the outer race on the hub.

(d) Lift the outer race to put it a little above the inner race. Install the bearing balls and cage in the outer race. Lower the outer race.

(e) With correct gloves on your hands, remove the rear half of the inner race from the heat source. Hold the inner race with the puller groove up. Align the X marks on the front and rear inner races. Install the inner race on the hub. Use PWA 85186 Drift.

Subtask 72−31−00−430−058:

CAUTION: IF THE NUT YOU INSTALL IS NOT NEW, YOU MUST PUT NEW SILVER PLATE ON IT BEFORE YOU INSTALL IT. IF YOU DO NOT, IT WILL CAUSE DAMAGE TO THE MATING PARTS. TO PLATE THE NUT, REFER TO PW4000 Series CIR, PN 51A357.

(7) Install the nut on the hub as follows. See Figure 1004.

(a) Install the nut, threads lubricated with Engine Oil P03−001, on the hub.

(b) Install PWA 85793 Adapter on PWA 85791 Adapter.

(c) Install PWA 85653 Wrench on the adapter.

(d) Install PWA 29614 Wrench on the adapter. Install PWA 29615 Holder and PWA 45419 Multiplier or PWA 80651 Multiplier on the wrench.

(e) Tighten the nut with PWA 29614 Wrench.

CAUTION: IF YOU MUST COMPLETE THE FOLLOWING TORQUE PROCESS MORE THAN THREE TIMES, YOU MUST REMOVE THE NUT AND PLATE IT AGAIN BEFORE YOU TORQUE IT THE FOURTH TIME. THE MAXIMUM NUMBER OF TIMES YOU CAN COMPLETE THE TORQUE PROCESS BEFORE IT IS NECESSARY TO RE−PLATE THE NUT IS THREE. TO PLATE THE NUT, REFER TO PW4000 SERIES CIR, PN 51A357.

(8) (Reference 460) Torque the nut as follows.

(a) Torque the nut to 33,600 − 37,200 lb−in. (3796.289 − 4203.035 N.m). Turn the nut through an angle of 14 − 16 degrees. Loosen the nut to zero.

(b) Torque the nut to 33,600 − 37,200 lb−in. (3796.289 − 4203.035 N.m).

(c) Use a Marker Pen P05−045 and make a reference point mark on the nut and an adjacent part. Marks must be aligned.

(d) Measure Dimension L as follows.

1 The temperature of all parts must be within ± 5°F (2.8°C) of room temperature when you measure the parts.

2 Set the dial indicator of PWA 85178 Gage to zero.

3 Measure the dimension from the rear (top) face of the nut to the rear (top) face of the hub (Dimension Z). Use the detail−15 bar and the detail−16 flush pin. Do the measurement several times. Calculate the value of average Dimension Z.

NOTE: It is permitted to use standard shop equipment to measure Dimension L.

4 Add Dimension Z to the basic gage size stamped on the detail bar if the flush pin is below the top of the detail bar. Subtract Dimension Z from the basic gage size stamped on the detail

bar if the flush pin is above the top of the detail bar.

L = detail−15 basic gage size + average Z OR
L = detail−15 basic gage size − average Z

NOTE: This equation does not apply if you do not use the gage.

5 The statements that follow must be true:

L <= F − B + 0.000 inch (0.0000 mm) AND
L >= F − B − 0.001 inch (0.025 mm)

(e) Turn the nut through an angle of 14 − 16 degrees. Loosen the nut to zero.

(f) Torque the nut to 33,600 − 37,200 lb−in. (3796.289 − 4203.035 N.m).

(g) Do a check of the reference points as follows.

1 The reference point on the nut must be either aligned with the reference point on the mating part or beyond it within 1 degree 30 minutes.

2 If the reference points are within limits, turn the nut through an angle of 14 − 16 degrees. If necessary, advance 2 degrees 30 minutes, maximum, to the next locking feature.

3 If the reference points are not within limits, do steps (d), (e), and (f), in that order, until the reference points are within limits. Then do step (g).

(9) Remove from the hub the tools that you used to torque the nut.

Subtask 72−31−00−430−059:

(10) Install the rivets in the nut as follows.

(a) Install two rivets, 180 degrees apart, through the hub and the nut. The head of the rivet must be in the ID of the hub.

(b) Flare the heads of the rivets. Use PWA 86338 Riveter or PWA 26523 Riveter.

(11) Put PWA 85524 Ring over the flange of the bearing. With the detail foolproof and location pins, align the bearing with the seal assembly.

Subtask 72−31−00−430−062:

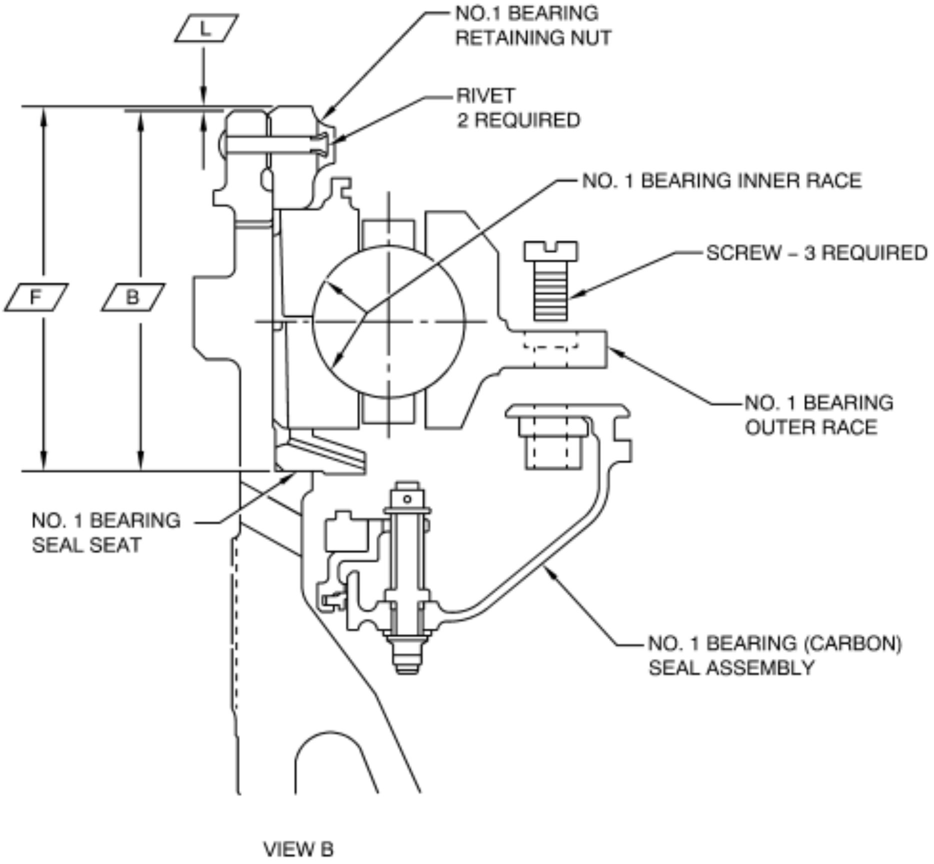
(12) Attach the bearing to the seal assembly as follows.

  (a) Apply Engine Oil P03−001 to the threads of three fillister head screws.

  (b) Lift the seal assembly to touch the flange of the bearing outer race.

  (c) Install the three screws in the outer race. Tighten and torque the screws to 22 lb−in. (2.486 N.m) plus the torque necessary to turn the screw through the self−locking threads. The maximum torque permitted is 95 lb−in. (10.734 N.m).

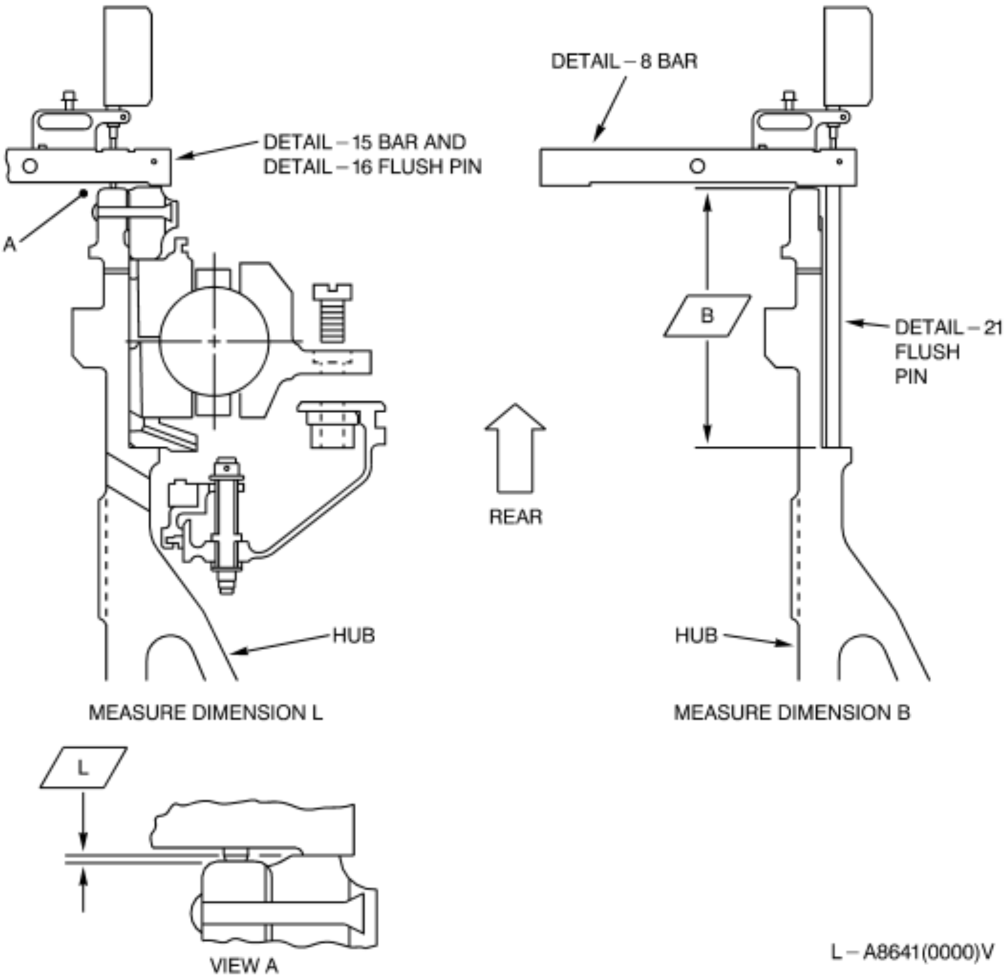
(13) Remove the ring from the hub. Install PWA 85584 Protector over the bearing and seal assembly.


L
NO.1 BEARING RETAINING NUT
RIVET 2 REQUIRED
NO. 1 BEARING INNER RACE
SCREW - 3 REQUIRED
F
B
NO. 1 BEARING OUTER RACE
NO. 1 BEARING SEAL SEAT
NO. 1 BEARING (CARBON) SEAL ASSEMBLY
VIEW B

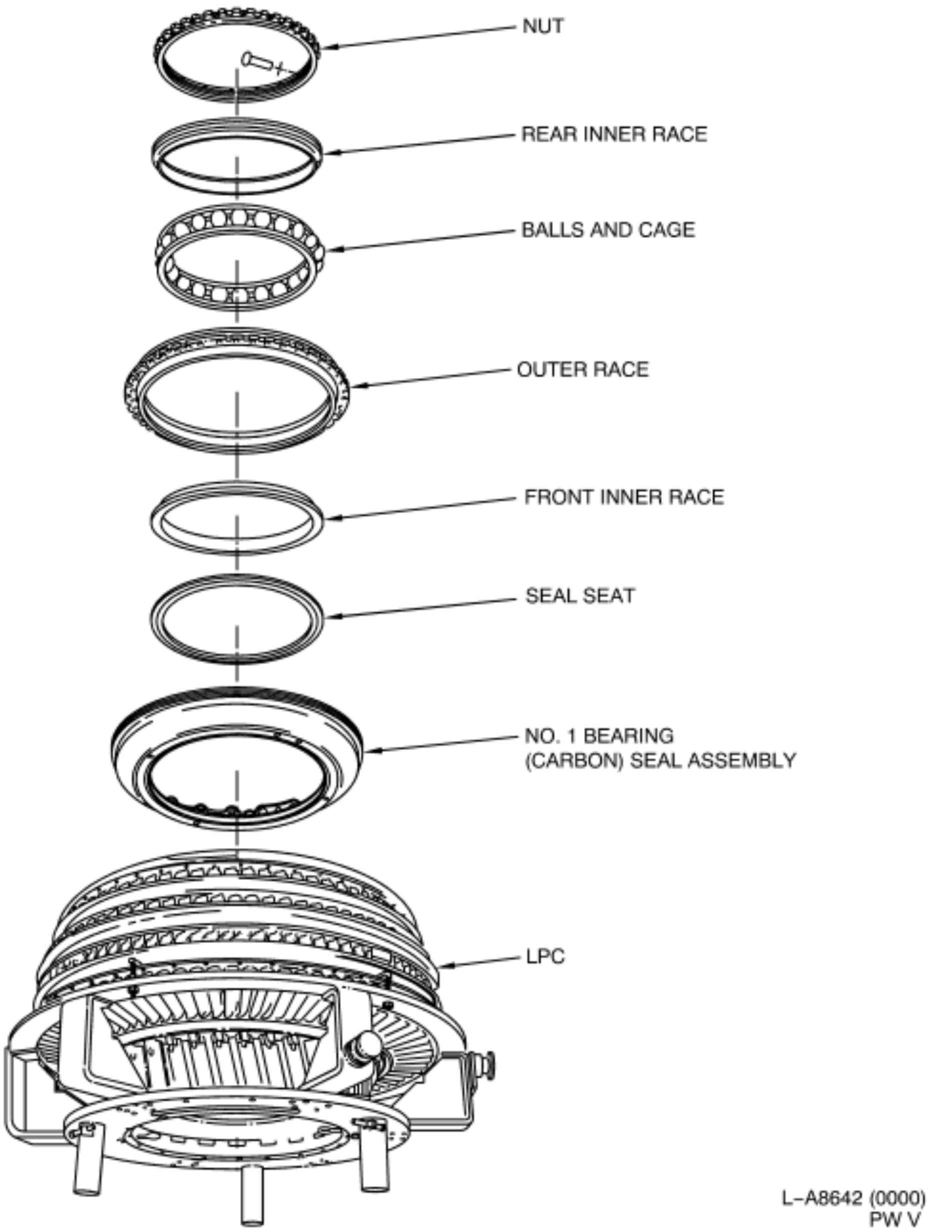
L-A0109 (0000)
PW V

Dimensions F, B, And L
Figure 1001
(Task 72-31-00-400-002-001)

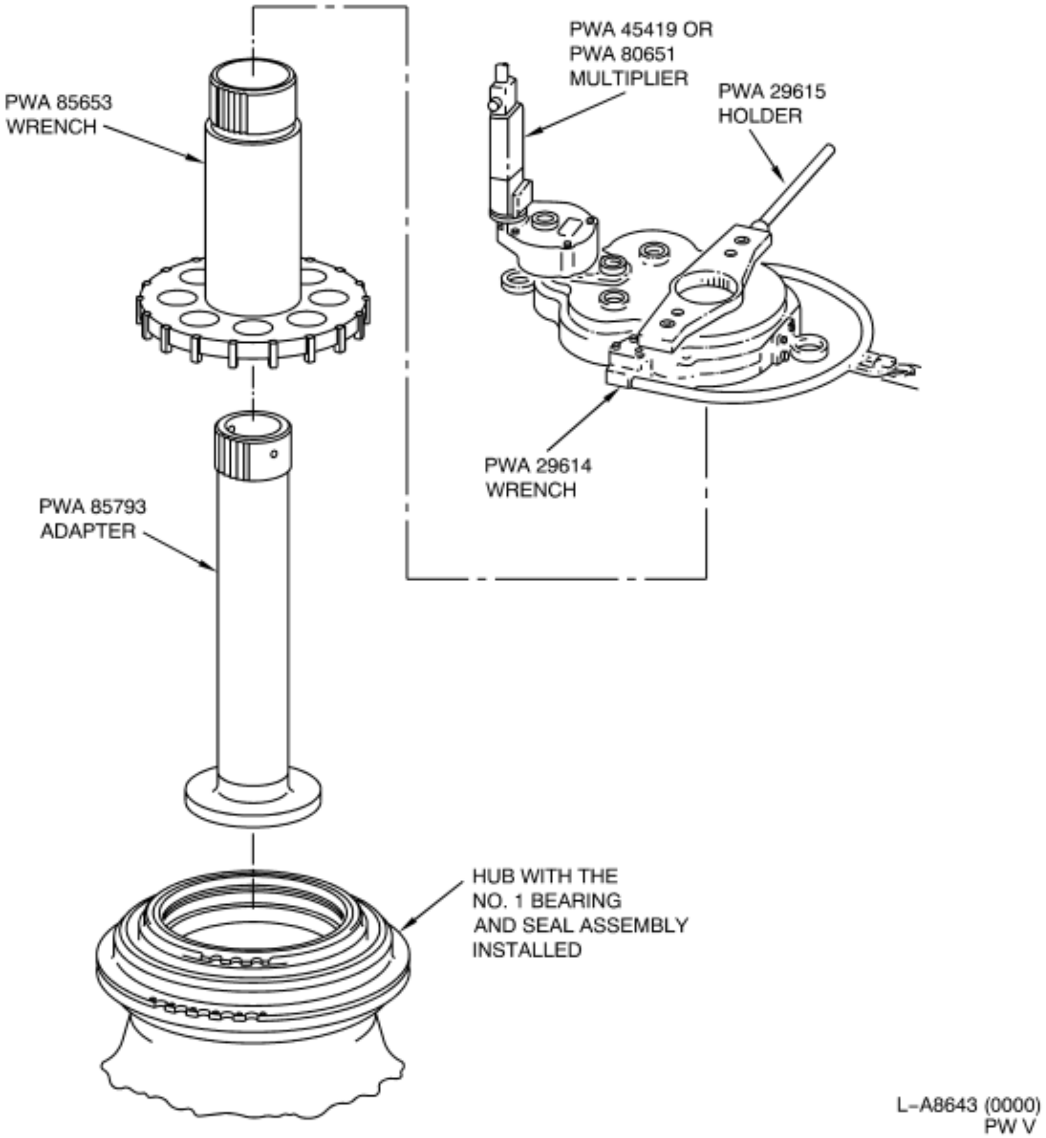
LOW PRESSURE COMPRESSOR (LPC) - ASSEMBLY-02


DETAIL - 8 BAR
DETAIL - 15 BAR AND
DETAIL - 16 FLUSH PIN
A
B
DETAIL - 21
FLUSH
PIN
REAR
HUB
HUB
MEASURE DIMENSION L
MEASURE DIMENSION B
L
VIEW A
L - A8641(0000)V

Measure Dimensions B And L
Figure 1002
(Task 72-31-00-400-002-001)


NUT
REAR INNER RACE
BALLS AND CAGE
OUTER RACE
FRONT INNER RACE
SEAL SEAT
NO. 1 BEARING
(CARBON) SEAL ASSEMBLY
LPC
L-A8642 (0000)
PW V

Installation Of The Seal Assembly And No. 1 Bearing On The Hub
Figure 1003
(Task 72-31-00-400-002-001)


PWA 45419 OR
PWA 80651
MULTIPLIER
PWA 29615
HOLDER
PWA 85653
WRENCH
PWA 29614
WRENCH
PWA 85793
ADAPTER
HUB WITH THE
NO. 1 BEARING
AND SEAL ASSEMBLY
INSTALLED
L-A8643 (0000)
PW V

Torque The No. 1 Bearing (Inner Race) Retaining Nut
Figure 1004
(Task 72-31-00-400-002-001)

Previous Pageblock Return to Previous Menu Next Pageblock

LOW PRESSURE COMPRESSOR (LPC) - ASSEMBLY-03

Task 72-31-00-400-002-002:

1. Install The No. 1 Bearing And Seal Assembly (Hydraulic Method)

A. Prerequisites

(1) Assemble the low pressure compressor. See Assembly-01 Task 72-31-01-440-001.

B. Equipment And Materials Required

Special Tools:

PWA 25000	Wrench, Hydraulic
PWA 26523	Riveter (Optional to PWA 86338)
PWA 28668	Pump
PWA 28669	Cart
PWA 29510	Pump (Optional to PWA 28668)
PWA 85178	Gage, Assembly
PWA 85186	Drift
PWA 85524	Ring, Alignment
PWA 85584	Protector, Plastic
PWA 85641	Wrench, Torque
PWA 85792	Adapter, Holding
PWA 86338	Riveter

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-045	Pen, Marker (PMC 4092)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Rivet	2	72-31-00/7/200

C. Procedure

NOTE: The LPC is rear end up in PWA 85520 Fixture. PWA 85791 Adapter is installed in the ID of the front compressor hub assembly (called hub).

Subtask 72−31−00−430−065:

(1) (Reference 460) Measure Dimension F as follows (Method 1). See Figure 1001.

NOTE: To measure Dimension F, use either this method or Method 2.

(a) Install the No. 1 bearing seal seat (called seal seat), the bearing inner races, and the No. 1 bearing (inner race) retaining nut (called nut), lubricated with Engine Oil P03−001, on PWA 85178 Gage. The diametral empty space between the gage and the stacked parts must be 0.001 − 0.005 inch (0.026 − 0.127 mm).

(b) Attach PWA 85792 Adapter to the gage. Install PWA 85641 Wrench on the nut. Remove PWA 25000 Wrench from PWA 28669 Cart and install it on PWA 85641 Wrench. With PWA 28668 Pump or PWA 29510 Pump, tighten and torque the nut to 33,600 − 37,200 lb−in. (3796.289 − 4203.035 N.m). There must be zero clearance between all mating parts.

R (c) Put the detail−8 bar and dial indicator of the gage on top of the nut. Move the dial indicator off the detail−16 flush pin to set the indicator on zero.

(d) Move the dial indicator on the flush pin. Read the measurement (Dimension M). Write the measurement. Do this measurement at several positions. Calculate the average value of Dimension M. Add this value to the basic gage size
R stamped on the detail−8 bar (Dimension X). Call this sum Dimension F.

$$F = X + \text{average } M$$

(e) Remove the engine parts from the gage.

(2) (Reference 460) Measure Dimension F as follows (Method 2).

NOTE: To measure Dimension F, use either this method or Method 1.

(a) Measure the thickness of each of the parts that follow. Do the measurements at four positions that are at the same distance from each other. Write the measurements.

1 The seal seat (Dimension K)

2 The inner races (Dimensions N and P)

3 The nut (Dimension Q).

(b) Add together the maximum thicknesses from each part. Call this sum Dimension F.

F = maximum K + maximum N + maximum P + maximum Q

(3) (Reference 460) Measure Dimension B as follows. See Figure 1002.

(a) Measure the dimension from the rear (top) face of the fan hub to the shoulder of the hub. Use the detail−8 bar, detail−21 flush pin, and detail dial indicator of PWA 85178 Gage. Call this Dimension Y.

NOTE: It is permitted to use standard shop equipment to measure Dimension B.

(b) Add Dimension Y to the basic gage size stamped on the detail−8 bar (Dimension X) if the flush pin is below the top of the bar. Subtract Dimension Y from Dimension X if the flush pin is above the top of the bar. Call this Dimension B

B = X + Y OR B = X − Y

NOTE: This equation does not apply if you do not use the gage.

Subtask 72−31−00−430−066:

(4) Install the No. 1 bearing (carbon) seal assembly on the hub as follows. See Figure 1003.

Subtask 72−31−00−430−067:

(5) Install the seal seat on the hub. The flat face marked FRONT must be face down.

Subtask 72−31−00−430−068:

(6) Install the No. 1 ball bearing on the hub as follows.

(a) Heat the inner races. Refer to Standard Practices Manual, PN 585005.

(b) With correct gloves on your hands, remove the front half of the inner race (without the puller groove). Install the inner race on the hub. Use PWA 85186 Drift.

(c) Install the outer race on the hub.

(d) Lift the outer race to put it a little above the inner race. Install the bearing balls and cage in the outer race. Lower the outer race.

(e) With correct gloves on your hands, remove the rear half of the inner race from the heat source. Hold the inner race with the puller groove up. Align the X marks on the front and rear inner races. Install the inner race on the hub. Use PWA 85186 Drift.

Subtask 72−31−00−430−060:

CAUTION: IF THE NUT YOU INSTALL IS NOT NEW, YOU MUST PUT NEW SILVER PLATE ON IT BEFORE YOU INSTALL IT. IF YOU DO NOT, IT WILL CAUSE DAMAGE TO THE MATING PARTS. TO PLATE THE NUT, REFER TO PW4000 Series CIR, PN 51A357.

(7) Install the nut on the hub as follows. See Figure 1004.

(a) Install the nut, threads lubricated with Engine Oil P03−001, on the hub.

(b) Install PWA 85792 Adapter on PWA 85791 Adapter.

(c) Install PWA 85641 Wrench on the nut.

(d) Remove PWA 25000 Wrench from PWA 28669 Cart. Install the wrench on PWA 85792 Adapter.

(e) Use either PWA 28668 Pump or PWA 29510 Pump to torque the nut.

CAUTION: IF YOU MUST COMPLETE THE FOLLOWING TORQUE PROCESS MORE THAN THREE TIMES, YOU MUST REMOVE THE NUT AND PLATE IT AGAIN BEFORE YOU TORQUE IT THE FOURTH TIME. THE MAXIMUM NUMBER OF TIMES YOU CAN COMPLETE THE TORQUE PROCESS BEFORE IT IS NECESSARY TO RE−PLATE THE NUT IS THREE. TO PLATE THE NUT, REFER TO PW4000 Series CIR, PN 51A357.

(8) (Reference 460) Torque the nut as follows.

(a) Torque the nut to 33,600 − 37,200 lb−in. (3796.289 − 4203.035 N.m). Turn the nut through an angle of 14 − 16 degrees. Loosen the nut to zero.

(b) Torque the nut to 33,600 − 37,200 lb−in. (3796.289 − 4203.035 N.m).

(c) Use a Marker Pen P05−045 and make a reference point mark on the nut and an adjacent part. Marks must be aligned.

(d) Measure Dimension L as follows.

1 The temperature of all parts must be within ± 5°F (2.8°C) of room temperature when you measure the parts.

2 Set the dial indicator of PWA 85178 Gage to zero.

3 Measure the dimension from the rear (top) face of the nut to the rear (top) face of the hub (Dimension Z). Use the detail−15 bar and the detail−16 flush pin. Do the measurement several times. Calculate the value of average Dimension Z.

NOTE: It is permitted to use standard shop equipment to measure Dimension L.

4 Add Dimension Z to the basic gage size stamped on the detail bar if the flush pin is below the top of the detail bar. Subtract Dimension Z

from the basic gage size if the flush pin is above the top of the detail bar.

L = detail−15 basic gage size + average Z OR
L = detail−15 basic gage size − average Z

NOTE: This equation does not apply if you do not use the gage.

5 The statements that follow must be true:

L <= F − B + 0.000 inch (0.0000 mm) And
L >= F − B − 0.001 inch (0.025 mm)

(e) Turn the nut through an angle of 14 − 16 degrees. Loosen the nut to zero.

(f) Torque the nut to 33,600 − 37,200 lb−in. (3796.289 − 4203.035 N.m).

(g) Do a check of the reference points as follows.

1 The reference point on the nut must be either aligned with the reference point on the mating part or beyond it within 1 degree 30 minutes.

2 If the reference points are within limits, turn the nut through an angle of 14 − 16 degrees. If necessary, advance 2 degrees 30 minutes, maximum, to the next locking feature.

3 If the reference points are not within limits, do steps (d), (e), and (f), in that order, until the reference points are within limits. Then do step (g).

(9) Remove from the hub the tools that you used to torque the nut.

Subtask 72−31−00−430−061:

(10) Install the rivets in the nut as follows.

(a) Install two rivets, 180 degrees apart, through the hub and the nut. The head of the rivet must be in the ID of the hub.

(b) Flare the heads of the rivets. Use PWA 86338 Riveter or PWA 26523 Riveter.

(11) Put PWA 85524 Ring over the flange of the bearing. With the detail foolproof and location pins, align the bearing with the seal assembly.

Subtask 72−31−00−430−070:

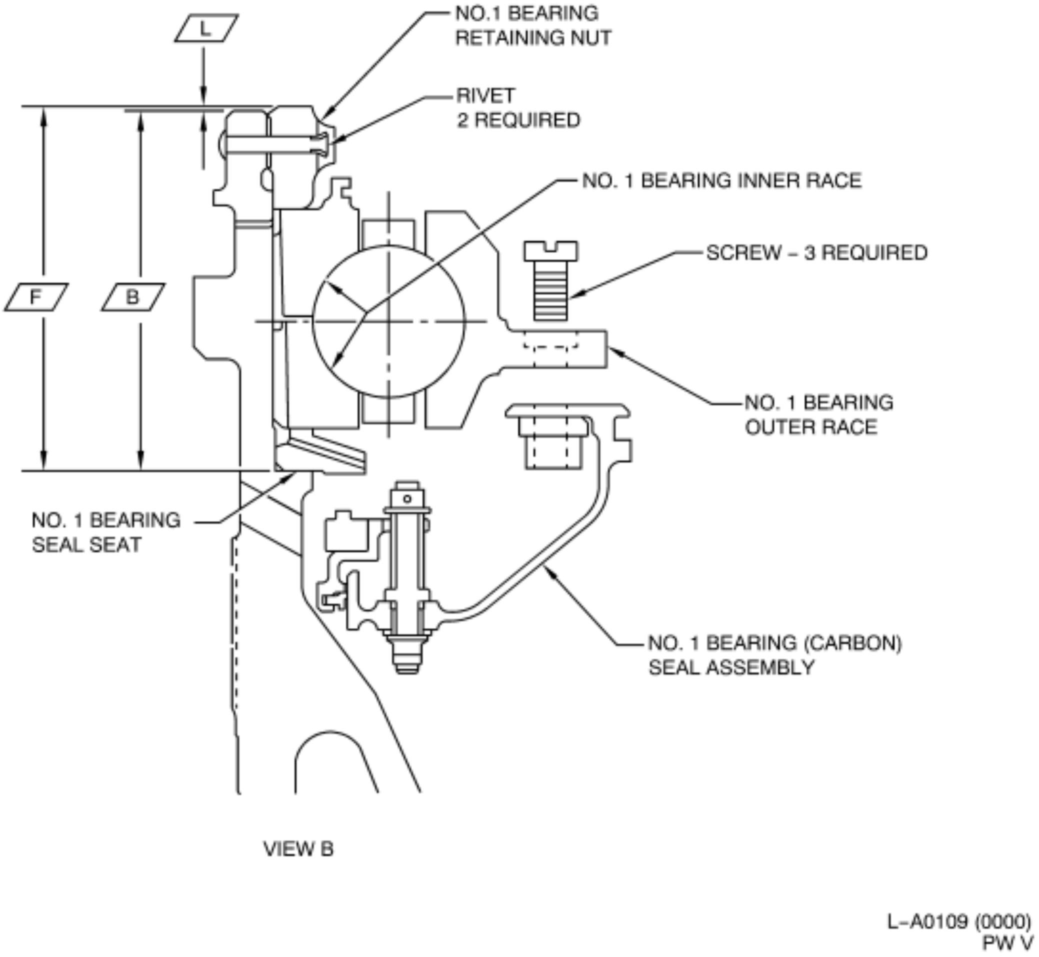
(12) Attach the bearing to the seal assembly as follows.

  (a) Apply Engine Oil P03−001 to the threads of three fillister head screws.

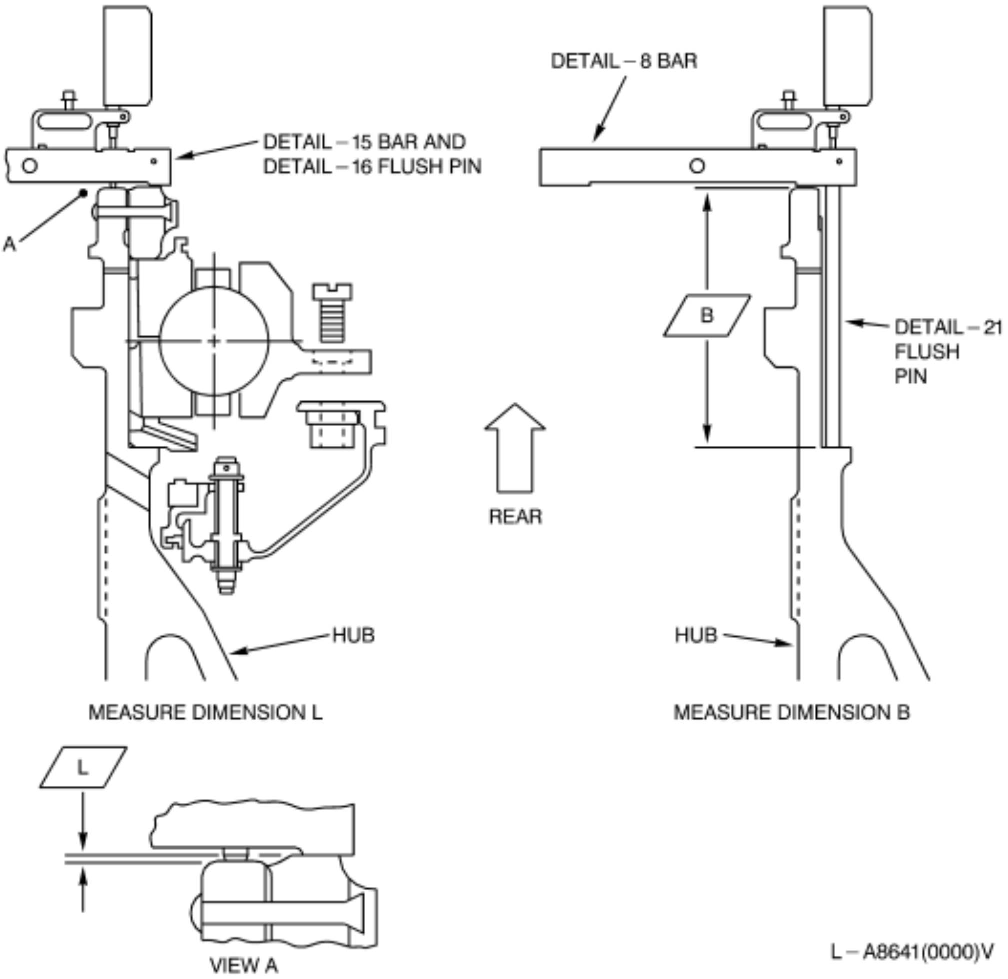
  (b) Lift the seal assembly to touch the flange of the bearing outer race.

  (c) Install the three screws in the outer race. Tighten and torque the screws to 22 lb−in. (2.486 N.m) plus the torque necessary to turn the screw through the self−locking threads. The maximum torque permitted is 95 lb−in. (10.734 N.m).

(13) Remove the ring from the hub. Install PWA 85584 Protector over the bearing and seal assembly.

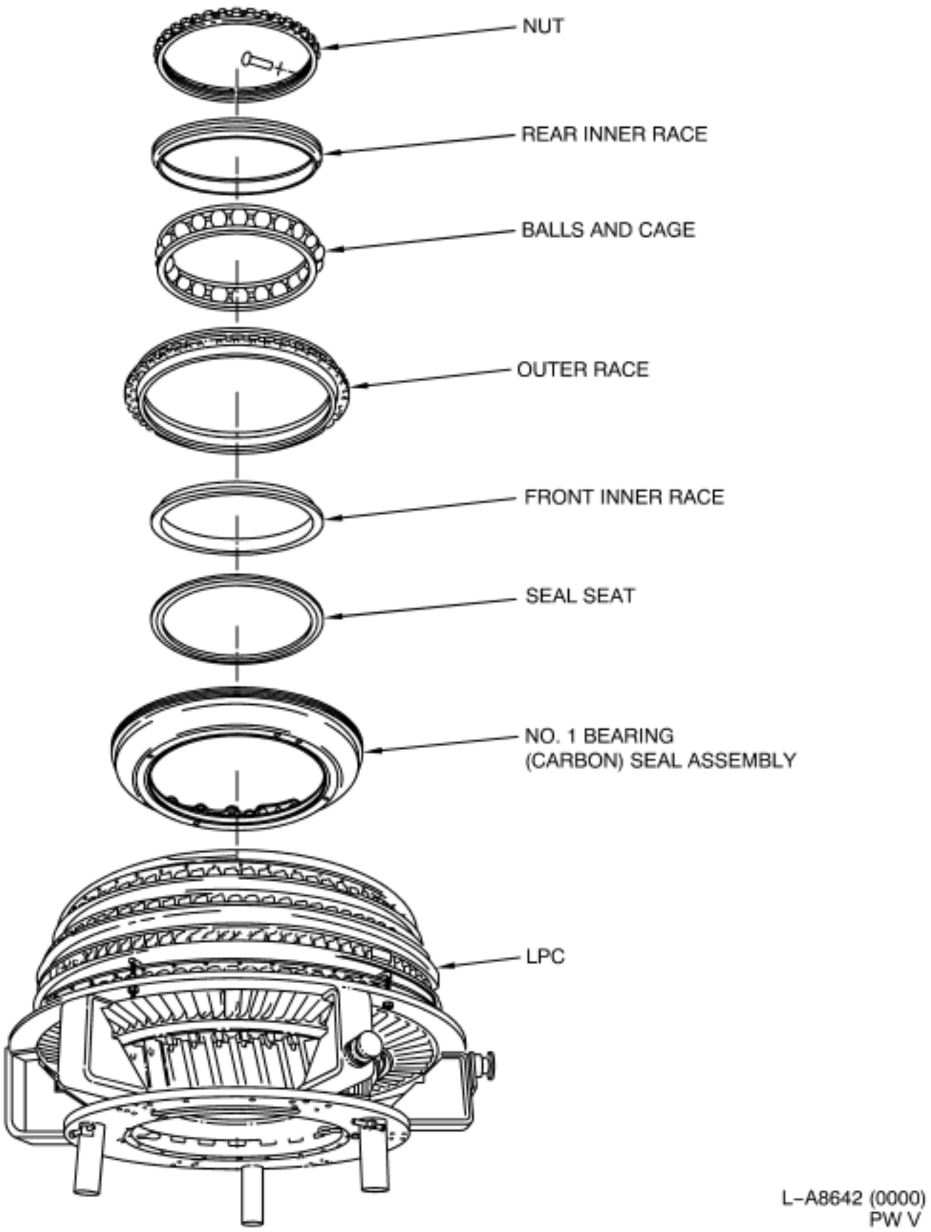

L
NO.1 BEARING RETAINING NUT
RIVET 2 REQUIRED
NO. 1 BEARING INNER RACE
SCREW − 3 REQUIRED
F
B
NO. 1 BEARING OUTER RACE
NO. 1 BEARING SEAL SEAT
NO. 1 BEARING (CARBON) SEAL ASSEMBLY
VIEW B
L−A0109 (0000)
PW V

Dimensions F, B, And L
Figure 1001
(Task 72−31−00−400−002−002)

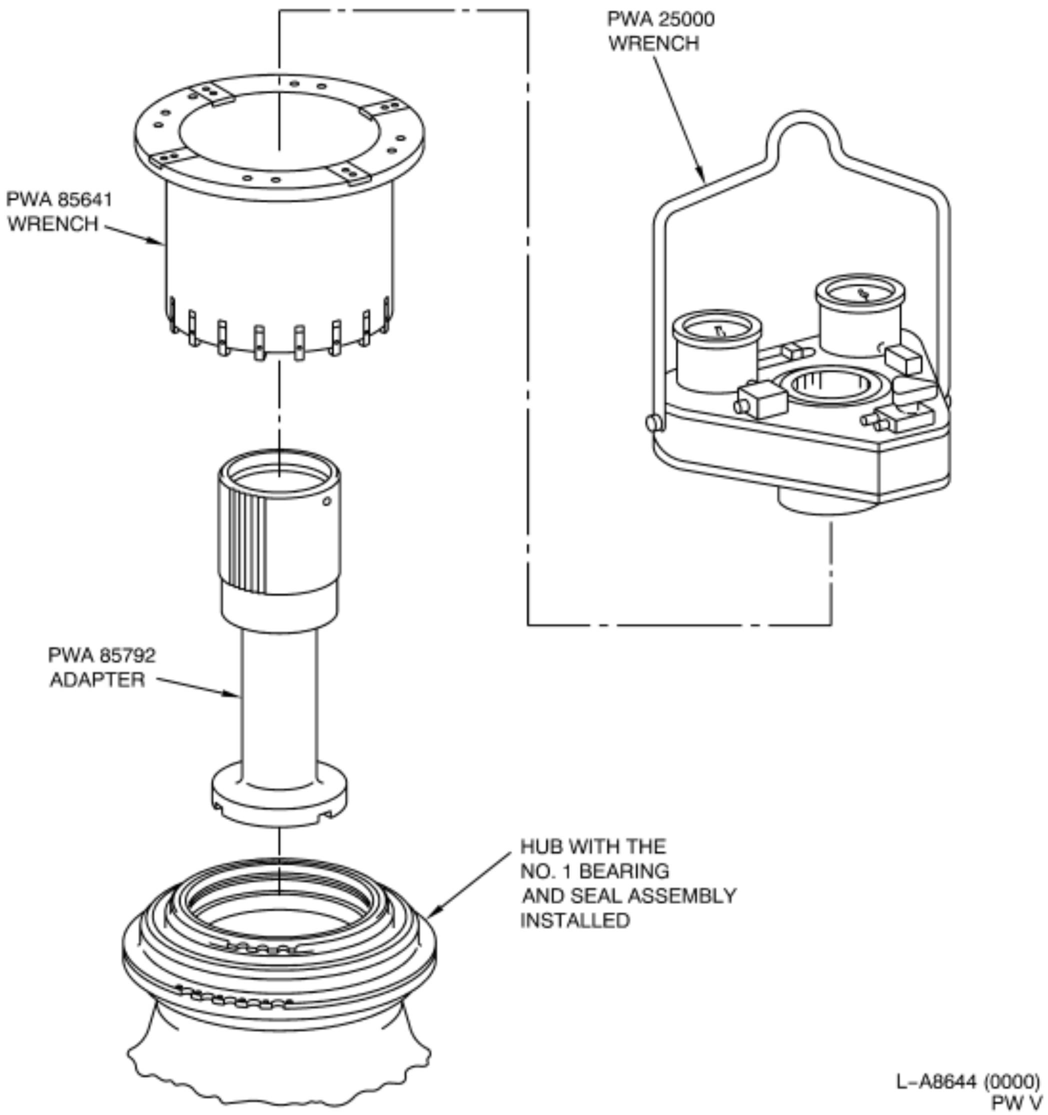

DETAIL - 15 BAR AND
DETAIL - 16 FLUSH PIN
A
HUB
MEASURE DIMENSION L
L
VIEW A
DETAIL - 8 BAR
B
DETAIL - 21
FLUSH
PIN
REAR
HUB
MEASURE DIMENSION B
L - A8641(0000)V

Measure Dimensions B And L
Figure 1002
(Task 72-31-00-400-002-002)

LOW PRESSURE COMPRESSOR (LPC) - ASSEMBLY-03


NUT
REAR INNER RACE
BALLS AND CAGE
OUTER RACE
FRONT INNER RACE
SEAL SEAT
NO. 1 BEARING (CARBON) SEAL ASSEMBLY
LPC
L-A8642 (0000)
PW V

Installation Of The Seal Assembly And No. 1 Bearing On The Hub
Figure 1003
(Task 72-31-00-400-002-002)


PWA 25000
WRENCH
PWA 85641
WRENCH
PWA 85792
ADAPTER
HUB WITH THE
NO. 1 BEARING
AND SEAL ASSEMBLY
INSTALLED
L−A8644 (0000)
PW V

Torque The No. 1 Bearing (Inner Race) Retaining Nut
Figure 1004
(Task 72−31−00−400−002−002)

LOW PRESSURE COMPRESSOR (LPC) - STORAGE-01

Task 72-31-00-530-001:

1. Pack Low Pressure Compressor (LPC)

A. Equipment And Materials Required

Special Tools:
PWA 28657 Sling
PWA 76154 Adapter (Two Necessary)
PWA 85520 Fixture

Consumable Materials:

NOTE: The following items not normally supplied by container manufacturer.

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-156	Seal, Lead
P15-001	Dehydrator

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Lockwire, MS20995-C41				

Packaging Equipment:

NOTE: The following table lists assembly number, dimensions, and gross weight for low pressure compressor shipping container available from Pratt & Whitney. Further information can be obtained from:

Commercial Parts Support
Commercial Engine Business
Pratt & Whitney
400 Main St.
East Hartford, CT 06108

Container Assembly No.	Dimensions	Approximate Gross Weight Including Low Pressure Compressor
P60040	72.5 Inch (1841.500 mm) x 72.5 Inch (1841.500 mm) x 56.5 Inch (1435.100 mm)	2,075 lbs. (941.20 kg)

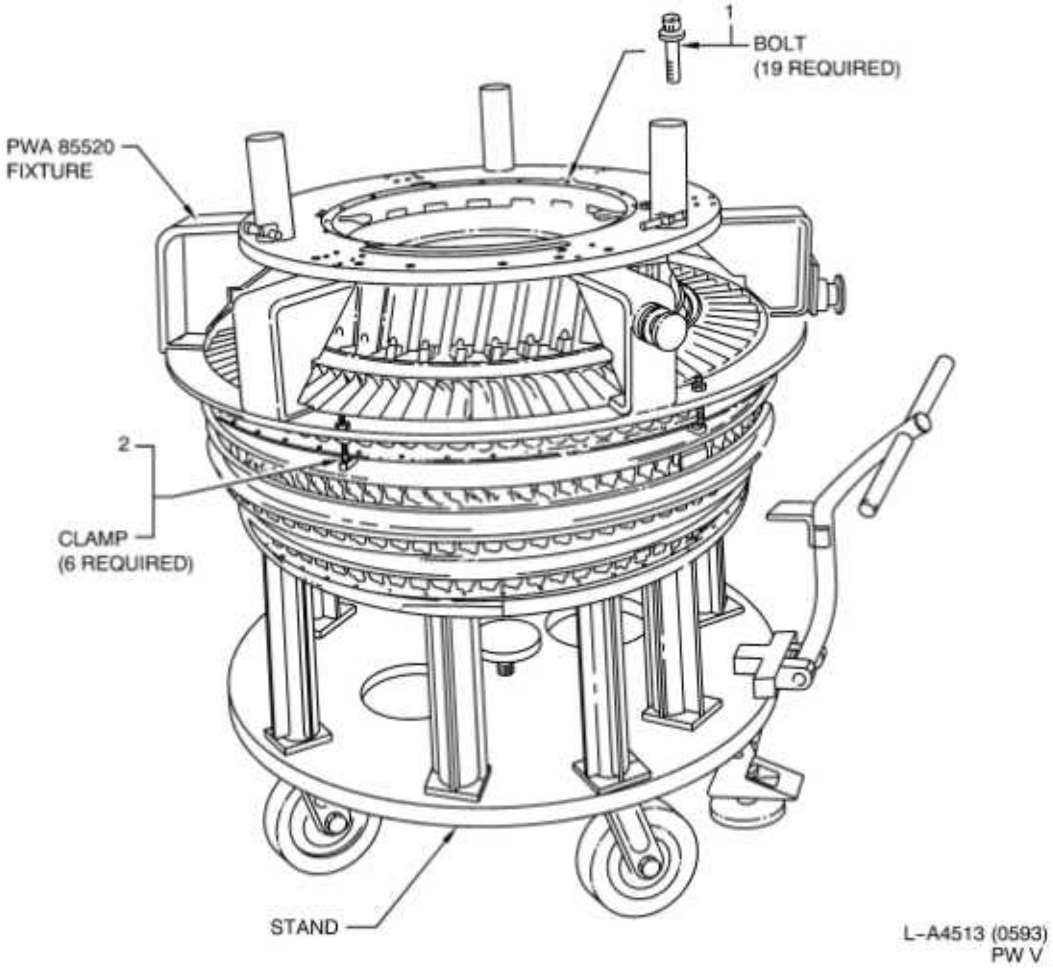
LOW PRESSURE COMPRESSOR (LPC) − STORAGE−01

B. Procedure

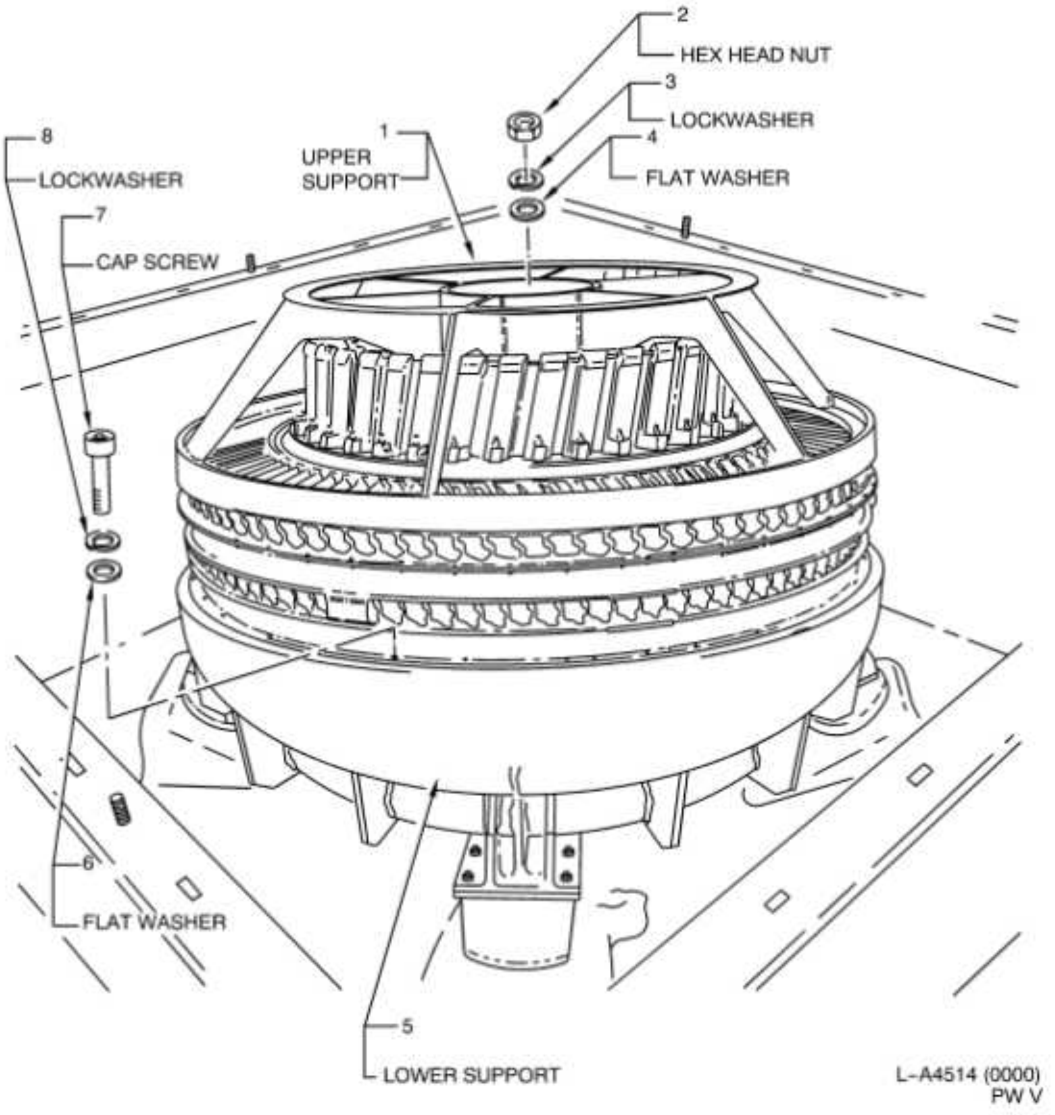
NOTE: The LPC is installed in either PWA 88183 or PWA 85660 Stand.

(1) Install PWA 85520 Fixture onto low pressure compressor. See Figure 1201.
  (a) Using PWA 76154 Adapters, PWA 28657 Sling, and a hoist, raise PWA 85520 Fixture.
  (b) Position fixture to LPC and secure to LPC hub using 19 bolts (1201/1) and to shroud using six clamps (1201/2).
(2) Remove top half of P60040 Container Assembly and upper support detail.
  (a) Actuate relief valve on side of container to release pressure before opening container.
  (b) Loosen nuts securing container flange bolts, and rotate bolts 1/4 turn.
  (c) Connect suitable sling to lifting rings on cover of container. Using hoist, remove top cover of container.
  (d) Remove nut (1202/2) from tierod. Using suitable sling, lift upper support (1202/1) from lower support (1202/5). See Figure 1202.
(3) Using hoist position LPC, rear end down, over P60040 Container Assembly. See Figure 1202.
(4) Lower LPC onto lower support (1202/5), aligning dowel pins in support with boltholes in case.
(5) Secure case to lower support with 24 flat washers (1202/6), lockwashers (1202/8) and cap screws (1202/7).
(6) Remove PWA 85520 Fixture from LPC.

(7) Using hoist and suitable sling, carefully install upper support (1202/1) onto LPC.
(8) Secure upper support to lower support with flat washer (1202/4), lockwasher (1202/3) and hex−head nut (1202/2), threads lubricated with Engine Oil (P03−001). Torque hex−head nut to 735 − 815 lb−in. (83.044 − 92.083 N.m).
(9) Connect hoist to lifting rings on top cover of container, and position top cover over bottom half of container. Align dowel pins with dowel pin holes and lower top cover onto bottom half of container.
(10) Secure container using detail bolts and nuts.
(11) Install lockwire, MS20995−C41 through holes in cover flange and attach Lead Seal (P05−156). Using bulldog pliers, compress seal on wire and cut off excess wire.
(12) Inspect condition of Dehydrator (P15−001) and replace as required.


1
BOLT
(19 REQUIRED)
PWA 85520
FIXTURE
2
CLAMP
(6 REQUIRED)
STAND
L-A4513 (0593)
PW V

Handling Fixture Removal Installation
Figure 1201
(Task 72-31-00-530-001)


2
HEX HEAD NUT
3
LOCKWASHER
4
FLAT WASHER
8
LOCKWASHER
1
UPPER SUPPORT
7
CAP SCREW
6
FLAT WASHER
5
LOWER SUPPORT
L-A4514 (0000)
PW V

Pack And Unpack Low Pressure Compressor
Figure 1202
(Task 72−31−00−530−001)

LOW PRESSURE COMPRESSOR (LPC) − STORAGE−01

Task 72−31−00−540−001:

2. Unpack Low Pressure Compressor (LPC)
   - A. Equipment And Materials Required

     Special Tools:
     PWA 28657 Sling
     PWA 76154 Adapter (Two Necessary)
     PWA 85520 Fixture
     PWA 85660 Stand, Storage (Optional to PWA 88183)
     PWA 88183 Stand, Build/Storage

   - B. Procedure
     - (1) Break and remove lockwire and seal from container flange.
     - (2) Remove top half of P60040 Container Assembly.
       - (1) Actuate relief valve on side of container to release pressure before opening container.
       - (a) Loosen nuts securing container flange bolts, and rotate bolts 1/4 turn.
       - (b) Connect suitable sling to lifting rings on top cover of container. Using hoist, remove top cover of container.
     - (3) Remove hex head nut (1202/2), lockwasher (1202/3) and flat washer (1202/4) securing upper support (1202/1) to lower support (1202/5) of container.
     - (4) Using suitable sling, lift upper support (1202/1) from lower support (1202/5).
     - (5) Remove 24 cap screws (1202/7), lockwashers (1202/8) and flat washers (1202/8) securing LPC case to lower support.
     - (6) Install PWA 85520 Fixture onto LPC. See Figure 1201.
       - (a) Using PWA 76154 Adapters, PWA 28657 Sling, and a hoist, raise PWA 85520 Fixture.
       - (b) Position fixture to LPC and secure to LPC hub using 19 bolts (1201/1) and to shroud using six clamps (1201/2).
     - (7) Using hoist, remove LPC from container.
     - (8) Place LPC rear end down into PWA 88183 or PWA 85660 Storage Stand. See Figure 1201.
     - (9) Remove fixture from LPC.

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Pratt & Whitney
PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

Tab Separator - Low Pressure Compressor (LPC)

List of Effective Pages - Low Pressure Compressor (LPC)
See end of list.

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Task 72-31-01-040-001:

1. Disassemble The Axial Compressor Rotor Assembly

A. Equipment And Materials Necessary

Special Tools:

	PWA 85086	Arm, Lift (2 Necessary)
	PWA 85621	Eye, Lifting, Front (For Hub Only) (Optional to PWA 87221)
	PWA 85622	Eye, Lifting, Rear (For Hub Only) (Optional to PWA 87266)
	PWA 85628	Fixture, Lifting
	PWA 85660	Stand (Optional to PWA 88183)
	PWA 86133	Drift, Tab Bending (Optional to PWA 105331)
	PWA 86134	Drift, Tab Bending (Optional to PWA 105331 and PWA 105332)
	PWA 86534	Fixture, Lifting
	PWA 87221	Eye, Lifting, Front (For Hub Only) (Optional to PWA 88748)
	PWA 87266	Eye, Lifting, Rear (For Hub Only) (Optional to PWA 86534)
	PWA 88183	Stand (Optional to PWA 85660)
	PWA 88748	Adapter, Lift And Turn (For Hub/HPC Rotor)
R	PWA 104359	Puller, Jackscrew
	PWA 105330	Kit, Tab Bending
R	PWA 106333	Guide, Drill

(The tools that follow are contained in this kit)
*PWA 105331 Drift, Tab Bending
*PWA 105332 Drift, Tab Bending
*PWA 105333 Drift, Tab Bending

B. Procedure

NOTE: The axial compressor rotor assembly is rear end down in PWA 88183 Stand or PWA 85660 Stand.

(1) Remove the hub as follows. See Figure 501.

(a) If not already done, install knife-edge protectors on the drum rotor knife-edge seals.

(b) Remove the balance counterweights, if any, from the hub.

(c) Remove the 38 nuts that attach the hub to the drum rotor.

(d) Move the slide clamps of the PWA 104359 Jackscrew Puller to center of puller. Attach a lift sling and hoist to the lift eyes of puller. Position puller on the hub so that the jackscrew pads touch the drum rotor flange. Remove sling and hoist.

(e) Move and engage the clamps in the hub. Tighten knurled knobs to lock clamps in position. Use an opposite pattern and tighten each jackscrew approximately one−half turn each until the hub is disengaged.

(f) Attach a lift sling and hoist to the lift eyes of (PWA 104359) puller. Loosen the knurled knob and move the slide clamps to center of puller. Remove the puller from the hub.

(g) Thread either PWA 87221 Eye or PWA 85621 Eye or PWA 88748 Adapter into the ID of the hub.

(h) Attach a hoist to the eye and lift the hub from the drum rotor. If removal of the hub is difficult, tap the front flange of the drum rotor with a mallet and fiber drift. Put the hub away. Remove the eye.

NOTE: To trunnion the hub, use either PWA 87266 Eye or PWA 85622 Eye.

(2) Remove the Stage 1.6 blades from the drum rotor as follows.

(a) Locally fabricate segmented protectors to be installed over LPC blades, Stages 2 and 4, to protect the blades from dropped objects.

(b) Install locally fabricated blade protector on 2nd stage blades.

(c) Straighten smaller bent end of 1.6 stage blade locks using PWA 86134 or PWA 105331 Tab Bending Drift and plastic mallet.

(d) Remove 1.6 stage blade locks.

(e) Remove 1.6 stage blades. If necessary, tap rear of blade, at blade root, using small mallet and fiber drift.

(3) Remove the Stage 3 blades from the drum rotor as follows.

(a) Install locally fabricated blade protector on 4th stage blades.

(b) Straighten smaller bent end of 3rd stage blade locks using PWA 86134 or PWA 105332 Tab Bending Drift and plastic mallet.

(c) Remove 3rd stage blade locks.

(d) Remove 3rd stage blades. If necessary tap forward end of blade, at blade root, using mallet and fiber drift.

(4) Remove the Stage 4 blades from the drum rotor as follows.

(a) Use the PWA 105333 Tab Bending Drift and a plastic mallet to make the smaller bent end of the 4th stage blade locks straight.

(b) Remove the 4th stage blade locks.

(c) Lift the PWA 85628 Fixture with a hoist. Attach the fixture to the front flange of the drum rotor with the detail screws and nuts.

(d) Install the PWA 85086 Arm to the eye of the fixture with the detail nut and pin. Attach a hoist to the arm. Lift the drum rotor sufficiently to permit 4th stage blade removal.

(e) Remove 4th stage blades. If necessary tap forward end of blade, at the blade root, use a mallet and a fiber drift.

(5) Trunnion the drum rotor to front end down as follows. See Figure 502.

(a) Clamp PWA 86534 Fixture to the rear flange of the drum rotor.

(b) Install PWA 85086 Arm in the eye in the rear fixture. Attach a hoist to the arm. Trunnion the drum rotor to front end down. Remove the hoist and arm from the front fixture and lower the drum rotor onto the PWA 88183 Stand or PWA 85660 Stand.

(6) Remove the Stage 2 blades as follows.

(a) Straighten smaller bent end of 2nd stage blade locks using PWA 86133 or PWA 105331 Tab Bending Drift and plastic mallet.

(b) Remove 2nd stage blade locks.

(c) Remove 2nd stage blades. As necessary tap forward end of blade, at blade root, using mallet and fiber drift.

(7) Remove the balance counterweights, if any, from the
R drum rotor rear flange only. Use PWA 106333 Drill
R Guide to remove the rotor balance weight rivet. See
R Figure 502 (Sheet 2).

R (a) Install the locator details for the wide or narrow
R counterweight as applicable.

R NOTE: The locator details are designed for the
R two counterweight widths.

R (b) Set the stop on the drill using the "DRILL SET−UP
R GAGE" on the side of the frame

R (c) Install the Guide around the counterweight with
R the handle parallel to the flange of the drum.

R (d) Install the detail drill to help align the guide
R to the center of the rivet. Tighten the hex bolt
R against the counterweight.

R NOTE: You can use the slot in the end of the hex
R head bolt to make sure that the dill is
R aligned with the center of the rivet

R (e) Remove the drill detail.

R (f) Install the drill into the drill motor.

R (g) Install the drill into the Guide.

R (h) Actuate the drill motor until the drill stop contacts the stop contacts the hex bolts.

R (i) Remove the drill from the Guide.

R (j) Install the drift into the Guide

R (k) Use a hammer to hit the drift until the rivet is removed.

R (l) Loosen the hex bolt and remove the Guide.

(8) Trunnion the drum rotor to rear end down as follows.

(a) Raise the drum rotor from the stand.

(b) Attach a hoist and arm to the fixture on the front of the drum rotor.

(c) Trunnion the drum rotor to rear end down. Remove the hoist, arm, and fixture from the rear flange. Lower the rotor onto the stand. Remove the hoist, arm, and fixture from the front flange.

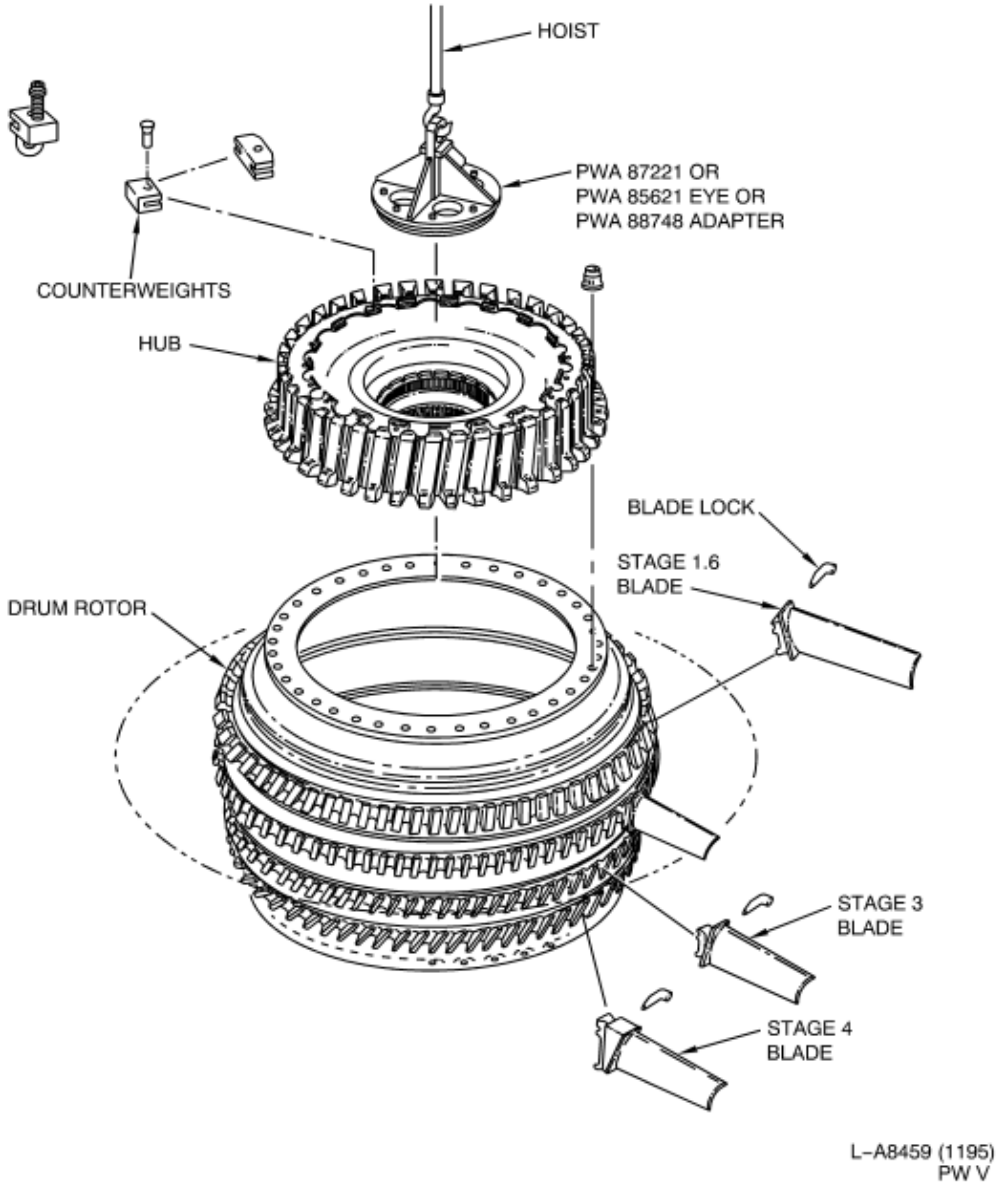
(9) Remove the tierods as follows.

(a) Straighten the end of tierod locks.

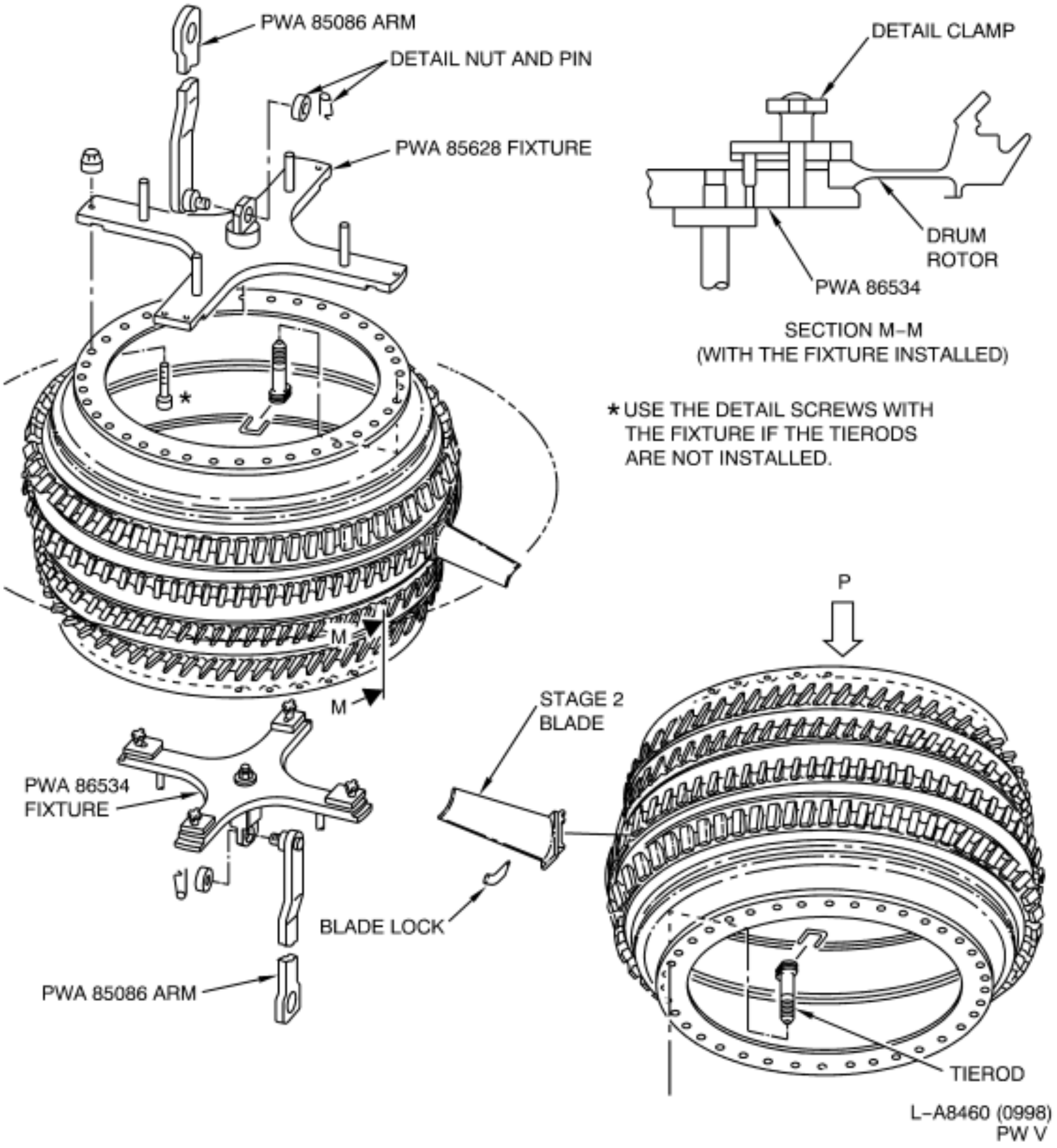
(b) Remove each tierod lock and tierod from the flange of the drum rotor.

(10) Install PWA 85628 Fixture on the front flange of the drum rotor. With a hoist and PWA 85086 Arm, remove the drum rotor from the stand. Put the drum rotor on storage rack. Remove the hoist, arm, and fixture.

AXIAL COMPRESSOR ROTOR ASSEMBLY - DISASSEMBLY-01

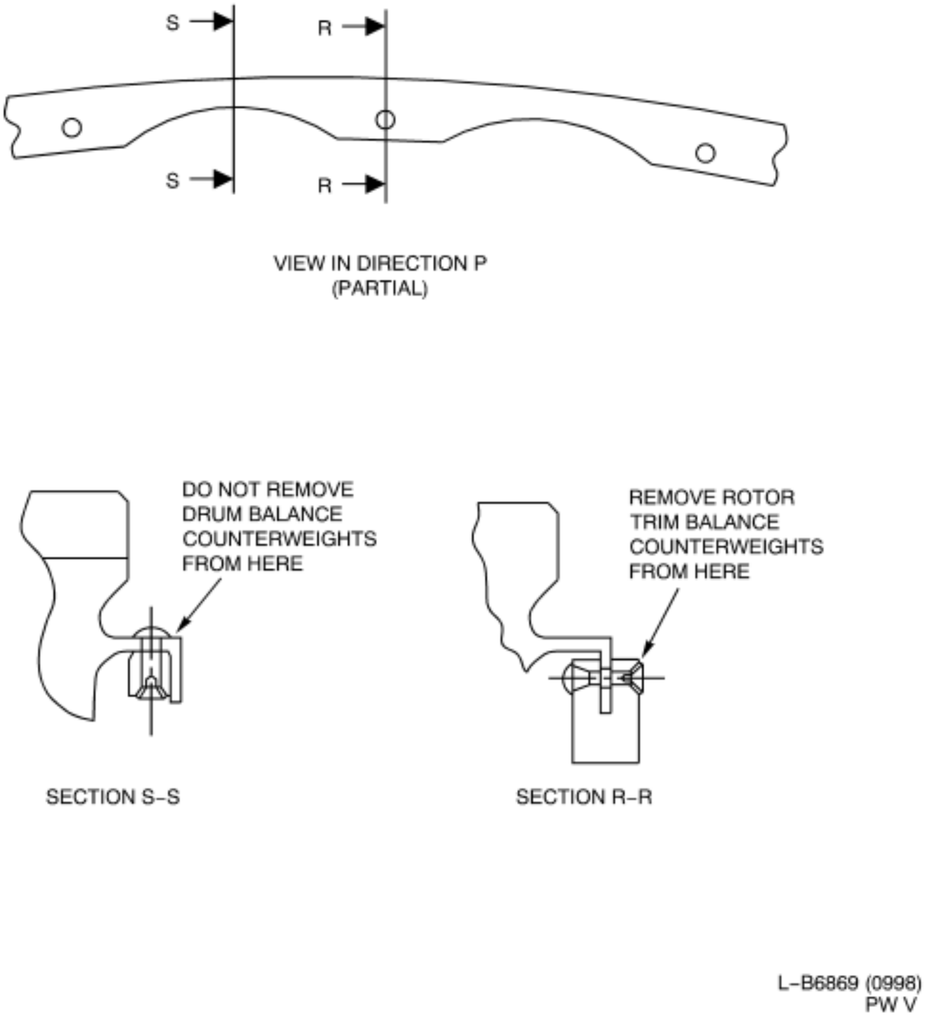

HOIST
PWA 87221 OR
PWA 85621 EYE OR
PWA 88748 ADAPTER
COUNTERWEIGHTS
HUB
BLADE LOCK
STAGE 1.6
BLADE
DRUM ROTOR
STAGE 3
BLADE
STAGE 4
BLADE
L-A8459 (1195)
PW V

Remove The Hub And Blades
Figure 501
(Task 72-31-01-040-001)


PWA 85086 ARM
DETAIL NUT AND PIN
PWA 85628 FIXTURE
DETAIL CLAMP
DRUM ROTOR
PWA 86534
SECTION M−M
(WITH THE FIXTURE INSTALLED)
*
M
M
P
STAGE 2 BLADE
PWA 86534 FIXTURE
BLADE LOCK
PWA 85086 ARM
TIEROD
L−A8460 (0998)
PW V

* USE THE DETAIL SCREWS WITH THE FIXTURE IF THE TIERODS ARE NOT INSTALLED.

Trunnion The Drum Rotor, Remove The Stage 2 Blades And Tierods
Figure 502 (Sheet 1)
(Task 72−31−01−040−001)


S
R
S
R
VIEW IN DIRECTION P
(PARTIAL)
DO NOT REMOVE
DRUM BALANCE
COUNTERWEIGHTS
FROM HERE
REMOVE ROTOR
TRIM BALANCE
COUNTERWEIGHTS
FROM HERE
SECTION S−S
SECTION R−R
L−B6869 (0998)
PW V

Trunnion The Drum Rotor, Remove The Stage 2 Blades And Tierods
Figure 502 (Sheet 2)
(Task 72−31−01−040−001)

AXIAL COMPRESSOR ROTOR ASSEMBLY - INSPECTION/CHECK-00

Task 72-31-01-990-001:

1. Inspection/Check Part Number Index - Axial Compressor Rotor Assembly
   A. Inspection Functional Arrangement
      (1) Inspection/Check-01 through Inspection/Check-06 contain procedures for complete inspection of rotor. Inspection function and applicability for this part are shown in Table 801.

INSPECTION/CHECK NUMBER	INSPECTION/CHECK CATEGORY	INSPECTION/CHECK APPLICABILITY
-01	Preinspection Preparation	Not Applicable
-02	Non-destructive Inspection	Not Applicable
-03	Visual Inspection	Applicable
-04	Dimensional Inspection	Not Applicable
-05	Functional Check Inspection	Not Applicable
-06	Inspection Postrequisites	Not Applicable

Inspection Functional Arrangement
Table 801

   B. Inspection/Check Part Number Index
      (1) Table 802 is a listing of part numbers and appropriate Inspection/Check numbers. Referenced service bulletins are listed for parts introduced or obtained by service bulletin incorporation.

PART NUMBER	INSPECTION/CHECK	SERVICE BULLETIN
See Note	03	None

NOTE: Subassembly is made up of details 72-31-03, 72-31-04, 72-31-05, 72-31-06, 72-31-07 and 72-31-08.

Inspection/Check Part Number Index
Table 802

Previous Pageblock Return to Previous Menu Next Pageblock

AXIAL COMPRESSOR ROTOR ASSEMBLY - INSPECTION/CHECK-03

Task 72-31-01-200-003:

1. Visual Inspection - Axial Compressor Rotor Assembly
   A. Prerequisites
      (1) See Inspection/Check-00 (Task 72-31-01-990-001) for functional arrangement and part number applicability.
   B. Equipment And Materials Required - None
   C. Procedure
      See Figure 801.
      (1) Accomplish inspection requirements in this section whenever extent of engine disassembly permits. It is not necessary to remove any parts for the purpose of inspection unless inspection reveals that additional disassembly is required.
      (2) Low compressor rotor assemblies that pass all inspection/check requirements may be returned to service. Assemblies that do not pass inspection requirements must be in accordance with applicable section of this manual.
      (3) Visually inspect the part for obvious surface damage and/or deformations which will preclude proper functioning of the part. The inspection can be enhanced by using fluorescent (white) light and a 3X magnifying glass.

Subtask 72-31-01-220-051:
      (4) Visually inspect fan hub for cracks, nicks, dents, scratches or corrosion pits. Check security of counterweights and for surface damage to spline or threads.

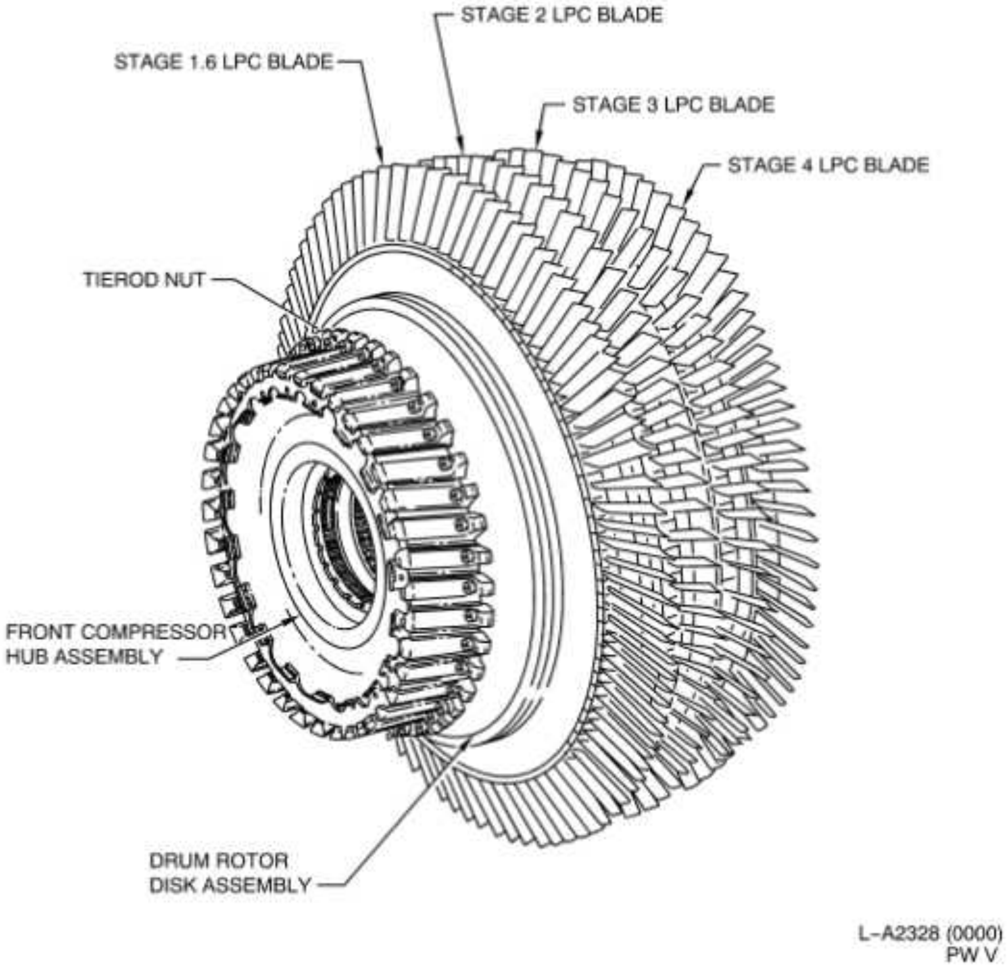
Subtask 72-31-01-220-052:
      (5) Visually inspect compressor blades for indications of excessive blade rub, curled tips, excessive looseness, foreign object damage, and excessive erosion. Check security of silicone rubber sealant around drum rotor blade slots.

Subtask 72-31-01-220-053:
      (6) Visually inspect drum rotor for cracked or bent knife-edge seals. Visually inspect all accessible surfaces for cracks, nicks, dents, scratches or corrosion pits.

Subtask 72-31-01-220-054:
      (7) Visually inspect tierod nuts and bolts security of attachment. Visually inspect for damaged threads.

Subtask 72-31-01-220-055:
      (8) Visually inspect for broken, missing or loose bladelocks.

AXIAL COMPRESSOR ROTOR ASSEMBLY - INSPECTION/CHECK-03


STAGE 2 LPC BLADE
STAGE 1.6 LPC BLADE
STAGE 3 LPC BLADE
STAGE 4 LPC BLADE
TIEROD NUT
FRONT COMPRESSOR HUB ASSEMBLY
DRUM ROTOR DISK ASSEMBLY
L-A2328 (0000)
PW V

Axial Compressor Rotor Assembly
Visual Inspection
Figure 801
(Task 72-31-01-200-003)

Previous Pageblock Return to Previous Menu Next Pageblock

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-01

Task 72-31-01-440-001:

1. Assemble Axial Compressor Rotor Assembly (Stage 2)

A. Prerequisites

(1) See Inspection/Check-04, Task 72-31-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows:

B. Equipment And Materials Required

Special Tools:

	PWA 78227	Bender, Tierod Lock
	PWA 80673	Crimper, Tierod Lock
	PWA 85086	Lift Arm (2 Required)
	PWA 85189	Crimper, Manual
	PWA 85628	Fixture, Lifting
	PWA 85645	Gage, Go-No Go
	PWA 85660	Stand, Build/Storage (Optional to PWA 88183)
R R	PWA 85958	Bender, Pneumatic (Blade Lock) (Optional to PWA 85189, PWA 106228 and PWA 106229)
	PWA 86534	Fixture, Lifting
	PWA 88183	Stand, Build/Storage
	PWA 101562	Riveter, Manual
R R	PWA 106228	Bender, Pneumatic (Blade Lock) (Initial Bend)
R R	PWA 106229	Bender, Pneumatic (Blade Lock) (Final Bend)

Consumable Materials:

Item No.	Designation
P09-014	Sealant, Silicone Rubber (PWA 36003)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lock	38	72-31-00/5/20
Lock	88	72-31-00/5/100
Rivet	0 - 6	72-31-00/5/4

C. Procedure
Figure 1001

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-01

(1) Install PWA 85628 Lifting Fixture on front flange of drum rotor using hoist. Secure fixture to flange.

(2) Raise drum rotor from storage rack and place on PWA 88183 Build Stand or PWA 85660 Build Stand front end up. Remove hoist and fixture.

(3) Install tierod in front flange of drum rotor. Install tierod lock (from right to left) slot of tierod head while holding tierod against rear face of flange. See Figure 1002. Install remaining tierods.

(4) Bend tierod locks with PWA 78227 Bender or PWA 80673 Crimper. See Figure 1002.

(5) Install PWA 85628 Lifting Fixture on front flange of drum rotor using hoist. Secure fixture to flange. Remove hoist and install PWA 85086 Arm to eye on fixture. Attach hoist and raise drum rotor.

(6) Install PWA 86534 Lifting Fixture on rear (bottom) of drum rotor. Clamp fixture to rear of drum. Install PWA 85086 Arm to eye on fixture. Attach hoist and trunnion drum rotor to tierod end down. Remove lower hoist, arm and fixture from drum rotor.

(7) Lower drum rotor to PWA 85660 Build Stand. Remove hoist, arm and fixture from upper flange of drum rotor.

(8) If necessary, install the drum balance counterweights to the drum rotor rear flange ID. Make sure you install the counterweights to their initial location. Use PWA 101562 Manual Riveter to install the rivet. See Figure 1001 (Sheet 2).

NOTE: The part number and class of the balance weight is marked on the drum rotor to the right of the rivet hole.

CAUTION: PN 50B902 AND PN 50B202 STAGE 2 LPC BLADES ARE INTERCHANGEABLE IN ANY COMBINATION WITH LPC COMPRESSOR STATOR ASSEMBLIES PN 54B016 OR PN 54B916 OR PN 56B016 OR PN 56B116.

(9) Prior to installation, weigh the 2nd stage blades.

R
R

(10) Ink mark the 2nd stage blade weight on the individual airfoils with a suitable ink marker. See Standard Practices Manual, PN 585005, "Marking Of Parts" 70−11−00.

(11) Arrange 2nd stage blades in four columns of 22 blades, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. Lightest blade will be at bottom right (Column 4). See Figure 1003.

(12) Prior to applying compound, wipe blade areas to be sealed by SPOP 208 Wipe Method Task, Standard Practices Manual, PN 585005, 70−21−00−110−040.

CAUTION: CARE SHOULD BE TAKEN TO ENSURE THAT ANY PRESSURE OR FORCE REQUIRED TO INSTALL BLADE IN DRUM, BE APPLIED TO ROOT PLATFORM AREA OF BLADE AND NOT TO LEADING OR TRAILING EDGE OF BLADES. AIRFOIL SECTION OF BLADES ARE EASILY DAMAGED BY ANY KIND OF FORCE.

(13) Starting with lightest (bottom) blade in Column 4, apply Silicone Rubber P09−014, to blade root in areas shown in Figure 1004, and install blade, leading edge down in drum slot.

(14) Grasp blade and pull radially outward to load blade against bearing surface of drum slot. Slowly seat blade completely in drum.

(15) Remove excess compound from blade lock area and around blade root area. Fill in any voids.

(16) Install blade lock in hole formed by blade and drum per Figure 1005.

(17) Repeating compound application procedure, install remaining blades from Column 4 continuing vertically upward from lighter blades to heavier blades. Install blades to drum in a clockwise direction. Install blade lock after installing each blade.

(18) After all blades in Column 4 are installed, move to bottom of Column 2, repeat compound application procedure and install blades from Column 2, selecting blades vertically upward from lighter blades to heavier blades. Install blades in a clockwise direction. Secure each blade with blade lock.

(19) After all blades in Column 2 are installed, move to bottom of Column 3, and repeat compound application and blade installation procedures.

(20) After all blades in Column 3 are installed, move to bottom of Column 1, and repeat compound application and blade installation procedures.

R (21) Bend the locks as follows: See Figure 1004.

R NOTE: See the following step to bend the locks with PWA 106228 Bender (initial) and PWA 106229 Bender (final).

R (a) With PWA 85958 Bender or PWA 85189 Crimper, bend locks (to retain blades) to 0.135 inch (3.429 mm) minimum.

R (b) Check dimension with PWA 85645 Gage.

R (22) Bend the locks as follows:

R (a) Attach an air supply to the quick disconnect plug on PWA 106228 Bender.

R (b) Put the stationary jaw of the Bender on the manufactured bend of the blade lock.

R (c) Apply pressure to the stationary jaw to hold the blade lock in position.

R (d) Push the lever on the handle to move the movable jaw detail to make the initial bend on the blade lock.

R (e) Repeat the preceding steps but use the PWA 106229 Bender to make the final bend on the blade lock.

R (f) Check dimension with PWA 85645 Gage. The bend to retain blades must be 0.135 inch (3.429 mm) minimum.

R (23) Allow sealant to cure at 22 percent minimum relative humidity and at room temperature for 4 hours prior to balance and 24 hours minimum (total time) prior to engine test.

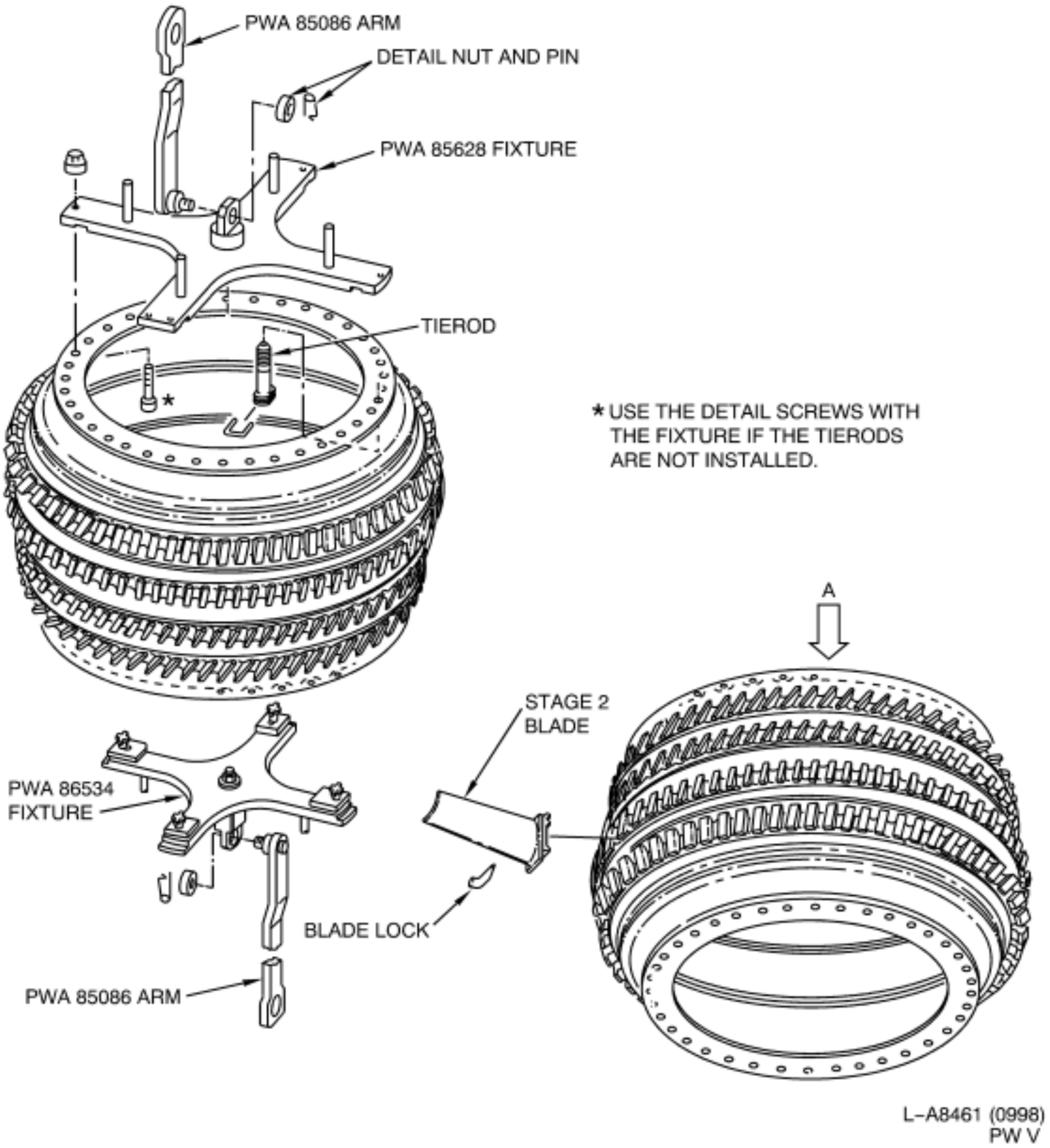
R (24) Install PWA 86534 Lifting Fixture to top (rear) of drum rotor. Clamp fixture to drum. Install PWA 85086 Arm to eye on fixture. Attach hoist and raise drum rotor.

R (25) Install PWA 85628 Lifting Fixture to bottom (front) of drum rotor. Secure fixture to flange. Install PWA 85086 Arm to eye on fixture. Attach hoist and trunnion drum rotor to tierod end up. Remove bottom hoist, arm and fixture from drum rotor.

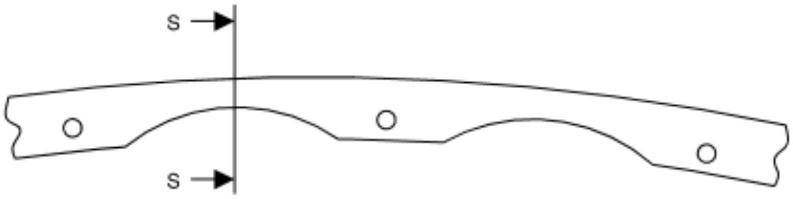
R (26) Lower drum rotor to PWA 85660 Build Stand. Remove hoist, arm and fixture from drum.

D. Postrequisites

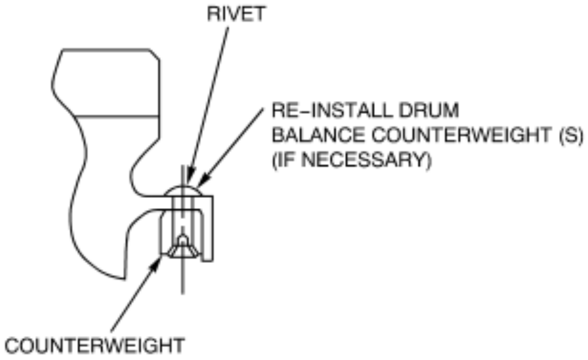
(1) Assemble axial compressor rotor assembly (Stage 4). See Assembly−02 Task 72−31−01−440−002.


PWA 85086 ARM
DETAIL NUT AND PIN
PWA 85628 FIXTURE
TIEROD
*
* USE THE DETAIL SCREWS WITH THE FIXTURE IF THE TIERODS ARE NOT INSTALLED.
A
STAGE 2 BLADE
PWA 86534 FIXTURE
BLADE LOCK
PWA 85086 ARM
L-A8461 (0998)
PW V

Assemble The Axial Compressor Rotor Assembly (Stage 2)
Figure 1001 (Sheet 1)
(Task 72-31-01-440-001)



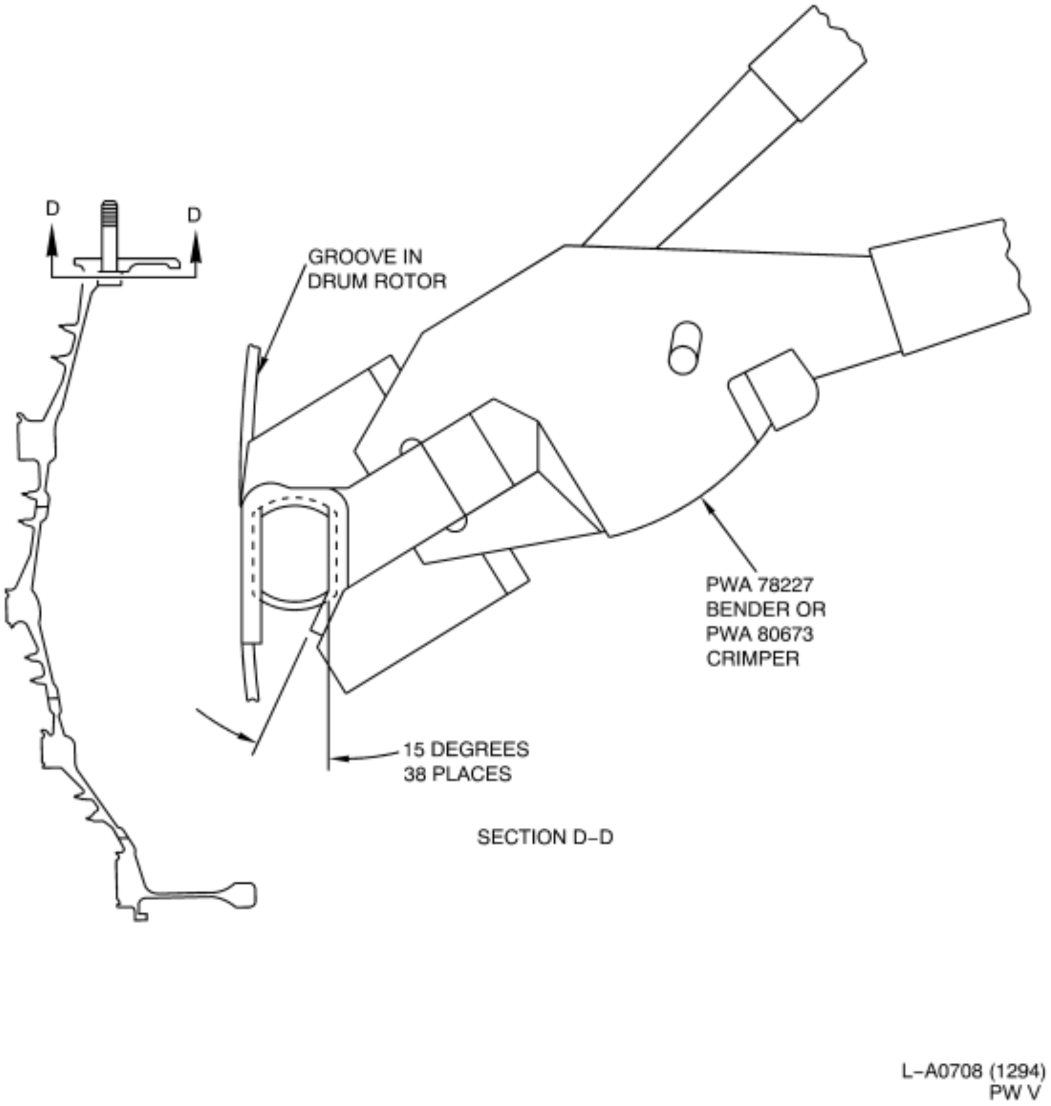
VIEW IN DIRECTION A
(PARTIAL)


RIVET
RE−INSTALL DRUM
BALANCE COUNTERWEIGHT (S)
(IF NECESSARY)
COUNTERWEIGHT

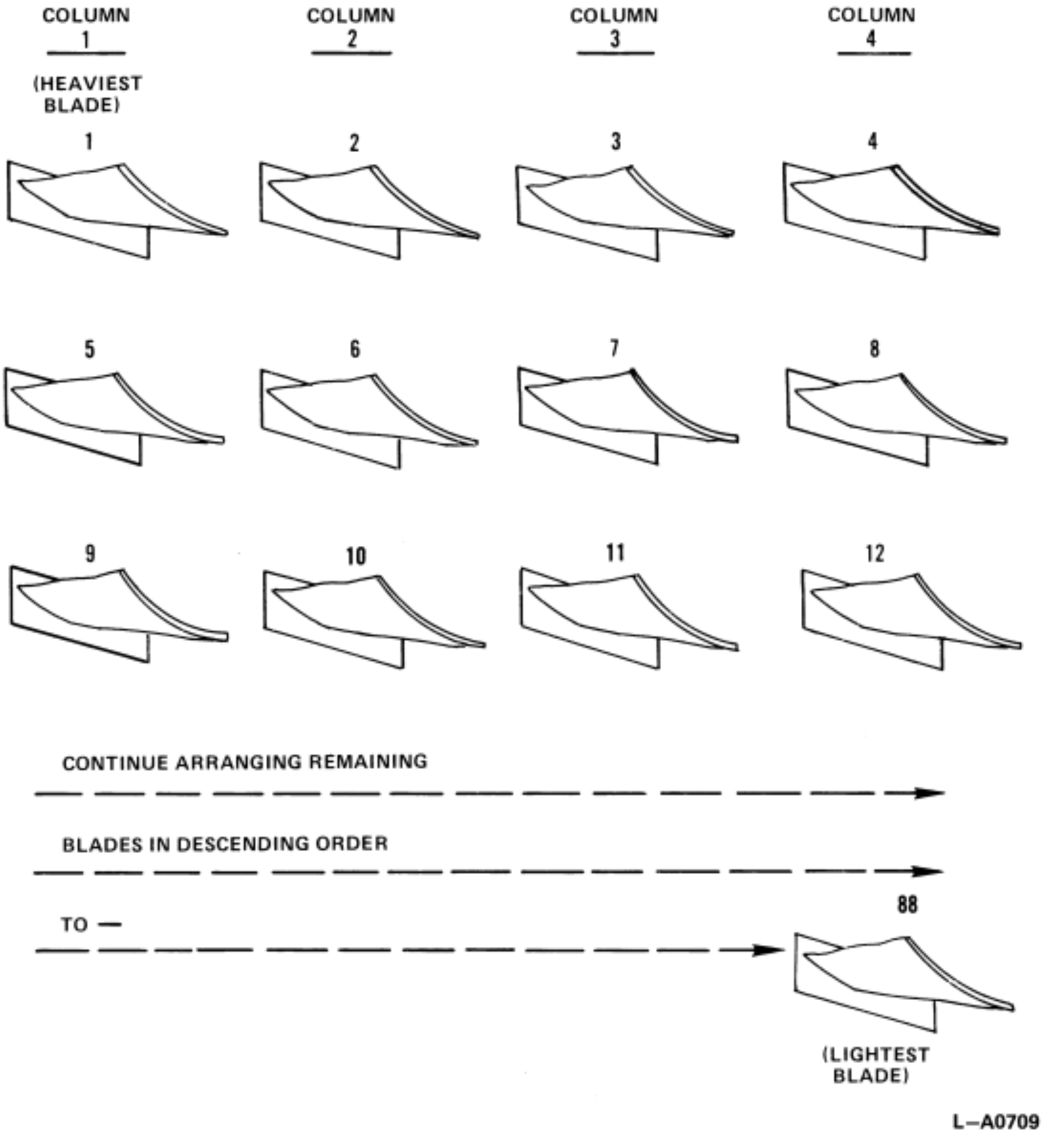
SECTION S−S

L−B6870 (0998)
PW V

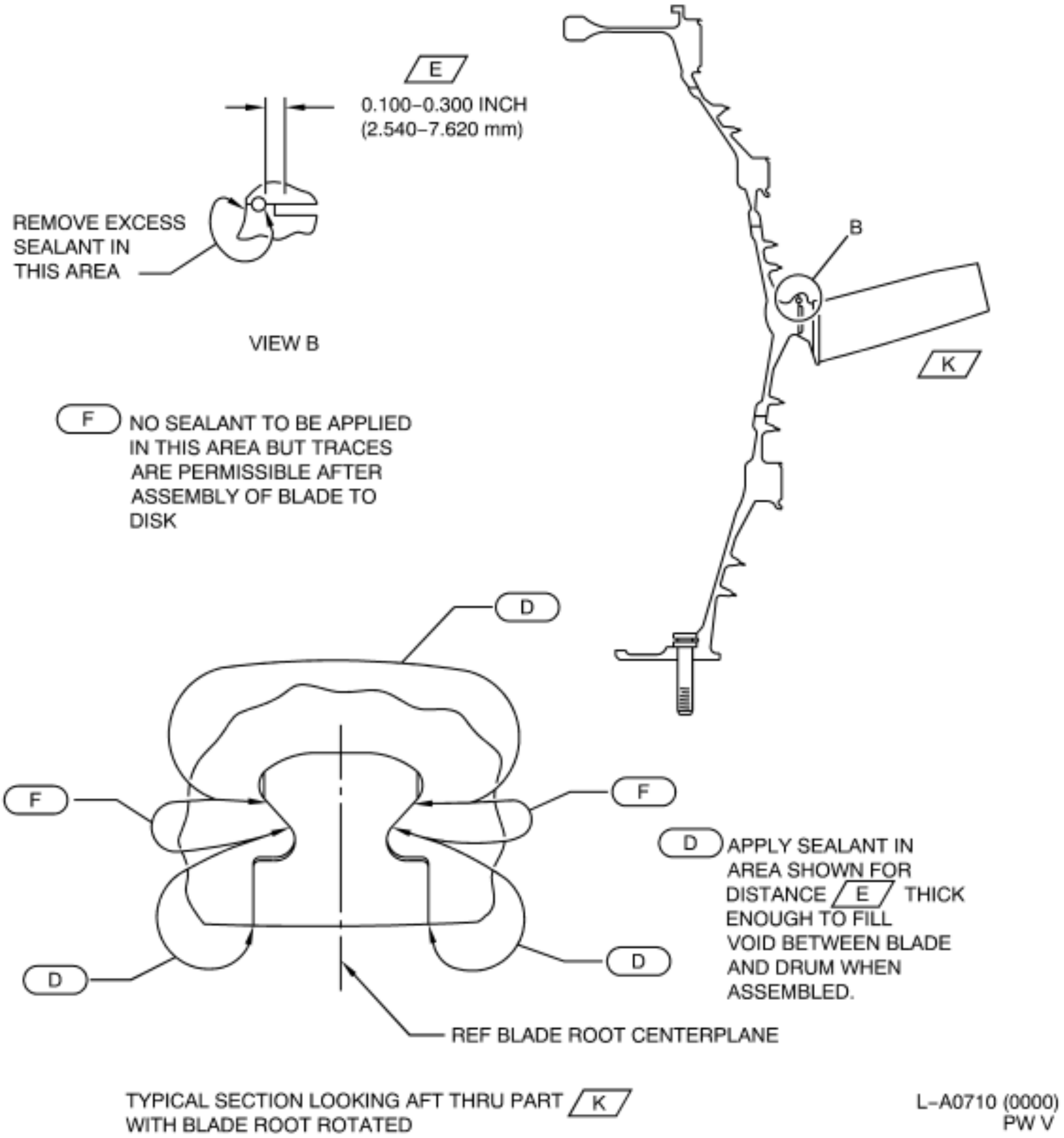
Assemble The Axial Compressor Rotor Assembly (Stage 2)
Figure 1001 (Sheet 2)
(Task 72−31−01−440−001)


D
D
GROOVE IN DRUM ROTOR
PWA 78227 BENDER OR PWA 80673 CRIMPER
15 DEGREES 38 PLACES
SECTION D−D
L−A0708 (1294)
PW V

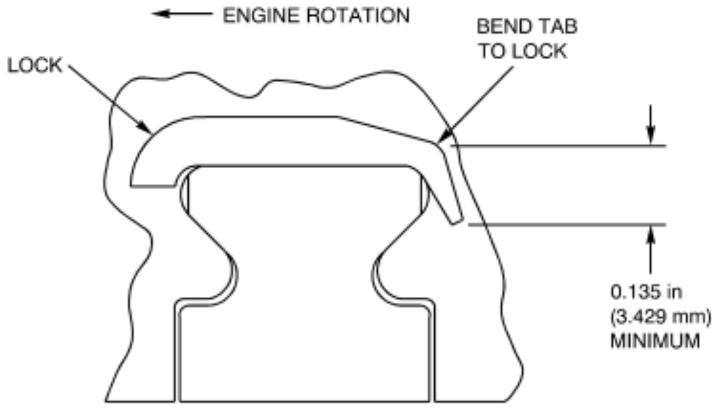
Tierod Installation
Figure 1002
(Task 72−31−01−440−001)


COLUMN 1
COLUMN 2
COLUMN 3
COLUMN 4
(HEAVIEST BLADE)
1
2
3
4
5
6
7
8
9
10
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO —
88
(LIGHTEST BLADE)
L-A0709

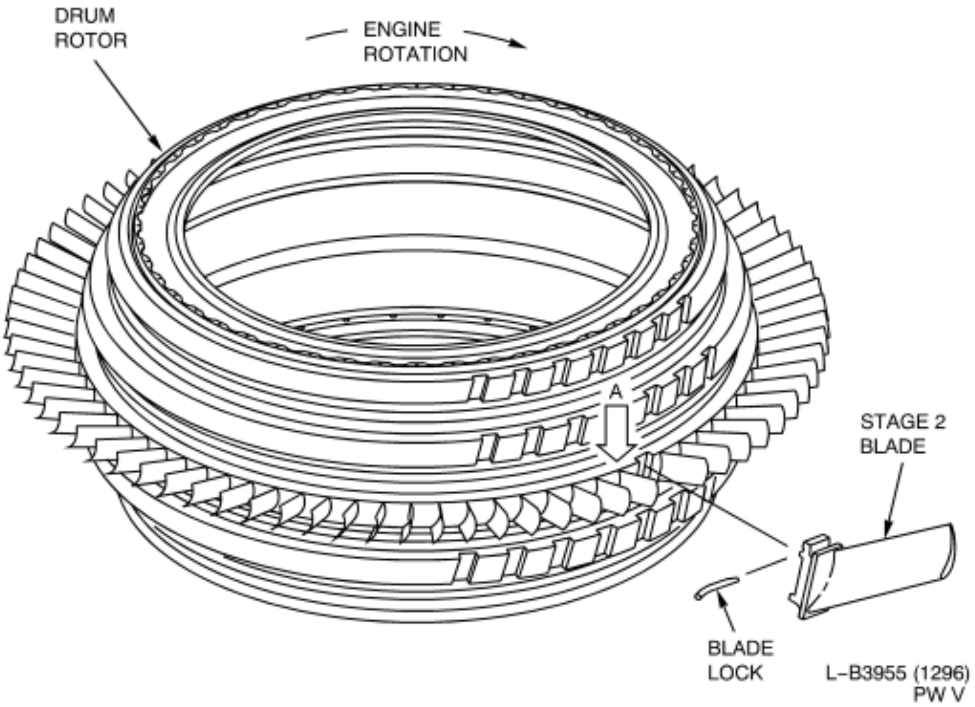
LPC Blade Arrangement
Figure 1003
(Task 72-31-01-440-001)


E
0.100-0.300 INCH
(2.540-7.620 mm)
REMOVE EXCESS
SEALANT IN
THIS AREA
VIEW B
B
K
F NO SEALANT TO BE APPLIED
IN THIS AREA BUT TRACES
ARE PERMISSIBLE AFTER
ASSEMBLY OF BLADE TO
DISK
D
F
F
D APPLY SEALANT IN
AREA SHOWN FOR
DISTANCE E THICK
ENOUGH TO FILL
VOID BETWEEN BLADE
AND DRUM WHEN
ASSEMBLED.
D
D
REF BLADE ROOT CENTERPLANE
TYPICAL SECTION LOOKING AFT THRU PART K
WITH BLADE ROOT ROTATED
L-A0710 (0000)
PW V

Sealant Application
Figure 1004
(Task 72-31-01-440-001)


ENGINE ROTATION
LOCK
BEND TAB TO LOCK
0.135 in (3.429 mm) MINIMUM

VIEW A


DRUM ROTOR
ENGINE ROTATION
A
STAGE 2 BLADE
BLADE LOCK
L-B3955 (1296)
PW V

Blade Lock Installation
Figure 1005
(Task 72-31-01-440-001)

Task 72-31-01-440-002:

1. Assemble Axial Compressor Rotor Assembly (Stage 4)

A. Prerequisites

(1) Assemble axial compressor rotor assembly (Stage 2). See Task 72-31-01-440-001.

B. Equipment And Materials Necessary

Special Tools:

	PWA 85188	Pliers, Crimper
	PWA 85567	Gage, Go-No Go (Optional to PWA 87948 Gage)
R R	PWA 85959	Bender, Pneumatic (Blade Lock) (Optional PWA 106299 And PWA 106300)
	PWA 87948	Gage, Go-No Go
R R	PWA 106299	Bender, Pneumatic (Blade Lock) (Initial Bend)
R	PWA 106300	Bender, Pneumatic (Blade Lock) (Final Bend)

Consumable Materials:

Item No.	Designation
P09-014	Sealant, Silicone Rubber (PWA 36003)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lock	66	72-31-00/5/140

C. Procedure

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−02

CAUTION: THE FOLLOWING STAGE 4 LPC BLADES AND 4TH STAGE DUCTS MUST BE ASSEMBLED IN SETS ONLY OR BLADE, RUBSTRIP AND SHROUD DAMAGE MAY OCCUR.

CAUTION: PN 51B104 STAGE 4 LPC BLADES MUST BE ASSEMBLED WITH PN 50B023 4TH STAGE DUCT.

CAUTION: PN 51B404 STAGE 4 LPC BLADES CAN BE ASSEMBLED WITH PN 50B227, PN 50B023−001 OR PN 50B023 4TH STAGE DUCT.

CAUTION: THE ABOVE SETS ARE INTERCHANGEABLE WITH PN 54B016 OR PN 54B916 OR PN 56B016 OR PN 56B116 LPC COMPRESSOR STATOR ASSEMBLIES.

(1) Prior to installation, weigh the 4th stage blades.

(2) Ink mark the 4th stage blade weight on the individual airfoils with a suitable ink marker. See Standard Practices Manual, PN 585005, "Marking Of Parts" 70−11−00.

(3) Arrange the 4th stage blades as follows. See Figure 1001.

  (a) Arrange the blades in four columns.

  (b) Start with the heaviest blade at top left Column 1.

  (c) Continue from left to right, in descending order of weight.

  (d) The lightest blade will be at the bottom of Column 2.

(4) Clean the areas of the blades that will have sealant on them. Use the SPOP 208 Wipe Method, Standard Practices Manual, PN 585005, 70−21−00−110−040. Refer to Figure 1002 for sealant areas.

CAUTION: CARE SHOULD BE TAKEN TO ENSURE THAT ANY PRESSURE OR FORCE REQUIRED TO INSTALL BLADE IN DRUM, BE APPLIED TO ROOT PLATFORM AREA OF BLADE AND NOT TO LEADING OR TRAILING EDGE OF BLADES. AIRFOIL SECTION OF BLADES ARE EASILY DAMAGED BY ANY KIND OF FORCE.

(5) Apply Sealant P09−014 to the lightest (bottom) blade in Column 4.

- (a) Make it sufficiently thick to fill the empty space between Parts K and L when assembled.
- (b) Install the blade before the sealant cures.

(6) Install the blade in the drum rotor disk assembly as follows.

- (a) Install the blade, leading edge up, in the slots of the disk assembly.
- (b) Hold the blade radially outward while you install it.

  NOTE: This loads the blade against the bearing surface of the disk slot. It also makes sure that the layer of sealant is equally applied along the platform of the blade.

- (c) Slowly seat the blade fully in the disk assembly.
- (d) If there is too much sealant in the area of the blade lock, remove it. Fill any empty spaces.

(7) Install a blade lock in the hole made by the blade and the disk assembly. Refer to Figure 1003.

(8) For each blade, apply Sealant P09−014 to the blade, install the blade, then install the blade lock. Install the blades in the sequence that follows.

- (a) Install the blades in a counterclockwise direction.
- (b) Install the remaining blades from Column 4. Start at the bottom of the column and go to the top of the column (lighter blades to heavier blades).

(c) Install the blades in Column 2. Start at the bottom of the column and go to the top of the column.

(d) Install the blades in Column 3. Start at the bottom of the column and go to the top of the column.

(e) Install the blades in Column 1. Start at the bottom of the column and go to the top of the column.

R (9) Bend the locks as follows: See Figure 1003.

R NOTE: See the following step to bend the locks with
R PWA 106299 Bender (initial) and PWA 106300
R Bender (final).

R (a) With PWA 85959 Bender or PWA 85188 Crimper, bend locks (to retain blades) to 0.135 inch (3.429 mm) minimum.

R (b) Check dimension with PWA 87948 Gage.

R (10) Bend the locks as follows:

R (a) Attach an air supply to the quick disconnect plug
R on PWA 106299 Bender.

R (b) Put the stationary jaw of the Bender on the
R manufactured bend of the blade lock.

R (c) Apply pressure to the stationary jaw to hold the
R blade lock in position.

R (d) Push the lever on the handle to move the movable
R jaw detail to make the initial bend on the blade
R lock.

R (e) Repeat the preceding steps but use the PWA 106300
R Bender to make the final bend on the blade lock.

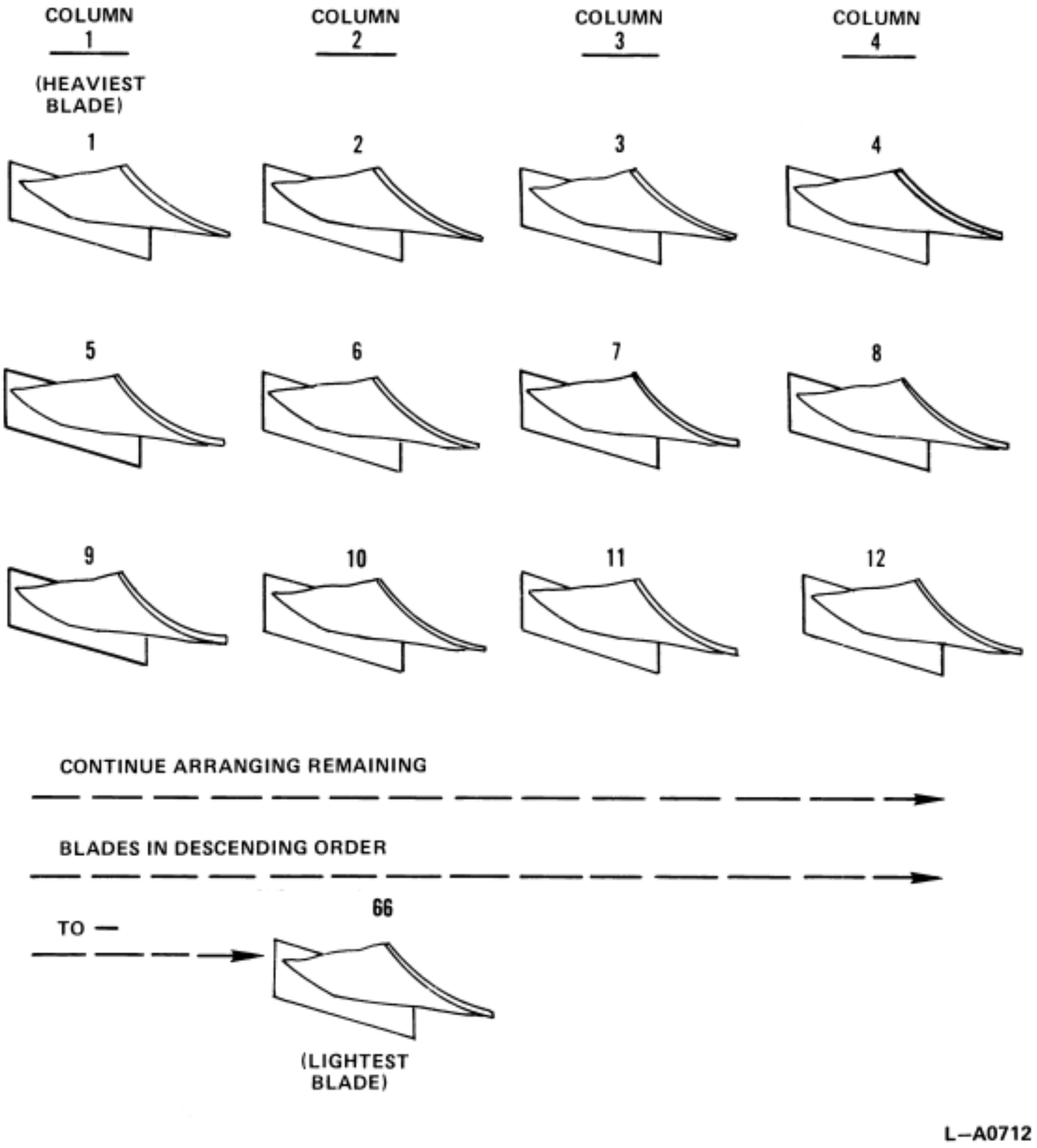
R (f) Check dimension with PWA 85645 Gage. The bend
R to retain blades must be 0.135 inch (3.429 mm)
R minimum.

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−02

R (11) Cure the sealant in room temperature air that is at 25 percent minimum relative humidity. Cure the sealant for eight hours before you balance the assembly. Cure the sealant for 24 hours, minimum, before engine test.

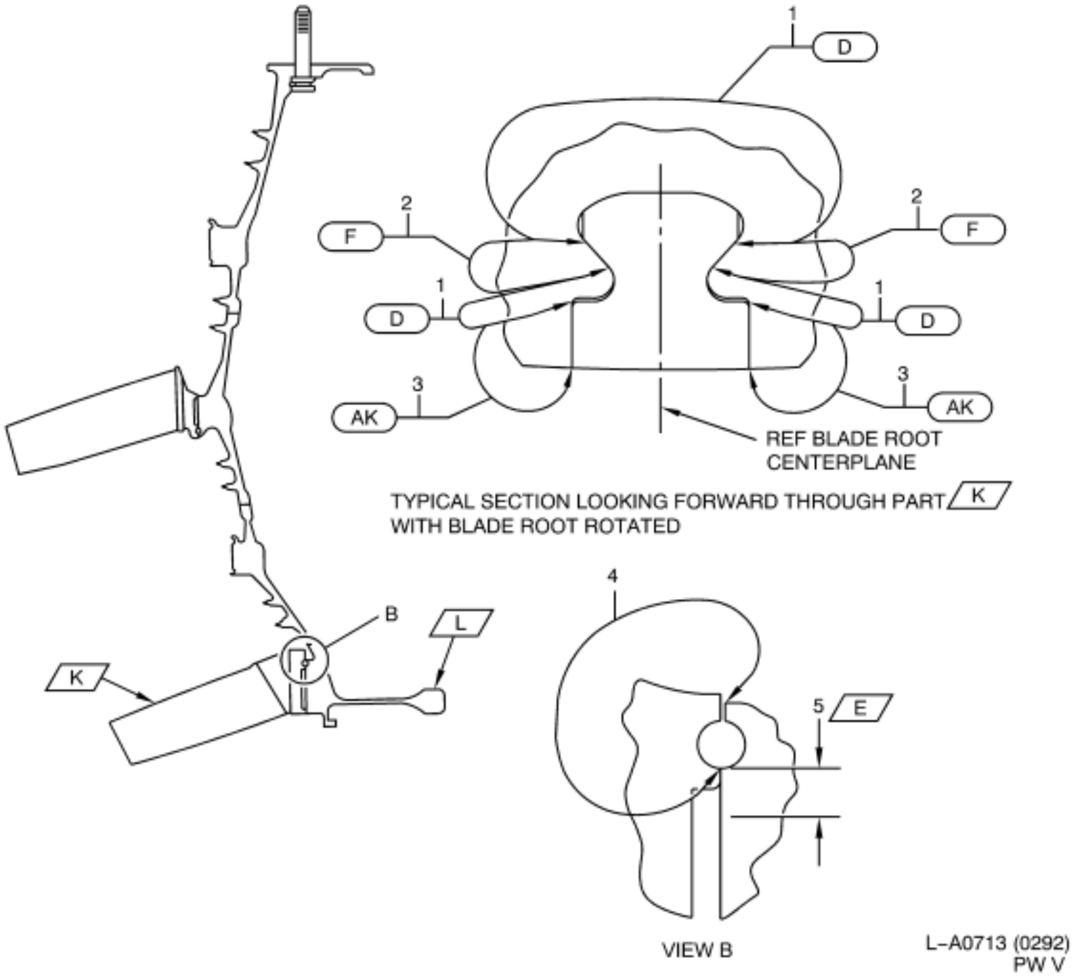
D. Postrequisites

(1) Assemble axial compressor rotor assembly (Stage 3). See Assembly−03 Task 72−31−01−440−003.


COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
COLUMN 3
COLUMN 4
1
2
3
4
5
6
7
8
9
10
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO -
66
(LIGHTEST BLADE)
L-A0712

LPC Blade Arrangement
Figure 1001
(Task 72-31-01-440-002)

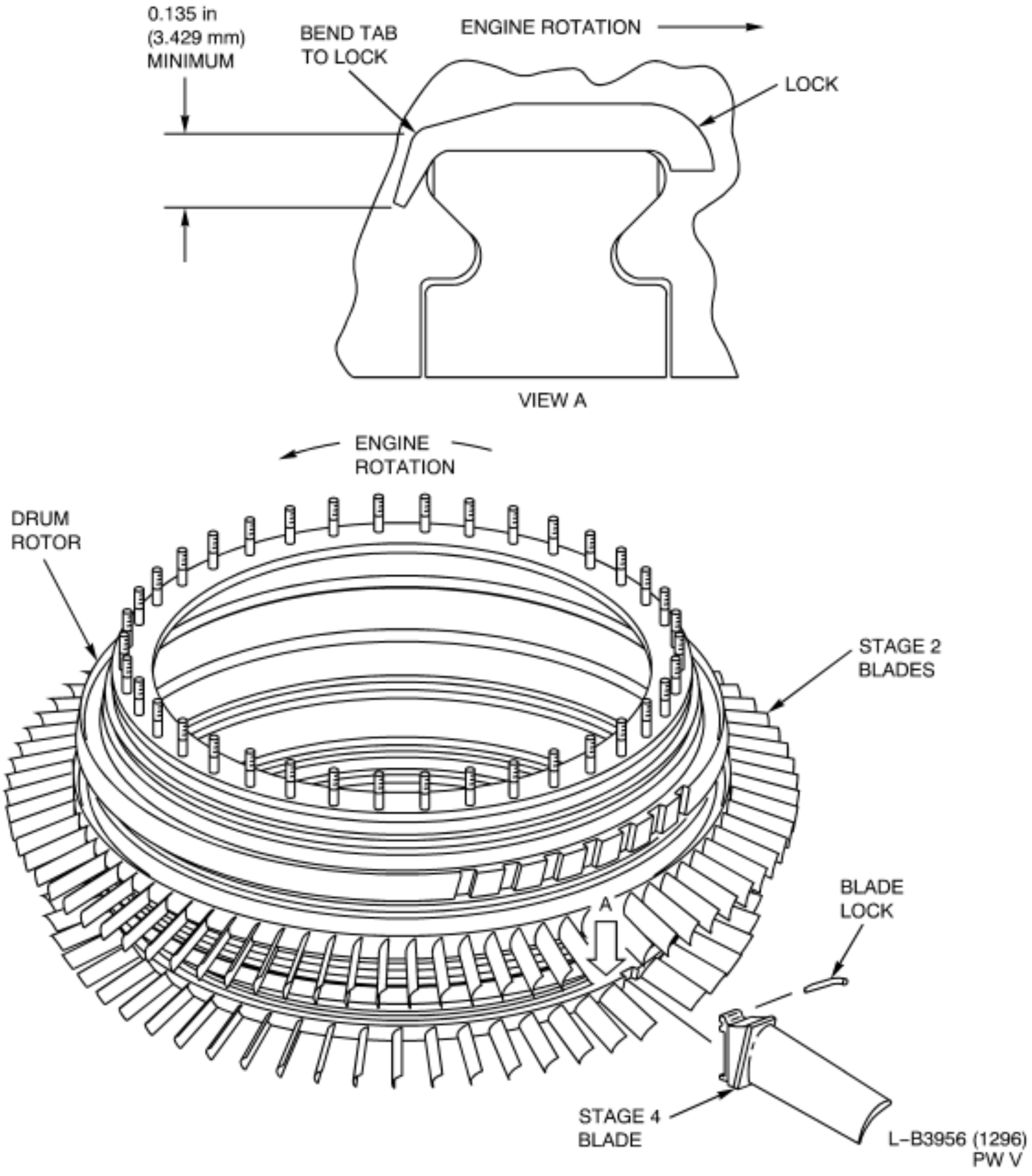
AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−02


1
D
2
F
1
D
3
AK
2
F
1
D
3
AK
REF BLADE ROOT CENTERPLANE
TYPICAL SECTION LOOKING FORWARD THROUGH PART K
WITH BLADE ROOT ROTATED
B
L
K
4
5
E
VIEW B
L−A0713 (0292)
PW V

1. Apply Sealant For Distance E.
2. Do Not Apply Sealant In This Area. It Is Permitted For There To Be A Small Quantity Of Sealant In This Area After Installation Of The Blade In The Disk Assembly.
3. Apply Sealant For The Full Length Of The Blade Platform. It Is Permitted To Touch−up This Area After Assembly. No Sealant Is Permitted On Gaspath Surfaces.
4. Remove Excess Sealant In This Area.
5. 0.100 Inch (2.540 mm) Minimum

Sealant Application
Figure 1002
(Task 72−31−01−440−002)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-02


0.135 in
(3.429 mm)
MINIMUM
BEND TAB
TO LOCK
ENGINE ROTATION
LOCK
VIEW A
ENGINE
ROTATION
DRUM
ROTOR
STAGE 2
BLADES
A
BLADE
LOCK
STAGE 4
BLADE
L-B3956 (1296)
PW V

Blade Lock Installation
Figure 1003
(Task 72-31-01-440-002)

R
R

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-31-01-440-003:

1. Assemble Axial Compressor Rotor Assembly (Stage 3)

A. Prerequisites

(1) Assemble axial compressor rotor assembly (Stage 4). See Assembly-02 Task 72-31-01-440-002.

B. Equipment And Materials Required

Special Tools:

	PWA 85188	Pliers, Crimper
	PWA 85567	Gage, Go-No Go (Optional to PWA 87948 Gage)
R	PWA 85959	Bender, Pneumatic (Blade Lock) (Optional PWA 106301 And PWA 106302)
	PWA 87948	Gage, Go-No Go
R	PWA 106301	Bender, Pneumatic (Blade Lock) (Initial Bend)
R	PWA 106302	Bender, Pneumatic (Blade Lock) (Final Bend)

Consumable Materials:

Item No.	Designation
P09-014	Sealant, Silicone Rubber (PWA 36003)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lock	72	72-31-00/5/120

C. Procedure

CAUTION: PN 50B203 AND PN 50B903 STAGE 3 LPC BLADES ARE INTERCHANGEABLE IN ANY COMBINATION WITH LPC COMPRESSOR STATOR ASSEMBLIES PN 54B016 OR PN 54B916 OR PN 56B016 OR PN 56B116.

(1) Prior to installation, weigh the 3rd stage blades.

(2) Ink mark the 3rd stage blade weight on the individual airfoils with a suitable ink marker. See Standard Practices Manual, PN 585005, "Marking Of Parts" 70-11-00.

(3) Arrange the 3rd stage blades in four columns of 18 blades, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. Lightest blade will be at bottom right (Column 4). See Figure 1001.

(4) Prior to applying compound, wipe blade areas to be sealed by SPOP 208 Wipe Method. See 70−21, Standard Practices Manual, PN 585005.

CAUTION: CARE SHOULD BE TAKEN TO ENSURE THAT ANY PRESSURE OR FORCE REQUIRED TO INSTALL BLADE IN DRUM, BE APPLIED TO ROOT PLATFORM AREA OF BLADE AND NOT TO LEADING OR TRAILING EDGE OF BLADES. AIRFOIL SECTION OF BLADES ARE EASILY DAMAGED BY ANY KIND OF FORCE.

(5) Starting with lightest (bottom) blade in Column 4, apply Silicone Rubber P09−014, to blade root in areas shown in Figure 1002, and install blade, leading edge up in drum slot.

(6) Grasp blade and pull radially outward to load blade against bearing surface of drum slot. Slowly seat blade completely in drum.

(7) Remove excess compound from blade lock area and around blade root area. Fill in any voids.

(8) Install blade lock in hole formed by blade and drum per Figure 1003.

(9) Repeating compound application procedure, install remaining blades from Column 4 continuing vertically upward from lighter blades to heavier blades. Install blades to drum in a counterclockwise direction. Install blade lock after installing each blade.

(10) After all blades in Column 4 are installed, move to bottom of Column 2, repeat compound application procedure and install blades from Column 2, selecting blades vertically upward from lighter blades to heavier blades. Install blades in a counterclockwise direction. Secure each blade with blade lock.

(11) After all blades in Column 2 are installed, move to bottom of Column 3, and repeat compound application and blade installation procedures.

(12) After all blades in Column 3 are installed, move to bottom of Column 1, and repeat compound application and blade installation procedures.

(13) Bend the locks as follows: See Figure 1003.

NOTE: See the following step to bend the locks with PWA 106301 Bender (initial) and PWA 106302 Bender (final).

(a) With PWA 85959 Bender or PWA 85188 Crimper, bend locks (to retain blades) to 0.135 inch (3.429 mm) minimum.

(b) Check dimension with PWA 87948 Gage.

(14) Bend the locks as follows:

(a) Attach an air supply to the quick disconnect plug on PWA 106301 Bender.

(b) Put the stationary jaw of the Bender on the manufactured bend of the blade lock.

(c) Apply pressure to the stationary jaw to hold the blade lock in position.

(d) Push the lever on the handle to move the movable jaw detail to make the initial bend on the blade lock.

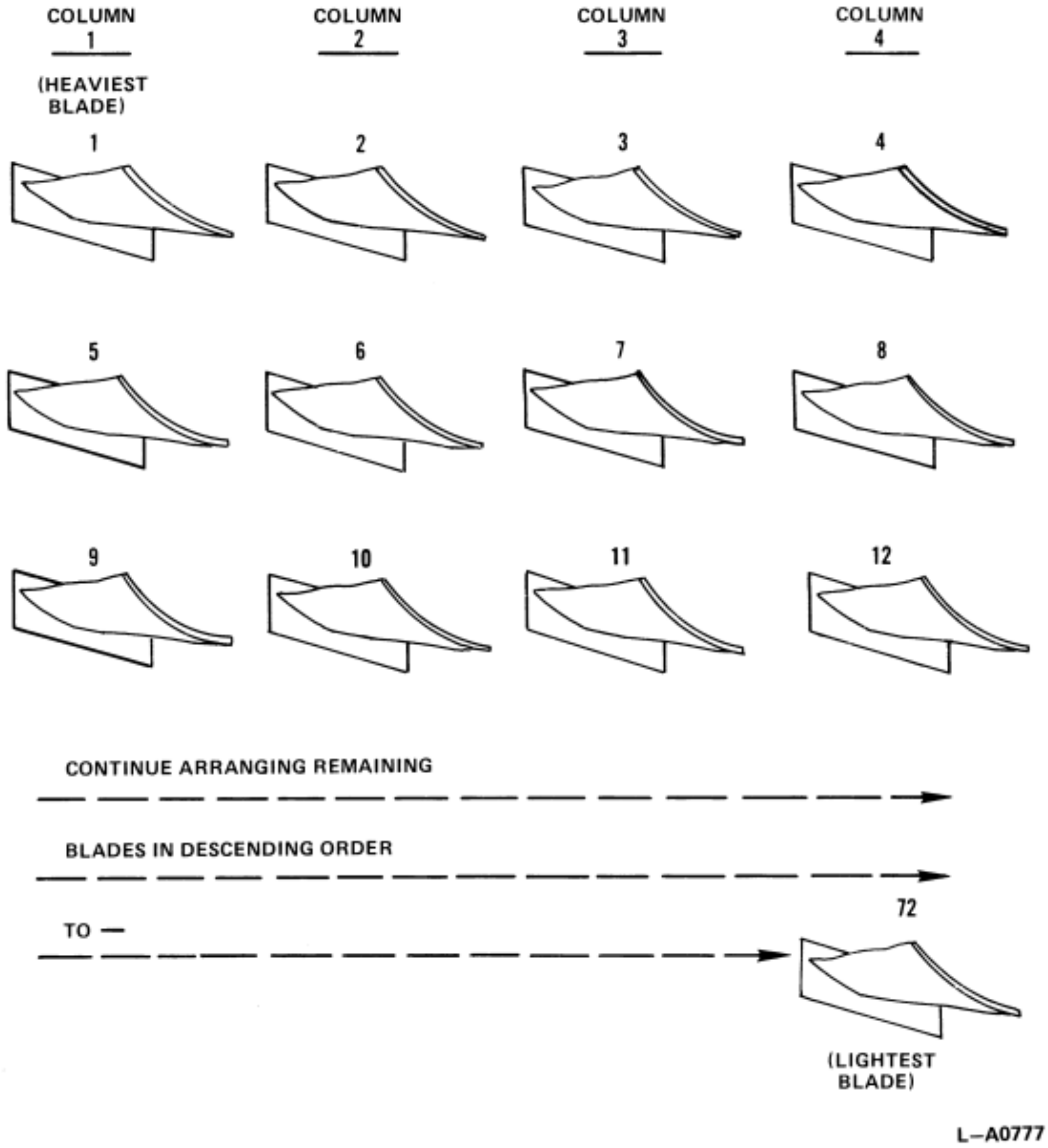
(e) Repeat the preceding steps but use the PWA 106302 Bender to make the final bend on the blade lock.

(f) Check dimension with PWA 85645 Gage. The bend to retain blades must be 0.135 inch (3.429 mm) minimum.

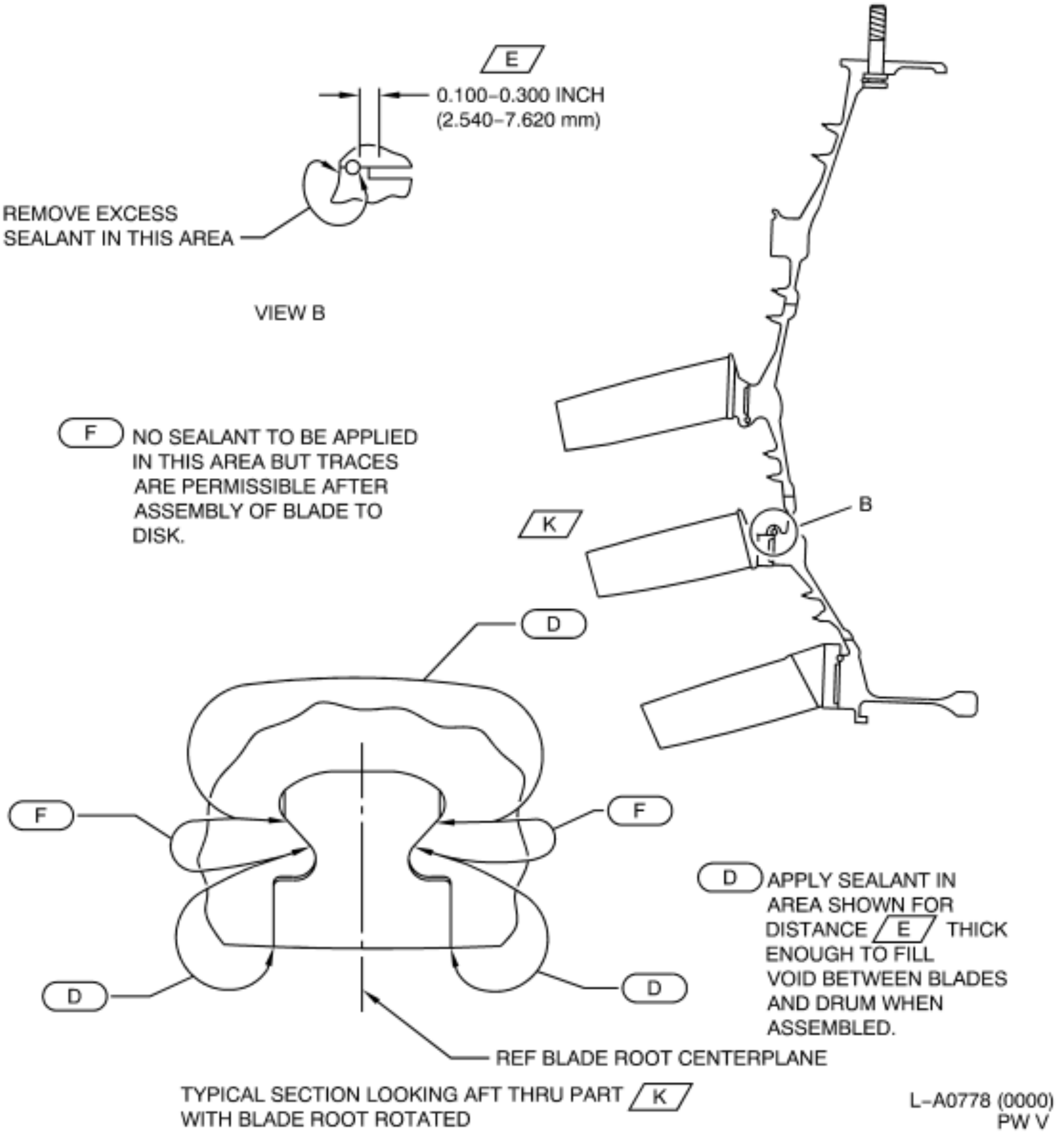
(15) Allow sealant to cure at 22 percent minimum relative humidity and at room temperature for 8 hours prior to balance and 24 hours minimum (total time) prior to engine test.

D. Postrequisites

(1) Assemble axial compressor rotor assembly (Stage 1.6). See Assembly−04 Task 72−31−01−440−004.

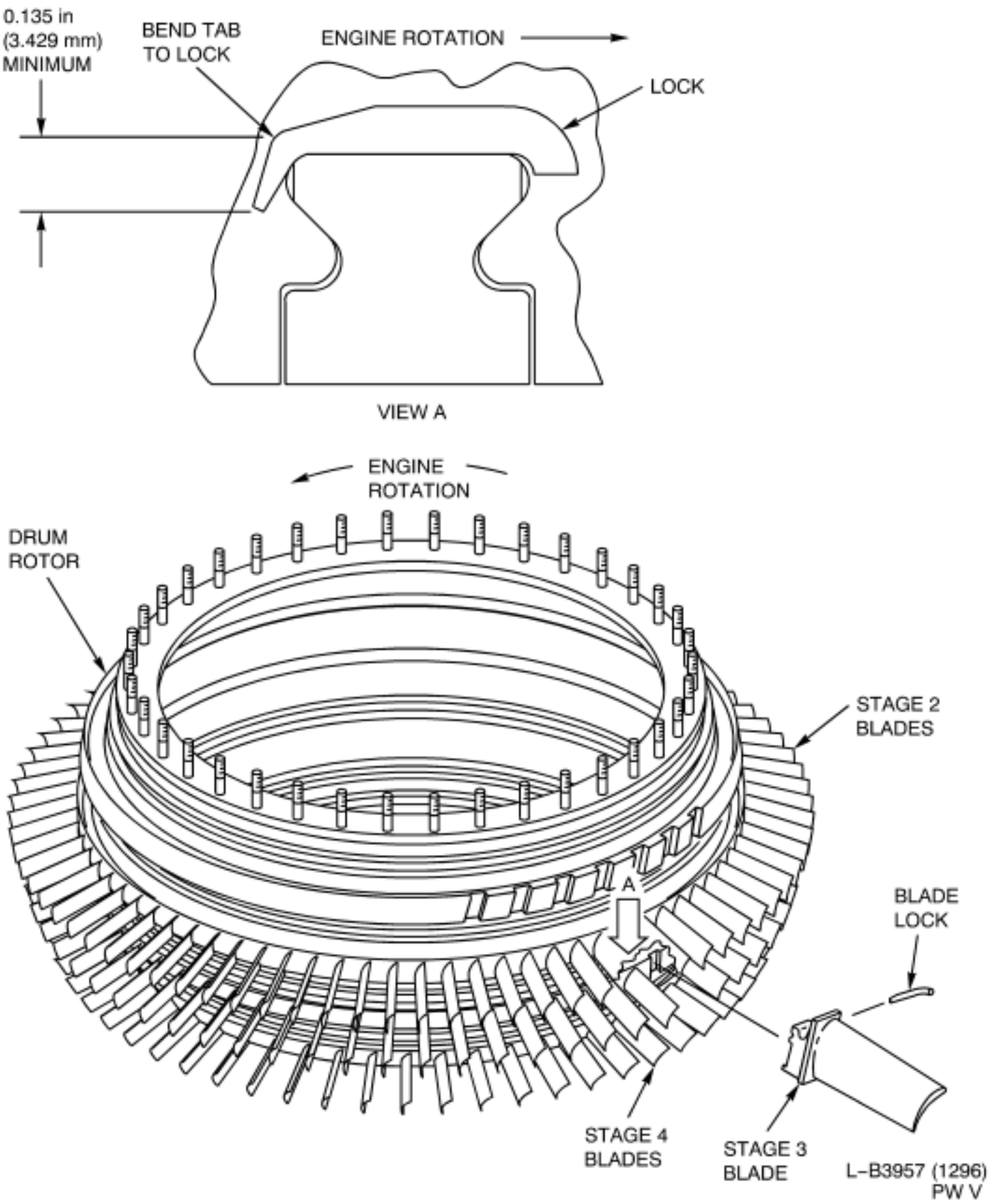

COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
COLUMN 3
COLUMN 4
1
2
3
4
5
6
7
8
9
10
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO —
72
(LIGHTEST BLADE)
L−A0777

LPC Blade Arrangement
Figure 1001
(Task 72−31−01−440−003)


E
0.100-0.300 INCH
(2.540-7.620 mm)
REMOVE EXCESS
SEALANT IN THIS AREA
VIEW B
F NO SEALANT TO BE APPLIED
IN THIS AREA BUT TRACES
ARE PERMISSIBLE AFTER
ASSEMBLY OF BLADE TO
DISK.
K
B
D
F
F
D APPLY SEALANT IN
AREA SHOWN FOR
DISTANCE E THICK
ENOUGH TO FILL
VOID BETWEEN BLADES
AND DRUM WHEN
ASSEMBLED.
D
D
REF BLADE ROOT CENTERPLANE
TYPICAL SECTION LOOKING AFT THRU PART K
WITH BLADE ROOT ROTATED
L-A0778 (0000)
PW V

Sealant Application
Figure 1002
(Task 72-31-01-440-003)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-03


0.135 in
(3.429 mm)
MINIMUM
BEND TAB
TO LOCK
ENGINE ROTATION
LOCK
VIEW A
ENGINE
ROTATION
DRUM
ROTOR
STAGE 2
BLADES
A
BLADE
LOCK
STAGE 4
BLADES
STAGE 3
BLADE
L-B3957 (1296)
PW V

Blade Lock Installation
Figure 1003
(Task 72-31-01-440-003)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-04

Task 72-31-01-440-004:

1. Assemble Axial Compressor Rotor Assembly (Stage 1.6)

A. Prerequisites

(1) Assemble axial compressor rotor assembly (Stage 3). See Assembly-03 Task 72-31-01-440-003.

B. Equipment And Materials Required

Special Tools:

	PWA 85188	Pliers, Crimper
	PWA 85567	Gage, Go-No Go (Optional to PWA 87948 Gage)
R R	PWA 85959	Bender, Pneumatic (Blade Lock) (Optional PWA 106301 And PWA 106302)
	PWA 87948	Gage, Go-No Go
R R	PWA 106301	Bender, Pneumatic (Blade Lock) (Initial Bend)
R	PWA 106302	Bender, Pneumatic (Blade Lock) (Final Bend)

Consumable Materials:

Item No.	Designation
P09-014	Sealant, Silicone Rubber (PWA 36003)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lock	94	72-31-00/5/80

C. Procedure

CAUTION: PN 53B516 AND PN 55B116 STAGE 1.6 LPC BLADES ARE INTERCHANGEABLE IN ANY COMBINATION WITH LPC COMPRESSOR STATOR ASSEMBLIES PN 54B016 OR PN 54B916 OR PN 56B016 OR PN 56B116.

(1) Prior to installation, weigh the 1.6 stage blades.

(2) Ink mark the 1.6 stage blade weight on the individual airfoils with a suitable ink marker. See Standard Practices Manual, PN 585005, "Marking Of Parts" 70-11-00.

(3) Arrange 1.6 stage blades in four columns, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. Lightest blade will be at bottom of (Column 2). See Figure 1001.

(4) Prior to applying compound, wipe blade areas to be sealed by SPOP 208 Wipe Method. See 70−21, Standard Practices Manual, PN 585005.

CAUTION: CARE SHOULD BE TAKEN TO ENSURE THAT ANY PRESSURE OR FORCE REQUIRED TO INSTALL BLADE IN DRUM, BE APPLIED TO ROOT PLATFORM AREA OF BLADE AND NOT TO LEADING OR TRAILING EDGE OF BLADES. AIRFOIL SECTION OF BLADES ARE EASILY DAMAGED BY ANY KIND OF FORCE.

(5) Starting with lightest (bottom) blade in Column 4, apply Silicone Rubber P09−014, to blade root in areas shown in Figure 1002, and install blade, leading edge up in drum slot.

(6) Grasp blade and pull radially outward to load blade against bearing surface of drum slot. Slowly seat blade completely in drum.

(7) Remove excess compound from blade lock area and around blade root area. Fill in any voids.

(8) Install blade lock in hole formed by blade and drum per Figure 1003.

(9) Repeating compound application procedure, install remaining blades from Column 4 continuing vertically upward from lighter blades to heavier blades. Install blades to drum in a counterclockwise direction. Install blade lock after installing each blade.

(10) After all blades in Column 4 are installed, move to bottom of Column 2, repeat compound application procedure and install blades from Column 2, selecting blades vertically upward from lighter blades to heavier blades. Install blades in a counterclockwise direction. Secure each blade with blade lock.

(11) After all blades in Column 2 are installed, move to bottom of Column 3, and repeat compound application and blade installation procedures.

(12) After all blades in Column 3 are installed, move to bottom of Column 1, and repeat compound application and blade installation procedures.

R (13) Bend the locks as follows: See Figure 1003.

R NOTE: See the following step to bend the locks with PWA 106301 Bender (initial) and PWA 106302 Bender (final).

R (a) With PWA 85959 Bender or PWA 85188 Crimper, bend locks (to retain blades) to 0.135 inch (3.429 mm) minimum.

R (b) Check dimension with PWA 87948 Gage.

R (14) Bend the locks as follows:

R (a) Attach an air supply to the quick disconnect plug on PWA 106301 Bender.

R (b) Put the stationary jaw of the Bender on the manufactured bend of the blade lock.

R (c) Apply pressure to the stationary jaw to hold the blade lock in position.

R (d) Push the lever on the handle to move the movable jaw detail to make the initial bend on the blade lock.

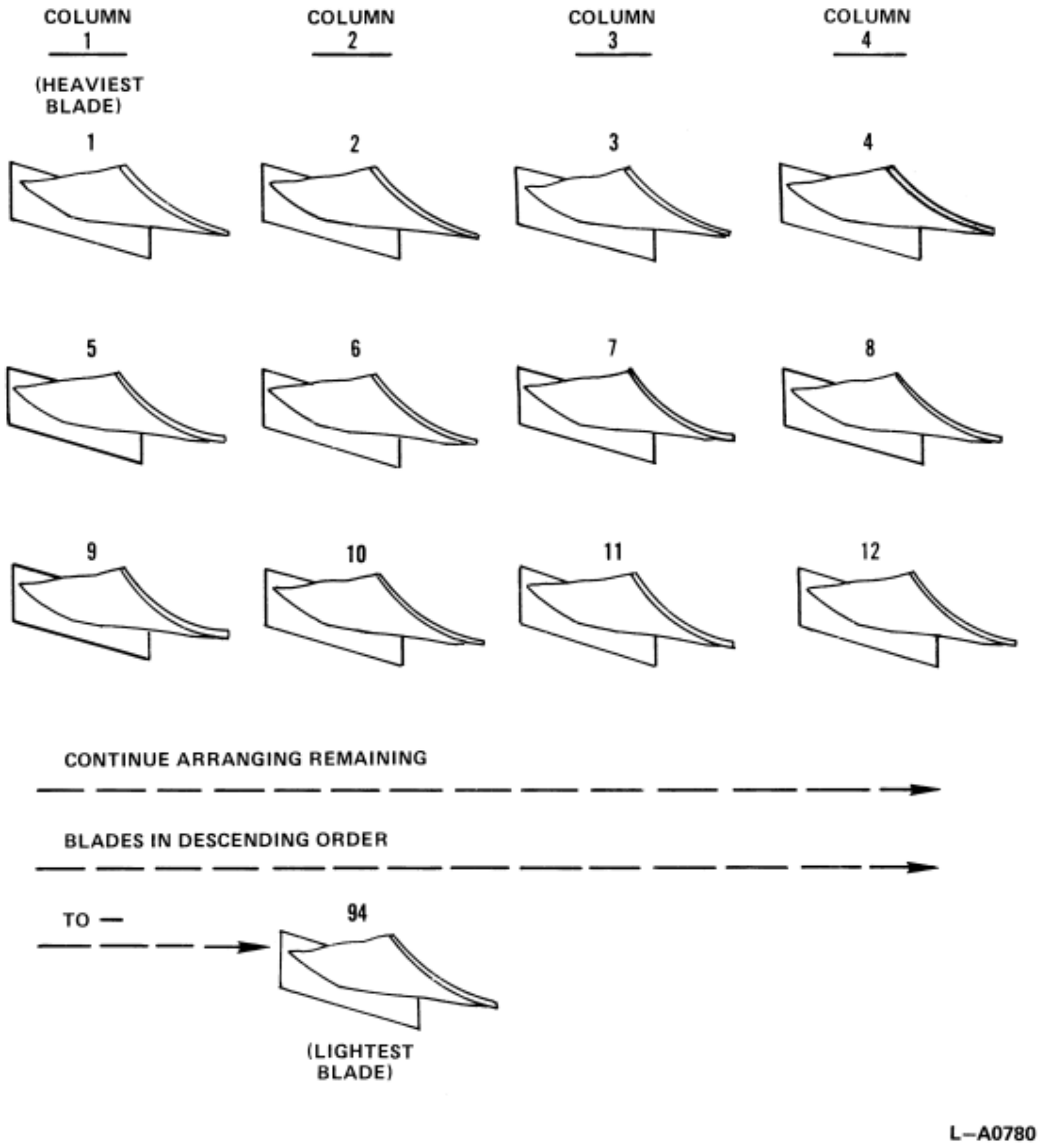
R (e) Repeat the preceding steps but use the PWA 106302 Bender to make the final bend on the blade lock.

R (f) Check dimension with PWA 85645 Gage. The bend to retain blades must be 0.135 inch (3.429 mm) minimum.

R (15) Allow sealant to cure at 22 percent minimum relative humidity and at room temperature for 8 hours prior to balance and 24 hours minimum (total time) prior to engine test.

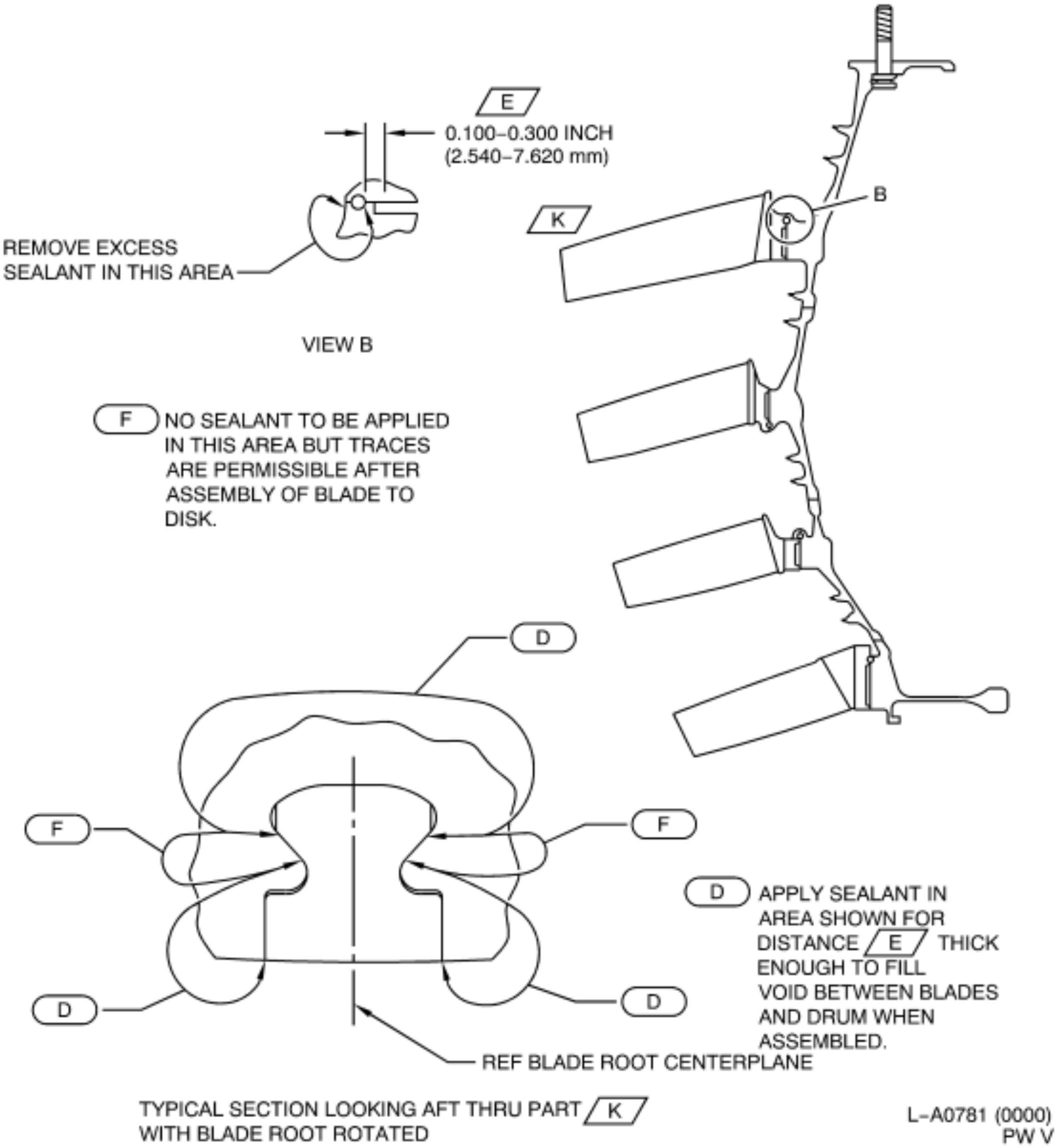
D. Postrequisites

(1) Assemble hub to drum rotor and check runout. See Assembly−05 Task 72−31−01−440−005.


COLUMN 1
COLUMN 2
COLUMN 3
COLUMN 4
(HEAVIEST BLADE)
1
2
3
4
5
6
7
8
9
10
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO —
94
(LIGHTEST BLADE)
L-A0780

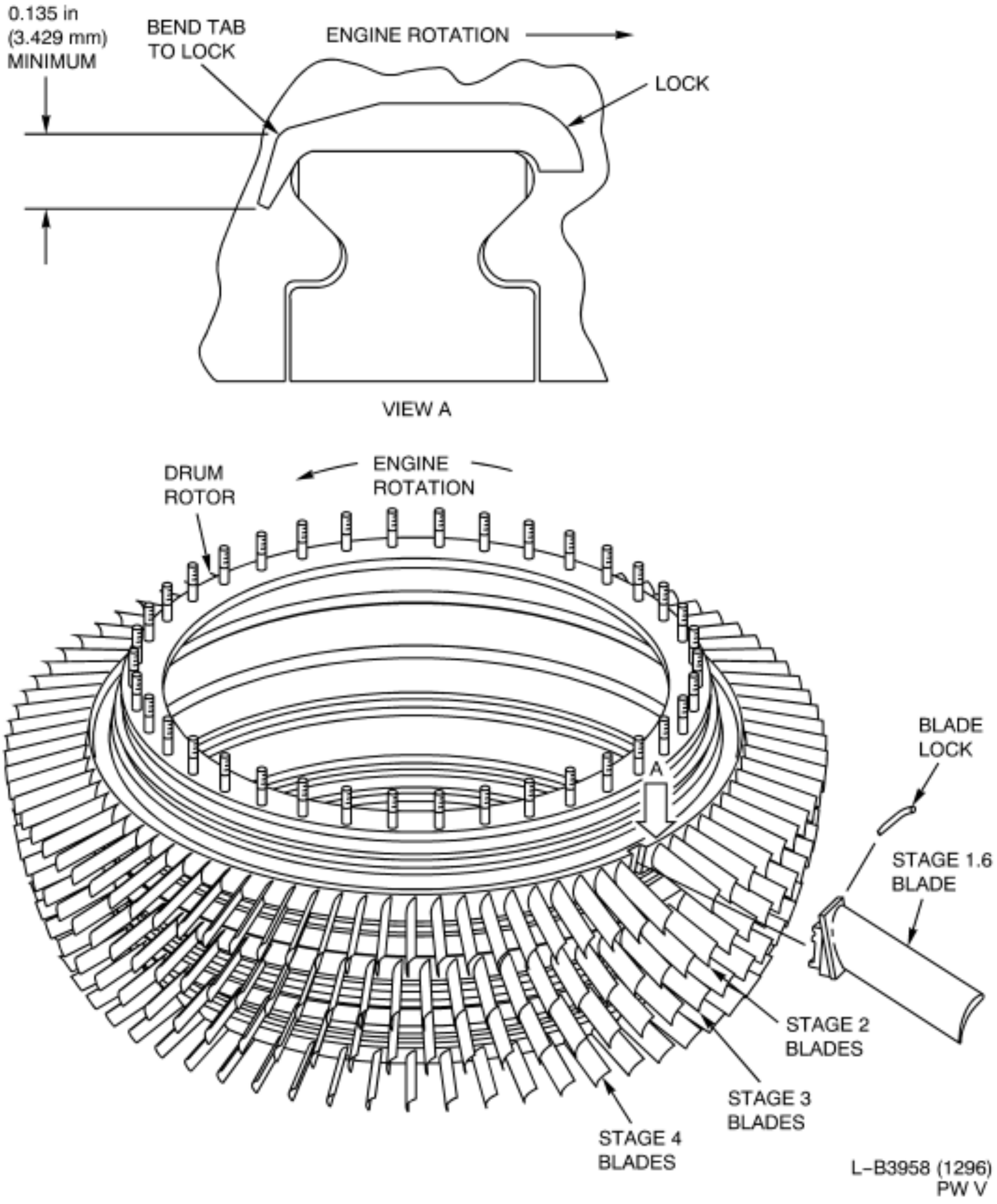
LPC Blade Arrangement
Figure 1001
(Task 72-31-01-440-004)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-04


E
0.100-0.300 INCH
(2.540-7.620 mm)
REMOVE EXCESS
SEALANT IN THIS AREA
VIEW B
K
B
F NO SEALANT TO BE APPLIED IN THIS AREA BUT TRACES ARE PERMISSIBLE AFTER ASSEMBLY OF BLADE TO DISK.
D
F
F
D APPLY SEALANT IN AREA SHOWN FOR DISTANCE E THICK ENOUGH TO FILL VOID BETWEEN BLADES AND DRUM WHEN ASSEMBLED.
D
D
REF BLADE ROOT CENTERPLANE
TYPICAL SECTION LOOKING AFT THRU PART K
WITH BLADE ROOT ROTATED
L-A0781 (0000)
PW V

Sealant Application
Figure 1002
(Task 72-31-01-440-004)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-04


0.135 in
(3.429 mm)
MINIMUM
BEND TAB
TO LOCK
ENGINE ROTATION
LOCK
VIEW A
DRUM
ROTOR
ENGINE
ROTATION
A
BLADE
LOCK
STAGE 1.6
BLADE
STAGE 2
BLADES
STAGE 3
BLADES
STAGE 4
BLADES
L-B3958 (1296)
PW V

Blade Lock Installation
Figure 1003
(Task 72-31-01-440-004)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-05

Task 72-31-01-440-005:

1. Assemble Hub To Drum Rotor And Check Runout

A. Prerequisites

(1) Assemble axial compressor rotor assembly (Stage 1.6). See Assembly-04 (Task 72-31-01-440-004).

B. Equipment And Materials Necessary

Special Tools:

PWA 29754	Controller
PWA 85183	Fixture, Angle Of Turn
PWA 85185	Heater
PWA 85086	Arm, Lift (2 Required)
PWA 85586	Eye, Handling
PWA 85621	Eye, Lifting, Front (For Hub Only) (Optional To PWA 87221)
PWA 85622	Eye, Lifting, Rear (For Hub Only) (Optional To PWA 87266)
PWA 85684	Arbor, Balancing (Optional To PWA 85695)
PWA 85695	Arbor, Balance (Optional To PWA 87037)
PWA 86534	Fixture, Lifting
PWA 86545	Stand, Transportation
PWA 87037	Arbor, Balance
PWA 87135	Adapter, Lift
PWA 87163	Cover, Protective
PWA 87221	Eye, Lifting, Front (For Hub Only) (Optional To PWA 88748)
PWA 87266	Eye, Lifting, Rear (For Hub Only)
PWA 88748	Adapter, Lift And Turn (For Hub/HPC Rotor)

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
R	P06-054	Paste, Antiseize (PWA 36246)

C. Procedure

(1) Install PWA 85185 Heater on front flange of drum rotor. Connect heater to PWA 29754 Controller. Heat flange to 200°F (93°C).

(2) Using hoist and PWA 85086 Lift Arm, install either PWA 87221 or PWA 85621 Eye or PWA 88748 Adapter on front compressor hub assembly.

NOTE: If hub is front face down, use either PWA 87266 or PWA 85622 Eye along with PWA 85586 Eye to access hub front face.

(3) When temperature of hub flange is achieved, shut off controller and remove heater from drum.

(4) Raise hub and position high point runout on hub 180 degrees from high point runout on drum. Install onto heated drum aligning tierods with tierod holes. Seat hub on drum rotor. Remove tooling from hub. See Figure 1001.

R R (5) Apply Antiseize Paste P06−054, to threads of tierods, nuts and washer face of nuts. Wipe off unwanted paste. Remove excess lubrication.

(6) Install tierod nuts, noting run−on torque, as each nut is assembled. Replace nut if run−on torque is less than 9 lb−in. (1.017 N.m).

(7) (Reference 1660) Torque tierod nuts as follows:

(a) Torque nuts in sequence as specified in Figure 1002 to 130 − 150 lb−in. (14.688 − 16.948 N.m) plus run−on torque noted for each nut.

(b) Repeat step (a).

(c) Verify maximum torque using tightening sequence specified in figure. Repeat until nuts do not turn anymore.

(d) Loosen nuts and retorque, one pair at a time to 20 − 30 lb−in. (2.260 − 3.390 N.m) plus noted run−on torque and apply 52 − 56 degree angle of turn using PWA 85183 Fixture.

(8) If necessary, the drum rotor and hub may be trunnioned to the front end down position as follows:

(a) Install PWA 88748 Adapter to the hub and install PWA 85086 Arm to the adapter.

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−05

(b) Install PWA 86534 Fixture to the rear flange of the drum and install PWA 85086 Arm to the fixture.

(9) Install the balance arbor to the LPC hub and drum rotor assembly.

NOTE: The hub and drum rotor assembly is in the front end up position.

(a) For PWA 85684 or PWA 85695 Balance Arbors.

1 Attach a hoist to the eye on the arbor. Lift the arbor over the hub and drum rotor assembly and carefully lower the arbor to engage the hub/arbor splines.

2 Attach the hub to the balance arbor using detail retaining nut lubricated with Engine Oil P03−001, and hydraulic actuation screw. Torque nut to 800 − 1200 lb−in. (90.388 − 135.582 N.m) with two standard one−half inch square drive torque wrenches.

(b) For PWA 87037 Balance Arbor.

1 Install PWA 87135 Adapter to the hub and drum rotor assembly. Attach the adapter to the front face of the hub.

2 Lift PWA 87135 Adapter with the hub and drum rotor assembly and install the assembly to PWA 87037 Arbor.

3 Remove PWA 87135 Adapter from the hub and drum rotor assembly.

4 Install PWA 87163 Protective Covers over the hub and drum rotor assembly to prevent damage to the assembly.

5 Attach the hub to the balance arbor using detail retaining nut lubricated with Engine Oil P03−001, and hydraulic actuation screw. Torque nut to 800 − 1200 lb−in. (90.388 − 135.582 N.m) with detail adapter wrench and a standard one−half inch square drive torque wrench.

6 Remove PWA 87163 Protective Covers.

R
R

(10) Raise arbor and hub/drum assembly from build stand. Attach PWA 85086 Lift Arm to eye on other end of arbor. Using hoist, trunnion assembly to horizontal position.

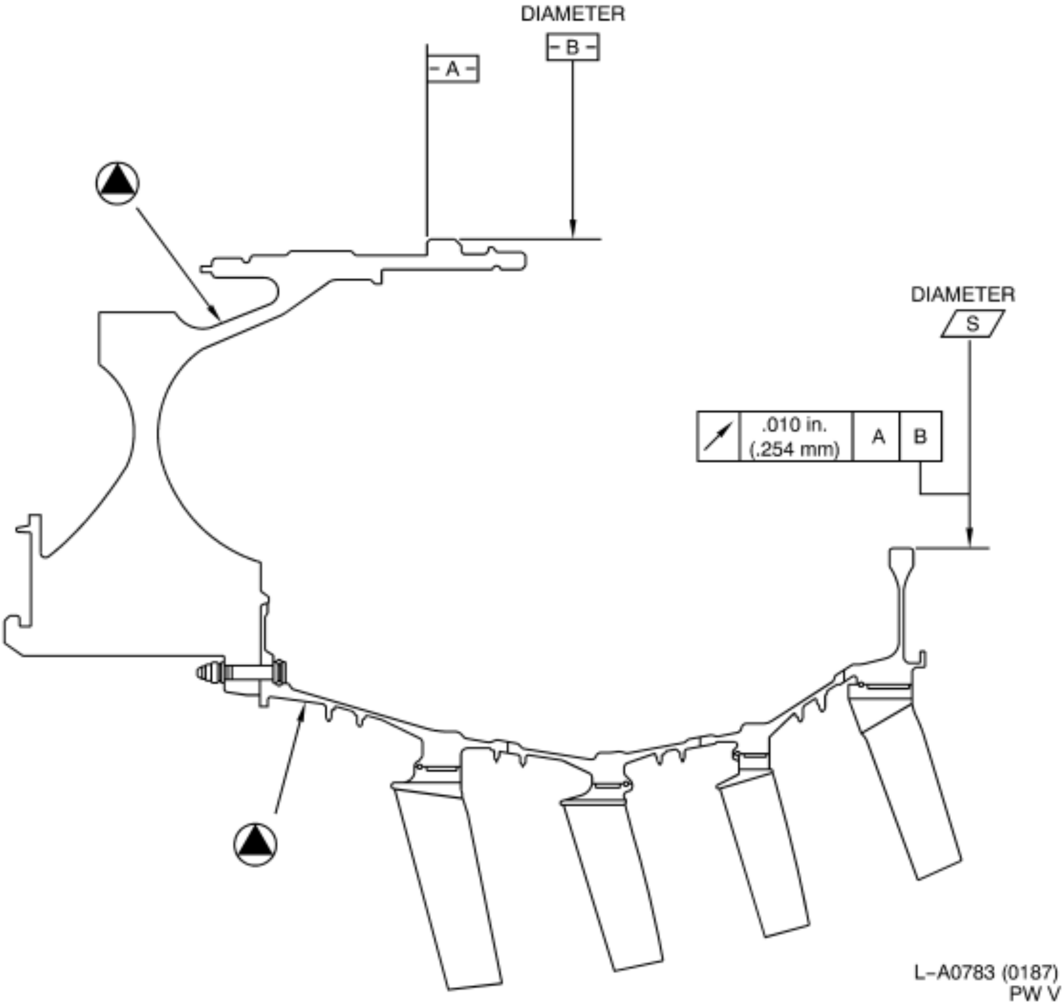
(11) Lower assembly onto balance machine. Secure arbor to machine.

(12) Check runout at bore of Stage 4 disk. Runout shall not exceed 0.010 inch (0.254 mm) FIR. Drum may be rotated on hub to meet this requirement. See Figure 1001.

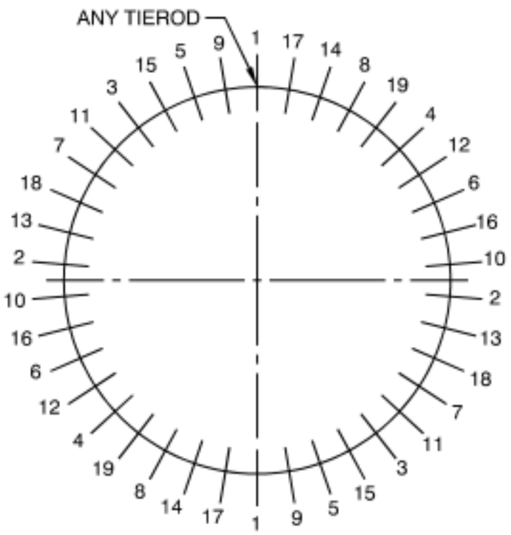
(13) If you want to put away the axial compressor rotor assembly before you balance it, install it with the arbor installed in PWA 86545 Stand.

D. Postrequisites

(1) Balance LPC rotor (fan blades not included). See Assembly−06 (Task 72−31−01−440−006).


DIAMETER
-B-
-A-
DIAMETER
S
.010 in.
(.254 mm)
A
B
L-A0783 (0187)
PW V

Axial Compressor Rotor Assembly Runout
Figure 1001
(Task 72-31-01-440-005)


ANY TIEROD
1
17
14
8
19
4
12
6
16
10
2
13
18
7
11
3
15
5
9
1
17
14
8
19
4
12
6
16
10
2
13
18
7
11
3
15
5
9

L−A0784 (0000)
PW V

Tierod Tightening Sequence
Figure 1002
(Task 72−31−01−440−005)

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Task 72-31-01-440-006:

1. Balance LPC Rotor (Fan Blades Not Included)

A. Prerequisites

(1) Assemble hub to drum rotor and check runout. See Assembly-05 Task 72-31-01-440-005.

B. Equipment And Materials Necessary

Special Tools:

PWA 28375	Riveter
PWA 85174	Shroud (Optional to PWA 86526 and PWA 86529)
PWA 85086	Arm (2 Necessary)
PWA 85184	Stand (Optional to PWA 87111)
PWA 85587	Weight, Calibration (Check Weight)
PWA 85588	Weight, Calibration (Check Weight)
PWA 86526	Shroud (Optional to PWA 85174 and 86529)
PWA 86529	Shroud (Optional to PWA 85174 and 86526)
PWA 86545	Stand
PWA 87111	Stand, Installation

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Rivet	0-10	72-31-00/5/60

C. Procedure

NOTE: If the rotor assembly is in a stand, remove the assembly and install it in a balance machine.

(1) With rotor assembly in balance machine, attach arbor to balance machine with either belt drive or end drive.

(2) Install PWA 85174 Shroud, PWA 86526 Shroud, or PWA
R 86529 Shroud, or suitable shroud to balance machine base.

(3) Operate the dynamic balance machine.

(a) Find the dynamic unbalance of the compressor hub and drum rotor assembly while it turns at 900 rpm minimum.

(b) Get three unbalance readings. For balance machines that do not have an automatic recording feature, record the average angle and the average amount of unbalance.

(4) Remove the arbor and the compressor hub and drum rotor assembly from the balance machine and turn the arbor on the rotor assembly 180 degrees from the original location as follows.

(a) Remove the belt drive or the end drive from the arbor assembly.

(b) Attach a hoist and PWA 85086 Lifting Arm to each eye of the balance arbor and lift the rotor assembly from the balance machine.

(c) Turn the assembly to a vertical position and remove the lower hoist and lifting arm. Lower the assembly to the build stand.

(d) Make a reference mark on the hub of the drum rotor, the shaft of the arbor and the spline with a Marker P05-045 to identify the original location.

(e) Remove the arbor from the rotor assembly. Refer to Assembly-09, (Task 72-31-01-440-009).

(f) Turn the arbor 180 degrees from the original location and lower the arbor to the rotor assembly.

(g) Attach the arbor to the rotor assembly. Refer to Assembly-05, (Task 72-31-01-440-005).

(h) Attach a hoist and PWA 85086 Lifting Arm to the upper eye of the balance arbor. Lift the rotor and arbor assembly from the build stand.

(i) Attach a hoist and PWA 85086 Lifting Arm to the lower eye of the balance arbor. Trunnion the assembly to a horizontal position.

(j) Lower the assembly to the balance machine. Attach the arbor to the balance machine with either a belt drive or end drive.

(5) Dynamic balance the compressor hub and drum rotor assembly.

  (a) Find the dynamic unbalance of the compressor hub and drum rotor assembly while the assembly turns at 900 rpm minimum.

  (b) The initial unbalance must not to be more than 15.0 oz−in. (10800.0 g.mm) for the front plane and 15.0 oz−in. (10800.0 g.mm) for the rear plane if the unbalance vectors are not within 30 degrees of each other. However, if the unbalance vectors are within 30 degrees of each other, the initial unbalance must not be more than 7.5 oz−in. (5400.0 g.mm) for the front plane and 7.5 oz−in. (5400.0 g.mm) for the rear plane.

  (c) For balance machines that have an automatic recording feature, get three unbalance readings. Average the readings. Use the machine to determine the unbalance amount and angle of the assembly.

  (d) For balance machines that do not have an automatic recording feature, get three unbalance readings. Average and record the three unbalance readings. Use the average readings from the first and second balance runs to do a polar plot to get the assembly unbalance angle and amount.

(6) Balance the assembly to get a remaining unbalance of 1.0 oz−in. (720.0 g.mm) maximum in the front and rear planes.

  (a) Residual unbalance must not be more than 1.0 oz−in. (720.0 g.mm) in the front plane and must not be more than 1.0 oz−in. (720.0 g.mm) in the rear plane.

  (b) Correct the residual unbalance in the front plane (Plane J) by adding any combination of PN 534493 and PN 534495 Counterweights, up to a maximum of ten. See Figure 1001.

  (c) Correct the residual unbalance in the rear plane (Plane H) by adding any combination of PN 534493 and PN 534495 Counterweights, up to a maximum of ten. See Figure 1001.

(d) Install the counterweights and rivets to the rivet holes and hold in position with Pressure Sensitive Sealing Tape P05−323.

(7) Record the angle and the amount of assembly unbalance in the front and rear planes.

(8) Optional process based on the experience of the operator, do a check of the dynamic balance machine as follows:

(a) Install the PWA 85587 Calibration Weight (Check Weight) to Plane J (compressor hub front flange) as close as possible to the heavy angle.

NOTE: Do not install a check weight at a location where a counterweight is installed.

(b) Turn the dynamic balance machine at 900 rpm minimum. Check the machine, with the check weight installed in the front plane.

1 The check weight on the front plane pulls 4.0 oz−in. (2880.0 g.mm).

2 Read the angle and the amount of assembly unbalance in the front plane.

3 The amount of unbalance in the front plane should agree in ± 0.4 oz−in. (288.0 g.mm) or less with the amount recorded when the assembly was balanced.

4 Remove the check weight from the front plane.

(c) Install the PWA 85588 Calibration Weight (Check Weight) to Plane H (drum rotor rear flange) as close as possible to the heavy angle.

(d) Turn the dynamic balance machine at 900 rpm minimum. Check the machine, with the check weight installed in the rear plane.

1 The check weight on the rear plane pulls 4.0 oz−in. (2880.0 g.mm).

2 Read the angle and the amount of assembly unbalance in the rear plane.

3 The amount of unbalance in the rear plane should agree in ± 0.4 oz-in. (288.0 g.mm) or less with the amount recorded when the assembly was balanced.

4 Remove the check weight from the rear plane.

(e) For balance machines with electronic calibration, use the manufacturer's instructions to do a check of the dynamic balance machine.

(9) Attach the counterweights in Plane J and Plane H with the installed rivets as follows.

(a) Flare the rivets on Plane J (compressor hub front flange) with the PWA 28375 Hand Riveter to 0.125 inch (3.175 mm) diameter minimum.

(b) Flare the rivets on Plane H (drum rotor rear flange) with the PWA 28375 Hand Riveter to 0.125 inch (3.175 mm) diameter minimum.

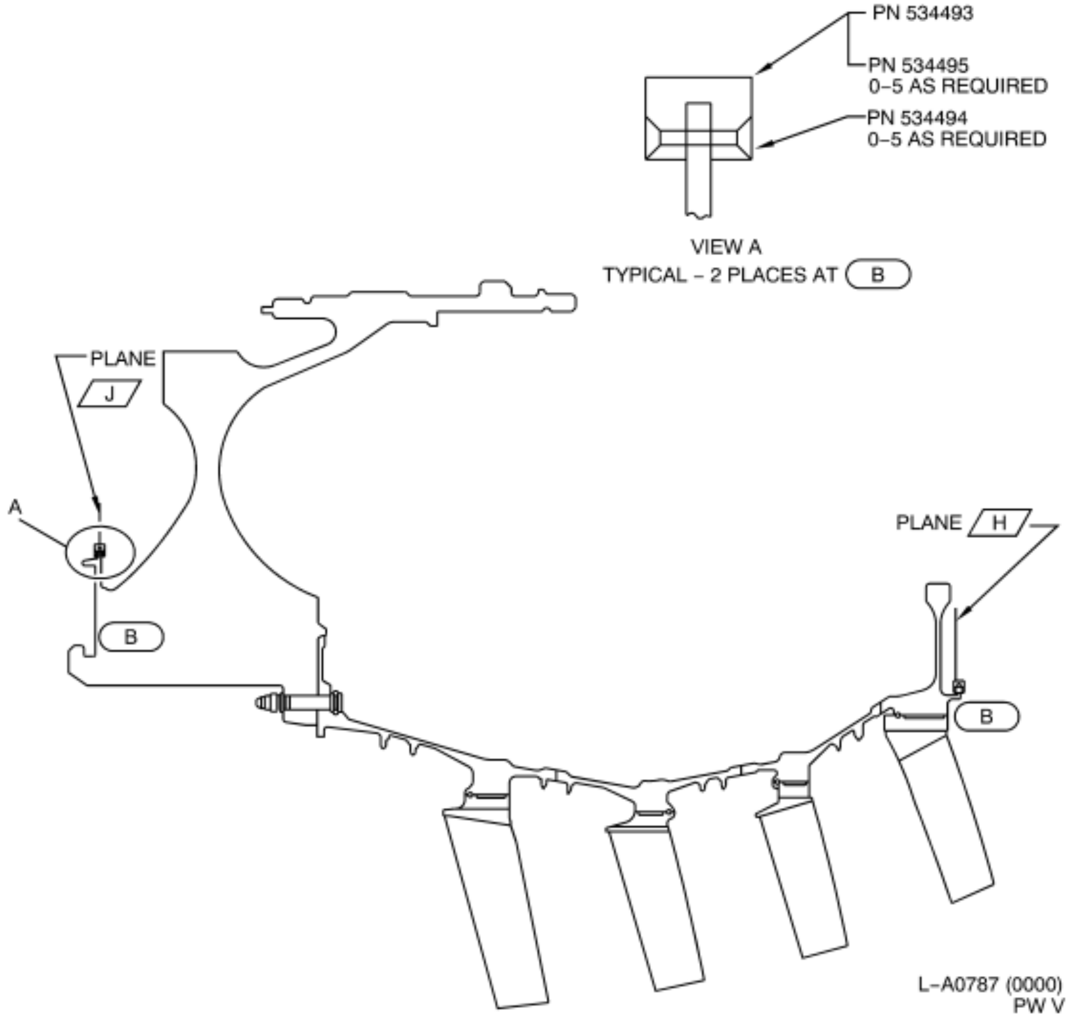
(10) Disconnect arbor from balance machine. Install eye to each end of arbor. Attach two PWA 85086 Arm to eyes. Install hoist on each arm and raise rotor from balance machine.

(11) Lower rotor onto PWA 87111 Stand, PWA 85184 Stand, or PWA 86545 Stand. Secure rotor in place. Remove hoist and arms from arbor.

NOTE: Use PWA 86545 Stand only if you do not install the Stage 1 LPC blades now. When you install the Stage 1 LPC blades, the axial compressor rotor assembly must be installed in either PWA 87111 Stand or PWA 85184 Stand.

D. Postrequisites

(1) Assemble the Stage 1 LPC blades to hub. See Assembly-07 Task 72-31-01-440-007.


PN 534493
PN 534495
0-5 AS REQUIRED
PN 534494
0-5 AS REQUIRED
VIEW A
TYPICAL - 2 PLACES AT B
PLANE
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A
B
PLANE H
B
L-A0787 (0000)
PW V

LPC Balancing (Fan Blades Not Included)
Figure 1001
(Task 72-31-01-440-006)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-31-01-440-007:

1. Assemble Fan Blades To Hub
   A. Prerequisites
      (1) Balance LPC rotor (fan blades not included). See Assembly-06 (Task 72-31-01-440-006).
   B. Equipment And Materials Required

      Special Tools:
      PWA 86651 Cart, Storage

      Consumable Materials:

Item No.	Designation
P06-005	Lubricant (PWA 587)

   C. Procedure

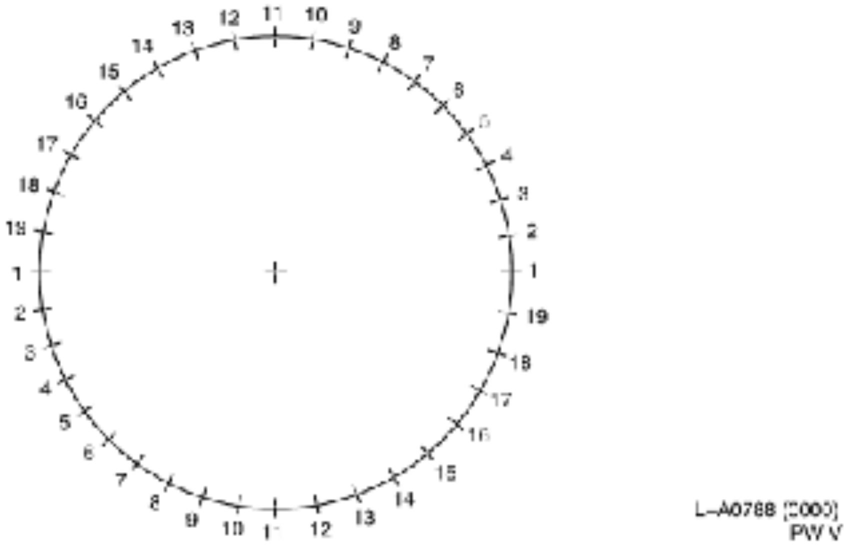
      NOTE: It is permitted as an alternative procedure not to install the rotor fan blades during this step of assembly only if the operator can do an engine trim balance. Reference 71-00-00, Testing-00, Trim Balance (Task 71-00-00-760-052).

      (1) Remove blades from PWA 86651 Cart and arrange in 19 pairs of moment weighted sets.
      (2) Install blades in hub as follows:

         WARNING: DO NOT PERMIT THE LUBRICANT (P06-005) TO TOUCH YOUR SKIN. IF IT DOES WASH IMMEDIATELY WITH SOAP AND WATER.

         (a) Brush Lubricant (P06-005) on contact faces of mid-span shroud of blades and permit to dry five minutes.
         (b) Install first blade in any hub slot. Install second blade in hub slot 180 degrees from first blade. Install first blade of second pair adjacent to previously installed pair. Install second blade of second pair 180 degrees from last installed blade. Continue installing pairs 180 degrees apart until all 38 blades are installed. See Figure 1001.
      (3) Install compressor blade (Stage 1) lock assembly as follows:
         (a) Position lock to align anti-rotation pin of lock with anti-rotation slot of hub.
         (b) Install lock starting at joint.
         (c) Seat lock using fiber drift.

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-07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L-A0788 (2000)
PW V

Blade Arrangement On Hub
Figure 1001
(Task 72-31-01-440-007)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-07

(d) (Reference 761) Make sure the lock is correctly installed by measurement of the gap between the lock ends. The gap must be 0.010 - 0.060 inch (0.25 - 1.52 mm). If you can not get the correct gap measurement, you must make sure the lock is fully seated.

D. Postrequisites

(1) Balance LPC rotor (fan blades included). See Assembly-08 (Task 72-31-01-440-008).

Task 72−31−01−440−008−A:

1. Balance LPC Rotor (Fan Blades Included) By Fan Blade Set Replacement

A. Prerequisites

(1) Assemble fan blades to hub. See Assembly−07 (Task 72−31−01−440−007).

B. Equipment And Materials Necessary

Special Tools:

PWA 85086	Lift Arm (2 Necessary)
PWA 85172	Weight, Calibration (Check Weight) (Optional To PWA 85587)
PWA 85174	Shroud
PWA 85184	Stand (Optional To PWA 87111)
PWA 85587	Weight, Calibration (Check Weight) (Optional To PWA 85172)
PWA 87111	Stand, Installation
PWA 102828	Mechanical Compressor (Fan Blade Lock) (Optional)

C. Procedure

NOTE: It is permitted as an alternative procedure not to install the rotor fan blades during this step of assembly only if the operator can do an engine trim balance. Reference 71−00−00, Testing−19, Trim Balance (Task 71−00−00−760−043) or (Task 71−00−00−760−052) or (Task 71−00−00−760−057).

(1) Attach two PWA 85086 Arms to each eye on ends of arbor. Install hoist on each arm and raise rotor from the stand.

(2) Lower assembly onto balance machine. Secure arbor to machine. Remove hoist, arms and eyes from arbor. Attach arbor to balance machine with either belt drive or end drive.

(3) Install PWA 85174 Shroud to balance machine base.

(4) Operate the dynamic balance machine.

(a) Find the dynamic unbalance of the compressor hub and drum rotor assembly while it turns at 900 rpm minimum.

(b) Get three unbalance readings. For balance machines that do not have an automatic recording feature, record the average angle and the average amount of unbalance.

(5) Remove the arbor and the compressor hub and drum rotor assembly from the balance machine and turn the arbor on the rotor assembly 180 degrees from the original location as follows.

(a) Remove the belt drive or the end drive from the arbor assembly.

(b) Attach a hoist and PWA 85086 Lifting Arm to each eye of the balance arbor and lift the rotor assembly from the balance machine.

(c) Turn the assembly to a vertical position and remove the lower hoist and lifting arm. Lower the assembly to the build stand.

(d) Make a reference mark on the hub of the drum rotor, the shaft of the arbor and the spline with a Marker P05−045 to identify the original location.

(e) Remove the arbor from the rotor assembly. Refer to Assembly−09 (Task 72−31−01−440−009).

(f) Turn the arbor 180 degrees from the original location and lower the arbor to the rotor assembly.

(g) Attach the arbor to the rotor assembly. Refer to Assembly−05 (Task 72−31−01−440−005).

(h) Attach a hoist and PWA 85086 Lifting Arm to the upper eye of the balance arbor. Lift the rotor and arbor assembly from the build stand.

(i) Attach a hoist and PWA 85086 Lifting Arm to the lower eye of the balance arbor. Trunnion the assembly to a horizontal position.

(j) Lower the assembly to the balance machine. Attach the arbor to the balance machine with either a belt drive or end drive.

(6) Operate the dynamic balance machine.

(a) Find the dynamic unbalance of the compressor hub and drum rotor assembly while the assembly turns at 900 rpm minimum.

(b) For balance machines that have an automatic recording feature, get three unbalance readings. Average the readings. Use the machine to determine the unbalance amount and angle of the assembly.

(c) For balance machines that do not have an automatic recording feature, get three unbalance readings. Average and record the three unbalance readings. Use the average readings from the first and second balance runs to do a polar plot to get the assembly unbalance angle and amount.

(7) If the initial unbalance in the front plane (Plane J) is more than 25.0 oz−in. (18000.0 g.mm) in the front plane, check that all blades are in moment weighted pairs separated 180 degrees then interchange fan blade sets to reduce the unbalance to less than 25.0 oz−in. (18000.0 g.mm) as follows.

(a) Remove blade lock using small pin punch in hole located near joint or PWA 102828 Mechanical Compressor.

(b) Turn rotor to locate blade to be removed at 12 o'clock position.

(c) Unseat CCW blades until stopped by mid−span shroud of each blade. Remove selected blade. Seat blades using CW sequence.

(d) Turn rotor 180 degrees and remove second blade as stated in above instructions.

(e) Install first blade of replacement blade set. Seat blades partially using CW sequence.

(f) Turn rotor 180 degrees. Unseat blades until stopped by mid−span shroud of each adjacent blade.

(g) Install second blade of replacement set. Seat blades using CW sequence.

(h) Install blade lock assembly.

(8) Check the balance again. The rotor assembly must be balanced within 5.0 oz−in. (3600.0 g.mm).

(9) Record the angle and the amount of assembly unbalance in the front plane.

(10) Optional process based on the experience of the operator, do a check of the dynamic balance machine as follows:

(a) Install the PWA 85172 or PWA 85587 Calibration Weight (Check Weight) to Plane J (compressor hub front flange) as close as possible to the heavy angle.

NOTE: Do not install a check weight at a location where a counterweight is installed.

(b) Turn the dynamic balance machine at 900 rpm minimum. Check the machine, with the check weight installed in the front plane.

1 The check weight on the front plane pulls 4.0 oz−in. (2880.0 g.mm).

2 Read the angle and the amount of assembly unbalance in the front plane.

3 The amount of unbalance in the front plane should agree in ± 0.4 oz−in. (288.0 g.mm) or less with the amount recorded when the assembly was balanced.

4 Remove the check weight from the front plane.

(c) For balance machines with electronic calibration, use the manufacturer's instructions to do a check of the dynamic balance machine.

(11) Disconnect arbor from balance machine. Install eye to each end of arbor. Attach two PWA 85086 Arms to eyes. Install hoist to each arm and raise rotor from balance machine.

(12) Lower rotor onto either PWA 87111 or PWA 85184 Stand. Secure rotor to stand. Remove hoist and arms.

D. Postrequisites

(1) Remove fan blades and arbor. See Assembly-09 Task 72-31-01-440-009.

Task 72-31-01-440-008-B:

2. Balance LPC Rotor (Fan Blades Included) By Counterweight Installation

A. Prerequisites

(1) Balance the LPC rotor without the fan blades installed. See Assembly-06 Task 72-31-01-440-006.

(2) Assemble fan blades to hub. See Assembly-07 Task 72-31-01-440-007.

B. Equipment And Materials Necessary

Special Tools:

PWA 28375	Riveter
PWA 85086	Lift Arm (2 Necessary)
PWA 85172	Weight, Calibration (Check Weight) (Optional to PWA 85587)
PWA 85173	Weight, Calibration (Check Weight) (Optional to PWA 85588)
PWA 85174	Shroud
PWA 85184	Stand (Optional to PWA 87111)
PWA 85587	Weight, Calibration (Check Weight)
PWA 85588	Weight, Calibration (Check Weight)
PWA 87111	Stand, Installation

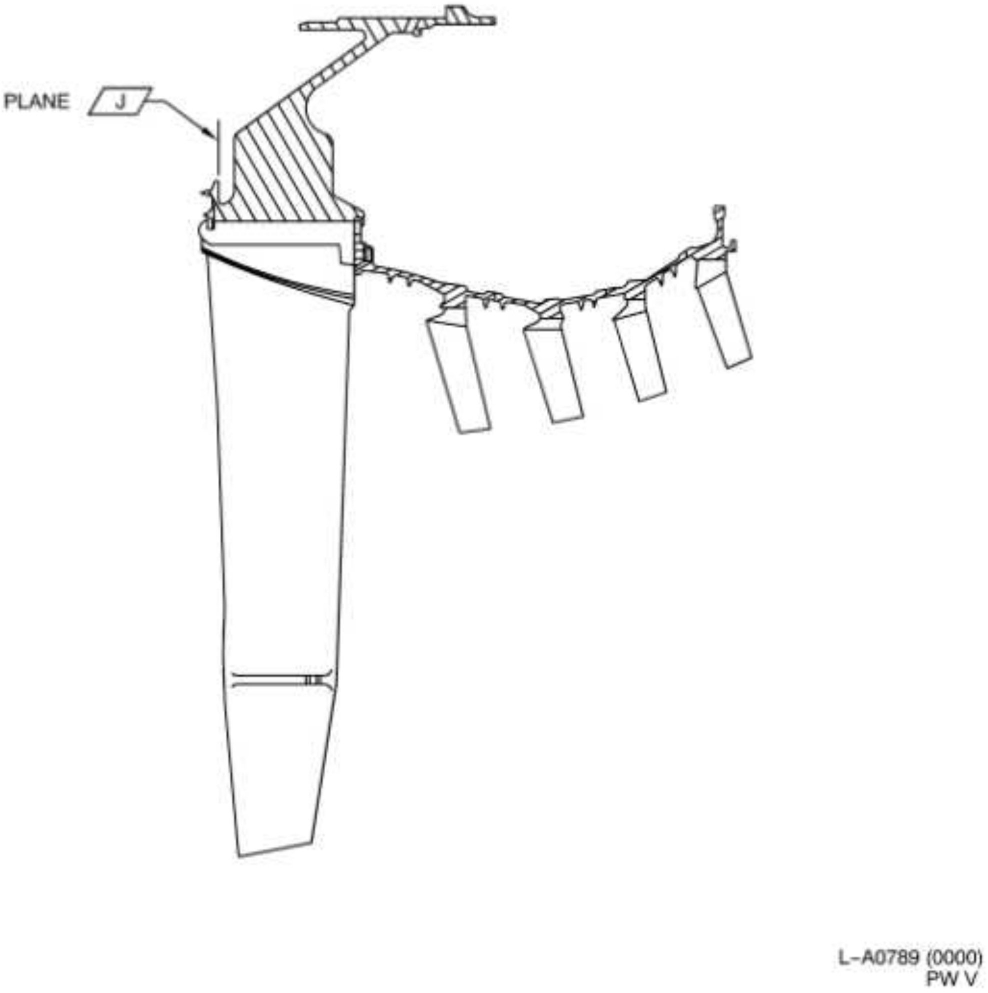
C. Procedure
Figure 1002

(1) Attach two PWA 85086 Arms to each eye on the ends of arbor. Install a hoist on each arm and raise the rotor from the stand.

(2) Lower the assembly to the balance machine. Attach the arbor to the machine. Remove the hoist, arms and eyes from the arbor. Attach the arbor to the balance machine with the belt drive or the end drive.

(3) Install the PWA 85174 Shroud to the balance machine base.

(4) Operate the dynamic balance machine.



LPC Balancing (Fan Blades Included)
Figure 1001
(Task 72-31-01-440-008-A)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−08

(a) Find the dynamic unbalance of the compressor hub and drum rotor assembly while it turns at 900 rpm minimum.

(b) Get three unbalance readings. For balance machines that do not have an automatic recording feature, record the average angle and the average amount of unbalance.

(5) Remove the rotor assembly from the balance machine. Lower the rotor onto the PWA 87111 Stand.

(6) Remove the fan blades from the compressor hub. See Assembly−09 (Task 72−31−01−440−009).

(7) Install the fan blades in the compressor hub 180 degrees from the original location, retaining the original order and direction. See Assembly−07 (Task 72−31−01−440−007).

(8) Attach a hoist and PWA 85086 Lifting Arm to each eye of the balance arbor and lift the rotor assembly from the stand.

(9) Lower the assembly to the balance machine. Attach the arbor to the balance machine with either a belt drive or end drive.

(10) Force moment balance the rotor at 900 rpm minimum. Record the results, amount and angle.

(a) Make a polar plot of both runs to find the quantity and direction of the unbalance added by the compressor hub and drum rotor assembly and the fan blade set.

(b) If the unbalance of the compressor hub and drum rotor assembly is more than 2.0 oz−in. (1440.0 g.mm), add PN 534493 and PN 534495 counterweights at Plane F to correct the unbalance to under 2.0 oz−in. (1440.0 g.mm). Before you attach the counterweights, mark the forward face of the counterweight with the word HUB.

NOTE: If the fan blade unbalance is more than 25.0 oz−in. (18000.0 g.mm), it is an indication that the fan blades were installed incorrectly.

(c) Check that all the fan blades are in moment weighted pairs, separated 180 degrees apart.

(d) Change fan blade pair positions to get an unbalance of less than 25.0 oz-in. (18000.0 g.mm).

(e) Add PN 534493 and PN 534494 counterweights at Plane F to correct the fan unbalance. Before you attach the counterweights, mark the word FAN on the forward face of the counterweights.

(f) Residual unbalance must not be more than 5.0 oz-in. (3600.0 g.mm).

(g) If the fan blades must be replaced at a later time, only the counterweights with the word FAN on the forward surface must be removed if there is an unbalance correction necessary.

NOTE: The counterweights with the mark HUB on the forward surface must remain with the same serial numbered hub unless that hub gets refurbished, at which time they would be removed.

(h) The total quantity of all balance weights attached to Plane J from Assembly-06 (Task 72-31-01-440-006) and this procedure is limited to a maximum of 10, with a maximum of five PN 534493 counterweights and five PN 534495 counterweights.

(11) Force moment balance the rotor at 900 rpm minimum. Record the results, amount and angle.

(12) If the unbalance is equal to or less than 15.0 oz-in. (10800.0 g.mm) do the steps that follow.

(a) Add PN 534493 and PN 534495 weights to correct the unbalance as necessary at Plane J.

(b) Make sure the residual unbalance is not more than 5.0 oz-in. (3600.0 g.mm).

(13) Attach the counterweights in Plane F and Plane E with the installed rivets as follows.

(a) Flare the rivets on Plane F (compressor hub front flange) with the PWA 28375 Hand Riveter to 0.125 inch (3.175 mm) diameter minimum.

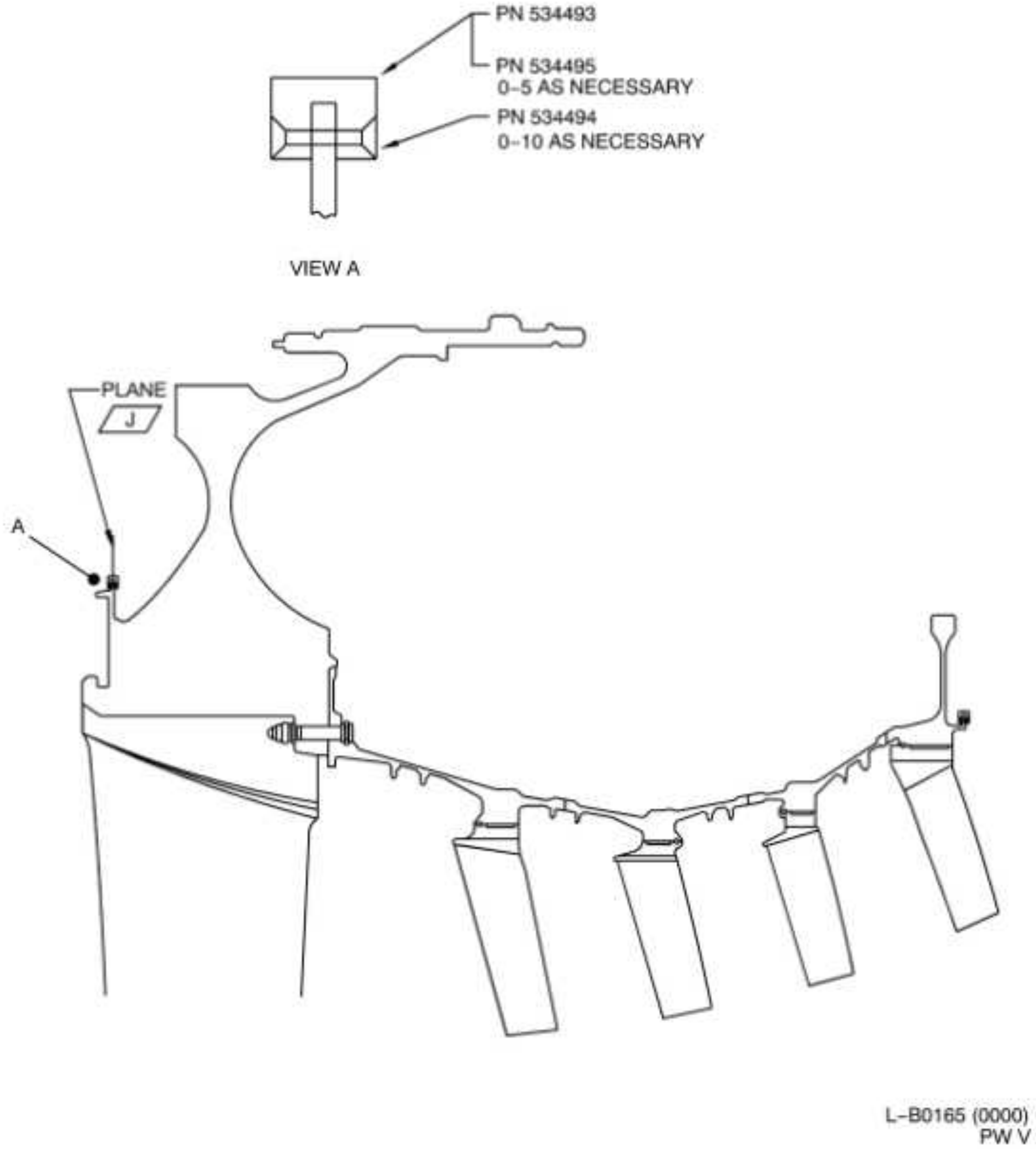
(b) Flare the rivets on Plane E (drum rotor rear flange) with the PWA 28375 Hand Riveter to 0.125 inch (3.175 mm) diameter minimum.

(14) Disconnect the arbor from the balance machine. Install the eye to each end of the arbor. Attach two PWA 85086 Arms to the eyes. Install a hoist to each arm and raise the rotor from the balance machine.

(15) Lower the rotor to the PWA 87111 Stand or PWA 85184 Stand. Attach the rotor to the stand. Remove the hoist and arms.

D. Postrequisites

(1) Remove fan blades and arbor. See Assembly−09 Task 72−31−01−440−009.


PN 534493
PN 534495
0-5 AS NECESSARY
PN 534494
0-10 AS NECESSARY
VIEW A
PLANE
J
A
L-B0165 (0000)
PW V

LPC Balancing (Fan Blades Included)
Figure 1002
(Task 72-31-01-440-008-B)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-09

Task 72-31-01-440-009:

1. Remove Fan Blades And Arbor
   - A. Prerequisites
     - (1) Balance LPC Rotor (Fan Blades Included). See Assembly-08 (Task 72-31-01-440-008).
   - B. Equipment And Materials Required

Special Tools:
PWA 85086 Arm (2 Required)

PWA 85660 Build/Storage Stand (Optional to PWA 88183)
PWA 86651 Cart, Storage
PWA 88183 Stand

   - C. Procedure
     - (1) Number blades 1 - 38 using CW sequence (viewed from front). Mark several corresponding hub slots.
     - (2) Remove blade lock assembly using small pin punch in hole located near joint.
     - (3) Turn rotor to locate No. 38 at 12 o'clock position.
     - (4) Unseat blades until stopped by mid-span shroud of each adjacent blade.
     - (5) Remove No. 38, 37, 36, etc. blades and store blades in PWA 86651 Cart.
     - (6) Install PWA 85086 Arm to each eye on arbor. Attach hoist to arms and raise rotor from stand.
     - (7) Trunnion rotor to hub end up. Remove hoist and arm from lower end. Lower rotor down onto PWA 88183 or PWA 85660 Build Stand.
     - (8) Loosen nut on arbor using standard tooling. Remove arbor nut. Release hydraulic pressure on arbor and raise arbor out of rotor. Place arbor in storage box.
     - (9) Cover rotor assembly with protective covering.

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TO: RECIPIENTS OF PW4152, PW4152−3, PW4156A, PW4156A−3,
PW4158, PW4158−3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 85 DATED JANUARY 1, 2008

HIGHLIGHTS − LOW PRESSURE COMPRESSOR (LPC)

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72−31−00 INSP/CHK−04	808 815 −816	Revised Reverence Number 1581 to add a NOTE concerning the hub oversized tierod hole diameters and revised task numbers. (Reference IEN99KA127, Editorial)	ALL

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CHAPTER 72

LOW PRESSURE COMPRESSOR (LPC)

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NO. 1 BEARING (CARBON) SEAL ASSEMBLY − DISASSEMBLY−01

Task 72−31−17−040−001:

1. Disassemble No. 1 Bearing (Carbon) Seal Assembly

   A. Equipment And Materials Required − None

   B. Procedure

      (1) Depress seal face assembly against springs.

      (2) Remove cotter pins, collars and washers. Separate seal face assembly from seal ring holder assembly.

      (3) Remove sleeve spacers and springs.

      (4) Remove seal ring from seal ring holder assembly.

      (5) Remove nuts retaining pins to support. Remove packing and discard.

NO. 1 BEARING (CARBON) SEAL ASSEMBLY - ASSEMBLY-01

Task 72-31-17-440-001:

1. Assemble No. 1 Bearing (Carbon) Seal Assembly

A. Equipment And Materials Required

Special Tools:

PWA 86514	Guide, Assembly

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	4	72-31-00/7/150
Packing	4	72-31-00/7/50
Seal Ring*	1	72-31-00/7/100A
Seal Ring*	1	72-31-00/7/100B

R NOTE: * These seal rings are for seal assembly part numbers other than PN 50B199. PN 50B199 uses a piston ring. Piston rings are not expendable items.

B. Procedure
See Figure 1001, Figure 1002 and Figure 1003.

(1) Install support assembly on bench large OD down.

(2) Install new packing, lubricated with Engine Oil P03-001, to each of 4 pins at the threaded end and seat against pin shoulder.

(3) Install pins to support assembly so that the threaded portion of pin is up and exposed. Install nuts and washers, threads lubricated with Engine Oil P03-001, to pins. Torque nuts 75 - 85 lb-in. (8.474 - 9.604 N.m).

NOTE: Attach pins so that cotter pin hole is positioned 90 degrees from radial axis of support assembly.

CAUTION: CARBON SEAL IS EASILY DAMAGED. HANDLE WITH CARE.

(4) Carefully install seal/piston ring in groove of seal assembly.

NOTE: When you handle and install the seal ring you must be careful not to pinch or damage the seal ring.

(a) (PN 50B199) Be sure gap in piston ring is installed as shown in Figure 1002.

(5) Put the support assembly on PWA 86514 Guide.

(6) Turn support assembly so that pins are facing upward on bench. Install 12 springs into support assembly. Install two sleeve spacers on two pins which are located 90 degree from offset pin.

NOTE: Damage to springs will occur if springs buckle, bend or are compressed to their solid height during installation. Damaged springs reduce spring load and could effect carbon seal integrity.

NOTE: If you have much wear on the flat sides of the sleeve spacers, you can install the sleeve spacers with the wear towards the support. See Figure 1002.

(7) Carefully install face seal, carbon side up, aligning slots in seal with pins on support. Install collars and secure with cotter pins. Bend tangs of pins around collars.

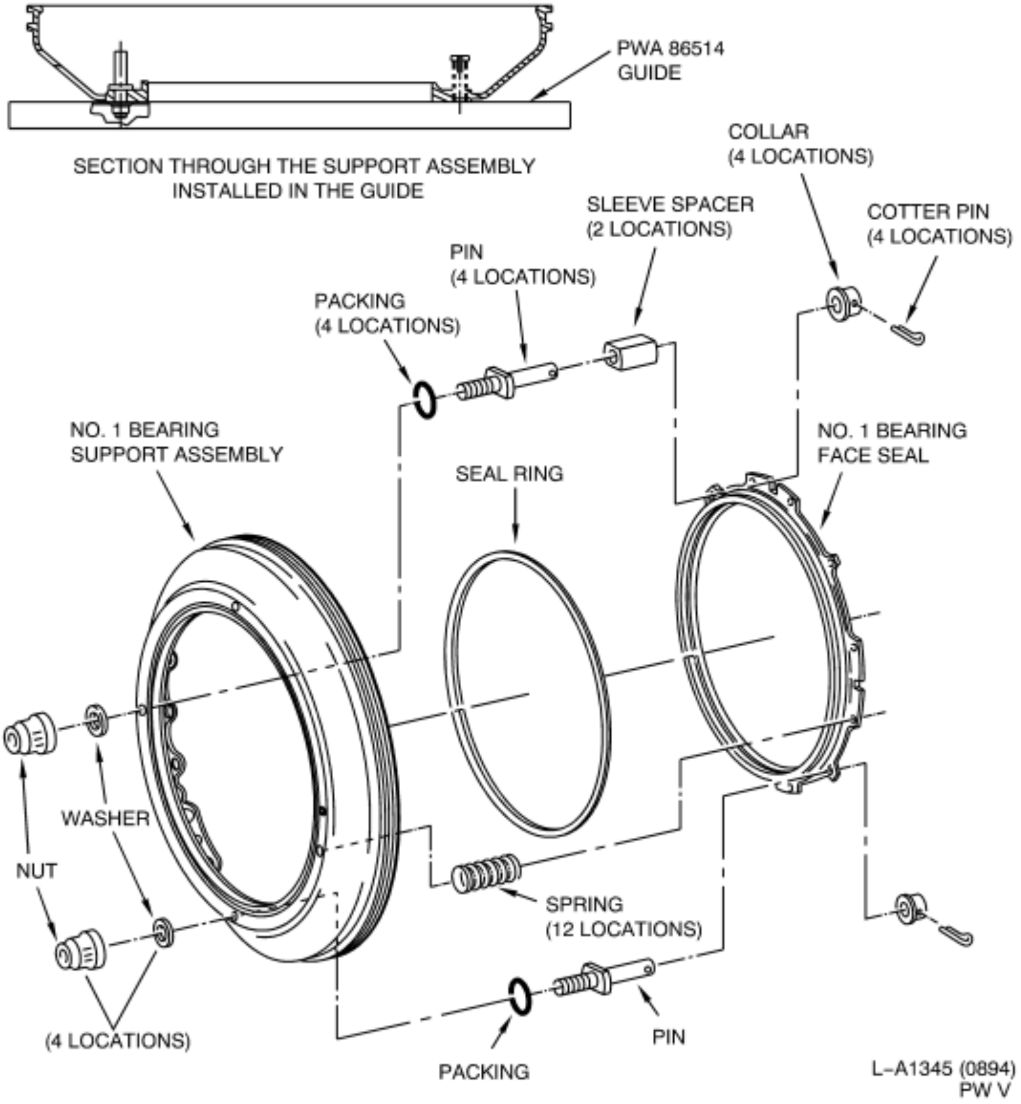
NOTE: Be careful not to pinch or damage the seal ring when you install the face seal into the support assembly. See Figure 1002.

(8) Put the tool away.

C. Postrequisites

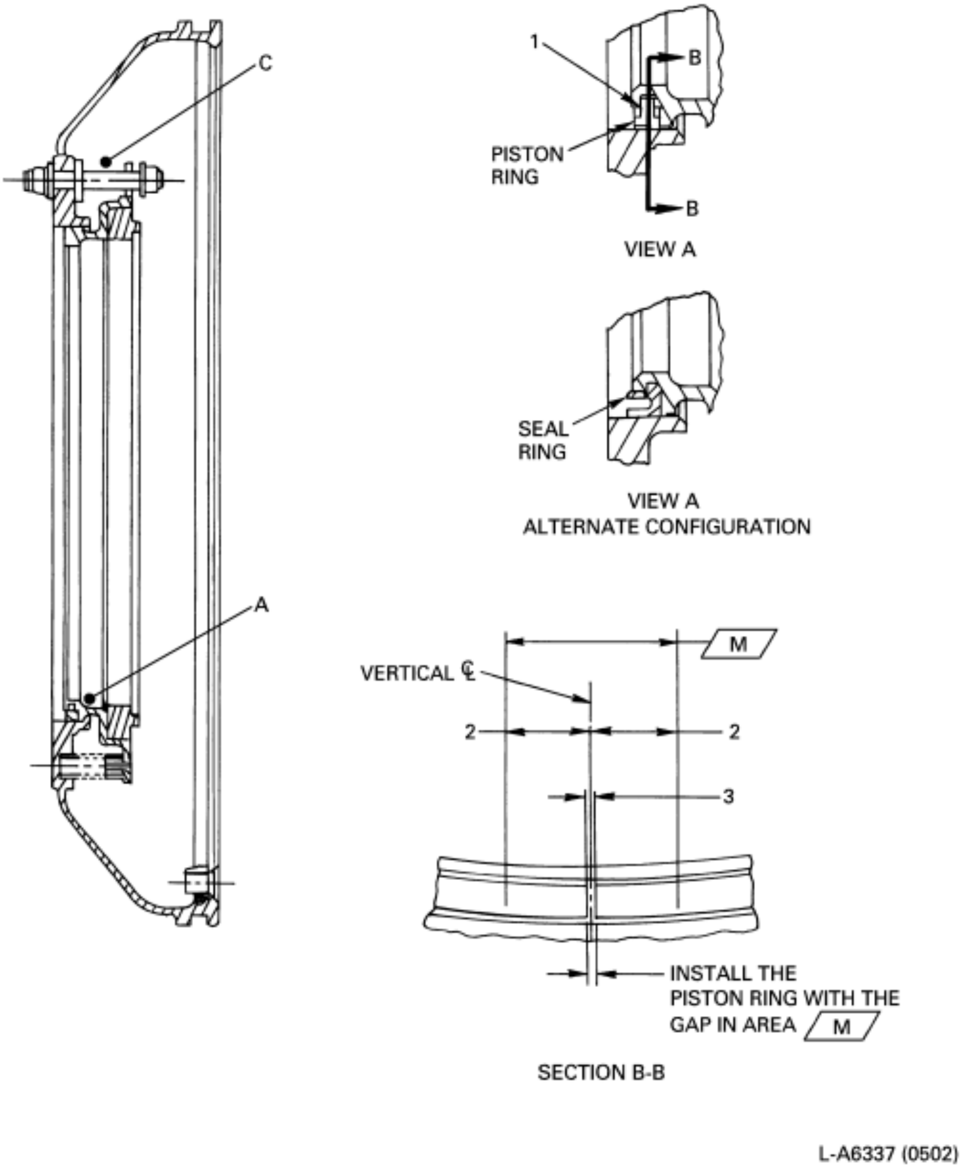
(1) Airflow check No. 1 bearing (carbon) seal assembly per 72-31-17, Testing-01 Task 72-31-17-720-001.

NO. 1 BEARING (CARBON) SEAL ASSEMBLY − ASSEMBLY−01


PWA 86514
GUIDE
SECTION THROUGH THE SUPPORT ASSEMBLY
INSTALLED IN THE GUIDE
COLLAR
(4 LOCATIONS)
SLEEVE SPACER
(2 LOCATIONS)
COTTER PIN
(4 LOCATIONS)
PIN
(4 LOCATIONS)
PACKING
(4 LOCATIONS)
NO. 1 BEARING
SUPPORT ASSEMBLY
SEAL RING
NO. 1 BEARING
FACE SEAL
WASHER
NUT
SPRING
(12 LOCATIONS)
(4 LOCATIONS)
PIN
PACKING
L−A1345 (0894)
PW V

No. 1 Bearing Seal Assembly
Figure 1001
(Task 72−31−17−440−001)

NO. 1 BEARING (CARBON) SEAL ASSEMBLY - ASSEMBLY-01


C
A
1
B
B
PISTON RING
VIEW A
SEAL RING
VIEW A
ALTERNATE CONFIGURATION
M
VERTICAL ℄
2
2
3
INSTALL THE PISTON RING WITH THE GAP IN AREA M
SECTION B-B
L-A6337 (0502)

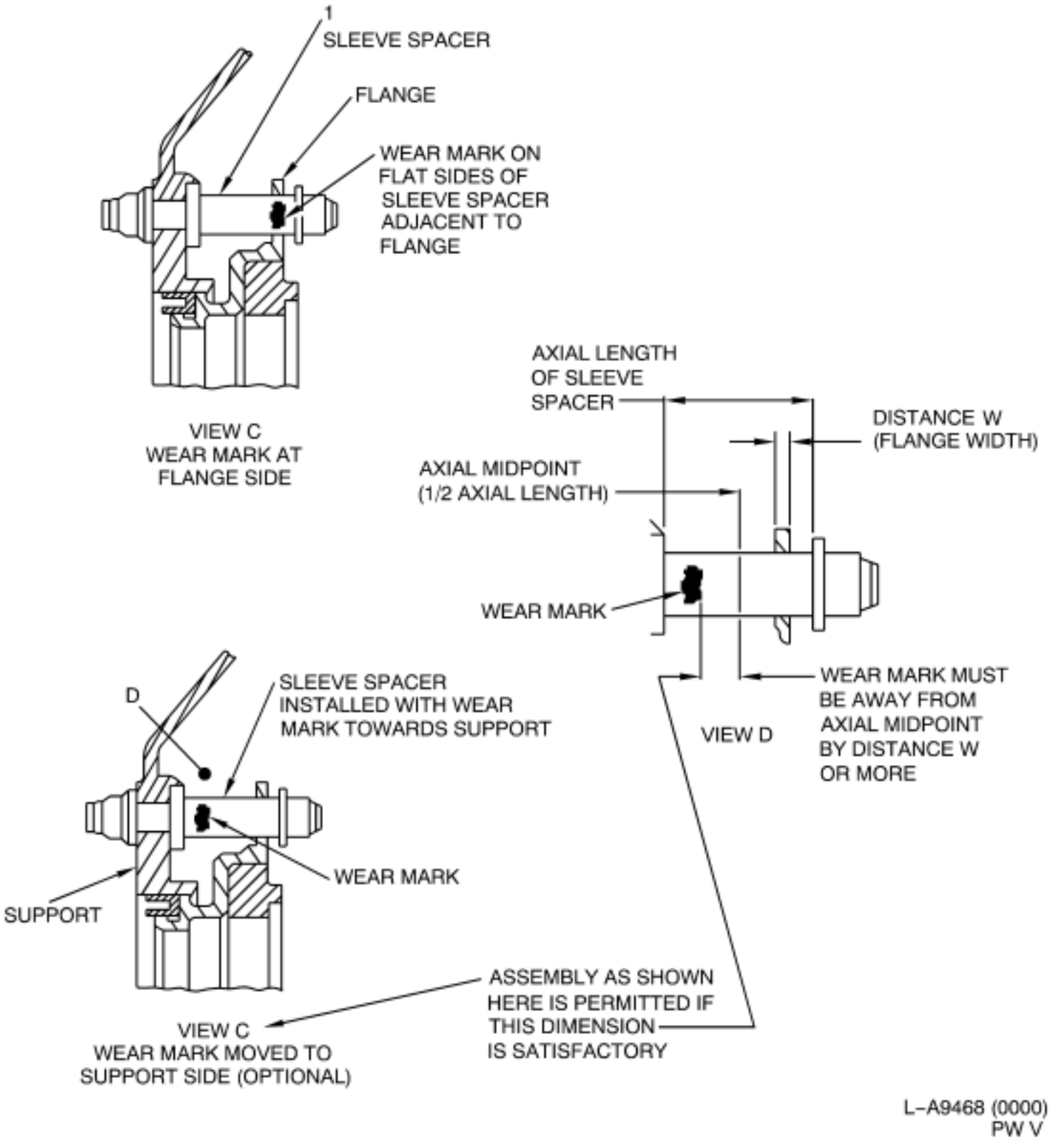
No. 1 Bearing Seal Assembly
Figure 1002 (Sheet 1)
(Task 72-31-17-440-001)

NO. 1 BEARING (CARBON) SEAL ASSEMBLY − ASSEMBLY−01

1. −For Piston Ring Side Clearance
   (Reference 441) 0.121 − 0.124 Inch (3.074 − 3.149 mm)
   −For Face Seal Assembly
   (Reference 441) 0.127 − 0.130 Inch (3.226 − 3.302 mm)
2. −For Piston Ring (At Vertical Centerline) 0.500 Inch (12.700 mm) Maximum
3. −(Reference 440) 0.020 − 0.030 Inch (0.51 − 0.76 mm) When Installed In A Ring Gage With An ID Of 14.370 Inches (364.998 mm)
   −(Reference 440) 0.017 − 0.033 Inch (0.43 − 0.84 mm) When Installed In A Support Assembly With An ID Of 14.369 − 14.371 Inches (364.973 − 365.023 mm)

Key to Figure 1002 (Sheet 1)

NO. 1 BEARING (CARBON) SEAL ASSEMBLY - ASSEMBLY-01


1
SLEEVE SPACER
FLANGE
WEAR MARK ON FLAT SIDES OF SLEEVE SPACER ADJACENT TO FLANGE
VIEW C
WEAR MARK AT FLANGE SIDE
AXIAL LENGTH OF SLEEVE SPACER
DISTANCE W (FLANGE WIDTH)
AXIAL MIDPOINT (1/2 AXIAL LENGTH)
WEAR MARK
D
SLEEVE SPACER INSTALLED WITH WEAR MARK TOWARDS SUPPORT
WEAR MARK MUST BE AWAY FROM AXIAL MIDPOINT BY DISTANCE W OR MORE
VIEW D
WEAR MARK
SUPPORT
ASSEMBLY AS SHOWN HERE IS PERMITTED IF THIS DIMENSION IS SATISFACTORY
VIEW C
WEAR MARK MOVED TO SUPPORT SIDE (OPTIONAL)
L-A9468 (0000)
PW V

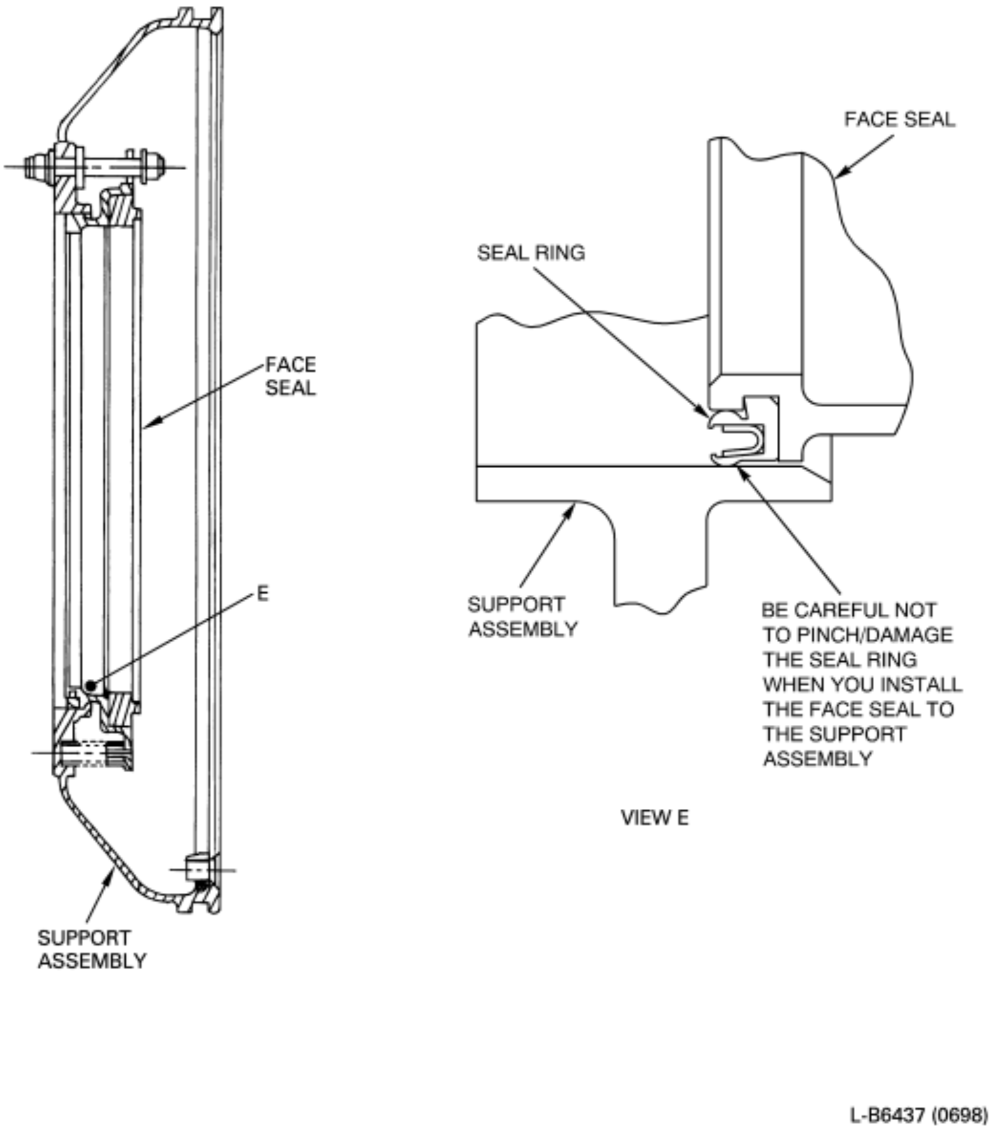
No. 1 Bearing Seal Assembly
Figure 1002 (Sheet 2)
(Task 72-31-17-440-001)

NO. 1 BEARING (CARBON) SEAL ASSEMBLY - ASSEMBLY-01

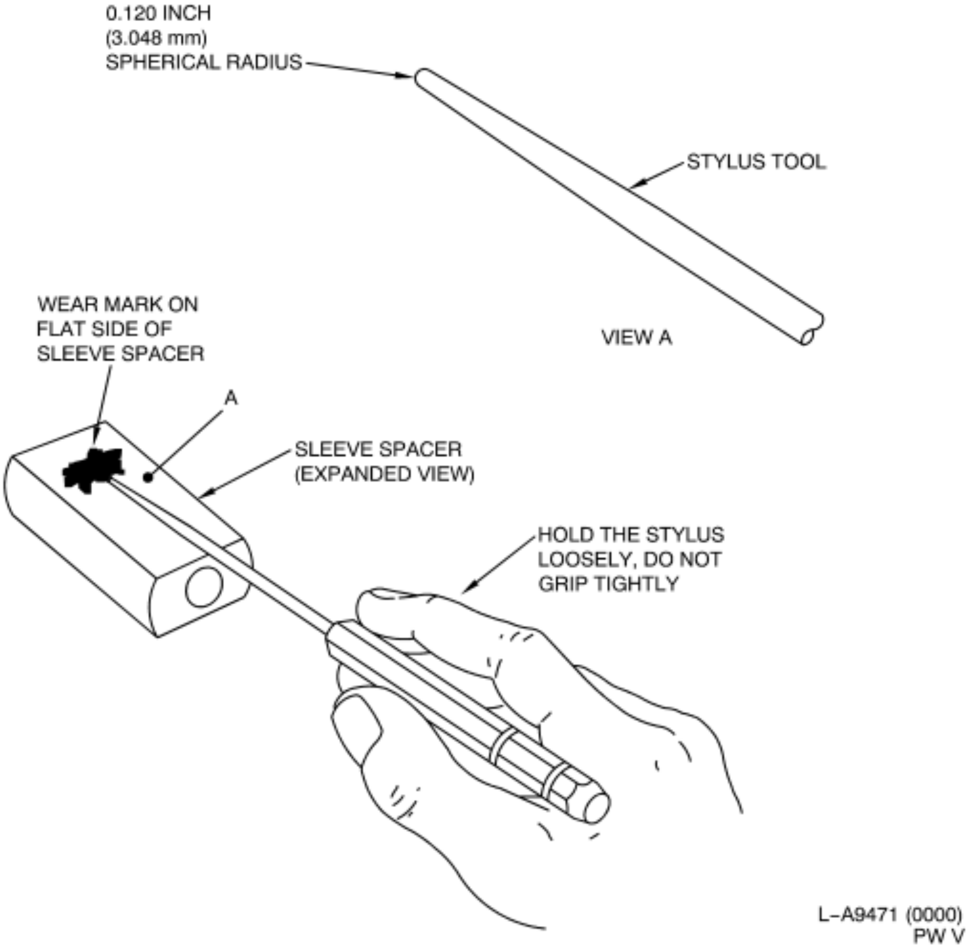
1. Examine The Flat Sides Of The Sleeve Spacer With A Hand Held Stylus Tool. See Figure 1003. Hold The Stylus Loosely At A 30 Degree Angle To The Wear Surface. Guide The Stylus Perpendicular To The Lay Of The Wear. Only Use The Weight Of The Stylus, Do Not Force The Stylus With Your Fingers. If The Stylus Catches On The Wear, You Must Install The Sleeve Spacer With The Wear Towards The Support (Away From The Flange).

Key to Figure 1002 (Sheet 2)

NO. 1 BEARING (CARBON) SEAL ASSEMBLY − ASSEMBLY−01


FACE SEAL
E
SUPPORT ASSEMBLY
FACE SEAL
SEAL RING
SUPPORT ASSEMBLY
BE CAREFUL NOT TO PINCH/DAMAGE THE SEAL RING WHEN YOU INSTALL THE FACE SEAL TO THE SUPPORT ASSEMBLY
VIEW E
L-B6437 (0698)

No. 1 Bearing Seal Assembly
Figure 1002 (Sheet 3)
(Task 72−31−17−440−001)


0.120 INCH
(3.048 mm)
SPHERICAL RADIUS
STYLUS TOOL
VIEW A
WEAR MARK ON FLAT SIDE OF SLEEVE SPACER
A
SLEEVE SPACER (EXPANDED VIEW)
HOLD THE STYLUS LOOSELY, DO NOT GRIP TIGHTLY
L-A9471 (0000)
PW V

Examination Of Wear On Sleeve Spacers
Figure 1003
(Task 72-31-17-440-001)

Previous Pageblock   Return to Previous Menu   Next Pageblock

NO. 1 BEARING (CARBON) SEAL ASSEMBLY - TESTING-01

Task 72-31-17-720-001:

1. Airflow Check No. 1 Bearing (Carbon) Seal Assembly

A. Prerequisites

(1) Assemble No. 1 bearing (carbon) seal assembly by Assembly-01 (Task 72-31-17-440-001).

B. Equipment And Materials Necessary

Special Tools:

PWA 6507	Flowmeter, Leak Test
PWA 45411	Gage, Differential Pressure
PWA 46400	Gage, Measurement
PWA 85036	Fixture, Leak Test

C. Procedure
See Figure 1301.

(1) Remove cover from PWA 85036 Fixture and inspect packings and neoprene sealing surfaces.

(2) Remove detail seal ring and inspect micro-finish surface for nicks and scratches.

(3) Reinstall seal ring with micro-finish surface up and secure.

(4) Carefully lower seal assembly into fixture to seat on fixture seal ring face and base.

(5) Install detail plate over seal assembly outside diameter and secure.

(6) Using lifting handles, install cover in fixture locating on top surface of seal assembly. Secure cover.

(7) For operators who use PWA 6507 Flowmeter and PWA 45411 Gage, connect the flowmeter and gage to the fixture:

(a) Connect hose from PWA 6507 Flowmeter to larger of two quick-diconnect fittings (marked FLOWMETER) attached to fixture face.

(b) Attach smaller fitting of PWA 45411 Gage to the remaining fitting on fixture base.

(c) Attach air inlet hose to fitting marked INLET on cover.

(d) Attach the larger quick−disconnect fitting on the gage to the remaining quick−disconnect fitting on the fixture cover.

(8) For operators who use PWA 46400 Gage, connect the gage to the fixture:

(a) Install the gage hose marked RETURN on the fixture fitting marked FLOWMETER, on the base of the fixture.

(b) Install the gage hose marked D.P. LOW on the remaining fitting on the fixture base.

(c) Install the gage hose marked SUPPLY on the fitting marked INLET, on the fixture cover.

(d) Install the gage hose marked D.P. HIGH on the remaining quick−disconnect fitting on the cover.

(9) Do the check for total air leakage:

(a) Supply regulated, filtered air to the fixture to 40 psi (275.8 kPa) and permit it to stabilize for five minutes.

(b) For PN 50B199, leakage must not be greater than 2.5 cfm (0.07 cmm).

(c) For PNs 50B247, 50B275, 50B772 and 51B170, leakage must not be greater than 0.5 cfm (0.01 cmm).

(10) If the seal assembly is not inside limits, it is necessary to do a check of the leakage at the piston/seal ring:

(a) Remove the fixture cover.

(b) Remove the seal assembly.

(c) Remove the detail seal ring.

(d) Install the detail seal ring in the fixture, rubber side up.

(e) Install the seal assembly and the cover.

(f) Do another air flow check. This value is the leakage at the piston/seal ring.

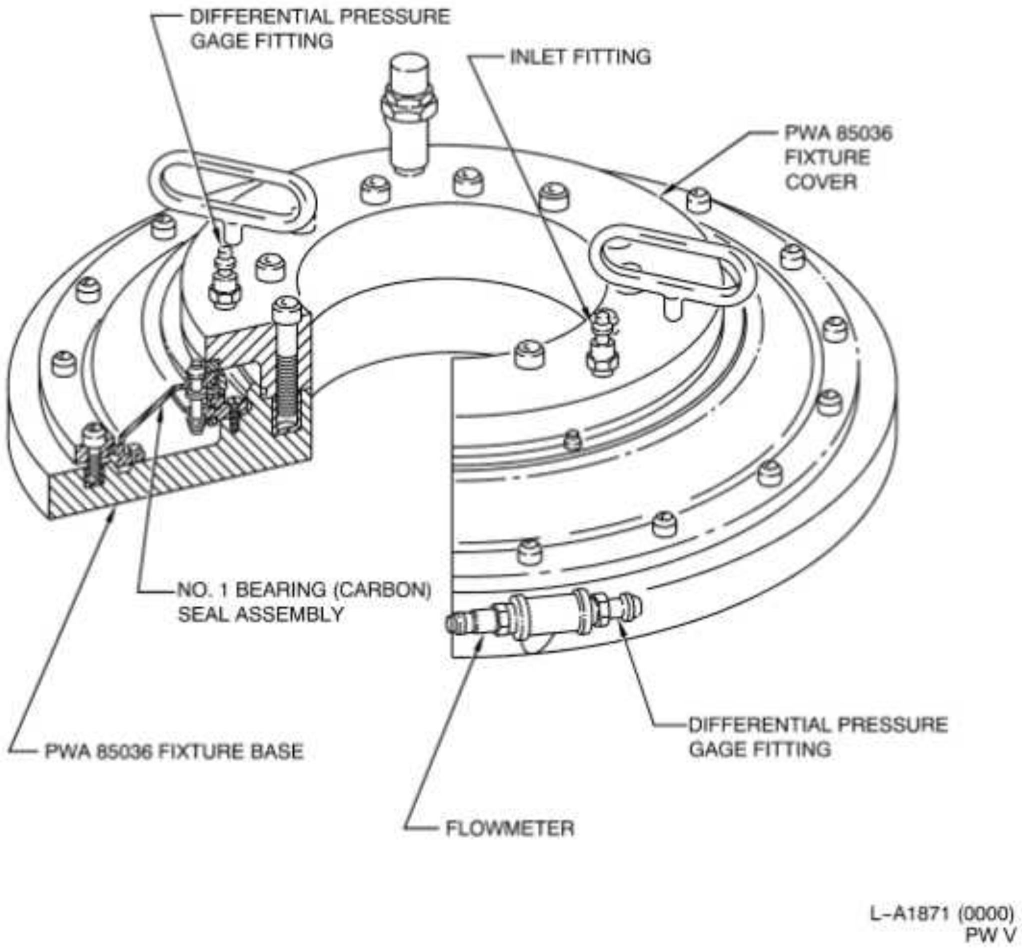
1 Subtract this value from the total leakage value. The result is the leakage at the carbon element.

D. Postrequisites

(1) If there is leakage at the carbon element, lap the carbon element. Refer to the PW4000 Series CIR, PN 51A357, 72-31-18, Repair-06.

(2) If the leakage is not within limits and not at the carbon element, replace the piston/seal ring. Refer to Disassembly-01 (Task 72-31-17-040-001) and Assembly-01 (Task 72-31-17-440-001).

NO. 1 BEARING (CARBON) SEAL ASSEMBLY - TESTING-01


DIFFERENTIAL PRESSURE GAGE FITTING
INLET FITTING
PWA 85036 FIXTURE COVER
NO. 1 BEARING (CARBON) SEAL ASSEMBLY
PWA 85036 FIXTURE BASE
DIFFERENTIAL PRESSURE GAGE FITTING
FLOWMETER
L-A1871 (0000)
PW V

Airflow Check No. 1 Bearing (Carbon) Seal Assembly
Figure 1301
(Task 72-31-17-720-001)

COMPRESSOR INLET CONE (REAR) SEGMENT ASSEMBLY - ASSEMBLY-01

Task 72-31-81-440-001:

1. Balance Compressor Inlet Cone (Rear) Segment Assembly

A. Equipment And Materials

Special Tools:

PWA 25704	Housing, Balance (Use With PWA 29231)
PWA 29231	Arbor, Balance (Optional To PWA 86547)
PWA 8170-27	Housing, Balance (Use With PWA 29231)
PWA 86115	Adapter, Arbor (For Inlet Cone Segments With A Maximum Diameter of 27.384 Inch (695.554 mm)
PWA 86116	Weight, Calibration (For Balance Machines Without Electronic Calibration)
PWA 86117	Weight, Calibration (For Balance Machines Without Electronic Calibration)
PWA 86118	Fixture
PWA 86403	Arbor, Balance (Optional To PWA 86547)
PWA 86547	Arbor, Balance
PWA 86599	Adapter, Arbor (For Inlet Cone Segments With A Maximum Diameter of 27.410 Inch (696.214 mm)

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-150	Fiberglass Cloth (AMS 3824, Style 7781)
P08-039	Resin,(Hysol EA 9396 Part A)
P08-039	Resin,(Hysol EA 9396 Part B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Rivet	0-12	72-31-00/1/130

B. Procedure
See Figure 1001, Figure 1002, Figure 1003 and Figure 1004.

NOTE: This balance procedure is necessary if it is specified in any repair procedure done on the inlet cone.

COMPRESSOR INLET CONE (REAR) SEGMENT ASSEMBLY − ASSEMBLY−01

(1) Install PWA 86599 or PWA 86115 Adapter on PWA 86547 Arbor, PWA 86403 Arbor or PWA 29231 Arbor.

NOTE: Arbor and adapter must be balanced before installation of inlet cone.

NOTE: Use PWA 86115 Adapter only on inlet cone segments with a maximum part diameter of 27.384 Inch (695.554 mm). Use PWA 86599 Adapter only on inlet cone segments with a maximum part diameter of 27.410 Inch (696.214 mm).

(2) Install inlet cone rear segment, front end down, in PWA 86118 Fixture. See Figure 1001.

NOTE: Make sure old counterweights have been removed from inlet cone.

(3) Install arbor and adapter to inlet cone with 19 cap screws and washers lubricated with Engine Oil P03−001. Torque screws to 65 − 70 lb−in. (7.344 − 7.909 N.m).

(4) (For operators who use PWA 29231 Arbor) Install PWA 8170−27 Housing to cradle supports of balance machine and attach PWA 25704 Housing to PWA 8170−27 Housing. See Figure 1002.

(5) (For operators who use Post PWA 29231 Arbors) Install balance machine rollers in the balance machine. Refer to Figure 1002.

NOTE: The balance machine rollers are not shown in the referenced figure.

(6) With hoist, lift arbor assembly and inlet cone rear segment from fixture. With additional hoist, trunnion assembly to horizontal position. Place arbor and inlet cone onto balance machine removing detail lifting eyes.

(7) Make a reference line on balance arbor and inlet cone rear segment.

(8) Attach PWA 86116 Calibration Weight to one of the 0.112 − 0.116 inch (2.845 − 2.946 mm) diameter counterweight holes on the 11.998 inch (304.749 mm) diameter bolt circle.

(9) Attach PWA 86117 Calibration Weight to one of the 0.208 − 0.223 inch (5.28 − 5.66 mm) diameter counterweight holes on the 28.080 inch (713.232 mm) diameter bolt circle.

(10) Start balance machine and calibrate meter on machine to 1.0 oz−in. (720.0 g.mm).

(a) For balance machines without electronic calibration, do a check of the static balance machine. After you calibrate the balance machine, remove the calibration weights.

(b) For balance machines with electronic calibration, use the manufacturer's instructions to do a check of the static balance machine.

(11) Run the machine at 600 RPM minimum (900 RPM maximum allowed) to find initial unbalance. Initial unbalance should not be greater than 36.0 oz−in. (25920.0 g.mm) in Plane C and 12.0 oz.in. (8640.0 g.mm) in Plane AC.

(12) Run the machine at 600 RPM minimum (900 RPM maximum allowed) to find the dynamic unbalance. The dynamic unbalance of the inlet cone segment in Plane C and Plane AC must not be more than 1.0 oz−in. (720.0 g.mm).

(13) Correct the unbalance by adding counterweights. See Figure 1003.

(a) Correct unbalance In Plane C as follows:

1 Apply Engine Oil P03−001 to the threads of the screws you will use in the following step.

2 Use PN ST2194−030 screw, PN 776440 nut and PN 696853 washers. Use at least one washer for each screw but no more than four at each location.

3 Torque the screw(s) by measuring the torque necessary to turn the screw through the lock feature of the nut. Add this torque to 22 − 40 lb−in. (2.486 − 4.519 N.m) for the total torque.

4 Remove any excess lubricant.

R (b) Correct unbalance in Plane AC as follows:

R 1 Use PN 534493, PN 534495 or PN 534492 counterweight in any combination at nine holes maximum within ± 60° of unbalance vector. You can also add a maximum of two PN 534492 counterweights at any angular location.

R 2 Use the PWA 85234 Hand Riveter to flare counterweight PN 534492 and rivet PN 534494 to
R 0.125 inch (3.175 mm) minimum diameter. Refer
R to Section 70−43, Standard Practices Manual, PN
R 585005.

R (c) Check balance again on machine to make sure assembly is within specified limits.

(14) If dynamic unbalance continues after counterweight(s) are added, further correction may be made with the use of bonded fiberglass cloth as follows: See Figure 1004.

NOTE: The fiberglass cloth counterweight is to be of 3 layers (plies), an axial width (W) of 2.00 inches (50.80 mm) and an appropriate circumferential length (L) to correct the approximate amount of unbalance as specified in Table 1001.

OZ−IN. (g.mm)	# Plies	Axial Width (W), Inches (mm)	Circ. Length (L), Inches (mm)
1.00 (720)	3	2.00 (50.80)	2.00 (50.80)
2.00 (1440)	3	2.00 (50.80)	3.00 (76.20)
3.00 (2160)	3	2.00 (50.80)	4.00 (101.60)
4.00 (2880)	3	2.00 (50.80)	5.00 (127.00)
5.00 (3600)	3	2.00 (50.80)	6.00 (152.40)

Fiberglass Cloth Counterweight
Table 1001

(a) After you determine the proper location for the fiberglass counterweight, locally hand sand the location with 120/150 grit the inside wall of the "Y" flange and clean by the SPOP 208. See 70−21−00, Standard Practices Manual, PN 585005.

CAUTION: TO MAKE SURE YOU HAVE BOND INTEGRITY, THE FIBERGLASS COUNTERWEIGHT MUST BE APPLIED IN A CLEAN ROOM, PRESSURIZED ABOVE ATMOSPHERIC PRESSURE, FREE OF CONTAMINANTS, AND AT CONTROLLED CONSTANT TEMPERATURE OF 75 DEGREES +/− 10 DEGREES F (23.4 DEGREES +/− 5.5 DEGREES C)

(b) Apply a patch with 68 − 73 percent Fiberglass Cloth P05−150 and 27 − 32 percent resin mixture by weight. Resin mixture to be 100 parts of Resin P08−039, Part A and 30 parts of Resin P08−039, Part B by weight. Follow the resin manufacturer's instructions.

(c) Successive layers can be reduced in size as appropriate.

(d) Allow the bond to set at room temperature for 24 hours followed by 150 degree F +/− 10 degrees for 1 hour cure time.

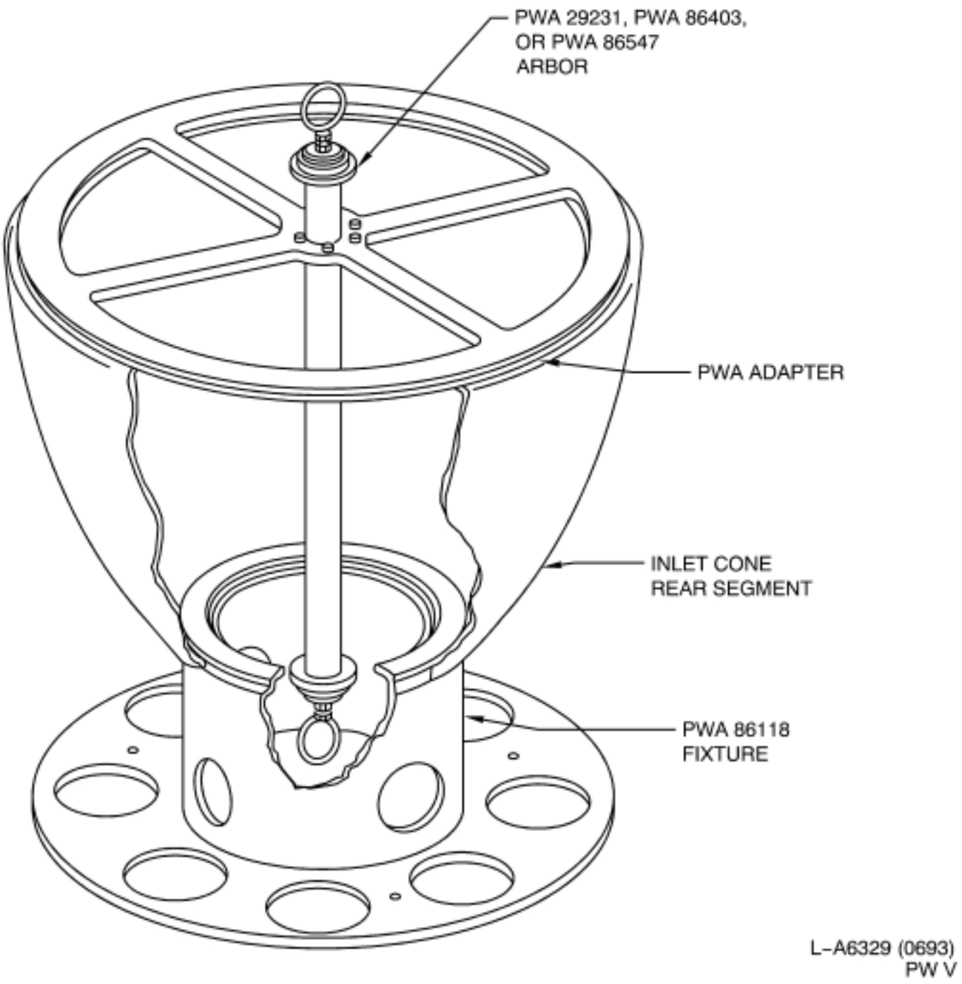
(e) Check the unbalance on the balance machine for compiance with step (13) limits.

(15) Remove arbor assembly and inlet cone rear segment from the balance machine and install in PWA 86118 Fixture, front end down.

(16) Remove the 19 cap screws and washers which hold the inlet cone rear segment to the arbor. Remove arbor assembly.

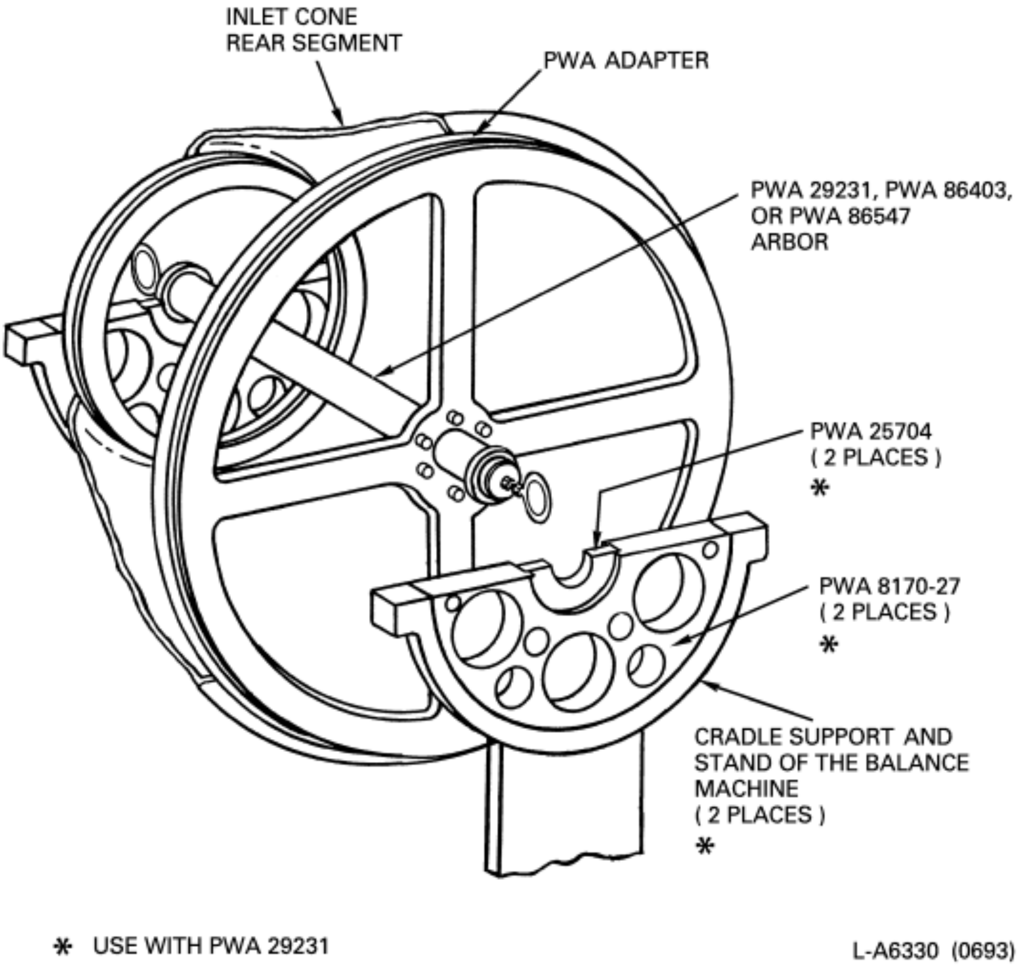
(17) Remove inlet cone rear segment from fixture.

COMPRESSOR INLET CONE (REAR) SEGMENT ASSEMBLY - ASSEMBLY-01


PWA 29231, PWA 86403,
OR PWA 86547
ARBOR
PWA ADAPTER
INLET CONE
REAR SEGMENT
PWA 86118
FIXTURE
L-A6329 (0693)
PW V

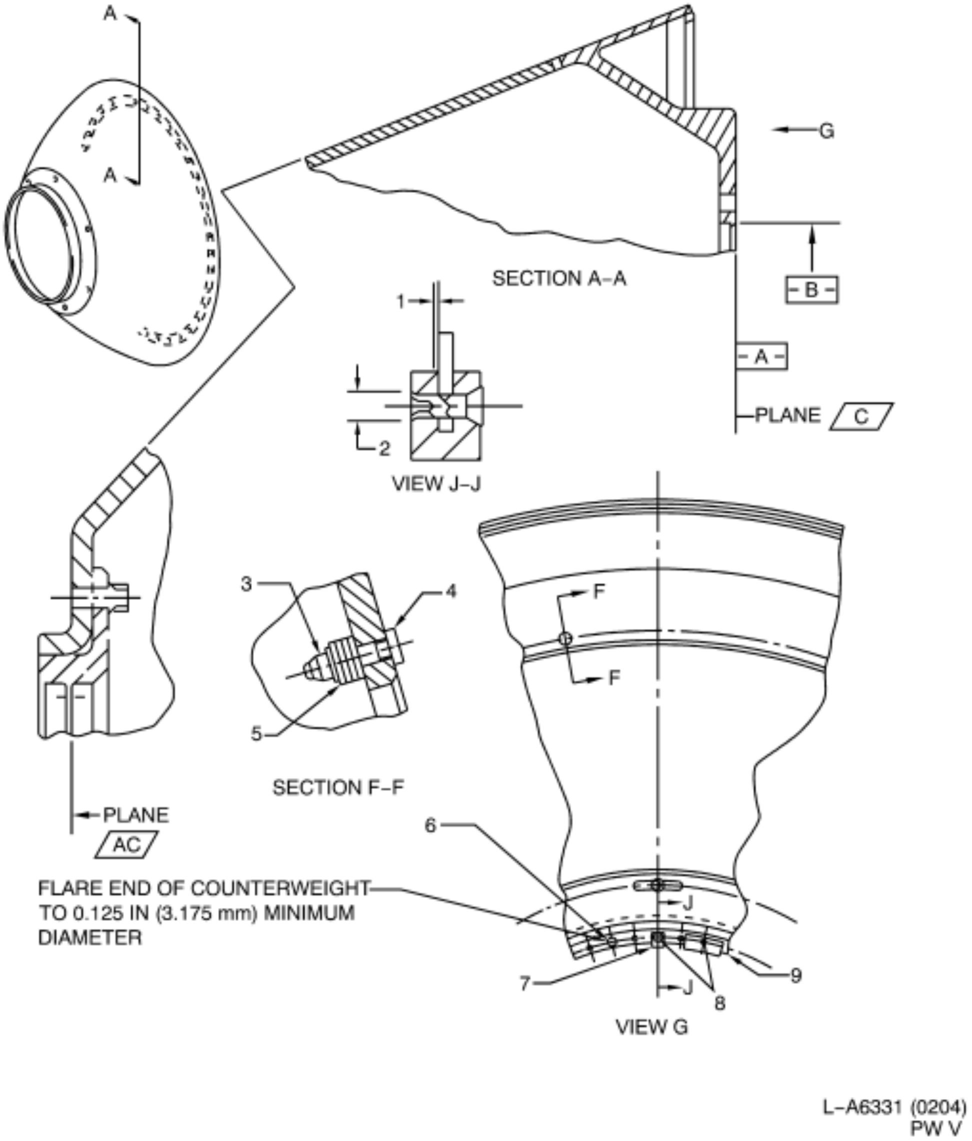
Balance Compressor Inlet Cone (Rear) Segment Assembly
Figure 1001
(Task 72-31-81-440-001)

COMPRESSOR INLET CONE (REAR) SEGMENT ASSEMBLY - ASSEMBLY-01


INLET CONE REAR SEGMENT
PWA ADAPTER
PWA 29231, PWA 86403, OR PWA 86547 ARBOR
PWA 25704 (2 PLACES) *
PWA 8170-27 (2 PLACES) *
CRADLE SUPPORT AND STAND OF THE BALANCE MACHINE (2 PLACES) *
* USE WITH PWA 29231
L-A6330 (0693)

Balance Compressor Inlet Cone (Rear) Segment Assembly
Figure 1002
(Task 72-31-81-440-001)

COMPRESSOR INLET CONE (REAR) SEGMENT ASSEMBLY − ASSEMBLY−01


A
A
G
SECTION A−A
B
A
PLANE
C
1
2
VIEW J−J
3
4
5
SECTION F−F
F
F
PLANE
AC
6
FLARE END OF COUNTERWEIGHT TO 0.125 IN (3.175 mm) MINIMUM DIAMETER
J
J
7
8
9
VIEW G
L−A6331 (0204)
PW V

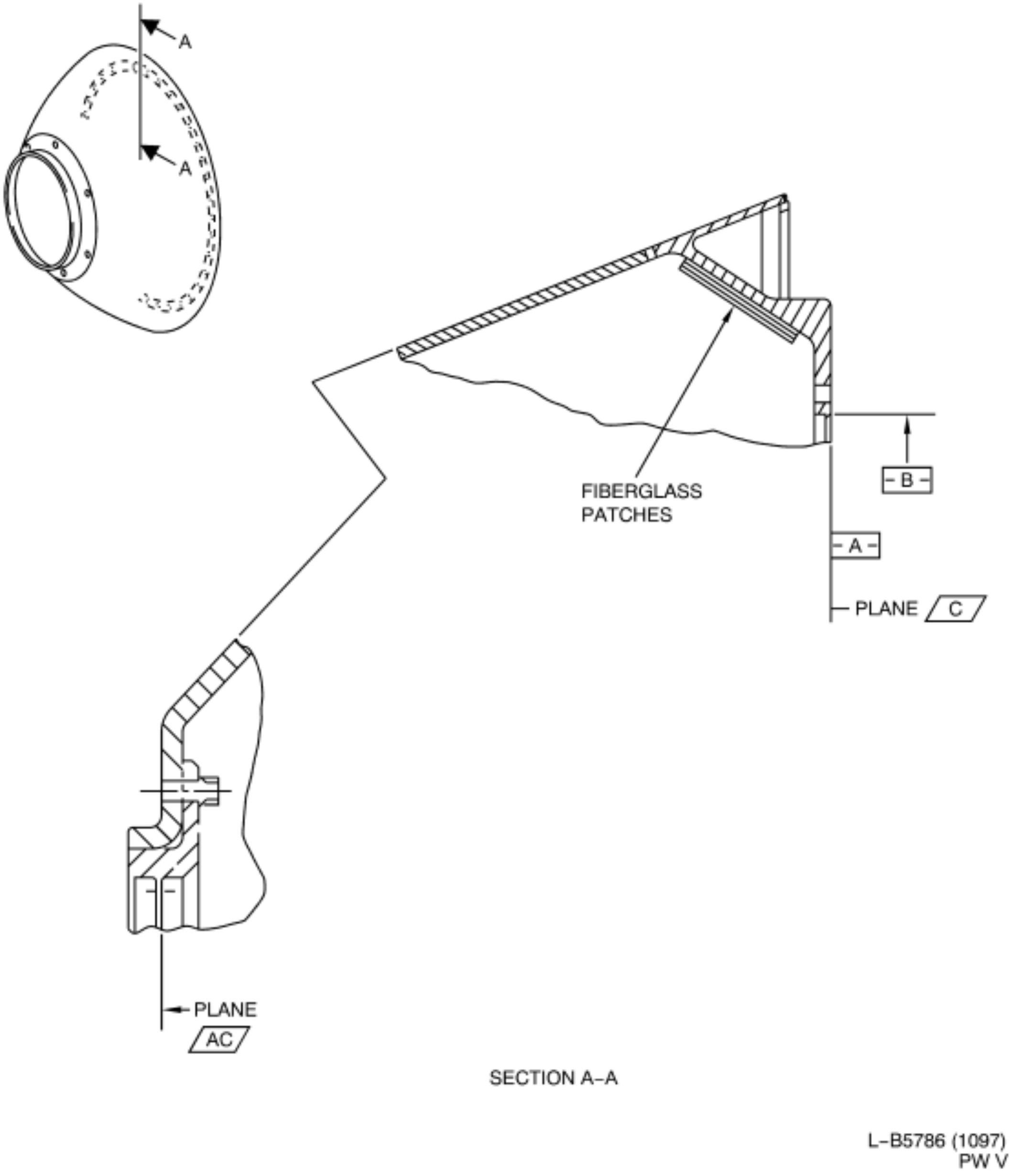
Balance Compressor Inlet Cone (Rear) Segment Assembly
Figure 1003
(Task 72−31−81−440−001)

COMPRESSOR INLET CONE (REAR) SEGMENT ASSEMBLY − ASSEMBLY−01

1. 0.001 Inch (0.025 mm) Minimum Gap Either Side After Flaring Rivet.
2. 0.125 Inch (3.175 mm) Minimum Diameter. Flare Rivet To Get This Diameter. Rivet Head Location Optional.
3. Nut, PN 776440 (0−19, Use As Necessary)
4. Screw, PN ST2194−030 (0−19, Use As Necessary)
5. Washer, PN MS9321−09 or PN 696853 (0−76, Use As Necessary)
6. Counterweight, PN 534492 Class 1−3 (0−11, Use As Necessary)
7. Counterweight, PN 534493 Class 1−3 (0−9, Use As Necessary)
8. Rivet, PN 534494 (0−9, Use As Necessary)
9. Counterweight, PN 534495 Class 1−5 (0−9, Use As Necessary)

Key to Figure 1003

COMPRESSOR INLET CONE (REAR) SEGMENT ASSEMBLY − ASSEMBLY−01


A
A
FIBERGLASS
PATCHES
B
A
PLANE
C
PLANE
AC
SECTION A−A
L−B5786 (1097)
PW V

Correct Umbalance On Compressor Inlet Cone (Rear) Segment Assembly
Figure 1004
(Task 72−31−81−440−001)

STAGE 1 LPC BLADE ASSEMBLY - ASSEMBLY-01

Task 72-31-82-440-001:

1. Balance Complete Stage 1 LPC Blade (Fan Blade Set) Assemblies

A. Equipment And Materials Necessary

Special Tools:

PWA 85086	Lift Arm (2 Necessary)
PWA 85174	Shroud
PWA 85660	Stand (Optional to PWA 88183)
PWA 85684	Arbor (Optional to PWA 85695)
PWA 85695	Arbor (Optional to PWA 87037)
PWA 85804	Ring, Retaining
PWA 85847	Adapter, Build Stand
PWA 86651	Cart, Storage
PWA 87037	Arbor
PWA 87135	Adapter
PWA 88183	Stand, Build/Storage

Consumable Materials:

Item No.	Designation
P03-001	Engine Oil (PWA 521B)
P06-005	Lubricant (PWA 587)

B. Procedure

See Figure 1001 and Figure 1002.

(1) Remove a blade set (pair) from PWA 86651 Cart and place on bench to form the beginning of two columns.

NOTE: A matched set of blades consists of two blades with the same moment weight oz-in. value or as close as possible within 1.0 oz-in. (720 g.mm). The oz-in. (g.mm) value is marked on concave side of airfoil just inboard of mid-span shroud.

(2) Remove remaining blade sets from container and place one blade from each set into each column.

(3) Rearrange blades in both columns in ascending order (light to heavy) moving blades in sets. When blades are assembled into hub, blades of the same set must be 180 degrees apart.

(4) Identify blades in column one, 1 through 19 and 20 through 38 in column two, on convex side of airfoil.

STAGE 1 LPC BLADE ASSEMBLY − ASSEMBLY−01

(5) Visually check the exterior of the blades for security of details, absence of damage and absence of foreign material. Particular attention should be directed to the mating surfaces.

(6) Obtain bill of material from compressor hub and secure PWA 85804 Retaining Ring onto rear face of hub as follows:

(a) Place special washers onto shoulder bolts.

(b) Insert shoulder bolts into front face of hub and into the retaining ring.

(c) Place the remaining special washers on the shoulder bolts and secure with nuts.

(7) Install PWA 85847 Adapter on PWA 88183 or PWA 85660 Stand.

(8) Secure hub/retaining ring onto PWA 85847 Adapter.

(9) Install the balance arbor to the LPC hub assembly.

NOTE: The hub assembly is in the front end up position.

(a) For PWA 85684 or PWA 85695 Balance Arbors.

1 Attach a hoist to the eye on the arbor. Lift the arbor over the hub assembly and carefully

2 Attach the hub to the balance arbor using detail retaining nut lubricated with Engine Oil P03−001, and hydraulic actuation screw. Torque nut to 800 − 1200 lb−in. (90.388 − 135.582 N.m) with two standard one−half inch square drive torque wrenches.

(b) For PWA 87037 Balance Arbor.

1 Install PWA 87135 Adapter to the hub assembly. Attach the adapter to the front face of the hub.

2 Lift PWA 87135 Adapter with the hub assembly and install the assembly to PWA 87037 Arbor .

3 Remove PWA 87135 Adapter from the hub assembly.

4 Attach the hub to the balance arbor using detail retaining nut lubricated with Engine Oil P03−001, and hydraulic actuation screw. Torque nut to 800 − 1200 lb−in. (90.388 − 135.582 N.m) with detail adapter wrench and a standard one−half inch square drive torque wrench.

(10) Raise arbor and hub from build stand. Attach PWA 85086 Lift Arms on eyes at each end of arbor. Wit a hoist, trunnion assembly to horizontal position.

(11) Lower arbor and hub assembly onto balance machine. Remove lifting equipment and attach arbor to balance machine.

(12) Install PWA 85174 Shroud to balance machine.

(13) Balance hub assembly.

(14) Install blades in hub as follows:

WARNING: AVOID CONTACT OF LUBRICANT P06−005, WITH SKIN. IF CONTACT OCCURS, WASH IMMEDIATELY WITH SOAP AND WATER.

(a) Brush Lubricant P06−005 on contact faces of mid−span shroud of blades and permit to dry five minutes.

(b) Install number one blade into hub blade slot located at six o'clock position and identified as number one on hub nut flange. See Figure 1003. Engage blade root approximately one quarter of the way into blade slot. Using same procedure, install remaining blades in sequence in a clockwise (CW) direction until all blades are installed.

(c) Tap blades evenly in a CW direction as viewed from the front until all 38 blades are seated.

NOTE: Blades may be seated only when all blades are installed.

(d) Install blade lock assembly starting with left half of split, positioning lock to align anti−rotation pin of lock with anit−rotation slot of hub. Tap lock lightly to seat using fiber drift.

STAGE 1 LPC BLADE ASSEMBLY − ASSEMBLY−01

(15) Balance hub and blade assembly to within 10 oz−in. (7200 g.mm) at 900 rpm. Blade sets may be repositioned to correct unbalance.

(16) Reposition blade sets as follows:

(a) Remove blade lock using small pin punch in hole located near joint.

(b) Turn assembly to locate blade to be removed at 12 o'clock position.

(c) Unseat counterclockwise (CCW) blades until stopped by mid−span shroud of each blade.

(d) Remove selected blade. Seat blades partially CW sequence.

(e) Turn assembly 180 degrees and remove second blade per above instructions.

(f) Remove other blade set(s) selected for repositioning per above instructions.

(g) Install first blade of repositioning blade set. Seat blades partially using CW sequence.

(h) Turn assembly 180 degrees. Unseat blades until stopped by mid−span shroud of each adjacent blade.

(i) Install second blade of repositioned set. Seat blades partially using CW sequence. Continue procedure until all blade sets selected for repositioning are installed in hub. Seat blades using CW sequence.

NOTE: Blades of a set must be positioned 180 degrees apart.

(j) Install blade lock assembly.

(17) Check balance to limits specified above.

(18) Once blades are balanced, record amount and angle of residual "FORCE" unbalance.

(19) Record amount and angle of residual "MOMENT" unbalance.

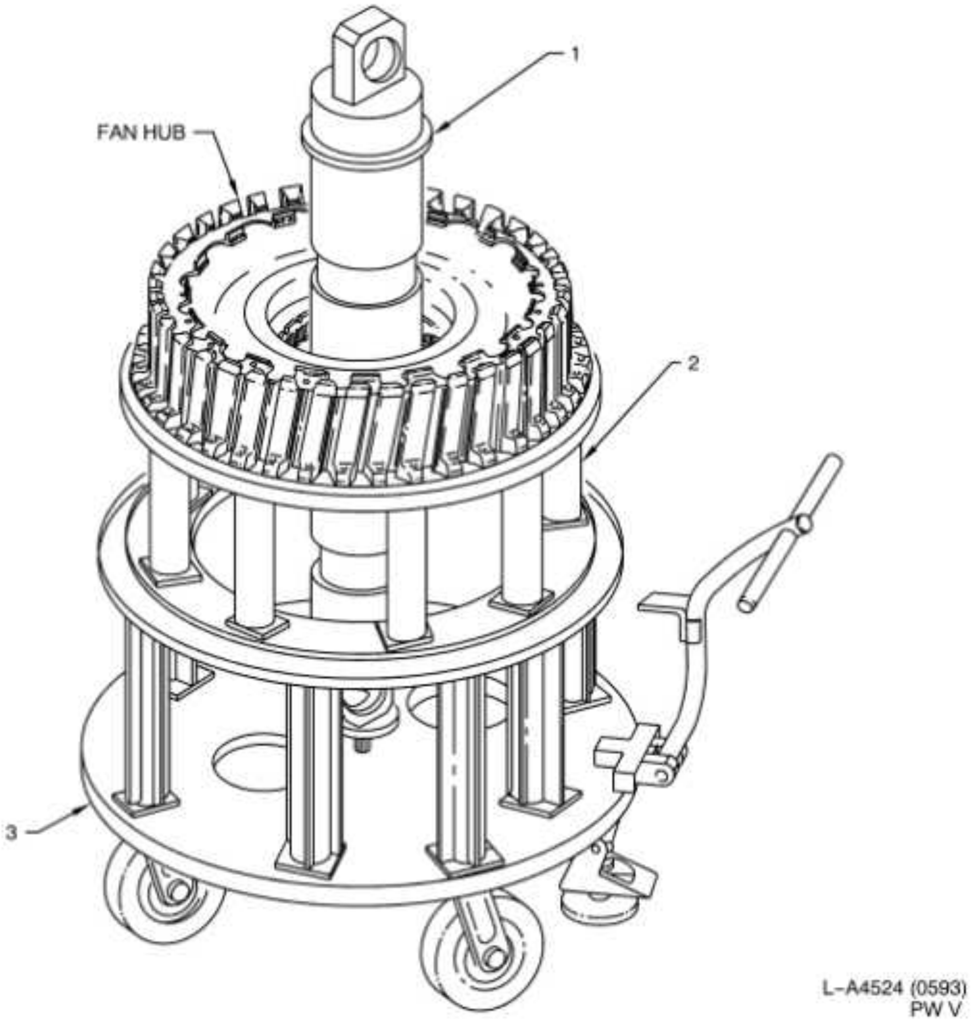
STAGE 1 LPC BLADE ASSEMBLY − ASSEMBLY−01

(20) Reidentify blades 1 through 38 on convex side of airfoil in sequence.

(21) Transfer the balanced set of fan blades to the engine hub or storage cart.

(22) Remove arbor and hub from balance machine.

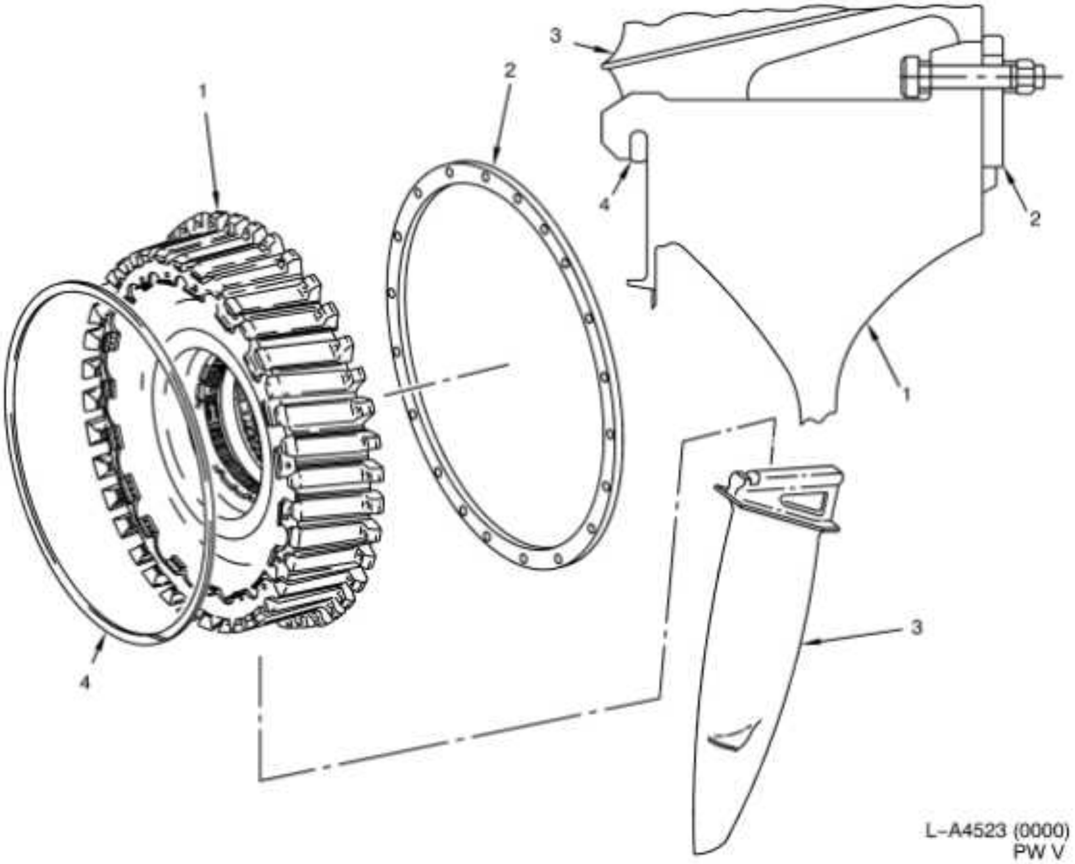
STAGE 1 LPC BLADE ASSEMBLY − ASSEMBLY−01



1. PWA 85864, PWA 85695 Or PWA 87037 Arbor
2. PWA 85847 Adapter
3. PWA 85660 Or PWA 88183 Stand

Hub And Fan Blade Installation
Figure 1001
(Task 72−31−82−440−001)

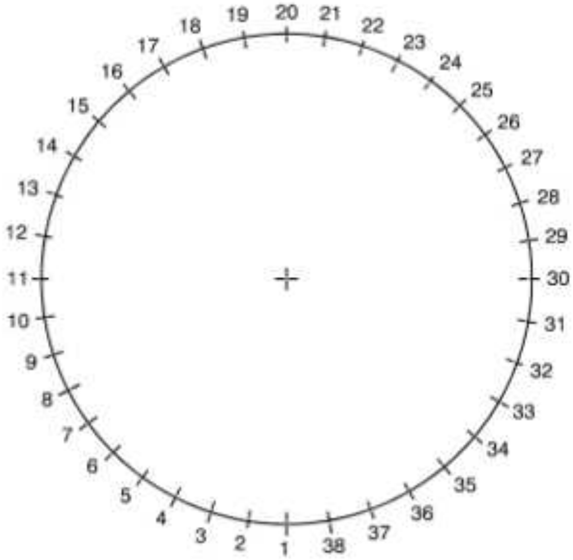
STAGE 1 LPC BLADE ASSEMBLY - ASSEMBLY-01



1. Hub
2. PWA 85804 Retaining Ring
3. Fan Blade
4. Blade Lock

Fan Blade Installation
Figure 1002
(Task 72-31-82-440-001)

STAGE 1 LPC BLADE ASSEMBLY − ASSEMBLY−01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L−A4522 (0000)
PW V

Blade Arrangement On Hub
Figure 1003
(Task 72−31−82−440−001)

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72−32−00

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	HIGHLIGHTS
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72−32−00	LPC/LPT COUPLING − DESCRIPTION AND OPERATION • 72−32−00−990−002: LPC/LPT Coupling
72−32−00	LPC/LPT COUPLING − DISASSEMBLY−01 • 72−32−00−030−001−001: Disassemble LPC/LPT Coupling (Mechanical Wrench)
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72−32−00	LPC/LPT COUPLING − INSPECTION/CHECK−01 • 72−32−00−990−004: General Inspection Requirements − LPC/LPT Coupling
72−32−00	LPC/LPT COUPLING − INSPECTION/CHECK−03 • 72−32−00−990−005: Visual Inspection − LPC/LPT Coupling
72−32−00	LPC/LPT COUPLING − INSPECTION/CHECK−04 • 72−32−00−990−001: Specific Fits And Clearances
72−32−00	LPC/LPT COUPLING − ASSEMBLY−01 • 72−32−00−400−001−001: Assemble LPC/LPT Coupling (Mechanical Wrench)
72−32−00	LPC/LPT COUPLING − ASSEMBLY−02 • 72−32−00−400−001−002: Assemble LPC/LPT Coupling (Hydraulic Wrench)

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LPC/LPT COUPLING - HOW TO USE MANUAL

Task 72-32-00-990-003:

1. Chapter/Section/Subject Numbering Outline

See Figure 1.

NOTE: See the tab separated How To Use Manual section located at the beginning of this manual set for information concerning Data Location Guidelines and a complete Chapter/Section/Subject numbering outline for all manual sections.

A. The following is a complete listing of the individual Chapter/Section/Subject numbers and specific nomenclatures which have been assigned to the significant LPC/LPT Coupling parts.

(1) Numbers which are not assigned are indicated in the list by one of the following terms:

UNASSIGNED - This designation is for numbers intentionally omitted and reserved for possible future use.

NOT USED - This designation is applied to numbers used in other related engine model programs which are not, at this time, applicable to the engine models represented by this manual.

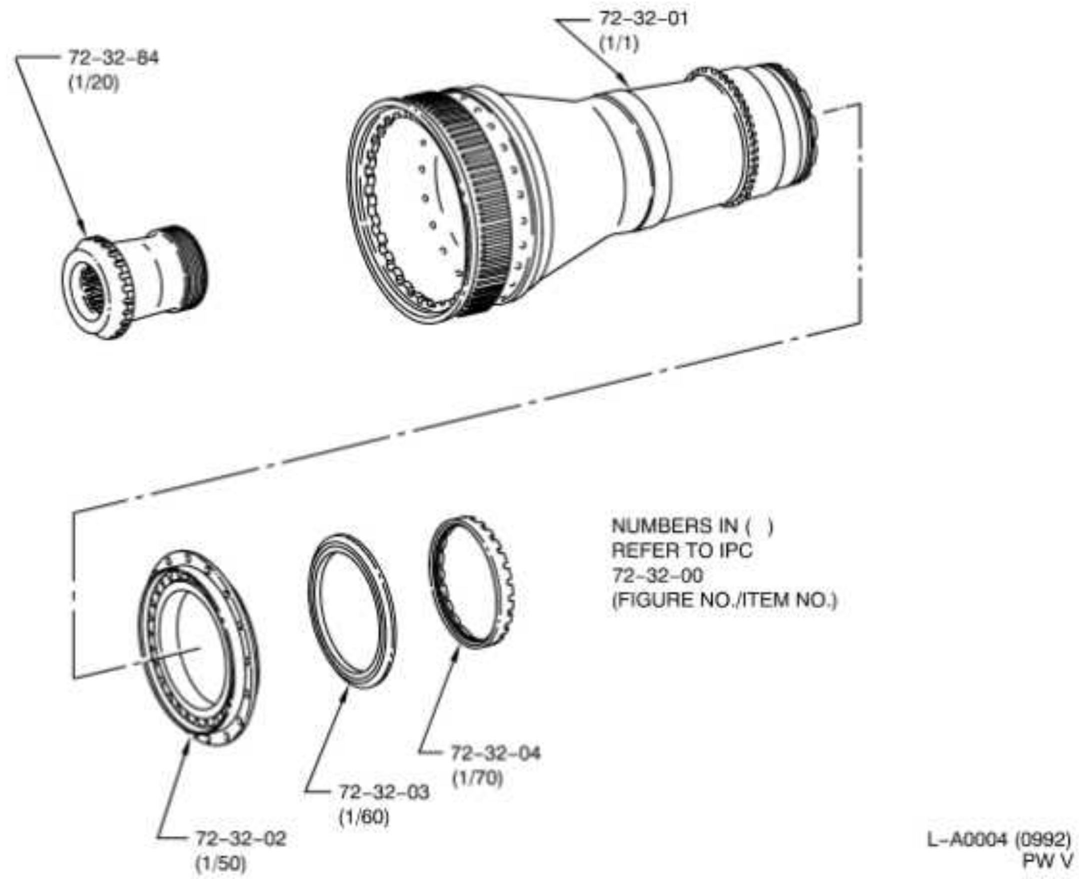
LPC/LPT COUPLING	72-32-00
TURBINE SHAFT COUPLING ASSEMBLY	72-32-01
NO. 1.5 ROLLER BEARING	72-32-02
NO. 1.5 BEARING SEAL SEAT	72-32-03
NO. 1.5 BEARING (INNER RACE) RETAINING NUT	72-32-04
UNASSIGNED	72-32-05 through 72-32-79
TURBINE SHAFT (COUPLING RETAINING) NUT	72-32-80
TURBINE SHAFT PLUG	72-32-81
UNASSIGNED	72-32-82 and 72-32-83

LPC/LPT COUPLING − HOW TO USE MANUAL

TURBINE SHAFT NUT .... 72−32−84

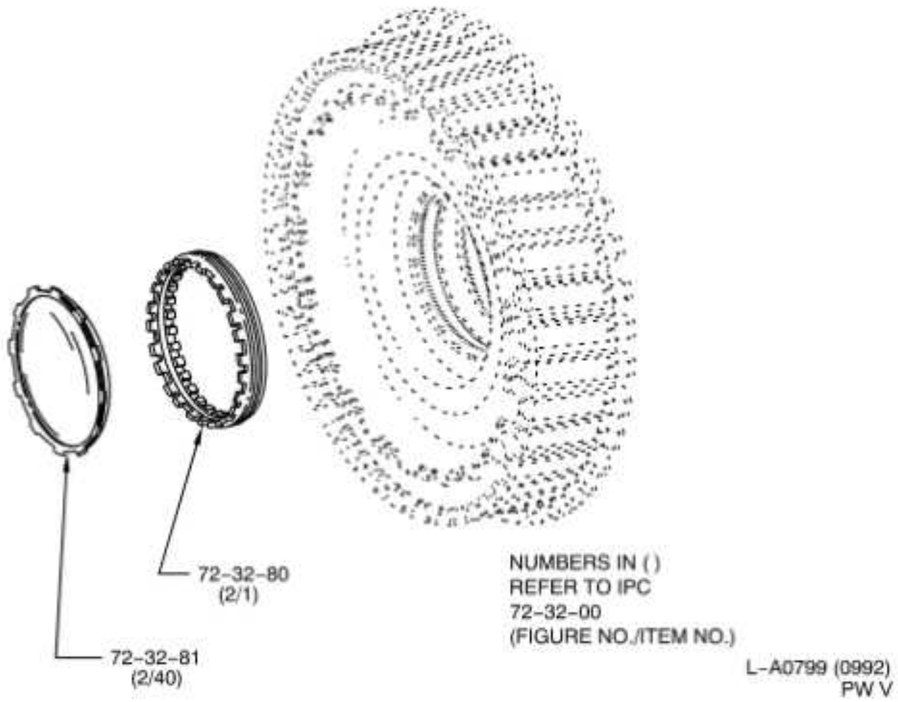
UNASSIGNED .... 72−32−85
through
72−32−98

LPC/LPT COUPLING − HOW TO USE MANUAL


72−32−84
(1/20)
72−32−01
(1/1)
NUMBERS IN ( )
REFER TO IPC
72−32−00
(FIGURE NO./ITEM NO.)
72−32−04
(1/70)
72−32−03
(1/60)
72−32−02
(1/50)
L−A0004 (0992)
PW V

LPC/LPT Coupling
Figure 1 (Sheet 1)
(Task 72−32−00−990−003)

LPC/LPT COUPLING − HOW TO USE MANUAL


72−32−80
(2/1)
72−32−81
(2/40)
NUMBERS IN ( )
REFER TO IPC
72−32−00
(FIGURE NO./ITEM NO.)
L−A0799 (0992)
PW V

LPC/LPT Coupling
Figure 1 (Sheet 2)
(Task 72−32−00−990−003)

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LPC/LPT COUPLING − DESCRIPTION AND OPERATION

Task 72−32−00−990−002:

1. LPC/LPT Coupling

See Figure 1.

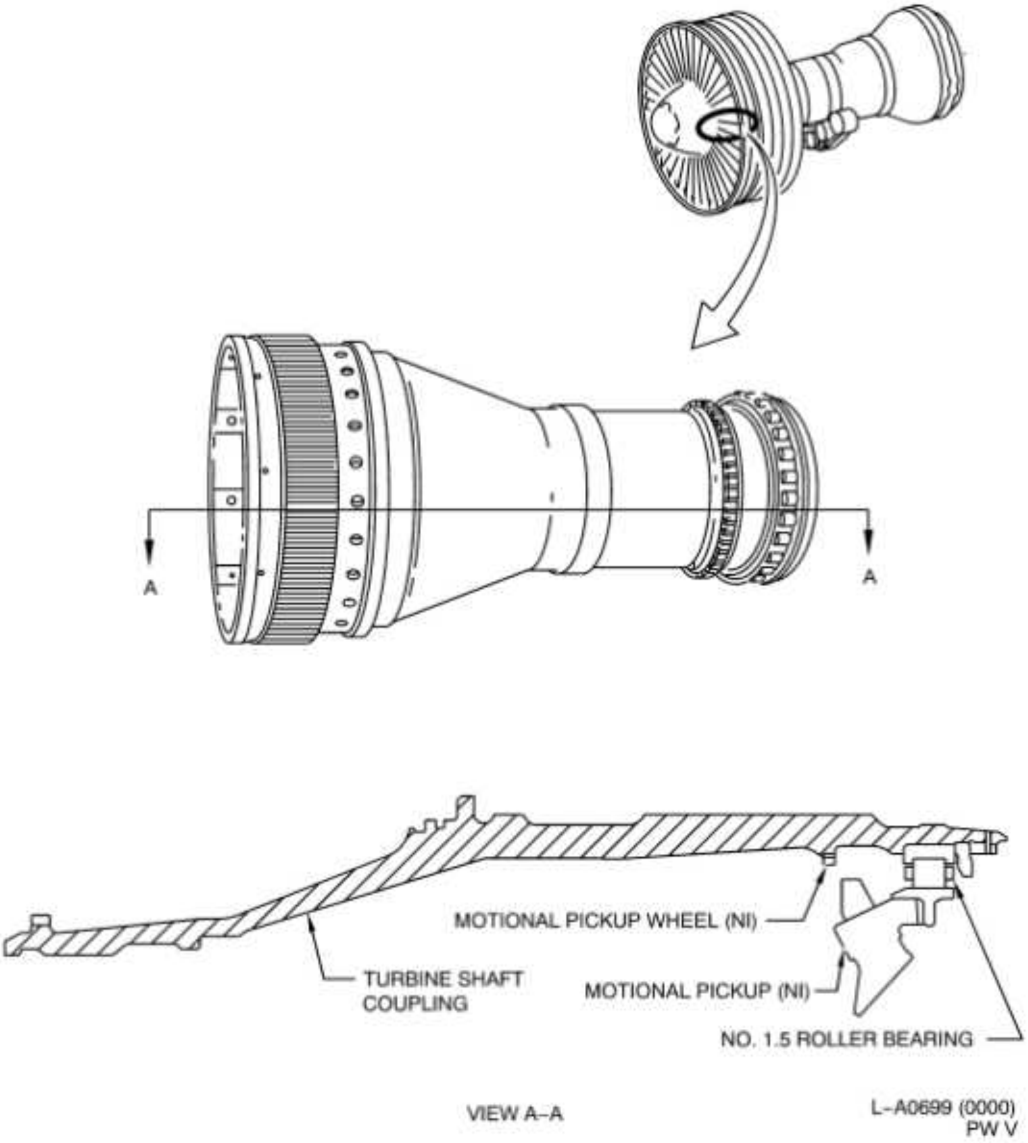
A. General

(1) The low pressure compressor (LPC) rotor is driven by the low pressure turbine (LPT). The LPC/LPT coupling consists of those interface parts that attach and secure the front compressor hub of the LPC rotor to the front compressor drive turbine (LPT) shaft.

(2) The main feature of the LPC/LPT coupling is a titanium turbine shaft coupling which at the front is splined to the front compressor hub and at the rear is splined to the LPT shaft. A steel retaining nut secures the front compressor hub to the turbine shaft coupling while a titanium retaining nut secures the coupling to the LPT shaft. The turbine shaft coupling is supported structurally through the No. 1.5 roller bearing to the intermediate case.

(3) Mounted on the turbine shaft coupling is a steel motional pickup wheel from which the low rotor speed (N1) is determined.

LPC/LPT COUPLING − DESCRIPTION AND OPERATION


A
A
MOTIONAL PICKUP WHEEL (NI)
TURBINE SHAFT COUPLING
MOTIONAL PICKUP (NI)
NO. 1.5 ROLLER BEARING
VIEW A–A
L–A0699 (0000)
PW V

LPC/LPT Coupling
Figure 1
(Task 72−32−00−990−002)

Previous Pageblock Return to Previous Menu Next Pageblock

LPC/LPT COUPLING - DISASSEMBLY-01

Task 72-32-00-030-001-001:

1. Disassemble LPC/LPT Coupling (Mechanical Wrench)
   A. Equipment And Materials Required

      Special Tools:
      PWA 3755 Hydraulic Pump (Optional to PWA 29389)
      PWA 29389 Hydraulic Pump
      PWA 45418 Wrench, Mechanical*
      PWA 45419 Multiplier, Pneumatic*
      PWA 76154 Adapter
      PWA 80071 Multiplier, Torque*
      PWA 80187 Wrench, Mechanical*
      PWA 80651 Multiplier, Pneumatic*
      PWA 85261 Adapter
      PWA 85264 Adapter, Holding*
      PWA 85265 Wrench, Torque*
      PWA 85375 Plate, Anchor*
      PWA 85266 Puller
      PWA 85468 Stand
      PWA 88100 Plate, Anchor*

      *Refer to Table 501 for tool options. Only Table 501 shows the correct combinations of tools for the removal of the No. 1.5 bearing (inner race) retaining nut.

   B. Procedure
      See Figure 501.

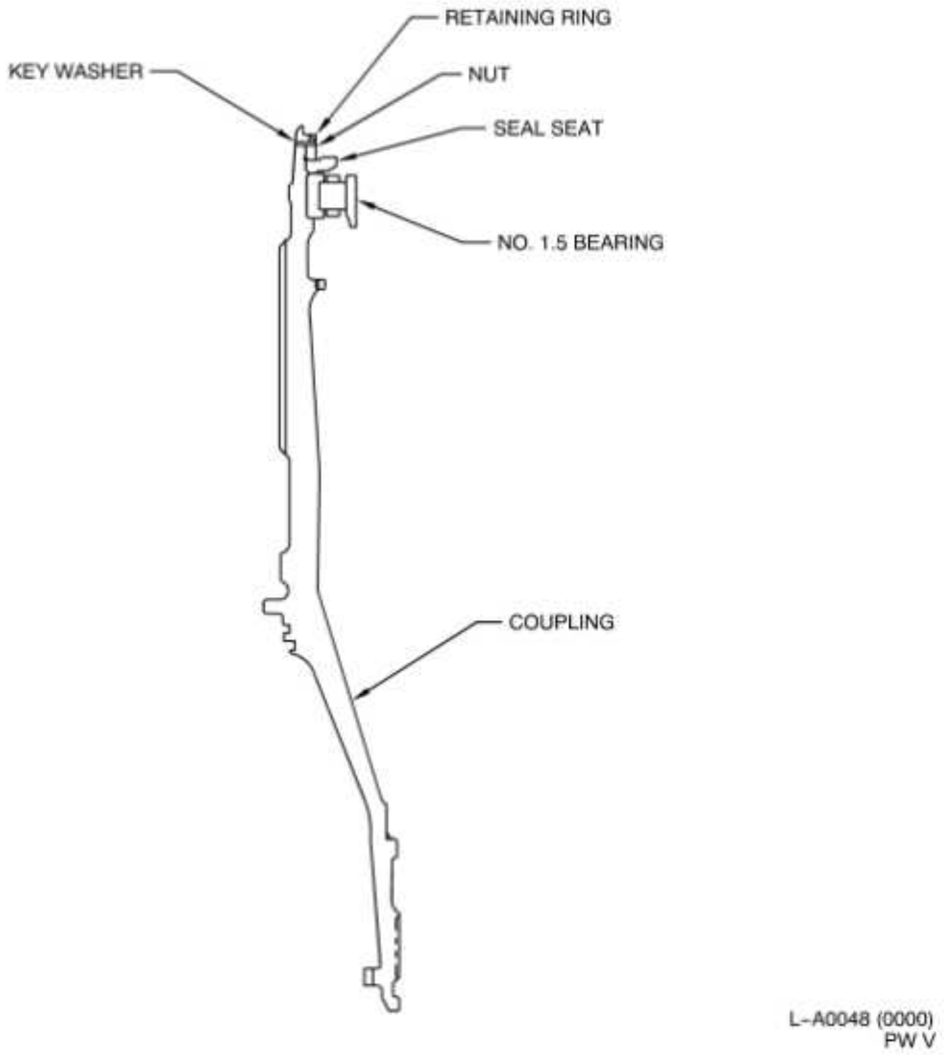
Subtask 72-32-00-030-051:

(1) Install PWA 85261 Adapter to coupling. Attach PWA 76154 Adapter to an appropriate two cable sling to lift and/or trunnion coupling. Install coupling in PWA 85468 Stand, bearing end up.

(2) Remove retaining ring securing key washer between coupling and nut. Remove key washer.

(3) Install PWA 85264 Adapter into coupling aligning splines. Install PWA 85265 Wrench on coupling aligning slots in wrench with slots in retaining nut. Install a torque multiplier or mechanical wrench on the torque wrench. Install an anchor plate and, if you want, a pneumatic multiplier on the mechanical wrench. Refer to Table 501. Loosen and remove nut securing seal seat and No. 1.5 bearing to coupling.

LPC/LPT COUPLING - DISASSEMBLY-01


RETAINING RING
KEY WASHER
NUT
SEAL SEAT
NO. 1.5 BEARING
COUPLING
L-A0048 (0000)
PW V

LPC/LPT Coupling Disassembly
Figure 501
(Task 72-32-00-030-001-001)

LPC/LPT COUPLING − DISASSEMBLY−01

PWA Torque Wrench	PWA Holding Adapter	PWA Mechanical Wrench or Torque Multiplier	PWA Pneumatic Multiplier	PWA Plate Holder or Anchor Plate
85265	85264	80187	80651 or 45419	88100 or 85375
85265	85264	45418	45419	88100 or 85375
85265	85264	80071	80651 or 45419	88100

Matrix Of Tools Used To Remove
The No. 1.5 Bearing (Inner Race) Retaining Nut
Table 501

(4) Remove seal seat from coupling. Place seal seat in protective container.

(5) Install PWA 85266 Puller to No. 1.5 bearing. Using PWA 3755 or PWA 29389 Hydraulic Pump remove bearing from coupling.

NOTE: Use gloves when handling bearing. See Standard Practices Manual.

(6) Install bearing in protective container.

LPC/LPT COUPLING - DISASSEMBLY-02

Task 72-32-00-030-001-002:

1. Disassemble LPC/LPT Coupling (Hydraulic Wrench)

A. Equipment And Materials Required

Special Tools:

PWA 3755	Pump, Hydraulic (Optional to PWA 29389)
PWA 18872	Wrench, Hydraulic*
PWA 28814	Pump*
PWA 28815	Cart*
PWA 29389	Pump, Hydraulic
PWA 29510	Pump*
PWA 33732	Wrench, Hydraulic*
PWA 75046	Cart*
PWA 76154	Adapter, Lifting
PWA 80070	Wrench, Hydraulic*
PWA 85261	Adapter
PWA 85264	Adapter, Holding*
PWA 85265	Wrench, Torque*
PWA 85266	Puller
PWA 85468	Stand
PWA 85516	Wrench, Torque
PWA 85517	Adapter, Holding
PWA 87354	Wrench, Hydraulic*
PWA 88100	Plate, Anchor*

*Refer to Table 501 for tool options. Only Table 501 shows the correct combinations of tools for the removal of the No. 1.5 bearing (inner race) retaining nut.

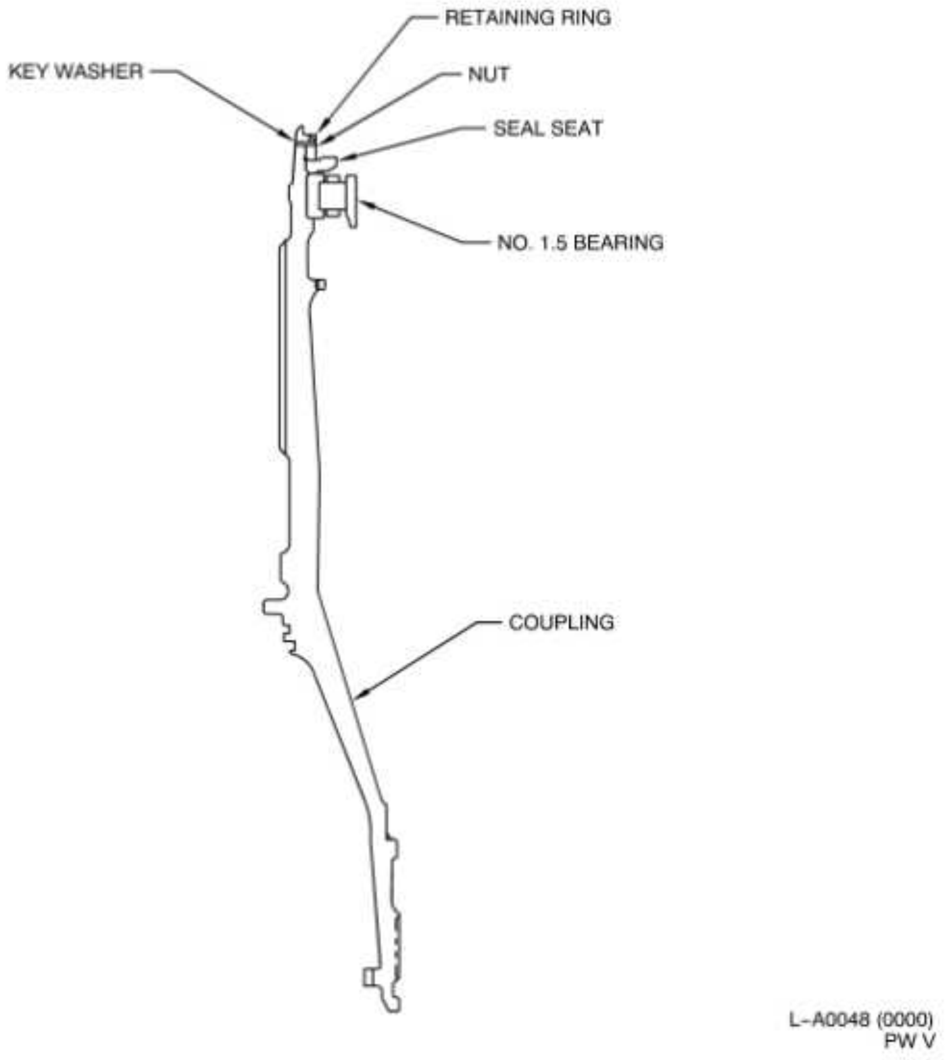
B. Procedure
See Figure 501.

Subtask 72-32-00-030-052:

(1) Install PWA 85261 Adapter to coupling. Attach PWA 76154 Adapter to an appropriate two cable sling to lift and/or trunnion coupling. Install coupling in PWA 85468 Stand, bearing end up.

(2) Remove retaining ring securing key washer between coupling and nut. Remove key washer.

LPC/LPT COUPLING − DISASSEMBLY−02


RETAINING RING
KEY WASHER
NUT
SEAL SEAT
NO. 1.5 BEARING
COUPLING
L-A0048 (0000)
PW V

LPC/LPT Coupling Disassembly
Figure 501
(Task 72−32−00−030−001−002)

LPC/LPT COUPLING - DISASSEMBLY-02

PWA Torque Wrench	PWA Holding Adapter	PWA Hydraulic Wrench	PWA Anchor Plate	PWA Pump	PWA Cart
85516	85517	33732	-----	28814 or 29510	75046
85516	85517	18872	-----	28814 or 29510	75046 or 28815
85265	85264	87354	88100	28814 or 29510	75046
85265	85264	80070	88100	28814 or 29510	75046

Matrix Of Tools Used To Remove
The No. 1.5 Bearing (Inner Race) Retaining Nut
Table 501

(3) Install a holding adapter into coupling aligning splines. Install a torque wrench on coupling aligning slots in wrench with slots in retaining nut. Install a hydraulic wrench on the torque wrench. If applicable, install the anchor plate on the hydraulic wrench. Loosen and remove nut securing seal seat and No. 1.5 bearing to coupling.

(4) Remove seal seat from coupling. Place seal seat in protective container.

(5) Install PWA 85266 Puller to No. 1.5 bearing. Using PWA 3755 or PWA 29389 Hydraulic Pump remove bearing from coupling.

NOTE: Use gloves when handling bearing. See Standard Practices Manual.

(6) Install bearing in protective container.

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LPC/LPT COUPLING - INSPECTION/CHECK-01

Task 72-32-00-990-004:

1. General Inspection Requirements - LPC/LPT Coupling

A. Organization Of Individual Part Or Subassembly Inspection Data

(1) Specific inspection functions for all significant parts/subassemblies are provided in individual Inspection/Check sections. Application of each inspection function is shown in Inspection/Check-00 for part/subassembly. Section designations and function descriptions are as follows.

(2) Inspection/Check-00 section contains, where applicable:

(a) Part number(s) for which the inspection data is applicable.

(b) Service Bulletin numbers applicable to part number(s).

(c) Inspection/Check numbers, data categories and applicability data.

(3) Inspection/Check-01, Preinspection Preparation, contains, where applicable:

(a) General inspection comments, notes, CAUTIONS, etc., which supplement data contained in this section.

(b) Identification of mechanical disassembly required prior to inspection.

(c) Identification of any surface treatment or coating removal, or other actions required prior to inspection.

(d) Identification of part/subassembly cleaning required prior to inspection.

(4) Inspection/Check-02, Nondestructive Inspection, contains the following nondestructive inspection methods, part/subassembly special attention areas and damage limits (as applicable):

(a) Fluorescent Penetrant Method

(b) Eddy Current Method

   - (c) Magnetic Particle Method
   - (d) X−ray Method
   - (e) Ultrasonic Method
   - (f) Hardness Check
   - (g) Other − As specified.

(5) Inspection/Check−03, Visual Inspection contains, where applicable:

   - (a) Visual inspection requirements which can be accomplished with or without magnification or special lighting (as specified).

     NOTE: Use of inspection tools may be required as a supplement to visual inspection process.

   - (b) Allowable blending for visual damage, which may be accomplished within the inspection area.

     NOTE: Blending requirement will also be shown in applicable repairs.

(6) Inspection/Check−04, Dimensional Inspection, contains, where applicable:

   - (a) Dimensional inspection requirements other than visual inspection. The requirements will include applicable fits and clearances, and other dimensional inspections necessary to ensure the part integrity and proper functioning.

(7) Inspection/Check−05, Functional Check Inspection contains, where applicable:

   - (a) Procedures, limits, and equipment used with any required functional checks (oil flow, air flow, leak, etc.).

(8) Inspection/Check−06, Inspection Postrequisites contains, references to procedures required to return part/ subassembly to serviceable condition. References include the following, as required.

   - (a) Reassembly

(b) Protective coatings, sealants and/or lubricant reapplication

B. Thorough and intelligent part/subassembly inspection is of major importance in achieving efficient engine operation and satisfactory service life. Inspection personnel should be thoroughly familiar with inspection procedures, inspection tooling, limits associated with normal and, where applicable, unusual operating conditions, limits associated with repairs, and with inspection procedures published in Standard Practices Manual.

C. During preliminary inspection of part/subassembly, comparison with mating or adjacent parts may provide indication of source of wear or damage. This procedure may indicate requirement for additional disassembly and inspection.

D. During inspection, records should be kept of deviations beyond serviceable limits to determine: (a) if part/subassembly will be repaired or replaced, and (b) if part is reparable, which repairs are required. Suitable documentation should accompany part/subassembly with results of this determination.

E. Inspection of individual part/subassembly dimensions which are also in Fits and Clearances will include Fits and Clearance Reference Numbers and will show new part/subassembly dimension unless specifically stated otherwise. Inspection Frequency Requirements (IFR) codes (for IFR Code A parts only) are included with Reference Number data. If acceptable dimensional deviations or results of repair affect Fits and Clearances, suitable documentation should accompany part/subassembly to ensure check of fit or clearance at final assembly.

NOTE: Parts/subassemblies which deviate dimensionally from new part/subassembly values may be acceptable provided required fit or clearance is achieved at final assembly.

LPC/LPT COUPLING − INSPECTION/CHECK−01

F. Dimensional inspection requirements will be accompanied by part/subassembly constraint data if such constraint requirements are required during part/subassembly manufacture. Adherence to constraint requirements when inspecting service operated parts/subassemblies should be dictated by experience. It is recommended that parts/subassemblies which do not meet dimensional inspection requirements in free state be constrained and re−measured prior to initiation of any repair or re−use activity.

G. Dimensional inspections of one detail of a subassembly, prior to removal from subassembly, may produce incorrect data due to constraint forces from mating details. If questionable data is obtained, subassembly should be disassembled and inspections repeated.

H. Dimensional inspection limits in inspection text provide continued use (as is) and, if applicable, repair limits. Parts/subassemblies which exceed both limits and nonreparable parts/subassemblies which exceed (as is) limits are unserviceable.

I. Inspections required to verify integrity of repair are contained within repair procedure. Unless otherwise stated, repaired part is expected to meet all inspection requirements contained in inspection text for part/subassembly.

J. Parts/subassemblies which do not require repairs except for those provided in Standard Practices Manual are identified by Chapter/Section/Subject Number 72−32−99 in cleaning table (Cleaning−01) and nondestructive inspection table (Inspection/Check−02). Determination of serviceability for those parts listed in 72−32−99 is limited to cleaning, non−destructive inspection, and the following:

(1) Visually inspect parts/subassemblies for surface defects, deformations, cuts, improper threads or wrenching surfaces, incomplete or missing protective coatings or other damage which will prevent proper functioning and make part/subassembly unserviceable. Unserviceable parts/subassemblies should not be reinstalled. Repair unserviceable parts/subassemblies per Standard Practices Manual, as applicable.

(2) Parts/subassemblies with crack indications to any length or depth detected by listed nondestructive inspection are unserviceable, and should not be reinstalled.

LPC/LPT COUPLING − INSPECTION/CHECK−01

K. When new part/subassembly is to be installed and it is important that it be identified as to engine number or position in engine, mark it by appropriate method described in Marking of Parts, 70−11, Standard Practices Manual.

L. In order to eliminate confusion and to maintain consistent terminology, various physical conditions which might be encountered during inspection of parts/subassemblies and explanation of unusual causes of such conditions are defined in Physical Inspection, 70−31, Standard Practices Manual.

M. If inspection reveals it necessary to replace fitted spacer, tag spacer to indicate that replacement must be made with spacer of correct classification at assembly.

N. If text refers to superficial or shallow imperfection, following definitions apply:

   (1) A superficial imperfection is defined as a nick, dent, scratch, toolmark, etc., which disrupts the surface but does not appear to penetrate surface roughness texture.

   (2) A shallow imperfection appears to penetrate surface finish texture, but does not have a dark bottom and would not cause a 0.007 inch (.178 mm) radius stylus to hesitate if passed over it.

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LPC/LPT COUPLING - INSPECTION/CHECK-03

Task 72-32-00-990-005:

1. Visual Inspection - LPC/LPT Coupling
   A. For inspection requirements applicable to installed (accessible) parts of LPC/LPT coupling see 72-00-32, Inspection/Check-XX (Task 72-00-32-XXX-XXX).

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LPC/LPT COUPLING - INSPECTION/CHECK-04

Task 72-32-00-990-001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

LPC/LPT COUPLING − INSPECTION/CHECK−04

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurement taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131)	(-)	0.512 (13.005)	=	.005 (0.126)
0.527 (13.385)	(-)	0.508 (12.903)	=	.019 (0.482)

EXAMPLE 2

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
765	B	Turbine Shaft Coupling Assembly (72-32-01) Front Compressor Hub Assembly (72-31-07) (See Figure 801, Sheet 2)				
		Coupling	12.0630 (306.401)	12.0640 (306.425)		
		Hub	12.0610 (306.350)	12.0630 (306.400)	.003T (0.076T)	.000T (0.000T)
766	B	Turbine Shaft Coupling Assembly (72-32-01) Front Compressor Hub Assembly (72-31-07) (See Figure 801, Sheet 1)				
		Coupling	11.1253 (282.583)	11.1263 (282.608)		
		Hub	11.1195 (282.436)	11.1205 (282.460)	.0068T (0.172T)	.0048T (0.122T)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
767	B	Turbine Shaft (Coupling Retaining) Nut (72−32−80) Front Compressor Hub Assembly (72−31−07) (See Figure 801, Sheet 2)				
		Nut	12.057 (306.248)	12.060 (306.324)		
		Hub	12.061 (306.375)	12.063 (306.400)	.001 (0.025)	.006 (0.152)
768	B	Turbine Shaft Nut (72−32−84) Turbine Shaft Coupling Assembly (72−32−01) (See Figure 801, Sheet 1)				
		Nut	4.438 (112.726)	4.440 (112.776)		
		Coupling	4.443 (112.853)	4.445 (112.903)	.003 (0.077)	.007 (0.177)
769	B	Front Compressor Drive Turbine (LPT) Shaft (72−53−80) Turbine Shaft Coupling Assembly (72−32−01) (See Figure 801, Sheet 1)				
		Shaft	5.2995 (134.608)	5.3005 (134.632)		
		Coupling	5.2975 (134.557)	5.2985 (134.581)	.003T (0.076T)	.001T (0.026T)
771	B	Front Compressor Drive Turbine (LPT) Shaft (72−53−80) Turbine Shaft Coupling Assembly (72−32−01) (See Figure 801, Sheet 2)				
		Shaft	5.6995 (144.768)	5.7005 (144.792)		
		Coupling	5.6975 (144.717)	5.6985 (144.741)	.003T (0.076T)	.001T (0.026T)
772	A	Turbine Shaft Coupling Assembly (72−32−01) No. 1.5 Roller Bearing (Inner Race) (72−32−02) (See Figure 801, Sheet 2)				
		Shaft	6.5593 (166.607)	6.5603 (166.631)		
		Bearing	6.5585 (166.5859)	6.5591 (166.6011)	.0018T (0.045T)	.0002T (0.006T)

	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
773	B	Turbine Shaft Coupling Assembly (72−32−01) No. 1.5 Bearing Seal Seat (72−32−03) (See Figure 801, Sheet 2)				
		Coupling	6.545 (166.243)	6.546 (166.268)		
		Seat	6.547 (166.294)	6.549 (166.344)	.001 (0.026)	.004 (0.101)
774	A	No. 1.5 Roller Bearing (Outer Race) (72−32−02) No. 1.5 Bearing Support Assembly (72−34−20) (See Figure 801, Sheet 2)				
		Bearing	10.4695 (265.9253)	10.4702 (265.9430)		
		Support	10.4671 (265.865)	10.4684 (265.897)	.0031T (0.078T)	.0011T (0.028T)

G. Turbine Shaft Coupling Assembly Limits

	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
2021	A	Turbine Shaft Coupling Assembly See Chapter 5−10−00, Time Limits (See Figure 801, Sheet 1)				

H. Spline Data

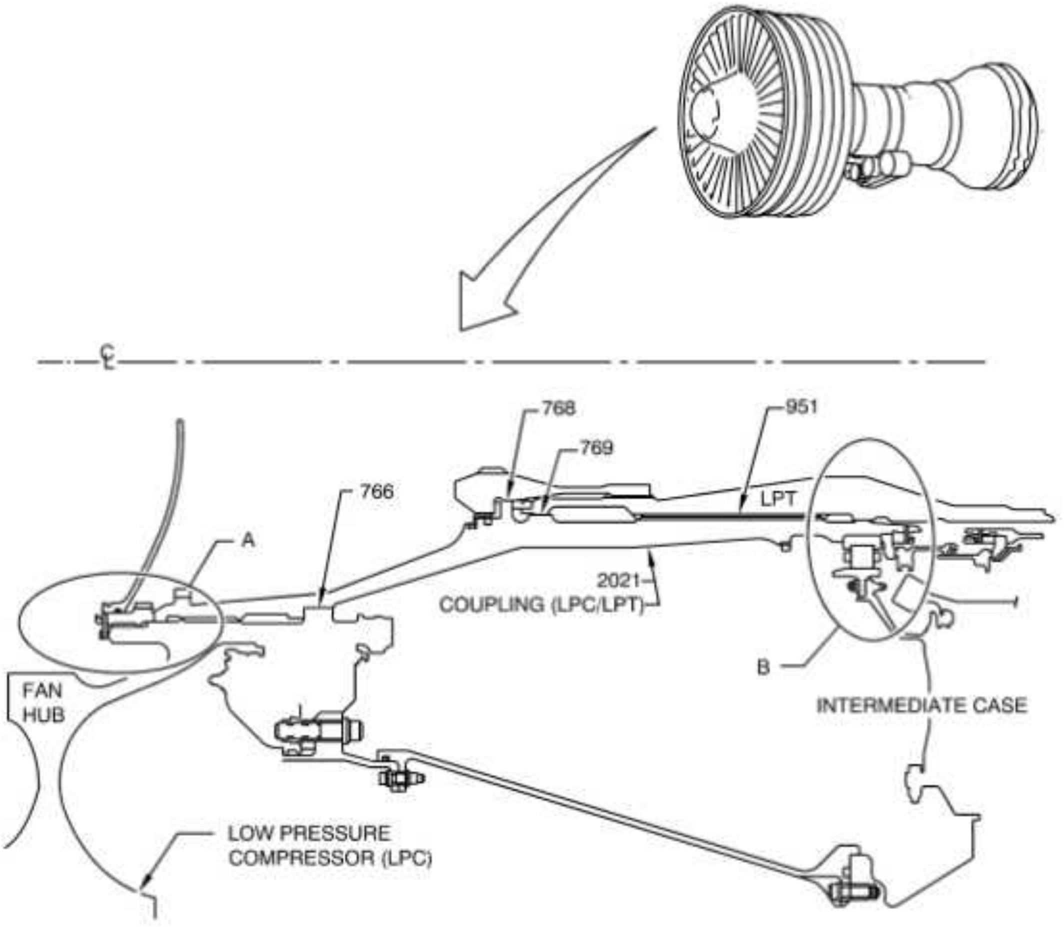
	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
950	B	1. Front Compressor Hub Assembly (72−31−07) Internal Spline (See Figure 801, Sheet 2)				
		A. Effective Space Width	.0982 (2.494)	−−−		
		B. Actual Space Width	−−−	.1023 (2.598)		

Ref.	I F		New Part Reference Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
(CONTINUED)						
		2. Turbine Shaft Coupling Assembly (72–32–01) External Spline (See Figure 801, Sheet 2)				
		A. Effective Tooth Thickness	---	.0967 (2.456)		
		B. Actual Tooth Thickness	.0926 (2.352)	---		
		3. Fit			.0015 (0.038)	---
951	B	1. Turbine Shaft Coupling Assembly (72–32–01) Internal Spline (Straight, Uncrowned, Portion Of Spline) (See Figure 801, Sheet 1)				
		A. Effective Space Width	.1309 (3.325)	---		
		B. Actual Space Width	---	.1341 (3.406)		
		2. Front Compressor Drive Turbine (LPT) Shaft (72–53–80) External Spline (See Figure 801, Sheet 1)				
		A. Effective Tooth Thickness	---	.1294 (3.287)		
		B. Actual Tooth Thickness	.1262 (3.205)	---		
		3. Fit			.0015 (0.038)	---

LPC/LPT COUPLING − INSPECTION/CHECK−04

I. Special Torques

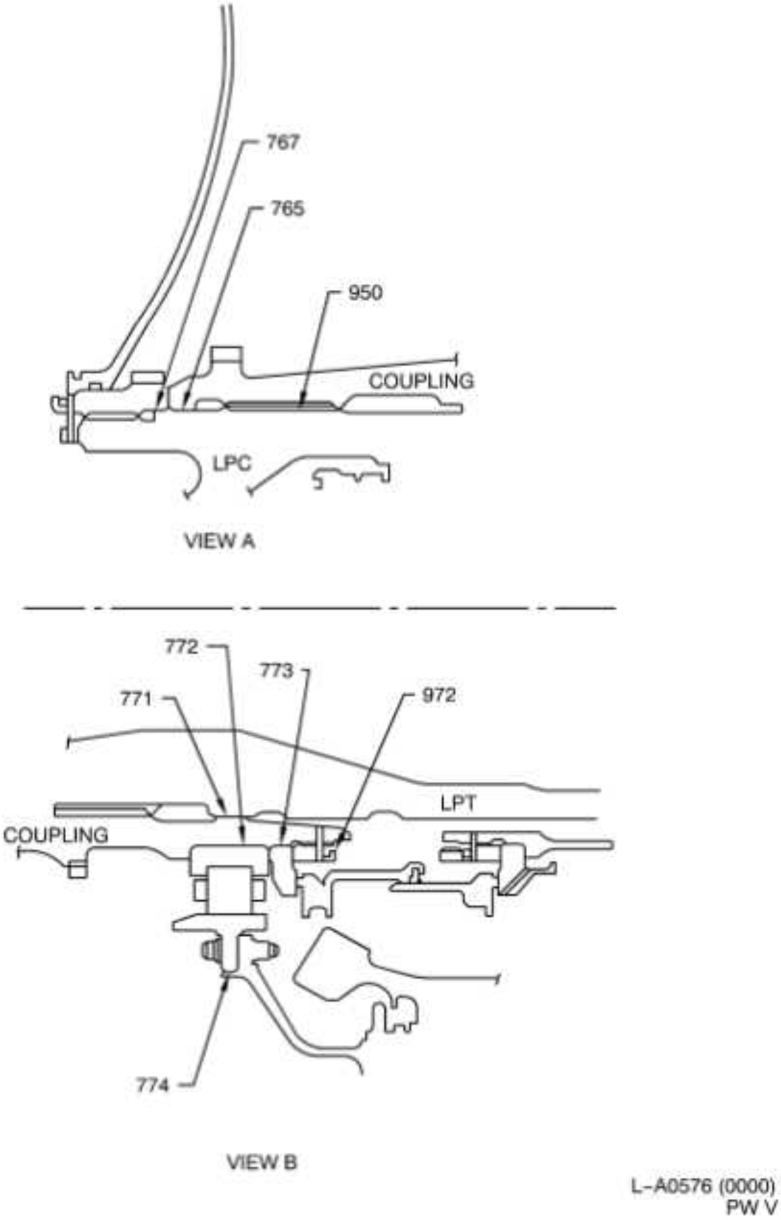
Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
972	A	No. 1.5 Bearing (Inner Race) Retaining Nut (See Figure 801, Sheet 2) See 72−32−00, Assembly−01 Task 72−32−00−400−001−001 See 72−32−00, Assembly−02 Task 72−32−00−400−001−002				


℄
768
951
769
766
LPT
A
2021
COUPLING (LPC/LPT)
B
FAN
HUB
INTERMEDIATE CASE
LOW PRESSURE
COMPRESSOR (LPC)

L−A0575 (0486)
PW V

LPC/LPT Coupling
Figure 801 (Sheet 1)
(Task 72−32−00−990−001)

LPC/LPT COUPLING − INSPECTION/CHECK−04


767
765
950
COUPLING
LPC
VIEW A
772
773
771
972
LPT
COUPLING
774
VIEW B
L-A0576 (0000)
PW V

LPC/LPT Coupling
Figure 801 (Sheet 2)
(Task 72−32−00−990−001)

LPC/LPT COUPLING - ASSEMBLY-01

Task 72-32-00-400-001-001:

1. Assemble LPC/LPT Coupling (Mechanical Wrench)

A. Prerequisites

(1) See 72-32-00, Inspection/Check-04 Task 72-32-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:

PWA 45418	Wrench, Mechanical*
PWA 45419	Multiplier, Pneumatic*
PWA 76154	Adapter
PWA 80071	Multiplier, Torque*
PWA 80187	Wrench, Mechanical*
PWA 80651	Multiplier, Pneumatic*
PWA 85261	Adapter
PWA 85262	Guide, Piloting
PWA 85263	Drift
PWA 85264	Adapter, Holding*
PWA 85265	Wrench, Torque*
PWA 85375	Plate, Anchor*
PWA 85468	Stand
PWA 88100	Plate, Anchor*

NOTE: *Refer to Table 1001 for tool options. Only Table 1001 shows the correct combinations of tools for the installation of the No. 1.5 bearing (inner race) retaining nut.

C. Procedure
See Figure 1001.

Subtask 72-32-00-430-051:

(1) Heat the No. 1.5 bearing inner race and rollers. See Standard Practices Manual, PN 585005.

(2) Install PWA 85261 Adapter to coupling. Attach PWA 76154 Adapters to appropriate 2 cable sling to lift and/or trunnion coupling. Position coupling on PWA 85468 Stand front end down. Install PWA 85262 Guide into end of coupling.

LPC/LPT COUPLING − ASSEMBLY−01

(3) Following assembly procedure should be accomplished as rapidly as possible.

  (a) Using proper gloves, position the heated No. 1.5 bearing on the coupling (mating mark up).

  (b) Install PWA 85263 Drift to pilot on rod of guide on coupling. Drift bearing to seat on coupling.

  (c) Leave the drift on the bearing until it cools to 75° − 85°F (23.9° − 29.4°C).

  (d) Remove drift from coupling.

  (e) Make sure the inner race of the bearing has cooled to 75° − 85°F (23.9° − 29.4°C) before you continue with the assembly procedure.

(4) Install seal seat over coupling with "REAR" up and butt against bearing.

(5) Install retaining nut to secure bearing and seal seat. Refer to Table 1001 for the correct combinations of tools.

PWA Torque Wrench	PWA Holding Adapter	PWA Mechanical Wrench or Torque Multiplier	PWA Pneumatic Multiplier	PWA Plate Holder or Anchor Plate
85265	85264	80187	80651 or 45419	88100 or 85375
85265	85264	45418	45419	88100 or 85375
85265	85264	80071	80651 or 45419	88100

Matrix Of Tools Used To Install The No. 1.5 Bearing (Inner Race) Retaining Nut
Table 1001

LPC/LPT COUPLING − ASSEMBLY−01

(6) Install PWA 85264 Adapter into coupling, aligning splines. Install PWA 85265 Torque Wrench on coupling, aligning slots in wrench with slots in retaining nut. Install a mechanical wrench on the torque wrench. Install an anchor plate on the mechanical wrench.

NOTE: Wrench may be actuated using a pneumatic multiplier.

(7) (Reference 972) Torque nut as follows:

(a) Tighten nut to 2200 − 2800 lb−in. (248.567 −
R 316.357 N.m). Turn nut through angle of 11 − 12
R degrees 12 minutes and loosen nut to zero.

(b) Tighten nut to 2200 − 2800 lb−in. (248.567 − 316.357 N.m).

(c) Establish common reference points between nut and its mating part.

R (d) Turn nut through angle of 11 − 12 degrees 12
R minutes.

(e) Loosen nut to zero and repeat step (b).

(f) If nut reference point is in line with mating part reference point or beyond it within 2 degrees maximum, apply final angle of turn per step (d).

(g) If reference points are not within limits, repeat steps (c), (d) and (e) in order until reference points are within limits. Then perform step (f).

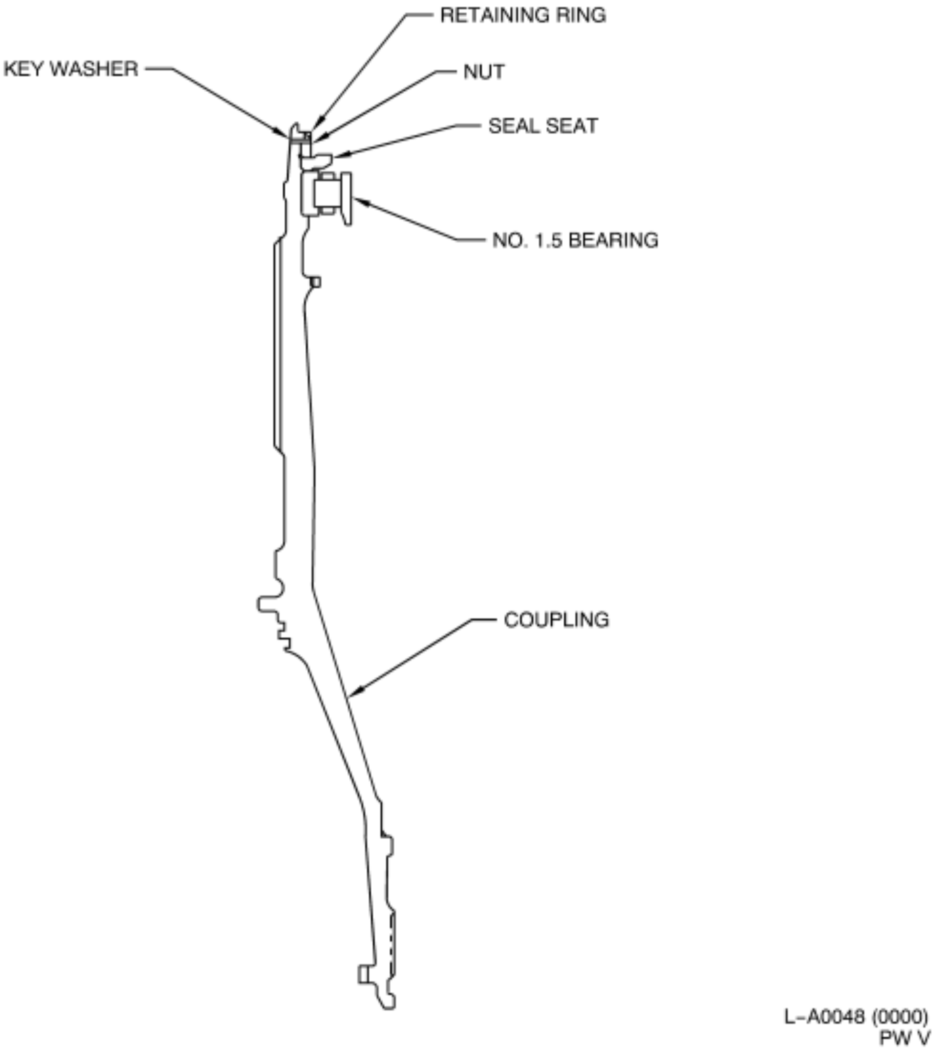
(8) Remove tooling from coupling.

(9) Check, with a 0.001 inch (0.025 mm) feeler gage, that the seal seat and bearing are correctly seated on the coupling. The seal seat and bearing are correctly seated if you are unable to fit the 0.001 inch (0.025 mm) feeler gage between the coupling shoulder, bearing and seal seat.

(10) Install key washer to nut and coupling. Install retaining ring to secure key washer.

(11) Install protector around bearing and seal seat.

LPC/LPT COUPLING - ASSEMBLY-01


RETAINING RING
KEY WASHER
NUT
SEAL SEAT
NO. 1.5 BEARING
COUPLING
L-A0048 (0000)
PW V

LPC/LPT Coupling Assembly
Figure 1001
(Task 72-32-00-400-001-001)

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Task 72-32-00-400-001-002:

1. Assemble LPC/LPT Coupling (Hydraulic Wrench)

A. Prerequisites

(1) See 72-32-00, Inspection/Check-04 Task 72-32-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows:

B. Equipment And Materials Required

Special Tools:

PWA 18872	Wrench, Hydraulic*
PWA 28814	Pump*
PWA 28815	Cart*
PWA 29510	Pump*
PWA 33732	Wrench, Hydraulic*
PWA 75046	Cart*
PWA 76154	Adapter
PWA 80070	Wrench, Hydraulic*
PWA 85261	Adapter
PWA 85262	Guide
PWA 85263	Drift
PWA 85264	Adapter, Holding*
PWA 85265	Wrench, Torque*
PWA 85468	Stand
PWA 85516	Wrench
PWA 85517	Adapter
PWA 87354	Wrench, Hydraulic*
PWA 88100	Plate, Anchor*

NOTE: *Refer to Table 1001 for tool options. Only Table 1001 shows the correct combinations of tools for the installation of the No. 1.5 bearing (inner race) retaining nut.

C. Procedure
See Figure 1001.

Subtask 72-32-00-430-052:

(1) Heat the No. 1.5 bearing inner race and rollers. See Standard Practices Manual, PN 585005.

LPC/LPT COUPLING − ASSEMBLY−02

(2) Install PWA 85261 Adapter to coupling. Attach PWA 76154 Adapter to appropriate 2 cable sling to lift and/or trunnion coupling. Position coupling on PWA 85468 Stand front end down. Install PWA 85262 Guide into end of coupling.

(3) Following assembly procedure should be accomplished as rapidly as possible.

  (a) Using proper gloves, position the No. 1.5 bearing on the coupling (mating mark up).

  (b) Install PWA 85263 Drift to pilot on rod of guide on coupling. Drift bearing to seat on coupling.

  (c) Leave the drift on the bearing until it cools to 75° − 85°F (23.9° − 29.4°C).

  (d) Remove drift from coupling.

  (e) Make sure the inner race of the bearing has cooled to 75° − 85°F (23.9° − 29.4°C) before you continue with the assembly procedure.

(4) Install seal seat over coupling with "REAR" up and butt against bearing.

(5) Install retaining nut to secure bearing and seal seat. Refer to Table 1001 for the correct combinations of tools.

PWA Torque Wrench	PWA Holding Adapter	PWA Hydraulic Wrench	PWA Anchor Plate	PWA Pump	PWA Cart
85516	85517	33732	-----	28814 or 29510	75046
85516	85517	18872	-----	28814 or 29510	75046 or 28815
85265	85264	87354	88100	28814 or 29510	75046
85265	85264	80070	88100	28814 or 29510	75046

Matrix Of Tools Used To Torque The Retaining Nut
Table 1001

LPC/LPT COUPLING − ASSEMBLY−02

(6) Install an adapter into coupling, aligning splines. Install a torque wrench on coupling, aligning slots in wrench with slots in retaining nut. Install a hydraulic wrench on the torque wrench. If applicable, install an anchor plate on the hydraulic wrench.

(7) (Reference 972) Torque nut as follows:

(a) Tighten nut to 2200 − 2800 lb−in. (248.567 − 316.357 N.m). Turn nut through angle of 11 − 12 degrees 12 minutes. Loosen nut to zero. R R

(b) Tighten nut to 2200 − 2800 lb−in. (248.567 − 316.357 N.m).

(c) Establish common reference points between nut and its mating part.

R R (d) Turn nut through angle of 11 − 12 degrees 12 minutes.

(e) Loosen nut to zero and repeat step (b).

(f) If nut reference point is in line with mating part reference point or beyond it within 2 degrees maximum, apply final angle of turn per step (d).

(g) If reference points are not within limits, repeat steps (c), (d) and (e) in order until reference points are within limits. Then perform step (f).

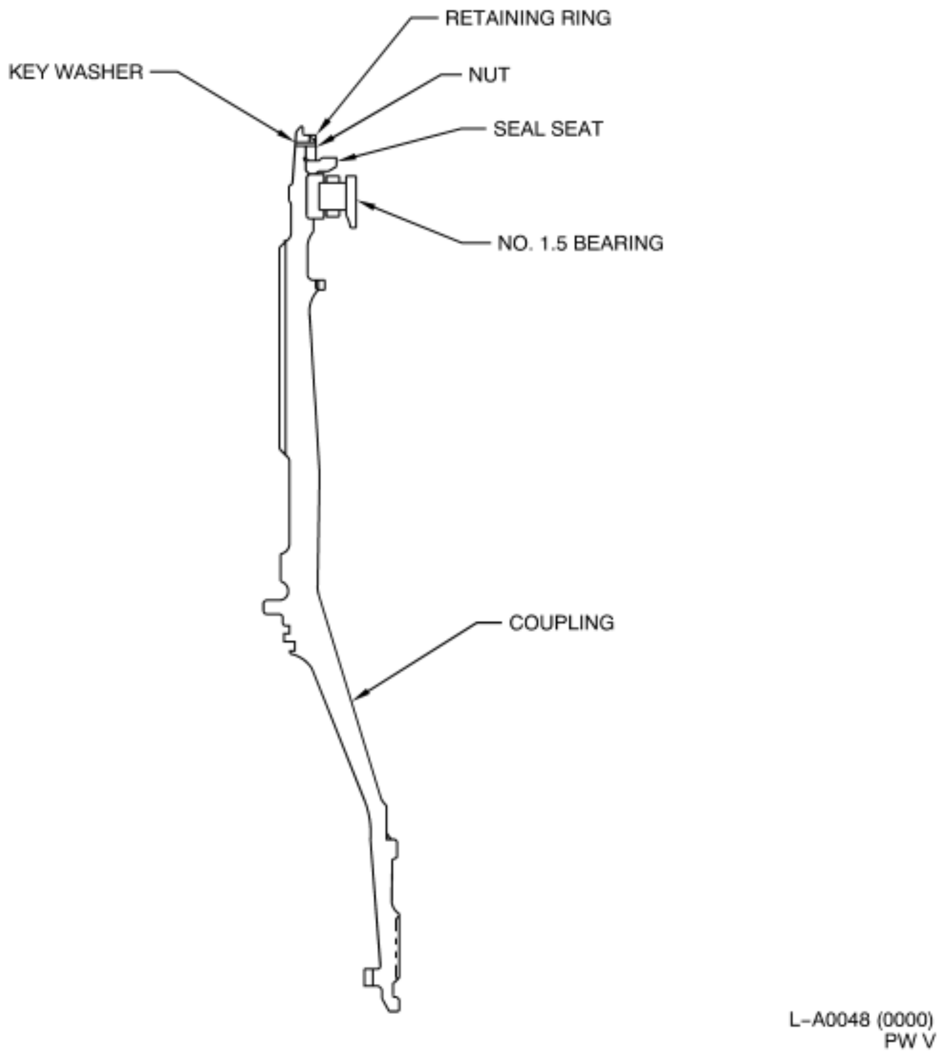
(8) Remove tooling from coupling.

(9) Check, with a 0.001 inch (0.025 mm) feeler gage, that the seal seat and bearing are correctly seated on the coupling. The seal seat and bearing are correctly seated if you are unable to fit the 0.001 inch (0.025 mm) feeler gage between the coupling shoulder, bearing and seal seat.

(10) Install key washer to nut and coupling. Install retaining ring to secure key washer.

(11) Install protector around bearing and seal seat.

LPC/LPT COUPLING − ASSEMBLY−02


RETAINING RING
KEY WASHER
NUT
SEAL SEAT
NO. 1.5 BEARING
COUPLING
L−A0048 (0000)
PW V

LPC/LPT Coupling Assembly
Figure 1001
(Task 72−32−00−400−001−002)

Pratt & Whitney
PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

Tab Separator - LPC/LPT Coupling

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REVISION NO. 75 DATED MARCH 15, 2005

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72−32−00 ASSEMBLY−02	1003	Increased the angle of turn for the No. 1.5 bearing inner race retaining nut. (IEN03KA121)	ALL

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CHAPTER 72

LPC/LPT COUPLING

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FAN CASE − HOW TO USE

Task 72−33−00−990−003:

1. Chapter/Section/Subject Numbering Outline

See Figure 1.

NOTE: See the tab separated How To Use Manual section located at the beginning of this manual set for information concerning Data Location Guidelines and a complete Chapter/Section/Subject numbering outline for all manual sections.

A. The following is a complete listing of the individual Chapter/Section/Subject numbers and specific nomenclatures which have been assigned to the significant Fan Case parts.

(1) Numbers which are not assigned are indicated in the list by one of the following terms:

UNASSIGNED − This designation is for numbers intentionally omitted and reserved for possible future use.

NOT USED − This designation is applied to numbers used in other related engine model programs which are not, at this time, applicable to the engine models represented by this manual.

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FAN CASE - HOW TO USE

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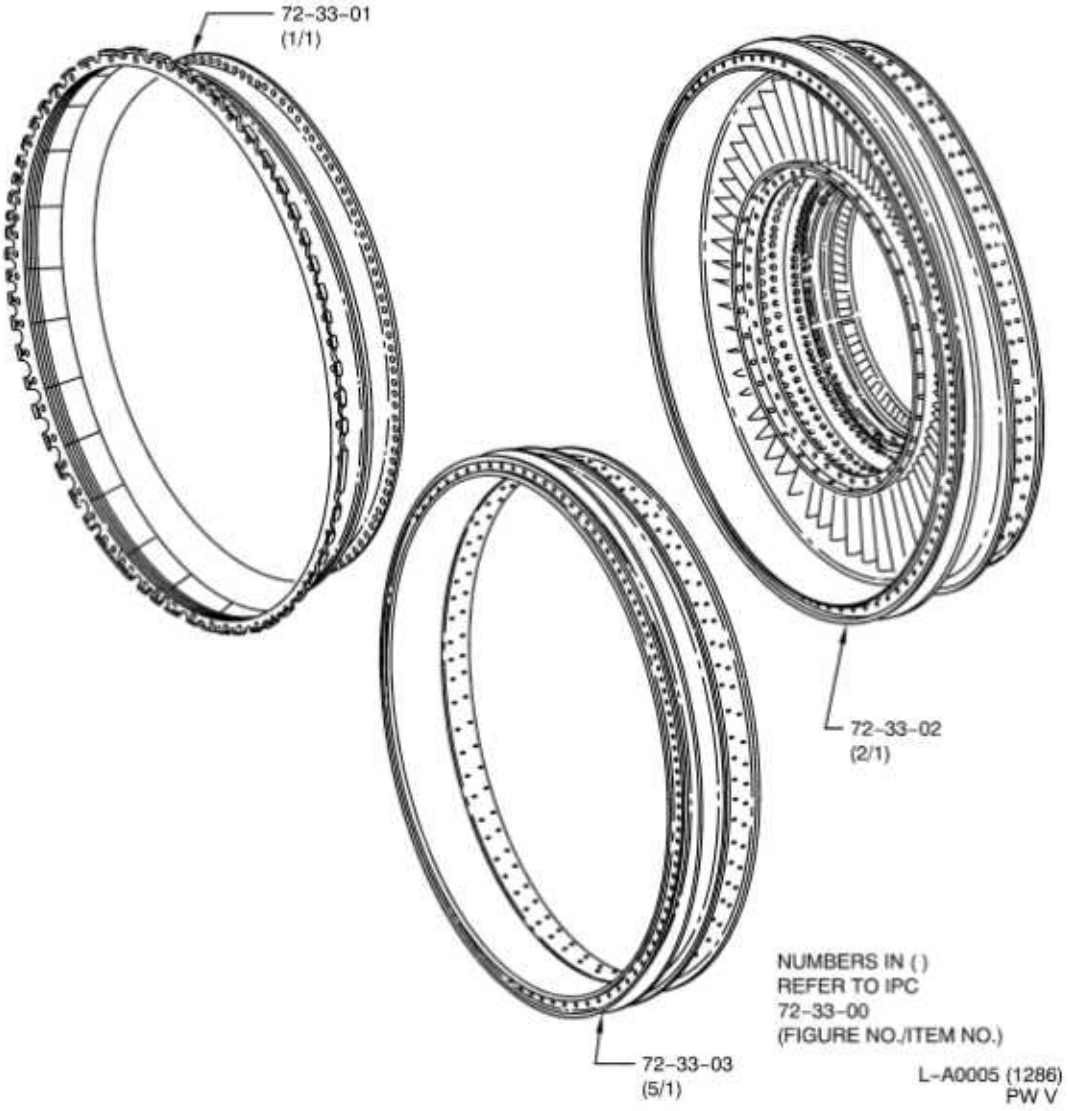
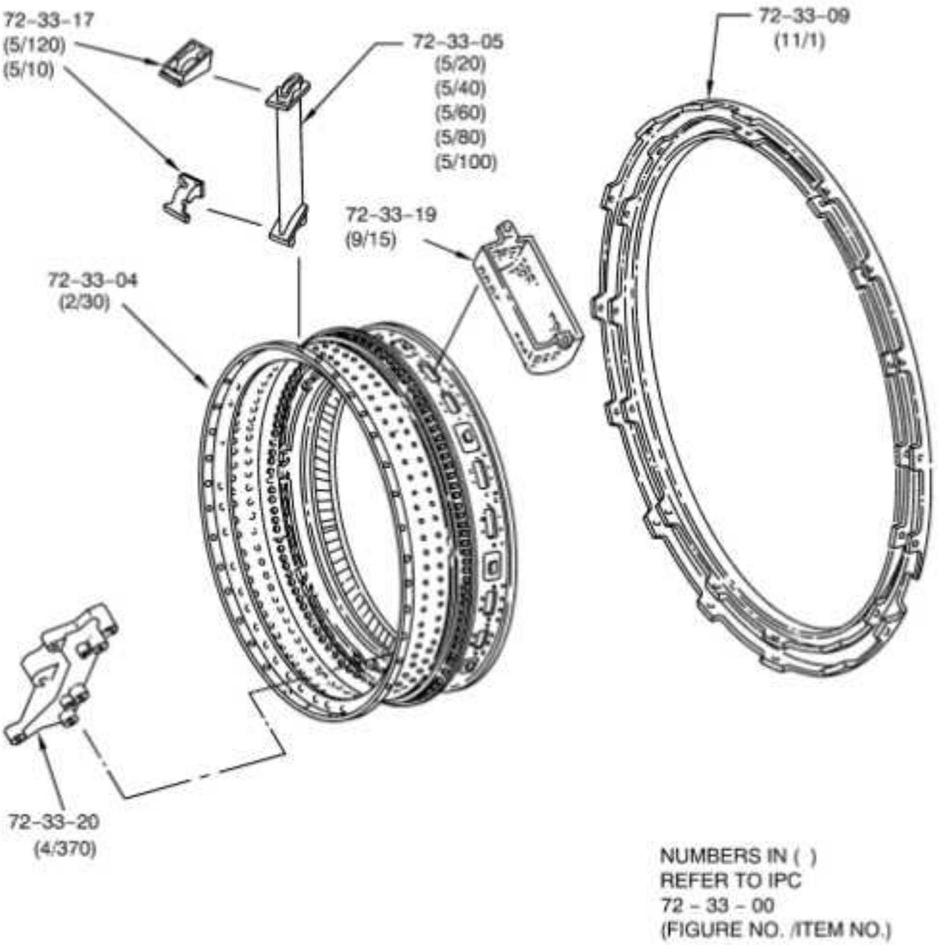
NOT USED	72-33-77 through 72-33-79
FAN EXIT (INNER) LINER SEGMENT ASSEMBLIES	72-33-80
FAN EXIT (FRONT) LINER SEGMENT ASSEMBLY	72-33-81
FAN EXIT INNER (BIFURCATION) FAIRING ASSEMBLY	72-33-82
FAN EXIT OUTER (BIFURCATION) FAIRING ASSEMBLY	72-33-83
NO. 3 BEARING AIR COOLER ASSEMBLY	72-33-84
NOT USED	72-33-85 through 72-33-92
UNASSIGNED	72-33-93 through 72-33-99

FAN CASE - HOW TO USE


72-33-01
(1/1)
72-33-02
(2/1)
72-33-03
(5/1)
NUMBERS IN ( )
REFER TO IPC
72-33-00
(FIGURE NO./ITEM NO.)
L-A0005 (1286)
PW V

Fan Case
Figure 1 (Sheet 1)
(Task 72-33-00-990-003)

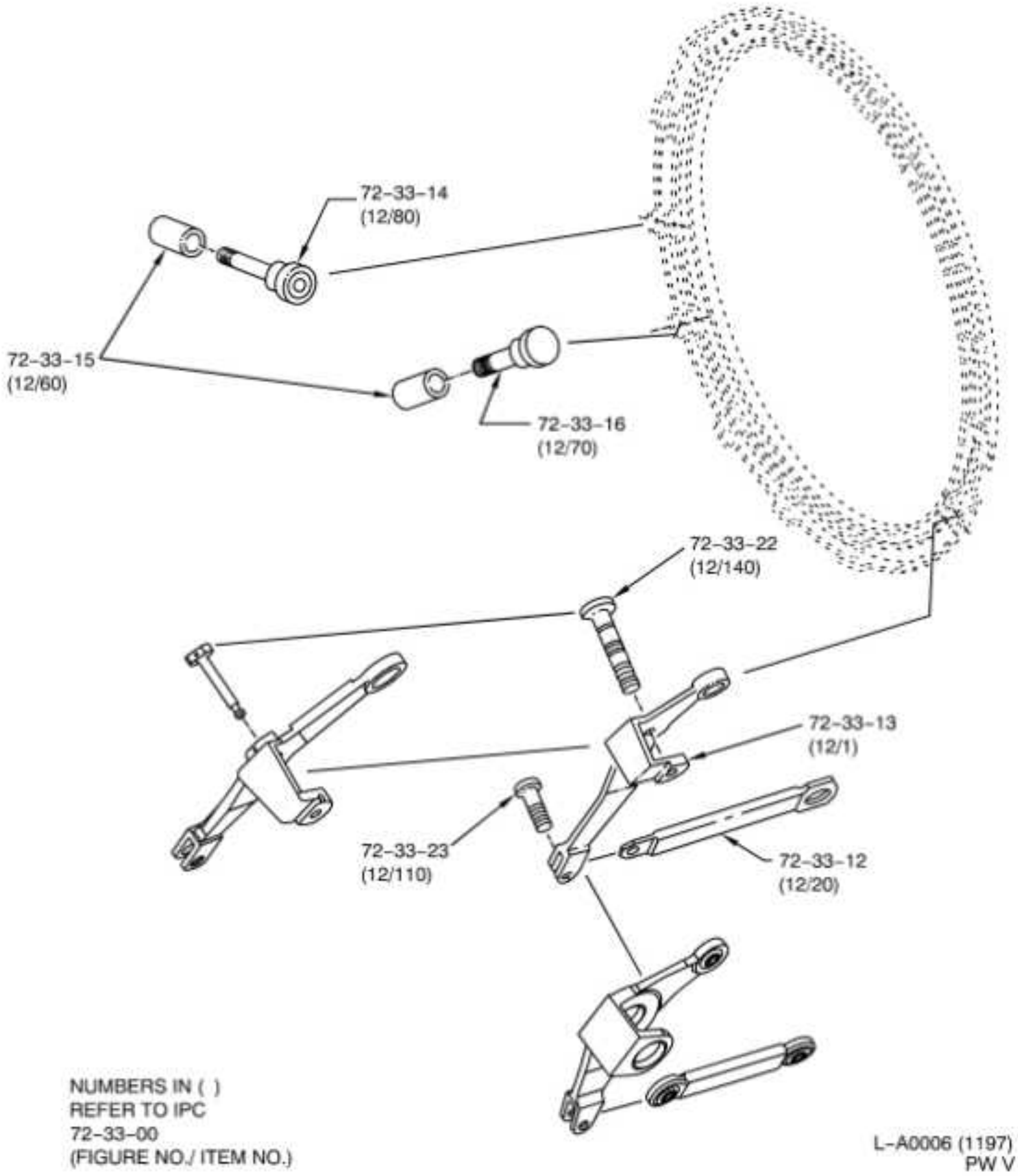
FAN CASE − HOW TO USE


72-33-17
(5/120)
(5/10)
72-33-05
(5/20)
(5/40)
(5/60)
(5/80)
(5/100)
72-33-09
(11/1)
72-33-19
(9/15)
72-33-04
(2/30)
72-33-20
(4/370)
NUMBERS IN ( )
REFER TO IPC
72 - 33 - 00
(FIGURE NO. /ITEM NO.)

L-A0800 (1299)
PW V

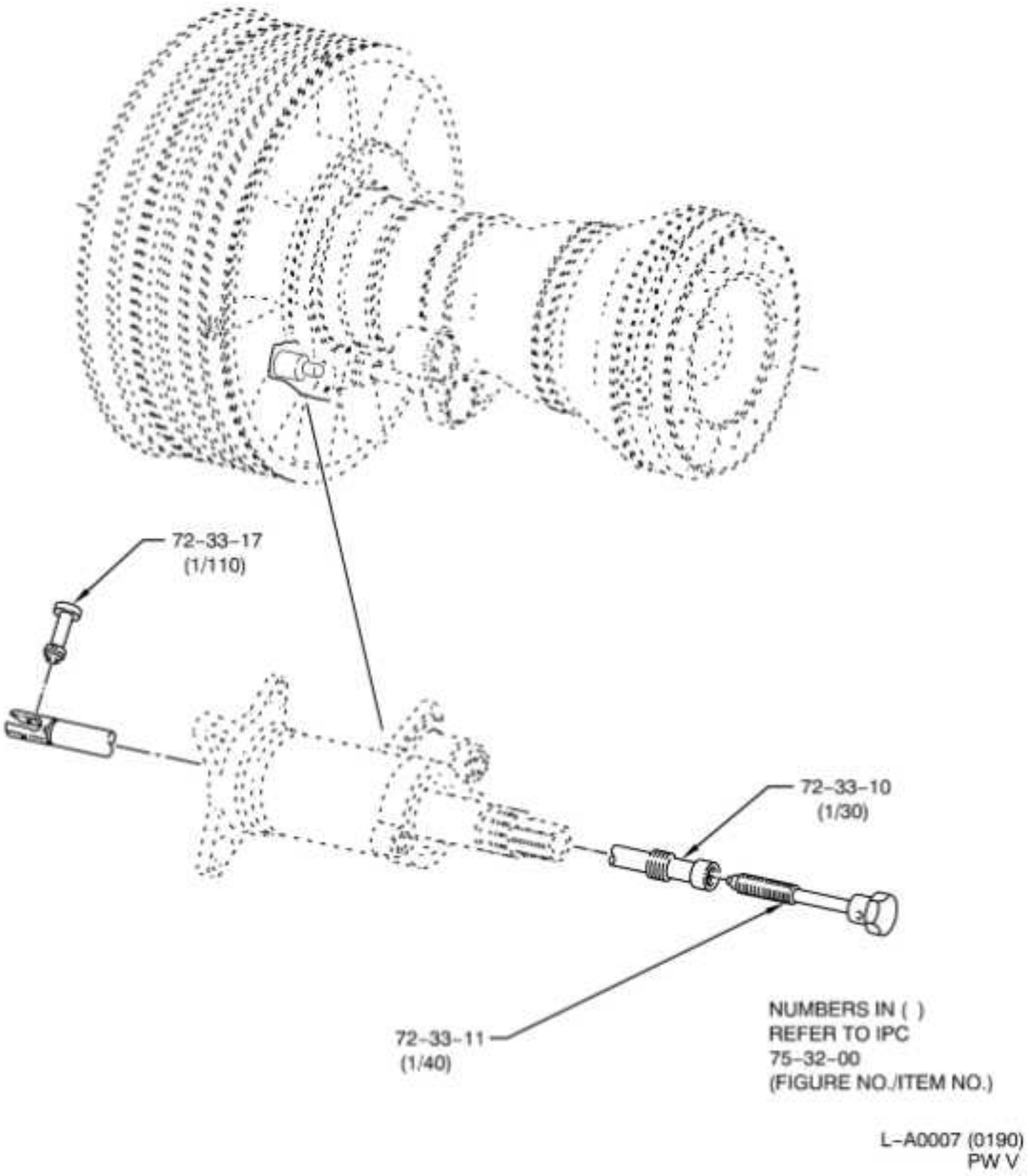
Fan Case
Figure 1 (Sheet 2)
(Task 72−33−00−990−003)

FAN CASE − HOW TO USE


72−33−14
(12/80)
72−33−15
(12/60)
72−33−16
(12/70)
72−33−22
(12/140)
72−33−13
(12/1)
72−33−23
(12/110)
72−33−12
(12/20)
NUMBERS IN ( )
REFER TO IPC
72−33−00
(FIGURE NO./ ITEM NO.)
L−A0006 (1197)
PW V

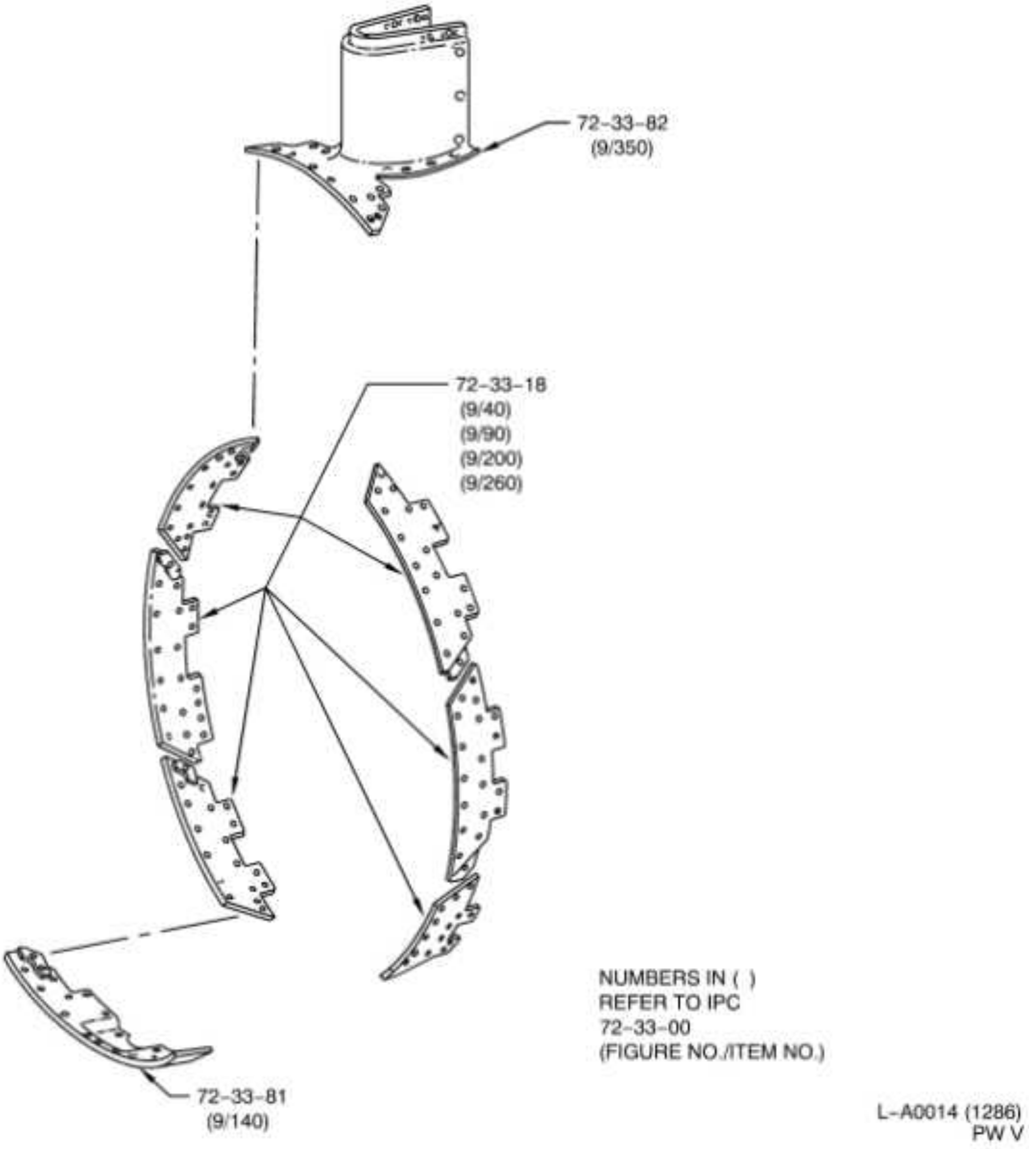
Fan Case
Figure 1 (Sheet 3)
(Task 72−33−00−990−003)

FAN CASE − HOW TO USE


72−33−17
(1/110)
72−33−10
(1/30)
72−33−11
(1/40)
NUMBERS IN ( )
REFER TO IPC
75−32−00
(FIGURE NO./ITEM NO.)
L−A0007 (0190)
PW V

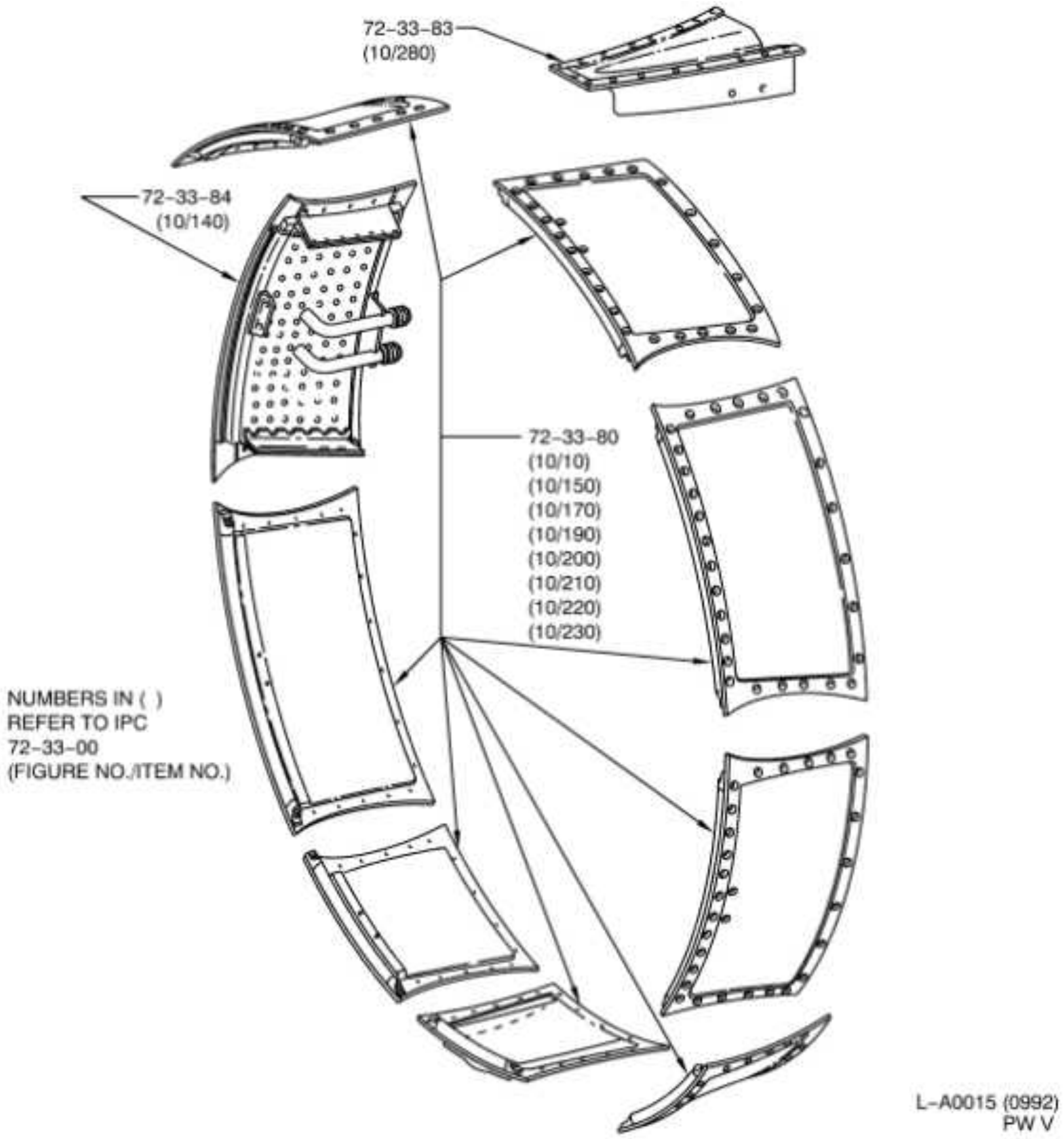
Fan Case
Figure 1 (Sheet 4)
(Task 72−33−00−990−003)

FAN CASE − HOW TO USE


72−33−82
(9/350)
72−33−18
(9/40)
(9/90)
(9/200)
(9/260)
NUMBERS IN ( )
REFER TO IPC
72−33−00
(FIGURE NO./ITEM NO.)
72−33−81
(9/140)
L−A0014 (1286)
PW V

Fan Case
Figure 1 (Sheet 5)
(Task 72−33−00−990−003)

FAN CASE - HOW TO USE


72-33-83
(10/280)
72-33-84
(10/140)
72-33-80
(10/10)
(10/150)
(10/170)
(10/190)
(10/200)
(10/210)
(10/220)
(10/230)
NUMBERS IN ( )
REFER TO IPC
72-33-00
(FIGURE NO./ITEM NO.)
L-A0015 (0992)
PW V

Fan Case
Figure 1 (Sheet 6)
(Task 72-33-00-990-003)

FAN CASE - DESCRIPTION AND OPERATION

Task 72-33-00-990-002:

1. Fan Case

See Figure 1.

A. Fan Case - General

(1) Between the inlet cowl and the airframe supplied fan exhaust hardware are three separate fan cases whose purpose is to contain and direct the fan discharge airstream and to provide the structural link between the airframe and the core engine. They are the fan case assembly, the fan exit case and vane assembly, and the fan exit rear case. The fan case assembly and the fan exit case and vane assembly, including the 2.5 bleed valve and linkage, comprise the fan cases and are addressed here. The fan exit rear case is integral to the intermediate case and is addressed in the intermediate case section.

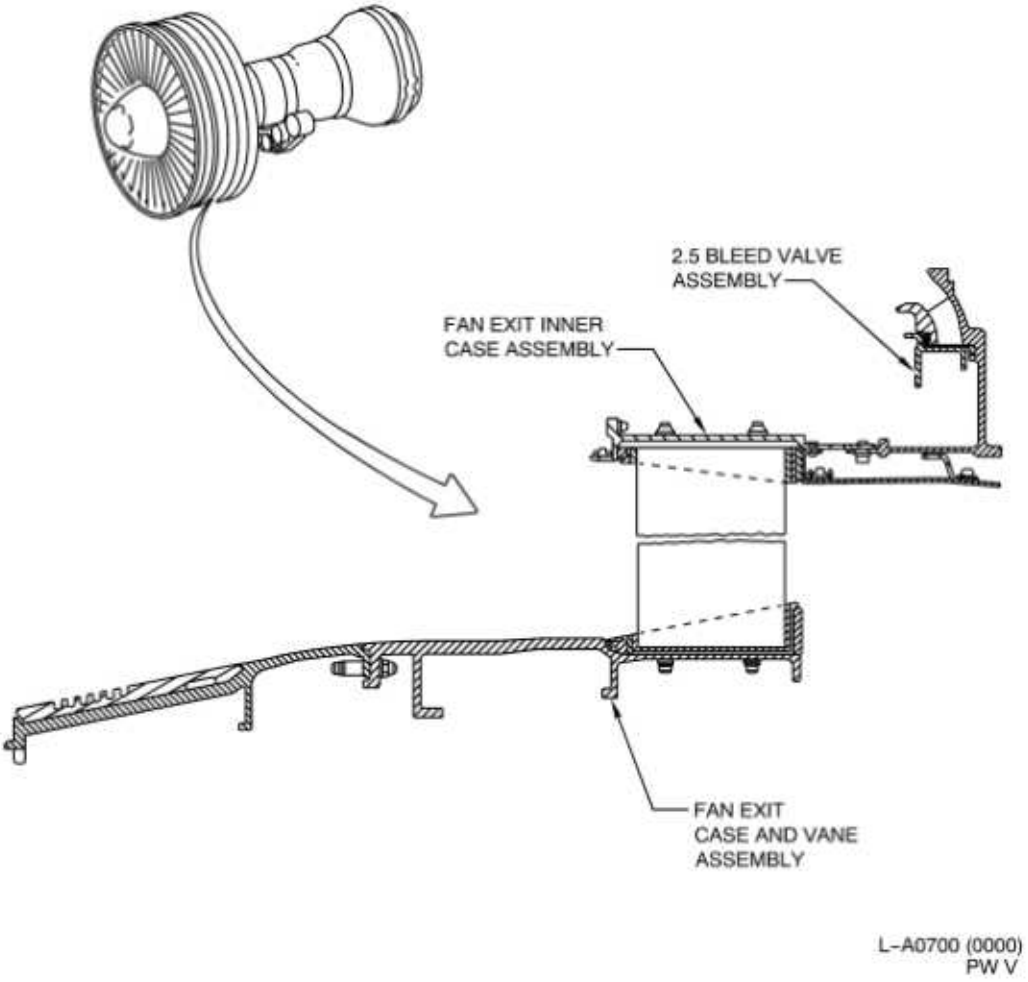
B. Fan Case Assembly

(1) The strengthened stainless steel fan case assembly supports the inlet cowl and provides for containment of the fan blades. Abradable fan blade rubstrip segments, which are made by an injection molding process that requires no finish machining, are secured to the ID of the fan case assembly with adhesive and mechanical retention. The fan case assembly is supported by mechanical attachment to the outer fan exit case.

C. Fan Exit Case And Vane Assembly

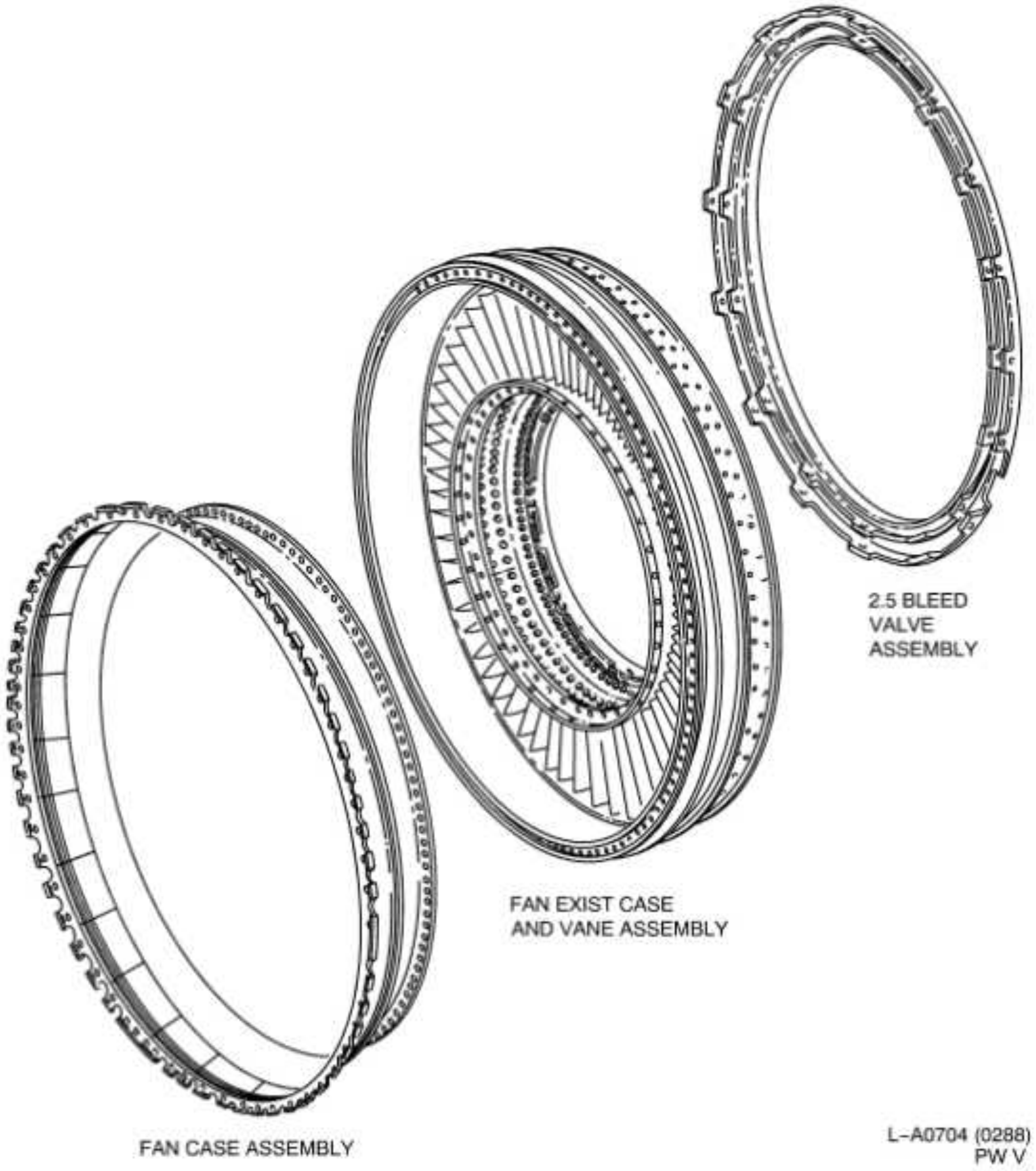
(1) The fan exit case and vane assembly consists of an aluminum outer case, an aluminum inner case assembly and eighty-four fan exit vanes that span the two cases. At the front the outer case supports the fan case assembly while at the rear the outer case itself is supported by mechanical attachment to the fan exit rear case. The inner case assembly supports the LPC stator assembly at the front while itself being supported at the rear by mechanical attachment to the intermediate case. The fan exit vanes, made of a composite material, are designed to straighten the fan discharge airstream prior to the air entering the airframe supplied fan exhaust hardware.

D. 2.5 Bleed Valve Assembly


2.5 BLEED VALVE ASSEMBLY
FAN EXIT INNER CASE ASSEMBLY
FAN EXIT CASE AND VANE ASSEMBLY
L−A0700 (0000)
PW V

Fan Cases
Figure 1 (Sheet 1)
(Task 72−33−00−990−002)

FAN CASE − DESCRIPTION AND OPERATION


2.5 BLEED
VALVE
ASSEMBLY
FAN EXIST CASE
AND VANE ASSEMBLY
FAN CASE ASSEMBLY
L−A0704 (0288)
PW V

Fan Cases
Figure 1 (Sheet 2)
(Task 72−33−00−990−002)

FAN CASE − DESCRIPTION AND OPERATION

(1) The 2.5 bleed valve assembly is attached to the fan exit inner case assembly at the LPC exit. The purpose of this bleed valve is to ensure stable operation at low power levels and to increase stall margin during starting and when required at other operating conditions. The bleed system is actuated through linkages by a hydraulic cylinder mounted on the intermediate case. Bleed air is exhausted through the inner fan exit case assembly into the fan discharge airstream to provide maximum diffusion of the bleed air and minimum effect on the fan discharge airstream.

FAN CASE - DISASSEMBLY-01

Task 72-33-00-030-001:

1. Disassemble The Fan Case

A. Equipment And Materials Required

Special Tools:

PWA 26520	Sling, Lifting
PWA 76154	Adapter, Lift And Trunnion (2 Necessary)
PWA 76155	Sling
PWA 85450	Stand, Storage/Transport (Optional to PWA 87078)
PWA 85570	Bracket (4 Necessary)
PWA 85676	Adapter, (Front Fan Case) Lift And Trunnion (2 Necessary) (Optional to PWA 86423)
PWA 85678	Stand (3 Necessary) (Optional to PWA 87166/PWA 101960)
PWA 85750	Blocks, Support (4 Necessary) (Optional to PWA 87166/PWA 101960)
PWA 85982	Adapter, (Fan Exit Case And Vane Assembly) Lift And Trunnion (2 Necessary)
PWA 86423	Adapter Lift And Trunnion (2 Necessary)
PWA 87078	Stand, Storage/Transport
PWA 87166	Stand, Support (3 Necessary)
PWA 87518	Adapter, Lifting (3 Necessary)
PWA 101224	Dolly, Support
PWA 101960	Adapter, Support (3 or 4 Necessary)

B. Procedure

Subtask 72-33-00-030-051:

(1) Put the fan case in the vertical position - front end down (when stored in a PWA 87078 Stand or a PWA 85450 Stand). See Figure 501.

(a) Attach a hoist to PWA 76155 Sling .

(b) Attach the sling to two PWA 76154 Adapters.

(c) Open the clamps of the stand the fan case is in. Remove the detail ball lock pins.

(d) Install Adapters PWA 76154 on the lift and trunnion adapters already on the fan case.

(e) Lift the fan case from the stand.

FAN CASE - DISASSEMBLY-01

(f) Turn the fan case to front end down (vertical) position.

(g) There are three options for the vertical support of the fan case (front end down). See Figure 502.

1 Put the fan case on a pallet.

2 Use three PWA 85678 Stands or PWA 87166 Stands with three PWA 101960 Adapters to support the fan case.

3 Use four PWA 101224 Support Dollys with four PWA 101960 Adapters or PWA 85750 Adapters to support the fan case. The fan case assembly can be moved with this support system.

(h) Remove the PWA 85698 Adapters or PWA 86431 Adapters from the fan case.

(2) Move apart the fan exit case and vane assembly (called case and vane assembly) from the front fan case. See Figure 502.

(a) Remove the Flange B hardware as follows. Refer to 72-33-00 Disassembly-21 (Task 72-33-00-030-021).

(b) Attach four PWA 85570 Brackets, equally spaced, to the top flange of the fan case. Use the detail bolts, washers, spacers, and nuts.

(c) Attach a hoist to PWA 26520 Sling.

(d) Attach the sling to the brackets.

(e) Lift the case and vane assembly.

(3) Put the case and vane assembly in a stand.

(a) Attach PWA 85982 Adapter to the case and vane assembly at 3 and 9 o'clock. Use the detail bolts, washers, and nuts.

(b) Attach a hoist to PWA 76155 Sling.

(c) Attach the sling to two PWA 76154 Adapters.

(d) Install PWA 85982 Adapters in PWA 76154 Adapters.

(e) Turn the case and vane assembly to horizontal position.

(f) Install the case and vane assembly in either PWA 87078 Stand or PWA 85450 Stand.

1 Move the detail hand knobs.

2 Remove the detail ball lock pins.

3 Open the tops of the detail clamps.

4 Install the case and vane assembly in the stand.

5 Lock the case and vane assembly in position with the detail ball lock pins.

6 Close the tops of the detail clamps.

7 Lock the detail clamps with the detail hand knobs.

8 Remove the PWA 76154 Adapters, sling, hoist, and brackets.

(4) Put the front fan case away.

(a) To put the front fan case in vertical position, do as follows.

1 Either leave it where it is

2 Or with four PWA 85570 Brackets attached to the top flange, PWA 26520 Sling, and a hoist, move it to a pallet. Remove the tools.

3 Use three PWA 87518 Adapters, with a sling, to move only the fan case vertically, front end up.

(b) To put the front fan case in horizontal position, do as follows.

1 Attach two PWA 86423 Adapters or PWA 85676 Adapters to the front fan case at 3 and 9 o'clock positions.

2 Attach a hoist to PWA 76155 Sling.

FAN CASE - DISASSEMBLY-01

3 Attach the sling to two PWA 76154 Adapters.

4 Install the adapters on the front fan case in the adapters on the sling.

5 Lift the front fan case.

6 Turn the front fan case to horizontal position.

7 Install the front fan case in either PWA 87078 Stand or PWA 85450 Stand.

  a Move the detail hand knobs.

  b Remove the detail ball lock pins.

  c Open the top of the detail clamps.

  d Install the front fan case in the stand.

  e Lock the front fan case in position with the detail ball lock pins.

  f Close the tops of the detail clamps. Lock the detail clamps with the detail hand knobs.

8 Remove the PWA 76154 Adapters, sling, and hoist.

Subtask 72-33-00-030-053:

(5) Remove bolts and washers securing bleed valve ducts, and screens. Remove ducts and screens. See Figure 504.

Subtask 72-33-00-030-054:

(6) If required, remove Flange A brackets.

(7) If required, remove the Flange A1 hardware as follows. Refer to 72-33-00, Disassembly-20 (Task 72-33-00-430-020).

(8) Remove Flange B1 hardware as follows. Refer to 72-33-00, Disassembly-22 (Task 72-33-00-430-022).

(9) Remove Flange B2 hardware as follows. Refer to 72-33-00, Disassembly-23 (Task 72-33-00-430-023)..

(10) Remove fan exit case bleed valve duct covers, if required. See Figure 505.

Subtask 72−33−00−030−052:

(11) Remove the compressor bleed actuator as follows. See Figure 506 and Figure 507.

CAUTION: THE SHOULDER BOLT HAS LEFT HAND THREADS. TURN THE SHOULDER BOLT IN THE CORRECT DIRECTION.

(a) Remove the cotter pin from the shoulder bolt in the actuator. Discard the cotter pin. While you hold the piston shaft, remove the shoulder bolt from the actuator.

(b) Remove the four bolts and washers that attach the compressor bleed actuator to the case and vane assembly. Remove the actuator with the rod end clevis and connecting link assembly.

(c) Remove the cotter pin, collar, and self−retaining pin that attach the rod end clevis to the bell crank connecting link assembly. Discard the cotter pin.

(d) Remove the rod end clevis from the piston shaft in the actuator. The rod end clevis is threaded into the piston shaft.

(e) Remove the two adapters from the actuator. Remove and discard the packings.

Subtask 72−33−00−030−056:

(12) (Pre SB PW4ENG 72−659) Remove bell crank parts as follows. See Figure 506 (Sheet 1).

(a) Remove the cotter pin, collar, and self−retaining pin that attach the bell crank assembly to the connecting link assembly. Discard the cotter pin.

(b) Remove the cotter pin and self−retaining pin that attach the bell crank assembly to the bell crank bracket. Discard the cotter pin.

(13) (Post SB PW4ENG 72−659) Remove bell crank parts as follows. See Figure 506 (Sheet 2).

(a) Remove the nut, washer and bolt that attach the bell crank assembly to the connecting link assembly.

(b) Remove the nut, two bearings and bolt that attach the bell crank assembly to the bell crank bracket. Discard the cotter pin.

(14) Remove the bleed valve assembly from the fan case. To remove the assembly, turn it in the slots of the fan case.

Subtask 72−33−00−030−055:

(15) (Post SB PW4ENG 72−346) Remove the six bolts that keep the bellcrank bracket in position. Remove the bracket. See Figure 507.

CAUTION: IF YOU WANT TO STORE THE CASE AND VANE ASSEMBLY IN VERTICAL POSITION, YOU MUST STORE IT FRONT END DOWN. IF YOU DO NOT STORE IT FRONT END DOWN, YOU WILL DAMAGE THE VANES.

(16) There are three options to put the case and vane assembly in the vertical position (front end down).

(a) Put the fan case on a pallet.

(b) Use three PWA 85678 Stands or PWA 87166 Stands with three PWA 101960 Adapters to support the fan case.

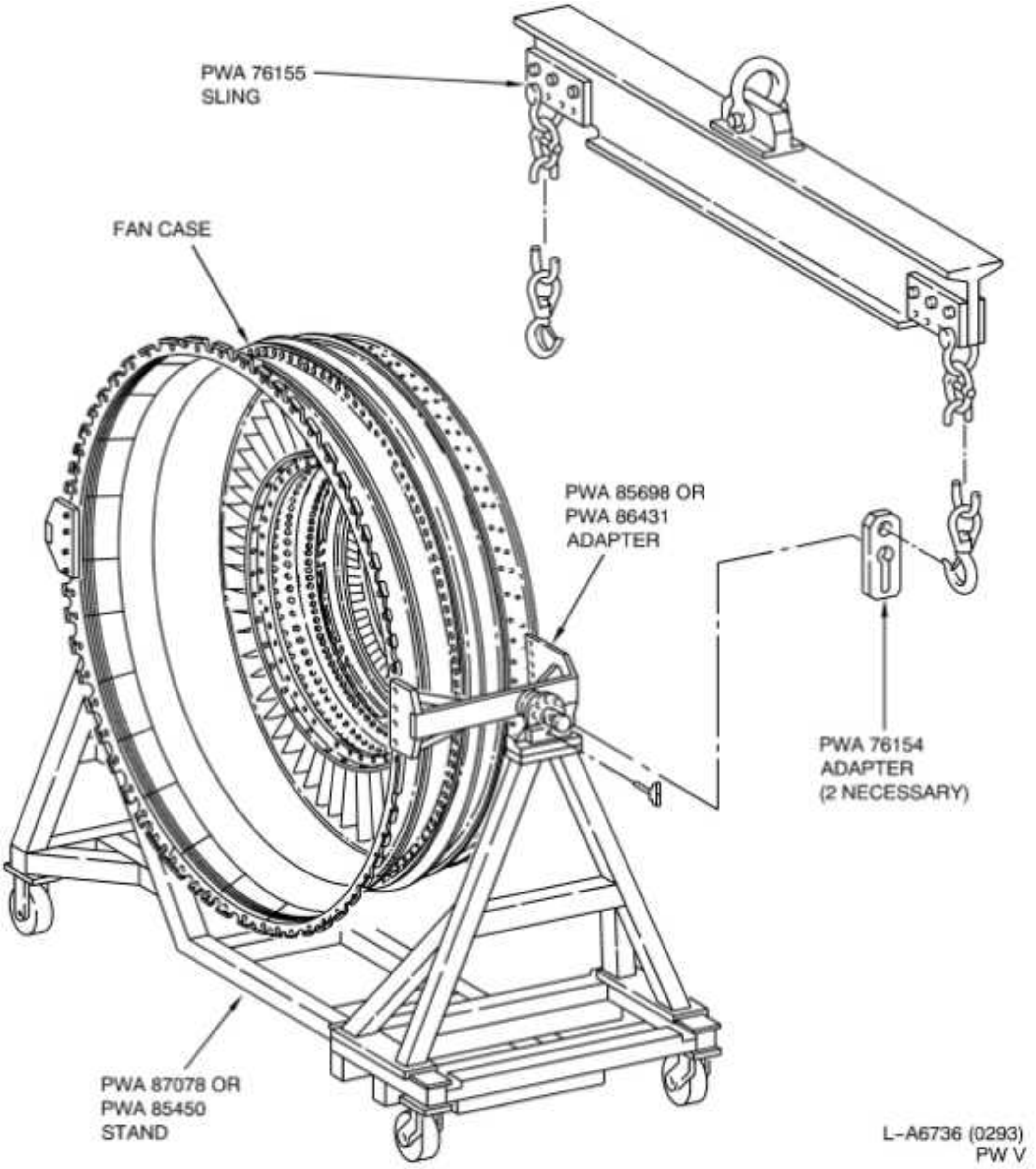
(c) Use four PWA 101224 Support Dollys with four PWA 101960 Adapters or PWA 85750 Adapters to support the fan case. The fan case assembly can be moved with this support system.

(17) Remove the tools.

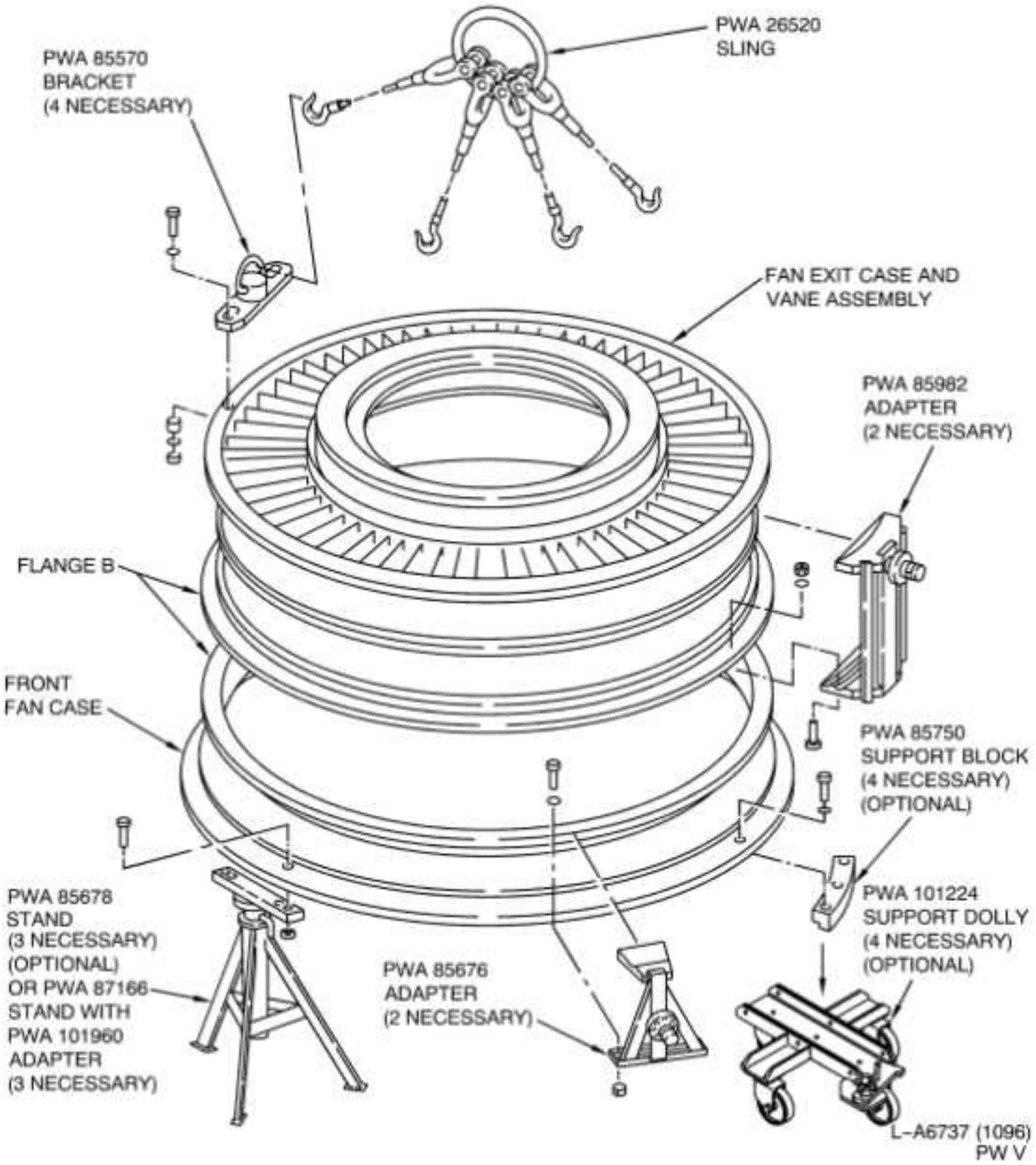
C. Postrequisites

(1) Disassemble bleed valve. See Disassembly−02 Task 72−33−00−030−002.

FAN CASE − DISASSEMBLY−01

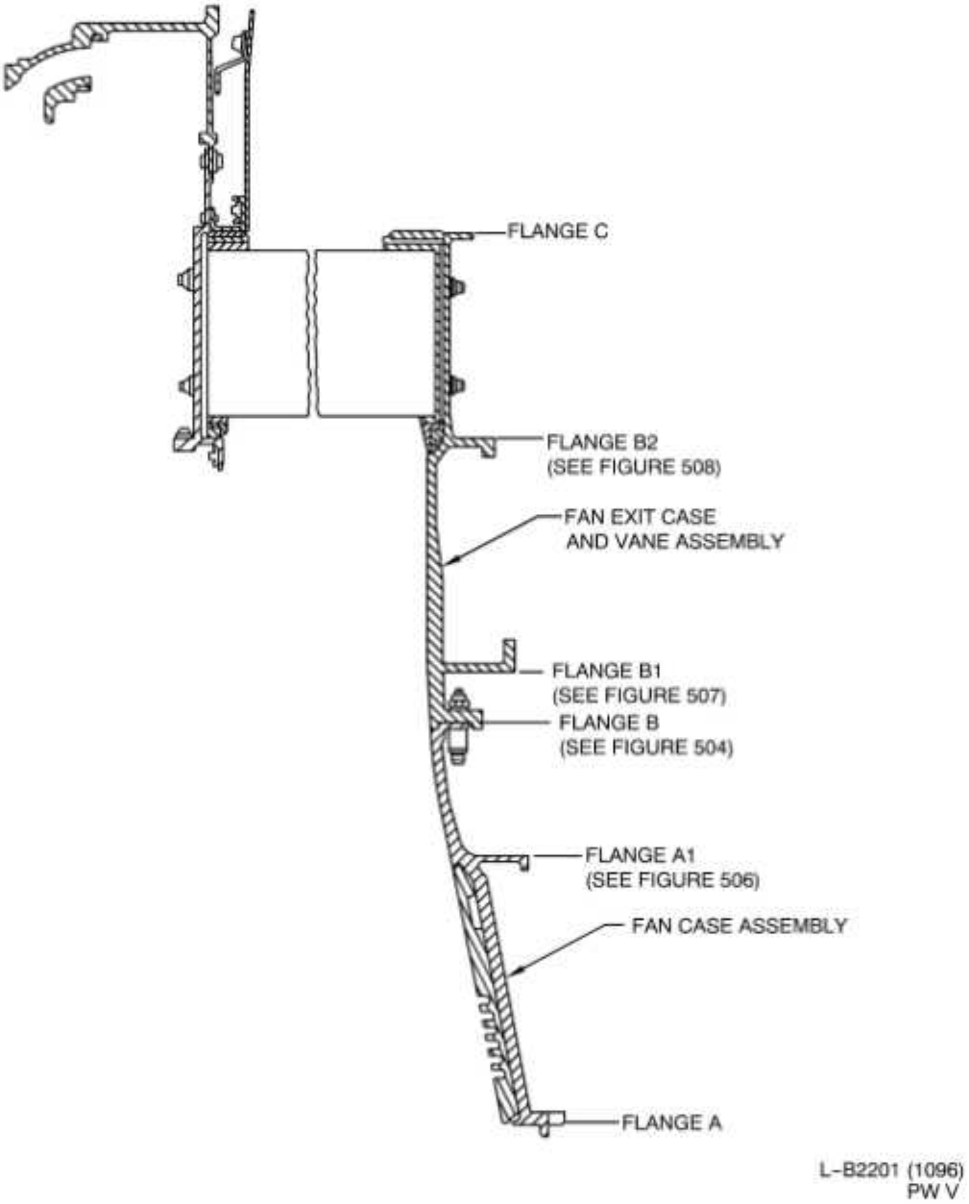

PWA 76155
SLING
FAN CASE
PWA 85698 OR
PWA 86431
ADAPTER
PWA 76154
ADAPTER
(2 NECESSARY)
PWA 87078 OR
PWA 85450
STAND
L−A6736 (0293)
PW V

Storage Of The Fan Case In Horizontal Position
Figure 501
(Task 72−33−00−030−001)

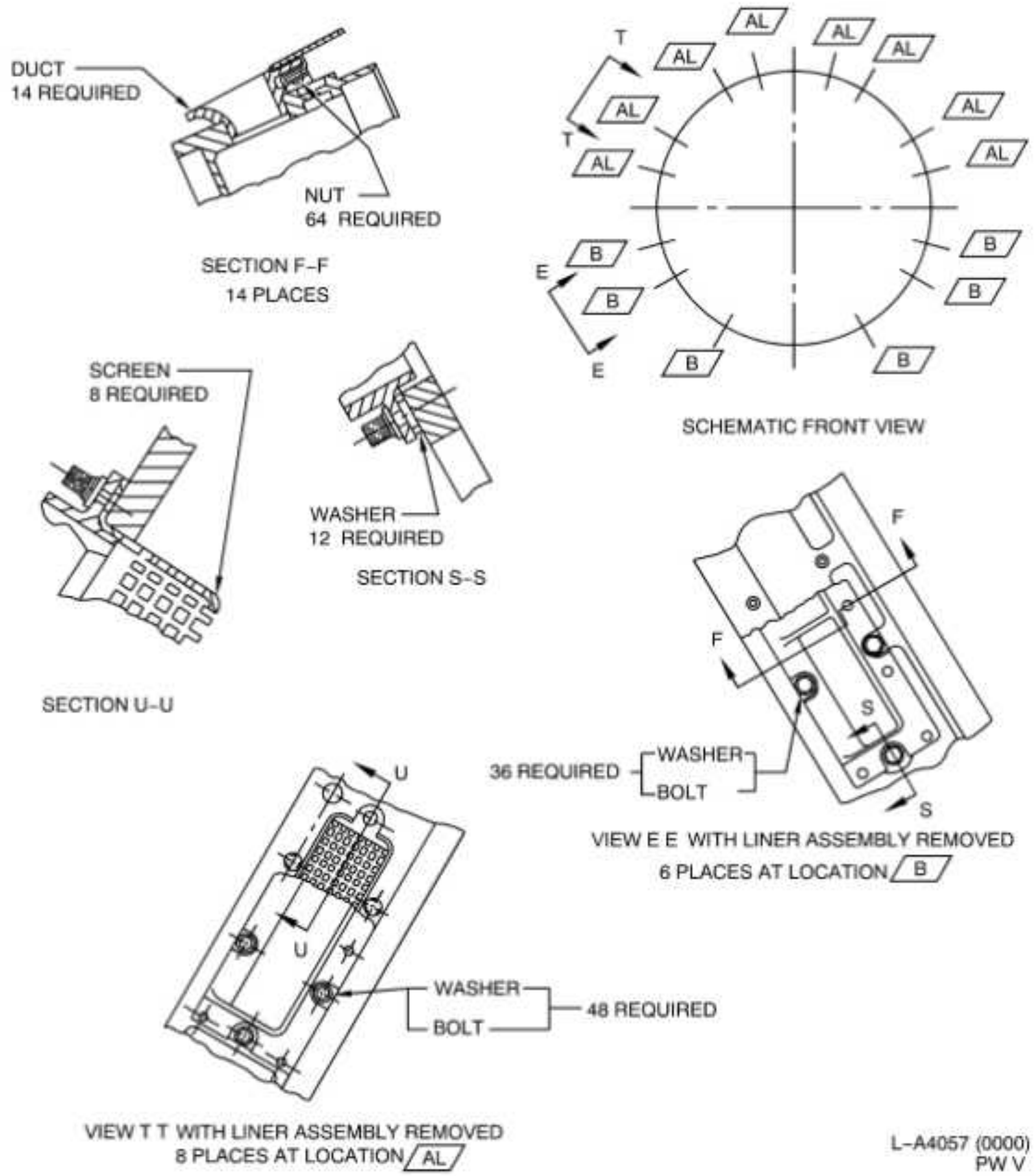

PWA 85570
BRACKET
(4 NECESSARY)
PWA 26520
SLING
FAN EXIT CASE AND
VANE ASSEMBLY
PWA 85982
ADAPTER
(2 NECESSARY)
FLANGE B
FRONT
FAN CASE
PWA 85750
SUPPORT BLOCK
(4 NECESSARY)
(OPTIONAL)
PWA 85678
STAND
(3 NECESSARY)
(OPTIONAL)
OR PWA 87166
STAND WITH
PWA 101960
ADAPTER
(3 NECESSARY)
PWA 85676
ADAPTER
(2 NECESSARY)
PWA 101224
SUPPORT DOLLY
(4 NECESSARY)
(OPTIONAL)
L-A6737 (1096)
PW V

The Fan Case In Vertical Position
Figure 502
(Task 72-33-00-030-001)

FAN CASE - DISASSEMBLY-01

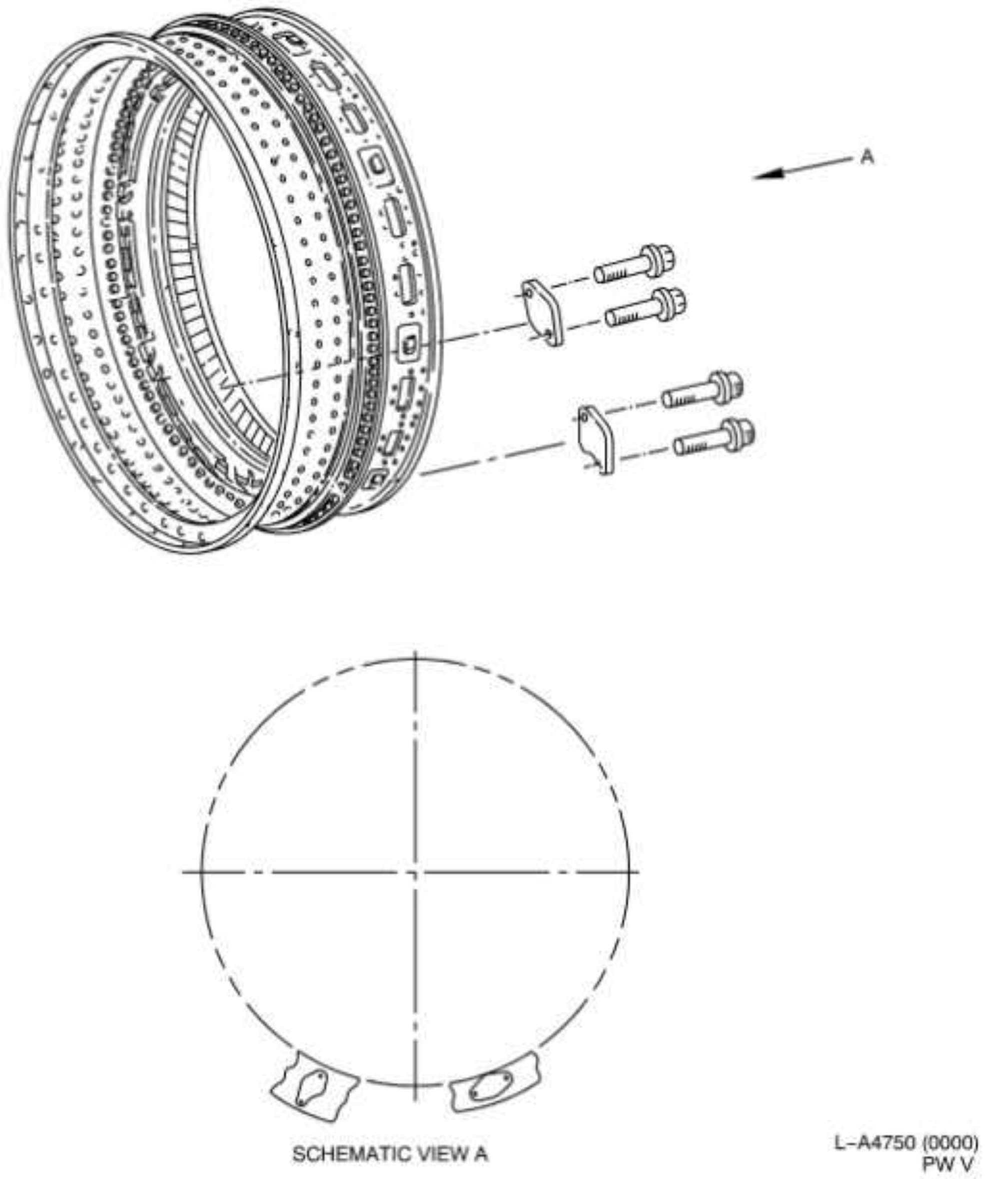

FLANGE C
FLANGE B2
(SEE FIGURE 508)
FAN EXIT CASE
AND VANE ASSEMBLY
FLANGE B1
(SEE FIGURE 507)
FLANGE B
(SEE FIGURE 504)
FLANGE A1
(SEE FIGURE 506)
FAN CASE ASSEMBLY
FLANGE A
L-B2201 (1096)
PW V

Section Through The Fan Case
Figure 503
(Task 72-33-00-030-001)

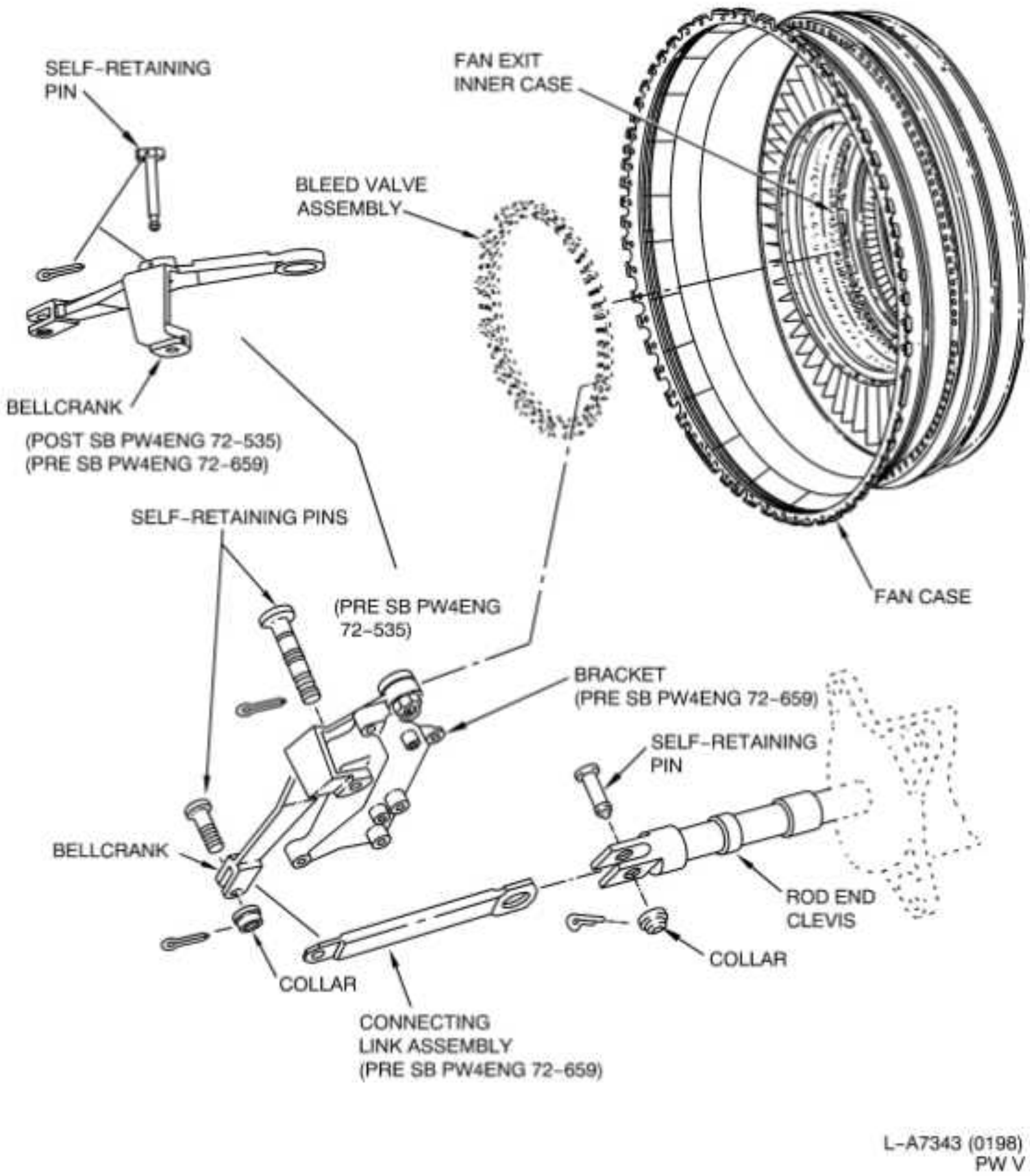

DUCT
14 REQUIRED
NUT
64 REQUIRED
SECTION F-F
14 PLACES
T
T
AL
AL
AL
AL
AL
AL
AL
AL
E
E
B
B
B
B
B
B
SCHEMATIC FRONT VIEW
SCREEN
8 REQUIRED
SECTION U-U
WASHER
12 REQUIRED
SECTION S-S
F
F
S
S
36 REQUIRED
WASHER
BOLT
VIEW E E WITH LINER ASSEMBLY REMOVED
6 PLACES AT LOCATION B
U
U
WASHER
BOLT
48 REQUIRED
VIEW T T WITH LINER ASSEMBLY REMOVED
8 PLACES AT LOCATION AL
L-A4057 (0000)
PW V

Bleed Duct And Screen Removal
Figure 504
(Task 72−33−00−030−001)

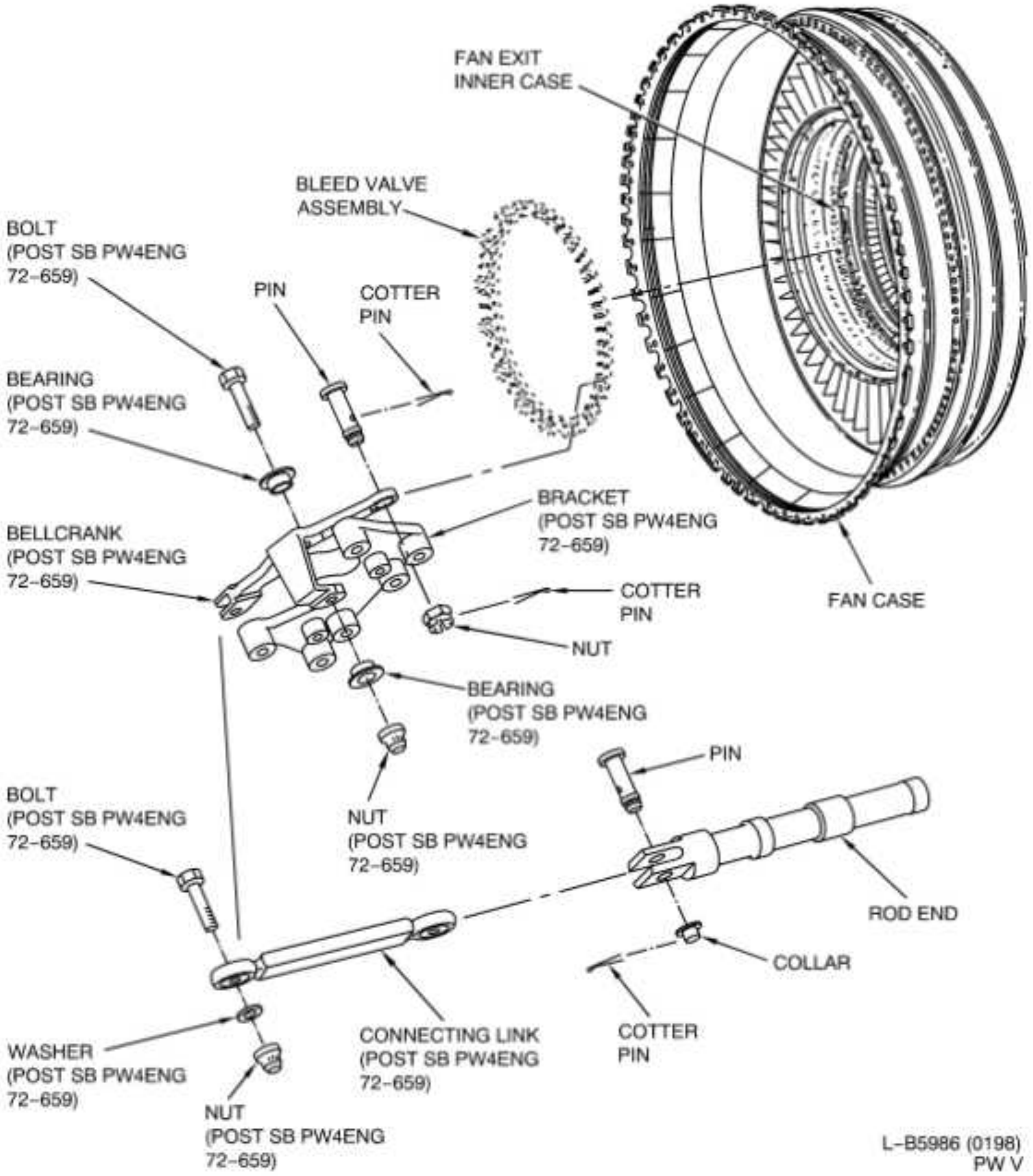
FAN CASE - DISASSEMBLY-01


A
SCHEMATIC VIEW A
L-A4750 (0000)
PW V

Cover Removal
Figure 505
(Task 72-33-00-030-001)

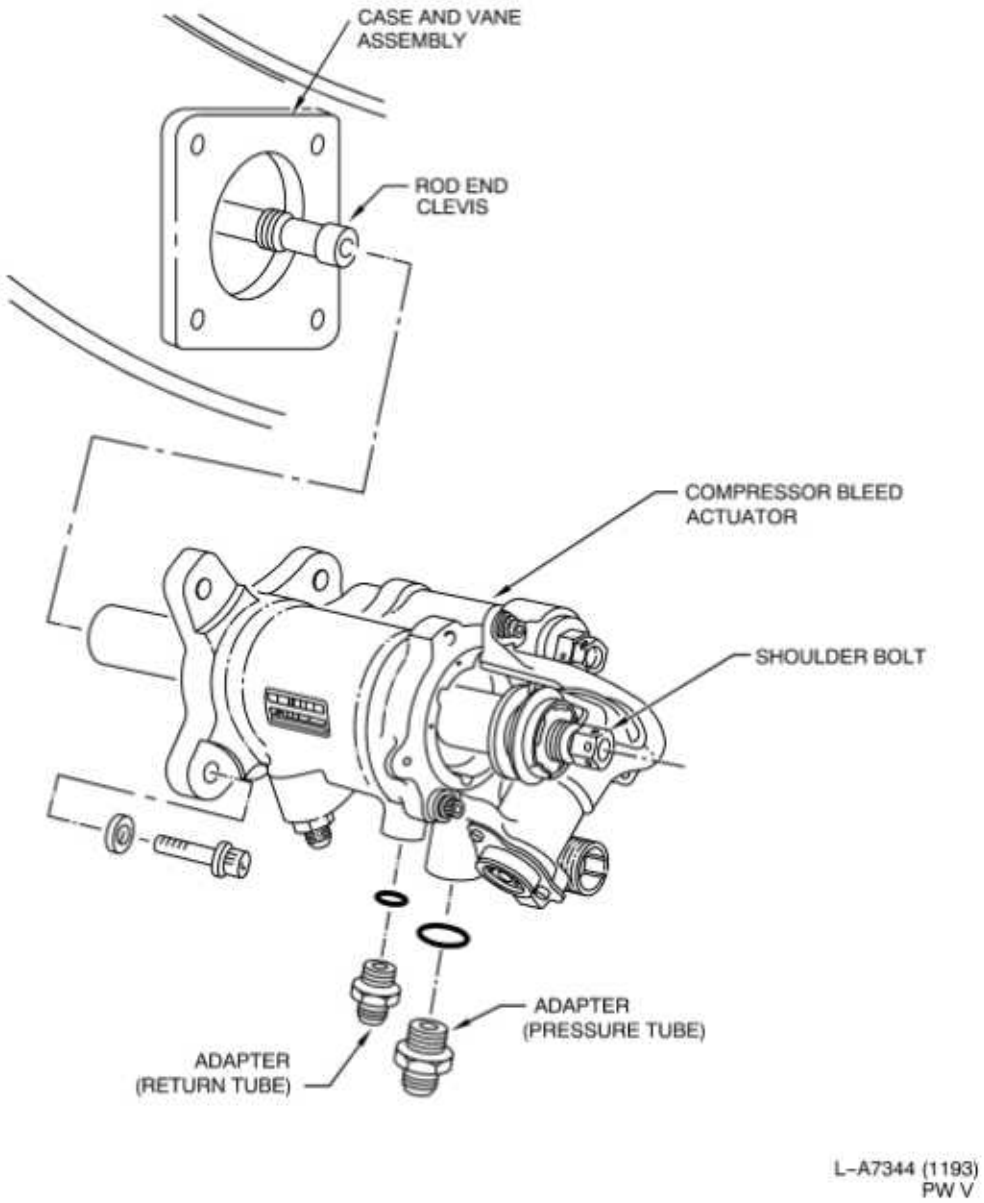

SELF-RETAINING PIN
FAN EXIT INNER CASE
BLEED VALVE ASSEMBLY
BELLCRANK
(POST SB PW4ENG 72-535)
(PRE SB PW4ENG 72-659)
SELF-RETAINING PINS
(PRE SB PW4ENG 72-535)
FAN CASE
BRACKET
(PRE SB PW4ENG 72-659)
SELF-RETAINING PIN
BELLCRANK
ROD END CLEVIS
COLLAR
COLLAR
CONNECTING LINK ASSEMBLY
(PRE SB PW4ENG 72-659)
L-A7343 (0198)
PW V

Removal Of The Compressor Bleed Actuator And
Bell Crank Assembly Parts (Pre SB PW4ENG 72−659)
Figure 506 (Sheet 1)
(Task 72−33−00−030−001)

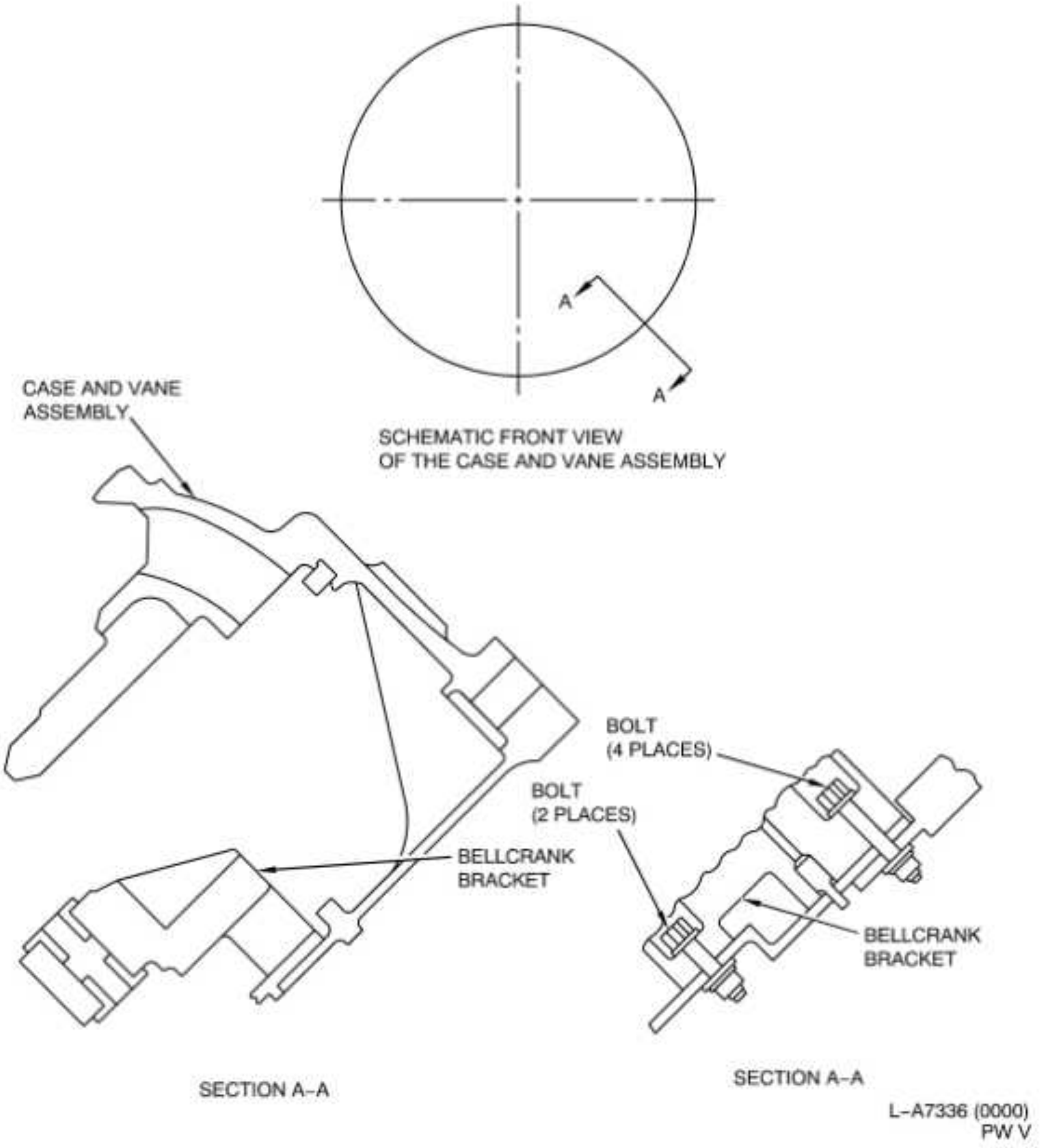

FAN EXIT
INNER CASE
BLEED VALVE
ASSEMBLY
BOLT
(POST SB PW4ENG
72-659)
PIN
COTTER
PIN
BEARING
(POST SB PW4ENG
72-659)
BELLCRANK
(POST SB PW4ENG
72-659)
BRACKET
(POST SB PW4ENG
72-659)
COTTER
PIN
NUT
FAN CASE
BEARING
(POST SB PW4ENG
72-659)
PIN
BOLT
(POST SB PW4ENG
72-659)
NUT
(POST SB PW4ENG
72-659)
ROD END
COLLAR
COTTER
PIN
WASHER
(POST SB PW4ENG
72-659)
CONNECTING LINK
(POST SB PW4ENG
72-659)
NUT
(POST SB PW4ENG
72-659)
L-B5986 (0198)
PW V

Removal Of The Compressor Bleed Actuator And Bell
Crank Assembly Parts (Post SB PW4ENG 72−659)
Figure 506 (Sheet 2)
(Task 72−33−00−030−001)

FAN CASE − DISASSEMBLY−01


CASE AND VANE ASSEMBLY
ROD END CLEVIS
COMPRESSOR BLEED ACTUATOR
SHOULDER BOLT
ADAPTER (PRESSURE TUBE)
ADAPTER (RETURN TUBE)
L−A7344 (1193)
PW V

Removal Of The Compressor Bleed
Actuator And Bell Crank Assembly Parts
Figure 506 (Sheet 3)
(Task 72−33−00−030−001)


CASE AND VANE
ASSEMBLY
A
A
SCHEMATIC FRONT VIEW
OF THE CASE AND VANE ASSEMBLY
BOLT
(4 PLACES)
BOLT
(2 PLACES)
BELLCRANK
BRACKET
BELLCRANK
BRACKET
SECTION A−A
SECTION A−A
L−A7336 (0000)
PW V

Removal Of The Bellcrank Bracket
Figure 507
(Task 72−33−00−030−001)

Previous Pageblock Return to Previous Menu Next Pageblock

FAN CASE - DISASSEMBLY-02

Task 72-33-00-030-002:

1. Disassemble Bleed Valve

A. Equipment And Materials Required - None

B. Procedure

Subtask 72-33-00-030-057:

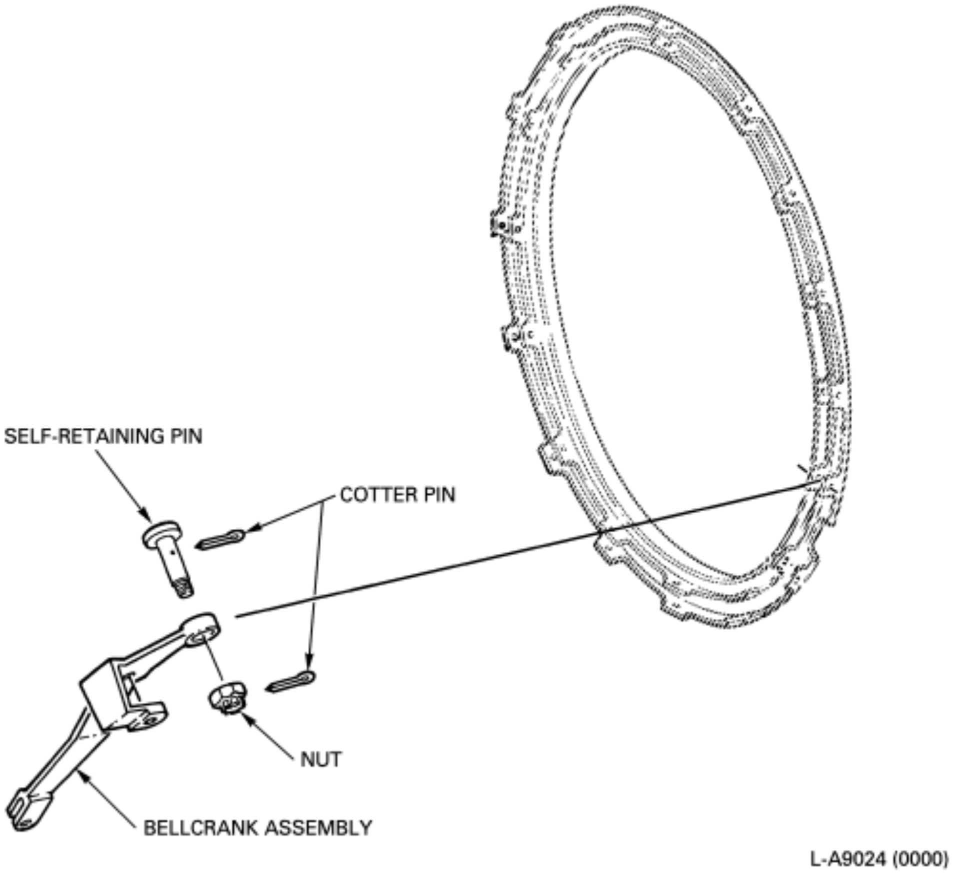
(1) Remove the cotter pins, nut, and self-retaining pin that attach the bell crank assembly to the bleed valve. Remove the bell crank assembly. Discard the cotter pins and self-retaining pin. See Figure 501. R

Subtask 72-33-00-030-058:

(2) Remove cotter pins and nuts securing cam follower dampers to bleed valve. Discard cotter pins. Remove cam follower dampers, washers and spacers from bleed valve (8 places).

(3) (Pre SB PW4ENG 72-660) Remove the cotter pins and nuts securing cam follower to bleed valve. Discard cotter pins. Remove cam followers, washers and spacers from bleed valve (7 places).

(4) (Post SB PW4ENG 72-660) Remove the nuts that attach the cam follower to the bleed valve. Remove the cam followers, washers and spacers from the bleed valve (7 places).


SELF-RETAINING PIN
COTTER PIN
NUT
BELLCRANK ASSEMBLY
L-A9024 (0000)

Removal Of The Bell Crank Assembly
Figure 501
(Task 72-33-00-030-002)

Previous Pageblock Return to Previous Menu Next Pageblock

FAN CASE - DISASSEMBLY-20

Task 72-33-00-030-020:

1. Remove The Flange A1 Brackets And Hardware

   A. Equipment And Materials Necessary - None

   B. Procedure

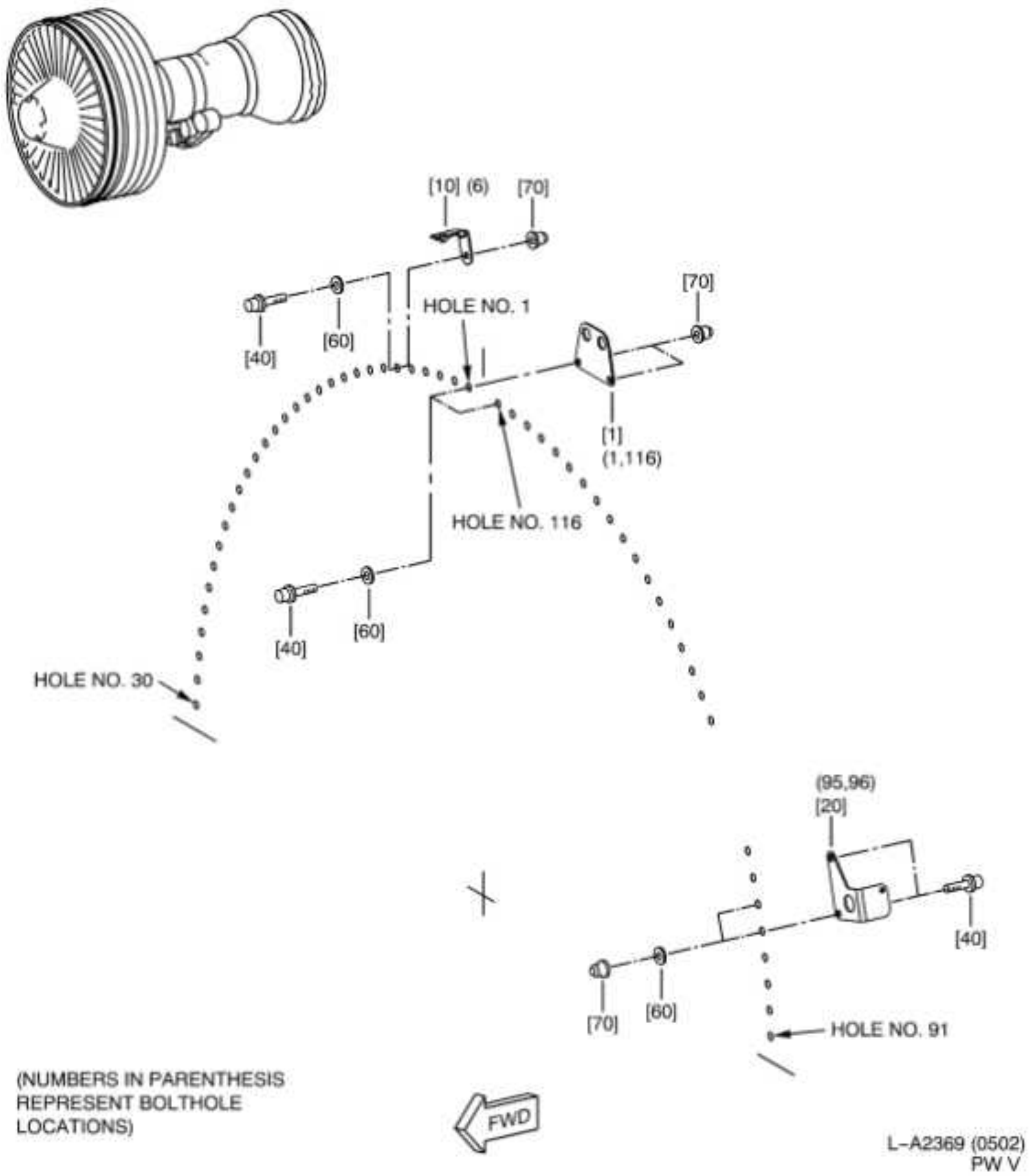
      (1) Remove the Flange A1 brackets as follows. See Figure 501.

         (a) Tag and identify the flange A1 hardware for the correct bolthole locations.

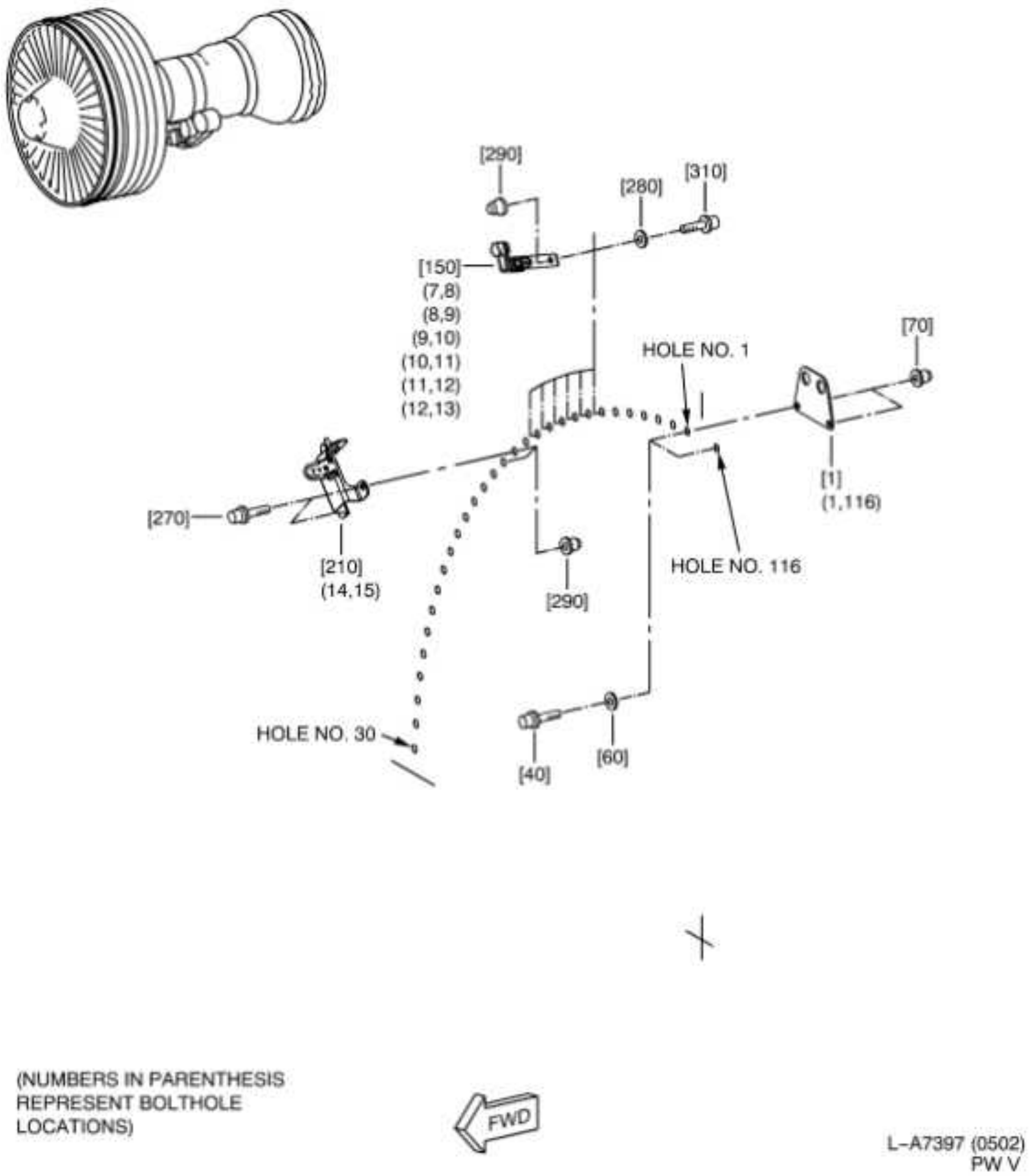
            NOTE: All the part item numbers in the figures are the same as the item numbers in the IPC.

         (b) Remove brackets from locations on Flange A1.

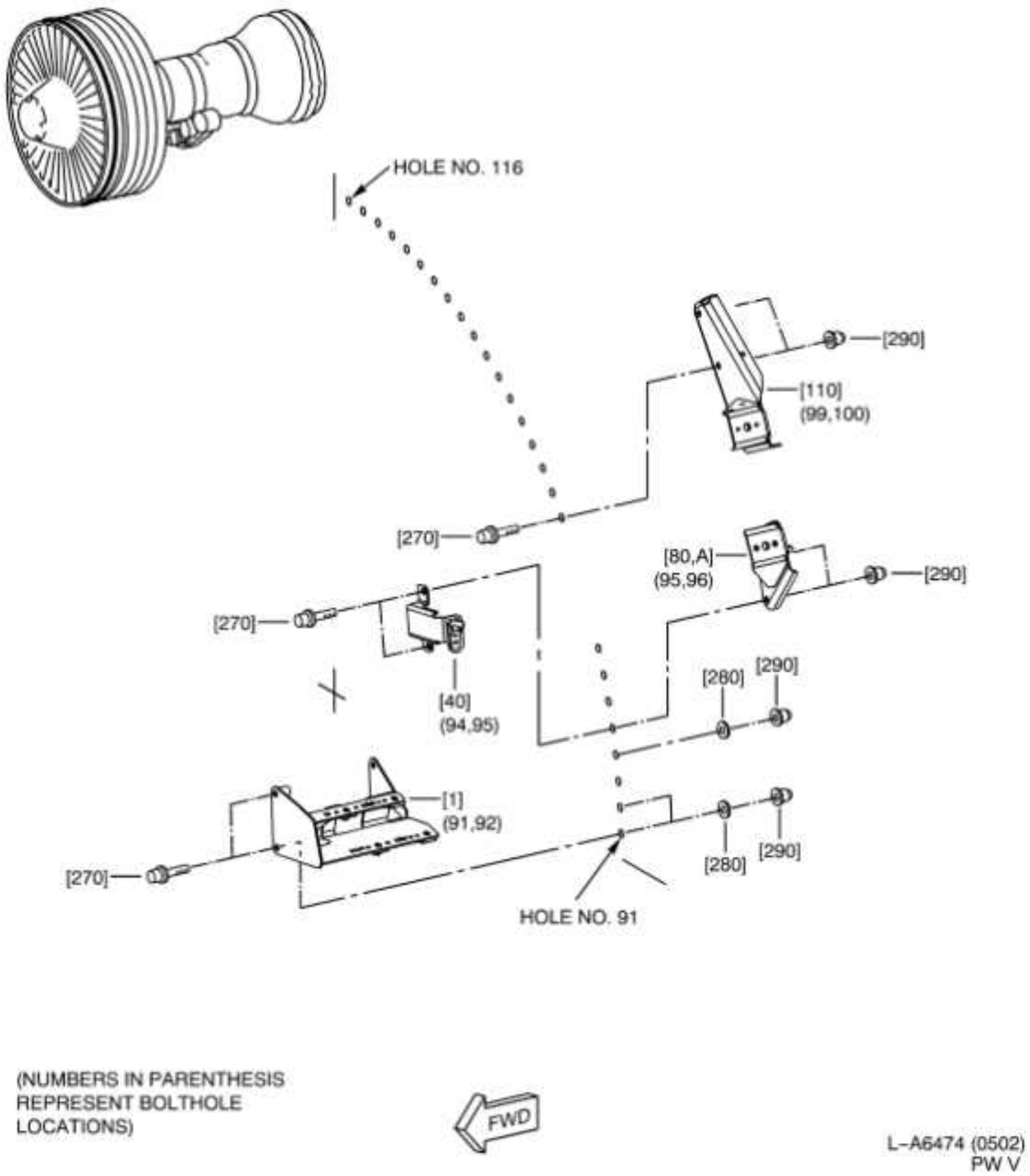
         (c) If equipped, remove vibration pick-up bracket from Flange A at approximately 1 o'clock position.


[10] (6)
[70]
[70]
HOLE NO. 1
[40]
[60]
[1]
(1,116)
HOLE NO. 116
[40]
[60]
HOLE NO. 30
(95,96)
[20]
[40]
[70]
[60]
HOLE NO. 91
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L−A2369 (0502)
PW V

Flange A1 Bracket Locations (For Basic Engines)
Figure 501 (Sheet 1)
(Task 72−33−00−030−020)


[290]
[280]
[310]
[150]
(7,8)
(8,9)
(9,10)
(10,11)
(11,12)
(12,13)
[70]
HOLE NO. 1
[1]
(1,116)
[270]
[210]
(14,15)
[290]
HOLE NO. 116
HOLE NO. 30
[40]
[60]
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-A7397 (0502)
PW V

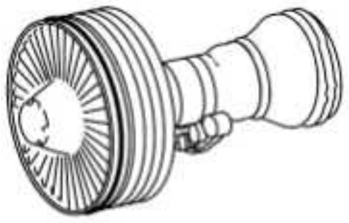
Flange A1 Bracket Locations (Engines With Common Fan Cases)
Figure 501 (Sheet 2)
(Task 72−33−00−030−020)

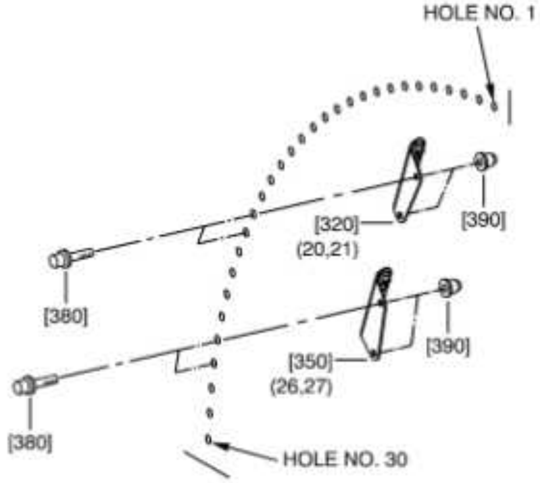

HOLE NO. 116
[290]
[110]
(99,100)
[270]
[80,A]
(95,96)
[290]
[270]
[40]
(94,95)
[280]
[290]
[1]
(91,92)
[270]
[280]
[290]
HOLE NO. 91
FWD

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

L-A6474 (0502)
PW V

Flange A1 Bracket Locations (Engines With Common Fan Cases)
Figure 501 (Sheet 3)
(Task 72-33-00-030-020)




HOLE NO. 1
[320]
(20,21)
[390]
[380]
[350]
(26,27)
[390]
[380]
HOLE NO. 30

NOTE: FOR ENGINES EQUIPPED WITH SUPPLEMENTAL CONTROL UNIT ONLY.

(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

L−A7373 (0502)
PW V

Flange A1 Bracket Locations (Engines Equipped With SCU)
Figure 501 (Sheet 4)
(Task 72−33−00−030−020)

FAN CASE - DISASSEMBLY-21

Task 72-33-00-030-021:

1. Remove The Flange B Brackets And Hardware

A. Equipment And Materials Necessary

Special Tools:

PWA 87503	Handle, Nut (For the Airbus/McDonnell Douglas common parts configuration only)

B. Procedure

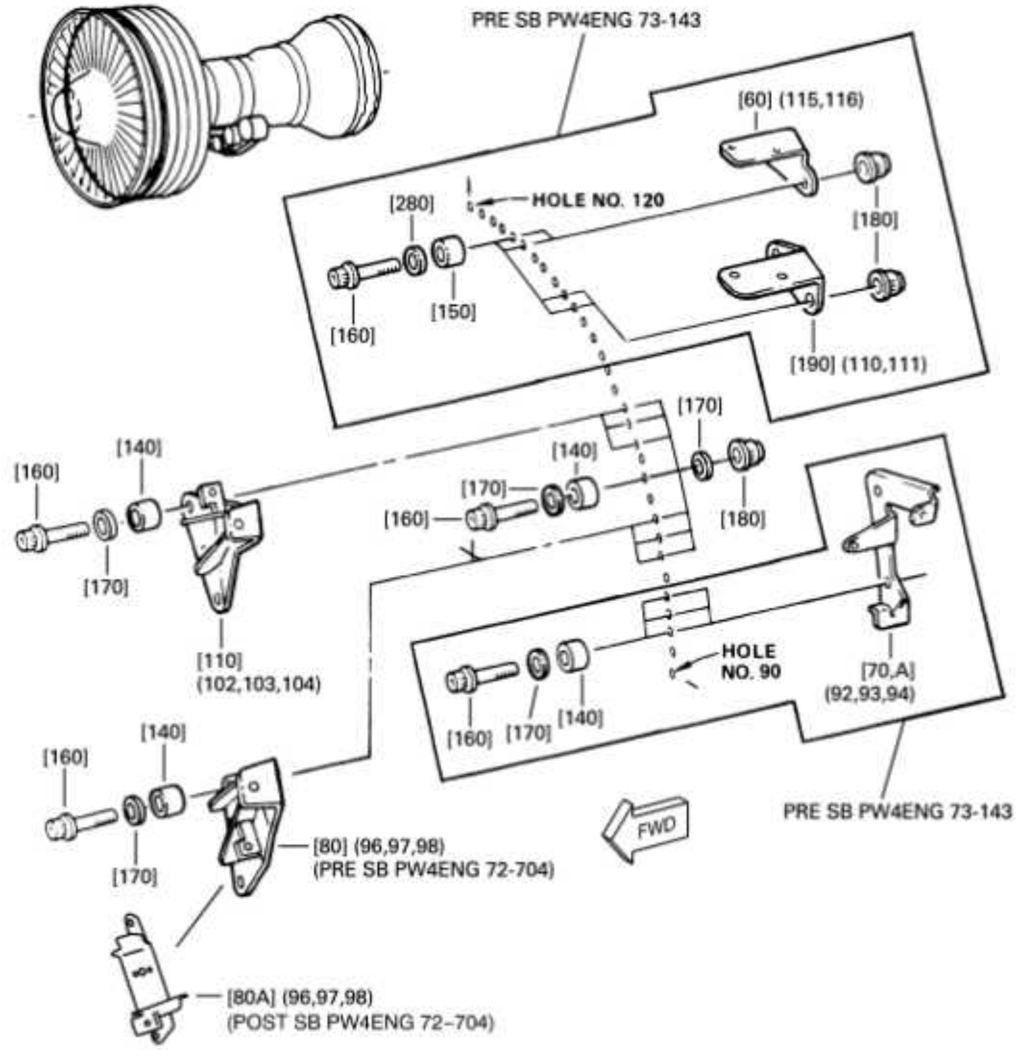
(1) Remove the Flange B brackets as follows. See Figure 501.

(a) Tag and identify the flange B hardware for the correct bolthole locations.

NOTE: All the part item numbers in the figures are the same as the item numbers in the IPC.

(b) Use the PWA 87503 Nut Handle and remove nuts, washers, spacers and bolts that attach brackets to Flange B.

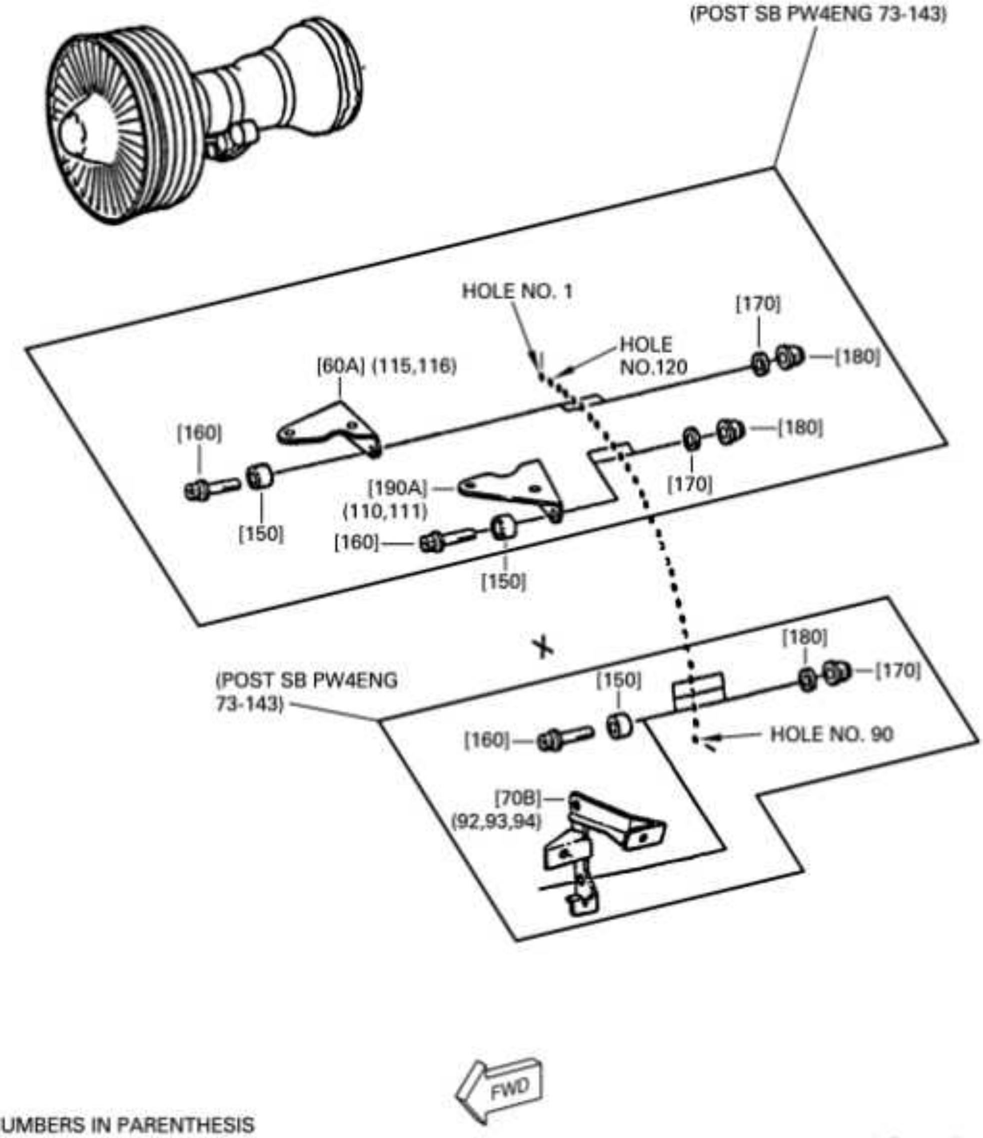
(c) Remove the brackets from the engine.


PRE SB PW4ENG 73-143
[60] (115,116)
HOLE NO. 120
[280]
[180]
[160]
[150]
[190] (110,111)
[170]
[140]
[160]
[140]
[170]
[160]
[180]
[170]
[110]
(102,103,104)
HOLE
NO. 90
[70,A]
(92,93,94)
[160]
[170]
[140]
[140]
[160]
[170]
PRE SB PW4ENG 73-143
FWD
[80] (96,97,98)
(PRE SB PW4ENG 72-704)
[80A] (96,97,98)
(POST SB PW4ENG 72-704)

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE LOCATIONS)

L-A1350 (0502)

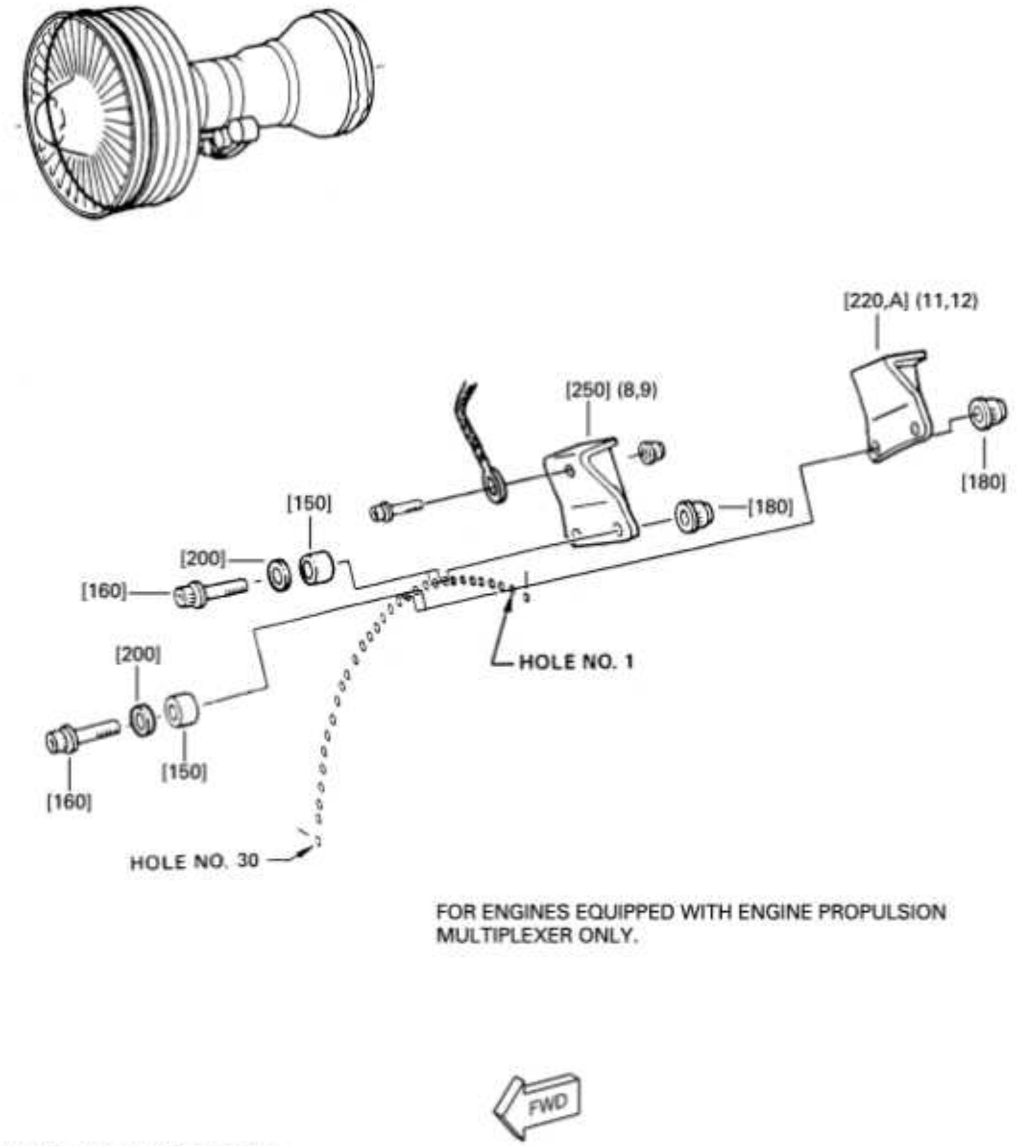
Flange B Bracket Locations
Figure 501 (Sheet 1)
(Task 72–33–00–030–021)


(POST SB PW4ENG 73-143)
HOLE NO. 1
[170]
HOLE NO.120
[180]
[60A] (115,116)
[160]
[180]
[190A]
(110,111)
[170]
[150]
[160]
[150]
X
[180]
(POST SB PW4ENG 73-143)
[150]
[170]
[160]
HOLE NO. 90
[70B]
(92,93,94)
FWD

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE LOCATIONS)

L-B2167 (0502)

Flange B Bracket Locations
Figure 501 (Sheet 2)
(Task 72−33−00−030−021)

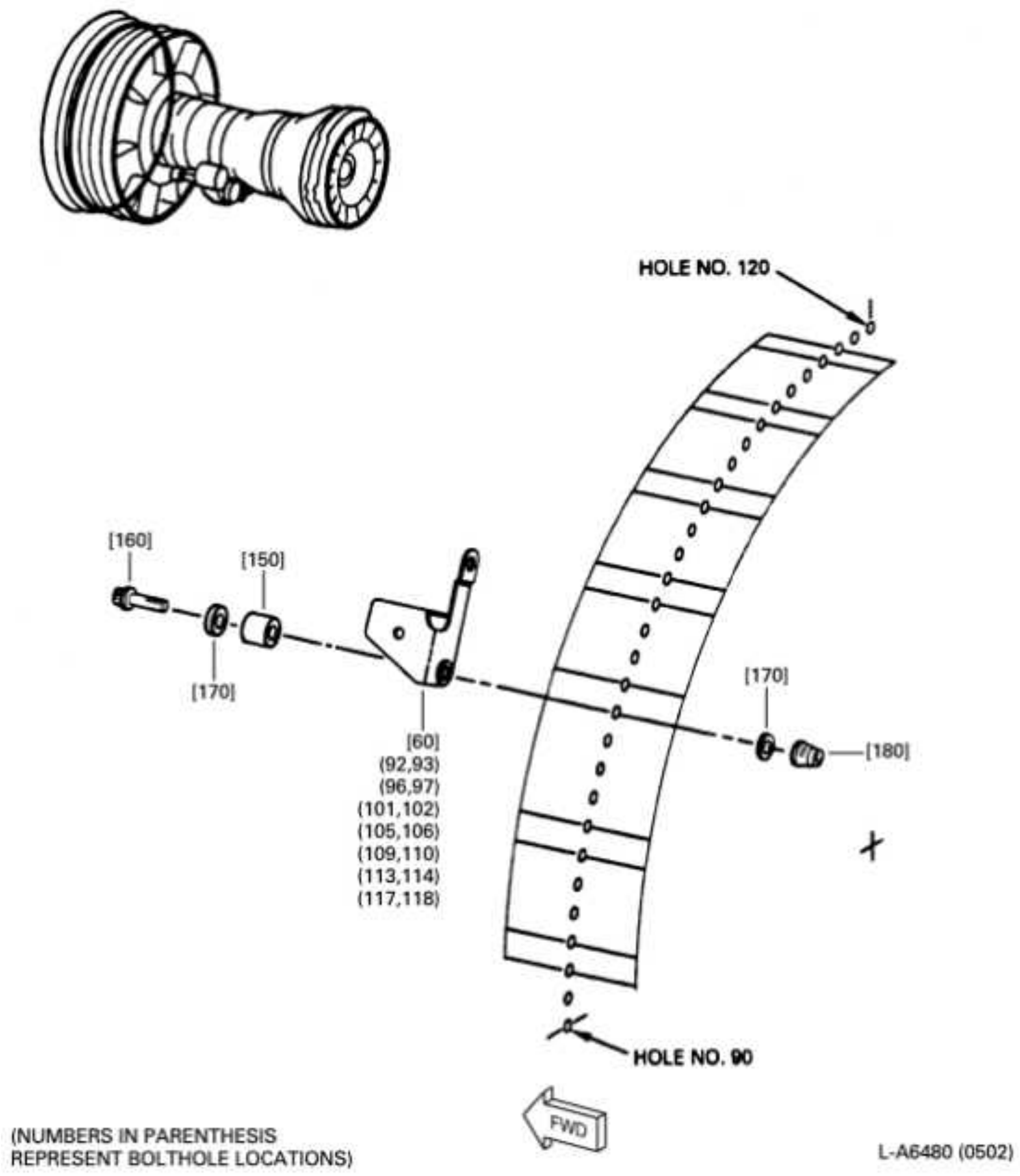

[220,A] (11,12)
[250] (8,9)
[180]
[180]
[150]
[200]
[160]
HOLE NO. 1
[200]
[150]
[160]
HOLE NO. 30
FWD

FOR ENGINES EQUIPPED WITH ENGINE PROPULSION MULTIPLEXER ONLY.

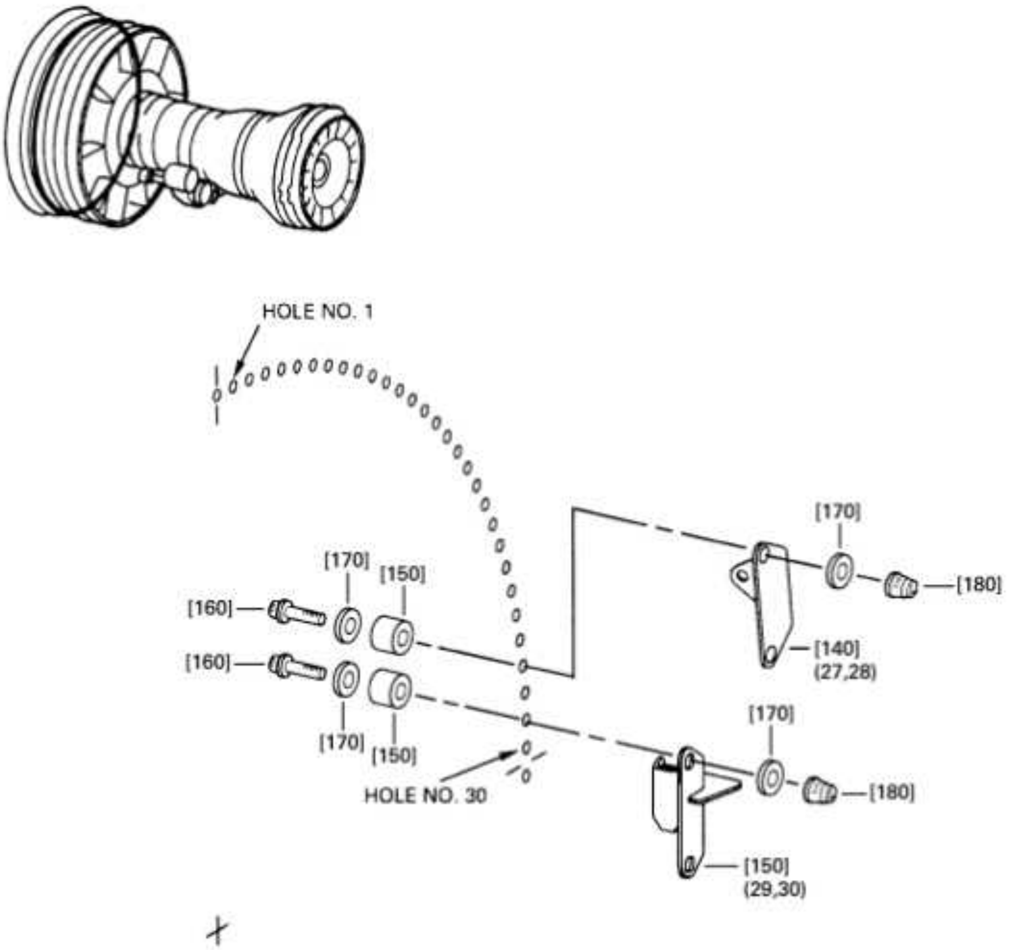
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

L-A3471 (0502)

Flange B (Brackets Required For Engine Propulsion Multiplexer Unit)
Figure 501 (Sheet 3)
(Task 72-33-00-030-021)


HOLE NO. 120
[160]
[150]
[170]
[60]
(92,93)
(96,97)
(101,102)
(105,106)
(109,110)
(113,114)
(117,118)
[170]
[180]
HOLE NO. 90
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE LOCATIONS)
L-A6480 (0502)

Flange B Bracket Locations (Engines With Common Fan Cases)
Figure 501 (Sheet 4)
(Task 72−33−00−030−021)


HOLE NO. 1
[170]
[180]
[170]
[150]
[160]
[140]
(27,28)
[160]
[170]
[170]
[150]
[180]
HOLE NO. 30
[150]
(29,30)

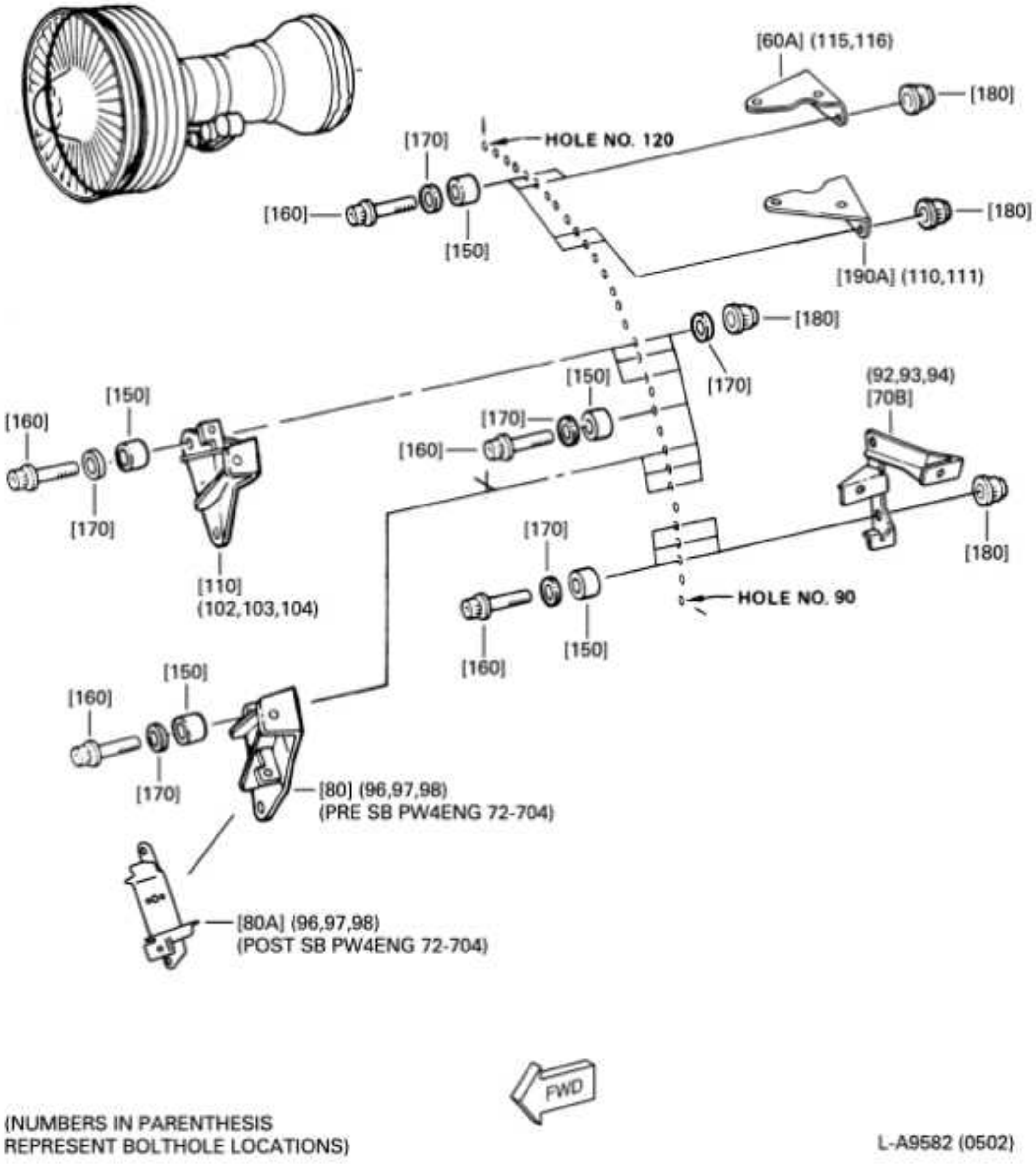
NOTE: FOR ENGINES EQUIPPED WITH
SUPPLEMENTAL CONTROL UNIT
WITH MULTIPLEXING ONLY.

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE LOCATIONS)

L-A7399 (0502)

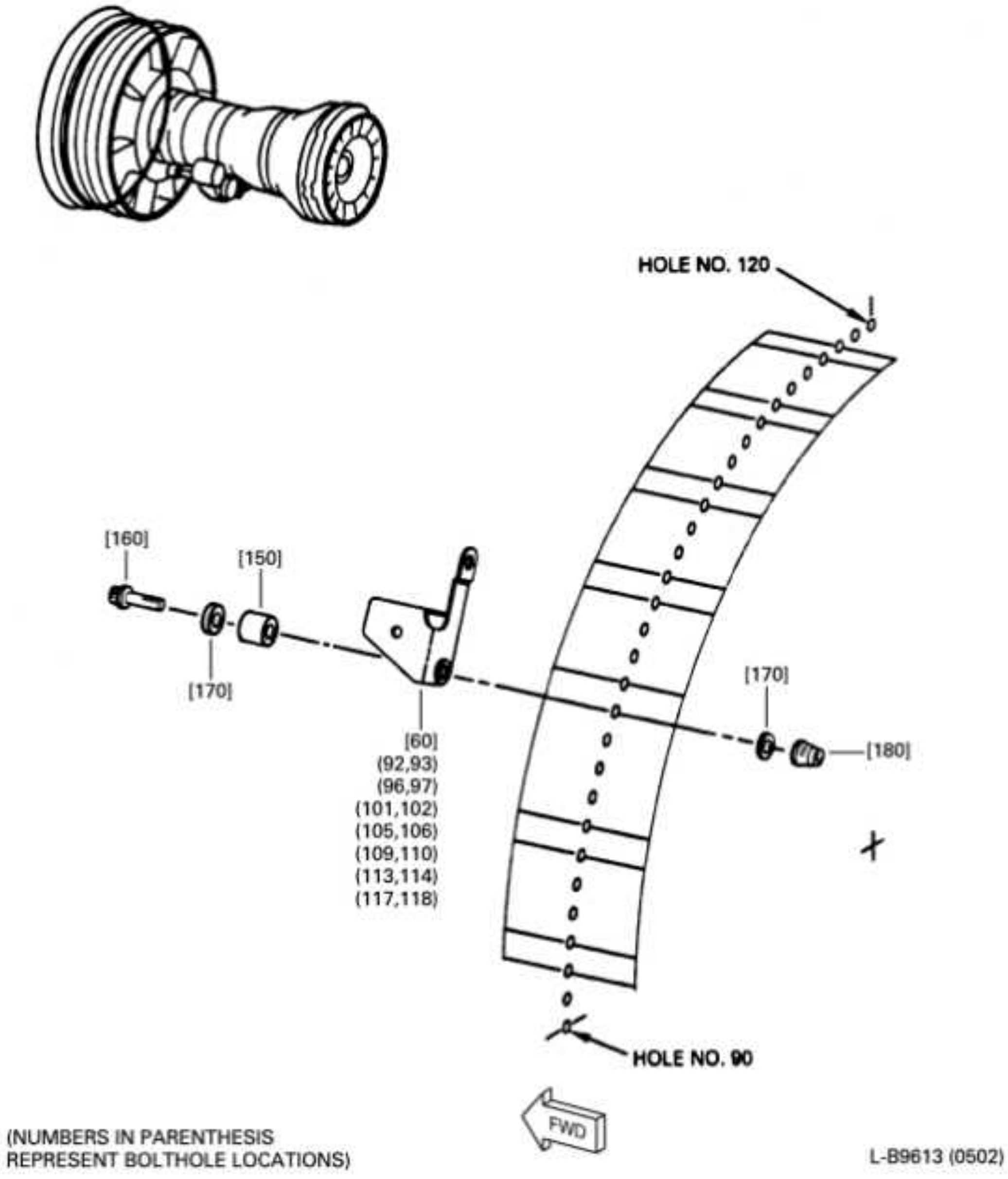
Flange B Bracket Locations (Engines With SCU With Multiplexing)
Figure 501 (Sheet 5)
(Task 72−33−00−030−021)

FAN CASE − DISASSEMBLY−21

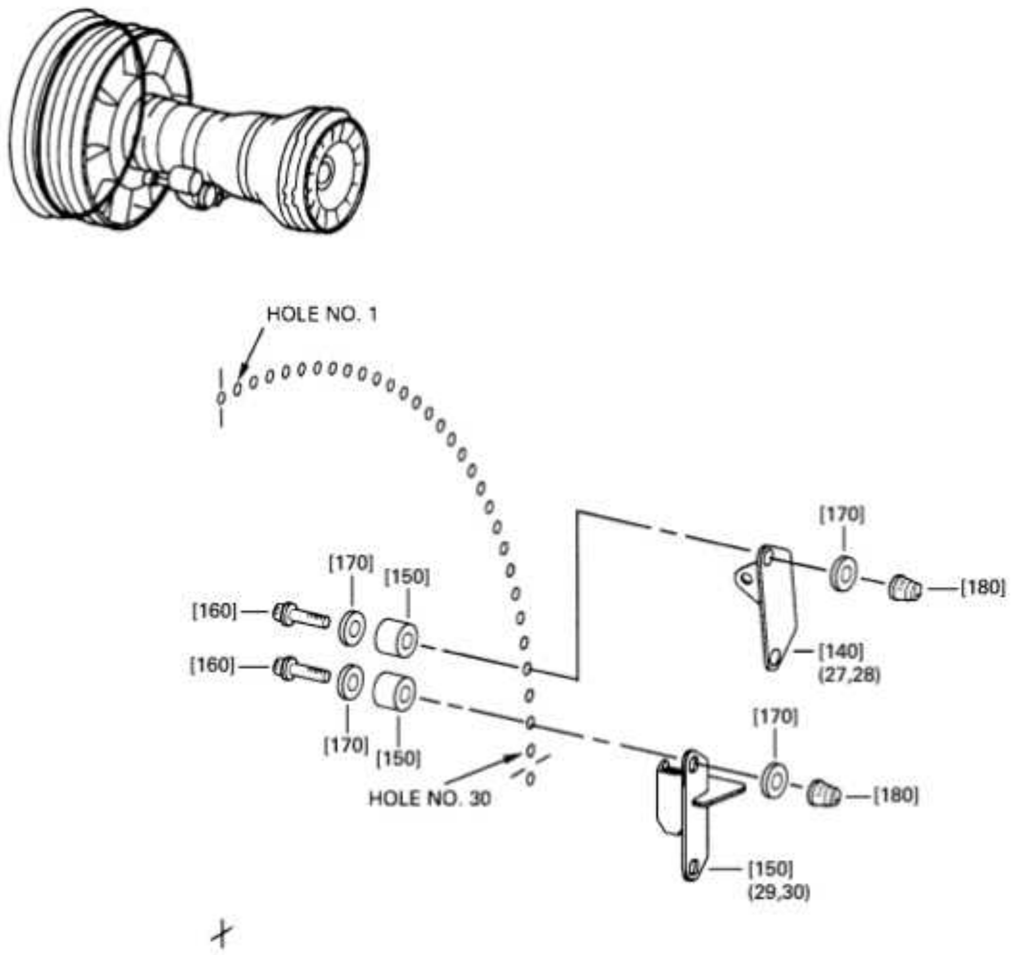

[60A] (115,116)
[180]
[170]
HOLE NO. 120
[160]
[150]
[180]
[190A] (110,111)
[180]
[150]
[170]
[160]
[150]
[160]
[170]
[160]
[170]
(92,93,94)
[70B]
[180]
[110]
(102,103,104)
[170]
[150]
HOLE NO. 90
[160]
[150]
[160]
[170]
[80] (96,97,98)
(PRE SB PW4ENG 72-704)
[80A] (96,97,98)
(POST SB PW4ENG 72-704)
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE LOCATIONS)
L-A9582 (0502)

Flange B Brackets Locations
Figure 501 (Sheet 6)
(Task 72−33−00−030−021)

FAN CASE − DISASSEMBLY−21


HOLE NO. 120
[160]
[150]
[170]
[170]
[180]
[60]
(92,93)
(96,97)
(101,102)
(105,106)
(109,110)
(113,114)
(117,118)
HOLE NO. 90
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE LOCATIONS)
L-B9613 (0502)

Flange B Bracket Locations (Engines With Common Fan Cases)
Figure 501 (Sheet 7)
(Task 72−33−00−030−021)


HOLE NO. 1
[170]
[180]
[170]
[150]
[160]
[160]
[140]
(27,28)
[170]
[170]
[150]
HOLE NO. 30
[180]
[150]
(29,30)

NOTE: FOR ENGINES EQUIPPED WITH
SUPPLEMENTAL CONTROL UNIT

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE LOCATIONS)

L-A9583 (0502)

Flange B Bracket Locations (Engines With SCU)
Figure 501 (Sheet 8)
(Task 72−33−00−030−021)

FAN CASE - DISASSEMBLY-22

Task 72-33-00-030-022:

1. Remove The Flange B1 Brackets And Hardware

   A. Equipment And Materials Necessary - None

   B. Procedure

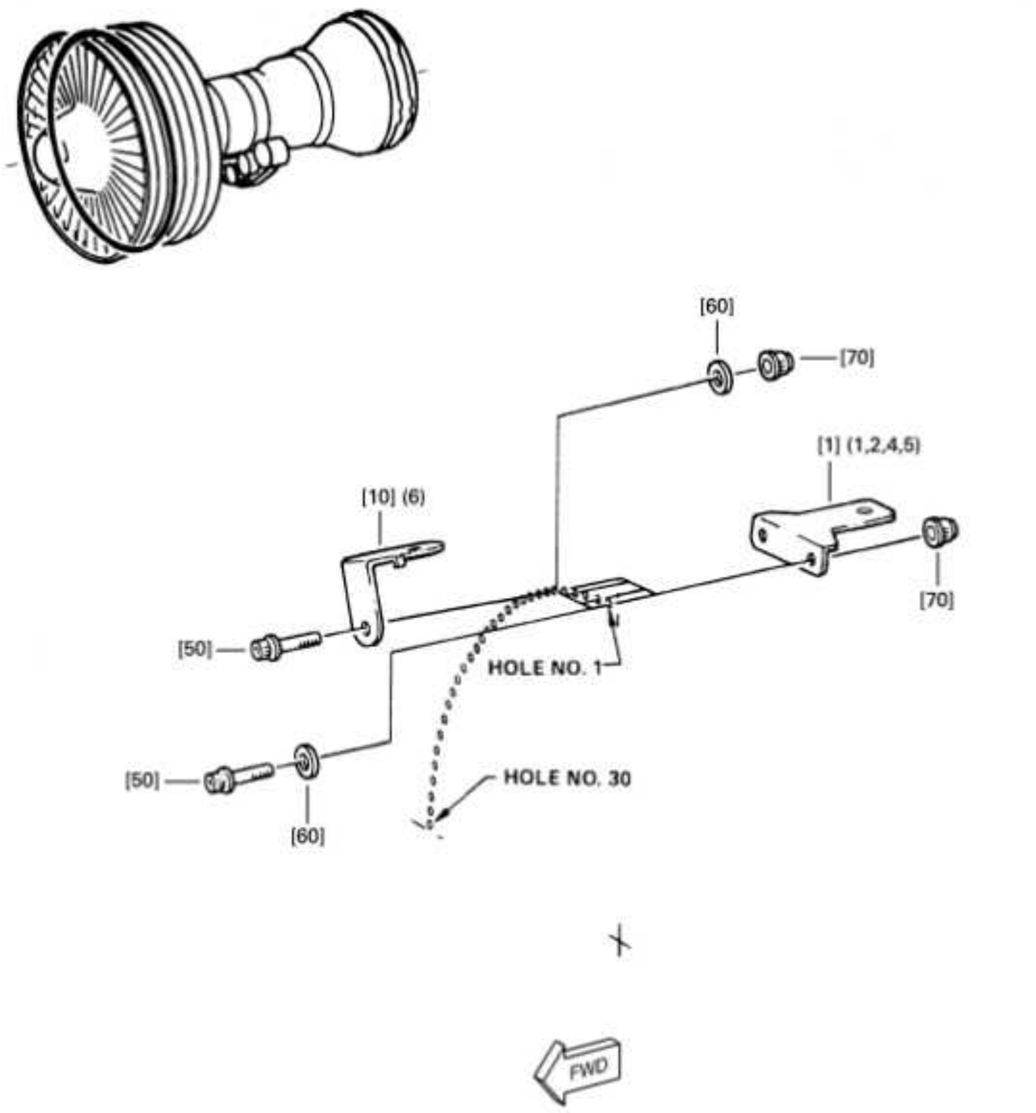
      (1) Remove the Flange B1 brackets as follows. See Figure 501.

         (a) Tag and identify the flange B1 hardware for the correct bolthole locations.

            NOTE: All the part item numbers in the figures are the same as the item numbers in the IPC.

         (b) Remove the bolts, washers, brackets, and nuts from Flange B1.

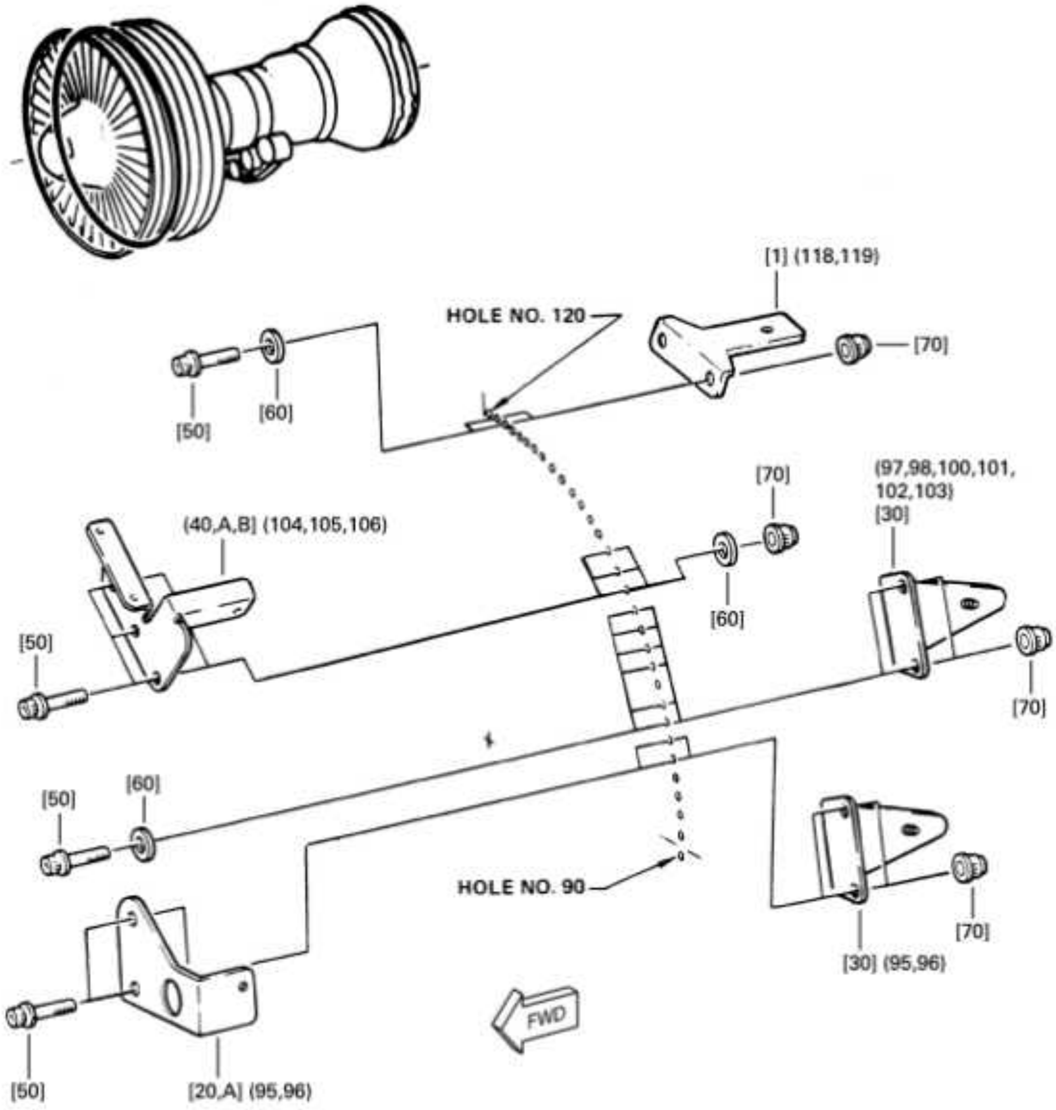
FAN CASE − DISASSEMBLY−22


[60]
[70]
[1] (1,2,4,5)
[10] (6)
[70]
[50]
HOLE NO. 1
[50]
HOLE NO. 30
[60]
FWD

(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)

L-A2370 (0502)

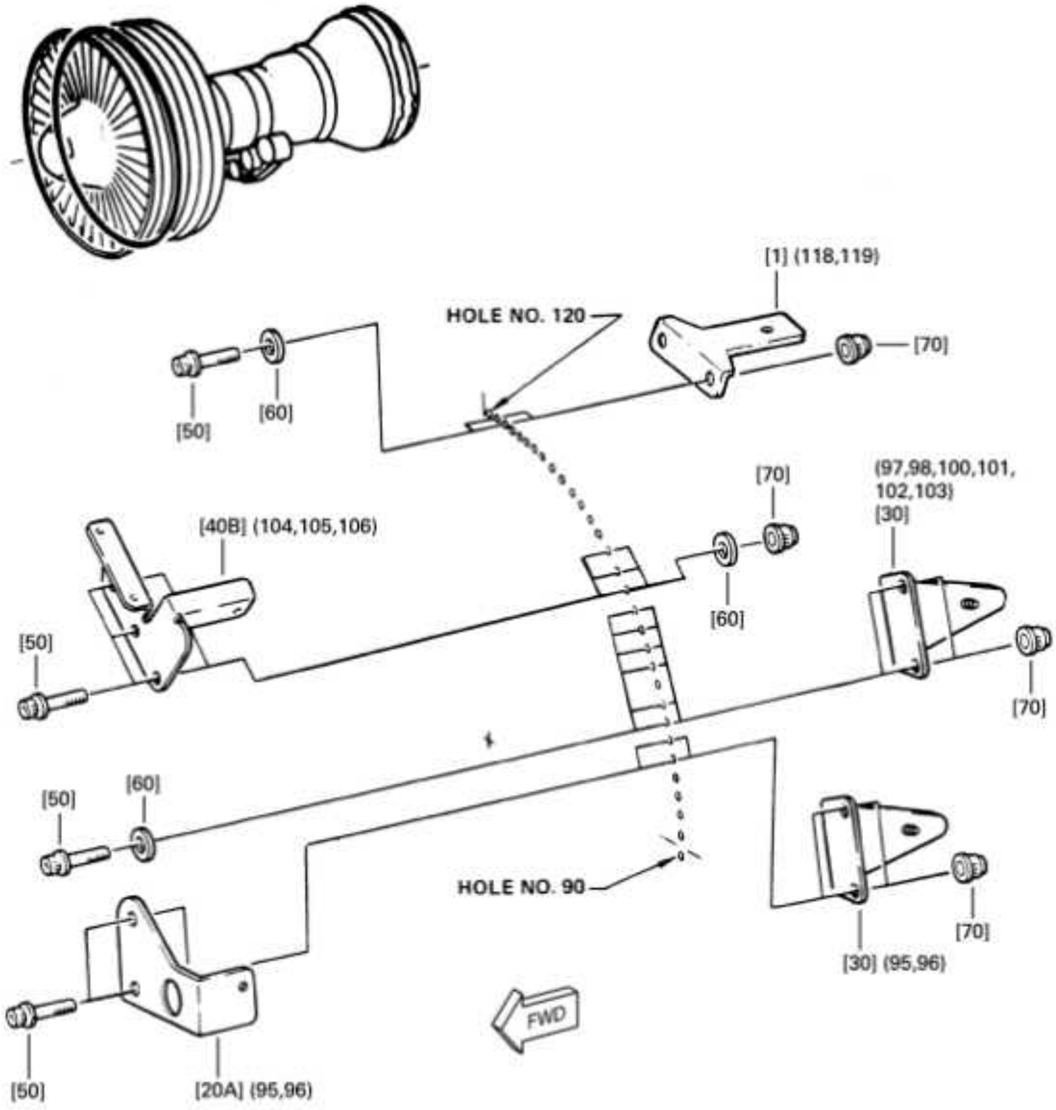
Flange B1 Bracket Locations (Basic Engines)
Figure 501 (Sheet 1)
(Task 72−33−00−030−022)


[1] (118,119)
HOLE NO. 120
[70]
[50]
[60]
[70]
(97,98,100,101,
102,103)
[30]
(40,A,B] (104,105,106)
[60]
[50]
[70]
[50]
[60]
HOLE NO. 90
[70]
[30] (95,96)
FWD
[50]
[20,A] (95,96)

(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)

L-A2375 (0502)

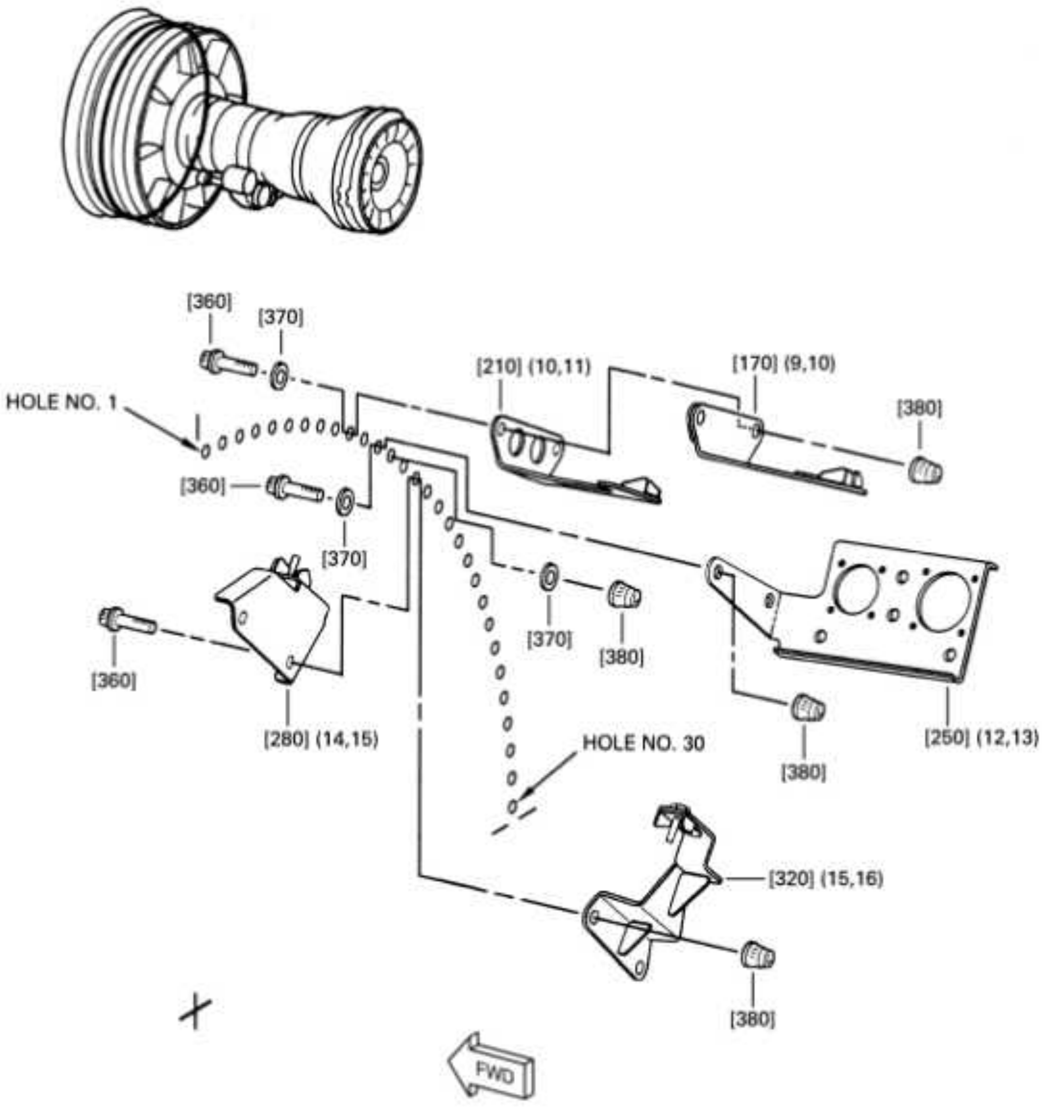
Flange B1 Bracket Locations (Basic Engines)
Figure 501 (Sheet 2)
(Task 72−33−00−030−022)


[1] (118,119)
HOLE NO. 120
[70]
[50]
[60]
[70]
(97,98,100,101,
102,103)
[30]
[40B] (104,105,106)
[60]
[50]
[70]
[50]
[60]
HOLE NO. 90
[70]
[30] (95,96)
FWD
[50]
[20A] (95,96)

(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)

L-A9586 (0502)

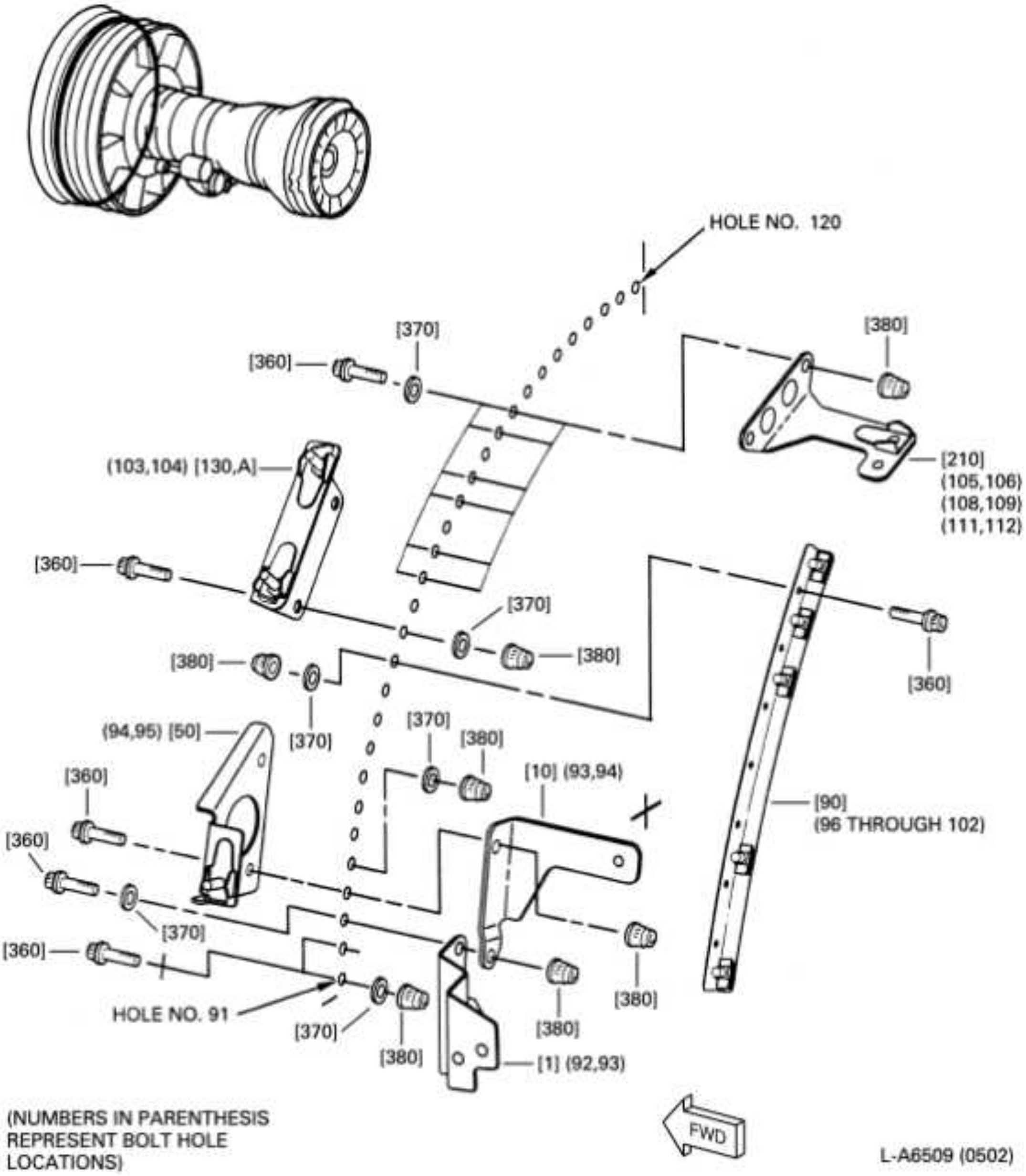
Flange B1 Bracket Locations (Basic Engines)
Figure 501 (Sheet 3)
(Task 72-33-00-030-022)


[360]
[370]
HOLE NO. 1
[210] (10,11)
[170] (9,10)
[380]
[360]
[370]
[360]
[370]
[380]
[280] (14,15)
HOLE NO. 30
[380]
[250] (12,13)
[320] (15,16)
[380]
FWD

(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)

L-A6508 (0502)

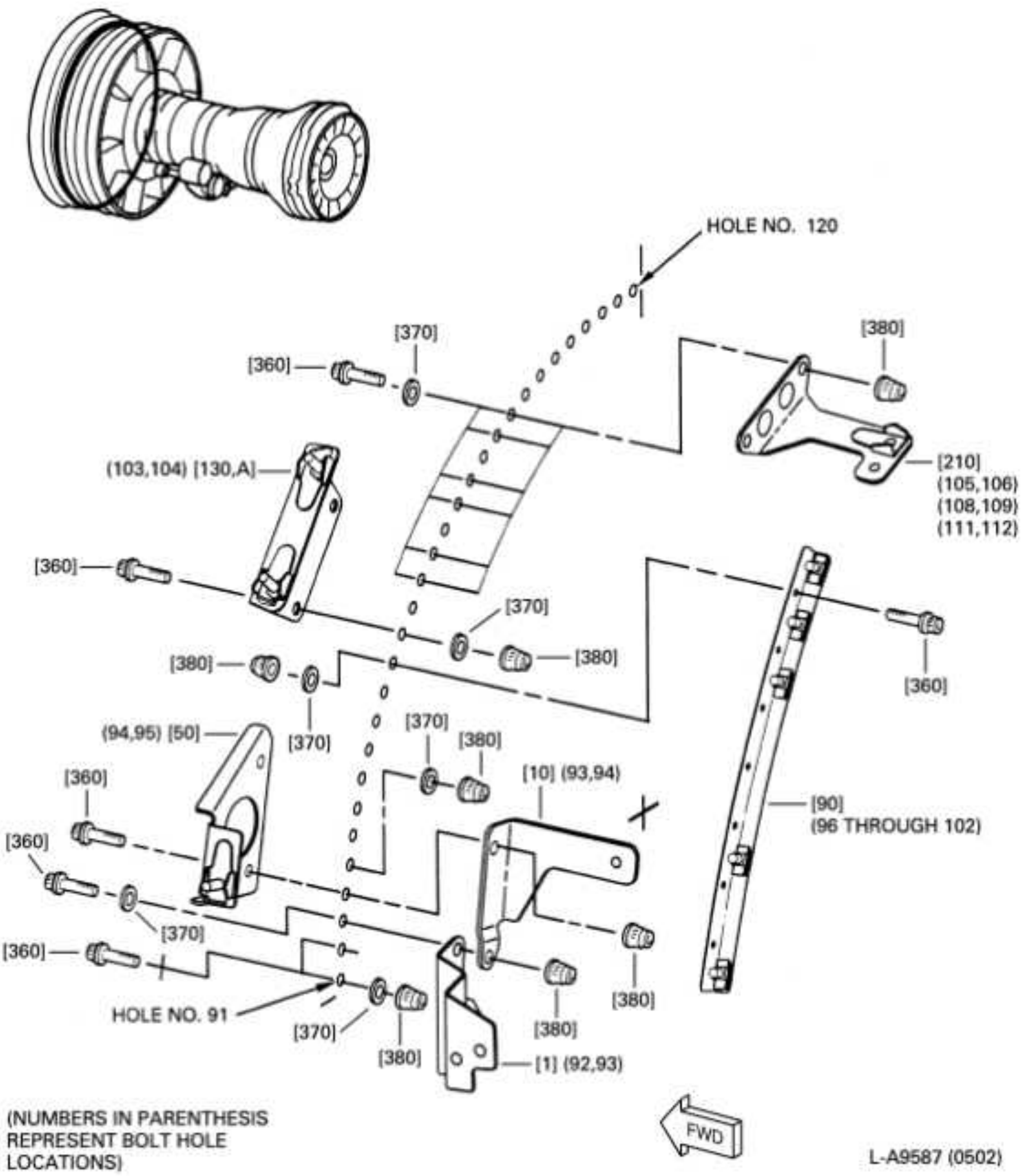
Flange B1 Bracket Locations (Engines With Common Fan Cases)
Figure 501 (Sheet 4)
(Task 72−33−00−030−022)


HOLE NO. 120
[370]
[380]
[360]
(103,104) [130,A]
[210]
(105,106)
(108,109)
(111,112)
[360]
[370]
[380]
[380]
[360]
[370]
(94,95) [50]
[370]
[380]
[360]
[10] (93,94)
[90]
(96 THROUGH 102)
[360]
[370]
[360]
[380]
HOLE NO. 91
[370]
[380]
[380]
[1] (92,93)
FWD

(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)

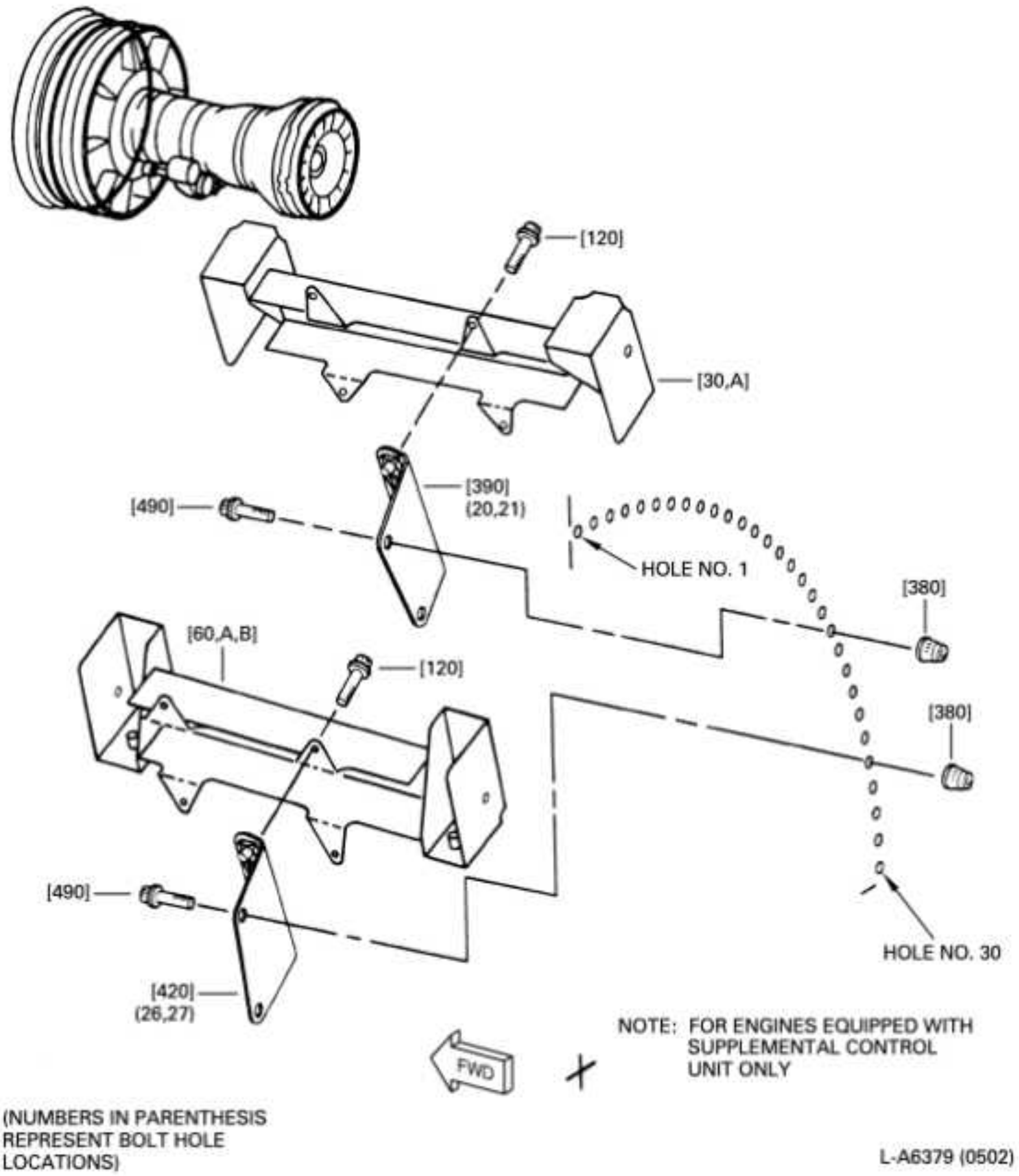
L-A6509 (0502)

Flange B1 Bracket Locations (Engines With Common Fan Cases)
Figure 501 (Sheet 5)
(Task 72–33–00–030–022)

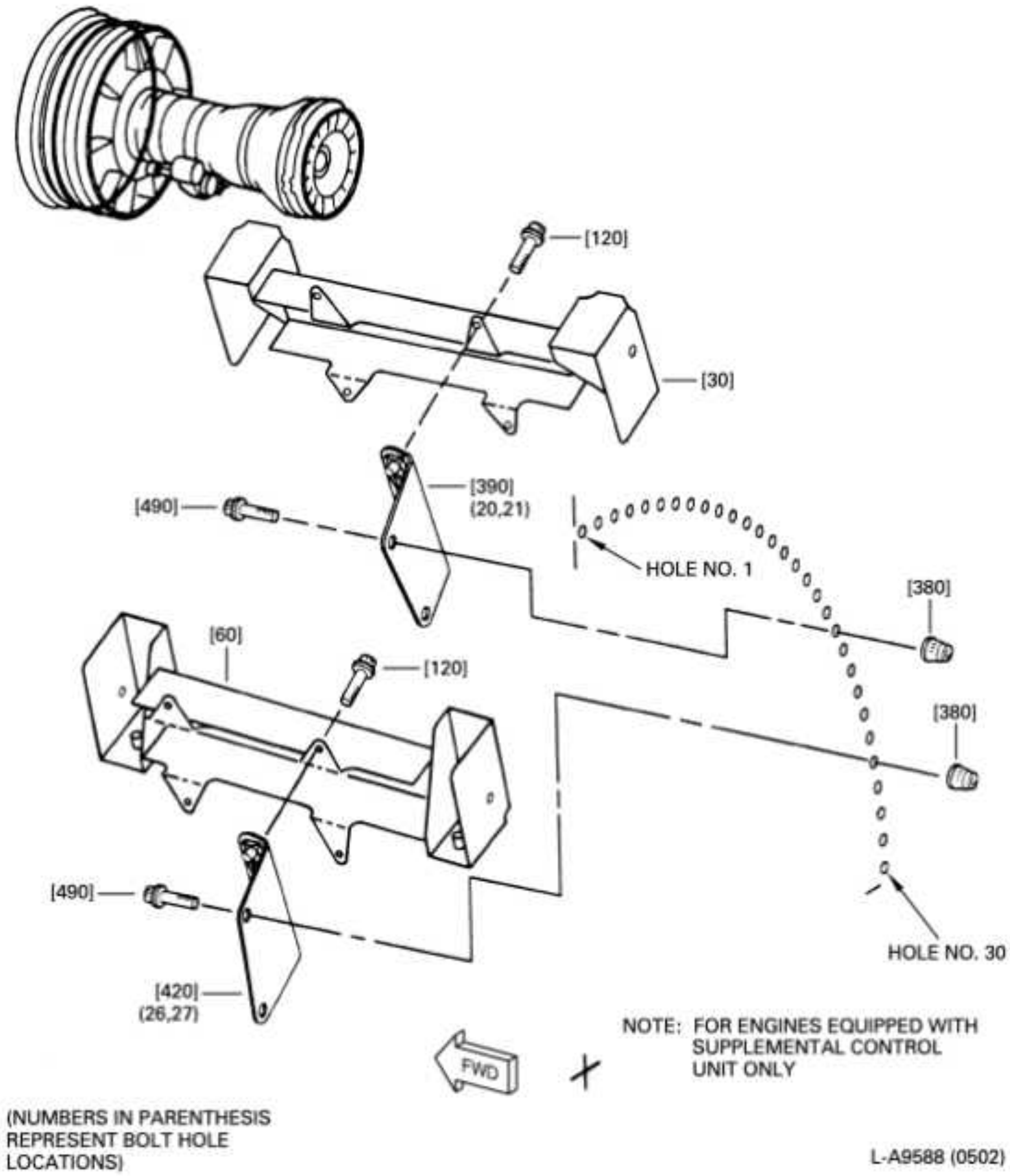

HOLE NO. 120
[370]
[380]
[360]
(103,104) [130,A]
[210]
(105,106)
(108,109)
(111,112)
[360]
[370]
[380]
[380]
[360]
[370]
(94,95) [50]
[370]
[380]
[360]
[10] (93,94)
[90]
(96 THROUGH 102)
[360]
[370]
[360]
[380]
[380]
HOLE NO. 91
[370]
[380]
[1] (92,93)
(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)
FWD
L-A9587 (0502)

Flange B1 Bracket Locations (Engines With Common Fan Cases)
Figure 501 (Sheet 6)
(Task 72−33−00−030−022)

FAN CASE − DISASSEMBLY−22


[120]
[30,A]
[490]
[390]
(20,21)
HOLE NO. 1
[380]
[60,A,B]
[120]
[380]
[490]
HOLE NO. 30
[420]
(26,27)
FWD
NOTE: FOR ENGINES EQUIPPED WITH SUPPLEMENTAL CONTROL UNIT ONLY
(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)
L-A6379 (0502)

Flange B1 Bracket Locations (Engines Equipped With SCU)
Figure 501 (Sheet 7)
(Task 72−33−00−030−022)


[120]
[30]
[390]
(20,21)
[490]
HOLE NO. 1
[380]
[60]
[120]
[380]
[490]
HOLE NO. 30
[420]
(26,27)
FWD
NOTE: FOR ENGINES EQUIPPED WITH SUPPLEMENTAL CONTROL UNIT ONLY
(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)
L-A9588 (0502)

Flange B1 Bracket Locations (Engines Equipped With SCU)
Figure 501 (Sheet 8)
(Task 72-33-00-030-022)

FAN CASE − DISASSEMBLY−23

Task 72−33−00−030−023:

1. Remove The Flange B2 Brackets And Hardware

   A. Equipment And Materials Necessary − None

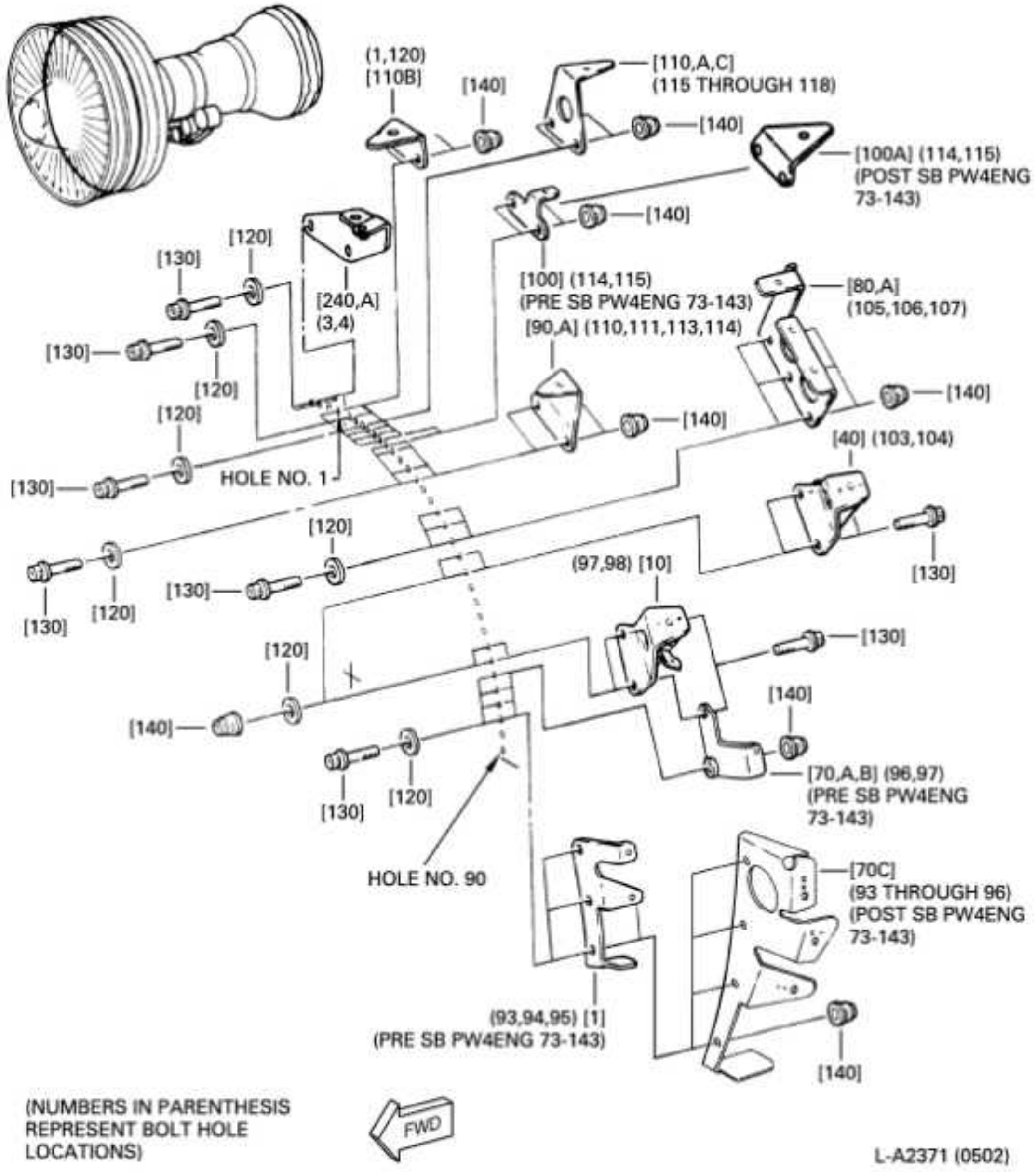
   B. Procedure

      (1) Remove the Flange B2 brackets as follows. Figure 501.

         (a) Tag and identify the flange B2 hardware for the correct bolthole locations.

            NOTE: All the part item numbers in the figures are the same as the item numbers in the IPC.

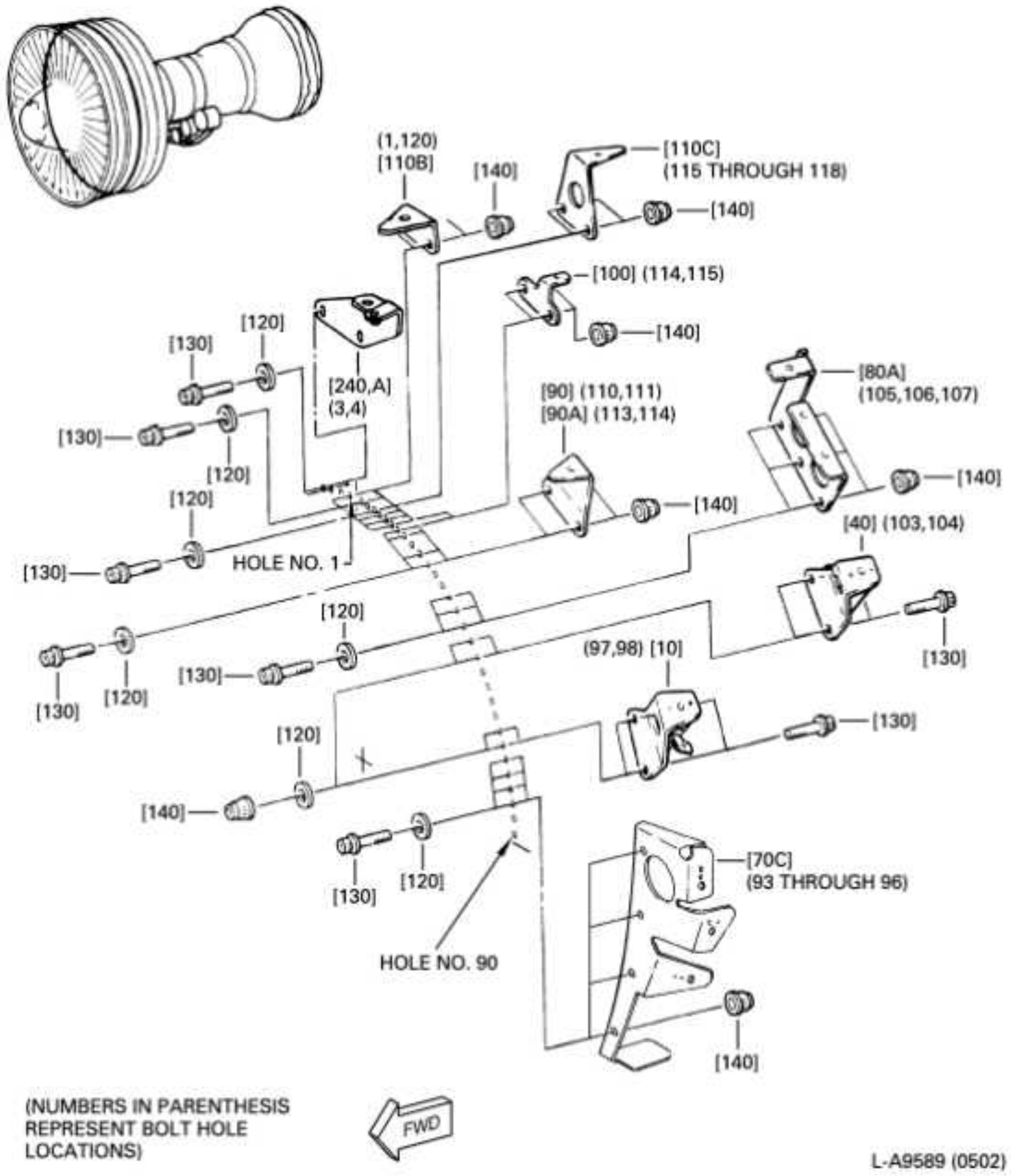
         (b) Remove the bolts, washers, brackets, and nuts from Flange B2.


(1,120)
[110B]
[140]
[110,A,C]
(115 THROUGH 118)
[140]
[100A] (114,115)
(POST SB PW4ENG
73-143)
[140]
[120]
[130]
[240,A]
(3,4)
[100] (114,115)
(PRE SB PW4ENG 73-143)
[90,A] (110,111,113,114)
[80,A]
(105,106,107)
[130]
[120]
[120]
[140]
[140]
[120]
[130]
HOLE NO. 1
[40] (103,104)
[120]
[130]
[120]
[130]
[130]
(97,98) [10]
[130]
[120]
[140]
[140]
[130]
[120]
[70,A,B] (96,97)
(PRE SB PW4ENG
73-143)
HOLE NO. 90
[70C]
(93 THROUGH 96)
(POST SB PW4ENG
73-143)
(93,94,95) [1]
(PRE SB PW4ENG 73-143)
[140]
FWD

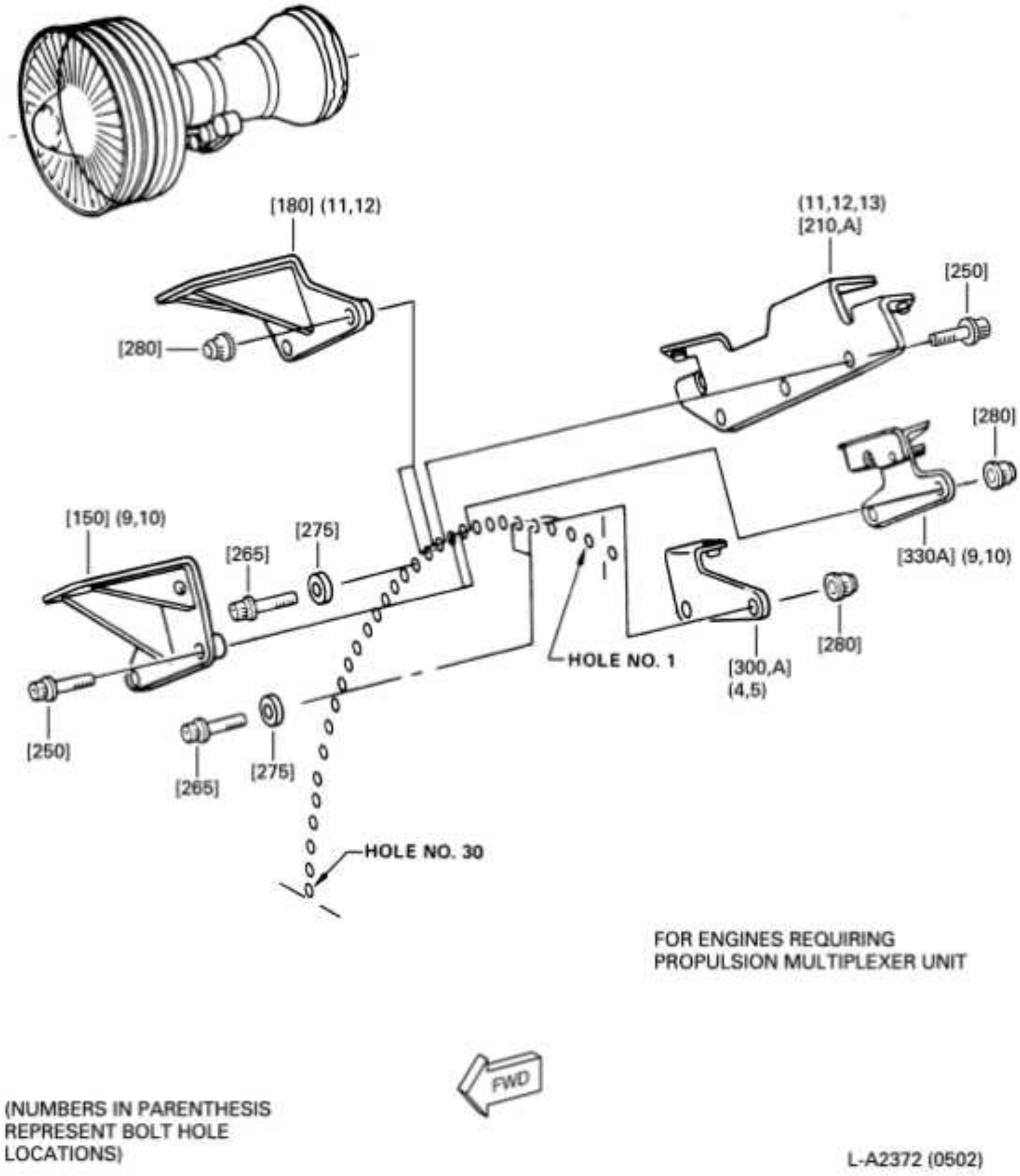
(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)

L-A2371 (0502)

Flange B2 Bracket Locations (Basic Engines)
Figure 501 (Sheet 1)
(Task 72−33−00−030−023)


(1,120)
[110B]
[140]
[110C]
(115 THROUGH 118)
[140]
[100] (114,115)
[140]
[120]
[130]
[240,A]
(3,4)
[130]
[120]
[80A]
(105,106,107)
[90] (110,111)
[90A] (113,114)
[120]
[140]
[140]
[130]
HOLE NO. 1
[40] (103,104)
[120]
[130]
[130]
[120]
[130]
(97,98) [10]
[130]
[120]
[140]
[70C]
(93 THROUGH 96)
[130]
[120]
HOLE NO. 90
[140]
(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)
FWD
L-A9589 (0502)

Flange B2 Bracket Locations (Basic Engines)
Figure 501 (Sheet 2)
(Task 72-33-00-030-023)

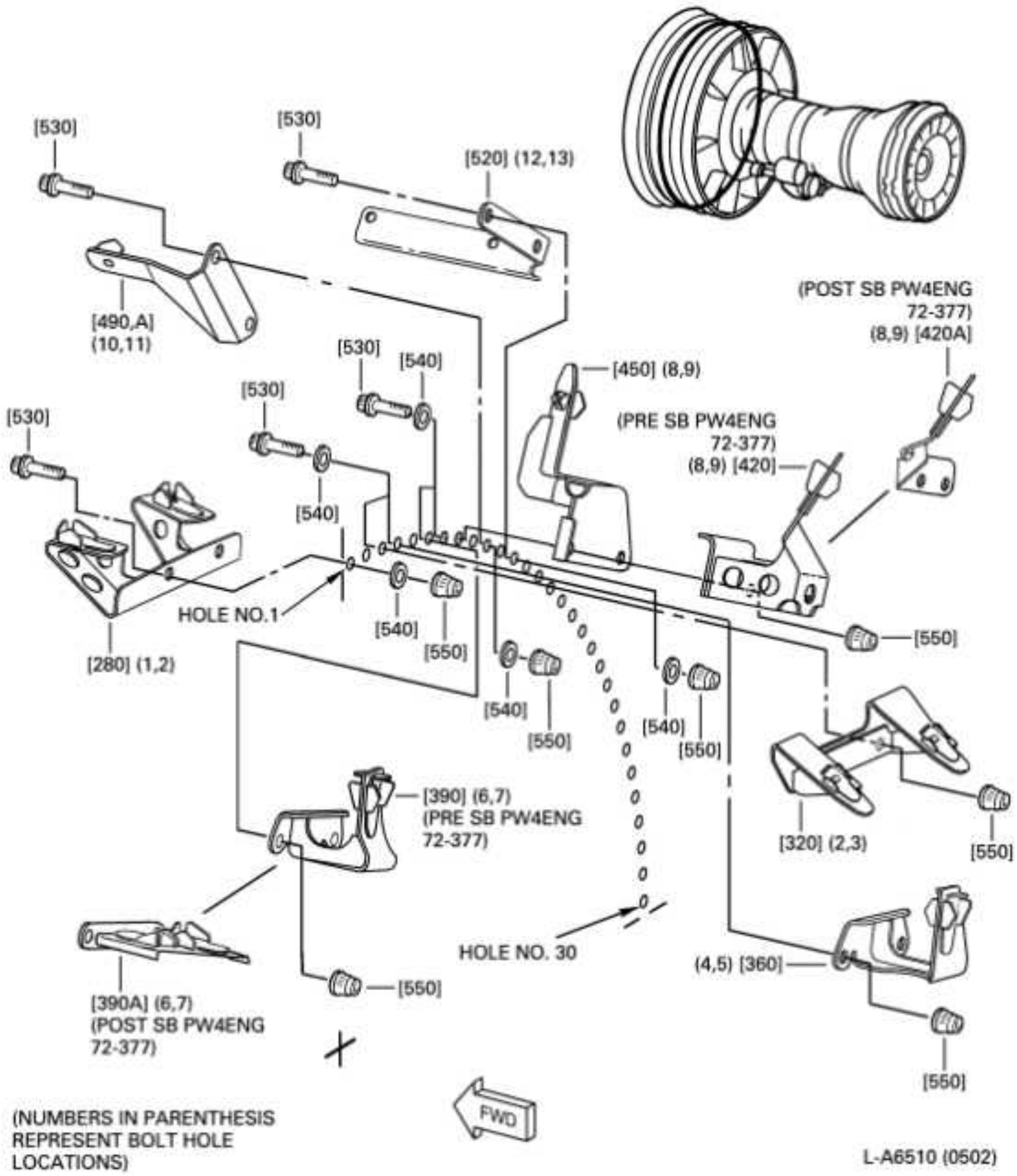

[180] (11,12)
(11,12,13)
[210,A]
[250]
[280]
[280]
[150] (9,10)
[265]
[275]
[330A] (9,10)
HOLE NO. 1
[300,A]
(4,5)
[280]
[250]
[265]
[275]
HOLE NO. 30
FWD

FOR ENGINES REQUIRING
PROPULSION MULTIPLEXER UNIT

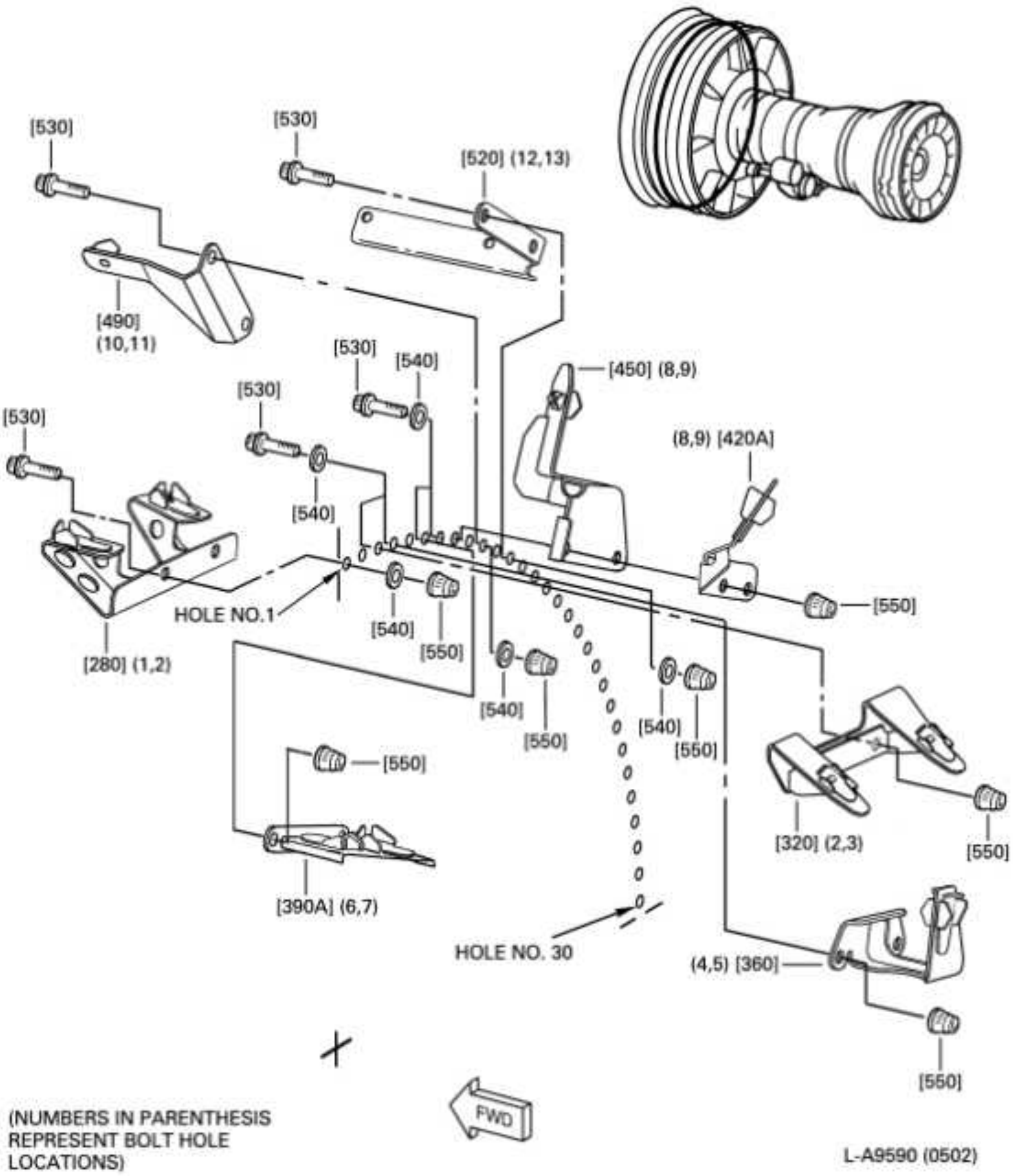
(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)

L-A2372 (0502)

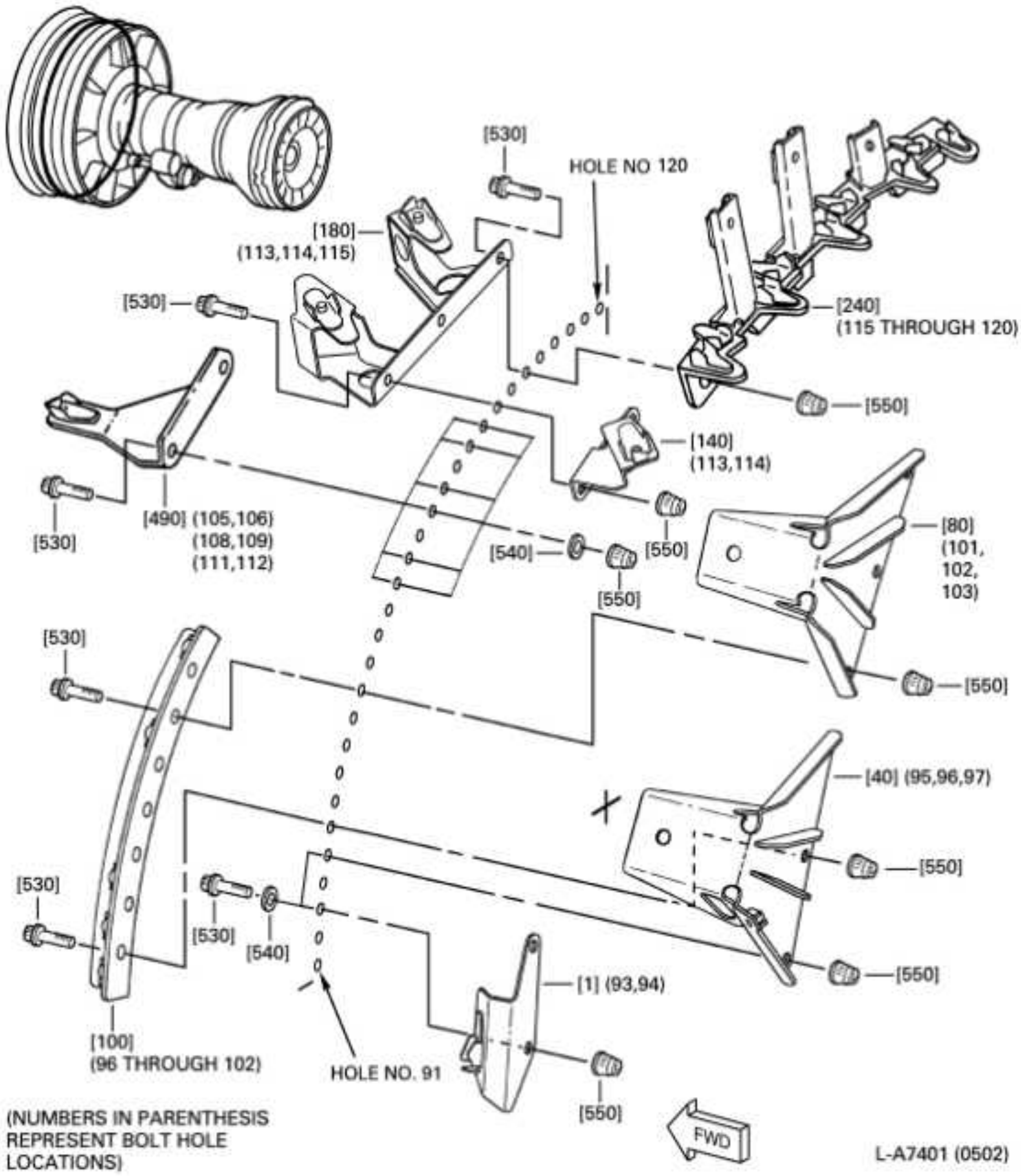
Flange B2 (Brackets Required For Engine Propulsion Multiplexer Unit)
Figure 501 (Sheet 3)
(Task 72-33-00-030-023)


[530]
[530]
[520] (12,13)
[490,A]
(10,11)
(POST SB PW4ENG
72-377)
(8,9) [420A]
[530]
[540]
[450] (8,9)
[530]
[530]
(PRE SB PW4ENG
72-377)
(8,9) [420]
[540]
HOLE NO.1
[540]
[550]
[550]
[280] (1,2)
[540]
[550]
[540]
[550]
[390] (6,7)
(PRE SB PW4ENG
72-377)
[320] (2,3)
[550]
HOLE NO. 30
(4,5) [360]
[550]
[390A] (6,7)
(POST SB PW4ENG
72-377)
[550]
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)
L-A6510 (0502)

Flange B2 Bracket Locations (Engines With Common Fan Cases)
Figure 501 (Sheet 4)
(Task 72–33–00–030–023)


[530]
[530]
[520] (12,13)
[490] (10,11)
[530]
[540]
[450] (8,9)
[530]
[530]
(8,9) [420A]
[540]
HOLE NO.1
[540]
[550]
[550]
[280] (1,2)
[540]
[550]
[540]
[550]
[550]
[320] (2,3)
[550]
[390A] (6,7)
HOLE NO. 30
(4,5) [360]
[550]
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)
L-A9590 (0502)

Flange B2 Bracket Locations (Engines With Common Fan Cases)
Figure 501 (Sheet 5)
(Task 72-33-00-030-023)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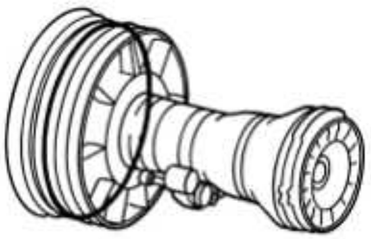
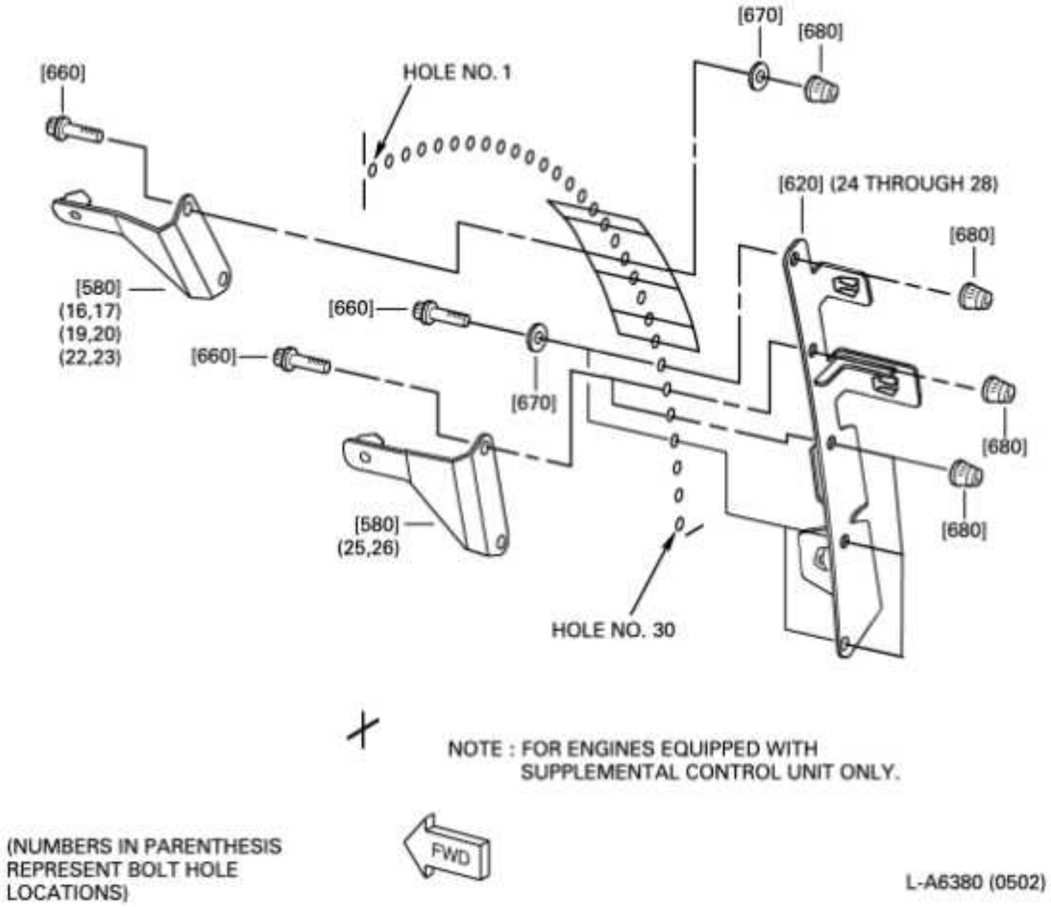
HOLE NO 120
[180]
(113,114,115)
[530]
[240]
(115 THROUGH 120)
[550]
[140]
(113,114)
[530]
[490] (105,106)
(108,109)
(111,112)
[540]
[550]
[550]
[80]
(101,
102,
103)
[530]
[550]
[40] (95,96,97)
[530]
[550]
[530]
[540]
[550]
[1] (93,94)
[100]
(96 THROUGH 102)
HOLE NO. 91
[550]
FWD

(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)

L-A7401 (0502)

Flange B2 Bracket Locations (Engines With Common Fan Cases)
Figure 501 (Sheet 6)
(Task 72−33−00−030−023)




[670]
[680]
[660]
HOLE NO. 1
[620] (24 THROUGH 28)
[680]
[580]
(16,17)
(19,20)
(22,23)
[660]
[660]
[670]
[680]
[680]
[580]
(25,26)
HOLE NO. 30
NOTE : FOR ENGINES EQUIPPED WITH
SUPPLEMENTAL CONTROL UNIT ONLY.
(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)
FWD
L-A6380 (0502)

Flange B2 Bracket Locations (Engines Equipped With SCU)
Figure 501 (Sheet 7)
(Task 72−33−00−030−023)

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FAN CASE - CLEANING-01

Task 72-33-00-100-001:

1. Clean Fan Case Parts - Deleted

A. General

(1) This cleaning procedure is deleted and moved to the 94 inch Cleaning, Inspection and Repair Manual, PN 51A357.

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FAN CASE - INSPECTION/CHECK-01

Task 72-33-00-990-004:

1. General Inspection Requirements - Fan Case

   A. Organization Of Individual Part Or Subassembly Inspection Data

      (1) Specific inspection functions for all significant parts/subassemblies are provided in individual Inspection/Check sections. Application of each inspection function is shown in Inspection/Check-00 for part/subassembly. Section designations and function descriptions are as follows.

      (2) Inspection/Check-00 section contains, where applicable:

         (a) Part number(s) for which the inspection data is applicable.

         (b) Service Bulletin numbers applicable to part number(s).

         (c) Inspection/Check numbers, data categories and applicability data.

      (3) Inspection/Check-01, Preinspection Preparation, contains, where applicable:

         (a) General inspection comments, notes, CAUTIONS, etc., which supplement data contained in this section.

         (b) Identification of mechanical disassembly required prior to inspection.

         (c) Identification of any surface treatment or coating removal, or other actions required prior to inspection.

         (d) Identification of part/subassembly cleaning required prior to inspection.

      (4) Inspection/Check-02, Nondestructive Inspection, contains the following nondestructive inspection methods, part/subassembly special attention areas and damage limits (as applicable):

         (a) Fluorescent Penetrant Method

         (b) Eddy Current Method

(c) Magnetic Particle Method

(d) X−ray Method

(e) Ultrasonic Method

(f) Hardness Check

(g) Other − As specified.

(5) Inspection/Check−03, Visual Inspection contains, where applicable:

(a) Visual inspection requirements which can be accomplished with or without magnification or special lighting (as specified).

NOTE: Use of inspection tools may be required as a supplement to visual inspection process.

(b) Allowable blending for visual damage, which may be accomplished within the inspection area.

NOTE: Blending requirement will also be shown in applicable repairs.

(6) Inspection/Check−04, Dimensional Inspection, contains, where applicable:

(a) Dimensional inspection requirements other than visual inspection. The requirements will include applicable fits and clearances, and other dimensional inspections necessary to ensure the part integrity and proper functioning.

(7) Inspection/Check−05, Functional Check Inspection contains, where applicable:

(a) Procedures, limits, and equipment used with any required functional checks (oil flow, air flow, leak, etc.).

(8) Inspection/Check−06, Inspection Postrequisites contains, references to procedures required to return part/ subassembly to serviceable condition. References include the following, as required.

(a) Reassembly

(b) Protective coatings, sealants and/or lubricant reapplication

B. Thorough and intelligent part/subassembly inspection is of major importance in achieving efficient engine operation and satisfactory service life. Inspection personnel should be thoroughly familiar with inspection procedures, inspection tooling, limits associated with normal and, where applicable, unusual operating conditions, limits associated with repairs, and with inspection procedures published in Standard Practices Manual.

C. During preliminary inspection of part/subassembly, comparison with mating or adjacent parts may provide indication of source of wear or damage. This procedure may indicate requirement for additional disassembly and inspection.

D. During inspection, records should be kept of deviations beyond serviceable limits to determine: (a) if part/subassembly will be repaired or replaced, and (b) if part is reparable, which repairs are required. Suitable documentation should accompany part/subassembly with results of this determination.

E. Inspection of individual part/subassembly dimensions which are also in Fits and Clearances will include Fits and Clearance Reference Numbers and will show new part/subassembly dimension unless specifically stated otherwise. Inspection Frequency Requirements (IFR) codes (for IFR Code A parts only) are included with Reference Number data. If acceptable dimensional deviations or results of repair affect Fits and Clearances, suitable documentation should accompany part/subassembly to ensure check of fit or clearance at final assembly.

NOTE: Parts/subassemblies which deviate dimensionally from new part/subassembly values may be acceptable provided required fit or clearance is achieved at final assembly.

F. Dimensional inspection requirements will be accompanied by part/subassembly constraint data if such constraint requirements are required during part/subassembly manufacture. Adherence to constraint requirements when inspecting service operated parts/subassemblies should be dictated by experience. It is recommended that parts/subassemblies which do not meet dimensional inspection requirements in free state be constrained and re−measured prior to initiation of any repair or re−use activity.

G. Dimensional inspections of one detail of a subassembly, prior to removal from subassembly, may produce incorrect data due to constraint forces from mating details. If questionable data is obtained, subassembly should be disassembled and inspections repeated.

H. Dimensional inspection limits in inspection text provide continued use (as is) and, if applicable, repair limits. Parts/subassemblies which exceed both limits and nonreparable parts/subassemblies which exceed (as is) limits are unserviceable.

I. Inspections required to verify integrity of repair are contained within repair procedure. Unless otherwise stated, repaired part is expected to meet all inspection requirements contained in inspection text for part/subassembly.

J. Parts/subassemblies which do not require repairs except for those provided in Standard Practices Manual are identified by Chapter/Section/Subject Number 72−33−99 in cleaning table (Cleaning−01) and nondestructive inspection table (Inspection/Check−02). Determination of serviceability for those parts listed in 72−33−99 is limited to cleaning, non−destructive inspection, and the following:

(1) Visually inspect parts/subassemblies for surface defects, deformations, cuts, improper threads or wrenching surfaces, incomplete or missing protective coatings or other damage which will prevent proper functioning and make part/subassembly unserviceable. Unserviceable parts/subassemblies should not be reinstalled. Repair unserviceable parts/subassemblies per Standard Practices Manual, as applicable.

(2) Parts/subassemblies with crack indications to any length or depth detected by listed nondestructive inspection are unserviceable, and should not be reinstalled.

K. When new part/subassembly is to be installed and it is important that it be identified as to engine number or position in engine, mark it by appropriate method described in Marking of Parts, 70−11, Standard Practices Manual.

L. In order to eliminate confusion and to maintain consistent terminology, various physical conditions which might be encountered during inspection of parts/subassemblies and explanation of unusual causes of such conditions are defined in Physical Inspection, 70−33, Standard Practices Manual.

M. If inspection reveals it necessary to replace fitted spacer, tag spacer to indicate that replacement must be made with spacer of correct classification at assembly.

N. If text refers to superficial or shallow imperfection, following definitions apply:

  (1) A superficial imperfection is defined as a nick, dent, scratch, toolmark, etc., which disrupts the surface but does not appear to penetrate surface roughness texture.

  (2) A shallow imperfection appears to penetrate surface finish texture, but does not have a dark bottom and would not cause a 0.007 inch (.178 mm) radius stylus to hesitate if passed over it.

FAN CASE − INSPECTION/CHECK−04

Task 72−33−00−990−001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131)	(−)	0.512 (13.005)	=	.005 (0.126)
0.527 (13.385)	(−)	0.508 (12.903)	=	.019 (0.482)

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126) [.005 [(0.13)	0.019 (0.482) .022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
490	B	Fan Exit (Outer) Case (72-33-03) Fan Case Assembly (72-33-01) (See Figure 801)				
		Exit Case	90.334 (2294.48)	90.354 (2294.99)		
		Fan Case	90.318 (2294.08)	90.328 (2294.33)	.036T (0.914T)	.006T (0.152T)
491	B	Axial Gap, Fan Exit (Outer) Case (72-33-03) Fan Case Assembly (72-33-01) (See Figure 801)				
		Outer Case	.215 (5.46)	.225 (5.72)		
		Fan Case	.225 (5.72)	.235 (5.97)	.000 (0.00)	.020 (.051)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
492	B	Self-Retaining Pin (Bleed Valve Linkage) Bleed Valve Connecting Link Bearing (72-33-12) (See Figure 802)				
		Pin	.248 (6.300)	.249 (6.324)		
		Bearing	.2495 (6.3373)	.2500 (6.3500)	.0005 (0.013)	.002 (0.050)
493	B	Side Clearance, Bleed Valve Connecting Link Bearing (72-33-12) Bleed Valve Linkage Rod Assembly (72-33-10) (See Figure 802)				
		Bearing	.338 (8.586)	.343 (8.712)		
		Rod	.344 (8.738)	.346 (8.788)	.001 (0.025)	.008 (0.203)
494	B	Bleed Valve Cam Follower (72-33-14) Damper Assembly (72-33-16) Bleed Valve Bracket (72-33-09) (See Figure 803 and Figure 804 (Sheet 3).				
		Cam Follower	.2475 (6.287)	.2485 (6.311)		
		Valve	.249 (6.325)	.250 (6.350)	.0005 (0.013)	.0025 (0.063)
495	B	End Clearance, Sleeve Spacer (Cam Follower) (72-33-15) Bleed Valve Bracket (72-33-09) (See Figure 803 and Figure 804)				
		Spacer	.808 (20.524)	.812 (20.624)		
		Bracket	.812 (20.625)	.818 (20.777)	.000 (.000)	.010 (0.25)

	Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
	498	B	Fan Exit Inner Case Assembly (72-33-04) Bleed Valve Assembly (72-33-09) (See Figure 803)				
R			Duct	47.610 (1209.29)	47.620 (1209.55)		
R			Valve	47.635 (1209.93)	47.645 (1210.18)	.015 (0.381)	.035 (0.889)
R			NOTE: Measure the parts at the interrupted surfaces, eight locations.				
	499	B	Fan Exit Inner Case Assembly (72-33-04) Bleed Valve Assembly (72-33-09) (See Figure 803)				
			Case	48.345 (1227.96)	48.355 (1228.22)		
			Valve	48.395 (1229.23)	48.405 (1229.49)	.040 (1.02)	.060 (1.52)
	500	B	Groove Headed Pins (Bleed Valve Linkage) (72-33-22) Fan Exit Inner Case Assembly (72-33-04) (See Figure 804, Sheet 1)				
			Pin	.248 (6.300)	.249 (6.324)		
			Bearing	.2495 (6.338)	.2505 (6.362)	.0005 (0.013)	.0025 (0.063)
	501	B	Groove Headed Pins (Bleed Valve Linkage) (72-33-22) Bleed Valve Linkage Bell Crank Assembly (72-33-13) (See Figure 804, Sheet 1)				
			Pin	.248 (6.300)	.249 (6.324)		
			Crank	.2495 (6.338)	.2505 (6.362)	.0005 (0.013)	.0025 (0.063)
	502	B	Fan Exit Inner Case 2.5 Bellcrank Bracket Bearing (72-33-04) Fan Exit Inner Case 2.5 Bellcrank Bracket (72-33-04)/(72-33-20)				
			Bearing	.374 (9.500)	.375 (9.525)		
			Bracket (72-33-04) (Pre PW4ENG 72-346)	.373 (9.475)	.374 (9.499)	.002T (0.050T)	.000 (.000)
			Bracket	.3725	.374	.0025T	.000

FAN CASE - INSPECTION/CHECK-04

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)						
		(72-33-20)	(9.462)	(9.499)	(0.063T)	(.000)
		50D939-01				
		(Post PW4ENG 72-346)				
503	B	Fan Exit Inner Case Assembly (72-33-04)				
		Bleed Valve Linkage Bell Crank Assembly (72-33-09)				
		(See Figure 804, Sheet 1)				
		Case	1.116	1.124		
			(28.346)	(28.550)		
		Bell Crank	1.125	1.131	.001	.015
			(28.575)	(28.727)	(0.03)	(0.38)
504	B	Shoulder Pin (72-33-01)				
		Fan Exit (Outer) Case (72-33-03)				
		(See Figure 803)				
		Pin	.2465	.2470		
			(6.2611)	(6.2738)		
		Case	.2490	.2505	.002	.004
			(6.325)	(6.362)	(0.051)	(0.101)
505	B	Self-Retaining Pin (Bleed Valve Linkage)				
		Rod End Clevis (Bleed Valve Actuator) (72-33-10)				
		(See Figure 802)				
		Pin	.248	.249		
			(6.300)	(6.324)		
		Rod	.2495	.2505	.0005	.0025
			(6.338)	(6.362)	(0.013)	(0.063)
506	B	Bleed Valve Cam Follower (72-33-14)				
		Bleed Valve (72-33-09)				
		(See Figure 803)				
		Cam Follower	.3095	.3105		
			(7.862)	(7.886)		
		Valve	.311	.313	.0005	.0035
		(Post SB	(7.900)	(7.950)	(0.013)	(0.089)
		PW4ENG 72-660)				
507	B	Bleed Valve Bolt				
		Bearing				
		(See Figure 804, Sheet 2)				
		Bolt	.436	.437		
			(11.075)	(11.099)		
		Bearing	.438	.440	.001	.004
			(11.126)	(11.176)	(0.025)	(0.102)

FAN CASE − INSPECTION/CHECK−04

	Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
	508	B	Bearing Bleed Valve Linkage Bellcrank Assembly (72−33−13) (See Figure 804, Sheet 2)				
			Bearing	1.2010 (30.506)	1.2020 (30.530)		
			Bellcrank	1.2025 (30.544)	1.2055 (30.619)	.0005 (0.013)	.0045 (0.114)
	509	B	Bleed Valve Bolt Bell Crank Bracket Assembly (72−33−20) (See Figure 804, Sheet 2)				
			Bolt	.436 (11.075)	.437 (11.099)		
			Bracket	.438 (11.126)	.440 (11.176)	.001 (0.025)	.004 (0.102)
	510	B	Bleed Valve Linkage Bell Crank Assembly (72−33−13) Bell Crank Bracket Assembly (72−33−20) (See Figure 804, Sheet 2)				
			Crank	1.379 (35.027)	1.385 (35.179)		
			Bracket	1.388 (35.260)	1.404 (35.660	.003 (0.076)	.025 (0.635)
	511	B	Bearing Bleed Valve Linkage Bellcrank Assembly (72−33−13) (See Figure 804, Sheet 2)				
			Bearing	.8735 (22.187)	.8745 (22.212)		
			Bellcrank	.8750 (22.225)	.8780 (22.301)	.0005 (0.013)	.0045 (0.114)
R	512	B	Bleed Valve Linkage Bolt Bleed Valve Linkage Bell Crank Assembly (72−33−13) (See Figure 802)				
			Bolt	.2485 (6.312)	.2495 (6.337)		
R			Bell Crank	.250 (6.350)	.251 (6.375)	.0005 (0.013)	.0025 (0.064)

FAN CASE - INSPECTION/CHECK-04

	Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
	513	B	Side Clearance				
R			Bleed Valve Connecting Link (72-33-12)				
R			Bleed Valve Linkage Bell Crank Assembly (72-33-13)				
			(See Figure 802)				
			Bearing	.338	.343		
				(8.586)	(8.712)		
R			Bell Crank	.344	.346	.001	.008
				(8.738)	(8.788)	(0.025)	(0.203)
	514	B	Bleed Valve Linkage Bolt				
			Bleed Valve Linkage Bearing				
			(See Figure 802)				
			Bolt	.2485	.2495		
				(6.3120)	(6.3373)		
			Bearing	.2495	.2500	.000	.0015
				(6.3373)	(6.3500)	(0.000)	(0.038)
	776	B	LPC (Stages 1.6, 2 And 3) Compressor Stator Assembly (72-31-10)				
			Fan Exit Inner Case Assembly (72-33-04)				
			(See Figure 805)				
			Stator	52.403	52.409		
				(1331.036)	(1331.189)		
			Case	52.397	52.403	.000T	.012T
				(1330.884)	(1331.036)	(0.00T)	(0.30T)
	777	B	LPC Stage 4 Duct (72-31-11)				
			Fan Exit Inner Case Assembly (Bleed Valve Duct) (72-33-04)				
			(See Figure 805)				
			LPC	46.791	46.801		
				(1188.49)	(1188.75)		
			Case	46.798	46.802	.003T	.071*
			(Bleed Valve Duct)	(1188.670)	(1188.770)	(0.076T)	(1.803)*
	778	B	Fan Exit Inner Case Assembly (72-33-04)				
			Intermediate Case Assembly (72-34-01)				
			(See Figure 805)				
			Inner Case	54.947	54.953		
				(1395.654)	(1395.806)		
			Intermediate	54.941	54.947	.000T	.012T
			Case	(1395.501)	(1395.654)	(0.00T)	(0.30T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
779	B	Fan Exit (Outer) Case (72-33-03) Intermediate Case Assembly (72-34-01) (See Figure 805)				
		Fan Case	92.108 (2339.54)	92.124 (2339.95)		
		Intermediate Case	92.092 (2339.14)	92.108 (2339.54)	.000T (.000T)	.032T (0.81T)
837	B	Support Link Shoulder Bolts No. 3 Bearing Air Cooler Assembly Support Brackets (See Figure 806)				
		Bolt	.2494 (6.3348)	.2499 (6.3474)		
		Bracket	.2500 (6.350)	.2510 (6.375)	.0001 (0.003)	.0016 (0.040)
838	B	Support Link Shoulder Bolts Support Link Rod End Bearings (72-33-86) (See Figure 806)				
		Bolt	.2494 (6.3348)	.2499 (6.3474)		
		Bearing	.2495 (6.3373)	.2500 (6.3500)	.0006 (0.0152)	.0004T (0.0102T)
839	B	Side Clearance Support Link Rod End Bearings (72-33-86) No. 3 Bearing Air Cooler Assembly Support Brackets (See Figure 806)				
		Bearing	.432 (10.973)	.437 (11.099)		
		Bracket	.4375 (11.113)	.4395 (11.163)	.0005 (0.013)	.0075 (0.190)

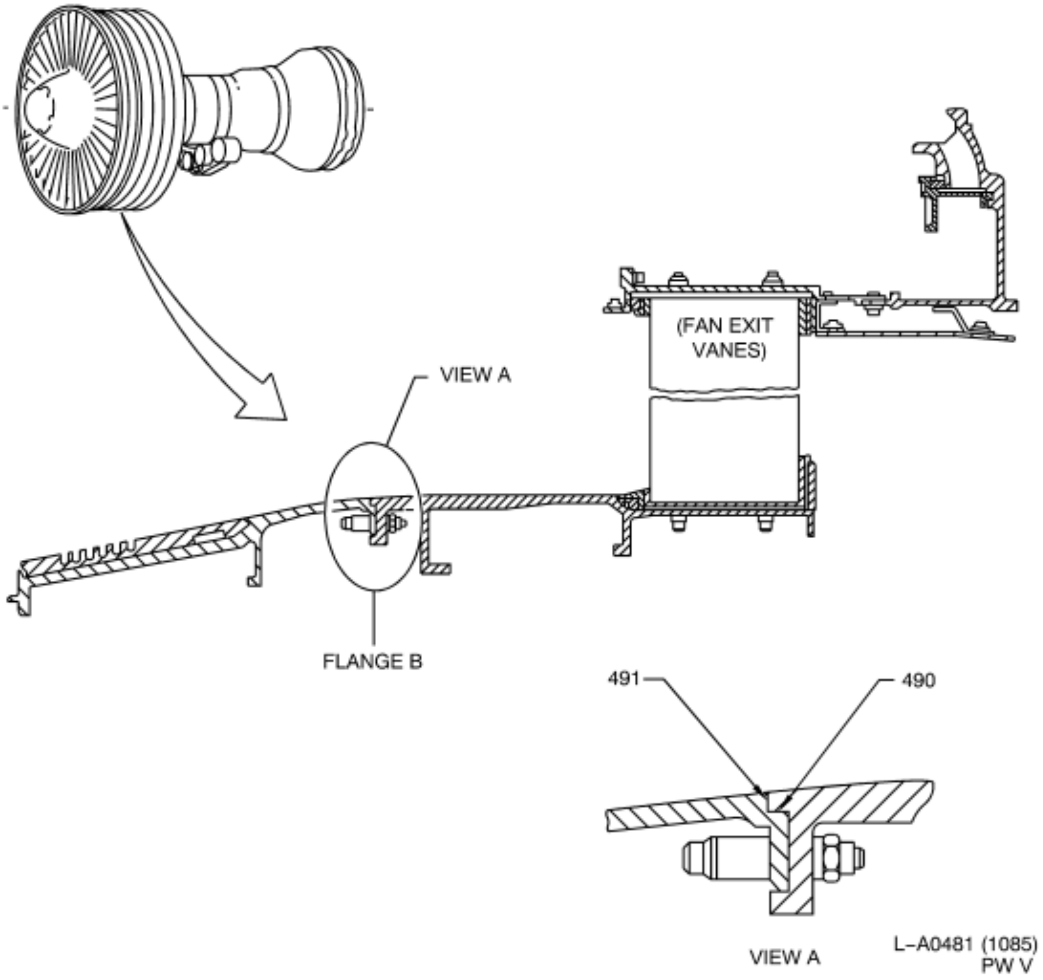
G. Special Assembly Procedures

FAN CASE - INSPECTION/CHECK-04

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
750	A	Bleed Valve Rigging Procedure (See Figures 802 and 803) See 72-00-00, Special Procedures-03 (Task 72-00-00-830-001)				

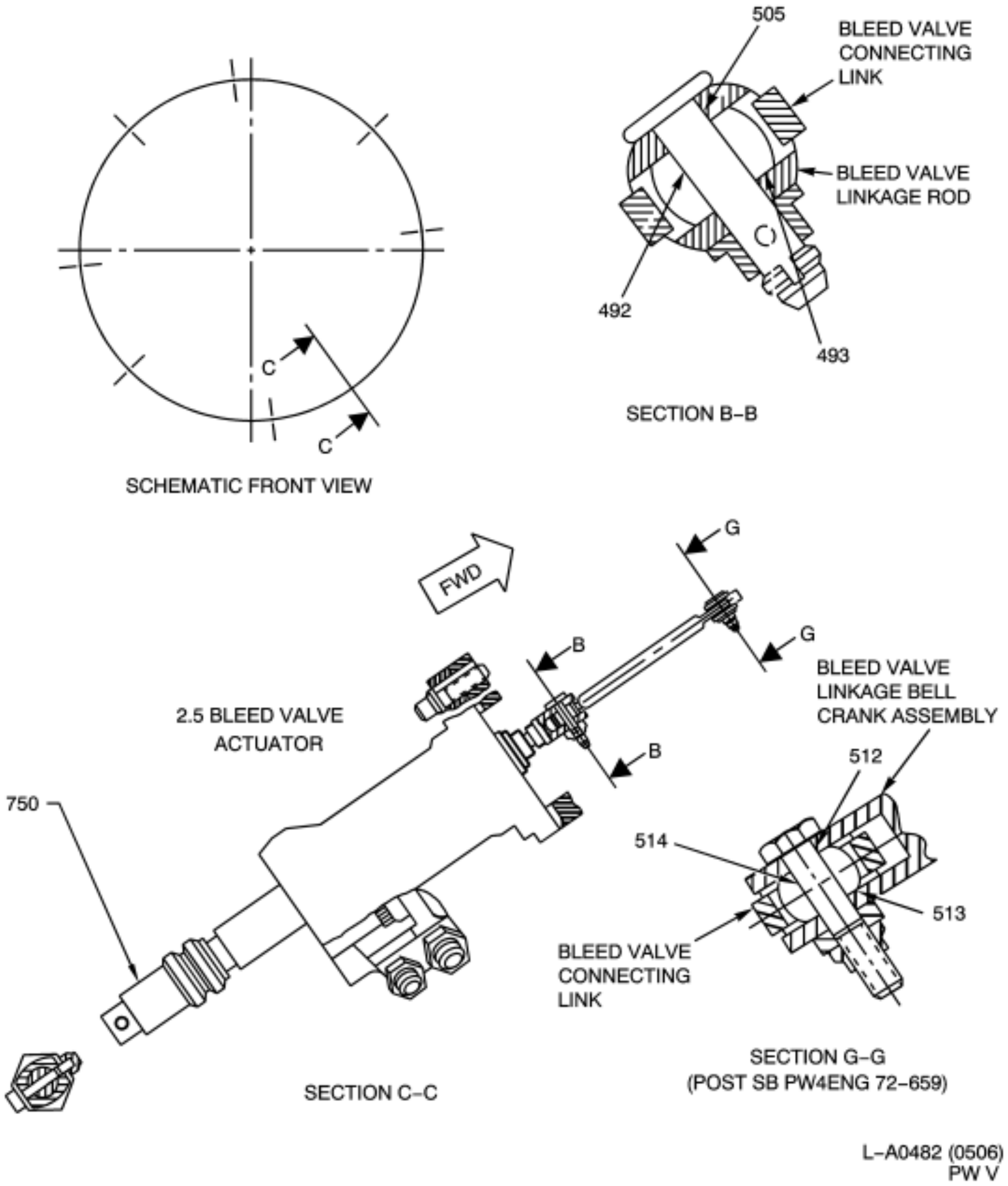
H. Special Torques

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
752	A	Bleed Valve Bell Crank Assembly Procedure (See Figure 804, Sheet 2) See 72-33-00, Assembly-01 Task 72-33-00-400-001				

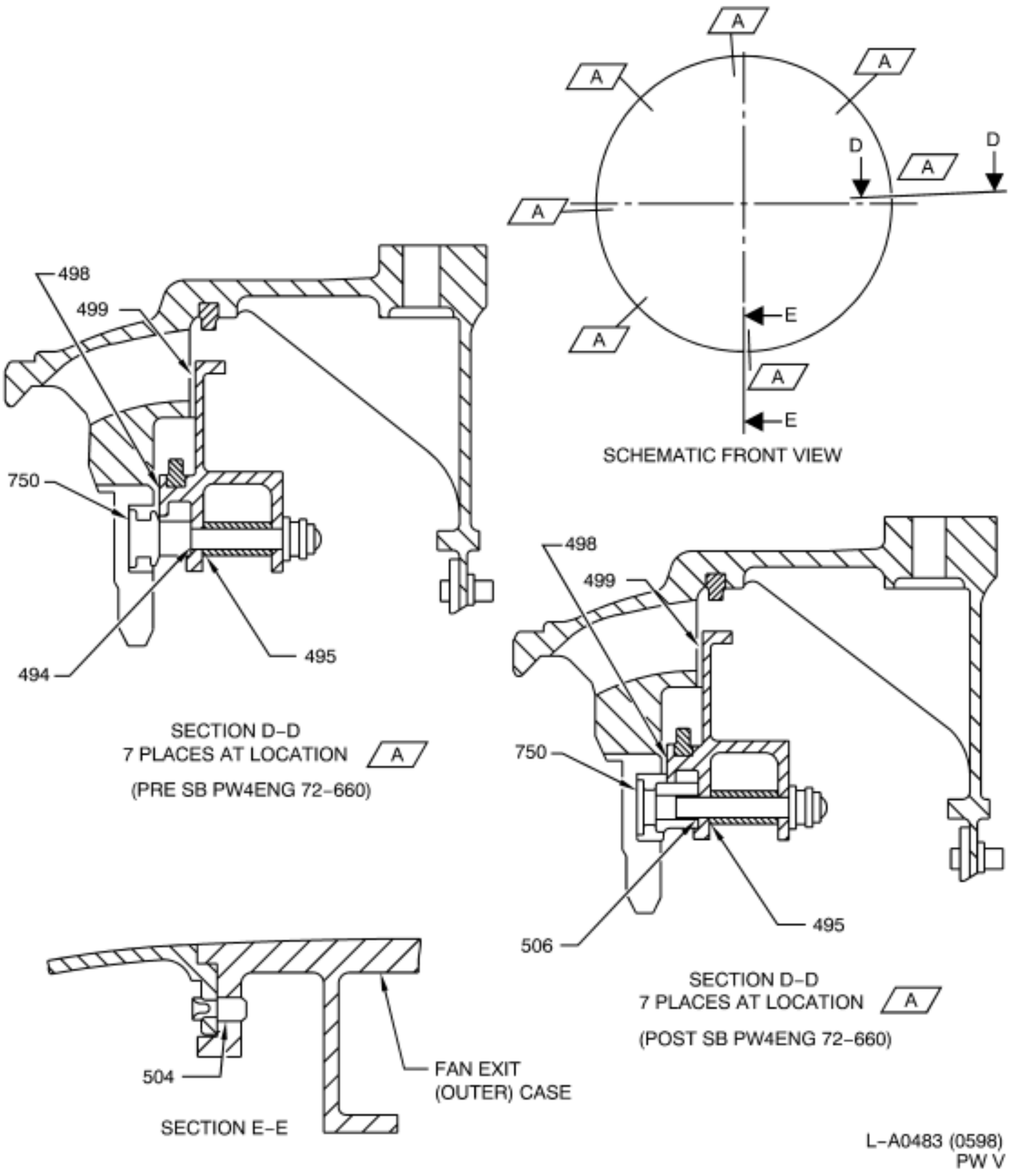

(FAN EXIT VANES)
VIEW A
FLANGE B
491
490
VIEW A
L−A0481 (1085)
PW V

Fan Cases
Figure 801
(Task 72−33−00−990−001)

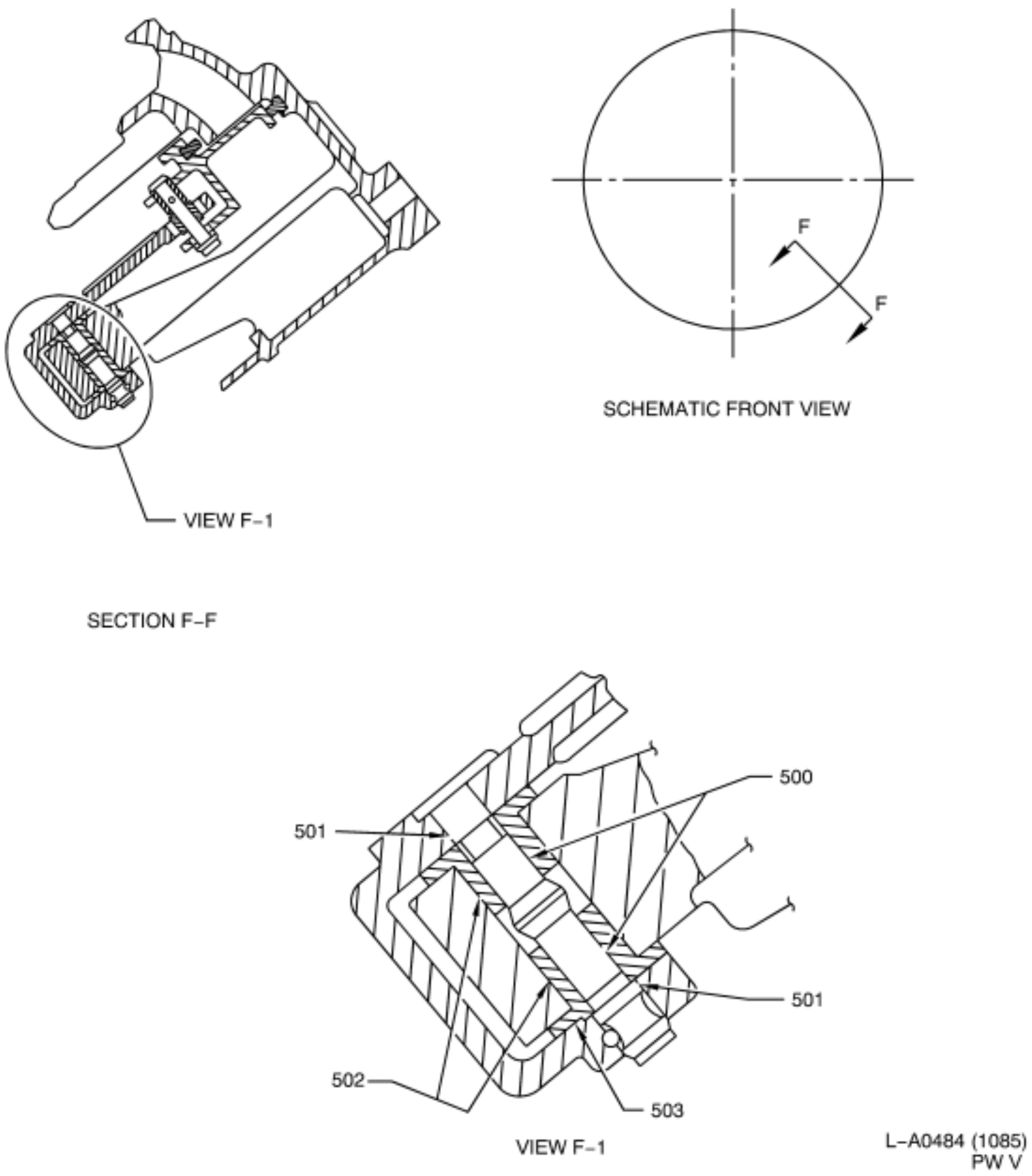
FAN CASE − INSPECTION/CHECK−04


505
BLEED VALVE CONNECTING LINK
BLEED VALVE LINKAGE ROD
492
493
SECTION B−B
C
C
SCHEMATIC FRONT VIEW
FWD
G
G
B
B
BLEED VALVE LINKAGE BELL CRANK ASSEMBLY
2.5 BLEED VALVE ACTUATOR
750
512
514
513
BLEED VALVE CONNECTING LINK
SECTION G−G
(POST SB PW4ENG 72−659)
SECTION C−C
L−A0482 (0506)
PW V

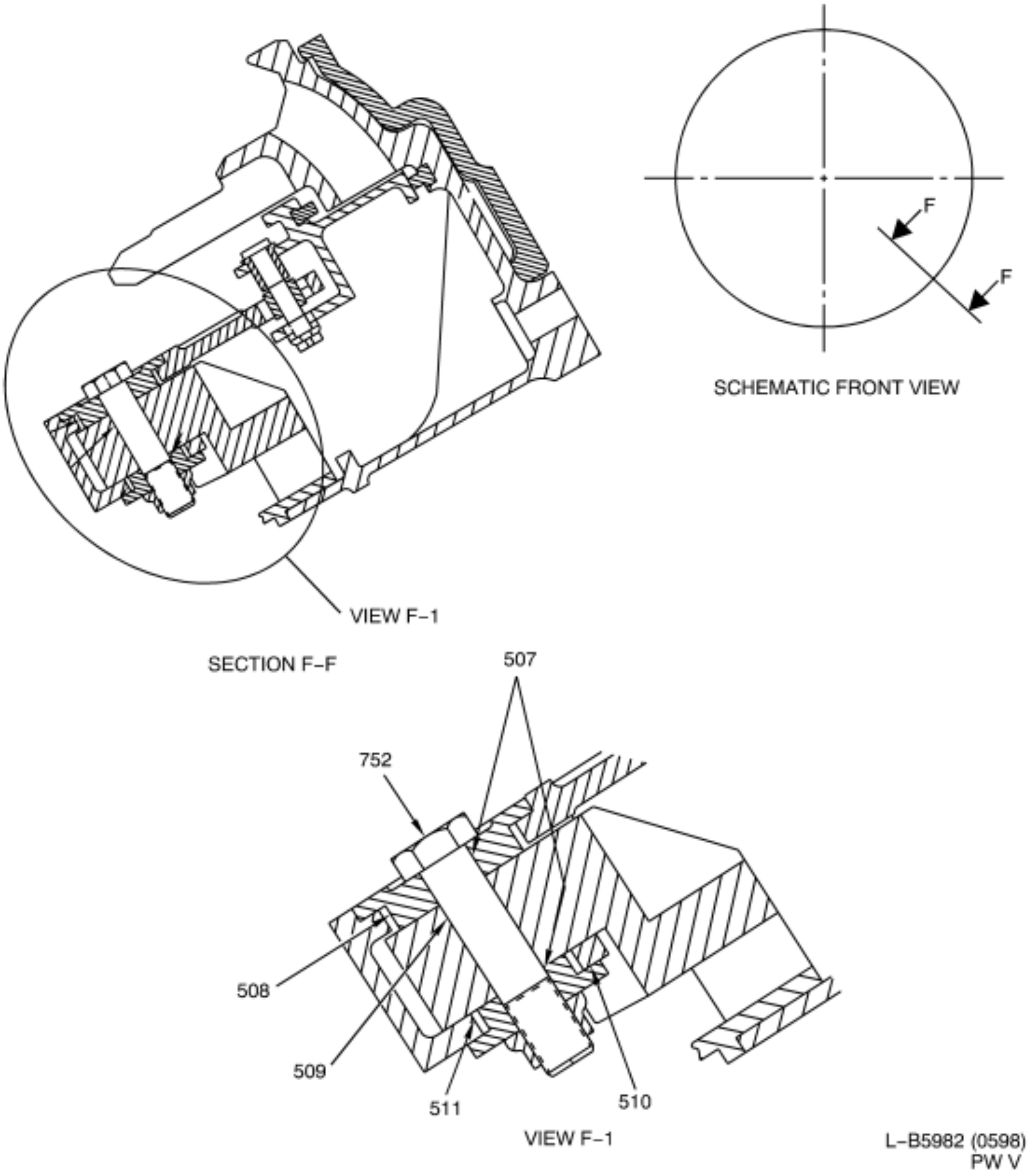
Fan Cases
Figure 802
(Task 72−33−00−990−001)


A
A
A
D
D
A
A
E
A
A
E
SCHEMATIC FRONT VIEW
498
499
750
494
495
SECTION D−D
7 PLACES AT LOCATION A
(PRE SB PW4ENG 72−660)
498
499
750
506
495
SECTION D−D
7 PLACES AT LOCATION A
(POST SB PW4ENG 72−660)
504
FAN EXIT
(OUTER) CASE
SECTION E−E
L−A0483 (0598)
PW V

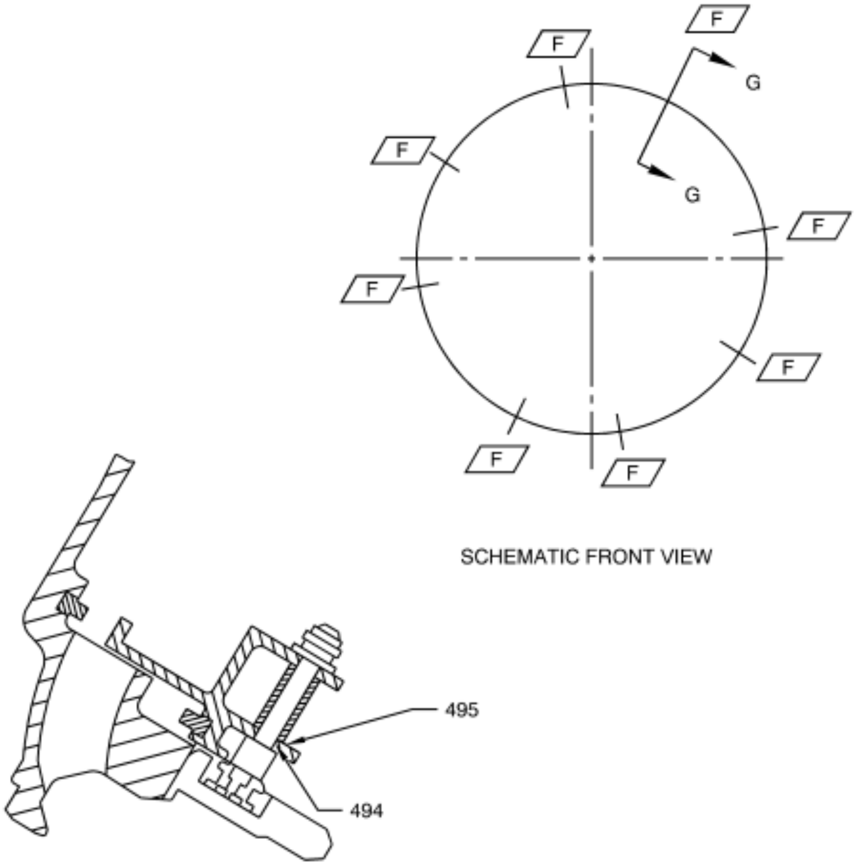
Fan Cases
Figure 803
(Task 72−33−00−990−001)


SCHEMATIC FRONT VIEW
F
F
VIEW F-1
SECTION F-F
500
501
501
502
503
VIEW F-1
L-A0484 (1085)
PW V

Fan Cases (Pre SB PW4ENG 72-659)
Figure 804 (Sheet 1)
(Task 72-33-00-990-001)


F
F
SCHEMATIC FRONT VIEW
VIEW F−1
SECTION F−F
507
752
508
509
511
510
VIEW F−1
L−B5982 (0598)
PW V

Fan Cases (Post SB PW4ENG 72−659)
Figure 804 (Sheet 2)
(Task 72−33−00−990−001)



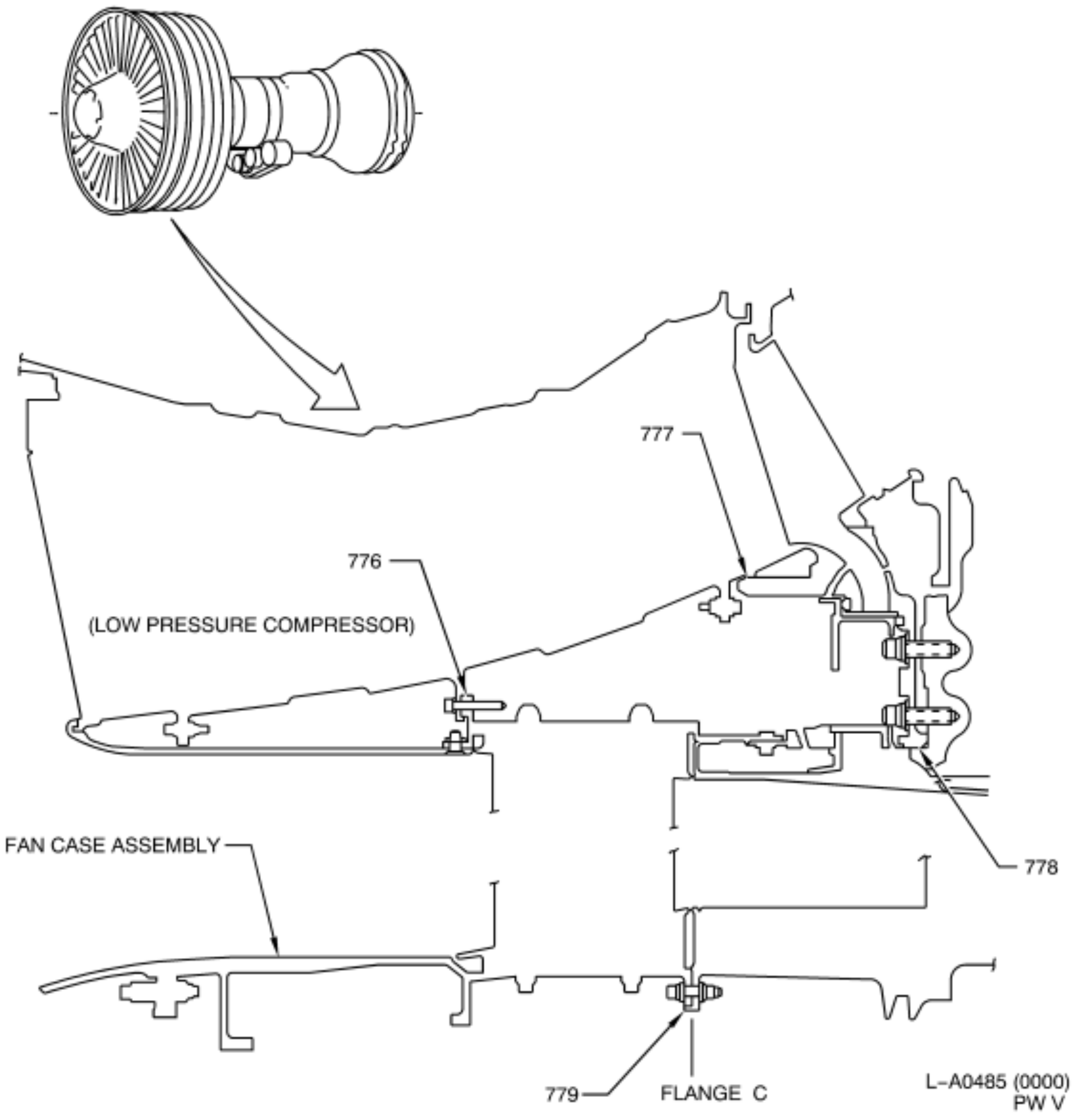
SCHEMATIC FRONT VIEW

SECTION G-G
8 PLACES AT LOCATION F

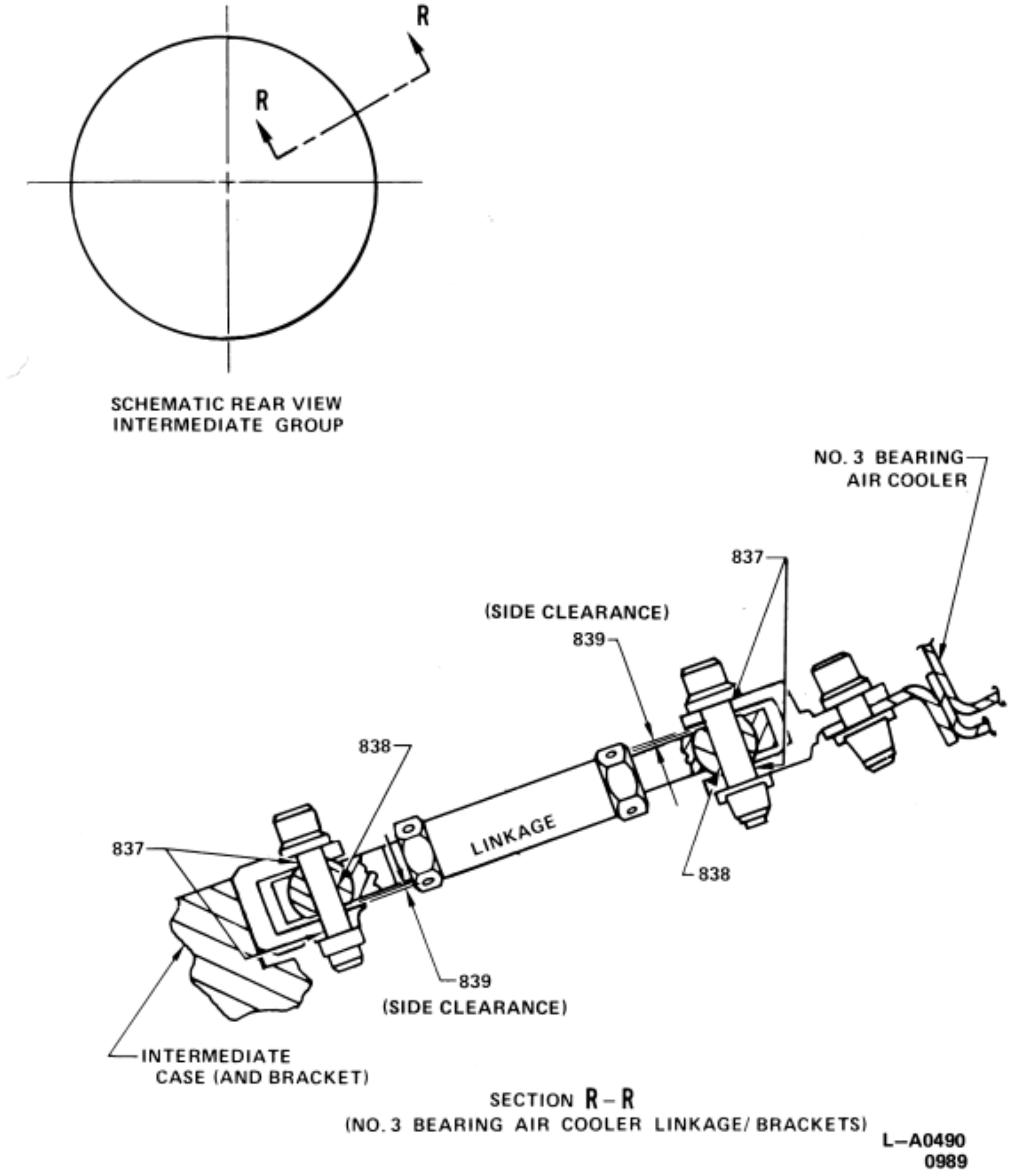
L-A0620 (0000)
PW V

Fan Cases
Figure 804 (Sheet 3)
(Task 72-33-00-990-001)

FAN CASE − INSPECTION/CHECK−04


777
776
(LOW PRESSURE COMPRESSOR)
FAN CASE ASSEMBLY
778
779
FLANGE C
L−A0485 (0000)
PW V

Fan Cases
Figure 805
(Task 72−33−00−990−001)


R
R
SCHEMATIC REAR VIEW
INTERMEDIATE GROUP
NO. 3 BEARING
AIR COOLER
837
(SIDE CLEARANCE)
839
838
837
LINKAGE
838
839
(SIDE CLEARANCE)
INTERMEDIATE
CASE (AND BRACKET)
SECTION R − R
(NO. 3 BEARING AIR COOLER LINKAGE/ BRACKETS)
L−A0490
0989

Fan Cases
Figure 806
(Task 72−33−00−990−001)

Previous Pageblock Return to Previous Menu Next Pageblock

FAN CASE - ASSEMBLY-01

Task 72-33-00-400-001:

1. Assemble The Fan Case

A. Prerequisites

(1) Assemble the fan exit case and vane assembly. See 72-33-02, Assembly-01 Task 72-33-02-440-001.

(2) Assemble the bleed valve. Refer to 72-33-00, Assembly-02 Task 72-33-00-400-002.

B. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 26520	Sling, Lifting
PWA 76154	Adapter (2 Necessary)
PWA 76155	Sling
PWA 85450	Stand, Storage/Transport (Optional to PWA 87078)
PWA 85570	Bracket, Handling (4 Necessary)
PWA 85676	Adapter, (Front Fan Case) Lift And Trunnion (2 Necessary) (Optional to PWA 86423)
PWA 85677	Bracket, Handling
PWA 85678	Stand (3 Necessary) (Optional to PWA 87166/ PWA 101960)
PWA 85698	Adapter, Lift And Trunnion (2 Necessary) (Optional to PWA 86431)
PWA 85750	Blocks, Support (4 Necessary) (Optional to PWA 87166/ PWA 101960)
PWA 85928	Adapter, Torque
PWA 86423	Adapter, Lift And Trunnion, Fan Case (2 Necessary)
PWA 86431	Adapter, Lift And Trunnion (2 Necessary)
PWA 87078	Stand, Storage/Transport
PWA 87166	Stand, Support (3 Necessary)
PWA 101224	Dolly, Support
PWA 101960	Adapter, Support (3 or 4 Necessary)

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	1	72-33-00/12/130
Cotter Pin	1	72-33-00/12/150
Cotter Pin	1	72-33-00/12/160
Cotter Pin	1	75-32-00/01/130
Packing	1	75-32-00/01/140
Packing	1	75-32-00/01/160

C. Procedure

Subtask 72-33-00-430-051:

R (1) Install the bleed ducts. See Figure 1001 (Sheet 1).

R (a) Apply Engine Oil P03-001 to the 84 bolts that you
R will use to install the bleed valve ducts.

R (b) Use the lubricated bolts to install the bleed
R ducts into fan exit case and vane assembly.
R Install the bleed ducts at fourteen locations,
R with screens installed under ducts at eight
R locations above the horizontal centerline, and
R washers installed at twelve locations.

R (c) Torque the bolts to 36 - 40 lbf-in. (4.067 -
R 4.519 N.m).

R (d) Install clip nuts (64 total) to each bleed duct
R with nuts toward inner diameter of fan exit case.
R Do not use the six clip nuts at the locations
R shown in Figure 1001 (Sheet 2).

Subtask 72-33-00-430-061:

(2) (Post SB PW4ENG 72-346) Install the bell crank bracket assembly as follows. See Figure 1002 and Figure 1007 (Sheet 1) or Figure 1007 (Sheet 2) as applicable.

(a) Align the holes in the bracket with the mating holes in the fan exit case and vane assembly (called case and vane assembly).

(b) Apply Engine Oil P03−001 to the threads of six bolts. Attach the bracket to the case and vane assembly with the six bolts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

Subtask 72−33−00−430−055:

(3) If the front fan case is in horizontal position, put the front fan case in vertical position. See Figure 1003.

NOTE: If the front fan case stays in horizontal position, it is permitted to use PWA 85677 Bracket on the case to attach a hoist to.

(a) Attach a hoist to PWA 76155 Sling.

(b) Put a PWA 76154 Adapter in each hook of the sling.

(c) Prepare the stand for removal of the front fan case.

1 Move the detail hand knobs that are on the clamps of the stand.

2 Remove the detail ball lock pins.

3 Open the top part of the detail clamps.

(d) Put the spools of PWA 85676 Adapters or PWA 86423 Adapters on the front fan case in the keyholes of the PWA 76154 Adapters.

(e) With the hoist and sling, lift the front fan case.

(f) Turn the front fan case so that it is front end down.

(g) There are three options that can be used to put the front fan case in the vertical position.

1 Put the front fan case on a pallet.

2 Use three PWA 85678 Stands or PWA 87166 Stands with three PWA 101960 Adapters to support the fan case.

3 Use four PWA 101224 Support Dollys with four PWA 101960 Adapters or PWA 85750 Adapters to support the fan case. The fan case assembly can be moved with this support system.

(h) Remove the adapters, sling, and hoist.

(4) If the fan exit case and vane assembly (called case and vane assembly) is in horizontal position, put it in vertical (front end down) position.

(a) Attach a hoist to PWA 76155 Sling.

(b) Put PWA 76154 Adapter in each hook of the sling.

(c) Prepare the stand for removal of the case and vane assembly.

1 Move the detail hand knobs that are on the clamps of the stand.

2 Remove the detail ball lock pins.

3 Open the top part of the detail clamps.

(d) Put the spools of the adapters on the case and vane assembly case in the keyholes of the PWA 76154 Adapters.

(e) With the hoist and sling, lift the case and vane assembly.

(f) Turn the case and vane assembly so that it is front end down.

(5) Attach the case and vane assembly to the front fan case.

(a) Attach four PWA 85570 Brackets, equally spaced, to the top flange of the case and vane assembly. Use the detail bolts, washers, spacers, and nuts.

(b) Attach PWA 26520 Sling to a hoist.

(c) Attach the sling to the four brackets.

FAN CASE - ASSEMBLY-01

(d) Lift the case and vane assembly.

(e) If PWA 85982 Adapters are attached to the case and vane assembly at 3 and 9 o'clock, remove them.

(f) Align the dowel pin at 6:30 o'clock on the front fan case rear flange with the mating hole in the case and vane assembly. Put the case and vane assembly on the front fan case.

(g) Install the Flange B hardware as follows. Refer to 72-33-00, Assembly-21 (Task 72-33-00-430-021).

(6) Put the fan case in horizontal position as follows: See Figure 1005.

(a) Attach two PWA 86431 Adapters or PWA 85698 Adapters to the fan case at 3 and 9 o'clock with the detail cap screws, washers, and nuts.

(b) With a hoist, PWA 76155 Sling and two PWA 76154 Adapters installed over the adapters on the fan case, lift the fan case.

(c) Install the fan case in either PWA 87078 Stand or PWA 85450 Stand as follows.

1 Move the detail hand knobs that are on the clamps of the stand.

2 Remove the detail ball lock pins.

3 Open the top of the detail clamps.

4 Install the fan case in the stand.

5 Lock the fan case in position with the detail ball lock pins.

6 Close the detail clamps.

7 Lock the detail clamps with the detail hand knobs.

(d) Remove the hoist, sling, and PWA 76154 Adapters.

Subtask 72-33-00-430-060:

(7) If previously removed, install the Flange A1 hardware as follows. Refer to 72-33-00, Assembly-20 (Task 72-33-00-430-020).

(8) If previously removed, install Flange B1 hardware as follows. refer to 72-33-00, Disassembly-22 (Task 72-33-00-030-022).

(9) If previously removed, install Flange B2 hardware as follows. refer to 72-33-00, Disassembly-22 (Task 72-33-00-030-023).

(10) If previously removed, install hole covers. Secure with bolts, threads lubricated with Engine Oil P03-001. Torque bolts to 75 - 85 lb-in. (8.474 - 9.604 N.m). See Figure 1006.

Subtask 72-33-00-430-062:

(11) Install the bleed valve assembly in the fan case as follows. See Figure 1007.

- (a) With the small OD of the bleed valve to the rear, install the bleed valve in the fan case.
- (b) Turn the bleed valve to engage the cam followers in the slots of the fan exit inner case.
- (c) Push the bleed valve to the rear.

Subtask 72-33-00-430-063:

(12) (Pre SB PW4ENG 72-659) Attach the bell crank assembly to the bell crank bracket that is in the fan exit inner case at 4:30 o'clock, as follows. See Figure 1007 (Sheet 1).

- (a) Install a self-retaining pin through the bell crank and bracket.
- (b) Install cotter pins in the bell crank and self retaining pin. Bend the legs of the cotter pins.
- (c) Do a check of the bleed valve to be sure that it does not stick. To do the check, move the bell crank with your hand.

(13) (Post SB PW4ENG 72-659) Attach the bell crank assembly to the bell crank bracket that is in the fan exit inner case at 4:30 o'clock, as follows. See Figure 1007 (Sheet 2).

(a) Install two bushings into the bell crank.

(b) Install a bolt through the bell crank and bracket.

(c) Install a nut onto end of the bolt. Measure and record the run-on torque necessary to advance the nut self-locking feature on the bolt threads.

(d) Torque the bolt to 370 - 410 lb-in. (41.804 - 46.324 N.m) in addition to the run-on torque as recorded above.

(e) Do a check of the bleed valve to be sure that it does not stick. To do the check, move the bell crank with your hand to make sure that it moves freely.

Subtask 72-33-00-430-064:

(14) Install the compressor bleed actuator (called actuator) in the fan case as follows. See Figure 1007.

NOTE: The shoulder bolt of the actuator is installed during the rigging procedure.

(a) Install new packings, lubricated with Engine Oil P03-001, on two adapters. Install the adapters, threads lubricated with Engine Oil P03-001, in the holes in the actuator. Torque the smaller adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m). Torque the larger adapter to 150 - 170 lb-in. (16.948 - 19.207 N.m).

(b) Align the hole in the connecting link assembly with the holes in the rod end clevis. Install a pin in the side of the clevis with the chamfered hole. Hit the pin lightly with a hammer. The head of the pin must touch the clevis.

(c) Install a collar on the pin. Install a cotter pin in the collar. Bend the legs of the cotter pin.

(d) Align the actuator piston shaft with the rod end clevis. Turn the rod end clevis clockwise to engage the internal thread of the piston shaft.

(e) From the rear of the fan case, put the actuator with the rod end clevis and connecting link in position over the four-hole boss that is at 7:30 o'clock.

CAUTION: BE SURE TO USE THE CORRECT TORQUE READING. REFER TO THE STANDARD PRACTICES MANUAL, PN 585005, 70-52, FOR THE NECESSARY TORQUE ADJUSTMENT WITH A WRENCH EXTENSION.

(f) Attach the actuator to the case with four washers and four bolts, lubricated with Engine Oil P03-001. Tighten the bolts with your hand. With PWA 85928 Torque Adapter, torque the bolts to 180 - 200 lb-in. (20.337 - 22.597 N.m).

(g) Install the free end of the connecting link in the remaining free clevis of the bell crank assembly. If necessary, turn the rod end clevis and connecting link.

(h) (Pre SB PW4ENG 72-659) Install a self-retaining pin through the bell crank and connecting link. Hit the pin lightly so that the head of the pin touches the bell crank.

(i) (Pre SB PW4ENG 72-659) Install a collar on the self-retaining pin.

(j) (Pre SB PW4ENG 72-659) Install a cotter pin in the collar. Bend the legs of the cotter pin.

(k) (Post SB PW4ENG 72-659) Install a bolt through the bell crank and connecting link. Install a washer and nut on the bolt.

(l) (Post SB PW4ENG 72-659) Torque the bolt to 65 - 75 lb-in. (7.344 - 8.474 N.m)

Subtask 72-33-00-360-001-001:

(15) Apply sealant to the self-retaining pins in the bell crank assembly as follows. See Figure 1008.

R
R

(a) Clean the self-retaining pins and cotter pins at Location C. Apply PWA 83-A4.

NOTE: See Standard Practices Manual, PN 585005 70-48, for the cleaning methods given above.

(b) Apply Sealant P09-014 at Location C.

D. Postrequisites

(1) Rig the compressor bleed actuator. Refer to Special Procedures-03, 72-00-00, Task 72-00-00-830-001 to manually rig the bleed valve actuator or 72-00-00, Special Procedure-24 Task 72-00-00-830-006 to hydraulically rig the bleed valve actuator.

R
R
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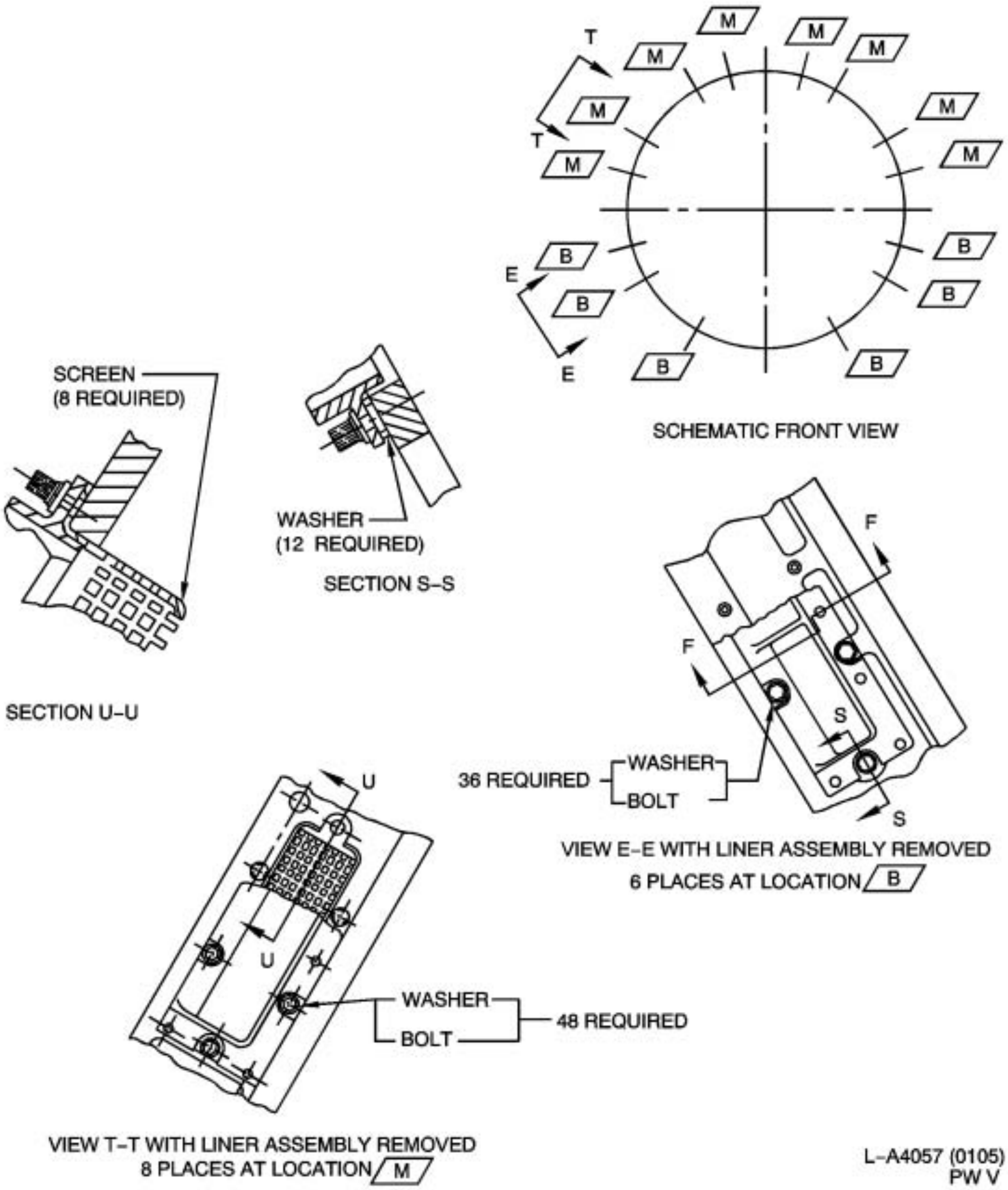
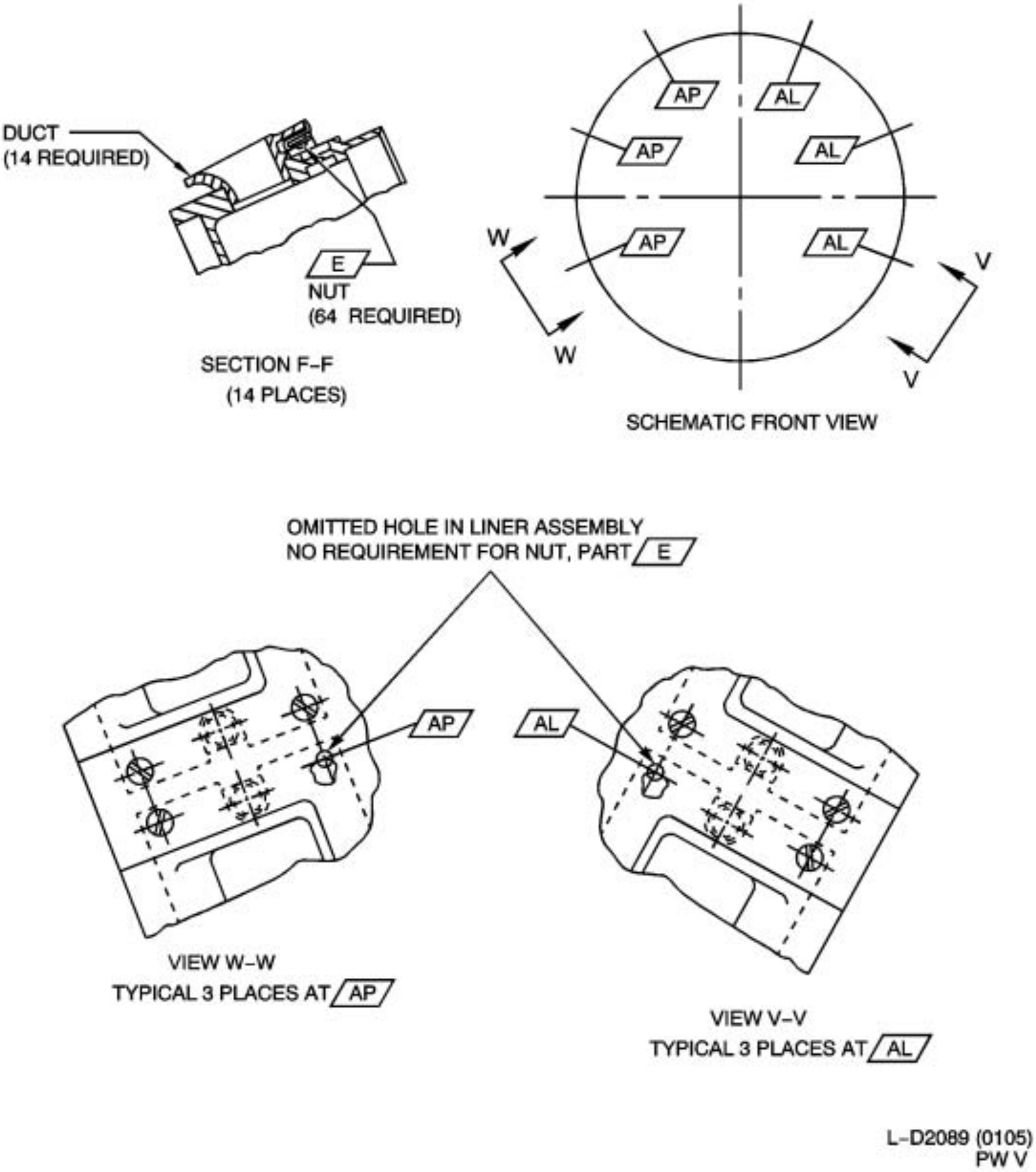
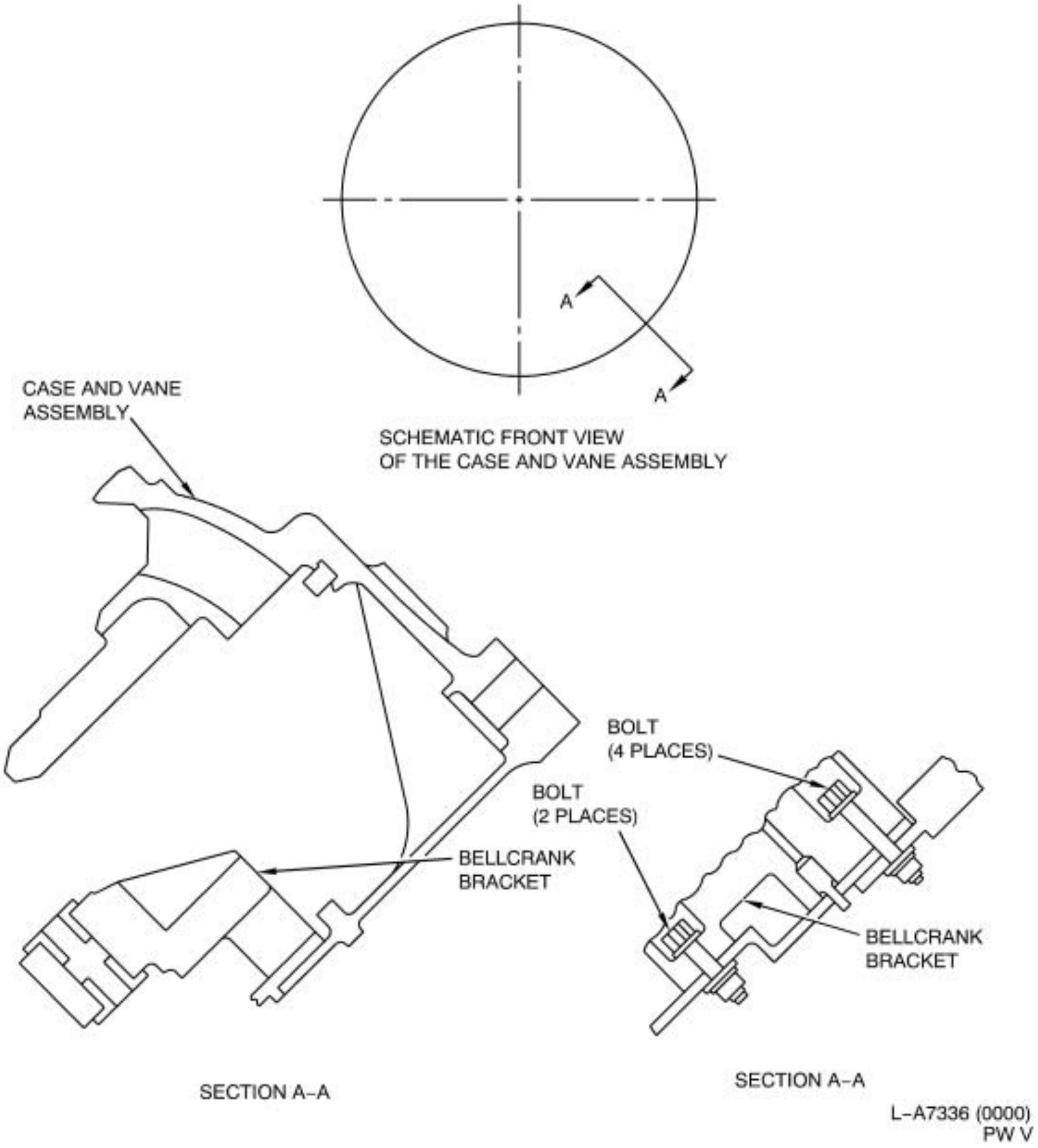
R
R


M
M
M
M
M
M
M
M
M
B
B
B
B
B
B
T
T
E
E
SCHEMATIC FRONT VIEW
SCREEN (8 REQUIRED)
SECTION U-U
WASHER (12 REQUIRED)
SECTION S-S
F
F
S
S
36 REQUIRED
WASHER
BOLT
VIEW E-E WITH LINER ASSEMBLY REMOVED
6 PLACES AT LOCATION B
U
U
WASHER
BOLT
48 REQUIRED
VIEW T-T WITH LINER ASSEMBLY REMOVED
8 PLACES AT LOCATION M
L-A4057 (0105)
PW V

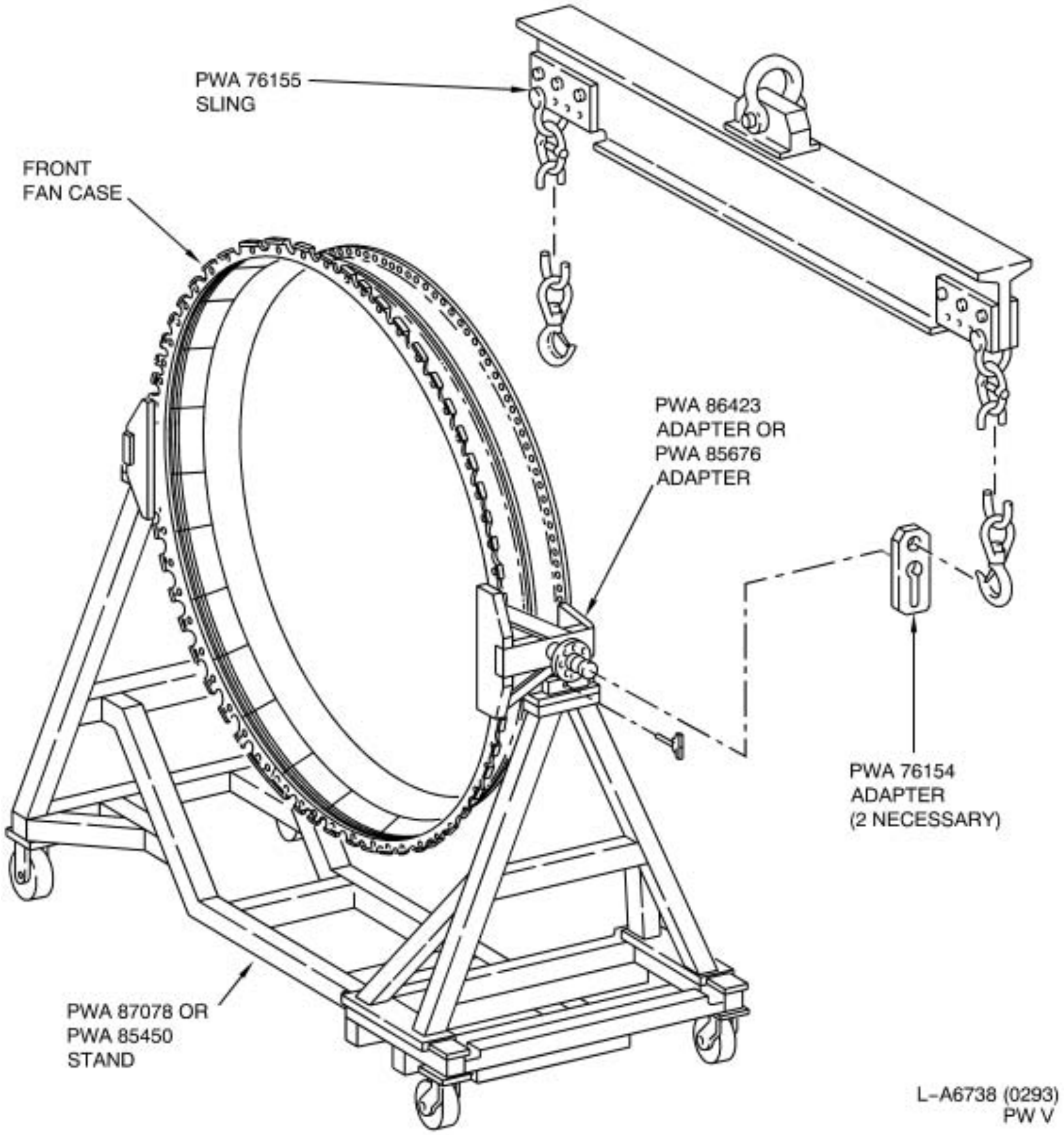
Bleed Duct And Screen Installation
R Figure 1001 (Sheet 1)
R (Task 72-33-00-400-001)


DUCT
(14 REQUIRED)
E
NUT
(64 REQUIRED)
SECTION F−F
(14 PLACES)
AP
AL
AP
AL
AP
AL
W
W
V
V
SCHEMATIC FRONT VIEW
OMITTED HOLE IN LINER ASSEMBLY
NO REQUIREMENT FOR NUT, PART E
AP
AL
VIEW W−W
TYPICAL 3 PLACES AT AP
VIEW V−V
TYPICAL 3 PLACES AT AL
L−D2089 (0105)
PW V

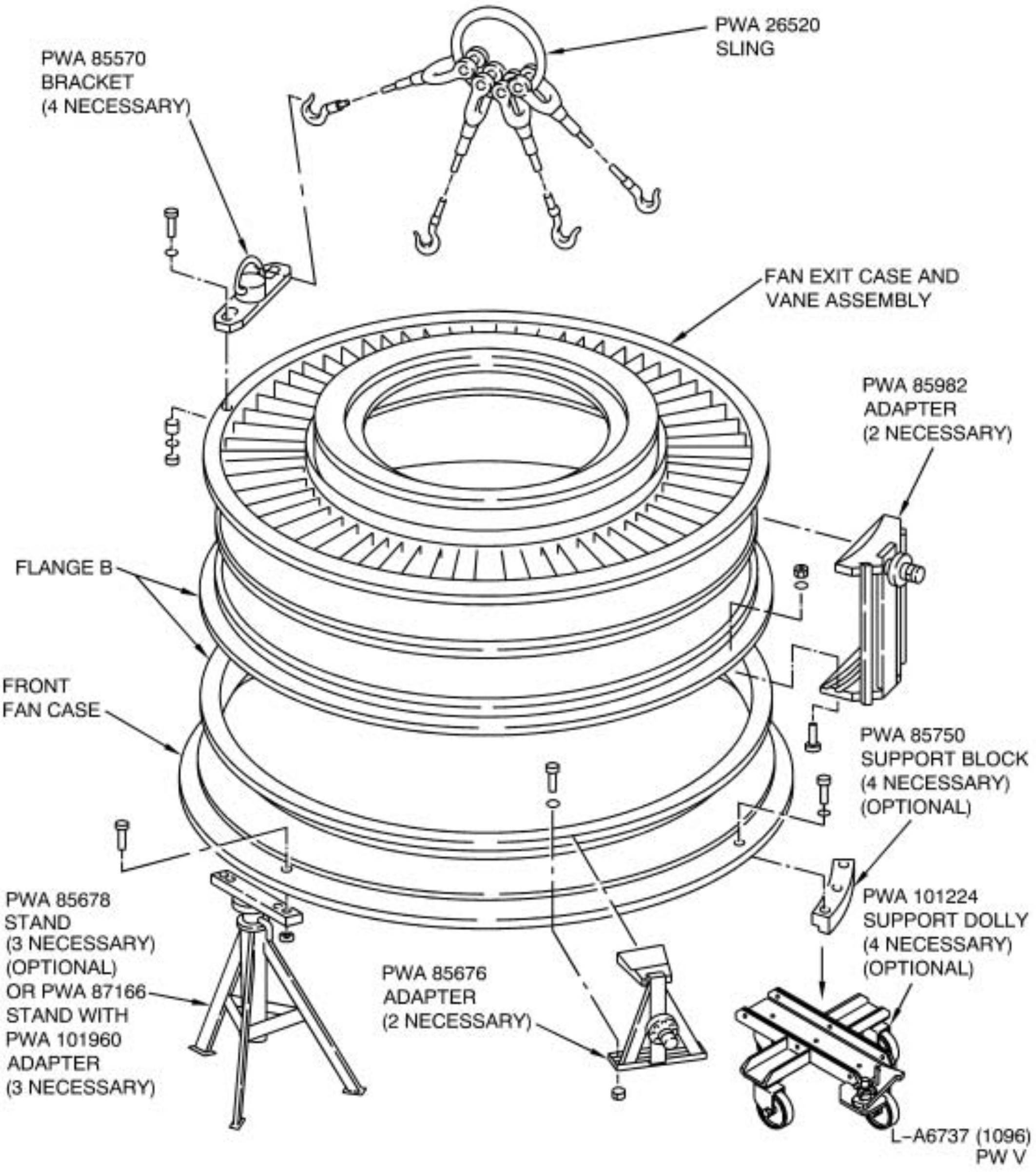
R Bleed Duct And Screen Installation
R Figure 1001 (Sheet 2)
(Task 72−33−00−400−001)


A
A
CASE AND VANE ASSEMBLY
SCHEMATIC FRONT VIEW OF THE CASE AND VANE ASSEMBLY
BOLT (4 PLACES)
BOLT (2 PLACES)
BELLCRANK BRACKET
BELLCRANK BRACKET
SECTION A-A
SECTION A-A
L-A7336 (0000)
PW V

Installation Of The Bellcrank Bracket
Figure 1002
(Task 72-33-00-400-001)


PWA 76155
SLING
FRONT
FAN CASE
PWA 86423
ADAPTER OR
PWA 85676
ADAPTER
PWA 76154
ADAPTER
(2 NECESSARY)
PWA 87078 OR
PWA 85450
STAND
L-A6738 (0293)
PW V

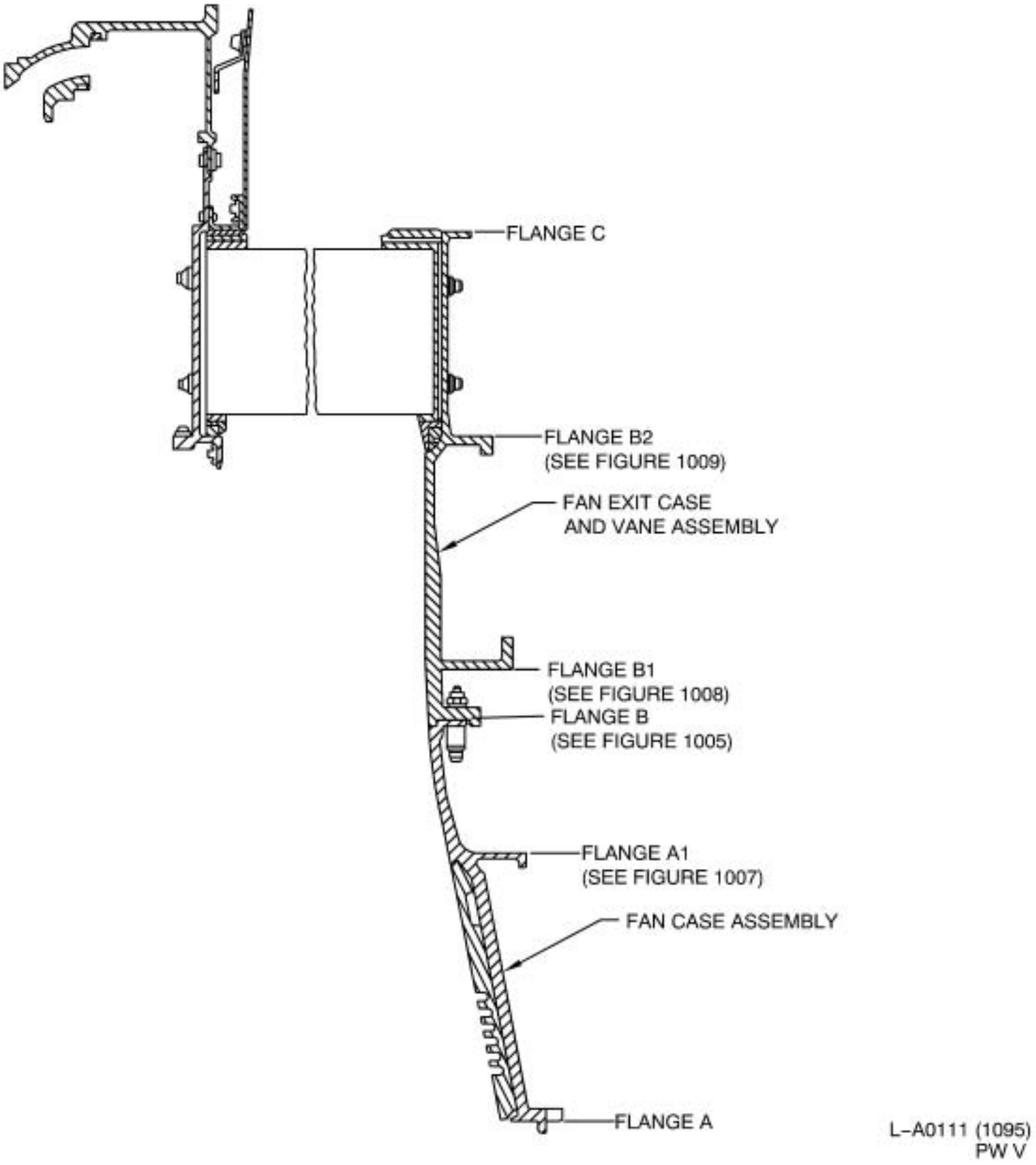
Storage Of The Front Fan Case In Horizontal Position
Figure 1003 (Sheet 1)
(Task 72-33-00-400-001)


PWA 85570
BRACKET
(4 NECESSARY)
PWA 26520
SLING
FAN EXIT CASE AND
VANE ASSEMBLY
PWA 85982
ADAPTER
(2 NECESSARY)
FLANGE B
FRONT
FAN CASE
PWA 85750
SUPPORT BLOCK
(4 NECESSARY)
(OPTIONAL)
PWA 85678
STAND
(3 NECESSARY)
(OPTIONAL)
OR PWA 87166
STAND WITH
PWA 101960
ADAPTER
(3 NECESSARY)
PWA 85676
ADAPTER
(2 NECESSARY)
PWA 101224
SUPPORT DOLLY
(4 NECESSARY)
(OPTIONAL)
L-A6737 (1096)
PW V

Storage Of The Front Fan Case In Vertical Position
Figure 1003 (Sheet 2)
(Task 72-33-00-400-001)

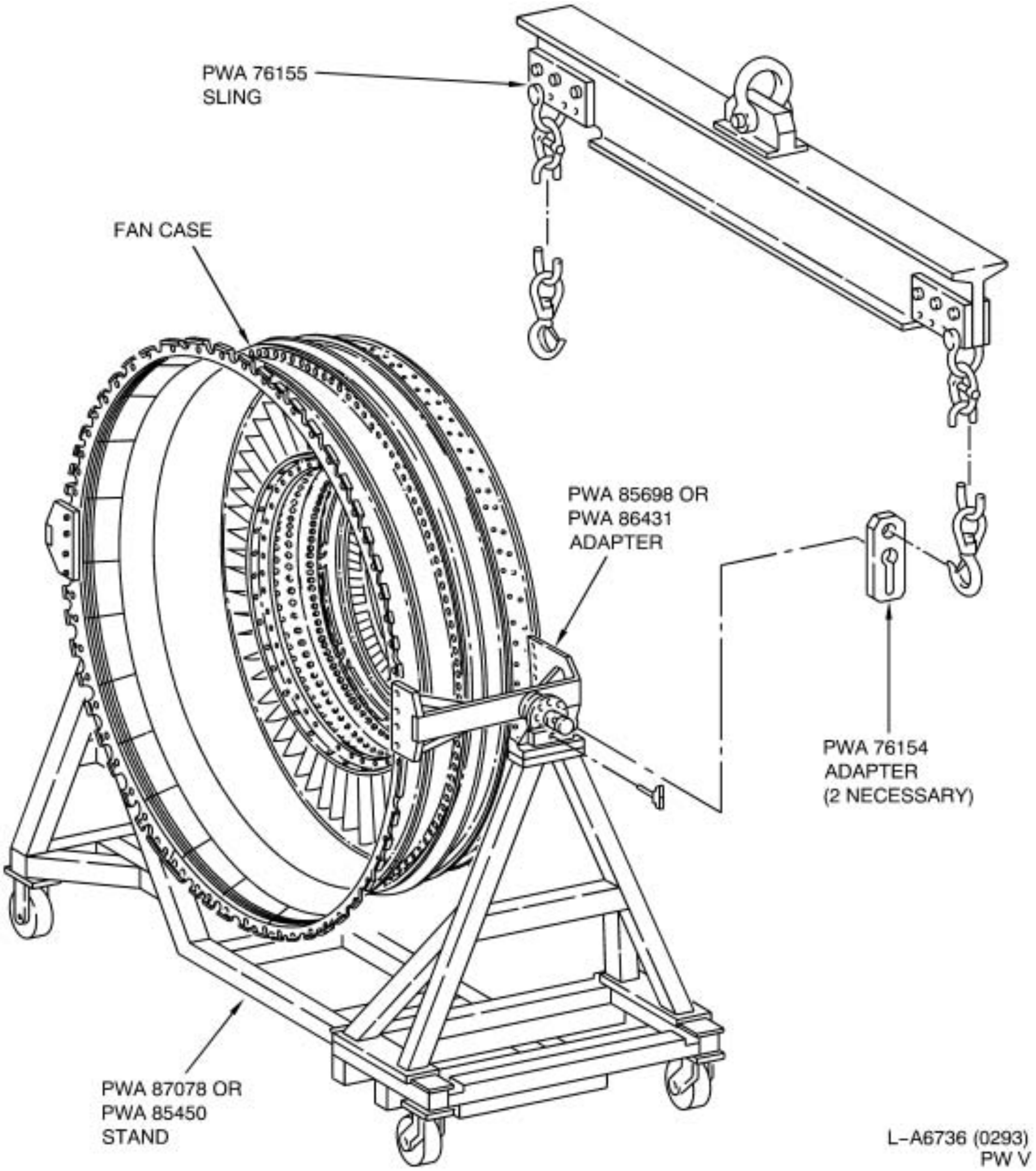
R
R

FAN CASE - ASSEMBLY-01

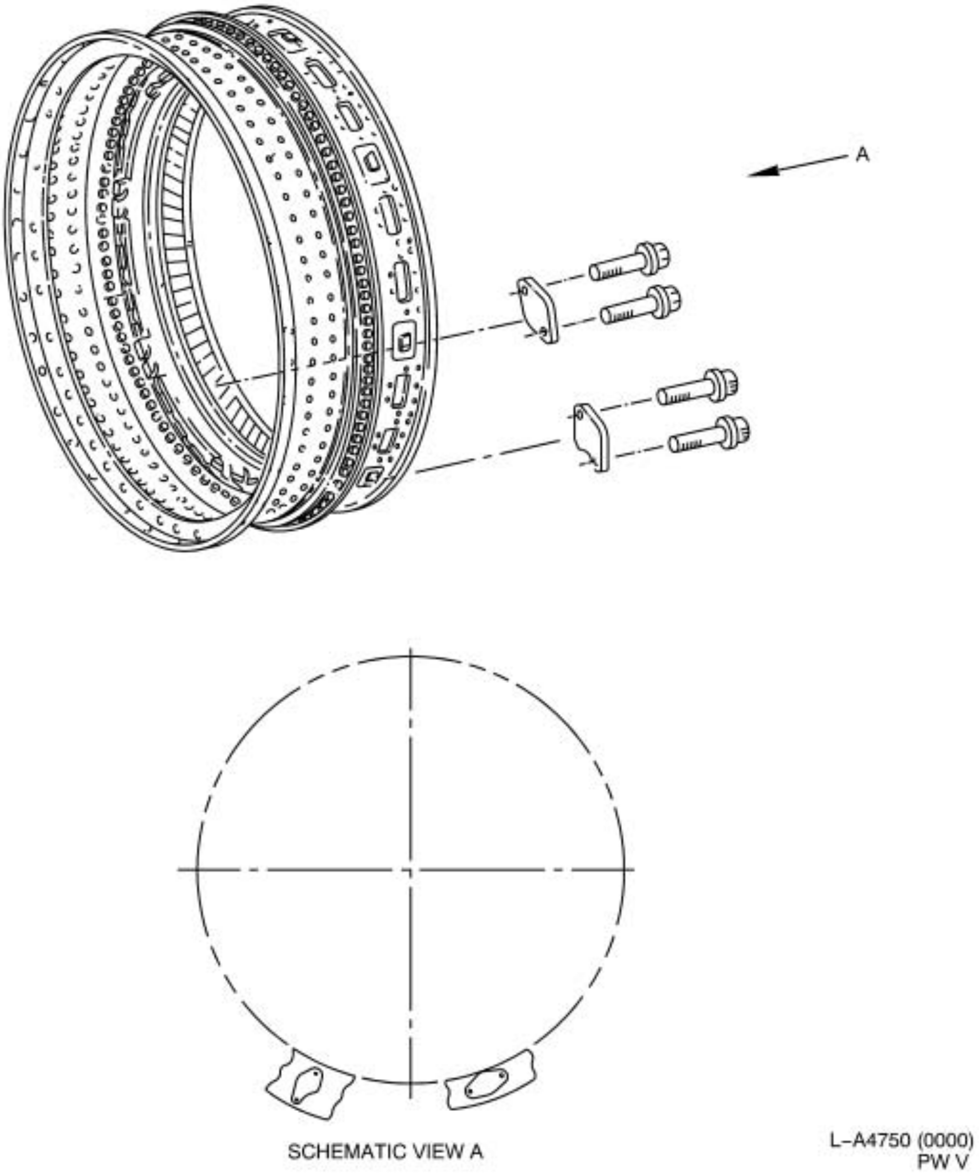

FLANGE C
FLANGE B2
(SEE FIGURE 1009)
FAN EXIT CASE
AND VANE ASSEMBLY
FLANGE B1
(SEE FIGURE 1008)
FLANGE B
(SEE FIGURE 1005)
FLANGE A1
(SEE FIGURE 1007)
FAN CASE ASSEMBLY
FLANGE A
L-A0111 (1095)
PW V

Section Through The Fan Case
Figure 1004
(Task 72-33-00-400-001)

R
R

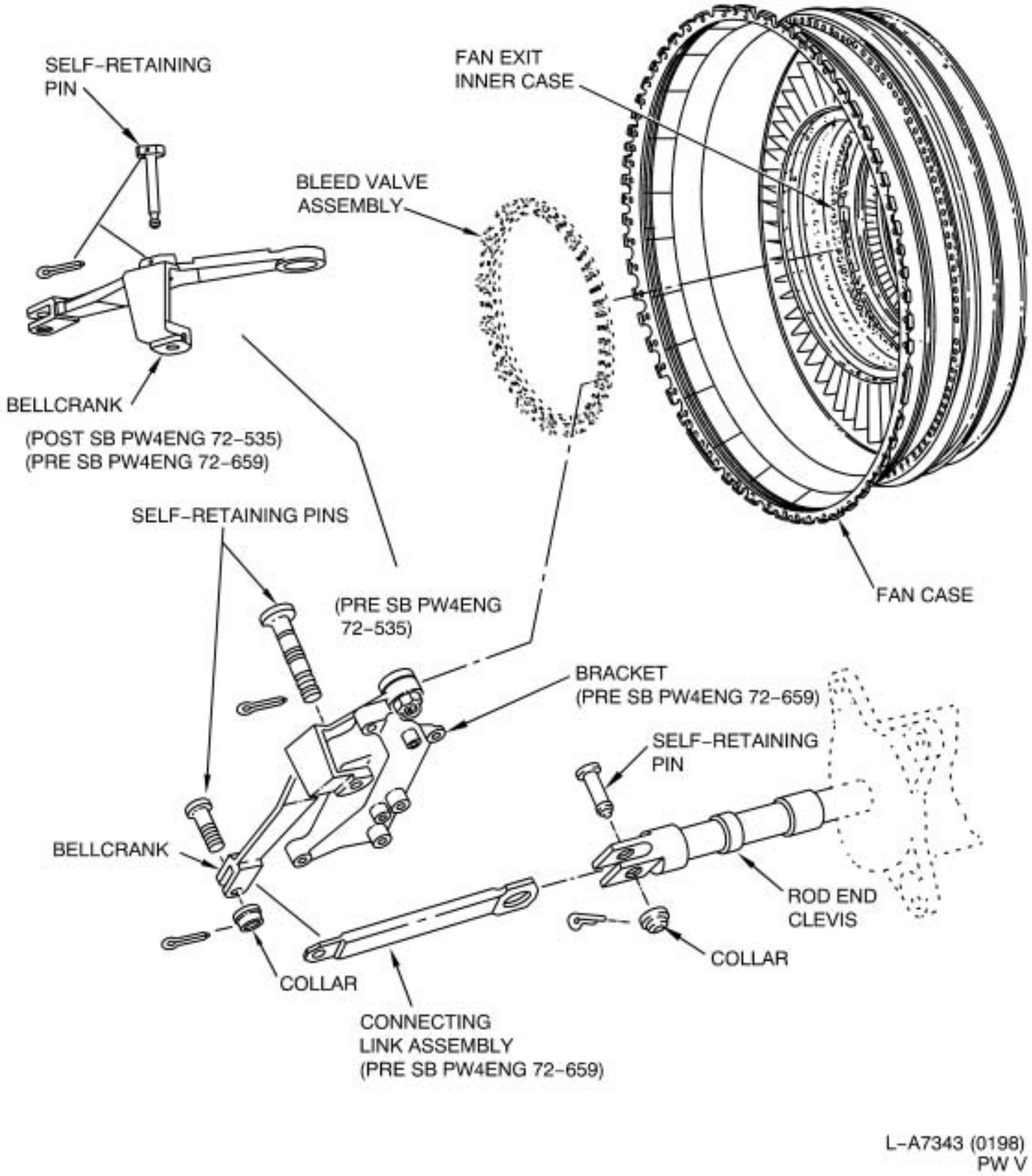

PWA 76155
SLING
FAN CASE
PWA 85698 OR
PWA 86431
ADAPTER
PWA 76154
ADAPTER
(2 NECESSARY)
PWA 87078 OR
PWA 85450
STAND
L-A6736 (0293)
PW V

Storage Of The Fan Case In Horizontal Position
Figure 1005
(Task 72-33-00-400-001)

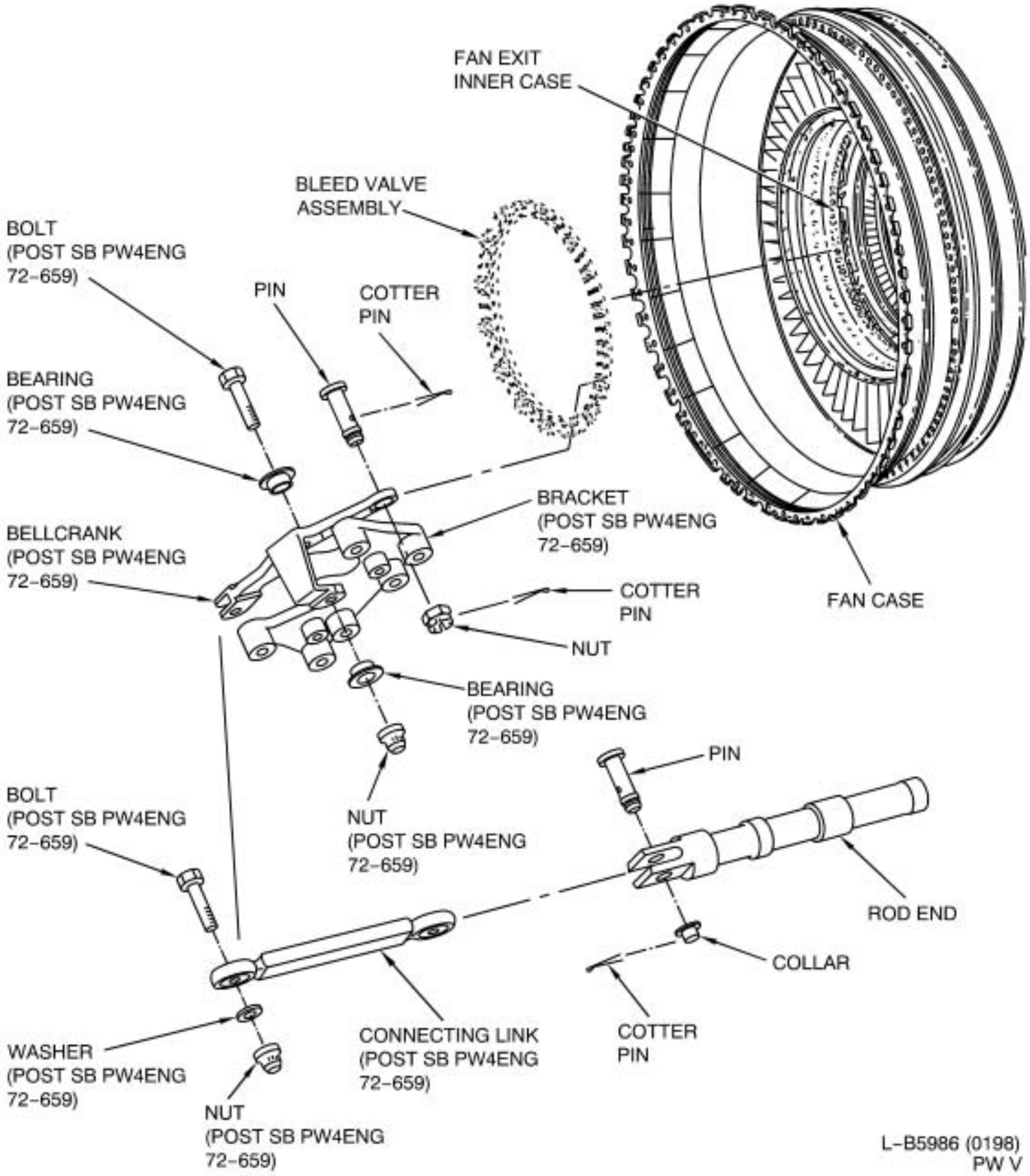

A
SCHEMATIC VIEW A
L−A4750 (0000)
PW V

Cover Installation
Figure 1006
(Task 72−33−00−400−001)

FAN CASE - ASSEMBLY-01

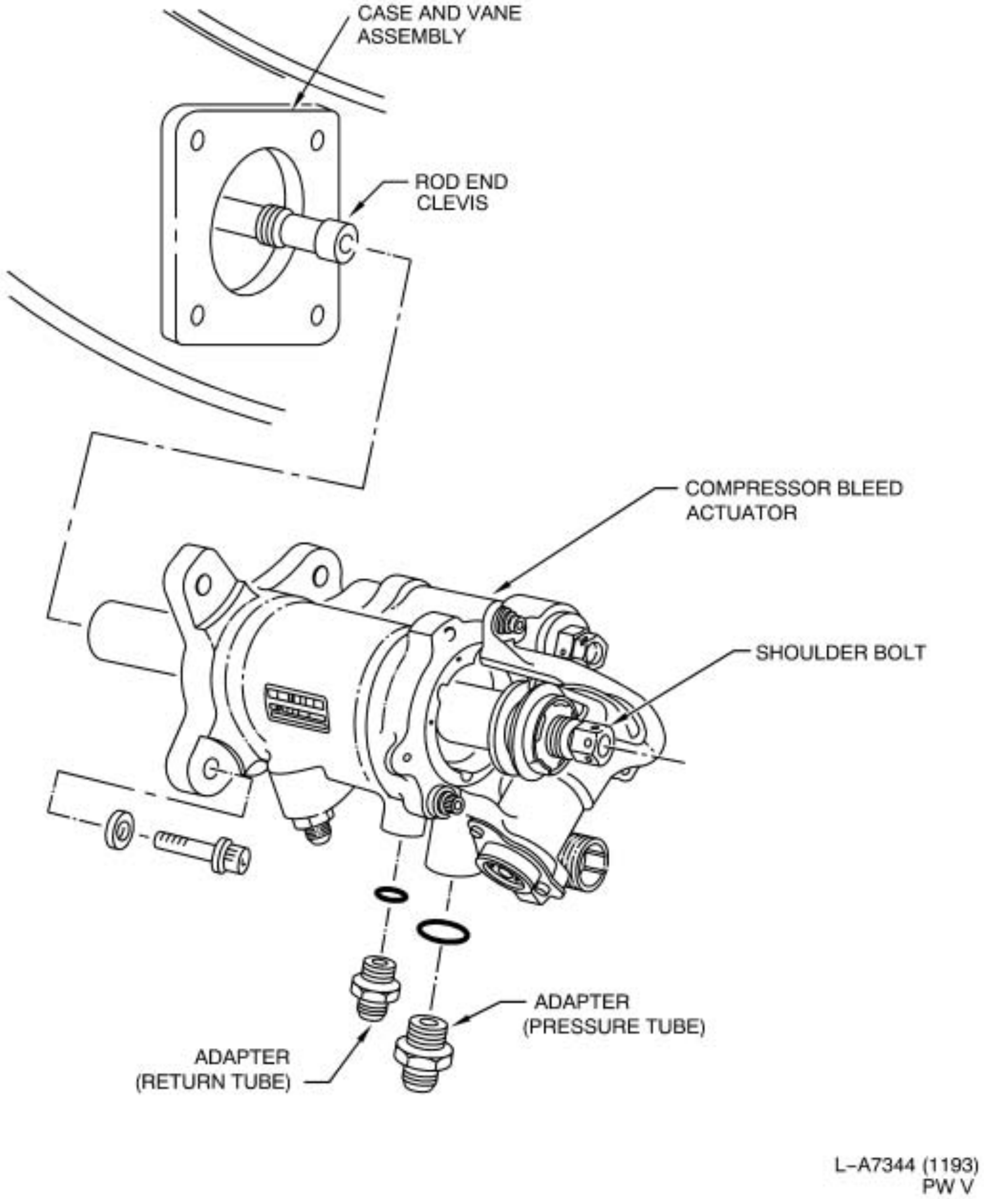

SELF-RETAINING PIN
FAN EXIT INNER CASE
BLEED VALVE ASSEMBLY
BELLCRANK
(POST SB PW4ENG 72-535)
(PRE SB PW4ENG 72-659)
SELF-RETAINING PINS
(PRE SB PW4ENG 72-535)
FAN CASE
BRACKET
(PRE SB PW4ENG 72-659)
SELF-RETAINING PIN
BELLCRANK
ROD END CLEVIS
COLLAR
COLLAR
CONNECTING LINK ASSEMBLY
(PRE SB PW4ENG 72-659)
L-A7343 (0198)
PW V

Installation Of The Bleed Valve Assembly, The Bell
Crank, And The Actuator (Pre SB PW4ENG 72-659)
Figure 1007 (Sheet 1)
(Task 72-33-00-400-001)

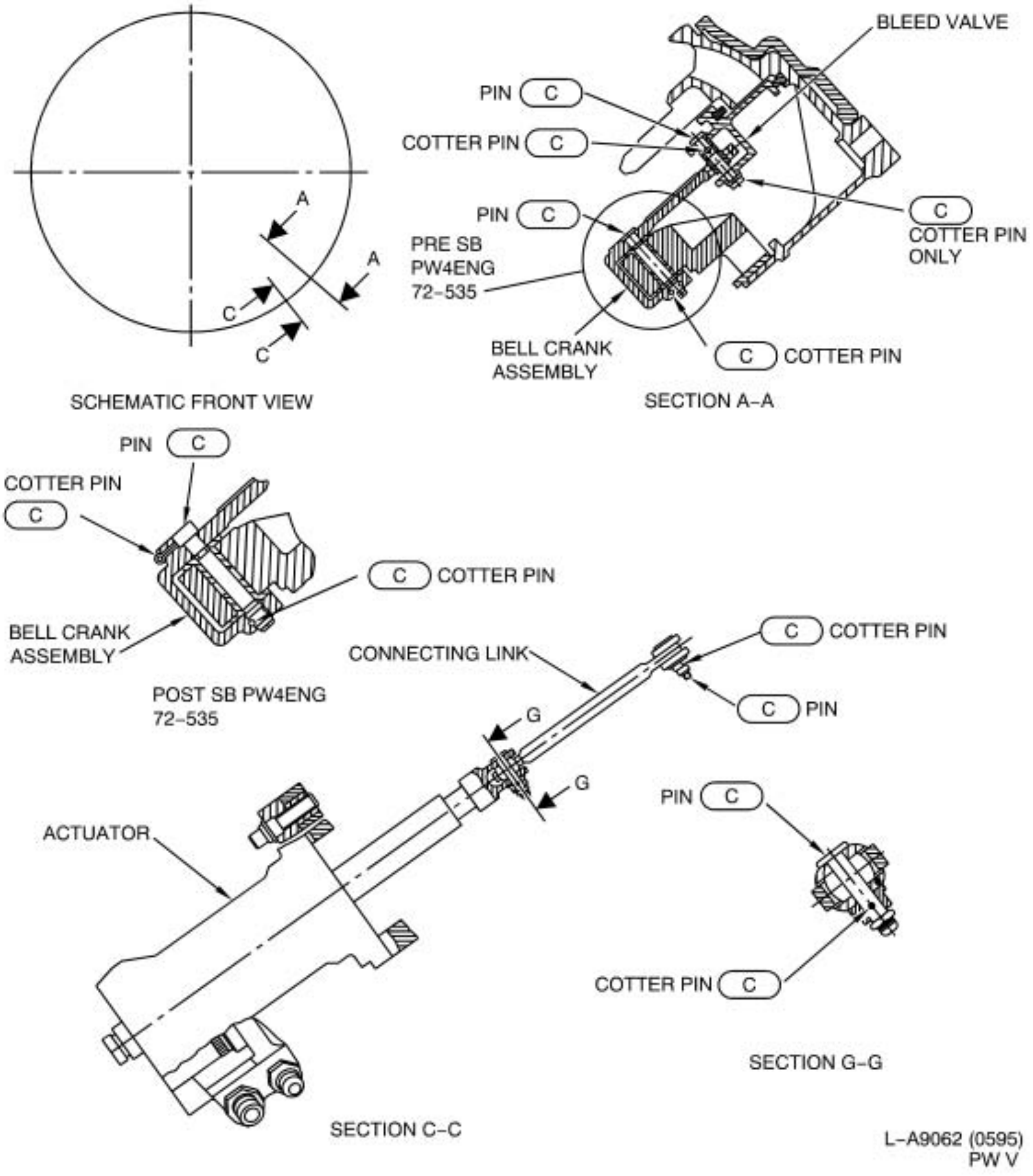

FAN EXIT
INNER CASE
BLEED VALVE
ASSEMBLY
BOLT
(POST SB PW4ENG
72-659)
PIN
COTTER
PIN
BEARING
(POST SB PW4ENG
72-659)
BRACKET
(POST SB PW4ENG
72-659)
BELLCRANK
(POST SB PW4ENG
72-659)
COTTER
PIN
FAN CASE
NUT
BEARING
(POST SB PW4ENG
72-659)
PIN
BOLT
(POST SB PW4ENG
72-659)
NUT
(POST SB PW4ENG
72-659)
ROD END
COLLAR
WASHER
(POST SB PW4ENG
72-659)
CONNECTING LINK
(POST SB PW4ENG
72-659)
COTTER
PIN
NUT
(POST SB PW4ENG
72-659)
L-B5986 (0198)
PW V

Installation Of The Bleed Valve Assembly, The Bell
Crank, And The Actuator (Post SB PW4ENG 72-659)
Figure 1007 (Sheet 2)
(Task 72-33-00-400-001)

FAN CASE - ASSEMBLY-01


CASE AND VANE ASSEMBLY
ROD END CLEVIS
COMPRESSOR BLEED ACTUATOR
SHOULDER BOLT
ADAPTER (PRESSURE TUBE)
ADAPTER (RETURN TUBE)
L-A7344 (1193)
PW V

Installation Of The Bell Crank, And The Actuator
Installation Of The Bleed Valve Assembly,
The Bell Crank, And The Actuator
Figure 1007 (Sheet 3)
(Task 72-33-00-400-001)


BLEED VALVE
PIN C
COTTER PIN C
PIN C
PRE SB PW4ENG 72-535
C COTTER PIN ONLY
BELL CRANK ASSEMBLY
C COTTER PIN
SECTION A-A
A
A
C
C
SCHEMATIC FRONT VIEW
PIN C
COTTER PIN C
C COTTER PIN
BELL CRANK ASSEMBLY
POST SB PW4ENG 72-535
CONNECTING LINK
C COTTER PIN
C PIN
G
G
PIN C
ACTUATOR
COTTER PIN C
SECTION G-G
SECTION C-C
L-A9062 (0595)
PW V

Application Of Sealant On The Bell Crank Assembly
Figure 1008
(Task 72-33-00-400-001)

Task 72-33-00-400-002:

1. Assemble Bleed Valve

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P06-054	Paste, Antiseize (PWA 36246)
P09-014	Sealant, Silicone Rubber (PWA 36003)

Expendable Parts:

	PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
	Cotter Pin	1	72-33-00/12/40
	Cotter Pin	1	72-33-00/12/50
	Cotter Pin	15	72-33-00/12/100
R	Pin, Self Aligning	1	72-33-00/12/35

B. Procedure

NOTE: Instructions are with the bleed valve assembly (called bleed valve) small OD down on a bench.

Subtask 72-33-00-430-056:

(1) Install the bleed valve cam followers as follows. See Figure 1001 (Sheet 1) and Figure 1001 (Sheet 2).

CAUTION: ENGINES THAT ARE PRE SB PW4ENG 72-566, MUST USE ROUND HEAD TYPE CAM FOLLOWERS AND BE INSTALLED IN A FAN EXIT INNER CASE WITH CAM SLOTS THAT HAVE A SERVICEABLE LIMIT OF 0.850 INCH (21.590 mm) MAXIMUM WIDTH FOR ALL SEVEN SLOTS AS RECORDED DURING DETAIL INSPECTION OF THE
R FAN EXIT INNER CASE. REFER TO SECTION
R 72-33-04, INSPECTION/CHECK-04 IN THE
R PW4000 SERIES CIR, PN 51A357. ENGINES THAT ARE POST SB PW4ENG 72-566, BUT PRE SB PW4ENG 72-660, MUST USE SQUARE HEAD TYPE CAM FOLLOWERS AND BE INSTALLED IN A FAN EXIT INNER CASE WITH CAM SLOTS THAT HAVE A SERVICEABLE LIMIT OF 0.790 INCH (20.066 mm) MAXIMUM WIDTH FOR ALL

SEVEN SLOTS AS RECORDED DURING DETAIL INSPECTION OF THE FAN EXIT INNER CASE. ENGINES THAT ARE POST SB PW4ENG 72-660, HAVE STRONGER, LOW FRICTION ROLLER TYPE CAM FOLLOWERS AND STEEL CAM SLOT LINERS THAT HAVE AN ALUMINUM BRONZE COATING TO REDUCE FRICTION, SLOT WEAR WHICH, IN TURN, ELIMINATE BINDING. ALSO, THE 2.5 BLEED BEARING PADS ARE MADE OF A STRONGER AND MORE WEAR RESISTANT
R MATERIAL. REFER TO SECTION 72-33-04,
R INSPECTION/CHECK-04 IN THE PW4000
R SERIES CIR, PN 51A357. IF THE CORRECT PARTS ARE NOT INSTALLED FOR THE ABOVE CONFIGURATION, AS SPECIFIED, THE BLEED VALVE ASSEMBLY COULD MALFUNCTION AND SUBSEQUENTLY CAUSE DAMAGE TO THE ENGINE.

(a) (Reference 750) Assemble sleeve spacer (1001/1) to bleed valve (Location A, 7 places). Install bleed valve cam follower (1001/2) to each spacer on valve.

(b) (Pre SB PW4ENG 72-660) Lubricate threads with Engine Oil P03-001, and install washers and nuts. Torque nuts to 65 - 85 lb-in. (7.344 - 9.604 N.m).

(c) (Post SB PW4ENG 72-660) Lubricate the threads of the cam follower with Antiseize Paste P06-054, and install the washers and the nuts. Wipe off unwanted paste. Torque the nuts to 125 - 140 lb-in. (14.123 - 15.818 N.m).

(d) (Pre SB PW4ENG 72-660) Secure nuts with cotter pins. Bend tangs of pins around nuts.

Subtask 72-33-00-430-057:

(2) Install the bleed valve dampers as follows. See Figure 1001 (Sheet 3).

(a) Assemble sleeve spacer (1001/3) to bleed valve (Location F, 8 places). Install bleed valve cam follower damper assembly (1001/4) to each spacer.

(b) Lubricate threads with Engine Oil P03-001, and install washers and nuts. Torque nuts to 65 - 85 lb-in. (7.344 - 9.604 N.m).

(c) Secure nuts with cotter pins. Bend tangs of pins around nuts.

Subtask 72-33-00-430-059:

(3) (Pre SB PW4ENG 72-660) Apply sealant to the pins at Location A.

(a) Clean cotter pin areas and both ends of pins by SPOP 208 Wipe Method. SeeStandard Practices Manual, PN 585005, 70-21-00. Surfaces shall be thoroughly dried in air at ambient temperatures. Drying time shall be sufficient to remove traces of solvent detrimental to sealant.

(b) Apply Silicone Rubber Sealant P09-014, to pins and both ends of cotter pins at locations shown in referenced figure.

Subtask 72-33-00-430-058:

(4) Install the bell crank assembly on the bleed valve as follows. See Figure 1002.

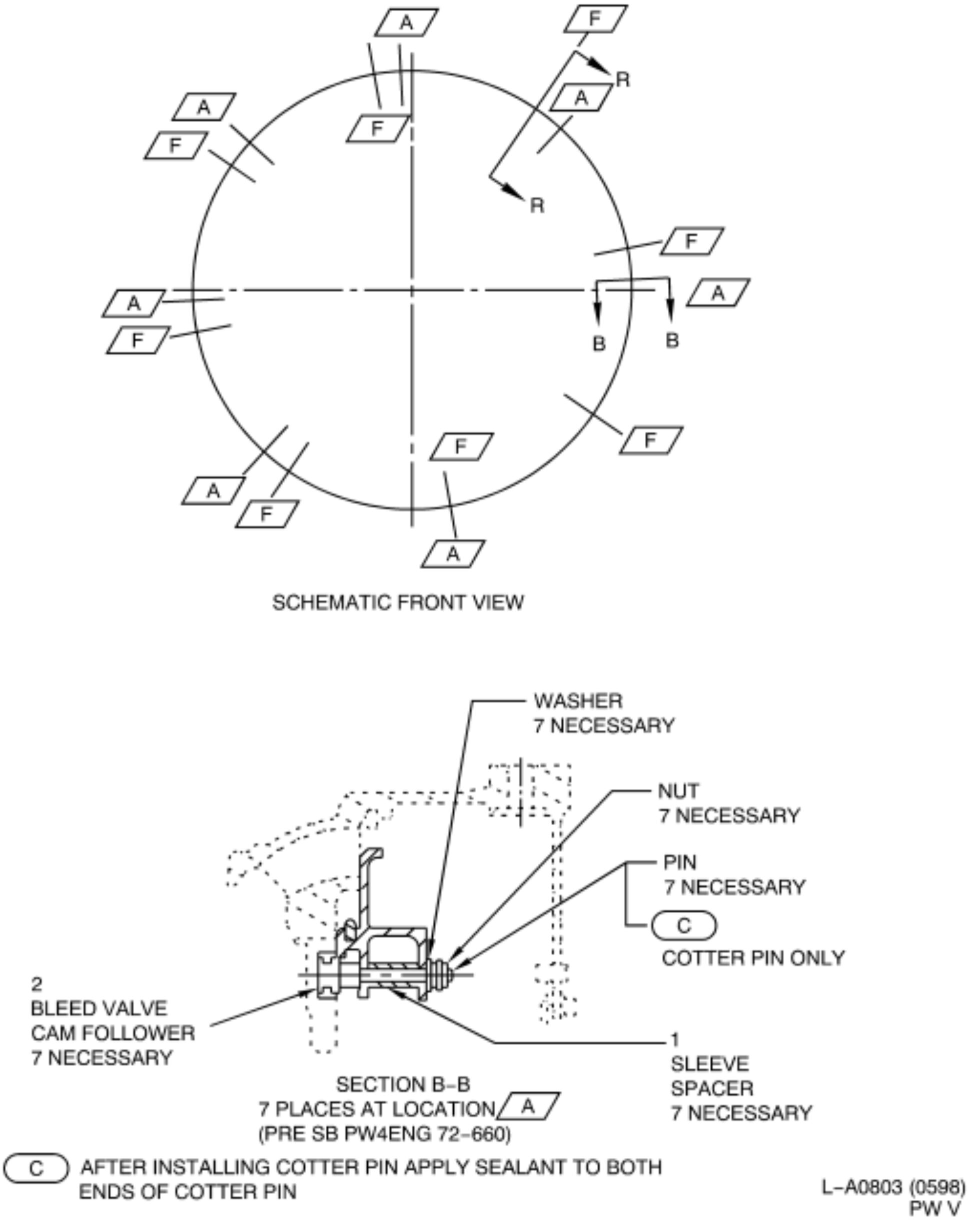
(a) Align the hole in the bearing of the bell crank with the holes in the clevis on the bleed valve.

R (b) Install a new self-retaining pin through the clevis and the bell crank.

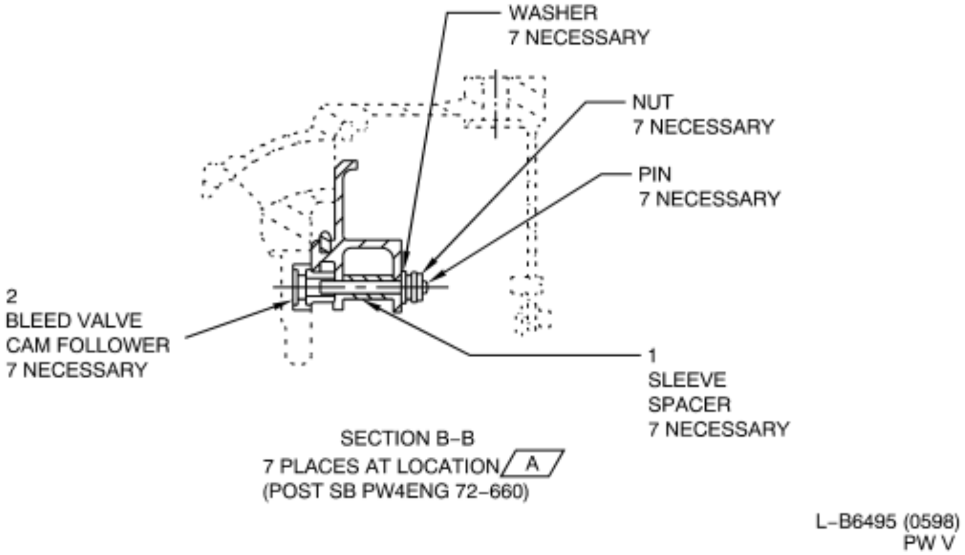
(c) Install a cotter pin in the self-retaining pin. Bend the legs of the cotter pin.

(d) Install a nut, threads lubricated with Engine Oil P03-001, on the self-retaining pin. Torque the nut to 24 - 36 lb-in. (2.712 - 4.067 N.m).

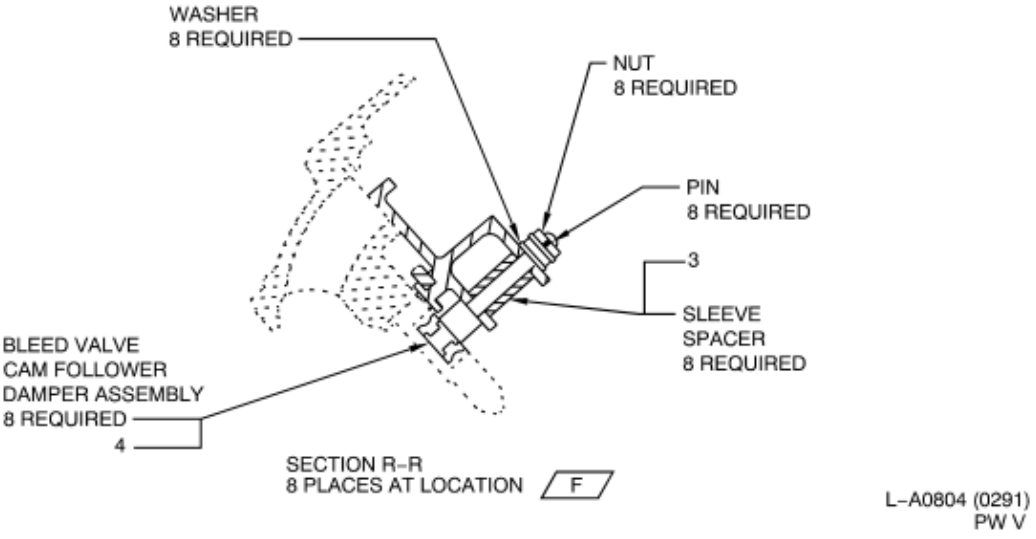
(e) Install a cotter pin in the nut. Bend the legs of the cotter pin.


A
F
R
R
A
F
A
F
F
A
A
F
B
B
F
F
A
F
A
SCHEMATIC FRONT VIEW
WASHER
7 NECESSARY
NUT
7 NECESSARY
PIN
7 NECESSARY
C
COTTER PIN ONLY
2
BLEED VALVE
CAM FOLLOWER
7 NECESSARY
1
SLEEVE
SPACER
7 NECESSARY
SECTION B-B
7 PLACES AT LOCATION A
(PRE SB PW4ENG 72-660)
C AFTER INSTALLING COTTER PIN APPLY SEALANT TO BOTH
ENDS OF COTTER PIN
L-A0803 (0598)
PW V

Bleed Valve Assembly
Figure 1001 (Sheet 1)
(Task 72-33-00-400-002)

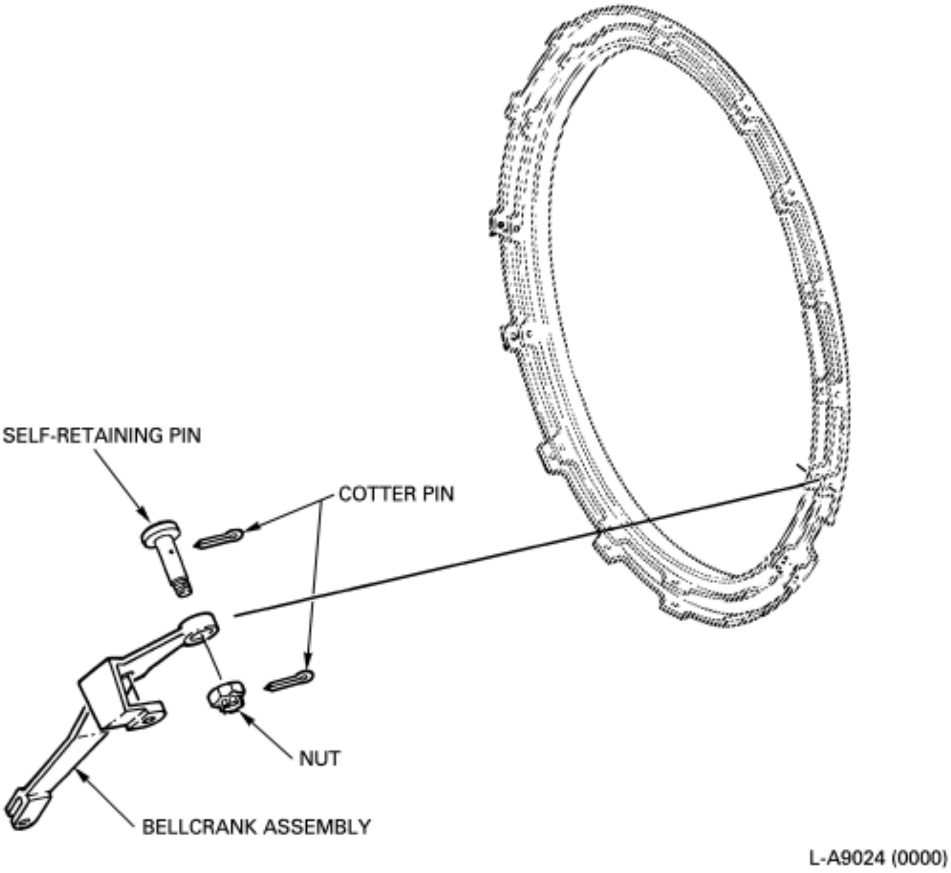

WASHER
7 NECESSARY
NUT
7 NECESSARY
PIN
7 NECESSARY
2
BLEED VALVE
CAM FOLLOWER
7 NECESSARY
1
SLEEVE
SPACER
7 NECESSARY
SECTION B−B
7 PLACES AT LOCATION A
(POST SB PW4ENG 72−660)
L−B6495 (0598)
PW V

Bleed Valve Assembly
Figure 1001 (Sheet 2)
(Task 72−33−00−400−002)


WASHER
8 REQUIRED
NUT
8 REQUIRED
PIN
8 REQUIRED
3
SLEEVE
SPACER
8 REQUIRED
BLEED VALVE
CAM FOLLOWER
DAMPER ASSEMBLY
8 REQUIRED
4
SECTION R-R
8 PLACES AT LOCATION
F
L-A0804 (0291)
PW V

Bleed Valve Assembly
Figure 1001 (Sheet 3)
(Task 72-33-00-400-002)

FAN CASE - ASSEMBLY-02


SELF-RETAINING PIN
COTTER PIN
NUT
BELLCRANK ASSEMBLY
L-A9024 (0000)

Installation Of The Bell Crank Assembly
Figure 1002
(Task 72-33-00-400-002)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-33-00-430-020:

1. Install The Flange A1 Brackets And Hardware

A. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P03-001	Oil, Engine (PWA 521B)

B. Procedure

(1) Install Flange A1 hardware as follows. See Figure 1001.

(a) Lubricated the bolts threads with Engine Oil P03-001.

(b) Install brackets to Flange A1 and secure with bolts, washers and nuts.

(c) Torque nuts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(d) If applicable position vibration pickup bracket to rear of Flange A at approximately 1 o'clock position.

(e) Lubricated the bolts threads with Engine Oil P03-001.

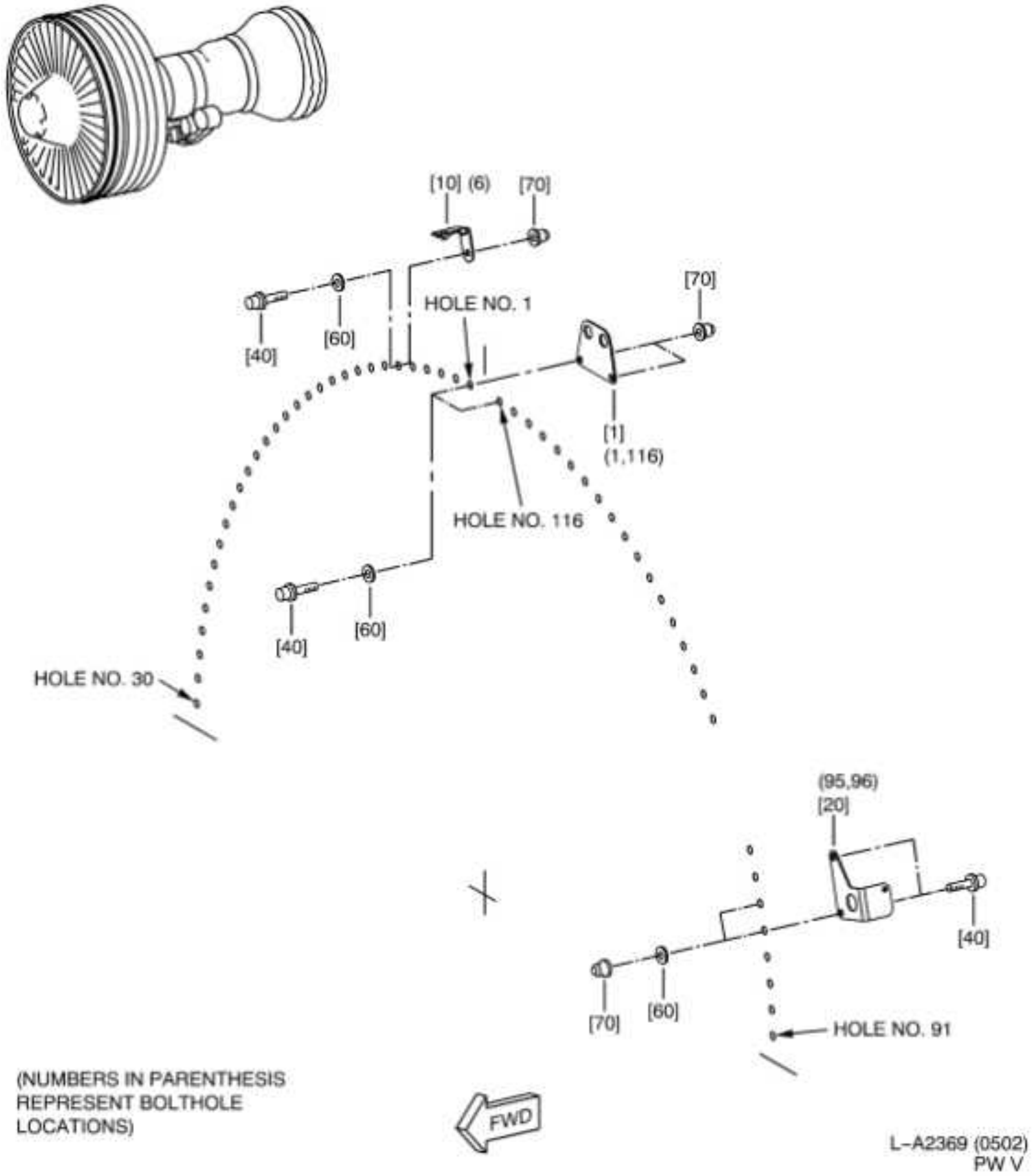
(f) Secure the vibration pickup bracket with bolts.

(g) Torque bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m).

(h) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(2) Remove any tags or markings on the brackets or flange.

(3) Examine the assembly for foreign objects, damage, and correct assembly.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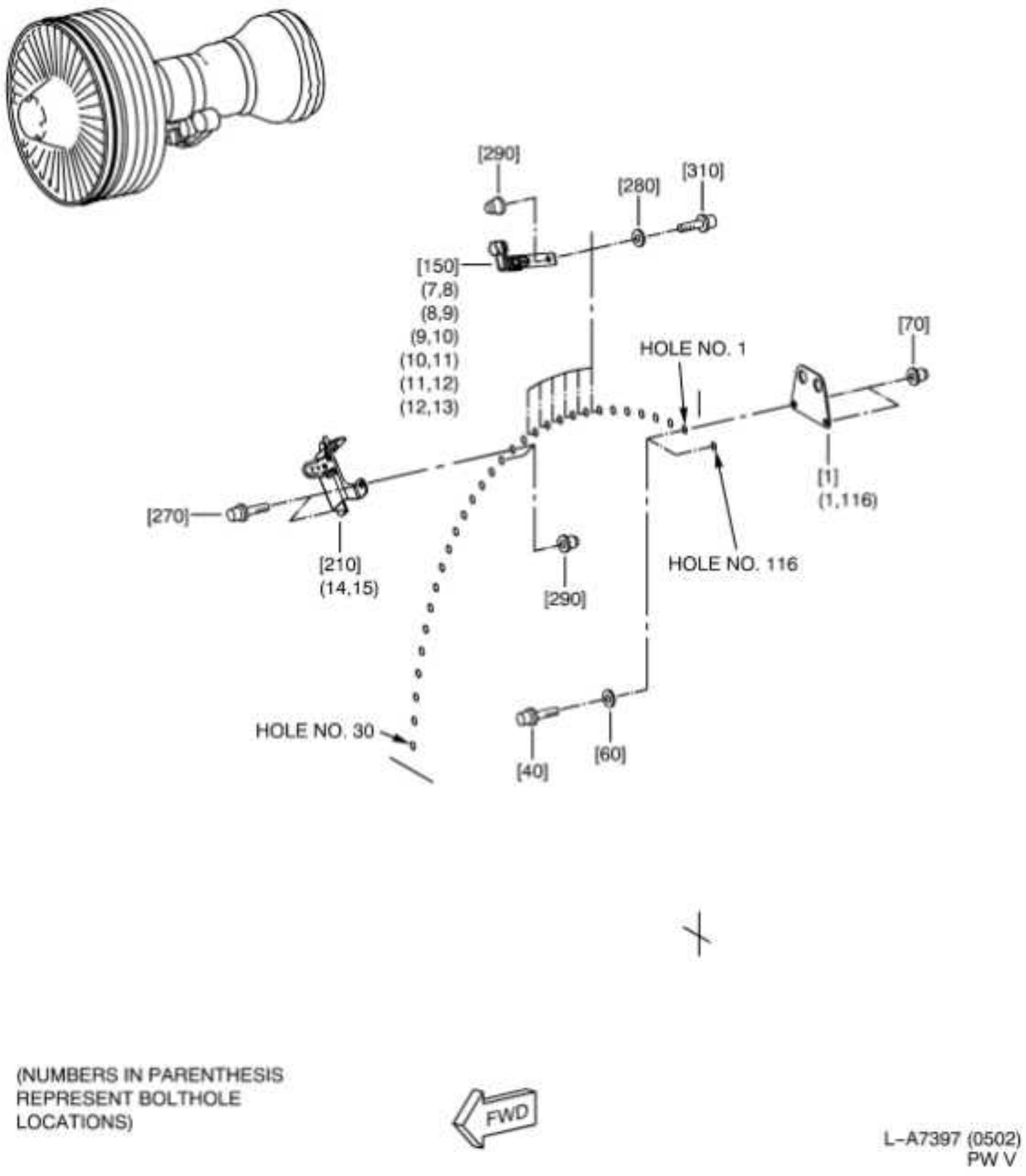
[70]
[70]
HOLE NO. 1
[40]
[60]
[1]
(1,116)
HOLE NO. 116
[40]
[60]
HOLE NO. 30
(95,96)
[20]
[40]
[70]
[60]
HOLE NO. 91
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-A2369 (0502)
PW V

Flange A1 Bracket locations
Figure 1001 (Sheet 1)
(Task 72-33-00-430-020)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[310]
[150]
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(8,9)
(9,10)
(10,11)
(11,12)
(12,13)
[70]
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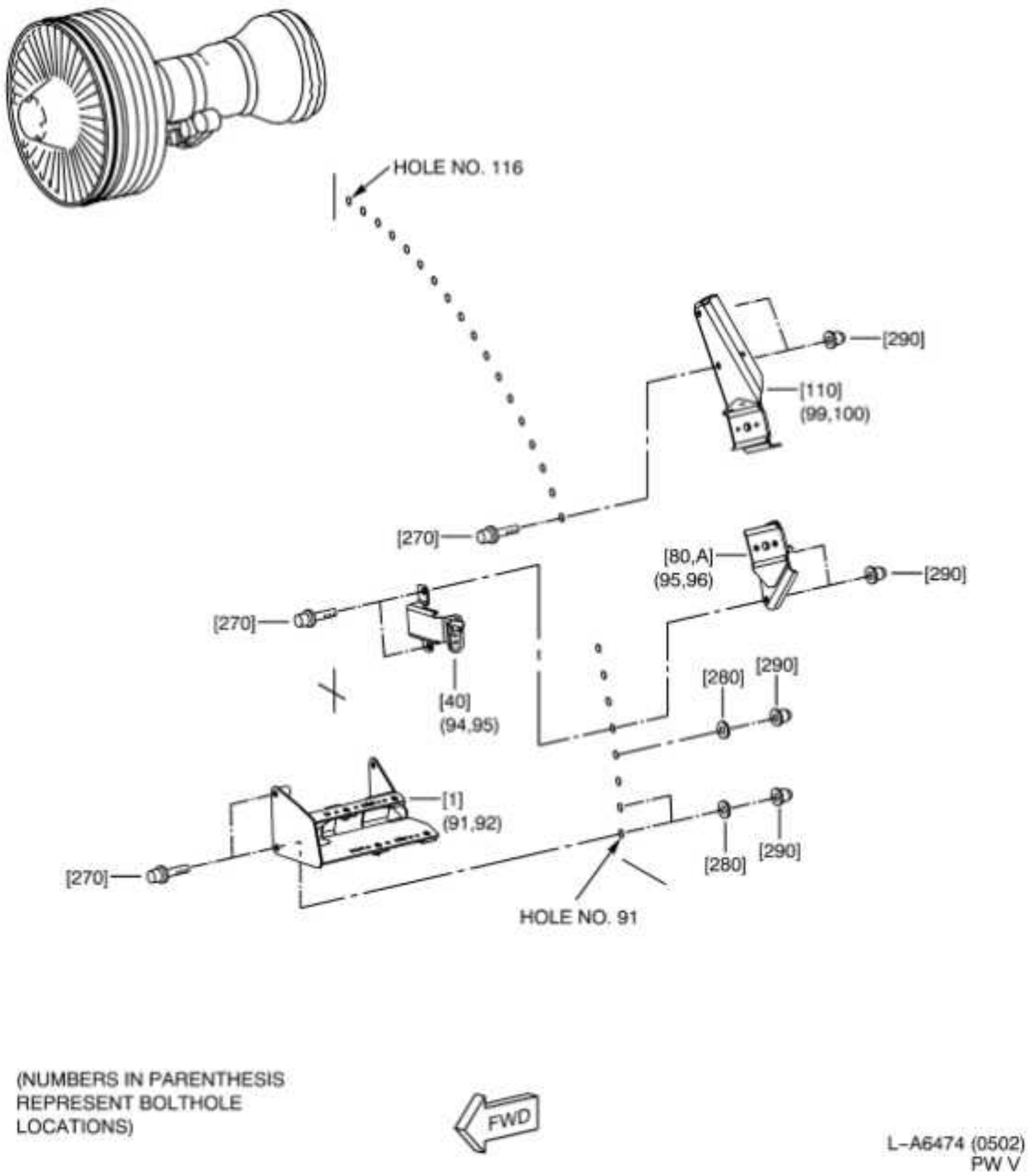
(1,116)
[210]
(14,15)
HOLE NO. 116
[290]
HOLE NO. 30
[40]
[60]
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-A7397 (0502)
PW V

Flange A1 Bracket Locations (Engines With Common Fan Cases)
Figure 1001 (Sheet 2)
(Task 72-33-00-430-020)

FAN CASE - ASSEMBLY-20


HOLE NO. 116
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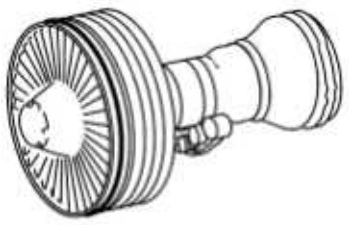
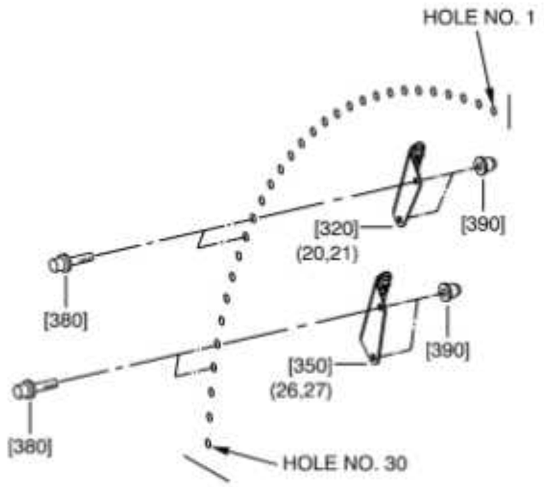
(99,100)
[270]
[80,A]
(95,96)
[290]
[270]
[280]
[290]
[40]
(94,95)
[1]
(91,92)
[270]
[280]
[290]
HOLE NO. 91
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-A6474 (0502)
PW V

Flange A1 Bracket Locations (Engines With Common Fan Cases)
Figure 1001 (Sheet 3)
(Task 72-33-00-430-020)




HOLE NO. 1
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(20,21)
[390]
[380]
[350]
(26,27)
[390]
[380]
HOLE NO. 30

NOTE: FOR ENGINES EQUIPPED WITH SUPPLEMENTAL CONTROL UNIT ONLY.

(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

FWD

L-A7373 (0502)
PW V

Flange A1 Bracket Locations (Engines Equipped With SCU)
Figure 1001 (Sheet 4)
(Task 72-33-00-430-020)

Previous Pageblock Return to Previous Menu Next Pageblock

FAN CASE - ASSEMBLY-21

Task 72-33-00-430-021:

1. Install The Flange B Brackets And Hardware

A. Equipment And Materials Necessary

Standard Tools:
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 87503	Handle, Nut (For the Airbus/McDonnell Douglas common parts configuration only)

Consumable Materials:

Item No.	Designation
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P03-001	Oil, Engine (PWA 521B)

B. Procedure

(1) Install Flange B hardware as follows. See Figure 1001.

(a) Lubricated the bolts threads with Engine Oil P03-001.

(b) Use the PWA 87503 Nut Handle and attach brackets to Flange B and secure with bolts, washers, spacers, and nuts.

(c) Tighten and torque the bolts to 180 - 200 lb-in. (20.337 - 22.597 N.m).

(d) (Reference 491) Check gap between cases at ID of Flange B to be within 0.000 - 0.020 inch (0.000 - 0.508 mm).

(e) If applicable position vibration pickup bracket to rear of Flange A at approximately 1 o'clock position.

(f) Lubricated the bolts threads with Engine Oil P03-001.

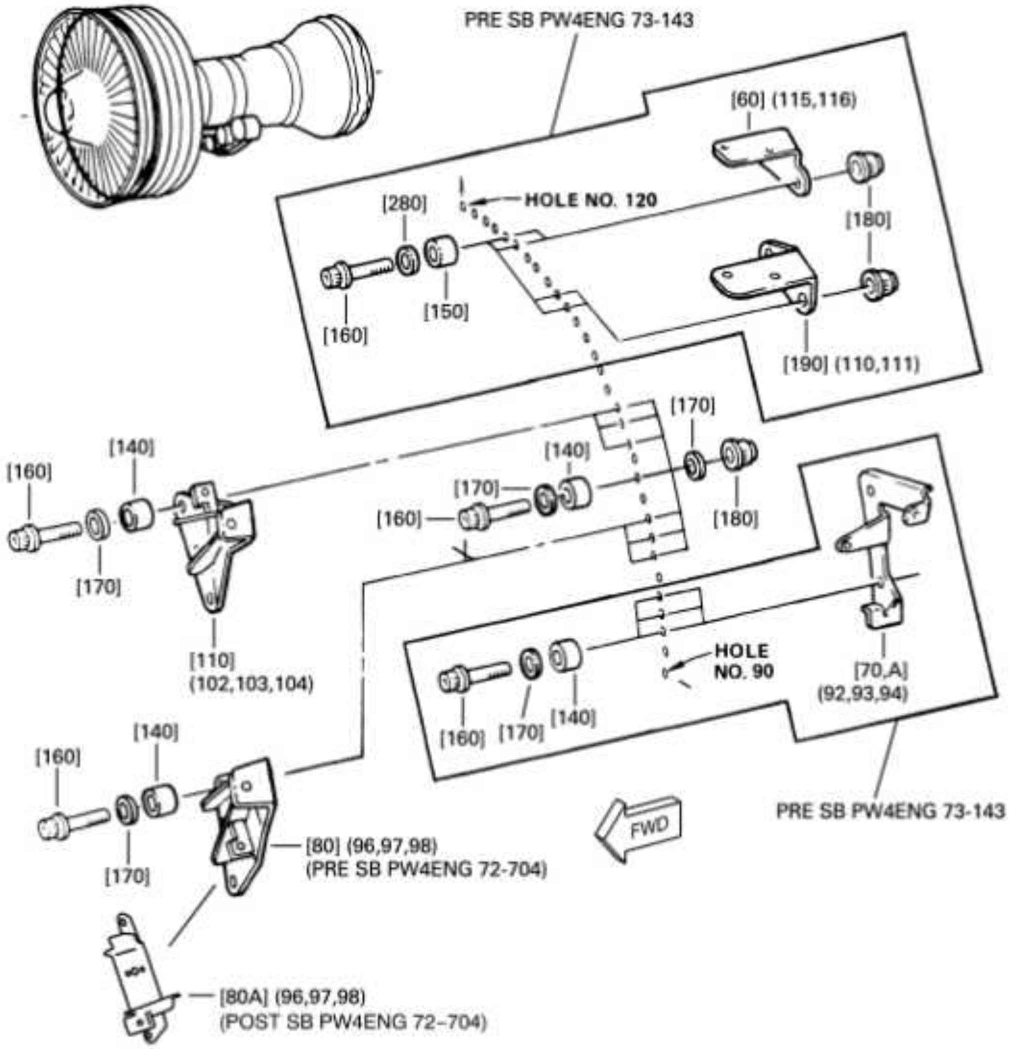
(g) Secure the vibration pickup bracket with bolts.

(h) Torque bolts to 65 − 85 lb−in. (7.344 − 9.604 N.m).

(i) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(2) Remove any tags or markings on the brackets or flange.

(3) Examine the assembly for foreign objects, damage, and correct assembly.


PRE SB PW4ENG 73-143
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HOLE NO. 120
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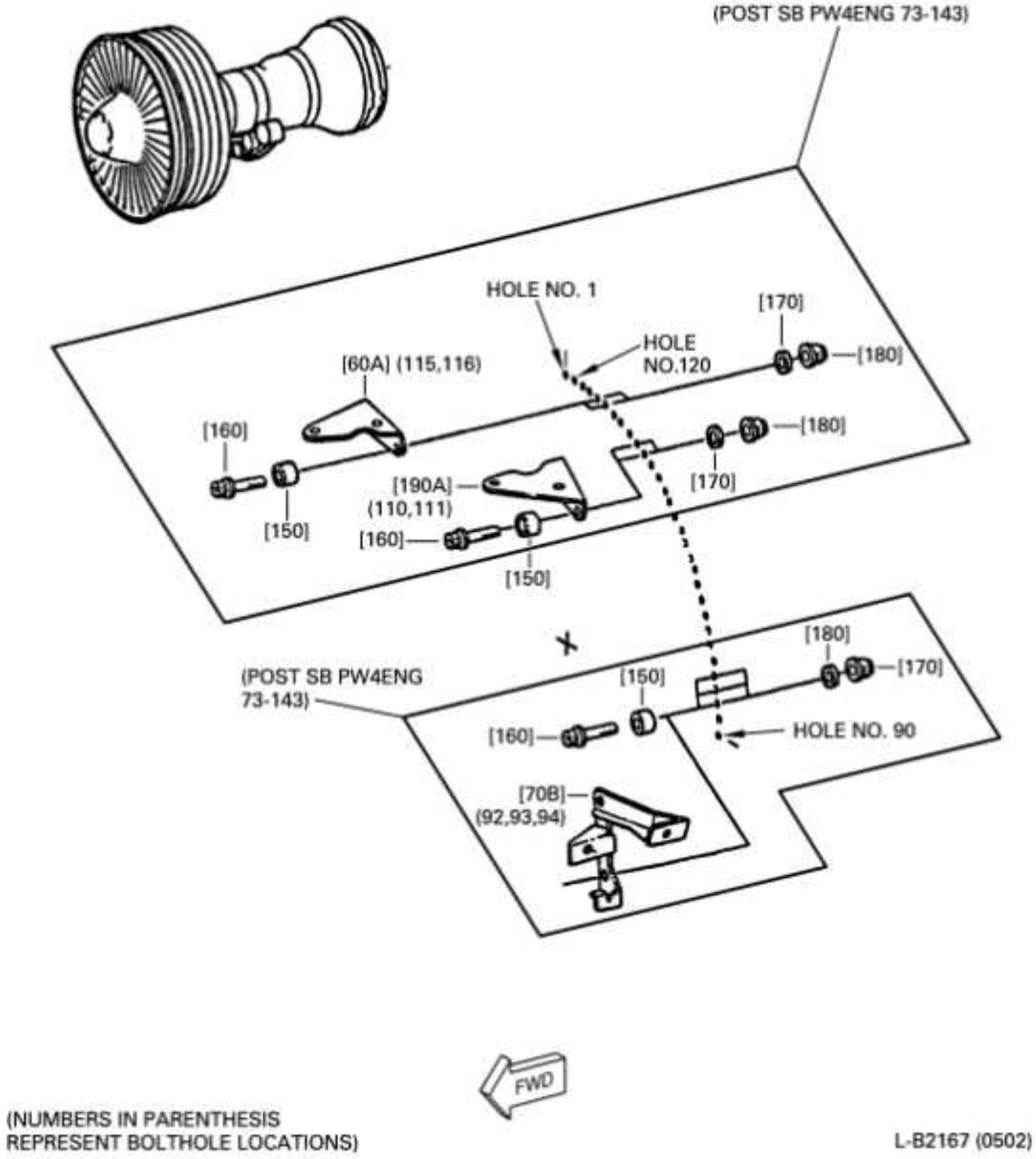
[170]
[160]
[180]
[170]
[110]
(102,103,104)
HOLE
NO. 90
[70,A]
(92,93,94)
[160]
[170]
[140]
[140]
[160]
PRE SB PW4ENG 73-143
FWD
[170]
[80] (96,97,98)
(PRE SB PW4ENG 72-704)
[80A] (96,97,98)
(POST SB PW4ENG 72-704)

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE LOCATIONS)

L-A1350 (0502)

Flange B Bracket Locations
Figure 1001 (Sheet 1)
(Task 72−33−00−430−021)


(POST SB PW4ENG 73-143)
HOLE NO. 1
HOLE NO.120
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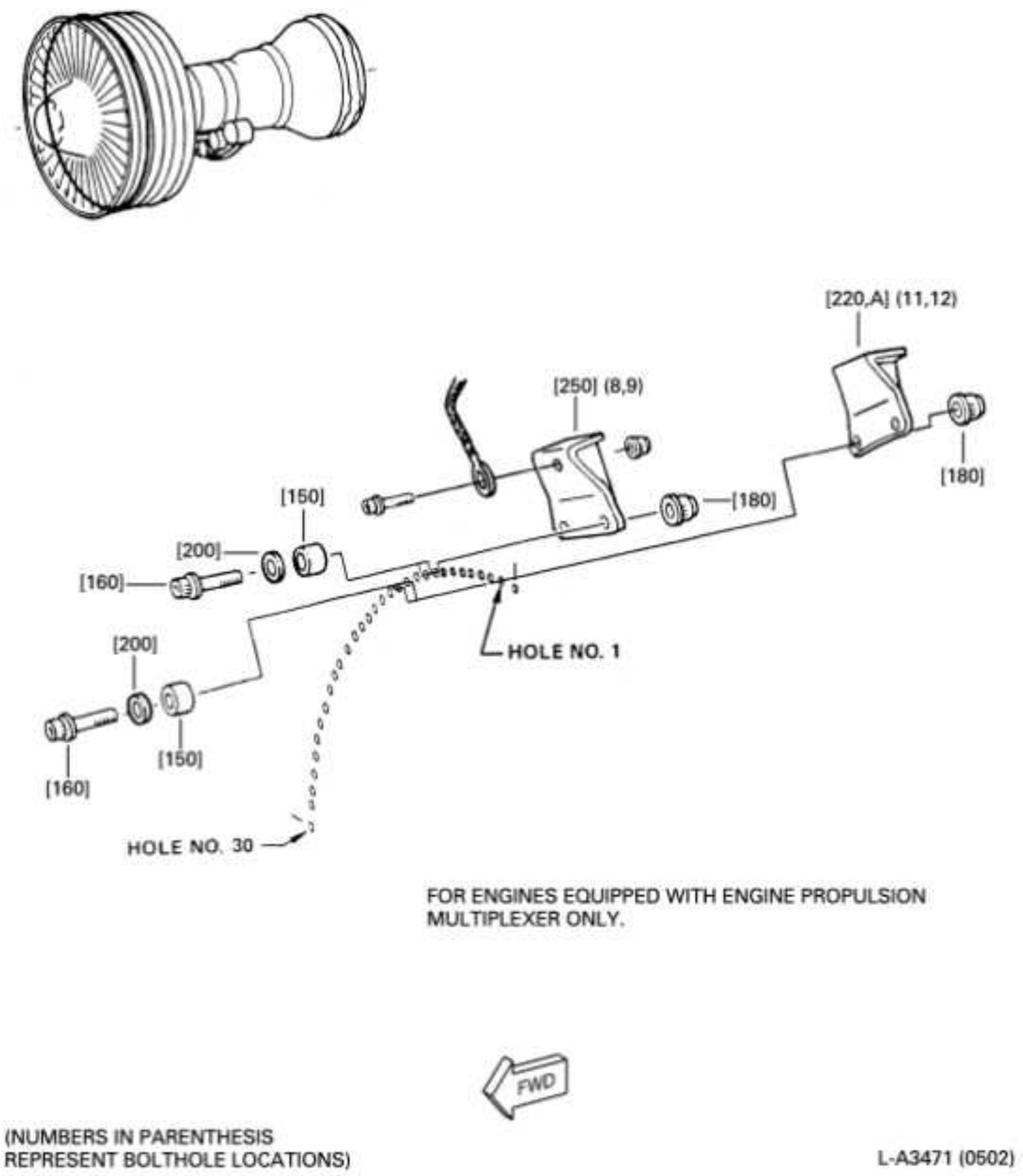
[170]
[190A]
(110,111)
[160]
[150]
X
[180]
(POST SB PW4ENG 73-143)
[150]
[170]
[160]
HOLE NO. 90
[70B]
(92,93,94)
FWD
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L-B2167 (0502)

Flange B Bracket Locations
Figure 1001 (Sheet 2)
(Task 72−33−00−430−021)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HOLE NO. 1
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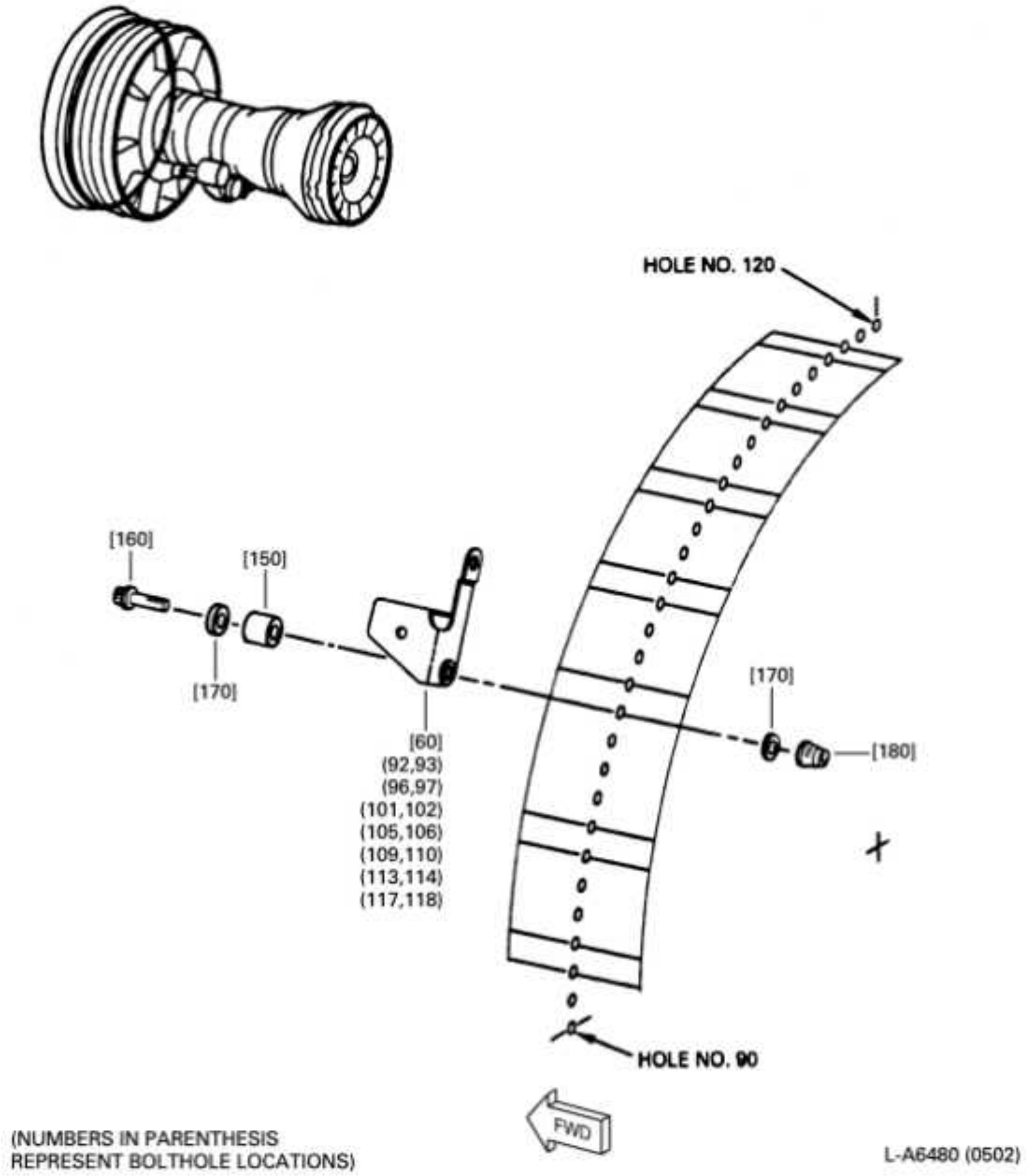
[160]
HOLE NO. 30
FWD

FOR ENGINES EQUIPPED WITH ENGINE PROPULSION MULTIPLEXER ONLY.

(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

L-A3471 (0502)

Flange B (Brackets Required For Engine Propulsion Multiplexer Unit)
Figure 1001 (Sheet 3)
(Task 72−33−00−430−021)


HOLE NO. 120
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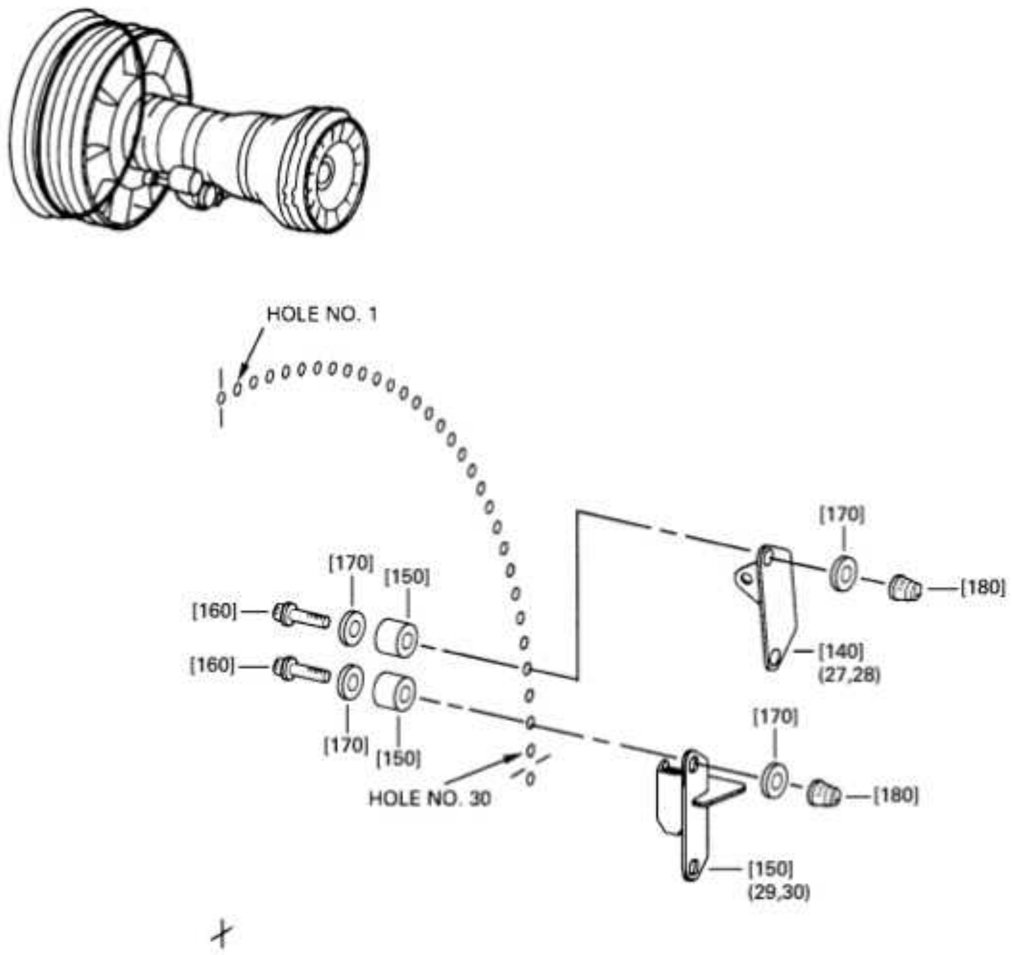
(96,97)
(101,102)
(105,106)
(109,110)
(113,114)
(117,118)
HOLE NO. 90
FWD

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE LOCATIONS)

L-A6480 (0502)

Flange B Bracket Locations (Engines With Common Fan Cases)
Figure 1001 (Sheet 4)
(Task 72−33−00−430−021)


HOLE NO. 1
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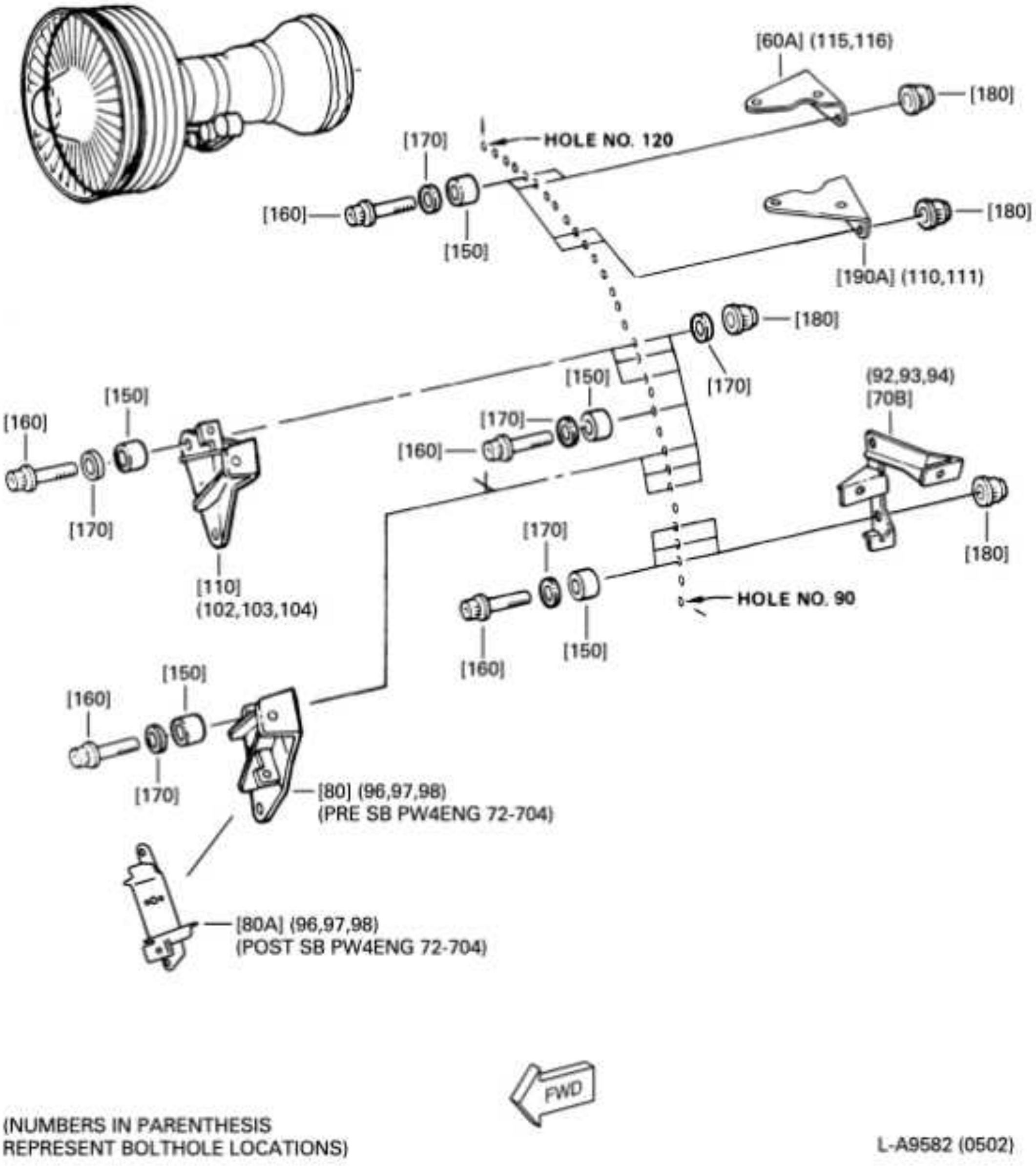
[170]
[170]
[150]
HOLE NO. 30
[180]
[150]
(29,30)

NOTE: FOR ENGINES EQUIPPED WITH
SUPPLEMENTAL CONTROL UNIT
WITH MULTIPLEXING ONLY.

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE LOCATIONS)

L-A7399 (0502)

Flange B Bracket Locations (Engines With SCU With Multiplexing)
Figure 1001 (Sheet 5)
(Task 72−33−00−430−021)


[60A] (115,116)
[180]
HOLE NO. 120
[170]
[160]
[150]
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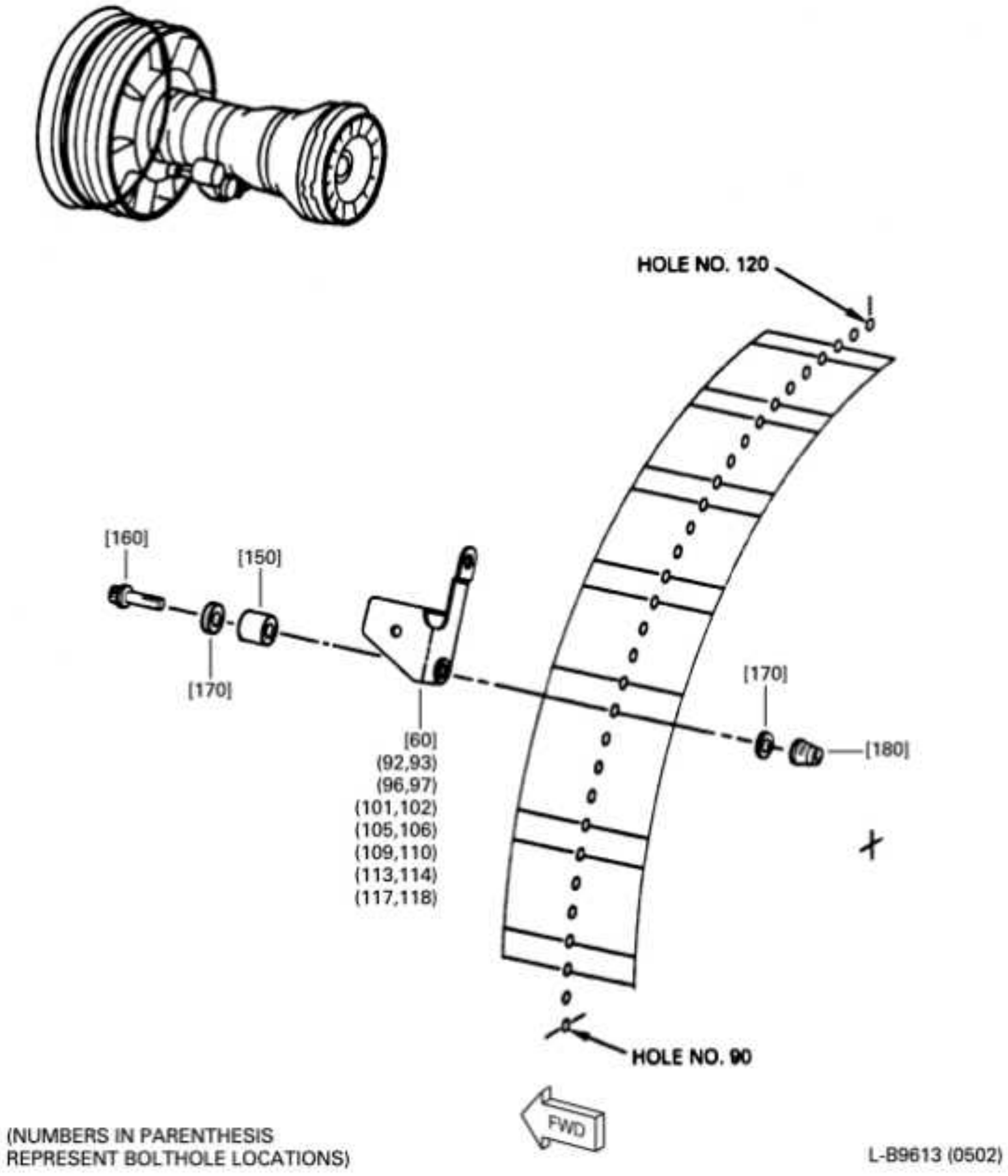
[190A] (110,111)
[180]
[170]
[150]
[160]
[150]
[170]
[160]
[170]
[110]
(102,103,104)
(92,93,94)
[70B]
[180]
[170]
HOLE NO. 90
[160]
[150]
[160]
[150]
[170]
[80] (96,97,98)
(PRE SB PW4ENG 72-704)
[80A] (96,97,98)
(POST SB PW4ENG 72-704)
FWD

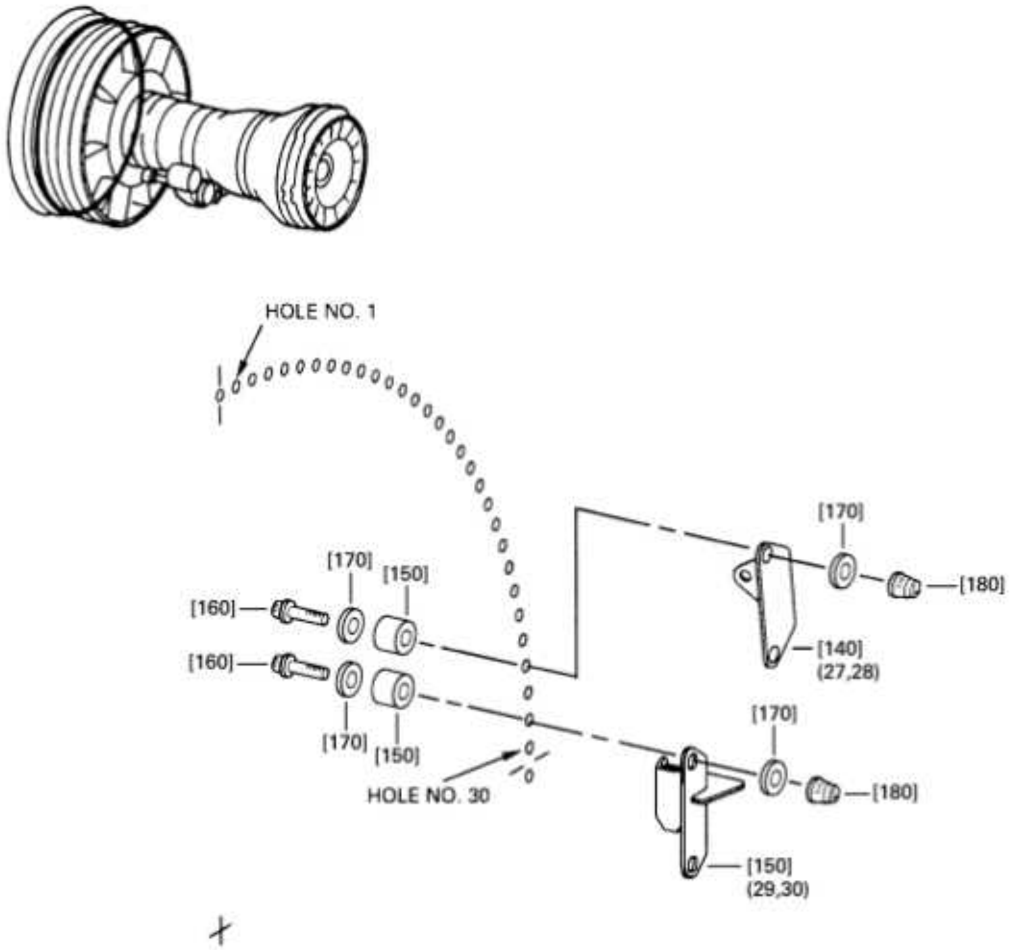
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE LOCATIONS)

L-A9582 (0502)

Flange B Brackets Locations
Figure 1001 (Sheet 6)
(Task 72−33−00−430−021)


HOLE NO. 120
[160]
[150]
[170]
[60]
(92,93)
(96,97)
(101,102)
(105,106)
(109,110)
(113,114)
(117,118)
[170]
[180]
HOLE NO. 90
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE LOCATIONS)
L-B9613 (0502)

Flange B Bracket Locations (Engines With Common Fan Cases)
Figure 1001 (Sheet 7)
(Task 72−33−00−430−021)


HOLE NO. 1
[170]
[180]
[170]
[150]
[160]
[160]
[140]
(27,28)
[170]
[150]
[170]
HOLE NO. 30
[180]
[150]
(29,30)

NOTE: FOR ENGINES EQUIPPED WITH
SUPPLEMENTAL CONTROL UNIT

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE LOCATIONS)

L-A9583 (0502)

Flange B Bracket Locations (Engines With SCU)
Figure 1001 (Sheet 8)
(Task 72−33−00−430−021)

FAN CASE - ASSEMBLY-22

Task 72-33-00-430-022:

1. Install The Flange B1 Brackets And Hardware

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

B. Procedure

(1) Install Flange B1 hardware as follows. See Figure 1001.

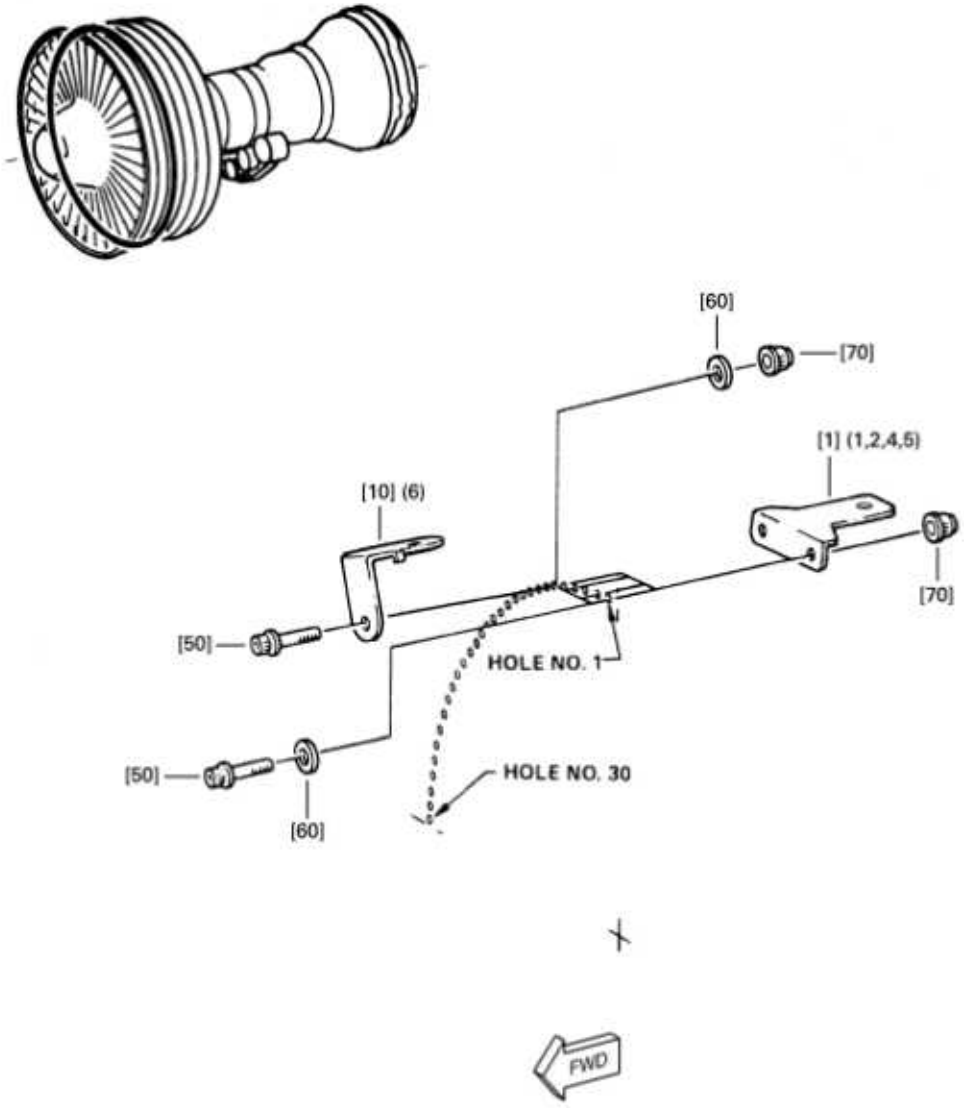
(a) Lubricate bolt threads with Engine Oil P03-001.

(b) Secure the brackets to the flange with bolts, washers, and nuts.

(c) Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(2) Remove any tags or markings on the brackets or flange.

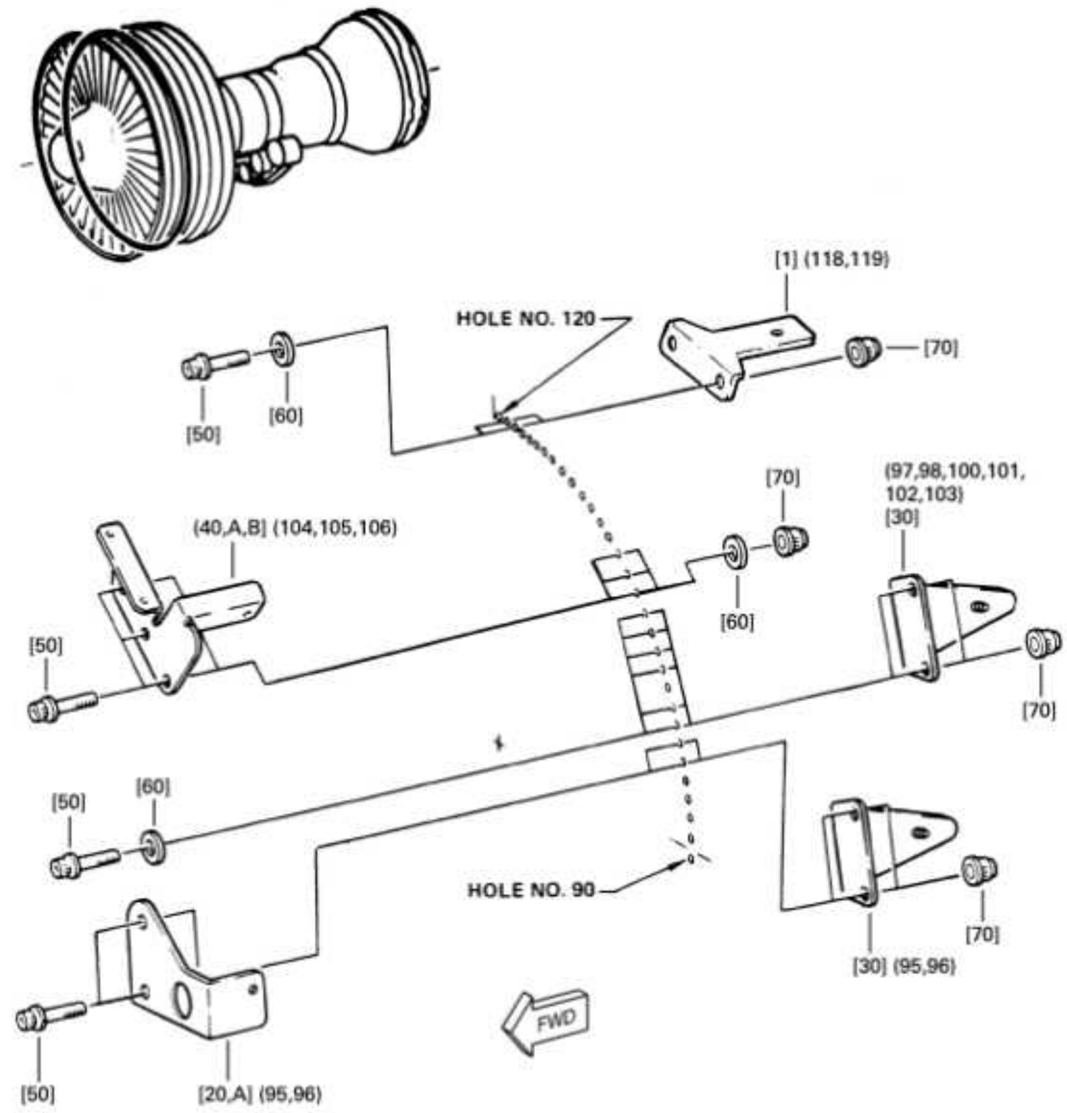
(3) Examine the assembly for foreign objects, damage, and correct assembly.


[60]
[70]
[1] (1,2,4,5)
[10] (6)
[70]
[50]
HOLE NO. 1
[50]
HOLE NO. 30
[60]
FWD

(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)

L-A2370 (0502)

Flange B1 Bracket Locations (Basic Engines)
Figure 1001 (Sheet 1)
(Task 72−33−00−430−022)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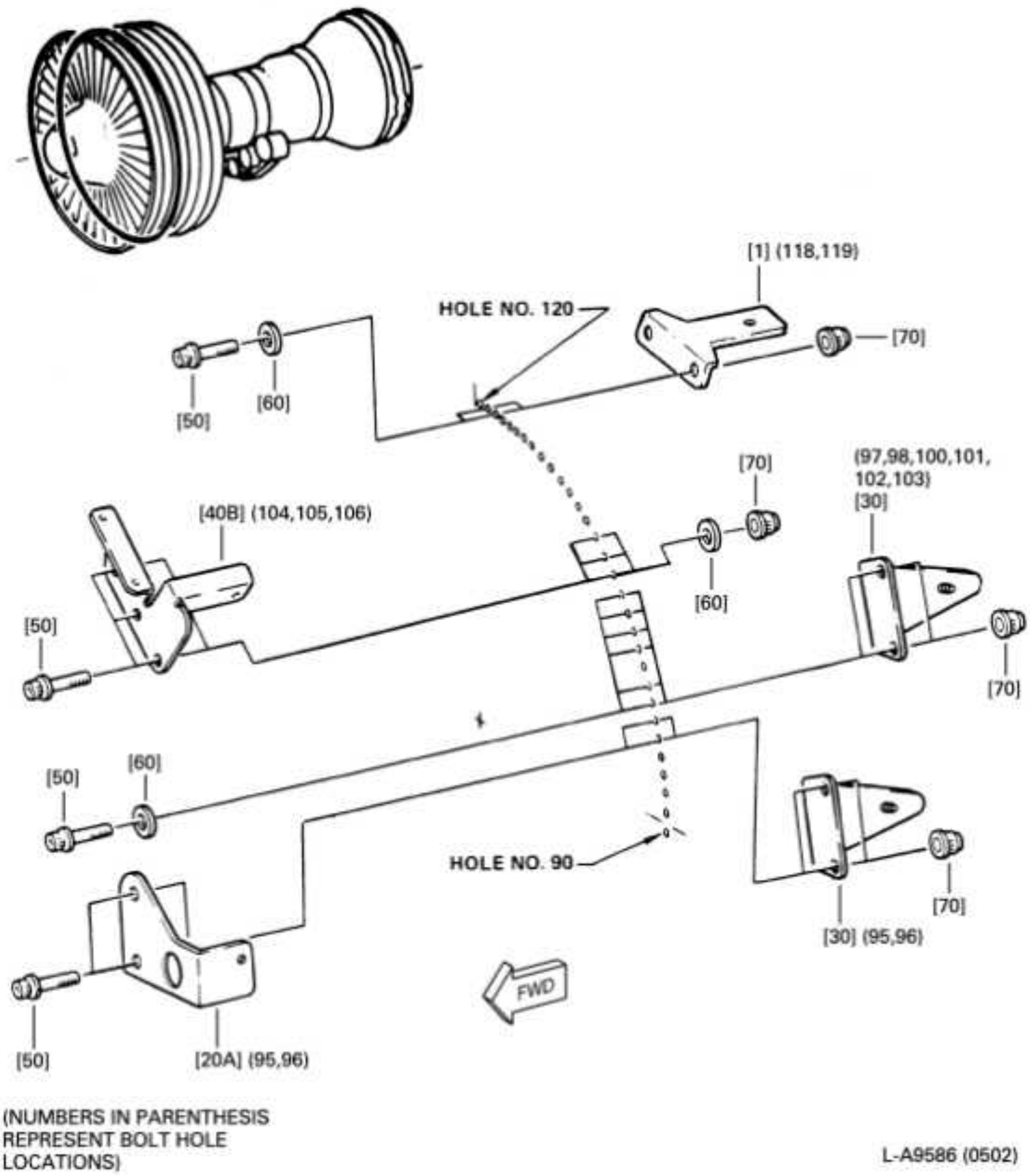
HOLE NO. 120
[70]
[50]
[60]
[70]
(97,98,100,101,
102,103)
[30]
(40,A,B] (104,105,106)
[50]
[60]
[70]
[50]
[60]
HOLE NO. 90
[70]
[30] (95,96)
FWD
[50]
[20,A] (95,96)

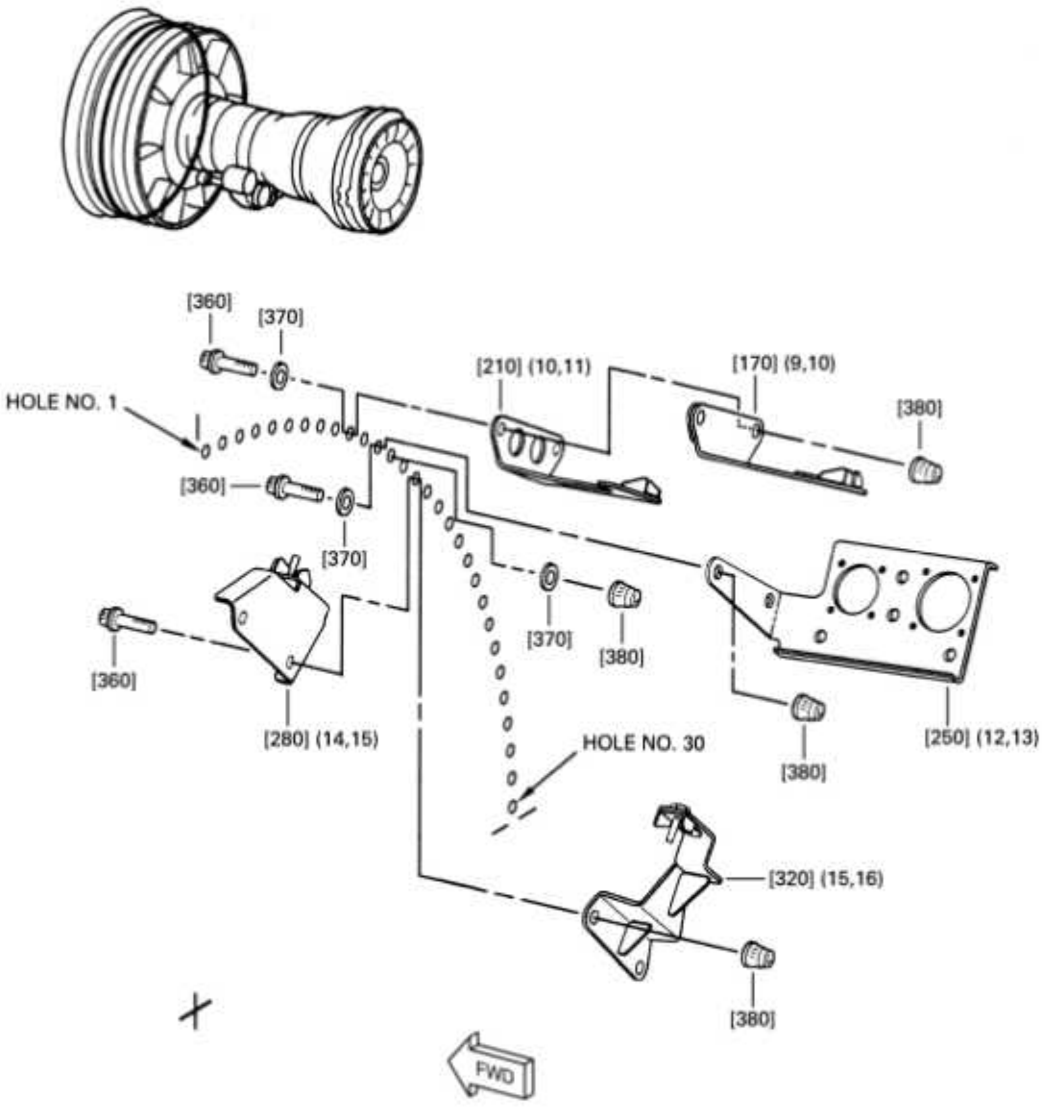
(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)

L-A2375 (0502)

Flange B1 Bracket Locations (Basic Engines)
Figure 1001 (Sheet 2)
(Task 72-33-00-430-022)


[1] (118,119)
HOLE NO. 120
[70]
[50]
[60]
[70]
(97,98,100,101,
102,103)
[30]
[40B] (104,105,106)
[60]
[50]
[70]
[50]
[60]
HOLE NO. 90
[70]
[30] (95,96)
FWD
[50]
[20A] (95,96)
(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)
L-A9586 (0502)

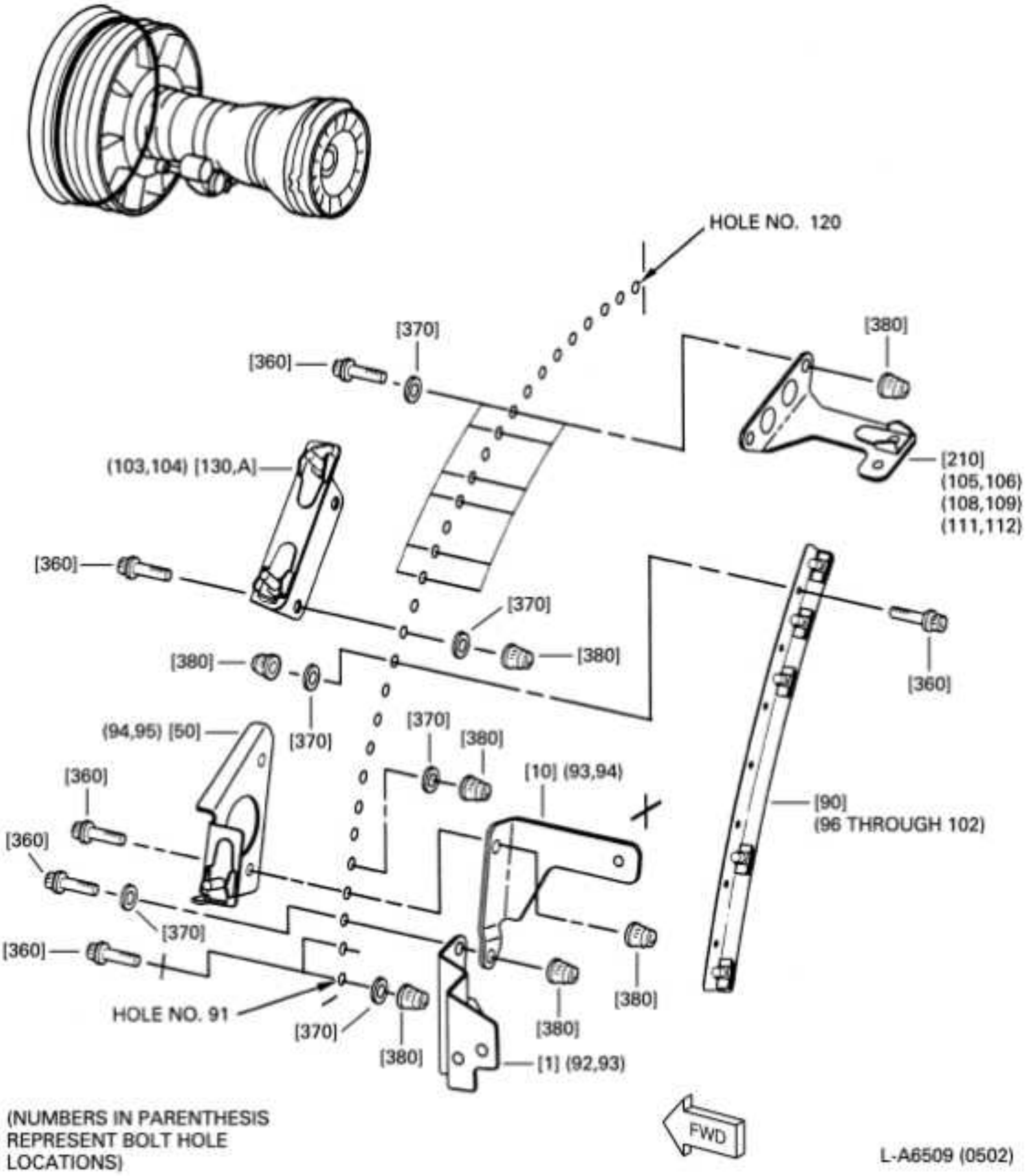
Flange B1 Bracket Locations (Basic Engines)
Figure 1001 (Sheet 3)
(Task 72–33–00–430–022)


[360]
[370]
HOLE NO. 1
[210] (10,11)
[170] (9,10)
[380]
[360]
[370]
[360]
[280] (14,15)
[370]
[380]
HOLE NO. 30
[250] (12,13)
[380]
[320] (15,16)
[380]
FWD

(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)

L-A6508 (0502)

Flange B1 Bracket Locations (Engines With Common Fan Cases)
Figure 1001 (Sheet 4)
(Task 72−33−00−430−022)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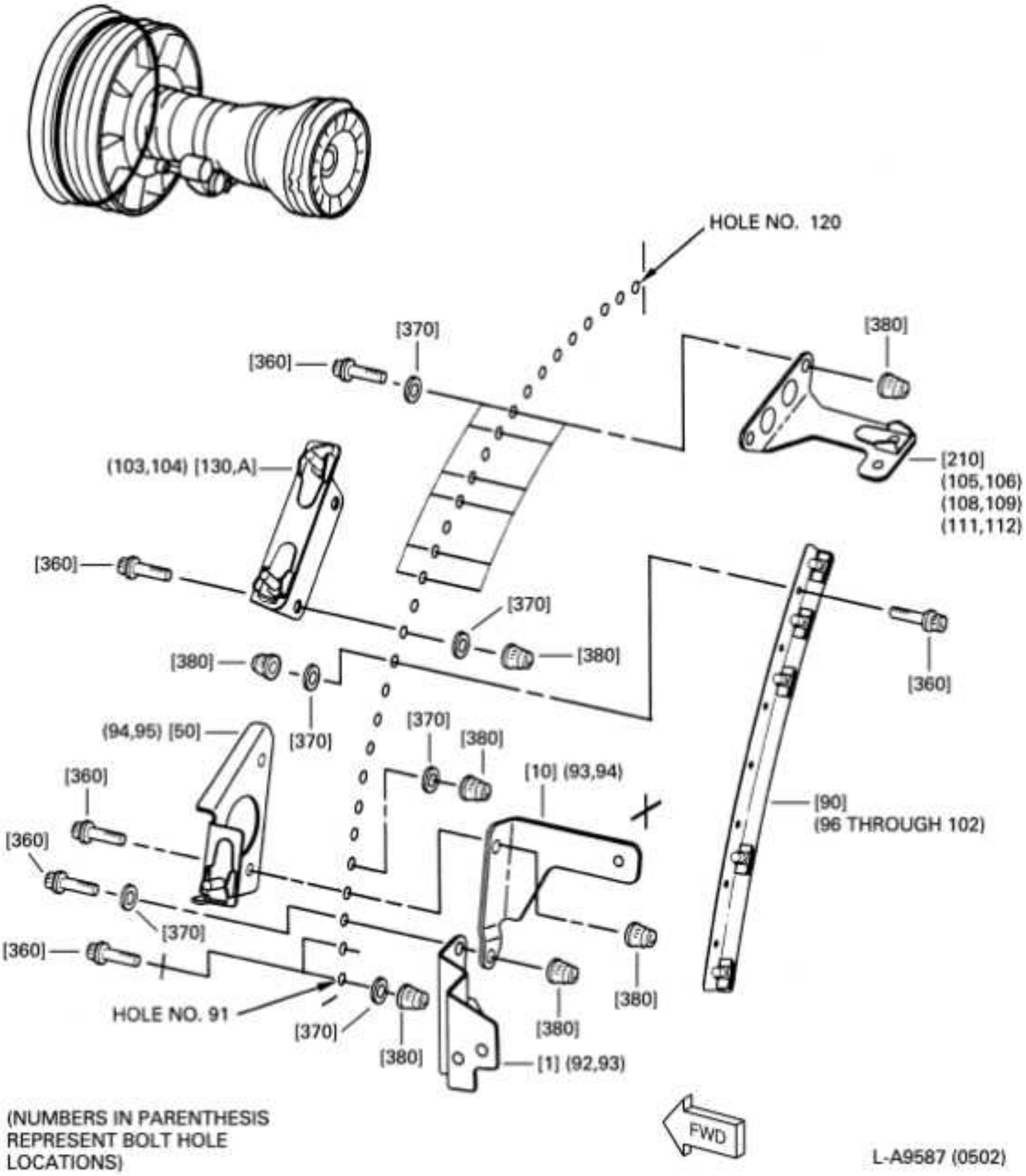
(103,104) [130,A]
[210]
(105,106)
(108,109)
(111,112)
[360]
[370]
[380]
[380]
[360]
[370]
(94,95) [50]
[370]
[380]
[360]
[10] (93,94)
[360]
[90]
(96 THROUGH 102)
[370]
[360]
[380]
HOLE NO. 91
[380]
[370]
[380]
[1] (92,93)
(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)
FWD
L-A6509 (0502)

Flange B1 Bracket Locations (Engines With Common Fan Cases)
Figure 1001 (Sheet 5)
(Task 72−33−00−430−022)

FAN CASE − ASSEMBLY−22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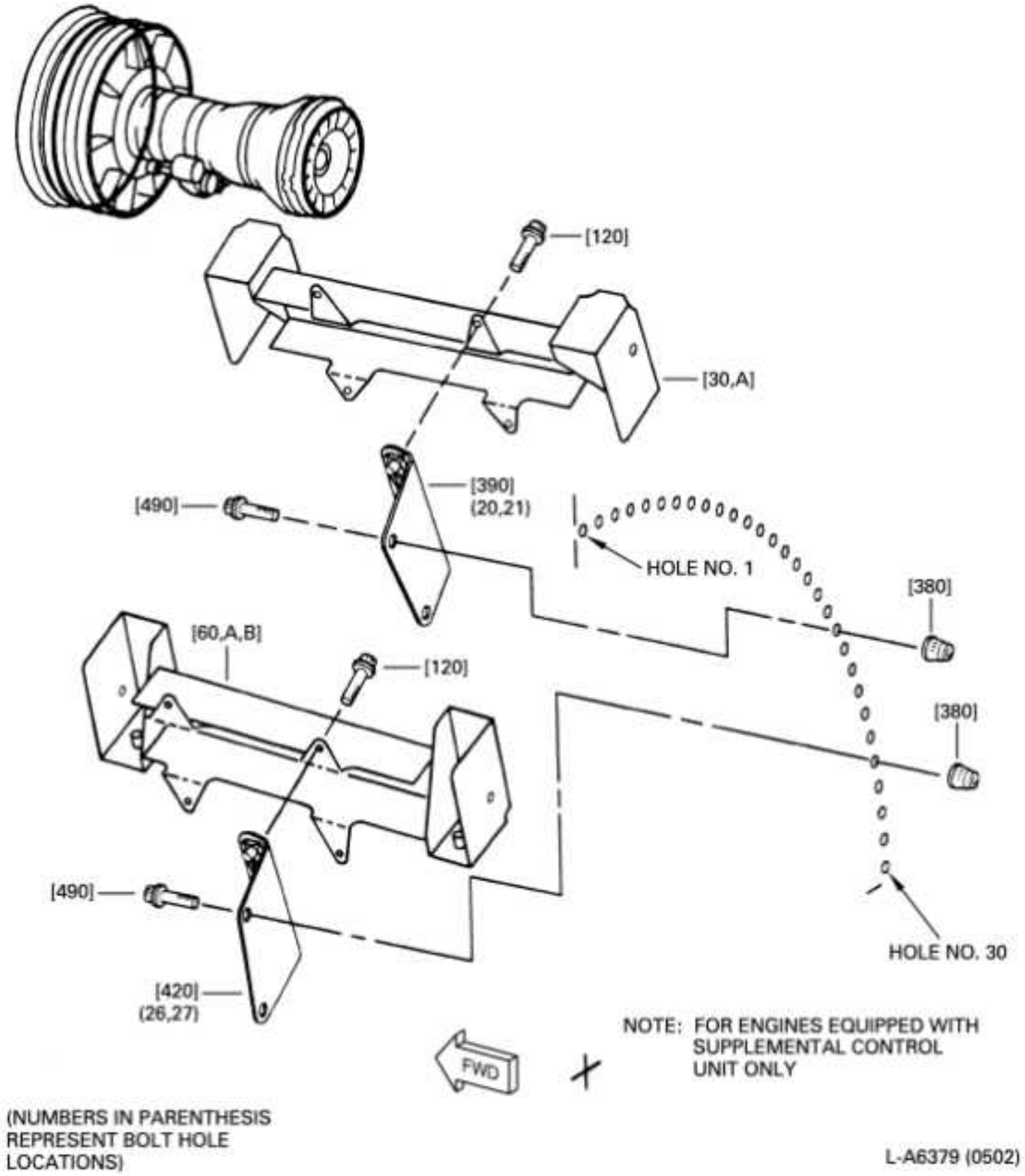
[360]
(103,104) [130,A]
[210]
(105,106)
(108,109)
(111,112)
[360]
[370]
[380]
[380]
[360]
[370]
(94,95) [50]
[370]
[380]
[360]
[10] (93,94)
[90]
(96 THROUGH 102)
[360]
[370]
[360]
[380]
HOLE NO. 91
[370]
[380]
[380]
[1] (92,93)
(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)
FWD
L-A9587 (0502)

Flange B1 Bracket Locations (Engines With Common Fan Cases)
Figure 1001 (Sheet 6)
(Task 72−33−00−430−022)


[120]
[30,A]
[490]
[390]
(20,21)
HOLE NO. 1
[380]
[60,A,B]
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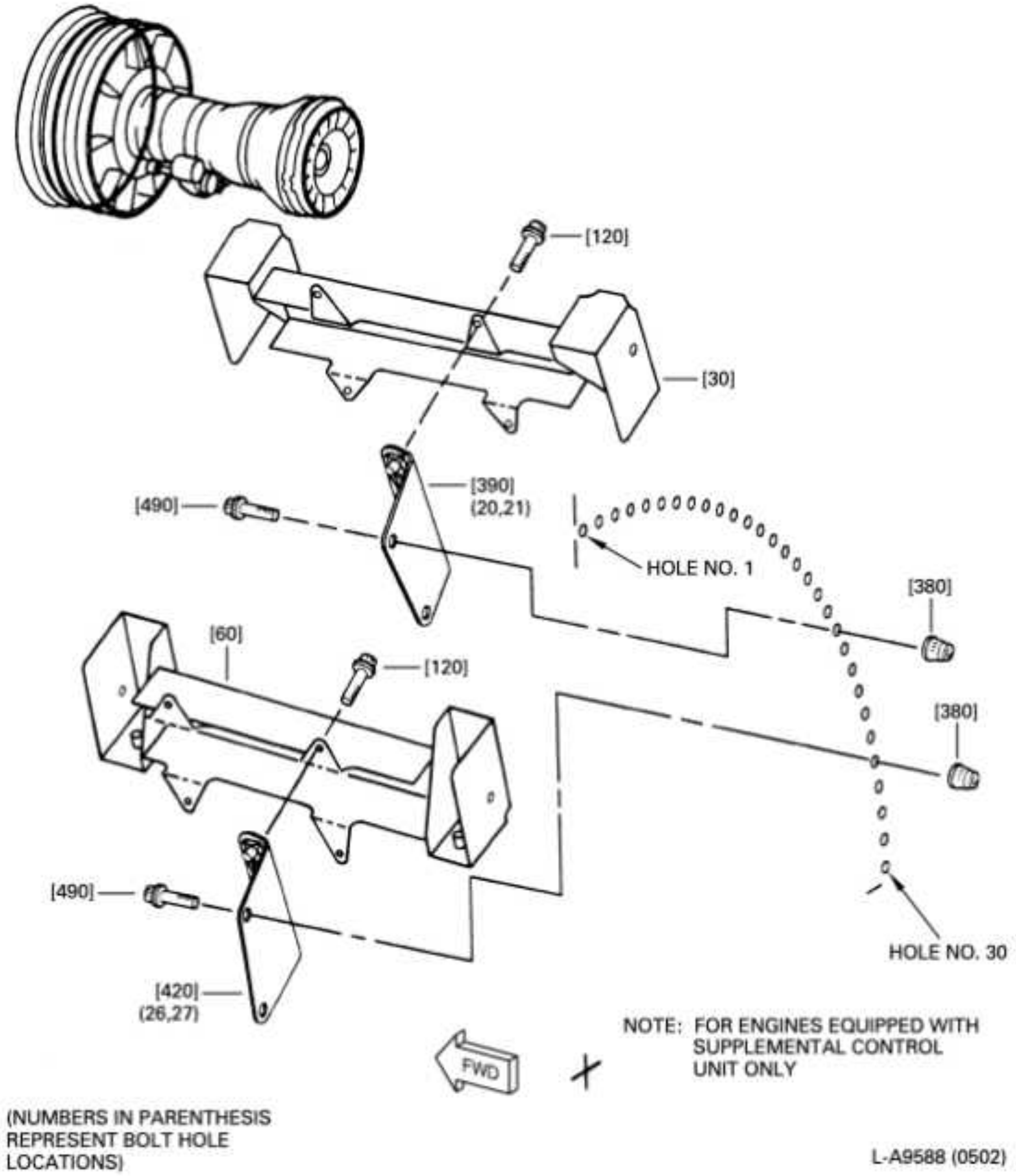
[380]
[490]
HOLE NO. 30
[420]
(26,27)
FWD
NOTE: FOR ENGINES EQUIPPED WITH SUPPLEMENTAL CONTROL UNIT ONLY
(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)
L-A6379 (0502)

Flange B1 Bracket Locations (Engines Equipped With SCU)
Figure 1001 (Sheet 7)
(Task 72−33−00−430−022)


[120]
[30]
[390]
(20,21)
[490]
HOLE NO. 1
[380]
[60]
[120]
[380]
[490]
HOLE NO. 30
[420]
(26,27)
FWD
NOTE: FOR ENGINES EQUIPPED WITH SUPPLEMENTAL CONTROL UNIT ONLY
(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)
L-A9588 (0502)

Flange B1 Bracket Locations (Engines Equipped With SCU)
Figure 1001 (Sheet 8)
(Task 72−33−00−430−022)

FAN CASE − ASSEMBLY−23

Task 72−33−00−430−023:

1. Install The Flange B2 Brackets And Hardware

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)

B. Procedure

(1) Install Flange B2 hardware as follows. See Figure 1001.

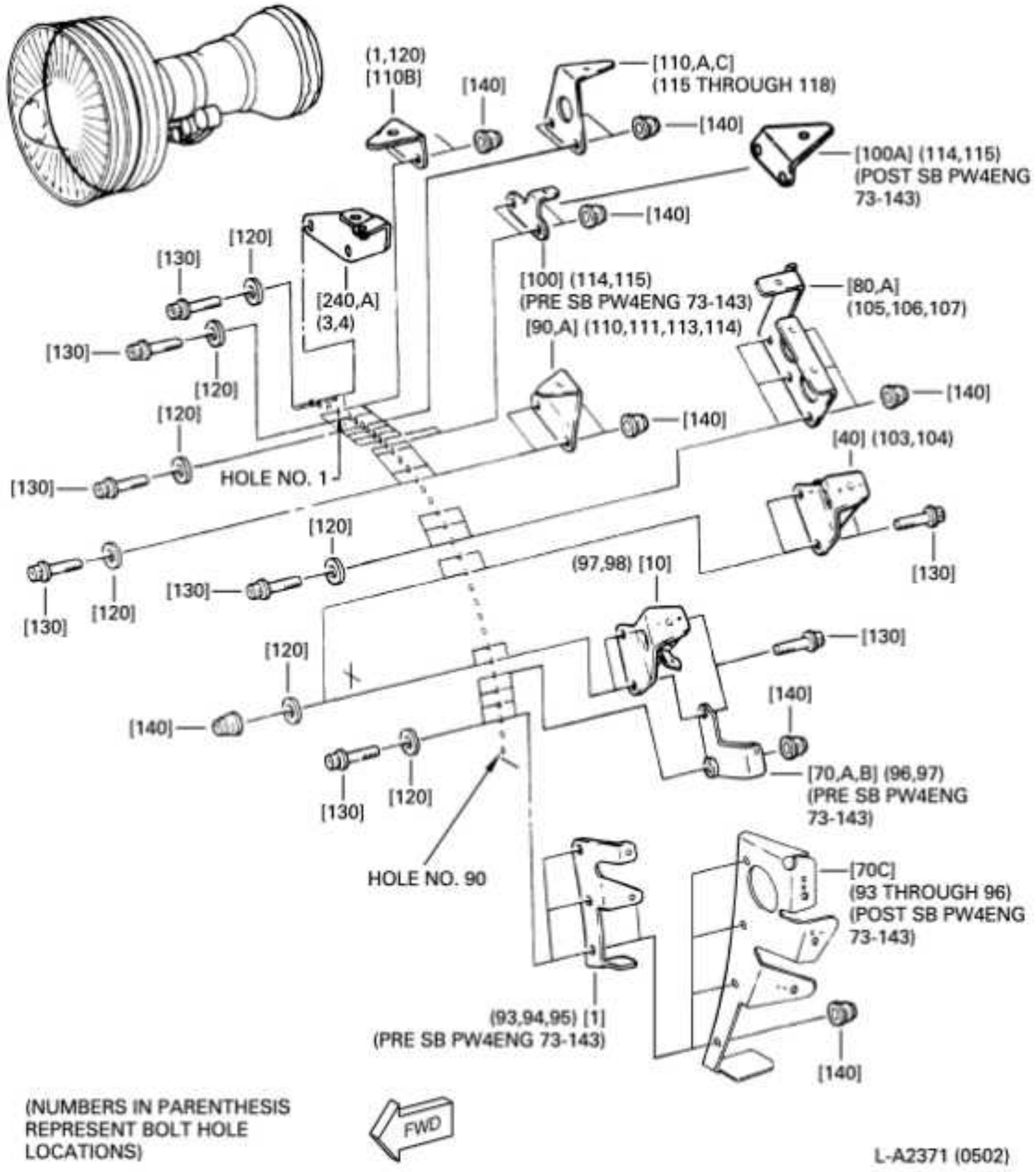
(a) Lubricate bolt threads with Engine Oil P03−001.

(b) Secure the brackets to the flange with bolts, washers, and nuts.

(c) Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(2) Remove any tags or markings on the brackets or flange.

(3) Examine the assembly for foreign objects, damage, and correct assembly.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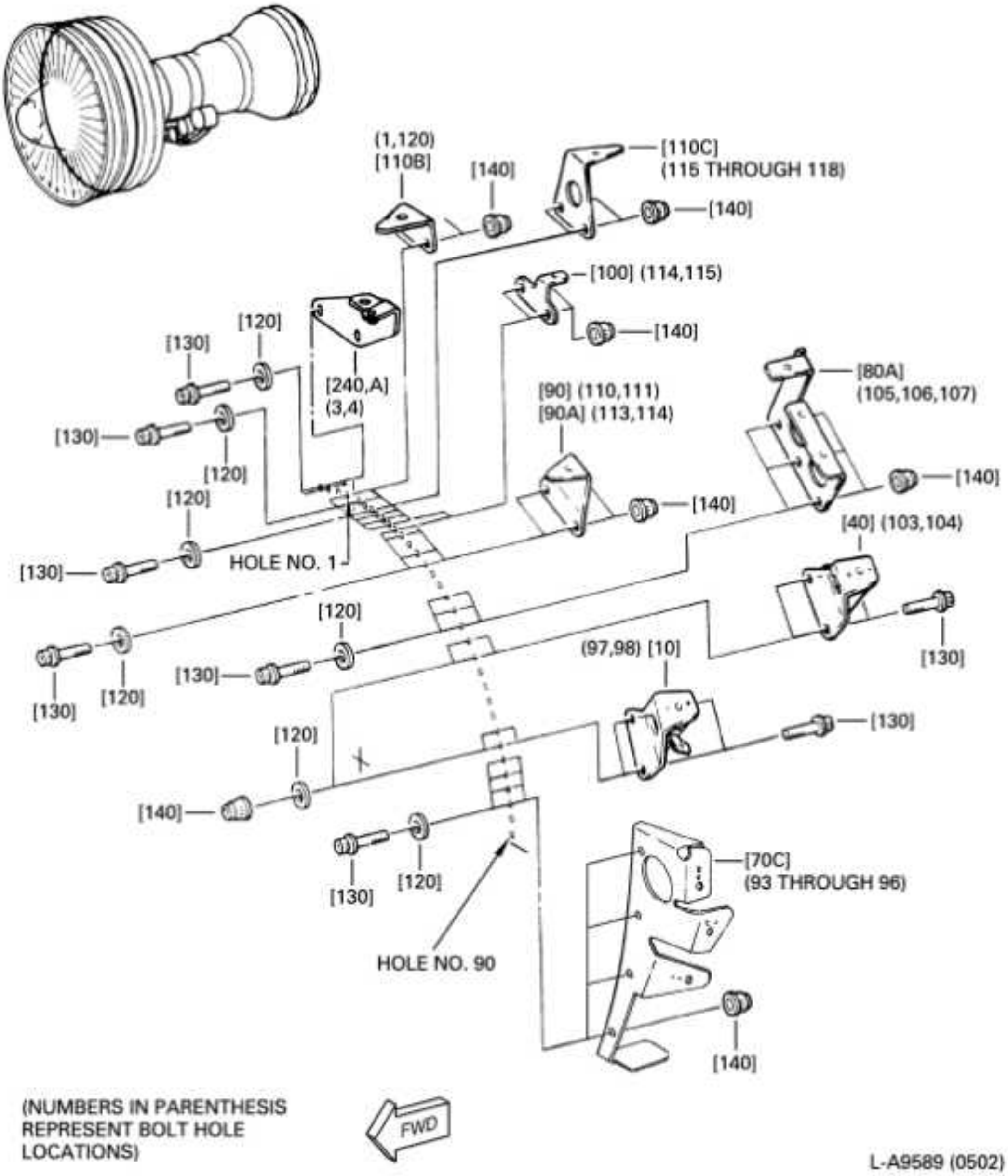
[110B]
[140]
[110,A,C]
(115 THROUGH 118)
[140]
[100A] (114,115)
(POST SB PW4ENG
73-143)
[140]
[120]
[130]
[240,A]
(3,4)
[100] (114,115)
(PRE SB PW4ENG 73-143)
[90,A] (110,111,113,114)
[80,A]
(105,106,107)
[130]
[120]
[120]
[140]
[140]
[120]
[130]
HOLE NO. 1
[40] (103,104)
[120]
[130]
[130]
[120]
[130]
(97,98) [10]
[130]
[120]
[140]
[140]
[130]
[120]
[70,A,B] (96,97)
(PRE SB PW4ENG
73-143)
HOLE NO. 90
[70C]
(93 THROUGH 96)
(POST SB PW4ENG
73-143)
(93,94,95) [1]
(PRE SB PW4ENG 73-143)
[140]
FWD

(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)

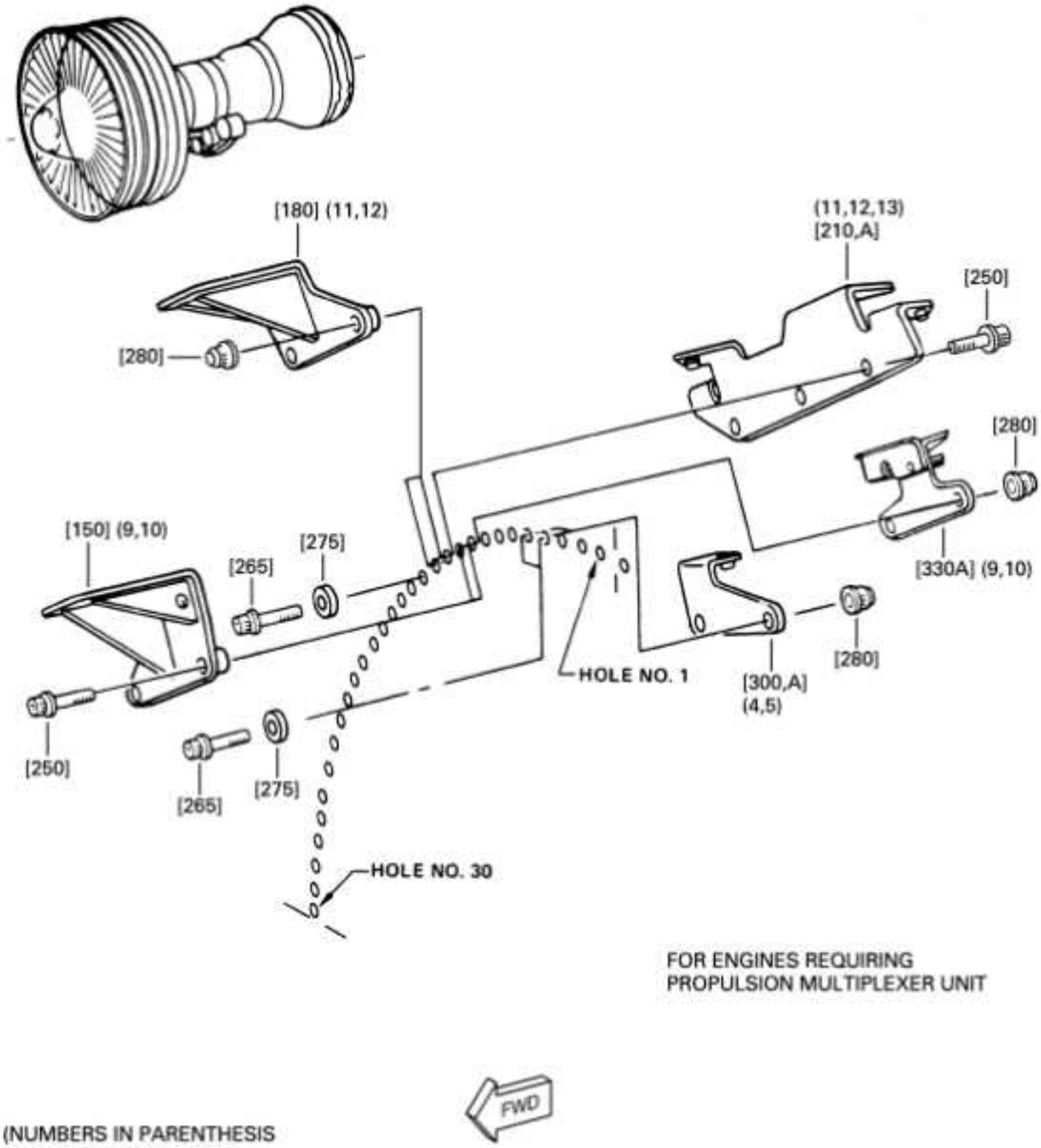
L-A2371 (0502)

Flange B2 Bracket Locations (Basic Engines)
Figure 1001 (Sheet 1)
(Task 72−33−00−430−023)


(1,120)
[110B]
[140]
[110C]
(115 THROUGH 118)
[140]
[100] (114,115)
[140]
[120]
[130]
[240,A]
(3,4)
[130]
[120]
[80A]
(105,106,107)
[90] (110,111)
[90A] (113,114)
[140]
[140]
[120]
[130]
HOLE NO. 1
[40] (103,104)
[120]
[130]
[120]
[130]
[130]
(97,98) [10]
[120]
[130]
[140]
[130]
[120]
[70C]
(93 THROUGH 96)
HOLE NO. 90
[140]
FWD
L-A9589 (0502)

(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)

Flange B2 Bracket Locations (Basic Engines)
Figure 1001 (Sheet 2)
(Task 72-33-00-430-023)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HOLE NO. 1
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[300,A]
(4,5)
[250]
[275]
[265]
HOLE NO. 30
FWD

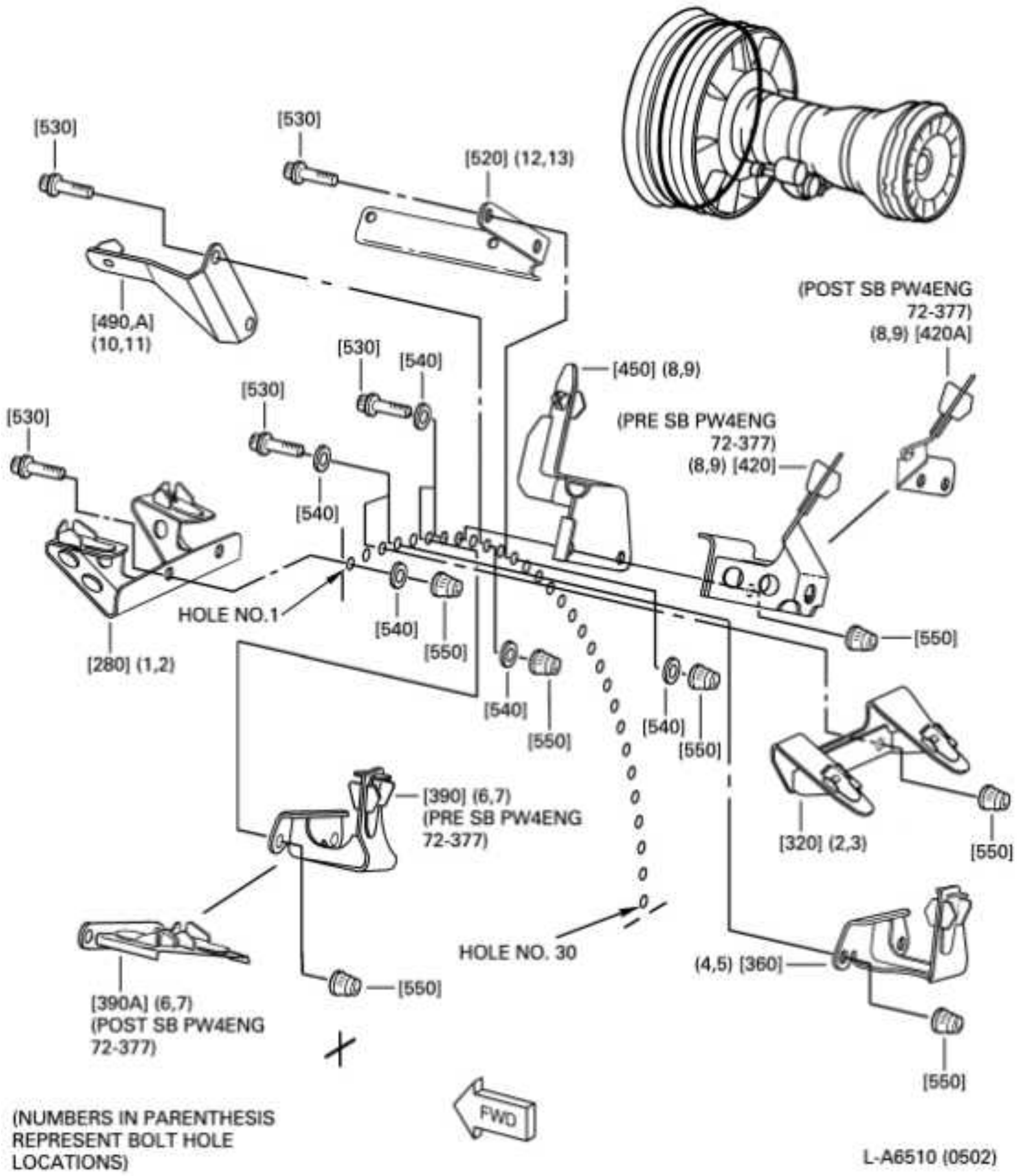
FOR ENGINES REQUIRING
PROPULSION MULTIPLEXER UNIT

(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)

L-A2372 (0502)

Flange B2 (Brackets Required For Engine Propulsion Multiplexer Unit)
Figure 1001 (Sheet 3)
(Task 72-33-00-430-023)

FAN CASE − ASSEMBLY−23


[530]
[530]
[520] (12,13)
[490,A]
(10,11)
(POST SB PW4ENG
72-377)
(8,9) [420A]
[530]
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[450] (8,9)
[530]
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(PRE SB PW4ENG
72-377)
(8,9) [420]
[540]
HOLE NO.1
[540]
[550]
[550]
[280] (1,2)
[540]
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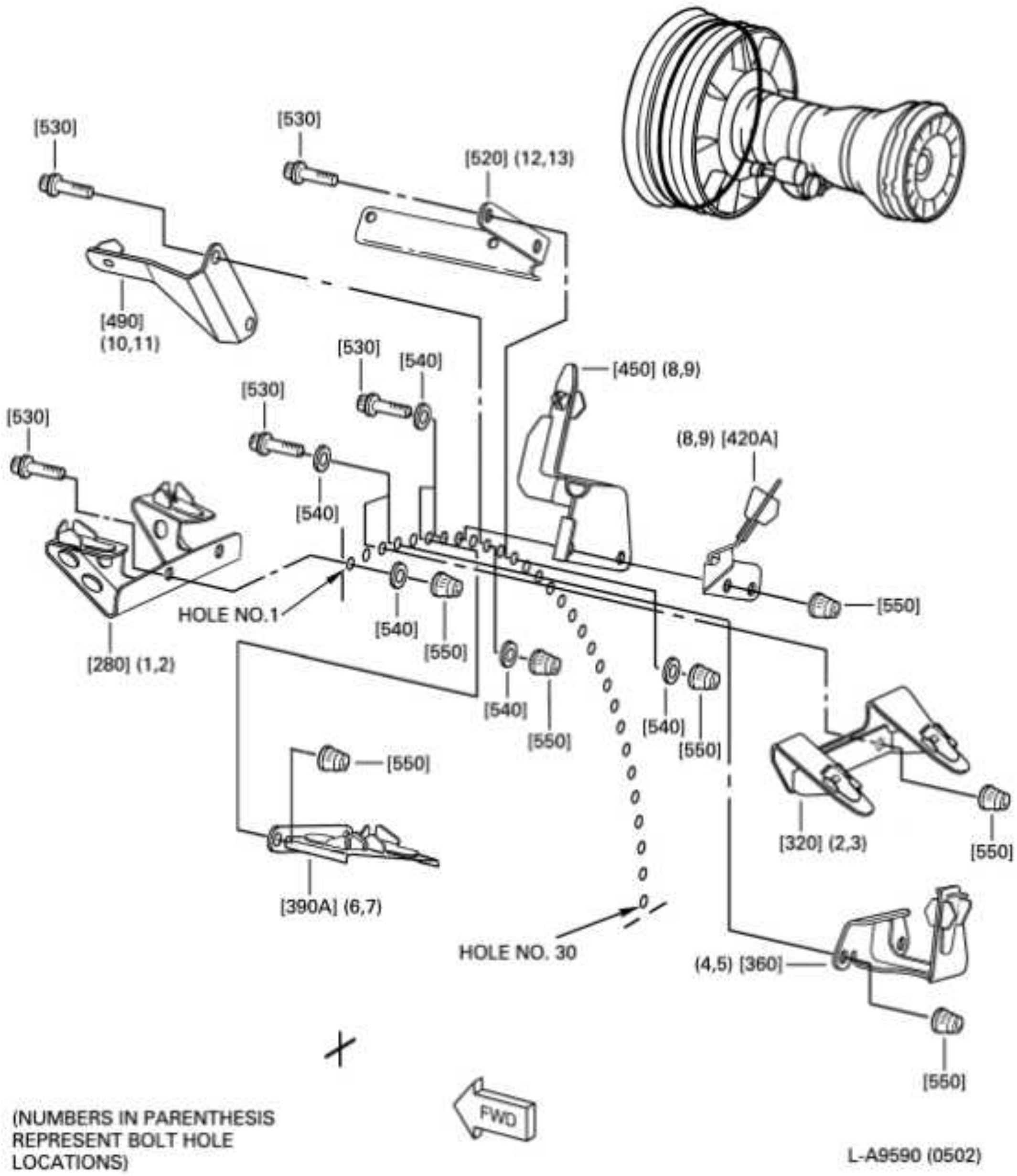
[540]
[550]
[390] (6,7)
(PRE SB PW4ENG
72-377)
[320] (2,3)
[550]
HOLE NO. 30
(4,5) [360]
[550]
[390A] (6,7)
(POST SB PW4ENG
72-377)
[550]
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)
L-A6510 (0502)

Flange B2 Bracket Locations (Engines With Common Fan Cases)
Figure 1001 (Sheet 4)
(Task 72−33−00−430−023)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HOLE NO.1
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[390A] (6,7)
HOLE NO. 30
(4,5) [360]
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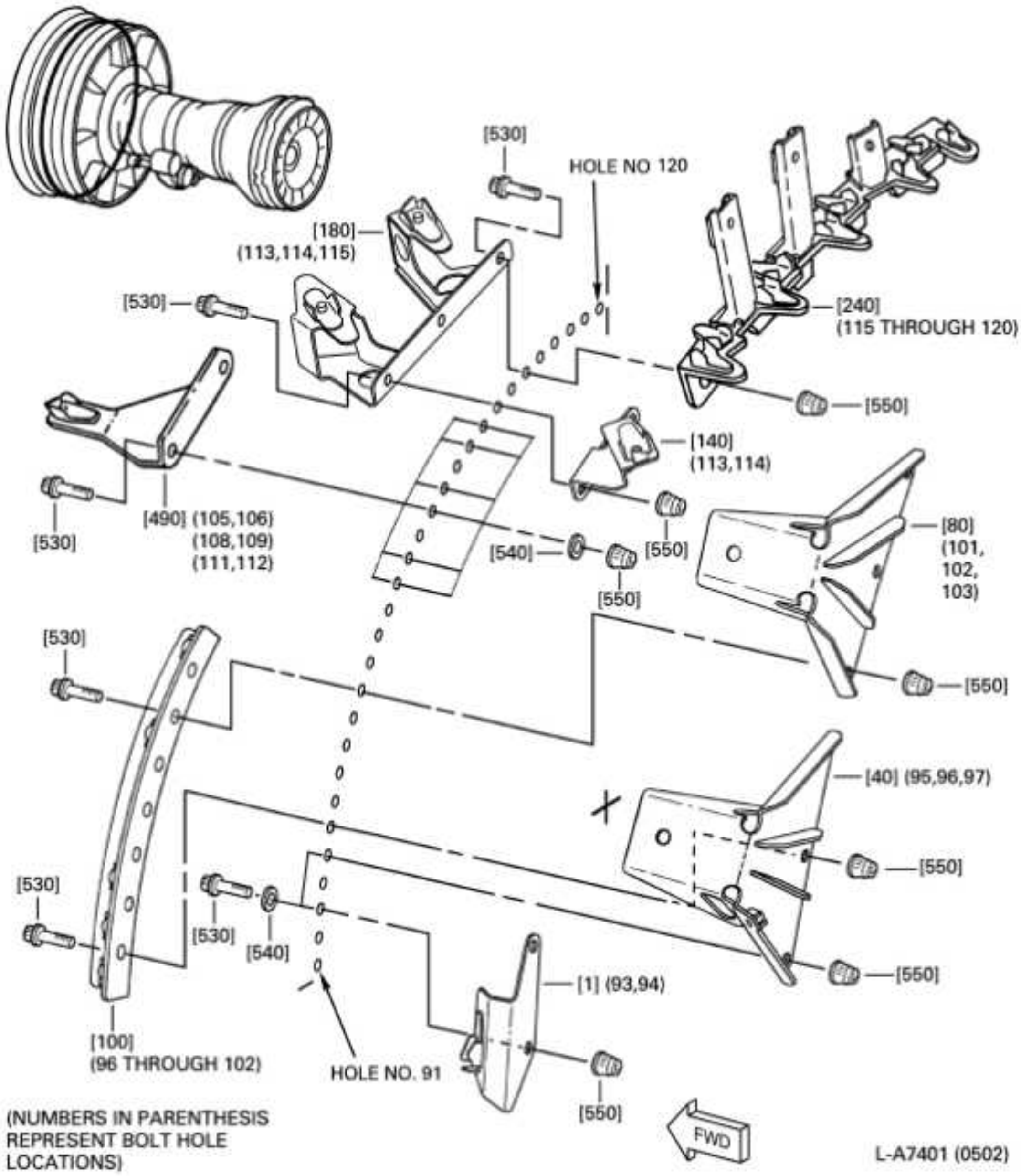
FWD
L-A9590 (0502)

(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)

Flange B2 Bracket Locations (Engines With Common Fan Cases)
Figure 1001 (Sheet 5)
(Task 72−33−00−430−023)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(115 THROUGH 120)
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(113,114)
[530]
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(108,109)
(111,112)
[540]
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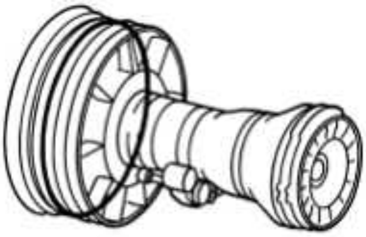
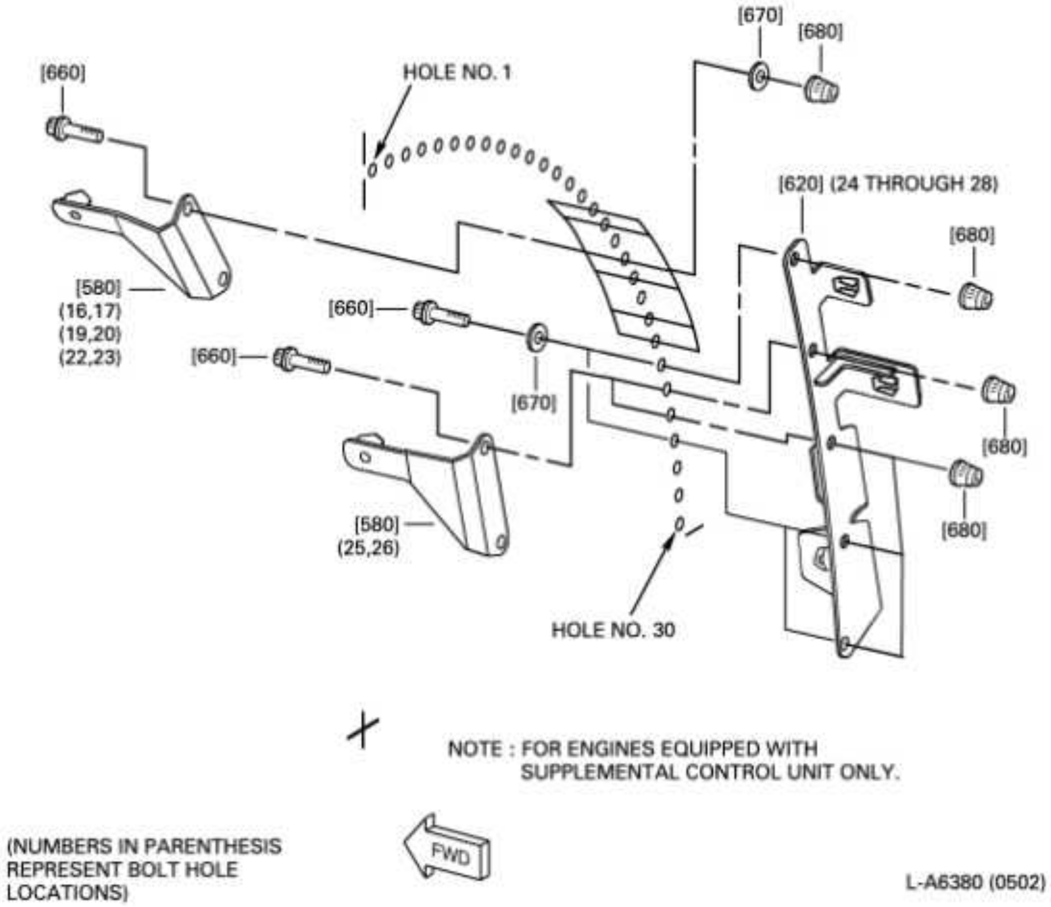
[80]
(101,
102,
103)
[530]
[550]
[40] (95,96,97)
[550]
[530]
[530]
[540]
[550]
[1] (93,94)
[100]
(96 THROUGH 102)
HOLE NO. 91
[550]
FWD
L-A7401 (0502)

(NUMBERS IN PARENTHESIS
REPRESENT BOLT HOLE
LOCATIONS)

Flange B2 Bracket Locations (Engines With Common Fan Cases)
Figure 1001 (Sheet 6)
(Task 72−33−00−430−023)

FAN CASE − ASSEMBLY−23




[670]
[680]
[660]
HOLE NO. 1
[620] (24 THROUGH 28)
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(16,17)
(19,20)
(22,23)
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[580]
(25,26)
HOLE NO. 30
NOTE : FOR ENGINES EQUIPPED WITH SUPPLEMENTAL CONTROL UNIT ONLY.
(NUMBERS IN PARENTHESIS REPRESENT BOLT HOLE LOCATIONS)
FWD
L-A6380 (0502)

Flange B2 Bracket Locations (Engines Equipped With SCU)
Figure 1001 (Sheet 7)
(Task 72−33−00−430−023)

Previous Pageblock Return to Previous Menu Next Pageblock

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

Tab Separator - Fan Case

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			004		JUN 15/00
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			006		MAR 15/98
			007		MAR 15/98
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			510		SEP 15/02
			511		SEP 15/02
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	504		SEP 15/02
	505		SEP 15/02
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72-33-00			
72-33-00	501	ALL	SEP 15/02
DISASSY-23	502	4152 4156A 4158	SEP 15/02
	503	4152-3 4156A-3 4158-3	SEP 15/02
	504	4152 4156A 4158	SEP 15/02
	505		SEP 15/02
	506	4152-3 4156A-3 4158-3	SEP 15/02
	507	ALL	SEP 15/02
	508		SEP 15/02
72-33-00			
72-33-00	601/602	ALL	JUN 15/97
CLEANING-01			
72-33-00			
72-33-00	801	ALL	JUN 15/98
INSP/CHK-01	802		JUN 15/98
	803		JUN 15/98
	804		JUN 15/98
	805/806		JUN 15/98
72-33-00			
72-33-00	801	ALL	DEC 15/97
INSP/CHK-04	802		DEC 15/97
	803		JUN 15/06
	804		JUN 15/06
	805		SEP 15/06
	806		SEP 15/06
	807		SEP 15/06
	808		SEP 15/06
	809		SEP 15/06
	810		SEP 15/06
	811		SEP 15/06
	812		SEP 15/06
	813		SEP 15/06
	814		SEP 15/06
	815		SEP 15/98
	816		SEP 15/98
	817		MAR 15/98
	818		MAR 15/98
	819/820		MAR 15/98
72-33-00			
72-33-00	1001	ALL	JUN 15/05
ASSEMBLY-01	1002		JUN 15/05
	1003		JUN 15/05
	1004		JUN 15/05
	1005		JUN 15/05
	1006		JUN 15/05

		1007		JUN 15/05
		1008		JUN 15/05
		1009		JUN 15/05
		1010		JUN 15/05
		1011		JUN 15/05
		1012		JUN 15/05
		1013		JUN 15/05
		1014		JUN 15/05
		1015		JUN 15/05
		1016		JUN 15/05
		1017		JUN 15/05
		1018		JUN 15/05
		1019		JUN 15/05
		1020		JUN 15/05
		1021/1022		JUN 15/05
72-33-00				
72-33-00	R	1001	ALL	MAY 1/07
ASSEMBLY-02	R	1002		MAY 1/07
	R	1003		MAY 1/07
	R	1004		MAY 1/07
		1005		SEP 15/98
		1006		SEP 15/98
		1007/1008		SEP 15/98
72-33-00				
72-33-00		1001	ALL	SEP 15/02
ASSEMBLY-20		1002		SEP 15/02
		1003		SEP 15/02
		1004		SEP 15/02
		1005		SEP 15/02
		1006		SEP 15/02
72-33-00				
72-33-00		1001	ALL	SEP 15/02
ASSEMBLY-21		1002		SEP 15/02
		1003	4152 4156A 4158	SEP 15/02
		1004		SEP 15/02
		1005		SEP 15/02
		1006		SEP 15/02
		1007		SEP 15/02
		1008	4152-3 4156A-3 4158-3	SEP 15/02
		1009		SEP 15/02
		1010		SEP 15/02
72-33-00				
72-33-00		1001	ALL	SEP 15/02
ASSEMBLY-22		1002		SEP 15/02
		1003	4152 4156A 4158	SEP 15/02
		1004	4152-3 4156A-3 4158-3	SEP 15/02
		1005	ALL	SEP 15/02
		1006	4152 4156A 4158	SEP 15/02
		1007	4152-3 4156A-3 4158-3	SEP 15/02
		1008	4152 4156A 4158	SEP 15/02
		1009/1010	4152-3 4156A-3 4158-3	SEP 15/02
72-33-00				
72-33-00		1001	ALL	SEP 15/02
ASSEMBLY-23		1002	4152 4156A 4158	SEP 15/02
		1003	4152-3 4156A-3 4158-3	SEP 15/02
		1004	4152 4156A 4158	SEP 15/02
		1005		SEP 15/02
		1006	4152-3 4156A-3 4158-3	SEP 15/02
		1007	ALL	SEP 15/02
		1008		SEP 15/02
72-33-02				
72-33-02		501	ALL	DEC 15/04
DISASSY-01		502		DEC 15/04
		503		DEC 15/04
		504		DEC 15/04
		505		DEC 15/04

	506		DEC 15/04
	507		DEC 15/04
	508		DEC 15/04
	509		DEC 15/04
	510		DEC 15/04
72-33-02			
72-33-02	1001	ALL	DEC 15/04
ASSEMBLY-01	1002		DEC 15/04
	1003		DEC 15/04
	1004		DEC 15/04
	1005		DEC 15/04
	1006		DEC 15/04
	1007		DEC 15/04
	1008		DEC 15/04
	1009		DEC 15/04
	1010		DEC 15/04
	1011		DEC 15/04
	1012		DEC 15/04
	1013		DEC 15/04
	1014		DEC 15/04
	1015		DEC 15/04
	1016		DEC 15/04
	1017/1018		DEC 15/04

Previous Pageblock Return to Previous Menu Next Pageblock

TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 83 DATED MAY 1, 2007

HIGHLIGHTS - FAN CASE

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-33-00 DISASSY-02	501	Added text to discard the self-retaining pin. (PSAF06KC773)	ALL
72-33-00 ASSEMBLY-02	1001 -1003	Revised the Expendable Parts list and added text to install a new self-retaining pin. Editorially deleted the task reference. (PSAF06KC773, EDITORIAL)	ALL

Previous Pageblock Return to Previous Menu Next Pageblock

FAN EXIT CASE AND VANE ASSEMBLY − DISASSEMBLY−01

Task 72−33−02−040−001:

1. Disassemble The Fan Exit Case And Vane Assembly

A. Equipment And Materials Required

Standard Tools:
No. 10 Torq−set Drive

Special Tools:
PWA 76154 Adapter, Lift And Trunnion (2 Necessary)
PWA 76155 Sling

B. Procedure

(1) Remove the fan exit liner segment assemblies (called liners). See Figure 501.

(a) Cut the sealant at the edges of the liners.

(b) Remove the screws that attach the liners. Use a No. 10 Torq−set Drive.

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE A LINER SEGMENT. IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THE LINER. IT IS EASY FOR THESE WASHERS TO BECOME DISCONNECTED FROM THE LINER.

(c) Remove the liners.

(2) Remove the fan exit case and vane assembly (called case and vane assembly) from the stand. See Figure 502.

(a) Turn the case and vane assembly to vertical position (vanes down).

(b) Put PWA 76155 Sling in a hoist. Put two PWA 76154 Adapters on the sling.

(c) Install the spools of the adapters on the case and vane assembly in Adapters PWA 76154.

(d) Move the detail hand knobs on the clamps of the stand. Remove the ball lock pins. Open the clamps.

(e) Lift the case and vane assembly.

FAN EXIT CASE AND VANE ASSEMBLY - DISASSEMBLY-01

CAUTION: WITH THE CASE AND VANE ASSEMBLY IN REAR END DOWN POSITION, YOU MUST SUPPORT THE OUTER CASE. IF YOU DO NOT, YOU WILL DAMAGE THE VANES.

(f) Carefully put the case and vane assembly on a correct surface, vanes down.

(3) Remove the fan exit (outer) case (called outer case). See Figure 503 and Figure 504.

NOTE: It is possible that some of the vane boltholes in the fan exit (outer) case were repaired with a bushing. There is no washer at these positions.

(a) (Pre SB PW4ENG 72-262) Remove the lockwire that attaches the vane attachment bolts to the fan exit (outer) case. Remove the bolts and washers.

(b) (Post SB PW4ENG 72-262) Remove the nuts, washers, and, if applicable, brackets from the slab-bolts at the OD of the case and vane assembly. Sealant covers the heads of the slab-bolts on the underside of the outer fairings. Mechanically remove the sealant. Remove the slab-bolts.

(c) Lift the fan exit (outer) case and put it on a pallet. Remove the hoist, sling, and adapters from the (outer) case.

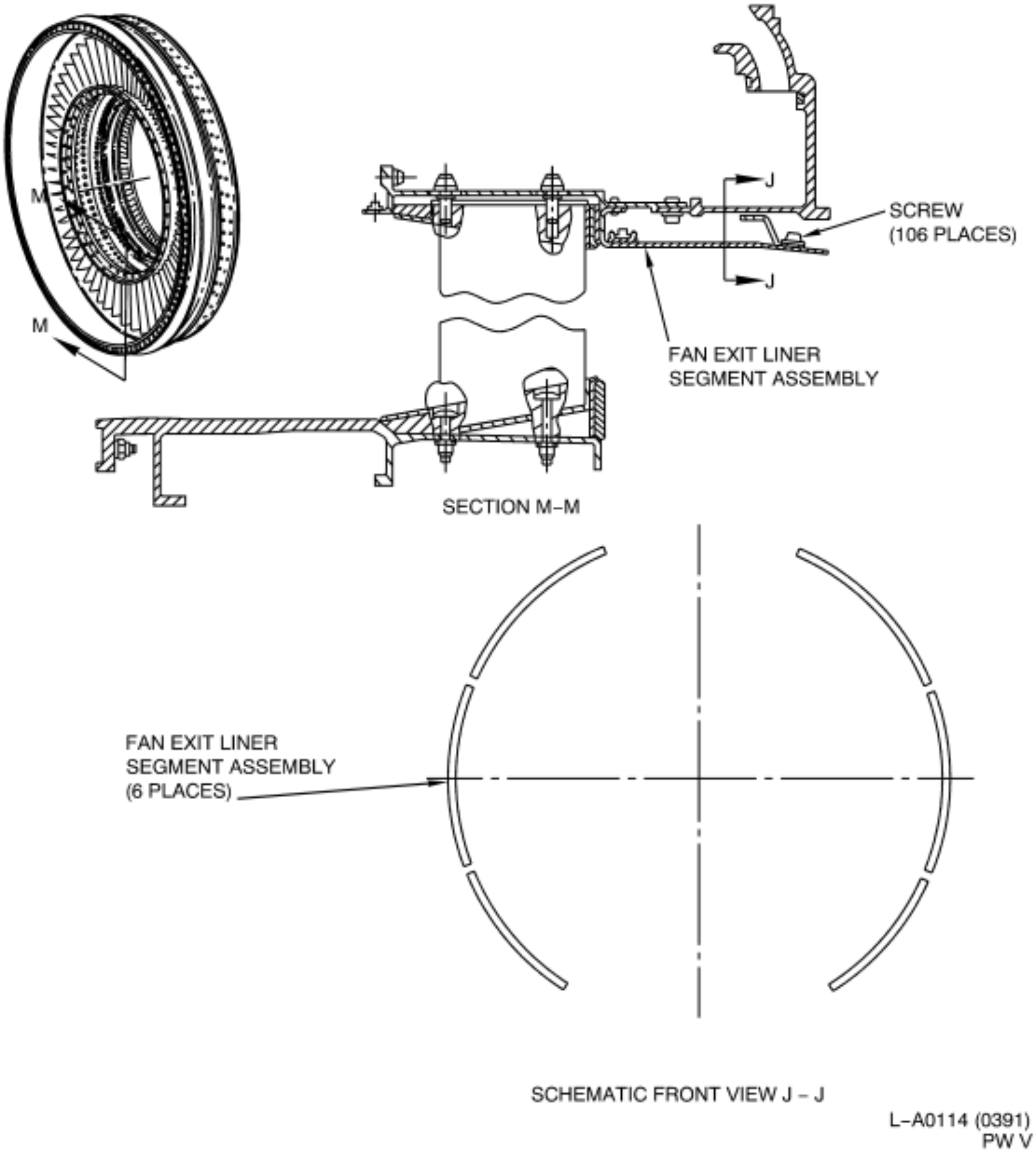
(4) Remove the base and vane assemblies (called vanes) as follows. See Figure 505.

R (a) If it is there, carefully cut and mechanically
R remove the sealant from between the fan exit guide
R vane bases.

(b) Remove the vanes from the inner case in a clockwise direction (as viewed from the front).

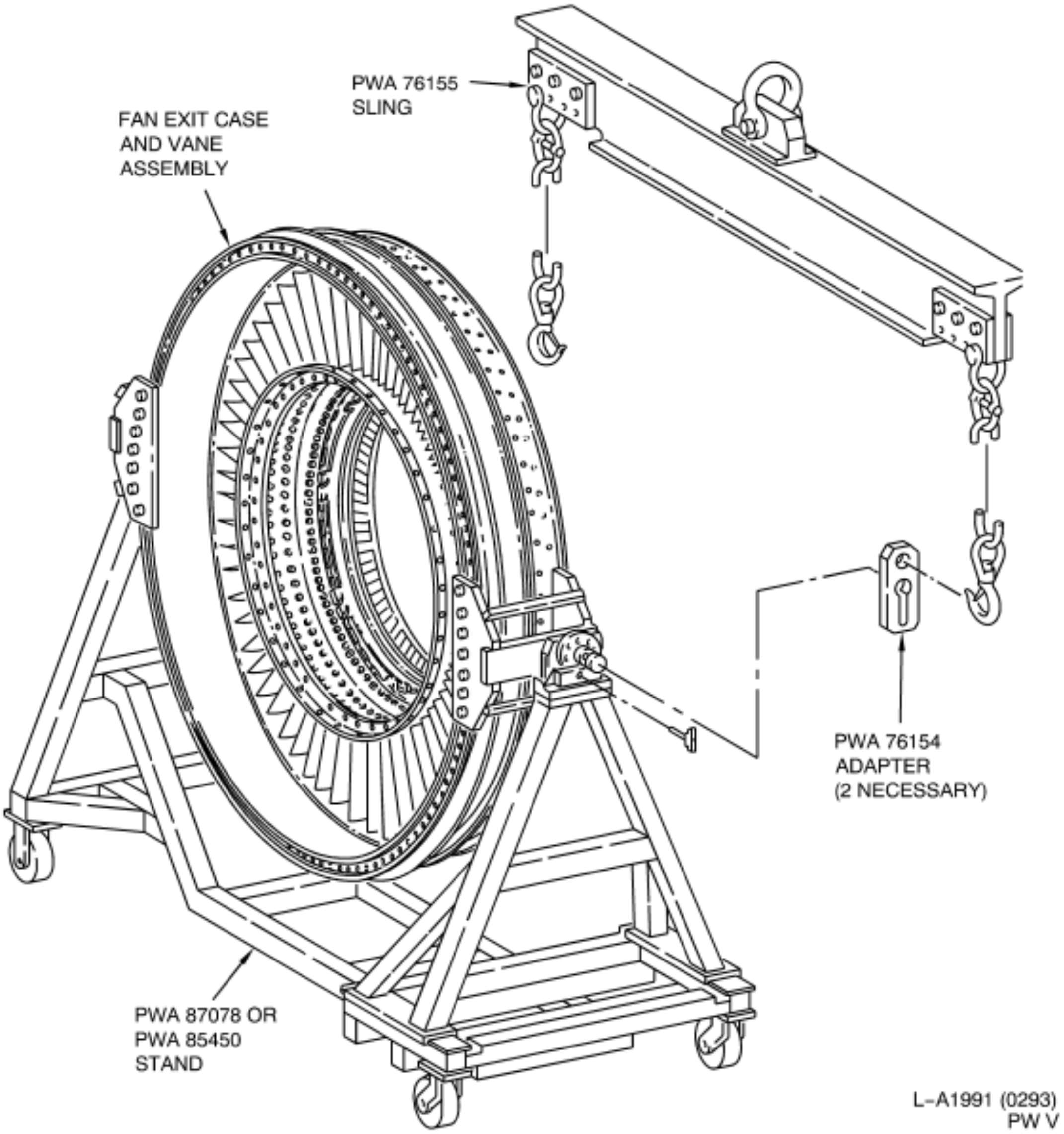
(c) Remove the inner and outer fairings from the vanes.

(d) Put the vanes in a storage rack.

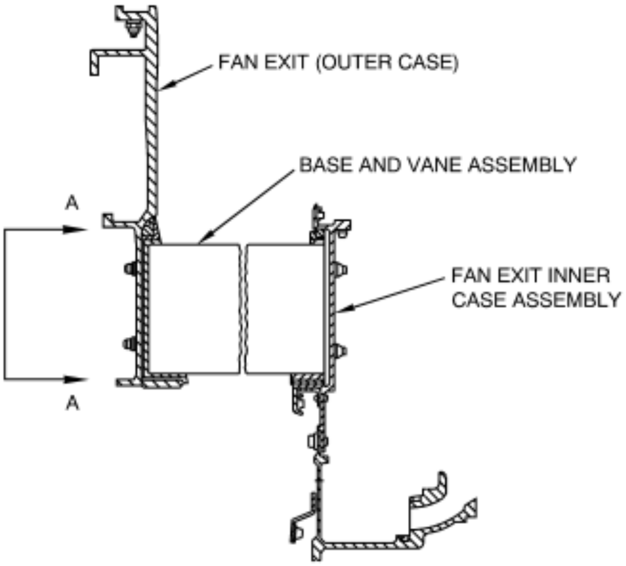

M
M
J
J
SCREW
(106 PLACES)
FAN EXIT LINER
SEGMENT ASSEMBLY
SECTION M-M
FAN EXIT LINER
SEGMENT ASSEMBLY
(6 PLACES)
SCHEMATIC FRONT VIEW J - J
L-A0114 (0391)
PW V

Removal Of The Fan Exit Liner Segment Assemblies
Figure 501
(Task 72-33-02-040-001)

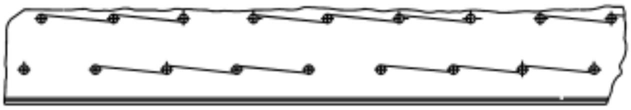
FAN EXIT CASE AND VANE ASSEMBLY - DISASSEMBLY-01


PWA 76155
SLING
FAN EXIT CASE
AND VANE
ASSEMBLY
PWA 76154
ADAPTER
(2 NECESSARY)
PWA 87078 OR
PWA 85450
STAND
L-A1991 (0293)
PW V

Removal Of The Fan Exit Case And Vane Assembly From The Stand
Figure 502
(Task 72-33-02-040-001)

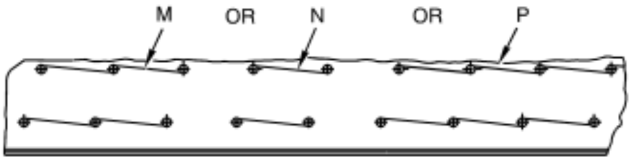

FAN EXIT (OUTER CASE)
BASE AND VANE ASSEMBLY
A
FAN EXIT INNER CASE ASSEMBLY
A

SECTION THROUGH THE FAN EXIT CASE AND VANE ASSEMBLY



VIEW A-A

(PERMITTED LOCKWIRE PATTERN FOR ASSEMBLIES THAT ARE PRE SB PW4ENG 72-262)



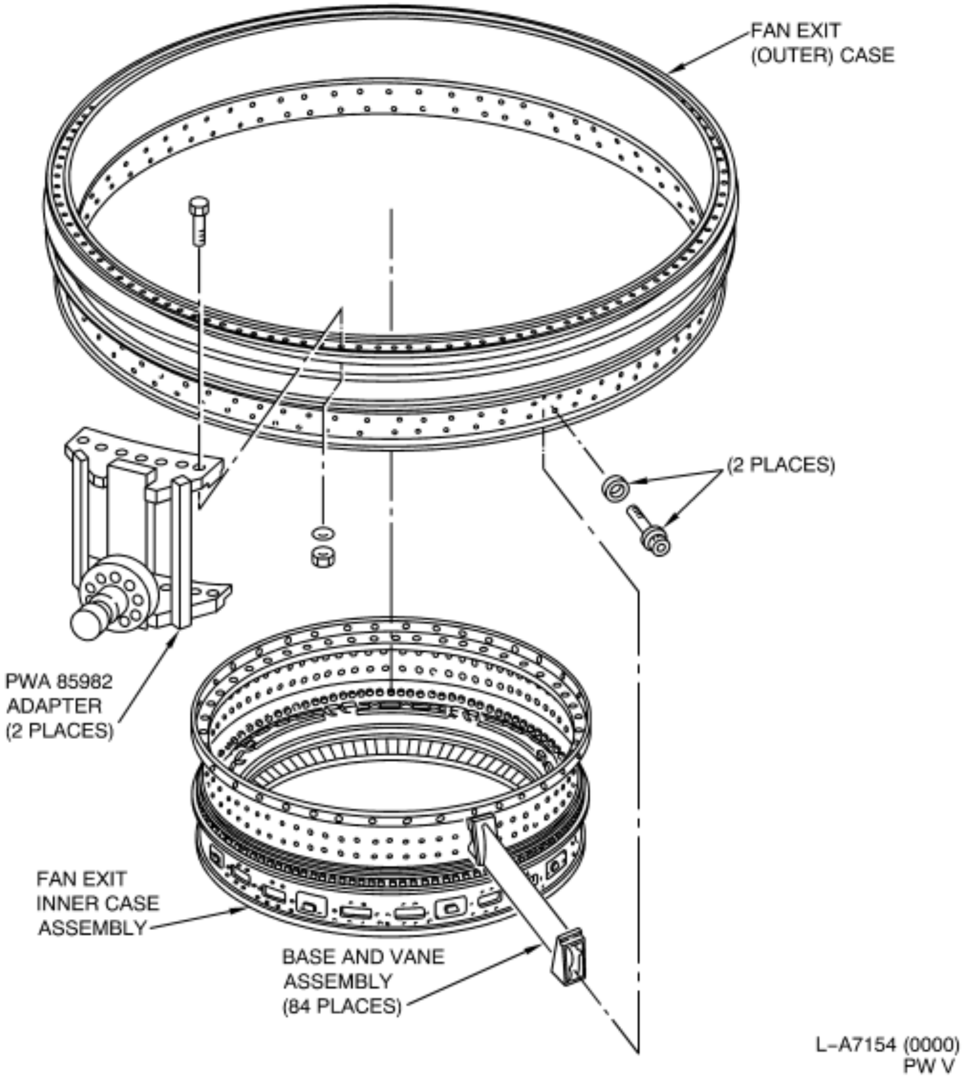
VIEW A-A

(PERMITTED LOCKWIRE PATTERNS -M, N, OR P- FOR ASSEMBLIES WITH PARTIAL INCORPORATION OF SB PW4ENG 72-262)

L-A7155 (0000)
PW V

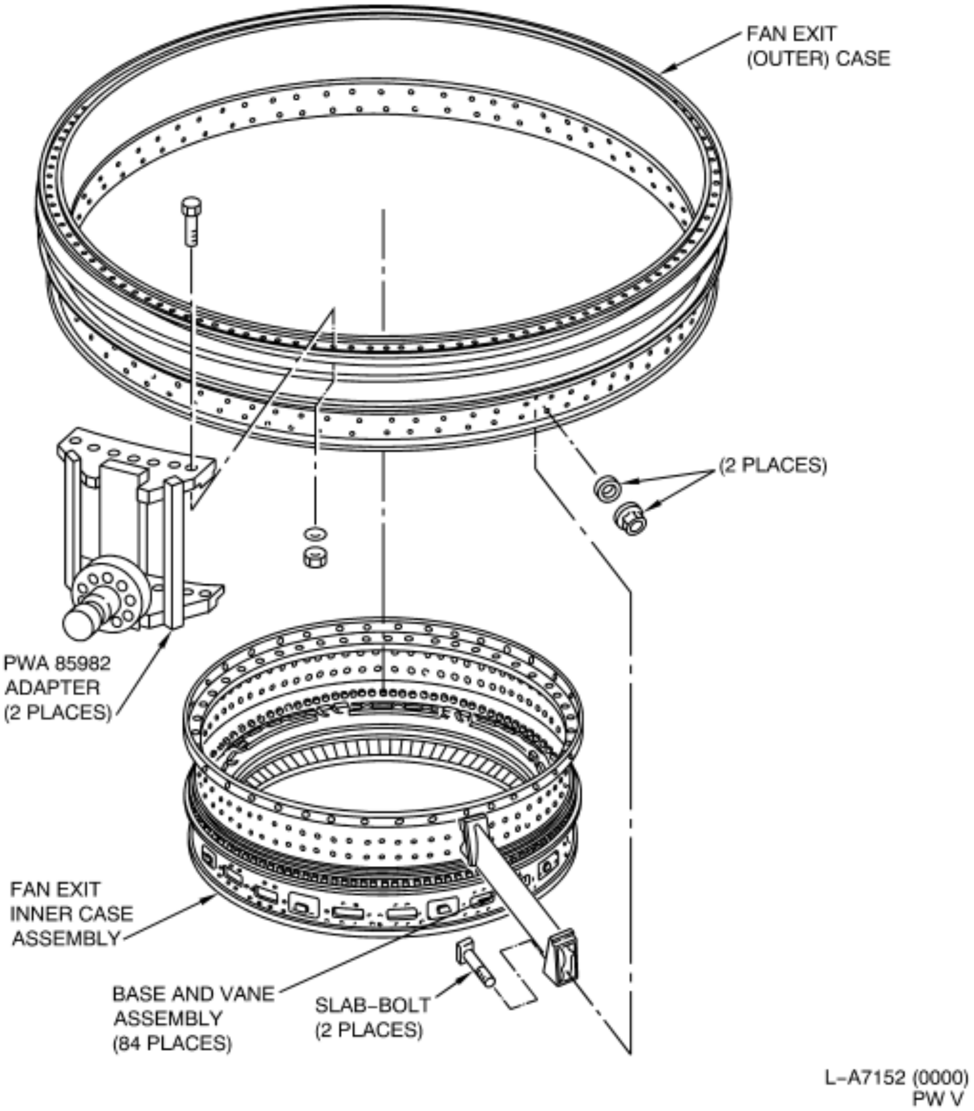
Removal Of The Outer Case (Pre SB PW4ENG 72-262)
Figure 503 (Sheet 1)
(Task 72-33-02-040-001)

FAN EXIT CASE AND VANE ASSEMBLY - DISASSEMBLY-01

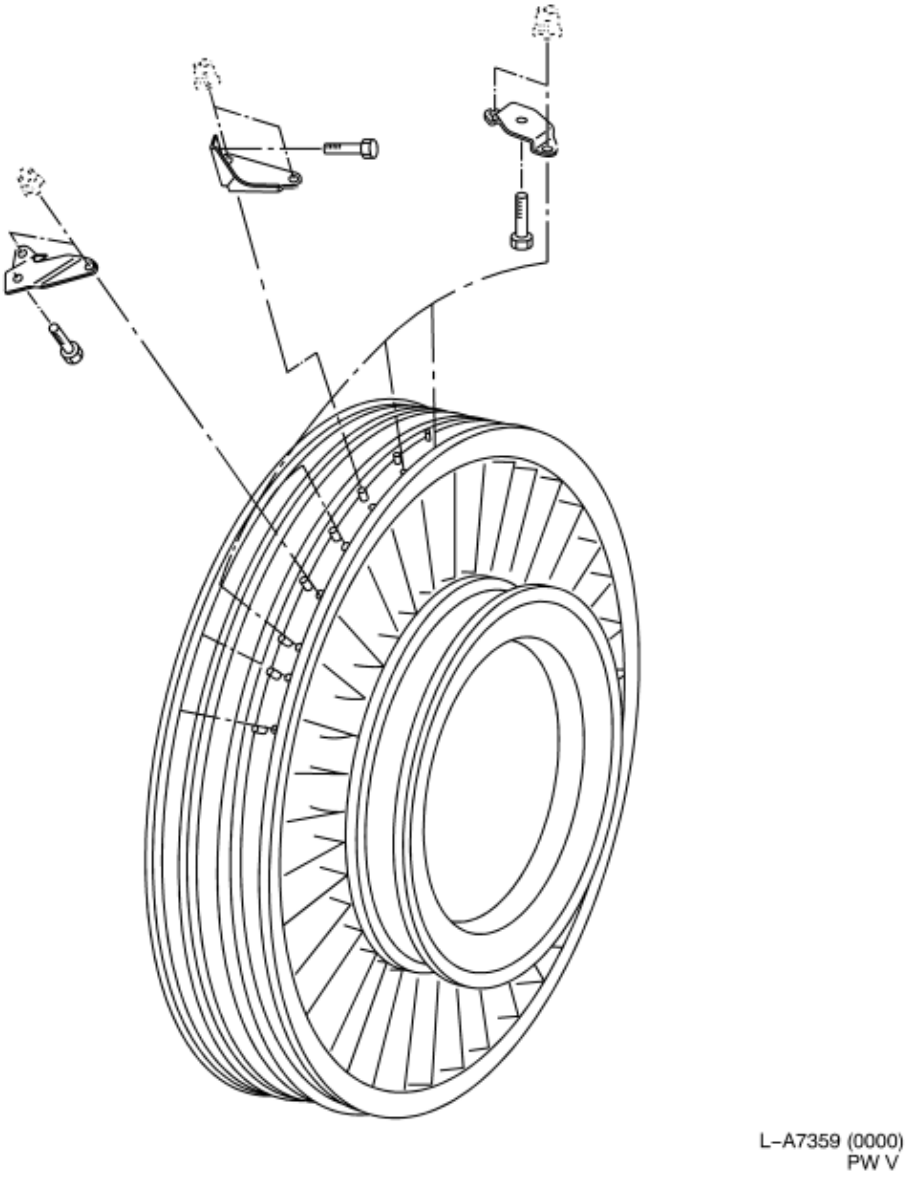

FAN EXIT
(OUTER) CASE
(2 PLACES)
PWA 85982
ADAPTER
(2 PLACES)
FAN EXIT
INNER CASE
ASSEMBLY
BASE AND VANE
ASSEMBLY
(84 PLACES)
L-A7154 (0000)
PW V

Removal Of The Outer Case (Pre SB PW4ENG 72-262)
Figure 503 (Sheet 2)
(Task 72-33-02-040-001)

FAN EXIT CASE AND VANE ASSEMBLY − DISASSEMBLY−01

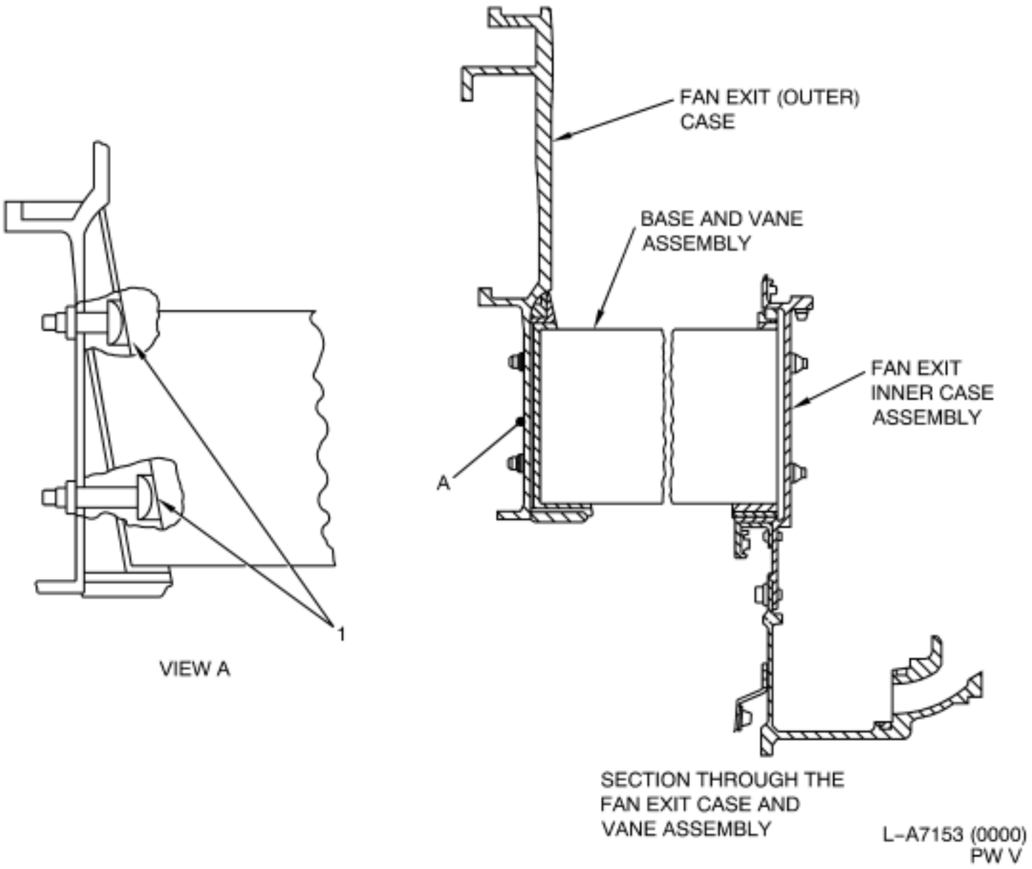

FAN EXIT
(OUTER) CASE
(2 PLACES)
PWA 85982
ADAPTER
(2 PLACES)
FAN EXIT
INNER CASE
ASSEMBLY
BASE AND VANE
ASSEMBLY
(84 PLACES)
SLAB−BOLT
(2 PLACES)
L−A7152 (0000)
PW V

Removal Of The Outer Case (Post SB PW4ENG 72−262)
Figure 504 (Sheet 1)
(Task 72−33−02−040−001)



Removal Of The Outer Case (Post SB PW4ENG 72-262)
Figure 504 (Sheet 2)
(Task 72-33-02-040-001)

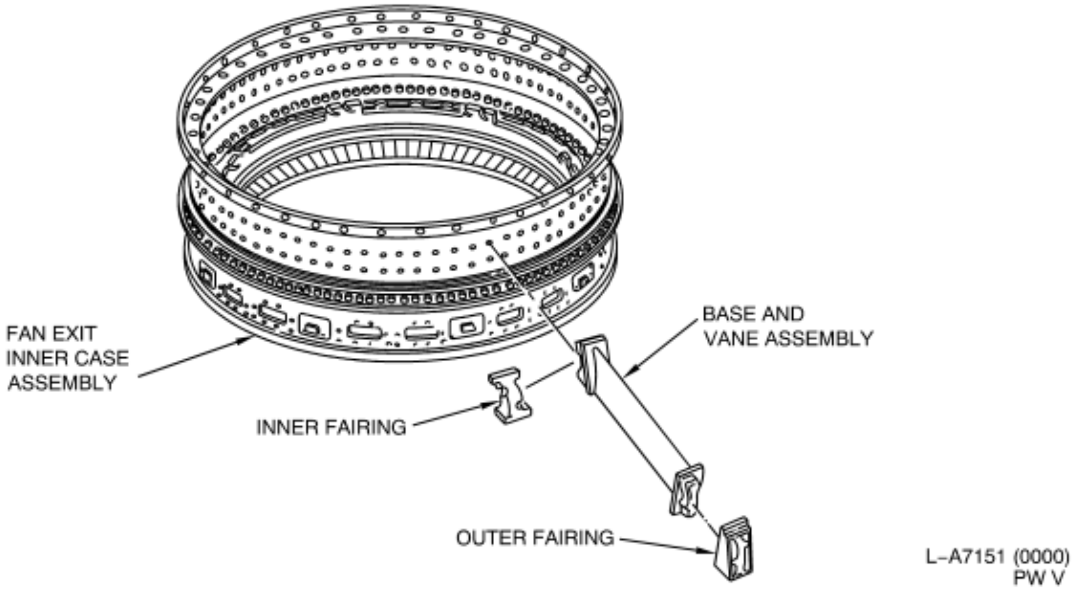
FAN EXIT CASE AND VANE ASSEMBLY - DISASSEMBLY-01


FAN EXIT (OUTER) CASE
BASE AND VANE ASSEMBLY
FAN EXIT INNER CASE ASSEMBLY
A
1
VIEW A
SECTION THROUGH THE FAN EXIT CASE AND VANE ASSEMBLY
L-A7153 (0000)
PW V

1. Remove The Sealant From These Places, 84 Places.

Removal Of The Outer Case (Post SB PW4ENG 72-262)
Figure 504 (Sheet 3)
(Task 72-33-02-040-001)

FAN EXIT CASE AND VANE ASSEMBLY - DISASSEMBLY-01


FAN EXIT INNER CASE ASSEMBLY
BASE AND VANE ASSEMBLY
INNER FAIRING
OUTER FAIRING
L-A7151 (0000)
PW V

Removal Of The Base And Vane Assemblies
Figure 505
(Task 72-33-02-040-001)

Task 72-33-02-440-001:

1. Assemble The Fan Exit Case And Vane Assembly

A. Equipment And Materials Necessary

Standard Tools:
No. 10 Torq-set Drive

Special Tools:

PWA 76154	Adapter (2 Necessary)
PWA 76155	Sling
PWA 85450	Stand, Storage/Transport (Optional to PWA 87078)
PWA 85982	Adapter, Lift And Trunnion (2 Necessary)
PWA 87078	Stand, Storage/Transport

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P09-014	Sealant, Silicone Rubber (PWA 36003)
P09-029	Sealant, Silicone Rubber (PWA 36029)

B. Procedure

Subtask 72-33-02-360-053:

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER BASE AND VANE ASSEMBLY. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 72-262.

(1) Install the vanes on the fan exit inner case assembly (called inner case). See Figure 1001.

(2) Install the fan exit (outer) case (called outer case) on the vanes. See Figure 1002, Figure 1003 and Figure 1004.

(a) Install two PWA 85982 Adapters on the outer case at 3 and 9 o'clock positions. With a hoist, two PWA 76154 Adapters, and PWA 76155 Sling, lift the outer case.

CAUTION: YOU MUST USE A SUPPORT UNDER THE OUTER CASE. IF YOU DO NOT, YOU WILL DAMAGE THE VANES.

(b) With the outer case rear end down (bolt holes down), put the outer case on a correct surface over the vane and inner case assembly. Align the holes in the outer case with the mating part on the vane. See Figure 1002.

CAUTION: FOR THESE MODELS: 4152, 4156A, 4158 DO NOT USE WASHERS AT THE BOLTHOLES IN THE FAN EXIT (OUTER) CASE WITH BUSHINGS IN THEM. IF YOU DO, YOU WILL DAMAGE THE CASE AND VANE ASSEMBLY.

(c) FOR THESE MODELS: 4152, 4156A, 4158
R (Pre SB PW4ENG 72-262) For engines that use hex
R head bolts, apply Engine Oil P03-001 to the threads of 168 bolts. Attach the outer case to the vanes with 168 washers and the bolts. Torque the bolts to 74 - 82 lb-in. (8.361 - 9.265 N.m). Install Lockwire P05-289. See Figure 1003.

CAUTION: DO NOT USE WASHERS AT THE BOLTHOLES IN THE FAN EXIT (OUTER) CASE WITH BUSHINGS IN THEM. IF YOU DO, YOU WILL DAMAGE THE CASE AND VANE ASSEMBLY.

R (d) For engines that use slab-head bolts, apply Engine Oil P03-001 to the threads of 168 slab-bolts. Install the bolts through the vane, outer fairing, and outer case. Install washers and nuts on the bolts. Torque the nuts to 85 - 95 lb-in. (9.604 - (10.734 N.m). See Figure 1004.

NOTE: Engines with the common Airbus-McDonnell Douglas fan case externals sales order option, have eight brackets attached to the slab-bolts at the top left of the outer case. To install these brackets, first put the brackets and bolts in position over the mating slab-bolts, then install the nuts (no washers at these positions), then tighten to the same torque as above.

R (e) For engines that use slab−head bolts, clean and fill the holes where the heads of the slab−bolts are, as follows:

Subtask 72−33−02−360−001−001:

R 1 Clean the surfaces the sealant will touch. Use PWA 83−D4 Task 70−48−00−360−001. See section 70−48 in the Standard Practices Manual, PN 585005.

R 2 Fill the hole with Sealant P09−029. The sealant must be 0.040 inch (1.016 mm) above or below the adjacent surfaces.

R NOTE: Do the fill operation at room temperature in a room that has 25 percent minimum relative humidity.

R NOTE: It is permitted to have 0.060 inch (1.524 mm) surface voids in the rubber sealant.

Subtask 72−33−02−360−051:

(3) Store the fan exit case and vane assembly (called case and vane assembly). See Figure 1005.

(a) With PWA 76154 Adapters, PWA 76155 Sling, and a hoist, install the case and vane assembly in either PWA 87078 Stand or PWA 85450 Stand.

(b) Remove the hoist, sling, and adapters.

R (4) Install the fan exit liner segment assemblies (called liners). See Figure 1006.

CAUTION: BE VERY CAREFUL WHEN YOU INSTALL A LINER SEGMENT. IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THE LINER. IT IS EASY FOR THESE WASHERS TO BECOME DISCONNECTED FROM THE LINER.

(a) Apply Engine Oil P03−001 to 106 screws. Attach the liners to the case and vane assembly with the screws. It is necessary to use the correct length of screw at the trailing edge. Refer to Table 1001.

NOTE: Screw length is a function of washer thickness at the trailing edge.

NOTE: (Engines with acoustical fan exit rear liner segment assemblies)

NOTE: Only a Class 6 washer is permitted at the trailing edge of the front liner.

Screw PN	Screw Length	Washer Thickness	Quantity of Screws
593111	0.495 - 0.505	0.000 - 0.015	0 - 36 As Necessary
ST1382-09	0.542 - 0.562	0.016 - 0.070	0 - 36 As Necessary
ST1382-10	0.594 - 0.625	0.071 - 0.130	0 - 36 As Necessary
ST1382-11	0.656 - 0.687	0.131 - 0.210	0 - 36 As Necessary

Fan Exit (Front) Liners - Washer Thickness And Screw Length
Table 1001

(b) With a No. 10 Torq-set drive, tighten and torque the screws to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(c) Use PWA 83-A4 Task 70-48-00-360-001 to clean the surfaces that will touch the sealant. See section 70-48 in the Standard Practices Manual, PN 585005.

(d) Apply Sealant P09-014 to the spaces between the liners. Do PWA 615 Task 70-48-00-360-002 as shown in section 70-48 in the Standard Practices Manual, PN 585005, except as follows:

1 Cure in air with a relative humidity of 20 percent, minimum at room temperature for 24 hours before engine run.

R

Subtask 72-33-02-360-054:

R (5) Optional (except for engines pre SB PW4ENG 72-591),
R apply Sealant P09-029 around the bases of the base and
R vane assemblies. See Figure 1006.

R NOTE: Engines that are pre SB PW4ENG 72-591 require
R sealant applied around the vane bases.

R NOTE: The optional sealant can be applied to help reduce erosion of the vane base material.

R (a) Remove any loose sealant.

R (b) Clean the areas that the sealant will touch. Refer to PWA 83−D4 (Task 70−48−00−360−001) in section 70−48, Standard Practices Manual, PN 585005.

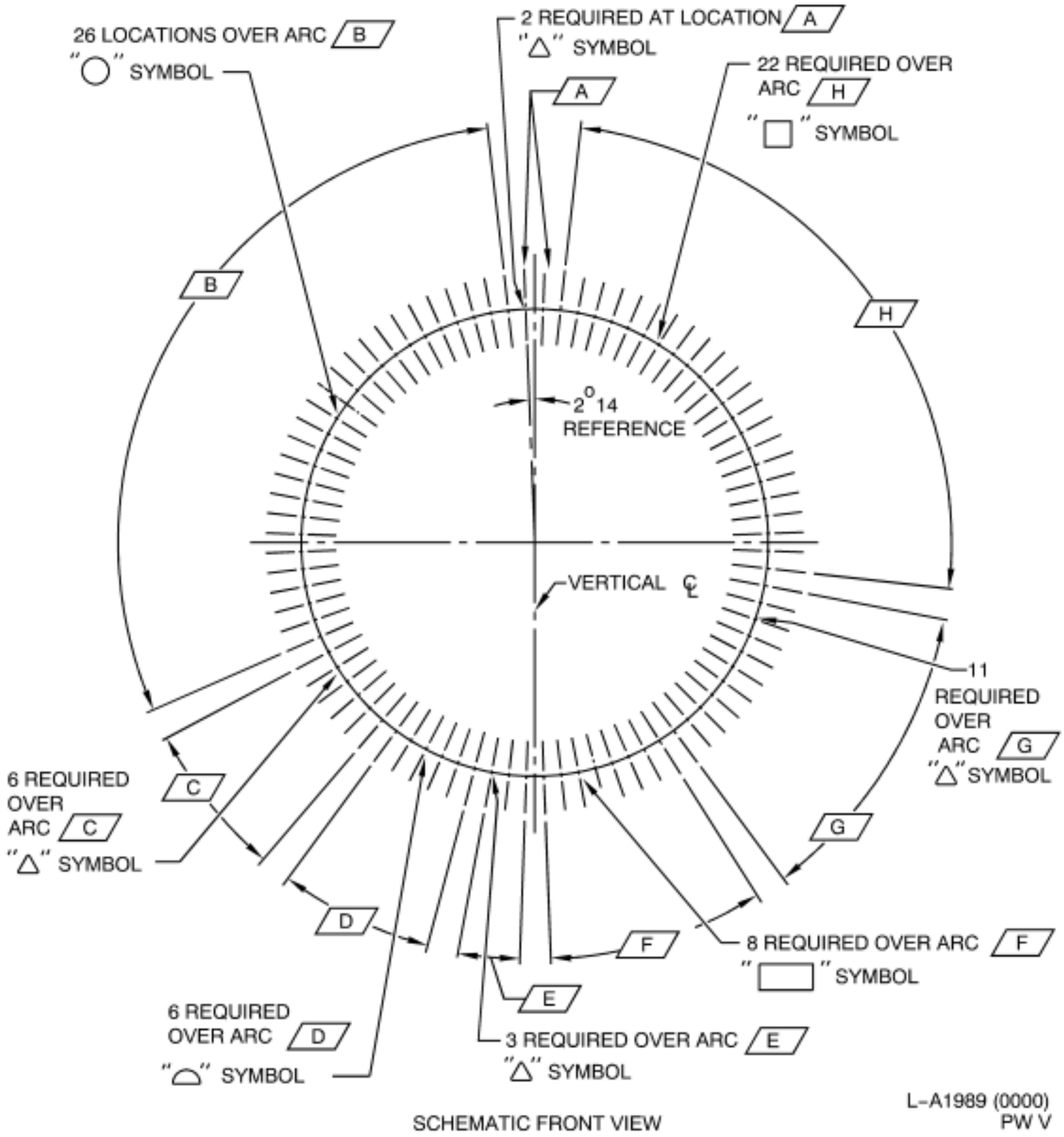
R NOTE: The fan exit guide vane base material is polyetherimide.

R (c) Fill the spaces around the bases of the base and vane assemblies with Sealant P09−029. The surface of the sealant must be smooth and continuous and flush to 0.040 inch (1.016 mm) below the adjacent surface.

R (d) Remove excess sealant.

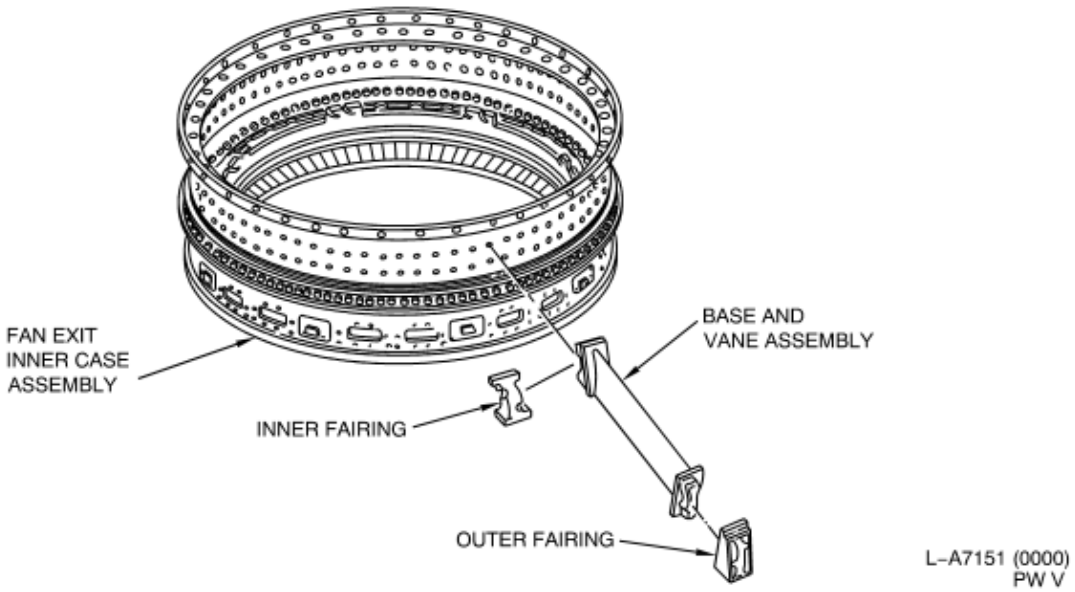
R (e) Cure the sealant in air with a relative humidity of 50 percent minimum at 75° F (23.9° C) or equivalent. Cure the sealant for 24 hours, minimum, before you touch the sealant.

R NOTE: The sealant is fully cured in 72 hours.

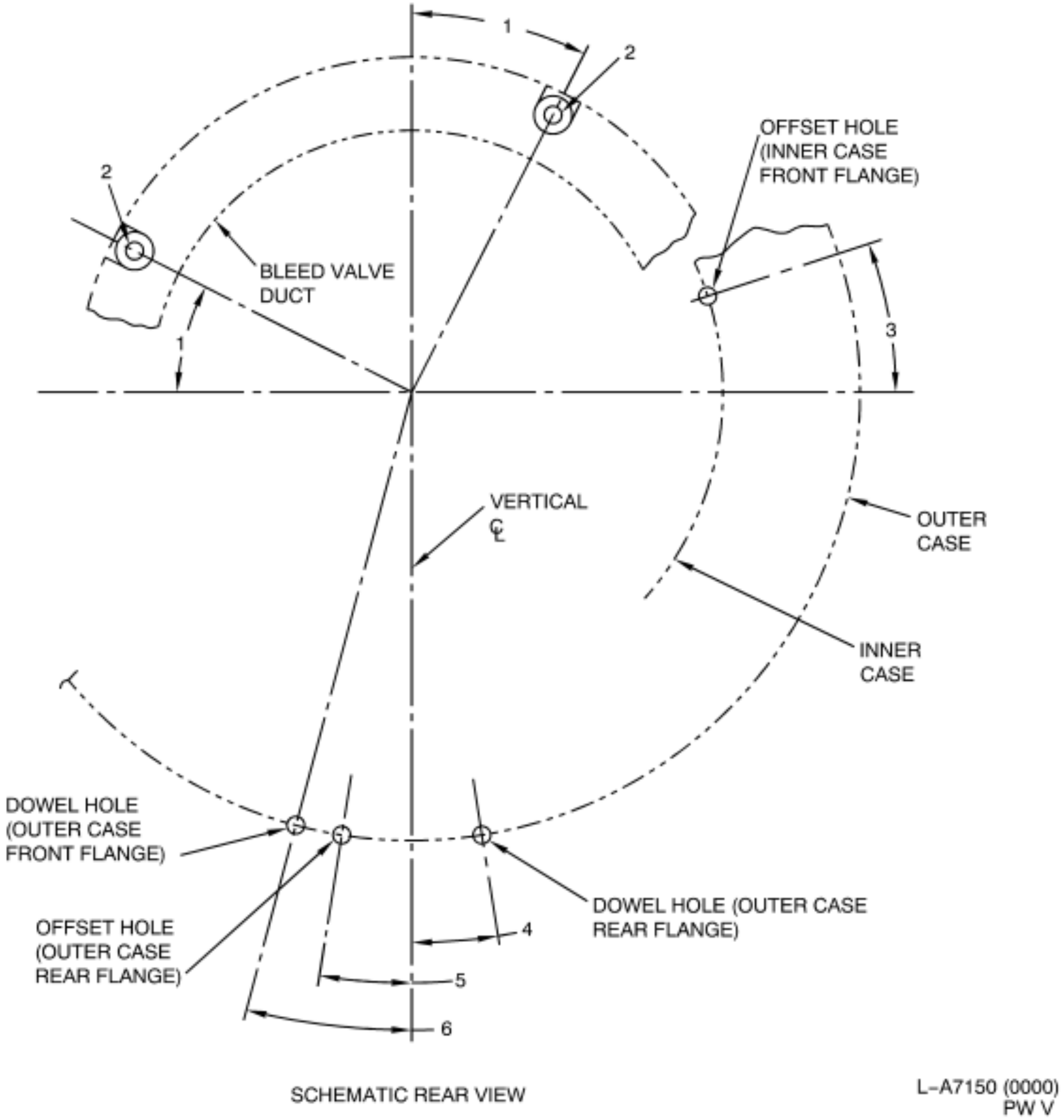

26 LOCATIONS OVER ARC B
"○" SYMBOL
2 REQUIRED AT LOCATION A
"△" SYMBOL
A
22 REQUIRED OVER ARC H
"□" SYMBOL
B
H
2° 14
REFERENCE
VERTICAL ℄
11 REQUIRED OVER ARC G
"△" SYMBOL
G
6 REQUIRED OVER ARC C
"△" SYMBOL
C
D
F
8 REQUIRED OVER ARC F
"▭" SYMBOL
E
6 REQUIRED OVER ARC D
"⌓" SYMBOL
3 REQUIRED OVER ARC E
"△" SYMBOL
L−A1989 (0000)
PW V
SCHEMATIC FRONT VIEW

Installation Of The Vanes
Figure 1001 (Sheet 1)
(Task 72−33−02−440−001)

FAN EXIT CASE AND VANE ASSEMBLY - ASSEMBLY-01


FAN EXIT
INNER CASE
ASSEMBLY
BASE AND
VANE ASSEMBLY
INNER FAIRING
OUTER FAIRING
L-A7151 (0000)
PW V

Installation Of The Vanes
Figure 1001 (Sheet 2)
(Task 72-33-02-440-001)


1
2
2
OFFSET HOLE (INNER CASE FRONT FLANGE)
BLEED VALVE DUCT
1
3
VERTICAL ℄
OUTER CASE
INNER CASE
DOWEL HOLE (OUTER CASE FRONT FLANGE)
OFFSET HOLE (OUTER CASE REAR FLANGE)
DOWEL HOLE (OUTER CASE REAR FLANGE)
4
5
6
SCHEMATIC REAR VIEW
L-A7150 (0000)
PW V

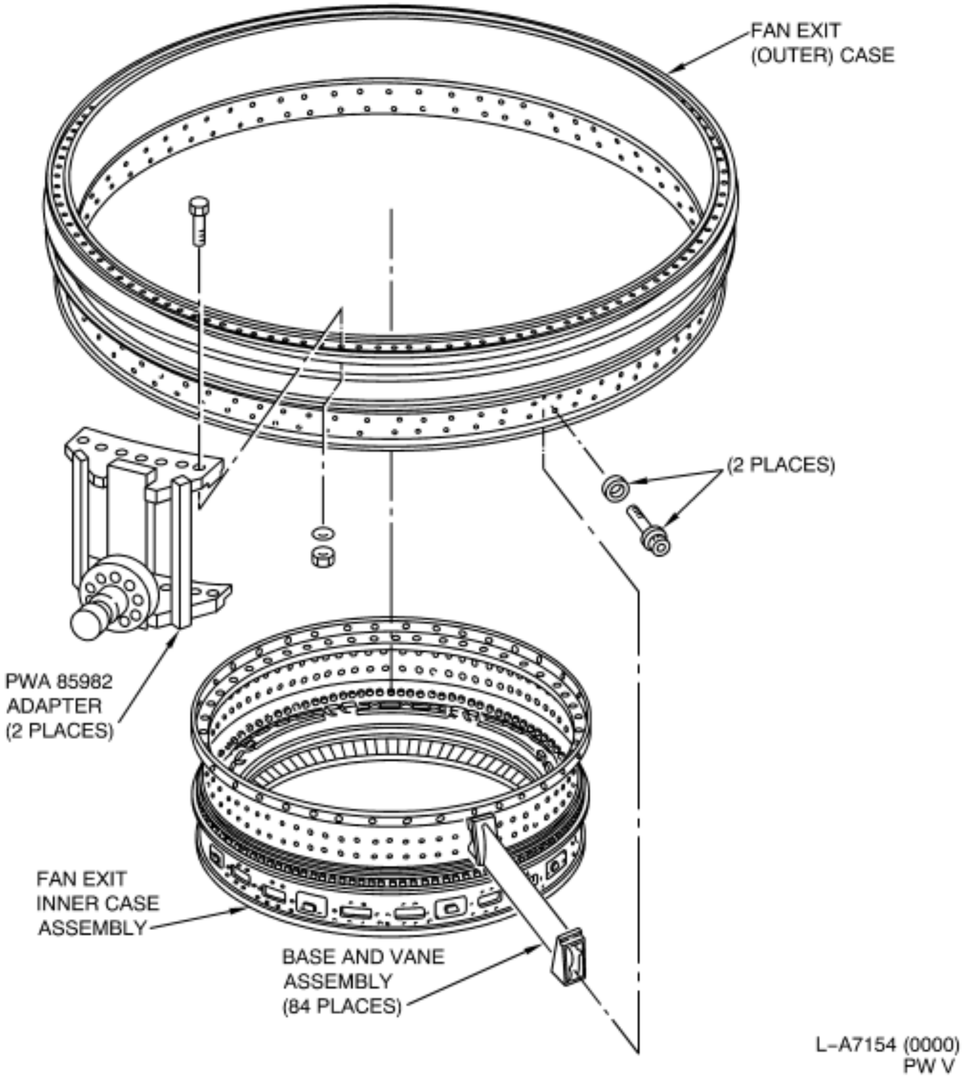
Alignment Of The Fan Exit (Outer) Case
With The Fan Exit Inner Case Assembly
Figure 1002
(Task 72-33-02-440-001)

FAN EXIT CASE AND VANE ASSEMBLY − ASSEMBLY−01

1. 25° 59' 58", Reference
2. 0.3755 Inch (9.538 mm) Diameter Reference
3. 2° 42' 30"
4. 1° 8'
5. 0° 55' Reference
6. 1° 30' Reference

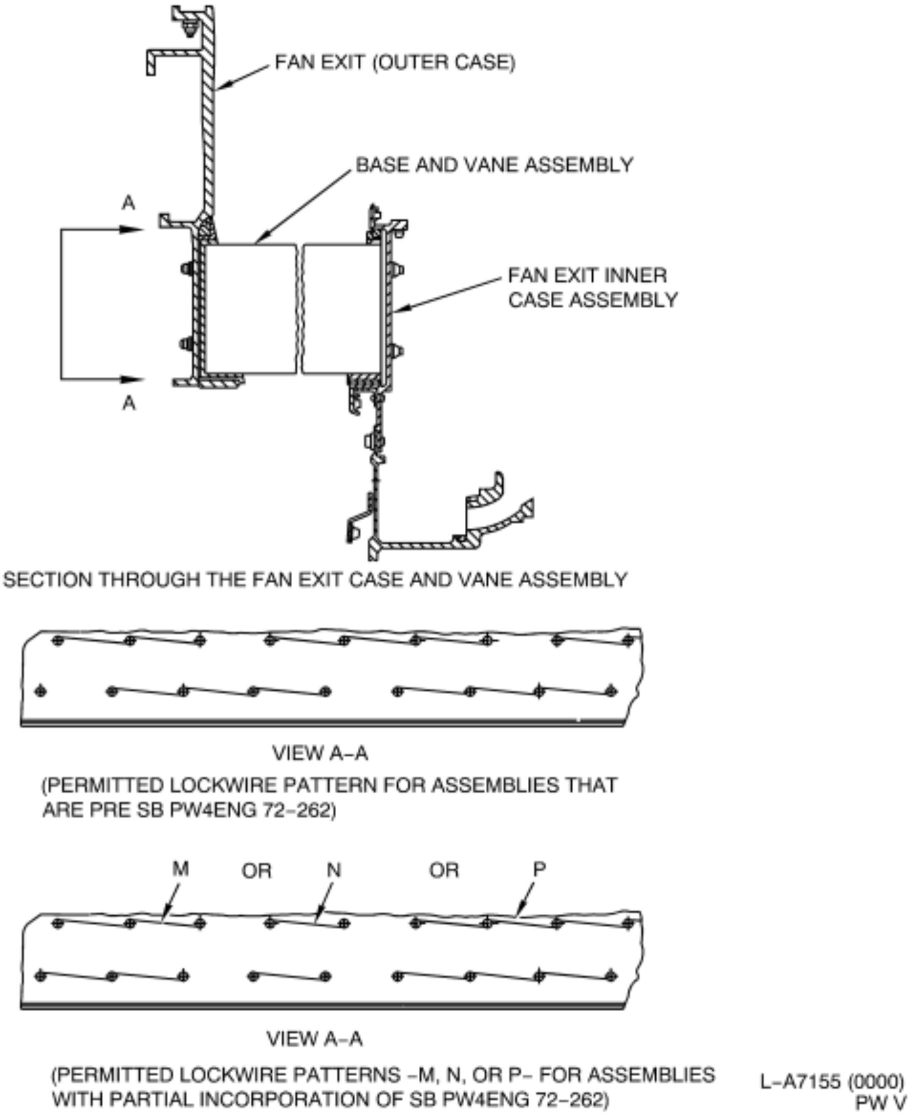
Key to Figure 1002

FAN EXIT CASE AND VANE ASSEMBLY − ASSEMBLY−01


FAN EXIT
(OUTER) CASE
(2 PLACES)
PWA 85982
ADAPTER
(2 PLACES)
FAN EXIT
INNER CASE
ASSEMBLY
BASE AND VANE
ASSEMBLY
(84 PLACES)
L−A7154 (0000)
PW V

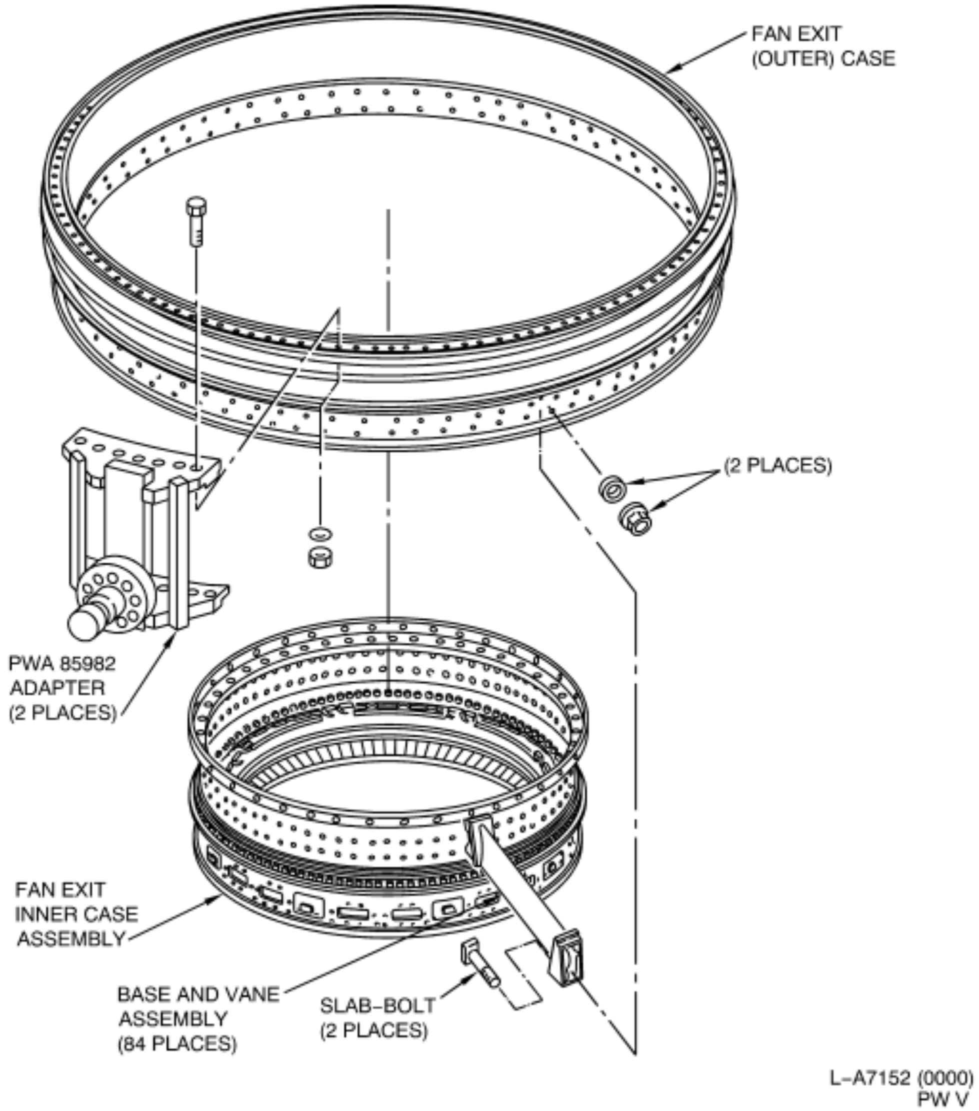
Installation Of The Fan Exit (Outer) Case (Pre SB PW4ENG 72−262)
Figure 1003 (Sheet 1)
(Task 72−33−02−440−001)

FAN EXIT CASE AND VANE ASSEMBLY - ASSEMBLY-01

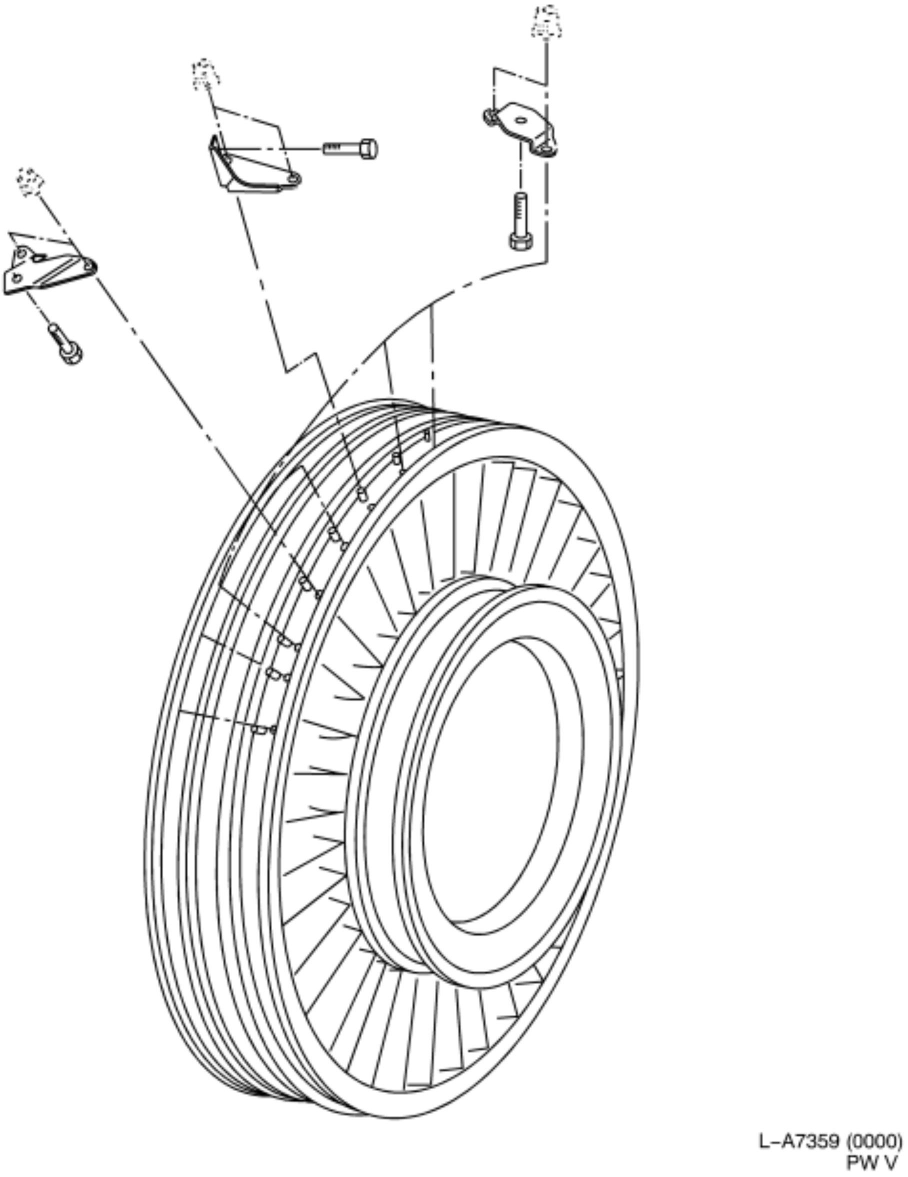

FAN EXIT (OUTER CASE)
BASE AND VANE ASSEMBLY
A
FAN EXIT INNER CASE ASSEMBLY
A
SECTION THROUGH THE FAN EXIT CASE AND VANE ASSEMBLY
VIEW A-A
(PERMITTED LOCKWIRE PATTERN FOR ASSEMBLIES THAT ARE PRE SB PW4ENG 72-262)
M
OR
N
OR
P
VIEW A-A
(PERMITTED LOCKWIRE PATTERNS -M, N, OR P- FOR ASSEMBLIES WITH PARTIAL INCORPORATION OF SB PW4ENG 72-262)
L-A7155 (0000)
PW V

Installation Of The Fan Exit (Outer) Case (Pre SB PW4ENG 72-262)
Figure 1003 (Sheet 2)
(Task 72-33-02-440-001)

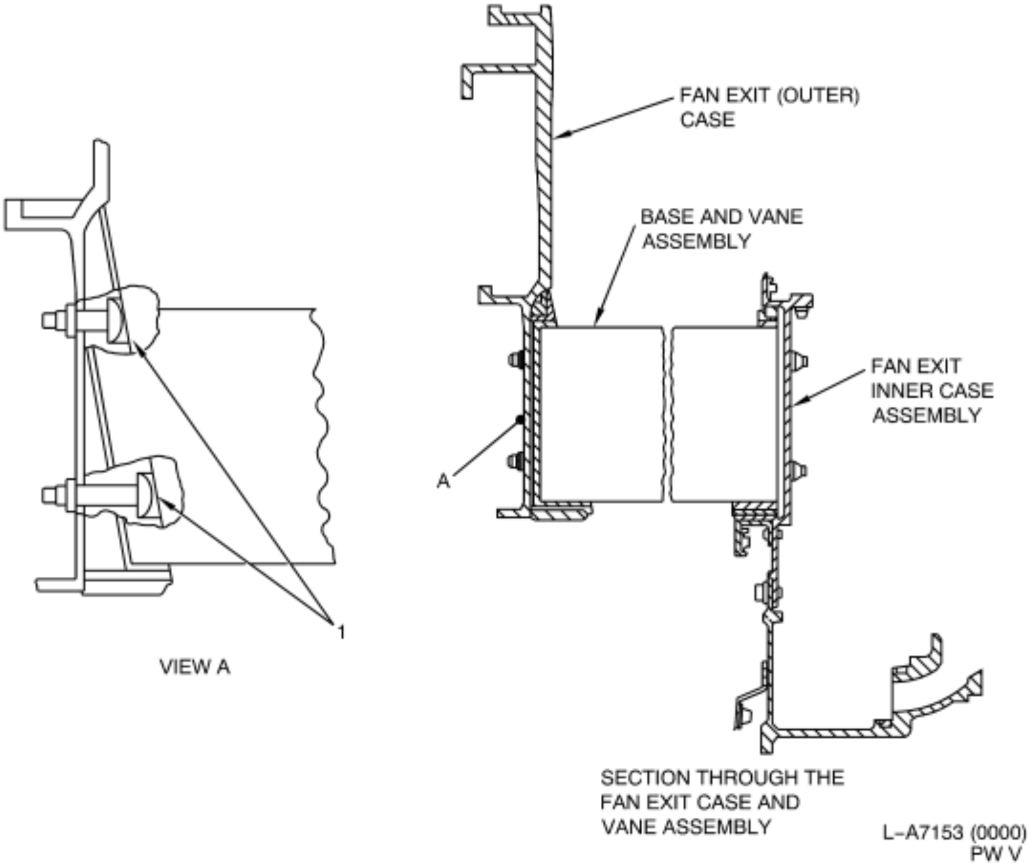
FAN EXIT CASE AND VANE ASSEMBLY - ASSEMBLY-01


FAN EXIT
(OUTER) CASE
(2 PLACES)
PWA 85982
ADAPTER
(2 PLACES)
FAN EXIT
INNER CASE
ASSEMBLY
BASE AND VANE
ASSEMBLY
(84 PLACES)
SLAB-BOLT
(2 PLACES)
L-A7152 (0000)
PW V

Installation Of The Fan Exit (Outer) Case (Post SB PW4ENG 72-262)
Figure 1004 (Sheet 1)
(Task 72-33-02-440-001)

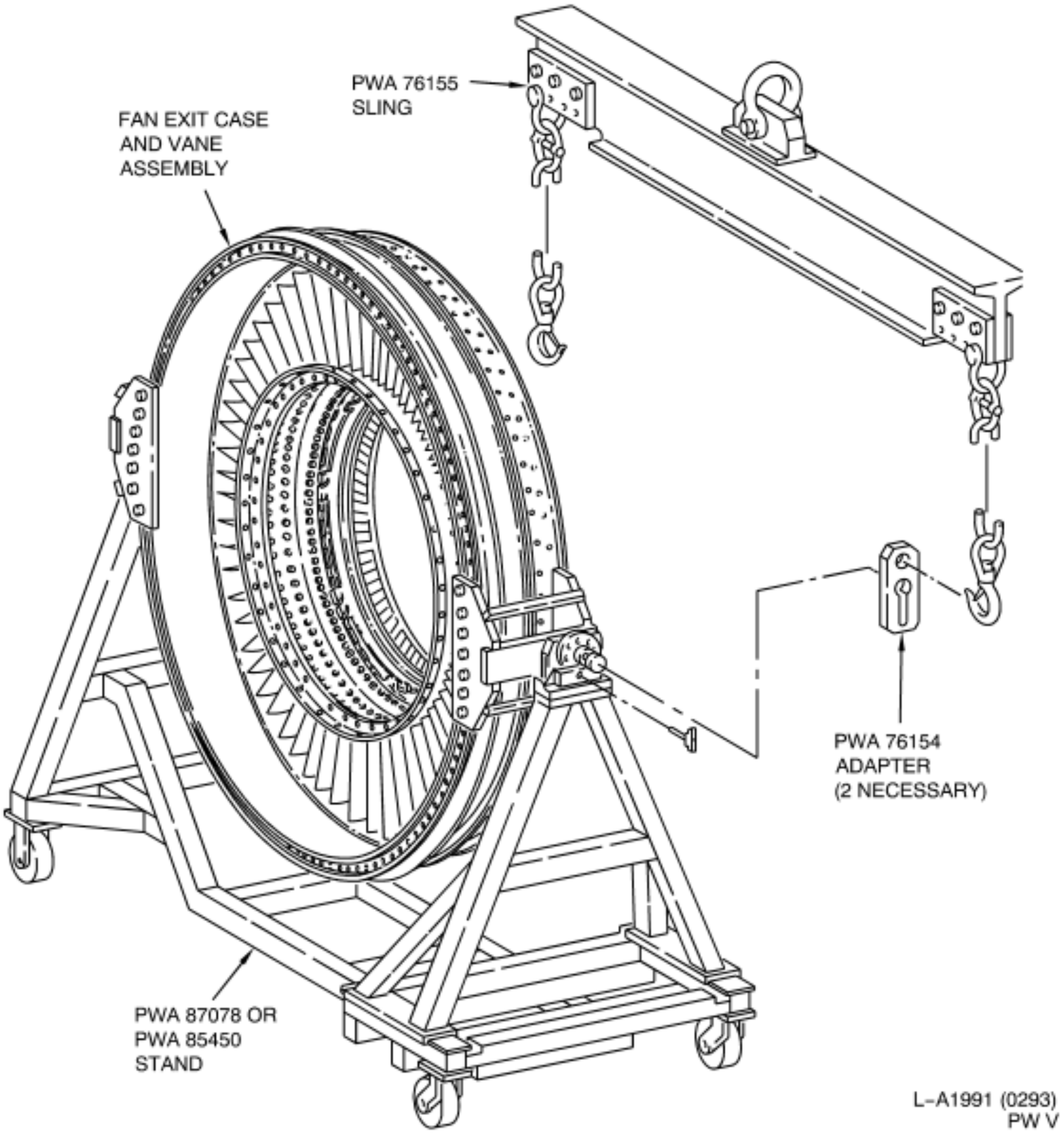


Installation Of The Fan Exit (Outer) Case (Post SB PW4ENG 72-262)
Figure 1004 (Sheet 2)
(Task 72-33-02-440-001)

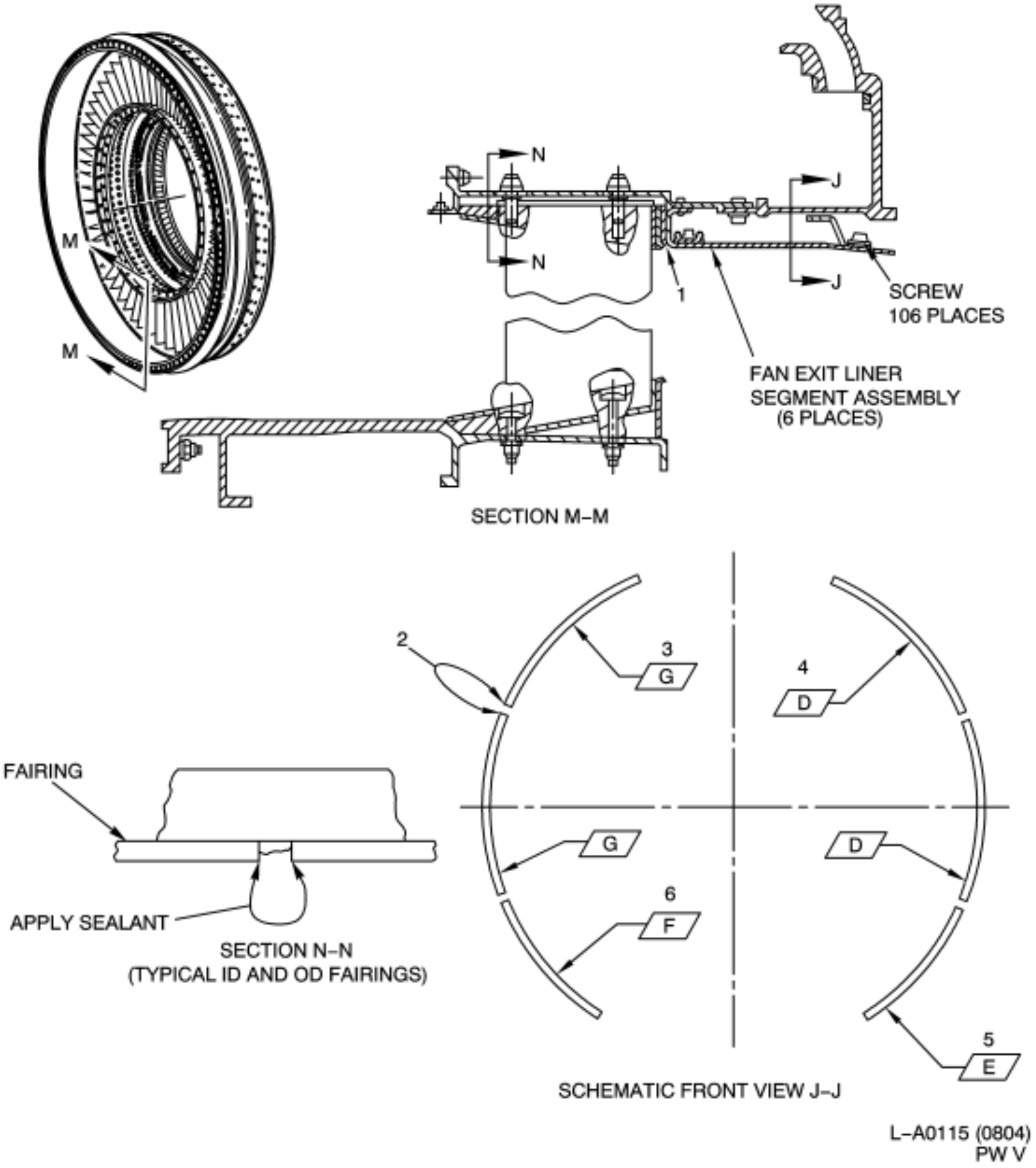

FAN EXIT (OUTER) CASE
BASE AND VANE ASSEMBLY
FAN EXIT INNER CASE ASSEMBLY
A
1
VIEW A
SECTION THROUGH THE FAN EXIT CASE AND VANE ASSEMBLY
L-A7153 (0000) PW V

1. Fill This Hole With Sealant. The Sealant Must Be 0.040 Inch (1.016 mm) Above or Below This Surface.

Installation Of The Fan Exit (Outer) Case (Post SB PW4ENG 72-262)
Figure 1004 (Sheet 3)
(Task 72-33-02-440-001)


PWA 76155
SLING
FAN EXIT CASE
AND VANE
ASSEMBLY
PWA 76154
ADAPTER
(2 NECESSARY)
PWA 87078 OR
PWA 85450
STAND
L-A1991 (0293)
PW V

Storage Of The Fan Exit Outer Case Assembly
Figure 1005
(Task 72-33-02-440-001)


N
N
J
J
M
M
1
SCREW
106 PLACES
FAN EXIT LINER
SEGMENT ASSEMBLY
(6 PLACES)
SECTION M-M
2
3
G
4
D
FAIRING
G
D
6
F
APPLY SEALANT
SECTION N-N
(TYPICAL ID AND OD FAIRINGS)
5
E
SCHEMATIC FRONT VIEW J-J
L-A0115 (0804)
PW V

Application Of Sealant Around The Base And Vane Assemblies And Installation Of The Fan Exit Liner Segment Assemblies
Figure 1006
(Task 72-33-02-440-001)

FAN EXIT CASE AND VANE ASSEMBLY - ASSEMBLY-01

1. (Pre SB PW4ENG 72-591) Fill All Around The Circumference And Between The Bases Of The Vanes, 84 Places, With Sealant (P09-029)
2. The Sealant (P09-014) Must Be Even With, To 0.010 Inch (0.254 mm) Above, These Surfaces, Typical Four Places.
3. (Pre SB PW4ENG 72-312) PN 50G664, Two Places At G
   (Post SB PW4ENG 72-312) PN 51G768-01, Two Places At G
   (Post SB PW4ENG 72-622) PN 52G190-01, Two Places At G
4. (Pre SB PW4ENG 72-312) PN 50G669, Two Places At D
   (Post SB PW4ENG 72-312) PN 51G772-01, Two Places At D
   (Post SB PW4ENG 72-622) PN 52G193-01, Two Places At D
5. (Pre SB PW4ENG 72-312) PN 50G666, One Place At F
   (Post SB PW4ENG 72-312) PN 51G769-01, One Place At F
   (Post SB PW4ENG 72-622) PN 52G191-01, One Places At F
6. (Pre SB PW4ENG 72-312) PN 50G668, One Place At E
   (Post SB PW4ENG 72-312) PN 51G771-01, One Place At E
R (PostSB PW4ENG 72-622) PN 52G192-01, One Places At E

Key to Figure 1006

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CHAPTER 72

FAN CASE

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72−34−04	NO. 2 BEARING AND SEAL ASSEMBLY − ASSEMBLY−01 • 72−34−04−440−001−001: Assemble No. 2 Bearing Outer Race And Housing Assembly (Mechanical Wrench)
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	- 72−34−05−720−001: Airflow Check − No. 2 Bearing (Carbon) Seal Assembly
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72−34−35	NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY − TESTING−01 - 72−34−35−720−001: Airflow Check − No. 1.5 and 2 Bearing (Carbon) Seal Assembly

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INTERMEDIATE CASE - HOW TO USE MANUAL

Task 72-34-00-990-003:

1. Chapter/Section/Subject Numbering Outline

See Figure 1.

NOTE: See the tab separated How To Use Manual section located at the beginning of this manual set for information concerning Data Location Guidelines and a complete Chapter/Section/Subject numbering outline for all manual sections.

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NO. 2 BEARING REAR FACE SEAL ASSEMBLY	72-34-07
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GEARSHAFT BALL BEARING .... 72−34−23

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NOT USED .... 72−34−94

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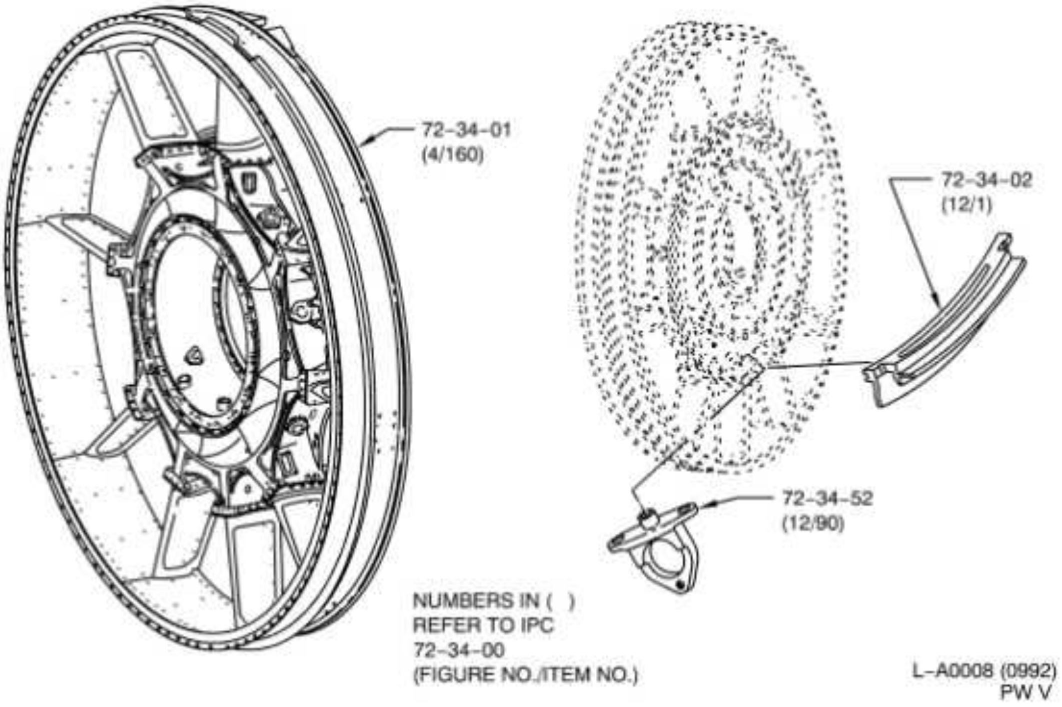
INTERMEDIATE CASE − HOW TO USE MANUAL


72−34−01
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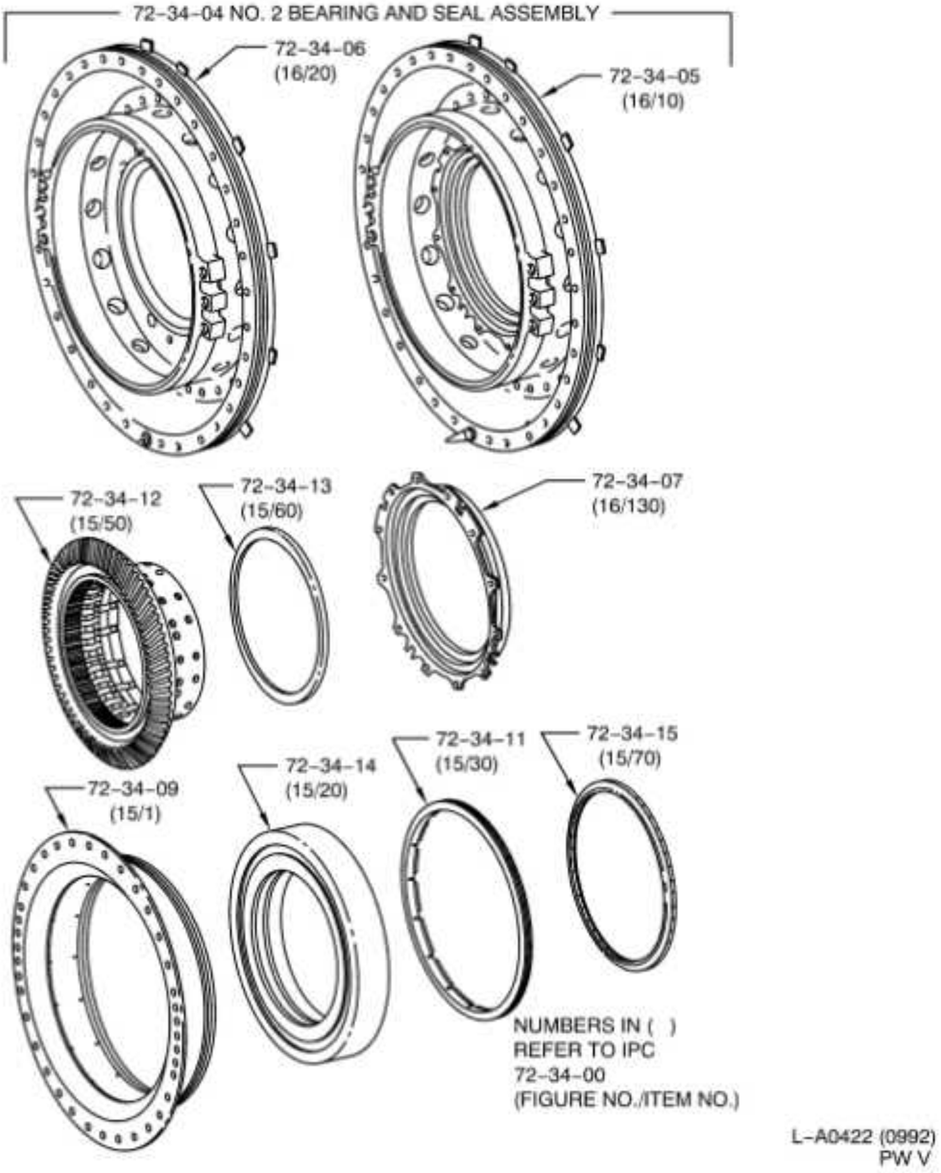
72−34−02
(12/1)
72−34−52
(12/90)
NUMBERS IN ( )
REFER TO IPC
72−34−00
(FIGURE NO./ITEM NO.)
L−A0008 (0992)
PW V

Intermediate Case
Figure 1 (Sheet 1)
(Task 72−34−00−990−003)

INTERMEDIATE CASE − HOW TO USE MANUAL


72-34-04 NO. 2 BEARING AND SEAL ASSEMBLY
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72-34-12
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72-34-13
(15/60)
72-34-07
(16/130)
72-34-09
(15/1)
72-34-14
(15/20)
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(15/30)
72-34-15
(15/70)
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REFER TO IPC
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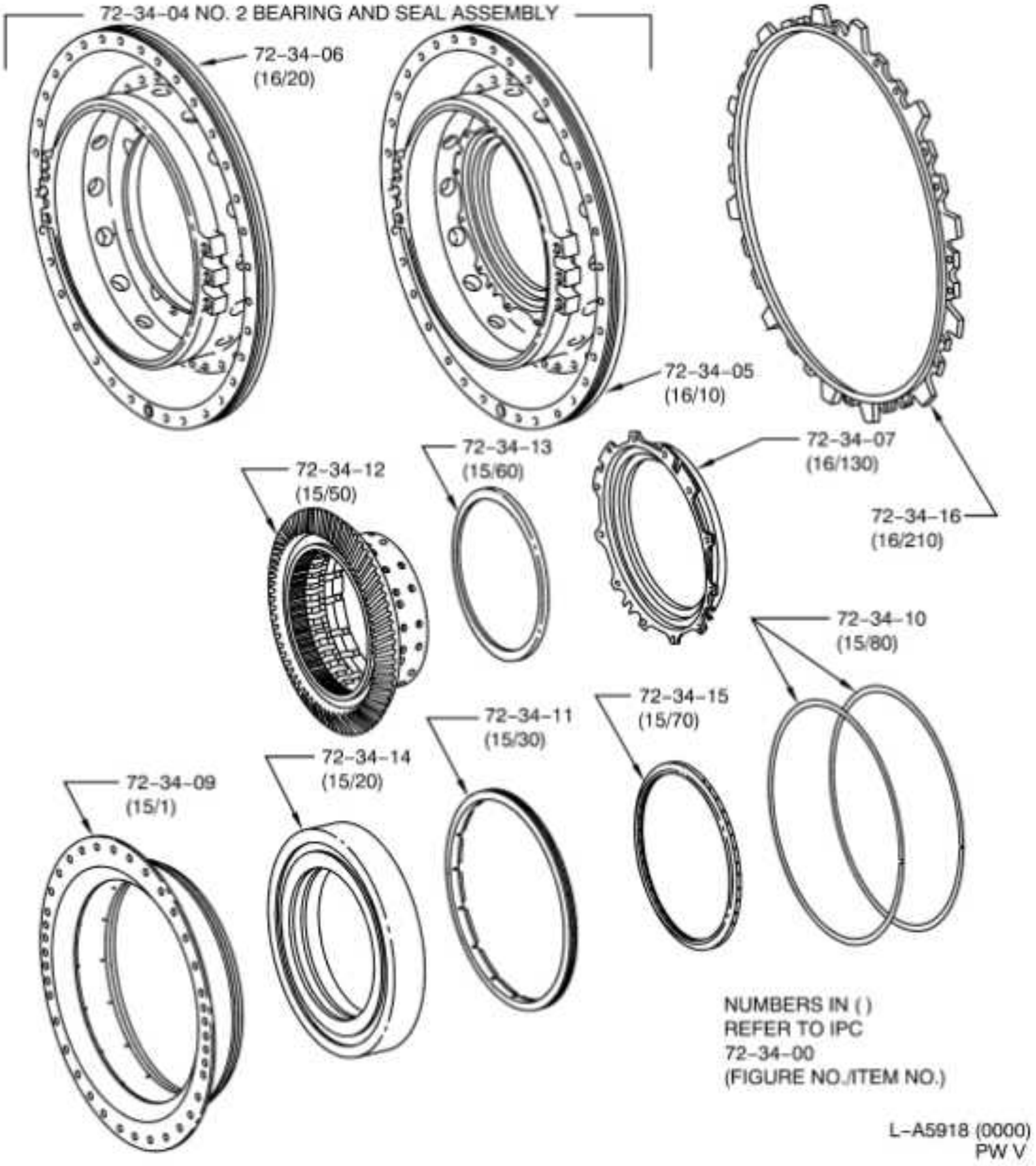
(FIGURE NO./ITEM NO.)
L-A0422 (0992)
PW V

Intermediate Case
(Pre Service Bulletin PW4ENG 72−204)
(The Retaining Ring Is Part Of The Support Assembly)
Figure 1 (Sheet 2)
(Task 72−34−00−990−003)

INTERMEDIATE CASE – HOW TO USE MANUAL


72-34-04 NO. 2 BEARING AND SEAL ASSEMBLY
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(15/50)
72-34-07
(16/130)
72-34-16
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72-34-10
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(15/30)
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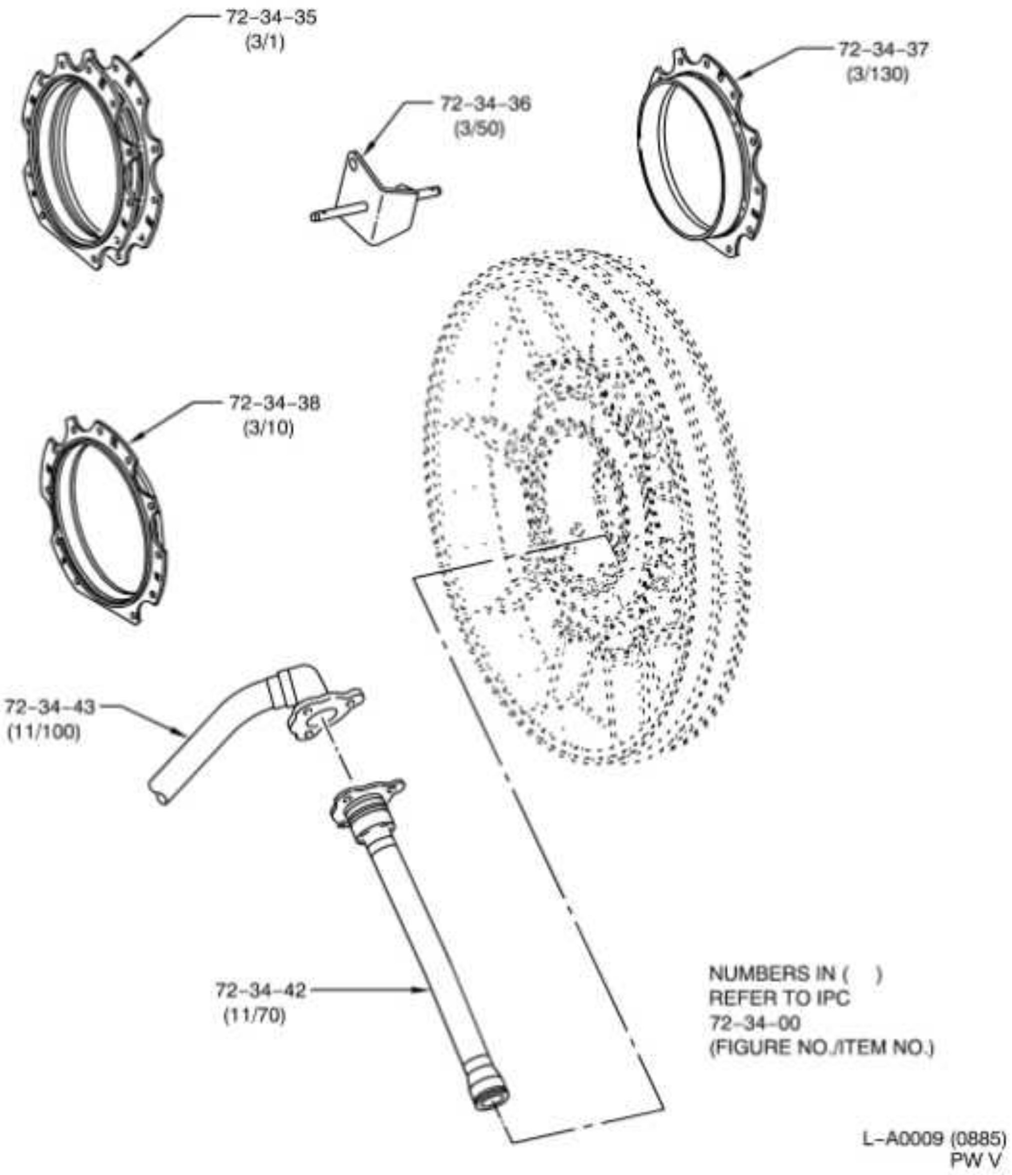
(FIGURE NO./ITEM NO.)
L-A5918 (0000)
PW V

Intermediate Case
(Post Service Bulletin PW4ENG 72-204)
(The Retaining Ring Is Separate From The Support Assembly
Figure 1 (Sheet 3)
(Task 72-34-00-990-003)


72−34−35
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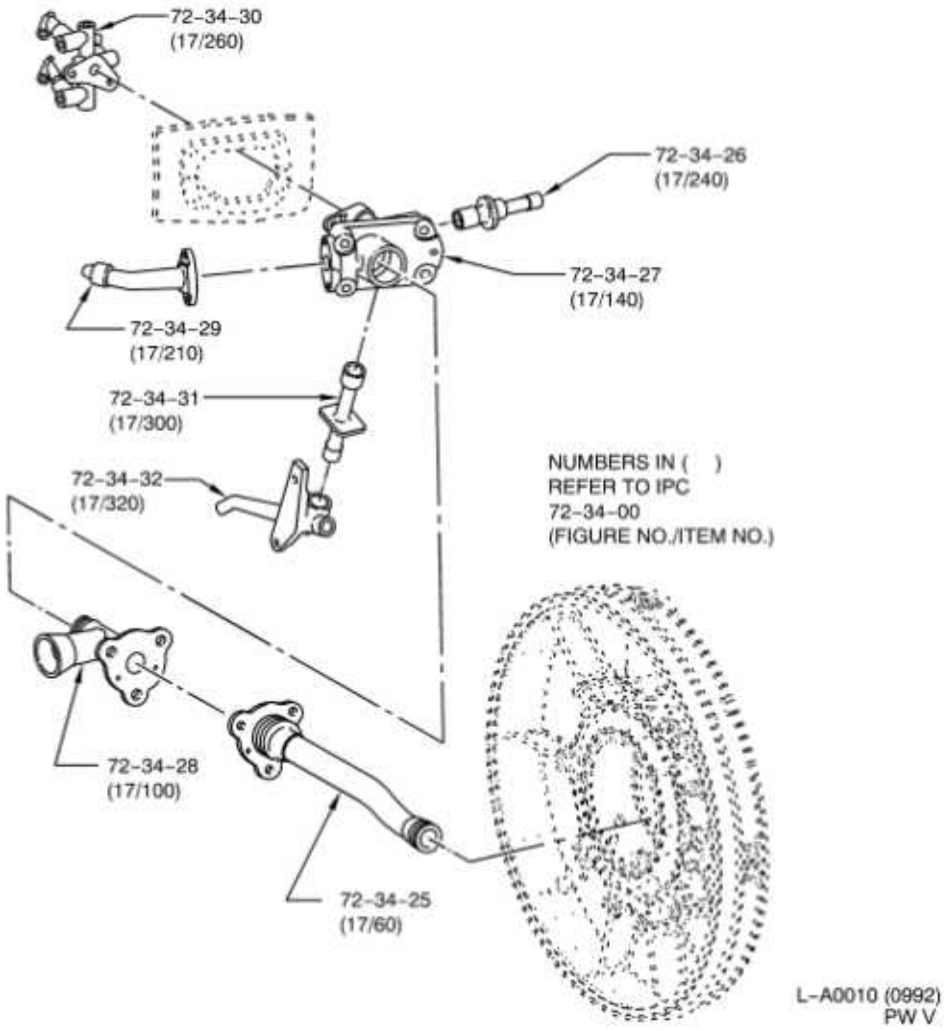
(11/100)
72−34−42
(11/70)
NUMBERS IN ( )
REFER TO IPC
72−34−00
(FIGURE NO./ITEM NO.)
L−A0009 (0885)
PW V

Intermediate Case
Figure 1 (Sheet 4)
(Task 72−34−00−990−003)

INTERMEDIATE CASE − HOW TO USE MANUAL


72−34−30
(17/260)
72−34−26
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72−34−27
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72−34−31
(17/300)
72−34−32
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NUMBERS IN ( )
REFER TO IPC
72−34−00
(FIGURE NO./ITEM NO.)
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(17/100)
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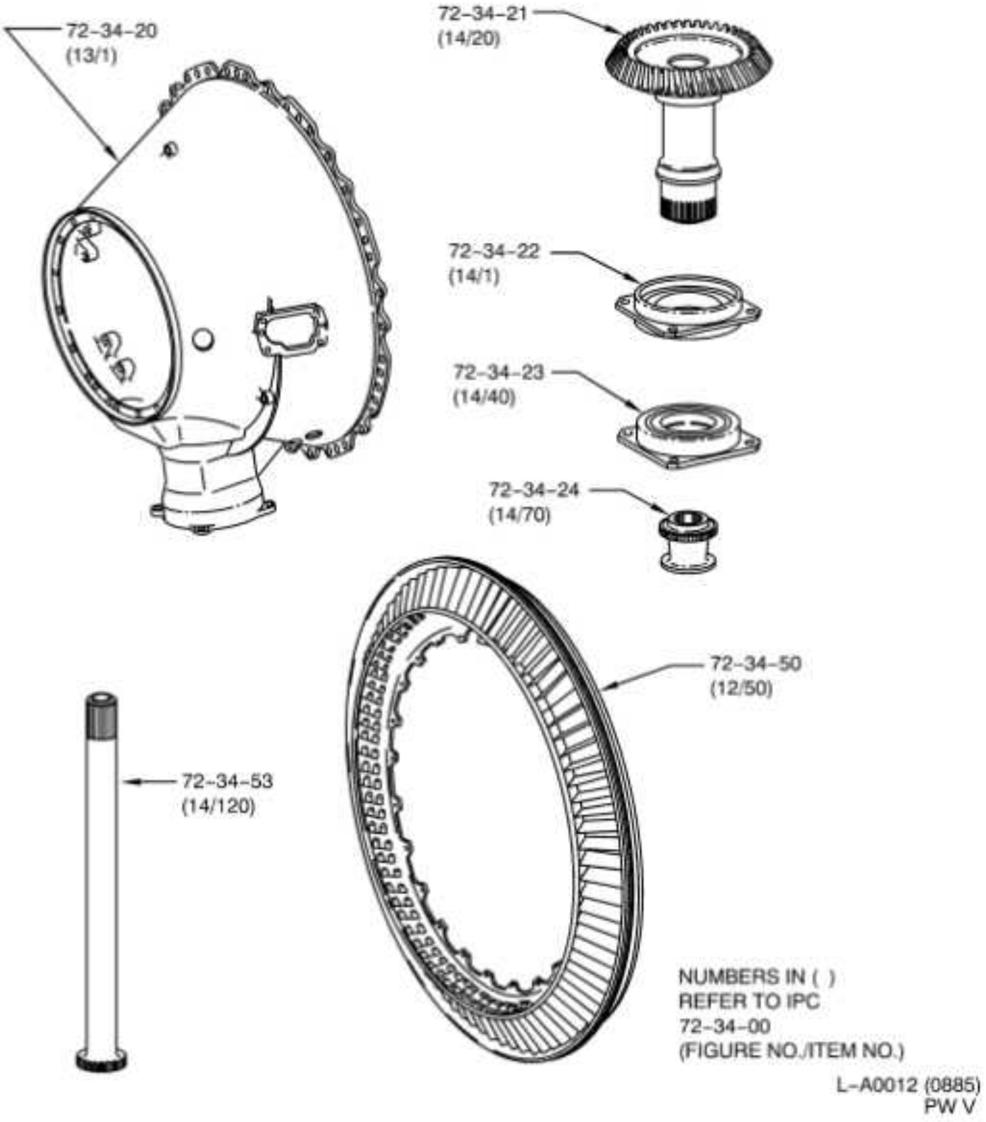
(17/60)
L−A0010 (0992)
PW V

Intermediate Case
Figure 1 (Sheet 5)
(Task 72−34−00−990−003)

INTERMEDIATE CASE - HOW TO USE MANUAL


72-34-20
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72-34-21
(14/20)
72-34-22
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(14/40)
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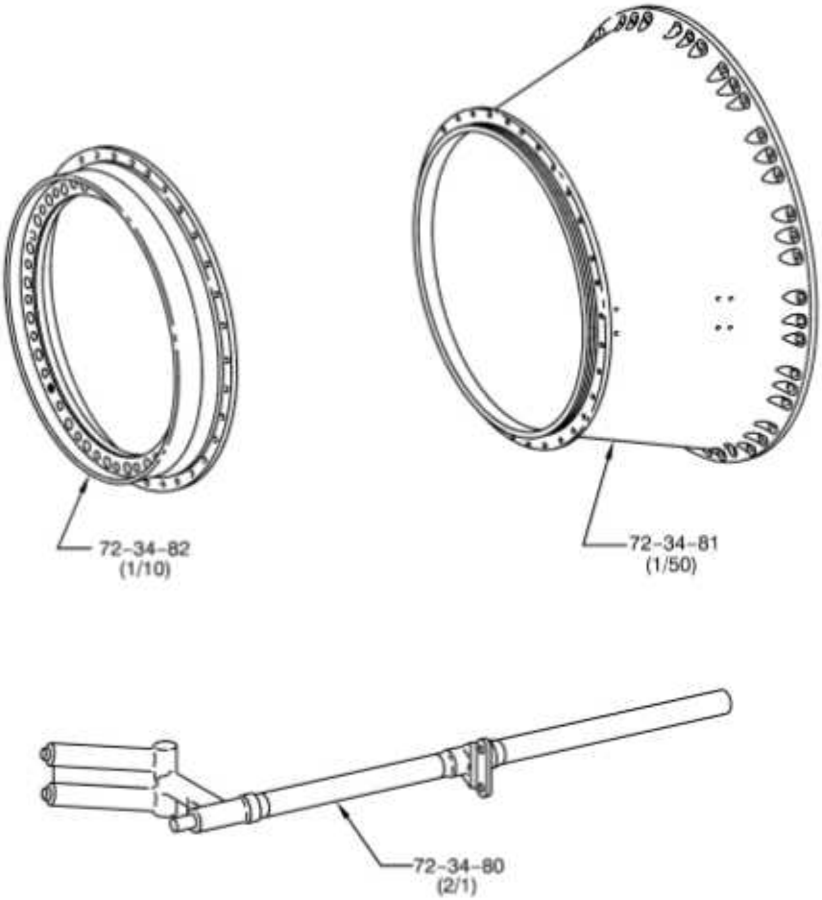
72-34-53
(14/120)
NUMBERS IN ( )
REFER TO IPC
72-34-00
(FIGURE NO./ITEM NO.)
L-A0012 (0885)
PW V

Intermediate Case
Figure 1 (Sheet 6)
(Task 72-34-00-990-003)


72-34-82
(1/10)
72-34-81
(1/50)
72-34-80
(2/1)

NUMBERS IN ( )
REFER TO IPC
72-34-00
(FIGURE NO./ITEM NO.)

L-A0013 (0885)
PW V

Intermediate Case
Figure 1 (Sheet 7)
(Task 72−34−00−990−003)

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INTERMEDIATE CASE − DESCRIPTION AND OPERATION

Task 72−34−00−990−002:

1. Intermediate Case

See Figure 1.

A. Intermediate Case − General

(1) The intermediate case is a major structural member of the engine that supports the thrust bearings for both the LPC and HPC rotors. The No. 1 ball bearing is supported by a cone support attached to the inner front flange of the compressor intermediate case. The No. 2 ball bearing is supported by the inner rear flange of the compressor intermediate case. Two mount brackets located on the rear of the compressor intermediate case transmit the thrust generated by both rotors directly to the airframe structure. A puck arrangement on the upper rear face of the compressor intermediate case provides for an airframe structure connection to carry engine vertical and side loads.

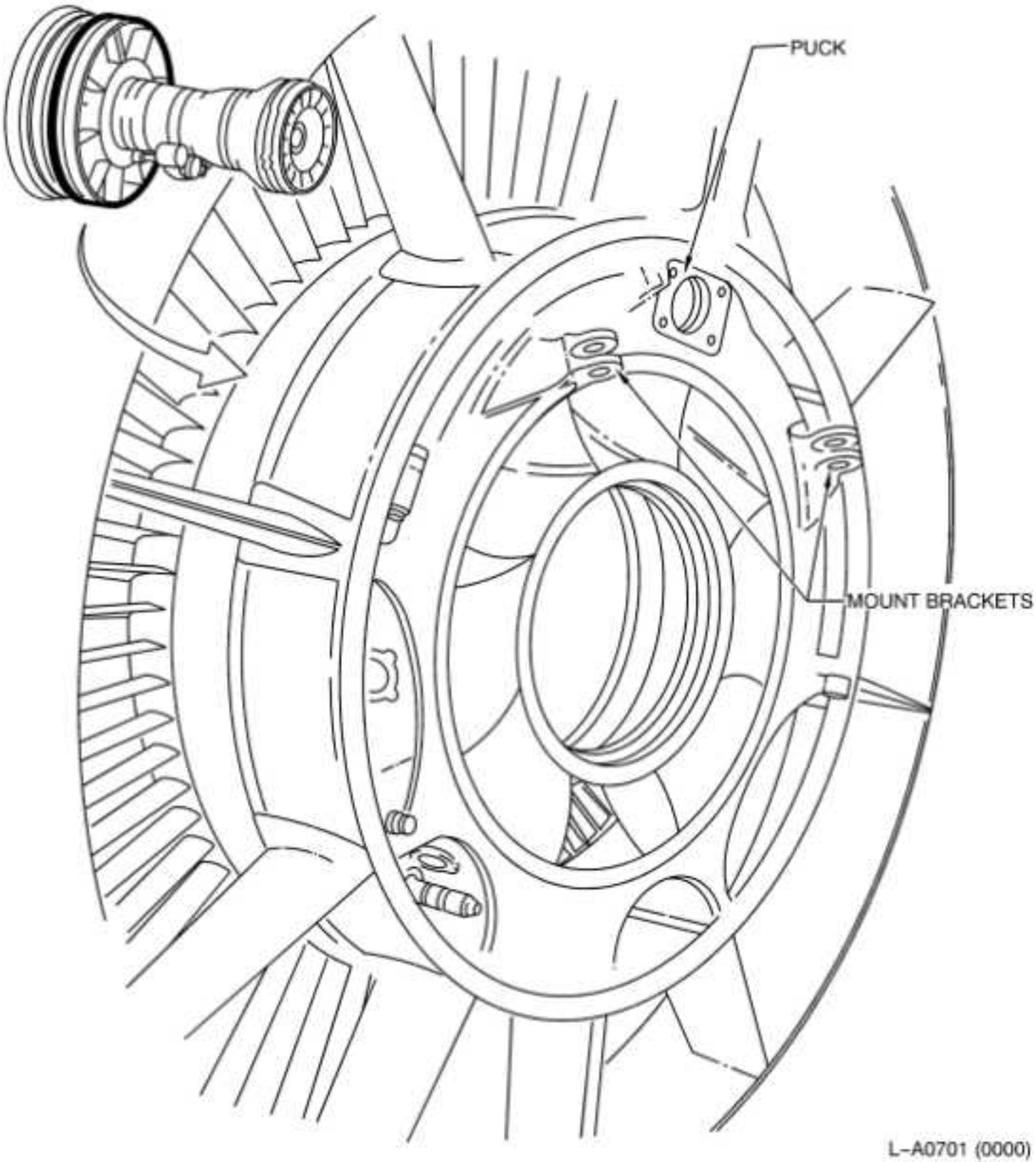
(2) In addition to the compressor intermediate case assembly, the intermediate case group consists of the 4th stage compressor stator, the angle gearbox and the bevel gear, gearshaft and driveshaft assembly which transmit power from the HPC rotor (N2) to the gearbox group.

B. Compressor intermediate case Assembly

(1) A steel compressor intermediate case and an aluminum fan exit rear case are attached through nine steel struts to form the compressor intermediate case assembly, the main structural element of the intermediate case group.

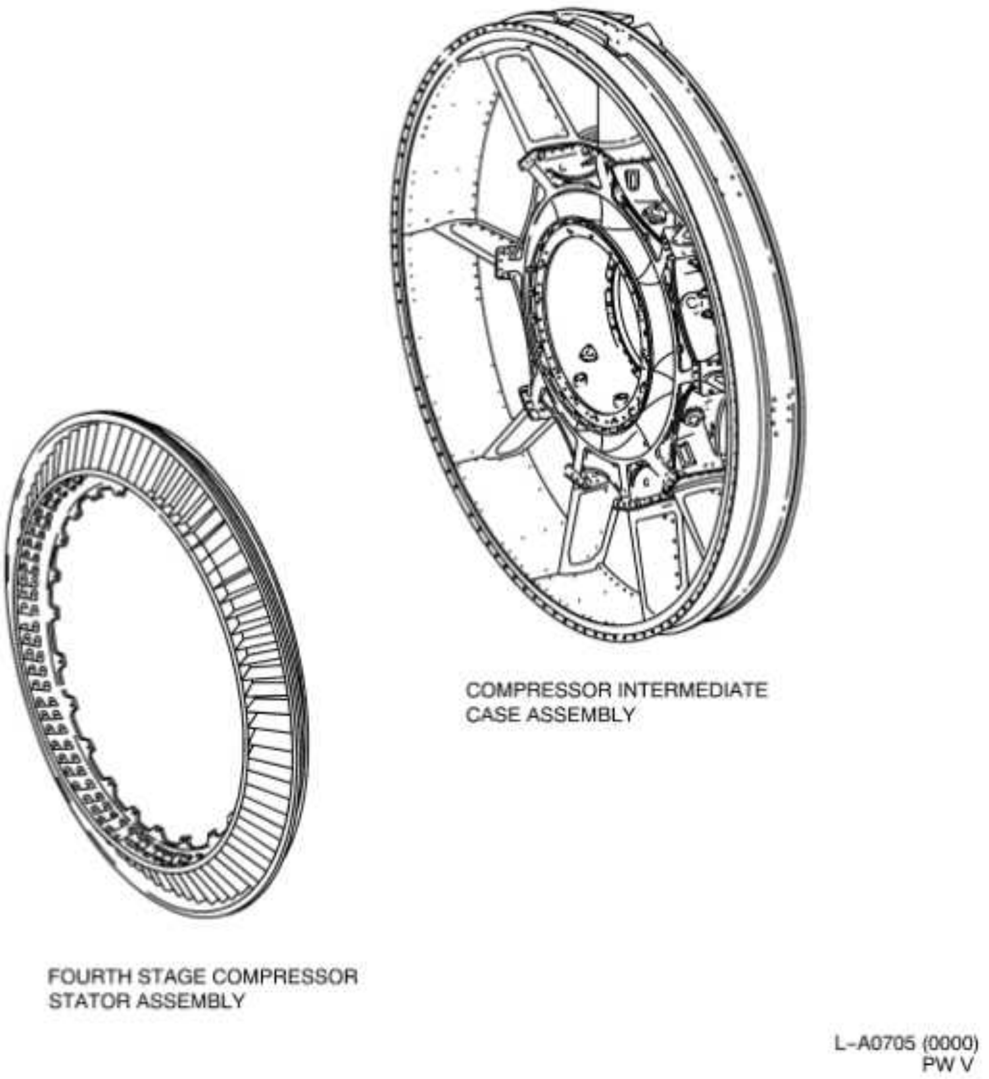
(2) The compressor intermediate case is a large investment casting which supports the No. 1, 1.5 and 2 bearings and transmits the thrust loads generated by the LPC and HPC rotors to the airframe structure through two mount brackets. The primary (main gas generator) air−stream passes through the compressor intermediate case on its way from the LPC to the HPC. Aerodynamic panels attached to the OD provide the inner containment for the secondary (fan discharge) airstream.

INTERMEDIATE CASE − DESCRIPTION AND OPERATION


PUCK
MOUNT BRACKETS
L−A0701 (0000)
PW V

Intermediate Case
Figure 1 (Sheet 1)
(Task 72−34−00−990−002)

INTERMEDIATE CASE − DESCRIPTION AND OPERATION


COMPRESSOR INTERMEDIATE
CASE ASSEMBLY
FOURTH STAGE COMPRESSOR
STATOR ASSEMBLY
L−A0705 (0000)
PW V

Intermediate Case
Figure 1 (Sheet 2)
(Task 72−34−00−990−002)

INTERMEDIATE CASE − DESCRIPTION AND OPERATION

(3) The fan exit rear case is an aluminum weldment which at the front attaches to the fan exit case and vane assembly and at the rear to the airframe supplied fan exhaust hardware. Aerodynamic panels attached to the ID of the fan exit rear case provides the outer containment for the secondary (fan discharge) airstream.

(4) The nine struts that span the secondary (fan discharge) airstream are welded to the compressor intermediate case and are attached to the fan exit rear case by pin rivets to provide the stiffness required of this assembly.

C. Fourth Stage Compressor Stator Assembly

(1) The 4th stage compressor stator consists of 80 aluminum vanes retained in aluminum inner and outer shroud rings. The stator is bolted to the inner front flange of the compressor intermediate case. The vanes serve to direct the primary (main gas generator) airflow as it exits the LPC.

INTERMEDIATE CASE - DISASSEMBLY-01

Task 72-34-00-030-001:

1. Disassemble Intermediate Case

A. Equipment And Materials Necessary

Standard Tools:
1/4-28 Jackscrews (3 Necessary)

Special Tools:

PWA 76154	Adapter (2 Necessary)
PWA 76155	Sling
PWA 85450	Stand, Storage/Transport
PWA 85662	Bracket, Support (2 Necessary - Optional To PWA 85667)
PWA 85667	Bracket, Support (2 Necessary)
PWA 102119	Fixture
PWA 102120	Fixture

B. Procedure

Subtask 72-34-00-030-051:

(1) Install PWA 85662 or PWA 85667 Bracket at the 3 and 9 o'clock locations on intermediate case with bolts provided. Using hoist, PWA 76154 Adapters, and PWA 76155 Sling raise case from assembly fixture and install in PWA 85450 Stand. Remove hoist and sling. Trunnion case to horizontal (flight position). See Figure 501.

Subtask 72-34-00-030-053:

(2) FOR THESE MODELS: 4152, 4156A, 4158
Remove the HPC secondary flow control valve, IDGS air/oil heat exchanger valve override solenoid as follows. See Figure 502.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove the lockwire that attaches the pressure switch tube assembly to the IDGS air/oil heat exchanger valve override pressure switch and the solenoid adapters at approximately the 1 o'clock position on intermediate case. Remove the pressure switch tube from the engine.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Remove the two bolts that attach the switch to the bracket and remove the switch.

(c) FOR THESE MODELS: 4152, 4156A, 4158
Remove the four bolts that attach the solenoid to the case and remove the solenoid and the brackets.

(d) FOR THESE MODELS: 4152, 4156A, 4158
Remove cap, adapters, plug, and gaskets from the solenoid. Install protective closures.

Subtask 72−34−00−030−063:

(3) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the turbine vane and blade cooling air valve, IDGS air/oil heat exchanger valve override solenoid as follows. See Figure 502A.

(a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the lockwire that attaches the pressure switch tube assembly to the IDGS air/oil heat exchanger valve override pressure switch and the solenoid adapters at approximately the 1 o'clock position on intermediate case. Remove the pressure switch tube from the engine.

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the two bolts that attach the switch to the bracket and remove the switch.

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the four bolts that attach the solenoid to the case and remove the solenoid and the brackets.

(d) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the cap, adapters, plug, and gaskets from the solenoid. Install protective closures.

Subtask 72−34−00−030−060:

(4) Remove the start/stability bleed valve solenoid at 5 o'clock position as follows. See Figure 503.

INTERMEDIATE CASE − DISASSEMBLY−01

(a) Remove the lockwire and disconnect the (AA35), (AA36), and (AA37) bleed valve supply tubes. Remove any clamp installations that attach the tubes. Remove the tubes. Remove the four bolts and bracket. Remove the solenoid. Remove the cap, adapters, plug, and gaskets from the solenoid. Install the protection covers.

NOTE: The bracket attached to the solenoid is for (Post SB PW4ENG 75−41) engines only.

Subtask 72−34−00−030−062:

(5) Remove the four bolts that attach the brackets and the stability bleed pneumatic relay valve to intermediate case. Remove the brackets and valve. Remove the three bolts and nuts that attach the valve to the bracket. Remove the valve. Remove the adapters and gaskets from the valve. Install the protection covers.

NOTE: The clamp bracket attached to the solenoid support bracket is for (Post SB PW4ENG 75−41) engines only.

Subtask 72−34−00−030−061:

(6) FOR THESE MODELS: 4152, 4156A, 4158
Remove the HPC secondary flow control valve, turbine vane and blade cooling air valve solenoid as follows. See Figure 504.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove the four bolts that attach the HPC secondary flow control valve, turbine vane and blade cooling air valve solenoid to the intermediate case at approximately the 10 o'clock position.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Remove the solenoid and bracket from the case. Remove the caps, adapters, and gaskets from the solenoid. Install protective closures.

Subtask 72−34−00−030−064:

(7) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the turbine vane cooling air valve, turbine vane and blade cooling air valve solenoid as follows. See Figure 504A.

INTERMEDIATE CASE - DISASSEMBLY-01

(a) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Remove the four bolts that attach the turbine vane cooling air valve, turbine vane and blade cooling air valve solenoid to the intermediate case at approximately the 10 o'clock position.

(b) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Remove the solenoid and bracket from the case. Remove the caps, adapters, and gaskets from the solenoid. Install protective closures.

(8) Use PWA 102120 Fixture to remove the main bearing (oil) pressure tube assembly from the tube connector in the intermediate case at approximately the 9 o'clock position. See Figure 505.

R (9) Remove the main bearing (outer) scavenge tube assembly from the scavenge tube (elbow) assembly in the intermediate case at approximately the 7:30 o'clock position. See Figure 505.

R (a) Get the PWA 102119 Fixture.

R (b) Install the two detail studs through two holes in the scavenge tube flange and into the intermediate case.

R (c) Screw the locating pin into the last threaded hole.

R (d) Turn the collar nut counter-clockwise until it is near the T-handel.

R (e) Turn the C-washer away from the threaded rod, and remove the support assembly from the tube assembly.

R (f) Put the tube assembly into the scavenge tube. With the tube assembly not fully into the scavenge tube, align the locating pin with the clearance hole in the support and put the support on the threaded rod.

R (g) Put the tube assembly into the scavenge tube.

R (h) Align the two studs with the clearance holes in the support. When the support hits the knurled stop of the locating pin, turn the check nuts and make the support level.

R (i) Move the C-washer so it covers the slot in the
R support and turn the collar nut until it stops
R against the C-washer.

R (j) Turn the T-handle counter-clockwise to loosen the
R scavenge tube from the intermediate case.

R (k) Remove the Fixture details from the scavenge tube.
R Remove the two studs and locating pin from the
R intermediate case.

R (l) Remove the two studs and locating pin from the
R intermediate case, and store the details in the
R support detail.

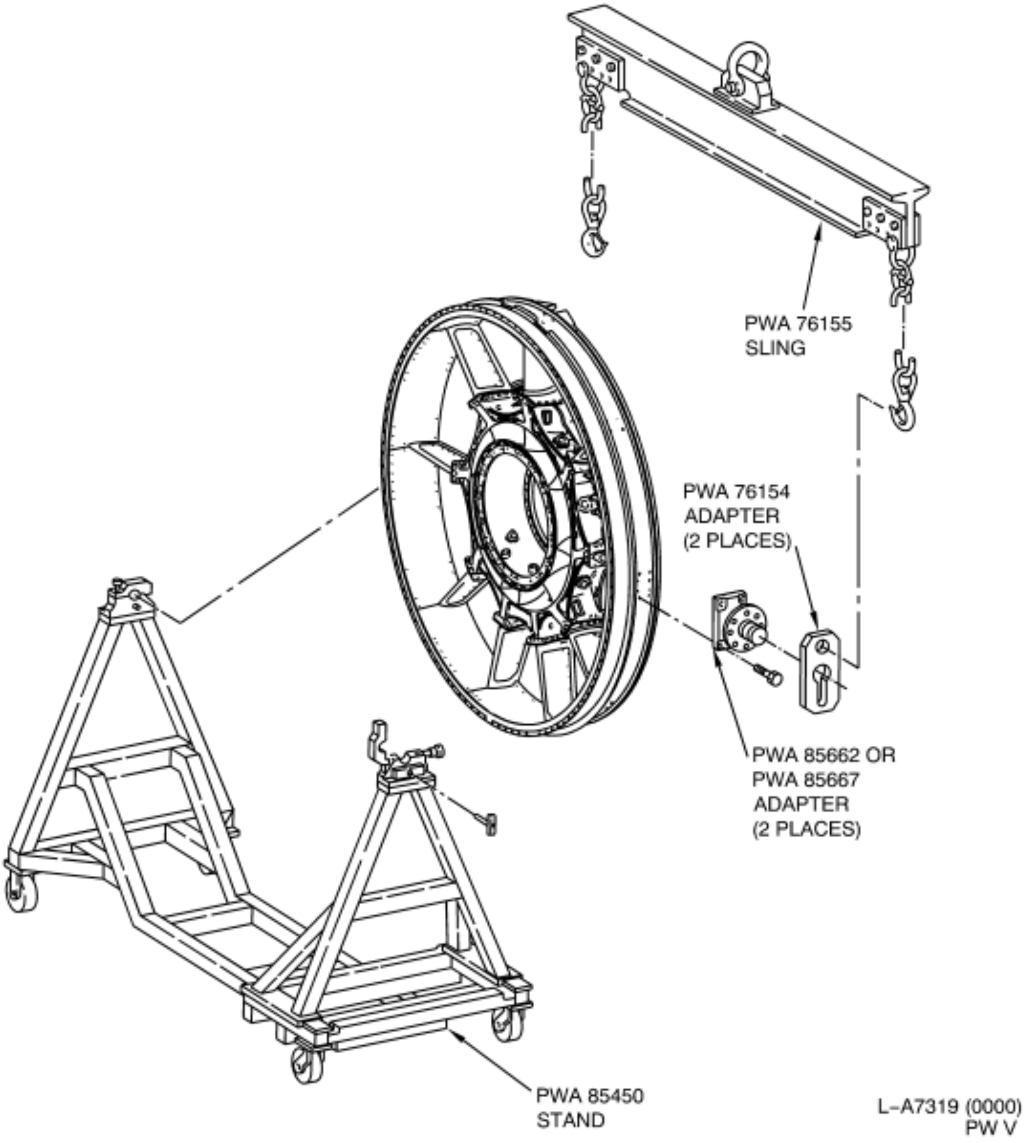
R (m) Remove the scavenge tube from the intermediate
R case. Discard the packings.

(10) Remove the engine mount nuts and lock plates from the engine mount boss at the 12 o'clock position on the rear of the intermediate case as follows: See Figure 506.

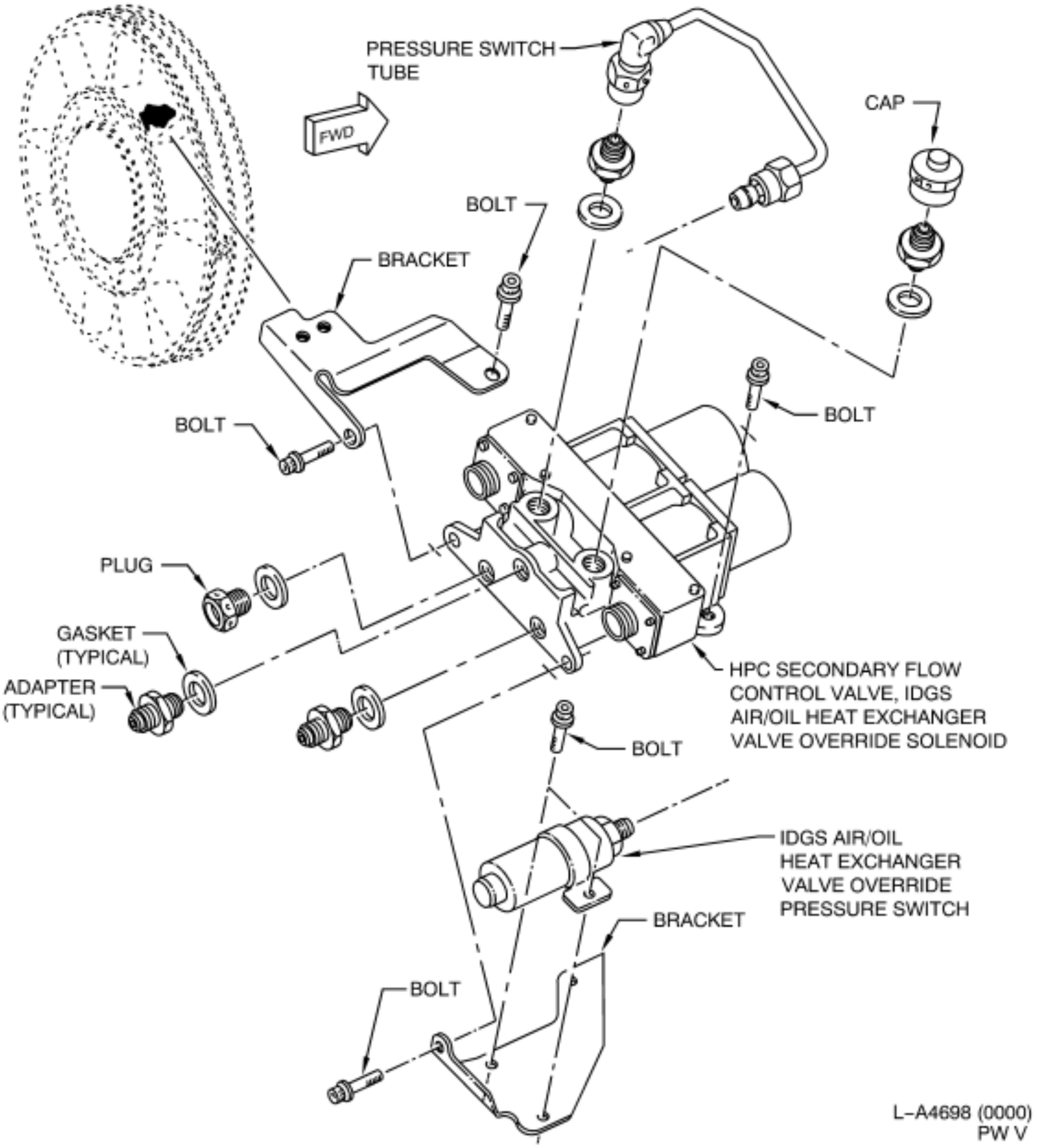
(a) Remove the safety wire from the two bolts (506/3).

(b) Remove the bolts (506/3) at two locations and remove the nuts and lock plate assembly from the intermediate case,.

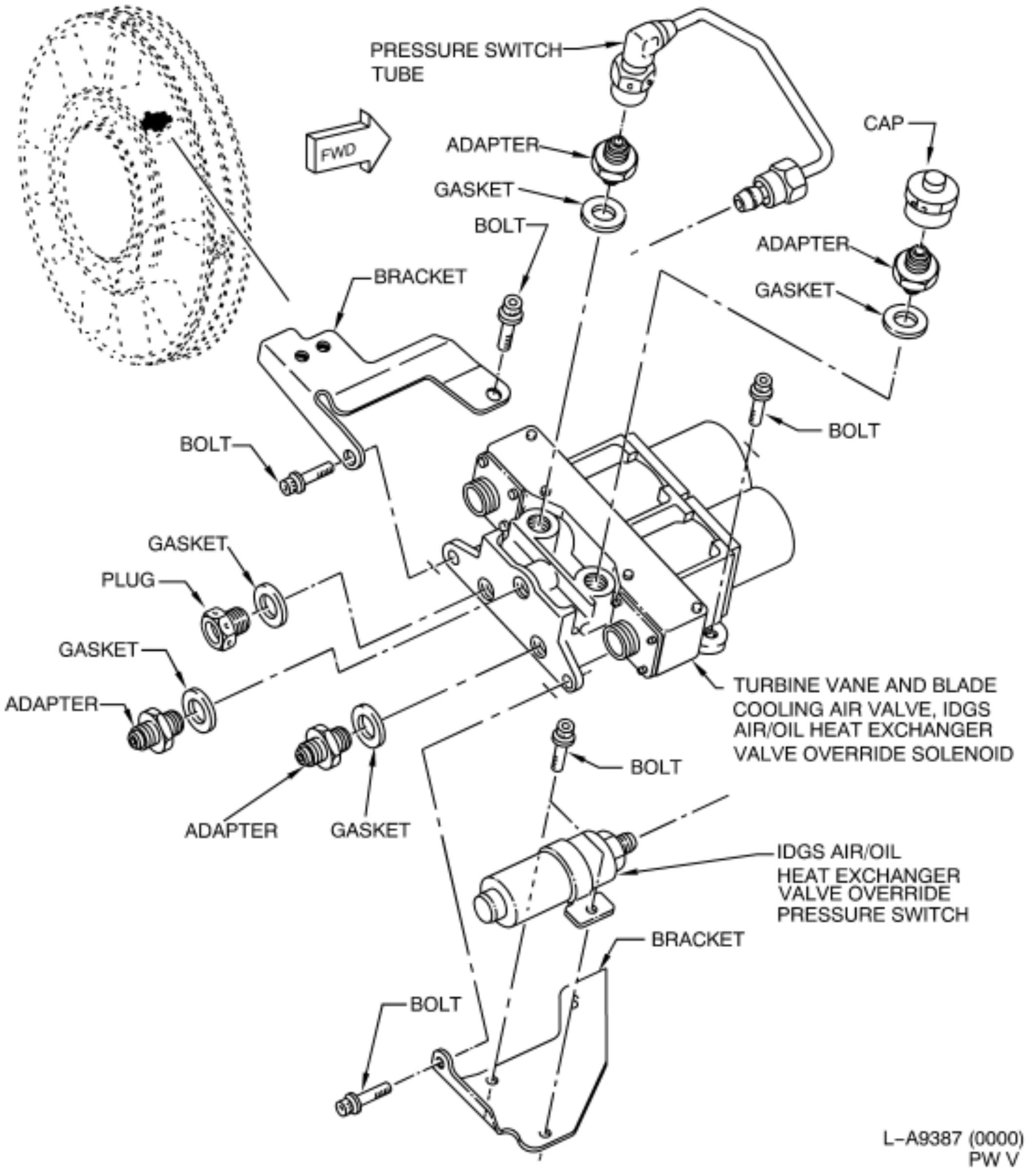
(c) Remove the engine mount nuts (506/1) from the engine mount lock plates (506/2).


PWA 76155
SLING
PWA 76154
ADAPTER
(2 PLACES)
PWA 85662 OR
PWA 85667
ADAPTER
(2 PLACES)
PWA 85450
STAND
L−A7319 (0000)
PW V

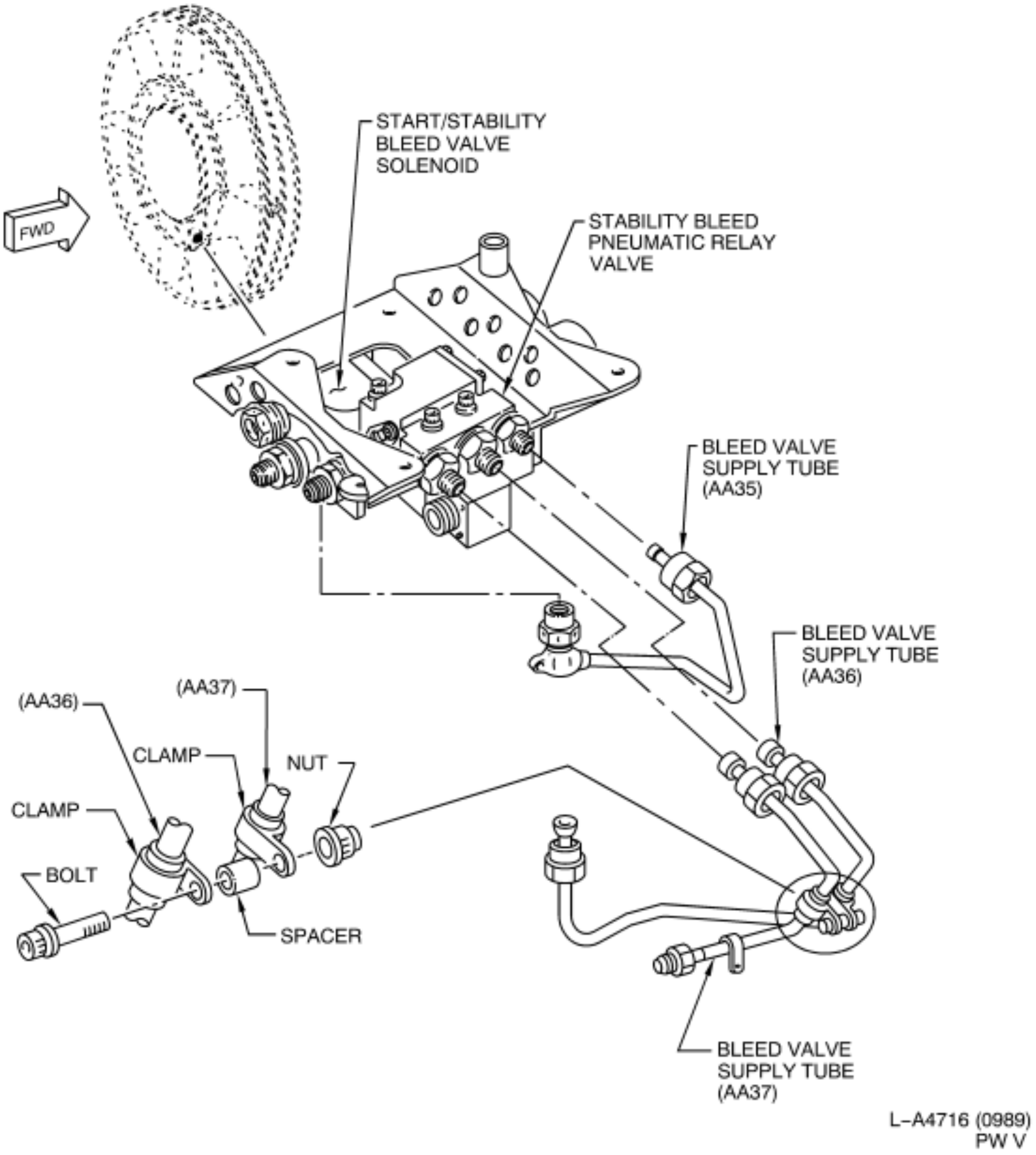
Installation Of The Intermediate Case In A Stand
Figure 501
(Task 72−34−00−030−001)


PRESSURE SWITCH TUBE
FWD
CAP
BOLT
BRACKET
BOLT
BOLT
PLUG
GASKET (TYPICAL)
ADAPTER (TYPICAL)
HPC SECONDARY FLOW CONTROL VALVE, IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE SOLENOID
BOLT
IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE PRESSURE SWITCH
BRACKET
BOLT
L-A4698 (0000)
PW V

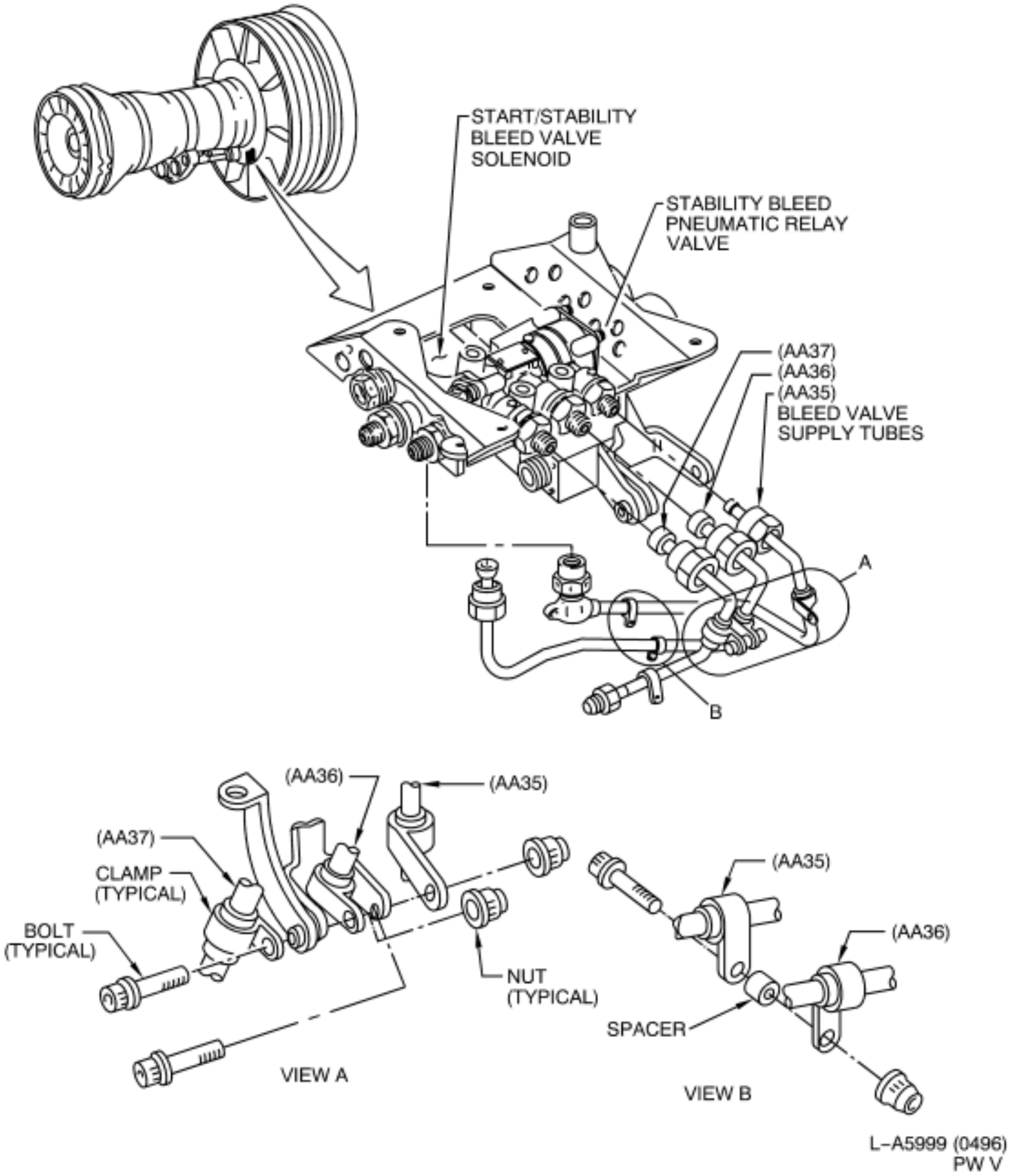
Removal Of The HPC Secondary Flow Control Valve,
IDGS Air/Oil Heat Exchanger Valve Override Solenoid
Figure 502
(Task 72-34-00-030-001)


PRESSURE SWITCH TUBE
FWD
ADAPTER
GASKET
CAP
BOLT
BRACKET
ADAPTER
GASKET
BOLT
BOLT
GASKET
PLUG
GASKET
ADAPTER
TURBINE VANE AND BLADE COOLING AIR VALVE, IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE SOLENOID
BOLT
ADAPTER
GASKET
IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE PRESSURE SWITCH
BRACKET
BOLT
L-A9387 (0000)
PW V

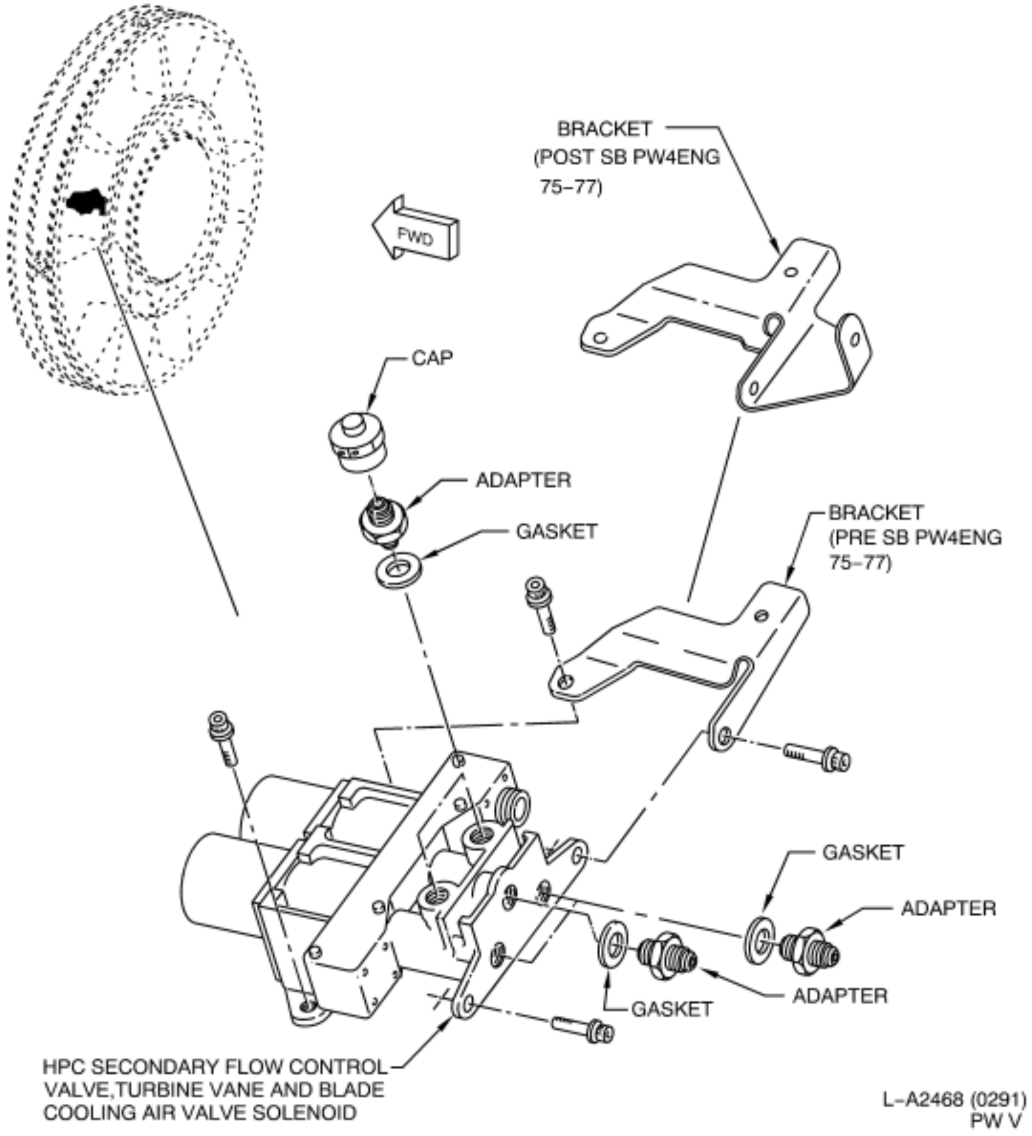
Removal Of The Turbine Vane And Blade Cooling Air Valve,
IDGS Air/Oil Heat Exchanger Valve Override Solenoid
Figure 502A
(Task 72-34-00-030-001)


FWD
START/STABILITY BLEED VALVE SOLENOID
STABILITY BLEED PNEUMATIC RELAY VALVE
BLEED VALVE SUPPLY TUBE (AA35)
BLEED VALVE SUPPLY TUBE (AA36)
(AA36)
(AA37)
CLAMP
NUT
CLAMP
BOLT
SPACER
BLEED VALVE SUPPLY TUBE (AA37)
L-A4716 (0989)
PW V

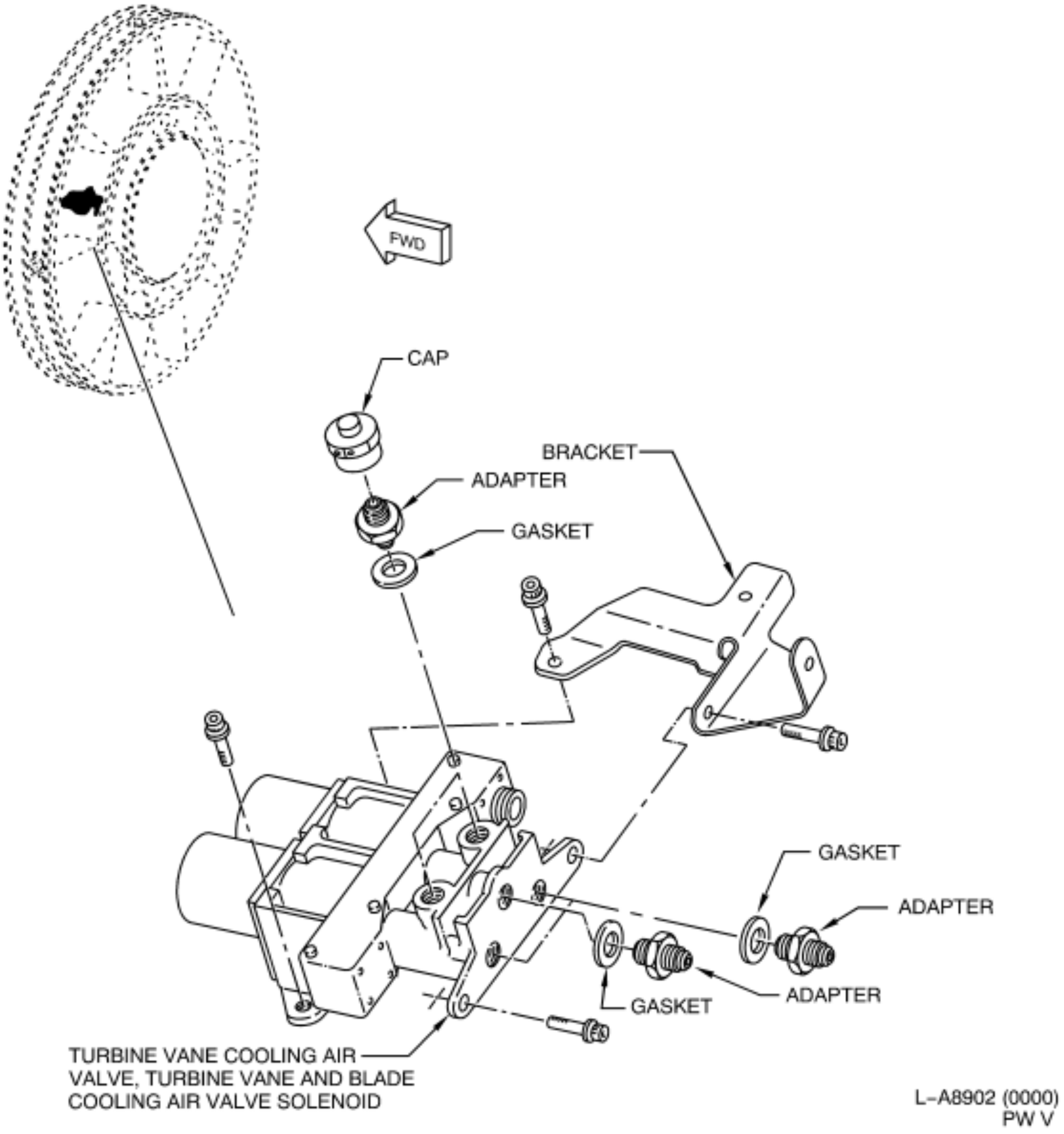
Removal Of The Start/Stability Bleed
Valve Solenoid (Post SB PW4ENG 75-28)
Figure 503 (Sheet 1)
(Task 72-34-00-030-001)


START/STABILITY BLEED VALVE SOLENOID
STABILITY BLEED PNEUMATIC RELAY VALVE
(AA37)
(AA36)
(AA35)
BLEED VALVE SUPPLY TUBES
A
B
(AA36)
(AA35)
(AA37)
CLAMP (TYPICAL)
BOLT (TYPICAL)
NUT (TYPICAL)
VIEW A
(AA35)
(AA36)
SPACER
VIEW B
L-A5999 (0496)
PW V

Removal Of The Start/Stability Bleed
Valve Solenoid (Post SB PW4ENG 75-41)
Figure 503 (Sheet 2)
(Task 72-34-00-030-001)


BRACKET
(POST SB PW4ENG
75-77)
FWD
CAP
ADAPTER
GASKET
BRACKET
(PRE SB PW4ENG
75-77)
GASKET
ADAPTER
ADAPTER
GASKET
HPC SECONDARY FLOW CONTROL
VALVE,TURBINE VANE AND BLADE
COOLING AIR VALVE SOLENOID
L-A2468 (0291)
PW V

Removal Of The HPC Secondary Flow Control Valve,
Turbine Vane And Blade Cooling Air Valve Solenoid
Figure 504
(Task 72-34-00-030-001)


FWD
CAP
BRACKET
ADAPTER
GASKET
GASKET
ADAPTER
ADAPTER
GASKET
TURBINE VANE COOLING AIR VALVE, TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
L-A8902 (0000)
PW V

Removal Of The Turbine Vane Cooling Air Valve,
Turbine Vane And Blade Cooling Air Valve Solenoid
Figure 504A
(Task 72-34-00-030-001)

INTERMEDIATE CASE - DISASSEMBLY-01

R
R
R
R
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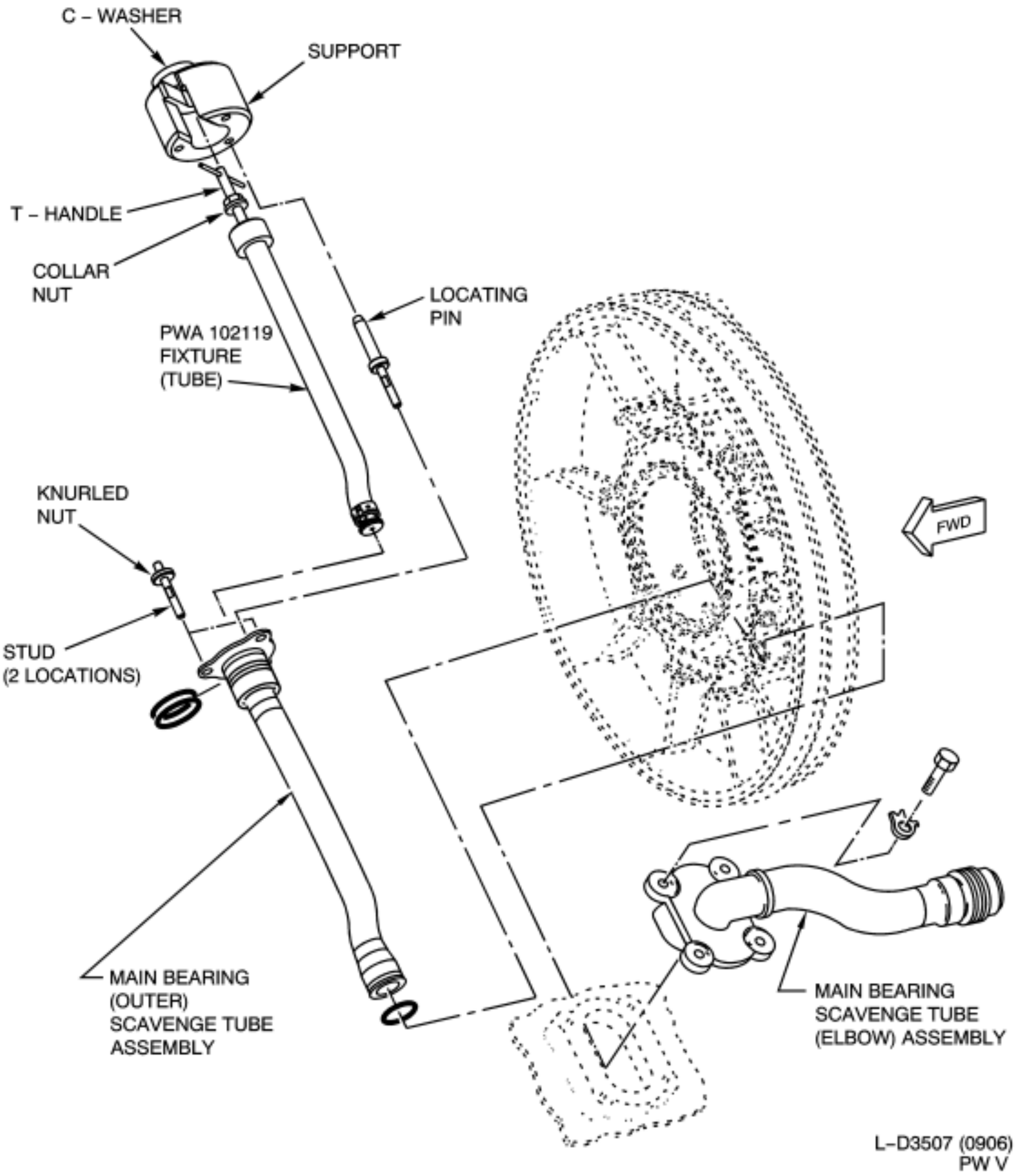
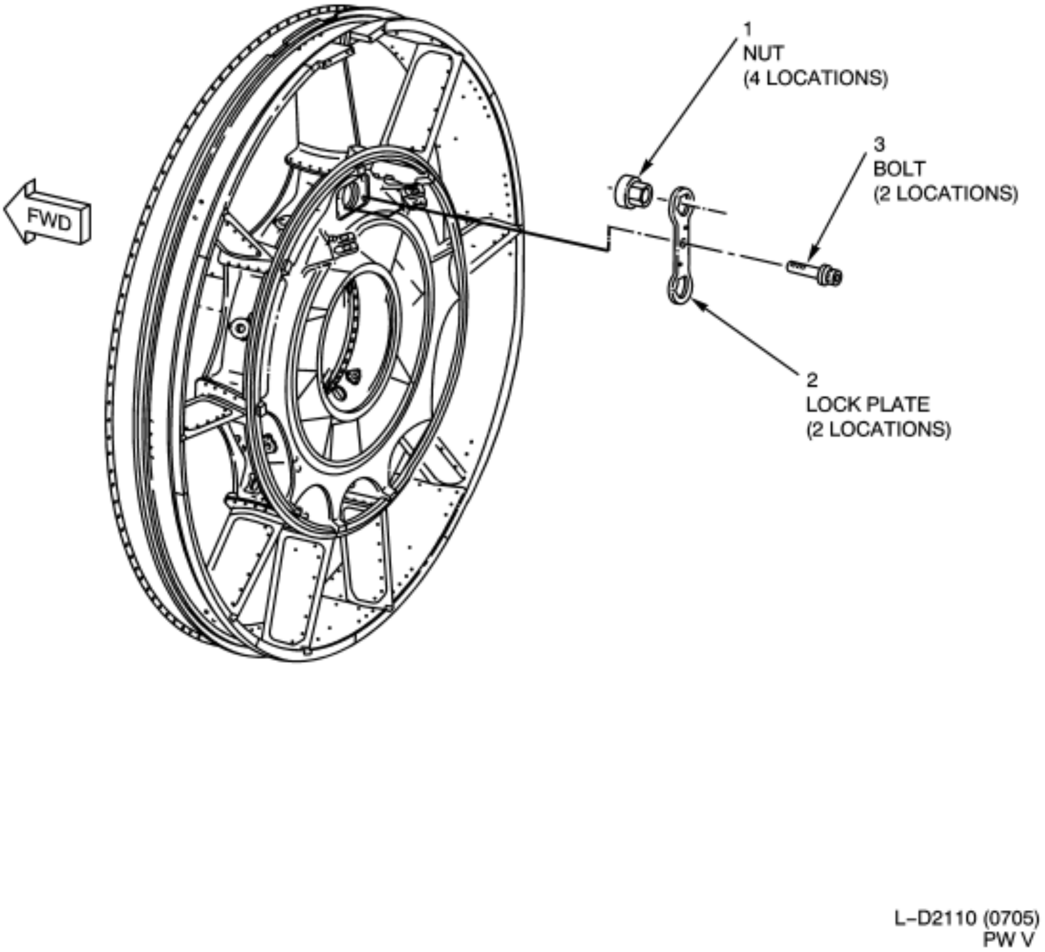
R


C - WASHER
SUPPORT
T - HANDLE
COLLAR NUT
LOCATING PIN
PWA 102119 FIXTURE (TUBE)
KNURLED NUT
FWD
STUD (2 LOCATIONS)
MAIN BEARING (OUTER) SCAVENGE TUBE ASSEMBLY
MAIN BEARING SCAVENGE TUBE (ELBOW) ASSEMBLY
L-D3507 (0906)
PW V

Removal Of The Main Bearing Scavenge Tubes And (Oil) Pressure Tube
Figure 505
(Task 72-34-00-030-001)


FWD
1
NUT
(4 LOCATIONS)
3
BOLT
(2 LOCATIONS)
2
LOCK PLATE
(2 LOCATIONS)
L-D2110 (0705)
PW V

Engine Mount Nuts And Lock Plates Removal
Figure 506
(Task 72-34-00-030-001)

Previous Pageblock Return to Previous Menu Next Pageblock

INTERMEDIATE CASE - DISASSEMBLY-02

Task 72-34-00-030-002:

1. Disassemble Intermediate Case Parts

A. Equipment And Materials Required

Special Tools:
PWA 12126 Base
PWA 85011 Wrench
PWA 85012 Puller (Optional To PWA 102000 Puller)
PWA 85199 Fixture
PWA 85251 Adapter
PWA 85252 Bracket
PWA 85259 Drift
PWA 85363 Plate, Disassembly
PWA 102000 Puller

Subtask 72-34-00-030-058:

B. Remove The Tube And Nozzle Assemblies

(1) Install PWA 85251 Adapter on PWA 85199 Fixture. Install the 1.5 bearing support assembly on the adapter with three clamps. See Figure 501.

(2) Remove the gearbox drive (oil) nozzle assembly (502/5) from the 1.5 bearing support assembly. See Figure 502.

(3) Remove the gearbox drive (oil) pressure tube assembly (502/4) from both the nozzle assembly and the No. 1.5 and 2 bearing tube connector assembly (502/2).

  (a) If applicable, discard the packing.

(4) Remove the No. 2 bearing (oil) nozzle assembly (502/1) from the tube connector.

  (a) Remove the metering plug from the tube connector.

(5) Remove the No. 1.5 bearing (oil) nozzle assembly (503/1) from the tube connector. See Figure 503.

  (a) Remove the metering plug from the tube connector.

(6) Remove the tube connector (503/2) from the 1.5 bearing support assembly (503/3).

C. Remove The No. 1.5 And 2 Bearing (Carbon) Seal Assembly (Called Seal Assembly)
See Figure 504.

(1) Remove the bolts and washers that attach the seal assembly to the No. 1.5 bearing support assembly.

(2) Remove the seal assembly.

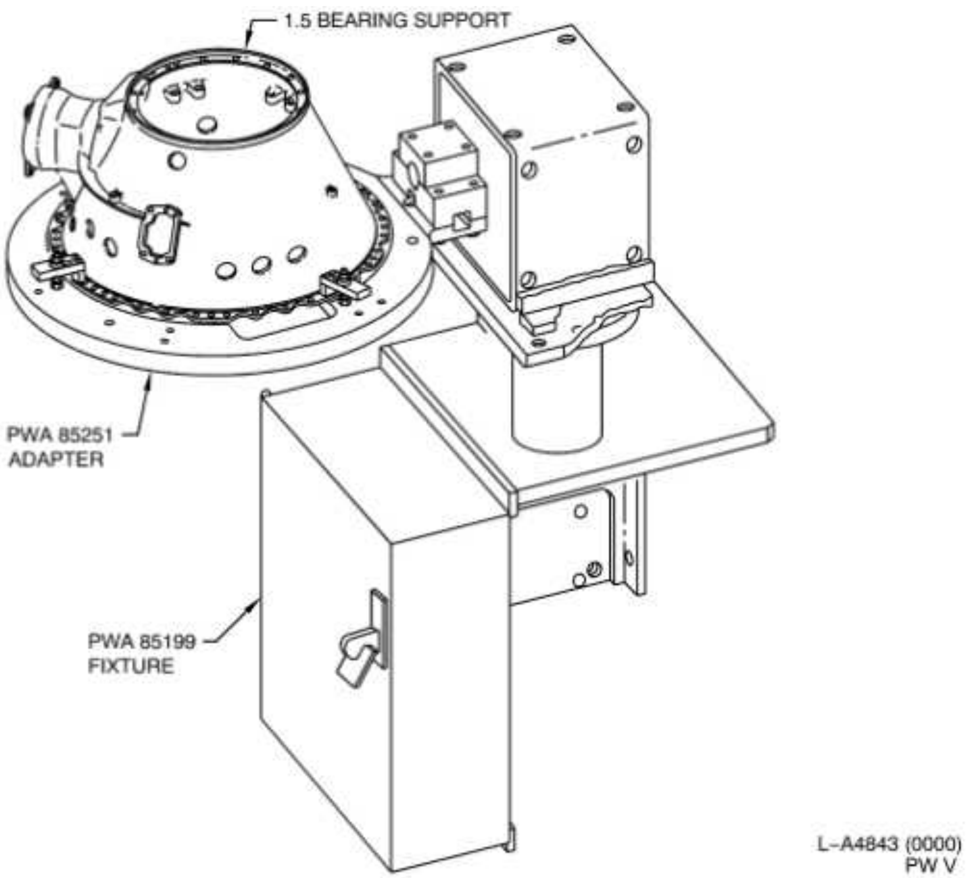
Subtask 72-34-00-030-059:

D. Remove The Gearbox Drive Bevel Gearshaft And Related Parts
See Figure 505.

(1) Remove the gearbox drive deflector.

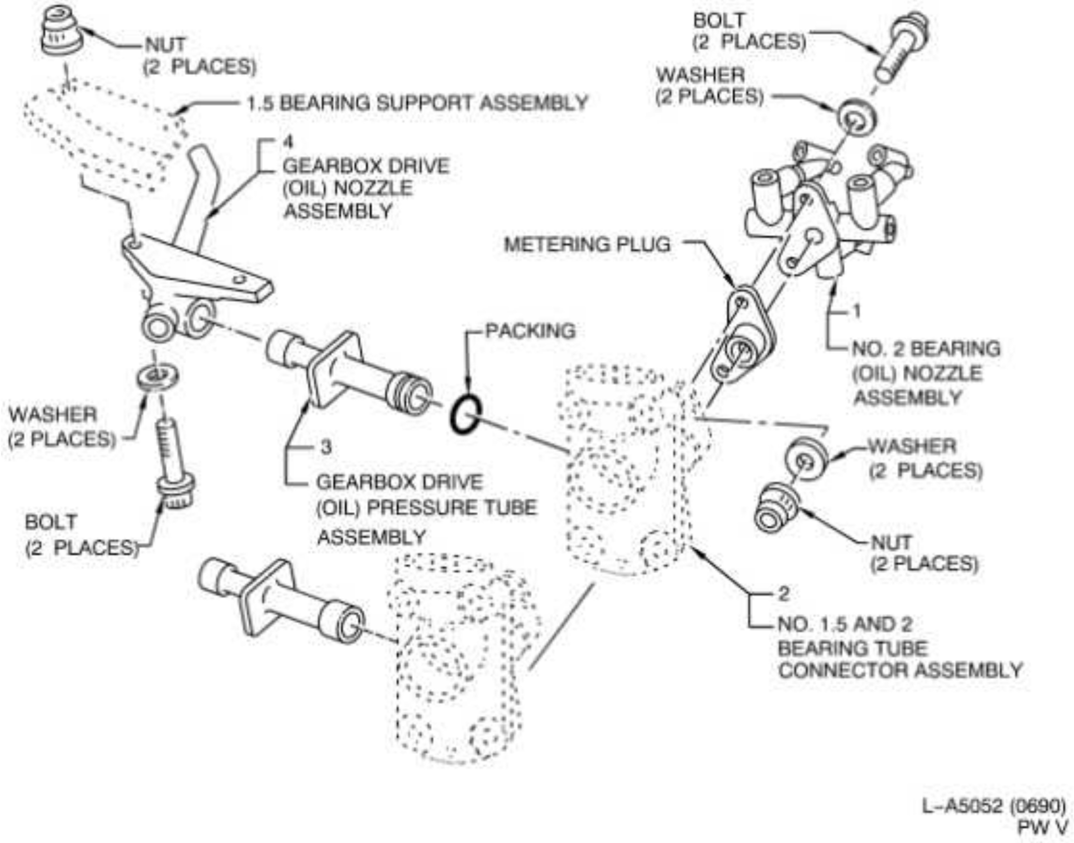
  (a) Remove the bolts and nuts that attach the deflector and ball bearing outer race to the 1.5 bearing support assembly.

INTERMEDIATE CASE − DISASSEMBLY−02


1.5 BEARING SUPPORT
PWA 85251
ADAPTER
PWA 85199
FIXTURE
L−A4843 (0000)
PW V

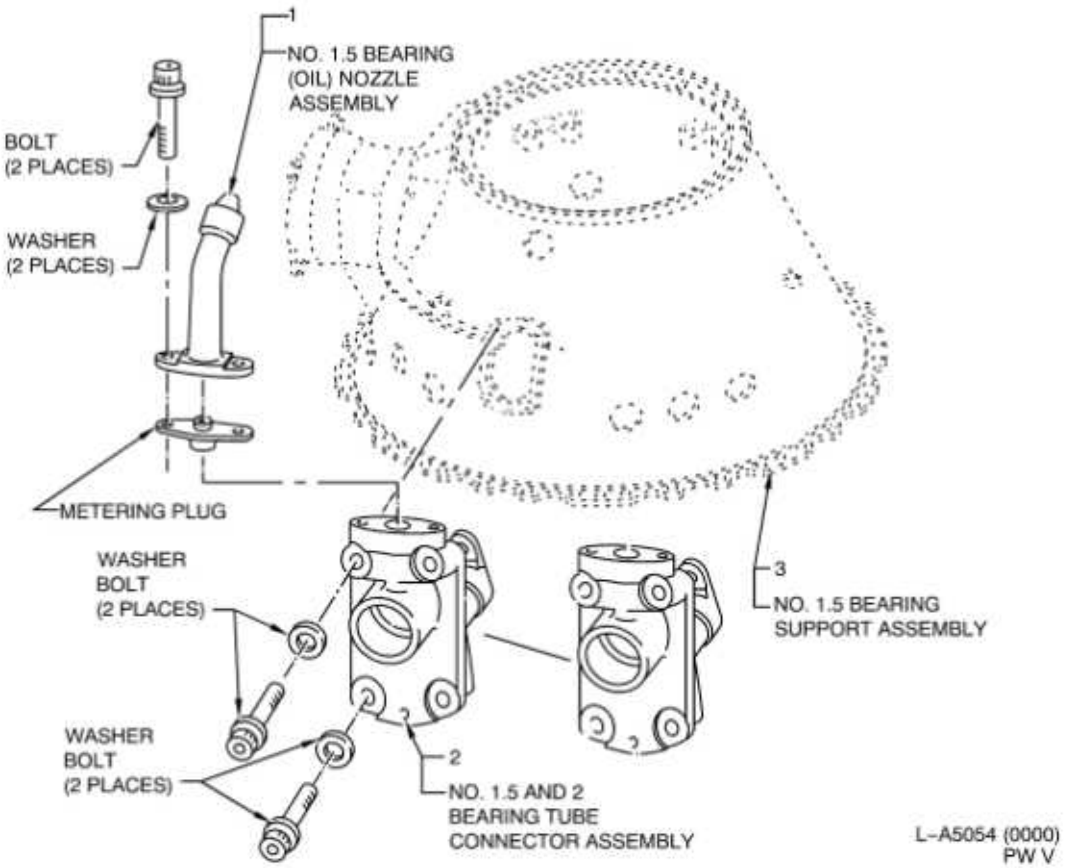
Install the No. 1.5 Bearing Support Assembly
In The Adapter
Figure 501
(Task 72−34−00−030−002)

INTERMEDIATE CASE - DISASSEMBLY-02


NUT
(2 PLACES)
1.5 BEARING SUPPORT ASSEMBLY
4
GEARBOX DRIVE
(OIL) NOZZLE
ASSEMBLY
BOLT
(2 PLACES)
WASHER
(2 PLACES)
METERING PLUG
1
NO. 2 BEARING
(OIL) NOZZLE
ASSEMBLY
PACKING
WASHER
(2 PLACES)
3
GEARBOX DRIVE
(OIL) PRESSURE TUBE
ASSEMBLY
BOLT
(2 PLACES)
WASHER
(2 PLACES)
NUT
(2 PLACES)
2
NO. 1.5 AND 2
BEARING TUBE
CONNECTOR ASSEMBLY
L-A5052 (0690)
PW V

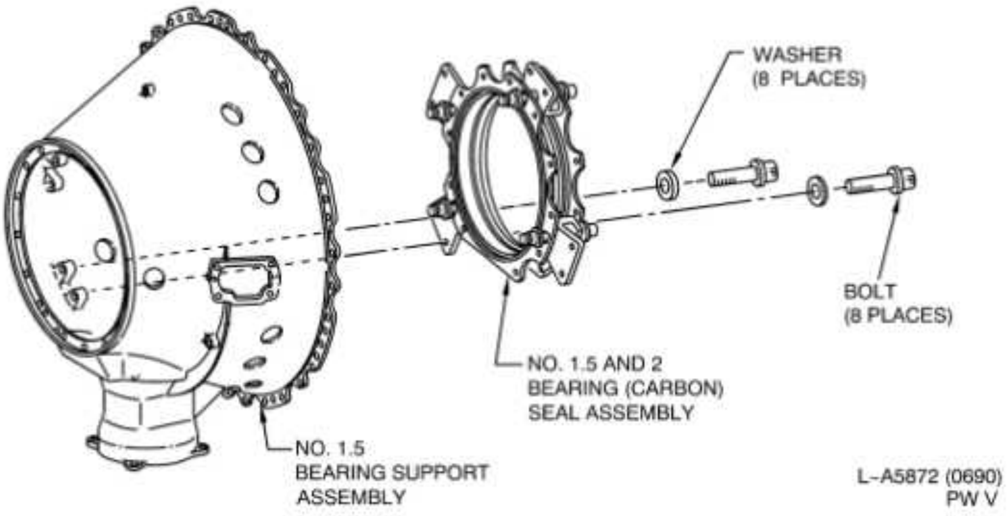
Remove The Nozzles
Figure 502
(Task 72-34-00-030-002)

INTERMEDIATE CASE − DISASSEMBLY−02


1
NO. 1.5 BEARING (OIL) NOZZLE ASSEMBLY
BOLT (2 PLACES)
WASHER (2 PLACES)
METERING PLUG
WASHER BOLT (2 PLACES)
WASHER BOLT (2 PLACES)
2
NO. 1.5 AND 2 BEARING TUBE CONNECTOR ASSEMBLY
3
NO. 1.5 BEARING SUPPORT ASSEMBLY
L−A5054 (0000)
PW V

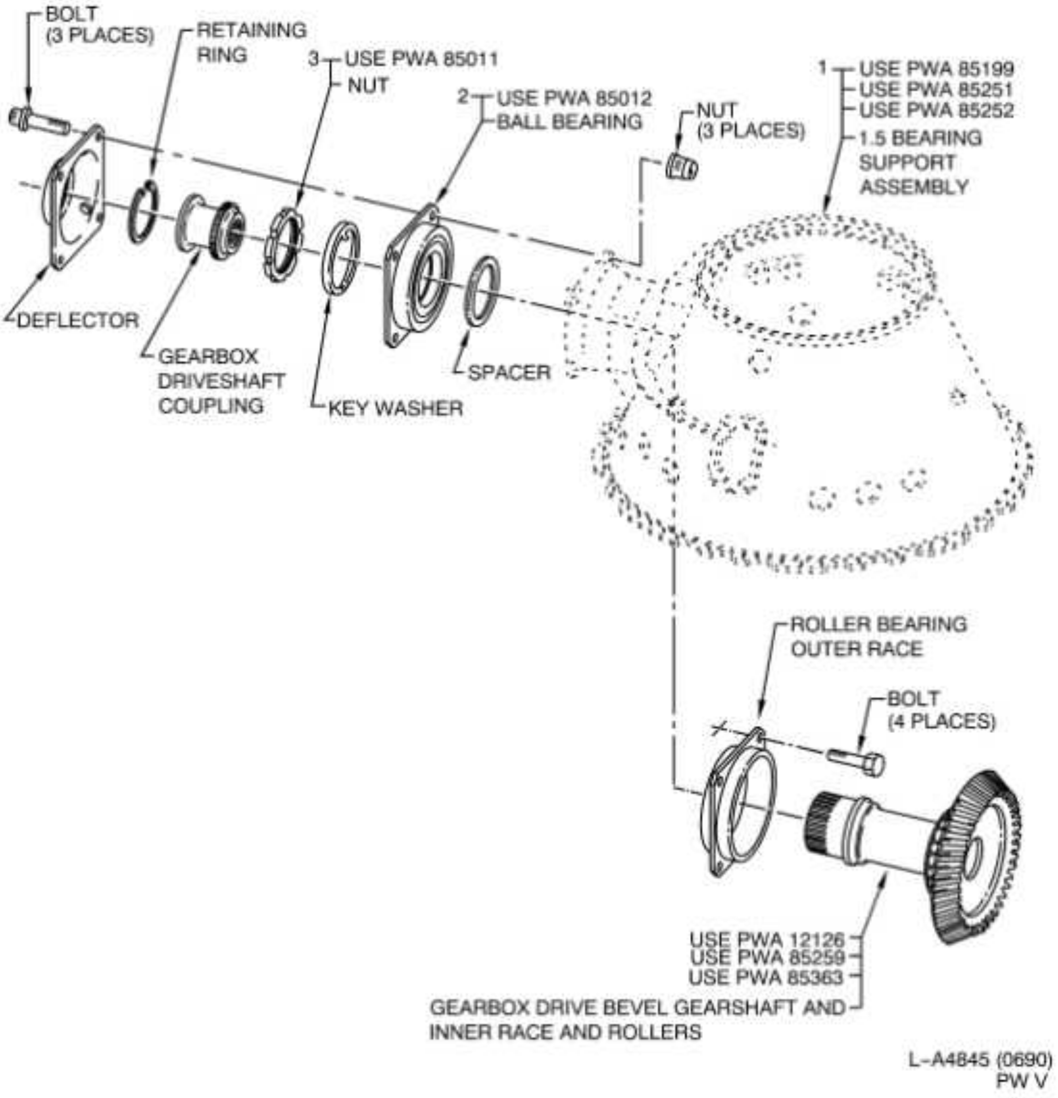
Remove The No. 1.5 Bearing (Oil) Nozzle Assembly And
The No. 1.5 and 2 Bearing Tube Connector Assembly
Figure 503
(Task 72−34−00−030−002)

INTERMEDIATE CASE − DISASSEMBLY−02


WASHER
(8 PLACES)
BOLT
(8 PLACES)
NO. 1.5 AND 2
BEARING (CARBON)
SEAL ASSEMBLY
NO. 1.5
BEARING SUPPORT
ASSEMBLY
L-A5872 (0690)
PW V

Remove the No. 1.5 And 2 Bearing
(Carbon) Seal Assembly
Figure 504
(Task 72−34−00−030−002)

INTERMEDIATE CASE - DISASSEMBLY-02


BOLT
(3 PLACES)
RETAINING
RING
3 USE PWA 85011
NUT
2 USE PWA 85012
BALL BEARING
NUT
(3 PLACES)
1 USE PWA 85199
USE PWA 85251
USE PWA 85252
1.5 BEARING
SUPPORT
ASSEMBLY
DEFLECTOR
GEARBOX
DRIVESHAFT
COUPLING
KEY WASHER
SPACER
ROLLER BEARING
OUTER RACE
BOLT
(4 PLACES)
USE PWA 12126
USE PWA 85259
USE PWA 85363
GEARBOX DRIVE BEVEL GEARSHAFT AND
INNER RACE AND ROLLERS
L-A4845 (0690)
PW V

1. See Figure 501
2. See Figure 507
3. See Figure 506

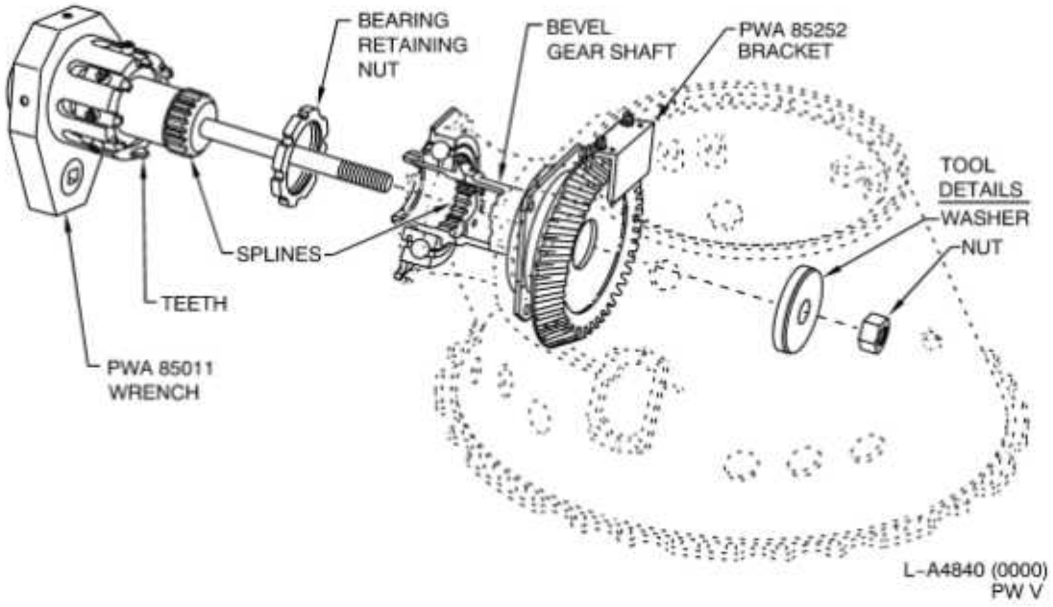
Remove The Gearbox Drive Bevel
Gearshaft And Related Parts
Figure 505
(Task 72-34-00-030-002)

- (b) Remove the deflector.
- (2) Remove the gearbox driveshaft coupling.
  - (a) Remove the retaining ring.
  - (b) Carefully pull out the coupling.
- (3) Remove the bearing retaining nut. Use PWA 85011 Wrench. See Figure 506.
  - (a) Attach PWA 85252 Bracket to the top inner flange of the 1.5 bearing support assembly at the 6 o'clock position.
  - (b) Un−bend the key washer on the gearshaft.
  - (c) Install the wrench on the gearshaft.
    - 1 Align the splines of the wrench with the internal splines of the gearshaft.
    - 2 Align the teeth of the wrench with the slots in the nut.
    - 3 Hold the wrench in place with the detail washer and nut.
  - (d) Remove the nut.
- (4) Remove the outer half of the ball bearing inner race with PWA 102000 or PWA 85012 Puller. See Figure 507.

  NOTE: PWA 102000 Puller will attach to all towershaft bearings. PWA 85012 Puller will attach to only PN 50A046, 50A048, 51G992 and 51G993 towershaft bearings.

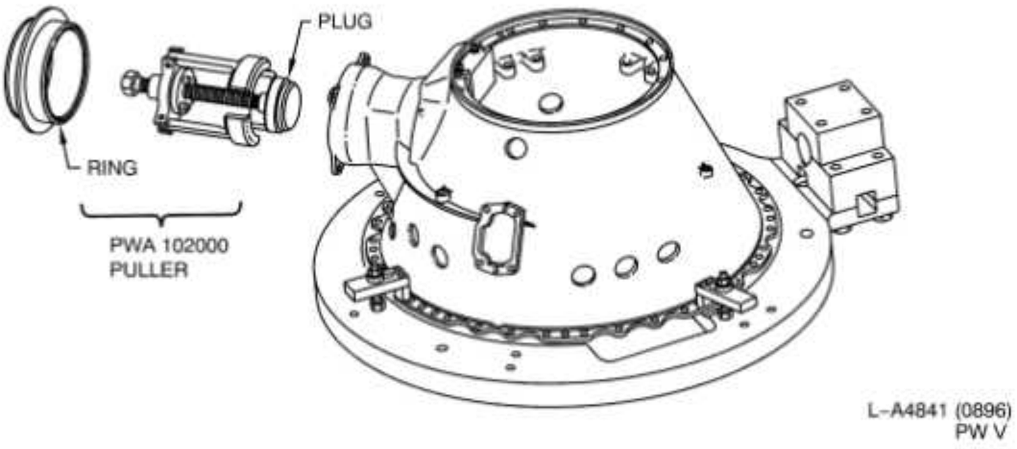
  - (a) Put the plug in the gearshaft.
  - (b) Adjust the jackscrew to engage the detail jaw in the puller groove of the inner race.
  - (c) Install the ring detail.
  - (d) Remove the outer half of the inner race.
- (5) Remove the bearing outer race and balls. See Figures 505 and 507.
- (6) Remove the inner half of the ball bearing inner race with PWA 102000 or PWA 85012 Puller.
  - (a) Put the plug in the gearshaft.
  - (b) Adjust the jackscrew to install the detail jaw behind the inner race.
  - (c) Install the ring detail.
  - (d) Remove the inner race.
  - (e) Remove the spacer from the gearshaft.
  - (f) Remove (PWA 85252) Bracket.
- (7) Remove the gearshaft and roller bearing inner race and rollers from the 1.5 bearing support assembly. See Figure 505.
- (8) Remove the roller bearing inner race from the gearshaft.
  - (a) Install PWA 85363 Plate on the gearshaft under the inner race.

INTERMEDIATE CASE - DISASSEMBLY-02


BEARING RETAINING NUT
BEVEL GEAR SHAFT
PWA 85252 BRACKET
TOOL DETAILS
WASHER
NUT
SPLINES
TEETH
PWA 85011 WRENCH
L-A4840 (0000)
PW V

Remove The Bearing Retaining Nut
Figure 506
(Task 72-34-00-030-002)

    - (b) Put the gearshaft on PWA 12126 Base.
    - (c) With PWA 85259 Drift and an arbor press, remove the inner race.
- (9) Remove the roller bearing outer race from the support assembly.
    - (a) Remove the four bolts that attach the outer race to the support assembly.
    - (b) Remove the outer race.
- (10) Remove the tools from the support assembly.


PLUG
RING
PWA 102000
PULLER
L−A4841 (0896)
PW V

Remove The Ball Bearing Inner Races
Figure 507
(Task 72−34−00−030−002)

INTERMEDIATE CASE - INSPECTION/CHECK-01

Task 72-34-00-990-004:

1. General Inspection Requirements - Intermediate Case

A. Organization Of Individual Part Or Subassembly Inspection Data

(1) Specific inspection functions for all significant parts/subassemblies are provided in individual Inspection/Check sections. Application of each inspection function is shown in Inspection/Check-00 for part/subassembly. Section designations and function descriptions are as follows.

(2) Inspection/Check-00 section contains, where applicable:

(a) Part number(s) for which the inspection data is applicable.

(b) Service Bulletin numbers applicable to part number(s).

(c) Inspection/Check numbers, data categories and applicability data.

(3) Inspection/Check-01, Preinspection Preparation, contains, where applicable:

(a) General inspection comments, notes, CAUTIONS, etc., which supplement data contained in this section.

(b) Identification of mechanical disassembly required prior to inspection.

(c) Identification of any surface treatment or coating removal, or other actions required prior to inspection.

(d) Identification of part/subassembly cleaning required prior to inspection.

(4) Inspection/Check-02, Nondestructive Inspection, contains the following nondestructive inspection methods, part/subassembly special attention areas and damage limits (as applicable):

(a) Fluorescent Penetrant Method

(b) Eddy Current Method

  - (c) Magnetic Particle Method
  - (d) X−ray Method
  - (e) Ultrasonic Method
  - (f) Hardness Check
  - (g) Other − As specified.

(5) Inspection/Check−03, Visual Inspection contains, where applicable:

  - (a) Visual inspection requirements which can be accomplished with or without magnification or special lighting (as specified).

    NOTE: Use of inspection tools may be required as a supplement to visual inspection process.

  - (b) Allowable blending for visual damage, which may be accomplished within the inspection area.

    NOTE: Blending requirement will also be shown in applicable repairs.

(6) Inspection/Check−04, Dimensional Inspection, contains, where applicable:

  - (a) Dimensional inspection requirements other than visual inspection. The requirements will include applicable fits and clearances, and other dimensional inspections necessary to ensure the part integrity and proper functioning.

(7) Inspection/Check−05, Functional Check Inspection contains, where applicable:

  - (a) Procedures, limits, and equipment used with any required functional checks (oil flow, air flow, leak, etc.).

(8) Inspection/Check−06, Inspection Postrequisites contains, references to procedures required to return part/subassembly to serviceable condition. References include the following, as required.

  - (a) Reassembly

(b) Protective coatings, sealants and/or lubricant reapplication

B. Thorough and intelligent part/subassembly inspection is of major importance in achieving efficient engine operation and satisfactory service life. Inspection personnel should be thoroughly familiar with inspection procedures, inspection tooling, limits associated with normal and, where applicable, unusual operating conditions, limits associated with repairs, and with inspection procedures published in Standard Practices Manual.

C. During preliminary inspection of part/subassembly, comparison with mating or adjacent parts may provide indication of source of wear or damage. This procedure may indicate requirement for additional disassembly and inspection.

D. During inspection, records should be kept of deviations beyond serviceable limits to determine: (a) if part/subassembly will be repaired or replaced, and (b) if part is reparable, which repairs are required. Suitable documentation should accompany part/subassembly with results of this determination.

E. Inspection of individual part/subassembly dimensions which are also in Fits and Clearances will include Fits and Clearance Reference Numbers and will show new part/subassembly dimension unless specifically stated otherwise. Inspection Frequency Requirements (IFR) codes (for IFR Code A parts only) are included with Reference Number data. If acceptable dimensional deviations or results of repair affect Fits and Clearances, suitable documentation should accompany part/subassembly to ensure check of fit or clearance at final assembly.

NOTE: Parts/subassemblies which deviate dimensionally from new part/subassembly values may be acceptable provided required fit or clearance is achieved at final assembly.

F. Dimensional inspection requirements will be accompanied by part/subassembly constraint data if such constraint requirements are required during part/subassembly manufacture. Adherence to constraint requirements when inspecting service operated parts/subassemblies should be dictated by experience. It is recommended that parts/subassemblies which do not meet dimensional inspection requirements in free state be constrained and re−measured prior to initiation of any repair or re−use activity.

G. Dimensional inspections of one detail of a subassembly, prior to removal from subassembly, may produce incorrect data due to constraint forces from mating details. If questionable data is obtained, subassembly should be disassembled and inspections repeated.

H. Dimensional inspection limits in inspection text provide continued use (as is) and, if applicable, repair limits. Parts/subassemblies which exceed both limits and nonreparable parts/subassemblies which exceed (as is) limits are unserviceable.

I. Inspections required to verify integrity of repair are contained within repair procedure. Unless otherwise stated, repaired part is expected to meet all inspection requirements contained in inspection text for part/subassembly.

J. Parts/subassemblies which do not require repairs except for those provided in Standard Practices Manual are identified by Chapter/Section/Subject Number 72−34−99 in cleaning table (Cleaning−01) and nondestructive inspection table (Inspection/Check−02). Determination of serviceability for those parts listed in 72−34−99 is limited to cleaning, non−destructive inspection, and the following:

(1) Visually inspect parts/subassemblies for surface defects, deformations, cuts, improper threads or wrenching surfaces, incomplete or missing protective coatings or other damage which will prevent proper functioning and make part/subassembly unserviceable. Unserviceable parts/subassemblies should not be reinstalled. Repair unserviceable parts/subassemblies per Standard Practices Manual, as applicable.

(2) Parts/subassemblies with crack indications to any length or depth detected by listed nondestructive inspection are unserviceable, and should not be reinstalled.

K. When new part/subassembly is to be installed and it is important that it be identified as to engine number or position in engine, mark it by appropriate method described in Marking of Parts, 70−11, Standard Practices Manual.

L. In order to eliminate confusion and to maintain consistent terminology, various physical conditions which might be encountered during inspection of parts/subassemblies and explanation of unusual causes of such conditions are defined in Physical Inspection, 70−31, Standard Practices Manual.

M. If inspection reveals it necessary to replace fitted spacer, tag spacer to indicate that replacement must be made with spacer of correct classification at assembly.

N. If text refers to superficial or shallow imperfection, following definitions apply:

  (1) A superficial imperfection is defined as a nick, dent, scratch, toolmark, etc., which disrupts the surface but does not appear to penetrate surface roughness texture.

  (2) A shallow imperfection appears to penetrate surface finish texture, but does not have a dark bottom and would not cause a 0.007 inch (.178 mm) radius stylus to hesitate if passed over it.

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INTERMEDIATE CASE - INSPECTION/CHECK-03

Task 72-34-00-990-005:

1. Visual Inspection - Intermediate Case
   A. For inspection requirements applicable to installed (accessible) parts of intermediate case see 72-00-34, Inspection/Check-XX (Task 72-00-31-XXX-XXX).

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INTERMEDIATE CASE - INSPECTION/CHECK-04

Task 72-34-00-990-001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131)	(−)	0.512 (13.005)	=	.005 (0.126)
0.527 (13.385)	(−)	0.508 (12.903)	=	.019 (0.482)

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
100	B	No. 1.5 Bearing Support Assembly (72−34−20) Compressor Intermediate Case Assembly (72−34−01) (See Figure 801, Sheet 2)				
		Support	18.284 (464.414)	18.288 (464.515)		
		Case	18.277 (464.236)	18.283 (464.388)	.011T (0.28T)	.001T (0.03T)
101	B	No. 2 Bearing Support Assembly (72−34−06) Compressor Intermediate Case Assembly (72−34−01) (See Figure 801, Sheet 2)				
		Support	19.811 (503.200)	19.813 (503.250)		
		Case	19.797 (502.844)	19.803 (502.996)	.016T (0.406T)	.008T (0.203T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
102	B	No. 2 Ball Bearing (72−34−14)				
		No. 2 Bearing Housing Assembly (72−34−09)				
		(See Figure 801, Sheet 2)				
		Bearing	11.4011 (289.5880)	11.4018 (289.6057)		
		Housing	11.4018 (289.606)	11.4031 (289.638)	.000 (0.000)	.002 (0.050)
103	A	Gearbox Drive Bevel Gear (72−34−12)				
		No. 2 Ball Bearing (72−34−14)				
		(See Figure 801, Sheet 2)				
		Gear	7.6626 (194.631)	7.6636 (194.655)		
		Bearing	7.6608 (194.5844)	7.6614 (194.5995)	.0038T* (0.097T)*	.0012T (0.031T)
104	A	Gearbox Drive Bevel Gearshaft (72−34−21)				
		Gearshaft Roller Bearing (ID) (72−34−22)				
		(See Figure 801, Sheet 2)				
		Gearshaft	2.7569 (70.0253)	2.7574 (70.0379)		
		Bearing (ID)	2.7555 (69.9897)	2.7559 (69.9998)	.0019T (0.0482T)	.0010T (0.0254T)
105	B	Gearshaft Roller Bearing (OD) (72−34−22)				
		No. 1.5 Bearing Support Assembly (72−34−20)				
		(See Figure 801, Sheet 2)				
		Bearing (OD)	4.3304 (109.9922)	4.3308 (110.0023)		
		Support	4.3310 (110.0074)	4.3319 (110.0302)	.0002 (0.006)	.0015 (0.038)
106	A	Gearbox Drive Bevel Gearshaft (72−34−21)				
		Gearshaft Ball Bearing (72−34−23)				
		(See Figure 801, Sheet 2)				
		Gearshaft	2.3623 (60.0025)	2.3628 (60.0151)		
		Ball Bearing	2.3618 (59.9898)	2.3622 (59.9998)	.0010T (0.0254T)	.0001T (0.0026T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
107	B	Gearshaft Ball Bearing (72−34−23)				
		No. 1.5 Bearing Support Assembly (72−34−20)				
		(See Figure 801, Sheet 2)				
		Bearing	4.3304 (109.9922)	4.3308 (110.0023)		
		Support	4.3310 (110.0074)	4.3319 (110.0302)	.0002 (0.006)	.0015 (0.038)
112	B	Plug (Angle Gearbox Cover) (72−62−80)				
		Angle Gearbox Cover Assembly (72−62−10)				
		(See Figure 801, Sheet 4)				
		Plug	2.488 (63.196)	2.490 (63.246)		
		Cover	2.492 (63.297)	2.496 (63.398)	.002 (0.051)	.008 (0.203)
121	B	Angle Gearbox Housing Assembly (72−62−01)				
		Compressor Intermediate Case Assembly (72−34−01)				
		(See Figure 801, Sheet 4)				
		Housing	5.998 (152.350)	6.000 (152.400)		
		Case	6.001 (152.426)	6.005 (152.527)	.001 (0.026)	.007 (0.177)
122	B	Pin, Hollow (Angle Gearbox Mounting) (72−34−51)				
		Bushing (72−34−52)				
		(See Figure 801, Sheet 5)				
		Pin	1.0015 (25.4381)	1.0020 (25.4508)		
		Bushing	1.0025 (25.464)	1.0040 (25.501)	.0005 (0.013)	.0025 (0.063)
124	B	Fourth Stage Compressor Stator Assembly (72−34−50)				
		Compressor Intermediate Case Assembly (72−34−01)				
		(See Figure 801, Sheet 1)				
		Stator	30.485 (774.319)	30.491 (774.471)		
		Case	30.495 (774.57)	30.505 (774.83)	.004 (0.10)	.031* (0.79)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
125	A	Side Clearance, No. 2 Bearing Housing Seal Ring (72−34−10) No. 2 Bearing Housing Assembly (72−34−09) (See Figure 801, Sheet 3)				
		Ring	.148 (3.760)	.150 (3.810)		
		Housing	.153 (3.887)	.155 (3.937)	.003 (0.077)	.007 (0.177)
126 (1)	A	Gap, No. 2 Bearing Housing Seal Ring (72−34−10) (PN 50G418) (See Figure 801, Sheet 3)				
		Gap			.045 (1.14)	.055 (1.40)
		Seal Ring Installed In Ring Gage 12.240 (310.896) Diameter (Ring Gage)				
		Gap			.045 (1.14)	.058 (1.47)
		Seal Ring Installed In No. 2 Bearing Support (72−34−06) 12.239 (310.871) 12.241 (310.921) Diameter (No. 2 Bearing Support)				
126 (2)	A	Gap, No. 2 Bearing Housing Seal Ring (72−34−10) (PN 50G873) (See Figure 801, Sheet 3)				
		Gap			.025 (0.64)	.035 (0.89)
		Seal Ring Installed In Ring Gage 12.240 (310.896) Diameter (Ring Gage)				
		Gap			.022 (0.56)	.038 (0.97)
		Seal Ring Installed In No. 2 Bearing Support (72−34−06) 12.239 (310.871) 12.241 (310.921) Diameter (No. 2 Bearing Support)				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
127	A	Side Clearance, No. 1.5 And 2 Bearing (Carbon) Seal Assembly, Seal Ring (72-34-35) No. 1.5 Bearing Face Seal Assembly (72-34-38) (See Figure 803)				
		Ring	.121 (3.074)	.124 (3.149)		
		Seal Assembly	.127 (3.226)	.130 (3.302)	.003 (0.077)	.009 (0.228)
128	A	Gap, No. 1.5 And 2 Bearing (Carbon) Seal Assembly, Seal Ring (72-34-35) (See Figure 803)				
		Gap			.030 (0.76)	.040 (1.02)
		Seal Ring Installed In Ring Gage 7.720 (196.088) Diameter (Ring Gage)				
		Gap			.0253 (0.64)	.0447 (1.14)
		Seal Ring Installed In No. 2 Bearing Face Seal Assembly (72-34-37) 7.7185 (196.050) 7.7215 (196.126) Diameter (No. 2 Bearing Face Seal Assembly)				
129	B	No. 2 Bearing (Oil) Pressure Tube (72-34-26) (PN 50A390) Prior SB PW4ENG 72-179 No. 2 Bearing Support Assembly (72-34-06) (PN 50G417) (See Figure 804, Sheet 1)				
		Tube	.372 (9.449)	.373 (9.474)		
		Support	.374 (9.500)	.376 (9.550)	.001 (0.026)	.004 (0.101)
130	B	No. 2 Bearing (Oil) Pressure Tube (72-34-26) No. 1.5 And 2 Bearing Tube Connector (72-34-27) (See Figure 804, Sheet 1)				
		Tube	.622 (15.799)	.623 (15.824)		
		Connector	.624 (15.850)	.626 (15.900)	.001 (0.026)	.004 (0.101)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
131	B	Gearbox Drive (Oil) Pressure Tube Assembly (72−34−31) Gearbox Drive (Oil) Nozzle Assembly (72−34−32) (See Figure 804, Sheet 2)				
		Tube	.497 (12.624)	.498 (12.649)		
		Nozzle	.499 (12.675)	.501 (12.725)	.001 (0.026)	.004 (0.101)
132	B	Gearbox Drive (Oil) Pressure Tube Assembly (72−34−31) No. 1.5 And 2 Bearing Tube Connector (72−34−27) (See Figure 804, Sheet 2)				
		Tube	.590 (14.986)	.591 (15.011)		
		Connector	.592 (15.037)	.594 (15.087)	.001 (0.026)	.004 (0.101)
134	A	No. 2 Bearing Rear Face Seal Assembly (72−34−07) (See Figure 801, Sheet 2)				
		Height Of Carbon Seal Step			.075* (1.905)*	.105 (2.67)
135	A	Side Clearance, No. 2 Bearing (Carbon) Seal Assembly, Seal Ring (72−34−05) (See Figure 801, Sheet 3)				
		NOTE: The following seal ring side clearance measurement is not a requirement for later teflon seal ring PN 51G198.				
		Seal Ring	.121 (3.074)	.124 (3.149)		
		Ring Holder (72−34−07)	.127 (3.226)	.130 (3.302)	.003 (0.077)	.009 (0.228)
136	A	Gap, No. 2 Bearing (Carbon) Seal Assembly, Seal Ring (72−34−05) (See Figure 801, Sheet 3)				
		NOTE: The following seal ring gap measurement is not a requirement for later teflon seal ring PN 51G198.				
		Gap			.030	.040

INTERMEDIATE CASE - INSPECTION/CHECK-04

(CONTINUED)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
					(0.76)	(1.02)
		Seal Ring Installed In Ring Gage 8.930 (226.822) Diameter (Ring Gage)				
		Gap			.027	.043
					(0.69)	(1.09)
		Seal Ring Installed In No. 2 Bearing Support (72-34-06) 8.929 (226.797) 8.931 (226.847) Diameter (No. 2 Bearing Support)				
139	B	No. 2 Bearing Rear Seal Seat (72-34-15) Gearbox Drive Bevel Gear (72-34-12) (See Figure 801, Sheet 2)				
		Seat	7.6650	7.6665		
			(194.691)	(194.729)		
		Gear	7.6626	7.6636	.0039	.0004*
			(194.631)	(194.655)	(0.099)	(0.010)*
141	B	Pin, Hollow (Angle Gearbox Mounting) (72-34-51) Bushing ID, Angle Gearbox Housing (72-62-01) (See Figure 801, Sheet 5)				
		Pin	1.0015	1.0020		
			(25.4381)	(25.4508)		
		Bushing	.999	1.001	.0005T	.0030T
			(25.375)	(25.425)	(0.013T)	(0.076T)
142 (1)	B	No. 2 Bearing (Oil) Pressure Tube (72-34-26) (PN 50A687) Post SB PW4ENG 72-179, Prior To SB PW4ENG 72-394 No. 2 Bearing Support Assembly (72-34-06) (PN 51G082) (See Figure 804, Sheet 1)				
		Tube	.384	.385		
			(9.754)	(9.779)		
		Support	.386	.388	.001	.004
			(9.805)	(9.855)	(0.026)	(0.101)

INTERMEDIATE CASE - INSPECTION/CHECK-04

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
142 (2)	B	No. 2 Bearing Damper Oil Shutoff Valve (Ref. CMM 79-21-21) (PN 51D114) Post SB PW4ENG 72-394 No. 2 Bearing Support Assembly (72-34-06) (PN 51G082) (See Figure 804, Sheet 1)				
		Tube	.380 (9.652)	.384 (9.753)		
		Support	.386 (9.805)	.388 (9.855)	.002 (0.051)	.008 (0.203)
143	B	IGV Inner Shroud Retaining Ring (72-34-16) No. 2 Bearing Support Assembly (72-34-06) (See Figure 801, Sheet 1)				
		Ring	18.438 (468.326)	18.441 (468.401)		
		Support	18.435 (468.249)	18.438 (468.325)	.000 (.000)	.006T (0.152T)
144	B	Shoulder Stud No. 2 Bearing Housing Assembly (72-34-09) (See Figure 801, Sheet 2)				
		Stud	.4400 (11.1760)	.4406 (11.1912)		
		Housing	.4386 (11.141)	.4396 (11.165)	.0020T (0.050T)	.0004T (0.011T)
145	B	Shoulder Stud No. 2 Bearing Support Assembly (72-34-06) (See Figure 801, Sheet 2)				
		Stud	.4400 (11.1760)	.4406 (11.1912)		
		Support	.4386 (11.141)	.4396 (11.165)	.0020T (0.050T)	.0004T (0.011T)
763	A	No. 1 Ball Bearing (72-31-14) No. 1 Bearing Front Support (72-34-82) (See Figure 807)				
		Bearing	17.6605 (448.5767)	17.6613 (448.5970)		
		Support	17.6589 (448.537)	17.6599 (448.561)	.0006T (0.016T)	.0024T (0.060T)

INTERMEDIATE CASE − INSPECTION/CHECK−04

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
764	B	No. 1 Bearing Rear Support Assembly (72−34−81)				
		No. 1 Bearing Front Support (72−34−82)				
		(See Figure 807)				
		Rear Support	20.279 (515.087)	20.282 (515.162)		
		Front Support	20.274 (514.960)	20.279 (515.086)	.000T (0.000T)	.008T (0.203T)
770	B	No. 1 Bearing Rear Support Assembly (72−34−81)				
		Compressor Intermediate Case Assembly (72−34−01)				
		(See Figure 806)				
		Support	26.602 (675.691)	26.606 (675.792)		
		Case	26.598 (675.590)	26.602 (675.690)	.000T (0.000T)	.008T (0.203T)
774	A	No. 1.5 Roller Bearing (72−32−02)				
		No. 1.5 Bearing Support Assembly (72−34−20)				
		(See Figure 805)				
		Bearing	10.4695 (265.9253)	10.4702 (265.9430)		
		Support	10.4671 (265.865)	10.4684 (265.897)	.0011T (0.028T)	.0031T (0.078T)
778	B	Bleed Valve Duct (72−33−08)				
		Intermediate Case Assembly (72−34−01)				
		(See Figure 806)				
		Duct	54.947 (1395.654)	54.953 (1395.806)		
		Case	54.941 (1395.501)	54.947 (1395.654)	.000T (0.00T)	.012T (0.030T)
779	B	Fan Exit (Outer) Case (72−33−03)				
		Intermediate Case Assembly (72−34−01)				
		(See Figure 806)				
		Fan Case	92.108 (2339.54)	92.124 (2339.95)		
		Intmd. Case	92.092 (2339.14)	92.108 (2339.54)	.000T (.000T)	.032T (0.81T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
780	B	Pin, No. 1 Bearing (Oil) Pressure Manifold (72−34−80) No. 1 Bearing Rear Support Assembly (72−34−81) (See Figure 807)				
		Pin	.2485 (6.312)	.2495 (6.337)		
		Support	.250 (6.350)	.251 (6.375)	.0005 (0.013)	0.0030* (0.076)*
781	B	No. 1 Bearing (Oil) Pressure Manifold Assembly (72−34−80) Main Bearing Tube Connector (72−34−28) (See Figure 807)				
		Manifold	.679 (17.247)	.680 (17.272)		
		Connector	.681 (17.298)	.683 (17.348)	.001 (0.026)	.004 (0.101)
783	A	No. 1.5 Bearing Face Seal Assembly (72−34−38)/And No. 2 Bearing Front Face Seal Assembly (72−34−37) (See Figure 805)				
		Height Of Seal Step			.075* (1.905)*	.105 (2.67)
784	A	HPC Front Hub (72−35−05) Gearbox Drive Bevel Gear (72−34−12) (See Figure 805)				
		Hub	7.305 (185.547)	7.306 (185.572)		
		Gear	7.301 (185.446)	7.302 (185.470)	.003T (0.077T)	.005T (0.127T)
785	B	Intermediate Case Assembly (72−34−01) HPC Front Case Assembly (72−35−40) (See Figure 806)				
		Intd. Case	34.574 (878.180)	34.578 (878.281)		
		HPC Case	34.568 (878.028)	34.572 (878.128)	.002T (0.051T)	.010T (0.254T)

	Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
	837	B	Support Link Shoulder Bolt (72-33-87) No. 3 Bearing Air Cooler Assembly				
R			Support Bracket (See Figure 808)				
			Bolt	.2494 (6.3348)	.2499 (6.3474)		
			Bracket	.2500 (6.350)	.2510 (6.375)	.0001 (0.003)	.0016 (0.040)
	839	B	Side Clearance, Support Link Rod End Bearing (72-33-86) No. 3 Bearing Air Cooler Assembly				
R			Support Bracket (See Figure 808)				
			Bearing	.432 (10.973)	.437 (11.099)		
			Bracket	.4375 (11.113)	.4395 (11.163)	.0005 (0.013)	.0075 (0.190)
	840	B	No. 1 Bearing Front Support (72-34-82) No. 1 Bearing (Carbon) Seal Assembly (72-31-17) (See Figure 807)				
			Support	20.135 (511.429)	20.139 (511.530)		
			Seal	20.131 (511.328)	20.133 (511.378)	.002 (0.051)	.008 (0.203)

G. Spring Loads

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
480	A	Compression Spring, No. 2 Bearing Face Seal Assembly (72-34-07) (See Figure 802)				
			At 0.765 Inch (19.431 mm)	1.841 lbs (0.84 kg)	2.508 lbs (1.14 kg)	

H. Spline Data

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
231	B	1. Angle Gearbox Bevel Gear Assembly (72-62-03) Internal Spline (See Figure 801, Sheet 4)				
		A. Effective Space Width	.0915 (2.324)	---		
		B. Actual Space Width	---	.0946 (2.403)		
		2. Gearbox Driveshaft Assembly (72-34-53) External Spline (See Figure 801, Sheet 4)				
		A. Effective Tooth Thickness	---	.0875 (2.222)		
		B. Actual Tooth Thickness	.0845 (2.146)	---		
		3. Fit			.004 (0.102)	---
232	B	1. Gearbox Driveshaft Coupling (72-34-24) Internal Spline (See Figure 801, Sheet 2)				
		A. Effective Space Width	.0491 (1.248)	.0506 (1.285)		
		B. Actual Space Width	.0491 (1.248)	.0529 (1.343)		
		2. Gearbox Driveshaft Assembly (72-34-53) External Spline (See Figure 801, Sheet 2)				
		A. Effective Tooth Thickness	---	.0476 (1.209)		

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
(CONTINUED)						
		B. Actual Tooth Thickness	.0455 (1.156)	−−−		
		3. Fit			.0015 (0.038)	−−−
233	B	1. Gearbox Drive Bevel Gearshaft (72−34−21) Internal Spline (See Figure 801, Sheet 2)				
		A. Effective Space Width	.0915 (2.324)	−−−		
		B. Actual Space Width	−−−	.0946 (2.403)		
		2. Gearbox Driveshaft Coupling (72−34−24) External Spline (See Figure 801, Sheet 2)				
		A. Effective Tooth Thickness	.0855 (2.172)	.0875 (2.222)		
		B. Actual Tooth Thickness	.0830 (2.109)	.0875 (2.222)		
		3. Fit			.0040 (0.102)	−−−
952	B	1. Gearbox Drive Bevel Gear (72−34−12) Internal Spline (See Figure 805)				
		A. Effective Space Width	.0491 (1.247)	−−−		
		B. Actual Space Width	−−−	.0555 (1.410)		

Ref. No.	IFR	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
(CONTINUED)						
		2. HPC Front Hub (72-35-05) External Spline (See Figure 805)				
		A. Effective Tooth Thickness	---	.0476 (1.209)		
		B. Actual Tooth Thickness	.0412 (1.046)	---		
		3. Fit			.0015 (0.038)	---

I. Special Torques

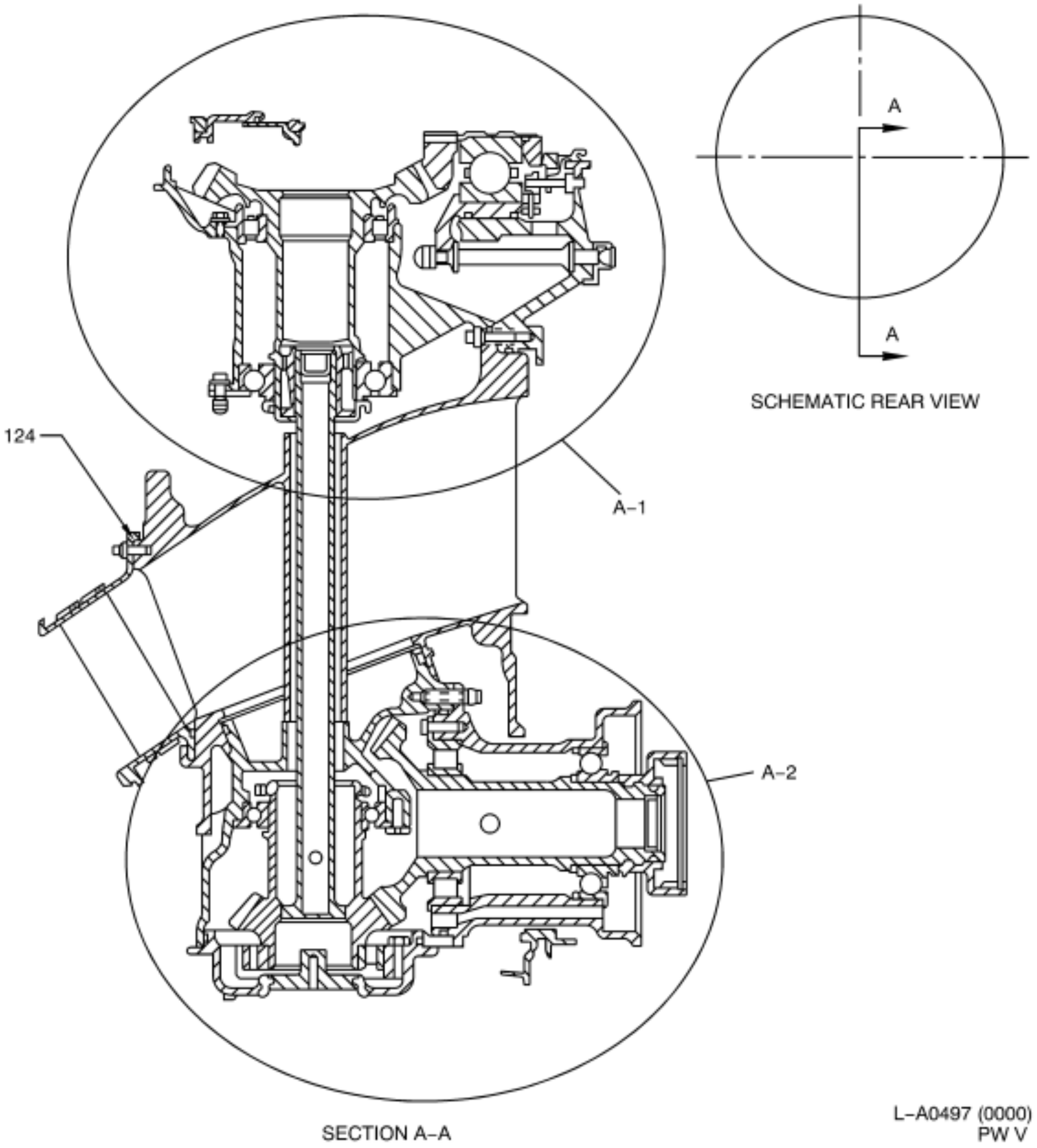
Ref. No.	IFR	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
250	A	Gearbox Drive Bevel Gearshaft Ball Bearing Inner Race Retaining Nut (See Figure 801, Sheet 2) See 72-34-00, Assembly-03 Task 72-34-00-400-003				
253	A	No. 2 Ball Bearing Outer Race Retaining Nut (See Figure 801, Sheet 2) See 72-34-04, Assembly-01 Task 72-34-04-440-001-001 See 72-34-04, Assembly-02 Task 72-34-04-440-001-002				

J. Special Assembly Procedures

Ref. No.	IFR	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
133	A	Installation Of Fan Exit Case Flange Assembly Lower Ring Segment Keys. (Following Installation Of Angle Gearbox To Intermediate Case). (See Figure 802)				

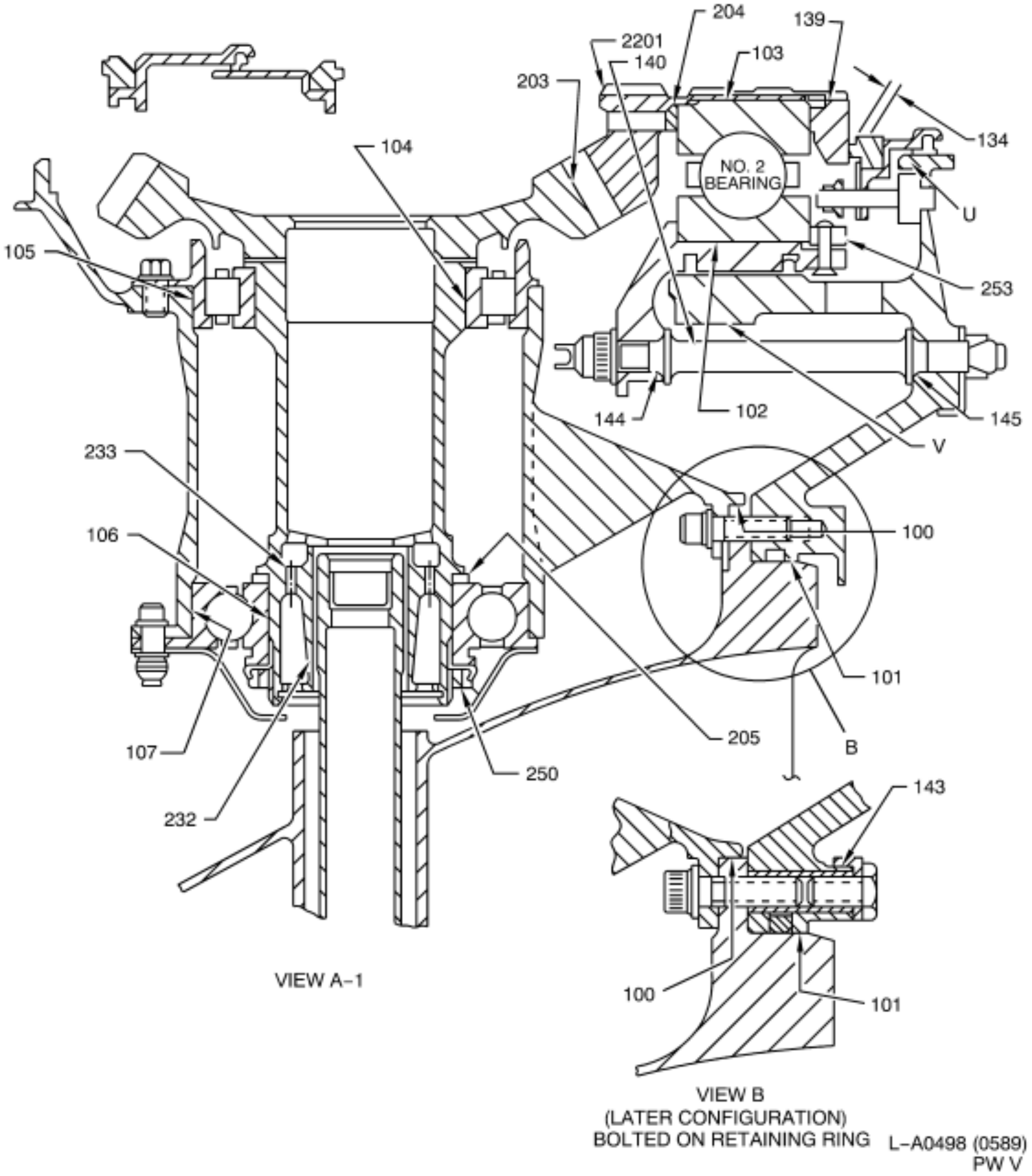
Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)		See 72−34−00, Assembly−01 Task 72−34−00−400−001				
138	A	Installation Of Fan Exit Case Flange Assembly, Lower Segment, (Following Installation Of Angle Gearbox To Intermediate Case) (See Figure 801, Sheet 4) See 72−34−00, Assembly−01 Task 72−34−00−400−001				
140	A	No. 2 Bearing Housing Assembly (See Figure 801, Sheet 2) See 72−34−04, Assembly−03 Task 72−34−04−440−002				
203	A	Backlash Measurement For Gearbox Drive Bevel Gear (See Figure 801, Sheet 2) See 72−34−00, Assembly−01 Task 72−34−00−400−001				
204	A	Spacer Measurement Procedure (Spacer Ring At Gearbox Drive Bevel Gear Location) (See Figure 801, Sheet 2) See 72−34−04, Assembly−03 Task 72−34−00−440−002				
205	A	Spacer Measurement Procedure (Spacer Ring At Gearbox Drive Bevel Gearshaft Location) (See Figure 801, Sheet 2) See 72−34−00, Assembly−02 Task 72−34−00−400−002				
2201	A	Bottoming Procedure For Seal, Bearing, And Spacer On Gear (See Figure 801, Sheet 2) See 72−34−00, Assembly−02 Task 72−34−00−430−001				

INTERMEDIATE CASE − INSPECTION/CHECK−04

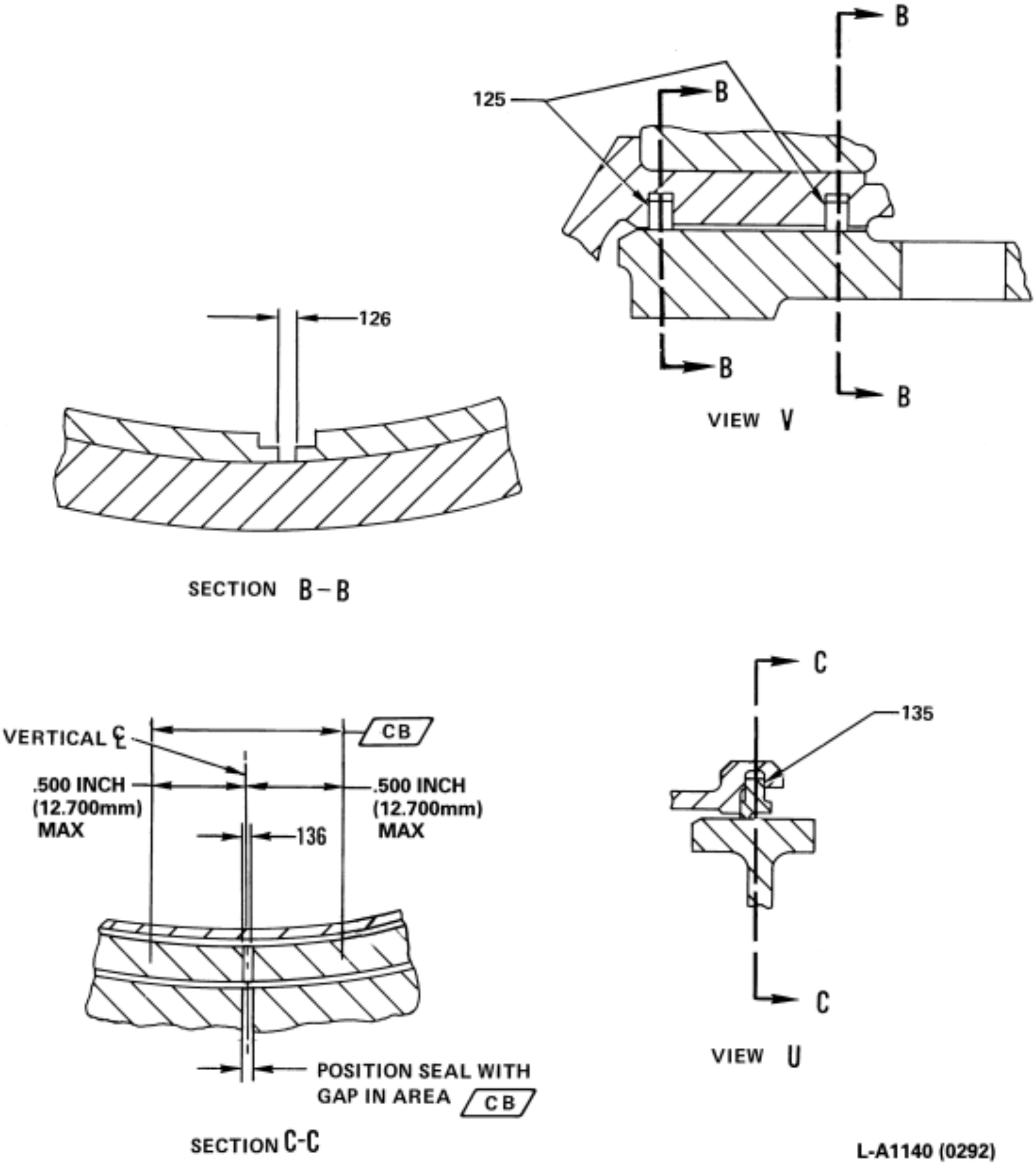

A
A
SCHEMATIC REAR VIEW
124
A−1
A−2
SECTION A−A
L−A0497 (0000)
PW V

Intermediate Case
Figure 801 (Sheet 1)
(Task 72−34−00−990−001)

INTERMEDIATE CASE − INSPECTION/CHECK−04

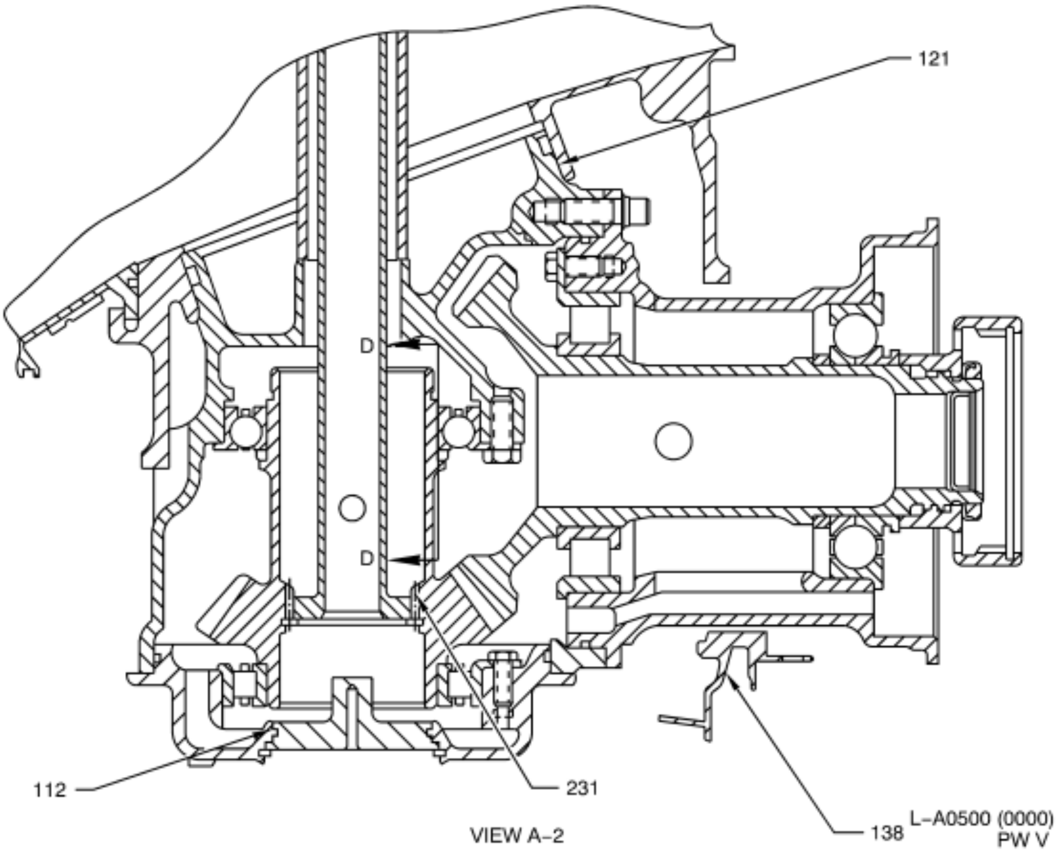

204
139
2201
140
103
203
134
104
NO. 2 BEARING
U
105
253
144
102
145
V
233
100
106
101
107
205
B
232
250
143
VIEW A−1
100
101
VIEW B
(LATER CONFIGURATION)
BOLTED ON RETAINING RING
L−A0498 (0589)
PW V

Intermediate Case
Figure 801 (Sheet 2)
(Task 72−34−00−990−001)

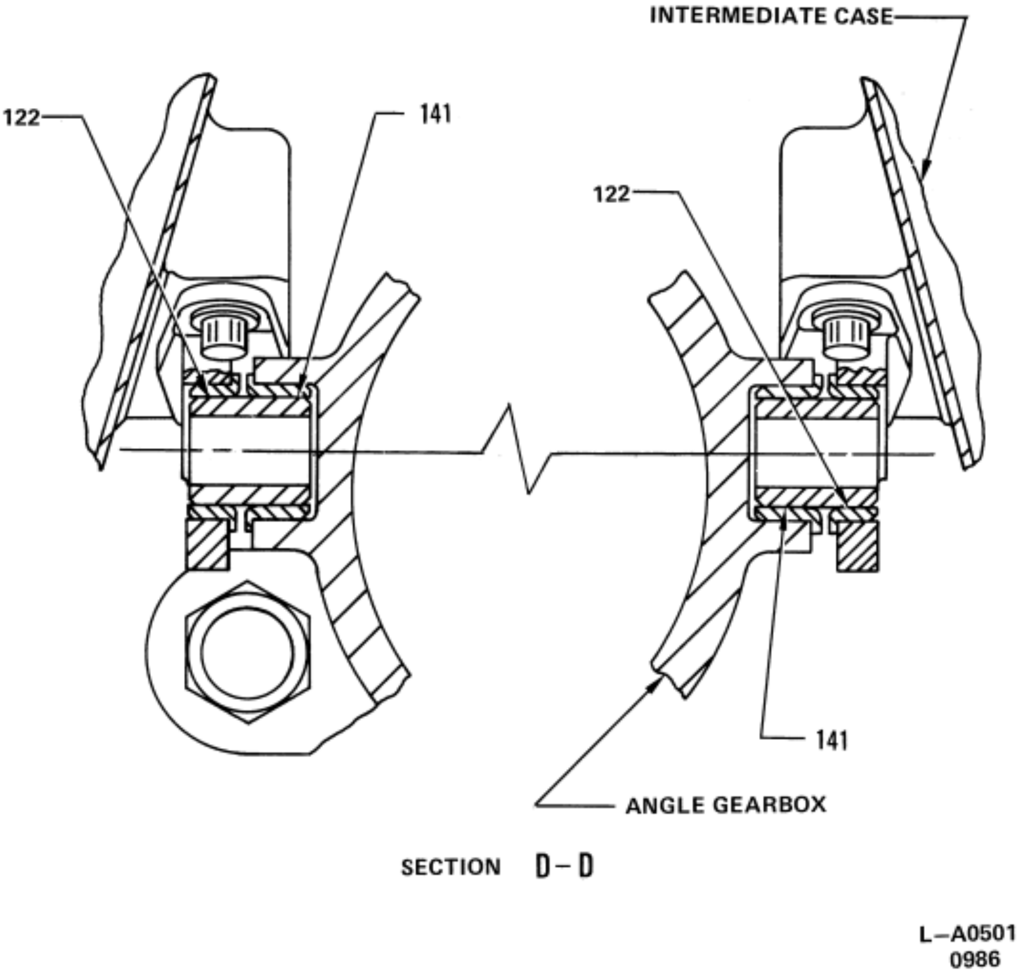

125
B
B
B
B
VIEW V
126
SECTION B-B
VERTICAL ℄
CB
.500 INCH
(12.700mm)
MAX
.500 INCH
(12.700mm)
MAX
136
POSITION SEAL WITH
GAP IN AREA
CB
SECTION C-C
C
135
C
VIEW U
L-A1140 (0292)

Intermediate Case
Figure 801 (Sheet 3)
(Task 72-34-00-990-001)

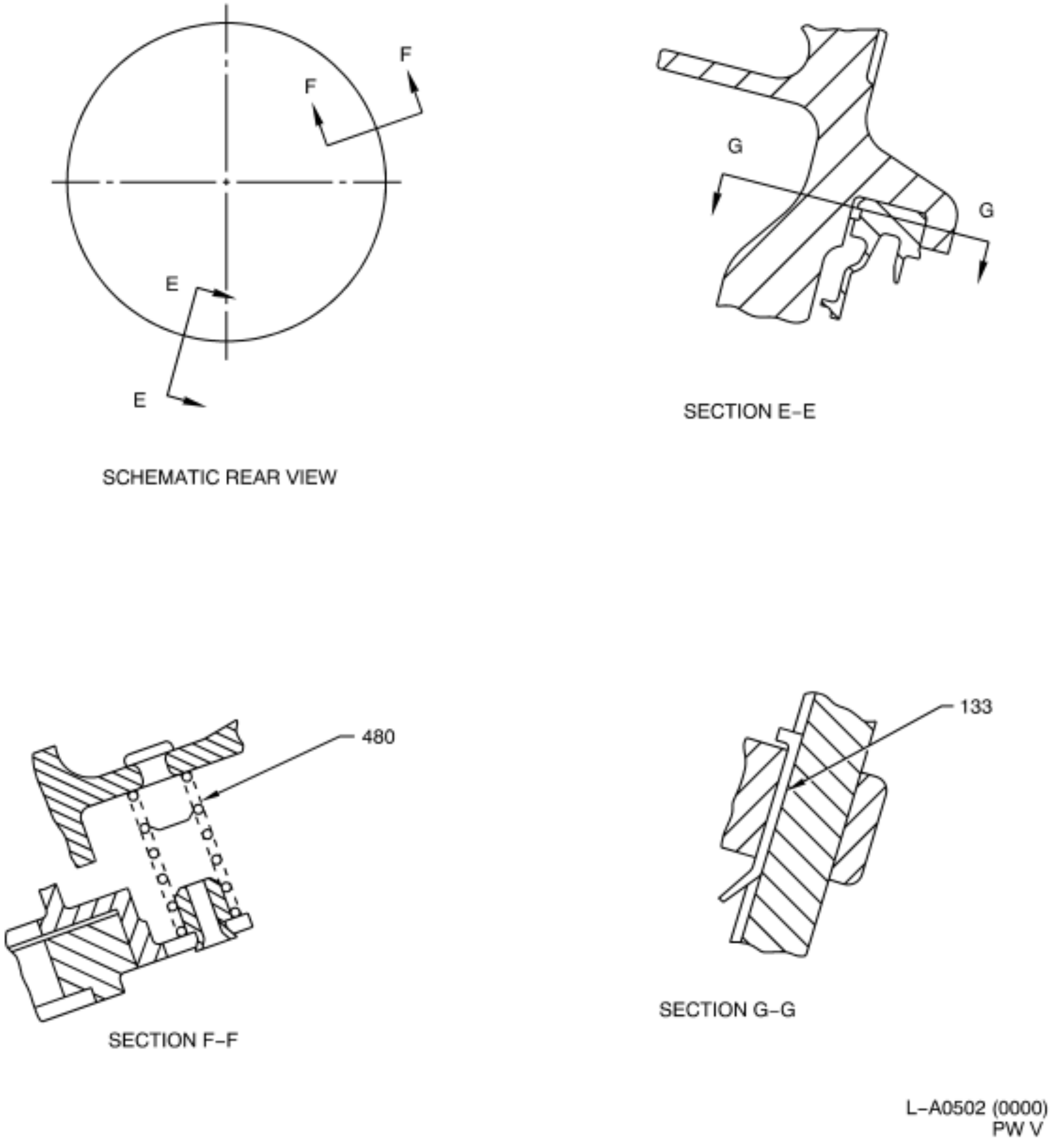
INTERMEDIATE CASE − INSPECTION/CHECK−04


121
D
D
112
231
VIEW A−2
138
L−A0500 (0000)
PW V

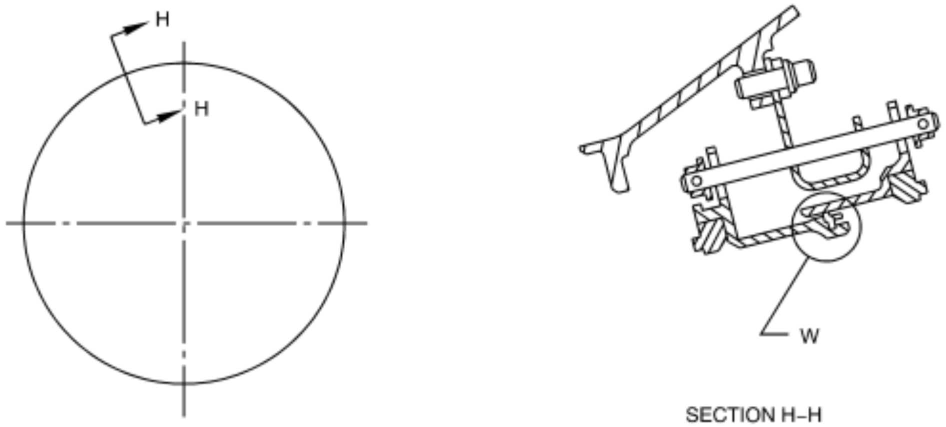
Intermediate Case
Figure 801 (Sheet 4)
(Task 72−34−00−990−001)


INTERMEDIATE CASE
122
141
122
141
ANGLE GEARBOX
SECTION D-D
L-A0501
0986

Intermediate Case
Figure 801 (Sheet 5)
(Task 72-34-00-990-001)

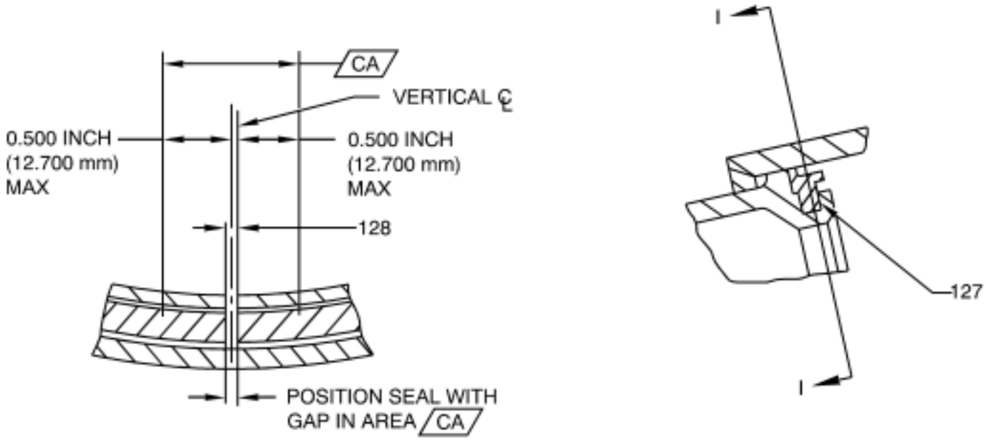

F
F
E
E
SCHEMATIC REAR VIEW
G
G
SECTION E−E
480
SECTION F−F
133
SECTION G−G
L−A0502 (0000)
PW V

Intermediate Case
Figure 802
(Task 72−34−00−990−001)



SCHEMATIC REAR VIEW

SECTION H−H

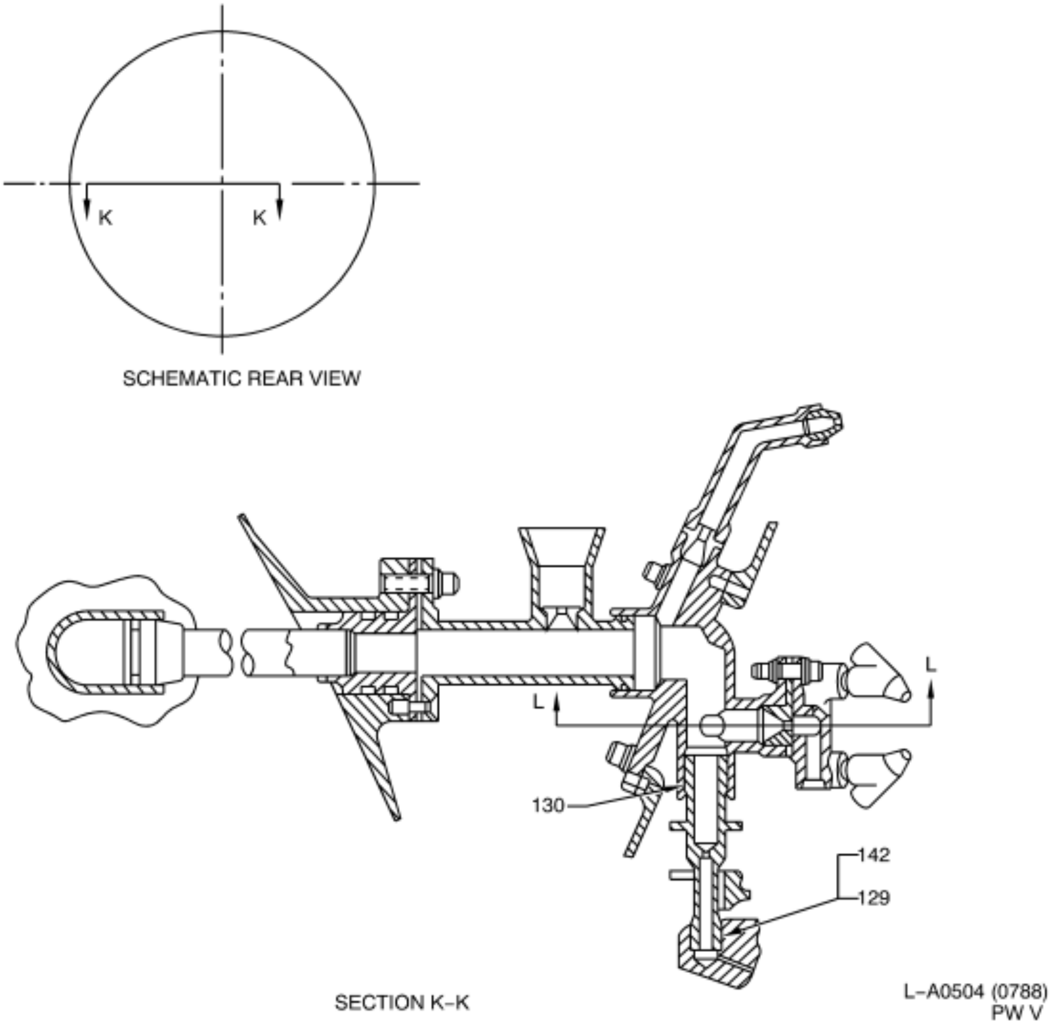

CA
VERTICAL ℄
0.500 INCH
(12.700 mm)
MAX
0.500 INCH
(12.700 mm)
MAX
128
POSITION SEAL WITH
GAP IN AREA CA
I
I
127

SECTION I−I

VIEW W

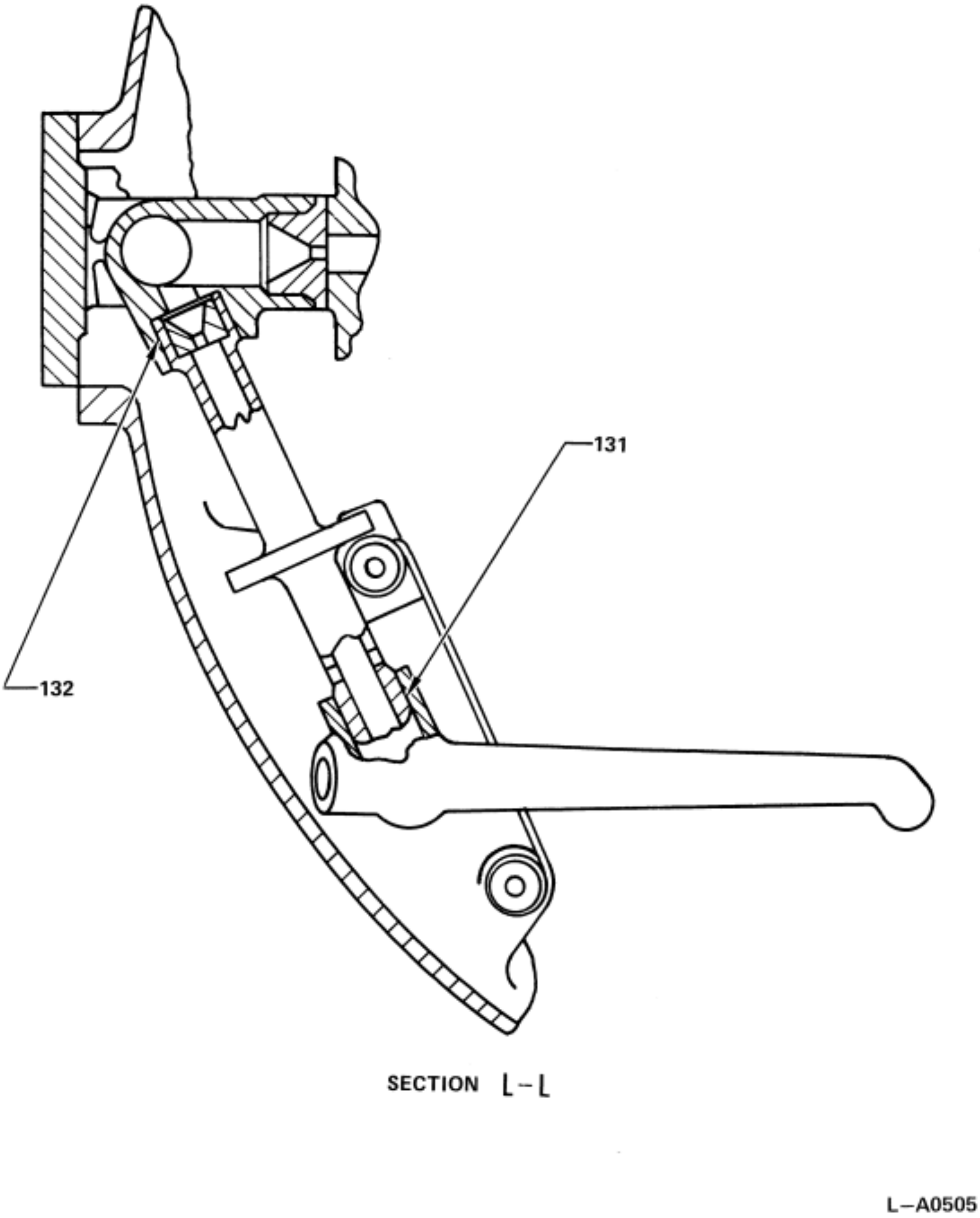
L−A1141 (0000)
PW V

Intermediate Case
Figure 803
(Task 72−34−00−990−001)

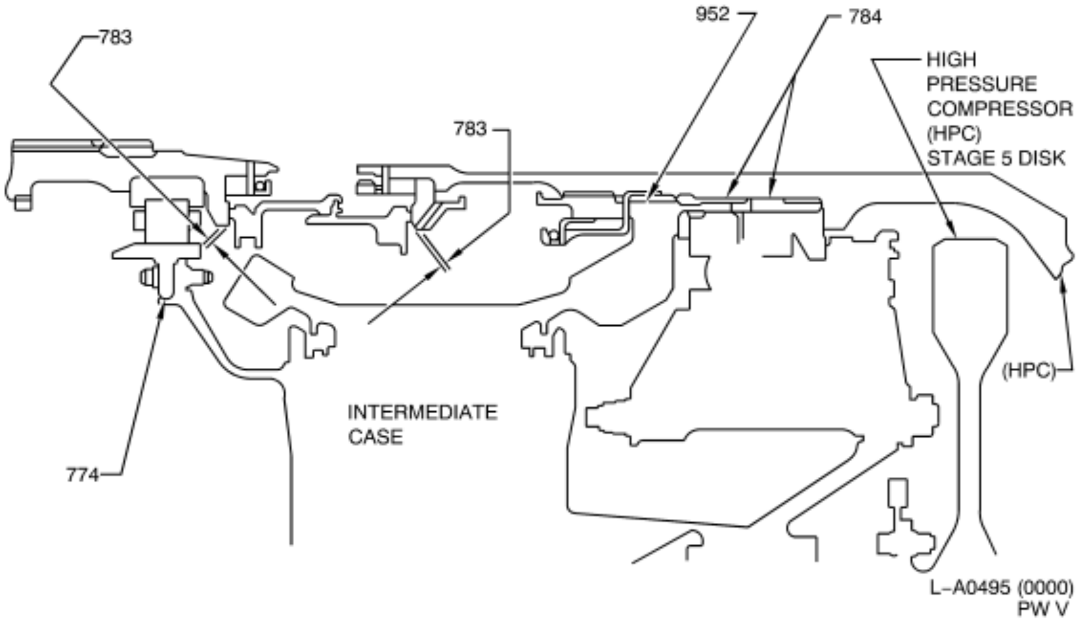

K
K
SCHEMATIC REAR VIEW
L
L
130
142
129
SECTION K−K
L−A0504 (0788)
PW V

Intermediate Case
Figure 804 (Sheet 1)
(Task 72−34−00−990−001)

INTERMEDIATE CASE - INSPECTION/CHECK-04

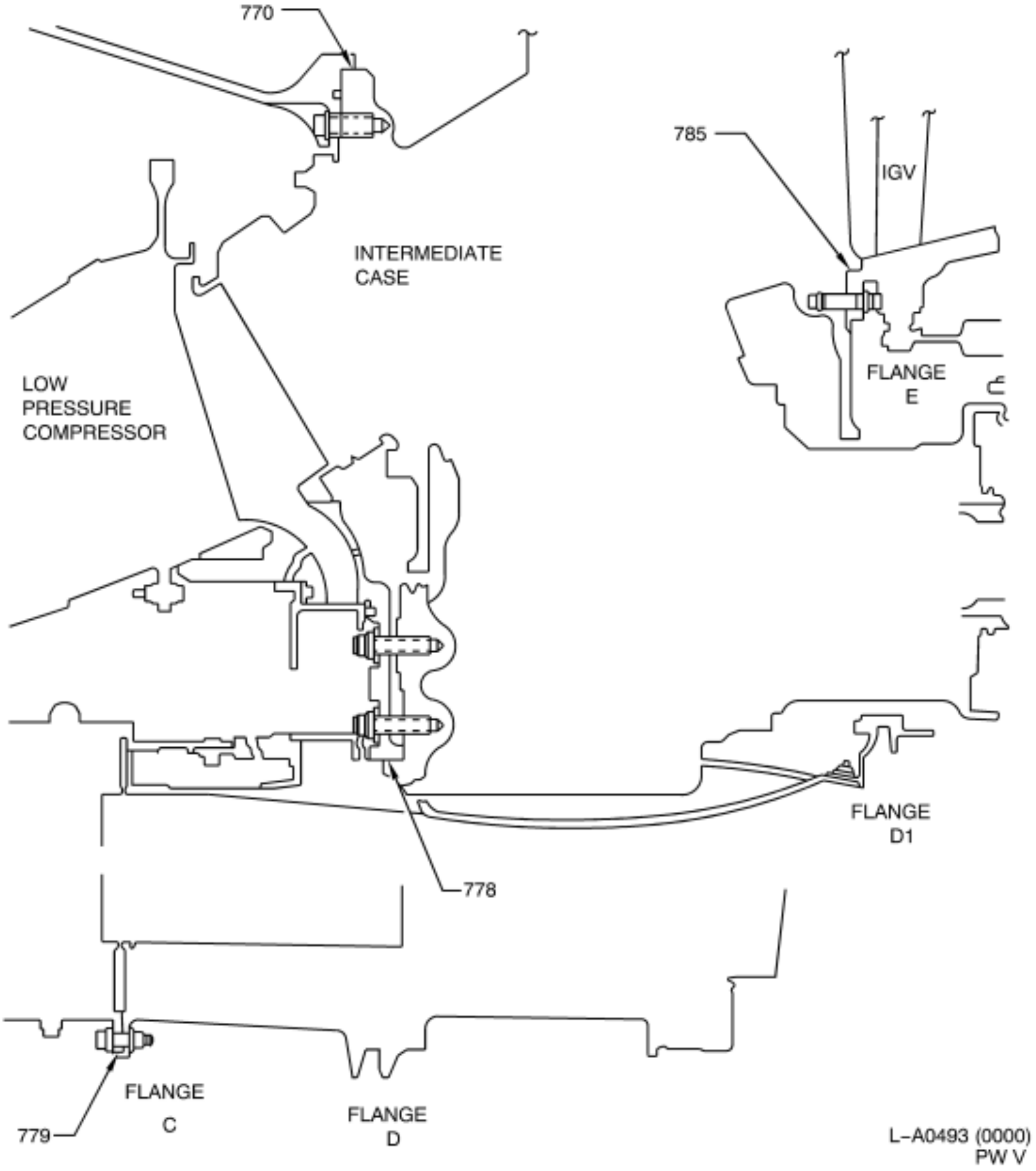

131
132
SECTION L-L
L-A0505

Intermediate Case
Figure 804 (Sheet 2)
(Task 72-34-00-990-001)

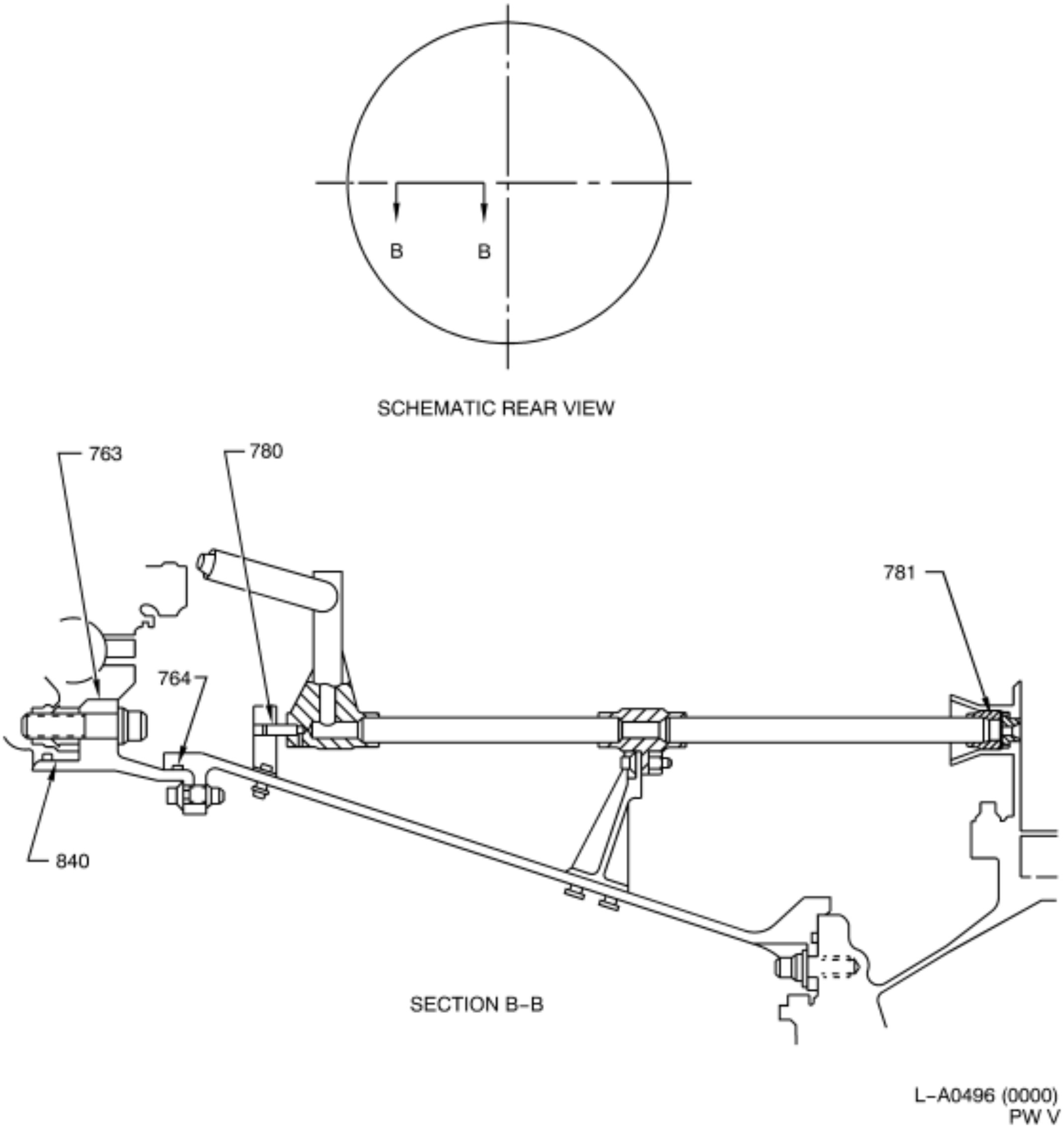

783
952
784
HIGH PRESSURE COMPRESSOR (HPC) STAGE 5 DISK
783
(HPC)
INTERMEDIATE CASE
774
L−A0495 (0000)
PW V

Intermediate Case
Figure 805
(Task 72−34−00−990−001)

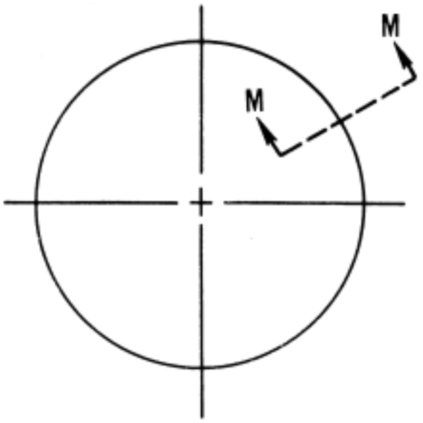
INTERMEDIATE CASE - INSPECTION/CHECK-04


770
785
IGV
INTERMEDIATE CASE
FLANGE E
LOW PRESSURE COMPRESSOR
FLANGE D1
778
FLANGE C
779
FLANGE D
L-A0493 (0000)
PW V

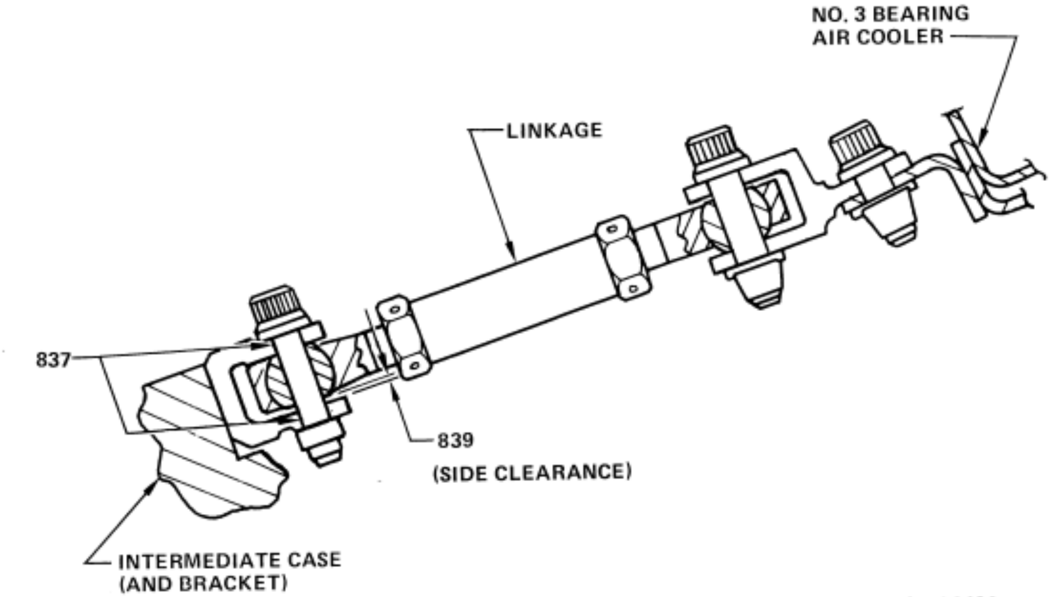
Intermediate Case
Figure 806
(Task 72-34-00-990-001)


B
B
SCHEMATIC REAR VIEW
763
780
781
764
840
SECTION B-B
L-A0496 (0000)
PW V

Intermediate Case
Figure 807
(Task 72-34-00-990-001)



SCHEMATIC REAR VIEW
INTERMEDIATE GROUP


NO. 3 BEARING
AIR COOLER
LINKAGE
837
839
(SIDE CLEARANCE)
INTERMEDIATE CASE
(AND BRACKET)
L-A0489
0989

SECTION M-M
(NO. 3 BEARING AIR COOLER LINKAGE/BRACKETS)

Intermediate Case
Figure 808
(Task 72-34-00-990-001)

INTERMEDIATE CASE - INSPECTION/CHECK-05

Task 72-34-00-200-005:

1. Functional Check - Vacuum Check No. 2 Bearing Compartment

This Section Has Been Relocated To Assembly-01

INTERMEDIATE CASE - ASSEMBLY-01

Task 72-34-00-400-001:

1. Assemble The Intermediate Case

A. Prerequisites

(1) Determine gear spacer thickness. See 72-34-00, Assembly-02 Task 72-34-00-400-002.

(2) Assemble the No. 1.5 bearing support assembly with the gearbox drive bevel gearshaft and bearings. See 72-34-00, Assembly-03 Task 72-34-00-400-003.

(3) Assemble No. 2 bearing and seal assembly. See 72-34-04, Assembly-03 Task 72-34-04-440-002.

B. Equipment And Materials Required

Standard Tools:

Rubber Plug 1.420 Inch (36.068 mm)
Rubber Plug 1 Inch (25.400 mm)
Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

CTE 6075	Cart, Vacuum
PWA 76154	Adapter (2 Required)
PWA 76155	Sling
PWA 85000	Adapter, Lifting
PWA 85001	Adapter
PWA 85002	Arm, Lift And Trunnion (Optional to PWA 101720)
PWA 85005	Fixture
PWA 85029	Adapter, Lifting
PWA 85450	Stand, Storage/Transport
PWA 85473	Cover, Vacuum Check (3 Required)
PWA 85474	Cover, Vacuum Check
PWA 85475	Plug, Vacuum Check (Optional to PWA 101110)
PWA 85476	Cover, Vacuum Check
PWA 85480	Adapter, Vacuum Check
PWA 85662	Bracket, Support (2 Required - Optional to PWA 85667)
PWA 85667	Bracket, Support (2 Required)
PWA 85668	Weight (For Horizontal Assemblies)
PWA 86287	Fixture, Loading (For Vertical Assemblies)
PWA 87552	Crimper, Finish Bend

INTERMEDIATE CASE − ASSEMBLY−01

Special Tools:

(CONTINUED)

PWA 87553	Crimper, Prebend
PWA 101110	Plug, Vacuum Check
PWA 101720	Arm, Lift and Trunnion

Consumable Materials:

	Item No.	Designation
	P03−001	Oil, Engine (PWA 521B)
	P05−004	Tape, Magic Mending
	P05−289	Lockwire (AS3214−02)
	P05−291	Cable, Safety (Optional)
	P05−292	Ferrule, Safety Cable (Optional)
	P06−002	Petrolatum, White (PMC 9609)
R	P06−054	Paste, Antiseize (PWA 36246)
	P09−027	Sealant, Silicone Rubber (PWA 36003−2)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	77−32−00/1/10
Key	2	72−34−00/12/30
Key Washer	3	72−34−00/4/156
Key Washer	4	72−34−00/11/30
Key Washer	2	72−34−00/12/110A
Key Washer	3	72−34−00/17/20
Key Washer	3	72−34−00/17/380
Key Washer	3	77−32−00/1/30
Packing	4	72−34−00/4/152
Packing	1	72−34−00/11/50
Packing	2	72−34−00/11/60
Packing	2	72−34−00/17/1
Packing	2	72−34−00/17/40
Packing	2	72−34−00/17/50
Packing	1	72−62−00/1/1
Packing	1	72−62−00/3/130
Packing	1	77−32−00/1/10
Pin Stop	2	72−00−62/1/10

C. Procedure

Subtask 72−34−00−430−067:

(1) Install PWA 85662 Bracket or PWA 85667 Bracket at the 3 and 9 o'clock locations on intermediate case with bolts provided. Using hoist, PWA 76154 Adapters, and PWA 76155 Sling, install case into PWA 85450 Stand. Remove hoist and sling. Trunnion case to horizontal (flight position). See Figure 1001.

Subtask 72−34−00−430−052:

(2) For engines with a boss on the intermediate case at 11 o'clock (Pre SB PW4ENG 72−86):

(a) Install new packing, lubricated with Engine Oil P03−001, to groove on cover. Install cover to outer case at approximately 11 o'clock location.

(b) Secure cover with four bolts, threads lubricated with Engine Oil P03−001, and key washers.

(c) Tighten and torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Bend tabs to secure bolts.

Subtask 72−34−00−430−068:

(3) Temporarily install the No. 1.5 bearing support assembly (called support assembly) in the compressor intermediate case assembly. See Figure 1002.

(a) Attach PWA 85000 Adapter to the front flange of the support assembly with four hex head bolts.

(b) Attach PWA 101720 Arm or PWA 85002 Arm to the lift holes in the adapter with ball lock pins.

(c) Attach a hoist to the arm and raise the support assembly.

(d) Attach the support assembly to the rear inner flange of the intermediate case assembly with workbolts.

Subtask 72−34−00−430−063:

(4) Temporarily install the No. 2 bearing and seal assembly (called bearing and seal assembly). See Figure 1003.

(a) Install PWA 85001 Adapter on the No. 2 bearing and seal assembly (called bearing and seal assembly).

1 Put the rod of the adapter through the center of the bearing and seal assembly.

2 With the detail nut, attach the front half of the adapter to the rear half of the adapter.

(b) Attach PWA 101720 Arm or PWA 85002 Arm to the adapter with the detail ball lock pins.

(c) With a hoist, lift the bearing and seal assembly.

(d) Attach the bearing and seal assembly to the intermediate case and the support assembly.

1 Install 33 workbolts in the rear flange of the No. 1.5 bearing support assembly.

2 Tighten and torque the bolts to 180 - 200 lb-in. (20.337 - 22.597 N.m).

(e) Remove the arm and adapter from the support assembly. Remove the arm from the bearing and seal assembly.

Subtask 72-34-00-430-069:

(5) Do a check of the gear backlash. See Figure 1004.

(a) Attach PWA 85005 Fixture to the No. 2 bearing support assembly (Pre SB PW4ENG 72-204).

1 Align a tab on the support assembly with a slot in the fixture.

2 Rotate the fixture to mis-align the tabs and slots.

3 Tighten the four clamps.

(b) Attach PWA 85005 Fixture to the No. 2 bearing support assembly (Post SB PW4ENG 72-204).

1 Attach the fixture to the rear flange of the support assembly with the detail screws.

(c) Attach PWA 85005 Fixture to the adapter with the detail ball lock pins. Turn the detail hex head bolt until the detail force gage shows a value of 80 − 120 lb. (355.0 − 533.8 N.).

(d) (For an intermediate case that is in horizontal position) Install PWA 85668 Weight in the hole at the bottom of the support assembly.

NOTE: It is possible to do a check of the backlash with PWA 85668 Weight, Change C, with the angle gearbox installed.

1 Remove the detail weight.

2 Turn the knob to collapse the jaws.

3 Hang the tool from the inside of the gearbox drive bevel gearshaft.

4 Attach the detail weight to the tool.

NOTE: The weight applies a load of 15 − 25 lb. (66.7 − 111.2 N.).

(e) (For an intermediate case that is in vertical position) Install PWA 86287 Fixture in the bore of the intermediate case.

1 Turn the knob to collapse the jaws.

2 With the lip of the jaws behind the inner ID of the gearbox drive bevel gearshaft, and holding the detail tube with a wrench, turn the knob to expand the jaws.

3 Put the detail collar into the bore of the intermediate case.

4 Turn the detail nut until it touches the detail collar.

5 Turn the detail nut back 1/8 turn. This applies the correct load to the bevel gearshaft.

(f) (Reference 203) Do a check of the backlash.

1 Attach a standard gage holder to the assembly.

2 Put the point of a dial indicator at the middle position of a tooth of the gearbox drive bevel gearshaft.

3 With your hand, push the gearbox drive bevel gearshaft to make it gently move back and forth.

4 Read and write the maximum value on the dial indicator. The maximum value permitted is 0.024 − 0.038 inch (0.61 − 0.97 mm) in the plane of rotation.

5 Remove the gage holder and dial indicator.

6 If the backlash check is not in the limits, it is necessary to do as follows.

a Check the classified spacer in the No. 2 bearing and seal assembly. Refer to 72−34−04, Assembly−03 Task 72−34−04−440−002.

b Check the classified spacer in the No. 1.5 bearing and seal assembly. Refer to 72−34−00, Assembly−02 Task 72−34−00−400−002.

(g) Remove the weight, fixture, and adapter from the bearing and seal assembly.

Subtask 72−34−00−430−070:

(6) Do a vacuum check of the No. 2 bearing compartment. See Figure 1005.

(a) Install PWA 85476 Cover on the gearbox drive bevel gear.

1 Remove the nut, washer, and clamp from the cover.

2 Install the detail cover from the rear to touch the seal seat.

3 Put the detail clamp on the threaded rod. The clamp must touch the gear.

4 Attach the cover with the detail washer and nut.

(b) Attach PWA 85473 Cover to each of three pads: breather (12 o'clock), oil pressure (9 o'clock) and oil scavenge (7:30 o'clock).

  1 Attach one cover to the pad in the 12 o'clock strut with bolts, handtight.

  2 Attach another cover to the pad at 9 o'clock with bolts, handtight.

  3 Attach the third cover to the pad at 7:30 o'clock with bolts, handtight.

  NOTE: If the oil scavenge tube (elbow) is installed, install a rubber plug in the tube in place of the cover.

(c) Put a rubber plug in the hole at 6 o'clock.

(d) Install PWA 101110 Plug or PWA 85475 Plug.

  1 Locate the N1 speed sensor hole at 5:00 o'clock.

  2 Lubricate packings with White Petrolatum P06−002. Install plug through intermediate case outer boss until it is in the chamfer.

(e) Install PWA 85474 Cover.

  1 Locate the three hole pad adjacent at 4:30 o'clock.

  2 If neither the N1 bearing transducer nor cover is there, attach the cover to the pad with bolts, handtight.

(f) Attach PWA 85480 Adapter to front of intermediate case with detail cap screws, handtight.

(g) Attach vacuum hose and pressure sense line from CTE 6075 Vacuum Cart to the adapter. Do the vacuum check.

  1 Necessary vacuum: vacuum cart pressure must be set at PAMB minus 10 psi (69 kPa), or PAMB minus 20 inches (508 mm) HG. At sea level this is 5.0 psia (34.5 kPa absolute).

2 (Pre SB PW4ENG 72−245) Airflow must not exceed 8 lbs. (3.63 kg) per hour.

3 (Post SB PW4ENG 72−245) Airflow must not exceed 5 lbs. (2.27 kg) per hour.

(h) Disconnect lines from cover. Remove the vacuum check tools.

(7) Remove the support assembly and bearing and seal assembly.

(a) Install the PWA 85000 Adapter, arm, and hoist on the support assembly.

(b) Install PWA 85001 Adapter, arm, and hoist on the No. 2 bearing and seal assembly.

(c) Remove the 33 workbolts from the flange of the support assembly.

(d) Remove the support and bearing and seal assemblies.

(e) Put the support assembly on a bench. Remove the tools. Put a cover on the support assembly to protect it.

(f) Put the bearing and seal assembly on a bench. Remove the tools. Put a cover on the assembly to protect it.

Subtask 72−34−00−430−071:

(8) Install the main bearing scavenge tube (elbow) assembly. See Figure 1006.

(a) Apply Engine Oil P03−001 to the threads of four bolts.

(b) Attach the tube assembly to the pad on the intermediate case with four key washers and the four bolts.

(c) Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(d) Bend the tabs of the key washers.

Subtask 72−34−00−430−072:

(9) Install the main bearing (outer) scavenge tube assembly. See Figure 1006.

- (a) Apply Engine Oil P03−001 to three new packings. Install the packings on the tube assembly.
- (b) Install the tube assembly in the intermediate case at 7:30 o'clock. Install the outer end of the tube assembly in the scavenge tube (elbow) assembly.

Subtask 72−34−00−430−075:

(10) Install the tube connector. See Figure 1006.

- (a) Apply Engine Oil P03−001 to the threads of four bolts.
- (b) Attach the tube connector to the pad on the intermediate case with four key washers and the four bolts.
- (c) Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).
- (d) Bend the tabs of the key washers.

(11) Install the main bearing (oil) pressure tube assembly. See Figure 1006.

- (a) Apply Engine Oil P03−001 to three packings. Install the packings on the tube assembly.
- (b) Install the tube assembly in the intermediate case at 9 o'clock. Install the outer end of the tube assembly in the tube connector.

Subtask 72−34−00−430−054:

(12) Install the angle gearbox. See Figure 1007.

- (a) Trunnion the intermediate case to vertical (front end down) position.
- (b) Attach a new pin stop to each support bracket with bolts, lubricated with Engine Oil P03−001. Tighten the bolts with your fingers.

(c) Install the brackets on the pins at the sides of the angle gearbox.

(d) Twist the bent end of the of the stop counterclockwise until it touches the ID of the pin.

(e) While you hold the pin stops, torque the bolts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(f) Bend the keys on the stops.

(g) Apply Engine Oil P03−001 to one packing. Put the packing in the groove at the top of the angle gearbox.

(h) Install PWA 85029 Adapter on the rear flange of the angle gearbox with three detail bolts. With a hoist, lift the gearbox. Put it in the correct position in the intermediate case.

(i) Attach the angle gearbox to the intermediate case.

  1 Apply Engine Oil P03−001 to the threads of four bolts.

  2 (Pre SB PW4ENG 72−438) Attach the angle gearbox with the bolts through the support brackets. Torque the bolts to 225 − 300 lb−in. (25.422 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

  3 (Post SB PW4ENG 72−438) Put the two key washers in the correct position against the support brackets. Attach the angle gearbox with the bolts through the key washers and support brackets. Torque the bolts to 275 − 300 lb−in. (31.071 − 33.895 N.m). Bend the tabs of the key washers against the bolts. Use PWA 87553 Crimper, then use PWA 87552 Crimper.

(j) Remove the adapter.

(k) Trunnion the intermediate case to horizontal (flight) position.

Subtask 72−34−00−430−073:

(13) (Reference 138) Install the fan exit case flange assembly on the intermediate case. See Figure 1008.

(a) Install the flange assembly at the flange assembly on the intermediate case.

(b) Install two keys in the lugs of the intermediate case struts. Use the correct class of key. The class of key is correct if there is no empty space between the key and the case. Refer to the figure. Bend the keys as shown in the figure.

(c) Clean Areas K and CH. Use PWA 83−A4. See Standard Practices Manual, PN 585005.

(d) Fill Area K with Sealant P09−027. Cure the sealant in room temperature air of 20 percent minimum relative humidity. Cure the sealant for eight hours, minimum, before engine operation.

(e) Fill Area CF with Sealant P09−027. Cure the sealant in room temperature air of 25 percent minimum relative humidity. Cure the sealant for two hours, minimum, before you touch the part.

Subtask 72−34−00−430−074:

(14) (Post SB PW4ENG 77−19) If the engine does NOT have a No. 1 bearing (vibration) transducer, install a cover. See Figure 1009.

(a) Apply Engine Oil P03−001 to two packings.

(b) Put the packing on the cover.

(c) Apply Engine Oil P03−001 to the threads of three bolts.

(d) Attach the cover to the pad on the ID of the intermediate case at 4:30 o'clock. Use three key washers and the three bolts. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Bend the tabs of the key washers.

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER CONDUIT AND ATTACHING PARTS. INTERCHANGEABILITY IS AFFECTED. REFER TO (SB PW4ENG 77−13).

(15) If the engine HAS a No. 1 bearing (vibration) transducer, install the transducer conduit.

(a) Install a packing on the conduit.

1 Apply Engine Oil P03−001 to the packing.

2 Install it in the packing groove under the flange of the conduit.

(b) Install a gasket under the flange of the conduit.

(c) Attach the conduit to the boss at 4:30 o'clock (rear view) on the intermediate case.

1 Apply Engine Oil P03−001 to the threads of three bolts.

2 Attach the conduit to the intermediate case with three key washers and the three bolts.

3 Torque the bolts to 85 − 95 lb−in. (9.604 − 10.7 N.m). Bend the tabs of the key washers.

4 Apply Engine Oil P03−001 to the threads of one clamp−bolt.

5 Clamp the conduit to the boss on the inside of the intermediate case with a clamp, spacer (if applicable), the bolt, and a nut.

6 Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

7 Install protective covers.

Subtask 72−34−00−430−064:

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER BRACKET. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 77−13.

(16) Install brackets to intermediate case at 5 o'clock position and secure with four bolts, threads lubricated

with Engine Oil P03-001, and torque to 85 - 95 lb-in. (9.064 - 10.734 N.m). See Figure 1010. Remove protective closures from stability bleed pneumatic relay valve. Install gaskets to adapters and install adapters, threads lubricated with Engine Oil P03-001, to three threaded ports. Torque largest adapter to 150 - 170 lb-in. (16.948 - 19.207 N.m). Torque smallest adapter to 65 - 75 lb-in. (7.344 - 8.474 N.m). Torque medium adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m). Install valve to bracket and secure with three bolts, threads lubricated with Engine Oil P03-001, and nuts. Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

NOTE: For engines with the revised bleed valve supply tube clamp installation (Post SB PW4ENG 75-41), the clamp bracket must be aligned during the installation of the bracket attached to the solenoid. See Figure 1010 (Sheet 1).

Subtask 72-34-00-430-065:

(17) Remove protective closures from start/stability bleed valve solenoid. See Figure 1010. Install two gaskets to two adapters and install adapters, threads lubricated with Engine Oil P03-001, to two adjacent ports in solenoid. Torque adapters to 65 - 75 lb-in. (7.344 - 8.474 N.m). Install three gaskets to two adapters and one plug. Install adapters and plug, threads lubricated with Engine Oil P03-001, to three ports at rear of valve solenoid. Torque plug and smaller adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m). Torque larger adapter to 150 - 170 lb-in. (16.948 - 19.207 N.m).

(18) Install solenoid to bracket at 5 o'clock position and secure with four bolts, lubricated with Engine Oil P03-001 (and bracket Post SB PW4ENG 75-41). Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

NOTE: For engines with the revised clamp installations (Post SB PW4ENG 75-41), the two clamp brackets must align per Figure 1010 (Sheet 1). Loosen and torque the bolts again if necessary.

(19) Install the (AA35) bleed valve supply tube assembly, threads at elbow end lubricated with Engine Oil P03−001, and threads at straight end lubricated with Antiseize Paste P06−054, refer to figure and tighten by hand. Remove unwanted paste. For (Post SB PW4ENG 75−41) engines install clamps, bolt, lubricated with Engine Oil P03−001, and nut that attach the tube to the bracket. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). Torque elbow end to solenoid to 90 − 100 lb−in. (10.169 − 11.298 N.m). Torque straight end to relay valve adapter to 65 − 75 lb−in. (7.344 − 8.474 N.m). Install cap, threads lubricated with Engine Oil P03−001, to solenoid adapter adjacent to tube and torque to 90 − 100 lb−in. (10.169 − 11.298 N.m). Secure tube and cap with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(20) For engines with the (AA37) bleed valve supply tube maintenance break at 5 o'clock position (Post SB PW4ENG 75−28) install tubes as follows.

(a) Remove protective closures from the (AA36) and (AA37) bleed valve supply tubes.

(b) Lubricate all tube threads with Antiseize Paste P06−054. Remove unwanted paste.

(c) Attach the (AA36) and (AA37) tubes per figure and tighten by hand.

(d) Install clamps, bolts, lubricated with Engine Oil P03−001, spacer, and nuts as necessary per figures. Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(e) Torque the larger (AA37) tube nut to 225 − 250 lb−in. (25.422 − 28.246 N.m). Torque the smaller (AA36) tube nut to 200 − 225 lb−in. (22.597 − 25.422 N.m). Secure tubes with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

Subtask 72−34−00−430−055:

(21) FOR THESE MODELS: 4152, 4156A, 4158
Install the HPC secondary flow control valve, IDGS air/oil heat exchanger valve override solenoid as follows. See Figure 1011.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove the protective closures from the solenoid.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Install two gaskets to the two adapters and install the adapters, threads lubricated with Engine Oil P03−001, to the ports on the top of of the solenoid. Torque the adapters to 65 − 75 lb−in. (7.344 − 8.474 N.m).

(c) FOR THESE MODELS: 4152, 4156A, 4158
Install three gaskets to the two adapters and one plug and install the adapters and plug, threads lubricated with Engine Oil P03−001, to the three ports at the rear of the solenoid. Torque the plug and smaller adapter to 110 − 120 lb−in. (12.428 − 13.558 N.m). Torque the larger adapter to 150 − 170 lb−in. (16.948 − 19.207 N.m).

Subtask 72−34−00−430−076:

(22) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the turbine vane and blade cooling air valve, IDGS air/oil heat exchanger valve override solenoid as follows. See Figure 1011A.

(a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the protection covers from the solenoid.

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install two gaskets to the two adapters and install the adapters, threads lubricated with Engine Oil P03−001, to the ports on top of the solenoid. Torque the adapters to 65 − 75 lb−in. (7.344 − 8.474 N.m).

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install three gaskets to the two adapters and one plug and install the adapters and plug, threads lubricated with Engine Oil P03−001, to the three ports at the rear of the solenoid. Torque the plug and smaller adapter to 110 − 120 lb−in. (12.428 − 13.558 N.m). Torque the larger adapter to 150 − 170 lb−in. (16.948 − 19.207 N.m).

(23) Install the solenoid to the intermediate case at approximately the 1 o'clock position with two brackets. Attach with four bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(24) Install the IDGS air/oil heat exchanger valve override pressure switch to the bracket and attach with two bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(25) Install the pressure switch tube assembly, threads at the elbow end lubricated with Engine Oil P03−001 and
R threads at the straight end lubricated with Antiseize
R Paste P06−054, to the switch and solenoid. Remove
R unwanted paste. Torque the elbow end to the solenoid adapter to 90 − 100 lb−in. (10.169 − 11.298 N.m). Torque the straight end to the pressure switch adapter to 65 − 75 lb−in. (7.344 − 8.474 N.m). Install cap, threads lubricated with Engine Oil P03−001, to the remaining adapter on the top of the solenoid and torque to 90 − 100 lb−in. (10.169 − 11.298 N.m). Safety the tube and cap with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

Subtask 72−34−00−430−066:

(26) FOR THESE MODELS: 4152, 4156A, 4158
Install the HPC secondary flow control valve, turbine vane and blade cooling air valve solenoid as follows. See Figure 1012.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove the protective closures.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Install the two gaskets to the adapters and install the adapters, threads lubricated with Engine Oil P03−001, to the two adjacent ports on the top of the solenoid. Torque the adapters to 65 − 75 lb−in. (7.344 − 8.474 N.m).

(c) FOR THESE MODELS: 4152, 4156A, 4158
Install two caps, threads lubricated with Engine Oil P03−001, to the same adapters and torque the caps to 90 − 100 lb−in. (10.169 − 11.298 N.m). Safety the caps with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(d) FOR THESE MODELS: 4152, 4156A, 4158
Install three gaskets to the two smaller adapters and one larger adapter and install the adapters, threads lubricated with Engine Oil P03−001, to the ports on the rear of the solenoid. Torque the smaller two adapters to 110 − 120 lb−in. (12.428 − 13.558 N.m). Torque the larger adapter to 150 − 170 lb−in. (16.948 − 19.207 N.m).

Subtask 72−34−00−430−077:

(27) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the turbine vane cooling air valve, turbine vane and blade cooling air valve solenoid as follows.
R See Figure 1012 (Sheet 2).

(a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the protection covers from the turbine vane cooling air valve, turbine vane and blade cooling air valve solenoid.

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install two gaskets to the two adapters and install the adapters, threads lubricated with Engine Oil P03−001, to the two adjacent ports on the top of the solenoid. Torque the adapters to 65 − 75 lb−in. (7.344 − 8.474 N.m).

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install two caps, threads lubricated with Engine Oil P03−001, to the same adapters and torque the caps to 90 − 100 lb−in. (10.169 − 11.298 N.m). Safety the caps with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(d) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install three gaskets to the two smaller adapters and one larger adapter and install the adapters, threads lubricated with Engine Oil P03−001, to the ports on the rear of the solenoid. Torque the smaller two adapters to 110 − 120 lb−in. (12.428 − 13.558 N.m). Torque the larger adapter to 150 − 170 lb−in. (16.948 − 19.207 N.m).

(28) Install the solenoid and bracket to the intermediate case at approximately the 10 o'clock position and attach with four bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

Subtask 72−34−00−430−079:

R (29) Install the engine mount nuts and lock plate at two
R locations as follows: See Figure 1013.

R (a) Apply Engine Oil P03−001 to the two bolts (1013/3)
R you will use to install the lock plates.

R (b) Assemble two engine mount nuts (1013/1) to the
R engine mount lock plate (1013/2).

R (c) Install the nuts and lock plate assembly to the
R engine mount boss at the 12 o'clock position
R on the rear of the intermediate case with a
R lubricated bolt (1013/3).

R (d) Tighten and torque the bolt to 65 − 85 lb−in.
R (7.344 − 9.604 N.m).

R (e) Safety the bolt with Lockwire P05−289.

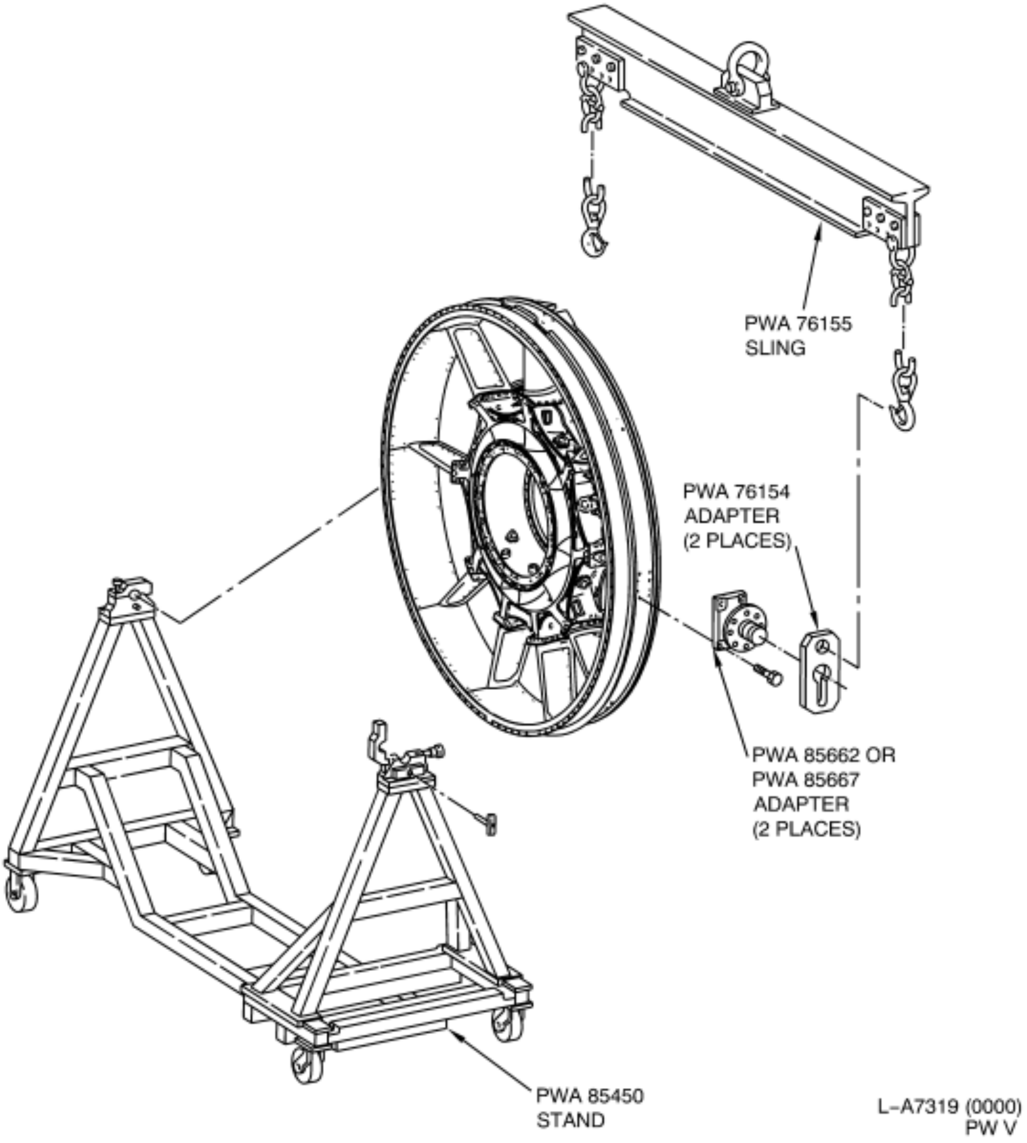
Subtask 72−34−00−430−057:

R (30) Using hoist, adapters, and sling, raise case from build stand and install front end down into assembly fixture/workstand.

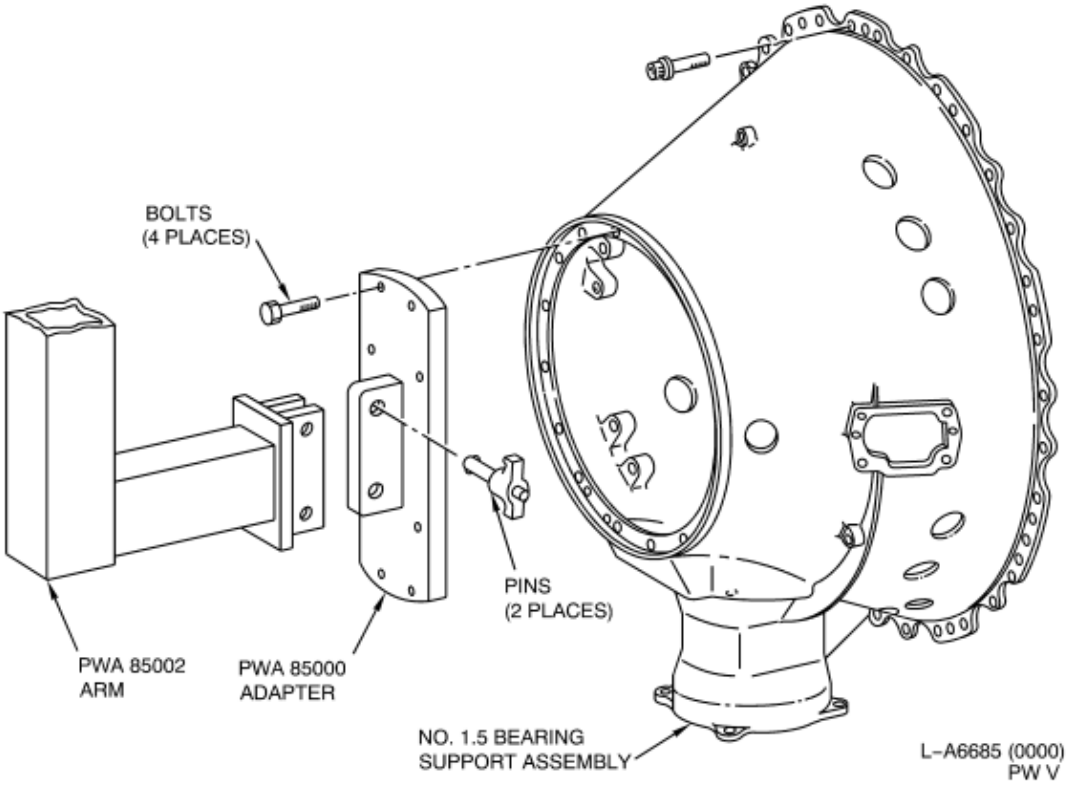
D. Postrequisites

(1) Assemble the No. 1.5 bearing support assembly with the tube and nozzles. Refer to 72−34−00, Assembly−04 Task 72−34−00−400−004.

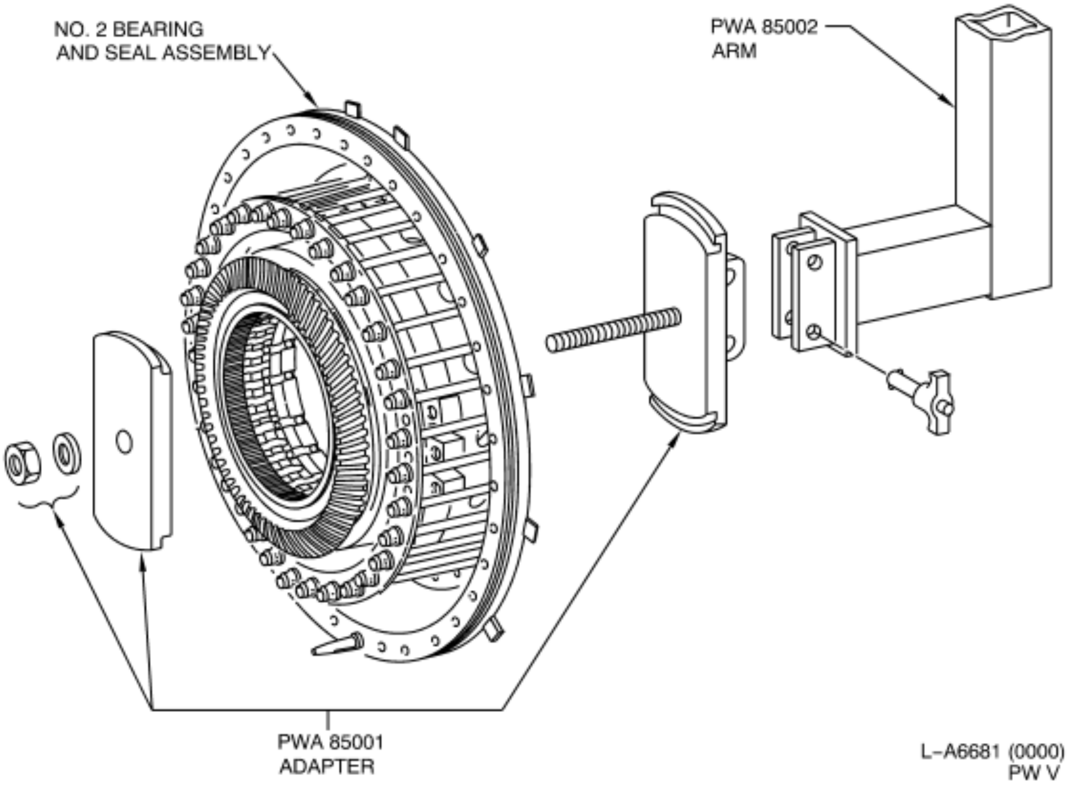
INTERMEDIATE CASE − ASSEMBLY−01


PWA 76155
SLING
PWA 76154
ADAPTER
(2 PLACES)
PWA 85662 OR
PWA 85667
ADAPTER
(2 PLACES)
PWA 85450
STAND
L−A7319 (0000)
PW V

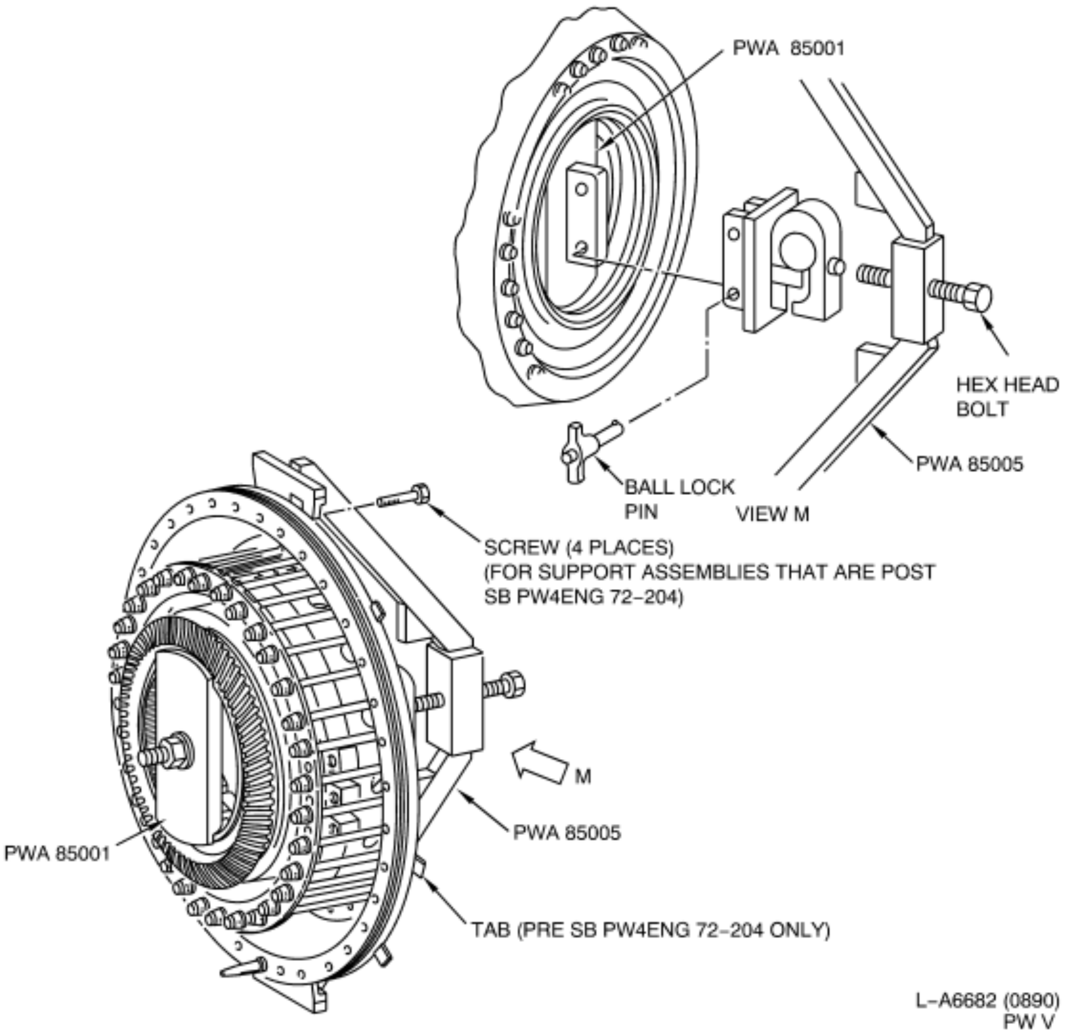
Installation Of The Intermediate Case In A Stand
Figure 1001
(Task 72−34−00−400−001)


BOLTS
(4 PLACES)
PINS
(2 PLACES)
PWA 85002
ARM
PWA 85000
ADAPTER
NO. 1.5 BEARING
SUPPORT ASSEMBLY
L-A6685 (0000)
PW V

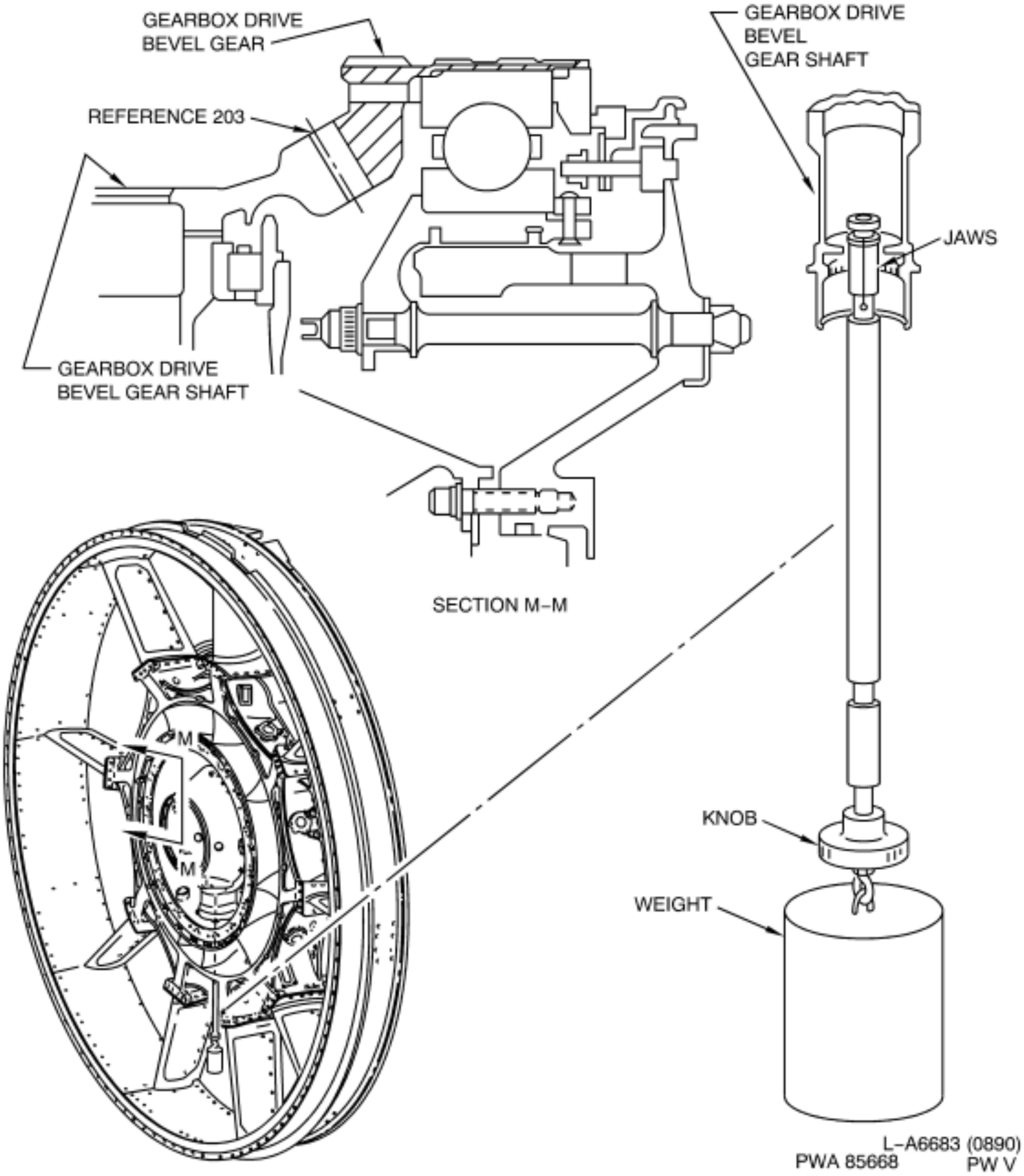
Install The No. 1.5 Bearing Support Assembly
Figure 1002
(Task 72-34-00-400-001)


NO. 2 BEARING AND SEAL ASSEMBLY
PWA 85002 ARM
PWA 85001 ADAPTER
L-A6681 (0000)
PW V

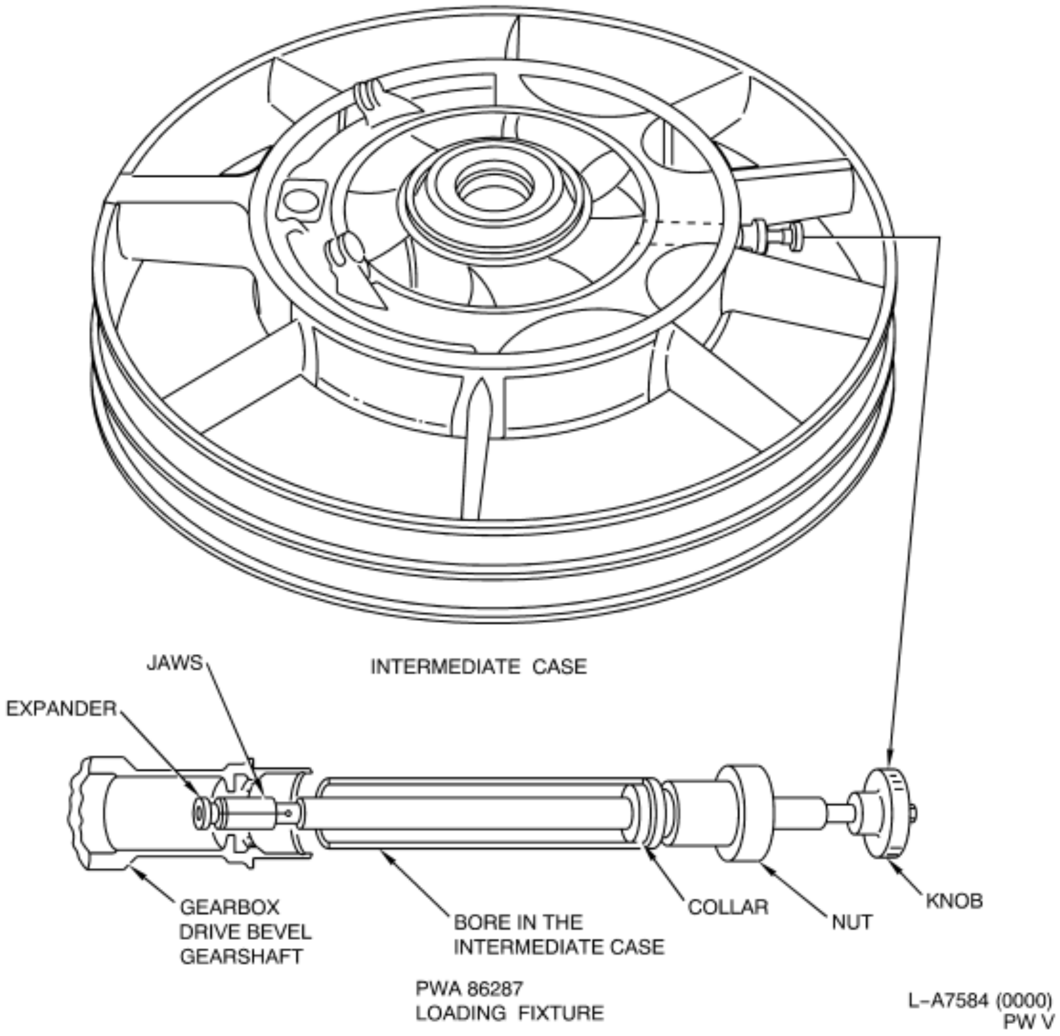
Install The No. 2 Bearing And Seal Assembly
Figure 1003
(Task 72-34-00-400-001)


PWA 85001
HEX HEAD BOLT
PWA 85005
BALL LOCK PIN
VIEW M
SCREW (4 PLACES) (FOR SUPPORT ASSEMBLIES THAT ARE POST SB PW4ENG 72-204)
M
PWA 85005
PWA 85001
TAB (PRE SB PW4ENG 72-204 ONLY)
L-A6682 (0890)
PW V

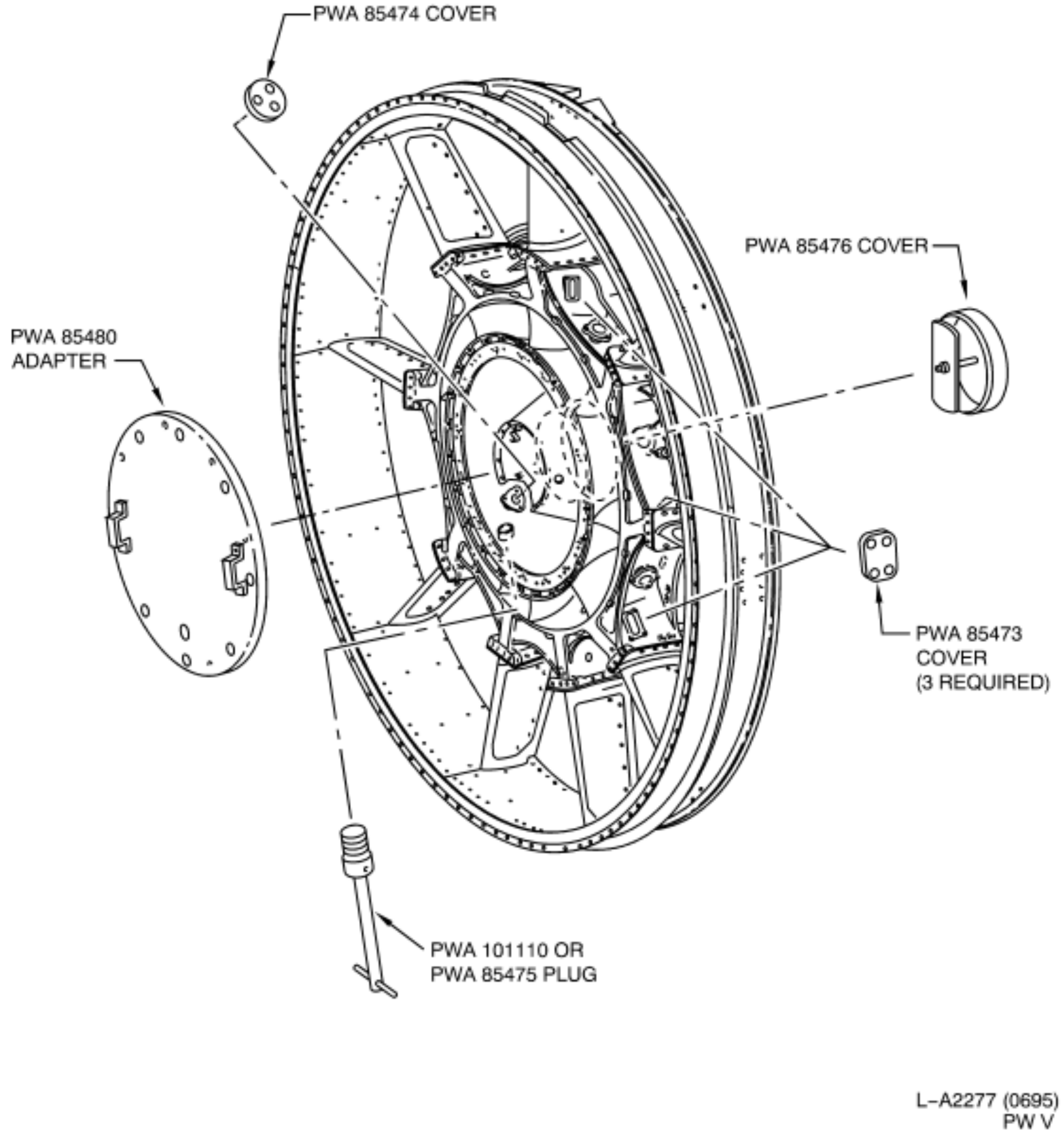
The Gear Backlash Check
Figure 1004 (Sheet 1)
(Task 72-34-00-400-001)


GEARBOX DRIVE BEVEL GEAR
REFERENCE 203
GEARBOX DRIVE BEVEL GEAR SHAFT
GEARBOX DRIVE BEVEL GEAR SHAFT
JAWS
SECTION M-M
M
M
KNOB
WEIGHT
L-A6683 (0890)
PWA 85668
PW V

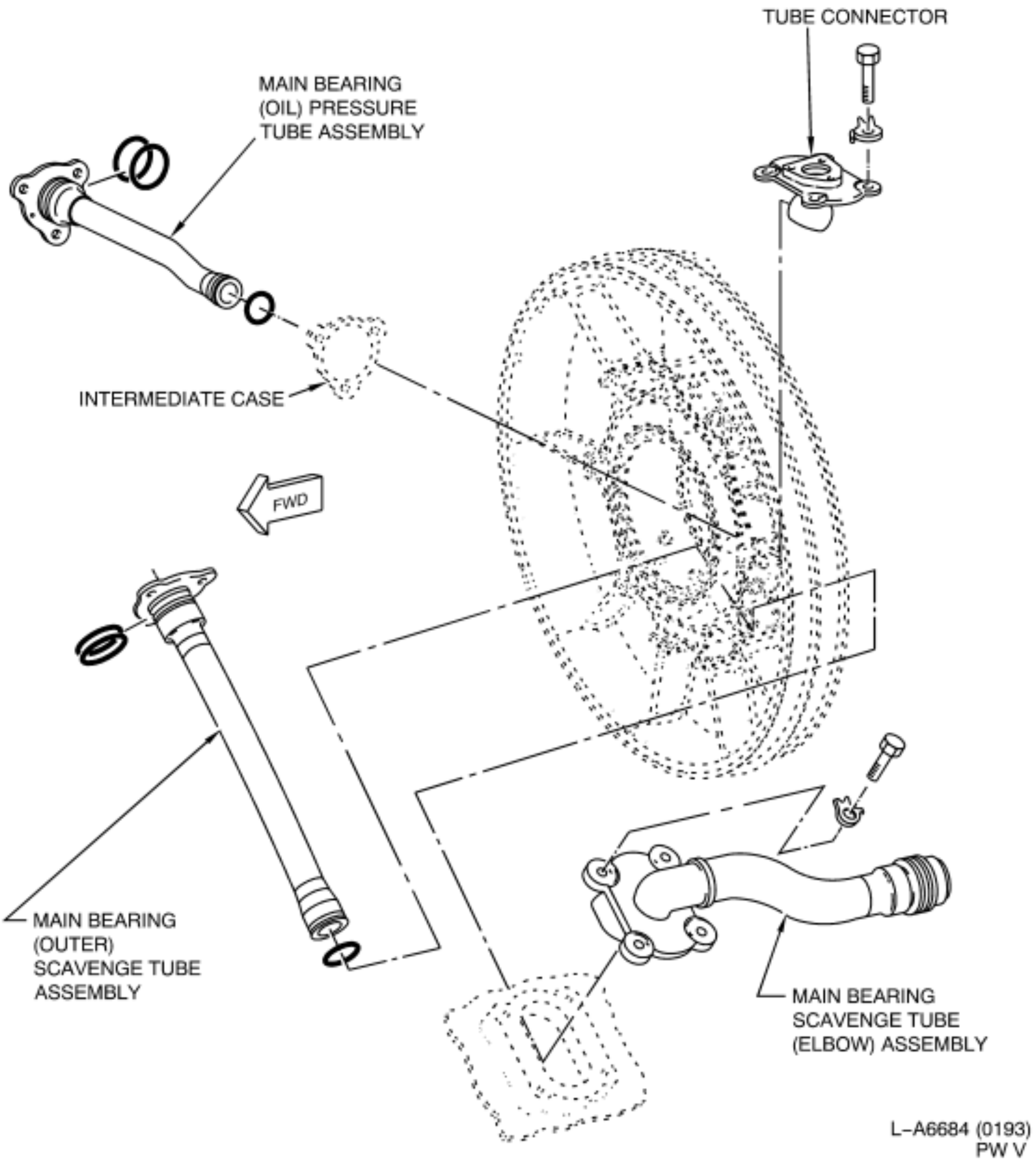
The Gear Backlash Check
Figure 1004 (Sheet 2)
(Task 72-34-00-400-001)


INTERMEDIATE CASE
JAWS
EXPANDER
GEARBOX DRIVE BEVEL GEARSHAFT
BORE IN THE INTERMEDIATE CASE
COLLAR
NUT
KNOB
PWA 86287 LOADING FIXTURE
L-A7584 (0000)
PW V

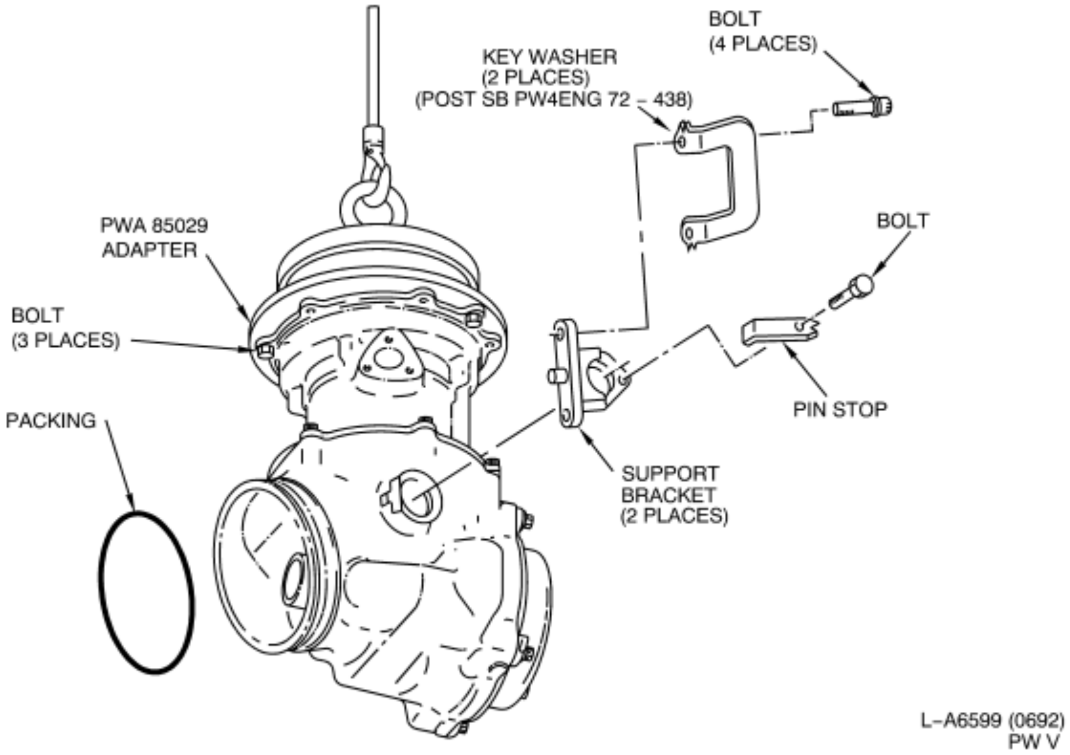
The Gear Backlash Check
Figure 1004 (Sheet 3)
(Task 72-34-00-400-001)


PWA 85474 COVER
PWA 85476 COVER
PWA 85480
ADAPTER
PWA 85473
COVER
(3 REQUIRED)
PWA 101110 OR
PWA 85475 PLUG
L-A2277 (0695)
PW V

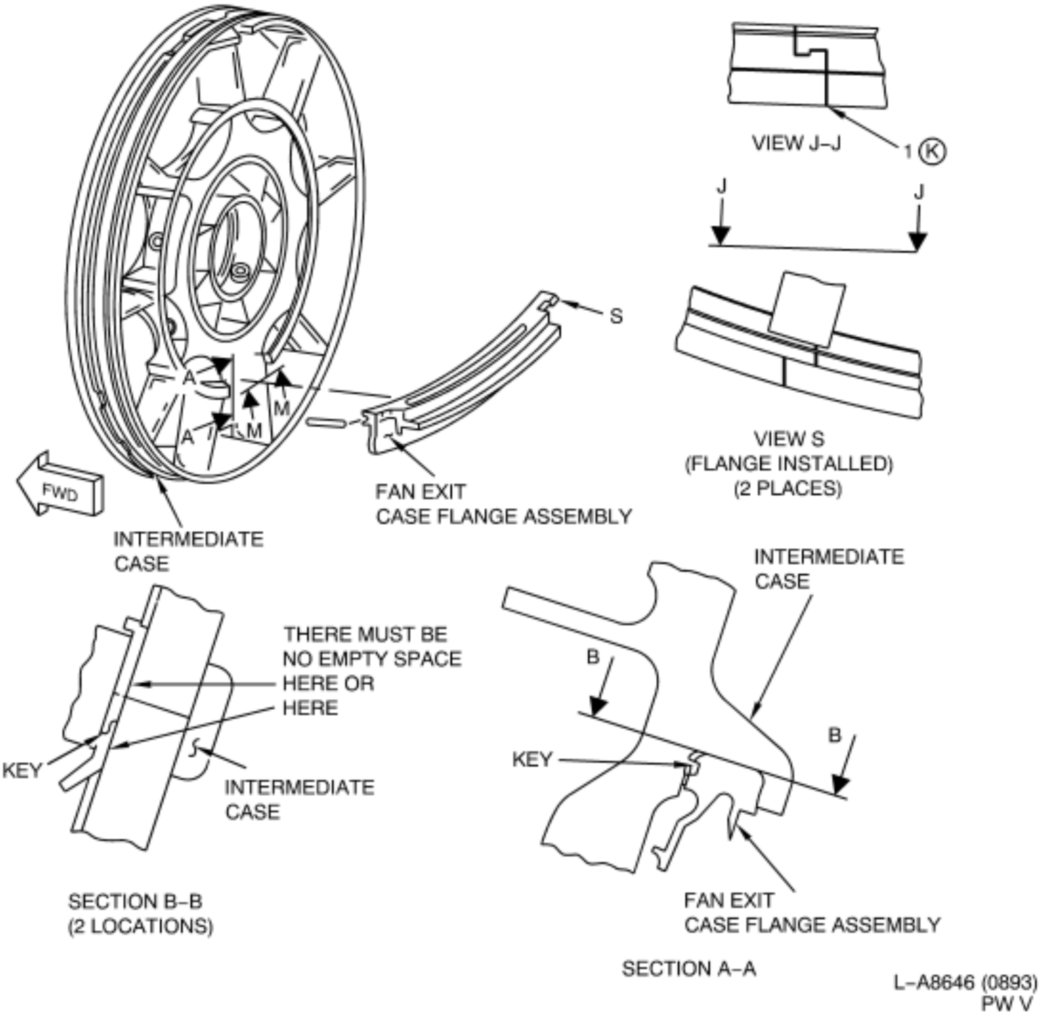
Vacuum Check The No. 2 Bearing Compartment
Figure 1005
(Task 72-34-00-400-001)


TUBE CONNECTOR
MAIN BEARING (OIL) PRESSURE TUBE ASSEMBLY
INTERMEDIATE CASE
FWD
MAIN BEARING (OUTER) SCAVENGE TUBE ASSEMBLY
MAIN BEARING SCAVENGE TUBE (ELBOW) ASSEMBLY
L-A6684 (0193)
PW V

Install The Main Bearing Scavenge Tubes And (Oil) Pressure Tube
Figure 1006
(Task 72-34-00-400-001)

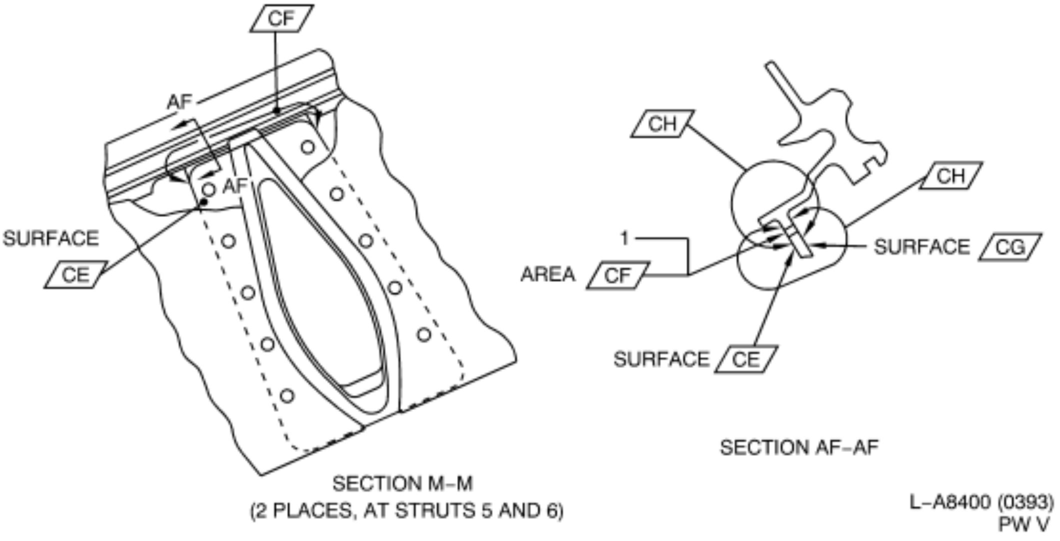

BOLT
(4 PLACES)
KEY WASHER
(2 PLACES)
(POST SB PW4ENG 72 - 438)
BOLT
PWA 85029
ADAPTER
BOLT
(3 PLACES)
PACKING
PIN STOP
SUPPORT
BRACKET
(2 PLACES)
L-A6599 (0692)
PW V

Install the Angle Gearbox Assembly
Figure 1007
(Task 72-34-00-400-001)


VIEW J-J
1 Ⓚ
J
J
S
A
M
A
M
FWD
INTERMEDIATE CASE
FAN EXIT CASE FLANGE ASSEMBLY
VIEW S (FLANGE INSTALLED) (2 PLACES)
INTERMEDIATE CASE
THERE MUST BE NO EMPTY SPACE HERE OR HERE
KEY
INTERMEDIATE CASE
SECTION B-B (2 LOCATIONS)
B
B
KEY
FAN EXIT CASE FLANGE ASSEMBLY
SECTION A-A
L-A8646 (0893)
PW V

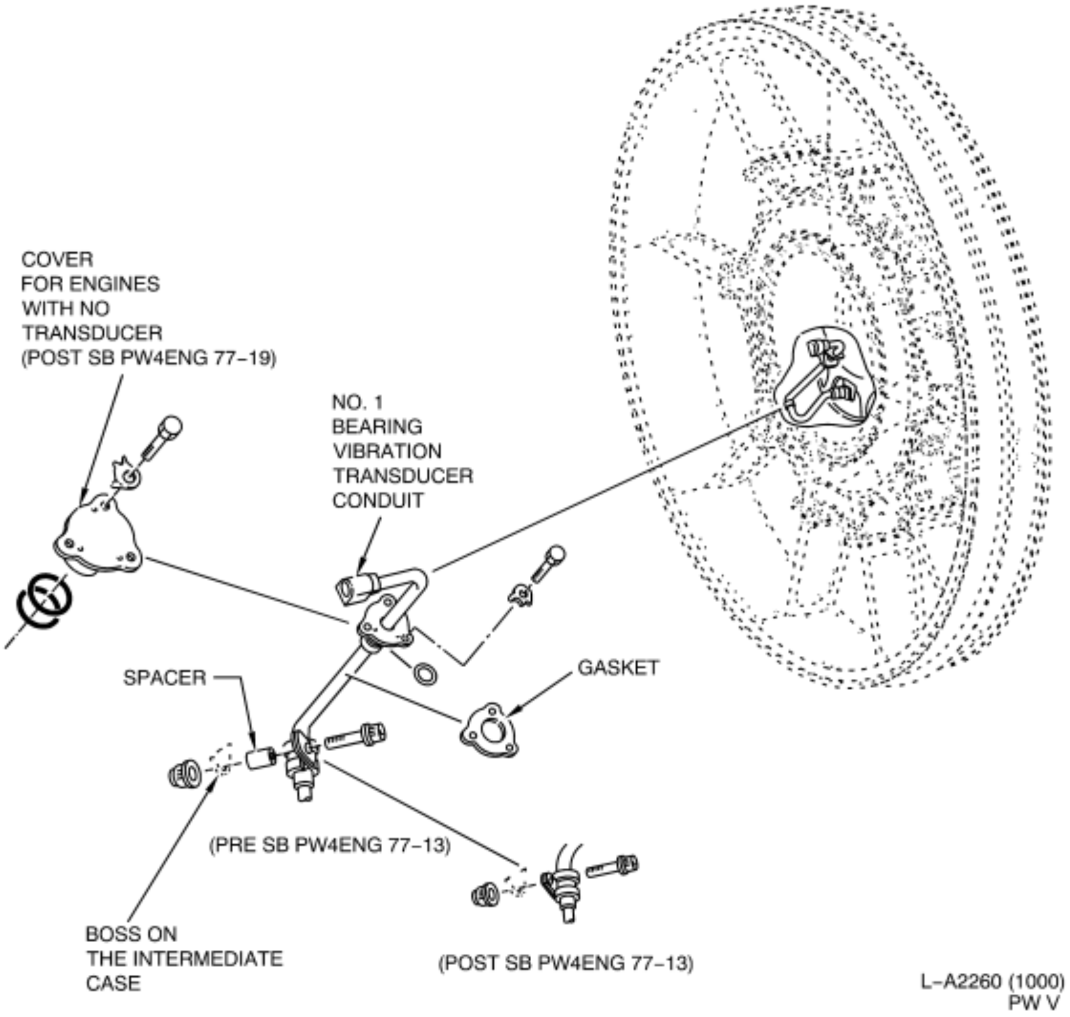
1. Apply Sealant To The Ends Of The Flange Assembly, Two Locations. Fill The Joint After Assembly Flush To 0.010 Inch (0.254 mm) Above All Surfaces, Two Places.

Install the Fan Exit Case Flange Assembly
Figure 1008 (Sheet 1)
(Task 72-34-00-400-001)

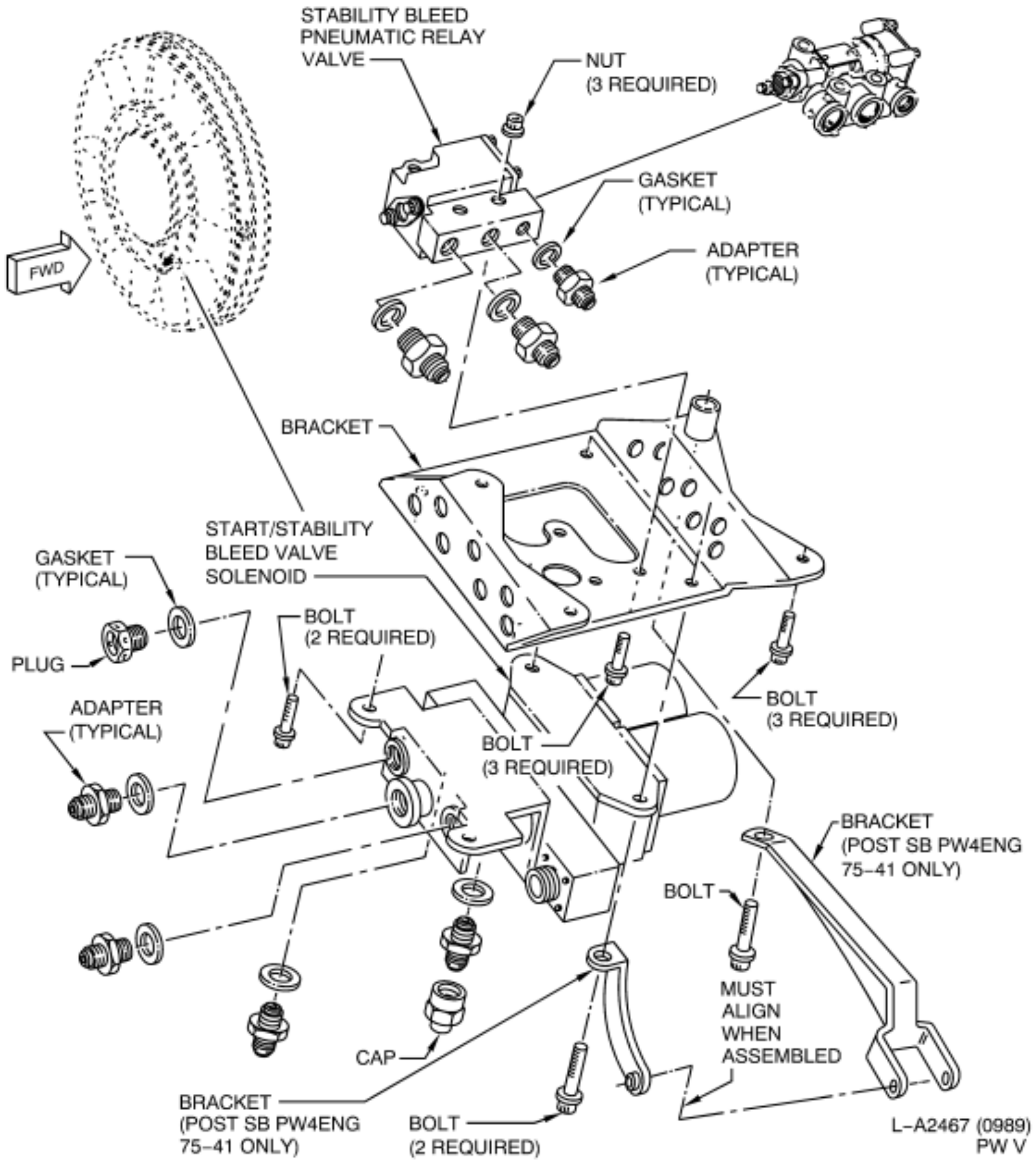

CF
AF
AF
SURFACE
CE
SECTION M-M
(2 PLACES, AT STRUTS 5 AND 6)
CH
CH
1
AREA
CF
SURFACE
CG
SURFACE
CE
SECTION AF-AF
L-A8400 (0393)
PW V

1. Fully Fill Area CF. The Sealant Must Be Flush With, Or Up To 0.020 Inch (0.508 mm) Below, Surface CE. It Is Permitted For The Sealant To Be Above Surface CG. The Height Is Not Important.

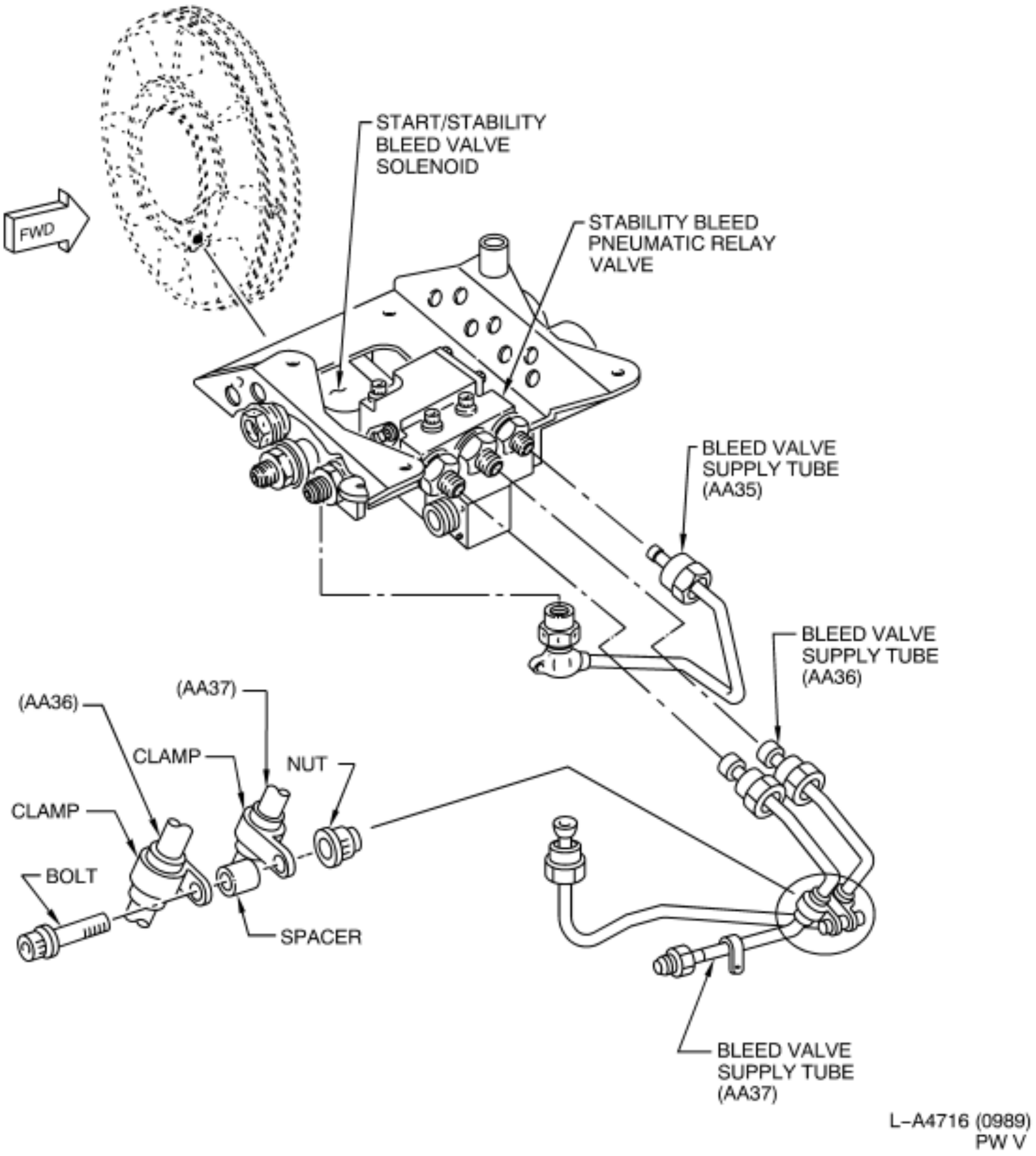
Install the Fan Exit Case Flange Assembly
Figure 1008 (Sheet 2)
(Task 72-34-00-400-001)


COVER
FOR ENGINES
WITH NO
TRANSDUCER
(POST SB PW4ENG 77-19)
NO. 1
BEARING
VIBRATION
TRANSDUCER
CONDUIT
SPACER
GASKET
(PRE SB PW4ENG 77-13)
BOSS ON
THE INTERMEDIATE
CASE
(POST SB PW4ENG 77-13)
L-A2260 (1000)
PW V

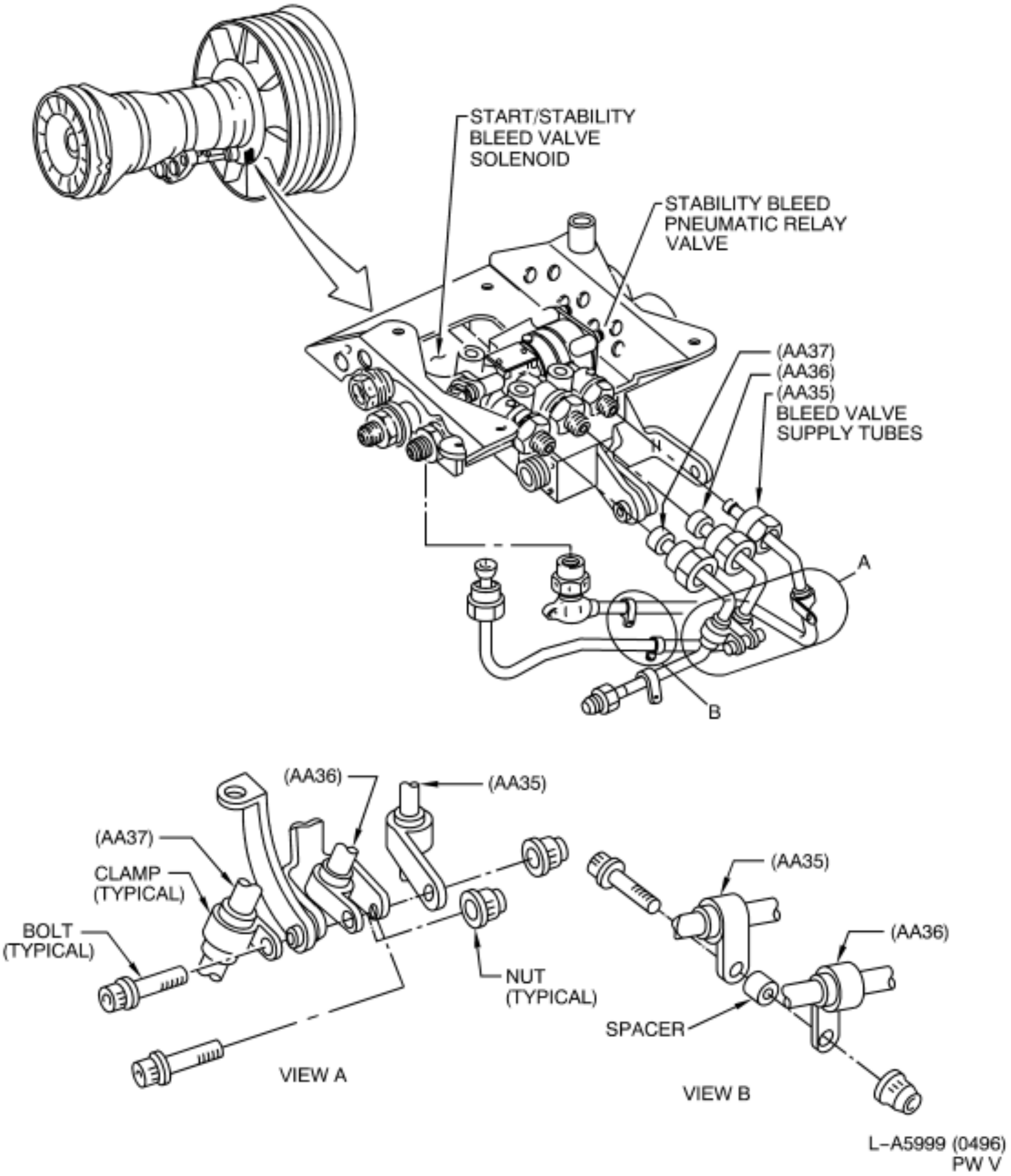
No. 1 Bearing (Vibration) Transducer Conduit
Figure 1009
(Task 72-34-00-400-001)


STABILITY BLEED PNEUMATIC RELAY VALVE
NUT (3 REQUIRED)
GASKET (TYPICAL)
ADAPTER (TYPICAL)
FWD
BRACKET
START/STABILITY BLEED VALVE SOLENOID
GASKET (TYPICAL)
PLUG
BOLT (2 REQUIRED)
ADAPTER (TYPICAL)
BOLT (3 REQUIRED)
BOLT (3 REQUIRED)
BRACKET (POST SB PW4ENG 75-41 ONLY)
BOLT
MUST ALIGN WHEN ASSEMBLED
CAP
BRACKET (POST SB PW4ENG 75-41 ONLY)
BOLT (2 REQUIRED)
L-A2467 (0989)
PW V

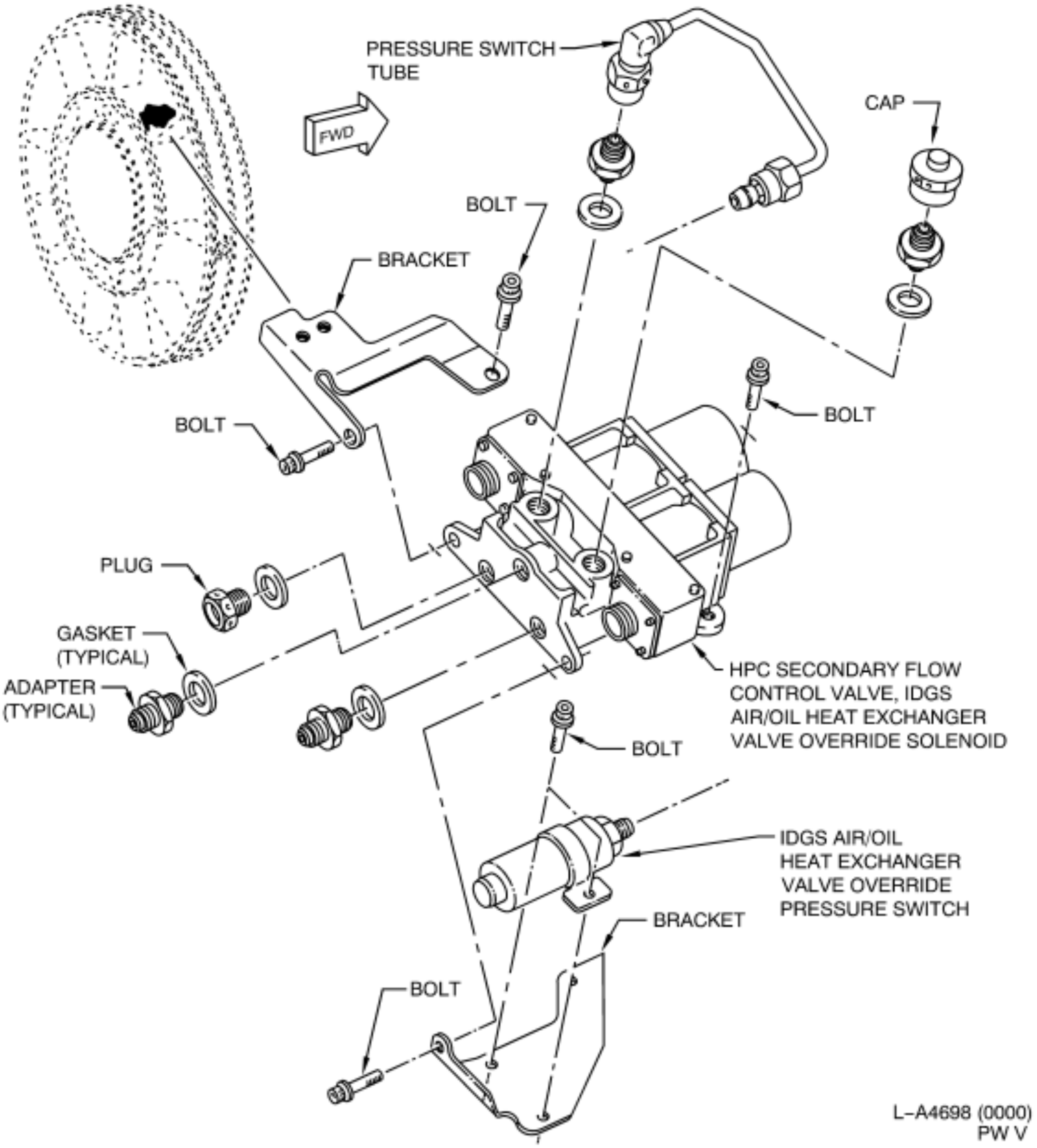
Installation Of The Stability Bleed Pneumatic Relay Valve And Start/Stability Bleed Valve Solenoid
Figure 1010 (Sheet 1)
(Task 72-34-00-400-001)


FWD
START/STABILITY BLEED VALVE SOLENOID
STABILITY BLEED PNEUMATIC RELAY VALVE
BLEED VALVE SUPPLY TUBE (AA35)
BLEED VALVE SUPPLY TUBE (AA36)
(AA36)
(AA37)
CLAMP
NUT
CLAMP
BOLT
SPACER
BLEED VALVE SUPPLY TUBE (AA37)
L−A4716 (0989)
PW V

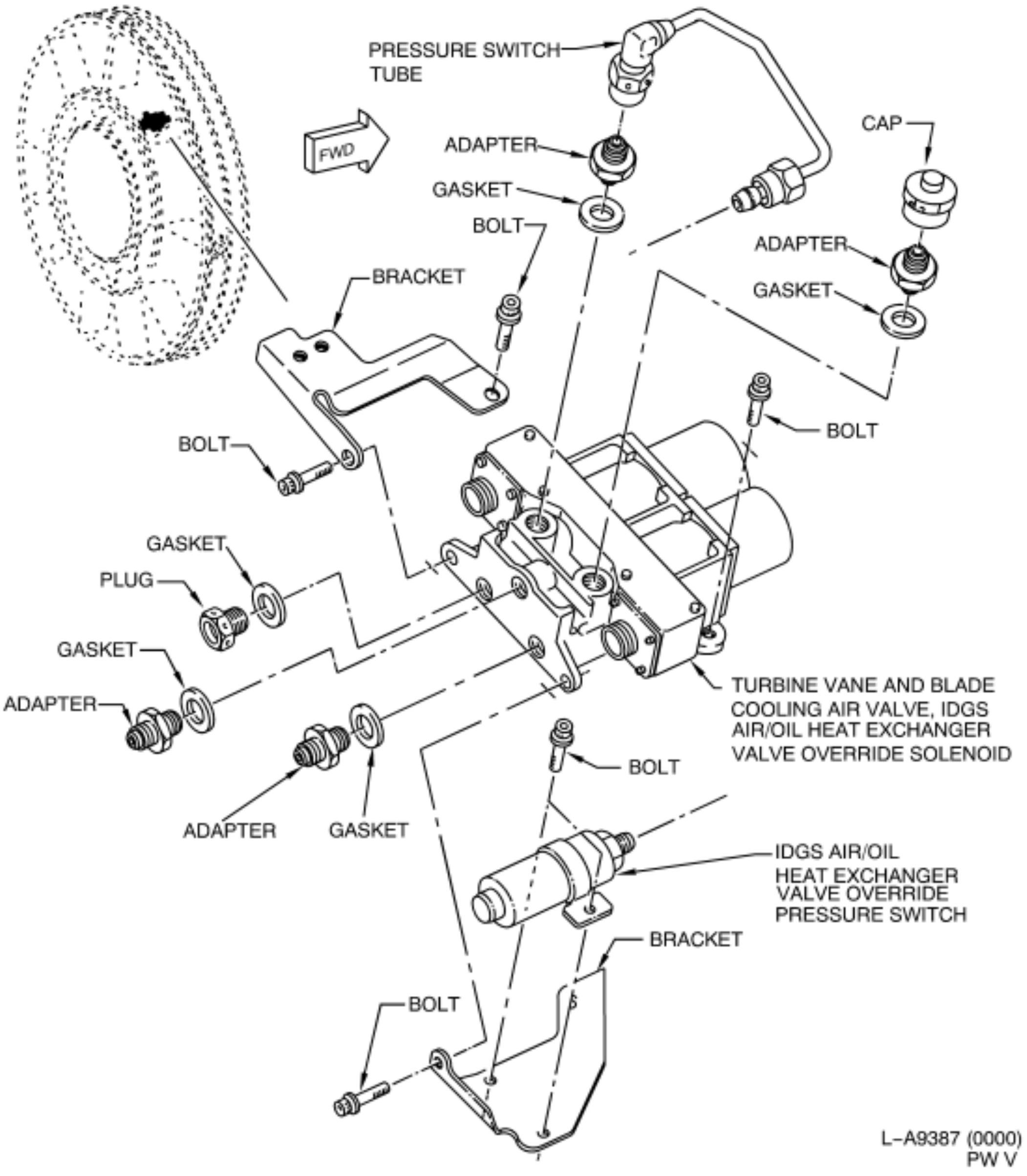
Installation Of The Stability Bleed Pneumatic Relay Valve And Start/Stability Bleed Valve Solenoid (Post SB PW4ENG 75−28)
Figure 1010 (Sheet 2)
(Task 72−34−00−400−001)


START/STABILITY BLEED VALVE SOLENOID
STABILITY BLEED PNEUMATIC RELAY VALVE
(AA37)
(AA36)
(AA35)
BLEED VALVE SUPPLY TUBES
A
B
(AA36)
(AA35)
(AA37)
CLAMP (TYPICAL)
BOLT (TYPICAL)
NUT (TYPICAL)
VIEW A
(AA35)
(AA36)
SPACER
VIEW B
L-A5999 (0496)
PW V

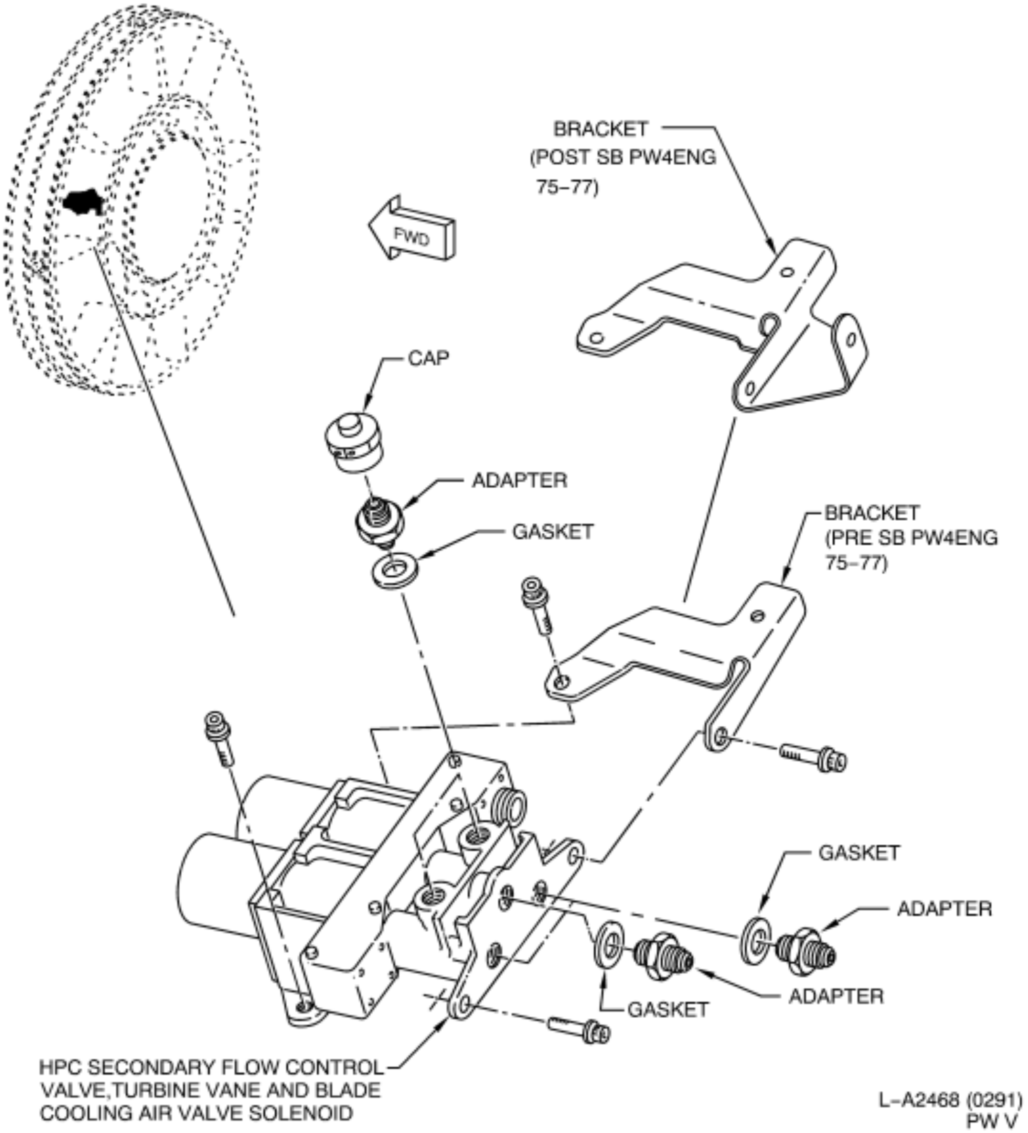
Installation Of The Stability Bleed Pneumatic Relay Valve And Start/Stability Bleed Valve Solenoid (Post SB PW4ENG 75-41)
Figure 1010 (Sheet 3)
(Task 72-34-00-400-001)


PRESSURE SWITCH TUBE
FWD
CAP
BOLT
BRACKET
BOLT
BOLT
PLUG
GASKET (TYPICAL)
ADAPTER (TYPICAL)
HPC SECONDARY FLOW CONTROL VALVE, IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE SOLENOID
BOLT
IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE PRESSURE SWITCH
BRACKET
BOLT
L-A4698 (0000)
PW V

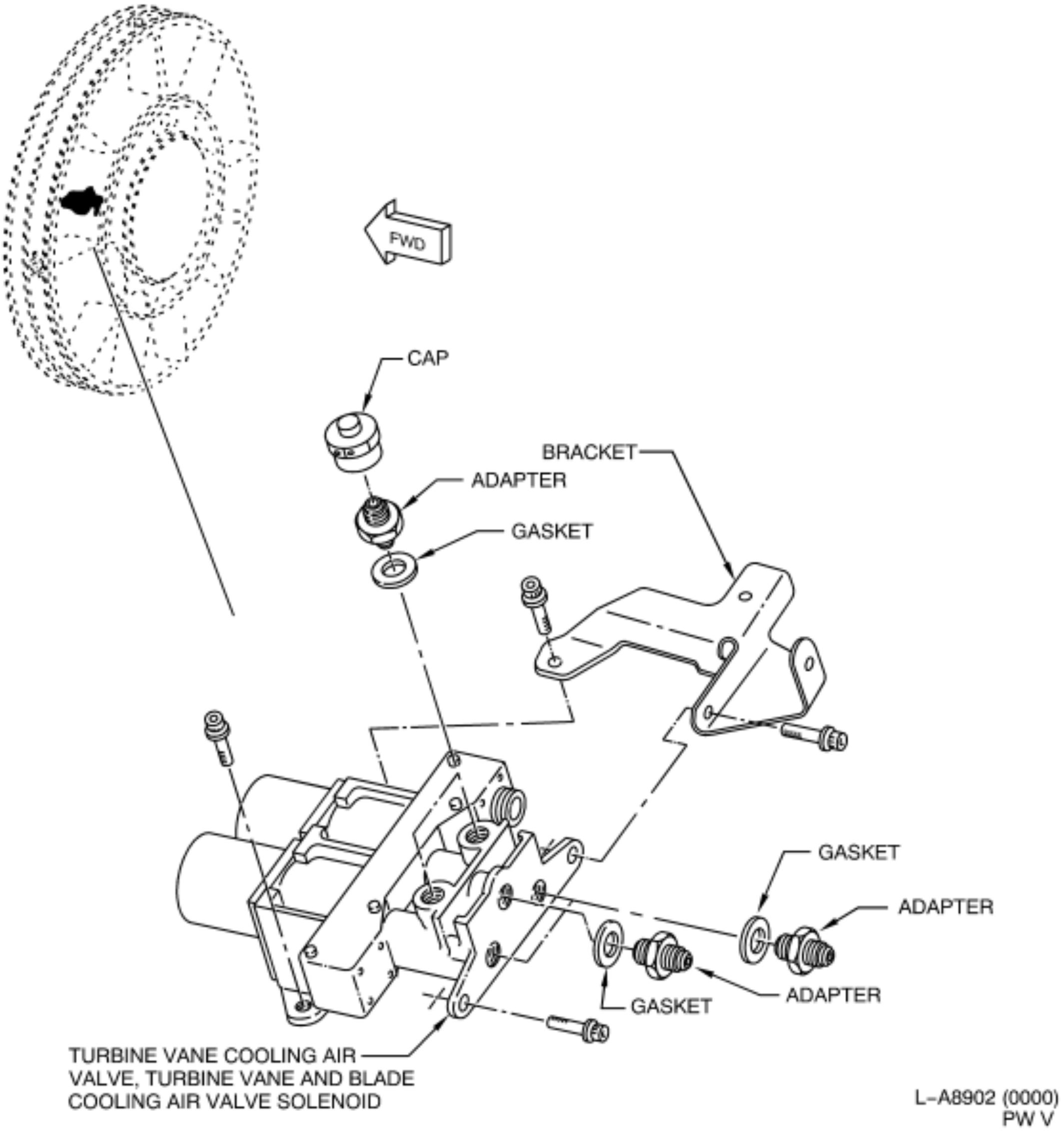
Installation Of The HPC Secondary Flow Control Valve
Figure 1011
(Task 72-34-00-400-001)


PRESSURE SWITCH TUBE
FWD
ADAPTER
GASKET
BOLT
CAP
ADAPTER
GASKET
BRACKET
BOLT
BOLT
GASKET
PLUG
GASKET
ADAPTER
ADAPTER
GASKET
TURBINE VANE AND BLADE COOLING AIR VALVE, IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE SOLENOID
BOLT
IDGS AIR/OIL HEAT EXCHANGER VALVE OVERRIDE PRESSURE SWITCH
BRACKET
BOLT
L-A9387 (0000)
PW V

Installation Of The Turbine Vane And Blade Cooling Air
Valve, IDGS Air/Oil Heat Exchanger Valve Override Solenoid
Figure 1011A
(Task 72-34-00-400-001)


BRACKET
(POST SB PW4ENG
75-77)
FWD
CAP
ADAPTER
GASKET
BRACKET
(PRE SB PW4ENG
75-77)
GASKET
ADAPTER
ADAPTER
GASKET
HPC SECONDARY FLOW CONTROL
VALVE,TURBINE VANE AND BLADE
COOLING AIR VALVE SOLENOID
L-A2468 (0291)
PW V

Installation Of The HPC Secondary Flow Control Valve,
Turbine Vane And Blade Cooling Air Valve Solenoid
R Figure 1012 (Sheet 1)
(Task 72-34-00-400-001)


CAP
BRACKET
ADAPTER
GASKET
FWD
GASKET
ADAPTER
ADAPTER
GASKET
TURBINE VANE COOLING AIR VALVE, TURBINE VANE AND BLADE COOLING AIR VALVE SOLENOID
L-A8902 (0000)
PW V

Installation Of The Turbine Vane Cooling Air Valve,
Turbine Vane And Blade Cooling Air Valve Solenoid
R Figure 1012 (Sheet 2)
(Task 72-34-00-400-001)

INTERMEDIATE CASE - ASSEMBLY-01

R
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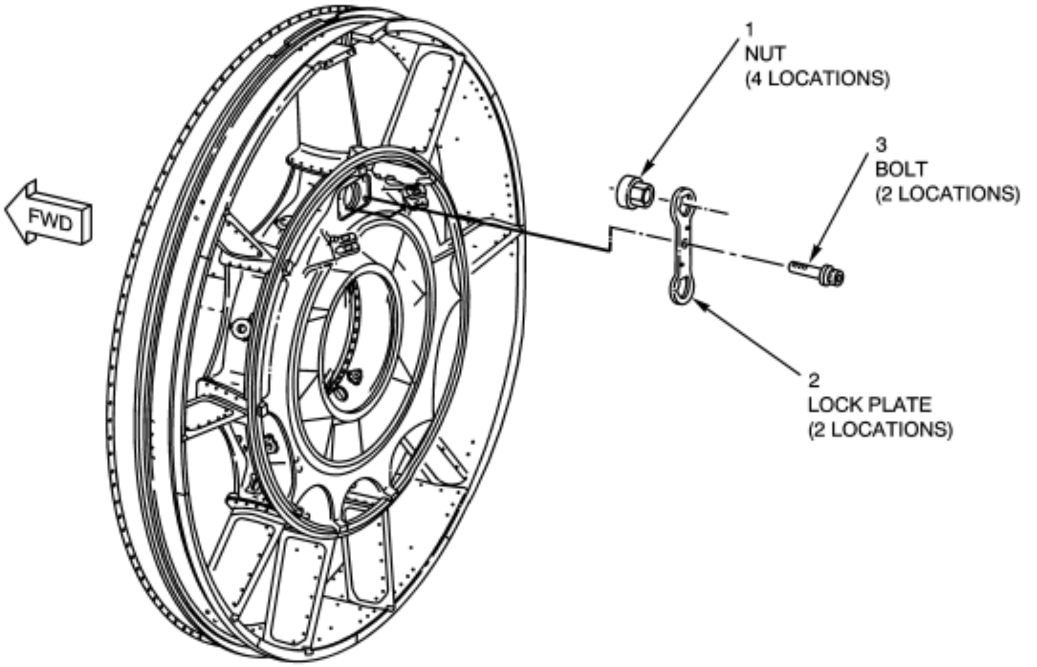
R


FWD
1
NUT
(4 LOCATIONS)
3
BOLT
(2 LOCATIONS)
2
LOCK PLATE
(2 LOCATIONS)

L-D2110 (0705)
PW V

R Engine Mount Nuts And Lock Plates Installation
R Figure 1013
R (Task 72-34-00-400-001)

Task 72-34-00-400-002:

1. Determine Gear Spacer Thickness

A. Equipment And Materials Required

Special Tools:

PWA 85006 Gage, Mounting Distance
PWA 85021 Fixture, Loading
PWA 85199 Fixture
PWA 85251 Adapter

B. Procedure
See Figure 1001.

Subtask 72-34-00-430-060:

(1) Install No. 1.5 bearing support to PWA 85251 Adapter which is attached to PWA 85199 Fixture mounted on bench. The support is attached to side of adapter with three clamps. Rotate support to working position.

(2) Install PWA 85006 Gage. See Figure 1002.

(a) Set dial indicator to zero by positioning indicator and holder on locating post of setting master.

(b) Rotate the holder to position the indicating point perpendicular to the upright gaging plate of the master.

(c) Adjust indicator to obtain 0.100 - 0.125 inch (2.540 - 3.175 mm) travel of needle from initial contact with upright gaging surface on master.

(d) Lock indicator on holder and rotate dial face of indicator to align zero with needle point.

(e) Insert post of the detail base through bore of towershaft boss of support. Secure in position with cover detail and knurled nut.

(f) Attach the body of the gage to the bearing support.

Subtask 72-34-00-430-061:

(3) Measure Dimension "M".

(a) Position dial indicator and holder over post of detail base and rotate holder to align indicator point with center of post on detail body.

(b) Measure distance from rear face of bearing support to point of intersection of centerline of two bearing bores with axis through center of rear locating diameter perpendicular to rear face.

(c) Observe amount dial indicator moves from original zero position. Add this reading to 4.695 inches (119.253 mm) and record as Dimension "M". This dimension is needed to accomplish 72−34−04, Assembly−03 (Task 72−34−04−440−002). R

Subtask 72−34−00−430−062:

(4) (Reference 205) Determine Spacer "AC".

(a) Measure Dimension "U".

1 Position dial indicator and holder to align indicator point with center of post on detail base. See Figure 1002.

2 Measure distance from outer face of towershaft boss to point of intersection of centerline of two bearing bores in towershaft boss with axis through center of rear locating diameter perpendicular to rear face.

3 Observe amount dial indicator moves from original zero position. Add this indicator reading to 10.939 inches (277.851 mm) and record as Dimension "U".

4 Remove PWA 85006 Gage.

(b) Measure Dimension "S". Measure distance from upper bearing shoulder to lower bearing shoulder on gearshaft. See Figure 1003.

(c) Measure Dimension "AA".

1 Measure distance from top face of bearing inner race to top face flange on outer race.

2 Use PWA 85021 Loading Fixture to apply required load to bearing for proper measurement. See Figure 1002.

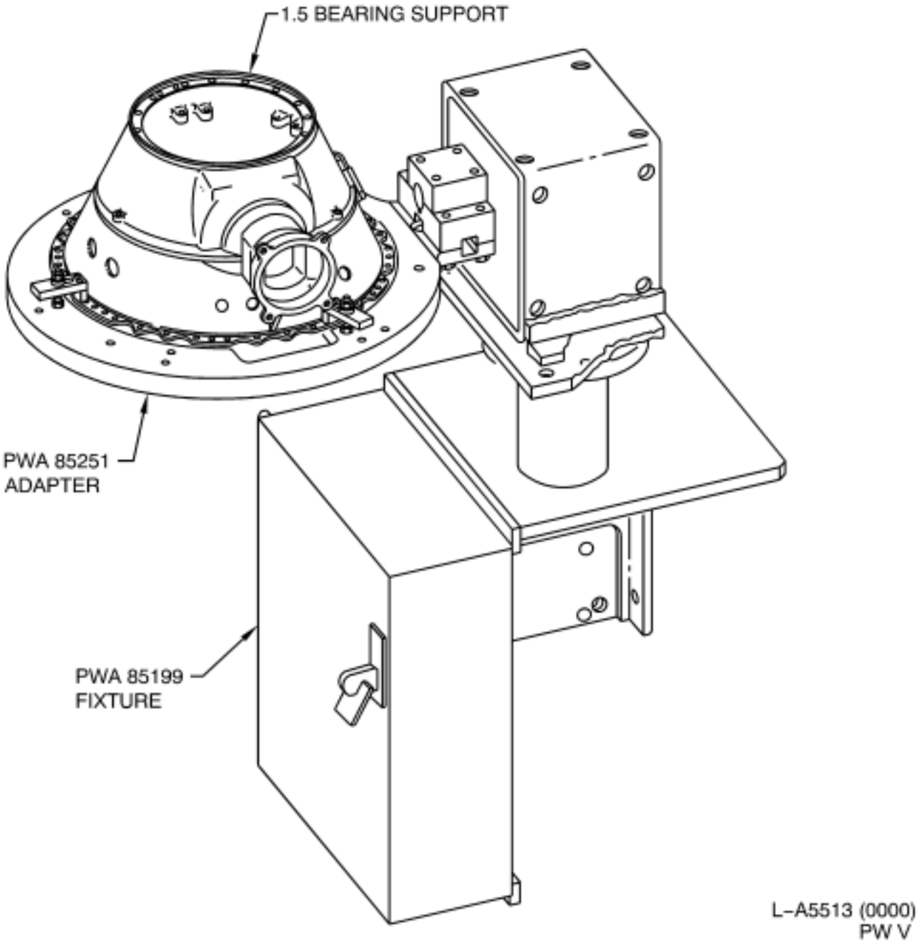
(d) Spacer "AC" must have thickness equal to Dimension "U" minus total of "S", "AA" and 6.0261 inches (153.063 mm) within ± 0.001 inch (0.025 mm).

R (e) Select the classified spacer from Table 1001 that
R is necessary to do 72-34-00, Assembly-03 (Task
R 72-34-00-400-003). The faces of the spacer must be parallel in 0.0002 inch (0.0051 mm) total.

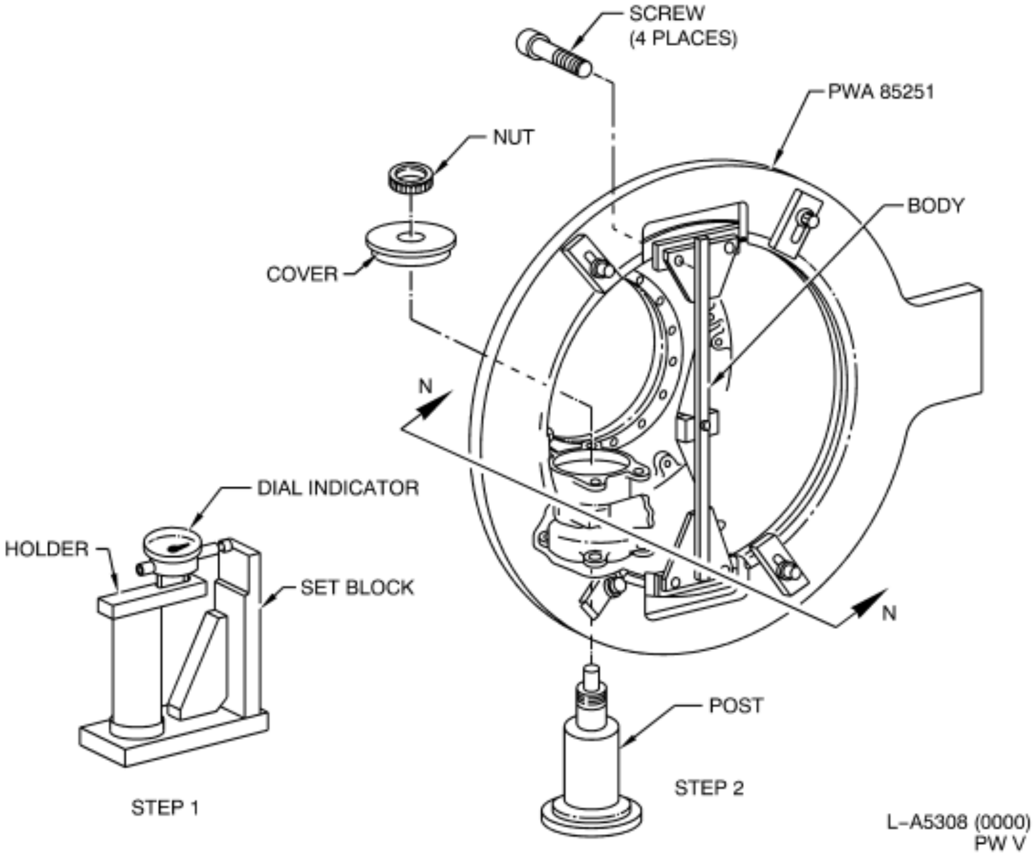
CLASS	DIMENSION-INCH (mm)
1	0.093 - 0.094 (2.363 - 2.387)
2	OVER 0.094 - 0.095 (2.388 - 2.413)
3	OVER 0.095 - 0.096 (2.413 - 2.438)
4	OVER 0.096 - 0.097 (2.439 - 2.463)
5	OVER 0.097 - 0.098 (2.464 - 2.489)
6	OVER 0.098 - 0.099 (2.490 - 2.514)
7	OVER 0.099 - 0.100 (2.515 - 2.540)
8	OVER 0.100 - 0.101 (2.540 - 2.565)
9	OVER 0.101 - 0.102 (2.566 - 2.590)
10	OVER 0.102 - 0.103 (2.591 - 2.616)
11	OVER 0.103 - 0.104 (2.617 - 2.641)
12	OVER 0.104 - 0.105 (2.642 - 2.667)
13	OVER 0.105 - 0.106 (2.667 - 2.692)
14	OVER 0.106 - 0.107 (2.693 - 2.717)
15	OVER 0.107 - 0.108 (2.718 - 2.743)
16	OVER 0.108 - 0.109 (2.744 - 2.768)
17	OVER 0.109 - 0.110 (2.769 - 2.794)
18	OVER 0.110 - 0.111 (2.794 - 2.819)
19	OVER 0.111 - 0.112 (2.820 - 2.844)
20	OVER 0.112 - 0.113 (2.845 - 2.870)
21	OVER 0.113 - 0.114 (2.871 - 2.895)
22	OVER 0.114 - 0.115 (2.896 - 2.921)
23	OVER 0.115 - 0.116 (2.921 - 2.946)
24	OVER 0.116 - 0.117 (2.947 - 2.971)
25	OVER 0.117 - 0.118 (2.972 - 2.997)
26	OVER 0.118 - 0.119 (2.998 - 3.022)
27	OVER 0.119 - 0.120 (3.023 - 3.048)

Spacer Classification
Table 1001

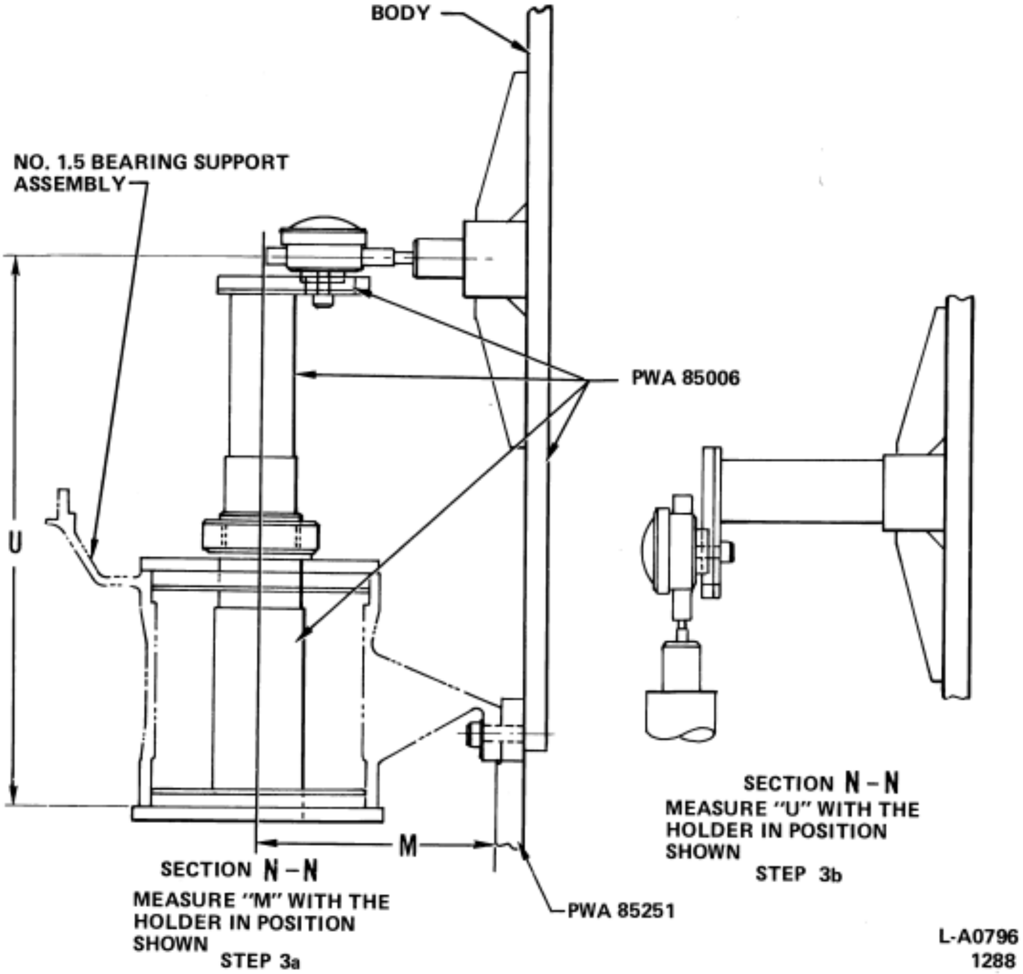
INTERMEDIATE CASE − ASSEMBLY−02


1.5 BEARING SUPPORT
PWA 85251
ADAPTER
PWA 85199
FIXTURE
L−A5513 (0000)
PW V

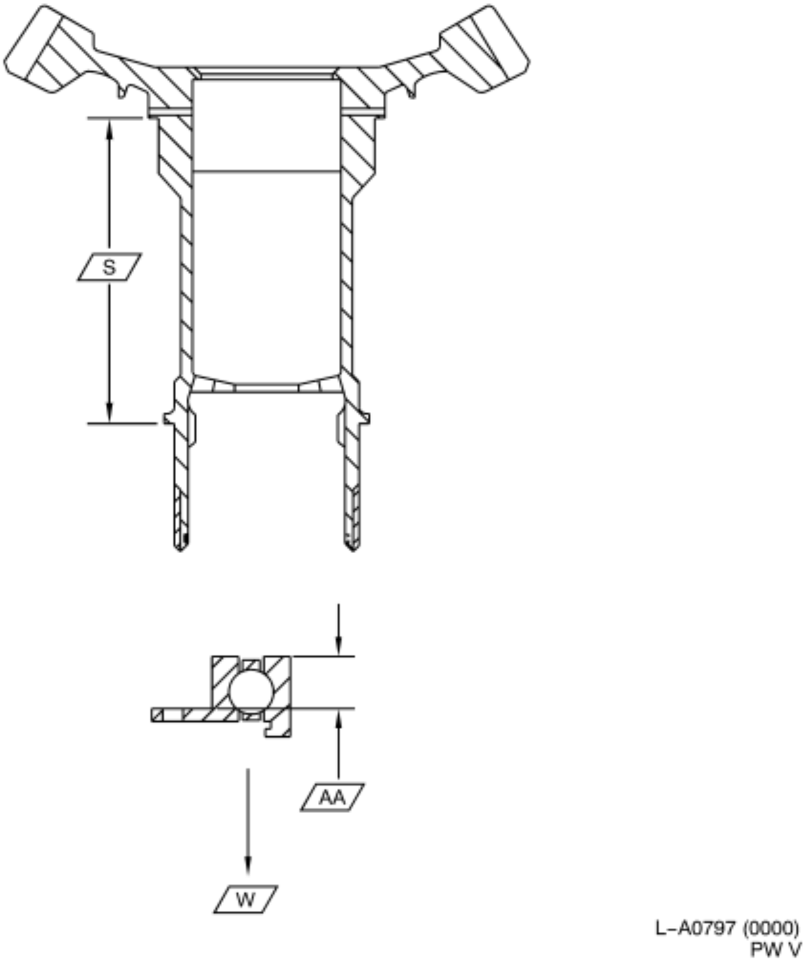
Use PWA 85199 And PWA 85251
Figure 1001
(Task 72−34−00−400−002)


SCREW
(4 PLACES)
PWA 85251
NUT
BODY
COVER
N
DIAL INDICATOR
HOLDER
SET BLOCK
N
POST
STEP 2
STEP 1
L-A5308 (0000)
PW V

Use PWA 85006 Gage
Figure 1002 (Sheet 1)
(Task 72-34-00-400-002)


BODY
NO. 1.5 BEARING SUPPORT ASSEMBLY
PWA 85006
U
M
PWA 85251
SECTION N - N
MEASURE "M" WITH THE HOLDER IN POSITION SHOWN
STEP 3a
SECTION N - N
MEASURE "U" WITH THE HOLDER IN POSITION SHOWN
STEP 3b
L-A0796
1288

Measure Dimensions "M" And "U"
Figure 1002 (Sheet 2)
(Task 72-34-00-400-002)



Measure Dimensions "S" And "AA"
Figure 1003
(Task 72-34-00-400-002)

INTERMEDIATE CASE - ASSEMBLY-03

Task 72-34-00-400-003:

1. Assemble The No. 1.5 Bearing Support Assembly With The Gearbox Drive Bevel Gearshaft And Bearings

A. Prerequisites

(1) Determine gear spacer thickness. See 72-34-00, Assembly-02 Task 72-34-00-400-002.

B. Equipment And Materials Required

Special Tools:

PWA 85007	Base
PWA 85008	Drift
PWA 85010	Pusher
PWA 85011	Wrench
PWA 85252	Bracket, Retaining

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-045	Pen, Marker (PMC 4092)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	1	72-34-00/14/050

C. Procedure

Subtask 72-34-00-430-058:
See Figure 1001.

NOTE: The 1.5 bearing support assembly is still installed on PWA 85251 Adapter and PWA 85199 Fixture.

(1) Install the roller bearing inner race and rollers on the gearbox drive bevel gearshaft.

(a) Put the gearshaft, gear down, on PWA 85007 Base.

(b) Heat the roller bearing inner race. Refer to Standard Practices Manual, PN 585005.

(c) Install the inner race, mating number down, on the gearshaft.

(d) Seat the inner race on the lower bearing journal with PWA 85008 Drift and an arbor press.

(2) Install the roller bearing outer race in the 1.5 bearing support assembly.

(a) Lubricate the threads of four bolts with Engine Oil P03-001.

(b) Attach the outer race to the assembly with the four bolts.

(c) Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(3) Install the gearshaft in the support assembly.

(a) Put the gearshaft into the largest opening of the assembly.

(b) Seat the gearshaft in the assembly. The gearshaft is seated when the roller bearing parts are mated.

(c) Attach PWA 85252 Bracket to the assembly at 6 o'clock position. See Figure 1002. Use the two detail screws.

(4) Install the classified spacer that was selected in 72-34-00, Assembly-02 Task 72-34-00-400-002.

(a) Install it over the shaft of the gear.

(b) Seat it against the bearing shoulder.

(5) Install the ball bearing inner races on the gearshaft. Use PWA 85010 Pusher. See Figure 1002.

(a) Heat the inner races. See Standard Practices Manual, PN 585005.

(b) Install the inner half of the inner race (no puller groove).

1 Install the inner race on the gearshaft.

2 Install PWA 85010 Pusher in the gearshaft.

a Install the detail ring over the gearshaft.

b Turn the knob to retract the pin and collapse the jaw.

c Align the keys with the slots in the threads of the gearshaft.

d Put the jaw in the gearshaft.

e Turn the knob to extend the pin. This action expands the jaw.

f While you hold the rod with a wrench, turn the nut until the inner race is seated against the spacer.

3 Remove the pusher and detail ring.

(c) Install the bearing outer race and balls in the support assembly. Install workbolts in the bearing flange to hold it in place.

(d) Install the outer half of the inner race (with a puller groove).

1 Install the inner race on the gearshaft.

2 Install PWA 85010 Pusher in the gearshaft. Use the procedure that was just outlined, but omit installation of the detail ring.

(6) Install the remaining parts on the gearshaft. See Figure 1003.

(a) Install the key washer.

(b) (Reference 250) Install the nut.

1 Install the nut.

2 Use PWA 85011 Wrench. Engage the splines of the wrench with the internal splines of the gearshaft. Engage the teeth of the wrench with the slots in the bearing retaining nut. Use a 1/2 inch drive torque wrench and breaker bar.

3 Torque the nut to 1600 − 1700 lb−in. (180.776 − 192.074 N.m).

4 Secure the nut with the key washer. Refer to Standard Practices Manual, PN 585005.

(c) Install the gearbox driveshaft coupling in the gearshaft. See Figure 1001.

1 Align the splines of both parts.

2 Install the coupling.

3 Install the retaining ring in the groove inside the gearshaft.

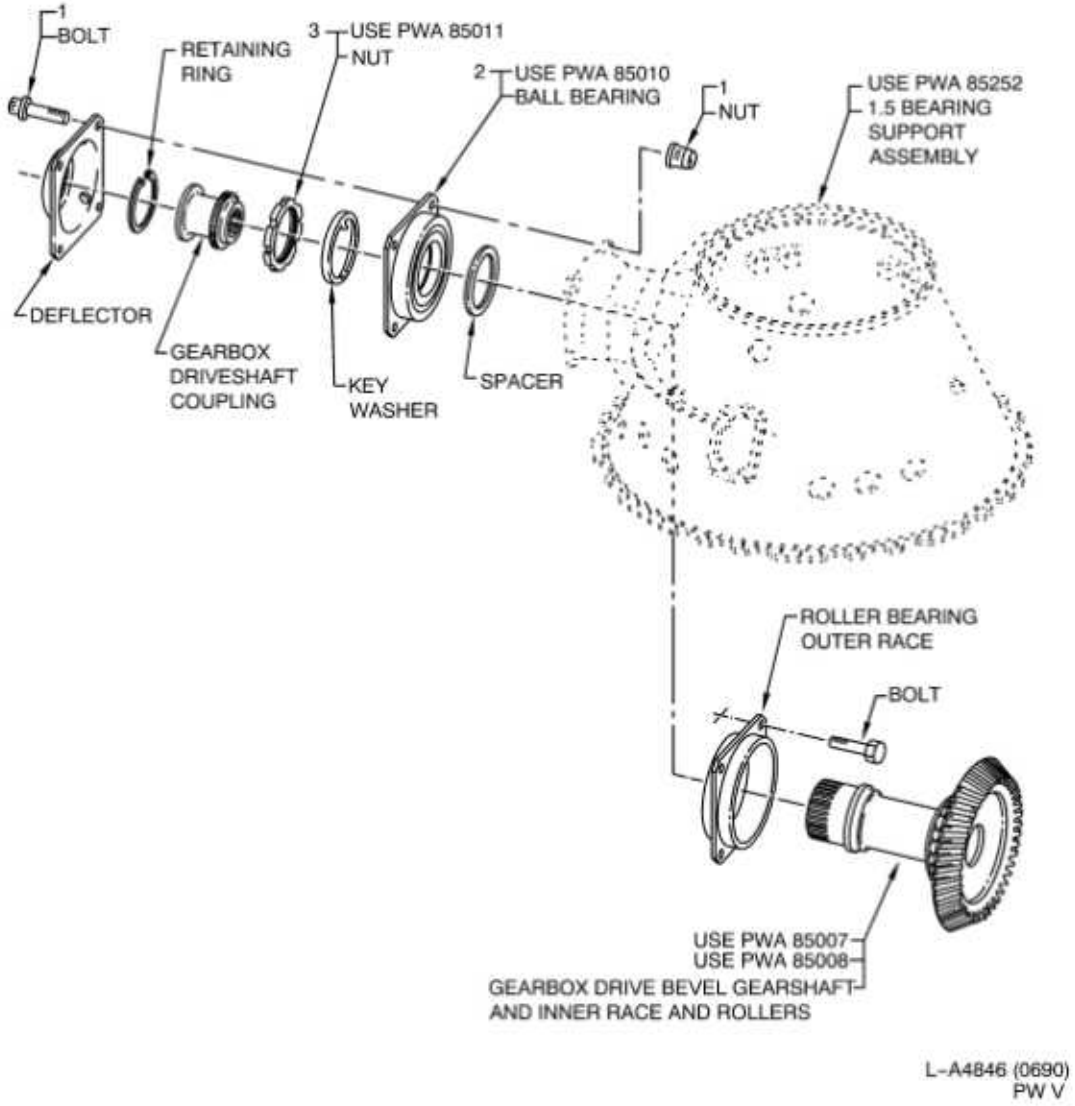
(d) Attach the ball bearing outer race and deflector. See Figure 1004.

1 Lubricate the threads of three bolts with Engine Oil P03-001.

2 Attach the deflector and outer race with the three bolts (heads out) and nuts.

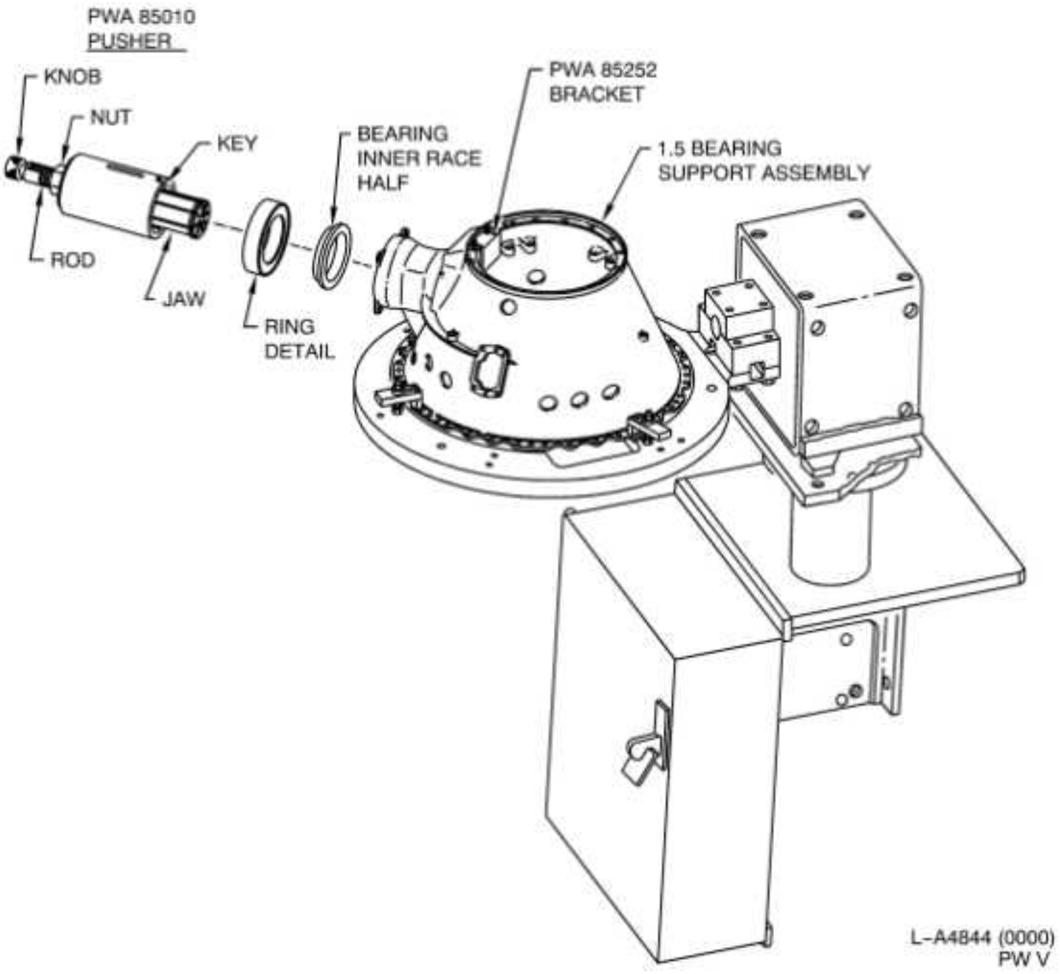
3 Torque the nuts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(7) Remove PWA 85252 Bracket from the support assembly. Remove the support assembly from the adapter and fixture.

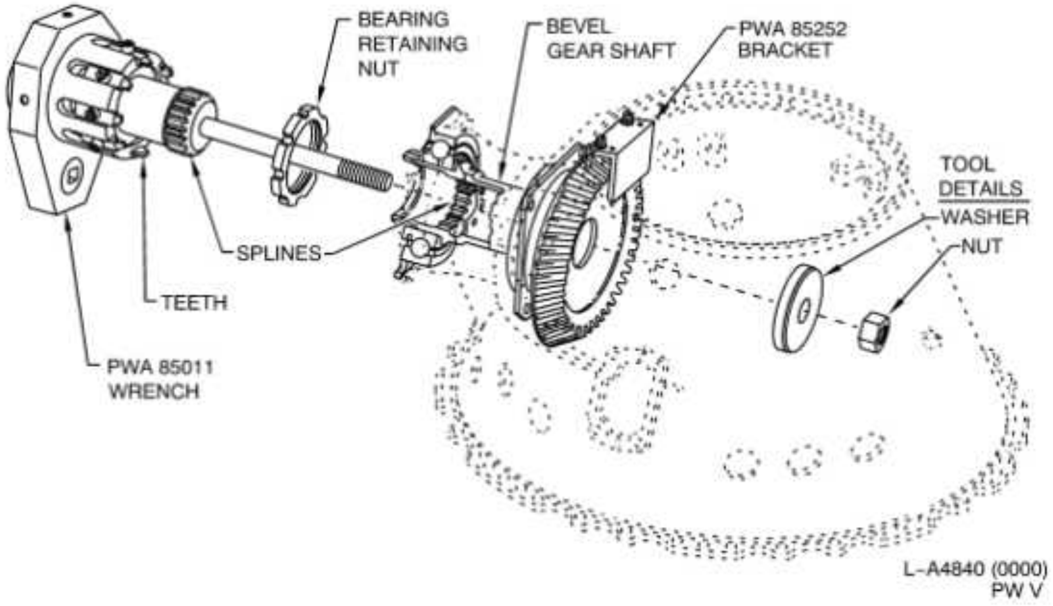

1
BOLT
RETAINING RING
3 USE PWA 85011
NUT
2 USE PWA 85010
BALL BEARING
1
NUT
USE PWA 85252
1.5 BEARING SUPPORT ASSEMBLY
DEFLECTOR
GEARBOX DRIVESHAFT COUPLING
KEY WASHER
SPACER
ROLLER BEARING OUTER RACE
BOLT
USE PWA 85007
USE PWA 85008
GEARBOX DRIVE BEVEL GEARSHAFT AND INNER RACE AND ROLLERS
L-A4846 (0690)
PW V

1. See Figure 1004
2. See Figure 1002
3. See Figure 1003

Install The Gearbox Drive Bevel Gearshaft And Related Parts
Figure 1001
(Task 72-34-00-400-003)

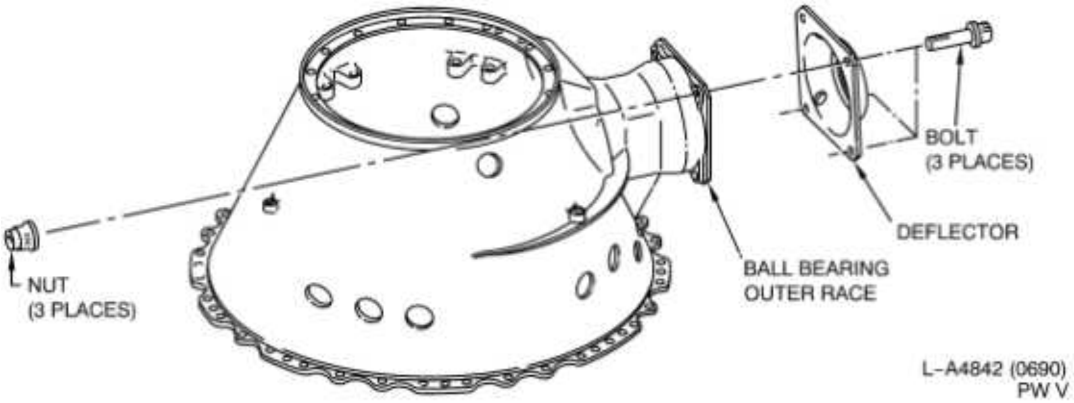

PWA 85010
PUSHER
KNOB
NUT
KEY
ROD
JAW
RING
DETAIL
BEARING
INNER RACE
HALF
PWA 85252
BRACKET
1.5 BEARING
SUPPORT ASSEMBLY
L-A4844 (0000)
PW V

Install The Ball Bearing Inner Races PWA 85010 And PWA 85252
Figure 1002
(Task 72-34-00-400-003)


BEARING RETAINING NUT
BEVEL GEAR SHAFT
PWA 85252 BRACKET
TOOL DETAILS
WASHER
NUT
SPLINES
TEETH
PWA 85011 WRENCH
L-A4840 (0000)
PW V

Install The Bearing Retaining Nut PWA 85011
Figure 1003
(Task 72-34-00-400-003)

INTERMEDIATE CASE - ASSEMBLY-03


BOLT
(3 PLACES)
DEFLECTOR
BALL BEARING
OUTER RACE
NUT
(3 PLACES)
L-A4842 (0690)
PW V

Install The Bolts That Hold The Deflector
Figure 1004
(Task 72-34-00-400-003)

Previous Pageblock Return to Previous Menu Next Pageblock

INTERMEDIATE CASE - ASSEMBLY-04

Task 72-34-00-400-004:

1. Assemble The Tubes And Nozzles In The No. 1.5 Bearing Support Assembly

A. Prerequisites

(1) Assemble the intermediate case. Refer to Assembly-01 Task 72-34-00-400-001.

B. Equipment And Materials Required

Special Tools:
PWA 85199 Fixture
PWA 85251 Adapter

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72-34-00/17/295

C. Procedure

Subtask 72-34-00-430-078:

(1) Install the support assembly on PWA 85251 Adapter. See Figure 1001.

(a) Install the adapter on PWA 85199 Fixture.

(b) Install the support assembly on the side of the adapter with three clamps.

Subtask 72-34-00-430-059:

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER 1.5 AND 2 BEARING TUBE CONNECTOR. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 72-179.

(2) Install the No. 1.5 and 2 bearing tube connector assembly (1002/2). See Figure 1002.

(a) Lubricate with Engine Oil P03−001 the threads of four bolts.

(b) Attach the tube connector to the No. 1.5 bearing support assembly (1002/3) with four washers and the four bolts.

(c) Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(3) Install the No. 1.5 bearing (oil) nozzle assembly (1002/1).

(a) Install the metering plug in the tube connector (1002/2).

(b) Lubricate with Engine Oil P03−001 the threads of two bolts.

(c) Put the end of the nozzle in the hole of the 1.5 bearing support assembly. Attach the nozzle assembly to the metering plug and the tube connector with two washers and the two bolts.

(d) Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(4) Install the No. 2 bearing (oil) nozzle assembly (1003/1). See Figure 1003.

(a) Install the metering plug in the tube connector (1003/2).

(b) Lubricate with Engine Oil P03−001 the threads of two bolts.

(c) Attach the nozzle assembly to the metering plug and the tube connector with four washers, the two bolts, and two nuts.

(d) Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER GEARBOX DRIVE (OIL) PRESSURE TUBE ASSEMBLY. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 72-179.

(5) Install the gearbox drive (oil) pressure tube assembly (1003/3).

  (a) Install the tube assembly in the gearbox drive (oil) nozzle assembly (1003/4).

  (b) Lubricate with Engine Oil P03-001:

    1 A new packing, if applicable.

    2 The threads of two bolts.

  (c) If applicable, install the packing on the tube assembly.

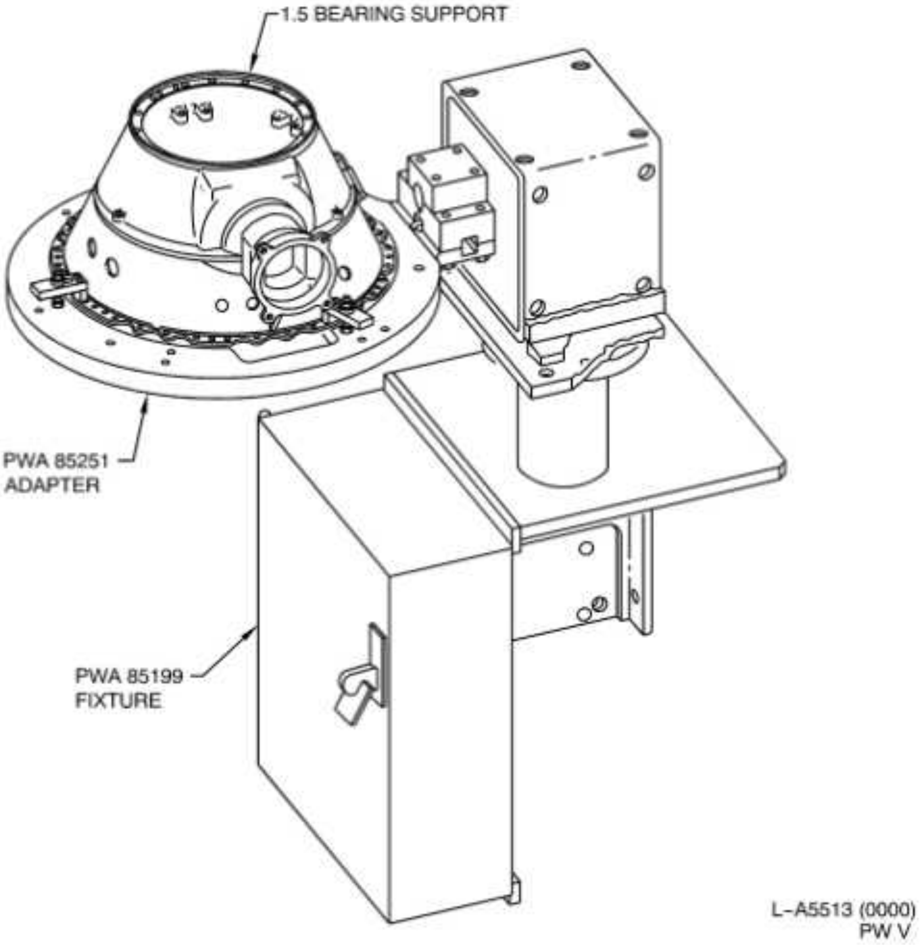
  (d) Install the tube assembly in the tube connector.

  (e) Attach the nozzle assembly to the 1.5 bearing support assembly with two washers, the two bolts, and two nuts. Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(6) Remove the tools from the support assembly.

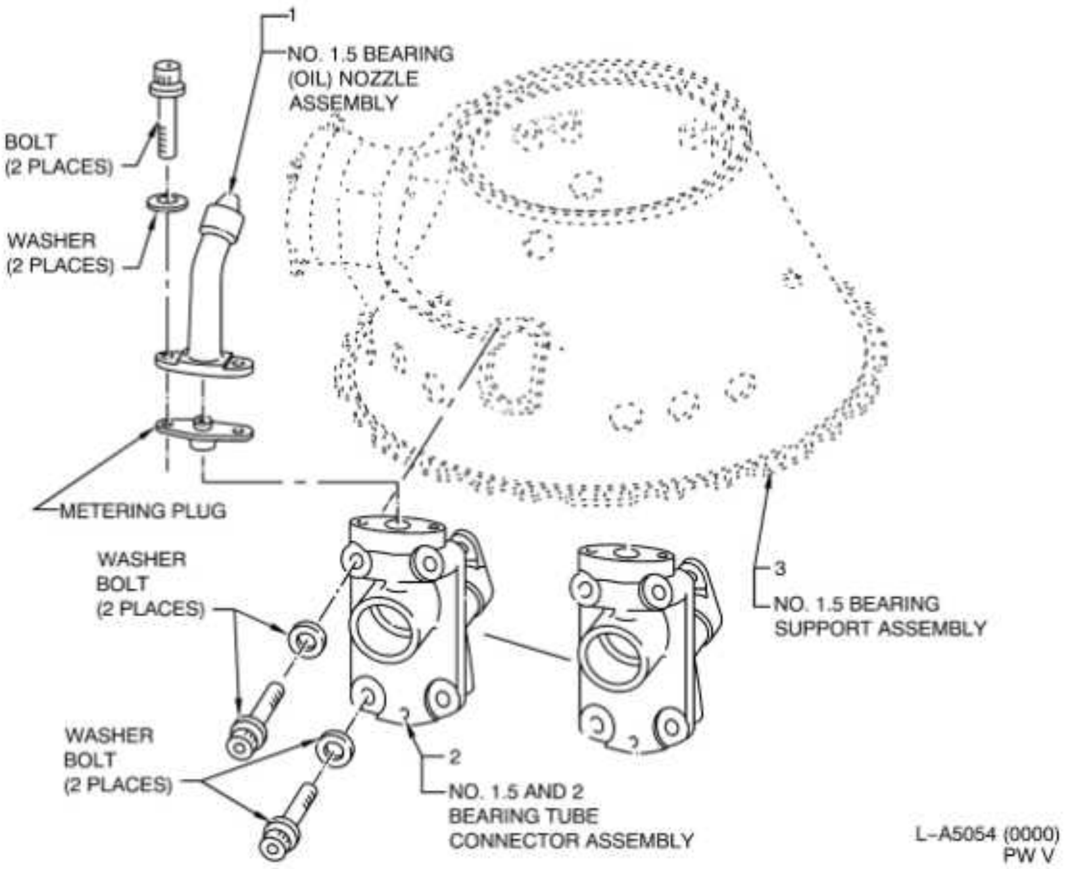
D. Postrequisites

(1) Flow the No. 1, 1.5, and 2 bearing compartments with oil. Use Testing-01 Task 72-34-00-710-001.

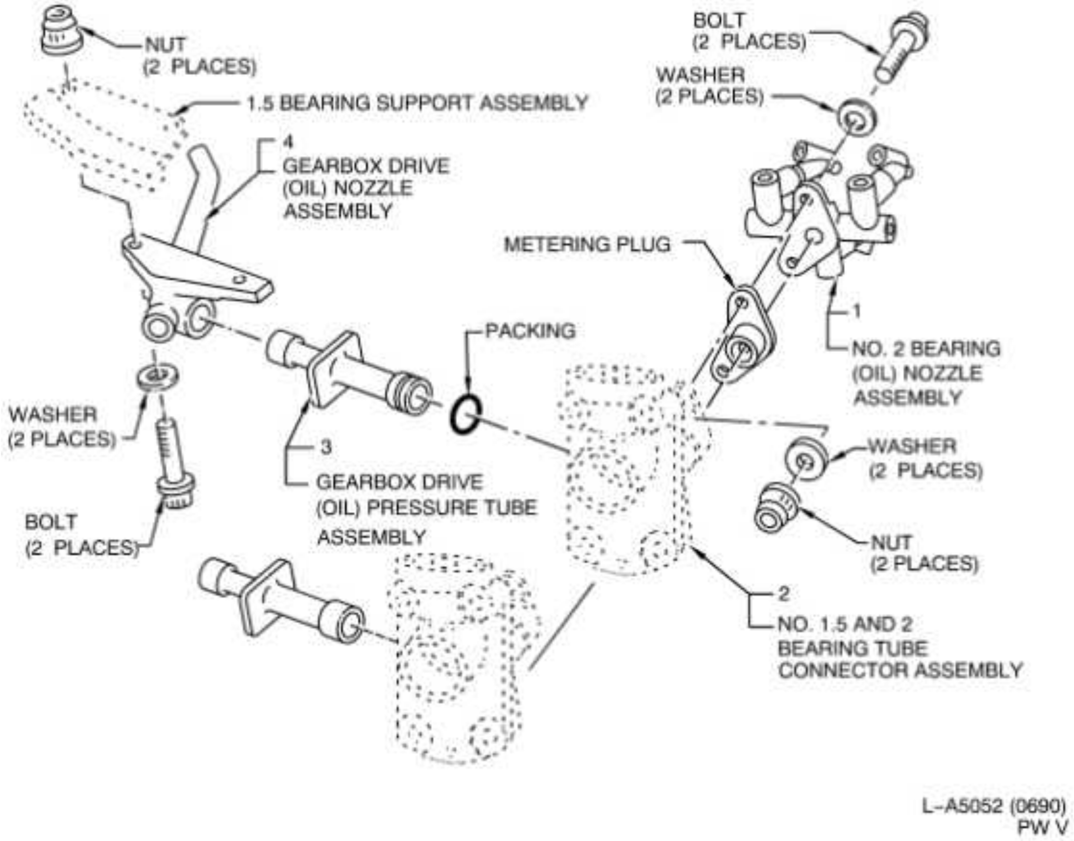

1.5 BEARING SUPPORT
PWA 85251 ADAPTER
PWA 85199 FIXTURE
L-A5513 (0000)
PW V

Install The No. 1.5 Bearing Support Assembly On The Adapter
Figure 1001
(Task 72-34-00-400-004)

INTERMEDIATE CASE − ASSEMBLY−04


1
NO. 1.5 BEARING (OIL) NOZZLE ASSEMBLY
BOLT (2 PLACES)
WASHER (2 PLACES)
METERING PLUG
WASHER BOLT (2 PLACES)
WASHER BOLT (2 PLACES)
2
NO. 1.5 AND 2 BEARING TUBE CONNECTOR ASSEMBLY
3
NO. 1.5 BEARING SUPPORT ASSEMBLY
L−A5054 (0000)
PW V

Install The No. 1.5 And 2 Bearing Tube Connector Assembly And The No. 1.5 Bearing (Oil) Nozzle Assembly
Figure 1002
(Task 72−34−00−400−004)


NUT
(2 PLACES)
1.5 BEARING SUPPORT ASSEMBLY
4
GEARBOX DRIVE
(OIL) NOZZLE
ASSEMBLY
BOLT
(2 PLACES)
WASHER
(2 PLACES)
METERING PLUG
1
NO. 2 BEARING
(OIL) NOZZLE
ASSEMBLY
PACKING
WASHER
(2 PLACES)
3
GEARBOX DRIVE
(OIL) PRESSURE TUBE
ASSEMBLY
BOLT
(2 PLACES)
WASHER
(2 PLACES)
NUT
(2 PLACES)
2
NO. 1.5 AND 2
BEARING TUBE
CONNECTOR ASSEMBLY
L−A5052 (0690)
PW V

Install The Pressure Tube And The
Gearbox Drive (Oil) Nozzle Assembly
Figure 1003
(Task 72−34−00−400−004)

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INTERMEDIATE CASE - ASSEMBLY-05

Task 72-34-00-400-005:

1. Assemble The No. 1.5 And 2 Bearing (Carbon) Seal Assembly In The No. 1.5 Bearing Support Assembly

A. Prerequisites

(1) Assemble the tubes and nozzles in the No. 1.5 bearing support assembly. Refer to Assembly-04 (Task 72-34-00-400-004).

B. Equipment And Materials Required

Special Tools:
PWA 85199 Fixture
PWA 85251 Adapter

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

C. Procedure

(1) Install the support assembly on PWA 85251 Adapter. See Figure 1001.

(a) Install the adapter on PWA 85199 Fixture.

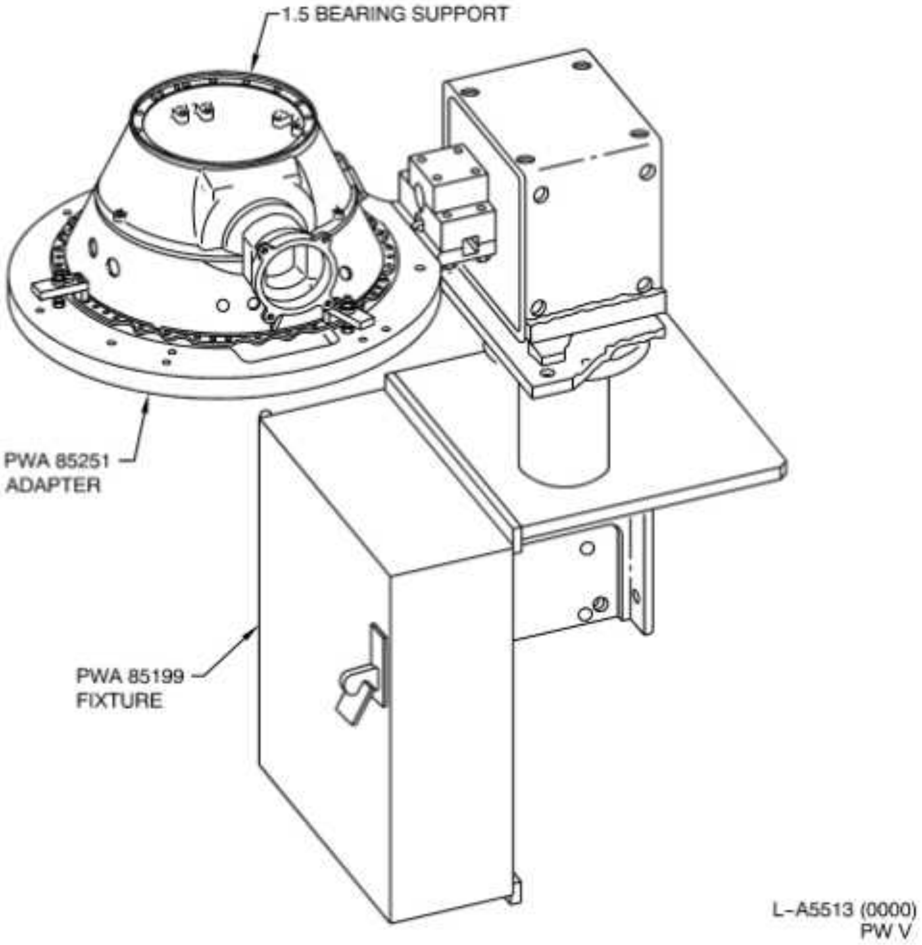
(b) Install the support assembly on the side of the adapter with three clamps.

(2) Install the No. 1.5 and 2 bearing (carbon) seal assembly (called seal assembly). Refer to Figure 1002.

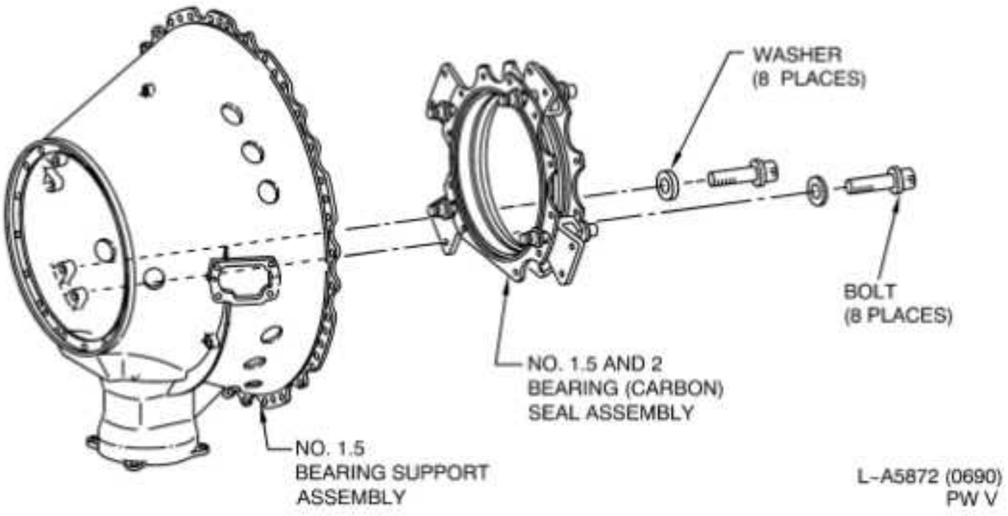
(a) Apply Engine Oil (P03-001) to the threads of eight bolts.

(b) Attach the seal assembly to the inside of the No. 1.5 bearing support assembly with eight washers and the eight bolts.

(c) Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).


1.5 BEARING SUPPORT
PWA 85251
ADAPTER
PWA 85199
FIXTURE
L-A5513 (0000)
PW V

Install The No. 1.5 Bearing Support Assembly On The Adapter
Figure 1001
(Task 72-34-00-400-005)


WASHER
(8 PLACES)
BOLT
(8 PLACES)
NO. 1.5 AND 2
BEARING (CARBON)
SEAL ASSEMBLY
NO. 1.5
BEARING SUPPORT
ASSEMBLY
L-A5872 (0690)
PW V

Install The No. 1.5 And 2 Bearing
(Carbon) Seal Assembly
Figure 1002
(Task 72-34-00-400-005)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-34-00-710-001:

1. Oil Flow The No. 1, 1.5, And 2 Bearing Compartments

A. Oil Flow Requirement Check

NOTE: You can use this check to find if it is necessary to do the oil flow procedure which follows.

(1) It is not necessary to do an oil flow check of the nozzles if they are examined and there is no damage to the oil nozzles or metering plugs, and there is no coking, contamination or blockage in a nozzle. Examine the parts as follows.

(a) Examine each nozzle before you close the access to the holes.

(b) Examine the nozzles for blockage. Use one of these methods.

1 Use a light to see if there is blockage.

WARNING: BE CAREFUL DURING AN AIRFLOW CHECK. UNWANTED MATERIAL OR OIL BLOWN FROM A NOZZLE CAN CAUSE INJURY TO PERSONNEL.

2 Use air pressure to make sure that there is no blockage.

WARNING: BE CAREFUL DURING AN AIRFLOW CHECK. UNWANTED MATERIAL OR OIL BLOWN FROM A NOZZLE CAN CAUSE INJURY TO PERSONNEL.

(c) Make sure that the module assembly does not have blockage. Supply compressed air to the main bearing pressure manifold assembly. Make sure that there is airflow from each metering hole.

(d) Do the oil flow check of the module assembly if:

1 The airflow step shows blockage in a part.

2 Oil nozzle parts were replaced, interchanged, or repaired.

a You do not have to do an oil flow and spray pattern check for "new" or properly overhauled replacement parts (because they are in the original manufacture limits).

3 A part is from an engine which had an oil system service problem (or one found during the shop visit):

a which caused coking in the oil system tubes.

b which made it necessary to flush the oil system.

c which made it necessary to make sure that the nozzle oil flow and spray pattern are in the limits in the PW4000 Series CIR, PN 51A357.

B. Prerequisites

(1) Assemble the tubes and nozzles in the No. 1.5 bearing support assembly. Refer to Assembly-04 Task 72-34-00-400-004.

C. Equipment And Materials Necessary

Special Tools:

CTE 6050	Stand, Oil Flow
PWA 86224	Fixture, Oil Flow (Optional to PWA 87169)
PWA 87169	Fixture, Oil Flow

Consumable Material:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72-34-00/17/40
Packing	2	72-34-00/17/50
Packing	1	72-34-00/17/235
Packing	1	72-34-00/17/245
Packing	1	79-21-00/11/80

D. Procedure

(1) Apply Engine Oil P03−001 to two bolts. Attach the main bearing tube connector to either PWA 87169 or PWA 86224Fixture with the bolts, two washers, and two nuts. See Figure 1301.

(2) Apply Engine Oil P03−001 to three packings. Install the packings on the main bearing pressure tube assembly. Put the tube assembly through the hole in the fixture.

(3) Attach the No. 1.5 bearing support assembly and the No. 2 bearing and seal assembly to the fixture as follows. See Figure 1302.

  (a) Put the No. 2 bearing and seal assembly on a bench, front end up.

  (b) (Post SB PW4ENG 72−179) Apply Engine Oil P03−001 to two packings. Install the packings on the No. 2 bearing (oil) pressure tube or oil shut−off valve (Post SB PW4ENG 72−394).

  (c) Install the pressure tube in the No. 2 bearing housing at 9 o'clock.

  (d) Align the holes of the detail plate and spacer with the threaded holes of the No. 2 bearing and seal assembly at 9 and 3 o'clock (from the rear), respectively.

  (e) Align the 9 and 3 o'clock holes of the No. 1.5 bearing support assembly with the mating holes in the fixture and the No. 2 bearing and seal assembly.

  (f) Align the holes in the flange of the main bearing pressure tube assembly with the mating holes in the main bearing tube connector assembly.

  (g) Push the main bearing pressure tube assembly in the main bearing tube connector until it touches the bottom.

  (h) Attach the main bearing tube connector assembly, gasket, fixture, and main bearing oil pressure tube together with three washers and three bolts.

(i) Attach the No. 1.5 bearing support assembly, fixture, and No. 2 bearing and seal assembly together with four washers and four bolts.

(4) Apply Engine Oil P03−001 to a packing. Install the packing on the main bearing oil pressure manifold assembly. Attach the manifold assembly to the main bearing tube connector with three bolts. Refer to Figure 1303 for the correct position of the manifold assembly.

(5) Install the No. 1 bearing pressure manifold as follows:

(a) Install the manifold in the main bearing tube connector. Refer to the illustration for the correct position of the manifold assembly.

(b) Attach the manifold to the fixture with two bolts, two washers, and two nuts.

(6) With a hoist, raise the assembly. Put it in a booth. Make the assembly immobile. See Figure 1304.

(7) Put a curved piece of metal under the assembly to catch oil from the No. 2 bearing damper and joints.

(8) Install a tube on each nozzle. During the test, collect oil from each nozzle and from the curved piece of metal under the assembly.

(9) Oil flow procedure:

(a) Attach CTE 6050 Oil Flow Stand to the main bearing oil pressure manifold. Supply oil at 200° − 230°F (93.° − 110.°C) and at 100 psig (689.5 kPa).

(b) Do not take measurements until the oil that leaves the nozzles is at 200°F (93.3°C) minimum. For the damper flow, the oil temperature must be 200°F (93.3°C) at the inlet.

(c) The oil from the nozzles must either go into the open air or to a hose with an inside diameter of 5/8 inch (15.875 mm), minimum. The adapters that connect the hoses to the nozzles must not restrict the flow of oil.

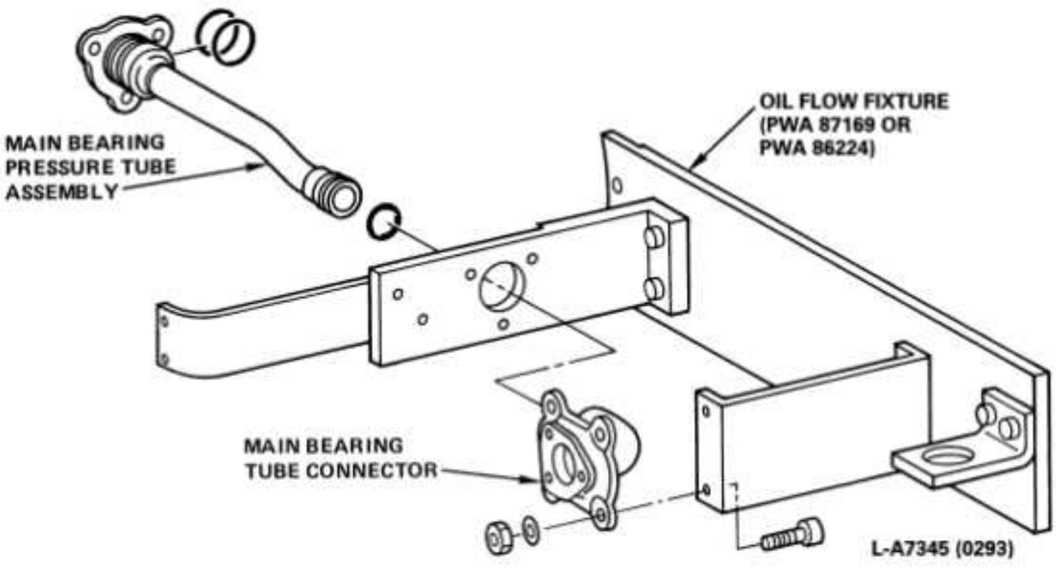
(d) All the nozzles must be flowing in the specified range when the measurements are taken. See Figure 1305.

(10) Remove the stand from the assembly.

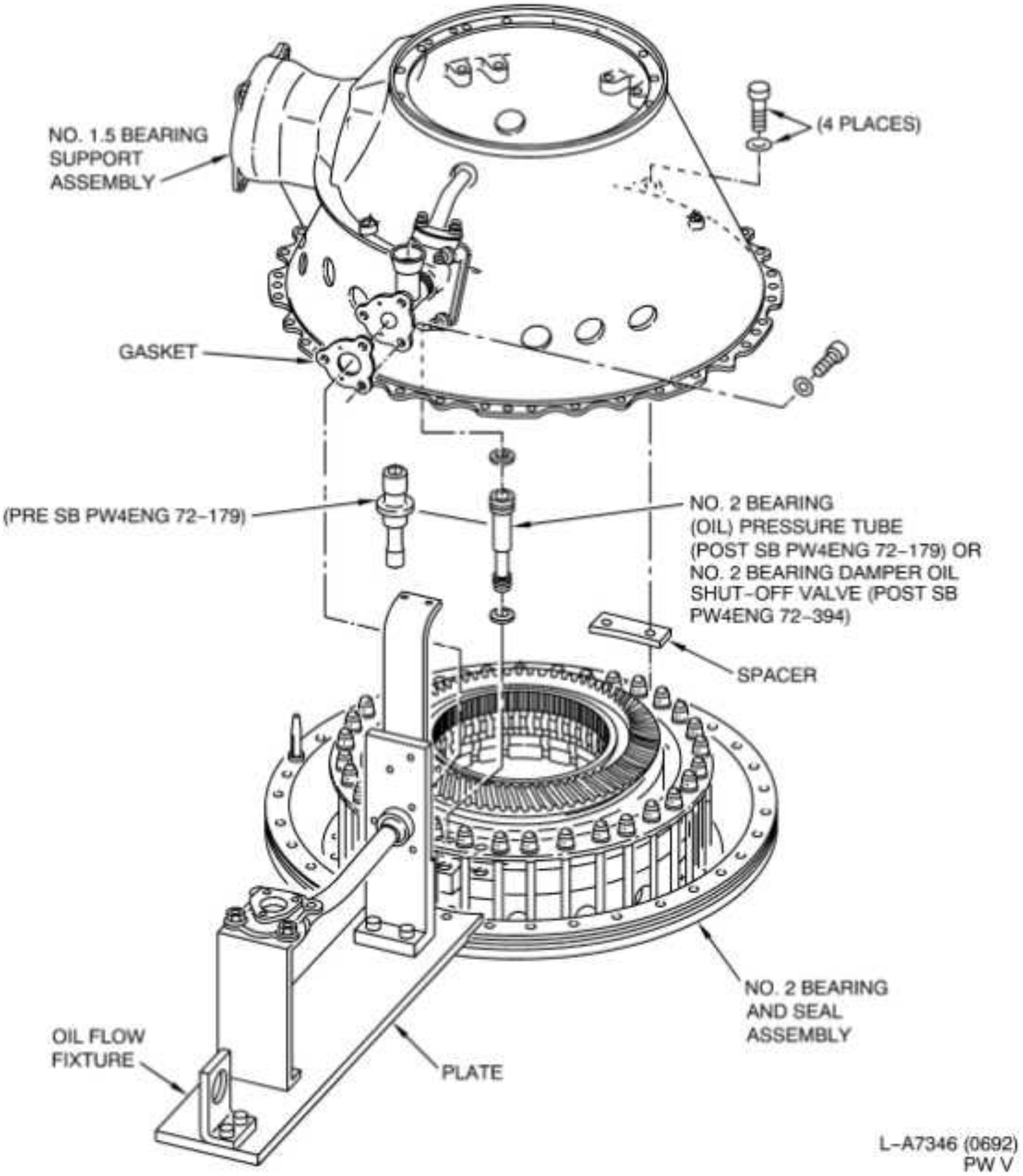
NOTE: Do not remove the engine parts from the oil flow fixture if you do the airflow check next.

E. Postrequisites

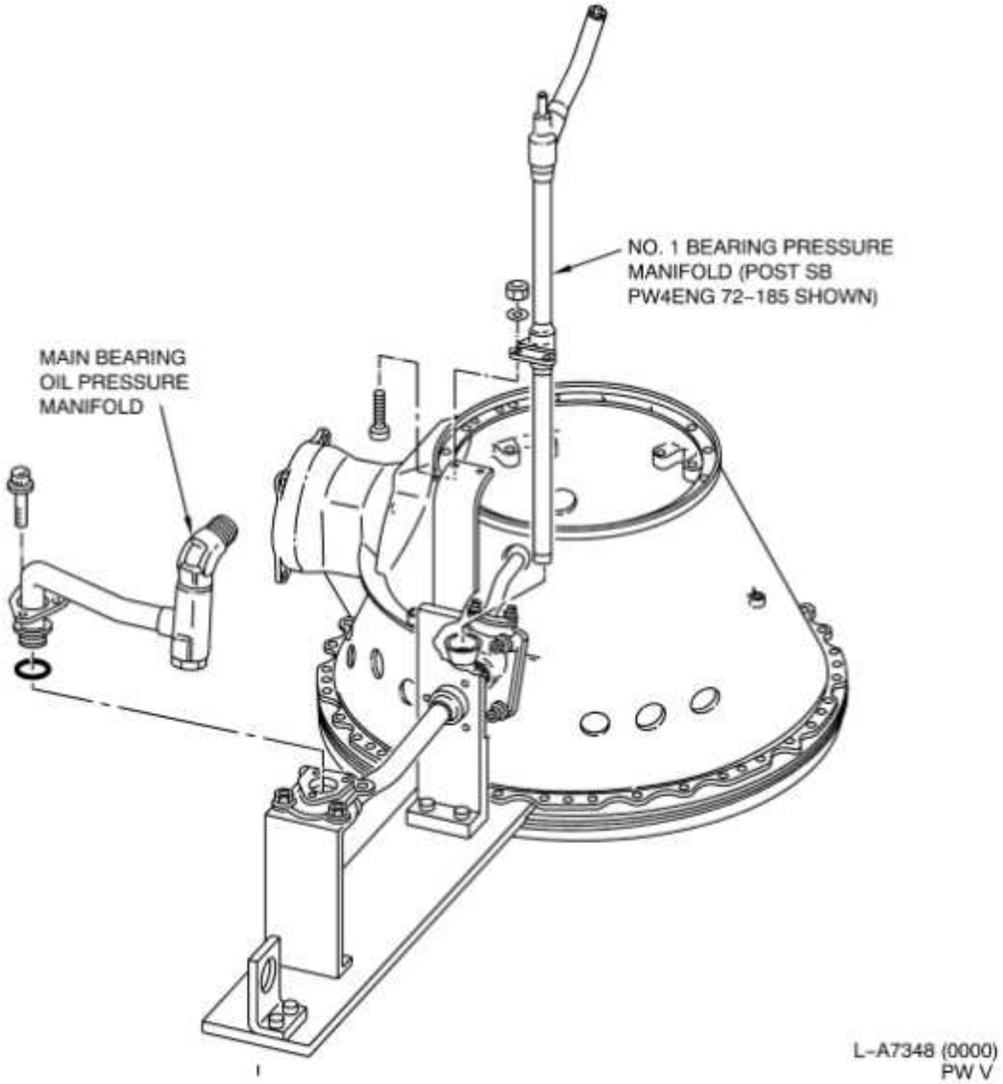
(1) Do an airflow check of the No. 1, 1.5, and 2 bearing compartments. Refer to Testing−02 Task 72−34−00−720−001.


OIL FLOW FIXTURE
(PWA 87169 OR
PWA 86224)
MAIN BEARING
PRESSURE TUBE
ASSEMBLY
MAIN BEARING
TUBE CONNECTOR
L-A7345 (0293)

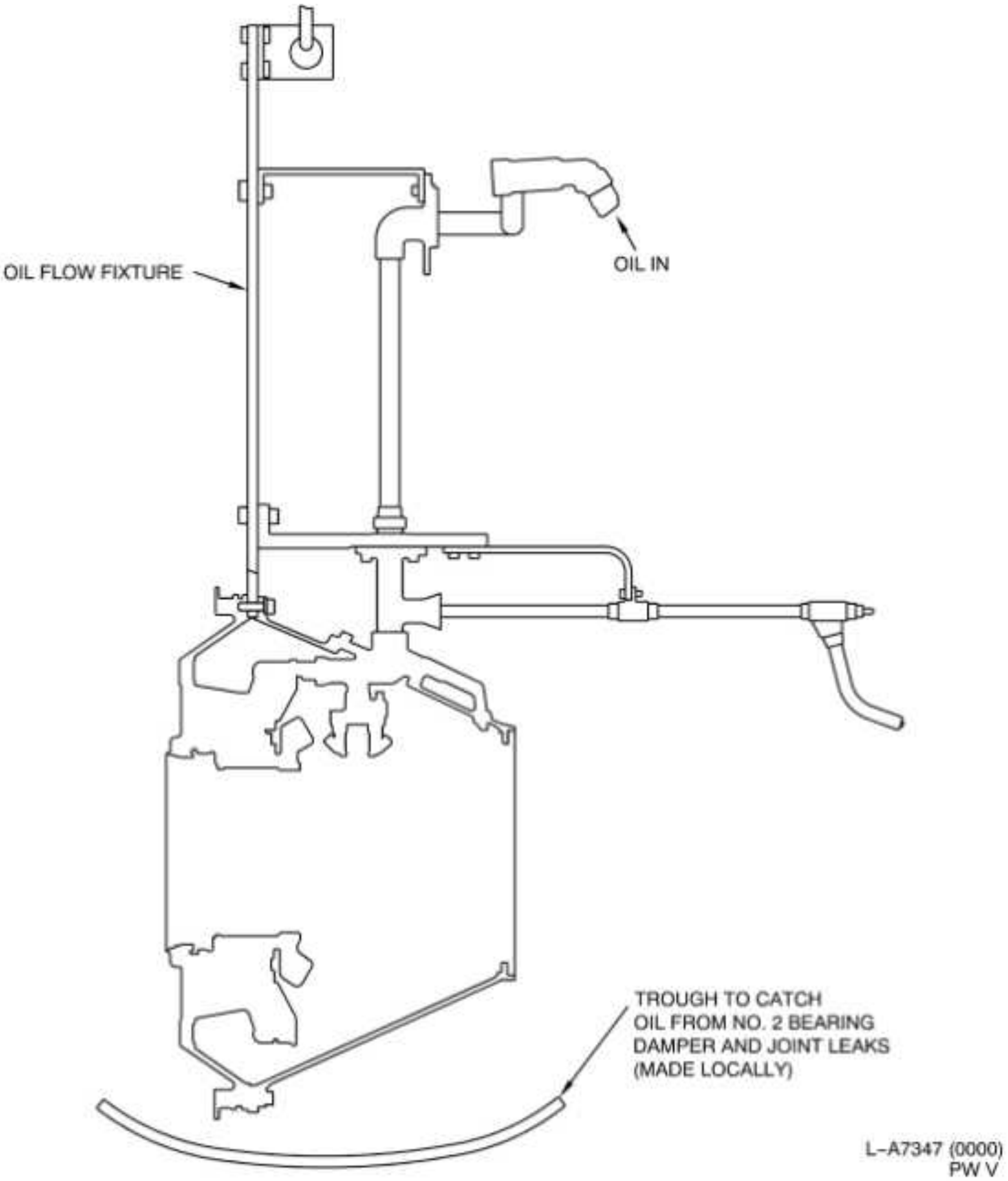
Installation Of The Main Bearing Pressure
Tube Assembly In The Oil Flow Fixture
Figure 1301
(Task 72−34−00−710−001)


NO. 1.5 BEARING SUPPORT ASSEMBLY
(4 PLACES)
GASKET
(PRE SB PW4ENG 72−179)
NO. 2 BEARING (OIL) PRESSURE TUBE (POST SB PW4ENG 72−179) OR NO. 2 BEARING DAMPER OIL SHUT−OFF VALVE (POST SB PW4ENG 72−394)
SPACER
NO. 2 BEARING AND SEAL ASSEMBLY
OIL FLOW FIXTURE
PLATE
L−A7346 (0692)
PW V

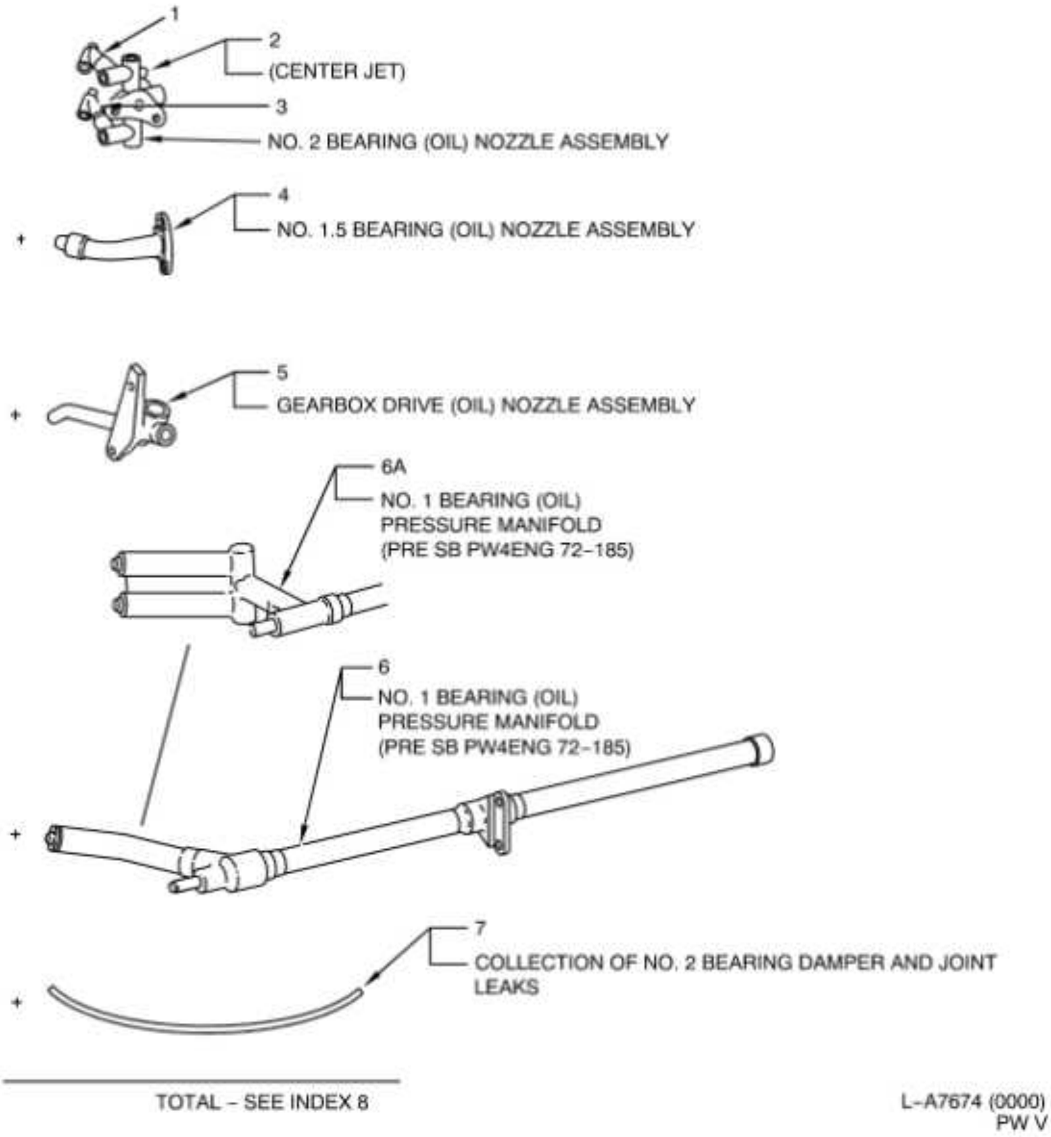
Installation Of The No. 2 Bearing Pressure Tube, The No. 1.5 Bearing Support Assembly, And The No. 2 Bearing And Seal Assembly
Figure 1302
(Task 72−34−00−710−001)


NO. 1 BEARING PRESSURE MANIFOLD (POST SB PW4ENG 72-185 SHOWN)
MAIN BEARING OIL PRESSURE MANIFOLD
L-A7348 (0000)
PW V

Installation Of The Main Bearing Oil Pressure Manifold
Assembly And The No. 1 Bearing Pressure Manifold
Figure 1303
(Task 72−34−00−710−001)


OIL FLOW FIXTURE
OIL IN
TROUGH TO CATCH OIL FROM NO. 2 BEARING DAMPER AND JOINT LEAKS (MADE LOCALLY)
L−A7347 (0000)
PW V

Position Of The Assembly During Test
Figure 1304
(Task 72−34−00−710−001)


1
2
(CENTER JET)
3
NO. 2 BEARING (OIL) NOZZLE ASSEMBLY
+
4
NO. 1.5 BEARING (OIL) NOZZLE ASSEMBLY
+
5
GEARBOX DRIVE (OIL) NOZZLE ASSEMBLY
6A
NO. 1 BEARING (OIL)
PRESSURE MANIFOLD
(PRE SB PW4ENG 72-185)
+
6
NO. 1 BEARING (OIL)
PRESSURE MANIFOLD
(PRE SB PW4ENG 72-185)
+
7
COLLECTION OF NO. 2 BEARING DAMPER AND JOINT
LEAKS
TOTAL - SEE INDEX 8
L-A7674 (0000)
PW V

Flow Rates
Figure 1305
(Task 72-34-00-710-001)

INTERMEDIATE CASE − TESTING−01

1. 11.5 − 13.2 lb (5.22 − 5.99 kg) Each Minute
2. 6.7 − 7.9 lb (3.04 − 3.58 kg) Each Minute
3. 11.5 − 13.2 lb (5.22 − 5.99 kg) Each Minute
4. 5.2 − 6.4 lb (2.36 − 2.90 kg) Each Minute
5. 2.24 − 3.0 lb (1.02 − 1.36 kg) Each Minute
6. (Pre SB PW4ENG 72−185) 10.0 − 11.3 lb (4.54 − 5.13 kg) Each Minute, Each Jet
   (Post SB PW4ENG 72−185) 20.0 − 23.42 lb (9.07 − 10.62 kg) Each Minute
7. (Pre SB PW4ENG 72−179) 1.0 − 9.1 lb (0.45 − 4.13 kg) Each Minute
   (Post SB PW4ENG 72−179) 0.6 − 5.4 lb (0.27 − 2.45 kg) Each Minute
8. (Pre SB PW4ENG 72−179) 58.5 − 74.3 lb (26.54 − 33.70 kg) Each Minute
   (Post SB PW4ENG 72−179) 58.1 − 69.1 lb (26.35 − 31.34 kg) Each Minute

Key to Figure 1305

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INTERMEDIATE CASE - TESTING-02

Task 72-34-00-720-001:

1. Airflow The No. 1, 1.5, and 2 Bearing Compartments

A. Equipment and Materials

Special Tools:
CTE 5070 Cart, Airflow (Optional To CTE 6070)
CTE 6070 Cart, Airflow
PWA 85564 Adapter

B. Procedure

See Figure 1301.

NOTE: The engine parts are still installed in the oil flow fixture.

(1) Attach PWA 85564 Adapter to the main bearing oil pressure manifold.

(2) Attach the air supply hose from CTE 6070 or CTE 5070 Airflow Cart to the larger threaded hole of the adapter. Attach the pressure sensing line to the smaller threaded hole in the adapter.

(3) Do an airflow check of the nozzles at 10 psig (68.9 kPa). Write the value of the air flow. Call this value the base rate.

NOTE: The airflow value given for test equipment provision and reference only is 40 - 57 lb/hr (18.14 - 25.85 kg/hr).

(4) Remove the adapter and cart.

(5) Remove from the assembly the engine parts that follow:

(a) Remove the main bearing oil pressure manifold. Discard the packing. Remove the No. 1 bearing pressure manifold.

(b) Remove the No. 1.5 bearing support assembly, the oil flow fixture, and the No. 2 bearing (oil) pressure tube (Pre SB PW4ENG 72-394) or oil shut-off valve (Post SB PW4ENG 72-394) from the No. 2 bearing and seal assembly. Remove the No. 2 bearing (oil) pressure tube/valve from the support assembly. Discard the packings.

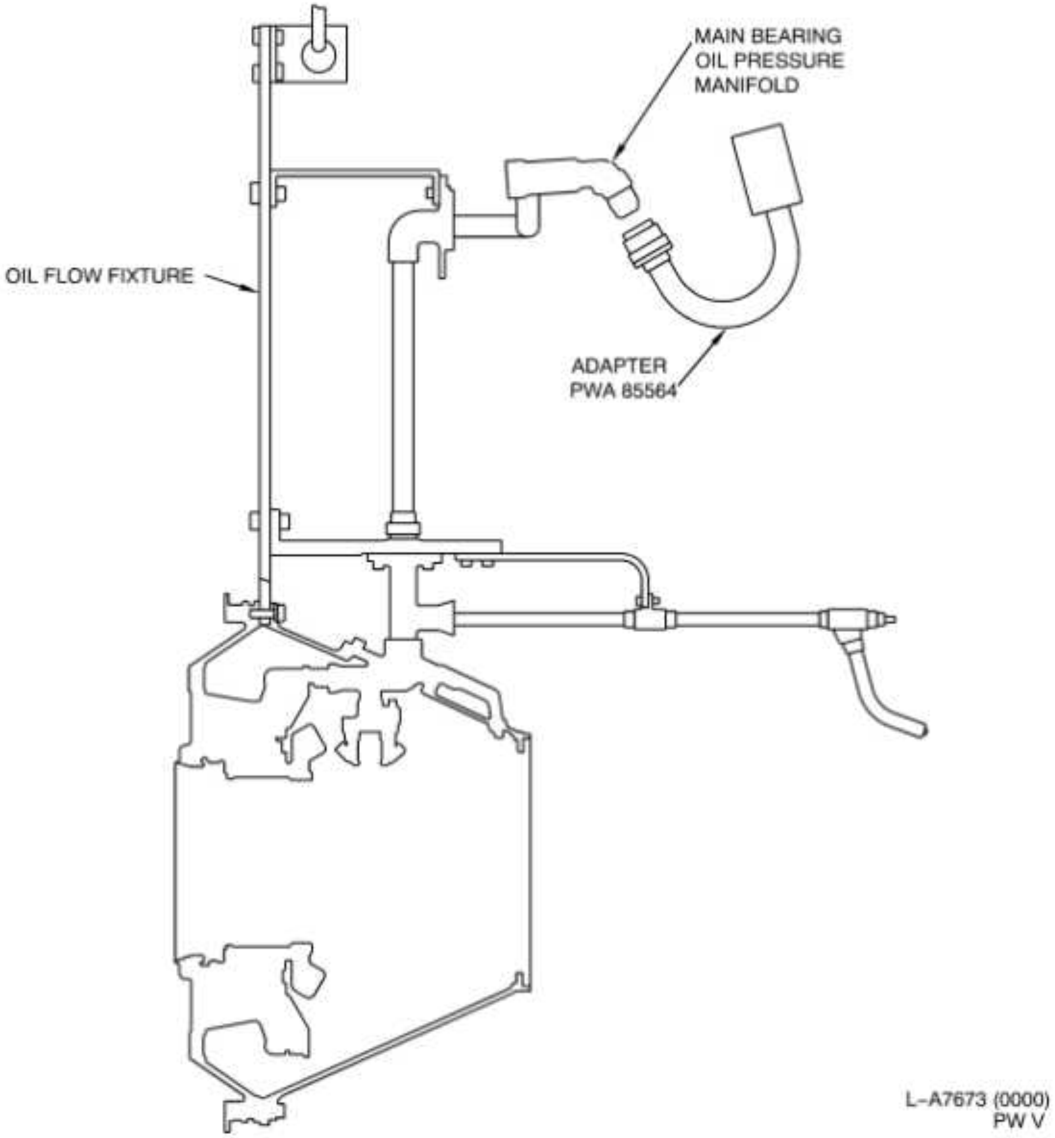
INTERMEDIATE CASE - TESTING-02

(c) Remove the main bearing pressure tube assembly from the oil flow fixture. Discard the packings. Remove the main bearing tube connector.

(d) Remove the gasket.

C. Postrequisites

(1) Install the No. 1.5 and 2 bearing (carbon) seal assembly. Refer to Assembly-05 (Task 72-34-00-400-005).


MAIN BEARING
OIL PRESSURE
MANIFOLD
OIL FLOW FIXTURE
ADAPTER
PWA 85564
L-A7673 (0000)
PW V

Airflow The No. 1, 1.5, And 2 Bearing Compartments
Figure 1301
(Task 72-34-00-720-001)

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Pratt & Whitney
PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

Tab Separator - Intermediate Case

List of Effective Pages - Intermediate Case
See end of list.

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	509		DEC 15/96
	510		DEC 15/96
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72-34-00			
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ASSEMBLY-02	R	1002		DEC 15/06
	R	1003		DEC 15/06
	R	1004		DEC 15/06
	R	1005		DEC 15/06
	R	1006		DEC 15/06
	R	1007/1008		DEC 15/06
72-34-00				
72-34-00		1001	ALL	MAR 15/98
ASSEMBLY-03		1002		MAR 15/98
		1003		MAR 15/98
		1004		MAR 15/98
		1005		MAR 15/98
		1006		MAR 15/98
		1007		MAR 15/98
		1008		MAR 15/98
72-34-00				
72-34-00		1001	ALL	SEP 15/97
ASSEMBLY-04		1002		SEP 15/97
		1003		SEP 15/97
		1004		SEP 15/97
		1005		SEP 15/97
		1006		SEP 15/97
72-34-00				
72-34-00		1001	ALL	JUL 15/91
ASSEMBLY-05		1002		JUL 15/91
		1003/1004		JUL 15/91
72-34-00				
72-34-00		1301	ALL	MAR 15/02
TESTING-01		1302		MAR 15/02
		1303		DEC 15/00
		1304		DEC 15/00
		1305		DEC 15/00
		1306		DEC 15/00
		1307		DEC 15/00
		1308		DEC 15/00
		1309		DEC 15/00
		1310		DEC 15/00
		1311/1312		DEC 15/00
72-34-00				
72-34-00		1301	ALL	SEP 15/93
TESTING-02		1302		SEP 15/93
		1303/1304		OCT 15/91
72-34-04				
72-34-04		501	ALL	DEC 15/01
DISASSY-01		502		DEC 15/01
		503		DEC 15/01
		504		DEC 15/01
		505		DEC 15/01
		506		DEC 15/01
		507		DEC 15/01

	508		DEC 15/01
	509		DEC 15/01
	510		DEC 15/01
	511		DEC 15/01
	512		DEC 15/01
72-34-04			
72-34-04	501	ALL	MAR 15/01
DISASSY-02	502		MAR 15/01
	503		MAR 15/01
	504		MAR 15/01
	505		MAR 15/01
	506		MAR 15/01
	507		JUN 15/00
	508		JUN 15/00
	509		JUN 15/00
	510		JUN 15/00
	511		MAR 15/01
	512		MAR 15/01
	513/514		JUN 15/00
72-34-04			
72-34-04	1001	ALL	DEC 15/01
ASSEMBLY-01	1002		DEC 15/01
	1003		JUN 15/02
	1004		JUN 15/02
	1005		JUN 15/02
	1006		JUN 15/02
72-34-04			
72-34-04	1001	ALL	JUN 15/06
ASSEMBLY-02	1002		JUN 15/06
	1003		JUN 15/06
	1004		JUN 15/06
	1005		MAR 15/01
	1006		MAR 15/01
	1007/1008		MAR 15/01
72-34-04			
72-34-04	1001	ALL	DEC 15/05
ASSEMBLY-03	1002		DEC 15/05
	1003		DEC 15/05
	1004		DEC 15/05
	1005		DEC 15/05
	1006		DEC 15/05
	1007		DEC 15/05
	1008		DEC 15/05
	1009		SEP 15/05
	1010		SEP 15/05
	1011		SEP 15/02
	1012		SEP 15/02
	1013		SEP 15/03
	1014		SEP 15/03
	1015		MAR 15/98
	1016		MAR 15/98
	1017		MAR 15/98
	1018		MAR 15/98
	1019/1020		MAR 15/98
72-34-05			
72-34-05	501	ALL	DEC 15/93
DISASSY-01	502		DEC 15/93
72-34-05			
72-34-05	1001	ALL	DEC 15/97
ASSEMBLY-01	1002		DEC 15/97
	1003		DEC 15/97
	1004		DEC 15/97
72-34-05			
72-34-05	1301	ALL	JUN 15/94
TESTING-01	1302		JUN 15/94
	1303		JUN 15/94
	1304		JUN 15/94
	1305/1306		JUN 15/94
72-34-06			
72-34-06	1301/1302	ALL	OCT 15/91
TESTING-01			
72-34-35			

72-34-35	501	ALL	DEC 15/93
DISASSY-01	502		DEC 15/93
72-34-35			
72-34-35	1001	ALL	DEC 15/94
ASSEMBLY-01	1002		DEC 15/94
	1003		DEC 15/96
	1004		DEC 15/96
	1005		DEC 15/96
	1006		DEC 15/96
	1007		DEC 15/94
	1008		DEC 15/94
72-34-35			
72-34-35	1301	ALL	DEC 15/00
TESTING-01	1302		DEC 15/00
	1303		DEC 15/00
	1304		DEC 15/00
	1305		DEC 15/00
	1306		DEC 15/00
	1307		MAR 15/98
	1308		MAR 15/98
	1309/1310		MAR 15/98

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TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 82 DATED DECEMBER 15, 2006

HIGHLIGHTS - INTERMEDIATE CASE

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-34-00 DISASSY-01	504 -505 513	Revised the test and figure concerning removal of the main bearing scavenge tube. (Editorial)	ALL
72-34-00 ASSEMBLY-02	1002 -1003	Editorially revised assembly task numbers. (EDITORIAL)	ALL

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CHAPTER 72

INTERMEDIATE CASE

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Task 72-34-00-990-002: Intermediate Case		001	
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SUBJECT	CHP/SEC/SUB	PAGE	EFFECTIVITY
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NO. 2 BEARING AND SEAL ASSEMBLY - DISASSEMBLY-01

Task 72-34-04-040-001-001:

1. Disassemble No. 2 Bearing And Seal Assembly (Mechanical Wrench)

A. Equipment And Materials Necessary

Special Tools:

PWA 3755	Pump (Optional To PWA 29389)
PWA 29389	Pump
PWA 45418	Wrench, Mechanical*
PWA 45419	Multiplier, Pneumatic*
PWA 80071	Multiplier, Torque*
PWA 80187	Wrench, Mechanical*
PWA 80651	Multiplier, Pneumatic*
PWA 85016	Wrench (Optional To PWA 86024)
PWA 85022	Fixture
PWA 85023	Puller
PWA 85026	Drift
PWA 85027	Wrench, Torque*
PWA 85028	Adapter, Holding*
PWA 85199	Fixture
PWA 85251	Adapter
PWA 85375	Plate, Anchor*
PWA 85639	Puller, Jackscrew
PWA 86024	Driver, Hand
PWA 88100	Plate, Anchor*
PWA 104314	Base
PWA 105046	Adapter, Holding*

*See Table 501 for tool options. Only Table 501 shows the correct combinations of tools for the removal of the No. 2 bearing (outer race) retaining nut.

B. Procedure
See Figure 501.

(1) Remove the gearbox drive bevel gear. Use PWA 85023 Hydraulic Puller and PWA 85022 Holding Fixture. See Figure 502.

(a) Install PWA 85023 Puller on PWA 85022 Fixture.

1 Remove the detail nut and washer.

2 Remove the detail hydraulic cylinder.

3 Remove the detail guide ring.

4 Remove the detail pins.

NO. 2 BEARING AND SEAL ASSEMBLY − DISASSEMBLY−01

5 Install PWA 85023 Puller on PWA 85022 Fixture.

(b) Install the No. 2 bearing and seal assembly on PWA 85022 Fixture.

(c) Assemble PWA 85023 Puller.

1 Install the detail guide ring.

2 Install the detail pins in the detail guide ring and through the holes in the gear.

3 Install the detail hydraulic cylinder. Attach it with the detail washer and nut.

(d) Remove the gear.

1 Attach either PWA 3755 Pump or PWA 29389 Hydraulic Pump to the puller.

2 With the pump and puller, remove the gear from the assembly.

(e) Remove the puller.

(2) Remove the spacer.

(3) Remove the top (front) half of the bearing inner race.

(4) Remove the 32 nuts that attach the studs to the No. 2 bearing housing. Use PWA 85199 Fixture, PWA 85251 Adapter and PWA 86024 Driver or PWA 85016 Wrench. See Figure 503.

(a) Remove the No. 2 bearing and seal assembly from PWA 85022 Fixture.

(b) Attach PWA 85199 Fixture to a bench.

(c) Attach PWA 85251 Adapter to PWA 85199 Fixture with the detail bolts.

(d) (Pre SB PW4ENG 72−204) Attach the No. 2 bearing and seal assembly to PWA 85251 Adapter. Put the four detail clamps on four of the tabs at the rear flange of the assembly.

(e) (Post SB PW4ENG 72−204) Attach the No. 2 bearing and seal assembly to PWA 85251 Adapter with the four detail bolts. Attach the assembly to the side with the four clamps.

(f) With PWA 86024 Driver or PWA 85016 Wrench, remove the nuts.

(5) Remove the No. 2 bearing housing assembly from the studs. Use PWA 85639 Jackscrew Puller and PWA 85022 Fixture. See Figure 504.

(a) Install the No. 2 bearing and seal assembly on PWA 85022 Fixture. Install it with the front end up.

(b) Align the dowel pin of the No. 2 bearing (carbon) seal assembly with one of the holes in the detail outer ring. Put the detail outer ring on the seal assembly.

(c) Put each half of the puller under the lip of the No. 2 bearing housing assembly. Attach the two halves to each other with the detail screws.

(d) Turn the jackscrews equally to remove the housing from the studs.

(e) Remove the puller.

(6) Remove the balls and cage from the bearing.

(7) Remove the bottom (rear) half of the inner race and the seal seat from the support assembly.

(8) Remove the outer race retaining nut as follows. See Table 501 for the correct combinations of tools. See Figure 505.

PWA Torque Wrench	PWA Holding Adapter	PWA Mechanical Wrench or Torque Multiplier	PWA Pneumatic Multiplier	PWA Anchor Plate
85027	85028 and 105046	80187	80651 or 45419	88100 or 85375

Matrix Of Tools Used To Remove The No. 2 Bearing (Outer Race) Retaining Nut
Table 501

PWA Torque Wrench	PWA Holding Adapter	PWA Mechanical Wrench or Torque Multiplier	PWA Pneumatic Multiplier	PWA Anchor Plate
85027	85028 and 105046	45418	45419	88100 or 85375
85027	85028 and 105046	80071	80651 or 45419	88100

Matrix Of Tools Used To Remove The No. 2 Bearing (Outer Race) Retaining Nut
Table 501 (Continued)

(a) Install the No. 2 bearing housing assembly and outer race in PWA 104314 Base, the retaining nut up.

(b) Cut the flare and remove the rivet that attaches the nut.

(c) Install the shaft detail of the PWA 105046 Holding Adapter to the center ID of the support base. See Figure 505.

(d) Install PWA 85028 Holding Adapter on the base.

(e) Install the PWA 85027 Torque Wrench over the PWA 85028 Holding Adapter. Engage the wrench in the slots of the retaining nut.

(f) Attach a hoist to the mechanical wrench (or torque multiplier) and install that tool over the adapter.

(g) Install the PWA 88100 or the PWA 85375 Anchor Plate on the mechanical wrench. Engage the pins of the mechanical wrench in the holes of the plate.

(h) Remove the hoist and sling.

(i) Install the nut and plate details of the Holding Adapter (PWA 105046) to seat against the PWA 88100 Anchor Plate.

NO. 2 BEARING AND SEAL ASSEMBLY − DISASSEMBLY−01

(j) If you want to use a pneumatic multiplier, refer to the referenced table. Otherwise, use a standard wrench.

WARNING: INJURY TO PERSONNEL AND/OR DAMAGE TO PARTS AND TOOLS WILL OCCUR IF THE DETAIL NUT (PWA 105046) IS NOT LOOSENED DURING BEARING RETAINER NUT REMOVAL. DURING REMOVAL OF THE BEARING RETAINER NUT, THE DETAIL NUT MUST BE LOOSENED AT EACH 45 DEGREE TURN OF THE BEARING RETAINER NUT TO PREVENT STRESS LOAD ON THE TOOL.

(k) Loosen the detail nut of the Holding Adapter (PWA 105046) at each 45 degree turn of the bearing retaining nut. Loosen the bearing retaining nut to zero lb−in.

(l) Remove the wrenches and adapters.

(m) Remove the bearing retaining nut.

(9) Remove the bearing outer race. Use PWA 85026 Drift. See Figure 506.

(a) Put the No. 2 bearing housing, threads down, on PWA 104314 Base.

(b) With PWA 85026 Drift and an arbor press, remove the outer race.

(c) Remove the housing from the base.

(d) Remove the two seal rings from the housing.

(10) Remove the studs from the No. 2 bearing (carbon) seal assembly. Use PWA 85251 Adapter.

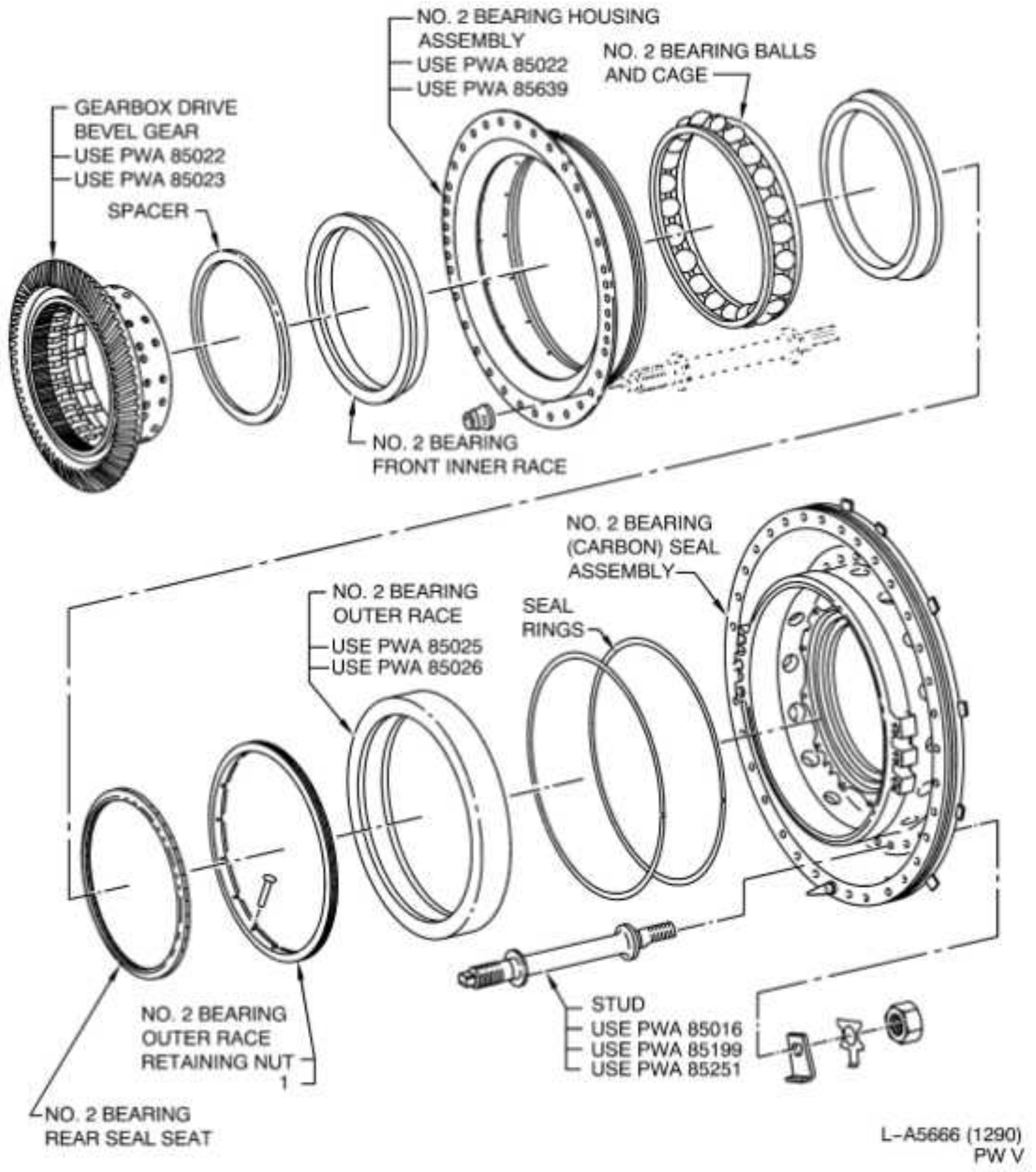
(a) Put the (carbon) seal assembly in the adapter.

(b) With a standard 7/16 inch wrench, remove the 32 nuts that attach the studs to the (carbon) seal assembly.

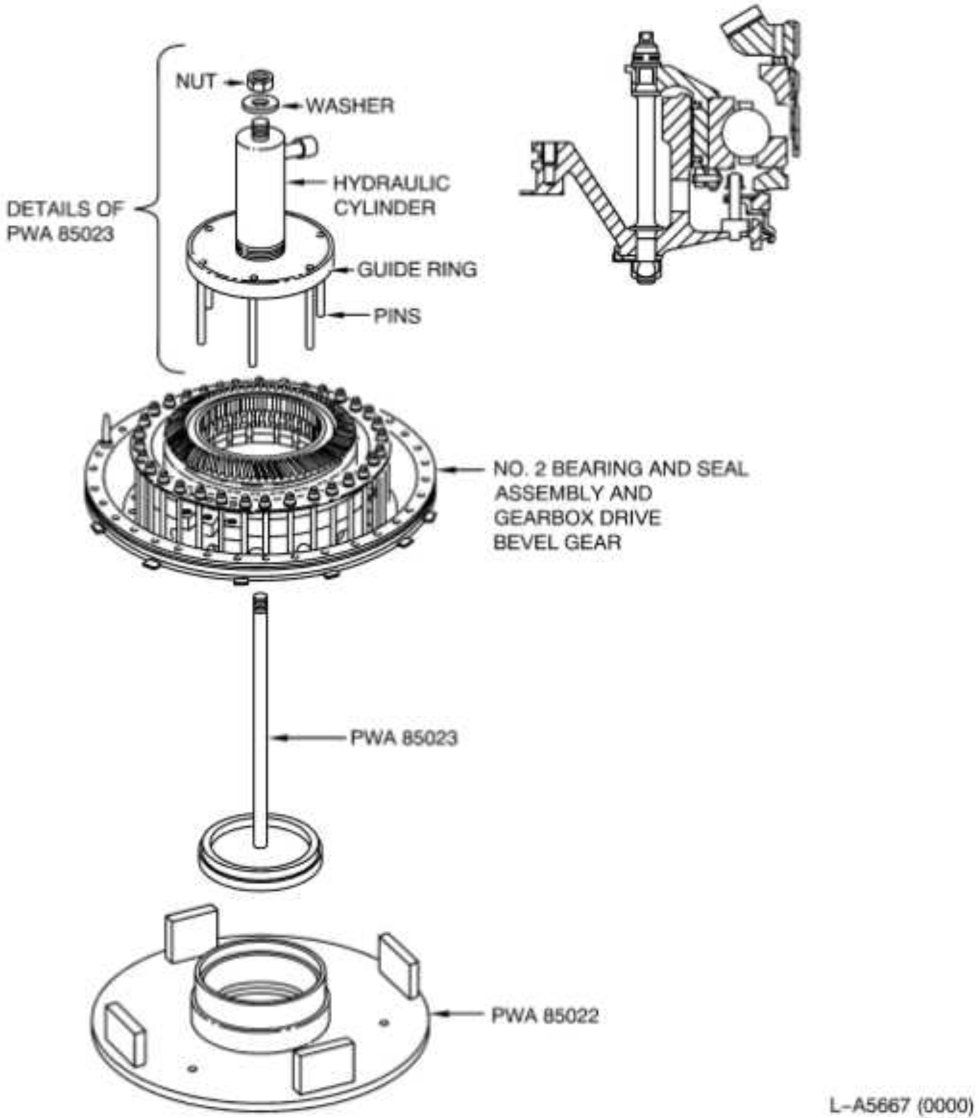
(c) Remove the two washers that are on each stud.

(d) With an applicable tool, remove the studs from the (carbon) seal assembly.

(e) Remove the (carbon) seal assembly from the tool.

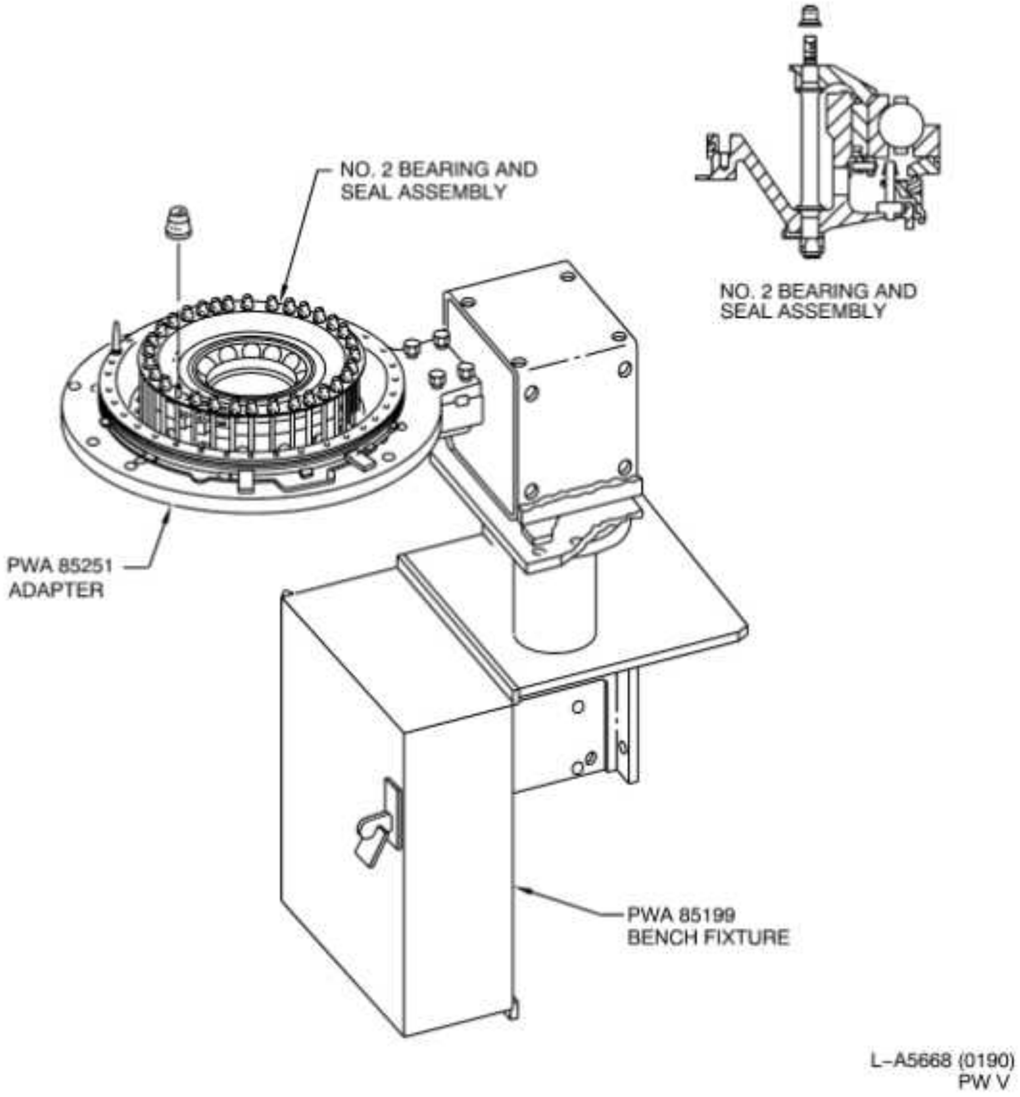

NO. 2 BEARING HOUSING ASSEMBLY
USE PWA 85022
USE PWA 85639
NO. 2 BEARING BALLS AND CAGE
GEARBOX DRIVE BEVEL GEAR
USE PWA 85022
USE PWA 85023
SPACER
NO. 2 BEARING FRONT INNER RACE
NO. 2 BEARING (CARBON) SEAL ASSEMBLY
NO. 2 BEARING OUTER RACE
USE PWA 85025
USE PWA 85026
SEAL RINGS
NO. 2 BEARING OUTER RACE RETAINING NUT
1
STUD
USE PWA 85016
USE PWA 85199
USE PWA 85251
NO. 2 BEARING REAR SEAL SEAT
L-A5666 (1290)
PW V

1. Use The Tools Shown In Table 501.
Disassembly Of The No. 2 Bearing And Seal Assembly
Figure 501
(Task 72-34-04-040-001-001)


NUT
WASHER
HYDRAULIC CYLINDER
DETAILS OF PWA 85023
GUIDE RING
PINS
NO. 2 BEARING AND SEAL ASSEMBLY AND GEARBOX DRIVE BEVEL GEAR
PWA 85023
PWA 85022
L−A5667 (0000)
PW V

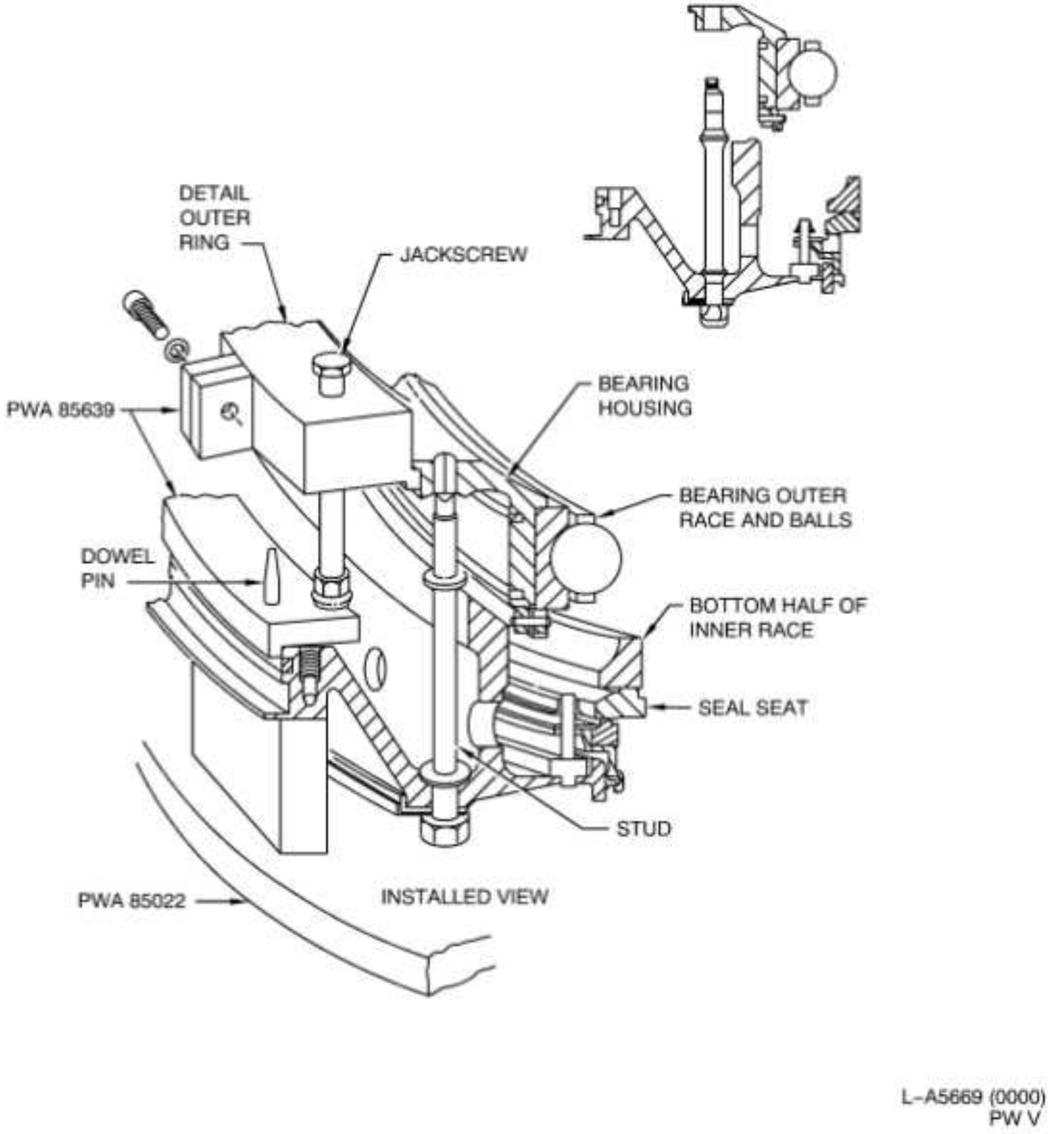
Use Of PWA 85022 And PWA 85023
Figure 502
(Task 72−34−04−040−001−001)

NO. 2 BEARING AND SEAL ASSEMBLY − DISASSEMBLY−01


NO. 2 BEARING AND SEAL ASSEMBLY
NO. 2 BEARING AND SEAL ASSEMBLY
PWA 85251 ADAPTER
PWA 85199 BENCH FIXTURE
L−A5668 (0190)
PW V

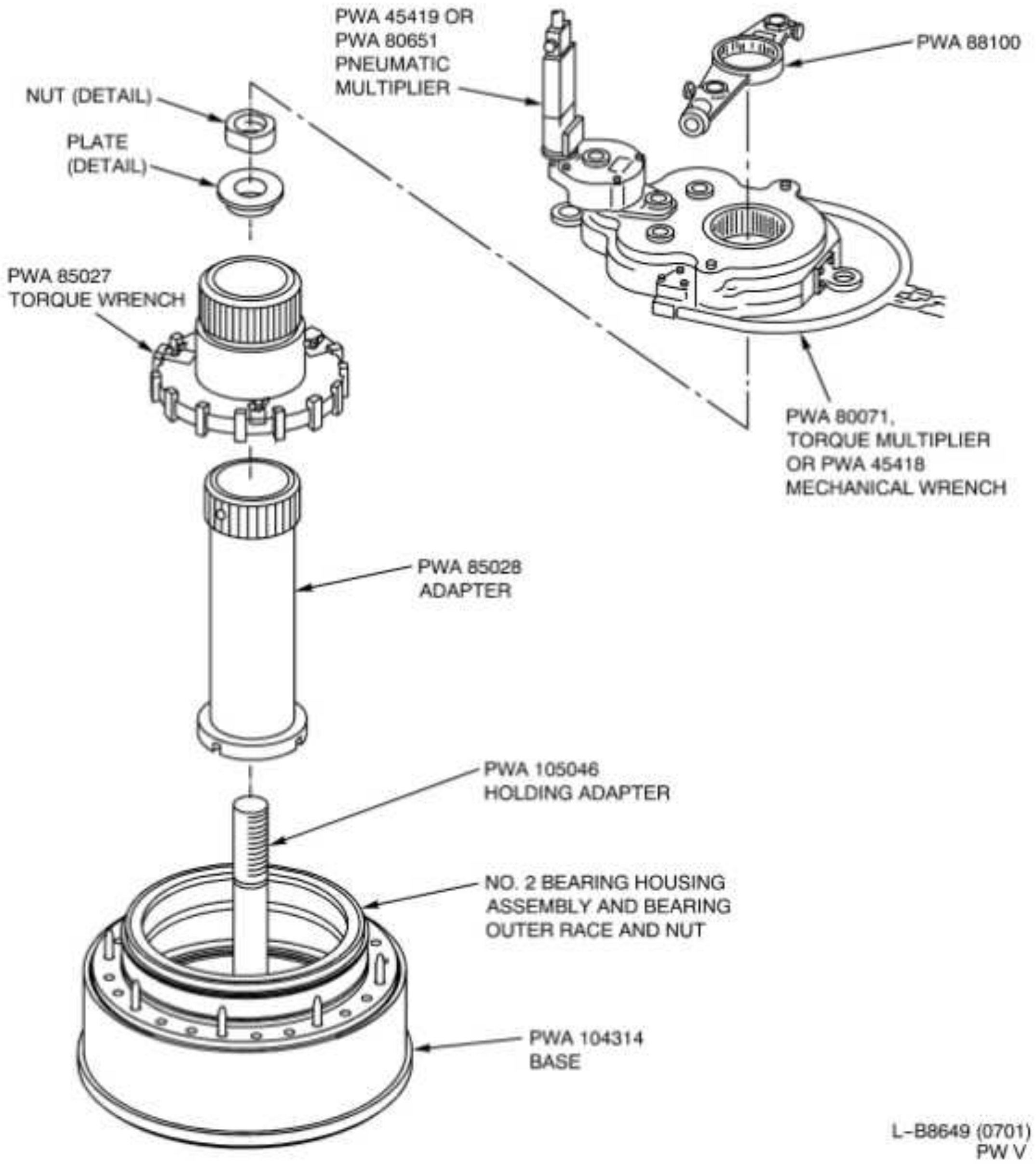
Use PWA 85251 And PWA 85199
Figure 503
(Task 72−34−04−040−001−001)

NO. 2 BEARING AND SEAL ASSEMBLY - DISASSEMBLY-01


DETAIL
OUTER
RING
JACKSCREW
PWA 85639
BEARING
HOUSING
BEARING OUTER
RACE AND BALLS
DOWEL
PIN
BOTTOM HALF OF
INNER RACE
SEAL SEAT
STUD
PWA 85022
INSTALLED VIEW
L-A5669 (0000)
PW V

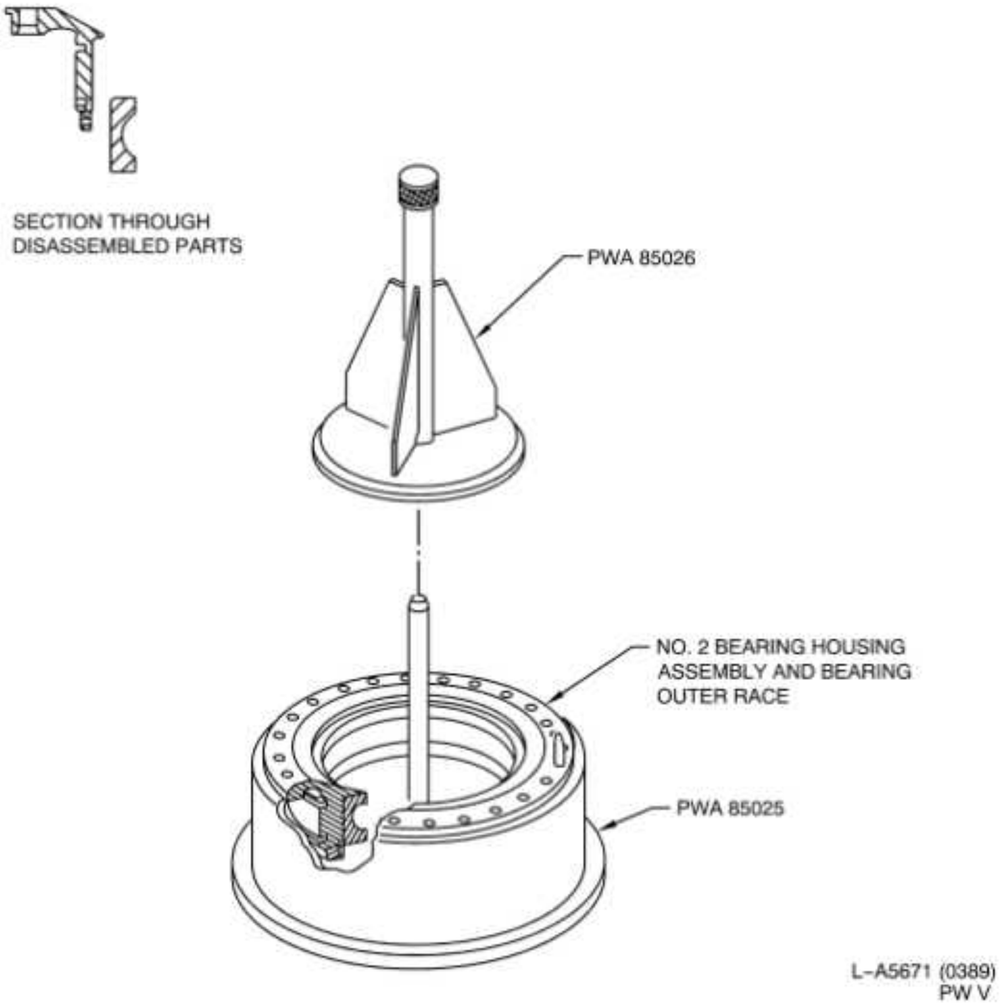
Use PWA 85639
Figure 504
(Task 72-34-04-040-001-001)

NO. 2 BEARING AND SEAL ASSEMBLY - DISASSEMBLY-01


PWA 45419 OR
PWA 80651
PNEUMATIC
MULTIPLIER
PWA 88100
NUT (DETAIL)
PLATE
(DETAIL)
PWA 85027
TORQUE WRENCH
PWA 80071,
TORQUE MULTIPLIER
OR PWA 45418
MECHANICAL WRENCH
PWA 85028
ADAPTER
PWA 105046
HOLDING ADAPTER
NO. 2 BEARING HOUSING
ASSEMBLY AND BEARING
OUTER RACE AND NUT
PWA 104314
BASE
L-B8649 (0701)
PW V

Remove The No. 2 Bearing (Outer Race) Retaining Nut
Figure 505
(Task 72-34-04-040-001-001)

NO. 2 BEARING AND SEAL ASSEMBLY − DISASSEMBLY−01


SECTION THROUGH DISASSEMBLED PARTS
PWA 85026
NO. 2 BEARING HOUSING ASSEMBLY AND BEARING OUTER RACE
PWA 85025
L−A5671 (0389)
PW V

Use PWA 85026
Figure 506
(Task 72−34−04−040−001−001)

NO. 2 BEARING AND SEAL ASSEMBLY - DISASSEMBLY-02

Task 72-34-04-040-001-002:

1. Disassemble No. 2 Bearing And Seal Assembly (Hydraulic Wrench)

A. Equipment And Materials Necessary

Special Tools:

PWA 3755	Pump (Optional To PWA 29389)
PWA 29389	Pump
PWA 18872	Wrench, Hydraulic*
PWA 28814	Pump, Hydraulic*
PWA 28815	Cart*
PWA 29510	Pump, Hydraulic*
PWA 33732	Wrench, Hydraulic*
PWA 75046	Cart*
PWA 80070	Wrench, Hydraulic*
PWA 85016	Wrench (Optional To PWA 86024)
PWA 85022	Fixture
PWA 85023	Puller
PWA 85026	Drift
PWA 85027	Wrench, Torque*
PWA 85028	Adapter, Holding*
PWA 85199	Fixture
PWA 85251	Adapter
PWA 85370	Wrench, Torque*
PWA 85371	Adapter, Holding*
PWA 85639	Puller, Jackscrew
PWA 86024	Driver, Hand
PWA 87354	Wrench, Hydraulic*
PWA 88100	Plate, Anchor*
PWA 104314	Base
PWA 104437	Adapter, Holding

*See Table 501 for tool options. Only Table 501 shows the correct combinations of tools for the removal of the No. 2 bearing (outer race) retaining nut.

B. Procedure
See Figure 501.

(1) Remove the gearbox drive bevel gear. Use PWA 85023 Hydraulic Puller and PWA 85022 Holding Fixture. See Figure 502.

(a) Install PWA 85023 Puller on PWA 85022 Fixture.

1 Remove the detail nut and washer.

2 Remove the detail hydraulic cylinder.

NO. 2 BEARING AND SEAL ASSEMBLY − DISASSEMBLY−02

3 Remove the detail guide ring.

4 Remove the detail pins.

5 Install PWA 85023 Puller on PWA 85022 Fixture.

(b) Install the No. 2 bearing and seal assembly on PWA 85022 Fixture.

(c) Assemble PWA 85023 Puller.

1 Install the detail guide ring.

2 Install the detail pins in the detail guide ring and through the holes in the gear.

3 Install the detail hydraulic cylinder. Attach it with the detail washer and nut.

(d) Remove the gear.

1 Attach either PWA 3755 Pump or PWA 29389 Hydraulic Pump to the puller.

2 With the pump and puller, remove the gear from the assembly.

(e) Remove the puller.

(2) Remove the spacer.

(3) Remove the top (front) half of the bearing inner race.

(4) Remove the 32 nuts that attach the studs to the No. 2 bearing housing. Use PWA 85199 Fixture, PWA 85251 Adapter, and PWA 86024 Driver or PWA 85016 Wrench. See Figure 503.

(a) Remove the No. 2 bearing and seal assembly from PWA 85022 Fixture.

(b) Attach PWA 85199 Fixture to a bench.

(c) Attach PWA 85251 Adapter to PWA 85199 Fixture with the detail bolts.

NO. 2 BEARING AND SEAL ASSEMBLY − DISASSEMBLY−02

(d) (Pre SB PW4ENG 72−204) Attach the No. 2 bearing and seal assembly to PWA 85251 Adapter. Put the four detail clamps on four of the tabs at the rear flange of the assembly.

(e) (Post SB PW4ENG 72−204) Attach the No. 2 bearing and seal assembly to PWA 85251 Adapter with the four detail bolts. Attach the assembly to the side with the four clamps.

(f) With PWA 86024 Driver or PWA 85016 Wrench, remove the nuts.

(5) Remove the No. 2 bearing housing assembly from the studs. Use PWA 85639 Jackscrew Puller and PWA 85022 Fixture. See Figure 504.

(a) Install the No. 2 bearing and seal assembly on PWA 85022 Fixture. Install it with the front end up.

(b) Align the dowel pin of the No. 2 bearing (carbon) seal assembly with one of the holes in the detail outer ring. Put the detail outer ring on the seal assembly.

(c) Put each half of the puller under the lip of the No. 2 bearing housing assembly. Attach the two halves to each other with the detail screws.

(d) Turn the jackscrews equally to remove the housing from the studs.

(e) Remove the puller.

(6) Remove the balls and cage from the bearing.

(7) Remove the bottom (rear) half of the inner race and the seal seat from the support assembly.

(8) Remove the outer race retaining nut. See Table 501 for the correct combinations of tools. Refer to Figure 505.

NO. 2 BEARING AND SEAL ASSEMBLY - DISASSEMBLY-02

PWA Torque Wrench	PWA Holding Adapter	PWA Hydraulic Wrench	PWA Anchor Plate	PWA Pump	PWA Cart
85370	85371	33732	-----	28814 or 29510	75046
85370	85371	18872	-----	28814 or 29510	75046 or 28815
85027	85028	87354	88100	28814 or 29510	75046
85027	85028	80070	88100	28814 or 29510	75046

Matrix Of Tools Used To Remove The No. 2 Bearing (Outer Race) Retaining Nut
Table 501

(a) Install the No. 2 bearing housing assembly and outer race in PWA 104314 Base, the retaining nut up.

(b) Cut the flare and remove the rivet that attaches the nut to the bearing housing assembly.

(c) (Method 1)

1 Install the shaft detail of the PWA 104437 Holding Adapter to the center ID of the support base.

2 Install PWA 85370 Torque Wrench on the nut. Engage the teeth of the wrench in the slots of the nut.

3 Install the nut and washer details of the Holding Adapter (PWA 104437) to seat against the top of the Torque Wrench (PWA 85370).

4 Install PWA 85371 Adapter on the torque wrench. Engage the detail pins of the base in the holes of the outer ring of the adapter.

5 With a hoist, remove a hydraulic wrench from a cart.

6 Put the hydraulic wrench on the adapter.

7 Connect a pump to the hydraulic wrench.

8 Loosen and remove the nut.

(d) (Method 2)

1 Install PWA 85028 Adapter in the base. Engage the slots in the adapter with the lugs in the base.

2 Install PWA 85027Torque Wrench over the adapter. Engage the teeth of the wrench with the slots of the nut.

3 With a hoist, remove a hydraulic wrench from from a cart. Install the hydraulic wrench on the torque wrench.

4 Install PWA 88100 Anchor Plate on the adapter, splines aligned. Engage the pins on the hydraulic wrench with the holes in the anchor plate.

5 Connect a pump to the hydraulic wrench.

6 Loosen and remove the nut.

(e) Remove the wrenches, pump, and adapters.

(9) Remove the bearing outer race. Use PWA 85026 Drift. See Figure 506.

(a) Put the No. 2 bearing housing, threads down, on PWA 104314 Base.

(b) With PWA 85026 Drift and an arbor press, remove the outer race.

(c) Remove the housing from the base.

(d) Remove the two seal rings from the housing.

(10) Remove the studs from the No. 2 bearing (carbon) seal assembly. Use PWA 85251 Adapter.

(a) Put the (carbon) seal assembly in the adapter.

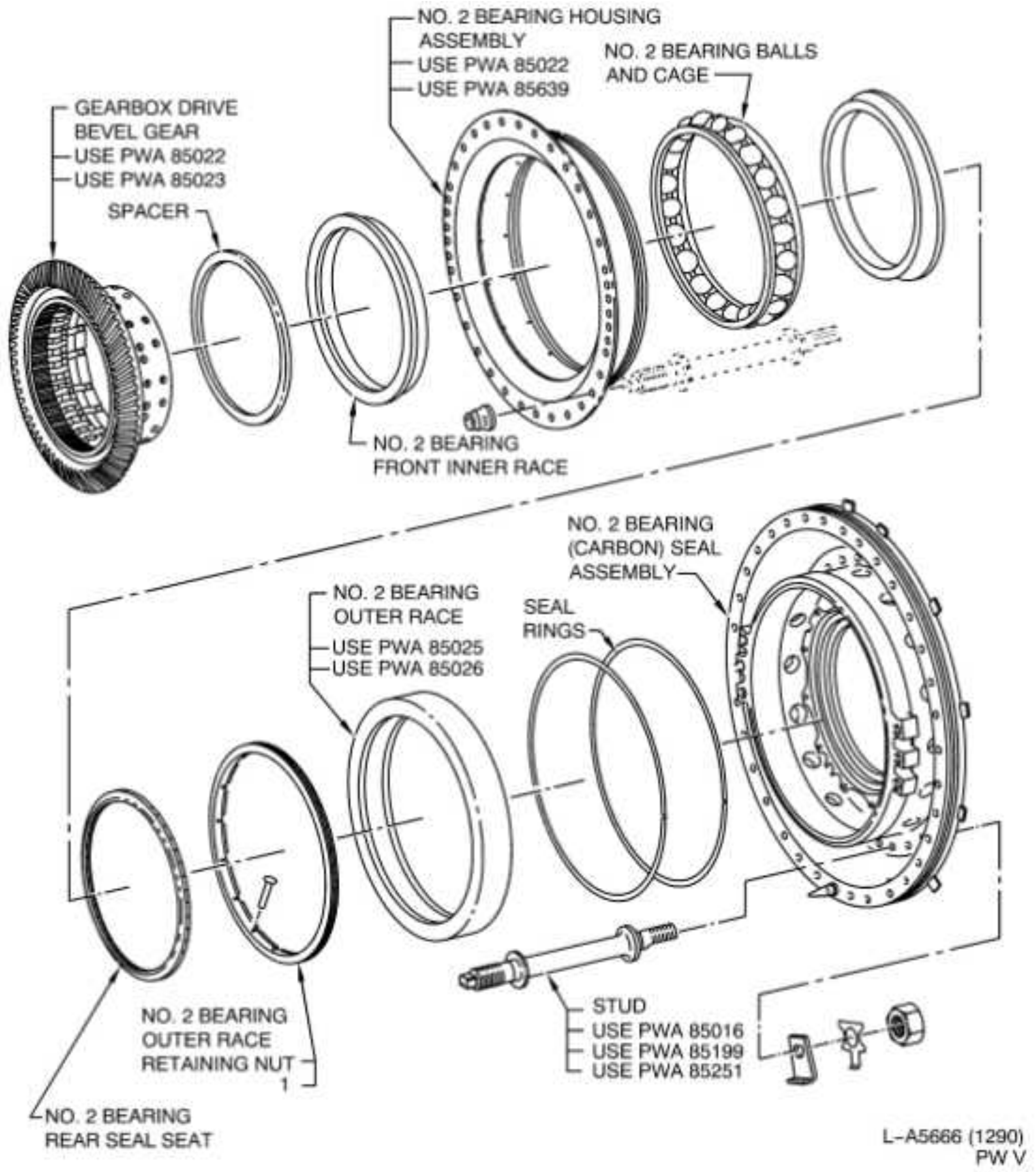
(b) With a standard 7/16 inch wrench, remove the 32 nuts that attach the studs to the (carbon) seal assembly.

(c) Remove the two washers that are on each stud.

(d) With an applicable tool, remove the studs from the (carbon) seal assembly.

(e) Remove the (carbon) seal assembly from the tool.

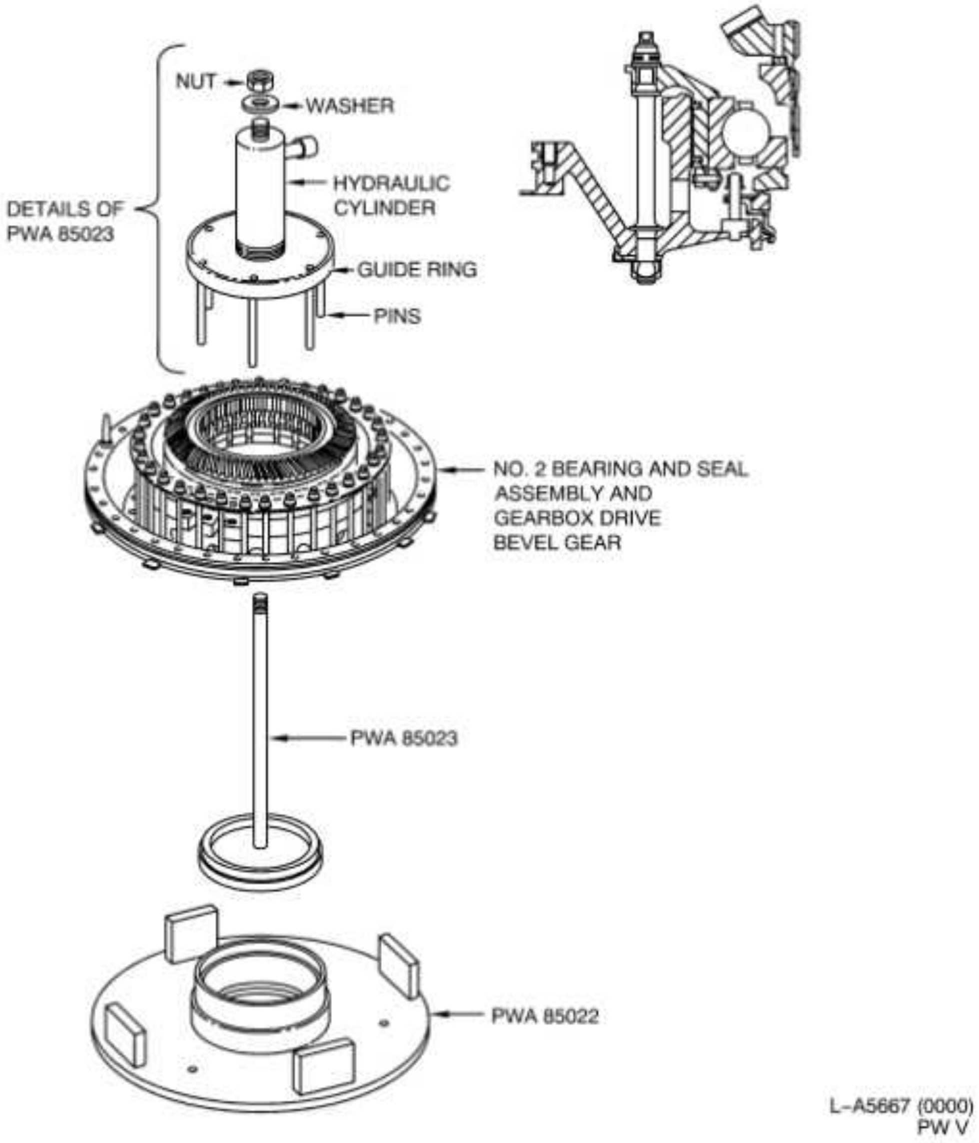
NO. 2 BEARING AND SEAL ASSEMBLY - DISASSEMBLY-02


NO. 2 BEARING HOUSING ASSEMBLY
USE PWA 85022
USE PWA 85639
NO. 2 BEARING BALLS AND CAGE
GEARBOX DRIVE BEVEL GEAR
USE PWA 85022
USE PWA 85023
SPACER
NO. 2 BEARING FRONT INNER RACE
NO. 2 BEARING (CARBON) SEAL ASSEMBLY
NO. 2 BEARING OUTER RACE
USE PWA 85025
USE PWA 85026
SEAL RINGS
NO. 2 BEARING OUTER RACE RETAINING NUT
1
NO. 2 BEARING REAR SEAL SEAT
STUD
USE PWA 85016
USE PWA 85199
USE PWA 85251
L-A5666 (1290)
PW V

1. Refer to Table 501 For Tool Options.

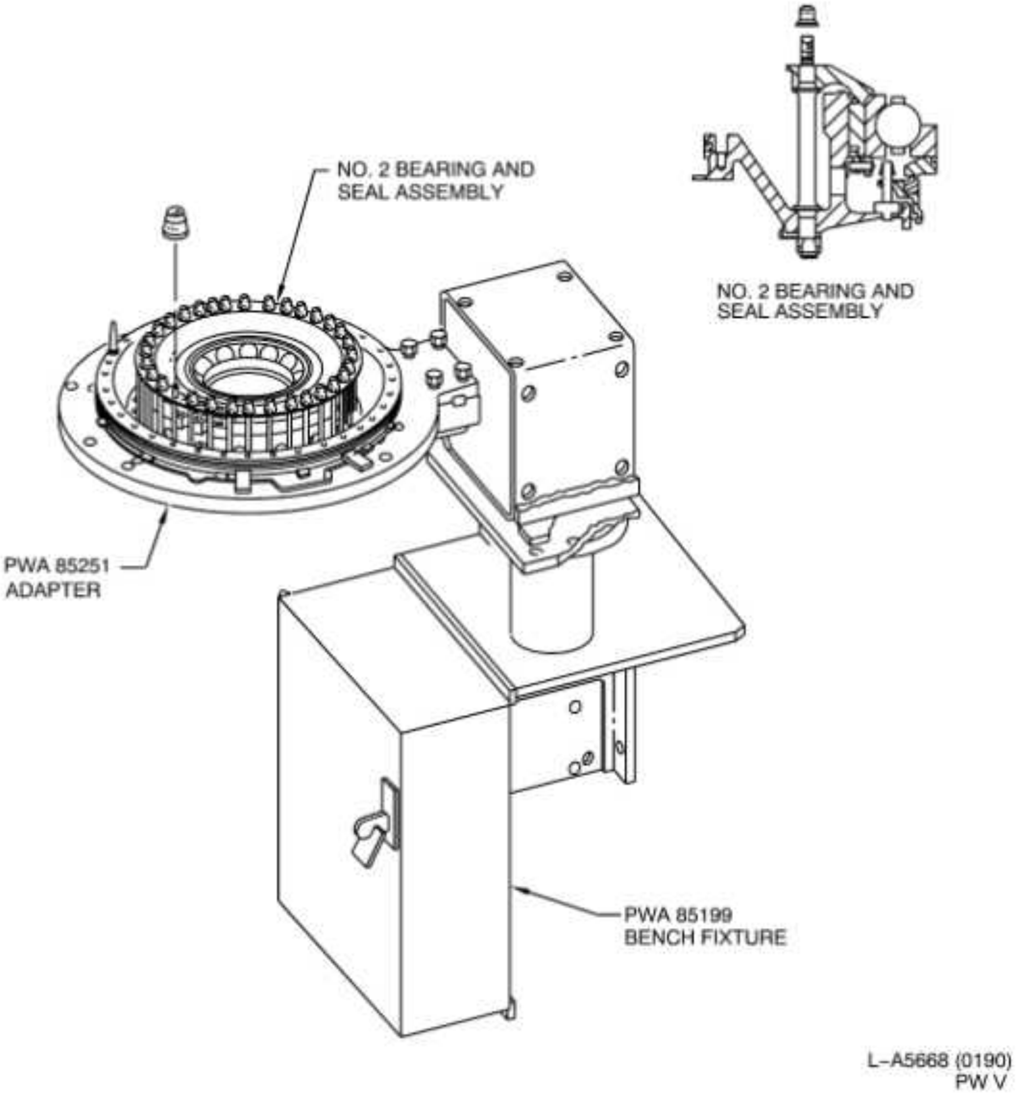
Disassembly Of The No. 2 Bearing And Seal Assembly
Figure 501
(Task 72-34-04-040-001-002)

NO. 2 BEARING AND SEAL ASSEMBLY − DISASSEMBLY−02


NUT
WASHER
HYDRAULIC CYLINDER
DETAILS OF PWA 85023
GUIDE RING
PINS
NO. 2 BEARING AND SEAL ASSEMBLY AND GEARBOX DRIVE BEVEL GEAR
PWA 85023
PWA 85022
L−A5667 (0000)
PW V

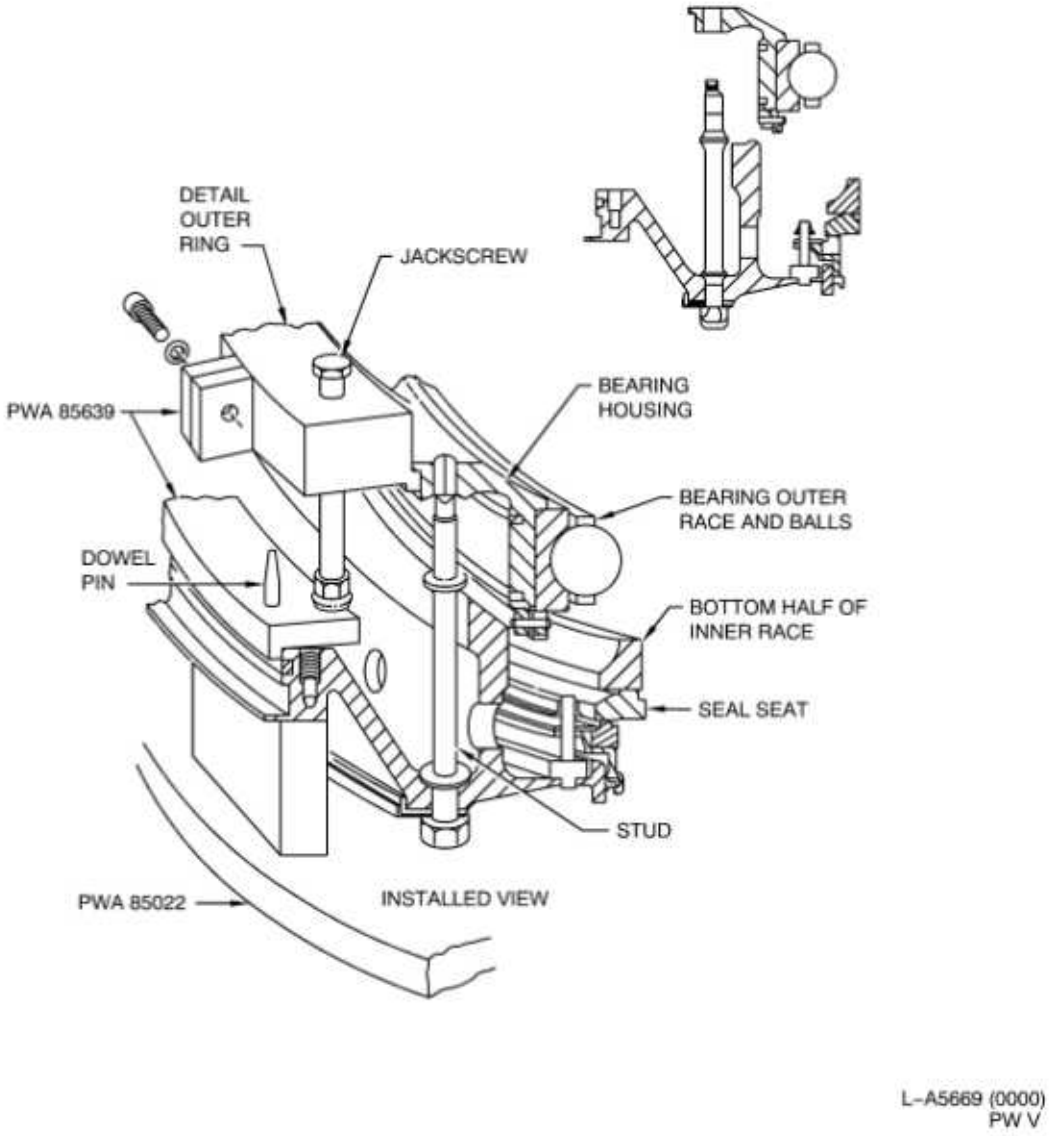
Use Of PWA 85022 And PWA 85023
Figure 502
(Task 72−34−04−040−001−002)

NO. 2 BEARING AND SEAL ASSEMBLY - DISASSEMBLY-02

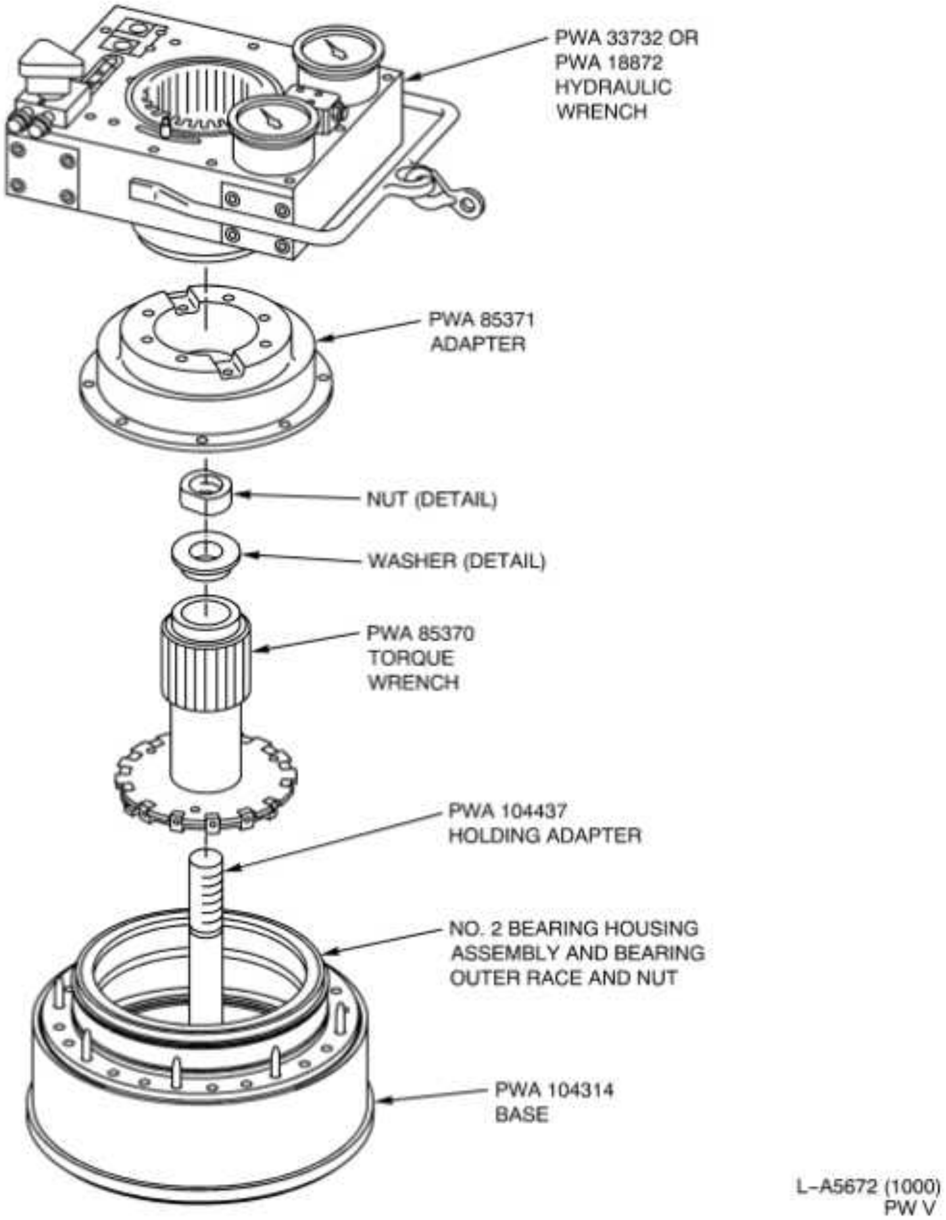

NO. 2 BEARING AND SEAL ASSEMBLY
NO. 2 BEARING AND SEAL ASSEMBLY
PWA 85251 ADAPTER
PWA 85199 BENCH FIXTURE
L-A5668 (0190)
PW V

Use PWA 85251 And PWA 85199
Figure 503
(Task 72-34-04-040-001-002)

NO. 2 BEARING AND SEAL ASSEMBLY - DISASSEMBLY-02

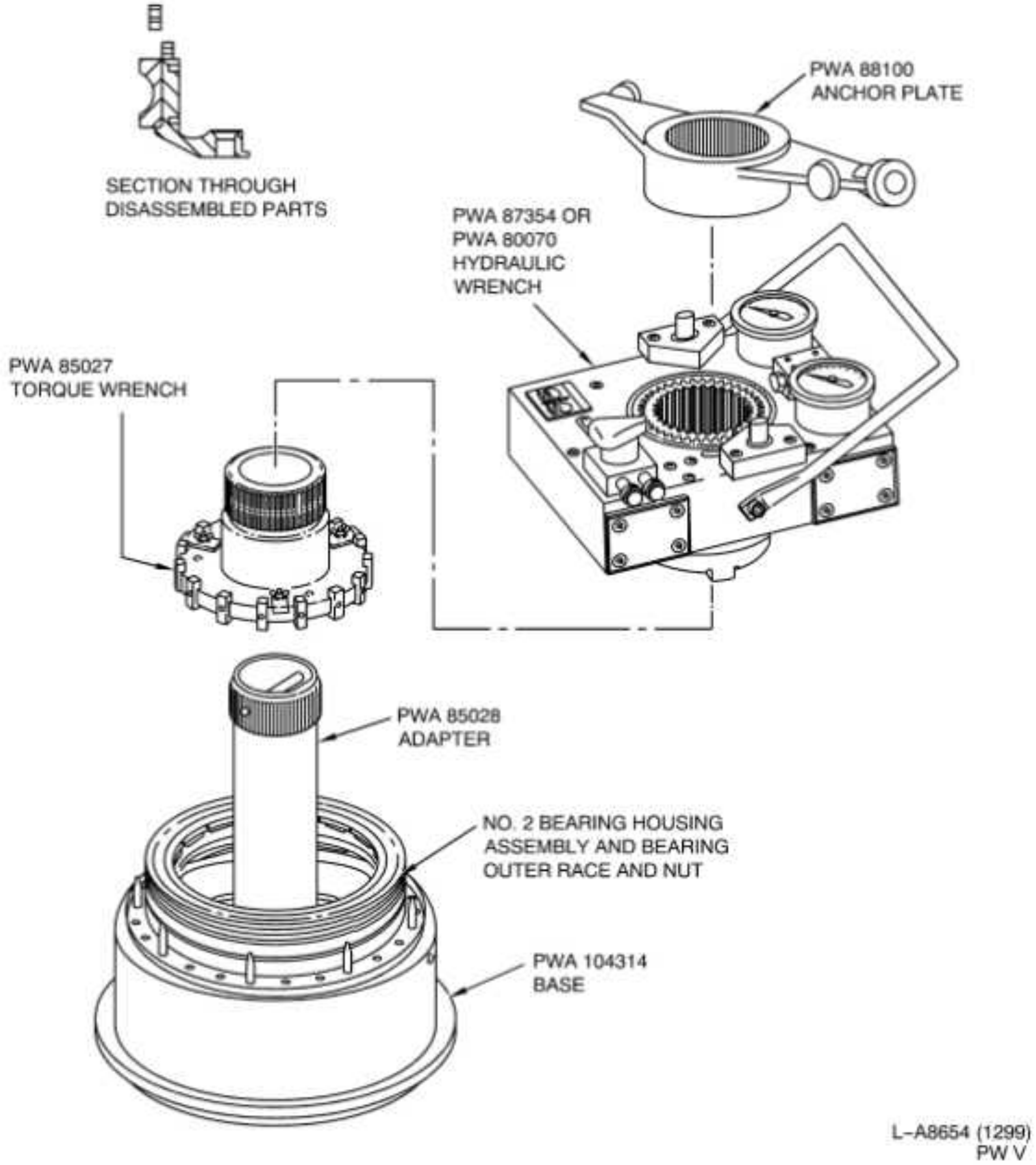

DETAIL OUTER RING
JACKSCREW
PWA 85639
BEARING HOUSING
BEARING OUTER RACE AND BALLS
DOWEL PIN
BOTTOM HALF OF INNER RACE
SEAL SEAT
STUD
PWA 85022
INSTALLED VIEW
L-A5669 (0000)
PW V

Use PWA 85639
Figure 504
(Task 72-34-04-040-001-002)


PWA 33732 OR
PWA 18872
HYDRAULIC
WRENCH
PWA 85371
ADAPTER
NUT (DETAIL)
WASHER (DETAIL)
PWA 85370
TORQUE
WRENCH
PWA 104437
HOLDING ADAPTER
NO. 2 BEARING HOUSING
ASSEMBLY AND BEARING
OUTER RACE AND NUT
PWA 104314
BASE
L−A5672 (1000)
PW V

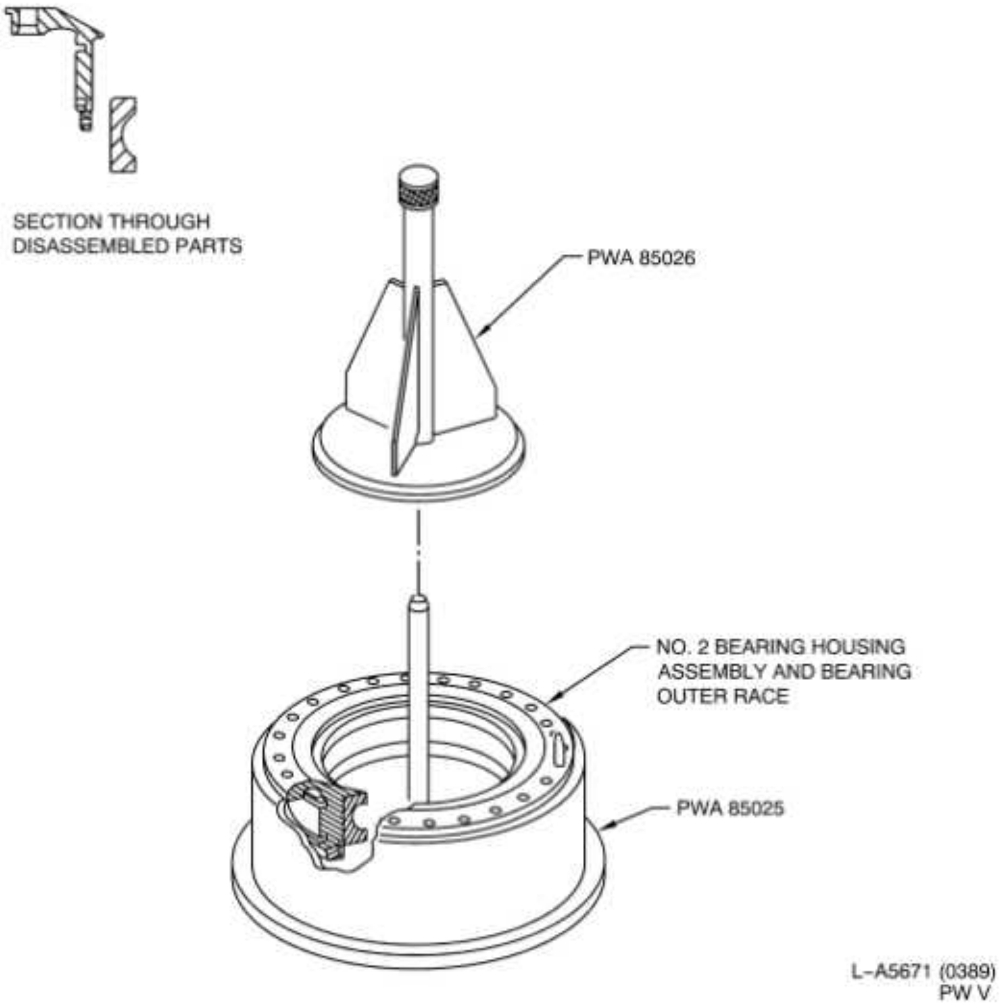
Remove The No. 2 Bearing (Outer Race) Retaining Nut (Method 1)
Figure 505 (Sheet 1)
(Task 72−34−04−040−001−002)

NO. 2 BEARING AND SEAL ASSEMBLY - DISASSEMBLY-02


SECTION THROUGH DISASSEMBLED PARTS
PWA 88100 ANCHOR PLATE
PWA 87354 OR PWA 80070 HYDRAULIC WRENCH
PWA 85027 TORQUE WRENCH
PWA 85028 ADAPTER
NO. 2 BEARING HOUSING ASSEMBLY AND BEARING OUTER RACE AND NUT
PWA 104314 BASE
L-A8654 (1299)
PW V

Remove The No. 2 Bearing (Outer Race) Retaining Nut (Method 2)
Figure 505 (Sheet 2)
(Task 72-34-04-040-001-002)

NO. 2 BEARING AND SEAL ASSEMBLY - DISASSEMBLY-02


SECTION THROUGH
DISASSEMBLED PARTS
PWA 85026
NO. 2 BEARING HOUSING
ASSEMBLY AND BEARING
OUTER RACE
PWA 85025
L-A5671 (0389)
PW V

Use PWA 85026
Figure 506
(Task 72-34-04-040-001-002)

Previous Pageblock Return to Previous Menu Next Pageblock

NO. 2 BEARING AND SEAL ASSEMBLY - ASSEMBLY-01

Task 72-34-04-440-001-001:

1. Assemble No. 2 Bearing Outer Race And Housing Assembly (Mechanical Wrench)

A. Equipment And Materials Necessary

Special Tools:

PWA 45418	Wrench, Mechanical*
PWA 45419	Multiplier, Pneumatic*
PWA 80071	Multiplier, Torque*
PWA 80187	Wrench, Mechanical*
PWA 80651	Multiplier, Pneumatic*
PWA 85026	Drift
PWA 85027	Wrench, Torque*
PWA 85028	Adapter, Holding*
PWA 85375	Plate, Anchor*
PWA 85901	Riveter
PWA 88100	Plate, Anchor*
PWA 104314	Base
PWA 105046	Adapter, Holding*

*See Table 1001 for tool options. Only Table 1001 shows the correct combinations of tools for the installation of the No. 2 bearing (outer race) retaining nut.

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Rivet	1	72-34-00/15/40

B. Procedure

(1) Install housing into PWA 104314 Base, threaded end up. Install No. 2 bearing outer race into housing with "FRONT", marked on bearing race, down. Seat outer race using PWA 85026 Drift. See Figure 1001.

CAUTION: A NEW OR REFURBISHED NO. 2 BEARING (OUTER RACE) RETAINING NUT MUST BE INSTALLED OR DAMAGE TO ENGINE PARTS MAY OCCUR. NUT MAY BE REFURBISHED PER 72-34-11, REPAIR-01 TASK 72-34-11-300-001.

(2) Install the outer race retaining nut as follows. Refer to Table 1001 for the correct combinations of tools. Refer to Figure 1002.

NO. 2 BEARING AND SEAL ASSEMBLY - ASSEMBLY-01

PWA Torque Wrench	PWA Holding Adapter	PWA Mechanical Wrench or Torque Multiplier	PWA Pneumatic Multiplier	PWA Anchor Plate
85027	85028 and 105046	80187	80651 or 45419	88100 or 85375
85027	85028 and 105046	45418	45419	88100 or 85375
85027	85028 and 105046	80071	80651 or 45419	88100

Matrix Of Tools Used To Install The
No. 2 Bearing (Outer Race) Retaining Nut
Table 1001

(a) Install the tools. See Figure 1002.

1 Install the shaft detail of the PWA 105046 Holding Adapterto the center ID of the PWA 104314 Supprot Base with cap screws.

2 Install PWA 85028 Adapter in the base. Engage the slots in the adapter with the lugs in the base.

3 Install PWA 85027 Torque Wrench over the adapter. Engage the teeth of the wrench with the slots of the nut.

4 Attach a hoist to the mechanical wrench (or torque multiplier) and install that tool over the adapter.

5 Install the PWA 88100 or the PWA 85375 Anchor Plate on the mechanical wrench. Engage the pins of the mechanical wrench in the holes of the plate.

6 Remove the hoist and sling.

7 Install the nut and plate details of the Holding Adapter (PWA 105046) to seat against the PWA 88100 Anchor Plate.

8 If you want to use a pneumatic multiplier, refer to the referenced table. Otherwise, use a standard wrench.

(3) (Reference 253) Torque nut as follows:

(a) Tighten nut to 2200 - 2800 lb-in. (248.567 - 316.357 N.m).

NOTE: If the bearing retaining nut is installed with holding adapter (PWA 105046) the detail nut must be tightened each 45 degrees of bearing retaining nut rotation to keep the torque wrench teeth engaged with the bearing retaining nut.

(b) Establish common reference points between nut and its mating part.

(c) Turn nut through angle of 2 - 3.5 degrees.

(d) Loosen nut to zero and repeat step (a).

(e) If the nut reference point is in line with the mating part reference point or beyond it within 0 degrees 30 minutes maximum, apply final angle of turn per step (g).

(f) If the reference points are not within limits, repeat step (b), (c) and (d) in order until reference points are within limits. Then perform step (e).

(g) Turn the nut through an angle of 44 - 47 degrees.

(h) Visually examine the No. 2 bearing outer race and housing assembly shoulder to make sure it is seated. Make sure the gap is less than 0.001 inch (0.025 mm).

NOTE: A slight 0.002 - 0.003 inch (0.051 - 0.076 mm) rolling of the nut in relation to the rear face of the outer race is acceptable.

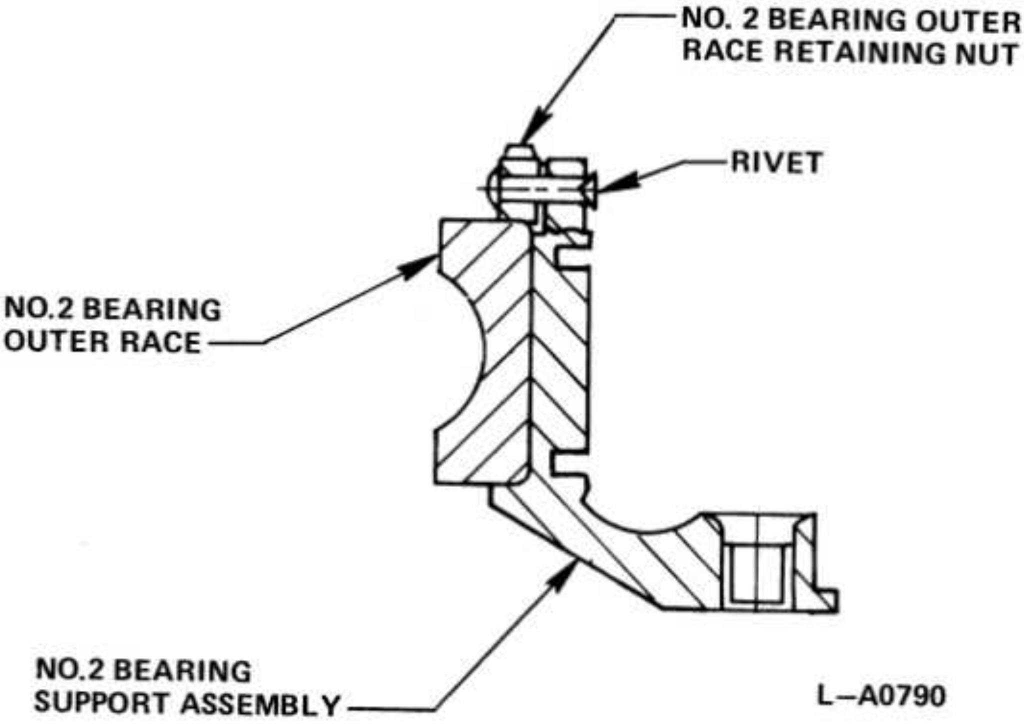
(4) Secure nut to outer race housing with rivet (head toward ID). Flare rivet with PWA 85901 Riveter.

C. Postrequisites

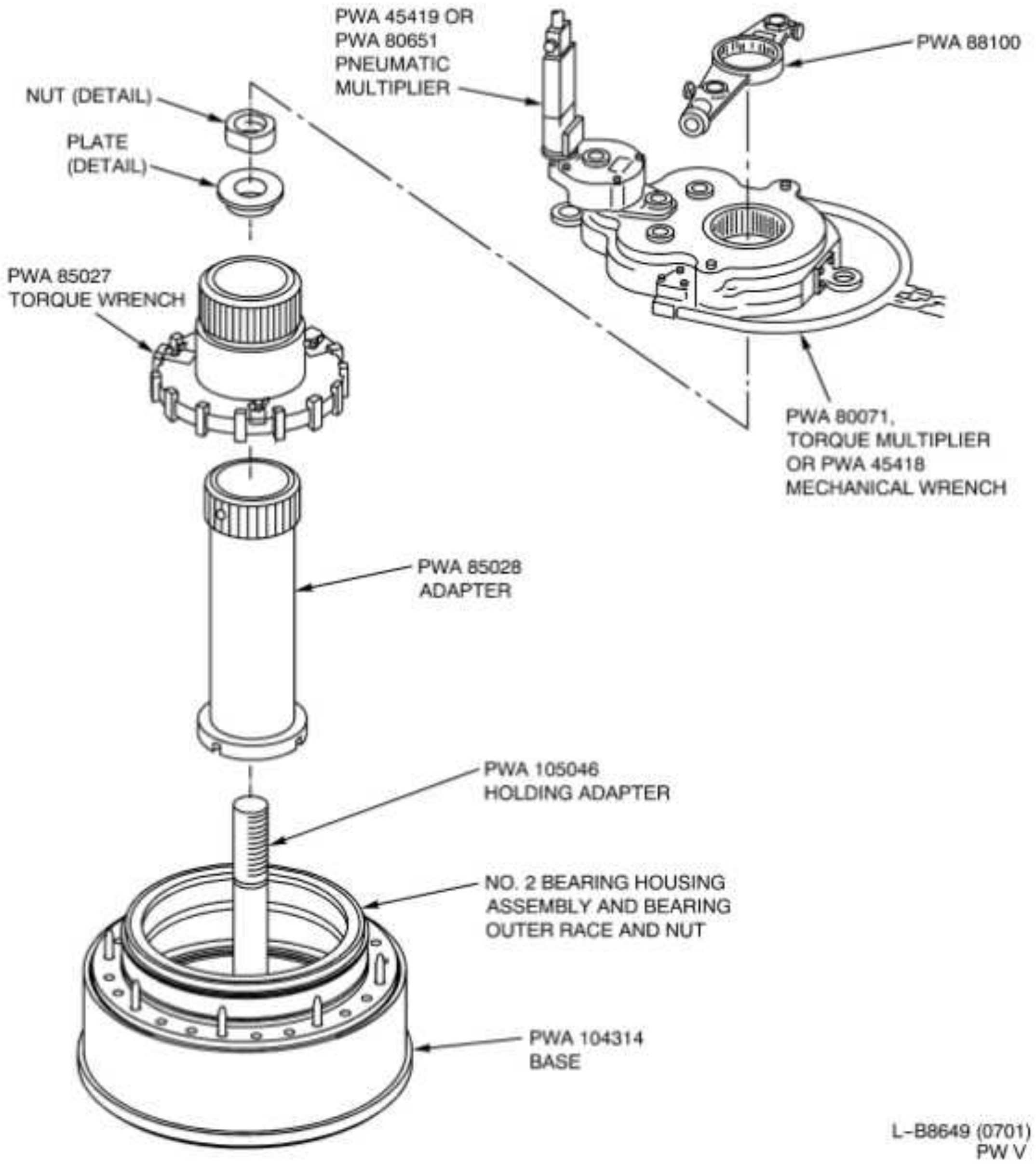
NO. 2 BEARING AND SEAL ASSEMBLY − ASSEMBLY−01

(1) Final assemble No. 2 bearing and seal assembly. See Assembly−03.

NO. 2 BEARING AND SEAL ASSEMBLY − ASSEMBLY−01


NO. 2 BEARING OUTER RACE RETAINING NUT
RIVET
NO.2 BEARING OUTER RACE
NO.2 BEARING SUPPORT ASSEMBLY
L—A0790

No. 2 Bearing Outer Race And Housing Assembly
Figure 1001
(Task 72−34−04−440−001−001)


PWA 45419 OR
PWA 80651
PNEUMATIC
MULTIPLIER
PWA 88100
NUT (DETAIL)
PLATE
(DETAIL)
PWA 85027
TORQUE WRENCH
PWA 80071,
TORQUE MULTIPLIER
OR PWA 45418
MECHANICAL WRENCH
PWA 85028
ADAPTER
PWA 105046
HOLDING ADAPTER
NO. 2 BEARING HOUSING
ASSEMBLY AND BEARING
OUTER RACE AND NUT
PWA 104314
BASE
L-B8649 (0701)
PW V

Install The No. 2 Bearing (Outer Race) Retaining Nut
Figure 1002
(Task 72-34-04-440-001-001)

Task 72-34-04-440-001-002:

1. Assemble No. 2 Bearing Outer Race And Housing Assembly (Hydraulic Wrench)

A. Equipment And Materials Necessary

Special Tools:

PWA 18872	Wrench, Hydraulic*
PWA 28814	Pump, Hydraulic*
PWA 28815	Cart*
PWA 29510	Pump, Hydraulic*
PWA 33732	Wrench, Hydraulic*
PWA 75046	Cart*
PWA 80070	Wrench, Hydraulic*
PWA 85026	Drift
PWA 85370	Wrench, Torque*
PWA 85371	Adapter, Holding*
PWA 85901	Riveter
PWA 87354	Wrench, Hydraulic*
PWA 88100	Plate, Anchor*
PWA 104314	Base
PWA 104437	Adapter, Holding

*See Table 1001 for tool options. Only Table 1001 shows the the correct combinations of tools for the installation of the No. 2 bearing (outer race) retaining nut.

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Rivet	1	72-34-00/15/40

B. Procedure

(1) Install housing into PWA 104314 Base, threaded end up. Install No. 2 bearing outer race into housing with "FRONT", marked on bearing race, down. Seat outer race using PWA 85026 Drift. See Figure 1001.

CAUTION: A NEW OR REFURBISHED NO. 2 BEARING (OUTER RACE) RETAINING NUT MUST BE INSTALLED OR DAMAGE TO ENGINE PARTS MAY OCCUR. NUT MAY BE REFURBISHED PER 72-34-11, REPAIR-01 (TASK
R 72-34-11-300-001), PW4000 Series CIR, PN
R 51A357.

(2) Install the outer race retaining nut. Refer to Table 1001 for the correct combinations of tools. Refer to Figure 1002.

PWA Torque Wrench	PWA Holding Adapter	PWA Hydraulic Wrench	PWA Anchor Plate	PWA Pump	PWA Cart
85370	85371	33732	-----	28814 or 29510	75046
85370	85371	18872	-----	28814 or 29510	75046 or 28815
85027	85028	87354	88100	28814 or 29510	75046
85027	85028	80070	88100	28814 or 29510	75046

Matrix Of Tools Used To Remove The No. 2 Bearing (Outer Race) Retaining Nut
Table 501

(a) Install the nut on the No. 2 bearing support assembly. Tighten it with your fingers.

(b) (Method 1)

1 Install the shaft detail of the PWA 104437 Holding Adapter to the center ID of the support base.

2 Install PWA 85370 Torque Wrench on the nut. Engage the teeth of the wrench in the slots of the nut.

3 Install the nut and washer details of the Holding Adapter (PWA 104437) to seat against the top of the Torque Wrench (PWA 85370).

4 Install PWA 85371 Adapter on the torque wrench. Engage the detail pins of the base in the holes of the outer ring of the adapter.

5 With a hoist, remove a hydraulic wrench from a cart.

6 Put the hydraulic wrench on the adapter.

7 Connect a pump to the hydraulic wrench.

(c) (Method 2)

1 Install PWA 85028 Adapter in the base. Engage the slots in the adapter with the lugs in the base.

2 Install PWA 85027 Torque Wrench over the adapter. Engage the teeth of the wrench with the slots of the nut.

3 With a hoist, remove a hydraulic wrench from from a cart. Install the hydraulic wrench on the torque wrench.

4 Install PWA 88100 Anchor Plate on the adapter, splines aligned. Engage the pins on the hydraulic wrench with the holes in the anchor plate.

5 Connect a pump to the hydraulic wrench.

(d) Remove the wrenches, pump, and adapter.

(3) (Reference 253) Torque nut as follows:

(a) Tighten nut to 2200 - 2800 lb-in. (248.567 - 316.357 N.m).

(b) Establish common reference points between nut and its mating part.

(c) Turn nut through angle of 2 - 3.5 degrees.

(d) Loosen nut to zero and repeat step (a).

(e) If the nut reference point is in line with the mating part reference point or beyond it within 0 degrees 30 minutes maximum, apply final angle of turn per step (g).

(f) If the reference points are not within limits, repeat step (b), (c) and (d) in order until reference points are within limits. Then perform step (e).

(g) Turn the nut through an angle of 44 − 47 degrees.

(h) Visually examine the No. 2 bearing outer race and housing assembly shoulder to make sure it is seated. Make sure the gap is less than 0.001 inch (0.025 mm).

R R R NOTE: A slight 0.002 − 0.003 inch (0.051 − 0.076 mm) rolling of the nut in relation to the rear face of the outer race is acceptable.

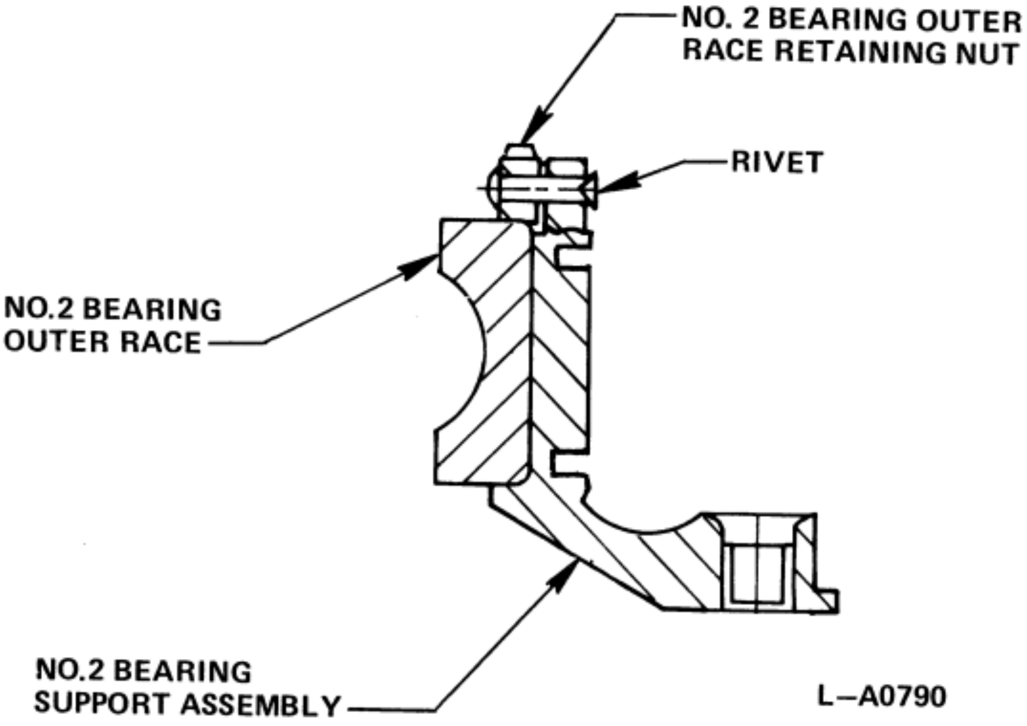
(i) Remove the wrenches, pump, and adapters.

(4) Secure nut to outer race housing with rivet (head toward ID). Flare rivet with PWA 85901 Riveter.

C. Postrequisites

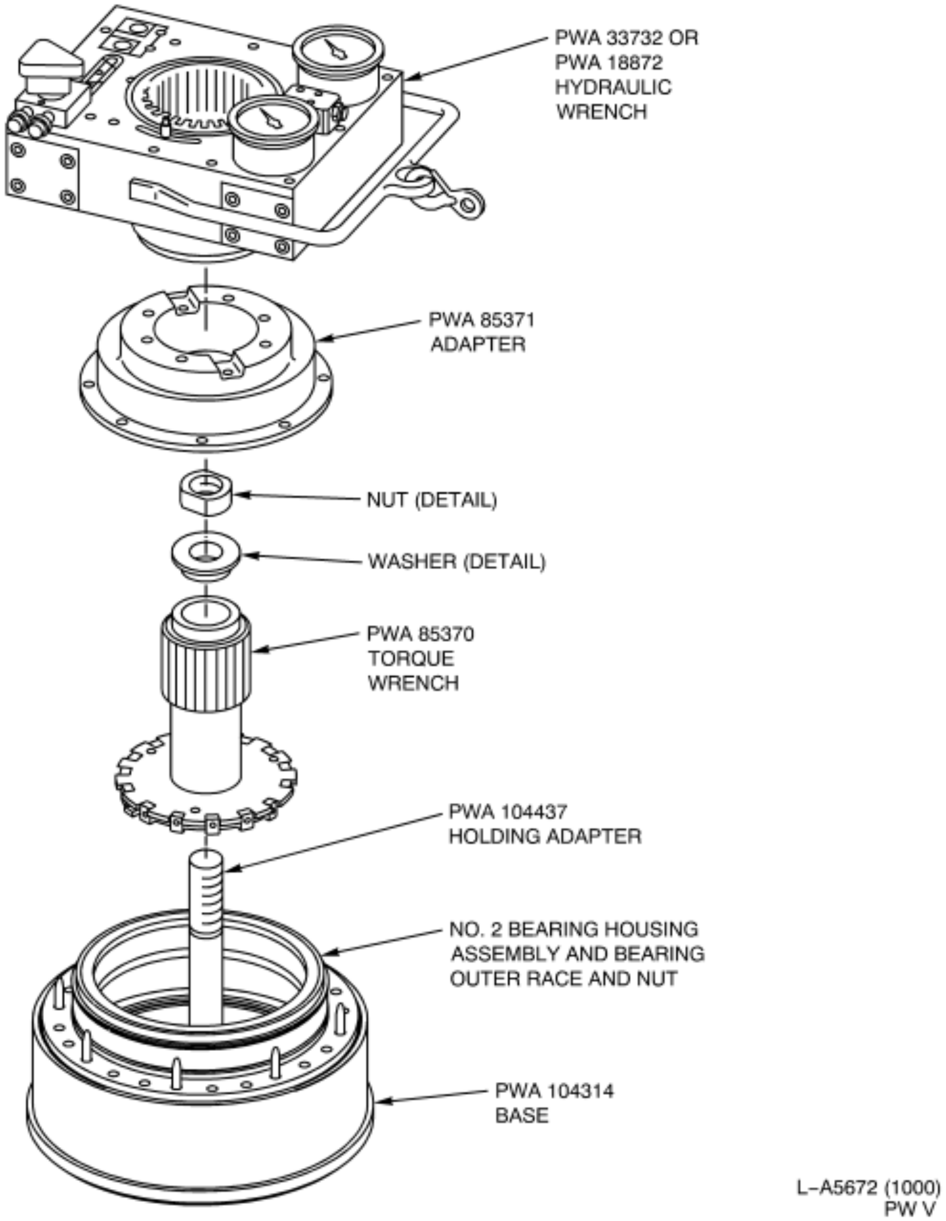
(1) Final assemble No. 2 bearing and seal assembly. See Assembly−03.

NO. 2 BEARING AND SEAL ASSEMBLY − ASSEMBLY−02

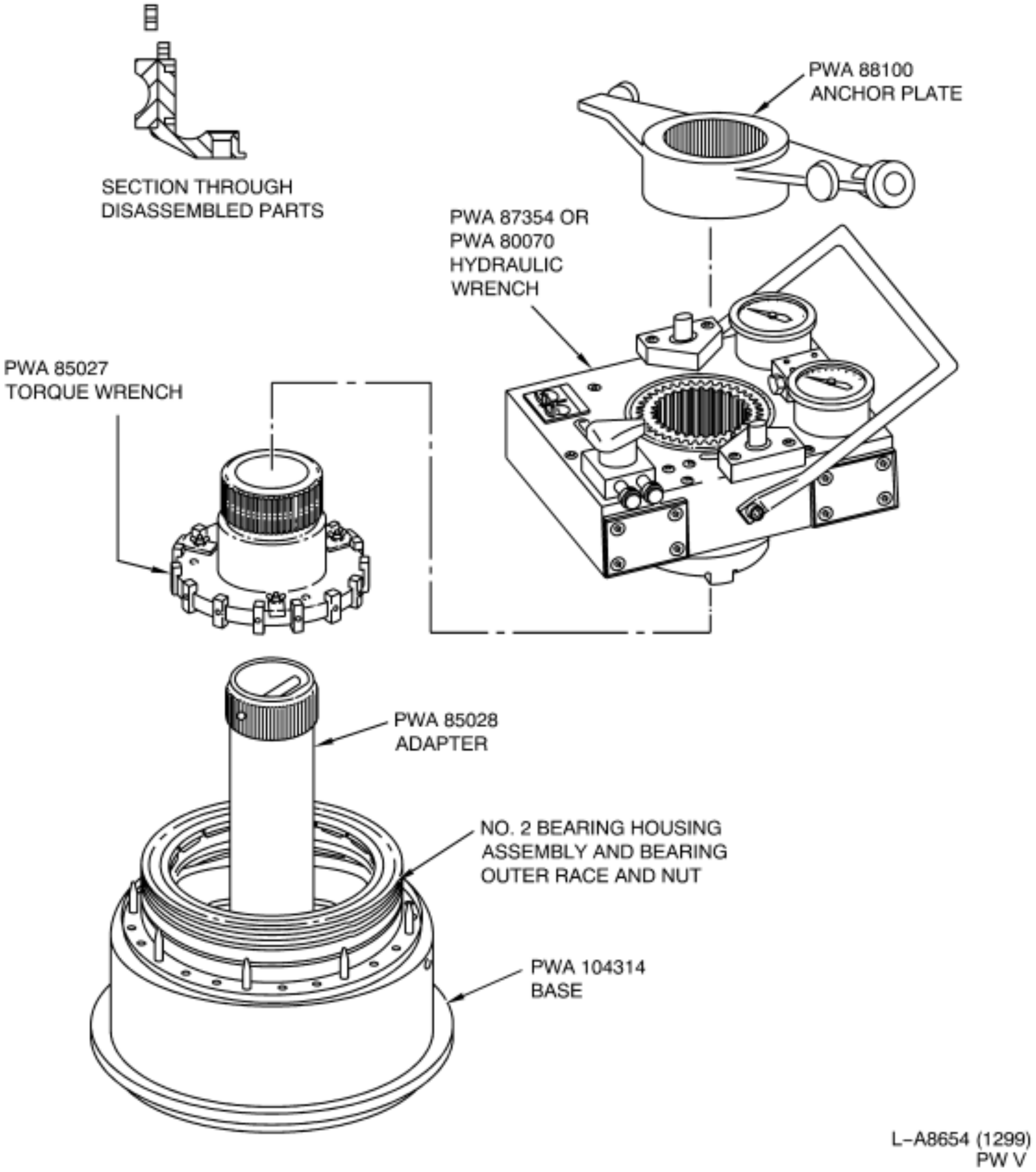

NO. 2 BEARING OUTER RACE RETAINING NUT
RIVET
NO.2 BEARING OUTER RACE
NO.2 BEARING SUPPORT ASSEMBLY
L−A0790

No. 2 Bearing Outer Race And Housing Assembly
Figure 1001
(Task 72−34−04−440−001−002)

NO. 2 BEARING AND SEAL ASSEMBLY - ASSEMBLY-02


PWA 33732 OR
PWA 18872
HYDRAULIC
WRENCH
PWA 85371
ADAPTER
NUT (DETAIL)
WASHER (DETAIL)
PWA 85370
TORQUE
WRENCH
PWA 104437
HOLDING ADAPTER
NO. 2 BEARING HOUSING
ASSEMBLY AND BEARING
OUTER RACE AND NUT
PWA 104314
BASE
L-A5672 (1000)
PW V

Install The No. 2 Bearing (Outer Race) Retaining Nut (Method 1)
Figure 1002 (Sheet 1)
(Task 72-34-04-440-001-002)


SECTION THROUGH DISASSEMBLED PARTS
PWA 88100 ANCHOR PLATE
PWA 87354 OR PWA 80070 HYDRAULIC WRENCH
PWA 85027 TORQUE WRENCH
PWA 85028 ADAPTER
NO. 2 BEARING HOUSING ASSEMBLY AND BEARING OUTER RACE AND NUT
PWA 104314 BASE
L-A8654 (1299)
PW V

Install The No. 2 Bearing (Outer Race) Retaining Nut (Method 2)
Figure 1002 (Sheet 2)
(Task 72-34-04-440-001-002)

NO. 2 BEARING AND SEAL ASSEMBLY - ASSEMBLY-03

Task 72-34-04-440-002:

1. Final Assemble The No. 2 Bearing And Seal Assembly

A. Prerequisites

(1) Assemble the No. 2 bearing outer race and housing assembly. See 72-34-04, Assembly-01 (Task 72-34-04-440-001-001) or 72-34-04, Assembly-02 (Task 72-34-04-440-001-002).

B. Equipment And Materials Necessary

Special Tools:

PWA 3755	Hydraulic Pump (Optional To PWA 29389)
PWA 29389	Hydraulic Pump
PWA 75028	Gage
PWA 85005	Fixture, Loading
PWA 85014	Cover
PWA 85016	Wrench (Optional To PWA 86024)
PWA 85017	Adapter, Retaining
PWA 85018	Pusher
PWA 85019	Base, Supporting
PWA 85020	Drift
PWA 85199	Fixture
PWA 85251	Adapter, Holding
PWA 86024	Driver, Hand

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-232	Marker (PMC 4058-6)
P06-001	Lubricant, Dry Film (PMC 9934)
R P06-054	Paste, Antiseize (PWA 36246)
P11-014	Alcohol, Isopropyl (PMC 9094)

C. Procedure

NOTE: Refer to Standard Practices Manual, PN 585005, for instructions on how to touch bearings.

(1) Attach PWA 85199 Fixture to a bench. Align the keyway in the arm of PWA 85251 Holding Adapter with the key in the fixture. Attach the adapter to the fixture with the detail bolts. See Figure 1001.

(2) Attach the No. 2 bearing support assembly (called support) to the side of the adapter with the four clamps.

NOTE: The dowel pin on the OD flange of the support must be aligned with one of the two cutouts in the adapter.

(a) (Pre SB PW4ENG 72-204) Align the four clamps with four of the tabs on the rear flange of the assembly. Tighten the four clamps.

(b) (Post SB PW4ENG 72-204) Align the four tapped holes in the assembly with the bolt holes in the adapter. Attach the assembly to the adapter with the four detail bolts.

(3) (Reference 140) Install the No. 2 bearing housing assembly (called housing) in the support as follows. See Figure 1002.

R (a) Apply Antiseize Paste P06-054 to the threads at
R each end of 32 studs. Wipe off unwanted paste.

(b) Install the 32 studs in the support, with the flats of the studs through the support.

NOTE: The studs will be fully installed in the support when you tighten the hex nuts.

(c) Install the thick key washers on the rear end of the studs. Install the hex nuts over the key washers. Tighten the hex nuts to seat the key washers. Remove the nuts.

(d) Install the thin key washers on the rear end of the studs to touch the thick key washers. Install the hex nuts. Tighten the hex nuts to seat the key washers.

(e) (Reference 126) Measure the end gap clearance for the No. 2 bearing housing seal rings. Install the seal rings in bearing housing with an ID of 12.240 inches (310.896 mm). See Figure 1002 for Pre SB PW4ENG 72-179 and Post SB PW4ENG 72-179 correct measurement.

(f) (Reference 125) Find the side clearance between the seal rings and the housing.

(g) Apply Engine Oil P03−001 to two seal rings. Install the seal rings in the grooves of the housing. Put the cutouts in the rings at the pins that are in the grooves of the housing.

(h) Install the housing, nut down, over the front end of the 32 studs. With the dowel pin in the support at 6 o'clock, the cutouts in the seal rings of the housing must be either on the vertical centerline or on the 3 o'clock position opposite to the oil inlet as seen from the rear of the engine. Do not fully install the housing at this time.

NOTE: It is thought a "best practice" to assemble the damper assembly such that the piston ring stops are not aligned with the oil supply line. When the piston ring stops are 180 degrees away from the oil supply, the oil must flow all the way around the bearing before it goes by the bearing at the piston ring stops.

NOTE: The studs will be fully installed in the housing when you tighten the locknuts.

(i) Install four locknuts, at equal distances from each other, on the front end of the studs. Tighten the locknuts past the locking feature but not more than 50 lb−in. (5.649 N.m) torque, maximum.

NOTE: Optional non−silver plated locknuts have been introduced by SPN P3013 for this assembly in order to reduce the potential for stress corrosion between the titanium studs (tierods) and the silver plated nuts. Stress corrosion can result when the silver
R plating comes in contact with the Antiseize
R Paste P06−054 which is added to the threads of the studs in step C.3.(a) above.

(j) Turn the assembly so that the hex nuts and key washers are face up. Before you torque the hex nuts, make sure that the seal rings of the housing are engaged in the grooves of the housing.

(k) Torque the hex nuts to 425 - 475 lb-in. (48.019 - 53.668 N.m). While you torque the hex nuts, put a wrench on the flats of the stud head on the opposite end to stop stud rotation and press the tabs of the thick key washers toward the center of the assembly. Refer to Standard Practices Manual, PN 585005, for key washer acceptance standards.

NOTE: If necessary, keep the tab of the thin key washer in position with an open end wrench while you torque the nuts.

(l) Bend the four keys of the thin key washers against the hex nuts. Refer to Standard Practices Manual, PN 585005, for key washer acceptance standards.

(m) Remove the support assembly from the adapter.

(4) Install the seal seat, rear inner race, and balls and cage as follows. See Figure 1003.

(a) Put the support assembly on PWA 85018 Pusher, dowel pin up.

1 (Post SB PW4ENG 72-204) The pusher must be Change Letter D. Engage the four detail dowel pins.

2 For reasons of alignment, put a mark on the conical surface of the housing. This mark should be aligned with the word "front" marked on the bearing outer race. Use Marker P05-232.

CAUTION: BE VERY CAREFUL NOT TO DAMAGE THE CARBON SEAL WHEN YOU INSTALL THE SEAL SEAT.

(b) Install the seal seat as follows.

NOTE: It is permitted to apply Engine Oil P03-001 to the sealing face of the seal seat. This is the surface that is outboard of the word "rear".

NOTE: It is permitted to apply Engine Oil P03-001 to the upper face of the carbon seal.

1 For reasons of alignment, put a mark on the seal seat in line with the word "rear". Use Marker P05-232.

2 With the marks on the seal seat and the housing aligned, very carefully install the seal seat, "rear" down, on the carbon seal.

3 Remove the mark from the seal seat.

(c) Install the rear inner race as follows.

1 For reasons of alignment, put a mark on the rear inner race in line with the "X". Use Marker P05−232.

2 With the marks on inner race and the housing aligned, very carefully install the inner race, curved side up.

3 Remove the mark from the inner race.

(d) Install the detail retainer over the center rod of the pusher. Install the detail washer and eye bolt. Tighten the eye bolt to compress the spring of the carbon seal assembly.

(e) Remove the four locknuts installed on the studs. Lift up the housing sufficiently to permit the balls and cage to drop into position. Install the balls and cage, serial number down, in the bearing outer race, which is installed in the the housing.

(f) Lower the bearing housing into the support. Be sure that the seal rings are engaged in the support. If it is necessary, use a nylon rod to engage the seal rings in the support. Re−install the four locknuts.

(5) (Reference 140) Assemble the No. 2 bearing assembly as follows.

(a) Install 28 additional (Post SPN P3013) locknuts on the studs. Tighten all 32 locknuts past the locking feature of the nuts, but not more than 50 lb−in. (5.649 N.m).

(b) Install PWA 85014 Cover on the assembly.

(c) While you hold the flats of the studs with PWA 86024 Driver or PWA 85016 Wrench, tighten and torque the locknuts to 450 − 500 lb−in. (50.843 − 56.492 N.m). Obey the torque sequence on the tool cover.

(d) Do a check of the seating at both ends of the 32 studs, between the shoulders of the studs and the adjacent surfaces of the support and housing, with a 0.001 inch (0.025 mm) feeler gage. The feeler gage must not fit between these surfaces.

(6) Remove the support assembly from the pusher. Install the support assembly in the holding adapter. Install it on the side with the four clamps. The dowel pin on the OD flange of the support assembly must be aligned with one of the two cutouts on the adapter.

(7) Install the front inner race as follows.

(a) For reasons of alignment, put a mark on the front inner race surface opposite the the "X." Use Marker P05−232.

(b) With the marks on inner race and the housing aligned, install the inner race, curved surface down.

(c) Remove the mark from the inner race.

(8) Attach the loading fixture and retaining adapter to the support assembly as follows. See Figure 1004.

(a) Install the detail force gage of PWA 85005 Loading Fixture to the lug on PWA 85017 Retaining Adapter. Use the detail ball lock pins.

(b) Very carefully install the detail locator, rod up, through the center of the seal assembly. The lip of the locator must touch the rear of the seal seat.

(c) Install the detail bung on the rod. The cutouts in the bung must not be aligned with the dowel pin in the OD flange of the support.

(d) Install the detail nut. Tighten the nut to bring the bearing inner races more closely together.

(e) Turn the holding adapter so that the dowel pin of the support is at 6 o'clock (in flight position).

(f) Install the loading fixture on the support assembly as follows.

1 Put the detail feet of the loading fixture in the cutouts of the holding adapter.

2 (Pre SB PW4ENG 72-204) Align a tab on the rear flange of the support with a slot in the detail feet of the fixture. Turn the fixture to mis-align the tabs of the support and the slots of the fixture. Tighten the four detail clamps on the fixture.

3 (Post SB PW4ENG 72-204) Align the holes in the detail feet with the threaded holes in the support assembly. Attach the feet to the support assembly with detail screws. Tighten the screws.

(9) (Reference 204) Find the necessary spacer thickness (Dimension Z) as follows.

(a) Turn the detail bolt on the loading fixture until it touches the ball on the force gage. Tighten the bolt against the ball until the reading on the gage is 80 - 120 lbf. (355.9 - 533.8 N). Loosen the bolt until the gage shows 0 lbs (0.00 kg). Tighten the bolt again until the gage shows 80 - 120 lbf. (355.9 - 533.8 N).

(b) Measure the distance from the front face of the bearing inner race to the face of the threaded flange of the support assembly. Take this measurement at four positions. Find the average of the four measurements. Write this average and call it Dimension A.

(c) Measure the thickness of the rear flange at the ID of the intermediate case. Call this Dimension B.

NOTE: Take an average of four readings for Dimension B.

(d) Subtract Dimension B from Dimension A. Call this Dimension X.

(e) Add 3.9380 inches (100.025 mm) to Dimension X. Subtract this total from Dimension M.

NOTE: Refer to 72-34-00, Assembly-02 Task 72-34-00-400-002 for Dimension M.

(f) Write the result as Dimension Z. Dimension Z ± 0.001 inch (0.025 mm) is the necessary thickness of the classified spacer for the assembly.

(g) Choose the correct classified spacer. Refer to Table 1001. The faces of the spacer must be parallel within 0.0002 inch (0.0051 mm).

CLASS	DIMENSION - INCH (mm)
1	0.151 - 0.152 (3.836 - 3.860)
2	OVER 0.152 - 0.153 (3.861 - 3.886)
3	OVER 0.153 - 0.154 (3.887 - 3.911)
4	OVER 0.154 - 0.155 (3.912 - 3.937)
5	OVER 0.155 - 0.156 (3.937 - 3.962)
6	OVER 0.156 - 0.157 (3.963 - 3.987)
7	OVER 0.157 - 0.158 (3.988 - 4.013)
8	OVER 0.158 - 0.159 (4.014 - 4.038)
9	OVER 0.159 - 0.160 (4.039 - 4.064)
10	OVER 0.160 - 0.161 (4.064 - 4.089)
11	OVER 0.161 - 0.162 (4.090 - 4.114)
12	OVER 0.162 - 0.163 (4.115 - 4.140)
13	OVER 0.163 - 0.164 (4.141 - 4.165)
14	OVER 0.164 - 0.165 (4.166 - 4.191)
15	OVER 0.165 - 0.166 (4.191 - 4.216)
16	OVER 0.166 - 0.167 (4.217 - 4.241)
17	OVER 0.167 - 0.168 (4.242 - 4.267)
18	OVER 0.168 - 0.169 (4.268 - 4.292)
19	OVER 0.169 - 0.170 (4.293 - 4.318)
20	OVER 0.170 - 0.171 (4.318 - 4.343)
21	OVER 0.171 - 0.172 (4.344 - 4.368)
22	OVER 0.172 - 0.173 (4.369 - 4.394)
23	OVER 0.173 - 0.174 (4.395 - 4.419)
24	OVER 0.174 - 0.175 (4.420 - 4.445)
25	OVER 0.175 - 0.176 (4.445 - 4.470)
26	OVER 0.176 - 0.177 (4.471 - 4.495)
27	OVER 0.177 - 0.178 (4.496 - 4.521)
28	OVER 0.178 - 0.179 (4.522 - 4.546)

Spacer Classification
Table 1001

R
R

NO. 2 BEARING AND SEAL ASSEMBLY − ASSEMBLY−03

(h) Loosen the detail force gage. Remove the loading fixture.

(i) Turn the holding adapter so the dowel pin in the support is face up. Remove the retaining adapter.

(10) (Reference 2201) Remove the front inner race from the assembly. Heat the inner race per Standard Practices Manual, PN 585005. Do not attach thermocouples to the inner race with tack welds.

(11) Remove the assembly from the adapter. Install the assembly on PWA 85018 Pusher.

(12) Assemble the gearbox drive bevel gear as follows. See Figure 1005.

NOTE: It is permitted to apply a thin layer of Lubricant P06−001 on the bearing journal of the gear. Remove any overspray from the shoulder of the gear with Alcohol P11−014 and lint−free cloth.

(a) Put the gearbox drive bevel gear, gear end down, on PWA 85019 Base. Install the classified spacer on the gear.

(b) Remove the front inner race from the heat source. Install the inner race, step down, on the gear.

(c) Seat the front inner race on the gear with PWA 85020 Drift and an arbor press. Keep the load on the drift for approximately 30 seconds. Remove the drift.

(d) With a 0.001 inch (0.025 mm) feeler gage, do a check of the seating of the front inner race.

(13) Install the gear assembly in the support assembly as follows. See Figure 1006.

(a) Install the detail press plate of the pusher in the gear assembly. Tighten the four detail clamps.

NO. 2 BEARING AND SEAL ASSEMBLY − ASSEMBLY−03

CAUTION: (Reference 2201) THE TEMPERATURE OF THE INNER RACE MUST BE NO MORE THAN 50°F (28°C) ABOVE THE TEMPERATURE OF THE OUTER RACE.

(b) Install the gear assembly over the rod of the pusher and into the support assembly. Remove the mark on the housing.

(c) Connect the hose from the PWA 3755 Pump or PWA 29389 Pump to the detail hydraulic cylinder. Install the hydraulic cylinder over the detail rod.

(d) Install the detail washer and eye bolt.

(e) (Reference 2201) With the pump and PWA 75028 Gage, put a 5800 psi (39989.6 kPa) load on the assembly. The tool must touch both ends of the assembly for 360 degrees. Permit the heated details to cool to room temperature. There must be zero clearance between all mating surfaces at all times.

(f) (Reference 2201) Reduce the load to 0 psi (0.0 kPa).

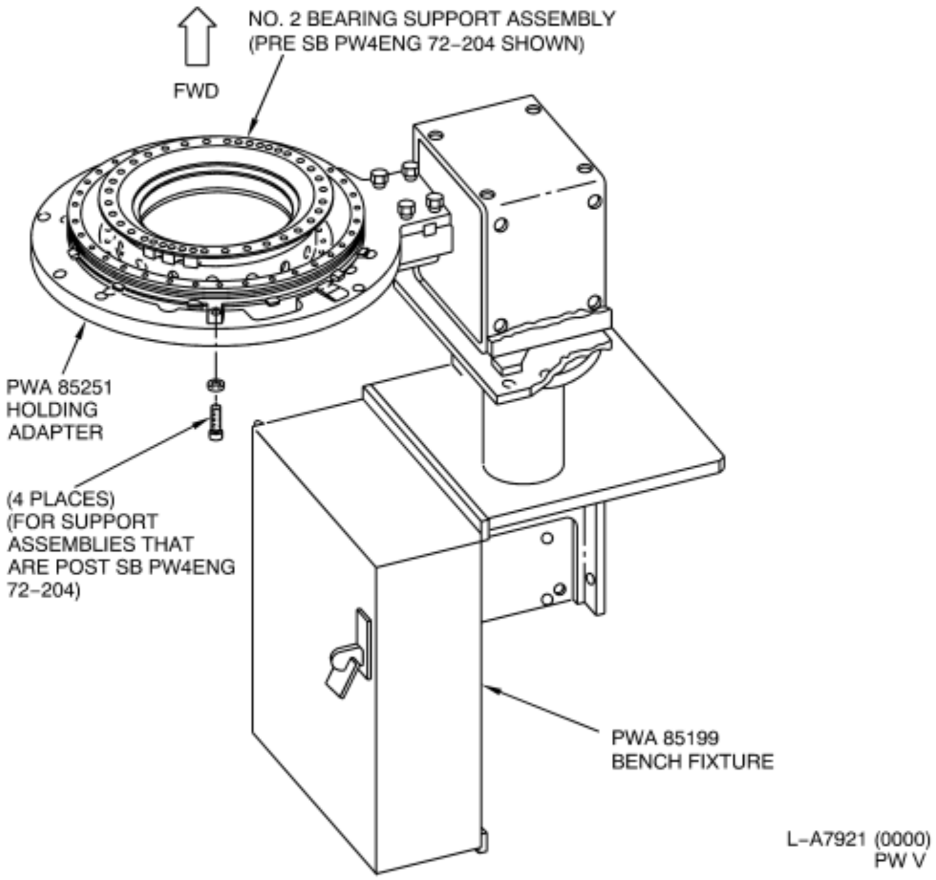
(g) (Reference 2201) Measure Dimension CC in three equally spaced positions. Write the average of these measurements. See Figure 1007.

NOTE: The temperature of all parts must be within 0° − 5°F (0° − 2.75°C) of room temperature when you take the measurements.

(h) Remove the tools.

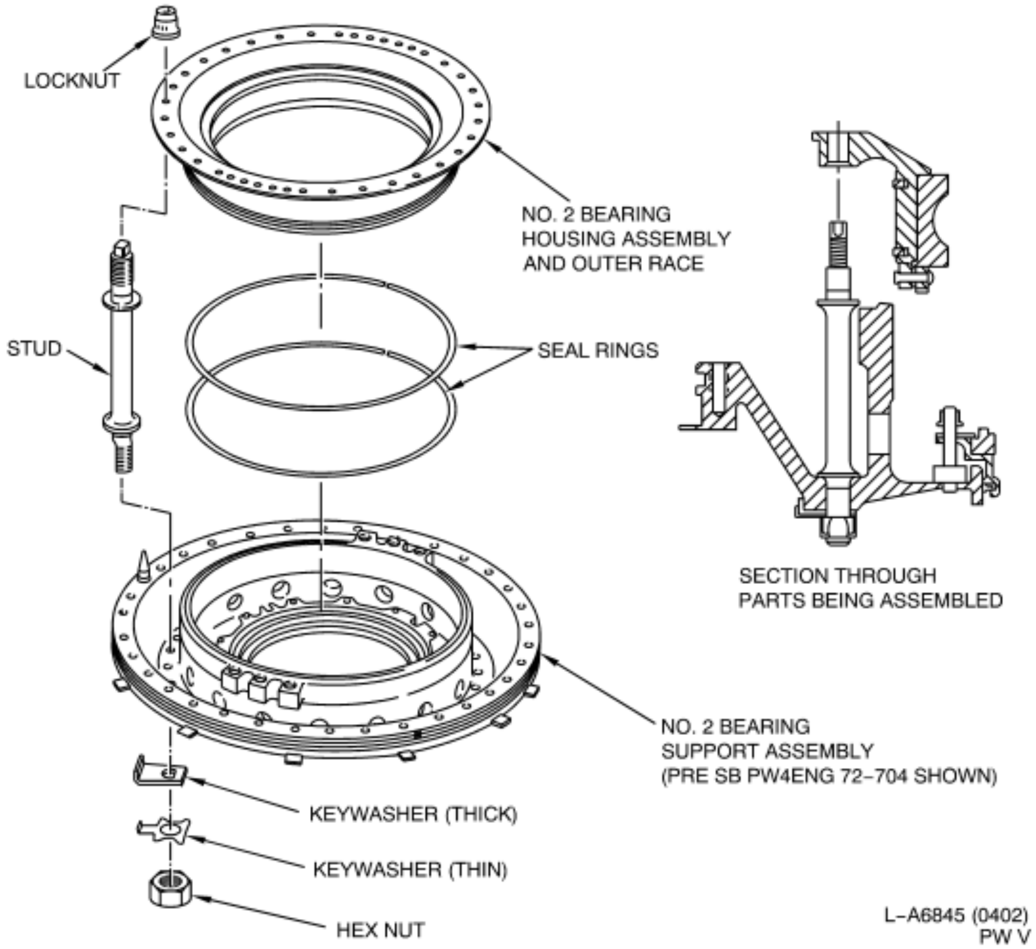
(14) Wrap the assembly in a cover that prevents contamination.

NO. 2 BEARING AND SEAL ASSEMBLY − ASSEMBLY−03

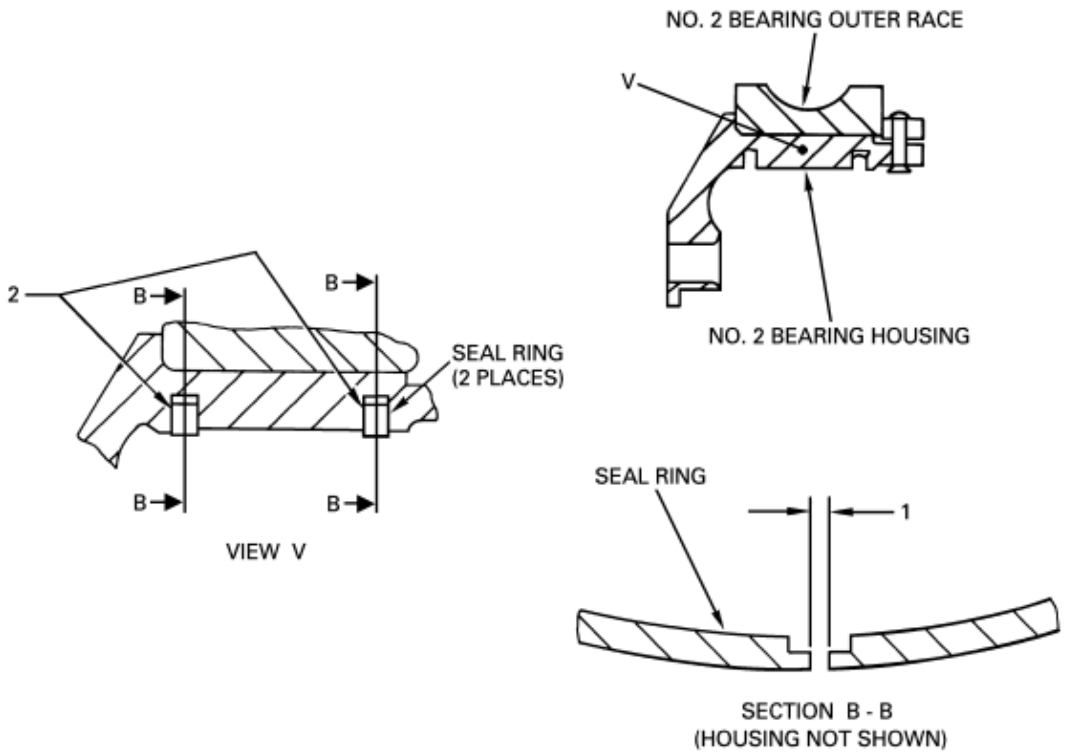

NO. 2 BEARING SUPPORT ASSEMBLY
(PRE SB PW4ENG 72-204 SHOWN)
FWD
PWA 85251
HOLDING
ADAPTER
(4 PLACES)
(FOR SUPPORT
ASSEMBLIES THAT
ARE POST SB PW4ENG
72-204)
PWA 85199
BENCH FIXTURE
L-A7921 (0000)
PW V

Installation Of The Support Assembly In The Holding Adapter
Figure 1001
(Task 72−34−04−440−002)

NO. 2 BEARING AND SEAL ASSEMBLY − ASSEMBLY−03


LOCKNUT
NO. 2 BEARING HOUSING ASSEMBLY AND OUTER RACE
STUD
SEAL RINGS
SECTION THROUGH PARTS BEING ASSEMBLED
NO. 2 BEARING SUPPORT ASSEMBLY (PRE SB PW4ENG 72−704 SHOWN)
KEYWASHER (THICK)
KEYWASHER (THIN)
HEX NUT
L−A6845 (0402)
PW V

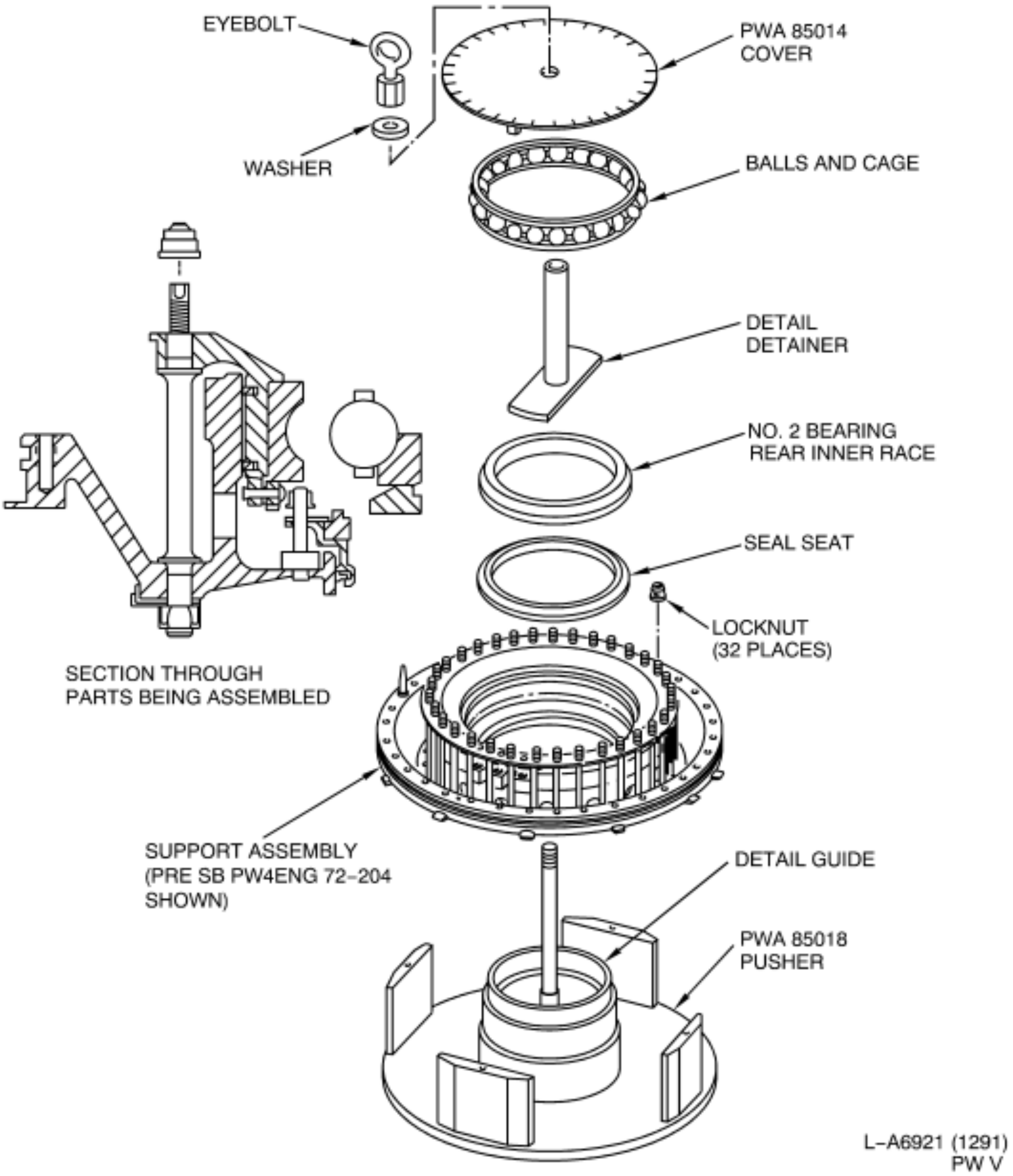
Installation Of The Studs And Bearing
Housing In The Support Assembly
Figure 1002 (Sheet 1)
(Task 72−34−04−440−002)


NO. 2 BEARING OUTER RACE
V
NO. 2 BEARING HOUSING
2
B
B
B
B
SEAL RING
(2 PLACES)
VIEW V
SEAL RING
1
SECTION B - B
(HOUSING NOT SHOWN)

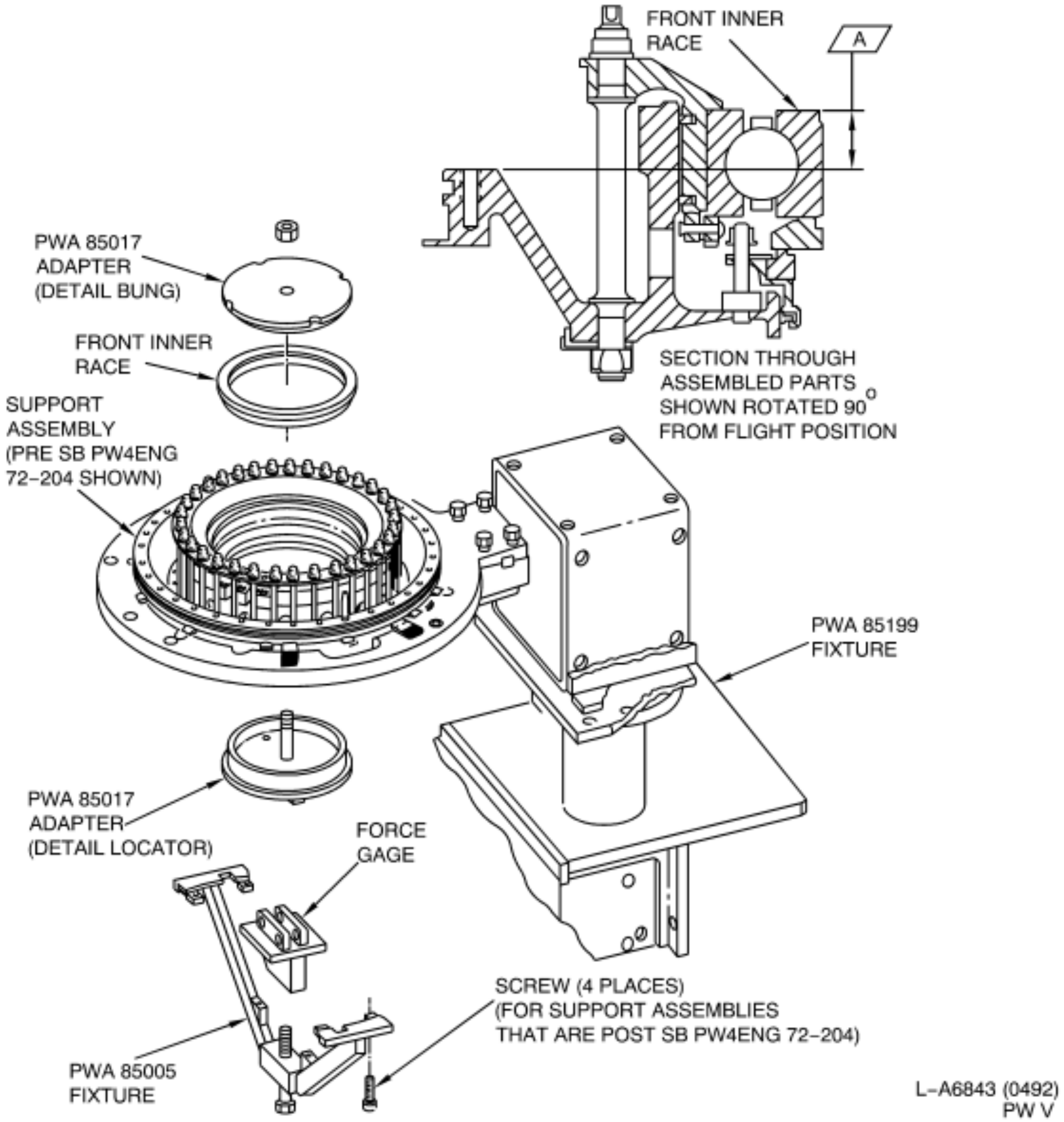
L-A8019 (0000)

1. (Reference 126)
   (Pre SB PW4ENG 72-179) 0.045 - 0.055 Inch (1.14 - 1.40 mm)
   Measure The End Gap With The Ring Installed With An ID Of 12.240 Inches
   (310.896 mm) 0.045 - 0.058 Inch (1.14 - 1.47 mm) When Installed In The No. 2 Bearing Support.
   (Post SB PW4ENG 72-179) 0.025 - 0.035 Inch (0.64 - 0.89 mm)
   Measure The End Gap With The Ring Installed With An ID Of 12.240 Inches
   (310.896 mm) 0.022 - 0.038 Inch (0.56 - 0.97 mm) When Installed In The No. 2 Bearing Support.
2. (Reference 125) 0.003 - 0.007 Inch (0.077 - 0.177 mm)

Installation Of The Studs And Bearing Housing In The Support Assembly (Seal Ring Measurements)
Figure 1002 (Sheet 2)
(Task 72-34-04-440-002)

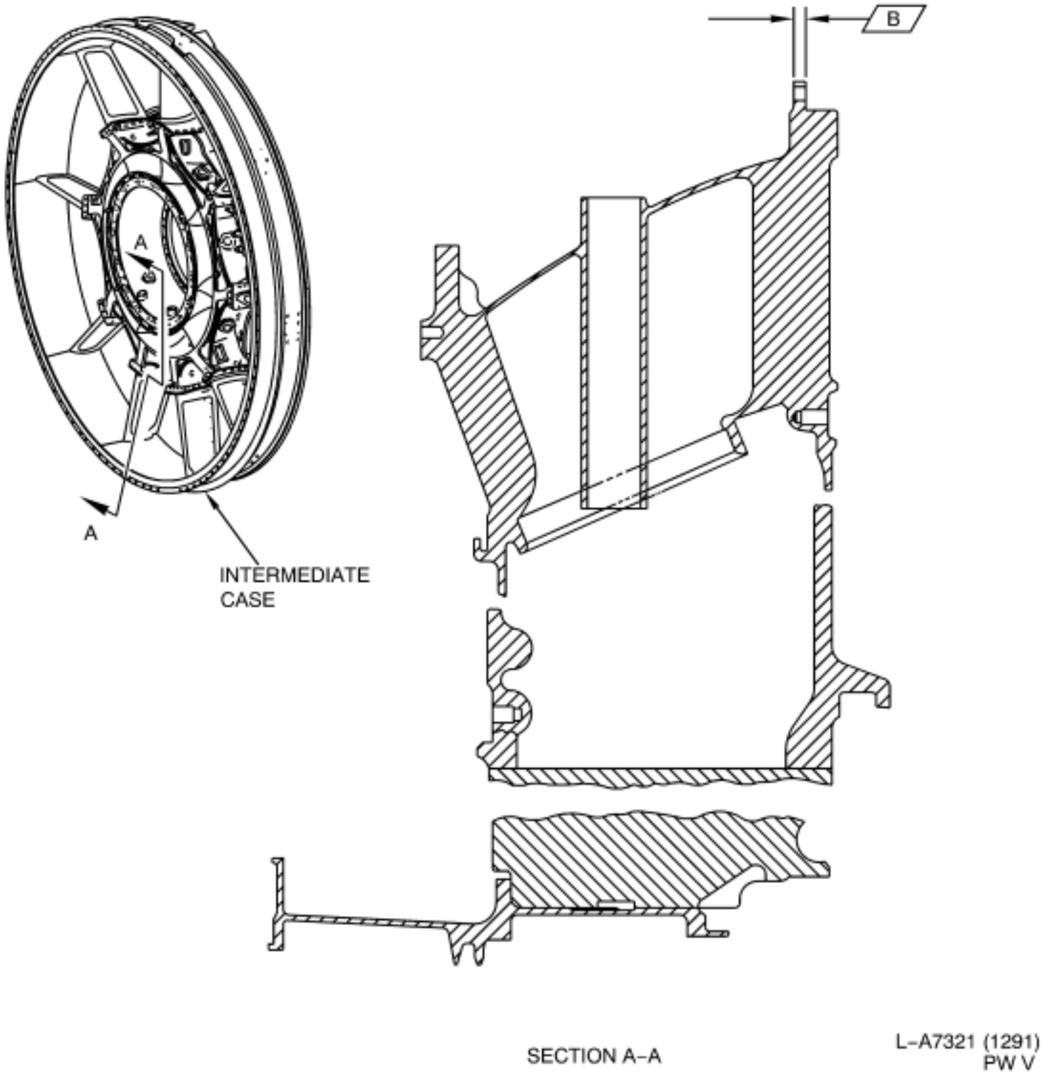

EYEBOLT
WASHER
PWA 85014
COVER
BALLS AND CAGE
DETAIL
DETAINER
NO. 2 BEARING
REAR INNER RACE
SEAL SEAT
LOCKNUT
(32 PLACES)
SECTION THROUGH
PARTS BEING ASSEMBLED
SUPPORT ASSEMBLY
(PRE SB PW4ENG 72-204
SHOWN)
DETAIL GUIDE
PWA 85018
PUSHER
L-A6921 (1291)
PW V

Installation Of The Seal Seat, Rear Inner Race, And Balls And Cage
Figure 1003
(Task 72-34-04-440-002)


FRONT INNER RACE
A
PWA 85017 ADAPTER (DETAIL BUNG)
FRONT INNER RACE
SUPPORT ASSEMBLY (PRE SB PW4ENG 72-204 SHOWN)
SECTION THROUGH ASSEMBLED PARTS SHOWN ROTATED 90° FROM FLIGHT POSITION
PWA 85199 FIXTURE
PWA 85017 ADAPTER (DETAIL LOCATOR)
FORCE GAGE
SCREW (4 PLACES) (FOR SUPPORT ASSEMBLIES THAT ARE POST SB PW4ENG 72-204)
PWA 85005 FIXTURE
L-A6843 (0492)
PW V

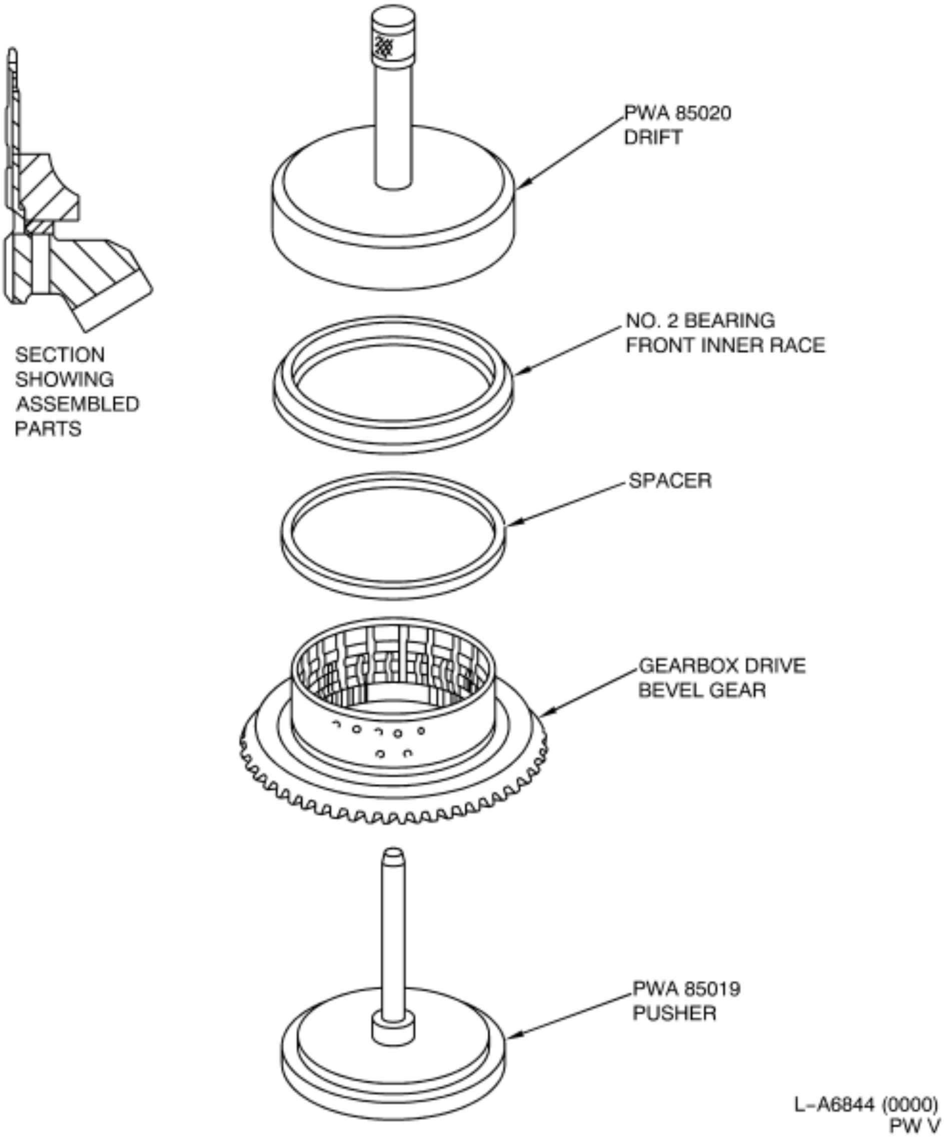
Load The Assembly
Figure 1004 (Sheet 1)
(Task 72-34-04-440-002)

NO. 2 BEARING AND SEAL ASSEMBLY − ASSEMBLY−03


B
A
A
INTERMEDIATE CASE
SECTION A−A
L−A7321 (1291)
PW V

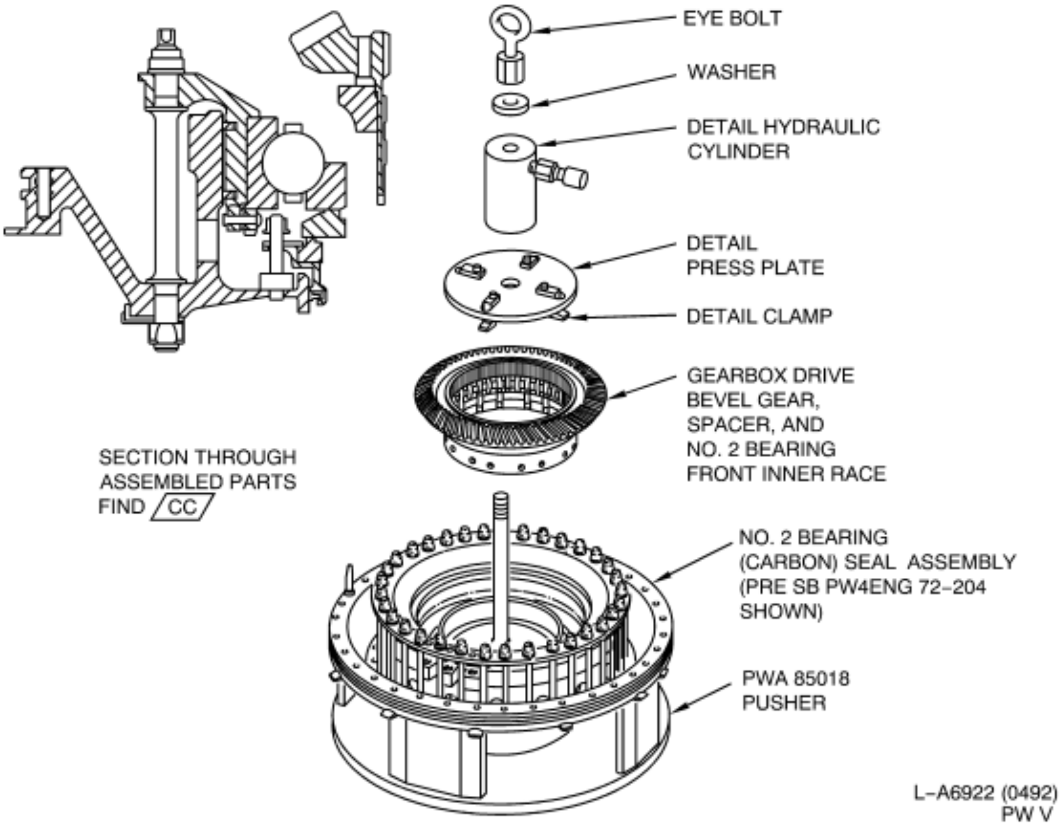
Dimension B
Figure 1004 (Sheet 2)
(Task 72−34−04−440−002)

NO. 2 BEARING AND SEAL ASSEMBLY − ASSEMBLY−03


PWA 85020
DRIFT
NO. 2 BEARING
FRONT INNER RACE
SPACER
GEARBOX DRIVE
BEVEL GEAR
PWA 85019
PUSHER
SECTION
SHOWING
ASSEMBLED
PARTS
L−A6844 (0000)
PW V

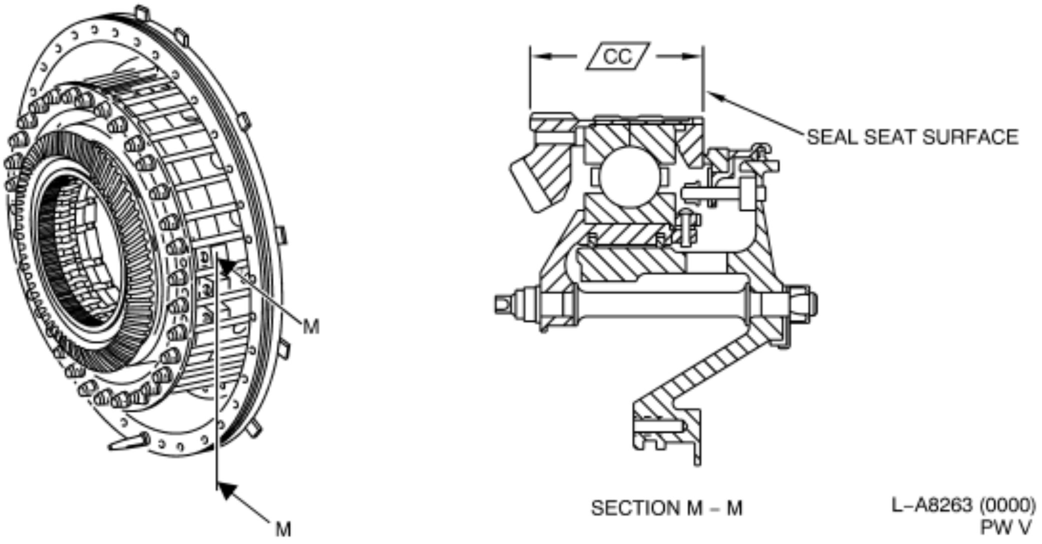
Install The Spacer And Front Inner Race On The Gear
Figure 1005
(Task 72−34−04−440−002)

NO. 2 BEARING AND SEAL ASSEMBLY - ASSEMBLY-03


EYE BOLT
WASHER
DETAIL HYDRAULIC CYLINDER
DETAIL PRESS PLATE
DETAIL CLAMP
GEARBOX DRIVE BEVEL GEAR, SPACER, AND NO. 2 BEARING FRONT INNER RACE
SECTION THROUGH ASSEMBLED PARTS FIND CC
NO. 2 BEARING (CARBON) SEAL ASSEMBLY (PRE SB PW4ENG 72-204 SHOWN)
PWA 85018 PUSHER
L-A6922 (0492)
PW V

Install The Gear Assembly In The Support Assembly
Figure 1006
(Task 72-34-04-440-002)

NO. 2 BEARING AND SEAL ASSEMBLY - ASSEMBLY-03


M
M
CC
SEAL SEAT SURFACE
SECTION M - M
L-A8263 (0000)
PW V

Measure Dimension CC
Figure 1007
(Task 72-34-04-440-002)

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NO. 2 BEARING (CARBON) SEAL ASSEMBLY − DISASSEMBLY−01

Task 72−34−05−040−001:

1. Disassemble No. 2 Bearing (Carbon) Seal Assembly

   A. Equipment And Materials Required − None

   B. Procedure

   See Figure 501.

   (1) Place No. 2 bearing seal assembly on workbench with dowel pin up.

   (2) Retain No. 2 bearing seal face against spring pressure. Remove cotter pins and retaining collars from seal support pins.

   (3) Remove No. 2 seal face from assembly.

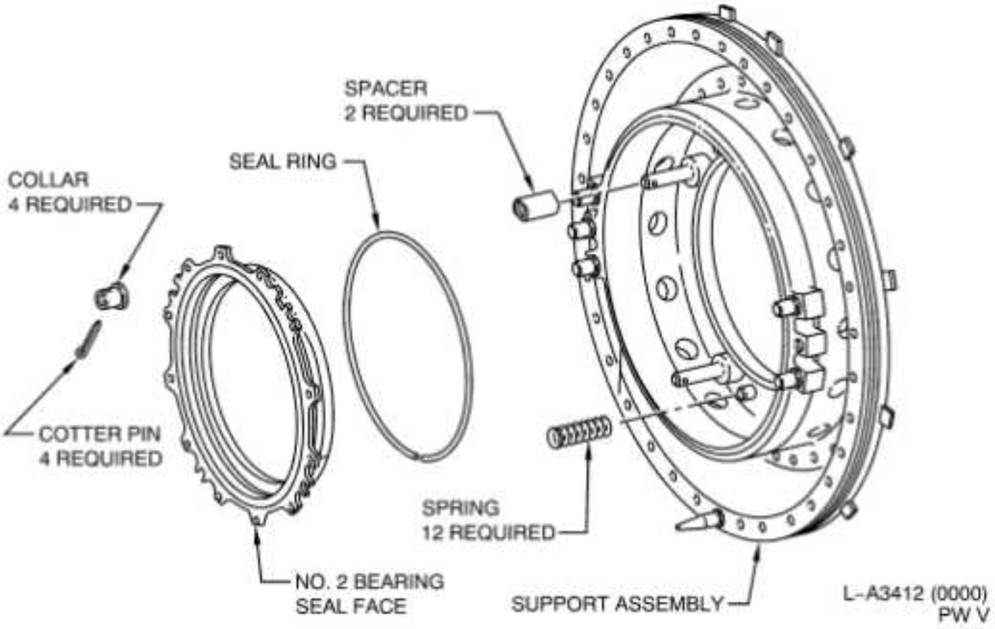
   (4) Remove seal ring from groove of No. 2 seal face.

      (a) (Seal assemblies with a non−metallic seal ring) Discard the seal ring.

   (5) Remove springs from seal support.

   (6) Remove spacers from two pins from support pins.

NO. 2 BEARING (CARBON) SEAL ASSEMBLY − DISASSEMBLY−01


SPACER
2 REQUIRED
SEAL RING
COLLAR
4 REQUIRED
COTTER PIN
4 REQUIRED
SPRING
12 REQUIRED
NO. 2 BEARING
SEAL FACE
SUPPORT ASSEMBLY
L−A3412 (0000)
PW V

No. 2 Bearing (Carbon)
Seal Assembly
Figure 501
(Task 72−34−05−040−001)

Previous Pageblock Return to Previous Menu Next Pageblock

NO. 2 BEARING (CARBON) SEAL ASSEMBLY - ASSEMBLY-01

Task 72-34-05-440-001:

1. Assemble No. 2 Bearing (Carbon) Seal Assembly

A. Equipment And Materials Required

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	4	72-34-00/16/110
Seal Ring*	1	72-34-00/16/120A
Seal Ring*	1	72-34-00/16/120B

NOTE: *These seal rings are not applicable to PN 50G415, 51G083, or 51G249 seal assemblies. Those part numbers use piston rings. Piston rings are not expendable items.

B. Procedure
See Figure 1001.

(1) Place No. 2 bearing (carbon) seal support assembly on workbench, dowel pin up.

(2) Install two spacers over opposite pins as noted in referenced figure.

(3) Install 12 springs over pins in support.

(4) Install seal/piston ring in groove of No. 2 bearing seal face and install seal face over pins and springs.

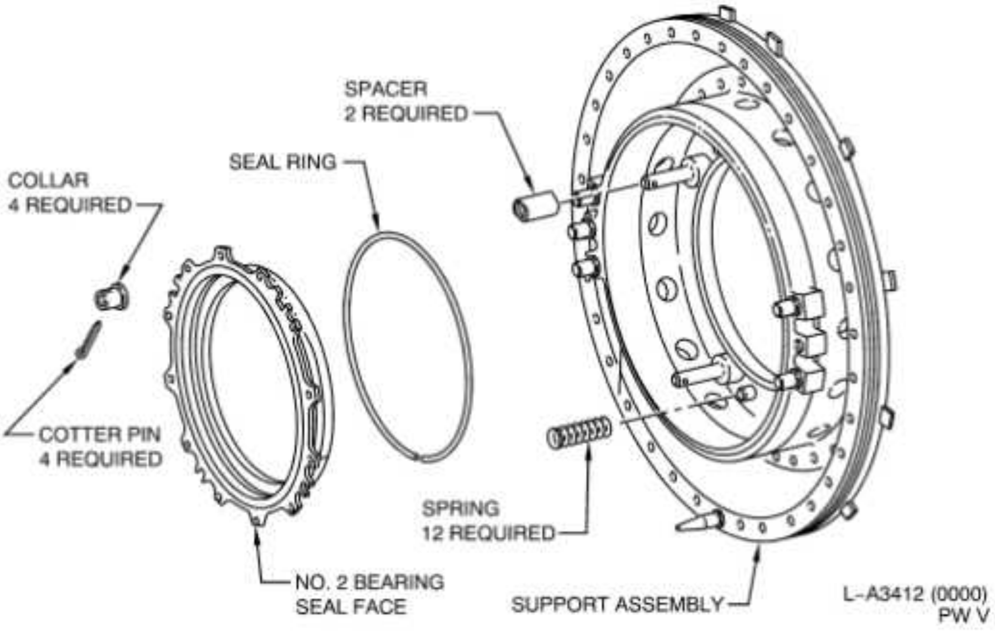
(a) (Seal assemblies with piston rings) Be sure gap in seal ring is installed per referenced figure.

(5) Retain seal assembly against springs and install four collars and secure with four cotter pins. See 70-53, Standard Practices Manual, PN 585005.

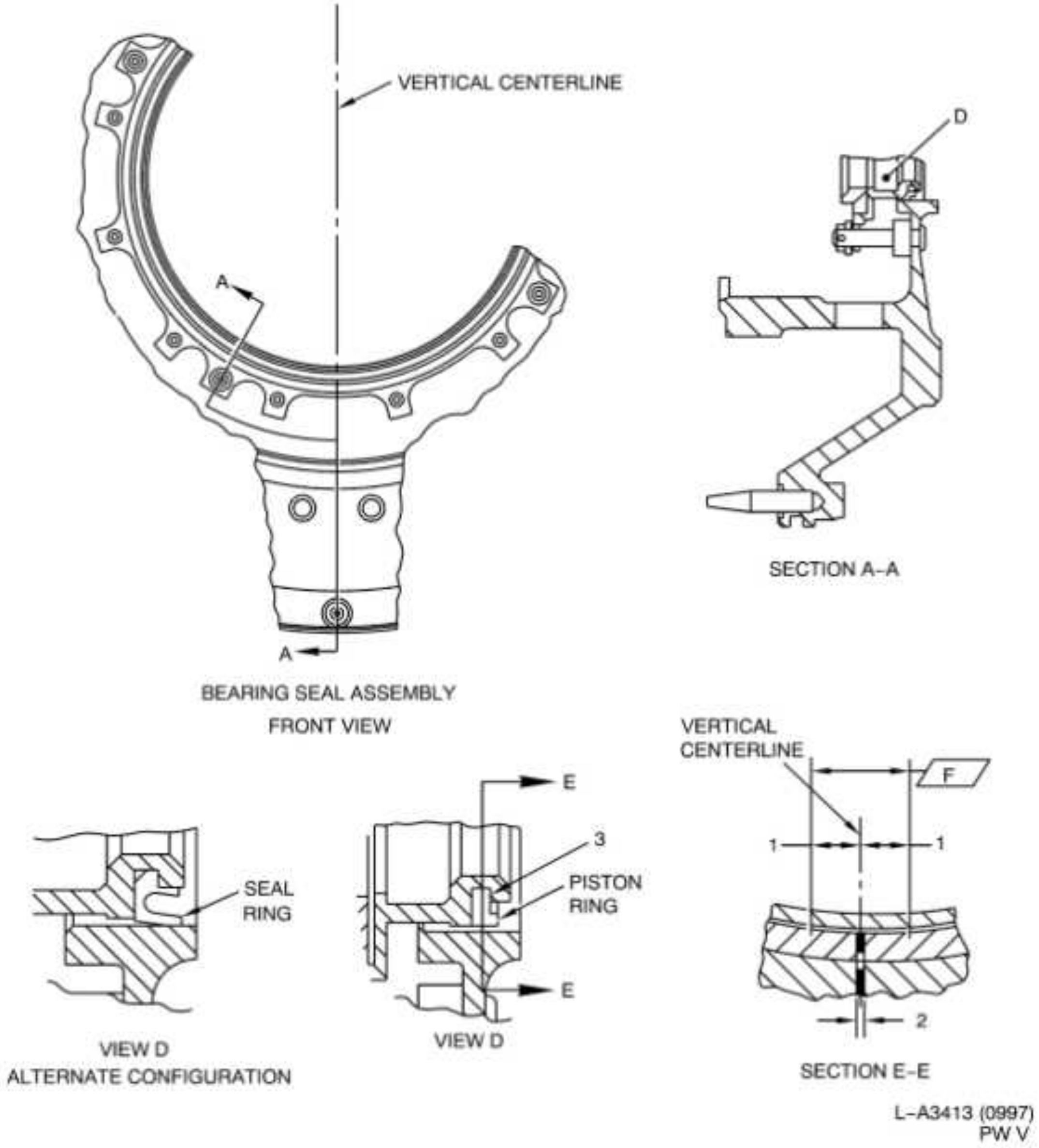
C. Postrequisites

(1) Airflow check No. 2 bearing (carbon) seal assembly per Testing-01 Task 72-34-05-720-001.

NO. 2 BEARING (CARBON) SEAL ASSEMBLY - ASSEMBLY-01


SPACER
2 REQUIRED
SEAL RING
COLLAR
4 REQUIRED
COTTER PIN
4 REQUIRED
SPRING
12 REQUIRED
NO. 2 BEARING
SEAL FACE
SUPPORT ASSEMBLY
L-A3412 (0000)
PW V

No. 2 Bearing (Carbon) Seal Assembly
Figure 1001 (Sheet 1)
(Task 72-34-05-440-001)


VERTICAL CENTERLINE
A
A
BEARING SEAL ASSEMBLY
FRONT VIEW
D
SECTION A-A
VERTICAL CENTERLINE
F
1
1
2
SECTION E-E
SEAL RING
VIEW D
ALTERNATE CONFIGURATION
E
3
PISTON RING
E
VIEW D
L-A3413 (0997)
PW V

No. 2 Bearing (Carbon) Seal Assembly
Figure 1001 (Sheet 2)
(Task 72-34-05-440-001)

NO. 2 BEARING (CARBON) SEAL ASSEMBLY − ASSEMBLY−01

1. (Seal Assemblies With Piston Rings) 0.500 Inch (12.700 mm) Maximum
2. (Seal Assemblies With Piston Rings) (Reference 136) 0.030 − 0.040 Inch (0.76 − 1.02 mm) When Installed In A Ring Gage With An ID Of 8.930 Inches (226.822 mm). 0.027 − 0.043 Inch (0.69 − 1.09 mm) When Installed In A No. 2 Bearing Support Assembly With An 8.929 − 8.931 Inch (226.797 − 226.847 mm) ID. The Gap In The Seal Ring Must Be In Area F.
3. (Seal Assemblies With Piston Rings) (Reference 135) Side Clearance 0.003 − 0.009 Inch (0.077 − 0.228 mm).

Key to Figure 1001 (Sheet 2)

NO. 2 BEARING (CARBON) SEAL ASSEMBLY - TESTING-01

Task 72-34-05-720-001:

1. Airflow Check - No. 2 Bearing (Carbon) Seal Assembly

A. Prerequisites

(1) Assemble the No. 2 bearing (carbon) seal assembly. Refer to Assembly-01 (Task 72-34-05-440-001).

B. Equipment And Materials Required

Special Tools:

PWA 6507	Flowmeter, Leak Test (with PWA 45411 Gage, optional to PWA 46400 Gage)
PWA 45411	Gage, Differential Pressure (with PWA 6507 Flowmeter, optional to PWA 46400 Gage)
PWA 46400	Gage, Measurement - Airflow and Differential Pressure Oil Seal Assemblies
PWA 85118	Fixture, Leak Test

C. Procedure

See Figures 1301 and 1302.

NOTE; It is possible to use the fixture with the 5th stage HPC shroud retaining ring attached to the seal assembly.

(1) Install three lifting eyes in the detail cover of PWA 85118 Leak Test Fixture. Remove the detail cover. Inspect the micro finished surfaces of the detail ring assembly for nicks and scratches. Repair as necessary. Put the detail ring assembly, micro finished surface up, in the fixture.

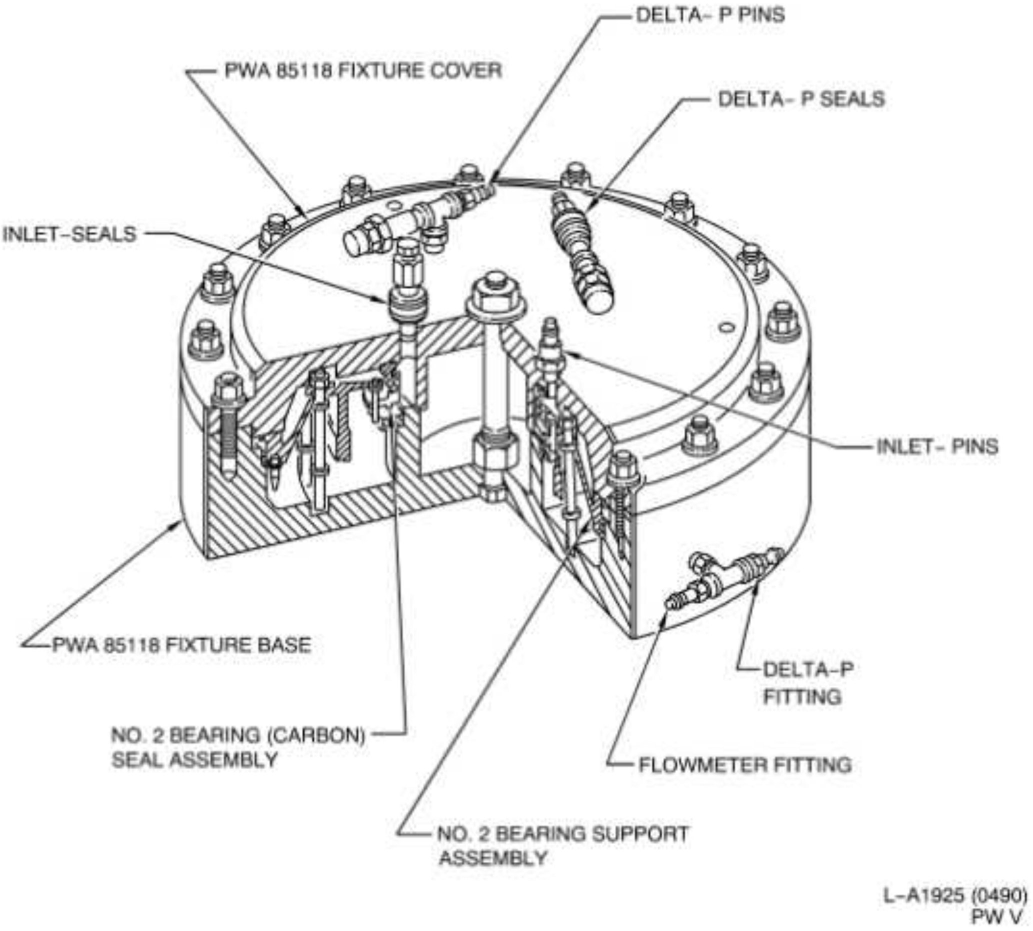
NOTE: It is permitted to use the No. 2 bearing seal seat instead of the detail ring assembly.

(2) Carefully put the seal assembly in the fixture base.

(3) Install the fixture cover. Attach the cover to the base at the center with the detail washer and large hex nut. Attach the cover to the base at the perimeter with 16 detail washers and hex nuts.

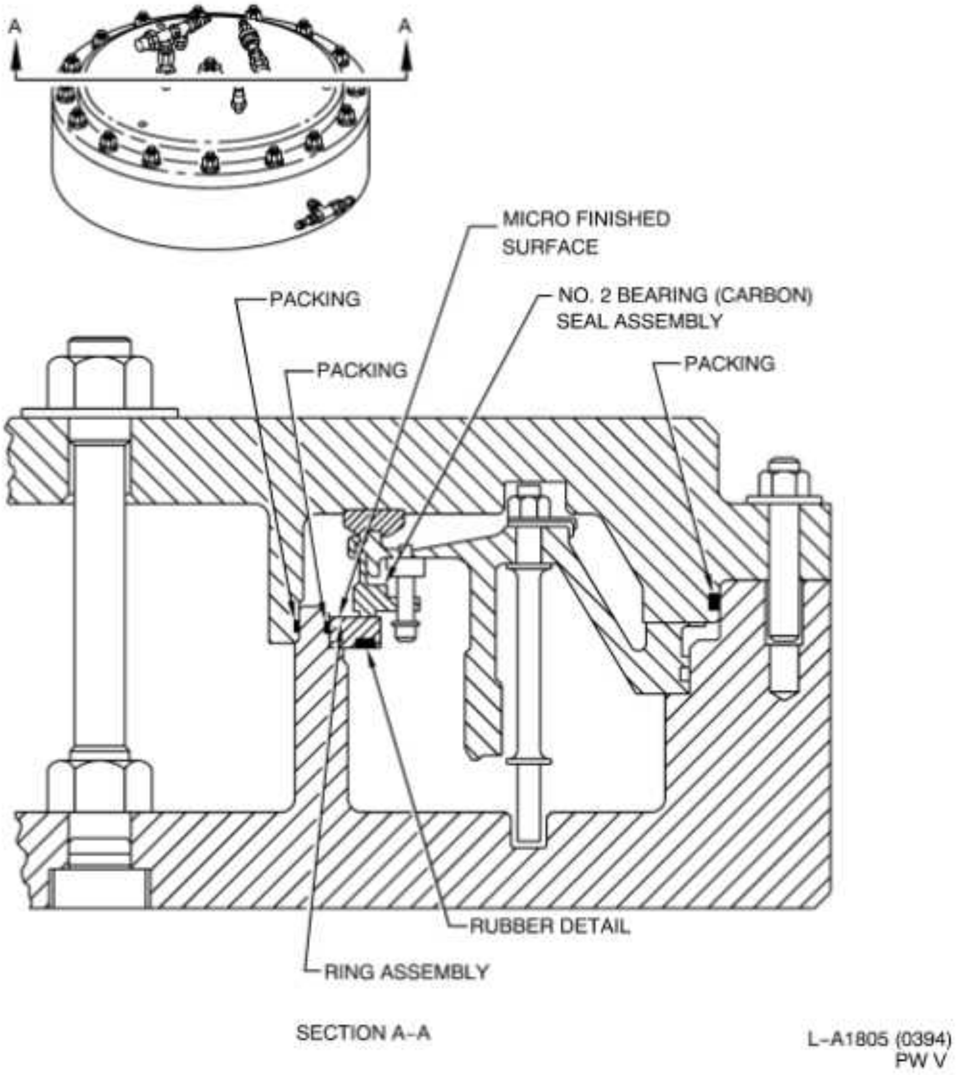
(4) For operators who use PWA 6507 Flowmeter and PWA 45411 Gage, connect the flowmeter and the gage to the fixture:

(a) Connect the hose from the flowmeter to the fitting marked FLOWMETER on the base of the fixture.


DELTA- P PINS
PWA 85118 FIXTURE COVER
DELTA- P SEALS
INLET-SEALS
INLET- PINS
PWA 85118 FIXTURE BASE
DELTA-P FITTING
NO. 2 BEARING (CARBON) SEAL ASSEMBLY
FLOWMETER FITTING
NO. 2 BEARING SUPPORT ASSEMBLY
L-A1925 (0490)
PW V

Leak Test Fixture External Details
Figure 1301
(Task 72-34-05-720-001)

NO. 2 BEARING (CARBON) SEAL ASSEMBLY - TESTING-01


A
A
MICRO FINISHED SURFACE
PACKING
NO. 2 BEARING (CARBON) SEAL ASSEMBLY
PACKING
PACKING
RUBBER DETAIL
RING ASSEMBLY
SECTION A-A
L-A1805 (0394)
PW V

Leak Test Fixture Internal Details
Figure 1302
(Task 72-34-05-720-001)

(b) Remove the quick−disconnect socket plugs from the fittings marked DELTA−P SEALS and INLET SEALS. Install these plugs in the fittings marked DELTA−P PINS and INLET PINS.

(c) Attach the larger quick−disconnect fitting of the gage to the DELTA−P SEALS fitting on the fixture base.

(d) Attach the air inlet hose to the fitting marked INLET SEALS.

(e) Attach the smaller quick−disconnect fitting of the gage to the fitting marked DELTA−P.

(5) For operators who use PWA 46400 Measurement Gage, connect the gage to the fixture:

(a) Install the gage hose marked RETURN on the fitting on the fixture base marked FLOWMETER.

(b) Remove the quick−disconnect socket plugs from the fittings marked DELTA−P SEALS and INLET SEALS. Install these plugs in the fittings marked DELTA−P PINS and INLET PINS.

(c) Install the gage hose marked D.P. HI. on the fitting on the fixture cover marked DELTA−P SEALS.

(d) Install the gage hose marked D.P. LO. on the fitting on the fixture base marked DELTA−P.

(e) Install the gage hose marked SUPPLY on the fitting on the fixture cover marked INLET SEALS.

(6) Do the air flow check for total air leakage:

(a) Supply regulated, filtered air to the fixture.

(b) For seal assemblies PNs 50G415, 51G083, and 51G249, leakage of air must not be more than 3.0 cu ft/min (0.08 cu m/min) with an 80 psi (551.6 kPa) pressure drop.

(c) For other part number seal assemblies, the leakage of air must not be more than 0.5 cu ft/min (0.01 cu m/min) with a 40 psi (275.8 kPa) pressure drop.

(7) If the seal assembly is not inside the limits, it is necessary to do a check of the leakage at the piston/seal ring:

(a) Remove the fixture cover.

(b) Remove the seal assembly.

(c) Remove the detail ring assembly.

(d) Install the ring assembly in the fixture, rubber side up.

(e) Install the seal assembly, if applicable the adapter, and the cover.

(f) Do another air flow check. This value is the leakage at the seal/piston ring.

1 Subtract this value from the total leakage value. The result is the leakage at the carbon element.

D. Postrequisites

(1) If there is leakage at the carbon element, lap the carbon element. Refer to the CIR Manual, 72-34-07, Repair-01 (Task 72-34-01-300-001).

(2) If the leakage is not within limits and not at the carbon element, replace the seal/piston ring. Refer to Diassembly-01 (Task 72-34-05-040-001) and Assembly-01 (Task 72-34-05-440-001).

NO. 2 BEARING SUPPORT ASSEMBLY − TESTING−01

Task 72−34−06−720−001:

1. Airflow Check − No. 2 Bearing Support Assembly

This Procedure Has Been Relocated To Inspection/Check−05

Previous Pageblock Return to Previous Menu Next Pageblock

NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY - DISASSEMBLY-01

Task 72-34-35-040-001:

1. Disassemble No. 1.5 And 2 Bearing (Carbon) Seal Assembly

   A. Equipment And Materials Required - None

   B. Procedure

      See Figure 501.

      (1) Place No. 1.5 and 2 bearing seal assembly on workbench with rear face down (resting on pins).

      (2) Retain No. 1.5 seal face against spring pressure. Remove cotter pins and retaining collars from seal support pins.

      (3) Remove No. 1.5 seal face from assembly.

      (4) Remove seal ring from groove of No. 1.5 seal face.

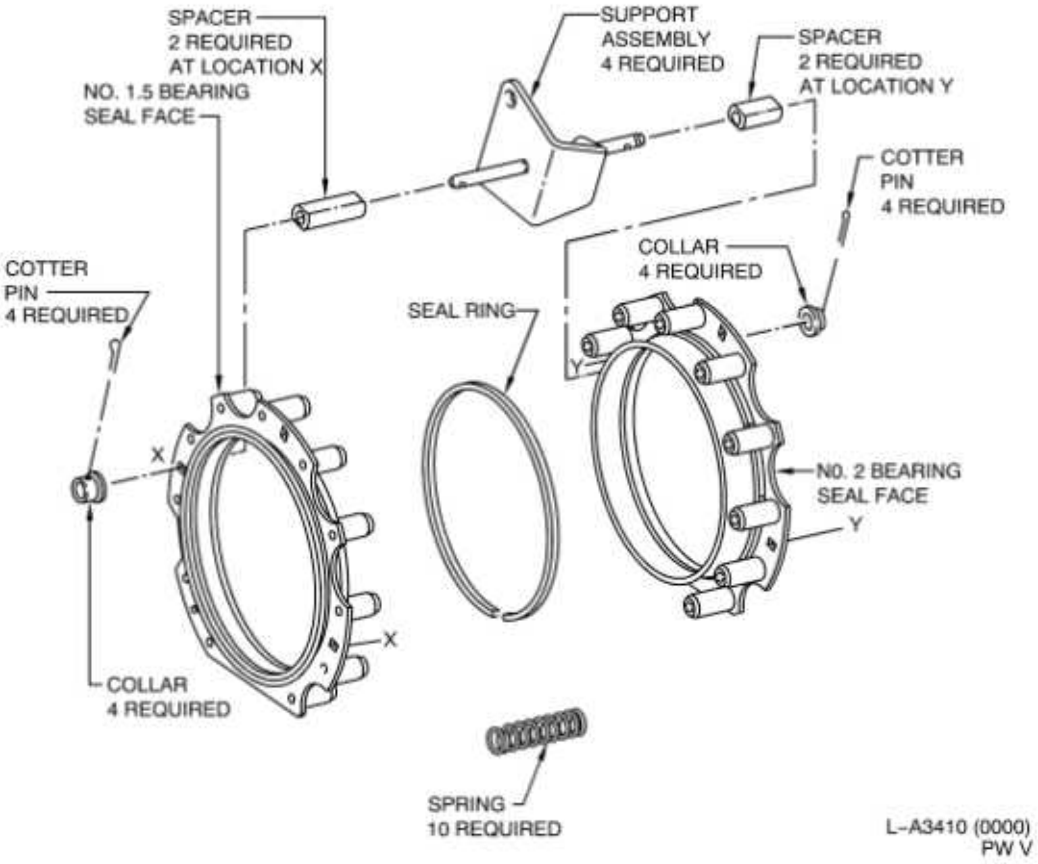
      (5) Remove springs from No. 2 seal face.

      (6) Remove two spacers from support assembly and invert No. 2 seal face, support assemblies down.

      (7) Remove cotter pins and retaining collars from pins on supports.

      (8) Remove support assemblies from seal face. Remove spacers from support assemblies.

NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY − DISASSEMBLY−01


SPACER
2 REQUIRED
AT LOCATION X
NO. 1.5 BEARING
SEAL FACE
SUPPORT
ASSEMBLY
4 REQUIRED
SPACER
2 REQUIRED
AT LOCATION Y
COTTER
PIN
4 REQUIRED
COLLAR
4 REQUIRED
COTTER
PIN
4 REQUIRED
SEAL RING
Y
X
NO. 2 BEARING
SEAL FACE
Y
X
COLLAR
4 REQUIRED
SPRING
10 REQUIRED
L−A3410 (0000)
PW V

No. 1.5 And 2 Bearing (Carbon)
Seal Assembly
Figure 501
(Task 72−34−35−040−001)

NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY - ASSEMBLY-01

Task 72-34-35-440-001:

1. Assemble No. 1.5 And 2 Bearing (Carbon) Seal Assembly

A. Equipment And Materials Required

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Cotter Pin	4	72-34-00	3	110
Cotter Pin	4	72-34-00	3	170

B. Procedure

See Figures 1001 and 1002.

(1) Install two short spacers over two support assemblies (short side of pin). Install four support assemblies, as noted in referenced figure, to No. 2 bearing seal face.

NOTE: If you have much wear on the flat sides of the sleeve spacers, you can install the sleeves with the wear towards the support. See Figure 1001 (Sheet 3).

(2) Install four collars and secure with four cotter pins. See 70-53, Standard Practices Manual. Invert seal face and support assemblies to collar end down.

(3) Install two long spacers over two pins already having spacers installed.

NOTE: If you have much wear on the flat sides of the sleeve spacers, you can install the sleeve spacers with the wear towards the support. See Figure 1001 (Sheet 3).

(4) Install ten springs over pins in seal face.

(5) Install seal ring in groove of No. 1.5 bearing seal face and install seal face over pins aligning pins with springs and with No. 2 bearing seal face. Be sure gap in seal ring is installed per referenced figure.

(6) Retain seal assembly against springs and install four collars and secure with four cotter pins. See 70-53, Standard Practices Manual.

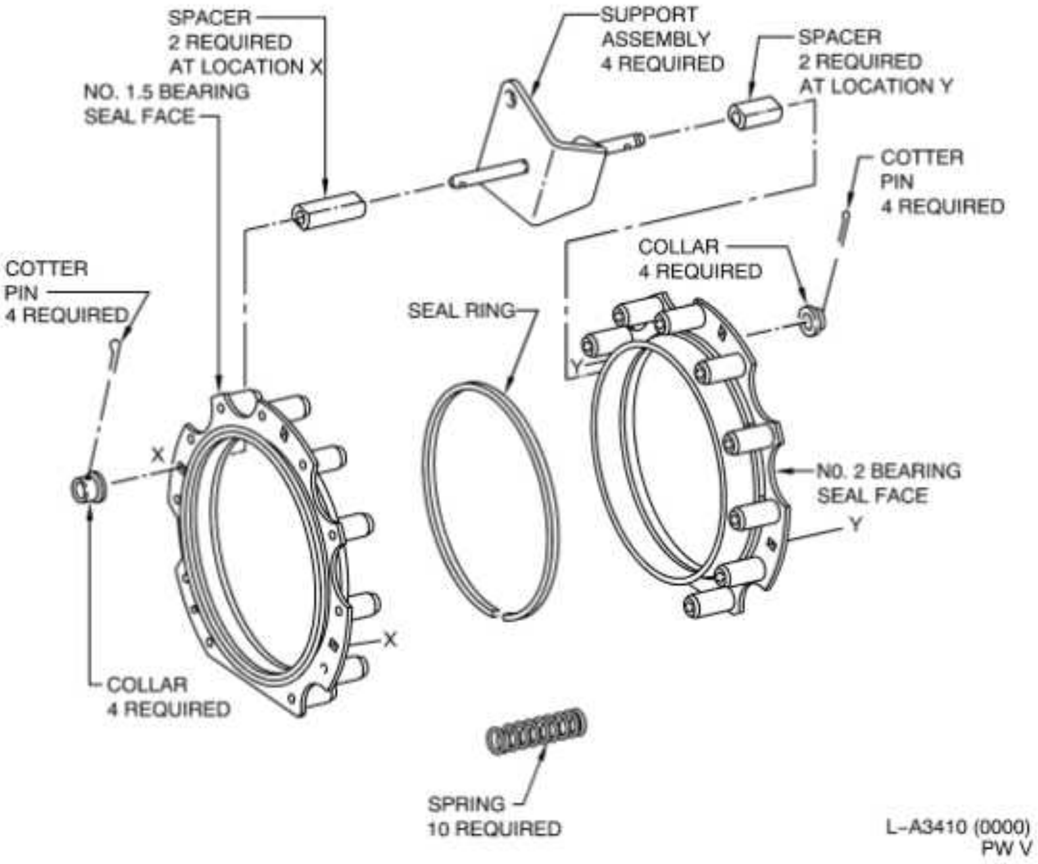
NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY − ASSEMBLY−01

(7) Dimensionally examine the seal assembly. Refer to the figure.

C. Postrequisites

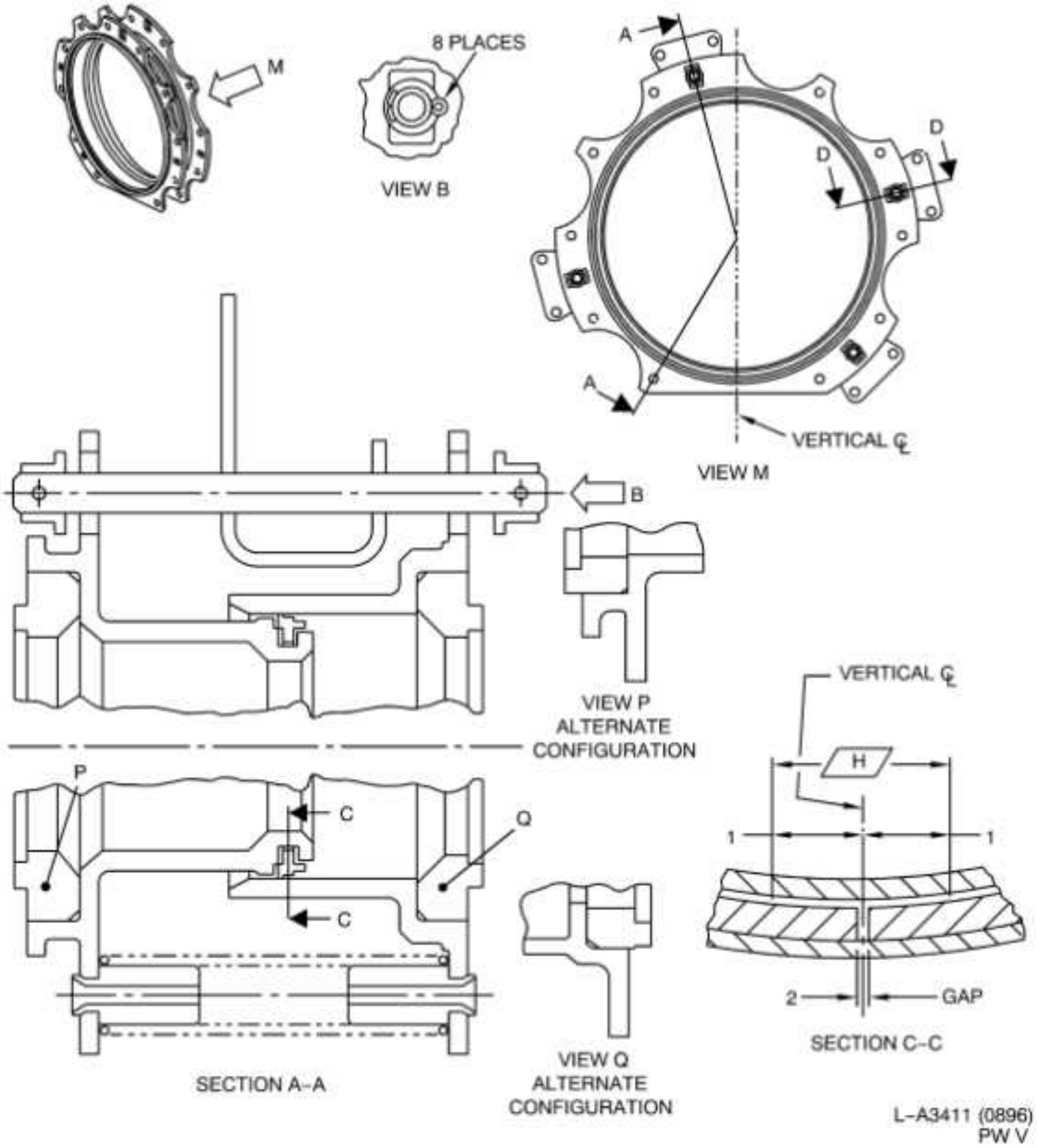
(1) Airflow check No. 1.5 and 2 bearing (carbon) seal assembly per Testing−01 (Task 72−34−35−720−001).

NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY - ASSEMBLY-01


SPACER
2 REQUIRED
AT LOCATION X
NO. 1.5 BEARING
SEAL FACE
SUPPORT
ASSEMBLY
4 REQUIRED
SPACER
2 REQUIRED
AT LOCATION Y
COTTER
PIN
4 REQUIRED
COLLAR
4 REQUIRED
COTTER
PIN
4 REQUIRED
SEAL RING
Y
X
NO. 2 BEARING
SEAL FACE
Y
X
COLLAR
4 REQUIRED
SPRING
10 REQUIRED
L-A3410 (0000)
PW V

No. 1.5 And 2 Bearing (Carbon)
Seal Assembly
Figure 1001 (Sheet 1)
(Task 72-34-35-440-001)

NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY − ASSEMBLY−01


M
8 PLACES
VIEW B
A
D
D
A
VERTICAL ℄
VIEW M
B
VIEW P
ALTERNATE
CONFIGURATION
VERTICAL ℄
H
1
1
P
C
C
Q
2
GAP
SECTION C-C
SECTION A-A
VIEW Q
ALTERNATE
CONFIGURATION
L-A3411 (0896)
PW V

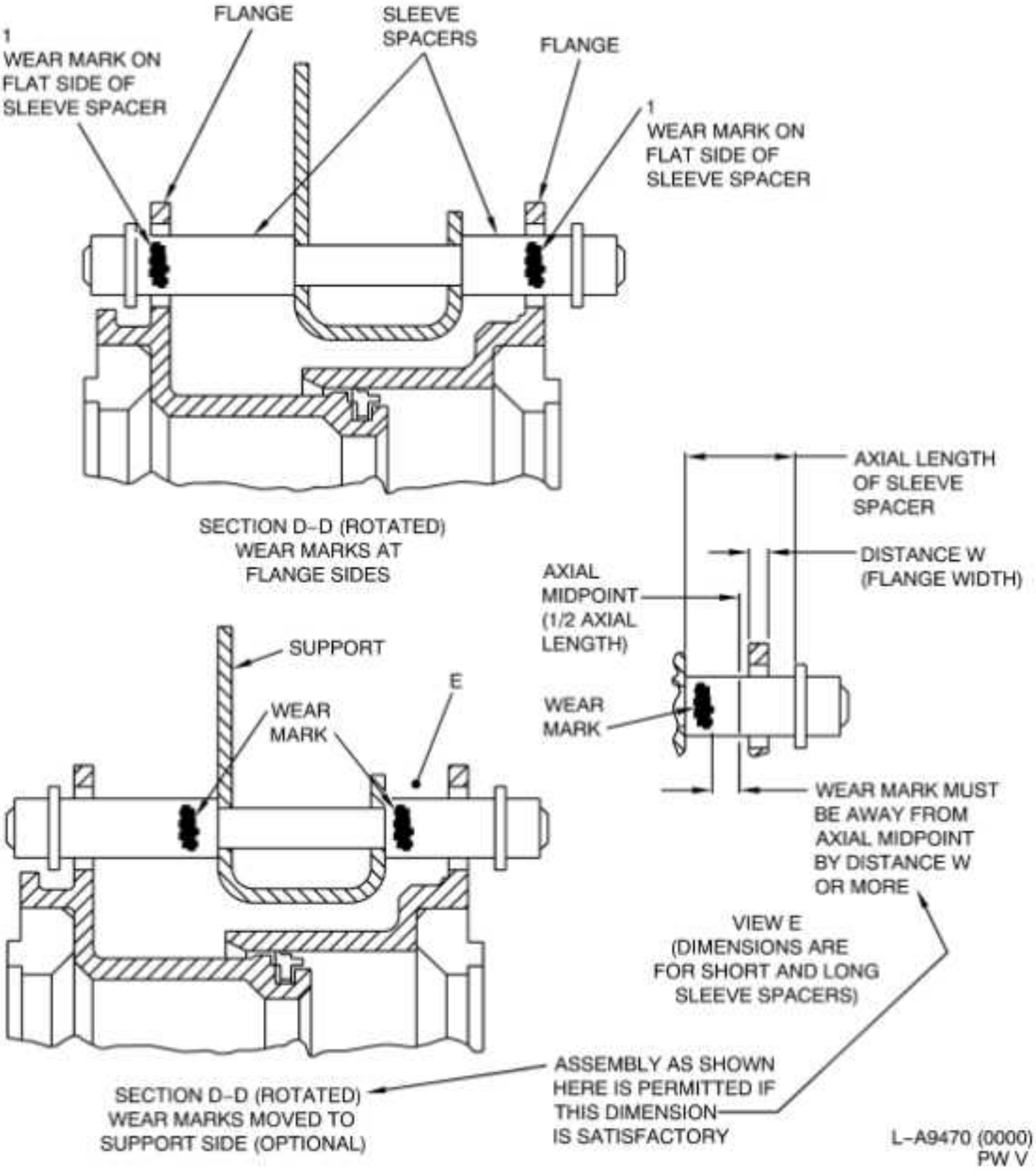
No. 1.5 And 2 Bearing (Carbon)
Seal Assembly
Figure 1001 (Sheet 2)
(Task 72−34−35−440−001)

NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY − ASSEMBLY−01

1. 0.500 Inch (12.700 mm) Both Sides
2. (Reference 128) 0.030 − 0.040 Inch (0.76 − 1.02 mm) When Installed In A Ring Gage With An ID Of 7.720 Inches (196.088 mm). 0.0253 − 0.0447 Inch (0.64 − 1.14 mm) When Installed In A Front No. 2 Bearing Face Seal Assembly With A 7.7185 − 7.7215 Inch (196.050 − 196.126 mm) ID. The Seal Ring Gap Must Be In Area H.

Key To Figure 1001 (Sheet 2)

NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY - ASSEMBLY-01

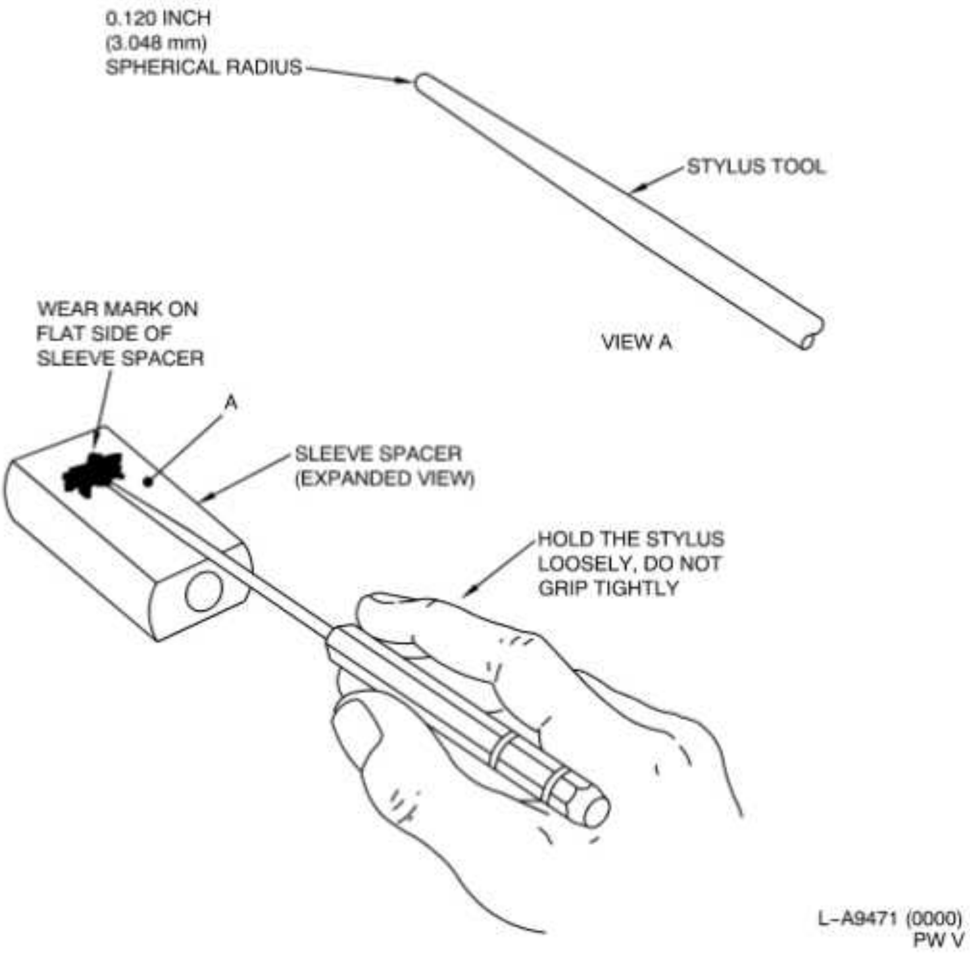

FLANGE
SLEEVE SPACERS
FLANGE
1 WEAR MARK ON FLAT SIDE OF SLEEVE SPACER
1 WEAR MARK ON FLAT SIDE OF SLEEVE SPACER
SECTION D-D (ROTATED) WEAR MARKS AT FLANGE SIDES
AXIAL LENGTH OF SLEEVE SPACER
DISTANCE W (FLANGE WIDTH)
AXIAL MIDPOINT (1/2 AXIAL LENGTH)
WEAR MARK
WEAR MARK MUST BE AWAY FROM AXIAL MIDPOINT BY DISTANCE W OR MORE
SUPPORT
WEAR MARK
E
VIEW E (DIMENSIONS ARE FOR SHORT AND LONG SLEEVE SPACERS)
SECTION D-D (ROTATED) WEAR MARKS MOVED TO SUPPORT SIDE (OPTIONAL)
ASSEMBLY AS SHOWN HERE IS PERMITTED IF THIS DIMENSION IS SATISFACTORY
L-A9470 (0000)
PW V

No. 1.5 And 2 Bearing (Carbon)
Seal Assembly
Figure 1001 (Sheet 3)
(Task 72-34-35-440-001)

NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY - ASSEMBLY-01

1. Examine the flat sides of the sleeve spacer with a hand held stylus tool. See Figure 1002. Hold the stylus loosely at a 30 degree angle to the wear surface. Guide the stylus perpendicular to the lay of the wear. Only use the weight of the stylus, do not force the stylus with your fingers. If the stylus catches on the wear, you must install the sleeve spacer with the wear towards the support, (away from the flange).

Key To Figure 1001 (Sheet 3)


0.120 INCH
(3.048 mm)
SPHERICAL RADIUS
STYLUS TOOL
VIEW A
WEAR MARK ON
FLAT SIDE OF
SLEEVE SPACER
A
SLEEVE SPACER
(EXPANDED VIEW)
HOLD THE STYLUS
LOOSELY, DO NOT
GRIP TIGHTLY
L-A9471 (0000)
PW V

Examination Of Wear On Sleeve Spacers
Figure 1002
(Task 72-34-35-440-001)

Previous Pageblock Return to Previous Menu Next Pageblock

NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY - TESTING-01

Task 72-34-35-720-001:

1. Airflow Check - No. 1.5 and 2 Bearing (Carbon) Seal Assembly

   A. Prerequisites

      (1) Assemble the No. 1.5 and 2 bearing (carbon) seal assembly. Refer to Assembly-01 (Task 72-34-35-440-001).

   B. Equipment And Materials Necessary

      Special Tools:

PWA 6507	Flowmeter, Leak Test (with PWA 45411 Gage, optional to PWA 46400 Gage)
PWA 45411	Gage, Differential Pressure (with PWA 6507 Flowmeter, optional to PWA 46400 Gage)
PWA 46400	Gage, Measurement - Airflow and Differential Pressure Oil Seal Assemblies
PWA 102625	Fixture, Leak Test

   C. Procedure

      CAUTION: DURING THE FOLLOWING AIRFLOW CHECK, HANDLE THE NO. 1.5 AND 2 BEARING (CARBON) SEAL FACE ASSEMBLIES CAREFULLY. THE CARBON FACES CAN BE EASILY DAMAGED.

      (1) Prepare the 102625 Leak Test Fixture. See Figure 1301 (Sheet 1) and Figure 1301 (Sheet 2).

         (a) Attach a hoist to the lifting eye and lift the PWA 102625 Leak Test Fixture and put it on an applicable work bench. Disconnect the hoist.

         (b) Turn to loosen the lifting eye and nut assembly and remove it from the fixture.

         (c) Use the two cover handles to remove the cover from the fixture.

         (d) Remove the eight cap screws that attach the containment sleeve to the base. Remove the containment sleeve from the base.

         (e) Remove the eight cap screws and remove the top ring detail.

(f) Inspect the packings in the base of the fixture, the inner pilot ring of the cover, the top of the locating ring and the top of containment sleeve for damage.

(g) If necessary, replace the packings.

(h) If necessary, lubricate a new packing with Engine Oil P03−001.

(i) Inspect the micro finished surface of the top ring detail and the micro finished surface of the part rest detail in the base for nicks and scratches. See Figure 1301 (Sheet 1).

(j) If necessary, repair the top ring detail or the part rest detail.

(k) If not installed, install the part rest detail, micro finished surface up, in the base of the fixture and attach with the eight detail screws.

NOTE: It is permitted to use the No. 2 bearing front seal seat instead of the part rest detail.

CAUTION: HANDLE THE NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY CAREFULLY. THE CARBON FACES CAN BE EASILY DAMAGED.

(2) Install the No. 1.5 and 2 bearing (carbon) seal assembly in the fixture. See Figure 1301 (Sheet 1) and Figure 1301 (Sheet 2).

(a) Carefully install the seal assembly (No. 1.5 bearing seal face assembly down) into the base of the leak test fixture.

(b) Align the bolt holes in the No. 1.5 and 2 bearing (carbon) seal assembly flange with the eight holes in the four fixture supports. Attach with the eight detail screws.

(c) Tighten all the detail screws, hand tight.

(d) Install the top ring detail, micro finished surface down, carefully on the No. 1.5 and 2 bearing (carbon) seal assembly and attach with the eight detail screws.

NOTE: It is permitted to use the No. 1.5 bearing seal seat instead of the detail plate assembly.

(3) Install the cover of the leak test fixture.

(a) Carefully lower the containment sleeve to the base and align the attachment holes.

(b) Attach the containment sleeve to the base with the eight cap screws.

(c) Carefully lower the cover on the seal assembly and on the containment sleeve of the fixture.

CAUTION: MAKE SURE THE FOUR COVER JACK SCREWS ARE BACKED OFF SUFFICIENTLY. IF THE JACK SCREWS ARE NOT BACKED OFF, YOU CAN BEND THE COVER AND CAUSE A LEAK WHEN YOU TIGHTEN THE LIFTING EYE AND NUT ASSEMBLY.

(d) Attach the cover to the containment sleeve of the fixture with the lifting eye and nut assembly.

(4) For operators who use PWA 6507 Flowmeter and PWA 45411 Gage, connect the flowmeter and gage to the fixture:

(a) Connect the hose from the flowmeter to the fitting marked FLOW METER on the fixture cover.

(b) Attach the larger quick−disconnect fitting of the gage to the tee with the pressure relief valve marked OUTLET TO DELTA PRESSURE GAGE on the fixture cover.

(c) Attach the smaller quick−disconnect fitting of the gage on the tee fitting marked TO DELTA PRESSURE GAGE on the fixture cover

(d) Attach the air supply hose to the fitting marked INLET on the fixture cover.

NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY − TESTING−01

(5) For operators who use PWA 46400 Measurement Gage, connect the gage to the fixture:

(a) Install the gage hose marked RETURN on the hose fitting to the tee fitting marked TO FLOW METER on the fixture cover.

(b) Install the gage hose marked SUPPLY on the hose fitting to the fitting marked INLET on the fixture cover.

(c) Install the gage hose marked D.P. HI. on the hose fitting to the tee with the pressure relief valve marked OUTLET TO DELTA PRESSURE GAGE on the fixture cover.

(d) Install the gage hose marked D.P. LO. on the hose fitting to the tee fitting marked DELTA PRESSURE GAGE on the fixture cover.

WARNING: DO NOT LOOSEN OR REMOVE THE LIFTING EYE AND NUT ASSEMBLY THAT ATTACHES THE COVER DURING THE AIR FLOW CHECK. THE LEAK CHECK FIXTURE IS UNDER AIR PRESSURE. IF YOU DO LOOSEN IT, THE AIR AND PARTS CAN COME OUT OF THE FIXTURE AT VERY HIGH SPEED AND CAUSE INJURY OR DEATH.

(6) Do the check for total air leakage:

(a) Supply regulated, filtered air to the fixture to 80 psi (551.6 kPa) and permit it to stabilize for five minutes.

(b) The leakage of air must not be more than 3 cu ft/min (0.08 cu m/min).

(c) If the total air leakage of the seal assembly IS in limits, remove the seal assembly from the fixture.

(d) If the total air leakage of the seal assembly IS NOT in limits, it is necessary to do a check of the leakage at the seal ring.

(7) Disconnect the PWA 6507 Flowmeter and PWA 45411 Gage from the fixture.

(a) Release the air pressure in the fixture.

NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY − TESTING−01

(b) Remove the gage hoses from the flowmeter, larger quick−disconnect fitting, smaller quick−disconnect fitting and return fitting from the fixture.

(8) Disconnect the PWA 46400 Measurement Gage from the fixture.

(a) Release the air pressure in the fixture.

(b) Remove the gage hoses marked SUPPLY, D.P. LO., D.P. HI. and RETURN from the fixture.

(9) Carefully remove the cover from the fixture.

WARNING: MAKE SURE THE AIR PRESSURE IS ZERO (0.0 PSI / 0.0 kPa) INSIDE THE LEAK TEST FIXTURE BEFORE YOU LOOSEN THE LIFTING EYE AND NUT ASSEMBLY. IF THE PRESSURE IS NOT RELEASED, THE AIR AND PARTS CAN COME OUT OF THE FIXTURE AT VERY HIGH SPEED AND CAUSE INJURY OR DEATH.

(a) Turn to loosen the lifting eye and nut assembly and remove it from the fixture.

(b) If necessary turn the four jack screws equally to loosen the cover from the fixture.

(c) Use the two cover handles to remove the cover carefully from the fixture.

(d) Remove the eight cap screws that attach the containment sleeve to the base. Carefully remove the containment sleeve from the base.

CAUTION: HANDLE THE NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY CAREFULLY. THE CARBON FACES CAN BE EASILY DAMAGED.

(10) Remove the seal assembly from the leak test fixture.

(a) Remove the eight cap screws and carefully remove the top ring detail.

(b) Remove the eight detail screws that attach the seal assembly to the four fixture supports.

(c) Carefully remove the seal assembly from the base of the fixture. Carefully put it on the workbench resting on the pins.

(11) If the seal assembly that IS IN limits, install the cover back on the fixture as follows:

(a) Install the top ring detail, micro finished surface down, carefully in the fixture and attach finger tight with the eight detail screws.

(b) Install the eight detail seal attachment screws finger tight to the four fixture supports.

(c) Carefully lower the containment sleeve to the base and align the attachment holes.

(d) Attach the containment sleeve to the base with the eight cap screws finger tight.

(e) Carefully lower the cover on the containment sleeve of the fixture.

CAUTION: MAKE SURE THE FOUR COVER JACK SCREWS ARE BACKED OFF SUFFICIENTLY. IF THE JACK SCREWS ARE NOT BACKED OFF, YOU CAN BEND THE COVER AND CAUSE A LEAK WHEN YOU TIGHTEN THE LIFTING EYE AND NUT ASSEMBLY.

(f) Attach the cover to the containment sleeve of the fixture with the lifting eye and nut assembly.

(12) If the seal assembly IS NOT inside limits, it is necessary to do a check of the leakage at the piston ring as follows:

(a) Remove the part rest detail from the base, turn it over and install it rubber ring side up in the base of the fixture. Attach with the eight detail screws.

(b) Carefully install the seal assembly (No. 1.5 seal face assembly down) to the base of the leak test fixture.

(c) Align the bolt holes in the No. 1.5 and 2 bearing (carbon) seal assembly flange with the eight holes in the four fixture supports. Attach with the eight detail screws.

(d) Tighten all the detail screws, hand tight.

(e) Install the top ring detail, rubber ring side down, carefully on the No. 1.5 and 2 bearing (carbon) seal assembly and attach with the eight detail screws.

(f) Carefully lower the containment sleeve to the base and align the attachment holes.

(g) Attach the containment sleeve to the base with the eight cap screws.

(h) Carefully lower the cover on the containment sleeve of the fixture.

CAUTION: MAKE SURE THE FOUR COVER JACK SCREWS ARE BACKED OFF SUFFICIENTLY. IF THE JACK SCREWS ARE NOT BACKED OFF, YOU CAN BEND THE COVER AND CAUSE A LEAK WHEN YOU TIGHTEN THE LIFTING EYE AND NUT ASSEMBLY.

(i) Attach the cover to the containment sleeve of the fixture with the lifting eye and nut assembly.

(j) Do another air flow check. This value is the leakage at the piston ring.

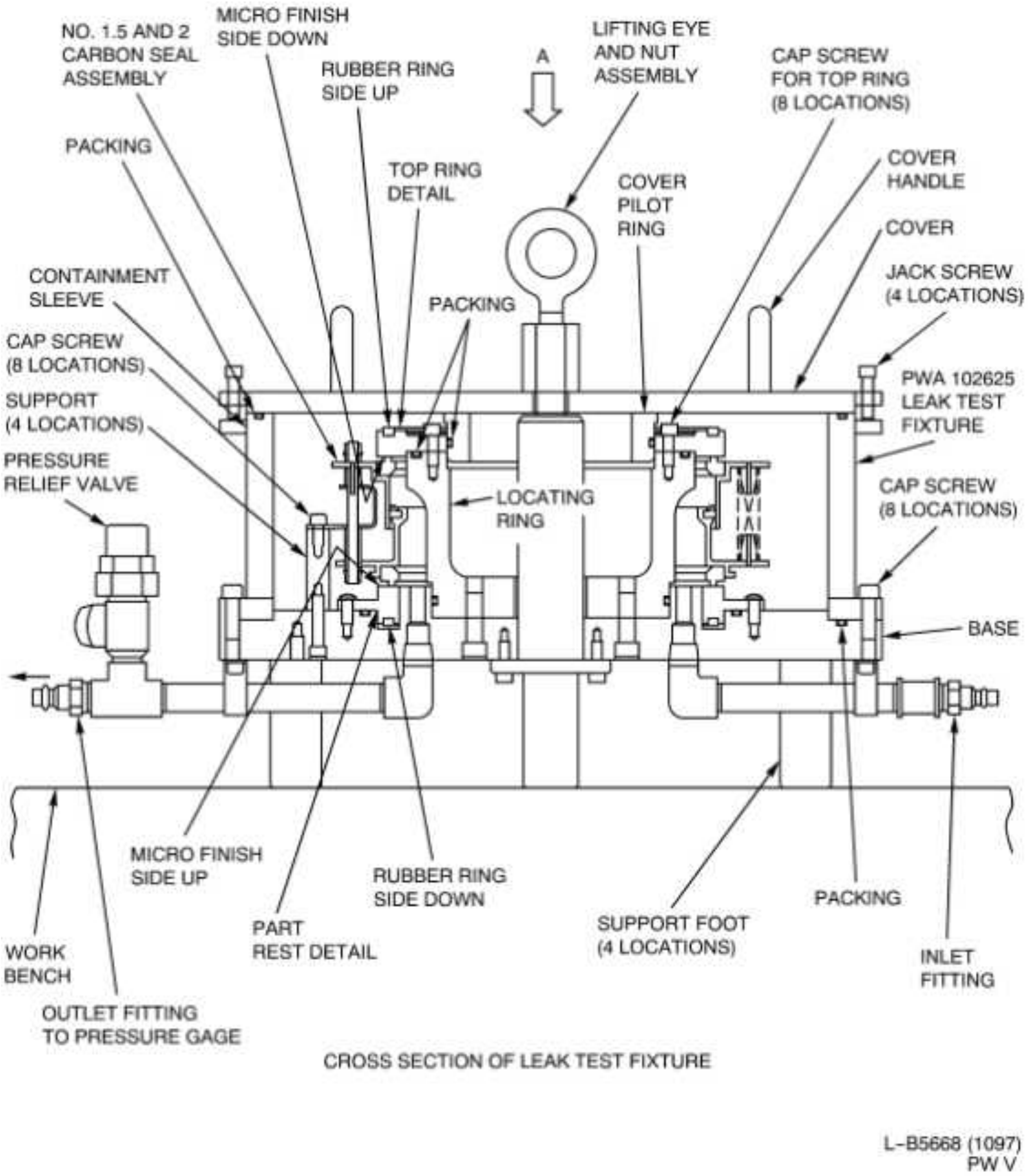
1 Subtract this value from the total leakage value. The result is the leakage at the carbon elements.

D. Postrequisites

(1) If there is leakage at the carbon elements, lap them. Refer to the PW4000 Series CIR, PN 51A357, 72-34-37, Repair-03 (Task 72-34-37-300-003) and 72-34-38, Repair-02 (Task 72-34-38-300-002).

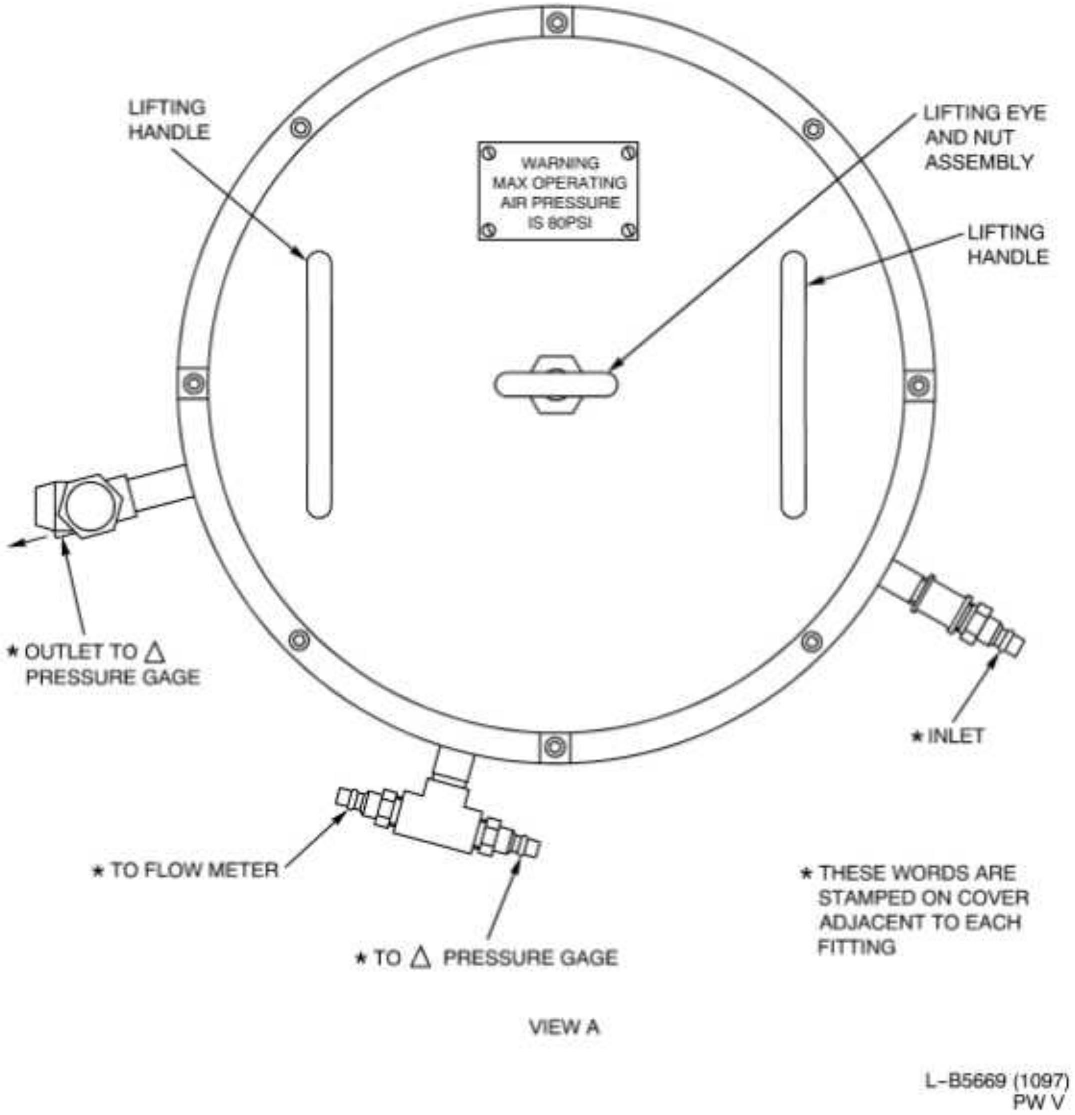
(2) If the leakage is not within limits and not at the carbon elements, replace the piston ring. Refer to Diassembly-01 Task 72-34-35-040-001 and Assembly-01 Task 72-34-35-440-001.

NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY − TESTING−01


NO. 1.5 AND 2 CARBON SEAL ASSEMBLY
MICRO FINISH SIDE DOWN
RUBBER RING SIDE UP
A
LIFTING EYE AND NUT ASSEMBLY
CAP SCREW FOR TOP RING (8 LOCATIONS)
PACKING
TOP RING DETAIL
COVER PILOT RING
COVER HANDLE
COVER
JACK SCREW (4 LOCATIONS)
CONTAINMENT SLEEVE
PACKING
CAP SCREW (8 LOCATIONS)
PWA 102625 LEAK TEST FIXTURE
SUPPORT (4 LOCATIONS)
PRESSURE RELIEF VALVE
LOCATING RING
CAP SCREW (8 LOCATIONS)
BASE
MICRO FINISH SIDE UP
RUBBER RING SIDE DOWN
PACKING
PART REST DETAIL
SUPPORT FOOT (4 LOCATIONS)
WORK BENCH
INLET FITTING
OUTLET FITTING TO PRESSURE GAGE
CROSS SECTION OF LEAK TEST FIXTURE
L-B5668 (1097)
PW V

PWA 102625 Leak Test Fixture
Figure 1301 (Sheet 1)
(Task 72−34−35−720−001)

NO. 1.5 AND 2 BEARING (CARBON) SEAL ASSEMBLY − TESTING−01


LIFTING HANDLE
WARNING MAX OPERATING AIR PRESSURE IS 80PSI
LIFTING EYE AND NUT ASSEMBLY
LIFTING HANDLE
★ OUTLET TO △ PRESSURE GAGE
★ INLET
★ TO FLOW METER
★ TO △ PRESSURE GAGE
★ THESE WORDS ARE STAMPED ON COVER ADJACENT TO EACH FITTING
VIEW A
L-B5669 (1097)
PW V

PWA 102625 Leak Test Fixture
Figure 1301 (Sheet 2)
(Task 72−34−35−720−001)

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72−35−00

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72−35−00	HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−01 • 72−35−00−030−001: Remove HPC External Parts • 72−35−00−030−005: Remove HPC External Parts
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HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE

Task 72−35−00−990−003:

1. Chapter/Section/Subject Numbering Outline

See Figure 1.

NOTE: See the tab separated How To Use Manual section located at the beginning of this manual set for information concerning Data Location Guidelines and a complete Chapter/Section/Subject numbering outline for all manual sections.

A. The following is a complete listing of the individual Chapter/Section/Subject numbers and specific nomenclatures which have been assigned to the significant High Pressure Compressor (HPC) parts.

(1) Numbers which are not assigned are indicated in the list by one of the following terms:

UNASSIGNED − This designation is for numbers intentionally omitted and reserved for possible future use.

NOT USED − This designation is applied to numbers used in other related engine model programs which are not, at this time, applicable to the engine models represented by this manual.

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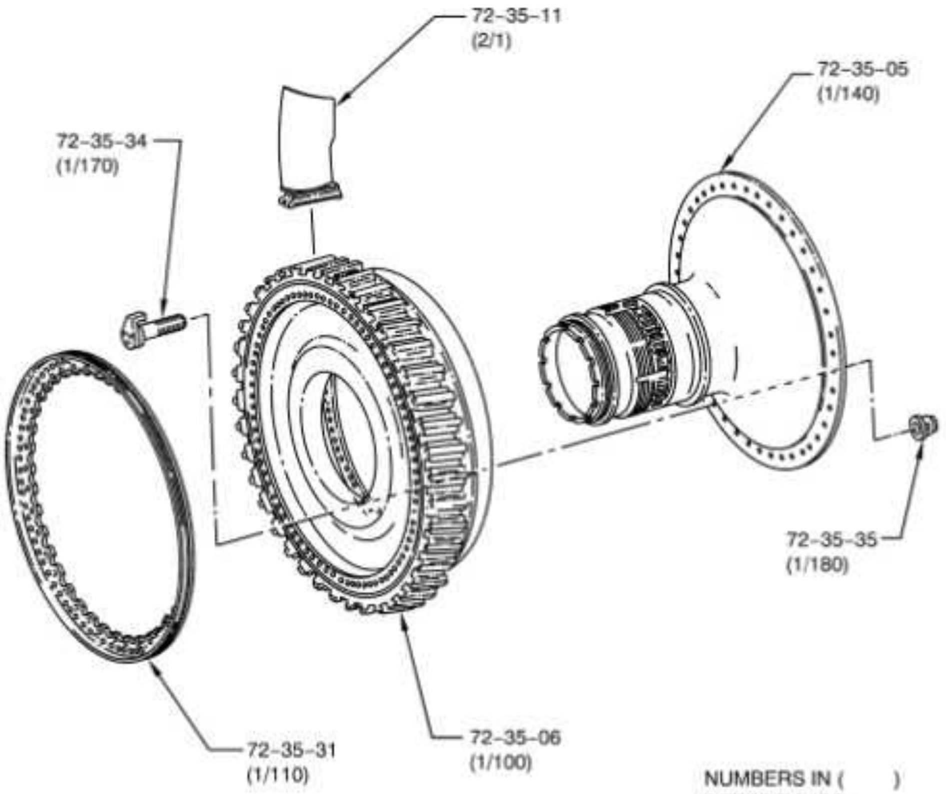
COMPRESSOR STATOR CYLINDER SUPPORT ASSEMBLY	72−35−73
HPC LEVER SET	72−35−74
STAGE 7 HPC LEVER	72−35−75
HPC CLEVISES	72−35−76
INTERNALLY THREADED ADJUSTERS	72−35−77
ROD END BEARINGS	72−35−78
HPC LEVER SET AND ACTUATOR BEARINGS	72−35−79
HPC HEAT SHIELDS	72−35−80
HEAT SHIELD RETAINERS	72−35−81
HPC SPACER SET	72−35−82
STAGE 8 HPC CASE ASSEMBLY	72−35−83
STAGE 9 HPC CASE ASSEMBLY	72−35−84
STAGE 10 HPC CASE ASSEMBLY	72−35−85
STAGE 11 HPC CASE ASSEMBLY	72−35−86
STAGE 12 HPC CASE ASSEMBLY	72−35−87
STAGE 13 HPC CASE ASSEMBLY	72−35−88
STAGE 14 HPC CASE ASSEMBLY	72−35−89
NO. 2 BEARING FRONT SEAL SEAT	72−35−90
PLAIN ROUND NUT (NO. 2 BEARING FRONT SEAL SEAT)	72−35−91
UNASSIGNED	72−35−92
STAGE 8 AIR SEAL SUPPORT SEGMENT SET	72−35−93
GEARBOX DRIVESHAFT HOUSING SUPPORT LINK SPHERICAL BEARINGS	72−35−94

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE

NO. 2 BEARING RETAINING NUT	72−35−95
NO. 2 BEARING NUT LOCK	72−35−96
UNASSIGNED	72−35−97 And 72−35−98
HIGH PRESSURE COMPRESSOR (HPC) MISCELLANEOUS	72−35−99

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE

72-35-01 AXIAL COMPRESSOR ROTOR ASSEMBLY
72-35-02 VARIABLE STATOR VANE AND HPC FRONT CASE ASSEMBLY
72-35-03 HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY
72-35-37 STAGE 5 HPC DISK AND BLADES ASSEMBLY
72-35-38 DRUM ROTOR AND BLADES (FRONT) ASSEMBLY
72-35-39 DRUM ROTOR AND BLADES (REAR) ASSEMBLY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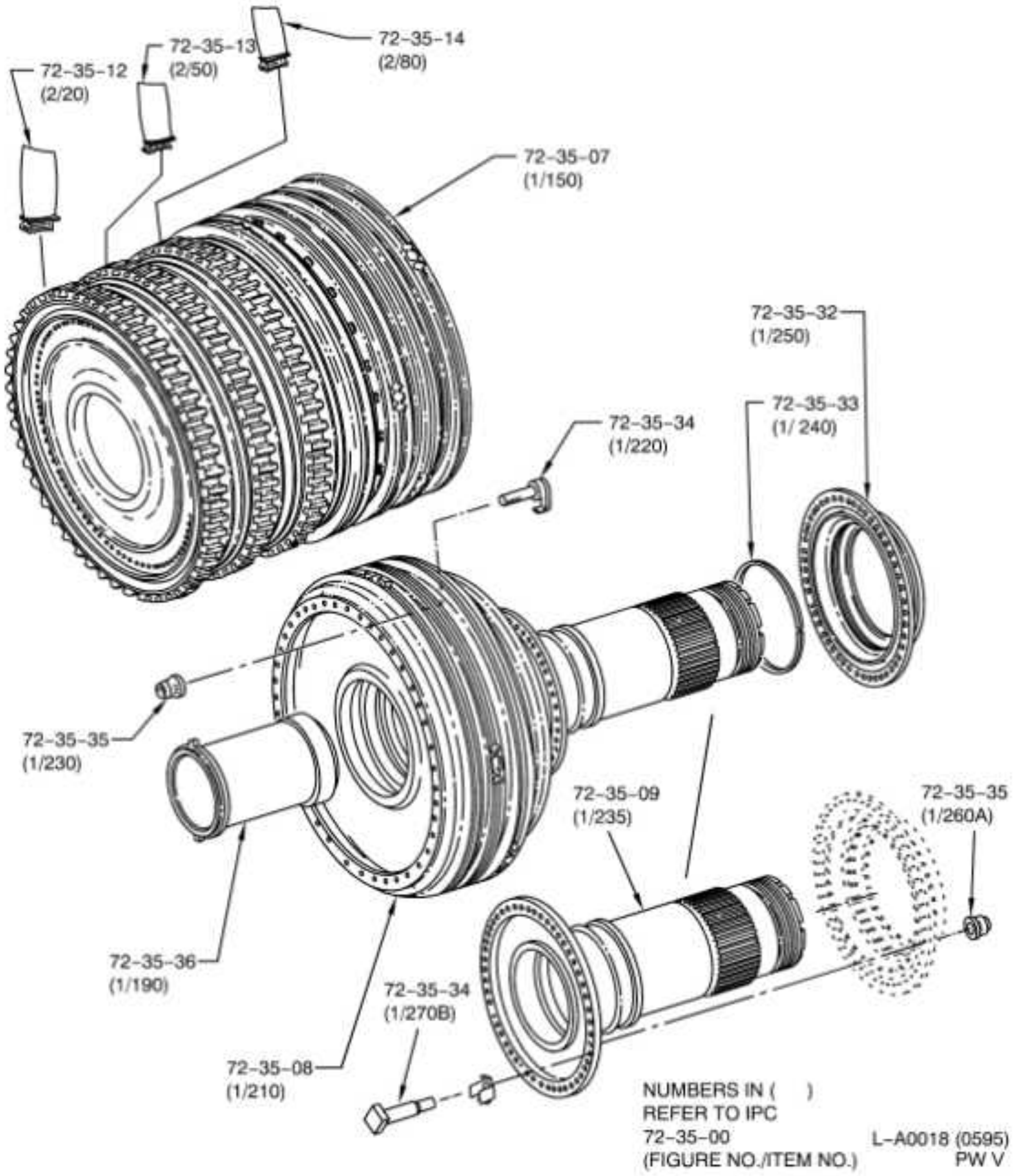
72-35-06
(1/100)

NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)

L-A0017 (0386)
PW V

High Pressure Compressor (HPC)
Figure 1 (Sheet 1)
(Task 72-35-00-990-003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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(1/220)
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(1/ 240)
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(1/230)
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(1/210)
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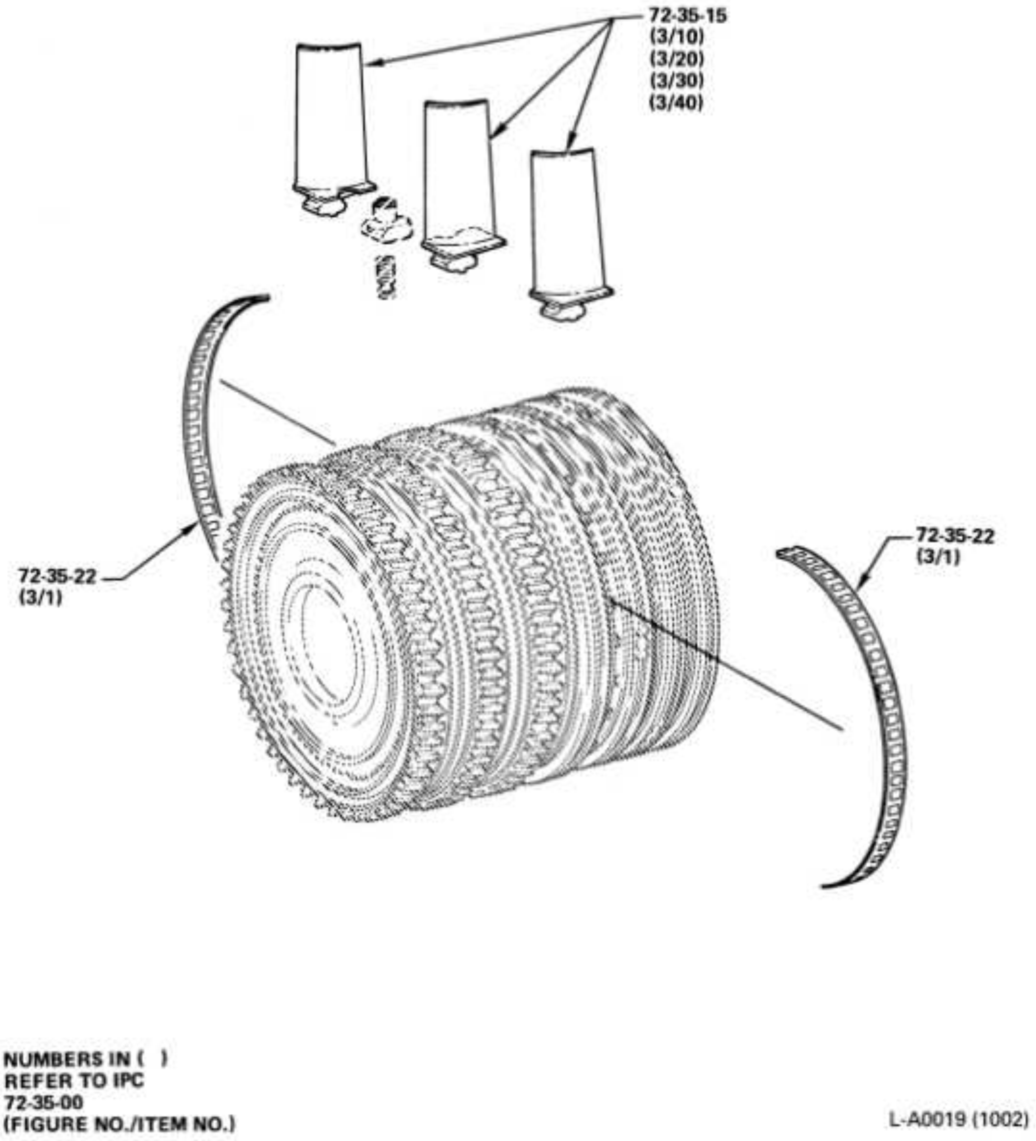
72-35-00
(FIGURE NO./ITEM NO.)
L-A0018 (0595)
PW V

High Pressure Compressor (HPC)
Figure 1 (Sheet 2)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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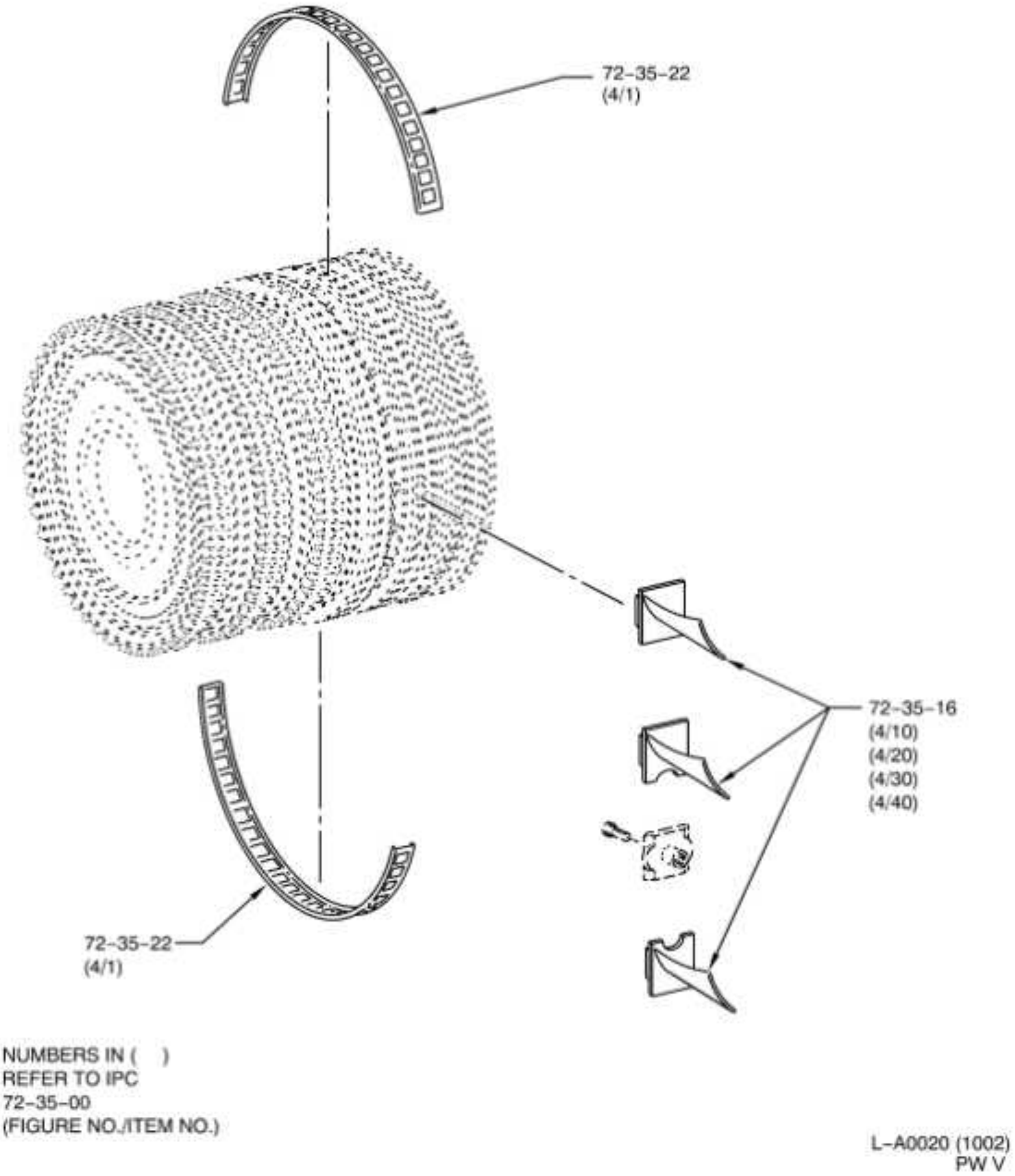
(3/1)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A0019 (1002)

High Pressure Compressor (HPC) (Non−Ring Case Configuration)
Figure 1 (Sheet 3)
(Task 72−35−00−990−003)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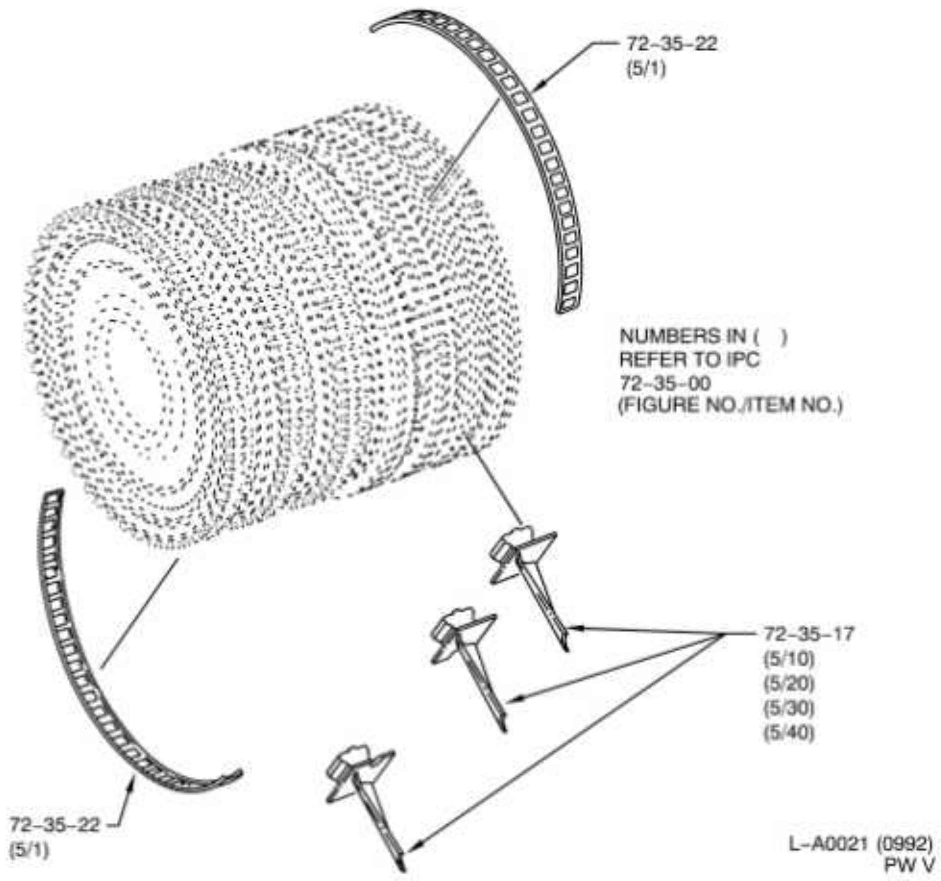
(4/40)
72−35−22
(4/1)
NUMBERS IN ( )
REFER TO IPC
72−35−00
(FIGURE NO./ITEM NO.)
L−A0020 (1002)
PW V

High Pressure Compressor (HPC) (Non−Ring Case Configuration)
Figure 1 (Sheet 4)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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REFER TO IPC
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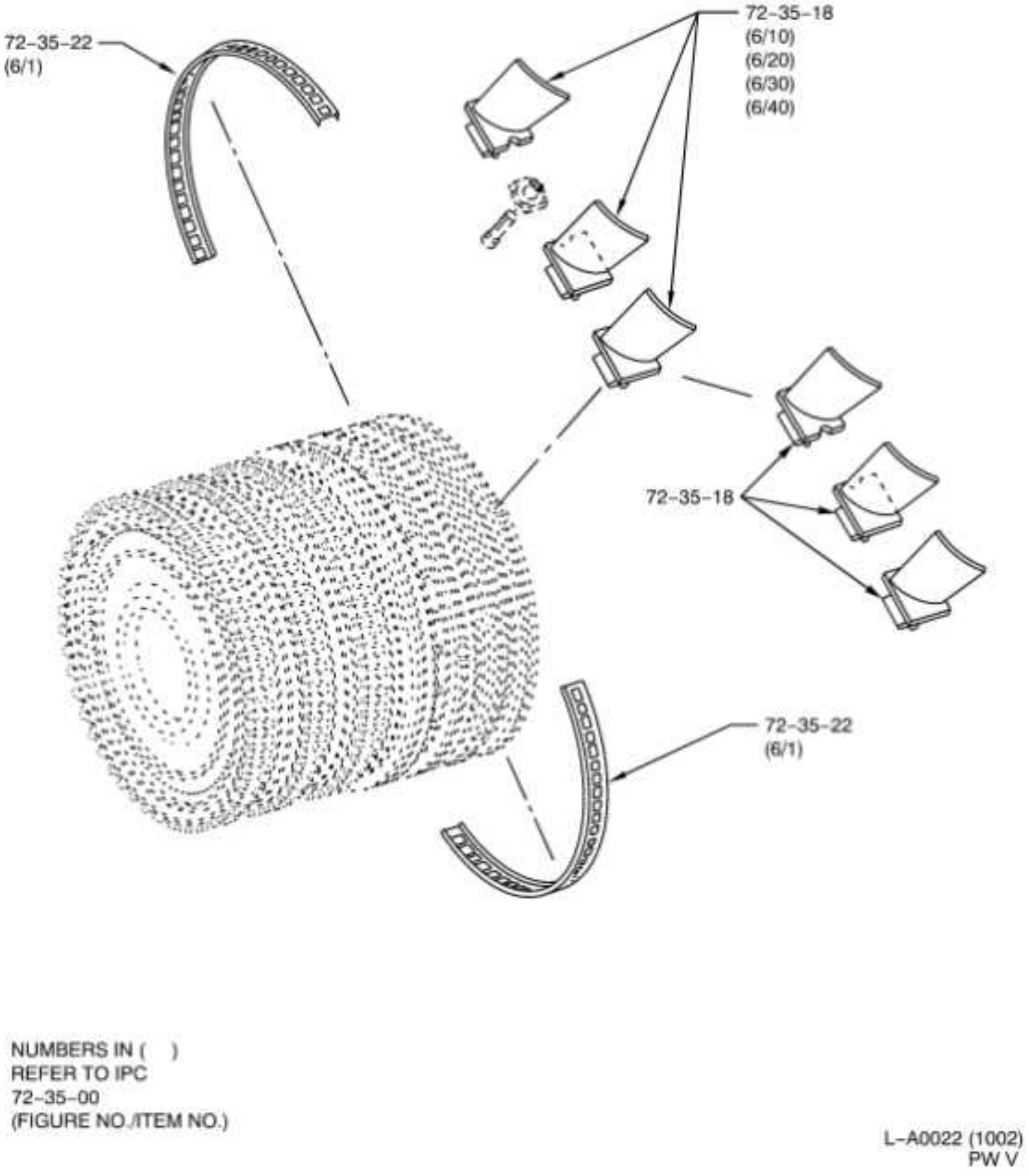
(FIGURE NO./ITEM NO.)
72−35−17
(5/10)
(5/20)
(5/30)
(5/40)
72−35−22
(5/1)
L−A0021 (0992)
PW V

High Pressure Compressor (HPC) (Non−Ring Case Configuration)
Figure 1 (Sheet 5)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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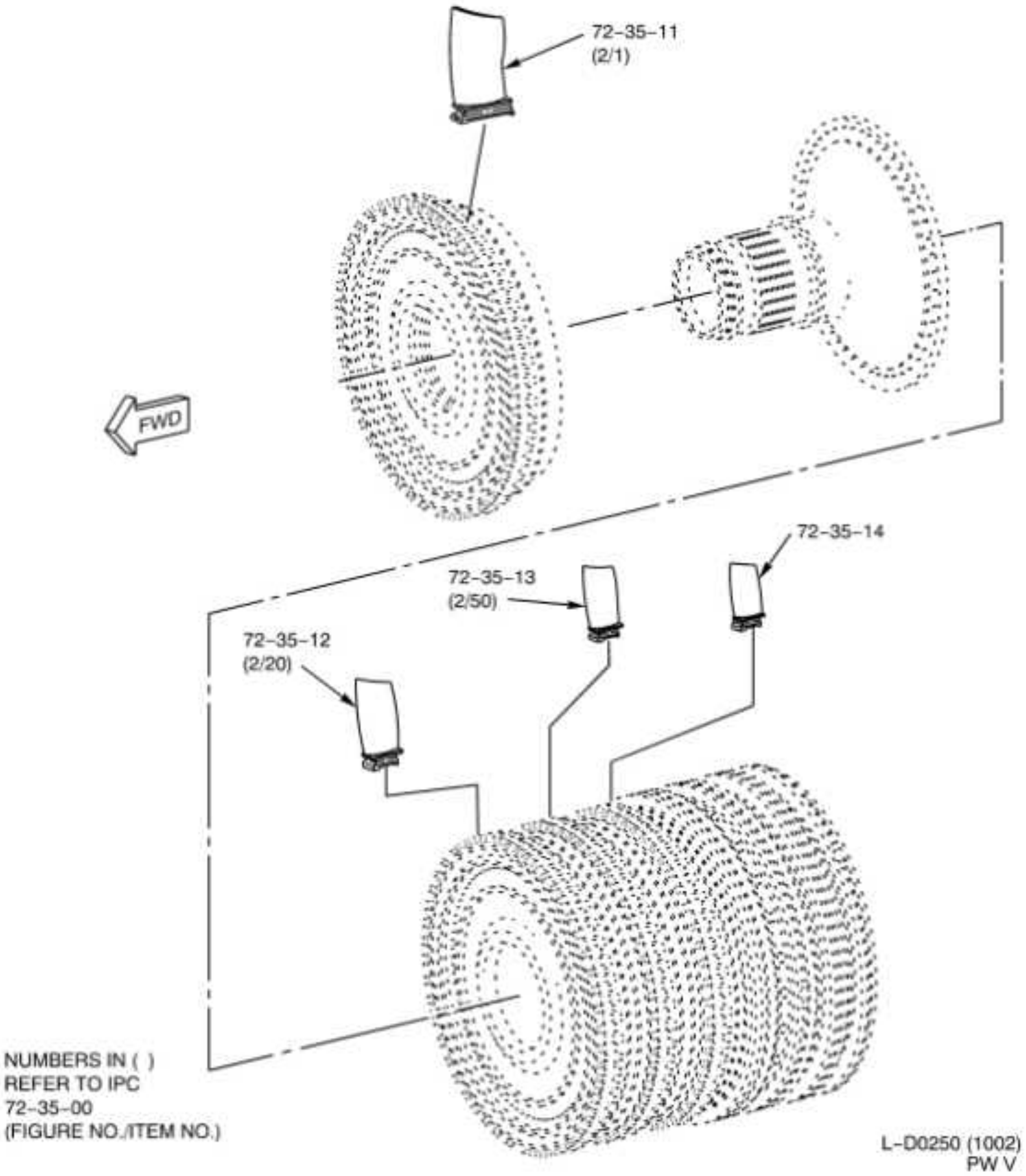
(6/20)
(6/30)
(6/40)
72-35-18
72-35-22
(6/1)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A0022 (1002)
PW V

High Pressure Compressor (HPC) (Non−Ring Case Configuration)
Figure 1 (Sheet 6)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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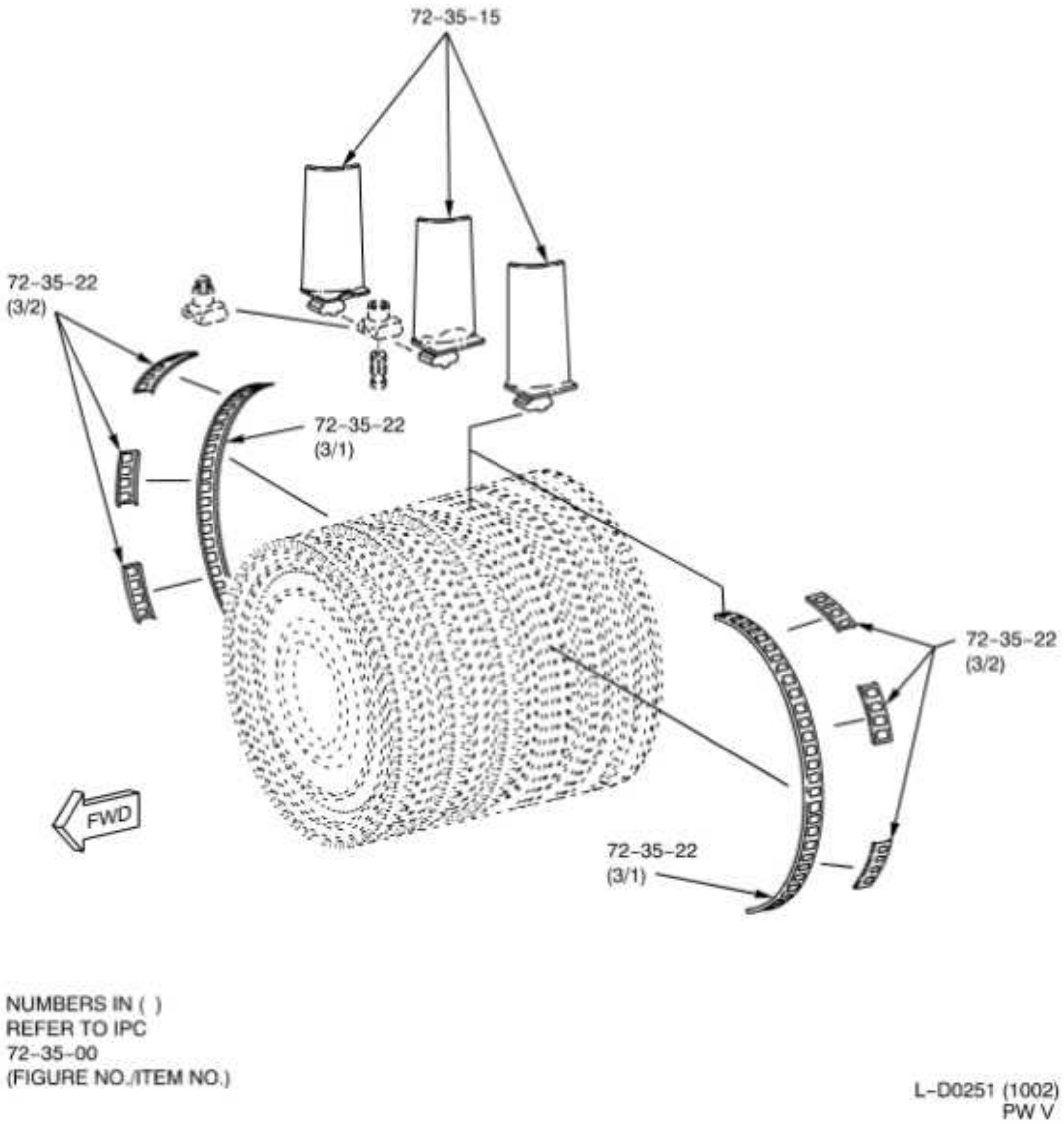
(2/50)
72−35−12
(2/20)
NUMBERS IN ( )
REFER TO IPC
72−35−00
(FIGURE NO./ITEM NO.)
L−D0250 (1002)
PW V

High Pressure Compressor (Ring Case Configuration)
Figure 1 (Sheet 7)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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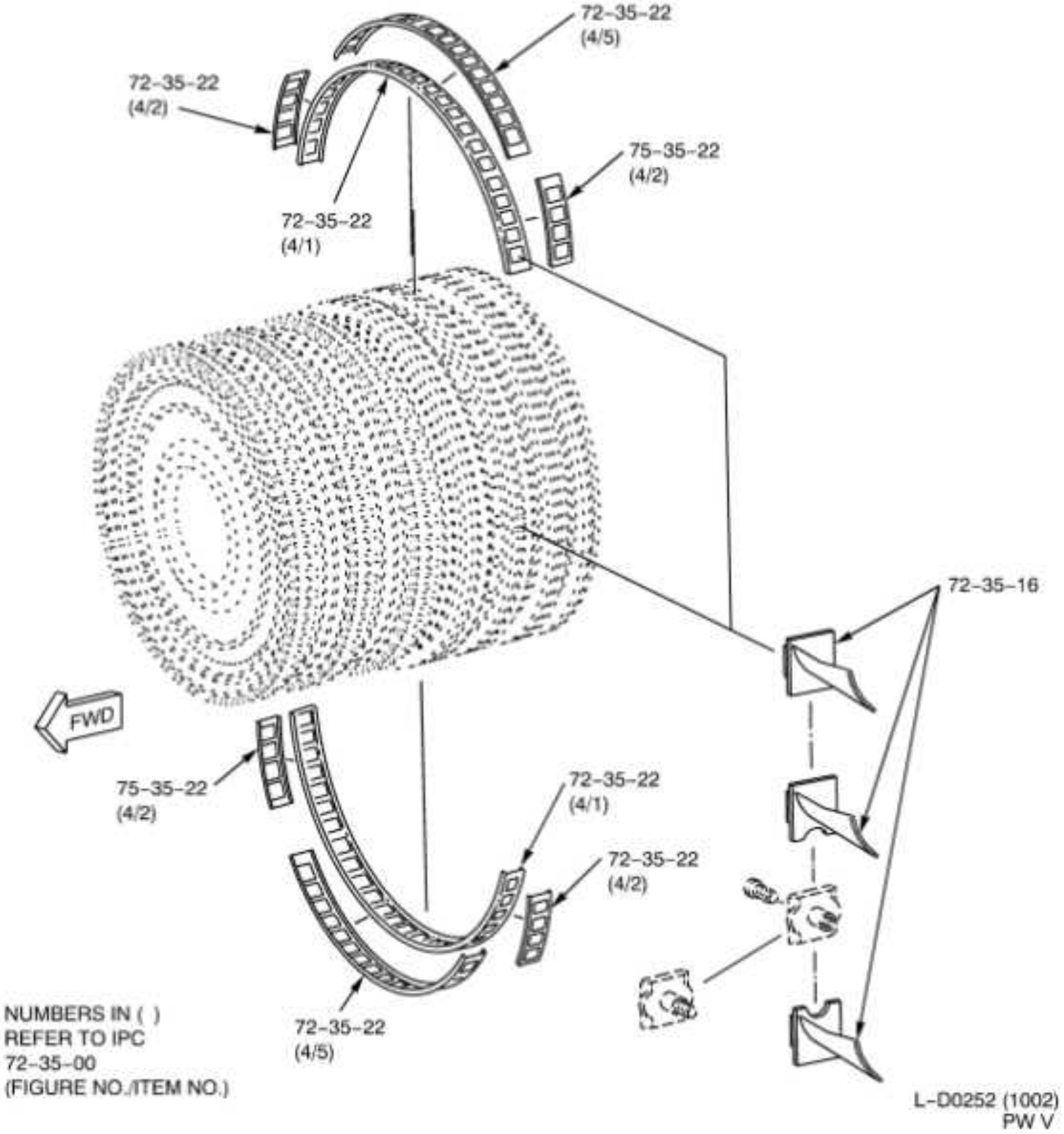
(3/2)
72-35-22
(3/1)
FWD
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-D0251 (1002)
PW V

High Pressure Compressor (Ring Case Configuration)
Figure 1 (Sheet 8)
(Task 72−35−00−990−003)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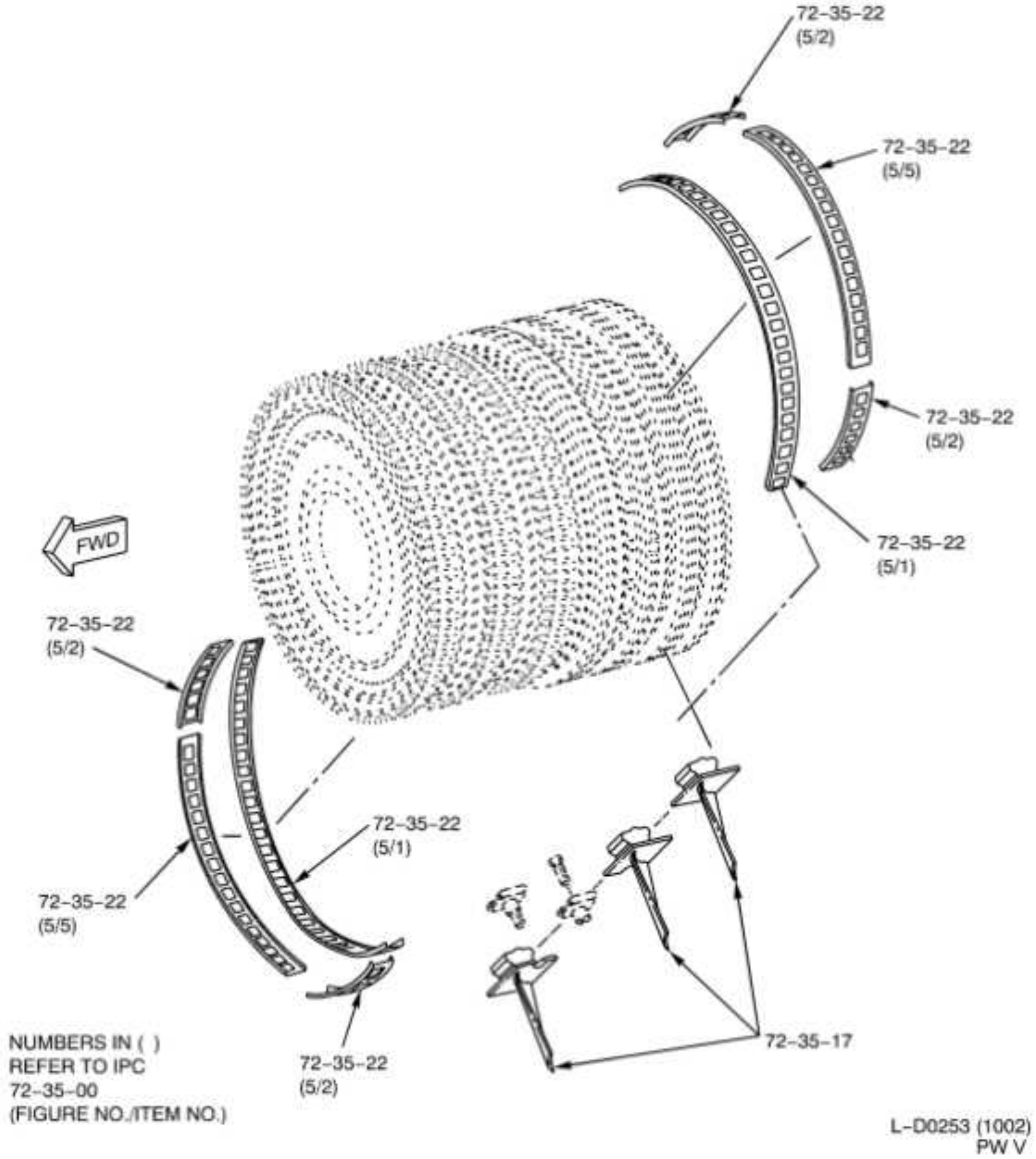
75-35-22
(4/2)
72-35-22
(4/1)
72-35-16
FWD
75-35-22
(4/2)
72-35-22
(4/1)
72-35-22
(4/2)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
72-35-22
(4/5)
L-D0252 (1002)
PW V

High Pressure Compressor (Ring Case Configuration)
Figure 1 (Sheet 9)
(Task 72−35−00−990−003)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72-35-22
(5/2)
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(5/1)
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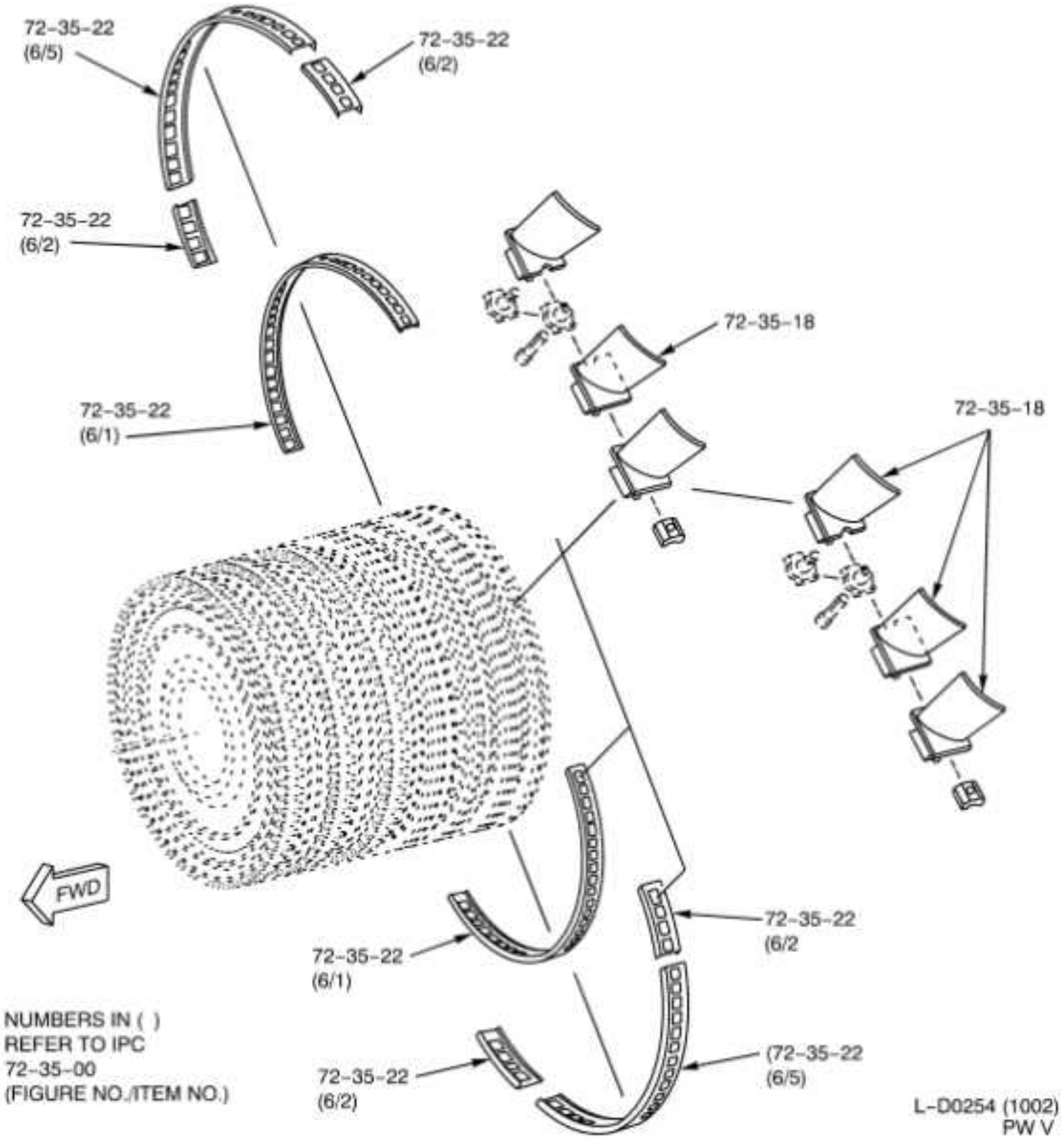
(5/2)
72-35-22
(5/1)
72-35-22
(5/5)
72-35-17
72-35-22
(5/2)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-D0253 (1002)
PW V

High Pressure Compressor (Ring Case Configuration)
Figure 1 (Sheet 10)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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(6/2)
72-35-22
(6/2)
72-35-18
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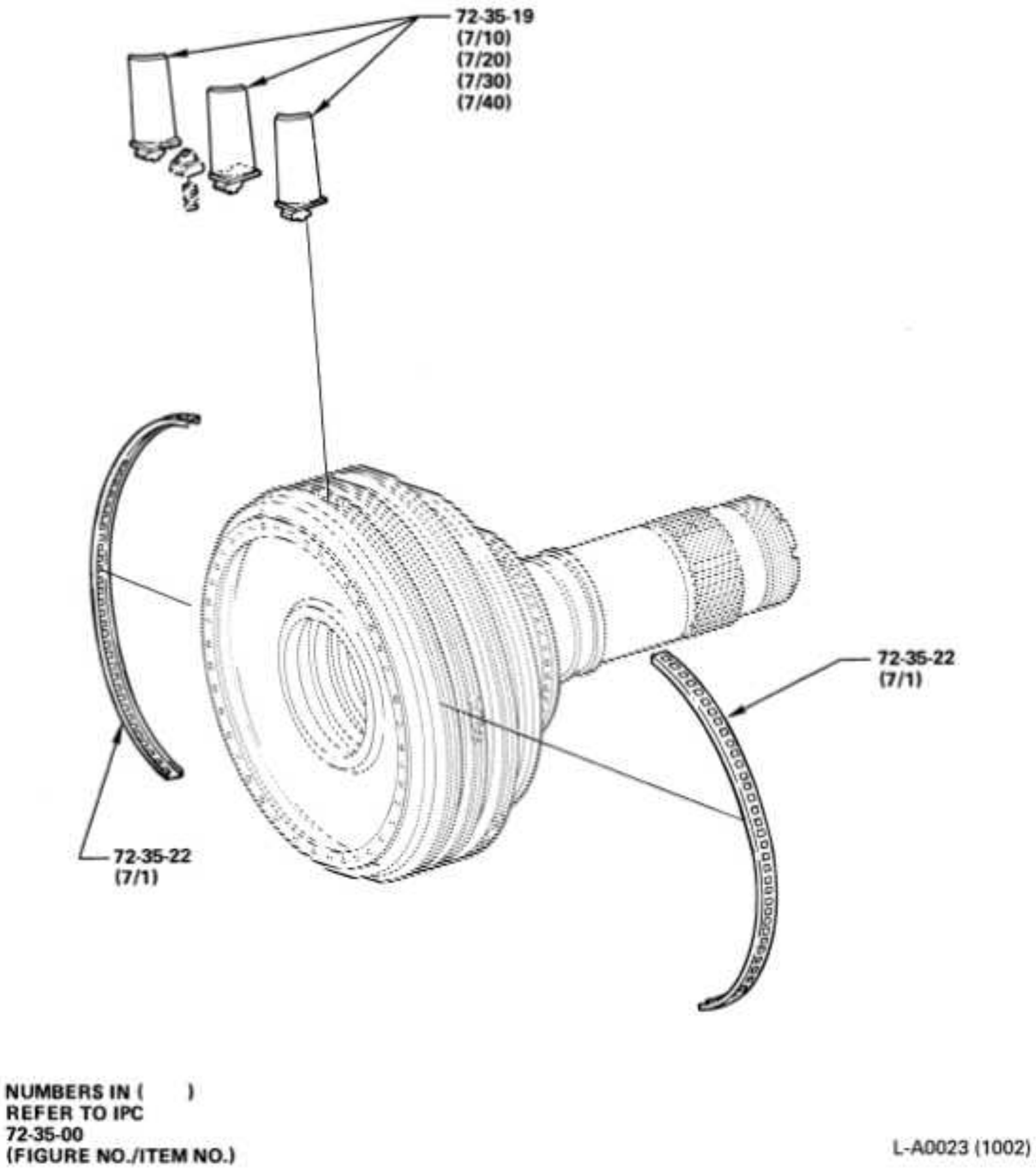
(6/1)
72-35-18
FWD
72-35-22
(6/2
72-35-22
(6/1)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
72-35-22
(6/2)
(72-35-22
(6/5)
L-D0254 (1002)
PW V

High Pressure Compressor (Ring Case Configuration)
Figure 1 (Sheet 11)
(Task 72−35−00−990−003)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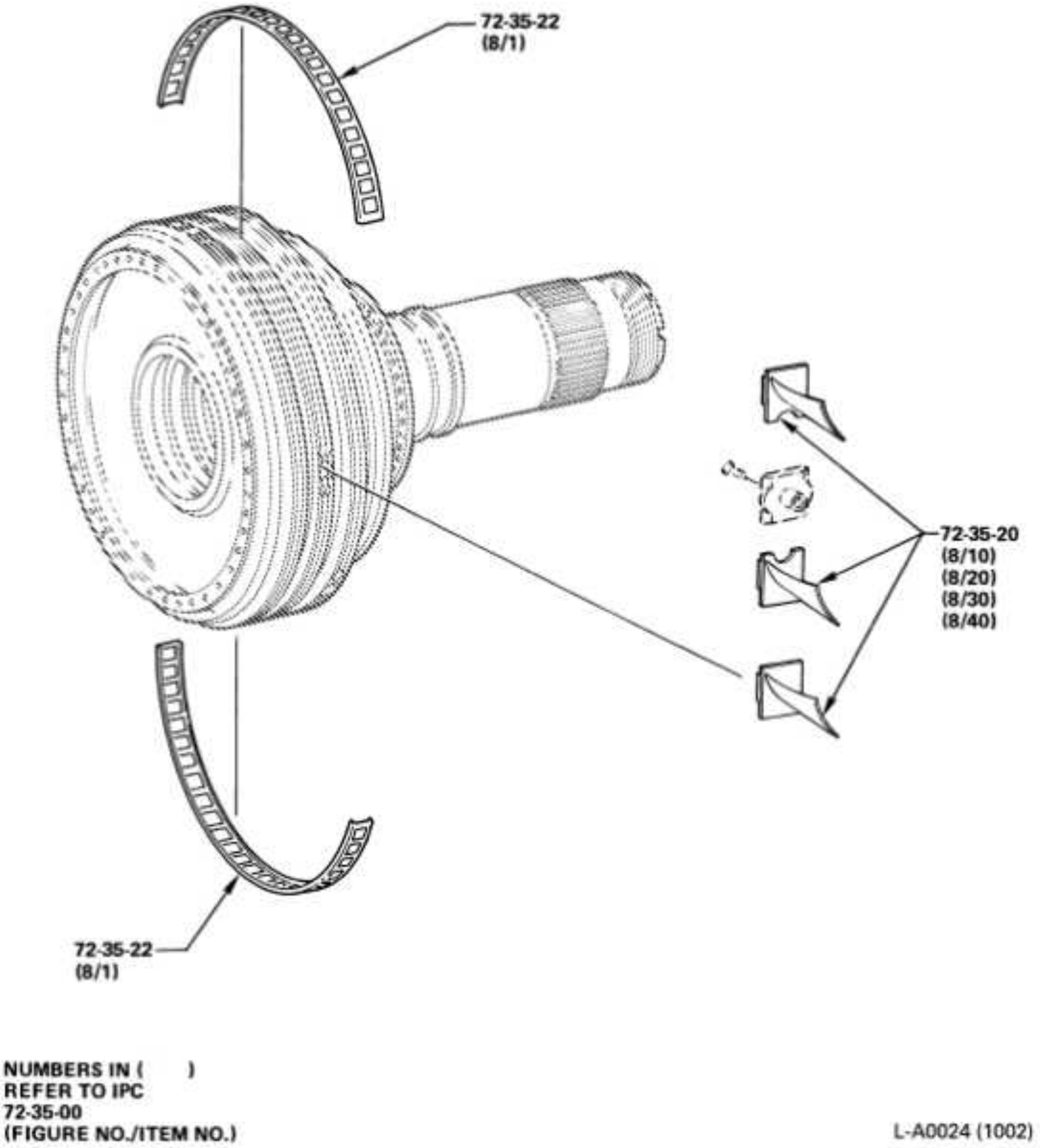
(7/1)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A0023 (1002)

High Pressure Compressor (HPC)
Figure 1 (Sheet 12)
(Task 72-35-00-990-003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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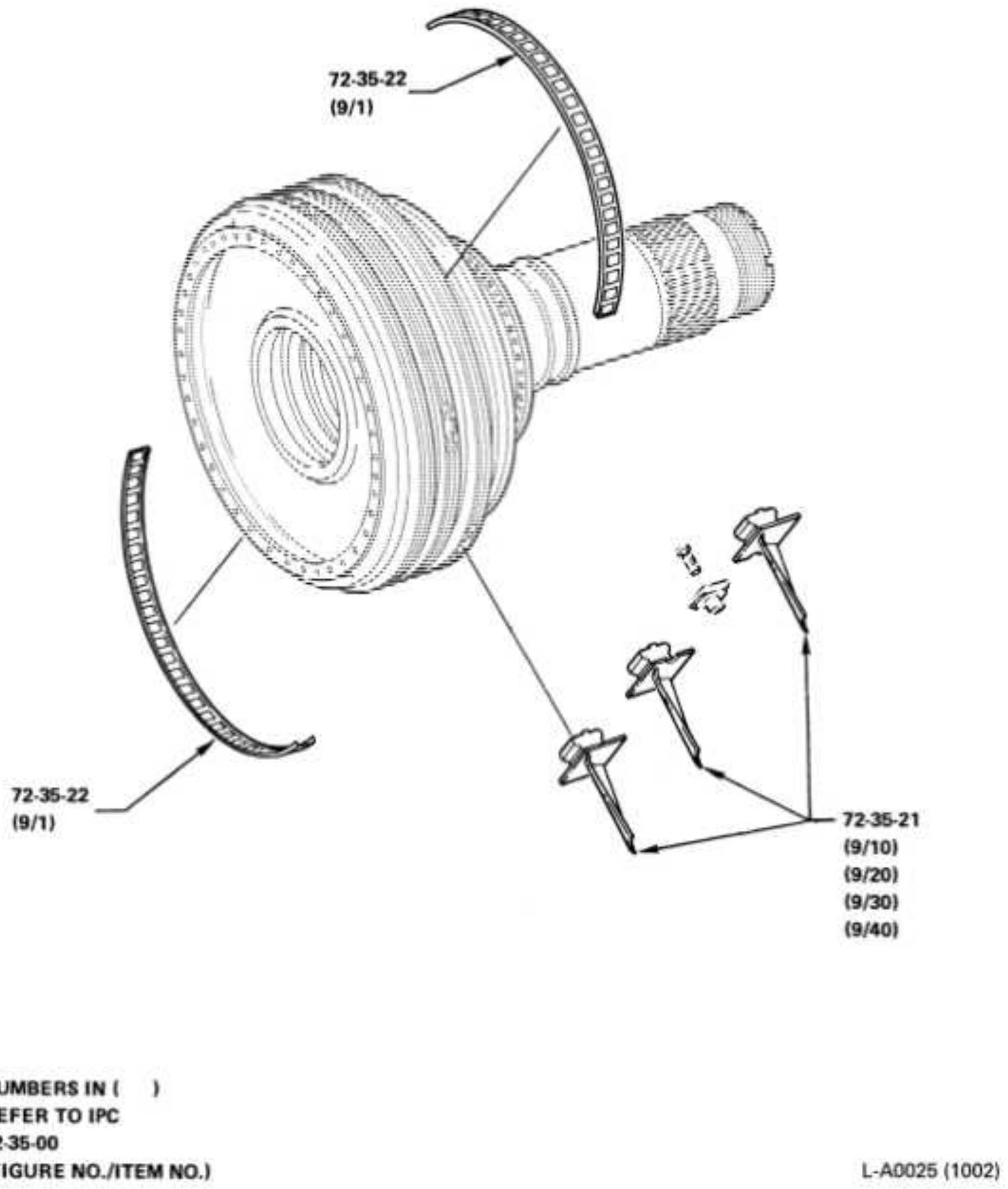
(8/30)
(8/40)
72-35-22
(8/1)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A0024 (1002)

High Pressure Compressor (HPC)
Figure 1 (Sheet 13)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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(9/20)
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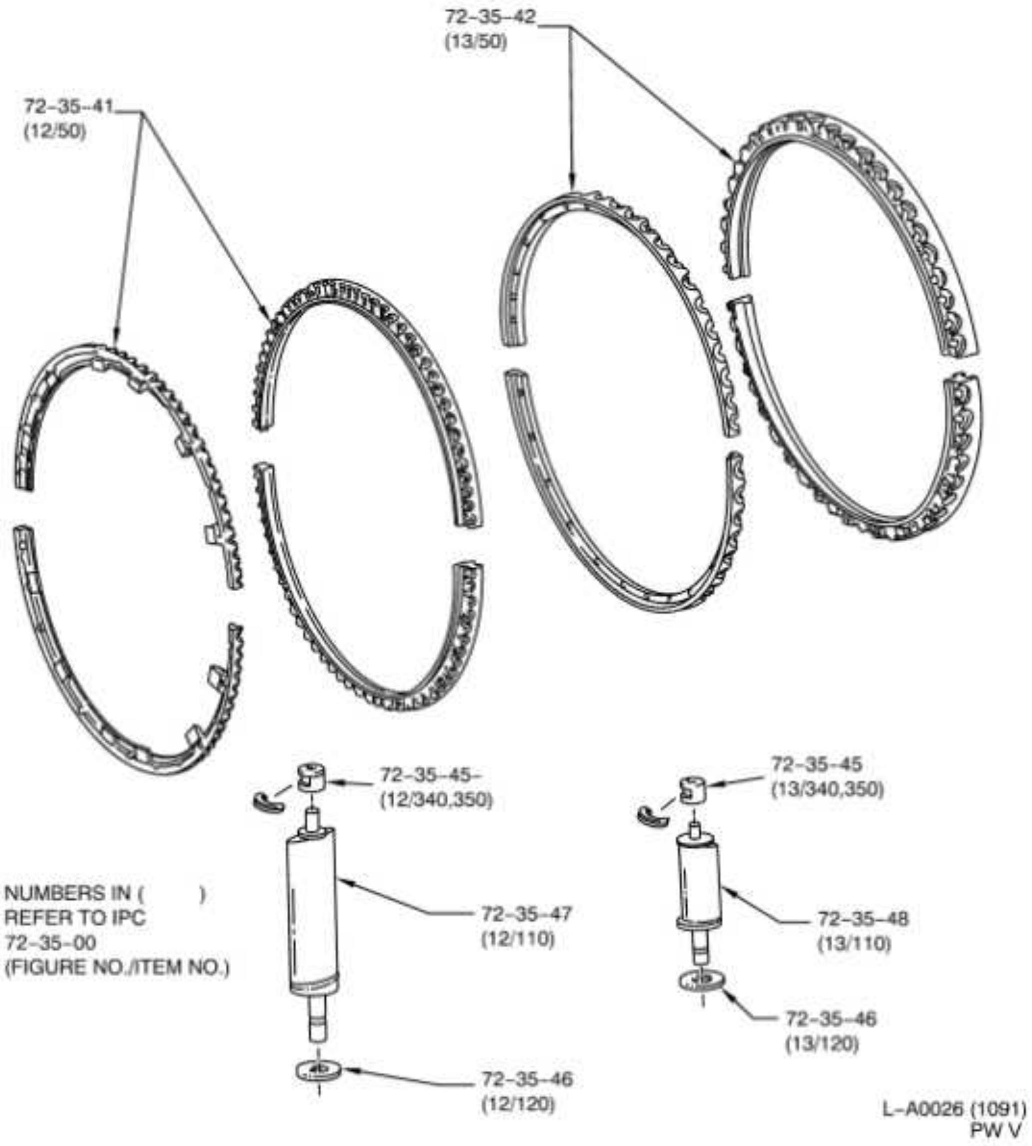
(9/40)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A0025 (1002)

High Pressure Compressor (HPC)
Figure 1 (Sheet 14)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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72-35-45
(13/340,350)
NUMBERS IN ( )
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(FIGURE NO./ITEM NO.)
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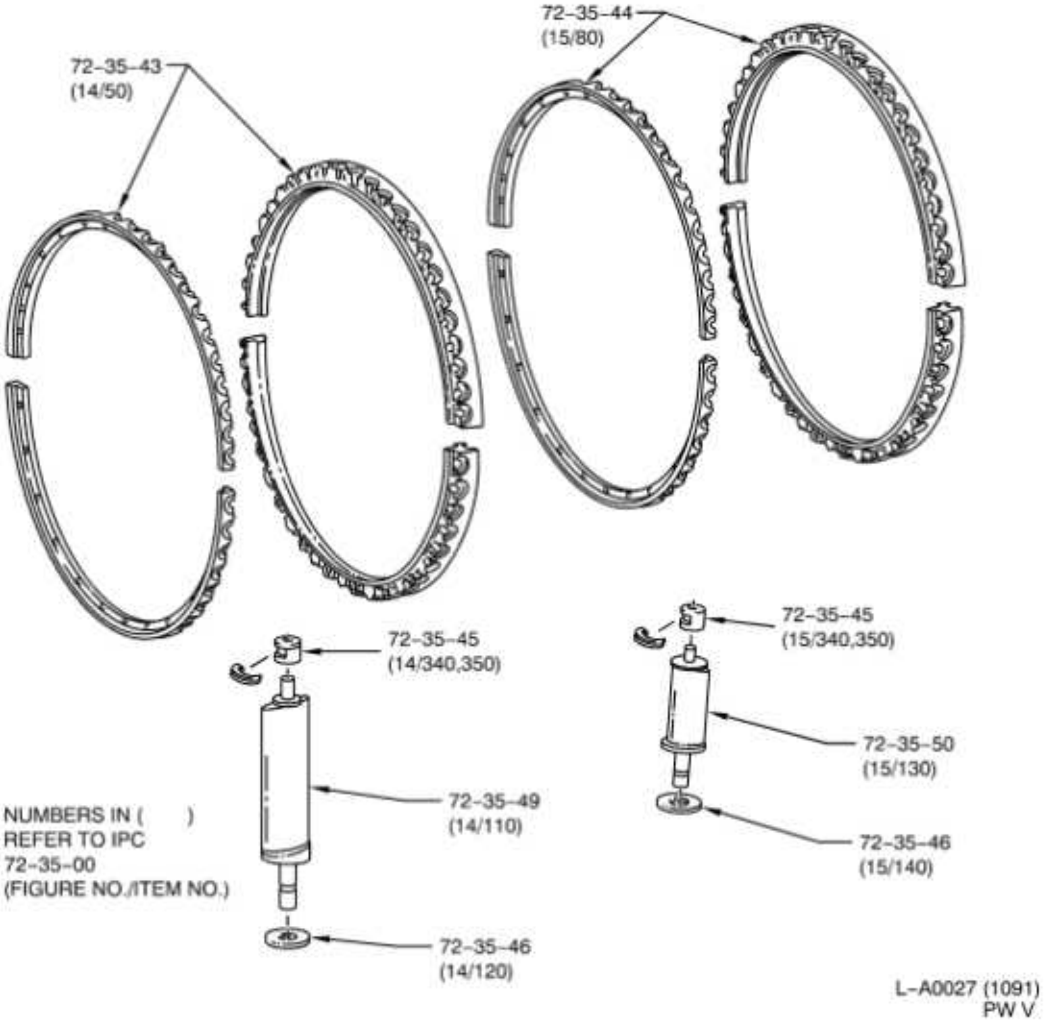
(12/110)
72-35-48
(13/110)
72-35-46
(13/120)
72-35-46
(12/120)
L-A0026 (1091)
PW V

High Pressure Compressor (HPC)
Figure 1 (Sheet 15)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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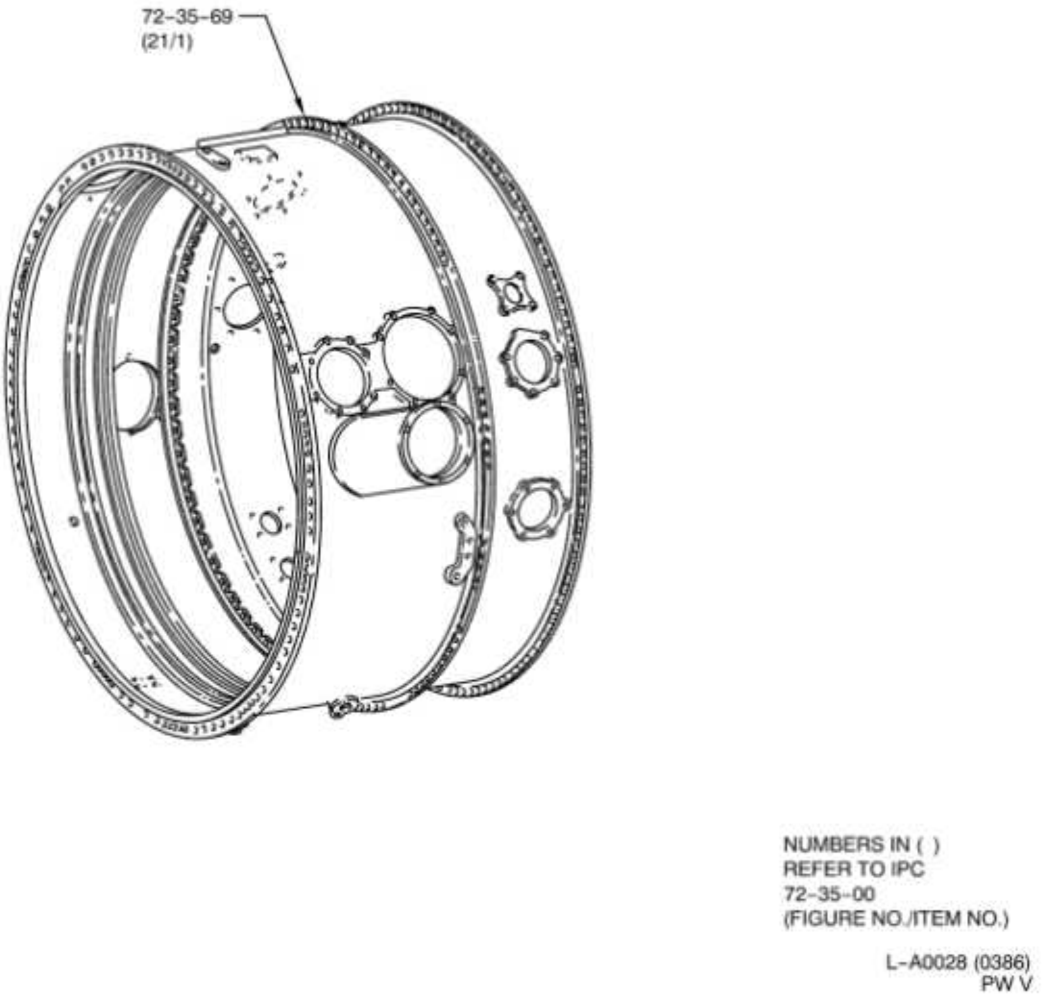
(15/130)
72-35-49
(14/110)
72-35-46
(15/140)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
72-35-46
(14/120)
L-A0027 (1091)
PW V

High Pressure Compressor (HPC)
Figure 1 (Sheet 16)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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REFER TO IPC
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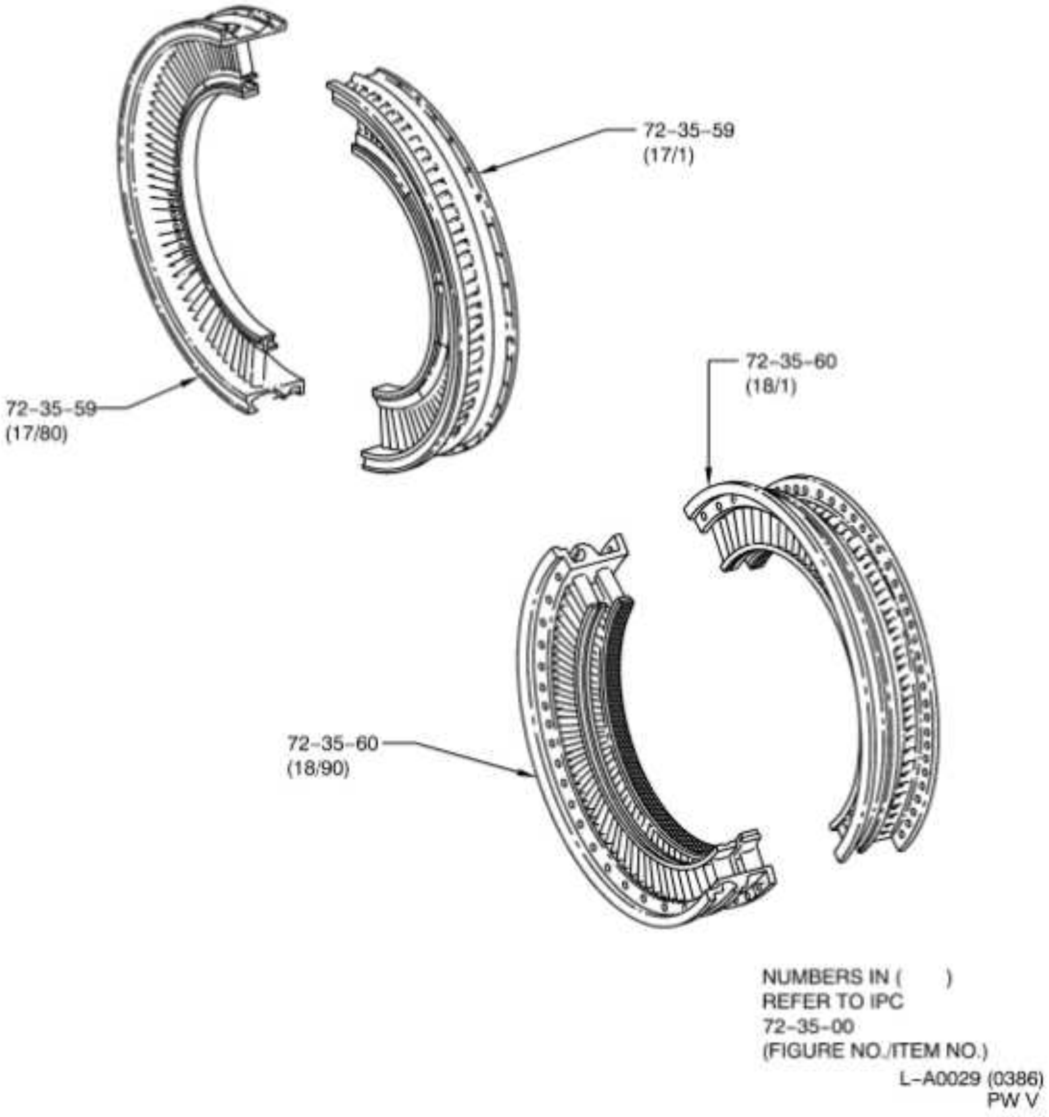
(FIGURE NO./ITEM NO.)
L-A0028 (0386)
PW V

High Pressure Compressor (HPC) (Non−Ring Case Configuration)
Figure 1 (Sheet 17)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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72−35−60
(18/1)
72−35−60
(18/90)
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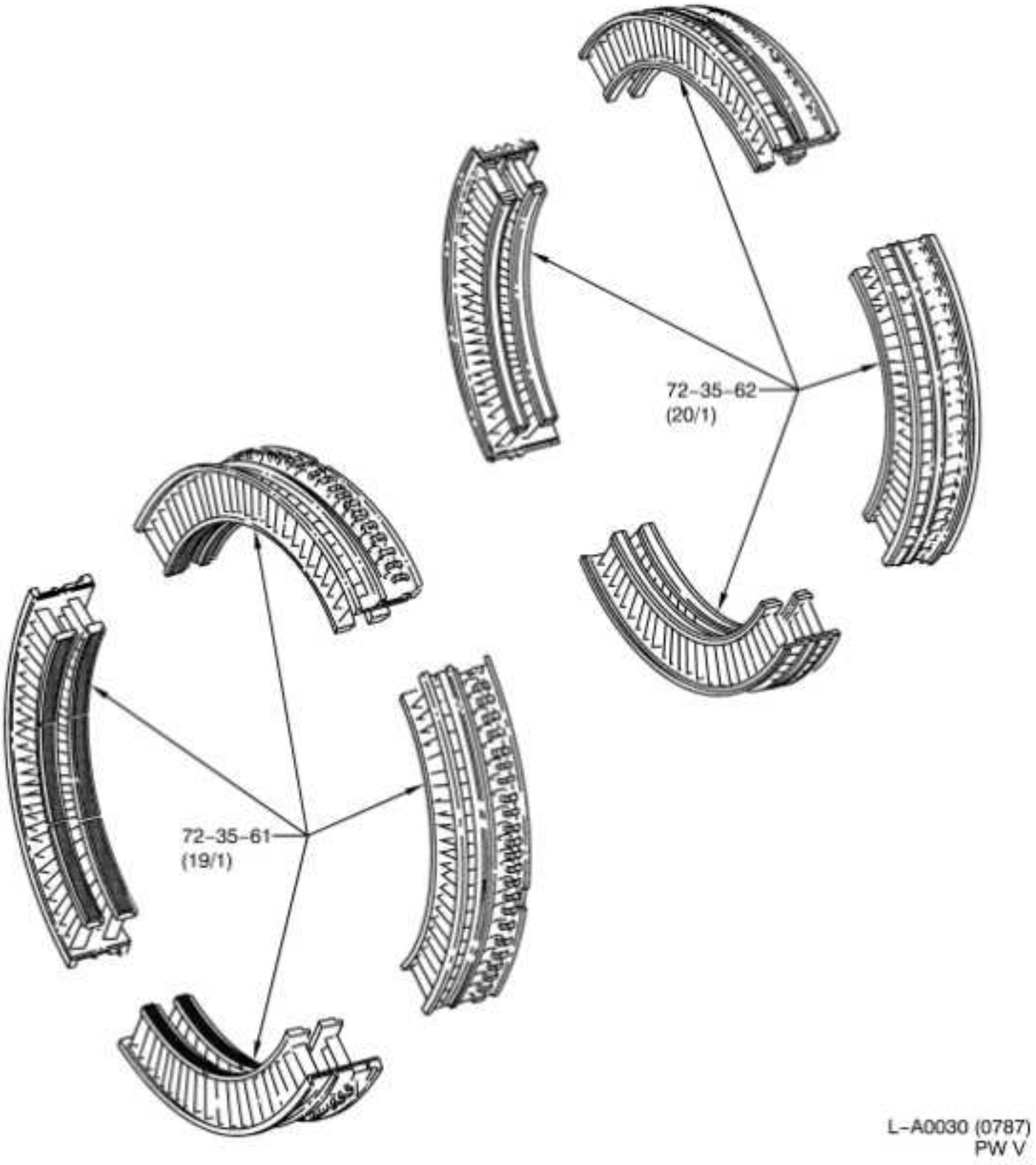
REFER TO IPC
72−35−00
(FIGURE NO./ITEM NO.)
L−A0029 (0386)
PW V

High Pressure Compressor (HPC) (Non−Ring Case Configuration)
Figure 1 (Sheet 18)
(Task 72−35−00−990−003)


72−35−62
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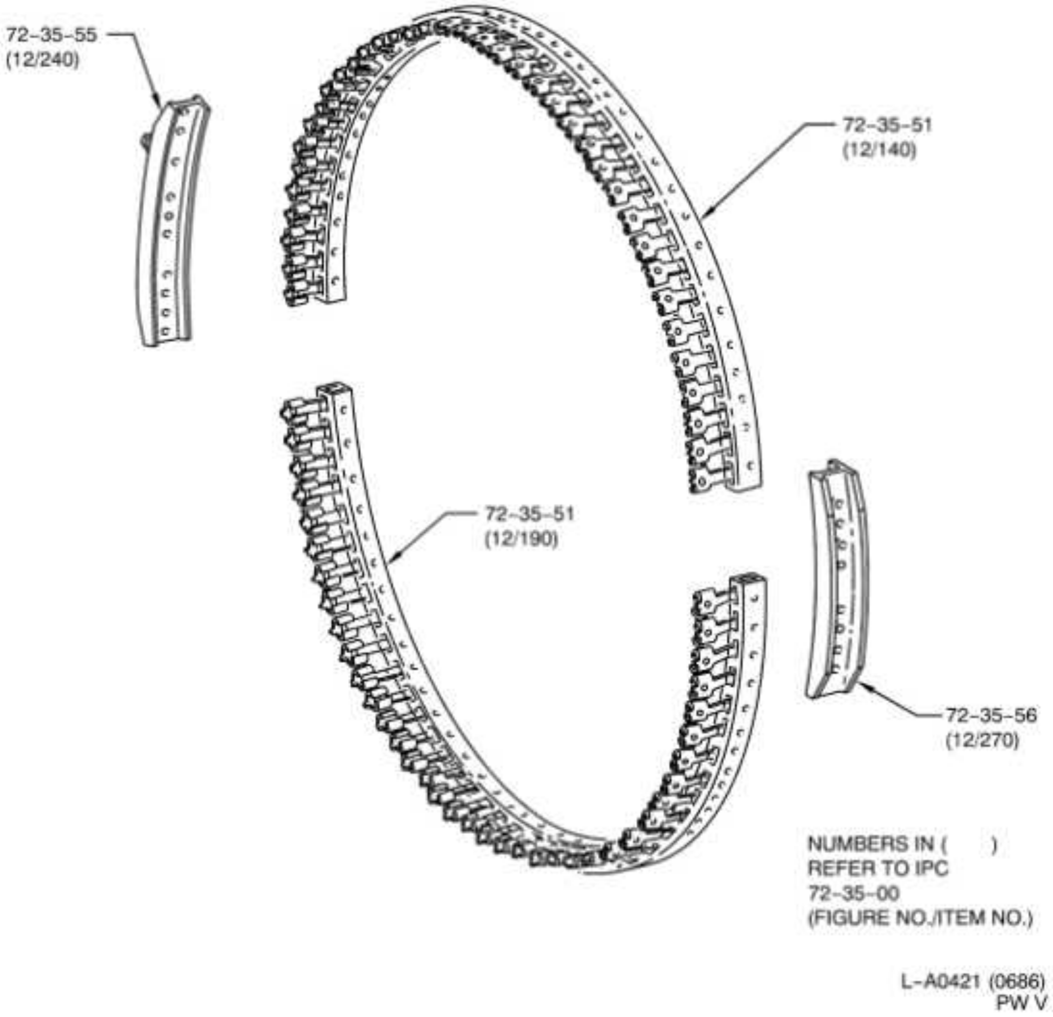
(19/1)
L−A0030 (0787)
PW V

High Pressure Compressor (HPC) (Non−Ring Case Configuration)
Figure 1 (Sheet 19)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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(12/270)
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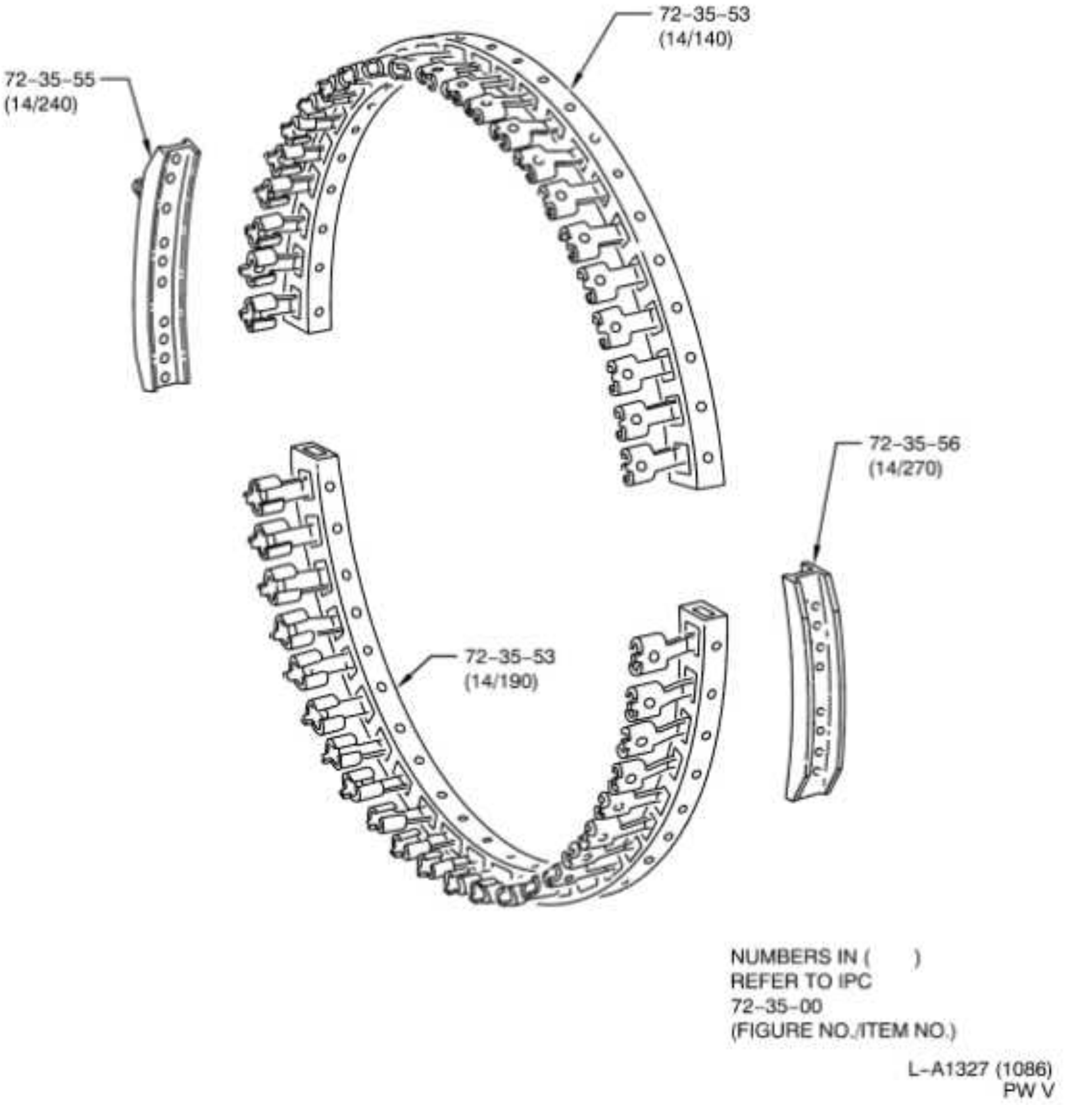
72-35-00
(FIGURE NO./ITEM NO.)
L-A0421 (0686)
PW V

High Pressure Compressor (HPC)
Figure 1 (Sheet 20)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) - HOW TO USE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(14/270)
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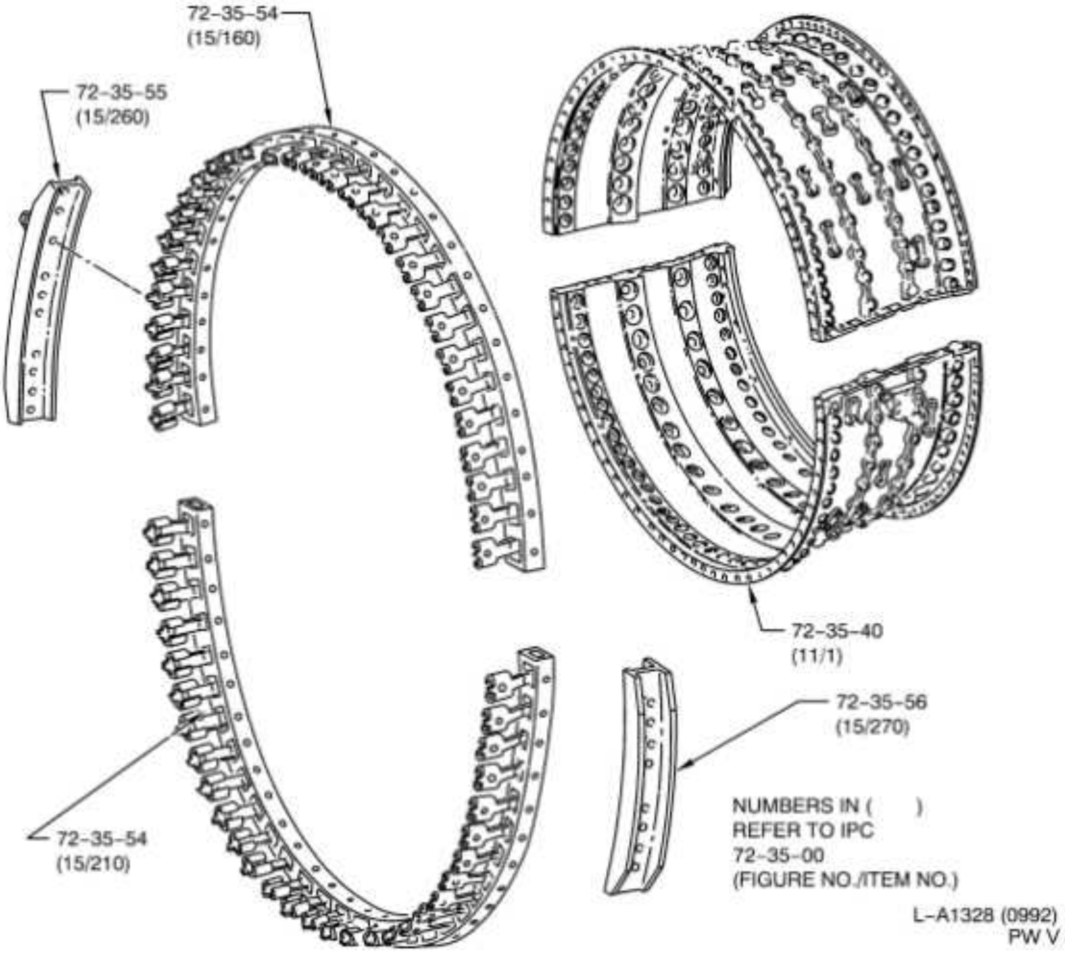
(14/190)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-A1327 (1086)
PW V

High Pressure Compressor (HPC)
Figure 1 (Sheet 21)
(Task 72-35-00-990-003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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72−35−55
(15/260)
72−35−40
(11/1)
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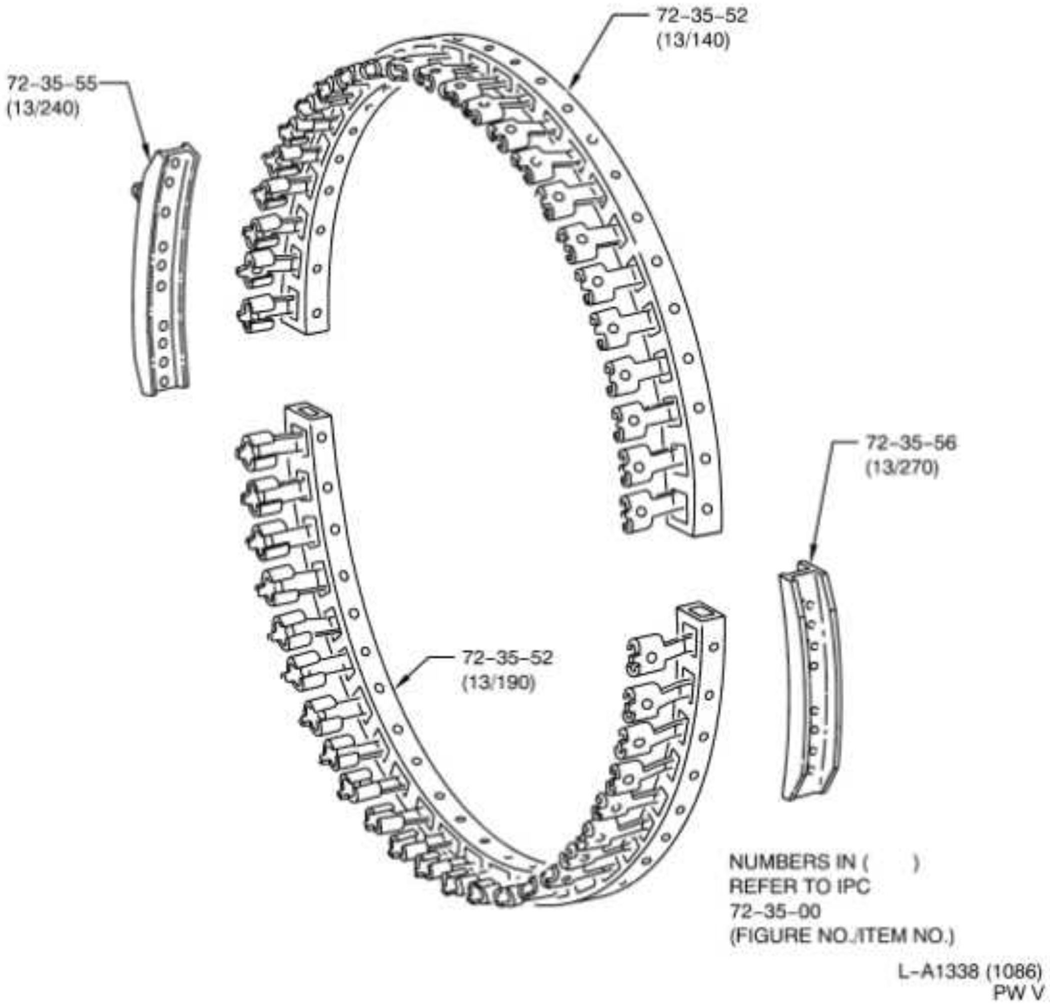
(15/270)
72−35−54
(15/210)
NUMBERS IN ( )
REFER TO IPC
72−35−00
(FIGURE NO./ITEM NO.)
L−A1328 (0992)
PW V

High Pressure Compressor (HPC)
Figure 1 (Sheet 22)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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(13/270)
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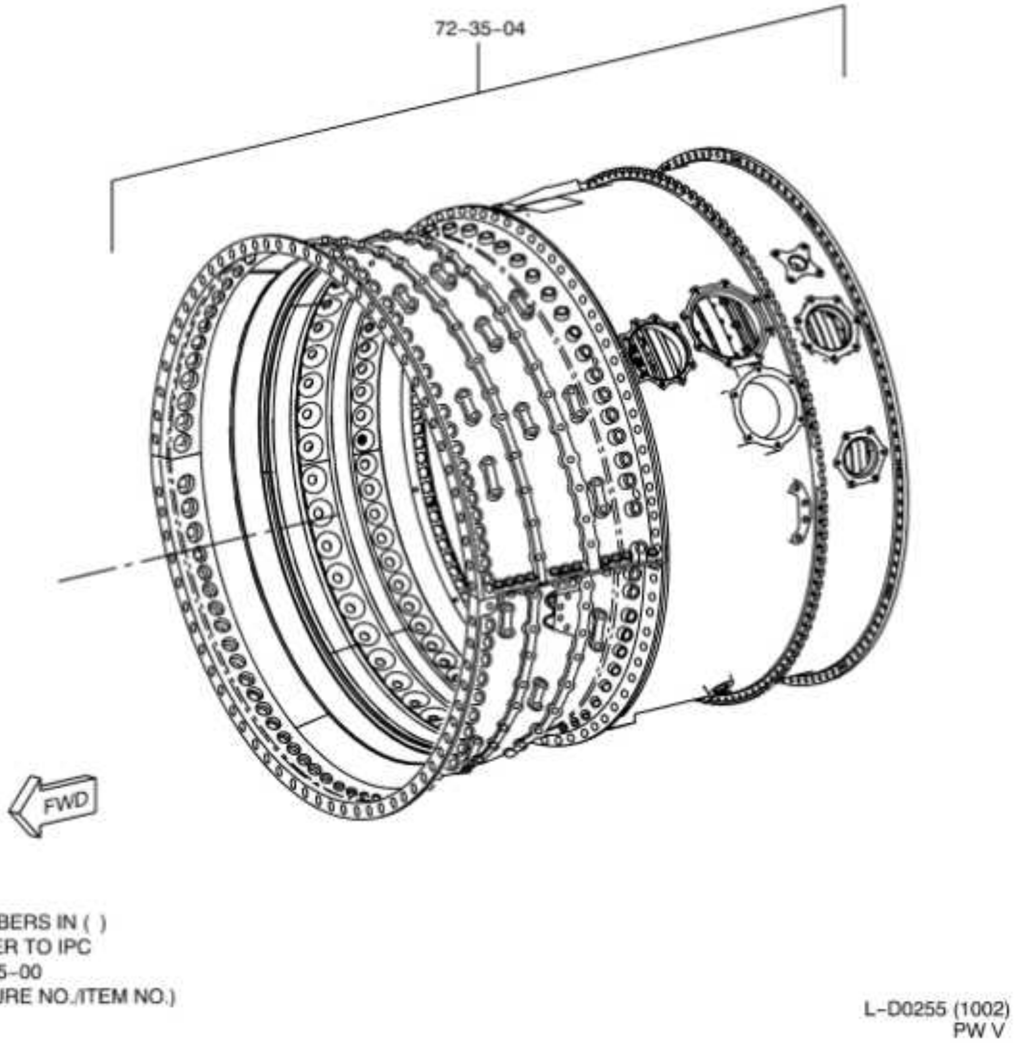
(13/190)
NUMBERS IN ( )
REFER TO IPC
72−35−00
(FIGURE NO./ITEM NO.)
L−A1338 (1086)
PW V

High Pressure Compressor (HPC)
Figure 1 (Sheet 23)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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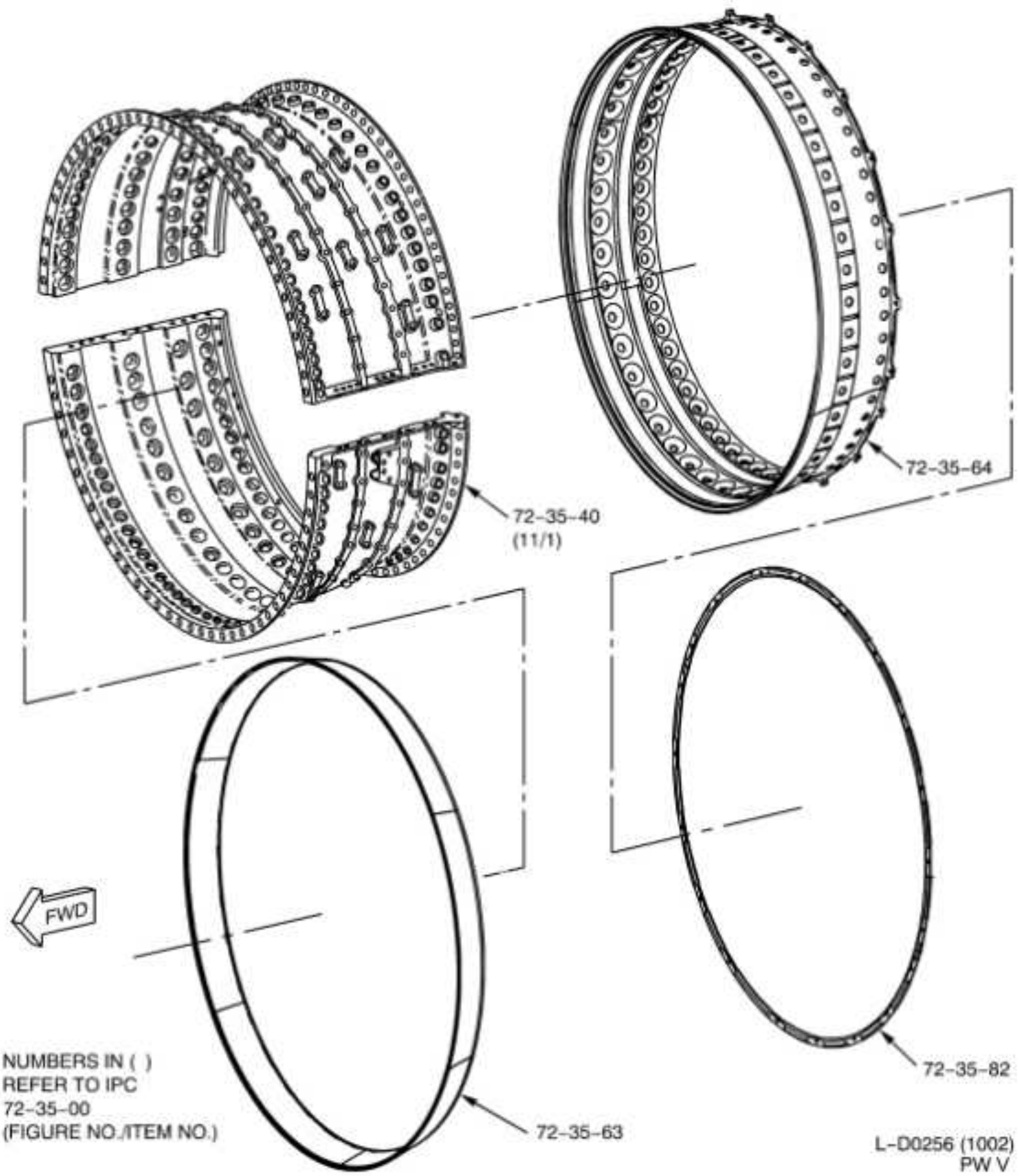
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-D0255 (1002)
PW V

High Pressure Compressor (Ring Case Configuration)
Figure 1 (Sheet 24)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE


72−35−64
72−35−40
(11/1)
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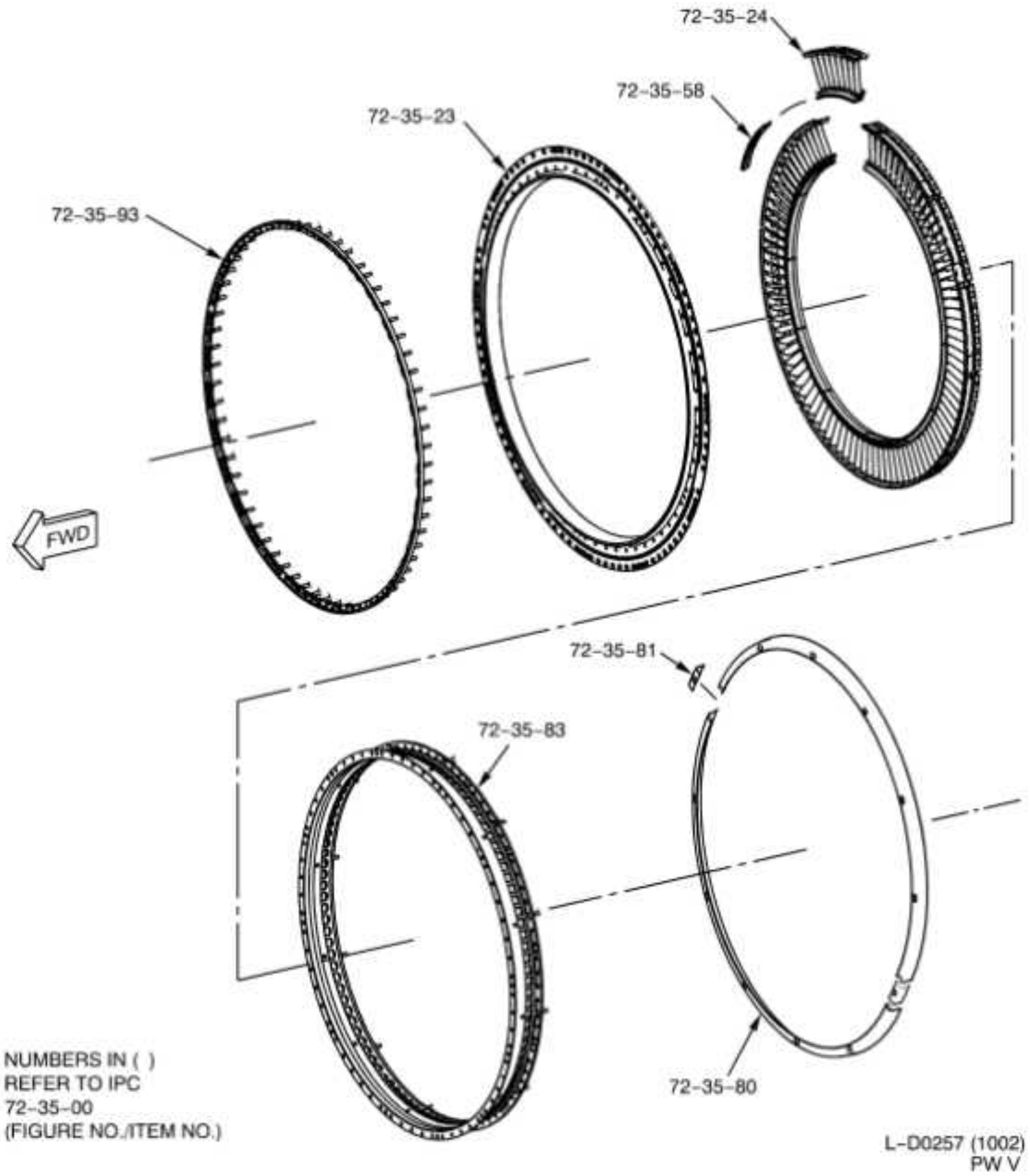
72−35−82
72−35−63
NUMBERS IN ( )
REFER TO IPC
72−35−00
(FIGURE NO./ITEM NO.)
L−D0256 (1002)
PW V

High Pressure Compressor (Ring Case Configuration)
Figure 1 (Sheet 25)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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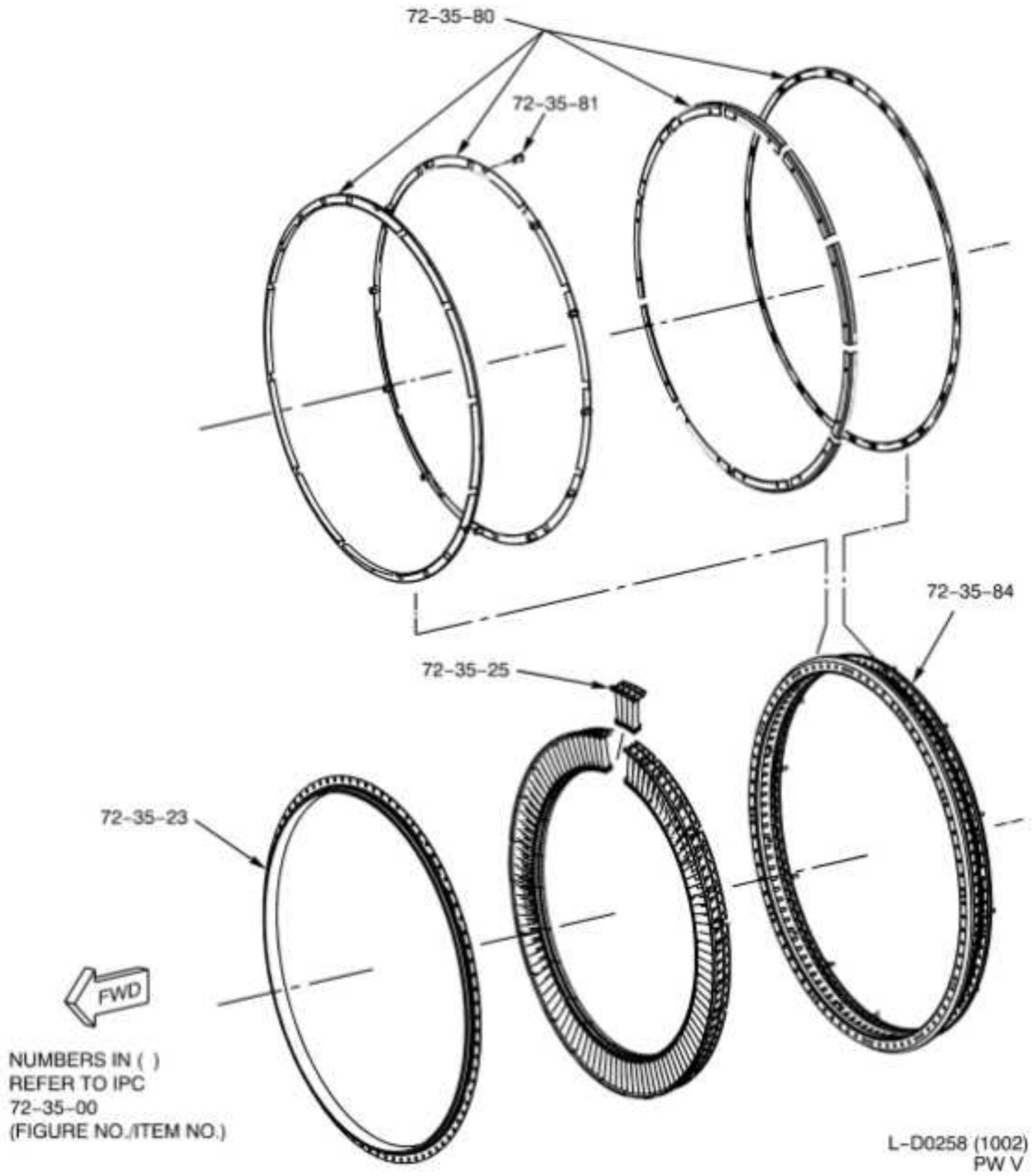
FWD
72-35-81
72-35-83
72-35-80
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-D0257 (1002)
PW V

High Pressure Compressor (Ring Case Configuration)
Figure 1 (Sheet 26)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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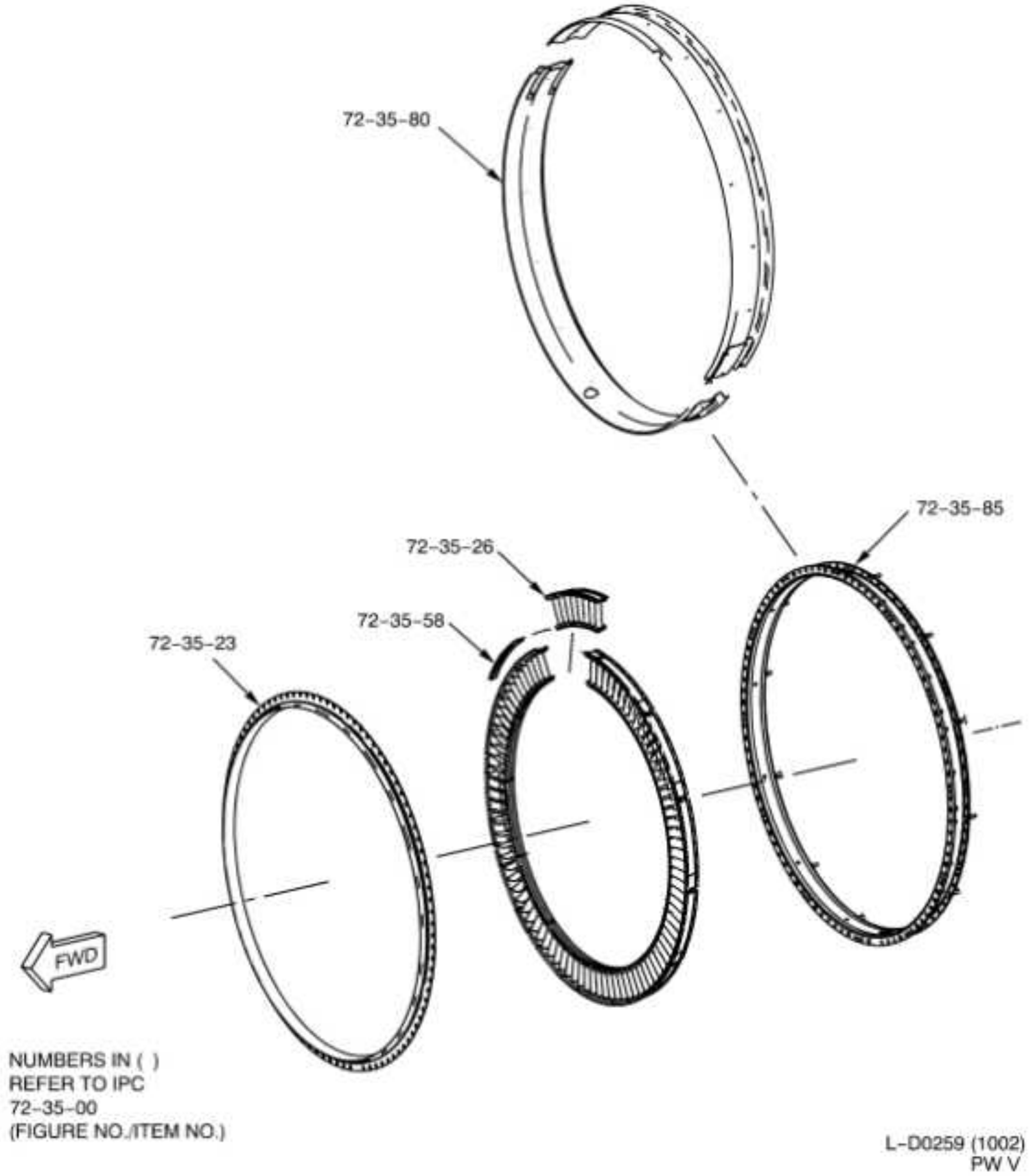
72-35-23
FWD
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-D0258 (1002)
PW V

High Pressure Compressor (Ring Case Configuration)
Figure 1 (Sheet 27)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE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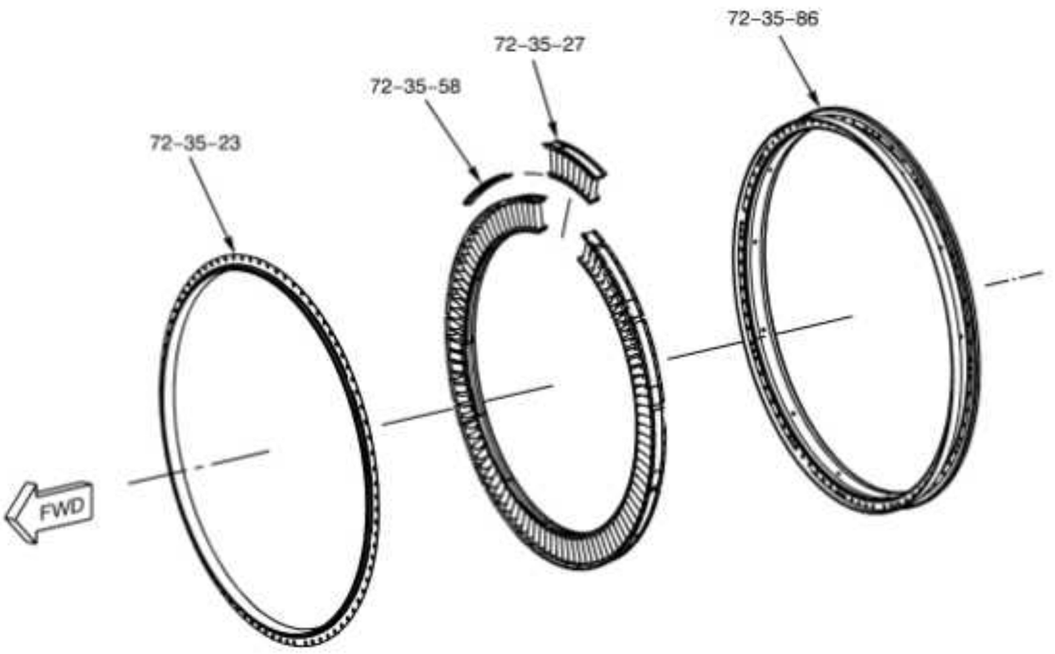
72-35-26
72-35-58
72-35-23
FWD
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-D0259 (1002)
PW V

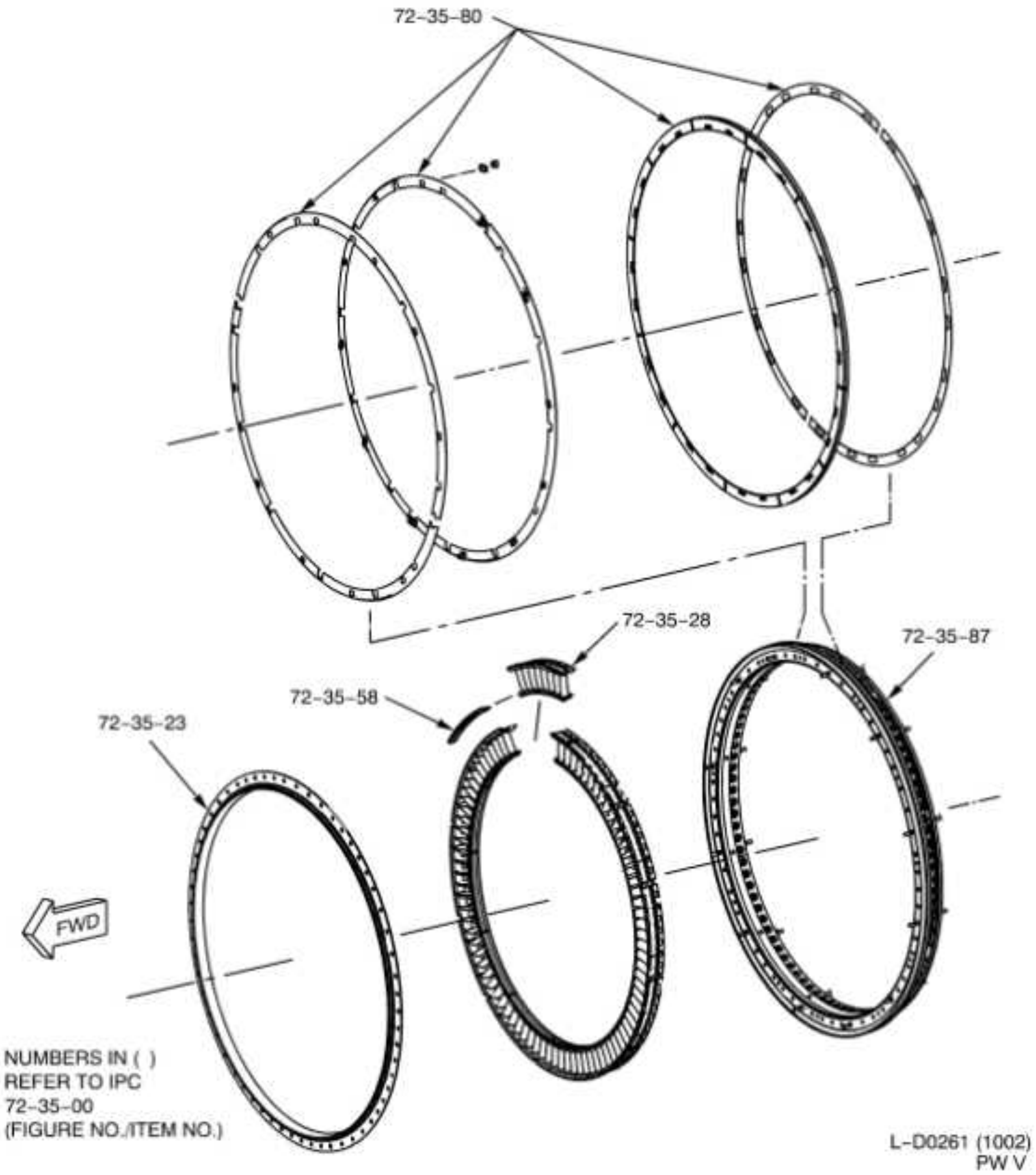
High Pressure Compressor (Ring Case Configuration)
Figure 1 (Sheet 28)
(Task 72−35−00−990−003)


72-35-86
72-35-27
72-35-58
72-35-23
FWD

NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)

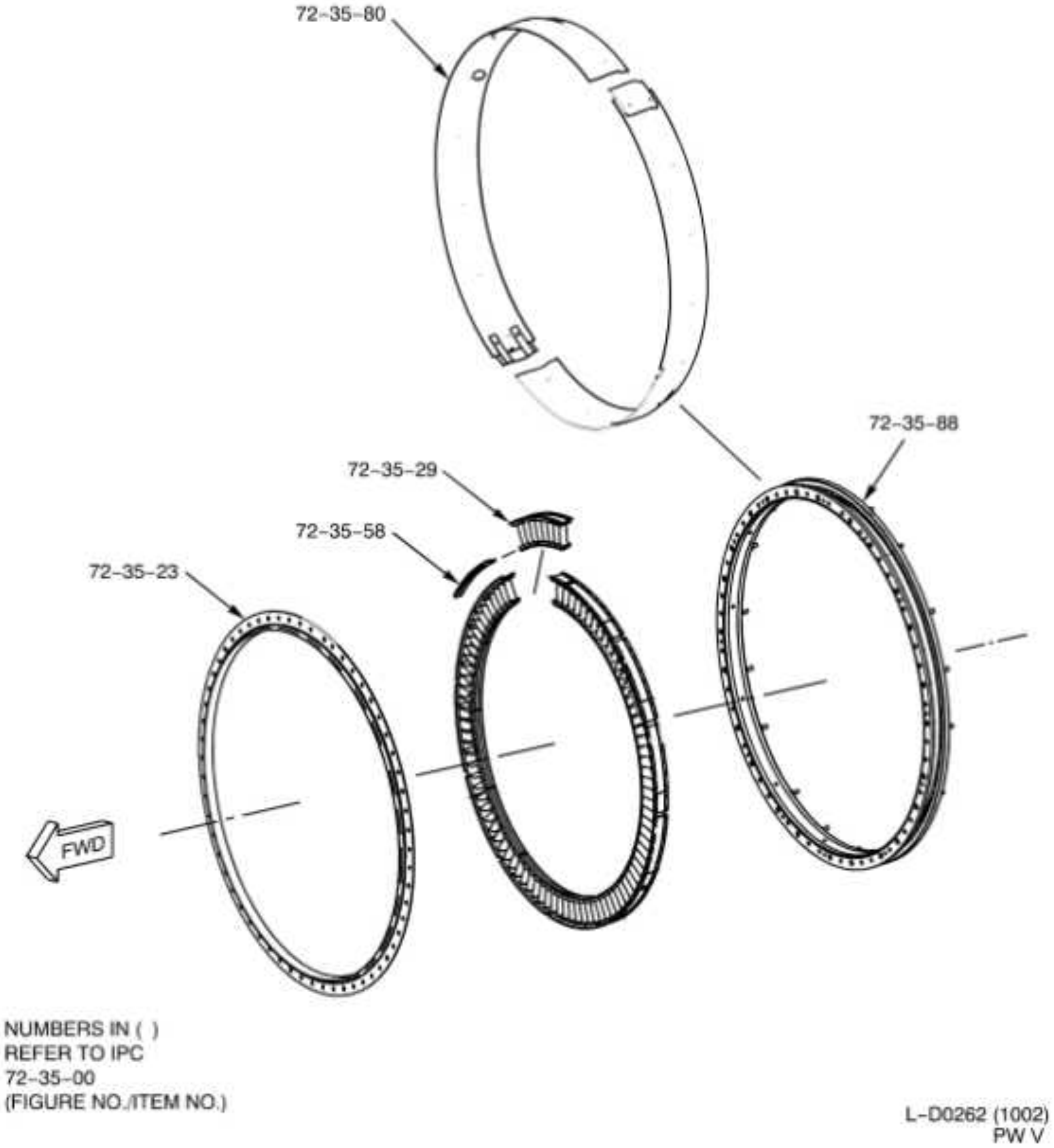
L-D0260 (1002)
PW V

High Pressure Compressor (Ring Case Configuration)
Figure 1 (Sheet 29)
(Task 72−35−00−990−003)

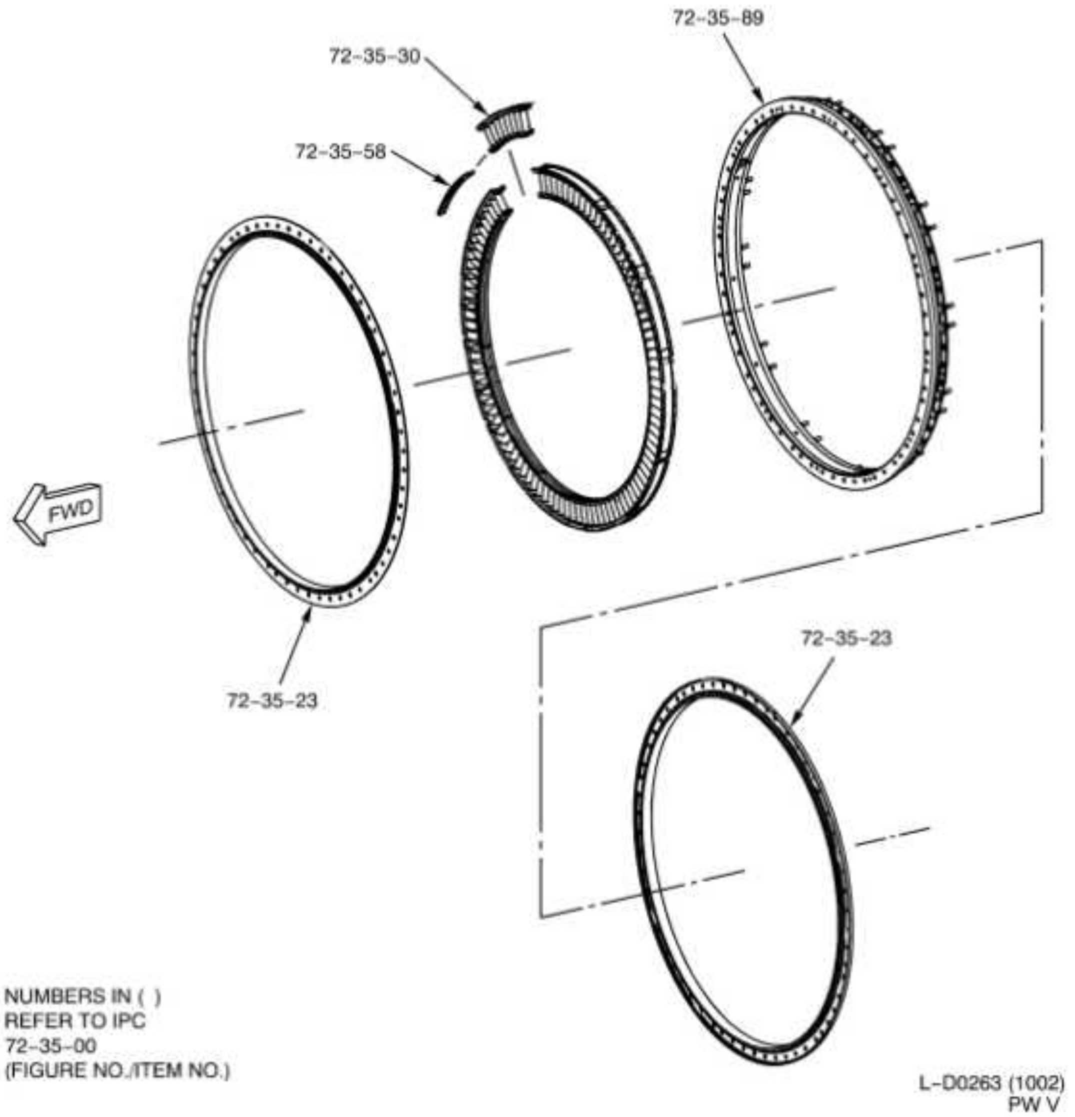

72-35-80
72-35-28
72-35-87
72-35-58
72-35-23
FWD
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-D0261 (1002)
PW V

High Pressure Compressor (Ring Case Configuration)
Figure 1 (Sheet 30)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE

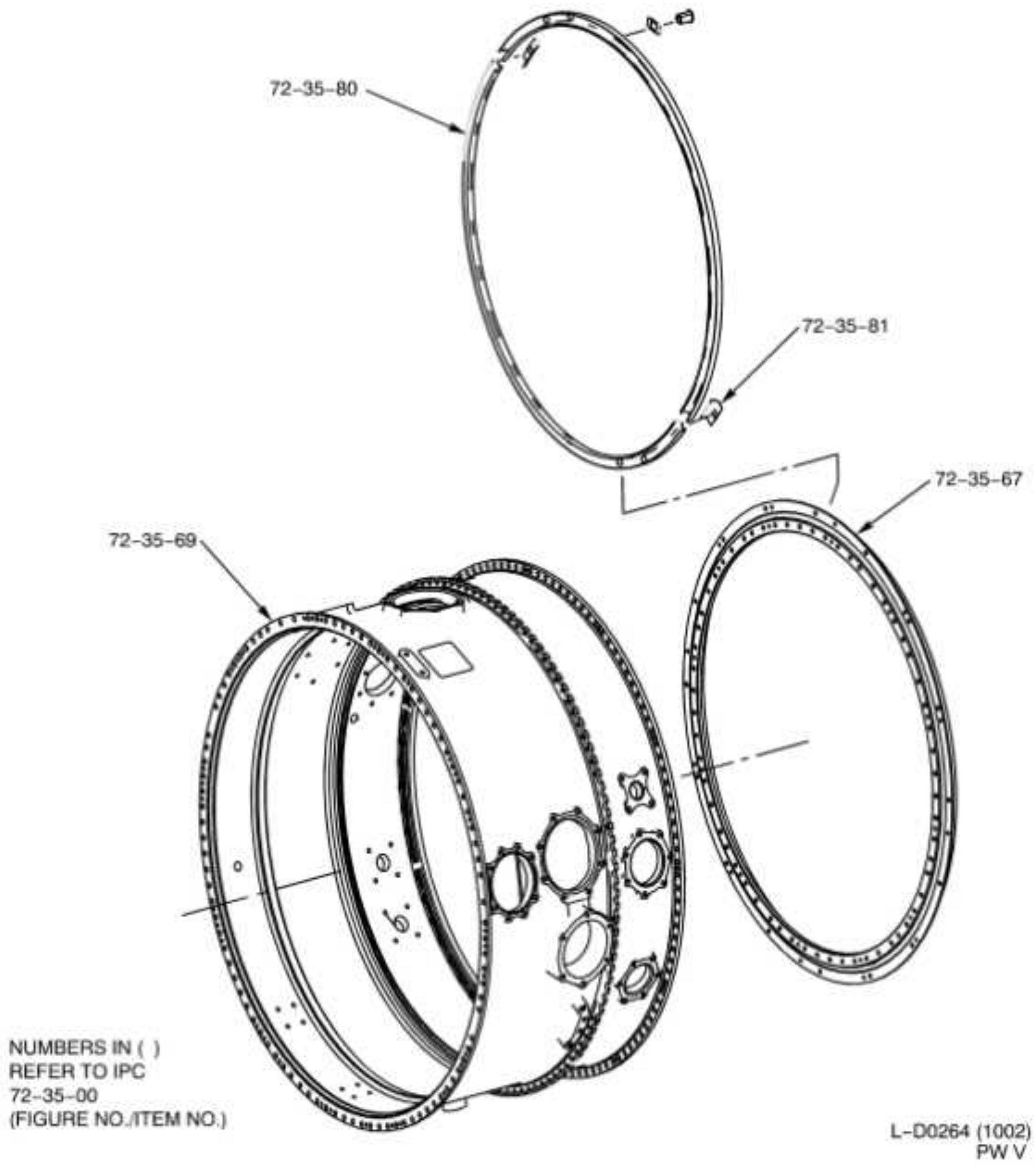

72-35-80
72-35-88
72-35-29
72-35-58
72-35-23
FWD
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-D0262 (1002)
PW V

High Pressure Compressor (Ring Case Configuration)
Figure 1 (Sheet 31)
(Task 72−35−00−990−003)


72-35-89
72-35-30
72-35-58
FWD
72-35-23
72-35-23
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
L-D0263 (1002)
PW V

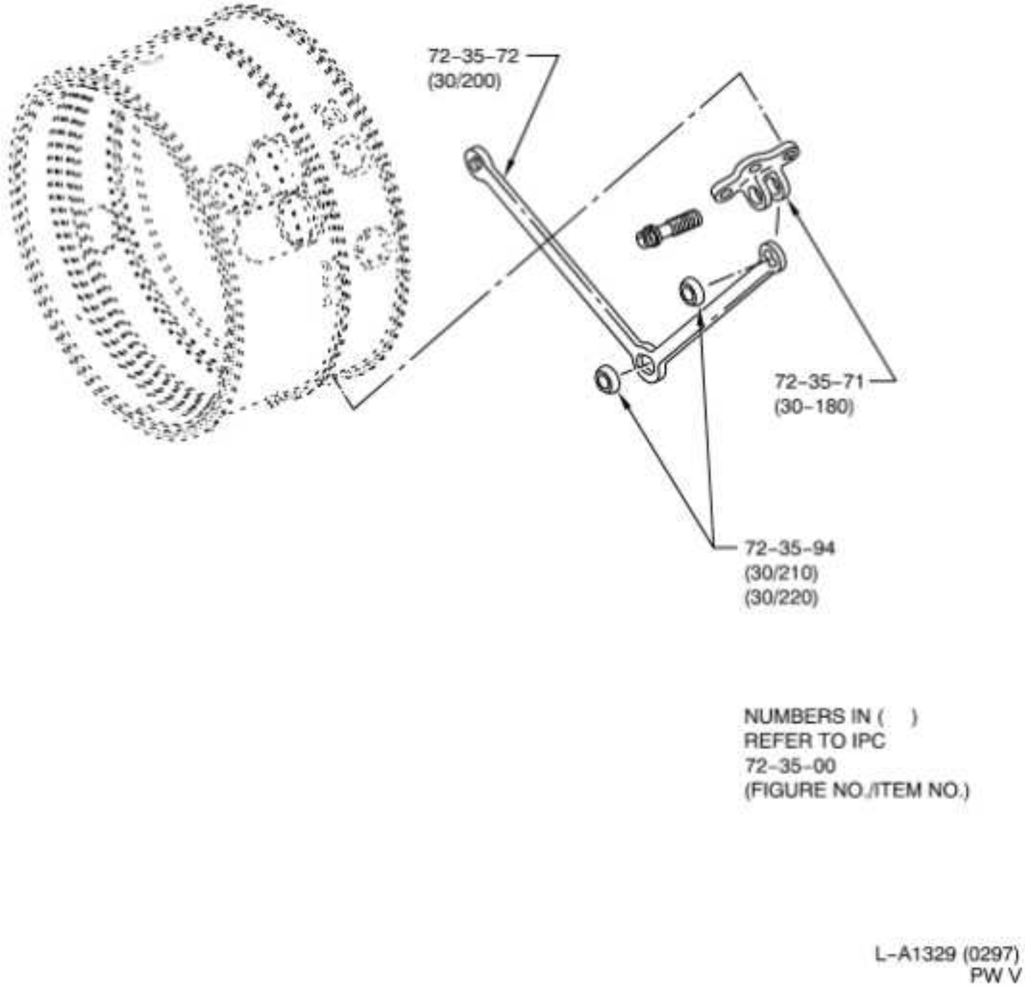
High Pressure Compressor (Ring Case Configuration)
Figure 1 (Sheet 32)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE


72−35−80
72−35−81
72−35−67
72−35−69
NUMBERS IN ( )
REFER TO IPC
72−35−00
(FIGURE NO./ITEM NO.)
L−D0264 (1002)
PW V

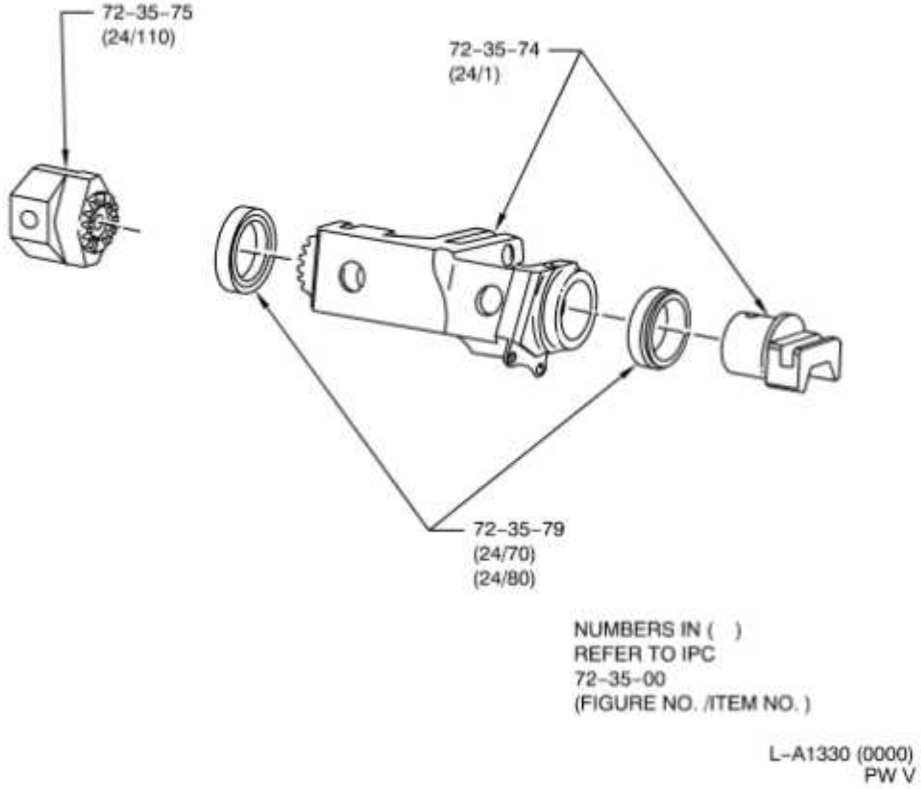
High Pressure Compressor (Ring Case Configuration)
Figure 1 (Sheet 33)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE


72−35−72
(30/200)
72−35−71
(30−180)
72−35−94
(30/210)
(30/220)
NUMBERS IN ( )
REFER TO IPC
72−35−00
(FIGURE NO./ITEM NO.)
L−A1329 (0297)
PW V

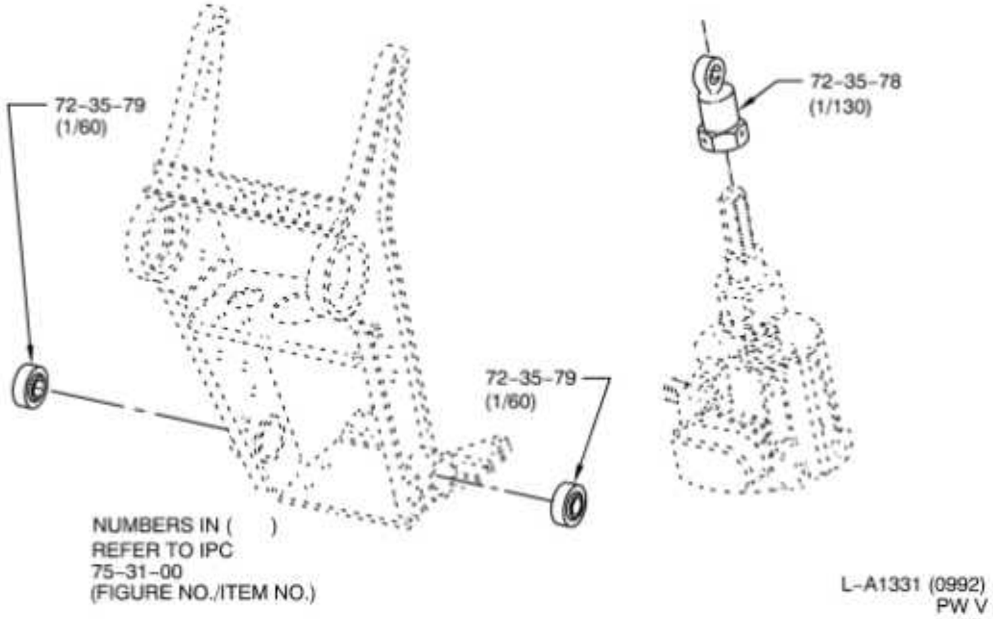
High Pressure Compressor (HPC)
Figure 1 (Sheet 34)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE


72-35-75
(24/110)
72-35-74
(24/1)
72-35-79
(24/70)
(24/80)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO. /ITEM NO.)
L-A1330 (0000)
PW V

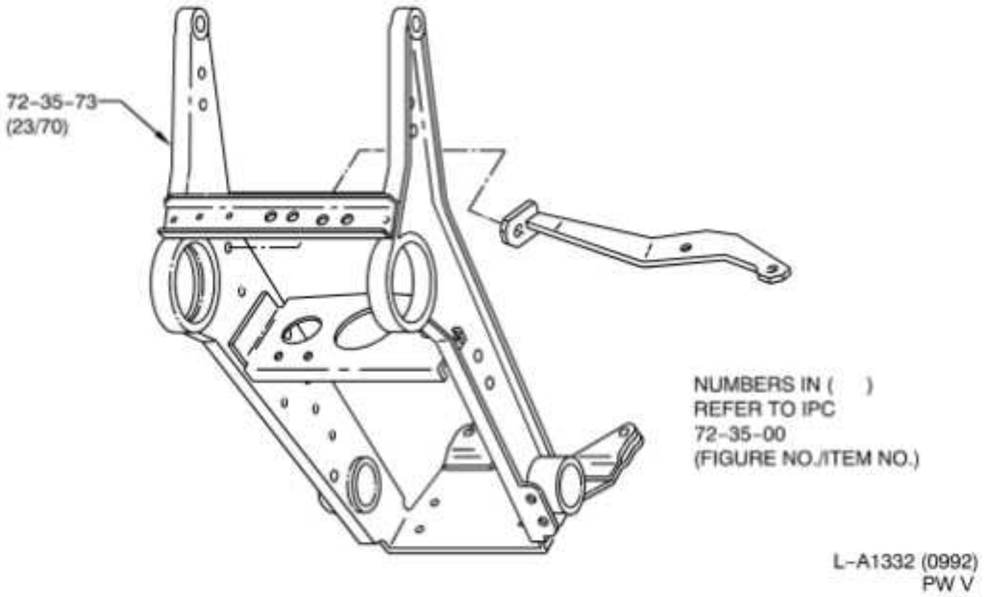
High Pressure Compressor (HPC)
Figure 1 (Sheet 35)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE

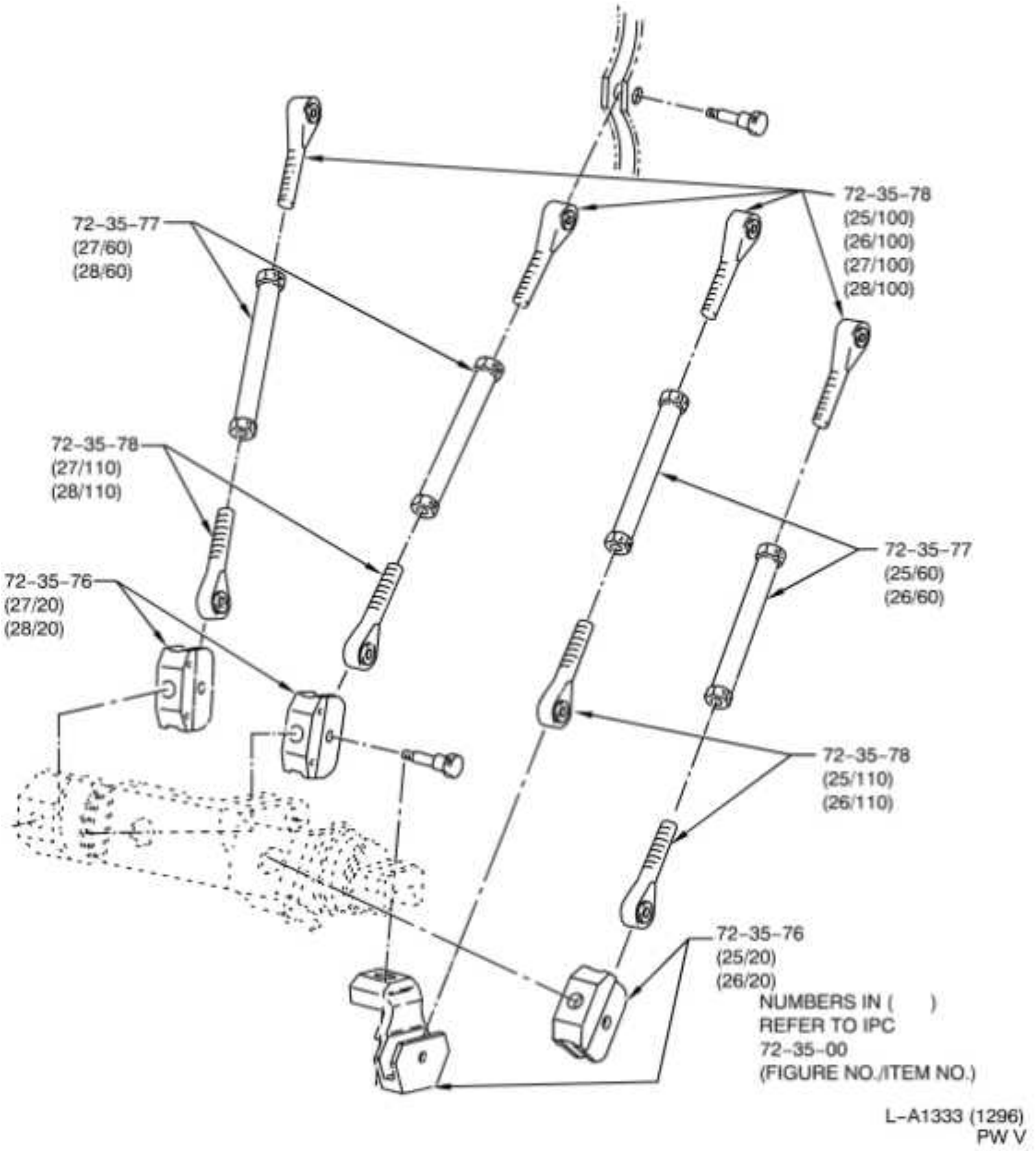

72−35−79
(1/60)
72−35−78
(1/130)
72−35−79
(1/60)
NUMBERS IN ( )
REFER TO IPC
75−31−00
(FIGURE NO./ITEM NO.)
L−A1331 (0992)
PW V

High Pressure Compressor (HPC)
Figure 1 (Sheet 36)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE

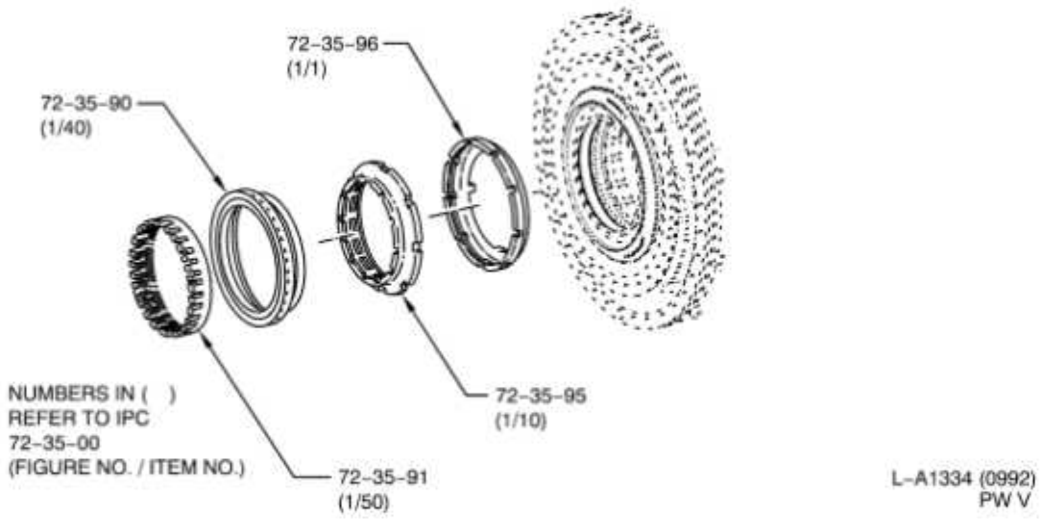

72−35−73
(23/70)
NUMBERS IN ( )
REFER TO IPC
72−35−00
(FIGURE NO./ITEM NO.)
L−A1332 (0992)
PW V

High Pressure Compressor (HPC)
Figure 1 (Sheet 37)
(Task 72−35−00−990−003)


72−35−77
(27/60)
(28/60)
72−35−78
(25/100)
(26/100)
(27/100)
(28/100)
72−35−78
(27/110)
(28/110)
72−35−76
(27/20)
(28/20)
72−35−77
(25/60)
(26/60)
72−35−78
(25/110)
(26/110)
72−35−76
(25/20)
(26/20)
NUMBERS IN ( )
REFER TO IPC
72−35−00
(FIGURE NO./ITEM NO.)
L−A1333 (1296)
PW V

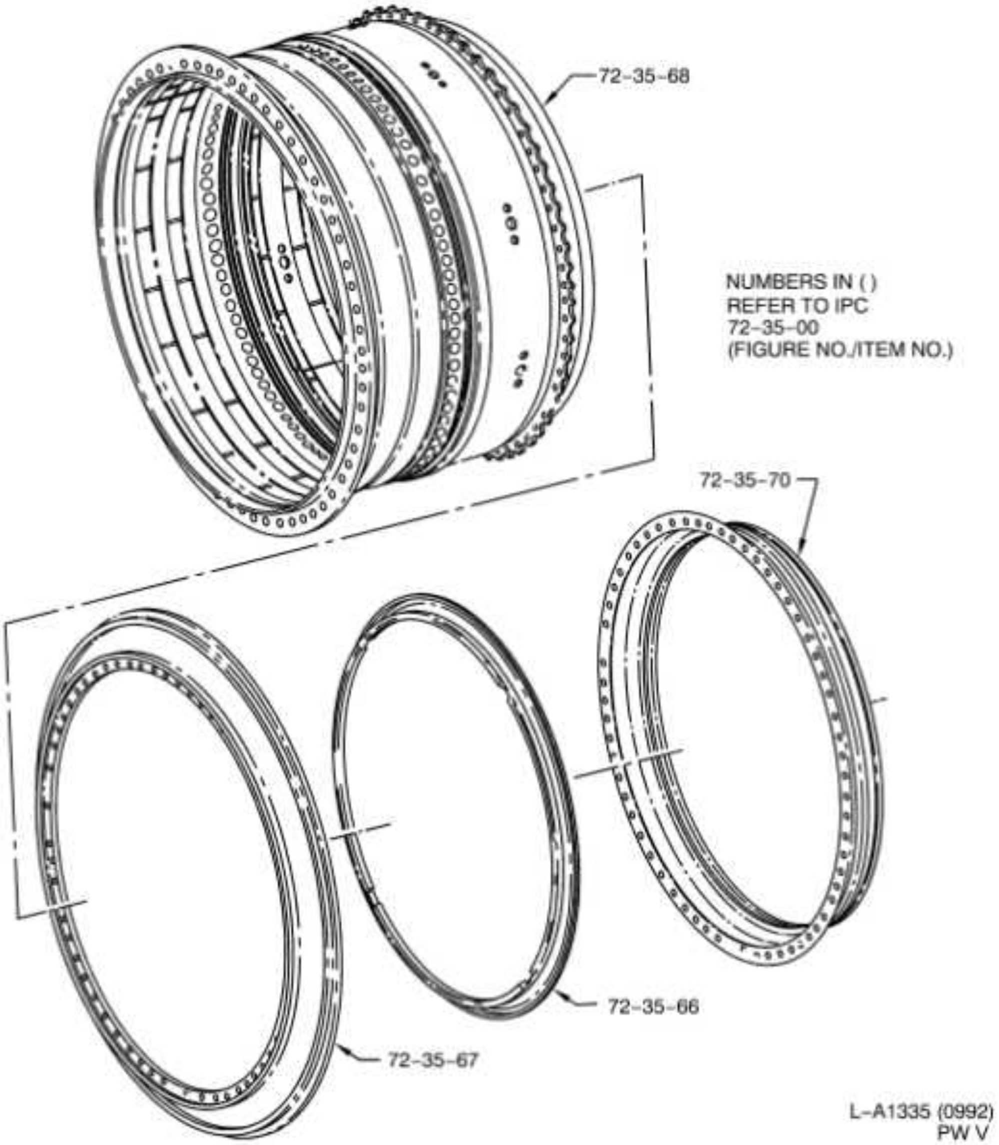
High Pressure Compressor (HPC)
Figure 1 (Sheet 38)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE


72-35-96
(1/1)
72-35-90
(1/40)
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO. / ITEM NO.)
72-35-95
(1/10)
72-35-91
(1/50)
L-A1334 (0992)
PW V

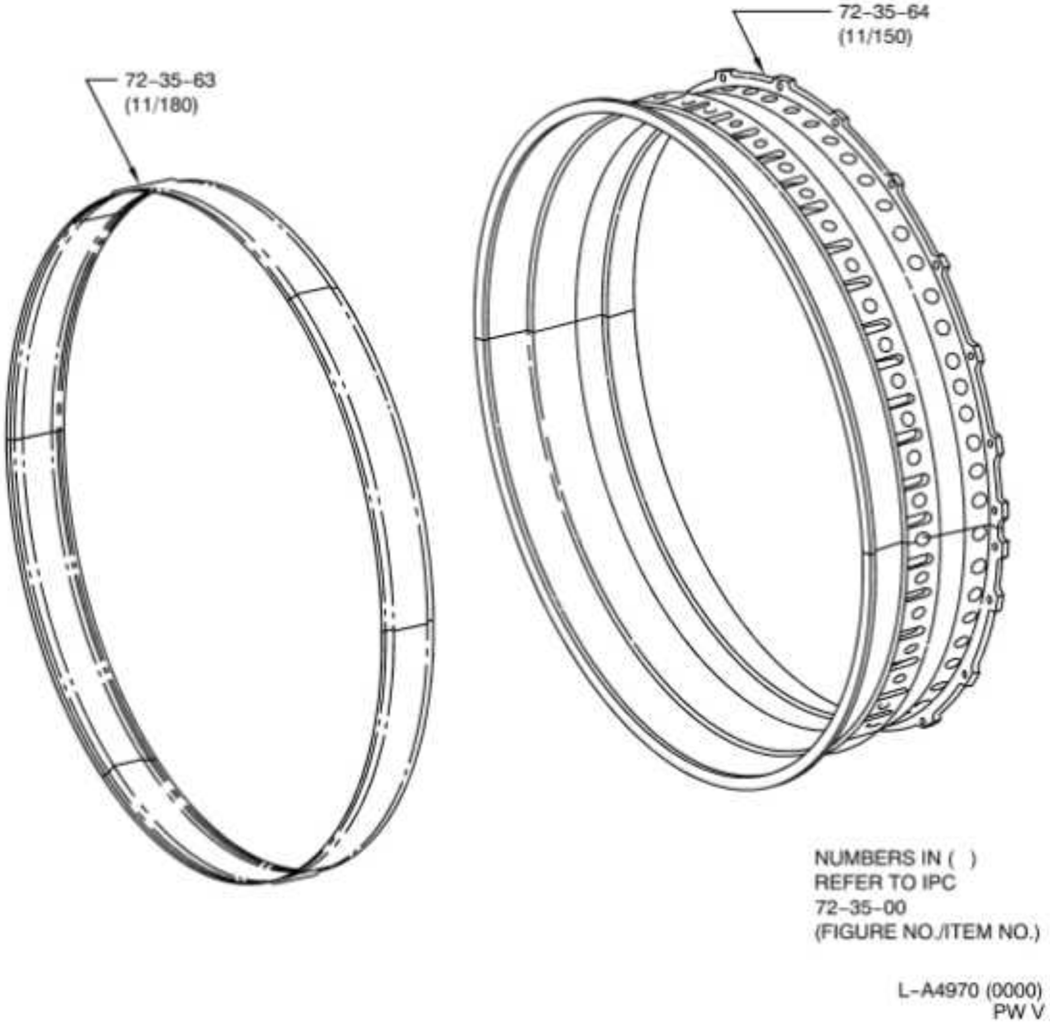
High Pressure Compressor (HPC)
Figure 1 (Sheet 39)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE


72-35-68
NUMBERS IN ( )
REFER TO IPC
72-35-00
(FIGURE NO./ITEM NO.)
72-35-70
72-35-66
72-35-67
L-A1335 (0992)
PW V

High Pressure Compressor (HPC) (Non−Ring Case Configuration)
Figure 1 (Sheet 40)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) − HOW TO USE


72−35−64
(11/150)
72−35−63
(11/180)
NUMBERS IN ( )
REFER TO IPC
72−35−00
(FIGURE NO./ITEM NO.)
L−A4970 (0000)
PW V

High Pressure Compressor (HPC) (Non−Ring Case Configuration)
Figure 1 (Sheet 41)
(Task 72−35−00−990−003)

HIGH PRESSURE COMPRESSOR (HPC) - DESCRIPTION AND OPERATION

Task 72-35-00-990-002:

1. High Pressure Compressor (HPC)

See Figure 1.

A. HPC General

(1) The high pressure compressor (HPC) consists of an inlet guide vane (IGV) stator assembly and an eleven stage rotor and stator assembly. The HPC is connected to the rear flange of the compressor intermediate case and to the front flange of the diffuser case. The purpose of the HPC is to further compress air delivered by the LPC and to direct this highly compressed air to the diffuser and combustor area.

(2) Customer bleed connections are provided at the 8th stage to satisfy aircraft pneumatic requirements. Twelfth stage air is delivered to a fan duct heat exchanger where the air is cooled prior to being delivered to the No. 3 bearing compartment to maintain a cool environment in that area. Twelfth stage air is also delivered to the high pressure turbine (HPT) to provide cooling for the 2nd stage turbine vanes and 2nd stage turbine blades.

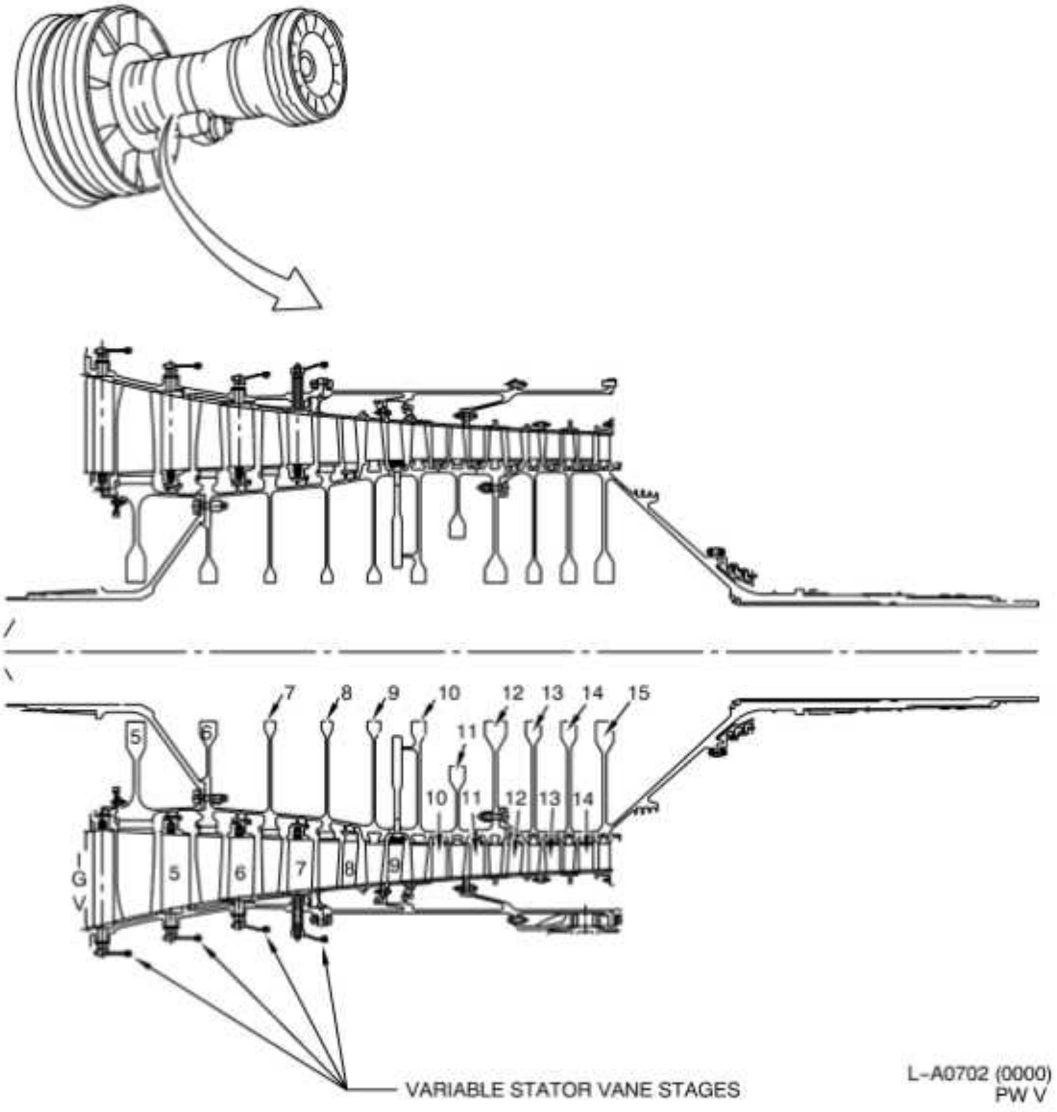
(3) The HPC consists of an eleven stage (stages 5 through 15) rotor assembly, eleven stages (IGV and stages 5 through 14) of stator assemblies, the HPC cases and their externally mounted accessories. The stage 15 HPC (compressor exit) stator is addressed as part of the diffuser and combustion build group.

B. HPC Stators And Cases

(1) The stators in the HPC consists of four stages (IGV and stages 5, 6 and 7) of variable stator vanes and seven stages (stage 8 through 14) of fixed stator vanes. All HPC stator vanes are made of nickel alloy. The stage 9 stator vanes are hollow while the other HPC stator vanes are solid.

(2) The four variable vane stages are contained in the split HPC front case that is bolted together during assembly. The case is made of titanium and has a steel fire liner at stages 6 and 7. The outer trunnion of each vane is mechanically attached through the HPC front case to a synchronizing ring assembly for each stage. The four synchronizing ring assemblies are

HIGH PRESSURE COMPRESSOR (HPC) − DESCRIPTION AND OPERATION


7
8
9
10
11
12
13
14
15
5
6
10
11
12
13
14
IGV
5
6
7
8
9
VARIABLE STATOR VANE STAGES
L−A0702 (0000)
PW V

High Pressure Compressor (HPC)
Figure 1
(Task 72−35−00−990−002)

then linked to a stator vane actuator controlled by the electronic engine control (EEC). The vanes are automatically adjusted to provide adequate stall margin for engine starting, acceleration and part power operation. Attached to the ID of the vanes are abradable rubstrips axially aligned with knife−edge seals on the drum rotor. Attached to the ID of the HPC front case are abradable rubstrips axially aligned with the stage 5, 6 and 7 blade tips.

(3) The seven fixed vane stages are mounted in the non−split titanium HPC rear case. A single stage split case stator assembly (stage 8) is bolted to a two stage split case stator assembly (stages 9 and 10). This assembly is bolted to an inner support case containing two sets of two stage stator quadrants (four 90 degree segments making up stages 11 and 12 and four 90 degree segments making up stages 13 and 14). On the ID shroud of each stator assembly are seal rings axially aligned with knife−edge seals on the drum rotor. On the OD shroud of each stator assembly are seal rings axially aligned with the rotor blade tips.

HIGH PRESSURE COMPRESSOR (HPC) - DISASSEMBLY-01

Task 72-35-00-030-001:

1. Remove HPC External Parts

A. Equipment And Materials Necessary - None

B. Procedure

Subtask 72-35-00-030-051:

(1) Remove the left and right HPC secondary-flow control valves. See Figure 501.

(a) Remove the six bolts and a bracket (Post SB PW4ENG 79-52) that attach the right valve to the HPC case. Remove the valve and discard the gasket. Remove the cap assembly (Pre SB PW4ENG 75-85), adapter, plug and gaskets from the valve. If necessary, remove the six bolts and two covers from the valve. Install protection covers.

(b) Remove the six bolts that attach the left valve to the HPC case. Remove the valve and discard the gasket. Remove the cap assembly (Pre SB PW4ENG 75-85), adapter, plug, and gaskets from the valve. Remove the six bolts, bracket (Post SB PW4ENG 72-211 only), and two covers from the valve. Install protective closures.

Subtask 72-35-00-030-052:

(2) Remove the left and right turbine vane and blade cooling air valves. See Figure 502.

(a) Remove the six bolts that attach each valve to the HPC case. Remove the valves and brackets. Discard the gaskets.

(b) Remove one adapter and one gasket from each valve.

(c) Install protective closures.

Subtask 72-35-00-030-053:

(3) Remove the left and right 9th stage start/stability (2.9) bleed valves. See Figure 503.

(a) Remove the eight bolts that attach each valve to the HPC case. Remove the valves and brackets. Discard the gaskets.

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−01

(b) Remove one adapter and one gasket from each valve.

(c) If equipped remove the bolts and the cover from the boss located on the side of each bleed valve.

(d) Install protective closures.

Subtask 72−35−00−030−054:

(4) Remove the fuel/oil cooler. See Figure 504.

(a) Hold the cooler and remove the four bolts, bracket, and washers that attach the rear of the cooler to the HPC rear case bracket.

(b) For engines without the front split mount bracket (Pre SB PW4ENG 79−20), move the cooler to the rear to disengage the pin. Remove the cooler. Remove the cotter pin, nut, washer, and pin from the front of the cooler.

(c) For engines with the front split mount bracket (Post SB PW4ENG 79−20), remove the two bolts that attach the front oil cooler bracket to the HPC front case bracket. Remove the cooler. Remove the cotter pin, nut, washer, bracket retainer, and pin from the front of the cooler.

(d) Remove the two brackets, plugs, adapters, and packings from the cooler. Discard the packings.

(e) Remove the plugs, adapters, and packings from the oil cooler bypass valve. Remove the four bolts and washers that attach the bypass valve to the cooler. Remove the valve and gasket.

(f) Discard all packings and the gasket. Install protective closures.

(g) Remove the four bolts and washers that attach the main bearing strainer element housing to the top of the cooler. Remove the bracket and the housing. Discard the packing. Install the protective closures.

Subtask 72−35−00−030−055:

(5) Remove lockwire and remove four bolts securing elbow at approximately 5 o'clock location. See Figure 505. Remove elbow and gasket. Discard gasket. Remove adapter and washer.

Subtask 72−35−00−030−065:

(6) Remove bolts and nuts securing ground cable to actuator and to brackets. Remove cable and bracket.

NOTE: For engines equipped with the longer ground cable (Pre SB PW4ENG 75−31), the ground cable is attached above the support under the bolthead.

(7) For engines not equipped with nut plates riveted to support bracket (Pre SB PW4ENG 75−35), remove bolts, clamps, and nuts securing actuator and loop clamp bracket to support bracket. Remove actuator and loop clamp bracket from engine.

(8) For engines equipped with nut plates riveted to support bracket (Post SB PW4ENG 75−35), remove bolts and clamps securing actuator to support bracket. Remove actuator from engine.

Subtask 72−35−00−030−066:

(9) Remove bolts and nuts securing turbine vane and blade cooling air valve and HPC secondary flow control valve filters to Flange J brackets. Remove filters from engine. See Figure 506.

Subtask 72−35−00−030−056:

(10) Remove the Flange J hardware. Refer to 72−35−00, Disassembly−20 (Task 72−35−00−030−020).

(11) Remove bolts and brackets from front case. See Figure 507.

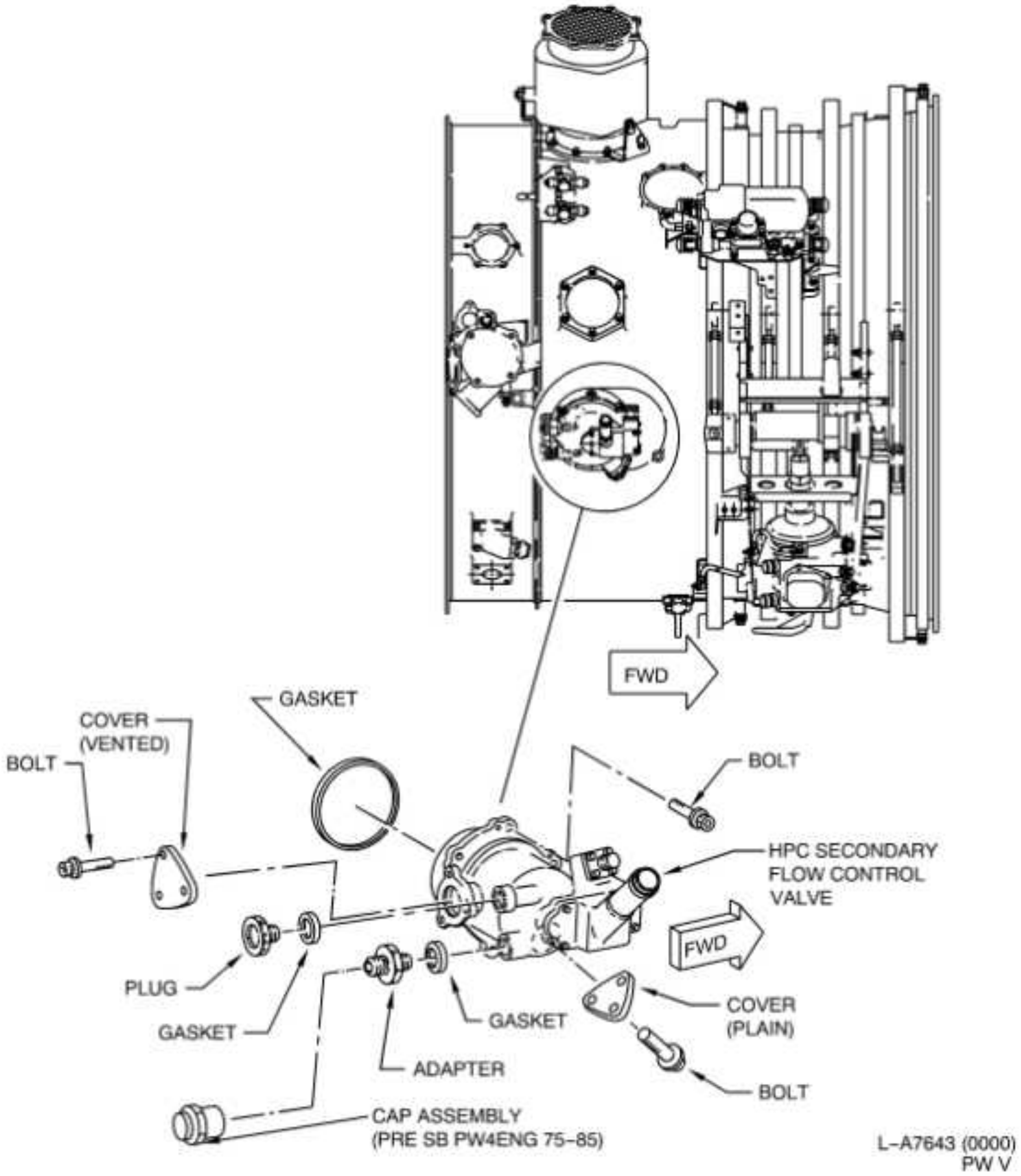
Subtask 72−35−00−030−067:

(12) Remove bolts, washers, and nuts securing brackets to support assembly. See Figure 508. Remove brackets and reinstall bolts to each bracket handtight.

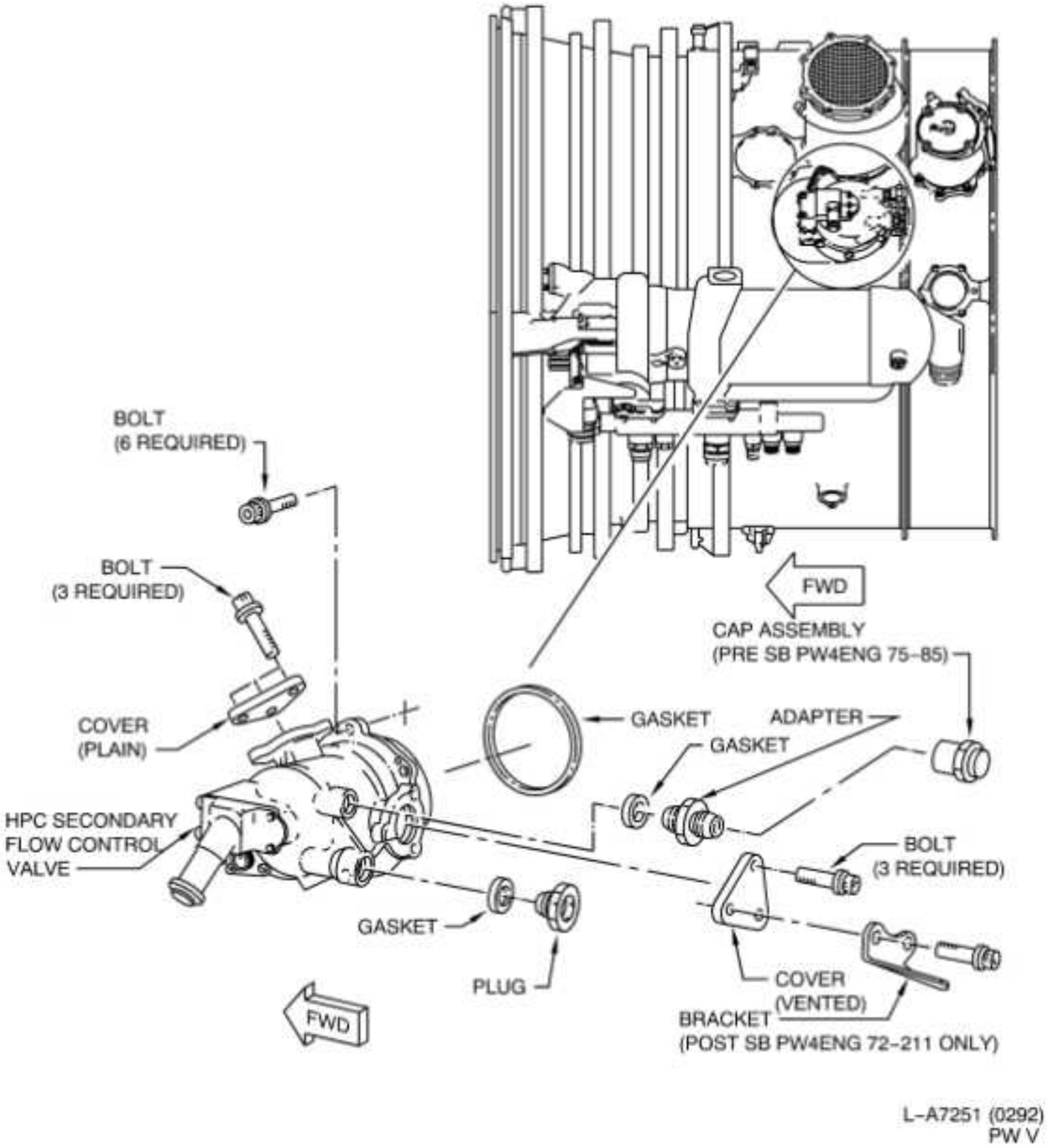
HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−01

(13) Remove and discard cotter pin securing nuts to bolts on gearbox link. Loosen and remove nuts and bolts securing link. Remove link. See Figure 509.

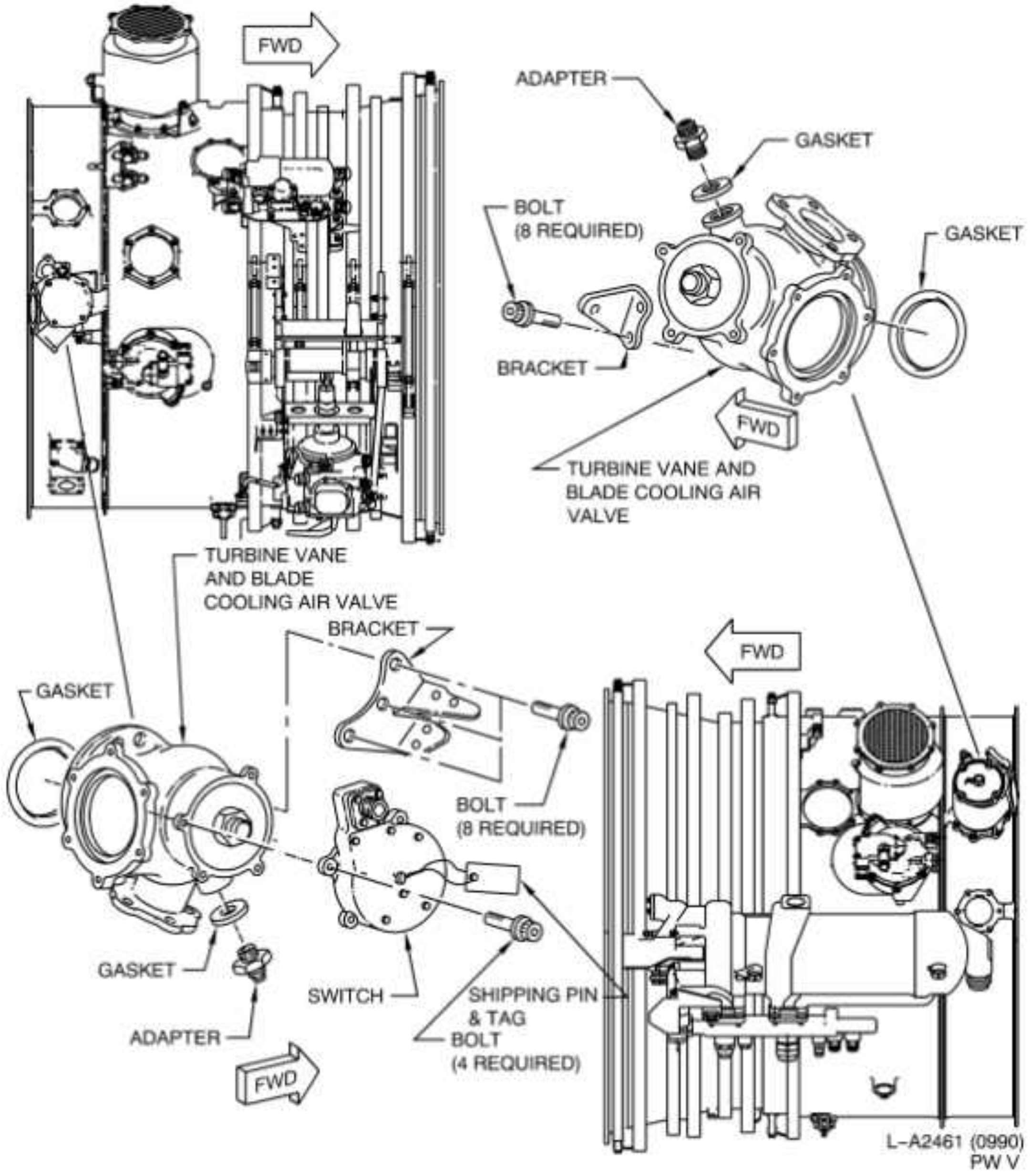
(14) Remove bolts securing link supports to rear case. Remove supports and a bracket (Post SB PW4ENG 75−95). Remove bolts and bracket from top of rear case. Remove four bolts and fuel/oil cooler bracket.


FWD
GASKET
COVER (VENTED)
BOLT
BOLT
HPC SECONDARY FLOW CONTROL VALVE
FWD
PLUG
GASKET
GASKET
ADAPTER
COVER (PLAIN)
BOLT
CAP ASSEMBLY (PRE SB PW4ENG 75-85)
L-A7643 (0000)
PW V

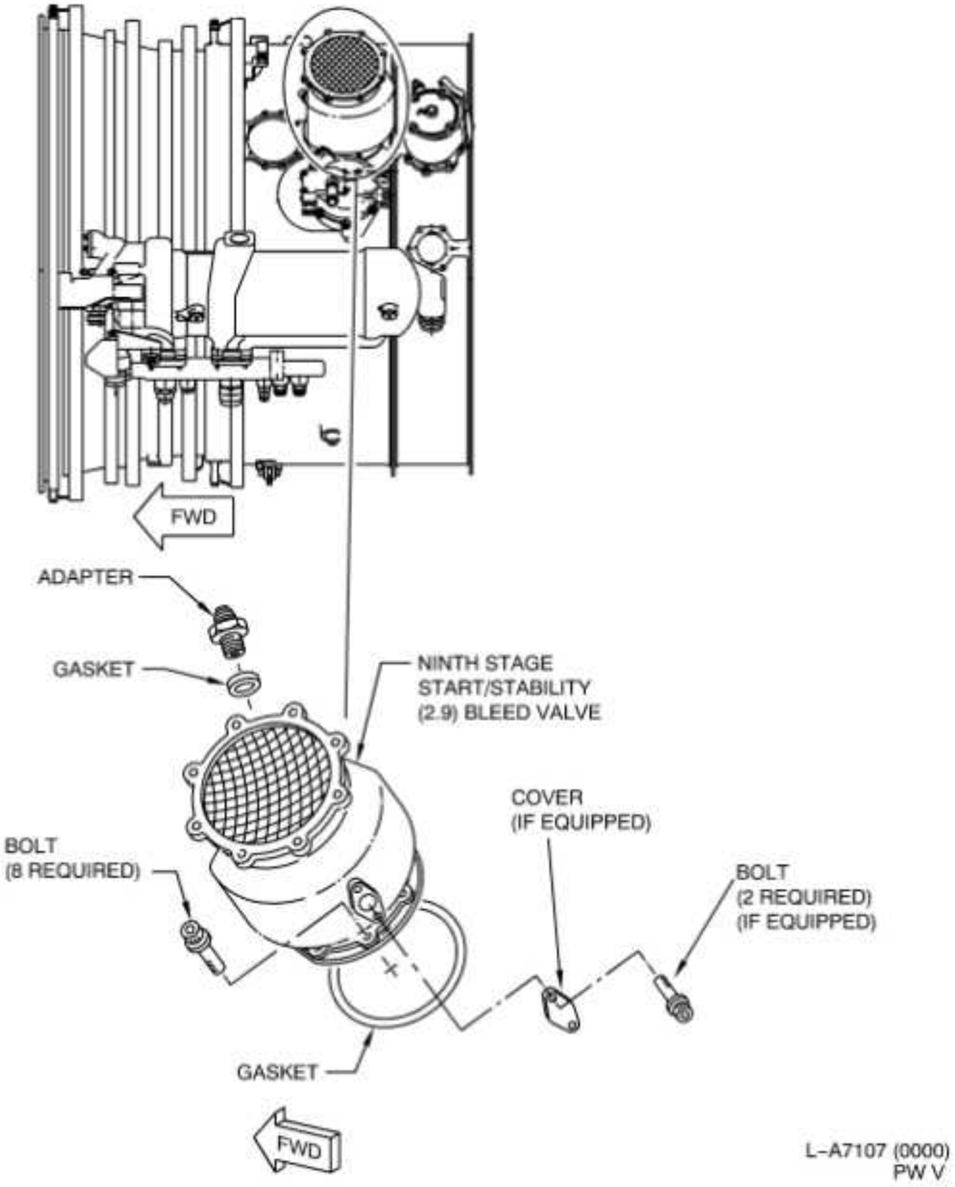
HPC Secondary-Flow Control Valve (Right)
Figure 501 (Sheet 1)
(Task 72-35-00-030-001)


BOLT
(6 REQUIRED)
BOLT
(3 REQUIRED)
COVER
(PLAIN)
HPC SECONDARY
FLOW CONTROL
VALVE
GASKET
PLUG
FWD
GASKET
ADAPTER
GASKET
CAP ASSEMBLY
(PRE SB PW4ENG 75-85)
FWD
BOLT
(3 REQUIRED)
COVER
(VENTED)
BRACKET
(POST SB PW4ENG 72-211 ONLY)
L-A7251 (0292)
PW V

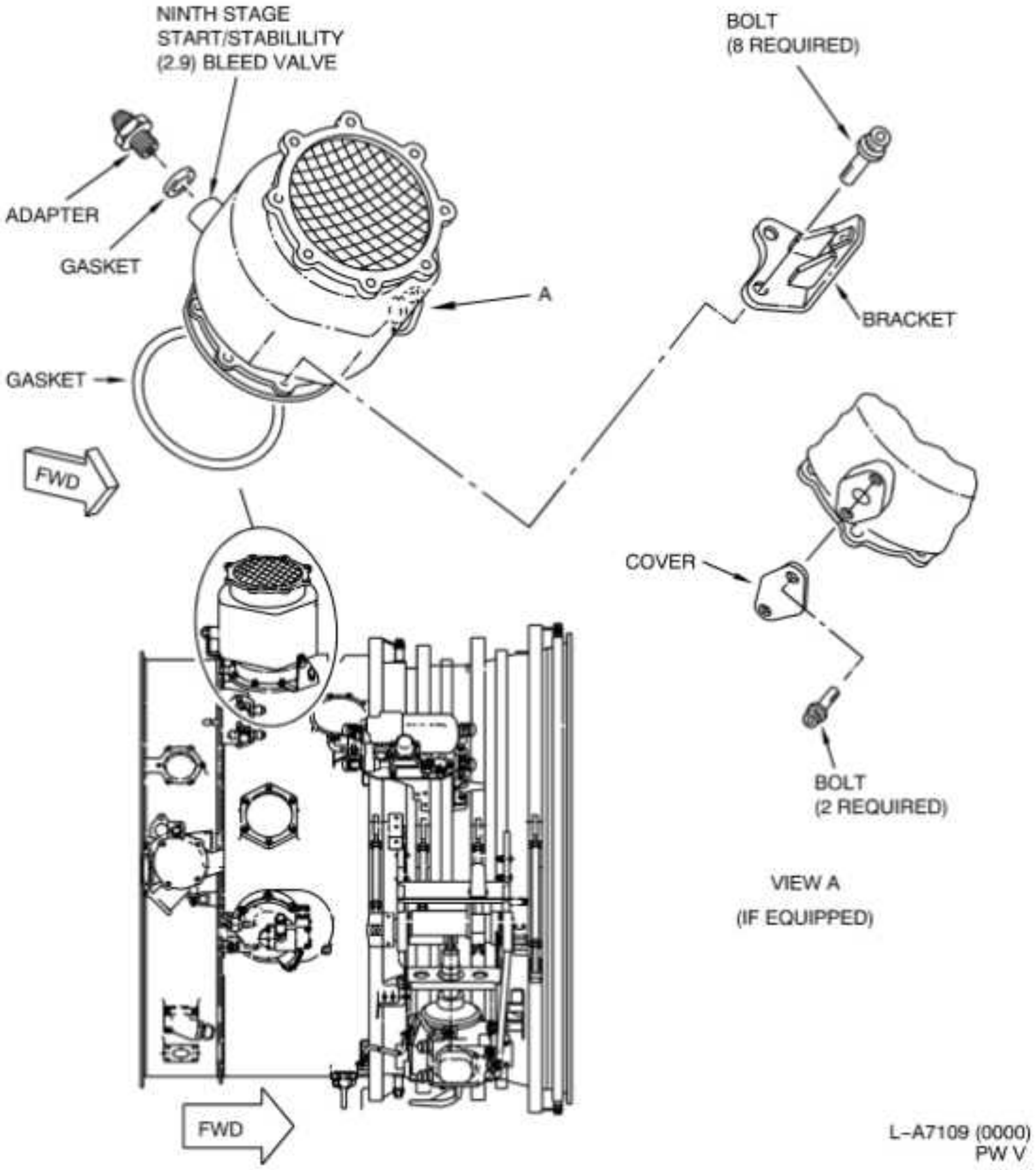
HPC Secondary-Flow Control Valve (Left)
Figure 501 (Sheet 2)
(Task 72-35-00-030-001)


FWD
ADAPTER
GASKET
BOLT
(8 REQUIRED)
GASKET
BRACKET
FWD
TURBINE VANE AND
BLADE COOLING AIR
VALVE
TURBINE VANE
AND BLADE
COOLING AIR VALVE
BRACKET
GASKET
FWD
BOLT
(8 REQUIRED)
GASKET
ADAPTER
SWITCH
SHIPPING PIN
& TAG
BOLT
(4 REQUIRED)
FWD
L−A2461 (0990)
PW V

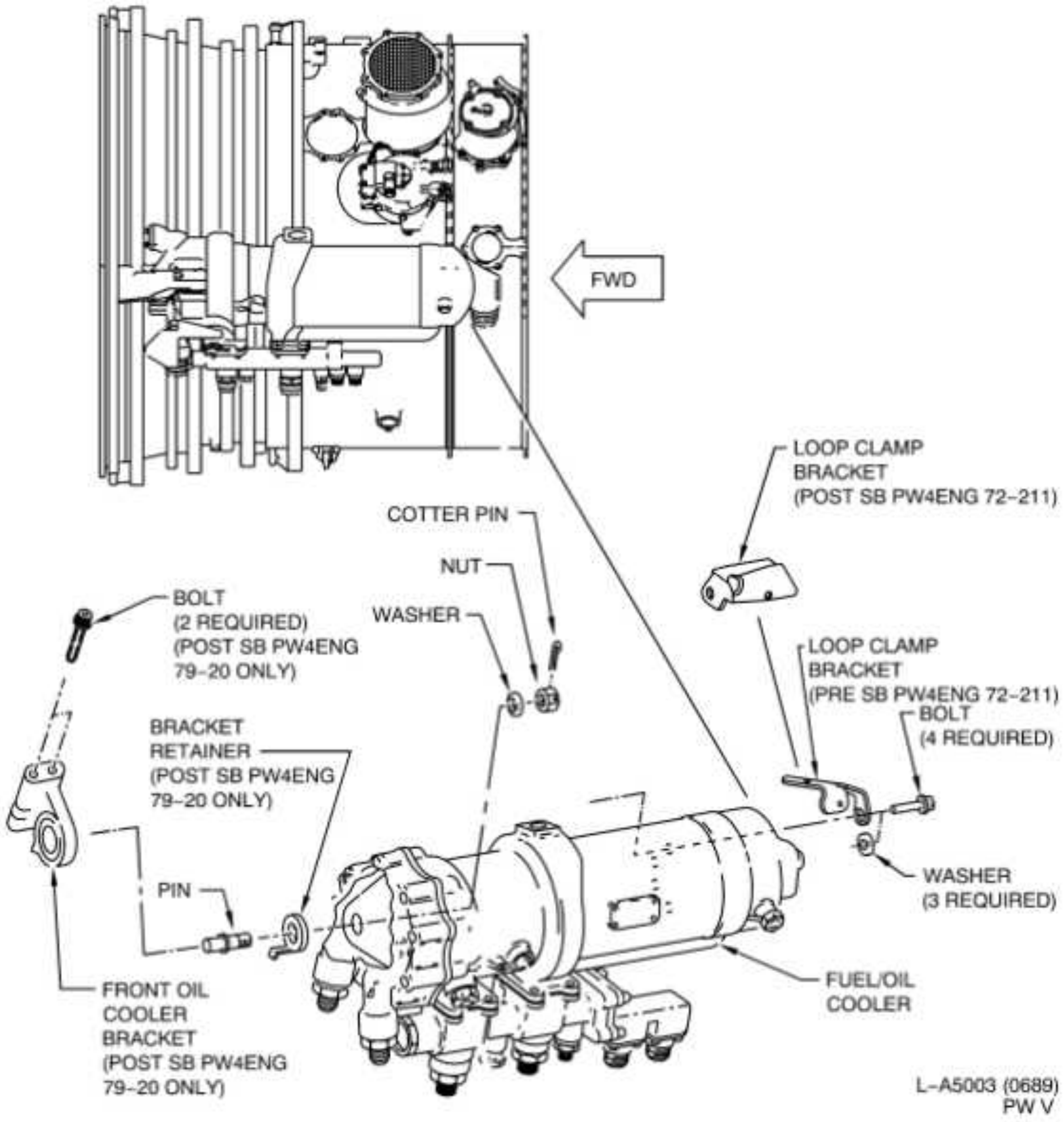
Turbine Vane And Blade Cooling Air Valves
Figure 502
(Task 72−35−00−030−001)


FWD
ADAPTER
GASKET
NINTH STAGE START/STABILITY (2.9) BLEED VALVE
COVER (IF EQUIPPED)
BOLT (8 REQUIRED)
BOLT (2 REQUIRED) (IF EQUIPPED)
GASKET
FWD
L−A7107 (0000)
PW V

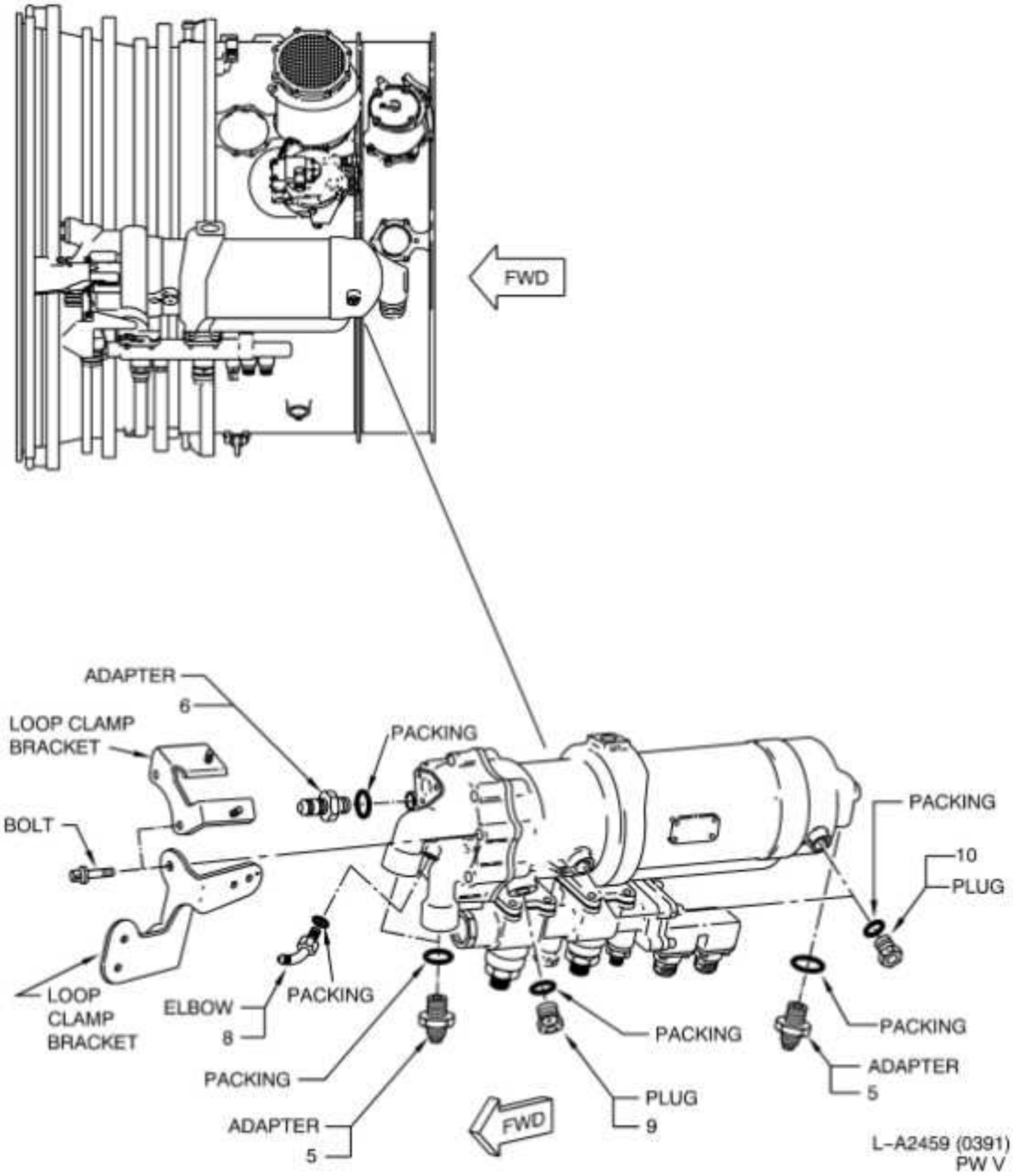
Ninth Stage Start/Stability (2.9) Bleed Valves
Figure 503 (Sheet 1)
(Task 72−35−00−030−001)


NINTH STAGE START/STABILILITY (2.9) BLEED VALVE
BOLT (8 REQUIRED)
ADAPTER
GASKET
A
BRACKET
GASKET
FWD
COVER
BOLT (2 REQUIRED)
VIEW A
(IF EQUIPPED)
FWD
L−A7109 (0000)
PW V

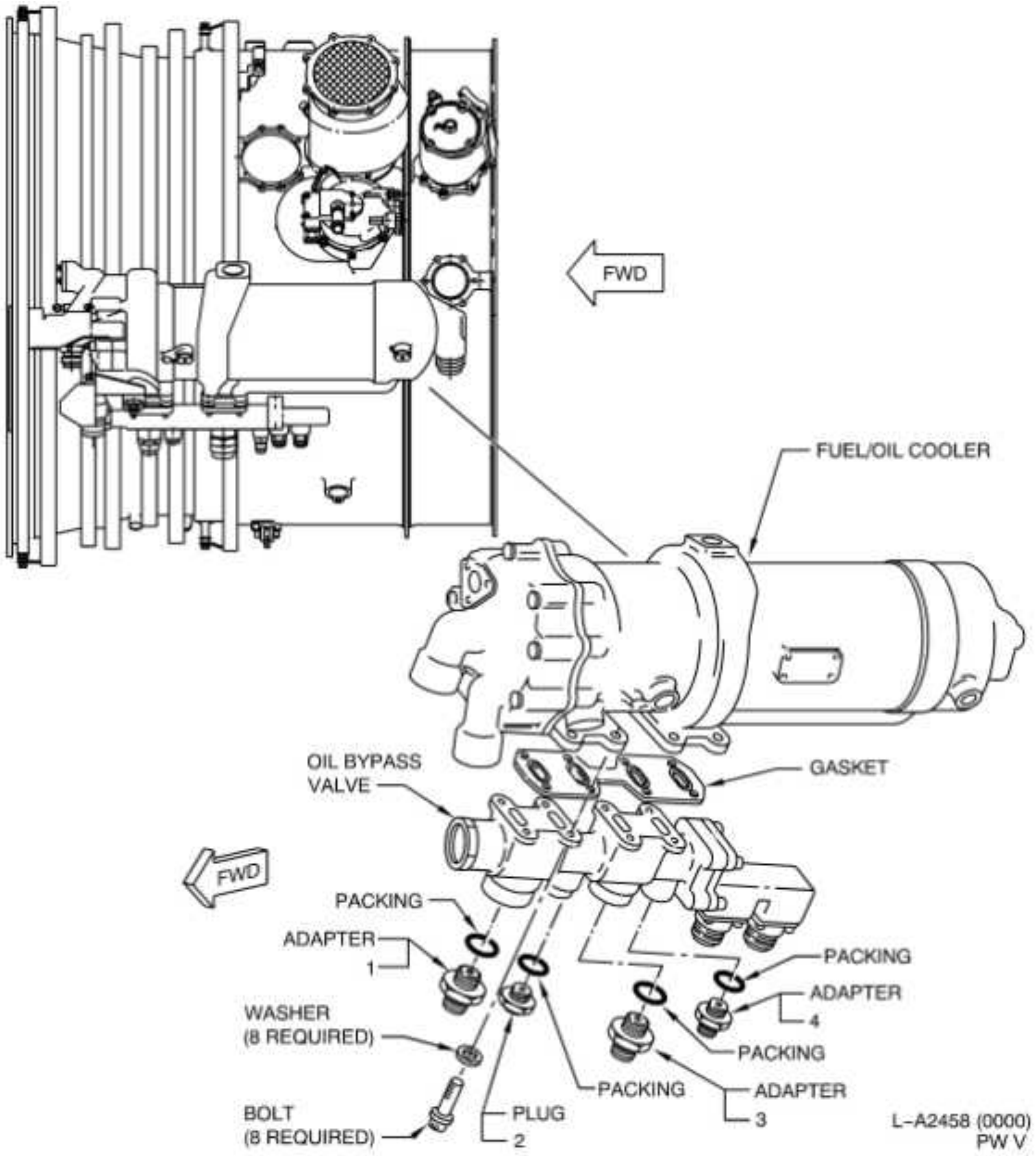
Ninth Stage Start/Stability (2.9) Bleed Valves
Figure 503 (Sheet 2)
(Task 72−35−00−030−001)


FWD
LOOP CLAMP BRACKET (POST SB PW4ENG 72-211)
COTTER PIN
NUT
WASHER
BOLT (2 REQUIRED) (POST SB PW4ENG 79-20 ONLY)
LOOP CLAMP BRACKET (PRE SB PW4ENG 72-211)
BOLT (4 REQUIRED)
BRACKET RETAINER (POST SB PW4ENG 79-20 ONLY)
PIN
WASHER (3 REQUIRED)
FUEL/OIL COOLER
FRONT OIL COOLER BRACKET (POST SB PW4ENG 79-20 ONLY)
L-A5003 (0689)
PW V

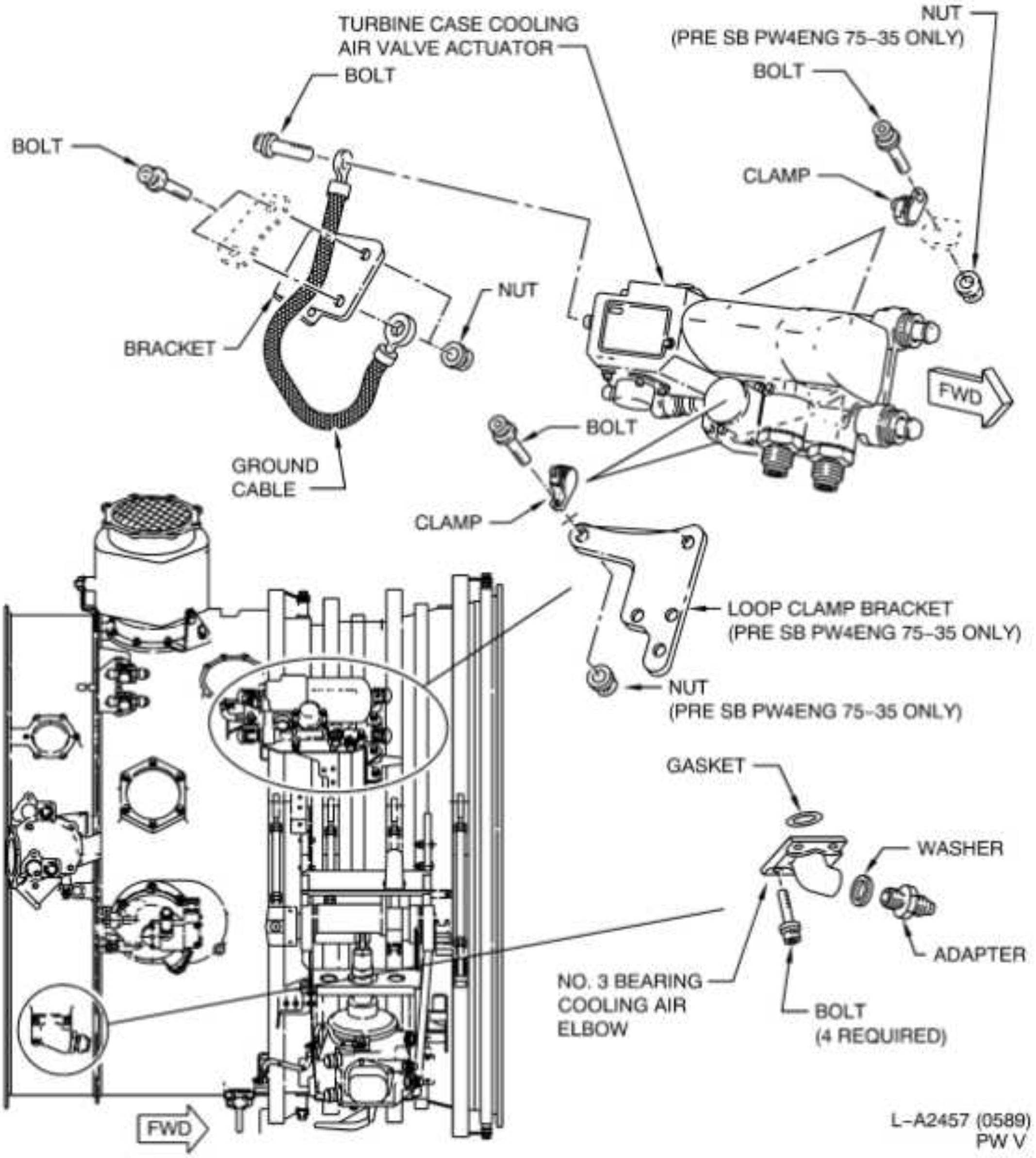
Fuel/Oil Cooler And Bypass Valve
Figure 504 (Sheet 1)
(Task 72−35−00−030−001)


FWD
ADAPTER
6
LOOP CLAMP
BRACKET
PACKING
BOLT
PACKING
10
PLUG
LOOP
CLAMP
BRACKET
ELBOW
8
PACKING
PACKING
PACKING
PACKING
ADAPTER
5
PLUG
9
ADAPTER
5
FWD
L−A2459 (0391)
PW V

Fuel/Oil Cooler And Bypass Valve
Figure 504 (Sheet 2)
(Task 72−35−00−030−001)

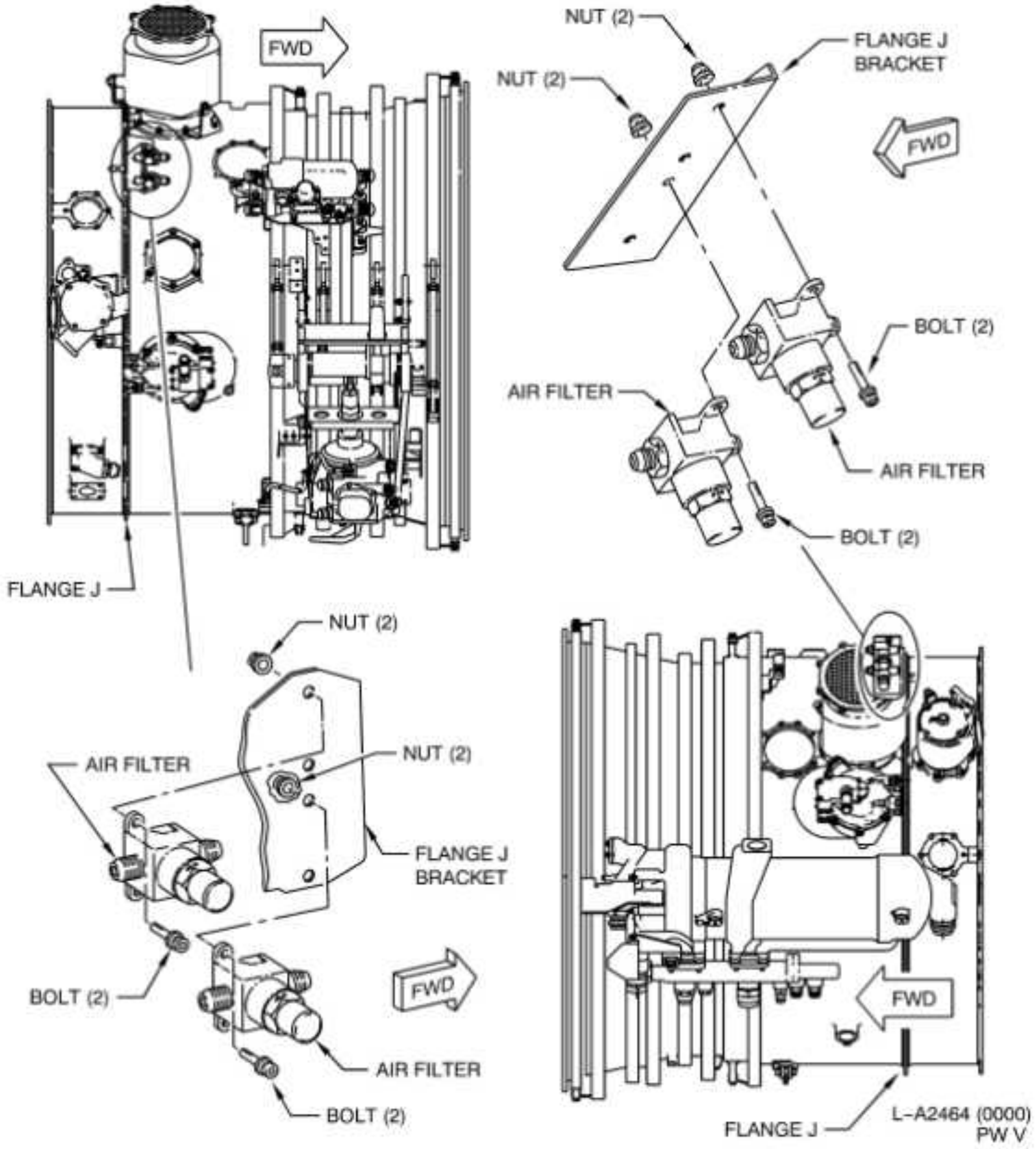

FWD
FUEL/OIL COOLER
OIL BYPASS VALVE
GASKET
FWD
PACKING
ADAPTER
1
WASHER (8 REQUIRED)
BOLT (8 REQUIRED)
PLUG
2
PACKING
PACKING
ADAPTER
4
PACKING
ADAPTER
3
L−A2458 (0000)
PW V

Fuel/Oil Cooler And Bypass Valve
Figure 504 (Sheet 3)
(Task 72−35−00−030−001)


TURBINE CASE COOLING AIR VALVE ACTUATOR
NUT (PRE SB PW4ENG 75-35 ONLY)
BOLT
BOLT
BOLT
CLAMP
NUT
BRACKET
FWD
BOLT
GROUND CABLE
CLAMP
LOOP CLAMP BRACKET (PRE SB PW4ENG 75-35 ONLY)
NUT (PRE SB PW4ENG 75-35 ONLY)
GASKET
WASHER
ADAPTER
NO. 3 BEARING COOLING AIR ELBOW
BOLT (4 REQUIRED)
FWD
L-A2457 (0589)
PW V

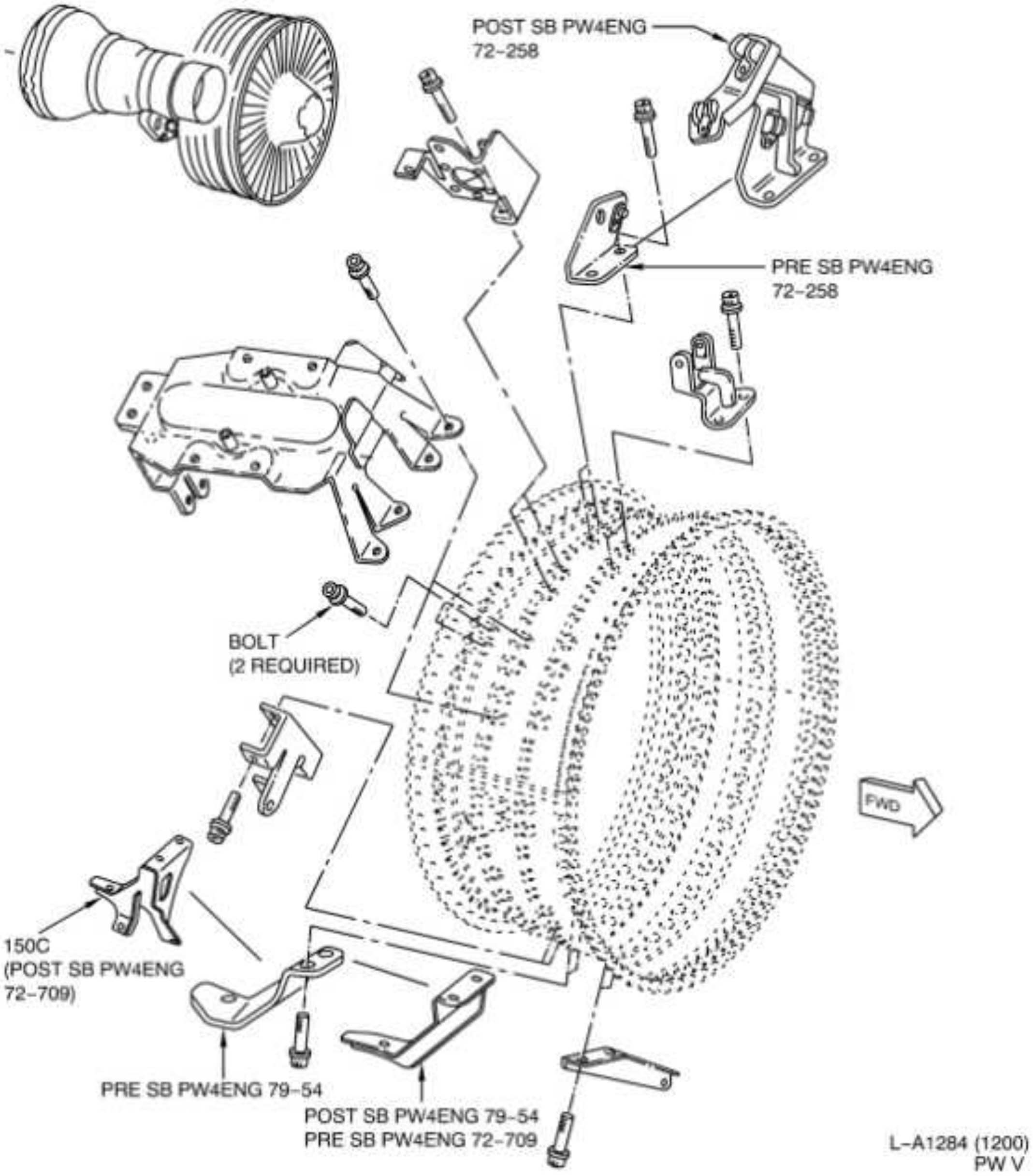
Turbine Case Cooling Air Valve Actuator
Figure 505
(Task 72-35-00-030-001)

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−01


FWD
NUT (2)
FLANGE J BRACKET
NUT (2)
FWD
BOLT (2)
AIR FILTER
AIR FILTER
BOLT (2)
FLANGE J
NUT (2)
AIR FILTER
NUT (2)
FLANGE J BRACKET
BOLT (2)
FWD
AIR FILTER
BOLT (2)
FWD
FLANGE J
L−A2464 (0000)
PW V

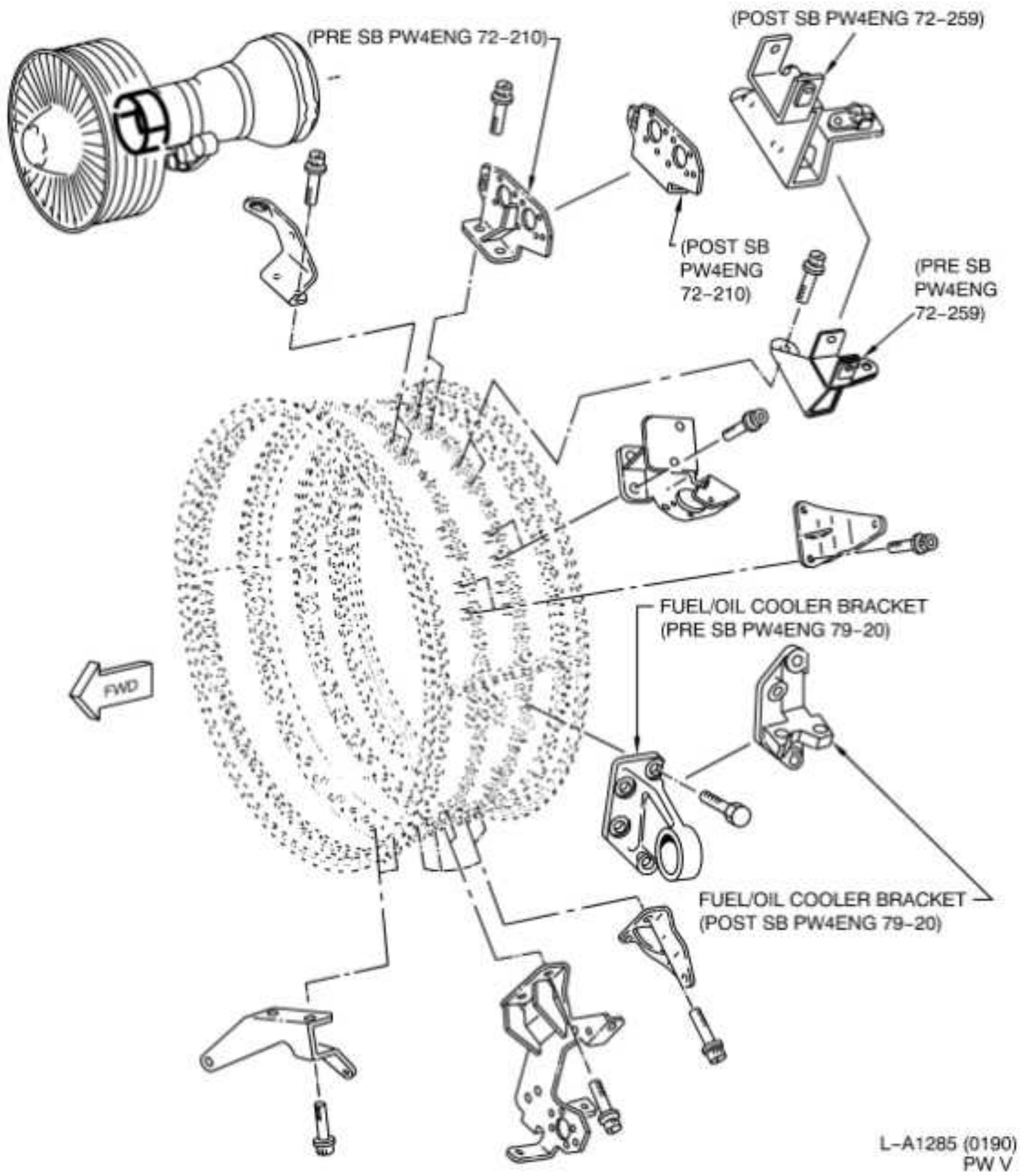
Turbine Vane And Blade Cooling Air Valve And
HPC Secondary Flow Control Valve Filters
Figure 506
(Task 72−35−00−030−001)

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−01

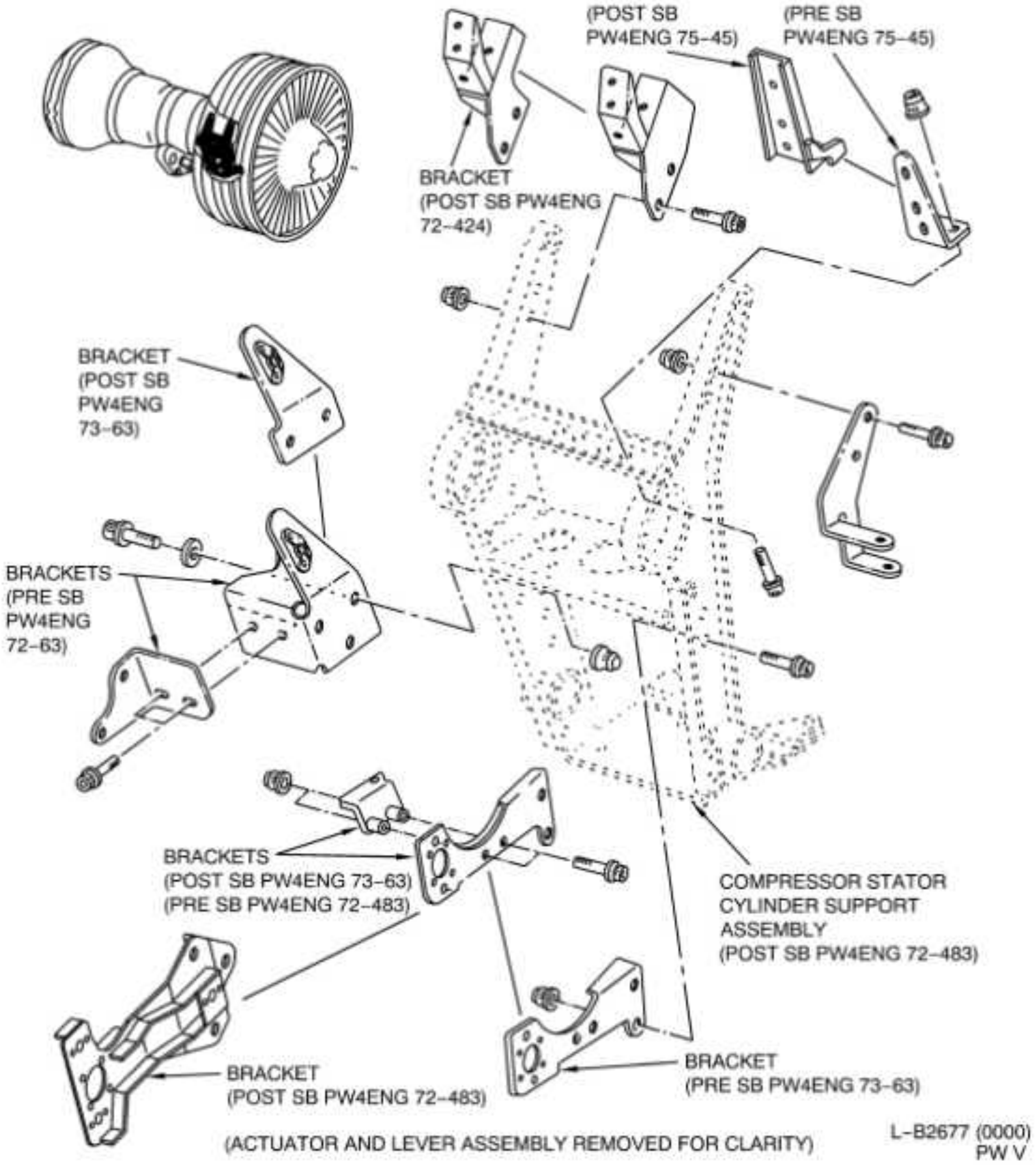

POST SB PW4ENG
72-258
PRE SB PW4ENG
72-258
BOLT
(2 REQUIRED)
FWD
150C
(POST SB PW4ENG
72-709)
PRE SB PW4ENG 79-54
POST SB PW4ENG 79-54
PRE SB PW4ENG 72-709
L-A1284 (1200)
PW V

Front HPC Case Bracket Locations
Figure 507 (Sheet 1)
(Task 72−35−00−030−001)

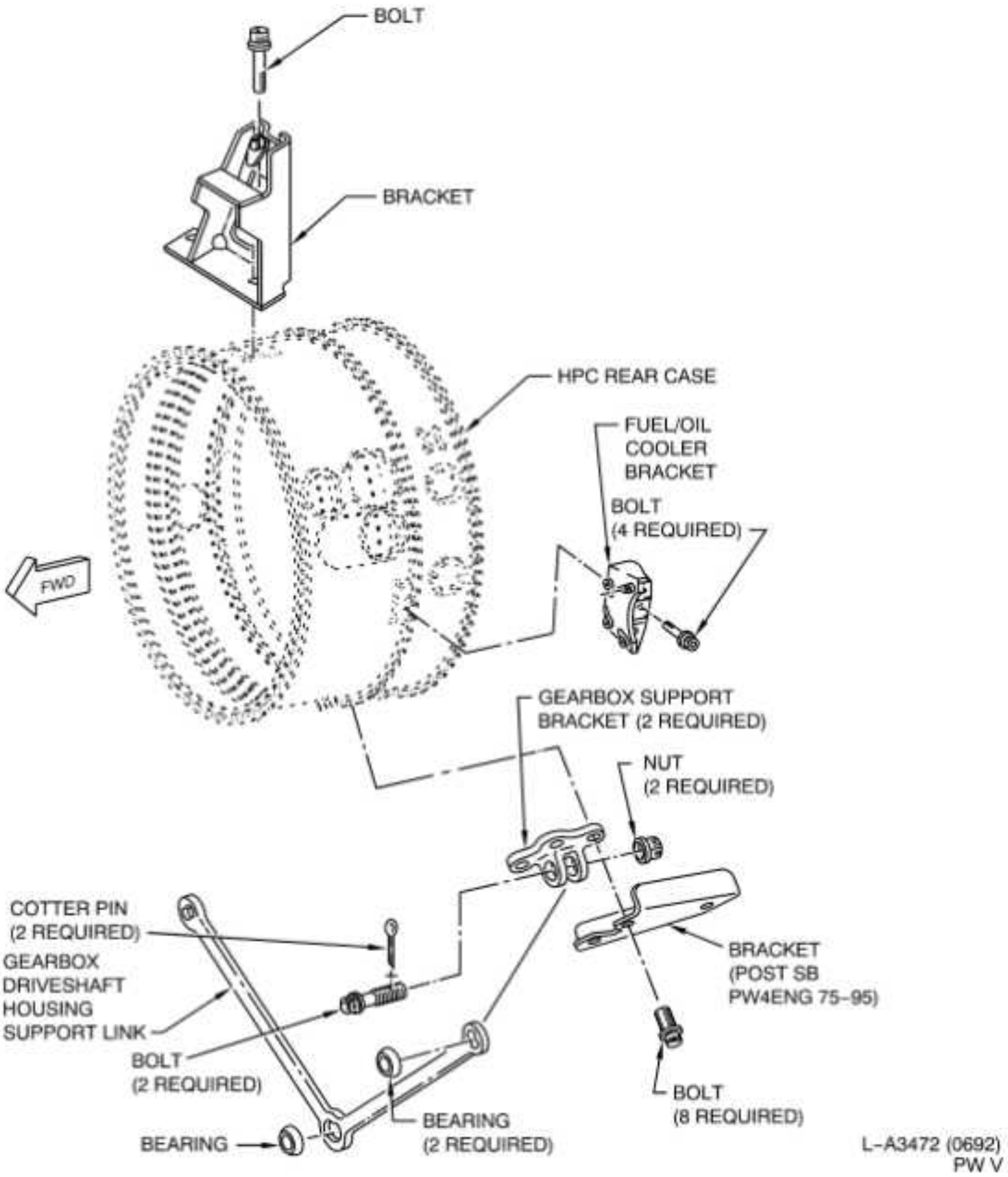
HIGH PRESSURE COMPRESSOR (HPC) - DISASSEMBLY-01


(PRE SB PW4ENG 72-210)
(POST SB PW4ENG 72-259)
(POST SB PW4ENG 72-210)
(PRE SB PW4ENG 72-259)
FWD
FUEL/OIL COOLER BRACKET (PRE SB PW4ENG 79-20)
FUEL/OIL COOLER BRACKET (POST SB PW4ENG 79-20)
L-A1285 (0190)
PW V

Front HPC Case Bracket Locations
Figure 507 (Sheet 2)
(Task 72-35-00-030-001)


(POST SB PW4ENG 75-45)
(PRE SB PW4ENG 75-45)
BRACKET (POST SB PW4ENG 72-424)
BRACKET (POST SB PW4ENG 73-63)
BRACKETS (PRE SB PW4ENG 72-63)
BRACKETS (POST SB PW4ENG 73-63) (PRE SB PW4ENG 72-483)
COMPRESSOR STATOR CYLINDER SUPPORT ASSEMBLY (POST SB PW4ENG 72-483)
BRACKET (POST SB PW4ENG 72-483)
BRACKET (PRE SB PW4ENG 73-63)
(ACTUATOR AND LEVER ASSEMBLY REMOVED FOR CLARITY)
L-B2677 (0000)
PW V

Compressor Stator Cylinder Support Bracket Locations
Figure 508
(Task 72−35−00−030−001)


BOLT
BRACKET
HPC REAR CASE
FUEL/OIL COOLER BRACKET
BOLT (4 REQUIRED)
FWD
GEARBOX SUPPORT BRACKET (2 REQUIRED)
NUT (2 REQUIRED)
COTTER PIN (2 REQUIRED)
GEARBOX DRIVESHAFT HOUSING SUPPORT LINK
BRACKET (POST SB PW4ENG 75-95)
BOLT (2 REQUIRED)
BOLT (8 REQUIRED)
BEARING
BEARING (2 REQUIRED)
L-A3472 (0692)
PW V

High Pressure Compressor Rear Case Bracket Locations
Figure 509
(Task 72−35−00−030−001)

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−01

Task 72−35−00−030−005:

1. Remove HPC External Parts

A. Equipment And Materials Required − None

B. Procedure

Subtask 72−35−00−030−075:

(1) Remove the left and right HPC case covers. See Figure 501.

(a) Remove lockwire and the six bolts that attach each cover to the HPC case. On the right side of the HPC case remove the cover and bracket and on the left side of the HPC case remove the cover and bracket.

(b) Discard the gaskets and install protection covers.

Subtask 72−35−00−030−076:

(2) Remove the left and right turbine vane and blade cooling air valves. See Figure 502.

(a) Remove the six bolts that attach each valve to the HPC case. Remove the valves and brackets. Discard the gaskets.

(b) Remove one adapter and one gasket from each valve.

(c) Install protective closures.

Subtask 72−35−00−030−077:

(3) Remove the turbine vane cooling air valve from the right side of the HPC case. See Figure 503.

(a) Remove the six bolts that attach the valve to the HPC case. Remove the valve and bracket. Discard the gaskets.

(b) Remove one adapter and one gasket from the valve.

(c) Install protection covers.

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−01

Subtask 72−35−00−030−078:

(4) Remove the left and right 9th stage start/stability (2.9) bleed valves. See Figure 504.

- (a) Remove the eight bolts that attach each valve to the HPC case. Remove the valves and brackets. Discard the gaskets.
- (b) Remove one adapter and one gasket from each valve.
- (c) Remove the bolts and the cover from the boss on the side of each bleed valve.
- (d) Install protective closures.

Subtask 72−35−00−030−079:

(5) Remove the fuel/oil cooler. See Figure 505.

- (a) Hold the cooler and remove the four bolts, bracket, and washers that attach the rear of the cooler to the HPC rear case bracket.
- (b) Remove the two bolts that attach the front oil cooler bracket to the HPC front case bracket. Remove the cooler.
- (c) Remove the bracket from the pin. Remove the cotter pin, nut, washer, bracket retainer, and pin from the front of the cooler.
- (d) Remove the two brackets, plugs, adapters, and packings from the cooler. Discard the packings.
- (e) Remove the plugs, adapters, and packings from the oil cooler bypass valve. Remove the four bolts and washers that attach the bypass valve to the cooler. Remove the valve and gasket.
- (f) Discard all packings and the gasket. Install protective closures.
- (g) Remove the four bolts and washers that attach the main bearing strainer element housing to the top of the cooler. Remove the bracket and the housing. Discard the packing. Install the protective closures.

Subtask 72-35-00-030-080:

(6) Remove the lockwire and four bolts that attach the elbow at approximately the 5 o'clock position. See Figure 506. Remove the elbow and gasket. Discard the gasket. Remove the adapter and washer.

Subtask 72-35-00-030-081:

(7) Remove the bolts and nuts that attach the ground cable to the actuator and to brackets. Remove the cable and bracket.

(8) Remove the bolts and clamps that attach the actuator to the support bracket. Remove the actuator from the engine.

Subtask 72-35-00-030-082:

(9) Remove the bolts and nuts that attach the turbine vane and blade cooling air valve filters to the brackets on Flange J. Remove the filters from the engine. See Figure 507.

Subtask 72-35-00-030-083:

(10) Remove the Flange J hardware. Refer to 72-35-00, Disassembly-20 (Task 72-35-00-030-020).

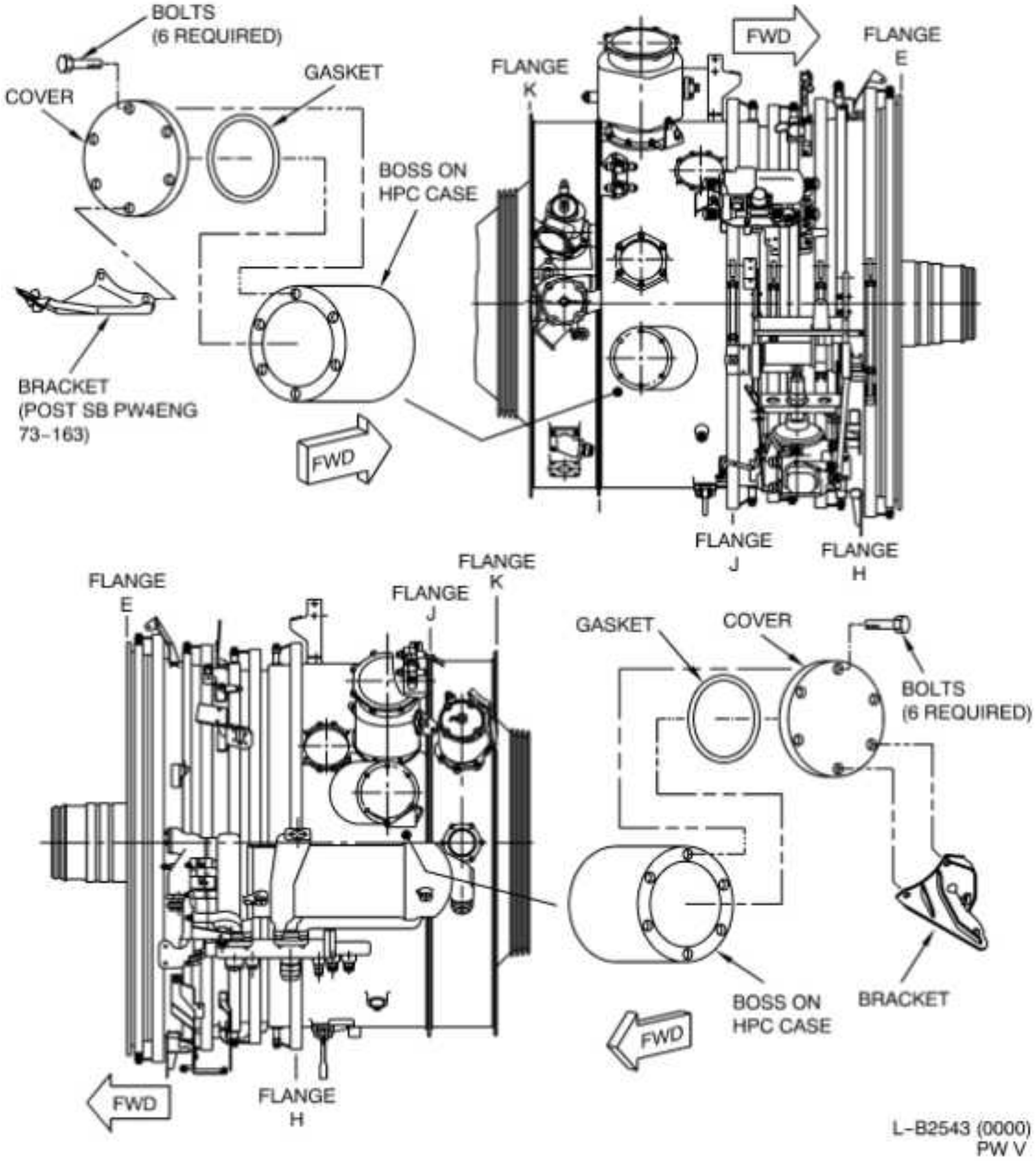
(11) Remove the bolts and brackets from the HPC front case. See Figure 508.

Subtask 72-35-00-030-084:

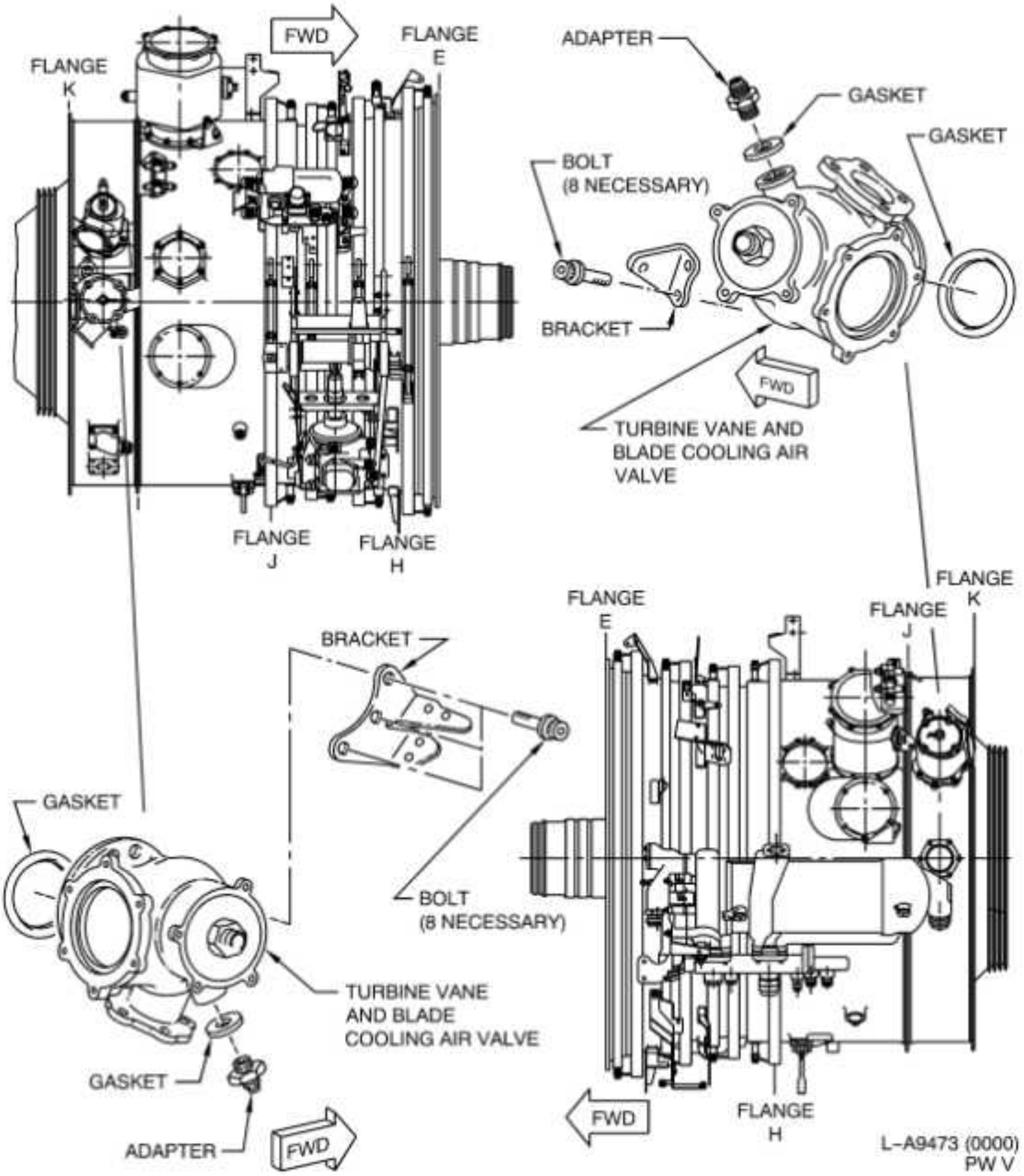
(12) Remove the bolts, washers, and nuts that attach the brackets to the support assembly. See Figure 509 . Remove the brackets and install the bolts to each bracket handtight.

(13) Remove and discard the cotter pin that attach the nuts to the bolts on the gearbox link. Loosen and remove the nuts and bolts that attach the link. Remove the link. See Figure 510.

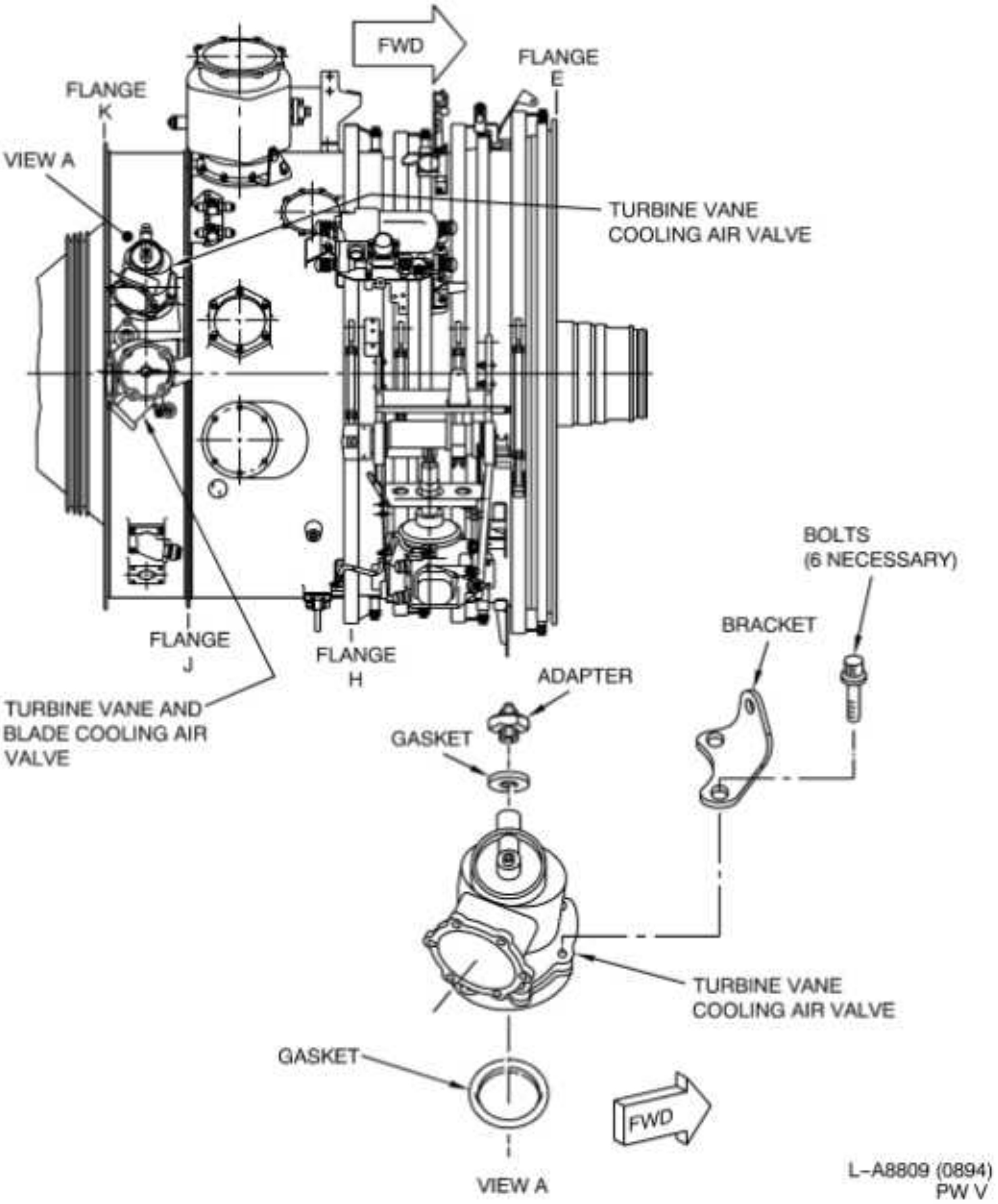
(14) Remove the bolts that attach the link supports to the rear case. Remove the supports and a bracket. Remove the bolts and bracket from the top of the rear case. Remove the four bolts and the fuel/oil cooler bracket.


BOLTS
(6 REQUIRED)
GASKET
COVER
FLANGE
K
FWD
FLANGE
E
BOSS ON
HPC CASE
BRACKET
(POST SB PW4ENG
73-163)
FWD
FLANGE
J
FLANGE
H
FLANGE
K
FLANGE
E
FLANGE
J
GASKET
COVER
BOLTS
(6 REQUIRED)
BOSS ON
HPC CASE
BRACKET
FWD
FWD
FLANGE
H
L-B2543 (0000)
PW V

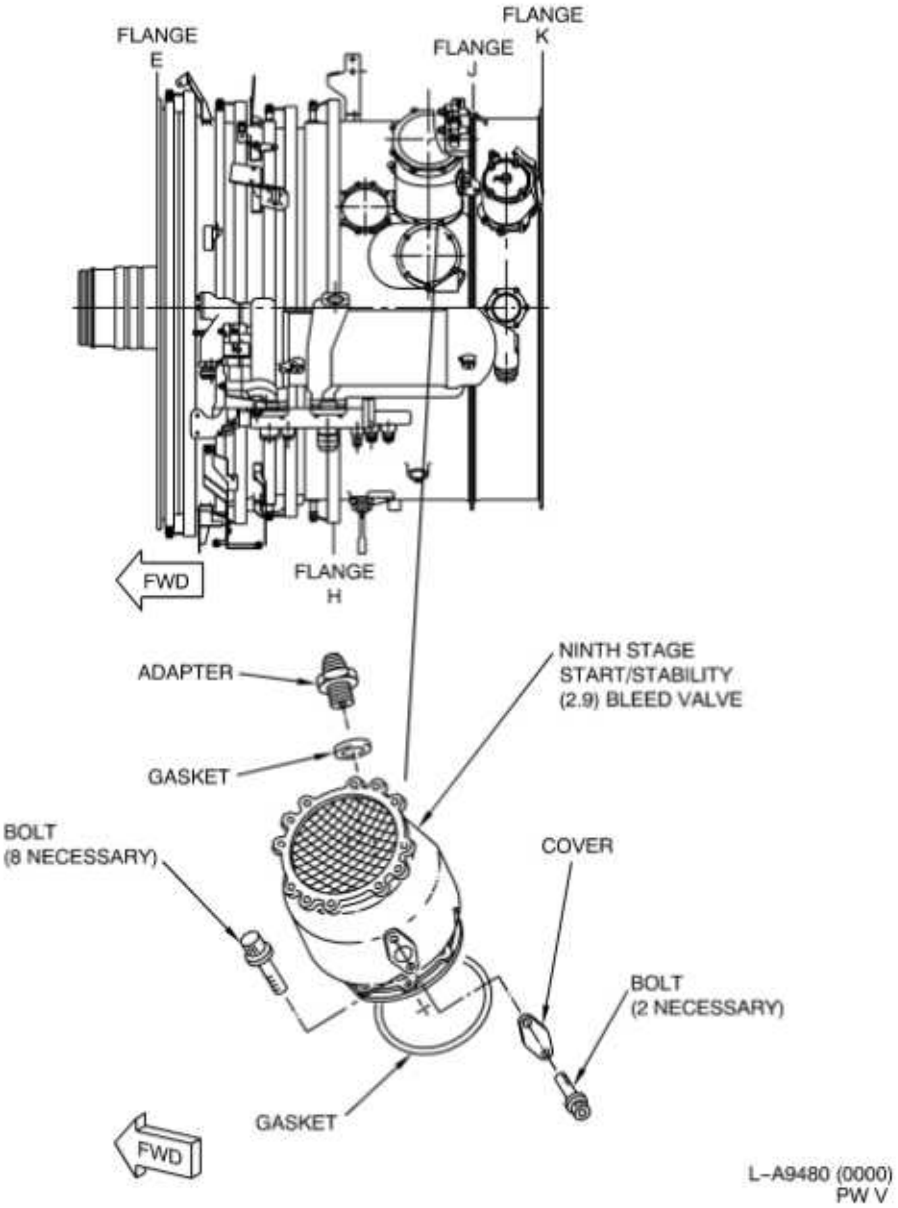
Cover − HPC Rear Case
Figure 501
(Task 72−35−00−030−005)


FWD
FLANGE E
FLANGE K
ADAPTER
GASKET
GASKET
BOLT (8 NECESSARY)
BRACKET
FWD
TURBINE VANE AND BLADE COOLING AIR VALVE
FLANGE J
FLANGE H
FLANGE K
FLANGE E
FLANGE J
BRACKET
GASKET
BOLT (8 NECESSARY)
TURBINE VANE AND BLADE COOLING AIR VALVE
GASKET
ADAPTER
FWD
FWD
FLANGE H
L-A9473 (0000)
PW V

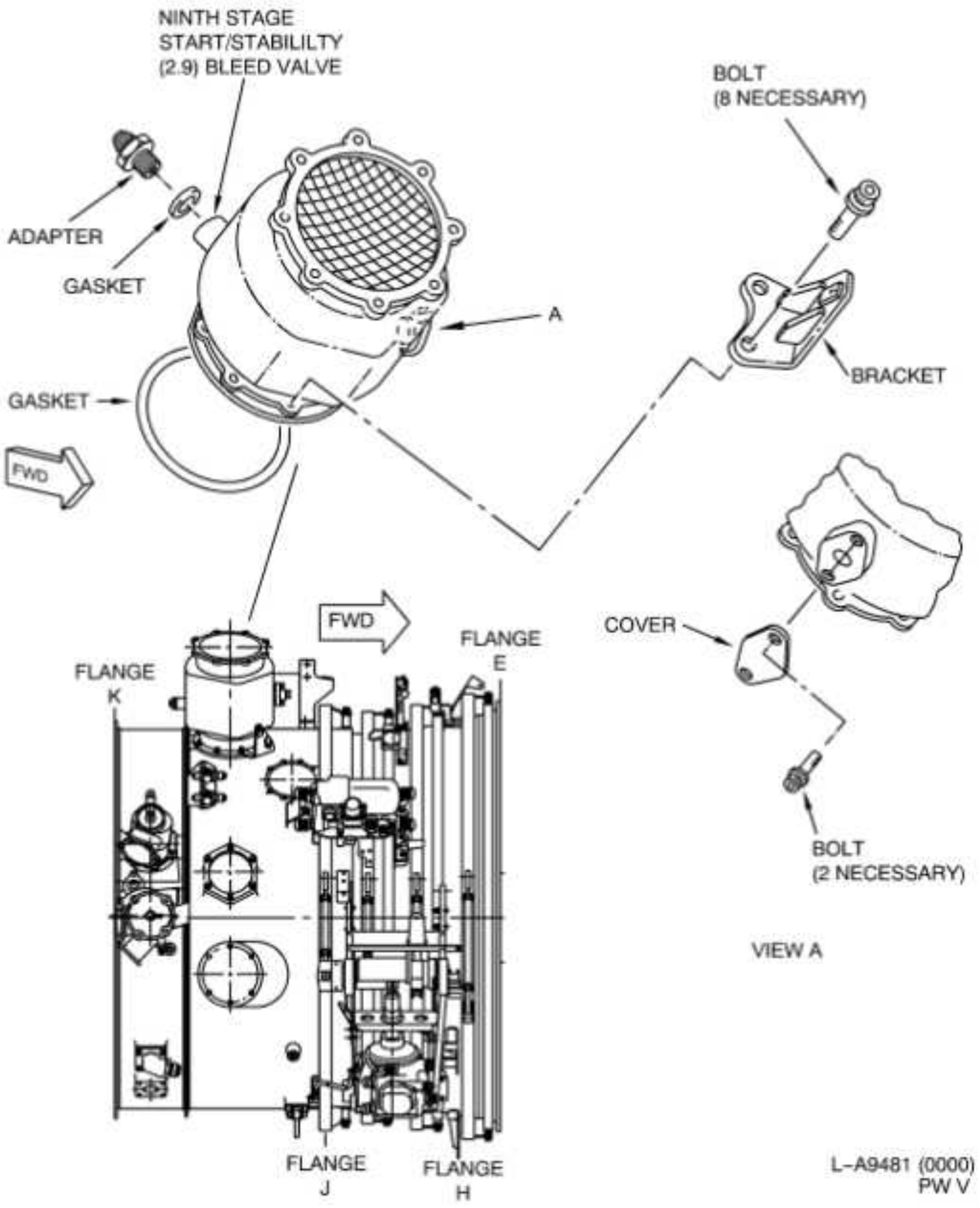
Turbine Vane And Blade Cooling Air Valves
Figure 502
(Task 72−35−00−030−005)


FWD
FLANGE E
FLANGE K
VIEW A
TURBINE VANE COOLING AIR VALVE
BOLTS (6 NECESSARY)
BRACKET
FLANGE J
FLANGE H
ADAPTER
TURBINE VANE AND BLADE COOLING AIR VALVE
GASKET
TURBINE VANE COOLING AIR VALVE
GASKET
FWD
VIEW A
L−A8809 (0894)
PW V

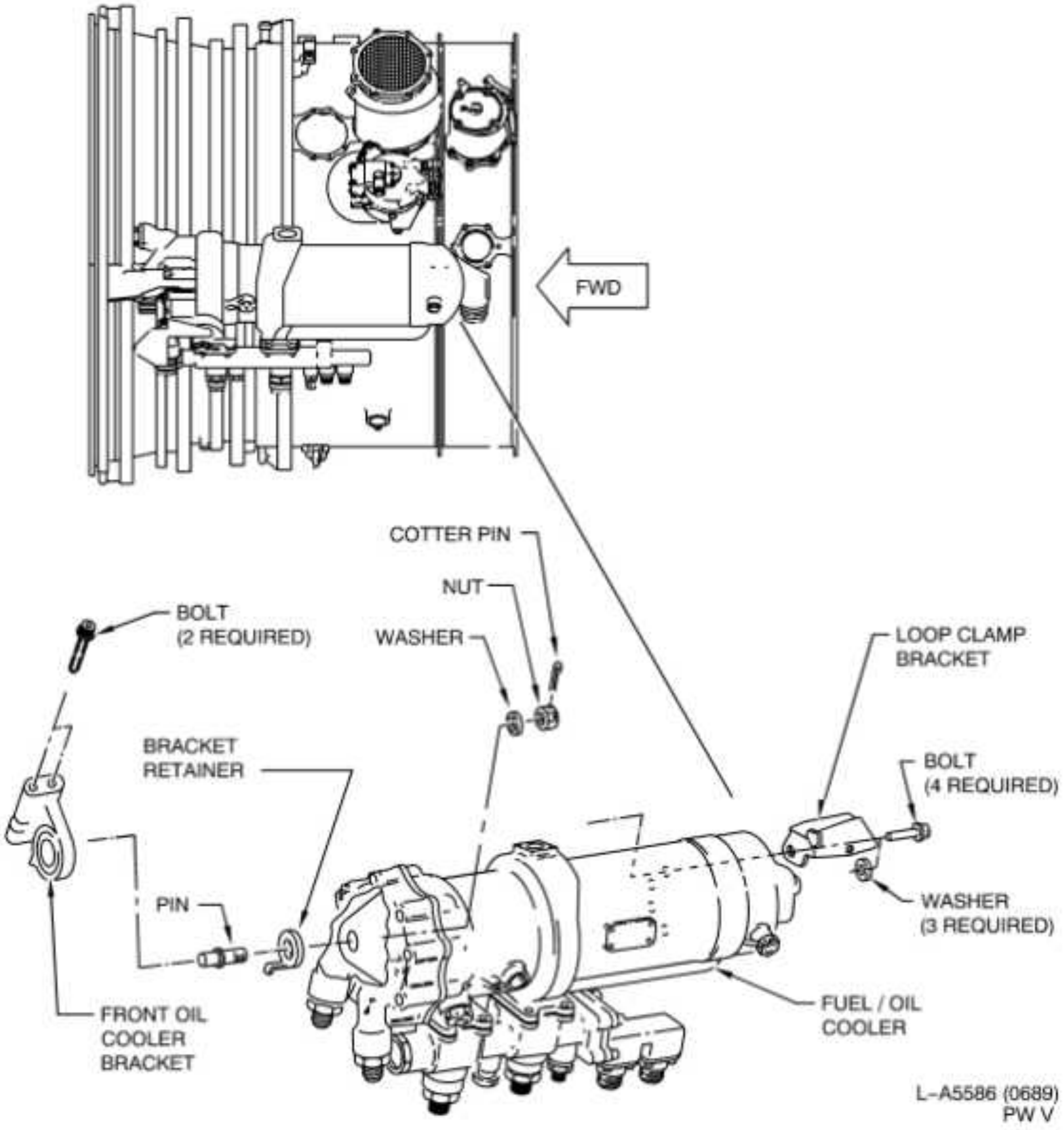
Turbine Vane Cooling Air Valve
Figure 503
(Task 72−35−00−030−005)


FLANGE E
FLANGE J
FLANGE K
FWD
FLANGE H
ADAPTER
NINTH STAGE START/STABILITY (2.9) BLEED VALVE
GASKET
BOLT (8 NECESSARY)
COVER
BOLT (2 NECESSARY)
GASKET
FWD
L−A9480 (0000)
PW V

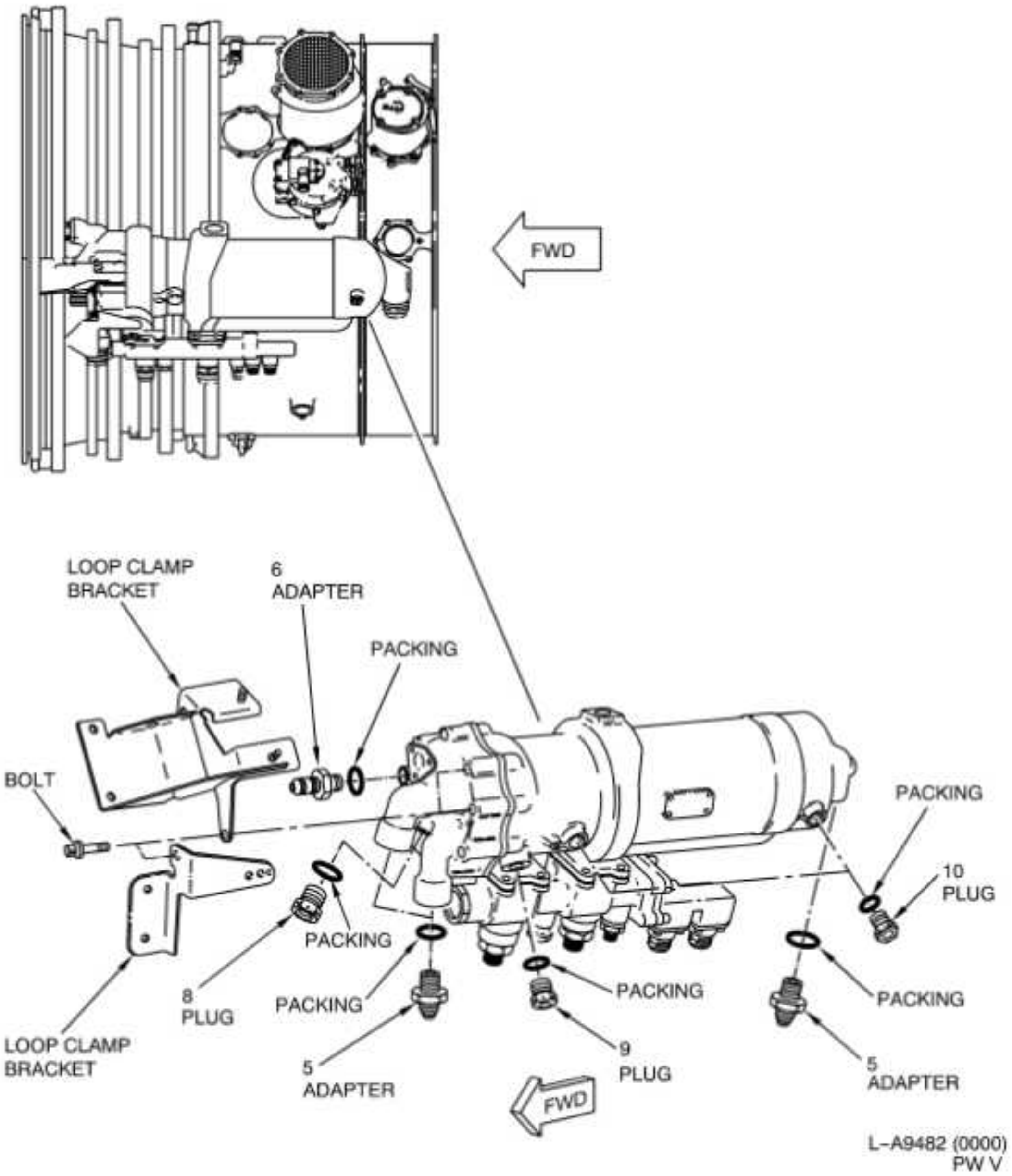
Ninth Stage Start/Stability (2.9) Bleed Valves
Figure 504 (Sheet 1)
(Task 72−35−00−030−005)


NINTH STAGE START/STABILILTY (2.9) BLEED VALVE
BOLT (8 NECESSARY)
ADAPTER
GASKET
A
BRACKET
GASKET
FWD
COVER
FWD
FLANGE E
FLANGE K
BOLT (2 NECESSARY)
VIEW A
FLANGE J
FLANGE H
L-A9481 (0000)
PW V

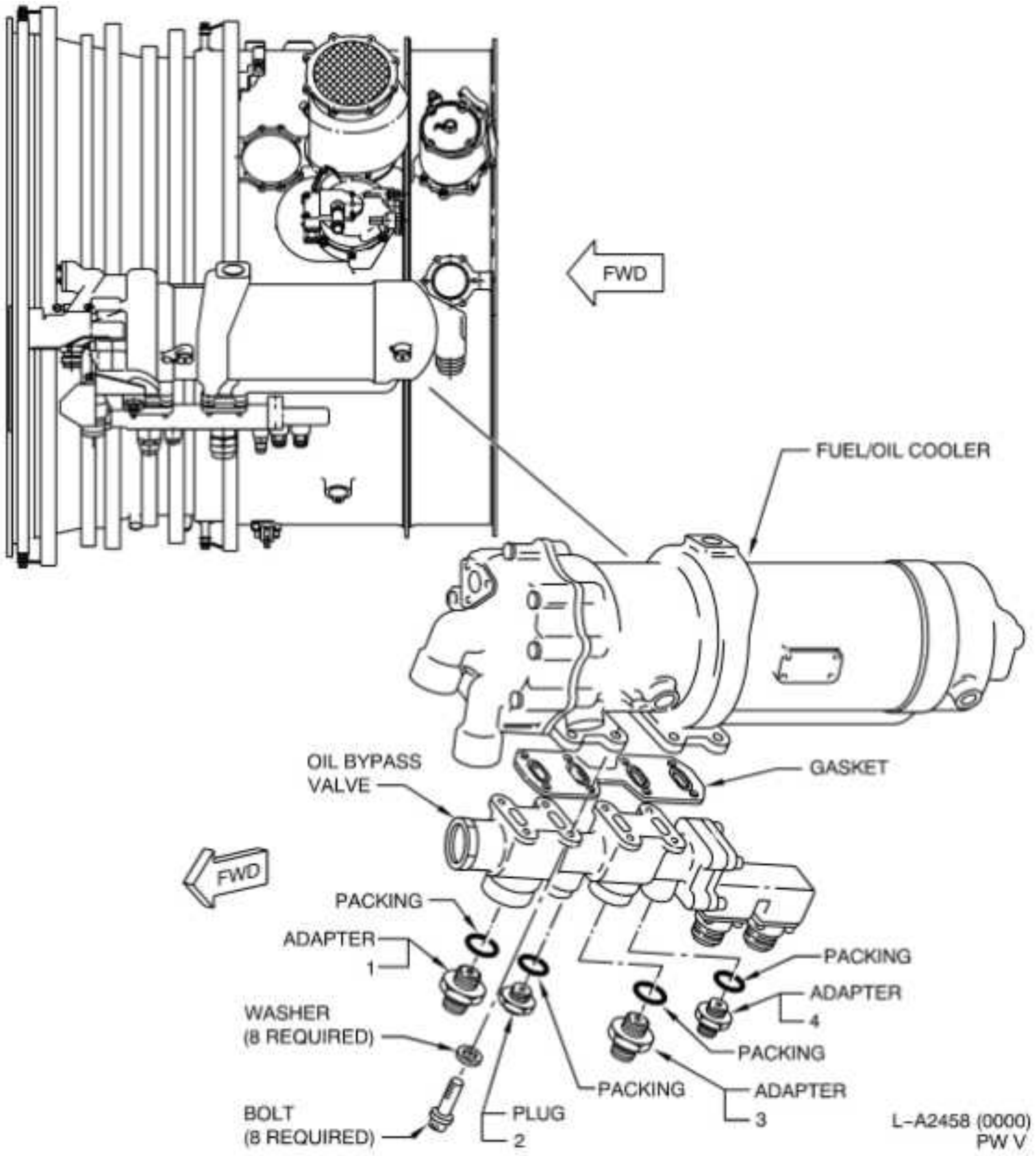
Ninth Stage Start/Stability (2.9) Bleed Valves
Figure 504 (Sheet 2)
(Task 72−35−00−030−005)


FWD
COTTER PIN
NUT
WASHER
BOLT
(2 REQUIRED)
LOOP CLAMP
BRACKET
BOLT
(4 REQUIRED)
BRACKET
RETAINER
PIN
WASHER
(3 REQUIRED)
FRONT OIL
COOLER
BRACKET
FUEL / OIL
COOLER
L−A5586 (0689)
PW V

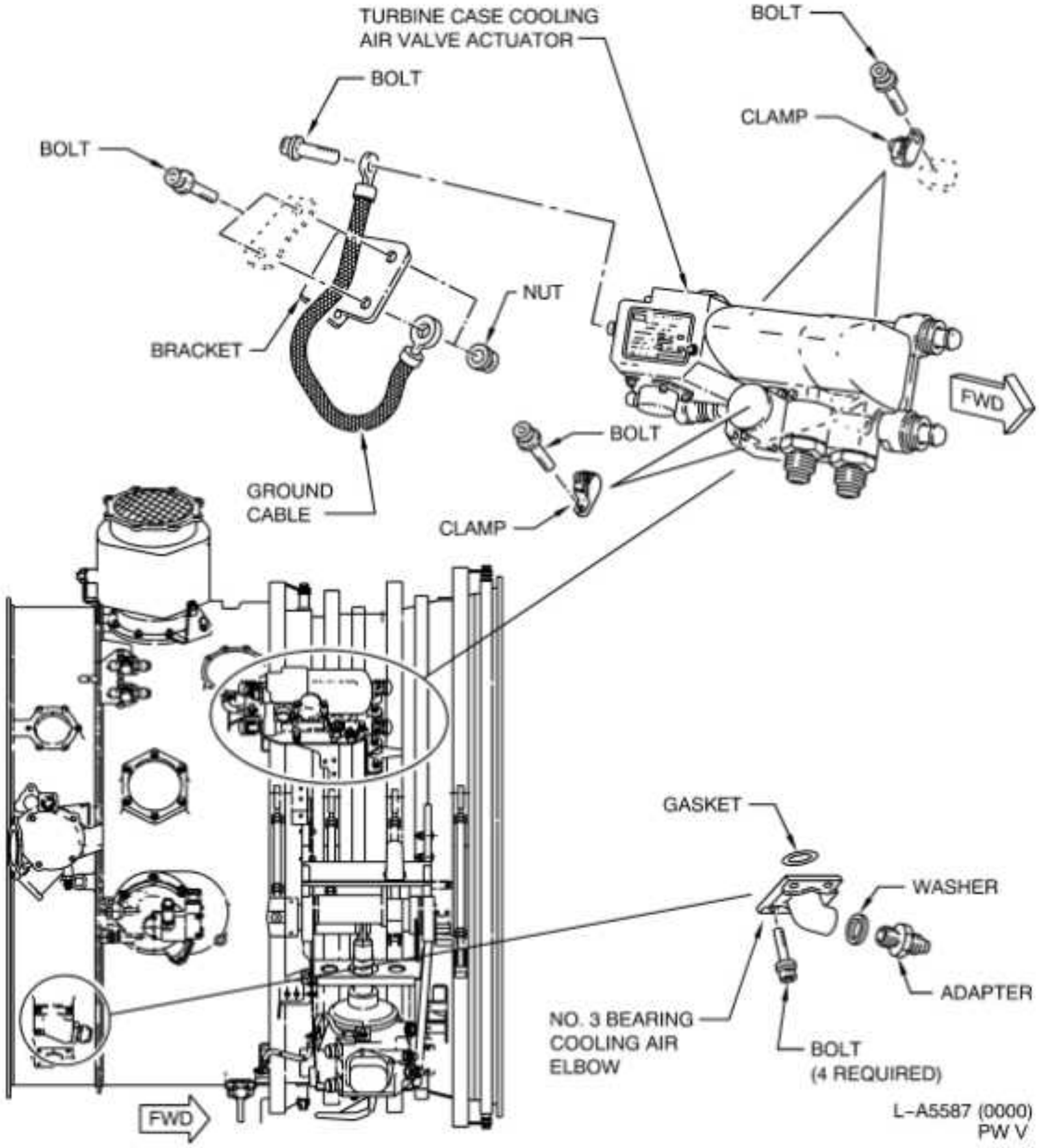
Fuel/Oil Cooler And Bypass Valve
Figure 505 (Sheet 1)
(Task 72−35−00−030−005)


FWD
LOOP CLAMP BRACKET
6 ADAPTER
PACKING
BOLT
PACKING
10 PLUG
PACKING
8 PLUG
PACKING
PACKING
PACKING
LOOP CLAMP BRACKET
5 ADAPTER
9 PLUG
5 ADAPTER
FWD
L−A9482 (0000)
PW V

Fuel/Oil Cooler And Bypass Valve
Figure 505 (Sheet 2)
(Task 72−35−00−030−005)

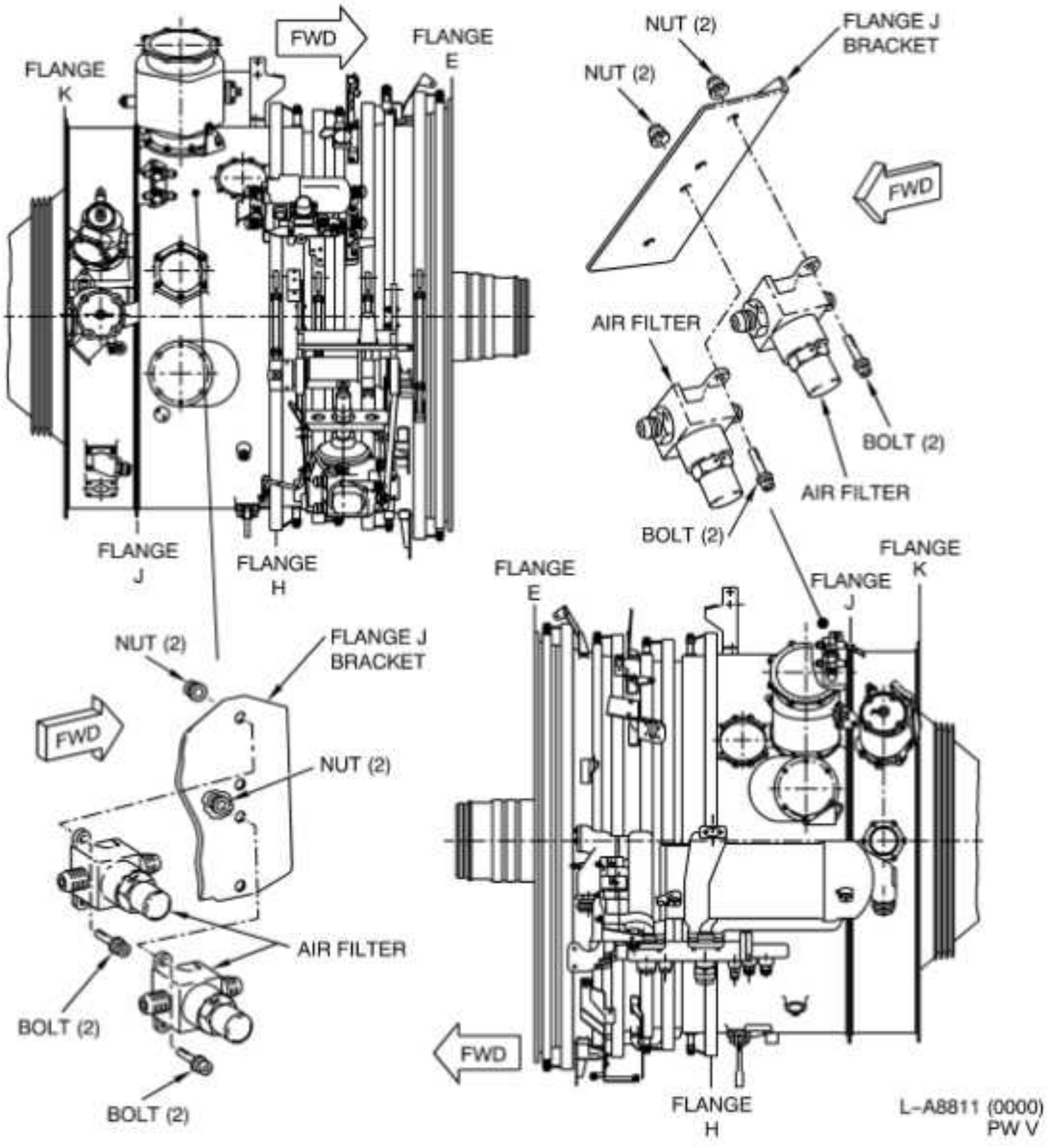

FWD
FUEL/OIL COOLER
GASKET
OIL BYPASS VALVE
FWD
PACKING
ADAPTER 1
WASHER (8 REQUIRED)
BOLT (8 REQUIRED)
PLUG 2
PACKING
PACKING
ADAPTER 3
PACKING
PACKING
ADAPTER 4
L−A2458 (0000)
PW V

Fuel/Oil Cooler And Bypass Valve
Figure 505 (Sheet 3)
(Task 72−35−00−030−005)

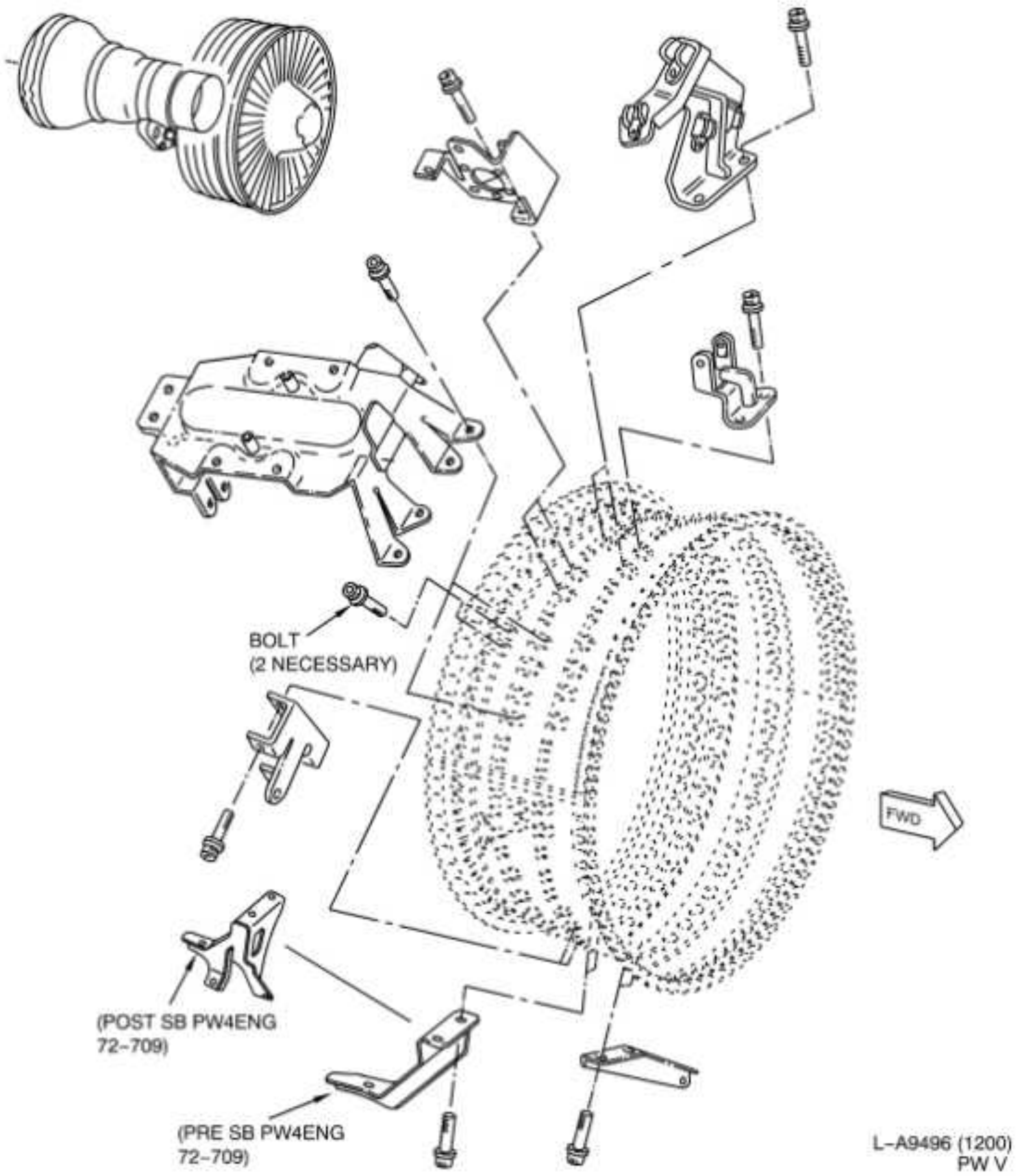

TURBINE CASE COOLING AIR VALVE ACTUATOR
BOLT
BOLT
BOLT
CLAMP
NUT
BRACKET
FWD
BOLT
GROUND CABLE
CLAMP
GASKET
WASHER
ADAPTER
NO. 3 BEARING COOLING AIR ELBOW
BOLT (4 REQUIRED)
FWD
L−A5587 (0000)
PW V

Turbine Case Cooling Air Valve Actuator
Figure 506
(Task 72−35−00−030−005)

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−01

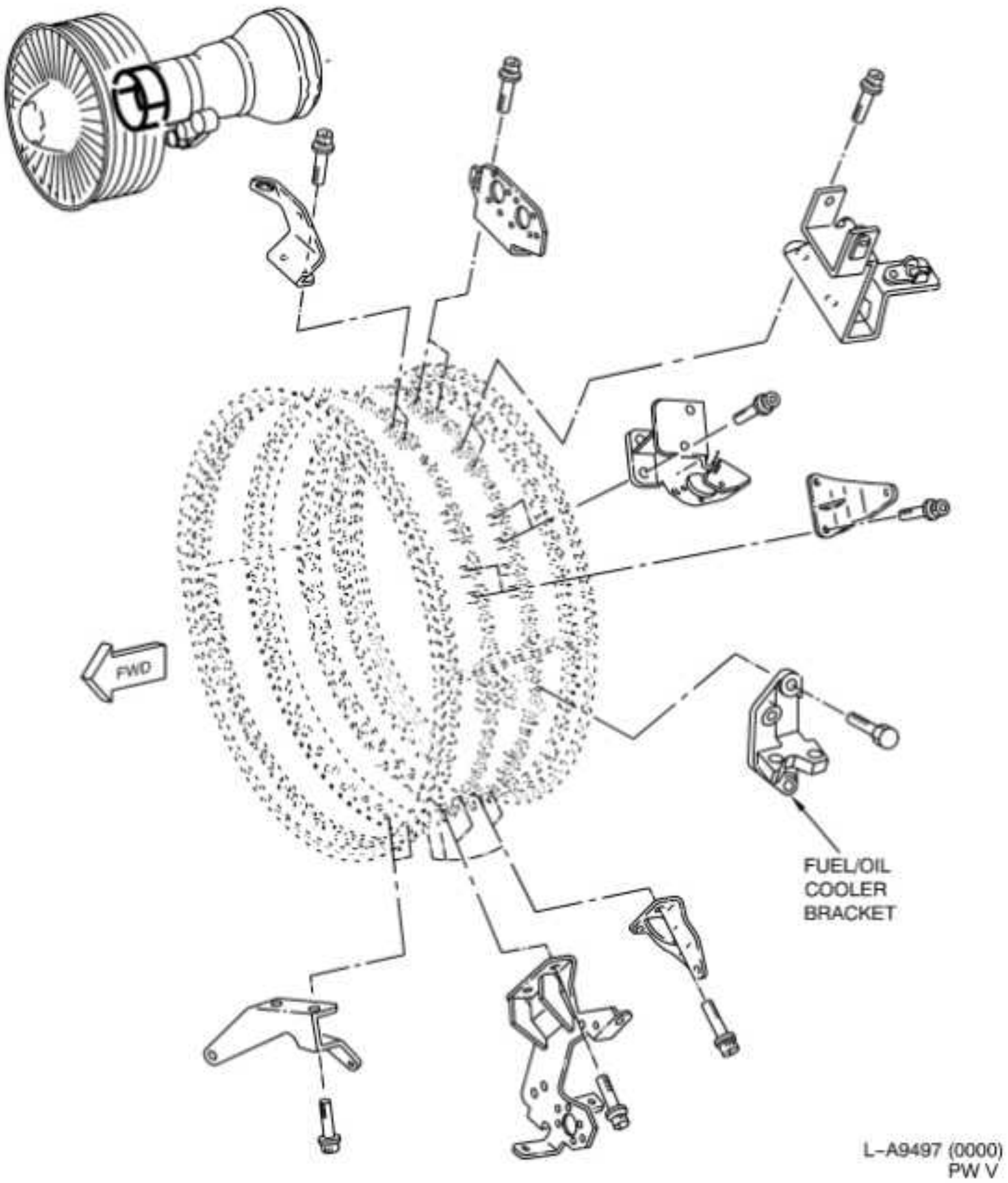

FLANGE K
FWD
FLANGE E
FLANGE J
FLANGE H
NUT (2)
FLANGE J BRACKET
NUT (2)
FWD
AIR FILTER
BOLT (2)
AIR FILTER
BOLT (2)
FLANGE K
FLANGE J
FLANGE E
NUT (2)
FLANGE J BRACKET
FWD
NUT (2)
AIR FILTER
BOLT (2)
BOLT (2)
FWD
FLANGE H
L−A8811 (0000)
PW V

Turbine Vane And Blade Cooling Air Valve Filters
Figure 507
(Task 72−35−00−030−005)


BOLT
(2 NECESSARY)
FWD
(POST SB PW4ENG
72−709)
(PRE SB PW4ENG
72−709)
L−A9496 (1200)
PW V

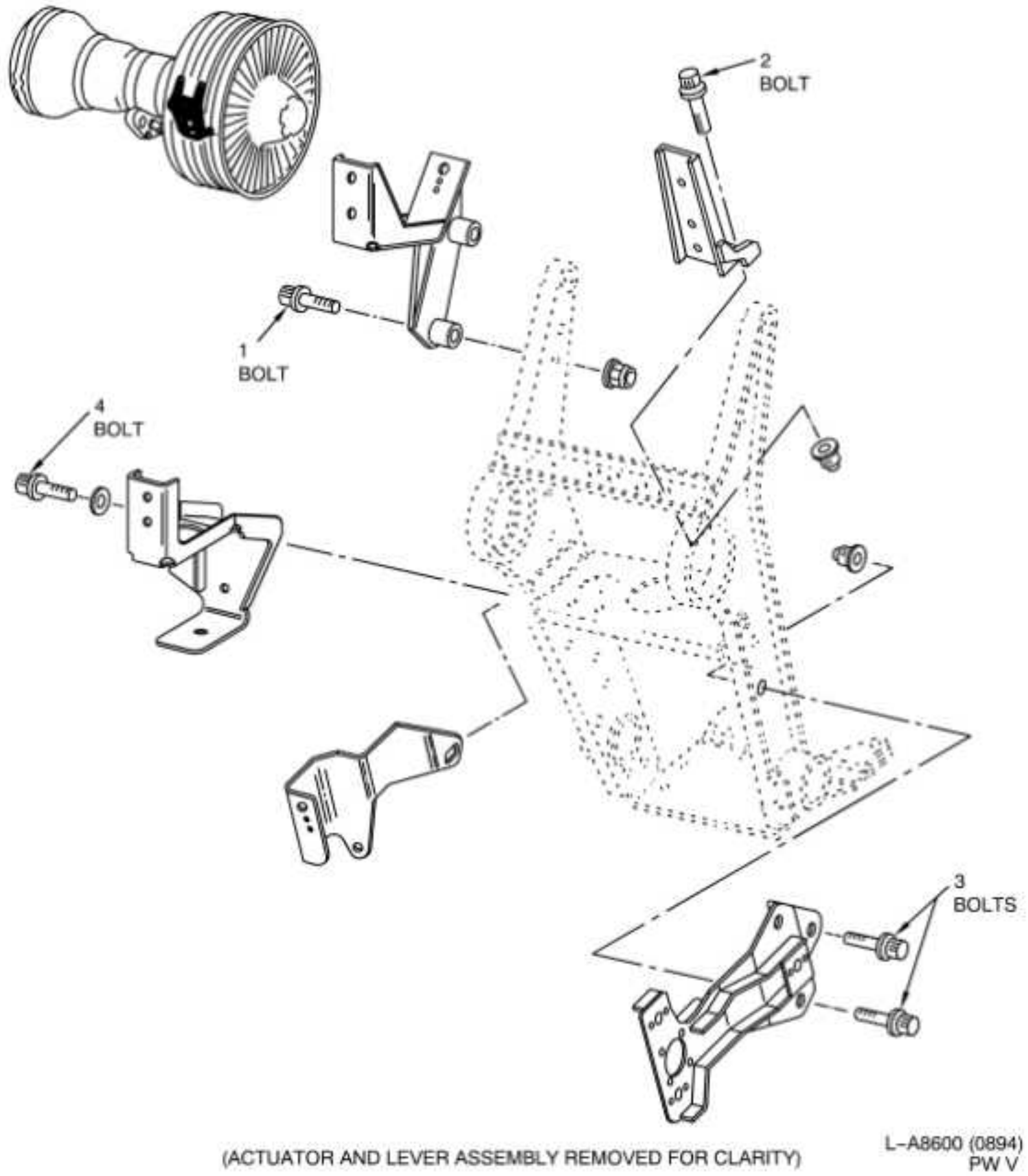
High Pressure Compressor Front Case Bracket Locations
Figure 508 (Sheet 1)
(Task 72−35−00−030−005)

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−01

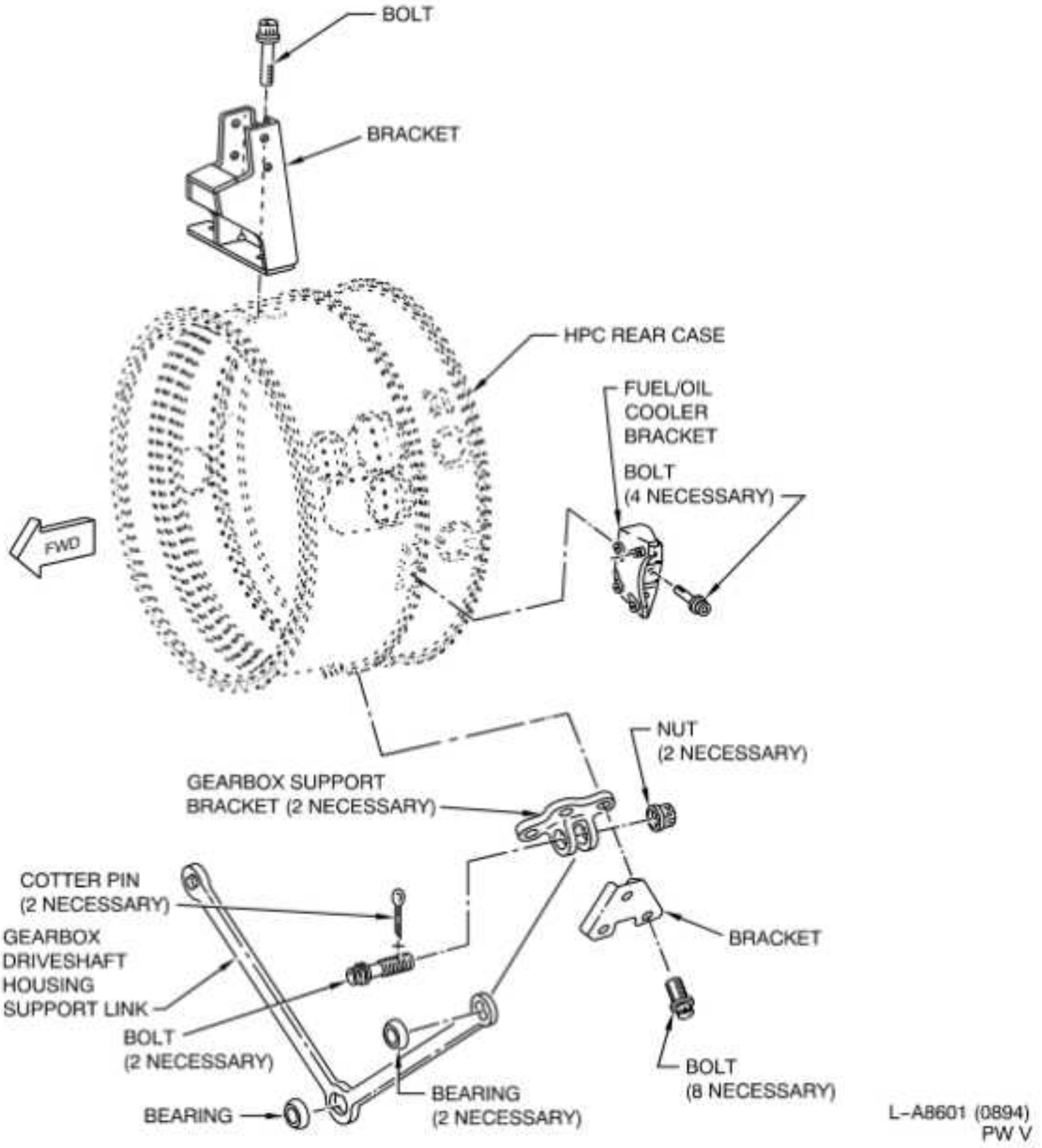

FWD
FUEL/OIL COOLER BRACKET
L−A9497 (0000)
PW V

Front HPC Case Bracket Locations
Figure 508 (Sheet 2)
(Task 72−35−00−030−005)

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−01


2
BOLT
1
BOLT
4
BOLT
3
BOLTS
(ACTUATOR AND LEVER ASSEMBLY REMOVED FOR CLARITY)
L−A8600 (0894)
PW V

Compressor Stator Cylinder Support Bracket Locations
Figure 509
(Task 72−35−00−030−005)


BOLT
BRACKET
HPC REAR CASE
FUEL/OIL COOLER BRACKET
BOLT (4 NECESSARY)
FWD
NUT (2 NECESSARY)
GEARBOX SUPPORT BRACKET (2 NECESSARY)
COTTER PIN (2 NECESSARY)
GEARBOX DRIVESHAFT HOUSING SUPPORT LINK
BRACKET
BOLT (2 NECESSARY)
BOLT (8 NECESSARY)
BEARING
BEARING (2 NECESSARY)
L-A8601 (0894)
PW V

High Pressure Compressor Rear Case Bracket Locations
Figure 510
(Task 72-35-00-030-005)

Previous Pageblock Return to Previous Menu Next Pageblock

HIGH PRESSURE COMPRESSOR (HPC) - DISASSEMBLY-02

Task 72-35-00-030-002:

1. Remove HPC Stator Vane Actuator And Lever Assembly

A. Equipment And Materials Required - None

B. Procedure

Subtask 72-35-00-030-057:

(1) (Pre SB PW4ENG 72-534) Remove wire and remove two cotter pins from each of the two upper support studs of the support assembly. Discard cotter pins. Remove nuts from each stud. Remove studs.

(2) (Post SB PW4ENG 72-534) Remove two cotter pins from each of the two upper support expandable studs (called studs) of the support assembly. Discard cotter pins. Remove nuts and washers from each end of the studs. Remove studs.

NOTE: (Post SB PW4ENG 72-534) Removal of the stud from the front attachment lug may require that the 5th stage unison ring be rotated to allow the stud to be removed through the hole in the clevis.

(3) Remove cotter pin from bolt and nut attaching brace to support assembly. Discard cotter pin. Remove nut and bolt.

(4) (Pre SB PW4ENG 72-506) Remove cotter pins securing nuts and bolts to each of the four links and synchronizing rings. Discard cotter pins. Remove nuts, washers (on stages where applicable) and bolts from rings.

(5) (Post SB PW4ENG 72-506) Remove cotter pins securing nut and bolts to each of the four links and synchronizing rings. Discard cotter pins. Remove nuts and bolts from rings.

(6) Remove cotter pins from bolts securing bottom of support to front case. Discard cotter pins. Remove nuts and bolts.

(7) Remove vane actuator and lever assembly and place on bench. Install protective closures to openings.

Subtask 72-35-00-030-058:

(8) Remove four bolts securing bracket to HPC front case at approximately 3 o'clock location. Remove bracket.

(9) Remove cotter pins securing bolts retaining brace to HPC front case at approximately 4 o'clock location. Remove nuts and bolts. Remove brace from front case.

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−03

Task 72−35−00−030−003:

1. Disassemble High Pressure Compressor (HPC)

A. Equipment And Materials Required

Special Tools:

PWA 76154	Adapter (4 Necessary)
PWA 80515	Stand
PWA 85086	Lift Arm
PWA 85108	Stand, Support (Optional to PWA 85580 and PWA 87022)
PWA 85124	Adapter, Lift
PWA 85159	Protector, Thread (Optional Tools)
PWA 85160	Protector, Thread (Optional Tools)
PWA 85294	Adapter, Support
PWA 85528	Adapter, Handling
PWA 85529	Nut, Retaining
PWA 85530	Wrench, Torque
PWA 85531	Adapter, Torque
PWA 85532	Bracket, Lift
PWA 85537	Fixture, Handling (For Compressors With A Symmetric Case)
PWA 85580	Stand, Support (Optional to PWA 85108 and PWA 87022)
PWA 85593	Adapter, Ring
PWA 85743	Puller, Jackscrew
PWA 85744	Puller, Knocker
PWA 86098	Pusher, Mechanical (3 Necessary, Optional to PWA 86588)
PWA 86220	Puller, Jackscrew
PWA 86536	Adapter, Torque
PWA 86588	Puller, Mechanical (Optional to PWA 102033)
PWA 87022	Stand, Support
PWA 88560	Fixture, Handling (For Compressors With An Asymmetric Case)
PWA 88643	Sling, Lifting (Optional to PWA 88673 and PWA 102286)
PWA 88673	Sling, Lifting (Optional to PWA 88643 and PWA 102286)
PWA 88700	Adapter, Lift
PWA 102033	Puller, Mechanical
PWA 102286	Adapter, Lift (Optional to PWA 88673 and PWA 88643)

B. Procedure

HIGH PRESSURE COMPRESSOR (HPC) - DISASSEMBLY-03

Subtask 72-35-00-030-059:

(1) Remove borescope plugs from locations at 5, 8, 8:30 and 9:30 o'clock on HPC rear case. Discard key washers.

(2) Remove bolts securing cover to HPC rear case at approximately 2:30 o'clock position. Remove cover and discard gasket. See Figure 501.

Subtask 72-35-00-030-060:

(3) Attach PWA 85528 Adapter to HPC front hub. Secure with PWA 85529 Nut, using PWA 85530 Wrench and PWA 85531 Adapter. Torque nut to 300 lb-in. (33.895 N.m). Attach PWA 85537 Fixture (for compressors with the symmetric case), or the PWA 88560 Fixture (for compressors with the asymmetric case) and adapter to the HPC front case.

(4) Install hoist and PWA 88643 Sling or PWA 88673 Sling with two PWA 76154 Adapters to fixture on front end of HPC. Raise HPC from stand and install second hoist and PWA 88643 Sling or PWA 88673 Sling with two PWA 76154 Adapters to fixture on rear case. Trunnion HPC to front end down on PWA 87022 Support Stand (Optional PWA 85580 Support Stand or PWA 85108 Support Stand). Remove bottom hoist, sling and adapters from fixture.

(5) Remove attaching hardware from rear fixture on rear case and hub. Using hoist and sling attached, remove rear fixture from HPC.

Subtask 72-35-00-030-061:

(6) Remove the Flange H hardware as follows. Refer to 72-35-00, Disassembly-21 (Task 72-35-00-030-021).

(7) Remove nuts, bolts, and washers securing runner assemblies. Remove runners and shims from flange.

(8) Remove 62 bolts securing HPC exit guide vane support to HPC inner rear case assembly.

NOTE: Some HPC compressors will not have HPC exit guide vane support and heat shield.

(9) Install PWA 85744 Puller over rim of support and secure with hand knob. Use sliding action to remove support. Remove puller. Remove heat shield.

(10) (Pre SB PW4ENG 72-602) Install PWA 86220 Puller or PWA 85743 Puller and locate it around HPC rear hub. Rest puller on case and rotate puller to allow jaws to slip under HPC rear support pull tabs. Apply equal turns to jackscrews to remove support. Remove puller.

NOTE: PWA 86220 Puller is used with supports having eight pull tabs (Post SB PW4ENG 72-298). Alternatively, if PWA 85743 Puller is to be used with supports having three pull tabs (Pre SB PW4ENG 72-298), use mallet and nylon drift to facilitate removal.

(11) (Post SB PW4ENG 72-602) Install PWA 101002 Puller or PWA 102301 Puller onto the HPC rear support.

NOTE: PWA 101002 Puller or PWA 102301 Puller is used with supports having a continuous full ring lip for puller clamp engagement (Post SB PW4ENG 72-602).

(a) Install PWA 101002 Puller onto the HPC rear support. Engage the four detail clamps under the full ring puller lip of the rear support. Tighten the 12 detail flange nuts to lock the clamps in position under the puller lip. After the clamps are positioned under the puller lip, continue to tighten the 12 flange nuts one at a time about one half turn until the rear support is removed from the HPC rear case. Remove the puller.

(b) Install PWA 102301 Puller onto the HPC rear support. Pull the four detail clamps under the puller lip of the rear support. Tighten the 12 detail cap screws to lock the clamps and rocker plates in position against the puller lip. After the clamps are correctly positioned under the puller lip, tighten the 12 flange nuts one at a time about one half turn until the rear support is disassembled from the rear case. Remove the puller.

(12) Remove 64 bolts from inside rear case which secures rear case and inner case to 9th and 10th stator set.

(13) Remove the 16 bolts that attach the eight thrust pins or thrust pin covers to the HPC inner rear case. Turn the rear case as necessary to remove the bolts.

(14) Remove the two bolts and nuts that attach the identification plate to the bracket on the HPC rear case Flange J.

(15) Remove borescope plugs from Stages 9, 10, 13 and 14 stators. Rotate rear case to remove plug over bleed port.

(16) Use a hoist and install either the PWA 88643 Sling or the PWA 88673 Sling or the PWA 102286 Lift Adapter to the HPC rear case. Raise the HPC rear case from the HPC. Put the case on the storage rack and remove the hoist and either the sling or the lift adapter from the case.

(17) Remove two gaskets from stage 9 stator and place on storage rack.

Subtask 72−35−00−030−062:

(18) Remove HPC inner rear case from stators, using PWA 102033 Puller, Mechanical. When case does not bind during removal, PWA 86098 Pullers can be used as optional tools for removing case, as follows:

(a) Secure three PWA 86098 Pushers equally spaced around rear flange of inner rear case with five cap screws.

(b) Install pusher with groove fitting into stepped groove in stator assembly.

(c) Turn single cap screw alternately between the three pushers to remove inner case.

(19) Remove Stages 13 and 14 with seals from HPC.

(20) Remove Stages 11 and 12 with seals from HPC.

(21) Remove 40 bolts securing Stage 9 and 10 to Stage 8. Remove 10 bolts and nuts securing Stages 9 and 10 set together. If applicable, remove featherseals and remove Stages 9 and 10.

(22) Remove 8 bolts and nuts securing Stage 8 set together. If applicable, remove featherseals and remove Stage 8 when front cases are removed.

HIGH PRESSURE COMPRESSOR (HPC) - DISASSEMBLY-03

Subtask 72-35-00-030-063:

(23) Remove 12 bolts securing three clevis assemblies to rings at 3 o'clock location. Remove clevis assemblies. Remove 12 bolts securing three plates to rings at 9 o'clock location. Remove plates. Discard all key washers.

CAUTION: (POST SB PW4ENG 72-485) THE 5TH THROUGH 7TH STAGE OUTER SHROUD SETS AND HPC FRONT CASE SET WERE ASSEMBLED AND MACHINED AS A MATCHED SET. THESE PARTS MUST BE KEPT TOGETHER AS A SET.

(24) Use PWA 86536 Adapter and remove the 22 nuts and bolts that attach the case halves together. Remove the hardware that attaches the front case to the adapter. Turn the 8th stage stator to align the splits. Use a hoist and two PWA 85532 Brackets installed at the fourth, fifth and sixth holes from the stator split line and remove one of the two case halves with the half stator. Do this procedure again for the remaining case half and half stator. Remove the stator halves from the case halves. Remove the two locks from the case halves.

Subtask 72-35-00-030-064:

(25) Use a hoist and install PWA 85593 Ring Adapter to the PWA 87022 Support Stand (Optional PWA 85580 Stand or PWA 85108 Stand). Use a hoist and install the PWA 80515 Support Stand onto the PWA 85593 Adapter and PWA 87022 Support Stand (Optional PWA 85580 Support Stand or PWA 85108 Stand) and attach in position.

(26) FOR THESE MODELS: 4152, 4156A, 4158
Install PWA 85124 Adapter to threads on rear shaft. Attach PWA 85086 Arm to installed adapter. Attach hoist to arm and raise rotor assembly from build stand.

(27) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
(Pre SB PW4ENG 72-562) Install the PWA 85124 Adapter to the threads on the rear shaft. Attach the PWA 85086 Arm to the installed adapter. Attach the hoist to the arm and raise the rotor assembly from the build stand.

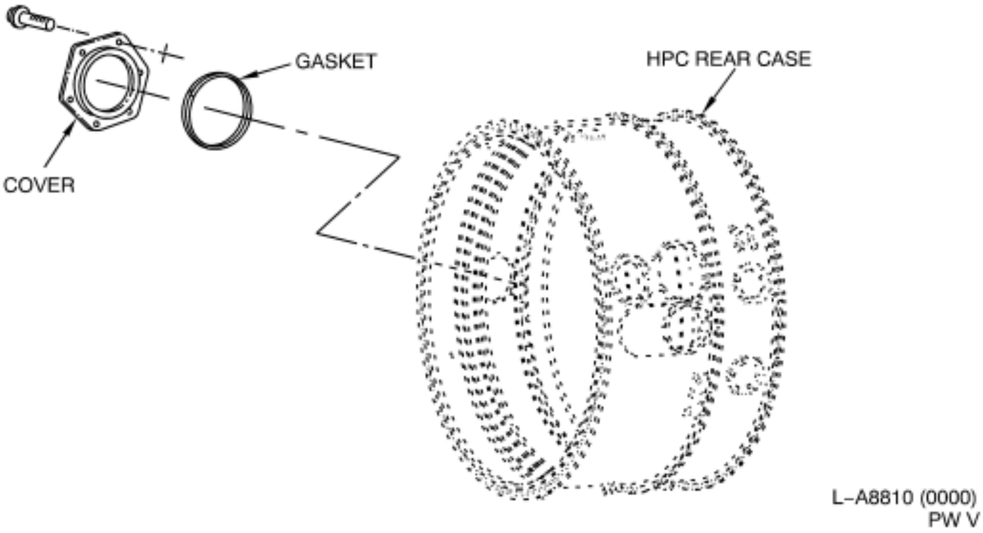
(28) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
(Post SB PW4ENG 72−562) Install the PWA 88700 Adapter to the threads on the rear shaft. Attach the PWA 85086 Arm to the installed adapter. Attach the hoist to the arm and raise the rotor assembly from the build stand.

(29) Install PWA 88643 Sling or PWA 88673 Sling to the adapter on front hub. Attach hoist to sling and trunnion rotor assembly to rear end down. Remove hoist, arm and adapter from rear shaft.

(30) Lower assembly down into PWA 80515 Stand with PWA 85294 Adapter. Remove nut, adapter and fixture from front hub. Install PWA 85160 Thread Protector on front hub and PWA 85159 Thread Protector on rear shaft.

NOTE: PWA 85159 Thread Protector and PWA 85160 Thread Protector are optional and some other type of thread protection can be used.

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−03


GASKET
HPC REAR CASE
COVER
L−A8810 (0000)
PW V

Cover − HPC Rear Case
Figure 501
(Task 72−35−00−030−003)

HIGH PRESSURE COMPRESSOR (HPC) - DISASSEMBLY-03

Task 72-35-00-030-006:

1. Disassemble The High Pressure Compressor (HPC) (Ring Case Configuration)

A. Prerequisites

(1) Remove The HPC External Parts. Refer to 72-35-00, Disassembly-01 (Task 72-35-00-030-001) or (Task 72-35-00-030-005) as applicable.

(2) Remove The Flange J Brackets And Hardware. Refer to 72-35-00, Disassembly-20 (Task 72-35-00-030-020).

B. Equipment And Materials Necessary

Standard Tools:

Optional, Wrench (Extended Socket) Part No. QCL 5/16-2D-3/16 Used With Optional Cleco Air Gun	Brimatco Corporation P.O. Box 88 1486 Highland Ave. Cheshire, CT 06410 USA
Optional Cleco Air Gun (Nutrunner) PN 44RNAL-2-H-3, or PN 44RNAL-2RA8 Or Equivalent	Local Distributor Or, Cooper Tools Sales and Service P.O. Box 1410 Lexington, SC 29071-1410 USA
Optional, Flexible Extension Part No. GSYMU101 Or Equivalent	Snap-On Technologies Inc. P.O. Box 1430 Kenosha, WI 53141-1430 USA

NOTE: The optional Brimatco wrench (extended socket) PN QCL 5/16-2D-3/16 can be use with the Cleco Air Gun to help remove the flange nuts on the 8th through 14th stage compressor cases.

Special Tools:

	PWA 76154	Adapter (2 Necessary)
	PWA 80515	Stand, Support
	PWA 85086	Arm, Lift
	PWA 85108	Stand, Support (Optional To PWA 85580 And PWA 87022)
	PWA 85124	Adapter, Lift
	PWA 85159	Protector, Thread (Optional Tools)
	PWA 85160	Protector, Thread (Optional Tools)
	PWA 85294	Adapter, Support
	PWA 85528	Adapter, Handling
	PWA 85529	Nut, Retaining
	PWA 85530	Wrench, Torque
	PWA 85531	Adapter, Torque
	PWA 85532	Bracket, Lift
	PWA 85537	Fixture, Handling
	PWA 85580	Stand, Support
	PWA 85593	Ring, Adapter
R R	PWA 86536	Adapter, Torque (HPC Front Case Split Flange Nuts) (Optional to PWA 107300)
	PWA 87022	Stand, Support
	PWA 88643	Sling, Lifting (Optional To PWA 88673)
	PWA 88673	Sling, (2 Necessary)
	PWA 88700	Adapter, Lift (Post SB PW4ENG 72-562)
	PWA 100383	Adapter, Torque (14th Stage Case At Borescope Location)
	PWA 102260	Adapter, Torque
	PWA 105504	Adapter, Lift (HPC Rear Case)
	PWA 105562	Puller, Jackscrew (15th Stage Air Seal)
	PWA 105588	Puller, Jackscrew (8th Stage Case) (3 Necessary)
	PWA 107299	Adapter, Breakaway (HPC Case Flange Nuts)
R R	PWA 107300	Adapter, Breakaway (HPC Front Case Split Flange Nuts) (Optional to PWA 86536)

C. Procedure

NOTE: The HPC outer airseal set (Stages 5 through 15) (called seal set) consists of the HPC front case set, 5th through 7th stage HPC shroud sets, 8th through 15th stage compressor air seal assemblies, 8th through 14th stage compressor case assemblies, HPC rear support, classified spacer, and the HPC rear case. The matched set detail parts are identified by the Letter M followed by the last five digits of the HPC rear case serial number. These parts should be identified and kept together as a set.

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−03

Subtask 72−35−00−030−085:

(1) Remove borescope plugs from locations at 5, 8, 8:30 and 9:30 o'clock on HPC rear case. Discard the key washers. See Figure 501.

(2) Remove bolts from the HPC rear case at approximately 2:30 o'clock position. See Figure 502.

Subtask 72−35−00−030−087:

(3) Trunnion the HPC to the front end down position.

- (a) Attach the PWA 85528 Adapter to HPC front hub.
- (b) Use the PWA 85530 Wrench and PWA 85531 Adapter to attach the PWA 85528 Adapter with the PWA 85529 Nut.
- (c) Torque the Nut to 300 lb−in. (33.895 N.m).
- (d) Attach the PWA 85537 Fixture and Adapter and HPC front case.
- (e) Install a hoist and the PWA 88643 Sling or PWA 88673 Sling with two PWA 76154 Adapters to the Fixture on front end of the HPC.
- (f) Raise HPC from stand and install second hoist and PWA 88643 Sling or PWA 88673 Sling with two PWA 76154 Adapters to the Fixture on the HPC rear case.
- (g) Trunnion the HPC to the front end down on PWA 87022 Support Stand (Optional PWA 85580 Support Stand or PWA 85108 Support Stand).
- (h) Remove bottom hoist, Sling and Adapters from the Fixture.
- (i) Remove the attaching hardware from rear Fixture on the HPC rear case and hub.
- (j) Using the hoist and Sling attached, remove the rear Fixture from the HPC.

Subtask 72−35−00−030−088:

(4) Remove four bolts and key washers from each of the synchronizing ring clevis assemblies installed at the 3 o'clock locations on the HPC front case. Remove the four clevis assemblies and discard the key washers.

NOTE: Be careful when you remove the bolts. Loosen the bolts in small equal amounts to prevent damage to the nutplates.

(5) Remove four bolts and key washers from the synchronizing ring plates installed at the 9 o'clock locations on the HPC front case. Remove the four plates and discard the key washers.

NOTE: Be careful when you remove the bolts. Loosen the bolts in small equal amounts to prevent damage to the nutplates.

Subtask 72−35−00−030−089:

(6) Remove the 15th stage compressor heat shields. See Figure 503.

(a) Remove the bolts (503/3), bushings (503/4), and spacer plates (503/5) and covers (503/6) that attach the heat shields to the HPC rear support.

NOTE: You can use the PWA 107299 Adapter or the PWA 102260 Torque Adapter with a 3/8 inch drive to loosen the case flange nuts in the steps that follow.

(b) Remove the 15th stage compressor heat shield upper (503/2) and lower (503/1) from the HPC rear support.

(7) Remove the HPC rear support. See Figure 504.

(a) Remove the bolts (504/6) and washers (504/7) that attach the HPC rear support (504/5) to the HPC rear case.

(b) Remove the bolts (504/1) and washers (504/2), nuts (504/2) and washers (504/4) that attach the HPC rear support (504/5) to the 15th stage air seal.

(c) Install 12 (.250-28) jackscrews in the threaded holes in the inner flange of the rear support.

(d) Evenly tighten the jackscrews to loosen the HPC rear support (504/5).

(e) Remove the HPC rear support from the case assembly.

(f) Remove the jackscrews.

(g) Remove the HPC spacers (504/8) from the HPC rear case.

(h) The HPC rear support and the HPC rear case is matched set. Use a suitable tag, or use an approved marker to make marks on the support to indicate that these parts must be kept together as a matched set.

Subtask 72-35-00-030-090:

(8) Remove the Flange H hardware. Refer to 72-35-00, Disassembly-21 (Task 72-35-00-030-021).

(9) Remove the 7th stage runners and shims.

(10) Remove the HPC rear case (505/1). See Figure 505.

(a) Attach the PWA 105504 Adapter to the HPC rear case.

1 Attach a hoist to the lift hole in the Adapter.

2 Use the hoist to lift the Adapter and put it over the HPC module.

3 Align the boltholes in the Adapter with the boltholes in the case.

NOTE: The Adapter has a scribed line on the OD of the outer ring. Align this line with the offset hole in the rear flange of the HPC rear case.

4 Install the Adapter to the rear case with eight detail screw assemblies and four nut plates.

(b) Remove the bolts, washers, brackets, and nuts that attach the HPC rear case (505/1) to the rear flange of the HPC front case.

(c) Install .250-28 jackscrews in the threaded holes in the front flange of the HPC rear case.

(d) Evenly tighten the jackscrews to remove the HPC rear case.

(e) Remove the jackscrews.

(f) Use the hoist to remove the rear case from the HPC module. Put the case on a pallet.

(g) Remove the screw assemblies and nut plates that attach the Adapter to the case.

(h) Remove the Adapter from the case.

(i) The HPC rear case and the HPC rear support is a matched set. Use a suitable tag, or use an approved marker to make marks on the case to indicate that these parts must be kept together as matched set.

(11) Remove the seals from the case assemblies. See Figure 506.

(a) Remove the seal (506/1) from the vertical (seal holder) groove in the front flange of the 12th stage case.

(b) Remove the seal ring seal (506/2) from the (seal holder) groove in the 12th stage case.

(c) Remove the seal ring (spring) (506/3) from the (seal holder) groove in the 12th stage case.

(d) Remove the gasket (506/4) from the upper groove in the 9th stage case. Discard the gasket.

Subtask 72-35-00-030-091:

(12) Remove the 9th stage compressor heat shields. See Figure 507 (Sheets 1 and 2).

(a) Remove the nuts (507/3), bushings (507/4), spacers (507/5), spacers (507/7), covers (507/6), bushing (507/8) and bolts (507/9), that attach the 9th stage compressor upper and lower heat shields (507/10) to the 8th and 9th stage case flanges. See Figure 507 (Sheet 2).

(b) Rotate and remove the left and right outer rear heat shields (507/1).

(c) Rotate and remove the upper and lower inner heat shield (507/2) from the groove in the forward flange of the 9th stage case.

(13) Remove the 11th stage compressor heat shield. See Figure 508.

(a) Remove the 24 bolts (508/3) that attach the heat shield retainers (508/4), (508/5), and 10th stage compressor heat shields (508/2) to the rear flange of the 9th stage compressor case.

(b) Lower the heat shield to remove it from the groove between the 11th and 12th stage case flanges.

(c) Expand and remove the heat shield (508/1) from the cases.

(14) Remove the 12th stage compressor rear heat shields. See Figure 509.

(a) Remove the bolts (509/1), bushings (509/2), spacers (509/3), and nuts (509/6) that attach the 12th stage compressor rear heat shields (509/8) to the front flange of the 12th stage case.

(b) Rotate and remove the left and right outer rear heat shields (509/4) and (509/8).

(c) Rotate and remove the upper and lower inner rear heat shields (509/5) and (509/7).

(15) Remove the 15th stage compressor air seal (510/1) with the PWA 105562 Puller. See Figure 510 (Sheet 1).

(a) Turn the 12 detail hex head screws to flush or below the detail ring segments.

(b) Loosen the four detail hand knobs.

(c) Remove the four detail pins.

(d) Expand the ring segments and install the four detail pins in the hole locations marked "A".

(e) Align the hole to the right of the TDC mark on the Puller with the bolt at the 12 o'clock on the air seal (510/1).

(f) Align the remaining bolts from the 15th stage air seal with the remaining holes in the detail segments. Make sure the 12 detail hex head screws are aligned with the 12 through holes in the air seal and install the Puller to the air seal (510/1).

(g) Remove the four detail pins.

(h) Contract the ring segments to engage the air seal puller groove, until four detail pins can be installed in the hole location marked "B".

(i) Tighten the four detail hand knobs.

(j) Turn the 12 detail hex head screws evenly in small increments until the air seal (510/1) is removed from the 14th stage compressor case.

(k) Remove the Puller.

(l) Remove the air seal (510/1).

(16) Remove the 13th and 14th stage compressor heat shield and retainers. See Figure 510 (Sheet 2).

(a) Remove the 13th and 14th stage compressor heat shield (510/1) from the 13th stage heat shield retainers.

(b) Remove the 24 bolts (510/5) that attach the 13th stage compressor heat shield retainers (510/2) and (510/4), and the 13th stage compressor heat shields (510/3) to the 12th stage compressor case.

Subtask 72−35−00−030−092:

(17) Remove the 14th stage compressor case assembly.

(a) Remove the bolts and nuts that attach the 14th stage case and air seal to the 13th stage case. If necessary, use the PWA 100383 Torque Adapter to remove the nuts at the borescope location.

(b) Install 12 (.250−28) jackscrews in the threaded holes in the front flange of the 14th stage case.

(c) Evenly tighten the jackscrews to loosen the case.

(d) Remove the jackscrews and case.

(18) Carefully remove the 14th stage vane stator segments.

(19) Remove the 14th stage compressor air seal.

(a) Install 12 (.250−28) jackscrews in the threaded holes in the rear (upper) flange of the 13th stage case.

(b) Evenly tighten the jackscrews to loosen the 14th stage air seal.

(c) Remove the jackscrews.

(d) Remove the air seal.

Subtask 72−35−00−030−093:

(20) Remove the 13th stage compressor case assembly.

(a) Remove the bolts and nuts that attach the 13th stage case and air seal to the 12th stage case.

(b) Install 12 (.250−28) jackscrews in the threaded holes in the front (lower) flange of the 13th stage case.

(c) Evenly tighten the jackscrews to loosen the case.

(d) Remove the jackscrews and case.

(21) Carefully remove the 13th stage vane stator segments.

(22) Remove the 13th stage compressor air seal.

(a) Install 12 (.250−28) jackscrews in the threaded holes in the rear (upper) flange of the 12th stage case.

(b) Evenly tighten the jackscrews to loosen the 13th stage air seal.

(c) Remove the jackscrews.

(d) Remove the air seal.

Subtask 72−35−00−030−094:

(23) Remove the 12th stage compressor case assembly.

(a) Remove the nuts and bolts that attach the 12th stage case and air seal to the 11th stage case.

(b) Install 12 (.250−28) jackscrews in the threaded holes in the front (lower) flange of the 12th stage case.

(c) Evenly tighten the jackscrews to loosen the case.

(d) Remove the jackscrews and case.

(24) Carefully remove the 12th stage vane stator segments.

(25) Remove the 12th stage compressor air seal.

(a) Install 12 (.250−28) jackscrews in the threaded holes in the rear (upper) flange of the 11th stage case.

(b) Evenly tighten the jackscrews to loosen the 12th stage air seal.

(c) Remove the jackscrews.

(d) Remove the air seal.

Subtask 72−35−00−030−095:

(26) Remove the 11th stage compressor case assembly.

(a) Use the PWA 102260 Torque Adapter with a 3/8 inch drive to loosen and remove the nuts that attach the 11th stage case and air seal to the 10th stage case. Remove the bolts.

(b) Remove the washers from the dowel bolts.

(c) Install 12 (.250−28) jackscrews in the threaded holes in the front flange of the 11th stage case.

(d) Evenly tighten the jackscrews to loosen the case.

(e) Remove the case and jackscrews.

(27) Carefully remove the 11th stage vane stator segments.

(28) Remove the 11th stage compressor air seal.

(a) Install 12 (.250−28) jackscrews in the threaded holes in the rear (upper) flange of the 10th stage case.

(b) Evenly tighten the jackscrews to loosen the 11th stage air seal.

(c) Remove the jackscrews.

(d) Remove the air seal.

Subtask 72−35−00−030−096:

(29) Remove the 10th stage compressor case assembly.

(a) Remove the bolts and nuts that attach the 10th stage case and air seal to the 9th stage compressor case.

(b) Install 12 (.250−28) jackscrews in the threaded holes in the front (lower) flange of the 10th stage case.

(c) Evenly tighten the jackscrews to loosen the case.

(d) Remove the jackscrews and case.

(30) Carefully remove the 10th stage vane stator segments.

(31) Remove the 10th stage compressor air seal.

(a) Install 12 (.250−28) jackscrews in the threaded holes in the rear (upper) flange of the 9th stage case.

(b) Evenly tighten the jackscrews to loosen the 10th stage air seal.

(c) Remove the jackscrews.

(d) Remove the air seal.

Subtask 72−35−00−030−097:

(32) Remove the 9th stage compressor case assembly.

(a) Remove the bolts and nuts that attach the 9th stage case and air seal to the 8th stage case.

(b) Install 12 (.250−28) jackscrews in the threaded holes in the front (lower) flange of the 9th stage case.

(c) Evenly tighten the jackscrews to loosen the case.

(d) Remove the jackscrews and case.

(33) Carefully remove the 9th stage vane stator segments.

(34) Remove the 9th stage compressor air seal.

(a) Install 12 (.250−28) jackscrews in the threaded holes in the rear (upper) flange of the 8th stage case.

(b) Evenly tighten the jackscrews to loosen the 9th stage air seal.

(c) Remove the jackscrews.

(d) Remove the air seal.

Subtask 72−35−00−030−098:

(35) Remove the 8th stage compressor case assembly.

(a) For the symmetric case configuration, remove the nuts (511/1) and washers (511/2) that attach the 8th stage case (511/3) to the 8th stage compressor air seal. See Figure 511 (Sheet 1).

NOTE: You can use a flexible extension (such as a Snap−On GSYMU101) to remove the nuts (511/1).

(b) For the asymmetric case configuration, remove the bolts (511/2) and washers (511/3) that attach the 8th stage case (511/1) to the 8th stage compressor air seal. See Figure 511 (Sheet 2).

(c) Turn the PWA 105588 Puller threaded driver detail counterclockwise to collapse the Puller assembly.

(d) Put three Pullers approximately equally spaced between the 8th stage case flanges.

(e) Put the detail pin in the through hole in the front (lower) flange of the case (511/3) so it contacts the 8th stage compressor air seal.

(f) Turn the driver clockwise until the housing assembly contacts the rear flange of the case.

(g) Use a standard wrench to turn the detail driver of the three Pullers approximately one turn each, one at a time, to remove the case (511/3). Remove and reposition the three pullers to another three equally spaced locations as necessary to remove the case (511/3).

(h) Remove the Pullers.

(i) Remove the case (511/3).

(36) Carefully remove the 8th stage vane stator segments.

(37) Remove the 8th stage compressor air seal (512/1). See Figure 512.

(38) For the symmetric case configuration, remove the air seal support segment set from the 8th stage compressor air seal. See Figure 513.

(a) Remove the eight screws (513/2) that attach the support segments to the air seal (513/1).

(b) Remove the four support segments (513/4) and eight spacers (513/3) from the air seal.

Subtask 72-35-00-030-099:

(39) Remove the HPC front case and vane assembly segments from the Support Fixture. See Figure 514.

R (a) Use the PWA 86536 and/or PWA 107300 Adapters to
R remove the 22 nuts (506/1) and bolts (506/2) that attach the HPC front case set upper and lower segments.

(b) Remove the detail nuts and bolts that attach front (lower) flange of the HPC front case segments to the Support Fixture.

(c) Install the PWA 85532 Lifting Brackets to the upper HPC front case segment.

(d) Attach a hoist and suitable sling to the Brackets and carefully remove the case and vane assembly from the rotor assembly.

(e) Repeat the above steps to remove the lower HPC front case segment.

(40) If necessary, remove the locks and the 5th stage shroud set segments.

Subtask 72−35−00−030−100:

(41) Use a hoist and install the PWA 85593 Ring Adapter to the PWA 87022 Support Stand (Optional PWA 85580 Stand or PWA 85108 Stand). Use a hoist and install the PWA 80515 Support Stand onto the PWA 85593 Adapter and PWA 87022 Support Stand (Optional PWA 85580 Stand or PWA 85108 Stand) and attach in position.

(42) Install the PWA 85124 Adapter to the threads on the rear shaft. Attach PWA 85086 Arm to the installed Adapter. Attach a hoist to the Arm and raise the rotor assembly from the Build Stand.

(43) (Pre SB PW4ENG 72−562) Install the PWA 85124 Adapter to the threads on the rear shaft. Attach the PWA 85086 Arm to the installed Adapter. Attach the hoist to the Arm and raise the rotor assembly from the Build Stand.

(44) (Post SB PW4ENG 72−562) Install the PWA 88700 Adapter to the threads on the rear shaft. Attach the PWA 85086 Arm to the installed Adapter. Attach the hoist to the Arm and raise the rotor assembly from the Build Stand.

HIGH PRESSURE COMPRESSOR (HPC) - DISASSEMBLY-03

(45) Install PWA 88643 or PWA 88673 Sling to the Adapter on front hub. Attach hoist to sling and trunnion rotor assembly to rear end down. Remove hoist, Arm and Adapter from rear shaft.

(46) Lower the assembly down into the PWA 80515 Stand with the PWA 85294 Adapter. Remove the Nut, Adapter and Fixture from the front hub. Install the PWA 85160 Thread Protector on the front hub and the PWA 85159 Thread Protector on the rear shaft.

NOTE: The PWA 85159 Thread Protectors and PWA 85160 Thread Protector are optional and some other type of thread protection can be used.

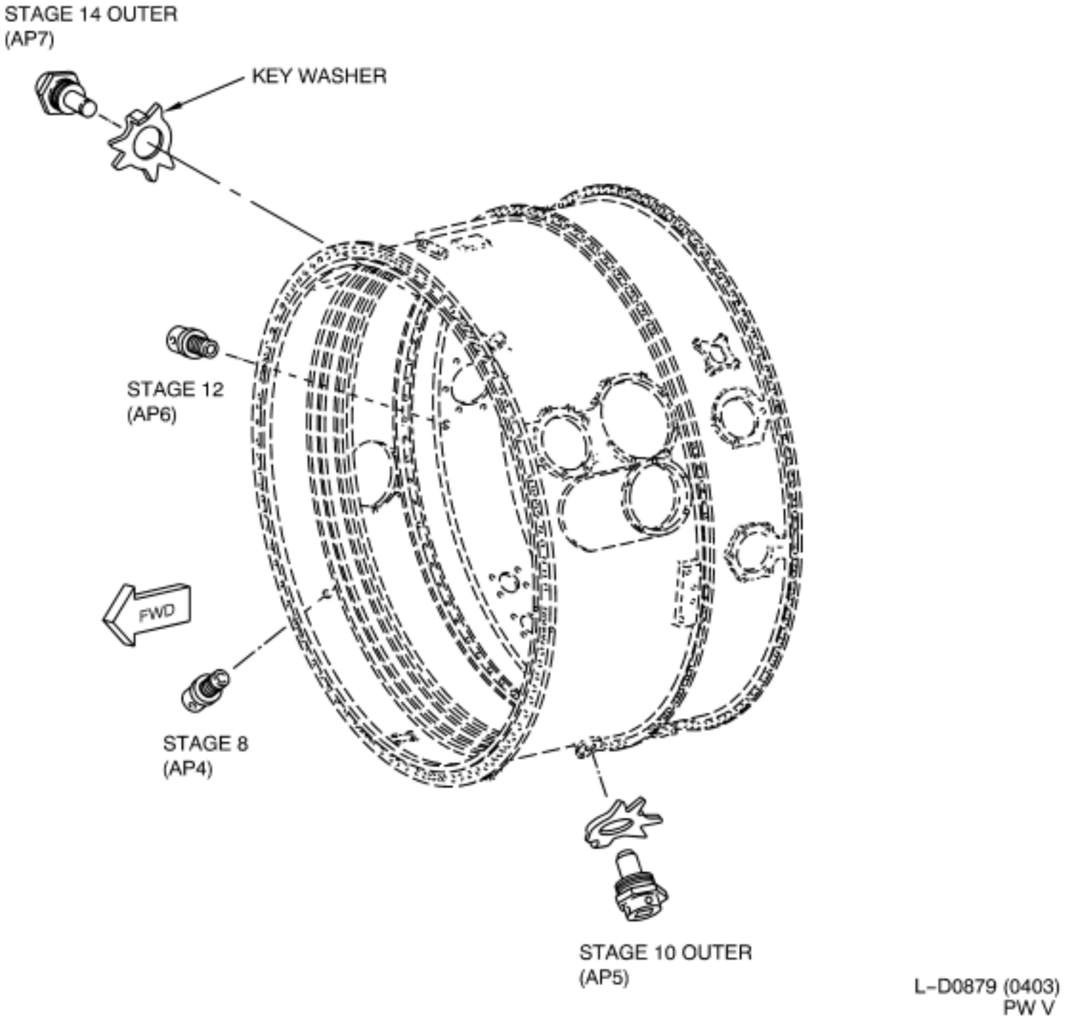
D. Postrequisites

(1) Disassemble The Variable Stator Vane And HPC Front Case Assembly. Refer to 72-35-02, Disassembly-01 (Task 72-35-02-040-001).

(2) Disassemble (Deblade) The Axial Compressor Rotor Assembly. Refer to 72-35-01, Disassembly-20 (Task 72-35-01-040-003).

(3) Disassemble (Debladed) The Axial Compressor Rotor Assembly. Refer to 72-35-01, Disassembly-21 (Task 72-35-01-040-004).

HIGH PRESSURE COMPRESSOR (HPC) - DISASSEMBLY-03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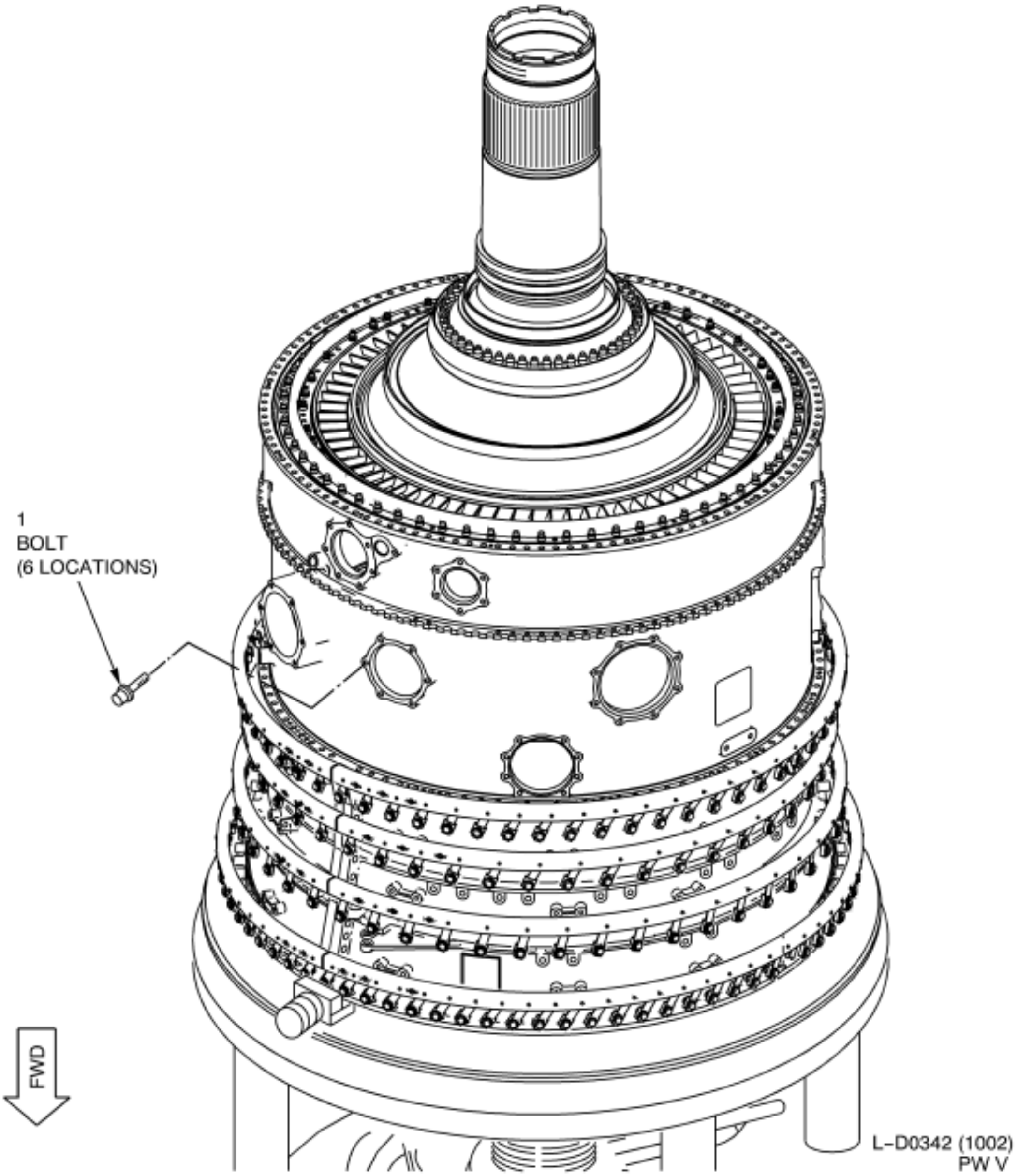
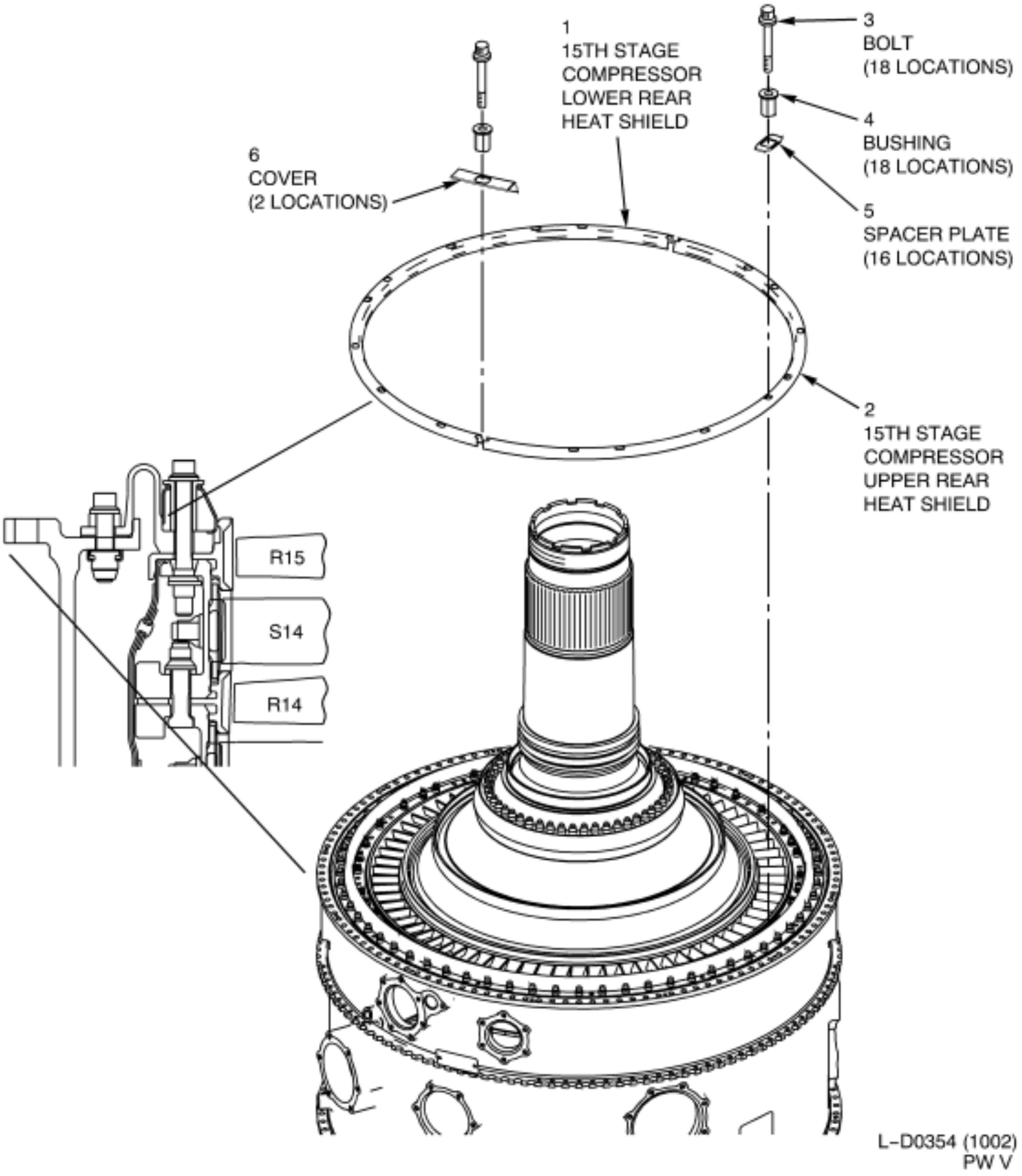
(AP7)
KEY WASHER
STAGE 12
(AP6)
FWD
STAGE 8
(AP4)
STAGE 10 OUTER
(AP5)
L-D0879 (0403)
PW V

Instrumentation Plugs (Borescope) Removal
Figure 501
(Task 72-35-00-030-006)

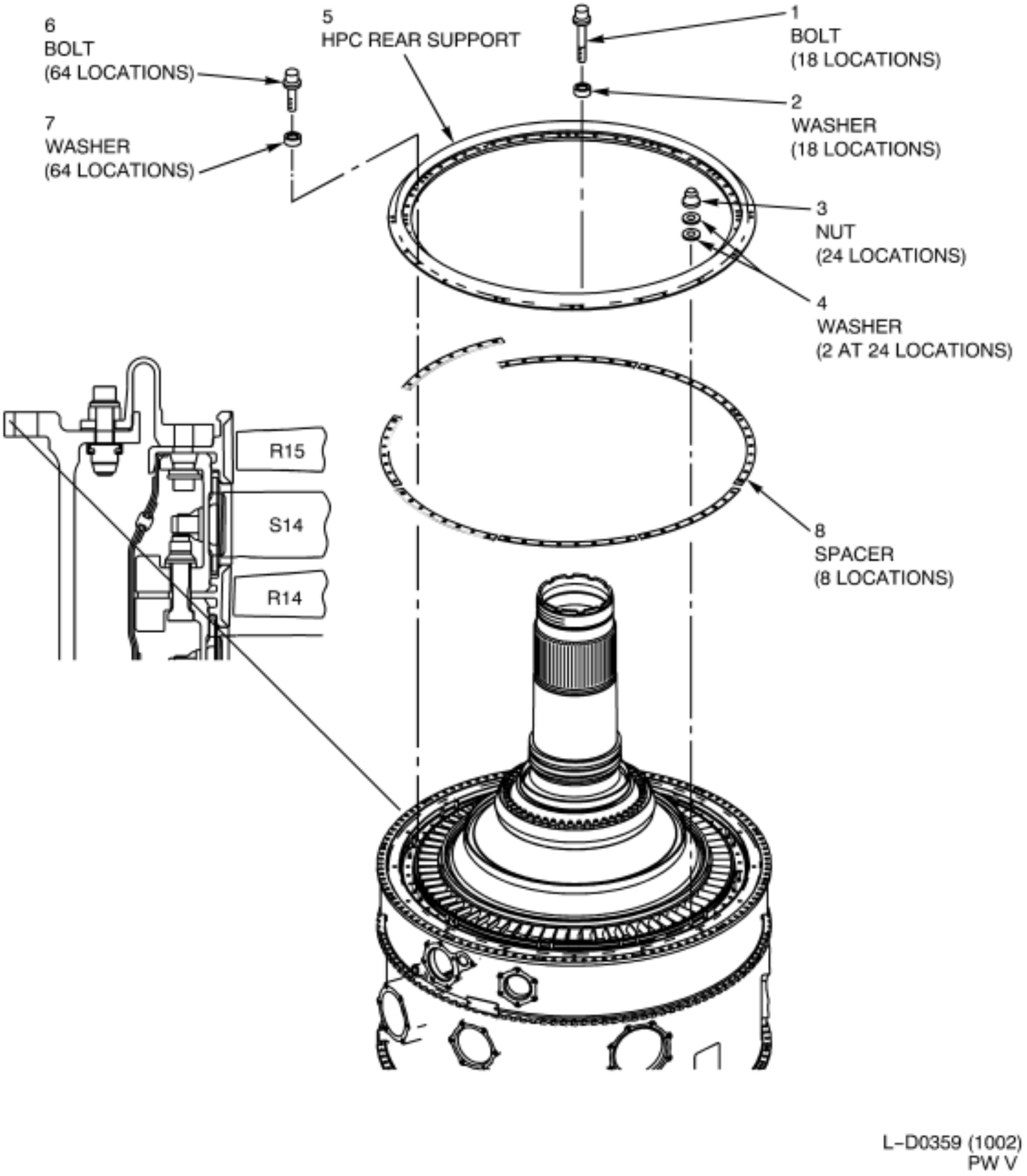
HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−03


1
BOLT
(6 LOCATIONS)
FWD
L-D0342 (1002)
PW V

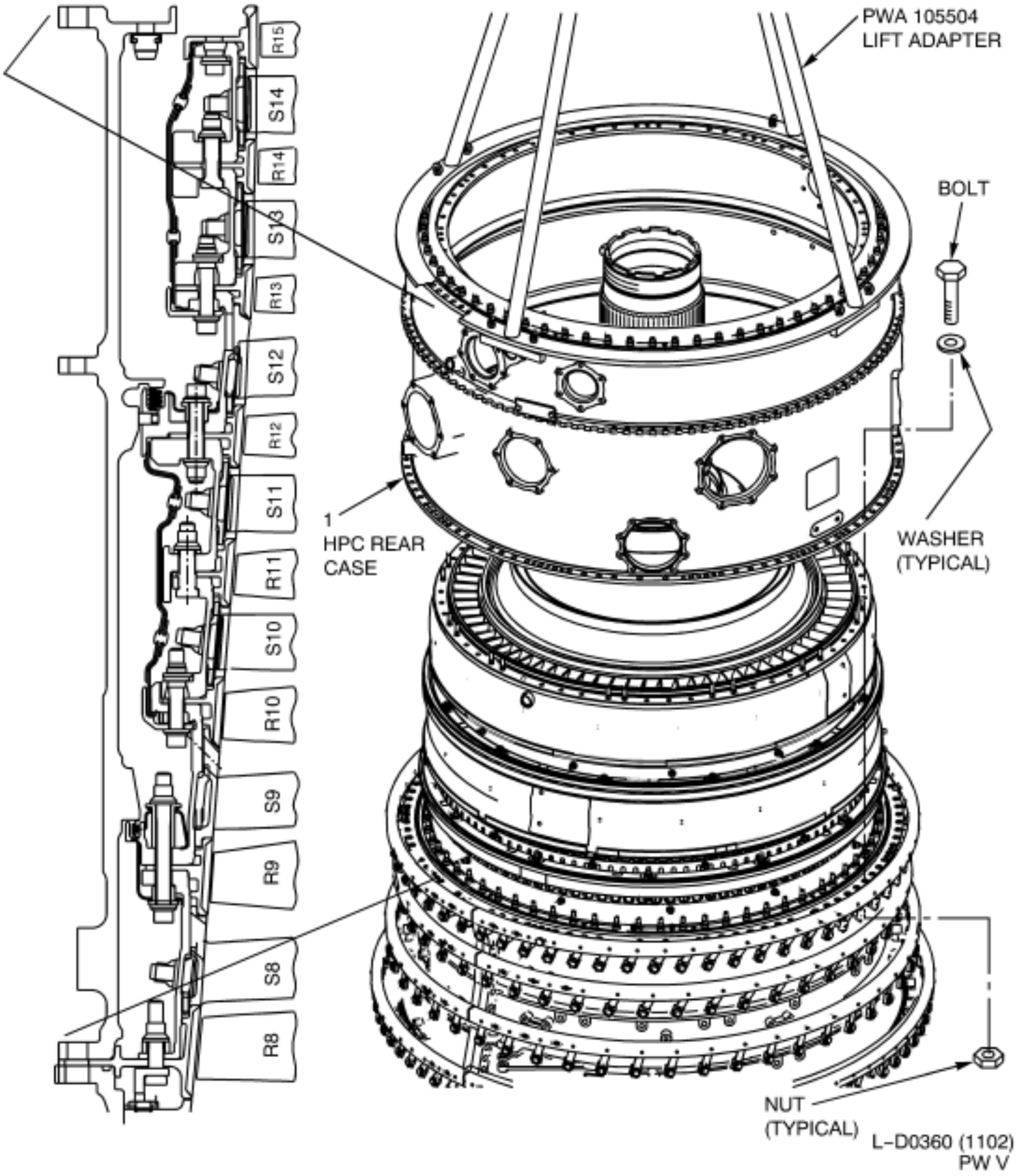
HPC Rear Case Bolt Removal
Figure 502
(Task 72−35−00−030−006)


1
15TH STAGE
COMPRESSOR
LOWER REAR
HEAT SHIELD
3
BOLT
(18 LOCATIONS)
4
BUSHING
(18 LOCATIONS)
6
COVER
(2 LOCATIONS)
5
SPACER PLATE
(16 LOCATIONS)
2
15TH STAGE
COMPRESSOR
UPPER REAR
HEAT SHIELD
R15
S14
R14
L−D0354 (1002)
PW V

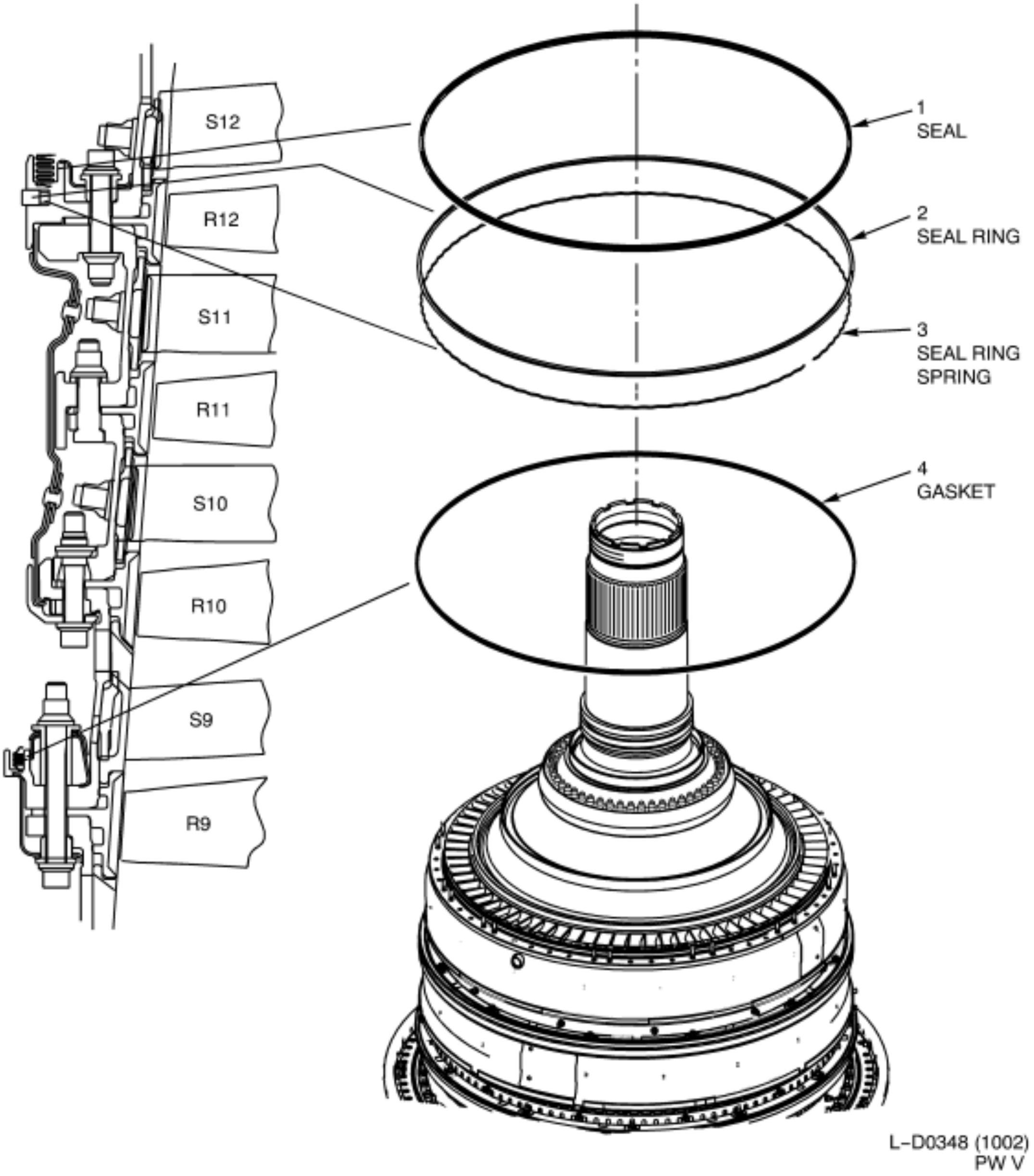
Fifteenth Stage Compressor Heat Shield Removal
Figure 503
(Task 72−35−00−030−006)


6
BOLT
(64 LOCATIONS)
7
WASHER
(64 LOCATIONS)
5
HPC REAR SUPPORT
1
BOLT
(18 LOCATIONS)
2
WASHER
(18 LOCATIONS)
3
NUT
(24 LOCATIONS)
4
WASHER
(2 AT 24 LOCATIONS)
R15
S14
R14
8
SPACER
(8 LOCATIONS)
L−D0359 (1002)
PW V

HPC Rear Support Removal
Figure 504
(Task 72−35−00−030−006)

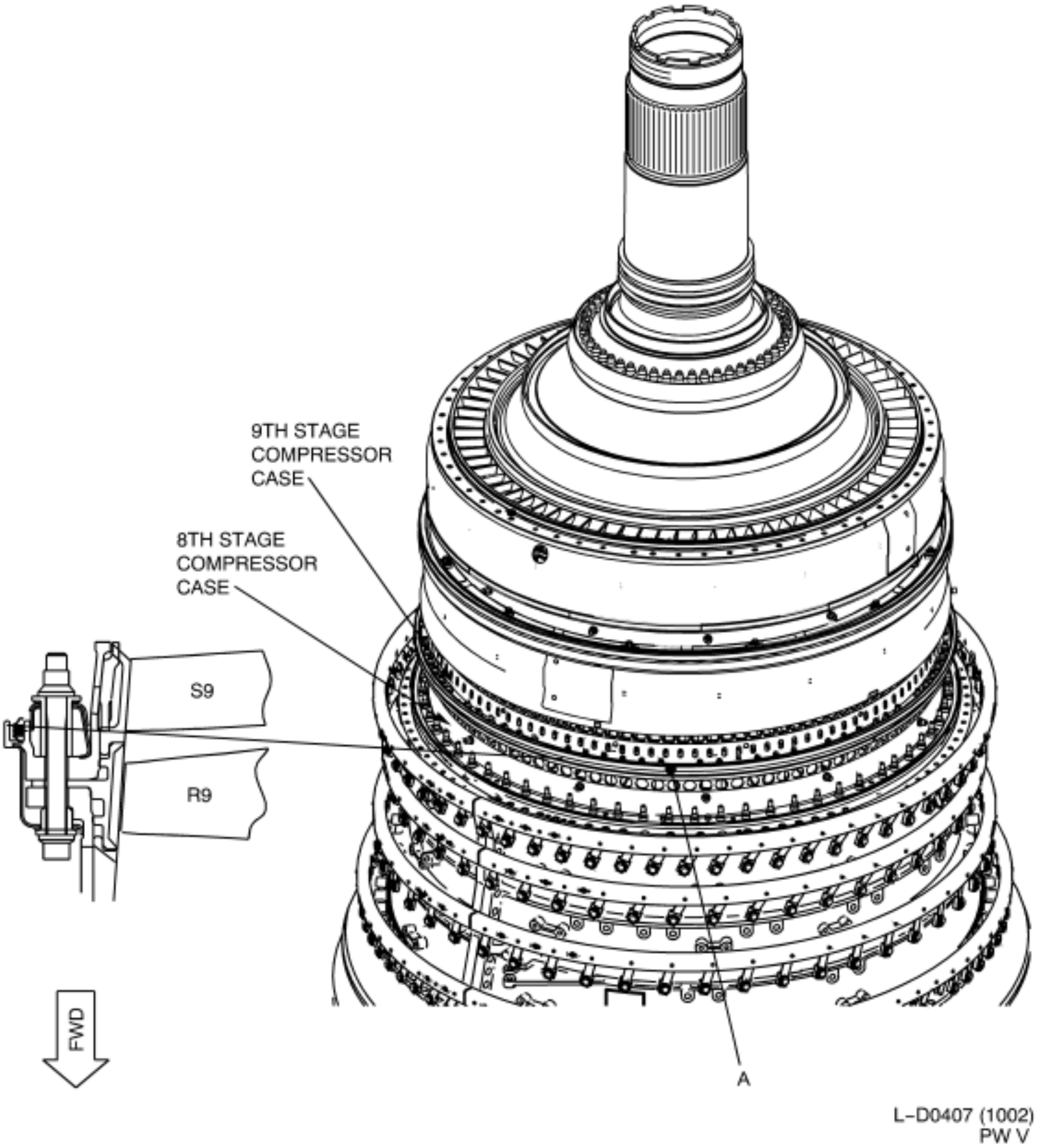

R15
S14
R14
S13
R13
S12
R12
S11
R11
S10
R10
S9
R9
S8
R8
PWA 105504
LIFT ADAPTER
BOLT
1
HPC REAR
CASE
WASHER
(TYPICAL)
NUT
(TYPICAL)
L-D0360 (1102)
PW V

HPC Rear Case Removal
Figure 505
(Task 72−35−00−030−006)

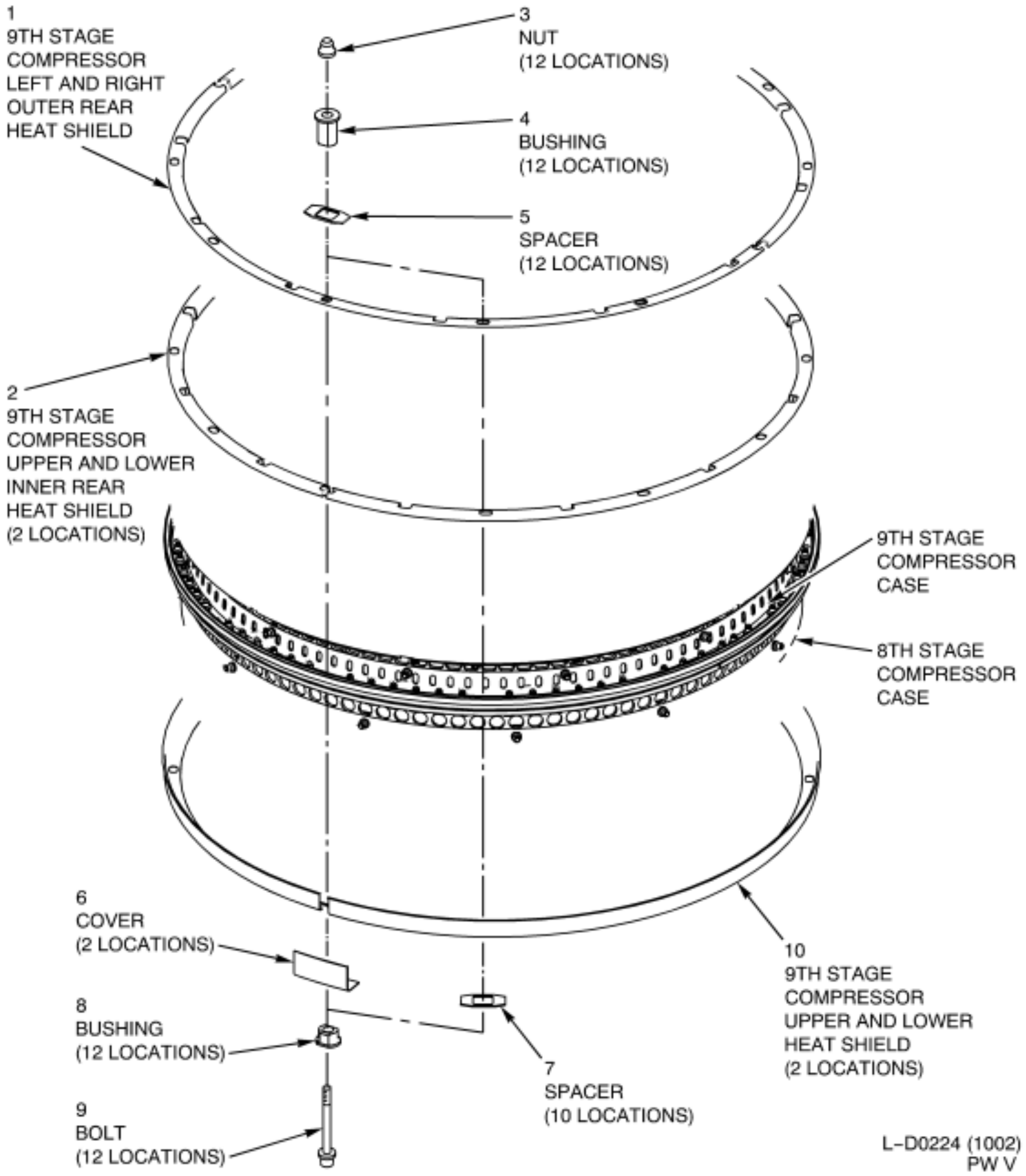

S12
R12
S11
R11
S10
R10
S9
R9
1
SEAL
2
SEAL RING
3
SEAL RING
SPRING
4
GASKET
L-D0348 (1002)
PW V

Gasket And Seals Removal
Figure 506
(Task 72-35-00-030-006)

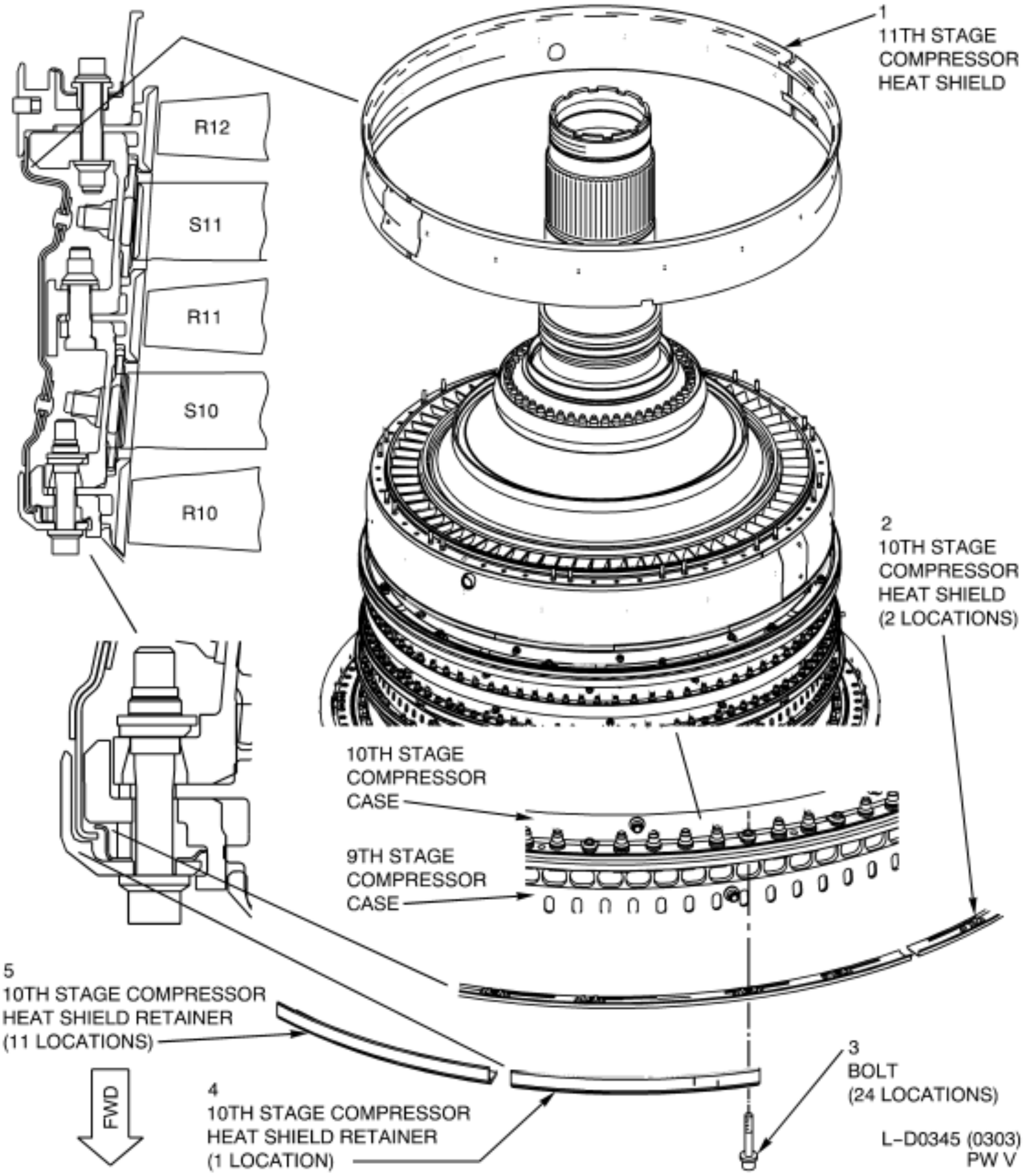
HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−03


9TH STAGE COMPRESSOR CASE
8TH STAGE COMPRESSOR CASE
S9
R9
FWD
A
L−D0407 (1002)
PW V

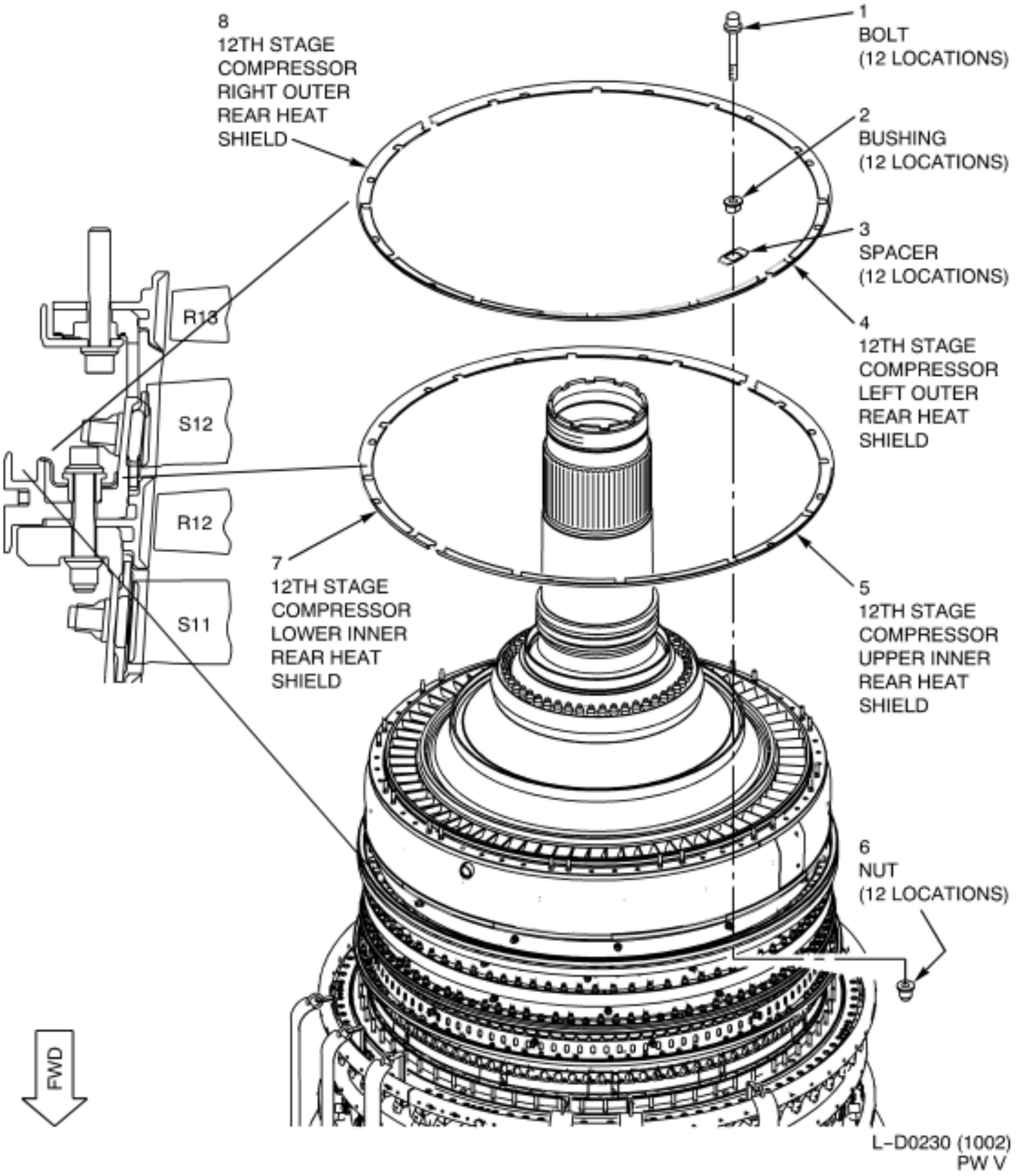
Ninth Stage Compressor Heat Shields Removal
Figure 507 (Sheet 1)
(Task 72−35−00−030−006)


1
9TH STAGE COMPRESSOR LEFT AND RIGHT OUTER REAR HEAT SHIELD
3
NUT (12 LOCATIONS)
4
BUSHING (12 LOCATIONS)
5
SPACER (12 LOCATIONS)
2
9TH STAGE COMPRESSOR UPPER AND LOWER INNER REAR HEAT SHIELD (2 LOCATIONS)
9TH STAGE COMPRESSOR CASE
8TH STAGE COMPRESSOR CASE
6
COVER (2 LOCATIONS)
10
9TH STAGE COMPRESSOR UPPER AND LOWER HEAT SHIELD (2 LOCATIONS)
8
BUSHING (12 LOCATIONS)
7
SPACER (10 LOCATIONS)
9
BOLT (12 LOCATIONS)
L-D0224 (1002)
PW V

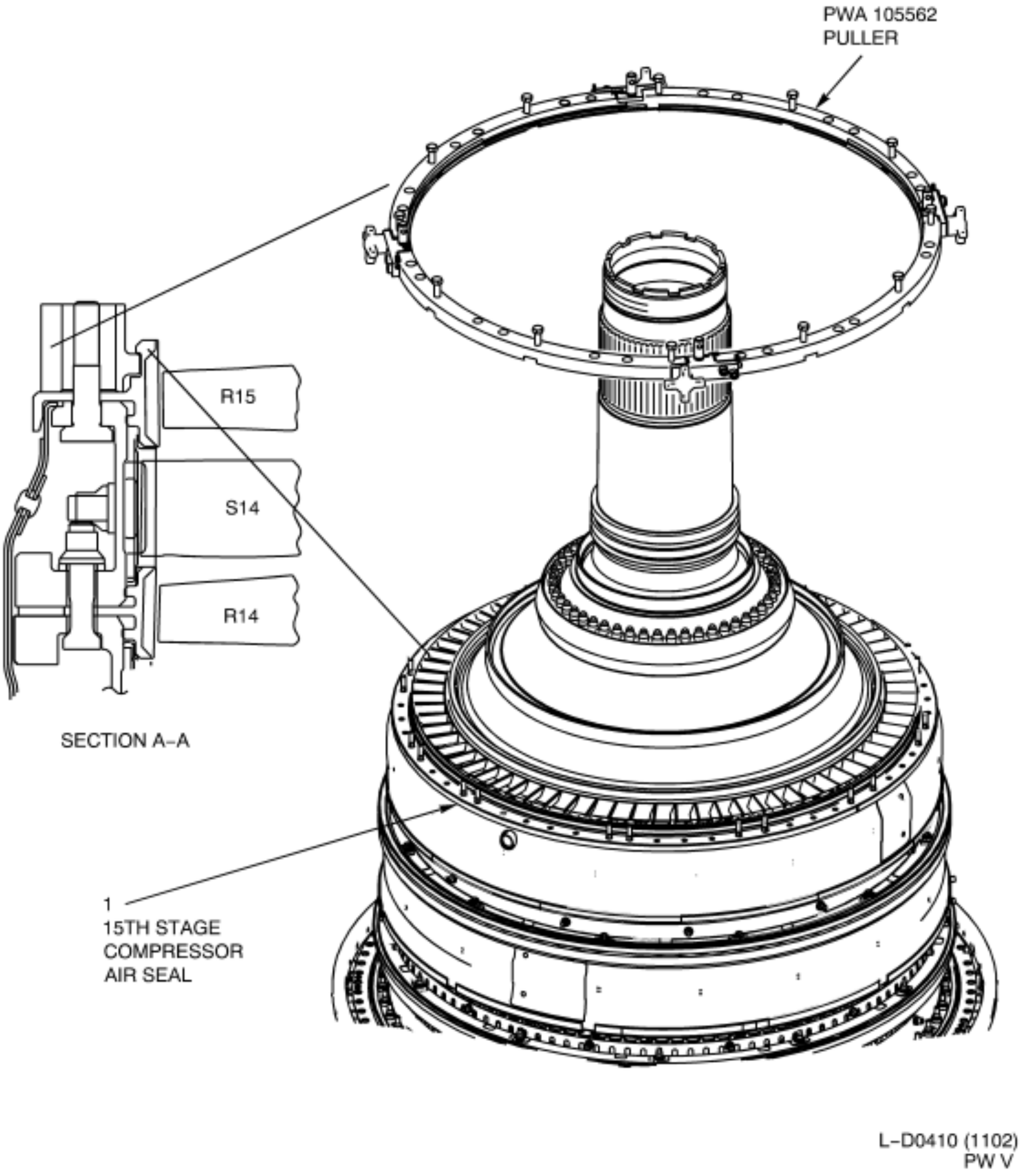
Ninth Stage Compressor Heat Shields Removal
Figure 507 (Sheet 2)
(Task 72-35-00-030-006)


R12
S11
R11
S10
R10
1
11TH STAGE COMPRESSOR HEAT SHIELD
2
10TH STAGE COMPRESSOR HEAT SHIELD (2 LOCATIONS)
10TH STAGE COMPRESSOR CASE
9TH STAGE COMPRESSOR CASE
5
10TH STAGE COMPRESSOR HEAT SHIELD RETAINER (11 LOCATIONS)
FWD
4
10TH STAGE COMPRESSOR HEAT SHIELD RETAINER (1 LOCATION)
3
BOLT (24 LOCATIONS)
L-D0345 (0303)
PW V

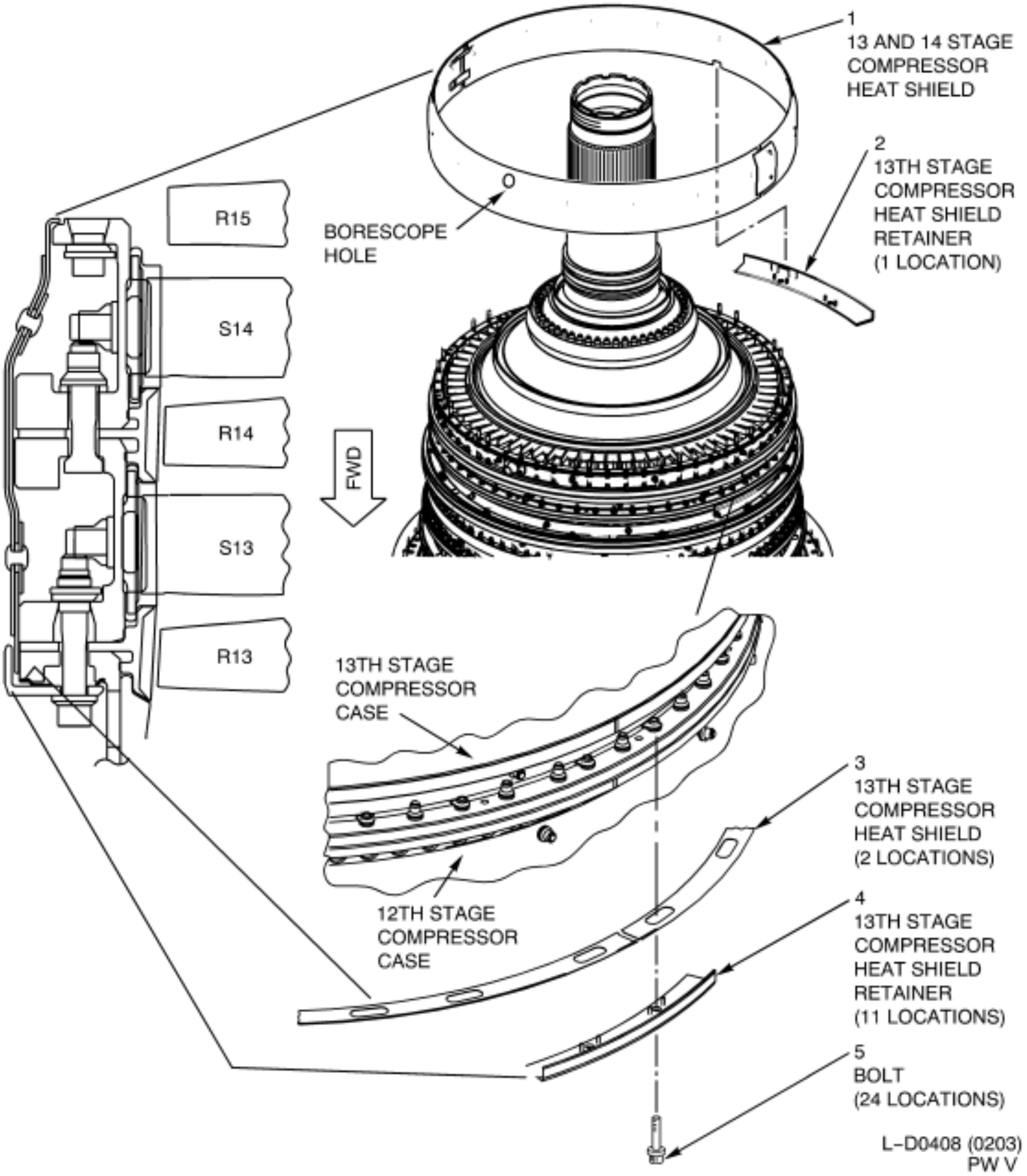
Eleventh Stage Compressor Heat Shield Removal
Figure 508
(Task 72−35−00−030−006)


8
12TH STAGE COMPRESSOR RIGHT OUTER REAR HEAT SHIELD
1
BOLT (12 LOCATIONS)
2
BUSHING (12 LOCATIONS)
3
SPACER (12 LOCATIONS)
4
12TH STAGE COMPRESSOR LEFT OUTER REAR HEAT SHIELD
R13
S12
R12
S11
7
12TH STAGE COMPRESSOR LOWER INNER REAR HEAT SHIELD
5
12TH STAGE COMPRESSOR UPPER INNER REAR HEAT SHIELD
6
NUT (12 LOCATIONS)
FWD
L-D0230 (1002)
PW V

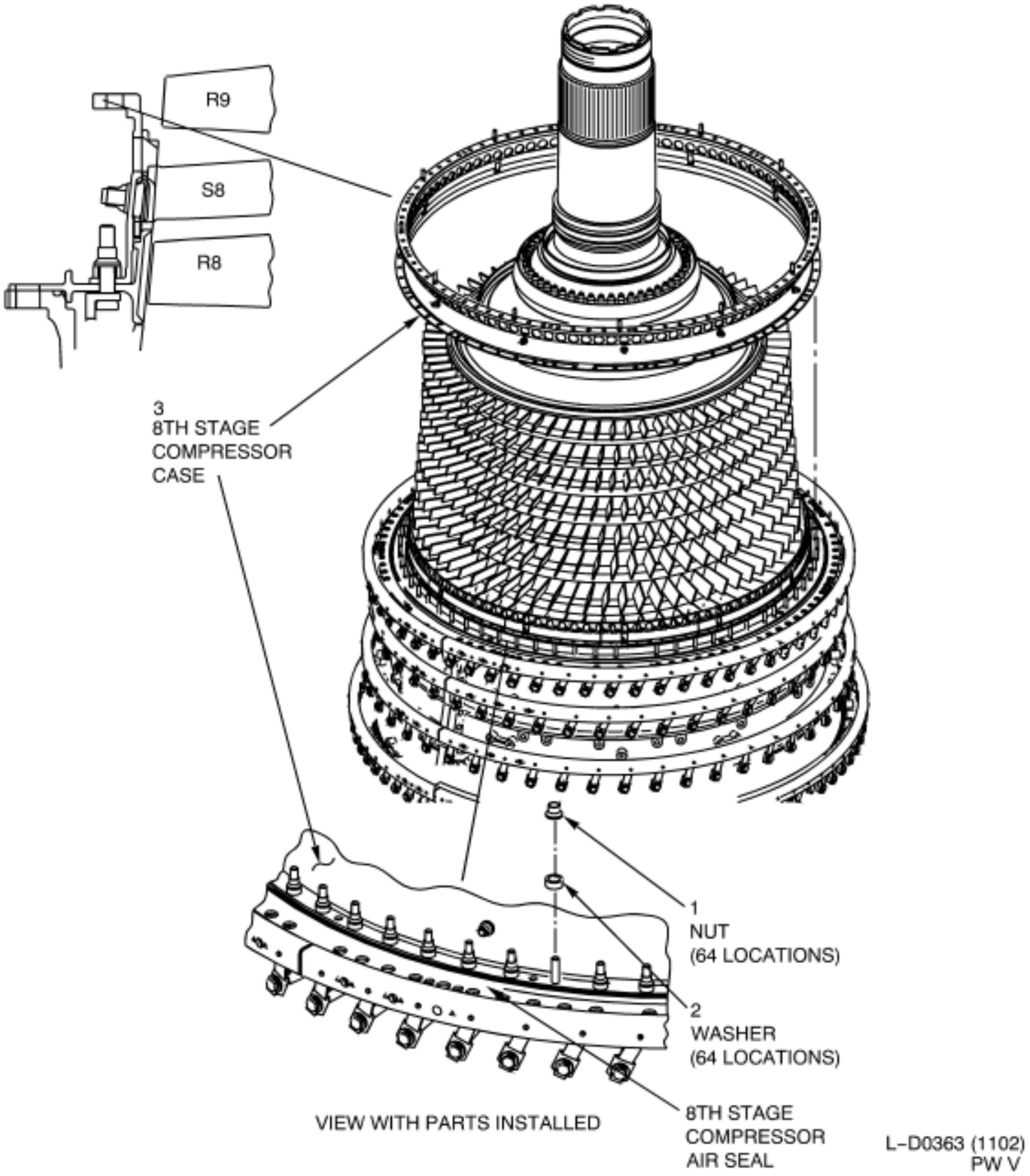
Twelfth Stage Compressor Heat Shields Removal
Figure 509
(Task 72-35-00-030-006)


PWA 105562
PULLER
R15
S14
R14
SECTION A−A
1
15TH STAGE
COMPRESSOR
AIR SEAL
L−D0410 (1102)
PW V

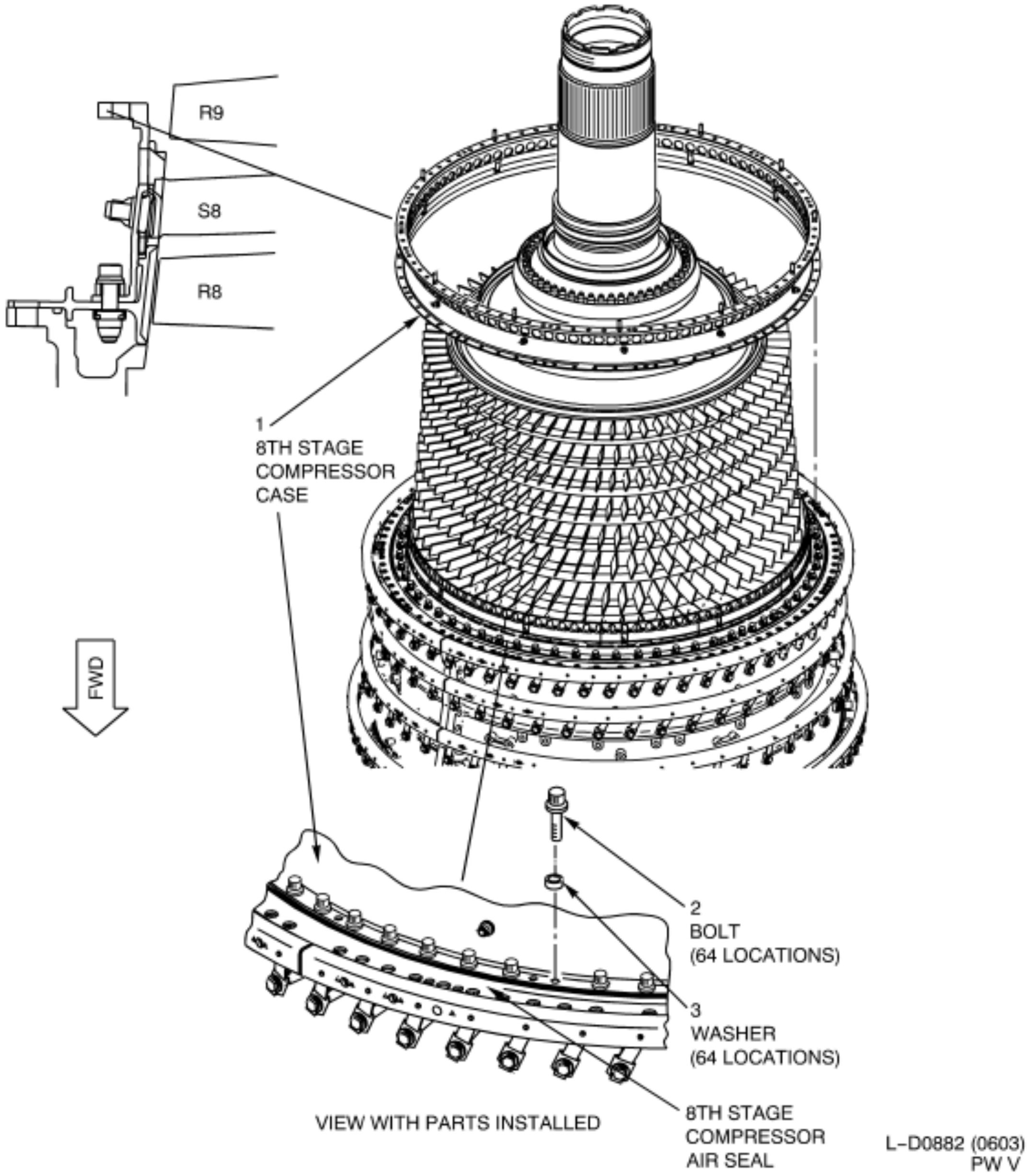
Fifteenth Stage Compressor Air Seal Removal
Figure 510 (Sheet 1)
(Task 72−35−00−030−006)


1
13 AND 14 STAGE
COMPRESSOR
HEAT SHIELD
2
13TH STAGE
COMPRESSOR
HEAT SHIELD
RETAINER
(1 LOCATION)
BORESCOPE
HOLE
R15
S14
R14
S13
R13
FWD
13TH STAGE
COMPRESSOR
CASE
12TH STAGE
COMPRESSOR
CASE
3
13TH STAGE
COMPRESSOR
HEAT SHIELD
(2 LOCATIONS)
4
13TH STAGE
COMPRESSOR
HEAT SHIELD
RETAINER
(11 LOCATIONS)
5
BOLT
(24 LOCATIONS)
L−D0408 (0203)
PW V

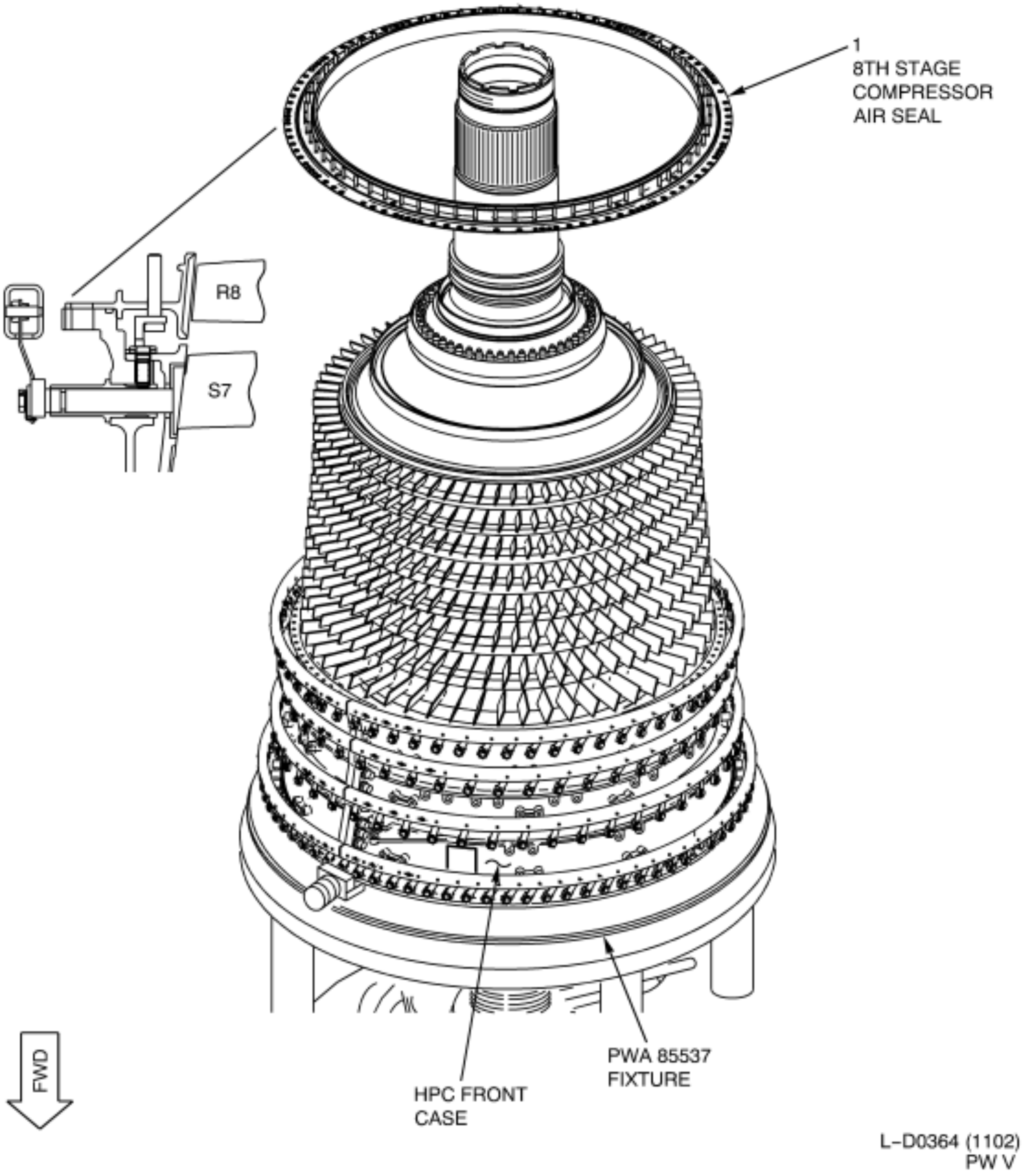
Thirteenth And Fourteenth Stage Heat Shield Removal
Figure 510 (Sheet 2)
(Task 72−35−00−030−006)


R9
S8
R8
3
8TH STAGE
COMPRESSOR
CASE
1
NUT
(64 LOCATIONS)
2
WASHER
(64 LOCATIONS)
VIEW WITH PARTS INSTALLED
8TH STAGE
COMPRESSOR
AIR SEAL
L-D0363 (1102)
PW V

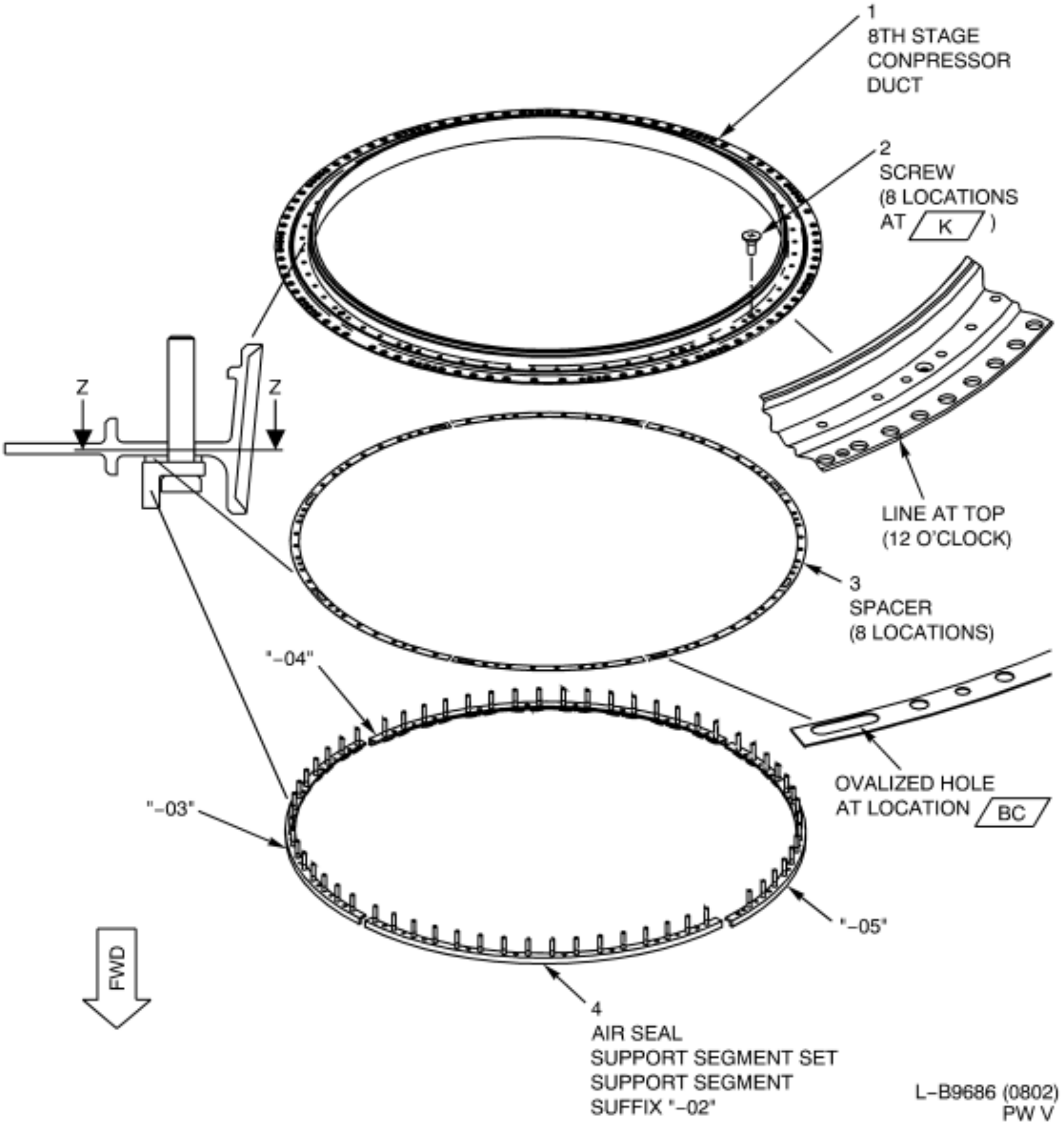
Eighth Stage Compressor Case Removal (Symmetric Case Configuration)
Figure 511 (Sheet 1)
(Task 72-35-00-030-006)


R9
S8
R8
1
8TH STAGE
COMPRESSOR
CASE
FWD
2
BOLT
(64 LOCATIONS)
3
WASHER
(64 LOCATIONS)
VIEW WITH PARTS INSTALLED
8TH STAGE
COMPRESSOR
AIR SEAL
L−D0882 (0603)
PW V

Eighth Stage Compressor Case Removal (Asymmetric Case Configuration)
Figure 511 (Sheet 2)
(Task 72−35−00−030−006)

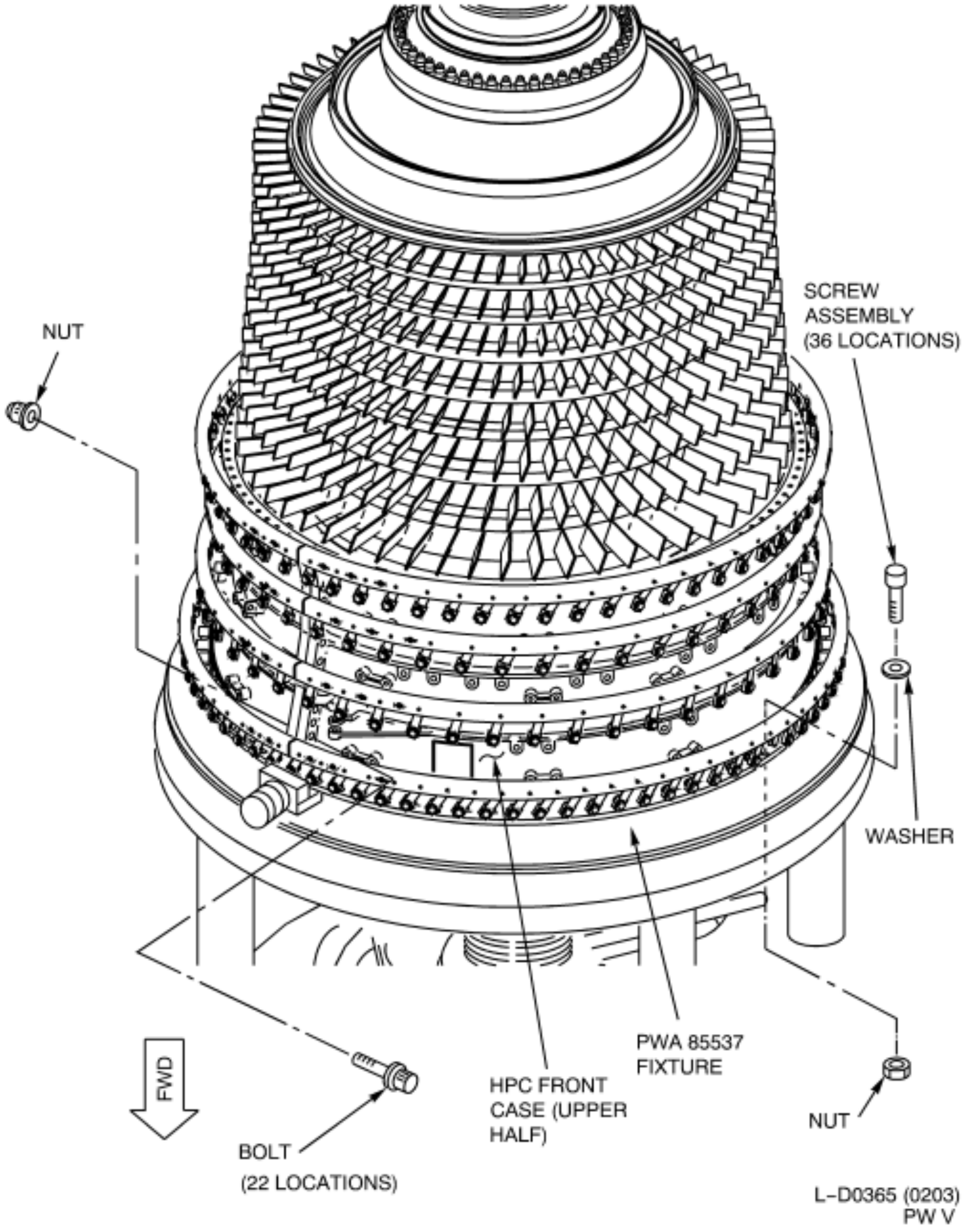

1
8TH STAGE
COMPRESSOR
AIR SEAL
R8
S7
FWD
PWA 85537
FIXTURE
HPC FRONT
CASE
L-D0364 (1102)
PW V

Eighth Stage Compressor Air Seal Removal (Typical)
Figure 512
(Task 72−35−00−030−006)

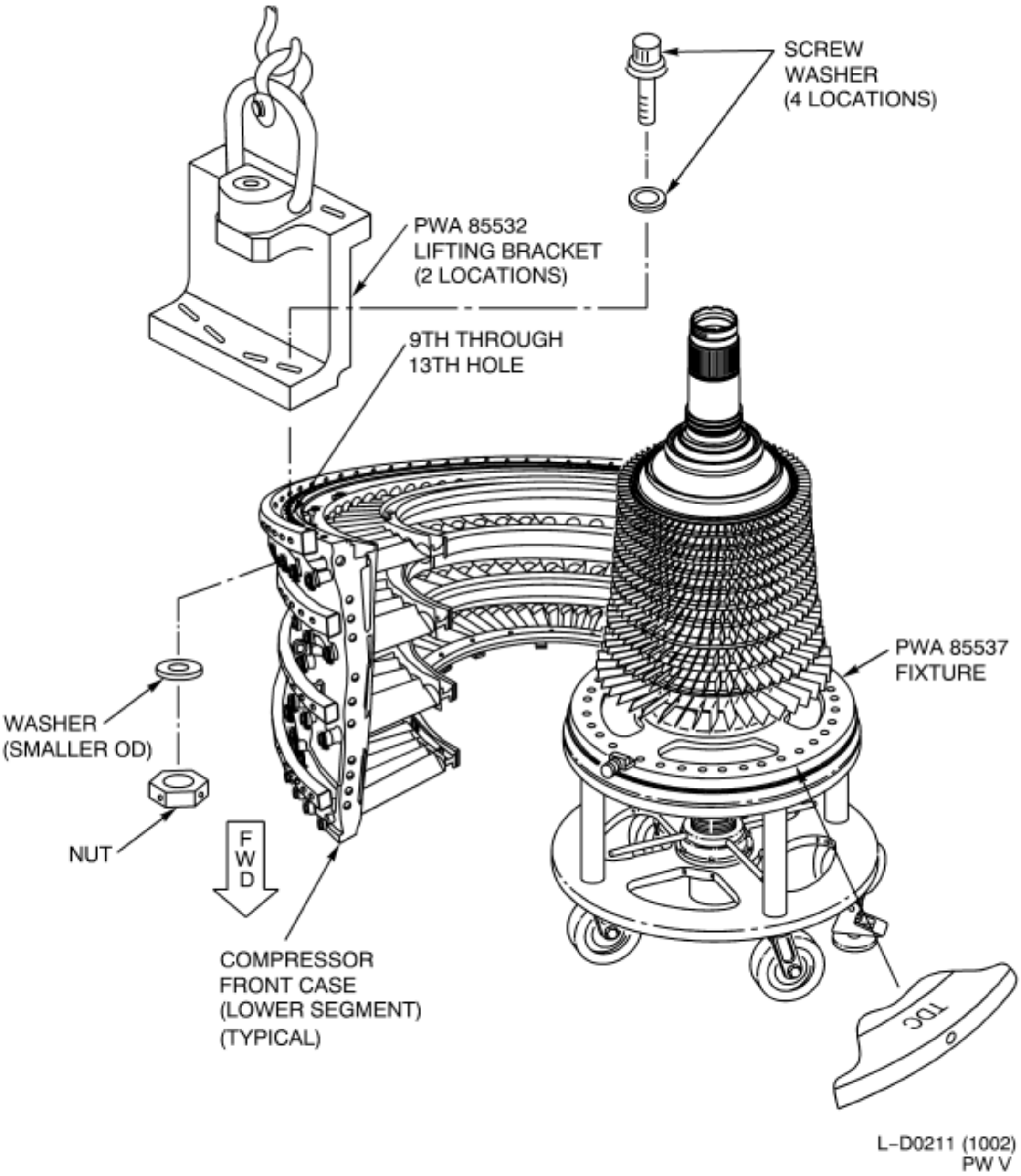

1
8TH STAGE
CONPRESSOR
DUCT
2
SCREW
(8 LOCATIONS
AT K)
Z
Z
LINE AT TOP
(12 O'CLOCK)
3
SPACER
(8 LOCATIONS)
"−04"
"−03"
OVALIZED HOLE
AT LOCATION BC
"−05"
FWD
4
AIR SEAL
SUPPORT SEGMENT SET
SUPPORT SEGMENT
SUFFIX "−02"
L−B9686 (0802)
PW V

Air Seal Support Segment Set Removal (Symmetric Case Configuration)
Figure 513
(Task 72−35−00−030−006)

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−03


NUT
SCREW ASSEMBLY (36 LOCATIONS)
WASHER
PWA 85537 FIXTURE
HPC FRONT CASE (UPPER HALF)
NUT
FWD
BOLT
(22 LOCATIONS)
L−D0365 (0203)
PW V

HPC Front Case Removal
Figure 514
(Task 72−35−00−030−006)


SCREW
WASHER
(4 LOCATIONS)
PWA 85532
LIFTING BRACKET
(2 LOCATIONS)
9TH THROUGH
13TH HOLE
PWA 85537
FIXTURE
WASHER
(SMALLER OD)
NUT
FWD
COMPRESSOR
FRONT CASE
(LOWER SEGMENT)
(TYPICAL)
TDC
L-D0211 (1002)
PW V

HPC Front Case Removal
Figure 515
(Task 72-35-00-030-006)

HIGH PRESSURE COMPRESSOR (HPC) - DISASSEMBLY-04

Task 72-35-00-030-004:

1. (Pre Ring Case Configuration) Disassemble Stator And Rear Case Pre-Assembly - High Pressure Compressor (HPC)

A. Equipment And Materials Required

Special Tools:

PWA 85537	Fixture, Handling
PWA 85743	Fixture, Handling (3 Necessary, Optional to PWA 86220) (Pre SB PW4ENG 72-602)
PWA 86098	Pusher, Mechanical
PWA 86220	Puller, Jackscrew (Pre SB PW4ENG 72-602)
PWA 88643	Sling (Optional to PWA 88673)
PWA 88673	Sling
PWA 101002	Puller, Jackscrew (Post SB PW4ENG 72-602) (Optional to PWA 102301)
PWA 101980	Bracket, Lift (2 Necessary)
PWA 102033	Puller, Mechanical
PWA 102301	Puller, Jackscrew (Post SB PW4ENG 72-602) (Optional to PWA 101002)

B. Procedure

Subtask 72-35-00-030-068:

(1) Using the PWA 85537 or PWA 88560 Handling Fixture as applicable, lower the stator case assembly (front end down) onto rotary table. Remove attaching hardware from rear fixture on rear case and remove rear fixture from HPC.

Subtask 72-35-00-030-069:

(2) Loosen 62 bolts that secure rear support to the rear (outer) case. See Figure 501.

(3) (Pre SB PW4ENG 72-602) Install PWA 86220 Puller or PWA 85743 Puller on rear case and rotate puller to allow jaws to slip under HPC rear support pull tabs. Apply equal turns to jackscrews to remove support. Remove puller.

NOTE: PWA 86220 Puller is used with supports having eight pull tabs (Post SB PW4ENG 72-298). Alternatively, if PWA 85743 Puller is to be used with supports having three pull tabs (Pre SB PW4ENG 72-298), use mallet and nylon drift to facilitate removal.

(4) (Post SB PW4ENG 72−602) Install PWA 101002 Puller or PWA 102301 Puller onto the HPC rear support.

NOTE: PWA 101002 Puller or PWA 102301 Puller is used with supports having a continuous full ring lip for puller clamp engagement (Post SB PW4ENG 72−602).

(a) Install PWA 101002 Puller onto the HPC rear support. Engage the four detail clamps under the full ring puller lip of the rear support. Tighten the 12 detail flange nuts to lock the clamps in position under the puller lip. After the clamps are positioned under the puller lip, continue to tighten the 12 flange nuts one at a time about one half turn until the rear support is removed from the HPC rear case. Remove puller.

(b) Install PWA 102301 Puller onto the HPC rear support. Pull the four detail clamps under the puller lip of the rear support. Tighten the 12 detail cap screws to lock the clamps and rocker plates in position against the puller lip. After the clamps are correctly positioned under the puller lip, tighten the 12 flange nuts one at a time about one half turn until the rear support is disassembled from the rear case. Remove the puller.

Subtask 72−35−00−030−070:

(5) Remove 64 bolts on lower flange of inside diameter of (outer) rear case. These bolts secure rear case and inner rear case to the 9th and 10th stator set.

(6) In an alternating pattern, lightly tap on upper flange of inner case at four locations (approximately 90 degrees apart) until the inner case/stator assembly releases from the outer case. See Figure 502.

(7) Attach PWA 88643 Sling or PWA 88673 Sling to HPC rear case. Remove the (outer) rear case.

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−04

Subtask 72−35−00−030−071:

(8) Use the two PWA 101980 Lifting Brackets and the PWA 102033 Puller, Mechanical to remove the HPC inner rear case from the stators. PWA 86098 Pullers can be used as optional tools for case removal when the case does not bind as follows:

  (a) Install two PWA 101980 Lifting Brackets on rear flange of the inner rear case 180 degrees apart. Attach PWA 88643 Sling or PWA 88673 Sling to lift the inner rear case.

  (b) Attach three PWA 86098 Pushers equally spaced around the rear flange of the inner rear case with five cap screws.

  (c) Install pusher with groove fitting into stepped groove in the stator assembly.

  (d) Turn single cap screw alternatively between the three pushers to remove the inner case.

  (e) Remove the two PWA 101980 Lifting Brackets.

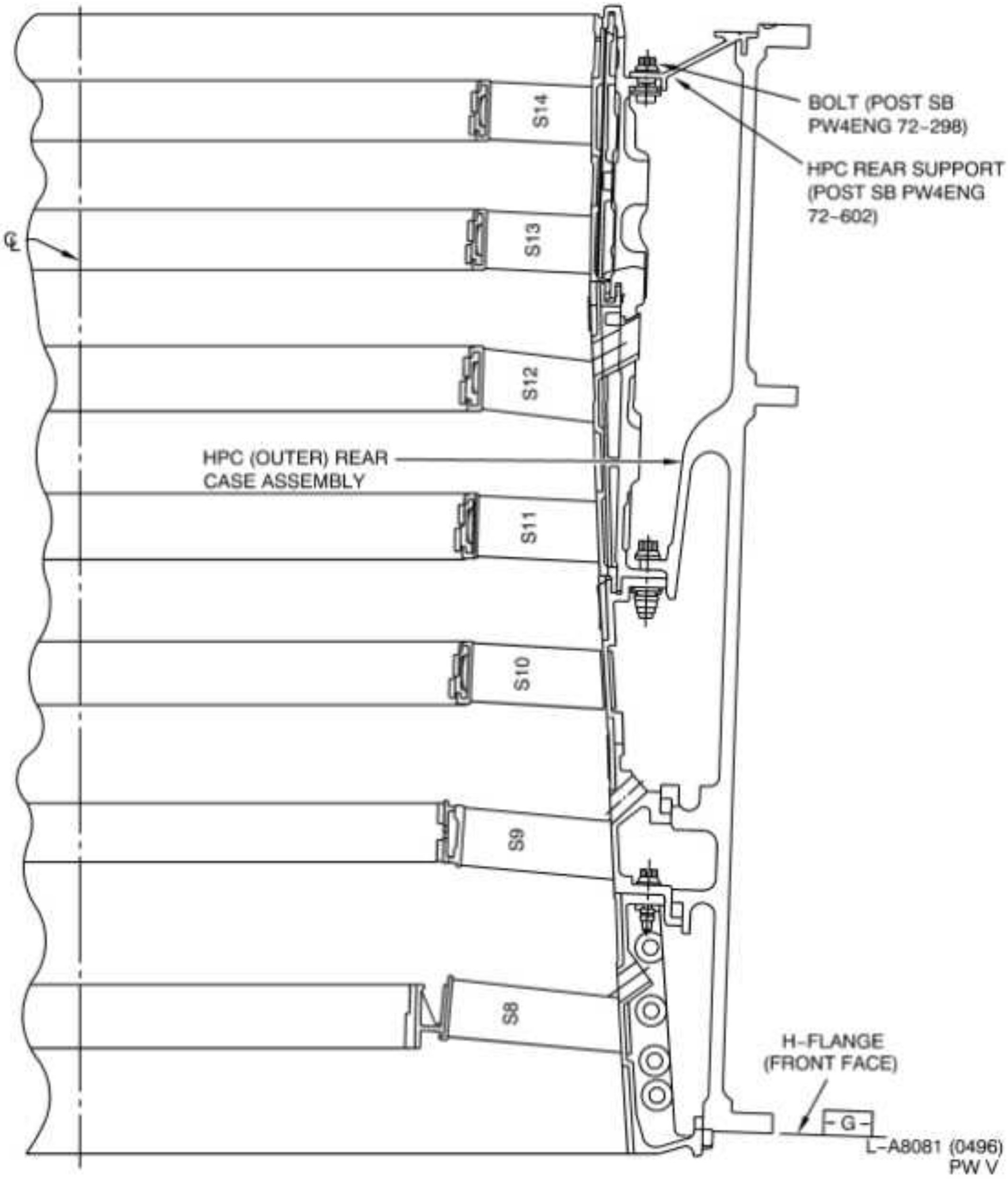
(9) Remove Stages 13 and 14 with seals from HPC.

(10) Remove Stages 11 and 12 with seals from HPC. See Figure 503.

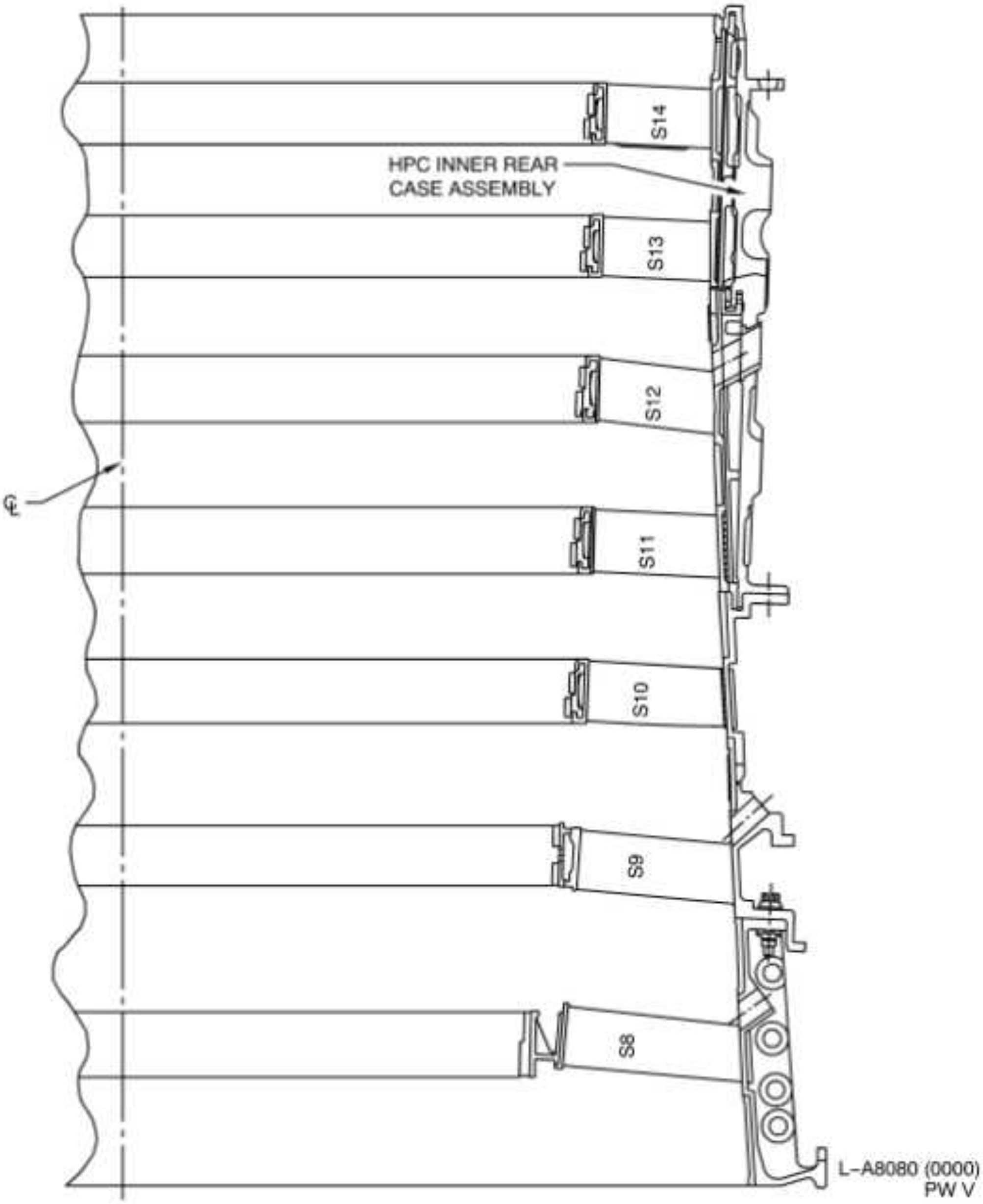
(11) Remove 40 bolts securing Stages 9 and 10 to Stage 8. Remove 10 bolts and nuts securing Stages 9 and 10 set together. Remove Stages 9 and 10. See Figure 504.

(12) Remove eight bolts and nuts securing Stage 8 set together. Remove Stage 8.

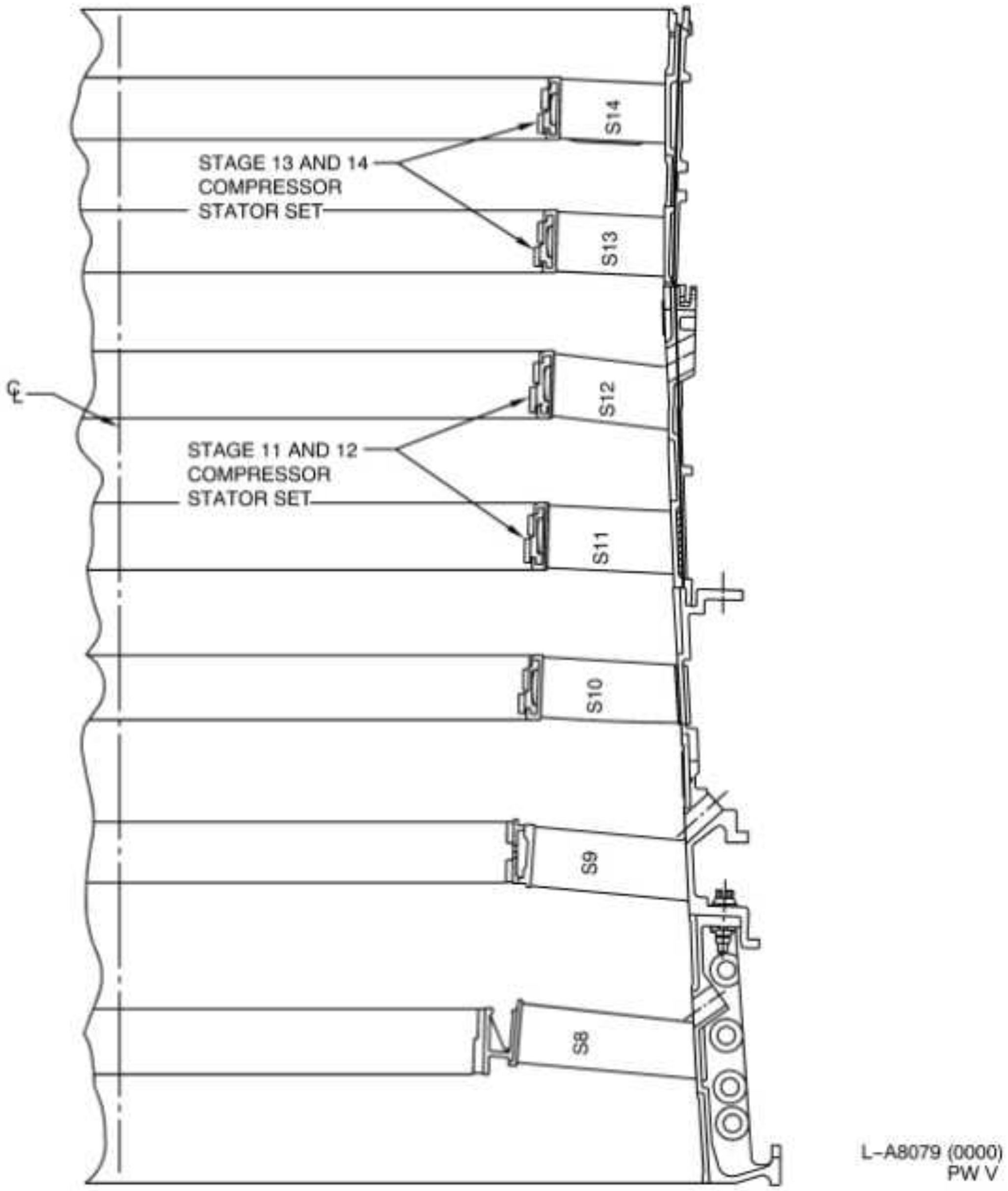
HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−04


BOLT (POST SB PW4ENG 72-298)
HPC REAR SUPPORT (POST SB PW4ENG 72-602)
S14
S13
℄
S12
HPC (OUTER) REAR CASE ASSEMBLY
S11
S10
S9
S8
H-FLANGE (FRONT FACE)
-G-
L-A8081 (0496)
PW V

Disassemble HPC Stator And Rear Case Pre−Assembly
Figure 501
(Task 72−35−00−030−004)

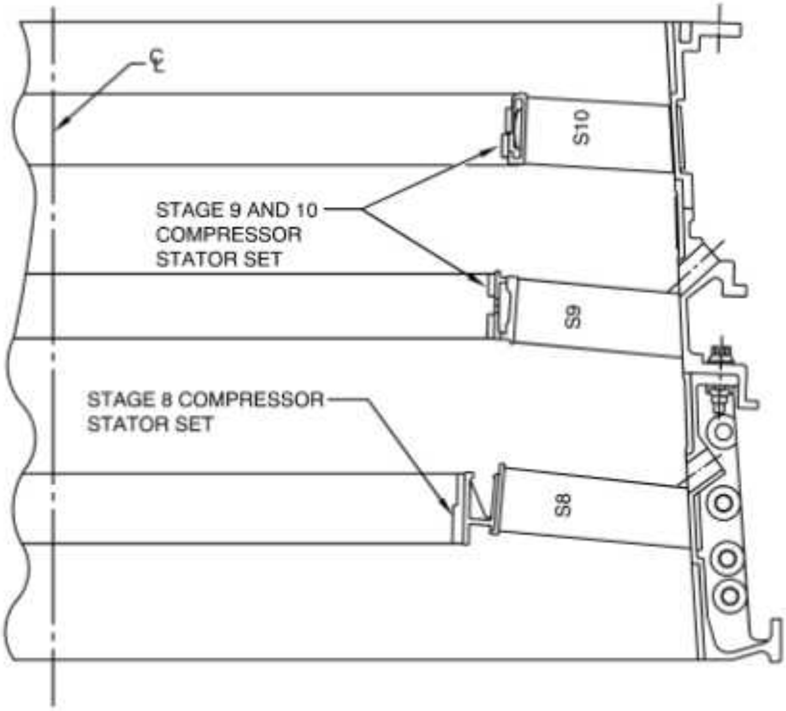

S14
HPC INNER REAR CASE ASSEMBLY
S13
S12
℄
S11
S10
S9
S8
L-A8080 (0000)
PW V

Disassemble HPC Stator And Rear Case Pre-Assembly
Figure 502
(Task 72-35-00-030-004)


S14
STAGE 13 AND 14
COMPRESSOR
STATOR SET
S13
S12
℄
STAGE 11 AND 12
COMPRESSOR
STATOR SET
S11
S10
S9
S8
L-A8079 (0000)
PW V

Disassemble HPC Stator And Rear Case Pre-Assembly
Figure 503
(Task 72-35-00-030-004)

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−04


℄
S10
STAGE 9 AND 10 COMPRESSOR STATOR SET
S9
STAGE 8 COMPRESSOR STATOR SET
S8

L−A8078 (0000)
PW V

Disassemble HPC Stator And Rear Case Pre−Assembly
Figure 504
(Task 72−35−00−030−004)

Previous Pageblock Return to Previous Menu Next Pageblock

HIGH PRESSURE COMPRESSOR (HPC) - DISASSEMBLY-05

Task 72-35-00-030-022:

1. Disassemble The Compressor Stator (Vane) Assemblies

A. Prerequisites

(1) Disassemble The High Pressure Compressor (HPC). Refer to 72-35-00, Disassembly-03, CONFIG-2 (Task 72-35-00-030-006).

B. Equipment And Materials Necessary

Special Tools:

PWA 105507	Adapter, Install/Remove, 8th Stage Stator (Vane) Assembly
PWA 105508	Adapter, Install/Remove, 10th Stage Stator (Vane) Assembly
PWA 105509	Adapter, Install/Remove, 11th Stage Stator (Vane) Assembly
PWA 105510	Adapter, Install/Remove, 12th Stage Stator (Vane) Assembly
PWA 105511	Adapter, Install/Remove, 13th Stage Stator (Vane) Assembly
PWA 105512	Adapter, Install/Remove, 14th Stage Stator (Vane) Assembly

C. Procedure

(1) Remove the thermal insulation blanket from the stator segment (vane) feet.

(2) In the steps that follow, use the applicable stator (vane) segment set Adapter to disassemble the vane segment assemblies required for each stage.

(3) Put the correct Install/Remove Adapter on a suitable workbench and prepare the Adapter as follows: See Table 501 and Figure 501.

Stage	Vane Segment Adapter
8	PWA 105507
10	PWA 105508
11	PWA 105509
12	PWA 105510
13	PWA 105511
14	PWA 105512

Vane Segment Assembly Adapters
Table 501

(a) Move the moveable arm to the left side of the Adapter.

(b) Assemble the removal arm detail to the moveable arm of the Adapter.

(c) Install the removal stop to the Adapter base.

(4) Obtain the stator (vane) assembly to be disassembled.

(a) Locate the anti−rotation lug detail of the shroud segment on the front side of the stator (vane) assembly.

(b) Place the stator assembly on the Adapter base with the removal stop between the vane segments and the TAB arrow on the removable stop pointing to the anti−rotation lug detail of the shroud segment.

CAUTION: IF EXCESSIVE RESISTANCE IS MET DURING REMOVAL, MAKE SURE THAT THE REMOVAL STOP POSITION IS BETWEEN THE VANE SEGMENTS.

(c) In a counterclockwise direction, use the removal arm to press the shroud segment, shroud spring, and the right stator segment from the stator assembly.

NOTE: Leave the arm detail of the Adapter on the right side of the Adapter.

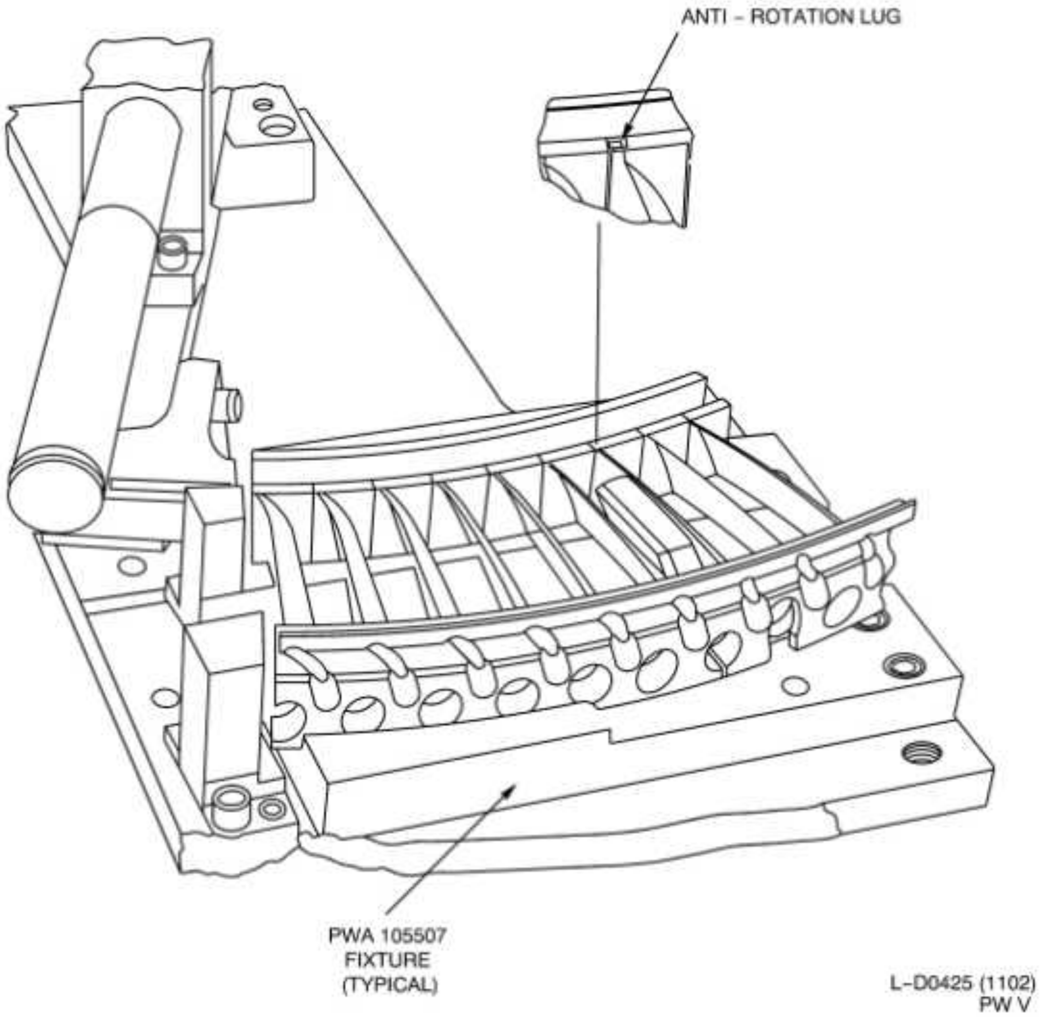
(d) Remove the stator segments from the Adapter base.

(e) Place the stator assembly with the shroud segment on the Adapter base with the stator segment against the inner and outer stop details of the Adapter.

(f) In a clockwise direction, use the removal arm to press the shroud segment and shroud spring from the remaining stator segment.

(g) Remove the vane segment, air seal, and spring from the Adapter.

(5) Do the above procedure again for each compressor stator (vane) assembly to be disassembled.


ANTI − ROTATION LUG
PWA 105507
FIXTURE
(TYPICAL)
L−D0425 (1102)
PW V

Compressor Stator (Vane) Assembly Disassembly (Typical)
Figure 501
(Task 72−35−00−030−022)

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−20

Task 72−35−00−030−020:

1. Remove The Flange J Brackets And Hardware

A. Equipment And Materials Necessary − None

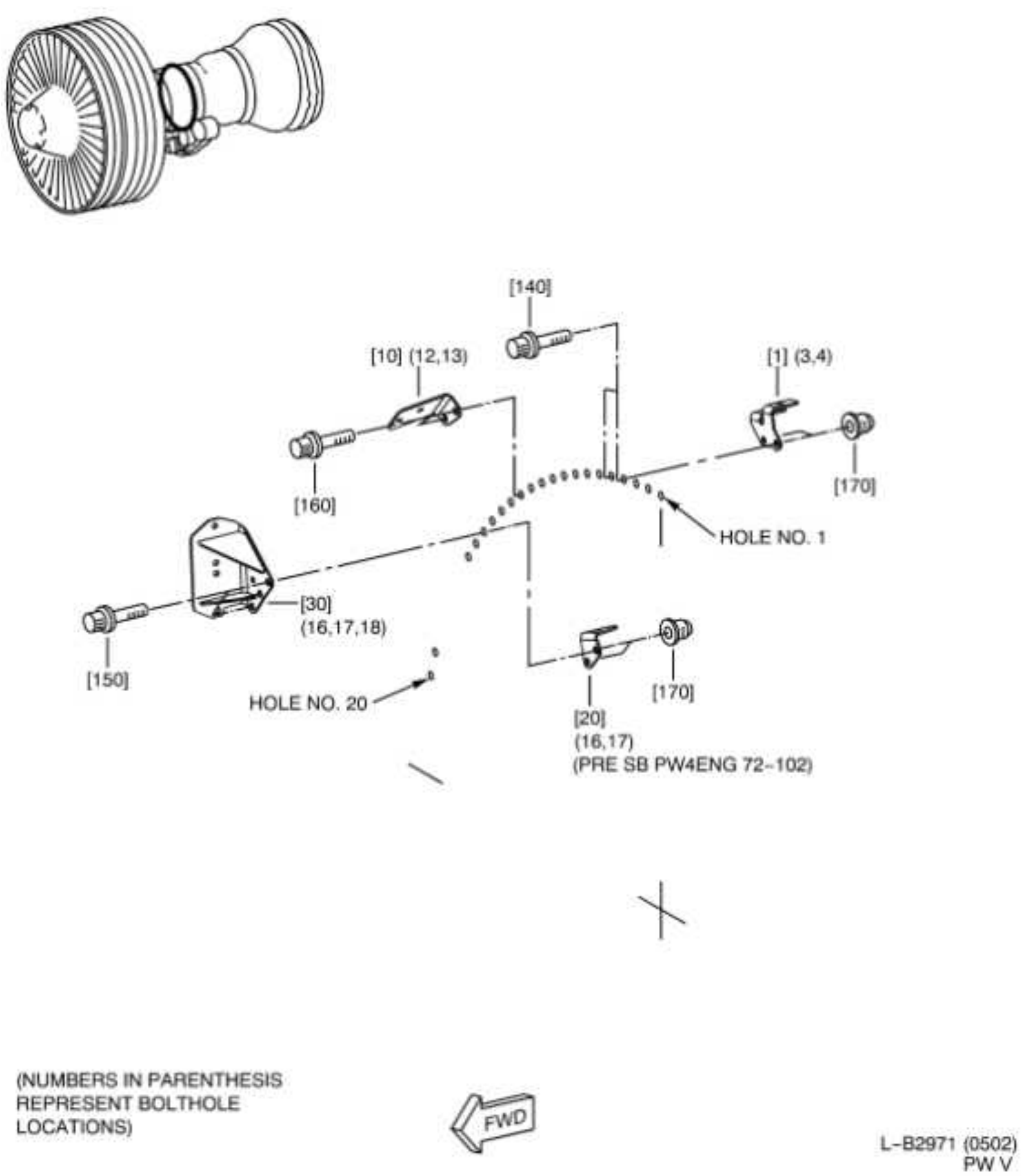
B. Procedure

(1) Remove the Flange J brackets as follows. See Figure 501.

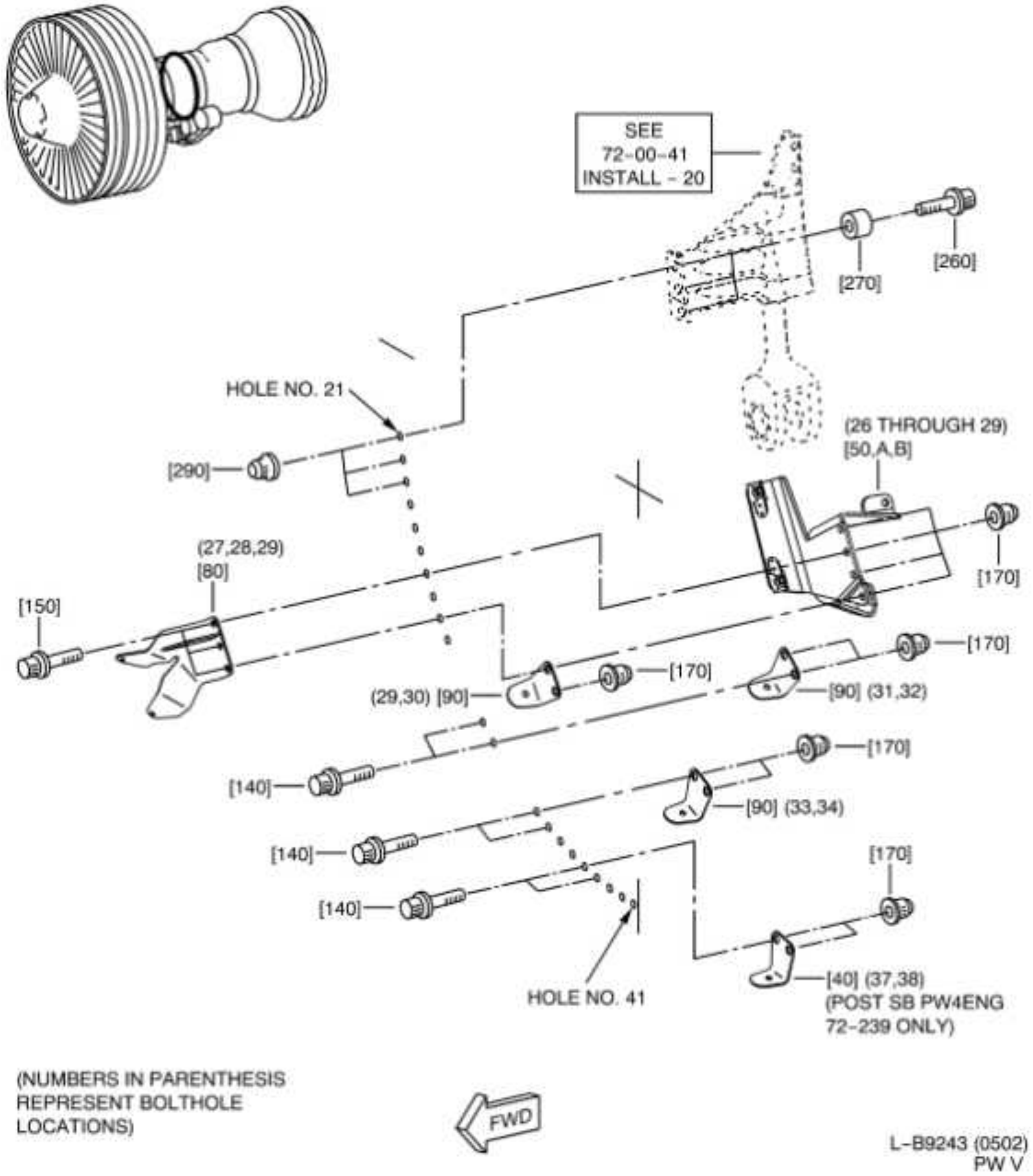
(a) Tag and identify the flange J hardware for the correct bolthole locations.

NOTE: All the part item numbers in the figures are the same as the item numbers in the IPC.

(b) Remove the bolts and nuts that attach the brackets to Flange J. Remove the brackets from the flange.


[140]
[10] (12,13)
[1] (3,4)
[170]
[160]
HOLE NO. 1
[30]
(16,17,18)
[150]
HOLE NO. 20
[170]
[20]
(16,17)
(PRE SB PW4ENG 72-102)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-B2971 (0502)
PW V

The Flange J Brackets And Hardware
Figure 501 (Sheet 1)
(Task 72−35−00−030−020)


SEE
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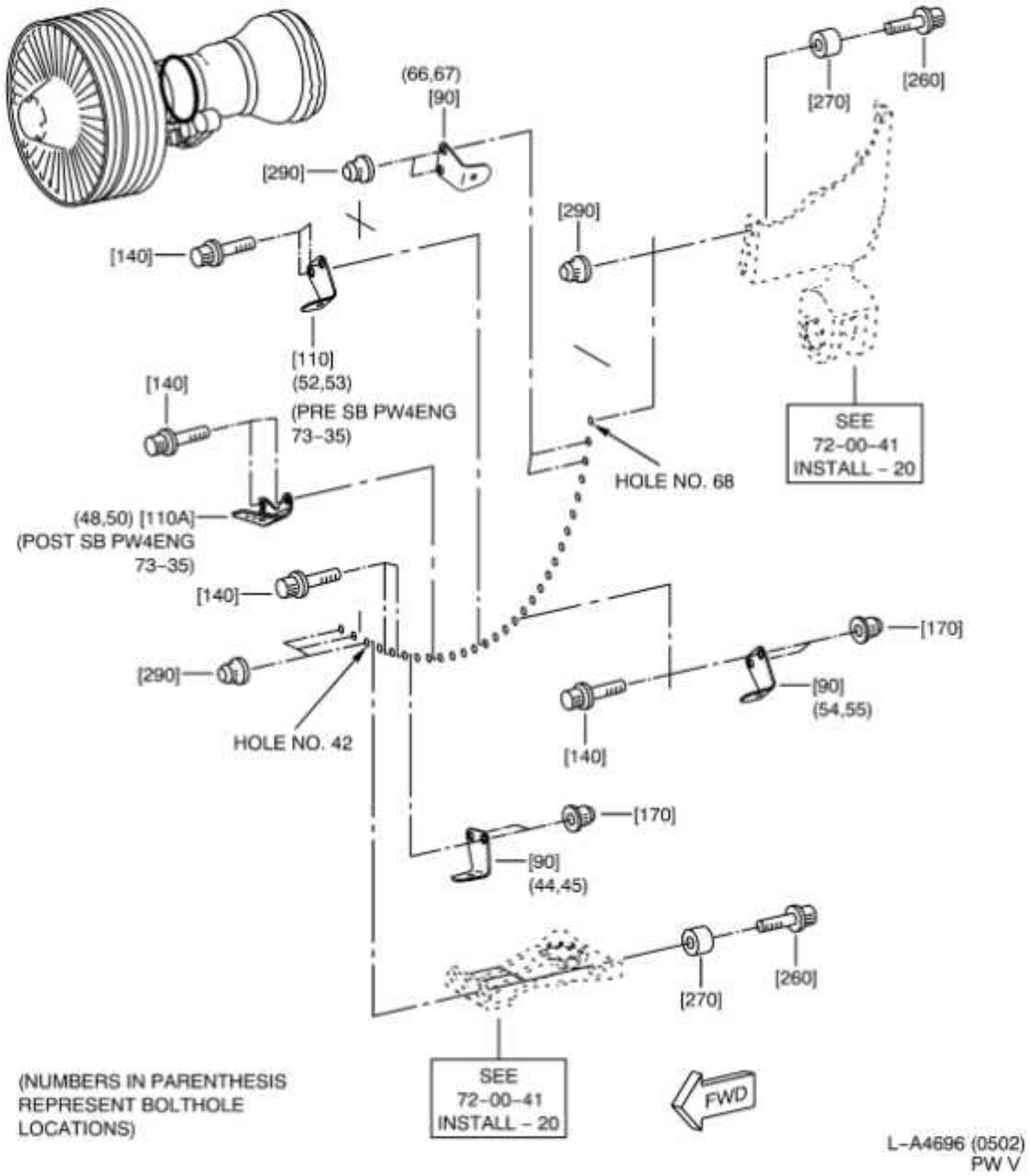
INSTALL - 20
[260]
[270]
HOLE NO. 21
[290]
(26 THROUGH 29)
[50,A,B]
[170]
(27,28,29)
[80]
[150]
[170]
(29,30) [90]
[170]
[90] (31,32)
[140]
[170]
[90] (33,34)
[140]
[170]
[140]
HOLE NO. 41
[40] (37,38)
(POST SB PW4ENG
72-239 ONLY)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-B9243 (0502)
PW V

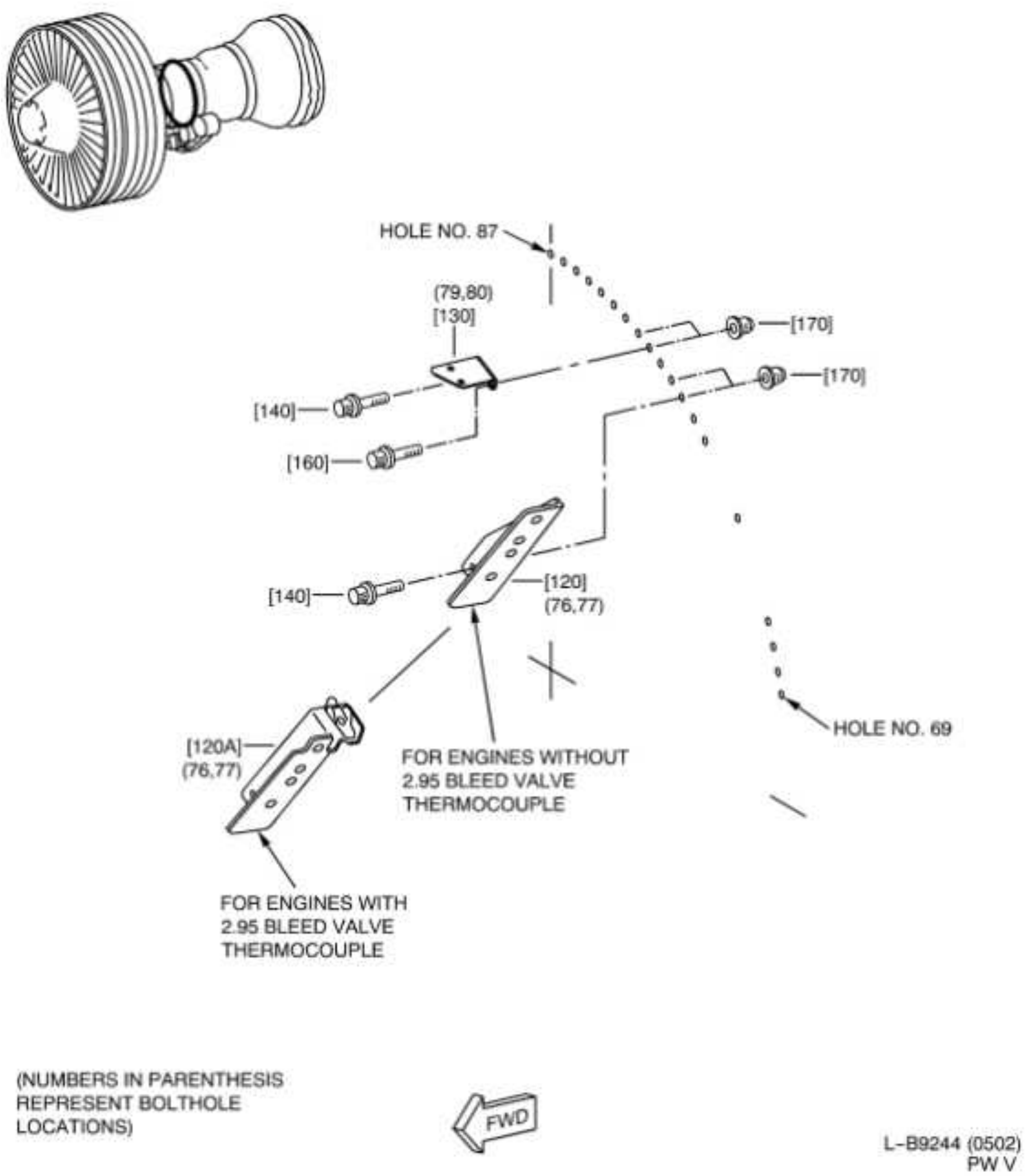
The Flange J Brackets And Hardware
Figure 501 (Sheet 2)
(Task 72-35-00-030-020)

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−20


(66,67)
[90]
[290]
[270]
[260]
[140]
[290]
[110]
(52,53)
(PRE SB PW4ENG 73-35)
[140]
SEE 72-00-41 INSTALL - 20
HOLE NO. 68
(48,50) [110A]
(POST SB PW4ENG 73-35)
[140]
[170]
[290]
[90]
(54,55)
HOLE NO. 42
[140]
[170]
[90]
(44,45)
[270]
[260]
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
SEE 72-00-41 INSTALL - 20
FWD
L-A4696 (0502)
PW V

The Flange J Brackets And Hardware
Figure 501 (Sheet 3)
(Task 72−35−00−030−020)

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−20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(79,80)
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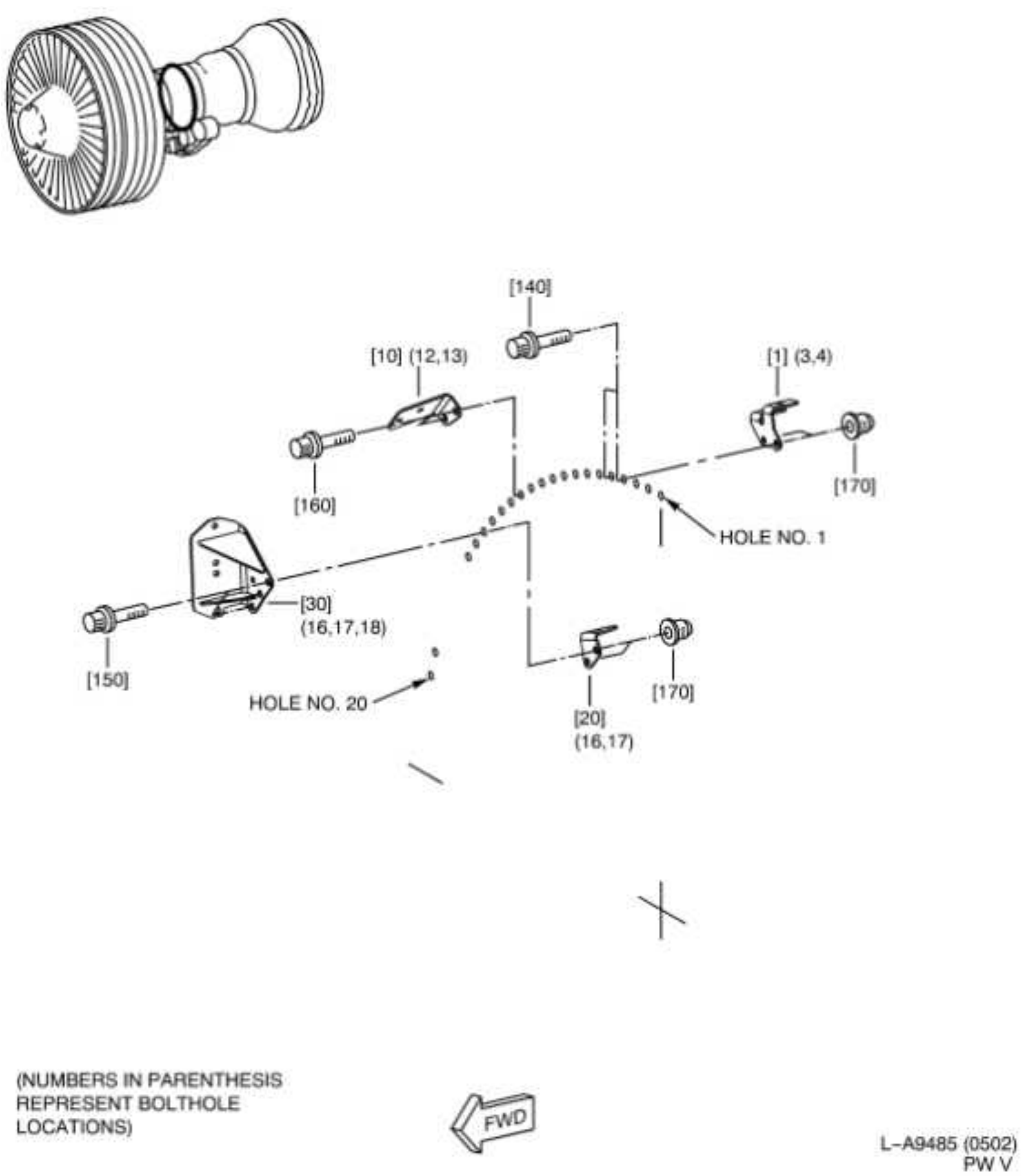
[160]
[140]
[120]
(76,77)
HOLE NO. 69
[120A]
(76,77)
FOR ENGINES WITHOUT 2.95 BLEED VALVE THERMOCOUPLE
FOR ENGINES WITH 2.95 BLEED VALVE THERMOCOUPLE
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B9244 (0502)
PW V

The Flange J Brackets And Hardware
Figure 501 (Sheet 4)
(Task 72−35−00−030−020)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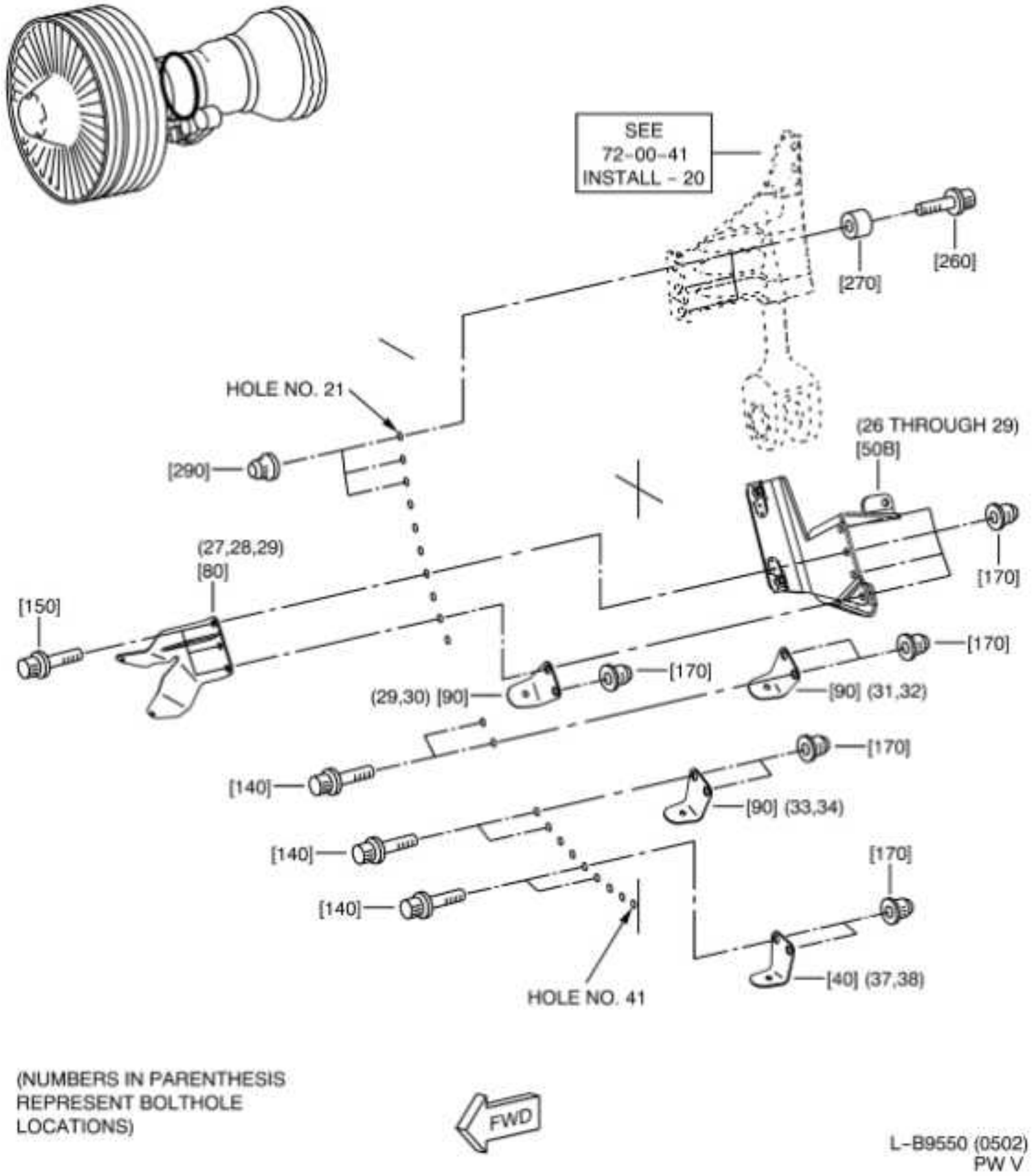
[10] (12,13)
[1] (3,4)
[160]
[170]
HOLE NO. 1
[30]
(16,17,18)
[150]
HOLE NO. 20
[170]
[20]
(16,17)
FWD
L−A9485 (0502)
PW V

(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

The Flange J Brackets And Hardware
Figure 501 (Sheet 5)
(Task 72−35−00−030−020)

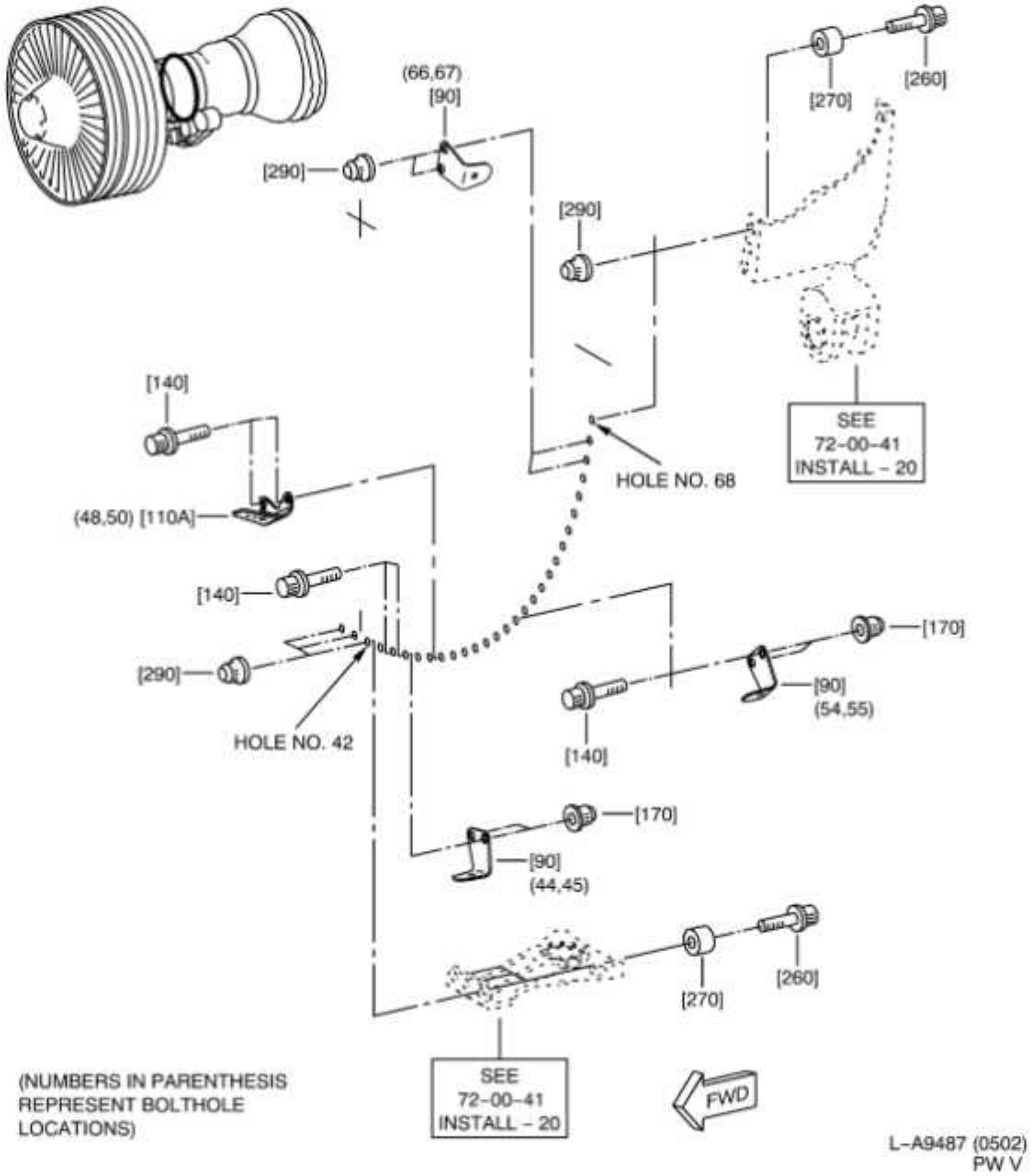
HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−20


SEE
72-00-41
INSTALL - 20
[260]
[270]
HOLE NO. 21
[290]
(26 THROUGH 29)
[50B]
[170]
(27,28,29)
[80]
[150]
[170]
(29,30) [90]
[170]
[90] (31,32)
[140]
[170]
[90] (33,34)
[140]
[170]
[140]
[40] (37,38)
HOLE NO. 41
FWD

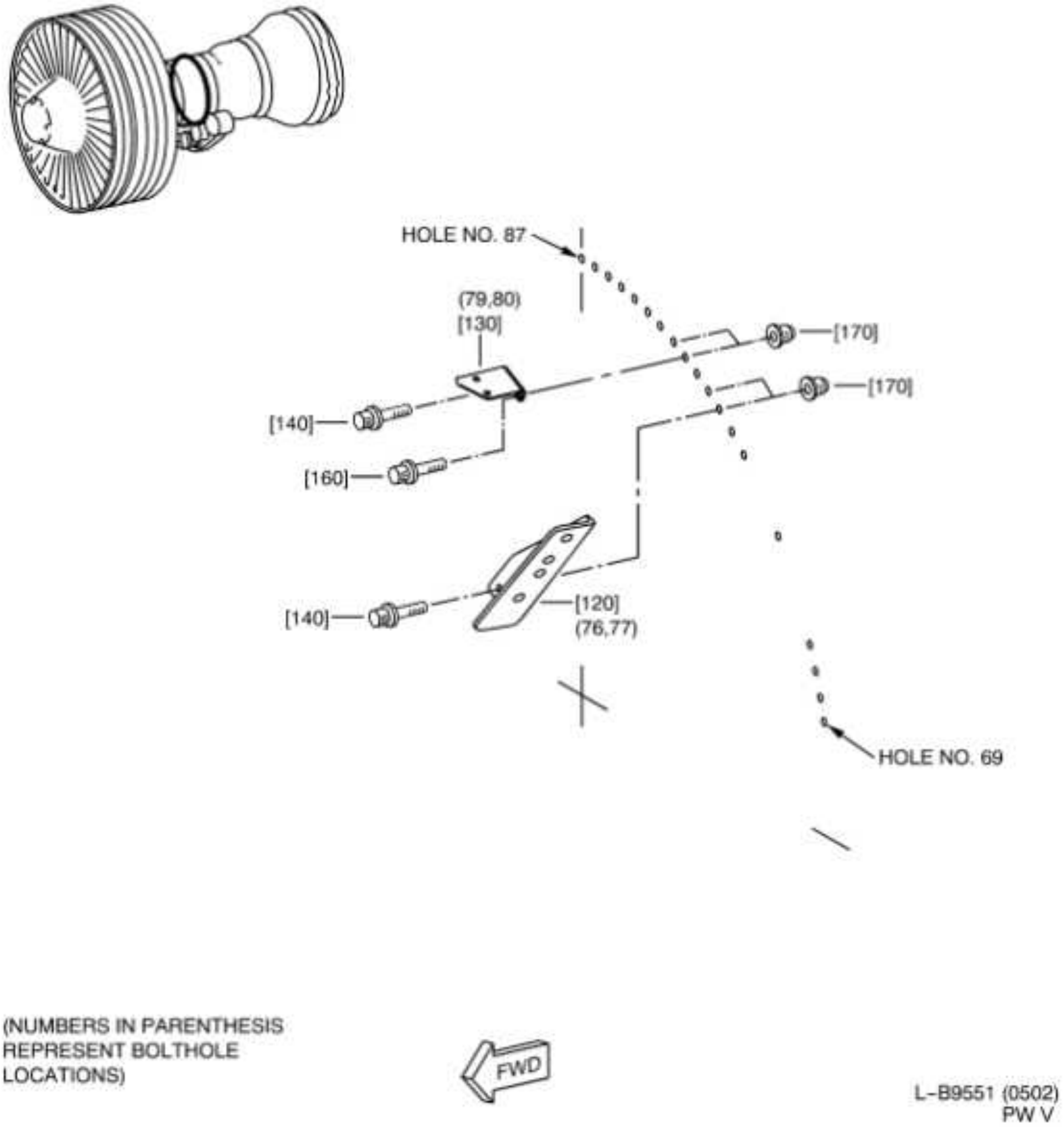
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

L-B9550 (0502)
PW V

The Flange J Brackets And Hardware
Figure 501 (Sheet 6)
(Task 72−35−00−030−020)


(66,67)
[90]
[290]
[270]
[260]
[290]
[140]
(48,50) [110A]
HOLE NO. 68
SEE
72-00-41
INSTALL - 20
[140]
[290]
HOLE NO. 42
[170]
[90]
(54,55)
[140]
[170]
[90]
(44,45)
[270]
[260]
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
SEE
72-00-41
INSTALL - 20
FWD
L-A9487 (0502)
PW V

The Flange J Brackets And Hardware
Figure 501 (Sheet 7)
(Task 72−35−00−030−020)


HOLE NO. 87
(79,80)
[130]
[170]
[170]
[140]
[160]
[140]
[120]
(76,77)
HOLE NO. 69
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-B9551 (0502)
PW V

The Flange J Brackets And Hardware
Figure 501 (Sheet 8)
(Task 72−35−00−030−020)

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HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−21

Task 72−35−00−030−021:

1. Remove The Flange H Brackets And Hardware

   A. Equipment And Materials Necessary − None

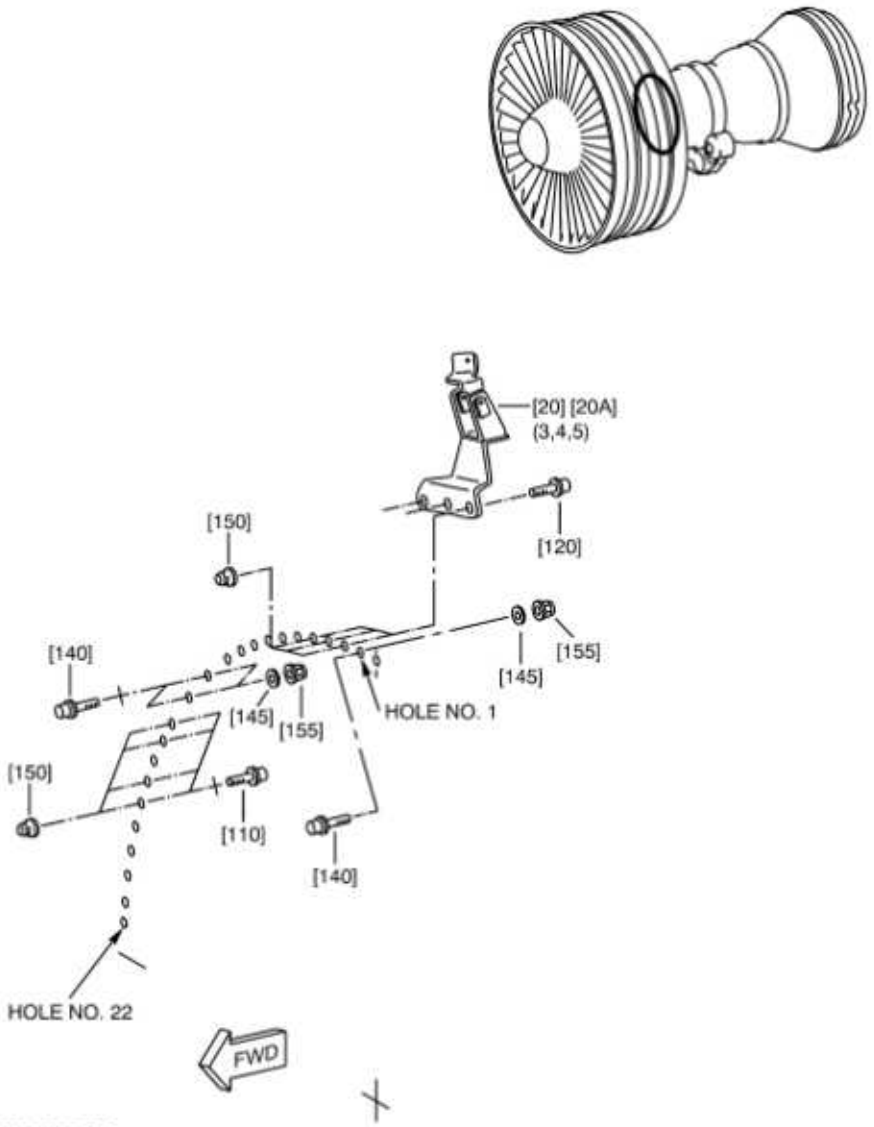
   B. Procedure

      (1) Remove the Flange H brackets as follows. See Figure 501 or Figure 502.

         (a) Tag and identify the flange H hardware for the correct bolthole locations.

            NOTE: All the part item numbers in the figures are the same as the item numbers in the IPC.

         (b) Remove the bolts and nuts that attach the brackets to Flange H. Remove the brackets from the flange.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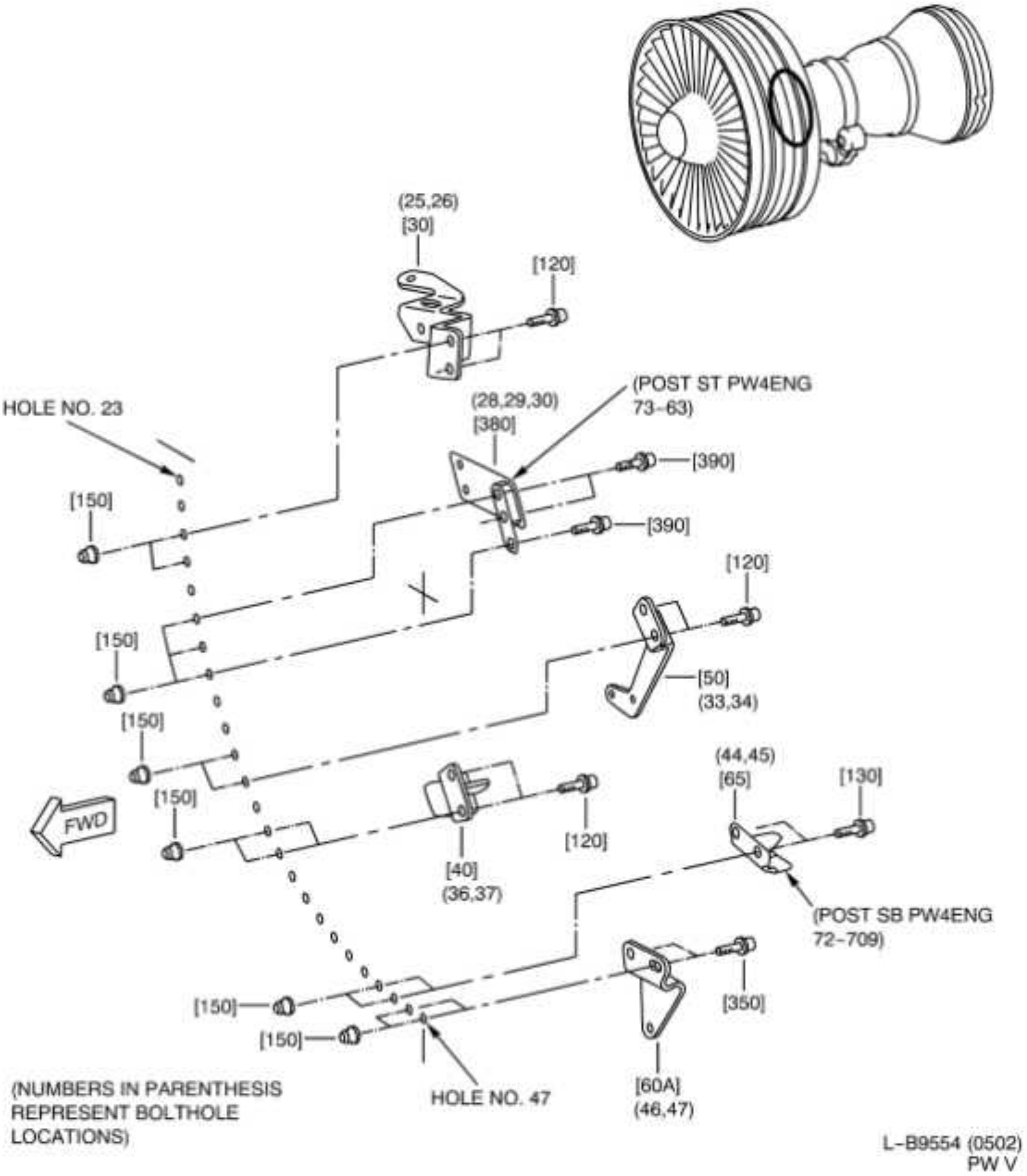
(3,4,5)
[150]
[120]
[140]
[155]
[145]
HOLE NO. 1
[145]
[155]
[150]
[110]
[140]
HOLE NO. 22
FWD

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

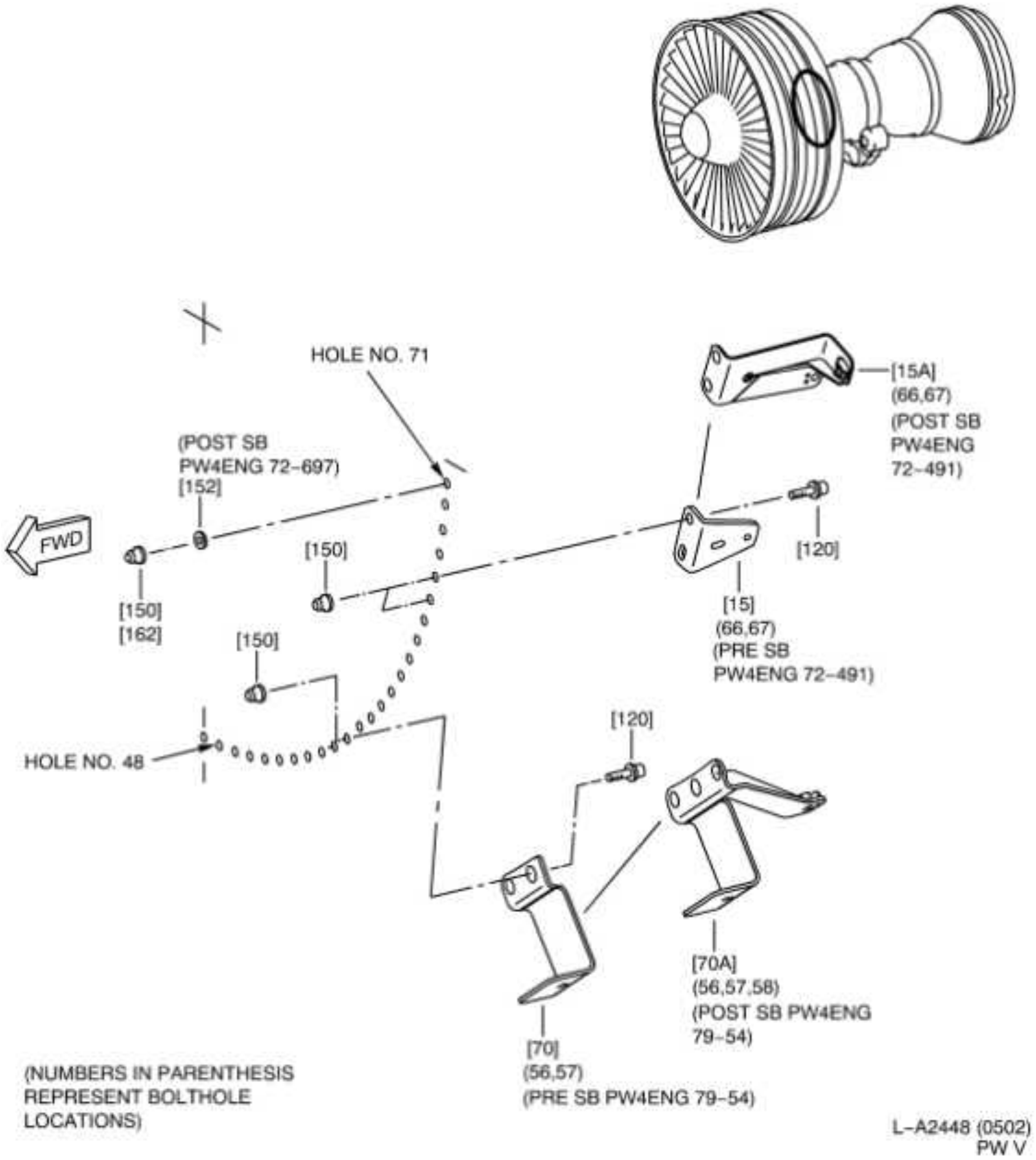
L−A1286 (0502)
PW V

The Flange H Brackets And Hardware (Pre SB PW4ENG 72−756 Or Pre SB PW4ENG 72−759))
Figure 501 (Sheet 1)
(Task 72−35−00−030−021)

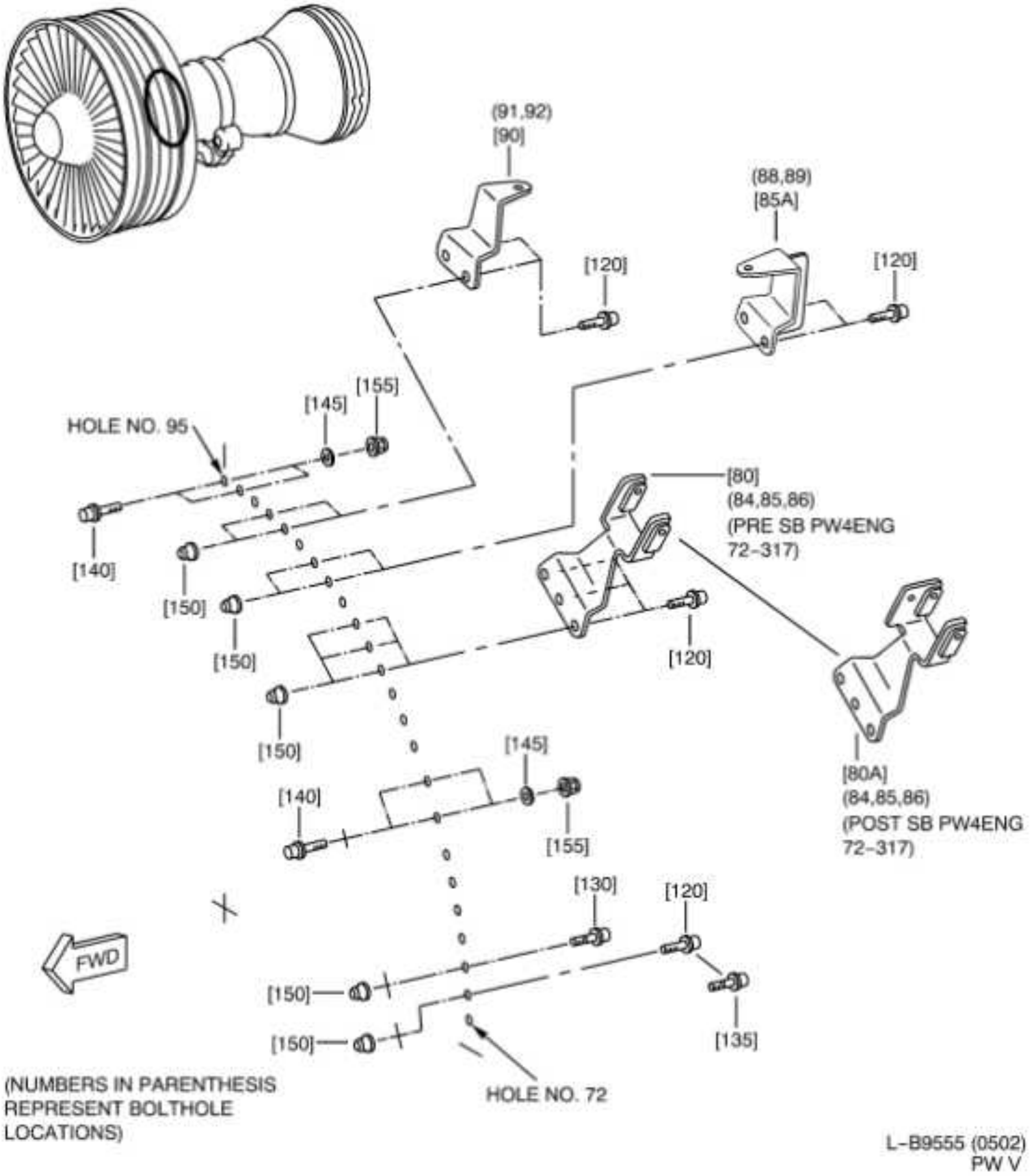
HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−21


(25,26)
[30]
[120]
HOLE NO. 23
(28,29,30)
[380]
(POST ST PW4ENG 73-63)
[390]
[390]
[150]
[120]
[150]
[50]
(33,34)
[150]
(44,45)
[65]
[130]
FWD
[150]
[120]
[40]
(36,37)
(POST SB PW4ENG 72-709)
[350]
[150]
[150]
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
HOLE NO. 47
[60A]
(46,47)
L-B9554 (0502)
PW V

The Flange H Brackets And Hardware (Pre SB PW4ENG 72−756 Or Pre SB PW4ENG 72−759))
Figure 501 (Sheet 2)
(Task 72−35−00−030−021)


HOLE NO. 71
(POST SB
PW4ENG 72-697)
[152]
FWD
[150]
[150]
[162]
[150]
HOLE NO. 48
[15A]
(66,67)
(POST SB
PW4ENG
72-491)
[120]
[15]
(66,67)
(PRE SB
PW4ENG 72-491)
[120]
[70A]
(56,57,58)
(POST SB PW4ENG
79-54)
[70]
(56,57)
(PRE SB PW4ENG 79-54)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L-A2448 (0502)
PW V

The Flange H Brackets And Hardware (Pre SB PW4ENG 72−756 Or Pre SB PW4ENG 72−759))
Figure 501 (Sheet 3)
(Task 72−35−00−030−021)


(91,92)
[90]
(88,89)
[85A]
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[120]
[155]
[145]
HOLE NO. 95
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[150]
[150]
[150]
[80]
(84,85,86)
(PRE SB PW4ENG 72-317)
[120]
[150]
[145]
[140]
[155]
[80A]
(84,85,86)
(POST SB PW4ENG 72-317)
[130]
[120]
FWD
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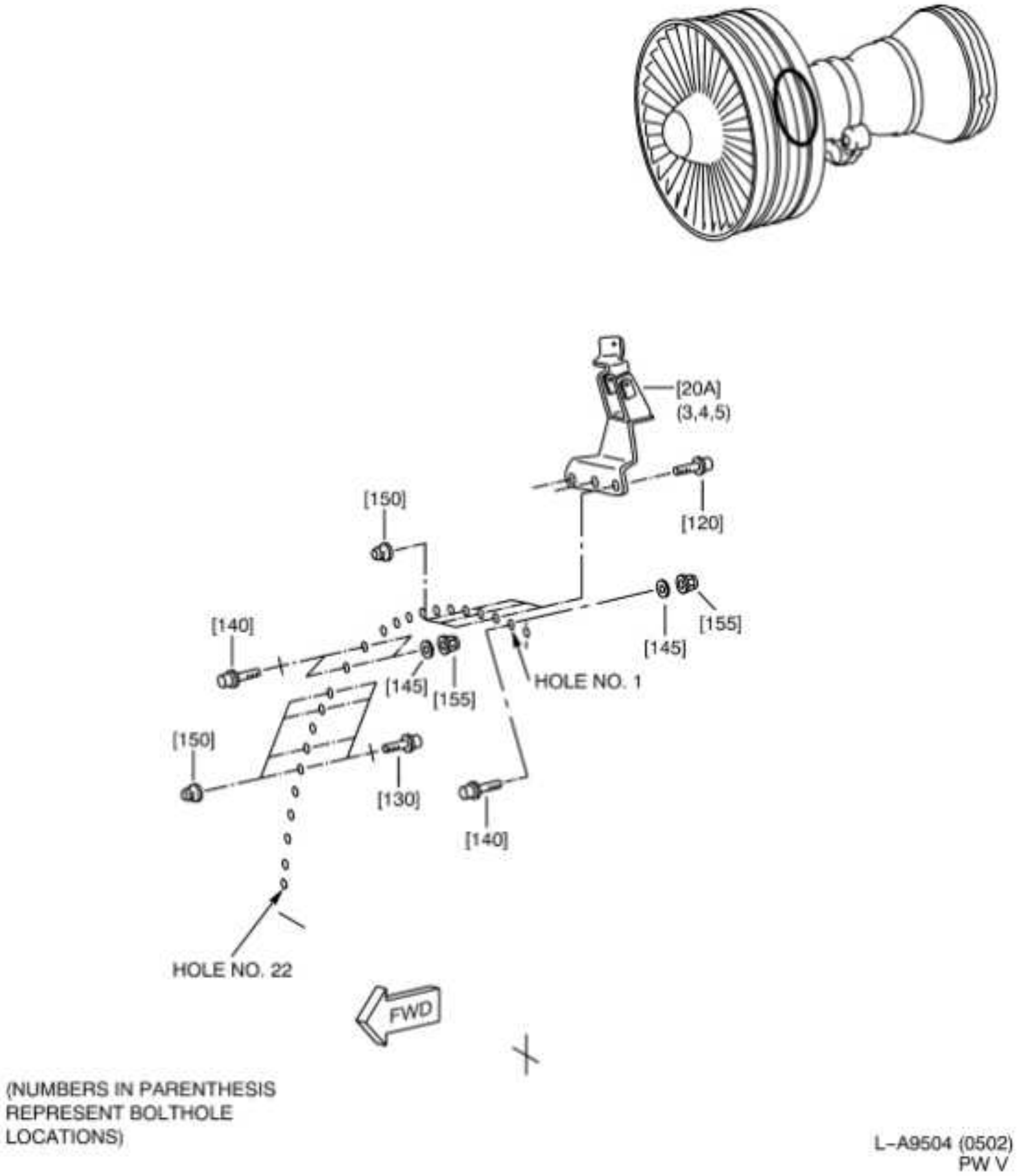
[135]
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
HOLE NO. 72
L-B9555 (0502)
PW V

The Flange H Brackets And Hardware (Pre SB PW4ENG 72−756 Or Pre SB PW4ENG 72−759))
Figure 501 (Sheet 4)
(Task 72−35−00−030−021)

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−21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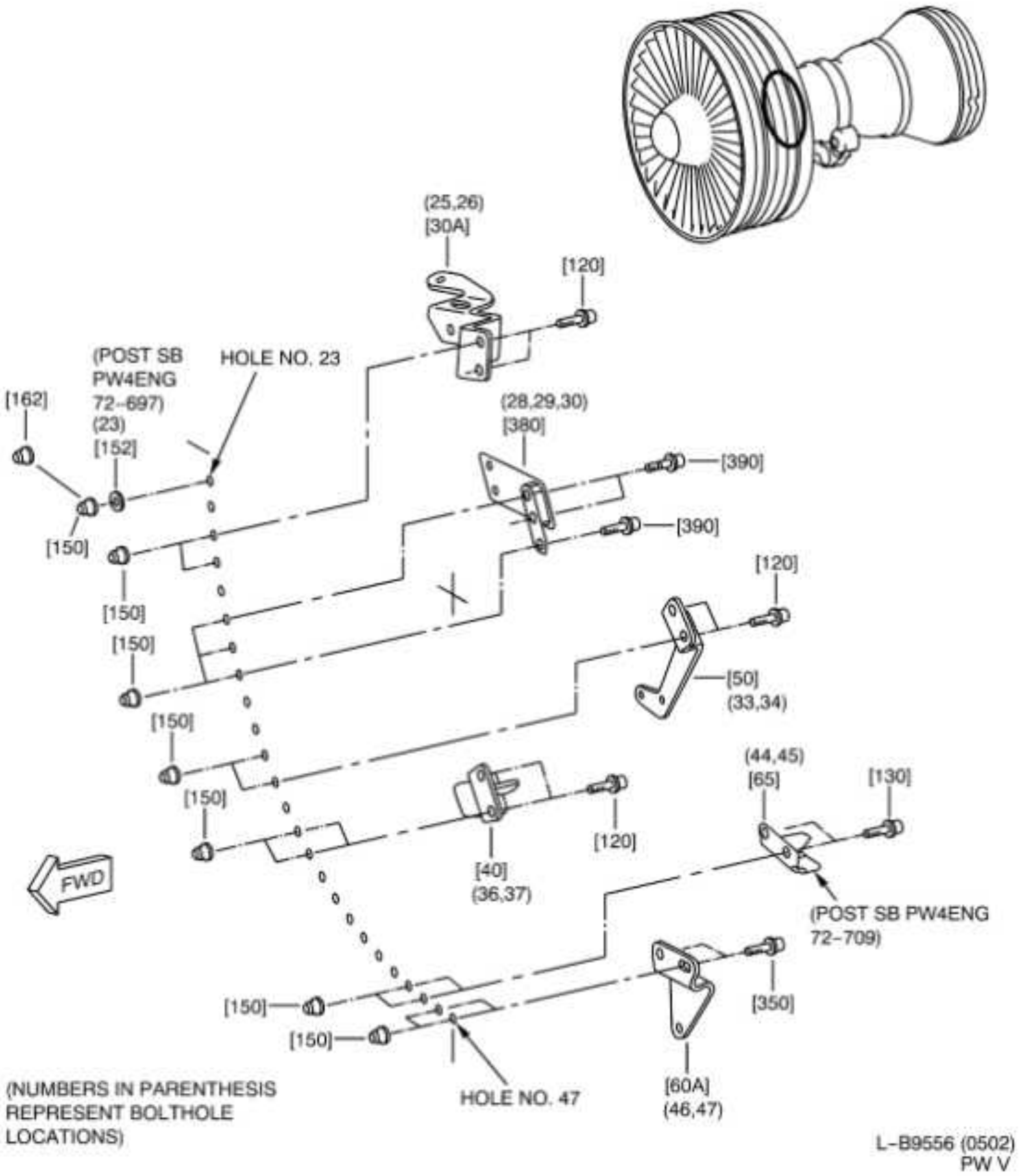
[155]
HOLE NO. 1
[150]
[130]
[140]
HOLE NO. 22
FWD
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L−A9504 (0502)
PW V

The Flange H Brackets And Hardware (Pre SB
PW4ENG 72−756 Or Pre SB PW4ENG 72−759))
Figure 501 (Sheet 5)
(Task 72−35−00−030−021)


(25,26)
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(POST SB PW4ENG 72-697) (23)
HOLE NO. 23
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(28,29,30)
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(33,34)
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(44,45)
[65]
[130]
[150]
[120]
[40]
(36,37)
FWD
(POST SB PW4ENG 72-709)
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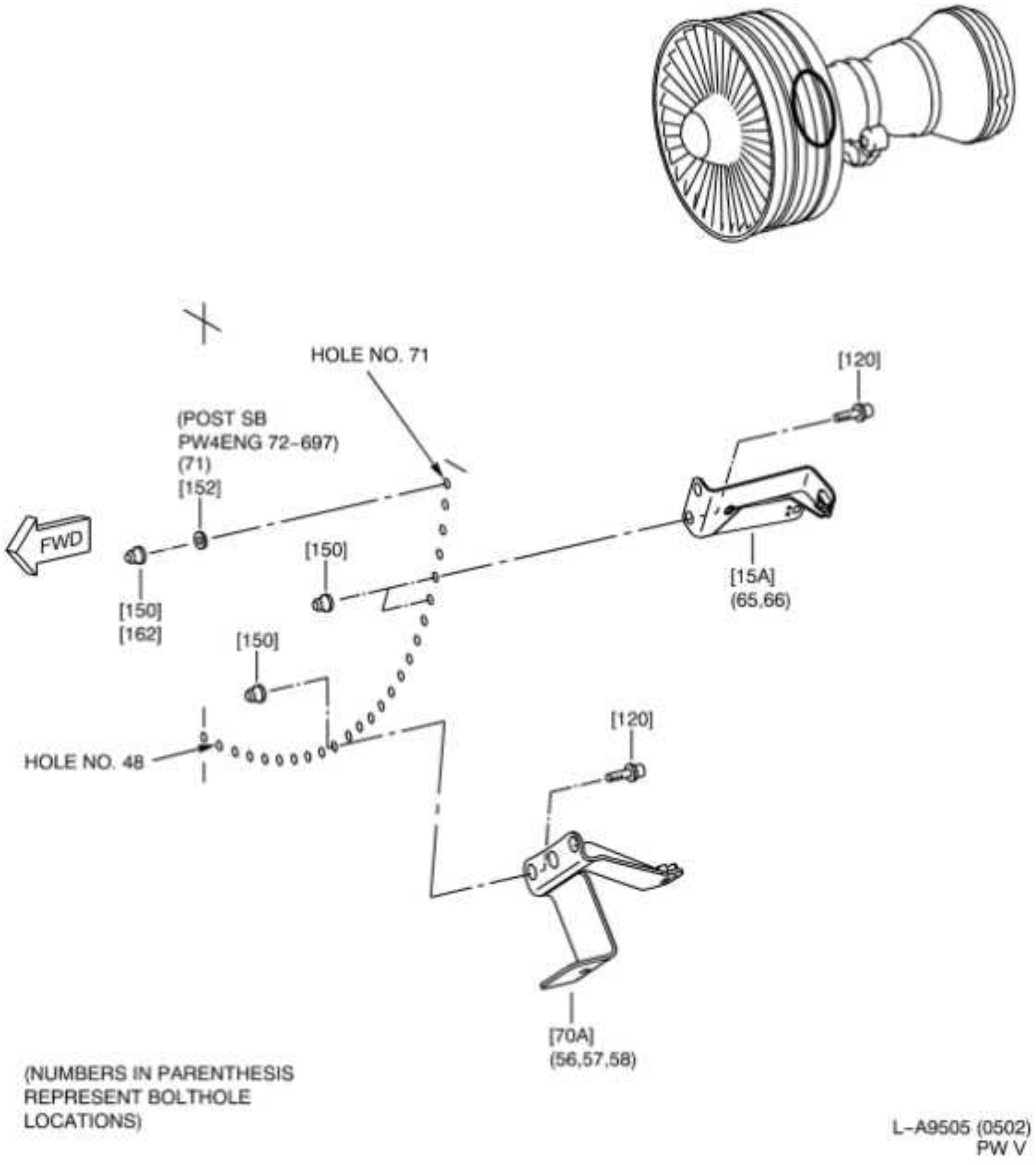
[150]
HOLE NO. 47
[60A]
(46,47)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L-B9556 (0502)
PW V

The Flange H Brackets And Hardware (Pre SB PW4ENG 72−756 Or Pre SB PW4ENG 72−759))
Figure 501 (Sheet 6)
(Task 72−35−00−030−021)

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−21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(POST SB
PW4ENG 72-697)
(71)
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FWD
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[150]
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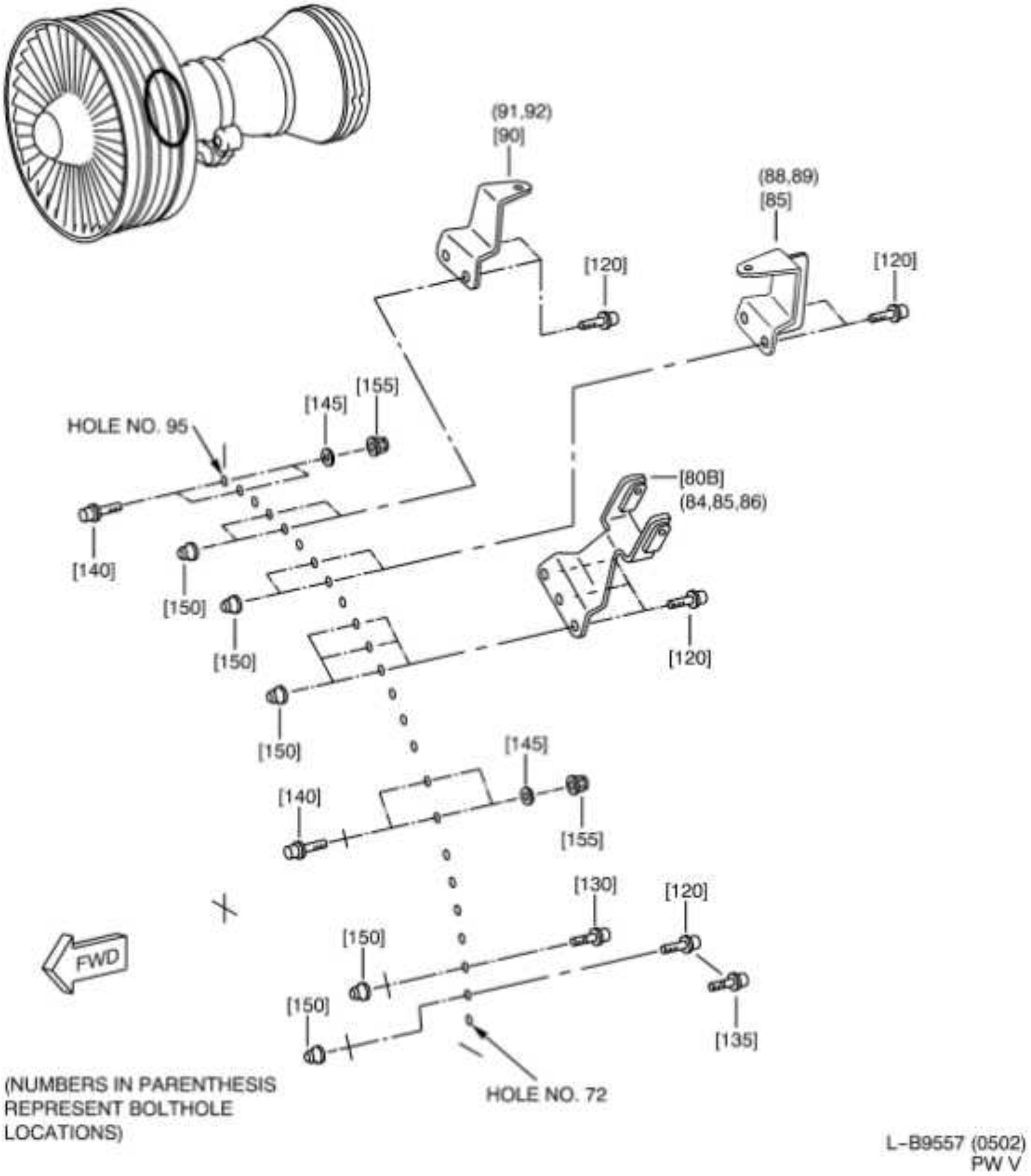
[15A]
(65,66)
[150]
HOLE NO. 48
[120]
[70A]
(56,57,58)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L-A9505 (0502)
PW V

The Flange H Brackets And Hardware (Pre SB PW4ENG 72−756 Or Pre SB PW4ENG 72−759)
Figure 501 (Sheet 7)
(Task 72−35−00−030−021)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(88,89)
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HOLE NO. 95
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(84,85,86)
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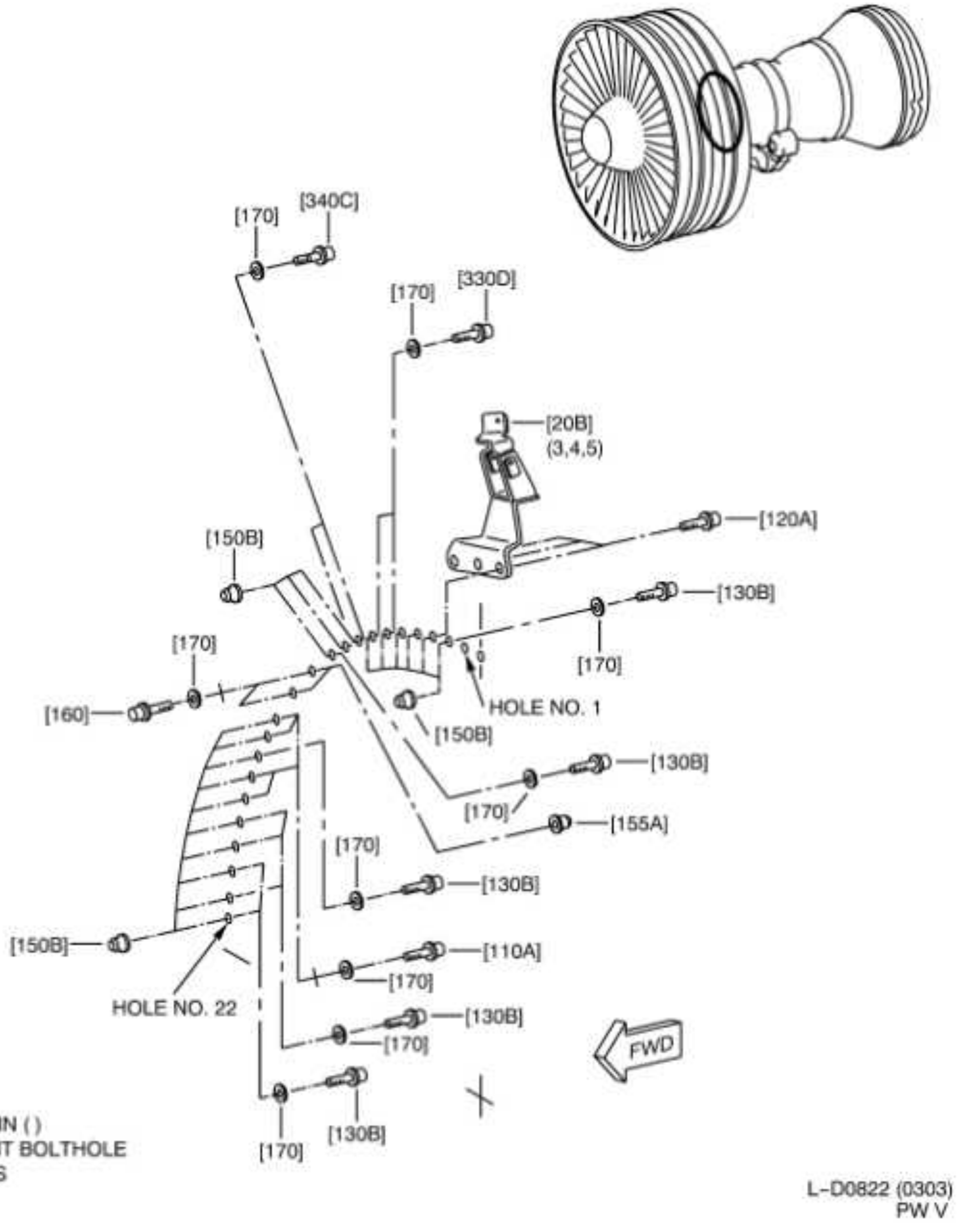
FWD
HOLE NO. 72
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L-B9557 (0502)
PW V

The Flange H Brackets And Hardware (Pre SB
PW4ENG 72−756 Or Pre SB PW4ENG 72−759)
Figure 501 (Sheet 8)
(Task 72−35−00−030−021)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HOLE NO. 22
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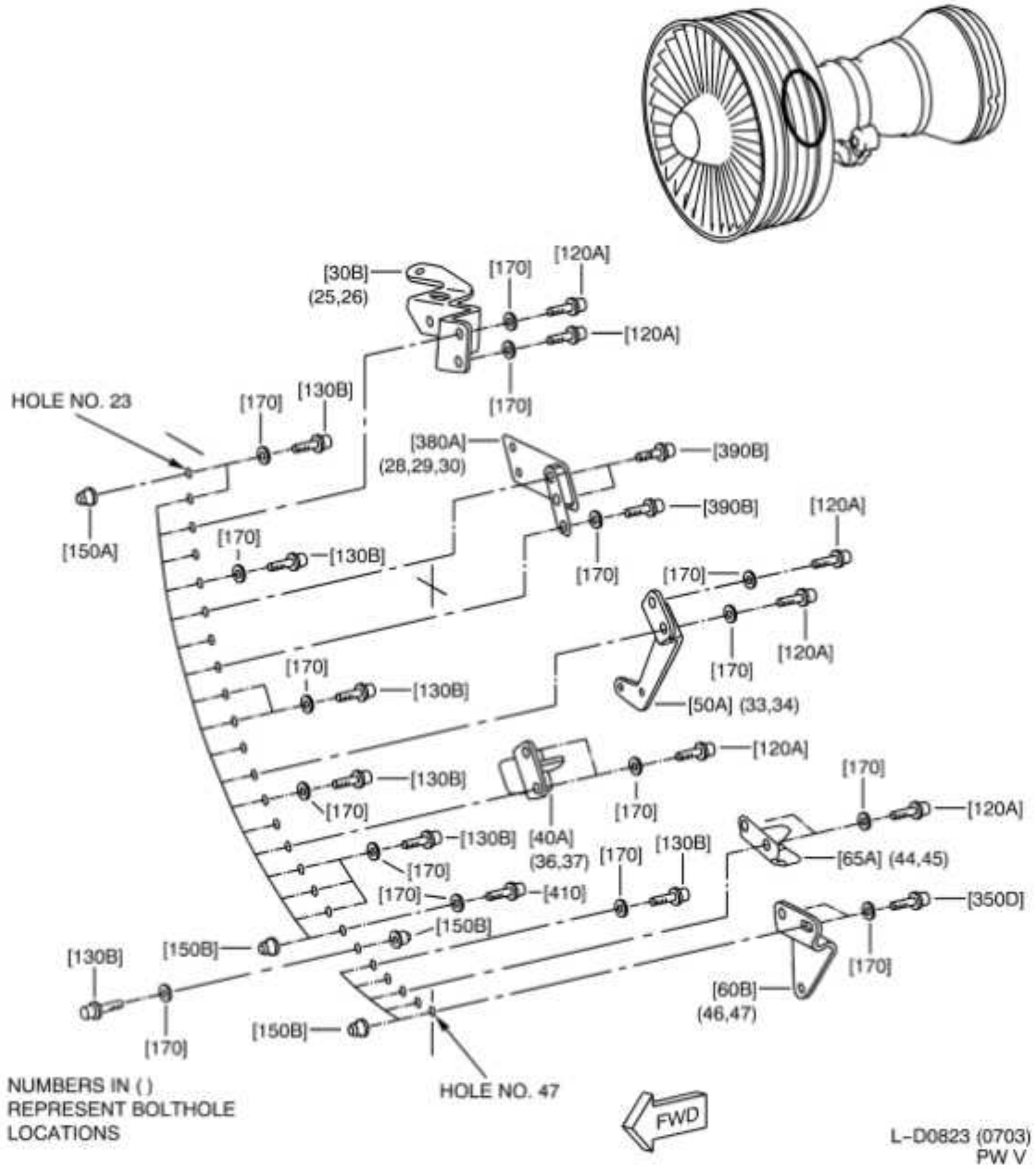
NUMBERS IN ( )
REPRESENT BOLTHOLE
LOCATIONS

L-D0822 (0303)
PW V

The Flange H Brackets And Hardware (Post SB PW4ENG 72-756 Or Post SB PW4ENG 72-759)
Figure 502 (Sheet 1)
(Task 72-35-00-030-021)

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−21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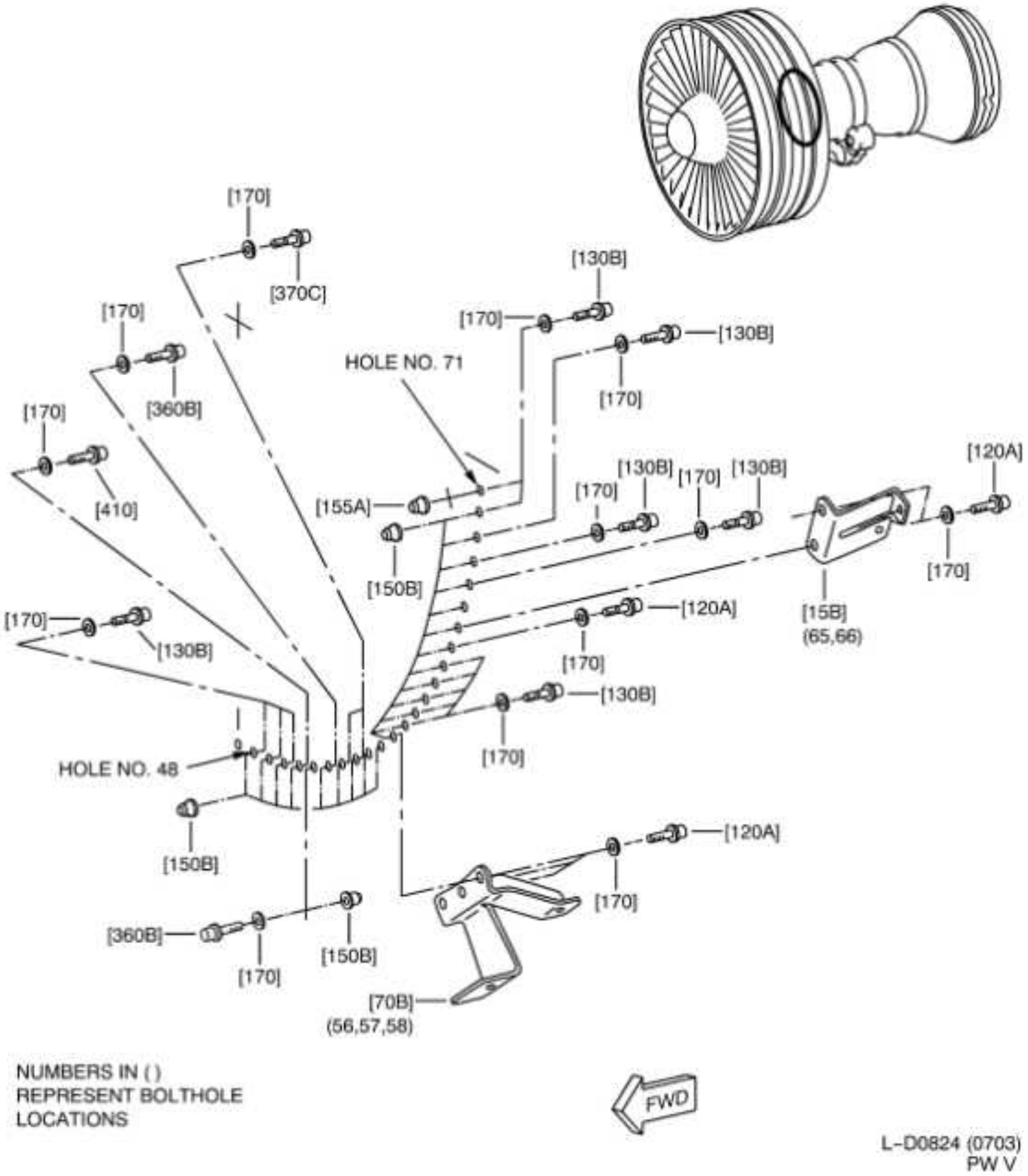
(46,47)
[170]
[150B]
HOLE NO. 47
FWD
L-D0823 (0703)
PW V

NUMBERS IN ( )
REPRESENT BOLTHOLE
LOCATIONS

The Flange H Brackets And Hardware (Post SB PW4ENG 72−756 Or Post SB PW4ENG 72−759)
Figure 502 (Sheet 2)
(Task 72−35−00−030−021)

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−21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[130B]
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(65,66)
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[130B]
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HOLE NO. 48
[150B]
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[360B]
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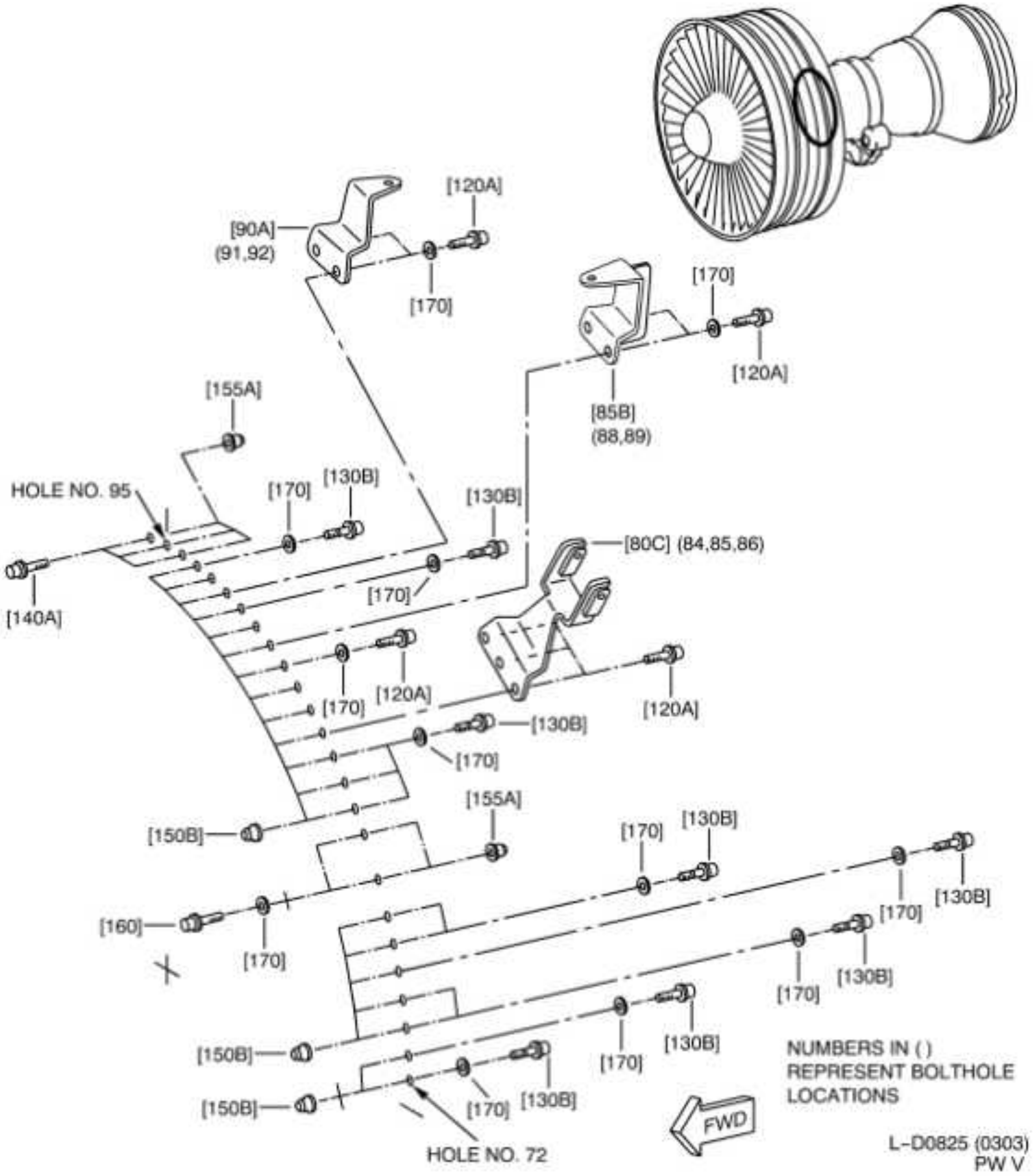
[70B]
(56,57,58)
NUMBERS IN ()
REPRESENT BOLTHOLE
LOCATIONS
FWD
L-D0824 (0703)
PW V

The Flange H Brackets And Hardware (Post SB PW4ENG 72−756 Or Post SB PW4ENG 72−759)
Figure 502 (Sheet 3)
(Task 72−35−00−030−021)

HIGH PRESSURE COMPRESSOR (HPC) − DISASSEMBLY−21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[120A]
[85B]
(88,89)
[155A]
HOLE NO. 95
[170]
[130B]
[130B]
[80C] (84,85,86)
[140A]
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[150B]
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[130B]
HOLE NO. 72
FWD
NUMBERS IN ( )
REPRESENT BOLTHOLE
LOCATIONS
L-D0825 (0303)
PW V

The Flange H Brackets And Hardware (Post SB
PW4ENG 72−756 Or Post SB PW4ENG 72−759)
Figure 502 (Sheet 4)
(Task 72−35−00−030−021)

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HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-01

Task 72-35-00-990-004:

1. General Inspection Requirements - High Pressure Compressor (HPC)

A. Organization Of Individual Part Or Subassembly Inspection Data

(1) Specific inspection functions for all significant parts/ subassemblies are provided in individual Inspection/ Check sections. Application of each inspection function is shown in Inspection/Check-00 for part/subassembly. Section designations and function descriptions are as follows.

(2) Inspection/Check-00 section contains, where applicable:

(a) Part number(s) for which the inspection data is applicable.

(b) Service Bulletin numbers applicable to part number(s).

(c) Inspection/Check numbers, data categories and applicability data.

(3) Inspection/Check-01, Preinspection Preparation, contains, where applicable:

(a) General inspection comments, notes, CAUTIONS, etc., which supplement data contained in this section.

(b) Identification of mechanical disassembly required prior to inspection.

(c) Identification of any surface treatment or coating removal, or other actions required prior to inspection.

(d) Identification of part/subassembly cleaning required prior to inspection.

(4) Inspection/Check-02, Nondestructive Inspection, contains the following nondestructive inspection methods, part/subassembly special attention areas and damage limits (as applicable):

(a) Fluorescent Penetrant Method

(b) Eddy Current Method

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−01

(c) Magnetic Particle Method

(d) X−ray Method

(e) Ultrasonic Method

(f) Hardness Check

(g) Other − As specified.

(5) Inspection/Check−03, Visual Inspection contains, where applicable:

(a) Visual inspection requirements which can be accomplished with or without magnification or special lighting (as specified).

NOTE: Use of inspection tools may be required as a supplement to visual inspection process.

(b) Allowable blending for visual damage, which may be accomplished within the inspection area.

NOTE: Blending requirement will also be shown in applicable repairs.

(6) Inspection/Check−04, Dimensional Inspection, contains, where applicable:

(a) Dimensional inspection requirements other than visual inspection. The requirements will include applicable fits and clearances, and other dimensional inspections necessary to ensure the part integrity and proper functioning.

(7) Inspection/Check−05, Functional Check Inspection contains, where applicable:

(a) Procedures, limits, and equipment used with any required functional checks (oil flow, air flow, leak, etc.).

(8) Inspection/Check−06, Inspection Postrequisites contains, references to procedures required to return part/ subassembly to serviceable condition. References include the following, as required.

(a) Reassembly

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−01

(b) Protective coatings, sealants and/or lubricant reapplication

B. Thorough and intelligent part/subassembly inspection is of major importance in achieving efficient engine operation and satisfactory service life. Inspection personnel should be thoroughly familiar with inspection procedures, inspection tooling, limits associated with normal and, where applicable, unusual operating conditions, limits associated with repairs, and with inspection procedures published in Standard Practices Manual.

C. During preliminary inspection of part/subassembly, comparison with mating or adjacent parts may provide indication of source of wear or damage. This procedure may indicate requirement for additional disassembly and inspection.

D. During inspection, records should be kept of deviations beyond serviceable limits to determine: (a) if part/subassembly will be repaired or replaced, and (b) if part is reparable, which repairs are required. Suitable documentation should accompany part/subassembly with results of this determination.

E. Inspection of individual part/subassembly dimensions which are also in Fits and Clearances will include Fits and Clearance Reference Numbers and will show new part/subassembly dimension unless specifically stated otherwise. Inspection Frequency Requirements (IFR) codes (for IFR Code A parts only) are included with Reference Number data. If acceptable dimensional deviations or results of repair affect Fits and Clearances, suitable documentation should accompany part/subassembly to ensure check of fit or clearance at final assembly.

NOTE: Parts/subassemblies which deviate dimensionally from new part/subassembly values may be acceptable provided required fit or clearance is achieved at final assembly.

F. Dimensional inspection requirements will be accompanied by part/subassembly constraint data if such constraint requirements are required during part/subassembly manufacture. Adherence to constraint requirements when inspecting service operated parts/subassemblies should be dictated by experience. It is recommended that parts/subassemblies which do not meet dimensional inspection requirements in free state be constrained and re−measured prior to initiation of any repair or re−use activity.

G. Dimensional inspections of one detail of a subassembly, prior to removal from subassembly, may produce incorrect data due to constraint forces from mating details. If questionable data is obtained, subassembly should be disassembled and inspections repeated.

H. Dimensional inspection limits in inspection text provide continued use (as is) and, if applicable, repair limits. Parts/subassemblies which exceed both limits and nonreparable parts/subassemblies which exceed (as is) limits are unserviceable.

I. Inspections required to verify integrity of repair are contained within repair procedure. Unless otherwise stated, repaired part is expected to meet all inspection requirements contained in inspection text for part/subassembly.

J. Parts/subassemblies which do not require repairs except for those provided in Standard Practices Manual are identified by Chapter/Section/Subject Number 72−35−99 in cleaning table (Cleaning−01) and nondestructive inspection table (Inspection/Check−02). Determination of serviceability for those parts listed in 72−35−99 is limited to cleaning, non−destructive inspection, and the following:

(1) Visually inspect parts/subassemblies for surface defects, deformations, cuts, improper threads or wrenching surfaces, incomplete or missing protective coatings or other damage which will prevent proper functioning and make part/subassembly unserviceable. Unserviceable parts/subassemblies should not be reinstalled. Repair unserviceable parts/subassemblies per Standard Practices Manual, as applicable.

(2) Parts/subassemblies with crack indications to any length or depth detected by listed nondestructive inspection are unserviceable, and should not be reinstalled.

K. When new part/subassembly is to be installed and it is important that it be identified as to engine number or position in engine, mark it by appropriate method described in Marking of Parts, 70−11, Standard Practices Manual.

L. In order to eliminate confusion and to maintain consistent terminology, various physical conditions which might be encountered during inspection of parts/subassemblies and explanation of unusual causes of such conditions are defined in Physical Inspection, 70−31, Standard Practices Manual.

M. If inspection reveals it necessary to replace fitted spacer, tag spacer to indicate that replacement must be made with spacer of correct classification at assembly.

N. If text refers to superficial or shallow imperfection, following definitions apply:

   (1) A superficial imperfection is defined as a nick, dent, scratch, toolmark, etc., which disrupts the surface but does not appear to penetrate surface roughness texture.

   (2) A shallow imperfection appears to penetrate surface finish texture, but does not have a dark bottom and would not cause a 0.007 inch (.178 mm) radius stylus to hesitate if passed over it.

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HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−03

Task 72−35−00−990−005:

1. Visual Inspection − High Pressure Compressor (HPC)
   A. For inspection requirements applicable to installed (accessible) parts of High Pressure Compressor (HPC) see 72−00−35, Inspection/Check−02 (Task 72−00−35−210−001) and 72−00−35, Inspection/Check−03 (Task 72−00−35−210−002).

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HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04

Task 72−35−00−990−001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B, C, or D located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.
D	This fit or clearance involves a component for which it is considered necessary to replace the used part with a new part at the time of overhaul in order to restore a wear or sealing surface. It is not required to dimensionally examine this fit if all of the conditions that follow are met: − The used wear, or sealing component has been replaced with a new part. − The mating part(s) have been visually and dimensionally examined as necessary by the applicable PW4000 series CIR, PN 51A375 section(s) for the part(s), and meet the permitted wear, and dimensional requirements on the surface(s) involved in the fit or clearance.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (−) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (−) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max

(CONTINUED)

less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances
The following General NOTES are applicable to two or more fits and Clearances reference numbers. The applicable reference numbers are included in the NOTES.

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04

NOTE: General NOTE 1: For Reference Numbers 1278 through 1291, you can measure the knife−edge diameter of the fit and not measure the HPC shroud segments (honeycomb) air seal diameters if all of the following conditions are met in the PW4000 Series CIR, PN 51A357.

The measured knife−edge diameter is within the CIR manual Inspection/Check−04 serviceable limits.

Honeycomb trenching (if present) is within the CIR manual Inspection/Check−03 and Inspection/Check−04 serviceable limits.

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
580	C	Plain Self-Aligning Bearing (72-35-79) Compressor Stator Cylinder Support Assembly (72-35-73) (See Figure 802, Sheet 9)				
		Bearing	2.6765 (67.9831)	2.6770 (67.9958)		
		Support	2.6774 (68.0060)	2.6784 (68.0310)	.0004 (0.011)	.0019 (0.048)
581	C	HPC Lever Set (72-35-74) Cylindrical Roller Bearing (72-35-79) (See Figure 802, Sheet 9)				
		Lever	1.7722 (45.0139)	1.7727 (45.0265)		
		Bearing	1.7712 (44.9885)	1.7717 (45.0011)	.0015T (0.038T)	.0005T (0.013T)
582	C	Bolt Stage 6 Rod End Bearing (72-35-78) (See Figure 802, Sheet 5)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Bearing	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
583	C	Bolt Stage 6 Synchronizing Ring Assembly (72-35-53) (See Figure 802, Sheet 5)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Ring	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
584	C	Bolt Inlet HPC Lever (72-35-74) (See Figure 802, Sheet 2)				
		Bolt	.3380 (8.5852)	.3382 (8.5902)		
		Lever	.3374 (8.5700)	.3380 (8.5852)	.0008T (0.0203T)	.0000 (0.0000)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
585	C	Bolt HPC Lever Set (72−35−74) (See Figure 802, Sheet 2)				
		Bolt	.3380 (8.5852)	.3382 (8.5902)		
		Lever	.3374 (8.5700)	.3380 (8.5852)	.0008T (0.0203T)	.0000 (0.0000)
586	C	HPC Lever Set (72−35−74) Inlet HPC Lever (72−35−74) (See Figure 802, Sheet 2)				
		Lever Set	1.7722 (45.0139)	1.7727 (45.0265)		
		Inlet Lever	1.7727 (45.027)	1.7737 (45.051)	.000 (0.000)	.0015 (0.038)
587	C	Inlet HPC Lever (72−35−74) Bearing (72−35−79) (See Figure 802, Sheet 2)				
		Lever Set	1.7722 (45.0139)	1.7727 (45.0265)		
		Bearing	1.7712 (44.9885)	1.7717 (45.0011)	.0015T (0.038T)	.0005T (0.013T)
588	B	Bearing (72−35−79) Compressor Stator Lever Support (72−35−73) (See Figure 802, Sheet 2)				
		Bearing	2.6757 (67.963)	2.6772 (68.000)		
		Support	2.6774 (68.0060)	2.6789 (68.044)	.0002 (0.006)	.0032 (0.081)
589	C	Bolt HPC Synchronizing Ring Clevis Assembly (72−35−55) (See Figure 802, Sheet 5)				
		Bolt	.4345 (11.037)	.4355 (11.061)		
		Ring	.437 (11.100)	.438 (11.125)	.0015 (0.039)	.0035 (0.088)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
590	C	Shoulder Bolt Compressor Stator Cylinder Support Assembly (72-35-73) (See Figure 802, Sheet 10)				
		Bolt	.3595 (9.132)	.3605 (9.156)		
		Support	.3615 (9.183)	.3635 (9.232)	.001 (0.025)	.0105* (0.267)*
591 (1)	B	Shoulder Bolt HPC Front Case Assembly (72-35-40) (See Figure 802, Sheet 10)				
		Bolt	.3595 (9.132)	.3605 (9.156)		
		Case (Pre SB PW4ENG 72-510)	.3745 (9.513)	.3755 (9.537)	.014 (0.356)	.016 (0.406)
591 (2)	B	Shoulder Bolt HPC Front Case Assembly (72-35-40) (See Figure 802, Sheet 10)				
		Bolt	.3595 (9.132)	.3605 (9.156)		
		Case (Post SB PW4ENG 72-510)	.3750 (9.525)	.3765 (9.563)	.0145 (0.368)	.017 (0.432)
592	C	Bolt Cylinder Stop (See Figure 802, Sheet 9)				
		Bolt	.216 (5.487)	.217 (5.511)		
		Stop	.218 (5.538)	.220 (5.588)	.001 (0.026)	.004 (0.101)
593	B	Bearing (72-35-79) Compressor Stator Cylinder Support (72-35-73) (See Figure 802, Sheet 9)				
		Bearing	1.4360 (36.475)	1.4375 (36.512)		
		Support	1.438 (36.526)	1.440 (36.576)	.0005 (0.013)	.004 (0.101)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
599	C	Compressor Cylinder (CMM) Bearing (72−35−79) (See Figure 802, Sheet 9)				
		Cylinder	.7487 (19.0170)	.7490 (19.0246)		
		Bearing	.7495 (19.0373)	.7500 (19.0500)	.0005 (0.0127)	.0013 (0.0330)
600	C	Bolt HPC Lever Set (72−35−74) (See Figure 802, Sheet 10)				
		Bolt	.497 (12.624)	.498 (12.649)		
		Lever	.4995 (12.688)	.5005 (12.712)	.0015 (0.039)	.0035 (0.088)
601	C	Bolt HPC Lever Set (72−35−74) (See Figure 802, Sheet 10)				
		Bolt	.3739 (9.4971)	.3744 (9.5097)		
		Lever	.3745 (9.513)	.3755 (9.537)	.0001 (0.003)	.0016 (0.040)
602	C	Bolt Rod End Bearing Assembly (72−35−78) (See Figure 802, Sheet 10)				
		Bolt	.3739 (9.4971)	.3744 (9.5097)		
		Bearing	.3745 (9.5123)	.3750 (9.5250)	.0001 (0.103)	.0011 (0.027)
603	C	Bearing (72−35−78) Rod End (72−35−78) (See Figure 802, Sheet 10)				
		Bearing	.8120 (20.6248)	.8125 (20.6375)		
		Rod	.8123 (20.6325)	.8128 (20.6451)	.0002T (0.0051T)	.0008 (0.0203)

	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
604	C	Bolt HPC Synchronizing Ring Clevis Assembly (72-35-55) (See Figure 802, Sheets 4 And 11)				
		Bolt	.4345 (11.037)	.4355 (11.061)		
		Ring	.437 (11.100)	.438 (11.125)	.0015 (0.039)	.0035 (0.088)
605	C	Bolt HPC Synchronizing Ring Clevis Assembly (72-35-55) (See Figure 802, Sheets 4 And 11)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Ring	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
606	C	Bolt Stage 5 And 7 Rod End Bearing (72-35-78) (See Figure 802, Sheets 4 And 11)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Bearing	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
607	A	Radial Clearance (See Figure 802, Sheets 3, 4, 5 And 11) Rod End Spherical Bearing (72-35-78)			.000	
609	C	Bolt HPC Clevis (72-35-76) (See Figure 802, Sheet 4)				
		Bolt	.4345 (11.037)	.4355 (11.061)		
		Clevis	.437 (11.100)	.438 (11.125)	.0015 (0.039)	.0035 (0.088)

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Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
610	C	Bolt Rod End Bearing (72-35-78) (See Figure 802, Sheet 4)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Bearing	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
611	C	Bolt HPC Clevis (72-35-76) (See Figure 802, Sheet 4)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Clevis	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
612	C	Bolt HPC Synchronizing Ring Clevis Assembly (72-35-55) (See Figure 802, Sheet 3)				
		Bolt	.4345 (11.037)	.4355 (11.061)		
		Ring	.437 (11.100)	.438 (11.125)	.0015 (0.039)	.0035 (0.088)
613	C	Bolt Rod End Bearing (72-35-78) (See Figure 802, Sheet 3)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Bearing	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
614	C	Bolt HPC Synchronizing Ring Clevis Assembly (72-35-55) (See Figure 802, Sheet 3)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Ring	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)

Ref. No.	IFR	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
616	C	Bolt Support Mounting Brace (See Figure 802, Sheet 8)				
		Bolt	.3685 (9.360)	.3695 (9.385)		
		Brace	.3745 (9.513)	.3755 (9.537)	.005 (0.127)	.007 (0.177)
617 (1)	B	Bolt HPC Front Case Assembly (72-35-40) (See Figure 802, Sheet 8)				
		Bolt	.3685 (9.360)	.3695 (9.385)		
		Case (Pre SB PW4ENG 72-510)	.3745 (9.513)	.3755 (9.537)	.005 (0.127)	.007 (0.177)
617 (2)	B	Bolt HPC Front Case Assembly (72-35-40) (See Figure 802, Sheet 8)				
		Bolt	.3685 (9.360)	.3695 (9.385)		
		Case (Post SB PW4ENG 72-510)	.3750 (9.525)	.3765 (9.563)	.0055 (0.140)	.008 (0.203)
619	C	Pin (72-35-40) Compressor Stator Cylinder Support Bracket (See Figure 802, Sheet 7)				
		Pin	.3740 (9.4996)	.3741 (9.5021)		
		Bracket	.376 (9.551)	.377 (9.575)	.0019 (0.049)	.0030 (0.076)
620	B	Gearbox Drive Shaft Housing Support Link Bearing (72-35-94) Gearbox Drive Shaft Housing Support Link (72-35-72) (See Figure 803, Sheet 2)				
		Bearing	.6865 (17.438)	.6875 (17.462)		
		Link	.6885 (17.488)	.6895 (17.513)	.001 (0.026)	.003 (0.076)

HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-04

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
621	B	Gearbox Drive Shaft Housing Support Clevis - Shoulder Bolt Gearbox Drive Shaft Housing Support Link Bearing (72-35-94) (See Figure 803, Sheet 2)				
		Clevis	.3732 (9.4793)	.3737 (9.4919)		
		Bearing	.3742 (9.5047)	.3747 (9.5173)	.0005 (0.013)	.0015 (0.038)
622	B	Pin Oil Cooler Front Bracket Bearing (See Figure 803, Sheet 2)				
		Pin	.6245 (15.8623)	.6250 (15.8750)		
		Bearing	.6255 (15.888)	.6265 (15.913)	.0005 (0.013)	.002 (0.050)
623	C	Spacer (72-35-73) Compressor Stator Cylinder Support Assembly (PN 53H036-01) (72-35-73) (See Figure 802, Sheet 10)				
		Spacer	.497 (12.624)	.498 (12.649)		
		Support	.499 (12.675)	.501 (12.725)	.001 (0.026)	.004 (0.101)
782 (1)	B	HPC Front Hub (72-35-05) (PN 50H570 Prior To Change Letter J/ PN 51H572 Prior To Change Letter E) No. 2 Bearing Front Seal Seat (72-35-90) (See Figure 804, Sheet 2)				
		Hub	6.550 (166.370)	6.551 (166.395)		
		Seat	6.552 (166.421)	6.554 (166.471)	.001 (0.026)	.004 (0.101)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
782	B	HPC Front Hub (72-35-05)				
(2)		(PN 50H470 Change Letter J And Subsequent/				
		PN 51H572 Change Letter E And Subsequent)				
		No. 2 Bearing Front Seal Seat				
		(72-35-90)				
		(See Figure 804, Sheet 2)				
		Hub	6.549	6.551		
			(166.345)	(166.395)		
		Seat	6.552	6.554	.001	.005
			(166.421)	(166.471)	(0.026)	(0.127)
784	A	HPC Front Hub (72-35-05)				
		Gearbox Drive Bevel Gear (72-34-12)				
		(See Figure 804, Sheet 2)				
		Hub	7.305	7.306		
			(185.547)	(185.572)		
		Gear	7.301	7.302	.003T	.005T
			(185.446)	(185.470)	(0.077T)	(0.127T)
785	B	Intermediate Case Assembly (72-34-01)				
		HPC Front Case Assembly (72-35-40)				
		(See Figure 804, Sheet 1)				
		Intd. Case	34.574	34.578		
			(878.180)	(878.281)		
		HPC Case	34.568	34.572	.002T	.010T
			(878.028)	(878.128)	(0.051T)	(0.254T)
787	B	Shoulder Bolt (72-61-83)				
		Gearbox Drive Shaft Housing Support				
		Link Bearing (72-35-94)				
		(See Figure 804, Sheet 2)				
		Bolt	.6232	.6237		
			(15.8293)	(15.8419)		
		Bearing	.6242	.6247	.0005	.0015
			(15.8547)	(15.8673)	(0.013)	(0.038)
789	B	Diffuser Case Assembly (72-41-01)				
		HPC (Outer) Rear Case Assembly				
		(72-35-69)				
		(See Figure 805, Sheet 2)				
		Diffuser Case	32.248	32.252		
			(819.100)	(819.200)		
		HPC Case	32.242	32.246	.000*	.010T
			(818.947)	(819.048)	(0.000)*	(0.254T)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
790	B	Compressor Exit Stator Assembly (72-41-02) HPC Exit Guide Vane Support (72-35-70) (See Figure 805, Sheet 2)				
		Stator	27.378 (695.402)	27.382 (695.502)		
		Stiffener	27.383 (695.529)	27.387 (695.629)	.001 (0.025)	.009 (0.229)
791	B	HPC Exit Guide Vane Support (72-35-70) Compressor Exit Stator Assembly (72-41-02) (See Figure 805, Sheet 2)				
		Stiffener	27.780 (705.612)	27.784 (705.713)		
		Stator	27.788 (705.816)	27.792 (705.916)	.004 (0.102)	.012 (0.305)
792	A	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) Compressor Exit Stator Assembly (72-41-02) (See Figure 805, Sheet 2)				
		HPC Rotor	23.409 (594.59)	23.421 (594.89)		
		Stator	23.441 (595.401)	23.447 (595.554)	.020 (0.51)	.048* (1.22)*
793	A	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) Stage 15 HPC Air Sealing Ring Assembly (72-41-03) (Pre SB PW4ENG 72-572) (See Figure 805, Sheet 2)				
		Radial Gap, Cold			.011 (0.279)	.024* (0.610)*
794	A	Diffuser Airseal (72-35-32) Diffuser Air Sealing Ring Assembly (72-41-05) (See Figure 80 5, Sheet 2)				
		Radial Gap, Cold			.011 (0.279)	.024* (0.610)*

Ref. No.	IFR	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
795	A	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Bearing Front Cooling Duct Assembly (72-41-06)				
		HPC Rotor	7.986 (202.84)	7.998 (203.15)		
		Duct	8.098 (205.690)	8.102 (205.790)	.100 (2.54)	.126* (3.20)*
797	B	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Bearing Front Seal Seat (72-41-80) (See Figure 805, Sheet 3)				
		HPC Rotor	7.229 (183.617)	7.231 (183.667)		
		Seal Seat	7.232 (183.693)	7.234 (183.743)	.001 (0.026)	.005 (0.127)
798	B	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Bearing Seal Spacer (72-41-81) (See Figure 805, Sheet 3)				
		HPC Rotor	7.209 (183.109)	7.211 (183.159)		
		Spacer	7.212 (183.185)	7.214 (183.235)	.001 (0.026)	.005 (0.127)
799 (1)	A	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Roller Bearing (72-41-82) (See Figure 805, Sheet 3)				
		HPC Rotor	7.2076 (183.0731)	7.2080 (183.0832)		
		Bearing (Pre SB PW4ENG 72-611)	7.2040 (182.9816)	7.2047 (182.9993)	.004T (0.101T)	.0029T (0.074T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
799 (2)	A	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Roller Bearing (72-41-82) (See Figure 805, Sheet 3)				
		HPC Rotor	7.2076 (183.0731)	7.2080 (183.0832)		
		Bearing (Post SB PW4ENG 72-611)	7.2060 (182.9816)	7.2067 (182.9993)	.002T (0.051T)	.0009T (0.023T)
800	B	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Bearing Rear Seal Seat (72-41-84) (See Figure 805, Sheet 3)				
		HPC Rotor	7.1455 (181.496)	7.1465 (181.521)		
		Seal Seat	7.1475 (181.547)	7.1505 (181.622)	.001 (0.026)	.005 (0.127)
810	B	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) Turbine Front Hub (Stage 1) (72-52-05) (See Figure 805, Sheet 3)				
		HPC Hub	7.1455 (181.496)	7.1465 (181.521)		
		HPT Hub	7.1335 (181.191)	7.1355 (181.241)	.010T (0.254T)	.013T (0.330T)
814	B	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) Turbine Intermediate Hub (Stage 2) (72-52-06) (See Figure 805, Sheet 3)				
		HPC Hub	6.5947 (167.506)	6.5957 (167.530)		
		HPT Hub	6.5827 (167.201)	6.5847 (167.251)	.007T* (0.178T)*	.013T (0.330T)

Ref. No.	IFR	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
816	B	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Bearing (And HPT) Retaining Nut (72-52-80) (See Figure 805, Sheet 3)				
		Hub	6.5947 (167.506)	6.5957 (167.530)		
		Nut	6.5967 (167.557)	6.5987 (167.606)	.001 (0.025)	.0052* (0.132)*
830	B	Spherical Bearing (72-35-94) Gearbox Drive Shaft Housing Support Link (72-35-72) (See Figure 804, Sheet 2)				
		Bearing	.9675 (24.575)	.9685 (24.599)		
		Link	.9695 (24.626)	.9705 (24.650)	.001 (0.025)	.003 (0.076)
844	B	HPC Drum Rotor Disk (Rear Hub) Assembly (72-35-08) Turbine Shaft Spacer (72-52-83) (See Figure 805, Sheet 3)				
		Disk (Hub	6.5947 (167.506)	6.5957 (167.530)		
		Spacer	6.5967 (167.557)	6.5987 (167.606)	.001 (0.026)	.0052* (0.132)*
1270	A	HPC Inlet Airseal (Front Knife-Edge) (72-35-31) HPC Inlet, Shroud Segment Assembly (72-35-41) (See Figure 801, Sheet 14)				
		Airseal	19.843 (504.01)	19.857 (504.37)		
		Vane	19.878 (504.90)	19.894 (505.31)	.021 (0.533)	.061* (1.549)*

Ref. No.	IFR	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1271	A	HPC Inlet Airseal (Rear Knife-Edge) (72-35-31) HPC Inlet, Shroud Segment Assembly (72-35-41) (See Figure 801, Sheet 14)				
		Airseal	19.943 (506.55)	19.957 (506.91)		
		Vane	19.978 (507.44)	19.994 (507.85)	.021 (0.533)	.061* (1.549)*
1272	A	Stage 5 HPC Disk (Front Knife-Edge) Airseal (72-35-06) Stage 5 HPC Shroud Segment Assembly (72-35-42) (See Figure 801, Sheet 14)				
		Airseal	20.273 (514.93)	20.287 (515.29)		
		Vane	20.298 (515.57)	20.314 (515.98)	.011 (0.279)	.051* (1.295)*
1273	A	Stage 5 HPC Disk (Rear Knife-Edge) Airseal (72-35-06) Stage 5 HPC Shroud Segment Assembly (72-35-42) See Figure 801, Sheet 14)				
		Airseal	20.173 (512.39)	20.187 (512.75)		
		Vane	20.198 (513.03)	20.214 (513.44)	.011 (0.279)	.051* (1.295)*
1274	A	Drum Rotor (Stage 6 Front Knife-Edge) Airseal (72-35-07) Stage 6 HPC Shroud Segment Assembly (72-35-43) (See Figure 801, Sheet 14)				
		Airseal	20.584 (522.83)	20.598 (523.189)		
		Vane	20.608 (523.44)	20.624 (523.85)	.010 (0.254)	.050* (1.270)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1275	A	Drum Rotor (Stage 6 Rear Knife−Edge) Airseal (72−35−07) Stage 6 HPC Shroud Segment Assembly (72−35−43) (See Figure 801, Sheet 14)				
		Airseal	20.704 (525.88)	20.718 (526.237)		
		Vane	20.728 (526.49)	20.744 (526.90)	.010 (0.254)	.050* (1.270)*
1276	A	Drum Rotor (Stage 7 Front Knife−Edge) Airseal (72−35−07) Stage 7 HPC Shroud Segment Assembly (72−35−44) (See Figure 801, Sheet 14)				
		Airseal	21.132 (536.75)	21.146 (537.108)		
		Vane	21.188 (538.18)	21.204 (538.582)	.042 (1.067)	.082* (2.083)*
1277	A	Drum Rotor (Stage 7 Rear Knife−Edge) Airseal (72−35−07) Stage 7 HPC Shroud Segment Assembly (72−35−44) (See Figure 801, Sheet 14)				
		Airseal	21.252 (539.80)	21.266 (540.156)		
		Vane	21.308 (541.22)	21.324 (541.63)	.042 (1.067)	.082* (2.08)*
1278	A	Drum Rotor (Stage 8 Front Knife−Edge) Airseal (72−35−07) Stage 8 Compressor Stator Segment Assembly (72−35−59) (See Figure 801, Sheet 14)				
		Airseal	22.124 (561.95)	22.138 (562.305)		
		Vane	22.156 (562.762)	22.164 (562.966)	.018 (0.457)	.050* (1.27)*

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Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1279	A	Drum Rotor (Stage 8 Rear Knife-Edge) Airseal (72-35-07) Stage 8 Compressor Stator Segment Assembly (72-35-59) (See Figure 801, Sheet 14)				
		Airseal	22.224 (564.49)	22.238 (564.845)		
		Vane	22.256 (565.302)	22.264 (565.506)	.018 (0.457)	.050* (1.27)*
		See General NOTE 1 before Reference Number 580.				
1280	A	Drum Rotor (Stage 9 Front Knife-Edge) Airseal (72-35-07) Stage 9 Compressor Stator Segment Assembly (72-35-60) (See Figure 801, Sheet 14)				
		Airseal	22.938 (582.63)	22.952 (582.981)		
		Vane	22.970 (583.438)	22.978 (583.641)	.018 (0.457)	.050* (1.27)*
		See General NOTE 1 before Reference Number 580.				
1281	A	Drum Rotor (Stage 9 Rear Knife-Edge) Airseal (72-35-07) Stage 9 Compressor Stator Segment Assembly (72-35-60) (See Figure 801, Sheet 14)				
		Airseal	22.938 (582.63)	22.952 (582.981)		
		Vane	22.970 (583.438)	22.978 (583.641)	.018 (0.457)	.050* (1.27)*
		See General NOTE 1 before Reference Number 580.				
1282 (1)	A	Drum Rotor (Stage 10 Front Knife-Edge) Airseal (72-35-07) (Pre SB PW4ENG 72-758) Stage 10 Compressor Stator Segment Assembly (72-35-60) (See Figure 801, Sheet 14)				
		Airseal	23.183 (588.85)	23.197 (589.204)		
		Vane	23.214	23.222	.017	.049*

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
(CONTINUED)						
			(589.636)	(589.839)	(0.432)	(1.24)*
		See General NOTE 1 before Reference Number 580.				
1282 (2)	A	Drum Rotor (Stage 10 Front Knife-Edge) Airseal (72-35-07) Stage 10 Compressor Stator Segment (Post SB PW4ENG 72-758) Assembly (72-35-60) (See Figure 801, Sheet 14)				
		Airseal	23.157 (588.19)	23.171 (588.54)		
		Vane	23.214 (589.636)	23.222 (589.839)	0.043 (1.092)	0.075* (1.905)*
		See General NOTE 1 before Reference Number 580.				
1283 (1)	A	Drum Rotor (Stage 10 Rear Knife-Edge) Airseal (72-35-07) (Pre SB PW4ENG 72-758) Stage 9/10 Compressor Stator Segment Assembly (72-35-60) (See Figure 801, Sheet 14)				
		Airseal	23.283 (591.39)	23.297 (591.744)		
		Vane	23.314 (592.176)	23.322 (592.379)	.017 (0.432)	.049* (1.24)*
		See General NOTE 1 before Reference Number 580.				
1283 (2)	A	Drum Rotor (Stage 10 Rear Knife-Edge) Airseal (72-35-07) (Post SB PW4ENG 72-758) Stage 9/10 Compressor Stator Segment Assembly (72-35-60) (See Figure 801, Sheet 14)				
		Airseal	23.257 (590.73)	23.271 (591.08)		
		Vane	23.314 (592.176)	23.322 (592.379)	.043 (1.092)	.075* (1.905)*
		See General NOTE 1 before Reference Number 580.				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1284 (1)	A	Drum Rotor (Stage 11 Front Knife-Edge) Airseal (72-35-07) Stage 11/12 Compressor Stator Segment Assembly (72-35-61) (Pre SB PW4ENG 72-223) (See Figure 801, Sheet 14)				
		Airseal	23.186 (588.92)	23.200 (589.280)		
		Vane	23.218 (589.737)	23.226 (589.940)	.007* (0.18)*	.063* (1.60)*
		See General NOTE 1 before Reference Number 580.				
1284 (2)	A	Drum Rotor (Stage 11 Front Knife-Edge) Airseal (72-35-07) (Pre SB PW4ENG 72-758) Stage 11/12 Compressor Stator Segment Assembly (72-35-61) (Post SB PW4ENG 72-223) (See Figure 801, Sheet 14)				
		Airseal	23.186 (588.92)	23.200 (589.280)		
		Vane	23.205 (589.41)	23.239 (590.27)	.005 (0.127)	.063* (1.60)*
		See General NOTE 1 before Reference Number 580.				
1284 (3)	A	Drum Rotor (Stage 11 Front Knife-Edge) Airseal (72-35-07) (Post SB PW4ENG 72-758) Stage 11/12 Compressor Stator Segment Assembly (72-35-61) (Post SB PW4ENG 72-223) (See Figure 801, Sheet 14)				
		Airseal	23.166 (588.42)	23.180 (588.77)		
		Vane	23.205 (589.41)	23.239 (590.27)	0.025 (0.635)	0.083* (2.108)*
		See General NOTE 1 before Reference Number 580.				

	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
1285 (1)	A	Drum Rotor (Stage 11 Rear Knife-Edge) Airseal (72-35-07) Stage 11/12 Compressor Stator Segment Assembly (72-35-61) (Pre SB PW4ENG 72-223) (See Figure 801, Sheet 14)				
		Airseal	23.286 (591.46)	23.300 (591.820)		
		Vane	23.318 (592.277)	23.326 (592.480)	.007* (0.18)*	.063* (1.60)*
		See General NOTE 1 before Reference Number 580.				
1285 (2)	A	Drum Rotor (Stage 11 Rear Knife-Edge) Airseal (72-35-07) (Pre SB PW4ENG 72-758) Stage 11/12 Compressor Stator Segment Assembly (72-35-61) (Post SB PW4ENG 72-223) (See Figure 801, Sheet 14)				
		Airseal	23.286 (591.46)	23.300 (591.820)		
		Vane	23.305 (591.95)	23.339 (592.81)	.005 (0.127)	.063* (1.60)*
		See General NOTE 1 before Reference Number 580.				
1285 (3)	A	Drum Rotor (Stage 11 Rear Knife-Edge) Airseal (72-35-07) (Post SB PW4ENG 72-758) Stage 11/12 Compressor Stator Segment Assembly (72-35-61) (Post SB PWENG 72-223) (See Figure 801, Sheet 14)				
		Airseal	23.266 (590.96)	23.280 (591.31)		
		Vane	23.305 (591.95)	23.339 (592.81)	.025 (0.635)	.083* (2.108)*
		See General NOTE 1 before Reference Number 580.				

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1286 (1)	A	Drum Rotor (Stage 12 Front Knife-Edge) Airseal (72-35-08) Stage 11/12 Compressor Stator Segment Assembly (72-35-61) (prior SB 72-223) (See Figure 801, Sheet 14)				
		Airseal	23.167 (588.44)	23.181 (588.797)		
		Vane	23.200 (589.280)	23.208 (589.483)	.008* (0.20)*	.064* (1.63)*
		See General NOTE 1 before Reference Number 580.				
1286 (2)	A	Drum Rotor (Stage 12 Front Knife-Edge) Airseal (72-35-08) Stage 11/12 Compressor Stator Segment Assembly (72-35-61) (with SB 72-223) (See Figure 801, Sheet 14)				
		Airseal	23.167 (588.44)	23.181 (588.797)		
		Vane	23.187 (588.95)	23.221 (589.81)	.006 (0.152)	.064* (1.63)*
		See General NOTE 1 before Reference Number 580.				
1287 (1)	A	Drum Rotor (Stage 12 Rear Knife-Edge) Airseal (72-35-08) Stage 11/12 Compressor Stator Segment Assembly (72-35-61) (prior SB 72-223) (See Figure 801, Sheet 14)				
		Airseal	23.267 (590.98)	23.281 (591.337)		
		Vane	23.300 (591.820)	23.308 (592.023)	.008* (0.20)*	.064* (1.63)*
		See General NOTE 1 before Reference Number 580.				

Ref. No.	IFR	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1287 (2)	A	Drum Rotor (Stage 12 Rear Knife−Edge) Airseal (72−35−08) Stage 11/12 Compressor Stator Segment Assembly (72−35−61) (with SB 72−223) (See Figure 801, Sheet 14)				
		Airseal	23.267 (590.98)	23.281 (591.337)		
		Vane	23.287 (591.49)	23.321 (592.35)	.006 (0.152)	.064* (1.63)*
		See General NOTE 1 before Reference Number 580.				
1288 (1)	A	Drum Rotor (Stage 13 Front Knife−Edge) Airseal (72−35−08) Stage 13/14 Compressor Stator Segment Assembly (72−35−62) (prior SB 72−223) (See Figure 801, Sheet 14)				
		Airseal	23.149 (587.98)	23.163 (588.340)		
		Vane	23.180 (588.772)	23.188 (588.975)	.006* (0.15)*	.062* (1.57)*
		See General NOTE 1 before Reference Number 580.				
1288 (2)	A	Drum Rotor (Stage 13 Front Knife−Edge) Airseal (72−35−08) Stage 13/14 Compressor Stator Segment Assembly (72−35−62) (With SB 72−223) (See Figure 801, Sheet 14)				
		Airseal	23.149 (587.98)	23.163 (588.340)		
		Vane	23.167 (588.44)	23.201 (589.31)	.004 (0.102)	.062* (1.57)*
		See General NOTE 1 before Reference Number 580.				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1289 (1)	A	Drum Rotor (Stage 13 Rear Knife−Edge) Airseal (72−35−08) Stage 13/14 Compressor Stator Segment Assembly (72−35−62) (prior SB 72−223) (See Figure 801, Sheet 14)				
		Airseal	23.249 (590.52)	23.263 (590.880)		
		Vane	23.280 (591.312)	23.288 (591.515)	.006* (0.15)*	.062* (1.57)*
		See General NOTE 1 before Reference Number 580.				
1289 (2)	A	Drum Rotor (Stage 13 Rear Knife−Edge) Airseal (72−35−08) Stage 13/14 Compressor Stator Segment Assembly (72−35−62) (with SB 72−223) (See Figure 801, Sheet 14)				
		Airseal	23.249 (590.52)	23.263 (590.880)		
		Vane	23.267 (590.98)	23.301 (591.85)	.004 (0.102)	.062* (1.57)*
		See General NOTE 1 before Reference Number 580.				
1290 (1)	A	Drum Rotor (Stage 14 Front Knife−Edge) Airseal (72−35−08) Stage 13/14 Compressor Stator Segment Assembly (72−35−62) (prior SB 72−223) (See Figure 801, Sheet 14)				
		Airseal	23.138 (587.71)	23.152 (588.061)		
		Vane	23.170 (588.518)	23.178 (588.721)	.017* (0.43)*	.073* (1.85)*
		See General NOTE 1 before Reference Number 580.				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1290 (2)	A	Drum Rotor (Stage 14 Front Knife−Edge) Airseal (72−35−08) Stage 13/14 Compressor Stator Segment Assembly (72−35−62) (with SB 72−223) (See Figure 801, Sheet 14)				
		Airseal	23.138 (587.71)	23.152 (588.061)		
		Vane	23.167 (588.44)	23.201 (589.31)	.015 (0.381)	.073* (1.85)*
		See General NOTE 1 before Reference Number 580.				
1291 (1)	A	Drum Rotor (Stage 14 Rear Knife−Edge) Airseal (72−35−08) Stage 14 Compressor Stator Segment Assembly (72−35−62) (prior SB 72−223) (See Figure 801, Sheet 14)				
		Airseal	23.238 (590.25)	23.252 (590.601)		
		Vane	23.270 (591.058)	23.278 (591.261)	.017* (0.43)*	.073* (1.85)*
		See General NOTE 1 before Reference Number 580.				
1291 (2)	A	Drum Rotor (Stage 14 Rear Knife−Edge) Airseal (72−35−08) Stage 14 Compressor Stator Segment Assembly (72−35−62) (with SB 72−223) (See Figure 801, Sheet 14)				
		Airseal	23.238 (590.25)	23.252 (590.601)		
		Vane	23.267 (590.98)	23.301 (591.85)	.015 (0.381)	.073* (1.85)*
		See General NOTE 1 before Reference Number 580.				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	 Max	Limits Min	 Max
1292	A	Stage 5 HPC Disk (IGV Rear Knife Edge Airseal) (72−35−06) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (Asymmetric Case Configuration Post SB PW4ENG 72−743) (72−35− 57) See Figure 801, Sheet 14)				
		Airseal	19.943 (506.55)	19.957 (506.91)		
		Guide	19.976 (507.390)	19.984 (507.594)	.019 (0.483)	.051* (1.295)*
1293	A	Stage 5 HPC Disk (Stage 5 Front Knife Edge Airseal) (72−35−06) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (Asymmetric Case Configuration Post SB PW4ENG 72−743) (72−35−57) See Figure 801, Sheet 14)				
		Airseal	20.273 (514.93)	20.287 (515.29)		
		Guide	20.306 (515.772)	20.314 (515.976)	.019 (0.483)	.051* (1.295)*
1294	A	Stage 5 HPC Disk (Stage 5 Rear Knife Edge Airseal) (72−35−06) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) Asymmetric Case Configuration Post SB PW4ENG 72−743) (72−35−57) See Figure 801, Sheet 14)				
		Airseal	20.173 (512.39)	20.187 (512.75)		
		Guide	20.206 (513.232)	20.214 (513.436)	.019 (0.483)	.051* (1.295)*
1295	A	HPC Drum Rotor (Front) (Stage 6 Front Knife Edge Airseal) (72−35−07) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) Asymmetric Case Configuration Post SB PW4ENG 72−743) (72−35−57) See Figure 801, Sheet 14)				
		Airseal	20.584 (522.83)	20.598 (523.19)		

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			New Part Reference Dimensions		Limits	
Ref. No.	I F R	Description	Min	Max	Min	Max
(CONTINUED)						
		Guide	20.617 (523.672)	20.625 (523.875)	.019 (0.483)	.051* (1.295)*
1296	A	HPC Drum Rotor (Front) (Stage 6 Rear Knife Edge Airseal) (72-35-07) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) Asymmetric Case Configuration Post SB PW4ENG 72-743) (72-35-57) See Figure 801, Sheet 14)				
		Airseal	20.704 (525.88)	20.718 (526.24)		
		Guide	20.737 (526.720)	20.745 (526.923)	.019 (0.483)	.051* (1.295)*
1297	A	HPC Drum Rotor (Front) (Stage 7 Front Knife Edge Airseal) (72-35-07) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) Asymmetric Case Configuration Post SB PW4ENG 72-743) (72-35-57) See Figure 801, Sheet 14)				
		Airseal	21.132 (536.75)	21.146 (537.11)		
		Guide	21.165 (537.591)	21.173 (537.794)	.019 (0.483)	.051* (1.295)*
1298	A	HPC Drum Rotor (Front) (Stage 7 Rear Knife Edge Airseal) (72-35-07) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) Asymmetric Case Configuration Post SB PW4ENG 72-743) (72-35-57) See Figure 801, Sheet 14)				
		Airseal	21.252 (539.80)	21.266 (540.16)		
		Guide	21.285 (540.639)	21.293 (540.842)	.019 (0.483)	.051* (1.295)*

Ref. No.	I F R	Description	Average Clearance At Assembly Min	Average Clearance At Assembly Max	Local Limits At Assembly Min	Local Limits At Assembly Max
1320	A	Stage 5 HPC Blade Tip Clearance (See Figure 801, Sheet 14)				
		Clearance (With SB PW4ENG 72-485)	.055 (1.40)	.074 (1.88)	.050 (1.27)	.079 (2.01)
1321 (1)	A	Stage 6 HPC Blade Tip Clearance (See Figure 801, Sheet 14)				
		Clearance (Prior to SB PW4ENG 72-485)	.049 (1.24)	.065 (1.65)	---	---
			.049 (1.245)	.075* (1.905)*	---	---
1321 (2)	A	Stage 6 HPC Blade Tip Clearance (See Figure 801, Sheet 14)				
		Clearance (With SB PW4ENG 72-485)	.050 (1.27)	.064 (1.63)	.045 (1.14)	.069 (1.75)
1322 (1)	A	Stage 7 HPC Blade Tip Clearance (See Figure 801, Sheet 14)				
		Clearance (Prior to SB PW4ENG 72-485)	.052 (1.32)	.068 (1.73)	---	---
			.052 (1.321)	.078* (1.981)*	---	---
1322 (2)	A	Stage 7 HPC Blade Tip Clearance (See Figure 801, Sheet 14)				
		Clearance (With SB PW4ENG 72-485)	.053 (1.35)	.067 (1.70)	.048 (1.22)	.072 (1.83)
1323	A	Stage 8 HPC Blade Tip Clearance (See Figure 801, Sheet 14)				
		Clearance (With SB PW4ENG 72-486)	.045 (1.14)	.064 (1.63)	.040 (1.02)	.069 (1.75)

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Ref. No.	IFR	Description	Average Clearance At Assembly Min	Average Clearance At Assembly Max	Local Limits At Assembly Min	Local Limits At Assembly Max
1324	A	Stage 9 HPC Blade Tip Clearance (See Figure 801, Sheet 14)				
		Clearance (With SB PW4ENG 72−486)	.025 (0.64)	.042 (1.07)	.020 (0.51)	.047 (1.19)
1325	A	Stage 10 HPC Blade Tip Clearance (See Figure 801, Sheet 14)				
		Clearance (With SB PW4ENG 72−486)	.026 (0.66)	.040 (1.02)	.019 (0.48)	.045 (1.14)
1326	A	Stage 11 HPC Blade Tip Clearance (See Figure 801, Sheet 14)				
		Clearance (With SB PW4ENG 72−486)	.022 (0.56)	.036 (0.91)	.015 (0.38)	.041 (1.04)
1327	A	Stage 12 HPC Blade Tip Clearance (See Figure 801, Sheet 14)				
		Clearance (With SB PW4ENG 72−486)	.022 (0.56)	.039 (0.99)	.017 (0.43)	.044 (1.12)
1328	A	Stage 13 HPC Blade Tip Clearance (See Figure 801, Sheet 14)				
		Clearance (With SB PW4ENG 72−486)	.026 (0.66)	.042 (1.07)	.023 (0.58)	.045 (1.14)
1329	A	Stage 14 HPC Blade Tip Clearance (See Figure 801, Sheet 14)				
		Clearance (With SB PW4ENG 72−486)	.030 (0.76)	.046 (1.17)	.027 (0.69)	.048 (1.22)

Ref. No.	IFR	Description	Average Clearance At Assembly Min	Average Clearance At Assembly Max	Local Limits At Assembly Min	Local Limits At Assembly Max
1330	A	Stage 15 HPC Blade Tip Clearance (See Figure 801, Sheet 14)				
		Clearance (With SB PW4ENG 72-486)	.027 (0.69)	.043 (1.10)	.024 (0.61)	.048 (1.22)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1350 (1)	B	HPC Shroud Front Segment Assembly (72-35-41) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) (See Figure 801, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.250 (6.350)	.252 (6.400)	.0015 (0.039)	.005 (0.127)
1350 (2)	B	HPC Shroud Front Segment Assembly (72-35-41) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) (See Figure 801, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.251 (6.376)	.253 (6.426)	.0025 (0.064)	.006 (0.152)
1351 (1)	B	Stage 5 HPC Shroud (Front) Segment Assembly (72-35-42) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) (See Figure 801, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.250 (6.350)	.252 (6.400)	.0015 (0.039)	.005 (0.127)

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Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1351 (2)	B	Stage 5 HPC Shroud (Front) Segment Assembly (72-35-42) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) (See Figure 801, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.251 (6.376)	.253 (6.426)	.0025 (0.064)	.006 (0.152)
1352 (1)	B	Stage 6 HPC Shroud (Front) Segment Assembly (72-35-43) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) (See Figure 801, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.250 (6.350)	.252 (6.400)	.0015 (0.039)	.005 (0.127)
1352 (2)	B	Stage 6 HPC Shroud (Front) Segment Assembly (72-35-43) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) (See Figure 801, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.251 (6.376)	.253 (6.426)	.0025 (0.064)	.006 (0.152)
1353 (1)	B	Stage 7 HPC Shroud (Front) Segment Assembly (72-35-44) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) (See Figure 801, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.250 (6.350)	.252 (6.400)	.0015 (0.039)	.005 (0.127)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1353 (2)	B	Stage 7 HPC Shroud (Front) Segment Assembly (72−35−44) Vane Inner Trunnion Sleeve Bearing (72−35−45) (Post SB PW4ENG 72−776) (See Figure 801, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.251 (6.376)	.253 (6.426)	.0025 (0.064)	.006 (0.152)
1354 (1)	B	Vane Inner Trunnion Sleeve Bearing (72−35−45) HPC Inlet Shroud (Rear) Segment Assembly (72−35−41) (PN 51H470−01, prior to Change Letter D) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.495 (12.573)	.005 (0.127)	.013 (0.330)
1354 (2)	B	Vane Inner Trunnion Sleeve Bearing (72−35−45) (Pre SB PW4ENG 72−776) HPC Inlet Shroud (Rear) Segment Assembly (72−35−41) (PN 51H470−01, Change Letter D and subsequent) (See Figure 801, Sheet 3)				
		Bearing	.480 (12.192)	.484 (12.293)		
		Segment	.490 (12.446)	.496 (12.598)	.006 (0.15)	.016 (0.41)
1354 (3)	B	Vane Inner Trunnion Sleeve Bearing (72−35−45) (Post SB PW4ENG 72−776) HPC Inlet Shroud (Rear) Segment Assembly (72−35−41) (PN 51H470−01, Change Letter D And Subsequent) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.490 (12.446)	.496 (12.598)	.004 (0.102)	.014 (0.356)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1355 (1)	B	Vane Inner Trunnion Sleeve Bearing (72−35−45) Stage 5 HPC Shroud (Rear) Segment Assembly (72−35−42) (PN 51H385−01, prior to Change Letter F) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (5)		
		Segment	.491 (12.472)	.495 (12.573)	.005 (0.127)	.013 (0.330)
1355 (2)	B	Vane Inner Trunnion Sleeve Bearing (72−35−45) (Pre SB PW4ENG 72−776) Stage 5 HPC Shroud (Rear) Segment Assembly (72−35−42) (PN 51H385−01, Change Letter F and subsequent) (See Figure 801, Sheet 3)				
		Bearing	.480 (12.192)	.484 (12.293)		
		Segment	.491 (12.472)	.496 (12.598)	.007 (0.178)	.016 (0.406)
1355 (3)	B	Vane Inner Trunnion Sleeve Bearing (72−35−45) (Post SB PW4ENG 72−776) Stage 5 HPC Shroud (Rear) Segment Assembly (72−35−42) (PN 51H385−01, Change Letter F And Subsequent) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.496 (12.598)	.005 (0.127)	.014 (0.356)
1356 (1)	B	Vane Inner Trunnion Sleeve Bearing (72−35−45) Stage 6 HPC Shroud (Rear) Segment Assembly (72−35−43) (PN 51H586−01, prior to Change Letter E) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.495 (12.573)	.005 (0.127)	.013 (0.330)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1356 (2)	B	Vane Inner Trunnion Sleeve Bearing (72−35−45) (Pre SB PW4ENG 72−776) Stage 6 HPC Shroud (Rear) Segment Assembly (72−35−43) (PN 51H586−01, Change Letter E and subsequent) (See Figure 801, Sheet 3)				
		Bearing	.480 (12.192)	.484 (12.293)		
		Segment	.491 (12.472)	.496 (12.598)	.007 (0.178)	.016 (0.406)
1356 (3)	B	Vane Inner Trunnion Sleeve Bearing (72−35−45) (Post SB PW4ENG 72−776) Stage 6 HPC Shroud (Rear) Segment Assembly (72−35−43) (PN 51H586−01, Change Letter E And Subsequent) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.496 (12.598)	.005 (0.127)	.014 (0.356)
1357 (1)	B	Vane Inner Trunnion Sleeve Bearing (72−35−45) Stage 7 HPC Shroud (Rear) Segment Assembly (72−35−44) (PN 51H387−01, prior to Change Letter E) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.495 (12.573)	.005 (0.127)	.013 (0.330)
1357 (2)	B	Vane Inner Trunnion Sleeve Bearing (72−35−45) (Pre SB PW4ENG 72−776) Stage 7 HPC Shroud (Rear) Segment Assembly (72−35−44) (PN 51H387−01, Change Letter E and subsequent) (See Figure 801, Sheet 3)				
		Bearing	.480 (12.192)	.484 (12.293)		
		Segment	.491 (12.472)	.496 (12.598)	.007 (0.178)	.016 (0.41)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1357 (3)	B	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) Stage 7 HPC Shroud (Rear) Segment Assembly (72-35-44) (PN 51H387-01, Change Letter E And Subsequent) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.496 (12.598)	.005 (0.127)	.014 (0.356)
1358	B	HPC Inlet Shroud (Rear) Segment Assembly (72-35-41) HPC Inlet Shroud (Front) Segment Assembly (72-35-41) (See Figure 801, Sheet 3)				
		Rear Segment	20.438 (519.126)	20.442 (519.226)		
		Front Segment	20.444 (519.278)	20.448 (519.379)	.002 (0.051)	.010 (0.254)
1359	B	Stage 5 HPC Shroud (Rear) Segment Assembly (72-35-42) Stage 5 HPC Shroud (Front) Segment Assembly (72-35-42) (See Figure 801, Sheet 3)				
		Rear Segment	20.798 (528.270)	20.802 (528.370)		
		Front Segment	20.804 (528.422)	20.808 (528.523)	.002 (0.051)	.010 (0.254)
1360	B	Stage 6 HPC Shroud (Rear) Segment Assembly (72-35-43) Stage 6 HPC Shroud (Front) Segment Assembly (72-35-43) (See Figure 801, Sheet 3)				
		Rear Segment	21.268 (540.208)	21.272 (540.308)		
		Front Segment	21.274 (540.360)	21.278 (540.461)	.002 (0.051)	.010 (0.254)

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Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1361 (1)	B	Stage 7 HPC Shroud (Rear) Segment Assembly (72-35-44) (PN 51H487 Shroud Set) Stage 7 HPC Shroud (Front) Segment Assembly (72-35-44) (PN 51H487 Shroud Set) (See Figure 801, Sheet 3)				
		Rear Segment	21.632 (549.453)	21.636 (549.554)		
		Front Segment	21.638 (549.606)	21.642 (549.706)	.002 (0.051)	.010 (0.254)
1361 (2)	B	Stage 7 HPC Shroud (Rear) Segment Assembly (72-35-44) (PN 51H387-01 Shroud Set) Stage 7 HPC Shroud (Front) Segment Assembly (72-35-44) (PN 51H387-01 Shroud Set) (See Figure 801, Sheet 3)				
		Rear Segment	21.694 (551.028)	21.698 (551.129)		
		Front Segment	21.700 (551.180)	21.704 (551.281)	.002 (0.051)	.010 (0.254)
1362	C	HPC Inlet Vane - Leading Edge To Shroud Segment Assembly (72-35-02) (See Figure 801, Sheet 3) End Clearance, (Shroud To Vane)			.006 (0.152)	---
		Vane Must Be Bottomed Against Inner Trunnion Bearing				
1363	C	Stage 5 HPC Vane - Leading Edge To Shroud Segment Assembly (72-35-02) (See Figure 801, Sheet 3) End Clearance, (Shroud To Vane)			.006 (0.152)	---
		Vane Must Be Bottomed Against Inner Trunnion Bearing				

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1364	C	Stage 6 HPC Vane - Leading Edge To Shroud Segment Assembly (72-35-02) (See Figure 801, Sheet 3) End Clearance, (Shroud To Vane)			.006 (0.152)	---
		Vane Must Be Bottomed Against Inner Trunnion Bearing				
1365	C	Stage 7 HPC Vane - Leading Edge To Shroud Segment Assembly (72-35-02) (See Figure 801, Sheet 3) End Clearance, (Shroud To Vane)			.006 (0.152)	---
		Vane Must Be Bottomed Against Inner Trunnion Bearing				
1370	B	HPC Inlet Vane (72-35-47) Outer Trunnion Sleeve Bearing (72-35-40) (See Figure 801, Sheet 3)				
		Vane	.4355 (11.062)	.4370 (11.099)		
		Bearing	.4380 (11.126)	.4400 (11.176)	.0010 (0.026)	.0045 (0.114)
1371	B	Stage 5 HPC Vane (72-35-48) Outer Trunnion Sleeve Bearing (72-35-40) (See Figure 801, Sheet 3)				
		Vane	.4355 (11.062)	.4370 (11.099)		
		Bearing	.4380 (11.126)	.4400 (11.176)	.0010 (0.026)	.0045 (0.114)
1372	B	Stage 6 HPC Vane (72-35-49) Outer Trunnion Sleeve Bearing (72-35-40) (See Figure 801, Sheet 3)				
		Vane	.4355 (11.062)	.4370 (11.099)		
		Bearing	.4380 (11.126)	.4400 (11.176)	.0010 (0.026)	.0045 (0.114)

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Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1373	B	Stage 7 HPC Vane (72−35−50) Outer Trunnion Sleeve Bearing (72−35−40) (See Figure 801, Sheet 3)				
		Vane	.4355 (11.062)	.4370 (11.099)		
		Bearing	.4380 (11.126)	.4400 (11.176)	.0010 (0.026)	.0045 (0.114)
1374	B	Compressor HPC Vane (IGV, 5, 6, 7) (72−35−47/48/49/50) Arm Assembly (72−35−51/52/53/54) (See Figure 801, Sheet 3)				
		Vane	.286 (7.265)	.290 (7.366)		
		Arm	.283 (7.189)	.285 (7.239)	.007T (0.177T)	.001T (0.026T)
1375	B	Drum Rotor (Stages 6 Through 12) Disk Assembly (72−35−07) Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72−35−08) (See Figure 801, Sheet 9)				
		Disk	21.657 (550.088)	21.661 (550.189)		
		Hub	21.662 (550.215)	21.666 (550.316)	.009T (0.229T)	.000T* (0.000T)*
1376	B	Stage 5 HPC Disk (72−35−06) Drum Rotor (Stages 6 Through 12) Disk Assembly (72−35−07) (See Figure 801, Sheet 2)				
		Disk (Stg. 5)	19.525 (495.935)	19.527 (495.985)		
		Disk (Stgs. 6 − 12)	19.518 (495.758)	19.522 (495.858)	.009T (0.229T)	.003T (0.076T)

	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
1377	B	Drum Rotor (Stages 6 Through 12) Disk Assembly (72−35−07) HPC Front Hub (72−35−05) (See Figure 801, Sheet 2)				
		Disk	16.097 (408.864)	16.101 (408.965)		
		Hub	16.094 (408.788)	16.096 (408.838)	.007T (0.178T)	.001T (0.025T)
1378	B	HPC Inlet Airseal (72−35−31) Stage 5 HPC Disk (72−35−06) (See Figure 801, Sheet 2)				
		Airseal	18.027 (457.886)	18.029 (457.936)		
		Disk	18.019 (457.683)	18.021 (457.733)	.010T (0.254T)	.006T (0.153T)
1379	B	HPC (Outer) Rear Case Assembly (72−35−69) HPC Front Case Assembly (72−35−40) (See Figure 801, Sheet 6)				
		Rear Case	31.974 (812.140)	31.978 (812.241)		
		Front Case	31.968 (811.988)	31.972 (812.088)	.010T (0.254T)	.002T (0.051T)
1380	B	Stage 8 Compressor Stator Segment Assembly (72−35−59) HPC (Outer) Rear Case Assembly (72−35−69) (See Figure 801, Sheet 6)				
		Stator	31.641 (803.681)	31.647 (803.834)		
		Case	31.646 (803.808)	31.654 (804.012)	.001T (0.025T)	.013L (0.330L)
1381	B	Stages 9 And 10 Compressor Stator Segment Assembly (72−35−60) HPC (Outer) Rear Case Assembly (72−35−69) (See Figure 801, Sheet 6)				
		Stator	30.792 (782.117)	30.796 (782.218)		
		Case	30.798 (782.270)	30.802 (782.370)	.002 (0.051)	.010 (0.254)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1382 (1)	B	Stage 8 Compressor Stator Segment Assembly (72-35-59) Stages 9 And 10 Compressor Stator Segment Assembly (72-35-60) (See Figure 801, Sheet 6)				
		Stator (8)	30.228 (767.792)	30.232 (767.892)		
		Stator (9 And 10) (Prior SB 72-452)	30.222 (767.639)	30.226 (767.740)	.010T (0.254T)	.002T (0.051T)
1382 (2)	B	Stage 8 Compressor Stator Segment Assembly (72-35-59) Stages 9 and 10 Compressor Stator Segment Assembly (72-35-60) (See Figure 801, Sheet 6)				
		Stator (8)	30.228) (767.792)	30.232 (767.892)		
		Stator (9 And 10) (With SB 72-452)	30.228 (767.792)	30.232 (767.892)	.004L (0.101L)	.004T (0.101T)
1383	B	Stages 9 And 10 Compressor Stator Segment Assembly (72-35-60) HPC (Outer) Rear Case Assembly (72-35-69) (See Figure 801, Sheet 6)				
		Stator	30.440 (773.176)	30.444 (773.277)		
		Case	30.449 (773.40)	30.461 (773.71)	.005 (0.13)	.021 (0.53)
1384	B	Stages 9 And 10 Compressor Stator Segment Assembly (72-35-60) HPC (Outer) Rear Case Assembly (72-35-69) (See Figure 801, Sheet 6)				
		Stator	30.348 (770.840)	30.352 (770.940)		
		Case	30.356 (771.043)	30.360 (771.144)	.004 (0.102)	.012 (0.305)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1385	B	Stages 9 And 10 Compressor Stator Segment Assembly (72-35-60) HPC (Outer) Rear Case Assembly (72-35-69) (See Figure 801, Sheet 6)				
		Stator	29.998 (761.950)	30.002 (762.050)		
		Case	30.007 (762.18)	30.019 (762.48)	.005 (0.13)	.021 (0.53)
1386	B	Stages 9 And 10 Compressor Stator Segment Assembly (72-35-60) HPC (Outer) Rear Case Assembly (72-35-69) (See Figure 801, Sheet 9)				
		Stator	29.948 (760.680)	29.952 (760.780)		
		Case	29.953 (760.807)	29.957 (760.907)	.001 (0.025)	.009 (0.229)
1387	B	HPC Inner Rear Case Assembly (72-35-68) HPC (Outer) Rear Case Assembly (72-35-69) (See Figure 801, Sheet 9)				
		Case (Inner)	29.959 (760.959)	29.963 (761.060)		
		Case (Outer)	29.953 (760.807)	29.957 (760.907)	.010T (0.254T)	.002T (0.051T)
1389	B	Diffuser Airseal (72-35-32) Drum Rotor (Stage 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) (See Figure 801, Sheet 11) (Pre SB PW4ENG 72-572)				
		Airseal	10.999 (279.375)	11.001 (279.425)		
		Hub	10.988 (279.096)	10.992 (279.196)	.013T (0.330T)	.005T* (0.127T)*

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1390	B	No. 3 Bearing (Inner Rear Hub) Heat Shield (72-35-36) Drum Rotor (Stage 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) (See Figure 801, Sheet 11)				
		Heat Shield	6.223 (158.065)	6.225 (158.115)		
		Hub	6.219 (157.963)	6.221 (158.013)	.009T* (0.229T)*	.000* (0.000)*
1391 (1)	B	No. 3 Bearing (Inner Rear Hub) Heat Shield (72-35-36) PN 50H100 - Prior To Letter Change "H" Drum Rotor (Stage 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) (See Figure 801, Sheet 11)				
		Heat Shield (Average Diameter)	6.176 (156.871)	6.180 (156.972)		
		Hub	6.159 (156.439)	6.161 (156.489)	.005* (0.127)*	.027* (0.659)*
1391 (2)	B	No. 3 Bearing (Inner Rear Hub) Heat Shield (72-35-36) PN 50H100 - Letter Change "H" And Subsequent Drum Rotor (Stage 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) (See Figure 801, Sheet 11)				
		Heat Shield (Diameter At Three Points)	6.176 (156.871)	6.180 (156.972)		
		Hub	6.159 (156.439)	6.161 (156.489)	.031T* (0.787T)*	.013T* (0.330T)*
1392	B	Compressor Tierod (72-35-34) Stage 5 HPC Disk (72-35-06) (See Figure 801, Sheet 2)				
		Tierod	.3755 (9.538)	.3765 (9.563)		
		Disk	.379 (9.627)	.381 (9.677)	.0025 (0.064)	.0075* (0.190)*

	Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
	1393	B	Compressor Tierod (72-35-34) HPC Front Hub (72-35-05) (See Figure 801, Sheet 2)				
			Tierod	.3755 (9.538)	.3765 (9.563)		
			Hub	.378 (9.602)	.380 (9.652)	.0015 (0.039)	.0065* (0.165)*
			(Two Holes In Any Ten May Be 0.390 Inch (9.906 mm) Diameter Maximum. See CIR Manual, PN 51A357, ATA 72-35-05, Inspection/ Check-04 For Other Oversized Allowances)				
	1394	B	Compressor Tierod (72-35-34) Drum Rotor (Stages 6 Through 12) Disk Assembly (72-35-07) (See Figure 801, Sheet 2)				
			Tierod	.3755 (9.538)	.3765 (9.563)		
R R			Disk	.379 (9.627)	.381 (9.677)	.0025 (0.064)	.0125* (0.318)*
	1395	B	Compressor Tierod (72-35-34) Drum Rotor (Stages 6 Through 12) Disk Assembly (72-35-07) (See Figure 801, Sheet 9)				
			Tierod	.3755 (9.538)	.3765 (9.563)		
R R			Disk	.379 (9.627)	.381 (9.677)	.0025 (0.064)	.0125* (0.318)*
	1396	B	Compressor Tierod (72-35-34) Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) (See Figure 801, Sheet 9)				
			Tierod	.3755 (9.538)	.3765 (9.563)		
			Hub	.379 (9.627)	.381 (9.677)	.0025 (0.064)	.0065* (0.165)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1397 (1)	B	Pin - Shoulder Headless (72-35-41/42/43) (PN 596020) HPC Inlet/Stage 5/Stage 6 - Shroud (Rear) Segment Assembly (PN 51H270/51H285/51H486 Shroud Sets) (72-35-41/42/43) (See Figure 801, Sheet 5)				
		Pin	0.18725 (4.7562)	0.18775 (4.7688)		
		Shroud (Rear)	0.18665 (4.7410)	0.18725 (4.7561)	.0011T (0.027T)	.0000 (0.000)
1397 (2)	B	Pin - Shoulder Headless (72-35-41/42/43/44) (PN 51H134) HPC Inlet/Stage 5/Stage 6/Stage 7 - Shroud (Rear) Segment Assembly (PN 51H470-01/51H385-01/51H586-01/51H387-01 Shroud Sets) (72-35-41/42/43/44) (See Figure 801, Sheet 5)				
		Pin	0.1870 (4.7498)	0.1871 (4.7523)		
		Shroud (Rear)	0.186 (4.725)	0.187 (4.749)	.0011T (0.028T)	.0000 (0.000)
1398 (1)	B	Pin - Shoulder, Headless (72-35-41/42/43) (PN 596020) HPC Inlet/Stage 5/Stage 6 - Shroud (Front) Segment Assembly (PN 51H270/51H285/51H486 Shroud Sets) (72-35-41/42/43) (See Figure 801, Sheet 5)				
		Pin	0.18725 (4.7562)	0.18775 (4.7688)		
		Shroud (Forward)	0.18665 (4.7410)	0.18725 (4.7561)	.0011T (0.028T)	.0000 (0.000)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1398 (2)	B	Pin - Shoulder, Headless (72-35-41/42/43/44) (PN 51H134) HPC Inlet/Stage 5/Stage 6/Stage 7 - Shroud (Front) Segment Assembly (PN 51H470-01/51H385-01/51H586-01/51H387-01 Shroud Sets) (72-35-41/42/43/44) (See Figure 801, Sheet 5)				
		Pin	0.1870 (4.7498)	0.1871 (4.7523)		
		Shroud (Forward)	0.1885 (4.788)	0.1895 (4.813)	.0014 (0.036)	.0025 (0.064)
1399	B	Pin - Shoulder (72-35-44) Stage 7 HPC Shroud (Front) Segment Assembly (72-35-44) (See Figure 801, Sheet 5)				
		Pin	.2492 (6.3297)	.2493 (6.3322)		
		Shroud (Forward)	.2510 (6.376)	.2520 (6.400)	.0017 (0.043)	.0028 (0.071)
1400	B	Pin - Shoulder (72-35-44) Stage 7 HPC Shroud (Rear) Segment Assembly (72-35-44) (See Figure 801, Sheet 5)				
		Pin	.2492 (6.3297)	.2493 (6.3322)		
		Shoulder (rear)	.2482 (6.305)	.2492 (6.329)	.0011T (0.028T)	.0000 (0.000)
1403 (1)	B	Stage 13 And 14 Compressor Stator Segment Assemblies (72-35-62)/HPC Inner Rear Case Assembly (72-35-68) Stage 11 And 12 Compressor Stator Segment Assemblies (72-35-61) (See Figure 801, Sheet 9)				
		Stator/Case	0.156 (3.962)	0.164 (4.166)		
		Stator (11 and 12) (Pre SB PW4ENG 72-486)	0.166 (4.217)	0.170 (4.318)	.002 (0.05)	.014 (0.36)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1403 (2)	B	Stage 13 And 14 Compressor Stator Segment Assemblies (72-35-62)/HPC Inner Rear Case Assembly (72-35-68) Stage 11 And 12 Compressor Stator Segment Assemblies (72-35-61) (See Figure 801, Sheet 9)				
		Stator/Case	0.1595 (4.051)	0.1685 (4.280)		
		Stator (11 and 12) (Post SB PW4ENG72-486)	0.169 (4.293)	0.1745 (4.432)	.0005 (0.013)	.015 (0.381)
1405 (1)	B	HPC Inner Rear Case Assembly (72-35-68) Stage 13 And 14 Compressor Stator Segment Assemblies (72-35-62) (See Figure 801, Sheet 11)				
		Case	.084 (2.134)	.088 (2.235)		
		Stator (Pre SB PW4ENG 72-486)	.078 (1.982)	.082 (2.082)	.002 (0.051)	.010 (0.254)
1405 (2)	B	HPC Inner Rear Case Assembly (72-35-68) Stage 13 And 14 Compressor Stator Segment Assemblies (72-35-62) (See Figure 801, Sheet 11)				
		Case	.084 (2.134)	.088 (2.235)		
		Stator (With SB PW4ENG 72-486)	.078 (1.982)	.082 (2.082)	.002 (0.051)	.011 (0.279)
1406	B	HPC Inner Rear Case Assembly (72-35-68) HPC Exit Guide Vane Support (72-35-70) (See Figure 801, Sheet 11)				
		Case	28.080 (713.232)	28.093 (713.562)		
		Support	28.083 (713.308)	28.089 (713.461)	.009 (0.229)	.010T (0.25T)

HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-04

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1407	B	HPC Rear Support (72-35-67) HPC (Outer) Rear Case Assembly (72-35-69) (See Figure 801, Sheet 11)				
		Support (PN 50H953, Pre SB 72-298)	31.950 (811.530)	31.954 (811.631)		
		(See No. 1416 for with SB 72-298)				
		Case	31.937 (811.200)	31.943 (811.352)	.007T (0.18T)	.017T (0.43T)
1408 (1)	B	HPC Inner Rear Case Assembly (72-35-68) Stage 11 And 12 Compressor Stator Segment Assemblies (72-35-61) (See Figure 801, Sheet 9)				
		Case	.084 (2.134)	.088 (2.235)		
		Stator (Pre SB PW4ENG 72-486)	.078 (1.982)	.082 (2.082)	.002 (0.051)	.010 (0.254)
1408 (2)	B	HPC Inner Rear Case Assembly (72-35-68) Stage 11 And 12 Compressor Stator Segment Assemblies (72-35-61) (See Figure 801, Sheet 9)				
		Case	.084 (2.134)	.088 (2.235)		
		Stator (Post SB PW4ENG 72-486)	.0755 (1.918)	.0825 (2.096)	.0015 (0.038)	.0125 (0.318)
1409 (1)	B	Stage 11 And 12 Compressor Stator Segment Assemblies (72-35-61)/HPC Inner Rear Case Assembly (72-35-68) (PN 51H144-01 Inner Rear Case) Stage 9 And 10 Compressor Stator Segment Assemblies (72-35-60) (See Figure 801, Sheet 9)				
		Stator/Case	.156 (3.962)	.164 (4.166)		
		Stator (9 and 10) (Pre SB PW4ENG 72-486)	.166 (4.217)	.170 (4.318)	.002 (0.05)	.014 (0.36)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1409 (2)	B	Stage 11 And 12 Compressor Stator Segment Assemblies (72-35-61)/HPC Inner Rear Case Assembly (72-35-68) (PN 51H248-01 Inner Rear Case) Stage 9 And 10 Compressor Stator Segment Assemblies (72-35-60) (See Figure 801, Sheet 9)				
		Stator/Case	.1585 (4.026)	.1645 (4.178)		
		Stator (9 and 10) (Pre SB PW4ENG 72-486)	.166 (4.217)	.170 (4.318)	.0015 (0.04)	.0115 (0.29)
1409 (3)	B	Stage 11 And 12 Compressor Stator Segment Assemblies (72-35-61)/HPC Inner Rear Case Assembly (72-35-68) (Inner Rear Case) Stage 9 And 10 Compressor Stator Segment Assemblies (72-35-60) (See Figure 801, Sheet 9)				
		Stator/Case (Post SB PW4ENG 72-486)	.1595 (4.051)	.1685 (4.280)		
		Stator (9 and 10) (Post SB PW4ENG 72-486)	.171 (4.217)	.175 (4.318)	.0025 (0.064)	.0155 (0.394)
1414	B	Diffuser Airseal (72-35-32) Drum Rotor (Stage 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) (See Figure 801, Sheet 11) (Post SB PW4ENG 72-572)				
		Airseal	10.999 (279.375)	11.001 (279.425)		
		Hub	10.988 (279.096)	10.992 (279.196)	.013T (0.330T)	.007T (0.178T)

	Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
	1416	B	HPC Rear Support (72-35-67) HPC (Outer) Rear Case Assembly (72-35-69) (See Figure 801, Sheet 11)				
			Support (PN 51H530, With SB PW4ENG 72-298) (See No. 1407 for Pre SB PW4ENG 72-298)	32.254 (819.252)	32.258 (819.353)		
			Case	32.242 (818.947)	32.246 (819.048)	.008T (0.203T)	.016T (0.406T)
R	1417	B	Bushing HPC Front Case Assy (72-35-40) See 72-35-40, Repair-05 (Task 72-35-40-300-005-B00) (See Figure 801, Sheet 15) NOTE: Select fit of			.0005 (0.013)	.0015T (0.038T)
R	1418	B	Bushing HPC Front Case Assy (72-35-40) See 72-35-40, Repair-05 (Task 72-35-40-300-005-B00) (See Figure 801, Sheet 15) NOTE: Select fit of			.0005 (0.013)	.0015T (0.038T)
R	1419	B	Bushing HPC Front Case Assy (72-35-40) See 72-35-40, Repair-05 (Task 72-35-40-300-005-B00) (See Figure 801, Sheet 15) NOTE: Select fit of			.0005 (0.013)	.0015T (0.038T)
R	2350	B	Bushing HPC Front Case Assy (72-35-40) See 72-35-40, Repair-05 (Task 72-35-40-300-005-B00) (See Figure 801, Sheet 15) NOTE: Select fit of			.0005 (0.013)	.0015T (0.038T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
2351	B	HPC Inner Rear Case (72-35-68) Stage 9 And 10 Compressor Stator Segment Assembly (72-35-60) (See Figure 801, Sheet 9)				
		Case	28.552 (725.221)	28.556 (725.322)		
		Stator 9/10 (With SB PW4ENG 72-486)	28.548 (725.120)	28.552 (725.220)	.000 (0.0000)	.008T (0.203T)
2353	B	HPC Inner Rear Case (72-35-68) HPC Rear Support (72-35-67) See Figure 801, Sheet 11)				
		Case	29.280 (743.712)	29.284 (743.814)		
		Support (With SB PW4ENG 72-486)	29.284 (743.814)	29.288 (743.915)	.000 (0.0000)	.008 (0.203)

G. Hub, Disk, Shaft, Airseal Limits

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1420	A	HPC Front Hub See 5-10-00, Time Limits (See Figure 801, Sheet 2)				
1421	A	Stage 5 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 2)				
1422	A	Stage 6 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 2)				
1423	A	Stage 7 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 2)				
1424	A	Stage 8 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 6)				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1425	A	Stage 9 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 6)				
1426	A	Stage 10 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 6)				
1427	A	Stage 11 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 9)				
1428	A	Stage 12 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 9)				
1429	A	Stage 13 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 9)				
1430	A	Stage 14 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 11)				
1431	A	Stage 15 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 11)				
1432	A	HPC Driveshaft See 5-10-00, Time Limits (See Figure 801, Sheet 11)				
1433	A	Drum Rotor (Stages 6 Through 12) Disk Assembly See 5-10-00, Time Limits (See Figure 801, Sheet 6)				
1434	A	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly See 5-10-00, Time Limits (See Figure 801, Sheet 9)				
1435	A	HPC Inlet Airseal See 5-10-00, Time Limits (See Figure 801, Sheet 2)				

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1436	A	Diffuser Airseal See 5-10-00, Time Limits (See Figure 801, Sheet 11)				

H. Spline Data

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
952	B	1. Gearbox Drive Bevel Gear (72-34-12) Internal Spline (See Figure 804, Sheet 2)				
		A. Effective Space Width	.0491 (1.247)	---		
		B. Actual Space Width	---	.0555 (1.410)		
		2. HPC Front Hub (72-35-05) External Spline (See Figure 804, Sheet 2)				
		A. Effective Tooth Thickness	---	.0476 (1.209)		
		B. Actual Tooth Thickness	.0412 (1.046)	---		
		3. Fit			.0015 (0.038)	---

I. Special Torques

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
730	A	Nut, Variable Stator Clevis Retaining (See Figure 802, Sheets 3, 4, 5 And 11) See 72-35-00, Assembly-03 Task 72-35-00-400-003 See 72-35-03, Assembly-01 Task 72-35-03-440-001				
731	A	Nut, Bellcrank Spacer Clevis Retaining (See Figure 802, Sheet 3) See 72-35-03, Assembly-01 Task 72-35-03-440-001				
732	A	Nut, Bellcrank Spacer Clevis Retaining (See Figure 802, Sheets 5 And 11) See 72-35-03, Assembly-01 Task 72-35-03-440-001				
733	A	Nut, Actuating Cylinder Retaining (See Figure 802, Sheet 10) See 72-35-00, Assembly-03 Task 72-35-00-400-003				
734	A	Bolt, Stage 7 HPC Lever (See Figure 802, Sheet 11) See 72-35-03, Assembly-01 Task 72-35-03-440-001				
735		Compressor Stator Actuator Rod End Bearing Retaining Nut (See Figure 802, Sheet 6) See 72-35-00, Assembly-03 Task 72-35-00-400-003				
736	A	Bolt And Nut Torquing Procedure, Turbine Case Cooling Air Valve Actuator Ground Cable See 72-35-00, Assembly-04 Task 72-35-00-400-004				
739	A	Variable Stator Mount Stud Retaining Nuts (See Figure 802, Sheet 7) See 72-35-00, Assembly-03 Task 72-35-00-400-003				

HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-04

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1550	A	Compressor Tierod Nut (See Figure 801, Sheets 2 And 9) See 72-35-01, Assembly-01 Task 72-35-01-440-001				
1551	A	Vane Arm Retaining Bolt (See Figure 801, Sheet 3) See 72-35-02, Assembly-01 Task 72-35-02-440-001				
1552	A	Stage 6 Borescope Plug (See Figure 801, Sheet 4) See 72-35-02, Assembly-01 Task 72-35-02-440-001				
1553	A	HPC Case Axial Flange Bolt - Nut (See Figure 801, Sheet 4) See 72-35-00, Assembly-01 Task 72-35-00-400-001				
1554	A	Stage 5 Borescope Plug (See Figure 801, Sheet 4) See 72-35-00, Assembly-01 Task 72-35-00-400-001				
1555	A	Stage 10 And Stage 14 (Outer) Borescope Plug (See Figure 801, Sheets 7 And 12) See 72-35-00, Assembly-01 Task 72-35-00-400-001				
1556	A	Stages 8 And 12 Borescope Plugs (See Figure 801, Sheets 7 And 10) See 72-35-00, Assembly-01 Task 72-35-00-400-001				
1557	A	Stage 10 (Inner) Borescope Plug (See Figure 801, Sheet 8) See 72-35-00, Assembly-01 Task 72-35-00-400-001				

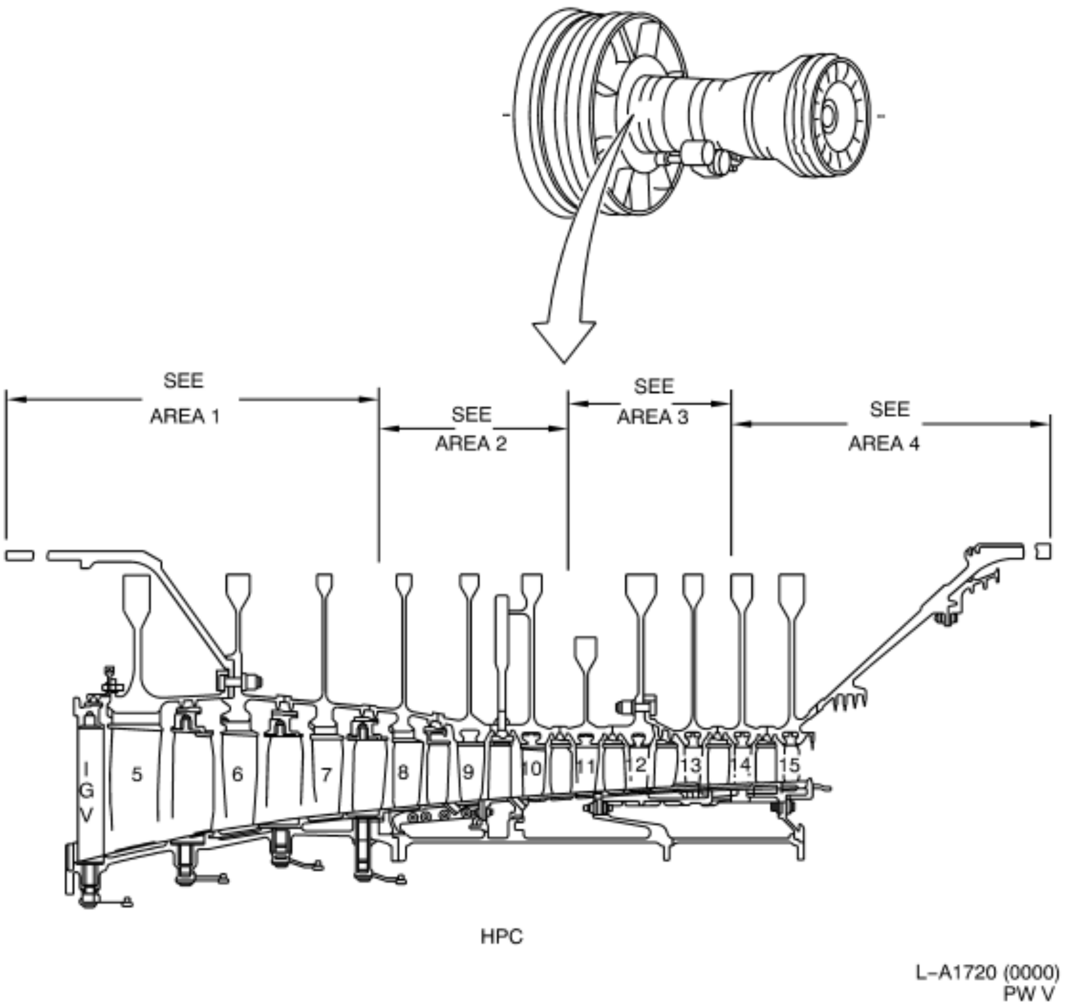
	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
1558	A	Synchronizing Ring Runner Pad Bolt (See Figure 806, Sheet 1) See 72-35-00, Assembly-02 Task 72-35-00-400-002				
1559	A	Stage 14 (Inner) Borescope Plug (See Figure 801, Sheet 13) See 72-35-00, Assembly-01 Task 72-35-00-400-001				

J. Special Assembly Procedure

	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
618	A	Compressor Stator Lever - Set Bracket - Shim Fitting (See Figure 802, Sheet 8) See 72-35-00, Assembly-03) Task 72-35-00-400-003				
749	A	Variable Stator Mount Assembly Instruction For Expanding Retaining Stud See 72-35-00, Assembly-03 Task 72-35-00-400-003				
760	A	Turbine Vane And Blade Cooling Air Valve Position Switch - Installation See 72-35-00, Assembly-04 Task 72-35-00-400-004				
1366	A	HPC Inlet Vane (Outer) Trunnion Sleeve Bearing HPC Front Case Assembly (See Figure 801, Sheet 3) See 72-35-40, Repair-01 R (Task 72-35-40-300-001)				
1367	A	Stage 5 HPC (Outer) Trunnion Sleeve Bearing HPC Front Case Assembly (See Figure 801, Sheet 3) See 72-35-40, Repair-01 R (Task 72-35-40-300-001)				

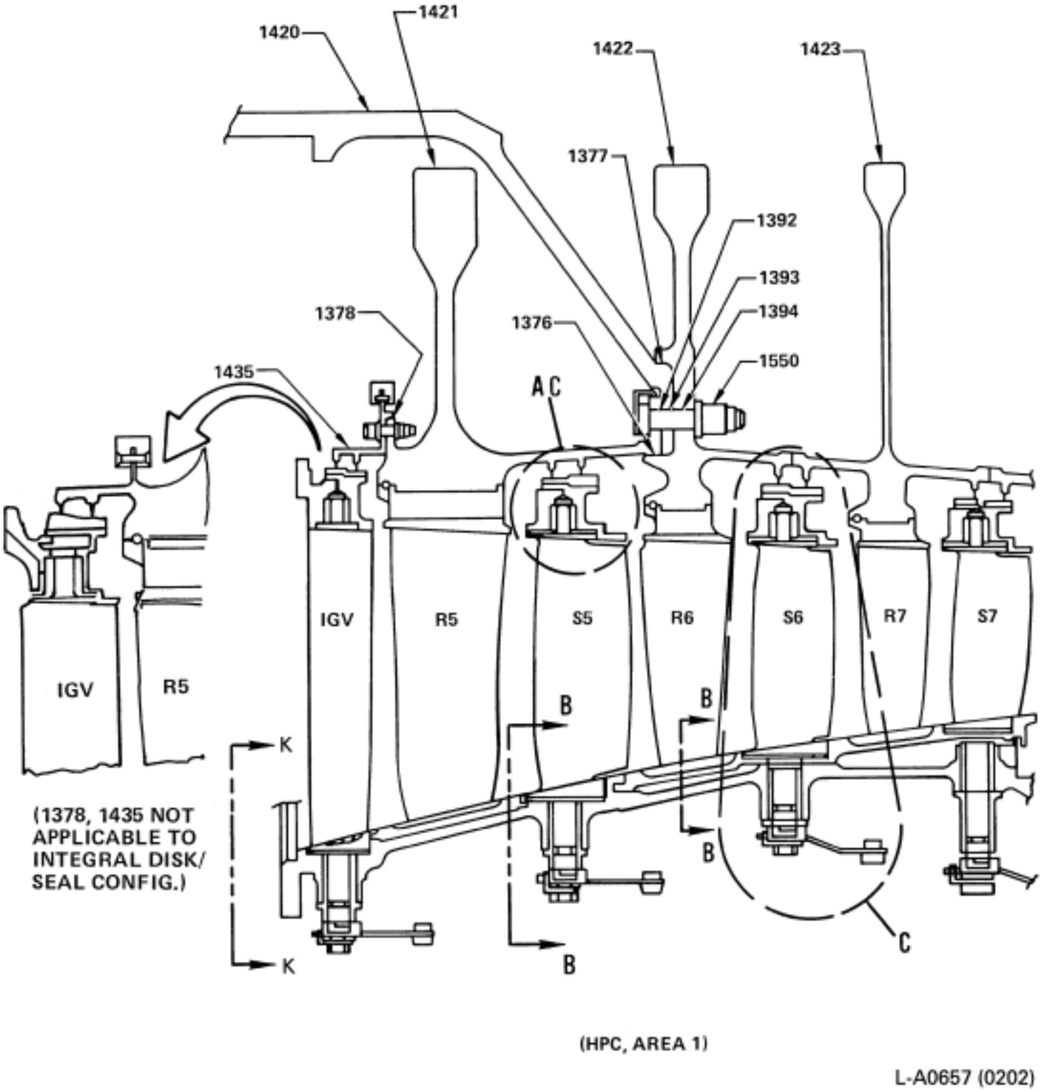
	Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
				Min	Max	Min	Max
R	1368	A	Stage 6 HPC (Outer) Trunnion Sleeve Bearing HPC Front Case Assembly (See Figure 801, Sheet 3) See 72−35−40, Repair−01 (Task 72−35−40−300−001)				
R	1369	A	Stage 7 HPC (Outer) Trunnion Sleeve Bearing HPC Front Case Assembly (See Figure 801, Sheet 3) See 72−35−40, Repair−01 (Task 72−35−40−300−001)				
R R	1401	A	Arm Assembly End Clearance − Select Spacer To Obtain (See Figure 801, Sheet 3) See 72−35−02, Assembly−01 (Task 72−35−02−440−001)				
	2101 2102 2103 2104	A	Shim Procedure For Unison Ring Runners And Spacers And Clearances For Runners (See Figure 806, Sheets 1 and 2) See 72−35−00, Assembly−02 Task 72−35−00−400−002				
	2126	A	Stage 13 And 14 Compressor Stator Thrust Pin See 72−35−00, Assembly−01 Task 72−35−00−400−001				

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04

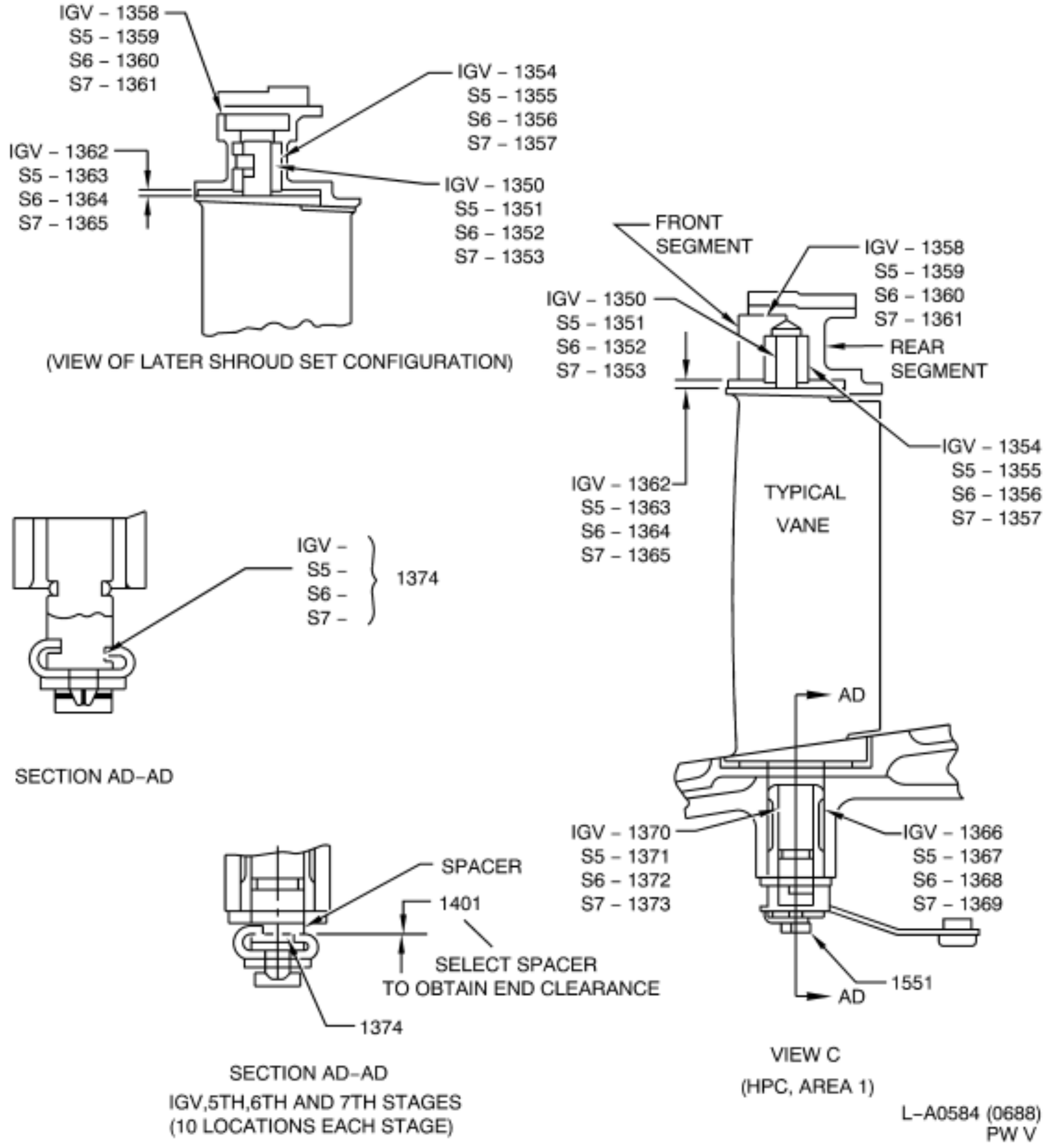

SEE
AREA 1
SEE
AREA 2
SEE
AREA 3
SEE
AREA 4
I
G
V
5
6
7
8
9
10
11
12
13
14
15
HPC
L−A1720 (0000)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 1)
(Task 72−35−00−990−001)

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04


1420
1421
1422
1423
1377
1392
1393
1394
1550
1378
1376
1435
A C
IGV
R5
S5
R6
S6
R7
S7
IGV
R5
B
B
B
B
K
K
C
(1378, 1435 NOT APPLICABLE TO INTEGRAL DISK/ SEAL CONFIG.)
(HPC, AREA 1)
L-A0657 (0202)

High Pressure Compressor (HPC)
Figure 801 (Sheet 2)
(Task 72−35−00−990−001)


IGV – 1358
S5 – 1359
S6 – 1360
S7 – 1361
IGV – 1354
S5 – 1355
S6 – 1356
S7 – 1357
IGV – 1362
S5 – 1363
S6 – 1364
S7 – 1365
IGV – 1350
S5 – 1351
S6 – 1352
S7 – 1353
FRONT SEGMENT
IGV – 1358
S5 – 1359
S6 – 1360
S7 – 1361
IGV – 1350
S5 – 1351
S6 – 1352
S7 – 1353
REAR SEGMENT
IGV – 1354
S5 – 1355
S6 – 1356
S7 – 1357
IGV – 1362
S5 – 1363
S6 – 1364
S7 – 1365
TYPICAL VANE
IGV –
S5 –
S6 –
S7 –
1374
AD
IGV – 1370
S5 – 1371
S6 – 1372
S7 – 1373
IGV – 1366
S5 – 1367
S6 – 1368
S7 – 1369
SPACER
1401
SELECT SPACER TO OBTAIN END CLEARANCE
1374
1551
AD
L-A0584 (0688)
PW V

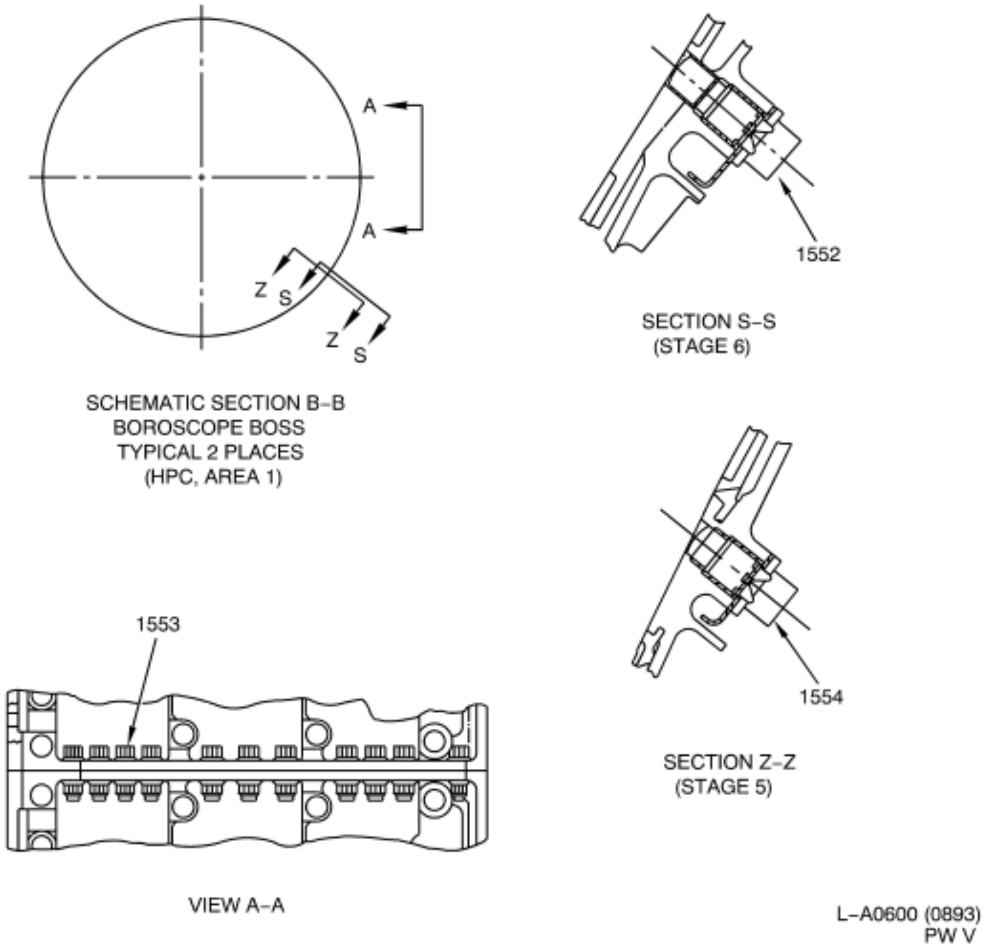
(VIEW OF LATER SHROUD SET CONFIGURATION)

SECTION AD-AD

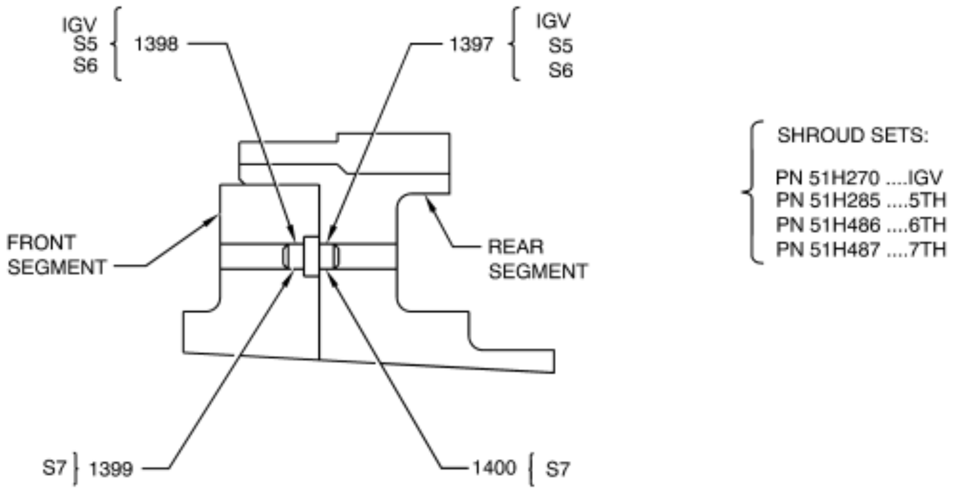
SECTION AD-AD
IGV,5TH,6TH AND 7TH STAGES
(10 LOCATIONS EACH STAGE)

VIEW C
(HPC, AREA 1)

High Pressure Compressor (HPC)
Figure 801 (Sheet 3)
(Task 72−35−00−990−001)

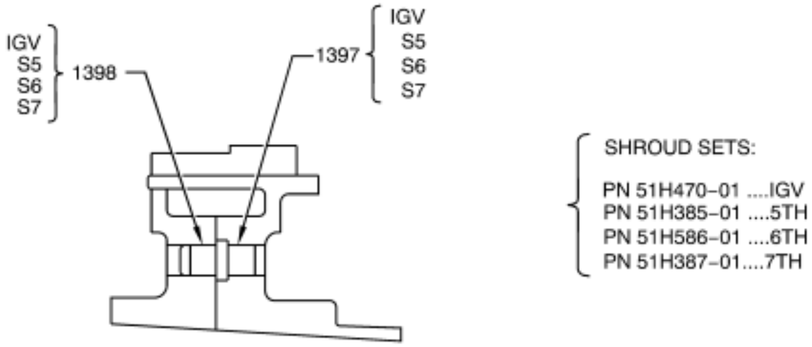

A
A
Z
S
Z
S
SCHEMATIC SECTION B−B
BOROSCOPE BOSS
TYPICAL 2 PLACES
(HPC, AREA 1)
1552
SECTION S−S
(STAGE 6)
1553
VIEW A−A
1554
SECTION Z−Z
(STAGE 5)
L−A0600 (0893)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 4)
(Task 72−35−00−990−001)


IGV
S5
S6
1398
1397
IGV
S5
S6
SHROUD SETS:
PN 51H270 ....IGV
PN 51H285 ....5TH
PN 51H486 ....6TH
PN 51H487 ....7TH
FRONT SEGMENT
REAR SEGMENT
S7
1399
1400
S7

VIEW AC

(HPC, AREA 1)


IGV
S5
S6
S7
1398
1397
IGV
S5
S6
S7
SHROUD SETS:
PN 51H470−01 ....IGV
PN 51H385−01 ....5TH
PN 51H586−01 ....6TH
PN 51H387−01....7TH

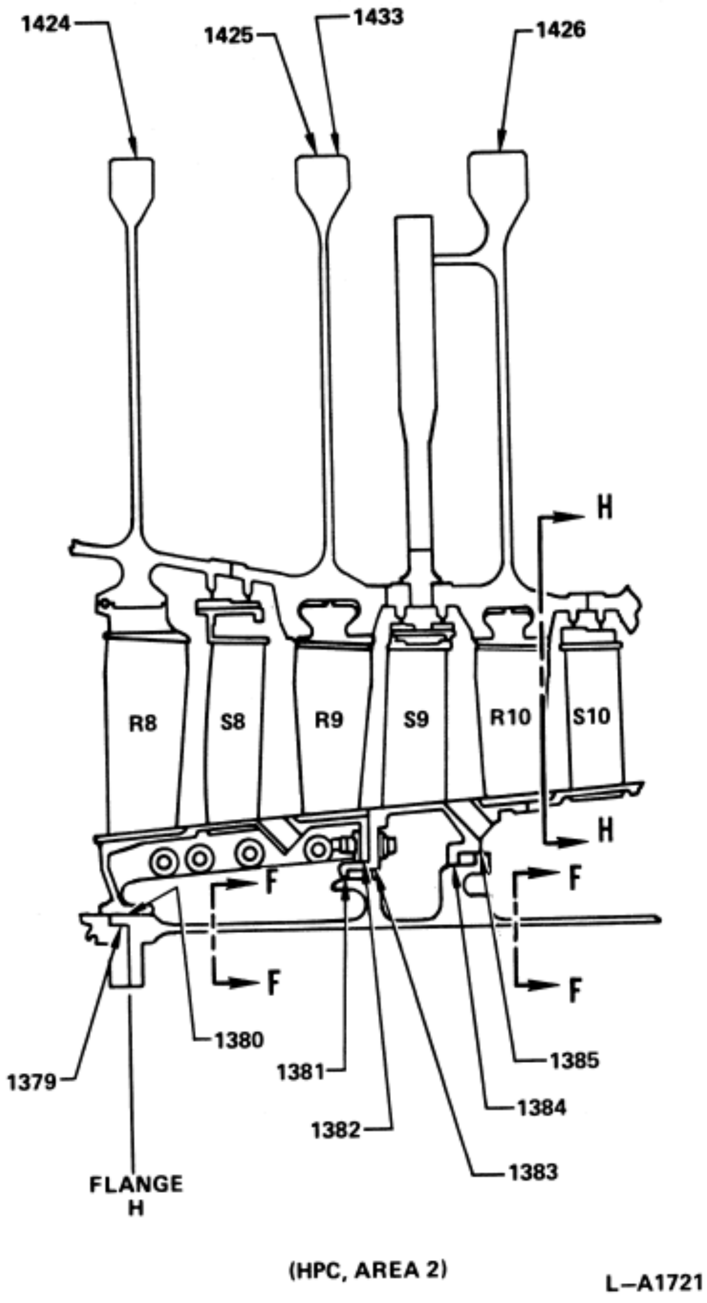
VIEW AC

(HPC, AREA 1)

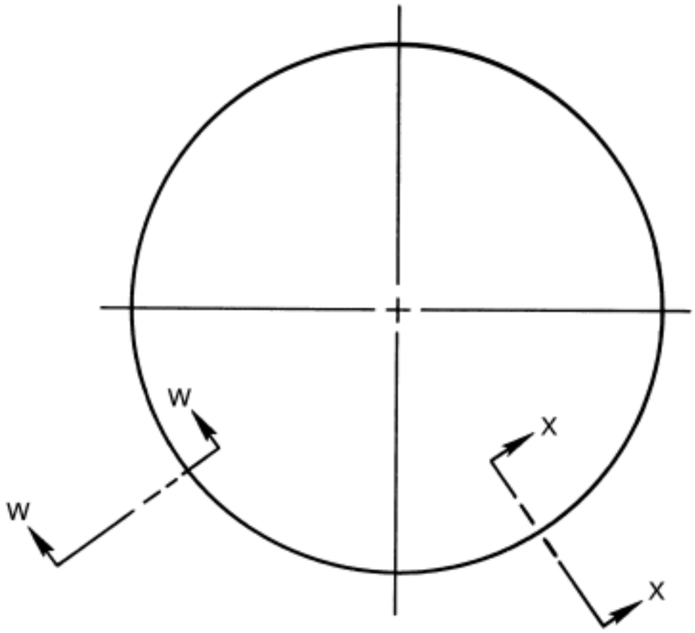
L−A0624 (0287)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 5)
(Task 72−35−00−990−001)

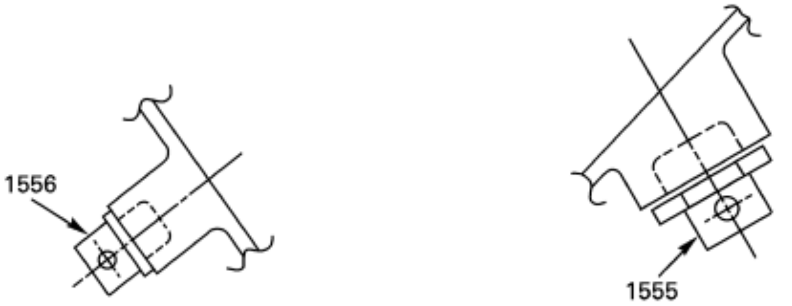
HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-04


1424
1425
1433
1426
H
H
R8
S8
R9
S9
R10
S10
F
F
F
F
1379
1380
1381
1382
1383
1384
1385
FLANGE
H
(HPC, AREA 2)
L-A1721

High Pressure Compressor (HPC)
Figure 801 (Sheet 6)
(Task 72-35-00-990-001)



SCHEMATIC SECTION F-F
BOROSCOPE BOSS
(HPC, AREA 2)

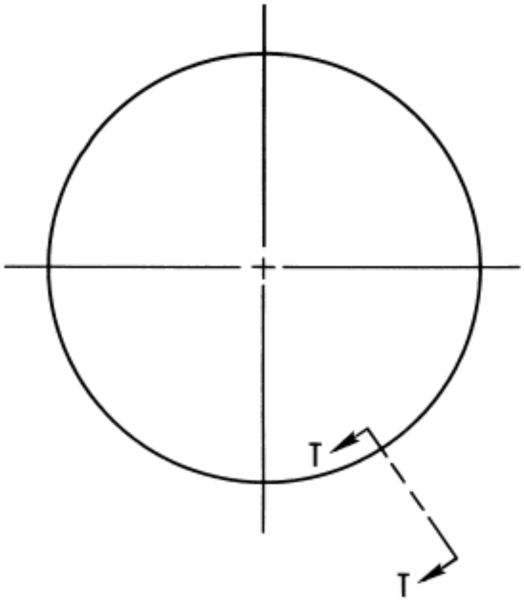


SECTION W-W
(STAGE 8)

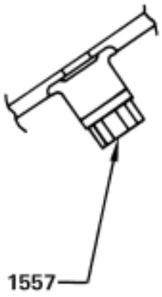
SECTION X-X
(STAGE 10)

L-A0606 (0893)

High Pressure Compressor (HPC)
Figure 801 (Sheet 7)
(Task 72−35−00−990−001)



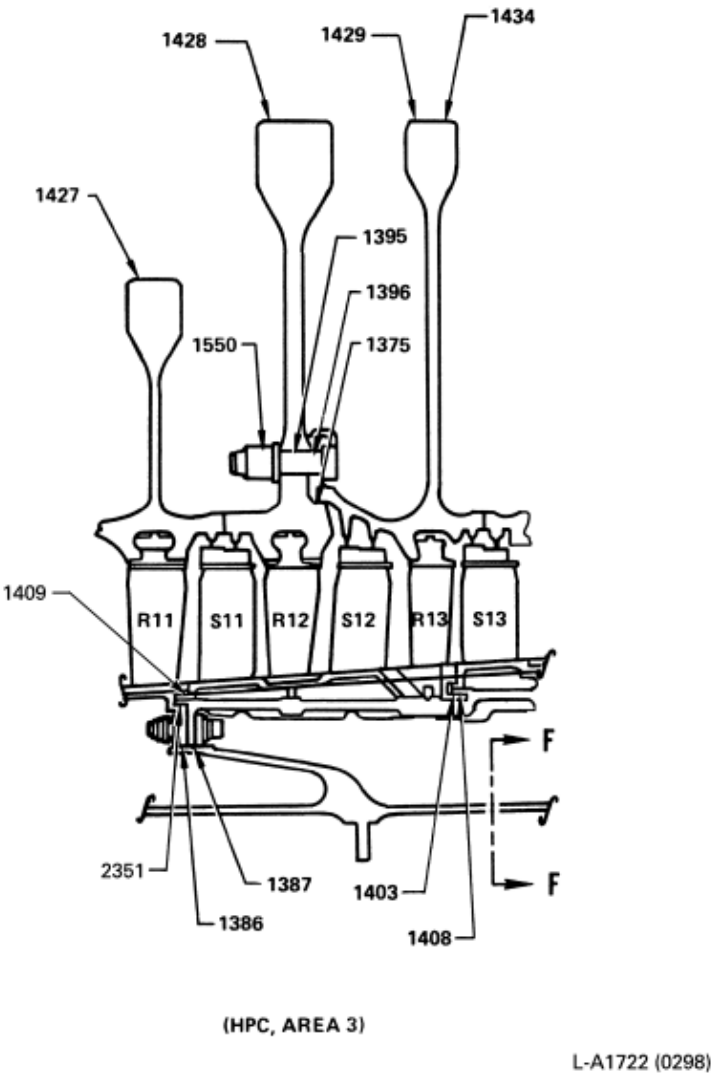
SCHEMATIC SECTION H−H
BOROSCOPE BOSS
(HPC, AREA 2)



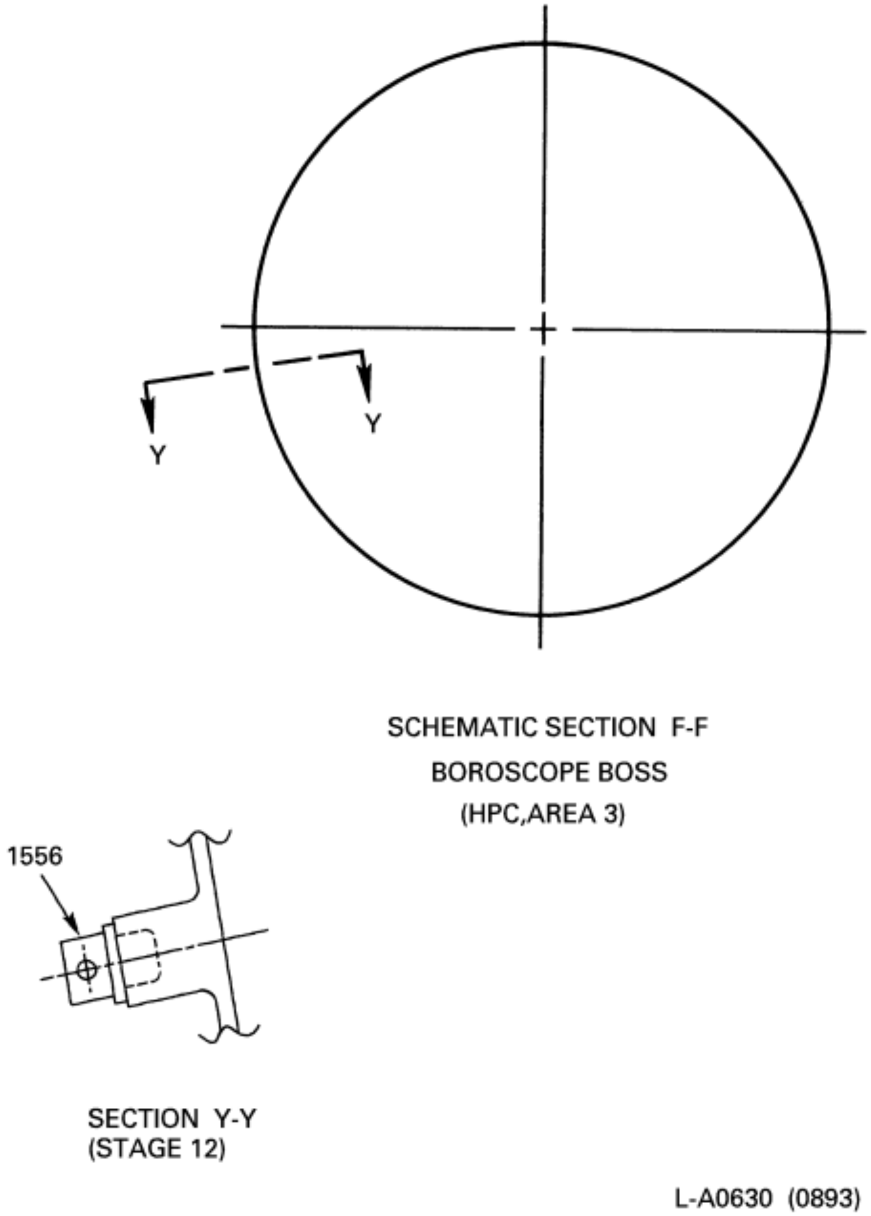
SECTION T−T
(STAGE 10)

L−A0618

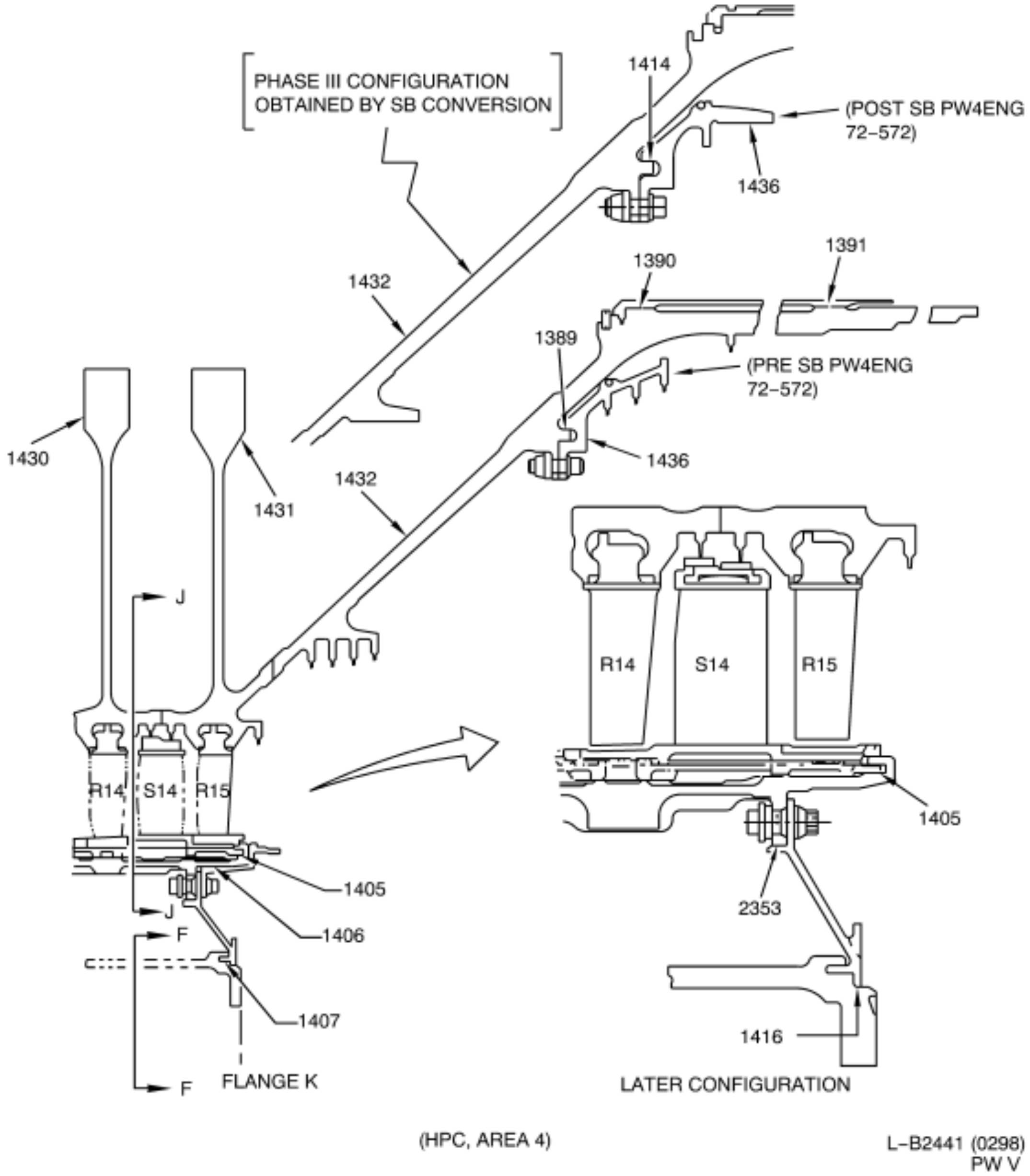
High Pressure Compressor (HPC)
Figure 801 (Sheet 8)
(Task 72−35−00−990−001)


1428
1429
1434
1427
1395
1396
1550
1375
1409
R11
S11
R12
S12
R13
S13
F
F
2351
1387
1403
1386
1408
(HPC, AREA 3)
L-A1722 (0298)

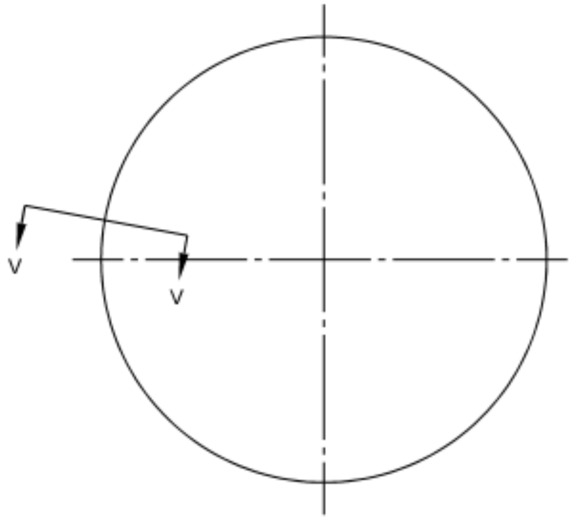
High Pressure Compressor (HPC)
Figure 801 (Sheet 9)
(Task 72−35−00−990−001)


Y
Y
SCHEMATIC SECTION F-F
BOROSCOPE BOSS
(HPC,AREA 3)
1556
SECTION Y-Y
(STAGE 12)
L-A0630 (0893)

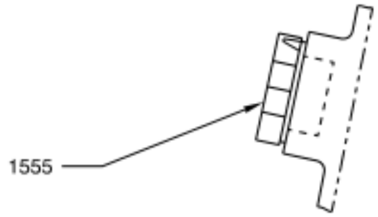
High Pressure Compressor (HPC)
Figure 801 (Sheet 10)
(Task 72−35−00−990−001)


PHASE III CONFIGURATION
OBTAINED BY SB CONVERSION
1414
(POST SB PW4ENG
72-572)
1436
1432
1390
1391
1389
(PRE SB PW4ENG
72-572)
1430
1431
1436
1432
J
R14
S14
R15
R14
S14
R15
1405
1405
J
2353
1406
F
1407
1416
F
FLANGE K
LATER CONFIGURATION
(HPC, AREA 4)
L-B2441 (0298)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 11)
(Task 72-35-00-990-001)



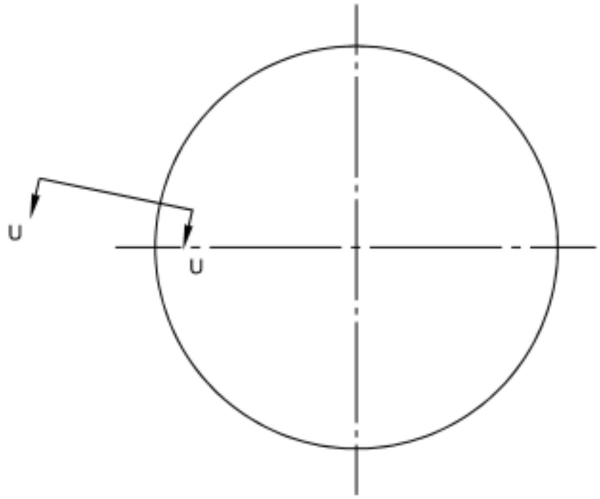
SCHEMATIC SECTION F−F
BOROSCOPE BOSS
(OUTER)
(HPC, AREA 4)



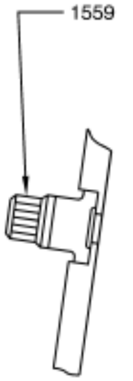
SECTION V−V
(STAGE 14 OUTER)

L−A0636 (0000)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 12)
(Task 72−35−00−990−001)



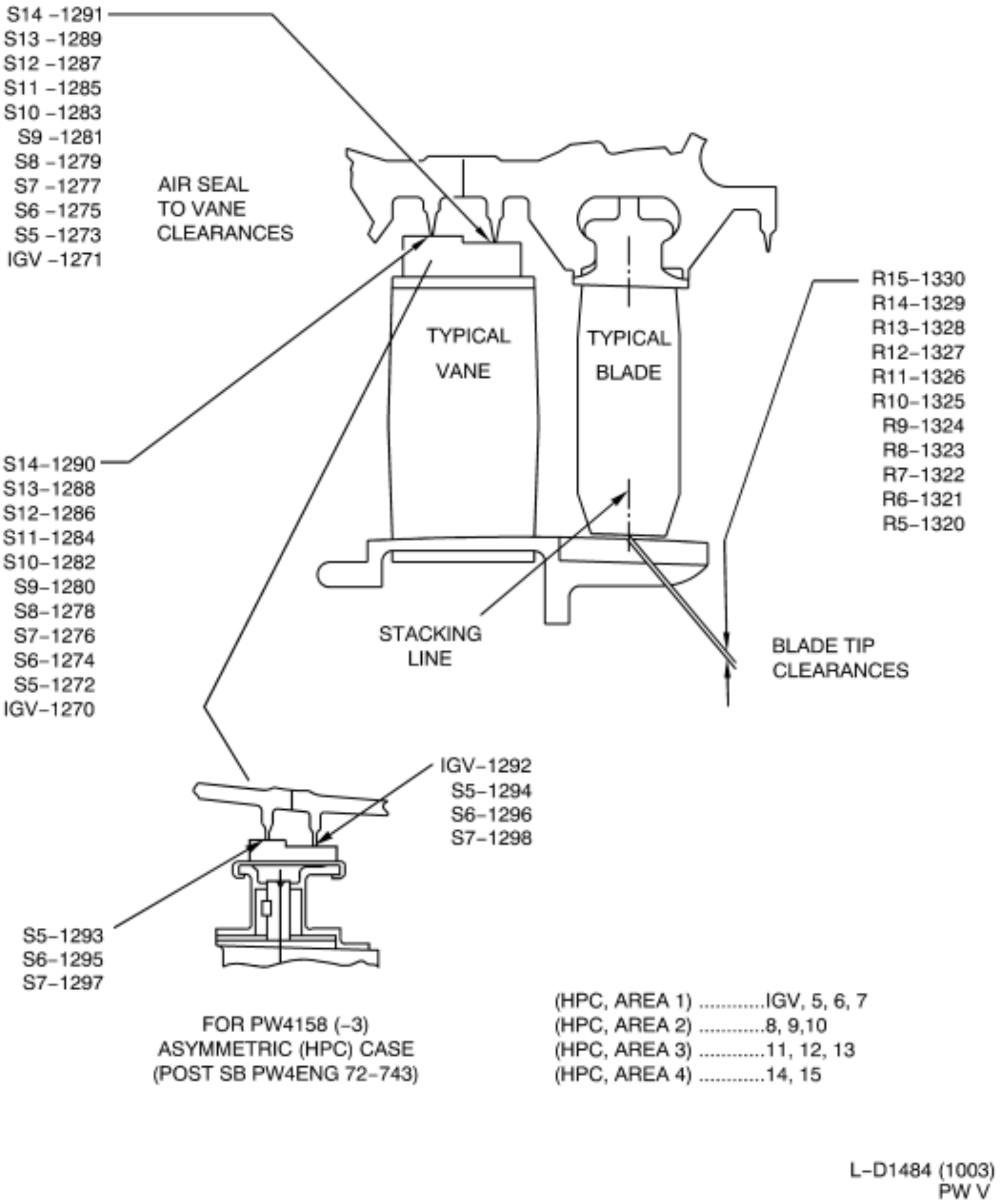
SCHEMATIC SECTION J−J (HPC, AREA 4)
BOROSCOPE BOSS
(INNER)



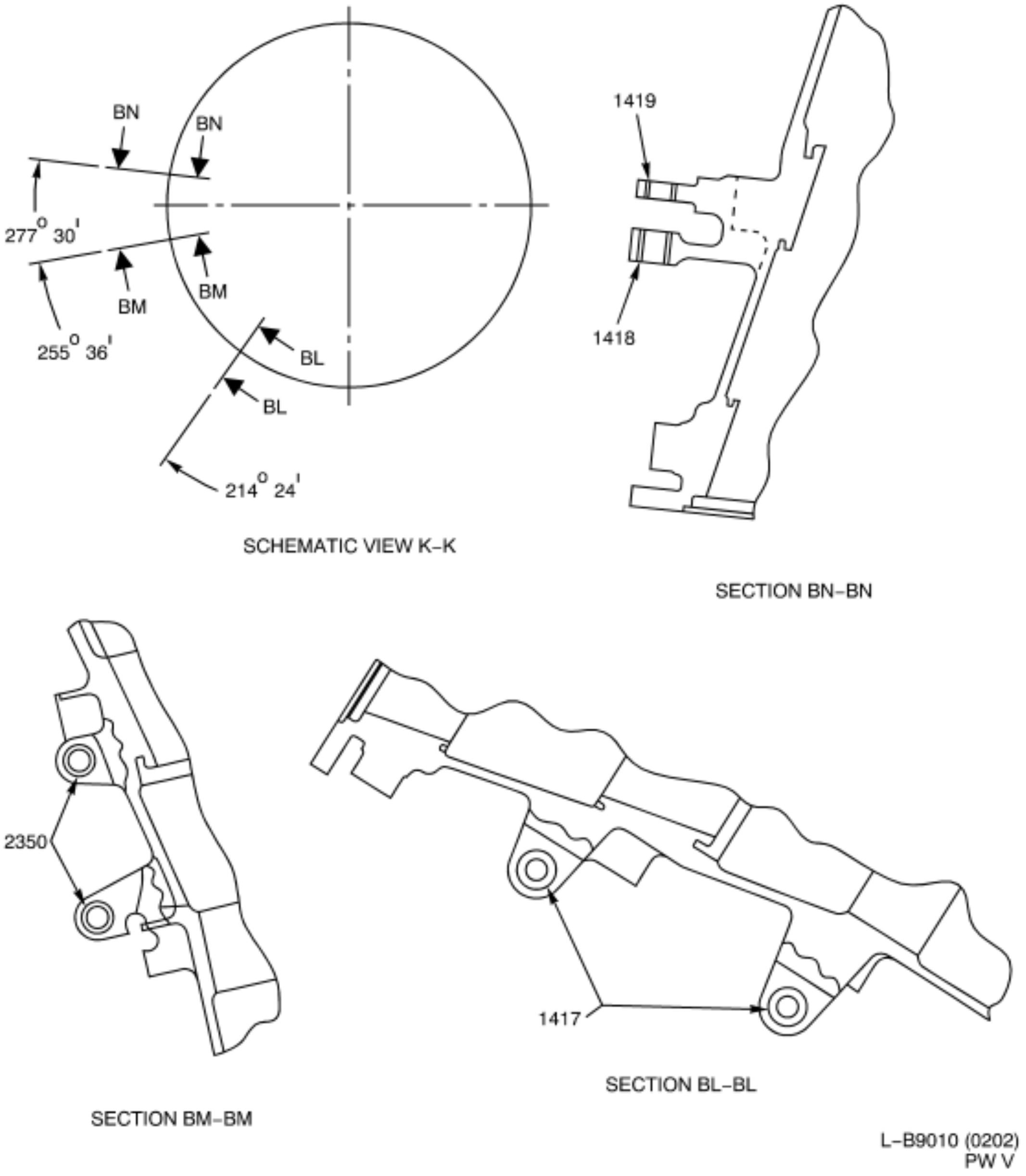
SECTION U−U
(STAGE 14 INNER)

L−A0642 (0487)
PW V

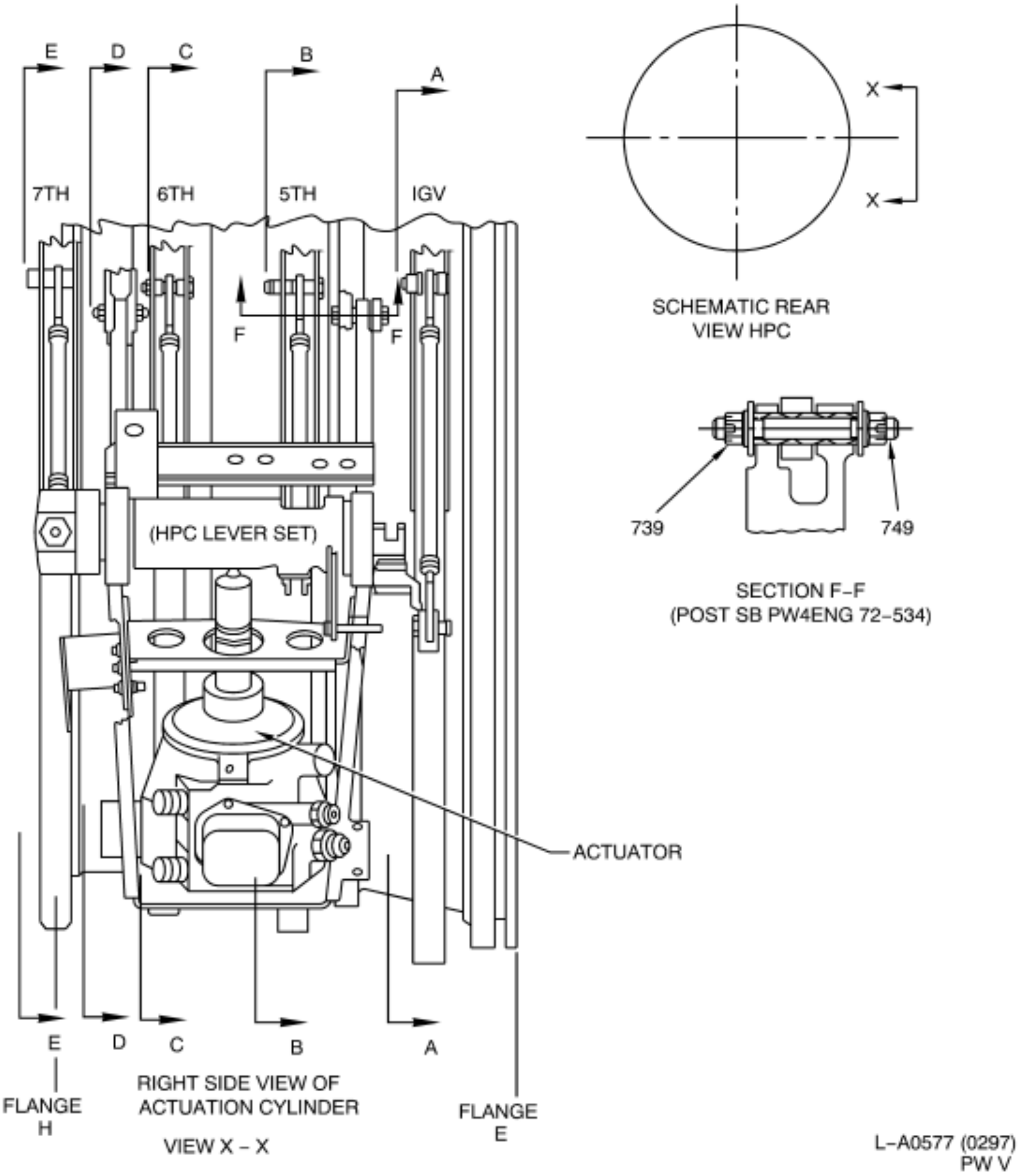
High Pressure Compressor (HPC)
Figure 801 (Sheet 13)
(Task 72−35−00−990−001)


S14 −1291
S13 −1289
S12 −1287
S11 −1285
S10 −1283
S9 −1281
S8 −1279
S7 −1277
S6 −1275
S5 −1273
IGV −1271
AIR SEAL TO VANE CLEARANCES
TYPICAL VANE
TYPICAL BLADE
R15−1330
R14−1329
R13−1328
R12−1327
R11−1326
R10−1325
R9−1324
R8−1323
R7−1322
R6−1321
R5−1320
S14−1290
S13−1288
S12−1286
S11−1284
S10−1282
S9−1280
S8−1278
S7−1276
S6−1274
S5−1272
IGV−1270
STACKING LINE
BLADE TIP CLEARANCES
IGV−1292
S5−1294
S6−1296
S7−1298
S5−1293
S6−1295
S7−1297
FOR PW4158 (−3) ASYMMETRIC (HPC) CASE (POST SB PW4ENG 72−743)
(HPC, AREA 1) ....IGV, 5, 6, 7
(HPC, AREA 2) 8, 9,10
(HPC, AREA 3) 11, 12, 13
(HPC, AREA 4) 14, 15
L−D1484 (1003)
PW V

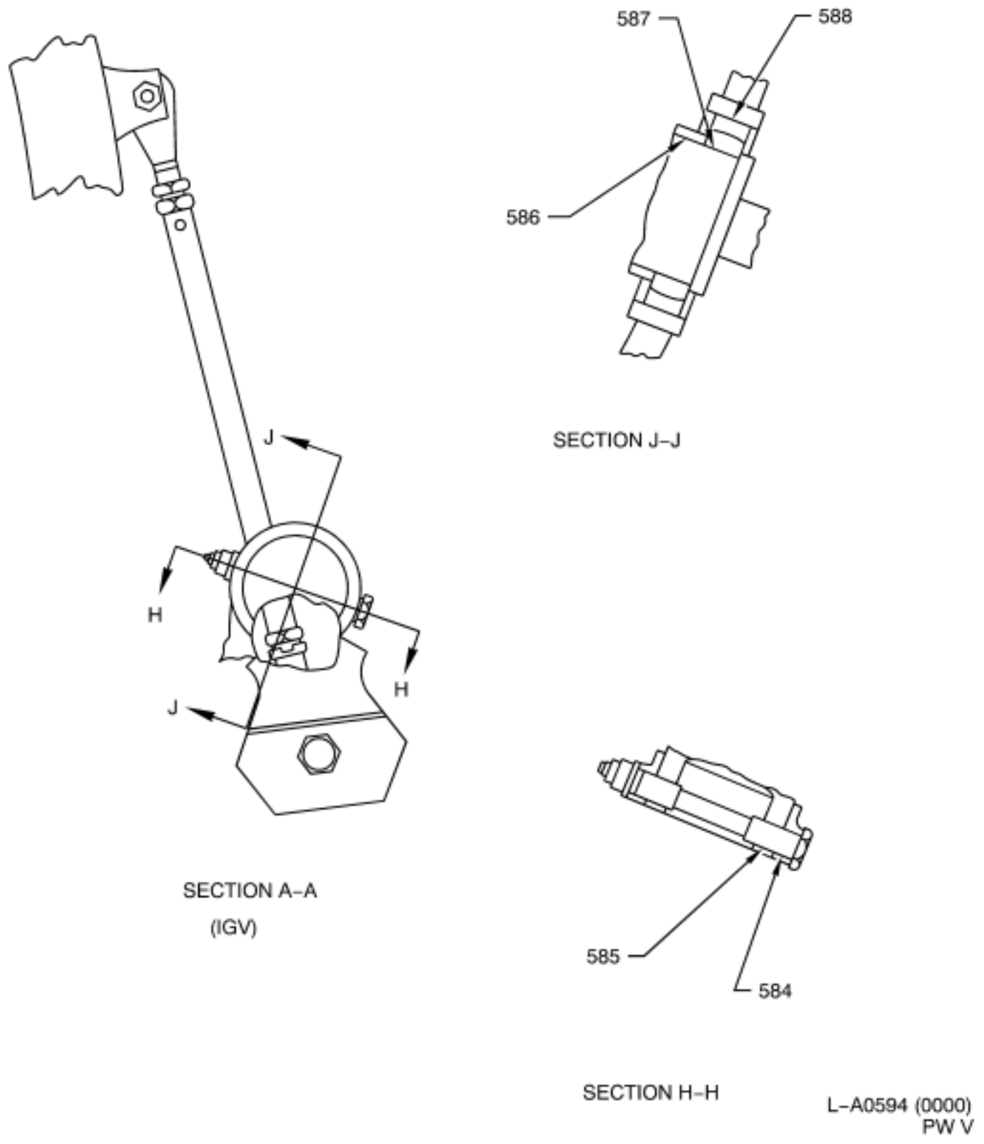
High Pressure Compressor (HPC)
Figure 801 (Sheet 14)
(Task 72−35−00−990−001)


BN
BN
277° 30'
BM
BM
255° 36'
BL
BL
214° 24'
SCHEMATIC VIEW K−K
1419
1418
SECTION BN−BN
2350
SECTION BM−BM
1417
SECTION BL−BL
L−B9010 (0202)
PW V

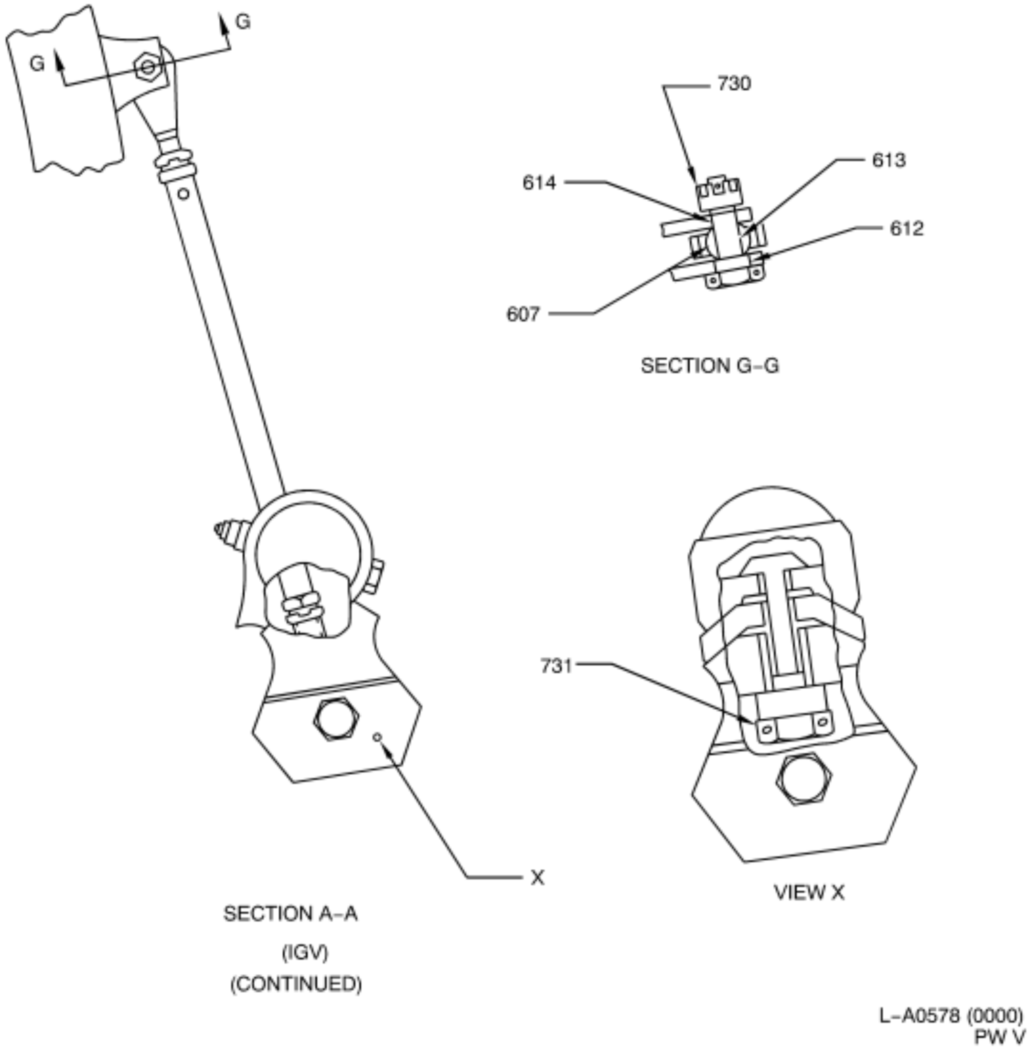
High Pressure Compressor (HPC)
Figure 801 (Sheet 15)
(Task 72−35−00−990−001)


E
D
C
B
A
7TH
6TH
5TH
IGV
F
F
(HPC LEVER SET)
ACTUATOR
E
D
C
B
A
FLANGE
H
RIGHT SIDE VIEW OF
ACTUATION CYLINDER
VIEW X − X
FLANGE
E
X
X
SCHEMATIC REAR
VIEW HPC
739
749
SECTION F−F
(POST SB PW4ENG 72−534)
L−A0577 (0297)
PW V

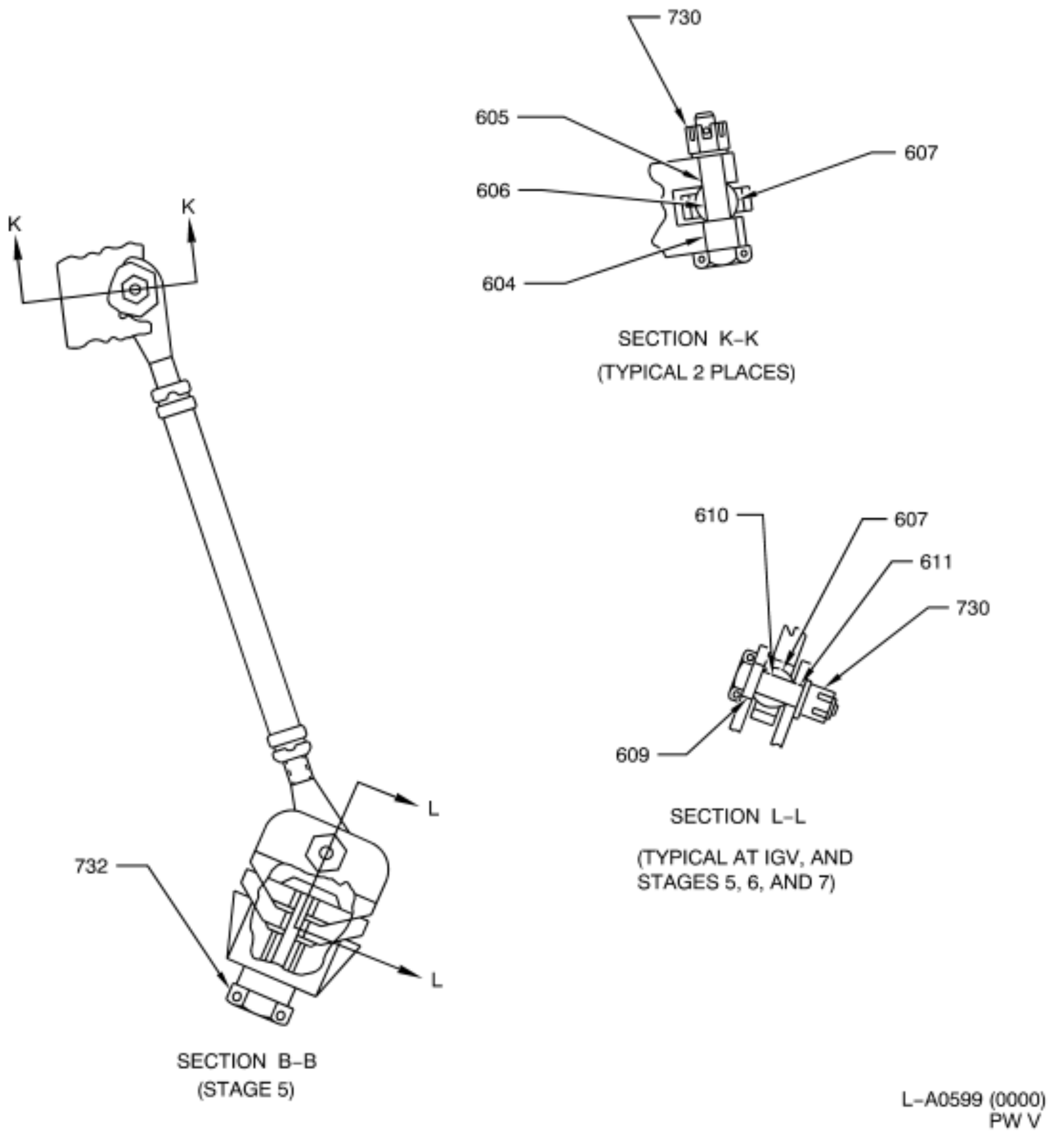
High Pressure Compressor (HPC)
Figure 802 (Sheet 1)
(Task 72−35−00−990−001)


587
588
586
SECTION J−J
J
H
H
J
SECTION A−A
(IGV)
585
584
SECTION H−H
L−A0594 (0000)
PW V

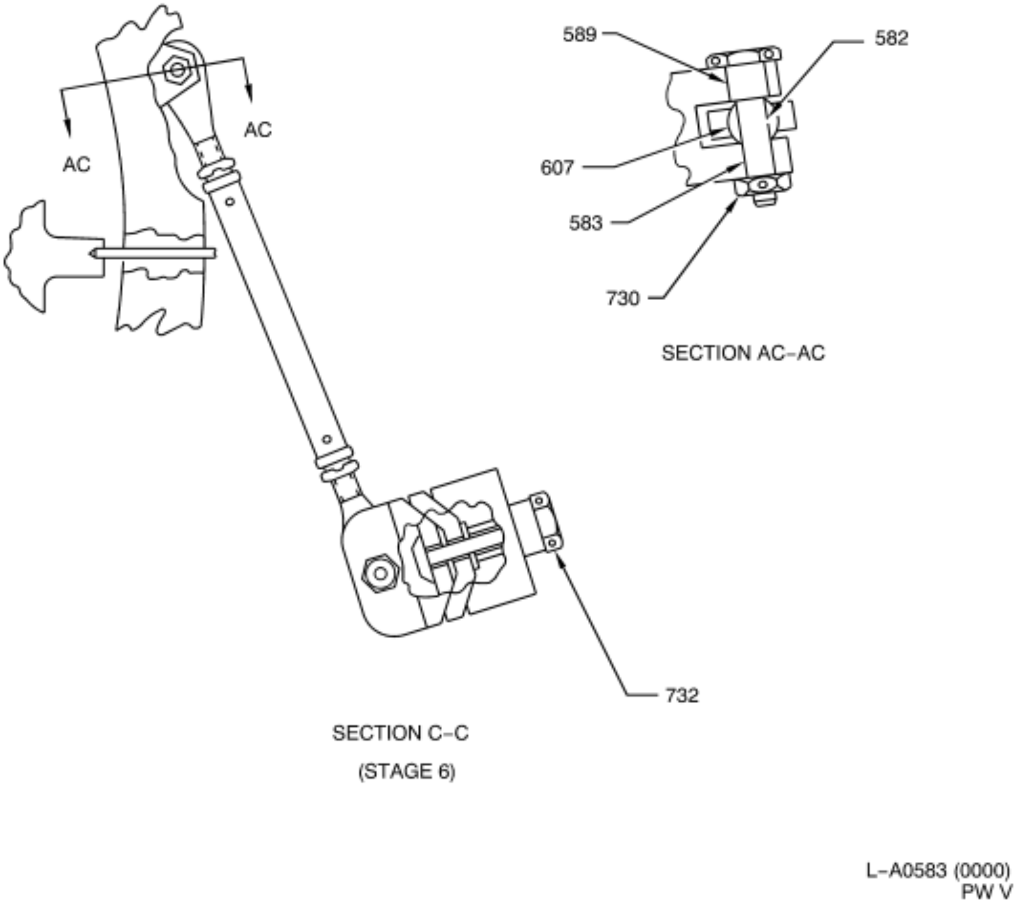
High Pressure Compressor (HPC)
Figure 802 (Sheet 2)
(Task 72−35−00−990−001)


G
G
730
614
613
612
607
SECTION G−G
731
X
VIEW X
SECTION A−A
(IGV)
(CONTINUED)
L−A0578 (0000)
PW V

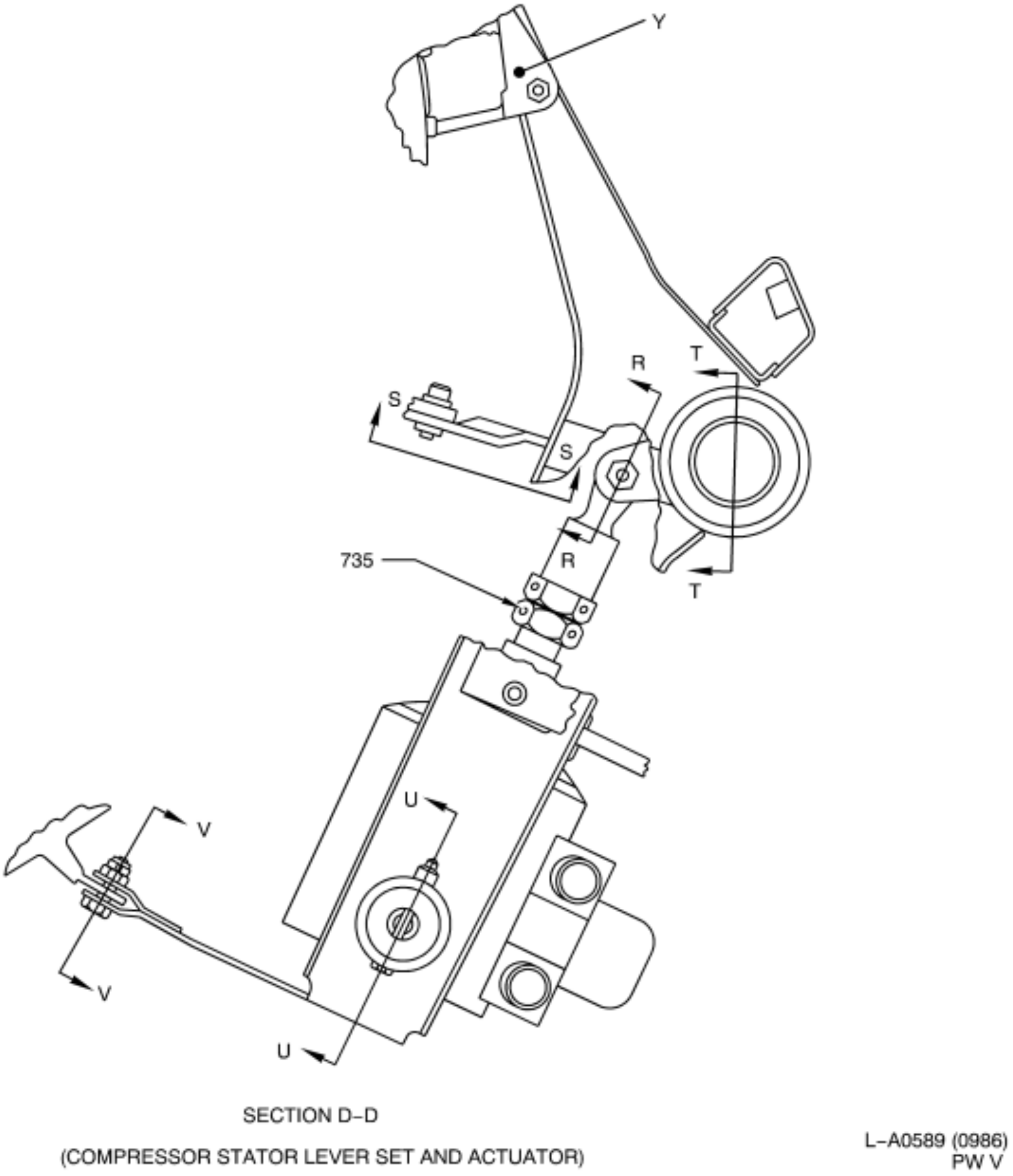
High Pressure Compressor (HPC)
Figure 802 (Sheet 3)
(Task 72−35−00−990−001)


730
605
607
606
604
SECTION K-K
(TYPICAL 2 PLACES)
K
K
610
607
611
730
609
SECTION L-L
(TYPICAL AT IGV, AND STAGES 5, 6, AND 7)
L
732
L
SECTION B-B
(STAGE 5)
L-A0599 (0000)
PW V

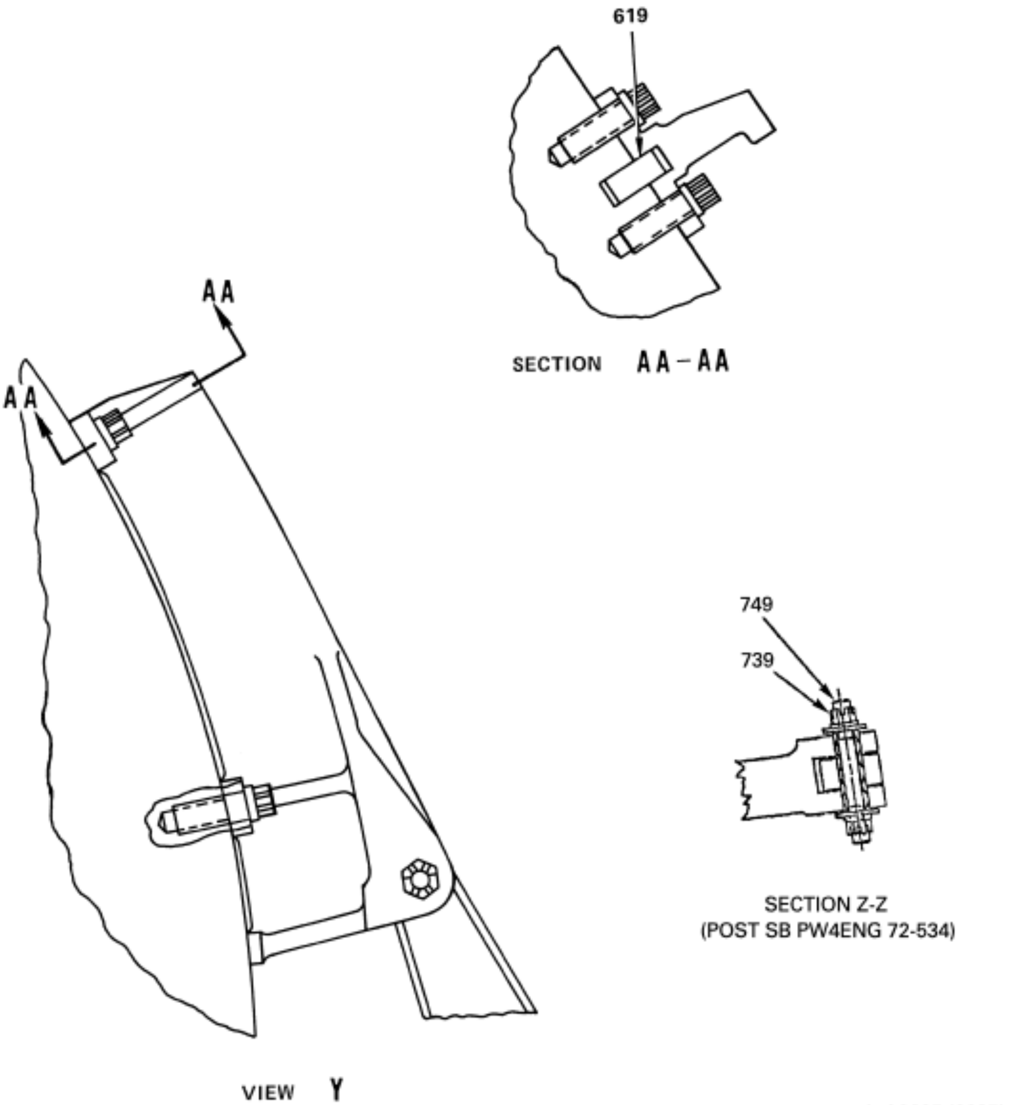
High Pressure Compressor (HPC)
Figure 802 (Sheet 4)
(Task 72-35-00-990-001)


589
582
AC
AC
607
583
730
SECTION AC−AC
732
SECTION C−C
(STAGE 6)
L−A0583 (0000)
PW V

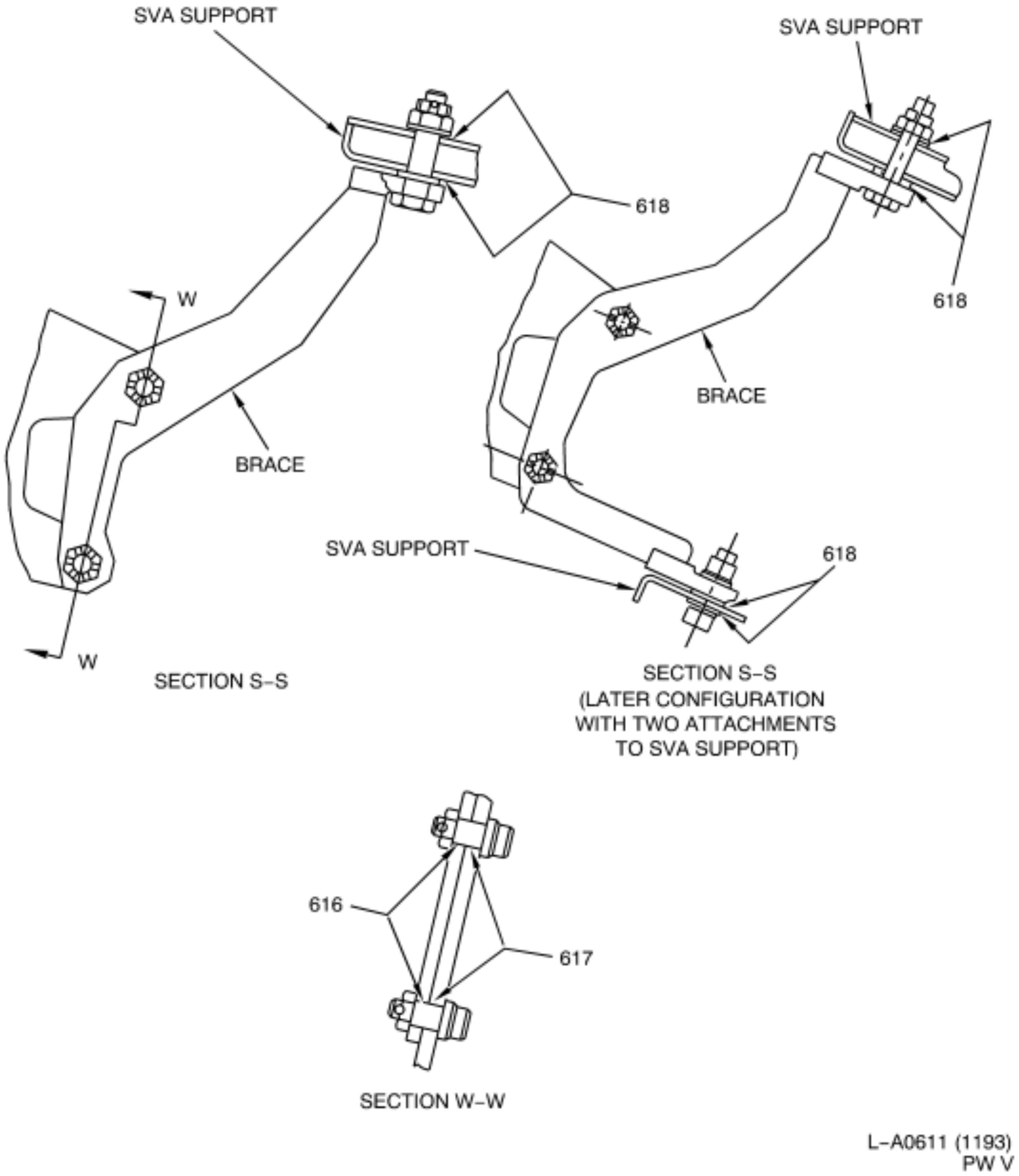
High Pressure Compressor (HPC)
Figure 802 (Sheet 5)
(Task 72−35−00−990−001)


Y
R
T
S
S
735
R
T
U
V
V
U
SECTION D−D
(COMPRESSOR STATOR LEVER SET AND ACTUATOR)
L−A0589 (0986)
PW V

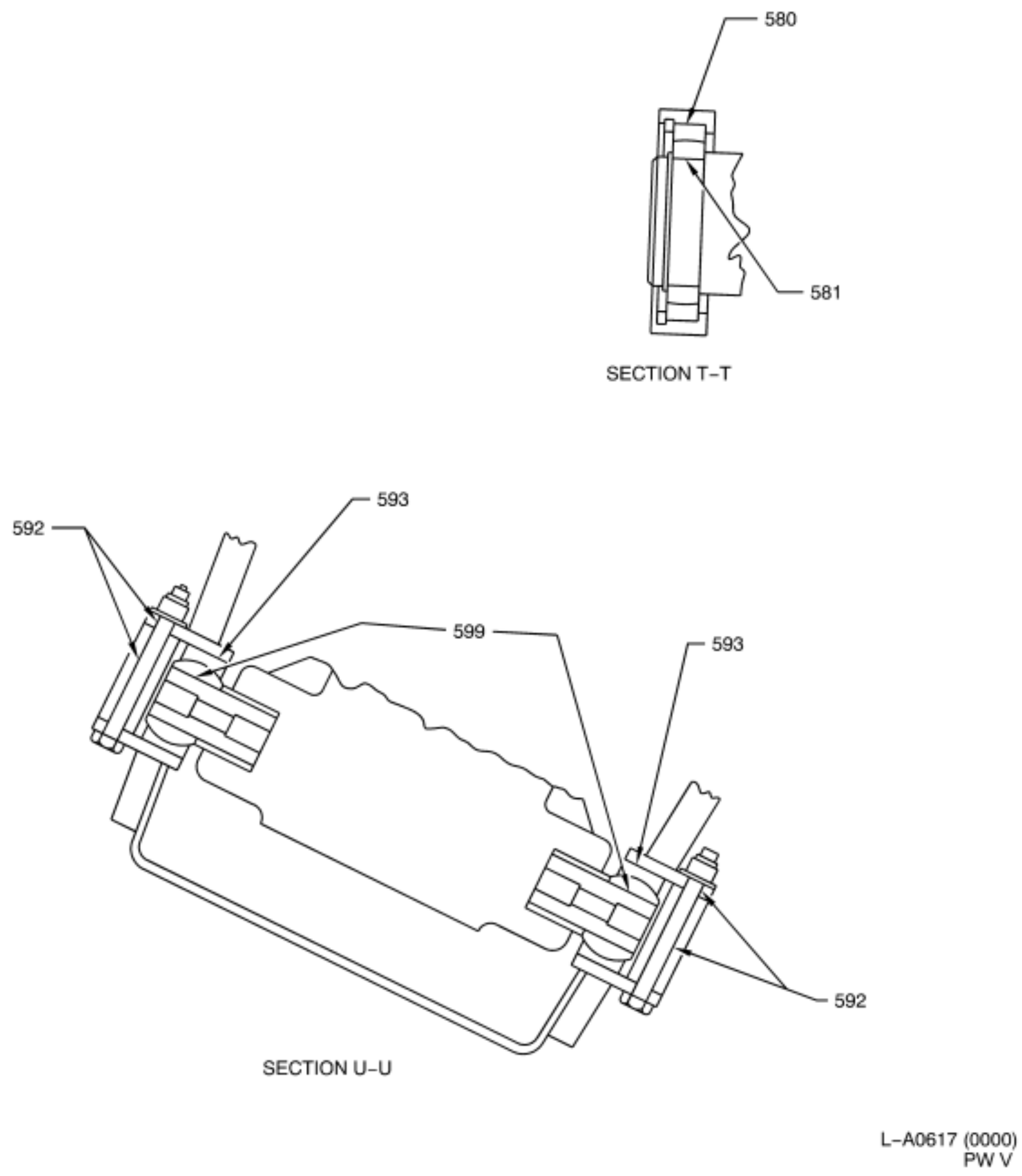
High Pressure Compressor (HPC)
Figure 802 (Sheet 6)
(Task 72−35−00−990−001)


619
SECTION AA − AA
AA
AA
749
739
SECTION Z-Z
(POST SB PW4ENG 72-534)
VIEW Y
L-A0605 (0297)

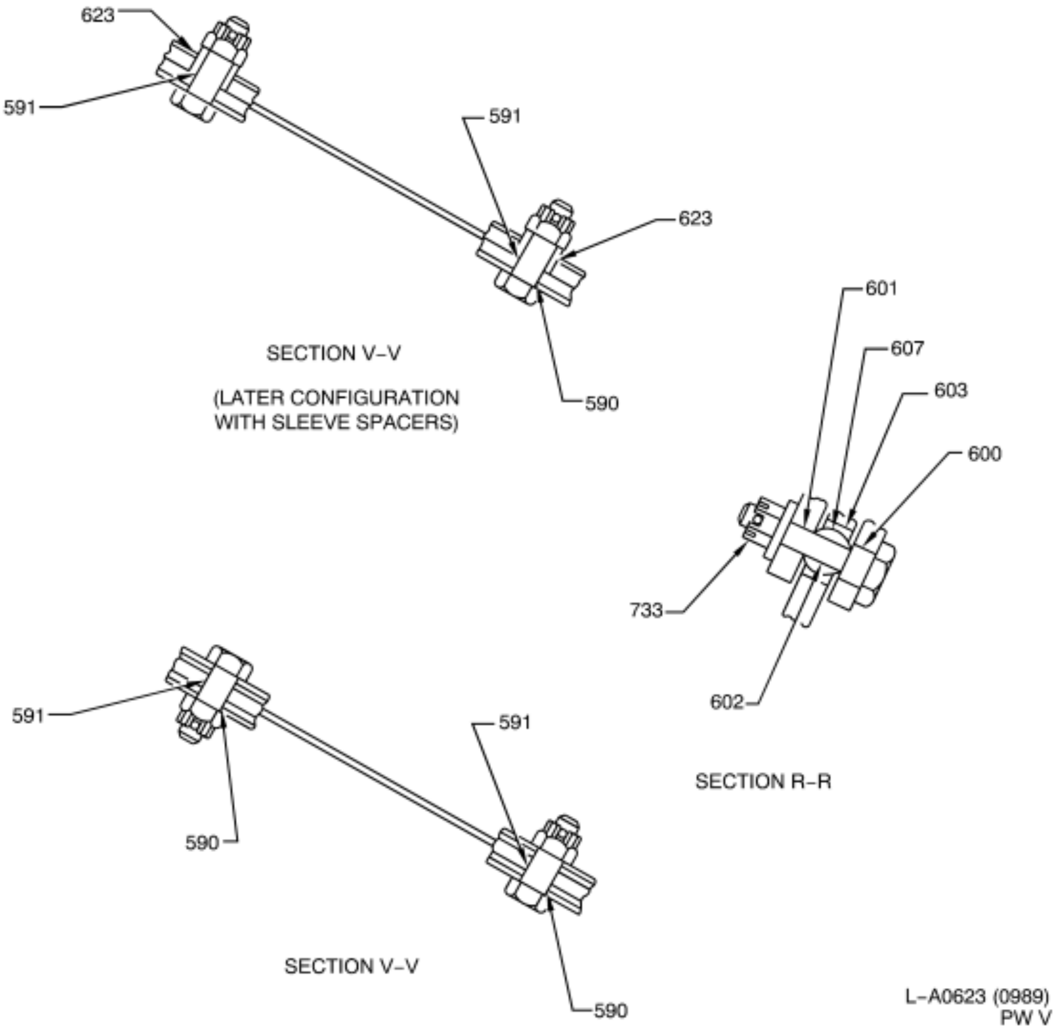
High Pressure Compressor (HPC)
Figure 802 (Sheet 7)
(Task 72−35−00−990−001)


SVA SUPPORT
618
W
BRACE
W
SECTION S−S
SVA SUPPORT
618
BRACE
SVA SUPPORT
618
SECTION S−S
(LATER CONFIGURATION
WITH TWO ATTACHMENTS
TO SVA SUPPORT)
616
617
SECTION W−W
L−A0611 (1193)
PW V

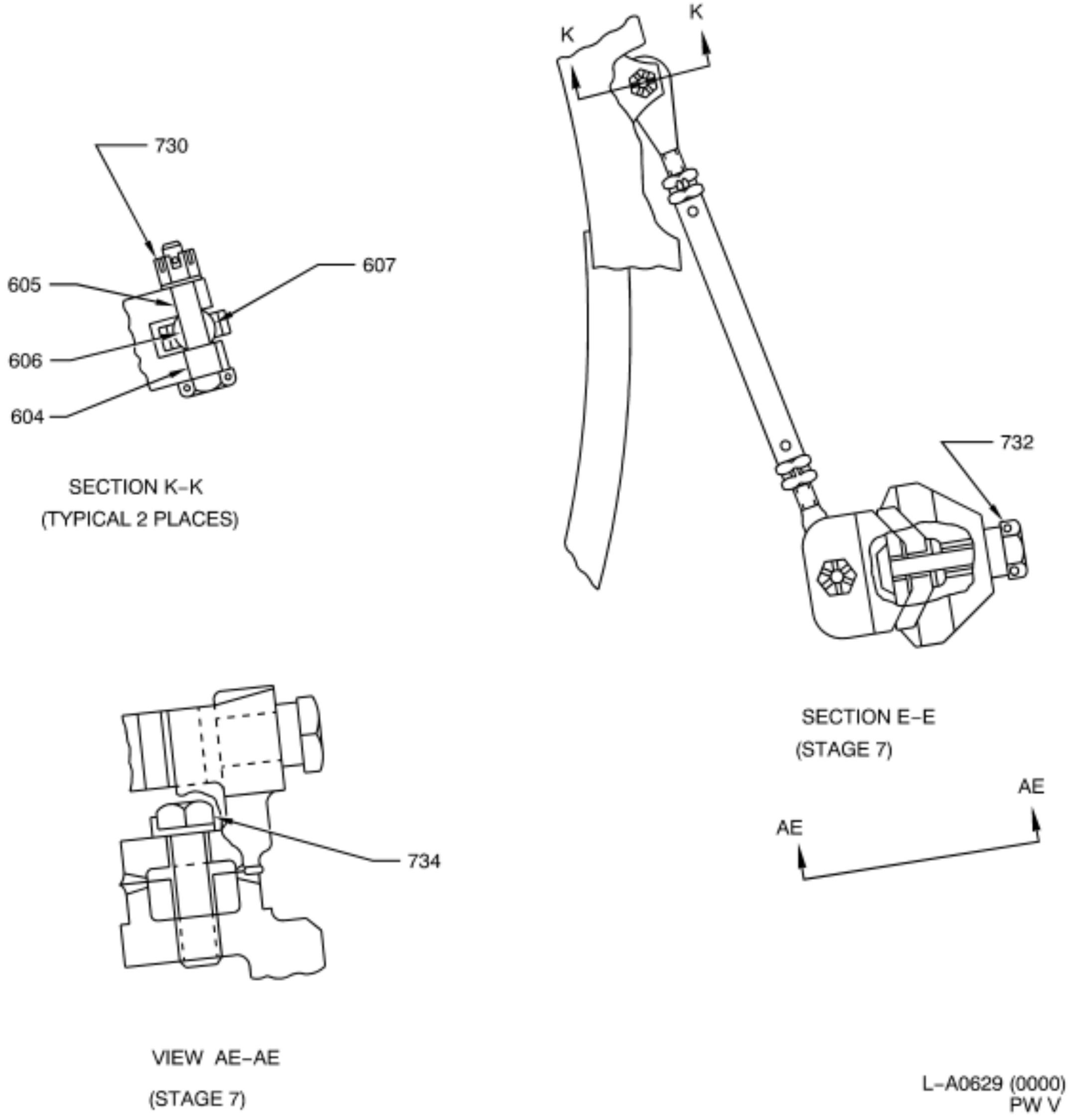
High Pressure Compressor (HPC)
Figure 802 (Sheet 8)
(Task 72−35−00−990−001)


580
581
SECTION T−T
592
593
599
593
592
SECTION U−U
L−A0617 (0000)
PW V

High Pressure Compressor (HPC)
Figure 802 (Sheet 9)
(Task 72−35−00−990−001)

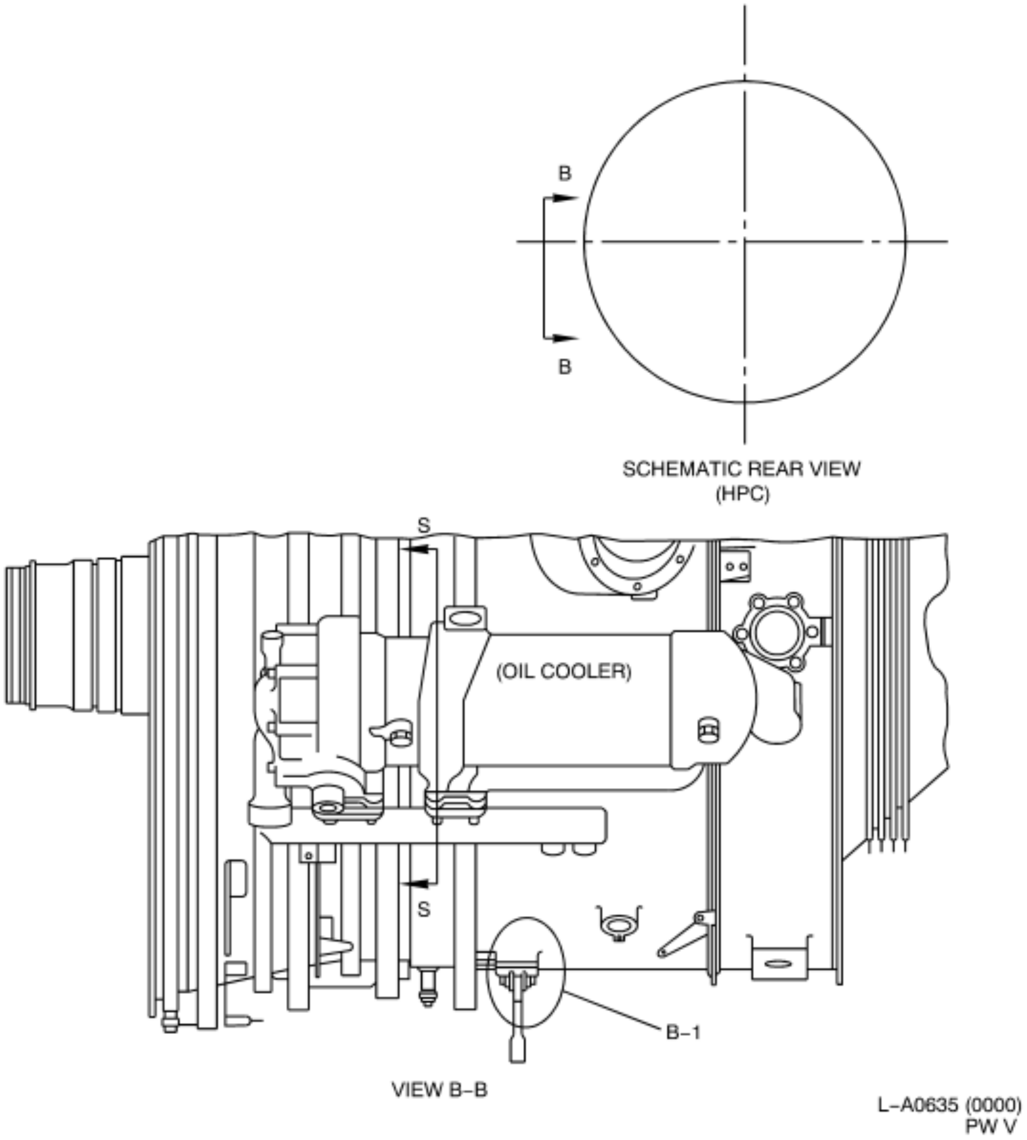

623
591
591
623
590
SECTION V−V
(LATER CONFIGURATION
WITH SLEEVE SPACERS)
601
607
603
600
733
602
SECTION R−R
591
591
590
590
SECTION V−V
L−A0623 (0989)
PW V

High Pressure Compressor (HPC)
Figure 802 (Sheet 10)
(Task 72−35−00−990−001)

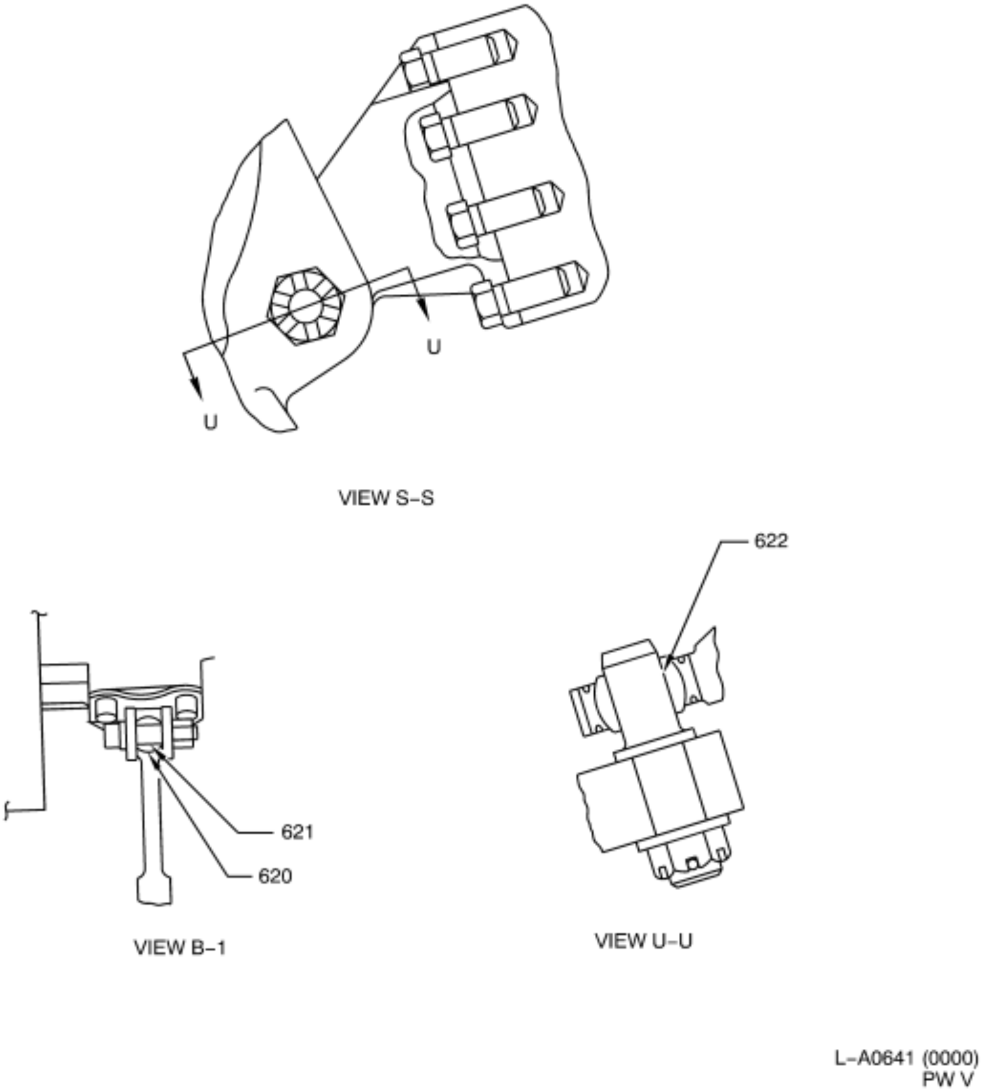

730
607
605
606
604
SECTION K−K
(TYPICAL 2 PLACES)
K
K
732
SECTION E−E
(STAGE 7)
AE
AE
734
VIEW AE−AE
(STAGE 7)
L−A0629 (0000)
PW V

High Pressure Compressor (HPC)
Figure 802 (Sheet 11)
(Task 72−35−00−990−001)

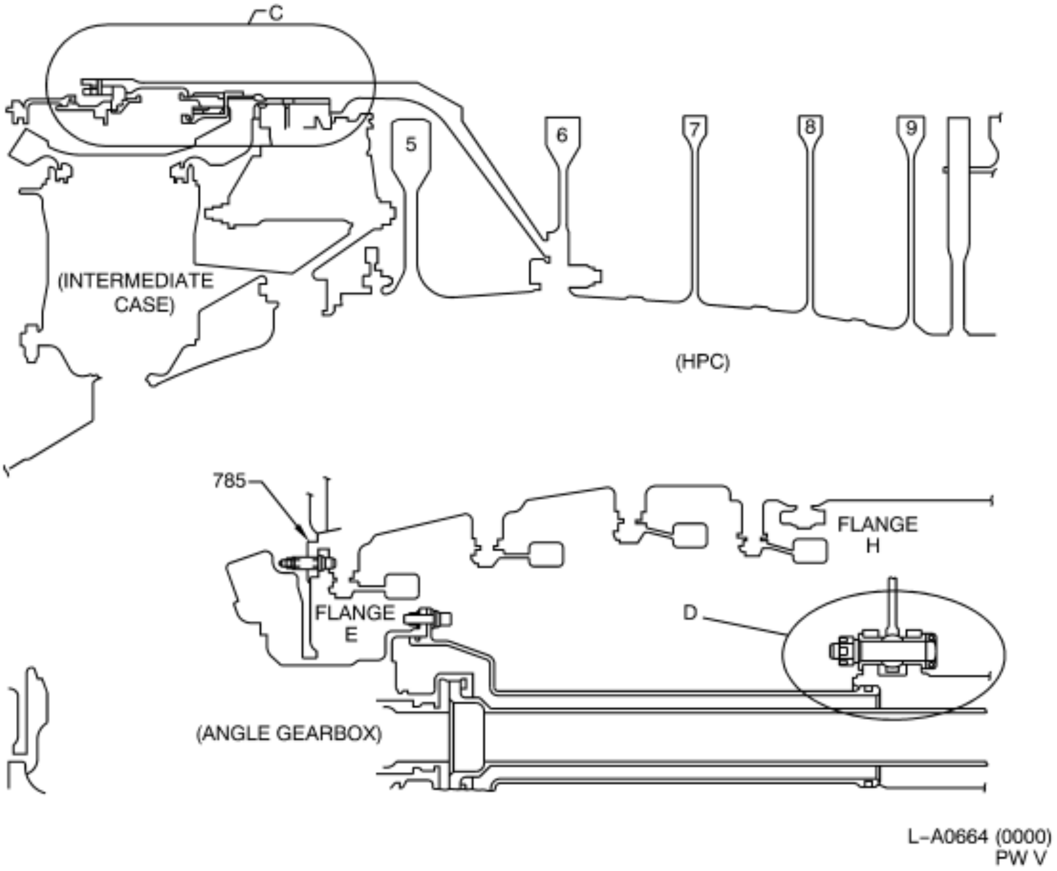
HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04


B
B
SCHEMATIC REAR VIEW
(HPC)
S
(OIL COOLER)
S
B−1
VIEW B−B
L−A0635 (0000)
PW V

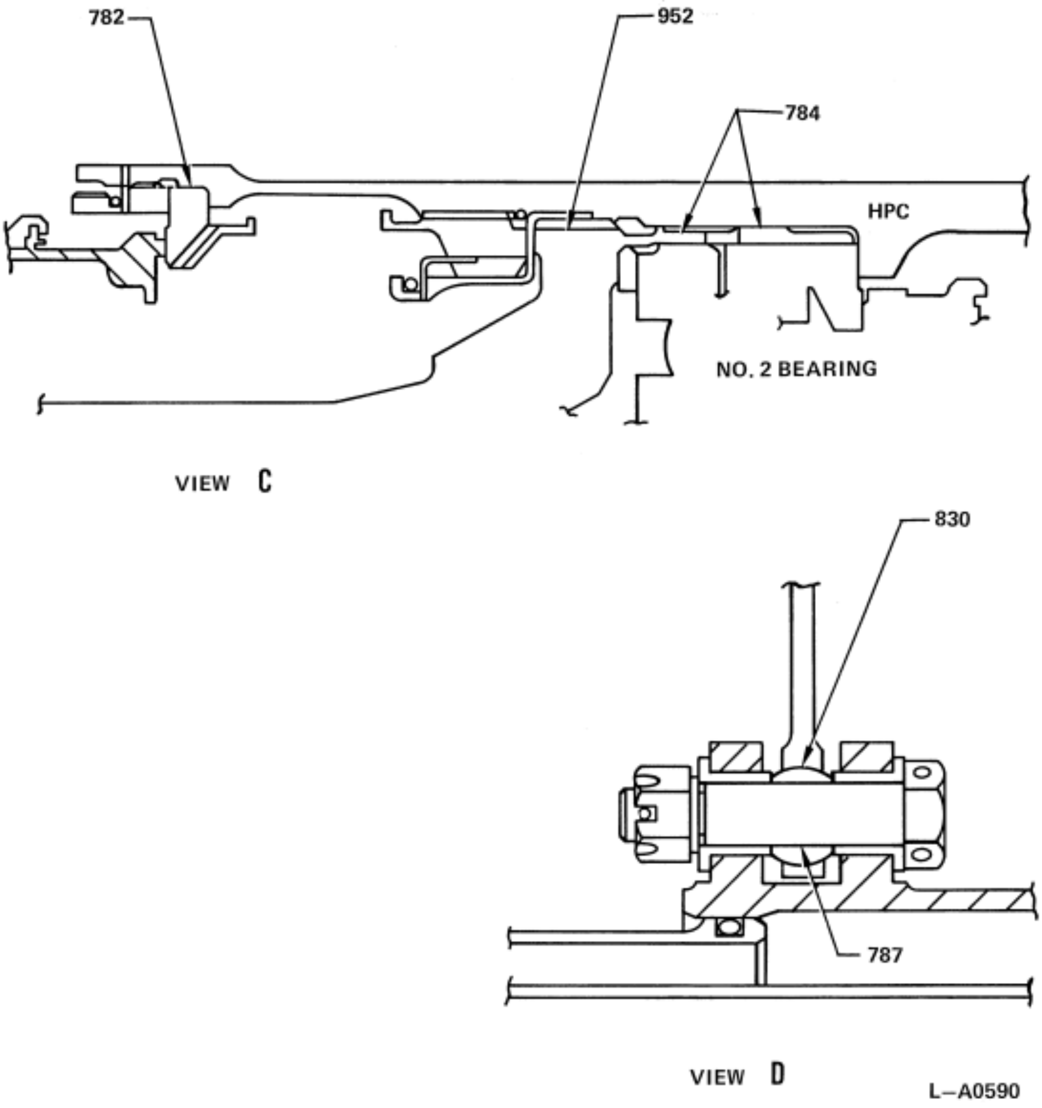
High Pressure Compressor (HPC)
Figure 803 (Sheet 1)
(Task 72−35−00−990−001)


U
U
VIEW S−S
622
621
620
VIEW B−1
VIEW U−U
L−A0641 (0000)
PW V

High Pressure Compressor (HPC)
Figure 803 (Sheet 2)
(Task 72−35−00−990−001)


C
5
6
7
8
9
(INTERMEDIATE CASE)
(HPC)
785
FLANGE H
FLANGE E
D
(ANGLE GEARBOX)
L−A0664 (0000)
PW V

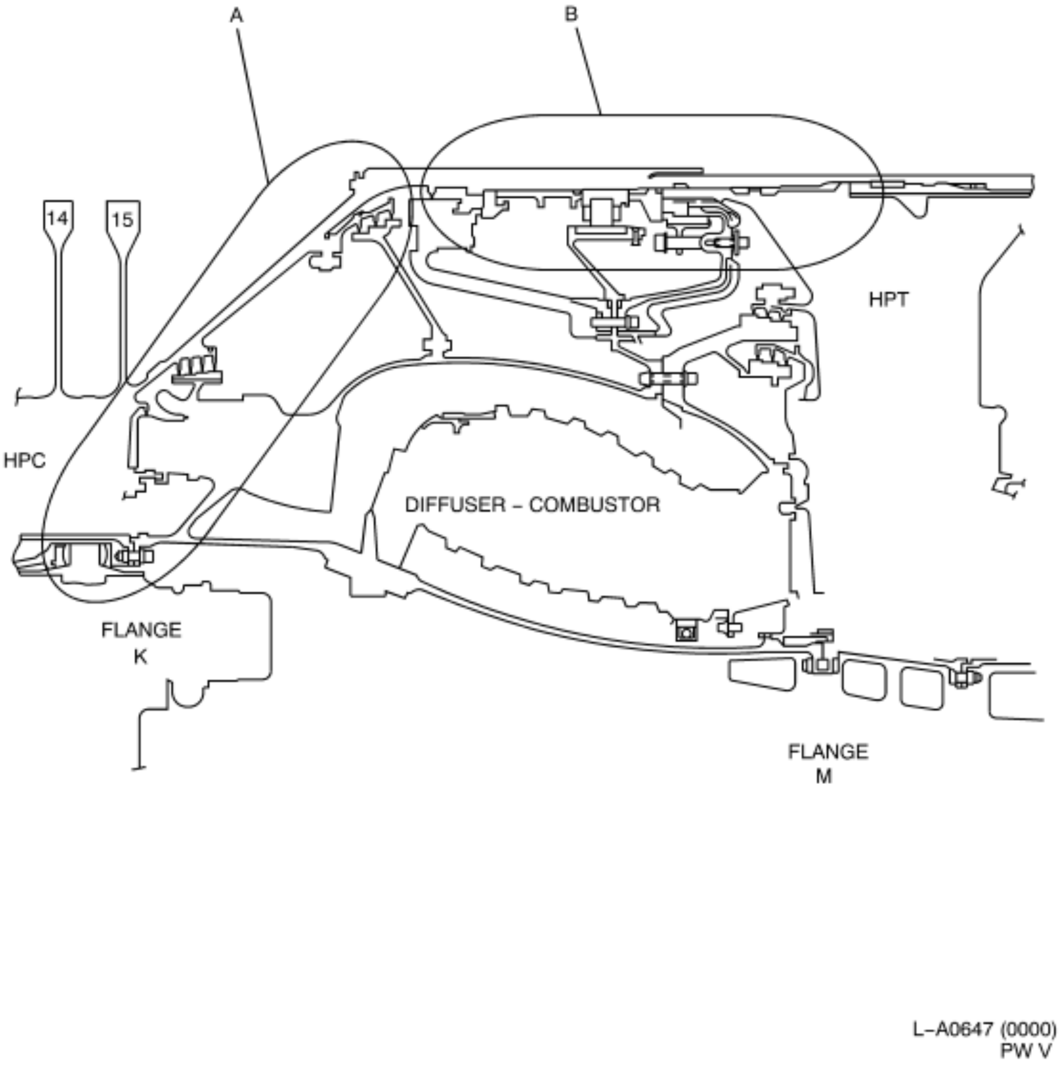
High Pressure Compressor (HPC)
Figure 804 (Sheet 1)
(Task 72−35−00−990−001)


782
952
784
HPC
NO. 2 BEARING
830
787
L−A0590

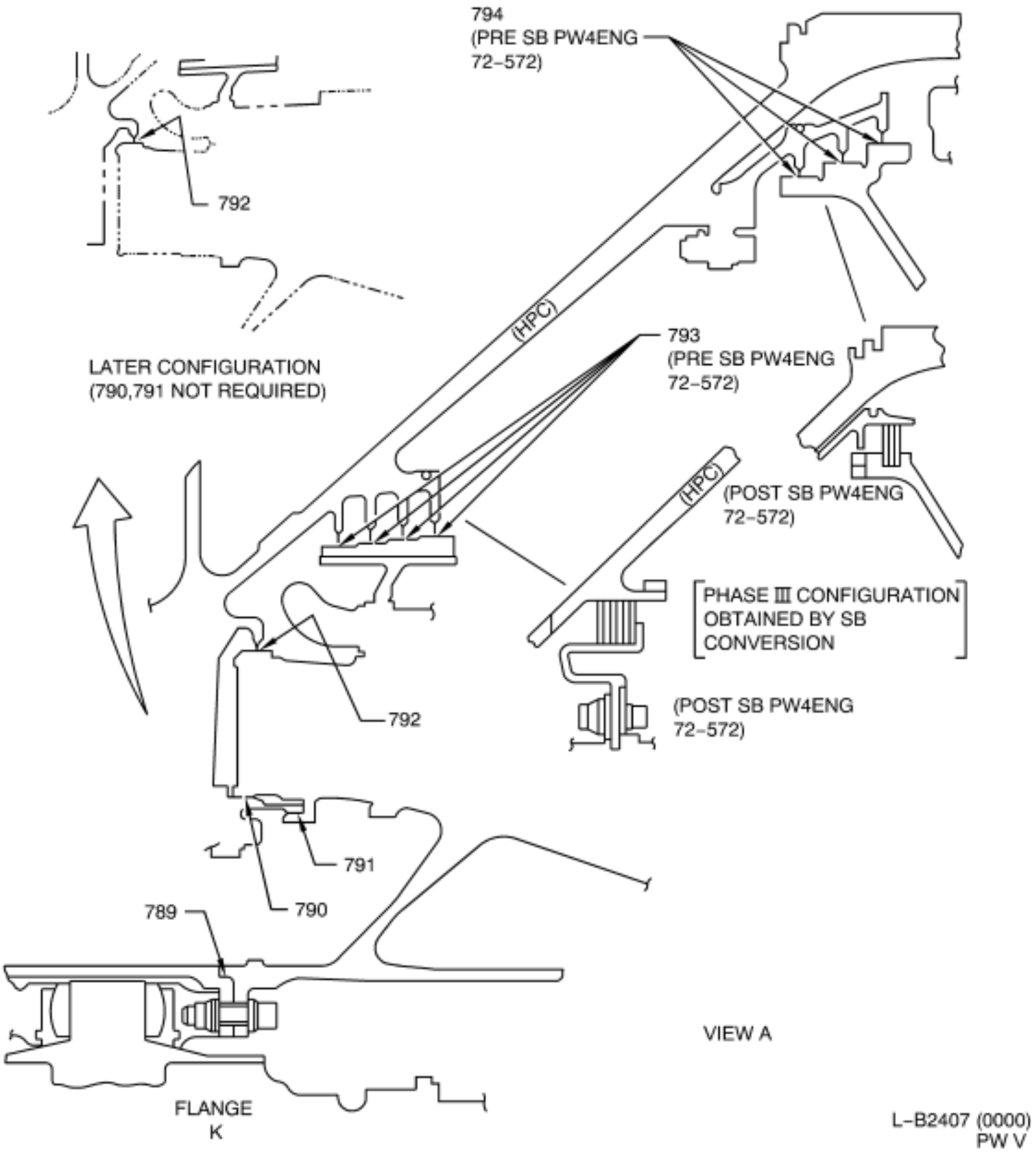
VIEW C

VIEW D

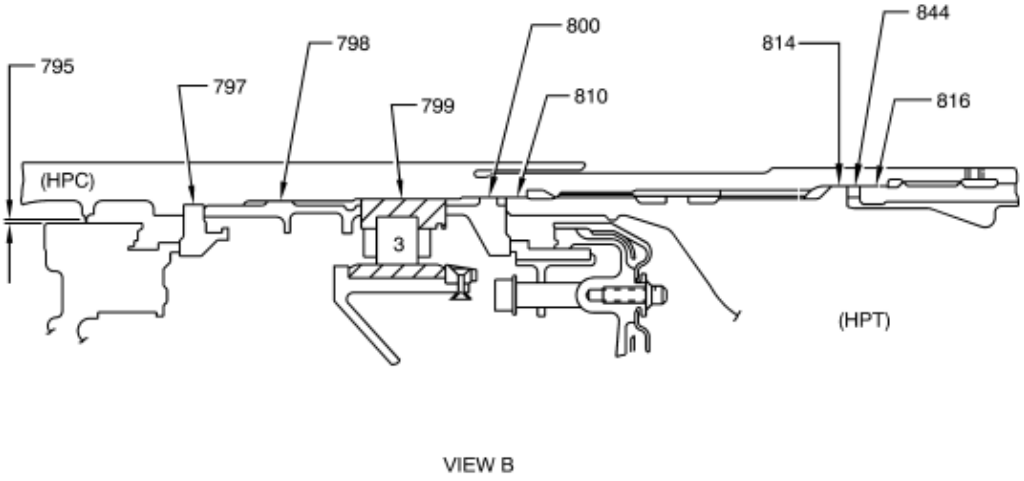
High Pressure Compressor (HPC)
Figure 804 (Sheet 2)
(Task 72−35−00−990−001)


A
B
14
15
HPC
HPT
DIFFUSER − COMBUSTOR
FLANGE
K
FLANGE
M
L−A0647 (0000)
PW V

High Pressure Compressor (HPC)
Figure 805 (Sheet 1)
(Task 72−35−00−990−001)

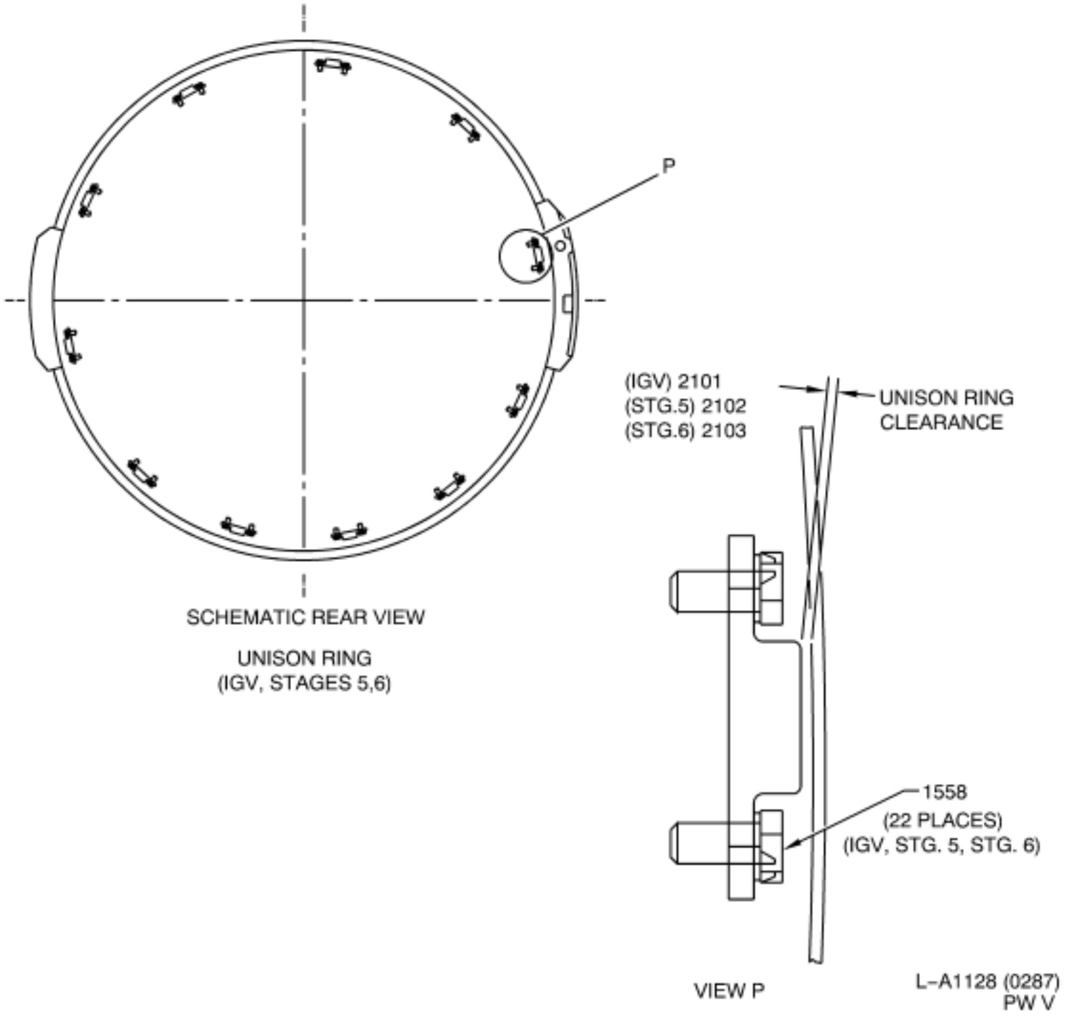

794
(PRE SB PW4ENG
72−572)
792
LATER CONFIGURATION
(790,791 NOT REQUIRED)
(HPC)
793
(PRE SB PW4ENG
72−572)
(HPC)
(POST SB PW4ENG
72−572)
PHASE III CONFIGURATION
OBTAINED BY SB
CONVERSION
792
(POST SB PW4ENG
72−572)
791
790
789
VIEW A
FLANGE
K
L−B2407 (0000)
PW V

High Pressure Compressor (HPC)
Figure 805 (Sheet 2)
(Task 72−35−00−990−001)

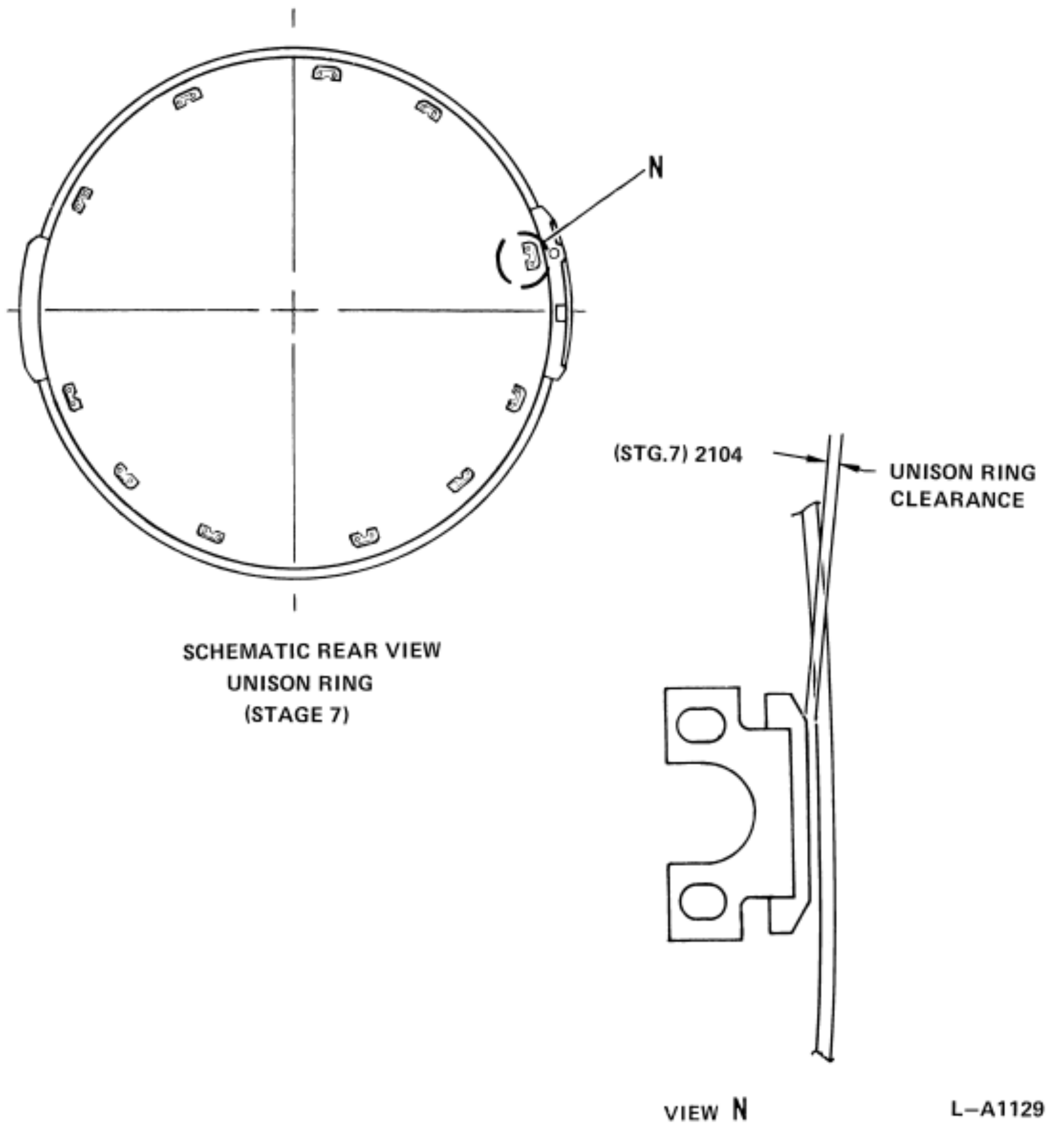

795
797
798
799
800
810
814
844
816
(HPC)
3
(HPT)
VIEW B

L−A0658 (0599)
PW V

High Pressure Compressor (HPC)
Figure 805 (Sheet 3)
(Task 72−35−00−990−001)


P
SCHEMATIC REAR VIEW
UNISON RING
(IGV, STAGES 5,6)
(IGV) 2101
(STG.5) 2102
(STG.6) 2103
UNISON RING
CLEARANCE
1558
(22 PLACES)
(IGV, STG. 5, STG. 6)
VIEW P
L-A1128 (0287)
PW V

High Pressure Compressor (HPC)
Figure 806 (Sheet 1)
(Task 72-35-00-990-001)


N
SCHEMATIC REAR VIEW
UNISON RING
(STAGE 7)
(STG.7) 2104
UNISON RING
CLEARANCE
VIEW N
L-A1129

High Pressure Compressor (HPC)
Figure 806 (Sheet 2)
(Task 72-35-00-990-001)

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04

Task 72−35−00−990−010:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B, C, or D located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.
D	This fit or clearance involves a component for which it is considered necessary to replace the used part with a new part at the time of overhaul in order to restore a wear or sealing surface. It is not required to dimensionally examine this fit if all of the conditions that follow are met: − The used wear, or sealing component has been replaced with a new part. − The mating part(s) have been visually and dimensionally examined as necessary by the applicable PW4000 series CIR, PN 51A375 section(s) for the part(s), and meet the permitted wear, and dimensional requirements on the surface(s) involved in the fit or clearance.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

```
0.517          (−)        0.512      =          .005
(13.131)                  (13.005)              (0.126)

0.527          (−)        0.508      =          .019
(13.385)                  (12.903)              (0.482)
```

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max

(CONTINUED)

less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances
The following General NOTES are applicable to two or more fits and Clearances reference numbers. The applicable reference numbers are included in the NOTES.

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04

NOTE: General NOTE 1: For Reference Nos. 1278 through 1291, you can measure the knife−edge diameter of the fit and not measure the HPC shroud segments (honeycomb) airseal diameters if all of the following conditions are met in the PW4000 Series CIR, PN 51A357.

The measured knife−edge diameter is within the CIR manual Inspection/Check−04 serviceable limits.

Honeycomb trenching (if present) is within the CIR manual Inspection/Check−03 and Inspection/Check−04 serviceable limits.

The 8th through 14th stage inner case diameter components of the fit Reference Nos. 6379, 6380, 6400 through 6410, 6414, 6415 and 6417 are within the CIR manual Inspection/Check−04 serviceable limits.

All vane to the inner case, vane to outer airseal, and vane to the inner airseal contact surface wear (if present) is within the CIR Manual Inspection/Check−03 and Inspection/Check−04 serviceable limits.

You must install new HPC shroud (damper) springs.

HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-04

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
580	C	Plain Self-Aligning Bearing (72-35-79) Compressor Stator Cylinder Support Assembly (72-35-73) (See Figure 802, Sheet 9)				
		Bearing	2.6765 (67.9831)	2.6770 (67.9958)		
		Support	2.6774 (68.0060)	2.6784 (68.0310)	.0004 (0.011)	.0019 (0.048)
581	C	HPC Lever Set (72-35-74) Cylindrical Roller Bearing (72-35-79) (See Figure 802, Sheet 9)				
		Lever	1.7722 (45.0139)	1.7727 (45.0265)		
		Bearing	1.7712 (44.9885)	1.7717 (45.0011)	.0015T (0.038T)	.0005T (0.013T)
582	C	Bolt Stage 6 Rod End Bearing (72-35-78) (See Figure 802, Sheet 5)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Bearing	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
583	C	Bolt Stage 6 Synchronizing Ring Assembly (72-35-53) (See Figure 802, Sheet 5)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Ring	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
584	C	Bolt Inlet HPC Lever (72-35-74) (See Figure 802, Sheet 2)				
		Bolt	.3380 (8.5852)	.3382 (8.5902)		
		Lever	.3374 (8.5700)	.3380 (8.5852)	.0008T (0.0203T)	.0000 (0.0000)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
585	C	Bolt				
		HPC Lever Set (72−35−74)				
		(See Figure 802, Sheet 2)				
		Bolt	.3380	.3382		
			(8.5852)	(8.5902)		
		Lever	.3374	.3380	.0008T	.0000
			(8.5700)	(8.5852)	(0.0203T)	(0.0000)
586	C	HPC Lever Set (72−35−74)				
		Inlet HPC Lever (72−35−74)				
		(See Figure 802, Sheet 2)				
		Lever Set	1.7722	1.7727		
			(45.0139)	(45.0265)		
		Inlet Lever	1.7727	1.7737	.000	.0015
			(45.027)	(45.051)	(0.000)	(0.038)
587	C	Inlet HPC Lever (72−35−74)				
		Bearing (72−35−79)				
		(See Figure 802, Sheet 2)				
		Lever Set	1.7722	1.7727		
			(45.0139)	(45.0265)		
		Bearing	1.7712	1.7717	.0015T	.0005T
			(44.9885)	(45.0011)	(0.038T)	(0.013T)
588	B	Bearing (72−35−79)				
		Compressor Stator Lever Support (72−35−73)				
		(See Figure 802, Sheet 2)				
		Bearing	2.6757	2.6772		
			(67.963)	(68.000)		
		Support	2.6774	2.6789	.0002	.0032
			(68.0060)	(68.044)	(0.006)	(0.081)
589	C	Bolt				
		HPC Synchronizing Ring Clevis Assembly (72−35−55)				
		(See Figure 802, Sheet 5)				
		Bolt	.4345	.4355		
			(11.037)	(11.061)		
		Ring	.437	.438	.0015	.0035
			(11.100)	(11.125)	(0.039)	(0.088)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
590	C	Shoulder Bolt Compressor Stator Cylinder Support Assembly (72−35−73) (See Figure 802, Sheet 10)				
		Bolt	.3595 (9.132)	.3605 (9.156)		
		Support	.3615 (9.183)	.3635 (9.232)	.001 (0.025)	.0105* (0.267)*
591 (1)	B	Shoulder Bolt HPC Front Case Assembly (72−35−40) (See Figure 802, Sheet 10)				
		Bolt	.3595 (9.132)	.3605 (9.156)		
		Case (Pre SB PW4ENG 72−510)	.3745 (9.513)	.3755 (9.537)	.014 (0.356)	.016 (0.406)
591 (2)	B	Shoulder Bolt HPC Front Case Assembly (72−35−40) (See Figure 802, Sheet 10)				
		Bolt	.3595 (9.132)	.3605 (9.156)		
		Case (Post SB PW4ENG 72−510)	.3750 (9.525)	.3765 (9.563)	.0145 (0.368)	.017 (0.432)
592	C	Bolt Cylinder Stop (See Figure 802, Sheet 9)				
		Bolt	.216 (5.487)	.217 (5.511)		
		Stop	.218 (5.538)	.220 (5.588)	.001 (0.026)	.004 (0.101)
593	B	Bearing (72−35−79) Compressor Stator Cylinder Support (72−35−73) (See Figure 802, Sheet 9)				
		Bearing	1.4360 (36.475)	1.4375 (36.512)		
		Support	1.438 (36.526)	1.440 (36.576)	.0005 (0.013)	.004 (0.101)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
599	C	Compressor Cylinder (CMM) Bearing (72−35−79) (See Figure 802, Sheet 9)				
		Cylinder	.7487 (19.0170)	.7490 (19.0246)		
		Bearing	.7495 (19.0373)	.7500 (19.0500)	.0005 (0.0127)	.0013 (0.0330)
600	C	Bolt HPC Lever Set (72−35−74) (See Figure 802, Sheet 10)				
		Bolt	.497 (12.624)	.498 (12.649)		
		Lever	.4995 (12.688)	.5005 (12.712)	.0015 (0.039)	.0035 (0.088)
601	C	Bolt HPC Lever Set (72−35−74) (See Figure 802, Sheet 10)				
		Bolt	.3739 (9.4971)	.3744 (9.5097)		
		Lever	.3745 (9.513)	.3755 (9.537)	.0001 (0.003)	.0016 (0.040)
602	C	Bolt Rod End Bearing Assembly (72−35−78) (See Figure 802, Sheet 10)				
		Bolt	.3739 (9.4971)	.3744 (9.5097)		
		Bearing	.3745 (9.5123)	.3750 (9.5250)	.0001 (0.103)	.0011 (0.027)
603	C	Bearing (72−35−78) Rod End (72−35−78) (See Figure 802, Sheet 10)				
		Bearing	.8120 (20.6248)	.8125 (20.6375)		
		Rod	.8123 (20.6325)	.8128 (20.6451)	.0002T (0.0051T)	.0008 (0.0203)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
604	C	Bolt HPC Synchronizing Ring Clevis Assembly (72-35-55) (See Figure 802, Sheets 4 And 11)				
		Bolt	.4345 (11.037)	.4355 (11.061)		
		Ring	.437 (11.100)	.438 (11.125)	.0015 (0.039)	.0035 (0.088)
605	C	Bolt HPC Synchronizing Ring Clevis Assembly (72-35-55) (See (See Figure 802, Sheets 4 And 11)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Ring	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
606	C	Bolt Stage 5 And 7 Rod End Bearing (72-35-78) (See (See Figure 802, Sheets 4 And 11)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Bearing	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
607	A	Radial Clearance (See Figure 802, Sheets 3, 4, 5, And 11) Rod End				
		Spherical Bearing (72-35-78)			.000	
609	C	Bolt HPC Clevis (72-35-76) (See Figure 802, Sheet 4)				
		Bolt	.4345 (11.037)	.4355 (11.061)		
		Clevis	.437 (11.100)	.438 (11.125)	.0015 (0.039)	.0035 (0.088)

HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-04

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
610	C	Bolt Rod End Bearing (72-35-78) (See Figure 802, Sheet 4)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Bearing	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
611	C	Bolt HPC Clevis (72-35-76) (See Figure 802, Sheet 4)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Clevis	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
612	C	Bolt HPC Synchronizing Ring Clevis Assembly (72-35-55) (See Figure 802, Sheet 3)				
		Bolt	.4345 (11.037)	.4355 (11.061)		
		Ring	.437 (11.100)	.438 (11.125)	.0015 (0.039)	.0035 (0.088)
613	C	Bolt Rod End Bearing (72-35-78) (See Figure 802, Sheet 3)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Bearing	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
614	C	Bolt HPC Synchronizing Ring Clevis Assembly (72-35-55) (See Figure 802, Sheet 3)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Ring	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
616	C	Bolt Support Mounting Brace (See Figure 802, Sheet 8)				
		Bolt	.3685 (9.360)	.3695 (9.385)		
		Brace	.3745 (9.513)	.3755 (9.537)	.005 (0.127)	.007 (0.177)
617 (1)	B	Bolt HPC Front Case Assembly (72-35-40) (See Figure 802, Sheet 8)				
		Bolt	.3685 (9.360)	.3695 (9.385)		
		Case (Pre SB PW4ENG 72-510)	.3745 (9.513)	.3755 (9.537)	.005 (0.127)	.007 (0.177)
617 (2)	B	Bolt HPC Front Case Assembly (72-35-40) (See Figure 802, Sheet 8)				
		Bolt	.3685 (9.360)	.3695 (9.385)		
		Case (Post SB PW4ENG 72-510)	.3750 (9.525)	.3765 (9.563)	.0055 (0.140)	.008 (0.203)
619	C	Pin (72-35-40) Compressor Stator Cylinder Support Bracket (See Figure 802, Sheet 7)				
		Pin	.3740 (9.4996)	.3741 (9.5021)		
		Bracket	.376 (9.551)	.377 (9.575)	.0019 (0.049)	.0030 (0.076)
620	B	Gearbox Drive Shaft Housing Support Link Bearing (72-35-94) Gearbox Drive Shaft Housing Support Link (72-35-72) (See Figure 803, Sheet 2)				
		Bearing	.6865 (17.438)	.6875 (17.462)		
		Link	.6885 (17.488)	.6895 (17.513)	.001 (0.026)	.003 (0.076)

Ref. No.	IFR	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
621	B	Gearbox Drive Shaft Housing Support Clevis - Shoulder Bolt Gearbox Drive Shaft Housing Support Link Bearing (72-35-94) (See Figure 803, Sheet 2)				
		Clevis	.3732 (9.4793)	.3737 (9.4919)		
		Bearing	.3742 (9.5047)	.3747 (9.5173)	.0005 (0.013)	.0015 (0.038)
622	B	Pin Oil Cooler Front Bracket Bearing (See Figure 803, Sheet 2)				
		Pin	.6245 (15.8623)	.6250 (15.8750)		
		Bearing	.6255 (15.888)	.6265 (15.913)	.0005 (0.013)	.002 (0.050)
623	C	Spacer (72-35-73) Compressor Stator Cylinder Support Assembly (PN 53H036-01) (72-35-73) (See Figure 802, Sheet 10)				
		Spacer	.497 (12.624)	.498 (12.649)		
		Support	.499 (12.675)	.501 (12.725)	.001 (0.026)	.004 (0.101)
782 (1)	B	HPC Front Hub (72-35-05) (PN 50H570 Prior To Change Letter J/ PN 51H572 Prior To Change Letter E) No. 2 Bearing Front Seal Seat (72-35-90) (See Figure 804, Sheet 2)				
		Hub	6.550 (166.370)	6.551 (166.395)		
		Seat	6.552 (166.421)	6.554 (166.471)	.001 (0.026)	.004 (0.101)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
782	B	HPC Front Hub (72-35-05)				
(2)		(PN 50H470 Change Letter J And Subsequent/				
		PN 51H572 Change Letter E And Subsequent)				
		No. 2 Bearing Front Seal Seat				
		(72-35-90)				
		(See Figure 804, Sheet 2)				
		Hub	6.549	6.551		
			(166.345)	(166.395)		
		Seat	6.552	6.554	.001	.005
			(166.421)	(166.471)	(0.026)	(0.127)
784	A	HPC Front Hub (72-35-05)				
		Gearbox Drive Bevel Gear (72-34-12)				
		(See Figure 804, Sheet 2)				
		Hub	7.305	7.306		
			(185.547)	(185.572)		
		Gear	7.301	7.302	.003T	.005T
			(185.446)	(185.470)	(0.077T)	(0.127T)
785	B	Intermediate Case Assembly (72-34-01)				
		HPC Front Case Assembly (72-35-40)				
		(See Figure 804, Sheet 1)				
		Intd. Case	34.574	34.578		
			(878.180)	(878.281)		
		HPC Case	34.568	34.572	.002T	.010T
			(878.028)	(878.128)	(0.051T)	(0.254T)
787	B	Shoulder Bolt (72-61-83)				
		Gearbox Drive Shaft Housing Support				
		Link Bearing (72-35-94)				
		(See Figure 804, Sheet 2)				
		Bolt	.6232	.6237		
			(15.8293)	(15.8419)		
		Bearing	.6242	.6247	.0005	.0015
			(15.8547)	(15.8673)	(0.013)	(0.038)
789	B	Diffuser Case Assembly (72-41-01)				
		HPC (Outer) Rear Case Assembly				
		(72-35-69)				
		(See Figure 805, Sheet 2)				
		Diffuser Case	32.248	32.252		
			(819.100)	(819.200)		
		HPC Case	32.234	32.238	.018T	.010T
			(818.744)	(818.845)	(0.457T)	(0.254T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
790	B	Compressor Exit Stator Assembly (72-41-02) HPC Exit Guide Vane Support (72-35-70) (See Figure 805, Sheet 2)				
		Stator	27.378 (695.402)	27.382 (695.502)		
		Stiffener	27.383 (695.529)	27.387 (695.629)	.001 (0.025)	.009 (0.229)
791	B	HPC Exit Guide Vane Support (72-35-70) Compressor Exit Stator Assembly (72-41-02) (See Figure 805, Sheet 2)				
		Stiffener	27.780 (705.612)	27.784 (705.713)		
		Stator	27.788 (705.816)	27.792 (705.916)	.004 (0.102)	.012 (0.305)
792	A	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) Compressor Exit Stator Assembly (72-41-02) (See Figure 805, Sheet 2)				
		HPC Rotor	23.409 (594.59)	23.421 (594.89)		
		Stator	23.441 (595.401)	23.447 (595.554)	.020 (0.51)	.048* (1.22)*
793	A	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) Stage 15 HPC Air Sealing Ring Assembly (72-41-03) (Pre SB PW4ENG 72-572) (See Figure 805, Sheet 2)				
		Radial Gap, Cold			.011 (0.279)	.024* (0.610)*
794	A	Diffuser Airseal (72-35-32) Diffuser Air Sealing Ring Assembly (72-41-05) (See Figure 805, Sheet 2)				
		Radial Gap, Cold			.011 (0.279)	.024* (0.610)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
795	A	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Bearing Front Cooling Duct Assembly (72-41-06) (See Figure 805, Sheet 3)				
		HPC Rotor	7.986 (202.84)	7.998 (203.15)		
		Duct	8.098 (205.690)	8.102 (205.790)	.100 (2.54)	.126* (3.20)*
797	B	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Bearing Front Seal Seat (72-41-80) (See Figure 805, Sheet 3)				
		HPC Rotor	7.229 (183.617)	7.231 (183.667)		
		Seal Seat	7.232 (183.693)	7.234 (183.743)	.001 (0.026)	.005 (0.127)
798	B	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Bearing Seal Spacer (72-41-81) (See Figure 805, Sheet 3)				
		HPC Rotor	7.209 (183.109)	7.211 (183.159)		
		Spacer	7.212 (183.185)	7.214 (183.235)	.001 (0.026)	.005 (0.127)
799 (1)	A	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Roller Bearing (72-41-82) (See Figure 805, Sheet 3)				
		HPC Rotor	7.2076 (183.0731)	7.2080 (183.0832)		
		Bearing (Pre SB PW4ENG 72-611)	7.2040 (182.9816)	7.2047 (182.9993)	.004T (0.101T)	.0029T (0.074T)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
799 (2)	A	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72−35−08) No. 3 Roller Bearing (72−41−82) (See Figure 805, Sheet 3)				
		HPC Rotor	7.2076 (183.0731)	7.2080 (183.0832)		
		Bearing (Post SB PW4ENG 72−611)	7.2060 (182.9816)	7.2067 (182.9993)	.002T (0.051T)	.0009T (0.023T)
800	B	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72−35−08) No. 3 Bearing Rear Seal Seat (72−41−84) (See Figure 805, Sheet 3)				
		HPC Rotor	7.1455 (181.496)	7.1465 (181.521)		
		Seal Seat	7.1475 (181.547)	7.1505 (181.622)	.001 (0.026)	.005 (0.127)
810	B	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72−35−08) Turbine Front Hub (Stage 1) (72−52−05) (See Figure 805, Sheet 3)				
		HPC Hub	7.1455 (181.496)	7.1465 (181.521)		
		HPT Hub	7.1335 (181.191)	7.1355 (181.241)	.010T (0.254T)	.013T (0.330T)
814	B	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72−35−08) Turbine Intermediate Hub (Stage 2) (72−52−06) (See Figure 805, Sheet 3)				
		HPC Hub	6.5947 (167.506)	6.5957 (167.530)		
		HPT Hub	6.5827 (167.201)	6.5847 (167.251)	.007T* (0.178T)*	.013T (0.330T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
816	B	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72−35−08) No. 3 Bearing (And HPT) Retaining Nut (72−52−80) (See Figure 805, Sheet 3)				
		Hub	6.5947 (167.506)	6.5957 (167.530)		
		Nut	6.5967 (167.557)	6.5987 (167.606)	.001 (0.025)	.0052* (0.132)*
830	B	Spherical Bearing (72−35−94) Gearbox Drive Shaft Housing Support Link (72−35−72) (See Figure 804, Sheet 2)				
		Bearing	.9675 (24.575)	.9685 (24.599)		
		Link	.9695 (24.626)	.9705 (24.650)	.001 (0.025)	.003 (0.076)
844	B	HPC Drum Rotor Disk (Rear Hub) Assembly (72−35−08) Turbine Shaft Spacer (72−52−83) (See Figure 805, Sheet 3)				
		Disk (Hub	6.5947 (167.506)	6.5957 (167.530)		
		Spacer	6.5967 (167.557)	6.5987 (167.606)	.001 (0.026)	.0052* (0.132)*
1270	A	HPC Inlet Airseal (Front Knife−Edge) (72−35−31) HPC Inlet, Shroud Segment Assembly (72−35−41) (See Figure 801, Sheet 15)				
		Airseal	19.843 (504.01)	19.857 (504.37)		
		Shroud	19.878 (504.90)	19.894 (505.31)	.021 (0.533)	.061* (1.549)*

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1271 (1)	A	HPC Inlet Airseal (Rear Knife-Edge) (72-35-31) HPC Inlet, Shroud Segment Assembly (72-35-41) (See Figure 801, Sheet 15)				
		Airseal	19.943 (506.55)	19.957 (506.91)		
		Shroud	19.978 (507.44)	19.994 (507.85)	.021 (0.533)	.061* (1.549)*
1271 (2)	A	Stage 5 HPC Disk (IGV Rear Knife-Edge Airseal) (72-35-06) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (Asymmetric Case Configuration) (72-35-57) (See Figure 801, Sheet 15)				
		Airseal	19.943 (506.55)	19.957 (506.91)		
		Guide	19.976 (507.390)	19.984 (507.594)	.019 (0.483)	.051* (1.295)*
1272 (1)	A	Stage 5 HPC Disk (Front Knife-Edge) Airseal (72-35-06) Stage 5 HPC Shroud Segment Assembly (72-35-42) (See Figure 801, Sheet 15)				
		Airseal	20.273 (514.93)	20.287 (515.29)		
		Shroud	20.298 (515.57)	20.314 (515.98)	.011 (0.279)	.051* (1.295)*
1272 (2)	A	Stage 5 HPC Disk (Front Knife-Edge) Airseal (72-35-06) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (Asymmetric Case Configuration) (72-35-57) (See Figure 801, Sheet 15)				
		Airseal	20.273 (514.93)	20.287 (515.29)		
		Guide	20.306 (515.772)	20.314 (515.976)	.019 (0.483)	.051* (1.295)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1273 (1)	A	Stage 5 HPC Disk (Rear Knife-Edge) Airseal (72-35-06) Stage 5 HPC Shroud Segment Assembly (72-35-42) See Figure 801, Sheet 15)				
		Airseal	20.173 (512.39)	20.187 (512.75)		
		Shroud	20.198 (513.03)	20.214 (513.44)	.011 (0.279)	.051* (1.295)*
1273 (2)	A	Stage 5 HPC Disk (Rear Knife-Edge) Airseal (72-35-06) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) Asymmetric Case Configuration) (72-35-57) (See Figure 801, Sheet 15)				
		Airseal	20.173 (512.39)	20.187 (512.75)		
		Guide	20.206 (513.232)	20.214 (513.436)	.019 (0.483)	.051* (1.295)*
1274 (1)	A	Drum Rotor (Stage 6 Front Knife-Edge) Airseal (72-35-07) Stage 6 HPC Shroud Segment Assembly (72-35-43) (See Figure 801, Sheet 15)				
		Airseal	20.584 (522.83)	20.598 (523.19)		
		Shroud	20.608 (523.44)	20.624 (523.85)	.010 (0.254)	.050* (1.270)*
1274 (2)	A	Drum Rotor (Stage 6 Front Knife-Edge) Airseal (72-35-07) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) Asymmetric Case Configuration) (72-35-57) (See Figure 801, Sheet 15)				
		Airseal	20.584 (522.83)	20.598 (523.19)		
		Guide	20.617 (523.672)	20.625 (523.875)	.019 (0.483)	.051* (1.295)*

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1275 (1)	A	Drum Rotor (Stage 6 Rear Knife-Edge) Airseal (72-35-07) Stage 6 HPC Shroud Segment Assembly (72-35-43) (See Figure 801, Sheet 15)				
		Airseal	20.704 (525.88)	20.718 (526.24)		
		Shroud	20.728 (526.49)	20.744 (526.90)	.010 (0.254)	.050* (1.270)*
1275 (2)	A	Drum Rotor (Stage 6 Rear Knife-Edge) Airseal (72-35-07) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) Asymmetric Case Configuration) (72-35-57) (See Figure 801, Sheet 15)				
		Airseal	20.704 (525.88)	20.718 (526.24)		
		Guide	20.737 (526.720)	20.745 (526.923)	.019 (0.483)	.051* (1.295)*
1276 (1)	A	Drum Rotor (Stage 7 Front Knife-Edge) Airseal (72-35-07) Stage 7 HPC Shroud Segment Assembly (72-35-44) (See Figure 801, Sheet 15)				
		Airseal	21.132 (536.75)	21.146 (537.11)		
		Shroud	21.188 (538.18)	21.204 (538.58)	.042 (1.067)	.082* (2.083)*
1276 (2)	A	Drum Rotor (Stage 7 Front Knife-Edge) Airseal (72-35-07) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) Asymmetric Case Configuration) (72-35-57) (See Figure 801, Sheet 15)				
		Airseal	21.132 (536.75)	21.146 (537.11)		
		Guide	21.165 (537.591)	21.173 (537.794)	.019 (0.483)	.051* (1.295)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1277 (1)	A	Drum Rotor (Stage 7 Rear Knife-Edge) Airseal (72-35-07) Stage 7 HPC Shroud Segment Assembly (72-35-44) (See Figure 801, Sheet 15)				
		Airseal	21.252 (539.80)	21.266 (540.16)		
		Shroud	21.308 (541.22)	21.324 (541.63)	.042 (1.067)	.082* (2.083)*
1277 (2)	A	Drum Rotor (Stage 7 Rear Knife-Edge) A irseal) (72-35-07) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) Asymmetric Case Configuration) (72-35-57) (See Figure 801, Sheet 15)				
		Airseal	21.252 (539.80)	21.266 (540.16)		
		Guide	21.285 (540.639)	21.293 (540.842)	.019 (0.483)	.051* (1.295)*
1278	A	Drum Rotor (Stage 8 Front Knife-Edge) Airseal (72-35-07) Stage 8 HPC Shroud Segment Assembly Assembly (72-35-58) (See Figure 801, Sheet 15)				
		Airseal	22.124 (561.95)	22.138 (562.31)		
		Shroud	22.165 (562.99)	22.215 (564.26)	.027 (0.686)	.101* (2.565)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1279	A	Drum Rotor (Stage 8 Rear Knife-Edge) Airseal (72-35-07) Stage 8 HPC Shroud Segment Assembly (72-35-58) (See Figure 801, Sheet 15)				
		Airseal	22.224 (564.49)	22.238 (564.85)		
		Shroud	22.265 (565.53)	22.315 (566.80)	.027 (0.686)	.101* (2.565)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
(CONTINUED)						
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1280	A	Drum Rotor (Stage 9 Front Knife−Edge) Airseal (72−35−07) Stage 9 Compressor Stator Segment (72−35−25) (See Figure 801, Sheet 15)				
		Airseal	22.938 (582.63)	22.952 (582.981)		
		Stator	22.957 (583.11)	22.991 (583.97)	.005 (0.127)	.063* (1.600)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1281	A	Drum Rotor (Stage 9 Rear Knife−Edge) Airseal (72−35−07) Stage 9 Compressor Stator Segment (72−35−25) (See Figure 801, Sheet 15)				
		Airseal	22.938 (582.63)	22.952 (582.981)		
		Stator	22.957 (583.11)	22.991 (583.97)	.005 (0.127)	.063* (1.600)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1282 (1)	A	Drum Rotor (Stage 10 Front Knife−Edge) Airseal (72−35−07) (Pre SB PW4ENG 72−758) Stage 10 HPC Shroud Segment Assembly (72−35−58) (See Figure 801, Sheet 15)				
		Airseal	23.183 (588.85)	23.197 (589.204)		
		Shroud	23.188 (588.98)	23.236 (590.19)	.009 (0.229)	.063* (1.600)*
		See General NOTE 1 before Reference Number 580. Fit				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)		calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1282 (2)	A	Drum Rotor (Stage 10 Front Knife-Edge) Air Seal (72-35-07) (Post SB PW4ENG 72-758) Stage 10 HPC Shroud Segment Assembly (72-35-58) (See Figure 801, Sheet 15)				
		Air Seal	23.157 (588.19)	23.171 (588.54)		
		Shroud	23.188 (588.98)	23.236 (590.19)	.017 (0.432)	.089* (2.261)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1283 (1)	A	Drum Rotor (Stage 10 Rear Knife-Edge) Airseal (72-35-07) (Pre SB PW4ENG 72-758) Stage 10 HPC Shroud Segment Assembly (72-35-58) (See Figure 801, Sheet 15)				
		Airseal	23.283 (591.39)	23.297 (591.74)		
		Shroud	23.302 (591.87)	23.350 (593.09)	.005 (0.127)	.077* (1.956)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1283 (2)	A	Drum Rotor (Stage 10 Rear Knife-Edge) Air Seal (72-35-07) (Post SB PW4ENG 72-758) Stage 10 HPC Shroud Segment Assembly (72-35-58) (See Figure 801, Sheet 15)				
		Airseal	23.257 (590.73)	23.271 (591.08)		
		Shroud	23.302 (591.87)	23.350 (593.09)	.031 (0.787)	.103* (2.616)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)						
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1284 (1)	A	Drum Rotor (Stage 11 Front Knife-Edge) Airseal (72-35-07) (Pre SB PW4ENG 72-758) Stage 11 HPC Shroud Segment Assembly (72-35-58) (See Figure 801, Sheet 15)				
		Airseal	23.186 (588.92)	23.200 (589.28)		
		Shroud	23.198 (589.23)	23.246 (590.45)	.002T (0.051T)	.070* (1.778)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1284 (2)	A	Drum Rotor (Stage 11 Front Knife-Edge) Airseal (72-35-07) (Post SB PW4ENG 72-758) Stage 11 HPC Shroud Segment Assembly Assembly (72-35-58) (See Figure 801, Sheet 15)				
		Airseal	23.166 (588.42)	23.180 (588.77)		
		Shroud	23.198 (589.23)	23.246 (590.45)	.018 (0.457)	.090* (2.286)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1285 (1)	A	Drum Rotor (Stage 11 Rear Knife-Edge) Airseal (72-35-07) (Pre SB PW4ENG 72-758) Stage 11 HPC Shroud Segment Assembly (72-35-58) (See Figure 801, Sheet 15)				
		Airseal	23.286 (591.46)	23.300 (591.82)		
		Shroud	23.298 (591.77)	23.346 (592.99)	.002T (0.051T)	.070* (1.778)*

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)						
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1285 (2)	A	Drum Rotor (Stage 11 Rear Knife-Edge) Air Seal (72-35-07) (Post SB PW4ENG 72-758) Stage 11 HPC Shroud Segment Assembly (72-35-58) (See Figure 801, Sheet 15)				
		Air seal	23.266 (590.96)	23.280 (591.31)		
		Shroud	23.298 (591.77)	23.346 (592.99)	.018 (0.457)	.090* (2.286)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1286	A	Drum Rotor (Stage 12 Front Knife-Edge) Airseal (72-35-08) Stage 12 HPC Shroud Segment Assembly (72-35-58) (See Figure 801, Sheet 15)				
		Airseal	23.167 (588.44)	23.181 (588.80)		
		Shroud	23.199 (589.25)	23.247 (590.47)	.018 (0.457)	.090* (2.286)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1287	A	Drum Rotor (Stage 12 Rear Knife-Edge) Airseal (72-35-08) Stage 12 HPC Shroud Segment Assembly (72-35-58) (See Figure 801, Sheet 15)				
		Airseal	23.267 (590.98)	23.281 (591.34)		
		Shroud	23.299 (591.79)	23.347 (593.01)	.018 (0.457)	.090* (2.286)*
		See General NOTE 1 before Reference Number 580. Fit				

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Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)		calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1288	A	Drum Rotor (Stage 13 Front Knife−Edge) Airseal (72−35−08) Stage 13 HPC Shroud Segment Assembly (72−35−58) (See Figure 801, Sheet 15)				
		Airseal	23.149 (587.98)	23.163 (588.34)		
		Shroud	23.191 (589.05)	23.239 (590.27)	.028 (0.711)	.100* (2.540)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1289	A	Drum Rotor (Stage 13 Rear Knife−Edge) Airseal (72−35−08) Stage 13 HPC Shroud Segment Assembly (72−35−58) (See Figure 801, Sheet 15)				
		Airseal	23.249 (590.52)	23.263 (590.88)		
		Shroud	23.291 (591.59)	23.339 (592.81)	.028 (0.711)	.100* (2.540)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1290	A	Drum Rotor (Stage 14 Front Knife−Edge) Airseal (72−35−08) Stage 14 HPC Shroud Segment Assembly (72−35−58) (See Figure 801, Sheet 15)				
		Airseal	23.138 (587.71)	23.152 (588.06)		
		Shroud	23.180 (588.77)	23.228 (589.99)	.028 (0.711)	.100* (2.540)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1291	A	Drum Rotor (Stage 14 Rear Knife−Edge) Airseal (72−35−08) Stage 14 HPC Shroud Segment Assembly (72−35−58) (See Figure 801, Sheet 15)				
		Airseal	23.238 (590.25)	23.252 (590.60)		
		Shroud	23.280 (591.31)	23.328 (592.53)	.028 (0.711)	.100* (2.540)*

See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.

Ref. No.	IFR	Description	Average Clearance At Assembly Min	Average Clearance At Assembly Max	Local Limits At Assembly Min	Local Limits At Assembly Max
1320	A	Stage 5 HPC Blade Tip Clearance (See Figure 801, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1321	A	Stage 6 HPC Blade Tip Clearance (See Figure 801, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1322	A	Stage 7 HPC Blade Tip Clearance (See Figure 801, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1323	A	Stage 8 HPC Blade Tip Clearance (See Figure 801, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1324	A	Stage 9 HPC Blade Tip Clearance (See Figure 801, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				

Ref. No.	IFR	Description	Average Clearance At Assembly Min	Average Clearance At Assembly Max	Local Limits At Assembly Min	Local Limits At Assembly Max
1325	A	Stage 10 HPC Blade Tip Clearance (See Figure 801, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1326	A	Stage 11 HPC Blade Tip Clearance (See Figure 801, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1327	A	Stage 12 HPC Blade Tip Clearance (See Figure 801, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1328	A	Stage 13 HPC Blade Tip Clearance (See Figure 801, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1329	A	Stage 14 HPC Blade Tip Clearance (See Figure 801, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1330	A	Stage 1 5 HPC Blade Tip Clearance (See Figure 801, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1350 (1)	D	HPC Shroud Front Segment Assembly (72−35−41) Vane Inner Trunnion Sleeve Bearing (72−35−45) (Pre SB PW4ENG 72−776) (See Figure 801, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.250 (6.350)	.252 (6.400)	.0015 (0.039)	.005 (0.127)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1350	D	HPC Shroud Front Segment Assembly (72-35-41)				
(2)		Vane Inner Trunnion Sleeve Bearing (72-35-45)				
		(Post SB PW4ENG 72-776)				
		(See Figure 801, Sheet 3)				
		Vane	.2470	.2485		
			(6.274)	(6.311)		
		Bearing	.251	.253	.0025	.006
			(6.376)	(6.426)	(0.064)	(0.152)
1351	D	Stage 5 HPC Shroud (Front) Segment Assembly (72-35-42)				
(1)		Vane Inner Trunnion Sleeve Bearing (72-35-45)				
		(Pre SB PW4ENG 72-776)				
		(See Figure 801, Sheet 3)				
		Vane	.2470	.2485		
			(6.274)	(6.311)		
		Bearing	.250	.252	.0015	.005
			(6.350)	(6.400)	(0.039)	(0.127)
1351	D	Stage 5 HPC Shroud (Front) Segment Assembly (72-35-42)				
(2)		Vane Inner Trunnion Sleeve Bearing (72-35-45)				
		(Post SB PW4ENG 72-776)				
		(See Figure 801, Sheet 3)				
		Vane	.2470	.2485		
			(6.274)	(6.311)		
		Bearing	.251	.253	.0025	.006
			(6.376)	(6.426)	(0.064)	(0.152)
1352	D	Stage 6 HPC Shroud (Front) Segment Assembly (72-35-43)				
(1)		Vane Inner Trunnion Sleeve Bearing (72-35-45)				
		(Pre SB PW4ENG 72-776)				
		(See Figure 801, Sheet 3)				
		Vane	.2470	.2485		
			(6.274)	(6.311)		
		Bearing	.250	.252	.0015	.005
			(6.350)	(6.400)	(0.039)	(0.127)
1352	D	Stage 6 HPC Shroud (Front) Segment Assembly (72-35-43)				
(2)		Vane Inner Trunnion Sleeve Bearing (72-35-45)				
		(Post SB PW4ENG 72-776)				
		(See Figure 801, Sheet 3)				
		Vane	.2470	.2485		
			(6.274)	(6.311)		
		Bearing	.251	.253	.0025	.006
			(6.376)	(6.426)	(0.064)	(0.152)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1353 (1)	D	Stage 7 HPC Shroud (Front) Segment Assembly (72-35-44) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) (See Figure 801, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.250 (6.350)	.252 (6.400)	.0015 (0.039)	.005 (0.127)
1353 (2)	D	Stage 7 HPC Shroud (Front) Segment Assembly (72-35-44) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) (See Figure 801, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.251 (6.376)	.253 (6.426)	.0025 (0.064)	.006 (0.152)
1354 (1)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) HPC Inlet Shroud (Rear) Segment Assembly (72-35-41) (PN 51H470-01, prior to Change Letter D) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.495 (12.573)	.005 (0.127)	.013 (0.330)
1354 (2)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) HPC Inlet Shroud (Rear) Segment Assembly (72-35-41) (PN 51H470-01, Change Letter D and subsequent) (See Figure 801, Sheet 3)				
		Bearing	.480 (12.192)	.484 (12.293)		
		Segment	.490 (12.446)	.496 (12.598)	.006 (0.15)	.016 (0.41)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1354 (3)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) HPC Inlet Shroud (Rear) Segment Assembly (72-35-41) (PN 51H470-01, Change Letter D and subsequent) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.490 (12.446)	.496 (12.598)	.004 (0.102)	.014 (0.356)
1355 (1)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) Stage 5 HPC Shroud (Rear) Segment Assembly (72-35-42) (PN 51H385-01, prior to Change Letter F) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.495 (12.573)	.005 (0.127)	.013 (0.330)
1355 (2)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) Stage 5 HPC Shroud (Rear) Segment Assembly (72-35-42) (PN 51H385-01, Change Letter F and subsequent) (See Figure 801, Sheet 3)				
		Bearing	.480 (12.192)	.484 (12.293)		
		Segment	.491 (12.472)	.496 (12.598)	.007 (0.178)	.016 (0.406)
1355 (3)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) Stage 5 HPC Shroud (Rear) Segment Assembly (72-35-42) (PN 51H385-01, Change Letter F and subsequent) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.496 (12.598)	.005 (0.127)	.014 (0.356)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1356 (1)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) Stage 6 HPC Shroud (Rear) Segment Assembly (72-35-43) (PN 51H586-01, prior to Change Letter E) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.495 (12.573)	.005 (0.127)	.013 (0.330)
1356 (2)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) Stage 6 HPC Shroud (Rear) Segment Assembly (72-35-43) (PN 51H586-01, Change Letter E and subsequent) (See Figure 801, Sheet 3)				
		Bearing	.480 (12.192)	.484 (12.293)		
		Segment	.491 (12.472)	.496 (12.598)	.007 (0.178)	.016 (0.406)
1356 (3)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) Stage 6 HPC Shroud (Rear) Segment Assembly (72-35-43) (PN 51H586-01, Change Letter E and subsequent) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.496 (12.598)	.005 (0.127)	.014 (0.356)
1357 (1)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) Stage 7 HPC Shroud (Rear) Segment Assembly (72-35-44) (PN 51H387-01, prior to Change Letter E) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.495 (12.573)	.005 (0.127)	.013 (0.330)

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Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1357 (2)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) Stage 7 HPC Shroud (Rear) Segment Assembly (72-35-44) (PN 51H387-01, Change Letter E and subsequent) (See Figure 801, Sheet 3)				
		Bearing	.480 (12.192)	.484 (12.293)		
		Segment	.491 (12.472)	.496 (12.598)	.007 (0.178)	.016 (0.41)
1357 (3)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) Stage 7 HPC Shroud (Rear) Segment Assembly (72-35-44) (PN 51H387-01, Change Letter E and subsequent) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.496 (12.598)	.005 (0.127)	.014 (0.356)
1358	B	HPC Inlet Shroud (Rear) Segment Assembly (72-35-41) HPC Inlet Shroud (Front) Segment Assembly (72-35-41) (See Figure 801, Sheet 3)				
		Rear Segment	20.438 (519.126)	20.442 (519.226)		
		Front Segment	20.444 (519.278)	20.448 (519.379)	.002 (0.051)	.010 (0.254)
1359	B	Stage 5 HPC Shroud (Rear) Segment Assembly (72-35-42) Stage 5 HPC Shroud (Front) Segment Assembly (72-35-42) (See Figure 801, Sheet 3)				
		Rear Segment	20.798 (528.270)	20.802 (528.370)		
		Front Segment	20.804 (528.422)	20.808 (528.523)	.002 (0.051)	.010 (0.254)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1360	B	Stage 6 HPC Shroud (Rear) Segment Assembly (72-35-43) Stage 6 HPC Shroud (Front) Segment Assembly (72-35-43) (See Figure 801, Sheet 3)				
		Rear Segment	21.268 (540.208)	21.272 (540.308)		
		Front Segment	21.274 (540.360)	21.278 (540.461)	.002 (0.051)	.010 (0.254)
1361 (1)	B	Stage 7 HPC Shroud (Rear) Segment Assembly (72-35-44) (PN 51H487 Shroud Set) Stage 7 HPC Shroud (Front) Segment Assembly (72-35-44) (PN 51H487 Shroud Set) (See Figure 801, Sheet 3)				
		Rear Segment	21.632 (549.453)	21.636 (549.554)		
		Front Segment	21.638 (549.606)	21.642 (549.706)	.002 (0.051)	.010 (0.254)
1361 (2)	B	Stage 7 HPC Shroud (Rear) Segment Assembly (72-35-44) (PN 51H387-01 Shroud Set) Stage 7 HPC Shroud (Front) Segment Assembly (72-35-44) (PN 51H387-01 Shroud Set) (See Figure 801, Sheet 3)				
		Rear Segment	21.694 (551.028)	21.698 (551.129)		
		Front Segment	21.700 (551.180)	21.704 (551.281)	.002 (0.051)	.010 (0.254)
1375	B	Drum Rotor (Stages 6 Through 12) Disk Assembly (72-35-07) Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) (See Figure 801, Sheet 10)				
		Disk	21.657 (550.088)	21.661 (550.189)		
		Hub	21.662 (550.215)	21.666 (550.316)	.009T (0.229T)	.000T* (0.000T)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1376	B	Stage 5 HPC Disk (72−35−06) Drum Rotor (Stages 6 Through 12) Disk Assembly (72−35−07) (See Figure 801, Sheet 2)				
		Disk (Stg. 5)	19.525 (495.935)	19.527 (495.985)		
		Disk (Stgs. 6 − 12)	19.518 (495.758)	19.522 (495.858)	.009T (0.229T)	.003T (0.076T)
1377	B	Drum Rotor (Stages 6 Through 12) Disk Assembly (72−35−07) HPC Front Hub (72−35−05) (See Figure 801, Sheet 2)				
		Disk	16.097 (408.864)	16.101 (408.965)		
		Hub	16.094 (408.788)	16.096 (408.838)	.007T (0.178T)	.001T (0.025T)
1378	B	HPC Inlet Airseal (72−35−31) Stage 5 HPC Disk (72−35−06) (See Figure 801, Sheet 2)				
		Airseal	18.027 (457.886)	18.029 (457.936)		
		Disk	18.019 (457.683)	18.021 (457.733)	.010T (0.254T)	.006T (0.153T)
1389	B	Diffuser Airseal (72−35−32) Drum Rotor (Stage 13, 14 And 15) Disk (Rear Hub) Assembly (72−35−08) (See Figure 801, Sheet 13) (Pre SB PW4ENG 72−572)				
		Airseal	10.999 (279.375)	11.001 (279.425)		
		Hub	10.988 (279.096)	10.992 (279.196)	.013T (0.330T)	.005T* (0.127T)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1390	B	No. 3 Bearing (Inner Rear Hub) Heat Shield (72-35-36) Drum Rotor (Stage 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) (See Figure 801, Sheet 13)				
		Heat Shield	6.223 (158.065)	6.225 (158.115)		
		Hub	6.219 (157.963)	6.221 (158.013)	.009T* (0.229T)*	.000* (0.000)*
1391 (1)	B	No. 3 Bearing (Inner Rear Hub) Heat Shield (72-35-36) PN 50H100 - Prior To Letter Change "H" Drum Rotor (Stage 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) (See Figure 801, Sheet 13)				
		Heat Shield (Average Diameter)	6.176 (156.871)	6.180 (156.972)		
		Hub	6.159 (156.439)	6.161 (156.489)	.005* (0.127)*	.027* (0.659)*
1391 (2)	B	No. 3 Bearing (Inner Rear Hub) Heat Shield (72-35-36) PN 50H100 - Letter Change "H" And Subsequent Drum Rotor (Stage 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) (See Figure 801, Sheet 13)				
		Heat Shield (Diameter At Three Points)	6.176 (156.871)	6.180 (156.972)		
		Hub	6.159 (156.439)	6.161 (156.489)	.031T* (0.787T)*	.013T* (0.330T)*
1397 (1)	B	Pin - Shoulder Headless (72-35-41/42/43) (PN 596020) HPC Inlet/Stage 5/Stage 6 - Shroud (Rear) Segment Assembly (PN 51H270/51H285/51H486 Shroud Sets) (72-35-41/42/43) (See Figure 801, Sheet 5)				
		Pin	0.18725 (4.7562)	0.18775 (4.7688)		

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
(CONTINUED)						
		Shroud (Rear)	0.18665 (4.7410)	0.18725 (4.7561)	.0011T (0.027T)	.0000 (0.000)
1397 (2)	B	Pin - Shoulder Headless (72-35-41/42/43/44) (PN 51H134) HPC Inlet/Stage 5/Stage 6/Stage 7 - Shroud (Rear) Segment Assembly (PN 51H470-01/51H385-01/51H586-01/51H387-01 Shroud Sets) (72-35-41/42/43/44) (See Figure 801, Sheet 5)				
		Pin	0.1870 (4.7498)	0.1871 (4.7523)		
		Shroud (Rear)	0.186 (4.725)	0.187 (4.749)	.0011T (0.028T)	.0000 (0.000)
1398 (1)	B	Pin - Shoulder, Headless (72-35-41/42/43) (PN 596020) HPC Inlet/Stage 5/Stage 6 - Shroud (Front) Segment Assembly (PN 51H270/51H285/51H486 Shroud Sets) (72-35-41/42/43) (See Figure 801, Sheet 5)				
		Pin	0.18725 (4.7562)	0.18775 (4.7688)		
		Shroud (Forward)	0.18665 (4.7410)	0.18725 (4.7561)	.0011T (0.028T)	.0000 (0.000)
1398 (2)	B	Pin - Shoulder, Headless (72-35-41/42/43/44) (PN 51H134) HPC Inlet/Stage 5/Stage 6/Stage 7 - Shroud (Front) Segment Assembly (PN 51H470-01/51H385-01/51H586-01/51H387-01 Shroud Sets) (72-35-41/42/43/44) (See Figure 801, Sheet 5)				
		Pin	0.1870 (4.7498)	0.1871 (4.7523)		
		Shroud (Forward)	0.1885 (4.788)	0.1895 (4.813)	.0014 (0.036)	.0025 (0.064)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1399	B	Pin - Shoulder (72-35-44) Stage 7 HPC Shroud (Front) Segment Assembly (72-35-44) (See Figure 801, Sheet 5)				
		Pin	.2492 (6.3297)	.2493 (6.3322)		
		Shroud (Forward)	.2510 (6.376)	.2520 (6.400)	.0017 (0.043)	.0028 (0.071)
1400	B	Pin - Shoulder (72-35-44) Stage 7 HPC Shroud (Rear) Segment Assembly (72-35-44) (See Figure 801, Sheet 5)				
		Pin	.2492 (6.3297)	.2493 (6.3322)		
		Shoulder (rear)	.2482 (6.305)	.2492 (6.329)	.0011T (0.028T)	.0000 (0.000)
1414	B	Diffuser Airseal (72-35-32) Drum Rotor (Stage 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) (See Figure 801, Sheet 13) (Post SB PW4ENG 72-572)				
		Airseal	10.999 (279.375)	11.001 (279.425)		
		Hub	10.988 (279.096)	10.992 (279.196)	.013T (0.330T)	.007T (0.178T)
1417	B	Bushing HPC Front Case Assy (72-35-40) See 72-35-40, Repair-05 (Task 72-35-40-300-005) (See Figure 801, Sheet 6)				
		NOTE: Select fit of			.0005 (0.013)	.0015T (0.038T)
1418	B	Bushing HPC Front Case Assy (72-35-40) See 72-35-40, Repair-05 (Task 72-35-40-300-005) (See Figure 801, Sheet 6)				
		NOTE: Select fit of			.0005 (0.013)	.0015T (0.038T)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1419	B	Bushing HPC Front Case Assy (72-35-40) See 72-35-40, Repair-05 (Task 72-35-40-300-005) (See Figure 801, Sheet 6)				
		NOTE: Select fit of			.0005 (0.013)	.0015T (0.038T)
2350	B	Bushing HPC Front Case Assy (72-35-40) See 72-35-40, Repair-05 (Task 72-35-40-300-005) (See Figure 801, Sheet 6)				
		NOTE: Select fit of			.0005 (0.013)	.0015T (0.038T)
6378	A	HPC (Outer) Rear Case Assembly (72-35-69) HPC Rear Support (72-35-67) (See Figure 801, Sheet 14)				
		Rear Case	30.096 (764.439)	30.098 (764.489)		
		Support	30.074 (763.880)	30.078 (763.981)	.018T (0.457T)	.024T (0.610T)
6379	A	Stage 15 Compressor Air Seal (72-35-23) HPC Rear Support (72-35-67) (See Figure 801, Sheet 14)				
		Air Seal	27.709 (703.809)	27.713 (703.910)		
		Support	27.686 (703.225)	27.690 (703.326)	.019T (0.483T)	.027T (0.686T)
6380	A	Stage 15 Compressor Air Seal (72-35-23) Stage 14 Compressor Case Assembly (72-35-89) (See Figure 801, Sheet 14)				
		Air Seal	27.775 (705.485)	27.779 (705.586)		
		Case	27.753 (704.927)	27.757 (705.027)	.018T (0.457T)	.026T (0.660T)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
6381	A	Stage 8 Compressor Air Seal (72-35-23) HPC (Outer) Rear Case Assembly (72-35-69) (See Figure 801, Sheet 8)				
		Air Seal	31.990 (812.546)	31.994 (812.647)		
		Case	31.968 (811.988)	31.972 (812.088)	.018T (0.457T)	.026T (0.660T)
6382	A	Stage 8 Compressor Air Seal (72-35-23) HPC Front Case (72-35-40) (See Figure 801, Sheet 8)				
		Air Seal	31.986 (812.445)	31.990 (812.546)		
		Case	31.968 (811.988)	31.972 (812.088)	.014T (0.356T)	.022T (0.559T)
6400	A	Stage 8 Compressor Air Seal (72-35-23) Stage 8 Compressor Case (72-35-83) (See Figure 801, Sheet 8)				
		Air Seal	29.694 (754.228)	29.698 (754.329)		
		Case	29.684 (753.974)	29.688 (754.075)	.006T (0.152T)	.014T (0.356T)
6401	A	Stage 9 Compressor Air Seal (72-35-23) Stage 8 Compressor Case (72-35-83) (See Figure 801, Sheet 8)				
		Air Seal	29.419 (747.243)	29.423 (747.344)		
		Case	29.401 (746.786)	29.405 (746.887)	.014T (0.356T)	.022T (0.559T)
6402	A	Stage 9 Compressor Air Seal (72-35-23) Stage 8 Compressor Case (72-35-83) (See Figure 801, Sheet 8)				
		Air Seal	29.471 (748.564)	29.475 (748.665)		
		Case	29.451 (748.056)	29.455 (748.157)	.016T (0.406T)	.024T (0.610T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
6403	A	Stage 9 Compressor Air Seal (72-35-23) Stage 9 Case Assembly (72-35-84) (See Figure 801, Sheet 8)				
		Air Seal	29.257 (743.128)	29.261 (743.229)		
		Case	29.239 (742.671)	29.243 (742.772)	.014T (0.356T)	.022T (0.559T)
6404	A	Stage 10 Compressor Air Seal (72-35-23) Stage 9 Case Assembly (72-35-84) (See Figure 801, Sheet 11)				
		Air Seal	29.002 (736.651)	29.006 (736.752)		
		Case	28.978 (736.042)	28.982 (736.142)	.020T (0.508T)	.028T (0.711T)
6405	A	Stage 10 Compressor Air Seal (72-35-23) Stage 10 Compressor Case Assembly (72-35-85) (See Figure 801, Sheet 11)				
		Air Seal	28.870 (733.298)	28.874 (733.399)		
		Case	28.846 (732.689)	28.850 (732.790)	.020T (0.508T)	.028T (0.711T)
6406	A	Stage 11 Compressor Air Seal (72-35-23) Stage 10 Compressor Case Assembly (72-35-85) (See Figure 801, Sheet 11)				
		Air Seal	28.643 (727.533)	28.647 (727.633)		
		Case	28.619 (726.923)	28.623 (727.024)	.020T (0.508T)	.028T (0.711T)
6407	A	Stage 11 Compressor Air Seal (72-35-23) Stage 11 Compressor Case Assembly (72-35-86) (See Figure 801, Sheet 11)				
		Air Seal	28.504 (724.002)	28.508 (724.103)		
		Case	28.494 (723.748)	28.498 (723.849)	.006T (0.152T)	.014T (0.356T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
6408	A	Stage 12 Compressor Air Seal (72-35-23) Stage 11 Compressor Case Assembly (72-35-86) (See Figure 801, Sheet 11)				
		Air Seal	28.329 (719.557)	28.333 (719.658)		
		Case	28.311 (719.100)	28.315 (719.201)	.014T (0.356T)	.022T (0.559T)
6409	A	Stage 12 Compressor Air Seal (72-35-23) Stage 12 Compressor Case Assembly (72-35-87) (See Figure 801, Sheet 11)				
		Air Seal	28.194 (716.128)	28.198 (716.229)		
		Case	28.172 (715.569)	28.176 (715.670)	.018T (0.457T)	.026T (0.660T)
6410	A	Stage 13 Compressor Air Seal (72-35-23) Stage 12 Compressor Case Assembly (72-35-87) (See Figure 801, Sheet 11)				
		Air Seal	27.962 (710.235)	27.966 (710.336)		
		Case	27.940 (709.676)	27.944 (709.777)	.018T (0.457T)	.026T (0.660T)
6414	A	Stage 13 Compressor Air Seal (72-35-23) Stage 13 Compressor Case Assembly (72-35-88) (See Figure 801, Sheet 11)				
		Air Seal	27.877 (708.076)	27.881 (708.177)		
		Case	27.855 (707.517)	27.859 (707.618)	.018T (0.457T)	.026T (0.660T)
6415	A	Stage 14 Compressor Air Seal (72-35-23) Stage 13 Compressor Case Assembly (72-35-88) (See Figure 801, Sheet 11)				
		Air Seal	27.850 (707.390)	27.854 (707.491)		
		Case	27.828 (706.832)	27.832 (706.932)	.018T (0.457T)	.026T (0.660T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
6417	A	Stage 14 Compressor Air Seal (72−35−23) Stage 14 Compressor Case Assembly (72−35−89) (See Figure 801, Sheet 11)				
		Air Seal	27.802 (706.171)	27.806 (706.272)		
		Case	27.780 (705.612)	27.784 (705.713)	.018T (0.457T)	.026T (0.660T)

G. Hub, Disk, Shaft, Airseal Limits

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1420	A	HPC Front Hub See 5−10−00, Time Limits (See Figure 801, Sheet 2)				
1421	A	Stage 5 HPC Disk See 5−10−00, Time Limits (See Figure 801, Sheet 2)				
1422	A	Stage 6 HPC Disk See 5−10−00, Time Limits (See Figure 801, Sheet 2)				
1423	A	Stage 7 HPC Disk See 5−10−00, Time Limits (See Figure 801, Sheet 2)				
1424	A	Stage 8 HPC Disk See 5−10−00, Time Limits (See Figure 801, Sheet 7)				
1425	A	Stage 9 HPC Disk See 5−10−00, Time Limits (See Figure 801, Sheet 7)				
1426	A	Stage 10 HPC Disk See 5−10−00, Time Limits (See (See Figure 801, Sheet 7)				
1427	A	Stage 11 HPC Disk See 5−10−00, Time Limits (See Figure 801, Sheet 10)				

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1428	A	Stage 12 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 10)				
1429	A	Stage 13 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 10)				
1430	A	Stage 14 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 13)				
1431	A	Stage 15 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 13)				
1432	A	HPC Driveshaft See 5-10-00, Time Limits (See Figure 801, Sheet 13)				
1433	A	Drum Rotor (Stages 6 Through 12) Disk Assembly See 5-10-00, Time Limits (See Figure 801, Sheet 7)				
1434	A	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly See 5-10-00, Time Limits (See Figure 801, Sheet 10)				
1435	A	HPC Inlet Airseal See 5-10-00, Time Limits (See Figure 801, Sheet 2)				
1436	A	Diffuser Airseal See 5-10-00, Time Limits (See Figure 801, Sheet 13)				

H. Spline Data

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
952	B	1. Gearbox Drive Bevel Gear (72-34-12) Internal Spline (See Figure 804, Sheet 2)				
		A. Effective Space Width	.0491 (1.247)	---		
		B. Actual Space Width	---	.0555 (1.410)		
		2. HPC Front Hub (72-35-05) External Spline (See Figure 804, Sheet 2)				
		A. Effective Tooth Thickness	---	.0476 (1.209)		
		B. Actual Tooth Thickness	.0412 (1.046)	---		
		3. Fit			.0015 (0.038)	---

I. Special Torques

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
730	A	Nut, Variable Stator Clevis Retaining (See Figure 802, Sheets 3, 4, 5, And 11) See 72-35-00, Assembly-03 (Task 72-35-00-400-003) See 72-35-03, Assembly-01 (Task 72-35-03-440-001)				
731	A	Nut, Bellcrank Spacer Clevis Retaining (See Figure 802, Sheet 3) See 72-35-03, Assembly-01 (Task 72-35-03-440-001)				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
732	A	Nut, Bellcrank Spacer Clevis Retaining (See Figure 802, Sheets 5 And 11) See 72−35−03, Assembly−01 (Task 72−35−03−440−001)				
733	A	Nut, Actuating Cylinder Retaining (See Figure 802, Sheet 10) See 72−35−00, Assembly−03 (Task 72−35−00−400−003)				
734	A	Bolt, Stage 7 HPC Lever (See Figure 802, Sheet 11) See 72−35−03, Assembly−01 (Task 72−35−03−440−001)				
735		Compressor Stator Actuator Rod End Bearing Retaining Nut (See Figure 802, Sheet 6) See 72−35−00, Assembly−03 (Task 72−35−00−400−003)				
736	A	Bolt And Nut Torquing Procedure, Turbine Case Cooling Air Valve Actuator Ground Cable See 72−35−00, Assembly−04 (Task 72−35−00−400−004)				
739	A	Variable Stator Mount Stud Retaining Nuts (See Figure 802, Sheet 1, And Sheet 7) See 72−35−00, Assembly−03 (Task 72−35−00−400−003)				
1550	A	Compressor Tierod Nut (See Figure 801, Sheet 2 And Sheet 10) See 72−35−01, Assembly−01 (Task 72−35−01−440−001)				
1551	A	Vane Arm Retaining Bolt (See Figure 801, Sheet 3) See 72−35−02, Assembly−01 (Task 72−35−02−440−001)				

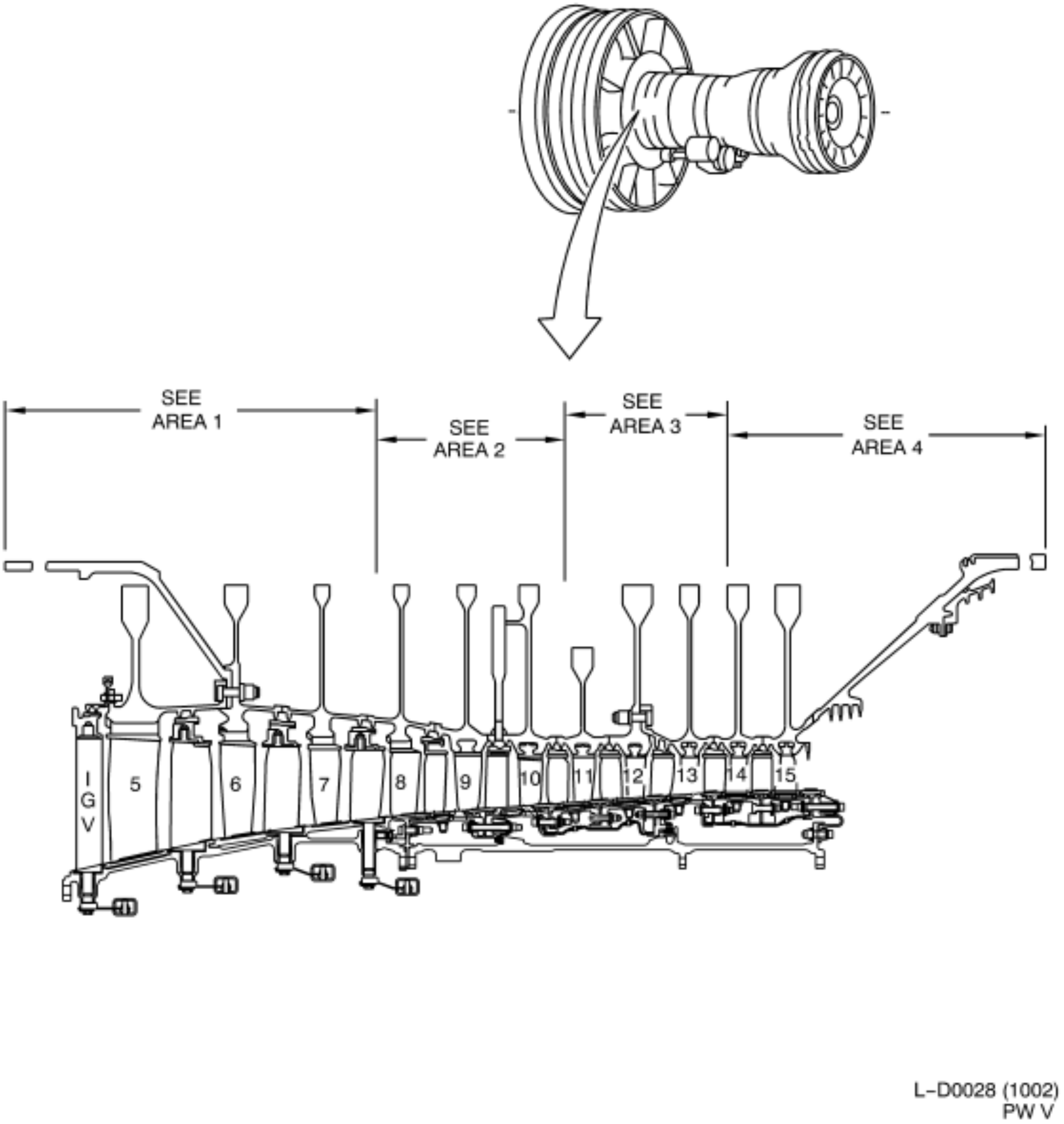
Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1552	A	Stage 6 Borescope Plug (See Figure 801, Sheet 4) See 72-35-02, Assembly-01 (Task 72-35-02-440-001)				
1553	A	HPC Case Axial Flange Bolt - Nut (See Figure 801, Sheet 4) See 72-35-00, Assembly-01 (Task 72-35-00-400-001)				
1554	A	Stages 5, 10, And 14 Borescope Plug (See Figure 801, Sheet 4, Sheet 9, And Sheet 14) See 72-35-00, Assembly-01 (Task 72-35-00-400-001)				
1556	A	Stages 8 And 12 Borescope Plugs (See Figure 801, Sheet 9 And Sheet 12) See 72-35-00, Assembly-01 (Task 72-35-00-400-001)				
1558	A	Synchronizing Ring Runner Pad Bolt (See Figure 806, Sheet 1) See 72-35-00, Assembly-02 (Task 72-35-00-400-002)				

J. Special Assembly Procedure

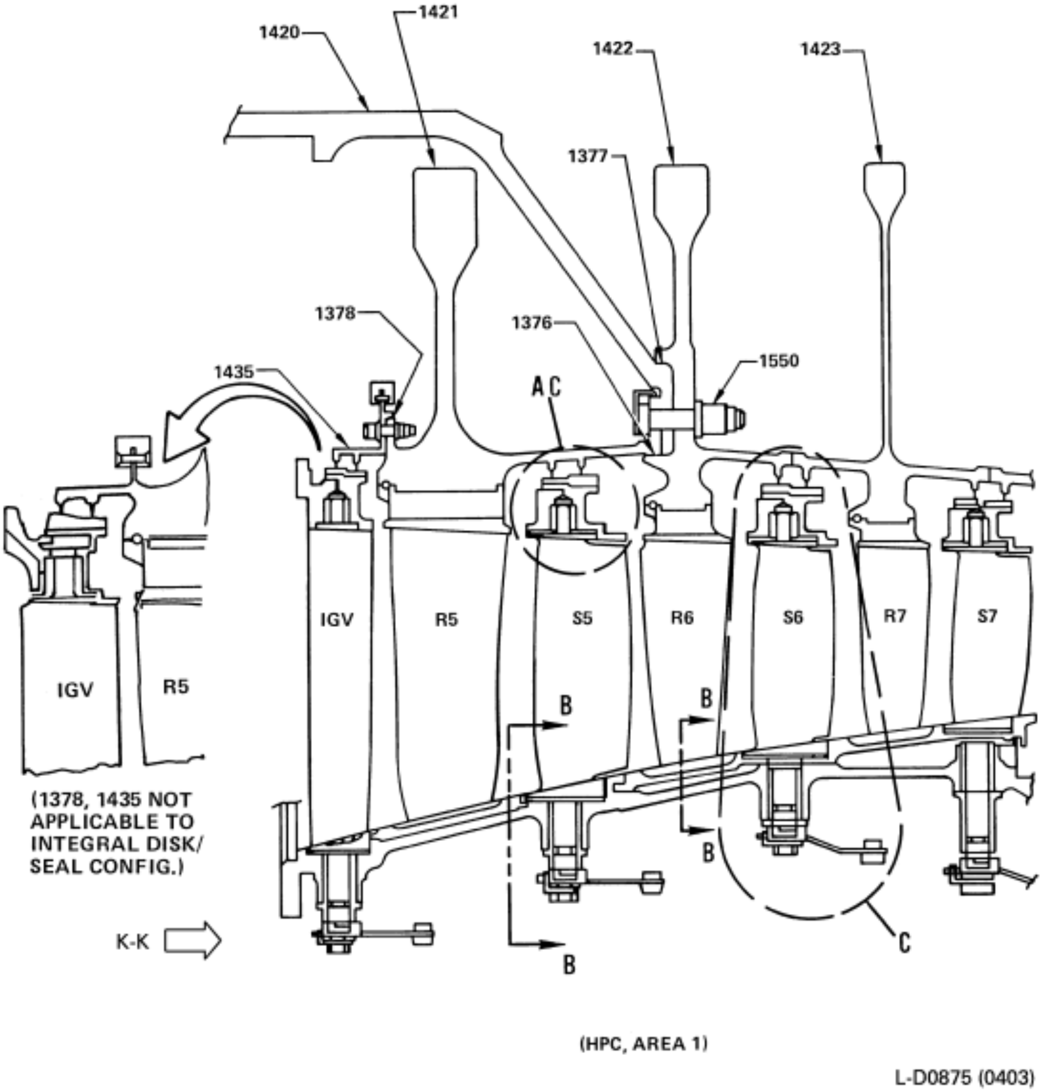
Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
618	A	Compressor Stator Lever - Set Bracket - Shim Fitting (See Figure 802, Sheet 8) See 72-35-00, Assembly-03) (Task 72-35-00-400-003)				
749	A	Variable Stator Mount Assembly Instruction For Expanding Retaining Stud (See Figure 802, Sheet 1, And Sheet 7) See 72-35-00, Assembly-03 (Task 72-35-00-400-003)				

HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-04

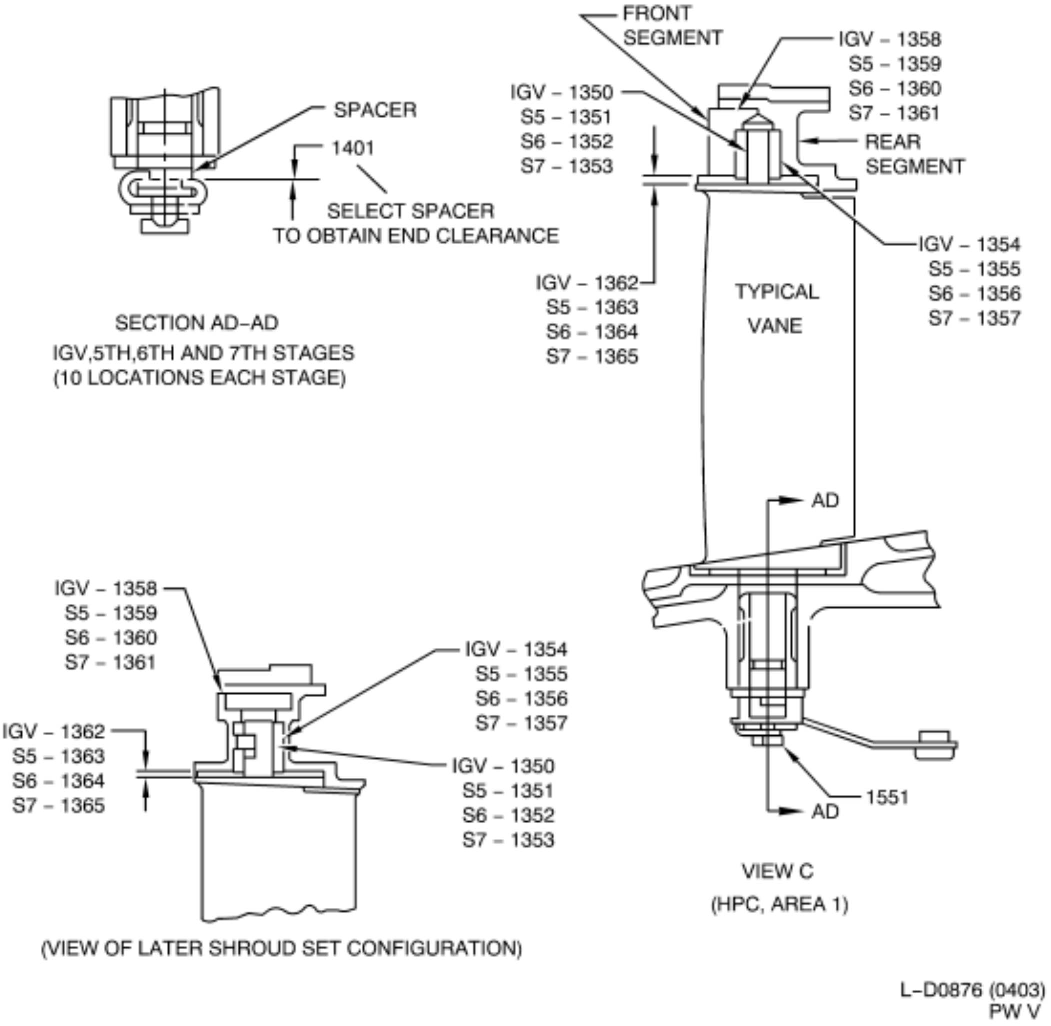
Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
760	A	Turbine Vane And Blade Cooling Air Valve Position Switch - Installation See 72-35-00, Assembly-04 (Task 72-35-00-400-004)				
1401	A	Arm Assembly End Clearance - Select Spacer To Obtain (See Figure 801, Sheet 3) See 72-35-02, Assembly-01 (Task 72-35-02-440-001)				
1580	A	Flange Seating Procedure (See Figure 801, Sheet 14) See 72-35-00, Assembly-01 (Task 72-35-00-400-007) And See 72-35-04, Assembly-01 (Task 72-35-04-440-001)				
2101 2102 2103 2104	A	Shim Procedure For Unison Ring Runners And Spacers And Clearances For Runners (See Figure 806, Sheets 1 and 2) See 72-35-00, Assembly-02 (Task 72-35-00-400-002)				


SEE AREA 1
SEE AREA 2
SEE AREA 3
SEE AREA 4
I G V
5
6
7
8
9
10
11
12
13
14
15
L−D0028 (1002)
PW V

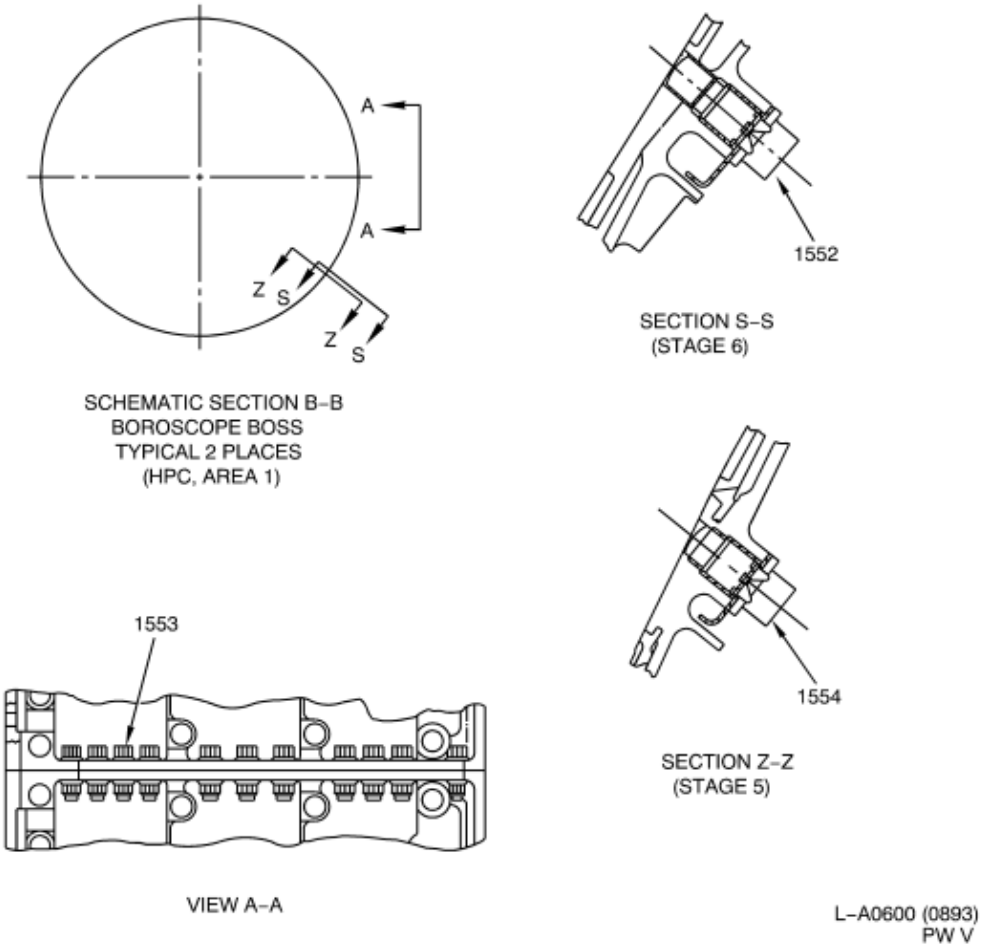
High Pressure Compressor (HPC)
Figure 801 (Sheet 1)
(Task 72−35−00−990−010)


1420
1421
1422
1423
1377
1378
1376
1435
1550
A C
IGV
R5
IGV
R5
S5
R6
S6
R7
S7
B
B
B
B
C
(1378, 1435 NOT APPLICABLE TO INTEGRAL DISK/ SEAL CONFIG.)
K-K
(HPC, AREA 1)
L-D0875 (0403)

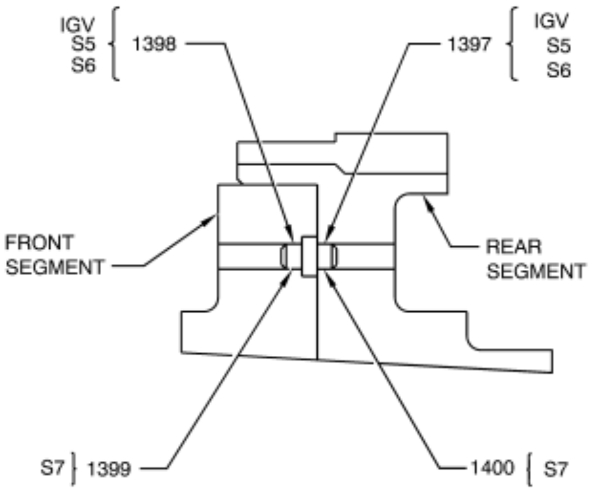
High Pressure Compressor (HPC)
Figure 801 (Sheet 2)
(Task 72−35−00−990−010)


SPACER
1401
SELECT SPACER
TO OBTAIN END CLEARANCE
SECTION AD-AD
IGV,5TH,6TH AND 7TH STAGES
(10 LOCATIONS EACH STAGE)
FRONT
SEGMENT
IGV – 1350
S5 – 1351
S6 – 1352
S7 – 1353
IGV – 1358
S5 – 1359
S6 – 1360
S7 – 1361
REAR
SEGMENT
IGV – 1362
S5 – 1363
S6 – 1364
S7 – 1365
TYPICAL
VANE
IGV – 1354
S5 – 1355
S6 – 1356
S7 – 1357
AD
AD
1551
VIEW C
(HPC, AREA 1)
IGV – 1358
S5 – 1359
S6 – 1360
S7 – 1361
IGV – 1354
S5 – 1355
S6 – 1356
S7 – 1357
IGV – 1362
S5 – 1363
S6 – 1364
S7 – 1365
IGV – 1350
S5 – 1351
S6 – 1352
S7 – 1353
(VIEW OF LATER SHROUD SET CONFIGURATION)
L-D0876 (0403)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 3)
(Task 72−35−00−990−010)


A
A
Z
S
Z
S
SCHEMATIC SECTION B−B
BOROSCOPE BOSS
TYPICAL 2 PLACES
(HPC, AREA 1)
1552
SECTION S−S
(STAGE 6)
1553
VIEW A−A
1554
SECTION Z−Z
(STAGE 5)
L−A0600 (0893)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 4)
(Task 72−35−00−990−010)

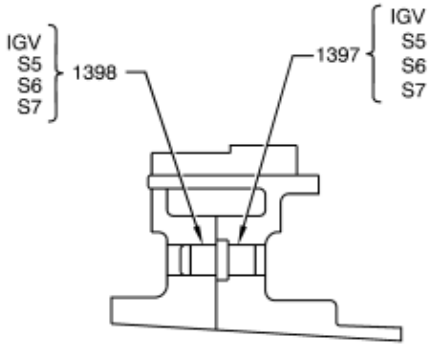

IGV
S5
S6
1398
1397
IGV
S5
S6
FRONT SEGMENT
REAR SEGMENT
S7
1399
1400
S7

SHROUD SETS:

PN 51H270 ....IGV
PN 51H285 ....5TH
PN 51H486 ....6TH
PN 51H487 ....7TH

VIEW AC

(HPC, AREA 1)


IGV
S5
S6
S7
1398
1397
IGV
S5
S6
S7

SHROUD SETS:

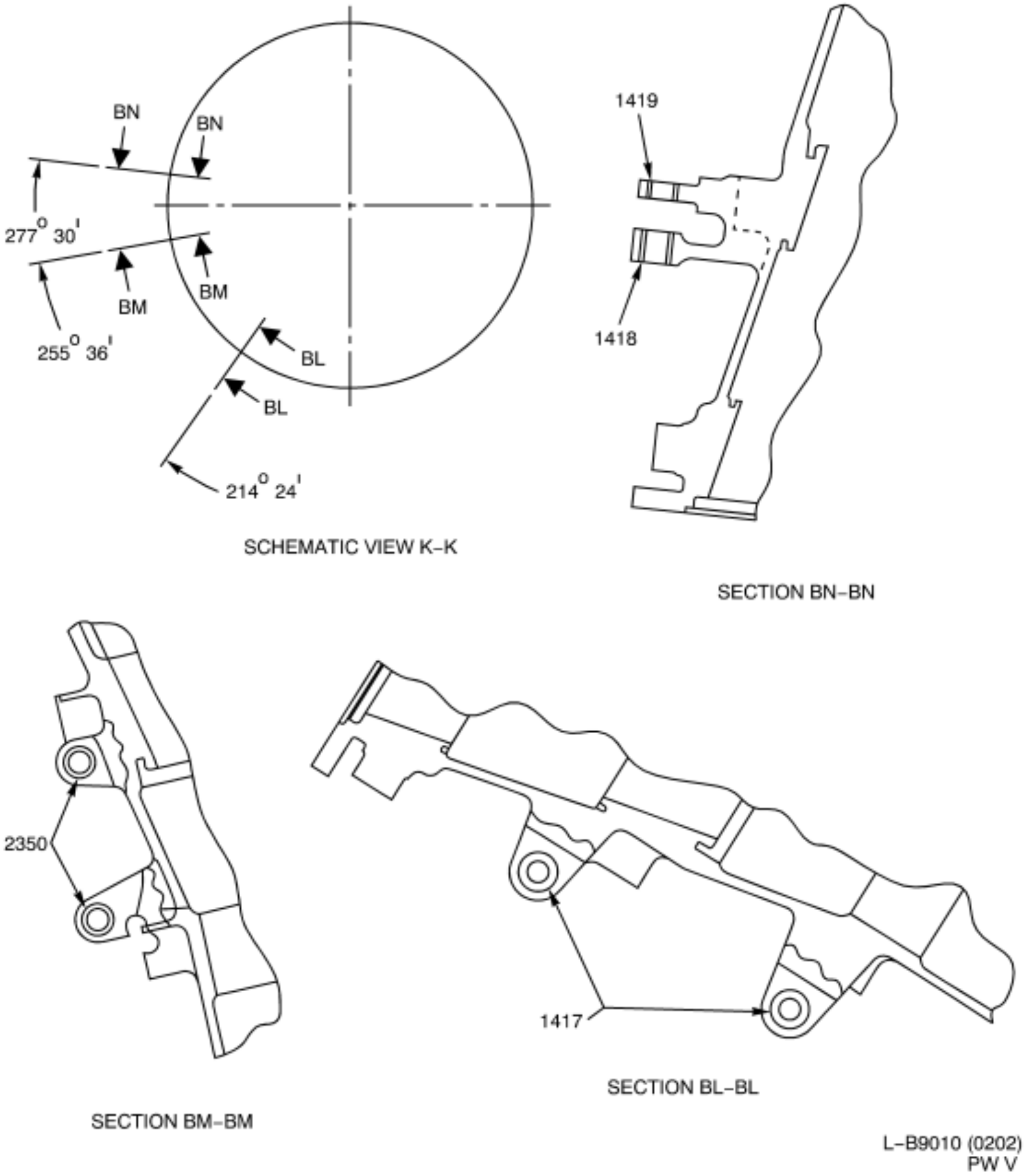
PN 51H470−01 ....IGV
PN 51H385−01 ....5TH
PN 51H586−01 ....6TH
PN 51H387−01....7TH

VIEW AC

(HPC, AREA 1)

L−A0624 (0287)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 5)
(Task 72−35−00−990−010)


BN
BN
277° 30'
BM
BM
255° 36'
BL
BL
214° 24'
1419
1418
2350
1417
L−B9010 (0202)
PW V

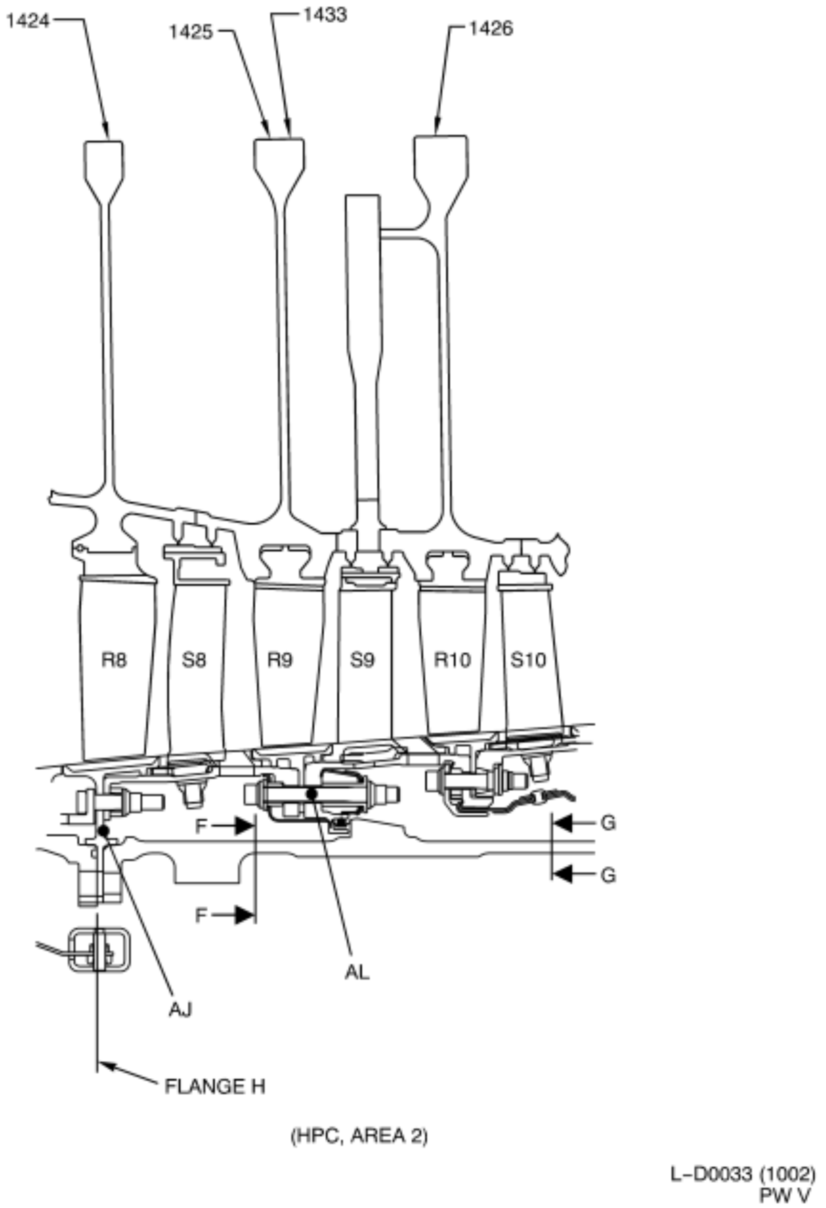
SCHEMATIC VIEW K−K

SECTION BN−BN

SECTION BM−BM

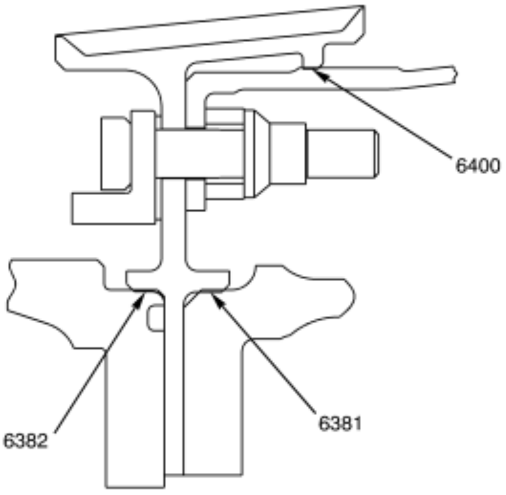
SECTION BL−BL

High Pressure Compressor (HPC)
Figure 801 (Sheet 6)
(Task 72−35−00−990−010)

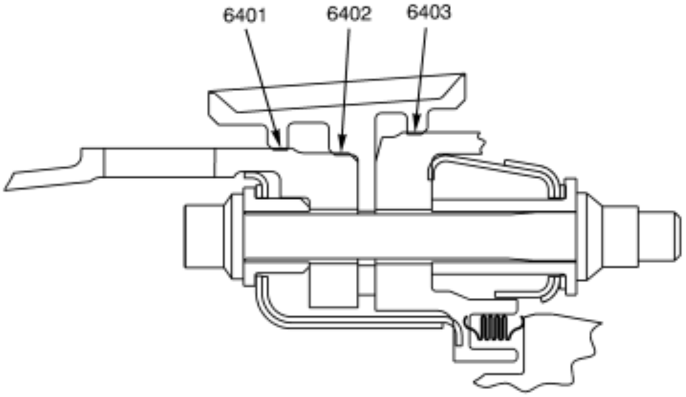

1424
1425
1433
1426
R8
S8
R9
S9
R10
S10
F
F
G
G
AL
AJ
FLANGE H
(HPC, AREA 2)
L−D0033 (1002)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 7)
(Task 72−35−00−990−010)

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04



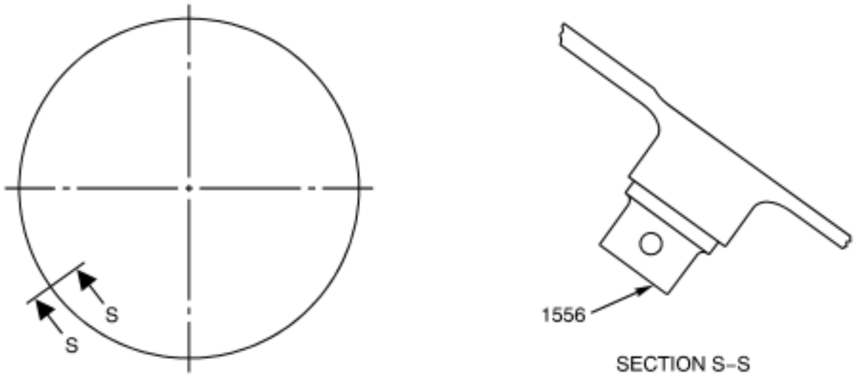
VIEW AJ



VIEW AL

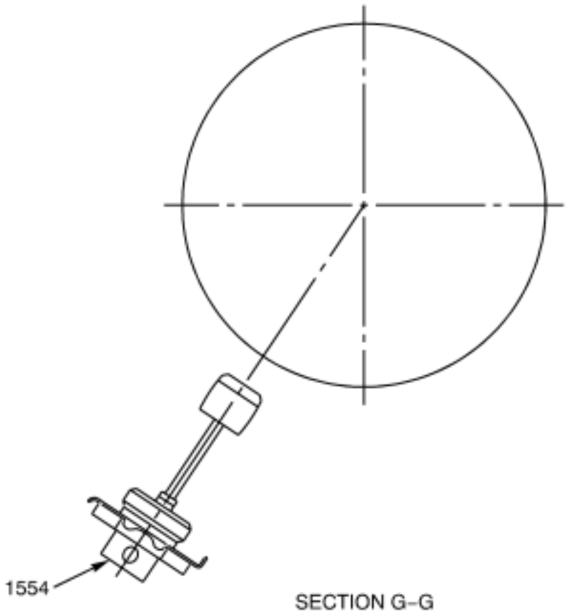
L−D0036 (0802)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 8)
(Task 72−35−00−990−010)



SCHEMATIC SECTION F−F
BOROSCOPE BOSS
HPC AREA 2

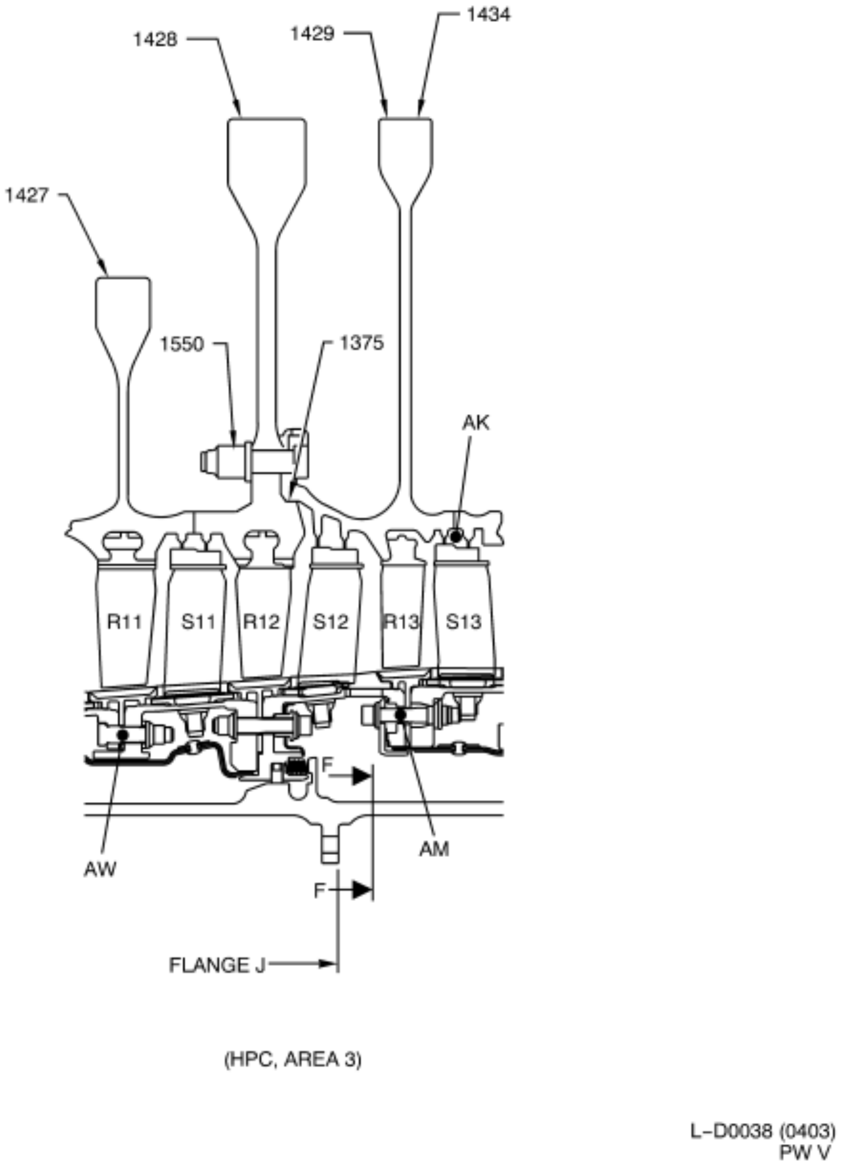
SECTION S−S
STAGE 8



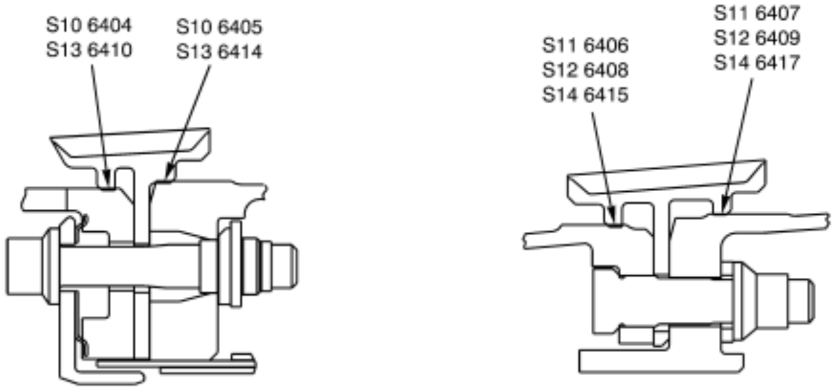
SECTION G−G
SCEMATIC REAR VIEW
STAGE 10

L−D0034 (0802)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 9)
(Task 72−35−00−990−010)


1434
1428
1429
1427
1550
1375
AK
R11
S11
R12
S12
R13
S13
F
AW
AM
F
FLANGE J
(HPC, AREA 3)
L−D0038 (0403)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 10)
(Task 72−35−00−990−010)

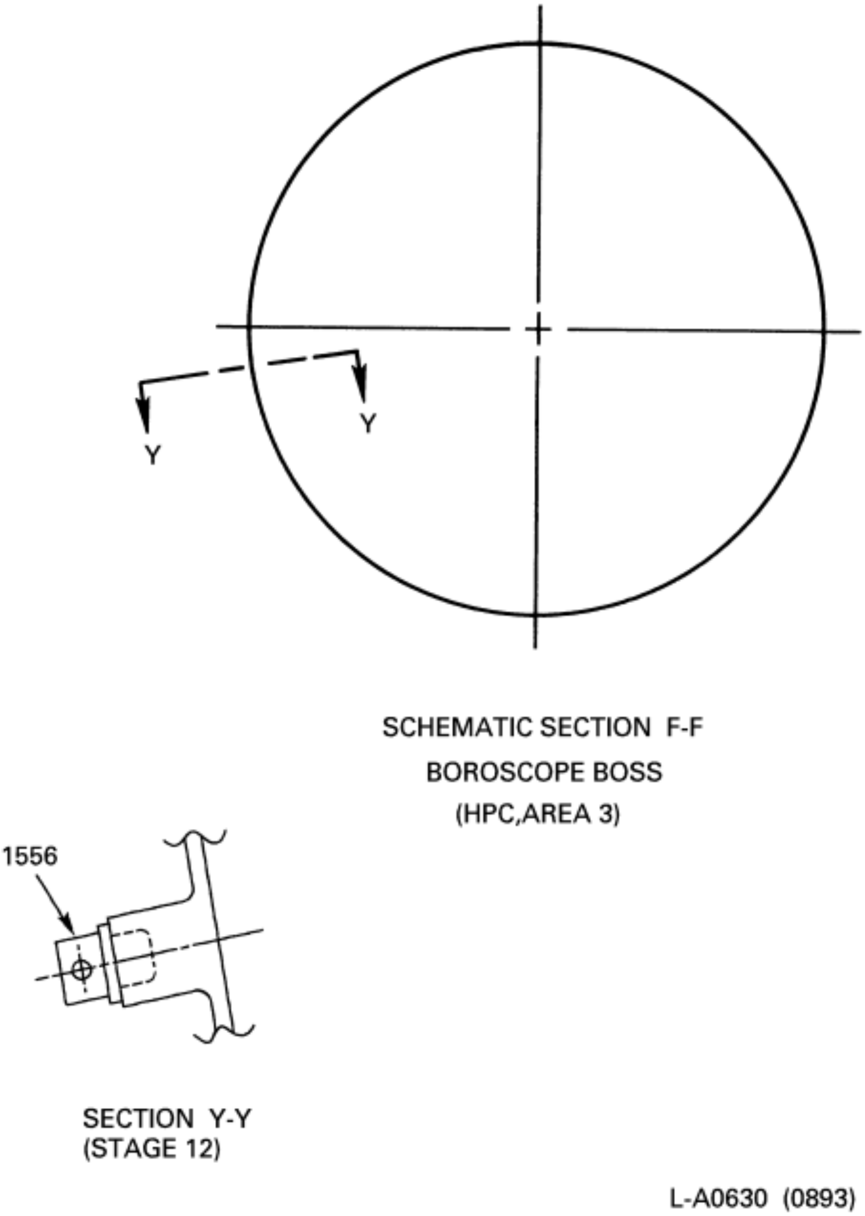

S10 6404
S13 6410
S10 6405
S13 6414
S11 6406
S12 6408
S14 6415
S11 6407
S12 6409
S14 6417

VIEW AM

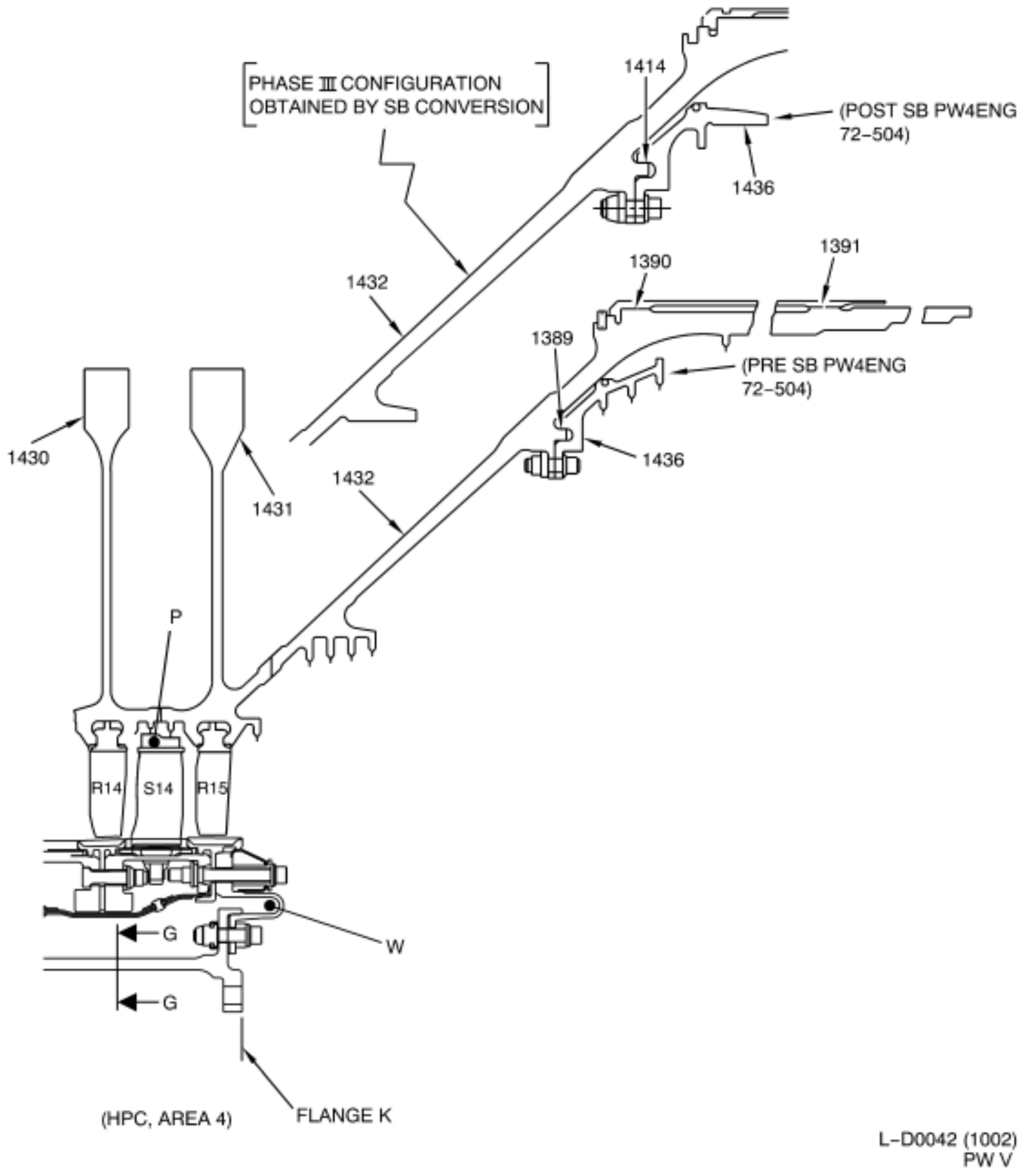
VIEW AW

L−D0041 (0403)
PW V

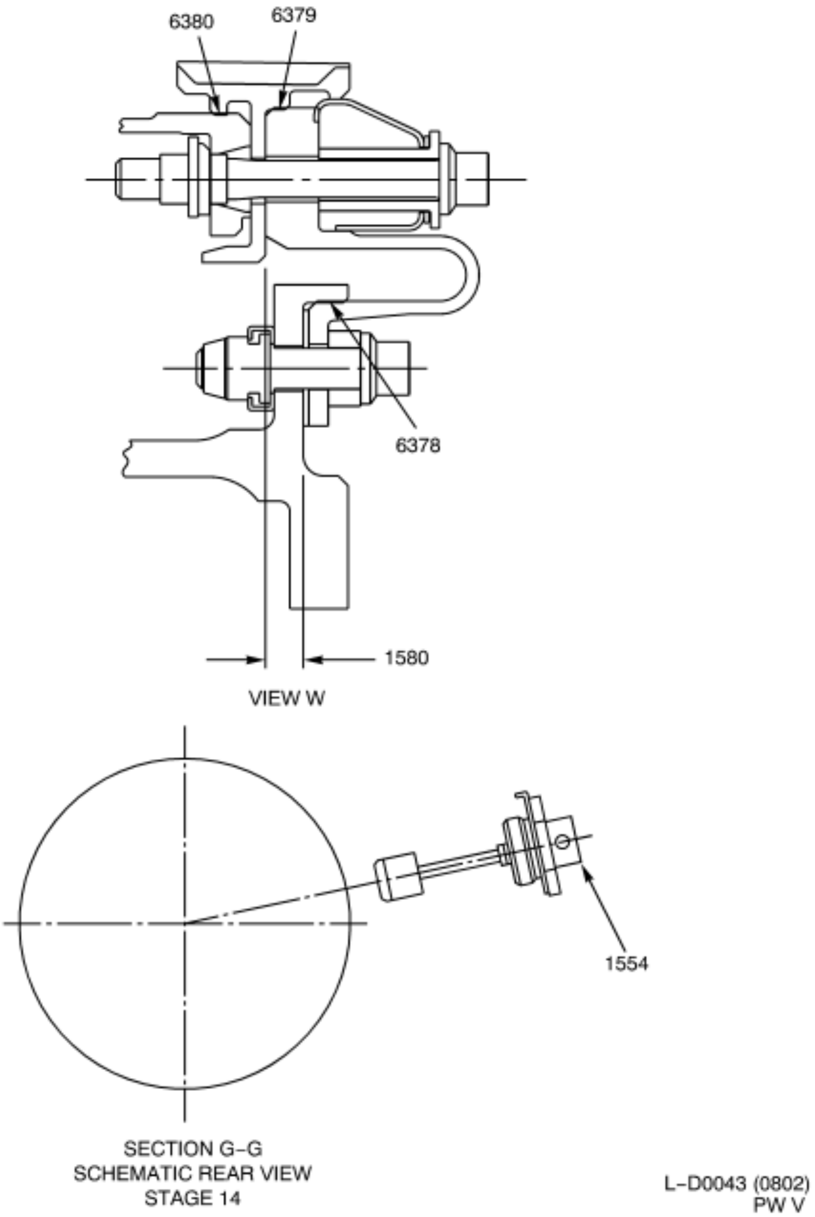
High Pressure Compressor (HPC)
Figure 801 (Sheet 11)
(Task 72−35−00−990−010)


Y
Y
SCHEMATIC SECTION F-F
BOROSCOPE BOSS
(HPC,AREA 3)
1556
SECTION Y-Y
(STAGE 12)
L-A0630 (0893)

High Pressure Compressor (HPC)
Figure 801 (Sheet 12)
(Task 72−35−00−990−010)

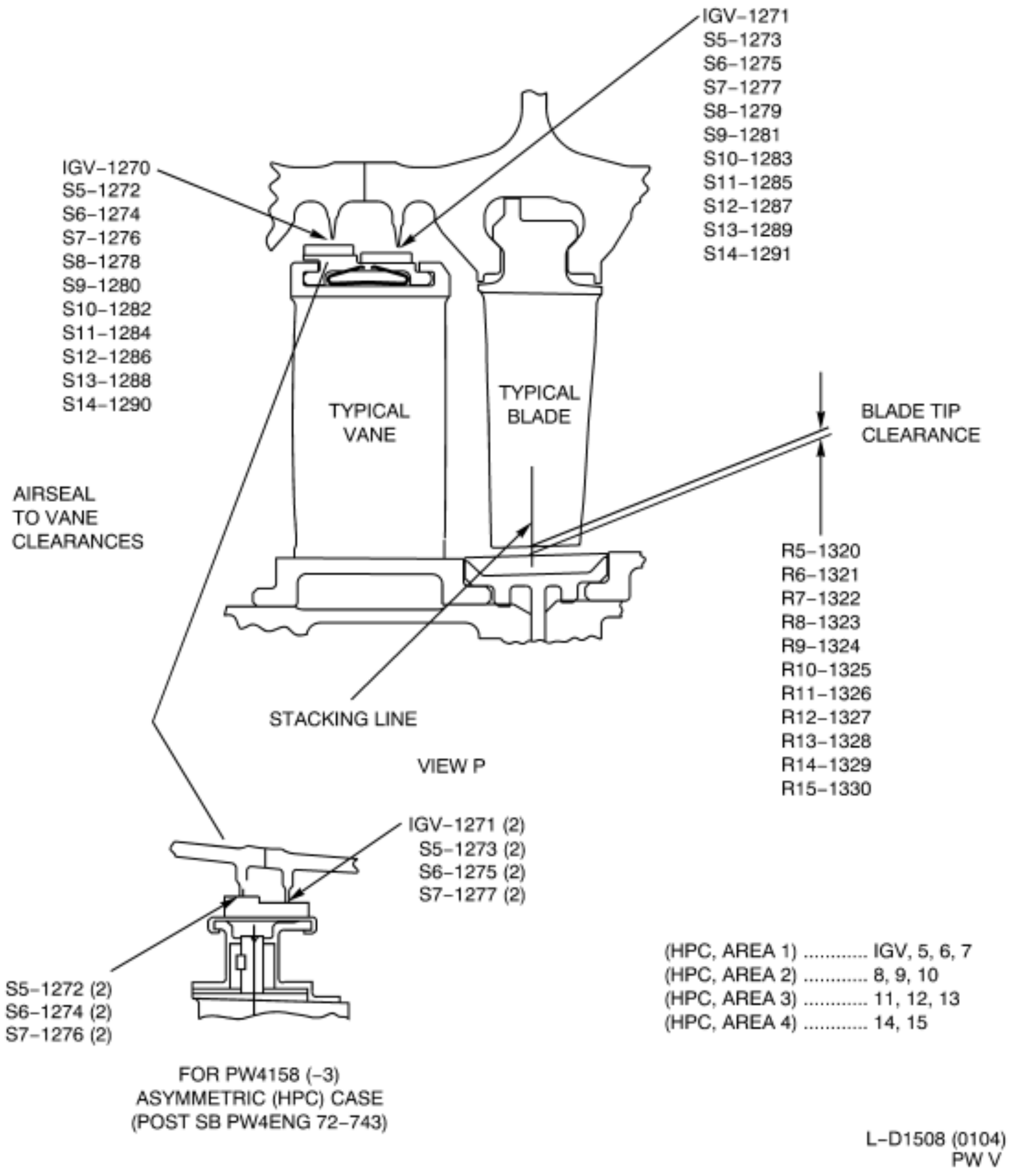

PHASE III CONFIGURATION OBTAINED BY SB CONVERSION
1414
(POST SB PW4ENG 72-504)
1436
1432
1390
1391
1389
(PRE SB PW4ENG 72-504)
1436
1430
1431
1432
P
R14
S14
R15
G
G
W
FLANGE K
(HPC, AREA 4)
L-D0042 (1002)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 13)
(Task 72-35-00-990-010)

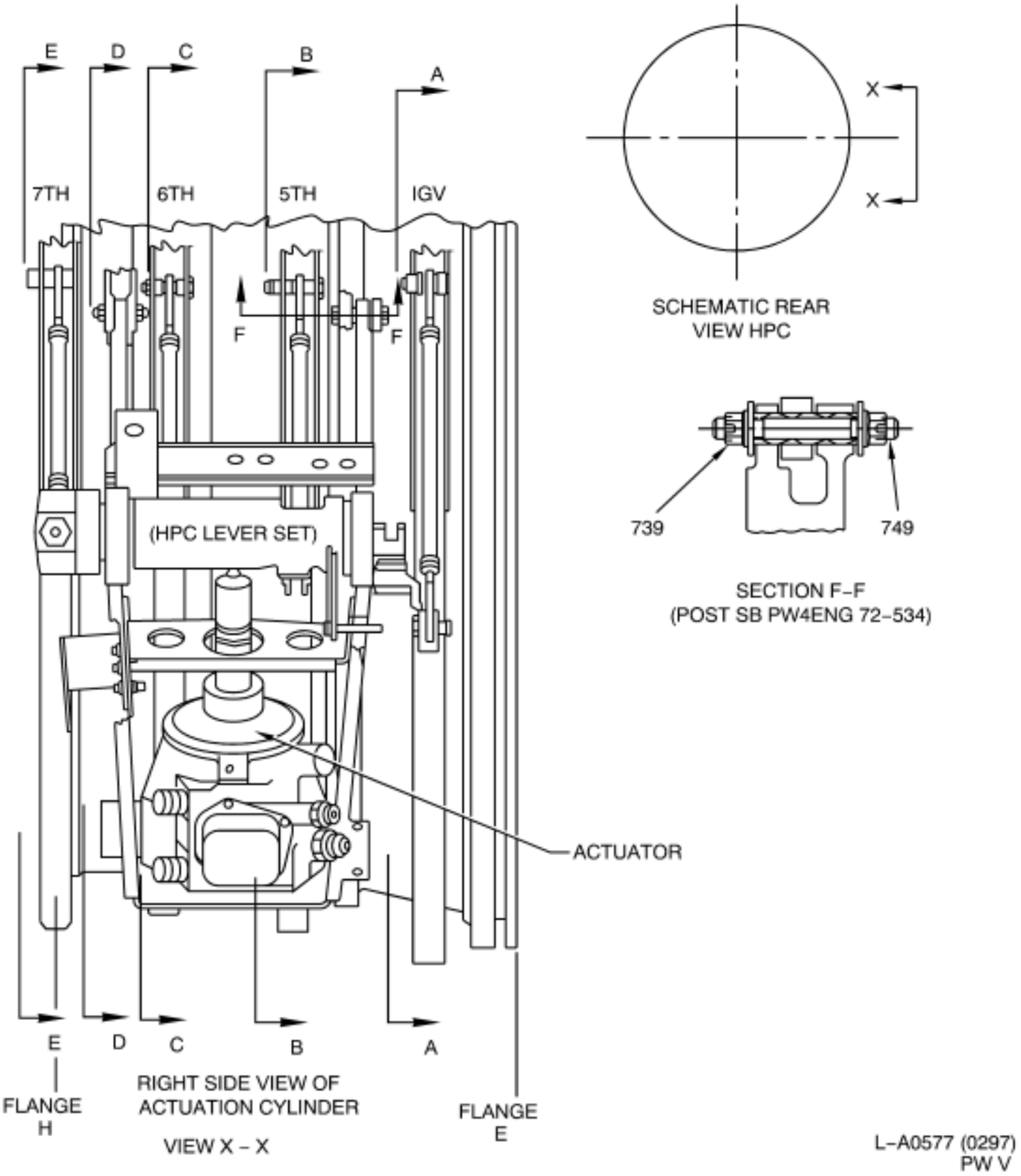

6380
6379
6378
1580
VIEW W
1554
SECTION G−G
SCHEMATIC REAR VIEW
STAGE 14
L−D0043 (0802)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 14)
(Task 72−35−00−990−010)

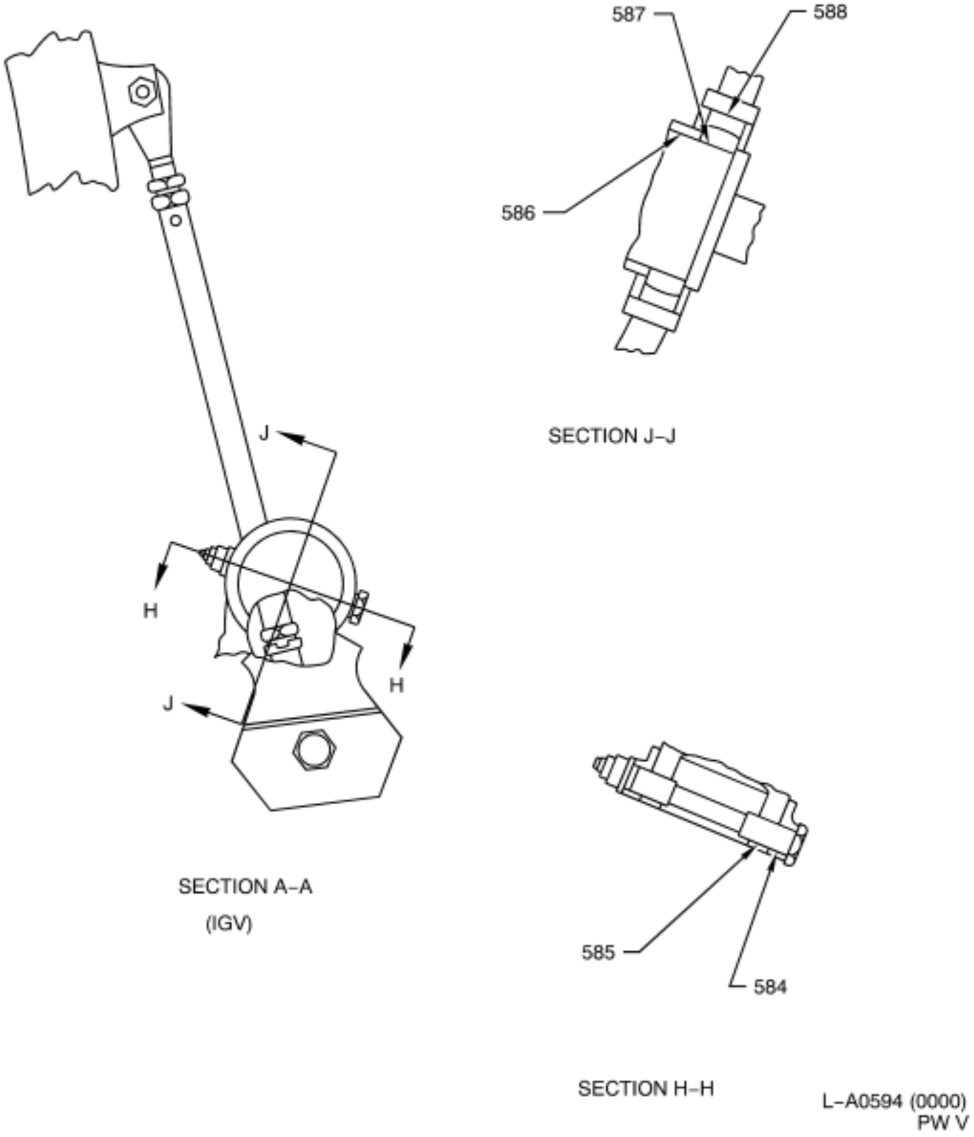
HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04


IGV−1271
S5−1273
S6−1275
S7−1277
S8−1279
S9−1281
S10−1283
S11−1285
S12−1287
S13−1289
S14−1291
IGV−1270
S5−1272
S6−1274
S7−1276
S8−1278
S9−1280
S10−1282
S11−1284
S12−1286
S13−1288
S14−1290
TYPICAL VANE
TYPICAL BLADE
BLADE TIP CLEARANCE
AIRSEAL TO VANE CLEARANCES
R5−1320
R6−1321
R7−1322
R8−1323
R9−1324
R10−1325
R11−1326
R12−1327
R13−1328
R14−1329
R15−1330
STACKING LINE
VIEW P
IGV−1271 (2)
S5−1273 (2)
S6−1275 (2)
S7−1277 (2)
S5−1272 (2)
S6−1274 (2)
S7−1276 (2)
(HPC, AREA 1) .... IGV, 5, 6, 7
(HPC, AREA 2) 8, 9, 10
(HPC, AREA 3) 11, 12, 13
(HPC, AREA 4) 14, 15
FOR PW4158 (−3) ASYMMETRIC (HPC) CASE (POST SB PW4ENG 72−743)
L−D1508 (0104)
PW V

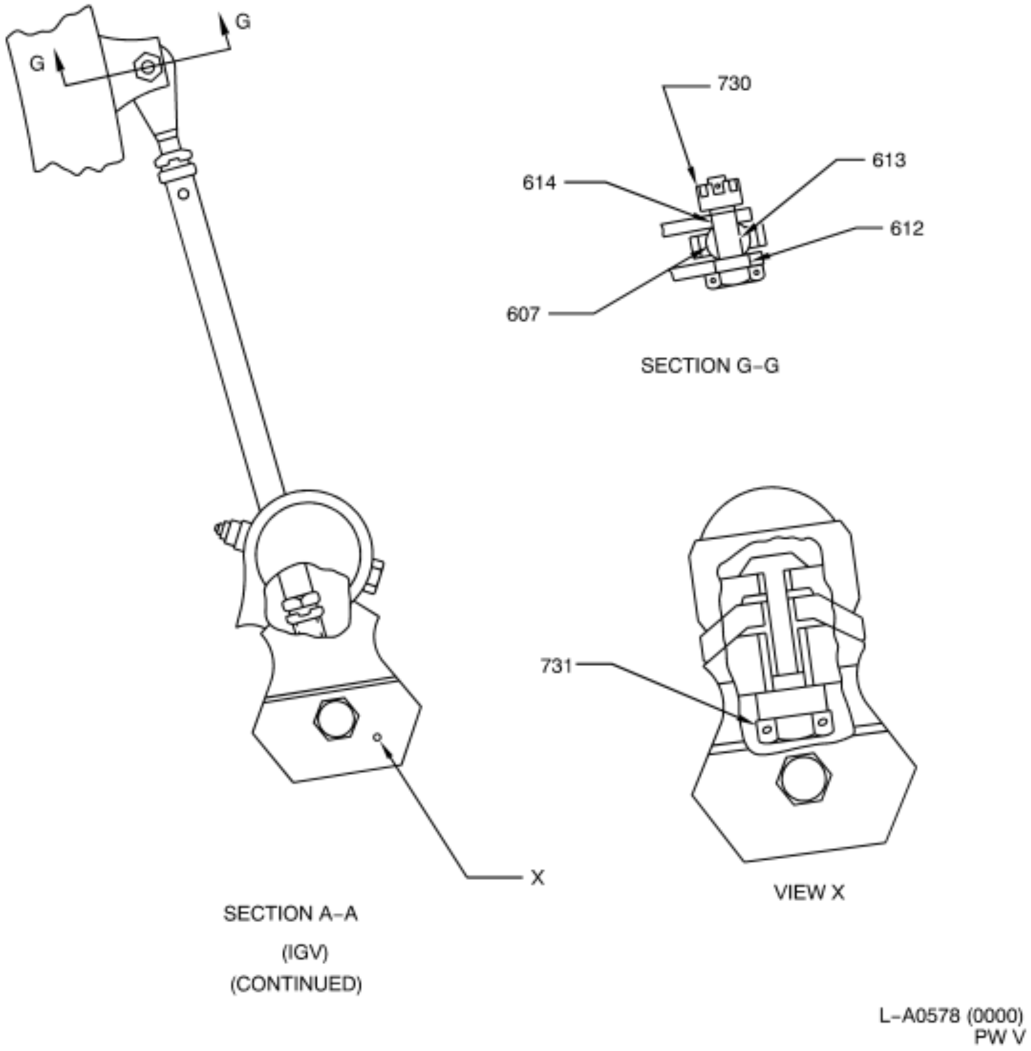
High Pressure Compressor (HPC)
Figure 801 (Sheet 15)
(Task 72−35−00−990−010)


E
D
C
B
A
7TH
6TH
5TH
IGV
F
F
(HPC LEVER SET)
ACTUATOR
E
D
C
B
A
FLANGE
H
RIGHT SIDE VIEW OF
ACTUATION CYLINDER
VIEW X − X
FLANGE
E
X
X
SCHEMATIC REAR
VIEW HPC
739
749
SECTION F−F
(POST SB PW4ENG 72−534)
L−A0577 (0297)
PW V

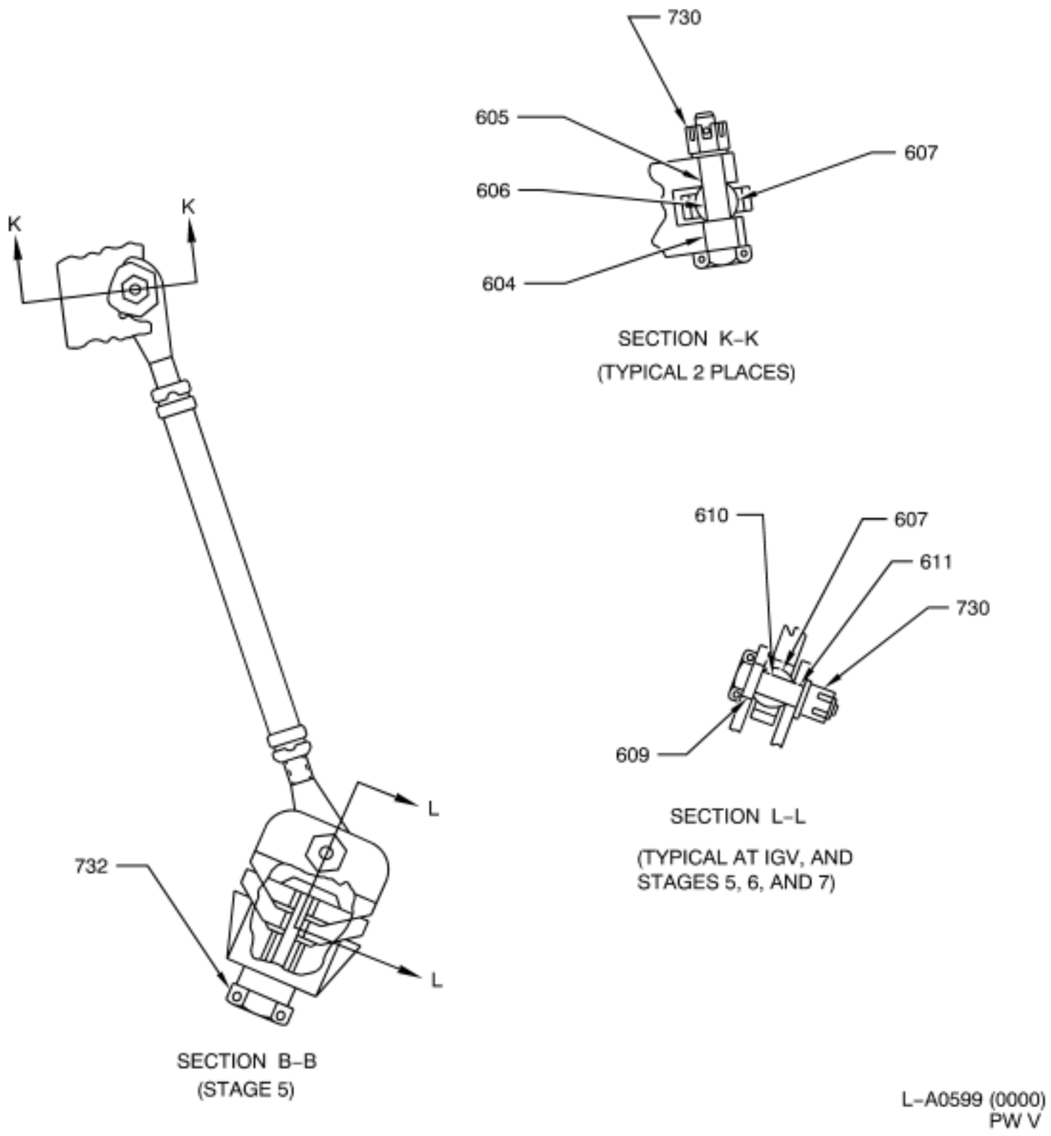
High Pressure Compressor (HPC)
Figure 802 (Sheet 1)
(Task 72−35−00−990−010)


587
588
586
SECTION J–J
J
H
H
J
SECTION A–A
(IGV)
585
584
SECTION H–H
L–A0594 (0000)
PW V

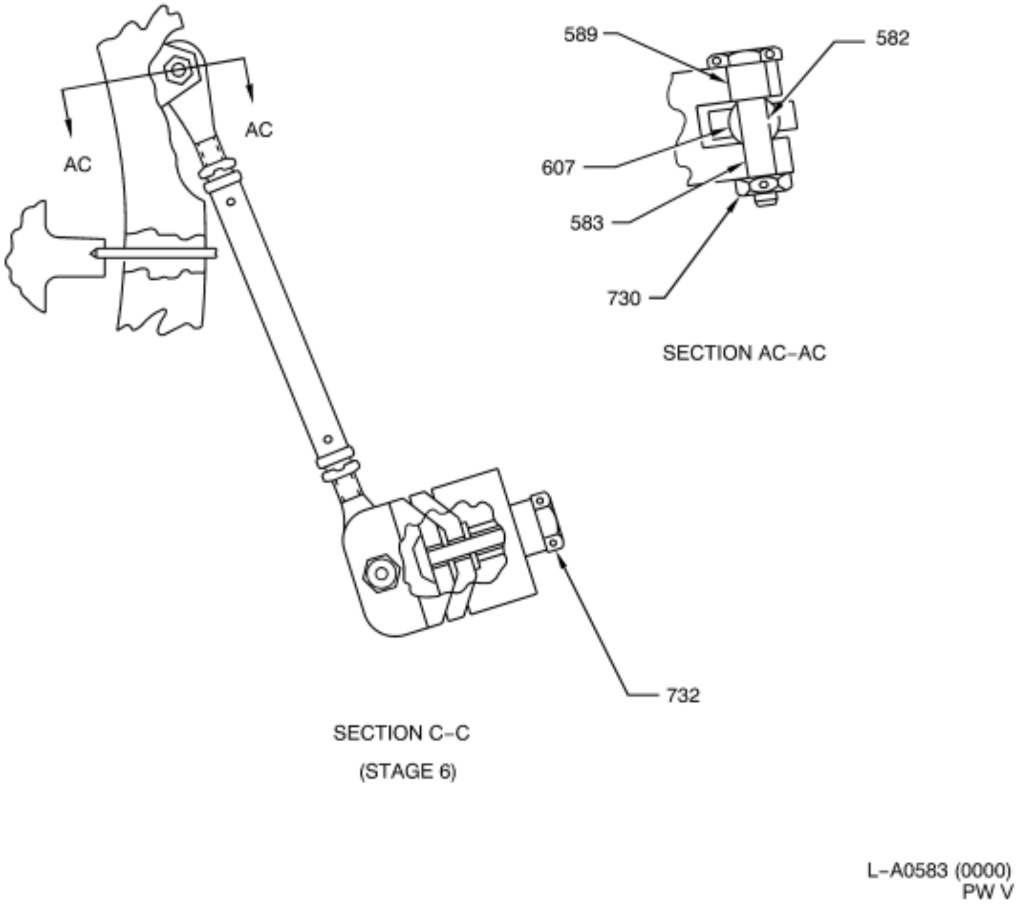
High Pressure Compressor (HPC)
Figure 802 (Sheet 2)
(Task 72−35−00−990−010)


G
G
730
613
614
612
607
SECTION G−G
731
X
VIEW X
SECTION A−A
(IGV)
(CONTINUED)
L−A0578 (0000)
PW V

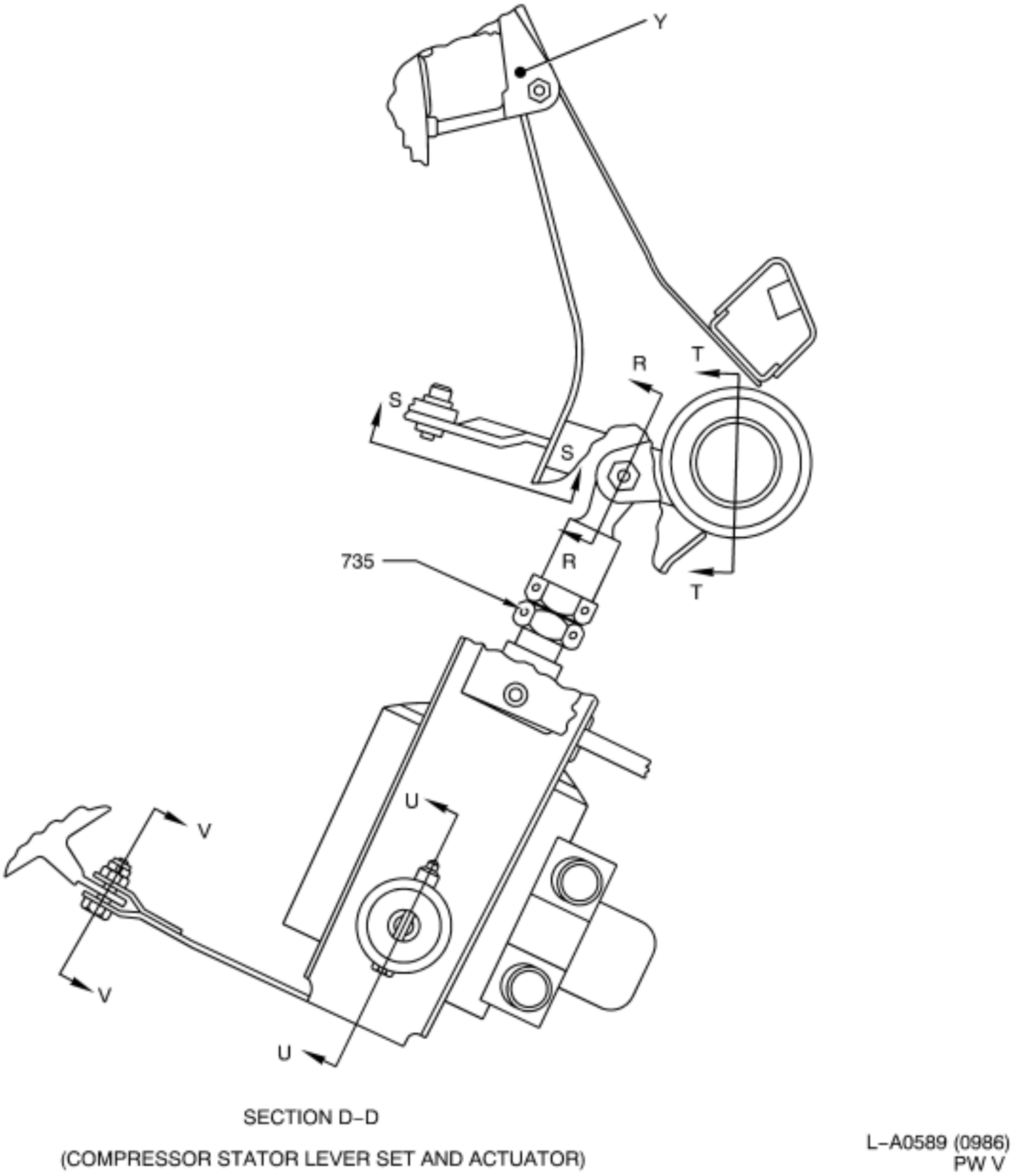
High Pressure Compressor (HPC)
Figure 802 (Sheet 3)
(Task 72−35−00−990−010)


730
605
607
606
604
SECTION K−K
(TYPICAL 2 PLACES)
K
K
610
607
611
730
609
SECTION L−L
(TYPICAL AT IGV, AND STAGES 5, 6, AND 7)
L
732
L
SECTION B−B
(STAGE 5)
L−A0599 (0000)
PW V

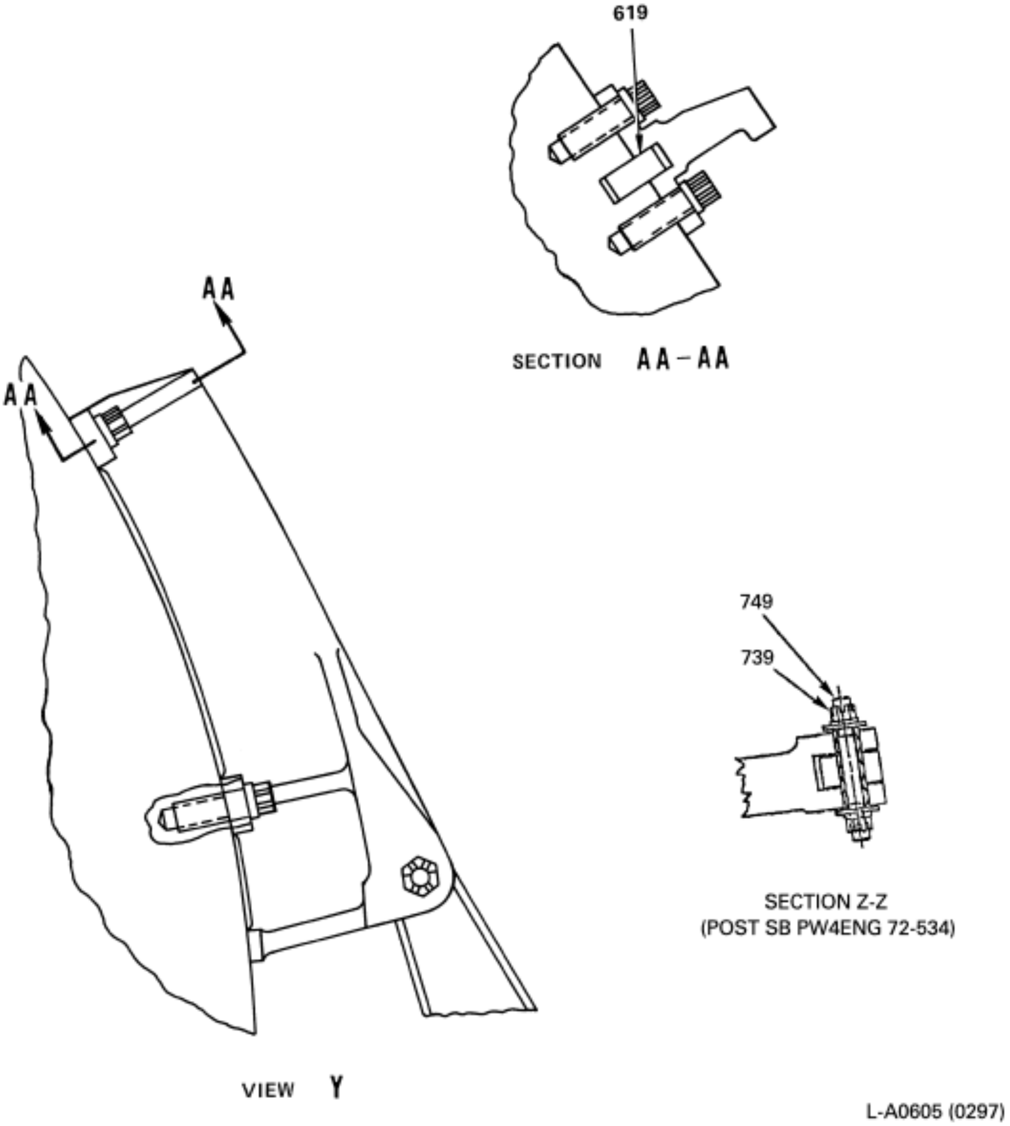
High Pressure Compressor (HPC)
Figure 802 (Sheet 4)
(Task 72−35−00−990−010)


589
582
607
583
730
SECTION AC−AC
AC
AC
732
SECTION C−C
(STAGE 6)
L−A0583 (0000)
PW V

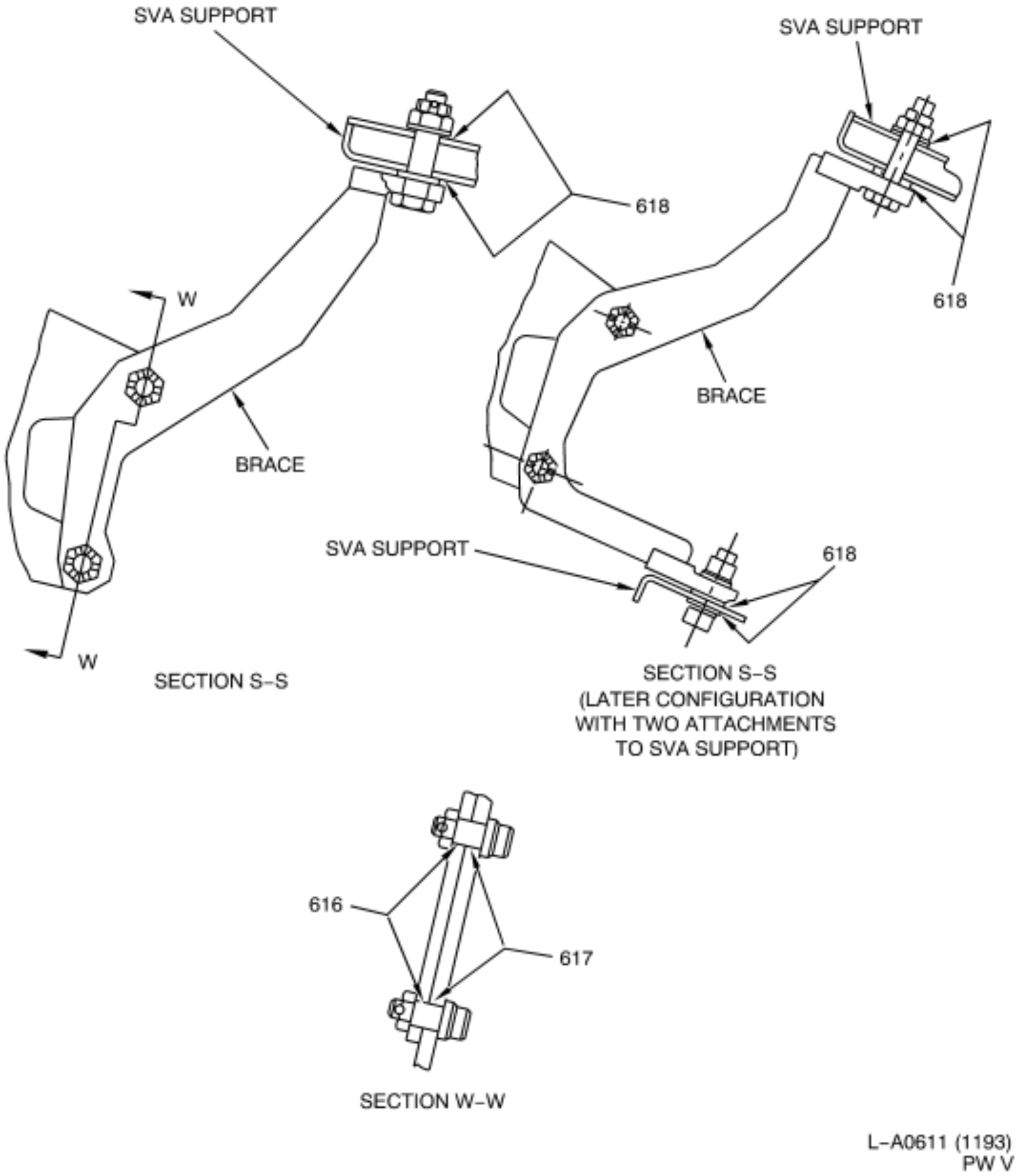
High Pressure Compressor (HPC)
Figure 802 (Sheet 5)
(Task 72−35−00−990−010)


Y
R
T
S
S
735
R
T
U
V
V
U
SECTION D−D
(COMPRESSOR STATOR LEVER SET AND ACTUATOR)
L−A0589 (0986)
PW V

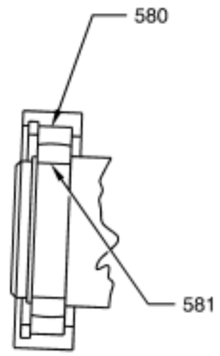
High Pressure Compressor (HPC)
Figure 802 (Sheet 6)
(Task 72−35−00−990−010)


619
SECTION AA − AA
AA
AA
749
739
SECTION Z-Z
(POST SB PW4ENG 72-534)
VIEW Y
L-A0605 (0297)

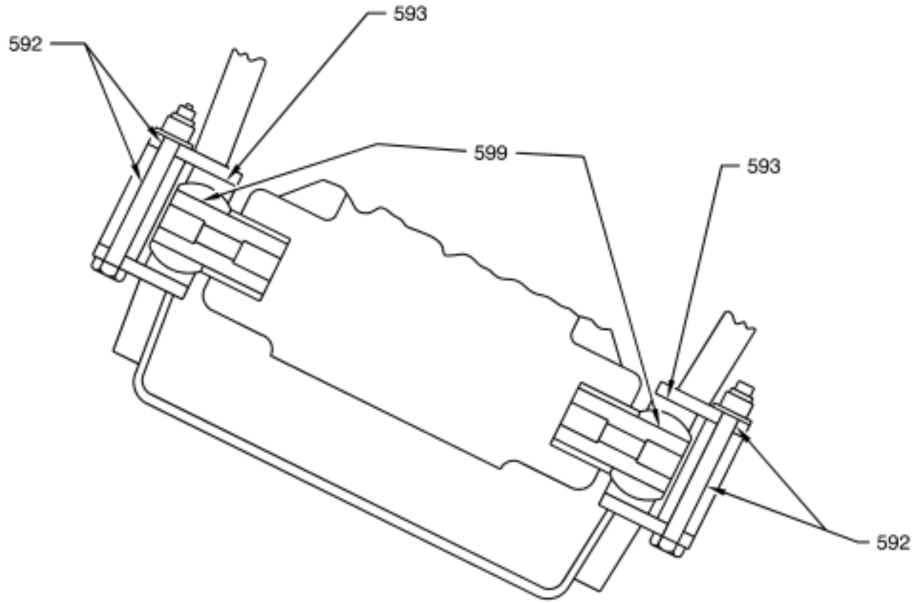
High Pressure Compressor (HPC)
Figure 802 (Sheet 7)
(Task 72−35−00−990−010)


SVA SUPPORT
618
W
BRACE
W
SECTION S−S
SVA SUPPORT
618
BRACE
SVA SUPPORT
618
SECTION S−S
(LATER CONFIGURATION
WITH TWO ATTACHMENTS
TO SVA SUPPORT)
616
617
SECTION W−W
L−A0611 (1193)
PW V

High Pressure Compressor (HPC)
Figure 802 (Sheet 8)
(Task 72−35−00−990−010)



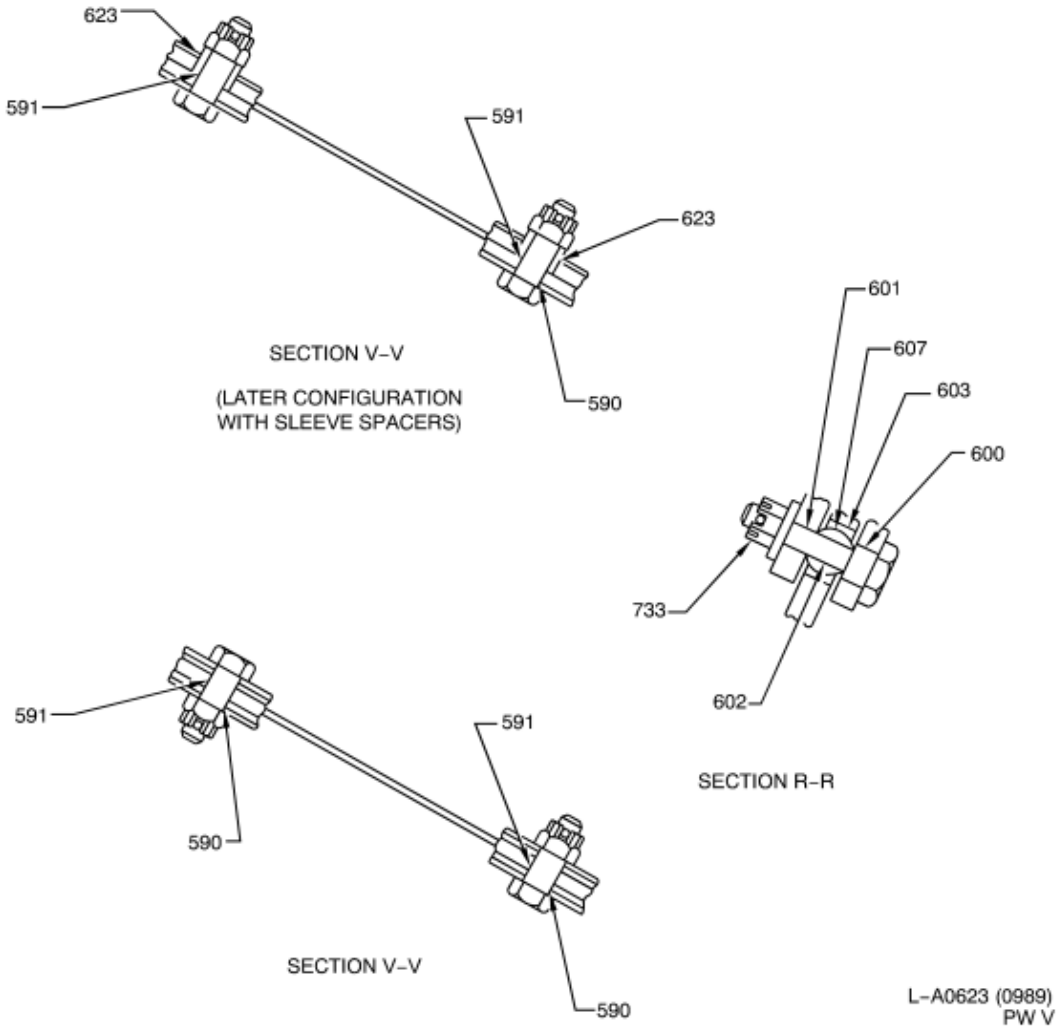
SECTION T−T



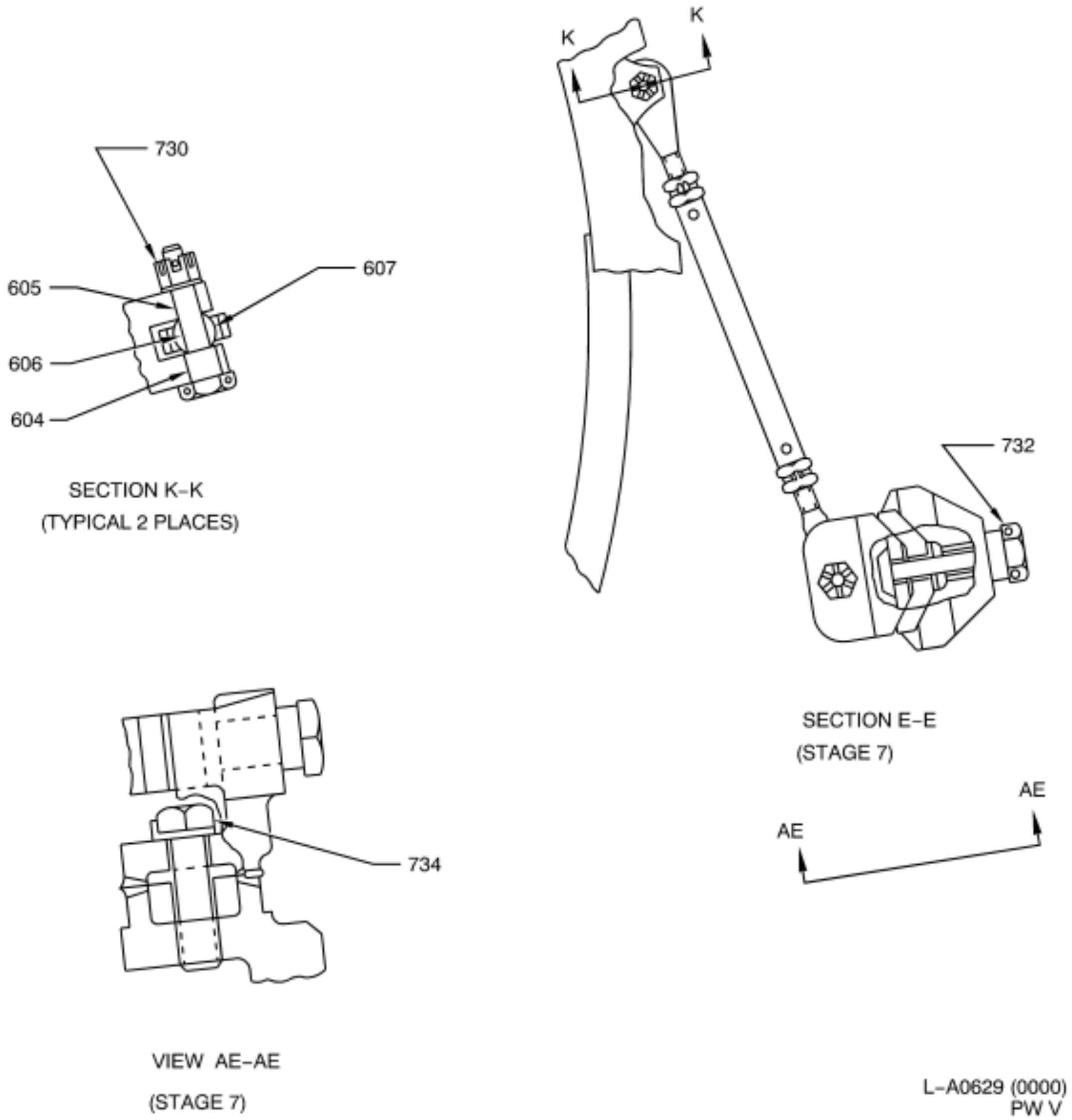
SECTION U−U

L−A0617 (0000)
PW V

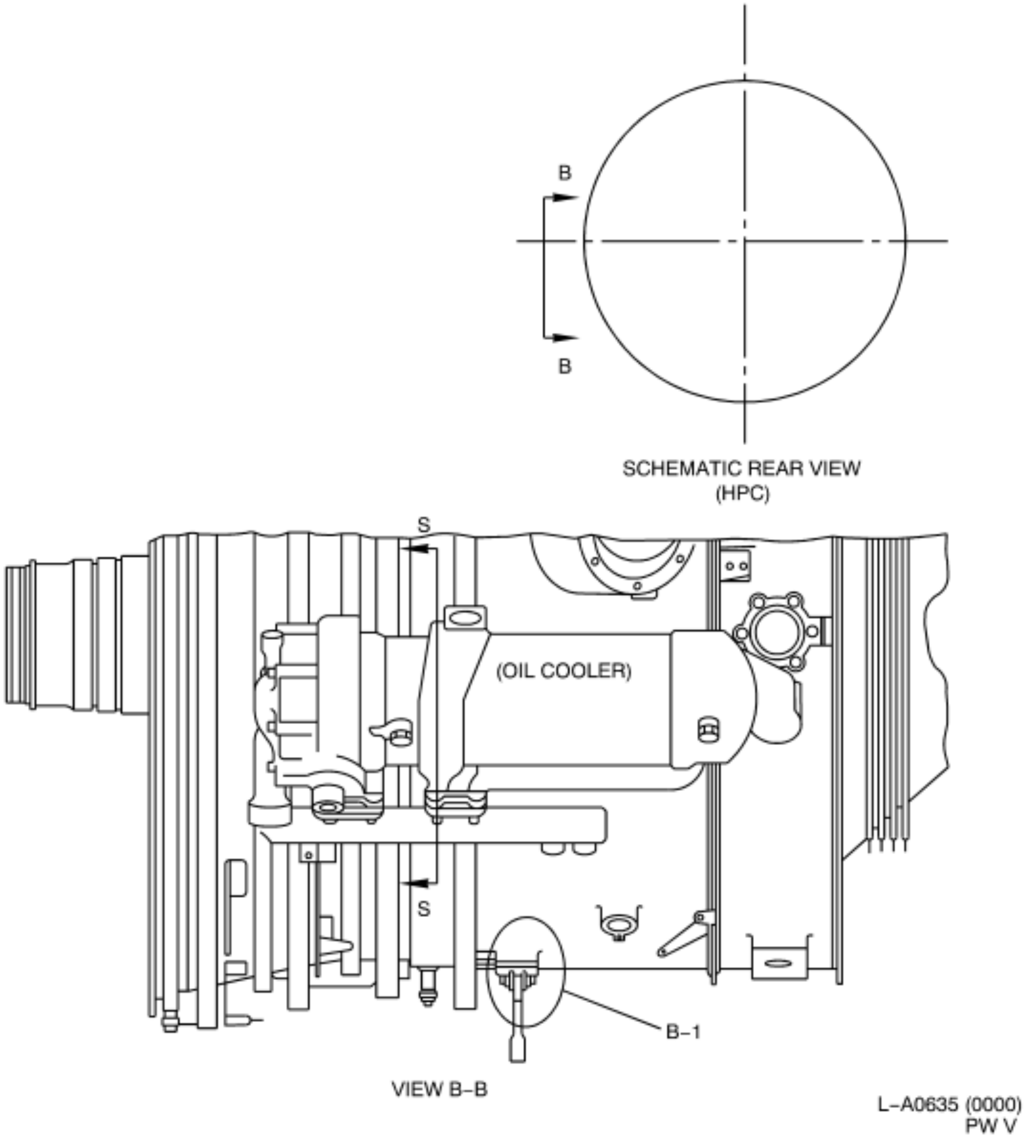
High Pressure Compressor (HPC)
Figure 802 (Sheet 9)
(Task 72−35−00−990−010)


623
591
591
623
SECTION V−V
(LATER CONFIGURATION
WITH SLEEVE SPACERS)
590
601
607
603
600
733
602
SECTION R−R
591
591
590
SECTION V−V
590
L−A0623 (0989)
PW V

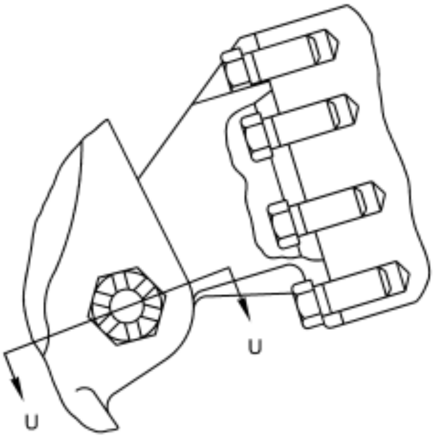
High Pressure Compressor (HPC)
Figure 802 (Sheet 10)
(Task 72−35−00−990−010)


730
605
607
606
604
SECTION K−K
(TYPICAL 2 PLACES)
K
K
732
SECTION E−E
(STAGE 7)
AE
AE
734
VIEW AE−AE
(STAGE 7)
L−A0629 (0000)
PW V

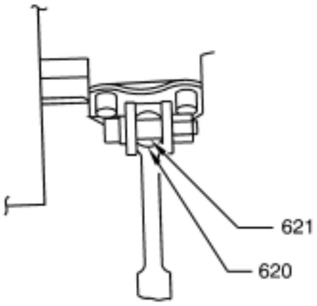
High Pressure Compressor (HPC)
Figure 802 (Sheet 11)
(Task 72−35−00−990−010)


B
B
SCHEMATIC REAR VIEW
(HPC)
S
(OIL COOLER)
S
B−1
VIEW B−B
L−A0635 (0000)
PW V

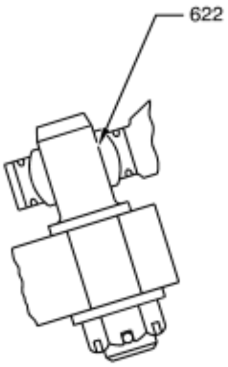
High Pressure Compressor (HPC)
Figure 803 (Sheet 1)
(Task 72−35−00−990−010)



VIEW S−S



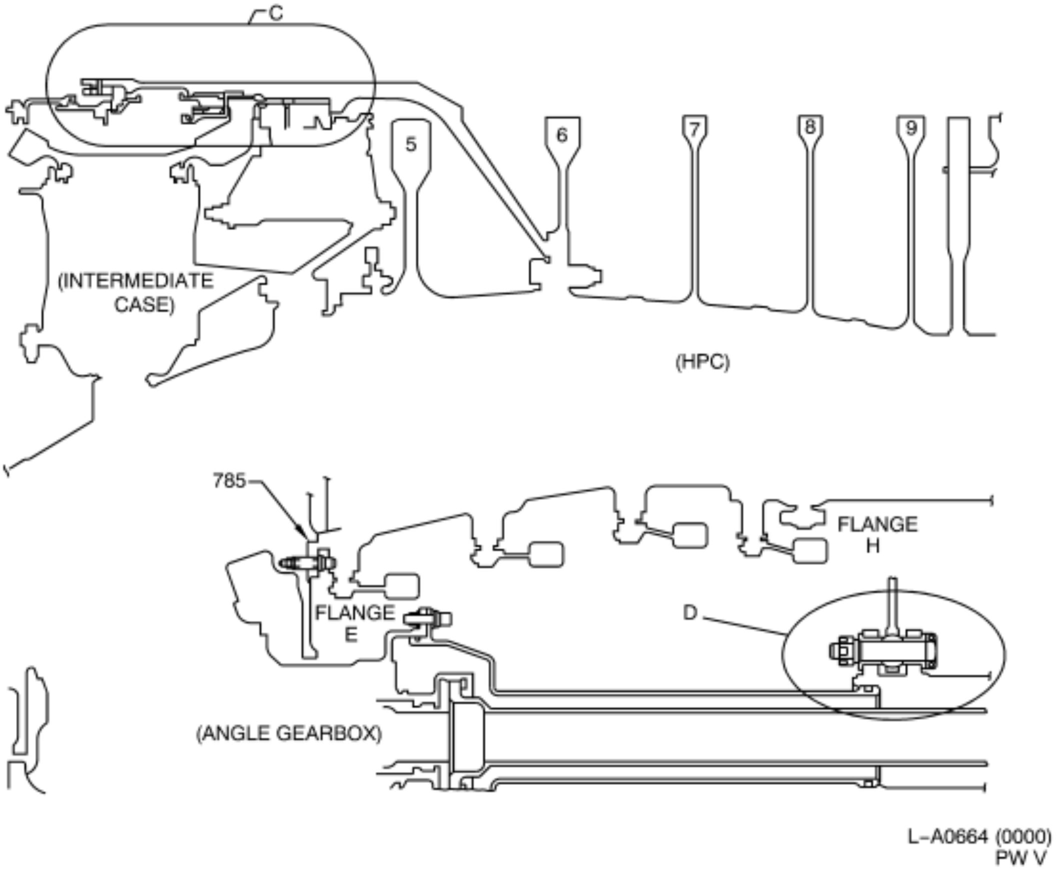
VIEW B−1



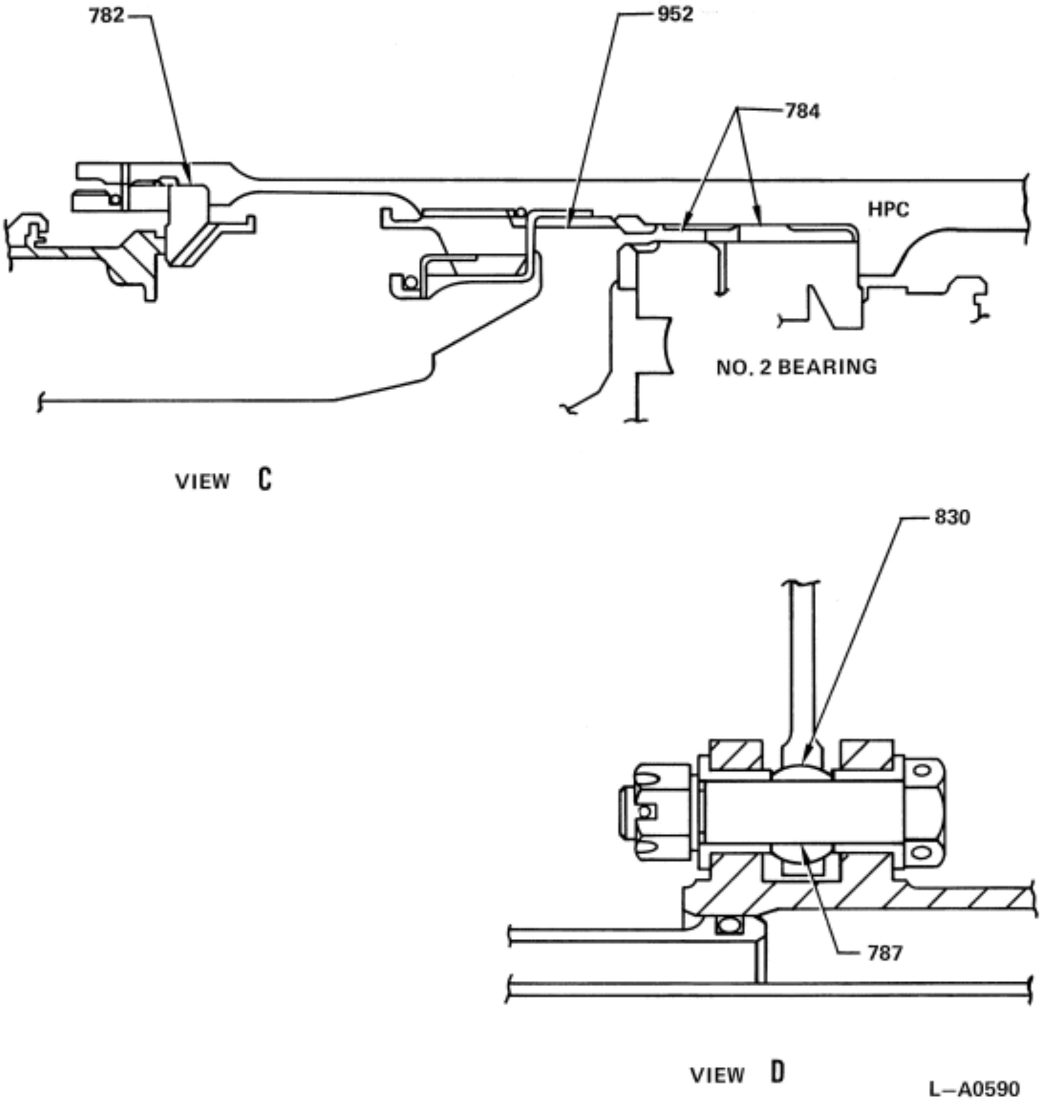
VIEW U−U

L−A0641 (0000)
PW V

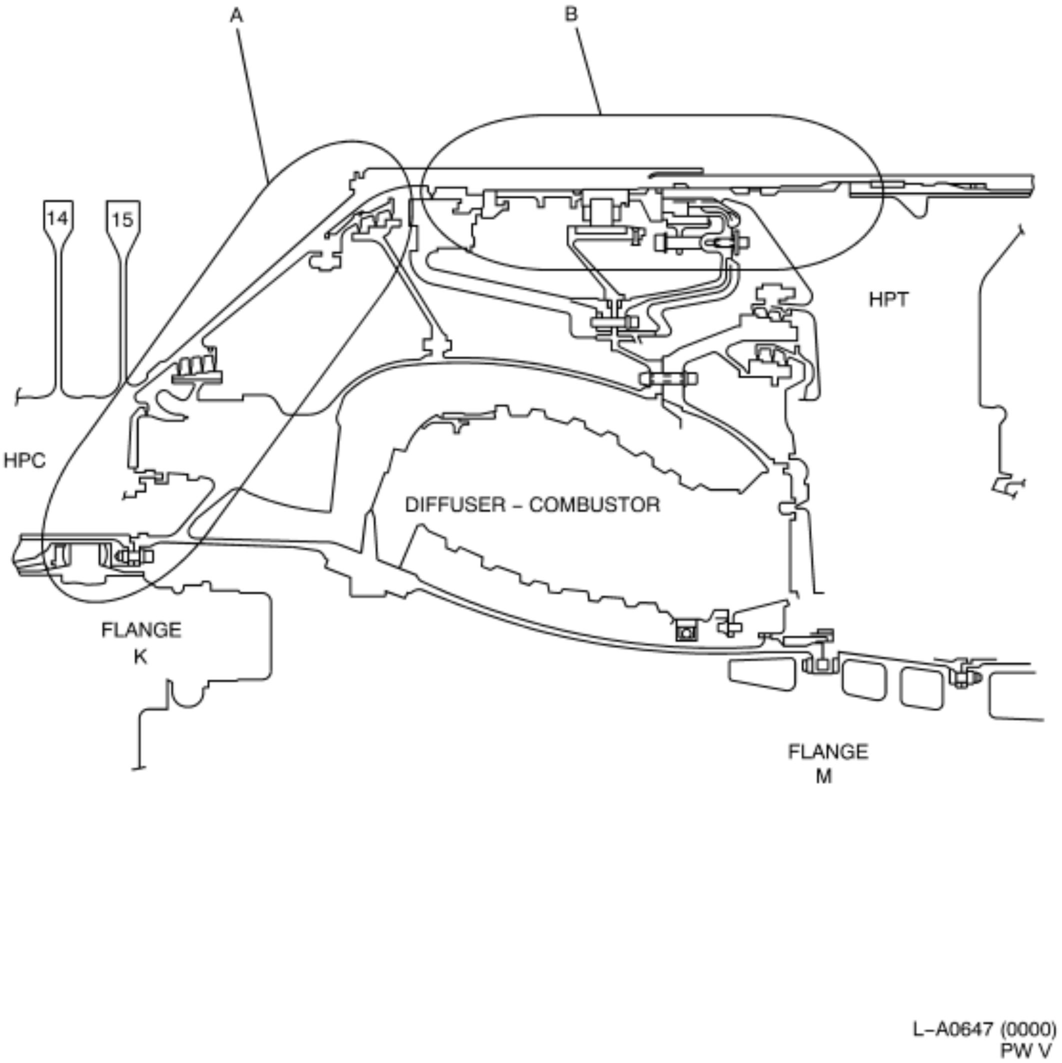
High Pressure Compressor (HPC)
Figure 803 (Sheet 2)
(Task 72−35−00−990−010)


C
5
6
7
8
9
(INTERMEDIATE CASE)
(HPC)
785
FLANGE H
FLANGE E
D
(ANGLE GEARBOX)
L−A0664 (0000)
PW V

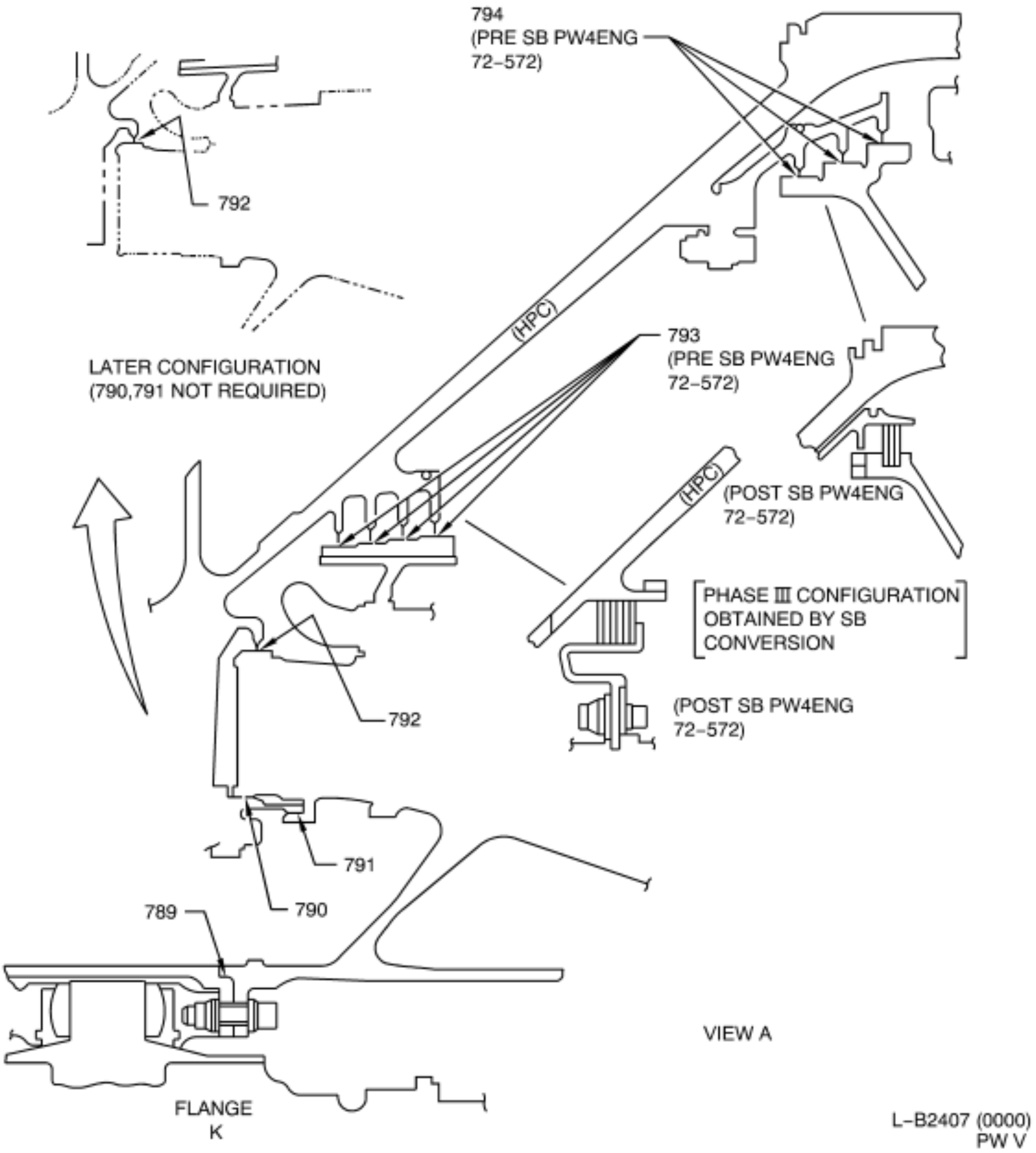
High Pressure Compressor (HPC)
Figure 804 (Sheet 1)
(Task 72−35−00−990−010)


782
952
784
HPC
NO. 2 BEARING
VIEW C
830
787
VIEW D
L-A0590

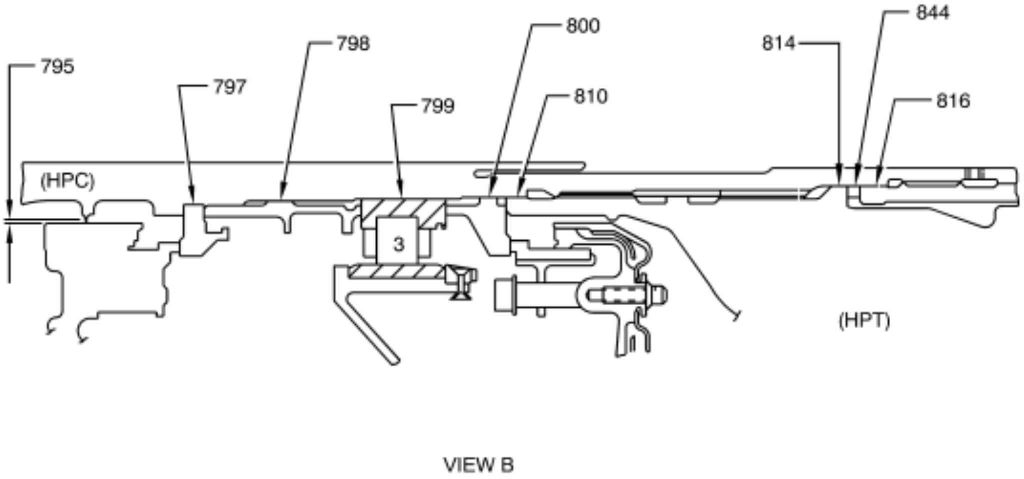
High Pressure Compressor (HPC)
Figure 804 (Sheet 2)
(Task 72-35-00-990-010)


A
B
14
15
HPC
HPT
DIFFUSER − COMBUSTOR
FLANGE
K
FLANGE
M
L−A0647 (0000)
PW V

High Pressure Compressor (HPC)
Figure 805 (Sheet 1)
(Task 72−35−00−990−010)

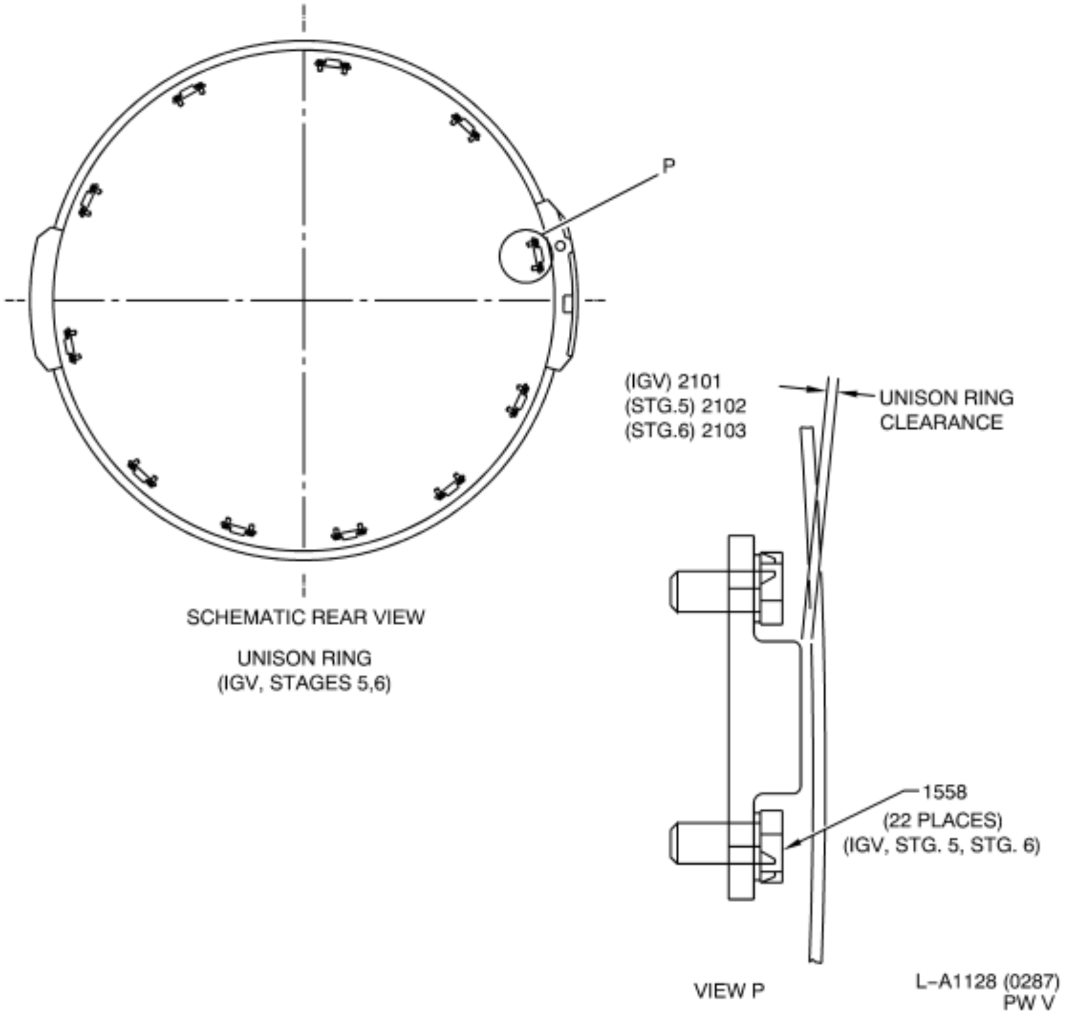

794
(PRE SB PW4ENG
72-572)
792
LATER CONFIGURATION
(790,791 NOT REQUIRED)
(HPC)
793
(PRE SB PW4ENG
72-572)
(HPC)
(POST SB PW4ENG
72-572)
PHASE III CONFIGURATION
OBTAINED BY SB
CONVERSION
(POST SB PW4ENG
72-572)
792
791
790
789
VIEW A
FLANGE
K
L-B2407 (0000)
PW V

High Pressure Compressor (HPC)
Figure 805 (Sheet 2)
(Task 72-35-00-990-010)

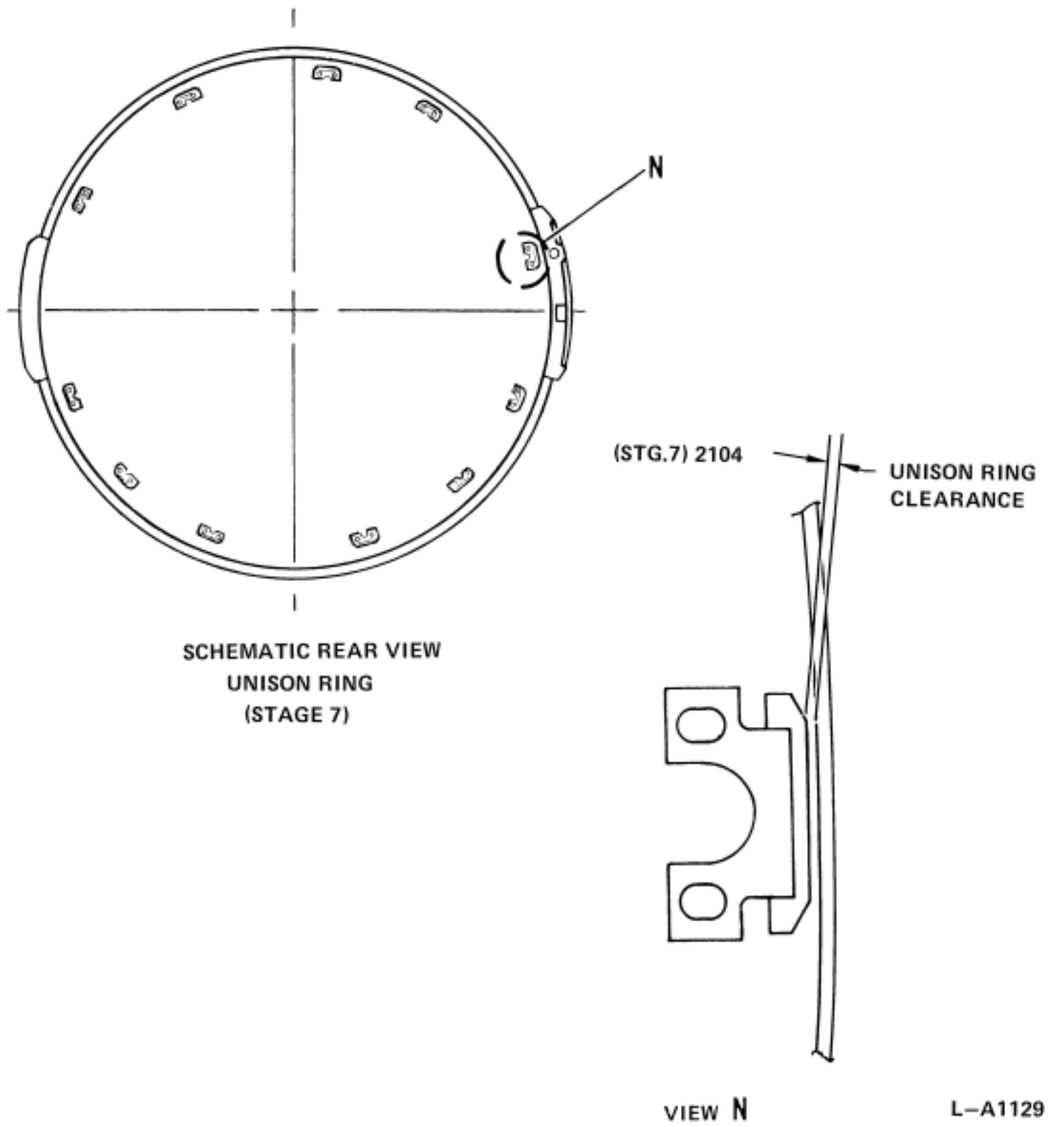

795
797
798
799
800
810
814
844
816
(HPC)
3
(HPT)
VIEW B

L−A0658 (0599)
PW V

High Pressure Compressor (HPC)
Figure 805 (Sheet 3)
(Task 72−35−00−990−010)


P
SCHEMATIC REAR VIEW
UNISON RING
(IGV, STAGES 5,6)
(IGV) 2101
(STG.5) 2102
(STG.6) 2103
UNISON RING
CLEARANCE
1558
(22 PLACES)
(IGV, STG. 5, STG. 6)
VIEW P
L−A1128 (0287)
PW V

High Pressure Compressor (HPC)
Figure 806 (Sheet 1)
(Task 72−35−00−990−010)


N
SCHEMATIC REAR VIEW
UNISON RING
(STAGE 7)
(STG.7) 2104
UNISON RING
CLEARANCE
VIEW N
L-A1129

High Pressure Compressor (HPC)
Figure 806 (Sheet 2)
(Task 72-35-00-990-010)

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04

Task 72−35−00−990−006:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B, C, or D located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.
D	This fit or clearance involves a component for which it is considered necessary to replace the used part with a new part at the time of overhaul in order to restore a wear or sealing surface. It is not required to dimensionally examine this fit if all of the conditions that follow are met: − The used wear, or sealing component has been replaced with a new part. − The mating part(s) have been visually and dimensionally examined as necessary by the applicable PW4000 series CIR, PN 51A375 section(s) for the part(s), and meet the permitted wear, and dimensional requirements on the surface(s) involved in the fit or clearance.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04

(1) Limits applicable to any combination of new or used parts.

- (a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.
- (b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.
- (c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (−) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (−) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent

EXAMPLE 2

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max

(CONTINUED)

less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances
The following General NOTES are applicable to two or more fits and Clearances reference numbers. The applicable reference numbers are included in the NOTES.

HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-04

NOTE: General NOTE 1: For Reference Numbers 1278 through 1291, you can measure the knife-edge diameter of the fit and not measure the HPC shroud segments (honeycomb) air seal diameters if all of the following conditions are met in the PW4000 Series CIR, PN 51A357.

> The measured knife-edge diameter is within the CIR manual Inspection/Check-04 serviceable limits.
>
> Honeycomb trenching (if present) is within the CIR manual Inspection/Check-03 and Inspection/Check-04 serviceable limits.

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
580	C	Plain Self-Aligning Bearing (72-35-79) Compressor Stator Cylinder Support Assembly (72-35-73) (See Figure 803, Sheet 9)				
		Bearing	2.6765 (67.9831)	2.6770 (67.9958)		
		Support	2.6774 (68.0060)	2.6784 (68.0310)	.0004 (0.011)	.0019 (0.048)
581	C	HPC Lever Set (72-35-74) Cylindrical Roller Bearing (72-35-79) (See Figure 803, Sheet 9)				
		Lever	1.7722 (45.0139)	1.7727 (45.0265)		
		Bearing	1.7712 (44.9885)	1.7717 (45.0011)	.0015T (0.038T)	.0005T (0.013T)
582	C	Bolt Stage 6 Rod End Bearing (72-35-78) (See Figure 803, Sheet 5)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Bearing	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
583	C	Bolt Stage 6 Synchronizing Ring Assembly (72-35-53) (See Figure 803, Sheet 5)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Ring	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
584	C	Bolt Inlet HPC Lever (72-35-74) (See Figure 803, Sheet 2)				
		Bolt	.3380 (8.5852)	.3382 (8.5902)		
		Lever	.3374 (8.5700)	.3380 (8.5852)	.0008T (0.0203T)	.0000 (0.0000)
585	C	Bolt HPC Lever Set (72-35-74) (See Figure 803, Sheet 2)				
		Bolt	.3380 (8.5852)	.3382 (8.5902)		
		Lever	.3374 (8.5700)	.3380 (8.5852)	.0008T (0.0203T)	.000 (0.000)
586	C	HPC Lever Set (72-35-74) Inlet HPC Lever (72-35-74) (See Figure 803, Sheet 2)				
		Lever Set	1.7722 (45.0139)	1.7727 (45.0265)		
		Inlet Lever	1.7727 (45.027)	1.7737 (45.051)	.000 (0.000)	.0015 (0.038)
587	C	Inlet HPC Lever (72-35-74) Bearing (72-35-79) (See Figure 803, Sheet 2)				
		Lever Set	1.7722 (45.0139)	1.7727 (45.0265)		
		Bearing	1.7712 (44.9885)	1.7717 (45.0011)	.0015T (0.038T)	.0005T (0.013T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
588	B	Bearing (72-35-79)				
		Compressor Stator Lever Support (72-35-73)				
		(See Figure 803, Sheet 2)				
		Bearing	2.6757	2.6772		
			(67.963)	(68.000)		
		Support	2.6774	2.6789	.0002	.0032
			(68.0060)	(68.044)	(0.006)	(0.081)
589	C	Bolt				
		HPC Synchronizing Ring Clevis Assembly (72-35-55)				
		(See Figure 803, Sheet 5)				
		Bolt	.4345	.4355		
			(11.037)	(11.061)		
		Ring	.437	.438	.0015	.0035
			(11.100)	(11.125)	(0.039)	(0.088)
590	C	Shoulder Bolt				
		Compressor Stator Cylinder Support Assembly (72-35-73)				
		(See Figure 803, Sheet 10)				
		Bolt	.3595	.3605		
			(9.132)	(9.156)		
		Support	.3615	.3635	.001	.0105*
			(9.183)	(9.232)	(0.025)	(0.267)*
591	B	Shoulder Bolt				
		HPC Front Case Assembly (72-35-40)				
		(See Figure 803, Sheet 10)				
		Bolt	.3595	.3605		
			(9.132)	(9.156)		
		Case	.3750	.3765	.0145	.017
			(9.5250)	(9.563)	(0.368)	(0.432)
592	C	Bolt				
		Cylinder Stop				
		(See Figure 803, Sheet 9)				
		Bolt	.216	.217		
			(5.487)	(5.511)		
		Stop	.218	.220	.001	.004
			(5.538)	(5.588)	(0.026)	(0.101)

HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-04

Ref. No.	IFR	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
593	B	Bearing (72-35-79) Compressor Stator Cylinder Support (72-35-73) (See Figure 803, Sheet 9)				
		Bearing	1.4360 (36.475)	1.4375 (36.512)		
		Support	1.438 (36.526)	1.440 (36.576)	.0005 (0.013)	.004 (0.101)
599	C	Compressor Cylinder (CMM) Bearing (72-35-79) (See Figure 803, Sheet 9)				
		Cylinder	.7487 (19.0170)	.7490 (19.0246)		
		Bearing	.7495 (19.0373)	.7500 (19.0500)	.0005 (0.0127)	.0013 (0.0330)
600	C	Bolt HPC Lever Set (72-35-74) (See Figure 803, Sheet 10)				
		Bolt	.497 (12.624)	.498 (12.649)		
		Lever	.4995 (12.688)	.5005 (12.712)	.0015 (0.039)	.0035 (0.088)
601	C	Bolt HPC Lever Set (72-35-74) (See Figure 803, Sheet 10)				
		Bolt	.3739 (9.4971)	.3744 (9.5097)		
		Lever	.3745 (9.513)	.3755 (9.537)	.0001 (0.003)	.0016 (0.040)
602	C	Bolt Rod End Bearing Assembly (72-35-78) (See Figure 803, Sheet 10)				
		Bolt	.3739 (9.4971)	.3744 (9.5097)		
		Bearing	.3745 (9.5123)	.3750 (9.5250)	.0001 (0.103)	.0011 (0.027)

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
603	C	Bearing (72−35−78)				
		Rod End (72−35−78)				
		(See Figure 803, Sheet 10)				
		Bearing	.8120 (20.6248)	.8125 (20.6375)		
		Rod	.8123 (20.6325)	.8128 (20.6451)	.0002T (0.0051T)	.0008 (0.0203)
604	C	Bolt				
		HPC Synchronizing Ring Clevis Assembly (72−35−55)				
		(See Figure 803, Sheets 4 And 11)				
		Bolt	.4345 (11.037)	.4355 (11.061)		
		Ring	.437 (11.100)	.438 (11.125)	.0015 (0.039)	.0035 (0.088)
605	C	Bolt				
		HPC Synchronizing Ring Clevis Assembly (72−35−55)				
		(See Figure 803, Sheets 4 And 11)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Ring	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
606	C	Bolt				
		Stage 5 And 7 Rod End Bearing (72−35−78)				
		(See Figure 803, Sheets 4 And 11)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Bearing	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
607	A	Radial Clearance				
		(See Figure 803, Sheet 3, 4, 5 And 11)				
		Rod End				
		Spherical Bearing (72−35−78)			.000	
609	C	Bolt				
		HPC Clevis (72−35−76)				
		(See Figure 803, Sheet 4)				
		Bolt	.4345 (11.037)	.4355 (11.061)		
		Clevis	.437 (11.100)	.438 (11.125)	.0015 (0.039)	.0035 (0.088)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
610	C	Bolt Rod End Bearing (72-35-78) (See Figure 803, Sheet 4)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Bearing	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
611	C	Bolt HPC Clevis (72-35-76) (See Figure 803, Sheet 4)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Clevis	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
612	C	Bolt HPC Synchronizing Ring Clevis Assembly (72-35-55) (See Figure 803, Sheet 3)				
		Bolt	.4345 (11.037)	.4355 (11.061)		
		Ring	.437 (11.100)	.438 (11.125)	.0015 (0.039)	.0035 (0.088)
613	C	Bolt Rod End Bearing (72-35-78) (See Figure 803, Sheet 3)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Bearing	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
614	C	Bolt HPC Synchronizing Ring Clevis Assembly (72-35-55) (See Figure 803, Sheet 3)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Ring	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
616	C	Bolt Support Mounting Brace (See Figure 803, Sheet 8)				
		Bolt	.3685 (9.360)	.3695 (9.385)		
		Brace	.3745 (9.513)	.3755 (9.537)	.005 (0.127)	.007 (0.177)
617	B	Bolt HPC Front Case Assembly (72-35-40) (See Figure 803, Sheet 8)				
		Bolt	.3685 (9.360)	.3695 (9.385)		
		Case	.3750 (9.525)	.3765 (9.563)	.0055 (0.140)	.008 (0.203)
619	C	Pin (72-35-40) Compressor Stator Cylinder Support Bracket (See Figure 803, Sheet 7)				
		Pin	.3740 (9.4996)	.3741 (9.5021)		
		Bracket	.376 (9.551)	.377 (9.575)	.0019 (0.049)	.0030 (0.076)
620	B	Gearbox Drive Shaft Housing Support Link Bearing (72-35-94) Gearbox Drive Shaft Housing Support Link (72-35-72) (See Figure 804, Sheet 2)				
		Bearing	.6865 (17.438)	.6875 (17.462)		
		Link	.6885 (17.488)	.6895 (17.513)	.001 (0.026)	.003 (0.076)
621	B	Gearbox Drive Shaft Housing Support Clevis - Shoulder Bolt Gearbox Drive Shaft Housing Support Link Bearing (72-35-94) (See Figure 804, Sheet 2)				
		Clevis	.3732 (9.4793)	.3737 (9.4919)		
		Bearing	.3742 (9.5047)	.3747 (9.5173)	.0005 (0.013)	.0015 (0.038)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
622	B	Pin Oil Cooler Front Bracket Bearing (See Figure 804, Sheet 2)				
		Pin	.6245 (15.8623)	.6250 (15.8750)		
		Bearing	.6255 (15.888)	.6265 (15.913)	.0005 (0.013)	.002 (0.050)
623	C	Spacer (72-35-73) Compressor Stator Cylinder Support Assembly (PN 53H036-01) (72-35-73) (See Figure 803, Sheet 10)				
		Spacer	.497 (12.624)	.498 (12.649)		
		Support	.499 (12.675)	.501 (12.725)	.001 (0.026)	.004 (0.101)
782	B	HPC Front Hub (72-35-05) No. 2 Bearing Front Seal Seat (72-35-90) (See Figure 805, Sheet 2)				
		Hub	6.549 (166.345)	6.551 (166.395)		
		Seat	6.552 (166.421)	6.554 (166.471)	.001 (0.026)	.005 (0.127)
784	A	HPC Front Hub (72-35-05) Gearbox Drive Bevel Gear (72-34-12) (See Figure 805, Sheet 2)				
		Hub	7.305 (185.547)	7.306 (185.572)		
		Gear	7.301 (185.446)	7.302 (185.470)	.003T (0.077T)	.005T (0.127T)
785	B	Intermediate Case Assembly (72-34-01) HPC Front Case Assembly (72-35-40) (See Figure 805, Sheet 1)				
		Intd. Case	34.574 (878.180)	34.578 (878.281)		
		HPC Case	34.568 (878.028)	34.572 (878.128)	.002T (0.051T)	.010T (0.254T)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
787	B	Shoulder Bolt (72-61-83) Gearbox Drive Shaft Housing Support Link Bearing (72-35-94) (See Figure 805, Sheet 2)				
		Bolt	.6232 (15.8293)	.6237 (15.8419)		
		Bearing	.6242 (15.8547)	.6247 (15.8673)	.0005 (0.013)	.0015 (0.038)
789	B	Diffuser Case Assembly (72-41-01) HPC (Outer) Rear Case Assembly (72-35-69) (See Figure 806, Sheet 2)				
		Diffuser Case	32.248 (819.100)	32.252 (819.200)		
		HPC Case	32.242 (818.947)	32.246 (819.048)	.000* (0.000)*	.010T (0.254T)
792	A	Drum Rotor (Rear) Disk Assembly (72-35-10) Compressor Exit Stator Assembly (72-41-02) (See Figure 806, Sheet 2)				
		Disk	23.409 (594.59)	23.421 (594.89)		
		Stator	23.441 (595.401)	23.447 (595.554)	.020 (0.51)	.048* (1.22)*
795	A	HPC Turbine Driveshaft (72-35-09) No. 3 Bearing Front Cooling Duct Assembly (72-41-06) (See Figure 806, Sheet 3)				
		Driveshaft	7.986 (202.84)	7.998 (203.15)		
		Duct	8.098 (205.690)	8.102 (205.790)	.100 (2.54)	.126* (3.20)*
797	B	HPC Turbine Driveshaft (72-35-09) No. 3 Bearing Front Seal Seat (72-41-80) (See Figure 806, Sheet 3)				
		Driveshaft	7.229 (183.617)	7.231 (183.667)		
		Seal Seat	7.232 (183.693)	7.234 (183.743)	.001 (0.026)	.005 (0.127)

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Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
798	B	HPC Turbine Driveshaft (72-35-09) No. 3 Bearing Seal Spacer (72-41-81) (See Figure 806, Sheet 3)				
		Driveshaft	7.209 (183.109)	7.211 (183.159)		
		Spacer	7.212 (183.185)	7.214 (183.235)	.001 (0.026)	.005 (0.127)
799 (1)	A	HPC Turbine Driveshaft (72-35-09) No. 3 Roller Bearing (72-41-82) (See Figure 806, Sheet 3)				
		Driveshaft	7.2076 (183.0731)	7.2080 (183.0832)		
		Bearing (Pre SB PW4ENG 72-611)	7.2040 (182.9816)	7.2047 (182.9993)	.004T (0.101T)	.0029T (0.074T)
799 (2)	A	HPC Turbine Driveshaft (72-35-09) No. 3 Roller Bearing (72-41-82) (See Figure 806, Sheet 3)				
		Driveshaft	7.2076 (183.0731)	7.2080 (183.0832)		
		Bearing (Post SB PW4ENG 72-611)	7.2060 (183.0324)	7.2067 (183.0501)	.002T (0.051T)	.0009T (0.023T)
800	B	HPC Turbine Driveshaft (72-35-09) No. 3 Bearing Rear Seal Seat (72-41-84) (See Figure 806, Sheet 3)				
		Driveshaft	7.1455 (181.496)	7.1465 (181.521)		
		Seal Seat	7.1475 (181.547)	7.1505 (181.622)	.001 (0.026)	.005 (0.127)
810	B	HPC Turbine Driveshaft (72-35-09) Turbine Front Hub (Stage 1) (72-52-05) (See Figure 806, Sheet 3)				
		Driveshaft	7.1455 (181.496)	7.1465 (181.521)		
		HPT Hub	7.1335 (181.191)	7.1355 (181.241)	.010T (0.254T)	.013T (0.330T)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
814	B	HPC Turbine Driveshaft (72-35-09) Turbine Intermediate Hub (Stage 2) (72-52-06) (See Figure 806, Sheet 3)				
		Driveshaft	6.5947 (167.506)	6.5957 (167.530)		
		HPT Hub	6.5827 (167.201)	6.5847 (167.251)	.007T* (0.178T)*	.013T (0.330T)
816	B	HPC Turbine Driveshaft (72-35-09) No. 3 Bearing (And HPT) Retaining Nut (72-52-80) (See Figure 806, Sheet 3)				
		Driveshaft	6.5947 (167.506)	6.5957 (167.530)		
		Nut	6.5967 (167.557)	6.5987 (167.606)	.001 (0.025)	.0052* (0.132)*
830	B	Spherical Bearing (72-35-94) Gearbox Drive Shaft Housing Support Link (72-35-72) (See Figure 805, Sheet 2)				
		Bearing	.9675 (24.575)	.9685 (24.599)		
		Link	.9695 (24.626)	.9705 (24.650)	.001 (0.025)	.003 (0.076)
844	B	HPC Turbine Driveshaft (72-35-09) Turbine Shaft Spacer (72-52-83) (See Figure 806, Sheet 3)				
		Driveshaft	6.5947 (167.506)	6.5957 (167.530)		
		Spacer	6.5967 (167.557)	6.5987 (167.606)	.001 (0.026)	.0052* (0.132)*
1270	A	HPC Inlet Airseal (Front Knife-Edge) (72-35-31) HPC Inlet, Shroud Segment Assembly (72-35-41) (See Figure 801, Sheet 14)				
		Airseal	19.843 (504.01)	19.857 (504.37)		
		Vane	19.878 (504.90)	19.894 (505.31)	.021 (0.533)	.061* (1.549)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1271	A	HPC Inlet Airseal (Rear Knife-Edge) (72-35-31) HPC Inlet, Shroud Segment Assembly (72-35-41) (See Figure 801, Sheet 14)				
		Airseal	19.943 (506.55)	19.957 (506.91)		
		Vane	19.978 (507.44)	19.994 (507.85)	.021 (0.533)	.061* (1.549)*
1272	A	Stage 5 HPC Disk (Front Knife-Edge) Airseal (72-35-06) Stage 5 HPC Shroud Segment Assembly (72-35-42) (See Figure 801, Sheet 14)				
		Airseal	20.273 (514.93)	20.287 (515.29)		
		Vane	20.298 (515.57)	20.314 (515.98)	.011 (0.279)	.051* (1.295)*
1273	A	Stage 5 HPC Disk (Rear Knife-Edge) Airseal (72-35-06) Stage 5 HPC Shroud Segment Assembly (72-35-42) (See Figure 801, Sheet 14)				
		Airseal	20.173 (512.39)	20.187 (512.75)		
		Vane	20.198 (513.03)	20.214 (513.44)	.011 (0.279)	.051* (1.295)*
1274	A	Drum Rotor (Stage 6 Front Knife-Edge) Airseal (72-35-07) Stage 6 HPC Shroud Segment Assembly (72-35-43) (See Figure 801, Sheet 14)				
		Airseal	20.584 (522.83)	20.598 (523.19)		
		Vane	20.608 (523.44)	20.624 (523.85)	.010 (0.254)	.050* (1.270)*
1275	A	Drum Rotor (Stage 6 Rear Knife-Edge) Airseal (72-35-07) Stage 6 HPC Shroud Segment Assembly (72-35-43) (See Figure 801, Sheet 14)				
		Airseal	20.704 (525.88)	20.718 (526.24)		
		Vane	20.728 (526.49)	20.744 (526.90)	.010 (0.254)	.050* (1.270)*

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1276	A	Drum Rotor (Stage 7 Front Knife-Edge) Airseal (72-35-07) Stage 7 HPC Shroud Segment Assembly (72-35-44) (See Figure 801, Sheet 14)				
		Airseal	21.132 (536.75)	21.146 (537.11)		
		Vane	21.188 (538.18)	21.204 (538.58)	.042 (1.07)	.082* (2.083)*
1277	A	Drum Rotor (Stage 7 Rear Knife-Edge) Airseal (72-35-07) Stage 7 HPC Shroud Segment Assembly (72-35-44) (See Figure 801, Sheet 14)				
		Airseal	21.252 (539.80)	21.266 (540.16)		
		Vane	21.308 (541.22)	21.324 (541.63)	.042 (1.07)	.082* (2.083)*
1278	A	Drum Rotor (Stage 8 Front Knife-Edge) Airseal (72-35-07) Stage 8 Compressor Stator Segment Assembly (72-35-59) (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Airseal	22.124 (561.95)	22.138 (562.31)		
		Vane	22.156 (562.762)	22.164 (562.966)	.018 (0.46)	.050* (1.270)*
		See General NOTE 1 before Reference Number 580.				
1279	A	Drum Rotor (Stage 8 Rear Knife-Edge) Airseal (72-35-07) Stage 8 Compressor Stator Segment Assembly (72-35-59) (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Airseal	22.224 (564.49)	22.238 (564.85)		
		Vane	22.256 (565.302)	22.264 (565.506)	.018 (0.46)	.050* (1.270)*
		See General NOTE 1 before Reference Number 580.				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Limits Max
1280	A	Drum Rotor (Stage 9 Front Knife-Edge) Airseal (72-35-07) Stage 9 Compressor Stator Segment Assembly (72-35-60) (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Airseal	22.938 (582.63)	22.952 (582.98)		
		Vane	22.970 (583.438)	22.978 (583.641)	.018 (0.46)	.050* (1.270)*
		See General NOTE 1 before Reference Number 580.				
1281	A	Drum Rotor (Stage 9 Rear Knife-Edge) Airseal (72-35-07) Stage 9 Compressor Stator Segment Assembly (72-35-60) (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Airseal	22.938 (582.63)	22.952 (582.98)		
		Vane	22.970 (583.438)	22.978 (583.641)	.018 (0.46)	.050* (1.270)*
		See General NOTE 1 before Reference Number 580.				
1282	A	Drum Rotor (Stage 10 Front Knife-Edge) Airseal (72-35-07) Stage 10 Compressor Stator Segment Assembly (72-35-60) (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Airseal	23.157 (588.19)	23.171 (588.54)		
		Vane	23.214 (589.636)	23.222 (589.839)	.043 (1.092)	.075* (1.905)*
		See General NOTE 1 before Reference Number 580.				
1283	A	Drum Rotor (Stage 10 Rear Knife-Edge) Airseal (72-35-07) Stage 9/10 Compressor Stator Segment Assembly (72-35-60) (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Airseal	23.257 (590.73)	23.271 (591.08)		
		Vane	23.314 (592.176)	23.322 (592.379)	.043 (1.092)	.075* (1.905)*
		See General NOTE 1 before Reference Number 580.				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1284	A	Drum Rotor (Stage 11 Front Knife−Edge) Airseal (72−35−07) Stage 11/12 Compressor Stator Segment Assembly (72−35−61) (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Airseal	23.166 (588.42)	23.180 (588.77)		
		Vane	23.205 (589.41)	23.239 (590.27)	.025 (0.635)	.083* (2.108)*
		See General NOTE 1 before Reference Number 580.				
1285	A	Drum Rotor (Stage 11 Rear Knife−Edge) Airseal (72−35−07) Stage 11/12 Compressor Stator Segment Assembly (72−35−61) (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Airseal	23.266 (590.96)	23.280 (591.31)		
		Vane	23.305 (591.95)	23.339 (592.81)	.025 (0.635)	.083* (2.108)*
		See General NOTE 1 before Reference Number 580.				
1286	A	Drum Rotor (Stage 12 Front Knife−Edge) Airseal (72−35−08) Stage 11/12 Compressor Stator Segment Assembly (72−35−61) (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Airseal	23.167 (588.44)	23.181 (588.80)		
		Vane	23.187 (588.95)	23.221 (589.81)	.006 (0.152)	.064* (1.626)*
		See General NOTE 1 before Reference Number 580.				
1287	A	Drum Rotor (Stage 12 Rear Knife−Edge) Airseal (72−35−08) Stage 11/12 Compressor Stator Segment Assembly (72−35−61) (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Airseal	23.267 (590.98)	23.281 (591.34)		
		Vane	23.287 (591.49)	23.321 (592.35)	.006 (0.152)	.064* (1.626)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)						
		See General NOTE 1 before Reference Number 580.				
1288	A	Drum Rotor (Stage 13 Front Knife-Edge) Airseal (72-35-08) Stage 13/14 Compressor Stator Segment Assembly (72-35-62) (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Airseal	23.149 (587.98)	23.163 (588.34)		
		Vane	23.167 (588.44)	23.201 (589.31)	.004 (0.102)	.062* (1.575)*
		See General NOTE 1 before Reference Number 580.				
1289	A	Drum Rotor (Stage 13 Rear Knife-Edge) Airseal (72-35-08) Stage 13/14 Compressor Stator Segment Assembly (72-35-62) (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Airseal	23.249 (590.52)	23.263 (590.88)		
		Vane	23.267 (590.98)	23.301 (591.85)	.004 (0.102)	.062* (1.575)*
		See General NOTE 1 before Reference Number 580.				
1290	A	Drum Rotor (Stage 14 Front Knife-Edge) Airseal (72-35-08) Stage 13/14 Compressor Stator Segment Assembly (72-35-62) (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Airseal	23.138 (587.71)	23.152 (588.06)		
		Vane	23.167 (588.44)	23.201 (589.31)	.015 (0.381)	.073* (1.854)*
		See General NOTE 1 before Reference Number 580.				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1291	A	Drum Rotor (Stage 14 Rear Knife−Edge) Airseal (72−35−08) Stage 14 Compressor Stator Segment Assembly (72−35−62) (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Airseal	23.238 (590.25)	23.252 (590.60)		
		Vane	23.267 (590.98)	23.301 (591.85)	.015 (0.381)	.073* (1.854)*
		See General NOTE 1 before Reference Number 580.				
1292	A	Stage 5 HPC Disk (IGV Rear Knife−Edge Airseal) (72−35−06) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (72−35−57) (Refer To Figure 802, Sheet 16)				
		Airseal	19.943 (506.55)	19.957 (506.91)		
		Guide	19.976 (507.390)	19.984 (507.594)	.019 (0.483)	.051* (1.295)*
1293	A	Stage 5 HPC Disk (Stage 5 Front Knife−Edge Airseal) (72−35−06) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (72−35−57) (Refer To Figure 802, Sheet 16)				
		Airseal	20.273 (514.93)	20.287 (515.29)		
		Guide	20.306 (515.772)	20.314 (515.976)	.019 (0.483)	.051* (1.295)*
1294	A	Stage 5 HPC Disk (Stage 5 Rear Knife−Edge Airseal) (72−35−06) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (72−35−57) (Refer To Figure 802, Sheet 16)				
		Airseal	20.173 (512.39)	20.187 (512.75)		
		Guide	20.206 (513.232)	20.214 (513.436)	.019 (0.483)	.051* (1.295)*

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1295	A	HPC Drum Rotor (Front) (Stage 6 Front Knife-Edge Airseal) (72-35-07) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (72-35-57) (Refer To Figure 802, Sheet 16)				
		Airseal	20.584 (522.834)	20.598 (523.19)		
		Guide	20.617 (523.672)	20.625 (523.875)	.019 (0.483)	.051* (1.295)*
1296	A	HPC Drum Rotor (Front) (Stage 6 Rear Knife-Edge Airseal) (72-35-07) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (72-35-57) (Refer To Figure 802, Sheet 16)				
		Airseal	20.704 (525.88)	20.718 (526.24)		
		Guide	20.737 (526.720)	20.745 (526.923)	.019 (0.483)	.051 (1.295)*
1297	A	HPC Drum Rotor (Front) (Stage 7 Front Knife-Edge Airseal) (72-35-07) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (72-35-57) (Refer To Figure 802, Sheet 16)				
		Airseal	21.132 (536.75)	21.146 (537.11)		
		Guide	21.165 (537.591)	21.173 (537.794)	.019 (0.483)	.051* (1.295)*
1298	A	HPC Drum Rotor (Front) (Stage 7 Rear Knife-Edge Airseal) (72-35-07) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (72-35-57) (Refer To Figure 802, Sheet 16)				
		Airseal	21.252 (539.80)	21.266 (540.16)		
		Guide	21.285 (540.639)	21.293 (540.842)	.019 (0.483)	.051* (1.295)*

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1299	B	HPC Inlet Vane (72-35-47)				
		Stage 5 HPC Shroud Segment Assembly (72-35-41)				
		(Refer To Figure 802, Sheet 5)				
		Vane	.115 (2.921)	.120 (3.048)		
		Shroud	.150 (3.810)	.158 (4.013)	.030 (0.762)	.043 (1.092)
1300	B	Stage 5 HPC Vane (72-35-48)				
		Stage 5 HPC Shroud Segment Assembly (72-35-42)				
		(Refer To Figure 802, Sheet 5)				
		Vane	.115 (2.921)	.120 (3.048)		
		Shroud	.150 (3.810)	.158 (4.013)	.030 (0.762)	.043 (1.092)
1301	B	Stage 6 HPC Vane (72-35-49)				
		Stage 6 HPC Shroud Segment Assembly (72-35-43)				
		(Refer To Figure 802, Sheet 5)				
		Vane	.115 (2.921)	.120 (3.048)		
		Shroud	.150 (3.810)	.158 (4.013)	.030 (0.762)	.043 (1.092)
1302	B	Stage 7 HPC Vane (72-35-50)				
		Stage 7 HPC Shroud Segment Assembly (72-35-44)				
		(Refer To Figure 802, Sheet 5)				
		Vane	.115 (2.921)	.120 (3.048)		
		Shroud	.150 (3.810)	.158 (4.013)	.030 (0.762)	.043 (1.092)
1303		Bolt (72-35-99)				
		HPC Inlet Shroud Segment Assembly (72-35-41)				
		(Refer To Figure 802, Sheet 4)				
		Bolt	.2485 (6.312)	.2495 (6.337)		
		Shroud	.2520 (6.401)	.2540 (6.451)	.0025 (0.064)	.0055 (0.140)

			New Part Reference Dimensions		Limits	
Ref. No.	I F R	Description	Min	Max	Min	Max
1304		Bolt (72-35-99) Stage 5 HPC Shroud Segment Assembly (72-35-42) (Refer To Figure 802, Sheet 4)				
		Bolt	.2485 (6.312)	.2495 (6.337)		
		Shroud	.2520 (6.401)	.2540 (6.451)	.0025 (0.064)	.0055 (0.140)
1305		Bolt (72-35-99) Stage 6 HPC Shroud Segment Assembly (72-35-43) (Refer To Figure 802, Sheet 4)				
		Bolt	.2485 (6.312)	.2495 (6.337)		
		Shroud	.2520 (6.401)	.2540 (6.451)	.0025 (0.064)	.0055 (0.140)
1306		Bolt (72-35-99) Stage 7 HPC Shroud Segment Assembly (72-35-44) (Refer To Figure 802, Sheet 4)				
		Bolt	.2485 (6.312)	.2495 (6.337)		
		Shroud	.2520 (6.401)	.2540 (6.451)	.0025 (0.064)	.0055 (0.140)
1307		HPC Shroud Guide Assembly (IGV) Honeycomb Airseal (72-35-57) HPC Inlet Shroud Segment Assembly (72-35-41) (Refer To Figure 802, Sheet 4)				
		Guide	.102 (2.591)	.106 (2.692		
		Shroud	.092 (2.337)	.096 (2.438)	.006 (0.152)	.014 (0.356)
1308		HPC Shroud Guide Assembly (Stage 5) Honeycomb Airseal (72-35-57) Stage 5 HPC Shroud Segment Assembly (72-35-42) (Refer To Figure 802, Sheet 4)				
		Guide	.102 (2.591)	.106 (2.692		
		Shroud	.092 (2.337)	.096 (2.438)	.006 (0.152)	.014 (0.356)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1309		HPC Shroud Guide Assembly (Stage 6) Honeycomb Airseal (72-35-57) Stage 6 HPC Shroud Segment Assembly (72-35-43) (Refer To Figure 802, Sheet 4)				
		Guide	.102 (2.591)	.106 (2.692		
		Shroud	.092 (2.337)	.096 (2.438)	.006 (0.152)	.014 (0.356)
1310		HPC Shroud Guide Assembly (Stage 7) Honeycomb Airseal (72-35-57) Stage 7 HPC Shroud Segment Assembly (72-35-44) (Refer To Figure 802, Sheet 4)				
		Guide	.102 (2.591)	.106 (2.692		
		Shroud	.092 (2.337)	.096 (2.438)	.006 (0.152)	.014 (0.356)
1311		HPC Inlet Shroud Segment Assembly (72-35-41) HPC Shroud Guide Assembly Honeycomb Airseal (72-35-57) (Refer To Figure 802, Sheet 4)				
		Shroud (Gap)	.817 (20.752)	.821 (20.853)		
		Guide (Gap)	.825 (20.955)	.832 (21.133)	.004 (0.102)	.015 (0.381)
1312		Stage 5 HPC Shroud Segment Assembly (72-35-42) HPC Shroud Guide Assembly Honeycomb Airseal (72-35-57) (Refer To Figure 802, Sheet 4)				
		Shroud (Gap)	1.059 (26.899)	1.067 (27.102)		
		Guide (Gap)	1.069 (27.153)	1.076 (27.330)	.002 (0.051)	.017 (0.432)
1313		Stage 6 HPC Shroud Segment Assembly (72-35-43) HPC Shroud Guide Assembly Honeycomb Airseal (72-35-57) (Refer To Figure 802, Sheet 4)				
		Shroud (Gap)	1.152 (29.261)	1.160 (29.464)		
		Guide (Gap)	1.162 (29.515)	1.169 (29.693)	.002 (0.051)	.017 (0.432)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1314		Stage 6 HPC Shroud Segment Assembly (72-35-44) HPC Shroud Guide Assembly Honeycomb Airseal (72-35-57) (Refer To Figure 802, Sheet 4)				
		Shroud (Gap)	1.247 (31.674)	1.255 (31.877)		
		Guide (Gap)	1.257 (31.928)	1.264 (32.106)	.002 (0.051)	.017 (0.432)
1315		Variable Stator Vane (IGV) And HPC Front Case Assembly (72-35-02) (Refer To Figure 802, Sheet 3)				
		End Clearance (Shroud To Vane)			.005 (0.127)	
NOTE:		Vane must be bottomed against the inner trunnion bearing.				
1316		Variable Stator Vane (Stage 5) And HPC Front Case Assembly (72-35-02) (Refer To Figure 802, Sheet 3)				
		End Clearance (Shroud To Vane)			.005 (0.127)	
NOTE:		Vane must be bottomed against the inner trunnion bearing.				
1317		Variable Stator Vane (Stage 6) And HPC Front Case Assembly (72-35-02) (Refer To Figure 802, Sheet 3)				
		End Clearance (Shroud To Vane)			.005 (0.127)	
NOTE:		Vane must be bottomed against the inner trunnion bearing.				
1318		Variable Stator Vane (Stage 7) And HPC Front Case Assembly (72-35-02) (Refer To Figure 802, Sheet 3)				
		End Clearance (Shroud To Vane)			.005 (0.127)	
NOTE:		Vane must be bottomed against the inner trunnion bearing.				

Ref. No.	I F R	Description	Average Clearance At Assembly Min	Average Clearance At Assembly Max	Local Limits At Assembly Min	Local Limits At Assembly Max
1320	A	Stage 5 HPC Blade Tip Clearance (See Figure 801, Sheet 14 And Figure 802, Sheet 16) Clerance	.055 (1.40)	.074 (1.88)	.050 (1.27)	.079 (2.01)
1321	A	Stage 6 HPC Blade Tip Clearance (See Figure 801, Sheet 14 And Figure 802, Sheet 16) Clearance	.050 (1.27)	.064 (1.63)	.045 (1.14)	.069 (1.75)
1322	A	Stage 7 HPC Blade Tip Clearance (See Figure 801, Sheet 14 And Figure 802, Sheet 16) Clearance	.053 (1.35)	.067 (1.70)	.048 (1.22)	.072 (1.83)
1323	A	Stage 8 HPC Blade Tip Clearance (See Figure 801, Sheet 14 And Figure 802, Sheet 16) Clearance	.045 (1.14)	.064 (1.63)	.040 (1.02)	.069 (1.75)
1324	A	Stage 9 HPC Blade Tip Clearance (See Figure 801, Sheet 14 And Figure 802, Sheet 16) Clearance	.025 (0.64)	.042 (1.07)	.020 (0.51)	.047 (1.19)
1325	A	Stage 10 HPC Blade Tip Clearance (See Figure 801, Sheet 14 And Figure 802, Sheet 16) Clearance	.026 (0.66)	.040 (1.02)	.019 (0.48)	.045 (1.14)
1326	A	Stage 11 HPC Blade Tip Clearance (See Figure 801, Sheet 14 And Figure 802, Sheet 16) Clearance	.022 (0.56)	.036 (0.91)	.015 (0.38)	.041 (1.04)

Ref. No.	I F R	Description	Average Clearance At Assembly Min	Average Clearance At Assembly Max	Local Limits At Assembly Min	Local Limits At Assembly Max
1327	A	Stage 12 HPC Blade Tip Clearance (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Clearance	.022 (0.56)	.039 (0.99)	.017 (0.43)	.044 (1.12)
1328	A	Stage 13 HPC Blade Tip Clearance (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Clerance	.026 (0.66)	.042 (1.07)	.023 (0.58)	.045 (1.14)
1329	A	Stage 14 HPC Blade Tip Clearance (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Clearance	.030 (0.76)	.046 (1.17)	.027 (0.69)	.048 (1.22)
1330	A	Stage 15 HPC Blade Tip Clearance (See Figure 801, Sheet 14 And Figure 802, Sheet 16)				
		Clearance	.027 (0.69)	.043 (1.10)	.024 (0.61)	.048 (1.22)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1350 (1)	B	HPC Shroud Front Segment Assembly (72-35-41) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.250 (6.350)	.252 (6.400)	.0015 (0.039)	.005 (0.127)
1350 (2)	B	HPC Shroud Front Segment Assembly (72-35-41) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.251 (6.376)	.253 (6.426)	.0025 (0.064)	.006 (0.152)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1351 (1)	B	Stage 5 HPC Shroud (Front) Segment Assembly (72−35−42) Vane Inner Trunnion Sleeve Bearing (72−35−45) (Pre SB PW4ENG 72−776) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.250 (6.350)	.252 (6.400)	.0015 (0.039)	.005 (0.127)
1351 (2)	B	Stage 5 HPC Shroud (Front) Segment Assembly (72−35−42) Vane Inner Trunnion Sleeve Bearing (72−35−45) (Post SB PW4ENG 72−776) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.251 (6.376)	.253 (6.426)	.0025 (0.064)	.006 (0.152)
1352 (1)	B	Stage 6 HPC Shroud (Front) Segment Assembly (72−35−43) Vane Inner Trunnion Sleeve Bearing (72−35−45) (Pre SB PW4ENG 72−776) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.250 (6.350)	.252 (6.400)	.0015 (0.039)	.005 (0.127)
1352 (2)	B	Stage 6 HPC Shroud (Front) Segment Assembly (72−35−43) Vane Inner Trunnion Sleeve Bearing (72−35−45) (Post SB PW4ENG 72−776) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.251 (6.376)	.253 (6.426)	.0025 (0.064)	.006 (0.152)
1353 (1)	B	Stage 7 HPC Shroud (Front) Segment Assembly (72−35−44) Vane Inner Trunnion Sleeve Bearing (72−35−45) (Pre SB PW4ENG 72−776) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.250 (6.350)	.252 (6.400)	.0015 (0.039)	.005 (0.127)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1353 (2)	B	Stage 7 HPC Shroud (Front) Segment Assembly (72-35-44) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.251 (6.376)	.253 (6.426)	.0025 (0.064)	.006 (0.152)
1354 (1)	B	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) HPC Inlet Shroud (Rear) Segment Assembly (72-35-41) (PN 51H470-01, Change Letter D and subsequent) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Bearing	.480 (12.192)	.484 (12.293)		
		Segment	.490 (12.446)	.496 (12.598)	.006 (0.15)	.016 (0.41)
1354 (2)	B	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) HPC Inlet Shroud (Rear) Segment Assembly (72-35-41) (PN 51H470-01, Change Letter D and subsequent) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.490 (12.446)	.496 (12.598)	.004 (0.102)	.014 (0.356)
1355 (1)	B	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) Stage 5 HPC Shroud (Rear) Segment Assembly (72-35-42) (PN 51H385-01, Change Letter F and subsequent) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Bearing	.480 (12.192)	.484 (12.293)		
		Segment	.491 (12.472)	.496 (12.598)	.007 (0.178)	.016 (0.406)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1355 (2)	B	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) Stage 5 HPC Shroud (Rear) Segment Assembly (72-35-42) (PN 51H385-01, Change Letter F and subsequent) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.496 (12.598)	.005 (0.127)	.014 (0.356)
1356 (1)	B	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) Stage 6 HPC Shroud (Rear) Segment Assembly (72-35-43) (PN 51H586-01, Change Letter E and subsequent) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Bearing	.480 (12.192)	.484 (12.293)		
		Segment	.491 (12.472)	.496 (12.598)	.007 (0.178)	.016 (0.406)
1356 (2)	B	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) Stage 6 HPC Shroud (Rear) Segment Assembly (72-35-43) (PN 51H586-01, Change Letter E and subsequent) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.496 (12.598)	.005 (0.127)	.014 (0.356)
1357 (1)	B	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) Stage 7 HPC Shroud (Rear) Segment Assembly (72-35-44) (PN 51H387-01, Change Letter E and subsequent) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Bearing	.480 (12.192)	.484 (12.293)		
		Segment	.491 (12.472)	.496 (12.598)	.007 (0.178)	.016 (0.406)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1357	B	Vane Inner Trunnion Sleeve Bearing (72-35-45)				
(2)		(Post SB PW4ENG 72-776)				
		Stage 7 HPC Shroud (Rear) Segment Assembly (72-35-44)				
		(PN 51H387-01, Change Letter E and subsequent)				
		(See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Bearing	.482	.486		
			(12.243)	(12.344)		
		Segment	.491	.496	.005	.014
			(12.472)	(12.598)	(0.127)	(0.356)
1358	B	HPC Inlet Shroud (Rear) Segment Assembly (72-35-41)				
		HPC Inlet Shroud (Front) Segment Assembly (72-35-41)				
		(See Figure 801, Sheet 3)				
		Rear	20.438	20.442		
		Segment	(519.126)	(519.226)		
		Front	20.444	20.448	.002	.010
		Segment	(519.278)	(519.379)	(0.051)	(0.254)
1359	B	Stage 5 HPC Shroud (Rear) Segment Assembly (72-35-42)				
		Stage 5 HPC Shroud (Front) Segment Assembly (72-35-42)				
		(See Figure 801, Sheet 3)				
		Rear	20.798	20.802		
		Segment	(528.270)	(528.370)		
		Front	20.804	20.808	.002	.010
		Segment	(528.422)	(528.523)	(0.051)	(0.254)
1360	B	Stage 6 HPC Shroud (Rear) Segment Assembly (72-35-43)				
		Stage 6 HPC Shroud (Front) Segment Assembly (72-35-43)				
		(See Figure 801, Sheet 3)				
		Rear	21.268	21.272		
		Segment	(540.208)	(540.308)		
		Front	21.274	21.278	.002	.010
		Segment	(540.360)	(540.461)	(0.051)	(0.254)
1361	B	Stage 7 HPC Shroud (Rear) Segment Assembly (72-35-44)				
		(PN 51H387-01 Shroud Set)				
		Stage 7 HPC Shroud (Front) Segment Assembly (72-35-44)				
		(PN 51H387-01 Shroud Set)				
		(See Figure 801, Sheet 3)				
		Rear	21.694	21.698		
		Segment	(551.028)	(551.129)		
		Front	21.700	21.704	.002	.010
		Segment	(551.180)	(551.281)	(0.051)	(0.254)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1362	C	HPC Inlet Vane - Leading Edge To Shroud Segment Assembly (72-35-02) (See Figure 801, Sheet 3) End Clearance, (Shroud To Vane)			.006 (0.152)	---
		Vane Must Be Bottomed Against Inner Trunnion Bearing				
1363	C	Stage 5 HPC Vane - Leading Edge To Shroud Segment Assembly (72-35-02) (See Figure 801, Sheet 3) End Clearance, (Shroud To Vane)			.006 (0.152)	---
		Vane Must Be Bottomed Against Inner Trunnion Bearing				
1364	C	Stage 6 HPC Vane - Leading Edge To Shroud Segment Assembly (72-35-02) (See Figure 801, Sheet 3) End Clearance, (Shroud To Vane)			.006 (0.152)	---
		Vane Must Be Bottomed Against Inner Trunnion Bearing				
1365	C	Stage 7 HPC Vane - Leading Edge To Shroud Segment Assembly (72-35-02) (See Figure 801, Sheet 3) End Clearance, (Shroud To Vane)			.006 (0.152)	---
		Vane Must Be Bottomed Against Inner Trunnion Bearing				

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Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1370	B	HPC Inlet Vane (72-35-47) Outer Trunnion Sleeve Bearing (72-35-40) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Vane	.4355 (11.062)	.4370 (11.099)		
		Bearing	.4380 (11.126)	.4400 (11.176)	.0010 (0.026)	.0045 (0.114)
1371	B	Stage 5 HPC Inlet Vane (72-35-48) Outer Trunnion Sleeve Bearing (72-35-40) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Vane	.4355 (11.062)	.4370 (11.099)		
		Bearing	.4380 (11.126)	.4400 (11.176)	.0010 (0.026)	.0045 (0.114)
1372	B	Stage 6 HPC Inlet Vane (72-35-49) Outer Trunnion Sleeve Bearing (72-35-40) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Vane	.4355 (11.062)	.4370 (11.099)		
		Bearing	.4380 (11.126)	.4400 (11.176)	.0010 (0.026)	.0045 (0.114)
1373	B	Stage 7 HPC Vane (72-35-50) Outer Trunnion Sleeve Bearing (72-35-40) (See Figure 801, Sheet 3 And Figure 802, Sheet 3)				
		Vane	.4355 (11.062)	.4370 (11.099)		
		Bearing	.4380 (11.126)	.4400 (11.176)	.0010 (0.026)	.0045 (0.114)
1374	B	Compressor HPC Vane (IGV, 5, 6, 7) (72-35-47/48/49/50) Arm Assembly (72-35-51/52/53/54) (See Figure 801, Sheet 3 And Figure 802, Sheet 5)				
		Vane	.286 (7.265)	.290 (7.366)		
		Arm	.283 (7.189)	.285 (7.239)	.007T (0.177T)	.001T (0.026T)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1375	B	Drum Rotor (Stages 6 Through 12) Disk Assembly (72-35-07) Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) (See Figure 801, Sheet 9 And Figure 802, Sheet 11)				
		Disk	21.657 (550.088)	21.661 (550.189)		
		Hub	21.662 (550.215)	21.666 (550.316)	.009T (0.229T)	.000T* (.000T)*
1376	B	Stage 5 HPC Disk (72-35-06) Drum Rotor (Stages 6 Through 12) Disk Assembly (72-35-07) (See Figure 801, Sheet 2 And Figure 802, Sheet 2)				
		Disk (Stg. 5)	19.525 (495.935)	19.527 (495.985)		
		Disk (Stgs. 6 - 12)	19.518 (495.758)	19.522 (495.858)	.009T (0.229T)	.003T (0.076T)
1377	B	Drum Rotor (Stages 6 Through 12) Disk Assembly (72-35-07) HPC Front Hub (72-35-05) (See Figure 801, Sheet 2 And Figure 802, Sheet 2)				
		Disk	16.097 (408.864)	16.101 (408.965)		
		Hub	16.094 (408.788)	16.096 (408.838)	.007T (0.178T)	.001T (0.025T)
1379	B	HPC (Outer) Rear Case Assembly (72-35-69) HPC Front Case Assembly (72-35-40) (See Figure 801, Sheet 6 And Figure 802, Sheet 8)				
		Rear Case	31.974 (812.140)	31.978 (812.241)		
		Front Case	31.968 (811.988)	31.972 (812.088)	.010T (0.254T)	.002T (0.051T)
1380	B	Stage 8 Compressor Stator Segment Assembly (72-35-59) HPC (Outer) Rear Case Assembly (72-35-69) (See Figure 801, Sheet 6 And Figure 802, Sheet 8)				
		Stator	31.641 (803.681)	31.647 (803.834)		
		Case	31.646 (803.808)	31.654 (804.012)	.001T (0.025T)	.013L (0.330L)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1381	B	Stages 9 And 10 Compressor Stator Segment Assembly (72-35-60) HPC (Outer) Rear Case Assembly (72-35-69) (See Figure 801, Sheet 6 And Figure 802, Sheet 8)				
		Stator	30.792 (782.117)	30.796 (782.218)		
		Case	30.798 (782.270)	30.802 (782.370)	.002 (0.051)	.010 (0.254)
1382	B	Stage 8 Compressor Stator Segment Assembly (72-35-59) Stages 9 and 10 Compressor Stator Segment Assembly (72-35-60) (See Figure 801, Sheet 6 And Figure 802, Sheet 8)				
		Stator (8)	30.228 (767.792)	30.232 (767.892)		
		Stator (9 And 10) (With SB 72-452)	30.228 (767.792)	30.232 (767.892)	.004L (0.101L)	.004T (0.101T)
1383	B	Stages 9 And 10 Compressor Stator Segment Assembly (72-35-60) HPC (Outer) Rear Case Assembly (72-35-69) (See Figure 801, Sheet 6 And Figure 802, Sheet 8)				
		Stator	30.440 (773.176)	30.444 (773.277)		
		Case	30.449 (773.40)	30.461 (773.71)	.005 (0.13)	.021 (0.53)
1384	B	Stages 9 And 10 Compressor Stator Segment Assembly (72-35-60) HPC (Outer) Rear Case Assembly (72-35-69) (See Figure 801, Sheet 6 And Figure 802, Sheet 8)				
		Stator	30.348 (770.840)	30.352 (770.940)		
		Case	30.356 (771.043)	30.360 (771.144)	.004 (0.102)	.012 (0.305)

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Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1385	B	Stages 9 And 10 Compressor Stator Segment Assembly (72−35−60) HPC (Outer) Rear Case Assembly (72−35−69) (See Figure 801, Sheet 6 And Figure 802, Sheet 8)				
		Stator	29.998 (761.950)	30.002 (762.050)		
		Case	30.007 (762.18)	30.019 (762.48)	.005 (0.13)	.021 (0.53)
1386	B	Stages 9 And 10 Compressor Stator Segment Assembly (72−35−60) HPC (Outer) Rear Case Assembly (72−35−69) (See Figure 801, Sheet 9 And Figure 802, Sheet 11)				
		Stator	29.948 (760.680)	29.952 (760.780)		
		Case	29.953 (760.807)	29.957 (760.907)	.001 (0.025)	.009 (0.229)
1387	B	HPC Inner Rear Case Assembly (72−35−68) HPC (Outer) Rear Case Assembly (72−35−69) (See Figure 801, Sheet 9 And Figure 802, Sheet 11)				
		Case (Inner)	29.959 (760.959)	29.963 (761.060)		
		Case (Outer)	29.953 (760.807)	29.957 (760.907)	.010T (0.254T)	.002T (0.051T)
1388	B	HPC Drum Rotor (Stages 13, 14 And 15) Disk Assembly (72−35−10) HPC Drive Turbine Shaft (72−35−09) (See Figure 801, Sheet 11 And Figure 802, Sheet 13)				
		Disk Assembly	12.999 (330.175)	13.001 (330.225)		
		Shaft	12.987 (329.870)	12.989 (329.920)	.010T (0.254T)	.014T (0.355T)
1389	B	Diffuser Airseal (72−35−32) HPC Drive Turbine Shaft (72−35−09) (See Figure 801, Sheet 11 And Figure 802, Sheet 13)				
		Airseal	12.991 (329.972)	12.995 (330.073)		
		Shaft	12.987 (329.870)	12.989 (329.920)	.002T (0.051T)	.008T (0.203T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1390 (1)	B	No. 3 Bearing (Inner Rear Hub) Heat Shield (72-35-36) HPC Turbine Driveshaft (72-35-09) (See Figure 801, Sheet 11)				
		Heat Shield (Pre SB PW4ENG 72-562	6.223 (158.065)	6.225 (158.115)		
		Driveshaft (Pre SB PW4ENG 72-562)	6.219 (157.963)	6.221 (158.013)	.009T* (0.229T)*	.000* (0.000)*
1390 (2)	B	No. 3 Bearing (Inner Rear Hub) Heat Shield (72-35-36) HPC Turbine Driveshaft (72-35-09) (See Figure 801, Sheet 11 And Figure 802, Sheet 13)				
		Heat Shield (Post SB PW4ENG 72-562	6.484 (164.694)	6.486 (164.744)		
		Driveshaft (Post SB PW4ENG 72-562)	6.480 (164.592)	6.482 (164.643)	.009T* (0.229T)*	.000* (0.000)*
1391 (1)	B	No. 3 Bearing (Inner Rear Hub) Heat Shield (72-35-36) HPC Turbine Driveshaft (72-35-09) (See Figure 801, Sheet 11)				
		Heat Shield (Average Diameter) (Pre SB PW4ENG 72-562)	6.176 (156.871)	6.180 (156.972)		
		Driveshaft (Pre SB PW4ENG 72-562)	6.159 (156.439)	6.161 (156.489)	.031T* (0.787T)*	.013T* (.330T)*
1391 (2)	B	No. 3 Bearing (Inner Rear Hub) Heat Shield (72-35-36) HPC Turbine Driveshaft (72-35-09) (See Figure 801, Sheet 11 And Figure 802, Sheet 13)				
		Heat Shield (Average Diameter) (Post SB PW4ENG 72-562)	6.444 (163.678)	6.448 (163.779)		
		Driveshaft (Post SB PW4ENG 72-562)	6.427 (163.246)	6.429 (163.297)	.031T* (0.787T)*	.010T* (.254T)*

	Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
	1392	B	Compressor Tierod (72-35-34) Stage 5 HPC Disk (72-35-06) (See Figure 801, Sheet 2 And Figure 802, Sheet 2)				
			Tierod	.3755 (9.538)	.3765 (9.563)		
			Disk	.379 (9.627)	.381 (9.677)	.0025 (0.064)	.0075* (0.190)*
	1393	B	Compressor Tierod (72-35-34) HPC Front Hub (72-35-05) (See Figure 801, Sheet 2 And Figure 802, Sheet 2)				
			Tierod	.3755 (9.538)	.3765 (9.563)		
			Hub	.378 (9.602)	.380 (9.652)	.0015 (0.039)	.0065* (0.165)*
			(Two Holes In Any Ten May Be 0.390 inch (9.906 MM) Diameter Maximum. See CIR Manual, PN 51A357, ATA 72-35-05, Inspection/Check-04 For Other Oversized Allowances)				
	1394	B	Compressor Tierod (72-35-34) Drum Rotor (Stages 6 Through 12) Disk Assembly (72-35-07) (See Figure 801, Sheet 2 And Figure 802, Sheet 2)				
			Tierod	.3755 (9.538)	.3765 (9.563)		
R R			Disk	.379 (9.627)	.381 (9.677)	.0025 (0.064)	.0125* (0.318)*
	1395	B	Compressor Tierod (72-35-34) Drum Rotor (Stages 6 Through 12) Disk Assembly (72-35-07) (See Figure 801, Sheet 9 And Figure 802, Sheet 11)				
			Tierod	.3755 (9.538)	.3765 (9.563)		
R R			Disk	.379 (9.627)	.381 (9.677)	.0025 (0.064)	.0125* (0.318)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1396	B	Compressor Tierod (72-35-34) Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) (See Figure 801, Sheet 9 And Figure 802, Sheet 11)				
		Tierod	.3755 (9.538)	.3765 (9.563)		
		Hub	.379 (9.627)	.381 (9.677)	.0025 (0.064)	.0065* (0.165)*
1397	B	Pin - Shoulder Headless (72-35-41/42/43/44) (PN 51H134) HPC Inlet/Stage 5/Stage 6/Stage 7 - Shroud (Rear) Segment Assembly (PN 51H470-01/51H385-01/51H586-01/51H387-01 Shroud Sets) (72-35-41/42/43/44) (See Figure 801, Sheet 5 And Figure 802, Sheet 6)				
		Pin	0.1870 (4.7498)	0.1871 (4.7523)		
		Shroud (Rear)	0.186 (4.725)	0.187 (4.749)	.0011T (0.028T)	.0000 (0.000)
1398	B	Pin - Shoulder Headless (72-35-41/42/43/44) (PN 51H134) HPC Inlet/Stage 5/Stage 6/Stage 7 - Shroud (Front) Segment Assembly (PN 51H470-01/51H385-01/51H586-01/51H387-01 Shroud Sets) (72-35-41/42/43/44) (See Figure 801, Sheet 5 And Figure 802, Sheet 6)				
		Pin	0.1870 (4.7498)	0.1871 (4.7523)		
		Shroud (Forward)	0.1885 (4.788)	0.1895 (4.813)	.0014 (0.036)	.0025 (0.064)
1403	B	Stage 13 And 14 Compressor Stator Segment Assemblies (72-35-62)/HPC Inner Rear Case Assembly (72-35-68) Stage 11 And 12 Compressor Stator Segment Assemblies (72-35-61) (See Figure 801, Sheet 9 And Figure 802, Sheet 11)				
		Stator/Case	0.1595 (4.051)	0.1685 (4.280)		
		Stator (11 and 12)	0.169	0.1745	.0005	.015

	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
(CONTINUED)						
			(4.293)	(4.432)	(0.013)	(0.381)
1405	B	HPC Inner Rear Case Assembly (72−35−68) Stage 13 And 14 Compressor Stator Segment Assemblies (72−35−62) (See Figure 801, Sheet 11 And Figure 802, Sheet 13)				
		Case	.084 (2.134)	.088 (2.235)		
		Stator	.077 (1.956)	.082 (2.082)	.002 (0.051)	.011 (0.279)
1407	B	HPC Rear Support (72−35−67) HPC (Inner) Rear Case Assembly (72−35−68) (See Figure 801, Sheet 11 And Figure 802, Sheet 13)				
		Support	29.284 (743.814)	29.288 (743.915)		
		Case	29.280 (743.712)	29.284 (743.813)	.000 (0.000)	.008 (0.203)
1408	B	HPC Inner Rear Case Assembly (72−35−68) Stage 11 And 12 Compressor Stator Segment Assemblies (72−35−61) (See Figure 801, Sheet 9 And Figure 802, Sheet 11)				
		Case	.084 (2.134)	.088 (2.235)		
		Stator	.0755 (1.918)	.0825 (2.096)	.0015 (0.038)	.0125 (0.318)
1409	B	Stage 11 And 12 Compressor Stator Segment Assemblies (72−35−61)/HPC Inner Rear Case Assembly (72−35−68) Stage 9 And 10 Compressor Stator Segment Assemblies (72−35−60) (See Figure 801, Sheet 9 And Figure 802, Sheet 11)				
		Stator/Case	.1595 (4.051)	.1685 (4.280)		
		Stator (9 and 10)	.171 (4.344)	.175 (4.445)	.0025 (0.064)	.0155 (0.394)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1410	B	HPC Rear Support (72−35−67) HPC (Outer) Rear Case Assembly (72−35−69) (See Figure 801, Sheet 11 And Figure 802, Sheet 13)				
		Support	32.254	32.258		
			(819.252)	(819.353)		
		Case	32.242	32.246	.008T	.016T
			(818.947)	(819.048)	(0.203T)	(0.406T)
1411	A	Compressor Tierod (72−35−34) Diffuser Airseal (72−35−32) (See Figure 801, Sheet 11 And Figure 802, Sheet 13)				
		Tierod	.3755	.3765		
			(9.538)	(9.563)		
		Airseal	.383	.387	.0065	.0115
			(9.729)	(9.829)	(0.166)	(0.292)
1412	A	Compressor Tierod (72−35−34) HPC Drive Turbine Shaft (72−35−09) (See Figure 801, Sheet 11 And Figure 802, Sheet 13)				
		Tierod	.3755	.3765		
			(9.538)	(9.563)		
		Shaft	.379	.381	.0025	.0055
			(9.627)	(9.677)	(0.064)	(0.139)
1413	A	Compressor Tierod (72−35−34) HPC Drum Rotor (Stages 13, 14 And 15) Disk Assembly (72−35−10) (See Figure 801, Sheet 11 And Figure 802, Sheet 13)				
		Tierod	.3755	.3765		
			(9.538)	(9.563)		
		Disk	.379	.381	.0025	.0055
		Assembly	(9.627)	(9.677)	(0.064)	(0.139)
1415	B	HPC Inner Rear Case (72−35−68) Stage 9 And 10 Compressor Stator Segment Assembly (72−35−60) (See Figure 801, Sheet 9 And Figure 802, Sheet 11)				
		Case	28.552	28.556		
			(725.221)	(725.322)		
		Stator 9/10	28.548	28.552	.000	.008T
			(725.120)	(725.220)	(0.0000)	(0.203T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1416	B	Bushing HPC Front Case Assy (72-35-40) See 72-35-40, Repair-05 R (Task 72-35-40-300-005-B00) (See Figure 801, Sheet 15 and Figure 802, Sheet 17) NOTE: Select fit of			.0005 (0.013)	.0015T (0.038T)

G. Hub, Disk, Shaft, Airseal Limits

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1420	A	HPC Front Hub See 5-10-00, Time Limits (See Figure 801, Sheet 2 And Figure 802, Sheet 2)				
1421	A	Stage 5 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 2 And Figure 802, Sheet 2)				
1422	A	Stage 6 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 2 And Figure 802, Sheet 2)				
1423	A	Stage 7 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 2 And Figure 802, Sheet 2)				
1424	A	Stage 8 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 6 And Figure 802, Sheet 8)				
1425	A	Stage 9 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 6 And Figure 802, Sheet 8)				
1426	A	Stage 10 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 6 And Figure 802, Sheet 8)				
1427	A	Stage 11 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 9 And Figure 802, Sheet 11)				

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1428	A	Stage 12 HPC Disk See 5−10−00, Time Limits (See Figure 801, Sheet 9 And Figure 802, Sheet 11)				
1429	A	Stage 13 HPC Disk See 5−10−00, Time Limits (See Figure 801, Sheet 9 And Figure 802, Sheet 11)				
1430	A	Stage 14 HPC Disk See 5−10−00, Time Limits (See Figure 801, Sheet 11 And Figure 802, Sheet 13)				
1431	A	Stage 15 HPC Disk See 5−10−00, Time Limits (See Figure 801, Sheet 11 And Figure 802, Sheet 13)				
1432	A	HPC Drive−Turbine Shaft See 5−10−00, Time Limits (See Figure 801, Sheet 11 And Figure 802, Sheet 13)				
1433	A	Drum Rotor (Stages 6 Through 12) Disk Assembly See 5−10−00, Time Limits (See Figure 801, Sheet 6 And Figure 802, Sheet 8)				
1434	A	HPC Drum Rotor (Stages 13, 14 And 15) Disk Assembly See 5−10−00, Time Limits (See Figure 801, Sheet 9 And Figure 802, Sheet 11)				
1435	A	Diffuser Airseal See 5−10−00, Time Limits (See Figure 801, Sheet 6 And Figure 802, Sheet 8)				
1436	A	Hub, Stage 15 See 5−10−00, Time Limits (See Figure 801, Sheet 11 And Figure 802, Sheet 13)				

H. Spline Data

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
952	B	1. Gearbox Drive Bevel Gear (72-34-12) Internal Spline (See Figure 805, Sheet 2)				
		A. Effective Space Width	.0491 (1.247)	---		
		B. Actual Space Width	---	.0555 (1.410)		
		2. HPC Front Hub (72-35-05) External Spline (See Figure 805, Sheet 2)				
		A. Effective Tooth Thickness	---	.0476 (1.209)		
		B. Actual Tooth Thickness	.0412 (1.046)	---		
		3. Fit			.0015 (0.038)	---

I. Special Torques

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
730	A	Nut, Variable Stator Clevis Retaining (See Figure 803, Sheets 3, 4, 5 And 11) See 72-35-00, Assembly-03 Task 72-35-00-400-003 See 72-35-03, Assembly-01 Task 72-35-03-440-001				
732	A	Nut, Bellcrank Spacer Clevis Retaining (See Figure 803, Sheets 5 And 11) See 72-35-03, Assembly-01 Task 72-35-03-440-001				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
733	A	Nut, Actuating Cylinder Retaining (See Figure 803, Sheet 10) See 72-35-00, Assembly-03 Task 72-35-00-400-003				
734	A	Bolt, Stage 7 HPC Lever (See Figure 803, Sheet 11) See 72-35-03, Assembly-01 Task 72-35-03-440-001				
735	A	Compressor Stator Actuator Rod End Bearing Retaining Nut (See Figure 803, Sheet 6) See 72-35-00, Assembly-03 Task 72-35-00-400-003				
736	A	Bolt And Nut Torquing Procedure, Turbine Case Cooling Air Valve Actuator Ground Cable See 72-35-00, Assembly-04 Task 72-35-00-400-004				
737	A	Nut, Bellcrank Spacer Clevis Retaining (See Figure 803, Sheet 3) See 72-35-03, Assembly-01 Task 72-35-03-440-001				
738	A	Nut, Bellcrank Spacer Clevis Retaining (See Figure 803, Sheets 5 And 11) See 72-35-03, Assembly-01 Task 72-35-03-440-001				
739	A	Variable Stator Mount Stud Retaining Nuts (See Figure 803, Sheet 7) See 72-35-00, Assembly-03 Task 72-35-00-400-003				
1550	A	Compressor Tierod Nut (See Figure 801, Sheet 2 And Figure 802, Sheet 2) See 72-35-01, Assembly-01 Task 72-35-01-440-001				

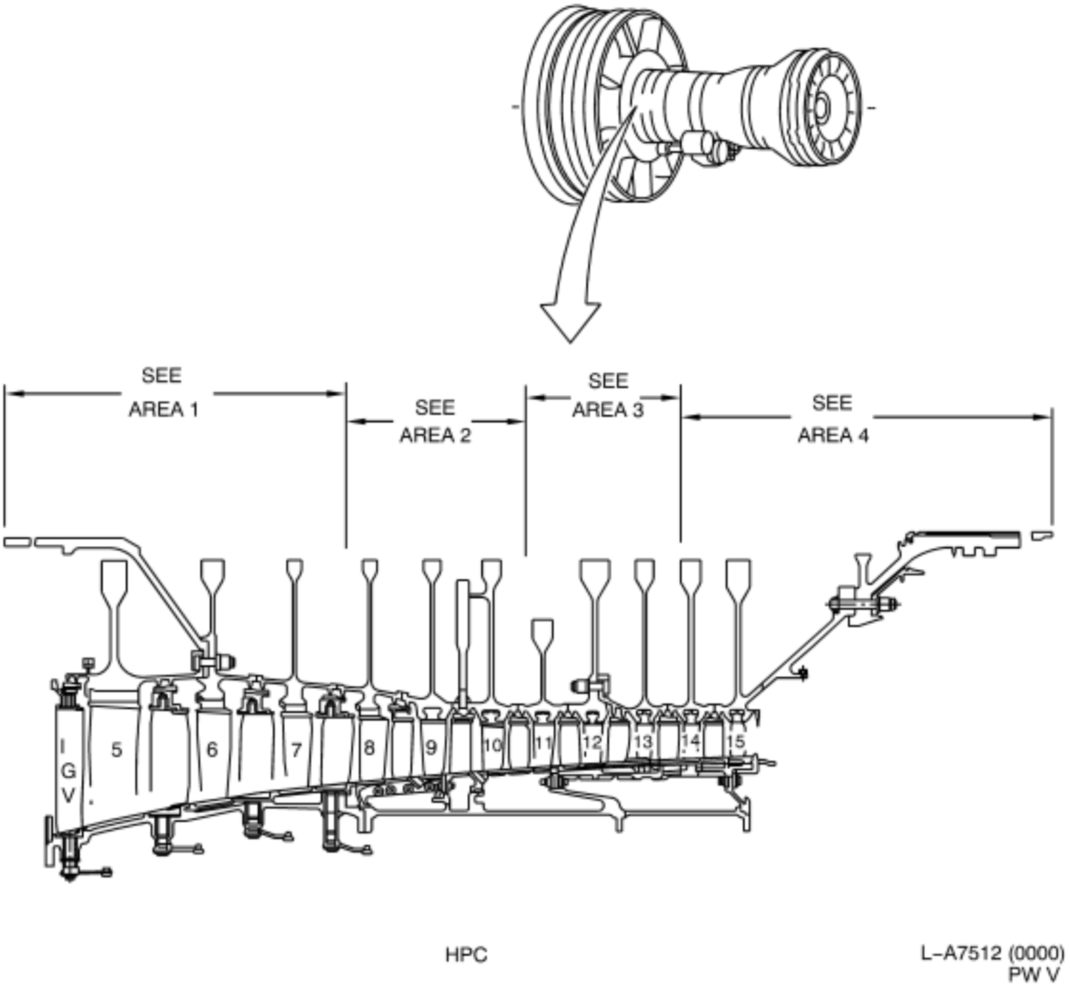
Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1551	A	Vane Arm Retaining Bolt (See Figure 801, Sheet 3 And Figure 802, Sheet 3) See 72−35−02, Assembly−01 Task 72−35−02−440−001				
1552	A	Stage 6 Borescope Plug (See Figure 801, Sheet 4 And Figure 802, Sheet 7) See 72−35−02, Assembly−01 Task 72−35−02−440−001				
1553	A	HPC Case Axial Flange Bolt − Nut (See Figure 801, Sheet 4 And Figure 802, Sheet 7) See 72−35−00, Assembly−01 Task 72−35−00−400−001				
1554	A	Stage 5 Borescope Plug (See Figure 801, Sheet 4 And Figure 802, Sheet 7) See 72−35−00, Assembly−01 Task 72−35−00−400−001				
1555	A	Stage 10 And Stage 14 (Outer) Borescope Plug (See Figure 801, Sheets 7 And 12, Figure 802, Sheets 9 And 14) See 72−35−00, Assembly−01 Task 72−35−00−400−001				
1556	A	Stages 8 And 12 Borescope Plugs (See Figure 801, Sheets 7 And 10, Figure 802, Sheets 9 And 12) See 72−35−00, Assembly−01 Task 72−35−00−400−001				
1557	A	Stage 10 (Inner) Borescope Plug (See Figure 801, Sheet 8 And Figure 802, Sheet 10) See 72−35−00, Assembly−01 Task 72−35−00−400−001				
1558	A	Synchronizing Ring Runner Pad Bolt (See Figure 807, Sheet 1) See 72−35−00, Assembly−02 Task 72−35−00−400−002				

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1559	A	Stage 14 (Inner) (See Figure 801, Sheet 13 And Figure 802, Sheet 15) Borescope Plug See 72-35-00, Assembly-01 Task 72-35-00-400-001				
1560	A	Tiebolt Nuts, HPC Drum Rotor (Stages 13, 14, And 15) Disk Assembly (See Figure 801, Sheet 9 And Figure 802, Sheet 11) See 72-35-01, Assembly-01 Task 72-35-01-440-001				
1561	A	Tiebolt Nuts, HPC Drive Turbine Shaft (See Figure 801, Sheet 11 And Figure 802, Sheet 13) See 72-35-39, Assembly-01 Task 72-35-39-440-001				

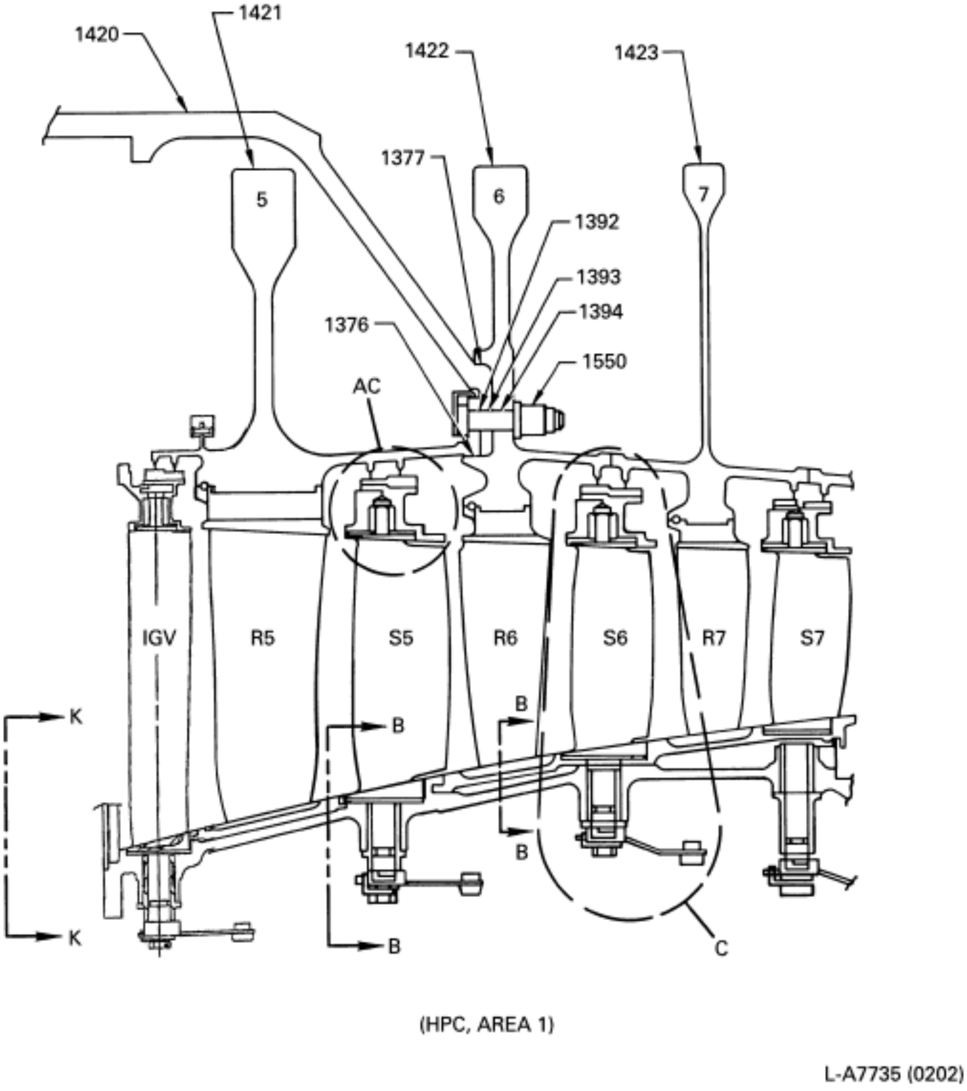
J. Special Assembly Procedure

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
618	A	Compressor Stator Lever - Set Bracket - Shim Fitting (See Figure 803, Sheet 8) See 72-35-00, Assembly-03) Task 72-35-00-400-003				
749	A	Variable Stator Mount Assembly Instruction For Expanding Retaining Stud See 72-35-00, Assembly-03 Task 72-35-00-400-003 (See Figure 803 Sheets 1 And 7)				
760	A	Turbine Vane And Blade Cooling Air Valve Position Switch - Installation See 72-35-00, Assembly-04 Task 72-35-00-400-004				

	Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
				Min	Max	Min	Max
	1366	A	HPC Inlet Vane (Outer) Trunnion Sleeve Bearing HPC Front Case Assembly (See Figure 801, Sheet 3 And Figure 802, Sheet 3) See 72-35-40, Repair-01 Task 72-35-40-300-001				
	1367	A	Stage 5 HPC (Outer) Trunnion Sleeve Bearing HPC Front Case Assembly (See Figure 801, Sheet 3 And Figure 802, Sheet 3) See 72-35-40, Repair-01 Task 72-35-40-300-001				
	1368	A	Stage 6 HPC (Outer) Trunnion Sleeve Bearing HPC Front Case Assembly (See Figure 801, Sheet 3 And Figure 802, Sheet 3) See 72-35-40, Repair-01 Task 72-35-40-300-001				
	1369	A	Stage 7 HPC (Outer) Trunnion Sleeve Bearing HPC Front Case Assembly (See Figure 801, Sheet 3 And Figure 802, Sheet 3) See 72-35-40, Repair-01 Task 72-35-40-300-001				
R R	1401	A	Arm Assembly End Clearance - Select Spacer To Obtain (See Figure 801, Sheet 3 And Figure 802, Sheet 3) See 72-35-02, Assembly-01 (Task 72-35-02-440-001)				
	2101 2102 2103 2104	A	Shim Procedure For Unison Ring Runners And Spacers And Clearances For Runners (See Figure 807, Sheets 1 And 2) See 72-35-00, Assembly-02 Task 72-35-00-400-002				


SEE
AREA 1
SEE
AREA 2
SEE
AREA 3
SEE
AREA 4
I
G
V
5
6
7
8
9
10
11
12
13
14
15
HPC
L−A7512 (0000)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 1)
(Task 72−35−00−990−006)


1420
1421
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1392
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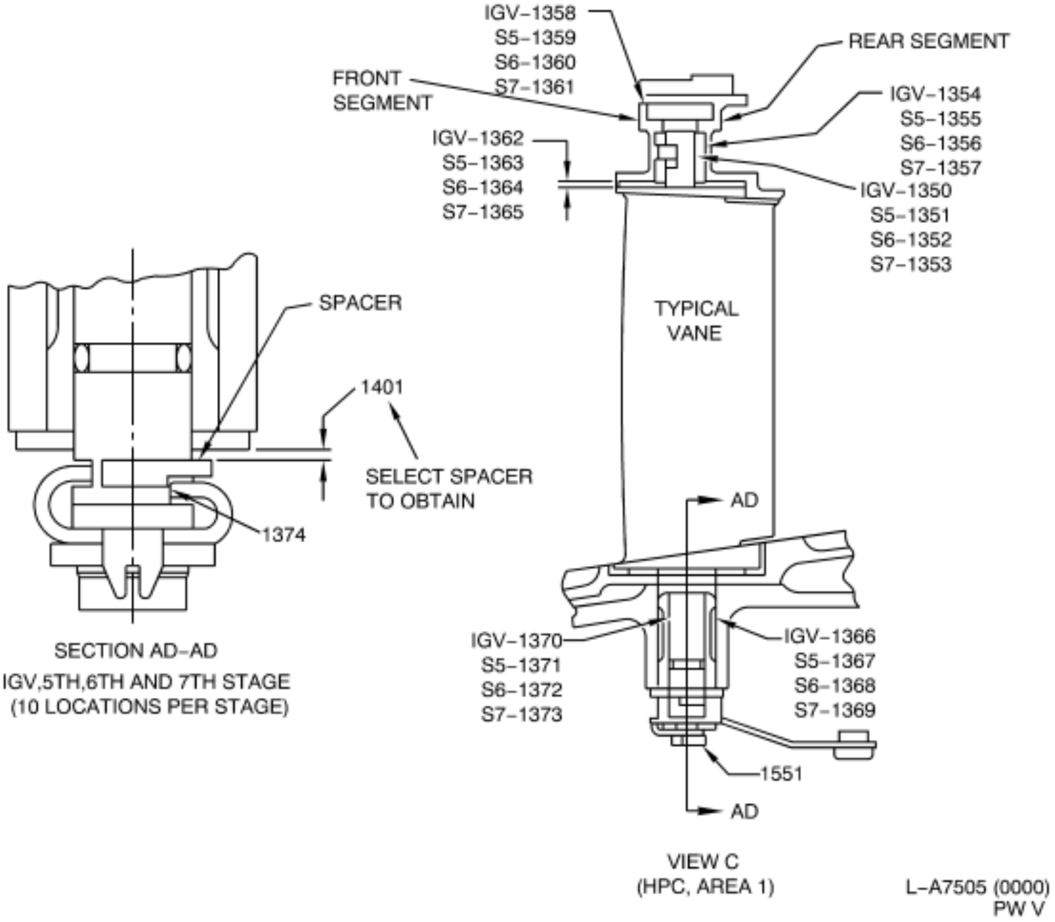
S5
R6
S6
R7
S7
K
K
B
B
B
B
C
(HPC, AREA 1)
L-A7735 (0202)

High Pressure Compressor (HPC)
Figure 801 (Sheet 2)
(Task 72−35−00−990−006)


IGV−1358
S5−1359
S6−1360
S7−1361
FRONT SEGMENT
REAR SEGMENT
IGV−1354
S5−1355
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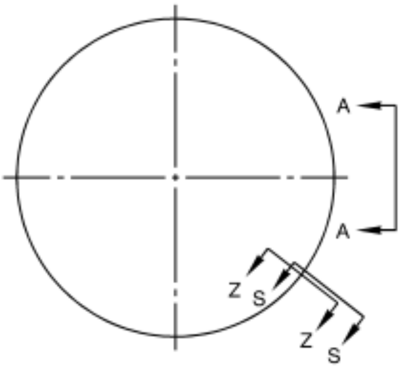
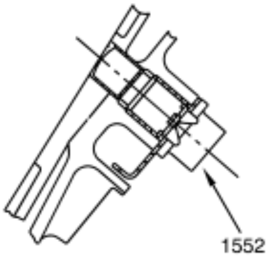
S7−1357
IGV−1362
S5−1363
S6−1364
S7−1365
IGV−1350
S5−1351
S6−1352
S7−1353
SPACER
TYPICAL VANE
1401
SELECT SPACER TO OBTAIN
AD
1374
SECTION AD−AD
IGV,5TH,6TH AND 7TH STAGE
(10 LOCATIONS PER STAGE)
IGV−1370
S5−1371
S6−1372
S7−1373
IGV−1366
S5−1367
S6−1368
S7−1369
1551
AD
VIEW C
(HPC, AREA 1)
L−A7505 (0000)
PW V

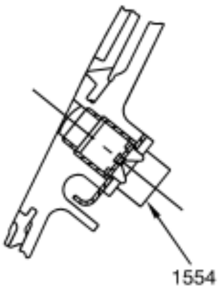
High Pressure Compressor (HPC)
Figure 801 (Sheet 3)
(Task 72−35−00−990−006)



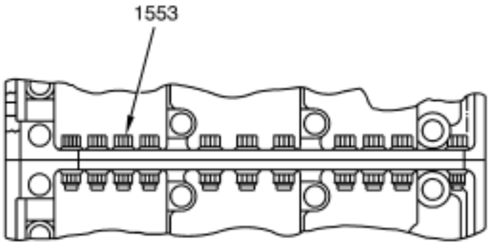
SCHEMATIC SECTION B−B
BOROSCOPE BOSS
TYPICAL 2 PLACES
(HPC, AREA 1)



SECTION S−S
(STAGE 6)



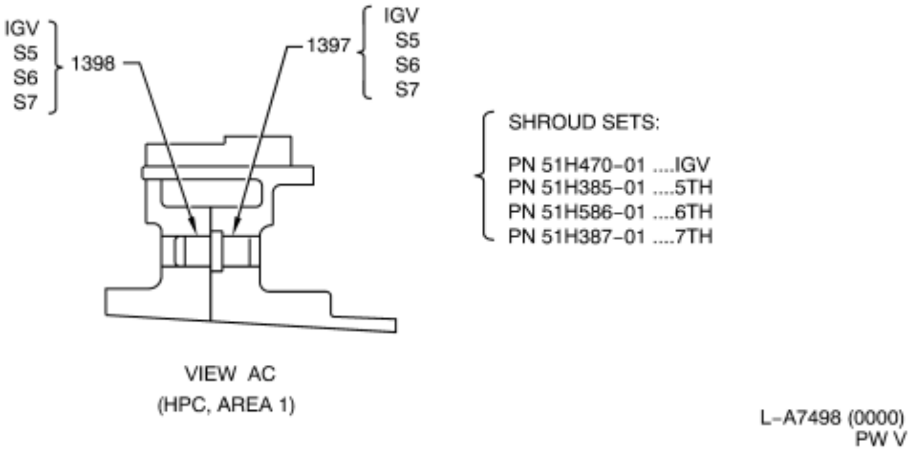
SECTION Z−Z
(STAGE 5)



VIEW A−A

L−A0600 (0893)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 4)
(Task 72−35−00−990−006)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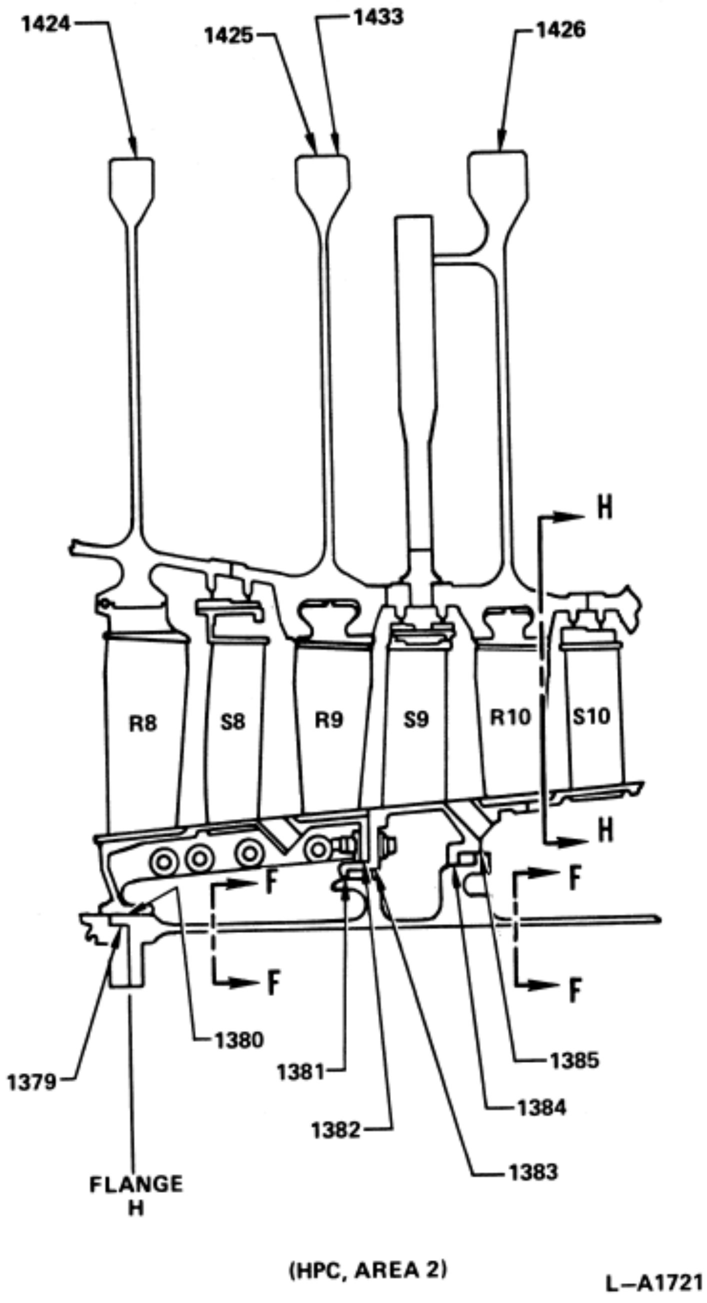
S5
S6
S7
1398
1397
IGV
S5
S6
S7
SHROUD SETS:
PN 51H470-01 ....IGV
PN 51H385-01 ....5TH
PN 51H586-01 ....6TH
PN 51H387-01 ....7TH
VIEW AC
(HPC, AREA 1)
L-A7498 (0000)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 5)
(Task 72−35−00−990−006)


1424
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S8
R9
S9
R10
S10
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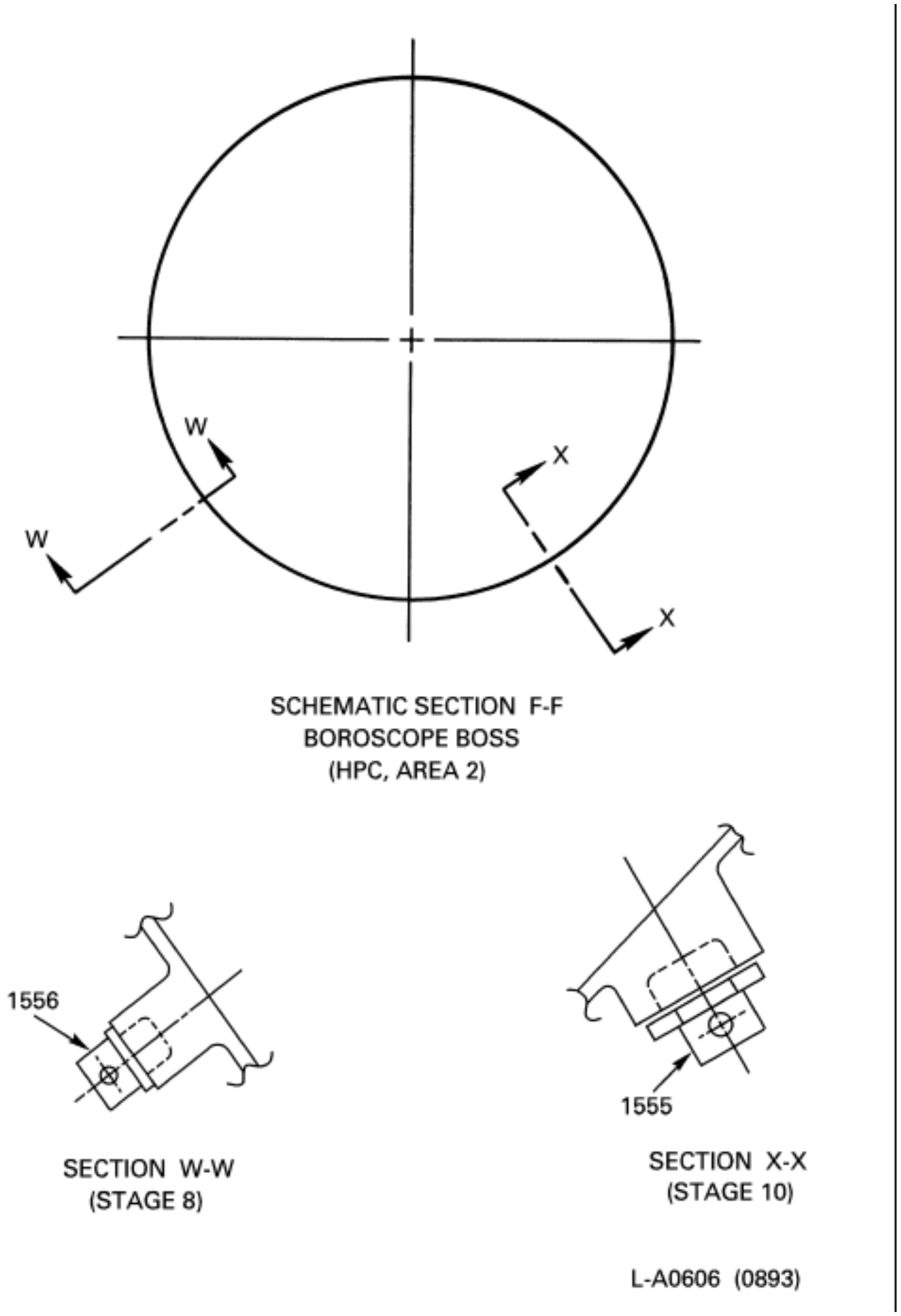
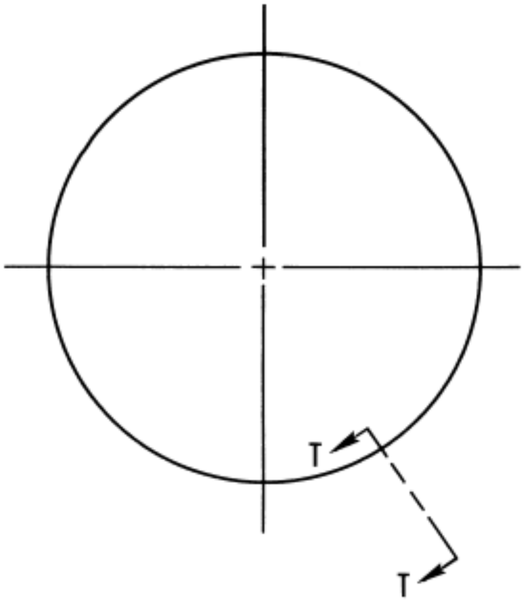
1379
1380
1381
1382
1383
1384
1385
FLANGE
H
(HPC, AREA 2)
L−A1721

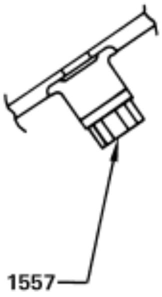
High Pressure Compressor (HPC)
Figure 801 (Sheet 6)
(Task 72−35−00−990−006)


W
X
W
X
SCHEMATIC SECTION F-F
BOROSCOPE BOSS
(HPC, AREA 2)
1556
1555
SECTION W-W
(STAGE 8)
SECTION X-X
(STAGE 10)
L-A0606 (0893)

High Pressure Compressor (HPC)
Figure 801 (Sheet 7)
(Task 72−35−00−990−006)



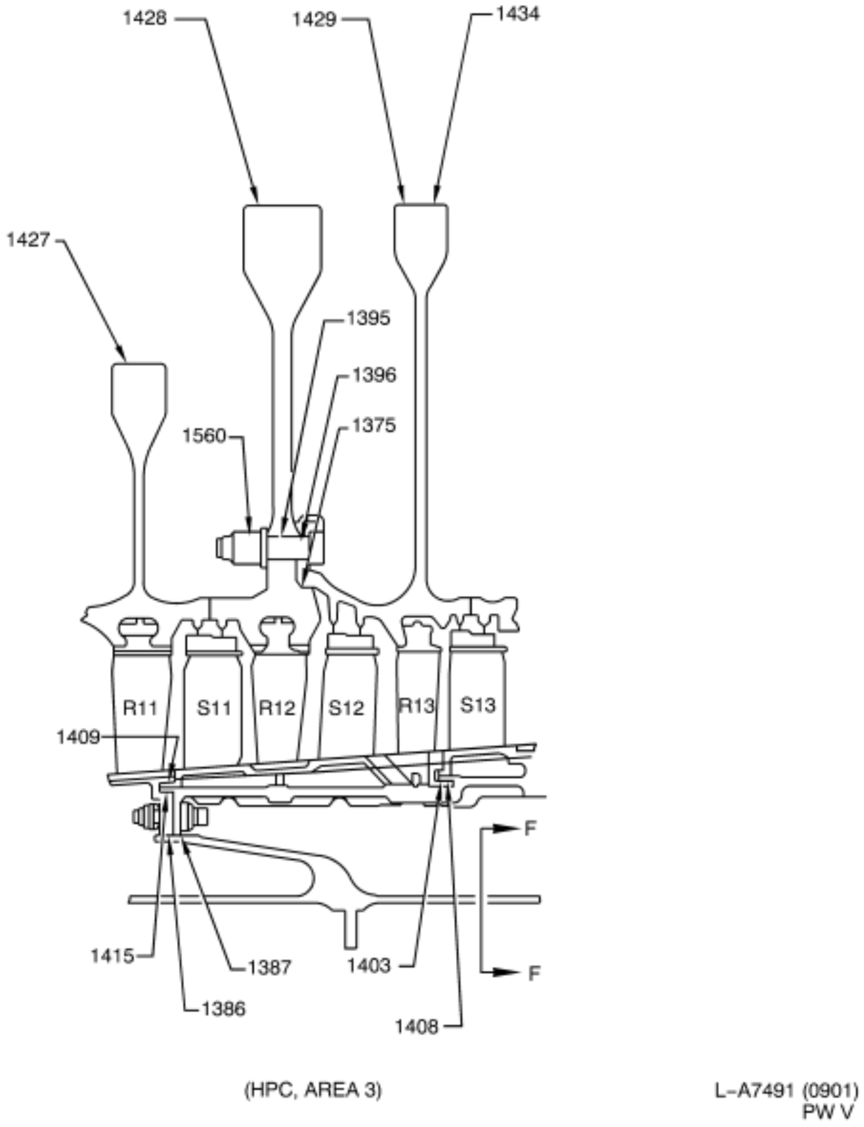
SCHEMATIC SECTION H-H
BOROSCOPE BOSS
(HPC, AREA 2)



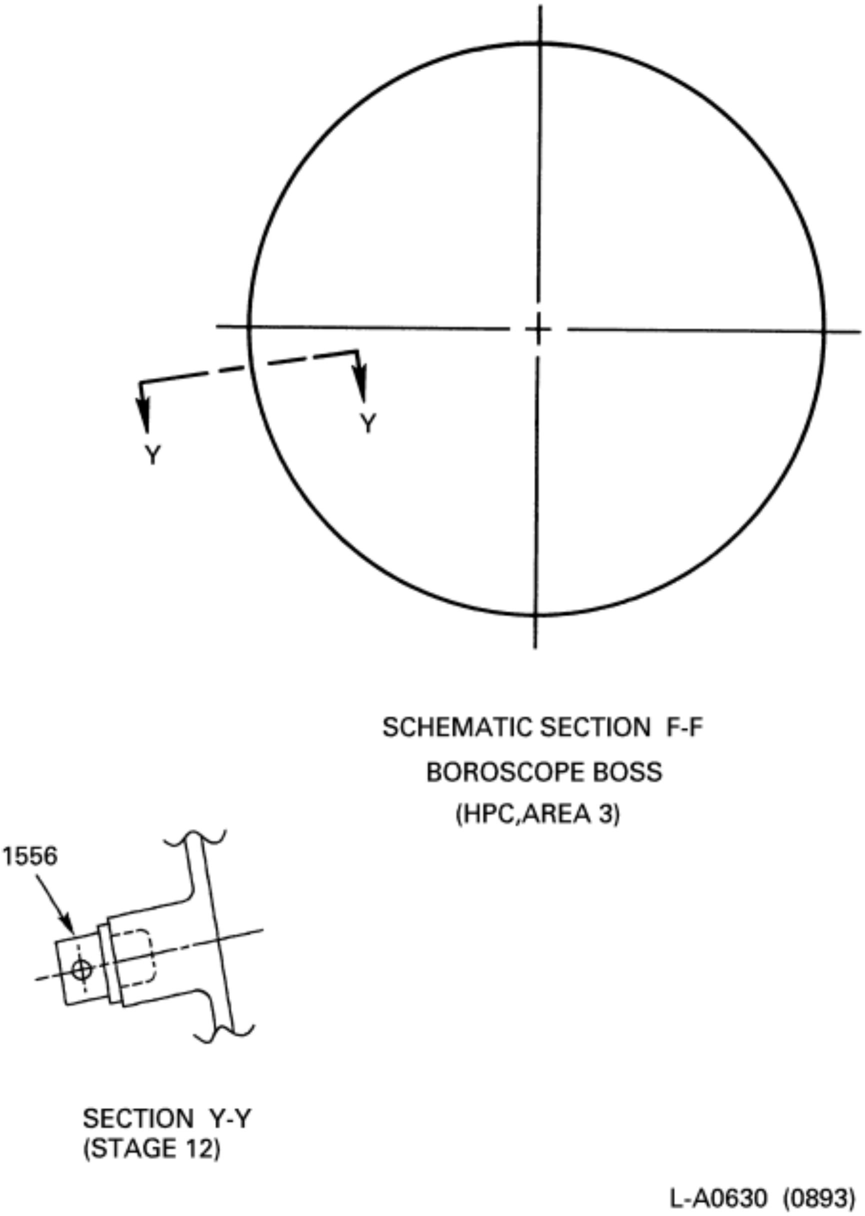
SECTION T-T
(STAGE 10)

L-A0618

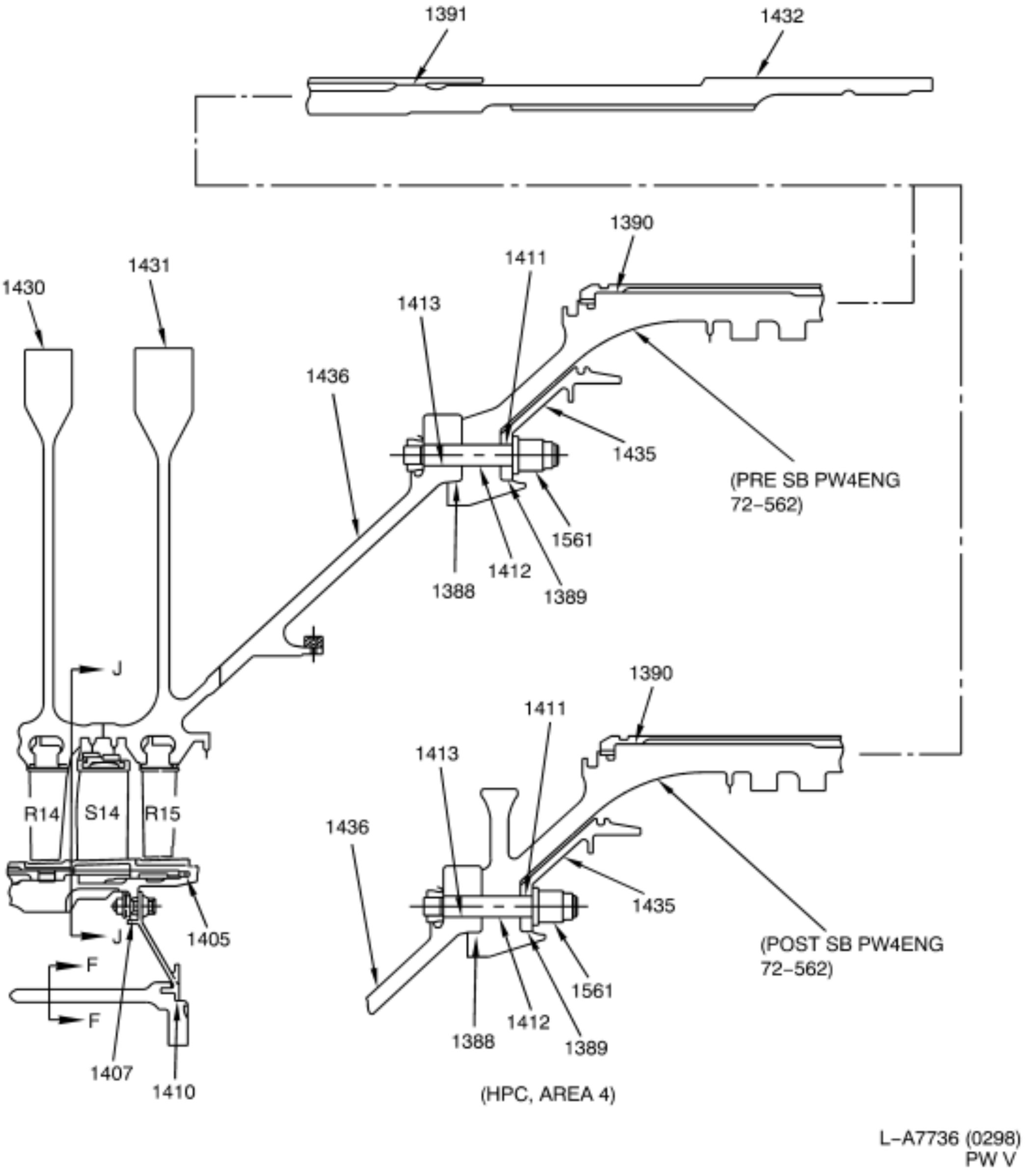
High Pressure Compressor (HPC)
Figure 801 (Sheet 8)
(Task 72-35-00-990-006)


1428
1429
1434
1427
1395
1396
1375
1560
R11
S11
R12
S12
R13
S13
1409
F
F
1415
1387
1403
1386
1408
(HPC, AREA 3)
L−A7491 (0901)
PW V

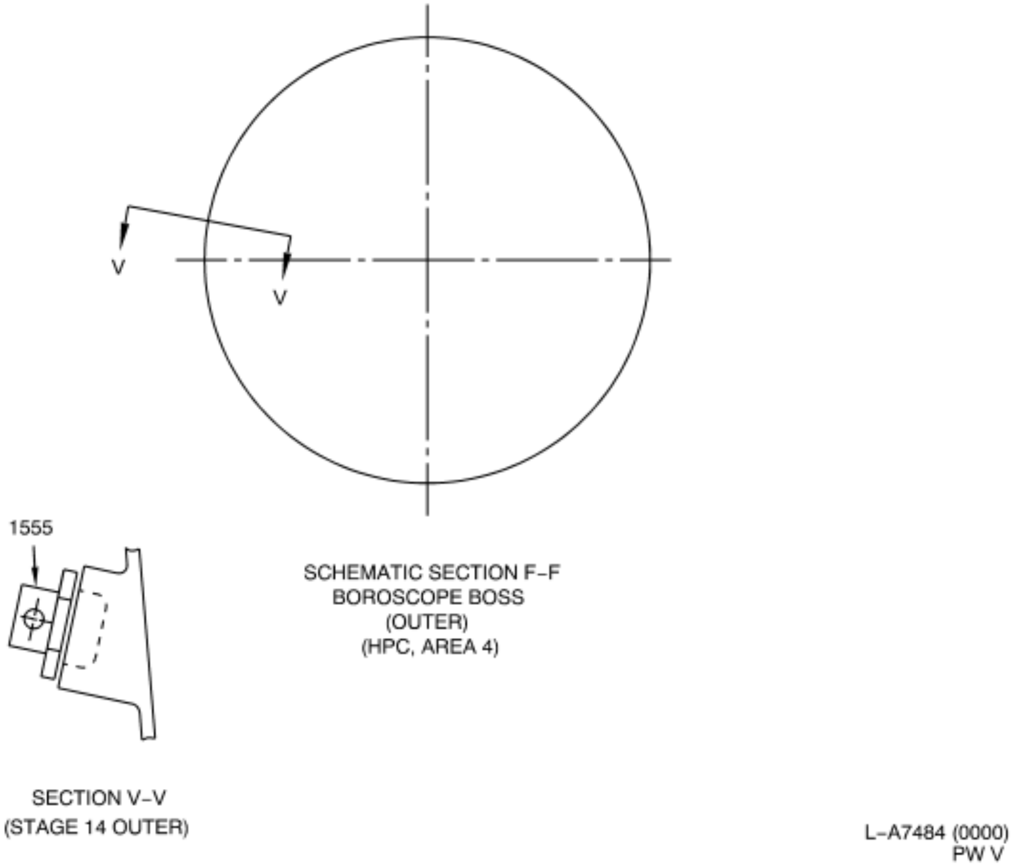
High Pressure Compressor (HPC)
Figure 801 (Sheet 9)
(Task 72−35−00−990−006)


Y
Y
SCHEMATIC SECTION F-F
BOROSCOPE BOSS
(HPC,AREA 3)
1556
SECTION Y-Y
(STAGE 12)
L-A0630 (0893)

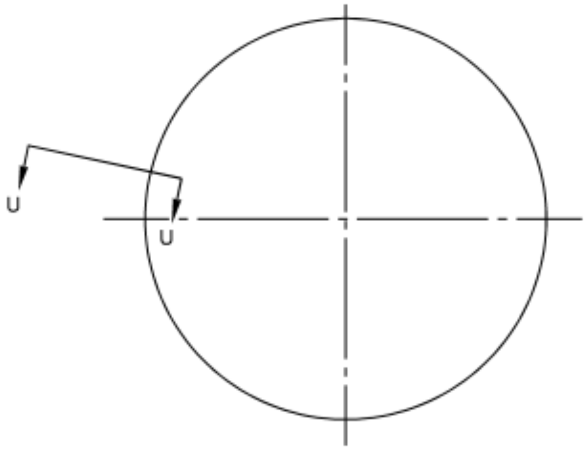
High Pressure Compressor (HPC)
Figure 801 (Sheet 10)
(Task 72−35−00−990−006)


1391
1432
1390
1411
1431
1430
1413
1436
1435
(PRE SB PW4ENG 72−562)
1561
1412
1388
1389
J
1390
1411
1413
R14
S14
R15
1436
1435
(POST SB PW4ENG 72−562)
J
1405
1561
F
F
1412
1388
1389
1407
1410
(HPC, AREA 4)
L−A7736 (0298)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 11)
(Task 72−35−00−990−006)

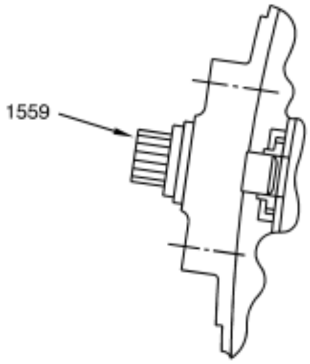

V
V
1555
SCHEMATIC SECTION F−F
BOROSCOPE BOSS
(OUTER)
(HPC, AREA 4)
SECTION V−V
(STAGE 14 OUTER)
L−A7484 (0000)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 12)
(Task 72−35−00−990−006)



SCHEMATIC SECTION J−J
BOROSCOPE BOSS
(INNER)

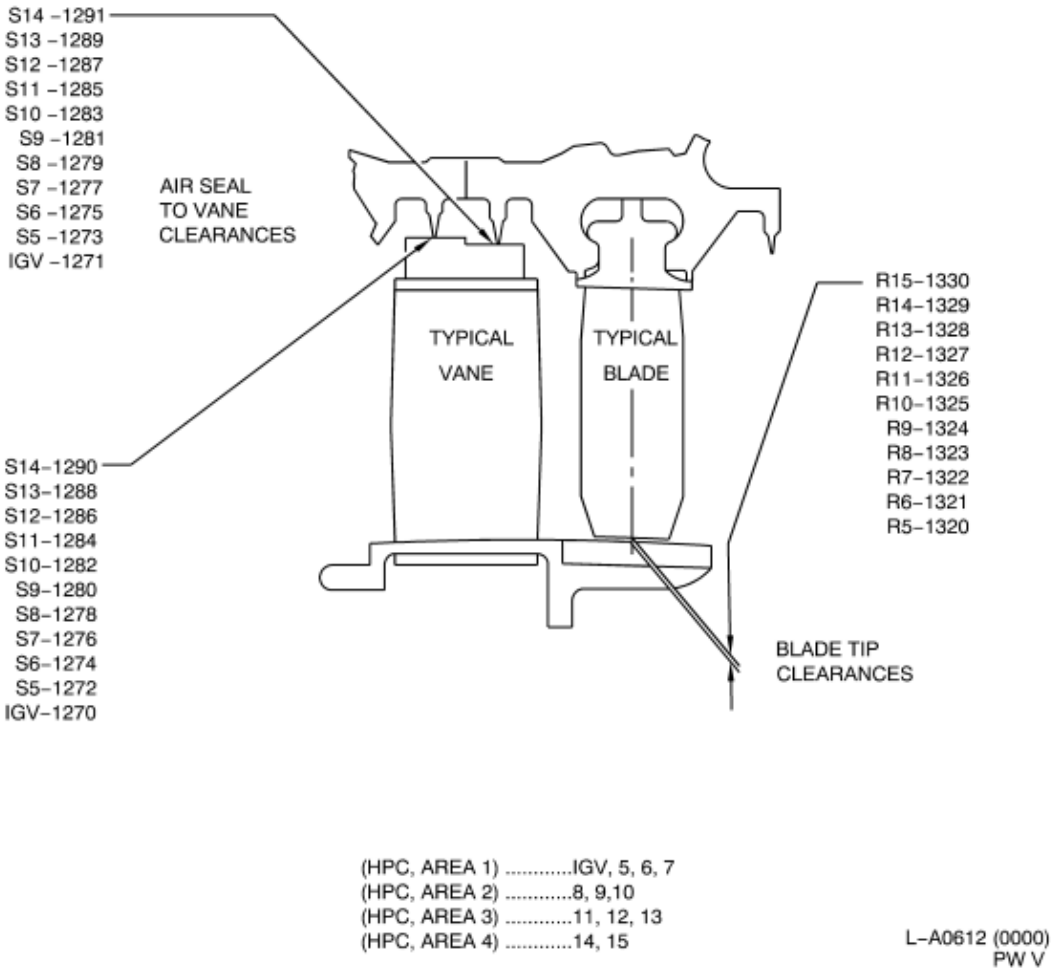
(HPC, AREA 4)



SECTION U−U
(STAGE 14 INNER)

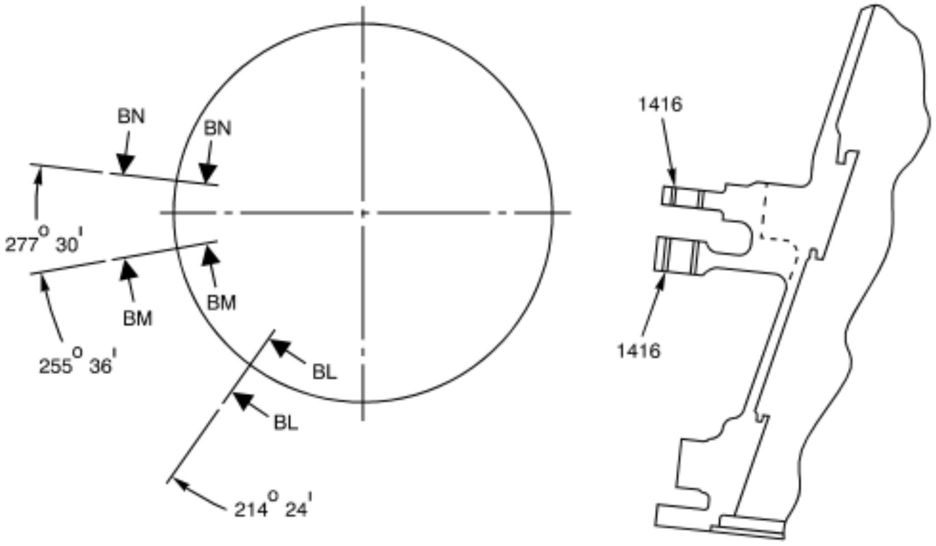
L−A0642 (0893)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 13)
(Task 72−35−00−990−006)


S14 −1291
S13 −1289
S12 −1287
S11 −1285
S10 −1283
S9 −1281
S8 −1279
S7 −1277
S6 −1275
S5 −1273
IGV −1271
AIR SEAL
TO VANE
CLEARANCES
TYPICAL
VANE
TYPICAL
BLADE
R15−1330
R14−1329
R13−1328
R12−1327
R11−1326
R10−1325
R9−1324
R8−1323
R7−1322
R6−1321
R5−1320
S14−1290
S13−1288
S12−1286
S11−1284
S10−1282
S9−1280
S8−1278
S7−1276
S6−1274
S5−1272
IGV−1270
BLADE TIP
CLEARANCES
(HPC, AREA 1) ....IGV, 5, 6, 7
(HPC, AREA 2) 8, 9,10
(HPC, AREA 3) 11, 12, 13
(HPC, AREA 4) 14, 15
L−A0612 (0000)
PW V

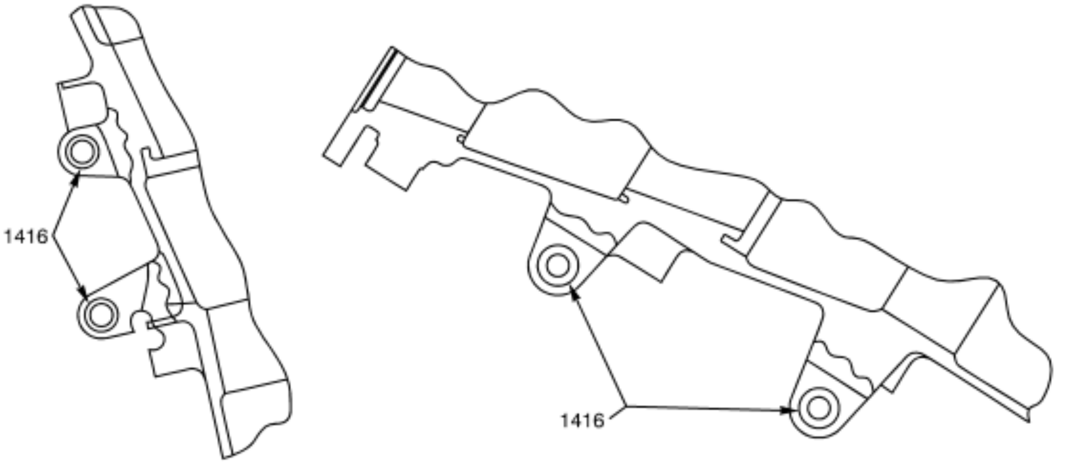
High Pressure Compressor (HPC)
Figure 801 (Sheet 14)
(Task 72−35−00−990−006)

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04


BN
BN
277° 30'
BM
BM
255° 36'
BL
BL
214° 24'
1416
1416

SCHEMATIC VIEW K−K

SECTION BN−BN

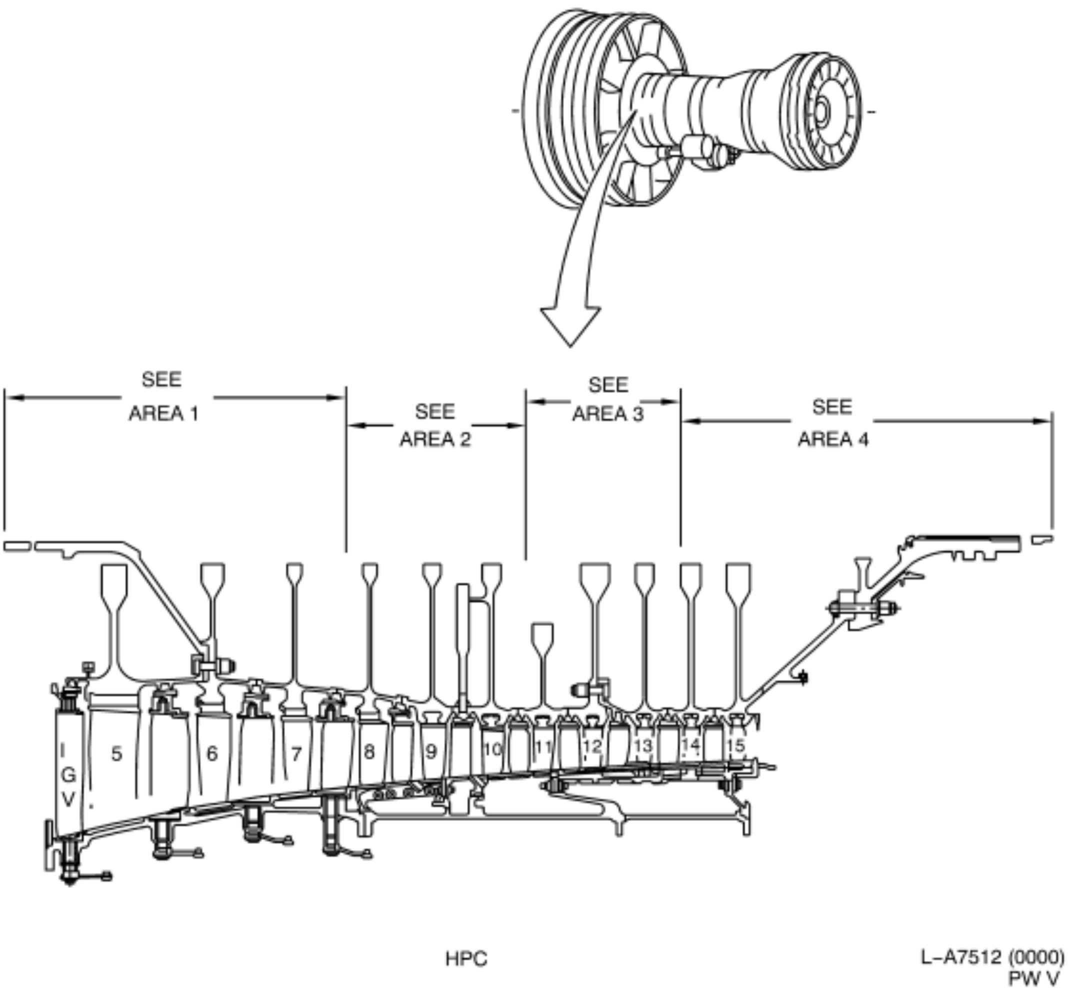


SECTION BM−BM

SECTION BL−BL

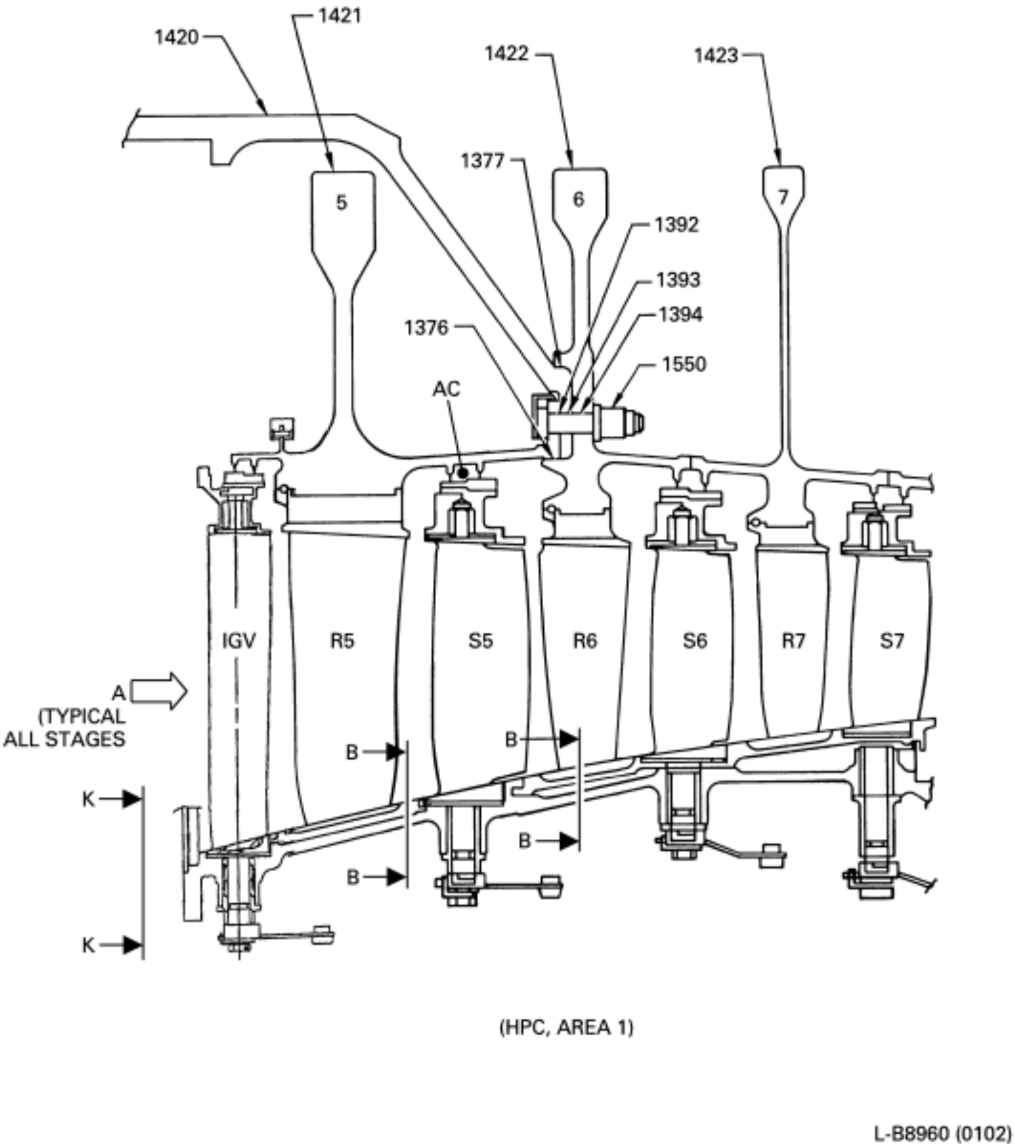
L−B9009 (0202)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 15)
(Task 72−35−00−990−006)

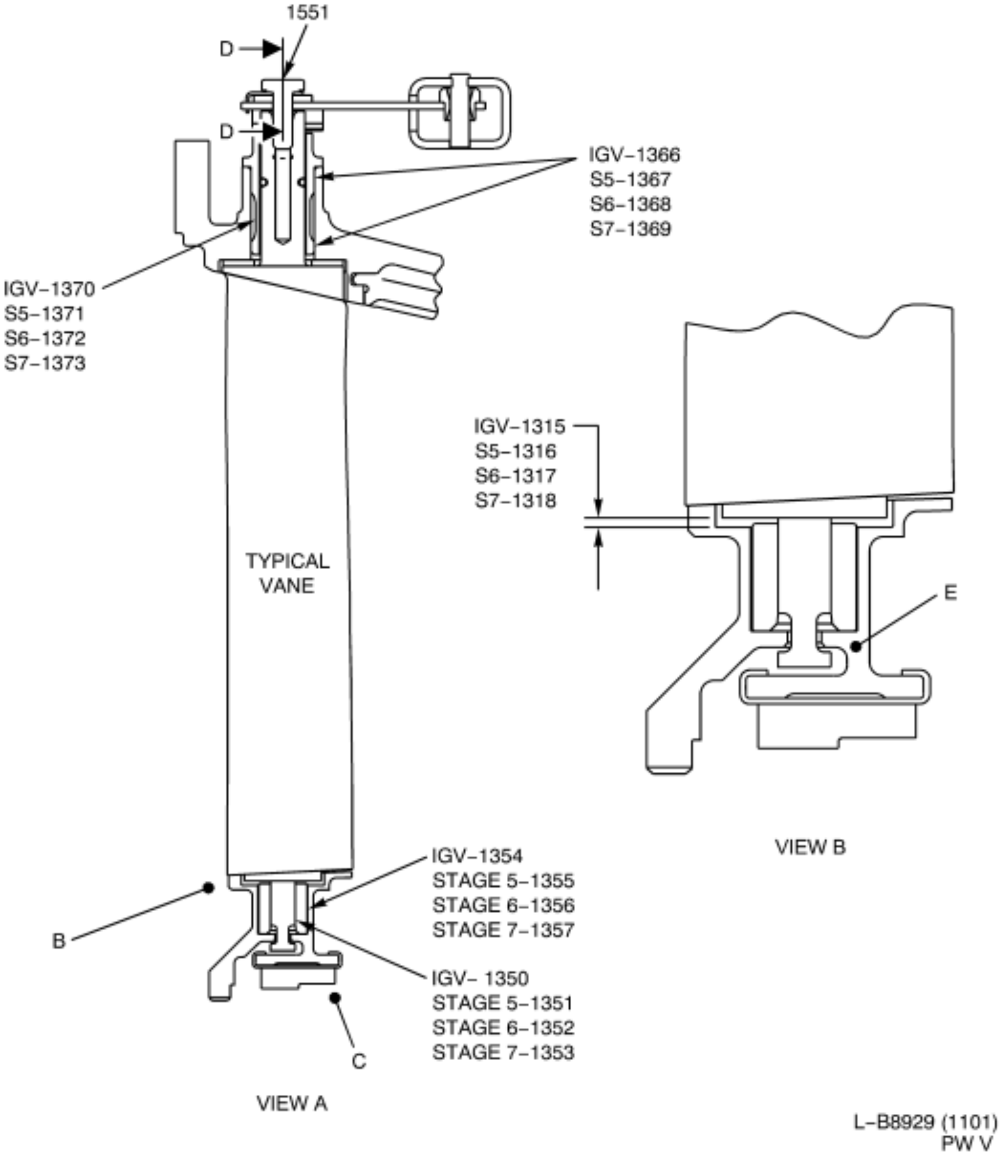

SEE
AREA 1
SEE
AREA 2
SEE
AREA 3
SEE
AREA 4
I
G
V
5
6
7
8
9
10
11
12
13
14
15
HPC
L−A7512 (0000)
PW V

High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 1)
(Task 72−35−00−990−006)

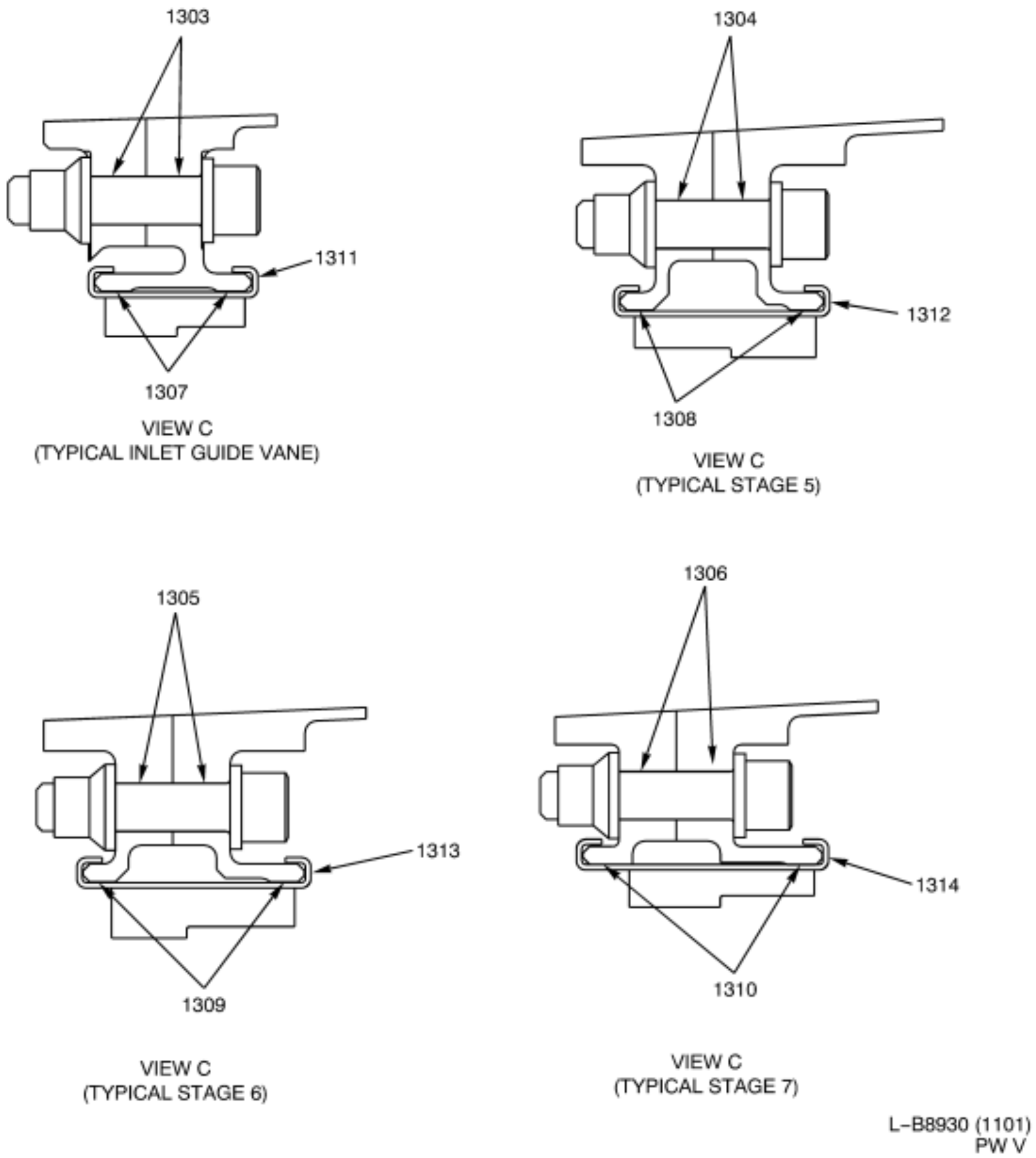
HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04


1421
1420
1422
1423
1377
5
6
7
1392
1393
1394
1376
1550
AC
IGV
R5
S5
R6
S6
R7
S7
A
(TYPICAL
ALL STAGES
B
B
B
B
K
K
(HPC, AREA 1)
L-B8960 (0102)

High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 2)
(Task 72−35−00−990−006)


1551
D
D
IGV−1366
S5−1367
S6−1368
S7−1369
IGV−1370
S5−1371
S6−1372
S7−1373
IGV−1315
S5−1316
S6−1317
S7−1318
E
TYPICAL
VANE
VIEW B
IGV−1354
STAGE 5−1355
STAGE 6−1356
STAGE 7−1357
B
IGV− 1350
STAGE 5−1351
STAGE 6−1352
STAGE 7−1353
C
VIEW A
L−B8929 (1101)
PW V

High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 3)
(Task 72−35−00−990−006)


1303
1311
1307
1304
1312
1308
1305
1313
1309
1306
1314
1310
L−B8930 (1101)
PW V

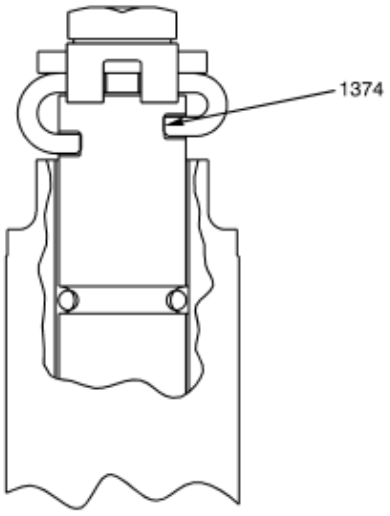
VIEW C
(TYPICAL INLET GUIDE VANE)

VIEW C
(TYPICAL STAGE 5)

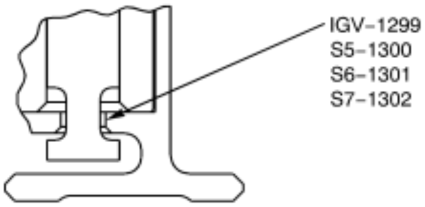
VIEW C
(TYPICAL STAGE 6)

VIEW C
(TYPICAL STAGE 7)

High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 4)
(Task 72−35−00−990−006)



SECTION D−D

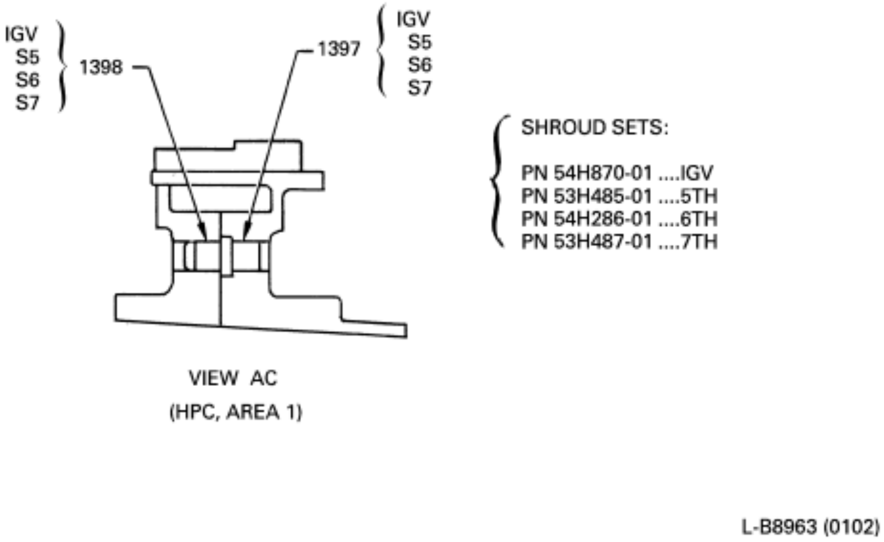

IGV−1299
S5−1300
S6−1301
S7−1302

VIEW E

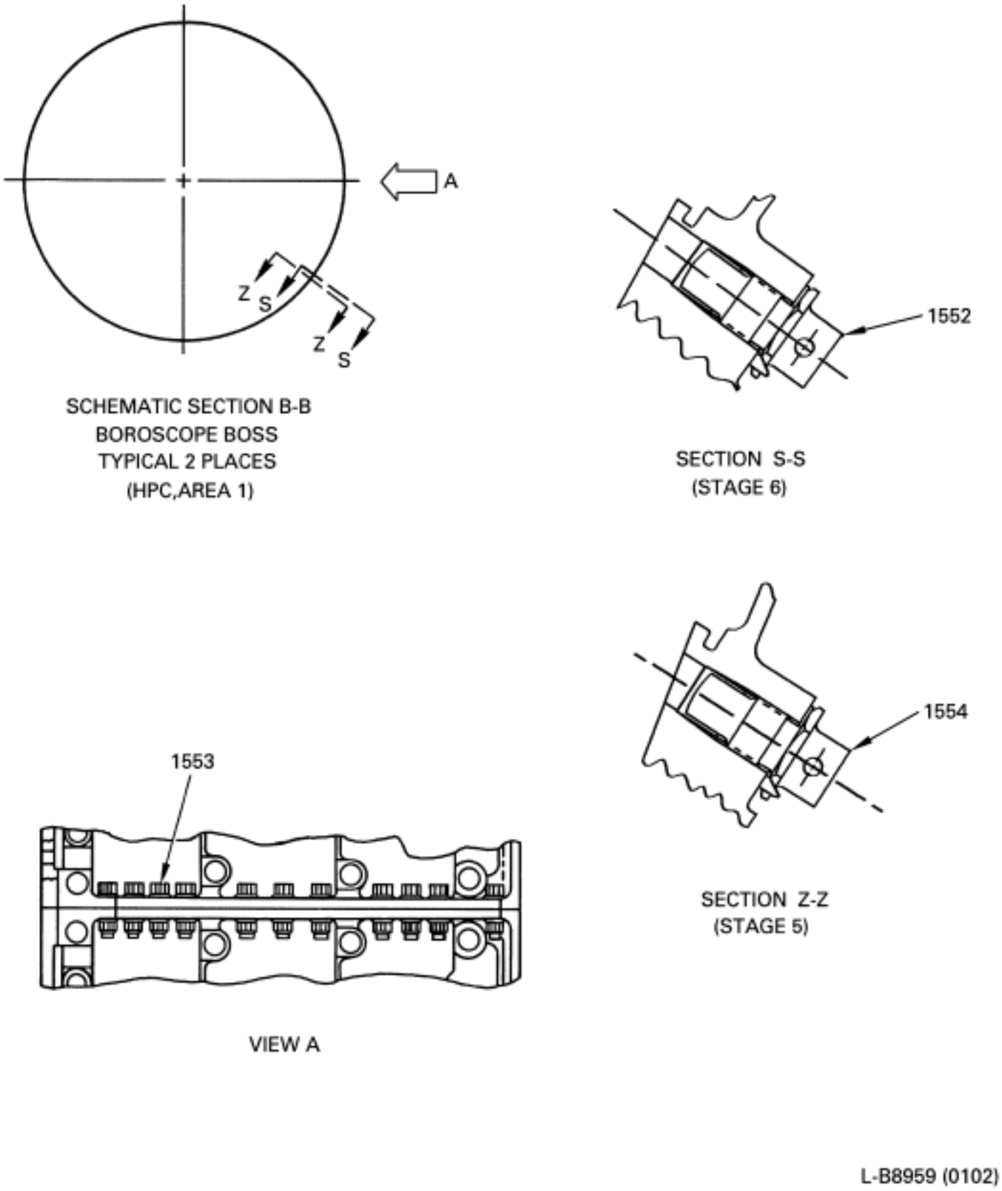
L−B8931 (1101)
PW V

High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 5)
(Task 72−35−00−990−006)

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04

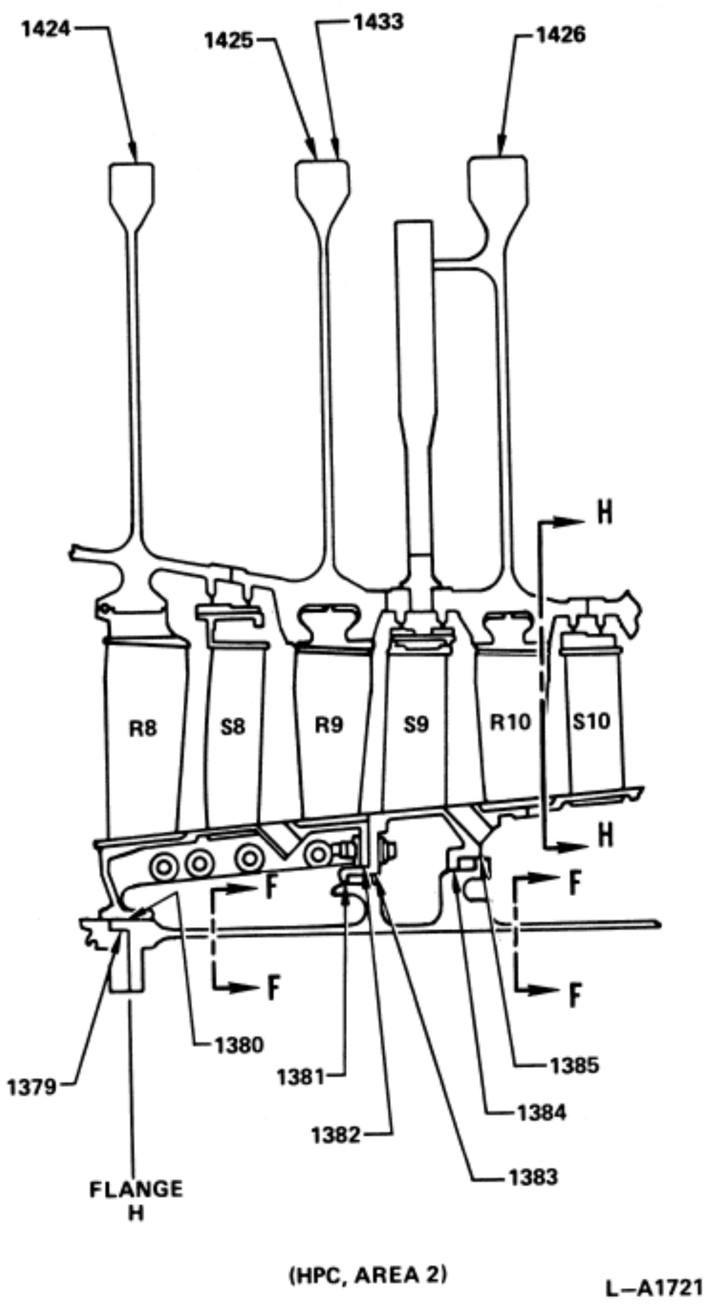

IGV
S5
S6
S7
1398
1397
IGV
S5
S6
S7
SHROUD SETS:
PN 54H870-01 ....IGV
PN 53H485-01 ....5TH
PN 54H286-01 ....6TH
PN 53H487-01 ....7TH
VIEW AC
(HPC, AREA 1)
L-B8963 (0102)

High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 6)
(Task 72−35−00−990−006)

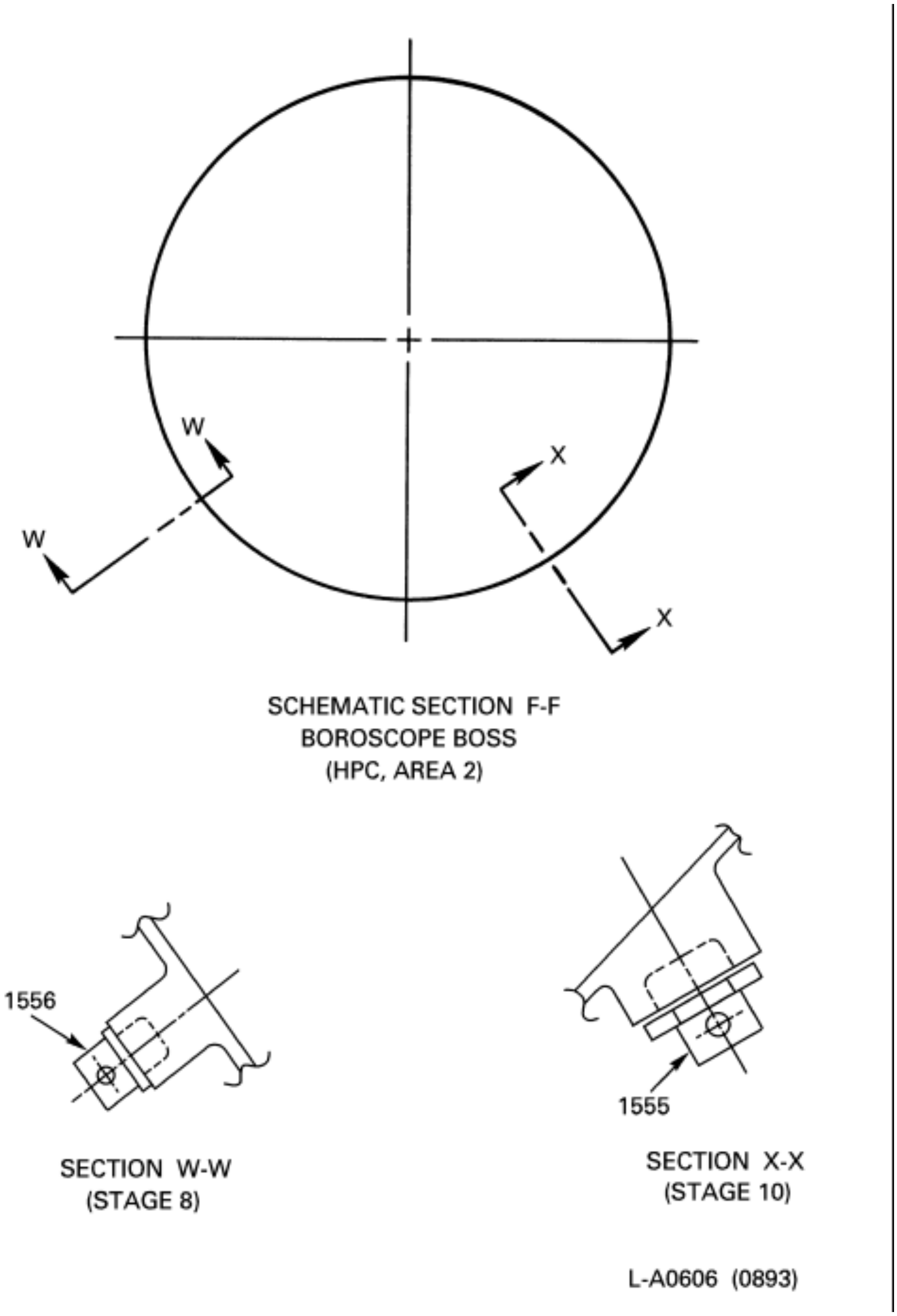

A
Z
S
Z
S
SCHEMATIC SECTION B-B
BOROSCOPE BOSS
TYPICAL 2 PLACES
(HPC,AREA 1)
1552
SECTION S-S
(STAGE 6)
1554
SECTION Z-Z
(STAGE 5)
1553
VIEW A
L-B8959 (0102)

High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 7)
(Task 72−35−00−990−006)

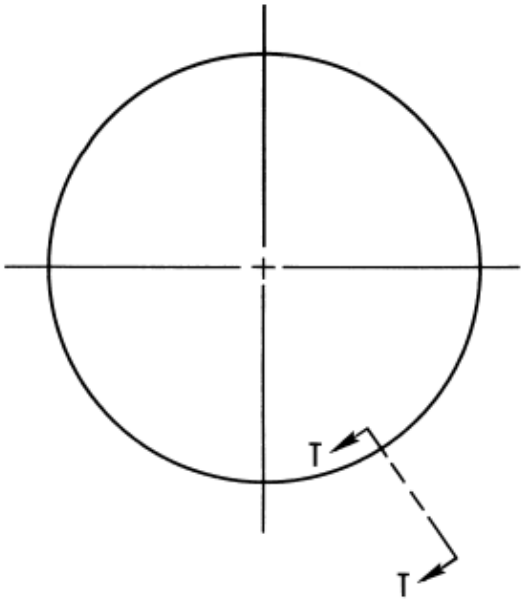
HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-04


1424
1425
1433
1426
H
H
R8
S8
R9
S9
R10
S10
F
F
F
F
1380
1379
1381
1385
1384
1382
1383
FLANGE
H
(HPC, AREA 2)
L-A1721

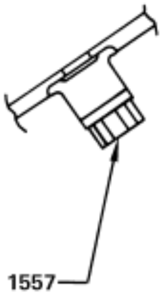
High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 8)
(Task 72-35-00-990-006)


W
W
X
X
SCHEMATIC SECTION F-F
BOROSCOPE BOSS
(HPC, AREA 2)
1556
SECTION W-W
(STAGE 8)
1555
SECTION X-X
(STAGE 10)
L-A0606 (0893)

High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 9)
(Task 72−35−00−990−006)



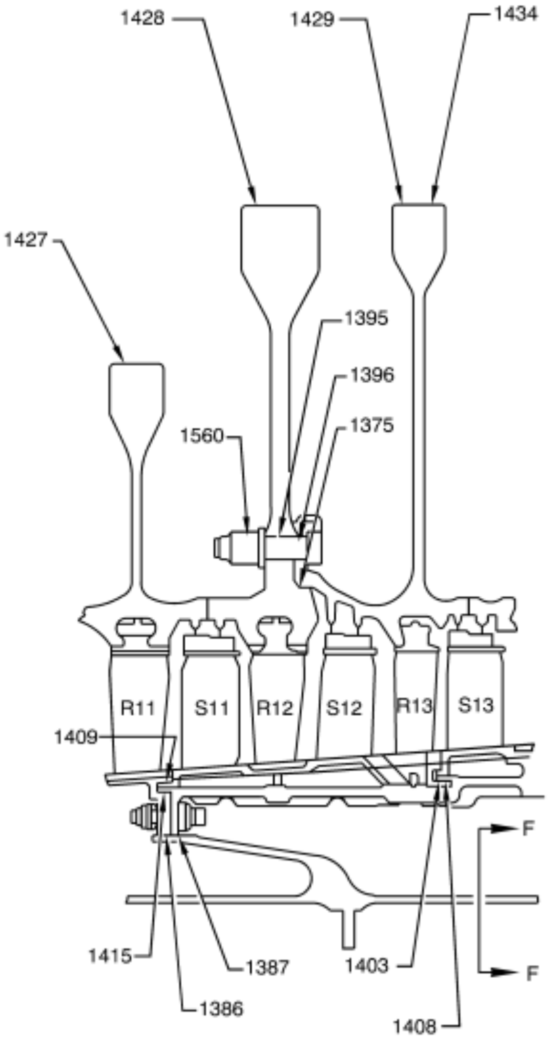
SCHEMATIC SECTION H−H
BOROSCOPE BOSS
(HPC, AREA 2)



SECTION T−T
(STAGE 10)

L−A0618

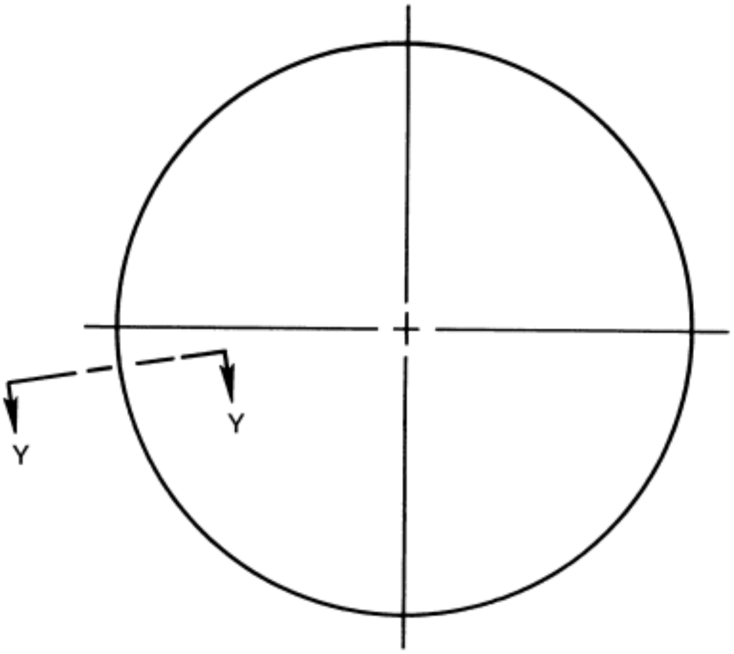
High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 10)
(Task 72−35−00−990−006)


1428
1429
1434
1427
1395
1396
1560
1375
R11
S11
R12
S12
R13
S13
1409
F
F
1415
1387
1403
1386
1408

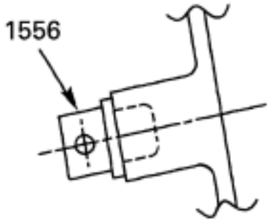
(HPC, AREA 3)

L−A7491 (0901)
PW V

High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 11)
(Task 72−35−00−990−006)



SCHEMATIC SECTION F-F
BOROSCOPE BOSS
(HPC,AREA 3)

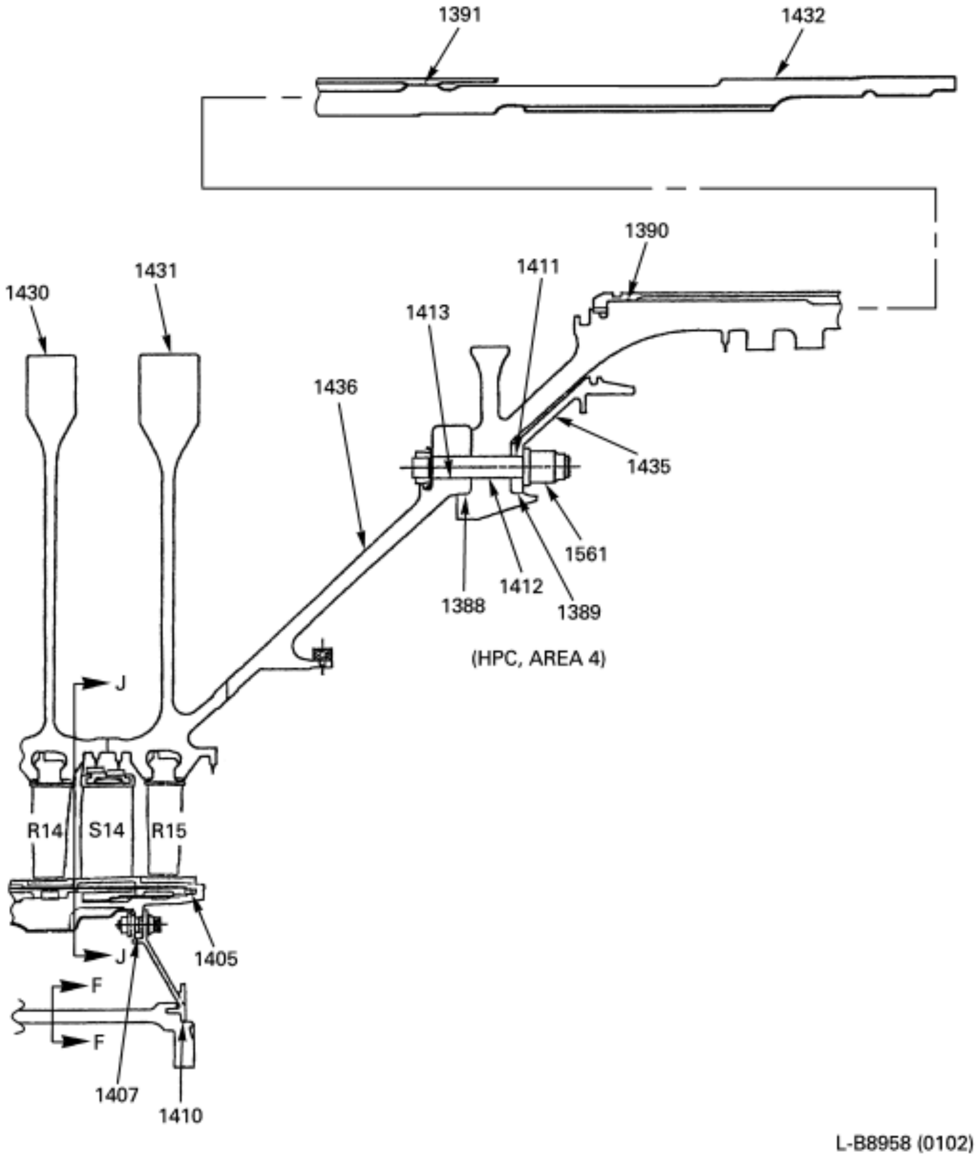


SECTION Y-Y
(STAGE 12)

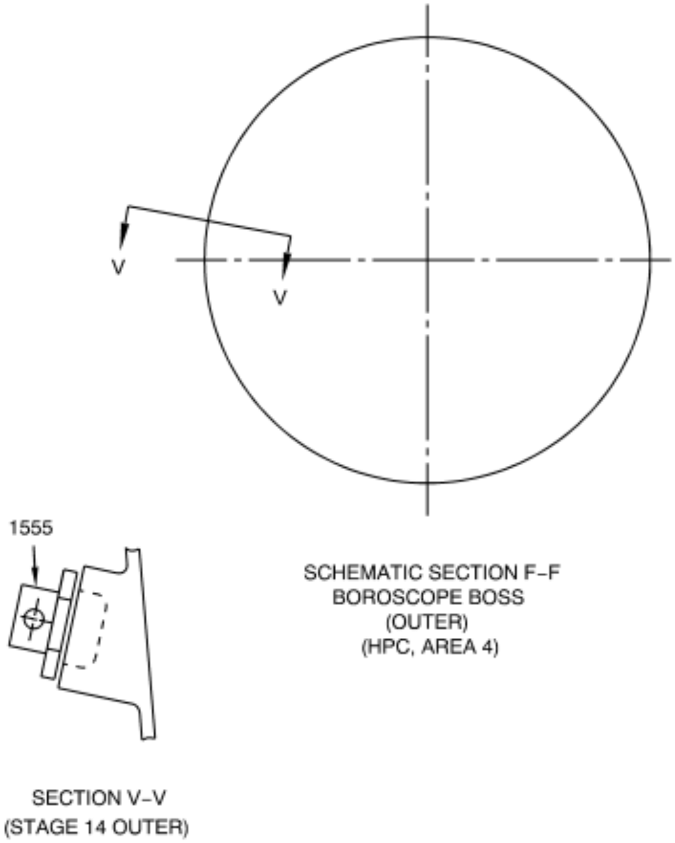
L-A0630 (0893)

High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 12)
(Task 72−35−00−990−006)

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04


1391
1432
1390
1430
1431
1411
1413
1436
1435
1561
1412
1388
1389
(HPC, AREA 4)
J
R14
S14
R15
1405
J
F
F
1407
1410
L-B8958 (0102)

High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 13)
(Task 72−35−00−990−006)

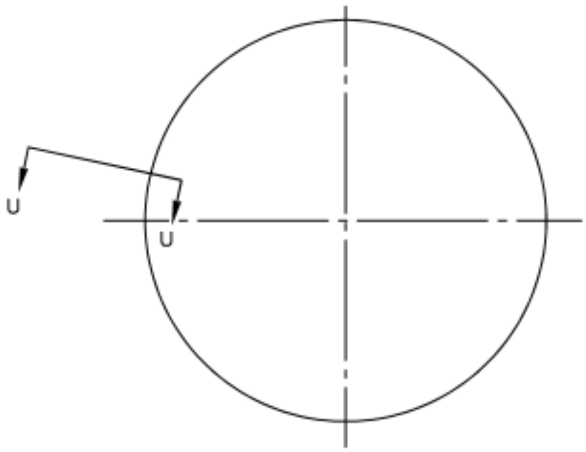


SCHEMATIC SECTION F−F
BOROSCOPE BOSS
(OUTER)
(HPC, AREA 4)

SECTION V−V
(STAGE 14 OUTER)

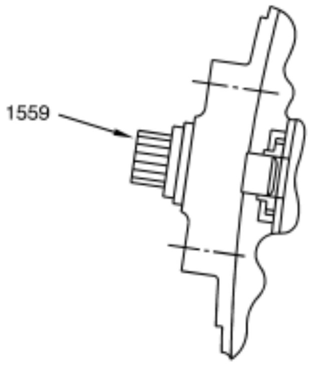
L−A7484 (0000)
PW V

High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 14)
(Task 72−35−00−990−006)



SCHEMATIC SECTION J−J
BOROSCOPE BOSS
(INNER)

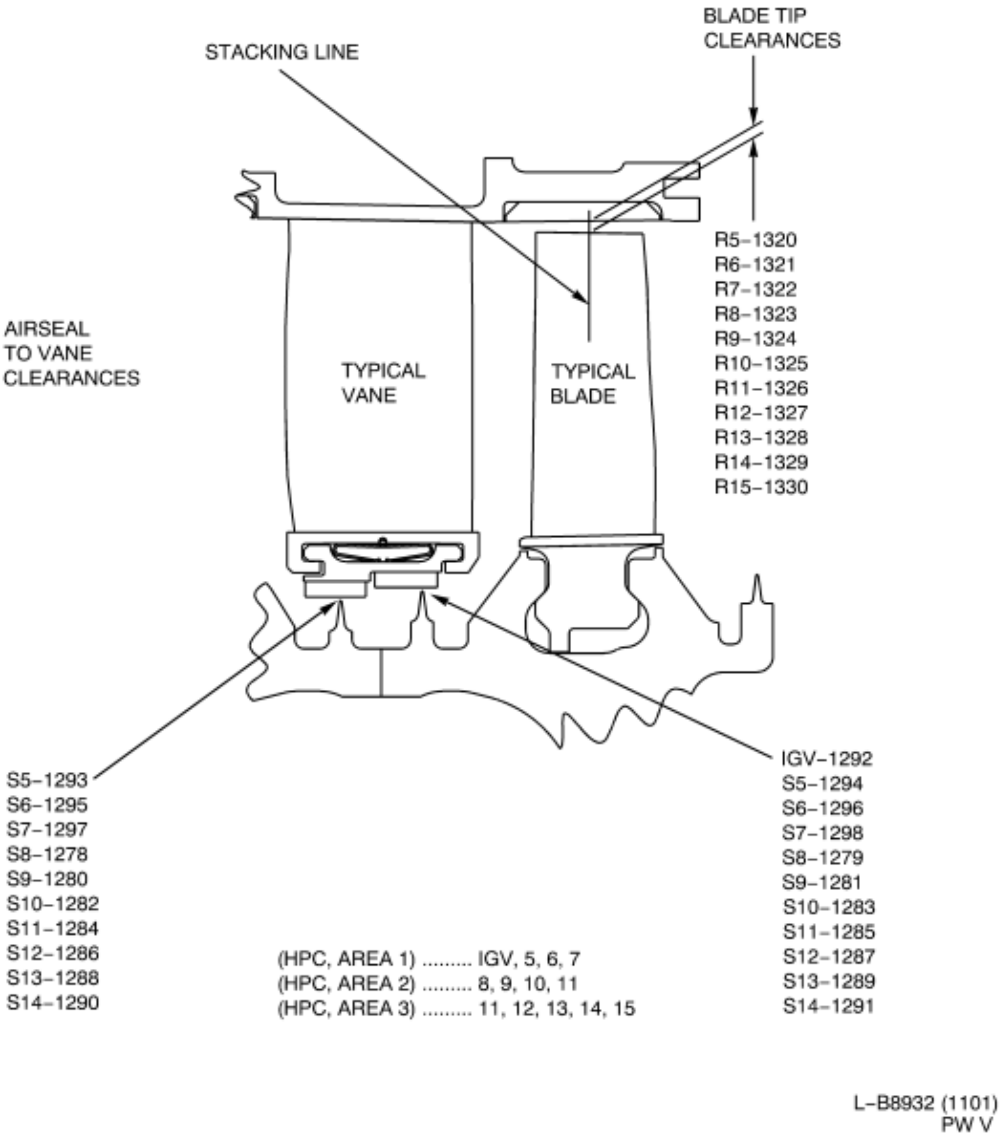
(HPC, AREA 4)



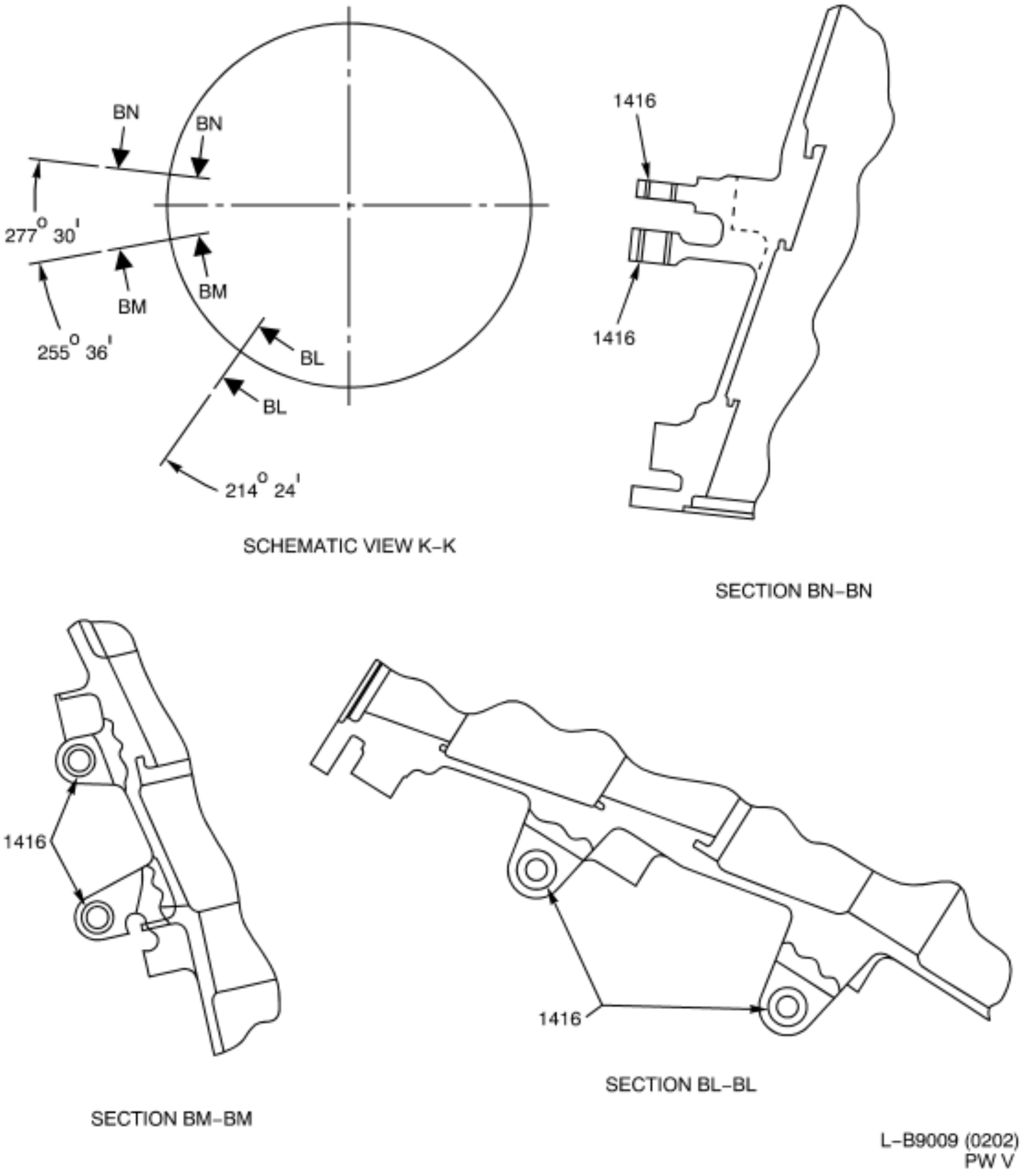
SECTION U−U
(STAGE 14 INNER)

L−A0642 (0893)
PW V

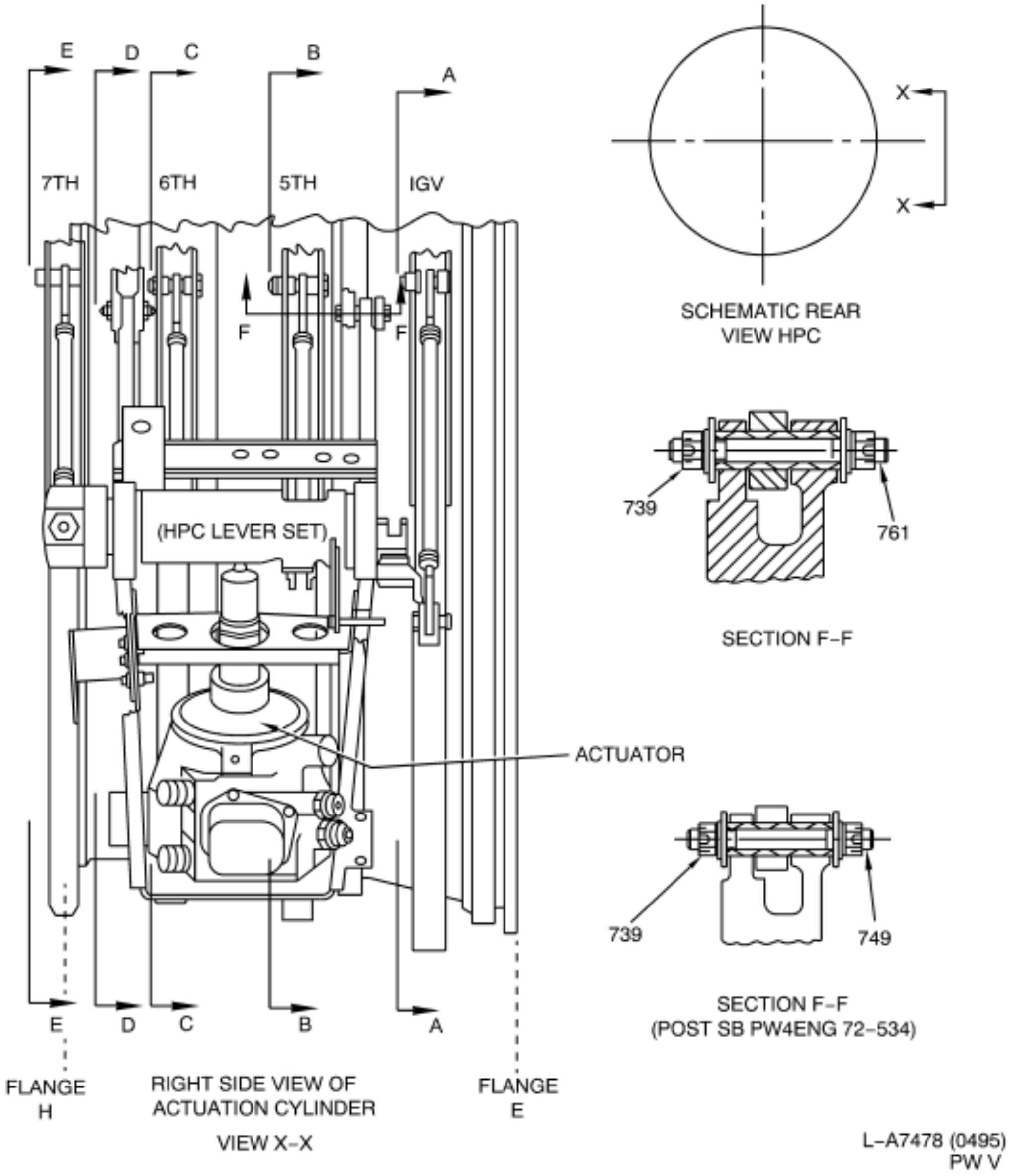
High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 15)
(Task 72−35−00−990−006)


BLADE TIP
CLEARANCES
STACKING LINE
R5−1320
R6−1321
R7−1322
R8−1323
R9−1324
R10−1325
R11−1326
R12−1327
R13−1328
R14−1329
R15−1330
AIRSEAL
TO VANE
CLEARANCES
TYPICAL
VANE
TYPICAL
BLADE
S5−1293
S6−1295
S7−1297
S8−1278
S9−1280
S10−1282
S11−1284
S12−1286
S13−1288
S14−1290
IGV−1292
S5−1294
S6−1296
S7−1298
S8−1279
S9−1281
S10−1283
S11−1285
S12−1287
S13−1289
S14−1291
(HPC, AREA 1) .... IGV, 5, 6, 7
(HPC, AREA 2) 8, 9, 10, 11
(HPC, AREA 3) 11, 12, 13, 14, 15
L−B8932 (1101)
PW V

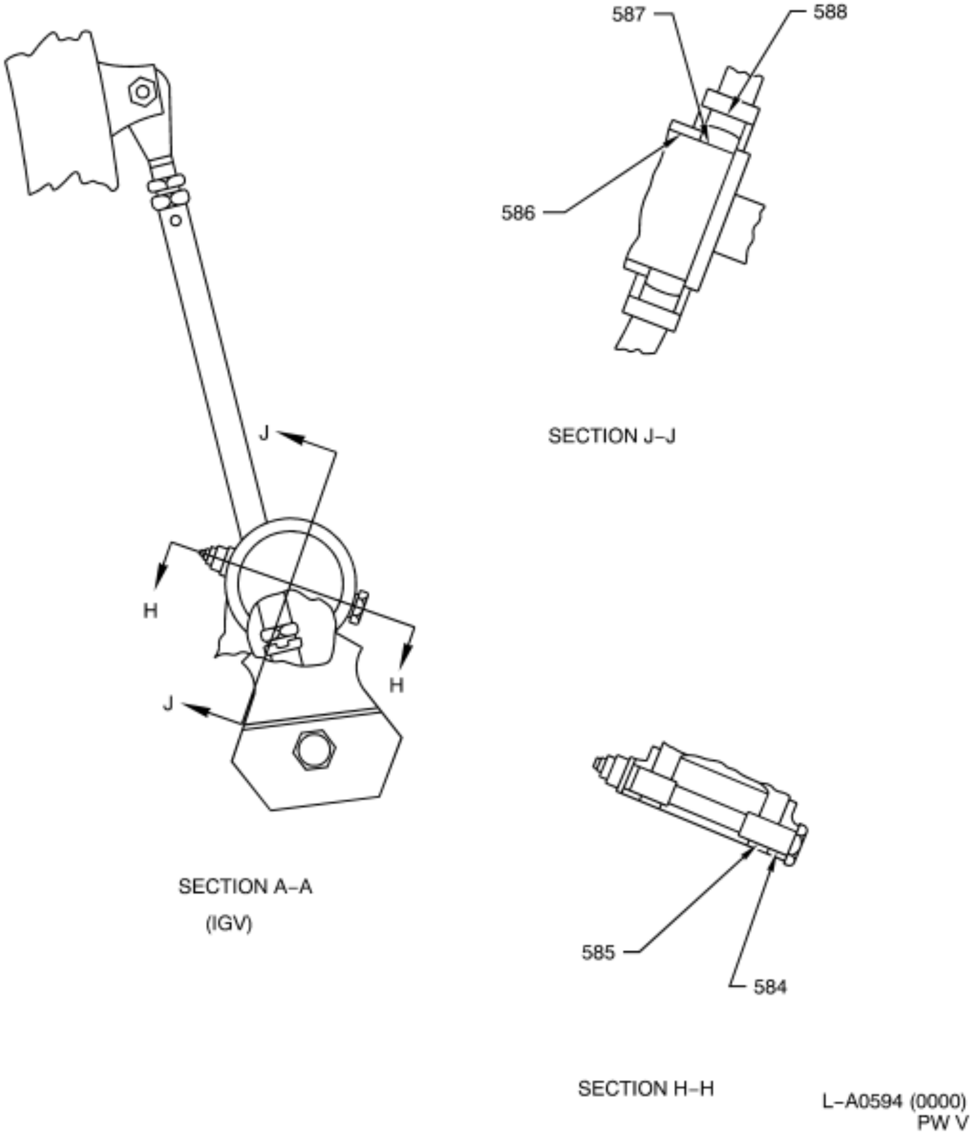
High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 16)
(Task 72−35−00−990−006)


BN
BN
277° 30'
BM
BM
255° 36'
BL
BL
214° 24'
SCHEMATIC VIEW K-K
1416
1416
SECTION BN-BN
1416
SECTION BM-BM
1416
SECTION BL-BL
L-B9009 (0202)
PW V

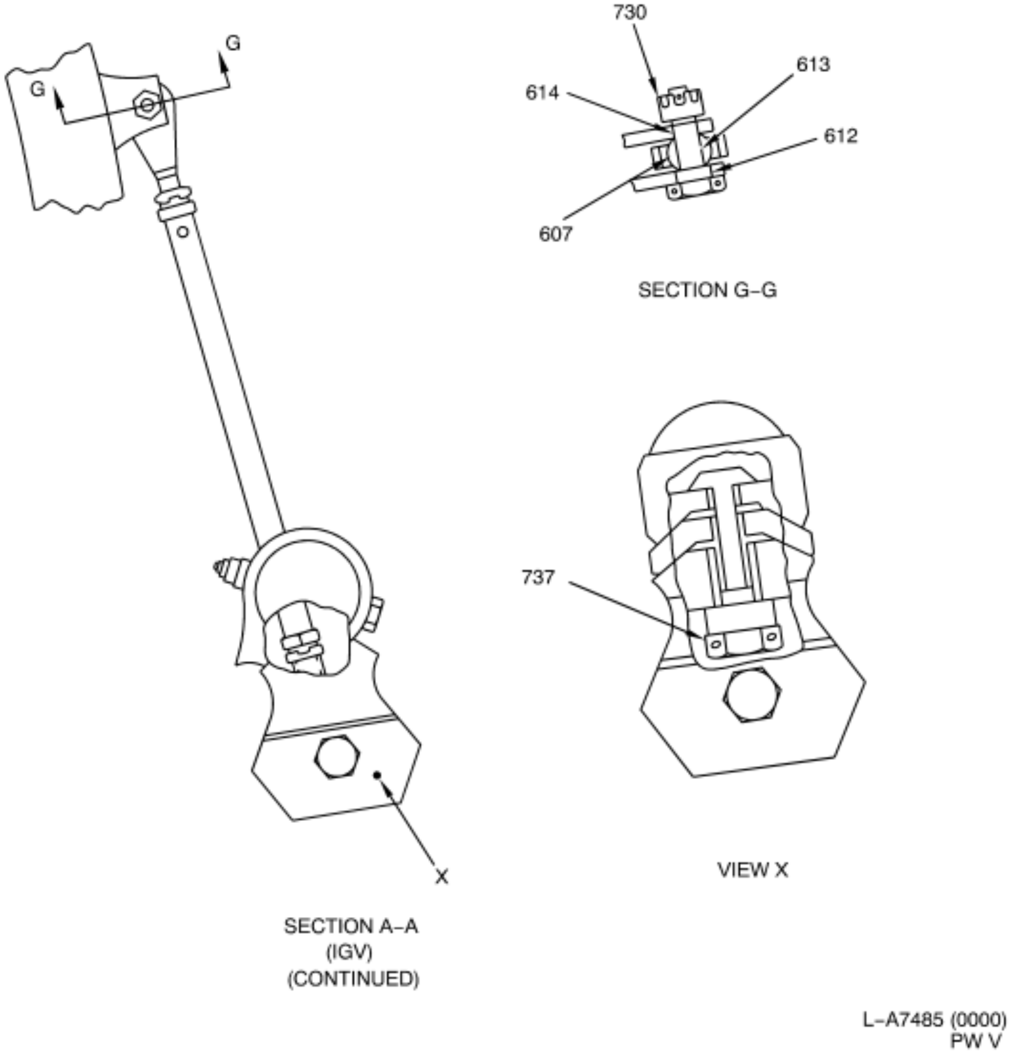
High Pressure Compressor (HPC) (UPS Configuration)
Figure 802 (Sheet 17)
(Task 72-35-00-990-006)


E
D
C
B
A
7TH
6TH
5TH
IGV
F
F
(HPC LEVER SET)
ACTUATOR
E
D
C
B
A
FLANGE H
RIGHT SIDE VIEW OF ACTUATION CYLINDER
VIEW X−X
FLANGE E
X
X
SCHEMATIC REAR VIEW HPC
739
761
SECTION F−F
739
749
SECTION F−F (POST SB PW4ENG 72−534)
L−A7478 (0495)
PW V

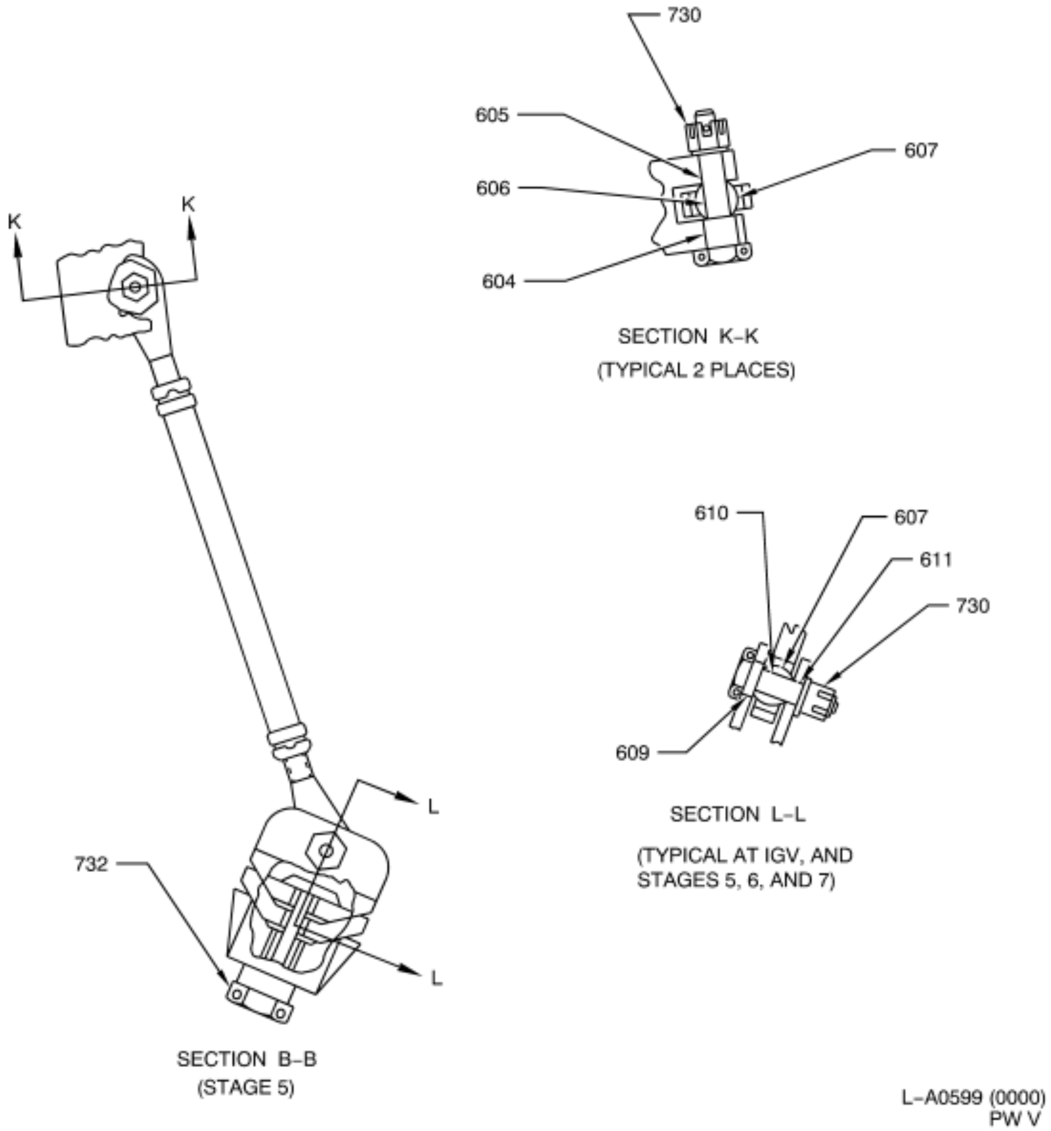
High Pressure Compressor (HPC)
Figure 803 (Sheet 1)
(Task 72−35−00−990−006)


587
588
586
SECTION J-J
J
H
H
J
SECTION A-A
(IGV)
585
584
SECTION H-H
L-A0594 (0000)
PW V

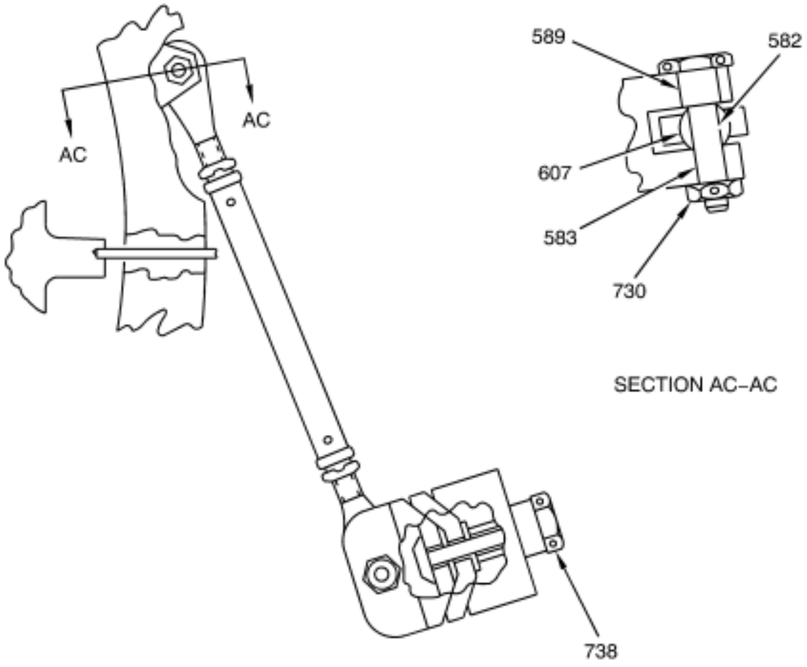
High Pressure Compressor (HPC)
Figure 803 (Sheet 2)
(Task 72-35-00-990-006)


G
G
730
614
613
612
607
SECTION G−G
737
X
VIEW X
SECTION A−A
(IGV)
(CONTINUED)
L−A7485 (0000)
PW V

High Pressure Compressor (HPC)
Figure 803 (Sheet 3)
(Task 72−35−00−990−006)


730
605
607
606
604
K
K
SECTION K–K
(TYPICAL 2 PLACES)
610
607
611
730
609
SECTION L–L
(TYPICAL AT IGV, AND STAGES 5, 6, AND 7)
L
L
732
SECTION B–B
(STAGE 5)
L–A0599 (0000)
PW V

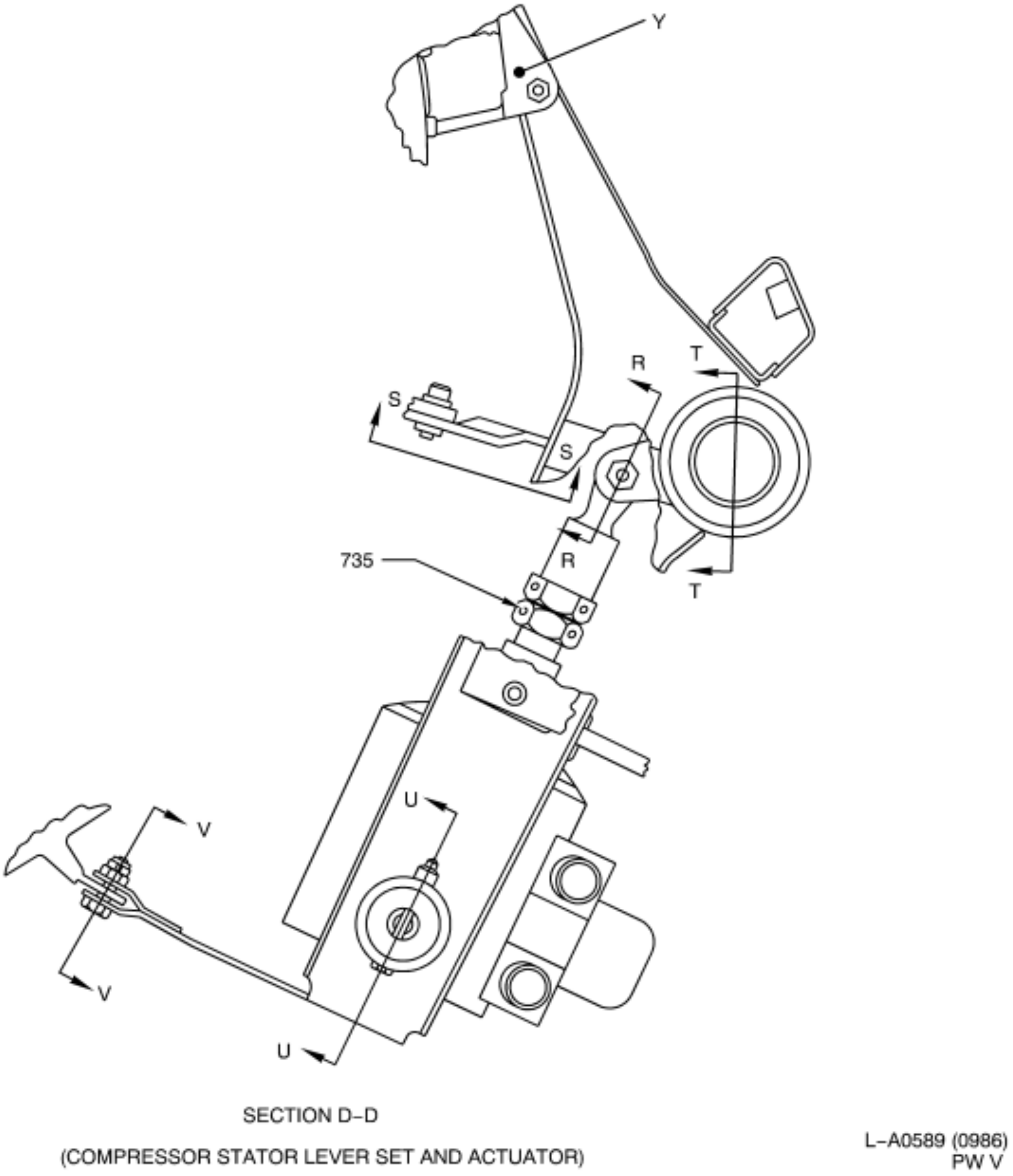
High Pressure Compressor (HPC)
Figure 803 (Sheet 4)
(Task 72−35−00−990−006)


589
582
607
583
730
AC
AC
738
L−A7492 (0000)
PW V

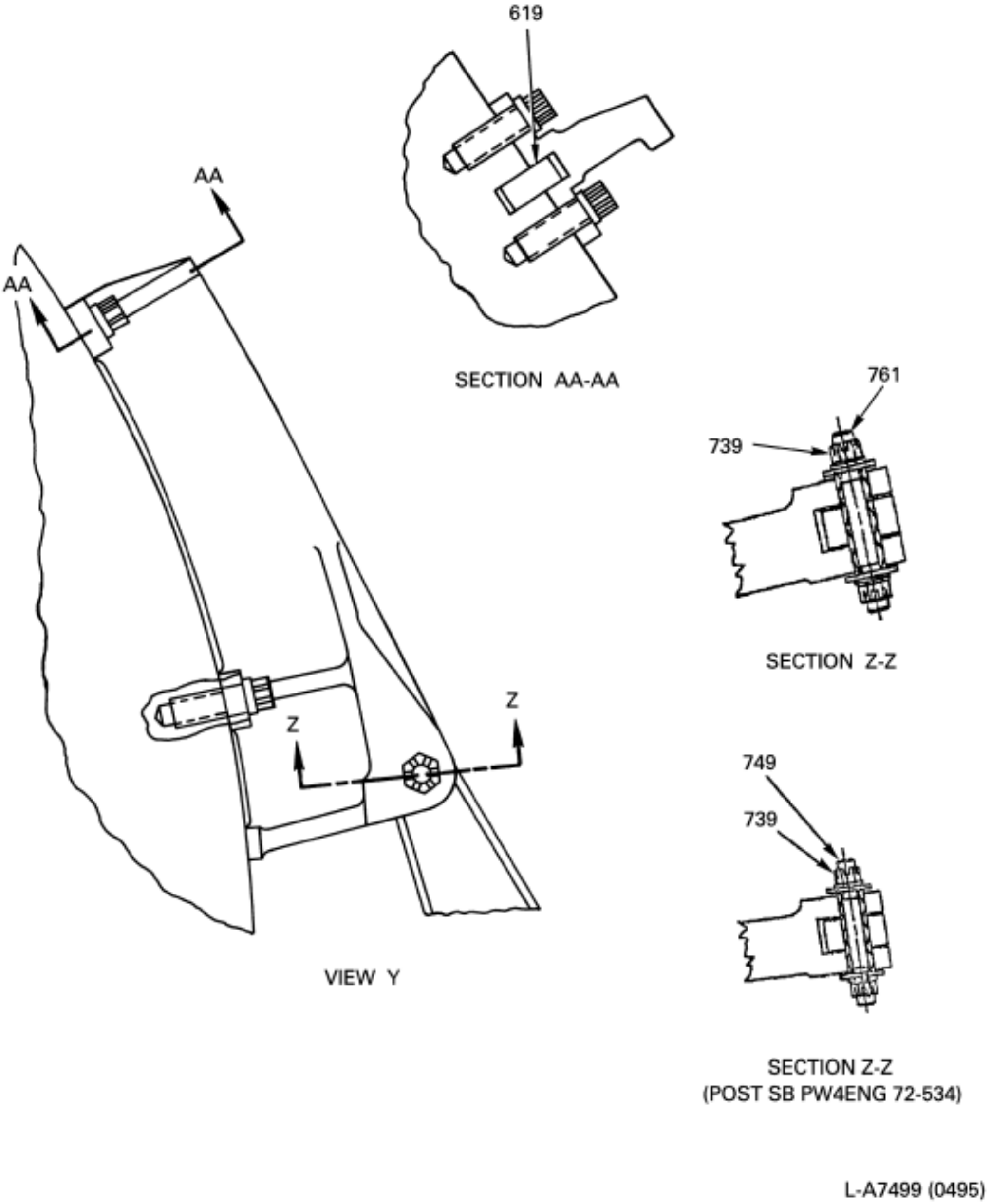
SECTION AC−AC

SECTION C−C
(STAGE 6)

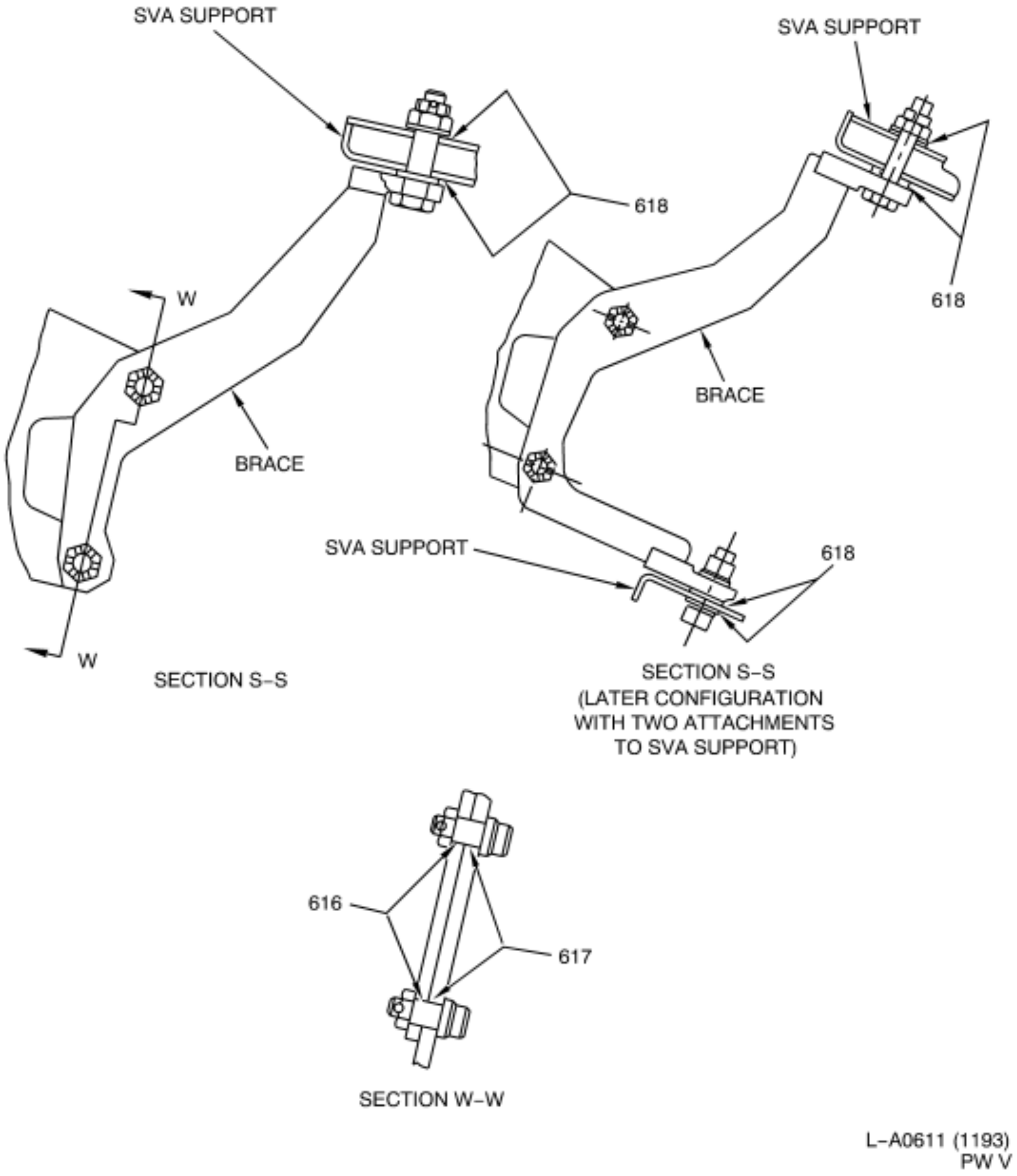
High Pressure Compressor (HPC)
Figure 803 (Sheet 5)
(Task 72−35−00−990−006)


Y
R
T
S
S
735
R
T
U
V
V
U
SECTION D−D
(COMPRESSOR STATOR LEVER SET AND ACTUATOR)
L−A0589 (0986)
PW V

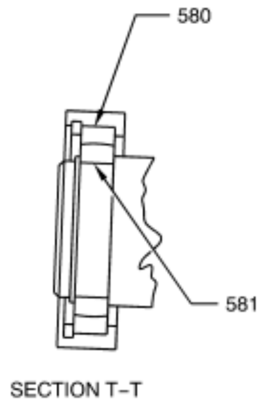
High Pressure Compressor (HPC)
Figure 803 (Sheet 6)
(Task 72−35−00−990−006)

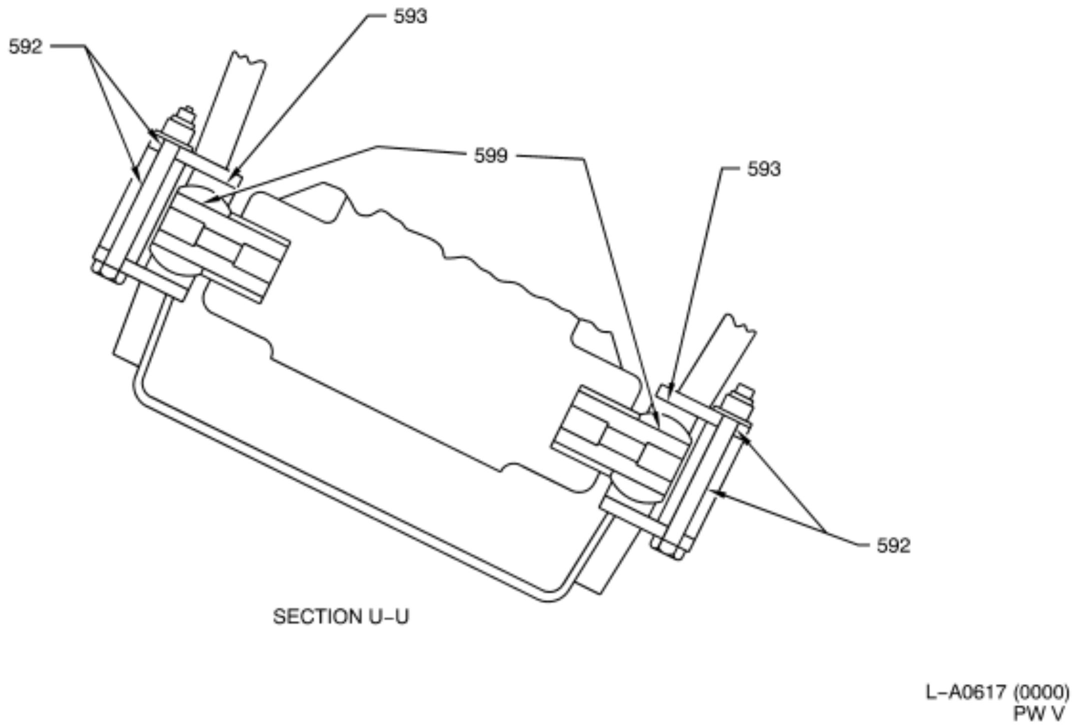

619
SECTION AA-AA
AA
AA
761
739
SECTION Z-Z
Z
Z
VIEW Y
749
739
SECTION Z-Z
(POST SB PW4ENG 72-534)
L-A7499 (0495)

High Pressure Compressor (HPC)
Figure 803 (Sheet 7)
(Task 72−35−00−990−006)

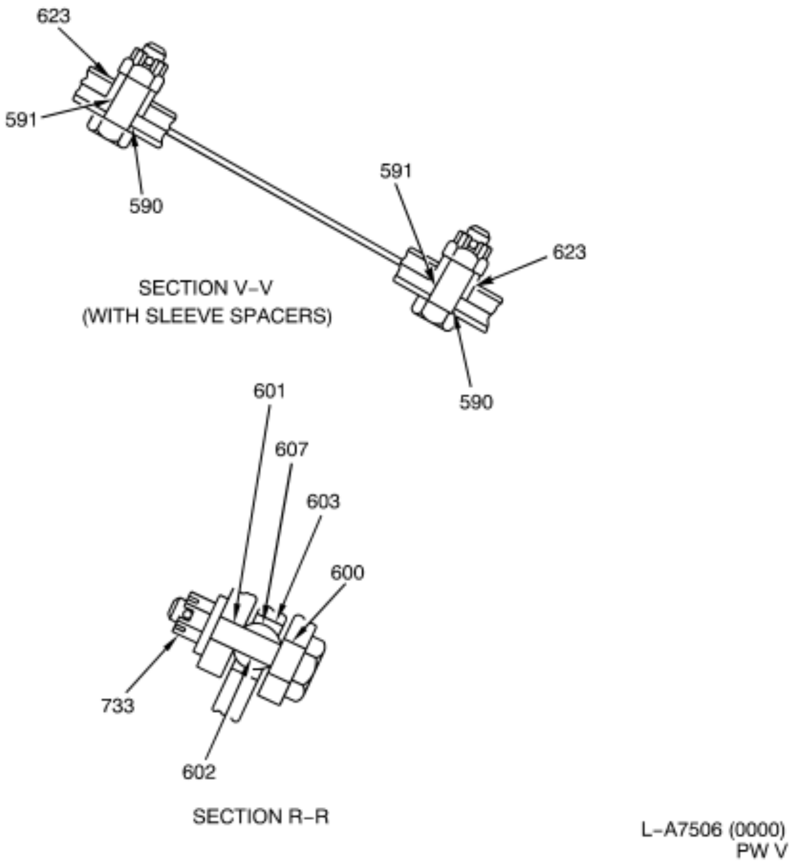

SVA SUPPORT
618
W
BRACE
W
SECTION S−S
SVA SUPPORT
618
BRACE
SVA SUPPORT
618
SECTION S−S
(LATER CONFIGURATION
WITH TWO ATTACHMENTS
TO SVA SUPPORT)
616
617
SECTION W−W
L−A0611 (1193)
PW V

High Pressure Compressor (HPC)
Figure 803 (Sheet 8)
(Task 72−35−00−990−006)

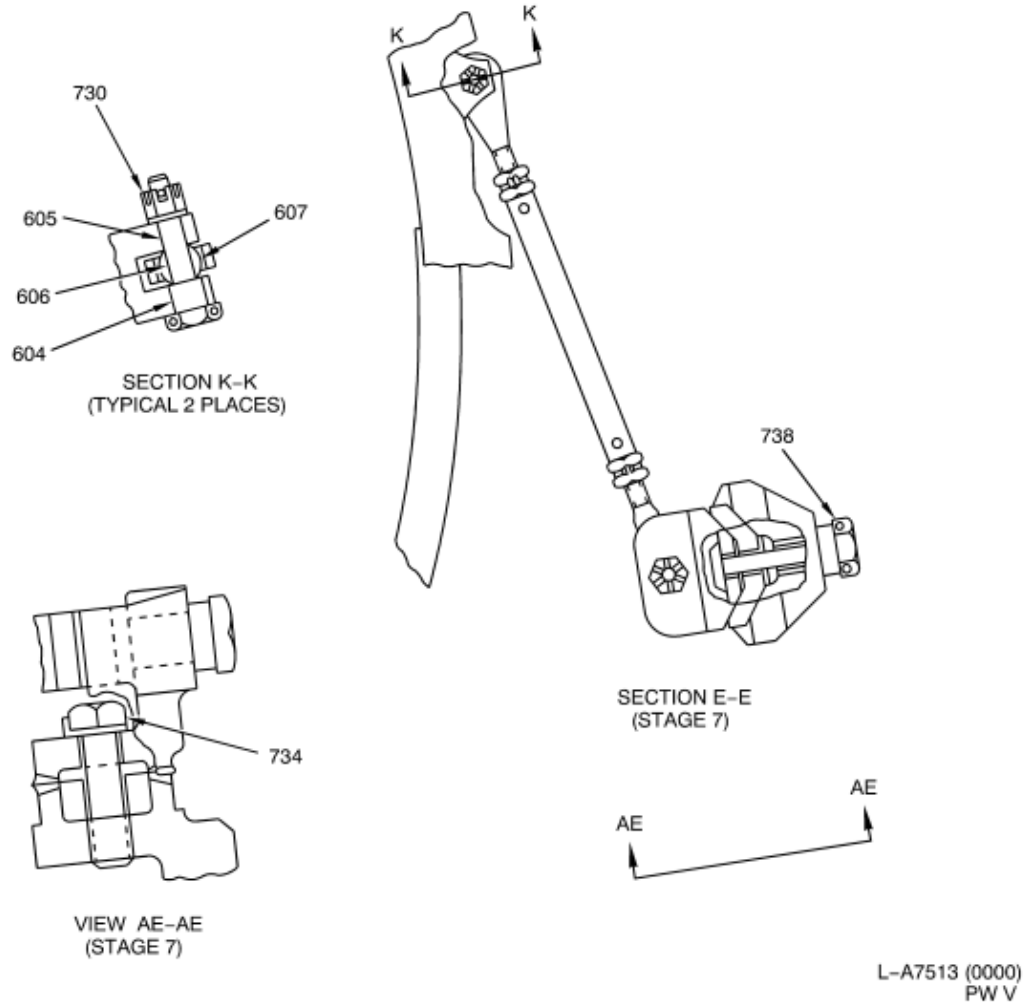

580
581
SECTION T−T


592
593
599
593
592
SECTION U−U
L−A0617 (0000)
PW V

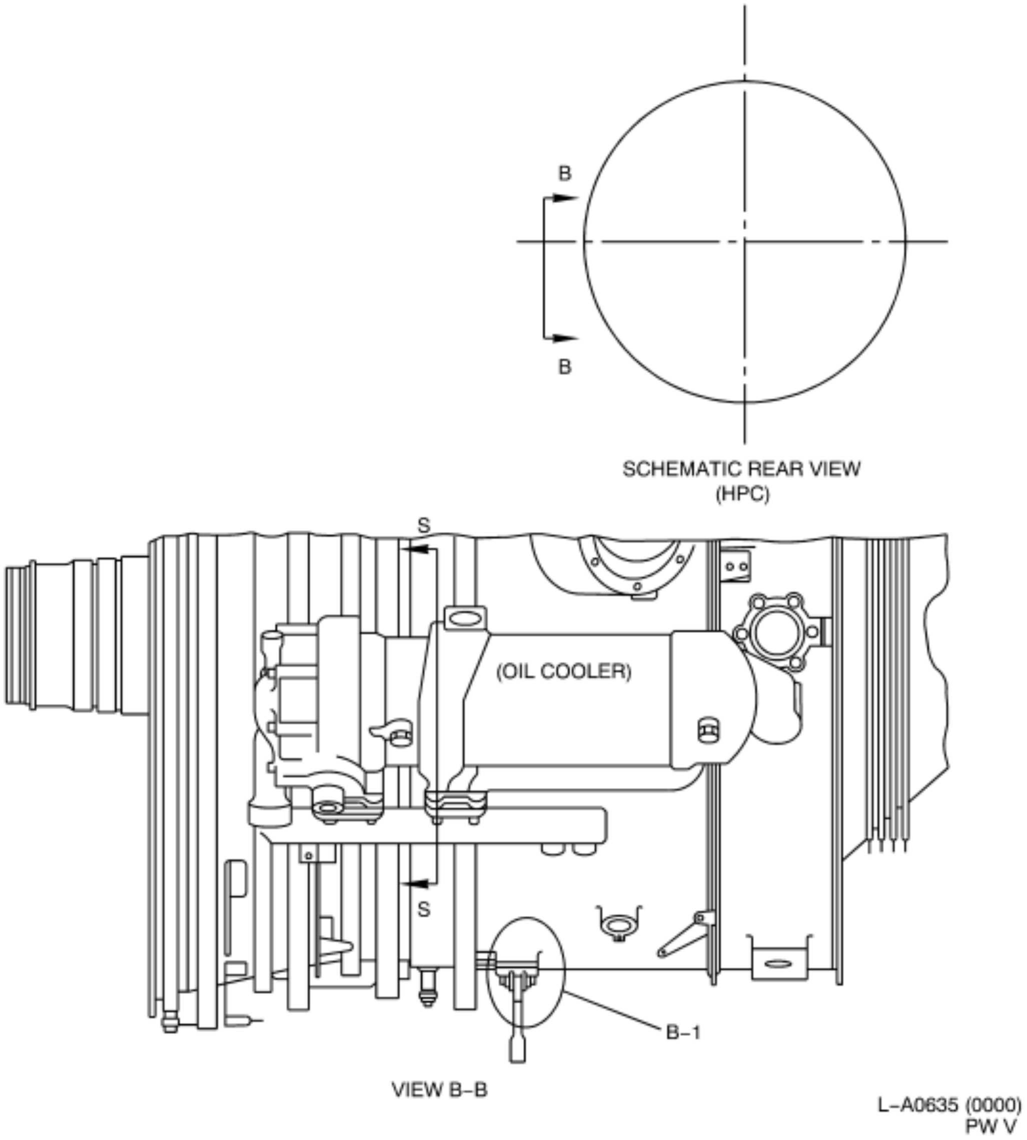
High Pressure Compressor (HPC)
Figure 803 (Sheet 9)
(Task 72−35−00−990−006)


623
591
590
591
623
590
SECTION V−V
(WITH SLEEVE SPACERS)
601
607
603
600
733
602
SECTION R−R
L−A7506 (0000)
PW V

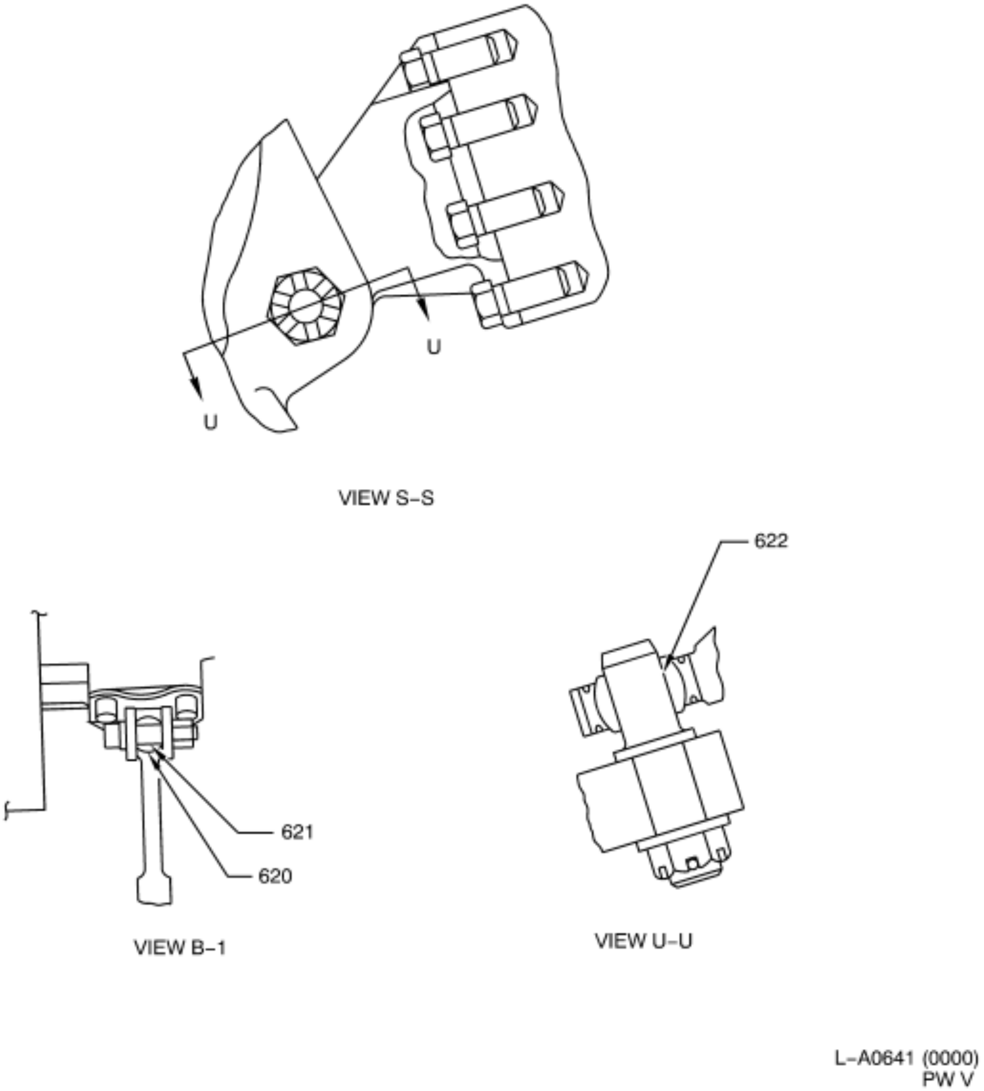
High Pressure Compressor (HPC)
Figure 803 (Sheet 10)
(Task 72−35−00−990−006)


K
K
730
605
607
606
604
SECTION K−K
(TYPICAL 2 PLACES)
738
SECTION E−E
(STAGE 7)
AE
AE
734
VIEW AE−AE
(STAGE 7)
L−A7513 (0000)
PW V

High Pressure Compressor (HPC)
Figure 803 (Sheet 11)
(Task 72−35−00−990−006)

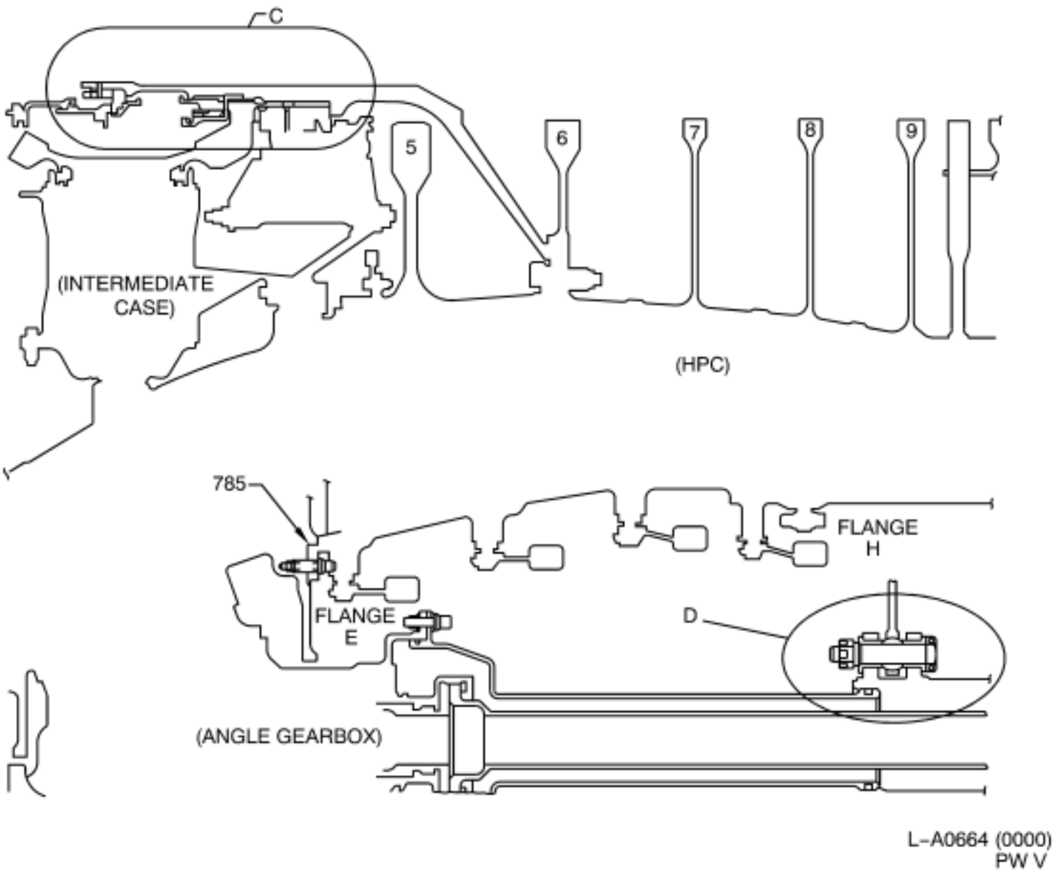

B
B
SCHEMATIC REAR VIEW
(HPC)
S
S
(OIL COOLER)
B−1
VIEW B−B
L−A0635 (0000)
PW V

High Pressure Compressor (HPC)
Figure 804 (Sheet 1)
(Task 72−35−00−990−006)

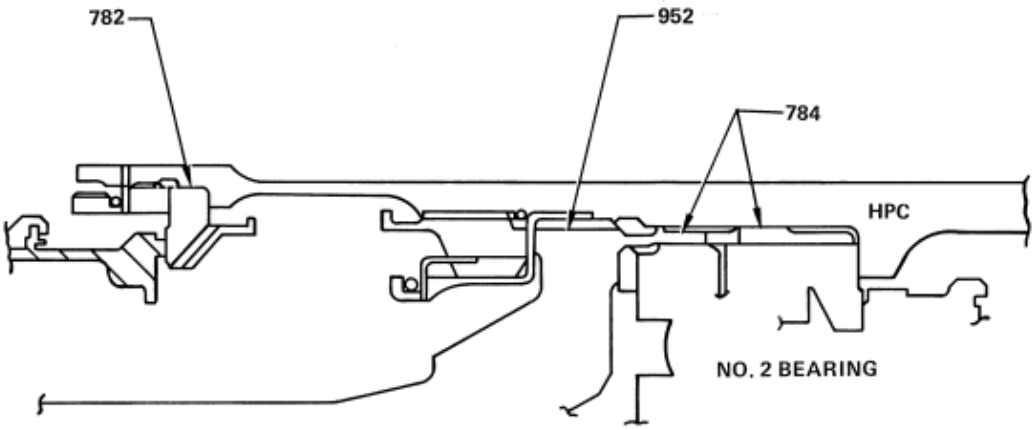

U
U
VIEW S−S
622
621
620
VIEW B−1
VIEW U−U
L−A0641 (0000)
PW V

High Pressure Compressor (HPC)
Figure 804 (Sheet 2)
(Task 72−35−00−990−006)

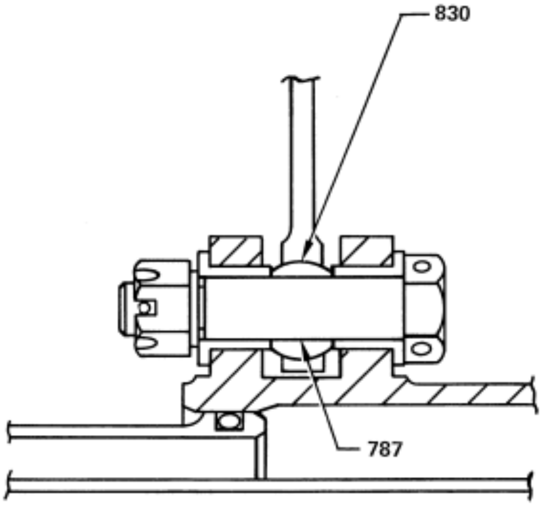
HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04


C
5
6
7
8
9
(INTERMEDIATE CASE)
(HPC)
785
FLANGE H
FLANGE E
D
(ANGLE GEARBOX)
L−A0664 (0000)
PW V

High Pressure Compressor (HPC)
Figure 805 (Sheet 1)
(Task 72−35−00−990−006)


782
952
784
HPC
NO. 2 BEARING

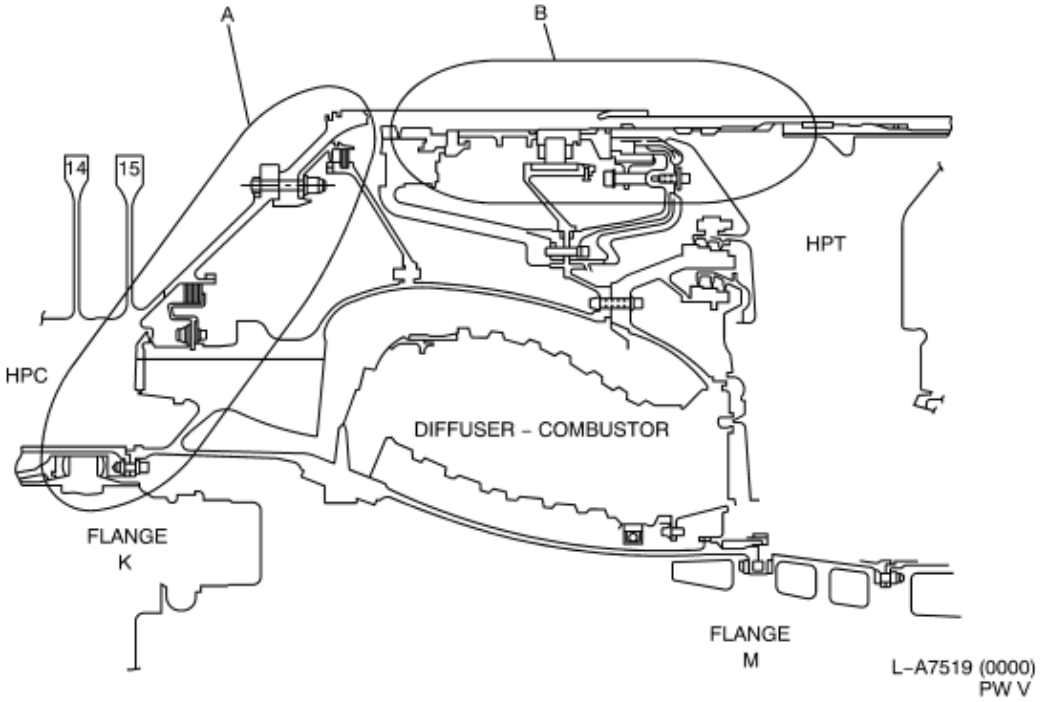
VIEW C



VIEW D

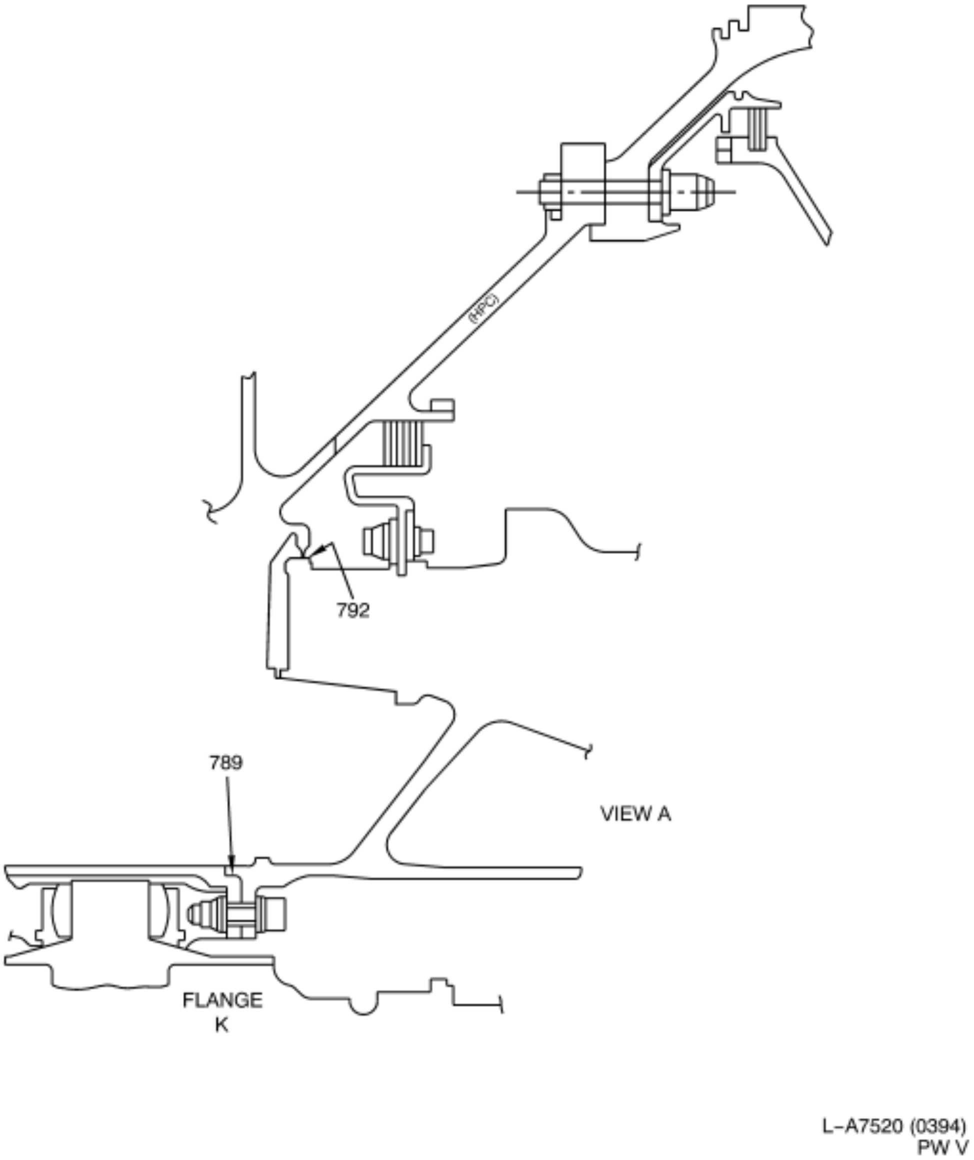
L−A0590

High Pressure Compressor (HPC)
Figure 805 (Sheet 2)
(Task 72−35−00−990−006)

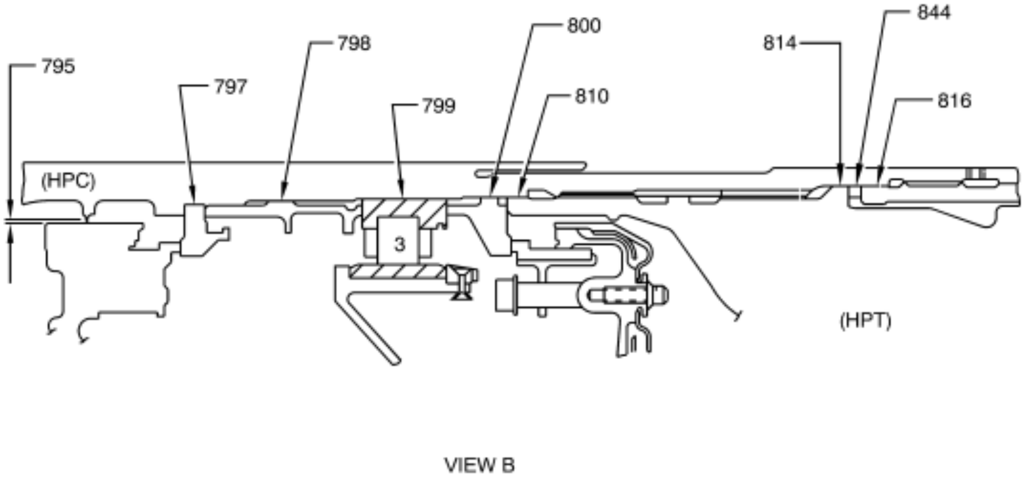

A
B
14
15
HPC
HPT
DIFFUSER − COMBUSTOR
FLANGE
K
FLANGE
M
L−A7519 (0000)
PW V

High Pressure Compressor (HPC)
Figure 806 (Sheet 1)
(Task 72−35−00−990−006)

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04

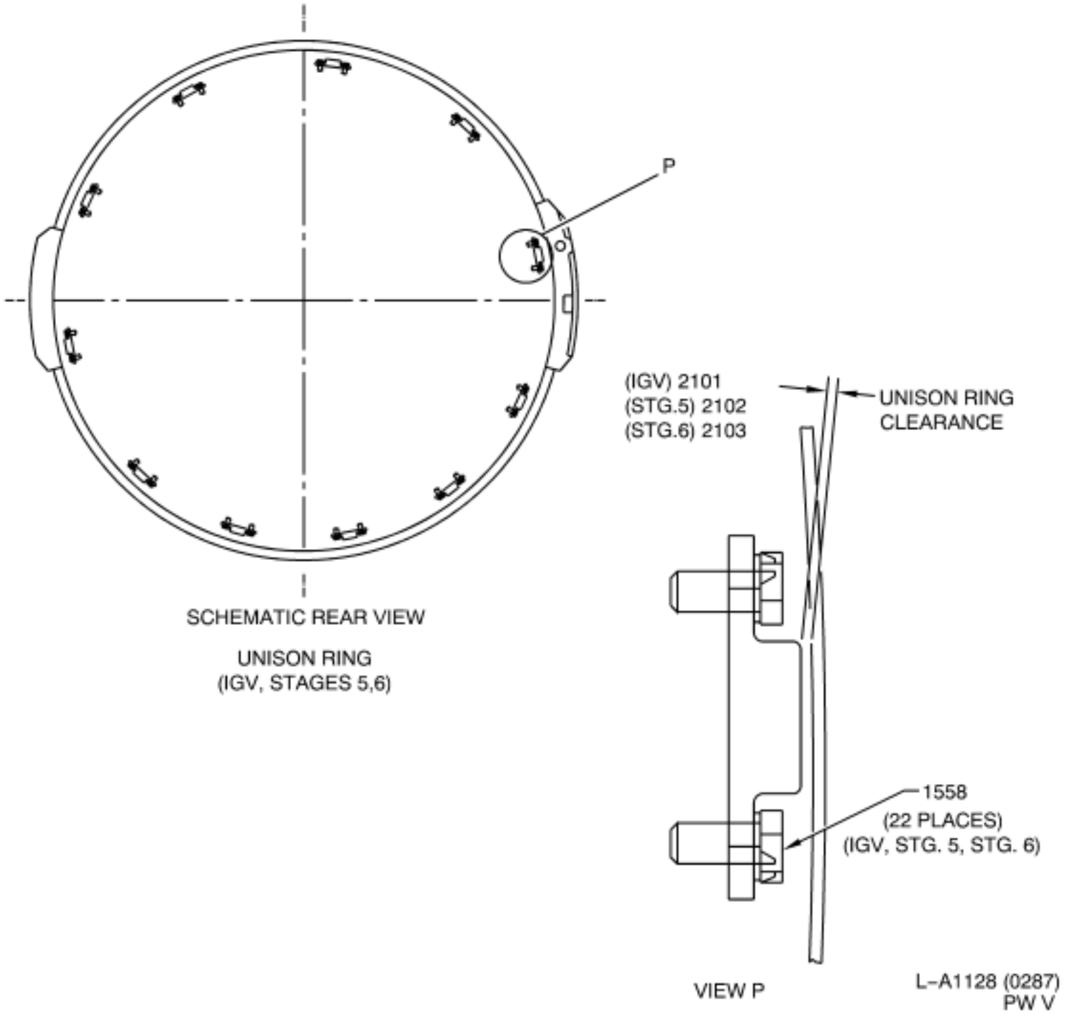

(HPC)
792
789
VIEW A
FLANGE K
L−A7520 (0394)
PW V

High Pressure Compressor (HPC)
Figure 806 (Sheet 2)
(Task 72−35−00−990−006)


795
797
798
799
800
810
814
844
816
(HPC)
3
(HPT)
VIEW B

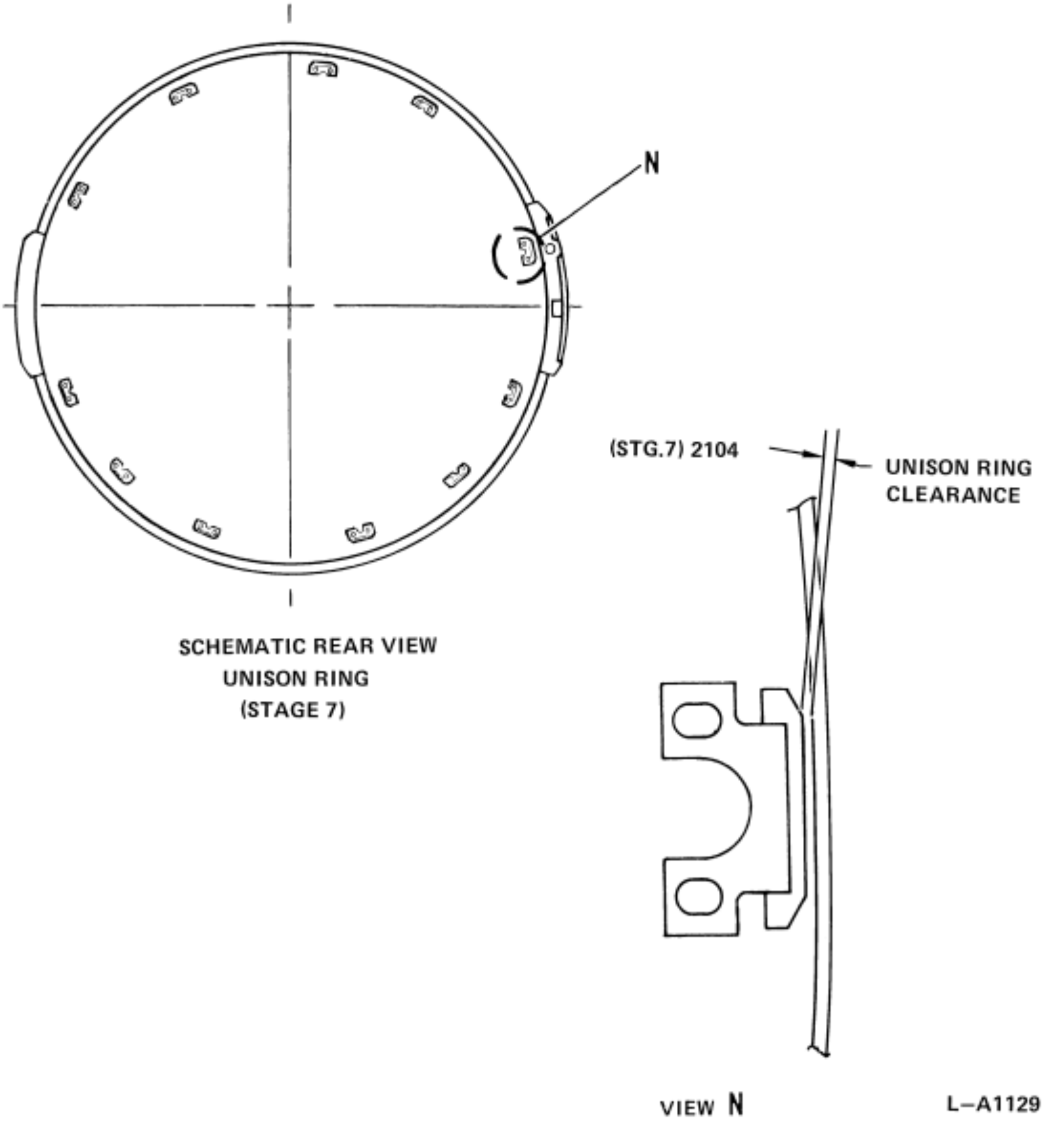
L−A0658 (0599)
PW V

High Pressure Compressor (HPC)
Figure 806 (Sheet 3)
(Task 72−35−00−990−006)


P
SCHEMATIC REAR VIEW
UNISON RING
(IGV, STAGES 5,6)
(IGV) 2101
(STG.5) 2102
(STG.6) 2103
UNISON RING
CLEARANCE
1558
(22 PLACES)
(IGV, STG. 5, STG. 6)
VIEW P
L-A1128 (0287)
PW V

High Pressure Compressor (HPC)
Figure 807 (Sheet 1)
(Task 72-35-00-990-006)

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04


N
SCHEMATIC REAR VIEW
UNISON RING
(STAGE 7)
(STG.7) 2104
UNISON RING
CLEARANCE
VIEW N
L−A1129

High Pressure Compressor (HPC)
Figure 807 (Sheet 2)
(Task 72−35−00−990−006)

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04

Task 72−35−00−990−011:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B, C, or D located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.
D	This fit or clearance involves a component for which it is considered necessary to replace the used part with a new part at the time of overhaul in order to restore a wear or sealing surface. It is not required to dimensionally examine this fit if all of the conditions that follow are met: − The used wear, or sealing component has been replaced with a new part. − The mating part(s) have been visually and dimensionally examined as necessary by the applicable PW4000 series CIR, PN 51A375 section(s) for the part(s), and meet the permitted wear, and dimensional requirements on the surface(s) involved in the fit or clearance.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131)	(−)	0.512 (13.005)	=	.005 (0.126)
0.527 (13.385)	(−)	0.508 (12.903)	=	.019 (0.482)

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
(CONTINUED)						

less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances
The following General NOTES are applicable to two or more fits and Clearances reference numbers. The applicable reference numbers are included in the NOTES.

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04

NOTE: General NOTE 1: For Reference Nos. 1278 through 1291, you can measure the knife−edge diameter of the fit and not measure the HPC shroud segments (honeycomb) airseal diameters if all of the following conditions are met in the PW4000 Series CIR, PN 51A357.

The measured knife−edge diameter is within the CIR manual Inspection/Check−04 serviceable limits.

Honeycomb trenching (if present) is within the CIR manual Inspection/Check−03 and Inspection/Check−04 serviceable limits.

The 8th through 14th stage inner case diameter components of the fit Reference Nos. 6379, 6380, 6400 through 6410, 6414, 6415 and 6417 are within the CIR manual Inspection/Check−04 serviceable limits.

All vane to the inner case, vane to outer airseal, and vane to the inner airseal contact surface wear (if present) is within the CIR Manual Inspection/Check−03 and Inspection/Check−04 serviceable limits.

You must install new HPC shroud (damper) springs.

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
580	C	Plain Self−Aligning Bearing (72−35−79) Compressor Stator Cylinder Support Assembly (72−35−73) (See Figure 803, Sheet 9)				
		Bearing	2.6765 (67.9831)	2.6770 (67.9958)		
		Support	2.6774 (68.0060)	2.6784 (68.0310)	.0004 (0.011)	.0019 (0.048)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
581	C	HPC Lever Set (72-35-74) Cylindrical Roller Bearing (72-35-79) (See Figure 803, Sheet 9)				
		Lever	1.7722 (45.0139)	1.7727 (45.0265)		
		Bearing	1.7712 (44.9885)	1.7717 (45.0011)	.0015T (0.038T)	.0005T (0.013T)
582	C	Bolt Stage 6 Rod End Bearing (72-35-78) (See Figure 803, Sheet 5)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Bearing	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
583	C	Bolt Stage 6 Synchronizing Ring Assembly (72-35-53) (See Figure 803, Sheet 5)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Ring	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
584	C	Bolt Inlet HPC Lever (72-35-74) (See Figure 803, Sheet 2)				
		Bolt	.3380 (8.5852)	.3382 (8.5902)		
		Lever	.3374 (8.5700)	.3380 (8.5852)	.0008T (0.0203T)	.0000 (0.0000)
585	C	Bolt HPC Lever Set (72-35-74) (See Figure 803, Sheet 2)				
		Bolt	.3380 (8.5852)	.3382 (8.5902)		
		Lever	.3374 (8.5700)	.3380 (8.5852)	.0008T (0.0203T)	.000 (0.000)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	 Max	 Limits Min	 Max
586	C	HPC Lever Set (72−35−74) Inlet HPC Lever (72−35−74) (See Figure 803, Sheet 2)				
		Lever Set	1.7722 (45.0139)	1.7727 (45.0265)		
		Inlet Lever	1.7727 (45.027)	1.7737 (45.051)	.000 (0.000)	.0015 (0.038)
587	C	Inlet HPC Lever (72−35−74) Bearing (72−35−79) (See Figure 803, Sheet 2)				
		Lever Set	1.7722 (45.0139)	1.7727 (45.0265)		
		Bearing	1.7712 (44.9885)	1.7717 (45.0011)	.0015T (0.038T)	.0005T (0.013T)
588	B	Bearing (72−35−79) Compressor Stator Lever Support (72−35−73) (See Figure 803, Sheet 2)				
		Bearing	2.6757 (67.963)	2.6772 (68.000)		
		Support	2.6774 (68.0060)	2.6789 (68.044)	.0002 (0.006)	.0032 (0.081)
589	C	Bolt HPC Synchronizing Ring Clevis Assembly (72−35−55) (See Figure 803, Sheet 5)				
		Bolt	.4345 (11.037)	.4355 (11.061)		
		Ring	.437 (11.100)	.438 (11.125)	.0015 (0.039)	.0035 (0.088)
590	C	Shoulder Bolt Compressor Stator Cylinder Support Assembly (72−35−73) (See Figure 803, Sheet 10)				
		Bolt	.3595 (9.132)	.3605 (9.156)		
		Support	.3615 (9.183)	.3635 (9.232)	.001 (0.025)	.0105* (0.267)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
591	B	Shoulder Bolt HPC Front Case Assembly (72-35-40) (See Figure 803, Sheet 10)				
		Bolt	.3595 (9.132)	.3605 (9.156)		
		Case	.3750 (9.5250)	.3765 (9.563)	.0145 (0.368)	.017 (0.432)
592	C	Bolt Cylinder Stop (See Figure 803, Sheet 9)				
		Bolt	.216 (5.487)	.217 (5.511)		
		Stop	.218 (5.538)	.220 (5.588)	.001 (0.026)	.004 (0.101)
593	B	Bearing (72-35-79) Compressor Stator Cylinder Support (72-35-73) (See Figure 803, Sheet 9)				
		Bearing	1.4360 (36.475)	1.4375 (36.512)		
		Support	1.438 (36.526)	1.440 (36.576)	.0005 (0.013)	.004 (0.101)
599	C	Compressor Cylinder (CMM) Bearing (72-35-79) (See Figure 803, Sheet 9)				
		Cylinder	.7487 (19.0170)	.7490 (19.0246)		
		Bearing	.7495 (19.0373)	.7500 (19.0500)	.0005 (0.0127)	.0013 (0.0330)
600	C	Bolt HPC Lever Set (72-35-74) (See Figure 803, Sheet 10)				
		Bolt	.497 (12.624)	.498 (12.649)		
		Lever	.4995 (12.688)	.5005 (12.712)	.0015 (0.039)	.0035 (0.088)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
601	C	Bolt HPC Lever Set (72−35−74) (See Figure 803, Sheet 10)				
		Bolt	.3739 (9.4971)	.3744 (9.5097)		
		Lever	.3745 (9.513)	.3755 (9.537)	.0001 (0.003)	.0016 (0.040)
602	C	Bolt Rod End Bearing Assembly (72−35−78) (See Figure 803, Sheet 10)				
		Bolt	.3739 (9.4971)	.3744 (9.5097)		
		Bearing	.3745 (9.5123)	.3750 (9.5250)	.0001 (0.103)	.0011 (0.027)
603	C	Bearing (72−35−78) Rod End (72−35−78) (See Figure 803, Sheet 10)				
		Bearing	.8120 (20.6248)	.8125 (20.6375)		
		Rod	.8123 (20.6325)	.8128 (20.6451)	.0002T (0.0051T)	.0008 (0.0203)
604	C	Bolt HPC Synchronizing Ring Clevis Assembly (72−35−55) (See Figure 803, Sheets 4 And 11)				
		Bolt	.4345 (11.037)	.4355 (11.061)		
		Ring	.437 (11.100)	.438 (11.125)	.0015 (0.039)	.0035 (0.088)
605	C	Bolt HPC Synchronizing Ring Clevis Assembly (72−35−55) (See Figure 803, Sheets 4 And 11)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Ring	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
606	C	Bolt Stage 5 And 7 Rod End Bearing (72−35−78) (See Figure 803, Sheets 4 And 11)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Bearing	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
607	A	Radial Clearance (See Figure 803, Sheets 3, 4, 5 And 11) Rod End Spherical Bearing (72−35−78)			.000	
609	C	Bolt HPC Clevis (72−35−76) (See Figure 803, Sheet 4)				
		Bolt	.4345 (11.037)	.4355 (11.061)		
		Clevis	.437 (11.100)	.438 (11.125)	.0015 (0.039)	.0035 (0.088)
610	C	Bolt Rod End Bearing (72−35−78) (See Figure 803, Sheet 4)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Bearing	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
611	C	Bolt HPC Clevis (72−35−76) (See Figure 803, Sheet 4)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Clevis	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
612	C	Bolt HPC Synchronizing Ring Clevis Assembly (72−35−55) (See Figure 803, Sheet 3)				
		Bolt	.4345 (11.037)	.4355 (11.061)		
		Ring	.437 (11.100)	.438 (11.125)	.0015 (0.039)	.0035 (0.088)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
613	C	Bolt Rod End Bearing (72-35-78) (See Figure 803, Sheet 3)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Bearing	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
614	C	Bolt HPC Synchronizing Ring Clevis Assembly (72-35-55) (See Figure 803, Sheet 3)				
		Bolt	.3109 (7.897)	.3119 (7.922)		
		Ring	.3120 (7.9248)	.3125 (7.9375)	.0001 (0.003)	.0016 (0.040)
616	C	Bolt Support Mounting Brace (See Figure 803, Sheet 8)				
		Bolt	.3685 (9.360)	.3695 (9.385)		
		Brace	.3745 (9.513)	.3755 (9.537)	.005 (0.127)	.007 (0.177)
617	B	Bolt HPC Front Case Assembly (72-35-40) (See Figure 803, Sheet 8)				
		Bolt	.3685 (9.360)	.3695 (9.385)		
		Case	.3750 (9.525)	.3765 (9.563)	.0055 (0.140)	.008 (0.203)
619	C	Pin (72-35-40) Compressor Stator Cylinder Support Bracket (See Figure 803, Sheet 7)				
		Pin	.3740 (9.4996)	.3741 (9.5021)		
		Bracket	.376 (9.551)	.377 (9.575)	.0019 (0.049)	.0030 (0.076)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
620	B	Gearbox Drive Shaft Housing Support Link Bearing (72-35-94) Gearbox Drive Shaft Housing Support Link (72-35-72) (See Figure 804, Sheet 2)				
		Bearing	.6865 (17.438)	.6875 (17.462)		
		Link	.6885 (17.488)	.6895 (17.513)	.001 (0.026)	.003 (0.076)
621	B	Gearbox Drive Shaft Housing Support Clevis - Shoulder Bolt Gearbox Drive Shaft Housing Support Link Bearing (72-35-94) (See Figure 804, Sheet 2)				
		Clevis	.3732 (9.4793)	.3737 (9.4919)		
		Bearing	.3742 (9.5047)	.3747 (9.5173)	.0005 (0.013)	.0015 (0.038)
622	B	Pin Oil Cooler Front Bracket Bearing (See Figure 804, Sheet 2)				
		Pin	.6245 (15.8623)	.6250 (15.8750)		
		Bearing	.6255 (15.888)	.6265 (15.913)	.0005 (0.013)	.002 (0.050)
623	C	Spacer (72-35-73) Compressor Stator Cylinder Support Assembly (PN 53H036-01) (72-35-73) (See Figure 803, Sheet 10)				
		Spacer	.497 (12.624)	.498 (12.649)		
		Support	.499 (12.675)	.501 (12.725)	.001 (0.026)	.004 (0.101)
782	B	HPC Front Hub (72-35-05) No. 2 Bearing Front Seal Seat (72-35-90) (See Figure 805, Sheet 2)				
		Hub	6.549 (166.345)	6.551 (166.395)		
		Seat	6.552 (166.421)	6.554 (166.471)	.001 (0.026)	.005 (0.127)

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Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
784	A	HPC Front Hub (72-35-05) Gearbox Drive Bevel Gear (72-34-12) (See Figure 805, Sheet 2)				
		Hub	7.305 (185.547)	7.306 (185.572)		
		Gear	7.301 (185.446)	7.302 (185.470)	.003T (0.077T)	.005T (0.127T)
785	B	Intermediate Case Assembly (72-34-01) HPC Front Case Assembly (72-35-40) (See Figure 805, Sheet 1)				
		Intd. Case	34.574 (878.180)	34.578 (878.281)		
		HPC Case	34.568 (878.028)	34.572 (878.128)	.002T (0.051T)	.010T (0.254T)
787	B	Shoulder Bolt (72-61-83) Gearbox Drive Shaft Housing Support Link Bearing (72-35-94) (See Figure 805, Sheet 2)				
		Bolt	.6232 (15.8293)	.6237 (15.8419)		
		Bearing	.6242 (15.8547)	.6247 (15.8673)	.0005 (0.013)	.0015 (0.038)
789	B	Diffuser Case Assembly (72-41-01) HPC (Outer) Rear Case Assembly (72-35-69) (See Figure 806, Sheet 2)				
		Diffuser Case	32.248 (819.100)	32.252 (819.200)		
		HPC Case	32.234 (818.744)	32.238 (818.845)	.018T (0.457T)	.010T (0.254T)
792	A	Drum Rotor (Rear) Disk Assembly (72-35-10) Compressor Exit Stator Assembly (72-41-02) (See Figure 806, Sheet 2)				
		Disk	23.409 (594.59)	23.421 (594.89)		
		Stator	23.441 (595.401)	23.447 (595.554)	.020 (0.51)	.048* (1.22)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
795	A	HPC Turbine Driveshaft (72-35-09)				
		No. 3 Bearing Front Cooling Duct Assembly (72-41-06)				
		(See Figure 806, Sheet 3)				
		Driveshaft	7.986	7.998		
			(202.84)	(203.15)		
		Duct	8.098	8.102	.100	.126*
			(205.690)	(205.790)	(2.54)	(3.20)*
797	B	HPC Turbine Driveshaft (72-35-09)				
		No. 3 Bearing Front Seal Seat (72-41-80)				
		(See Figure 806, Sheet 3)				
		Driveshaft	7.229	7.231		
			(183.617)	(183.667)		
		Seal Seat	7.232	7.234	.001	.005
			(183.693)	(183.743)	(0.026)	(0.127)
798	B	HPC Turbine Driveshaft (72-35-09)				
		No. 3 Bearing Seal Spacer (72-41-81)				
		(See Figure 806, Sheet 3)				
		Driveshaft	7.209	7.211		
			(183.109)	(183.159)		
		Spacer	7.212	7.214	.001	.005
			(183.185)	(183.235)	(0.026)	(0.127)
799	A	HPC Turbine Driveshaft (72-35-09)				
(1)		No. 3 Roller Bearing (72-41-82)				
		(Pre SB PW4ENG 72-611)				
		(See Figure 806, Sheet 3)				
		Driveshaft	7.2076	7.2080		
			(183.0731)	(183.0832)		
		Bearing	7.2040	7.2047	.004T	.0029T
			(182.9816)	(182.9993)	(0.101T)	(0.074T)
799	A	HPC Turbine Driveshaft (72-35-09)				
(2)		No. 3 Roller Bearing (72-41-82)				
		(Post SB PW4ENG 72-611)				
		(See Figure 806, Sheet 3)				
		Driveshaft	7.2076	7.2080		
			(183.0731)	(183.0832)		
		Bearing	7.2060	7.2067	.002T	.0009T
			(183.0324)	(183.0501)	(0.051T)	(0.023T)

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Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
800	B	HPC Turbine Driveshaft (72-35-09) No. 3 Bearing Rear Seal Seat (72-41-84) (See Figure 806, Sheet 3)				
		Driveshaft	7.1455 (181.496)	7.1465 (181.521)		
		Seal Seat	7.1475 (181.547)	7.1505 (181.622)	.001 (0.026)	.005 (0.127)
810	B	HPC Turbine Driveshaft (72-35-09) Turbine Front Hub (Stage 1) (72-52-05) (See Figure 806, Sheet 3)				
		Driveshaft	7.1455 (181.496)	7.1465 (181.521)		
		HPT Hub	7.1335 (181.191)	7.1355 (181.241)	.010T (0.254T)	.013T (0.330T)
814	B	HPC Turbine Driveshaft (72-35-09) Turbine Intermediate Hub (Stage 2) (72-52-06) (See Figure 806, Sheet 3)				
		Driveshaft	6.5947 (167.506)	6.5957 (167.530)		
		HPT Hub	6.5827 (167.201)	6.5847 (167.251)	.007T* (0.178T)*	.013T (0.330T)
816	B	HPC Turbine Driveshaft (72-35-09) No. 3 Bearing (And HPT) Retaining Nut (72-52-80) (See Figure 806, Sheet 3)				
		Driveshaft	6.5947 (167.506)	6.5957 (167.530)		
		Nut	6.5967 (167.557)	6.5987 (167.606)	.001 (0.025)	.0052* (0.132)*
830	B	Spherical Bearing (72-35-94) Gearbox Drive Shaft Housing Support Link (72-35-72) (See Figure 805, Sheet 2)				
		Bearing	.9675 (24.575)	.9685 (24.599)		
		Link	.9695 (24.626)	.9705 (24.650)	.001 (0.025)	.003 (0.076)

Ref. No.	IFR	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
844	B	HPC Turbine Driveshaft (72-35-09) Turbine Shaft Spacer (72-52-83) (See Figure 806, Sheet 3)				
		Driveshaft	6.5947 (167.506)	6.5957 (167.530)		
		Spacer	6.5967 (167.557)	6.5987 (167.606)	.001 (0.026)	.0052* (0.132)*
1271 (1)	A	HPC Inlet Airseal (Rear Knife-Edge) (72-35-31) HPC Inlet, Shroud Segment Assembly (72-35-41) (See Figure 801, Sheet 15)				
		Airseal	19.943 (506.55)	19.957 (506.91)		
		Shroud	19.978 (507.44)	19.994 (507.85)	.021 (0.533)	.061* (1.549)*
1271 (2)	A	HPC Inlet Airseal (Rear Knife-Edge) (72-35-31) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (72-35-57) (See Figure 802, Sheet 15)				
		Airseal	19.943 (506.55)	19.957 (506.91)		
		Guide	19.976 (507.390)	19.984 (507.594)	.019 (0.483)	.051* (1.295)*
1272 (1)	A	Stage 5 HPC Disk (Front Knife-Edge) Airseal (72-35-06) Stage 5 HPC Shroud Segment Assembly (72-35-42) (See Figure 801, Sheet 15)				
		Airseal	20.273 (514.93)	20.287 (515.29)		
		Shroud	20.298 (515.57)	20.314 (515.98)	.011 (0.279)	.051* (1.295)*
1272 (2)	A	Stage 5 HPC Disk (Front Knife-Edge) Airseal (72-35-06) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (72-35-57) (See Figure 802, Sheet 15)				
		Airseal	20.273 (514.93)	20.287 (515.29)		
		Guide	20.306 (515.772)	20.314 (515.976)	.019 (0.483)	.051* (1.295)*

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Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1273 (1)	A	Stage 5 HPC Disk (Rear Knife-Edge) Airseal (72-35-06) Stage 5 HPC Shroud Segment Assembly (72-35-42) (See Figure 801, Sheet 15)				
		Airseal	20.173 (512.39)	20.187 (512.75)		
		Shroud	20.198 (513.03)	20.214 (513.44)	.011 (0.279)	.051* (1.295)*
1273 (2)	A	Stage 5 HPC Disk (Rear Knife-Edge) Airseal (72-35-06) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (72-35-57) (See Figure 802, Sheet 15)				
		Airseal	20.173 (512.39)	20.187 (512.75)		
		Guide	20.206 (513.232)	20.214 (513.436)	.019 (0.483)	.051* (1.295)*
1274 (1)	A	Drum Rotor (Stage 6 Front Knife-Edge) Airseal (72-35-07) Stage 6 HPC Shroud Segment Assembly (72-35-43) (See Figure 801, Sheet 15)				
		Airseal	20.584 (522.83)	20.598 (523.19)		
		Shroud	20.608 (523.44)	20.624 (523.85)	.010 (0.254)	.050* (1.270)*
1274 (2)	A	Drum Rotor (Stage 6 Front Knife-Edge) Airseal (72-35-07) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (72-35-57) (See Figure 802, Sheet 15)				
		Airseal	20.584 (522.83)	20.598 (523.19)		
		Guide	20.617 (523.672)	20.625 (523.875)	.019 (0.483)	.051* (1.295)*

Ref. No.	IFR	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1275 (1)	A	Drum Rotor (Stage 6 Rear Knife-Edge) Airseal (72-35-07) Stage 6 HPC Shroud Segment Assembly (72-35-43) (See Figure 801, Sheet 15)				
		Airseal	20.704 (525.88)	20.718 (526.24)		
		Shroud	20.728 (526.49)	20.744 (526.90)	.010 (0.254)	.050* (1.270)*
1275 (2)	A	Drum Rotor (Stage 6 Rear Knife-Edge) Airseal (72-35-07) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (72-35-57) (See Figure 802, Sheet 15)				
		Airseal	20.704 (525.88)	20.718 (526.24)		
		Guide	20.737 (526.720)	20.745 (526.923)	.019 (0.483)	.051* (1.295)*
1276 (1)	A	Drum Rotor (Stage 7 Front Knife-Edge) Airseal (72-35-07) Stage 7 HPC Shroud Segment Assembly (72-35-44) (See Figure 801, Sheet 15)				
		Airseal	21.132 (536.75)	21.146 (537.11)		
		Shroud	21.188 (538.18)	21.204 (538.58)	.042 (1.07)	.082* (2.083)*
1276 (2)	A	Drum Rotor (Stage 7 Front Knife-Edge) Airseal (72-35-07) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (72-35-57) (See Figure 802, Sheet 15)				
		Airseal	21.132 (536.75)	21.146 (537.11)		
		Guide	21.165 (537.591)	21.173 (537.794)	.019 (0.483)	.051* (1.295)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1277 (1)	A	Drum Rotor (Stage 7 Rear Knife−Edge) Airseal (72−35−07) Stage 7 HPC Shroud Segment Assembly (72−35−44) (See Figure 801, Sheet 15)				
		Airseal	21.252 (539.80)	21.266 (540.16)		
		Shroud	21.308 (541.22)	21.324 (541.63)	.042 (1.07)	.082* (2.083)*
1277 (2)	A	Drum Rotor (Stage 7 Rear Knife−Edge) Airseal (72−35−07) HPC Shroud Guide Assembly (Honeycomb Airseal, Inner Shroud) (72−35−57) (See Figure 802, Sheet 15)				
		Airseal	21.252 (539.80)	21.266 (540.16)		
		Guide	21.285 (540.639)	21.293 (540.842)	.019 (0.483)	.051* (1.295)*
1278	A	Drum Rotor (Stage 8 Front Knife−Edge) Airseal (72−35−07) Stage 8 HPC Shroud Segment Assembly (72−35−58) (See Figure 801, Sheet 15, And Figure 802, Sheet 15)				
		Airseal	22.124 (561.95)	22.138 (562.31)		
		Shroud	22.165 (562.99)	22.215 (564.26)	.027 (0.686)	.101* (2.565)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1279	A	Drum Rotor (Stage 8 Rear Knife−Edge) Airseal (72−35−07) Stage 8 HPC Shroud Segment Assembly (72−35−58) (See Figure 801, Sheet 15, And Figure 802, Sheet 15)				
		Airseal	22.224 (564.49)	22.238 (564.85)		
		Shroud	22.265 (565.53)	22.315 (566.80)	.027 (0.686)	.101* (2.565)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases,				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)						
		vane details, vane assemblies and inner shroud segments.				
1280	A	Drum Rotor (Stage 9 Front Knife-Edge) Airseal (72-35-07) Stage 9 Compressor Stator Segment Assembly (72-35-25) (See Figure 801, Sheet 15, And Figure 802, Sheet 15)				
		Airseal	22.938 (582.63)	22.952 (582.98)		
		Stator	22.957 (583.11)	22.991 (583.97)	.005 (0.127)	.063* (1.600)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1281	A	Drum Rotor (Stage 9 Rear Knife-Edge) Airseal (72-35-07) Stage 9 Compressor Stator Segment Assembly (72-35-25) (See Figure 801, Sheet 15, And Figure 802, Sheet 15)				
		Airseal	22.938 (582.63)	22.952 (582.98)		
		Stator	22.957 (583.11)	22.991 (583.97)	.005 (0.127)	.063* (1.600)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1282	A	Drum Rotor (Stage 10 Front Knife-Edge) Airseal (72-35-07) Stage 10 HPC Shroud Segment Assembly Assembly (72-35-58) (See Figure 801, Sheet 15, And Figure 802, Sheet 15)				
		Airseal	23.157 (588.19)	23.171 (588.54)		
		Shroud	23.188 (588.98)	23.236 (590.19)	.017 (0.432)	.089* (2.261)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				

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Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1283	A	Drum Rotor (Stage 10 Rear Knife-Edge) Airseal (72-35-07) Stage 10 HPC Shroud Segment Assembly (72-35-58) (See Figure 801, Sheet 15, And Figure 802, Sheet 15)				
		Airseal	23.257 (590.73)	23.271 (591.08)		
		Shroud	23.302 (591.87)	23.350 (593.09)	.031 (0.787)	.103* (2.616)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1284	A	Drum Rotor (Stage 11 Front Knife-Edge) Airseal (72-35-07) Stage 11 HPC Shroud Segment Assembly (72-35-58) (See Figure 801, Sheet 15, And Figure 802, Sheet 15)				
		Airseal	23.166 (588.42)	23.180 (588.77)		
		Shroud	23.198 (589.23)	23.246 (590.45)	.018 (0.457)	.090* (2.286)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1285	A	Drum Rotor (Stage 11 Rear Knife-Edge) Airseal (72-35-07) Stage 11 HPC Shroud Segment Assembly (72-35-58) (See Figure 801, Sheet 15, And Figure 802, Sheet 15)				
		Airseal	23.266 (590.96)	23.280 (591.31)		
		Shroud	23.298 (591.77)	23.346 (592.99)	.018 (0.457)	.090* (2.286)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1286	A	Drum Rotor (Stage 12 Front Knife-Edge) Airseal (72-35-08) Stage 12 HPC Shroud Segment Assembly (72-35-58) (See Figure 801, Sheet 15, And Figure 802, Sheet 15)				
		Airseal	23.167 (588.44)	23.181 (588.80)		
		Shroud	23.199 (589.25)	23.247 (590.47)	.018 (0.457)	.090* (2.286)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1287	A	Drum Rotor (Stage 12 Rear Knife-Edge) Airseal (72-35-08) Stage 12 HPC Shroud Segment Assembly (72-35-58) (See Figure 801, Sheet 15, And Figure 802, Sheet 15)				
		Airseal	23.267 (590.98)	23.281 (591.34)		
		Shroud	23.299 (591.79)	23.347 (593.01)	.018 (0.457)	.090* (2.286)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1288	A	Drum Rotor (Stage 13 Front Knife-Edge) Airseal (72-35-08) Stage 13 HPC Shroud Segment Assembly (72-35-58) (See Figure 801, Sheet 15, And Figure 802, Sheet 15)				
		Airseal	23.149 (587.98)	23.163 (588.34)		
		Shroud	23.191 (589.05)	23.239 (590.27)	.028 (0.711)	.100* (2.540)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1289	A	Drum Rotor (Stage 13 Rear Knife−Edge) Airseal (72−35−08) Stage 13 HPC Shroud Segment Assembly (72−35−58) (See Figure 801, Sheet 15, And Figure 802, Sheet 15)				
		Airseal	23.249 (590.52)	23.263 (590.88)		
		Shroud	23.291 (591.59)	23.339 (592.81)	.028 (0.711)	.100* (2.540)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1290	A	Drum Rotor (Stage 14 Front Knife−Edge) Airseal (72−35−08) Stage 14 HPC Shroud Segment Assembly (72−35−58) (See Figure 801, Sheet 15, And Figure 802, Sheet 15)				
		Airseal	23.138 (587.71)	23.152 (588.06)		
		Shroud	23.180 (588.77)	23.228 (589.99)	.028 (0.711)	.100* (2.540)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				
1291	A	Drum Rotor (Stage 14 Rear Knife−Edge) Airseal (72−35−08) Stage 14 HPC Shroud Segment Assembly (72−35−58) (See Figure 801, Sheet 15, And Figure 802, Sheet 15)				
		Airseal	23.238 (590.25)	23.252 (590.60)		
		Shroud	23.280 (591.31)	23.328 (592.53)	.028 (0.711)	.100* (2.540)*
		See General NOTE 1 before Reference Number 580. Fit calculations include tolerances from the inner cases, vane details, vane assemblies and inner shroud segments.				

Ref. No.	I F R	Description	Average Clearance At Assembly Min	Average Clearance At Assembly Max	Local Limits At Assembly Min	Local Limits At Assembly Max
1320	A	Stage 5 HPC Blade Tip Clearance (See Figure 801, Sheet 15, And Figure 802, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1321	A	Stage 6 HPC Blade Tip Clearance (See Figure 801, Sheet 15, And Figure 802, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1322	A	Stage 7 HPC Blade Tip Clearance (See Figure 801, Sheet 15, And Figure 802, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1323	A	Stage 8 HPC Blade Tip Clearance (See Figure 801, Sheet 15, And Figure 802, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1324	A	Stage 9 HPC Blade Tip Clearance (See Figure 801, Sheet 15, And Figure 802, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1325	A	Stage 10 HPC Blade Tip Clearance (See Figure 801, Sheet 15, And Figure 802, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1326	A	Stage 11 HPC Blade Tip Clearance (See Figure 801, Sheet 15, And Figure 802, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1327	A	Stage 12 HPC Blade Tip Clearance (See Figure 801, Sheet 15, And Figure 802, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				
1328	A	Stage 13 HPC Blade Tip Clearance (See Figure 801, Sheet 15, And Figure 802, Sheet 15) See 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012)				

Ref. No.	IFR	Description	Average Clearance At Assembly Min	Average Clearance At Assembly Max	Local Limits At Assembly Min	Local Limits At Assembly Max
1329	A	Stage 14 HPC Blade Tip Clearance (See Figure 801, Sheet 15, And Figure 802, Sheet 15) See 72-35-00, Inspection/Check-05, CONFIG-2 (Task 72-35-00-990-012)				
1330	A	Stage 15 HPC Blade Tip Clearance (See Figure 801, Sheet 15, And Figure 802, Sheet 15) See 72-35-00, Inspection/Check-05, CONFIG-2 (Task 72-35-00-990-012)				

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1350 (1)	D	HPC Shroud Front Segment Assembly (72-35-41) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) (See Figure 801, Sheet 3, And Figure 802, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.250 (6.350)	.252 (6.400)	.0015 (0.038)	.005 (0.127)
1350 (2)	D	HPC Shroud Front Segment Assembly (72-35-41) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) (See Figure 801, Sheet 3, And Figure 802, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.251 (6.376)	.253 (6.426)	.0025 (0.064)	.006 (0.152)
1351 (1)	D	Stage 5 HPC Shroud (Front) Segment Assembly (72-35-42) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) (See Figure 801, Sheet 3, And Figure 802, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.250 (6.350)	.252 (6.400)	.0015 (0.038)	.005 (0.127)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1351 (2)	D	Stage 5 HPC Shroud (Front) Segment Assembly (72-35-42) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) (See Figure 801, Sheet 3, And Figure 802, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.251 (6.376)	.253 (6.426)	.0025 (0.064)	.006 (0.152)
1352 (1)	D	Stage 6 HPC Shroud (Front) Segment Assembly (72-35-43) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) (See Figure 801, Sheet 3, And Figure 802, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.250 (6.350)	.252 (6.400)	.0015 (0.038)	.005 (0.127)
1352 (2)	D	Stage 6 HPC Shroud (Front) Segment Assembly (72-35-43) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) (See Figure 801, Sheet 3, And Figure 802, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.251 (6.376)	.253 (6.426)	.0025 (0.064)	.006 (0.152)
1353 (1)	D	Stage 7 HPC Shroud (Front) Segment Assembly (72-35-44) Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) (See Figure 801, Sheet 3, And Figure 802, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.250 (6.350)	.252 (6.400)	.0015 (0.038)	.005 (0.127)
1353 (2)	D	Stage 7 HPC Shroud (Front) Segment Assembly (72-35-44) Vane Inner Trunnion Sleeve Bearing (72-35-45) (See Figure 801, Sheet 3, And Figure 802, Sheet 3)				
		Vane	.2470 (6.274)	.2485 (6.311)		
		Bearing	.251 (6.376)	.253 (6.426)	.0025 (0.064)	.006 (0.152)

	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
1354 (1)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) HPC Inlet Shroud (Rear) Segment Assembly (72-35-41) (PN 51H470-01, Change Letter D and subsequent) (See Figure 801, Sheet 3, And Figure 802, Sheet 3)				
		Bearing	.480 (12.192)	.484 (12.293)		
		Segment	.490 (12.446)	.496 (12.598)	.006 (0.15)	.016 (0.41)
1354 (2)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) HPC Inlet Shroud (Rear) Segment Assembly (72-35-41) (PN 51H470-01, Change Letter D And Subsequent) (See Figure 801, Sheet 3, And Figure 802, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.490 (12.446)	.496 (12.598)	.004 (0.102)	.014 (0.356)
1355 (1)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) Stage 5 HPC Shroud (Rear) Segment Assembly (72-35-42) (PN 51H385-01, Change Letter F and subsequent) (See Figure 801, Sheet 3, And Figure 802, Sheet 3)				
		Bearing	.480 (12.192)	.484 (12.293)		
		Segment	.491 (12.472)	.496 (12.598)	.007 (0.178)	.016 (0.406)
1355 (2)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) Stage 5 HPC Shroud (Rear) Segment Assembly (72-35-42) (PN 51H385-01, Change Letter F and subsequent) (See Figure 801, Sheet 3, And Figure 802, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.496 (12.598)	.005 (0.127)	.014 (0.356)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1356 (1)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) Stage 6 HPC Shroud (Rear) Segment Assembly (72-35-43) (PN 51H586-01, Change Letter E and subsequent) (See Figure 801, Sheet 3, And Figure 802, Sheet 3)				
		Bearing	.480 (12.192)	.484 (12.293)		
		Segment	.491 (12.472)	.496 (12.598)	.007 (0.178)	.016) (0.406
1356 (2)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) Stage 6 HPC Shroud (Rear) Segment Assembly (72-35-43) (PN 51H586-01, Change Letter E And Subsequent) (See Figure 801, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.496 (12.598)	.005 (0.127)	.014 (0.356)
1357 (1)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Pre SB PW4ENG 72-776) Stage 7 HPC Shroud (Rear) Segment Assembly (72-35-44) (PN 51H387-01, Change Letter E and subsequent) (See Figure 801, Sheet 3, And Figure 802, Sheet 3)				
		Bearing	.480 (12.192)	.484 (12.293)		
		Segment	.491 (12.472)	.496 (12.598)	.007 (0.178)	.016 (0.406)
1357 (2)	D	Vane Inner Trunnion Sleeve Bearing (72-35-45) (Post SB PW4ENG 72-776) Stage 7 HPC Shroud (Rear) Segment Assembly (72-35-44) (PN 51H387-01, Change Letter E And Subsequent) (See Figure 801, Sheet 3, And Figure 802, Sheet 3)				
		Bearing	.482 (12.243)	.486 (12.344)		
		Segment	.491 (12.472)	.496 (12.598)	.005 (0.127)	.014 (0.356)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1358	B	HPC Inlet Shroud (Rear) Segment Assembly (72-35-41) HPC Inlet Shroud (Front) Segment Assembly (72-35-41) (See Figure 801, Sheet 3)				
		Rear Segment	20.438 (519.126)	20.442 (519.226)		
		Front Segment	20.444 (519.278)	20.448 (519.379)	.002 (0.051)	.010 (0.254)
1359	B	Stage 5 HPC Shroud (Rear) Segment Assembly (72-35-42) Stage 5 HPC Shroud (Front) Segment Assembly (72-35-42) (See Figure 801, Sheet 3)				
		Rear Segment	20.798 (528.270)	20.802 (528.370)		
		Front Segment	20.804 (528.422)	20.808 (528.523)	.002 (0.051)	.010 (0.254)
1360	B	Stage 6 HPC Shroud (Rear) Segment Assembly (72-35-43) Stage 6 HPC Shroud (Front) Segment Assembly (72-35-43) (See Figure 801, Sheet 3)				
		Rear Segment	21.268 (540.208)	21.272 (540.308)		
		Front Segment	21.274 (540.360)	21.278 (540.461)	.002 (0.051)	.010 (0.254)
1361	B	Stage 7 HPC Shroud (Rear) Segment Assembly (72-35-44) (PN 51H387-01 Shroud Set) Stage 7 HPC Shroud (Front) Segment Assembly (72-35-44) (PN 51H387-01 Shroud Set) (See Figure 801, Sheet 3)				
		Rear Segment	21.694 (551.028)	21.698 (551.129)		
		Front Segment	21.700 (551.180)	21.704 (551.281)	.002 (0.051)	.010 (0.254)
1375	B	Drum Rotor (Stages 6 Through 12) Disk Assembly (72-35-07) Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) (See Figure 801, Sheet 10, And Figure 802, Sheet 10)				
		Disk	21.657 (550.088)	21.661 (550.189)		
		Hub	21.662 (550.215)	21.666 (550.316)	.009T (0.229T)	.000T* (.000T)*

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1376	B	Stage 5 HPC Disk (72-35-06) Drum Rotor (Stages 6 Through 12) Disk Assembly (72-35-07) (See Figure 801, Sheet 2 And, Figure 802, Sheet 2)				
		Disk (Stg. 5)	19.525 (495.935)	19.527 (495.985)		
		Disk (Stgs. 6 - 12)	19.518 (495.758)	19.522 (495.858)	.009T (0.229T)	.003T (0.076T)
1377	B	Drum Rotor (Stages 6 Through 12) Disk Assembly (72-35-07) HPC Front Hub (72-35-05) (See Figure 801, Sheet 2 And, Figure 802, Sheet 2)				
		Disk	16.097 (408.864)	16.101 (408.965)		
		Hub	16.094 (408.788)	16.096 (408.838)	.007T (0.178T)	.001T (0.025T)
1388	B	HPC Drum Rotor (Stages 13, 14 And 15) Disk Assembly (72-35-10) HPC Drive Turbine Shaft (72-35-09) (See Figure 801, Sheet 13 And Figure 802, Sheet 13)				
		Disk Assembly	12.999 (330.175)	13.001 (330.225)		
		Shaft	12.987 (329.870)	12.989 (329.920)	.010T (0.254T)	.014T (0.356T)
1389	B	Diffuser Airseal (72-35-32) HPC Drive Turbine Shaft (72-35-09) (See Figure 801, Sheet 13 And Figure 802, Sheet 13)				
		Airseal	12.991 (329.972)	12.995 (330.073)		
		Shaft	12.987 (329.870)	12.989 (329.920)	.002T (0.051T)	.008T (0.203T)
1390 (1)	B	No. 3 Bearing (Inner Rear Hub) Heat Shield (72-35-36) (Pre SB PW4ENG 72-562) HPC Turbine Driveshaft (72-35-09) (Pre SB PW4ENG 72-562) (See Figure 801, Sheet 13)				
		Heat Shield	6.223 (158.065)	6.225 (158.115)		
		Driveshaft	6.219 (157.963)	6.221 (158.013)	.009T* (0.229T)*	.000* (0.000)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1390 (2)	B	No. 3 Bearing (Inner Rear Hub) Heat Shield (72-35-36) (Post SB PW4ENG 72-562) HPC Turbine Driveshaft (72-35-09) (Post SB PW4ENG 72-562) (See Figure 801, Sheet 13 And Figure 802, Sheet 13)				
		Heat Shield	6.484 (164.694)	6.486 (164.744)		
		Driveshaft	6.480 (164.592)	6.482 (164.643)	.009T* (0.229T)*	.000* (0.000)*
1391 (1)	B	No. 3 Bearing (Inner Rear Hub) Heat Shield (72-35-36) (Pre SB PW4ENG 72-562) HPC Turbine Driveshaft (72-35-09) (Pre SB PW4ENG 72-562) (See Figure 801, Sheet 13)				
		Heat Shield (Average Diameter)	6.176 (156.871)	6.180 (156.972)		
		Driveshaft	6.159 (156.439)	6.161 (156.489)	.031T* (0.787T)*	.013T* (.330T)*
1391 (2)	B	No. 3 Bearing (Inner Rear Hub) Heat Shield (72-35-36) (Post SB PW4ENG 72-562) HPC Turbine Driveshaft (72-35-09) (Post SB PW4ENG 72-562) (See Figure 801, Sheet 13 And Figure 802, Sheet 13)				
		Heat Shield (Average Diameter)	6.444 (163.678)	6.448 (163.779)		
		Driveshaft	6.427 (163.246)	6.429 (163.296)	.031T* (0.787T)*	.010T* (.254T)*
1397	B	Pin - Shoulder Headless (72-35-41/42/43/44) (PN 51H134) HPC Inlet/Stage 5/Stage 6/Stage 7 - Shroud (Rear) Segment Assembly (PN 51H470-01/51H385-01/51H586-01/51H387-01 Shroud Sets) (72-35-41/42/43/44) (See Figure 801, Sheet 4)				
		Pin	0.1870 (4.7498)	0.1871 (4.7523)		
		Shroud (Rear)	0.186 (4.725)	0.187 (4.749)	.0011T (0.028T)	.0000 (0.000)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1398	B	Pin - Shoulder Headless (72-35-41/42/43/44) (PN 51H134) HPC Inlet/Stage 5/Stage 6/Stage 7 - Shroud (Front) Segment Assembly (PN 51H470-01/51H385-01/51H586-01/51H387-01 Shroud Sets) (72-35-41/42/43/44) (See Figure 801, Sheet 4)				
		Pin	0.1870 (4.7498)	0.1871 (4.7523)		
		Shroud (Forward)	0.1885 (4.788)	0.1895 (4.813)	.0014 (0.036)	.0025 (0.064)
1416	B	Bushing HPC Front Case Assy (72-35-40) See 72-35-40, Repair-05 (Task 72-35-40-300-005) (See Figure 801, Sheet 6)				
		NOTE: Select fit of			.0005 (0.013)	.0015T (0.038T)
6378	A	HPC (Outer) Rear Case Assembly (72-35-69) HPC Rear Support (72-35-67) (See Figure 801, Sheet 14 And Figure 802, Sheet 14)				
		Rear Case	30.096 (764.438)	30.098 (764.489)		
		Support	30.074 (763.880)	30.078 (763.981)	.018T (0.457T)	.024T (0.610T)
6379	A	Stage 15 Compressor Air Seal (72-35-23) HPC Rear Support (72-35-67) (See Figure 801, Sheet 14 And Figure 802, Sheet 14)				
		Air Seal	27.709 (703.809)	27.713 (703.910)		
		Support	27.686 (703.225)	27.690 (703.326)	.019T (0.483T)	.027T (0.686T)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
6380	A	Stage 15 Compressor Air Seal (72-35-23) Stage 14 Compressor Case Assembly (72-35-89) (See Figure 801, Sheet 14 And Figure 802, Sheet 14)				
		Air Seal	27.775 (705.485)	27.779 (705.586)		
		Case	27.753 (704.927)	27.757 (705.027)	.018T (0.457T)	.026T (0.660T)
6381	A	Stage 8 Compressor Air Seal (72-35-23) HPC (Outer) Rear Case Assembly (72-35-69) (See Figure 801, Sheet 8, And Figure 802, Sheet 8)				
		Air Seal	31.990 (812.546)	31.994 (812.647)		
		Case	31.968 (811.988)	31.972 (812.088)	.018T (0.457T)	.026T (0.660T)
6382	A	Stage 8 Compressor Air Seal (72-35-23) HPC Front Case (72-35-40) (See Figure 801, Sheet 8, And Figure 802, Sheet 8)				
		Air Seal	31.986 (812.445)	31.990 (812.546)		
		Case	31.968 (811.988)	31.972 (812.088)	.014T (0.356T)	.022T (0.559T)
6400	A	Stage 8 Compressor Air Seal (72-35-23) Stage 8 Compressor Case Assembly (72-35-83) (See Figure 801, Sheet 8, And Figure 802, Sheet 8)				
		Air Seal	29.694 (754.228)	29.698 (754.329)		
		Case	29.684 (753.974)	29.688 (754.075)	.006T (0.152T)	.014T (0.356T)
6401	A	Stage 9 Compressor Air Seal (72-35-23) Stage 8 Compressor Case Assembly (72-35-83) (See Figure 801, Sheet 8, And Figure 802, Sheet 8)				
		Air Seal	29.419 (747.243)	29.423 (747.344)		
		Case	29.401 (746.786)	29.405 (746.887)	.014T (0.356T)	.022T (0.559T)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
6402	A	Stage 9 Compressor Air Seal (72−35−23) Stage 8 Compressor Case Assembly (72−35−83) (See Figure 801, Sheet 8, And Figure 802, Sheet 8)				
		Air Seal	29.471 (748.564)	29.475 (748.665)		
		Case	29.451 (748.056)	29.455 (748.157)	.016T (0.406T)	.024T (0.610T)
6403	A	Stage 9 Compressor Air Seal (72−35−23) Stage 9 Compressor Case Assembly (72−35−84) (See Figure 801, Sheet 8, And Figure 802, Sheet 8)				
		Air Seal	29.257 (743.128)	29.261 (743.229)		
		Case	29.239 (742.671)	29.243 (742.772)	.014T (0.356T)	.022T (0.559T)
6404	A	Stage 10 Compressor Air Seal (72−35−23) Stage 9 Compressor Case Assembly (72−35−84) (See Figure 801, Sheet 11, And Figure 802, Sheet 11)				
		Air Seal	29.002 (736.651)	29.006 (736.752)		
		Case	28.978 (736.042)	28.982 (736.142)	.020T (0.508T)	.028T (0.711T)
6405	A	Stage 10 Compressor Air Seal (72−35−23) Stage 10 Compressor Case Assembly (72−35−85) (See Figure 801, Sheet 11, And Figure 802, Sheet 11)				
		Air Seal	28.870 (733.298)	28.874 (733.399)		
		Case	28.846 (732.689)	28.850 (732.790)	.020T (0.508T)	.028T (0.711T)
6406	A	Stage 11 Compressor Air Seal (72−35−23) Stage 10 Compressor Case Assembly (72−35−85) (See Figure 801, Sheet 11, And Figure 802, Sheet 11)				
		Air Seal	28.643 (727.533)	28.647 (727.633)		
		Case	28.619 (726.923)	28.623 (727.024)	.020T (0.508T)	.028T (0.711T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
6407	A	Stage 11 Compressor Air Seal (72-35-23) Stage 11 Compressor Case Assembly (72-35-86) (See Figure 801, Sheet 11, And Figure 802, Sheet 11)				
		Air Seal	28.504 (724.002)	28.508 (724.103)		
		Case	28.494 (723.748)	28.498 (723.849)	.006T (0.152T)	.014T (0.356T)
6408	A	Stage 12 Compressor Air Seal (72-35-23) Stage 11 Compressor Case Assembly (72-35-86) (See Figure 801, Sheet 11, And Figure 802, Sheet 11)				
		Air Seal	28.329 (719.557)	28.333 (719.658)		
		Case	28.311 (719.100)	28.315 (719.201)	.014T (0.356T)	.022T (0.559T)
6409	A	Stage 12 Compressor Air Seal (72-35-23) Stage 12 Compressor Case Assembly (72-35-87) (See Figure 801, Sheet 11, And Figure 802, Sheet 11)				
		Air Seal	28.194 (716.128)	28.198 (716.229)		
		Case	28.172 (715.569)	28.176 (715.670)	.018T (0.457T)	.026T (0.660T)
6410	A	Stage 13 Compressor Air Seal (72-35-23) Stage 12 Compressor Case Assembly (72-35-87) (See Figure 801, Sheet 11, And Figure 802, Sheet 11)				
		Air Seal	27.962 (710.235)	27.966 (710.336)		
		Case	27.940 (709.676)	27.944 (709.777)	.018T (0.457T)	.026T (0.660T)
6414	A	Stage 13 Compressor Air Seal (72-35-23) Stage 13 Compressor Case Assembly (72-35-88) (See Figure 801, Sheet 11, And Figure 802, Sheet 11)				
		Air Seal	27.877 (708.076)	27.881 (708.177)		
		Case	27.855 (707.517)	27.859 (707.618)	.018T (0.457T)	.026T (0.660T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
6415	A	Stage 14 Compressor Air Seal (72−35−23) Stage 13 Compressor Case Assembly (72−35−88) (See Figure 801, Sheet 11, And Figure 802, Sheet 11)				
		Air Seal	27.850 (707.390)	27.854 (707.491)		
		Case	27.828 (706.832)	27.832 (706.932)	.018T (0.457T)	.026T (0.660T)
6417	A	Stage 14 Compressor Air Seal (72−35−23) Stage 14 Compressor Case Assembly (72−35−89) (See Figure 801, Sheet 11, And Figure 802, Sheet 11)				
		Air Seal	27.802 (706.171)	27.806 (706.272)		
		Case	27.780 (705.612)	27.784 (705.713)	.018T (0.457T)	.026T (0.660T)

G. Hub, Disk, Shaft, Airseal Limits

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1420	A	HPC Front Hub See 5−10−00, Time Limits (See Figure 801, Sheet 2 And, Figure 802, Sheet 2)				
1421	A	Stage 5 HPC Disk See 5−10−00, Time Limits (See Figure 801, Sheet 2 And, Figure 802, Sheet 2)				
1422	A	Stage 6 HPC Disk See 5−10−00, Time Limits (See Figure 801, Sheet 2 And, Figure 802, Sheet 2)				
1423	A	Stage 7 HPC Disk See 5−10−00, Time Limits (See Figure 801, Sheet 2 And, Figure 802, Sheet 2)				
1424	A	Stage 8 HPC Disk See 5−10−00, Time Limits (See Figure 801, Sheet 7 And Figure 802, Sheet 7)				

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1425	A	Stage 9 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 7 And Figure 802, Sheet 7)				
1426	A	Stage 10 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 7, And Figure 802, Sheet 7)				
1427	A	Stage 11 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 10, And Figure 802, Sheet 10)				
1428	A	Stage 12 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 10, And Figure 802, Sheet 10)				
1429	A	Stage 13 HPC Disk See 5-10-00, Time Limits (See (See Figure 801, Sheet 10, And Figure 802, Sheet 10)				
1430	A	Stage 14 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 13 And Figure 802, Sheet 13)				
1431	A	Stage 15 HPC Disk See 5-10-00, Time Limits (See Figure 801, Sheet 13 And Figure 802, Sheet 13)				
1432	A	HPC Drive-Turbine Shaft See 5-10-00, Time Limits (See Figure 801, Sheet 13 And Figure 802, Sheet 13)				
1433	A	Drum Rotor (Stages 6 Through 12) Disk Assembly See 5-10-00, Time Limits (See Figure 801, Sheet 7, And Figure 802, Sheet 7)				
1434	A	HPC Drum Rotor (Stages 13, 14, And 15) Disk Assembly See 5-10-00, Time Limits (See Figure 801, Sheet 10, And Figure 802, Sheet 10)				
1435	A	Diffuser Airseal See 5-10-00, Time Limits (See Figure 801, Sheet 13 And Figure 802, Sheet 13)				

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1436	A	Hub, Stage 15 See 5-10-00, Time Limits (See Figure 801, Sheet 13 And Figure 802, Sheet 13)				

H. Spline Data

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
952	B	1. Gearbox Drive Bevel Gear (72-34-12) Internal Spline (See Figure 805, Sheet 2)				
		A. Effective Space Width	.0491 (1.247)	---		
		B. Actual Space Width	---	.0555 (1.410)		
		2. HPC Front Hub (72-35-05) External Spline (See Figure 805, Sheet 2)				
		A. Effective Tooth Thickness	---	.0476 (1.209)		
		B. Actual Tooth Thickness	.0412 (1.046)	---		
		3. Fit			.0015 (0.038)	---

I. Special Torques

HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-04

	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
730	A	Nut, Variable Stator Clevis Retaining (See Figure 803, Sheets 3, 4, 5, And 11) See 72-35-00, Assembly-03 (Task 72-35-00-400-003) See 72-35-03, Assembly-01 (Task 72-35-03-440-001)				
732	A	Nut, Bellcrank Spacer Clevis Retaining (See Figure 803, Sheets 5 And 11) See 72-35-03, Assembly-01 (Task 72-35-03-440-001)				
733	A	Nut, Actuating Cylinder Retaining (See Figure 803, Sheet 10) See 72-35-00, Assembly-03 (Task 72-35-00-400-003)				
734	A	Bolt, Stage 7 HPC Lever (See Figure 803, Sheet 11) See 72-35-03, Assembly-01 (Task 72-35-03-440-001)				
735	A	Compressor Stator Actuator Rod End Bearing Retaining Nut (See Figure 803, Sheet 6) See 72-35-00, Assembly-03 (Task 72-35-00-400-003)				
736	A	Bolt And Nut Torquing Procedure, Turbine Case Cooling Air Valve Actuator Ground Cable See 72-35-00, Assembly-04 (Task 72-35-00-400-004)				
737	A	Nut, Bellcrank Spacer Clevis Retaining (See Figure 803, Sheet 3) See 72-35-03, Assembly-01 (Task 72-35-03-440-001)				
738	A	Nut, Bellcrank Spacer Clevis Retaining (See Figure 803, Sheets 5 And 11) See 72-35-03, Assembly-01 (Task 72-35-03-440-001)				

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
739	A	Variable Stator Mount Stud Retaining Nuts (See Figure 803, Sheet 7) See 72-35-00, Assembly-03 (Task 72-35-00-400-003)				
1550	A	Compressor Tierod Nut (See Figure 801, Sheet 2 And, Figure 802, Sheet 2) See 72-35-01, Assembly-01 (Task 72-35-01-440-001)				
1551	A	Vane Arm Retaining Bolt (See Figure 801, Sheet 3, And Figure 802, Sheet 3) See 72-35-02, Assembly-01 (Task 72-35-02-440-001)				
1552	A	Stage 6 Borescope Plug (See Figure 801, Sheet 5, And Figure 802, Sheet 5) See 72-35-02, Assembly-01 (Task 72-35-02-440-001)				
1553	A	HPC Case Axial Flange Bolt - Nut (See Figure 801, Sheet 5 And Figure 802, Sheet 5) See 72-35-00, Assembly-01 (Task 72-35-00-400-001)				
1554	A	Stages 5, 10, And 14 Borescope Plugs (See Figure 801, Sheets 5, 9, 14, And Figure 802 Sheets 5, 9, And 14) See 72-35-00, Assembly-01 (Task 72-35-00-400-001)				
1556	A	Stages 8 And 12 Borescope Plugs (See Figure 801, Sheets 9, And 12, And Figure 802, Sheets 9, And 12) See 72-35-00, Assembly-01 (Task 72-35-00-400-001)				
1558	A	Synchronizing Ring Runner Pad Bolt (See Figure 807, Sheet 1) See 72-35-00, Assembly-02 (Task 72-35-00-400-002)				

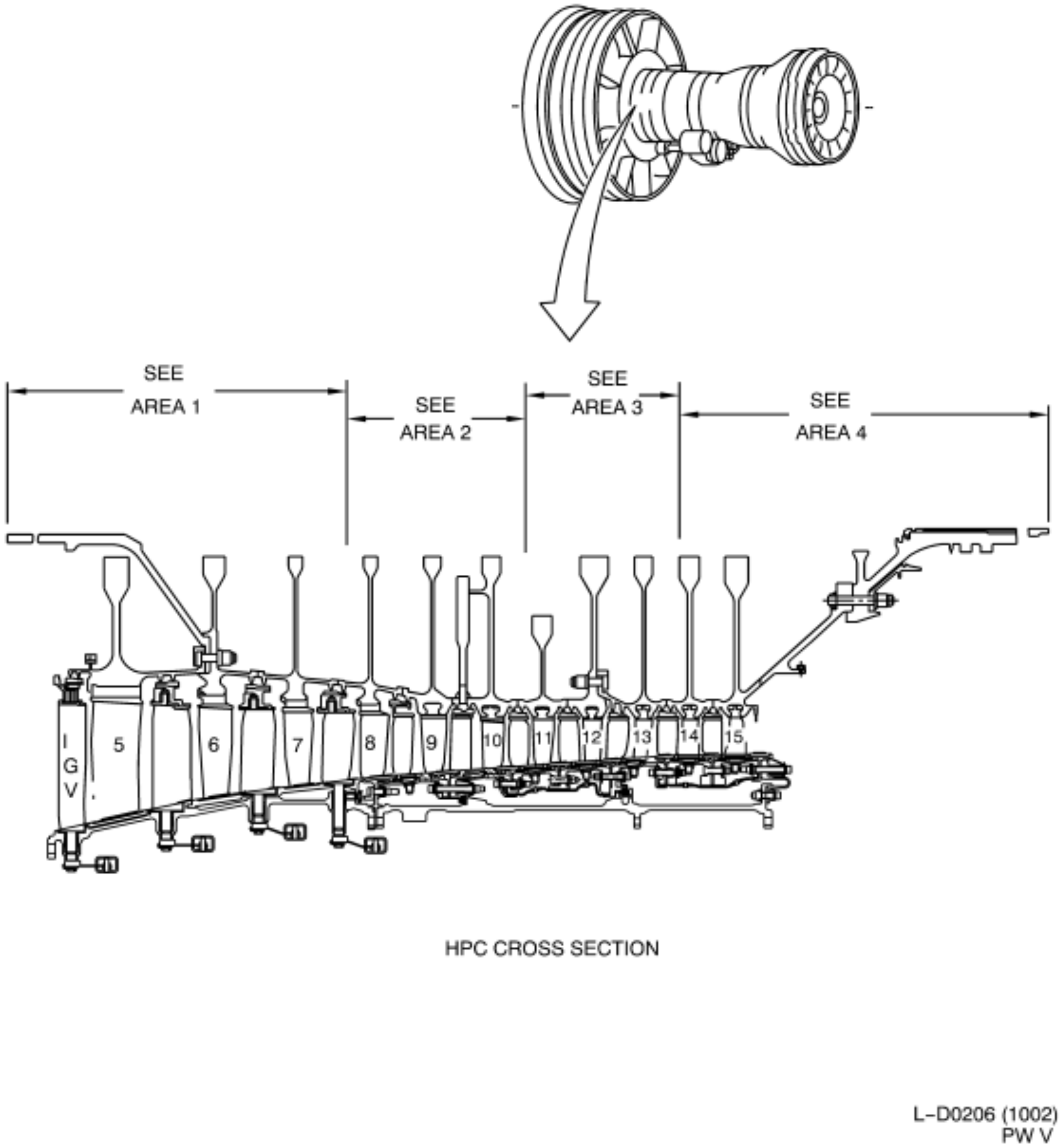
Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1560	A	Tiebolt Nuts, HPC Drum Rotor (Stages 13, 14, And 15) Disk Assembly (See Figure 801, Sheet 10 And Figure 802, Sheet 10) See 72-35-01, Assembly-01 (Task 72-35-01-440-001)				
1561	A	Tiebolt Nuts, HPC Drive Turbine Shaft (See Figure 801, Sheet 13 And Figure 802, Sheet 13) See 72-35-39, Assembly-01 (Task 72-35-39-440-001)				

J. Special Assembly Procedure

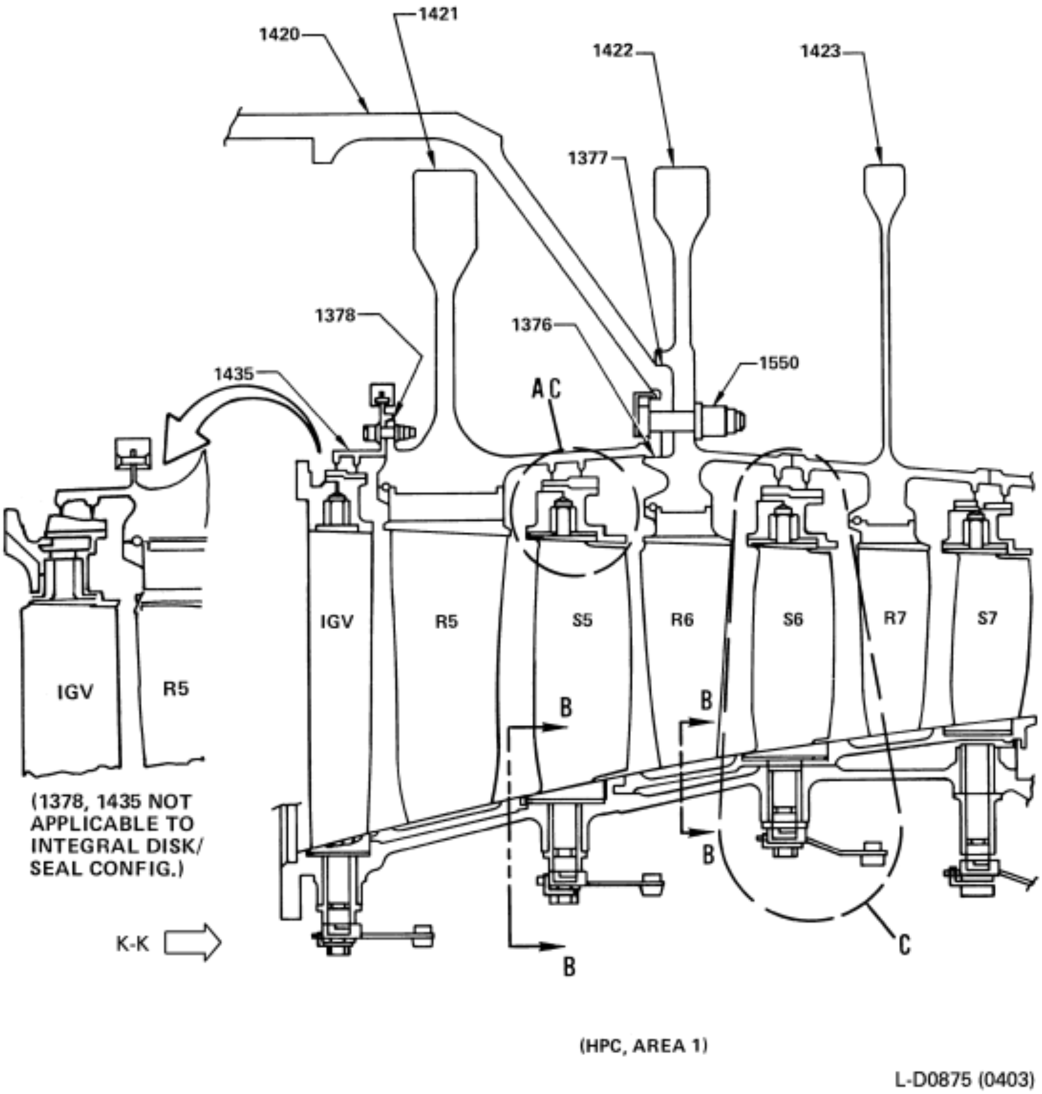
Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
618	A	Compressor Stator Lever - Set Bracket - Shim Fitting (See Figure 803, Sheet 8) See 72-35-00, Assembly-03) (Task 72-35-00-400-003)				
749	A	Variable Stator Mount Assembly Instruction For Expanding Retaining Stud (See Figure 803, Sheets 1, And 7) See 72-35-00, Assembly-03 (Task 72-35-00-400-003)				
760	A	Turbine Vane And Blade Cooling Air Valve Position Switch - Installation See 72-35-00, Assembly-04 (Task 72-35-00-400-004)				
1401	A	Arm Assembly End Clearance - Select Spacer To Obtain (See Figure 801, Sheet 3) See 72-35-02, Assembly-01 (Task 72-35-02-440-001)				

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04

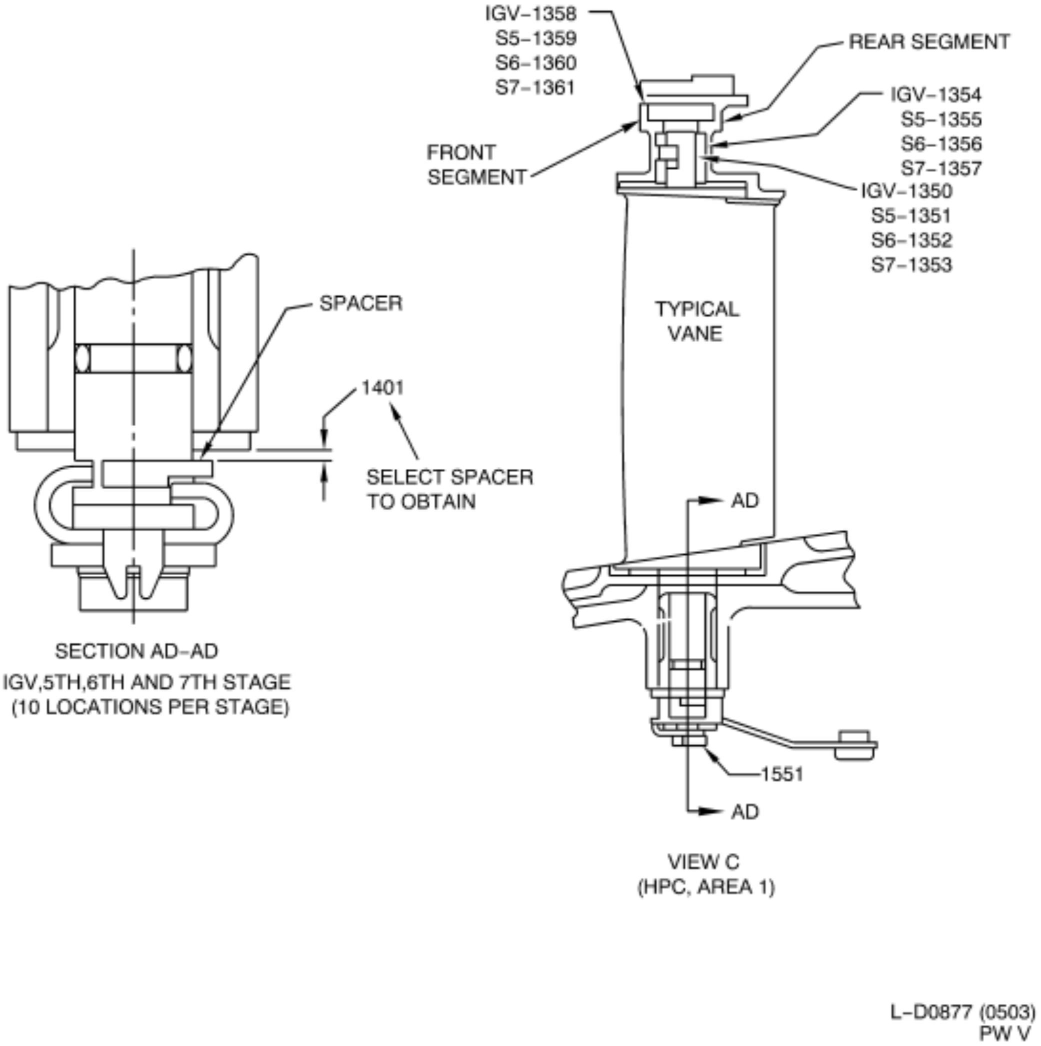
Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1580	A	Flange Seating Procedure (See Figure 801, Sheet 14 And Figure 802, Sheet 14) See 72−35−00, Assembly−01 (Task 72−35−00−400−007) And See 72−35−04, Assembly−01 (Task 72−35−04−440−001)				
2101 2102 2103 2104	A	Shim Procedure For Unison Ring Runners And Spacers And Clearances For Runners (See Figure 807, Sheets 1 And 2) See 72−35−00, Assembly−02 (Task 72−35−00−400−002)				


SEE AREA 1
SEE AREA 2
SEE AREA 3
SEE AREA 4
IGV
5
6
7
8
9
10
11
12
13
14
15
HPC CROSS SECTION
L-D0206 (1002)
PW V

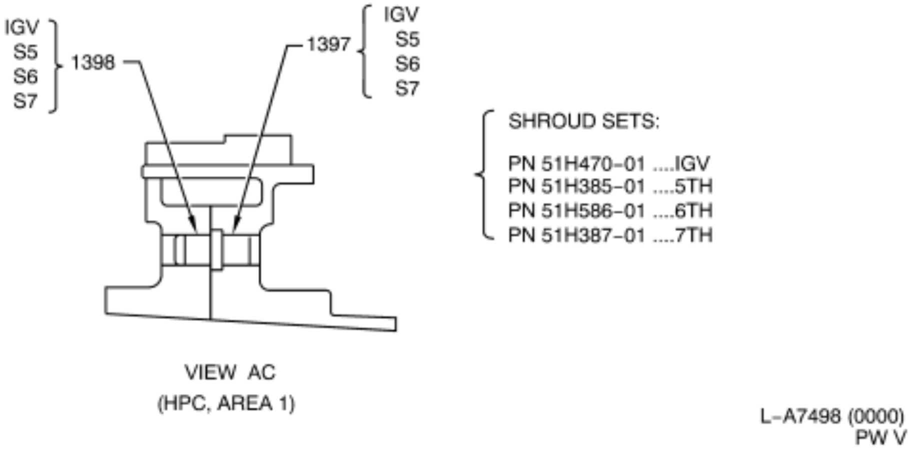
High Pressure Compressor (HPC) (Symmetric Case Configuration)
Figure 801 (Sheet 1)
(Task 72-35-00-990-011)


1420
1421
1422
1423
1377
1378
1376
1435
1550
A C
IGV
R5
S5
R6
S6
R7
S7
IGV
R5
B
B
B
B
C
(1378, 1435 NOT APPLICABLE TO INTEGRAL DISK/ SEAL CONFIG.)
K-K
(HPC, AREA 1)
L-D0875 (0403)

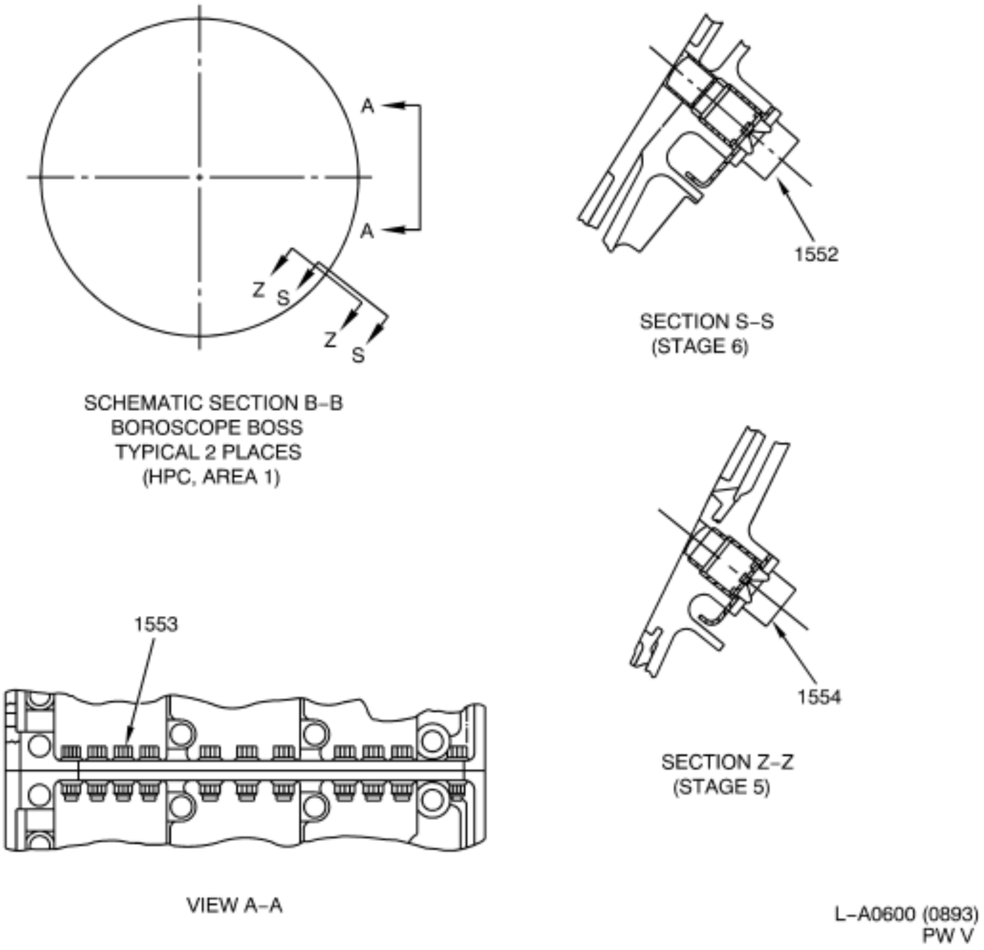
High Pressure Compressor (HPC) (Symmetric Case Configuration)
Figure 801 (Sheet 2)
(Task 72−35−00−990−011)


IGV−1358
S5−1359
S6−1360
S7−1361
REAR SEGMENT
IGV−1354
S5−1355
S6−1356
S7−1357
FRONT SEGMENT
IGV−1350
S5−1351
S6−1352
S7−1353
TYPICAL VANE
SPACER
1401
SELECT SPACER TO OBTAIN
AD
AD
1551
SECTION AD−AD
IGV,5TH,6TH AND 7TH STAGE
(10 LOCATIONS PER STAGE)
VIEW C
(HPC, AREA 1)
L−D0877 (0503)
PW V

High Pressure Compressor (HPC) (Symmetric Case Configuration)
Figure 801 (Sheet 3)
(Task 72−35−00−990−011)


IGV
S5
S6
S7
1398
1397
IGV
S5
S6
S7
SHROUD SETS:
PN 51H470−01 ....IGV
PN 51H385−01 ....5TH
PN 51H586−01 ....6TH
PN 51H387−01 ....7TH
VIEW AC
(HPC, AREA 1)
L−A7498 (0000)
PW V

High Pressure Compressor (HPC)
Figure 801 (Sheet 4)
(Task 72−35−00−990−011)



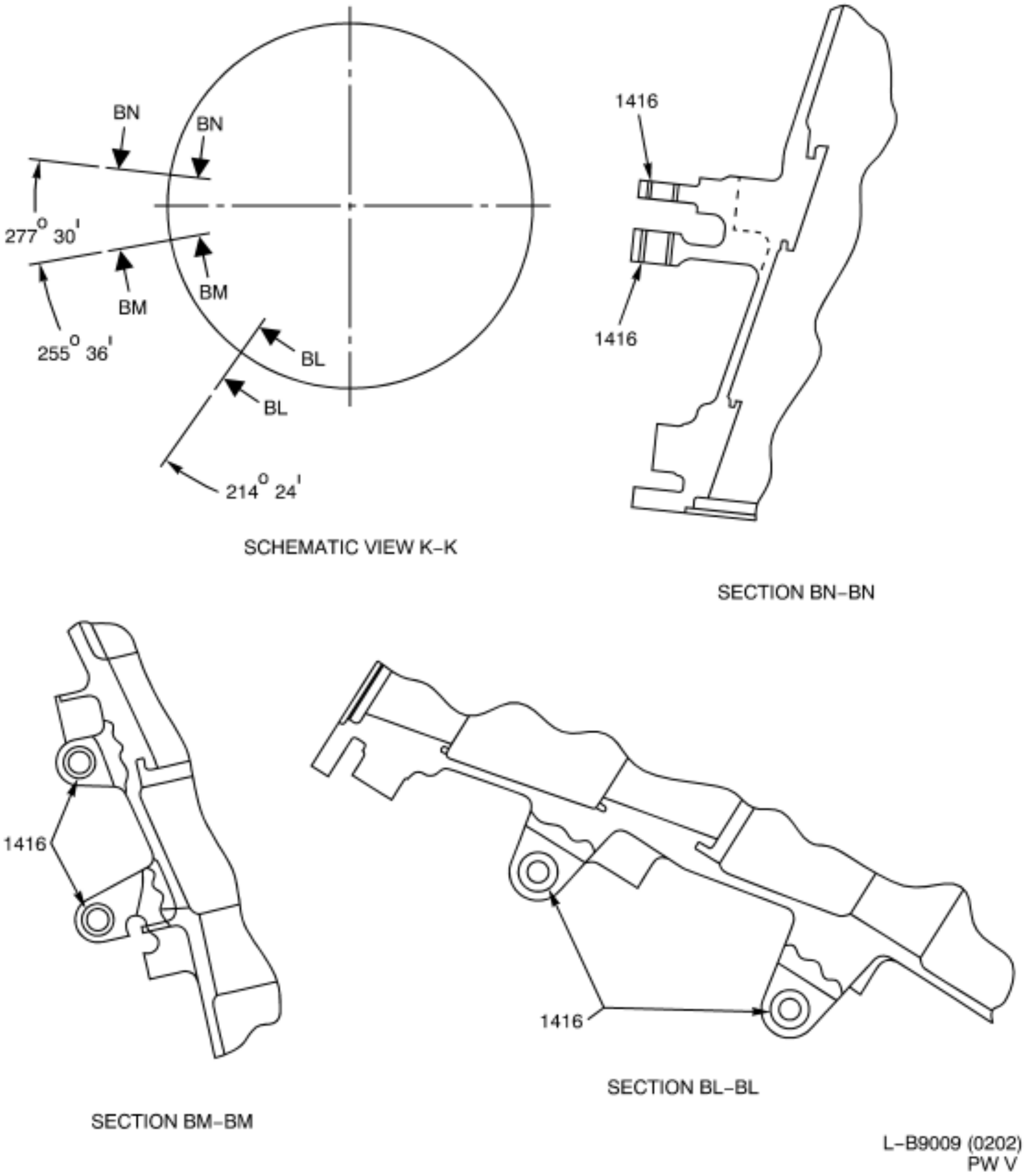
SCHEMATIC SECTION B−B
BOROSCOPE BOSS
TYPICAL 2 PLACES
(HPC, AREA 1)

SECTION S−S
(STAGE 6)

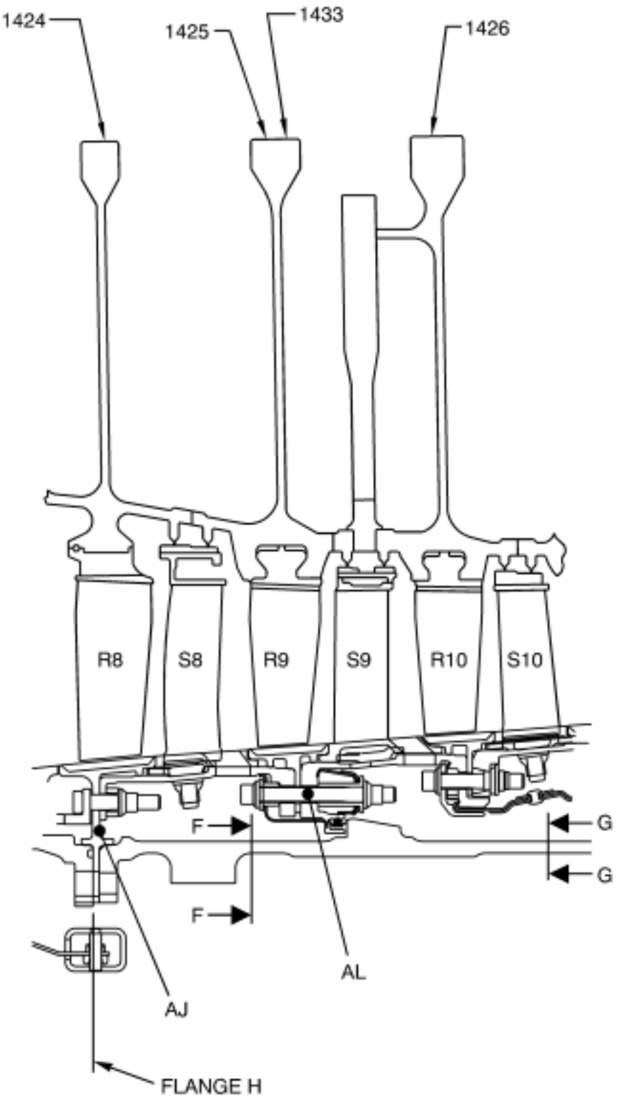
VIEW A−A

SECTION Z−Z
(STAGE 5)

High Pressure Compressor (HPC) (Symmetric Case Configuration)
Figure 801 (Sheet 5)
(Task 72−35−00−990−011)


BN
BN
277° 30'
BM
BM
255° 36'
BL
BL
214° 24'
SCHEMATIC VIEW K−K
1416
1416
SECTION BN−BN
1416
SECTION BM−BM
1416
SECTION BL−BL
L−B9009 (0202)
PW V

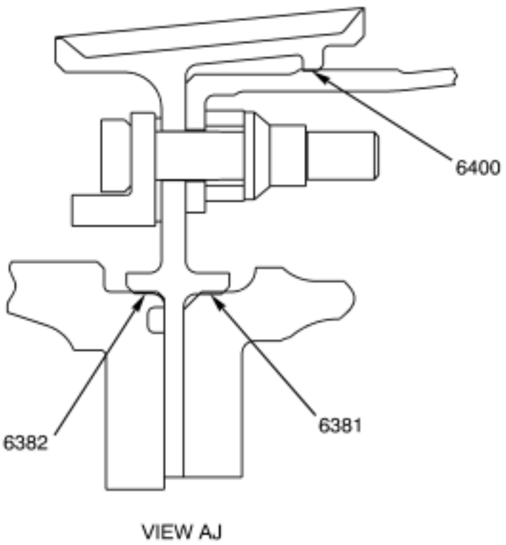
High Pressure Compressor (HPC)
Figure 801 (Sheet 6)
(Task 72−35−00−990−011)

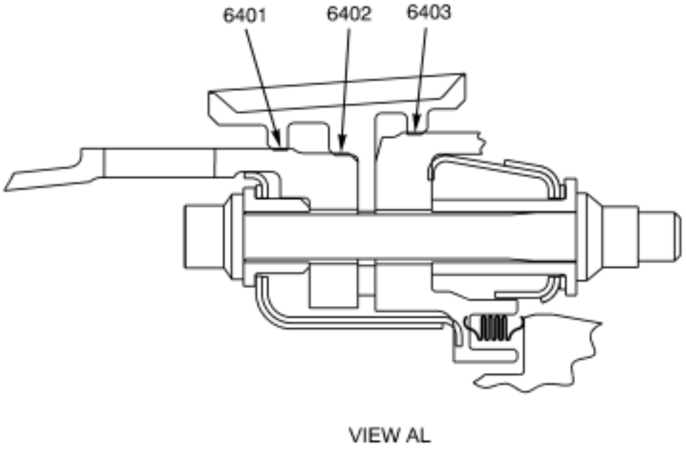

1424
1425
1433
1426
R8
S8
R9
S9
R10
S10
F
G
G
F
AL
AJ
FLANGE H

(HPC, AREA 2)

L−D0207 (1002)
PW V

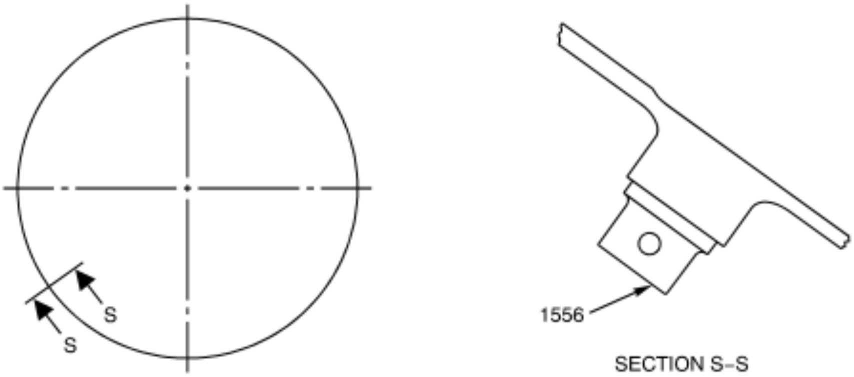
High Pressure Compressor (HPC) (Symmetric Case Configuration)
Figure 801 (Sheet 7)
(Task 72−35−00−990−011)


6400
6382
6381
VIEW AJ


6401
6402
6403
VIEW AL

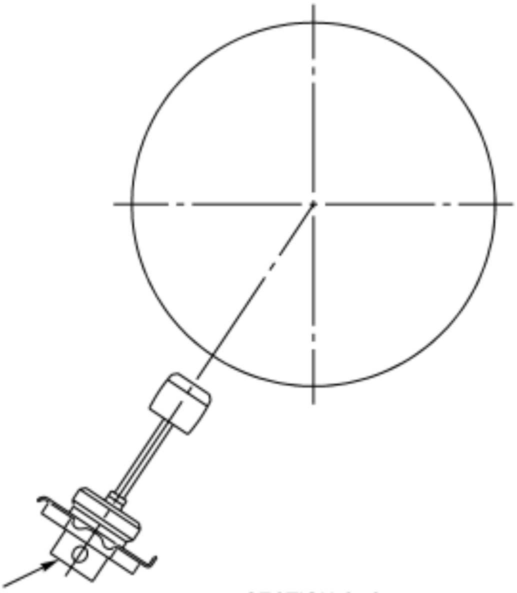
L−D0036 (0802)
PW V

High Pressure Compressor (HPC) (Symmetric Case Configuration)
Figure 801 (Sheet 8)
(Task 72−35−00−990−011)



SCHEMATIC SECTION F−F
BOROSCOPE BOSS
HPC AREA 2

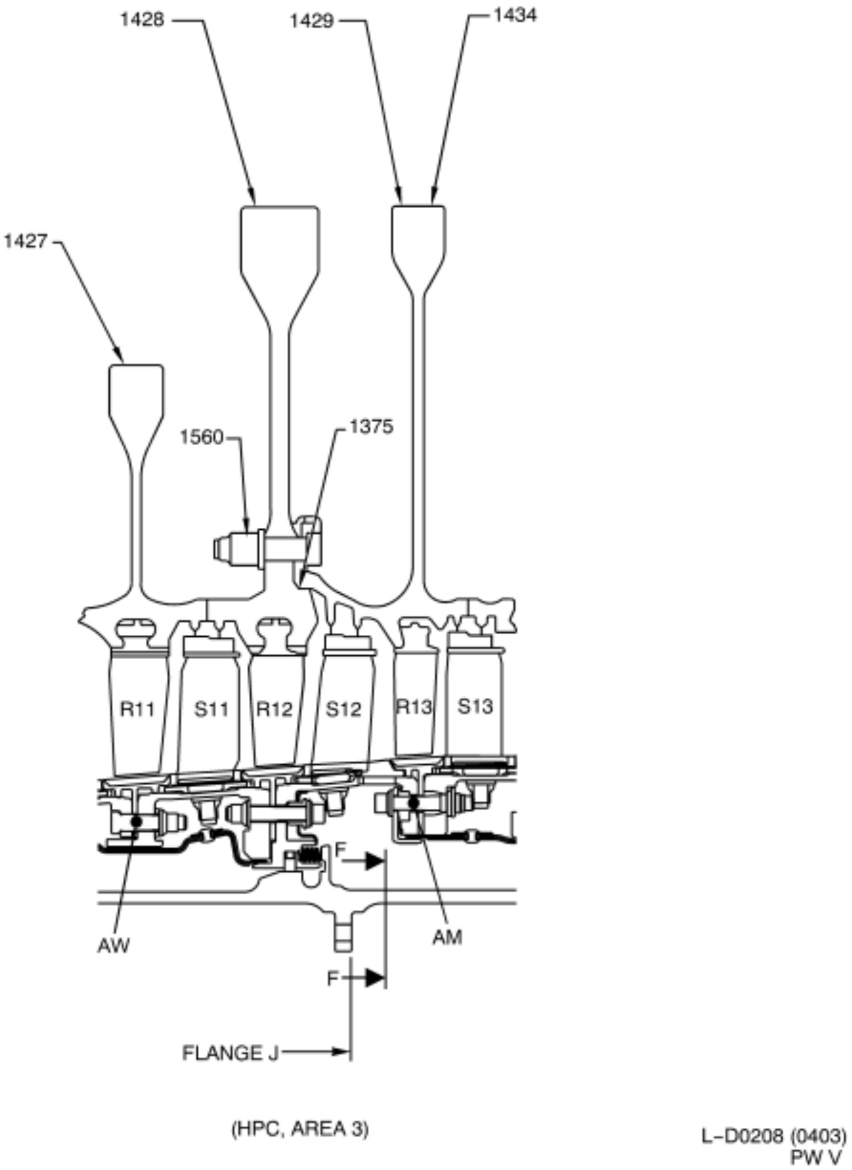
SECTION S−S
STAGE 8



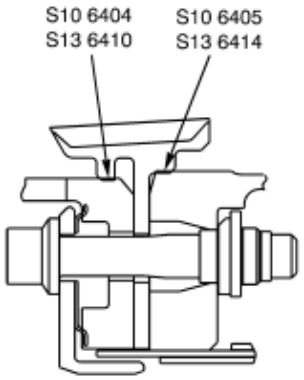
SECTION G−G
SCEMATIC REAR VIEW
STAGE 10

High Pressure Compressor (HPC) (Symmetric Case Configuration)
Figure 801 (Sheet 9)
(Task 72−35−00−990−011)

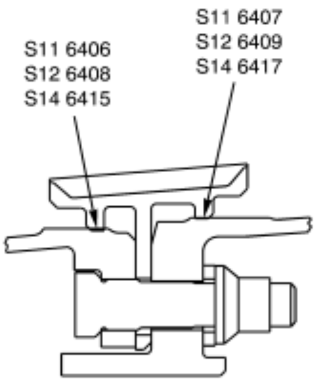
HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04


1428
1429
1434
1427
1560
1375
R11
S11
R12
S12
R13
S13
F
AW
AM
F
FLANGE J
(HPC, AREA 3)
L−D0208 (0403)
PW V

High Pressure Compressor (HPC) (Symmetric Case Configuration)
Figure 801 (Sheet 10)
(Task 72−35−00−990−011)


S10 6404
S13 6410
S10 6405
S13 6414

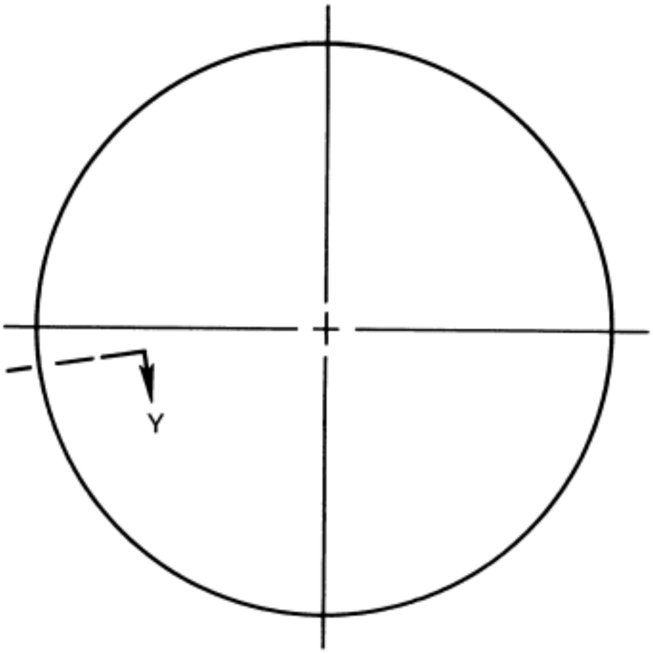
VIEW AM


S11 6406
S12 6408
S14 6415
S11 6407
S12 6409
S14 6417

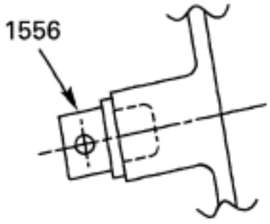
VIEW AW

L−D0041 (0403)
PW V

High Pressure Compressor (HPC) (Symmetric Case Configuration)
Figure 801 (Sheet 11)
(Task 72−35−00−990−011)



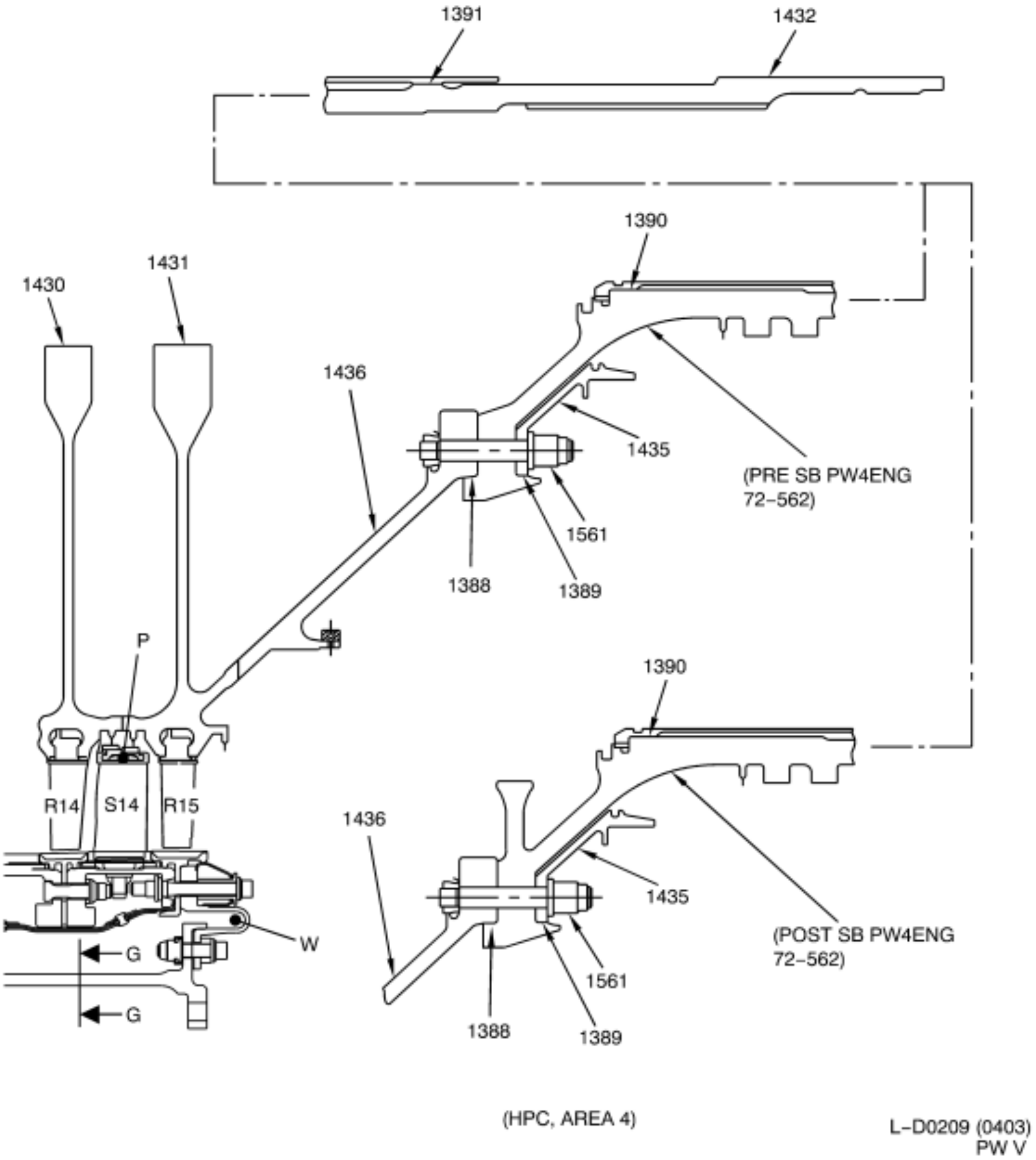
SCHEMATIC SECTION F-F
BOROSCOPE BOSS
(HPC,AREA 3)



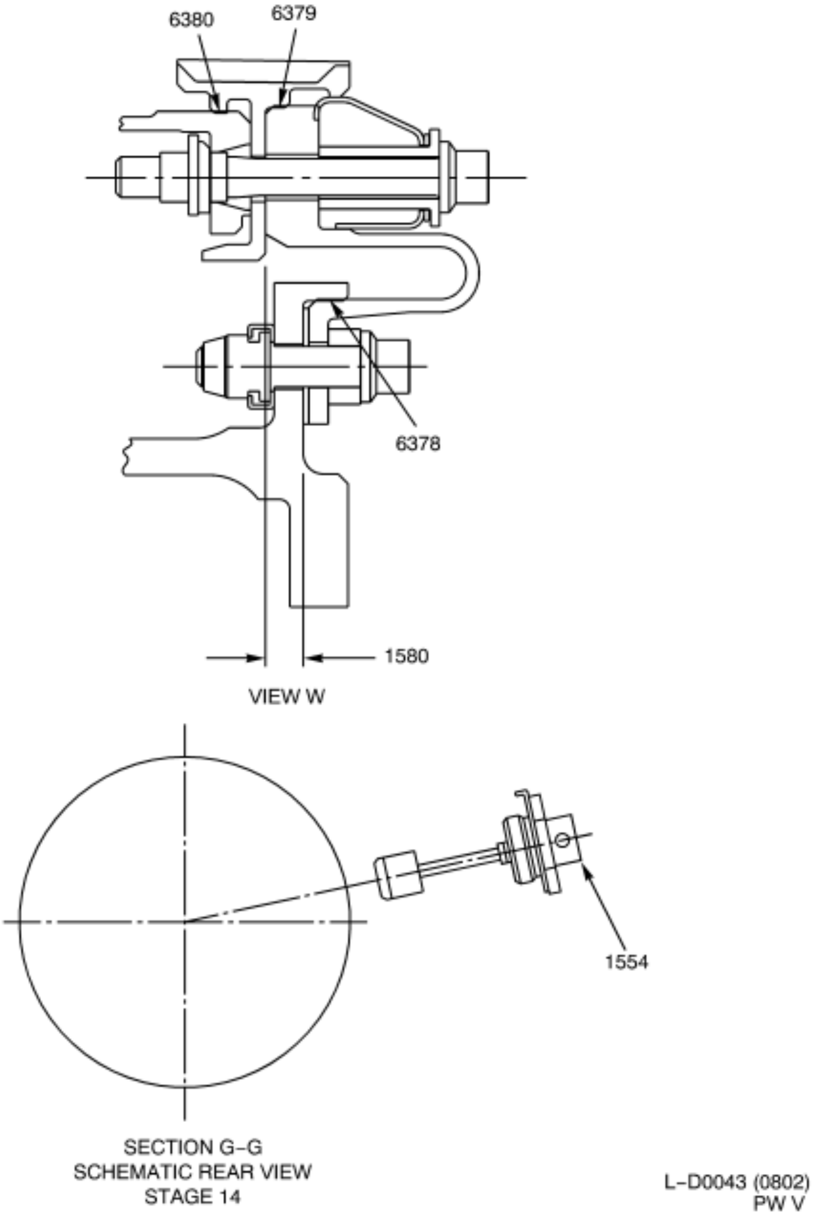
SECTION Y-Y
(STAGE 12)

L-A0630 (0893)

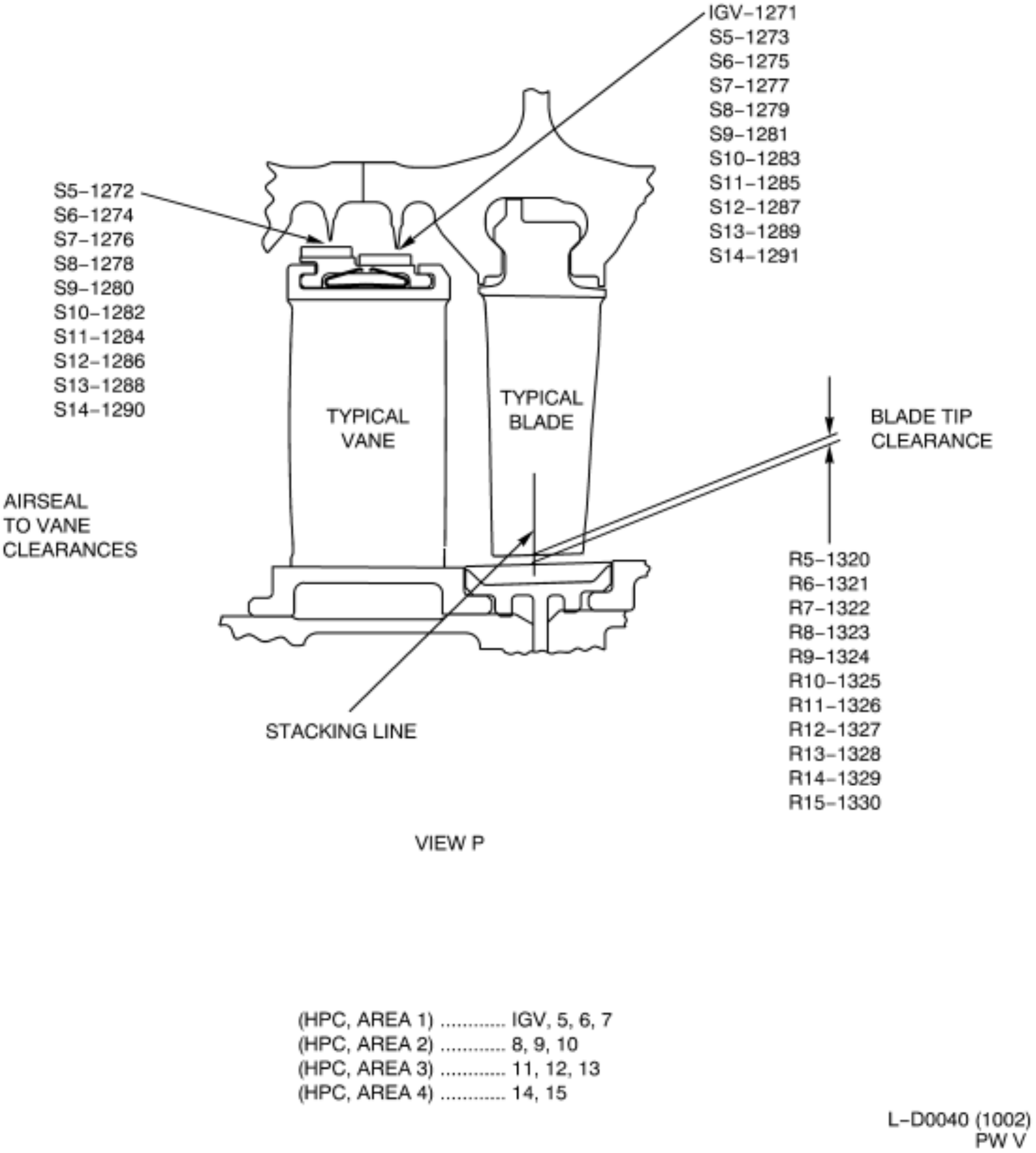
High Pressure Compressor (HPC) (Symmetric Case Configuration)
Figure 801 (Sheet 12)
(Task 72−35−00−990−011)


1391
1432
1390
1430
1431
1436
1435
(PRE SB PW4ENG 72−562)
1561
1388
1389
P
1390
R14
S14
R15
1436
1435
W
G
G
(POST SB PW4ENG 72−562)
1561
1388
1389
(HPC, AREA 4)
L−D0209 (0403)
PW V

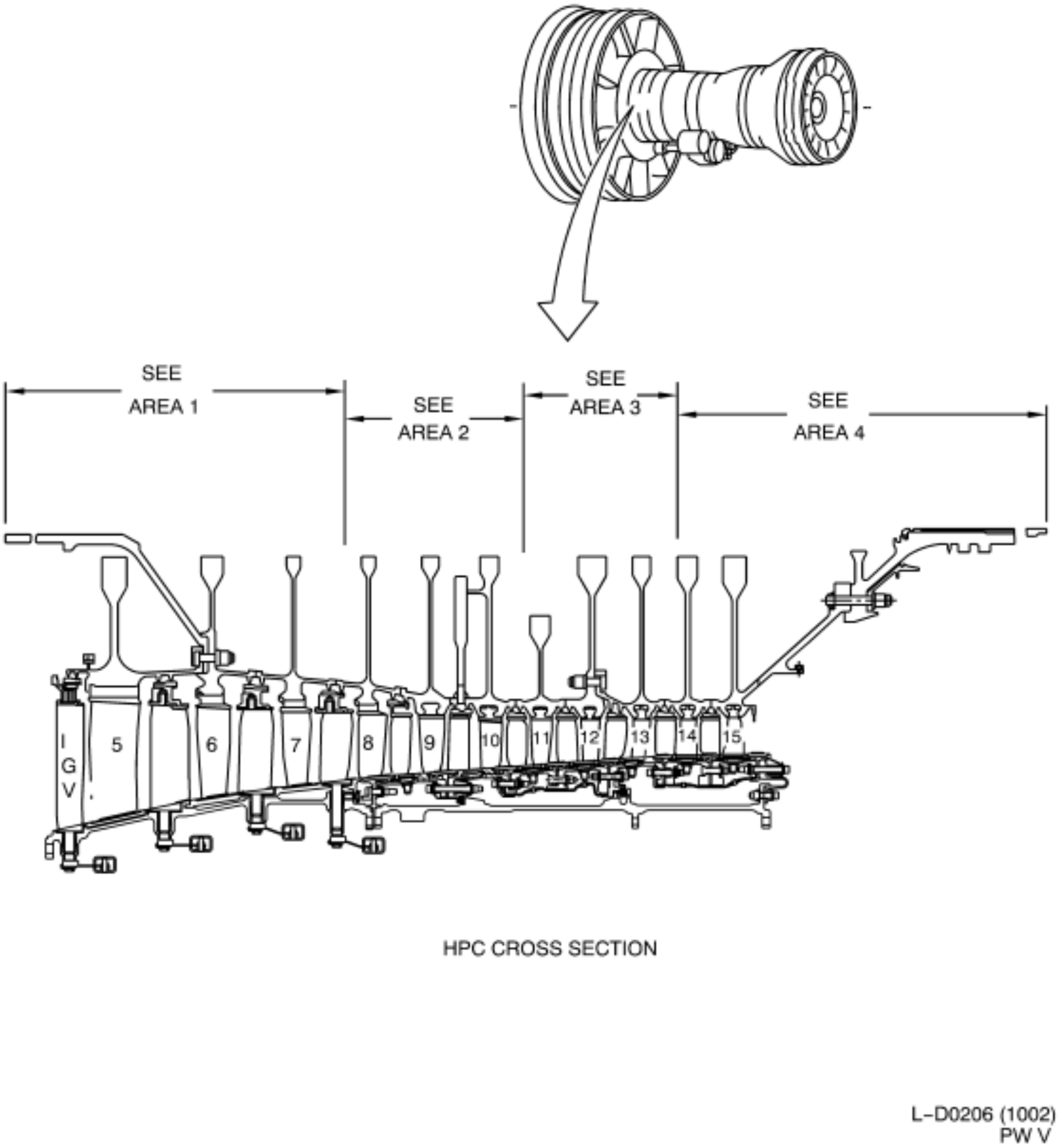
High Pressure Compressor (HPC) (Symmetric Case Configuration)
Figure 801 (Sheet 13)
(Task 72−35−00−990−011)


6380
6379
6378
1580
VIEW W
1554
SECTION G−G
SCHEMATIC REAR VIEW
STAGE 14
L−D0043 (0802)
PW V

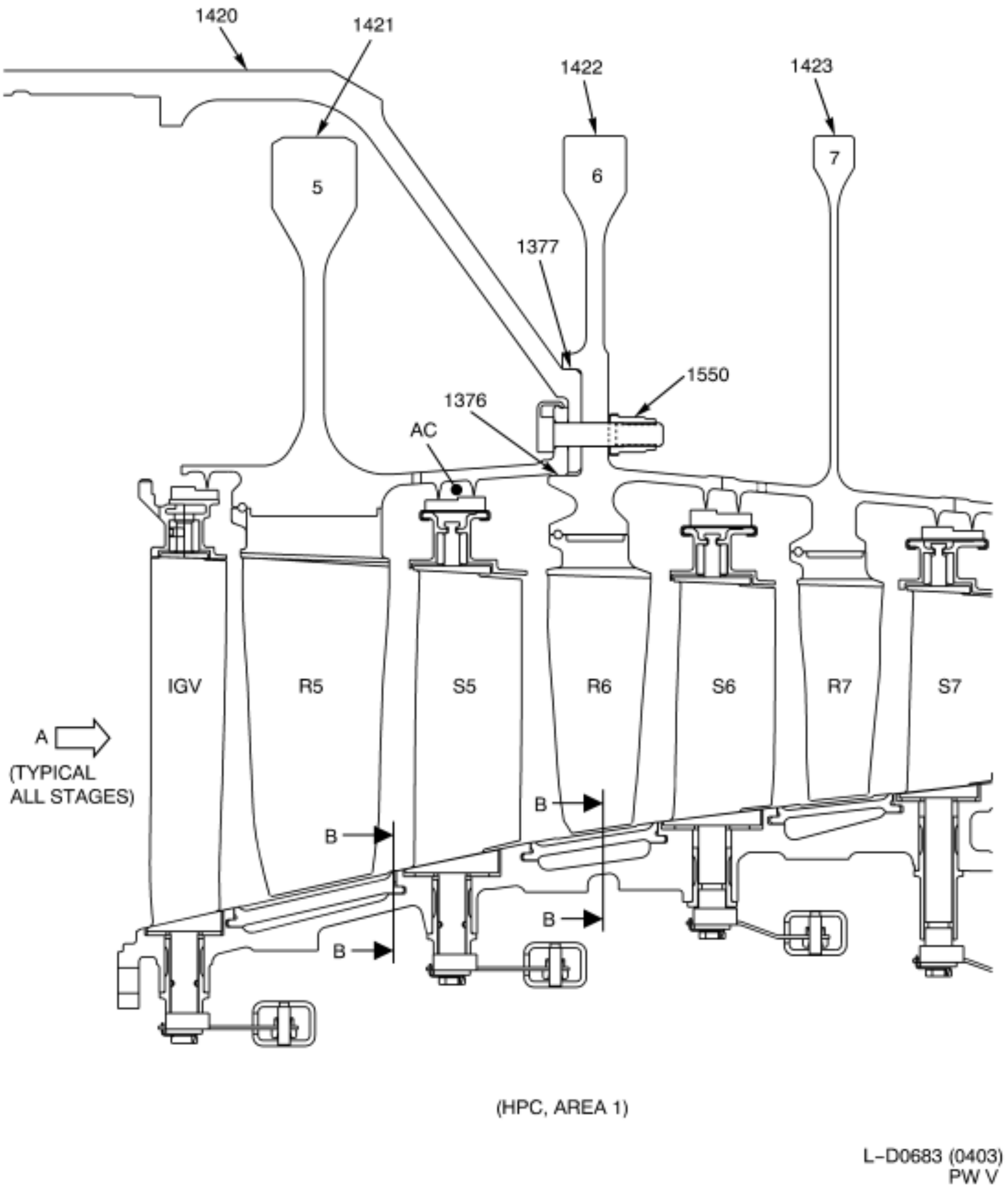
High Pressure Compressor (HPC) (Symmetric Case Configuration)
Figure 801 (Sheet 14)
(Task 72−35−00−990−011)


IGV−1271
S5−1273
S6−1275
S7−1277
S8−1279
S9−1281
S10−1283
S11−1285
S12−1287
S13−1289
S14−1291
S5−1272
S6−1274
S7−1276
S8−1278
S9−1280
S10−1282
S11−1284
S12−1286
S13−1288
S14−1290
TYPICAL VANE
TYPICAL BLADE
BLADE TIP CLEARANCE
AIRSEAL TO VANE CLEARANCES
R5−1320
R6−1321
R7−1322
R8−1323
R9−1324
R10−1325
R11−1326
R12−1327
R13−1328
R14−1329
R15−1330
STACKING LINE
VIEW P
(HPC, AREA 1) .... IGV, 5, 6, 7
(HPC, AREA 2) 8, 9, 10
(HPC, AREA 3) 11, 12, 13
(HPC, AREA 4) 14, 15
L−D0040 (1002)
PW V

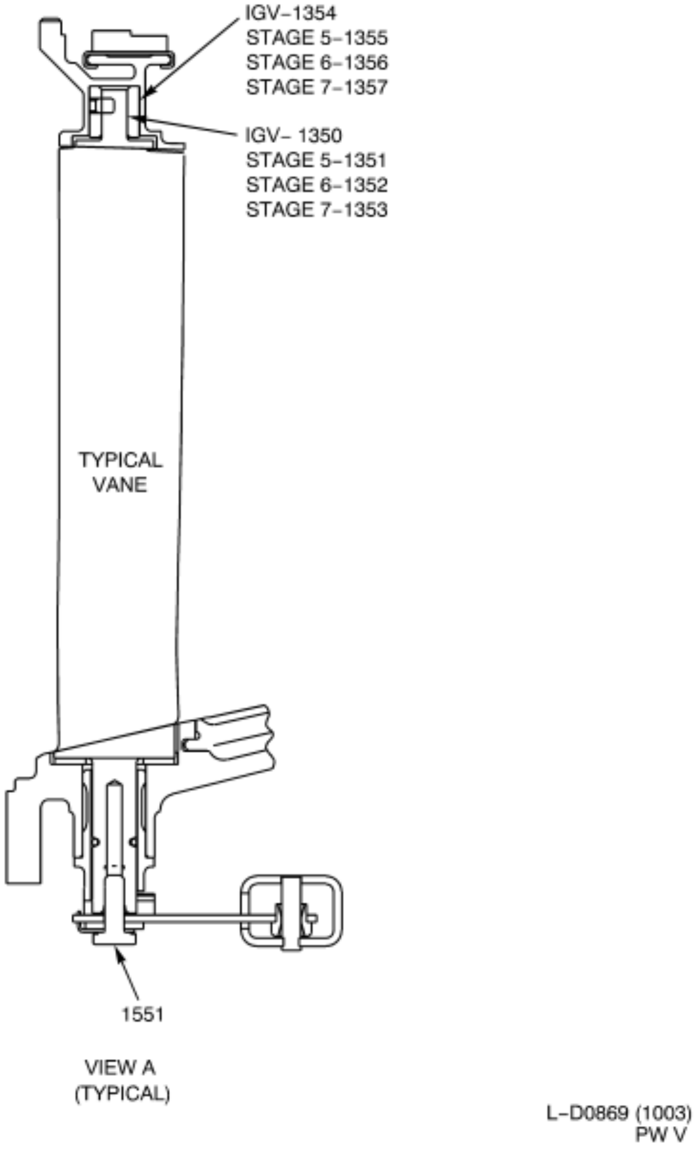
High Pressure Compressor (HPC) (Symmetric Case Configuration)
Figure 801 (Sheet 15)
(Task 72−35−00−990−011)


SEE AREA 1
SEE AREA 2
SEE AREA 3
SEE AREA 4
IGV
5
6
7
8
9
10
11
12
13
14
15
HPC CROSS SECTION
L−D0206 (1002)
PW V

High Pressure Compressor (HPC) (Asymmetric Case Configuration)
Figure 802 (Sheet 1)
(Task 72−35−00−990−011)


1420
1421
1422
1423
5
6
7
1377
1550
1376
AC
IGV
R5
S5
R6
S6
R7
S7
A
(TYPICAL
ALL STAGES)
B
B
B
B
(HPC, AREA 1)
L−D0683 (0403)
PW V

High Pressure Compressor (HPC) (Asymmetric Case Configuration)
Figure 802 (Sheet 2)
(Task 72−35−00−990−011)

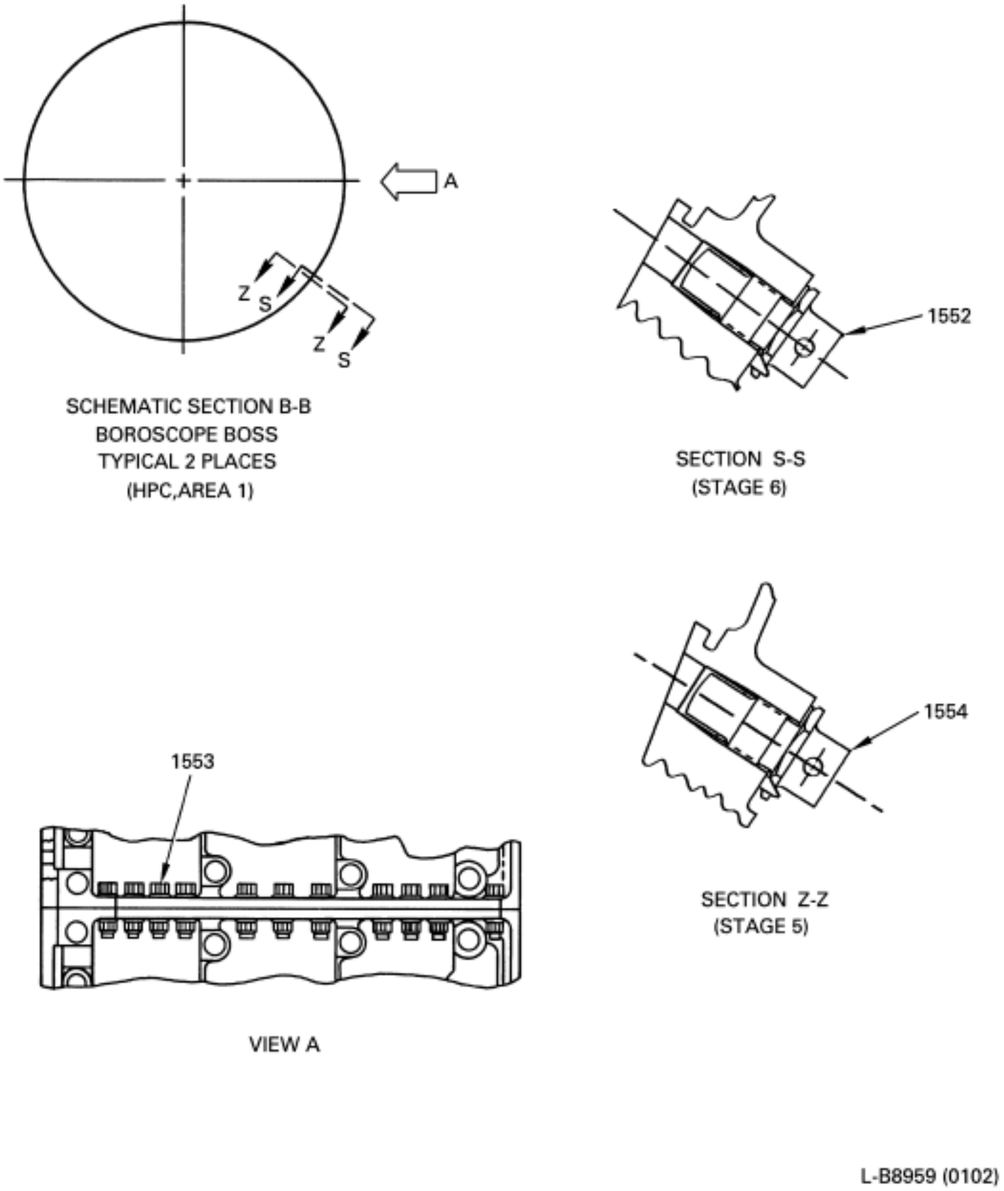

IGV−1354
STAGE 5−1355
STAGE 6−1356
STAGE 7−1357
IGV− 1350
STAGE 5−1351
STAGE 6−1352
STAGE 7−1353
TYPICAL VANE
1551
VIEW A (TYPICAL)
L−D0869 (1003)
PW V

High Pressure Compressor (HPC) (Asymmetric Case Configuration)
Figure 802 (Sheet 3)
(Task 72−35−00−990−011)

FIGURE NOT USED

L−00000 (0000)
PW V

High Pressure Compressor (HPC) (Asymmetric Case Configuration)
Figure 802 (Sheet 4)
(Task 72−35−00−990−011)

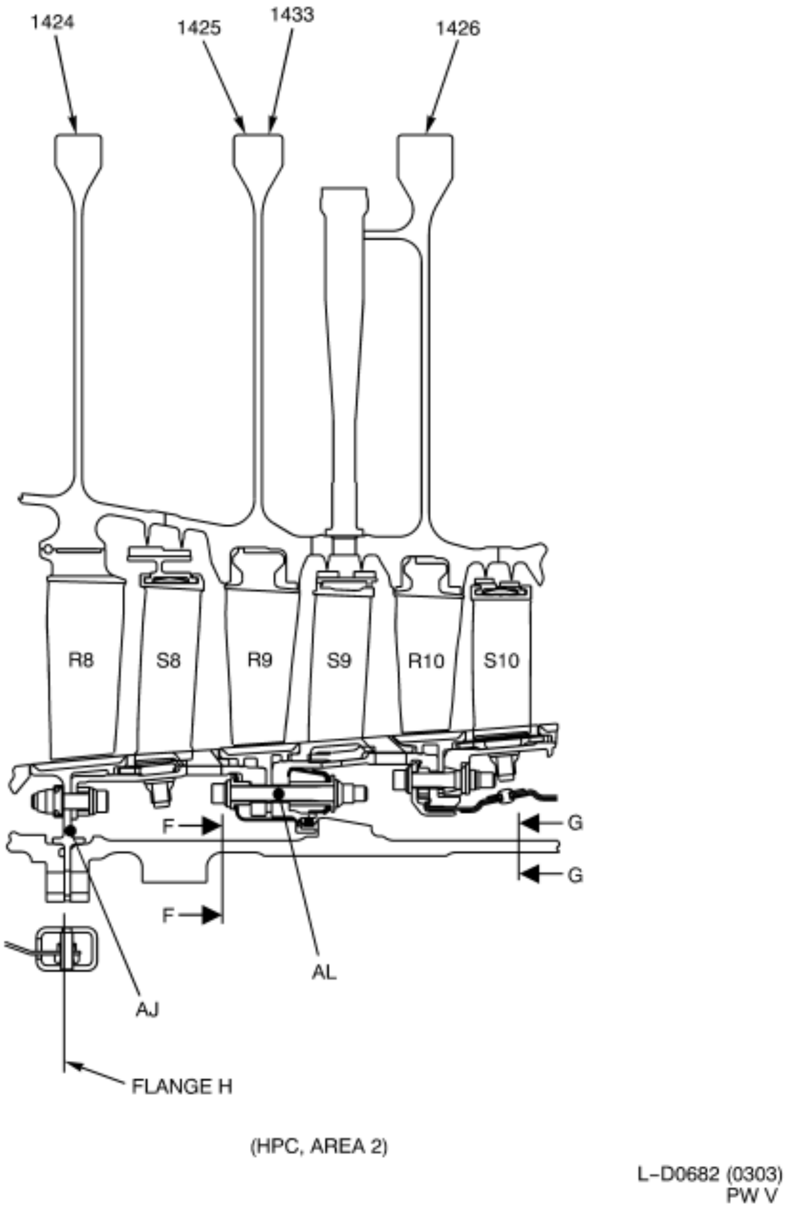

A
Z
S
Z
S
SCHEMATIC SECTION B-B
BOROSCOPE BOSS
TYPICAL 2 PLACES
(HPC,AREA 1)
1552
SECTION S-S
(STAGE 6)
1554
SECTION Z-Z
(STAGE 5)
1553
VIEW A
L-B8959 (0102)

High Pressure Compressor (HPC) (Asymmetric Case Configuration)
Figure 802 (Sheet 5)
(Task 72−35−00−990−011)

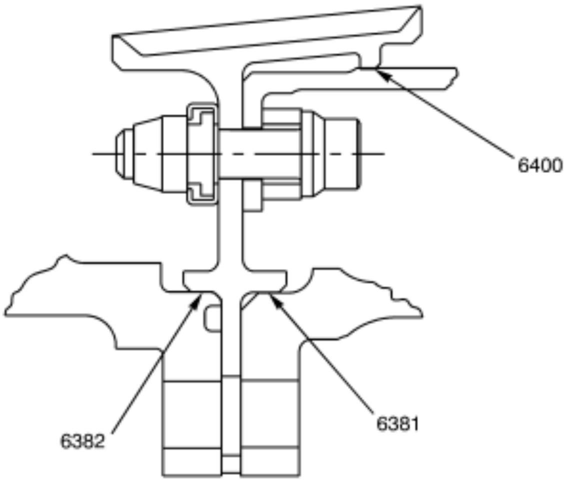
FIGURE NOT USED

L−00000 (0000)
PW V

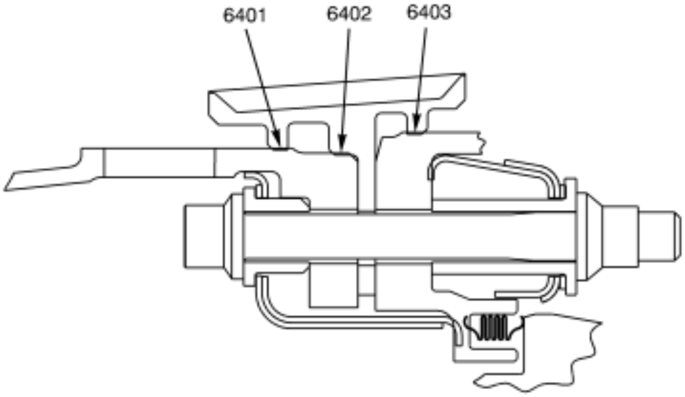
High Pressure Compressor (HPC) (Asymmetric Case Configuration)
Figure 802 (Sheet 6)
(Task 72−35−00−990−011)


1424
1425
1433
1426
R8
S8
R9
S9
R10
S10
F
F
G
G
AL
AJ
FLANGE H
(HPC, AREA 2)
L−D0682 (0303)
PW V

High Pressure Compressor (HPC) (Asymmetric Case Configuration)
Figure 802 (Sheet 7)
(Task 72−35−00−990−011)



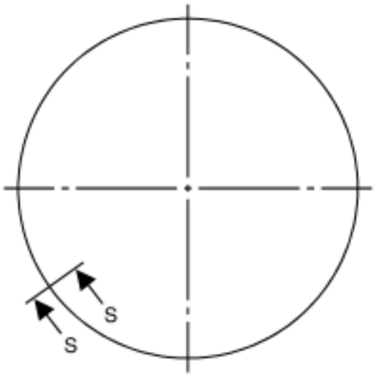
VIEW AJ



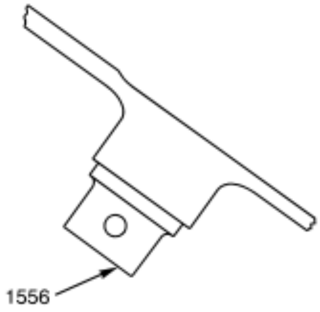
VIEW AL

L−D0871 (0303)
PW V

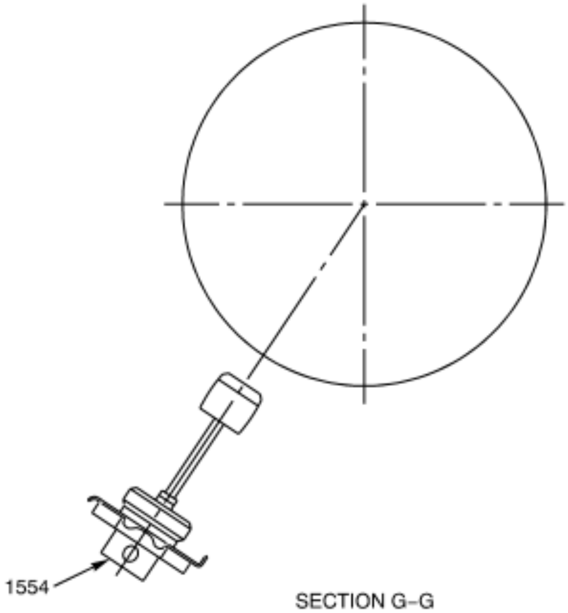
High Pressure Compressor (HPC) (Asymmetric Case Configuration)
Figure 802 (Sheet 8)
(Task 72−35−00−990−011)



SCHEMATIC SECTION F−F
BOROSCOPE BOSS
HPC AREA 2



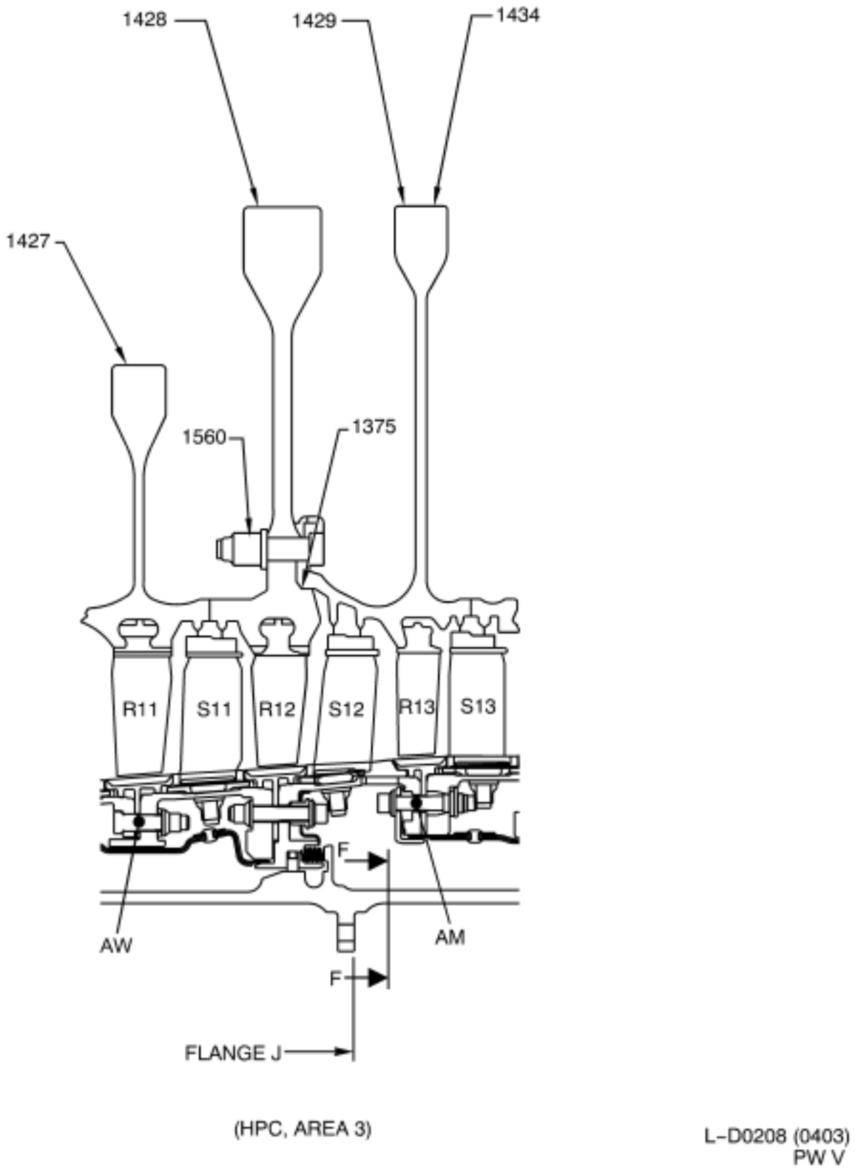
SECTION S−S
STAGE 8



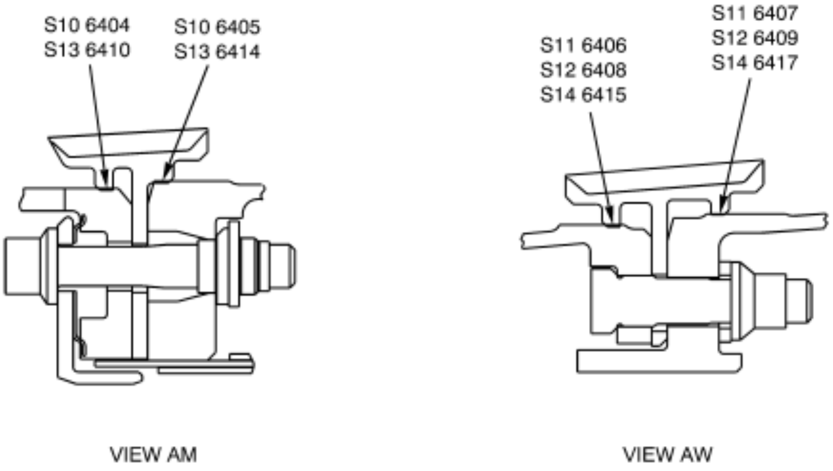
SECTION G−G
SCEMATIC REAR VIEW
STAGE 10

L−D0034 (0802)
PW V

High Pressure Compressor (HPC) (Asymmetric Case Configuration)
Figure 802 (Sheet 9)
(Task 72−35−00−990−011)

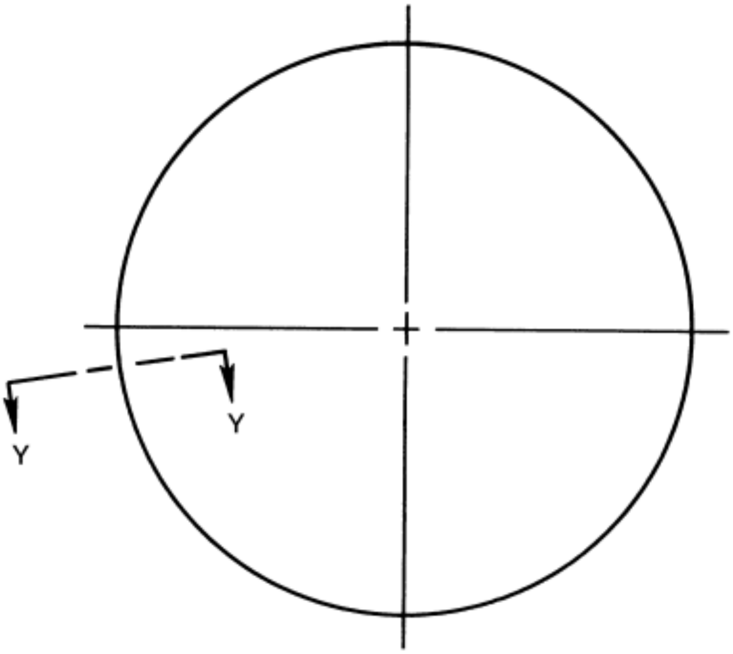

1428
1429
1434
1427
1560
1375
R11
S11
R12
S12
R13
S13
F
AW
AM
F
FLANGE J
(HPC, AREA 3)
L-D0208 (0403)
PW V

High Pressure Compressor (HPC) (Asymmetric Case Configuration)
Figure 802 (Sheet 10)
(Task 72−35−00−990−011)

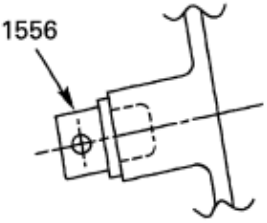

S10 6404
S13 6410
S10 6405
S13 6414
VIEW AM
S11 6406
S12 6408
S14 6415
S11 6407
S12 6409
S14 6417
VIEW AW

L−D0041 (0403)
PW V

High Pressure Compressor (HPC) (Asymmetric Case Configuration)
Figure 802 (Sheet 11)
(Task 72−35−00−990−011)



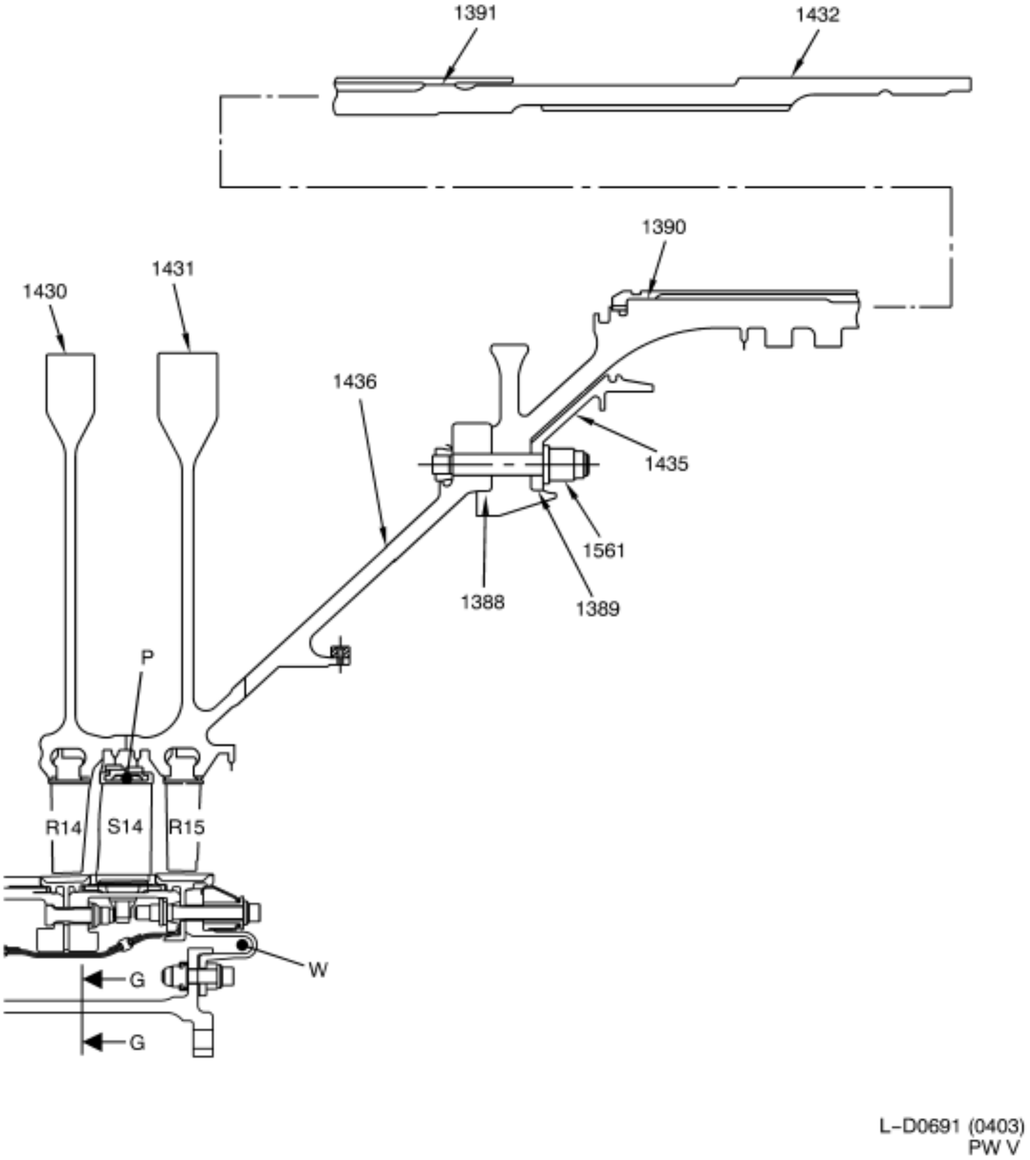
SCHEMATIC SECTION F-F
BOROSCOPE BOSS
(HPC,AREA 3)



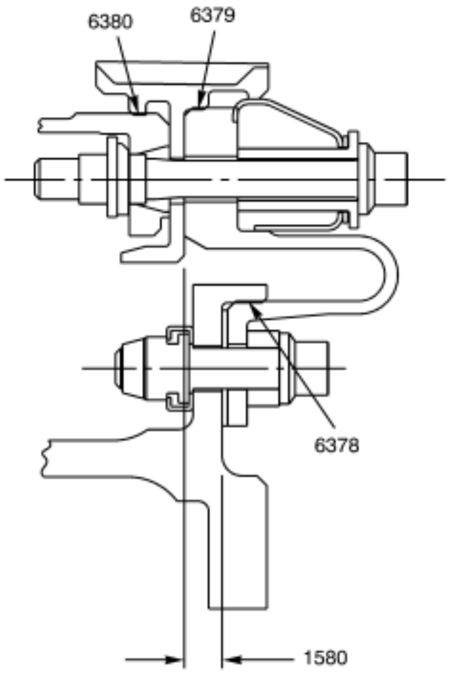
SECTION Y-Y
(STAGE 12)

L-A0630 (0893)

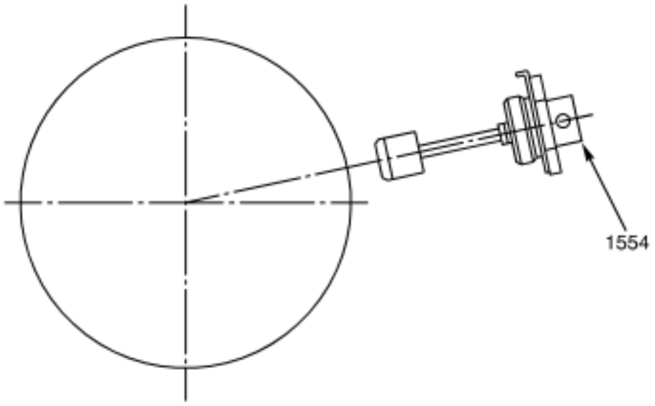
High Pressure Compressor (HPC) (Asymmetric Case Configuration)
Figure 802 (Sheet 12)
(Task 72−35−00−990−011)


1391
1432
1390
1430
1431
1436
1435
1561
1388
1389
P
R14
S14
R15
W
G
G
L−D0691 (0403)
PW V

High Pressure Compressor (HPC) (Asymmetric Case Configuration)
Figure 802 (Sheet 13)
(Task 72−35−00−990−011)

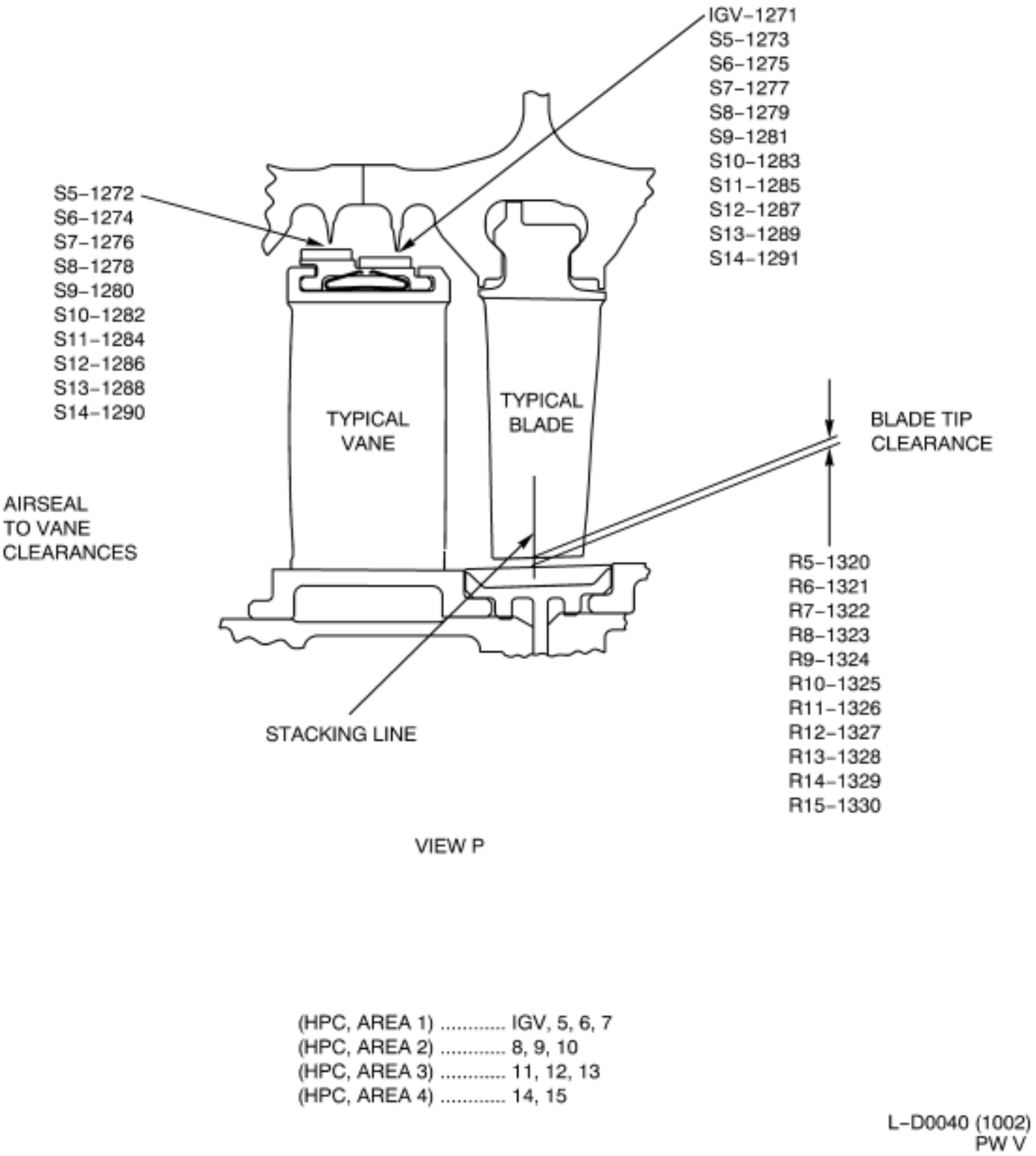


VIEW W

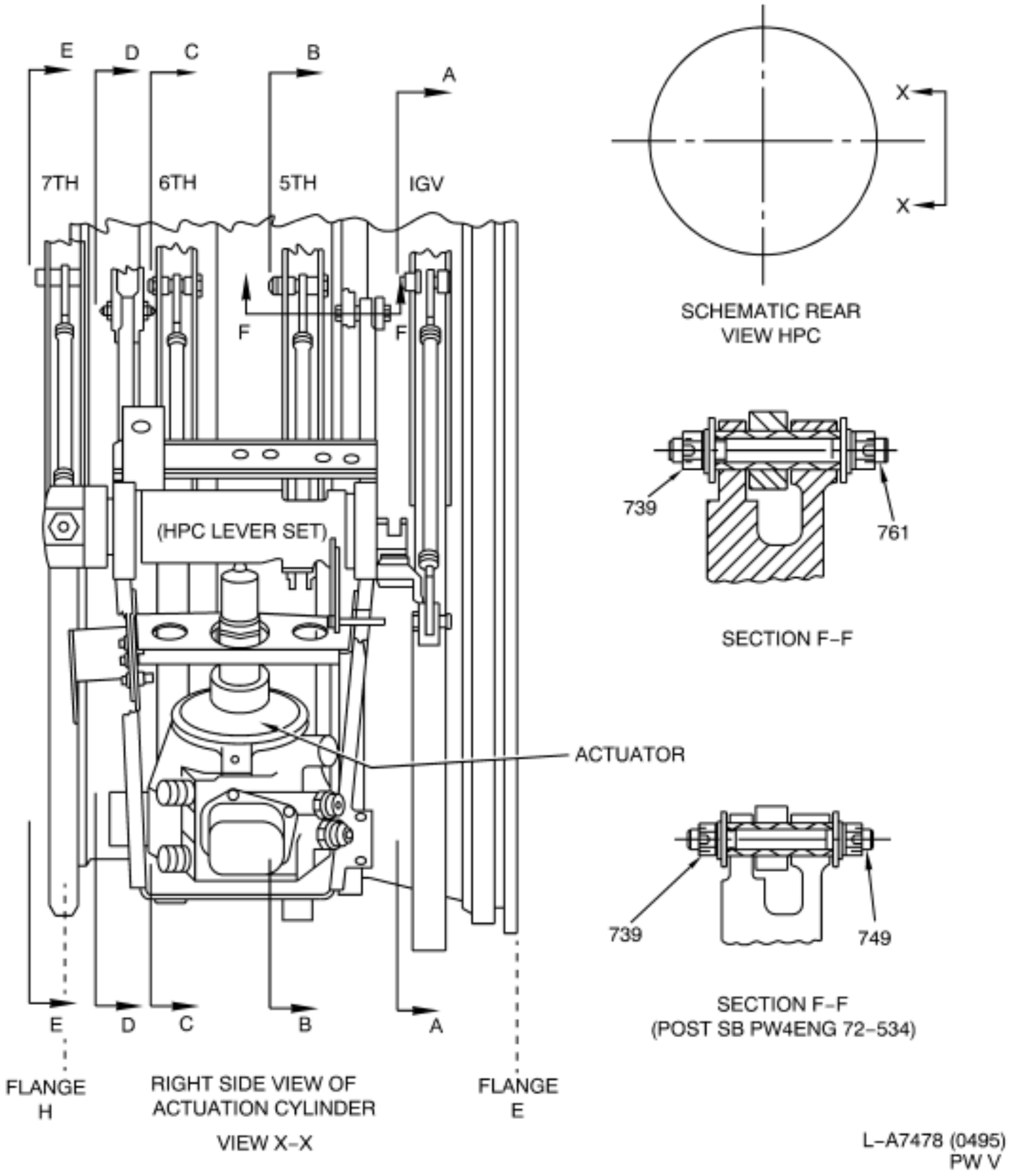


SECTION G−G
SCHEMATIC REAR VIEW
STAGE 14

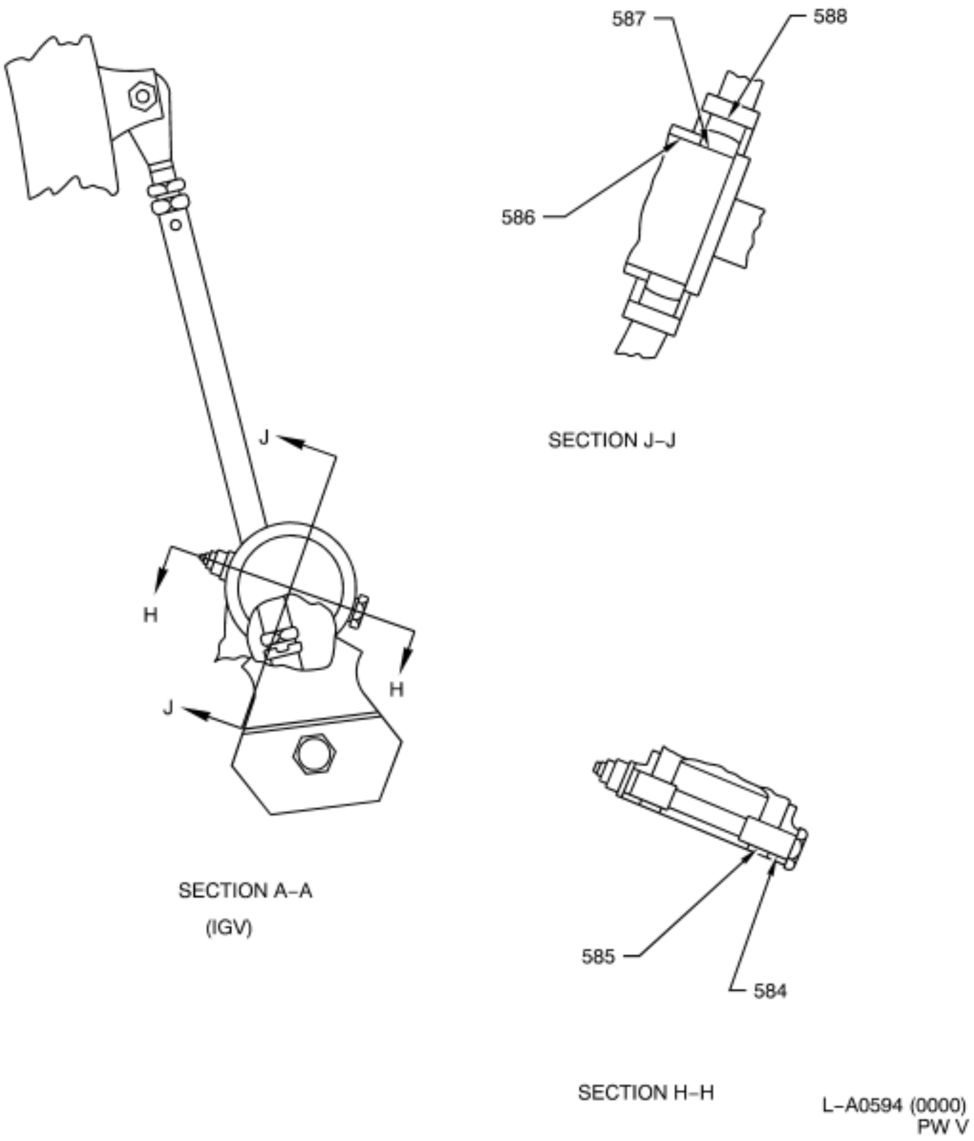
High Pressure Compressor (HPC) (Asymmetric Case Configuration)
Figure 802 (Sheet 14)
(Task 72−35−00−990−011)


IGV−1271
S5−1273
S6−1275
S7−1277
S8−1279
S9−1281
S10−1283
S11−1285
S12−1287
S13−1289
S14−1291
S5−1272
S6−1274
S7−1276
S8−1278
S9−1280
S10−1282
S11−1284
S12−1286
S13−1288
S14−1290
TYPICAL VANE
TYPICAL BLADE
BLADE TIP CLEARANCE
AIRSEAL TO VANE CLEARANCES
R5−1320
R6−1321
R7−1322
R8−1323
R9−1324
R10−1325
R11−1326
R12−1327
R13−1328
R14−1329
R15−1330
STACKING LINE
VIEW P
(HPC, AREA 1) .... IGV, 5, 6, 7
(HPC, AREA 2) 8, 9, 10
(HPC, AREA 3) 11, 12, 13
(HPC, AREA 4) 14, 15
L−D0040 (1002)
PW V

High Pressure Compressor (HPC) (Asymmetric Case Configuration)
Figure 802 (Sheet 15)
(Task 72−35−00−990−011)


E
D
C
B
A
7TH
6TH
5TH
IGV
F
F
(HPC LEVER SET)
ACTUATOR
E
D
C
B
A
FLANGE H
RIGHT SIDE VIEW OF ACTUATION CYLINDER
VIEW X-X
FLANGE E
X
X
SCHEMATIC REAR VIEW HPC
739
761
SECTION F-F
739
749
SECTION F-F (POST SB PW4ENG 72-534)
L-A7478 (0495)
PW V

High Pressure Compressor (HPC)
Figure 803 (Sheet 1)
(Task 72-35-00-990-011)

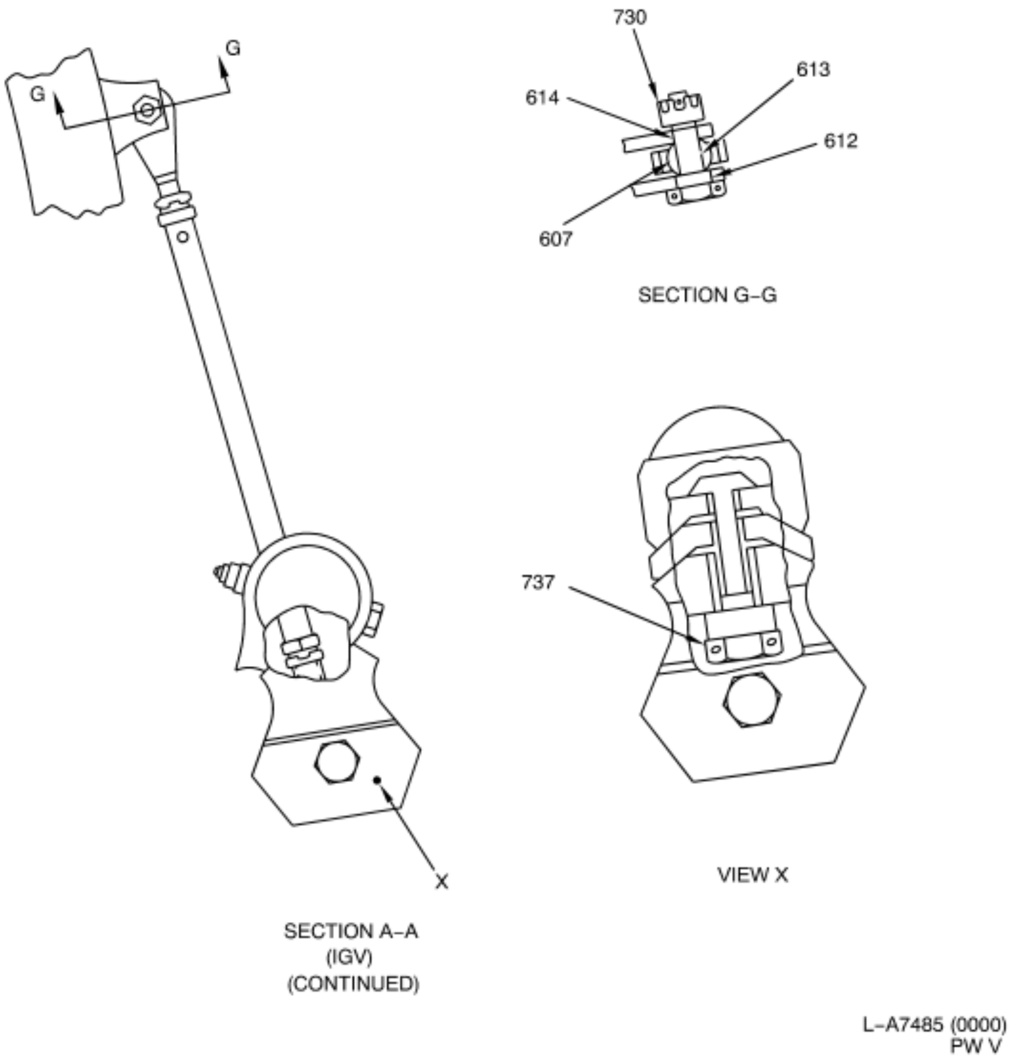

587
588
586
J
J
H
H
585
584
L−A0594 (0000)
PW V

SECTION J−J

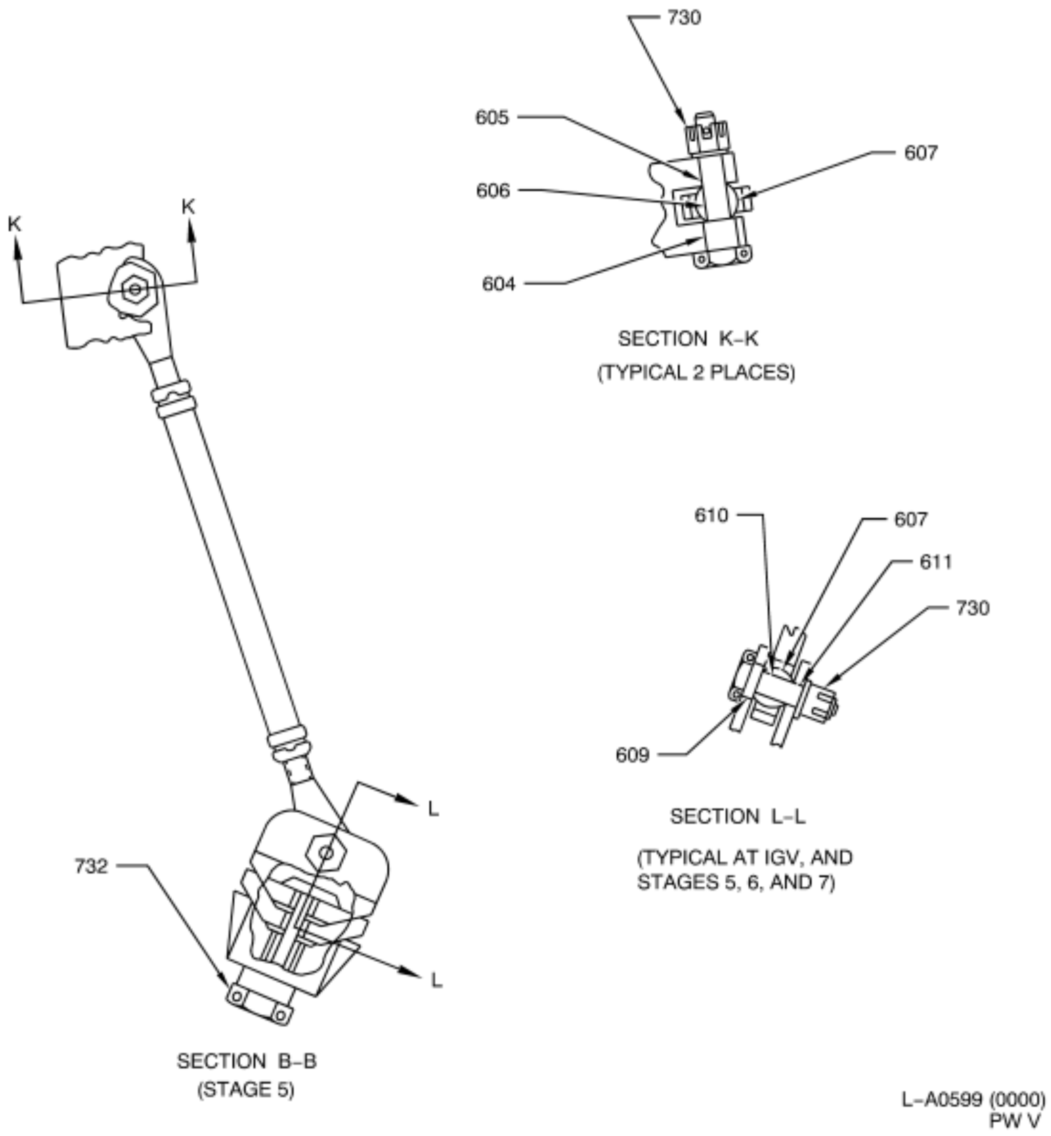
SECTION A−A
(IGV)

SECTION H−H

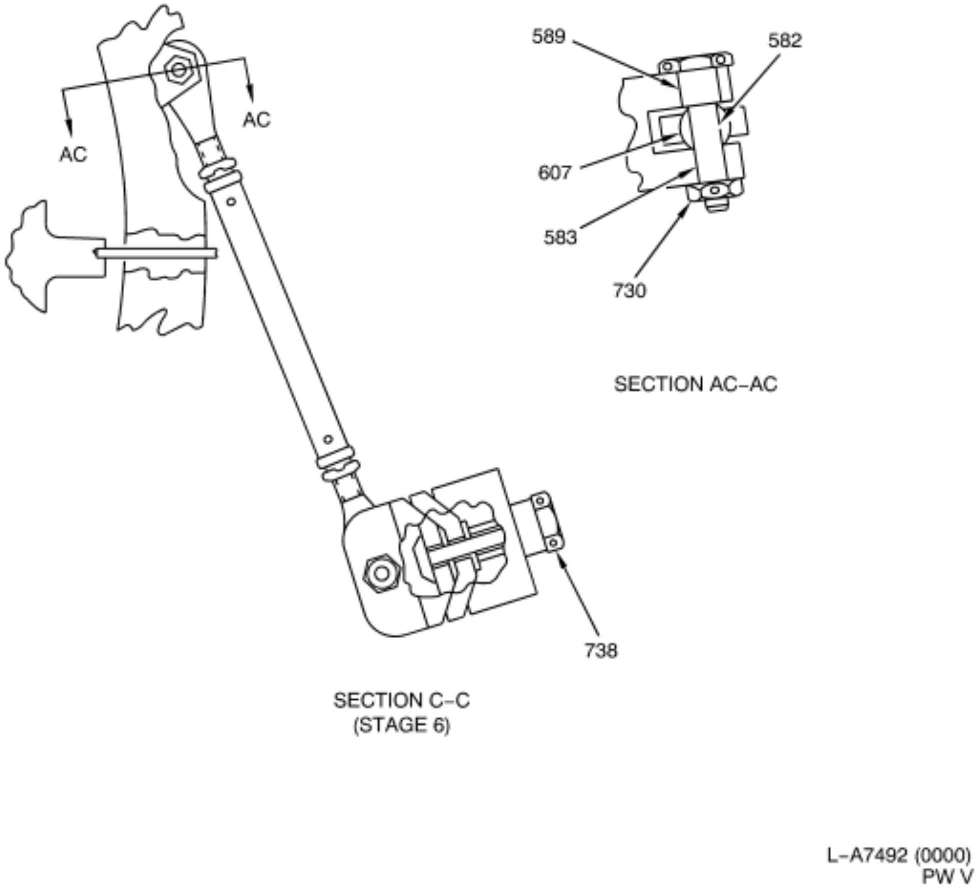
High Pressure Compressor (HPC)
Figure 803 (Sheet 2)
(Task 72−35−00−990−011)


G
G
730
614
613
612
607
SECTION G−G
737
X
VIEW X
SECTION A−A
(IGV)
(CONTINUED)
L−A7485 (0000)
PW V

High Pressure Compressor (HPC)
Figure 803 (Sheet 3)
(Task 72−35−00−990−011)

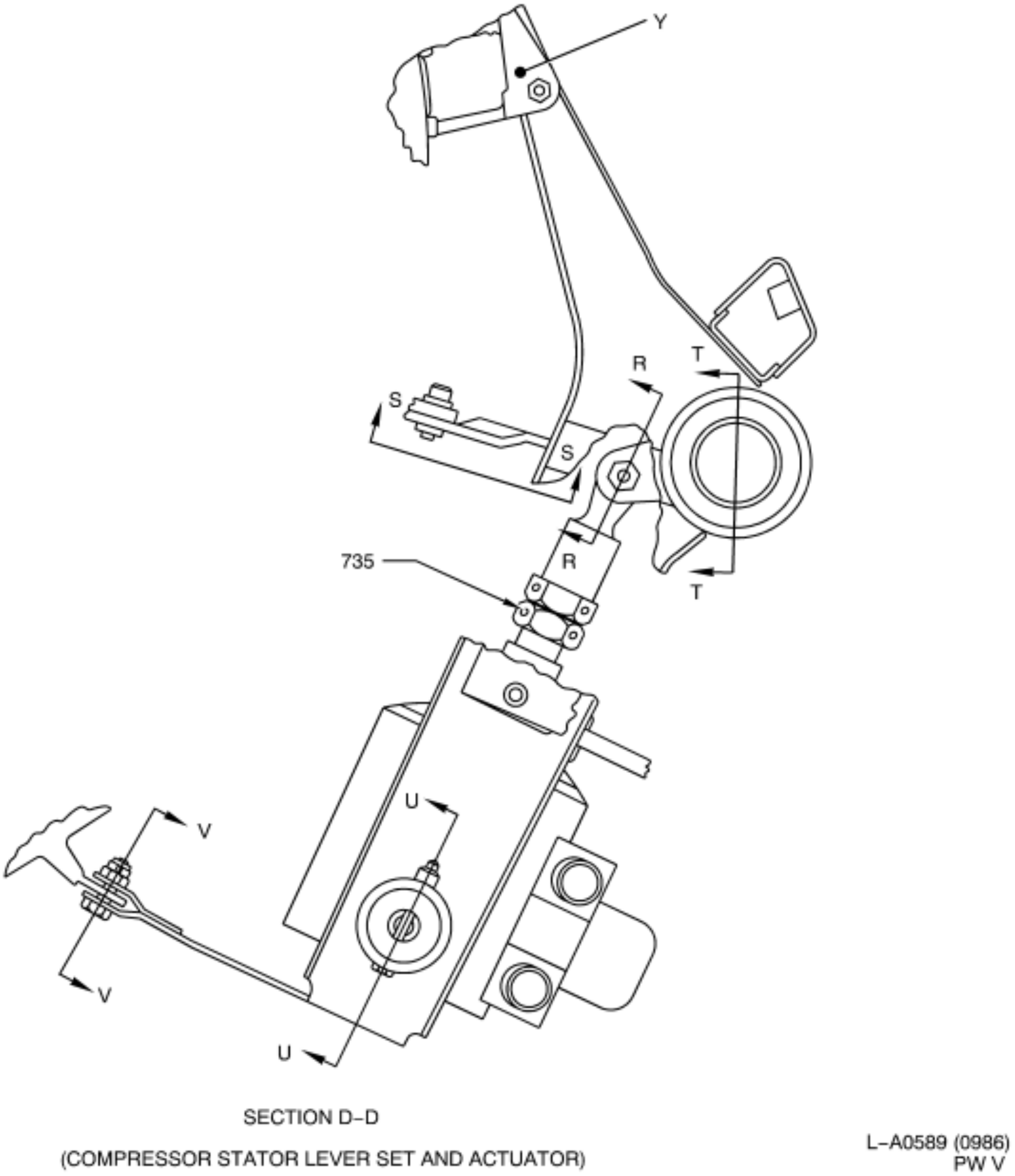

730
605
607
606
604
SECTION K−K
(TYPICAL 2 PLACES)
K
K
610
607
611
730
609
SECTION L−L
(TYPICAL AT IGV, AND STAGES 5, 6, AND 7)
L
732
L
SECTION B−B
(STAGE 5)
L−A0599 (0000)
PW V

High Pressure Compressor (HPC)
Figure 803 (Sheet 4)
(Task 72−35−00−990−011)

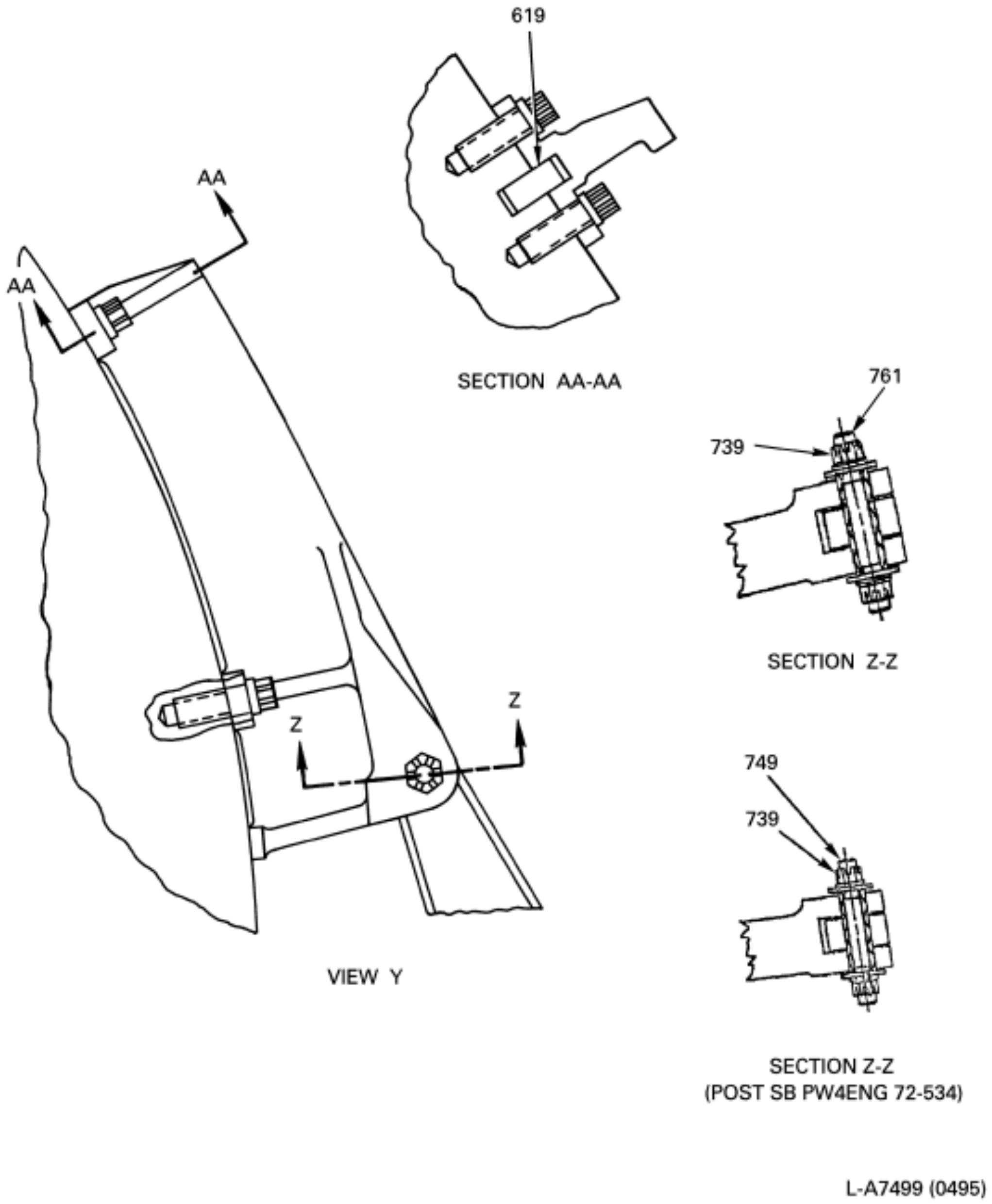

589
582
607
583
730
SECTION AC−AC
AC
AC
738
SECTION C−C
(STAGE 6)
L−A7492 (0000)
PW V

High Pressure Compressor (HPC)
Figure 803 (Sheet 5)
(Task 72−35−00−990−011)

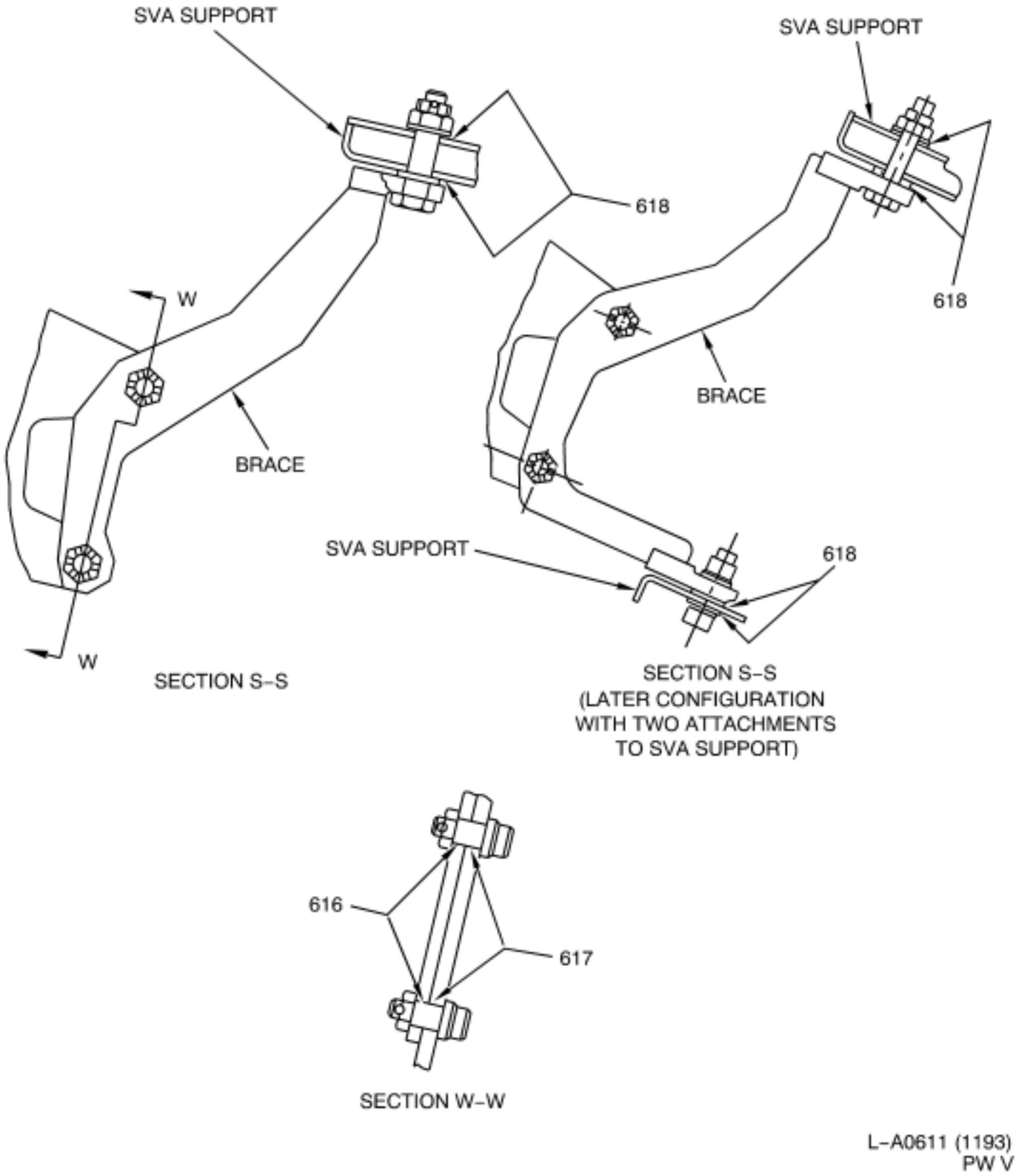
HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04


Y
R
T
S
S
735
R
T
U
V
V
U
SECTION D−D
(COMPRESSOR STATOR LEVER SET AND ACTUATOR)
L−A0589 (0986)
PW V

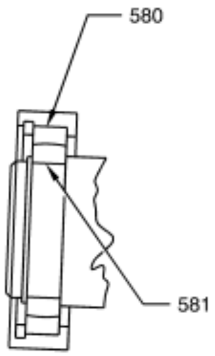
High Pressure Compressor (HPC)
Figure 803 (Sheet 6)
(Task 72−35−00−990−011)


619
SECTION AA-AA
AA
AA
761
739
SECTION Z-Z
Z
Z
VIEW Y
749
739
SECTION Z-Z
(POST SB PW4ENG 72-534)
L-A7499 (0495)

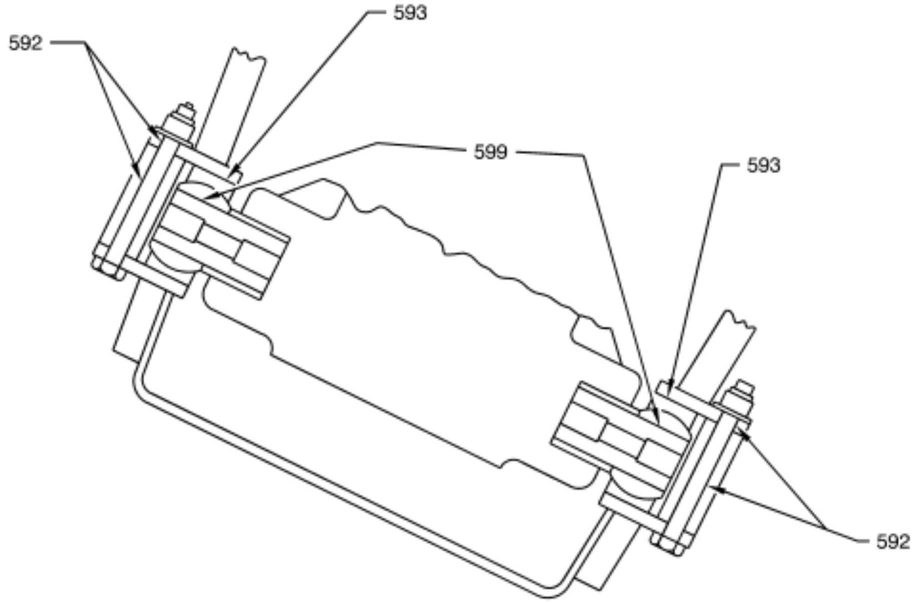
High Pressure Compressor (HPC)
Figure 803 (Sheet 7)
(Task 72−35−00−990−011)


SVA SUPPORT
618
W
BRACE
W
SECTION S−S
SVA SUPPORT
618
BRACE
SVA SUPPORT
618
SECTION S−S
(LATER CONFIGURATION
WITH TWO ATTACHMENTS
TO SVA SUPPORT)
616
617
SECTION W−W
L−A0611 (1193)
PW V

High Pressure Compressor (HPC)
Figure 803 (Sheet 8)
(Task 72−35−00−990−011)



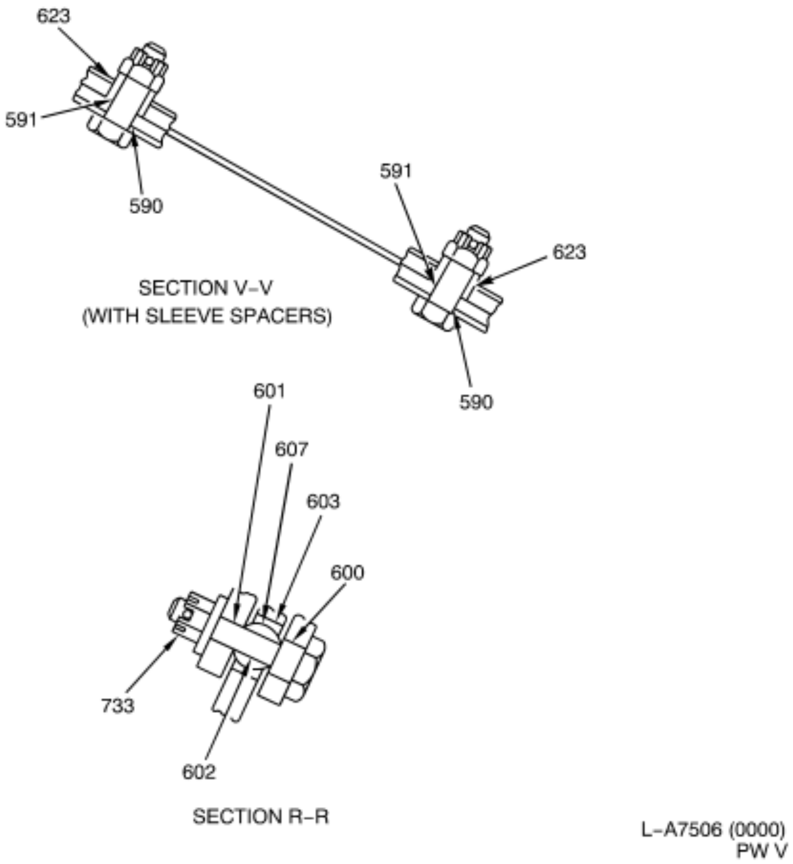
SECTION T−T


593
592
599
593
592

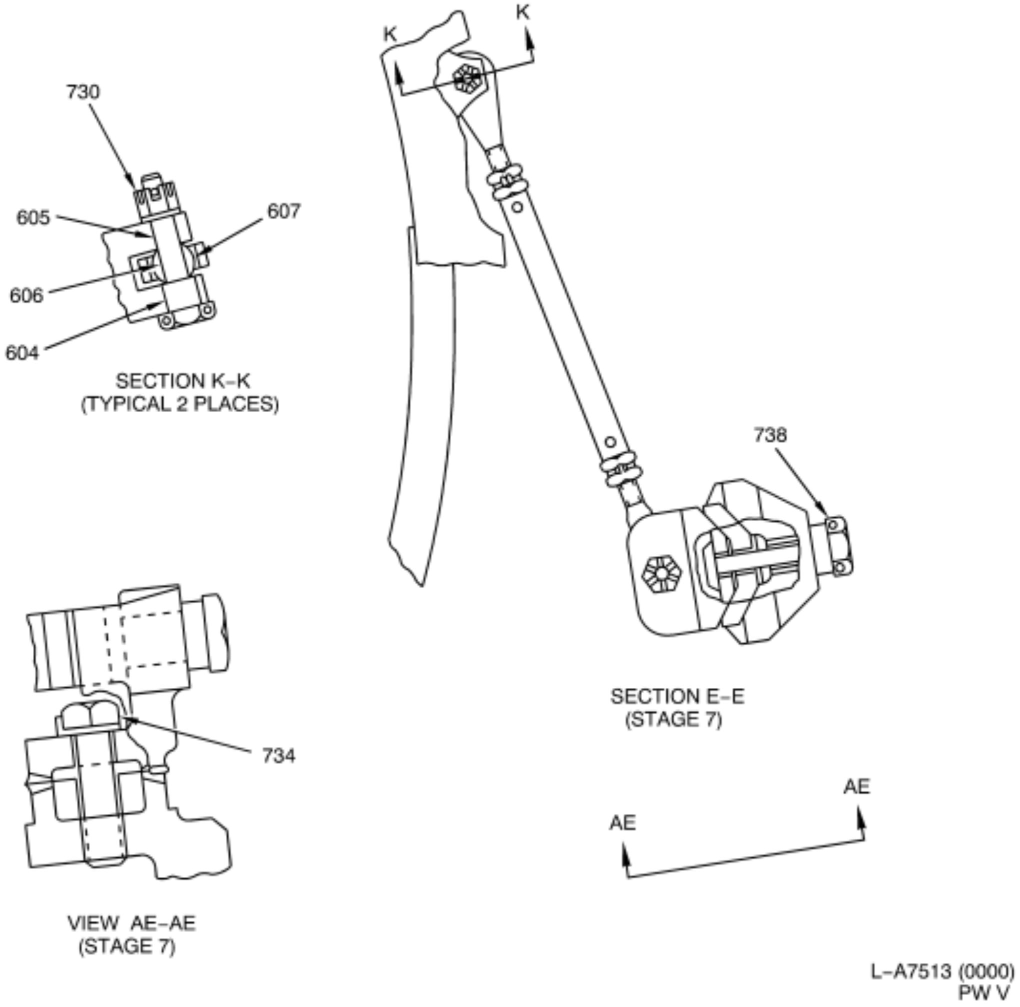
SECTION U−U

L−A0617 (0000)
PW V

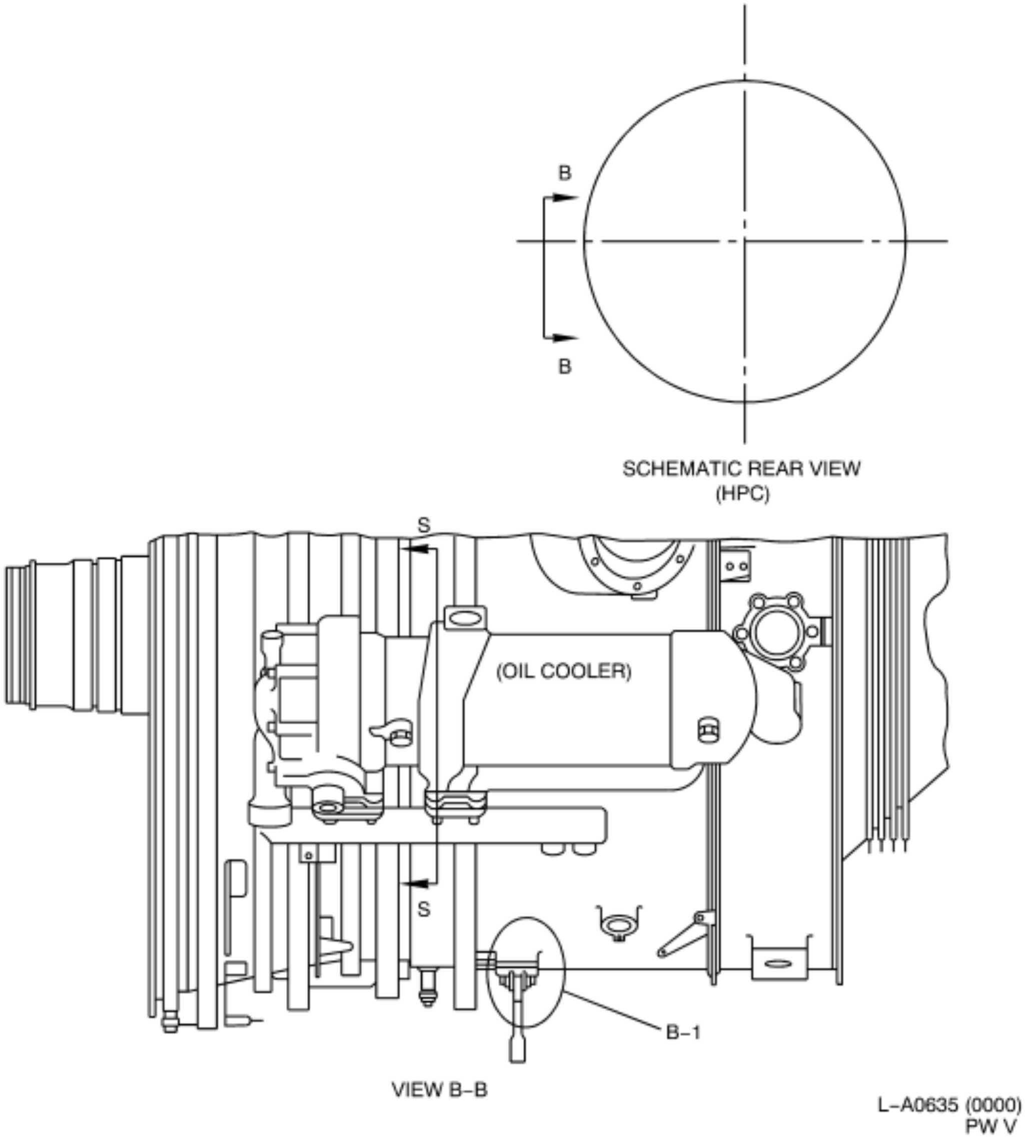
High Pressure Compressor (HPC)
Figure 803 (Sheet 9)
(Task 72−35−00−990−011)


623
591
590
591
623
590
SECTION V−V
(WITH SLEEVE SPACERS)
601
607
603
600
733
602
SECTION R−R
L−A7506 (0000)
PW V

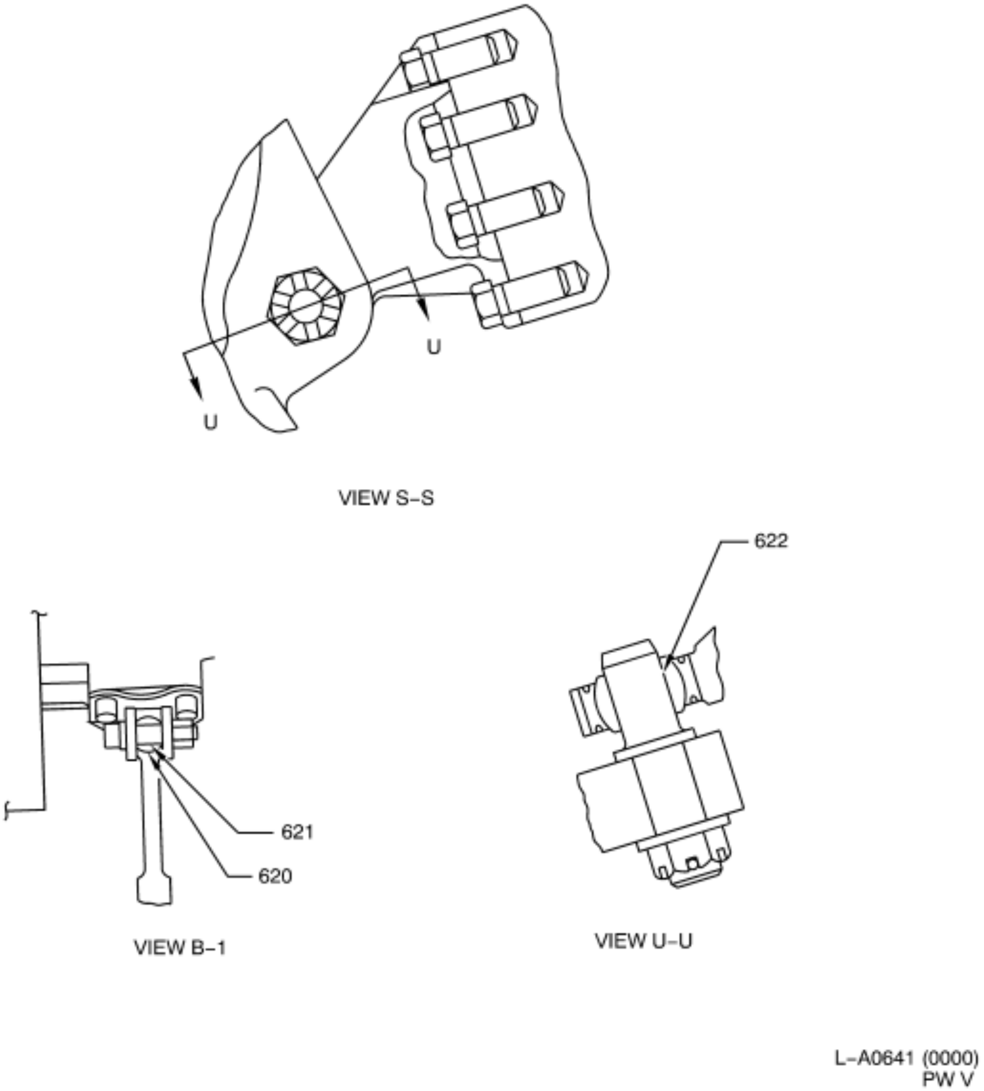
High Pressure Compressor (HPC)
Figure 803 (Sheet 10)
(Task 72−35−00−990−011)


K
K
730
605
607
606
604
SECTION K−K
(TYPICAL 2 PLACES)
738
SECTION E−E
(STAGE 7)
734
AE
AE
VIEW AE−AE
(STAGE 7)
L−A7513 (0000)
PW V

High Pressure Compressor (HPC)
Figure 803 (Sheet 11)
(Task 72−35−00−990−011)

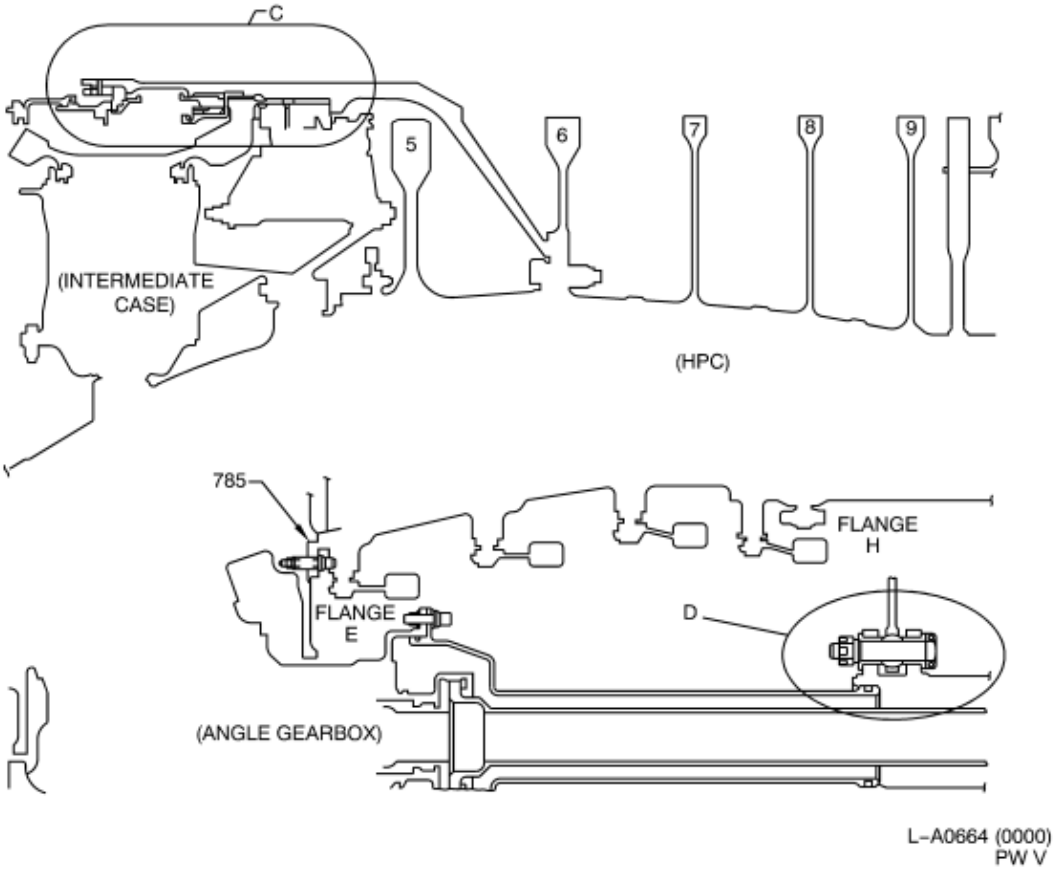

B
B
SCHEMATIC REAR VIEW
(HPC)
S
(OIL COOLER)
S
B−1
VIEW B−B
L−A0635 (0000)
PW V

High Pressure Compressor (HPC)
Figure 804 (Sheet 1)
(Task 72−35−00−990−011)

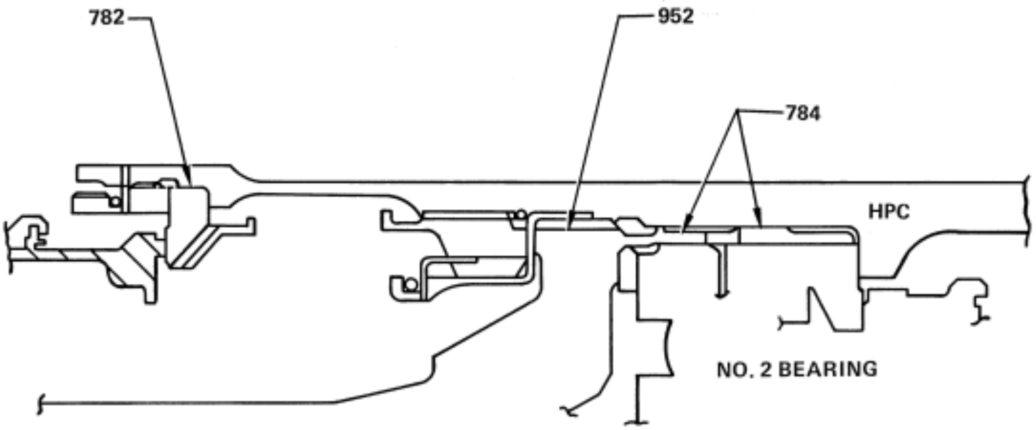

U
U
VIEW S−S
622
621
620
VIEW B−1
VIEW U−U
L−A0641 (0000)
PW V

High Pressure Compressor (HPC)
Figure 804 (Sheet 2)
(Task 72−35−00−990−011)

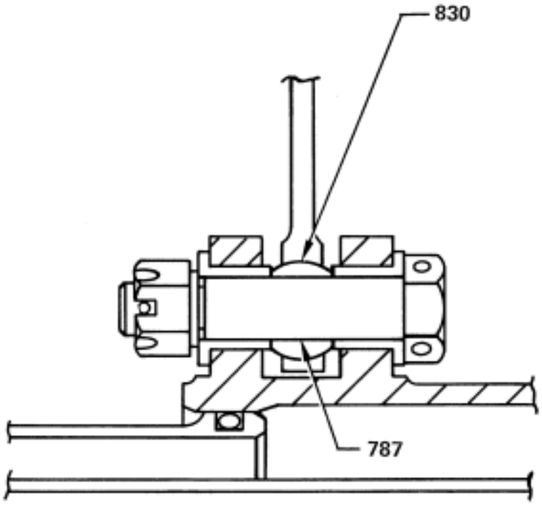
HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04


C
5
6
7
8
9
(INTERMEDIATE CASE)
(HPC)
785
FLANGE H
FLANGE E
D
(ANGLE GEARBOX)
L−A0664 (0000)
PW V

High Pressure Compressor (HPC)
Figure 805 (Sheet 1)
(Task 72−35−00−990−011)


782
952
784
HPC
NO. 2 BEARING

VIEW C

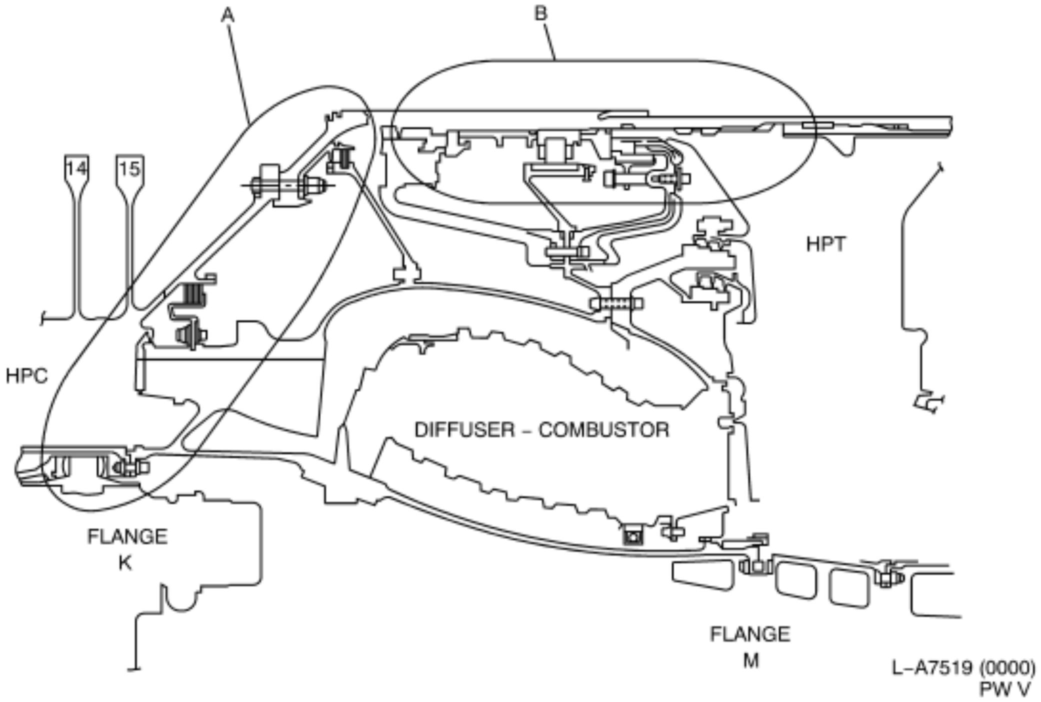

830
787

VIEW D

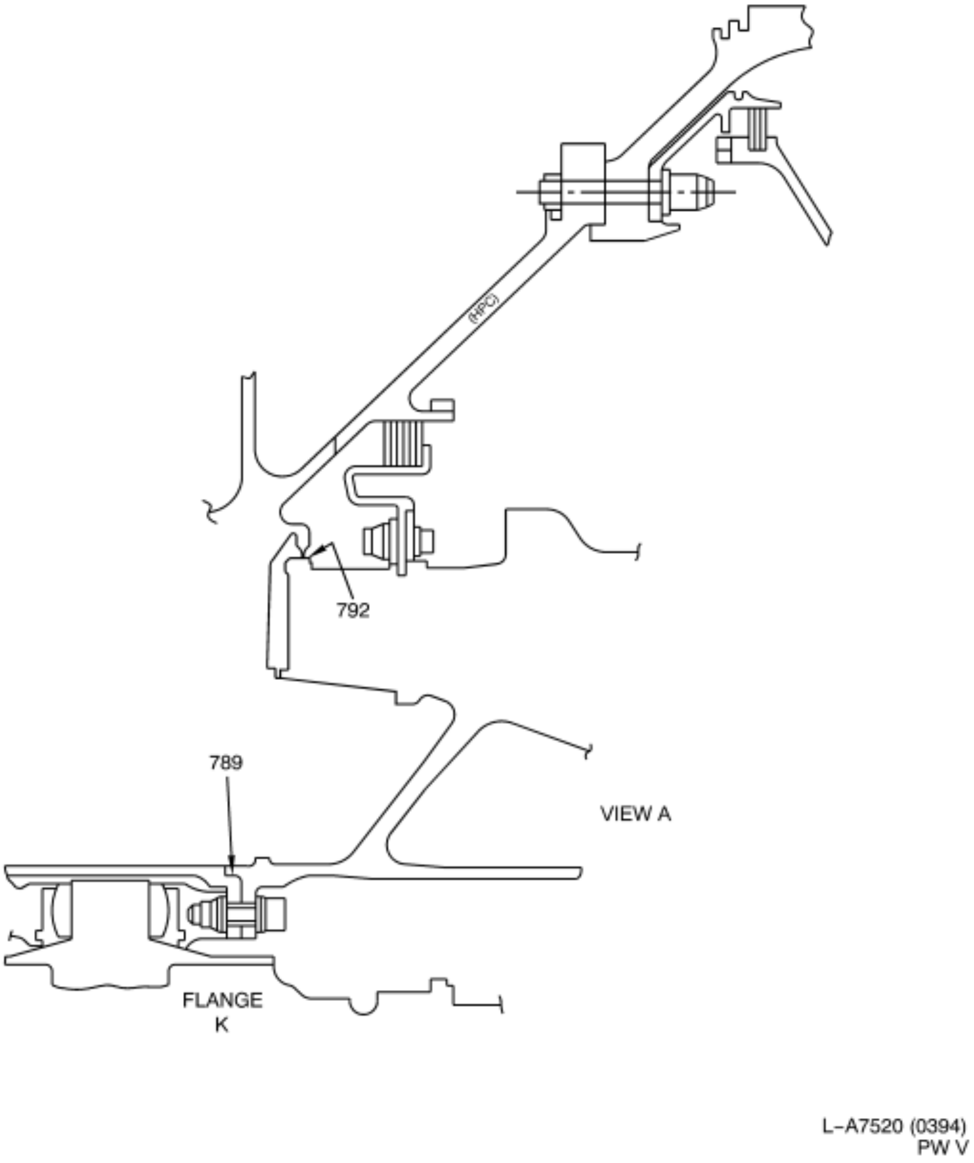
L−A0590

High Pressure Compressor (HPC)
Figure 805 (Sheet 2)
(Task 72−35−00−990−011)

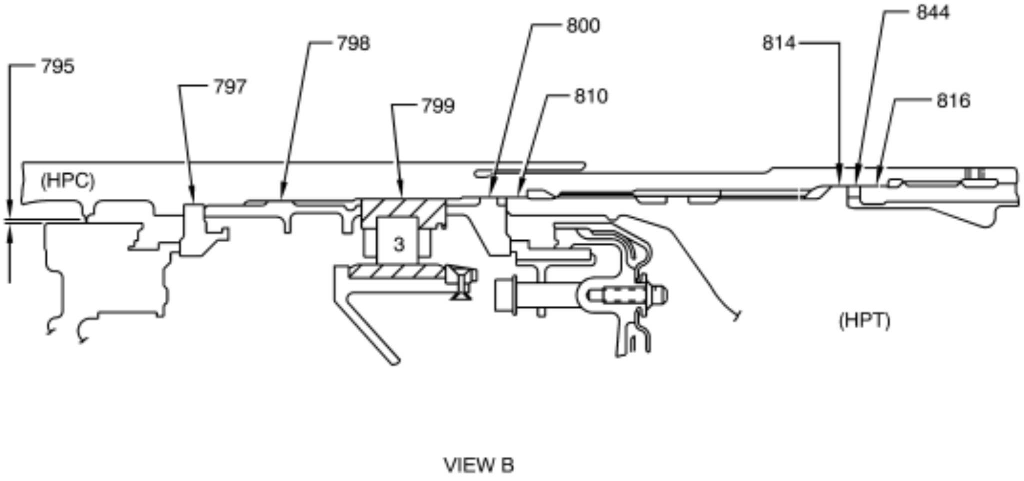
HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−04


A
B
14
15
HPC
HPT
DIFFUSER − COMBUSTOR
FLANGE
K
FLANGE
M
L−A7519 (0000)
PW V

High Pressure Compressor (HPC)
Figure 806 (Sheet 1)
(Task 72−35−00−990−011)

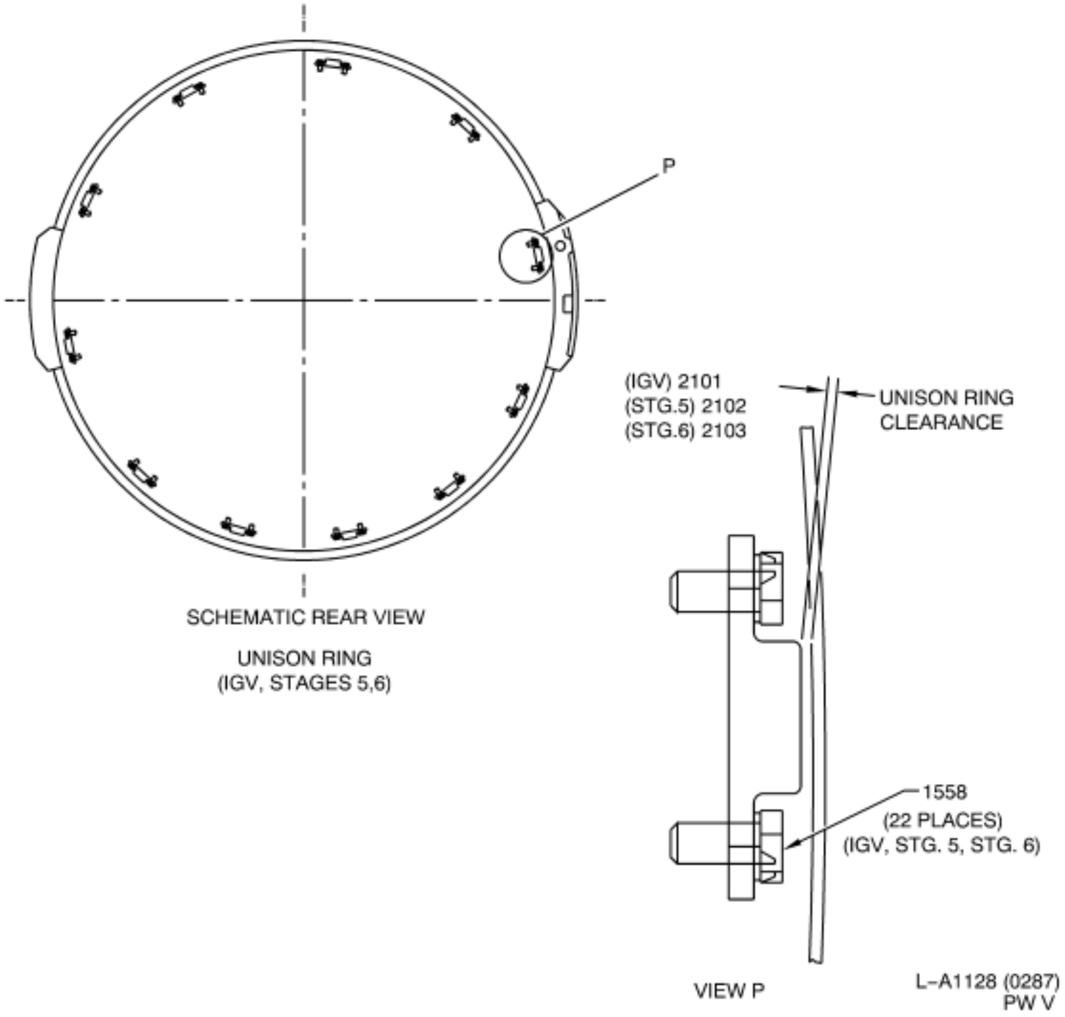

(HPC)
792
789
VIEW A
FLANGE K
L−A7520 (0394)
PW V

High Pressure Compressor (HPC)
Figure 806 (Sheet 2)
(Task 72−35−00−990−011)

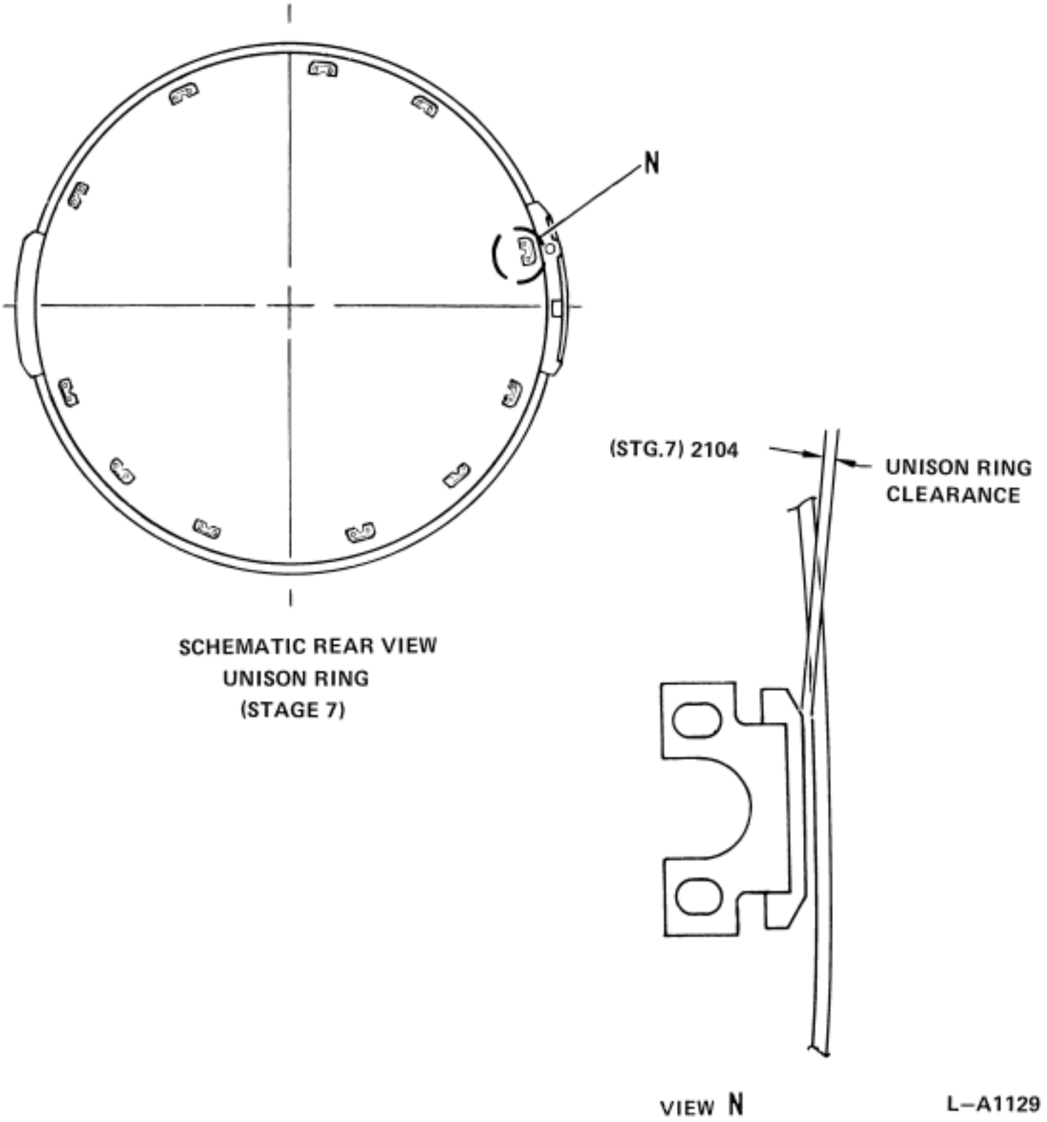

844
814
800
798
795
810
816
797
799
(HPC)
3
(HPT)
VIEW B

L−A0658 (0599)
PW V

High Pressure Compressor (HPC)
Figure 806 (Sheet 3)
(Task 72−35−00−990−011)


P
SCHEMATIC REAR VIEW
UNISON RING
(IGV, STAGES 5,6)
(IGV) 2101
(STG.5) 2102
(STG.6) 2103
UNISON RING
CLEARANCE
1558
(22 PLACES)
(IGV, STG. 5, STG. 6)
VIEW P
L-A1128 (0287)
PW V

High Pressure Compressor (HPC)
Figure 807 (Sheet 1)
(Task 72-35-00-990-011)


N
SCHEMATIC REAR VIEW
UNISON RING
(STAGE 7)
(STG.7) 2104
UNISON RING
CLEARANCE
VIEW N
L-A1129

High Pressure Compressor (HPC)
Figure 807 (Sheet 2)
(Task 72-35-00-990-011)

Previous Pageblock   Return to Previous Menu   Next Pageblock

HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-05

Task 72-35-00-200-005:

1. Functional Check Inspection - Blade Tip Clearance Evaluation - High Pressure Compressor

A. Purpose

(1) The purpose of this procedure is to control HPC blade tip clearances during the build of an HPC module so as to maintain an adequate surge margin and to ensure good compressor stability as well as good engine performance.

B. Equipment And Materials Required

Special Tools:
PWA 86668 HPC Stator Fixture (Optional)

C. General

(1) Blade Tip Clearance = (Rubstrip ID - Rotor OD)/2

(a) Blade Tip Clearance: This refers not only to average blade tip clearance but to local min-max clearance limits as well.

1 Calculate average blade tip clearances by Procedure E.(3)(a), below, using the measurements from Procedure E.(1) and E.(2), below. See 72-35-00, Inspection/ Check-04 (Task 72-35-00-990-001), Reference Numbers 1320 through 1330 for average blade tip clearance limits.

2 Calculate local min-max blade tip clearances by Procedure E.(3)(b), below using the measurements from Procedure E.(1) and E.(2), below.

(b) Rubstrip ID: This measurement requires pre-assembly of the HPC static structure (stators and cases). Measure Stages 5 through 15 rubstrips by Procedure E.(1), below.

(CONTINUED)

(c) Rotor OD: There are three alternatives for making these measurements as follows:

1 Alternative number one measures overall rotor diameters (rotor disks with blades) and depends on the availability of high−speed, rotor lade tip grinding machines that utilize dynamic laser optical probe measurement techniques. Measure by Procedure E.(2)(a), below.

2 Alternatives two and three both involve separate measurement of rotor disk Z−Plane diameters and blade lengths. These are then combined to obtain the rotor blade tip diameter for each each stage. Measure by Procedures E.(2)(b) and E.(2)(c), below.

(2) The following conditions are permitted.

(a) One (1) stage within the 5th through 8th stage can be up to +0.005 inch (0.127 mm) over maximum average clearance at assembly and/or maximum local limits at assembly. See 72−35−00, Inspection/ Check−04 Task 72−35−00−990−001, Reference Numbers 1320 through 1323.

(b) One (1) stage within the 9th through 12th stage can be up to +0.005 inch (0.127 mm) over maximum average clearance at assembly and/or maximum local limits at assembly. See 72−35−00, Inspection/ Check−04 Task 72−35−00−990−001, Reference Numbers 1324 through 1327.

D. Prerequisites

(1) Ensure that all rubstrips in a given stage have the same serial number since these segments are originally manufactured as a matched set.

(2) Ensure that the correct stator to HPC inner rear case interchangeability requirements are followed as defined in SB PW4ENG 72-229, SB PW4ENG 72-396 and SB PW4ENG 72-403.

(3) Rubstrips should be inspected for wear and damage in the blade tip rub area and reused only if the parts meet Engine CIR Manual limits. New or repaired parts should be used as necessary to ensure the optimum blade tip clearance at final assembly.

(4) All other dimensional and visual inspection requirements for stators, as specified in the Engine CIR Manual, should be followed, including those for localized wear near stator segment split lines.

(5) Ensure that all other HPC static structure parts are inspected and meet Engine CIR Manual limits prior to reuse in a repaired HPC.

(6) Ensure that antigallant is applied to stator segments as specified in 72-35-00, Assembly-01 (Task 72-35-00-400-001).

(7) Ensure that the proper seating of the compressor static structure is achieved, for SB PW4ENG 72-229 rotor stator assemblies only, by taking the drop dimension defined in 72-35-00, Assembly-01 Task 72-35-00-400-001.

(8) Ensure that there is no intermixing, within a stage, of Pre SB PW4ENG 72-395 blades (blade tips not coated with aluminum oxide) with Post SB PW4ENG 72-395 blades (blade tips coated with aluminum oxide).

(9) When mating rubstrips and/or supporting stator structure have been refurbished or replaced to EM limits, all blades in affected Stages 9 through 15, should have aluminum oxide tips and blade lengths must meet EM limits.

(10) When all blades are replaced, blades in Stages 9 through 15 should have aluminum oxide tips and blade lengths must meet EM limits.

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−05

(11) When replacing more than ten blades in a stage, the replacement blades cannot vary in length more than ±0.004 inch (±0.102 mm) from the average length of all existing blades in the stage.

(12) When ten or less blades are replaced in a stage the replacement blades cannot vary more than ±0.004 inch (±0.102 mm) from the average length of at least ten existing blades in the stage.

(13) If all blades in a stage are not being replaced, replacement blades must be approximately evenly spaced around the disk.

E. Procedure
See Figure 801.

(1) Rubstrip ID measurements:

(a) Measure rubstrip diameters for HPC Stages 5, 6 and 7 as installed in the HPC front case. Refer to dimensional inspection, 72−35−40, Inspection/Check−04 in the PW4000 Series CIR, PN 51A357.

(b) Measure the rubstrip diameters for Stages 8 through 15, as pre−assembled in the static structure (stators and cases). Refer to 72−35−00, Assembly−05 (Task 72−35−00−400−005). Use of PWA 86668 HPC Stator Fixture provides an accurate measurement of the rubstrip diameters by clamping the HPC rear stators axially forward in the HPC rear case. This more accurately simulates the stator running positions.

(c) Rubstrip diameters must be measured at the axial gage point for each stage. Refer to Table 801 as applicable for the axial location of gage points for each stage, measured from H−Flange front face (Surface G). See Figure 802.

(d) Two alternative methods are acceptable for making these measurements: the preferred method, when maintenance shops have the equipment available, is to use coordinate measuring machine (CMM) equipment.

(e) When CMM equipment is not available, use measurement gage tooling, similar to that referenced in 72−35−00, Assembly−05 (Task 72−35−00−400−005). For each stage, measure diameters at a minimum of sixteen (16) angular positions.

(2) Rotor OD measurements: there are three acceptable methods for measuring rotor OD, as follows:

(a) The preferred method, when maintenance shops have the equipment available, measures overall rotor diameters (rotor disks with blades) on high−speed, rotor blade tip grinding machines that utilize dynamic laser optical probe measurement techniques. See Table 802 for the axial location of gage points, relative to the No. 2 bearing rear seal seat (Plane CF) on the HPC front hub for the measurement of rotor blade tip diameters. See Figure 803.

(b) The second method is recommended when a high−speed, rotor blade tip grinding machine, with a dynamic laser optical probe, is not available. This involves separate measurement of blade lengths and rotor disk Z−Plane diameters. Z−Plane diameters are obtained by measurement across gage blocks that fit into disk blade slots. Refer to Table 803 for references to these measurements. Blade lengths are measured with special tooling at each blade dimensional inspection. Refer to Table 804 for these inspections. Combine blade lengths and Z−Plane diameters as follows to obtain rotor blade tip diameters.

Rotor OD = Z−Plane Diameter +
2 (Average Blade Length)

(c) The third method is similar to the second method, above, except that, instead of using a measured value for Z−Plane diameter, it uses the "nominal" blueprint Z−Plane diameter. This is an acceptable method, at least for an interim period, until Z−Plane measurement tooling is available. Refer to Table 803 for references to these measurements.

(3) Use the above measurements of rubstrip ID and rotor OD to calculate average and local min−max blade tip clearances for each stage as follows:

(a) Average Blade Tip Clearance = (Average Rubstrip ID − Average Rotor OD)/2. Compare the calculated values with the blade tip clearance limits specified in the Table Of Limits, 72−35−00, Inspection/Check−04 (Task 72−35−00−990−001), Reference Numbers 1320 through 1330. To enhance good stability experience, the individual stage average tip clearances for Stages 13 through 15 must conform to the Table of Limits Reference Numbers 1328 through 1330 values, respectively.

(b) Local Minimum Blade Tip Clearance =
(Minimum Rubstrip ID − Maximum Rotor OD)/2
Local Maximum Blade Tip Clearance =
(Maximum Rubstrip ID − Minimum Rotor OD)/2

(c) If minimum tip clearances are not met, it is permissible to use PWA 86668 HPC Stator Fixture to retain the rear stators in the outer case while skim cutting (local machining) the rubstrip(s) to remove the tight areas and meet the minimum average and minimum local tip clearances. If necessary, skim cut the rubstrips by 72−35−00, Repair−01 (Task 72−35−00−300−001).

Stage	Distance From H−Flange* (Surface G)	Chapter/Section	Task Number
8	0.223 inch (5.664 mm)	72−35−59, Inspection/Check−04	72−35−59−200−004
9	3.124 inch (79.350 mm)	72−35−59, Inspection/Check−04	72−35−59−200−004
10	5.869 inch (149.073 mm)	72−35−60, Inspection/Check−04	72−35−60−200−004
11	8.277 inch (210.236 mm)	72−35−60, Inspection/Check−04	72−35−60−200−004
12	10.627 inch (269.926 mm)	72−35−61, Inspection/Check−04	72−35−61−200−004
13	13.058 inch (331.673 mm)	72−35−61, Inspection/Check−04	72−35−61−200−004
14	15.243 inch (387.172 mm)	72−35−62, Inspection/Check−04	72−35−62−200−004
15	17.398 inch (441.909 mm)	72−35−62, Inspection/Check−04	72−35−62−200−004

*NOTE: Surface G is the front face of H−Flange, which is the front flange of the HPC (outer) rear case assembly.

Rubstrip Axial Gage Point Locations
Table 801

HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−05

Stage	Axial Distance From No. 2 Bearing Rear Seal Seat Face (Plane CF)
5	2.487 inch (63.170 mm)
6	6.991 inch (177.571 mm)
7	10.840 inch (275.336 mm)
8	14.356 inch (364.642 mm)
9	17.257 inch (438.328 mm)
10	20.002 inch (508.051 mm)
11	22.410 inch (569.214 mm)
12	24.760 inch (628.904 mm)
13	27.191 inch (690.651 mm)
14	29.376 inch (746.150 mm)
15	31.531 inch (800.887 mm)

Rotor Blade Tip Axial Gage Point Locations
Table 802

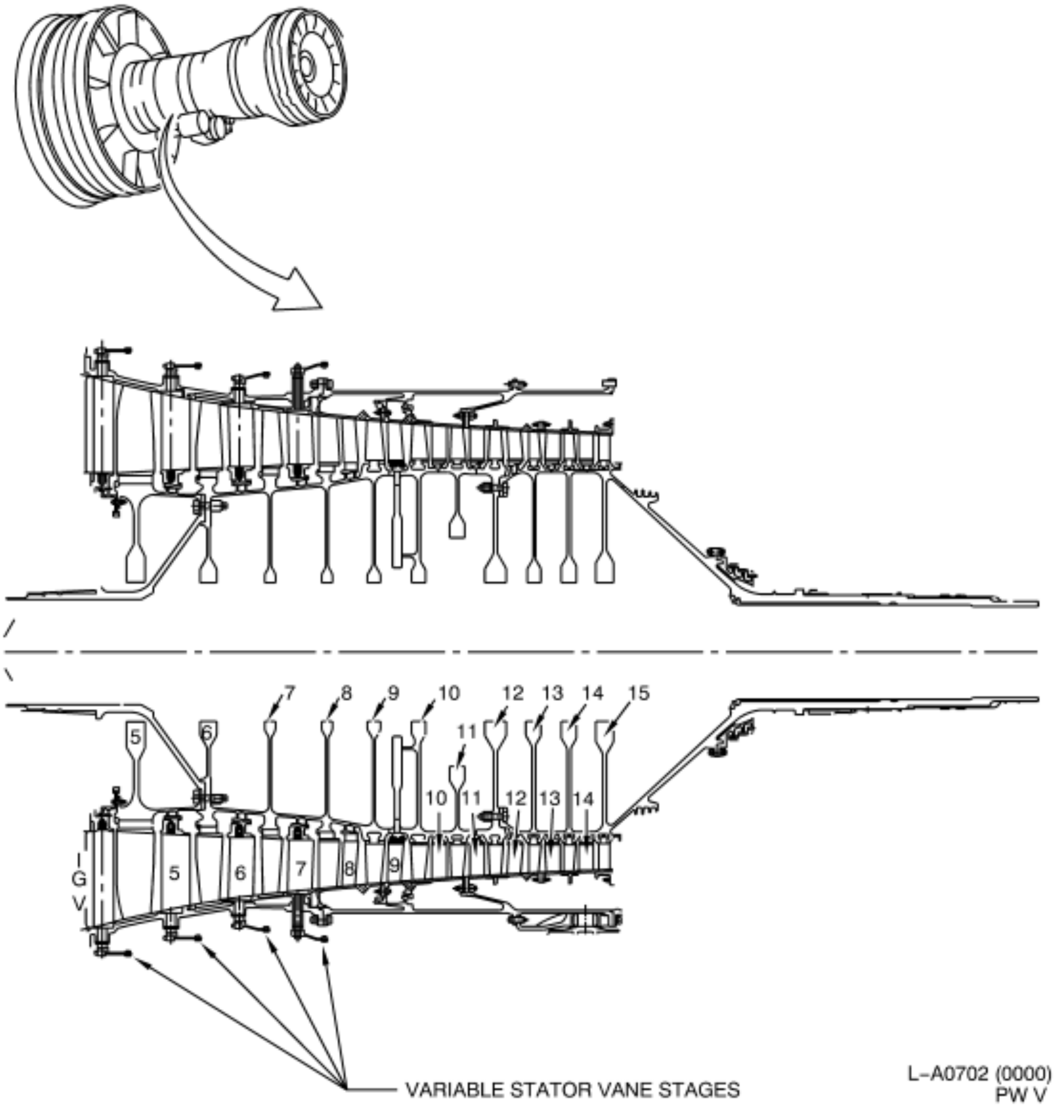
Stage	Chapter/Section	Task Number
5	72−35−37, Assembly−01	72−35−37−400−001
6 thru 12	72−35−38, Assembly−01	72−35−38−400−001
13, 14 & 15	72−35−39, Assembly−02	72−35−39−400−002

Rotor Disk Z−Plane Diameter Measurements
Table 803

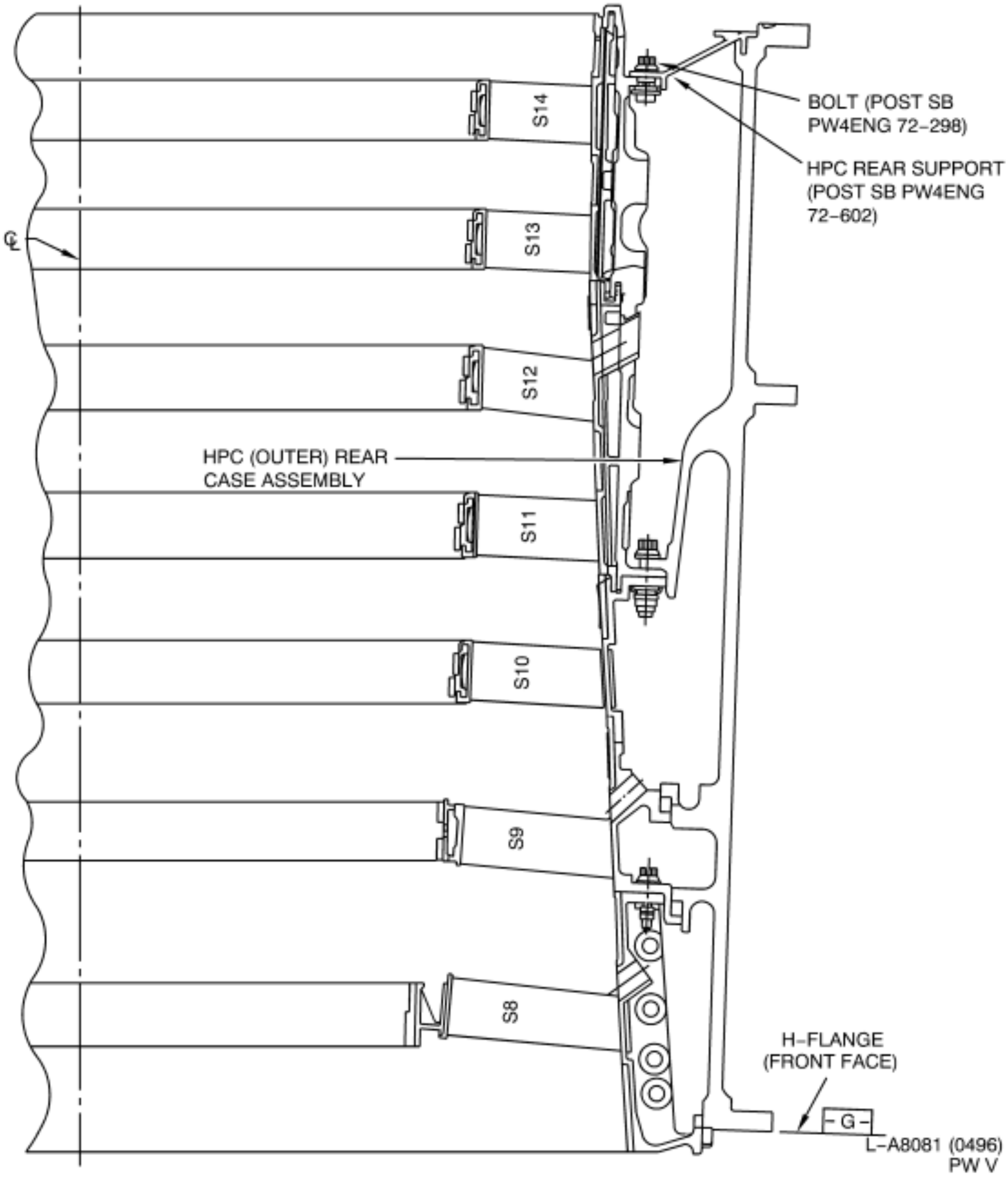
HIGH PRESSURE COMPRESSOR (HPC) − INSPECTION/CHECK−05

Stage	Chapter/Section	Task Number
5	72−35−11, Inspection/Check−04	72−35−11−200−004
6	72−35−12, Inspection/Check−04	72−35−12−200−004
7	72−35−13, Inspection/Check−04	72−35−13−200−004
8	72−35−14, Inspection/Check−04	72−35−14−200−004
9	72−35−15, Inspection/Check−04	72−35−15−200−004
10	72−35−16, Inspection/Check−04	72−35−16−200−004
11	72−35−17, Inspection/Check−04	72−35−17−200−004
12	72−35−18, Inspection/Check−04	72−35−18−200−004
13	72−35−19, Inspection/Check−04	72−35−19−200−004
14	72−35−20, Inspection/Check−04	72−35−20−200−004
15	72−35−21, Inspection/Check−04	72−35−21−200−004

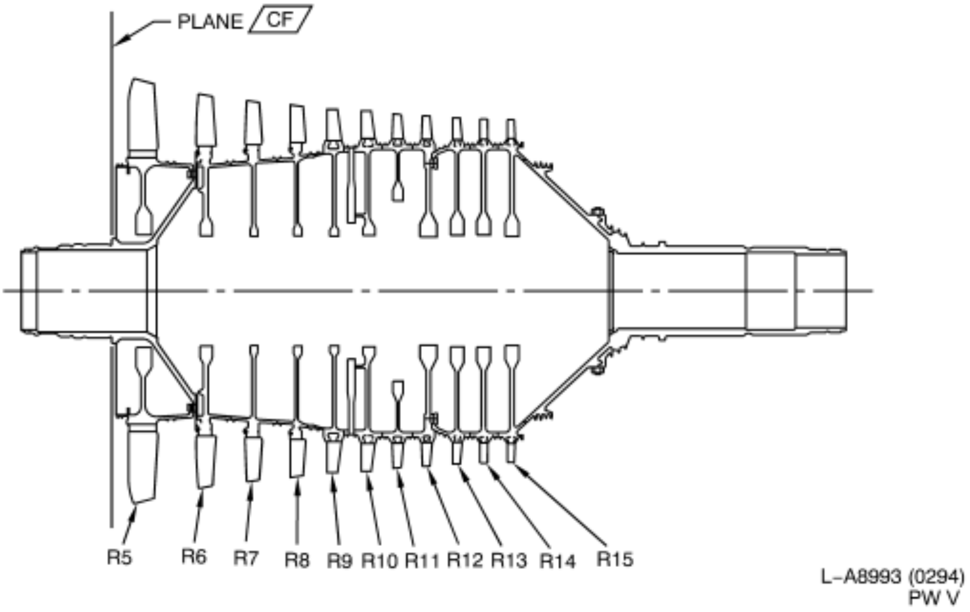
Blade Length Dimensional Inspections
Table 804


7
8
9
10
11
12
13
14
15
5
6
10
11
12
13
14
I
G
V
5
6
7
8
9
VARIABLE STATOR VANE STAGES
L−A0702 (0000)
PW V

Blade Tip Clearance Evaluation − HPC
Figure 801
(Task 72−35−00−200−005)


BOLT (POST SB PW4ENG 72−298)
HPC REAR SUPPORT (POST SB PW4ENG 72−602)
℄
S14
S13
S12
HPC (OUTER) REAR CASE ASSEMBLY
S11
S10
S9
S8
H−FLANGE (FRONT FACE)
G
L−A8081 (0496)
PW V

Blade Tip Clearance Evaluation − HPC Stators Assembly
Figure 802
(Task 72−35−00−200−005)


PLANE CF
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
L−A8993 (0294)
PW V

Blade Tip Clearance Evaluation − HPC Rotor Assembly
Figure 803
(Task 72−35−00−200−005)

HIGH PRESSURE COMPRESSOR (HPC) - INSPECTION/CHECK-05

Task 72-35-00-990-012:

1. Functional Check Inspection - Blade Tip Clearance Evaluation - High Pressure Compressor (HPC)

A. Purpose

(1) The purpose of this procedure is to control the HPC blade tip clearance during the assembly of the HPC module. Blade tip clearance must be evaluated to make sure the HPC has sufficient surge margin, good stability, and gives good engine performance.

B. Prerequisites

(1) Grind and measure the axial compressor rotor assembly blade tips. Refer to 72-35-01, Assembly-03, CONFIG-2 (Task 72-35-01-440-026).

(2) Pre-assemble the high compressor HPC outer airseal set. Refer to 72-35-04, Assembly-01 (Task 72-35-04-440-001).

(3) Machine and measure the HPC outer airseal set. Refer to 72-35-04, Assembly-02 (Task 72-35-04-440-002).

C. Equipment And Materials Necessary - None

D. Procedure

(1) The axial compressor rotor assembly blade tips were machined and measured in 72-35-01, Assembly-03, CONFIG-2 (Task 72-35-01-440-026). You must have a record that gives the actual measured dimensions, including the average diameter, the minimum local, and maximum local diameter for each stage.

(2) The 5th through 15th stage rubstrip diameters were machined and measured in 72-35-04, Assembly-02 (Task 72-35-04-440-002). You must have a record that gives the actual measured dimensions, including the average diameter, the minimum local and maximum local diameter for each stage.

(3) Calculate the average blade tip clearance for each stage as follows:

(a) Find the average rubstrip diameter.

(b) Find the average rotor outside diameter.

(c) Subtract the average rotor diameter from the average rubstrip diameter.

(d) Divide the remainder by 2 to find the average radial clearance at assembly.

(e) The average clearance at assembly must be within the limits shown in Table 801 for each stage.

Ref. No.	Description	Nominal Clearance	Average Clearance At Assembly Min	Average Clearance At Assembly Max	Local Limits Min	Local Limits Max
1320	Stage 5 HPC Blade (Tip Clearance) Clearance	0.067 (1.702)	0.055 (1.40)	0.074 (1.88)	See NOTE.	
1321	Stage 6 HPC Blade (Tip Clearance) Clearance	0.057 (1.448)	0.050 (1.27)	0.064 (1.63)	See NOTE.	
1322	Stage 7 HPC Blade (Tip Clearance) Clearance	0.060 (1.524)	0.053 (1.35)	0.067 (1.70)	See NOTE.	
1323	Stage 8 HPC Blade (Tip Clearance) Clearance	0.067 (1.702)	0.060 (1.52)	0.074 (1.88)	See NOTE.	
1324	Stage 9 HPC Blade (Tip Clearance) 0.036 INCH (0.914 mm) Clearance	0.033 (0.838)	0.030 (0.762)	0.036 (0.914)	See NOTE.	
1325	Stage 10 HPC Blade (Tip Clearance) Clearance	0.030 (0.762)	0.027 (0.686)	0.033 (0.838)	See NOTE.	
1326	Stage 11 HPC Blade (Tip Clearance) Clearance	0.038 (0.965)	0.035 (0.889)	0.041 (1.041)	See NOTE.	
1327	Stage 12 HPC Blade (Tip Clearance) Clearance	0.030 (0.762)	0.027 (0.686)	0.033 (0.838)	See NOTE.	

Blade Tip Clearance And Local Limits
Table 801

Ref. No.	Description	Nominal Clearance	Average Clearance At Assembly Min	Average Clearance At Assembly Max	Local Limits Min	Local Limits Max
1328	Stage 13 HPC Blade (Tip Clearance) Clearance	0.047 (1.194)	0.044 (1.118)	0.050 (1.270)	See NOTE.	
1329	Stage 14 HPC Blade (Tip Clearance) Clearance	0.047 (1.194)	0.044 (1.118)	0.050 (1.270)	See NOTE.	
1330	Stage 15 HPC Blade (Tip Clearance) Clearance	0.047 (1.194)	0 .044 (1.118)	0.050 (1.270)	See NOTE.	

NOTE: For Stage 5, the local Min. and Max. clearance variation must be within +0.012/− 0.017 inch (+0.305 mm)/(−0.432 mm) about the nominal clearance. You do not have to include up to five short blades in the local maximum clearance calculation as per the extended minimum radius limits as specified in 72−35−01, Assembly−03, CONFIG−2 (Task 72−35−01−440−026).

NOTE: For Stages 6, 7, and 8, the local Min. and Max. clearance variation must be within +/− 0.012 inch (+/− 0.305 mm) about the nominal clearance. You do not have to include up to five short blades in the local maximum clearance calculation as per the extended minimum radius limits as specified in 72−35−01, Assembly−03, CONFIG−2 (Task 72−35−01−440−026).

NOTE: For Stages 9 through 15, the local Min. and Max. clearance variation must be within +/− 0.005 inch (0.127 mm) about the nominal. You do not have to include up to five short blades in the local maximum clearance calculation as per the extended minimum radius limits as specified in 72−35−01, Assembly−03, CONFIG−2 (Task 72−35−01−440−026).

NOTE: One stage within the 5th through 8th stages can be up to + 0.005 inch (0.127 mm) over the maximum average and/or maximum local clearance calculation as specified in 72−35−01, Assembly−03, CONFIG−2 (Task 72−35−01−440−026).

Blade Tip Clearance And Local Limits
Table 801 (Continued)

Ref. No.	Description	Nominal Clearance	Average Clearance At Assembly		Local Limits	
			Min	Max	Min	Max

NOTE: One stage within the 9th through 12th stages can be up to + 0.005 inch (0.127 mm) over the maximum average and/or maximum local clearance calculation as specified in 72-35-01, Assembly-03, CONFIG-2 (Task 72-35-01-440-026).

NOTE: The blade tip clearance shown is for new blade and rubstrip conditions. Engines that have run will have more open clearances because the blade is permitted to cut its own trench in the abradable rubstrip.

Blade Tip Clearance And Local Limits
Table 801 (Continued)

(4) Calculate the local minimum blade tip clearance for each stage as follows:

  (a) Find the minimum rubstrip diameter.

  (b) Find the maximum rotor outside diameter.

  (c) Subtract the maximum rotor diameter from the minimum rubstrip diameter.

  (d) Divide the remainder by 2 to find the minimum local clearance.

  (e) The minimum local blade tip clearance must be within the limits shown in Table 801 for each stage.

(5) Calculate the local maximum blade tip clearance for each stage as follows:

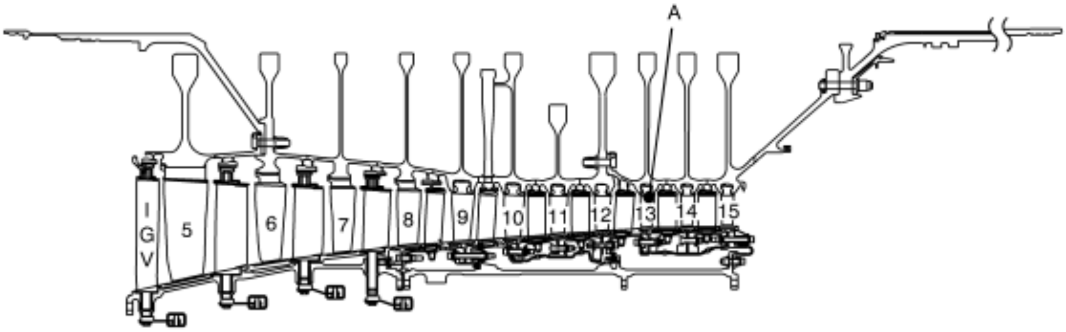
  (a) Find the maximum rubstrip diameter.

  (b) Find the minimum rotor outside diameter.

  (c) Subtract the minimum rotor diameter from the maximum rubstrip diameter.

  (d) Divide the remainder by 2 to find the maximum local clearance.

(e) The maximum local blade tip clearance must be within the limits shown in Table 801 for each stage.


A
I
G
V
5
6
7
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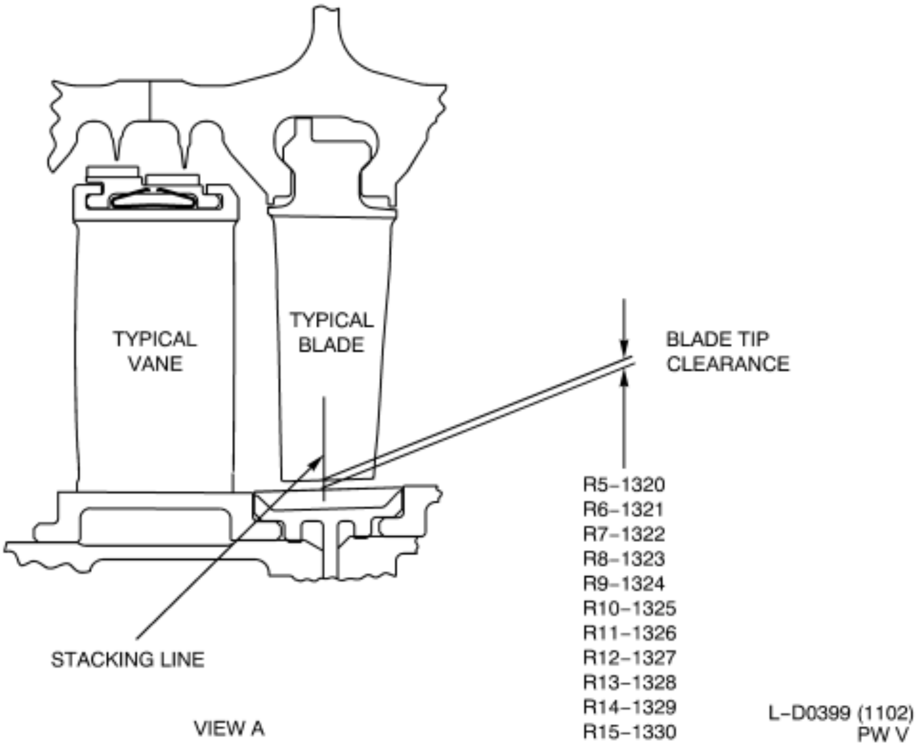
11
12
13
14
15

HPC CROSS SECTION
(TYPICAL)


TYPICAL
VANE
TYPICAL
BLADE
BLADE TIP
CLEARANCE
R5−1320
R6−1321
R7−1322
R8−1323
R9−1324
R10−1325
R11−1326
R12−1327
R13−1328
R14−1329
R15−1330
STACKING LINE
VIEW A
L−D0399 (1102)
PW V

Blade Tip Clearance Inspection
Figure 801
(Task 72−35−00−990−012)

Previous Pageblock Return to Previous Menu Next Pageblock

HIGH PRESSURE COMPRESSOR (HPC) - REPAIR-01

Task 72-35-00-300-001:

1. Skim Cut Stages 8 Through 15 Rubstrips

A. Prerequisites
Do the blade tip clearance evaluation functional check inspection. See Inspection/Check-05 (Task 72-35-00-200-005).

B. Equipment And Materials Necessary

Standard Tools:
Computer Numeric Control Vertical Turret Lathe (CNC VTL)
Single Point Carboloy Or Equivalent Carbide Tool,
Tool Radius Of 0.015 - 0.031 Inch (0.38 - 0.79 mm),
With A 5 Degree Positive Side Rake

Special Tools:

PWA 76154	Adapter
PWA 86643	Sling
PWA 86668	Fixture, Machine
PWA 102179	Holder, Insert
PWA 102180	Insert, Machining
PWA 102181	Holder, Insert
PWA 102182	Holder, Insert
PWA 102183	Insert, Machining

C. General Requirements

(1) This procedure is applicable for a assembly when the minimum tip clearances are not met in 72-35-00 Inspection/Check-05 (Task 72-35-00-200-005).

D. Procedure

(1) If necessary, install the HPC stator 8th thru 14th stage stators, inner case and outer case in the PWA 86668 Machine Fixture as follows:

(a) With the front ring on a suitable working surface, place the assembled HPC rear case into the front ring of the fixture.

(b) Attach the front ring to the case with the front holding screw assembly's provided.

(c) Position the two bracket assemblies and lightly attach in place with the socket head screws.

(d) Install the rear ring to the HPC rear case. Attach with the holding screw assembly's provided.

(e) Complete the attachment of the bracket assemblies and attach with the socket head screws.

(f) Use PWA 86643 Sling and PWA 76154 Adapter to lift and position the Fixture (PWA 86668) and the HPC rear case as necessary.

NOTE: The closely controlled machined surface located on the outer section of the front and rear ring is the indicating surface for machine setup.

(2) For stages 12 through 15, set the case and Fixture (PWA 86668) assembly rear end up on a computer numeric control vertical turret lathe (CNC VTL) for machining. See Figure 901 and Table 901.

(a) Use PWA 102179 Insert Holder with PWA 102180 Machining Insert and machine with a single point carboloy or equivalent carbide tool with a tool radius of 0.015 − 0.031 inch (0.38 − 0.79 mm), a 5 degree positive side rake, a feed rate of 0.006 − 0.008 inch/revolution (0.153 − 0.203 mm/revolution), a cutting speed of 150 − 275 feet/minute (45.72 − 83.82 m/minute) and a 0.003 − 0.007 inch (0.077 − 0.177 mm) depth of cut. Do not use lubricants.

NOTE: A fresh insert should be used for each stage. Dull inserts produce a glazed surface which is unacceptable for an abradable seal.

NOTE: Lubricants will contaminate the porous metal and do not improve tool life, cutting rate or the quality of the finished surface.

Stage	Dim. A Inches (Millimeters)	Dim. B Inches (Millimeters)	Dim. C Degrees	Dim. D Inches (Millimeters)
12	8.914 (226.416)	0.820 (20.828)	4.100	9.399 (238.735)
13	6.543 (166.192)	0.715 (18.161)	3.267	6.967 (176.962)
14	4.373 (111.074)	0.708 (17.983)	1.733	4.793 (121.742)
15	2.109 (53.569)	0.999 (25.375)	−0.667	2.638 (67.005)

NOTE: Stage 15 has a negative wall angle, and no trench. Skim across the shroud parent metal.

Machine Dimensions
Table 901

(3) For Stages 8 through 11, set the case and Fixture (PWA 86668) assembly front end up on a computer numeric control vertical turret lathe (CNC VTL) for machining. See Figure 902 and Table 902.

(a) For Stage 9: use PWA 102181 Insert Holder, PWA 102182 Insert Holder and PWA 102183 Machining Insert. The clearances between the tooling and the 8th and 9th stage vanes make it necessary that the 9th stage rubstrip be machined in two cuts. Machine one half of the axial height with one holder, then machine the half that remains with the other holder to prevent damage to the vanes.

NOTE: A fresh insert should be used for each stage. Dull inserts produce a glazed surface which is unacceptable for an abradable seal.

NOTE: Lubricants will contaminate the porous metal and do not improve tool life, cutting rate or the quality of the finished surface.

(b) For Stages 8, 10 and 11: use PWA 102179 Insert Holder with PWA 102180 Machining Insert and machine with a single point carboloy or equivalent carbide tool with a tool radius of 0.015 - 0.031 inch (0.38 - 0.79 mm), a 5 degree positive side rake, a feed rate of 0.006 - 0.008 inch/revolution (0.153 - 0.203 mm/revolution), a cutting speed of 150 - 275 feet/minute (45.72 - 83.82 m/minute) and a 0.003 - 0.007 inch (0.077 - 0.177 mm) depth of cut. Do not use lubricants.

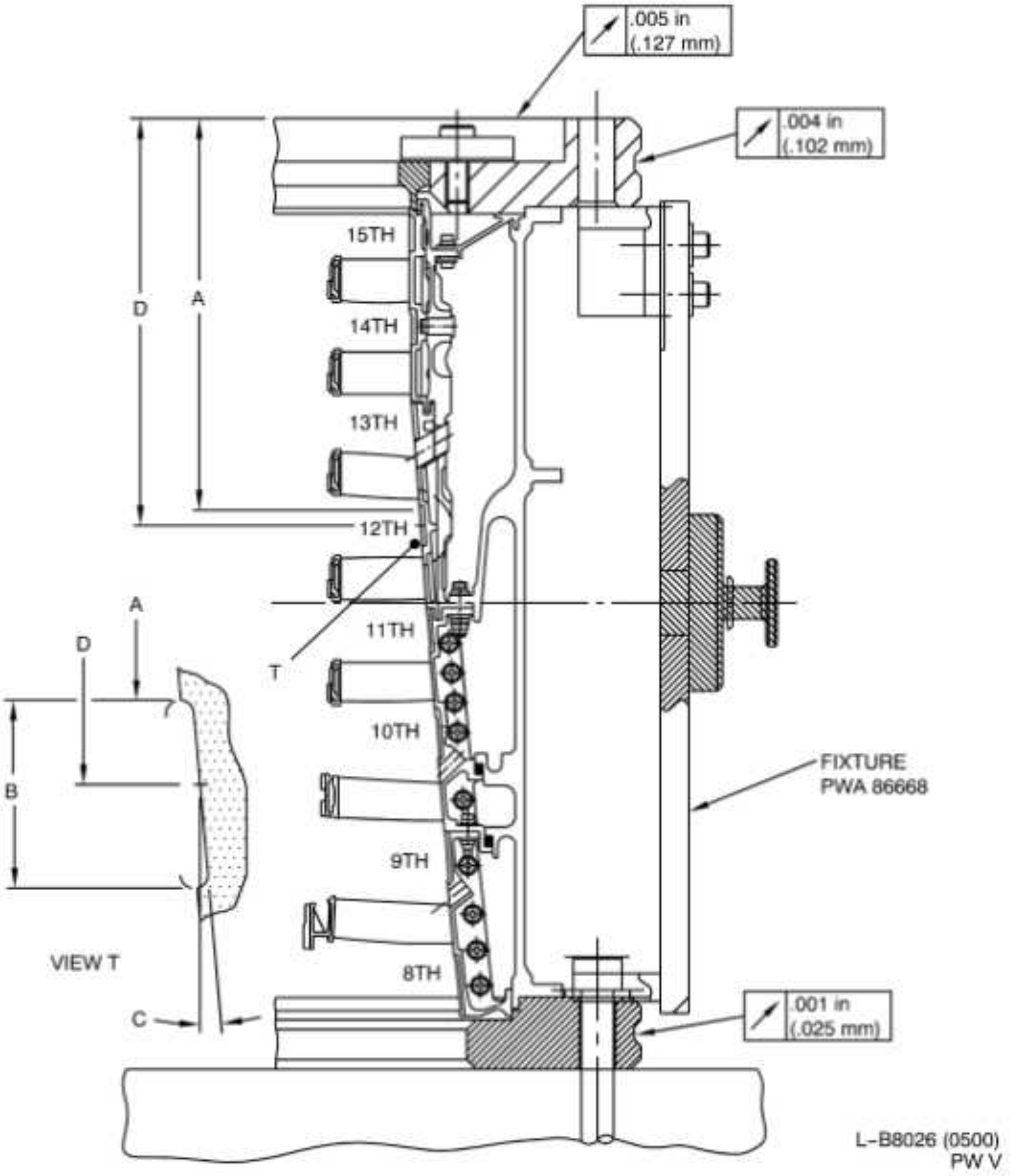
NOTE: A fresh insert should be used for each stage. Dull inserts produce a glazed surface which is unacceptable for an abradable seal.

NOTE: Lubricants will contaminate the porous metal and do not improve tool life, cutting rate or the quality of the finished surface.

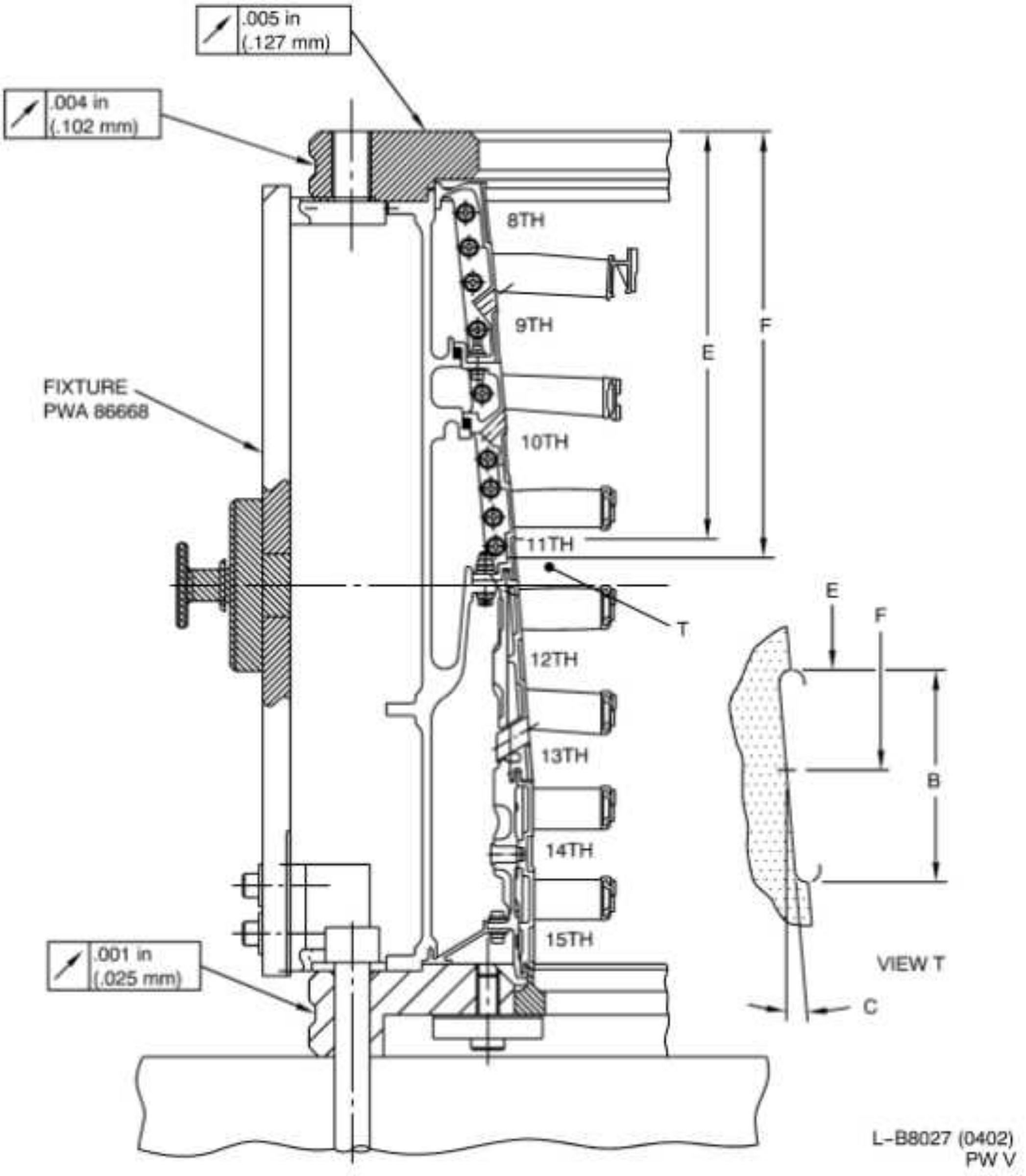
Stage	Dim. E Inches (Millimeters)	Dim. B Inches (Millimeters)	Dim. C Degrees	Dim. F Inches (Millimeters)
8	1.295 (32.893)	1.260 (32.004)	5.433	1.794 (45.568)
9	4.309 (109.449)	1.033 (26.238)	3.917	4.758 (120.853)
10	7.040 (178.816)	1.018 (25.857)	3.917	7.498 (190.449)
11	9.558 (242.773)	0.851 (21.615)	4.417	9.907 (251.638)

Machine Dimensions -
Table 902

(4) Before you remove the case and stator stack from the fixture, inspect the stages that were machined on a CMM and recompute the clearances to verify compliance with the minimum local, maximum local and average clearances as specified in 72-35-00 Inspection/Check-05 (Task 72-35-00-200-005).


.005 in
(.127 mm)
.004 in
(.102 mm)
15TH
14TH
13TH
12TH
11TH
10TH
9TH
8TH
D
A
T
A
D
B
VIEW T
C
FIXTURE
PWA 86668
.001 in
(.025 mm)
L−B8026 (0500)
PW V

Machine Setup For Stages 12 Through 15
Figure 901
(Task 72−35−00−300−001)


.005 in
(.127 mm)
.004 in
(.102 mm)
FIXTURE
PWA 86668
8TH
9TH
10TH
11TH
12TH
13TH
14TH
15TH
E
F
T
B
C
VIEW T
.001 in
(.025 mm)
L−B8027 (0402)
PW V

Machine Setup For Stages 8 Through 11
Figure 902
(Task 72−35−00−300−001)

HIGH PRESSURE COMPRESSOR (HPC) - ASSEMBLY-01

Task 72-35-00-400-001:

1. Assemble High Pressure Compressor (HPC) (Pre-Ring Case Configuration)

A. Prerequisites

(1) Assemble axial compressor rotor assembly. See 72-35-01, Assembly-01 (Task 72-35-01-440-001).

(2) Assemble variable stator vane and HPC front case assembly. See 72-35-02, Assembly-01 (Task 72-35-02-440-001).

(3) Assemble Stages 11 and 12 compressor stator set, shroud sets, and springs (Post SB PW4ENG 72-223). See 72-35-61, Assembly-01 (Task 72-35-61-440-001).

(4) Assemble Stages 13 and 14 compressor stator set, shroud sets, and springs (Post SB PW4ENG 72-223). See 72-35-62, Assembly-01 (Task 72-35-62-440-001).

(5) Blade tip clearance evaluation. See 72-35-00, Inspection/Check-05, CONFIG-1 (Task 72-35-00-200-005).

B. Equipment And Materials Necessary

Special Tools:

	PWA 76154	Adapter (4 Necessary)
	PWA 29855-6	Pin, Aligning (3 Necessary)
	PWA 85530	Wrench
	PWA 85532	Bracket, Lift (2 Necessary)
R	PWA 85535	Nut
	PWA 85536	Adapter
	PWA 86536	Adapter
	PWA 88643	Sling (2 Necessary) (Optional To PWA 88673 And PWA 102286)
	PWA 88673	Sling (2 Necessary) (Optional To PWA 88643 And PWA 102286)
	PWA 88701	Nut, Retaining
	PWA 105181	Crimper, Mechanical (AP-5 and AP-7 Plugs)
	PWA 101980	Bracket, Lift (2 Necessary)
	PWA 102286	Adapter, Lift (Optional To PWA 88673 And PWA 88643)
R	PWA 107219	Fixture, Handling

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	2	72-35-00/22/10 or 72-35-00/22/10A
Gasket	1	72-35-00/30/300

C. Procedure

Subtask 72-35-00-430-051:

(1) Position Stage 8 compressor stator set on each half of HPC front case rear flange, bolt hole flange up. Make sure that the Stage 8 borescope port is positioned correctly at about the 4:00 o'clock location.

CAUTION: (POST SB PW4ENG 72-485) THE 5TH THROUGH 7TH STAGE (OUTER) SHROUD SETS AND HPC FRONT CASE SET WERE ASSEMBLED AND MACHINED AS A MATCHED SET. THESE PARTS MUST BE KEPT TOGETHER AS A SET.

(2) Attach two PWA 85532 Brackets to rear flange of stator segment and to rear flange of front case. Position brackets approximately 22 degrees from horizontal centerline. Attach hoist with standard cable sling. Lift case and stator and position onto compressor rotor fixture. Place two HPC Stage 5 shroud set locks in case halves to keep HPC Stage 5 shroud set.

(3) (Reference 1553) HPC front case axial flange bolting and torque sequence.

(a) Flange bolt hole sequencing starts at front end (down position). "L" Refers to left axial flange of "lower" case. "R" Refers to right axial flange of "lower" case viewed from rear.

(b) Secure case with minimum of three bolts, threads lubricated with Engine Oil P03-001, per half segment, two bolts at upper and lower end and one bolt approximate center. Bolts are installed with the heads to the upper case. Install axial flange bolts, threads lubricated with Engine Oil P03-001 and nuts fingertight, 11 places, both sides.

(c) Using PWA 86536 Adapter torque axial flange bolts to 565 - 595 lb-in. (63.836 - 67.226 N.m). Starting with hole 1L, torque to following sequence: 1L, 1R, 2L, 2R, 3L, 3R, continue sequence to rear flange.

(4) Rotate Stage 8 stator set so that split centerline is approximately 90 degrees from front case bolts and nuts.

(5) If stators have featherseal slots, install featherseals. If stator slots are welded shut (SB PW4ENG 72-142), do not try to install featherseals. Secure set together with eight bolts, threads lubricated with Engine Oil P03-001, heads to left, and nuts. Tighten and torque nuts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

Subtask 72-35-00-430-052:

(6) Install Stages 9 and 10 stator set to rest on Stage 8 stator with case split centerline at 1:30 and 7:30 o'clock locations. If stators have featherseal slots, install featherseals. If stator slots are welded shut (SB PW4ENG 72-142), do not try to install featherseals. Secure set together with 10 bolts, threads lubricated with Engine Oil P03-001, heads to left and nuts fingertight. Tighten and torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). Make sure that the Stage 10 borescope port is positioned correctly at about the 7:00 o'clock location.

(7) Secure Stage 8 with Stages 9 and 10 with 40 bolts, threads lubricated with Engine Oil P03-001. Tighten and torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

Subtask 72−35−00−430−053:

CAUTION: THE 11TH AND 12TH STAGE STATOR SET WITH 24 HOUR OXIDATION CYCLE RING SEGMENTS (SB PW4ENG 72−396) MUST BE USED WITH THE 12TH AND 13TH STAGE ALUMINUM OXIDE COATED BLADE TIPS (SB PW4ENG 72−395).

(8) Raise rotor approximately 0.150 inch (3.810 mm) to allow Stages 11 and 12 stator set to be installed within Stages 9 and 10.

(9) Install one quarter section in 9th and 10th stage. Install a long seal in vertical groove in one end. Install second quarter section and butt against previously installed quarter and seal. Complete assembly of stators until all four sections are installed.

(10) Align splits in Stages 11 and 12 to be 45 degrees on either side of 6 o'clock location. Also align bolts holes with Stages 9 and 10. Make sure that the Stage 12 borescope port is positioned correctly at about the 3:00 o'clock location.

CAUTION: THE 13TH AND 14TH STAGE STATOR SET WITH 24 HOUR OXIDATION CYCLE RING SEGMENTS (SB PW4ENG 72−396) MUST BE USED WITH THE 14TH AND 15TH STAGE ALUMINUM OXIDE COATED BLADE TIPS (SB PW4ENG 72−395) AND THE MORE WEAR RESISTANT ANTI−ROTATION SLOTS, REAR INNER CASE (SB PW4ENG 72−403).

(11) Lower rotor assembly to previous height. Install Stages 13 and 14 stator aligning quadrants with previous stage installed. Install four long seals at each of four quadrant ends. Make sure that the Stage 14 borescope port is positioned correctly at about the 2:30 o'clock location.

(12) Install two sets of four seals at the 12th and 13th stage junction. Install another set of four seals at the 15th stage rubstrip location.

CAUTION: THE HPC REAR INNER CASE WITH THE MORE WEAR RESISTANT ANTI-ROTATION SLOTS (SB PW4ENG 72-403) MUST BE USED WITH THE 13TH AND 14TH STAGE STATOR SET WITH 24 HOUR OXIDATION CYCLE RING SEGMENTS (SB PW4ENG 72-396).

(13) Install HPC inner rear case over rear stators.

(a) Install two PWA 101980 Lifting Brackets 180 degrees apart on inner rear case rear flange. Attach PWA 88643 or PWA 88673 Sling to the lifting brackets and lower the inner rear case over the HPC rear stators.

(b) Carefully drift to seat on 10th stage flange after aligning holes in case with stator holes. Install eight bolts, threads lubricated with Engine Oil P03-001, equally spaced to secure case and stators. Tighten bolts to draw flanges together. After drawing flanges together remove bolts.

(c) Remove the two PWA 101980 Lifting Brackets from the inner rear case rear flange.

CAUTION: THIRTEENTH AND FOURTEENTH STAGE STATOR SET MUST BE USED IN SETS WITH THRUST PIN COVERS AND INNER REAR CASE ASSEMBLY (SB PW4ENG 72-229).

(14) Install eight HPC thrust pin covers as follows:

(a) (Reference 2126) For engines with axial thrust pins (Pre SB PW4ENG 72-229) use phenolic (or equivalent) guides to align both pin locations of each stator segment. After positioning with guides, remove guide from one location and install pin. After installing first pin, remove second guide and install pin at that location. Repeat procedure for all segments. Pin should not rotate freely when tight to case prior to bolting. Use only reasonable force to install pin to the case.

NOTE: The eight thrust pin covers will be secured, with 16 thrust pin cover bolts, after installation of the HPC outer rear case.

(b) For engines without axial thrust pins (Post SB PW4ENG 72-229), install the thrust pin covers.

NOTE: The eight thrust pin covers will be secured, with 16 thrust pin cover bolts, after installation of the HPC outer rear case.

Subtask 72-35-00-430-054:

(15) Install gaskets to locations in Stage 9 stator. Install packing material into each half of front case rear flange. Packing material must be flush or below case split line. Install either PWA 88673 or PWA 88643 Sling or PWA 102286 Lift Adapter to HPC outer rear case. Using hoist attached to sling or lift adapter, raise outer rear case over rotor. Install three PWA 29855-6 Aligning Pins equally spaced to stator flange stator 10 and 11. Lower outer rear case engaging pins and front case flange.

NOTE: Packings/gaskets are installed at HPC Flanges E, H, and K to reduce air leakage at those locations. The front and rear flanges of the HPC front case set have been modified to incorporate a packing groove. The rear flange of the HPC rear case assembly has been modified to incorporate a gasket groove. Because the modified flanges can be installed with or without seals, the case sets and case assemblies (Pre and Post SB PW4ENG 72-48) are interchangeable however, the packings and gaskets must only be used with the new or modified case sets and case assemblies.

Subtask 72-35-00-430-075:

(16) Secure thrust pins or thrust pin covers, as applicable, to the HPC inner rear case with 16 bolts, threads lubricated with Engine Oil P03-001. Tighten and torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

HIGH PRESSURE COMPRESSOR (HPC) - ASSEMBLY-01

CAUTION: (PRE AND POST SB PW4ENG 72-366) RUNNER AND SHIM ARE INTERCHANGEABLE IN SETS. HOWEVER, SHIM (POST SB PW4ENG 72-366) MAY BE USED WITH RUNNER (PRE SB PW4ENG 72-366).

(17) Install 11 runners to upper Flange H. Secure runners with shims using bolts, threads lubricated with Engine Oil P03-001, and nuts. Tighten and torque nuts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(18) Install the Flange H hardware as follows. Refer to 72-35-00, Assembly-21 (Task 72-35-00-430-021).

(19) Install four bolts, threads lubricated with Engine Oil P03-001, equally spaced around stator flange and draw stators up to outer rear case. Remove pins and install remaining 60 bolts, threads lubricated with Engine Oil P03-001. Tighten and torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(20) Install HPC rotor and stator identification plate to bracket on HPC rear case Flange J at approximately 2 o'clock location. Secure with bolts, threads lubricated with Engine Oil P03-001, heads outward, and nuts. Tighten and torque nuts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

Subtask 72-35-00-430-055:

CAUTION: THE INSTALLATION OF PN 50H879 SUPPORT AND PN 50H883 HEAT SHIELD IS OPTIONAL WITH PN 50J685 COMPRESSOR STATOR EXIT ASSEMBLY.

CAUTION: PN 50H879 SUPPORT AND PN 50H883 HEAT SHIELD CANNOT BE INSTALLED WITH PN 51J285-01, PN 51J385-01 OR PN 51J685-01 COMPRESSOR STATOR EXIT ASSEMBLY.

CAUTION: USE PN MS9723-05 BOLTS WITH EXIT GUIDE VANE SUPPORT, HEAT SHIELD AND 50H953 HPC REAR SUPPORT (PRE SB PW4ENG 72-234).

CAUTION: USE PN MS9696-06 BOLTS WITHOUT THE SUPPORT AND HEAT SHIELD AND WITH 50H953 HPC REAR

SUPPORT (POST SB PW4ENG 72-234, PRE SB PW4ENG 72-298).

CAUTION: USE PN MS9723-04 BOLTS WITHOUT THE EXIT GUIDE VANE SUPPORT, HEAT SHIELD AND WITH 51H530 REAR SUPPORT (POST SB PW4ENG 72-298).

(21) Install HPC rear support on 14th stator flange and outer rear case aligning holes in support with holes in inner rear case. Install heat shield to rest on inner rear case flange.

(22) Install exit guide vane support over heat shield and rear support aligning bolt holes. Secure rear support to inner rear case with 62 bolts, threads lubricated with Engine Oil P03-001. Tighten and torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(23) For post SB PW4ENG 72-229 rotor stator assembly only: Check dimensional constraints as shown on Figure 1002 to make sure stator installation is correct.

Subtask 72-35-00-430-056:

R (24) Attach hoist to PWA 107219 Fixture and raise fixture over rear hub of rotor. Lower fixture to HPC rear case. Secure fixture to case.

(25) FOR THESE MODELS: 4152, 4156A, 4158
R Install the PWA 85535 Nut over rear end of HPC rear hub. Position PWA 85530 Wrench over nut and engage drive teeth in nut. Insert PWA 85536 Adapter into rear end of HPC rear hub. Torque nut to 300 lb-in. (33.895 N.m).

(26) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
R (Pre SB PW4ENG 72-562) Attach the hoist to the PWA 107219 Fixture and raise the fixture over the rear shaft of the rotor. Lower the fixture to the HPC rear case. Tighten the fixture to the case. Install the PWA 85535 Nut over the rear end of the HPC rear shaft. Install the PWA 85530 Wrench over the nut and engage the drive teeth in the nut. Put the PWA 85536 Adapter into the rear end of the HPC rear shaft. Torque the nut to 300 lb-in. (33.895 N.m).

(27) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
R (Post SB PW4ENG 72−562) Attach the hoist to the PWA
R 107219 Fixture and raise the fixture over the rear shaft of the rotor. Lower the fixture to the HPC rear case. Tighten the fixture to the case. Install the PWA 88701 Nut over the rear end of the HPC rear shaft. Install the PWA 85530 Wrench over the nut and engage the drive teeth in the nut. Put the PWA 85536 Adapter into the rear end of the HPC rear shaft. Torque the nut to 300 lb−in. (33.895 N.m).

R (28) Attach PWA 88643 or PWA 88673 Sling to hoist. Attach sling with two PWA 76154 Adapters to fixture on rear case and raise rotor from stand. Install second hoist and PWA 88643 or PWA 88673 Sling with two PWA 76154 Adapters to front fixture and trunnion rotor to front end up. Lower rotor to build stand and remove sling, hoist, and adapters.

Subtask 72−35−00−430−057:

R (29) (Reference 1557) (Pre SB PW4ENG 72−675) Remove excess baked on compound from borescope plug threads using a nylon brush. Apply Antiseize Paste P06−054 to threads and washer face of plug. Wipe off unwanted paste. Do not use Engine Oil P03−001. Install plug into lower half of Stages 9 and 10 stator through rear case at approximately 5 o'clock location. Run plug in to be sure plug is seated. Tighten and torque plug to 175 − 190 lb−in. (19.8 − 21.5 N.m). See Figure 1002.

CAUTION: DO NOT APPLY ANTISEIZE PASTE P06−054 TO THE THREADS AND WASHER FACE OF THE POST SB PW4ENG 72−675 PLUGS. THESE PLUGS HAVE BAKED ON ANTIGALLANT COMPOUND.

R (30) (Reference 1557) (Post SB PW4ENG 72−675) Install plug into lower half of Stages 9 and 10 stator through rear case at approximately 5 o'clock location. Do not use Antiseize Paste P06−054 or Engine Oil P03−001. Run plug in to be sure plug is seated. Tighten and torque plug to 175 − 190 lb−in. (19.8 − 21.5 N.m). See Figure 1003.

R (31) (Reference 1559) (Pre SB PW4ENG 72-675) Remove excess baked on compound from borescope plug threads using a nylon brush. Apply Antiseize Paste P06-054 to threads and washer face of plug. Wipe off unwanted paste. Do not use Engine Oil P03-001. Install plug into Stage 14 stator through rear case at approximately 9:30 o'clock location. Run plug in to be sure plug is seated. Tighten and torque plug to 175 - 190 lb-in. (19.8 - 21.5 N.m).

CAUTION: DO NOT APPLY ANTISEIZE PASTE P06-054 TO THE THREADS AND WASHER FACE OF THE POST SB PW4ENG 72-675 PLUGS. THESE PLUGS HAVE BAKED ON ANTIGALLANT COMPOUND.

R (32) (Reference 1559) (Post SB PW4ENG 72-675) Install plug into Stage 14 stator through rear case at approximately 9:30 o'clock location. Do not use Antiseize Paste P06-054 or Engine Oil P03-001. Run plug in to be sure plug is seated. Tighten and torque plug to 175 - 190 lb-in. (19.8 - 21.5 N.m).

R (33) (Reference 1556) Remove excess baked on compound from borescope plug threads using a nylon brush. Apply Antiseize Paste P06-054 to threads and washer face of plug. Wipe off unwanted paste. Do not use Engine Oil P03-001. Install plug into rear case boss adjacent to Flange H at approximately 7:30 o'clock location. Run plug in to be sure plug is seated. Tighten and torque plug to 175 - 190 lb-in. (19.8 - 21.5 N.m).

CAUTION: IT IS VERY IMPORTANT TO OBEY THE PROCEDURES IN THE STANDARD PRACTICES MANUAL, PN 585005 70-53, LOCKING DEVICES, WHEN YOU INSTALL (BORESCOPE) PLUG KEY WASHERS. INCORRECT INSTALLATION OF THE KEY WASHERS CAN CAUSE THE (BORESCOPE) PLUGS TO COME OUT. IF A (BORESCOPE) PLUG IS NOT THERE, HOT GASES FROM THE PLUG OPENING CAN CAUSE DAMAGE TO THE THRUST REVERSER.

R (34) (Reference 1555) Remove excess baked on compound from borescope plug threads using a nylon brush. Apply Antiseize Paste P06-054 to threads and washer face of plug. Wipe off unwanted paste. Do not use Engine Oil P03-001. Install plug and washer into rear case boss above previously installed plug at approximately 5 o'clock location. Run plug in to be sure plug is seated. Tighten and torque plug to 175 - 190 lb-in.

(19.8 - 21.5 N.m). (Pre SB PW4ENG 72-708) After you torque the borescope plug, bend the tabs of the key washer by the instructions in Chapter/Section 70-53 of the Standard Practices Manual, PN 585005.

(a) (Post SB PW4ENG 72-708) (AP-5 and AP-7): Install the plugs into the compressor case. Do not use Antiseize Paste P06-054 or Engine Oil P03-001. Run in the borescope plug to be sure the plug is seated. Tighten and torque the plug to 175 - 190 lb-in. (19.8 - 21.5 N.m). After you torque the borescope plug, use the PWA 105181 Mechanical Crimper to bend the tabs of the key washer as follows:

1 Put the end of the crimper onto the end of the plug. Turn the crimper so the jaw is under a key washer tab.

2 Squeeze the crimper handle to bend the key washer tab until the tab makes contact with the hex head of the plug.

3 Release the handle and reposition the jaw so that it makes contact again at the base of the tab.

4 Squeeze the crimper handle to final bend the key washer tab until the tab makes contact with the hex head of the plug and maintains less than a 0.020 inch (0.508 mm) gap everywhere between the tab and the hex head of the plug.

5 Crimp all five (5) of the key washer tabs by the same method.

6 All tabs of the key washer must be bent, examine the tabs for the following conditions:

NOTE: Key washer PN 58H216 uses five tabs as an alternative to two. These additional tabs permit some deviation from the Standard Practices Manual, PN 585005 requirements but it is necessary that all five tabs meet these relaxed requirements. The variations to the Standard Practices Manual, PN 585005 procedure for this key washer are as follows:

a All five tabs must be within 0.020 inch (0.508 mm) maximum of the hex head of the plug. If a tab overlaps two different faces of the hex head the 0.020 inch (0.508 mm) gap requirement must be kept between the tab and which ever face of the hex head has the larger surface area coverage with the tab. It is a good practice to bend the tab against the remaining face.

b It is not necessary that 75 percent of the base of the tab make contact with the hex head of the plug.

c It is not necessary that the key washer tabs be pulled away from the axis of the plug before you torque the plug. This requirement, as stated in the Standard Practices Manual, PN 585005 is meant for key washers that have fewer tabs.

R (35) (Reference 1556) Remove excess baked on compound from borescope plug threads using a nylon brush. Apply Antiseize Paste P06-054 to threads and washer face of plug. Wipe off unwanted paste. Do not use Engine Oil P03-001. Install plug into rear case boss above previously installed plug at approximately 8:30 o'clock location. Run plug in to be sure plug is seated. Tighten and torque plug to 175 - 190 lb-in. (19.8 - 21.5 N.m).

CAUTION: IT IS VERY IMPORTANT TO OBEY THE PROCEDURES IN THE STANDARD PRACTICES MANUAL, PN 585005 70-53, LOCKING DEVICES, WHEN YOU INSTALL (BORESCOPE) PLUG KEY WASHERS. INCORRECT INSTALLATION OF THE KEY WASHERS CAN CAUSE THE (BORESCOPE) PLUGS TO COME OUT. IF A (BORESCOPE) PLUG IS NOT THERE, HOT GASES FROM THE PLUG OPENING CAN CAUSE DAMAGE TO THE THRUST REVERSER.

R (36) (Reference 1555) Remove excess baked on compound from borescope plug threads using a nylon brush. Apply Antiseize Paste P06-054 to threads and washer face of plug. Wipe off unwanted paste. Do not use Engine Oil P03-001. Install plug and washer into rear case boss above previously installed plug at approximately 9:30 o'clock location. Run plug in to be sure plug is seated. Tighten and torque plug to 175 - 190 lb-in.

(19.8 - 21.5 N.m). (Pre SB PW4ENG 72-708) After you torque the borescope plug, bend the tabs of the key washer by the instructions in Chapter/Section 70-53 of the Standard Practices Manual, PN 585005.

(a) (Post SB PW4ENG 72-708) (AP-5 and AP-7): Install the plugs into the compressor case. Do not use Antiseize Paste P06-054 or Engine Oil P03-001. Run in the borescope plug to be sure the plug is seated. Tighten and torque the plug to 175 - 190 lb-in. (19.8 - 21.5 N.m). After you torque the borescope plug, use the PWA 105181 Mechanical Crimper to bend the tabs of the key washer as follows:

1 Put the end of the crimper onto the end of the plug. Turn the crimper so the jaw is under a key washer tab.

2 Squeeze the crimper handle to bend the key washer tab until the tab makes contact with the hex head of the plug.

3 Release the handle and reposition the jaw so that it makes contact again at the base of the tab.

4 Squeeze the crimper handle to final bend the key washer tab until the tab makes contact with the hex head of the plug and maintains less than a 0.020 inch (0.508 mm) gap everywhere between the tab and the hex head of the plug.

5 Crimp all five (5) of the key washer tabs by the same method.

6 All tabs of the tab washer must be bent, examine the tabs for the following conditions:

NOTE: Tab washer PN 58H216 uses five tabs as an alternative to two. These additional tabs permit some deviation from the Standard Practices Manual, PN 585005 requirements but it is necessary that all five tabs meet these relaxed requirements. The variations to the Standard Practices Manual, PN 585005 procedure for this tab washer are as follows:

a All five tabs must be within 0.020 inch (0.508 mm) maximum of the hex head of the plug. If a tab overlaps two different faces of the hex head the 0.020 inch (0.508 mm) gap requirement must be kept between the tab and which ever face of the hex head has the larger surface area coverage with the tab. It is a good practice to bend the tab against the remaining face.

b It is not necessary that 75 percent of the base of the tab make contact with the hex head of the plug.

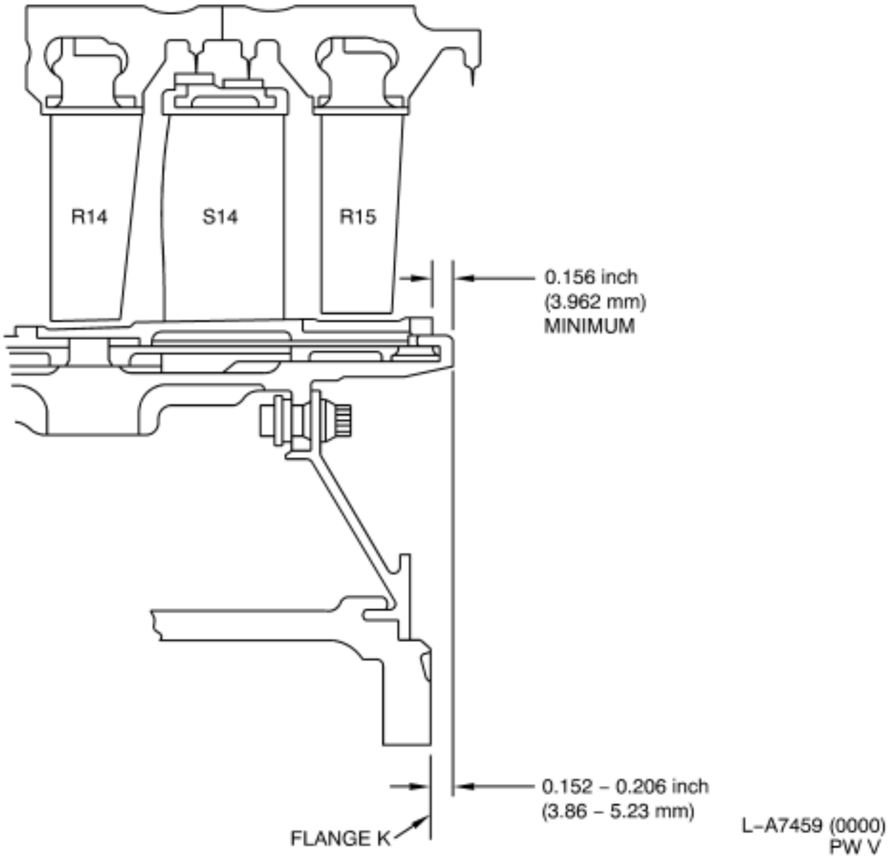
c It is not necessary that the tab washer tabs be pulled away from the axis of the plug before you torque the plug. This requirement, as stated in the Standard Practices Manual, PN 585005 is meant for washers that have fewer tabs.

R (37) (Pre SB PW4ENG 72-583) Install gasket to cover and install cover to HPC rear case at approximately 2:30 o'clock position. Secure cover with six non rust-proof bolts, threads lubricated with Engine Oil P03-001, and torque to 85 - 95 lb-in. (9.604 - 10.734 N.m), then without loosening, retorque to required torque until torque is maintained. See Figure 1003.

R (38) (Post SB PW4ENG 72-583) Install gasket to cover and install cover to HPC rear case at approximately 2:30 o'clock position. Secure cover with six rust-proof bolts, threads lubricated with Engine Oil P03-001, and torque to 85 - 95 lb-in. (9.604 - 10.734 N.m), then without loosening, retorque to required torque until torque is maintained. See Figure 1004.

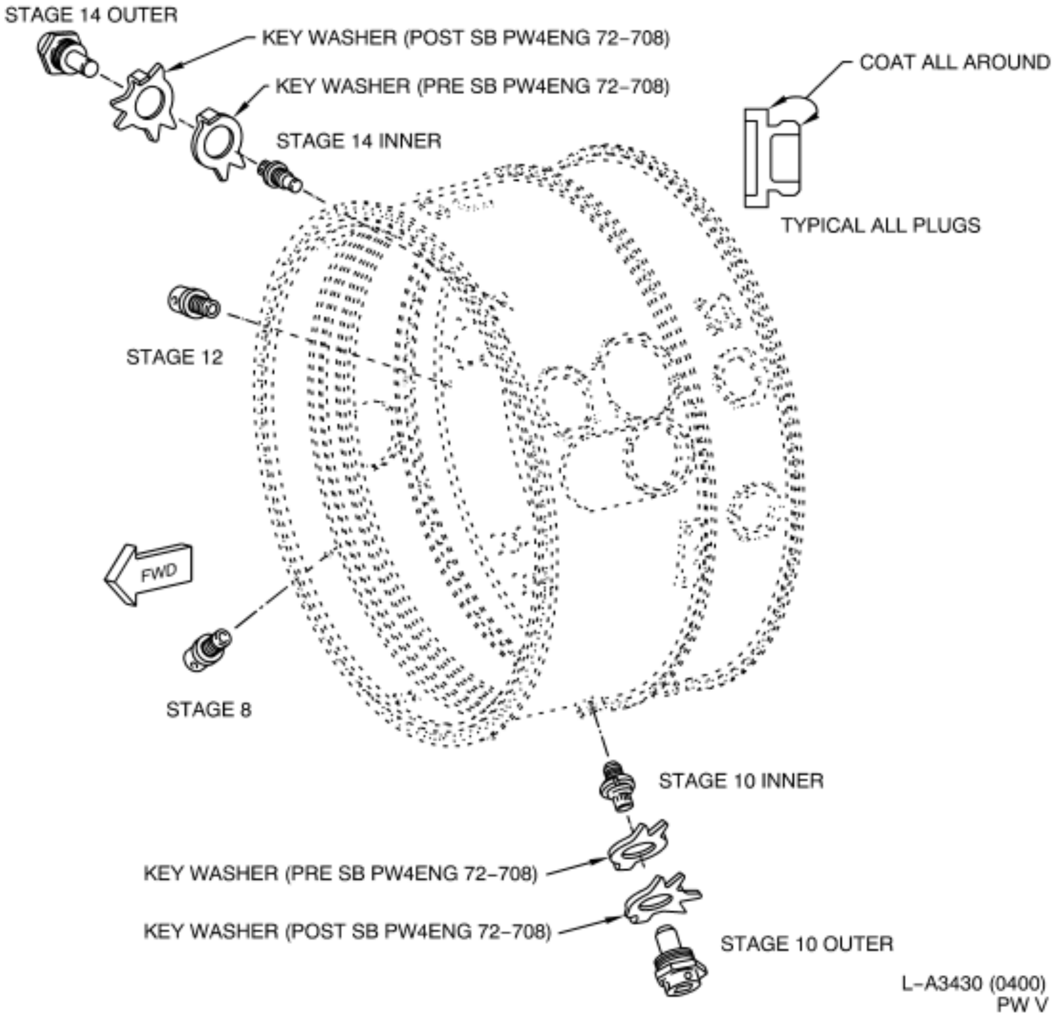
D. Postrequisites

(1) Install synchronizing rings and determine runner clearances. See Assembly-02 (Task 72-35-00-400-002).

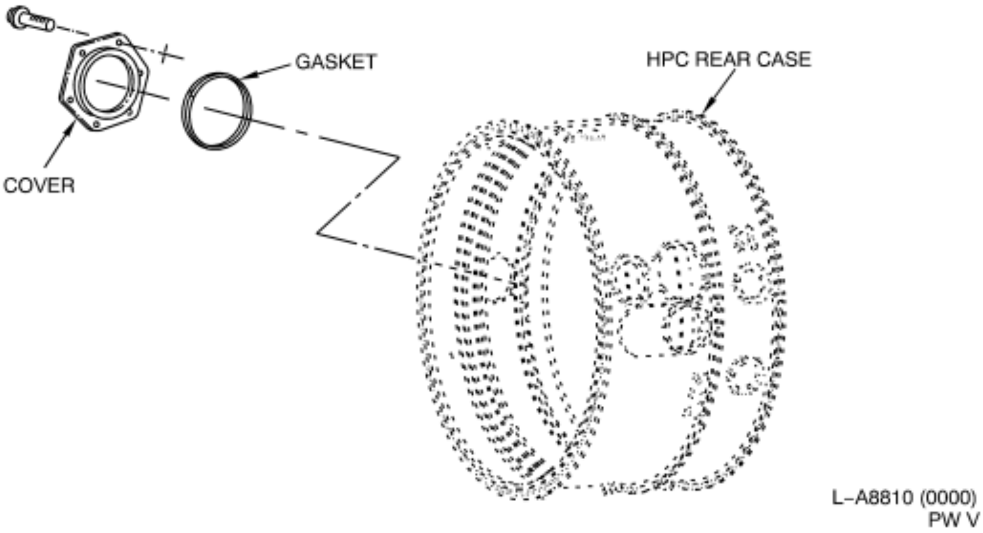

R14
S14
R15
0.156 inch
(3.962 mm)
MINIMUM
0.152 − 0.206 inch
(3.86 − 5.23 mm)
FLANGE K
L−A7459 (0000)
PW V

Dimensional Constraints For Correct Stator
Installation (Post SB PW4ENG 72−229 Only)
Figure 1001
(Task 72−35−00−400−001)

HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−01


STAGE 14 OUTER
KEY WASHER (POST SB PW4ENG 72−708)
KEY WASHER (PRE SB PW4ENG 72−708)
STAGE 14 INNER
COAT ALL AROUND
TYPICAL ALL PLUGS
STAGE 12
FWD
STAGE 8
STAGE 10 INNER
KEY WASHER (PRE SB PW4ENG 72−708)
KEY WASHER (POST SB PW4ENG 72−708)
STAGE 10 OUTER
L−A3430 (0400)
PW V

Borescope Plug Locations
Figure 1002
(Task 72−35−00−400−001)


GASKET
HPC REAR CASE
COVER
L-A8810 (0000)
PW V

Cover - HPC Rear Case
Figure 1003
(Task 72-35-00-400-001)

HIGH PRESSURE COMPRESSOR (HPC) - ASSEMBLY-01

Task 72-35-00-400-007:

1. Assemble High Pressure Compressor (HPC) (Post SB PW4ENG 72-756 And SB PW4ENG 72-759)

A. Prerequisites

(1) Refer to 72-35-00, Inspection/Check-04, CONFIG-2 (Task 72-35-00-990-010) or CONFIG-4 (Task 72-35-00-990-011) as applicable for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

(2) Assemble and balance the HPC rotor assembly. Refer to 72-35-01, Assembly-01 through Assembly-16.

(3) Assemble variable stator vane and HPC front case assembly. Refer to 72-35-02, Assembly-01 (Task 72-35-02-440-001).

(4) Assemble Stages 8 through 14 compressor stator vane sets. Refer to 72-35-00, Assembly-06 (Task 72-35-00-430-006).

(5) Assemble, machine, and disassemble the HPC outer air seal set. Refer to 72-35-04, Assembly-01 (Task 72-35-04-440-001), Assembly-02 (Task 72-35-04-440-002), and Disassemby-01 (Task 72-35-04-040-001) respectively.

(6) Blade tip clearance evaluation. Refer to 72-35-00, Inspection/Check-05, CONFIG-2 (Task 72-35-00-990-012).

B. Equipment And Materials Necessary

Standard Tools:

Optional, Wrench (Extended Socket) Part No. QCL 5/16-2D-3/16 Used With Optional Cleco Air Gun	Brimatco Corporation P.O. Box 88 1486 Highland Ave. Cheshire, CT 06410 USA
Optional Cleco Air Gun (Nutrunner) PN 44RNAL-2-H-3, or PN 44RNAL-2RA8	Local Distributor Or, Cooper Tools Sales and Service P.O. Box 1410 Lexington, SC 29071-1410

Standard Tools:

(CONTINUED)

Or Equivalent	USA

Optional,	
Flexible Extension	Snap−On Technologies Inc.
Part No.	P.O. Box 1430
GSYMU101	Kenosha, WI 53141−1430
Or Equivalent	USA

NOTE: The optional Brimatco wrench (extended socket) PN QCL 5/16−2D−3/16 can be use with the Cleco Air Gun to help install the flange nuts on the 8th through 14th stage compressor cases.

Special Tools:

	PWA 76154	Adapter (4 Necessary)
	PWA 85530	Wrench, Torque
	PWA 85532	Bracket, Lift (2 Necessary) (Front Split Case)
	PWA 85535	Nut
	PWA 86536	Adapter, Torque (HPC Front Case, Split Flange)
	PWA 87485	Gage, Indicating (Concentricity Check)
	PWA 88643	Sling (2 Necessary) (Optional To PWA 88673)
	PWA 88673	Sling (2 Necessary)
	PWA 88701	Nut, Retaining
	PWA 100357	Guide, Aligning(8th Through 14th Stage Anti−Rotation Lug Installation)
	PWA 100379	Pin, Alignment (2 Necessary) (12th Stage Compressor Air Seal Installation)
	PWA 100383	Adapter, Torque (12th Stage Case Installation)
	PWA 102260	Adapter, Torque (9th Through 14th Stage Compressor Case Flange Nuts)
	PWA 105181	Crimper, Mechanical (AP−5 And AP−7 Plugs)
R	PWA 105504	Adapter, Lift (HPC Rear Case)
	PWA 105506	Ring, Constraint (Concentricity Check)
	PWA 105609	Pin, Alignment (2 Necessary) (HPC Rear Case Installation)
	PWA 105768	Spacer, Positioning (40 Necessary)
R	PWA 107219	Fixture, Handling (HPC Rear)

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-341	Tape, Plastic (Yellow) (PMC 4134)
P05-395	Beeswax
P05-396	Paraffin Wax Blend
P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

See The Applicable Illustrated Parts Catalog For Specific Part Usage.

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72-35-00/018A/150A
Key Washer	2	72-35-00/022/020

C. Procedure

NOTE: The HPC air seal set (Stages 5 through 15) (called seal set), referred to in the following procedure, consists of the HPC front case set, 5th through 7th stage HPC shroud sets, 8th through 15th stage compressor air seal assemblies, 8th through 14th stage compressor case assemblies, HPC rear support, and the HPC rear case. The matched set detail parts are identified by the Letter M followed by the last five digits of the HPC rear case serial number.

NOTE: The HPC rotor assembly is front end down on PWA 87022 Build and Storage Stand. A PWA 88560 Handling Fixture is installed on the HPC front hub. See Figure 1002 (Sheet 1).

Subtask 72-35-00-430-114:

(1) Install anti-rotation lugs in the 8th through 14th stage compressor cases. See Figure 1001 (Sheets 1 and 2).

(a) Install anti-rotation lugs in the 8th stage case as follows.

1 Put the 8th stage case on the workbench, front end down.

NOTE: The each case has a reference line on the OD of the rear flange.

2 Apply Engine Oil P03-001 to the 12 anti-rotation lugs (1001/1).

3 Install the anti-rotation lugs (1001/1) through the holes in the side of the case, lug on the ID and longer sides in the vertical position. Install washers (1001/2) and nuts (1001/3).

NOTE: For the 8th and 12th stages, install the anti-rotation lugs with the longer leg of the lug down,

4 Put the PWA 100537 Guide on the workbench inside the case. See Figure 1001 (Sheet 2).

5 Use the correct guide side, and move the guide to engage the head of the anti-rotation bolt.

6 Use the Guide to hold the anti-rotation lug in the vertical position while you tighten and torque the nuts (1001/2) to 85 - 95 lb-in. (9.604 - 10.734 N.m).

7 Repeat the above steps to install the remaining anti-rotation lugs in the 8th stage case.

(b) Repeat the above steps to install the anti-rotation lugs in the 9th through 14th stage cases as shown in Figure 1001 (Sheet 1).

Subtask 72-35-00-430-097:

(2) Install the HPC front case and variable vane assembly. See Figure 1002 (Sheets 1 and 2).

(a) Attach two PWA 85532 Brackets to the rear flange of the "LOWER" HPC front case segment. Put four cap screws for each bracket in holes 9 through 13 of the rear flange split case half.

(b) Use a hoist to attach a PWA 88673 Sling to the Brackets.

(c) Make sure that the locks are seated fully on the 5th stage shroud segments at the vertical flanges of the HPC front case segments.

(d) Make sure that the upper vanes (7th stage) are in a closed (flat) position. Close the vanes if necessary.

CAUTION: USE CARE AS YOU INSTALL THE CASE AND VANE ASSEMBLY TO AVOID DAMAGE TO THE KNIFE EDGES, AIR SEALS, AND BLADE TIPS OF THE DRUM ASSEMBLY.

(e) Use the hoist to carefully align the vanes between the blades and install the "LOWER" HPC front case and vane assembly on the build stand, with the center of the case at the elongated slots position, and the end flanges of the case at the trunnion spool positions.

NOTE: The HPC front cases are marked "UPPER" and "LOWER" on the outer edge of the vertical (split) flanges of the cases.

(f) Align the boltholes in the front case with the boltholes in the fixture.

(g) Remove the hoist, sling, and brackets.

(h) Assemble the case segment to the fixture with a minimum of three bolts (one at each end and one at the approximate center). Install the bolts (boltheads up), washers (under boltheads), and nuts. Tighten the bolts fingertight.

(i) Attach two PWA 85532 Brackets to the rear flange of the "UPPER" HPC front case segment. Put four cap screws for each bracket in holes 9 through 13 of the rear flange split case half.

(j) Use a hoist to attach the PWA 88673 Sling to the Brackets.

(k) Use the host, carefully install the "UPPER" HPC front case and vane assembly on the build stand. Remove the hoist, sling, and brackets.

(l) (Reference 1580) Assemble the case segment to the Fixture with a minimum of three bolts (one at each end and one at the approximate center). Install the bolts (boltheads up), threads lubricated with Engine Oil P03-001, washers (under boltheads), and nuts. Tighten the bolts fingertight.

(m) Tighten the bolts fingertight.

(n) (Reference 1553) Assemble the two halves of the HPC front case set. See Figure 1002 (Sheet 2).

1 Install 22 bolts, bolt heads against the flange of the case marked "UPPER", and nuts to the vertical flanges of the case halves. Tighten the bolts fingertight.

NOTE: Figure 1002 (Sheet 2) shows the preferred bolt position. The bolts can be installed in a different direction if necessary.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

2 Use PWA 86536 Adapter to torque the axial flange bolts to 565 - 595 lb-in. (63.836 - 67.226 N.m) in the following sequence.

3 Start at Hole 1L and torque the bolts in the following sequence: 1L, 1R, 2L, 2R, 3L, 3R, 4L, 4R, 5L, 5R, 6L, 6R, 7L, 7R, 8L, 8R, 9L, 9R, 10L, 10R, 11L, 11R.

NOTE: The flange bolthole sequence starts at the middle as shown. The Letter L refers to the left axial flange. The Letter R refers to the right axial flange, aft, looking forward.

4 Make sure that each axial flange is properly seated.

a A gap of 0.005 inch (0.127 mm) is permitted provided that the gap does not extend through the flange.

(o) Install the remaining Fixture detail bolts (boltheads up), threads lubricated with Engine Oil P03-001, and washers under the bolthead through the case flange and into the Fixture. Assemble the nuts to install the case.

(p) Use an alternating pattern to tighten and torque the nuts that attach the case to the support to 250 - 270 lb-in. (28.246 - 30.506 N.m).

Subtask 72-35-00-430-098:

(3) Install the 8th stage air seal assembly. See Figure 1003, (Sheet 1 or 2) as applicable.

(a) Make sure that the air seal (1003/1) has the correct seal set mating number.

(b) Install the air seal (shorter leg of rubstrip down) on the rear flange of the HPC front case.

(c) Align the boltholes in the outer flange of the air seal with the boltholes in the HPC front case rear flange, with the offset bolt in the inner bolthole pattern, at approximately the 12 o'clock position.

NOTE: The 8th stage air seal flange OD has a reference line at the approximate 12 o'clock position.

(d) Install a minimum of 40 PWA 105768 Spacers, equally spaced, between the 8th stage air seal and the rear flange of the HPC front case.

NOTE: Install the spacers so that the tab with the ring and red flag is up and above the synchronizing ring.

(4) Make marks to show the location of the anti-rotation lugs of the 8th stage compressor case on the 8th stage air seal. See Figure 1004.

(a) Make sure that the case has the correct seal set mating number.

(b) Install the 8th stage compressor case, bolts in the rear flange up, on the 8th stage compressor air seal. Align the offset hole in the front flange with the offset hole in the 8th stage air seal.

NOTE: The 8th stage case rear flange OD has a reference line at the approximate 12 o'clock position.

(c) Locate the anti−rotation lugs in the ID of the 8th stage compressor case. Use an approved pen to temporarily mark the lug positions on the OD of the 8th stage air seal.

(d) Remove the 8th stage compressor case.

(5) Install the 8th stage HPC stator (vane) segments. See Figure 1005 (Sheet 1).

(a) Obtain the twelve 8th stage HPC stator (vane) segments. See 72−35−00, Assembly−06 (Task 72−35−00−430−006).

(b) Make sure that the sealant cure time is completed.

(c) Install the stator (vane) segments to the air seal assembly as follows:

1 If necessary, you can use Beeswax P05−395 or Paraffin Wax Blend P05−396 to hold the vanes in a horizontal position.

2 Install the stator (vane) segments with the thicker seal land down and away from the assembler, with the concave side of the airfoil to the assemblers right.

3 Align the anti−rotation lug slots in the stator (vane) segments with the reference ink marks on the air seal.

4 Make sure that the vanes do not touch the knife−edges of the drum rotor.

(d) Install a nine stator (vane) segment to the air seal assembly as specified above at approximately the top (12 o'clock) position. Align the left vane anti−rotation lug slot with the reference ink mark on the air seal on the assemblers left.

(e) Going to the assemblers right, use the procedure as specified above and install the remaining stator (vane) segments in the following sequence:
Two eight stator (vane) segments
One nine stator (vane) segment
Two eight stator (vane) segments
One nine stator (vane) segment
Two eight stator (vane) segments
One nine stator (vane) segment
Two eight stator (vane) segments

(6) (Reference 1580) Install the 8th stage compressor case (1006/1). See Figure 1006 (Sheet 1 or 2) as applicable.

(a) Make sure that the case has the correct seal set mating number.

CAUTION: AS YOU INSTALL THE 8TH STAGE CASE, THE ID OF THE STATOR (VANE) SEGMENTS CAN FALL DOWNWARD AND ENGAGE THE KNIFE−EDGE SEAL ON THE DRUM ASSEMBLY.

CAUTION: THE STATOR (VANE) SEGMENTS MUST BE LOOSE AFTER THE CASE IS INSTALLED OR DAMAGE TO THE DRUM OR VANES CAN OCCUR.

(b) Pull the stator (vane) segments upward and outward as you install the case in the following step. This will make sure that the vanes do not engage the knife−edge seal and that the vanes can move.

(c) Install the case, rear flange with bolts up, over the 8th stage vanes. Align the offset hole in the front flange of the case with the offset bolt in the 8th stage air seal (at approximately the 12 o'clock position). Align the anti−rotation lugs in the case with the slots in the stator (vane) segments.

NOTE: The 8th stage case rear flange OD has a reference line at the approximate 12 o'clock position. The 8th stage air seal flange OD has a reference line at the approximate 12 o'clock position.

(d) Make sure that the mating surfaces are clean. If necessary, use shop air to remove unwanted material.

(e) Apply Tape P05−341 to the OD of the case to cover all through holes.

(f) For the symmetric case configuration, apply Engine Oil P03−001 to the 64 nuts (1006/2). See Figure 1006 (Sheet 1).

(g) For the symmetric case configuration, install 16 lubricated nuts (1006/2), eight pairs equally spaced, and thick washers (1006/3) (under the nuts), to the bolts through the front flange of the 8th stage case.

NOTE: You can use a flexible extension (such as a Snap−On GSYMU101) to install the nuts.

(h) For the asymmetric case configuration, apply Engine Oil P03−001 to the 64 bolts (1006/2). See Figure 1006 (Sheet 2).

(i) For the asymmetric case configuration, install 16 lubricated bolts (1006/2), eight pairs equally spaced, and thick washers (1006/3) (under the bolts), through the front flange of the 8th stage case.

(j) Tighten and torque 16 nuts or bolts (as applicable) total, eight pairs at Location R, in the special sequence shown in Figure 1007 to 140 − 150 lb−in. (15.818 − 16.948 N.m).

NOTE: You can use a flexible extension (such as a Snap−On GSYMU101) to install the nuts.

(k) For the symmetric case configuration, install the remaining lubricated nuts (1006/2) and thick washers (1006/3) for a total of 64 nuts and thick washers. See Figure 1006 (Sheet 1).

(l) For the asymmetric case configuration, install the remaining lubricated nuts (1006/2) and thick washers (1006/3) for a total of 64 nuts and thick washers. See Figure 1006 (Sheet 2).

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(m) Use an alternating pattern (180 degrees apart) to tighten and torque the remaining nuts or bolts as applicable to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten the nuts until no loss of torque occurs.

Subtask 72−35−00−430−099:

(7) Install the 9th stage compressor air seal assembly. See Figure 1008.

(a) Make sure that the air seal has the correct seal set mating number.

(b) Install the 9th stage air seal, longer leg of air seal down, onto the 8th stage compressor case. Align the offset hole of the air seal with the offset hole in the rear flange of the 8th stage case at approximately the 12 o'clock position.

NOTE: The 9th stage air seal flange OD has a reference mark line at the approximate 12 o'clock position.

(c) Make sure that the air seal engages the upper vane foot of the stator (vane) segments.

(d) Install a suitable protective cover over the blades.

(e) Apply Engine Oil P03−001 to a minimum of 30 work bolts.

(f) Install a minimum of 30 lubricated work bolts (boltheads down), washers, and nuts equally spaced to into the 9th stage air seal flange.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(g) Use an alternating pattern (180 degrees apart) to tighten and torque the nuts to 140 − 150 lb−in. (15.818 − 16.948 N.m) to seat the air seal. Continue to tighten the nuts until no loss of torque occurs.

(h) Remove the work bolts, washers, and nuts.

(i) Remove the protective cover from the blades.

(8) Make marks to show the location of the anti−rotation lugs of the 9th stage compressor case on the 9th stage air seal.

(a) Make sure that the case has the correct seal set mating number.

(b) Install the 9th stage compressor case, bolts in the rear flange up, on the 9th stage air seal. Align the offset hole in the front flange of the case with the offset hole in the 9th stage air seal.

NOTE: The 9th stage case rear flange OD has a reference line at the approximate 12 o'clock position.

(c) Locate the anti−rotation lugs in the ID of the 9th stage compressor case. Use an approved pen to temporarily mark the lug positions on the OD of the 9th stage air seal.

(d) Remove the 9th stage compressor case.

(9) Install the 9th stage HPC stator (vane) segments. See Figure 1009.

(a) Obtain the 9th stage HPC stator (vane) segments.

(b) Install the stator (vane) segments to the air seal assembly as follows:

1 If necessary, you can use Beeswax P05−395 or Paraffin Wax Blend P05−396 to hold the vanes in a horizontal position.

2 Install the stator (vane) segments with the seal land down and away from the assembler.

3 Align the anti−rotation lug slots in the stator (vane) segments with the reference ink marks on the compressor air seal.

4 Make sure that the vanes do not touch the knife−edges of the drum rotor.

(c) Install the stator (vane) segments that follow to the air seal assembly, with the concave side of the vane airfoil to the assemblers right.

(d) Install a five vane stator segment to the air seal assembly as specified above at approximately the top (12 o'clock) position.

(e) Going to the assemblers right, use the procedure as specified above and install the remaining 23 stator (vane) segments as shown in Figure 1009.

NOTE: The two special four vane stator segments (1009/2) can be located at any four vane location. The special five vane stator segments (1009/3) can be located at any five vane location.

(10) (Reference 1580) Install the 9th stage compressor case assembly. See Figure 1010, (Sheet 1).

(a) Make sure that the case has the correct seal set mating number.

CAUTION: AS YOU INSTALL THE 9TH STAGE CASE, THE ID OF THE STATOR (VANE) SEGMENTS CAN FALL DOWNWARD AND ENGAGE THE KNIFE−EDGE SEAL ON THE DRUM ASSEMBLY.

CAUTION: THE STATOR (VANE) SEGMENTS MUST BE LOOSE AFTER THE CASE IS INSTALLED OR DAMAGE TO THE DRUM OR VANES CAN OCCUR.

(b) Pull the stator (vane) segments upward and outward as you install the case in the following step. This will make sure that the vanes do not engage the knife edge seal and that the vanes can move.

(c) Install the case, rear flange with bolts up, over the 9th stage vanes on the 9th stage air seal. Align the offset hole in the front flange of the case with the offset hole in the 9th stage air seal, and the anti−rotation lugs in the case with mating slots in the stator (vane) segments.

NOTE: The 9th stage case rear flange OD has a reference mark line at the approximate 12 o'clock position.

(d) Make sure that the mating surfaces are clean. If necessary, use shop air to remove unwanted material.

(e) Apply Tape P05−341 to the OD of the case to cover all through holes.

(f) Apply Engine Oil P03−001 to the 12 nuts (1010/2) you will install on the dowel bolts in the following step.

(g) Install the 12 lubricated nuts (1010/2) and washers (1010/3) onto the dowel bolts in the front flange of the 9th stage case. See Figure 1010 (Sheet 2).

(h) Apply Engine Oil P03−001 to the 60 bolts (1010/4).

(i) Install 16 lubricated bolts (1010/4) (boltheads down), washers, and nuts, eight pairs equally spaced to the boltholes in the front flange of the 9th stage case. See Figure 1007.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(j) Tighten and torque the 16 bolts, eight pairs at Location R, in the sequence shown in Figure 1007 to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten bolts until no loss of torque occurs.

NOTE: You can use the PWA 102260 Adapter to torque the flange nuts for all stages.

(k) Install the remaining lubricated bolts (boltheads down), and nuts in the flange boltholes except at bolthole Locations AJ. See Figure 1010 (Sheet 3).

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(l) Use an alternating pattern 180 degrees apart to tighten and torque the remaining nuts to 140 - 150 lb-in. (15.818 - 16.948 N.m). Continue to tighten the nuts until no loss of torque occurs.

Subtask 72-35-00-430-100:

(11) Install the 10th stage compressor air seal assembly.

(a) Make sure that the air seal has the correct seal set mating number.

(b) Install the 10th stage air seal, longer leg of the air seal down, on the 9th stage case. Align the offset hole in the air seal, at the approximate 12 o'clock position, with the offset hole in the rear flange of the 9th stage case.

NOTE: The 10th stage air seal flange OD has a reference line at the approximate 12 o'clock position.

(c) Make sure that the air seal engages the upper vane foot of the stator (vane) segments.

(d) Install a suitable protective cover over the blades.

(e) Apply Engine Oil P03-001 to a minimum of 30 work bolts.

(f) Install a minimum of 30 lubricated work bolts (boltheads down), washers, and nuts equally spaced into the 10th stage air seal flange.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(g) Use an alternating pattern (180 degrees apart) to tighten and torque the nuts to 140 - 150 lb-in. (15.818 - 16.948 N.m) to seat the air seal. Continue to tighten the nuts until no loss of torque occurs.

(h) Remove the work bolts, washers, and nuts.

(i) Remove the protective cover from the blades.

(12) Make marks to show the location of the anti-rotation lugs of the 10th stage compressor case on the 10th stage air seal.

(a) Make sure that the case has the correct seal set mating number.

(b) Install the 10th stage compressor case, bolts in the rear flange up, on the 10th stage air seal. Align the offset hole in the front flange with the offset hole in the 10th stage air seal.

NOTE: The 10th stage compressor case rear flange OD has a reference line at the approximate 12 o'clock position.

(c) Locate the anti-rotation lugs in the ID of the 10th stage compressor case. Use an approved pen to temporarily mark the lug positions on the OD of the 10th stage air seal.

(d) Remove the 10th stage compressor case.

(13) Install the 10th stage HPC stator (vane) segments. See Figure 1011.

(a) Obtain the twelve 10th stage HPC stator (vane) segments. See 72-35-00, Assembly-06 (Task 72-35-00-430-006).

(b) Make sure that the sealant cure time is completed.

(c) Locate the stator (vane) segment with the borescope hole and put it aside.

(d) Install the stator (vane) segments to the air seal assembly as follows:

1 If necessary, you can use Beeswax P05-395 or Paraffin Wax Blend P05-396 to hold the vanes in a horizontal position.

2 Install the stator (vane) segments with the thicker seal land down and away from the assembler.

3 Align the anti-rotation lug slot in the stator (vane) segment with the reference ink marks on the air seal.

4 Make sure that the vanes do not touch the knife-edges of the drum rotor.

(e) Install a stator (vane) segment to the air seal assembly as specified above at approximately the top (12 o'clock) position. Align the left vane anti-rotation lug slot with the reference ink mark on the air seal on the assemblers left.

(f) Continue to the assemblers right, use the procedure as specified above and install four additional stator (vane) segments.

(g) Continue to the assemblers right, use the procedure as specified above and install the stator (vane) segment with the borescope vane adjacent to the previously installed stator (vane) segments.

(h) Continue to the assemblers right, use the procedure as specified above and install the remaining stator (vane) segments adjacent to the previously installed stator (vane) segments.

(14) (Reference 1580) Install the 10th stage compressor case assembly onto the 10th stage air seal. See Figure 1012.

(a) Make sure that the case has the correct seal set mating number.

CAUTION: AS YOU INSTALL THE 10TH STAGE CASE, THE ID OF THE STATOR (VANE) SEGMENTS CAN FALL DOWNWARD AND ENGAGE THE KNIFE−EDGE SEAL ON THE DRUM ASSEMBLY.

CAUTION: THE STATOR (VANE) SEGMENTS MUST BE LOOSE AFTER THE CASE IS INSTALLED OR DAMAGE TO THE DRUM OR VANES CAN OCCUR.

(b) Pull the stator (vane) segments upward and outward as you install the case in the following step. This will make sure that the vanes do not engage the knife edge seal and that the vanes can move.

(c) Install the case, rear flange with bolts up, over the 10th stage vanes on the 10th stage air seal. Align the offset hole in the front flange of the case with the offset hole in the 10th stage air seal, and the anti−rotation lugs in the case with mating slots in the stator (vane) segments.

NOTE: The 10th stage case rear flange OD has a reference mark line at the approximate 12 o'clock position.

(d) Make sure that the mating surfaces are clean. If necessary, use shop air to remove unwanted material.

(e) Apply Engine Oil P03−001 to the 12 nuts you will install onto the dowel bolts in the next step.

(f) Install the 12 lubricated nuts and 24 washers (two under each nut) to the dowel bolts in the front flange of the 10th stage case.

(g) Apply Engine Oil P03−001 to the 71 bolts (1012/4).

(h) Install 16 lubricated bolts (1012/4) (boltheads down), washers (1012/3) (two under each nut), and nuts (1012/2) eight pairs equally spaced to the boltholes in the front flange of 10th stage case.

(i) Tighten and torque the 16 bolts, eight pairs at Location R, in the sequence shown in Figure 1007 to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten bolts until no loss of torque occurs.

(j) Install the remaining lubricated bolts (1012/4) (boltheads down), washers (1012/3) (two under each nut), and nuts in the flange boltholes in the front flange of the 10th stage case.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(k) Use an alternating pattern 180 degrees apart to tighten and torque the remaining nuts to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten the bolts until no loss of torque occurs.

NOTE: Do not tighten the bolt just to the left of the borescope boss and the bolt just to the right clockwise of the 6th anti−rotation lug at this time.

Subtask 72−35−00−430−101:

(15) Install the 11th stage compressor air seal assembly.

(a) Make sure that the air seal has the correct seal set mating number.

(b) Install the 11th stage air seal, larger OD and shorter leg of the air seal down, on the 10th stage case. Align the offset hole in the 11th stage air seal with the offset hole in the rear flange of the 10th stage case.

NOTE: The 11th stage air seal flange OD has a reference line at the approximate 12 o'clock position.

(c) Make sure that the air seal engages the upper vane foot of the stator (vane) segments.

(d) Install a suitable protective cover over the blades.

(e) Apply Engine Oil P03−001 to a minimum of 30 work bolts.

(f) Install a minimum of 30 work bolts (boltheads down), washers and nuts equally spaced into the 11th stage air seal flange.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(g) Use an alternating pattern (180 degrees apart) to tighten and torque the nuts to 140 - 150 lb-in. (15.818 - 16.948 N.m) to seat the air seal. Continue to tighten the nuts until no loss of torque occurs.

(h) Remove the work bolts, nuts and washers.

(i) Remove the protective cover from the blades.

(16) Make marks to show the location of the anti-rotation lugs of the 11th stage compressor case on the 11th stage air seal.

(a) Make sure that the case has the correct seal set mating number.

(b) Install the 11th stage compressor case, flange with the reference line on the OD up, on the 11th stage air seal. Align the offset hole in the front flange with the offset hole in the 11th stage air seal.

NOTE: The 11th stage case rear flange OD has a reference line at the approximate 12 o'clock position.

(c) Locate the anti-rotation lugs in the ID of the 11th stage compressor case. Use an approved pen to temporarily mark the lug positions on the OD of the 11th stage air seal.

(d) Remove the 11th stage compressor case.

(17) Install the 11th stage HPC stator (vane) segments. See Figure 1013.

(a) Obtain the thirteen 11th stage HPC stator (vane) segments. See 72-35-00, Assembly-06 (Task 72-35-00-430-006).

(b) Make sure that the sealant cure time is completed.

(c) Install the stator (vane) segments to the air seal assembly as follows:

1 If necessary, you can use Beeswax P05−395 or Paraffin Wax Blend P05−396 to hold the vanes in a horizontal position.

2 Install the stator (vane) segments with the thicker seal land down and away from the assembler.

3 Align the anti−rotation lug slot in the stator (vane) segment with the reference ink marks on the air seal.

4 Make sure that the vanes do not touch the knife−edges of the drum rotor.

(d) Install an 11th stage stator (vane) segment to the air seal as specified above at approximately the top (12 o'clock) position. Align the left vane anti−rotation lug slot with the reference ink mark on the air seal on the assemblers left.

(e) Going to the assemblers right, use the procedure as specified above and install the remaining 12 stator (vane) segments.

(18) (Reference 1580) Install the 11th stage compressor case assembly. See Figure 1014.

(a) Make sure that the case has the correct seal set mating number.

CAUTION: AS YOU INSTALL THE 11TH STAGE CASE, THE ID OF THE STATOR (VANE) SEGMENTS CAN FALL DOWNWARD AND ENGAGE THE KNIFE−EDGE SEAL ON THE DRUM ASSEMBLY.

CAUTION: THE STATOR (VANE) SEGMENTS MUST BE LOOSE AFTER THE CASE IS INSTALLED OR DAMAGE TO THE DRUM OR VANES CAN OCCUR.

(b) Pull the stator (vane) segments upward and outward as you install the case in the following step. This will make sure that the vanes do not engage the knife−edge seal and that the vanes can move.

(c) Install the case, rear flange with the reference line on the OD up, over the 11th stage vanes on the 11th stage air seal. Align the offset hole in the front flange of the case with the offset hole in the 11th stage air seal, and the anti-rotation lugs in the case with mating slots in the stator (vane) segments.

NOTE: The 11th stage case rear flange OD has a reference line at the approximate 12 o'clock position.

(d) Make sure that the mating surfaces are clean. If necessary, use shop air to remove unwanted material.

(e) Apply Engine Oil P03-001 to the 12 nuts you will install on the dowel bolts in the front flange of the 11th stage case.

(f) Install 12 washers and lubricated nuts, onto the dowel bolts in the front flange of the 11th stage case.

(g) Apply Engine Oil P03-001 to the 72 bolts.

(h) Install 16 bolts (1014/4) (boltheads down), washers, and nuts, eight pairs equally spaced to the boltholes in the front flange of the 11th stage case. See Figure 1007.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(i) Tighten and torque the 16 bolts, eight pairs at Location R, in the sequence shown in Figure 1007 to 140 - 150 lb-in. (15.818 - 16.948 N.m). Continue to tighten bolts until no loss of torque occurs.

(j) Apply Engine Oil P03-001 to the 56 remaining bolts.

(k) Install the remaining 56 lubricated bolts (boltheads down), washers (under nuts), and nuts in the boltholes in the front flange of the 11th stage case. See Figure 1010 (Sheet 3).

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(l) Use an alternating pattern (180 degrees apart) Tighten and torque the remaining nuts to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten the nuts until no loss of torque occurs.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(m) On the 10th stage compressor case front flange, locate the bolt just to the left of the borescope boss and the bolt just to the right clockwise of the 6th anti−rotation lug that was left handtight. Tighten and torque these bolts to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten the nuts until no loss of torque occurs.

Subtask 72−35−00−430−102:

(19) Install the 12th stage compressor air seal assembly. See Figure 1015.

(a) Install two PWA 100379 Alignment Pins equally spaced in the larger, 0.300 inch (7.620 mm), boltholes in the rear flange of the 11th stage case.

(b) Make sure that the air seal has the correct seal set mating number.

(c) Place the 12th stage compressor air seal (1015/1) (larger OD of the air seal down) on the 11th stage compressor case.

(d) Align the offset hole in the air seal (1015/1) with the offset hole in the rear flange of the 11th stage case.

NOTE: The 12th stage compressor air seal flange OD has a reference line at the approximate 12 o'clock position.

(e) Make sure that the air seal engages the upper vane foot of the stator (vane) segments.

(f) Install a suitable protective cover over the blades.

(g) Apply Engine Oil P03−001 to a minimum of 30 work bolts.

(h) Install a minimum of 30 work bolts (boltheads down), washers, and nuts equally spaced into boltholes in the 12th stage air seal flange.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(i) Use an alternating pattern (180 degrees apart) to tighten and torque the nuts to 140 − 150 lb−in. (15.818 − 16.948 N.m) to seat the air seal. Continue to tighten the nuts until no loss of torque occurs.

(j) Remove the Alignment Pins, work bolts, washers, and nuts.

(k) Remove the protective cover from the blades.

(20) Make marks to show the location of the anti−rotation lugs of the 12th stage compressor case on the 12th stage air seal.

(a) Make sure that the case has the correct seal set mating number.

(b) Install the 12th stage compressor case, larger OD flange down, onto the 12th stage air seal. Align the offset hole in the front flange with the offset hole in the 12th stage air seal.

NOTE: The 12th stage case rear flange OD has a reference line at the approximate 12 o'clock position.

(c) Locate the anti−rotation lugs in the ID of the 12th stage compressor case. Use an approved pen to temporarily mark the lug positions on the OD of the 12th stage air seal.

(d) Remove the 12th stage compressor case.

(21) Install the 12th stage HPC stator (vane) segments. See Figure 1016.

(a) Obtain the twelve 12th stage HPC stator (vane) segments. See 72-35-00, Assembly-06 (Task 72-35-00-430-006).

(b) Make sure that the sealant cure time is completed.

(c) Install the stator (vane) segments to the air seal assembly as follows:

1 If necessary, you can use Beeswax P05-395 or Paraffin Wax Blend P05-396 to hold the vanes in a horizontal position.

2 Install the stator (vane) segments on the air seal with the thicker seal land down and away from the assembler.

3 Align the anti-rotation lug slot in the stator (vane) segment with the reference ink marks on the air seal.

4 Make sure that the vanes do not touch the knife-edges of the drum rotor.

(d) Use the procedure as specified above and install an eight stator (vane) segment to the air seal at approximately the top (12 o'clock) position. Align the anti-rotation lug slot in the left vane with the reference ink mark on the air seal to the assemblers left.

(e) Going to the assemblers right, use the procedure as specified above and install the remaining stator (vane) segments in the following sequence:

One seven stator (vane) segment
Two eight stator (vane) segments
One seven stator (vane) segment
Two eight stator (vane) segments
One seven stator (vane) segment
Two eight stator (vane) segments
One seven stator (vane) segment
One eight stator (vane) segment

(22) (Reference 1580) Install the 12th stage compressor case assembly. See Figure 1017.

(a) Make sure that the case has the correct seal set mating number.

CAUTION: AS YOU INSTALL THE 12TH STAGE COMPRESSOR CASE, THE ID OF THE STATOR (VANE) SEGMENTS CAN FALL DOWNWARD AND ENGAGE THE KNIFE-EDGE SEAL ON THE DRUM ASSEMBLY.

CAUTION: THE STATOR (VANE) SEGMENTS MUST BE LOOSE AFTER THE CASE IS INSTALLED OR DAMAGE TO THE DRUM OR VANES CAN OCCUR.

(b) Pull the stator (vane) segments upward and outward as you install the case in the following step. This will make sure that the vanes do not engage the knife-edge seal and that the vanes can move.

(c) Install the case, larger OD flange down, over the 12th stage vanes on the 12th stage air seal. Align the offset hole in the front flange of the case with the offset hole in the air seal, and the anti-rotation lugs in the case with mating slots in the stator (vane) segments.

NOTE: The 12th stage compressor rear flange OD has a reference line at the approximate 12 o'clock position.

(d) Make sure that the mating surfaces are clean. If necessary, use shop air to remove unwanted material.

(e) Apply Tape P05-341 to the OD of the case to cover all through holes.

(f) Starting at the 12 o'clock position, and moving to the assemblers left, make a mark at every 5th hole in the 12th stage case front flange.

NOTE: You will not put bolts in the holes with the marks in the following step.

NOTE: The 12th stage compressor rear flange OD has a reference line at the approximate 12 o'clock position.

(g) Apply Engine Oil P03-001 to 36 bolts.

(h) Install 16 lubricated bolts (boltheads up), washers (below the flange) and nuts, eight pairs equally spaced, to the boltholes in the front flange of the 12th stage case.

NOTE: Do not put bolts in the holes with the marks at this time.

(i) Tighten and torque the bolts, eight pairs at Location R, in the sequence shown in Figure 1007 to 140 - 150 lb-in. (15.818 - 16.948 N.m). Continue to tighten bolts until no loss of torque occurs.

(j) Install the 20 remaining lubricated bolts (boltheads up), washers (below the flange) and nuts, to the boltholes in the front flange of the 12th stage case.

NOTE: Do not put bolts in the holes with the marks at this time.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(k) Tighten and torque the remaining bolts to 140 - 150 lb-in. (15.818 - 16.948 N.m). Continue to tighten bolts until no loss of torque occurs.

NOTE: If necessary, use the PWA 100383 Torque Adapter to tighten the bolts at the borescope location.

(l) Apply Engine Oil P03-001 to the 12 nuts you will install onto the dowel bolts.

(m) Install 12 washers and lubricated nuts onto the dowel bolts in the front flange of the 12th stage case.

(n) Using and alternating pattern (180 degrees apart) tighten and torque the nuts to 140 - 150 lb-in. (15.818 - 16.948 N.m). Continue to tighten the nuts until no loss of torque occurs.

Subtask 72-35-00-430-103:

(23) Install the 13th stage compressor air seal assembly.

(a) Make sure that the air seal has the correct seal set mating number.

(b) Place the 13th stage compressor air seal (larger OD and longer leg of the rubstrip down) on the 12th stage compressor case. Align the offset hole of the 13th stage air seal with the offset hole in the rear flange of the 12th stage case.

NOTE: The 13th stage compressor air seal flange OD has a reference line at the approximate 12 o'clock position.

(c) Make sure that the air seal engages the upper vane foot of the stator (vane) segments.

(d) Install a suitable protective cover over the blades.

(e) Apply Engine Oil P03-001 to a minimum of 30 work bolts.

(f) Install a minimum of 30 work bolts (boltheads down), washers and nuts equally spaced into boltholes in the 13th stage air seal flange.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(g) Use an alternating pattern (180 degrees apart) to tighten and torque the nuts to 140 - 150 lb-in. (15.818 - 16.948 N.m) to seat the air seal. Continue to tighten the nuts until no loss of torque occurs.

(h) Remove the work bolts, nuts, and washers.

(i) Remove the protective cover from the blades.

(24) Make marks to show the location of the anti-rotation lugs of the 13th stage compressor case on the 13th stage air seal.

(a) Make sure that the case has the correct seal set mating number.

(b) Install the 13th stage compressor case, bolts in the rear flange up, on the 13th stage air seal. Align the offset hole in the front flange with the offset hole in the air seal.

NOTE: The 13th stage compressor case rear flange OD has a reference line at the approximate 12 o'clock position.

(c) Locate the anti-rotation lugs in the ID of the 13th stage compressor case. Use an approved pen to temporarily mark the lug positions on the OD of the 13th stage air seal.

(d) Remove the 13th stage compressor case.

(25) Install the 13th stage HPC stator (vane) segments. See Figure 1018.

(a) Obtain the twelve 13th stage HPC stator (vane) segments. See 72-35-00, Assembly-06 (Task 72-35-00-430-006).

(b) Make sure that the sealant cure time is completed.

(c) Install the stator (vane) segments on the air seal assembly as follows:

1 If necessary, you can use Beeswax P05-395 or Paraffin Wax Blend P05-396 to hold the vanes in a horizontal position.

2 Install the stator (vane) segments that follow on the air seal assembly, thicker seal land down and away from the assembler.

3 Align the anti-rotation lug slot in the stator (vane) segment with the reference ink marks on the air seal.

4 Make sure that the vanes do not touch the knife-edges of the drum rotor.

(d) Install a stator (vane) segment to the air seal assembly as specified above at approximately the top (12 o'clock) position. Align the left vane anti-rotation lug slot with the reference ink mark on the air seal to the assemblers right.

(e) Going to the assemblers right, use the procedure as specified above and install the remaining 11 stator (vane) segments.

(26) (Reference 1580) Install the 13th stage compressor case assembly. See Figure 1019 (Sheet 1).

(a) Make sure that the case (1019/1) has the correct seal set mating number.

CAUTION: AS YOU INSTALL THE 13TH STAGE CASE, THE ID OF THE STATOR (VANE) SEGMENTS CAN FALL DOWNWARD AND ENGAGE THE KNIFE−EDGE SEAL ON THE DRUM ASSEMBLY.

CAUTION: THE STATOR (VANE) SEGMENTS MUST BE LOOSE AFTER THE CASE IS INSTALLED OR DAMAGE TO THE DRUM OR VANES CAN OCCUR.

(b) Pull the stator (vane) segments upward and outward as you install the case in the following step. This will make sure that the vanes do not engage the knife−edge seal and that the vanes can move.

(c) Install the case, rear flange with bolts up, over the 13th stage vanes on the 13th stage air seal. Align the offset hole in the front flange of the case with the offset hole in the air seal, and the anti−rotation lugs in the case with the mating slots in the stator (vane) segments.

NOTE: The 13th stage compressor case rear flange OD has a reference line at the approximate 12 o'clock position.

(d) Make sure that the mating surfaces are clean. If necessary, use shop air to remove unwanted material.

(e) Apply Engine Oil P03−001 to the 12 nuts (1019/6) you will install on the dowel bolts in the following step.

(f) Install the 12 lubricated nuts (1019/6) and washers (1019/4) onto the dowel bolts in the front flange of the 13th stage case (1019/1).

(g) Apply Engine Oil P03−001 to the 24 bolts (1019/5).

(h) Install 24 bolts (boltheads down), washers (above the flange), and nuts to the through holes in the front flange of the 13th stage case.

NOTE: Do not install bolts to the clinch nut locations at this time.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(i) Tighten and torque 16 nuts, eight pairs at Location R, in the sequence shown in Figure 1007 to 140 - 150 lb-in. (15.818 - 16.948 N.m). Continue to tighten the nuts until no loss of torque occurs.

(j) Use an alternating pattern (180 degrees apart) to tighten and torque the remaining nuts to 140 - 150 lb-in. (15.818 - 16.948 N.m). Continue to tighten the nuts until no loss of torque occurs.

Subtask 72-35-00-430-104:

(27) Install the 14th stage compressor air seal assembly.

(a) Make sure that the air seal has the correct seal set mating number.

(b) Place the 14th stage compressor air seal (larger OD and longer leg of rubstrip down) on the 13th stage compressor case. Align the offset hole of the 14th stage air seal with the offset hole in the rear flange of the 13th stage case.

NOTE: The 14th stage air seal flange OD has a reference line at the approximate 12 o'clock position.

(c) Make sure that the air seal engages the upper vane foot of the stator (vane) segments.

(d) Install a suitable protective cover over the blades.

(e) Apply Engine Oil P03-001 to a minimum of 30 work bolts.

(f) Install a minimum of 30 work bolts (boltheads down), washers and nuts equally spaced into boltholes in the air seal flange.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(g) Use an alternating pattern (180 degrees apart) to tighten and torque the nuts to 140 - 150 lb-in. (15.818 - 16.948 N.m) to seat the air seal. Continue to tighten the nuts until no loss of torque occurs.

(h) Remove the work bolts, washers, and nuts.

(i) Remove the protective cover from the blades.

(28) Make marks to show the location of the anti-rotation lugs of the 14th stage compressor case on the 14th stage air seal.

(a) Make sure that the case has the correct seal set mating number.

(b) Install the 14th stage compressor case, bolts in the rear flange up, on the 14th stage air seal. Align the offset hole in the front flange with the offset hole in the 14th stage air seal.

NOTE: The 14th stage case rear flange OD has a reference line at the approximate 12 o'clock position.

(c) Locate the anti-rotation lugs in the ID of the 14th stage compressor case. Use an approved pen to temporarily mark the lug positions on the OD of the 14th stage air seal.

(d) Remove the 14th stage compressor case.

(29) Install the 14th stage HPC stator (vane) segments. See Figure 1020.

(a) Obtain the twelve 14th stage HPC stator (vane) segments. See 72-35-00, Assembly-06 (Task 72-35-00-430-006).

(b) Make sure that the sealant cure time is completed.

(c) Install the stator (vane) segments on the air seal assembly as follows:

1 If necessary, you can use Beeswax P05-395 or Paraffin Wax Blend P05-396 to hold the vanes in a horizontal position.

2 Install the stator (vane) segments that follow on the air seal assembly, thicker seal land down and away from the assembler.

3 Align the anti-rotation lug slot in the stator (vane) segment with the reference ink marks on the air seal.

4 Make sure that the vanes do not touch the knife-edges of the drum rotor.

(d) Install a ten stator (vane) segment to the air seal assembly as specified above to the left of the top (12 o'clock) position. Align the left vane anti-rotation lug slot with the reference ink mark.

NOTE: Because of the adjacent studs, it can be easier to not install each stator segment fully until the last stator segment is installed. You can then move the vane segments as necessary to install the last stator segment. With all of the stator segments not fully installed, move the stator segments into their correct position.

(e) Going to the assemblers right, use the procedure as specified above and install the remaining stator (vane) segments in the following sequence:

One eight stator (vane) segment
One eight stator (vane) segment
One ten stator (vane) segment
One eight stator (vane) segment
One eight stator (vane) segment
One ten stator (vane) segment
One eight stator (vane) segment
One eight stator (vane) segment
One ten stator (vane) segment
One eight stator (vane) segment with borescope

hole
One eight stator (vane) segment

(30) (Reference 1580) Install the 14th stage compressor case. See Figure 1021.

(a) Make sure that the case has the correct seal set mating number.

CAUTION: AS YOU INSTALL THE 14TH STAGE CASE, THE ID OF THE STATOR (VANE) SEGMENTS CAN FALL DOWNWARD AND ENGAGE THE KNIFE-EDGE SEAL ON THE DRUM ASSEMBLY.

CAUTION: THE STATOR (VANE) SEGMENTS MUST BE LOOSE AFTER THE CASE IS INSTALLED OR DAMAGE TO THE DRUM OR VANES CAN OCCUR.

(b) Pull the stator (vane) segments upward and outward as you install the case in the following step. This will make sure that the vanes do not engage the knife-edge seal and that the vanes can move.

(c) Install the case, rear flange with bolts up, over the 14th stage vanes on the 14th stage air seal. Align the offset hole in the front flange of the case with the offset hole in the 14th stage air seal, and the anti-rotation lugs in the case with mating slots in the stator (vane) segments.

NOTE: The 14th stage case rear flange OD has a reference line at the approximate 12 o'clock position.

(d) Make sure that the mating surfaces are clean. If necessary, use shop air to remove unwanted material.

(e) Apply Engine Oil P03-001 to the 18 nuts you will install onto the dowel bolts.

(f) Install 18 washers and lubricated nuts onto the dowel bolts in the front flange of the 14th stage case.

(g) Apply Engine Oil P03-001 to the 42 bolts.

(h) Install 16 lubricated bolts (boltheads down), washers (above the flange) and nuts, eight pairs equally spaced, to the boltholes in the front flange of the 14th stage case.

(i) Tighten and torque 16 nuts total, eight pairs at Location R, in the special sequence shown in Figure 1007 to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten the nuts until there is no loss of torque.

(j) Install the remaining lubricated bolts (boltheads down), washers (above the flange) and nuts.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(k) Use an alternating pattern (180 degrees apart), to tighten and torque the remaining nuts to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten the nuts until there is no loss of torque.

Subtask 72−35−00−430−105:

(31) Install the 13th and 14th stage compressor heat shield (1022/1). See Figure 1022.

(a) Remove the protective tape from the case assemblies.

(b) Remove any remaining tape adhesive from the cases. Use the SPOP 208 (Task 70−21−00−110−040) wipe method, Standard Practices Manual, PN 585005.

(c) Transfer a mark from the reference line at the 12 o'clock position on the OD of the rear flange of the 14th stage case to the rear face of the 14th stage case.

NOTE: The mark will be used to position the 15th stage air seal after installation of the 13th stage heat shield.

(d) Apply Engine Oil P03−001 to the 24 bolts (1022/5).

(e) Starting at the clinch nut in the front flange of the 13th stage compressor case to the right of the offset hole (12 o'clock) position and working to the assemblers right, loosely assemble a 13th stage compressor heat shield (1022/3) (recessed side against the flange), a retainer (1022/4) (angle up), and a lubricated bolt (1022/5).

(f) Continue to the assemblers right, loosely install the 10 remaining retainers (1022/4), one retainer (1022/2), and the remaining heat shield (1022/3). Install the retainer (1022/2), with the lug detail, at the fourth retainer from the 12 o'clock location (opposite the borescope boss).

NOTE: The location of the shields (1022/3) is not important.

(g) Expand the heat shield (1022/1) to its maximum diameter.

(h) Install the heat shield (angle end up) down over the 13th stage compressor case to a point just above the 12th stage compressor case rear flange.

(i) Align the borescope hole in the heat shield with the 15th stage borescope boss.

(j) Close the heat shield around the case and position the heat shield rear hook detail over the rear flange of the 14th stage case. Keep the gaps at the ends of the heatshield approximately equal.

(k) Put the previously installed heat shield retainers (1022/2) and (1022/4) and heat shields (1022/3) to the rear flange of the 12th stage compressor case.

(l) Make sure that the lug in the heat shield retainer (1022/2) aligns with the notch in the heat shield which is 180 degrees from the borescope boss.

(m) Tighten and torque the 24 bolts (1022/5) to 75 − 85 lb−in. (8.474 − 9.604 N.m).

(32) Install the 15th stage compressor air seal assembly. See Figure 1023.

(a) Make sure that the air seal (1023/1) has the correct seal set mating number.

(b) Install the 15th stage air seal, heat shield retaining leg down, onto the 14th stage compressor case. Align the offset hole in the air seal with the offset hole in the rear flange of the 14th stage case, at the approximate 12 o'clock position.

NOTE: The 15th stage air seal flange OD has a reference line at the approximate 12 o'clock position.

(c) Make sure that the air seal engages the 13th and 14th stage heat shield, and that the air seal engages the upper vane foot of the stator (vane) segments.

(d) Install a suitable protective cover over the blades.

(e) Apply Engine Oil P03-001 to a minimum of 30 work bolts.

CAUTION: MAKE SURE THAT THE 15TH STAGE AIR SEAL ENGAGES THE 13TH AND 14TH STAGE HEAT SHIELD BEFORE YOU INSTALL THE AIRSEAL.

(f) Install a minimum of 30 equally spaced lubricated work bolts, washers, under boltheads, into the 15th stage air seal flange.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(g) Use an alternating pattern (180 degrees apart) to tighten and torque the bolts to 140 - 150 lb-in. (15.818 - 16.948 N.m) to seat the air seal. Continue to tighten the bolts until no loss of torque occurs.

(h) Remove the work bolts and washers.

(33) Install the 12th stage compressor heat shields. See Figure 1024.

(a) Install the upper (1024/5) and lower (1024/7) inner heat shields into the recess in the front flange of the 12th stage case and position the ends of the heat shields at the 3 and 9 o'clock positions.

(b) Install the left (1024/4) and right (1024/8) outer heat shields on top of the inner heat shields and position the ends of the heat shields at the 6 and 12 o'clock positions.

(c) Apply Engine Oil P03-001 to the 12 bolts (1024/1).

(d) Install 12 spacers (1024/3), bushings (1024/2) and 12 lubricated bolts (1024/1) through the boltholes in the heat shields.

(e) Install 12 nuts (1024/6) to the bolts fingertight.

(f) Tighten and torque the 12 nuts to 75 - 85 lb-in. (8.474 - 9.604 N.m). Continue to tighten the nuts until no loss of torque occurs.

(34) Install the 11th stage compressor heat shield. See Figure 1025 (Sheets 1 and 2).

(a) Apply Engine Oil P03-001 to 24 bolts (1025/2) that you will use to install the 11th stage heat shield retainers.

(b) Locate the second clinch nut in the front flange of the 10th stage compressor case to the left of the top (12 o'clock) position.

NOTE: This clinch nut will be the location for the right bolt in the special retainer (1025/3).

(c) Assemble a 10th stage compressor heat shield (1025/1) (recessed side against the flange). Assemble the special retainer (1025/3) with the right bolt hole in the retainer at the clinch nut identified in the previous step. Loosly install the heat shield and retainer with two lubricated bolts (1025/2).

(d) Continue to the assemblers right, loosely install the 11 remaining retainers (1025/4) and the remaining heat shield (1025/2) with bolts (1025/2). With the special retainer (1025/3) (with the detail lug) opposite the borescope boss. See Figure 1025 (Sheet 2).

NOTE: The location of the heat shields (1025/1) is not important.

(e) Expand the 11th stage compressor heat shield (1025/5) to its maximum diameter.

(f) Install the heat shield (1025/5) (angle up) down over the 10th stage case to a point just above the 9th stage case rear flange.

(g) Close the heat shield (1025/1) around the case aligning the heat shield borescope hole with the boss in the 10th stage compressor case. Keep the gaps at the ends of the heatshield approximately equal.

(h) Hold the two heat shields (1025/1) against the upper flange of the 9th stage case while you slide the heat shield (1025/5) up to engage the slot between the 11th and the 12th stage compressor cases.

NOTE: The lower lip of the 11th stage heat shield (1025/5) must engage the outer flange of the heat shields (1025/1).

(i) With the heat shields (1025/1) and (1025/5) correctly engaged, position the previously installed retainers (1025/3) and (1025/4) to the rear flange of the 9th stage case. Tighten the bolts (1025/2) fingertight.

(j) Make sure that the upper end of the heat shield (1025/5) is in the slot between the 11th and the 12th stage compressor cases.

(k) Tighten and torque the bolts (1025/2) to 75 - 85 lb-in. (8.474 - 9.604 N.m).

(35) Install the 9th stage compressor heat shields. See Figure 1026 (Sheets 1 and 2).

(a) Install the upper inner heat shield (1026/2) into the groove in the forward flange of the 9th stage case and rotate it approximately eight degrees clockwise to align the holes in the heat shield with the through holes in the 9th case front flange. See Figure 1026 (Sheet 2).

NOTE: The ends of the heat shields will be at approximately the 2:30 and 8:30 o'clock positions.

(b) Install the lower inner heat shield (1026/2) into the groove in the forward flange of the 9th stage case and rotate approximately 8 degrees) clockwise to align the holes in the heat shield with the 12 through holes in the case flange.

(c) Install the outer left and right heat shields (1026/1) on top of the previously installed inner heat shields.

(d) Rotate these heat shields approximately 8 degrees counter clockwise to align with the holes in the heat shields with the through holes in the 9th stage case front flange.

NOTE: The ends of the heat shields will be at approximately the 5:30 and 11:30 o'clock positions.

(e) Install two 9th stage front heat shields (1026/10) (angle up) below the 8th stage case rear flange.

NOTE: The ends of the heat shields will be at approximately the 2:30 and 8:30 o'clock positions.

(f) At the two ends of the heat shields just installed, install covers (1026/6), a bushing (1026/8), and a lubricated bolt (1026/9) up through the 8th stage case flange and the rear heat shield. Install a spacer (1026/5), a bushing (1026/4), and a nut (1026/3) to the bolt fingertight.

(g) At the ten remaining holes, install a spacer (1026/7), a bushing (1026/8), and a lubricated bolt (1026/9) up through the 8th stage case flange and the rear heat shield. Install a spacer (1026/5), a bushing (1026/4), and nut (1026/3) to the bolt fingertight.

(h) Tighten the bolts (1026/9) to 75 − 85 lb−in. (8.474 − 9.604 N.m).

Subtask 72−35−00−430−106:

(36) Install the gaskets and seals in the compressor cases. See Figure 1027.

(a) Install a new gasket (1027/4) in the upper groove in the 9th stage case.

(b) Install the seal ring (spring) (1027/3) in the (seal holder) groove in the 12th stage case.

(c) If necessary, you can use Beeswax P05−395 or Paraffin Wax Blend P05−396 to hold the seals in position.

(d) Install the seal ring (1027/2) over the spring (1027/3) in the (seal holder) groove in the 12th stage case.

(e) Install the seal (1027/1) in the vertical (seal holder) groove in the front flange of the 12th stage case.

(37) (Reference 1580) Temporarily assemble the HPC rear support to the HPC rear case. See Figure 1028 (Sheet 2) and Figure 1028 (Sheet 3).

(a) Attach a hoist to the lift hole in PWA 105504 Adapter. Use the hoist to lift the Adapter and put it over the rear flange of the HPC rear case (1028/1). Align the boltholes in the Adapter with the boltholes in the case. Install the Adapter to the rear case with eight detail screw assemblies and four nut plates.

NOTE: The Adapter has a scribed line on the OD of the Adapter. Align this line with the offset hole in the HPC rear case (rear flange).

(b) Use the hoist to put the rear case on a bench, rear (smaller ID flange with dowel bolts) end up.

(c) Remove the screw assemblies and nut plates that attach the Adapter to the case.

(d) Remove the Adapter from the case.

(e) Make sure that the rear case has the correct seal set mating number.

(f) Make sure that the HPC rear support (1028/1) has the correct seal set mating number.

CAUTION: YOU CAN MIS−ASSEMBLE THE REAR SUPPORT ON THE HPC REAR CASE AND DAMAGE TO THE CASE AND/OR SUPPORT CAN OCCUR.

(g) Find the "X" mark on the rear inner flange of the HPC rear case. This is at approximately the 12 o'clock position. Make a temporary mark on the outer flange of the case at the "X" location. Refer to 70−11−00, Standard Practices Manual, PN 585005.

(h) Find the reference 0.123 − 0.128 inch (3.125 − 3.251 mm) diameter non−through hole (dimple) in the rear face, outer flange, of the HPC rear support. This reference diameter is approximately at the 12 o'clock position.

(i) Align the non−through hole (dimple) reference on the HPC rear support with the "X" mark on the rear inner flange of the HPC rear case and lower the rear support onto the rear case.

(j) Apply Engine Oil P03−001 to eight work bolts (.250−28), approximately 1 inch (25.400 mm) long, that you will use to temporarily install in the HPC rear support (1028/1) to the HPC rear case (1028/3).

(k) Install the eight lubricated work bolts (1028/2) equally spaced at Positions BD in the HPC rear support outer flange. See Figure 1028 (Sheet 3).

(38) Remove the protective tape from the case assemblies.

(a) Remove any remaining tape adhesive from the cases. Use the SPOP 208 (Task 70−21−00−110−040) wipe method, Standard Practices Manual, PN 585005.

(39) Install two PWA 105609 Alignment Pins to the front flange of the HPC rear case. See Figure 1028 (Sheet 4).

(a) Install one pin at the jackscrew hole at the 4 o'clock position, and the second pin at the 7 o'clock position.

(b) To install the pin, remove the detail pin from the detail plate.

(c) Position the screw and plate into the jackscrew hole at the rear (upper) side of the front flange of the HPC rear case. Align the threaded hole with the bolthole next to the jackscrew hole, and install the detail pin through the bolthole and thread it into the threaded hole in the detail plate.

(d) Tighten the knurled screw to attach the pin to the case.

(40) Install the HPC rear case to the 8th stage compressor air seal. See Figure 1028 (Sheet 5).

(a) Attach a hoist to the lift hole in PWA 105504 Adapter. Use the hoist to lift the Adapter and put it over the HPC rear case. Align the boltholes in the Adapter with the boltholes in the case. Install the Adapter to the rear case with eight detail screw assemblies and four nut plates.

NOTE: The Adapter has a scribed line on the OD of the outer ring. Align this line with the offset hole in the rear flange of the HPC rear case.

CAUTION: YOU CAN MIS−ASSEMBLE THE HPC REAR SUPPORT ON THE 15TH STAGE COMPRESSOR AIR SEAL IF THE 12 O'CLOCK MARKINGS ARE NOT PROPERLY ALIGNED.

(b) Use the hoist to carefully lower the HPC rear case and rear support assembly over the 8th through 15th stage case assembly.

(c) Use the rear support as a guide to align the 12 o'clock position of the HPC rear case with the top 12 o'clock of the 15th stage air seal.

(d) Align the hole next to the reference hole in the OD flange of the rear support with the hole marked "X" in the 15th stage air seal, and lower the rear case front flange onto the 8th stage air seal.

(e) Remove the screw assemblies and nut plates that attach the Adapter to the case.

(f) Remove the Adapter from the case.

CAUTION: YOU CAN DAMAGE THE HPC REAR SUPPORT IF YOU DO NOT REMOVE THE BOLTS THAT ATTACH THE HPC REAR SUPPORT TO THE REAR CASE.

(g) Remove all of the bolts that were used to attach the HPC rear support to the HPC rear case.

(h) Make sure that there is a minimum of one PWA 105768 Spacer next to each work bolt before you install the HPC rear case front flange to the 8th stage air seal.

(i) Install a minimum of 40 equally spaced lubricated work bolts (boltheads up), threads lubricated with Engine Oil P03-001, into the boltholes in Flange H. Install washers and nuts to the bolts. See Figure 1028 (Sheet 5).

NOTE: Flange H is the front (lower) flange of the HPC rear case.

CAUTION: YOU CAN DAMAGE THE REAR SUPPORT IF YOU DO NOT TIGHTEN THE BOLTS EVENLY.

(j) You must monitor the HPC rear support while you tighten the bolts to make sure you install the HPC rear case evenly. Use an alternating pattern (180 degrees apart) to tighten the bolts in Flange H.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(k) Use an alternating pattern (180 degrees apart) to torque the bolts to 190 − 210 lb−in. (21.467 − 23.727 N.m). Continue to tighten the bolts until no loss of torque occurs.

(l) Loosen all of the work bolts used to install the HPC rear case front flange to the 8th stage air seal.

(m) Remove all of the PWA 105768 Spacers located between the HPC front (split) case and the 8th stage air seal.

NOTE: You can use jackscrews in the HPC front (split) case to lift the seal set assembly weight off of the assembly spacers. This can help you remove the assembly spacers.

(n) Remove the two Alignment Pins from the front flange of the HPC rear case.

(41) Install the 8th stage air seal and HPC rear case and to the HPC front case.

(a) Use an alternating pattern (180 degrees apart) to torque the bolts to 190 − 210 lb−in. (21.467 − 23.727 N.m). Continue to tighten the work bolts until no loss of torque occurs.

(b) Remove the work bolts, washers, and nuts.

(c) Refer to Install The Flange H Brackets And Hardware, 72−35−00, Assembly−21 (Task 72−35−00−430−021).

(42) Install the 7th stage synchronizing ring runners to Flange H. See Figure 1028 (Sheet 6).

(a) Apply Engine Oil P03−001 to the 22 bolts (1028/3).

(b) Assemble the 11 runners (1028/2), lug end up, at Location K; and attach the runners with the lubricated bolts (1028/3), bolt heads up, and nuts (1028/1).

Subtask 72−35−00−430−108:

(43) Install the HPC rear support (1029/1). See Figure 1029 (Sheet 1) and (Sheet 2).

(a) Remove the HPC rear support from the HPC rear case.

(b) Install one of the correct spacer class Spacer AB (1029/8) with the ovalizied hole at the bottom (6 o'clock) position of the outer case inner rear flange, then install the seven remaining spacers onto the flange.

(c) Make sure that the HPC rear support (1029/1) has the correct seal set mating number.

CAUTION: YOU CAN MIS−ASSEMBLE THE HPC REAR SUPPORT ON THE 15TH STAGE AIR SEAL IF THE HOLES WITH THE MARKINGS ARE NOT PROPERLY ALIGNED.

(d) Align the boltholes in the HPC rear support (1029/1) with the botholes in the HPC rear case and the 15th stage air seal.

NOTE: The HPC rear support has a reference spherical radius at the approximate 12 o'clock position.

(e) With the boltholes aligned, lower the HPC rear support (1029/1) onto the inner flange of the HPC rear case and the 15th stage air seal.

(f) Apply Engine Oil P03−001 to 64 bolts (1029/6).

(g) Install eight lubricated bolts (1029/6) and washers (1029/7) equally spaced at Positions BD in the HPC rear support outer flange. Run down the bolts to just touch the flange face. See Figure 1029 (Sheets 1 and 2).

NOTE: There are 16 boltholes in the HPC rear support outer flange that are larger in diameter. Do not install bolts in these boltholes at this time.

(h) Apply Engine Oil P03−001 to 18 bolts (1029/2).

(i) Install 18 bolts (1029/2) and washers (1029/3) to the HPC rear support inner flange. Bolts are not necessary at Locations AU. See Figure 1029 (Sheets 1 and 3).

(j) Apply Engine Oil P03-001 to 24 nuts (1029/4).

(k) Install 48 washers (1029/5) two on each dowel bolt, and nuts (1029/4) to the 24 dowel bolts in the inner flange of the HPC rear support (1029/1). Tighten the nuts fingertight.

NOTE: You can use non-self locking work nuts to prevent over stressing the bill of material parts and replace the work nuts after seating the HPC rear support.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(l) Torque the inner flange bolts (1029/2) and nuts (1029/4) to 140 - 150 lb-in. (15.818 - 16.948 N.m) using an alternating pattern 180 degrees apart. Continue to tighten the bolts and nuts until no loss of torque occurs.

(m) Install the remaining lubricated bolts (1029/6) and washers (1029/7) to the HPC rear support outer flange.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(n) Torque the 64 outer flange bolts (1029/6) to 105 - 115 lb-in. (11.863 - 12.993 N.m) using an alternating pattern 180 degrees apart. Continue to tighten the bolts until no loss of torque occurs.

(44) Install the 15th stage heat shield. See Figure 1030.

(a) Align the boltholes in the 15th stage HPC upper rear heat shield (1030/2) and lower heat shield (1030/1) with the boltholes in the HPC rear support and lower the heat shields onto the rear support.

NOTE: The ends of the heat shields will be at approximately the 2:30 and 8:30 o'clock positions.

(b) Install two covers (1030/6) with bushings (1030/4) at the bolthole locations at the ends of the heat shields.

(c) Install 16 spacer plates (1030/5) with bushings (1030/4) at the remaining bolthole locations in the heat shields.

(d) Apply Engine Oil P03−001 to the 18 bolts (1030/3).

(e) Install 18 lubricated bolts (1030/3) to the bushings in the heat shield. Tighten the bolts fingertight.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(f) Use an alternating pattern (180 degrees apart) to tighten and torque the 18 bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Continue to tighten the bolts until there is no loss of torque.

Subtask 72−35−00−430−109:

(45) Inspect the 15th stage compressor air seal for concentricity. See Figure 1031 (Sheet 1).

(a) Install PWA 105506 Constraint Ring on the rear flange of the HPC rear case.

1 Use a suitable sling to put the ring (step side down) over the rear flange of the HPC rear case.

2 Align the dowel pin in the ring with the offset dowel pin hole in the HPC rear case rear flange, at the 6 o'clock position, and lower the ring onto the rear case.

NOTE: The dowel pin in the constraint ring is at the 180 degree position on the constraint ring.

3 Use 12 cap screws (heads up), washers (under nuts), and nuts to install the ring to the case.

4 Use an alternating pattern, tighten the bolts to install the ring to the HPC rear case.

5 Make sure that the ring is against the case flange.

(b) Place PWA 87485 Gage on the rear of the Constraint Ring, with the two dowel pins on the bottom of the gage against the outside diameter of the Constraint Ring.

(c) Adjust the detail indicator so it touches the 15th stage air seal.

(d) Take 12 measurements at 12 equally spaced locations on the ID of the 15th stage air seal.

(e) The ID of the 15th stage air seal must be concentric with the HPC rear case within 0.010 in. (0.254 mm) at all 12 locations.

(f) Remove the Gage.

(g) Remove the Constraint Ring as follows.

1 Remove the cap screws, nuts and washers that attach the Constraint Ring to the HPC rear case.

2 Install jackscrews into six equally spaced threaded hole locations in the rear flange of the rear case.

3 Turn the jackscrews equally and evenly to loosen the Constraint Ring.

CAUTION: REMOVE THE CONSTRAINT RING FROM THE HPC REAR CASE CAREFULLY TO PREVENT DAMAGE TO THE DOWEL PIN DETAIL OF THE CONSTRAINT RING.

4 Use a suitable sling and hoist to remove the Constraint Ring from the rear case.

(46) Remove all of the tape from the HPC rear support.

Subtask 72−35−00−430−110:

(47) FOR THESE MODELS: 4152, 4156A, 4158
R Attach the PWA 107219 Fixture to the HPC rear case as follows.

(a) FOR THESE MODELS: 4152, 4156A, 4158
R Attach a hoist toPWA 107219 Fixture and raise the Fixture over the rear hub of rotor. See Figure 1032 (Sheet 1).

(b) FOR THESE MODELS: 4152, 4156A, 4158
Lower the Fixture to the HPC rear case.

(c) FOR THESE MODELS: 4152, 4156A, 4158
Attach the Fixture to the HPC rear case.

(d) FOR THESE MODELS: 4152, 4156A, 4158
Install the PWA 85535 Nut over the rear end of the HPC rear hub. See Figure 1032 (Sheet 1).

(e) FOR THESE MODELS: 4152, 4156A, 4158
Position the PWA 85530 Wrench over the nut and engage the drive teeth in the nut.

(f) FOR THESE MODELS: 4152, 4156A, 4158
Insert the PWA 85536 Adapter into the rear end of the HPC rear hub.

(g) FOR THESE MODELS: 4152, 4156A, 4158
Torque the nut to 300 lb−in. (33.895 N.m).

(48) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
R (Pre SB PW4ENG 72−562) Attach the PWA 107219 Fixture to the HPC rear case as follows.

(a) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
R Attach the hoist to the PWA 107219 Fixture and raise the Fixture over the rear shaft of the rotor. See Figure 1032 (Sheet 1).

(b) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Lower the Fixture to the HPC rear case.

(c) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Tighten the Fixture to the case.

(d) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install the PWA 85535 Nut over the rear end of the HPC rear shaft. See Figure 1032 (Sheet 1).

(e) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install the PWA 85530 Wrench over the nut and engage the drive teeth in the nut.

(f) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Put the PWA 85536 Adapter into the rear end of the HPC rear shaft.

(g) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Torque the nut to 300 lb-in. (33.895 N.m).

(49) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
R (Post SB PW4ENG 72-562) Attach PWA 107219 Fixture to the HPC rear case.

(a) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
R Attach the hoist to the PWA 107219 Fixture and raise the Fixture over the rear shaft of the rotor.

(b) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Lower the Fixture to the HPC rear case.

(c) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Tighten the Fixture to the case.

(d) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install the PWA 88701 Nut over the rear end of the HPC rear shaft.

(e) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install the PWA 85530 Wrench over the nut and engage the drive teeth in the nut.

(f) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Put the PWA 85536 Adapter into the rear end of the HPC rear shaft.

(g) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Torque the nut to 300 lb−in. (33.895 N.m).

(50) Trunnion the rotor and stator assembly to the front end up position as follows. See Figure 1032 (Sheet 3).

(a) Attach the PWA 88643 or PWA 88673 Sling to the hoist.

(b) Attach the Sling with two PWA 76154 Adapters to the Fixture on the HPC rear case and raise the rotor from the stand.

(c) Install a second hoist and the PWA 88643 or PWA 88673 Sling with two PWA 76154 Adapters to the front Fixture and trunnion the rotor to front end up.

(d) Lower the rotor to build stand and remove the Sling, hoist, and Adapters.

Subtask 72−35−00−430−113:

CAUTION: IT IS VERY IMPORTANT TO OBEY THE PROCEDURES IN THE STANDARD PRACTICES MANUAL, PN 585005 70−53, LOCKING DEVICES, WHEN YOU INSTALL (BORESCOPE) PLUG KEY WASHERS. INCORRECT INSTALLATION OF THE KEY WASHERS CAN CAUSE THE (BORESCOPE) PLUGS TO COME OUT. IF AN AP−5 OR AP−7 (BORESCOPE) PLUG IS NOT THERE, HOT GASSES FROM THE PLUG OPENING CAN CAUSE DAMAGE TO THE THRUST REVERSER.

(51) Install the AP−4 through AP−7 borescope plugs and new key washers. Refer to the requirements of Table 1001 and as follows. See Figure 1033.

AP Number And Location	Plug Locking Method	Plug Replacement Lubricant	Plug Torque lb-in. (N.m)
AP-4 Stage 8	Self-locking Insert	P06-054 Antiseize Paste	175 - 190 (19.772 - 21.467) Reference Number 1556
AP-5 Stage 10 Compr.	Key Washer 58H216	P06-054 Antiseize Paste	175 - 190 (19.772 - 21.467) Reference Number 1554
AP-6 Stage 12	Self-locking Insert	P06-054 Antiseize Paste	175 - 190 (19.772 - 21.467) Reference Number 1556
AP-7 Stage 14	Key Washer 58H216	P06-054 Antiseise Paste	175 - 190 (19.772 - 21.467) Reference Number 1554

HPC Borescope/Access Plug Installation Data
Table 1001

(a) Prior to installing borescope plugs, remove excess baked on compound from threads using a nylon brush.

(b) Apply Antiseize Paste P06-054 to threads and to plug head washer contact surface area.

NOTE: Do not use Engine Oil P03-001.

(c) Wipe off unwanted paste.

(d) Run in borescope plug to be sure plug is seated before applying torque per Table 1001.

(e) After you torque the borescope plug(s), bend the tabs of the key washer by the instructions in Chapter/Section 70-53 of the Standard Practices Manual, PN 585005.

1 Put the end of the crimper onto the end of the plug. Turn the crimper so the jaw is under a key washer tab.

2 Squeeze the crimper handle to bend the key washer tab until the tab makes contact with the hex head of the plug.

3 Release the handle and reposition the jaw so that it makes contact again at the base of the tab.

4 Squeeze the crimper handle to final bend the key washer tab until the tab makes contact with the hex head of the plug and maintains less than a 0.020 inch (0.508 mm) gap everywhere between the tab and the hex head of the plug.

5 Crimp all five (5) of the key washer tabs by the same method.

6 All tabs of the key washer must be bent, examine the tabs for the following conditions:

NOTE: Key washer PN 58H216 uses five tabs as an alternative to two. These additional tabs permit some deviation from the Standard Practices Manual, PN 585005 requirements but it is necessary that all five tabs meet these relaxed requirements. The variations to the Standard Practices Manual, PN 585005 procedure for this tab washer are as follows:

a All five tabs must be within 0.020 inch (0.508 mm) maximum of the hex head of the plug. If a tab overlaps two different faces of the hex head the 0.020 inch (0.508 mm) gap requirement must be kept between the tab and which ever face of the hex head has the larger surface area coverage with the tab. It is a good practice to bend the tab against the remaining face.

b It is not necessary that 75 percent of the base of the tab make contact with the hex head of the plug.

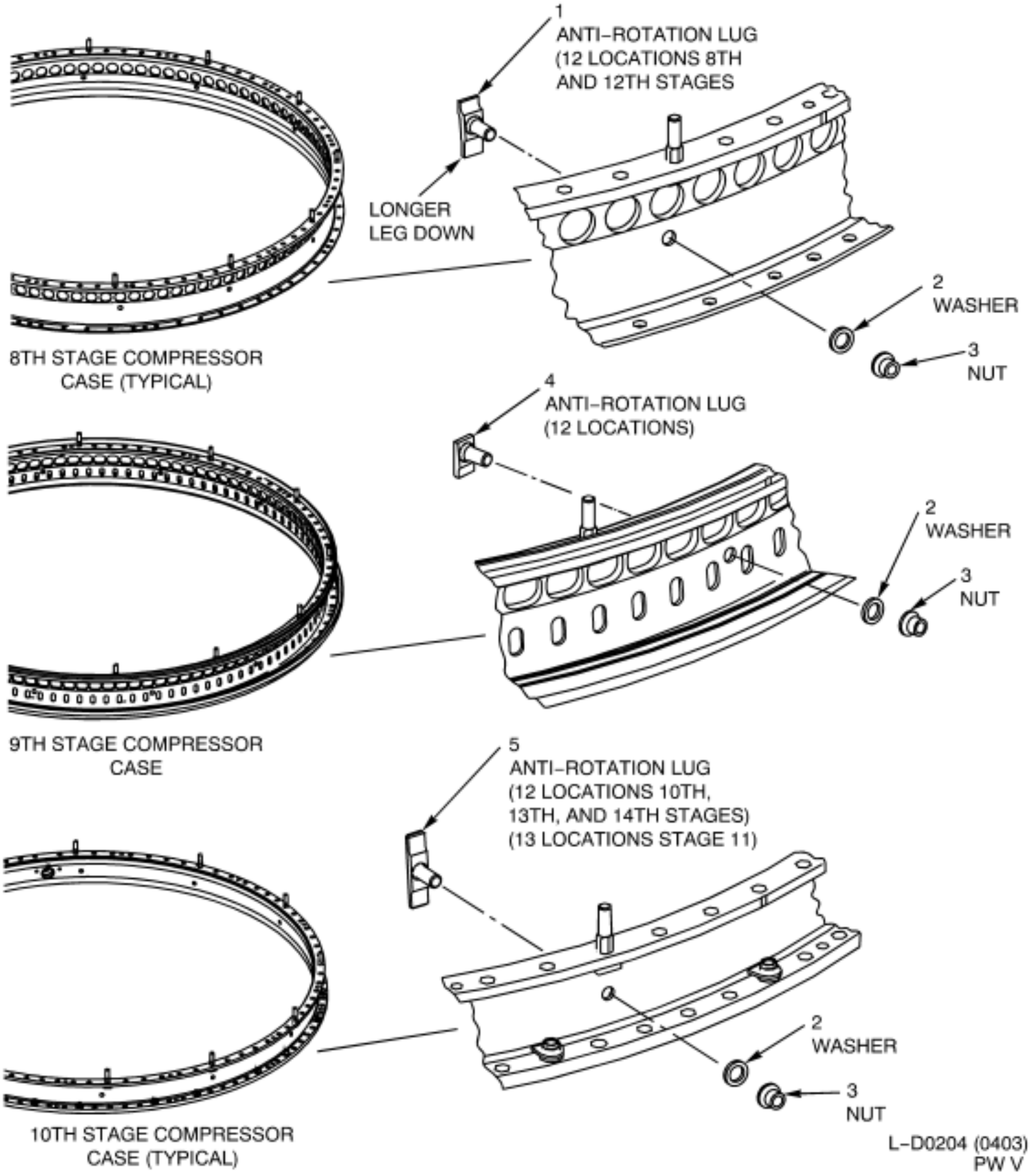
c It is not necessary that the key washer tabs be pulled away from the axis of the plug before you torque the plug. This requirement, as stated in the Standard Practices Manual, PN 585005 is meant for washers that have fewer tabs.

(52) Install bolts, threads lubricated with Engine Oil P03-001, to HPC rear case boss at approximately the 2:30 o'clock position. Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). See Figure 1034.

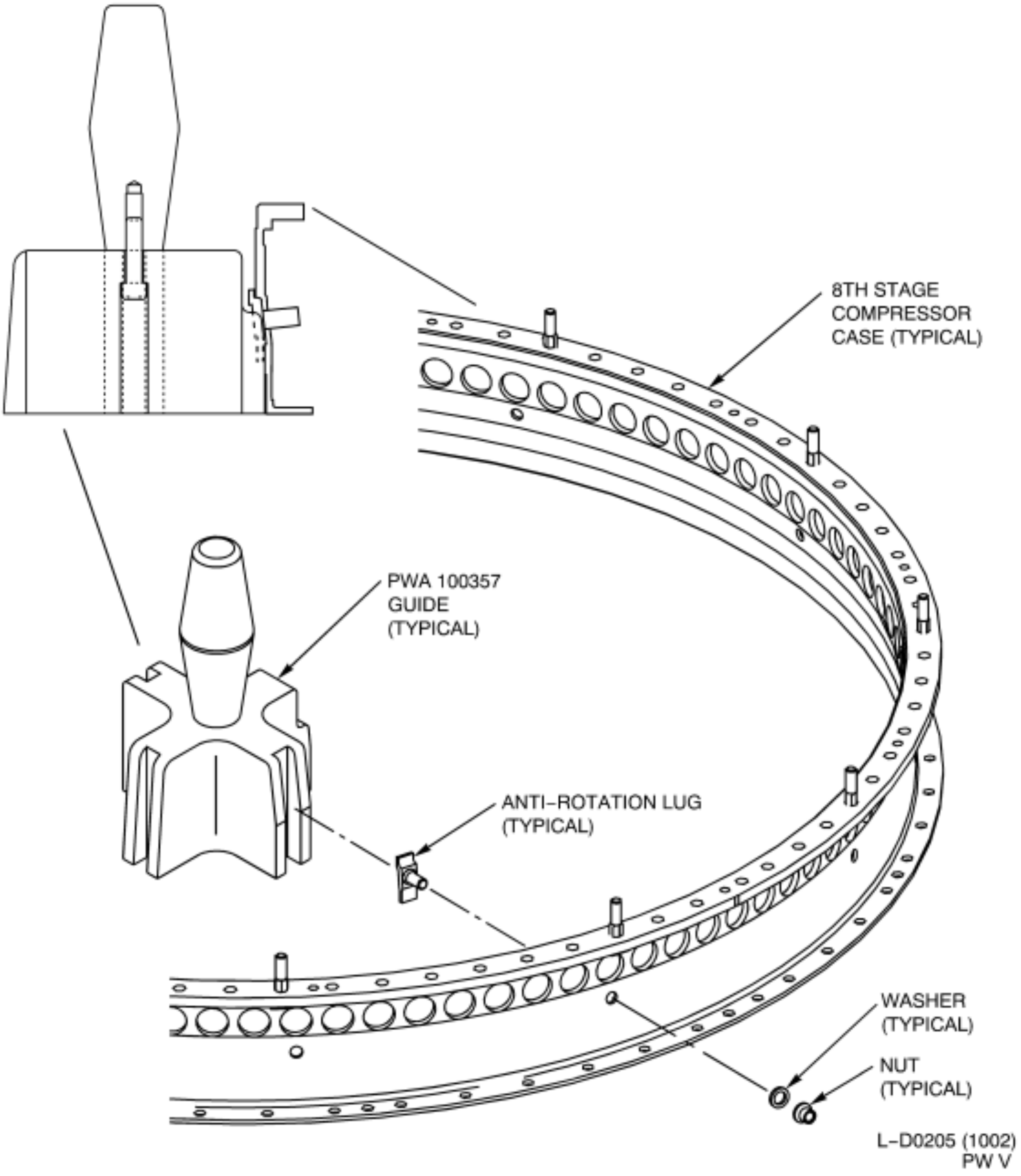
D. Postrequisites

(1) Install The Flange J Brackets And Hardware. Refer to 72-35-00, Assembly-20 (Task 72-35-00-430-020).

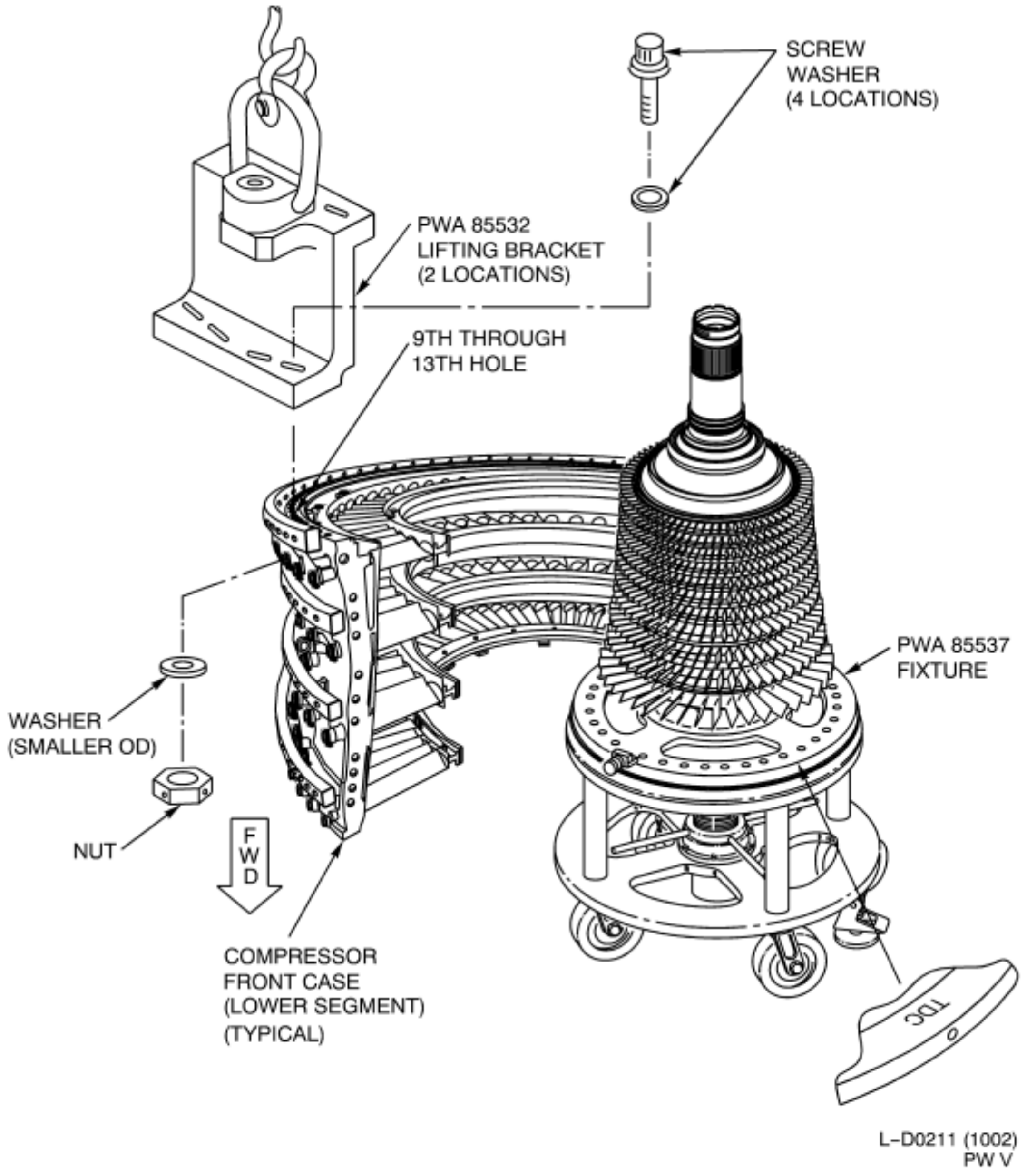
(2) Determine the (Synchronizing Ring) Runner Clearances. Refer to 72-35-00, Assembly-02 (Task 72-35-00-400-002) for the symmetric case configuration or Task 72-35-00-400-002-A) for the asemmetric case configuration as applicable.


1
ANTI−ROTATION LUG
(12 LOCATIONS 8TH
AND 12TH STAGES
LONGER
LEG DOWN
2
WASHER
3
NUT
8TH STAGE COMPRESSOR
CASE (TYPICAL)
4
ANTI−ROTATION LUG
(12 LOCATIONS)
2
WASHER
3
NUT
9TH STAGE COMPRESSOR
CASE
5
ANTI−ROTATION LUG
(12 LOCATIONS 10TH,
13TH, AND 14TH STAGES)
(13 LOCATIONS STAGE 11)
2
WASHER
3
NUT
10TH STAGE COMPRESSOR
CASE (TYPICAL)
L−D0204 (0403)
PW V

Anti−Rotation Lug Installation
Figure 1001 (Sheet 1)
(Task 72−35−00−400−007)

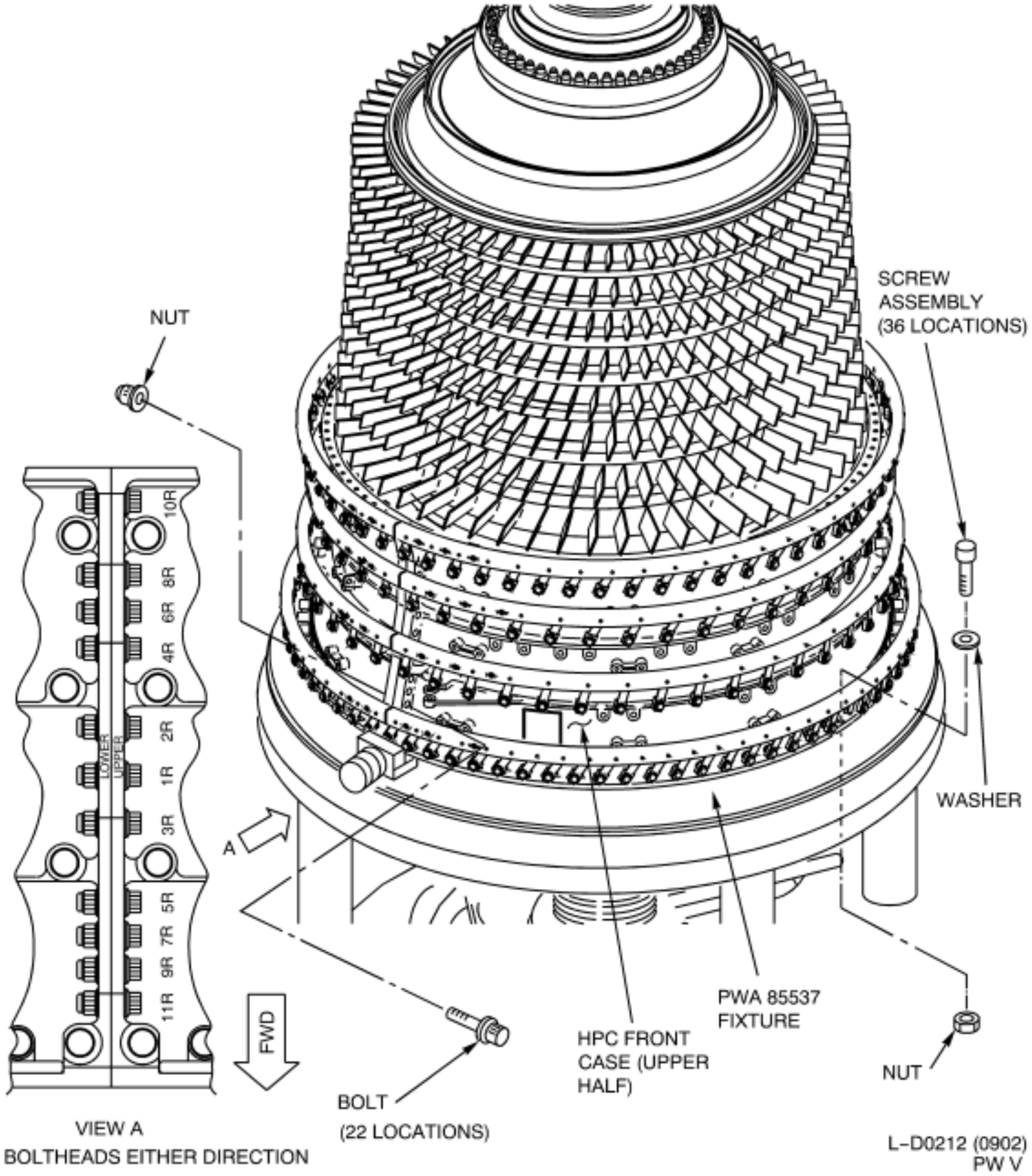

8TH STAGE
COMPRESSOR
CASE (TYPICAL)
PWA 100357
GUIDE
(TYPICAL)
ANTI−ROTATION LUG
(TYPICAL)
WASHER
(TYPICAL)
NUT
(TYPICAL)
L−D0205 (1002)
PW V

Anti−Rotation Lug Installation
Figure 1001 (Sheet 2)
(Task 72−35−00−400−007)

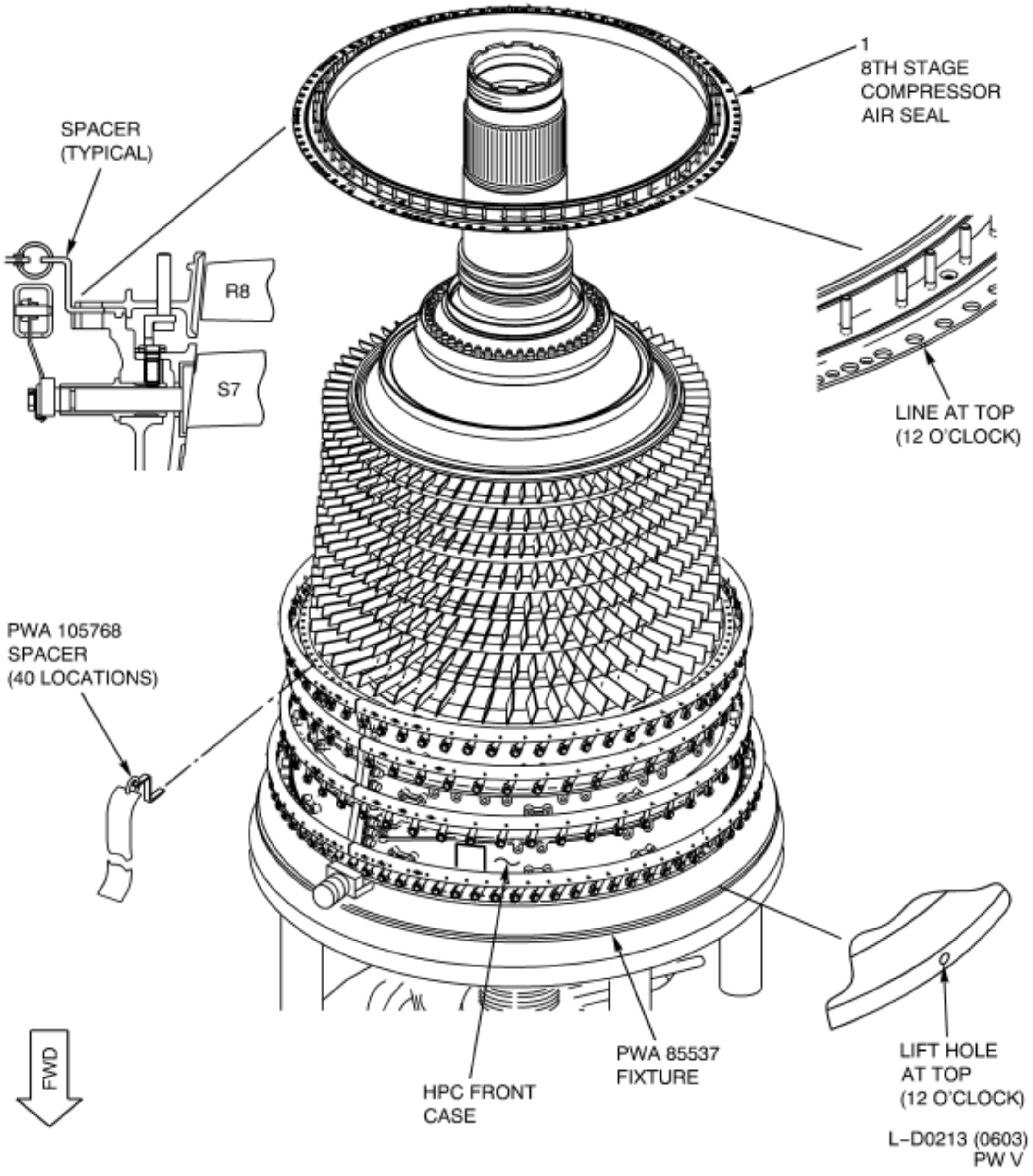

SCREW
WASHER
(4 LOCATIONS)
PWA 85532
LIFTING BRACKET
(2 LOCATIONS)
9TH THROUGH
13TH HOLE
PWA 85537
FIXTURE
WASHER
(SMALLER OD)
NUT
F
W
D
COMPRESSOR
FRONT CASE
(LOWER SEGMENT)
(TYPICAL)
TDC
L-D0211 (1002)
PW V

HPC Front Case And Vane Assembly Installation
Figure 1002 (Sheet 1)
(Task 72-35-00-400-007)

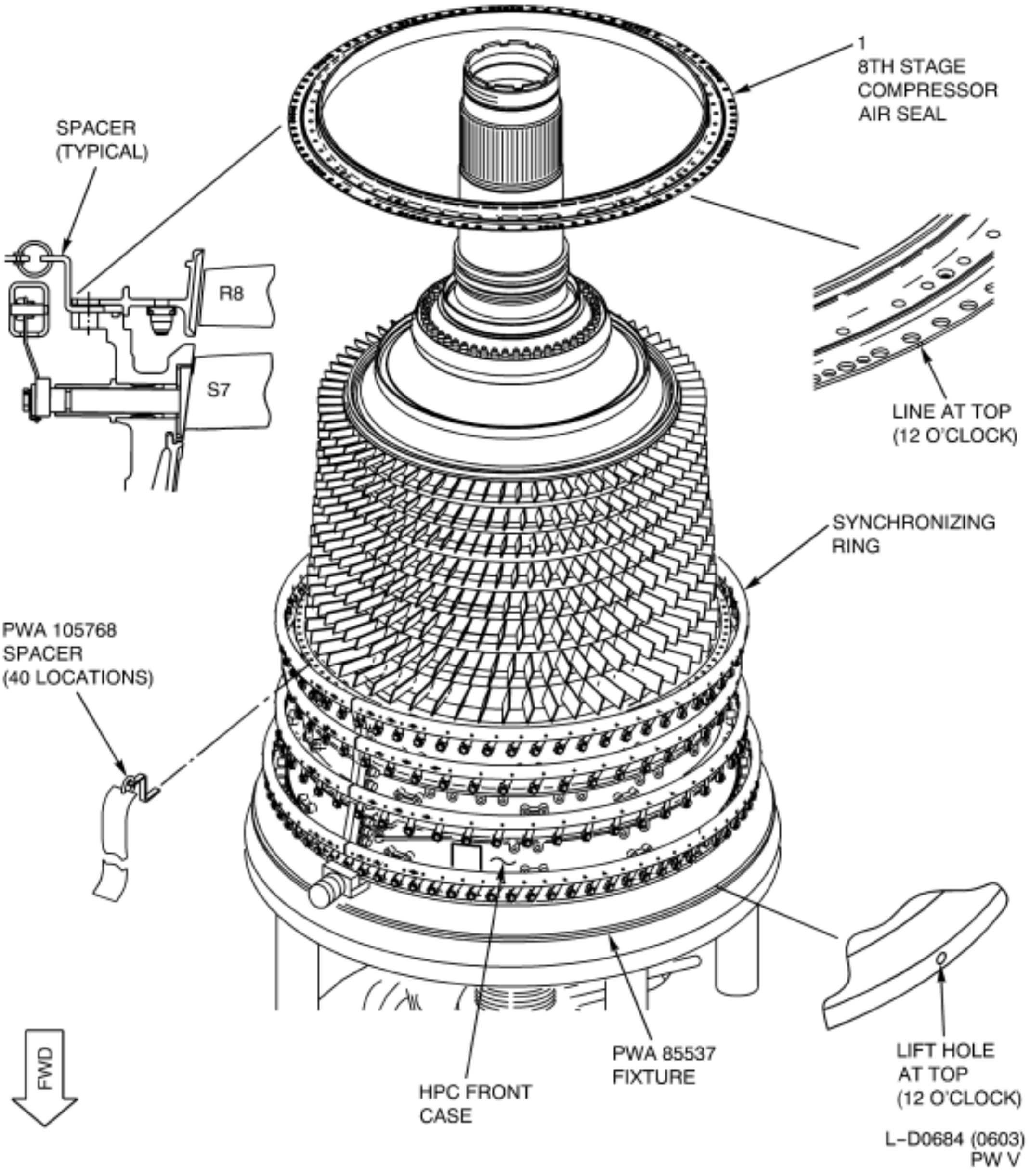
HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−01


NUT
SCREW ASSEMBLY (36 LOCATIONS)
10R
8R
6R
4R
2R
1R
3R
5R
7R
9R
11R
LOWER
UPPER
A
FWD
WASHER
PWA 85537 FIXTURE
HPC FRONT CASE (UPPER HALF)
NUT
BOLT (22 LOCATIONS)
VIEW A
BOLTHEADS EITHER DIRECTION
L−D0212 (0902)
PW V

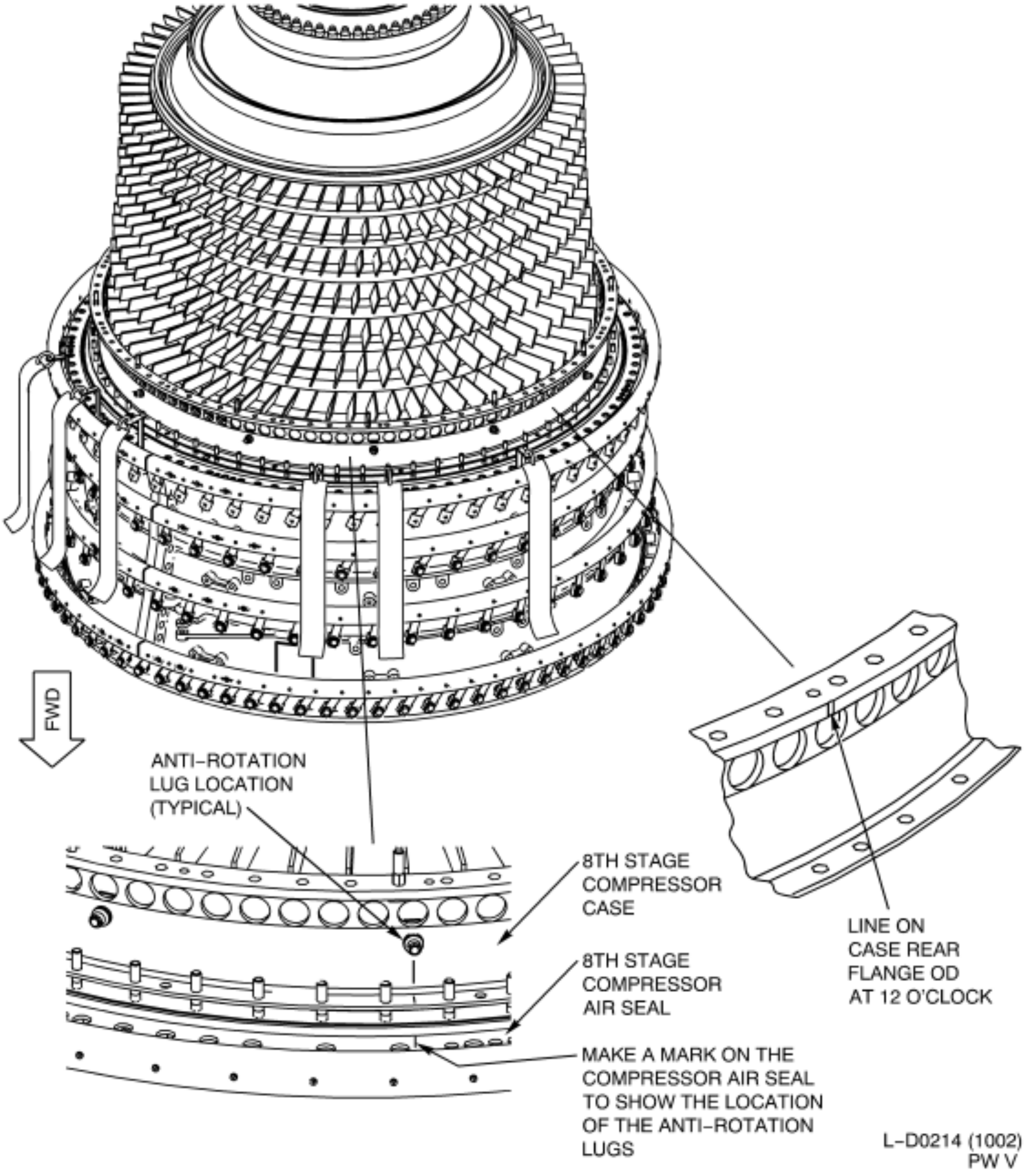
HPC Front Case And Vane Assembly Installation
Figure 1002 (Sheet 2)
(Task 72−35−00−400−007)


1
8TH STAGE COMPRESSOR AIR SEAL
SPACER (TYPICAL)
R8
S7
LINE AT TOP (12 O'CLOCK)
PWA 105768 SPACER (40 LOCATIONS)
FWD
PWA 85537 FIXTURE
HPC FRONT CASE
LIFT HOLE AT TOP (12 O'CLOCK)
L−D0213 (0603)
PW V

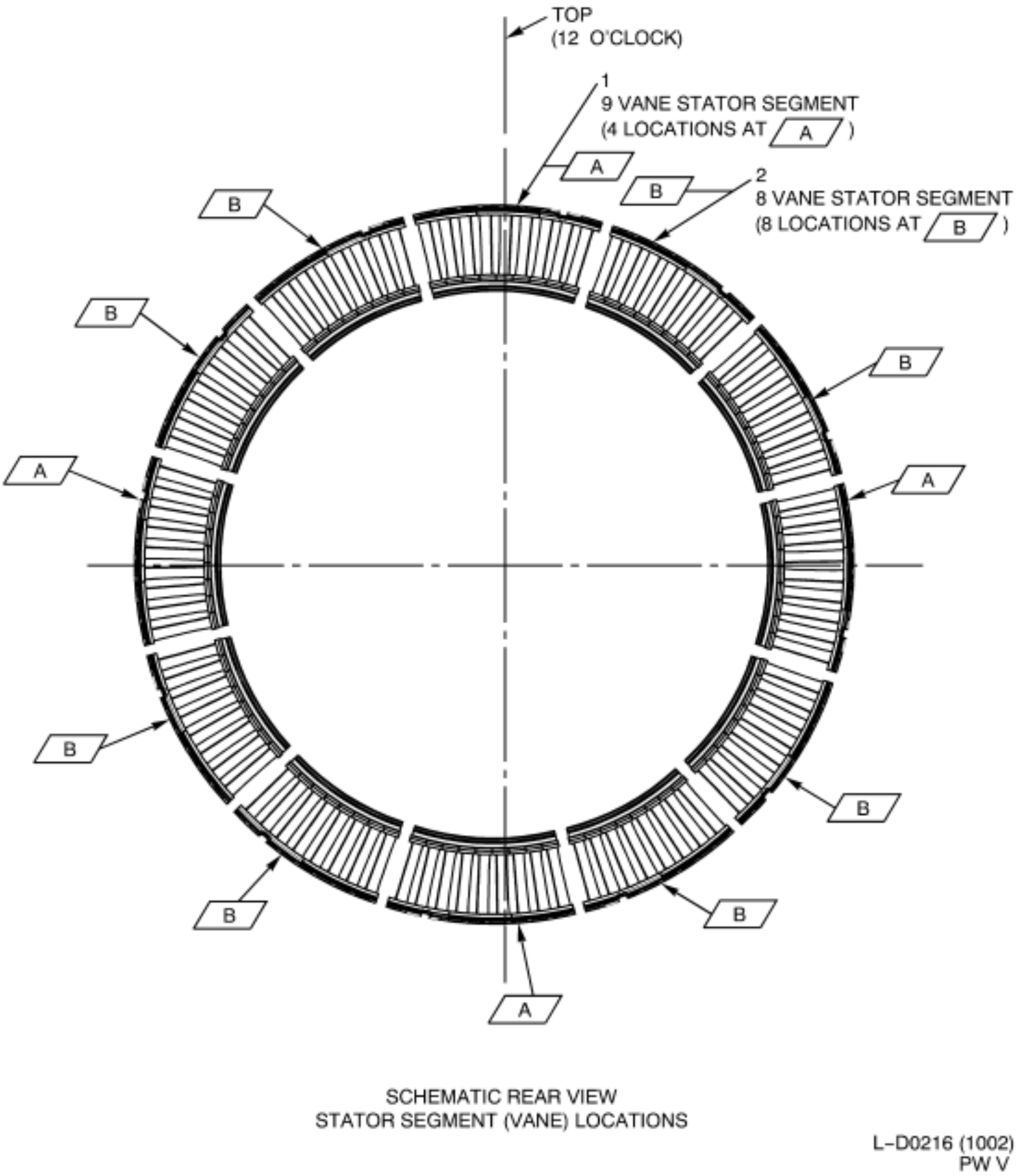
Eighth Stage Compressor Air Seal Installation (Symmetric Case)
Figure 1003 (Sheet 1)
(Task 72−35−00−400−007)


1
8TH STAGE
COMPRESSOR
AIR SEAL
SPACER
(TYPICAL)
R8
S7
LINE AT TOP
(12 O'CLOCK)
SYNCHRONIZING
RING
PWA 105768
SPACER
(40 LOCATIONS)
FWD
PWA 85537
FIXTURE
HPC FRONT
CASE
LIFT HOLE
AT TOP
(12 O'CLOCK)
L-D0684 (0603)
PW V

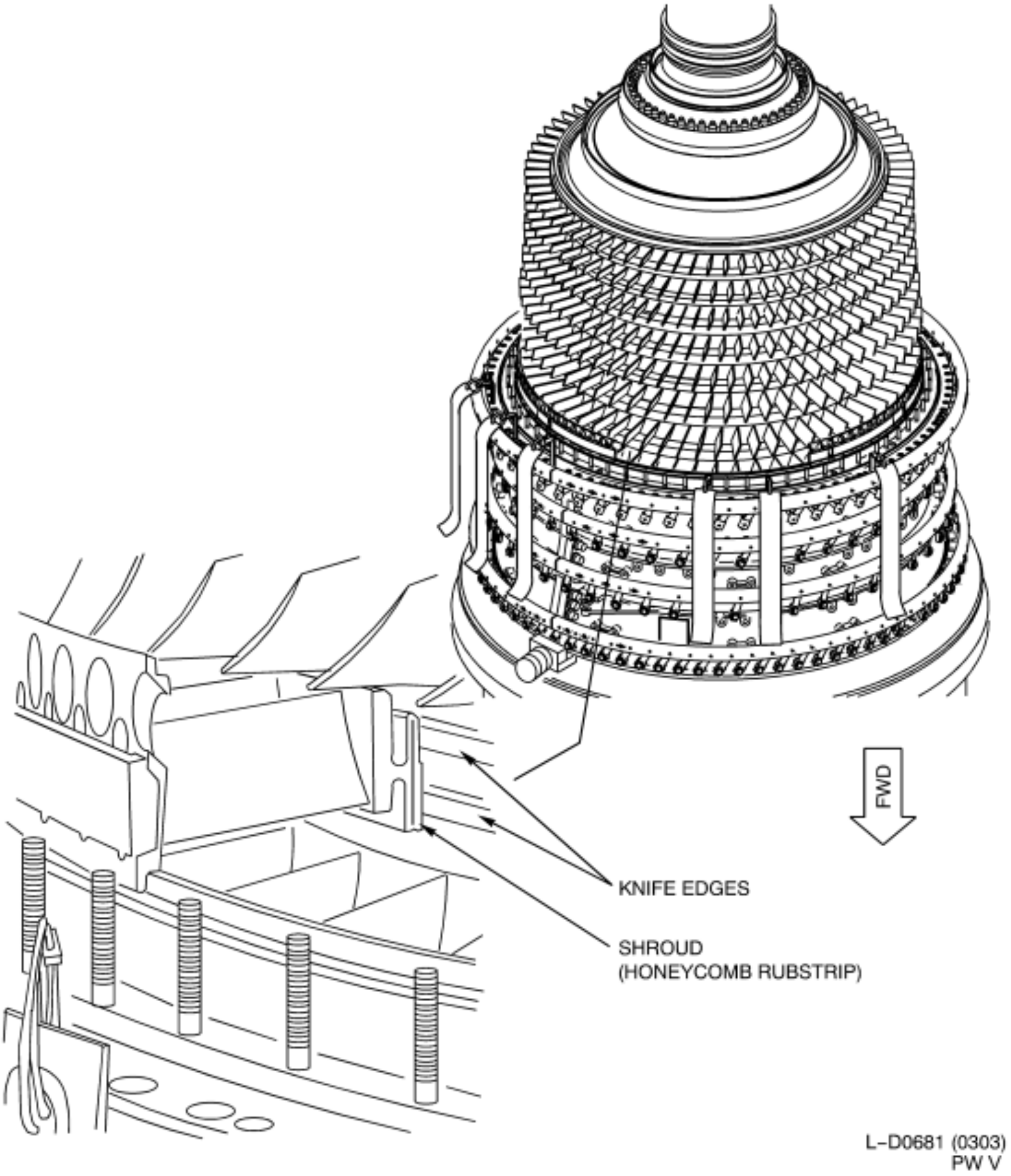
Eighth Stage Compressor Air Seal Installation (Asymmetric Case)
Figure 1003 (Sheet 2)
(Task 72−35−00−400−007)


FWD
ANTI−ROTATION LUG LOCATION (TYPICAL)
8TH STAGE COMPRESSOR CASE
8TH STAGE COMPRESSOR AIR SEAL
MAKE A MARK ON THE COMPRESSOR AIR SEAL TO SHOW THE LOCATION OF THE ANTI−ROTATION LUGS
LINE ON CASE REAR FLANGE OD AT 12 O'CLOCK
L−D0214 (1002)
PW V

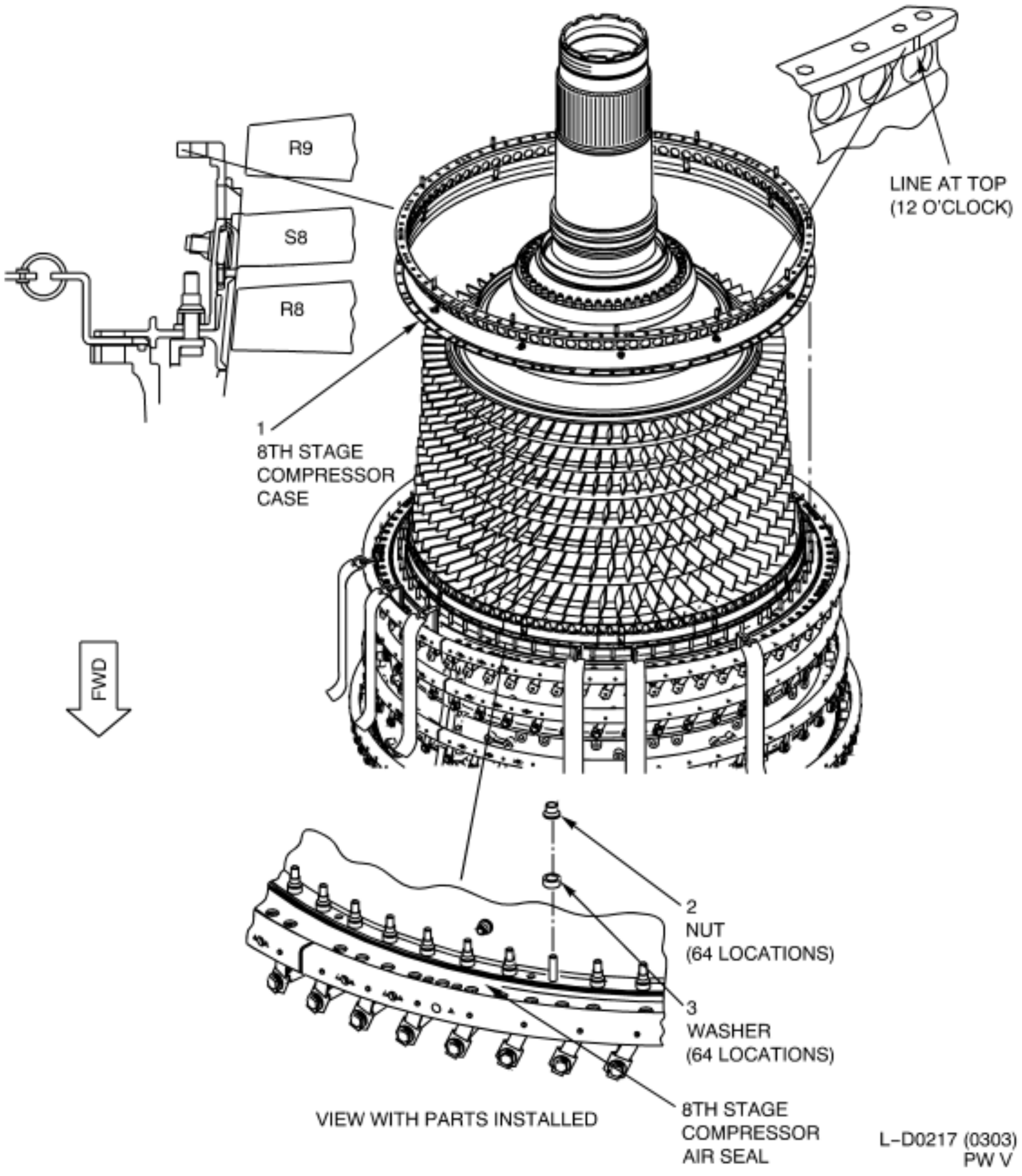
Anti−Rotation Lug Location Marks (Typical)
Figure 1004
(Task 72−35−00−400−007)


TOP
(12 O'CLOCK)
1
9 VANE STATOR SEGMENT
(4 LOCATIONS AT A)
2
8 VANE STATOR SEGMENT
(8 LOCATIONS AT B)
A
B
B
B
B
A
A
B
B
B
B
B
A
SCHEMATIC REAR VIEW
STATOR SEGMENT (VANE) LOCATIONS
L-D0216 (1002)
PW V

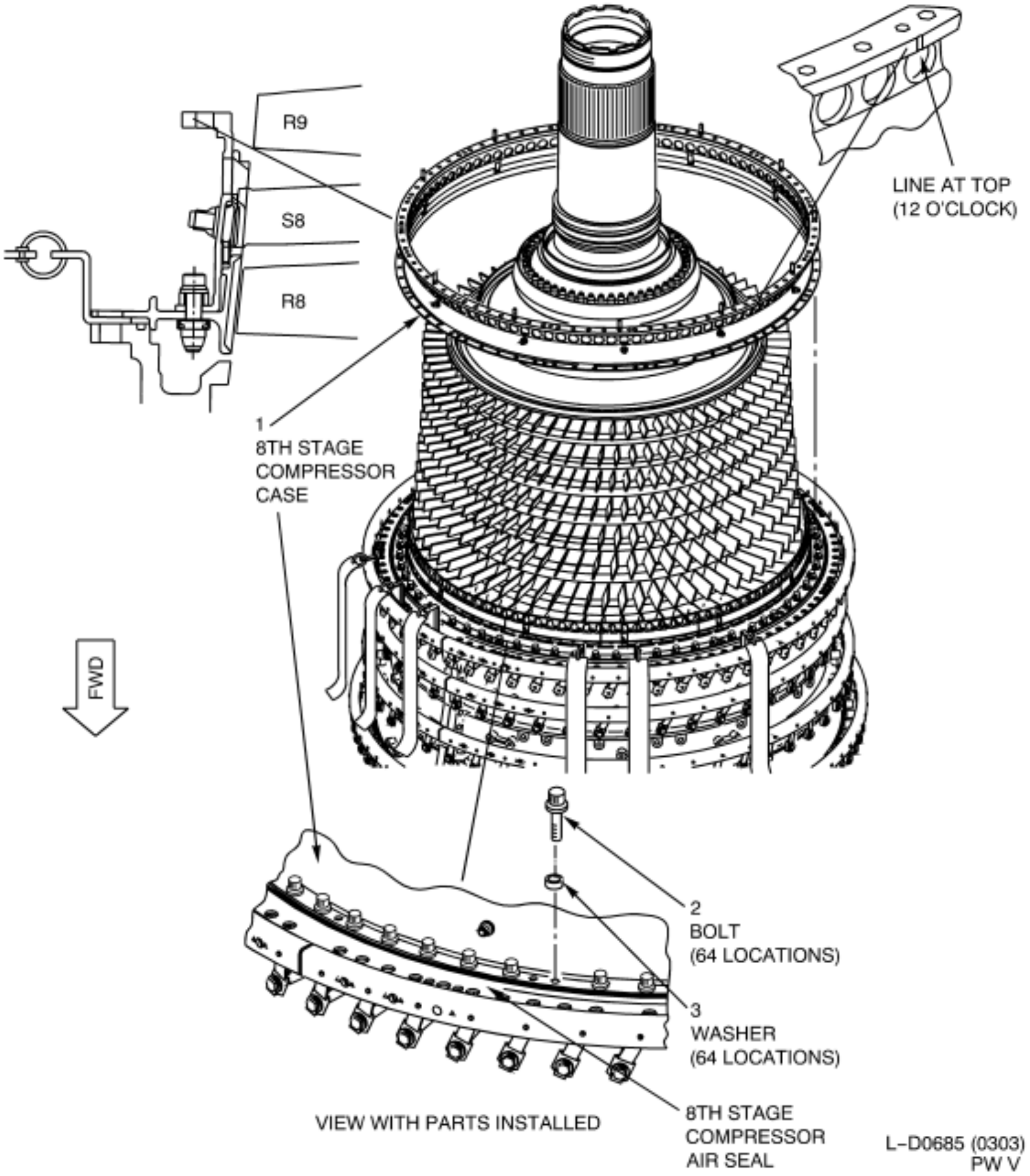
Eighth Stage Stator (Vane) Segments Installation
Figure 1005 (Sheet 1)
(Task 72-35-00-400-007)


FWD
KNIFE EDGES
SHROUD
(HONEYCOMB RUBSTRIP)
L−D0681 (0303)
PW V

Eighth Stage Stator (Vane) Segments Installation
Figure 1005 (Sheet 2)
(Task 72−35−00−400−007)

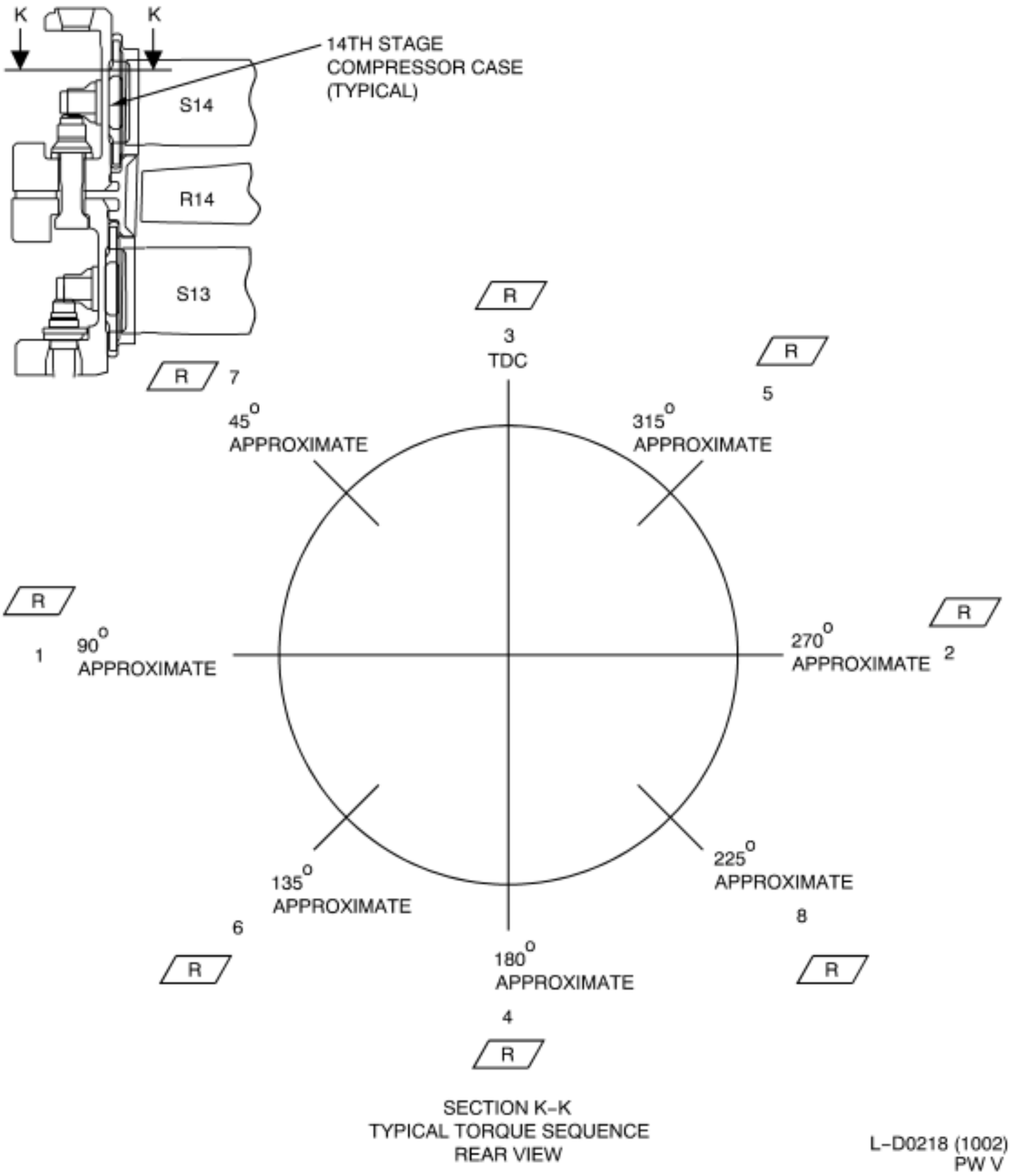

R9
S8
R8
LINE AT TOP
(12 O'CLOCK)
1
8TH STAGE
COMPRESSOR
CASE
FWD
2
NUT
(64 LOCATIONS)
3
WASHER
(64 LOCATIONS)
VIEW WITH PARTS INSTALLED
8TH STAGE
COMPRESSOR
AIR SEAL
L−D0217 (0303)
PW V

Eighth Stage Compressor Case Installation (Symmetric Case)
Figure 1006 (Sheet 1)
(Task 72−35−00−400−007)

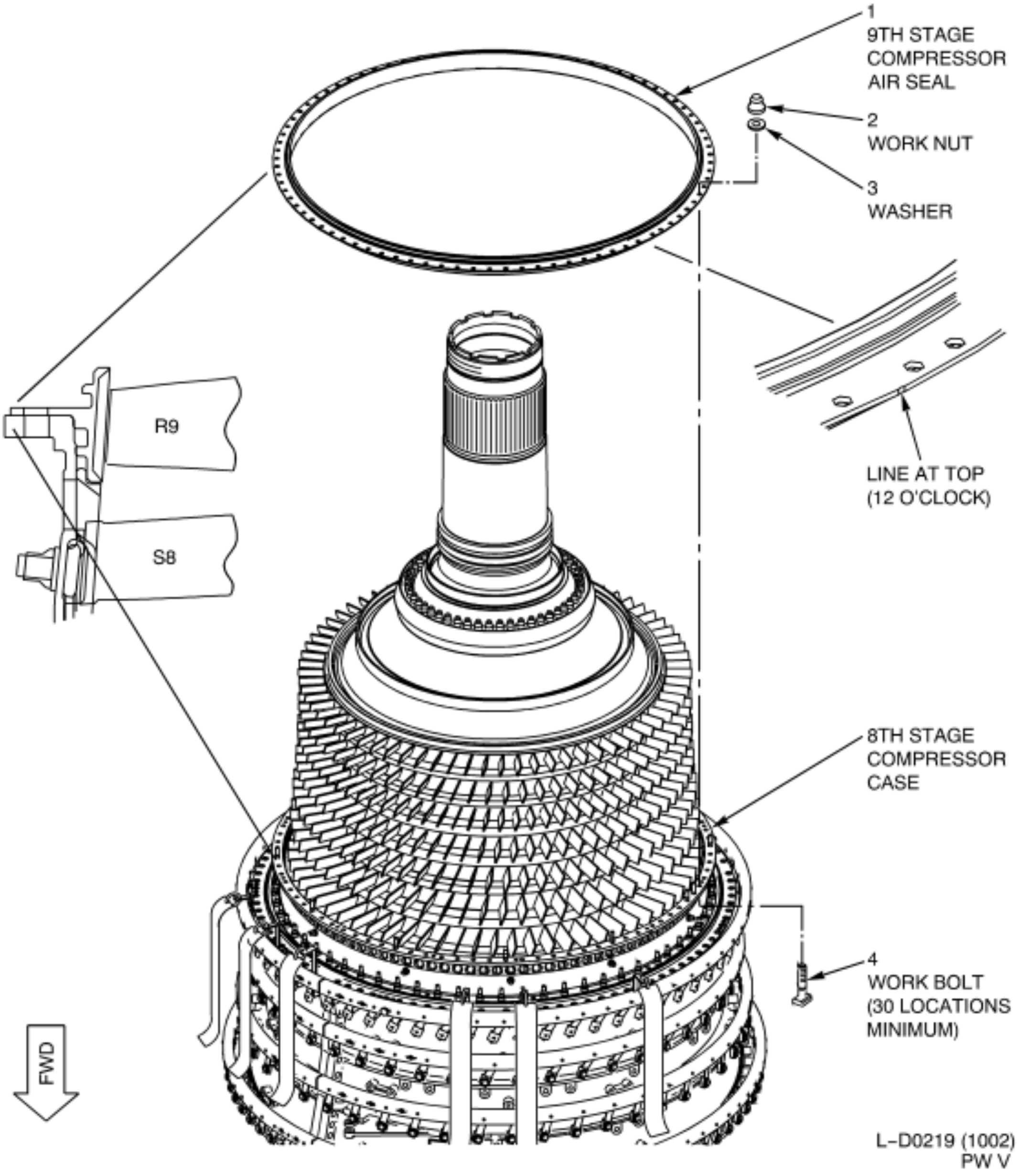

R9
S8
R8
LINE AT TOP
(12 O'CLOCK)
1
8TH STAGE
COMPRESSOR
CASE
FWD
2
BOLT
(64 LOCATIONS)
3
WASHER
(64 LOCATIONS)
VIEW WITH PARTS INSTALLED
8TH STAGE
COMPRESSOR
AIR SEAL
L−D0685 (0303)
PW V

Eighth Stage Compressor Case Installation (Asymmetric Case)
Figure 1006 (Sheet 2)
(Task 72−35−00−400−007)

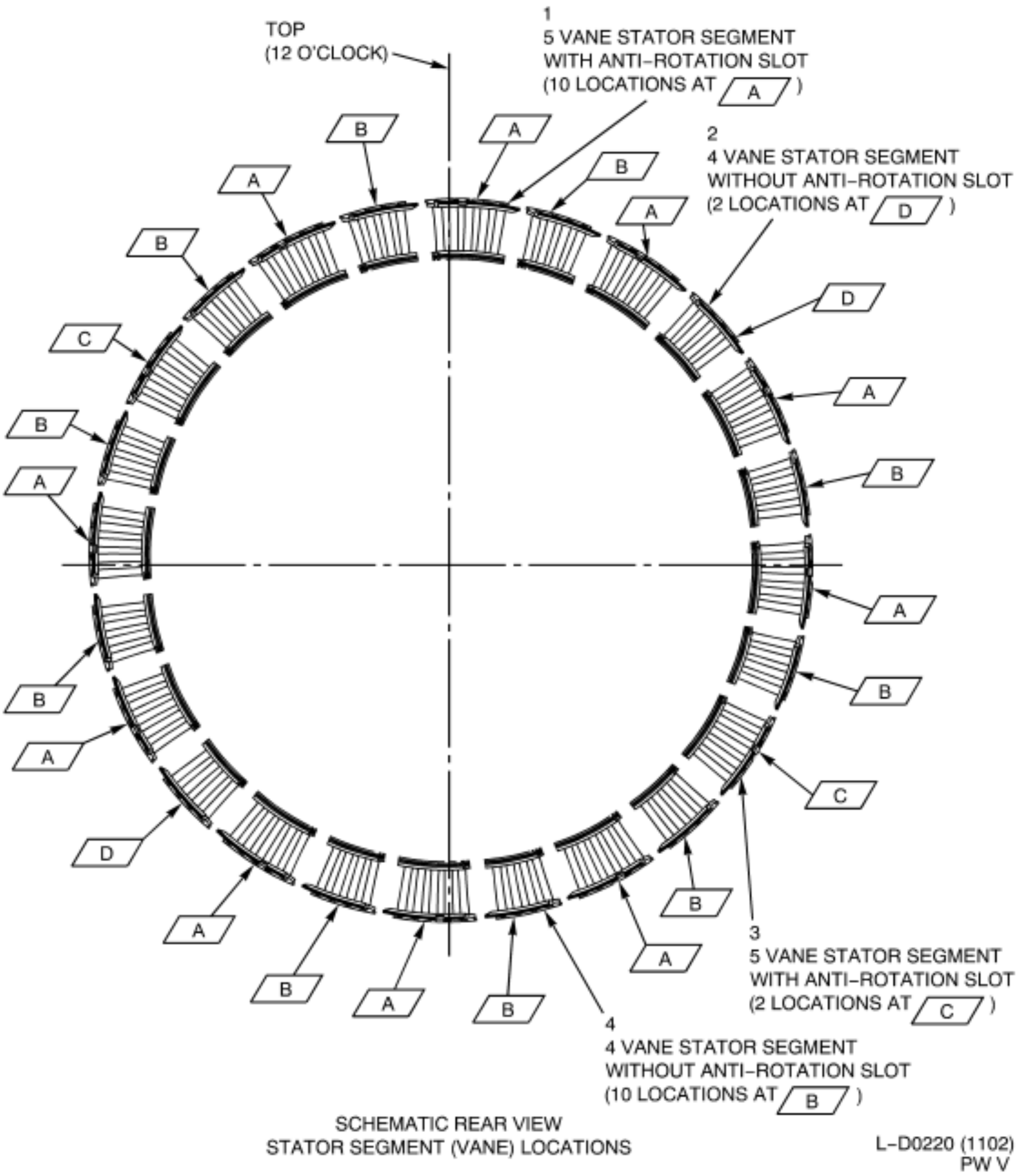
HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−01


K
K
14TH STAGE
COMPRESSOR CASE
(TYPICAL)
S14
R14
S13
R
3
TDC
R
5
315° APPROXIMATE
R
7
45° APPROXIMATE
R
1
90° APPROXIMATE
R
2
270° APPROXIMATE
135° APPROXIMATE
6
R
225° APPROXIMATE
8
R
180° APPROXIMATE
4
R
SECTION K−K
TYPICAL TORQUE SEQUENCE
REAR VIEW
L−D0218 (1002)
PW V

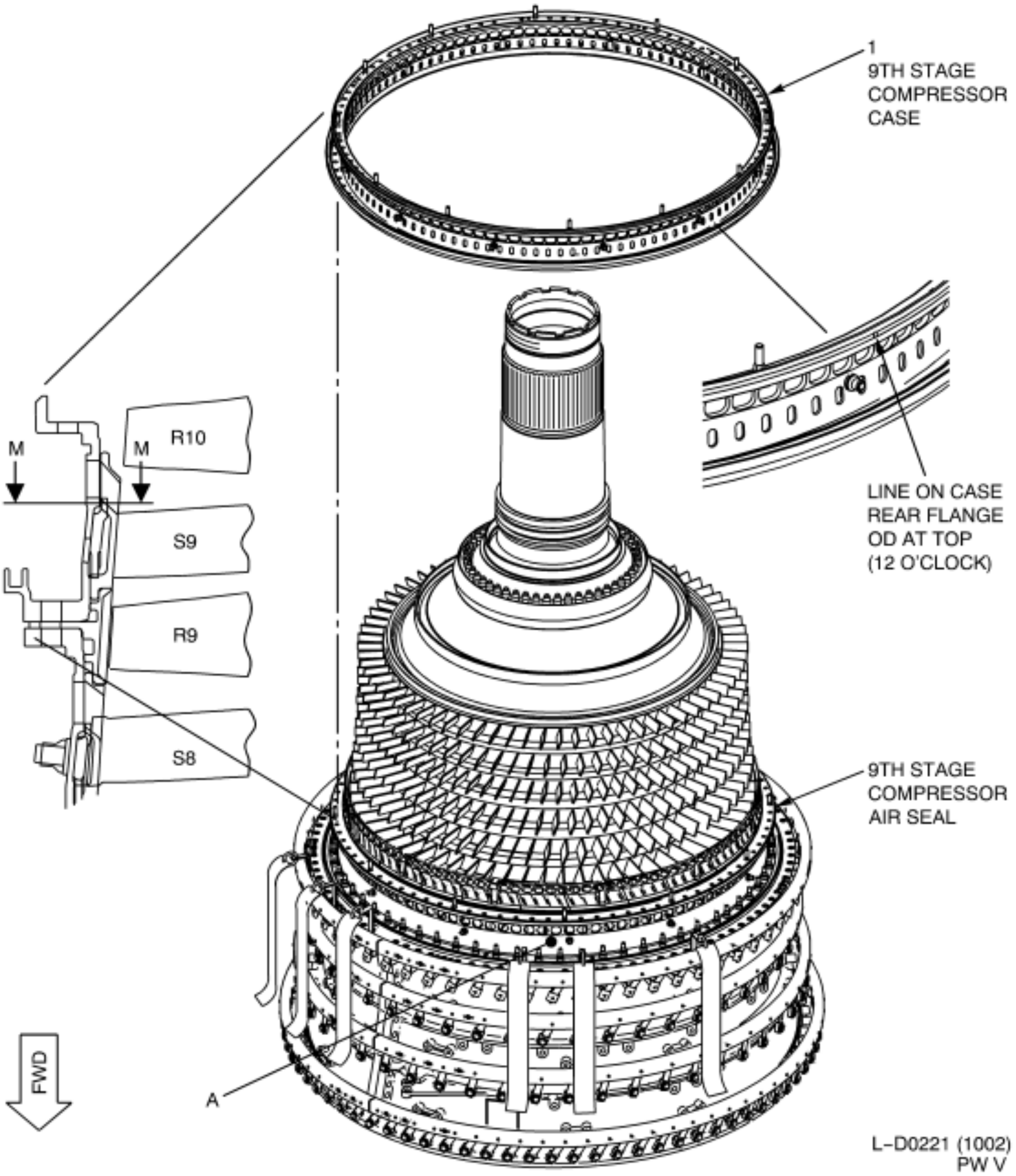
Special Torque Pattern
Figure 1007
(Task 72−35−00−400−007)


1
9TH STAGE COMPRESSOR AIR SEAL
2
WORK NUT
3
WASHER
R9
S8
LINE AT TOP (12 O'CLOCK)
8TH STAGE COMPRESSOR CASE
4
WORK BOLT (30 LOCATIONS MINIMUM)
FWD
L-D0219 (1002)
PW V

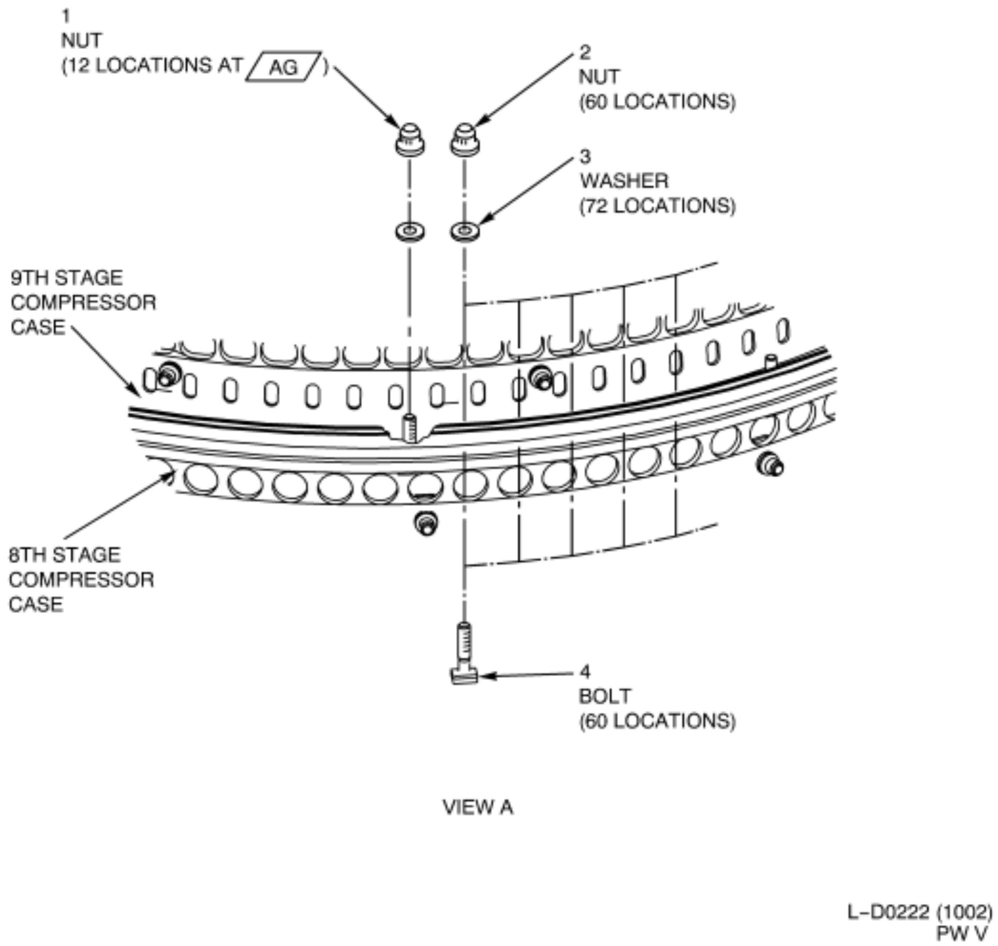
Ninth Stage Compressor Air Seal Installation
Figure 1008
(Task 72-35-00-400-007)


TOP
(12 O'CLOCK)
1
5 VANE STATOR SEGMENT
WITH ANTI-ROTATION SLOT
(10 LOCATIONS AT A)
2
4 VANE STATOR SEGMENT
WITHOUT ANTI-ROTATION SLOT
(2 LOCATIONS AT D)
3
5 VANE STATOR SEGMENT
WITH ANTI-ROTATION SLOT
(2 LOCATIONS AT C)
4
4 VANE STATOR SEGMENT
WITHOUT ANTI-ROTATION SLOT
(10 LOCATIONS AT B)
A
B
C
D
SCHEMATIC REAR VIEW
STATOR SEGMENT (VANE) LOCATIONS
L-D0220 (1102)
PW V

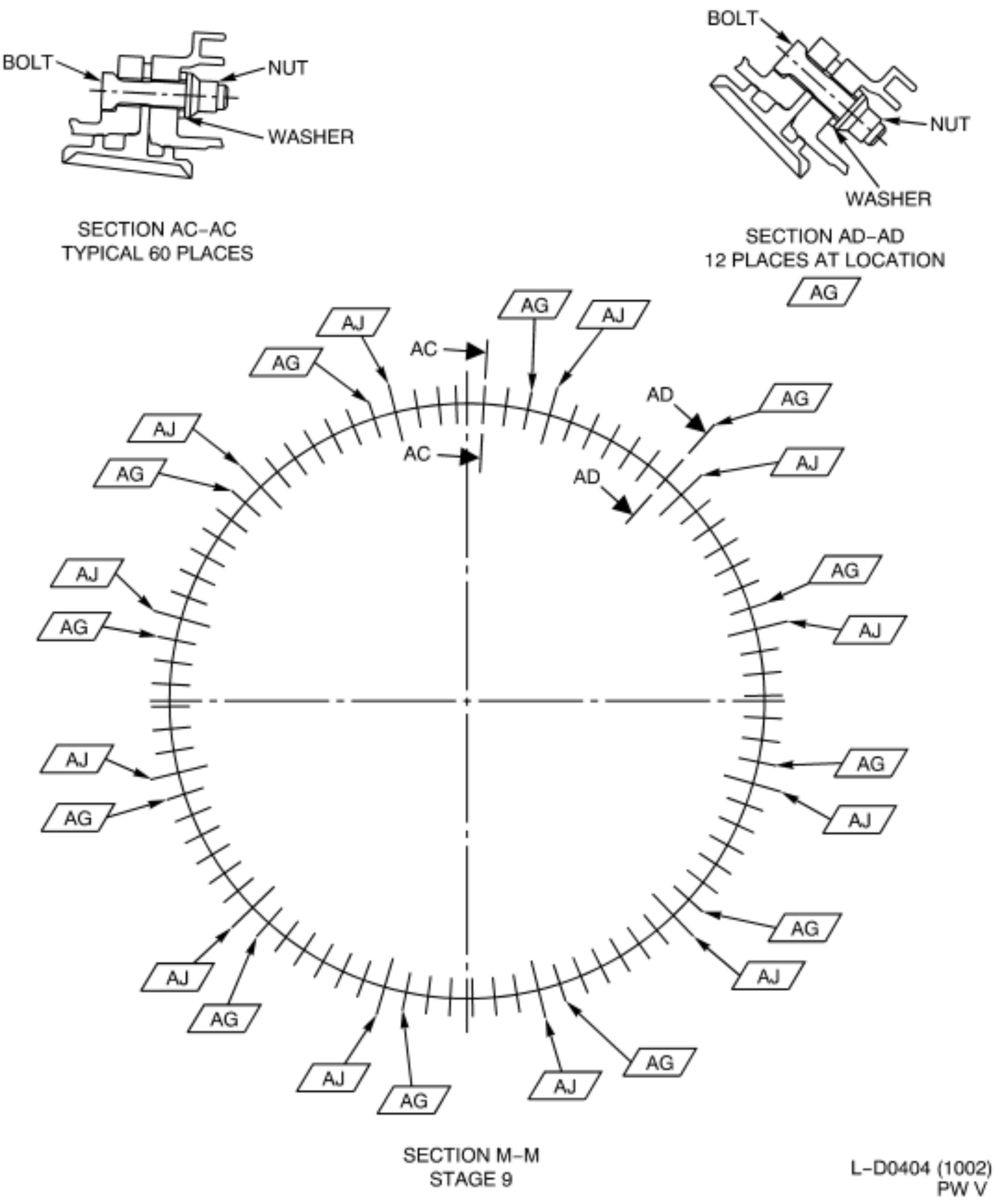
Ninth Stage Stator (Vane) Segments Installation
Figure 1009
(Task 72-35-00-400-007)


1
9TH STAGE COMPRESSOR CASE
LINE ON CASE REAR FLANGE OD AT TOP (12 O'CLOCK)
9TH STAGE COMPRESSOR AIR SEAL
M
M
R10
S9
R9
S8
FWD
A
L-D0221 (1002)
PW V

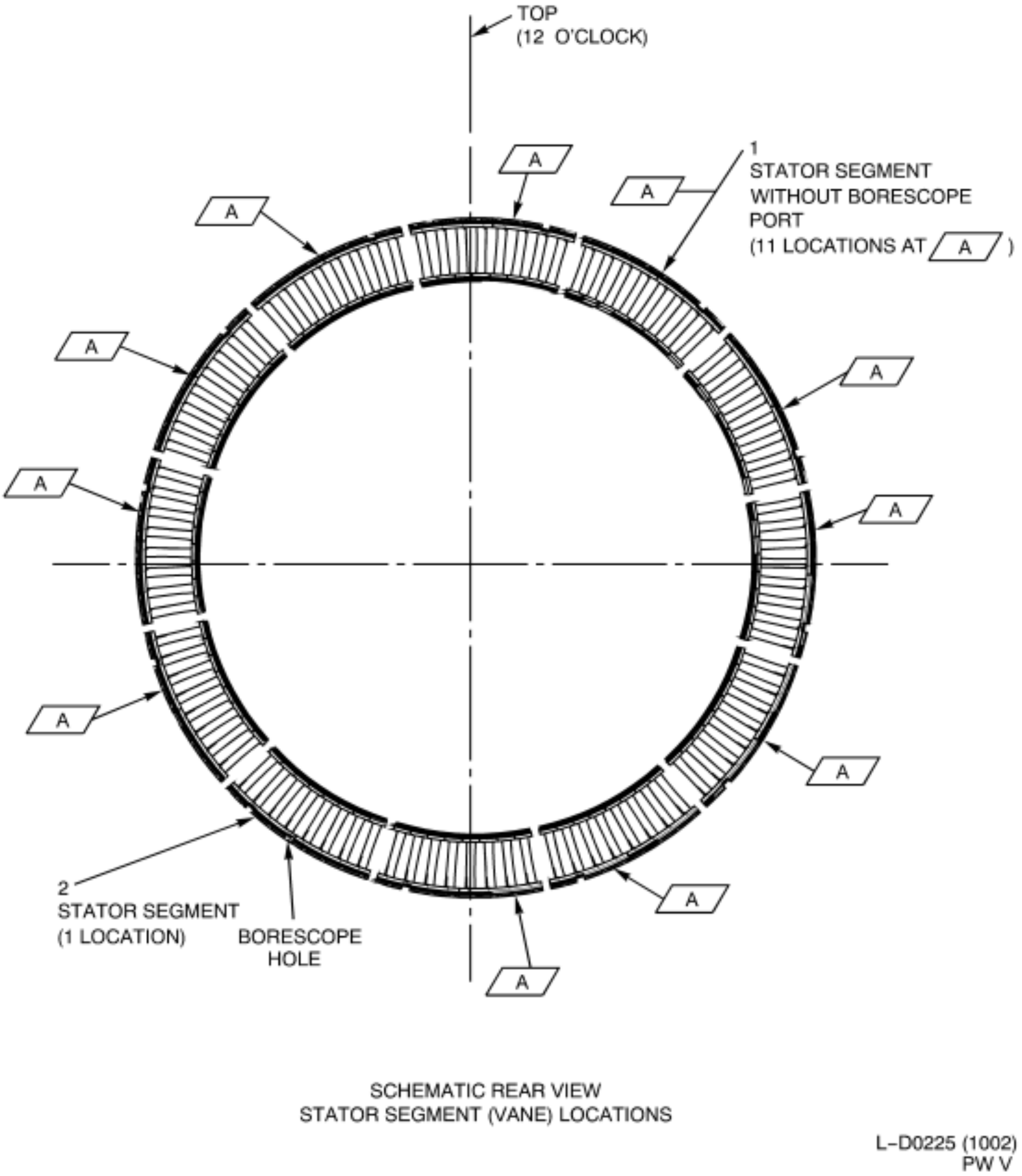
Ninth Stage Compressor Case Installation
Figure 1010 (Sheet 1)
(Task 72-35-00-400-007)


1
NUT
(12 LOCATIONS AT AG)
2
NUT
(60 LOCATIONS)
3
WASHER
(72 LOCATIONS)
9TH STAGE
COMPRESSOR
CASE
8TH STAGE
COMPRESSOR
CASE
4
BOLT
(60 LOCATIONS)
VIEW A
L−D0222 (1002)
PW V

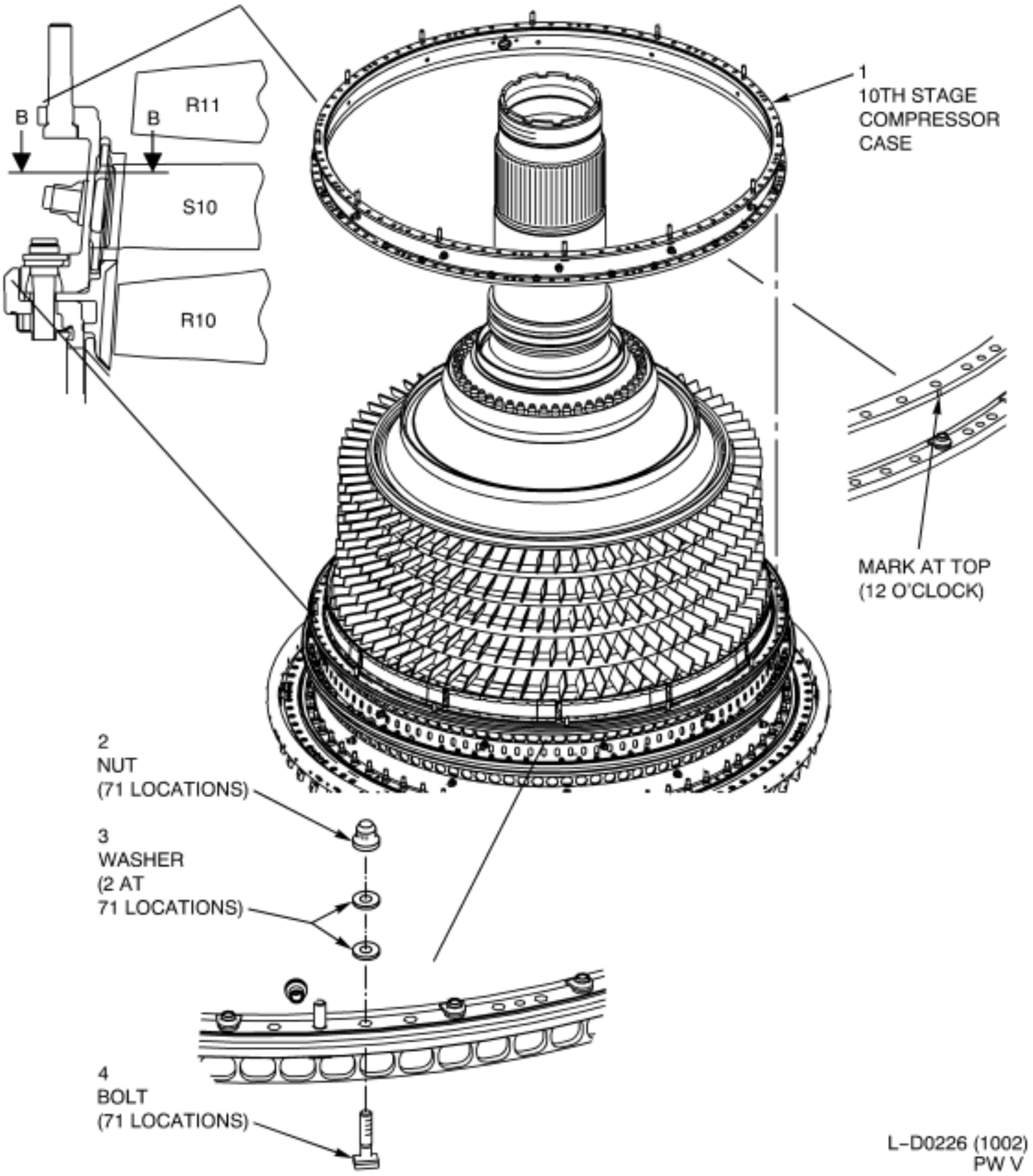
Ninth Stage Compressor Case Installation
Figure 1010 (Sheet 2)
(Task 72−35−00−400−007)


BOLT
NUT
WASHER
SECTION AC-AC
TYPICAL 60 PLACES
BOLT
NUT
WASHER
SECTION AD-AD
12 PLACES AT LOCATION
AG
AJ
AG
AJ
AG
AC
AC
AD
AD
AJ
AG
AJ
AG
AG
AJ
AJ
AG
AG
AJ
AJ
AG
AG
AJ
AG
AJ
AJ
AG
AJ
AG
AJ
AG
SECTION M-M
STAGE 9
L-D0404 (1002)
PW V

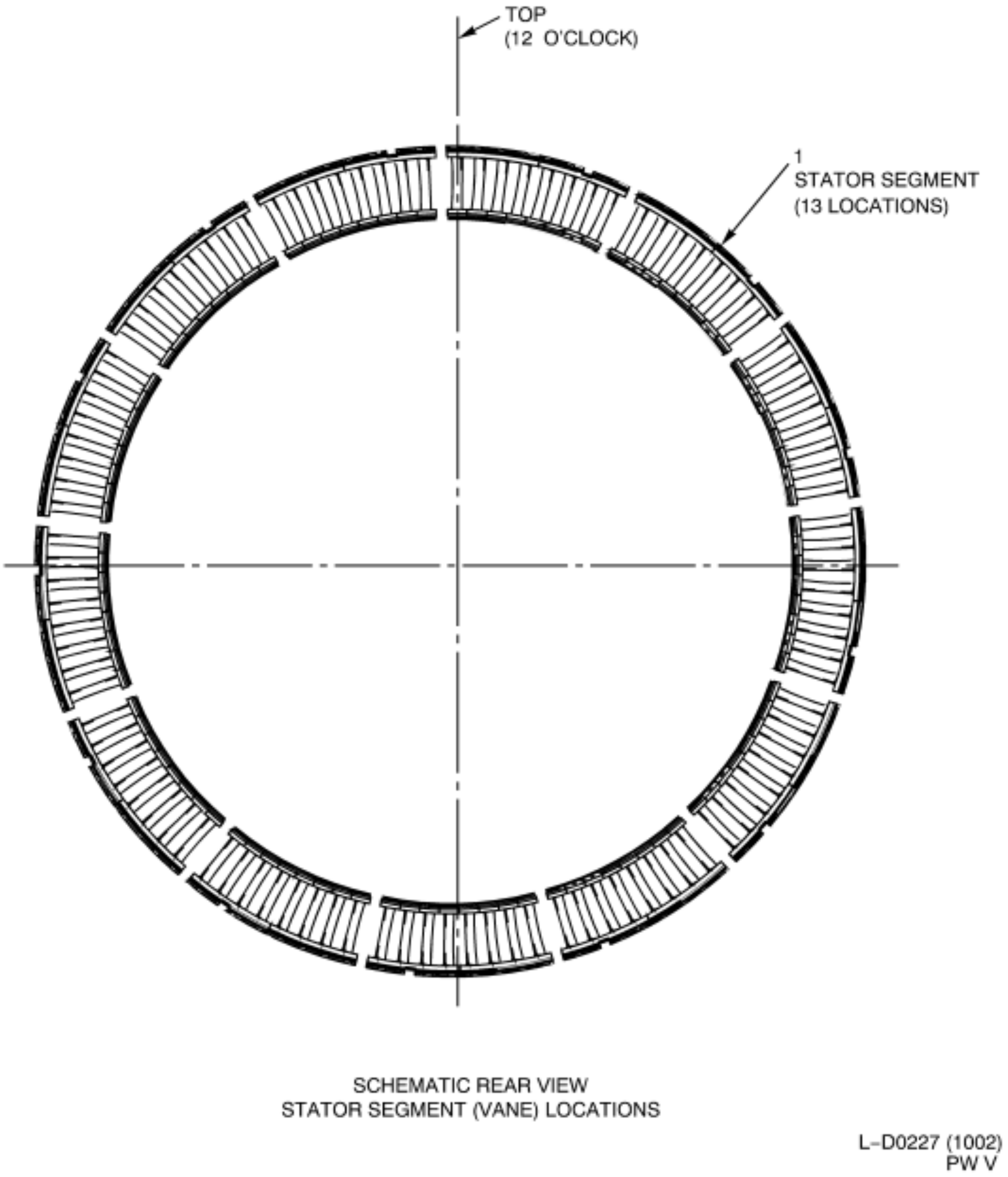
Ninth Stage Compressor Case Installation
Figure 1010 (Sheet 3)
(Task 72−35−00−400−007)


TOP
(12 O'CLOCK)
A
1
STATOR SEGMENT
WITHOUT BORESCOPE
PORT
(11 LOCATIONS AT A)
A
A
A
A
A
A
A
A
A
A
A
2
STATOR SEGMENT
(1 LOCATION)
BORESCOPE
HOLE
SCHEMATIC REAR VIEW
STATOR SEGMENT (VANE) LOCATIONS
L-D0225 (1002)
PW V

Tenth Stage Stator (Vane) Segments Installation
Figure 1011
(Task 72-35-00-400-007)

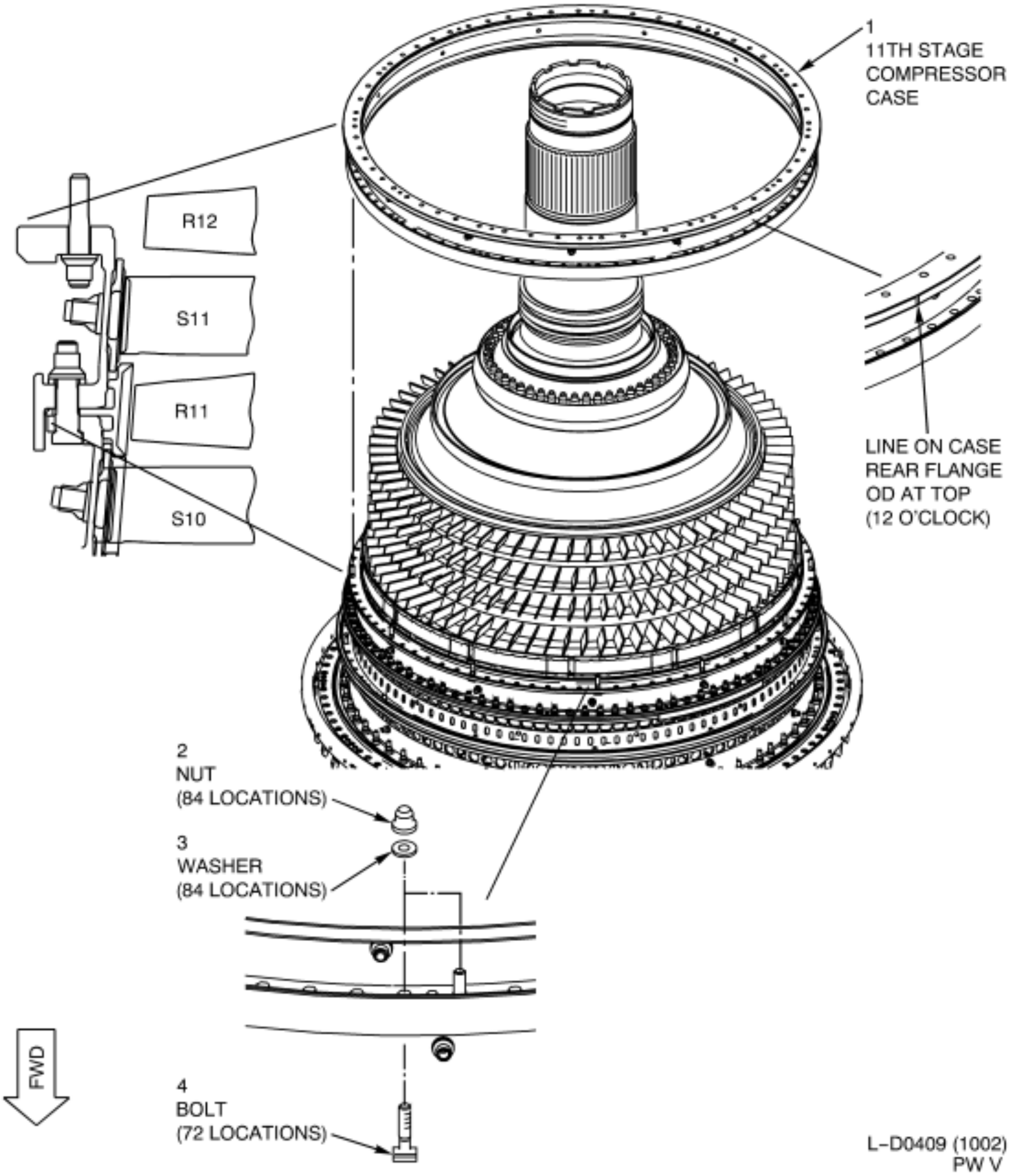

B
B
R11
S10
R10
1
10TH STAGE
COMPRESSOR
CASE
MARK AT TOP
(12 O'CLOCK)
2
NUT
(71 LOCATIONS)
3
WASHER
(2 AT
71 LOCATIONS)
4
BOLT
(71 LOCATIONS)
L-D0226 (1002)
PW V

Tenth Stage Compressor Case Installation
Figure 1012
(Task 72-35-00-400-007)

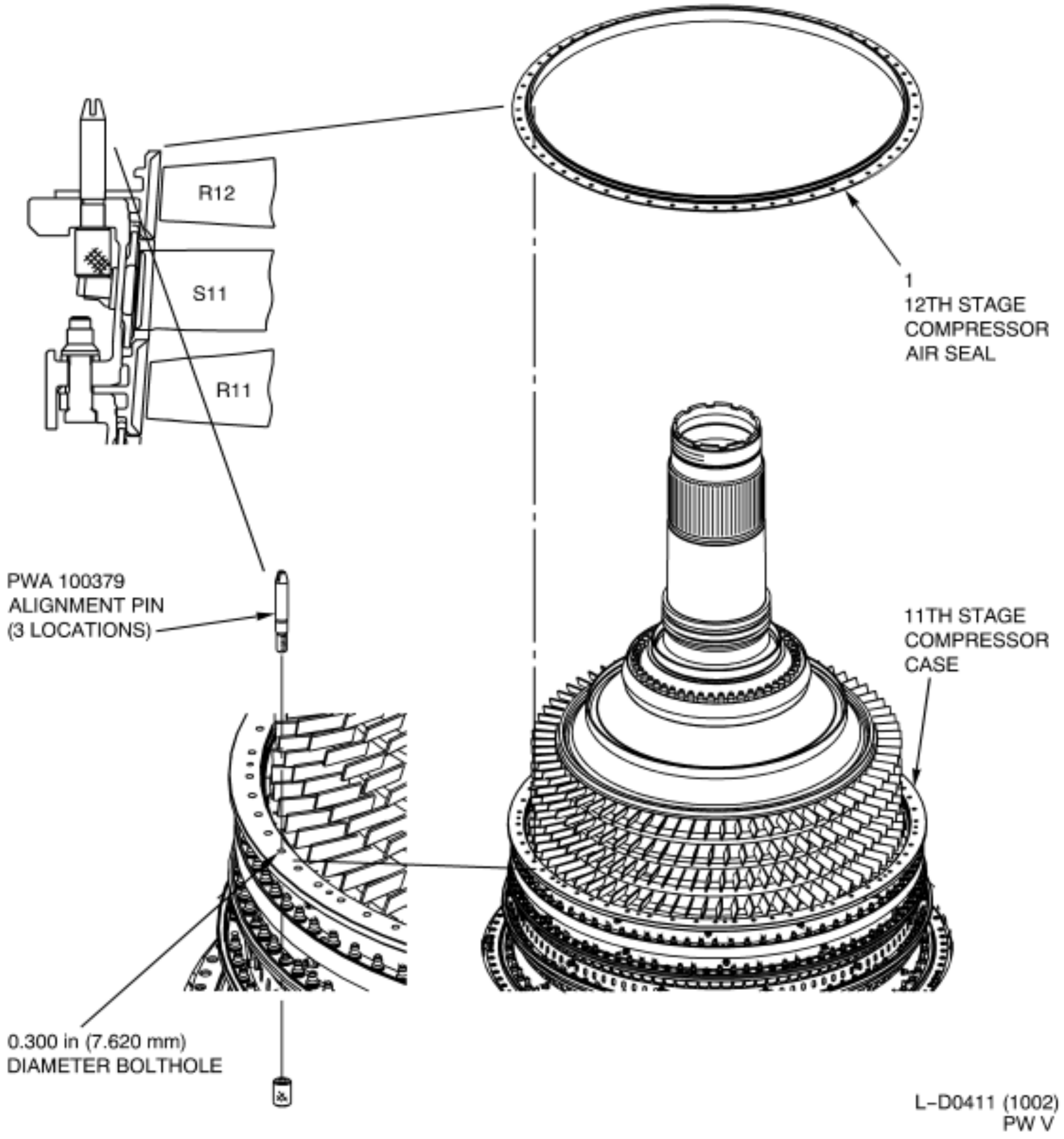

TOP
(12 O'CLOCK)
1
STATOR SEGMENT
(13 LOCATIONS)
SCHEMATIC REAR VIEW
STATOR SEGMENT (VANE) LOCATIONS
L−D0227 (1002)
PW V

Eleventh Stage Stator (Vane) Segments Installation
Figure 1013
(Task 72−35−00−400−007)

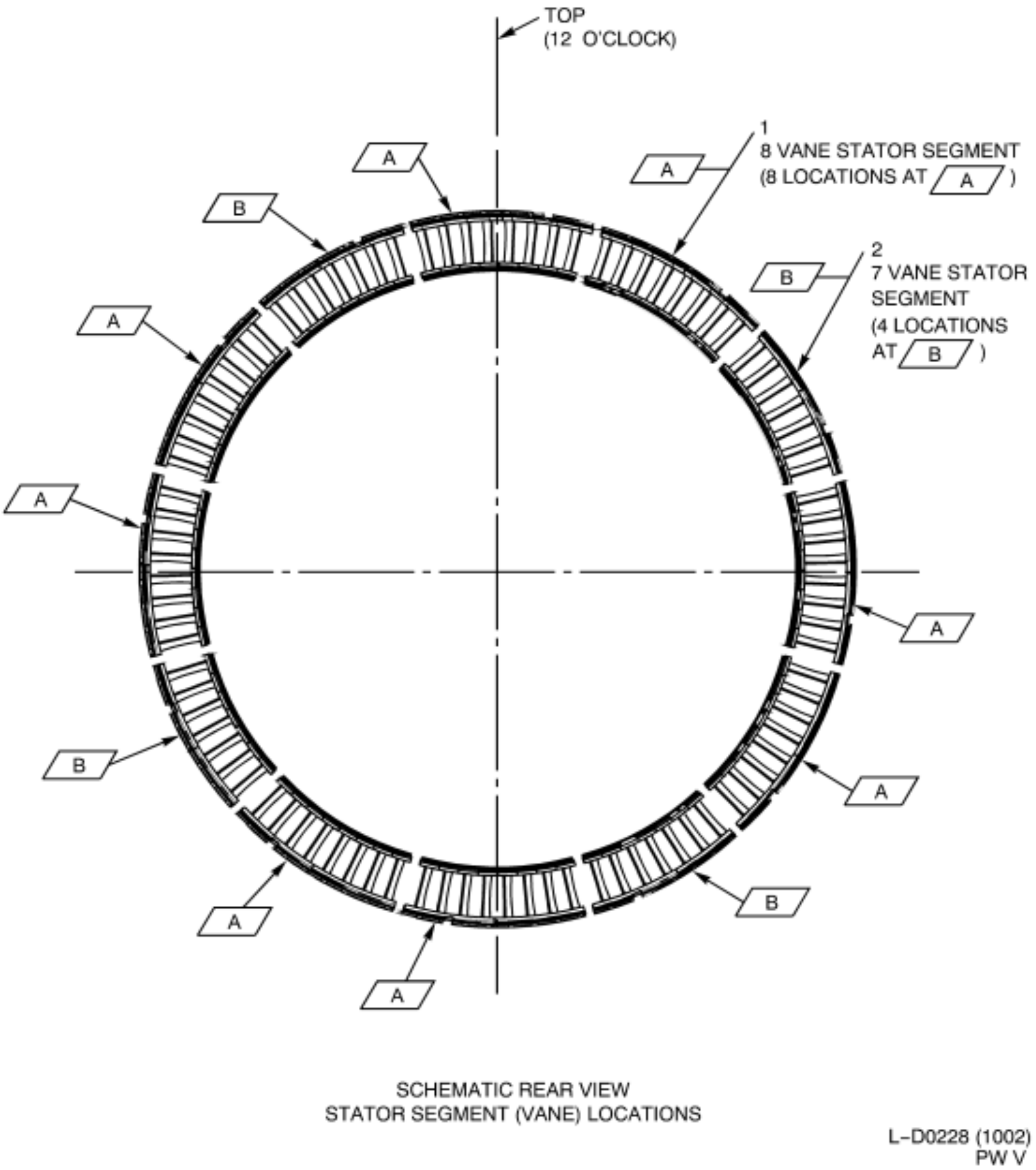
HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−01


1
11TH STAGE
COMPRESSOR
CASE
R12
S11
R11
S10
LINE ON CASE
REAR FLANGE
OD AT TOP
(12 O'CLOCK)
2
NUT
(84 LOCATIONS)
3
WASHER
(84 LOCATIONS)
FWD
4
BOLT
(72 LOCATIONS)
L-D0409 (1002)
PW V

Eleventh Stage Compressor Case Installation
Figure 1014
(Task 72−35−00−400−007)

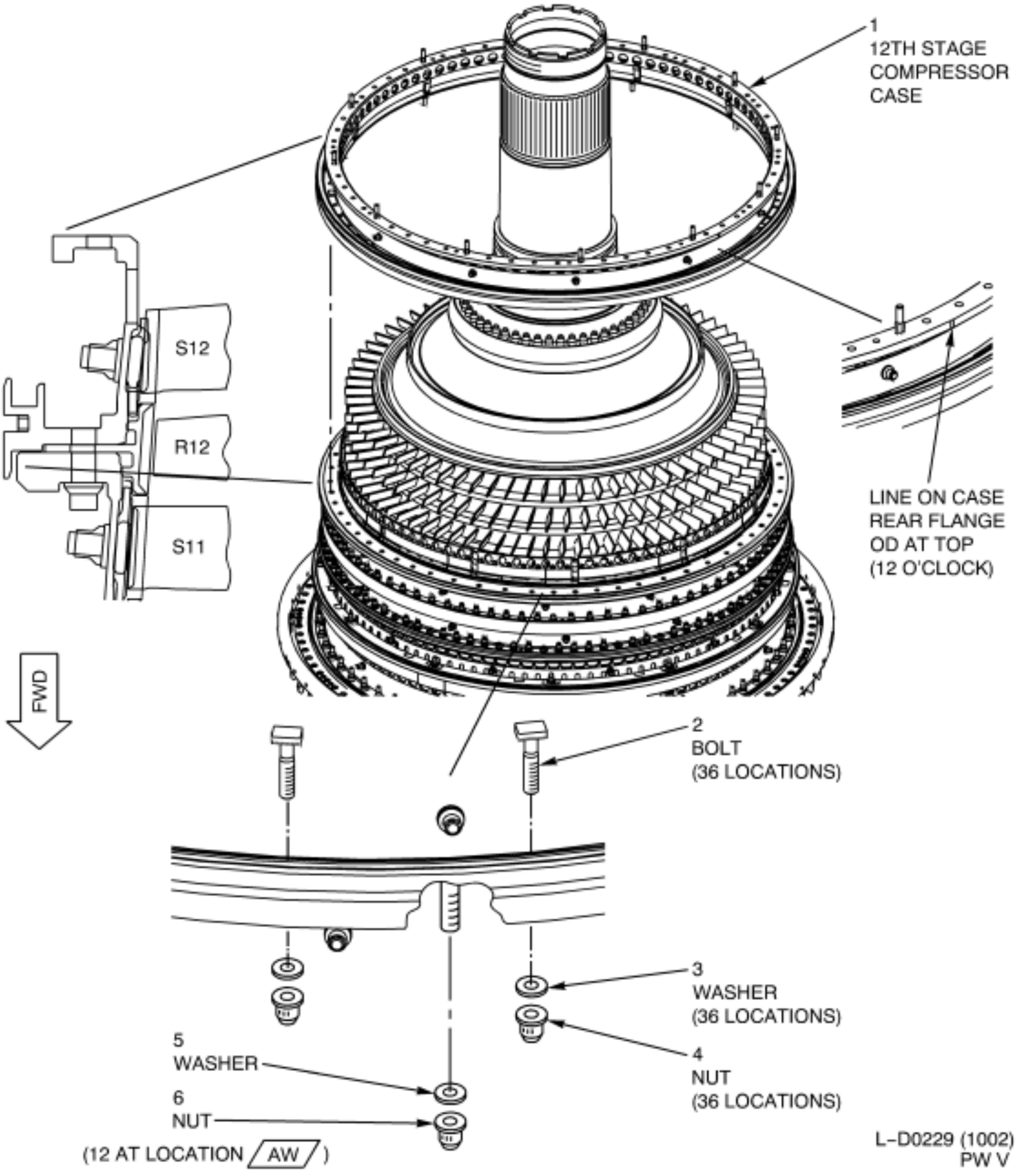

R12
S11
R11
1
12TH STAGE
COMPRESSOR
AIR SEAL
PWA 100379
ALIGNMENT PIN
(3 LOCATIONS)
11TH STAGE
COMPRESSOR
CASE
0.300 in (7.620 mm)
DIAMETER BOLTHOLE
L−D0411 (1002)
PW V

Twelfth Stage Compressor Air Seal Installation
Figure 1015
(Task 72−35−00−400−007)

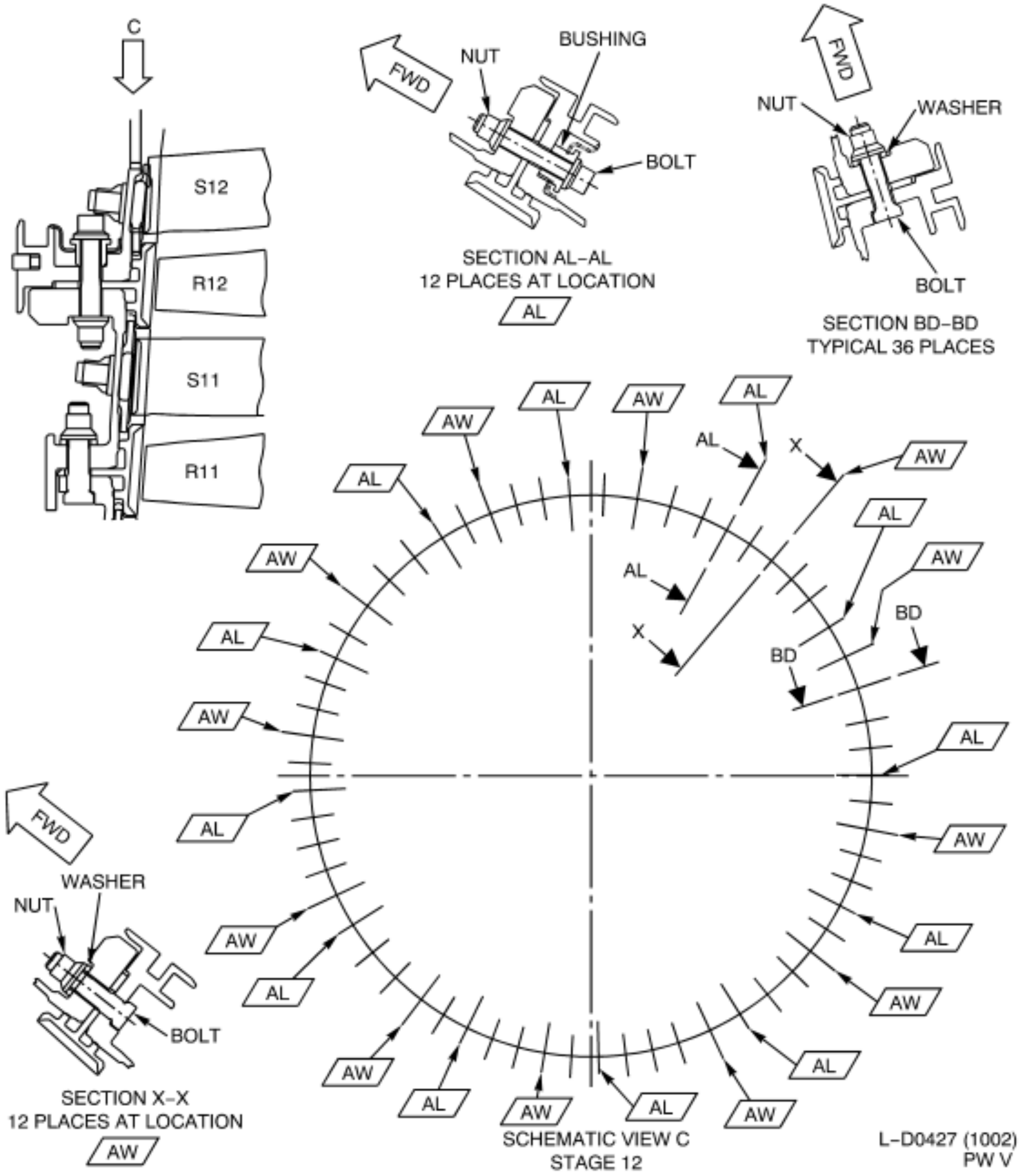

TOP
(12 O'CLOCK)
1
8 VANE STATOR SEGMENT
(8 LOCATIONS AT A)
2
7 VANE STATOR
SEGMENT
(4 LOCATIONS
AT B)
A
B
A
A
A
B
A
B
A
A
A
B
SCHEMATIC REAR VIEW
STATOR SEGMENT (VANE) LOCATIONS
L−D0228 (1002)
PW V

Twelfth Stage Stator (Vane) Segments Installation
Figure 1016
(Task 72−35−00−400−007)

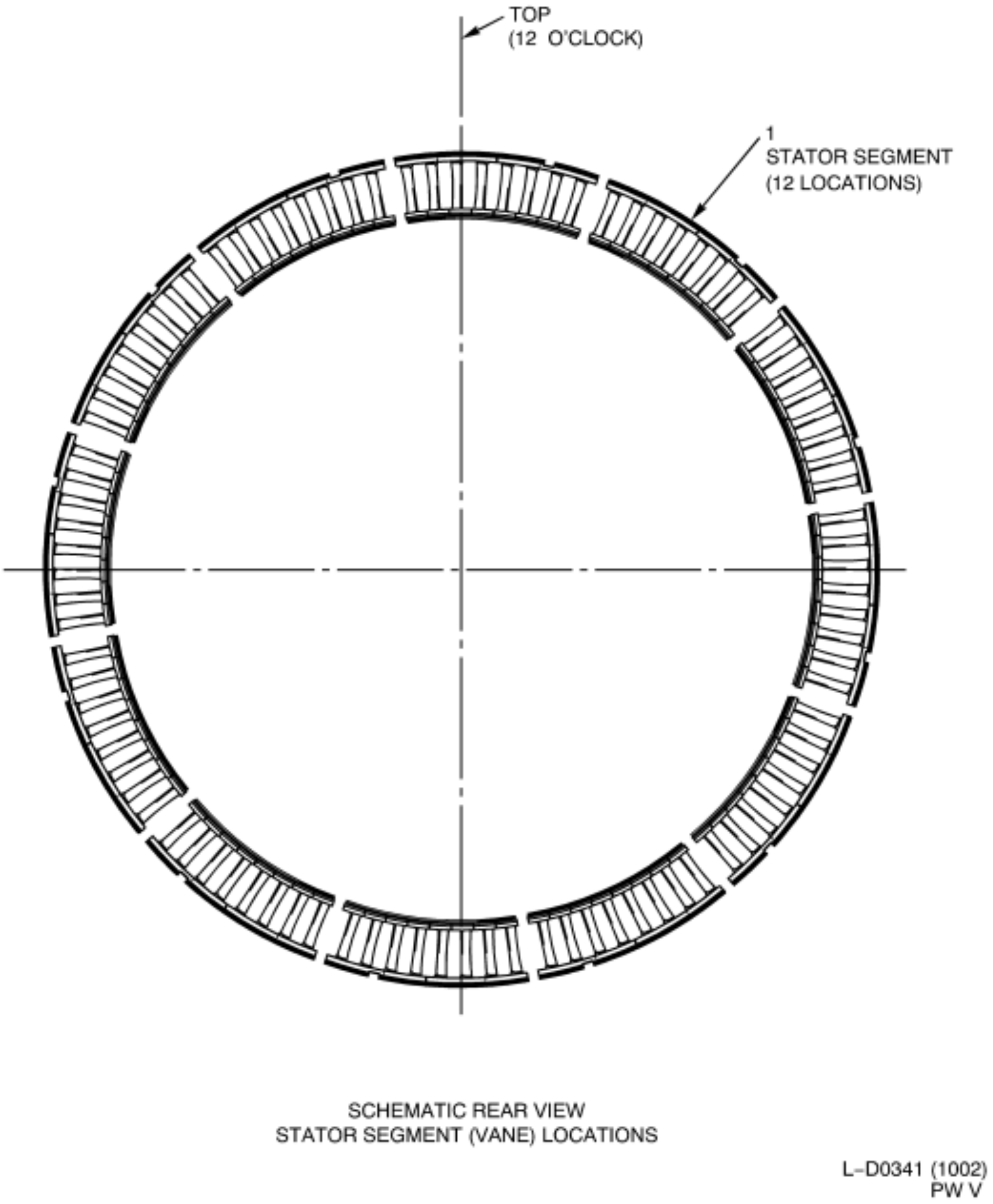
HIGH PRESSURE COMPRESSOR (HPC) - ASSEMBLY-01


1
12TH STAGE
COMPRESSOR
CASE
S12
R12
S11
LINE ON CASE
REAR FLANGE
OD AT TOP
(12 O'CLOCK)
FWD
2
BOLT
(36 LOCATIONS)
3
WASHER
(36 LOCATIONS)
4
NUT
(36 LOCATIONS)
5
WASHER
6
NUT
(12 AT LOCATION AW)
L-D0229 (1002)
PW V

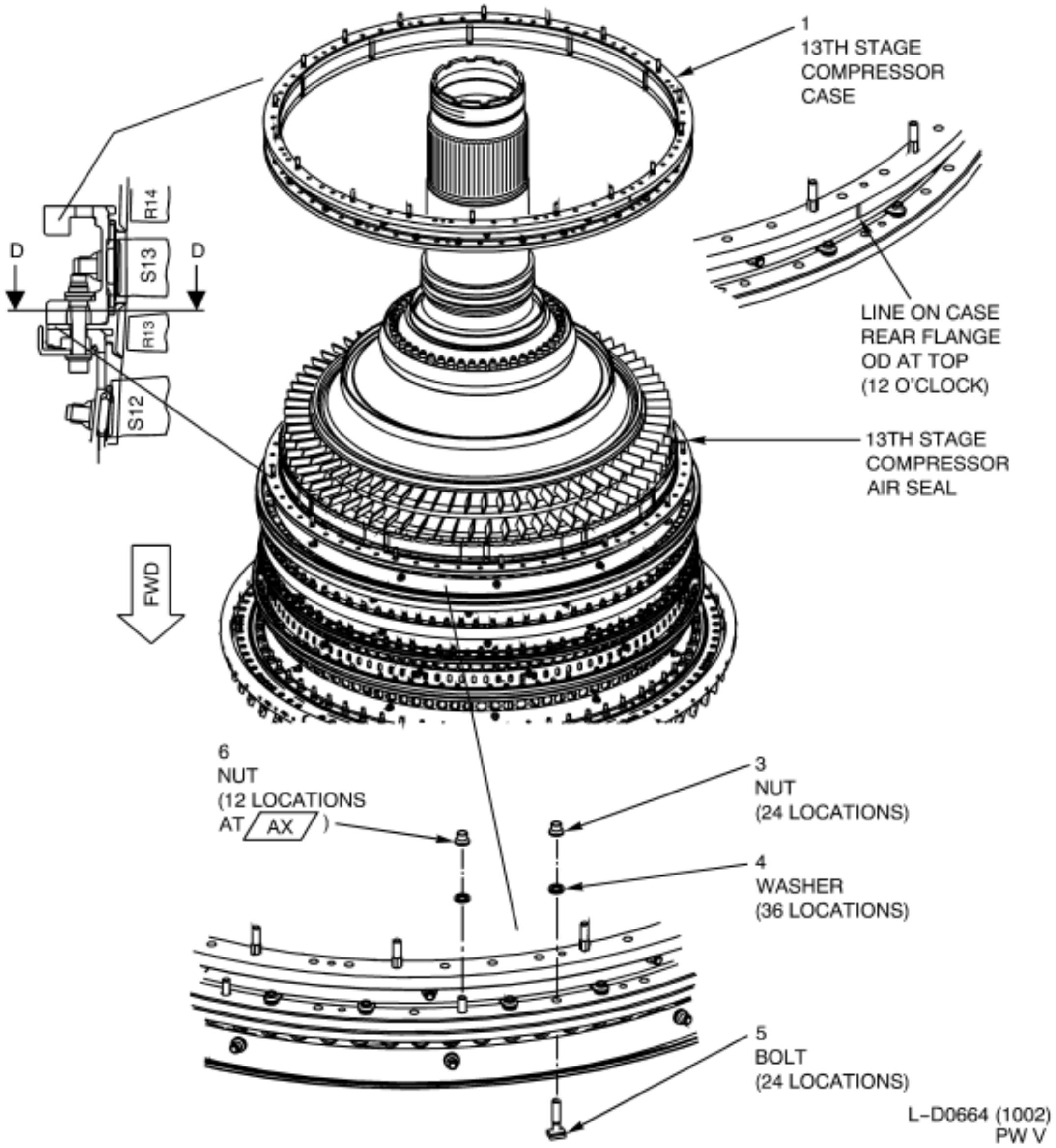
Twelfth Stage Compressor Case Installation
Figure 1017 (Sheet 1)
(Task 72-35-00-400-007)


C
S12
R12
S11
R11
FWD
NUT
BUSHING
BOLT
SECTION AL-AL
12 PLACES AT LOCATION
AL
FWD
NUT
WASHER
BOLT
SECTION BD-BD
TYPICAL 36 PLACES
AL
AW
X
BD
FWD
WASHER
NUT
BOLT
SECTION X-X
12 PLACES AT LOCATION
AW
SCHEMATIC VIEW C
STAGE 12
L-D0427 (1002)
PW V

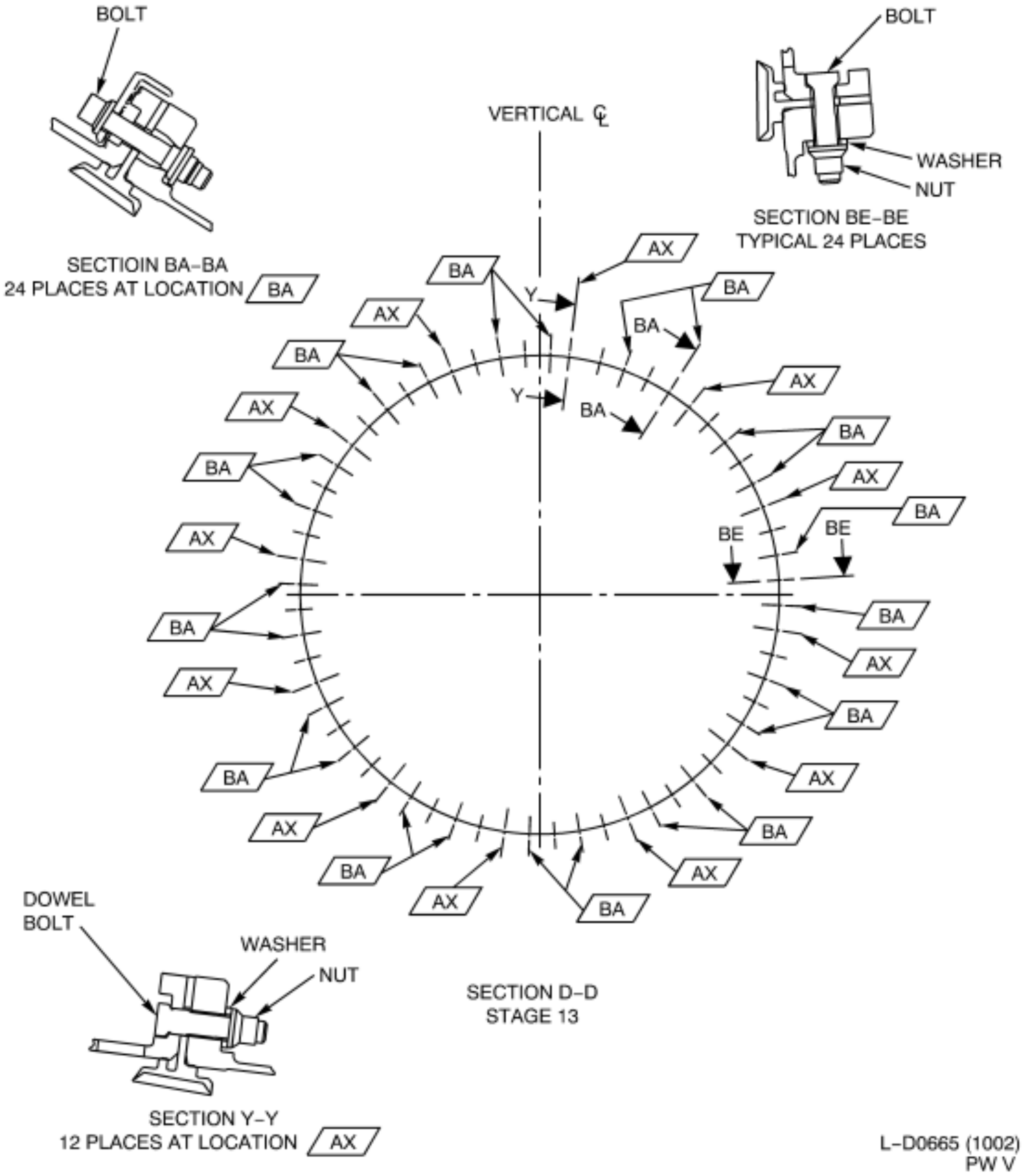
Twelfth Stage Compressor Case Installation
Figure 1017 (Sheet 2)
(Task 72−35−00−400−007)


TOP
(12 O'CLOCK)
1
STATOR SEGMENT
(12 LOCATIONS)
SCHEMATIC REAR VIEW
STATOR SEGMENT (VANE) LOCATIONS
L-D0341 (1002)
PW V

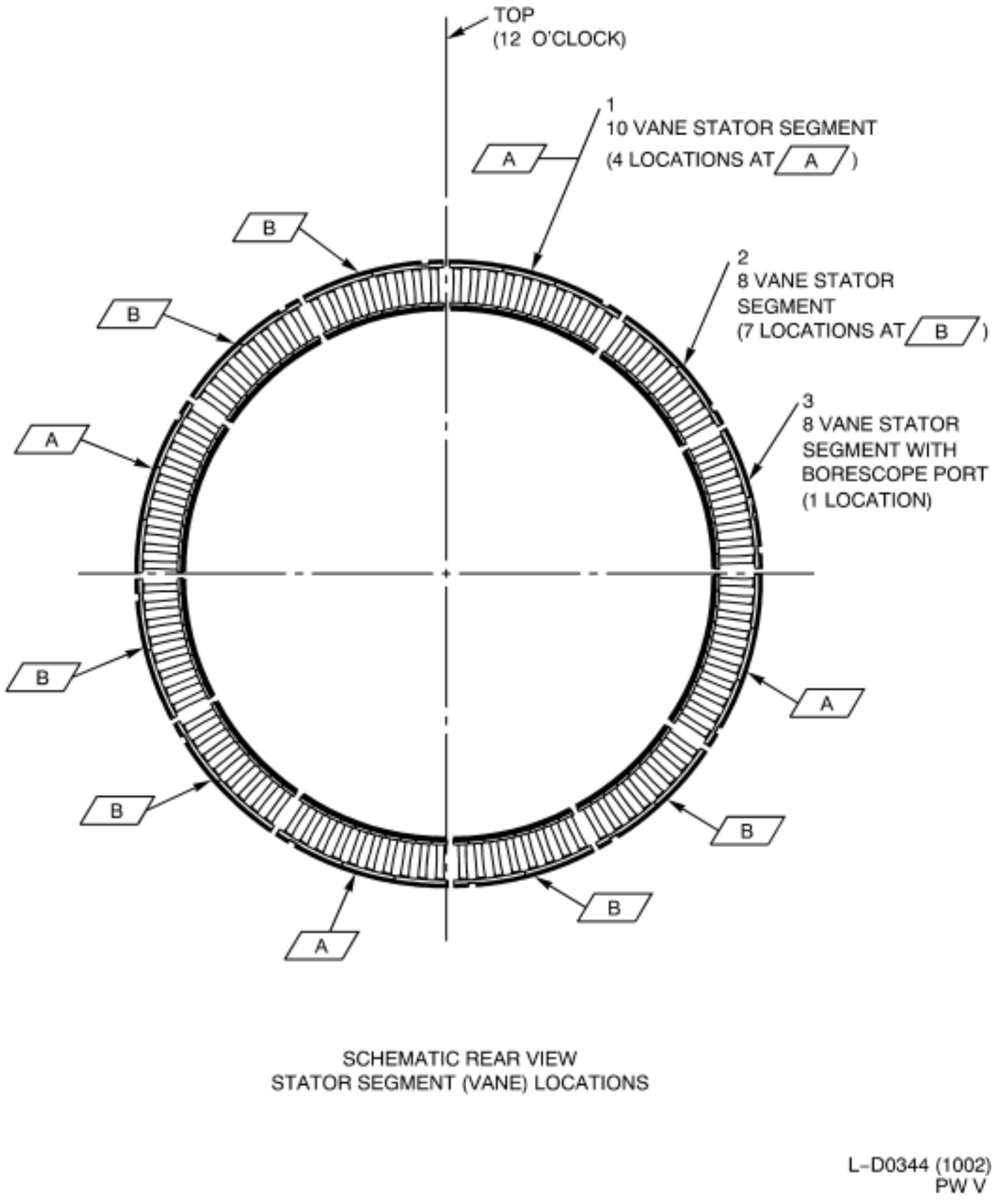
Thirteenth Stage Stator (Vane) Segments Installation
Figure 1018
(Task 72-35-00-400-007)


1
13TH STAGE
COMPRESSOR
CASE
D
D
R14
S13
R13
S12
LINE ON CASE
REAR FLANGE
OD AT TOP
(12 O'CLOCK)
13TH STAGE
COMPRESSOR
AIR SEAL
FWD
6
NUT
(12 LOCATIONS
AT AX)
3
NUT
(24 LOCATIONS)
4
WASHER
(36 LOCATIONS)
5
BOLT
(24 LOCATIONS)
L-D0664 (1002)
PW V

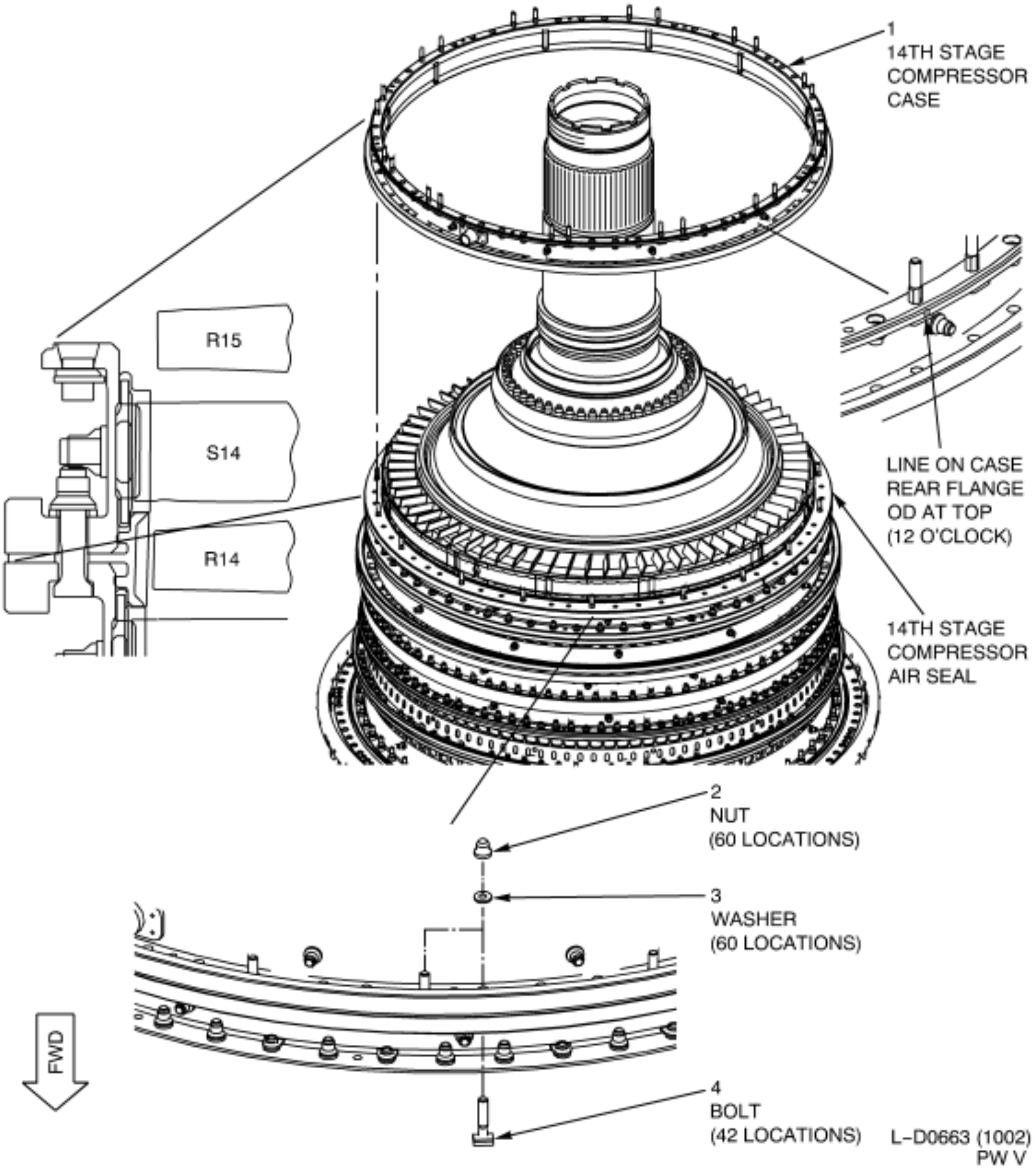
Thirteenth Stage Compressor Case Installation
Figure 1019 (Sheet 1)
(Task 72-35-00-400-007)


BOLT
SECTIOIN BA-BA
24 PLACES AT LOCATION
BA
VERTICAL ℄
BOLT
WASHER
NUT
SECTION BE-BE
TYPICAL 24 PLACES
AX
BA
Y
BE
DOWEL
BOLT
WASHER
NUT
SECTION D-D
STAGE 13
SECTION Y-Y
12 PLACES AT LOCATION
AX
L-D0665 (1002)
PW V

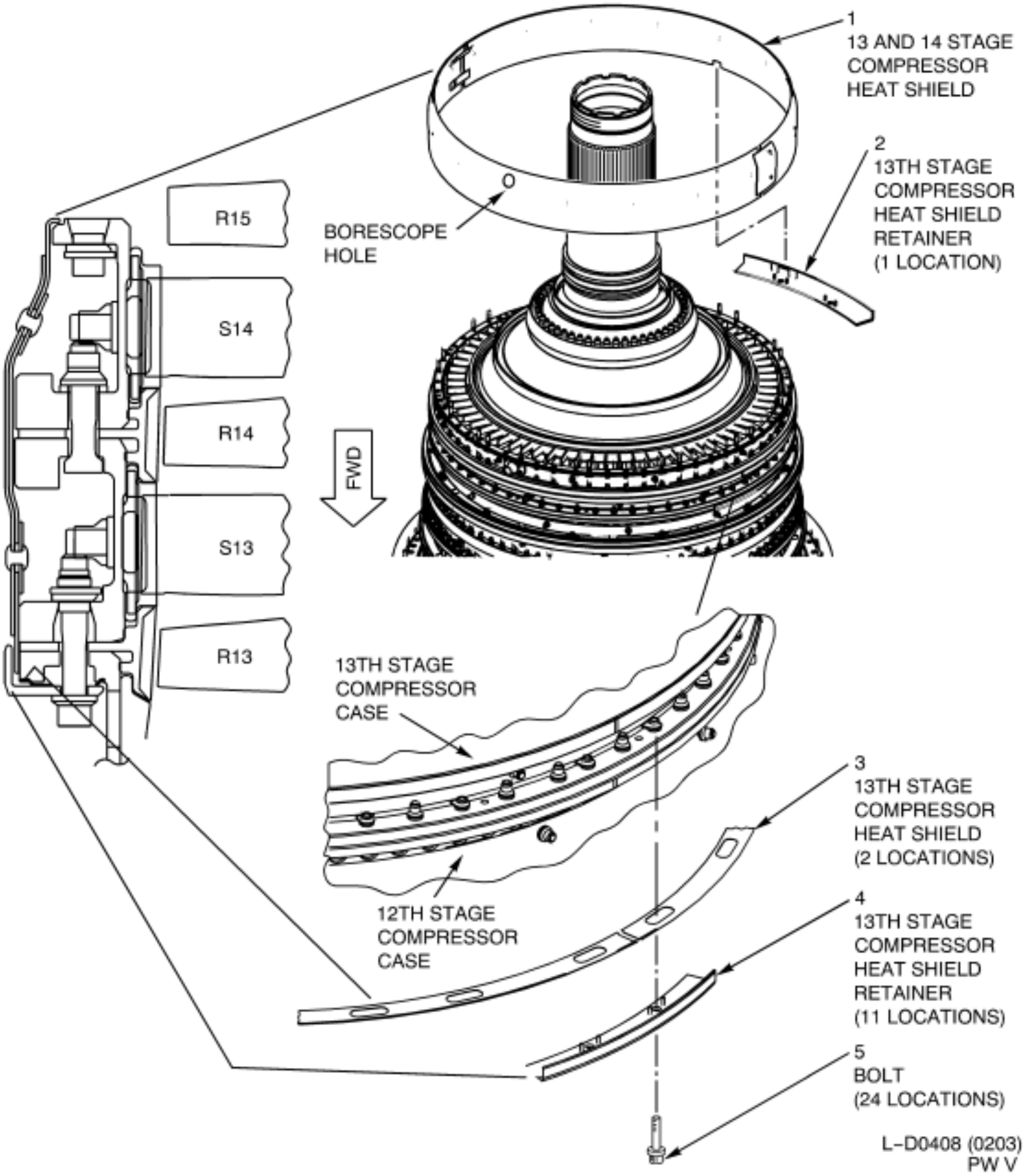
Thirteenth Stage Compressor Case Installation
Figure 1019 (Sheet 2)
(Task 72-35-00-400-007)


TOP
(12 O'CLOCK)
1
10 VANE STATOR SEGMENT
(4 LOCATIONS AT A)
2
8 VANE STATOR
SEGMENT
(7 LOCATIONS AT B)
3
8 VANE STATOR
SEGMENT WITH
BORESCOPE PORT
(1 LOCATION)
A
B
B
A
B
B
A
A
B
B
B
SCHEMATIC REAR VIEW
STATOR SEGMENT (VANE) LOCATIONS
L−D0344 (1002)
PW V

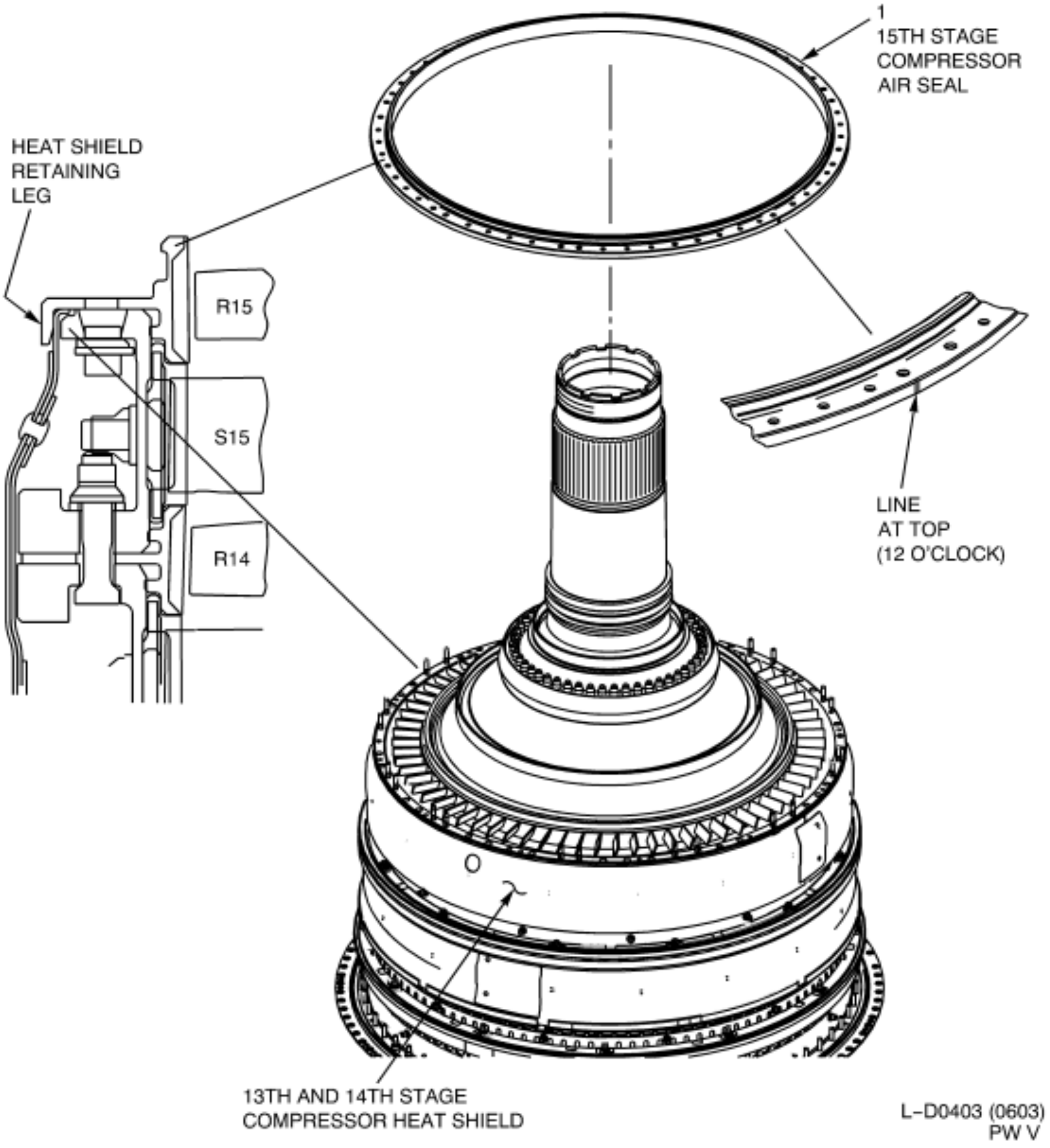
Fourteenth Stage Stator (Vane) Segments Installation
Figure 1020
(Task 72−35−00−400−007)


1
14TH STAGE COMPRESSOR CASE
R15
S14
R14
LINE ON CASE REAR FLANGE OD AT TOP (12 O'CLOCK)
14TH STAGE COMPRESSOR AIR SEAL
2
NUT (60 LOCATIONS)
3
WASHER (60 LOCATIONS)
FWD
4
BOLT (42 LOCATIONS)
L-D0663 (1002)
PW V

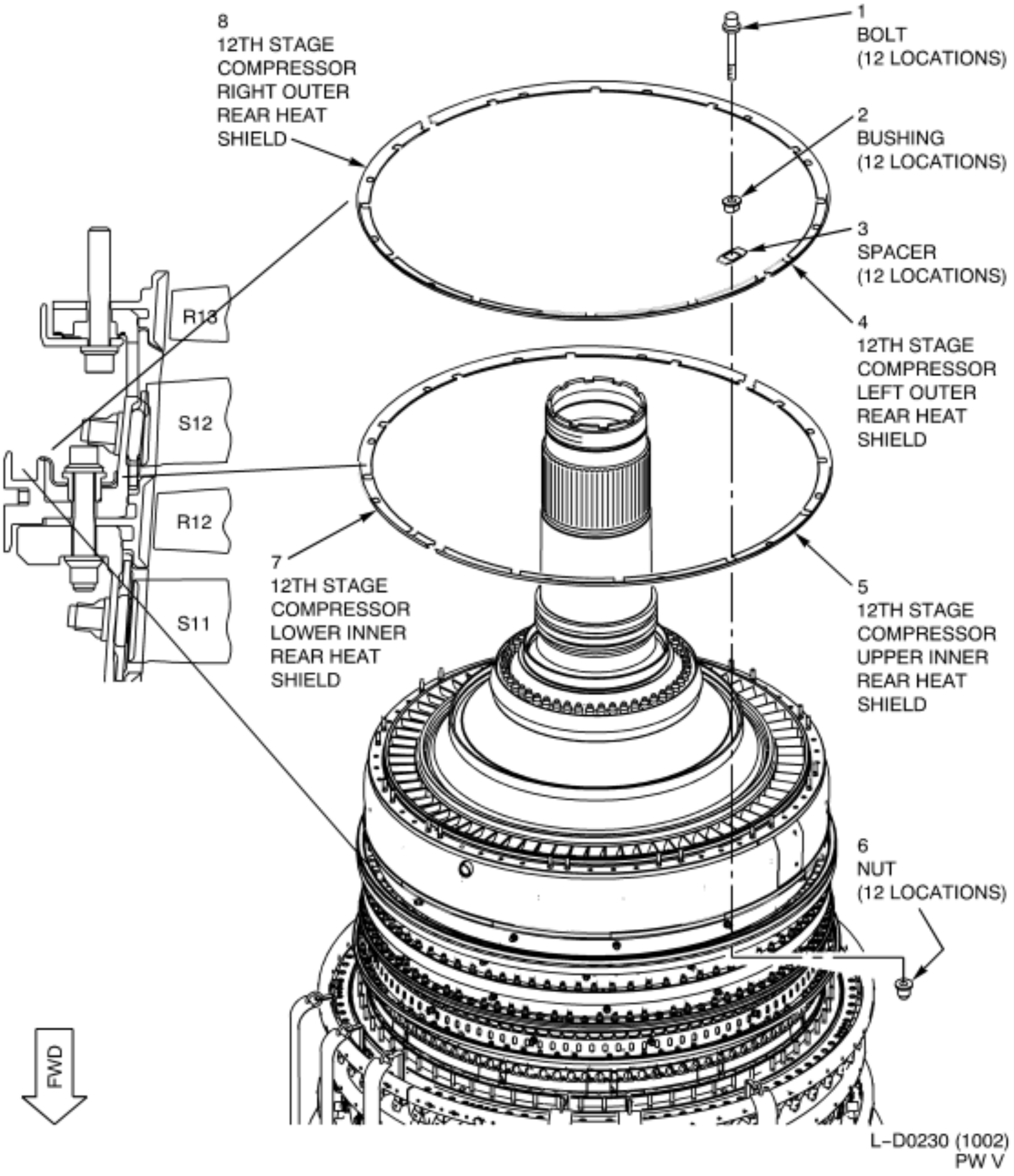
Fourteenth Stage Compressor Case Installation
Figure 1021
(Task 72-35-00-400-007)


1
13 AND 14 STAGE
COMPRESSOR
HEAT SHIELD
2
13TH STAGE
COMPRESSOR
HEAT SHIELD
RETAINER
(1 LOCATION)
BORESCOPE
HOLE
R15
S14
R14
S13
R13
FWD
13TH STAGE
COMPRESSOR
CASE
3
13TH STAGE
COMPRESSOR
HEAT SHIELD
(2 LOCATIONS)
12TH STAGE
COMPRESSOR
CASE
4
13TH STAGE
COMPRESSOR
HEAT SHIELD
RETAINER
(11 LOCATIONS)
5
BOLT
(24 LOCATIONS)
L-D0408 (0203)
PW V

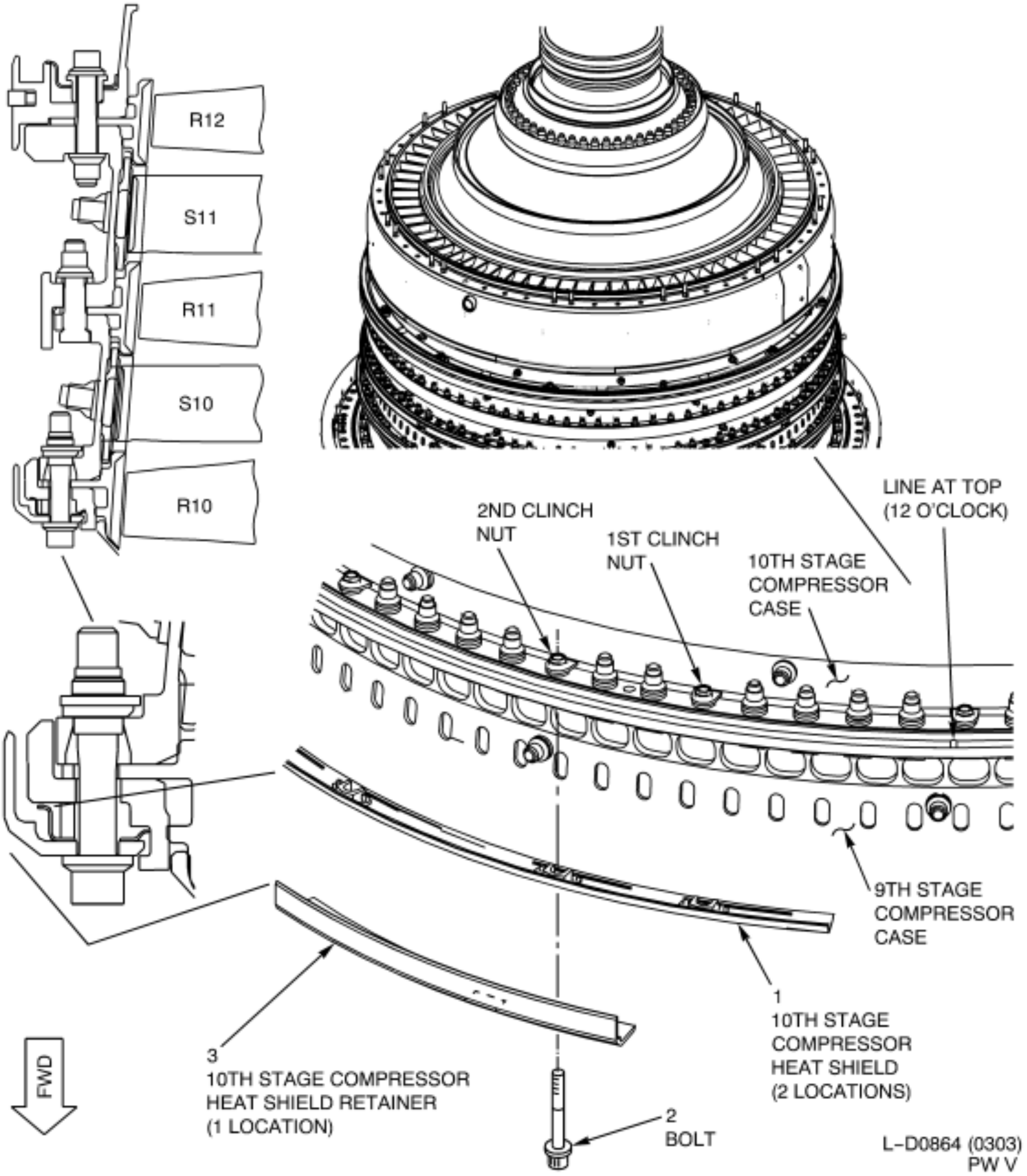
Thirteenth And 14th Stage Heat Shield Installation
Figure 1022
(Task 72-35-00-400-007)


1
15TH STAGE
COMPRESSOR
AIR SEAL
HEAT SHIELD
RETAINING
LEG
R15
S15
R14
LINE
AT TOP
(12 O'CLOCK)
13TH AND 14TH STAGE
COMPRESSOR HEAT SHIELD
L−D0403 (0603)
PW V

Fifteenth Stage Air Seal Installation
Figure 1023
(Task 72−35−00−400−007)

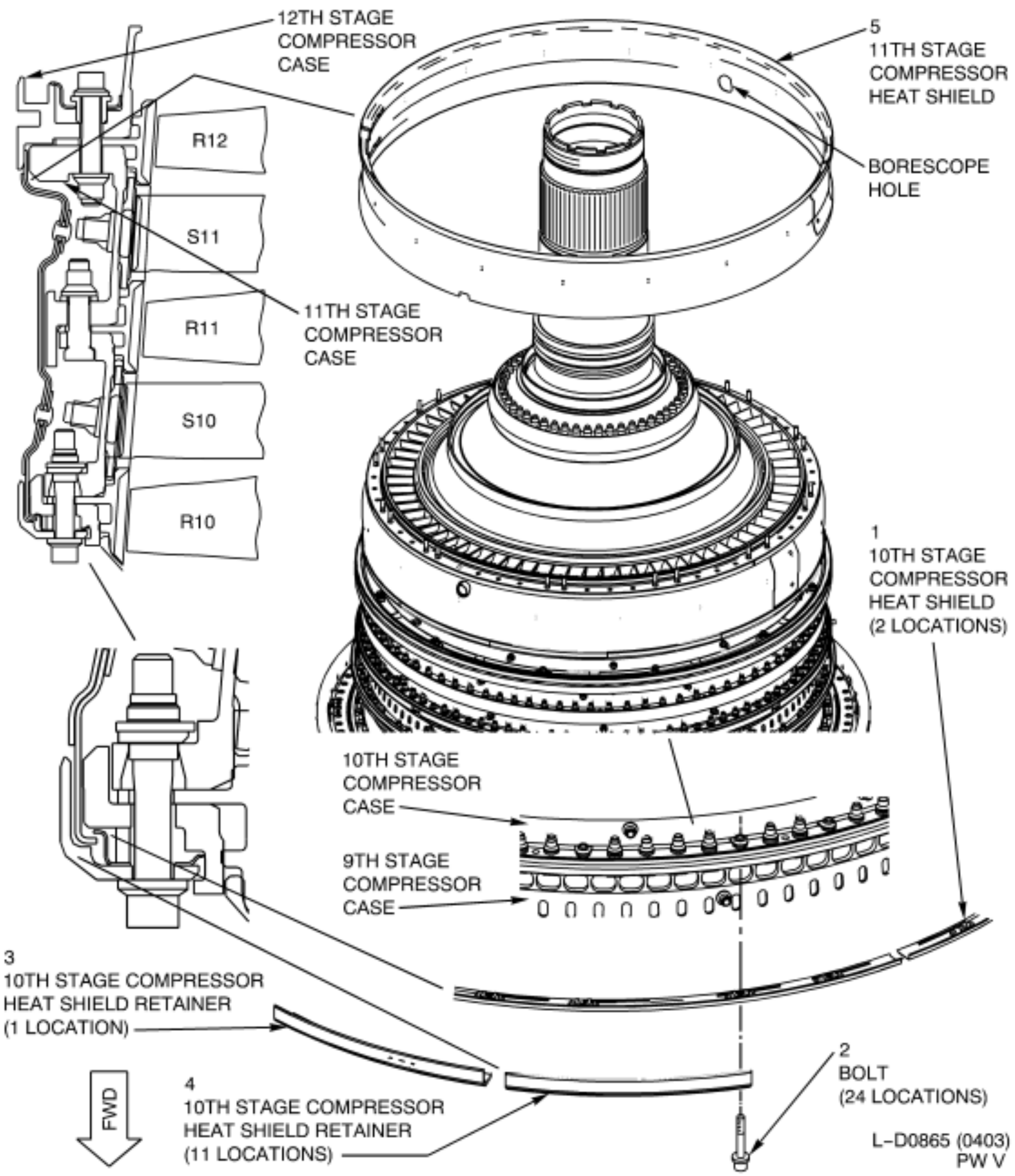

8
12TH STAGE COMPRESSOR RIGHT OUTER REAR HEAT SHIELD
1
BOLT (12 LOCATIONS)
2
BUSHING (12 LOCATIONS)
3
SPACER (12 LOCATIONS)
4
12TH STAGE COMPRESSOR LEFT OUTER REAR HEAT SHIELD
R13
S12
R12
S11
7
12TH STAGE COMPRESSOR LOWER INNER REAR HEAT SHIELD
5
12TH STAGE COMPRESSOR UPPER INNER REAR HEAT SHIELD
6
NUT (12 LOCATIONS)
FWD
L−D0230 (1002)
PW V

Twelfth Stage Compressor Rear Heat Shield Installation
Figure 1024
(Task 72−35−00−400−007)

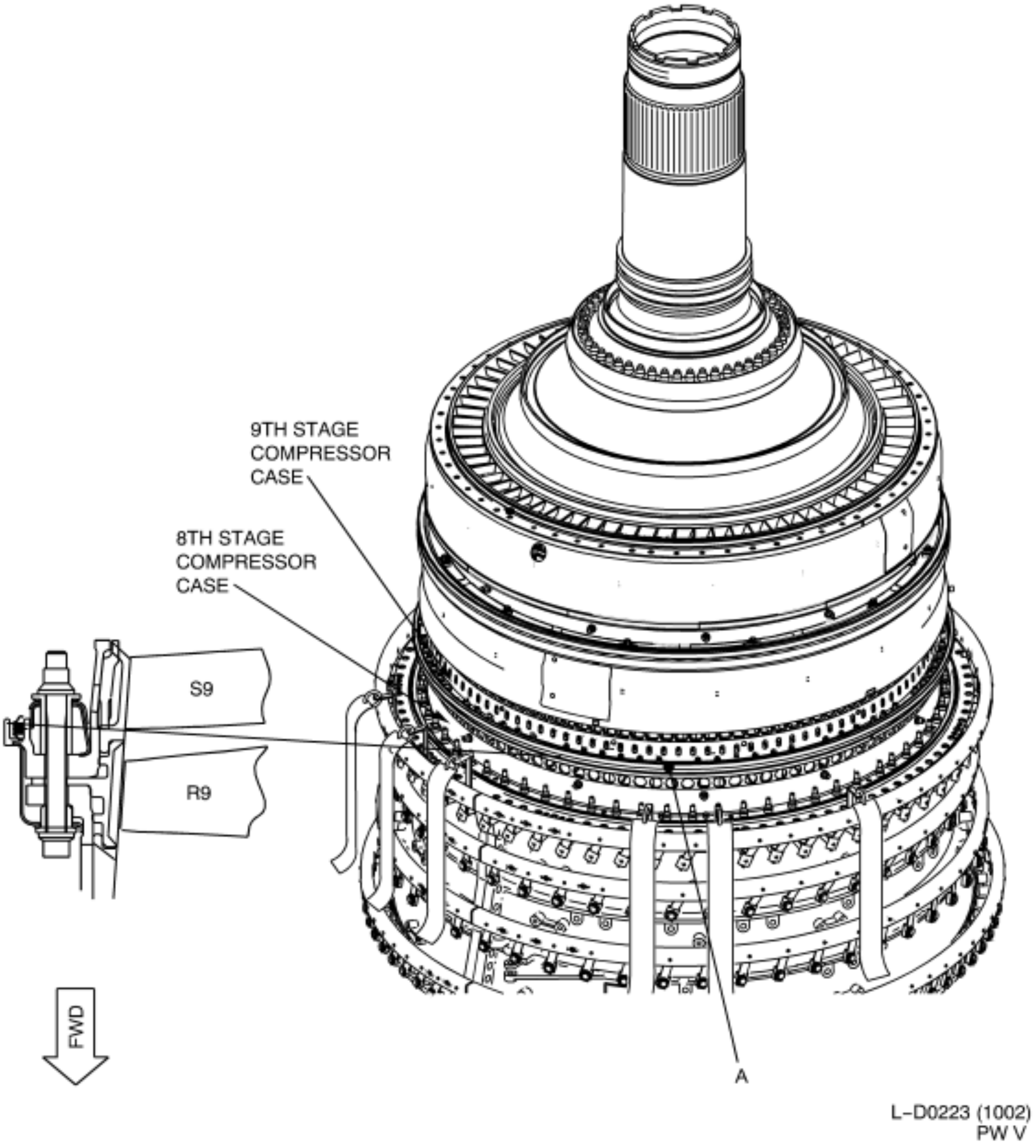

R12
S11
R11
S10
R10
2ND CLINCH NUT
1ST CLINCH NUT
10TH STAGE COMPRESSOR CASE
LINE AT TOP (12 O'CLOCK)
9TH STAGE COMPRESSOR CASE
1
10TH STAGE COMPRESSOR HEAT SHIELD (2 LOCATIONS)
3
10TH STAGE COMPRESSOR HEAT SHIELD RETAINER (1 LOCATION)
2
BOLT
FWD
L-D0864 (0303)
PW V

Eleventh Stage Compressor Heat Shield Installation
Figure 1025 (Sheet 1)
(Task 72-35-00-400-007)

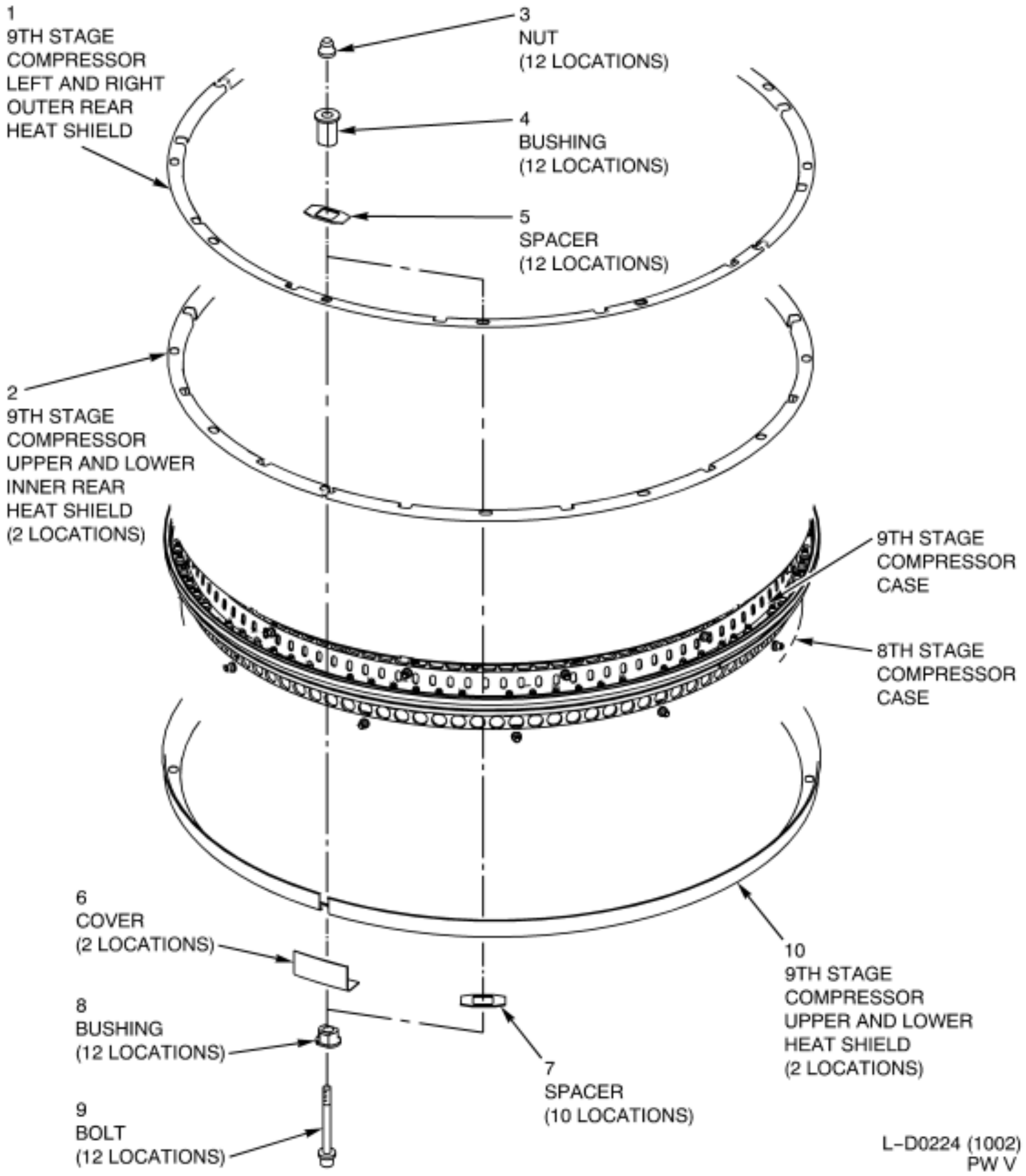
HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−01


12TH STAGE COMPRESSOR CASE
5
11TH STAGE COMPRESSOR HEAT SHIELD
BORESCOPE HOLE
R12
S11
R11
S10
R10
11TH STAGE COMPRESSOR CASE
1
10TH STAGE COMPRESSOR HEAT SHIELD (2 LOCATIONS)
10TH STAGE COMPRESSOR CASE
9TH STAGE COMPRESSOR CASE
3
10TH STAGE COMPRESSOR HEAT SHIELD RETAINER (1 LOCATION)
FWD
4
10TH STAGE COMPRESSOR HEAT SHIELD RETAINER (11 LOCATIONS)
2
BOLT (24 LOCATIONS)
L-D0865 (0403)
PW V

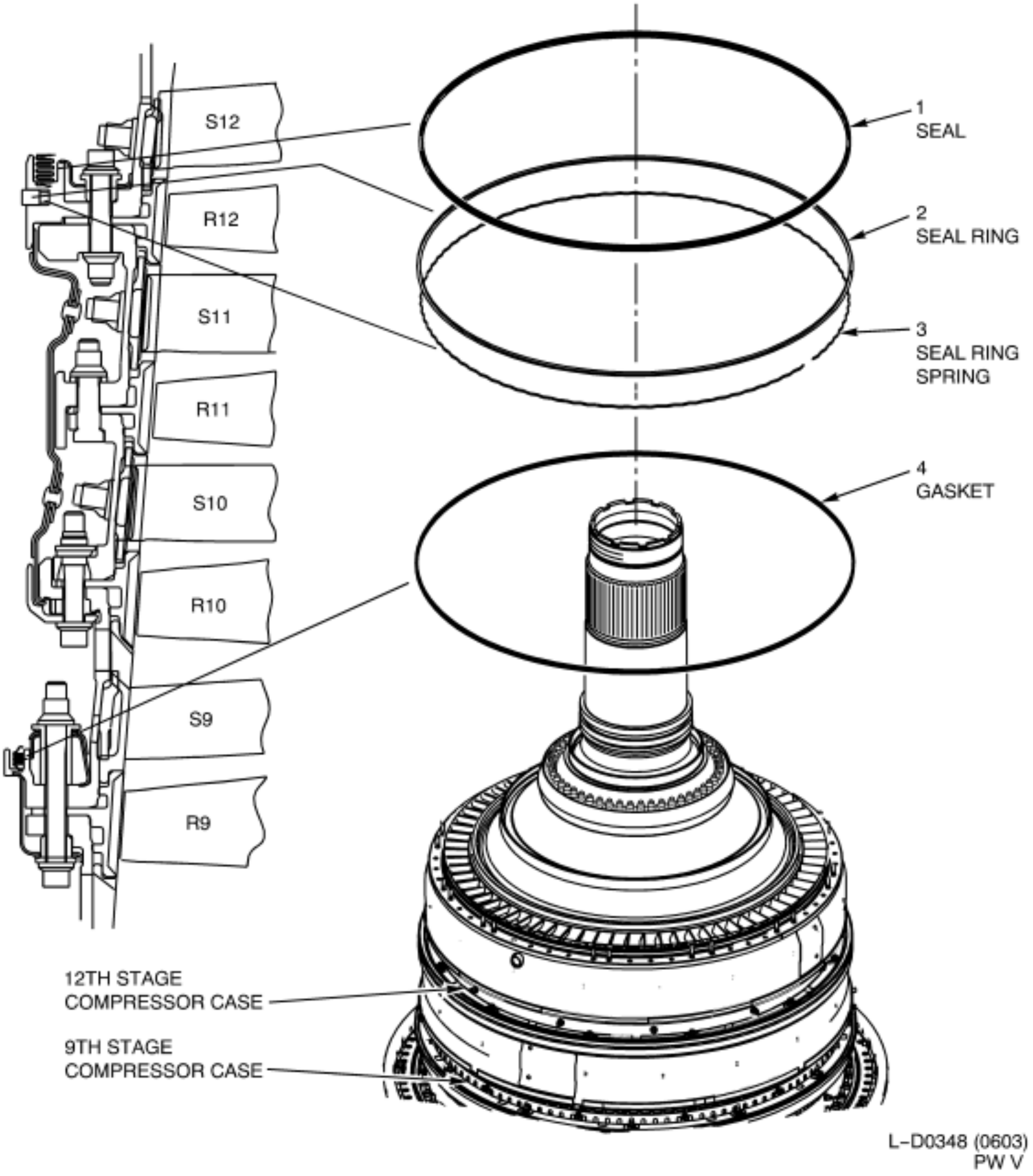
Eleventh Stage Compressor Heat Shield Installation
Figure 1025 (Sheet 2)
(Task 72−35−00−400−007)


9TH STAGE COMPRESSOR CASE
8TH STAGE COMPRESSOR CASE
S9
R9
FWD
A
L-D0223 (1002)
PW V

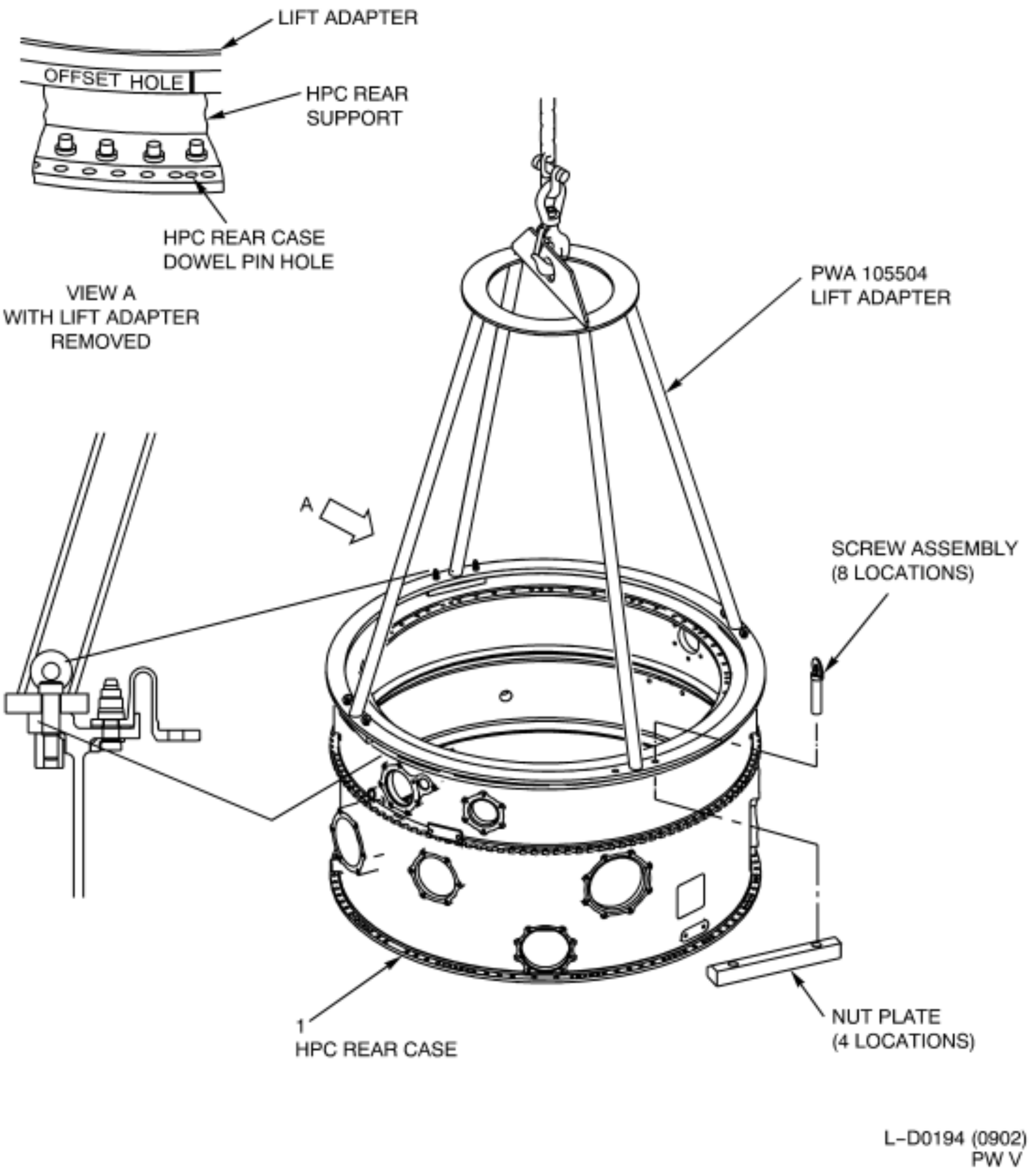
Ninth Stage Compressor Heat Shield Installation
Figure 1026 (Sheet 1)
(Task 72−35−00−400−007)


1
9TH STAGE
COMPRESSOR
LEFT AND RIGHT
OUTER REAR
HEAT SHIELD
3
NUT
(12 LOCATIONS)
4
BUSHING
(12 LOCATIONS)
5
SPACER
(12 LOCATIONS)
2
9TH STAGE
COMPRESSOR
UPPER AND LOWER
INNER REAR
HEAT SHIELD
(2 LOCATIONS)
9TH STAGE
COMPRESSOR
CASE
8TH STAGE
COMPRESSOR
CASE
6
COVER
(2 LOCATIONS)
8
BUSHING
(12 LOCATIONS)
9
BOLT
(12 LOCATIONS)
7
SPACER
(10 LOCATIONS)
10
9TH STAGE
COMPRESSOR
UPPER AND LOWER
HEAT SHIELD
(2 LOCATIONS)
L-D0224 (1002)
PW V

Ninth Stage Compressor Heat Shield Installation
Figure 1026 (Sheet 2)
(Task 72-35-00-400-007)

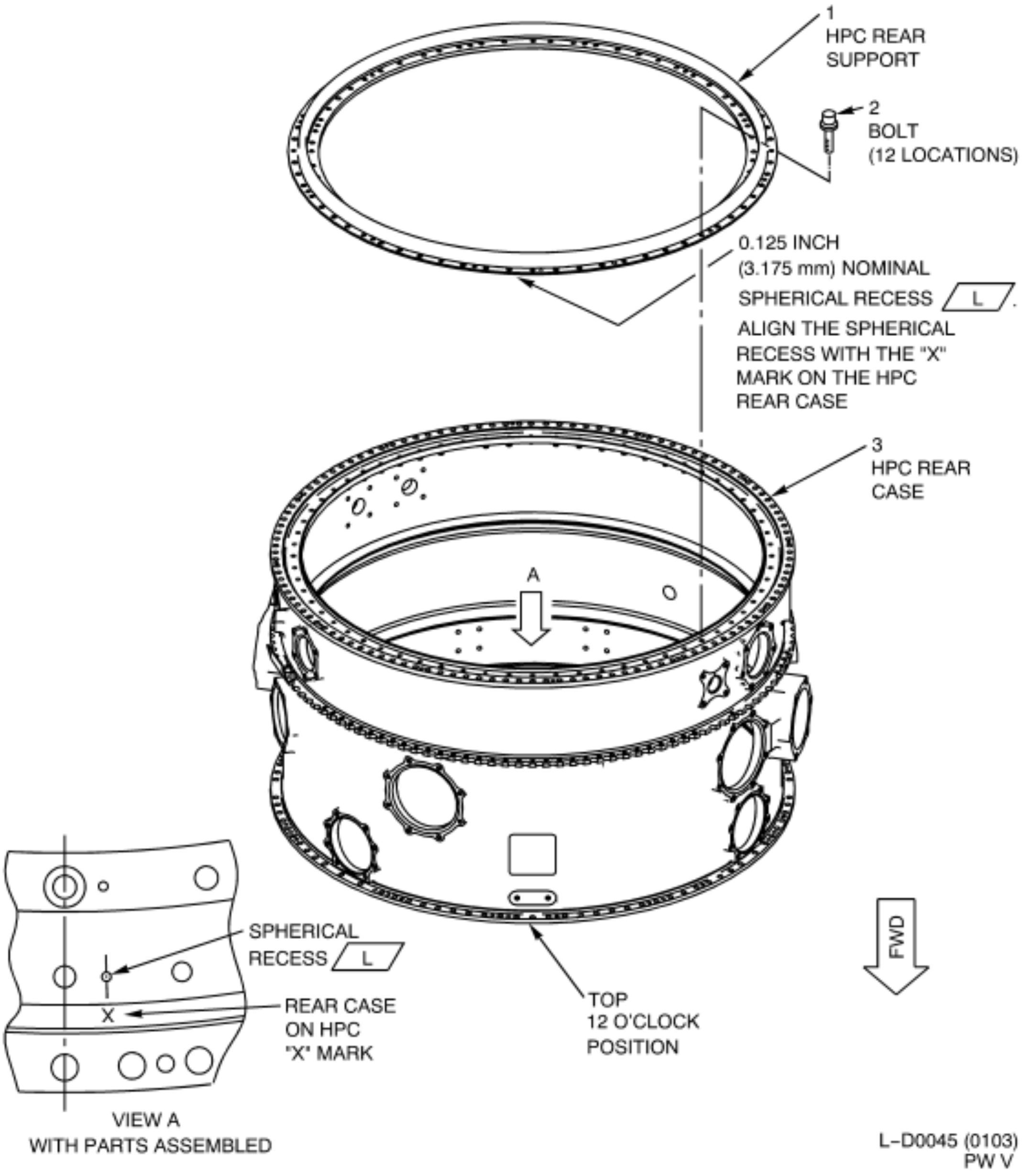

S12
R12
S11
R11
S10
R10
S9
R9
1
SEAL
2
SEAL RING
3
SEAL RING
SPRING
4
GASKET
12TH STAGE
COMPRESSOR CASE
9TH STAGE
COMPRESSOR CASE
L-D0348 (0603)
PW V

Gasket And Seals Installation
Figure 1027
(Task 72-35-00-400-007)

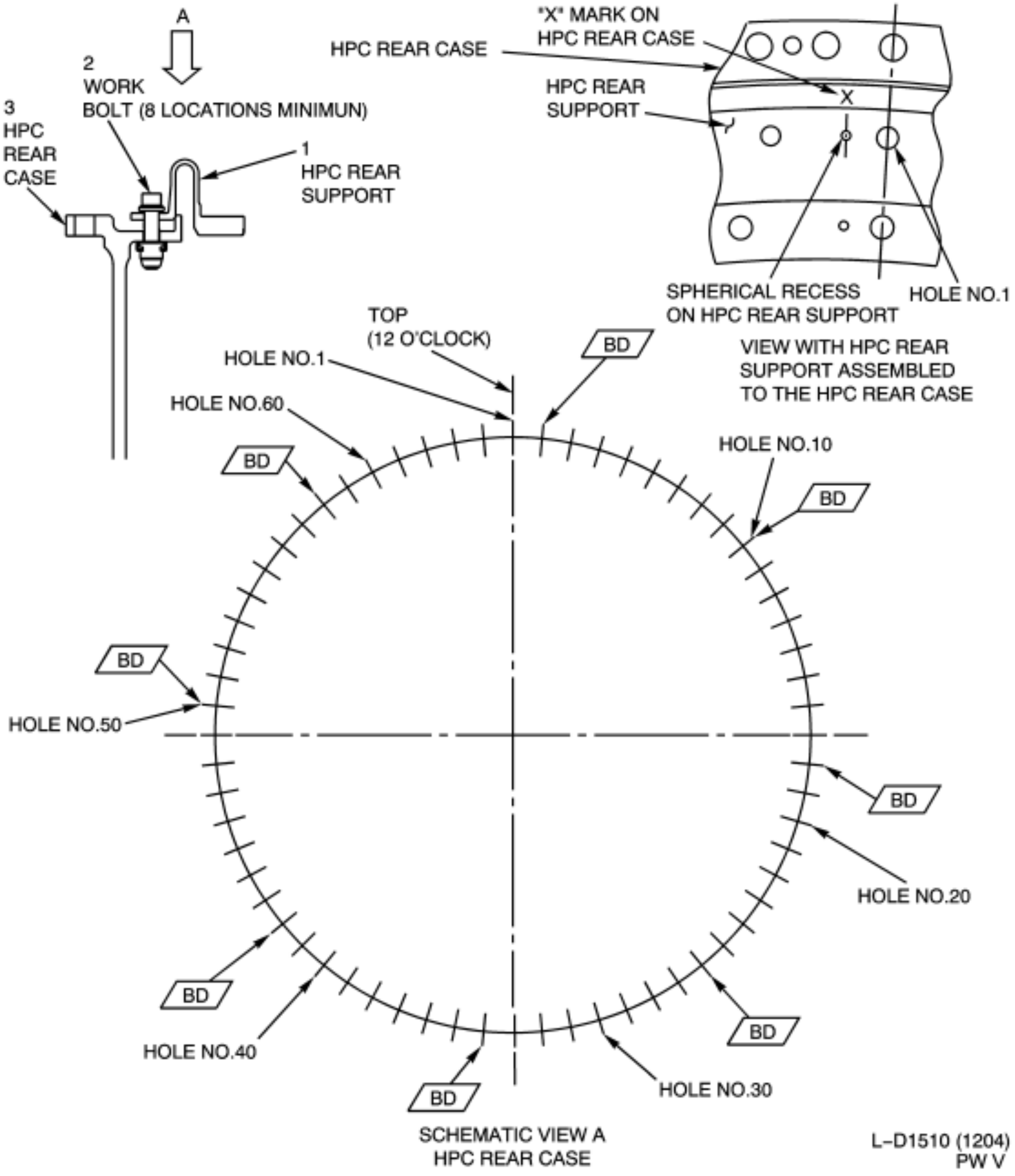

LIFT ADAPTER
OFFSET HOLE
HPC REAR SUPPORT
HPC REAR CASE DOWEL PIN HOLE
VIEW A WITH LIFT ADAPTER REMOVED
PWA 105504 LIFT ADAPTER
A
SCREW ASSEMBLY (8 LOCATIONS)
1
HPC REAR CASE
NUT PLATE (4 LOCATIONS)
L−D0194 (0902)
PW V

HPC Rear Case Installation
Figure 1028 (Sheet 1)
(Task 72−35−00−400−007)

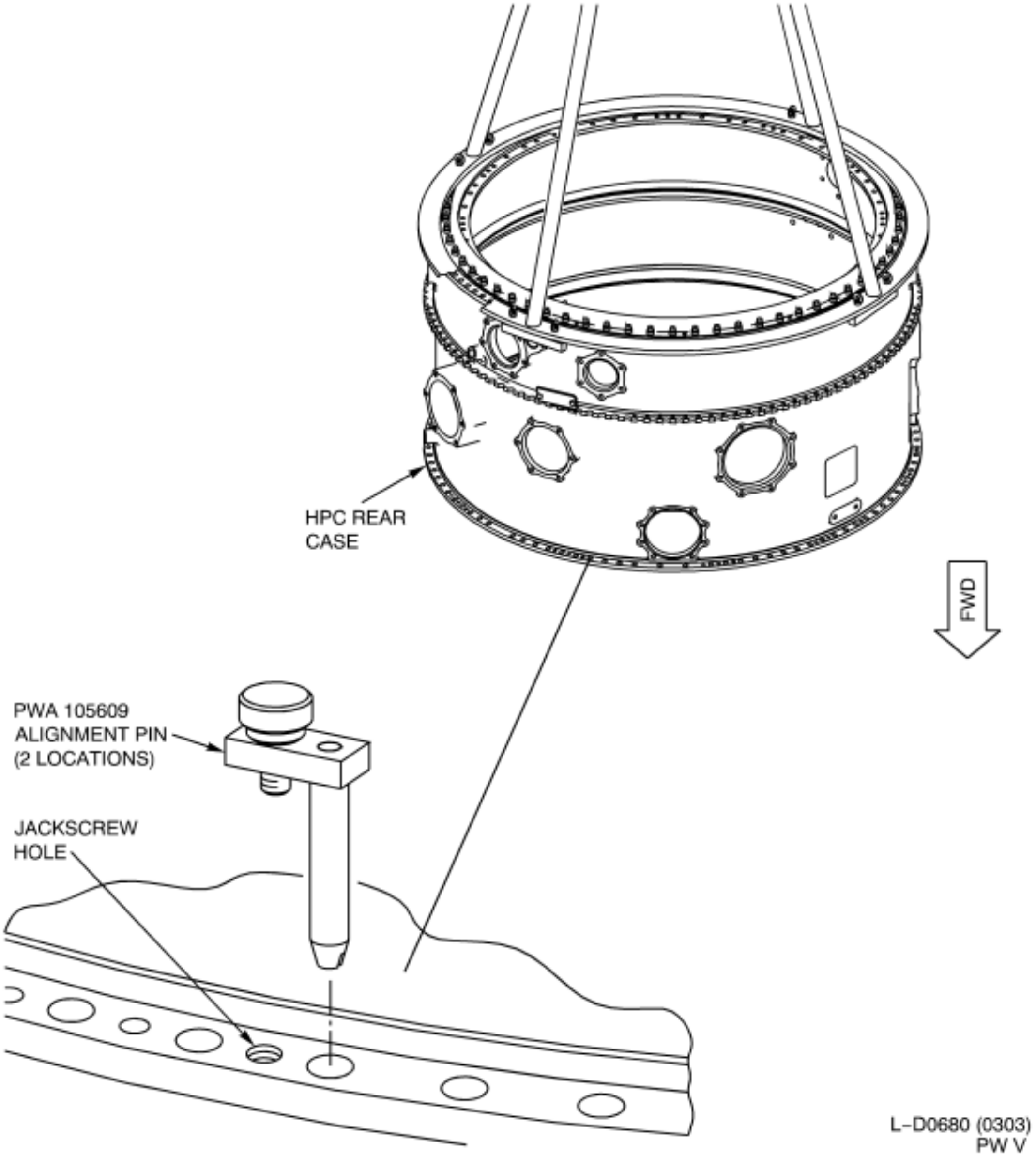
HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−01


1
HPC REAR
SUPPORT
2
BOLT
(12 LOCATIONS)
0.125 INCH
(3.175 mm) NOMINAL
SPHERICAL RECESS L.
ALIGN THE SPHERICAL
RECESS WITH THE "X"
MARK ON THE HPC
REAR CASE
3
HPC REAR
CASE
A
FWD
SPHERICAL
RECESS L
X
REAR CASE
ON HPC
"X" MARK
TOP
12 O'CLOCK
POSITION
VIEW A
WITH PARTS ASSEMBLED
L−D0045 (0103)
PW V

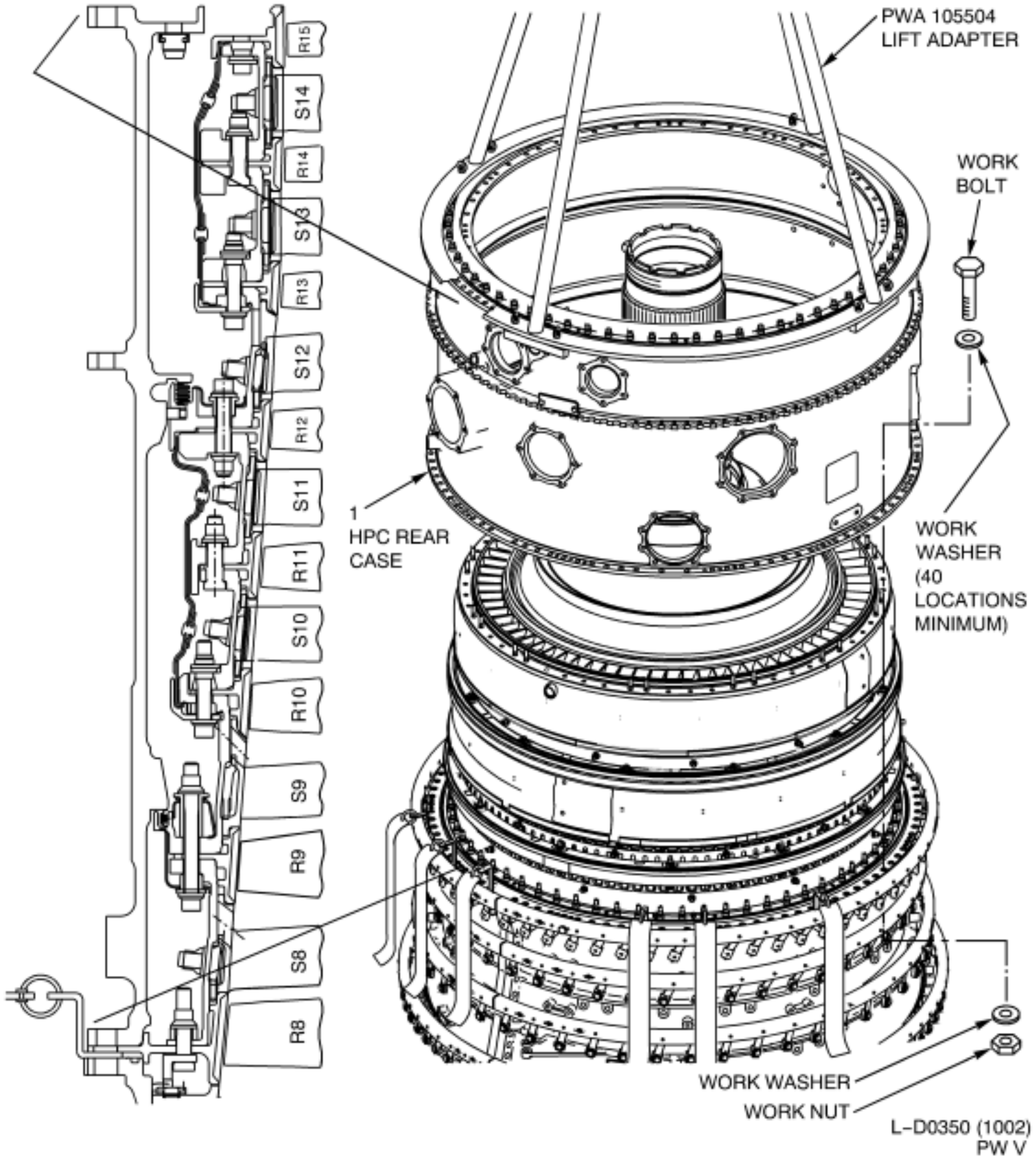
HPC Rear Case Installation
Figure 1028 (Sheet 2)
(Task 72−35−00−400−007)


A
2
WORK
BOLT (8 LOCATIONS MINIMUN)
3
HPC
REAR
CASE
1
HPC REAR
SUPPORT
HPC REAR CASE
"X" MARK ON
HPC REAR CASE
HPC REAR
SUPPORT
X
SPHERICAL RECESS
ON HPC REAR SUPPORT
HOLE NO.1
VIEW WITH HPC REAR
SUPPORT ASSEMBLED
TO THE HPC REAR CASE
TOP
(12 O'CLOCK)
HOLE NO.1
HOLE NO.60
BD
BD
HOLE NO.10
BD
BD
HOLE NO.50
BD
HOLE NO.20
BD
HOLE NO.40
BD
BD
HOLE NO.30
SCHEMATIC VIEW A
HPC REAR CASE
L-D1510 (1204)
PW V

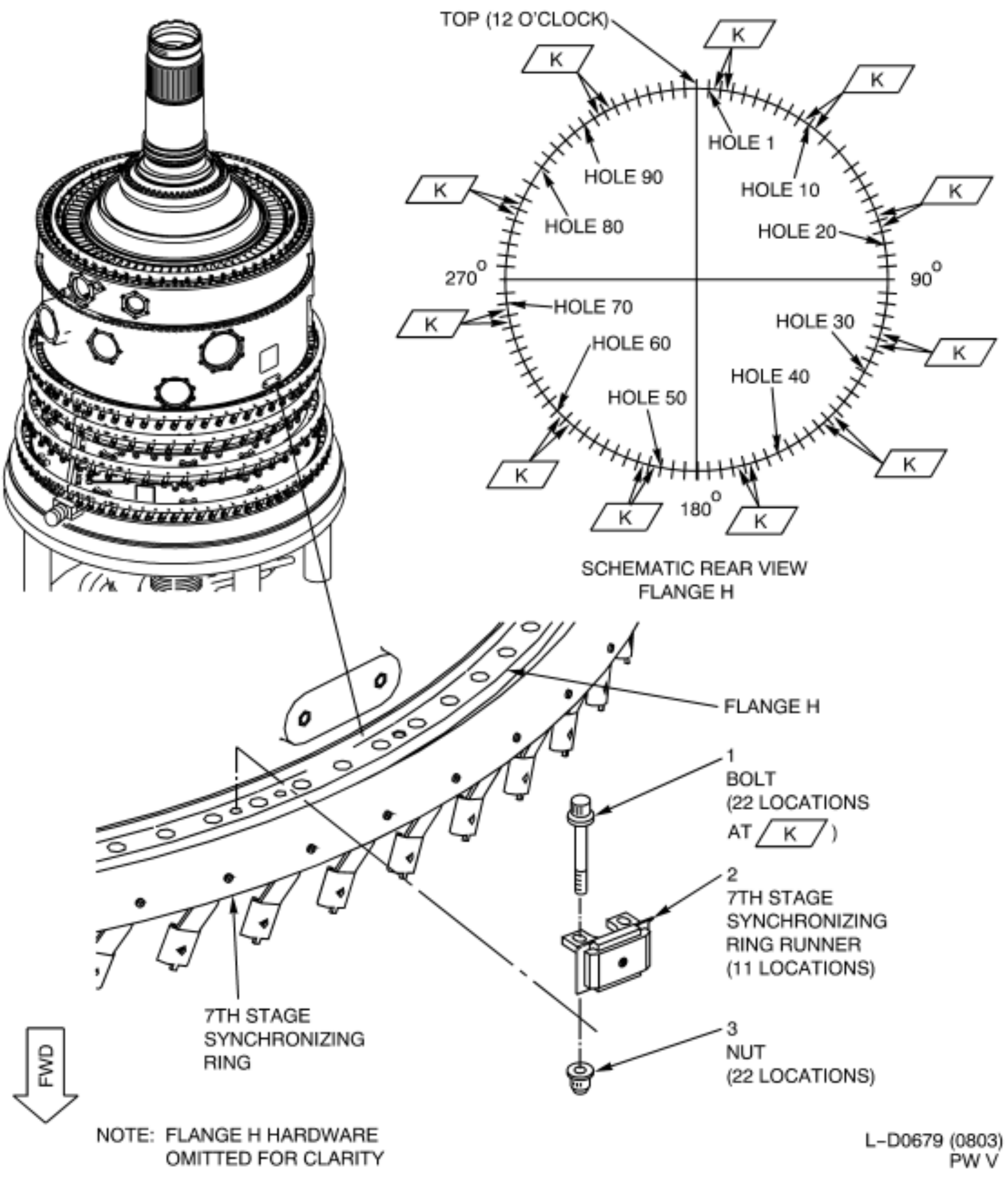
HPC Rear Case Installation
Figure 1028 (Sheet 3)
(Task 72-35-00-400-007)


HPC REAR CASE
FWD
PWA 105609 ALIGNMENT PIN (2 LOCATIONS)
JACKSCREW HOLE
L−D0680 (0303)
PW V

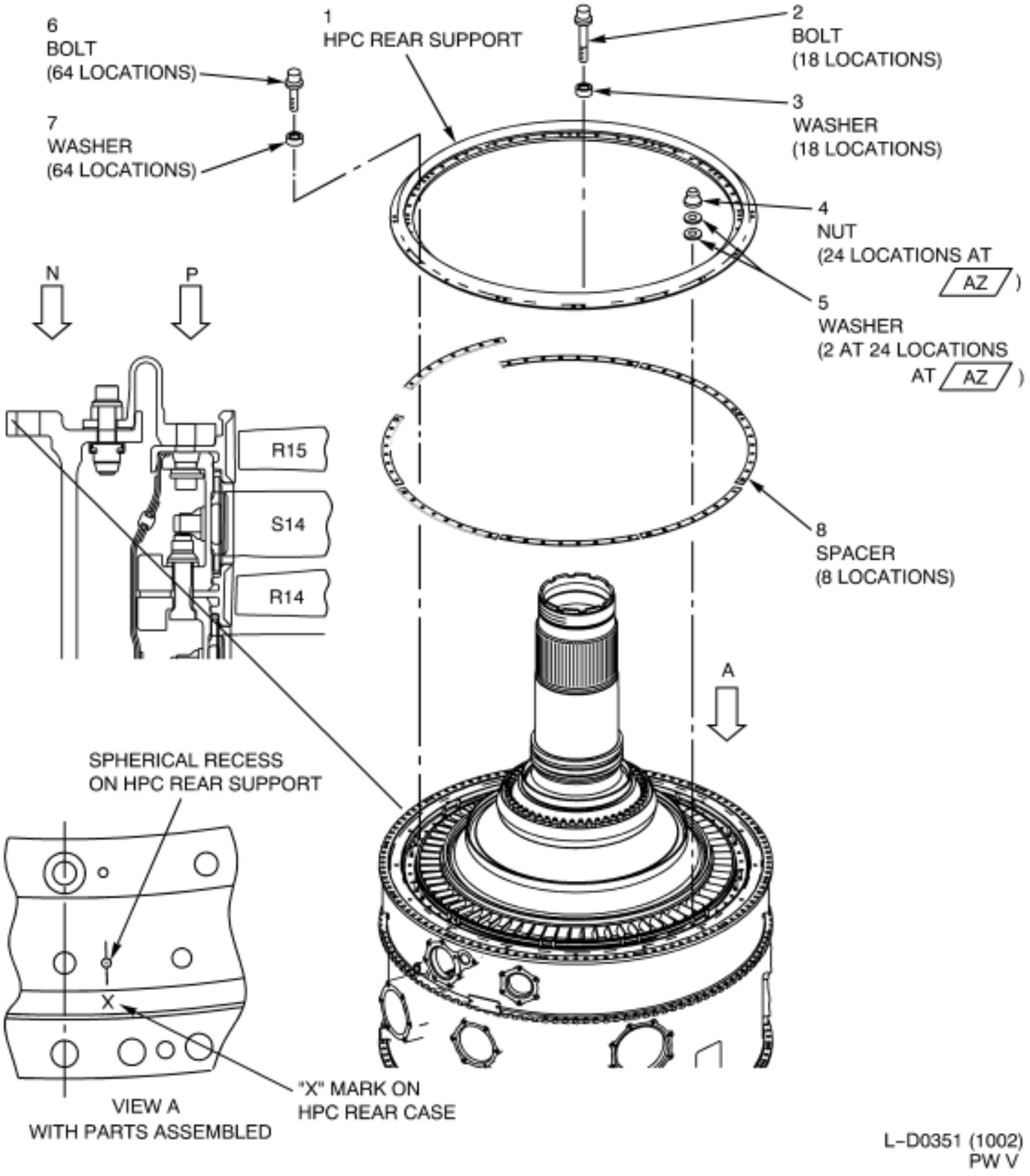
HPC Rear Case Installation
Figure 1028 (Sheet 4)
(Task 72−35−00−400−007)


R15
S14
R14
S13
R13
S12
R12
S11
R11
S10
R10
S9
R9
S8
R8
PWA 105504
LIFT ADAPTER
WORK
BOLT
1
HPC REAR
CASE
WORK
WASHER
(40
LOCATIONS
MINIMUM)
WORK WASHER
WORK NUT
L-D0350 (1002)
PW V

HPC Rear Case Installation
Figure 1028 (Sheet 5)
(Task 72−35−00−400−007)

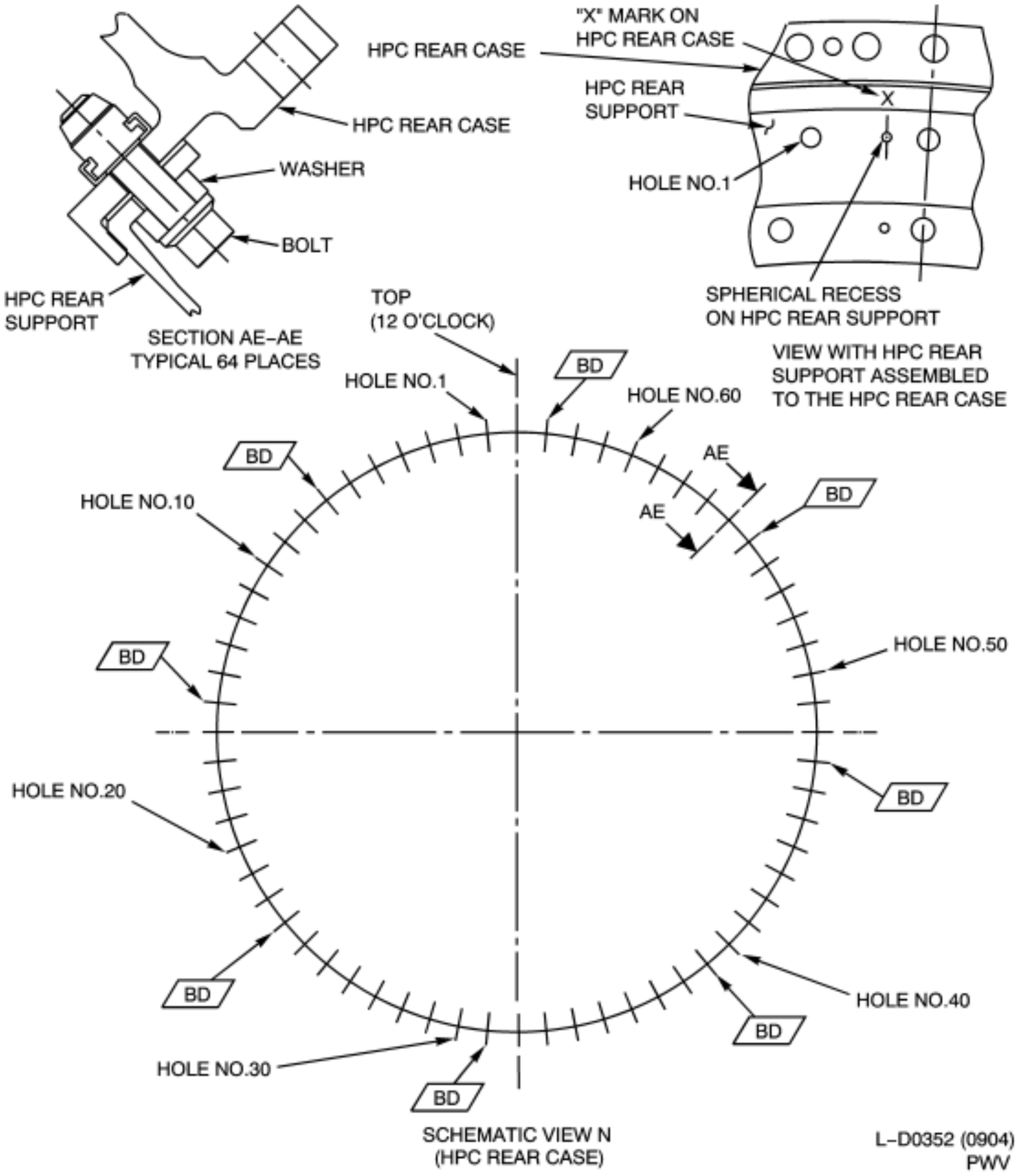

TOP (12 O'CLOCK)
K
HOLE 1
HOLE 10
HOLE 20
HOLE 30
HOLE 40
HOLE 50
HOLE 60
HOLE 70
HOLE 80
HOLE 90
270°
90°
180°
SCHEMATIC REAR VIEW
FLANGE H
FLANGE H
1
BOLT
(22 LOCATIONS
AT K)
2
7TH STAGE
SYNCHRONIZING
RING RUNNER
(11 LOCATIONS)
3
NUT
(22 LOCATIONS)
7TH STAGE
SYNCHRONIZING
RING
FWD
NOTE: FLANGE H HARDWARE
OMITTED FOR CLARITY
L-D0679 (0803)
PW V

HPC Rear Case Installation (7th Stage Synchronizing Ring Runner Installation)
Figure 1028 (Sheet 6)
(Task 72-35-00-400-007)


6
BOLT
(64 LOCATIONS)
7
WASHER
(64 LOCATIONS)
1
HPC REAR SUPPORT
2
BOLT
(18 LOCATIONS)
3
WASHER
(18 LOCATIONS)
4
NUT
(24 LOCATIONS AT AZ)
5
WASHER
(2 AT 24 LOCATIONS AT AZ)
N
P
R15
S14
R14
8
SPACER
(8 LOCATIONS)
A
SPHERICAL RECESS
ON HPC REAR SUPPORT
X
"X" MARK ON
HPC REAR CASE
VIEW A
WITH PARTS ASSEMBLED
L-D0351 (1002)
PW V

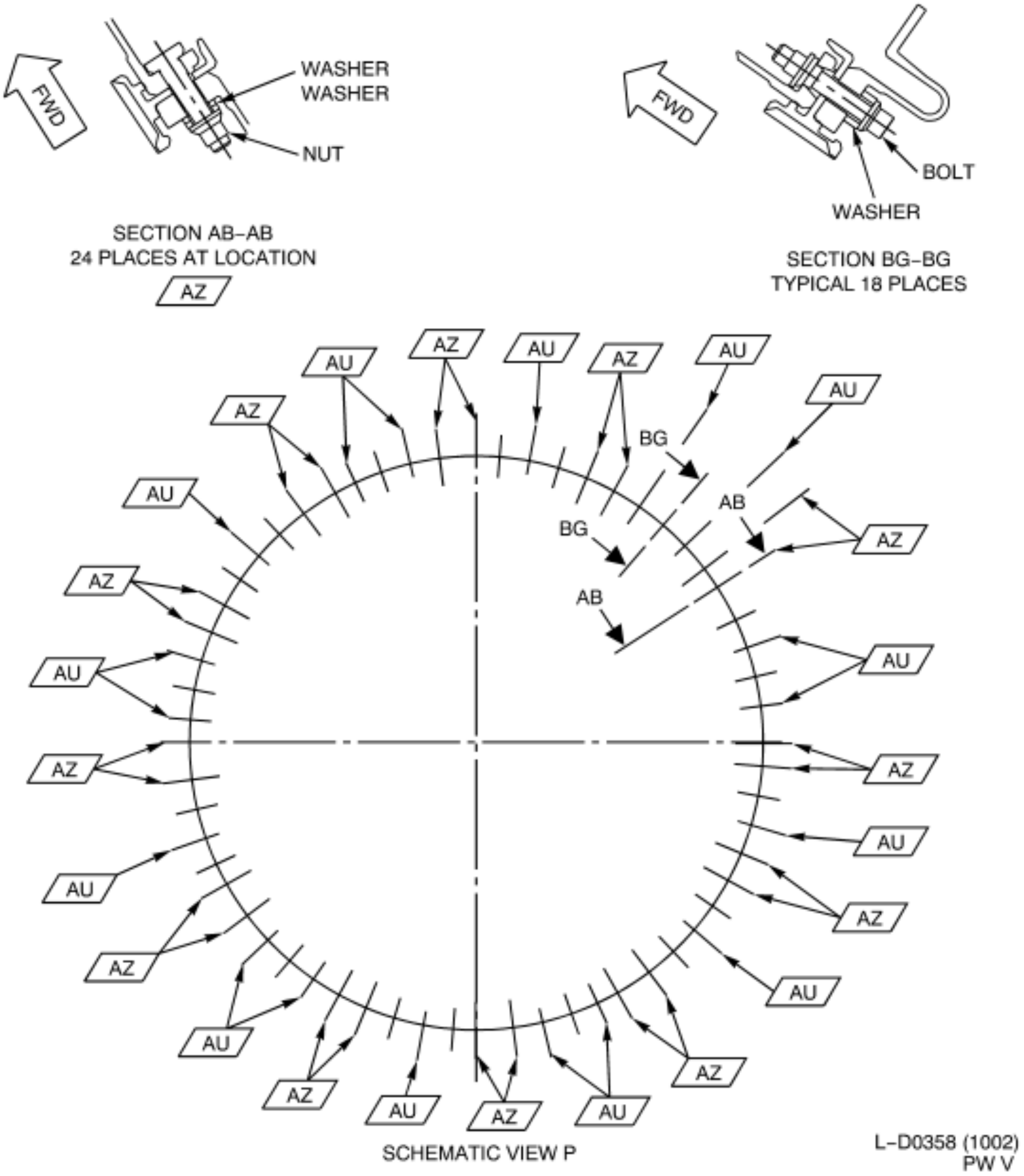
HPC Rear Support Installation
Figure 1029 (Sheet 1)
(Task 72-35-00-400-007)

HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−01


HPC REAR CASE
HPC REAR CASE
WASHER
BOLT
HPC REAR SUPPORT
SECTION AE−AE
TYPICAL 64 PLACES
"X" MARK ON HPC REAR CASE
HPC REAR CASE
HPC REAR SUPPORT
X
HOLE NO.1
SPHERICAL RECESS ON HPC REAR SUPPORT
VIEW WITH HPC REAR SUPPORT ASSEMBLED TO THE HPC REAR CASE
TOP (12 O'CLOCK)
HOLE NO.1
BD
HOLE NO.60
AE
AE
BD
BD
HOLE NO.10
BD
HOLE NO.50
BD
HOLE NO.20
BD
HOLE NO.40
BD
HOLE NO.30
BD
SCHEMATIC VIEW N
(HPC REAR CASE)
L−D0352 (0904)
PWV

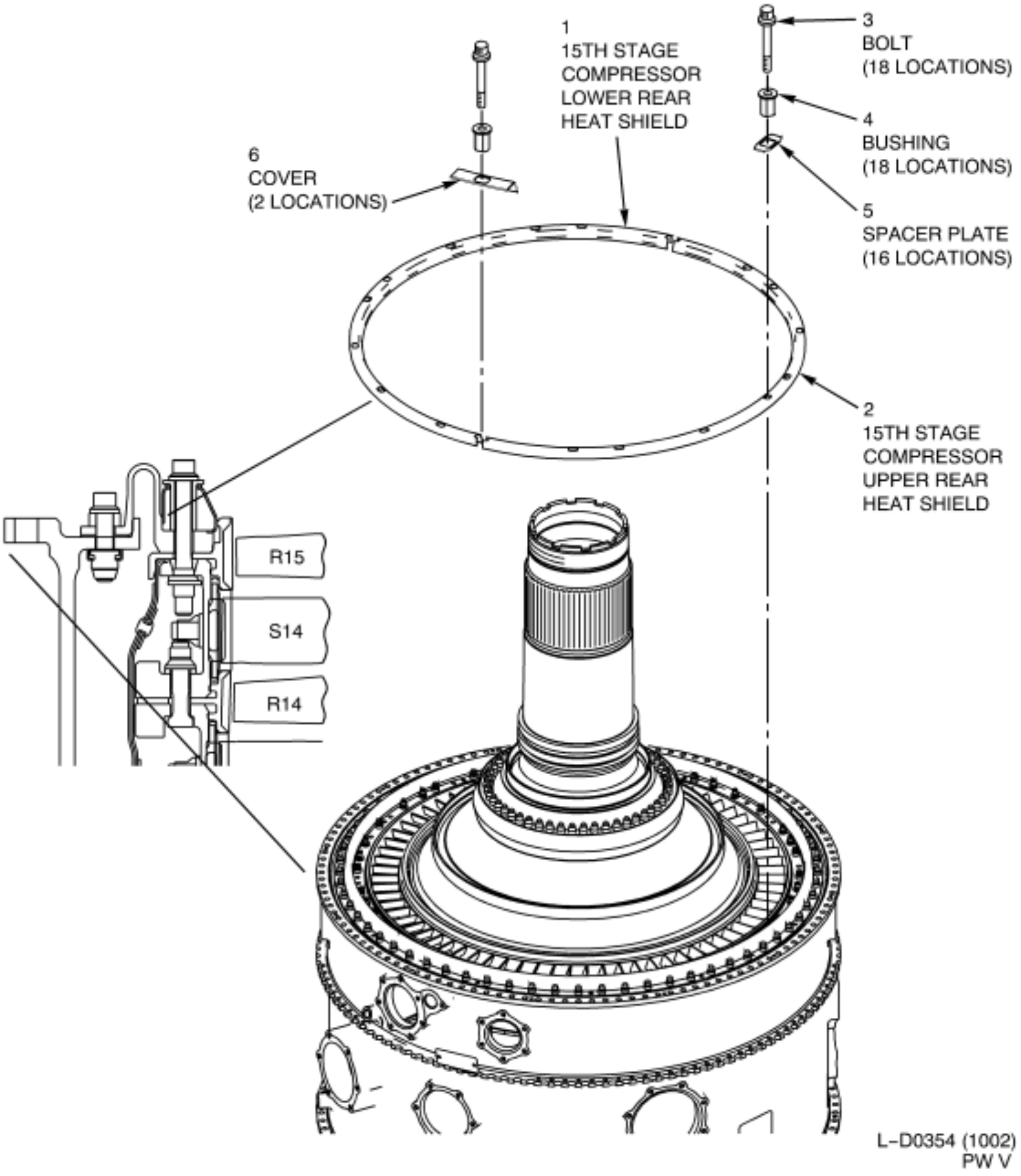
HPC Rear Support Installation
Figure 1029 (Sheet 2)
(Task 72−35−00−400−007)

HIGH PRESSURE COMPRESSOR (HPC) - ASSEMBLY-01

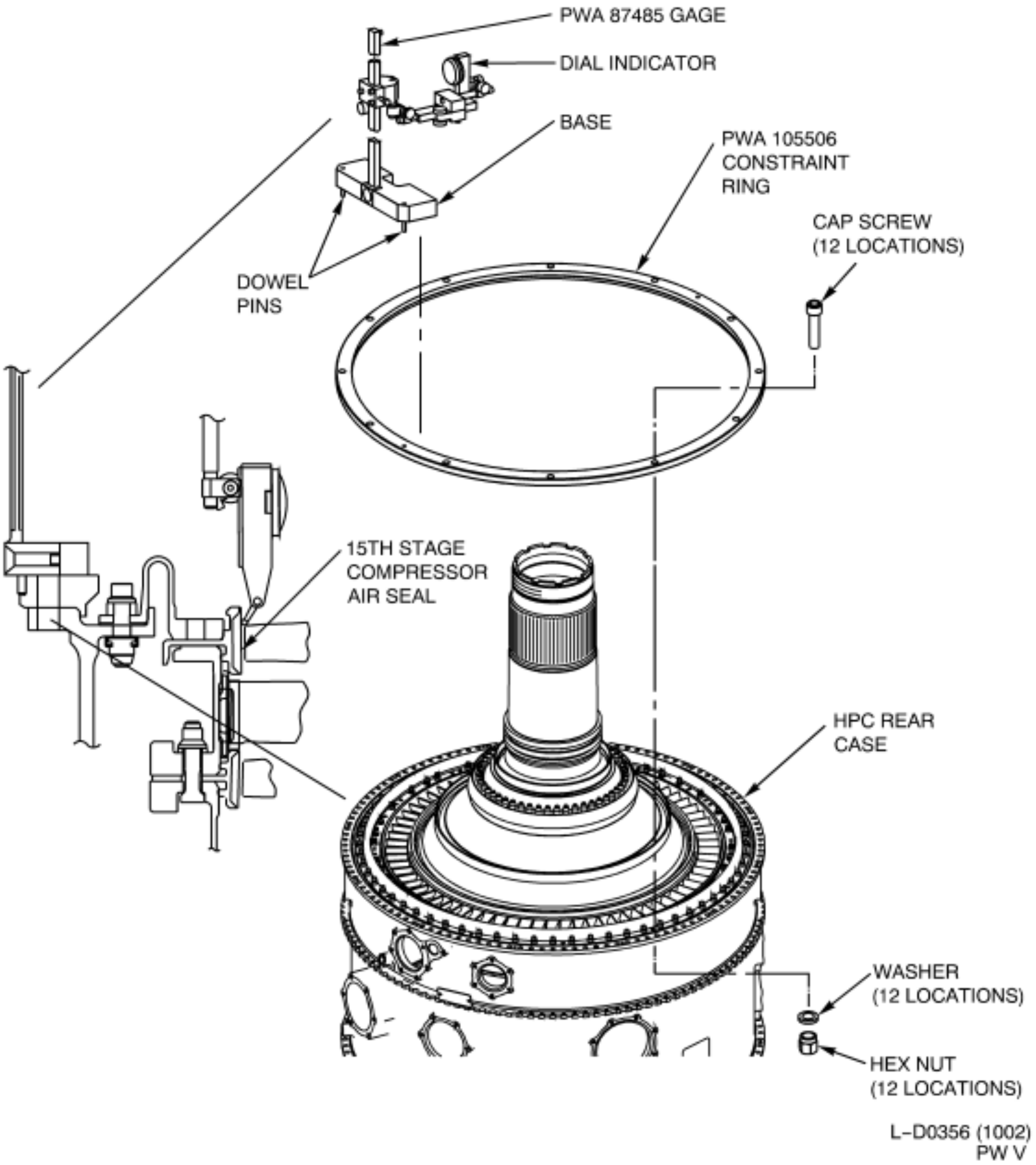

FWD
WASHER
WASHER
NUT
SECTION AB-AB
24 PLACES AT LOCATION
AZ
FWD
BOLT
WASHER
SECTION BG-BG
TYPICAL 18 PLACES
AU
AZ
BG
AB
SCHEMATIC VIEW P
L-D0358 (1002)
PW V

HPC Rear Support Installation
Figure 1029 (Sheet 3)
(Task 72-35-00-400-007)

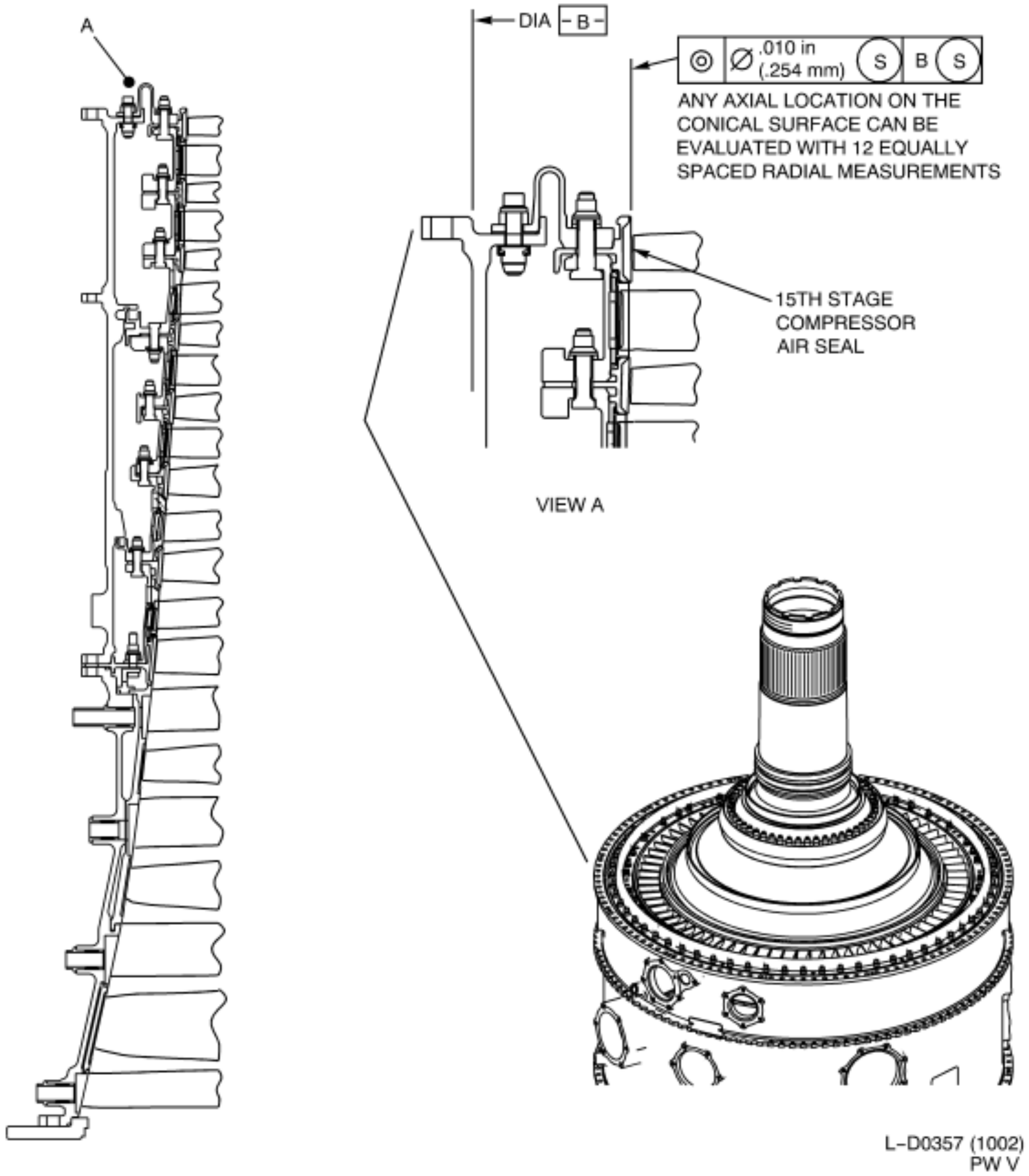
HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−01


1
15TH STAGE
COMPRESSOR
LOWER REAR
HEAT SHIELD
3
BOLT
(18 LOCATIONS)
4
BUSHING
(18 LOCATIONS)
6
COVER
(2 LOCATIONS)
5
SPACER PLATE
(16 LOCATIONS)
2
15TH STAGE
COMPRESSOR
UPPER REAR
HEAT SHIELD
R15
S14
R14
L-D0354 (1002)
PW V

Fifteenth Stage Heat Shield Installation
Figure 1030
(Task 72−35−00−400−007)

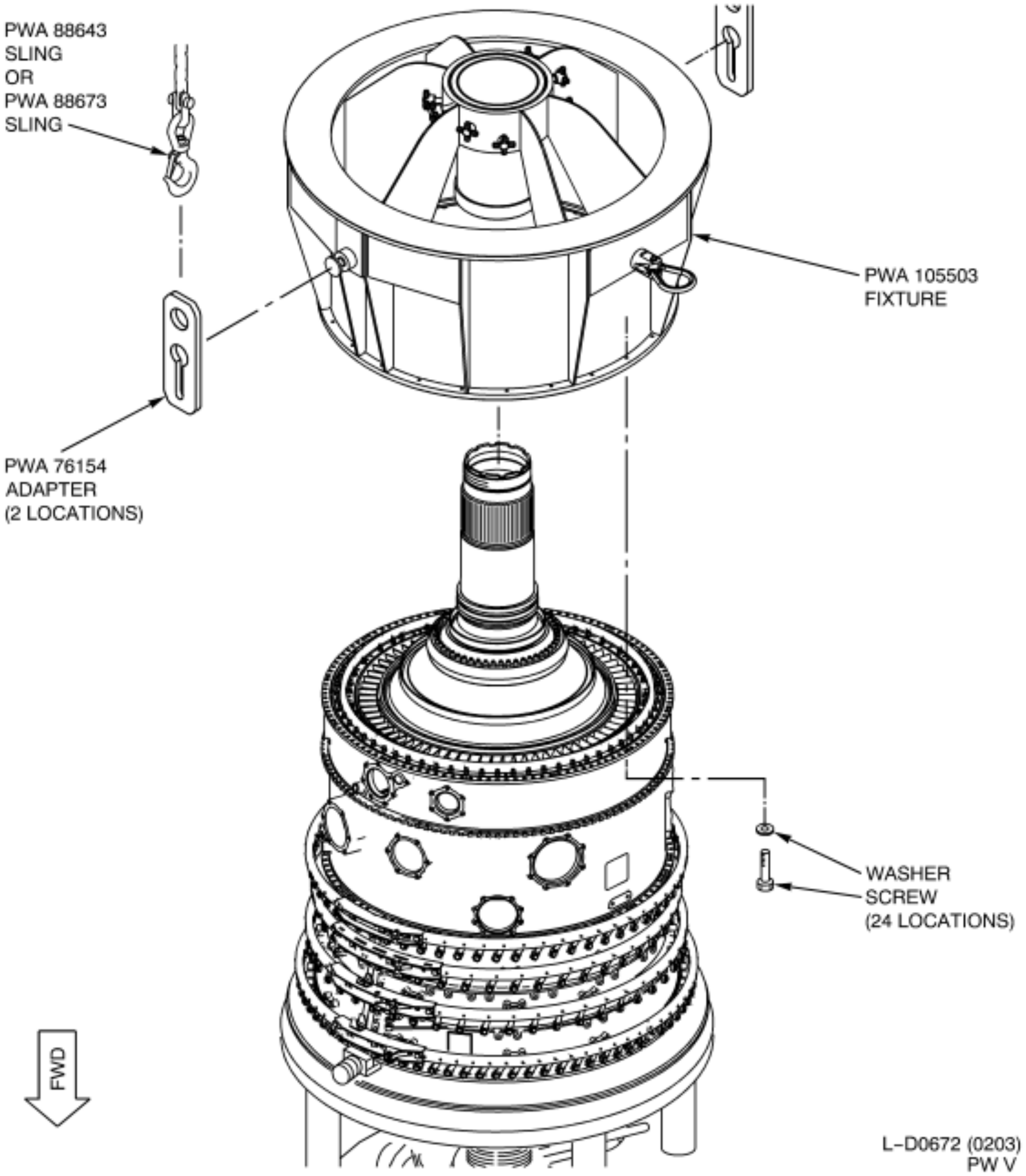

PWA 87485 GAGE
DIAL INDICATOR
BASE
PWA 105506 CONSTRAINT RING
CAP SCREW (12 LOCATIONS)
DOWEL PINS
15TH STAGE COMPRESSOR AIR SEAL
HPC REAR CASE
WASHER (12 LOCATIONS)
HEX NUT (12 LOCATIONS)
L−D0356 (1002)
PW V

Concentricity Check
Figure 1031 (Sheet 1)
(Task 72−35−00−400−007)


A
DIA -B-
◎ ∅ .010 in (.254 mm) Ⓢ B Ⓢ
ANY AXIAL LOCATION ON THE CONICAL SURFACE CAN BE EVALUATED WITH 12 EQUALLY SPACED RADIAL MEASUREMENTS
15TH STAGE COMPRESSOR AIR SEAL
VIEW A
L−D0357 (1002)
PW V

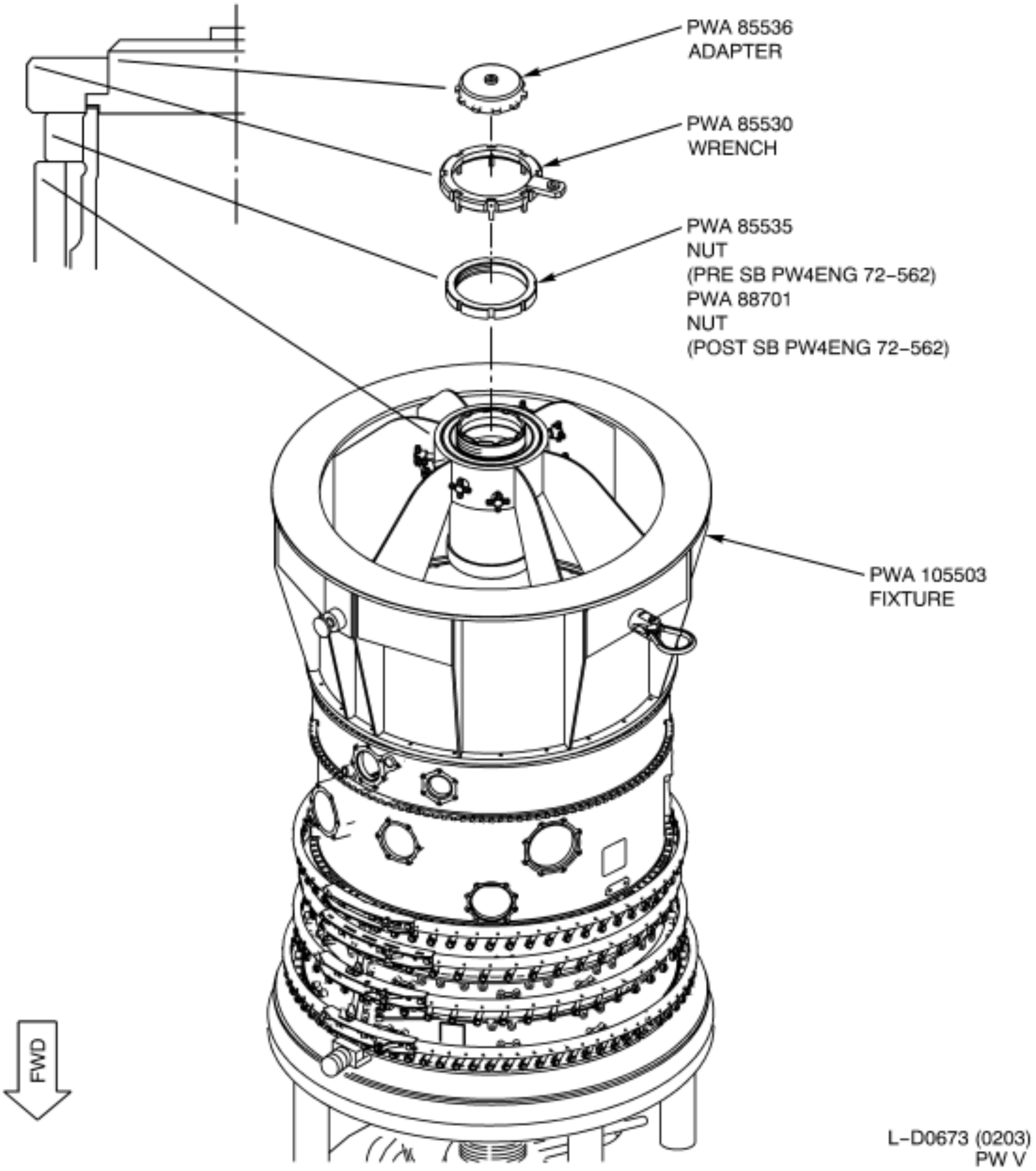
Concentricity Check
Figure 1031 (Sheet 2)
(Task 72−35−00−400−007)

HIGH PRESSURE COMPRESSOR (HPC) - ASSEMBLY-01

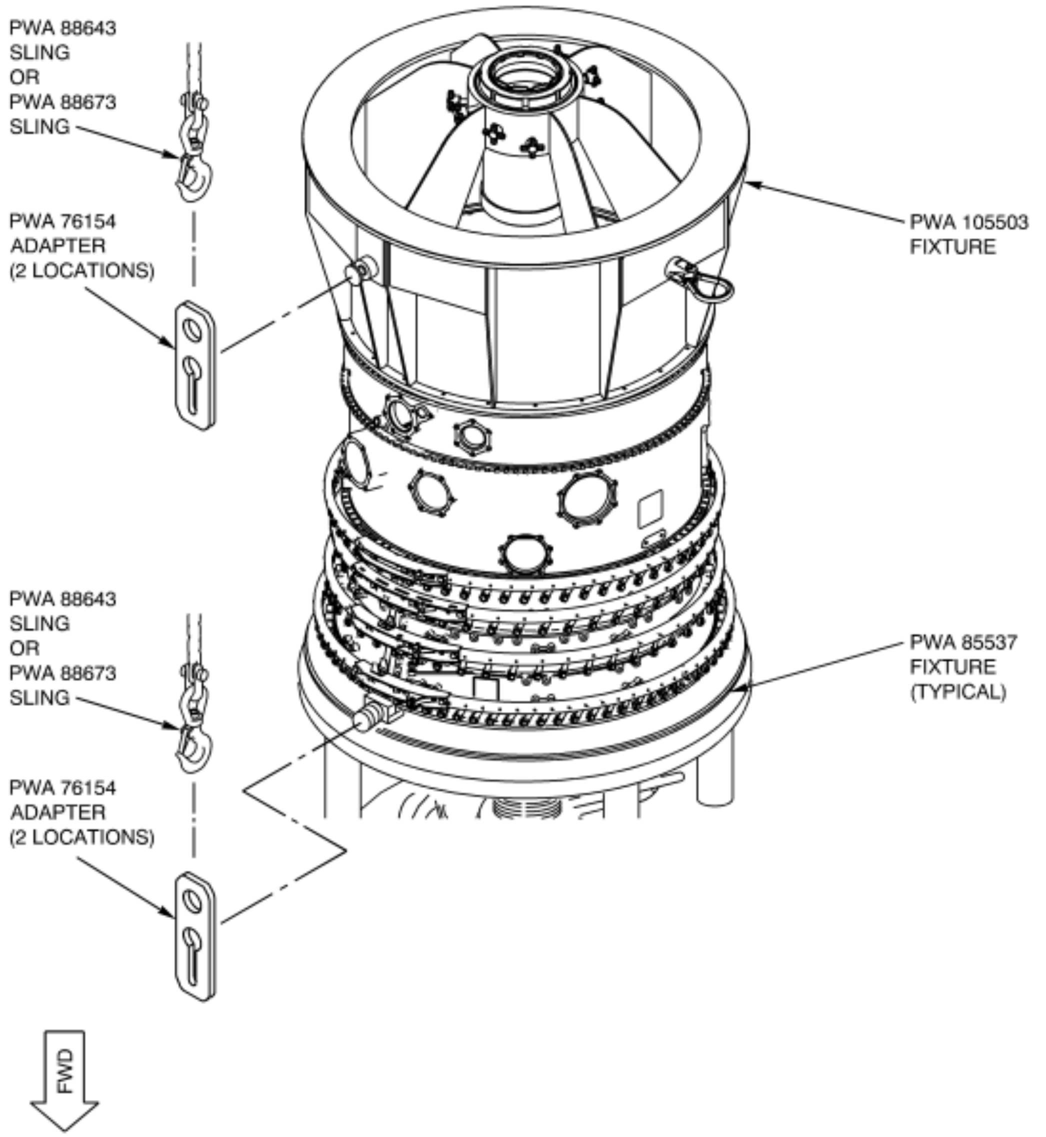

PWA 88643
SLING
OR
PWA 88673
SLING
PWA 105503
FIXTURE
PWA 76154
ADAPTER
(2 LOCATIONS)
WASHER
SCREW
(24 LOCATIONS)
FWD
L-D0672 (0203)
PW V

Trunnion The HPC Module To The Front End Down Position
Figure 1032 (Sheet 1)
(Task 72-35-00-400-007)

HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−01

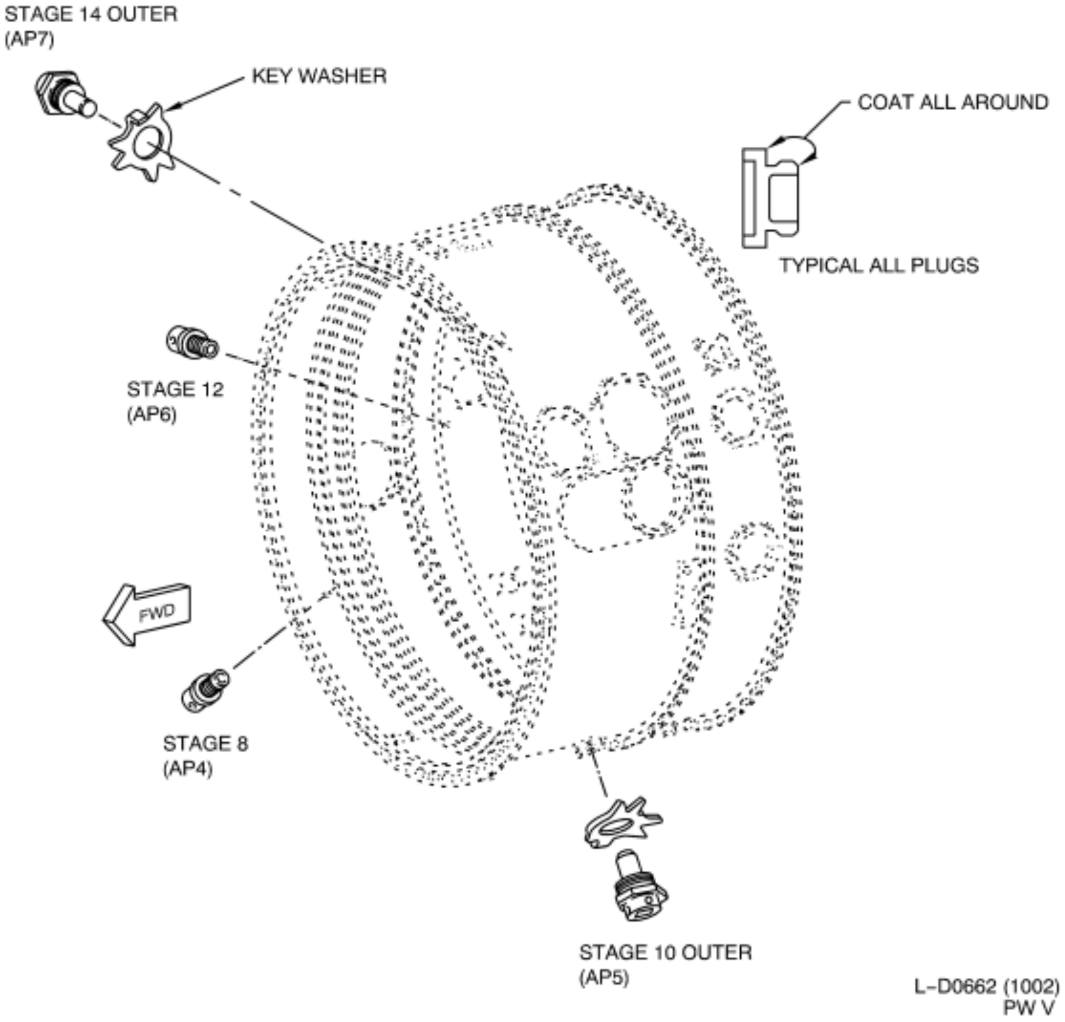

PWA 85536
ADAPTER
PWA 85530
WRENCH
PWA 85535
NUT
(PRE SB PW4ENG 72−562)
PWA 88701
NUT
(POST SB PW4ENG 72−562)
PWA 105503
FIXTURE
FWD
L−D0673 (0203)
PW V

Trunnion The HPC Module To The Front End Down Position
Figure 1032 (Sheet 2)
(Task 72−35−00−400−007)

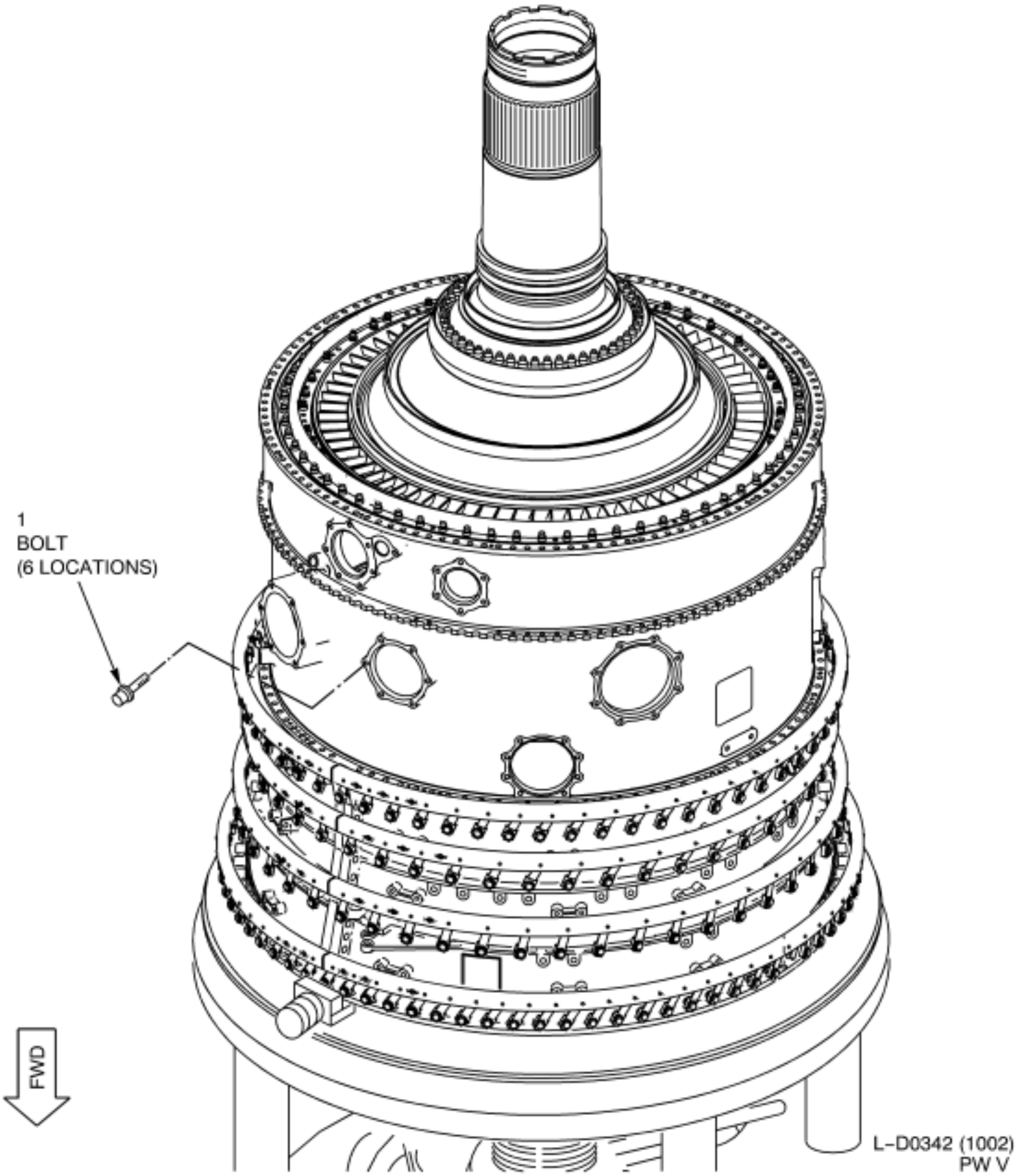

PWA 88643
SLING
OR
PWA 88673
SLING
PWA 76154
ADAPTER
(2 LOCATIONS)
PWA 105503
FIXTURE
PWA 88643
SLING
OR
PWA 88673
SLING
PWA 76154
ADAPTER
(2 LOCATIONS)
PWA 85537
FIXTURE
(TYPICAL)
FWD
L−D0674 (0203)
PW V

Trunnion The HPC Module To The Front End Down Position
Figure 1032 (Sheet 3)
(Task 72−35−00−400−007)

HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−01


STAGE 14 OUTER
(AP7)
KEY WASHER
COAT ALL AROUND
TYPICAL ALL PLUGS
STAGE 12
(AP6)
FWD
STAGE 8
(AP4)
STAGE 10 OUTER
(AP5)
L-D0662 (1002)
PW V

Borescope Plug Locations
Figure 1033
(Task 72−35−00−400−007)


1
BOLT
(6 LOCATIONS)
FWD
L−D0342 (1002)
PW V

Cover − HPC Rear Case
Figure 1034
(Task 72−35−00−400−007)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-35-00-400-002:

1. Determine Runner Clearances

A. Prerequisites

(1) Assemble high pressure compressor (HPC). See Assembly-01 (Task 72-35-00-400-001).

B. Equipment And Materials Necessary

Special Tools:

	PWA 85393	Pin, Rigging (3 Required)
	PWA 86197	Pin, Rigging
R R	PWA 87429	Adapter, Torque (IGV, 5th, And 6th Stage Synchronizing Ring Runner Bolts)
	PWA 102158	Crimper, Hand

Above rigging pin can be contained within the Rigging Pin Kit (PWA 85675).

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	8	72-35-00/12/280
Key Washer	8	72-35-00/13/280
Key Washer	8	72-35-00/14/280
Key Washer	8	72-35-00/15/280

C. Procedure
Figure 1001 and Figure 1002

Subtask 72-35-00-430-067:

(1) Install clevis assembly to inlet ring at 3 o'clock location. Secure clevis with bolts, threads lubricated with Engine Oil P03-001, and key washers. Install ring plate with bolts, threads lubricated with Engine Oil P03-001, and key washers. Tighten and torque all bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). Bend tabs to secure bolts.

(2) Move inlet ring to vane open rig position. Install PWA 85393 Rigging Pin in ring to engage slot in case. Move ring back and forth to ensure ring is locked to case.

(3) (References 2101 through 2104) Determine unision ring shim thickness. See Figure 1001.

  (a) Insert shim stock or runner shims into radial clearance at four locations approximately 45 degrees either side of the axial flanges to prevent unison ring motion.

  (b) Measure and record the remaining seven radial clearances between runners and inlet ring.

  (c) Remove, measure and record the four shim thicknesses from step (a).

(4) Average clearance by adding the 11 readings and divide by 11. Round off to three decimal places.

(5) Subtract desired radial clearance for this stage from average value. See Table 1001. The remaining value represents the shim thickness required at each runner location. Shim thickness may be obtained by selecting any combination of shims (Classes 1 − 5).

Variable Stator	Clearance − Inches (mm)
Inlet	0.009 − 0.013 (0.229 − 0.330)
5th	0.009 − 0.013 (0.229 − 0.330)
6th	0.014 − 0.018 (0.356 − 0.457)
7th	0.014 − 0.018 (0.356 − 0.457)

Runner To Ring Clearance
Table 1001

(6) Install shims as follows:

  (a) Loosen bolts securing runners and install shims, as determined by previous step, under runner.

  NOTE: Earlier synchronizing ring runner shims have bolt holes which require removal of runner bolts for insertion of shims, while newer configuration shims have slots which only require loosening of runner bolts for shim insertion.

(b) Use the PWA 87429 Torque Adapter and tighten and torque bolts to 45 − 55 lb−in. (5.084 − 6.214 N.m).

(c) Bend the tabs of the key washers with the PWA 102158 Crimper to safety the bolts. The long jaw of the Crimper must locate on the tab of the washer. Squeeze the Crimper handle to bend the tab of the washers.

Subtask 72−35−00−430−068:

CAUTION: FIFTH AND SIXTH STAGE SYNCHRONIZING RING CLEVISES AND 7TH STAGE SYNCHRONIZING RING MUST BE USED IN SETS FOR SIX STATOR VANE SCHEDULE OR 19 STATOR VANES SCHEDULE (SB PW4ENG 72−197).

(7) Install clevis assembly to Stage 5 ring at 3 o'clock location. Secure clevis with bolts, threads lubricated with Engine Oil P03−001, and key washers. Install ring plate with bolts, threads lubricated with Engine Oil P03−001, and key washers. Tighten and torque all bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Bend tabs to secure bolts.

NOTE: Do not intermix synchronizing plates and synchronizing rings. Make sure the correct synchronizing plate is used with the correct synchronizing ring.

(8) Move Stage 5 ring to vane open rig position. Install Rigging Pin (PWA 85393) in the ring to engage the slot in case. Move ring back and forth to ensure ring is locked to case.

(9) (Reference 2102) Determine unision ring shim thickness. See Figure 1001.

(a) Insert shim stock or runner shims into radial clearance at four locations approximately 45 degrees either side of the axial flanges to prevent unison ring motion.

(b) Measure and record the remaining seven radial clearances between runners and Stage 5 ring.

(c) Remove, measure and record the four shim thicknesses from step (a).

(10) Average clearance by adding the 11 readings and divide by 11. Round off to three decimal places.

(11) Subtract desired radial clearance for this stage from average value. See Table 1001. The remaining value represents the shim thickness required at each runner location. Shim thickness may be obtained by selecting any combination of shims (Classes 1 − 5).

(12) Install shims as follows:

(a) Loosen bolts securing runners and install shims, as determined by previous step, under runner.

NOTE: Earlier synchronizing ring runner shims have bolt holes which require removal of runner bolts for insertion of shims, while newer configuration shims have slots which only require loosening of runner bolts for shim insertion.

(b) Use the PWA 87429 Torque Adapter and tighten and torque bolts to 45 − 55 lb−in. (5.084 − 6.214 N.m).

(c) Bend the tabs of the key washers with the PWA 102158 Crimper to safety the bolts. The long jaw of the Crimper must locate on the tab of the washer. Squeeze the Crimper handle to bend the tab of the washers.

Subtask 72−35−00−430−069:

CAUTION: FIFTH AND SIXTH STAGE SYNCHRONIZING RING CLEVISES AND 7TH STAGE SYNCHRONIZING RING MUST BE USED IN SETS FOR SIX STATOR VANE SCHEDULE OR 19 STATOR VANES SCHEDULE (SB PW4ENG 72−197).

(13) Install clevis assembly to Stage 6 ring at 3 o'clock location. Secure clevis with bolts, threads lubricated with Engine Oil P03−001, and key washers. Install ring plate with bolts, threads lubricated with Engine Oil P03−001, and key washers. Tighten and torque all bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Bend tabs to secure bolts.

NOTE: Do not intermix synchronizing plates and synchronizing rings. Make sure the correct synchronizing plate is used with the correct synchronizing ring.

(14) Move Stage 6 ring to vane open rig position. Install Rigging Pin (PWA 85393) in ring to engage slot in case. Move ring back and forth to ensure ring is locked to case.

(15) (Reference 2103) Determine unision ring shim thickness. See Figure 1001.

(a) Insert shim stock or runner shims into radial clearance at four locations approximately 45 degrees either side of the axial flanges to prevent unison ring motion.

(b) Measure and record the remaining seven radial clearances between runners and Stage 6 ring.

(c) Remove, measure and record the four shim thicknesses from step (a).

(16) Average clearance by adding the 11 readings and divide by 11. Round off to three decimal places.

(17) Subtract desired radial clearance for this stage from average value. See Table 1001. The remaining value represents the shim thickness required at each runner location. Shim thickness may be obtained by selecting any combination of shims (Classes 1 − 5).

(18) Install shims as follows:

(a) Loosen bolts securing runners and install shims, as determined by previous step, under runner.

NOTE: Earlier synchronizing ring runner shims have bolt holes which require removal of runner bolts for insertion of shims, while newer configuration shims have slots which only require loosening of runner bolts for shim insertion.

(b) Use the PWA 87429 Torque Adapter and tighten and torque bolts to 45 − 55 lb−in. (5.084 − 6.214 N.m).

(c) Bend the tabs of the key washers with the PWA 102158 Crimper to safety the bolts. The long jaw of the Crimper must locate on the tab of the washer. Squeeze the Crimper handle to bend the tab of the washers.

Subtask 72−35−00−430−070:

(19) Install clevis assembly to Stage 7 ring at 3 o'clock location. Secure clevis with bolts, threads lubricated with Engine Oil P03−001, and key washers. Install ring plate with bolts, threads lubricated with Engine Oil P03−001, and key washers. Tighten and torque all bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Bend tabs to secure bolts.

(20) Move Stage 7 ring to vane open rig position. Install PWA 86197 Rigging Pin in ring to engage slot in bracket on case flange. Move ring back and forth to ensure ring is locked to case.

(21) (Reference 2104) Determine unision ring shim thickness. See Figure 1002.

(a) Insert shim stock or runner shims into radial clearance at four locations approximately 45 degrees either side of the axial flanges to prevent unison ring motion.

(b) Measure and record the remaining seven radial clearances between runners and Stage 7 ring.

(c) Remove, measure and record the four shim thicknesses from step (a).

(22) Average clearance by adding the 11 readings and divide by 11. Round off to three decimal places.

(23) Subtract desired radial clearance for this stage from average value. See Table 1001. The remaining value represents the shim thickness required at each runner location. Shim thickness may be obtained by selecting any combination of shims (Classes 1 − 5).

CAUTION: (PRE AND POST SB PW4ENG 72−366) RUNNER AND SHIM ARE INTERCHANGEABLE IN SETS. HOWEVER, SHIM (POST SB PW4ENG 72-366) MAY BE USED WITH RUNNER (PRE SB PW4ENG 72-366).

R (24) Install shims, single tab down and facing out, between runner bracket and case flange. Tighten and torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m). Repeat above procedure at 11 places.

NOTE: When securing runner, ensure shim(s) take on curvature of engine flange. Shim(s) must be tight against top of engine flange.

D. Postrequisites

(1) Install and rig HPC stator vane actuator and lever assembly. See Assembly-03 (Task 72-35-00-400-003).

Task 72-35-00-400-002-A:

2. Determine Runner Clearances (Asymetric Case Configuration)

A. Prerequisites

(1) Assemble high pressure compressor (HPC). See Assembly-01 (Task 72-35-00-400-001).

B. Equipment And Materials Necessary

Special Tools:

PWA 78232	Adapter, Pull Test
PWA 85108	Stand, Build
PWA 85393	Pin, Rigging (4 Necessary)
PWA 85528	Adapter, Handling
PWA 85530	Wrench
PWA 85534	Fixture, Handling
PWA 85536	Adapter
PWA 86536	Adapter, Torque
PWA 85537	Fixture, Handling
R PWA 88701	Nut

EXPENDABLE PARTS

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	20	72-35-00/12A/220
Key Washer	20	72-35-00/13A/160
Key Washer	20	72-35-00/14A/140
Key Washer	8	72-35-00/12A/260

HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−02

EXPENDABLE PARTS

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
(CONTINUED)		
Key Washer	8	72−35−00/13A/190
Key Washer	8	72−35−00/14A/180
Key Washer	8	72−35−00/15A/180
Shim	As Necessary	72−35−00/12A/100
Shim	As Necessary	72−35−00/13A/100
Shim	As Necessary	72−35−00/14A/100
Shim	As Necessary	72−35−00/15A/100

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)

C. Procedure

Subtask 72−35−00−430−096:
See Figure 1003 and Figure 1004.

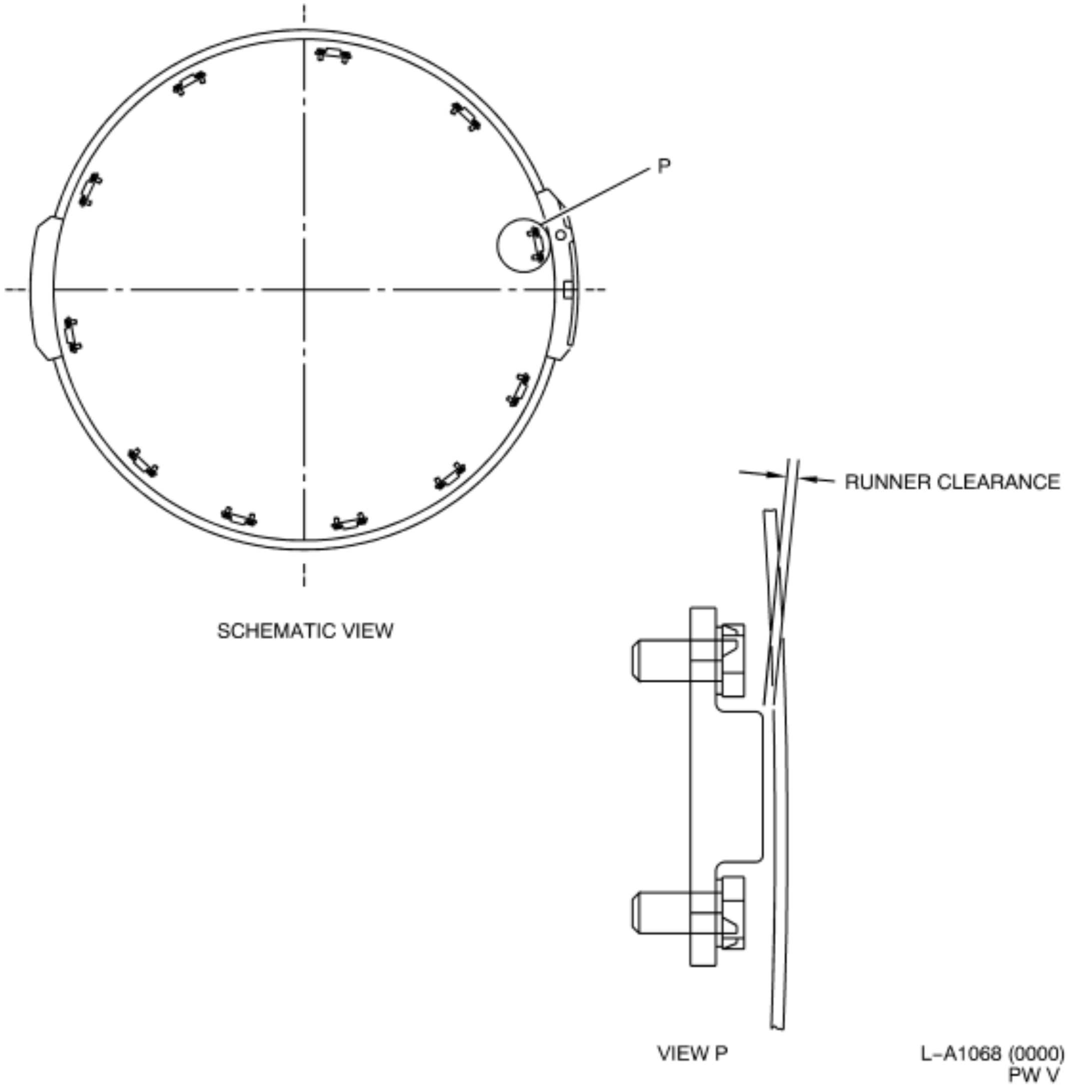
NOTE: This procedure starts with the axial compressor rotor installed, front end down, in a PWA 85108 Build Stand, PWA 85537 Handling Fixture and PWA 85528 Handling Adapter. Tools PWA 85534 Fixture, PWA 88701 Retaining Nut, PWA 85536 Adapter, and a PWA 85530 Wrench are installed on the rear of the assembly.

(1) Install ten runners on each of the synchronizing rings, inlet, 5th, and 6th stages.

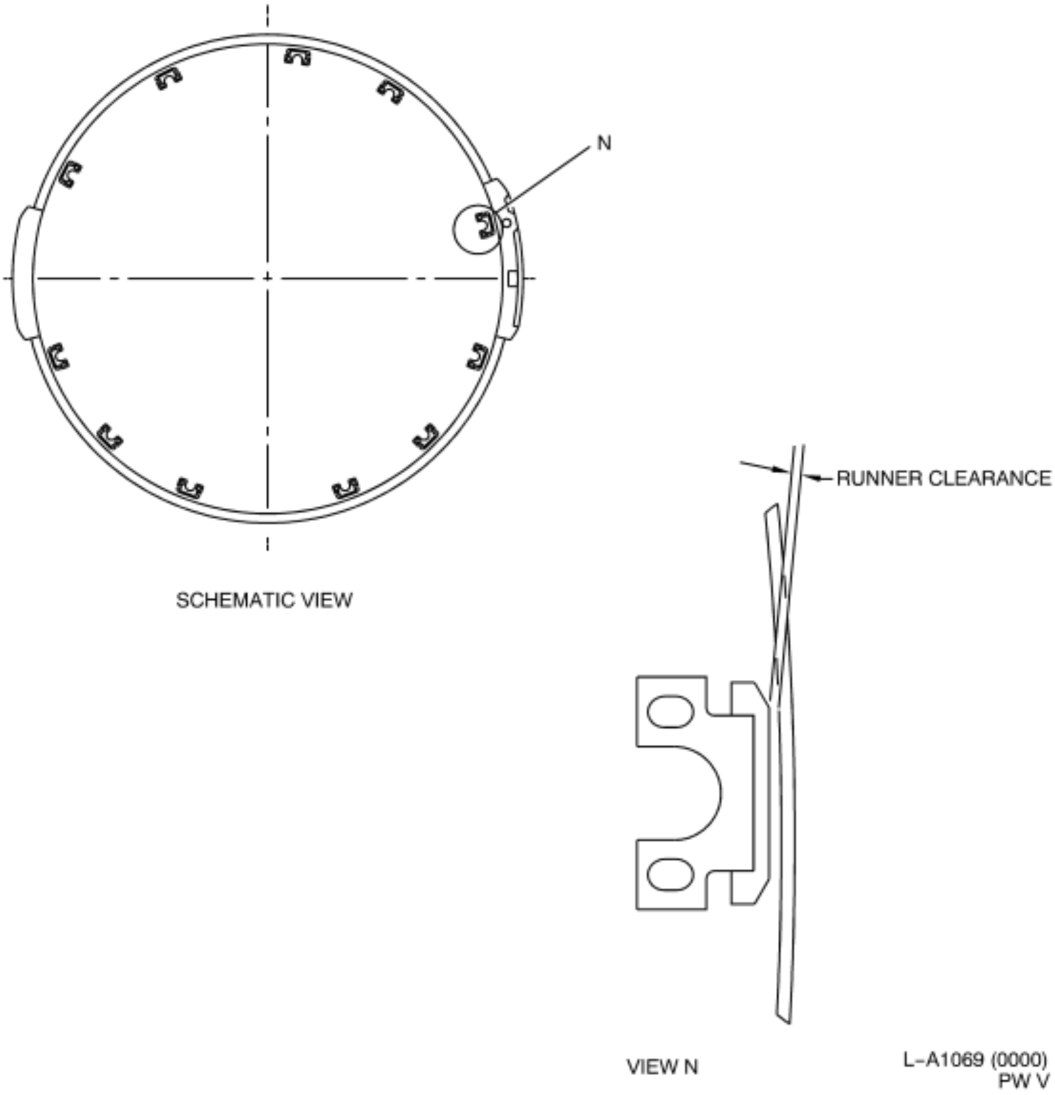
NOTE: The 7th stage runners are installed on Flange H.

(a) Loosely install the runners with key washers and bolts, threads lubricated with Engine Oil P03−001 on the synchronizing ring as shown. Refer to Figure 1001.

NOTE: Do not tighten the bolts. Shims must be installed in a later step when runner clearances are determined.


P
RUNNER CLEARANCE
SCHEMATIC VIEW
VIEW P
L−A1068 (0000)
PW V

Inlet, 5, 6 Stage Runner Clearance
Figure 1001
(Task 72−35−00−400−002)


N
SCHEMATIC VIEW
RUNNER CLEARANCE
VIEW N
L−A1069 (0000)
PW V

Seventh Stage Runner Clearance
Figure 1002
(Task 72−35−00−400−002)

(2) Install clevis assemblies to the inlet, 5th, 6th, and 7th stage synchronizing rings at the 3 o'clock position. Attach the clevis with bolts, threads lubricated with Engine Oil P03−001 and key washers. Install the two longer bolts at the raised pad locations on the clevis. Do not torque the bolts at this time.

(3) Install the inlet, 5th, 6th, and 7th stage HPC synchronizing ring plates at the 9 o'clock position with bolts, threads lubricated with Engine Oil P03−001 and key washers. Tighten and torque all bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Bend the tabs of the key washers to attach the bolts.

(4) Move the inlet, 5th, and 6th stage synchronizing rings to the open rig position. Install PWA 85393 Rigging Pin in the clevis bracket slot to engage the slot in the case. Try to move the synchronizing rings to make sure that the rings are locked to the case.

(5) Move the 7th stage synchronizing ring to the open rig position. For the 7th stage, install PWA 85393 Rigging Pin in the clevis bracket slot to engage the slot in the case. Try to move the ring to make sure that the ring is locked to the case.

(6) Determine the synchronizing ring runner shim thickness. See Figure 1003 and Figure 1004.

  (a) Put shim stock or runner shims into the radial clearance at four runner positions approximately 45 degrees either side of the axial flanges to prevent synchronizing ring movement.

  (b) Measure and write the radial runner clearances at the remaining six runner locations for the IGV, 5th, and 6th stages.

  (c) Measure and write the radial runner clearances for the remaining seven runner locations for the 7th stage.

  (d) Remove, measure, and write the first four shim thicknesses for each stage.

(7) For the seventh stage synchronizing ring, average the clearances by adding the seven runner clearances and the four shim thicknesses and divide by 11. Round off to three decimal places.

(8) For the IGV, 5th, and 6th stages synchronizing ring, average the clearances by adding the six runner clearances and the four shim thicknesses for each stage and divide by 10. Round off to three decimal places.

(9) Subtract the runner clearance given for each stage from the average value calculated in the previous steps. This value is the respective shim thickness required at each runner for each stage. See Table 1001.

Stage	Desired Runner Clearance
IGV	0.010 inch (0.254 mm)
5	0.010 inch (0.254 mm)
6	0.015 inch (0.381 mm)
7	0.015 inch (0.381 mm)

Desired Runner Clearance
Table 1001

R (10) Install the necessary number of shims, as follows:

R (a) Loosen the bolts that attach the runners and install the shims below the runners.

NOTE: The shim thickness can be found by the selection of different shim classes.

R (b) When you install the runner assemblies, make sure that the shim or shims are in the shape of the engine flange or the synchronizing ring applicable. Shims must be tight against the top of the engine flange or synchronizing ring.

R (c) For the IGV, 5th, and 6th stages, tighten and torque the bolts to 45 − 55 lb−in. (5.084 − 6.214 N.m).

R (d) For the 7th stage, tighten and torque the bolts to
R 36 − 40 lb−in. (4.067 − 4.519 N.m).

R (e) Bend the tabs of the key washers.

(11) After the shims are installed, the runner clearance must be as specified in Table 1002.

Variable Stator	Clearance − Inches (mm)
Inlet	0.009 − 0.013 (0.229 − 0.330)
5th	0.009 − 0.013 (0.229 − 0.330)
6th	0.014 − 0.018 (0.356 − 0.457)
7th	0.014 − 0.018 (0.356 − 0.457)

Runner To Synchronizing Ring Clearance
Table 1002

(12) Do the synchronizing ring pull test. See Figure 1006.

(a) Install a PWA 78232 Pull Test Adapter on the front case as follows:

1 Install the upper plate (1006/4) on the rear of Flange H (1006/1) at approximately the 2 o'clock position. Count all holes from the case split flange toward the 2 o'clock position and install the upper plate with bolts (1006/3) and nuts (1006/2) (boltheads down) in the 11th, 16th, and 17th holes.

2 Install the lower plate (1006/5) on the rear of Flange E at approximately the 2 o'clock position. Count all holes from the case split flange toward the 2 o'clock position and install the lower plate with bolts (1006/6) and nuts (1006/7) (boltheads up) in the 8th, 9th, and 10h holes.

NOTE: Make sure the shaft is parallel to the engine centerline.

3 Adjust the linkage arm (1006/9) so the ball lock pin engages the IGV synchroninzing ring clevis (1006/10).

NOTE: The pull test is done on the IGV, 5th, 6th, and 7th stage synchronizing rings starting with the IGV synchronizing ring.

4 Move the synchronizing ring (1006/11) until the vane arms are parallel to the engine axis.

5 Move the pointer to zero and tighten the swivel head screw (1006/8) to lock it in position.

6 Install a torque wrench in line with the pivot arm.

(b) Apply a tangental load to the synchronizing ring clevis (1006/10). The vanes must move through an minimum angle of 5 degrees but not more than 20 degrees. Use a torque wrench to apply the load in both directions, vanes closing and opening. The force to turn the vanes can be up to 100 lbs (45.36 kg) maximum. Refer to Table 1003 for the equivalent torque wrench values.

TO GET A MAXIMUM FORCE OF:	TORQUE WRENCH LENGTH	TORQUE WRENCH READING
100 LBS (45.36 kg)	16 Inches (406.400 mm)	244 LB−IN. (27.568 N.m)
100 LBS (45.36 kg)	18 Inches (457.200 mm)	248 LB−IN. (28.020 N.m)
100 LBS (45.36 kg)	21 Inches (533.400 mm)	254 LB−IN. (28.698 N.m)

Equivalent Torque Wrench Values
Table 1003

(c) Do the pull test again for the 5th, 6th, and 7th stage synchronizing rings.

(d) Remove mounting hardware and remove the PWA 78232 Pull Test Adapter from the HPC.

(13) Lift and turn the high pressure compressor (HPC) assembly.

(a) Attach a hoist to the (PWA 85534) fixture with a (PWA 88643 or PWA 88673) sling and two (PWA 76154) adapters.

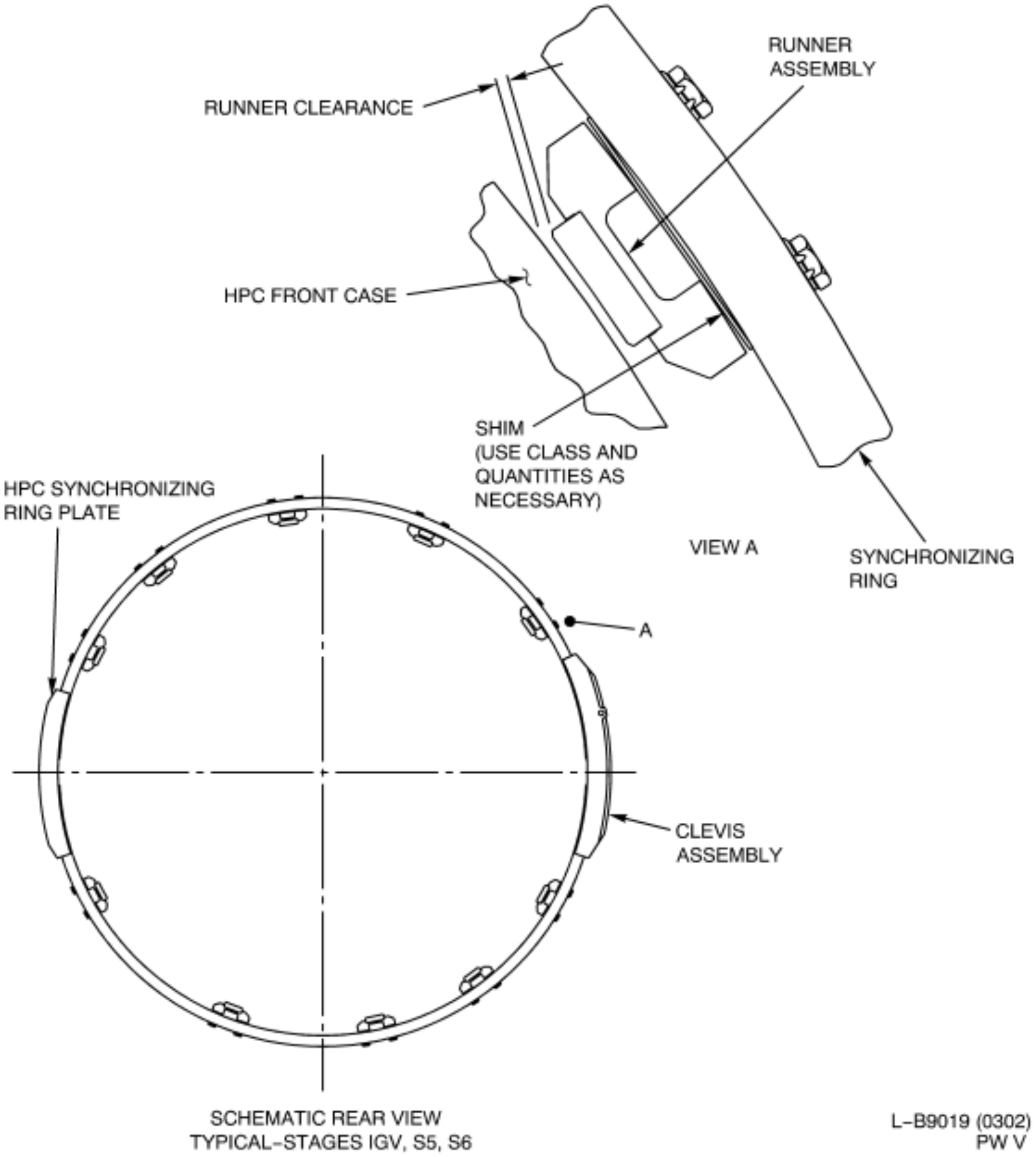
(b) Attach another hoist to the (PWA 85537) Handling fixture with a (PWA 88643 or PWA 88673) sling and two (PWA 76154) adapters.

(c) Use the two hoists to lift the HPC from the (PWA 85108) stand.

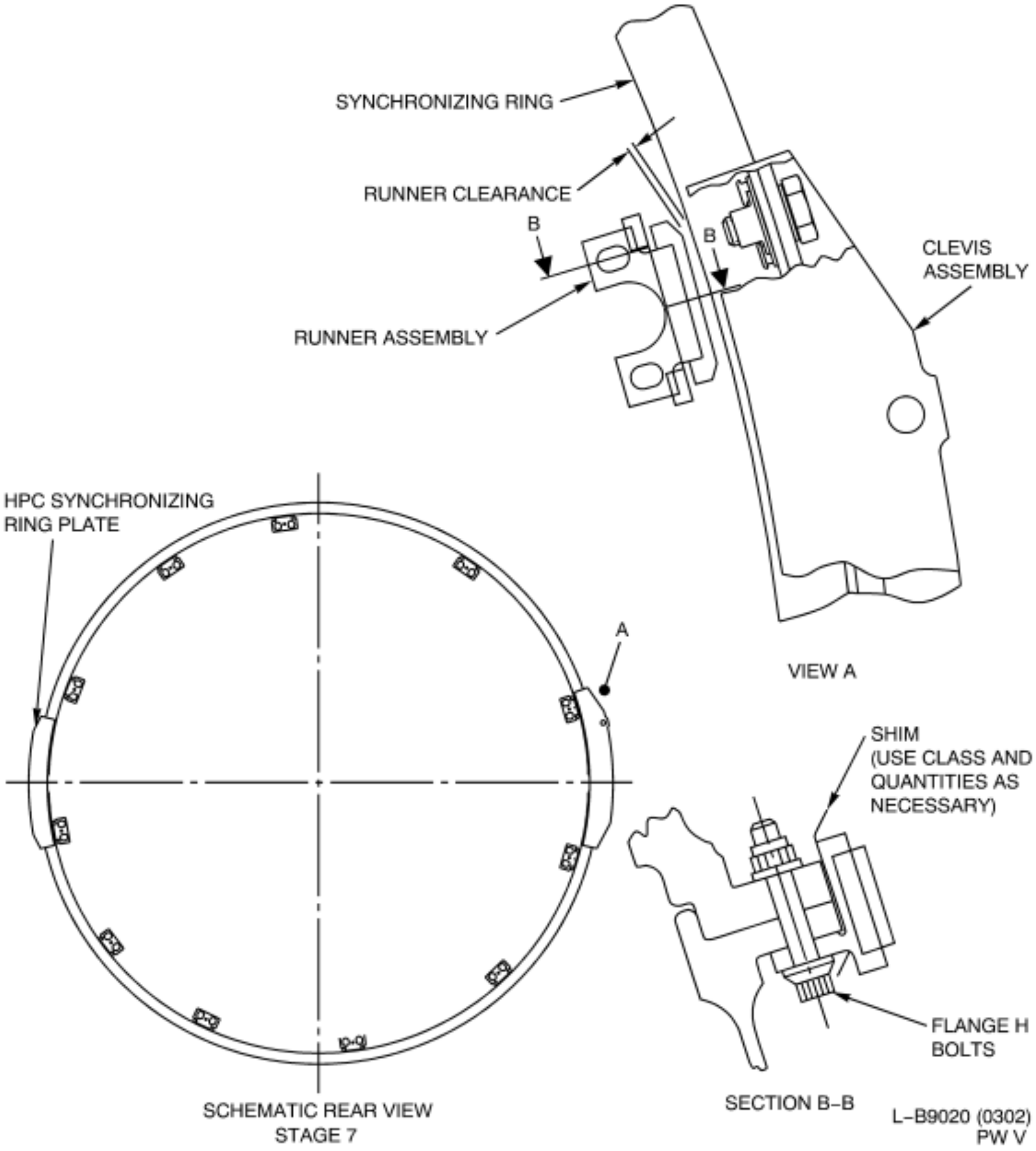
(d) Turn the HPC so the front end is up and lower it so it rests on the (PWA 85534) fixture. Remove hoists, slings and adapters.

D. Postrequisites

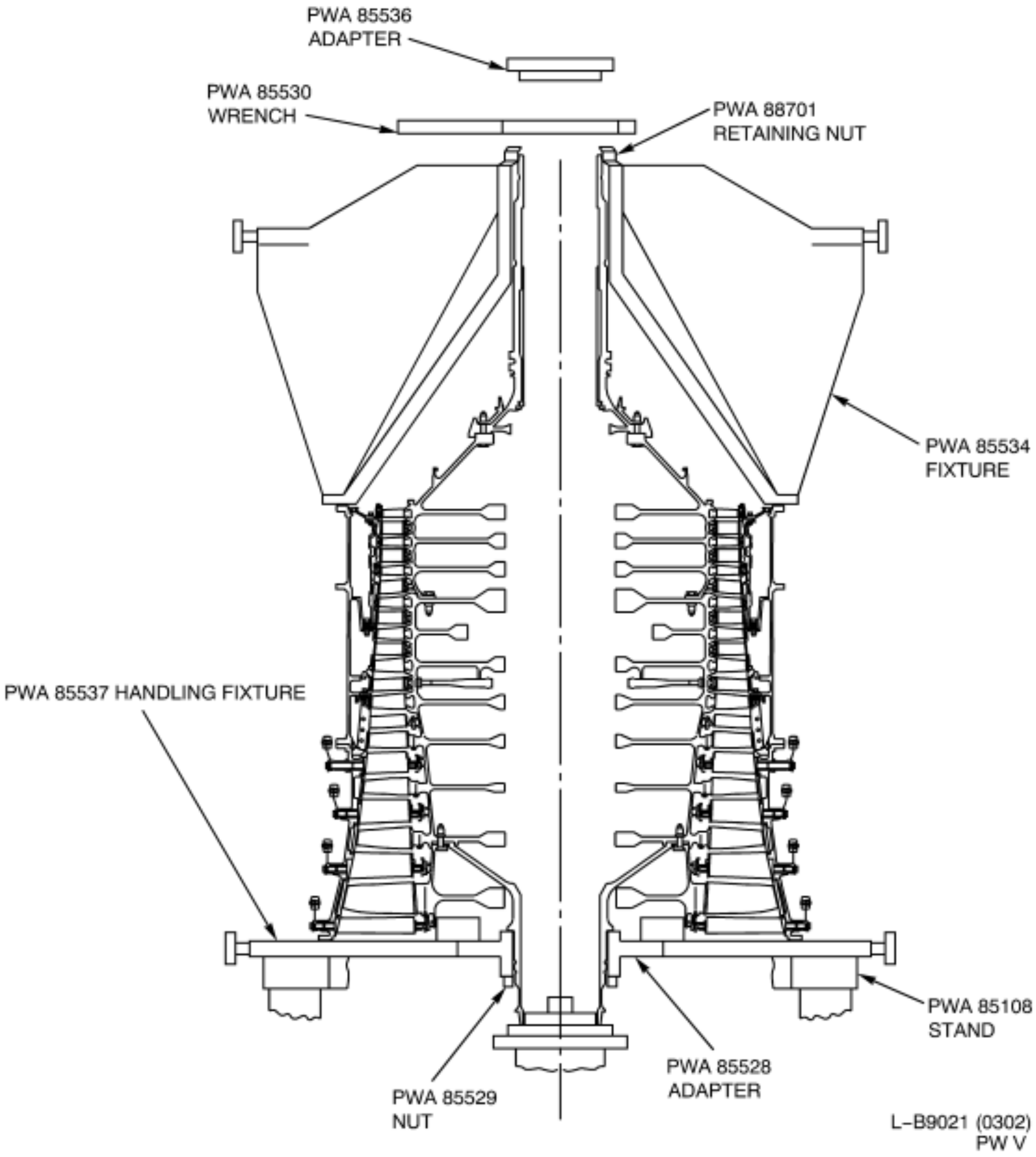
(1) Install and rig HPC stator vane actuator and lever assembly. See Assembly-03 (Task 72-35-00-400-003).


RUNNER ASSEMBLY
RUNNER CLEARANCE
HPC FRONT CASE
SHIM (USE CLASS AND QUANTITIES AS NECESSARY)
HPC SYNCHRONIZING RING PLATE
VIEW A
SYNCHRONIZING RING
A
CLEVIS ASSEMBLY
SCHEMATIC REAR VIEW TYPICAL-STAGES IGV, S5, S6
L-B9019 (0302)
PW V

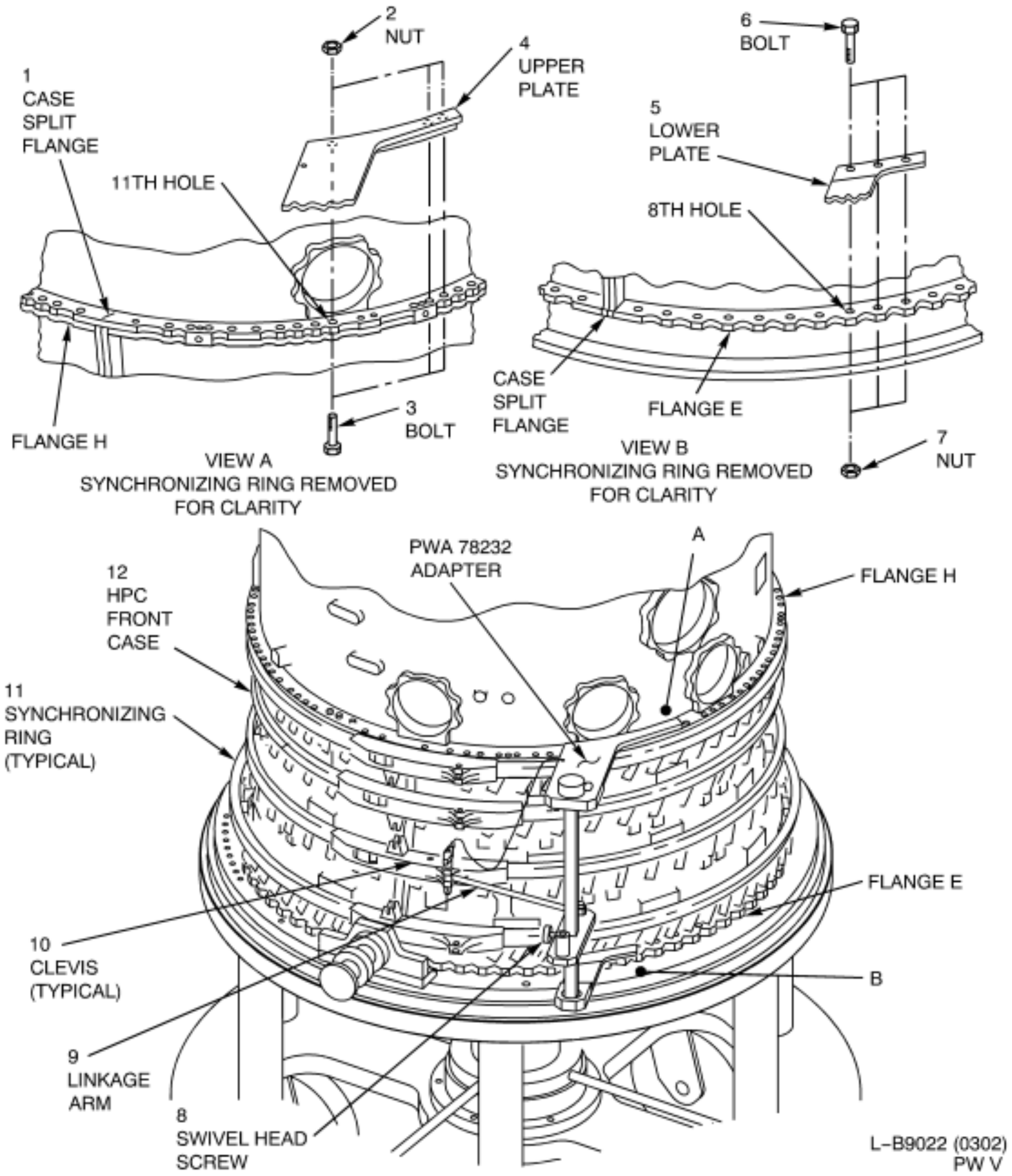
Determine Runner Clearances, Stages IGV, 5 And 6
Figure 1003
(Task 72-35-00-400-002-A)


SYNCHRONIZING RING
RUNNER CLEARANCE
B
B
RUNNER ASSEMBLY
CLEVIS ASSEMBLY
VIEW A
HPC SYNCHRONIZING RING PLATE
A
SHIM (USE CLASS AND QUANTITIES AS NECESSARY)
FLANGE H BOLTS
SCHEMATIC REAR VIEW STAGE 7
SECTION B-B
L-B9020 (0302)
PW V

Determine Runner Clearances, Stage 7
Figure 1004
(Task 72-35-00-400-002-A)


PWA 85536
ADAPTER
PWA 85530
WRENCH
PWA 88701
RETAINING NUT
PWA 85534
FIXTURE
PWA 85537 HANDLING FIXTURE
PWA 85108
STAND
PWA 85528
ADAPTER
PWA 85529
NUT
L-B9021 (0302)
PW V

HPC Installed In The Build Stand
Figure 1005
(Task 72-35-00-400-002-A)


2
NUT
4
UPPER
PLATE
1
CASE
SPLIT
FLANGE
11TH HOLE
FLANGE H
3
BOLT
VIEW A
SYNCHRONIZING RING REMOVED
FOR CLARITY
6
BOLT
5
LOWER
PLATE
8TH HOLE
CASE
SPLIT
FLANGE
FLANGE E
7
NUT
VIEW B
SYNCHRONIZING RING REMOVED
FOR CLARITY
PWA 78232
ADAPTER
A
FLANGE H
12
HPC
FRONT
CASE
11
SYNCHRONIZING
RING
(TYPICAL)
FLANGE E
10
CLEVIS
(TYPICAL)
B
9
LINKAGE
ARM
8
SWIVEL HEAD
SCREW
L-B9022 (0302)
PW V

Synchronizing Ring Pull Test
Figure 1006
(Task 72-35-00-400-002-A)

Task 72-35-00-400-003:

1. Install And Adjust The HPC Stator Vane Lever Assembly

A. Prerequisites

(1) Install synchronizing rings and determine runner clearances. See Assembly-02 (Task 72-35-00-400-002).

B. Equipment And Materials Necessary

Special Tools:

PWA 85395	Pin, Rigging (Pre SB PW4ENG 72-246)
PWA 86097	Pin, Rigging (Post SB PW4ENG 72-246)

NOTE: Rigging Pin Kit (PWA 85675) contains the above rigging pins.

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	3	72-35-00/23/300
Cotter Pin	4	72-35-00/23/310
Cotter Pin	1	72-35-00/25/160
Cotter Pin	1	72-35-00/26/160
Cotter Pin	1	72-35-00/27/140
Cotter Pin	1	72-35-00/28/160
Cotter Pin	1	72-35-00/28/260
Lockwire, MS9226-06		
Lockwire, AS3214-03		

C. Procedure

See Figure 1001.

Subtask 72−35−00−430−058:

(1) Install compressor stator cylinder support brace to lugs on case, at approximately 3 o'clock location, with brace pointed downward. Secure brace with two bolts, threads lubricated with Engine Oil P03−001, and nuts. Tighten and torque nuts to 125 − 170 lb−in. (14.123 − 19.207 N.m). Install cotter pins to secure nuts. Secure cotter pins. See Standard Practices Manual, PN 585005, 70−53−00.

(2) Install the compressor stator cylinder support bracket to case upper half at approximately the 3 o'clock location. See Figure 1001 (Sheet 1), (Sheet 2), and (Sheet 4).

NOTE: See the following step for engines with the asymmetric HPC case

- (a) Apply Engine Oil P03−001 to the four bolts you will use to install the bracket.
- (b) Install the bracket to the case with the four lubricated bolts.
- (c) Tighten and torque the bolts to 180 − 200 lb−in. (20.337 − (22.597 N.m).

(3) For the asymmetric HPC case configuration, install the compressor stator cylinder support bracket (1001/14) to case upper half at approximately the 3 o'clock location. See Figure 1001 (Sheet 5).

- (a) Apply Engine Oil P03−001 to the four bolts (1001/13) you will use to install the bracket (1001/14).
- (b) Install the bracket (1001/14) to the case with four lubricated bolts (1001/13).
- (c) Tighten and torque bolts (1001/13) to 180 − 200 lb−in. (20.337 − (22.597 N.m).

Subtask 72−35−00−430−059:

(4) (Pre SB PW4ENG 72−534) Install the vane actuator and lever assembly as follows.

(a) Install vane actuator and lever assembly to case bracket and lugs. Install two studs to upper attaching points on actuation support. Lubricate threads with Engine Oil P03−001. Install two nuts to both sides and torque nuts to 65 − 85 lb−in. (7.344 − 9.604 N.m). Secure nuts with four cotter pins. Secure cotter pins. See Standard Practices Manual, PN 585005, 70−53−00. For each upper attaching leg of the SVA support bracket, install lockwire through the cotter pin loop at one end of the stud, twist lockwire, wrap around the support upper leg, twist again and install through cotter pin loop at other end of the stud. See Figure 1001 (Sheet 7).

(5) (Post SB PW4ENG 72−534) Install the vane actuator and lever assembly as follows.

(a) (Reference 749) Install the vane actuator and lever assembly to the front compressor case bracket and lugs. Install two expandable studs (called studs) to upper attaching points on actuation support.

NOTE: Installation of the stud to the front attachment lug may require that the 5th stage unison ring be rotated so that the hole in the clevis is in line with the hole in the bracket and the lug of the front compressor case. This will allow the stud to pass through the hole in the clevis and into the bracket and the lug on the case.

(b) Lubricate the threads of the nuts with Engine Oil P03−001. Install a washer and a lubricated nut to each end of the studs. Center the studs so that an approximate equal length projects from the front and rear of the front compressor attachment points. Tighten the nuts fingertight.

(c) (Reference 739) Use a 3/32 inch (2.381 mm) hexagonal wrench in the end of the stud to prevent rotation during the torque process. Alternately torque each nut approximately one−half turn until a torque of 55 − 70 lb−in. (6.214 − 7.909 N.m) is obtained and a slot in the nuts is aligned with the cotter pin hole in the studs.

(d) After final torque of the nuts, do an inspection to ensure the following:

  1 That a gap exists between the washer and the front compressor attachment points on one or both sides. Replace the stud if the total gap is less than 0.005 inch (0.127 mm). Total gap is the gap at both ends added together, or if only one gap, a gap at either end. See Figure 1001 (Sheet 8).

  2 That the cotter pin holes are located entirely in the slot of the nuts.

  3 That the stud end projection is approximately equal, at both ends, plus or minus one thread beyond the outboard end of each nut.

(e) Install a cotter pin to secure each nut. Secure four cotter pins. See Standard Practices Manual, PN 585005, 70−53−00.

(f) Install two bolts to secure actuation support lower attaching flange to case lugs. Lubricate bolt threads with Engine Oil P03−001.

  1 (Pre SB PW4ENG 72−246 and SB PW4ENG 72−289) Install the forward bolt with the bolthead pointing up. Install the rearward bolt with the bolthead pointing down. Install the nuts to the bolts and torque the nuts to 125 − 170 lb−in. (14.123 − 19.207 N.m). Install MS9226−06 lockwire through each castellated nut and wire hole in the bolt threads. Twist the lockwire and wrap around the support and twist again. See Figure 1001 (Sheet 2) and Figure 1001 (Sheet 3).

  NOTE: This will prevent the bolts from turning.

  2 (Post SB PW4ENG 72−246 and SB PW4ENG 72−289). Install the bolts with the boltheads pointing down. Install spacers (next to nuts) and nuts to the bolts. Torque the nuts to 180 − 200 lb−in. (20.337 − 22.597 N.m). See Figure 1001 (Sheet 2) and Figure 1001 (Sheet 3).

(g) (For engines with the asymmetric high compressor case) Attach the lower two points of the support bracket to the HPC case lugs as follows: Figure 1001 (Sheet 5).

1 Apply Engine Oil P03-001 to the threads of two bolts (1001/10). Install the two lower bolts with the heads downward.

2 Install two spacers (1001/9) over the two bolts (1001/10) and into the bracket and attach in position with two nuts (1001/8), tightened hand tight only.

3 Torque the two nuts (1001/8) 180 - 200 lb-in. (20.337 - 22.597 N.m).

(h) (Reference 618) Install engine rear end of compressor stator cylinder support bracket (antisway brace) as follows. For (Post SB PW4ENG 72-483) only, install 0 - 12 shim washers (two sides), to get a fit of 0.008L - 0.008T inch (0.203L - 0.203T mm). After shimming, torque the nut to 50 - 80 lb-in. (5.649 - 9.039 N.m). Safety the nut with a cotter pin. Refer to Standard Practices Manual, PN 585005, 70-53-00.

NOTE: To get the correct fit (Reference 618) 0.008L - 0.008T inch (0.203L - 0.203T mm) you must have incorporated SB PW4ENG 72-246 or SB PW4ENG 72-289.

(i) (Reference 618) (Post SB PW4ENG 72-483) Install engine front end of compressor stator cylinder support bracket (anti-sway brace) as follows. Install bolt through support and brace with washer between support and bolt head. Measure gap between support and brace and install 0 - 8 shim washers to get a fit of 0.008L - 0.008T inch (0.203L - 0.203T mm) after shimming, lubricate bolt threads with Engine Oil P03-001, assemble nut on bolt and torque the nut to 50 - 80 lb-in. (5.649 - 9.039 N.m). R

(j) (For engines with the asymmetric high compressor case) Attach the brace (1001/2) to the support bracket and the boss on the HPC case as follows. See Figure 1001 (Sheet 5).

1 Apply Engine Oil P03−001 to the threads of the four bolts (1001/1, (1001/3) and (1001/7)).

2 Attach the rear leg of the brace to the support bracket as follows:

  a Install the rear (hex head) bolt (1001/7), bolt head forward next to the brace (1001/2) and a thin washer (1001/6) between the brace and the support bracket.

  b Push the bolt rearward until the bolt head touches the brace.

  c Install approximately six thin washers (1001/6) next to the support, one thicker washer (1001/5) and the nut (1001/11), hand tight only.

3 Attach the front leg of the brace to the support bracket as follows:

  a Install the front (double hex head) bolt (1001/1), bolt head rearward next to the front leg of the brace (1001/2) and install approximately six thin washers (1001/6) between the brace and the support bracket.

  b Push the bolt forward until the bolt head touches the brace.

  c Attach the brace to the support bracket with a thick washer (1001/5), next to the support bracket, and a nut (1001/4), hand tight only.

4 Attach the brace to the boss on the HPC case with bolts (1001/3) hand tight only.

5 Torque the bolts (1001/3) that attach the brace to the HPC case to 85 − 95 lb−in. (9.604 − 10.734 N.m).

6 (Reference 618) Torque the nuts (1001/4 and 1001/11) and bolts (1001/1 and 1001/7) which attach the brace to the support bracket as follows:

R
R

a Tighten the nut (1001/11) on the rear (hex head) bolt until the cotter pin hole in the bolt is visible in the slots in the nut and permits a cotter pin (1001/12) to be installed.

b Install the cotter pin (1001/12).

NOTE: Do not bend the cotter pin legs.

c While you hold the head of the rear (hex head) bolt (1001/7) against the brace (1001/2), measure the gap between the support bracket and the brace at the two thin washer (1001/6) locations, Gap A and Gap B. See Figure 1001 (Sheet 6).

d With the rear (hex head) bolt (1001/7) head still against the brace, measure the gap between the support bracket and the face of the nut (1001/11) Gap C.

e Add or subtract thin washers (1001/6), as necessary, to obtain a stack of washers that are in the gap limits of 0.008L − 0.008T inch (0.203L − 0.203T mm) at the three thin washer locations.

NOTE: The thin washers (1001/6) are 0.015 − 0.018 inch (0.381 − 0.457 mm) thick.

f These limits must be met on both sides of the rear bolt (1001/7) and between the brace (1001/2) and the support on the front bolt (1001/1).

g Remove the cotter pin (1001/12) from the rear nut (1001/11) and torque the nut to 50 − 80 lb−in. (5.649 − 9.039 N.m).

NOTE: Align the slot in the nut with the holes in the bolt while you torque.

h Install the cotter pin (1001/12) to safety the rear nut (1001/11).

i Bend the cotter pin (1001/12) legs so that the head and the upper leg are seated against the bolt and the lower leg is seated against the nut flat.

j Torque the front bolt (1001/1) to 180 − 200 lb−in. (20.337 − 22.597 N.m).

Subtask 72−35−00−430−060:

(6) Adjust the unison ring linkage as follows.

CAUTION: INCORRECT RIGGING OF THE STATOR VANE CONTROL SYSTEM CAN CAUSE TOO MUCH STRESS ON THE ENGINE COMPONENTS.

CAUTION: REFER TO SB PW4ENG 72−246 FOR THE APPLICABLE TOOL PART NUMBER FOR RIGGING THE VARIABLE STATOR VANE CONTROL.

(a) Use a standard crowsfoot wrench and rotate lever assembly to align slot in rigging plate with hole in lever support. For engines with the larger rigging slot (Pre SB PW4ENG 72−246), insert PWA 85395 Pin to lock lever assembly in vane open rig position. For engines with the smaller rigging slot (Post SB PW4ENG 72−246), insert PWA 86097 Pin to lock the lever assembly in vane open rig position.

(b) With lever assembly and unison rings pinned in vane open position, turn adjusters so that holes in rod end bearing and clevis will line up. Install bolt to each clevis to secure rod end bearing. Check for adequate thread engagement by inserting wire into linkage inspection holes at both ends of linkage. If wire does not go through linkage at both ends, lock rod ends by torquing jamnuts on linkage to 115 − 150 lb−in. (12.993 − 16.948 N.m). Bend one set of key washer tabs onto adjuster and other set onto jamnuts.

(c) If wire does go through linkage inspection holes at either end, readjust adjuster until wire does not go through at both ends. Lock rod ends by torquing jamnuts on linkage to 115 − 150 lb−in. (12.993 − 16.948 N.m). Bend one set of key washer tabs onto adjuster and other set onto jamnuts. Seal rod ends.

(d) (Pre SB PW4ENG 72-506) (Reference 730) Install washers to Stages IGV, 5 and 7 clevis bolts. Lubricate threads of bolts with Engine Oil P03-001. Install nuts to all four stages and torque nuts to 15 - 22 lb-in. (1.695 - 2.486 N.m) in addition to torque required to turn bolt through nut. Secure with cotter pins. Bend cotter pins. See Standard Practices Manual, PN 585005, 70-53-00.

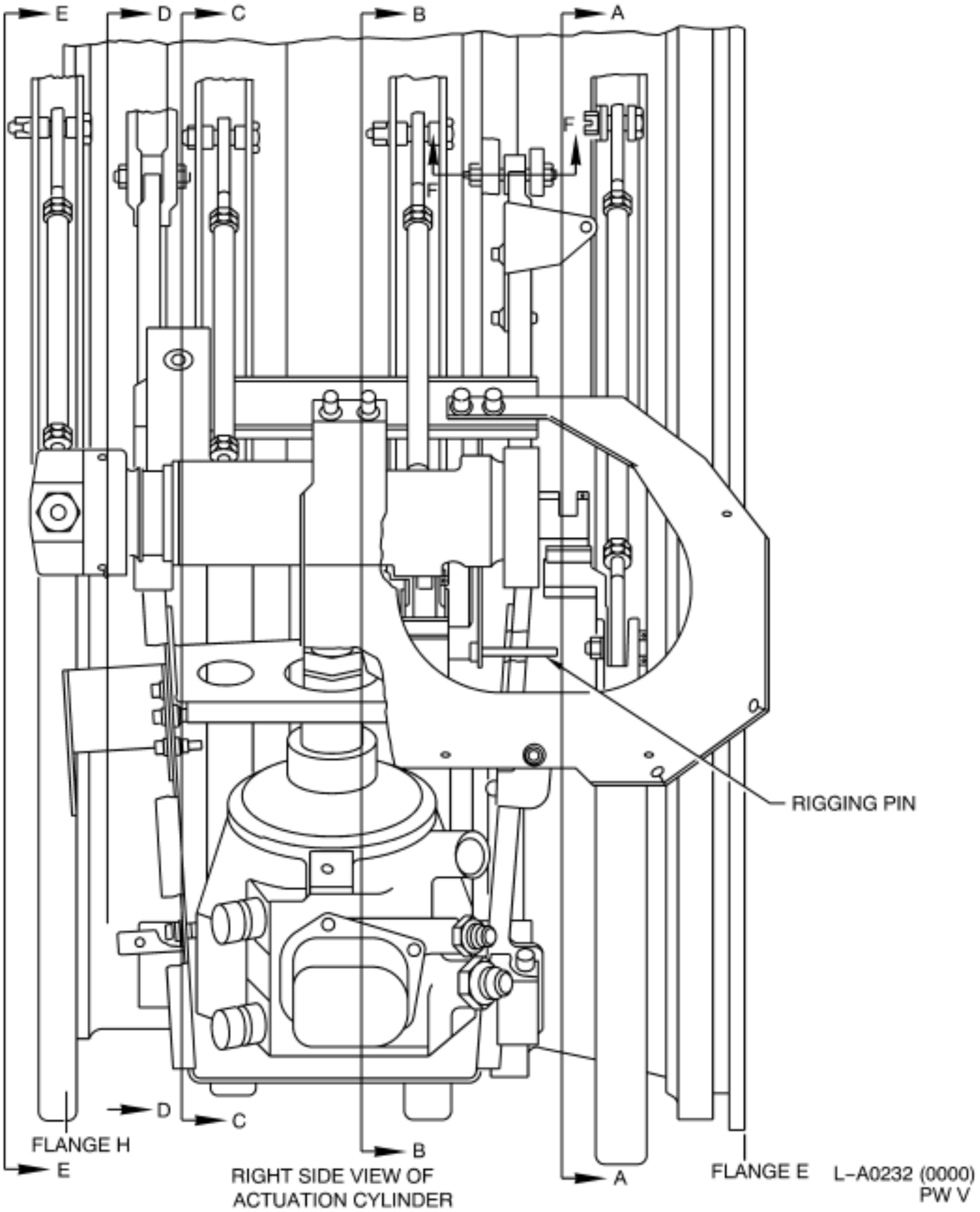
(e) (Post SB PW4ENG 72-506) (Reference 730) Lubricate threads of bolts with Engine Oil P03-001. Install nuts to all four stages and torque nuts to 15 - 22 lb-in. (1.695 - 2.486 N.m) in addition to torque required to turn bolt through nut. Secure with cotter pins. Bend cotter pins. See Standard Practices Manual, PN 585005, 70-53-00.

(f) Remove all rig pins.

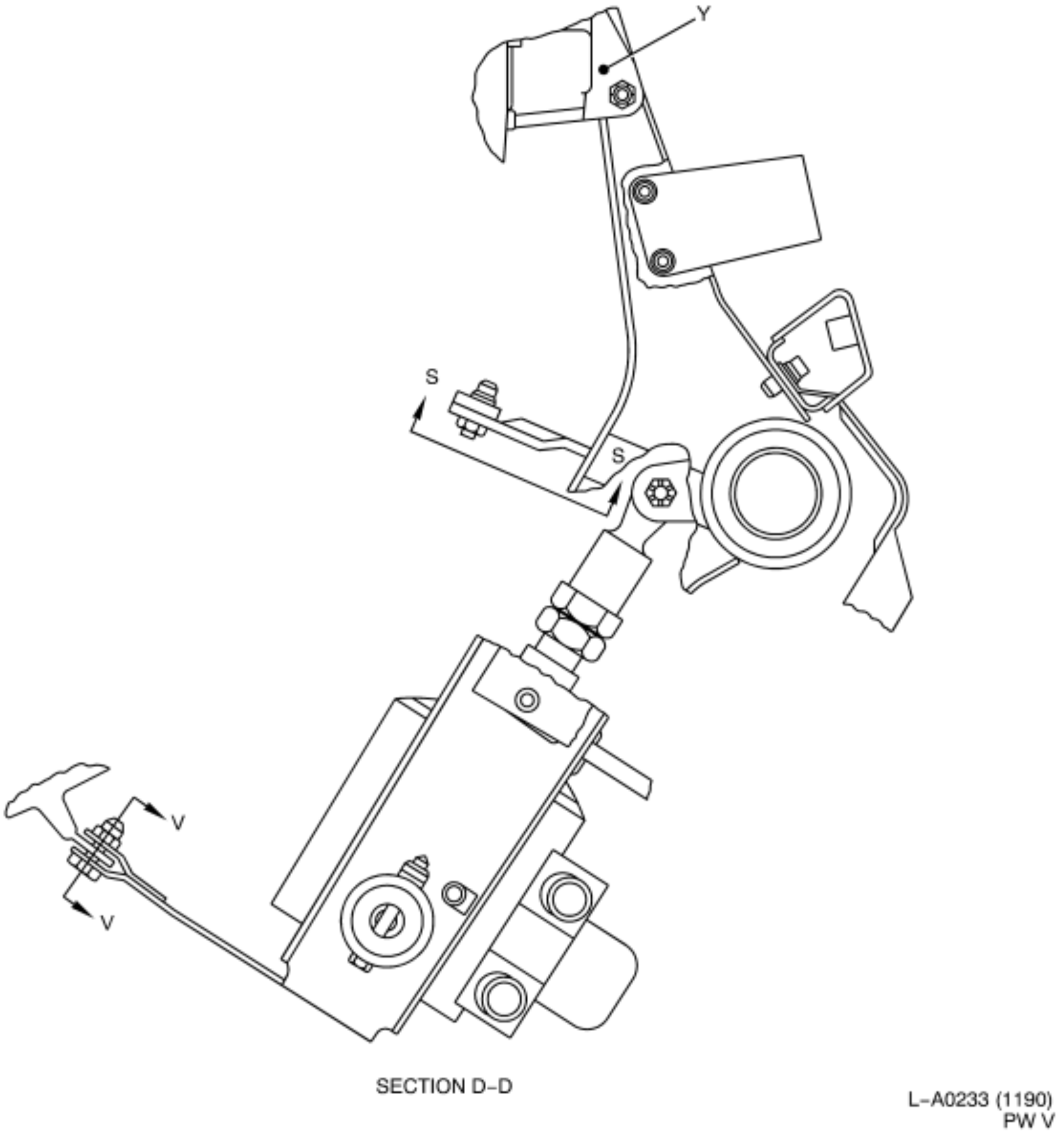
D. Postrequisites

(1) Rig the compressor stator vane control system. See72-35-62-440-001, Special Procedure-05 Task 72-35-62-440-001 or Task 72-35-62-440-001.

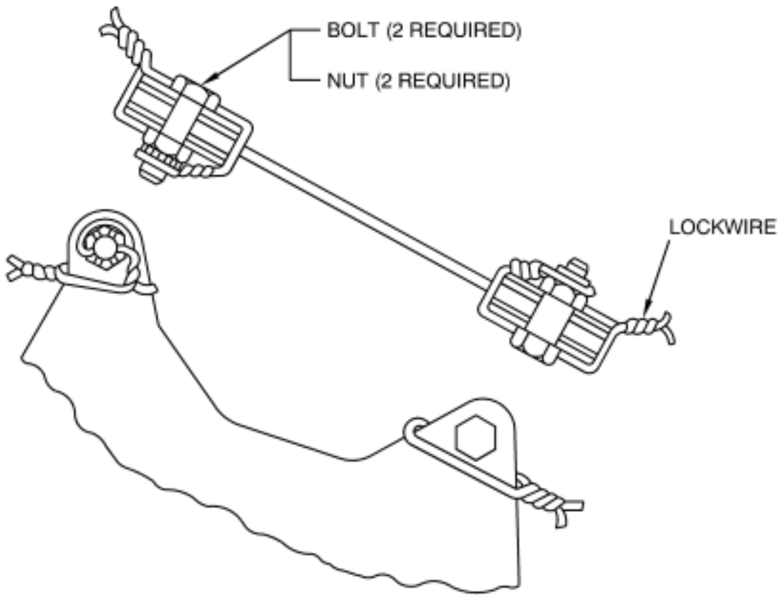
(2) Install HPC external parts. See Assembly-04 Task 72-35-00-400-004.


E
D
C
B
A
F
F
RIGGING PIN
FLANGE H
D
C
B
E
A
RIGHT SIDE VIEW OF ACTUATION CYLINDER
FLANGE E
L-A0232 (0000)
PW V

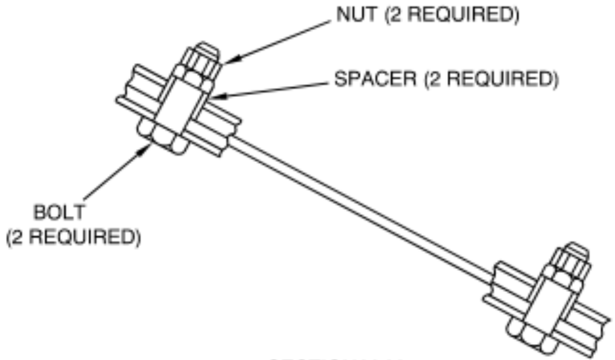
HPC Stator Vane Actuator And Lever Assembly Installation
Figure 1001 (Sheet 1)
(Task 72-35-00-400-003)


Y
S
S
V
V
SECTION D-D
L-A0233 (1190)
PW V

HPC Stator Vane Actuator And Lever Assembly Installation
Figure 1001 (Sheet 2)
(Task 72-35-00-400-003)


BOLT (2 REQUIRED)
NUT (2 REQUIRED)
LOCKWIRE

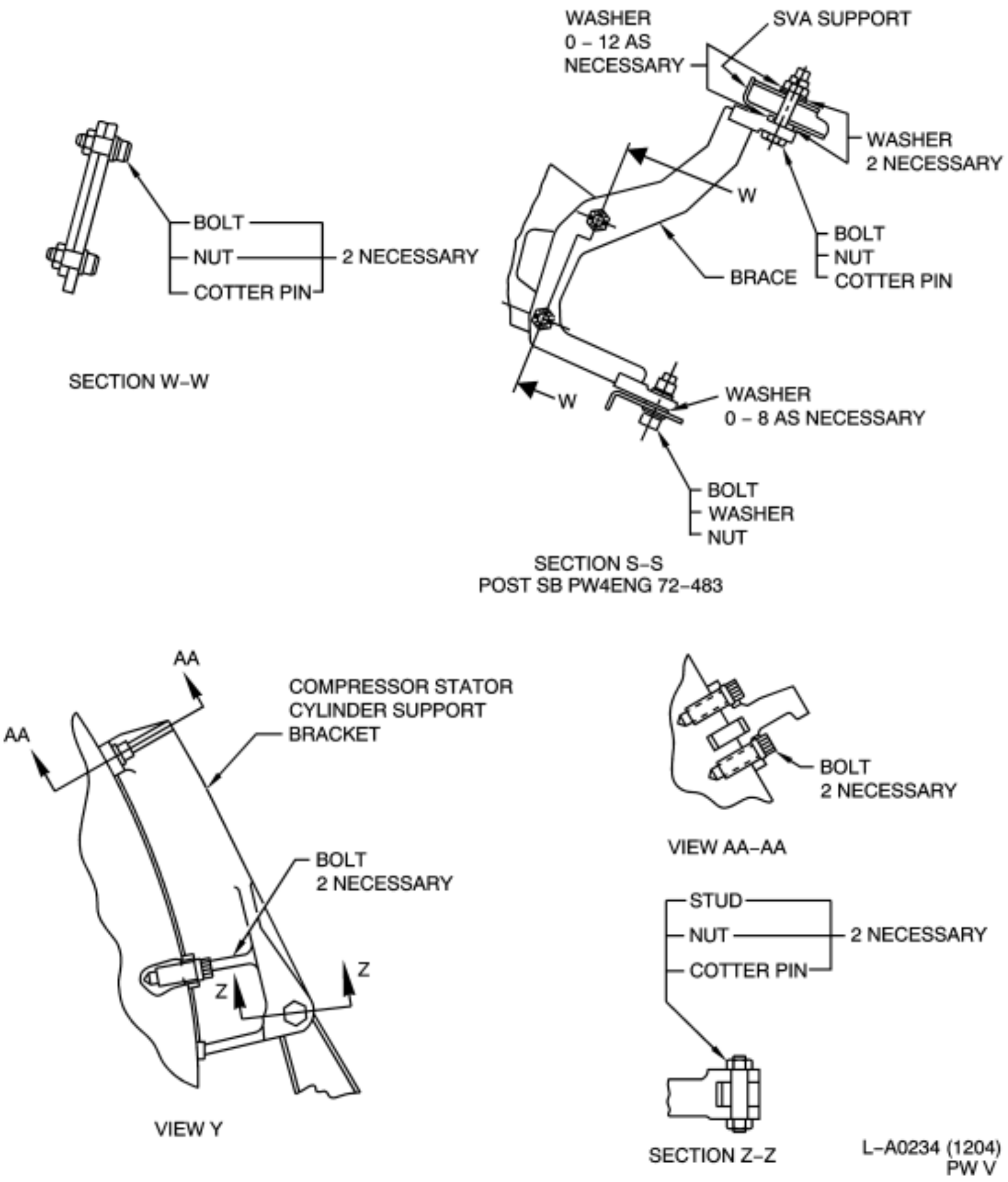
SECTION V−V
(PRE SB PW4ENG 72−246)


NUT (2 REQUIRED)
SPACER (2 REQUIRED)
BOLT
(2 REQUIRED)

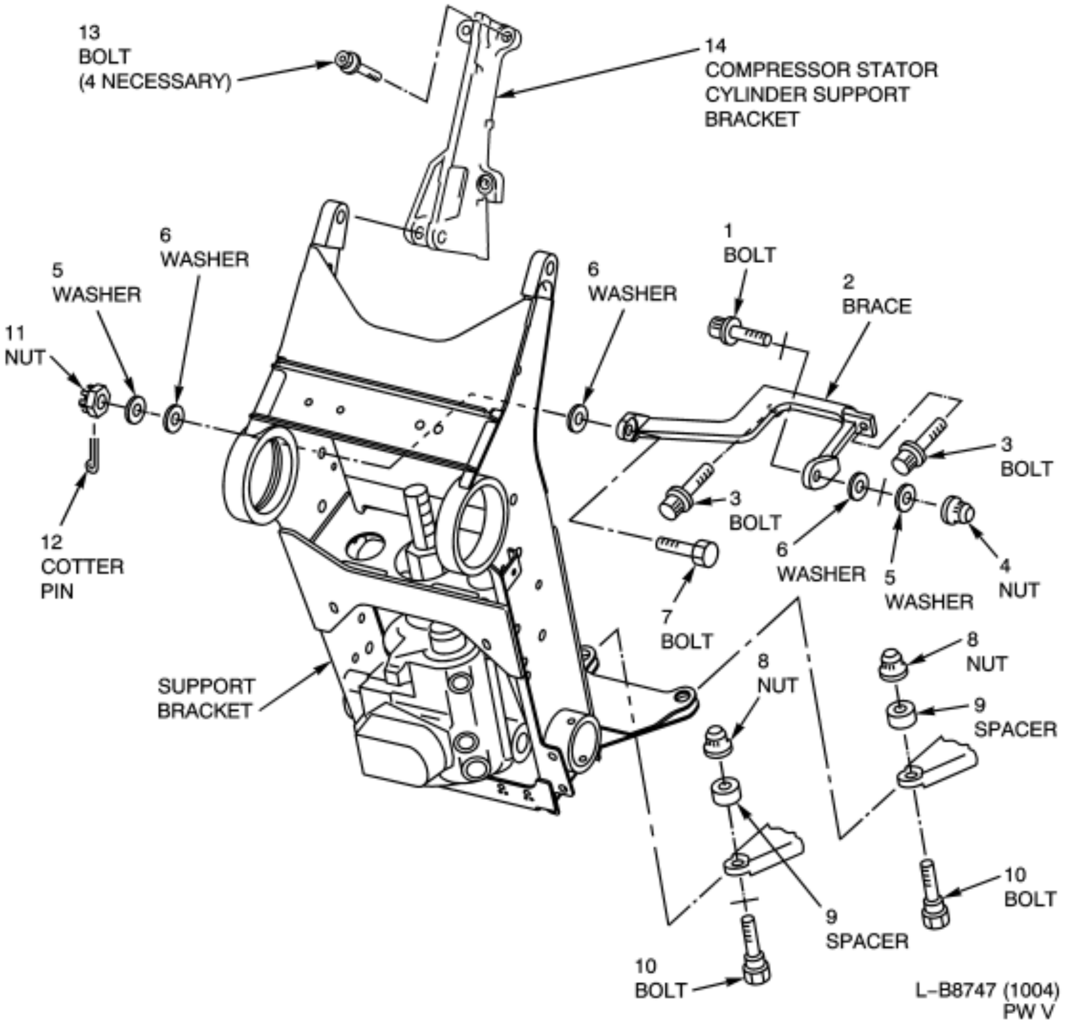
SECTION V−V
(POST SB PW4ENG 72−246)

L−A6827 (0000)
PW V

HPC Stator Vane Actuator And Lever Assembly Installation
Figure 1001 (Sheet 3)
(Task 72−35−00−400−003)

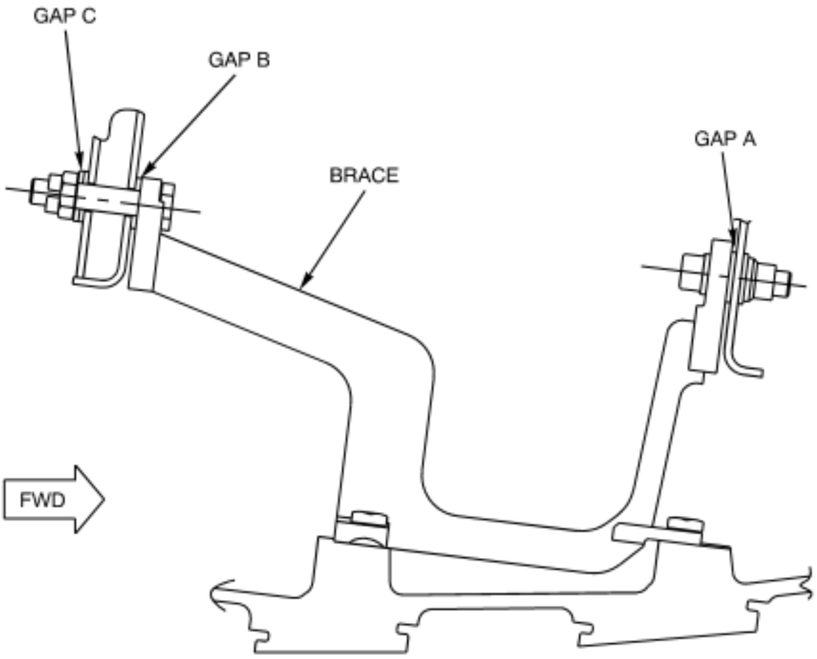

WASHER
0 - 12 AS
NECESSARY
SVA SUPPORT
WASHER
2 NECESSARY
BOLT
NUT
COTTER PIN
2 NECESSARY
W
BRACE
BOLT
NUT
COTTER PIN
SECTION W-W
W
WASHER
0 - 8 AS NECESSARY
BOLT
WASHER
NUT
SECTION S-S
POST SB PW4ENG 72-483
AA
AA
COMPRESSOR STATOR
CYLINDER SUPPORT
BRACKET
BOLT
2 NECESSARY
Z
Z
VIEW Y
BOLT
2 NECESSARY
VIEW AA-AA
STUD
NUT
COTTER PIN
2 NECESSARY
SECTION Z-Z
L-A0234 (1204)
PW V

HPC Stator Vane Actuator And Lever Assembly Installation
Figure 1001 (Sheet 4)
(Task 72-35-00-400-003)


13
BOLT
(4 NECESSARY)
14
COMPRESSOR STATOR
CYLINDER SUPPORT
BRACKET
6
WASHER
5
WASHER
11
NUT
6
WASHER
1
BOLT
2
BRACE
3
BOLT
3
BOLT
6
WASHER
5
WASHER
4
NUT
12
COTTER
PIN
7
BOLT
8
NUT
8
NUT
9
SPACER
SUPPORT
BRACKET
10
BOLT
9
SPACER
10
BOLT
L-B8747 (1004)
PW V

For Engines With The Asymmetric High Compressor Case

HPC Stator Vane Actuator And Lever Assembly Installation
Figure 1001 (Sheet 5)
(Task 72-35-00-400-003)

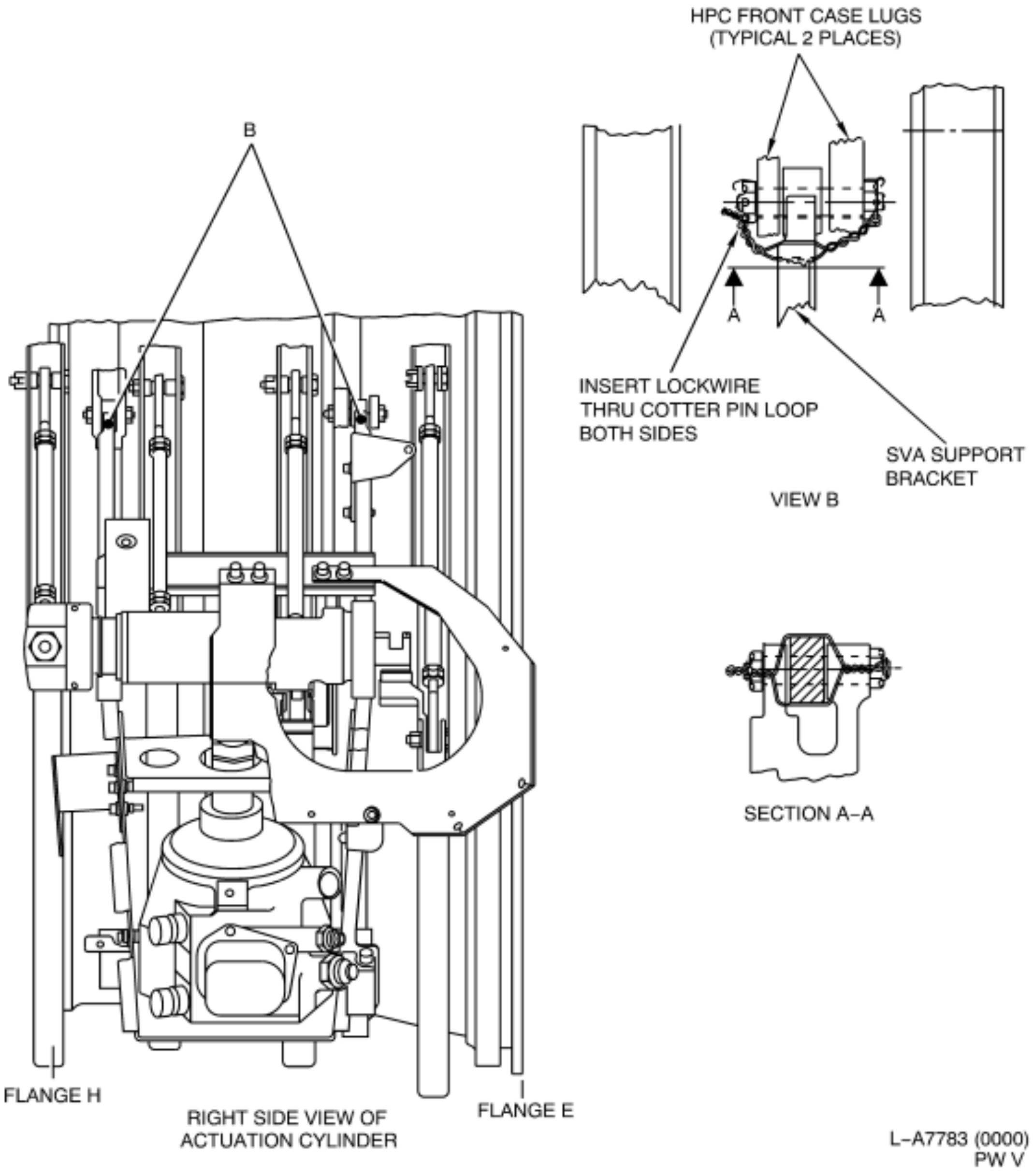


SUPPORT BRACKET
BRACE

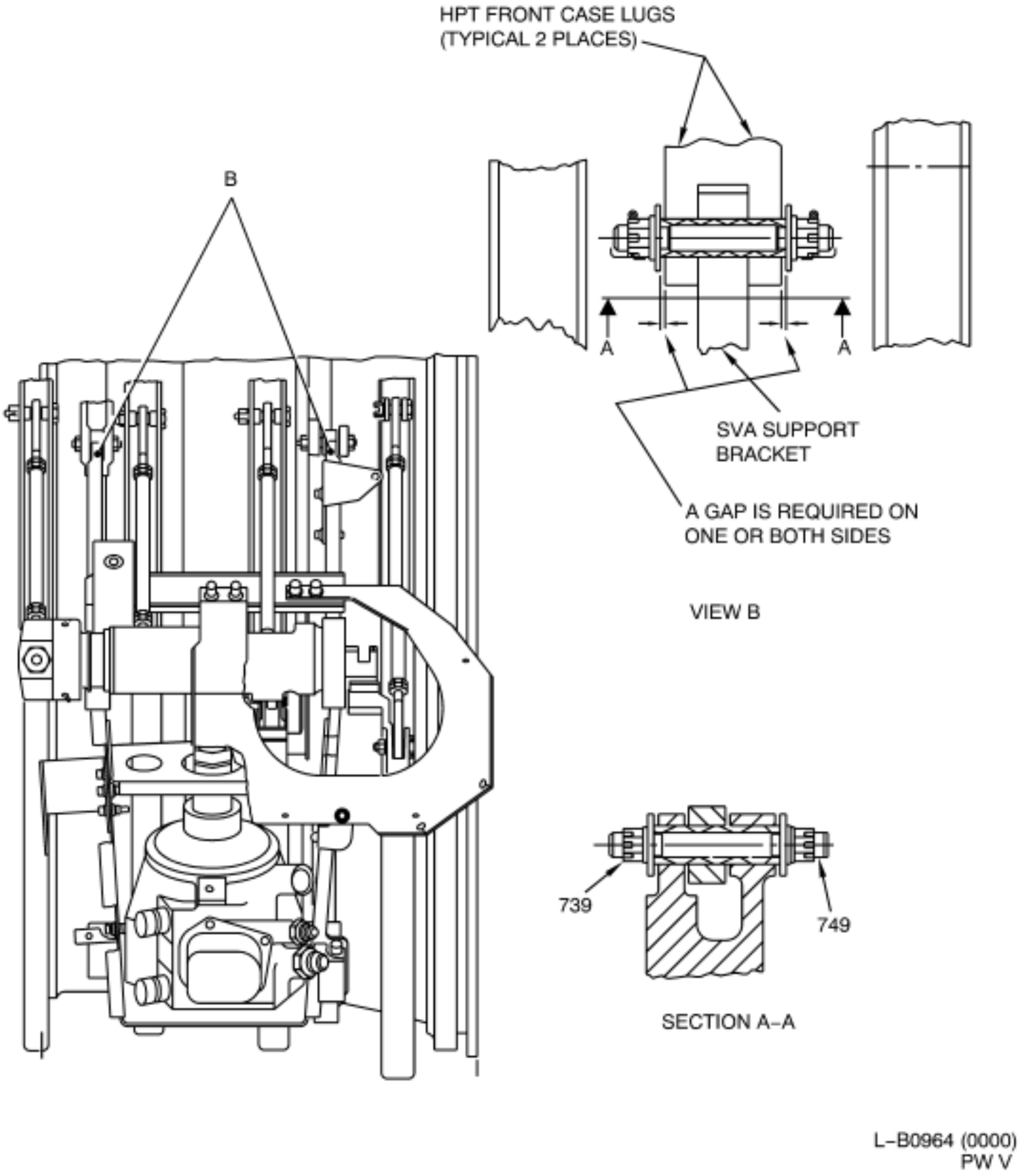
L−B8865 (1001)
PW V

For Engines With The Asymmetric High Compressor Case

HPC Stator Vane Actuator And Lever Assembly Installation
Figure 1001 (Sheet 6)
(Task 72−35−00−400−003)

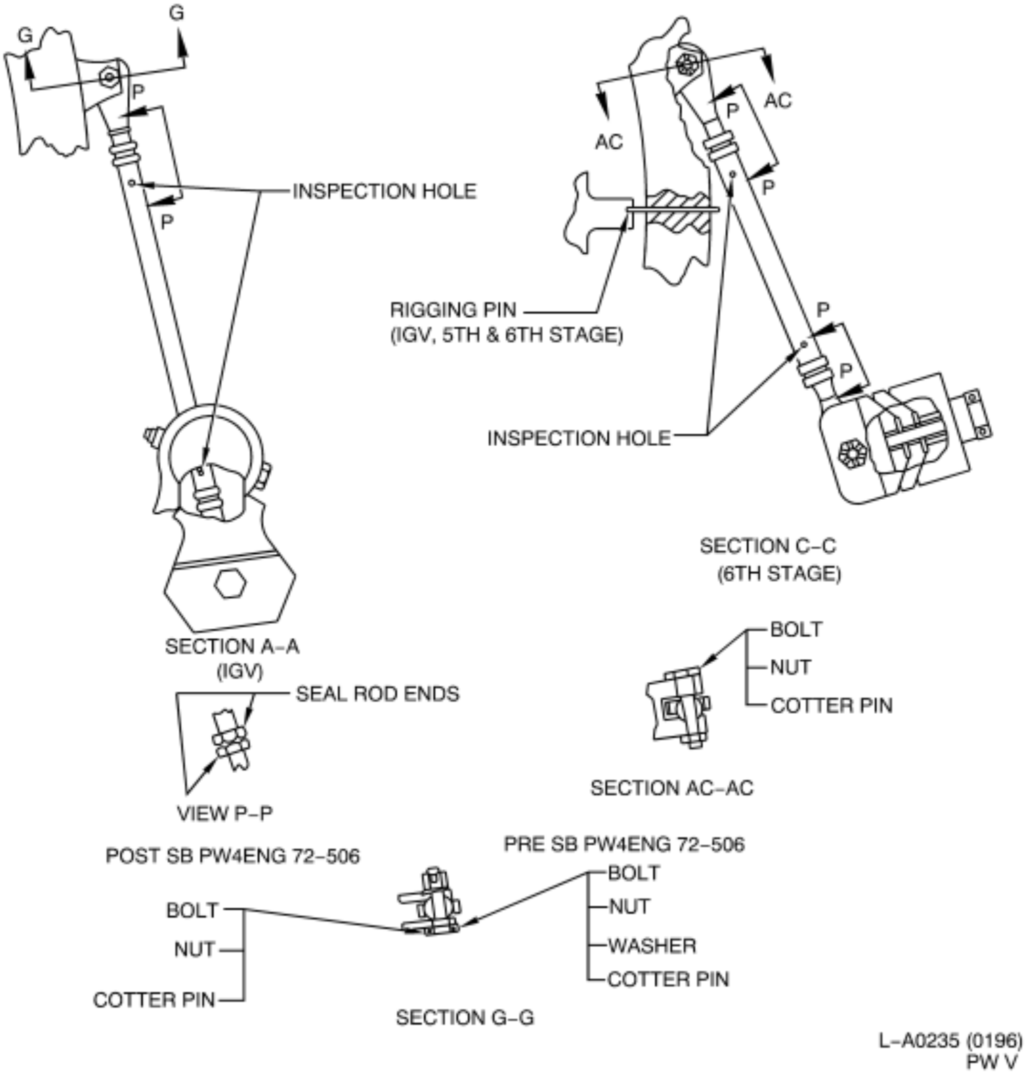

HPC FRONT CASE LUGS
(TYPICAL 2 PLACES)
B
A
A
INSERT LOCKWIRE
THRU COTTER PIN LOOP
BOTH SIDES
SVA SUPPORT
BRACKET
VIEW B
SECTION A-A
FLANGE H
RIGHT SIDE VIEW OF
ACTUATION CYLINDER
FLANGE E
L-A7783 (0000)
PW V

(Pre SB PW4ENG 72-534)
HPC Stator Vane Actuator And Lever Assembly Installation
Figure 1001 (Sheet 7)
(Task 72-35-00-400-003)

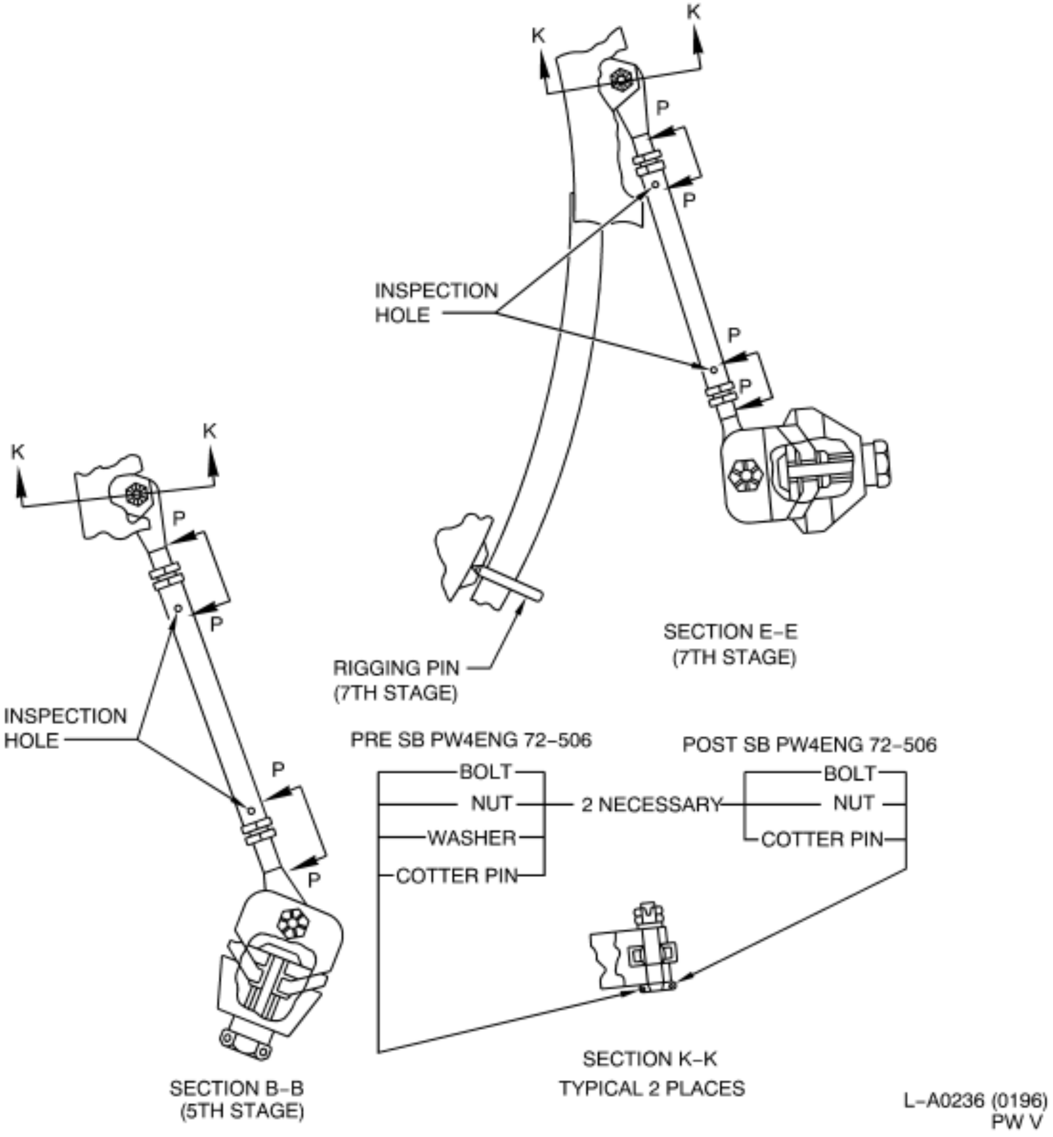

HPT FRONT CASE LUGS
(TYPICAL 2 PLACES)
B
A
A
SVA SUPPORT
BRACKET
A GAP IS REQUIRED ON
ONE OR BOTH SIDES
VIEW B
739
749
SECTION A-A
L-B0964 (0000)
PW V

(Post SB PW4ENG 72-534)

HPC Stator Vane Actuator And Lever Assembly Installation
Figure 1001 (Sheet 8)
(Task 72-35-00-400-003)


G
G
P
INSPECTION HOLE
P
SECTION A-A
(IGV)
AC
AC
P
P
RIGGING PIN
(IGV, 5TH & 6TH STAGE)
P
P
INSPECTION HOLE
SECTION C-C
(6TH STAGE)
SEAL ROD ENDS
VIEW P-P
BOLT
NUT
COTTER PIN
SECTION AC-AC
POST SB PW4ENG 72-506
BOLT
NUT
COTTER PIN
PRE SB PW4ENG 72-506
BOLT
NUT
WASHER
COTTER PIN
SECTION G-G
L-A0235 (0196)
PW V

HPC Stator Vane Actuator And Lever Assembly Installation
Figure 1001 (Sheet 9)
(Task 72-35-00-400-003)


K
K
P
P
INSPECTION
HOLE
P
P
K
K
P
P
RIGGING PIN
(7TH STAGE)
SECTION E-E
(7TH STAGE)
INSPECTION
HOLE
P
P
PRE SB PW4ENG 72-506
BOLT
NUT
WASHER
COTTER PIN
2 NECESSARY
POST SB PW4ENG 72-506
BOLT
NUT
COTTER PIN
SECTION K-K
TYPICAL 2 PLACES
SECTION B-B
(5TH STAGE)
L-A0236 (0196)
PW V

HPC Stator Vane Actuator And Lever Assembly Installation
Figure 1001 (Sheet 10)
(Task 72-35-00-400-003)

Task 72-35-00-400-004:

1. Install HPC External Parts

A. Prerequisites

(1) Install and rig HPC stator vane actuator and lever assembly. See Assembly-03 Task 72-35-00-400-003.

B. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 85436 Torque Adapter

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-059	Wax, Paraffin (PMC 9552)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
R P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	2	72-35-00/30/250
Cotter Pin	1	79-21-00/5/80
Gasket	1	75-22-00/1/1
Gasket	2	75-24-00/1/1
Gasket	1	75-33-00/1/1
Gasket	1	75-33-00/2/1
Gasket	1	79-21-00/6/1
Packing	3	79-21-00/5/30
Packing	1	79-21-00/5/190
Packing	1	79-21-00/5/170
Packing	1	79-21-00/5/10

C. Procedure

Subtask 72−35−00−430−061:

(1) Install brackets to the HPC front and rear cases as follows. See Figure 1001.

(a) Attach the fuel/oil cooler brackets to the HPC front and rear cases with the bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 180 − 200 lb−in. (20.337 − 22.597 N.m).

(b) Attach the remainder of the HPC front case brackets with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(c) Attach the bracket to the top of the HPC rear case with two bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(d) Attach the two gearbox support brackets and a bracket (Post SB PW4ENG 75−95) to the HPC rear case with eight bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(e) Make sure the bearings are installed in the gearbox driveshaft housing support link. Install the support link and attach it with the two bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the nuts to 180 − 200 lb−in. (20.337 − 22.597 N.m). Install the cotter pins. Lockwire the bolt heads to the gearbox support bolt heads. Temporarily attach lower bearing to link with lockwire.

(2) Install the Flange J hardware as follows. Refer to 72−350−00, Assembly−20 (Task 72−35−00−430−020).

Subtask 72−35−00−430−071:

(3) Install turbine case cooling air valve actuator to bracket at 2 o'clock position on front HPC case. See Figure 1002. Ensure bracket pins engage holes in actuator slide rails. Secure with four clamps and bolts, threads lubricated with Engine Oil P03−001. For engines not equipped with nut plates and bracket

riveted to support (Pre SB PW4ENG 75-35), install loop clamp bracket and four nuts. Torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(a) (Reference 736) Install bracket and ground cable to rear of actuator bracket and secure with two bolts, threads lubricated with Engine Oil P03-001, and nuts handtight only.

NOTE: The two bolts that attach the bracket and cable to the actuator bracket will be torqued after the installation of the bleed valve supply tubes (AA24), (AA28), and (AA30). See 72-00-35, Installation-03 Task 72-00-35-420-002.

(b) Install bolt securing ground cable to actuator and torque to 85 - 95 lb-in. (9.604 - 10.734 N.m).

NOTE: For engines equipped with the longer ground cable (Pre SB PW4ENG 75-31), the ground cable is attached above the support, under the bolthead.

NOTE: Ensure actuator slides on rails from front to rear without interference.

Subtask 72-35-00-430-062:

(4) Install the No. 3 bearing cooling air elbow as follows.

NOTE: See PW4ENG 72-244 for the correct No. 3 bearing cooling air elbow to be used with the No. 3 bearing front cooling duct assembly.

(a) Install the new gasket to the opening on the HPC rear case behind Flange J and at approximately 5 o'clock position. Apply Paraffin Wax P05-059 to hold the gasket in place. Install the elbow with the threaded opening to the front and attach with the four bolts, threads lubricated with Engine Oil P03-001. Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). Do not loosen the bolts. Torque the bolts again to the same limit until the torque is held. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(b) Install the washer and adapter, threads lubricated with Engine Oil P03−001. Torque the adapter to the elbow to 450 − 550 lb−in. (50.843 − 62.142 N.m).

Subtask 72−35−00−430−063:

(5) Install the fuel/oil cooler as follows. See Figure 1003.

(a) Put the cooler on a bench with the bolted end to the left. Remove all the protective closures.

(b) Install the oil cooler bypass valve with the gasket, lubricated with Engine Oil P03−001. The electrical connectors must be to the right. Attach the valve with the four bolts, threads lubricated with Engine Oil P03−001, and washers. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(c) Install the packings, plug, and adapters to the oil bypass valve as follows.

1 Install the packings, lubricated with Engine Oil P03−001, to the plug and adapters. Lubricate the threads of the plug and adapters with Engine Oil P03−001.

2 Install the adapter (1004/1) and torque to 375 − 425 lb−in. (42.369 − 48.019 N.m).

3 Install the plug (1003/2) and torque to 110 − 120 lb−in. (12.428 − 13.558 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

4 Install the adapter (1003/3) and torque to 650 − 750 lb−in. (73.440 − 84.739 N.m).

5 Install the adapter (1003/4) and torque to 110 − 120 lb−in. (12.428 − 13.558 N.m).

(d) Install the packings, plugs and adapters to the cooler as follows.

1 Install the packings, lubricated with Engine Oil P03−001, to the plugs and adapters. Lubricate the threads of the plugs and adapters with Engine Oil P03−001.

2 Install three adapters (1003/5) to each end of the cooler. Torque the adapters to 650 − 750 lb−in. (73.440 − 84.739 N.m).

3 Install the adapter (1003/6) to the port on the front of the cooler. Torque the adapter to 110 − 120 lb−in. (12.428 − 13.558 N.m).

4 Install the elbow (1003/8) to the angled port on the front of the cooler. Tighten the elbow handtight only. Torque the elbow when the airframe drain tube is installed.

5 Install the plug (1003/9) to the open port closet to the fuel inlet port. Torque the plug to 375 − 426 lb−in. (42.369 − 48.019 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

6 Install the two plugs (1003/10) to the remaining two ports. Torque the plugs to 110 − 120 lb−in. (12.482 − 13.558 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(e) Remove the four bolts and washers that will attach the two brackets to the front of the cooler. Attach the brackets to the cooler with the same four bolts. Do not use the washers when the brackets are installed. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) For engines without the front split mount bracket (Pre SB PW4ENG 79−20), install the pin, threads lubricated with Engine Oil P03−001, washer, and nut to front ear of cooler. Torque the nut to 550 − 750 lb−in. (62.142 − 84.739 N.m) and align the cotter pin hole. Install the cotter pin. Install the cooler to the engine and engage the pin to the front mount bracket bearing. Attach the rear of the cooler with one loop clamp bracket, three washers, and four bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 180 − 200 lb−in. (20.337 − 22.597 N.m).

(g) For engines with the front split mount bracket (Post SB PW4ENG 79−20), install the bracket retainer, the pin, threads lubricated with Engine Oil P03−001, washer, and nut. Torque the nut to 550 − 750 lb−in. (62.142 − 84.739 N.m) and align the cotter pin hole. Install the cotter pin. Install the front oil cooler bracket to the pin and engage the retainer. Install the cooler to the engine. Attach the front mount with two R bolts, threads lubricated with Antiseize Paste R P06−054. Wipe off unwanted paste. Torque the bolts to 125 − 140 lb−in. (14.123 − 15.818 N.m). Install the loop clamp bracket, three washers, and four bolts, threads lubricated with Engine Oil P03−001, that attach the rear of the cooler. Torque the bolts to 180 − 200 lb−in. (20.337 − 22.597 N.m).

Subtask 72−35−00−430−064:

(6) Install the left and right 9th stage start/stability (2.9) bleed valves. See Figure 1004.

(a) Install a gasket on the tube adapter for each bleed valve. Lubricate the adapter threads with Engine Oil P03−001. Install the adapters to the valves and torque to 110 − 120 lb−in. (12.428 − 13.558 N.m).

CAUTION: WHEN YOU USE THE PWA 85436 TORQUE ADAPTER, THE TORQUE WRENCH INDICATION IS LESS THAN THE CORRECT TORQUE. SEE STANDARD TORQUES IN THE STANDARD PRACTICES MANUAL.

(b) Install a gasket to each opening on the HPC rear case at 10 o'clock and 1 o'clock positions. Install and attach each bleed valve and brackets with eight bolts, threads lubricated with Engine Oil P03−001. Use PWA 85436 Torque Adapter to tighten and torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Do not loosen the bolts. Torque again to the same limit until torque is held.

(c) If equipped remove the protection cover from the boss on the side of each bleed valve. Install the cover to the boss and attach with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

Subtask 72−35−00−430−065:

(7) Install the left and right turbine vane and blade cooling air valves. See Figure 1005.

(a) Install a gasket on the tube adapter for each cooling air valve. Lubricate the adapter threads with Engine Oil P03−001. Install the adapters to the valves and torque to 110 − 120 lb−in. (12.428 − 13.558 N.m).

NOTE: There are seven bolts which attach the valve to the case; Make sure you use the longer bolts for the bracket location on the valve.

(b) (Pre SB PW4ENG 75−147) Install a gasket to each opening on the HPC rear case at 10 o'clock and 3 o'clock positions. Apply Paraffin Wax P05−059 to hold the gaskets in position. Install and attach each cooling air valve and brackets with seven bolts, threads lubricated with Engine Oil P03−001. Tighten and torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Do not loosen the bolts. Torque again to the same limit until torque is held. See Figure 1005.

NOTE: There are seven bolts which attach the valve to the case; Make sure you use the longer bolts for the bracket location on the valve.

(c) (Post SB PW4ENG 75−147) Install a gasket to each opening on the HPC rear case at 10 o'clock and 3 o'clock positions. Apply Paraffin Wax P05−059 to hold the gaskets in position. Install and attach each cooling air valve and brackets with seven bolts, threads lubricated with Engine Oil P03−001. Tighten and torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Do not loosen the bolts. Torque again to the same limit until torque is held. See Figure 1005 (Sheet 1) and Figure 1005 (Sheet 2).

NOTE: Ring case configuration compressor (SB PW4ENG 72−756 or SB PW4ENG 72−759) has a foolproofing pin on the valve flange to prevent (Pre SB PW4ENG 75−147) valves installed on (RCC) compressor.

(d) If valve has the position switch, position turbine vane and blade cooling air valve position switch to turbine vane and blade cooling air valve aligning bolt holes for proper positioning. See Figure 1005.

NOTE: (Post SB PW4ENG 75−107) and (Post SB PW4ENG 72−756) engines do not have a position switch.

(e) Secure position switch to valve with bolts, threads lubricated with Engine Oil P03−001. Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(f) Remove protective closures. Connect W4P21 harness connector to connector on position switch.

CAUTION: ENSURE SPECIFIED TORQUE WRENCH READING IS ADHERED TO. INCORRECT CONNECTOR TORQUE COULD RESULT IN CONNECTOR DAMAGE AND INADEQUATE LIGHTNING PROTECTION.

1 (Reference 2156) Tighten and torque connector to 30 − 35 lb−in. (3.390 − 3.954 N.m) and secure with lockwire.

(g) (Reference 760) If necessary, remove the shipping cotter pin and tag from the face of the switch.

Subtask 72−35−00−430−066:

(8) Install left and right HPC secondary−flow control valves. See Figure 1006.

NOTE: (Post SB PW4ENG 72−756) engines do not have the left and right HPC secondary flow control valve.

(a) Install a gasket on the plug for each control valve. Lubricate the plug threads with Engine Oil P03−001. Install the plug and gasket to the opening of each valve as shown in the figure. Torque the plugs to 110 − 120 lb−in. (12.428 − 13.558 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(b) Install a gasket on the tube adapter for each control valve. Lubricate the adapter threads with Engine Oil P03−001. Install the adapter and gasket to the opening of each valve as shown in the figure. Torque the adapters to 110 − 120 lb−in. (12.428 − 13.558 N.m).

(c) Install a cap assembly (Pre SB PW4ENG 75−85), threads lubricated with Engine Oil P03−001, onto the adapter. Torque the cap assembly to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to the cap assembly.

(d) Install the vented cover to the port adjacent to the plug (with the drilled vent holes towards the mounting flange) on each valve. Install the bracket (Post SB PW4ENG 72−211 only) with the vented cover on the left valve as shown in the figure. Attach each vented cover and bracket with three bolts, lubricated with Engine Oil P03−001. Tighten and torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 cover bolts which have provisions.

(e) Install a gasket to each opening on the HPC rear case at 2:20 o'clock and 9:30 o'clock positions. Apply Paraffin Wax P05−059 to hold the gaskets in position. Install and attach each control valve with six bolts, the threads lubricated with Engine Oil P03−001. Install a bracket (Post SB PW4ENG 79−52) to the lower flange of the left side secondary flow control valve. Tighten and torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Do not loosen the bolts. Torque again to the same limit until torque is held.

Subtask 72−35−00−430−072:

(9) Install two filters to Flange J bracket at approximately 2 o'clock position with bolts, threads lubricated with Engine Oil P03−001, and nuts. See Figure 1007. Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(10) Install two filters to Flange J bracket approximately 11 o'clock position with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

Subtask 72−35−00−430−073:

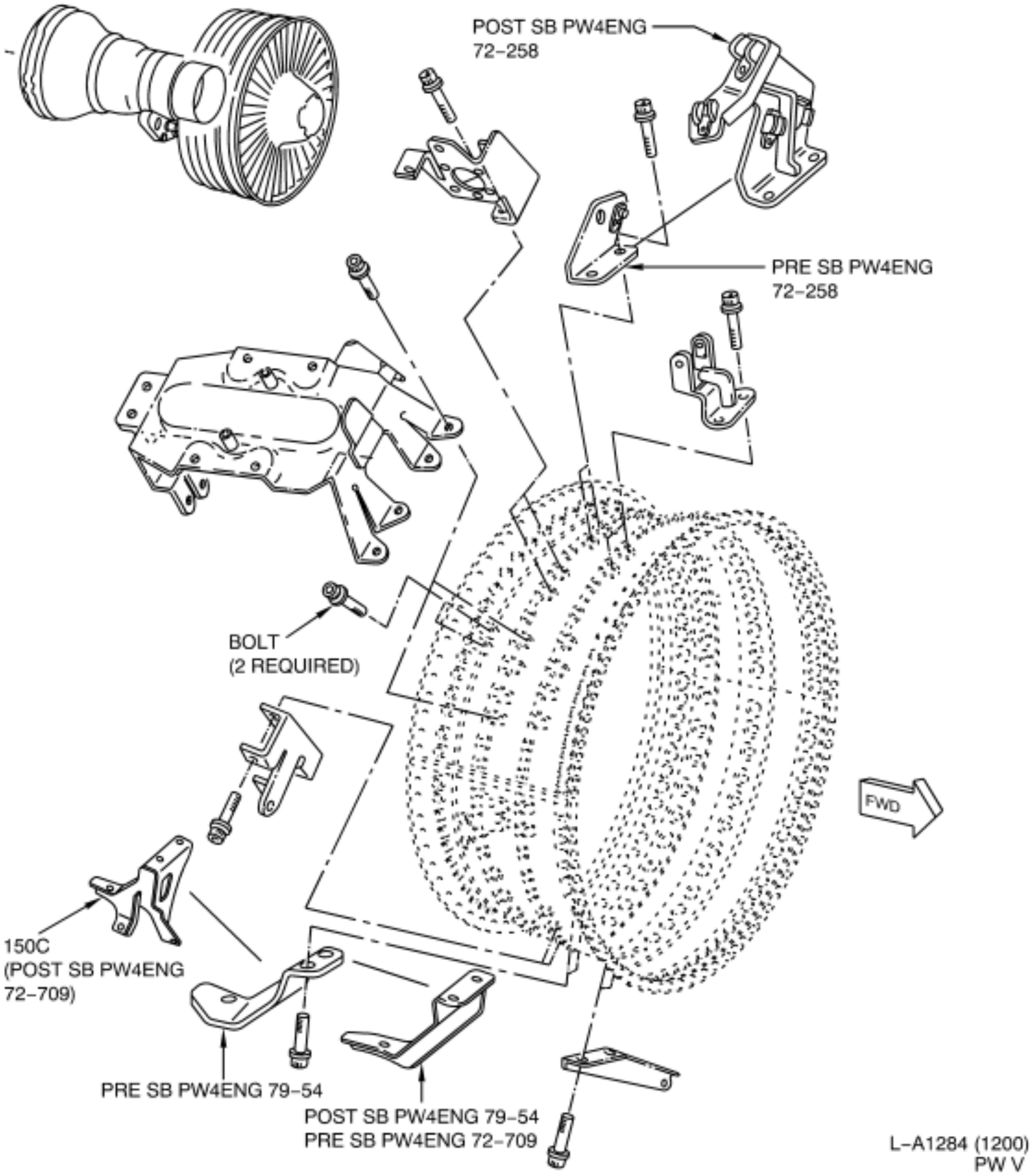
(11) Install brackets to compressor stator cylinder support assembly with bolts, threads lubricated with Engine Oil P03−001, washers, and nuts. See Figure 1008. Torque bolts (1008/1), (1008/2), (1008/3), and (1008/5) to 85 − 95 lb−in. (9.604 − 10.734 N.m). Torque bolts (1008/4) to 180 − 200 lb−in. (20.337 − 25.597 N.m). Torque bolts (1008/6) and (Post SB PW4ENG 73−63) bolts (1008/7) to 36 − 40 lb−in. (4.067 − 4.519 N.m).

NOTE: Do not torque (1008/5) bolts until installation of fuel flowmeter.

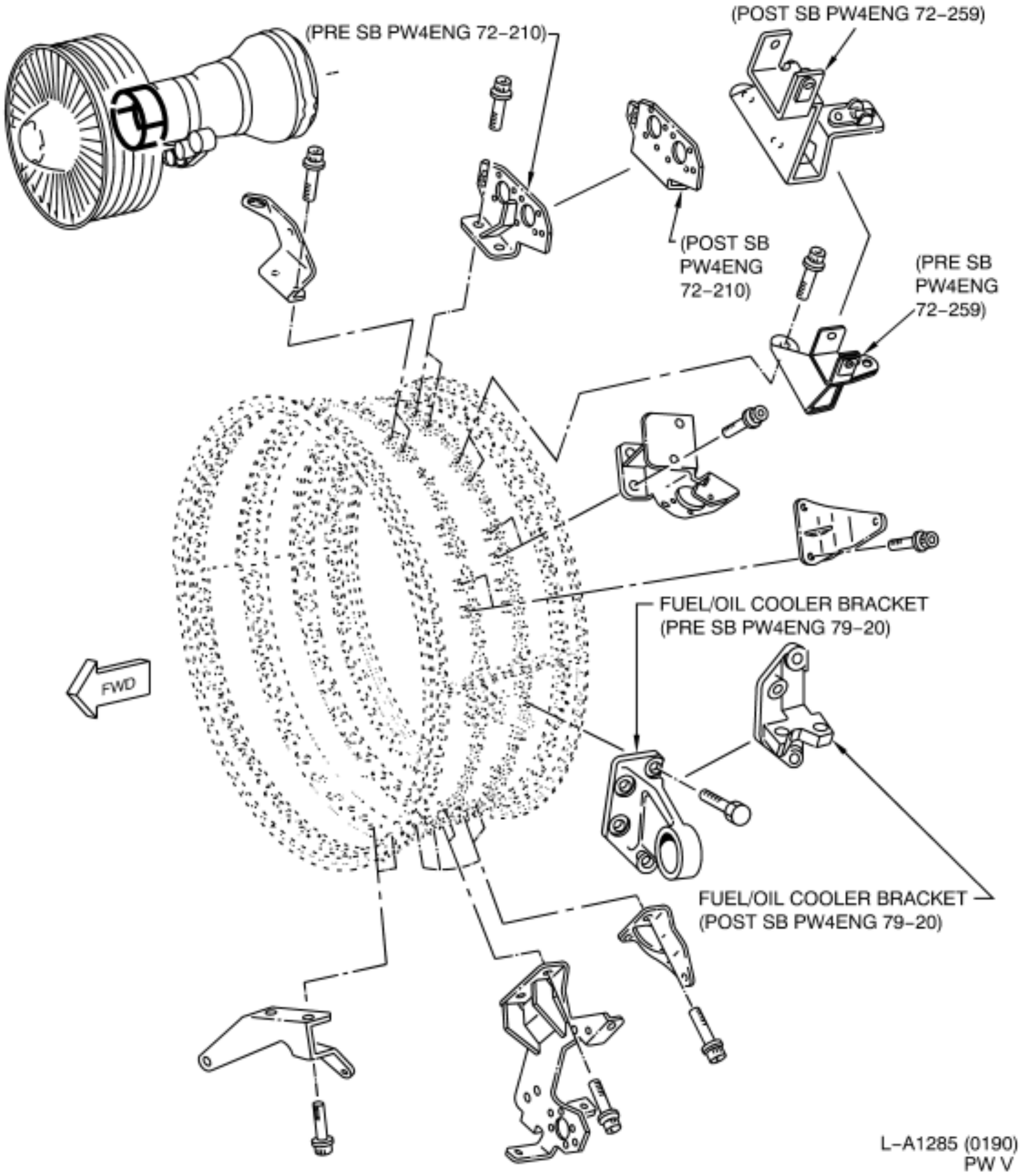
Subtask 72−35−00−430−074:

(12) Locate two hole boss on HPC front case approximately 12 inches (304.800 mm) from front leading edge and at approximately 2 o'clock location. Install two bolts, threads lubricated with Engine Oil P03−001. Tighten and torque bolts to 180 − 200 lb−in. (20.337 − 22.597 N.m). Refer to Figure 1001 (Sheet 1).

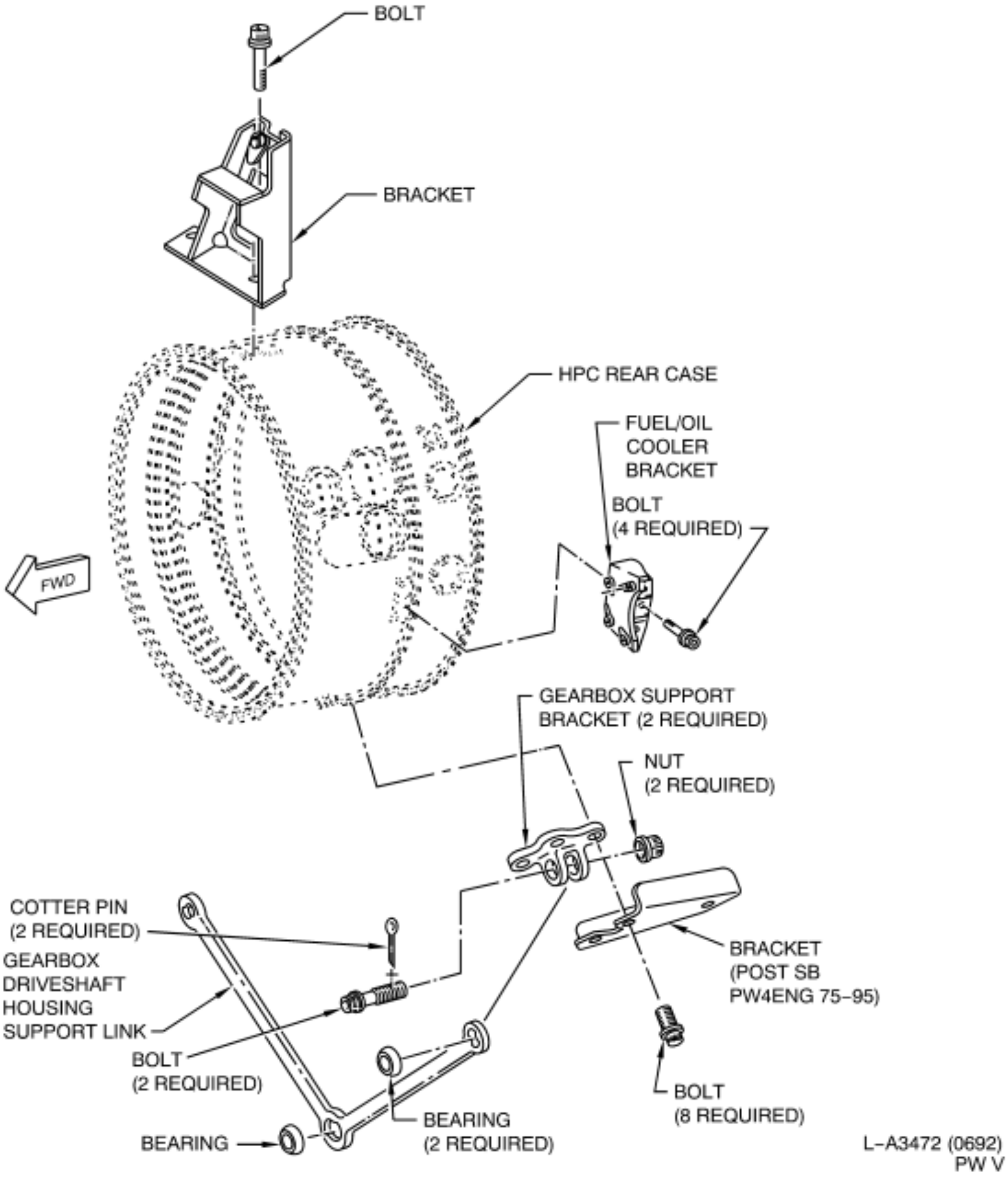
(13) If engine has the ring case configuration, make sure the identification plate has the "RC" after the serial number. The HPC rotor and stator identification plate is located on Flange J at approximately 2:30 o'clock position. See Figure 1009.


POST SB PW4ENG 72−258
PRE SB PW4ENG 72−258
BOLT (2 REQUIRED)
FWD
150C (POST SB PW4ENG 72−709)
PRE SB PW4ENG 79−54
POST SB PW4ENG 79−54
PRE SB PW4ENG 72−709
L−A1284 (1200)
PW V

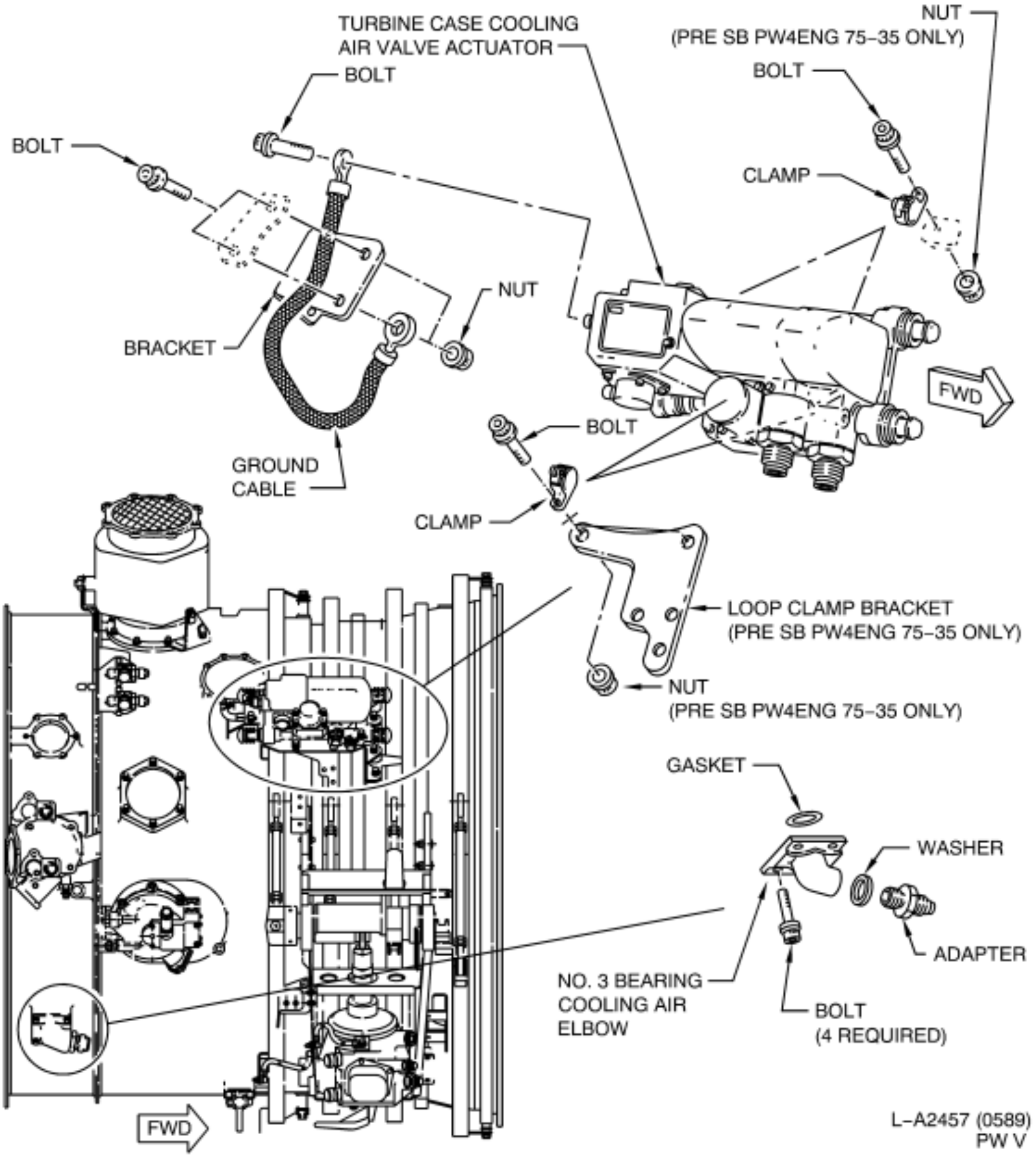
HPC Case Bracket Locations (Front)
Figure 1001 (Sheet 1)
(Task 72−35−00−400−004)


(PRE SB PW4ENG 72-210)
(POST SB PW4ENG 72-259)
(POST SB PW4ENG 72-210)
(PRE SB PW4ENG 72-259)
FWD
FUEL/OIL COOLER BRACKET (PRE SB PW4ENG 79-20)
FUEL/OIL COOLER BRACKET (POST SB PW4ENG 79-20)
L-A1285 (0190)
PW V

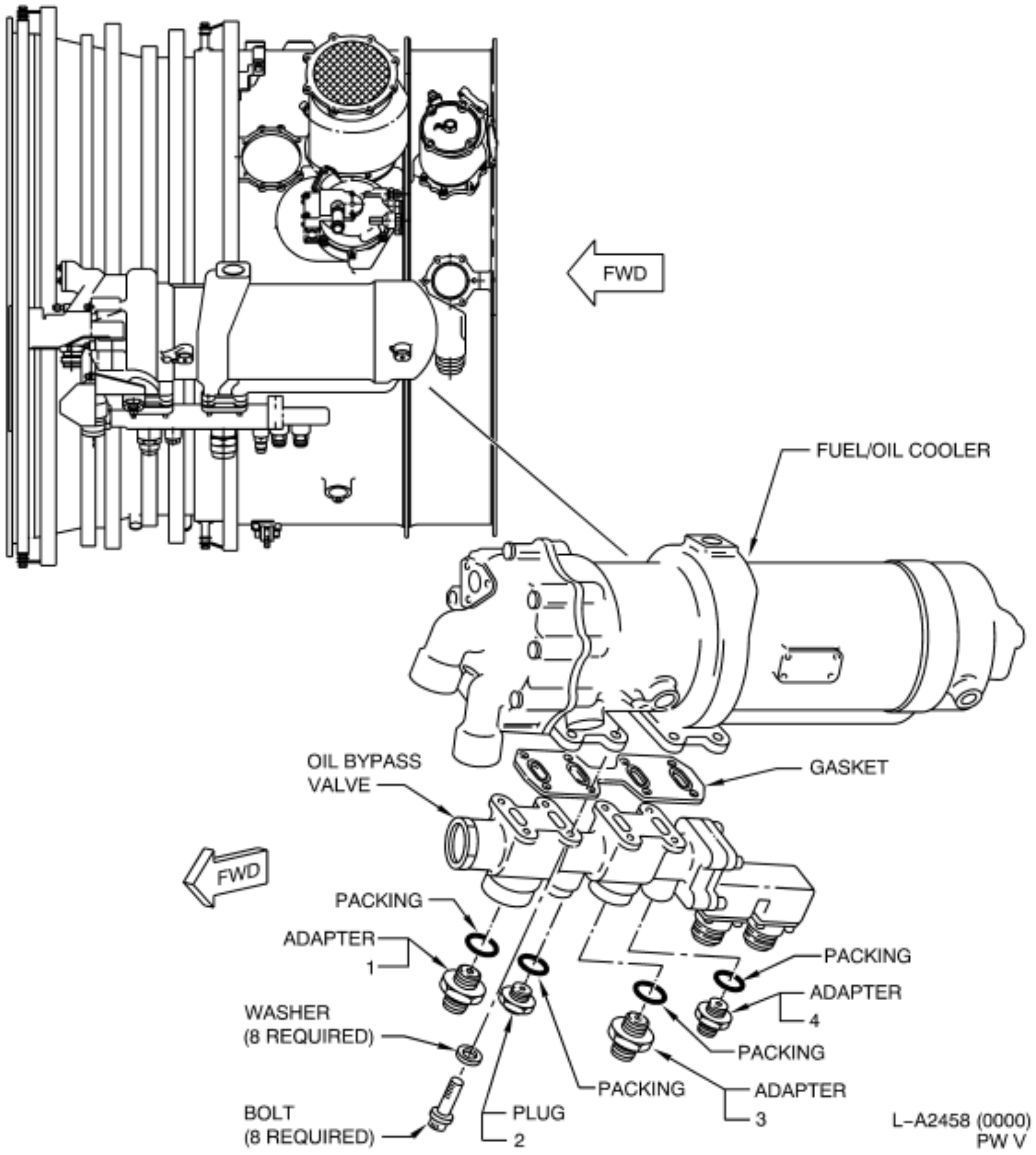
HPC Case Bracket Locations (Front)
Figure 1001 (Sheet 2)
(Task 72-35-00-400-004)


BOLT
BRACKET
HPC REAR CASE
FUEL/OIL COOLER BRACKET
BOLT (4 REQUIRED)
FWD
GEARBOX SUPPORT BRACKET (2 REQUIRED)
NUT (2 REQUIRED)
COTTER PIN (2 REQUIRED)
GEARBOX DRIVESHAFT HOUSING SUPPORT LINK
BRACKET (POST SB PW4ENG 75-95)
BOLT (2 REQUIRED)
BOLT (8 REQUIRED)
BEARING
BEARING (2 REQUIRED)
L-A3472 (0692)
PW V

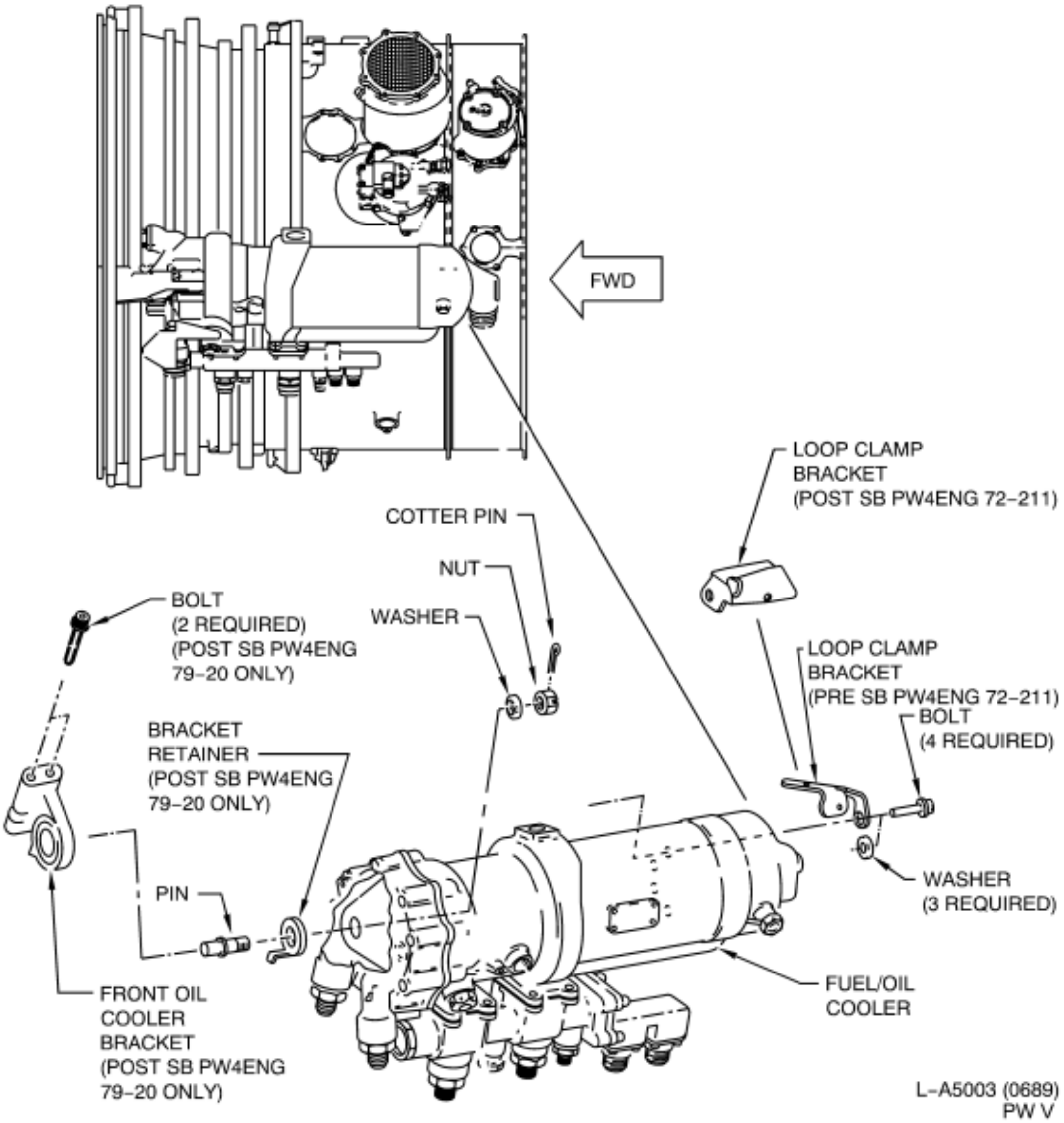
HPC Case Bracket Locations (Rear)
Figure 1001 (Sheet 3)
(Task 72−35−00−400−004)


TURBINE CASE COOLING AIR VALVE ACTUATOR
NUT (PRE SB PW4ENG 75-35 ONLY)
BOLT
BOLT
BOLT
CLAMP
NUT
BRACKET
FWD
BOLT
GROUND CABLE
CLAMP
LOOP CLAMP BRACKET (PRE SB PW4ENG 75-35 ONLY)
NUT (PRE SB PW4ENG 75-35 ONLY)
GASKET
WASHER
ADAPTER
NO. 3 BEARING COOLING AIR ELBOW
BOLT (4 REQUIRED)
FWD
L-A2457 (0589)
PW V

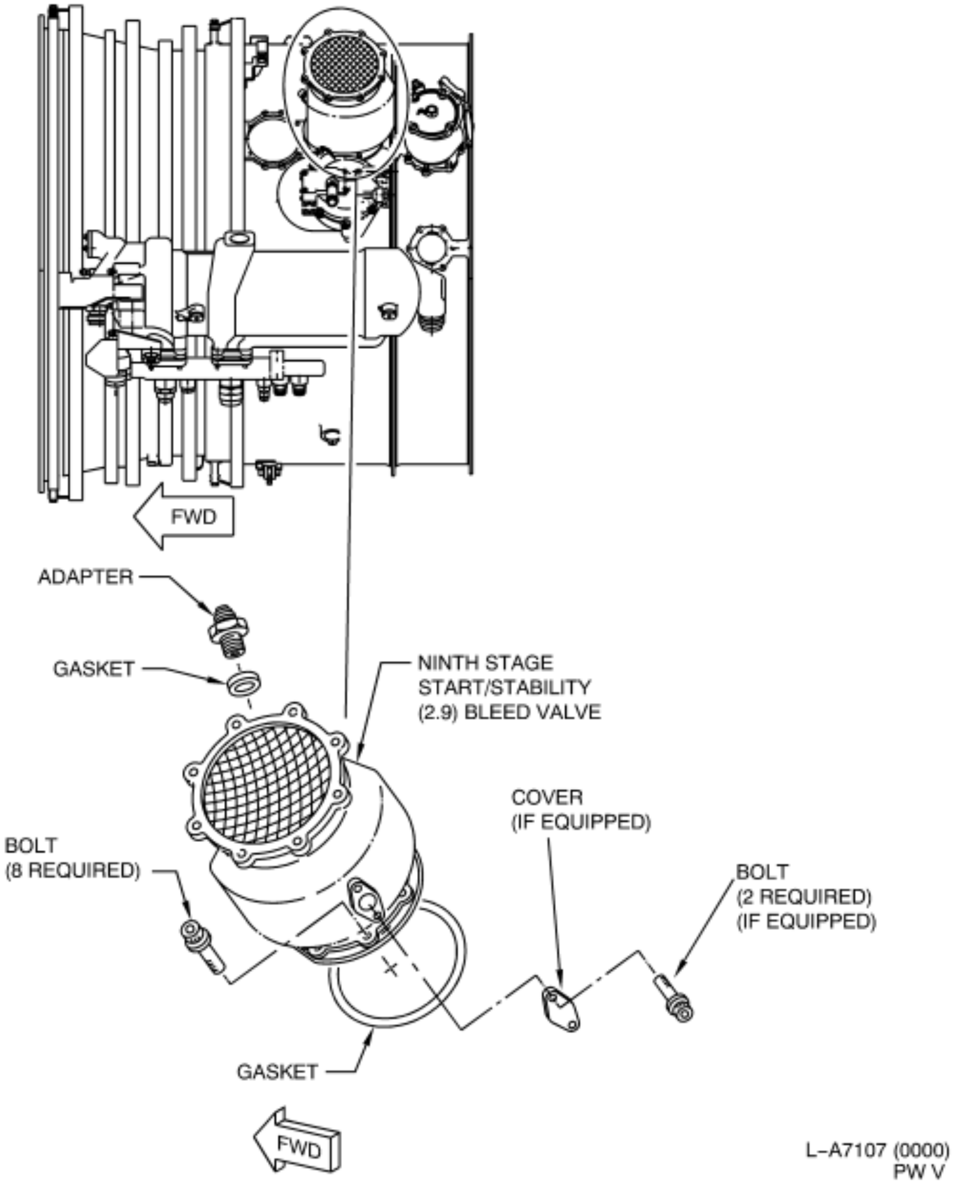
Turbine Case Cooling Air Valve Actuator
Figure 1002
(Task 72−35−00−400−004)


FWD
FUEL/OIL COOLER
OIL BYPASS VALVE
GASKET
FWD
PACKING
ADAPTER 1
WASHER (8 REQUIRED)
BOLT (8 REQUIRED)
PLUG 2
PACKING
PACKING
ADAPTER 4
PACKING
ADAPTER 3
L-A2458 (0000)
PW V

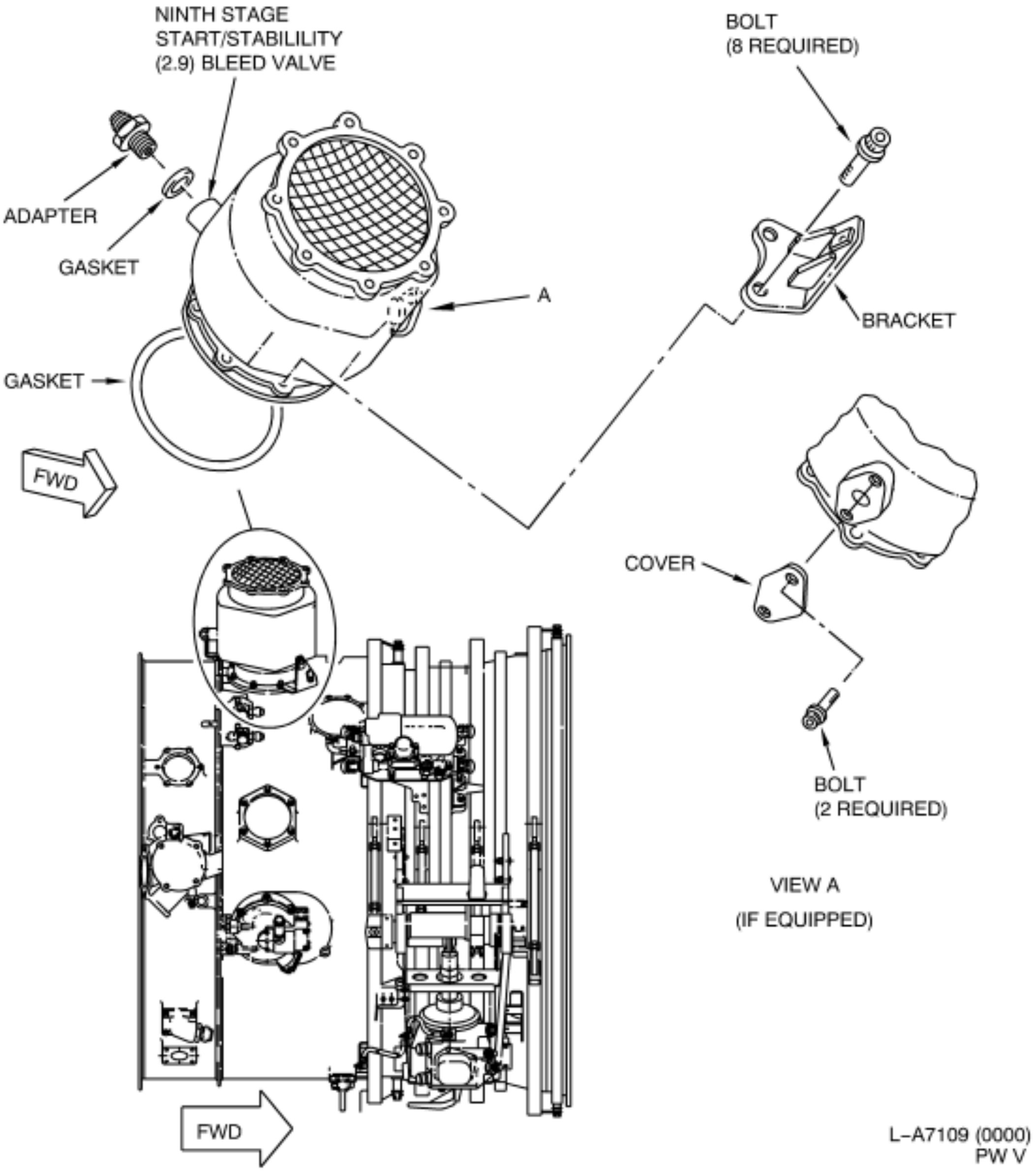
Fuel/Oil Cooler And Bypass Valve
Figure 1003 (Sheet 1)
(Task 72-35-00-400-004)


FWD
LOOP CLAMP BRACKET (POST SB PW4ENG 72-211)
COTTER PIN
NUT
WASHER
BOLT (2 REQUIRED) (POST SB PW4ENG 79-20 ONLY)
LOOP CLAMP BRACKET (PRE SB PW4ENG 72-211)
BOLT (4 REQUIRED)
BRACKET RETAINER (POST SB PW4ENG 79-20 ONLY)
WASHER (3 REQUIRED)
PIN
FUEL/OIL COOLER
FRONT OIL COOLER BRACKET (POST SB PW4ENG 79-20 ONLY)
L-A5003 (0689)
PW V

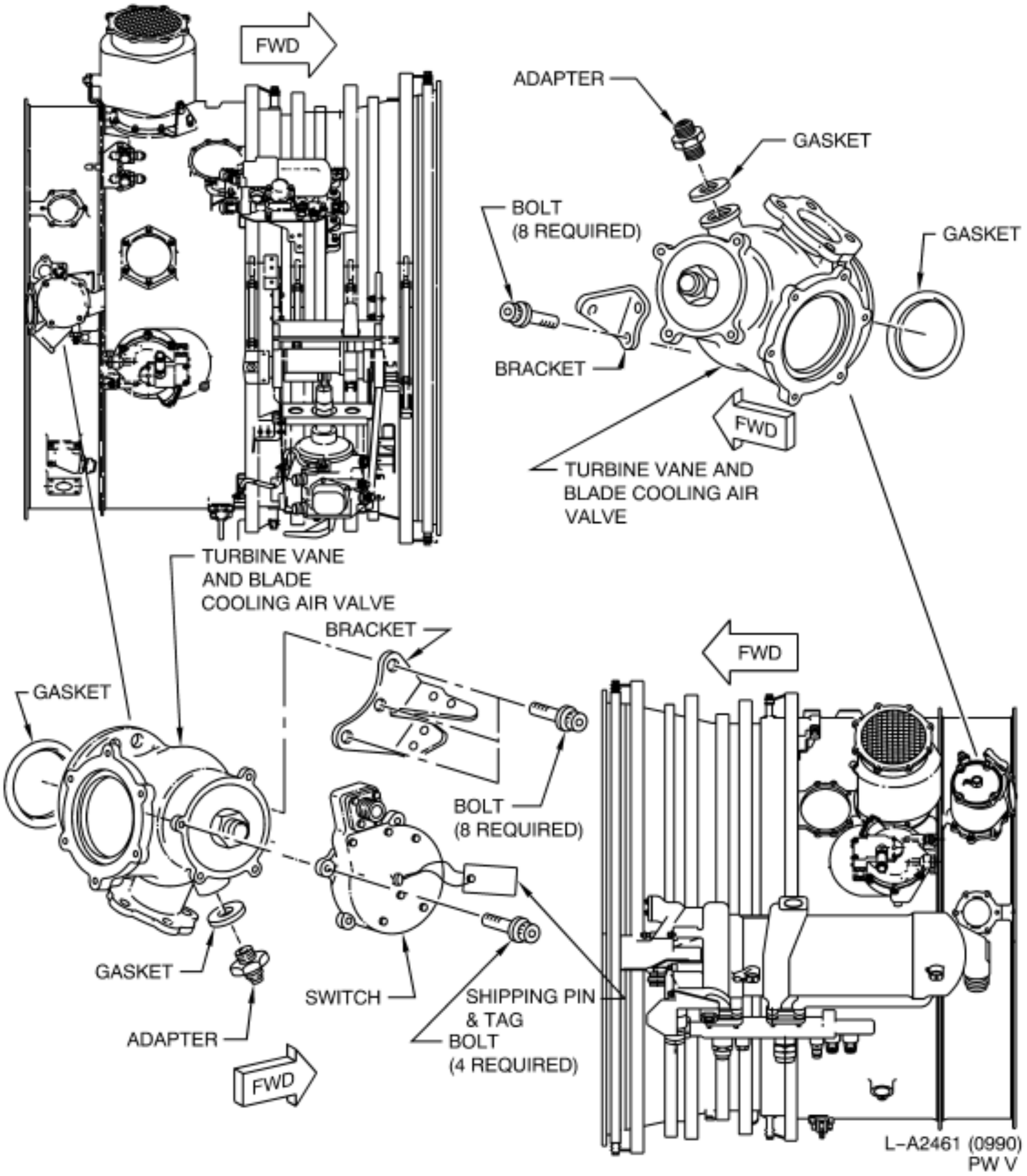
Fuel/Oil Cooler And Bypass Valve
Figure 1003 (Sheet 2)
(Task 72-35-00-400-004)


FWD
ADAPTER
GASKET
NINTH STAGE
START/STABILITY
(2.9) BLEED VALVE
COVER
(IF EQUIPPED)
BOLT
(8 REQUIRED)
BOLT
(2 REQUIRED)
(IF EQUIPPED)
GASKET
FWD
L−A7107 (0000)
PW V

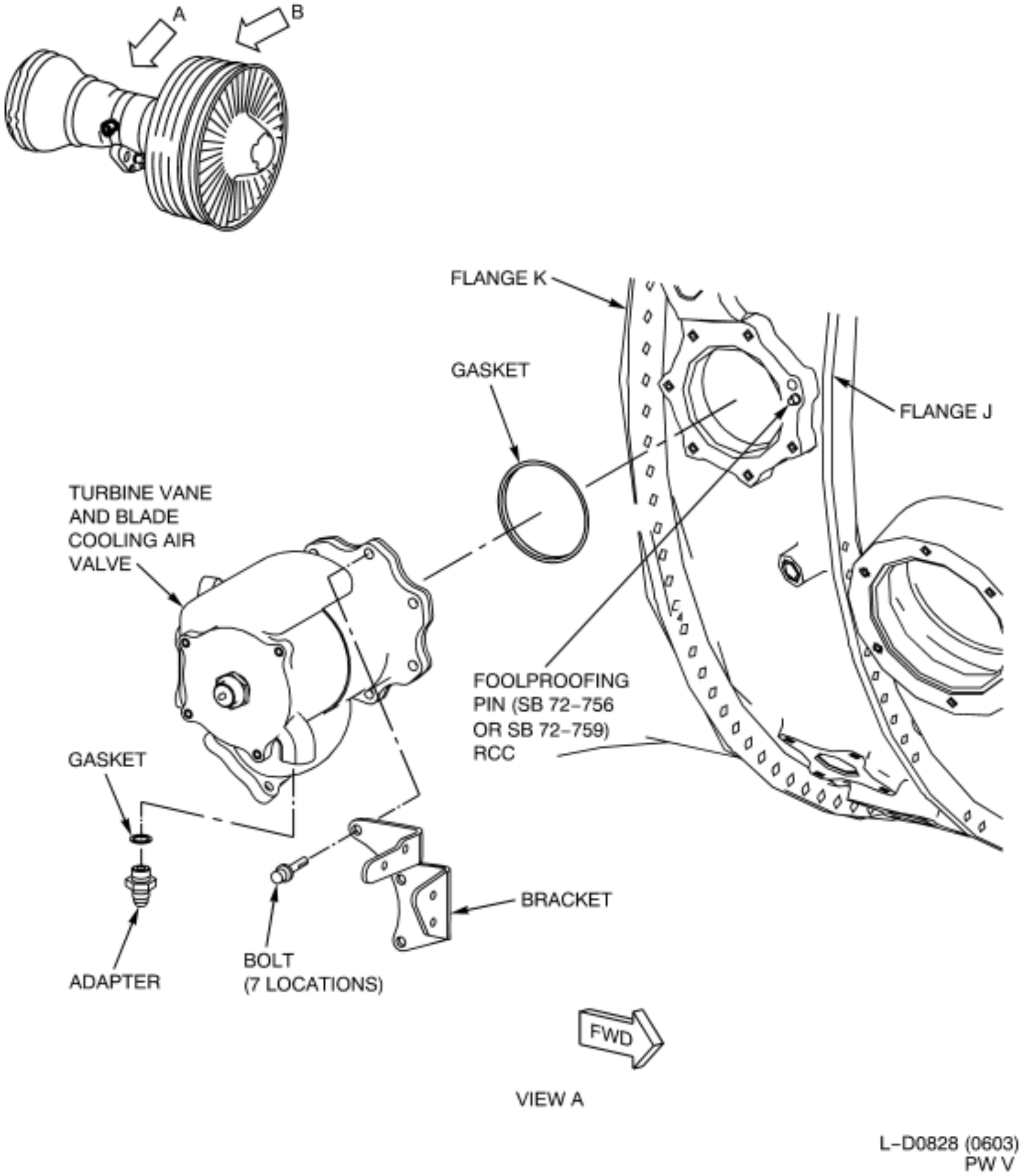
Ninth Stage Start/Stability (2.9) Bleed Valve
Figure 1004 (Sheet 1)
(Task 72−35−00−400−004)


NINTH STAGE START/STABILILITY (2.9) BLEED VALVE
BOLT (8 REQUIRED)
ADAPTER
GASKET
A
BRACKET
GASKET
FWD
COVER
BOLT (2 REQUIRED)
VIEW A
(IF EQUIPPED)
FWD
L-A7109 (0000)
PW V

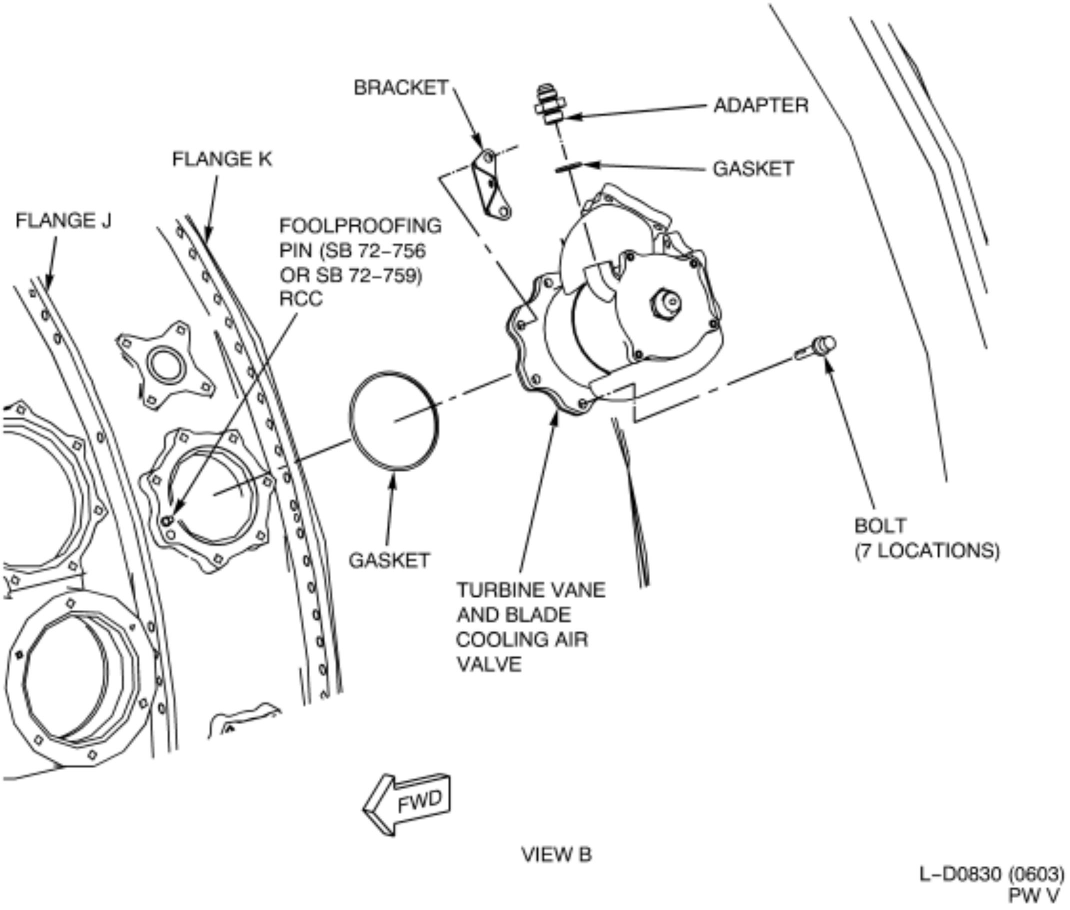
Ninth Stage Start/Stability (2.9) Bleed Valve
Figure 1004 (Sheet 2)
(Task 72-35-00-400-004)


FWD
ADAPTER
GASKET
BOLT
(8 REQUIRED)
GASKET
BRACKET
FWD
TURBINE VANE AND
BLADE COOLING AIR
VALVE
TURBINE VANE
AND BLADE
COOLING AIR VALVE
BRACKET
FWD
GASKET
BOLT
(8 REQUIRED)
GASKET
SWITCH
SHIPPING PIN
& TAG
BOLT
(4 REQUIRED)
ADAPTER
FWD
L-A2461 (0990)
PW V

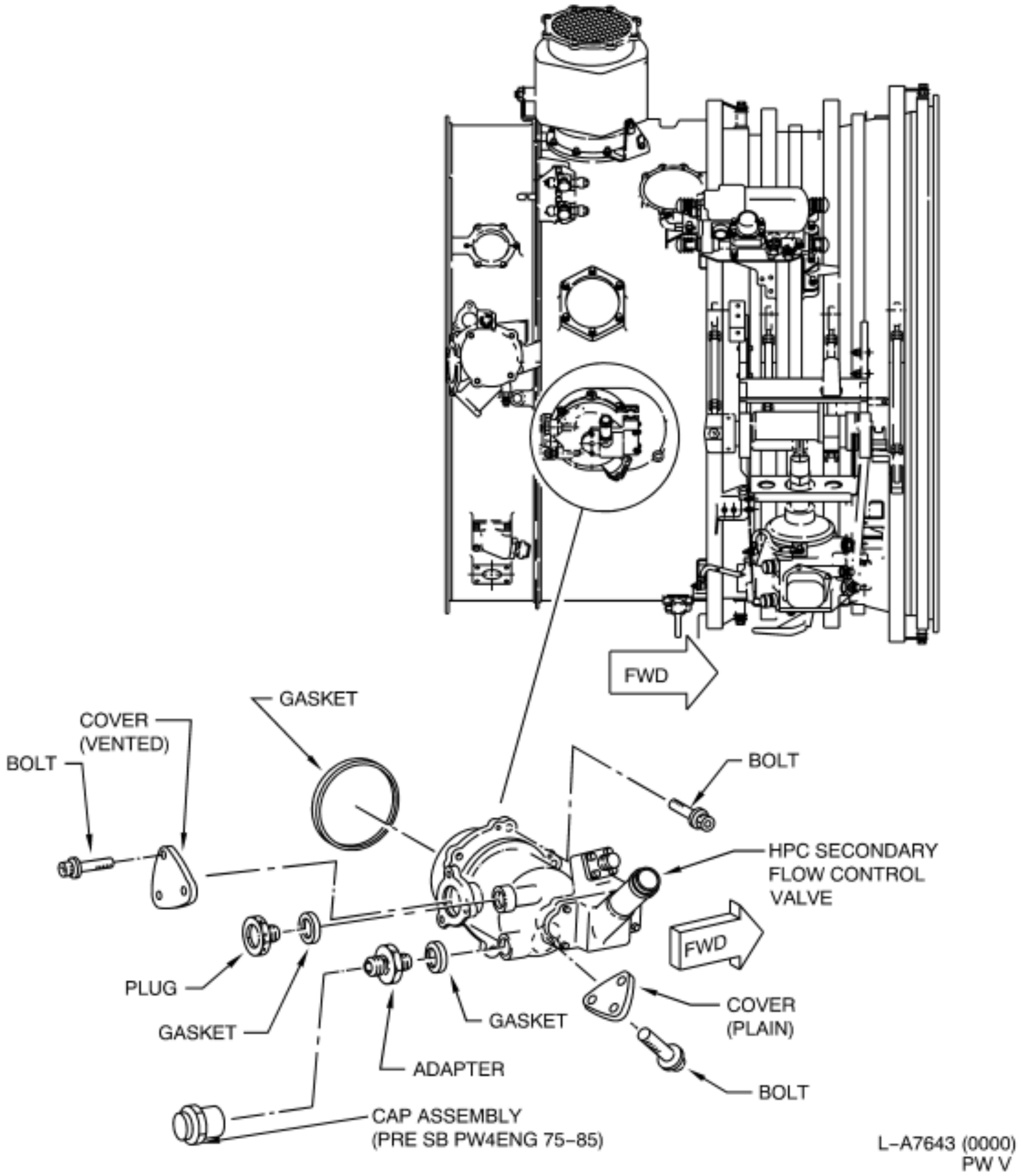
Turbine Vane And Blade Cooling Air Valves
Figure 1005 (Sheet 1)
(Task 72-35-00-400-004)


A
B
FLANGE K
GASKET
FLANGE J
TURBINE VANE AND BLADE COOLING AIR VALVE
FOOLPROOFING PIN (SB 72-756 OR SB 72-759) RCC
GASKET
BRACKET
ADAPTER
BOLT (7 LOCATIONS)
FWD
VIEW A
L-D0828 (0603)
PW V

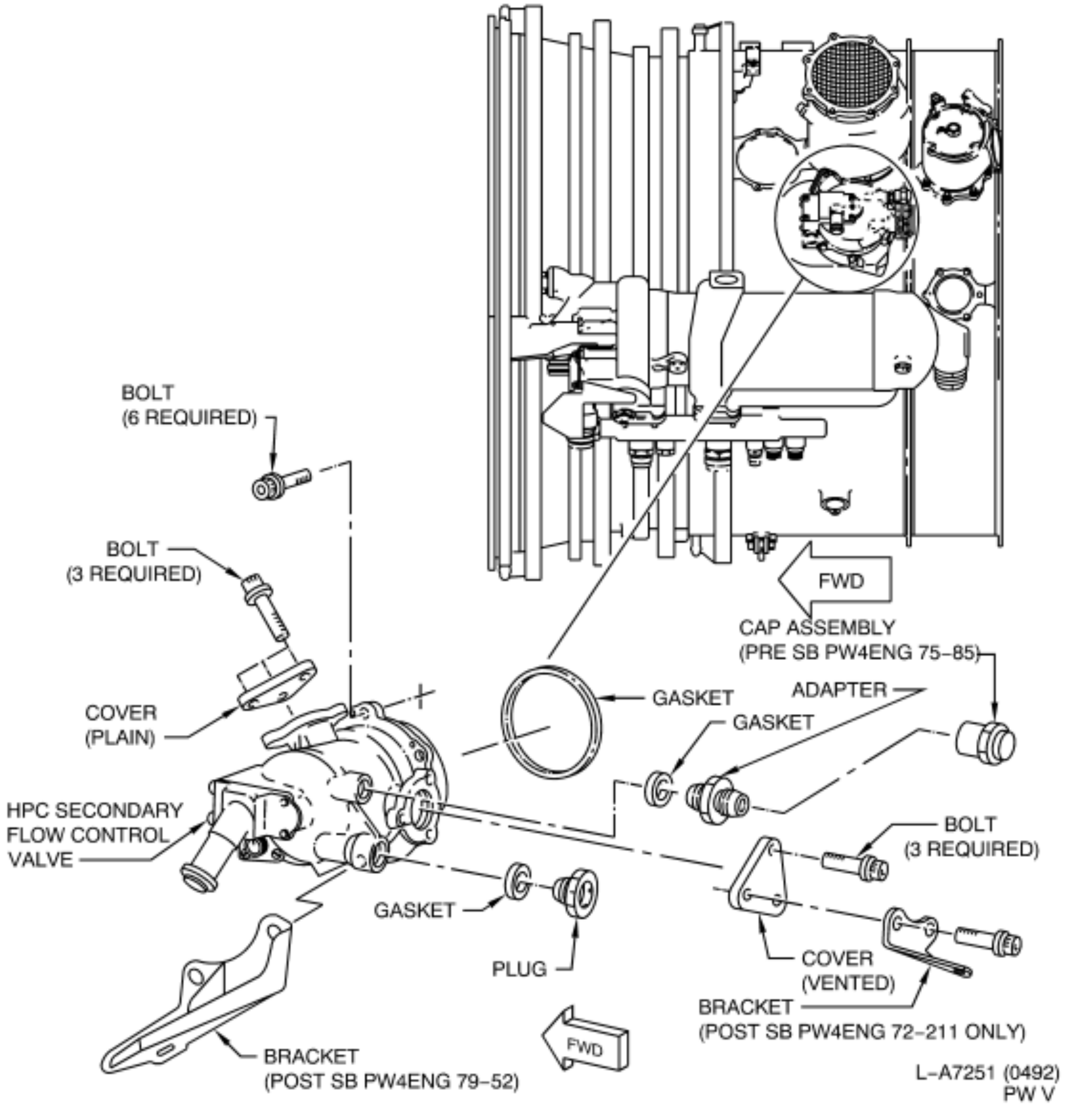
Turbine Vane And Blade Cooling Air
Valve (Right) (Post SB PW4ENG 75-147)
Figure 1005 (Sheet 2)
(Task 72-35-00-400-004)


BRACKET
ADAPTER
GASKET
FLANGE K
FLANGE J
FOOLPROOFING PIN (SB 72−756 OR SB 72−759) RCC
GASKET
TURBINE VANE AND BLADE COOLING AIR VALVE
BOLT (7 LOCATIONS)
FWD
VIEW B
L−D0830 (0603)
PW V

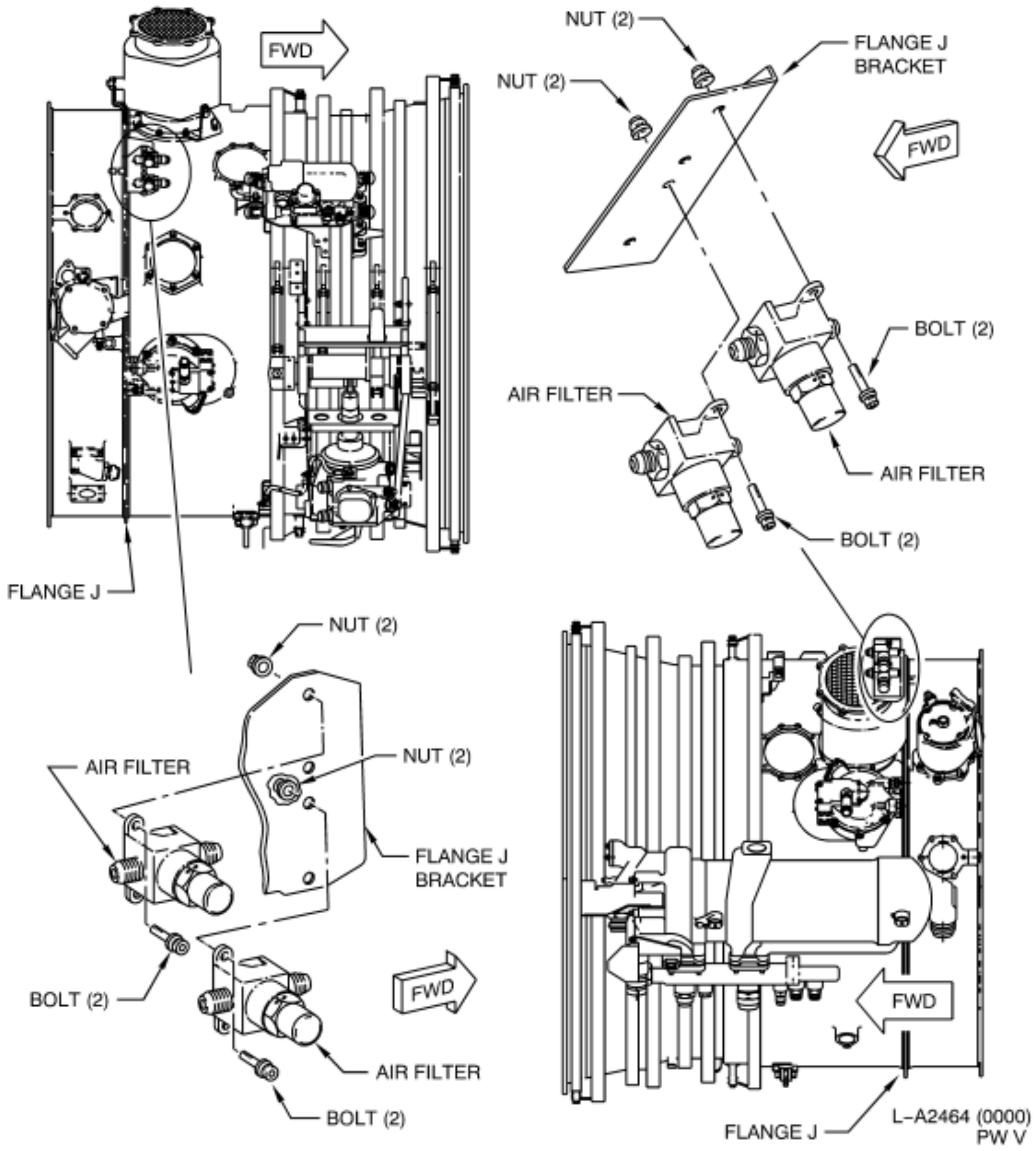
Turbine Vane And Blade Cooling Air
Valve (Left) (Post SB PW4ENG 75−147)
Figure 1005 (Sheet 3)
(Task 72−35−00−400−004)


FWD
GASKET
COVER
(VENTED)
BOLT
BOLT
HPC SECONDARY
FLOW CONTROL
VALVE
FWD
PLUG
GASKET
GASKET
COVER
(PLAIN)
ADAPTER
BOLT
CAP ASSEMBLY
(PRE SB PW4ENG 75−85)
L−A7643 (0000)
PW V

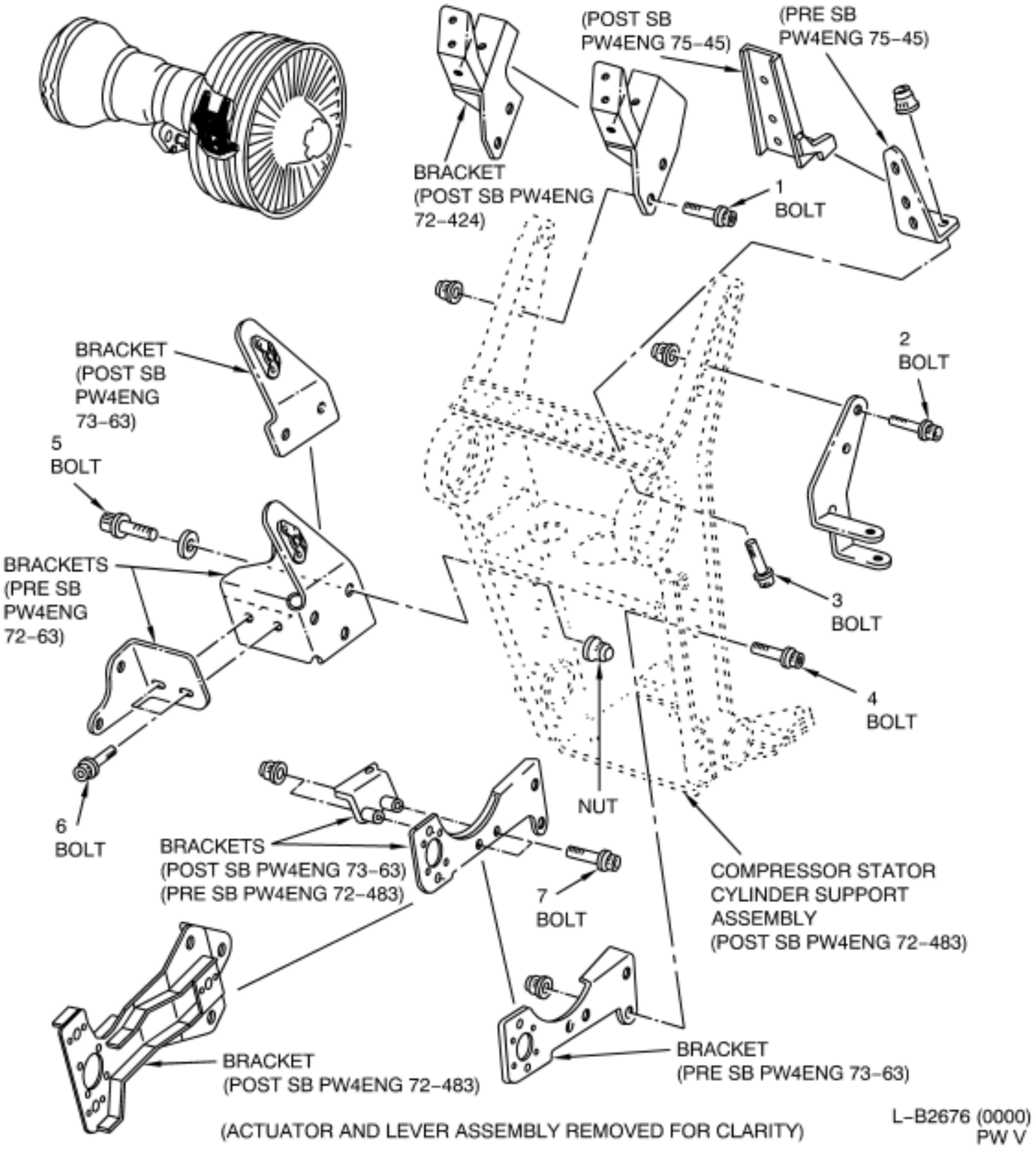
HPC Secondary Flow Control Valve (Right)
Figure 1006 (Sheet 1)
(Task 72−35−00−400−004)


BOLT
(6 REQUIRED)
BOLT
(3 REQUIRED)
COVER
(PLAIN)
HPC SECONDARY
FLOW CONTROL
VALVE
GASKET
PLUG
BRACKET
(POST SB PW4ENG 79−52)
FWD
FWD
CAP ASSEMBLY
(PRE SB PW4ENG 75−85)
GASKET
ADAPTER
GASKET
BOLT
(3 REQUIRED)
COVER
(VENTED)
BRACKET
(POST SB PW4ENG 72−211 ONLY)
L−A7251 (0492)
PW V

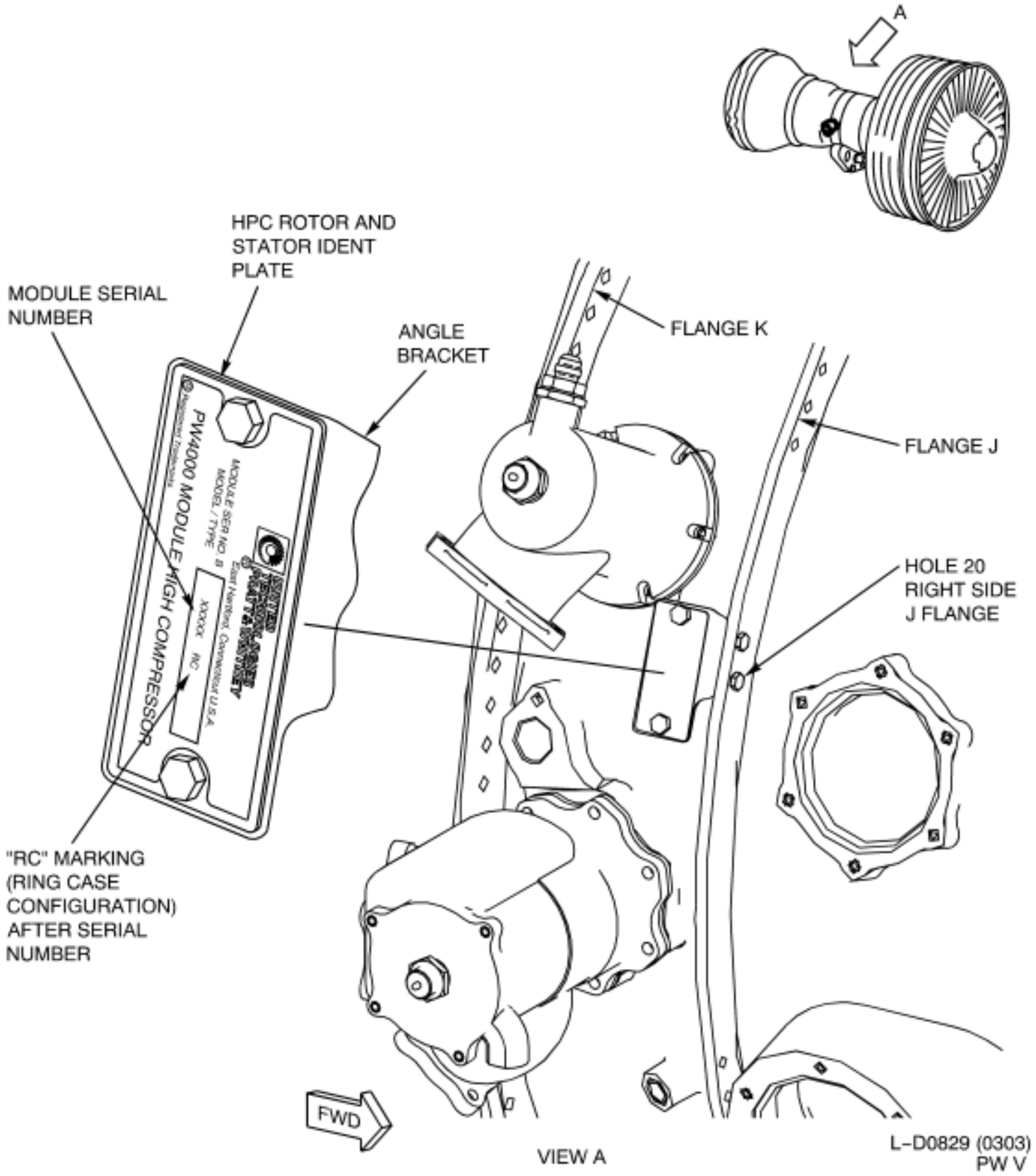
HPC Secondary Flow Control Valve (Left)
Figure 1006 (Sheet 2)
(Task 72−35−00−400−004)


FWD
NUT (2)
NUT (2)
FLANGE J BRACKET
FWD
BOLT (2)
AIR FILTER
AIR FILTER
BOLT (2)
FLANGE J
NUT (2)
AIR FILTER
NUT (2)
FLANGE J BRACKET
BOLT (2)
FWD
AIR FILTER
BOLT (2)
FWD
FLANGE J
L-A2464 (0000)
PW V

Turbine Vane And Blade Cooling Air And
HPC Secondary Flow Control Valve Filters
Figure 1007
(Task 72-35-00-400-004)


(POST SB
PW4ENG 75-45)
(PRE SB
PW4ENG 75-45)
BRACKET
(POST SB PW4ENG
72-424)
1
BOLT
2
BOLT
BRACKET
(POST SB
PW4ENG
73-63)
5
BOLT
BRACKETS
(PRE SB
PW4ENG
72-63)
3
BOLT
4
BOLT
6
BOLT
BRACKETS
(POST SB PW4ENG 73-63)
(PRE SB PW4ENG 72-483)
NUT
7
BOLT
COMPRESSOR STATOR
CYLINDER SUPPORT
ASSEMBLY
(POST SB PW4ENG 72-483)
BRACKET
(POST SB PW4ENG 72-483)
BRACKET
(PRE SB PW4ENG 73-63)
(ACTUATOR AND LEVER ASSEMBLY REMOVED FOR CLARITY)
L-B2676 (0000)
PW V

Compressor Stator Cylinder Support Bracket Locations
Figure 1008
(Task 72−35−00−400−004)


A
HPC ROTOR AND STATOR IDENT PLATE
MODULE SERIAL NUMBER
ANGLE BRACKET
FLANGE K
FLANGE J
HOLE 20 RIGHT SIDE J FLANGE
PW4000 MODULE HIGH COMPRESSOR
MODULE SER NO. B
MODEL / TYPE
XXXXX RC
East Hartford, Connecticut U.S.A.
"RC" MARKING (RING CASE CONFIGURATION) AFTER SERIAL NUMBER
FWD
VIEW A
L−D0829 (0303)
PW V

HPC Rotor and Stator Identification Plate (Ring Case Configuration) (Post SB PW4ENG 72−756 OR SB PW4ENG 72−759)
Figure 1009
(Task 72−35−00−400−004)

HIGH PRESSURE COMPRESSOR (HPC) - ASSEMBLY-04

Task 72-35-00-400-006:

1. Install HPC External Parts

A. Prerequisites

(1) Install and rig HPC stator vane actuator and lever assembly. See Assembly-03 Task 72-35-00-400-003.

B. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 85436 Torque Adapter

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-059	Wax, Paraffin (PMC 9552)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-002	Petrolatum White (PMC 9609)
R P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	2	72-35-00/30/250
Cotter Pin	1	79-21-00/5/80
Gasket	1	75-22-00/1/1
Gasket	2	75-24-00/1/1
Gasket	1	79-21-00/6/1
Packing	3	79-21-00/5/30
Packing	1	79-21-00/5/190
Packing	1	79-21-00/5/170
Packing	1	79-21-00/5/10

C. Procedure

HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−04

Subtask 72−35−00−430−085:

(1) Install the brackets to the HPC front and rear cases as follows. See Figure 1001.

- (a) Attach the fuel/oil cooler brackets to the HPC front and rear cases with the bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 180 − 200 lb−in. (20.337 − 22.597 N.m).
- (b) Attach the remaining HPC front case brackets with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).
- (c) Attach the bracket to the top of the HPC rear case with two bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).
- (d) Attach the two gearbox support brackets and a bracket to the HPC rear case with eight bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Safety the bolts with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.
- (e) Make sure the bearings are installed in the gearbox driveshaft housing support link. Install the support link and attach it with the two bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the nuts to 180 − 200 lb−in. (20.337 − 22.597 N.m). Install the cotter pins. Safety the bolt heads to the gearbox support bolt heads with lockwire. Temporarily attach the lower bearing to the link with lockwire.

(2) Install the Flange J hardware. Refer to 72−35−00, Assembly−20 (Task 72−35−00−430−020).

Subtask 72-35-00-430-086:

(3) Install the turbine case cooling air valve actuator to the bracket at the 2 o'clock position on the front HPC case. See Figure 1002. Make sure the bracket pins engage the holes in the actuator slide rails. Attach with four clamps and bolts, threads lubricated with Engine Oil P03-001. Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(a) (Reference 736) Install bracket and ground cable to rear of actuator bracket and attach with two bolts, threads lubricated with Engine Oil P03-001, and nuts handtight only.

NOTE: The two bolts that attach the bracket and cable to the actuator bracket are torqued after the installation of the bleed valve supply tubes (AA24), (AA28), and (AA30). See 72-00-35, Installation-03 Task 72-00-35-420-002.

(b) Install the bolt that attaches the ground cable to the actuator and torque the bolt to 85 - 95 lb-in. (9.604 - 10.734 N.m).

NOTE: Make sure the actuator moves easily on the rails from the front stop to the rear stop without interference.

Subtask 72-35-00-430-087:

(4) Install the No. 3 bearing cooling air elbow as follows. See Figure 1002.

(a) Install the new gasket to the opening on the HPC rear case behind Flange J and at approximately the 5 o'clock position. Apply Paraffin Wax P05-059 to hold the gasket in place. Install the elbow with the threaded opening to the front and attach with the four bolts, threads lubricated with Engine Oil P03-001. Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). Do not loosen the bolts. Torque the bolts again to the same limit until the torque is held. Safety the bolts with Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(b) Install the washer and adapter, threads lubricated with Engine Oil P03−001. Torque the adapter to the elbow to 450 − 550 lb−in. (50.843 − 62.142 N.m).

Subtask 72−35−00−430−088:

(5) Install the fuel/oil cooler as follows. See Figure 1003.

(a) Put the cooler on a bench with the bolted end to the left. Remove all the protective closures.

(b) Install the oil cooler bypass valve with the gasket, lubricated with Engine Oil P03−001. The electrical connectors must be to the right. Attach the valve with the four bolts, threads lubricated with Engine Oil P03−001, and washers. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(c) Install the packings, plug, and adapters to the oil bypass valve as follows.

1 Install the packings, lubricated with Engine Oil P03−001, to the plug and adapters. Lubricate the threads of the plug and adapters with Engine Oil P03−001.

2 Install the adapter (1003/1) and torque to 375 − 425 lb−in. (42.369 − 48.019 N.m).

3 Install the plug (1003/2) and torque to 110 − 120 lb−in. (12.428 − 13.558 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

4 Install the adapter (1003/3) and torque to 650 − 750 lb−in. (73.440 − 84.739 N.m).

5 Install the adapter (1003/4) and torque to 110 − 120 lb−in. (12.428 − 13.558 N.m).

(d) Install the packings, plugs and adapters to the cooler as follows.

1 Install the packings, lubricated with Engine Oil P03−001, to the plugs and adapters. Lubricate the threads of the plugs and adapters with Engine Oil P03−001.

2 Install three adapters (1003/5) to each end of the cooler. Torque the adapters to 650 − 750 lb−in. (73.440 − 84.739 N.m).

3 Install the adapter (1003/6) to the port on the front of the cooler. Torque the adapter to 110 − 120 lb−in. (12.428 − 13.558 N.m).

4 Install the plug (1003/8) to the angled port on the front of the cooler. Torque the plug to 110 − 120 lb−in. (12.428 − 13.558 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

5 Install the plug (1003/9) to the open port closet to the fuel inlet port. Torque the plug to 375 − 426 lb−in. (42.369 − 48.019 N.m). Safety the plug with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

6 Install the two plugs (1003/10) to the remaining two ports. Torque the plugs to 110 − 120 lb−in. (12.482 − 13.558 N.m). Safety the plugs with Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292.

(e) Remove the four bolts and washers that will attach the two brackets to the front of the cooler. Attach the brackets to the cooler with the same four bolts. Do not use the washers when the brackets are installed. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Install the bracket retainer, pin, threads lubricated with Engine Oil P03−001, washer and nut to the front ear of the cooler. Torque the nut to 550 − 750 lb−in. (62.142 − 84.739 N.m) and align the cotter pin hole. Install the cotter pin. Install the front oil cooler bracket to the pin and engage the retainer.

(g) Install the cooler to the engine. Attach the front mount with two bolts, threads lubricated R with Antiseize Paste P06−054. Wipe off unwanted R paste. Torque the bolts to 125 − 140 lb−in. (14.123 − 15.818 N.m). Install the loop clamp bracket, three washers, and four bolts, threads lubricated with Engine Oil P03−001, that attach the rear of the cooler. Torque the bolts to 180 − 200 lb−in. (20.337 − 22.597 N.m).

Subtask 72−35−00−430−089:

(6) Install the left and right 9th stage start/stability (2.9) bleed valves. See Figure 1004.

(a) Install a gasket on the tube adapter for each bleed valve. Lubricate the adapter threads with Engine Oil P03−001. Install the adapters to the valves and torque to 110 − 120 lb−in. (12.428 − 13.558 N.m).

CAUTION: WHEN YOU USE THE PWA 85436 TORQUE ADAPTER, THE TORQUE WRENCH INDICATION IS LESS THAN THE CORRECT TORQUE. SEE STANDARD TORQUES IN THE STANDARD PRACTICES MANUAL, PN 585005.

(b) Install a gasket to each opening on the HPC rear case at the 10 o'clock and 1 o'clock positions. Install and attach each bleed valve and brackets with eight bolts, threads lubricated with Engine Oil P03−001. Use PWA 85436 Torque Adapter to tighten and torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Do not loosen the bolts. Torque again to the same limit until torque is held.

(c) Install the bracket and thermocouple probe, as shown to each valve. Attach each probe with two bolts, lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(d) Remove the protection cover from the boss on the side of each bleed valve. Install the cover to the boss and attach with bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

Subtask 72−35−00−430−090:

(7) (Pre SB PW4ENG 75−147) Install the left and right turbine vane and blade cooling air valves. See Figure 1005.

(a) Install a gasket on the tube adapter for each cooling air valve. Lubricate the adapter threads with Engine Oil P03−001. Install the adapters to the valves and torque to 110 − 120 lb−in. (12.428 − 13.558 N.m).

NOTE: There are seven bolts which attach the valve to the case; Make sure you use the longer bolts for the bracket location on the valve.

(b) Install a gasket to each opening on the HPC rear case at the 10 o'clock and 3 o'clock positions. Apply Paraffin Wax P05−059 to hold the gaskets in position. Install and attach each cooling air valve and brackets with seven bolts, threads lubricated with Engine Oil P03−001. Tighten and torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Do not loosen the bolts. Torque again to the same limit until torque is held.

(8) (Post SB PW4ENG 75−147) Install the left and right turbine vane and blade cooling air valves. See Figure 1005 (Sheet 2) and Figure 1005 (Sheet 3).

(a) Install a gasket on the tube adapter for each cooling air valve. Lubricate the adapter threads with Engine Oil P03−001. Install the adapters to the valves and torque to 110 − 120 lb−in. (12.428 − 13.558 N.m).

NOTE: There are seven bolts which attach the valve to the case; Make sure you use the longer bolts for the bracket location on the valve.

(b) Install a gasket to each opening on the HPC rear case at the 10 o'clock and 3 o'clock positions. Apply Paraffin Wax P05−059 to hold the gaskets in position. Install and attach each cooling air valve and brackets with seven bolts, threads lubricated with Engine Oil P03−001. Tighten and torque the bolts to 85 − 95 lb−in. (9.604 −

10.734 N.m). Do not loosen the bolts. Torque again to the same limit until torque is held.

NOTE: Ring case configuration compressor (SB PW4ENG 72-756 or SB PW4ENG 72-759) has a foolproofing pin on the valve flange to prevent (Pre SB PW4ENG 75-147) valves installed on (RCC) compressor.

Subtask 72-35-00-430-091:

(9) Install the turbine vane cooling air valve to the HPC case. See Figure 1005.

(a) Install a gasket on the tube adapter for the cooling air valve. Lubricate the adapter threads with Engine Oil P03-001. Install the adapter to the valve and torque to 110 - 120 lb-in. (12.428 - 13.558 N.m).

(b) Install a gasket to the port on the HPC rear case at the 2:30 o'clock position. Apply Paraffin Wax P05-059 to hold the gasket in position. Install and attach the cooling air valve and bracket with six bolts, threads lubricated with Engine Oil P03-001. Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). Do not loosen the bolts. Torque the bolts again to the same limit until the torque is held.

Subtask 72-35-00-430-092:

(10) Install the left and right HPC case covers. See Figure 1006.

(a) Install a gasket to each cover.

(b) Install a cover with a bracket to the opening in the HPC rear case at approximately the 3:30 o'clock position. Attach the cover with six bolts, threads lubricated with Engine Oil P03-001.

(c) Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). Do not loosen the bolts, torque the bolts again until the 85 - 95 lb-in. (9.604 - 10.734 N.m) is held.

(d) Install a cover with a bracket to the opening in the HPC rear case at approximately the 9:30 o'clock position. Attach the cover with six bolts, threads lubricated with Engine Oil P03−001.

(e) Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Do not loosen the bolts, torque the bolts again until the 85 − 95 lb−in. (9.604 − 10.734 N.m) is held.

Subtask 72−35−00−430−093:

(11) Install two filters to the Flange J bracket at approximately the 2 o'clock position with bolts, threads lubricated with Engine Oil P03−001 and nuts. See Figure 1007. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(12) Install two filters to Flange J bracket at approximately the 11 o'clock position with bolts, threads lubricated with Engine Oil P03−001 and nuts. See Figure 1007. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

Subtask 72−35−00−430−094:

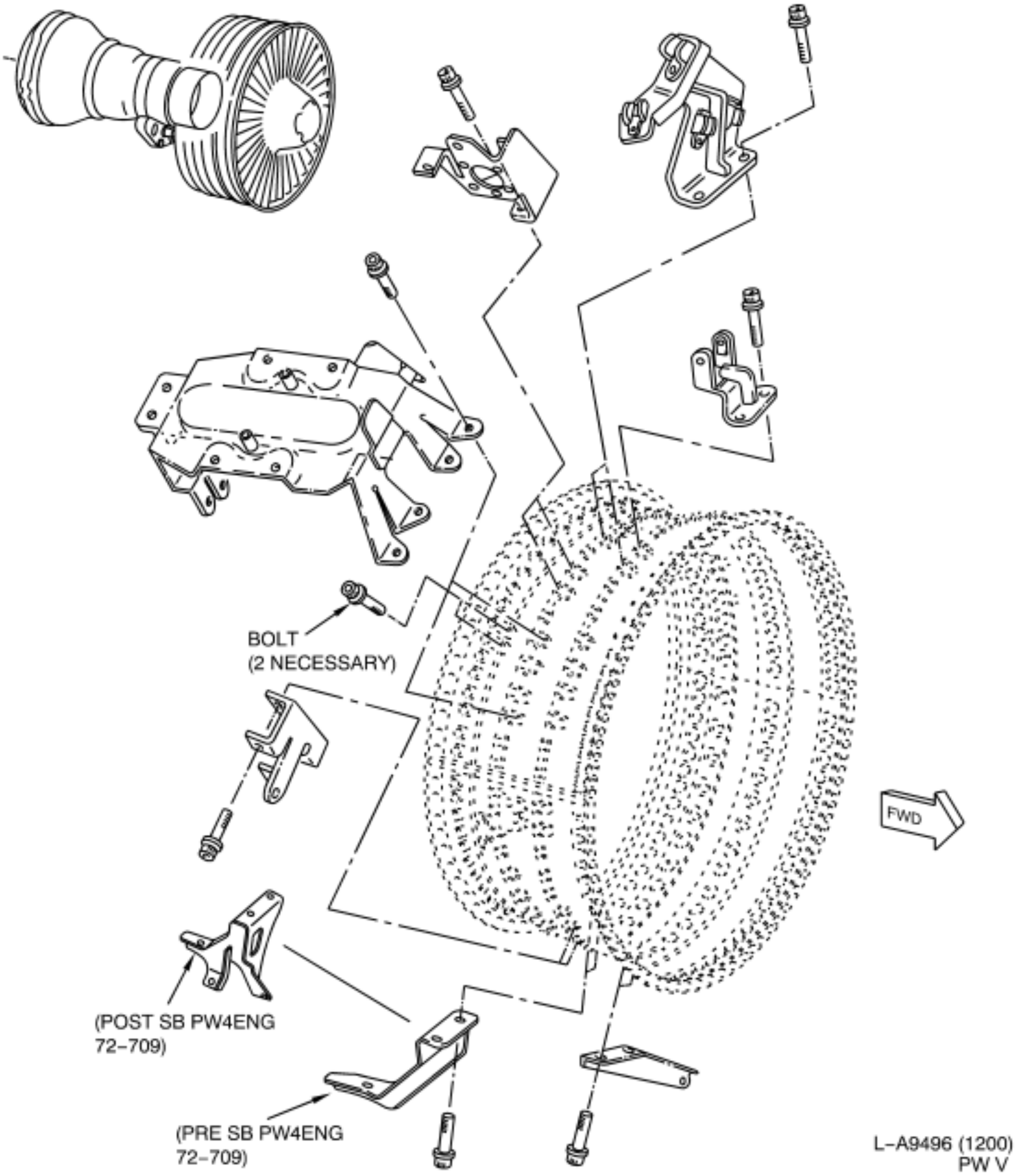
(13) Install brackets to compressor stator cylinder support. Attach with bolts, lubricated with Engine Oil P03−001, and nuts. See Figure 1008. Torque bolts (1008/1), (1008/2), (1008/3), and (1008/5) to 85 − 95 lb−in. (9.604 − 10.734 N.m). Torque bolts (1008/4) to 180 − 200 lb−in. (20.337 − 25.597 N.m). Torque bolts (1008/6) to 36 − 40 lb−in. (4.067 − 4.519 N.m).

NOTE: Do not torque (1008/4) bolts until installation of the fuel flowmeter.

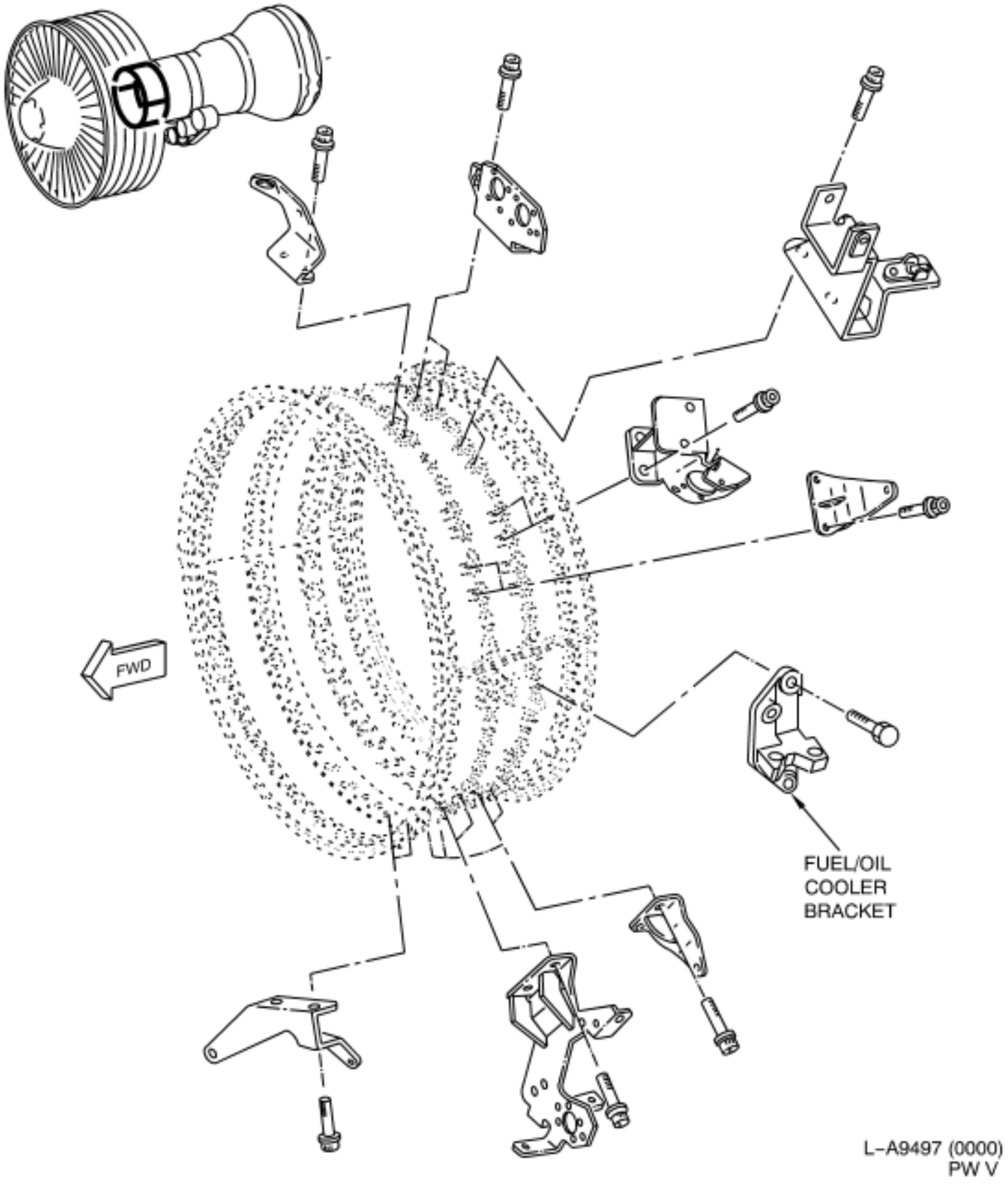
Subtask 72−35−00−430−095:

(14) Locate the two hole boss on HPC front case approximately 12 inches (304.800 mm) from front leading edge and at approximately the 2 o'clock position. Install two bolts threads lubricated with Engine Oil P03−001. Tighten and torque the bolts to 180 − 200 lb−in. (20.337 − 22.597 N.m). Refer to Figure 1001 (Sheet 1).

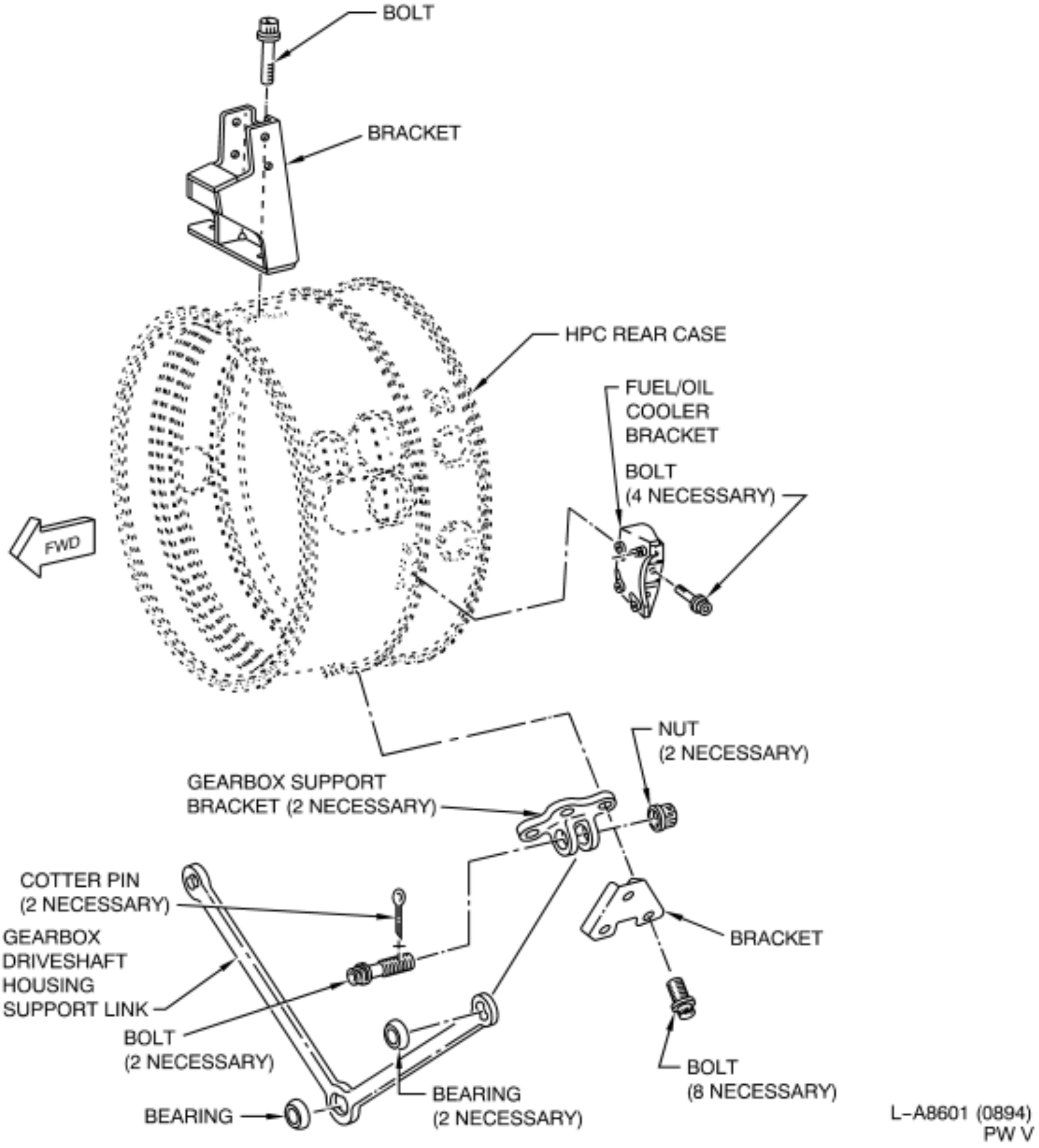
(15) If engine has the ring case configuration, make sure the identification plate has the "RC" after the serial number. The HPC rotor and stator identification plate is located on Flange J at approximately 2:30 o'clock position. See Figure 1009.


BOLT
(2 NECESSARY)
FWD
(POST SB PW4ENG
72−709)
(PRE SB PW4ENG
72−709)
L−A9496 (1200)
PW V

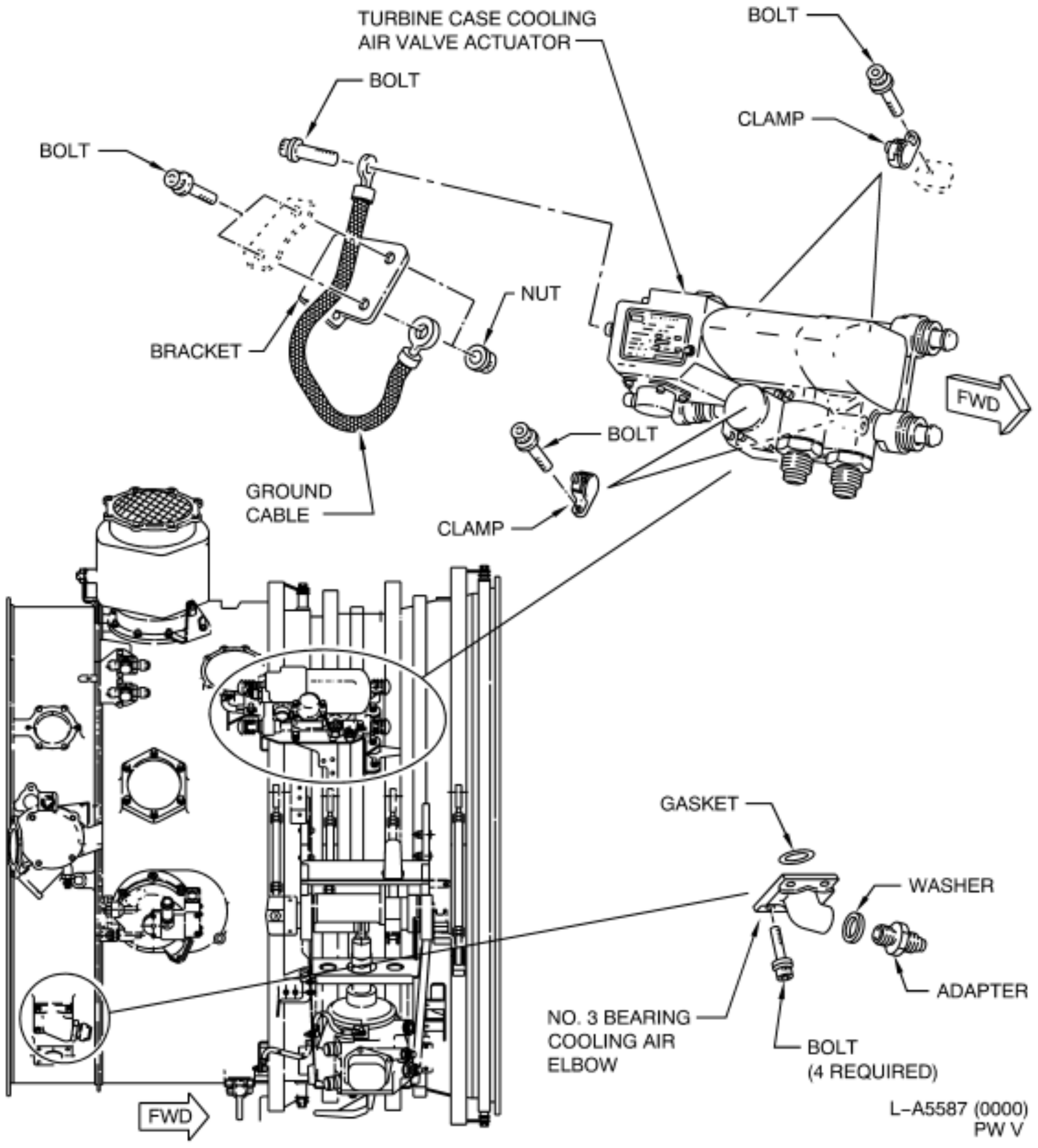
HPC Case Bracket Locations (Front)
Figure 1001 (Sheet 1)
(Task 72−35−00−400−006)


FWD
FUEL/OIL
COOLER
BRACKET
L-A9497 (0000)
PW V

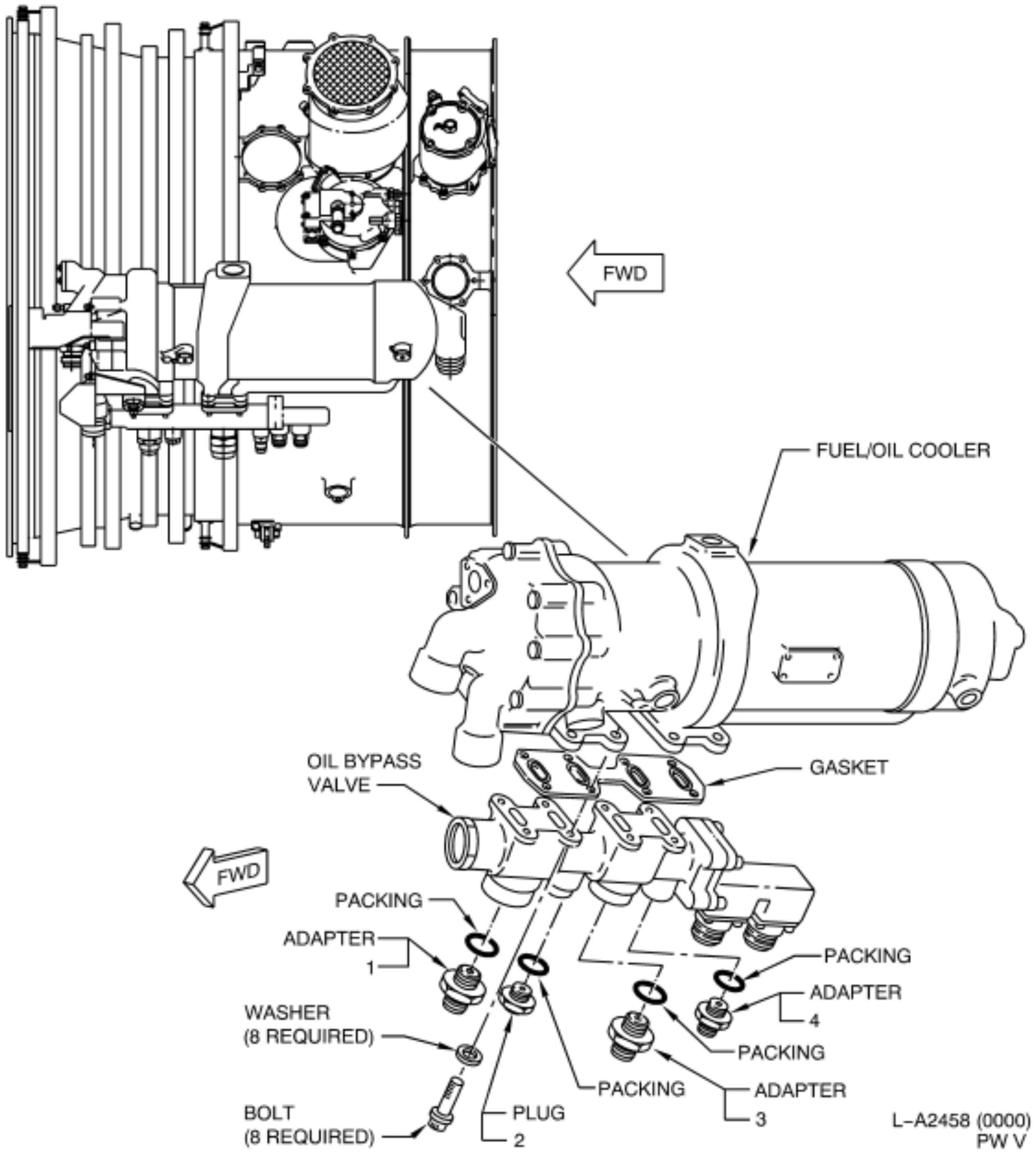
HPC Case Bracket Locations (Front)
Figure 1001 (Sheet 2)
(Task 72-35-00-400-006)


BOLT
BRACKET
HPC REAR CASE
FUEL/OIL
COOLER
BRACKET
BOLT
(4 NECESSARY)
FWD
NUT
(2 NECESSARY)
GEARBOX SUPPORT
BRACKET (2 NECESSARY)
COTTER PIN
(2 NECESSARY)
GEARBOX
DRIVESHAFT
HOUSING
SUPPORT LINK
BRACKET
BOLT
(2 NECESSARY)
BOLT
(8 NECESSARY)
BEARING
BEARING
(2 NECESSARY)
L-A8601 (0894)
PW V

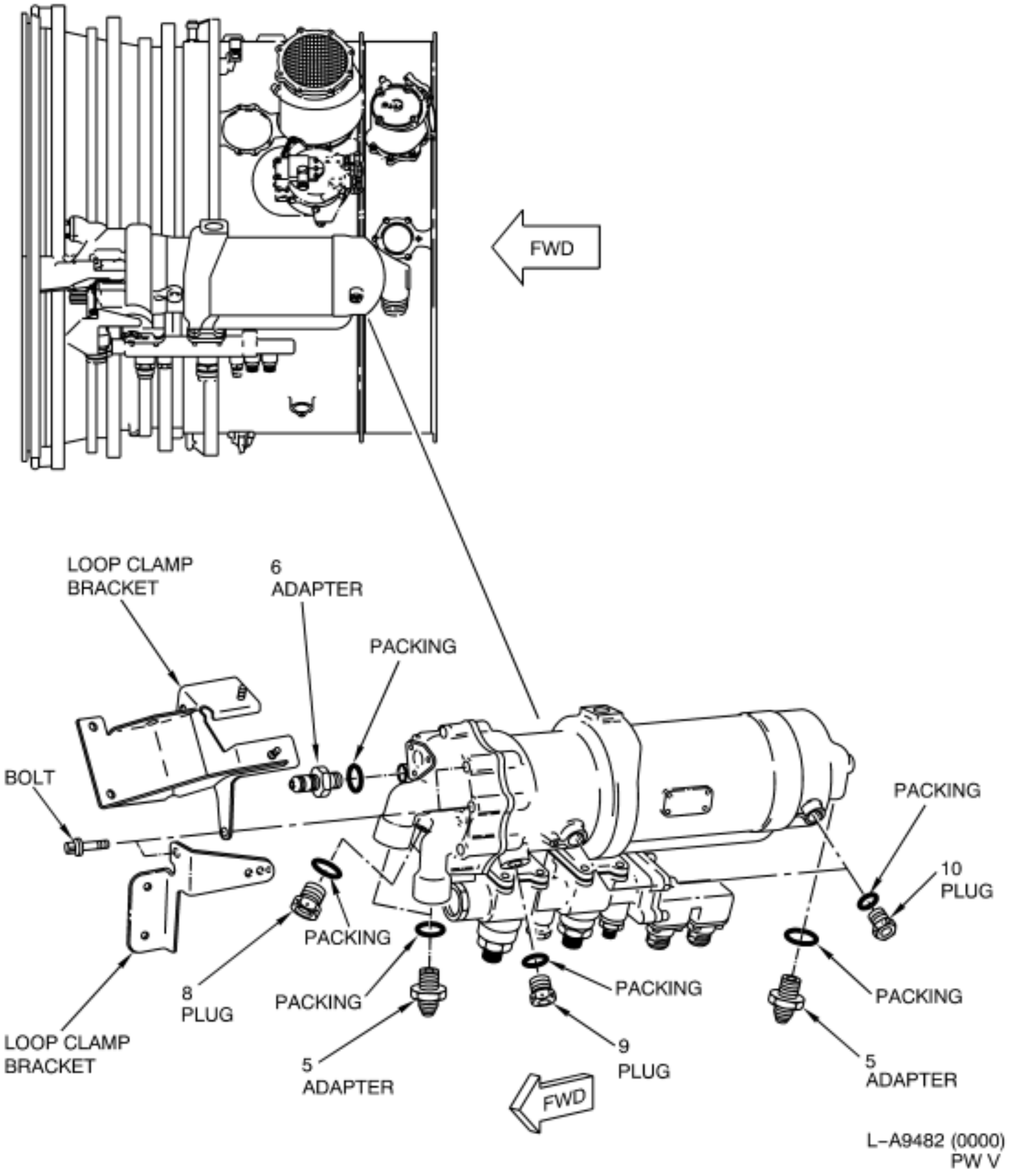
HPC Case Bracket Locations (Rear)
Figure 1001 (Sheet 3)
(Task 72-35-00-400-006)


TURBINE CASE COOLING AIR VALVE ACTUATOR
BOLT
BOLT
CLAMP
BOLT
BRACKET
NUT
BOLT
GROUND CABLE
CLAMP
FWD
GASKET
WASHER
ADAPTER
NO. 3 BEARING COOLING AIR ELBOW
BOLT (4 REQUIRED)
FWD
L-A5587 (0000)
PW V

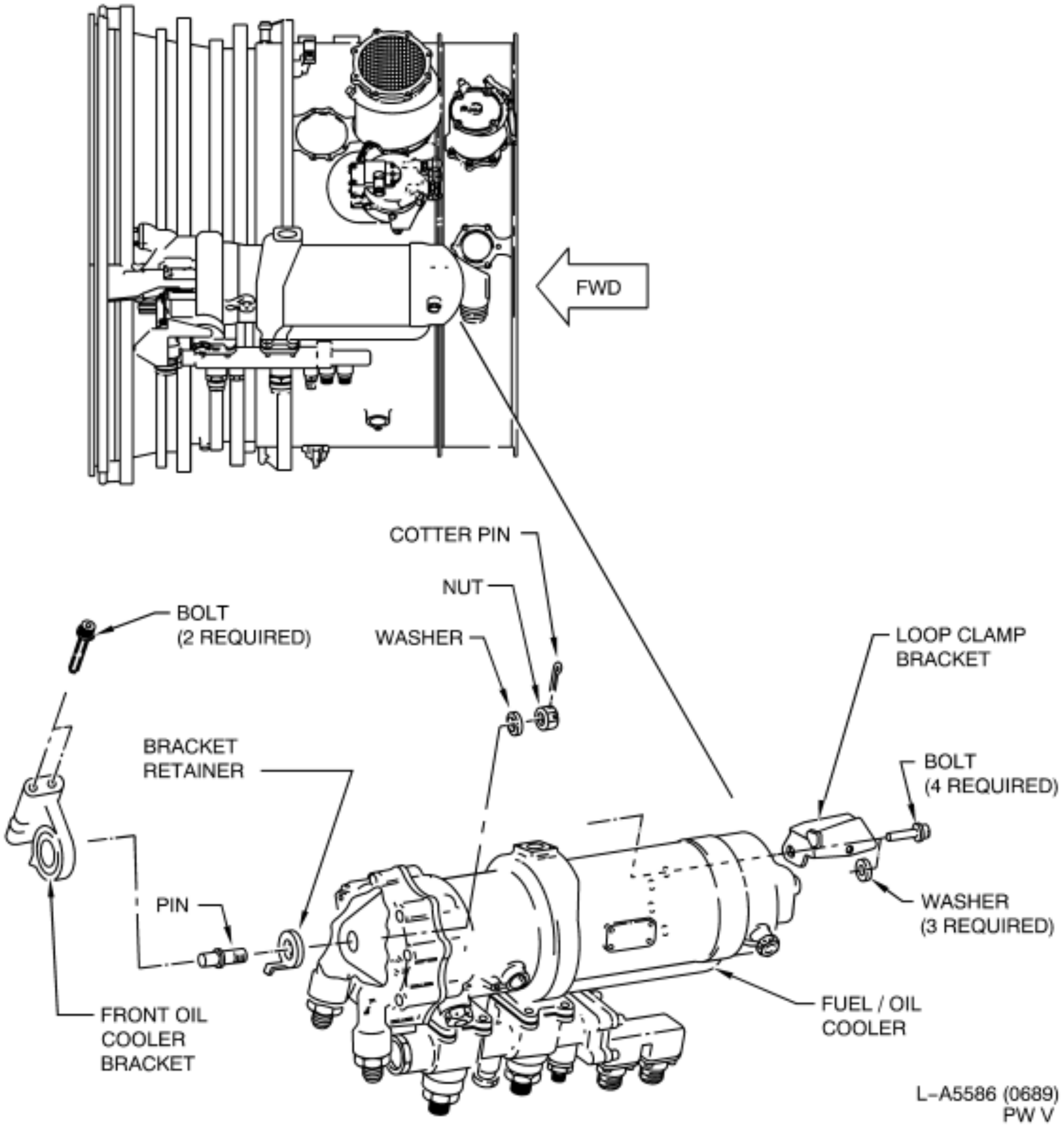
Turbine Case Cooling Air Valve Actuator
Figure 1002
(Task 72-35-00-400-006)


FWD
FUEL/OIL COOLER
GASKET
OIL BYPASS VALVE
FWD
PACKING
ADAPTER 1
WASHER (8 REQUIRED)
BOLT (8 REQUIRED)
PLUG 2
PACKING
PACKING
ADAPTER 4
PACKING
ADAPTER 3
PACKING
L-A2458 (0000)
PW V

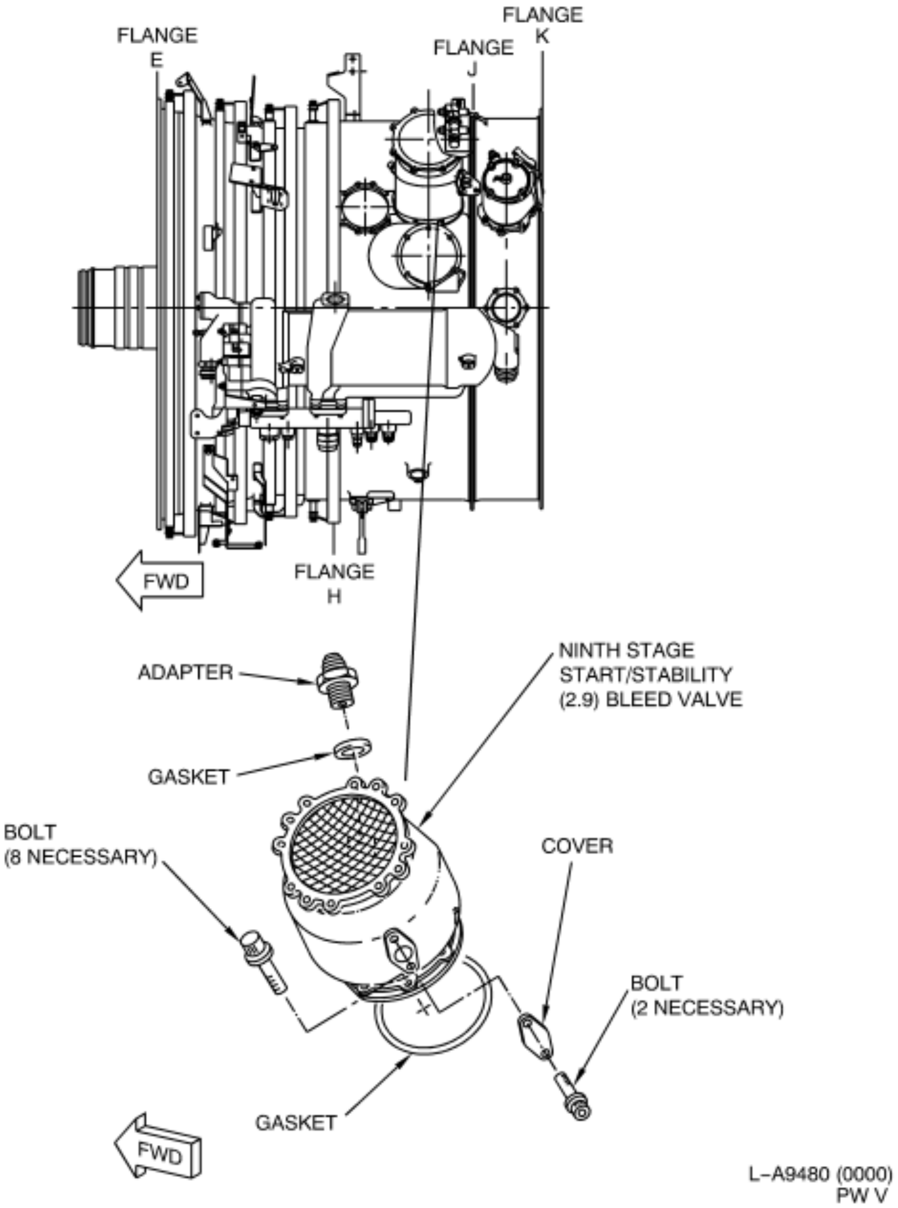
Fuel/Oil Cooler And Bypass Valve
Figure 1003 (Sheet 1)
(Task 72-35-00-400-006)


FWD
LOOP CLAMP BRACKET
6 ADAPTER
PACKING
BOLT
PACKING
10 PLUG
PACKING
8 PLUG
PACKING
PACKING
PACKING
LOOP CLAMP BRACKET
5 ADAPTER
9 PLUG
5 ADAPTER
FWD
L-A9482 (0000)
PW V

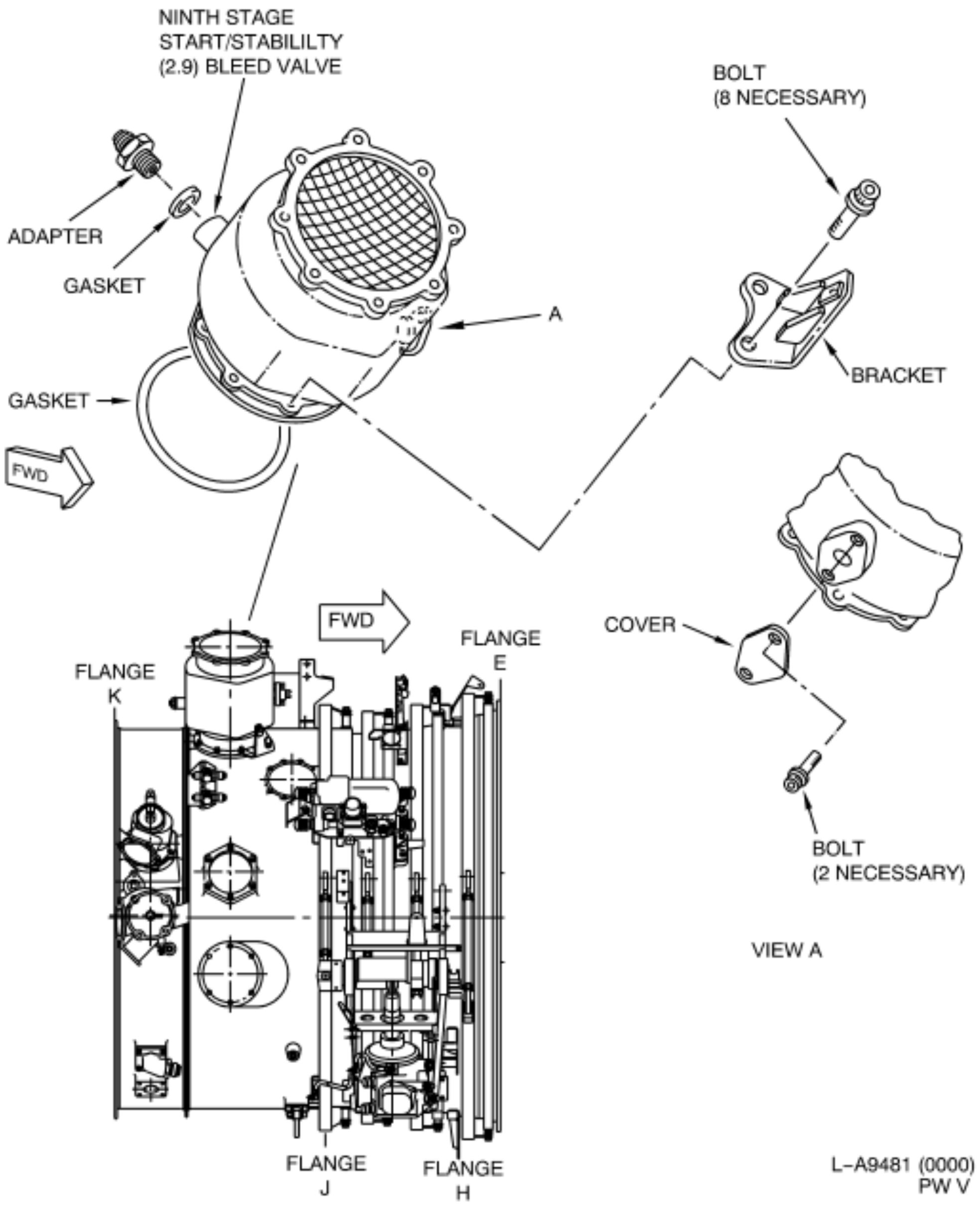
Fuel/Oil Cooler And Bypass Valve
Figure 1003 (Sheet 2)
(Task 72-35-00-400-006)


FWD
COTTER PIN
NUT
BOLT
(2 REQUIRED)
WASHER
LOOP CLAMP
BRACKET
BRACKET
RETAINER
BOLT
(4 REQUIRED)
WASHER
(3 REQUIRED)
PIN
FRONT OIL
COOLER
BRACKET
FUEL / OIL
COOLER
L−A5586 (0689)
PW V

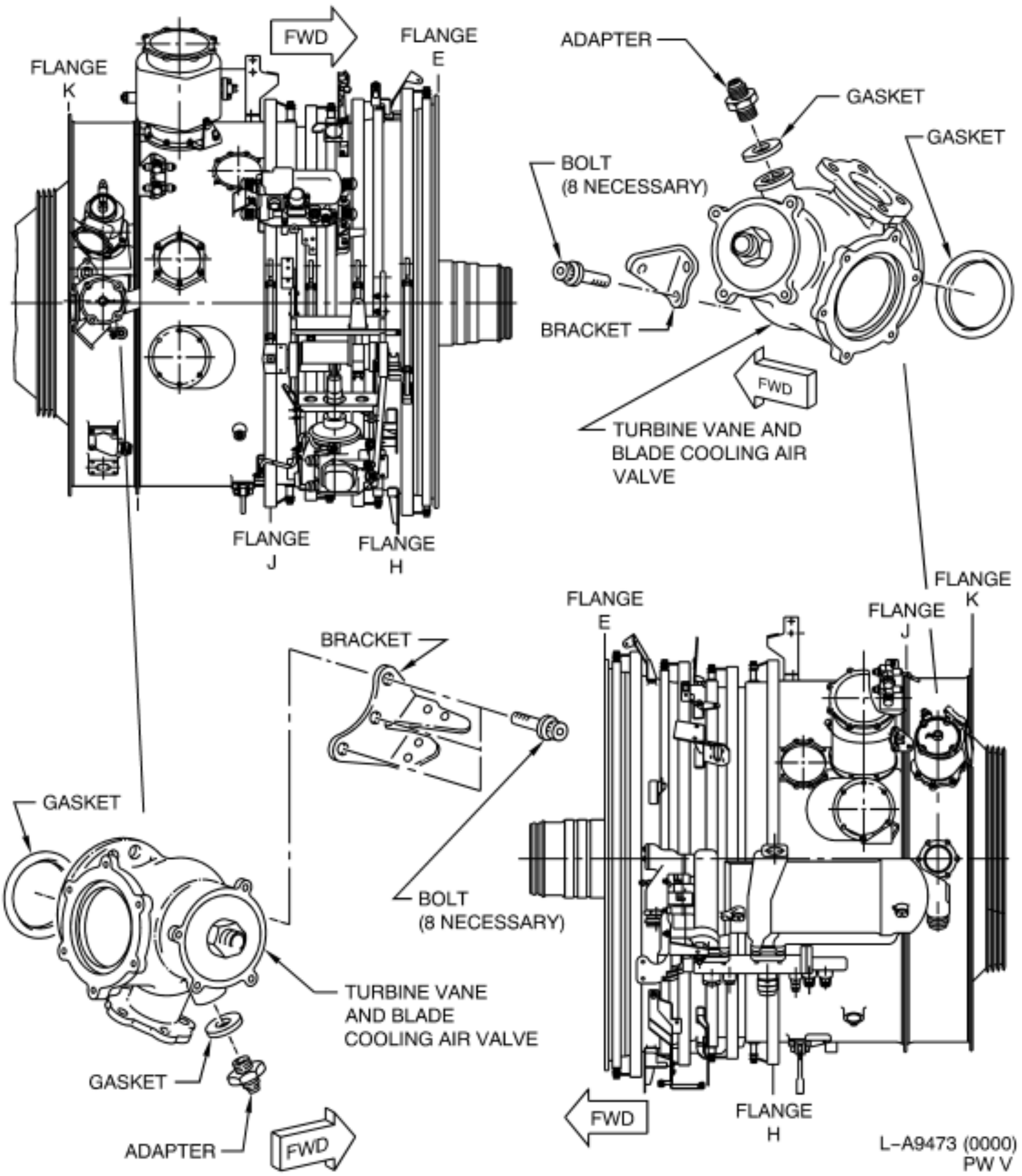
Fuel/Oil Cooler And Bypass Valve
Figure 1003 (Sheet 3)
(Task 72−35−00−400−006)


FLANGE
E
FLANGE
K
FLANGE
J
FWD
FLANGE
H
ADAPTER
NINTH STAGE
START/STABILITY
(2.9) BLEED VALVE
GASKET
BOLT
(8 NECESSARY)
COVER
BOLT
(2 NECESSARY)
GASKET
FWD
L-A9480 (0000)
PW V

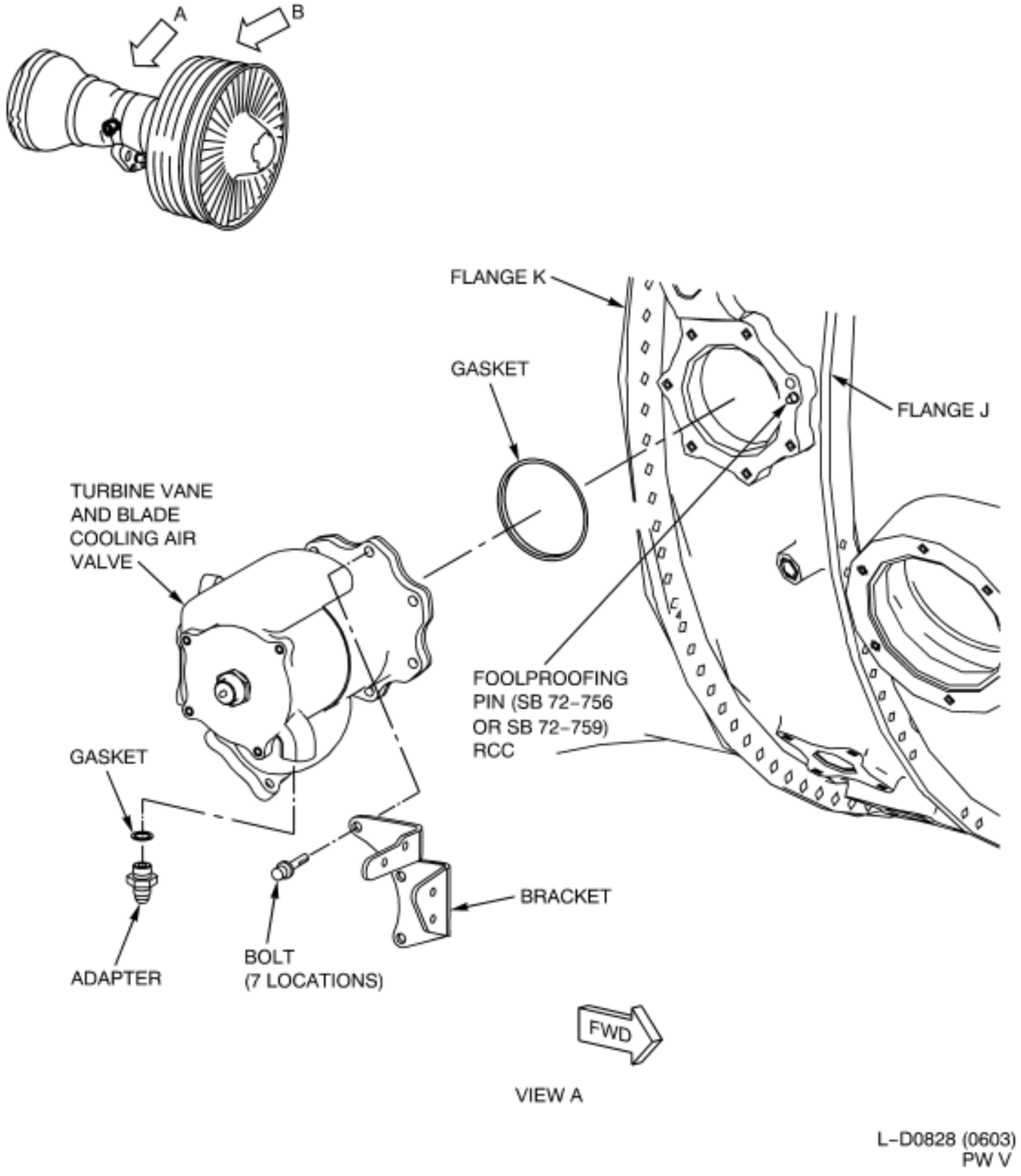
Ninth Stage Start/Stability (2.9) Bleed Valve
Figure 1004 (Sheet 1)
(Task 72-35-00-400-006)


NINTH STAGE
START/STABILILTY
(2.9) BLEED VALVE
BOLT
(8 NECESSARY)
ADAPTER
GASKET
A
BRACKET
GASKET
FWD
FWD
FLANGE
E
COVER
FLANGE
K
BOLT
(2 NECESSARY)
VIEW A
FLANGE
J
FLANGE
H
L−A9481 (0000)
PW V

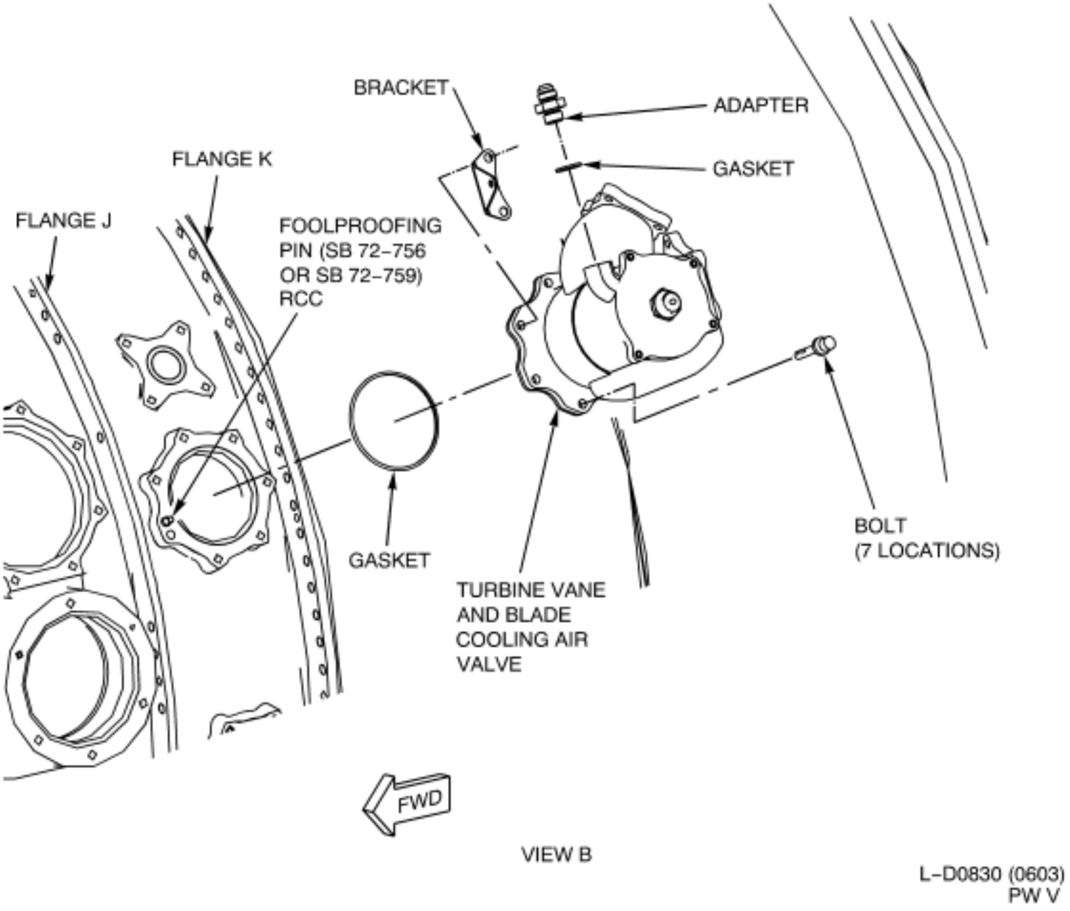
Ninth Stage Start/Stability (2.9) Bleed Valve
Figure 1004 (Sheet 2)
(Task 72−35−00−400−006)


FWD
FLANGE E
FLANGE K
ADAPTER
GASKET
GASKET
BOLT (8 NECESSARY)
BRACKET
FWD
TURBINE VANE AND BLADE COOLING AIR VALVE
FLANGE J
FLANGE H
FLANGE K
FLANGE J
FLANGE E
BRACKET
GASKET
BOLT (8 NECESSARY)
TURBINE VANE AND BLADE COOLING AIR VALVE
GASKET
ADAPTER
FWD
FWD
FLANGE H
L-A9473 (0000)
PW V

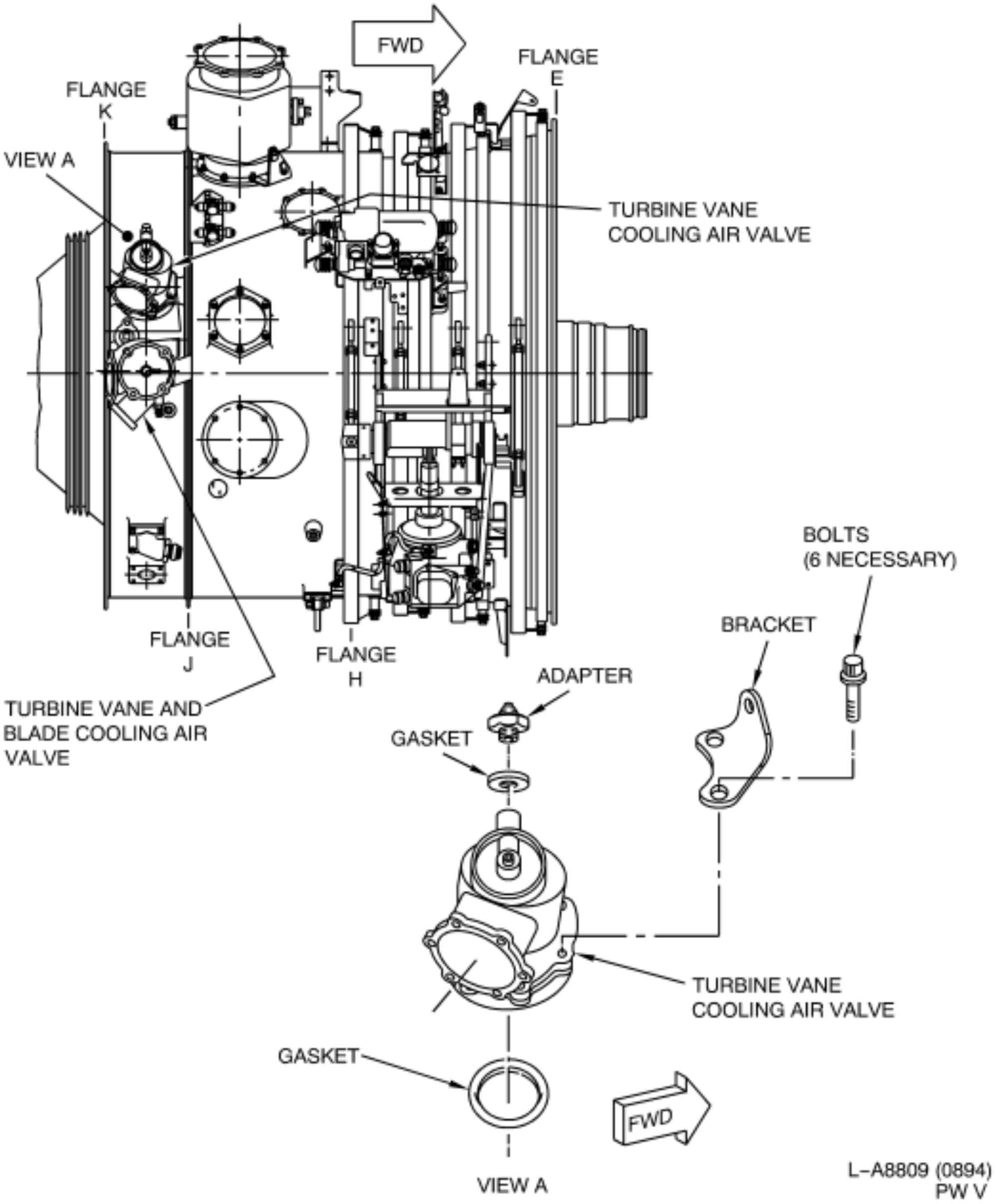
Turbine Vane And Blade Cooling Air Valves
Figure 1005 (Sheet 1)
(Task 72-35-00-400-006)


A
B
FLANGE K
GASKET
FLANGE J
TURBINE VANE AND BLADE COOLING AIR VALVE
FOOLPROOFING PIN (SB 72-756 OR SB 72-759) RCC
GASKET
BRACKET
ADAPTER
BOLT (7 LOCATIONS)
FWD
VIEW A
L-D0828 (0603)
PW V

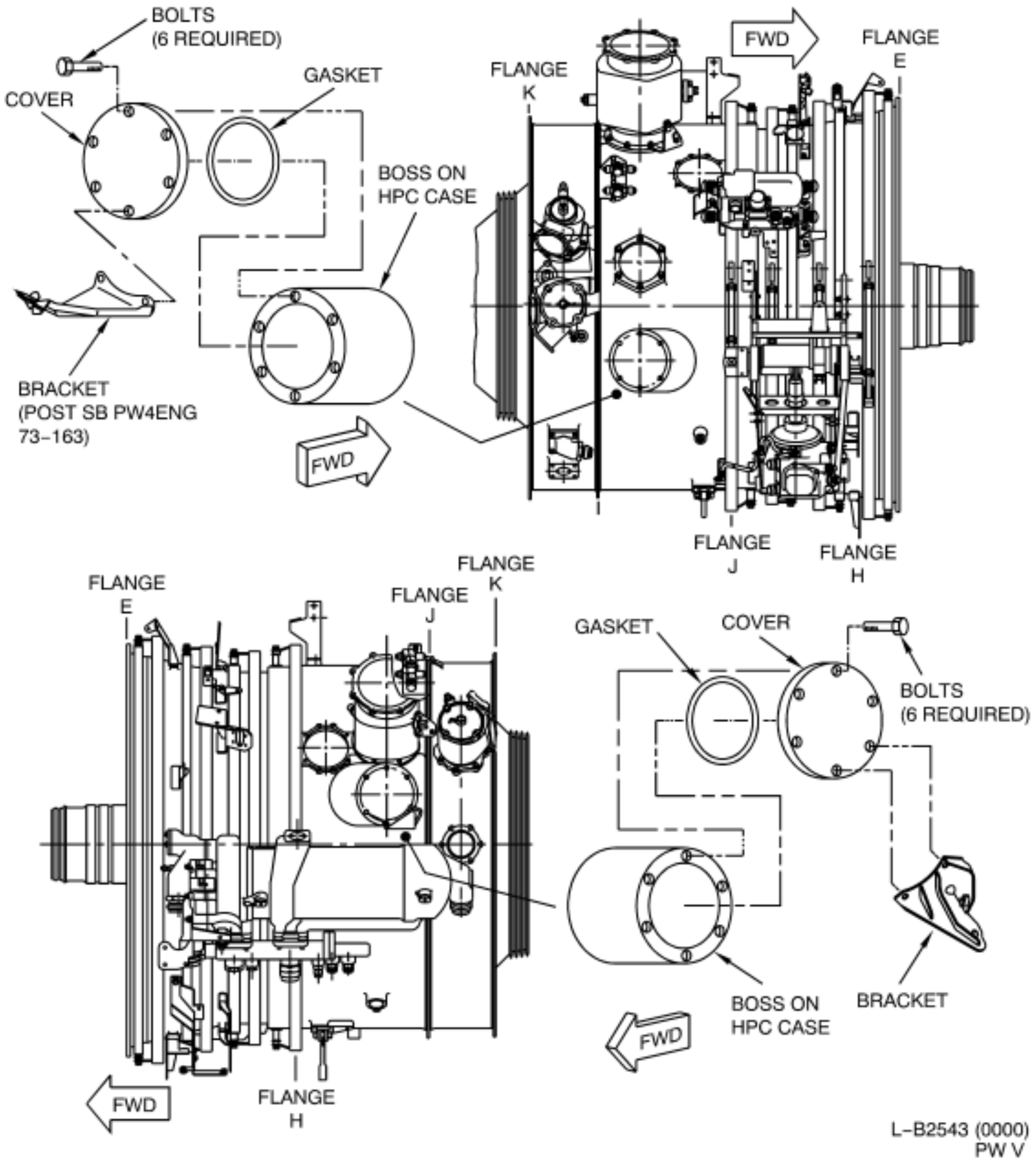
Turbine Vane and Blade Cooling Air
Valve (Right) (Post SB PW4ENG 75-147)
Figure 1005 (Sheet 2)
(Task 72-35-00-400-006)


BRACKET
ADAPTER
FLANGE K
GASKET
FLANGE J
FOOLPROOFING PIN (SB 72-756 OR SB 72-759) RCC
GASKET
TURBINE VANE AND BLADE COOLING AIR VALVE
BOLT (7 LOCATIONS)
FWD
VIEW B
L-D0830 (0603)
PW V

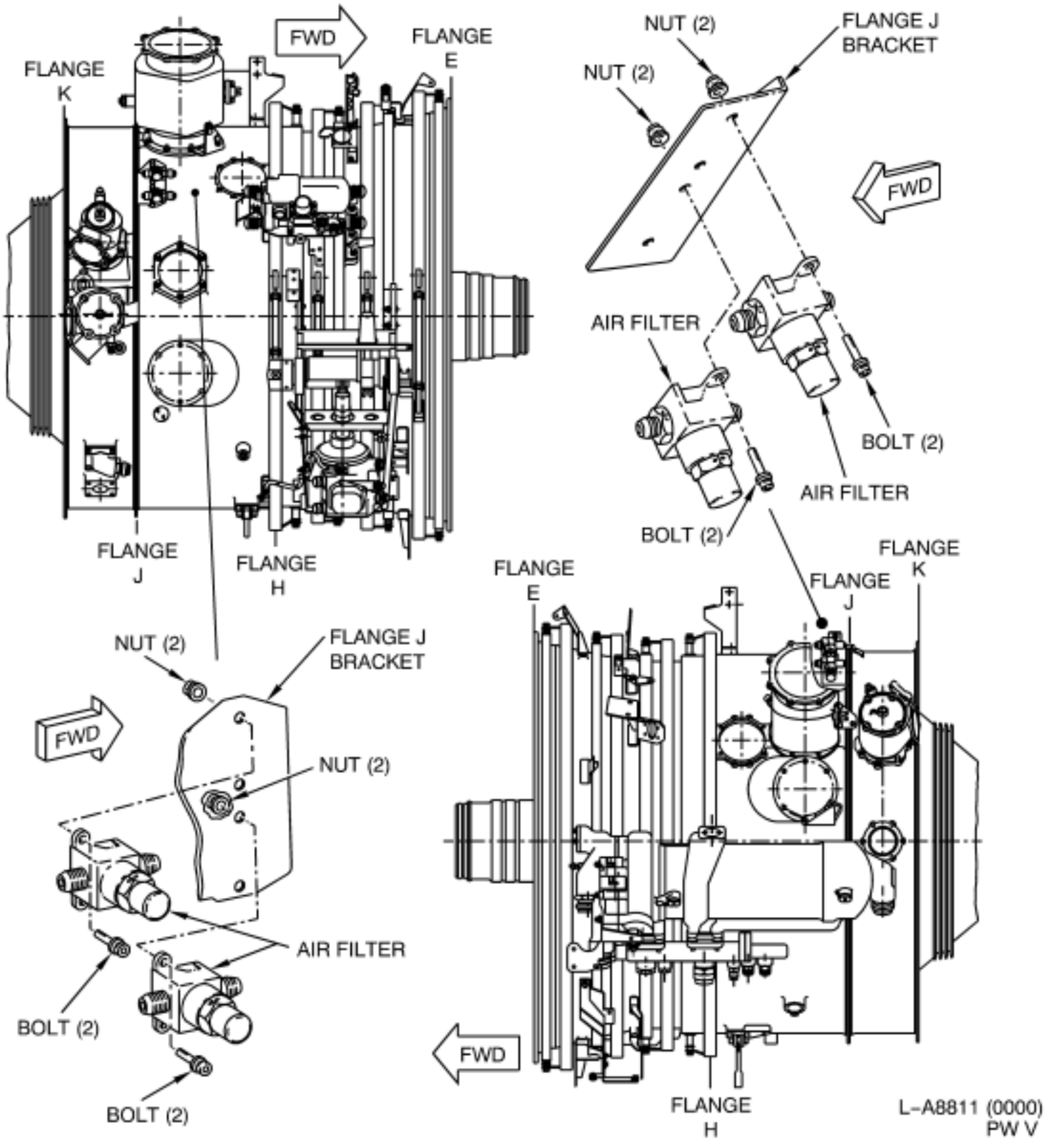
Turbine Vane and Blade Cooling Air
Valve (Left) (Post SB PW4ENG 75-147)
Figure 1005 (Sheet 3)
(Task 72-35-00-400-006)


FWD
FLANGE E
FLANGE K
VIEW A
TURBINE VANE COOLING AIR VALVE
BOLTS (6 NECESSARY)
BRACKET
FLANGE J
FLANGE H
ADAPTER
TURBINE VANE AND BLADE COOLING AIR VALVE
GASKET
TURBINE VANE COOLING AIR VALVE
GASKET
FWD
VIEW A
L−A8809 (0894)
PW V

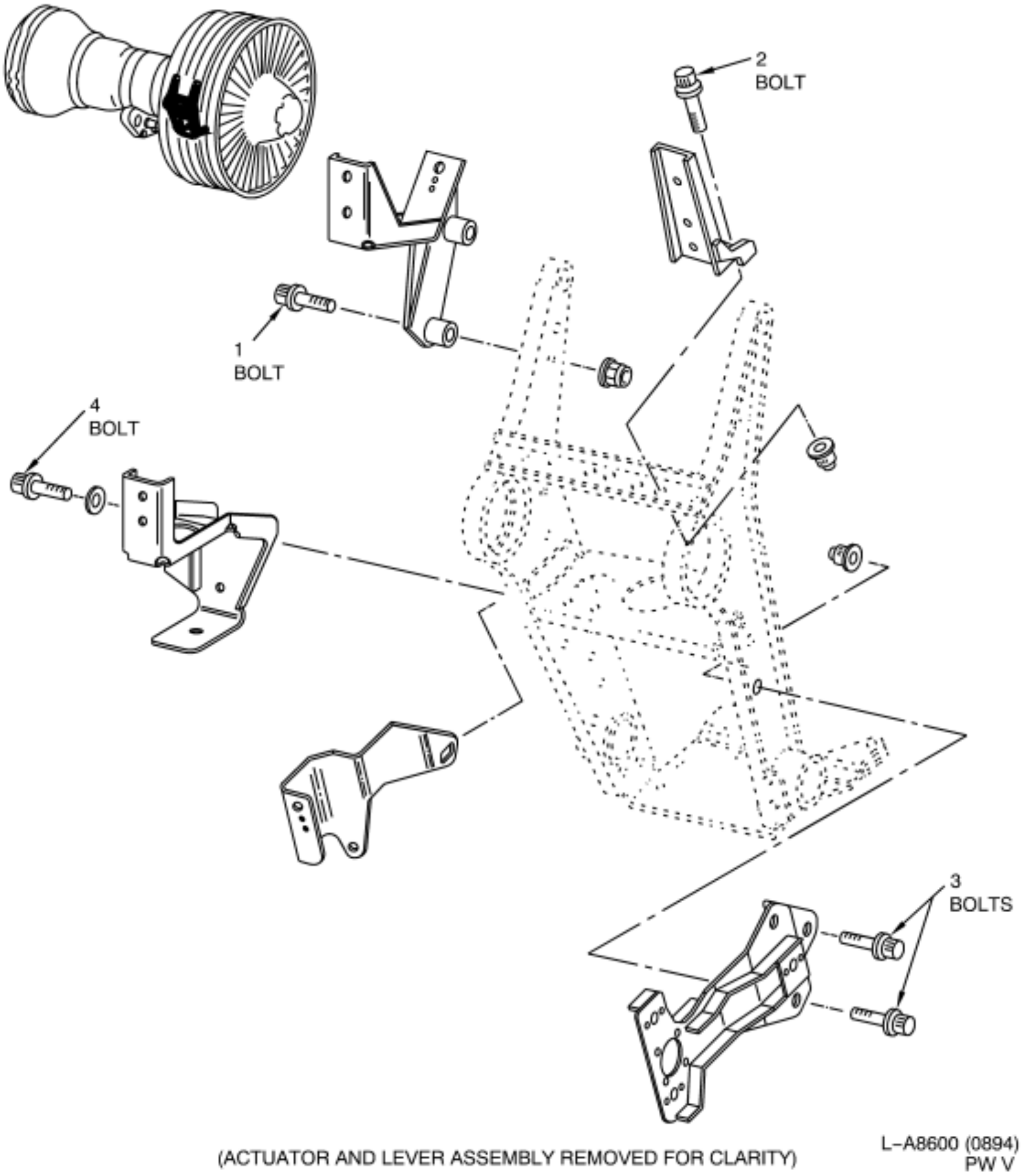
Turbine Vane Cooling Air Valve
Figure 1005 (Sheet 4)
(Task 72−35−00−400−006)


BOLTS
(6 REQUIRED)
GASKET
COVER
BOSS ON
HPC CASE
BRACKET
(POST SB PW4ENG
73−163)
FWD
FLANGE
K
FWD
FLANGE
E
FLANGE
J
FLANGE
H
FLANGE
E
FLANGE
J
FLANGE
K
GASKET
COVER
BOLTS
(6 REQUIRED)
BOSS ON
HPC CASE
BRACKET
FWD
FWD
FLANGE
H
L−B2543 (0000)
PW V

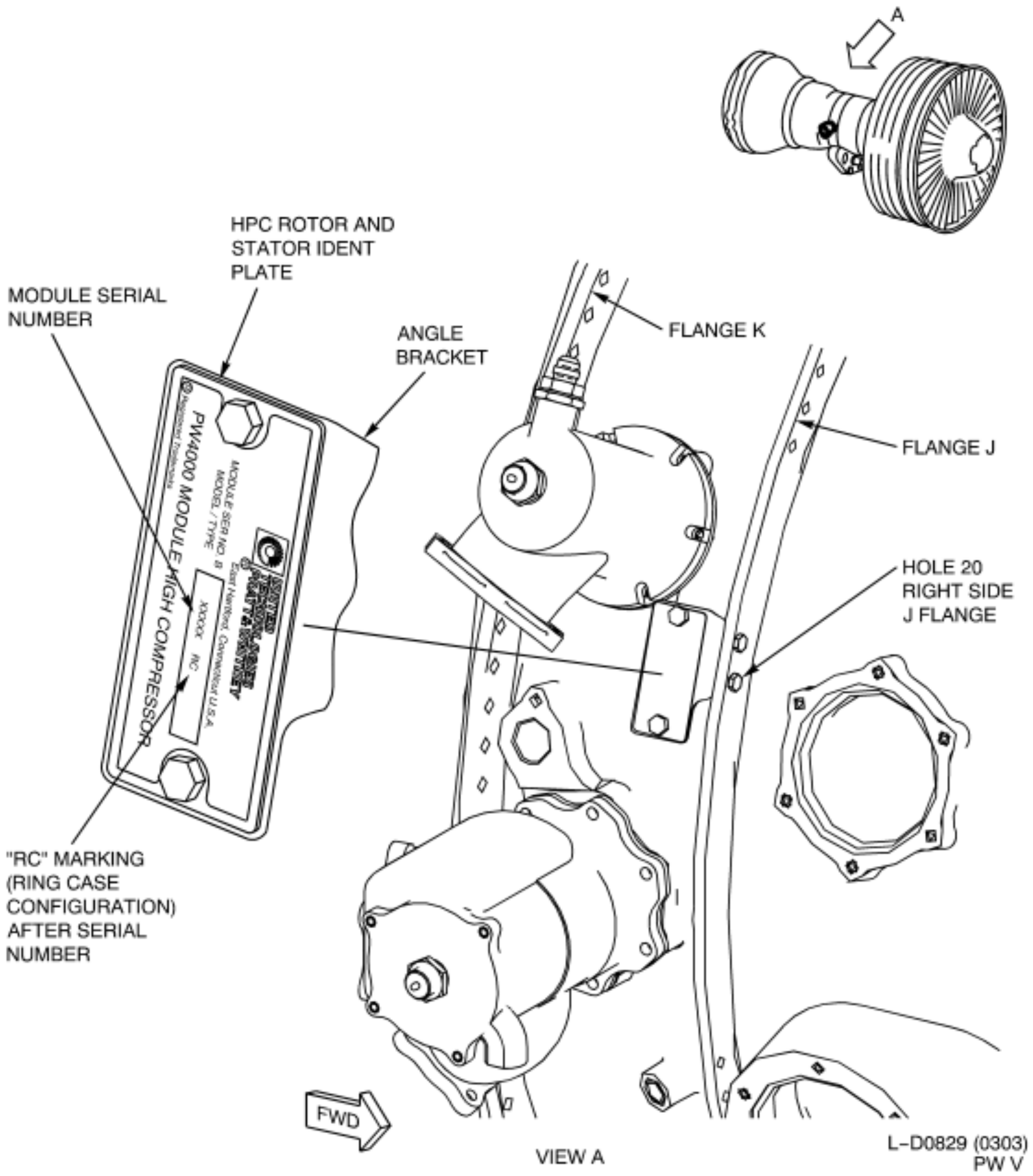
HPC Rear Case Cover
Figure 1006
(Task 72−35−00−400−006)


FWD
FLANGE E
FLANGE K
FLANGE J
FLANGE H
NUT (2)
NUT (2)
FLANGE J BRACKET
FWD
AIR FILTER
BOLT (2)
AIR FILTER
BOLT (2)
FLANGE E
FLANGE J
FLANGE K
NUT (2)
FLANGE J BRACKET
FWD
NUT (2)
AIR FILTER
BOLT (2)
BOLT (2)
FWD
FLANGE H
L−A8811 (0000)
PW V

Turbine Vane And Blade Cooling Air Filters
Figure 1007
(Task 72−35−00−400−006)


2
BOLT
1
BOLT
4
BOLT
3
BOLTS
(ACTUATOR AND LEVER ASSEMBLY REMOVED FOR CLARITY)
L−A8600 (0894)
PW V

Compressor Stator Cylinder Support Bracket Locations
Figure 1008
(Task 72−35−00−400−006)


A
HPC ROTOR AND STATOR IDENT PLATE
MODULE SERIAL NUMBER
ANGLE BRACKET
FLANGE K
FLANGE J
HOLE 20 RIGHT SIDE J FLANGE
PW4000 MODULE HIGH COMPRESSOR
XXXXX RC
"RC" MARKING (RING CASE CONFIGURATION) AFTER SERIAL NUMBER
FWD
VIEW A
L-D0829 (0303)
PW V

HPC Rotor and Stator Identification Plate (Ring Case Configuration) (Post SB PW4ENG 72-756 OR SB PW4ENG 72-759)
Figure 1009
(Task 72-35-00-400-006)

Task 72-35-00-400-005:

1. Pre-Assemble High Pressure Compressor (HPC) Stators And Rear Cases

A. Prerequisites

(1) Assemble Stages 11 and 12 compressor stator set, shroud sets, and springs. See 72-35-61, Assembly-01 Task 72-35-61-440-001.

(2) Assemble Stages 13 and 14 compressor stator set, shroud sets, and springs. See 72-35-62, Assembly-01 Task 72-35-62-440-001.

B. Equipment And Materials Required

Special Tools:

PWA 29855-6	Pin, Aligning (3 Required)
PWA 86572	Gage, ID - 8th Stage Rubstrip
PWA 86573	Gage, ID - 9th Stage Rubstrip
PWA 86574	Gage, ID - 10th Stage Rubstrip
PWA 86575	Gage, ID - 11th Stage Rubstrip
PWA 86576	Gage, ID - 12th Stage Rubstrip
PWA 86577	Gage, ID - 13th Stage Rubstrip
PWA 86578	Gage, ID - 14th Stage Rubstrip
PWA 86579	Gage, ID - 15th Stage Rubstrip
PWA 86581	Ring, Constraint - HPC Rear Case, Rear Flange
PWA 86582	Ring, Constraint - HPC Rear Case, Front Flange
PWA 86668	Fixture, HPC Stator Support (Optional)

Consumable Materials:

	Item No.	Designation
R	P03-001	Oil, Engine (PWA 521B)

C. Procedure

Subtask 72-35-00-430-076:

(1) Position the Stage 8 compressor stator set so that gangnut flange is up, Stage 8 borescope port is correctly positioned at about the 4:00 o'clock location and the stator set split centerline is at 12:00 and 6:00 o'clock. Secure stator segments together with eight bolts (heads to assemblers left), threads

lubricated with Engine Oil P03−001 and nuts. Tighten and torque nuts to 85 − 95 lb−in. (9.604 − 10.734 N.m). See Figure 1001.

Subtask 72−35−00−430−077:

(2) Install the Stages 9 and 10 stator set to rest on the Stage 8 stator, gangnut flange up, with stator split centerline at 1:30 and 7:30 o'clock locations and the Stage 10 borescope port at about the 7:00 o'clock location. Secure stator segments together with 10 bolts (heads to assemblers left), threads lubricated with Engine Oil P03−001 and nuts. Tighten and torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). See Figure 1001.

(3) Secure the Stages 9 and 10 stator to the Stage 8 stator with 40 bolts, threads lubricated with Engine Oil P03−001. Tighten and torque bolts, using an alternating pattern, 36 − 40 lb−in. (4.067 − 4.519 N.m).

Subtask 72−35−00−430−078:

CAUTION: THE 11TH AND 12TH STAGE STATOR SET WITH 24 HOUR OXIDATION CYCLE RING SEGMENTS (SB PW4ENG 72−396) MUST BE USED WITH THE 12TH AND 13TH STAGE ALUMINUM COATED BLADE TIPS (SB PW4ENG 72−395).

(4) Install one quarter section of the Stages 11 and 12 stator (stepped end down) into groove and anti−rotation feature in upper flange of the Stages 9 and 10 stator. Install a second quarter section to butt against previously installed section. Complete assembly of stator until all four sections are installed. See Figure 1002.

(5) Align splits in the Stages 11 and 12 stator set to be 45 degrees on either side of the 6 o'clock location. Align bolt holes with those in the Stages 9 and 10 stator. Make sure the Stage 12 borescope port is positioned at about the 3:00 o'clock location.

CAUTION: THE 13TH AND 14TH STAGE STATOR SET WITH 24 HOUR OXIDATION CYCLE RING SEGMENTS (SB PW4ENG 72−396) MUST BE USED WITH THE 14TH AND 15TH STAGE ALUMINUM OXIDE COATED BLADE TIPS (SB PW4ENG 72−395) AND THE MORE WEAR RESISTANT

ANTI-ROTATION SLOTS, REAR INNER CASE (SB PW4ENG 72-403).

(6) Install the Stages 13 and 14 stator, flat end up, aligning quadrants with the quadrants of previously installed stage. Make sure that the Stage 14 borescope port is positioned at the 2:30 o'clock location. See Figure 1002.

CAUTION: THE HPC REAR INNER CASE WITH THE MORE WEAR RESISTANT ANTI-ROTATION SLOTS (SB PW4ENG 72-403) MUST BE USED WITH THE 13TH AND 14TH STAGE STATOR SET WITH 24 HOUR OXIDATION CYCLE RING SEGMENTS (SB PW4ENG 72-396).

(7) Install the HPC inner rear case, gangnut, scalloped flange up, over the 11th through 14th stage stators. Carefully drift case to seat on the 10th stage flange after aligning holes in case flange with bolt holes in upper platform flange of the 9th and 10th stage stator. Install eight workbolts, threads lubricated with Engine Oil P03-001, equally spaced to secure case to stator. Tighten bolts to draw flanges together. If necessary, tap case to seat against stator flange. Remove workbolts. See Figure 1003.

Subtask 72-35-00-430-079:

(8) Locate offset holes in both the just installed HPC inner rear case lower flange and the front flange of the HPC (outer) rear case. Install three PWA 29855-6 Aligning Pins equally spaced to the Stages 10 and 11 stator flanges. With the offset holes of each case aligned with each other, lower the outer case over the previously installed inner case and stators, stepped flange down, engaging the three aligning pins. See Figure 1004.

(9) Install four bolts, threads lubricated with Engine Oil P03-001, equally spaced around lower flange on inside diameter of outer rear case and draw rear case down against the previously installed inner rear case and the Stages 9 and 10 stator flange. Remove the three aligning pins and install the remaining 60 bolts, threads lubricated with Engine Oil P03-001. Tighten and torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

Subtask 72-35-00-430-080:

CAUTION: THE INSTALLATION OF PN 50H879 SUPPORT AND PN 50H883 HEAT SHIELD IS OPTIONAL WITH PN 50J685 COMPRESSOR STATOR EXIT ASSEMBLY.

CAUTION: PN 50H879 SUPPORT AND PN 50H883 HEAT SHIELD CANNOT BE INSTALLED WITH PN 51J285-01 OR PN 51J385-01 COMPRESSOR STATOR EXIT ASSEMBLY.

CAUTION: USE PN MS9723-05 BOLTS WITH EXIT GUIDE VANE SUPPORT, HEAT SHIELD AND PN 50H953 HPC REAR SUPPORT (PRE SB PW4ENG 72-234).

CAUTION: USE PN MS9696-06 BOLTS WITHOUT THE SUPPORT AND HEAT SHIELD AND WITH PN 50H953 HPC REAR SUPPORT (POST SB PW4ENG 72-234, PRE SB PW4ENG 72-298).

CAUTION: USE PN MS9723-04 BOLTS WITHOUT THE EXIT GUIDE VANE SUPPORT, HEAT SHIELD AND WITH PN 51H530 REAR SUPPORT (POST SB PW4ENG 72-298).

(10) Install HPC rear support on 14th stage stator flange and on outer rear case, aligning holes in support with holes in inner rear case. Tap to seat. See Figure 1004.

(11) Secure rear support to inner rear case with 62 bolts, threads lubricated with Engine Oil P03-001. Tighten and torque bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

Subtask 72-35-00-430-081:

(12) Measure the rubstrip diameters of Stages 8 through 15, using the following tool numbers for the respective stages. Use PWA 86581 Constraint Ring and PWA 86582 Constraint Ring respectively, on the front and rear flanges of the HPC rear case. These constraint rings both improve the roundness of the case and establish reference planes from which to measure the axial location for the diametrical measurements. Refer to Table 1001 for correct axial location of gage points for these diameter measurements. See Figure 1004. Take measurements at sixteen (16) angular locations around the circumference of each rubstrip. Refer to Table 1002 for tooling applied to each stage.

R
R

(13) If Coordinate Measuring Machine (CMM) equipment is available (the preferred method), use PWA 86668 HPC Stator Fixture to clamp the HPC rear stators axially forward in the HPC rear case to more accurately simulate running positions.

D. Postrequisites

(1) Disassemble high pressure compressor (HPC) stators. See 72-35-00, Disassembly-04 Task 72-35-00-030-004.

Stage	Distance From H-Flange Front Face	Chapter/Section	Task Number
8	0.223 inch (5.664 mm)	72-35-59, Inspection/ Check-04	72-35-59-200-004
9	3.124 inch (79.350 mm)	72-35-59, Inspection/ Check-04	72-35-59-200-004
10	5.869 inch (149.073 mm)	72-35-60, Inspection/ Check-04	72-35-60-200-004
11	8.277 inch (210.236 mm)	72-35-60, Inspection/ Check-04	72-35-60-200-004
12	10.627 inch (269.926 mm)	72-35-61, Inspection/ Check-04	72-35-61-200-004
13	13.058 inch (331.673 mm)	72-35-61, Inspection/ Check-04	72-35-61-200-004
14	15.243 inch (387.172 mm)	72-35-62, Inspection/ Check-04	72-35-62-200-004
15	17.398 inch (441.909 mm)	72-35-62, Inspection/ Check-04	72-35-62-200-004

NOTE: H-Flange is the front flange of the HPC (outer) rear case assembly.

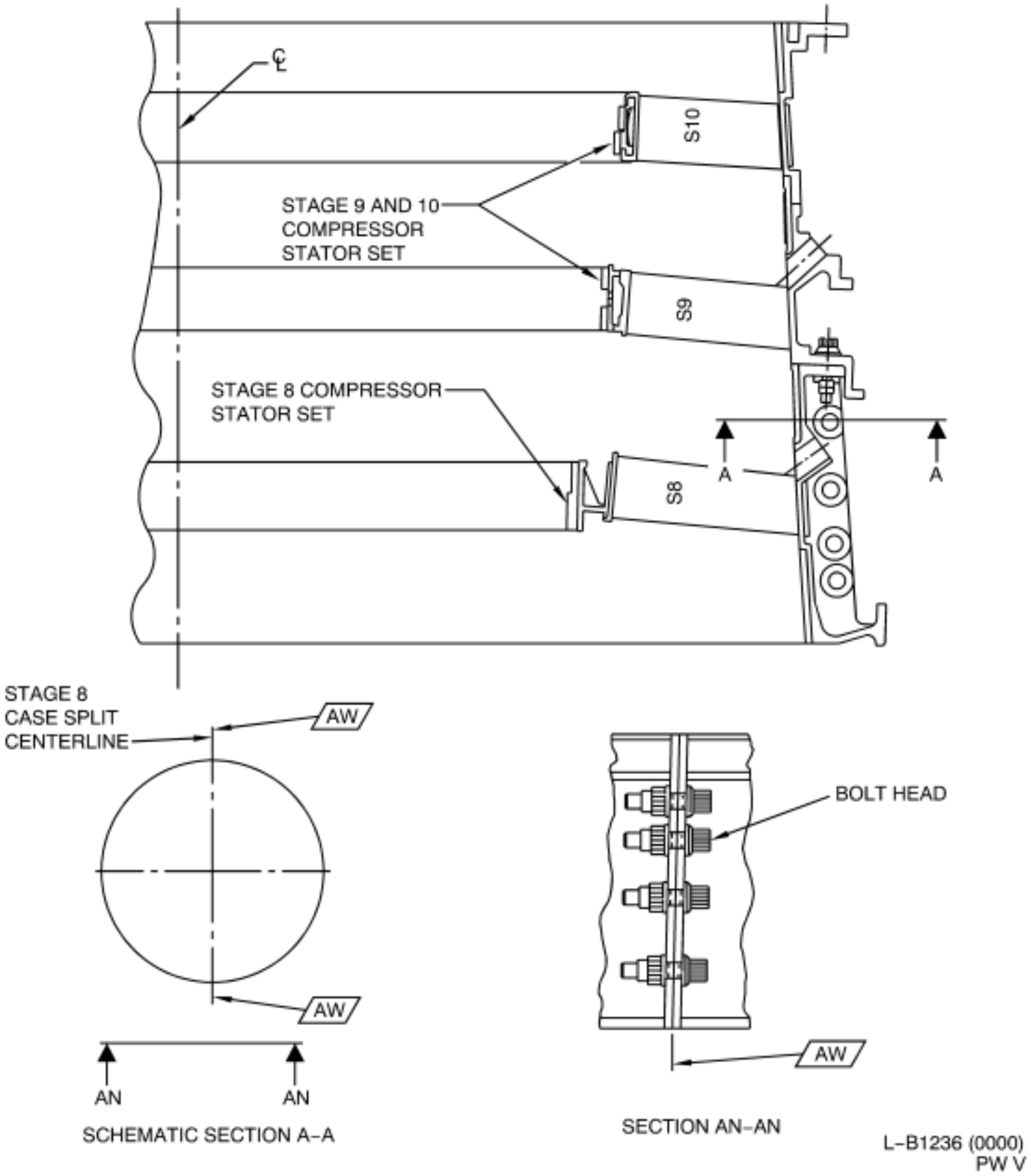
Rubstrip Axial Gage Point Locations
Table 1001

R
R

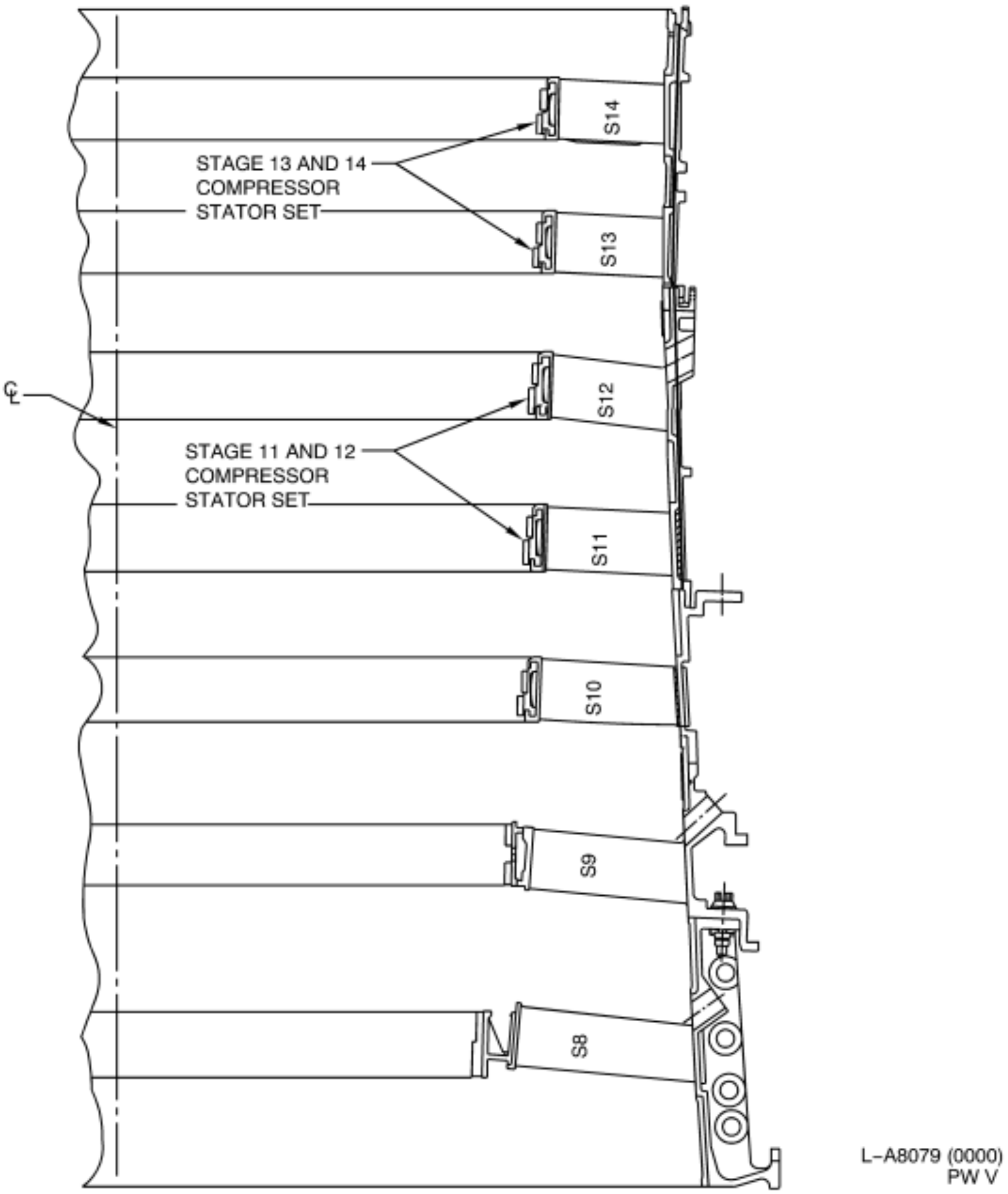
STAGE	ATA NUMBER	TOOL NUMBER
8	72−35−59	PWA 86572
9	72−35−59	PWA 86573
10	72−35−60	PWA 86574
11	72−35−60	PWA 86575
12	72−35−61	PWA 86576
13	72−35−61	PWA 86577
14	72−35−62	PWA 86578
15	72−35−62	PWA 86579

Tooling For Measuring Rubstrip Diameters
Table 1002

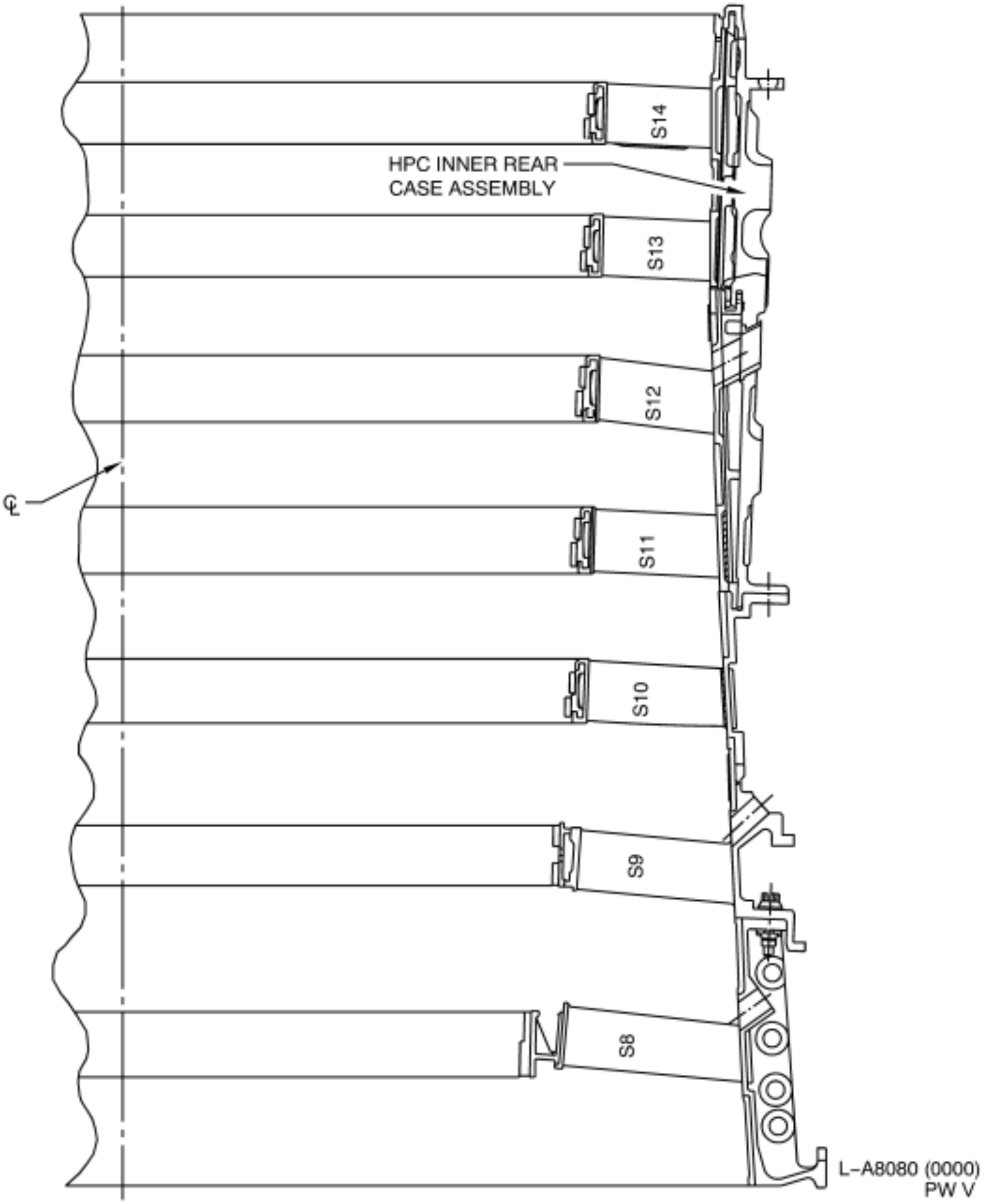
R
R


℄
S10
STAGE 9 AND 10 COMPRESSOR STATOR SET
S9
STAGE 8 COMPRESSOR STATOR SET
A
A
S8
STAGE 8 CASE SPLIT CENTERLINE
AW
AW
AN
AN
SCHEMATIC SECTION A–A
BOLT HEAD
AW
SECTION AN–AN
L–B1236 (0000)
PW V

Pre–Assemble HPC Stators And Rear Cases
Figure 1001
(Task 72–35–00–400–005)

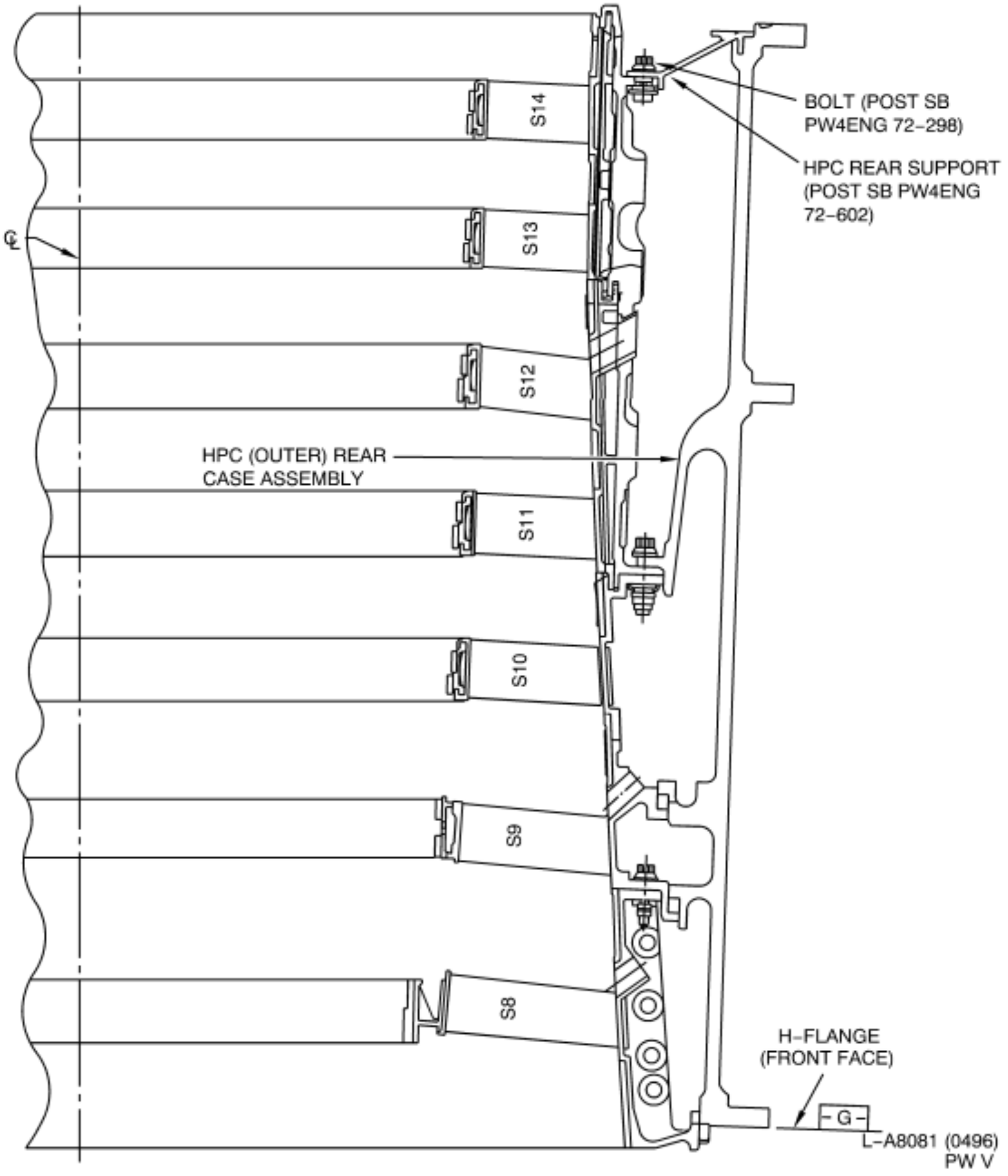

STAGE 13 AND 14 COMPRESSOR STATOR SET
S14
S13
℄
S12
STAGE 11 AND 12 COMPRESSOR STATOR SET
S11
S10
S9
S8
L-A8079 (0000)
PW V

Pre-Assemble HPC Stators And Rear Cases
Figure 1002
(Task 72-35-00-400-005)


S14
HPC INNER REAR CASE ASSEMBLY
S13
S12
℄
S11
S10
S9
S8
L−A8080 (0000)
PW V

Pre−Assemble HPC Stators And Rear Cases
Figure 1003
(Task 72−35−00−400−005)

HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−05


BOLT (POST SB PW4ENG 72−298)
HPC REAR SUPPORT (POST SB PW4ENG 72−602)
℄
S14
S13
S12
HPC (OUTER) REAR CASE ASSEMBLY
S11
S10
S9
S8
H−FLANGE (FRONT FACE)
−G−
L−A8081 (0496)
PW V

Pre−Assemble HPC Stators And Rear Cases
Figure 1004
(Task 72−35−00−400−005)

Task 72-35-00-430-006:

1. Assemble Stator (Vane) Segment Assemblies

A. Prerequisites

(1) See 72-35-00, Inspection/Check-04 (Task 72-35-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Necessary

Special Tools:

PWA 105507	Adapter, Install/Remove, 8th Stage Stator (Vane) Segments
PWA 105508	Adapter, Install/Remove, 10th Stage Stator (Vane) Segments
PWA 105509	Adapter, Install/Remove, 11th Stage Stator (Vane) Segments
PWA 105510	Adapter, Install/Remove, 12th Stage Stator (Vane) Segments
PWA 105511	Adapter, Install/Remove, 13th Stage Stator (Vane) Segments
PWA 105512	Adapter, Install/Remove, 14th Stage Stator (Vane) Segments

Consumable Materials:

Item No.	Designation
P09-014	Rubber, Silicone (PWA 36003)
P11-014	Alcohol, Isopropyl

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Spring, 8th Stage	8	72-35-00/17A/10
Spring, 8th Stage	4	72-35-00/17A/40
Spring, 10th Stage	12	72-35-00/18B/12
Spring, 11th Stage	13	72-35-00/18B/52
Spring, 12th Stage	8	72-35-00/19A/3
Spring, 12th Stage	4	72-35-00/19A/11
Spring, 13th Stage	12	72-35-00/19A/152
Spring, 14th Stage	7	72-35-00/20A/2
Spring, 14th Stage	4	72-35-00/20A/12
Spring, 14th Stage	1	72-35-00/20A/22

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
(CONTINUED)		
Insulation Blanket, Thermal	AR	72-35-00/17A/60
Insulation Blanket, Thermal	AR	72-35-00/18B /14
Insulation Blanket, Thermal	AR	72-35-00/18B/54
Insulation Blanket, Thermal	AR	72-35-00/19A/13
Insulation Blanket, Thermal	AR	72-35-00/19A/154
Insulation Blanket, Thermal	AR	72-35-00/20A/4
Insulation Blanket, Thermal	AR	72-35-00/20A/14
Insulation Blanket, Thermal	AR	72-35-00/20A/24

C. Assemble Stator (Vane) Segment Sets

Subtask 72-35-00-430-111:

(1) See Table 1001 for the applicable stator (vane) segment adapter.

Stage	Stator (Vane) Segment Adapter
8	PWA 105507
10	PWA 105508
11	PWA 105509
12	PWA 105510
13	PWA 105511
14	PWA 105512

Stator (Vane) Segment Assembly Adapters
Table 1001

(2) For each stage, assemble a set of stator (vane) segments as shown in the applicable figure.

(a) For 8th Stage vane assembly set, refer to Figure 1003.

(b) For 10th Stage vane assembly set, refer to Figure 1004.

(c) For 11th Stage vane assembly set, refer to Figure 1005.

(d) For 12th Stage vane assembly set, refer to Figure 1006.

(e) For 13th Stage vane assembly set, refer to Figure 1007.

(f) For 14th Stage vane assembly set, refer to Figure 1008.

(3) In the steps that follow, use the applicable stator (vane) segment set Adapter to obtain the part number sequence to assemble the stator (vane) segment assemblies required for each stage.

(4) Move the moveable arm to the right side of the Adapter.

(5) Assemble the installation arm detail to the moveable arm of the Adapter.

(6) Remove the stop detail from the Adapter base.

(7) Obtain the stator (vane) segments, air seals, and damper (spring) necessary for a stator assembly. See the applicable Figure.

(a) For vane segment assemblies that have three stator (vane) segments, you must assembly the middle segment first.

(b) Assemble the damper to the shroud, engaging the anti−rotation lug in the shroud with the mating slot in the damper.

(c) Put the end of the shroud and damper into the air seal hand holder of the Adapter.

(d) Align the end of the air seal with the slot in the stator (vane) segment and start to engage the parts by hand.

(e) With the anti−rotation lug of the air seal facing up, install the stator (vane) segment, air seal, and damper assembly onto the Adapter. Put the stator (vane) segment in the groove of the Adapter base and the stator (vane) segment end against the tool stop.

(f) In a clockwise direction, use the installation arm to press the air seal and damper into the stator (vane) segment.

(g) Remove the stator (vane) segment, air seal, and damper assembly from the Adapter.

(h) Start the next stator (vane) segment onto the air seal and damper by hand. For vane segment assemblies with three stator (vane) segments, you must assemble the stator (vane) segment that is closest to the Adapter stop detail.

(i) Re−install the stator (vane) segment, air seal, and damper assembly on the Adapter.

(j) In a clockwise direction, use the installation arm to press the air seal and damper into the stator (vane) segment.

(k) Make sure that the inner shrouds touch.

NOTE: Vane segments with too much gap between the stator (vane) segments can prevent the proper assembly of the mating compressor case anti−rotation lugs at final assembly.

(l) For vane segment assemblies that have three stator (vane) segments, proceed as follows:

1 Remove the stator (vane) segment air seal, and damper assembly from the Adapter.

2 Start the stator (vane) segment that is closest to the moveable arm detail by hand.

3 Re−install the stator (vane) segment air seal and damper assembly on the Adapter.

4 In a clockwise direction, use the installation arm to press the air seal and damper into the stator (vane) segment.

5 Make sure that the inner shrouds touch.

NOTE: The stator (vane) segments with too much gap between the segments can prevent the proper assembly of the mating compressor case at final assembly.

(m) Remove the stator (vane) segment from the Adapter.

(8) Repeat the above steps to assemble each of the stator (vane) segment assembly.

(9) Install the thermal insulation blanket to the vane foot as specified in Figure 1002.

(a) Use the PWA 83−C4 (Task 70−48−00−360−001) method to clean the vane foot area, where you will apply silicone rubber, as shown in the applicable figure.

NOTE: You can use Isopropyl Alcohol P11−014 as an alternative solvent.

(b) In an environment with a relative humidity of 20 percent minimum, apply a bead of Silicone Rubber P09−014 to the area shown in the referenced figure.

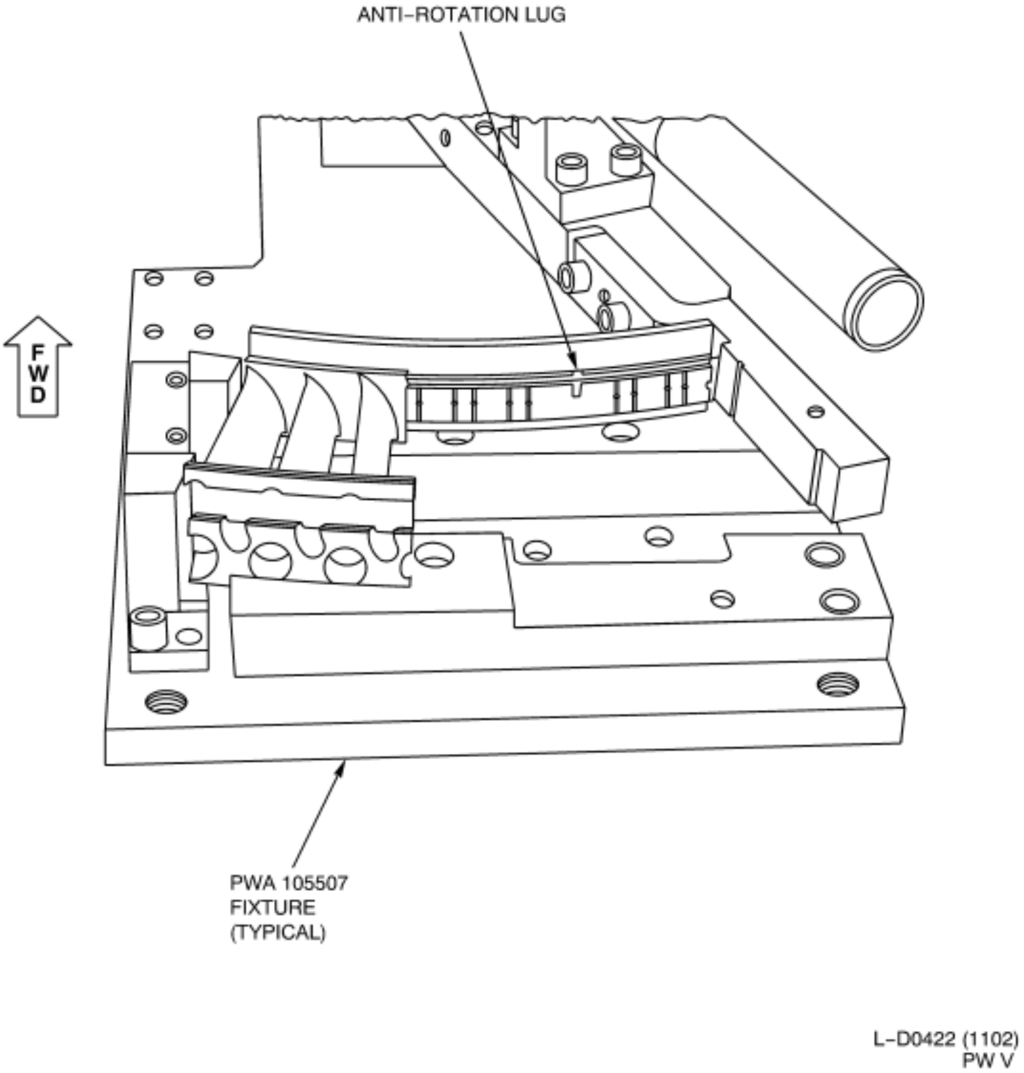
(c) Cut the thermal blanket to fit the recessed vane foot area and install it as shown in the referenced area as follows.

1 The thermal blanket must not extend into the anti−rotation slot or beyond the ends of the stator assembly.

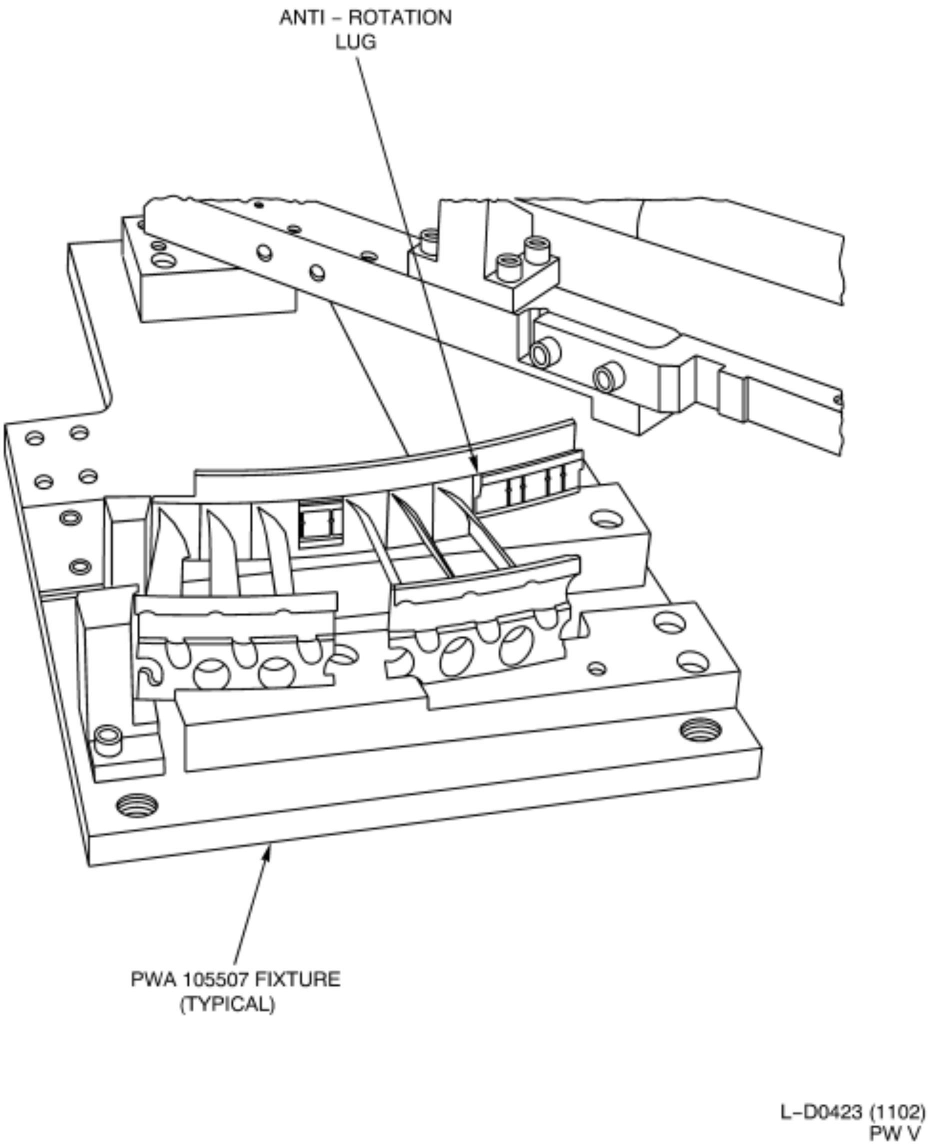
2 The uncovered areas adjacent to the anti−rotation slot ends and the ends of the stator assembly must not be more than 0.125 inch (3.175 mm) maximum, reference.

(d) Repeat the above steps for each of the stator (vane) segment assemblies.

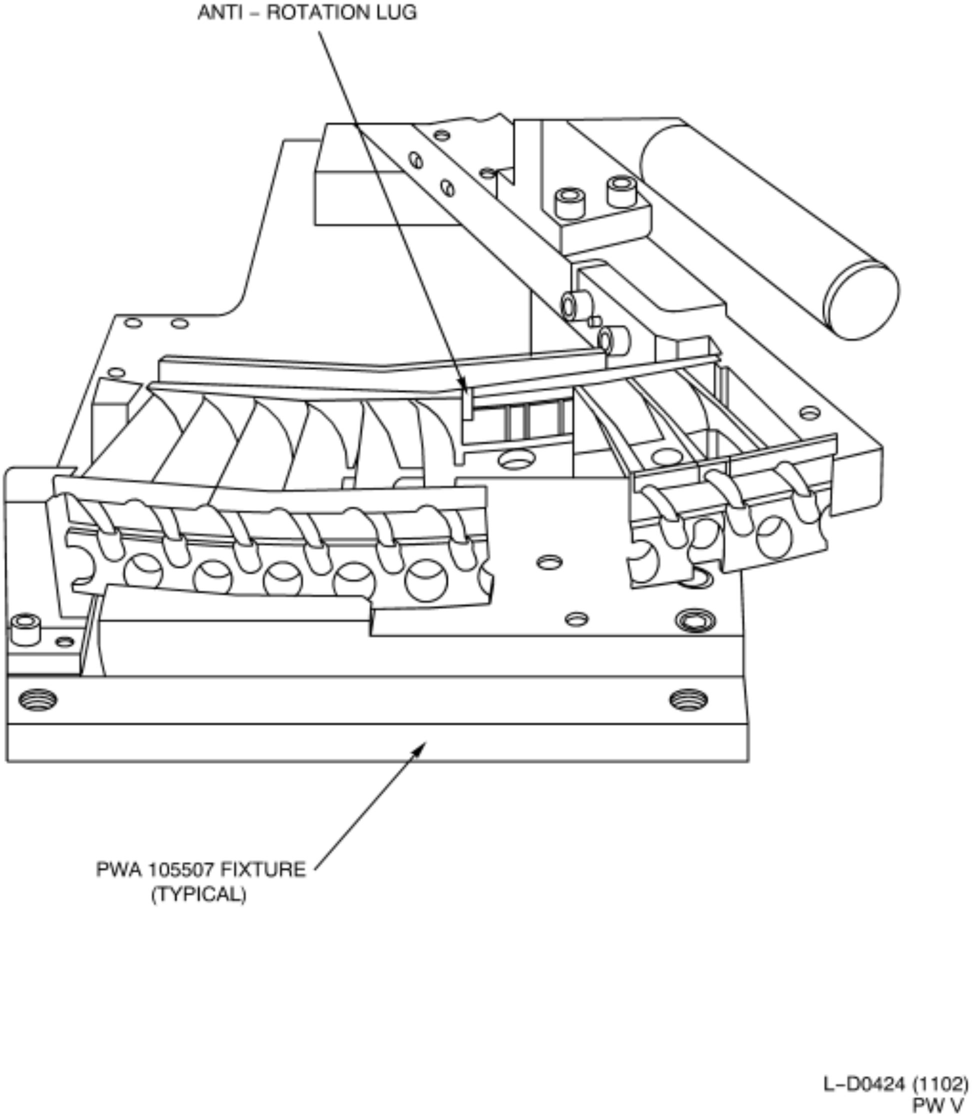
(e) Cure the sealant for 2 hours before you handle the stator (vane) segments.


ANTI−ROTATION LUG
F
W
D
PWA 105507
FIXTURE
(TYPICAL)
L−D0422 (1102)
PW V

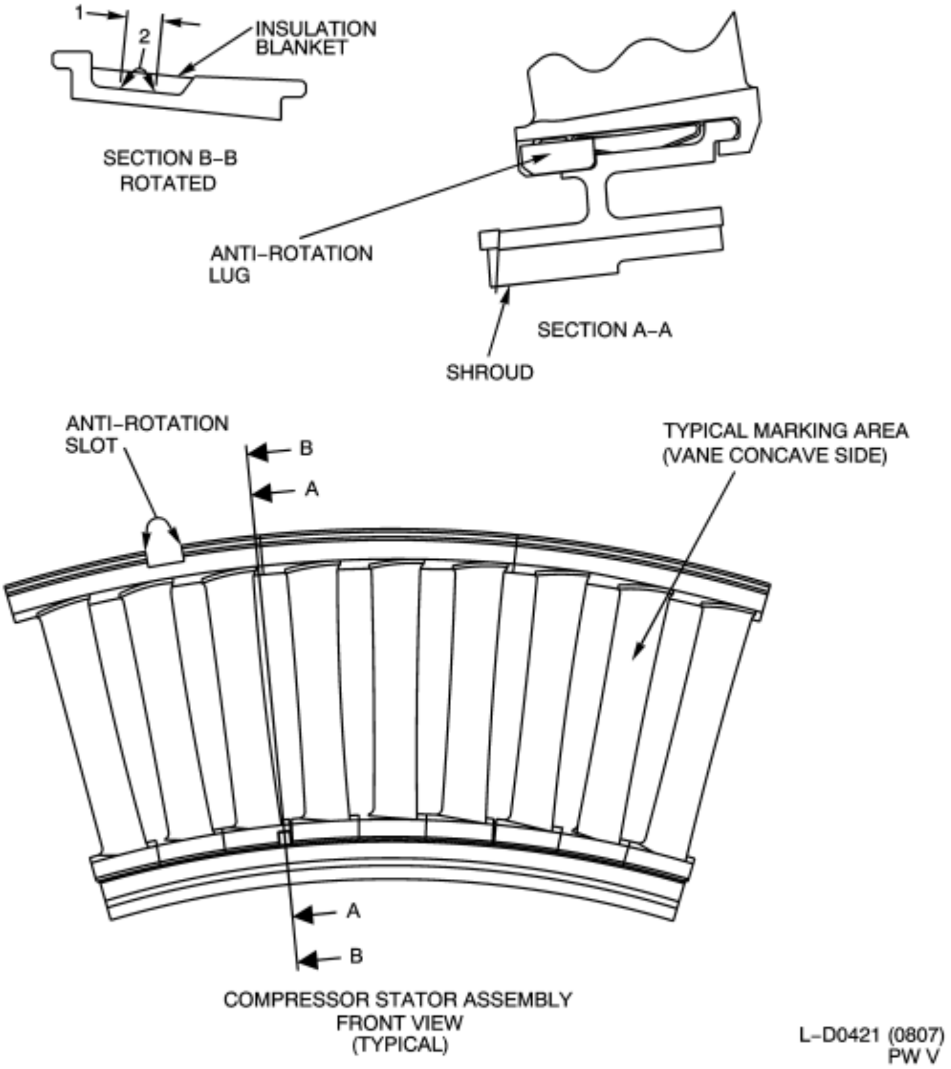
Stator (Vane) Segment Assembly Tooling
Figure 1001 (Sheet 1)
(Task 72−35−00−430−006)


ANTI – ROTATION LUG
PWA 105507 FIXTURE (TYPICAL)
L−D0423 (1102)
PW V

Stator (Vane) Segment Assembly Tooling
Figure 1001 (Sheet 2)
(Task 72−35−00−430−006)

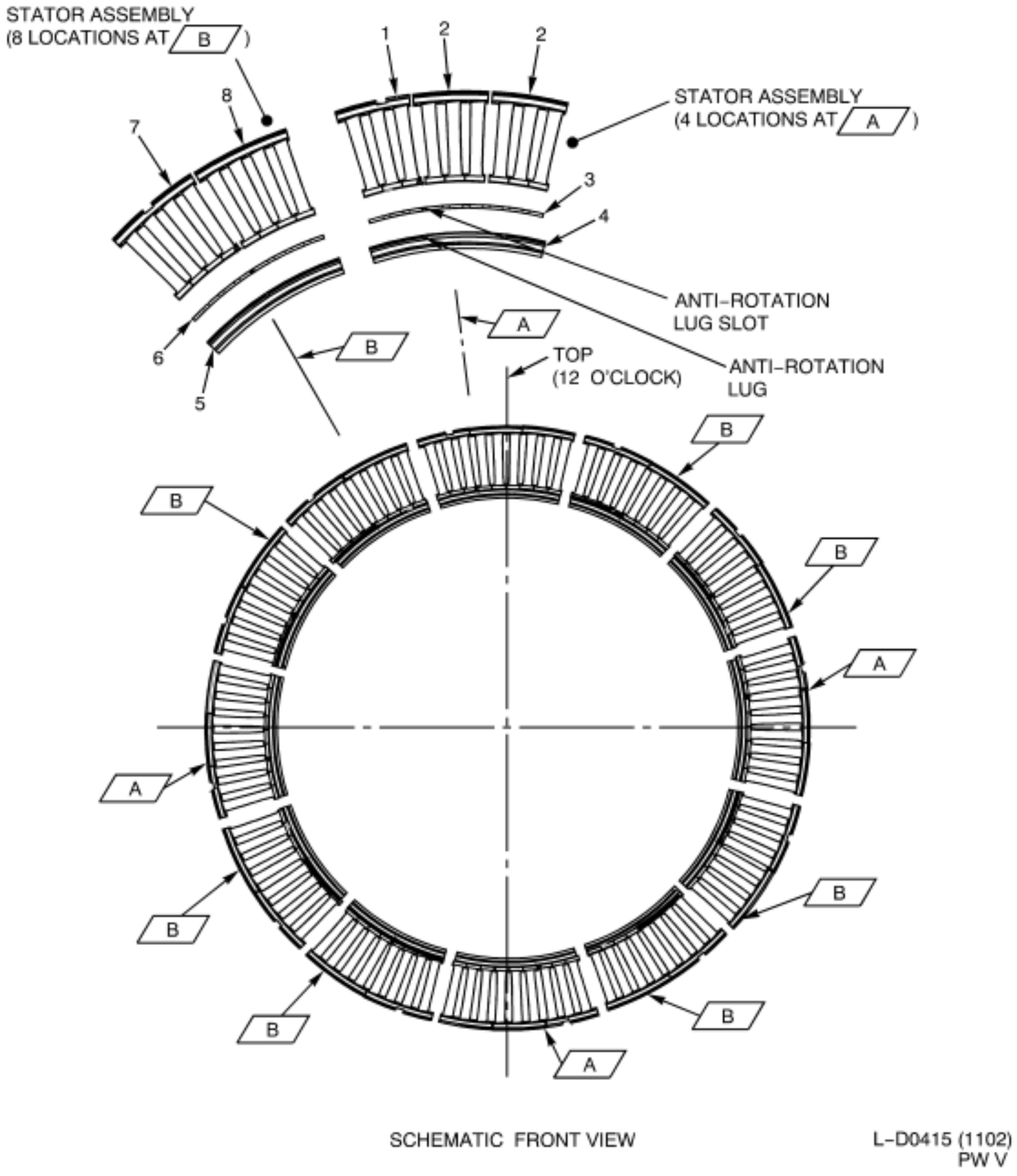

ANTI - ROTATION LUG
PWA 105507 FIXTURE (TYPICAL)
L-D0424 (1102)
PW V

Stator (Vane) Segment Assembly Tooling
Figure 1001 (Sheet 3)
(Task 72-35-00-430-006)


1
2
INSULATION BLANKET
SECTION B-B ROTATED
ANTI-ROTATION LUG
SECTION A-A
SHROUD
ANTI-ROTATION SLOT
B
A
TYPICAL MARKING AREA (VANE CONCAVE SIDE)
A
B
COMPRESSOR STATOR ASSEMBLY FRONT VIEW (TYPICAL)
L-D0421 (0807)
PW V

1. 0.250 Inch (6.350 mm) Maximum
2. Apply Sealant To This Area. See The Text.

Stator (Vane) Segment Assembly - General
Figure 1002
(Task 72-35-00-430-006)

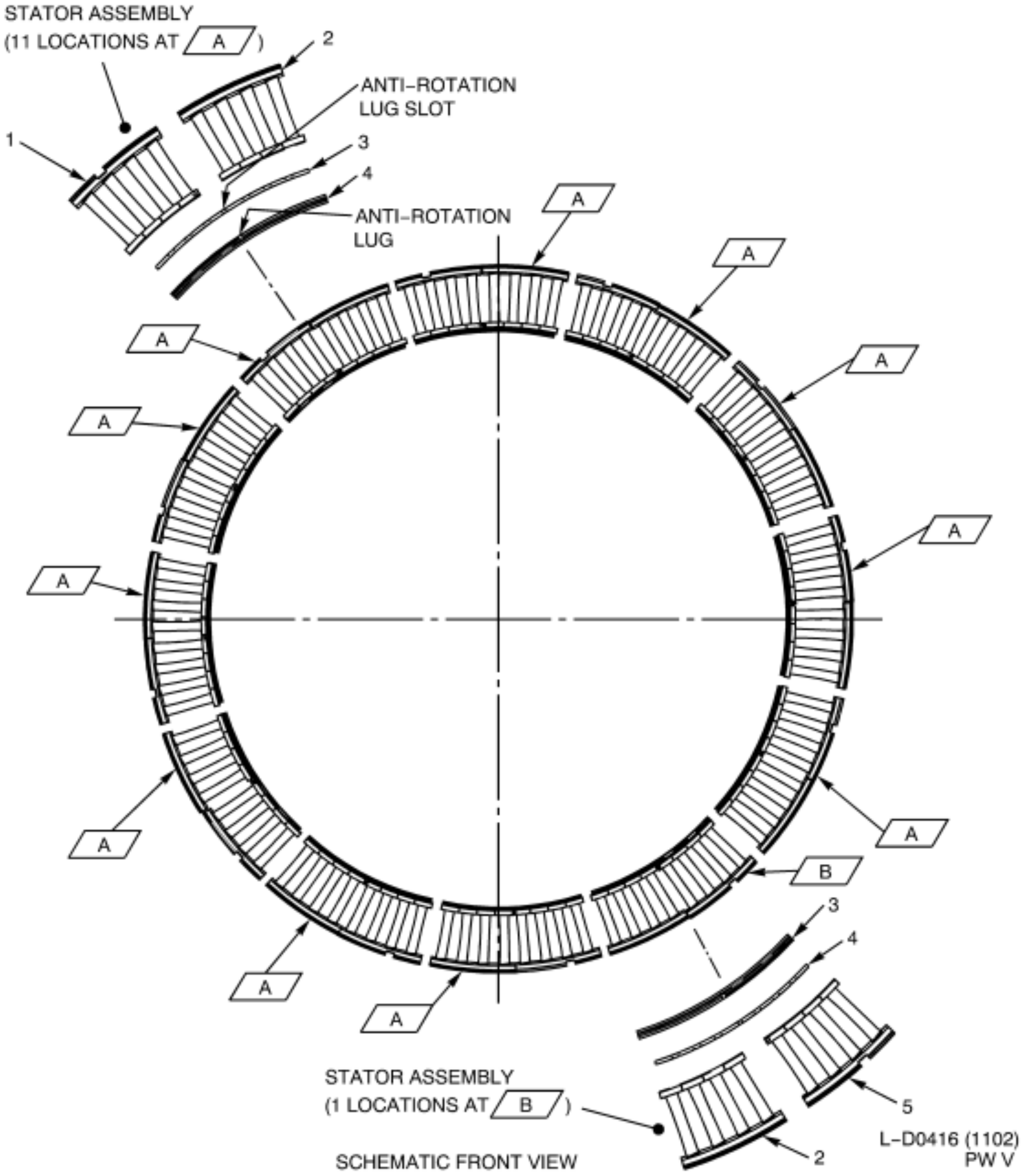

STATOR ASSEMBLY
(8 LOCATIONS AT B)
1
2
2
STATOR ASSEMBLY
(4 LOCATIONS AT A)
8
7
3
4
ANTI-ROTATION
LUG SLOT
A
B
TOP
(12 O'CLOCK)
ANTI-ROTATION
LUG
6
5
B
B
B
A
A
B
B
B
B
A
SCHEMATIC FRONT VIEW
L-D0415 (1102)
PW V

Eighth Stage Stator (Vane) Segment Assembly
Figure 1003
(Task 72-35-00-430-006)

HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−06

1. Stage 8 HPC Stator (Vane) Segment PN 58H388−03, 4 Required.
2. Stage 8 HPC Stator (Vane) Segment PN 58H388−04, 8 Required.
3. Stage 8 HPC Spring, PN 58H352, 4 Required.
4. Stage 8 HPC Shroud, PN 59H578−01, 4 Required.
5. Stage 8 HPC Shroud, PN 59H588−01, 8 Required.
6. Stage 8 HPC Spring, PN 58H351, 8 Required.
7. Stage 8 HPC Stator (Vane) Segment PN 58H388−01, 8 Required.
8. Stage 8 HPC Stator (Vane) Segment PN 58H388−02, 8 Required.

Key to Figure 1003

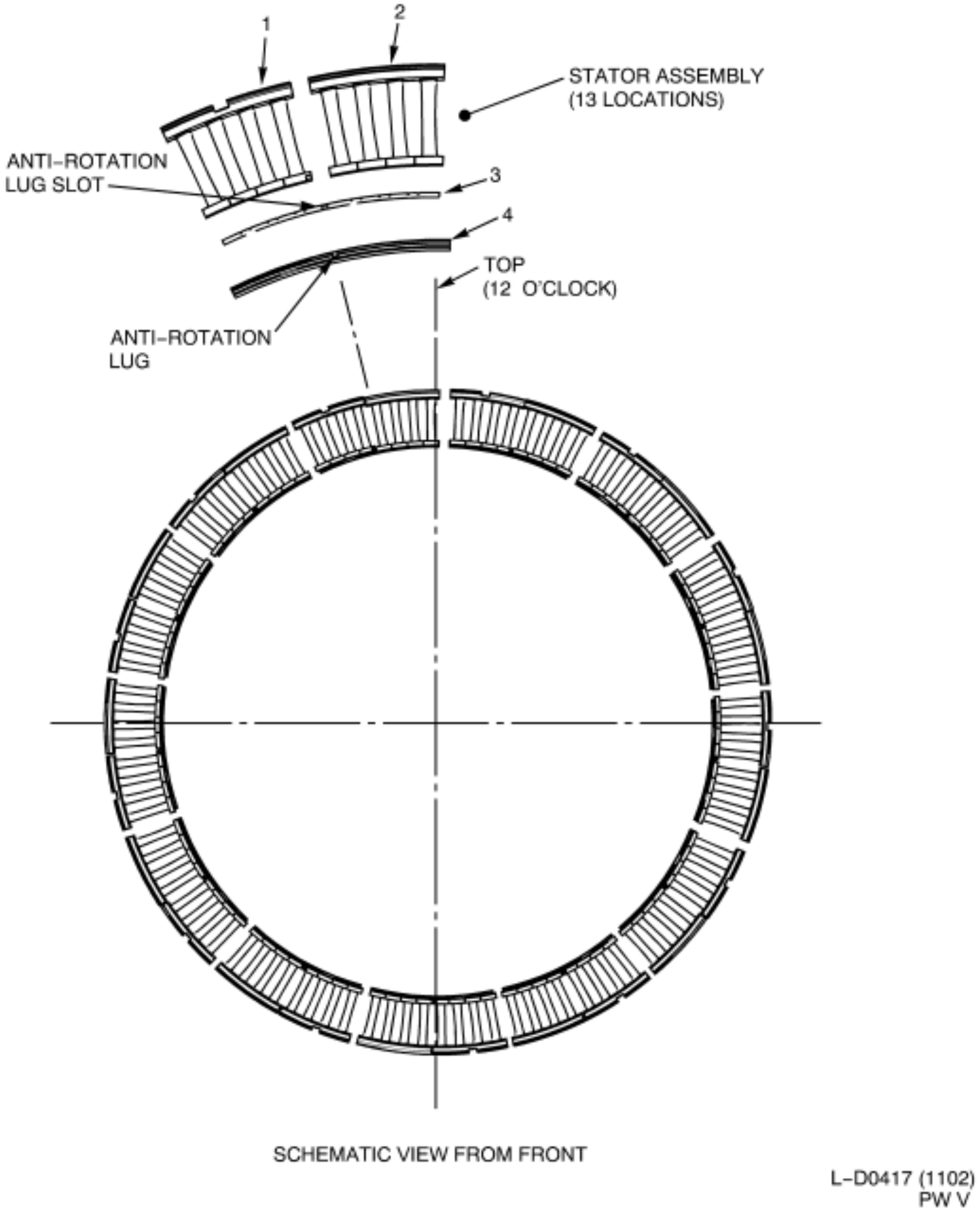

STATOR ASSEMBLY
(11 LOCATIONS AT A)
2
ANTI−ROTATION
LUG SLOT
1
3
4
ANTI−ROTATION
LUG
A
A
A
A
A
A
A
A
A
A
A
B
3
4
5
STATOR ASSEMBLY
(1 LOCATIONS AT B)
SCHEMATIC FRONT VIEW
2
L−D0416 (1102)
PW V

Tenth Stage Stator (Vane) Segment Assembly
Figure 1004
(Task 72−35−00−430−006)

HIGH PRESSURE COMPRESSOR (HPC) - ASSEMBLY-06

1. Stage 10 HPC Stator (Vane) Segment PN 59H380-01, 11 Required.
2. Stage 10 HPC Stator (Vane) Segment PN 59H380-02, 12 Required.
3. Stage 10 HPC Spring, PN 58H355, 12 Required.
4. Stage 10 HPC Shroud, PN 59H580-01, 12 Required.
5. Stage 10 HPC Stator (Vane) Segment PN 59H380-03, 1 Required.

Key to Figure 1004


1
2
STATOR ASSEMBLY
(13 LOCATIONS)
ANTI−ROTATION
LUG SLOT
3
4
TOP
(12 O'CLOCK)
ANTI−ROTATION
LUG
SCHEMATIC VIEW FROM FRONT
L−D0417 (1102)
PW V

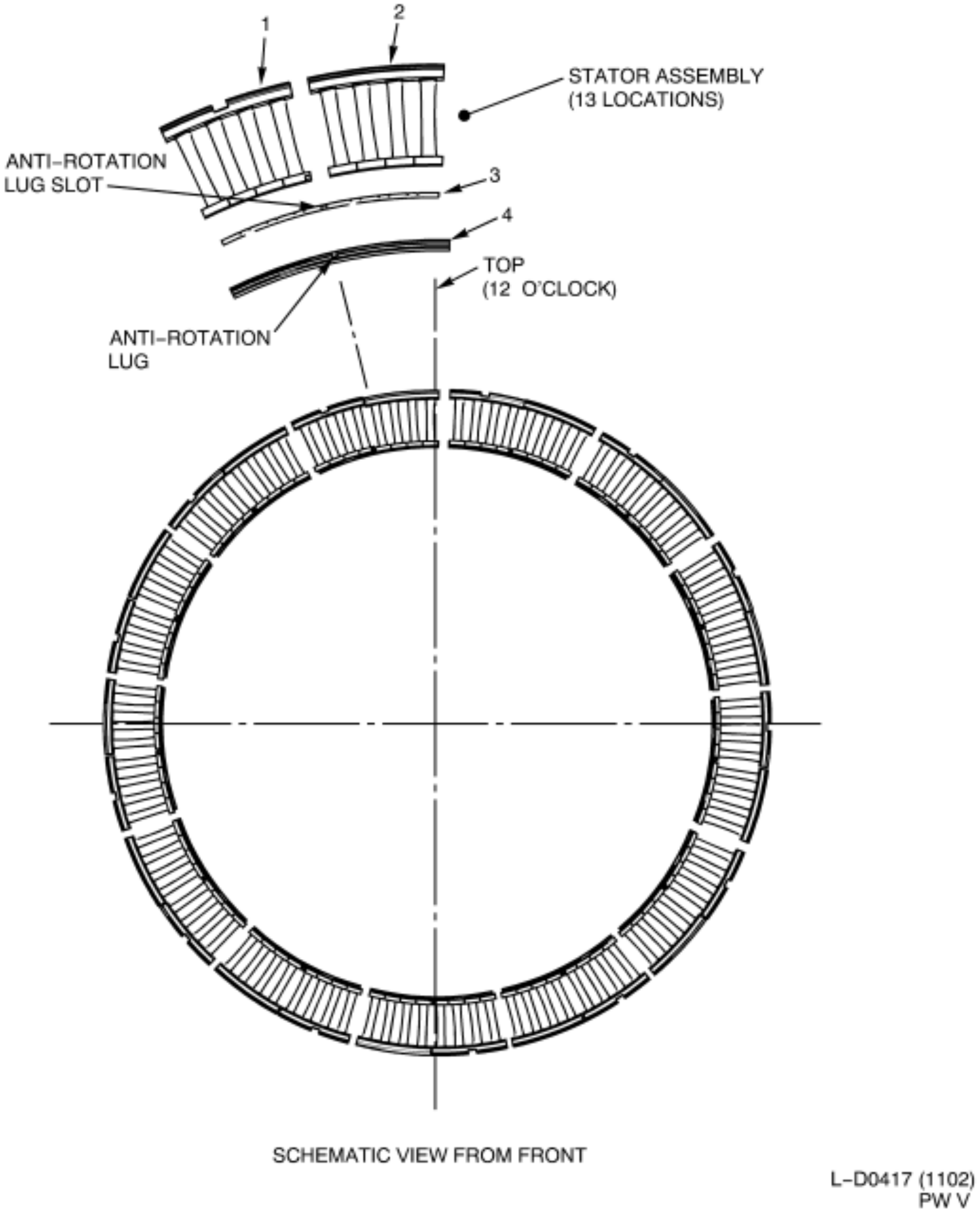
Eleventh Stage Stator (Vane) Segment Assembly
Figure 1005
(Task 72−35−00−430−006)

HIGH PRESSURE COMPRESSOR (HPC) - ASSEMBLY-06

1. Stage 11 HPC Stator (Vane) Segment PN 58H371-01, 13 Required.
2. Stage 11 HPC Stator (Vane) Segment PN 58H371-02, 13 Required.
3. Stage 11 HPC Spring, PN 58H337, 13 Required.
4. Stage 11 HPC Shroud, PN 58H381-01, 13 Required.

Key to Figure 1005

HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−06


1
2
STATOR ASSEMBLY
(13 LOCATIONS)
ANTI−ROTATION
LUG SLOT
3
4
TOP
(12 O'CLOCK)
ANTI−ROTATION
LUG
SCHEMATIC VIEW FROM FRONT
L−D0417 (1102)
PW V

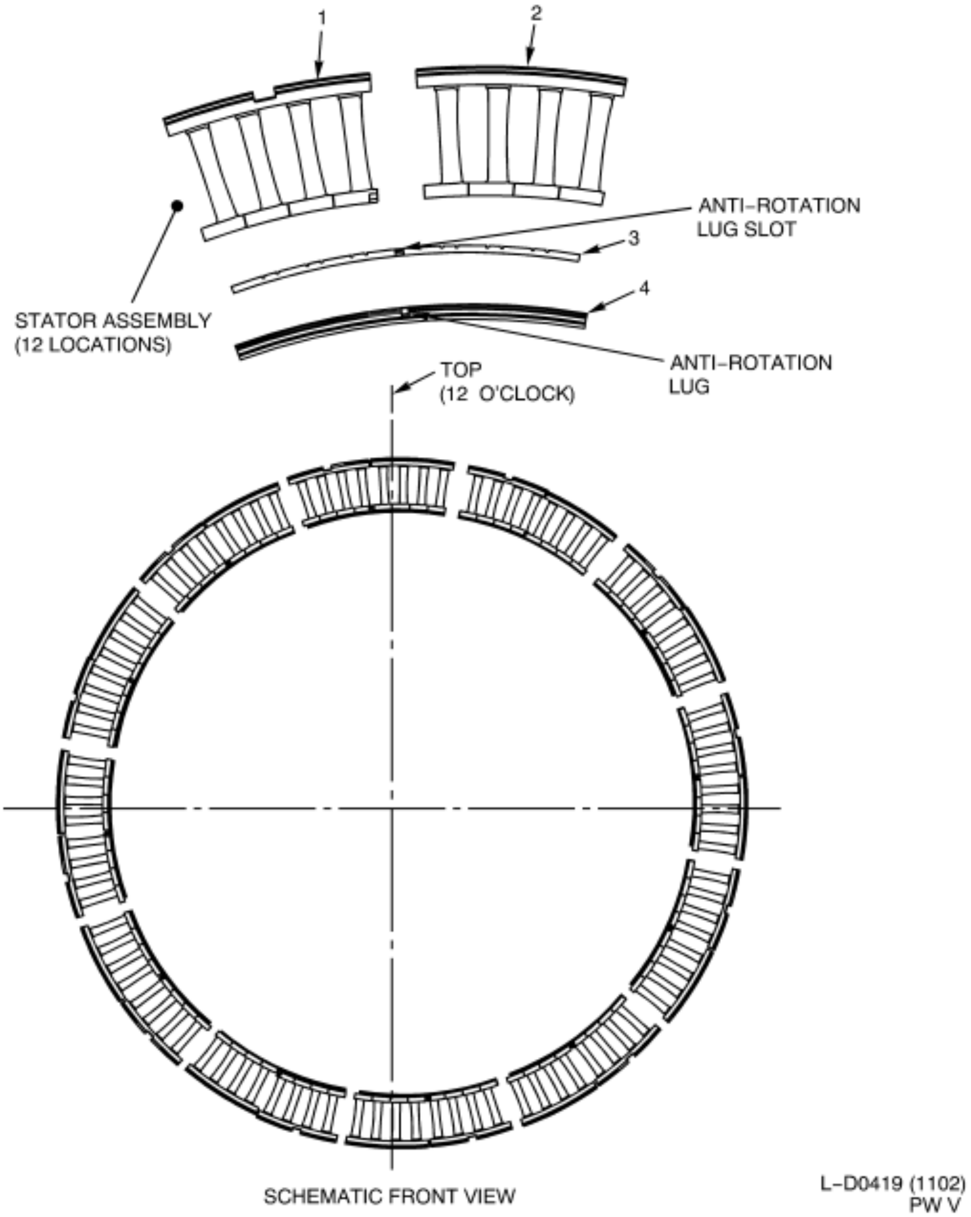
Twelfth Stage Stator (Vane) Segment Assembly
Figure 1006
(Task 72−35−00−430−006)

HIGH PRESSURE COMPRESSOR (HPC) - ASSEMBLY-06

1. Stage 12 HPC Stator (Vane) Segment PN 58H372-01, 12 Required.
2. Stage 12 HPC Stator (Vane) Segment PN 58H372-02, 8 Required.
3. Stage 12 HPC Stator (Vane) Segment PN 58H372-03, 4 Required.
4. Stage 12 HPC Spring, PN 58H338, 4 Required.
5. Stage 12 HPC Shroud, PN 58H392-01, 4 Required.
6. Stage 12 HPC Shroud, PN 58H382-01, 8 Required.
7. Stage 12 HPC Spring, PN 58H339, 8 Required.

Key to Figure 1006

HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−06

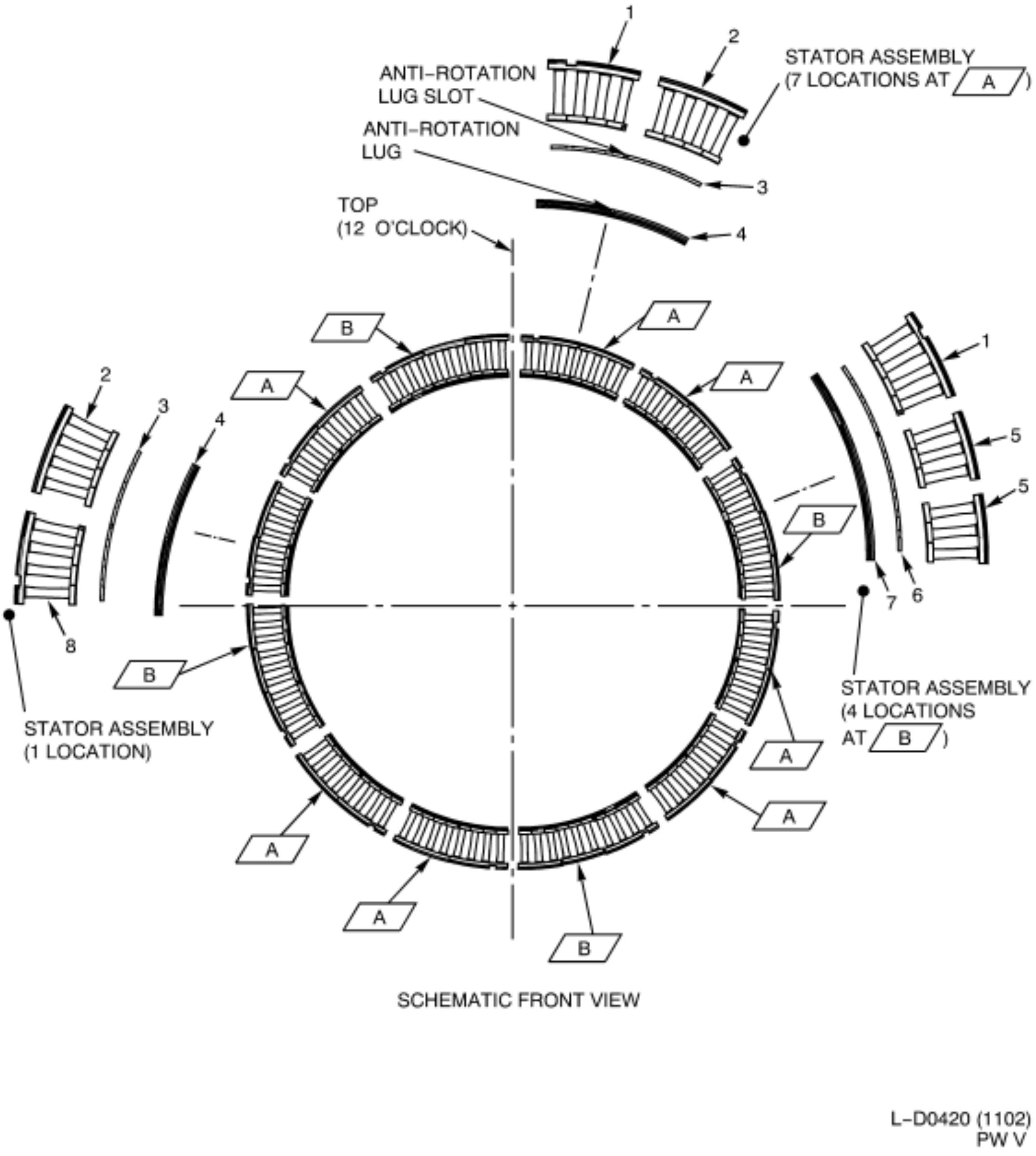

1
2
ANTI−ROTATION
LUG SLOT
3
4
STATOR ASSEMBLY
(12 LOCATIONS)
ANTI−ROTATION
LUG
TOP
(12 O'CLOCK)
SCHEMATIC FRONT VIEW
L−D0419 (1102)
PW V

Thirteenth Stage Stator (Vane) Segment Assembly
Figure 1007
(Task 72−35−00−430−006)

HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−06

1. Stage 13 HPC Stator (Vane) Segment PN 58H373−01, 12 Required.
2. Stage 13 HPC Stator (Vane) Segment PN 58H373−02, 12 Required.
3. Stage 13 HPC Spring, PN 58H340, 12 Required.
4. Stage 13 HPC Shroud, PN 58H383−0, 12 Required.

Key to Figure 1007


1
2
ANTI−ROTATION
LUG SLOT
STATOR ASSEMBLY
(7 LOCATIONS AT A)
ANTI−ROTATION
LUG
3
TOP
(12 O'CLOCK)
4
B
A
A
A
1
2
3
4
5
5
B
7
6
8
B
STATOR ASSEMBLY
(4 LOCATIONS
AT B)
STATOR ASSEMBLY
(1 LOCATION)
A
A
A
A
B
SCHEMATIC FRONT VIEW
L−D0420 (1102)
PW V

Fourteenth Stage Stator (Vane) Segment Assembly
Figure 1008
(Task 72−35−00−430−006)

HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−06

1. Stage 14 HPC Stator (Vane) Segment PN 58H374−01, 11 Required.
2. Stage 14 HPC Stator (Vane) Segment PN 58H374−02, 8 Required.
3. Stage 14 HPC Spring, PN 58H341, 8 Required.
4. Stage 14 HPC Shroud, PN 58H384−01, 8 Required.
5. Stage 14 HPC Stator (Vane) Segment PN 58H374−03, 8 Required.
6. Stage 14 HPC Spring, PN 58H342, 4 Required.
7. Stage 14 HPC Shroud, PN 58H384−01, 4 Required.
8. Stage 14 HPC Stator (Vane) Segment PN 58H374−04, 1 Required.

Key to Figure 1008

HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−20

Task 72−35−00−430−020:

1. Install The Flange J Brackets And Hardware

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)

B. Procedure

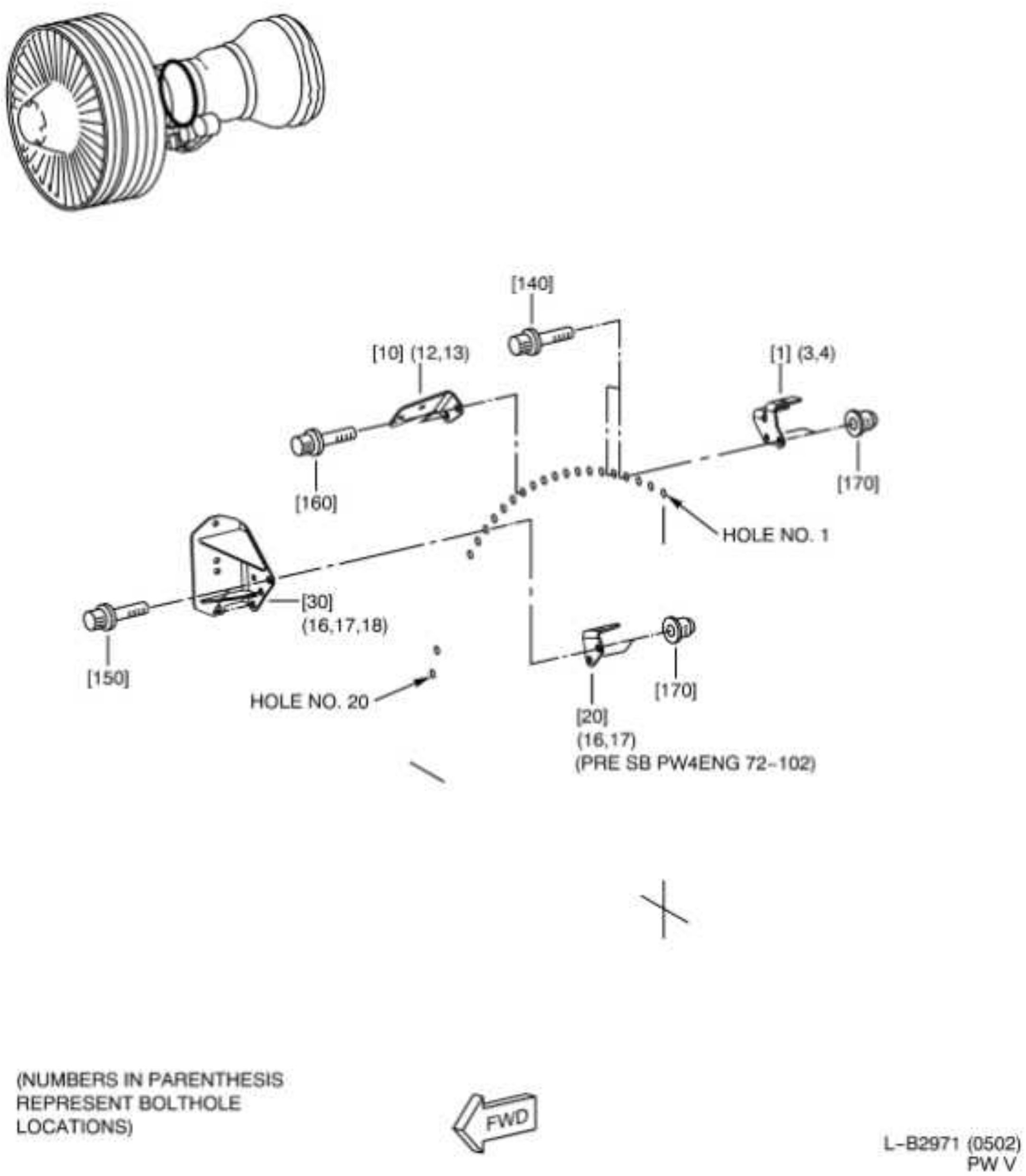
(1) Install Flange J hardware as follows. See Figure 1001.

(a) Attach the brackets with bolts, threads lubricated with Engine Oil P03−001, and nuts.

(b) Torque the nuts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

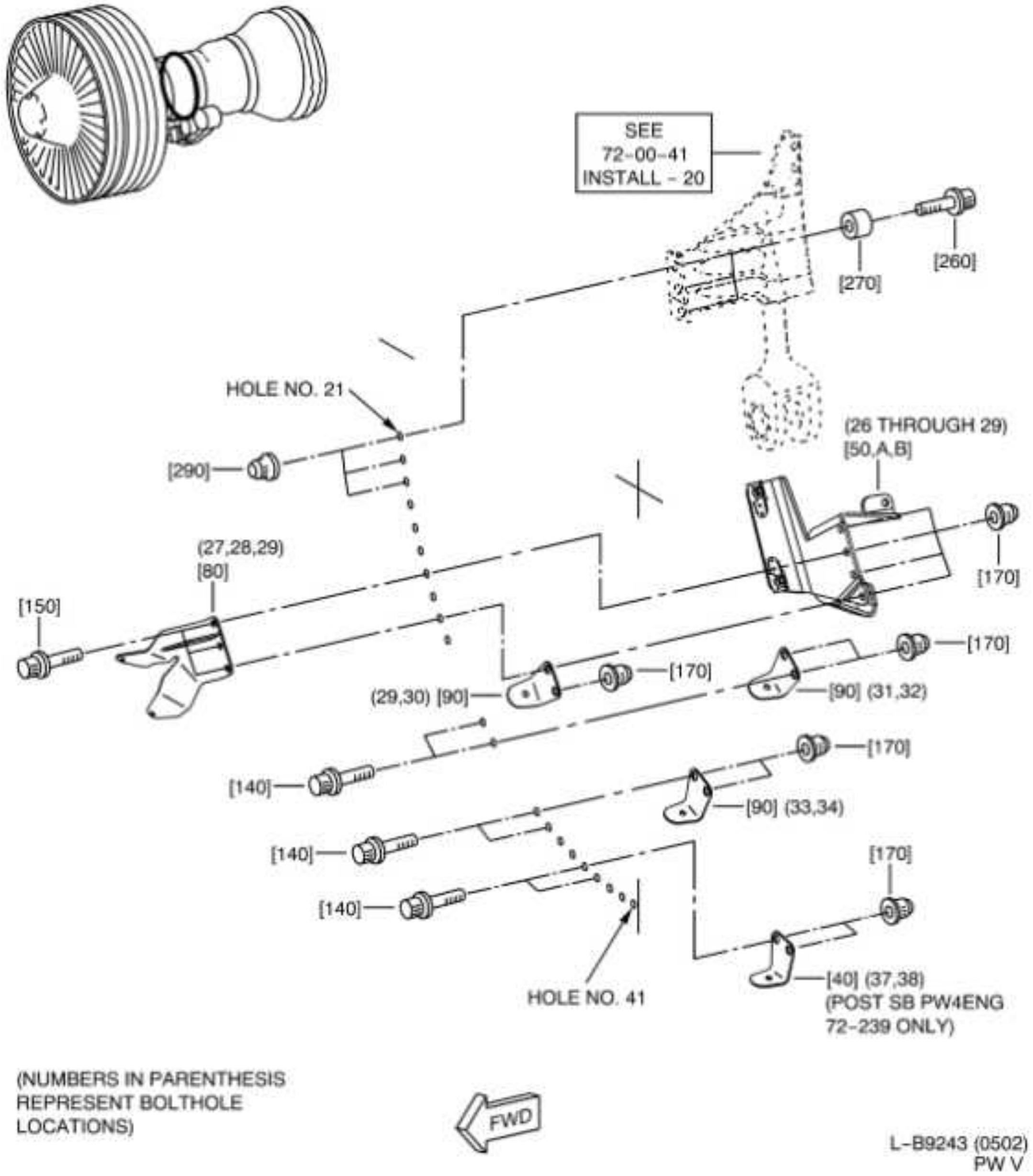
(2) Remove any tags or markings on the brackets or flange.

(3) Examine the assembly for foreign objects, damage, and correct assembly.


[140]
[10] (12,13)
[1] (3,4)
[160]
[170]
HOLE NO. 1
[30]
(16,17,18)
[150]
HOLE NO. 20
[170]
[20]
(16,17)
(PRE SB PW4ENG 72-102)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-B2971 (0502)
PW V

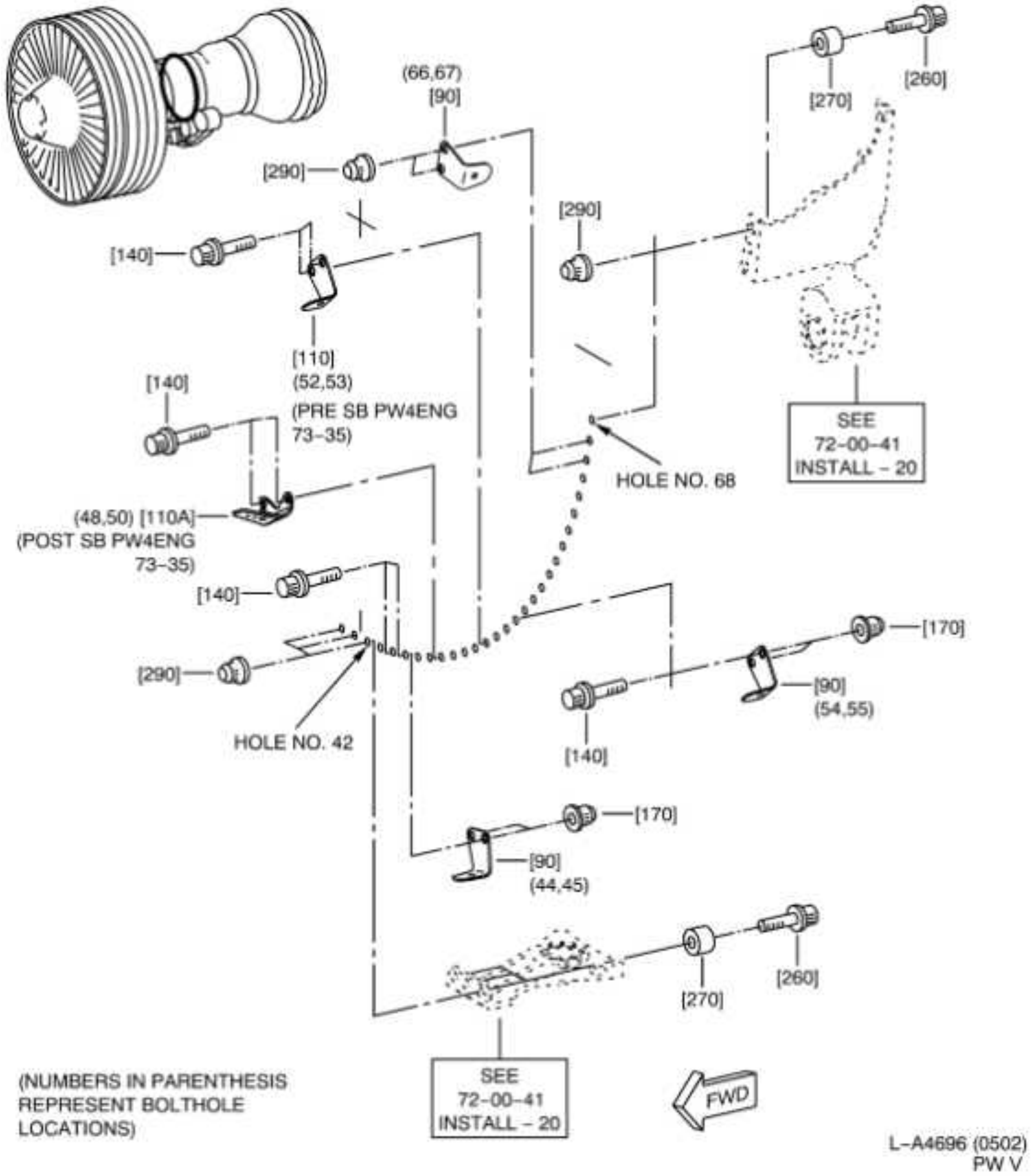
The Flange J Brackets And Hardware
Figure 1001 (Sheet 1)
(Task 72−35−00−430−020)

HIGH PRESSURE COMPRESSOR (HPC) − ASSEMBLY−20

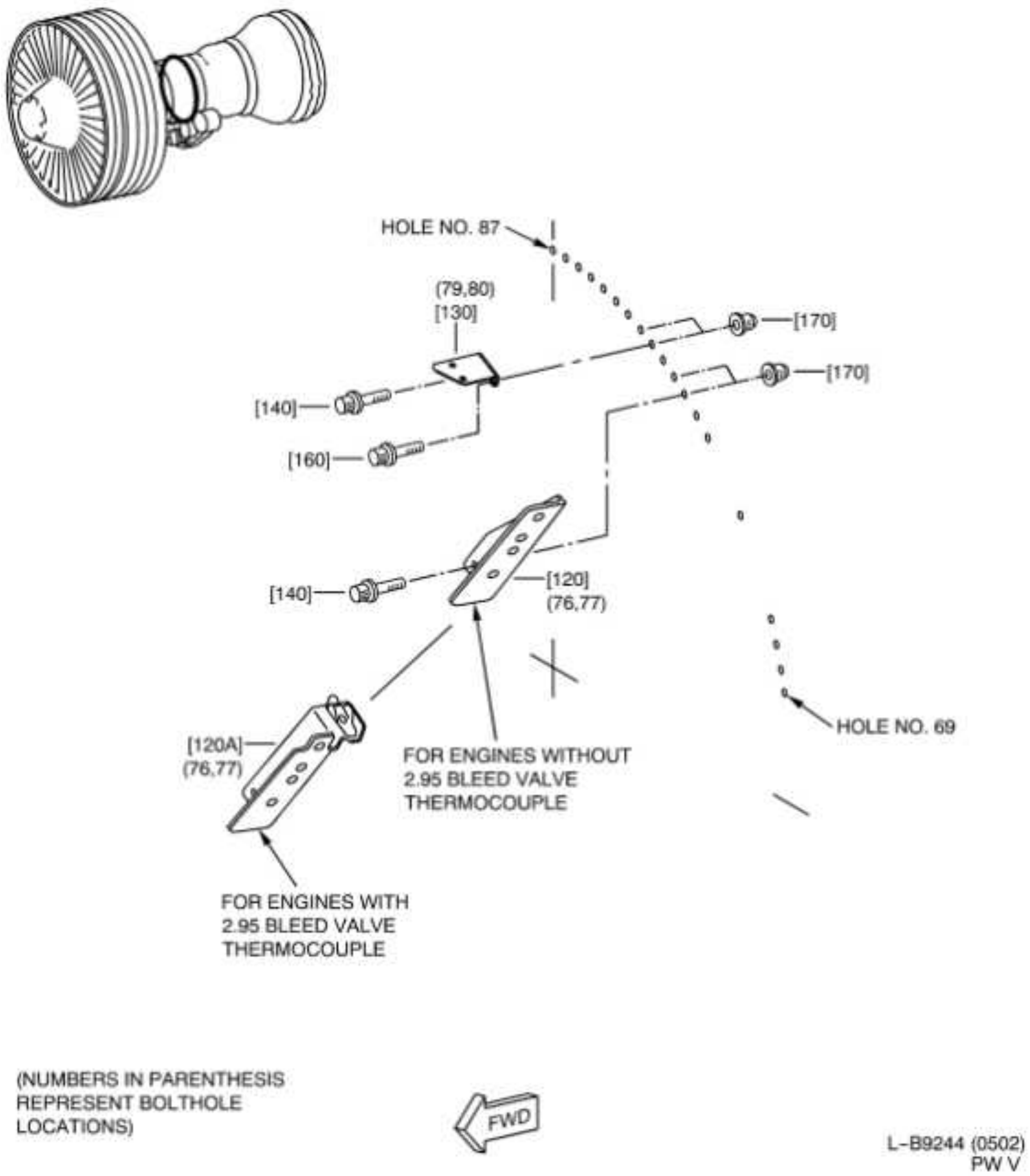

SEE
72-00-41
INSTALL - 20
[260]
[270]
HOLE NO. 21
[290]
(26 THROUGH 29)
[50,A,B]
(27,28,29)
[80]
[150]
[170]
[170]
[170]
(29,30) [90]
[90] (31,32)
[140]
[170]
[90] (33,34)
[140]
[140]
[170]
HOLE NO. 41
[40] (37,38)
(POST SB PW4ENG
72-239 ONLY)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-B9243 (0502)
PW V

The Flange J Brackets And Hardware
Figure 1001 (Sheet 2)
(Task 72−35−00−430−020)

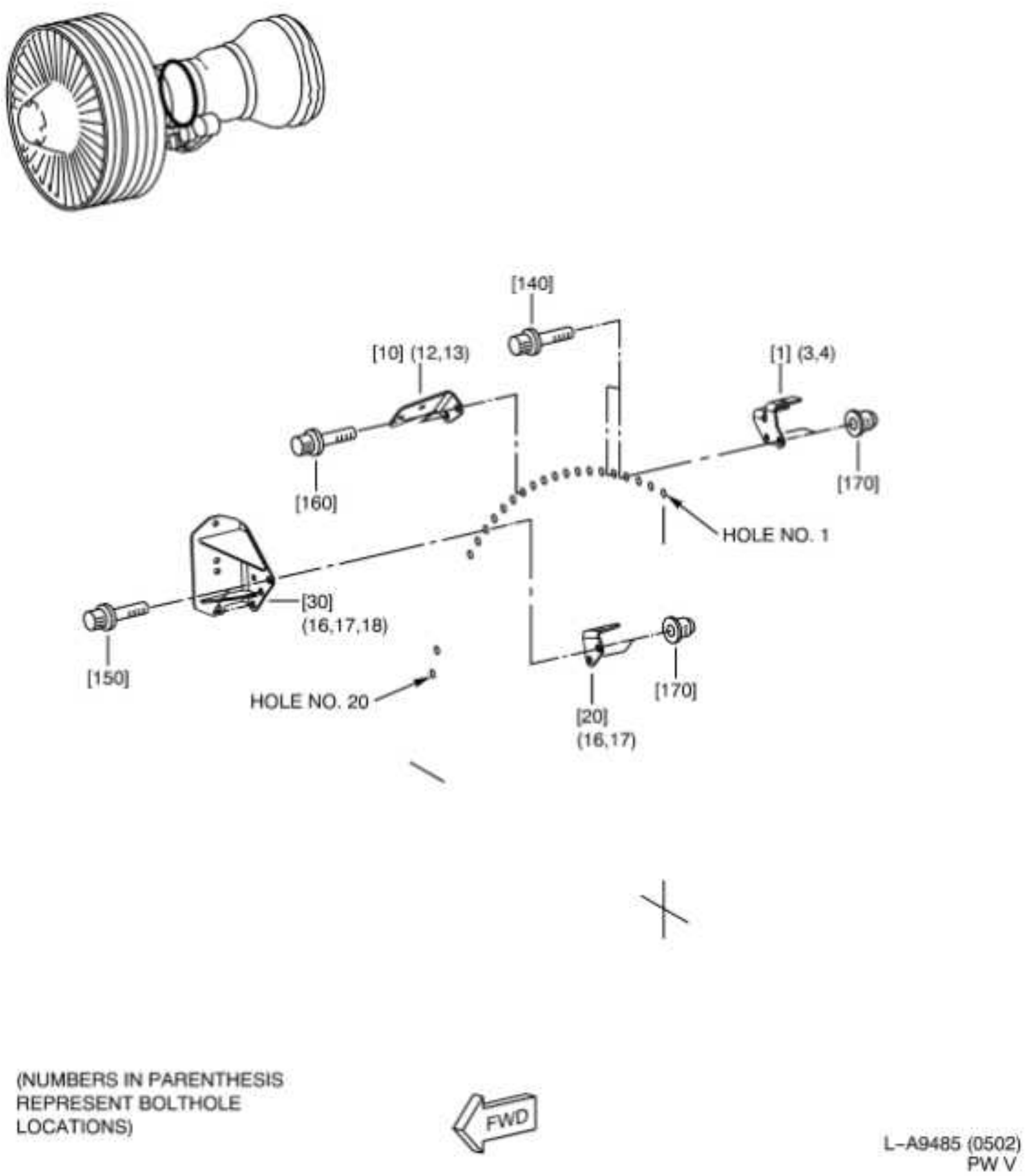
HIGH PRESSURE COMPRESSOR (HPC) - ASSEMBLY-20


(66,67)
[90]
[290]
[270]
[260]
[140]
[290]
[110]
(52,53)
(PRE SB PW4ENG
73-35)
[140]
SEE
72-00-41
INSTALL - 20
HOLE NO. 68
(48,50) [110A]
(POST SB PW4ENG
73-35)
[140]
[170]
[290]
[90]
(54,55)
HOLE NO. 42
[140]
[170]
[90]
(44,45)
[270]
[260]
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
SEE
72-00-41
INSTALL - 20
FWD
L-A4696 (0502)
PW V

The Flange J Brackets And Hardware
Figure 1001 (Sheet 3)
(Task 72-35-00-430-020)


HOLE NO. 87
(79,80)
[130]
[170]
[170]
[140]
[160]
[140]
[120]
(76,77)
[120A]
(76,77)
FOR ENGINES WITHOUT 2.95 BLEED VALVE THERMOCOUPLE
FOR ENGINES WITH 2.95 BLEED VALVE THERMOCOUPLE
HOLE NO. 69
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
FWD
L-B9244 (0502)
PW V

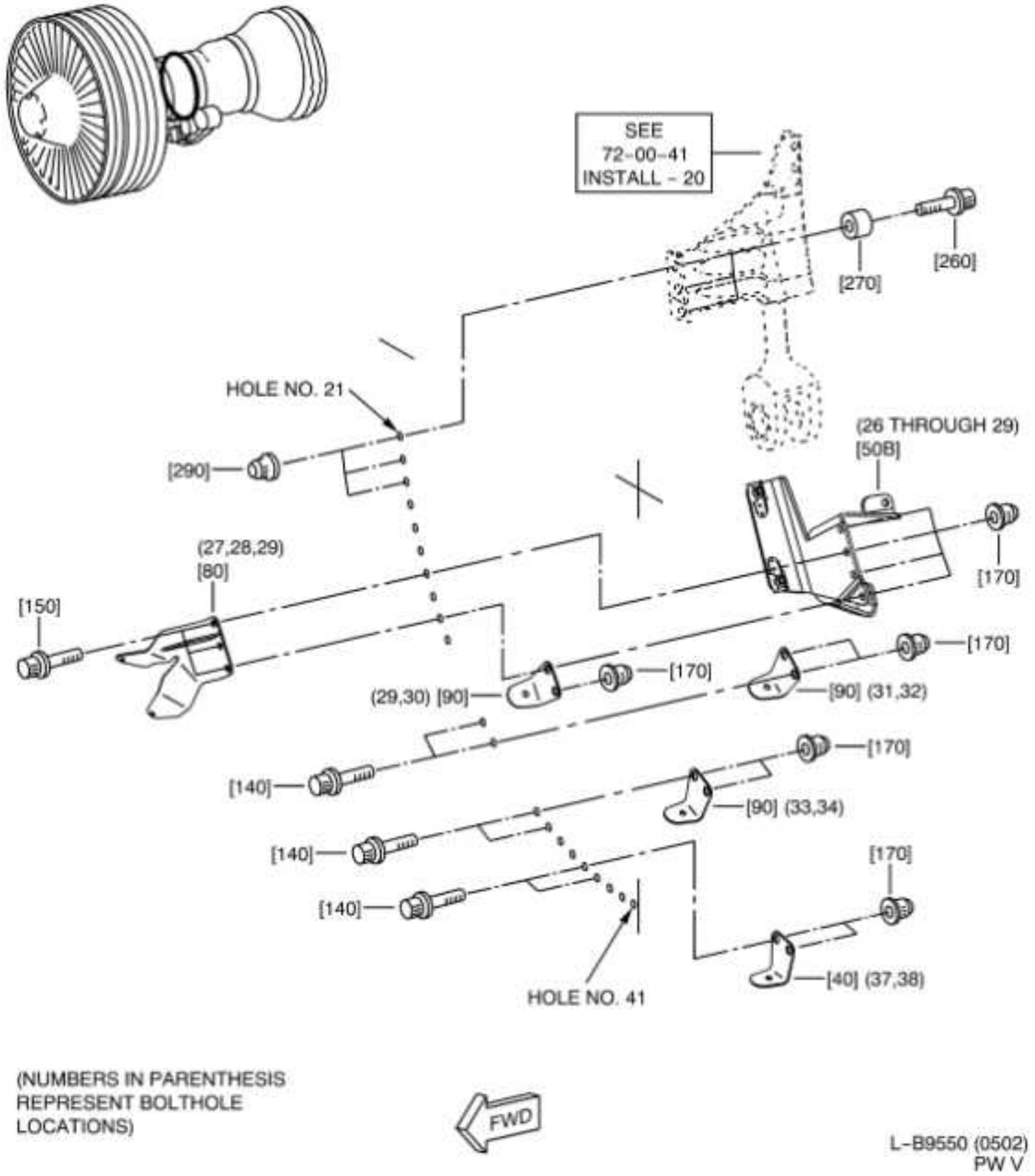
The Flange J Brackets And Hardware
Figure 1001 (Sheet 4)
(Task 72−35−00−430−020)


[140]
[10] (12,13)
[1] (3,4)
[170]
[160]
HOLE NO. 1
[30]
(16,17,18)
[150]
HOLE NO. 20
[170]
[20]
(16,17)
FWD

(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

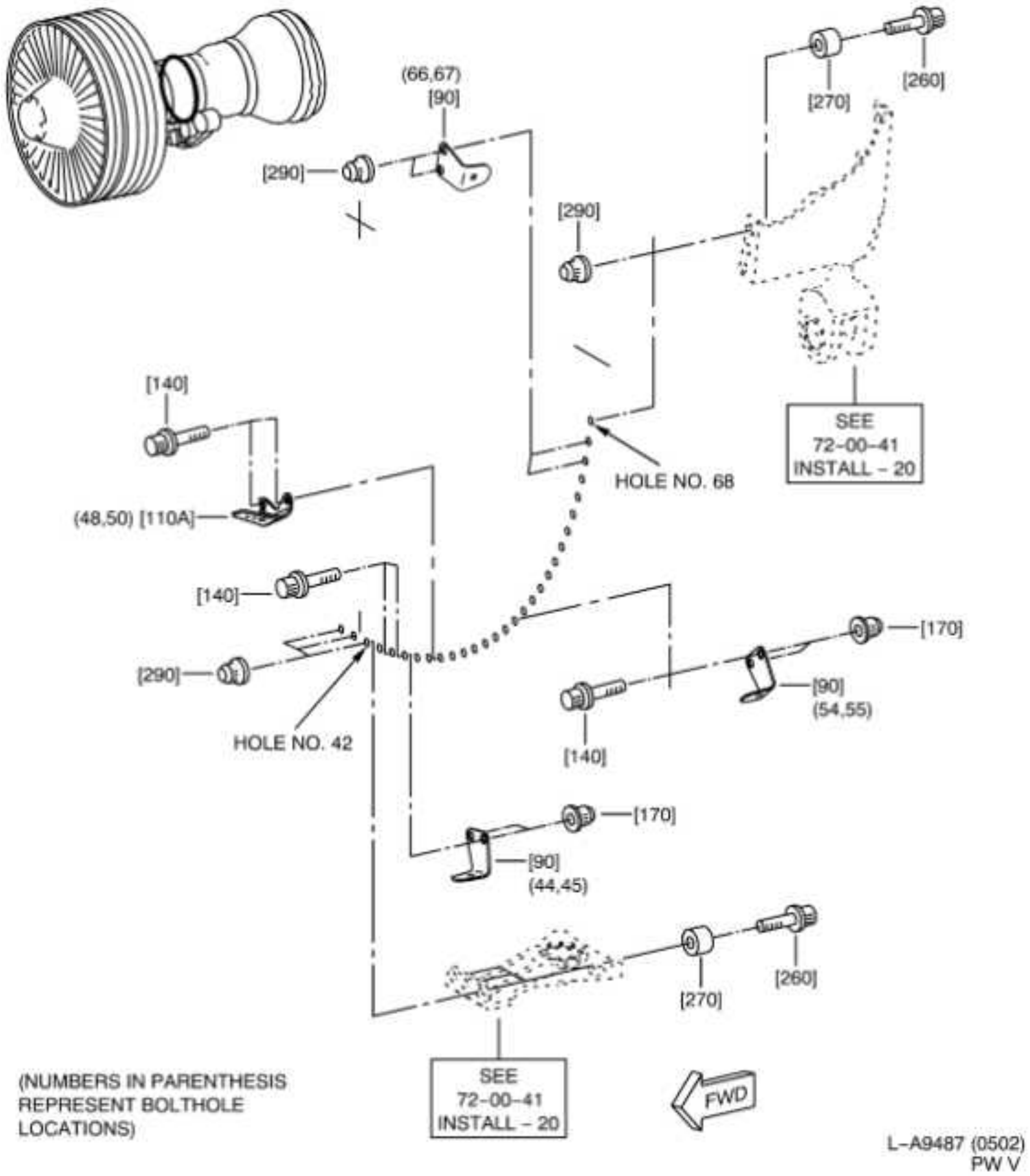
L−A9485 (0502)
PW V

The Flange J Brackets And Hardware
Figure 1001 (Sheet 5)
(Task 72−35−00−430−020)

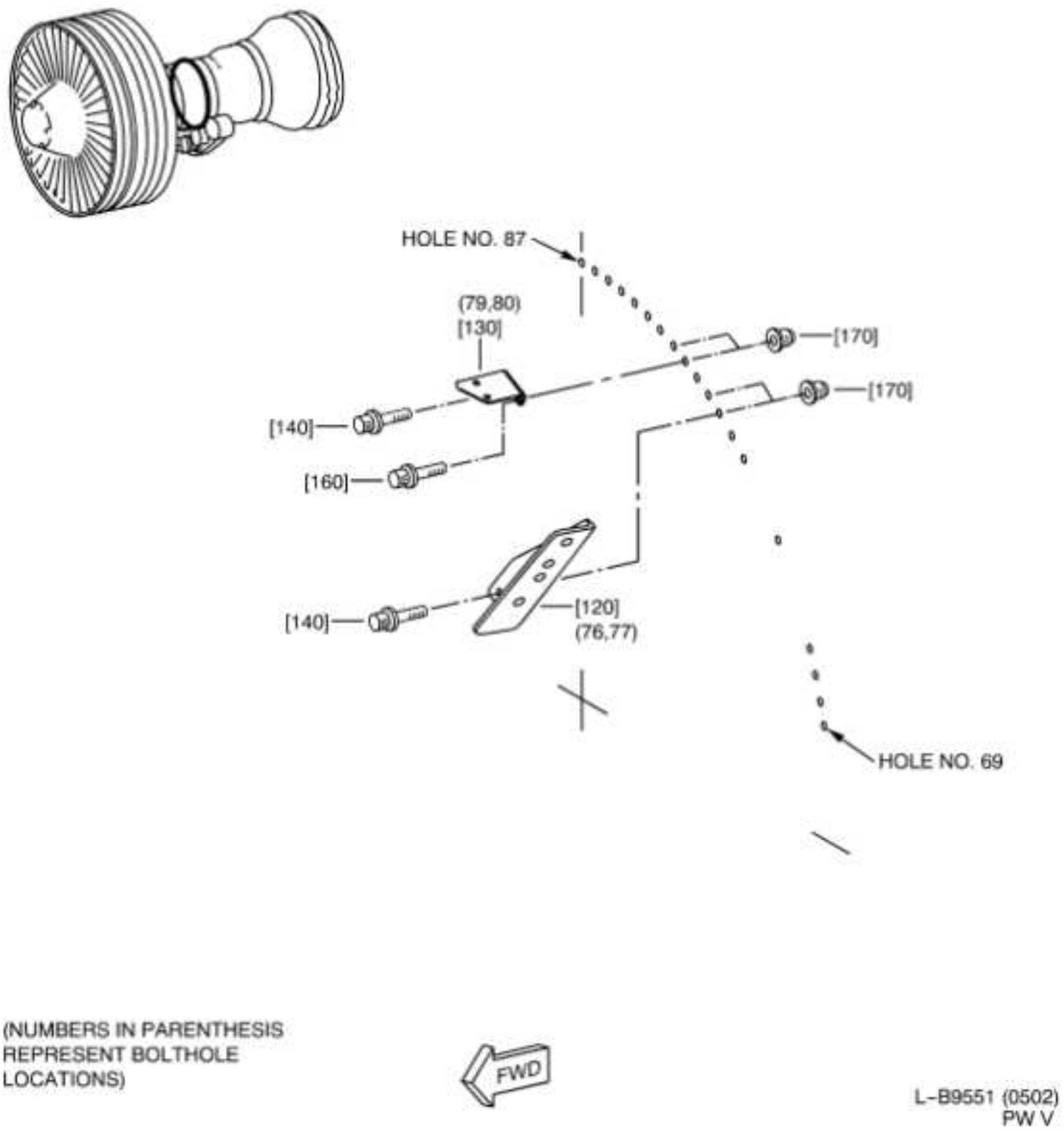

SEE
72-00-41
INSTALL - 20
[260]
[270]
HOLE NO. 21
[290]
(26 THROUGH 29)
[50B]
[170]
(27,28,29)
[80]
[150]
[170]
[170]
(29,30) [90]
[90] (31,32)
[140]
[170]
[90] (33,34)
[140]
[170]
[140]
HOLE NO. 41
[40] (37,38)
FWD
L-B9550 (0502)
PW V

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

The Flange J Brackets And Hardware
Figure 1001 (Sheet 6)
(Task 72−35−00−430−020)


(66,67)
[90]
[290]
[270]
[260]
[290]
SEE
72-00-41
INSTALL - 20
[140]
HOLE NO. 68
(48,50) [110A]
[140]
[170]
[290]
[90]
(54,55)
HOLE NO. 42
[140]
[170]
[90]
(44,45)
[270]
[260]
SEE
72-00-41
INSTALL - 20
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
FWD
L-A9487 (0502)
PW V

The Flange J Brackets And Hardware
Figure 1001 (Sheet 7)
(Task 72-35-00-430-020)


HOLE NO. 87
(79,80)
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[170]
[170]
[140]
[160]
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(76,77)
HOLE NO. 69
FWD
L-B9551 (0502)
PW V

(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)

The Flange J Brackets And Hardware
Figure 1001 (Sheet 8)
(Task 72−35−00−430−020)

Previous Pageblock Return to Previous Menu Next Pageblock

HIGH PRESSURE COMPRESSOR (HPC) - ASSEMBLY-21

Task 72-35-00-430-021:

1. Install The Flange H Brackets And Hardware

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

B. Procedure

(1) Install Flange H hardware as follows. See Figure 1001 or Figure 1002.

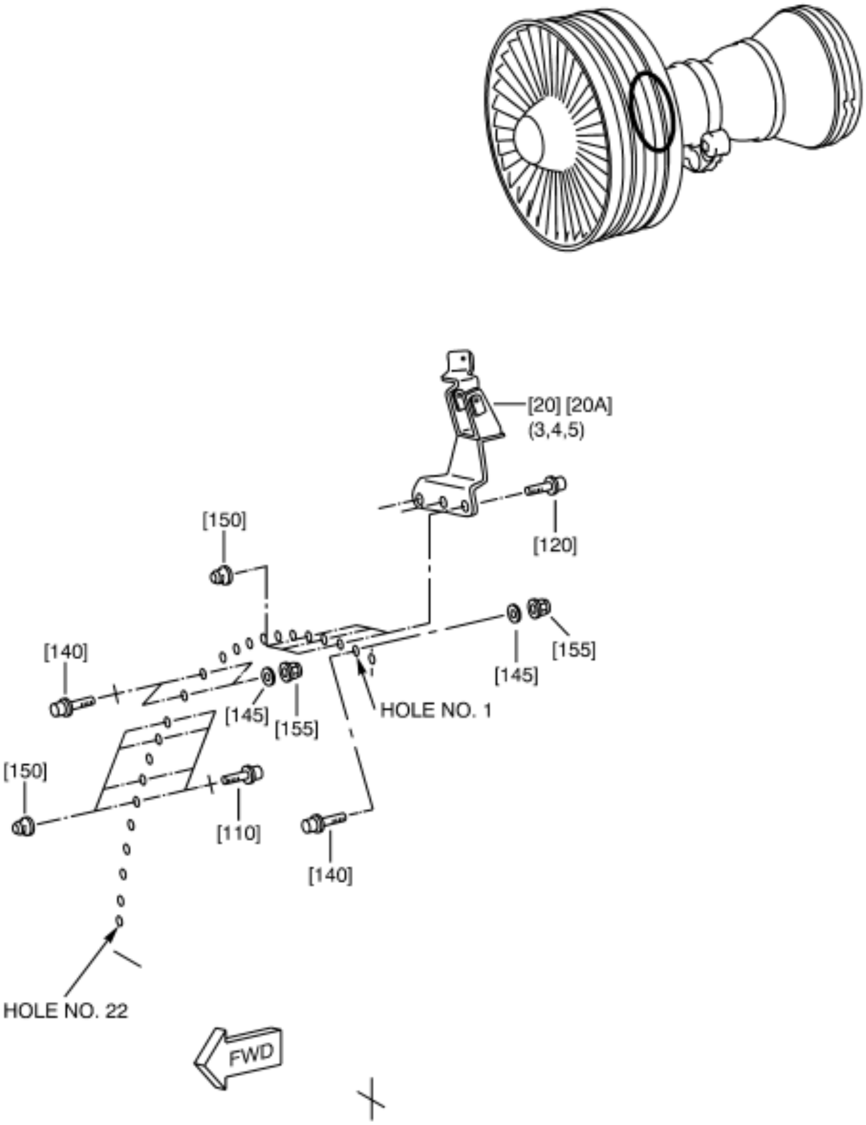
(a) Attach the brackets with bolts, threads lubricated with Engine Oil P03-001, and nuts.

R (b) For compressors without the ring case configuration (Pre SB PW4ENG 72-756 and 72-759), tighten and torque the nuts to 180 - 200 lb-in. (20.337 - 22.597 N.m).

R (c) For compressors with the ring case configuration (Post SB PW4ENG 72-756 and 72-759), tighten and torque the nuts to 190 - 210 lb-in. (21.467 - 23.727 N.m).

(2) Remove any tags or markings on the brackets or flange.

(3) Examine the assembly for foreign objects, damage, and correct assembly.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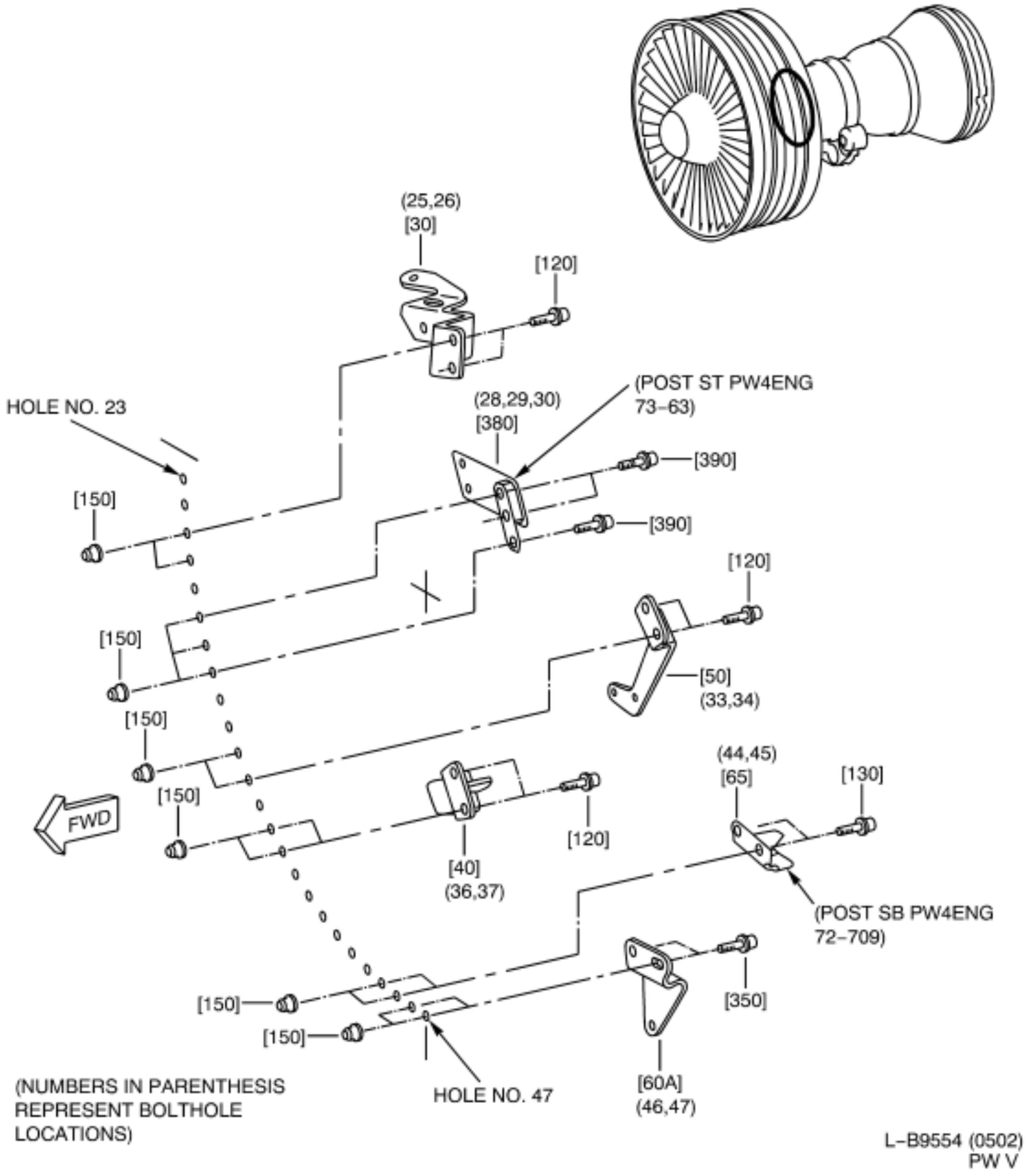
[140]
HOLE NO. 22
FWD

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

L−A1286 (0502)
PW V

The Flange H Brackets And Hardware (Pre SB PW4ENG 72−756 Or Pre SB PW4ENG 72−759)
Figure 1001 (Sheet 1)
(Task 72−35−00−430−021)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(POST ST PW4ENG 73−63)
HOLE NO. 23
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(33,34)
[150]
(44,45)
[65]
[130]
FWD
[150]
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(36,37)
(POST SB PW4ENG 72−709)
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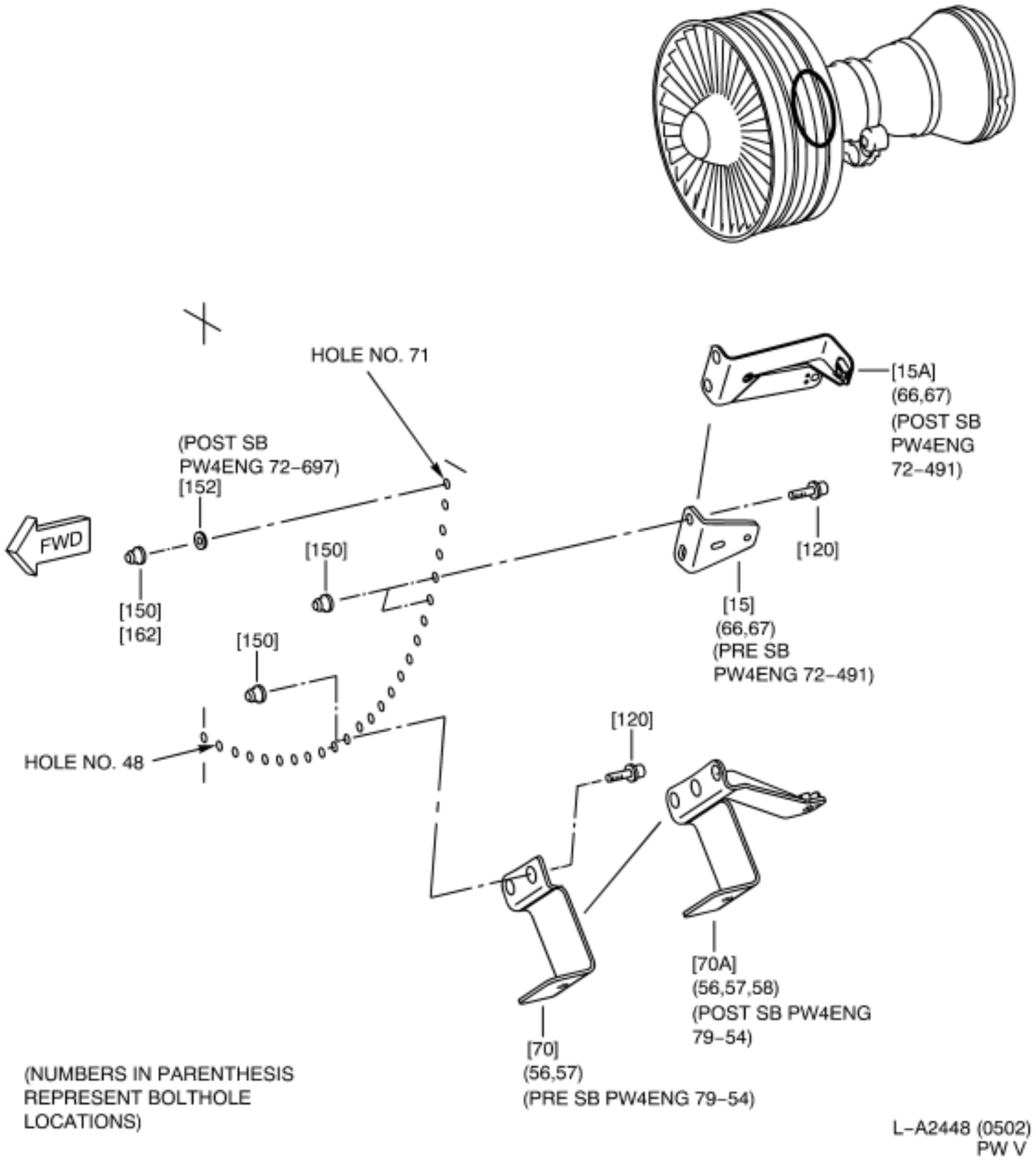
[350]
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
HOLE NO. 47
[60A]
(46,47)
L−B9554 (0502)
PW V

The Flange H Brackets And Hardware (Pre SB PW4ENG 72−756 Or Pre SB PW4ENG 72−759)
Figure 1001 (Sheet 2)
(Task 72−35−00−430−021)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(POST SB PW4ENG 72−697) [152]
FWD
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HOLE NO. 48
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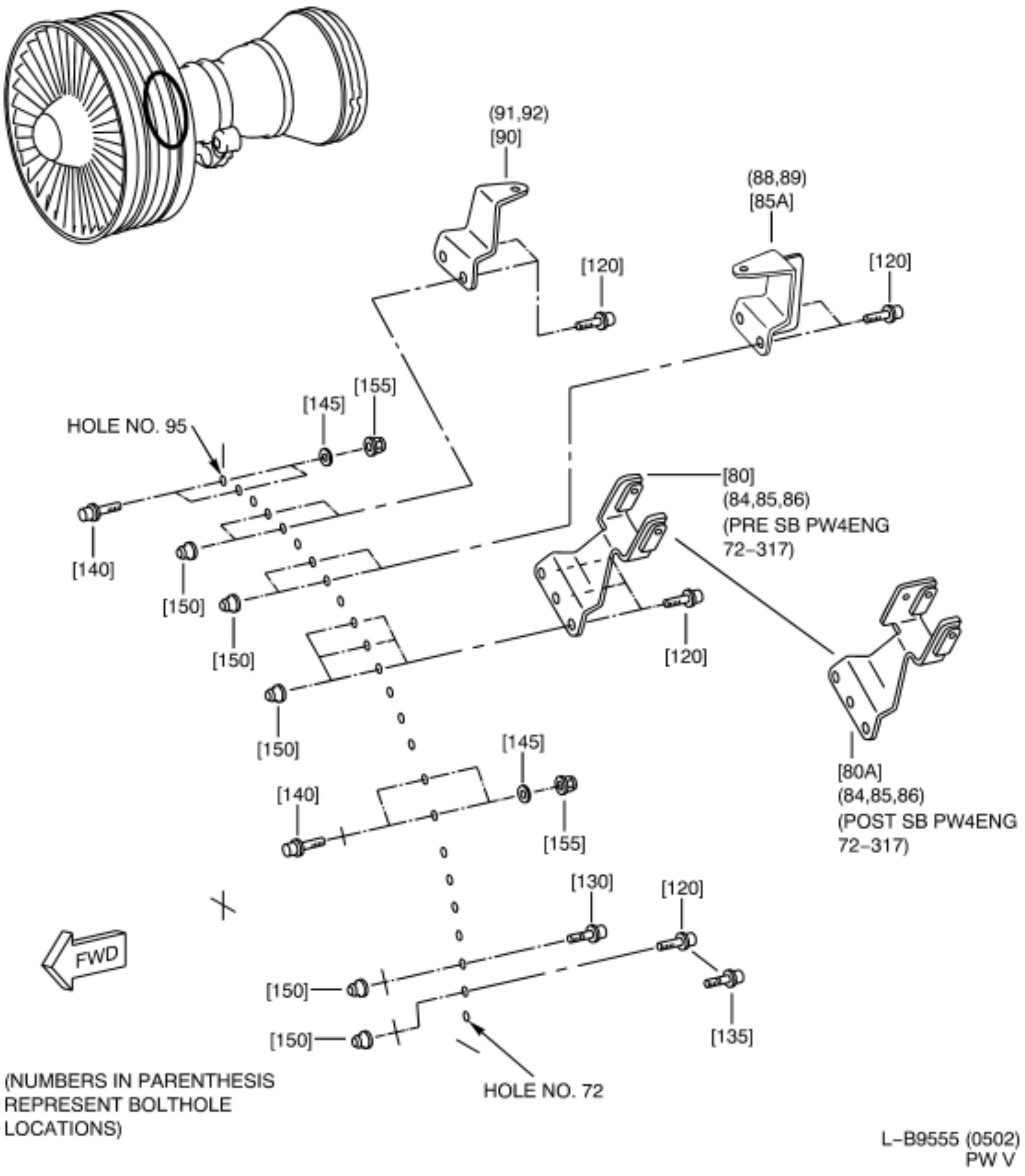
[120]
[15] (66,67) (PRE SB PW4ENG 72−491)
[120]
[70A] (56,57,58) (POST SB PW4ENG 79−54)
[70] (56,57) (PRE SB PW4ENG 79−54)
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L−A2448 (0502) PW V

The Flange H Brackets And Hardware (Pre SB PW4ENG 72−756 Or Pre SB PW4ENG 72−759)
Figure 1001 (Sheet 3)
(Task 72−35−00−430−021)

R
R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(PRE SB PW4ENG 72−317)
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(84,85,86)
(POST SB PW4ENG 72−317)
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FWD
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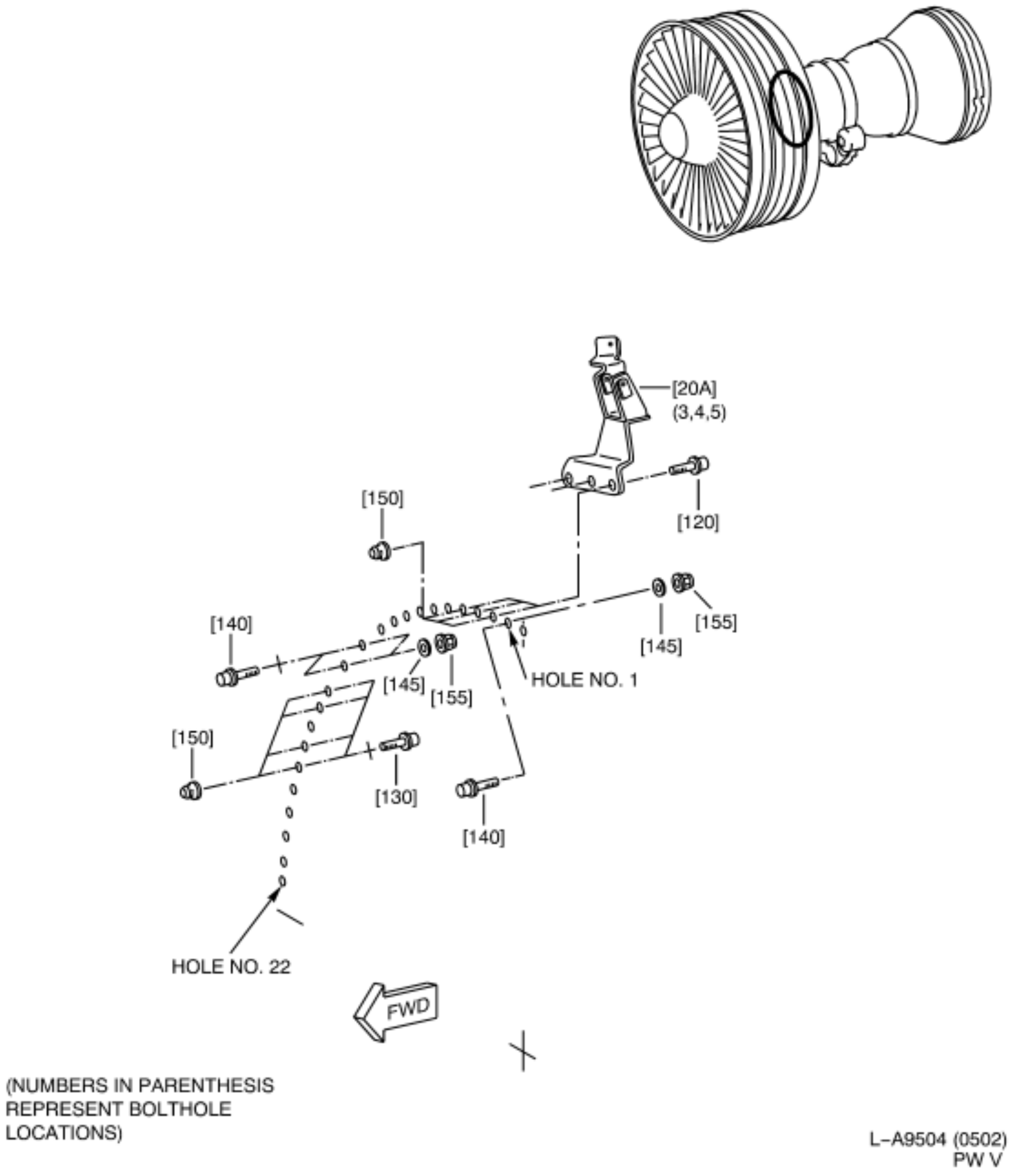
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
HOLE NO. 72
L−B9555 (0502)
PW V

The Flange H Brackets And Hardware (Pre SB PW4ENG 72−756 Or Pre SB PW4ENG 72−759)
Figure 1001 (Sheet 4)
(Task 72−35−00−430−021)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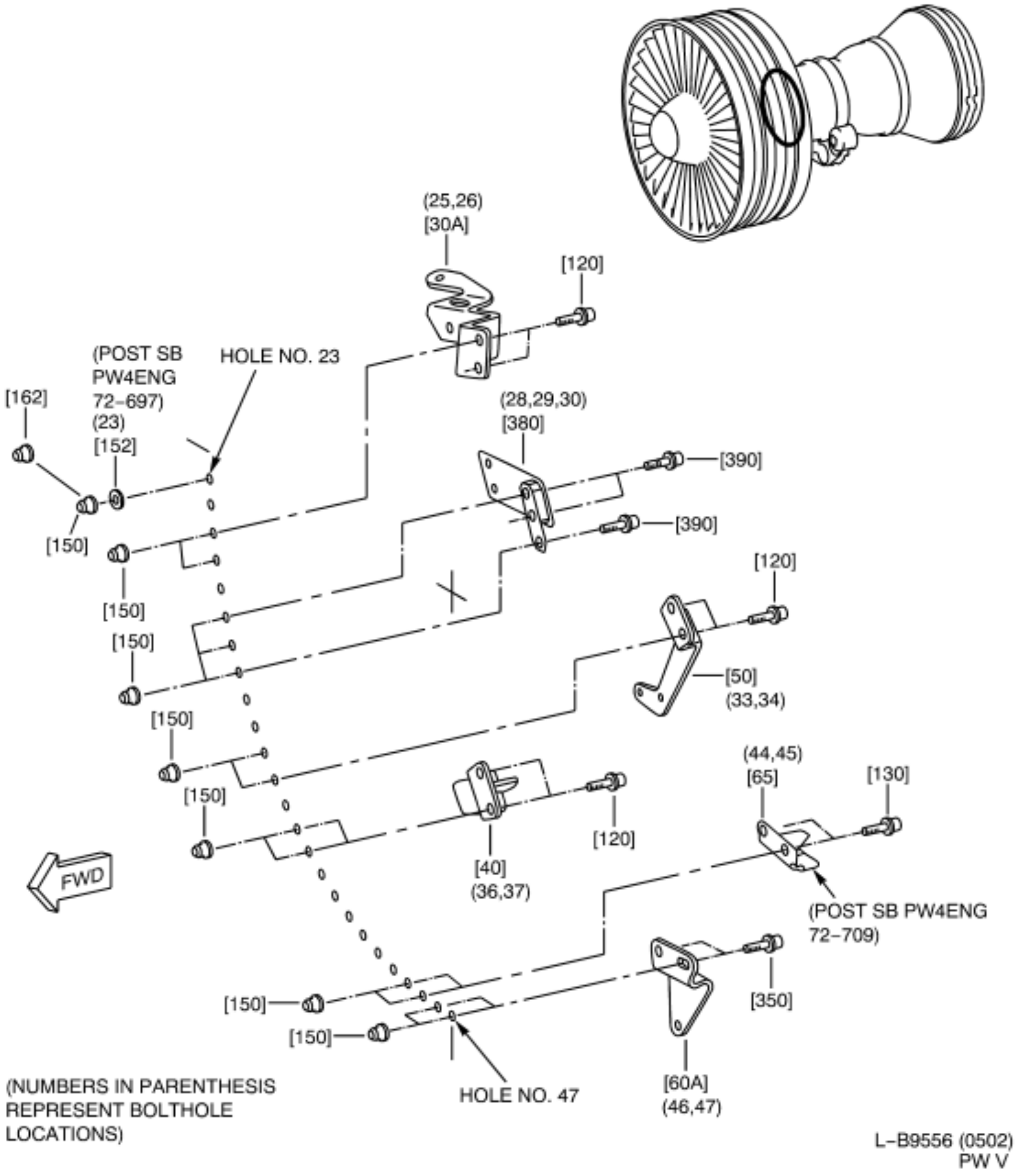
HOLE NO. 22
FWD
(NUMBERS IN PARENTHESIS REPRESENT BOLTHOLE LOCATIONS)
L−A9504 (0502)
PW V

The Flange H Brackets And Hardware (Pre SB PW4ENG 72−756 Or Pre SB PW4ENG 72−759)
Figure 1001 (Sheet 5)
(Task 72−35−00−430−021)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PW4ENG
72−697)
(23)
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FWD
(POST SB PW4ENG
72−709)
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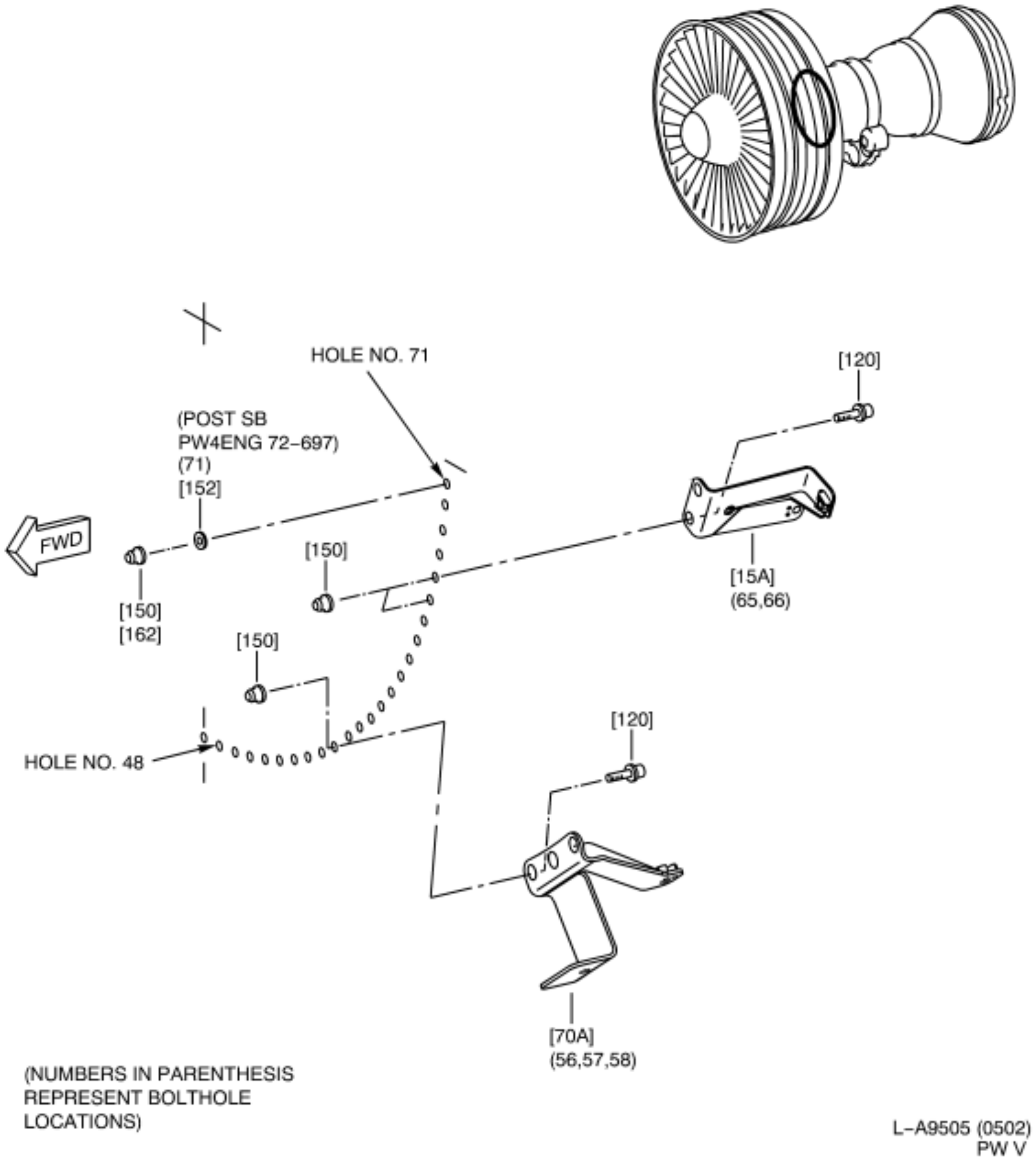
(46,47)
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L−B9556 (0502)
PW V

The Flange H Brackets And Hardware (Pre SB
PW4ENG 72−756 Or Pre SB PW4ENG 72−759)
Figure 1001 (Sheet 6)
(Task 72−35−00−430−021)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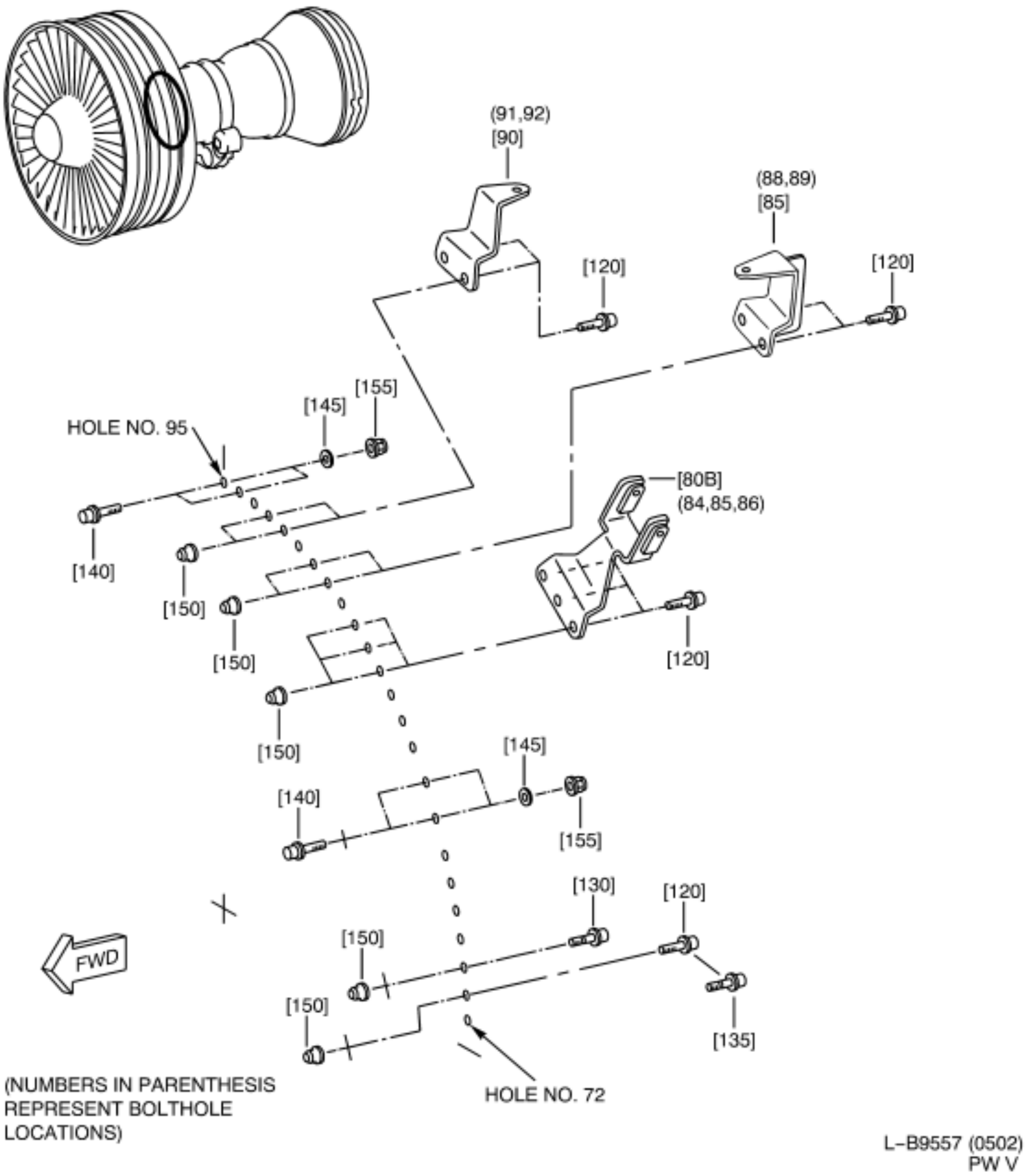
(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)
L−A9505 (0502)
PW V

The Flange H Brackets And Hardware (Pre SB PW4ENG 72−756 Or Pre SB PW4ENG 72−759)
Figure 1001 (Sheet 7)
(Task 72−35−00−430−021)

R
R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FWD
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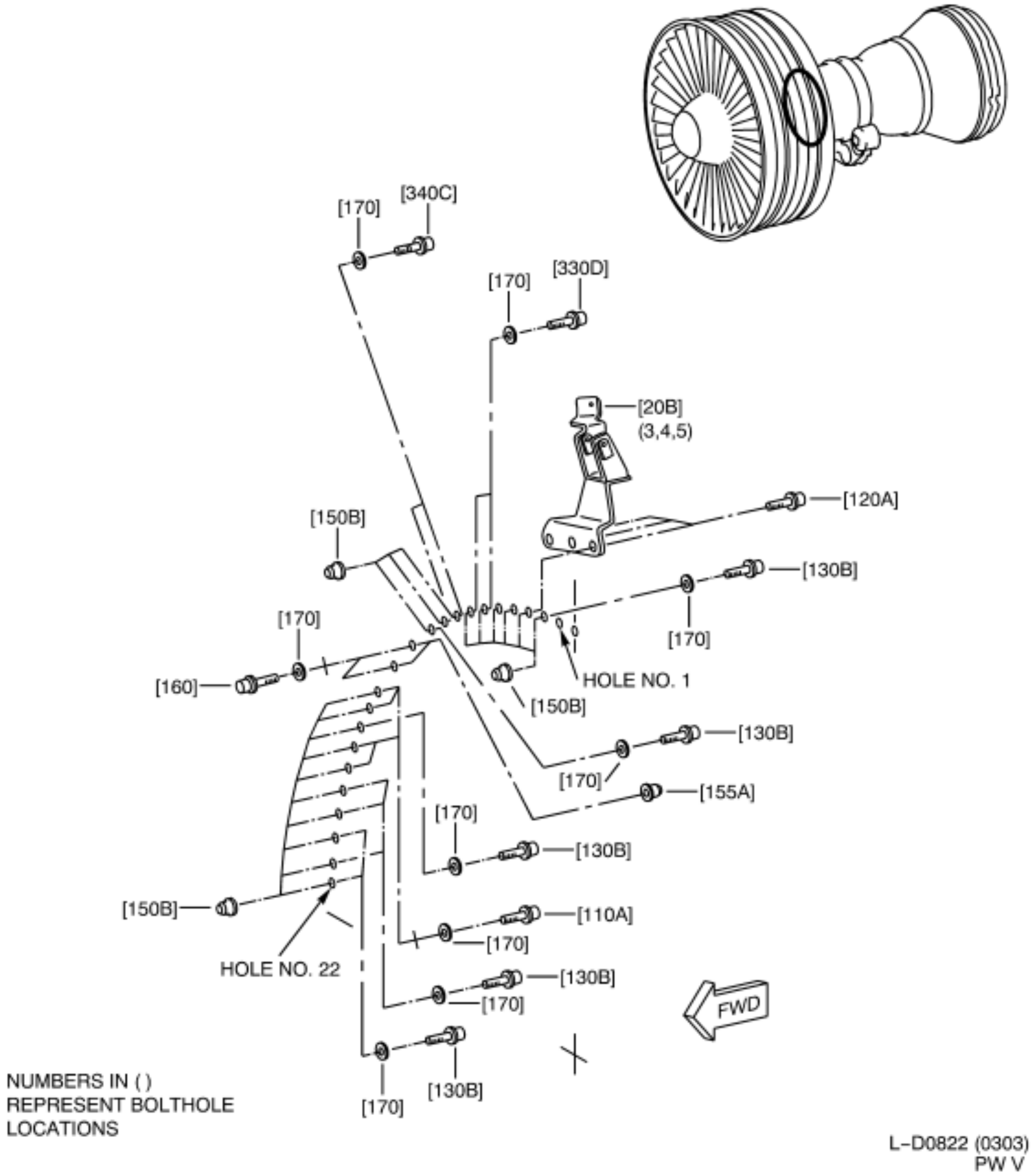
HOLE NO. 72
L−B9557 (0502)
PW V

(NUMBERS IN PARENTHESIS
REPRESENT BOLTHOLE
LOCATIONS)

The Flange H Brackets And Hardware (Pre SB PW4ENG 72−756 Or Pre SB PW4ENG 72−759)
Figure 1001 (Sheet 8)
(Task 72−35−00−430−021)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HOLE NO. 22
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FWD
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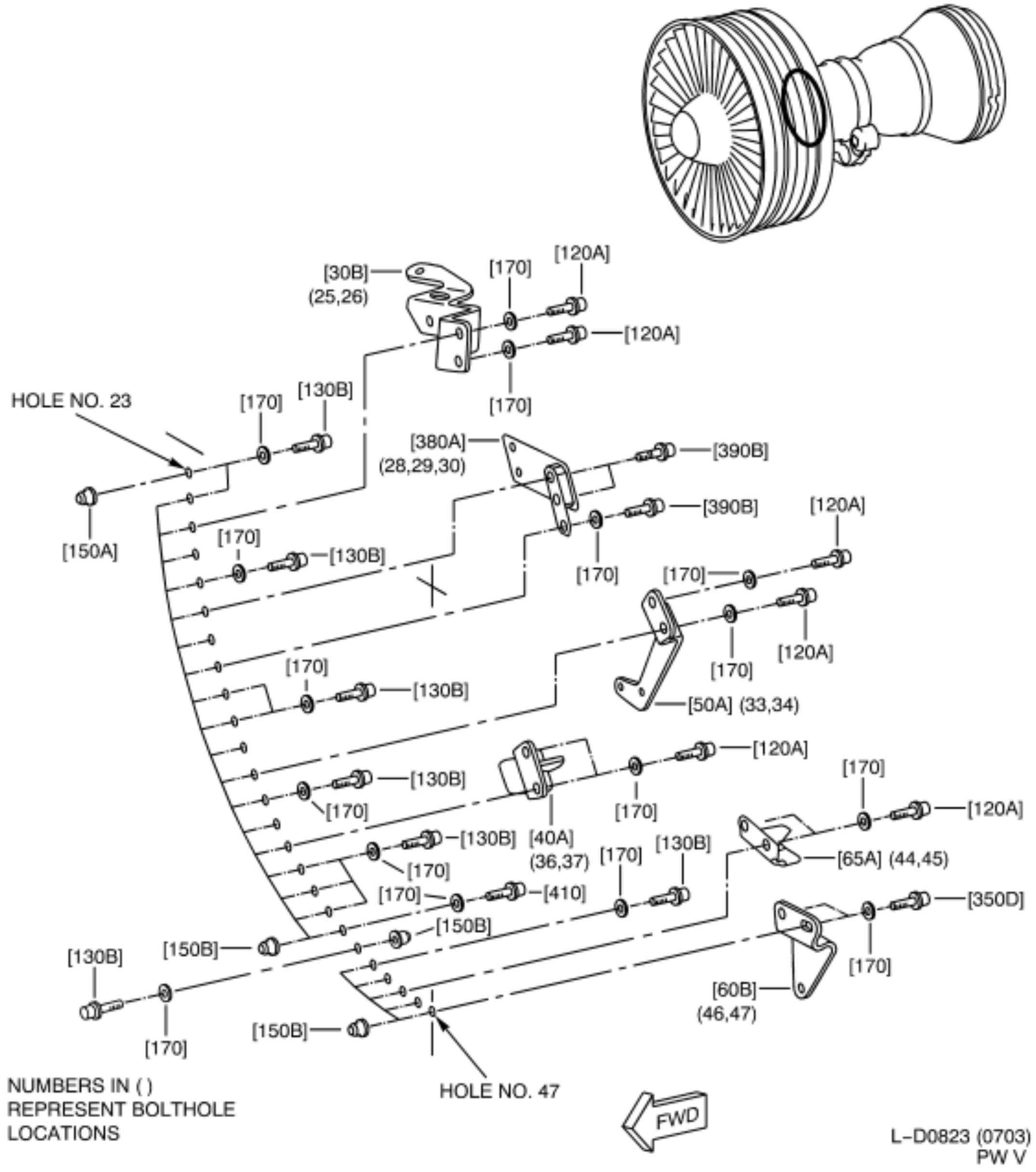
NUMBERS IN ( )
REPRESENT BOLTHOLE
LOCATIONS
L-D0822 (0303)
PW V

The Flange H Brackets And Hardware (Post
SB PW4ENG 72−756 Or Post SB PW4ENG 72−759)
Figure 1002 (Sheet 1)
(Task 72−35−00−430−021)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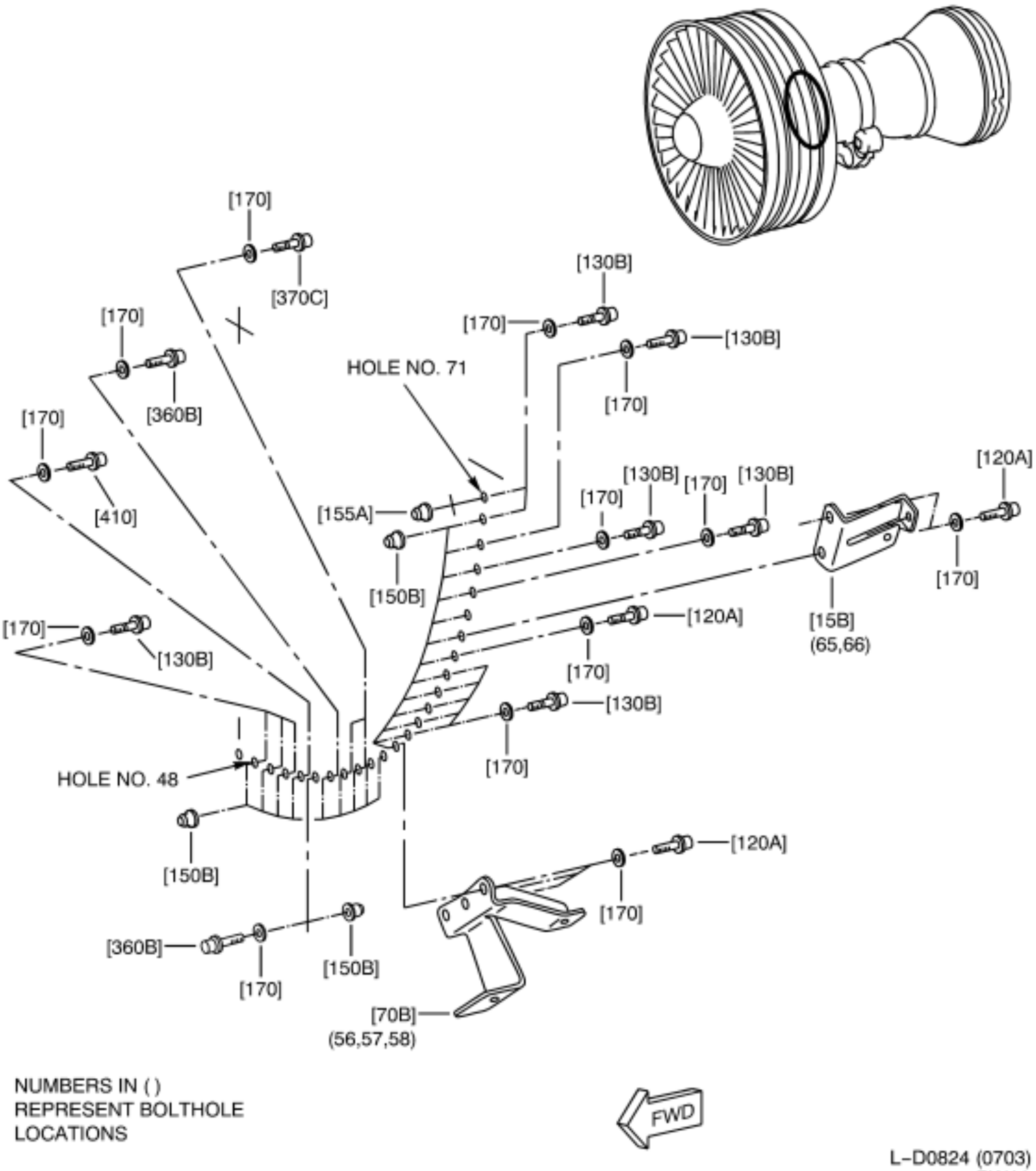
NUMBERS IN ()
REPRESENT BOLTHOLE
LOCATIONS
HOLE NO. 47
FWD
L−D0823 (0703)
PW V

The Flange H Brackets And Hardware (Post
SB PW4ENG 72−756 Or Post SB PW4ENG 72−759)
Figure 1002 (Sheet 2)
(Task 72−35−00−430−021)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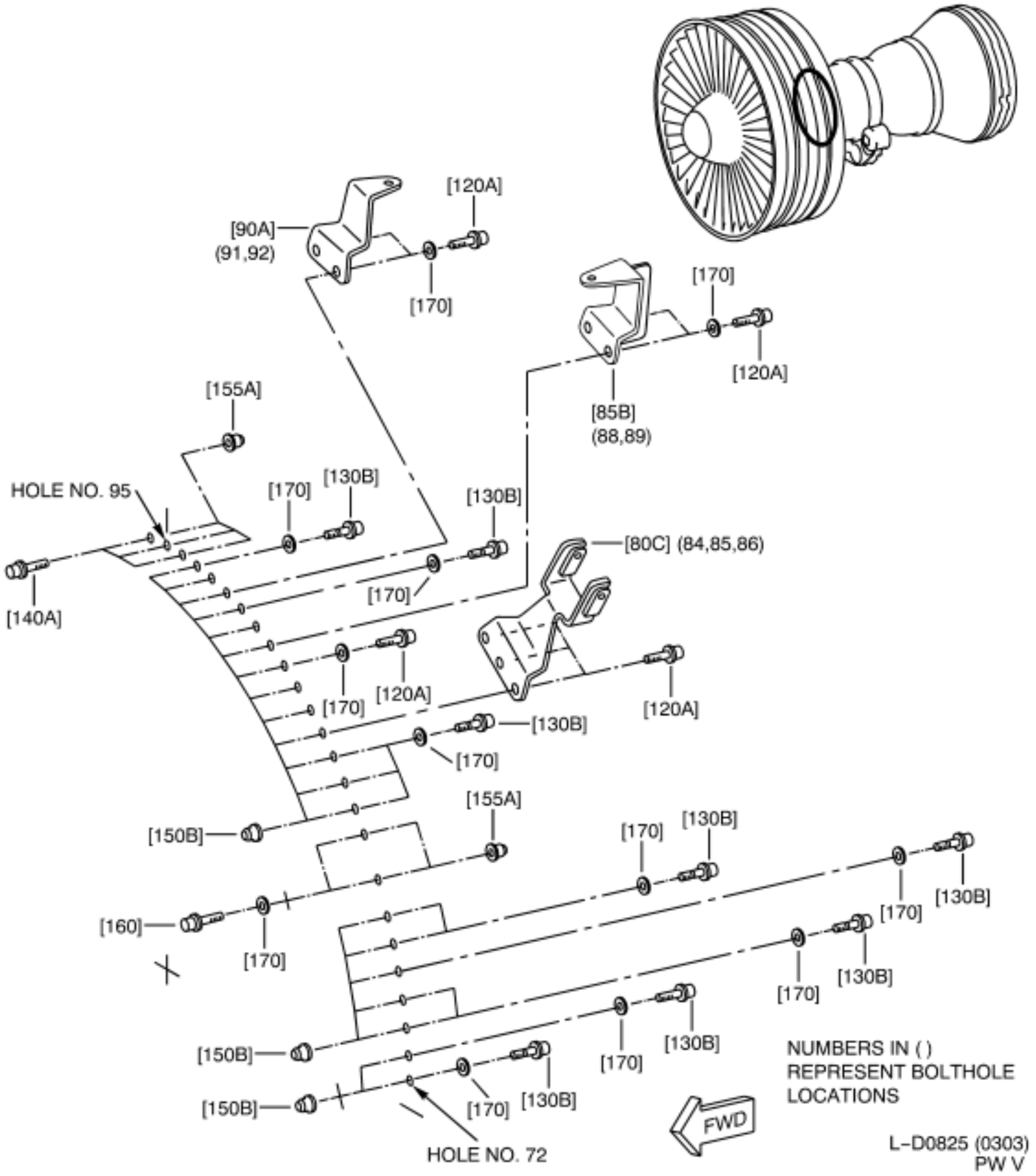
(56,57,58)
FWD

NUMBERS IN ( )
REPRESENT BOLTHOLE
LOCATIONS

L-D0824 (0703)
PW V

The Flange H Brackets And Hardware (Post SB PW4ENG 72-756 Or Post SB PW4ENG 72-759)
Figure 1002 (Sheet 3)
(Task 72-35-00-430-021)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NUMBERS IN ( )
REPRESENT BOLTHOLE
LOCATIONS
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FWD
HOLE NO. 72
L-D0825 (0303)
PW V

The Flange H Brackets And Hardware (Post
SB PW4ENG 72-756 Or Post SB PW4ENG 72-759)
Figure 1002 (Sheet 4)
(Task 72-35-00-430-021)

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HIGH PRESSURE COMPRESSOR (HPC) - STORAGE-01

Task 72-35-00-530-001:

1. Pack High Pressure Compressor (HPC)

A. Container Assembly P60042 (Phase-1)

NOTE: The following table lists assembly number, dimensions, and gross weight for high pressure compressor shipping container available from Pratt & Whitney. Further information can be obtained from:

Commercial Parts Support
Commercial Engine Business
Pratt & Whitney
400 Main St.
East Hartford, CT 06108-0969

Container Assembly No.	Dimensions	Approximate Gross Weight Including High Pressure Compressor
P60042	78 Inch (1981.200 mm) x 72 Inch (1828.800 mm) x 51 Inch (1295.400 mm)	3,726 lbs. (1690.09 kg)

(1) For operators that use P60042 Container for compressors with HPC drive turbine shafts (Pre SB PWENG 72-562), remove the top half of the Container as follows:

(a) Actuate relief valve on side of container to release pressure before opening container.

(b) Loosen nuts on T-head bolts to allow head to be rotated 90 degrees and pass through the slots in the cover flange. See Figure 1201.

NOTE: Do not remove lockwashers and nuts from bolts.

(c) Connect suitable sling to lift cover of container. Using hoist, remove top cover of container and place on the floor.

(2) Verify that the following details are furnished with the container and are present:

HIGH PRESSURE COMPRESSOR (HPC) - STORAGE-01

Quantity	Container Assy No.	Detail No.	Name
Details Of Container Assembly			
1	60042	Detail-1	Support - Front
1	60042	Detail-2	Support - Rear
1	60042	Detail-4	Nut - Front
1	60042	Detail-5	Nut - Rear
1	60042	Detail-7	Locator - Rear
20	60042	Detail-8	Hex Head Cap Screw (.312-18 X 1.0 Inch)
19	60042	Detail-10	Lockwasher (.375 Dia.)
19	60042	Detail-12	Hex Nut (.375-16)
20	60042	Detail-17	Flat Washer (.312 Dia. X .625 Max OD)
1	P60104	Detail-18	Cover
1	P60129-9	Detail-21	Cover
2	P60129-10	Detail-22	Cover
2	P60129-11	Detail-23	Cover
20	60042	Detail-26	Lockwasher (.312 Dia.)
1	P60129-13	Detail-29	Cover
19	60042	Detail-30	Socket Head Cap Screw (.375-16 X 2.0 Inch)
38	60042	Detail-31	Flat Washer (.375 Dia.)
47	60042	Detail-32	Hex Head Bolt (.250-28 X .500 Inch)
1	P60129-9	Detail-33	Cover (Altered As Shown)

B. Container Assemblies P60093, P60271, PWA 105525, And PWA 105526 (Phase-3)

Container Assembly No.	Dimensions	Approximate Gross Weight Including High Pressure Compressor
P60093, P60271, PWA 105525, And PWA 105526	88.5 Inch (2247.900 mm) x 76.5 Inch (1943.100 mm) x 55.5 Inch (1409.700 mm)	3,810 lbs. (1,728.19 kg.)

(1) Remove the top half of the P60093, P60271, PWA 105525, or PWA 105526 Container Assembly as follows: See Table 1201.

HIGH PRESSURE COMPRESSOR (HPC) - STORAGE-01

Container Assembly	Compressor Configuration
P60093	Non-Asymmetric Case Compressors, Without Ring Style Case
P60271	Symmetric And Asymmetric Case Compressors, Without Ring Style Case
PWA 105525 and PWA 105526	All Configurations

Container Assembly Applicability
Table 1201

(a) Actuate relief valve on side of container to release pressure before opening container.

(b) Loosen nuts on T-head bolts to allow head to be rotated 90 degrees and pass through the slots in the cover flange. See Figure 1201.

NOTE: Do not remove lockwashers and nuts from bolts.

(c) Connect suitable sling to lift cover of container. Using hoist, remove top cover of container and place on the floor.

(d) Verify that the following details are furnished with the container and are present:

Quantity	Container Assy No.	Detail No.	Name
Details Of Optional Container Assembly P60271, PWA 105525, And PWA 105526			
1	60093	Detail-1	Support - Front
1	60093	Detail-2	Support - Rear
1	60093	Detail-4	Nut - Front
1	60093	Detail-5	Nut - Rear (For HPC Rear Shaft Pre SB PW4ENG 72-562) (Phase-1)
1	60093	Detail-7	Locator - Rear
20	60093	Detail-8	Hex Head Cap Screw (.312-18 X 1.0 Inch)
1	60093	Detail-9	Nut - Rear (For HPC Rear Shaft Pre SB PW4ENG 72-562) (Phase-1)

HIGH PRESSURE COMPRESSOR (HPC) - STORAGE-01

Quantity	Container Assy No.	Detail No.	Name
Details Of Optional Container Assembly P60271, PWA 105525, And PWA 105526			
(CONTINUED)			
19	60093	Detail-10	Lockwasher (.375 Dia.)
19	60093	Detail-11	Hex Head Cap Screw (.375-16 X 2.0 Inch)
19	60093	Detail-12	Hex Nut (.375-16)
20	60093	Detail-17	Flat Washer (.312 Dia. X .625 Max OD)
1	P60104	Detail-18	Cover
47	60093	Detail-19	Hex Head Bolt (.250-28 X .500 Inch)
1	P60129-9	Detail-21	Cover
2	P60129-10	Detail-22	Cover
2	P60129-11	Detail-23	Cover
1	P60129-9	Detail-24	Cover (Altered As Shown)
20	60093	Detail-26	Lockwasher (.312 Dia.)
1	P60129-13	Detail-28	Cover
19	60093	Detail-29	Flat Washer (.375 Dia.)

C. Equipment And Materials Necessary

Special Tools:

PWA 76154	Adapter, Lift and Turn (4 Necessary)
PWA 85520	Fixture
PWA 85530	Wrench
PWA 85531	Adapter
PWA 85535	Nut, Retaining
PWA 85536	Adapter
PWA 85660	Stand, Lifting
PWA 88643	Sling, Lifting
PWA 88673	Sling, Lifting

Consumable Materials:

Item No. Designation

NOTE: The following items are not normally supplied by the container manufacturer.

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P04-001	Grease
P05-005	Cloth, Lint Free

Consumable Materials:

Item No. Designation

NOTE: The following items are not normally supplied by the container manufacturer.

(CONTINUED)

Item No.	Designation
P05-156	Seal, Lead
P05-262	Lockwire
P11-014	Alcohol, Isopropyl
P15-001	Dehydrator

D. Procedure

NOTE: The high pressure compressor is front end up with PWA
R 85528 Adapter and PWA 85537 Fixture on the front, PWA
R 107219 Fixture on the rear, and in PWA 87022 Support
Stand (Optional PWA 85108 Stand or PWA 85580 Stand).

(1) Remove the PWA 85537 Fixture from the high pressure compressor.

(a) Using PWA 85530 Wrench and PWA 85531 Adapter remove nut which keeps adapter and fixture to HPC front.

(b) Install PWA 88643 Sling or PWA 88673 Sling with two PWA 76154 Adapters to the spools of the fixture and remove the fixture from the HPC.

(2) Attach two nylon straps around two spokes of detail-1 front support inside shipping container and attach straps to hoist.

(3) Remove front support from container and position it journal side up on table or bench.

(4) Clean ID of journal with Cloth P05-005 and Alcohol P11-014.

(5) Lightly coat OD of hub shaft of rotor and stator with Grease P04-001.

(6) Position front support, journal side up, over front hub of rear compressor in build stand.

(7) Lower support to seat on bearing shoulder of hub and front flange of variable vane case. Align center of lifting spools with splits on variable vane cases and align bolt holes.

(8) Remove hoist and straps from spokes of support. Secure support to case with detail−30 bolts, threads lubricated with Engine Oil P03−001, heads down, with detail−31 washers, detail−10 lockwashers, and detail−12 nuts. Place bolts with washers (heads down) and secure with washers, lockwashers, and nuts. Three or four bolts will be installed, heads up, at the runner location.

(9) Tighten and torque nuts to 270 − 300 lb−in. (30.506 − 33.895 N.m).

CAUTION: IT MAY BE NECESSARY TO ADJUST HEIGHT OF ROTOR TO ALLOW SEATING OF FLANGES OR HUB SHOULDER. EXTREME CARE MUST BE TAKEN WHEN MAKING ADJUSTMENT TO PREVENT INTERNAL DAMAGE.

(10) Secure front support to hub with detail−4 nut lubricated with Engine Oil P03−001 and tighten handtight. Secure nut to front support with Lockwire P05−262.

(11) With PWA 88643 or PWA 88673 Sling and PWA 76154 Adapters attached to the spools of the front support, lift the HPC assembly from the build stand. Attach a second PWA 88643 or PWA 88673 Sling and PWA 76154 Adapters to the spools on the lower fixture. Turn the assembly front end down.

(12) Remove hoist, adapters, and sling from front support and lower assembly onto stand.

(13) Loosen and remove all bolts securing rear fixture to rear case assembly. Remove rear fixture and place in storage area. Remove hoist, sling, and adapters.

(14) Lightly coat OD of hub shaft of rotor and stator with Grease P04−001.

(15) Attach two nylon straps around two spokes of detail−2 rear support inside shipping container and attach straps to hoist.

(16) Remove rear support from container and position it journal side up on table or bench.

(17) Clean ID of journal with Cloth P05-005 and Alcohol P11-014.

(18) Position rear support, journal side up, over rear hub of rear compressor in build stand.

(19) Lower support to seat on bearing shoulder of hub and rear flange of rear case. Align center of lifting spools with spools on front support and align bolt holes.

(20) Remove hoist and straps from spokes of support. Secure support to case with detail-8 bolts, threads lubricated with Engine Oil P03-001, with detail-17 washers, and detail-26 lockwashers.

(21) Tighten and torque bolts to 160 - 175 lb-in. (18.078 - 19.772 N.m).

(22) Install detail-7 locator to OD threads of rear support and thread it on until approximately halfway between shoulder and end of shaft portion of rear support.

NOTE: When assembly is positioned in container it may be necessary to adjust locator to align it with rear clamp.

(23) Secure rear support to hub with detail-5 or -9 nut lubricated with Engine Oil P03-001 and tighten handtight. Secure nut to front support with Lockwire P05-262.

NOTE: For PWA 105525 and PWA 105526 Containers, you can use the detail-31 Wrench to hand tighten the nut.

(24) Install shipping covers and secure with bolts, threads lubricated with Engine Oil P03-001. See Figure 1202. Tighten bolts to 75 lb-in. (8.474 N.m) maximum.

(25) With PWA 88643 Sling or PWA 88673 Sling and PWA 76154 Adapters attached to the spools of the rear support, raise the HPC assembly from the build stand. Attach a second PWA 88643 Sling or PWA 88673 Sling and PWA 76154 Adapters to the spools on the lower fixture. Turn the assembly to a horizontal position.

(26) Carefully lower assembly into container, positioning front and rear support into clamps. Front end of assembly must be positioned in clamp marked front.

NOTE: As necessary, adjust position of locator on rear support to fit in rear clamp.

(27) Secure assembly with clamps and swing bolts, lockwashers, and nuts. Tighten and torque two nuts, lubricated with Engine Oil P03−001 on swing bolts 1250 − 1400 lb−in. (141.231 − 158.179 N.m).

(28) Remove slings from front and rear supports and remove hoists.

(29) Attach nylon straps to lifting rings on each end of cover and to hoist. Raise cover and position over container.

(30) Carefully lower the container cover over assembly (aligning alignment holes and pins) to seat on container flange.

(31) Secure cover with T−head bolts pushed up and rotated 90 degrees to engage bolt head in notch on cover.

(32) Remove hoist and nylon straps.

(33) Tighten and torque container flange nuts as specified on container cover. Seal container with Seal P05−156 and Lockwire P05−262.

(34) Loosen and remove cover from desiccant receptacle. Place quantity of Dehydrator P15−001 inside receptacle as specified on container cover and reinstall receptacle cover. Tighten to secure cover.

Task 72−35−00−540−001:

2. Unpack High Pressure Compressor Group

A. Equipment And Materials Necessary

Special Tools:

	PWA 76154	Adapter, Lift And Turn (4 Necessary)
	PWA 85108	Stand, Build (Optional to PWA 85580 or PWA 87022)
	PWA 85530	Wrench
R	PWA 85535	Nut, Retaining
	PWA 85536	Adapter, Torque
	PWA 85580	Stand, Build (Optional to PWA 85108 or PWA 87022)
R	PWA 88643	Sling, Lifting (Optional to PWA 88763)
	PWA 88673	Sling
	PWA 87022	Stand, Build
	PWA 88701	Nut, Retaining
	PWA 88763	Sling, Lifting (Optional to PWA 88643)
R R	PWA 107219	Fixture, Handling (For Non−Ring Style Compressor Case)

B. Procedure

(1) Cut and remove lockwire and seal from container flange.

(2) Remove top half of the Container Assembly as follows:

(a) Actuate relief valve on side of container to release any pressure inside container.

(b) Loosen nuts on T−head bolts to allow head to be rotated 90 degrees and pass through the slots in the cover flange.

NOTE: Do not remove lockwashers and nuts from bolts.

(c) Connect suitable sling to lift cover of container. Using hoist, remove top cover of container and place on the floor.

(3) Install PWA 88643 or PWA 88673 Sling and four PWA 76154 Adapters to the spools of the front and rear supports.

(4) Loosen nuts from swing bolts to disengage clamps. Do not remove nuts and lockwashers.

(5) Carefully remove HPC assembly from container.

HIGH PRESSURE COMPRESSOR (HPC) − STORAGE−01

(6) With the HPC assembly in horizontal position lower to front end down onto PWA 87022 Build Stand (Optional PWA 85108 Stand or PWA 85580Stand). Remove the slings and hoists.

(7) Cut lockwire and remove knurled nut from rear support. Remove locator from OD threads of rear support.

(8) Remove bolts securing rear support to case.

(9) Attach two nylon straps around two spokes of rear support and attach straps to hoist. Remove rear support.

R (10) Install the PWA 107219 Fixture over the rear shaft and to the HPC case with a PWA 88643 or PWA 88673 Sling and PWA 76154 Adapters. Remove the Sling and Adapters.

(11) FOR THESE MODELS: 4152, 4156A, 4158
R Secure Fixture to HPC rear case with cap screws. Install PWA 85535 Nut over rear hub and tighten with PWA 85530 Wrench using PWA 85536 Adapter to 300 lb−in. (33.895 N.m).

(12) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
R (Pre SB PW4ENG 72−562) Attach the PWA 107219 Fixture to the HPC rear case with cap screws. Install the PWA 85535 Nut over the HPC rear shaft and tighten with the PWA 85530 Wrench using the PWA 85536 Adapter to 300 lb−in. (33.895 N.m).

(13) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
R (Post SB PW4ENG 72−562) Attach the PWA 107219 Fixture to the HPC rear case with cap screws. Install the PWA 88701 Nut over the HPC rear shaft and tighten with the PWA 85530 Wrench using the PWA 85536 Adapter to 300 lb−in. (33.895 N.m).

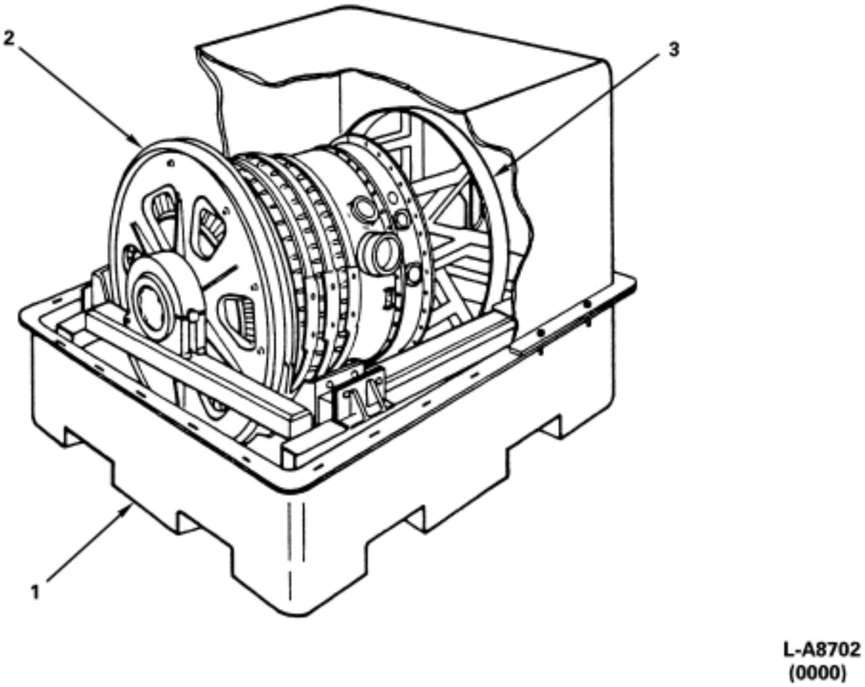
R (14) Attach PWA 88643 or PWA 88673 Sling and PWA 76154 Adapters to the spools on the rear fixture and lift the rotor from the stand. Attach a second PWA 88643 or PWA 88673 Sling and PWA 76154 Adapters to the spools on the lower fixture. Turn the assembly rear end down.

R (15) Remove hoist, adapters, and sling from rear support and lower assembly rear end down onto stand.

R (16) Cut lockwire and remove knurled nut from front support. Remove nuts, lockwashers, and bolts securing support to front case.

R (17) Attach two nylon straps around two spokes of front support and attach straps to hoist. Remove front support.

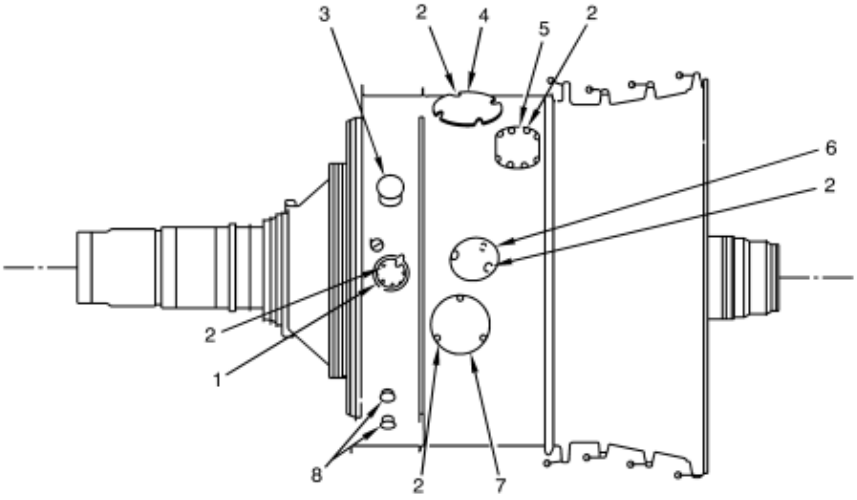
R (18) Remove bolts securing covers on rear case and remove all covers.



1. Shipping Container (Typical)
2. Detail−1 Front Support
3. Detail−2 Rear Support

Shipping Equipment Assembly
Figure 1201
(Task 72−35−00−540−001)

HIGH PRESSURE COMPRESSOR (HPC) − STORAGE−01



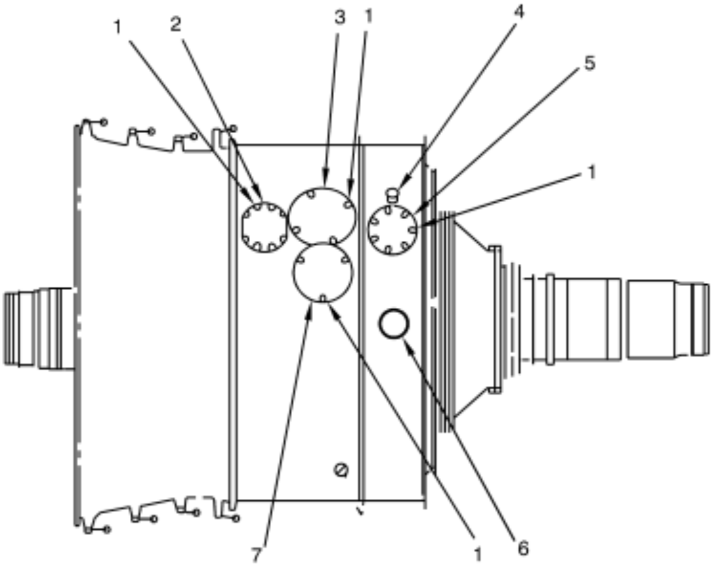
(ROTATED 90° CLOCKWISE)

L−A8703 (0000)
PW V

1. P60129−9 Cover
2. Detail−32 Bolt
3. P12782 Plug (For P60042 Container Assembly)
   P60129−13 Cover (For P60093, P60271, PWA 105525, PWA 105526 Container Assemblies)
4. P60129−11 Cover
5. P60104 Cover
6. P60129−13 Cover
7. P60129−10 Cover
8. P12771 Plug

Shipping Closures − Right Side View
Figure 1202 (Sheet 1)
(Task 72−35−00−540−001)

HIGH PRESSURE COMPRESSOR (HPC) − STORAGE−01



(ROTATED 90° COUNTERCLOCKWISE)

L−A8704 (0000)
PW V

1. Detail Hex Bolt
2. P60104 Cover
3. P60129−11 Cover
4. P12771 Plug (For P60042 Container Assembly)
   P60129−20 Cover (For P60093, P60271, PWA 105525, PWA 105526 Container Assemblies)
5. P60129−9 Cover
6. P12782 Plug (For P60042 Container Assembly)
   P60129−21 Cover (For P60093, P60271, PWA 105525, PWA 105526 Container Assemblies)
7. P60129−10 Cover

Shipping Closures − Left Side View
Figure 1202 (Sheet 2)
(Task 72−35−00−540−001)

Pratt & Whitney

PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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	815		DEC 15/03
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	818		DEC 15/03
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	823		DEC 15/03
	824		DEC 15/03
	825		MAR 15/06
	826		MAR 15/06
	827		MAR 15/06
	828		MAR 15/06
	829		SEP 15/05
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	835		SEP 15/05
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	838		SEP 15/05
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	848		SEP 15/05
	849		SEP 15/05

	850		SEP 15/05
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	868		SEP 15/05
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	889		SEP 15/05
	890		SEP 15/05
	890A		SEP 15/05
	890B		SEP 15/05
72-35-00			
72-35-00 INSP/CHK-05	801	CONFIG-1 4152 4152-3 4156A 4156A-3 4158 4158-3	JUN 15/03
	802		JUN 15/03
	803		JUN 15/03
	804		JUN 15/03
	805		JUN 15/03
	806		JUN 15/03
	807		JUN 15/03
	808		JUN 15/03
	809		JUN 15/03
	810		JUN 15/03
	811		JUN 15/03
	812		JUN 15/03
	813/814		JUN 15/03
72-35-00			
72-35-00 INSP/CHK-05	801	CONFIG-2 4152 4152-3 4156A 4156A-3 4158 4158-3	MAR 15/05
	802		MAR 15/05
	803		MAR 15/05
	804		MAR 15/05
	805		MAR 15/05
	806		MAR 15/05
72-35-00			
72-35-00	901	ALL	SEP 15/00

REPAIR−01	902		SEP 15/00
	903		SEP 15/02
	904		SEP 15/02
	905		SEP 15/02
	906		SEP 15/02
72−35−00			
72−35−00	1001	CONFIG−1	SEP 15/06
ASSEMBLY−01		4152 4152−3	
		4156A 4156A−3	
		4158 4158−3	
	1002		SEP 15/06
	1003		JUN 15/03
	1004		JUN 15/03
	1005		JUN 15/03
	1006		JUN 15/03
	1007		SEP 15/06
	1008		SEP 15/06
	1009		SEP 15/06
	1010		SEP 15/06
	1011		SEP 15/06
	1012		SEP 15/06
	1013		SEP 15/06
	1014		SEP 15/06
	1015		JUN 15/03
	1016		JUN 15/03
	1017/1018		JUN 15/03
72−35−00			
72−35−00	1001	CONFIG−2	SEP 15/06
ASSEMBLY−01		4152 4152−3	
		4156A 4156A−3	
		4158 4158−3	
	1002		SEP 15/06
	1003		DEC 15/05
	1004		DEC 15/05
	1005		JUN 15/05
	1006		JUN 15/05
	1007		SEP 15/03
	1008		SEP 15/03
	1009		SEP 15/03
	1010		SEP 15/03
	1011		JUN 15/03
	1012		JUN 15/03
	1013		JUN 15/03
	1014		JUN 15/03
	1015		JUN 15/03
	1016		JUN 15/03
	1017		SEP 15/03
	1018		SEP 15/03
	1019		JUN 15/03
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	1042		DEC 15/04

	1043		JUN 15/04
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	1045		JUN 15/04
	1046		JUN 15/04
	1047		JUN 15/04
	1048		JUN 15/04
	1049		SEP 15/06
	1050		SEP 15/06
	1051		SEP 15/06
	1052		SEP 15/06
	1053		DEC 15/05
	1054		DEC 15/05
	1055		JUN 15/03
	1056		JUN 15/03
	1057		JUN 15/03
	1058		JUN 15/03
	1059		SEP 15/03
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	1062		SEP 15/03
	1063		JUN 15/03
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	1085		JUN 15/03
	1086		JUN 15/03
	1087		SEP 15/03
	1088		SEP 15/03
	1089		SEP 15/03
	1090		SEP 15/03
	1090A		JUN 15/03
	1090B		JUN 15/03
	1090C		SEP 15/03
	1090D		SEP 15/03
	1090E		MAR 15/05
	1090F		MAR 15/05
	1090G		JUN 15/04
	1090H		JUN 15/04
	1090I		JUN 15/04
	1090J		JUN 15/04
	1090K		DEC 15/04
	1090L		DEC 15/04
	1090M		JUN 15/04
	1090N		JUN 15/04
	1090O		JUN 15/04
	1090P		JUN 15/04
	1090Q		JUN 15/04
	1090R		JUN 15/04
	1090S		JUN 15/04
	1090T		JUN 15/04
72-35-00			
72-35-00	1001	ALL	DEC 15/05
ASSEMBLY-02	1002		DEC 15/05
	1003		SEP 15/03

	1004		SEP 15/03
	1005		SEP 15/03
	1006		SEP 15/03
	1007		DEC 15/05
	1008		DEC 15/05
	1009		SEP 15/03
	1010		SEP 15/03
	1011		DEC 15/05
	1012		DEC 15/05
	1013		DEC 15/05
	1014		DEC 15/05
	1015		DEC 15/05
	1016		DEC 15/05
	1017		SEP 15/03
	1018		SEP 15/03
	1019/1020		SEP 15/03
72-35-00			
72-35-00	1001	ALL	DEC 15/04
ASSEMBLY-03	1002		DEC 15/04
	1003		DEC 15/04
	1004		DEC 15/04
	1005		MAR 15/05
	1006		MAR 15/05
	1007		MAR 15/05
	1008		MAR 15/05
	1009		MAR 15/05
	1010		MAR 15/05
	1011		MAR 15/02
	1012		MAR 15/02
	1013		MAR 15/05
	1014		MAR 15/05
	1015		MAR 15/02
	1016		MAR 15/02
	1017		MAR 15/02
	1018		MAR 15/02
	1019/1020		MAR 15/02
72-35-00			
72-35-00	1001	4152 4156A 4158	DEC 15/05
ASSEMBLY-04	1002		DEC 15/05
	1003		SEP 15/02
	1004		SEP 15/02
	1005		DEC 15/05
	1006		DEC 15/05
	1007		DEC 15/05
	1008		DEC 15/05
	1009		DEC 15/05
	1010		DEC 15/05
	1011		JUN 15/03
	1012		JUN 15/03
	1013		JUN 15/03
	1014		JUN 15/03
	1015		JUN 15/03
	1016		JUN 15/03
	1017		JUN 15/03
	1018		JUN 15/03
	1019		SEP 15/03
	1020		SEP 15/03
	1021		SEP 15/03
	1022		SEP 15/03
	1023		JUN 15/03
	1024		JUN 15/03
	1025		SEP 15/03
	1026		SEP 15/03
72-35-00			
72-35-00	1001	4152-3 4156A-3	DEC 15/05
ASSEMBLY-04		4158-3	
	1002		DEC 15/05
	1003		SEP 15/02
	1004		SEP 15/02
	1005		DEC 15/05
	1006		DEC 15/05
	1007		SEP 15/03

		1008		SEP 15/03
		1009		SEP 15/03
		1010		SEP 15/03
		1011		SEP 15/03
		1012		SEP 15/03
		1013		SEP 15/03
		1014		SEP 15/03
		1015		SEP 15/03
		1016		SEP 15/03
		1017		SEP 15/03
		1018		SEP 15/03
		1019		SEP 15/03
		1020		SEP 15/03
		1021		SEP 15/03
		1022		SEP 15/03
		1023		SEP 15/03
		1024		SEP 15/03
		1025		SEP 15/03
		1026		SEP 15/03
		1027/1028		SEP 15/03
72−35−00				
72−35−00		1001	ALL	DEC 15/05
ASSEMBLY−05		1002		DEC 15/05
		1003		DEC 15/05
		1004		DEC 15/05
		1005		DEC 15/05
		1006		DEC 15/05
		1007		DEC 15/97
		1008		DEC 15/97
		1009		DEC 15/97
		1010		DEC 15/97
72−35−00				
72−35−00 ASSEMBLY−06		1001	CONFIG−1 4152 4152−3 4156A 4156A−3 4158 4158−3	JUN 15/03
		1002		JUN 15/03
		1003		JUN 15/03
		1004		JUN 15/03
		1005		DEC 15/05
		1006		DEC 15/05
		1007		JUN 15/03
		1008		JUN 15/03
	R	1009		JAN 1/08
	R	1010		JAN 1/08
		1011		JUN 15/03
		1012		JUN 15/03
		1013		JUN 15/03
		1014		JUN 15/03
		1015		JUN 15/03
		1016		JUN 15/03
		1017		JUN 15/03
		1018		JUN 15/03
		1019		JUN 15/03
		1020		JUN 15/03
		1021/1022		SEP 15/04
72−35−00				
72−35−00		1001	ALL	SEP 15/02
ASSEMBLY−20		1002	4152 4156A 4158	SEP 15/02
		1003		SEP 15/02
		1004		SEP 15/02
		1005		SEP 15/02
		1006	4152−3 4156A−3 4158−3	SEP 15/02
		1007		SEP 15/02
		1008		SEP 15/02
		1009/1010		SEP 15/02
72−35−00				
72−35−00		1001	ALL	SEP 15/04
ASSEMBLY−21		1002	4152 4156A 4158	SEP 15/04
		1003		SEP 15/04
		1004		SEP 15/04

		1005		SEP 15/04
		1006	4152-3 4156A-3 4158-3	SEP 15/04
		1007		SEP 15/04
		1008		SEP 15/04
		1009		SEP 15/04
		1010	ALL	SEP 15/04
		1011		SEP 15/04
		1012		SEP 15/04
		1013/1014		SEP 15/04
72-35-00				
72-35-00		1201	ALL	JUN 15/03
STORAGE-01		1202		JUN 15/03
		1203		JUN 15/03
		1204		JUN 15/03
		1205		SEP 15/06
		1206		SEP 15/06
		1207		JUN 15/03
		1208		JUN 15/03
		1209		SEP 15/06
		1210		SEP 15/06
		1211		SEP 15/06
		1212		SEP 15/06
		1213		JUN 15/03
		1214		JUN 15/03
72-35-01				
72-35-01		501	ALL	SEP 1/07
DISASSY-01		502		SEP 1/07
		503		SEP 1/07
		504		SEP 1/07
		505		SEP 1/07
		506		SEP 1/07
72-35-01				
72-35-01		501	ALL	DEC 15/01
DISASSY-20		502		DEC 15/01
		503		DEC 15/01
		504		DEC 15/01
		505		DEC 15/01
		506		DEC 15/01
		507		DEC 15/01
		508		DEC 15/01
		509/510		DEC 15/01
72-35-01				
72-35-01		501	ALL	DEC 15/01
DISASSY-21		502		DEC 15/01
		503		DEC 15/02
		504		DEC 15/02
		505/506		DEC 15/01
72-35-01				
72-35-01 INSP/CHK-00		801/802	ALL	MAR 15/99
72-35-01				
72-35-01	R	801	ALL	JAN 1/08
INSP/CHK-03	R	802		JAN 1/08
	R	803		JAN 1/08
	R	804		JAN 1/08
		805		MAR 15/06
		806		MAR 15/06
72-35-01				
72-35-01		901	ALL	MAR 15/99
REPAIR-01		902		MAR 15/99
		903		MAR 15/99
		904		MAR 15/99
		905		MAR 15/99
		906		MAR 15/99
72-35-01				
72-35-01		1001	ALL	DEC 15/05
ASSEMBLY-01		1002		DEC 15/05
		1003		DEC 15/98
		1004		DEC 15/98
		1005		SEP 1/07
		1006		SEP 1/07

		1007		SEP 1/07
		1008		SEP 1/07
		1009		DEC 15/98
		1010		DEC 15/98
		1011		DEC 15/98
		1012		DEC 15/98
		1013		DEC 15/98
		1014		DEC 15/98
		1015		DEC 15/98
		1016		DEC 15/98
		1017	4152 4156A 4158	DEC 15/98
		1018	4152-3 4156A-3 4158-3	DEC 15/98
		1019/1020	ALL	DEC 15/98
72-35-01				
72-35-01 ASSEMBLY-02	R	1001	CONFIG-1 4152 4156A 4158	JAN 1/08
	R	1002		JAN 1/08
	R	1003		JAN 1/08
	R	1004		JAN 1/08
	R	1005		JAN 1/08
	R	1006		JAN 1/08
		1007		MAR 15/98
		1008		MAR 15/98
	R	1009		JAN 1/08
	R	1010		JAN 1/08
	R	1011/1012		JAN 1/08
	D	1012		MAR 15/98
72-35-01				
72-35-01 ASSEMBLY-02	R	1001	CONFIG-2 4152-3 4156A-3 4158-3	JAN 1/08
	R	1002		JAN 1/08
	R	1003		JAN 1/08
	R	1004		JAN 1/08
	R	1005		JAN 1/08
	R	1006		JAN 1/08
		1007		DEC 15/97
		1008		DEC 15/97
	R	1009		JAN 1/08
	R	1010		JAN 1/08
	R	1011/1012		JAN 1/08
	D	1012		DEC 15/97
72-35-01				
72-35-01 ASSEMBLY-03		1001	CONFIG-1 4152 4152-3 4156A 4156A-3 4158 4158-3	JUN 15/05
		1002		JUN 15/05
		1003		JUN 15/05
		1004		JUN 15/05
72-35-01				
72-35-01 ASSEMBLY-03		1001	CONFIG-2 4152 4152-3 4156A 4156A-3 4158 4158-3	JUN 15/05
		1002		JUN 15/05
		1003		DEC 15/03
		1004		DEC 15/03
		1005/1006		DEC 15/03
72-35-01				
72-35-01 ASSEMBLY-04		1001	CONFIG-1 4152 4156A 4158	MAR 15/98
		1002		MAR 15/98
		1003		MAR 15/02
		1004		MAR 15/02
		1005		MAR 15/02
		1006		MAR 15/02
		1007		MAR 15/98
		1008		MAR 15/98
		1009		MAR 15/98
		1010		MAR 15/98

	1011		MAR 15/02
	1012		MAR 15/02
	1013		MAR 15/98
	1014		MAR 15/98
	1015		MAR 15/98
	1016		MAR 15/98
	1017		MAR 15/98
	1018		MAR 15/98
	1019		MAR 15/98
	1020		MAR 15/98
72-35-01			
72-35-01	1001	CONFIG-2	JUN 15/03
ASSEMBLY-04		4152-3 4156A-3	
		4158-3	
	1002		JUN 15/03
	1003		MAR 15/02
	1004		MAR 15/02
	1005		JUN 15/03
	1006		JUN 15/03
	1007		JUN 15/03
	1008		JUN 15/03
	1009		DEC 15/97
	1010		DEC 15/97
	1011		MAR 15/02
	1012		MAR 15/02
	1013		MAR 15/02
	1014		MAR 15/02
	1015		DEC 15/97
	1016		DEC 15/97
	1017		JUN 15/03
	1018		JUN 15/03
	1019		JUN 15/03
	1020		JUN 15/03
	1021/1022		DEC 15/97
72-35-01			
72-35-01	1001	ALL	DEC 15/05
ASSEMBLY-20	1002		DEC 15/05
	1003		DEC 15/01
	1004		DEC 15/01
	1005		SEP 1/07
	1006		SEP 1/07
	1007		SEP 1/07
	1008		SEP 1/07
	1009		DEC 15/05
	1010		DEC 15/05
	1011		DEC 15/01
	1012		DEC 15/01
	1013		DEC 15/01
	1014		DEC 15/01
	1015		DEC 15/01
	1016		DEC 15/01
	1017		DEC 15/01
	1018		DEC 15/01
	1019		DEC 15/01
	1020		DEC 15/01
	1021		DEC 15/01
	1022		DEC 15/01
72-35-01			
72-35-01	1001	CONFIG-1	JUN 15/04
ASSEMBLY-21		4152 4156A 4158	
	1002		JUN 15/04
	1003		JUN 15/04
	1004		JUN 15/04
	1005		JUN 15/04
	1006		JUN 15/04
	1007		JUN 15/04
	1008		JUN 15/04
	1009		SEP 15/05
	1010		SEP 15/05
	1011		DEC 15/01
	1012		DEC 15/01
	1013		DEC 15/01

		1014		DEC 15/01
		1015		DEC 15/01
		1016		DEC 15/01
		1017/1018		DEC 15/01
72-35-01				
72-35-01	R	1001	CONFIG-2	JAN 1/08
ASSEMBLY-21			4152-3 4156A-3	
			4158-3	
	R	1002		JAN 1/08
	R	1003		JAN 1/08
	R	1004		JAN 1/08
		1005		JUN 15/04
		1006		JUN 15/04
		1007		JUN 15/04
		1008		JUN 15/04
		1009		JUN 15/04
		1010		JUN 15/04
		1011		JUN 15/04
		1012		JUN 15/04
	R	1013		JAN 1/08
	R	1014		JAN 1/08
		1015		JUN 15/04
		1016		JUN 15/04
	R	1017		JAN 1/08
	R	1018		JAN 1/08
	R	1019		JAN 1/08
	R	1020		JAN 1/08
		1021		JUN 15/04
		1022		JUN 15/04
		1023		JUN 15/04
		1024		JUN 15/04
		1025		JUN 15/04
		1026		JUN 15/04
		1027		JUN 15/04
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		1031		JUN 15/04
		1032		JUN 15/04
		1033		JUN 15/04
		1034		JUN 15/04
	R	1035		JAN 1/08
	R	1036		JAN 1/08
		1037		DEC 15/01
		1038		DEC 15/01
	R	1039		JAN 1/08
	R	1040		JAN 1/08
	R	1041		JAN 1/08
	R	1042		JAN 1/08
	R	1043		JAN 1/08
	R	1044		JAN 1/08
	R	1045		JAN 1/08
	R	1046		JAN 1/08
	R	1047		JAN 1/08
	R	1048		JAN 1/08
	R	1049		JAN 1/08
	R	1050		JAN 1/08
	R	1051		JAN 1/08
	R	1052		JAN 1/08
	R	1053		JAN 1/08
	R	1054		JAN 1/08
	R	1055		JAN 1/08
	R	1056		JAN 1/08
	R	1057		JAN 1/08
	R	1058		JAN 1/08
	R	1059		JAN 1/08
	R	1060		JAN 1/08
	R	1061		JAN 1/08
	R	1062		JAN 1/08
	R	1063		JAN 1/08
	R	1064		JAN 1/08
	R	1065		JAN 1/08

	R	1066		JAN 1/08
	D	1067		DEC 15/01
	D	1068		DEC 15/01
72–35–01				
72–35–01 ASSEMBLY–22		1001	CONFIG–1 4152 4156A 4158	JUN 15/04
		1002		JUN 15/04
		1003		JUN 15/04
		1004		JUN 15/04
		1005		JUN 15/04
		1006		JUN 15/04
		1007		JUN 15/04
		1008		JUN 15/04
		1009		SEP 15/05
		1010		SEP 15/05
		1011		DEC 15/01
		1012		DEC 15/01
		1013		DEC 15/01
		1014		DEC 15/01
		1015		DEC 15/01
		1016		DEC 15/01
		1017/1018		DEC 15/01
72–35–01				
72–35–01 ASSEMBLY–22		1001	CONFIG–2 4152–3 4156A–3 4158–3	DEC 15/01
		1002		DEC 15/01
		1003		JUN 15/04
		1004		JUN 15/04
		1005		JUN 15/04
		1006		JUN 15/04
		1007		JUN 15/04
		1008		JUN 15/04
		1009		JUN 15/04
		1010		JUN 15/04
		1011		JUN 15/04
		1012		JUN 15/04
		1013		DEC 15/01
		1014		DEC 15/01
		1015		DEC 15/01
		1016		DEC 15/01
		1017		JUN 15/04
		1018		JUN 15/04
		1019		DEC 15/01
		1020		DEC 15/01
		1021		DEC 15/01
		1022		DEC 15/01
		1023		JUN 15/05
		1024		JUN 15/05
		1025		JUN 15/05
		1026		JUN 15/05
		1027		JUN 15/05
		1028		JUN 15/05
		1029		JUN 15/05
		1030		JUN 15/05
		1031		JUN 15/05
		1032		JUN 15/05
		1033		JUN 15/05
		1034		JUN 15/05
		1035		JUN 15/05
		1036		JUN 15/05
		1037		JUN 15/04
		1038		JUN 15/04
		1039		JUN 15/04
		1040		JUN 15/04
		1041		JUN 15/04
		1042		JUN 15/04
		1043		JUN 15/04
		1044		JUN 15/04
		1045		JUN 15/04
		1046		JUN 15/04
72–35–01				

72-35-01		1001	CONFIG-1	DEC 15/01
ASSEMBLY-23			4152 4156A 4158	
		1002		DEC 15/01
		1003		JUN 15/04
		1004		JUN 15/04
		1005		JUN 15/04
		1006		JUN 15/04
		1007		JUN 15/04
		1008		JUN 15/04
		1009		JUN 15/04
		1010		JUN 15/04
		1011		DEC 15/01
		1012		DEC 15/01
		1013		DEC 15/01
		1014		DEC 15/01
		1015		DEC 15/01
		1016		DEC 15/01
		1017/1018		DEC 15/01
72-35-01				
72-35-01	R	1001	CONFIG-2	JAN 1/08
ASSEMBLY-23			4152-3 4156A-3	
			4158-3	
	R	1002		JAN 1/08
	R	1003		JAN 1/08
	R	1004		JAN 1/08
	R	1005		JAN 1/08
	R	1006		JAN 1/08
	R	1007		JAN 1/08
	R	1008		JAN 1/08
		1009		JUN 15/04
		1010		JUN 15/04
		1011		JUN 15/04
		1012		JUN 15/04
	R	1013		JAN 1/08
	R	1014		JAN 1/08
		1015		JUN 15/04
		1016		JUN 15/04
	R	1017		JAN 1/08
	R	1018		JAN 1/08
	R	1019		JAN 1/08
	R	1020		JAN 1/08
		1021		JUN 15/04
		1022		JUN 15/04
		1023		JUN 15/04
		1024		JUN 15/04
		1025		JUN 15/04
		1026		JUN 15/04
		1027		JUN 15/04
		1028		JUN 15/04
		1029		JUN 15/04
		1030		JUN 15/04
		1031		JUN 15/04
		1032		JUN 15/04
		1033		JUN 15/04
		1034		JUN 15/04
	R	1035		JAN 1/08
	R	1036		JAN 1/08
	R	1037		JAN 1/08
	R	1038		JAN 1/08
		1039		JUN 15/04
		1040		JUN 15/04
		1041		JUN 15/04
		1042		JUN 15/04
72-35-01				
72-35-01		1001	CONFIG-1	DEC 15/01
ASSEMBLY-24			4152 4156A 4158	
		1002		DEC 15/01
		1003		JUN 15/04
		1004		JUN 15/04
		1005		JUN 15/04
		1006		JUN 15/04
		1007		JUN 15/04

	1008		JUN 15/04
	1009		JUN 15/04
	1010		JUN 15/04
	1011		DEC 15/01
	1012		DEC 15/01
	1013		DEC 15/01
	1014		DEC 15/01
	1015		DEC 15/01
	1016		DEC 15/01
	1017		DEC 15/01
	1018		DEC 15/01
72−35−01			
72−35−01	1001	CONFIG−2	DEC 15/01
ASSEMBLY−24		4152−3 4156A−3	
		4158−3	
	1002		DEC 15/01
	1003		JUN 15/04
	1004		JUN 15/04
	1005		JUN 15/04
	1006		JUN 15/04
	1007		JUN 15/04
	1008		JUN 15/04
	1009		JUN 15/04
	1010		JUN 15/04
	1011		JUN 15/04
	1012		JUN 15/04
	1013		DEC 15/01
	1014		DEC 15/01
	1015		JUN 15/03
	1016		JUN 15/03
	1017		DEC 15/01
	1018		DEC 15/01
	1019		DEC 15/01
	1020		DEC 15/01
	1021		DEC 15/01
	1022		DEC 15/01
	1023		DEC 15/01
	1024		DEC 15/01
	1025		JUN 15/04
	1026		JUN 15/04
	1027		JUN 15/04
	1028		JUN 15/04
	1029		JUN 15/04
	1030		JUN 15/04
	1031		JUN 15/04
	1032		JUN 15/04
	1033		JUN 15/04
	1034		JUN 15/04
	1035		JUN 15/04
	1036		JUN 15/04
	1037		DEC 15/01
	1038		DEC 15/01
	1039		DEC 15/01
	1040		DEC 15/01
	1041		DEC 15/01
	1042		DEC 15/01
	1043		DEC 15/01
	1044		DEC 15/01
72−35−01			
72−35−01	1001	CONFIG−1	DEC 15/01
ASSEMBLY−25		4152 4156A 4158	
	1002		DEC 15/01
	1003		JUN 15/04
	1004		JUN 15/04
	1005		JUN 15/04
	1006		JUN 15/04
	1007		JUN 15/04
	1008		JUN 15/04
	1009		JUN 15/04
	1010		JUN 15/04
	1011		DEC 15/01
	1012		DEC 15/01

	1013		DEC 15/01
	1014		DEC 15/01
	1015		DEC 15/01
	1016		DEC 15/01
	1017/1018		DEC 15/01
72-35-01			
72-35-01 ASSEMBLY-25	1001	CONFIG-2 4152-3 4156A-3 4158-3	SEP 1/07
	1002		SEP 1/07
	1003		SEP 1/07
	1004		SEP 1/07
	1005		SEP 1/07
	1006		SEP 1/07
	1007		SEP 1/07
	1008		SEP 1/07
	1009		SEP 1/07
	1010		SEP 1/07
	1011		SEP 1/07
	1012		SEP 1/07
	1013		SEP 1/07
	1014		SEP 1/07
	1015		SEP 1/07
	1016		SEP 1/07
	1017		SEP 1/07
	1018		SEP 1/07
	1019		SEP 1/07
	1020		SEP 1/07
	1021		SEP 1/07
	1022		SEP 1/07
	1023/1024		SEP 1/07
72-35-01			
72-35-01 ASSEMBLY-26	1001	CONFIG-1 4152 4156A 4158	DEC 15/01
	1002		DEC 15/01
	1003		JUN 15/04
	1004		JUN 15/04
	1005		JUN 15/04
	1006		JUN 15/04
	1007		JUN 15/04
	1008		JUN 15/04
	1009		JUN 15/04
	1010		JUN 15/04
	1011		DEC 15/01
	1012		DEC 15/01
	1013		DEC 15/01
	1014		DEC 15/01
	1015		DEC 15/01
	1016		DEC 15/01
	1017/1018		DEC 15/01
72-35-01			
72-35-01 ASSEMBLY-26	1001	CONFIG-2 4152-3 4156A-3 4158-3	SEP 1/07
	1002		SEP 1/07
	1003		SEP 1/07
	1004		SEP 1/07
	1005		SEP 1/07
	1006		SEP 1/07
	1007		SEP 1/07
	1008		SEP 1/07
	1009		SEP 1/07
	1010		SEP 1/07
	1011		SEP 1/07
	1012		SEP 1/07
	1013		SEP 1/07
	1014		SEP 1/07
	1015		SEP 1/07
	1016		SEP 1/07
	1017		SEP 1/07
	1018		SEP 1/07
	1019		SEP 1/07

	1020		SEP 1/07
	1021		SEP 1/07
	1022		SEP 1/07
	1023/1024		SEP 1/07
72−35−01			
72−35−01	1001	CONFIG−1	DEC 15/01
ASSEMBLY−27		4152 4156A 4158	
	1002		DEC 15/01
	1003		JUN 15/04
	1004		JUN 15/04
	1005		JUN 15/04
	1006		JUN 15/04
	1007		JUN 15/04
	1008		JUN 15/04
	1009		JUN 15/04
	1010		JUN 15/04
	1011		DEC 15/01
	1012		DEC 15/01
	1013		DEC 15/01
	1014		DEC 15/01
	1015		DEC 15/01
	1016		DEC 15/01
	1017/1018		DEC 15/01
72−35−01			
72−35−01	1001	CONFIG−2	SEP 1/07
ASSEMBLY−27		4152−3 4156A−3 4158−3	
	1002		SEP 1/07
	1003		SEP 1/07
	1004		SEP 1/07
	1005		SEP 1/07
	1006		SEP 1/07
	1007		SEP 1/07
	1008		SEP 1/07
	1009		SEP 1/07
	1010		SEP 1/07
	1011		SEP 1/07
	1012		SEP 1/07
	1013		SEP 1/07
	1014		SEP 1/07
	1015		SEP 1/07
	1016		SEP 1/07
	1017		SEP 1/07
	1018		SEP 1/07
	1019		SEP 1/07
	1020		SEP 1/07
	1021		SEP 1/07
	1022		SEP 1/07
	1023/1024		SEP 1/07
72−35−01			
72−35−01	1001	ALL	DEC 15/06
ASSEMBLY−28	1002		DEC 15/06
	1003		DEC 15/06
	1004		DEC 15/06
	1005		DEC 15/01
	1006		DEC 15/01
	1007/1008		DEC 15/01
72−35−01			
72−35−01	1001	ALL	DEC 15/06
ASSEMBLY−29	1002		DEC 15/06
	1003		DEC 15/06
	1004		DEC 15/06
	1005		DEC 15/01
	1006		DEC 15/01
	1007/1008		DEC 15/01
72−35−01			
72−35−01	1001	ALL	DEC 15/06
ASSEMBLY−30	1002		DEC 15/06
	1003		DEC 15/06
	1004		DEC 15/06
	1005		JUN 15/04
	1006		JUN 15/04

		1007		JUN 15/04
		1008		JUN 15/04
72-35-01				
72-35-01 ASSEMBLY-31		1001	ALL	DEC 15/06
		1002		DEC 15/06
		1003		DEC 15/06
		1004		DEC 15/06
		1005		DEC 15/01
		1006		DEC 15/01
		1007		MAR 15/02
		1008		MAR 15/02
		1009	4152 4156A 4158	DEC 15/01
		1010	4152-3 4156A-3 4158-3	DEC 15/01
		1011/1012	ALL	DEC 15/01
72-35-02				
72-35-02 DISASSY-01		501/502	ALL	MAR 15/95
72-35-02				
72-35-02 ASSEMBLY-01		1001	CONFIG-1 4152 4152-3 4156A 4156A-3 4158 4158-3	DEC 15/05
		1002		DEC 15/05
		1003		DEC 15/03
		1004		DEC 15/03
		1005		DEC 15/03
		1006		DEC 15/03
		1007		DEC 15/03
		1008		DEC 15/03
		1009		DEC 15/03
		1010		DEC 15/03
		1011		DEC 15/03
		1012		DEC 15/03
		1013		DEC 15/05
		1014		DEC 15/05
		1015		DEC 15/03
		1016		DEC 15/03
		1017		DEC 15/03
		1018		DEC 15/03
		1019		DEC 15/03
		1020		DEC 15/03
		1021		DEC 15/03
		1022		DEC 15/03
		1023		DEC 15/03
		1024		DEC 15/03
72-35-02				
72-35-02 ASSEMBLY-01	R	1001	CONFIG-2 4152 4152-3 4156A 4156A-3 4158 4158-3	JAN 1/08
	R	1002		JAN 1/08
		1003		DEC 15/03
		1004		DEC 15/03
		1005		DEC 15/03
		1006		DEC 15/03
		1007		DEC 15/03
		1008		DEC 15/03
		1009		DEC 15/03
		1010		DEC 15/03
		1011		DEC 15/03
		1012		DEC 15/03
		1013		DEC 15/03
		1014		DEC 15/03
		1015		DEC 15/03
		1016		DEC 15/03
		1017		DEC 15/03
		1018		DEC 15/03
		1019		DEC 15/05
		1020		DEC 15/05
	R	1021		JAN 1/08
	R	1022		JAN 1/08

	R	1023		JAN 1/08
	R	1024		JAN 1/08
	R	1025		JAN 1/08
	R	1026		JAN 1/08
	R	1027		JAN 1/08
	R	1028		JAN 1/08
	R	1029		JAN 1/08
	R	1030		JAN 1/08
		1031		DEC 15/03
		1032		DEC 15/03
		1033		DEC 15/03
		1034		DEC 15/03
		1035		MAR 15/04
		1036		MAR 15/04
		1037		DEC 15/03
		1038		DEC 15/03
		1039		DEC 15/03
		1040		DEC 15/03
		1041		DEC 15/03
		1042		DEC 15/03
		1043		DEC 15/03
		1044		DEC 15/03
		1045/1046		DEC 15/03
72-35-03				
72-35-03		501	ALL	MAR 15/06
DISASSY-01		502		MAR 15/06
		503		MAR 15/06
		504		MAR 15/06
		505		MAR 15/06
		506		MAR 15/06
		507		MAR 15/06
		508		MAR 15/06
		509/510		MAR 15/06
72-35-03				
72-35-03		1001	ALL	SEP 15/06
ASSEMBLY-01		1002		SEP 15/06
		1003		SEP 15/06
		1004		SEP 15/06
		1005		JUN 15/03
		1006		JUN 15/03
		1007		SEP 15/99
		1008		SEP 15/99
		1009		SEP 15/99
		1010		SEP 15/99
		1011/1012		MAR 15/06
72-35-04				
72-35-04		501	CONFIG-1	MAY 1/07
DISASSY-01			4152 4152-3	
			4156A 4156A-3	
			4158 4158-3	
		502		MAY 1/07
		503		MAY 1/07
		504		MAY 1/07
		505		MAY 1/07
		506		MAY 1/07
		507		MAY 1/07
		508		MAY 1/07
		509		MAY 1/07
		510		MAY 1/07
		511		MAY 1/07
		512		MAY 1/07
		513		MAY 1/07
		514		MAY 1/07
		515		MAY 1/07
		516		MAY 1/07
		517/518		MAY 1/07
72-35-04				
72-35-04		1001	CONFIG-1	JUN 15/04
ASSEMBLY-01			4152 4152-3	
			4156A 4156A-3	
			4158 4158-3	
		1002		JUN 15/04

1003	JUN 15/04
1004	JUN 15/04
1005	JUN 15/04
1006	JUN 15/04
1007	JUN 15/04
1008	JUN 15/04
1009	SEP 15/05
1010	SEP 15/05
1011	JUN 15/04
1012	JUN 15/04
1013	JUN 15/04
1014	JUN 15/04
1015	DEC 15/05
1016	DEC 15/05
1017	DEC 15/05
1018	DEC 15/05
1019	DEC 15/05
1020	DEC 15/05
1021	DEC 15/05
1022	DEC 15/05
1023	DEC 15/05
1024	DEC 15/05
1025	JUN 15/04
1026	JUN 15/04
1027	JUN 15/04
1028	JUN 15/04
1029	JUN 15/04
1030	JUN 15/04
1031	JUN 15/04
1032	JUN 15/04
1033	JUN 15/04
1034	JUN 15/04
1035	JUN 15/04
1036	JUN 15/04
1037	JUN 15/04
1038	JUN 15/04
1039	JUN 15/04
1040	JUN 15/04
1041	JUN 15/04
1042	JUN 15/04
1043	JUN 15/04
1044	JUN 15/04
1045	JUN 15/04
1046	JUN 15/04
1047	JUN 15/04
1048	JUN 15/04
1049	SEP 15/05
1050	SEP 15/05
1051	JUN 15/04
1052	JUN 15/04
1053	JUN 15/04
1054	JUN 15/04
1055	JUN 15/04
1056	JUN 15/04
1057	JUN 15/04
1058	JUN 15/04
1059	JUN 15/04
1060	JUN 15/04
1061	JUN 15/04
1062	JUN 15/04
1063	JUN 15/04
1064	JUN 15/04
1065	JUN 15/04
1066	JUN 15/04
1067	MAR 15/05
1068	MAR 15/05
1069	JUN 15/04
1070	JUN 15/04
1071	JUN 15/04
1072	JUN 15/04
1073	JUN 15/04
1074	JUN 15/04

	1075		JUN 15/04
	1076		JUN 15/04
	1077		JUN 15/04
	1078		JUN 15/04
72-35-04			
72-35-04	1001	CONFIG-1	JUN 15/04
ASSEMBLY-02		4152 4152-3	
		4156A 4156A-3	
		4158 4158-3	
	1002		JUN 15/04
	1003		JUN 15/04
	1004		JUN 15/04
	1005		JUN 15/04
	1006		JUN 15/04
	1007		JUN 15/04
	1008		JUN 15/04
	1009		JUN 15/04
	1010		JUN 15/04
	1011		JUN 15/04
	1012		JUN 15/04
	1013		JUN 15/04
	1014		JUN 15/04
	1015		JUN 15/04
	1016		JUN 15/04
	1017		JUN 15/04
	1018		JUN 15/04
72-35-37			
72-35-37	501	ALL	SEP 15/02
DISASSY-01	502		SEP 15/02
	503		SEP 15/02
	504		SEP 15/02
	505		SEP 15/02
	506		SEP 15/02
	507/508		SEP 15/02
72-35-37			
72-35-37	1001	ALL	SEP 15/02
ASSEMBLY-01	1002		SEP 15/02
	1003		SEP 15/02
	1004		SEP 15/02
	1005		SEP 15/02
	1006		SEP 15/02
	1007/1008		SEP 15/02
72-35-37			
72-35-37	1001	ALL	SEP 15/98
ASSEMBLY-02	1002		SEP 15/98
	1003		SEP 15/98
	1004		SEP 15/98
	1005		SEP 15/98
	1006		SEP 15/98
	1007		MAR 15/01
	1008		MAR 15/01
	1009/1010		SEP 15/98
72-35-37			
72-35-37	1001	ALL	MAR 15/02
ASSEMBLY-03	1002		MAR 15/02
	1003		MAR 15/02
	1004		MAR 15/02
	1005		MAR 15/02
	1006		MAR 15/02
	1007		MAR 15/02
	1008		MAR 15/02
	1009/1010		MAR 15/02
72-35-38			
72-35-38	501	ALL	SEP 15/02
DISASSY-01	502		SEP 15/02
	503/504		SEP 15/02
72-35-38			
72-35-38	1001	CONFIG-1	SEP 15/02
ASSEMBLY-01		4152 4156A 4158	
	1002		SEP 15/02
	1003/1004		SEP 15/02
72-35-38			

72-35-38	1001	CONFIG-2	SEP 15/02
ASSEMBLY-01		4152-3 4156A-3	
		4158-3	
	1002		SEP 15/02
	1003		SEP 15/02
	1004		SEP 15/02
72-35-38			
72-35-38	1001	ALL	MAR 15/97
ASSEMBLY-02	1002		MAR 15/97
	1003	4152 4156A 4158	MAR 15/97
	1004	4152-3 4156A-3	MAR 15/97
		4158-3	
	1005/1006	ALL	MAR 15/97
72-35-38			
72-35-38	1001/1002	CONFIG-1	SEP 15/02
ASSEMBLY-03		4152 4156A 4158	
72-35-38			
72-35-38	1001/1002	CONFIG-2	SEP 15/02
ASSEMBLY-03		4152-3 4156A-3	
		4158-3	
72-35-38			
72-35-38	1001/1002	CONFIG-1	SEP 15/02
ASSEMBLY-04		4152 4156A 4158	
72-35-38			
72-35-38	1001/1002	CONFIG-2	SEP 15/02
ASSEMBLY-04		4152-3 4156A-3	
		4158-3	
72-35-38			
72-35-38	1001/1002	CONFIG-1	SEP 15/02
ASSEMBLY-05		4152 4156A 4158	
72-35-38			
72-35-38	1001/1002	CONFIG-2	SEP 15/02
ASSEMBLY-05		4152-3 4156A-3	
		4158-3	
72-35-38			
72-35-38	1001/1002	ALL	SEP 15/02
ASSEMBLY-06			
72-35-38			
72-35-38	1001/1002	ALL	SEP 15/02
ASSEMBLY-07			
72-35-38			
72-35-38	1001/1002	ALL	SEP 15/02
ASSEMBLY-08			
72-35-38			
72-35-38	1001/1002	ALL	APR 15/88
ASSEMBLY-09			
72-35-38			
72-35-38	1001/1002	ALL	APR 15/88
ASSEMBLY-10			
72-35-38			
72-35-38	1001/1002	ALL	APR 15/88
ASSEMBLY-11			
72-35-38			
72-35-38	1001/1002	ALL	APR 15/88
ASSEMBLY-12			
72-35-38			
72-35-38	1001	ALL	SEP 15/98
ASSEMBLY-13	1002		SEP 15/98
	1003		SEP 15/98
	1004		SEP 15/98
	1005		SEP 15/98
	1006		SEP 15/98
	1007/1008		SEP 15/98
72-35-39			
72-35-39	501	CONFIG-1	SEP 15/02
DISASSY-01		4152 4156A 4158	
	502		SEP 15/02
	503		SEP 15/02
	504		SEP 15/02
	505		SEP 15/02
	506		SEP 15/02
72-35-39			

72-35-39	501	CONFIG-2	DEC 15/05
DISASSY-01		4152-3 4156A-3	
		4158-3	
	502		DEC 15/05
	503		SEP 15/02
	504		SEP 15/02
	505		SEP 15/02
	506		SEP 15/02
	507		SEP 15/02
	508		SEP 15/02
	509		DEC 15/03
	510		DEC 15/03
	511		SEP 15/02
	512		SEP 15/02
	513/514		SEP 15/02
72-35-39			
72-35-39	1001	CONFIG-1	DEC 15/98
ASSEMBLY-01		4152 4156A 4158	
	1002		DEC 15/98
	1003		DEC 15/98
	1004		DEC 15/98
	1005		DEC 15/98
	1006		DEC 15/98
	1007		DEC 15/98
	1008		DEC 15/98
72-35-39			
72-35-39	1001	CONFIG-2	DEC 15/98
ASSEMBLY-01		4152-3 4156A-3	
		4158-3	
	1002		DEC 15/98
	1003		JUN 15/03
	1004		JUN 15/03
	1005		JUN 15/03
	1006		JUN 15/03
	1007		JUN 15/03
	1008		JUN 15/03
	1009		JUN 15/03
	1010		JUN 15/03
	1011		JUN 15/03
	1012		JUN 15/03
	1013		SEP 15/97
	1014		SEP 15/97
	1015		SEP 15/97
	1016		SEP 15/97
	1017		SEP 15/97
	1018		SEP 15/97
72-35-39			
72-35-39	1001/1002	CONFIG-1	SEP 15/02
ASSEMBLY-02		4152 4156A 4158	
72-35-39			
72-35-39	1001	CONFIG-2	SEP 15/02
ASSEMBLY-02		4152-3 4156A-3	
		4158-3	
	1002		SEP 15/02
72-35-39			
72-35-39	1001	ALL	OCT 15/92
ASSEMBLY-03	1002		OCT 15/92
72-35-39			
72-35-39	1001/1002	CONFIG-1	SEP 15/02
ASSEMBLY-04		4152 4156A 4158	
72-35-39			
72-35-39	1001	CONFIG-2	SEP 15/02
ASSEMBLY-04		4152-3 4156A-3	
		4158-3	
	1002		SEP 15/02
72-35-39			
72-35-39	1001	CONFIG-1	SEP 15/02
ASSEMBLY-05		4152 4156A 4158	
	1002		SEP 15/02
72-35-39			
72-35-39	1001	CONFIG-2	SEP 15/02
ASSEMBLY-05		4152-3 4156A-3	

		4158-3	
	1002		SEP 15/02
	1003		SEP 15/02
	1004		SEP 15/02
72-35-39			
72-35-39	1001/1002	ALL	APR 15/88
ASSEMBLY-06			
72-35-39			
72-35-39	1001/1002	ALL	APR 15/88
ASSEMBLY-07			
72-35-39			
72-35-39	1001/1002	ALL	APR 15/88
ASSEMBLY-08			
72-35-39			
72-35-39	1001	ALL	SEP 15/96
ASSEMBLY-09	1002		SEP 15/96
72-35-61			
72-35-61	1001	ALL	MAR 15/01
ASSEMBLY-01	1002		MAR 15/01
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	1004		MAR 15/01
	1005		MAR 15/01
	1006		MAR 15/01
	1007		MAR 15/01
	1008		MAR 15/01
	1009/1010		MAR 15/01
72-35-62			
72-35-62	1001	ALL	MAR 15/01
ASSEMBLY-01	1002		MAR 15/01
	1003		MAR 15/01
	1004		MAR 15/01
	1005		MAR 15/01
	1006		MAR 15/01
	1007		MAR 15/01
	1008		MAR 15/01
	1009/1010		MAR 15/01

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-35-01-040-001:

1. Disassemble (Bladed) Axial Compressor Rotor Assembly

A. Equipment And Materials Necessary

Special Tools:

	PWA 29389	Pump
	PWA 76154	Adapter, Lift And Trunnion (2 Necessary)
	PWA 85086	Lift Arm
	PWA 85125	Support, Drum Rotor
R R	PWA 85127	Adapter, Lift And Trunnion (Replaced By PWA 107349)
	PWA 85133	Adapter, Lift And Trunnion
	PWA 85161	Adapter, Lift
	PWA 85163	Adapter, Lift And Trunnion
R R	PWA 85166	Puller, Jackscrew (5th Stage Disk) (Replaced By PWA 107285)
	PWA 85296	Puller
	PWA 85297	Puller, Front Drum (For Application, See Text)
	PWA 85304	Wrench, System Torque (Optional to PWA 86215)
	PWA 85328	Stand, Storage (2 Necessary)
	PWA 86060	Console, Data Acquire
	PWA 86061	Test Stand, Calibration
	PWA 86215	Wrench System, Torque
	.PWA 86062	Assembly, Gearbox
	.PWA 86063	Module, Software
	.PWA 86064	Assembly, Gearbox
	.PWA 86065	Module, Software
	.PWA 86066	Adapter, Calibration
	.PWA 86067	Module, Software
	.PWA 86068	Cabinet, Storage
	.PWA 101501	Locator, Bolt
	PWA 86473	Wrench (Optional to PWA 85304 and PWA 86215)
	PWA 86474	Wrench (Optional to PWA 85304 and PWA 86215)
	PWA 86476	Wrench (Optional to PWA 85304 and PWA 86215)
	PWA 88643	Sling (Optional to PWA 88673)
	PWA 88673	Sling
	PWA 88770	Puller, Front Drum
	PWA 101480	Wrench (Optional to PWA 85304 and PWA 86215)
	PWA 102711	Holder, Tierod (If necessary)
R	PWA 107285	Puller, Jackscrew (5th Stage Disk)
R	PWA 107349	Adapter, Lift And Trunnion

AXIAL COMPRESSOR ROTOR ASSEMBLY − DISASSEMBLY−01

Special Tools:

(CONTINUED)

NOTE: The PWA 86215 Wrench System has all the tools indicated below the system.

B. Procedure

NOTE: Axial compressor rotor assembly is in PWA 80515 Support Stand with PWA 85294 Adapter, rear end down, with external cases removed. PWA 85160 Thread Protector is installed on front hub and PWA 85159 Thread Protector is installed on rear shaft.

(1) (Pre SB PW4ENG 72−515) Drift rivets from counterweights. Remove counterweights from airseal flange.

(2) Use the PWA 86215 Torque Wrench System (replaces PWA 85304 System Torque Wrench with the PWA 86060 Data Acquisition Console) and the PWA 86061 Calibration Test Stand to loosen the 42 tierod nuts that hold the 5th stage disk and front hub to the front drum rotor. (See the manufacturers data for complete use instructions of the torque wrench system). Remove 42 nuts that secure the 5th stage and front hub to drum.

NOTE: As an option to the above wrenches, PWA 86474 Wrench can be used to loosen the 42 nuts and PWA 86476 Wrench can be used to remove the 42 nuts.

(a) If necessary, use PWA 102711 Holder to prevent the tierod from turning when you remove the nut.

R (3) Use PWA 85166 or PWA 107285 Puller to remove the stage 5 disk and blades assembly from the drum snap. Remove the puller.

(4) Install PWA 85163 Adapter to disk blades. Using hoist and PWA 88643 Sling or PWA 88673 Sling with PWA 76154 Adapters, remove disk and blades from rotor and install on PWA 85328 Storage Stand tierods down. Remove hoist, sling adapters and adapter.

(5) Install PWA 85296 Puller to front hub and front drum rotor. Using PWA 29389 Pump remove hub from snap fit. Remove pump and puller.

(6) Install PWA 85161 Adapter to front hub threads. Using hoist and PWA 85086 Arm attached to hub, remove hub from rotor. Remove hoist, arm and adapter from hub.

(7) Use the PWA 86215 Torque Wrench System (replaces PWA 85304 System Torque Wrench with the PWA 86060 Data Acquisition Console) and the PWA 86061 Calibration Test Stand to loosen the 42 tierod nuts that hold the front drum rotor to the rear drum rotor. (See the manufacturers data for complete use instructions of the torque wrench system). Remove 42 nuts that secure the front drum rotor to the rear drum rotor.

NOTE: As an option to the above wrenches, PWA 86473 Wrench can be used to loosen the 42 nuts and PWA 101480 Wrench can be used to remove the 42 nuts.

(8) Use a hoist and PWA 88643 Sling or PWA 88673 Sling and PWA 76154 Adapters to install PWA 85133 Adapter to front drum flange. Remove the hoist, sling, and adapters.

(9) FOR THESE MODELS: 4152, 4156A, 4158
Using PWA 85297 Puller with PWA 29389 Pump attached to adapter remove front drum from rear drum snap. Remove puller.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
It is not necessary to remove the 9th stage bleed air tubes from the front drum assembly.

(10) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Use PWA 88770 Puller with PWA 29389 Pump attached to adapter to remove the front drum from the rear drum snap. Remove the puller.

NOTE: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
It is not necessary to remove the 9th stage bleed air tubes from the front drum assembly.

(11) Install hoist and PWA 88643 Sling or PWA 88673 Sling and PWA 76154 Adapters to PWA 85133 Adapter on the front drum to remove front drum rotor and install it onto the PWA 85328 Storage Stand. Remove the hoist, sling, and adapters.

(12) Put the drum rotor and blades (rear) assembly in the PWA 85125 Support. See Figure 501.

R (a) Install PWA 85127 or PWA 107349 Adapter to the
R tierod end of the drum rotor. See Figure 501.

(b) Use PWA 88643 Sling or PWA 88673 Sling with two PWA 76154 Adapters to lift the drum rotor from the Stand.

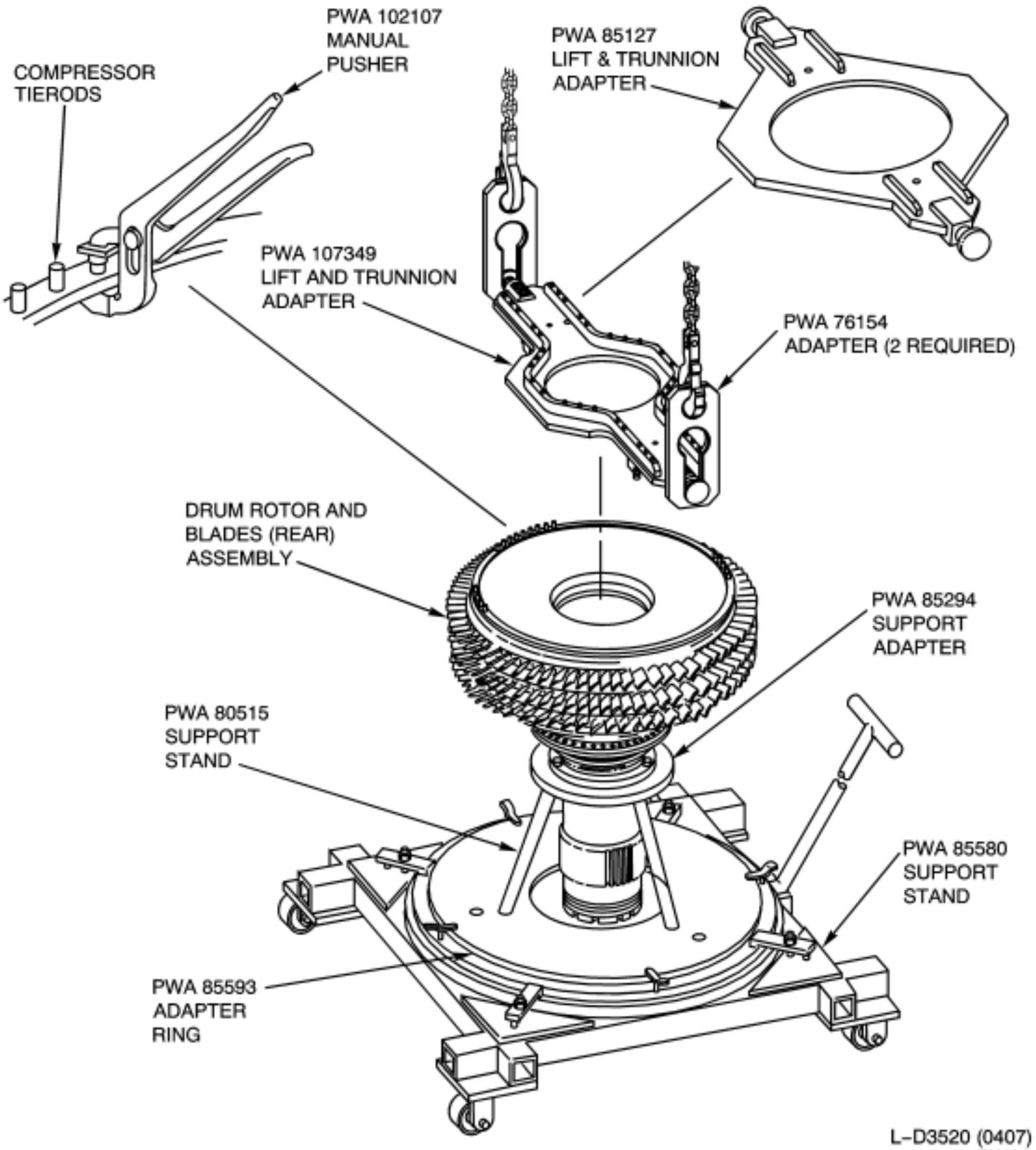
R (c) Lower the drum rotor into the PWA 85125 Stand.
R See Figure 502.

(d) Remove the hoist, Sling, and Adapters.

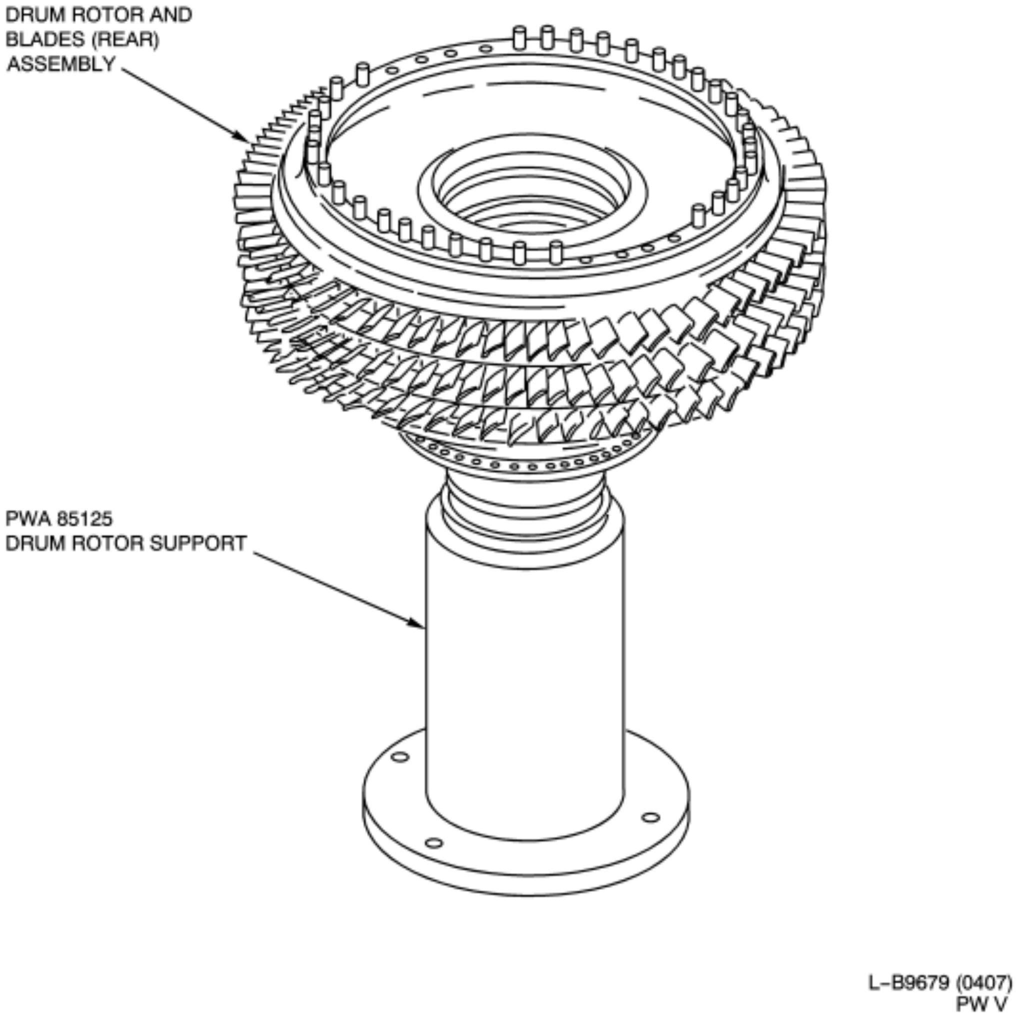
C. Postrequisites

(1) Disassemble The Drum Rotor And Blades (Rear) Assembly. Refer to 72-35-39, Disassembly-01 CONFIG-1 (Task 72-35-39-040-001), or CONFIG-2 (Task 72-35-39-040-002-001), or (Task 72-35-39-040-002-002).

AXIAL COMPRESSOR ROTOR ASSEMBLY - DISASSEMBLY-01


PWA 102107
MANUAL
PUSHER
COMPRESSOR
TIERODS
PWA 85127
LIFT & TRUNNION
ADAPTER
PWA 107349
LIFT AND TRUNNION
ADAPTER
PWA 76154
ADAPTER (2 REQUIRED)
DRUM ROTOR AND
BLADES (REAR)
ASSEMBLY
PWA 85294
SUPPORT
ADAPTER
PWA 80515
SUPPORT
STAND
PWA 85580
SUPPORT
STAND
PWA 85593
ADAPTER
RING
L-D3520 (0407)
PW V

Lift Adapter Installation
Figure 501
(Task 72-35-01-040-001)


DRUM ROTOR AND
BLADES (REAR)
ASSEMBLY
PWA 85125
DRUM ROTOR SUPPORT
L-B9679 (0407)
PW V

Drum Rotor And Blades (Rear) Assembly
R Figure 502
(Task 72-35-01-040-001)

AXIAL COMPRESSOR ROTOR ASSEMBLY - DISASSEMBLY-20

Task 72-35-01-040-003:

1. Disassemble (Deblade) The Axial Compressor Rotor Assembly

NOTE: The axial compressor rotor assembly is in a build stand made of a PWA 80515 Support Stand, PWA 85294 Support Adapter, PWA 85593 Adapter Ring and a PWA 85580 Support Stand. A PWA 85160 Thread Protector is installed on the front hub and a PWA 85159 Thread Protector is installed on the rear shaft. A PWA 87383 Protector is installed over the bladed drum assembly. See Figure 501.

A. Equipment And Materials Necessary

Special Tools:

PWA 83135	Driver
PWA 83136	Extension
PWA 86447	Blade Positioning Drift
PWA 86448	Blade Positioning Drift
PWA 86652	Blade Positioning Drift (Optional to PWA 86447)
PWA 87075	Removal Kit
PWA 87754	Tab Bending Drift

B. Procedure

(1) (Pre and Post SB PW4ENG 72-373) Use PWA 87754 Drift and a mallet to unbend the tab of the locks and remove the locks from the 5th disk. Discard the blade locks. See Figure 502.

CAUTION: CARE SHOULD BE TAKEN TO ENSURE THAT ANY PRESSURE OR FORCE, REQUIRED TO DEBLADE DISK, BE APPLIED TO ROOT PLATFORM AREA OF BLADE AND NOT TO LEADING OR TRAILING EDGE OF AIRFOIL. AIRFOIL SECTION OF BLADES ARE EASILY DAMAGED BY ANY KIND OF FORCE.

(2) If necessary, use drift and mallet at blade root area to remove blade from disk.

(3) Remove all blades and place them in blade tray.

(4) (Pre SB PW4ENG 72-373) Use PWA 87754 Drift with a plastic hammer to unbend the tab on the lock at the 6th stage blade root at two locations. Do this procedure again at 10 locks. Drift all the locks in the same direction to place the cutouts in the lock under the blade roots to permit blade removal. See Figure 502.

(5) (Post SB PW4ENG 72−373) Use PWA 87754 Drift with a plastic hammer to unbend the tab on the lock at the 6th stage blade root. Remove the blade lock. Do this procedure again for 51 locks. Discard the locks.

CAUTION: YOU MUST MAKE SURE THAT WHEN YOU APPLY ANY PRESSURE OR FORCE, NECESSARY DURING REMOVAL OF BLADES, YOU APPLY THAT PRESSURE OR FORCE TO THE ROOT PLATFORM AREA OF THE BLADE AND NOT TO THE LEADING OR TRAILING EDGE OF THE AIRFOIL. AIRFOIL SECTIONS OF ALL BLADES ARE EASILY DAMAGED BY ANY KIND OF FORCE. USE THE PWA 86447 OR PWA 86652 DRIFT TO HELP REMOVE THE BLADES. USE MINIMUM FORCE ON THE TOOL.

CAUTION: DO NOT TRY TO MOVE ALL THE BLADES AT ONE TIME WITH THE PWA 86448 DRIFT, MOVE ONLY APPROXIMATELY FIVE BLADES AT A TIME OR DAMAGE TO THE DRIFT CAN RESULT.

(6) (Pre SB PW4ENG 72−373) Push down on the blade platforms to remove the blades from the drum and remove the lock. Do this procedure against 10 places. Discard the locks.

(7) (Pre SB PW4ENG 72−373) Use PWA 87754 Drift with a plastic hammer to unbend the tab on the lock at the 7th stage blade root at two locations. Do this procedure again at 11 locks. Drift all the locks in same direction to place the cutouts in the lock under the blade roots to permit blade removal.

(8) (Post SB PW4ENG 72−373) Use PWA 87754 Drift with a plastic hammer to unbend the tab on the lock at the 7th stage blade root. Remove the blade lock. Do this procedure again for 56 locks. Discard the locks.

CAUTION: YOU MUST MAKE SURE THAT WHEN YOU APPLY ANY PRESSURE OR FORCE, NECESSARY DURING REMOVAL OF BLADES, YOU APPLY THAT PRESSURE OR FORCE TO THE ROOT PLATFORM AREA OF THE BLADE AND NOT TO THE LEADING OR TRAILING EDGE OF THE AIRFOIL. AIRFOIL SECTIONS OF ALL BLADES ARE EASILY DAMAGED BY ANY KIND OF FORCE. USE THE PWA 86447 OR PWA 86652 DRIFT TO HELP REMOVE THE BLADES. USE MINIMUM FORCE ON THE TOOL.

CAUTION: DO NOT TRY TO MOVE ALL THE BLADES AT ONE TIME WITH THE PWA 86448 DRIFT, MOVE ONLY

APPROXIMATELY FIVE BLADES AT A TIME OR DAMAGE TO THE DRIFT CAN RESULT.

(9) (Pre SB PW4ENG 72−373) Push down on the blade platforms to remove the blades from the drum and remove the lock. Do this procedure against 11 places. Discard the locks.

(10) (Pre SB PW4ENG 72−373) Use PWA 87754 Drift with a plastic hammer to unbend the tab on the lock at the 8th stage blade root at two locations. Do this procedure again at nine locks. Drift all the locks in same direction to place the cutouts in the lock under the blade roots to permit blade removal.

(11) (Post SB PW4ENG 72−373) Use PWA 87754 Drift with a plastic hammer to unbend the tab on the lock at the 8th stage blade root. Remove the blade lock. Do this procedure again for 53 locks. Discard the locks.

CAUTION: YOU MUST MAKE SURE THAT WHEN YOU APPLY ANY PRESSURE OR FORCE, NECESSARY DURING REMOVAL OF BLADES, YOU APPLY THAT PRESSURE OR FORCE TO THE ROOT PLATFORM AREA OF THE BLADE AND NOT TO THE LEADING OR TRAILING EDGE OF THE AIRFOIL. AIRFOIL SECTIONS OF ALL BLADES ARE EASILY DAMAGED BY ANY KIND OF FORCE. USE THE PWA 86447 DRIFT OR PWA 86652 DRIFT TO HELP REMOVE THE BLADES. USE MINIMUM FORCE ON THE TOOL.

CAUTION: DO NOT TRY TO MOVE ALL THE BLADES AT ONE TIME WITH THE PWA 86448 DRIFT, MOVE ONLY APPROXIMATELY 5 BLADES AT A TIME OR DAMAGE TO THE DRIFT CAN RESULT.

(12) (Pre SB PW4ENG 72−373) Push down on the blade platforms to remove the blades from the drum and remove the lock. Do this procedure against nine places. Discard the locks.

(13) FOR THESE MODELS: 4152, 4156A, 4158
Turn the drum to find two blade locks at the 9th stage and loosen the locks. For engines with SB PW4ENG 72−254, use the PWA 83135 Driver and PWA 83136 Extension. For engines without SB PW4ENG 72−254, use a standard hex head driver.

(14) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Turn the drum to find two blade locks at the 9th stage and loosen the locks. Use the PWA 83135 Driver and PWA 83136 Extension.

NOTE: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
When you find a lock setscrew that will not move use PWA 87075 Removal Kit. The kit has drills to remove the setscrews.

(15) If it is necessary to remove a setscrew with the PWA 87075 Removal Kit, set the depth of the drill with the set block detail to the correct depth as follows:

(a) For the HPC 9th stage setscrew(s), set the drill depth to 0.304 − 0.314 inch (7.72 − 7.98 mm).

(b) For the HPC 10th stage setscrew(s), set the drill depth to 0.244 − 0.254 inch (6.20 − 6.45 mm).

(c) For the HPC 11th stage setscrew(s), set the drill depth to 0.234 − 0.244 inch (5.94 − 6.20 mm).

(d) For the HPC 12th stage setscrew(s), set the drill depth to 0.237 − 0.247 inch (6.02 − 6.27 mm).

CAUTION: THE DRILLS THAT ARE SUPPLIED WITH PWA 87075 BLADE LOCK REMOVAL KIT HAVE LEFT HAND FLUTES. YOU MUST ROTATE THESE DRILLS IN A COUNTERCLOCKWISE (CCW) DIRECTION OR DAMAGE TO THE DRILLS CAN OCCUR.

(16) After you have correctly set the depth of the drill, drill out the setscrew of the blade lock. Remove the setscrew with a standard drift.

(17) FOR THESE MODELS: 4152, 4156A, 4158
Turn the drum 180 degrees and loosen the locks at the opposite side of the 9th stage. For engines with SB PW4ENG 72−254, use the PWA 83135 Driver and PWA 83136 Extension. For engines without SB PW4ENG 72−254, use a standard hex head driver.

(18) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Turn the drum 180 degrees and loosen the locks at the opposite side of the 9th stage. Use the PWA 83135 Driver and PWA 83136 Extension.

CAUTION: USE THE PWA 86448 DRIFT TO MOVE THE BLADES TO THE LOADING SLOT. THE USE OF A DIFFERENT METHOD CAN CAUSE AIRFOIL DAMAGE. USE MINIMUM FORCE ON THE TOOL.

CAUTION: DO NOT TRY TO MOVE ALL THE BLADES AT ONE TIME WITH THE PWA 86448 DRIFT, MOVE ONLY APPROXIMATELY FIVE BLADES AT A TIME OR DAMAGE TO THE DRIFT CAN RESULT.

(19) Use the PWA 86448 Drift and move the blades, approximately five blades at a time, to the left or right until one blade is between two blade locks. This will position the blade at the loading slot. Remove the blade from drum.

(20) Move the blades to the left or the right of the loading slot to remove all the blades, blade locks and seals from the drum.

(21) Do the Stage 9 procedure to remove the blades from the remaining Stages 10 through 12.

(22) FOR THESE MODELS: 4152, 4156A, 4158
Rotate drum to locate two blade locks at 13th stage and loosen the locks. For engines with SB PW4ENG 72−254 use the PWA 83135 Driver and PWA 83136 Extension. For engines without SB PW4ENG 72−254, use a standard hex head driver.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
When you find a lock setscrew that will not move, use PWA 87075 Removal Kit. The kit has drills to remove the setscrew.

(23) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Rotate drum to locate two blade locks at 13th stage and loosen locks using PWA 83135 Driver and PWA 83136 Extension.

NOTE: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
When you find a lock setscrew that will not move, use PWA 87075 Removal Kit. The kit has drills to remove the setscrew.

(24) If it is necessary to remove a setscrew with the PWA 87075 Removal Kit, set the depth of the drill with the set block detail to the correct depth as follows:

(a) For the HPC stage 13 and 14 blade setscrew(s), set the drill depth to 0.193 − 0.203 inch (4.90 − 5.16 mm).

(b) For the HPC stage 15 blade setscrew(s), set the drill depth to 0.189 − 0.199 inch (4.80 − 5.05 mm).

CAUTION: THE DRILLS THAT ARE SUPPLIED WITH PWA 87075 BLADE LOCK REMOVAL KIT HAVE LEFT HAND FLUTES. YOU MUST ROTATE THESE DRILLS IN A COUNTERCLOCKWISE (CCW) DIRECTION OR DAMAGE TO THE DRILLS CAN OCCUR.

(25) After you have correctly set the depth of the drill, drill out the setscrew of the blade lock. Remove the setscrew with a standard drift.

(26) FOR THESE MODELS: 4152, 4156A, 4158
Rotate drum 180 degrees and loosen the locks at the opposite side of the 13th stage. For engines with SB PW4ENG 72−254, use the PWA 83135 Driver and PWA 83136 Extension. For engines without SB PW4ENG 72−254, use a standard hex head drive.

(27) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Rotate drum 180 degrees and loosen locks using PWA 83135 Driver and PWA 83136 Extension at opposite side of 15th stage.

CAUTION: USE THE PWA 86448 DRIFT TO MOVE THE BLADES TO THE LOADING SLOT. THE USE OF A DIFFERENT METHOD CAN CAUSE AIRFOIL DAMAGE. USE MINIMUM FORCE ON THE TOOL.

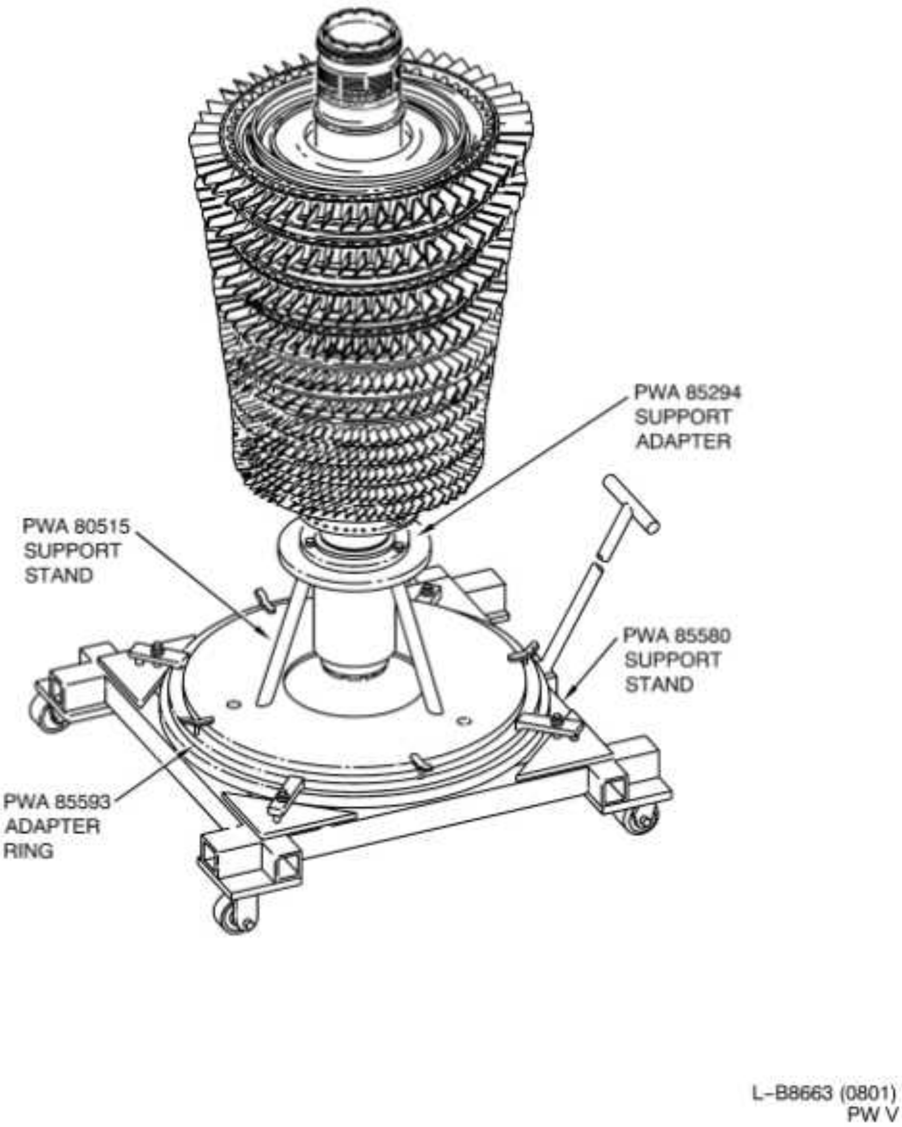
CAUTION: DO NOT TRY TO MOVE ALL THE BLADES AT ONE TIME WITH THE PWA 86448 DRIFT, MOVE ONLY APPROXIMATELY FIVE BLADES AT A TIME OR DAMAGE TO THE DRIFT CAN RESULT.

(28) Use the PWA 86448 Drift and move the blades, approximately five blades at a time, to the left or the right until one blade is between two blade locks. This will position the blade at the loading slot.

(29) Remove all blades, blade locks and seals from drum by moving blades to left or right of loading slot.

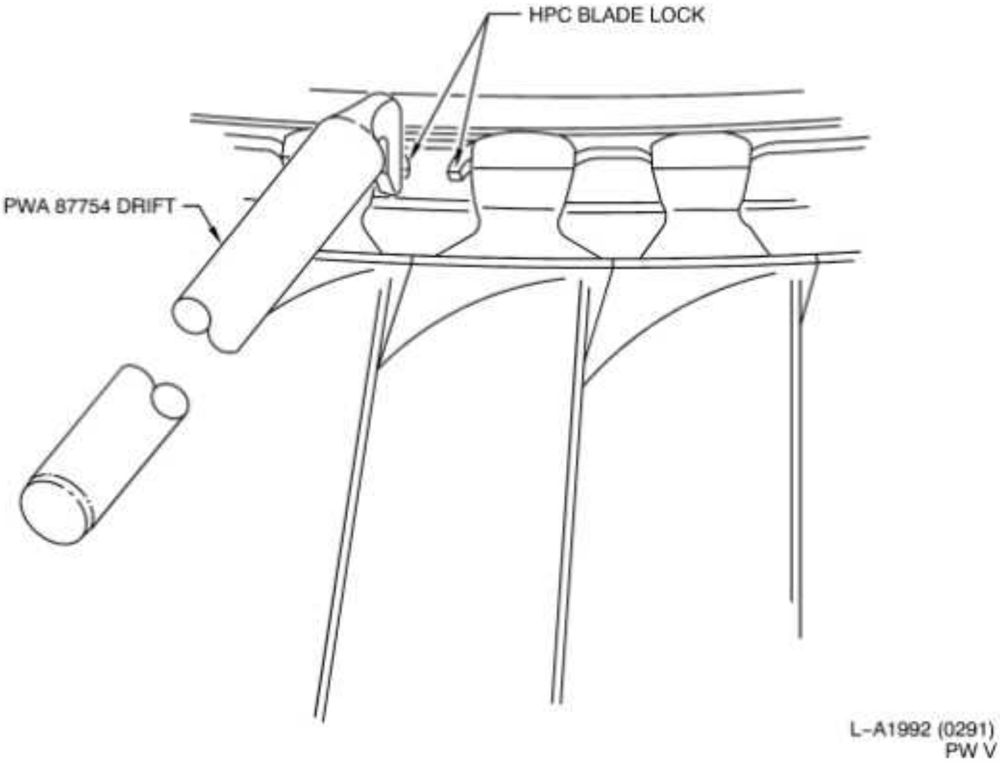
(30) Do the Stage 13 procedure to remove the blades from the remaining Stages 14 and 15.

AXIAL COMPRESSOR ROTOR ASSEMBLY - DISASSEMBLY-20


PWA 85294
SUPPORT
ADAPTER
PWA 80515
SUPPORT
STAND
PWA 85580
SUPPORT
STAND
PWA 85593
ADAPTER
RING
L-B8663 (0801)
PW V

Axial Compressor Rotor Assembly
Figure 501
(Task 72-35-01-040-003)

AXIAL COMPRESSOR ROTOR ASSEMBLY − DISASSEMBLY−20


HPC BLADE LOCK
PWA 87754 DRIFT
L−A1992 (0291)
PW V

Blade Lock Removal
Figure 502
(Task 72−35−01−040−003)

Previous Pageblock Return to Previous Menu Next Pageblock

AXIAL COMPRESSOR ROTOR ASSEMBLY - DISASSEMBLY-21

Task 72-35-01-040-004:

1. Disassemble (Debladed) Axial Compressor Rotor Assembly

A. Equipment And Materials Necessary

Special Tools:

PWA 29389	Pump
PWA 76154	Adapter, Lift And Trunnion (2 Necessary)
PWA 85086	Lift Arm
PWA 85133	Adapter, Lift And Trunnion
PWA 85161	Adapter, Lift
PWA 85162	Adapter, Lift And Trunnion
PWA 85165	Puller, Airseal
PWA 85166	Puller, Jackscrew
PWA 85296	Puller
PWA 85297	Puller, Front Drum (For Application, See Text)
PWA 85304	Wrench, System Torque (Optional To PWA 86215)
PWA 85328	Stand, Storage (2 Necessary)
PWA 86060	Console, Data Acquire
PWA 86061	Test Stand, Calibration
PWA 86215	Wrench System, Torque
.PWA 86062	Assembly, Gearbox
.PWA 86063	Module, Software
.PWA 86064	Assembly, Gearbox
.PWA 86065	Module, Software
.PWA 86066	Adapter, Calibration
.PWA 86067	Module, Software
.PWA 86068	Cabinet, Storage
.PWA 101501	Locator, Bolt
PWA 86473	Wrench (Optional To PWA 85304 And PWA 86215)
PWA 86474	Wrench (Optional To PWA 85304 And PWA 86215)
PWA 86476	Wrench (Optional To PWA 85304 And PWA 86215)
PWA 88643	Sling (Optional To PWA 88673)
PWA 88673	Sling
PWA 88770	Puller, Front Drum
PWA 101480	Wrench (Optional To PWA 85304 And PWA 86215)
PWA 102107	Pusher, Manual
PWA 102711	Holder, Tierod (If Necessary)

NOTE: The PWA 86215 Wrench System has all the tools indicated below the system.

AXIAL COMPRESSOR ROTOR ASSEMBLY − DISASSEMBLY−21

B. Procedure
Figure 501.

NOTE: Axial (debladed) compressor rotor assembly is in PWA 80515 Support Stand with PWA 85294 Adapter, rear end down. PWA 85160 Thread Protector is installed on front hub and PWA 85159 Thread Protector is installed on rear shaft.

(1) (Pre SB PW4ENG 72−515) Drift rivets from counterweights. Remove counterweights from airseal flange.

(2) Use the PWA 86215 Torque Wrench System (replaces PWA 85304 System Torque Wrench with the PWA 86060 Data Acquisition Console) and the PWA 86061 Calibration Test Stand to loosen the 42 tierod nuts that hold the 5th stage disk and front hub to the front drum rotor. (See the manufacturers data for complete use instructions of the torque wrench system). Remove 42 nuts that secure the 5th stage and front hub to drum.

NOTE: As an option to the above wrenches, PWA 86474 Wrench can be used to loosen the 42 nuts and PWA 86476 Wrench can be used to remove the 42 nuts.

(a) If necessary, use PWA 102711 Holder to prevent the tierod from turning when you remove the nut.

(3) Using PWA 85166 Puller, remove stage 5 disk from drum snap. Remove puller.

(4) Install PWA 85162 Adapter to disk blade slots. Using hoist and PWA 88643 Sling or PWA 88673 Sling with PWA 76154 Adapters, remove disk from rotor and install on PWA 85328 Storage Stand tierods down. Remove hoist, sling adapters and adapter.

(5) For engines incorporating integral inlet airseal and 5th stage disk (Post SB PW4ENG 72−290), install PWA 85426 Protector on airseal.

(6) For engines not incorporating integral inlet airseal and 5th stage disk (Pre SB PW4ENG 72−290), remove 40 nuts and bolts securing airseal to Stage 5 HPC disk. Using PWA 85165 Airseal Puller, remove airseal from disk.

AXIAL COMPRESSOR ROTOR ASSEMBLY − DISASSEMBLY−21

(7) Reinstall PWA 88643 Sling or PWA 88673 Sling with PWA 76154 Adapters and hoist to adapter on blade slots. Raise disk and trunnion to tierod up. Lower disk on stand.

(8) Using PWA 102107 Adapters, remove tierods from disk flange.

(9) Raise disk from support and trunnion to flange side down on stand. Remove hoist, sling and adapters from adapter. Remove adapter from disk.

(10) Install PWA 85296 Puller to front hub and front drum rotor. Using PWA 29389 Pump remove hub from snap fit. Remove pump and puller.

(11) Install PWA 85161 Adapter to front hub threads. Using hoist and PWA 85086 Arm attached to hub, remove hub from rotor. Remove hoist, arm and adapter from hub.

(12) Use the PWA 86215 Torque Wrench System (replaces PWA 85304 System Torque Wrench with the PWA 86060 Data Acquisition Console) and the PWA 86061 Calibration Test Stand to loosen the 42 tierod nuts that hold the front drum rotor to the rear drum rotor. (See the manufacturers data for complete use instructions of the torque wrench system). Remove 42 nuts that secure the front drum rotor to the rear drum rotor.

NOTE: As an option to the above wrenches, PWA 86473 Wrench can be used to loosen the 42 nuts and PWA 101480 Wrench can be used to remove the 42 nuts.

(13) FOR THESE MODELS: 4152, 4156A, 4158
Using PWA 85297 Puller with PWA 29389 Pump remove front drum from rear drum snap. Remove puller.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
It is not necessary to remove the 9th stage bleed air tubes from the front drum assembly.

(14) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Use PWA 88770 Puller with PWA 29389 Pump to remove the front drum from the rear drum snap. Remove the puller.

NOTE: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
It is not necessary to remove the 9th stage bleed air tubes from the front drum assembly.

(15) Install PWA 85133 Adapter to front drum flange. Use a hoist and PWA 88643 Sling or PWA 88673 Sling and PWA 76154 Adapters to remove front drum rotor and install it onto the PWA 85328 Storage Stand. Remove the hoist, sling, and adapters.

C. Postrequisites

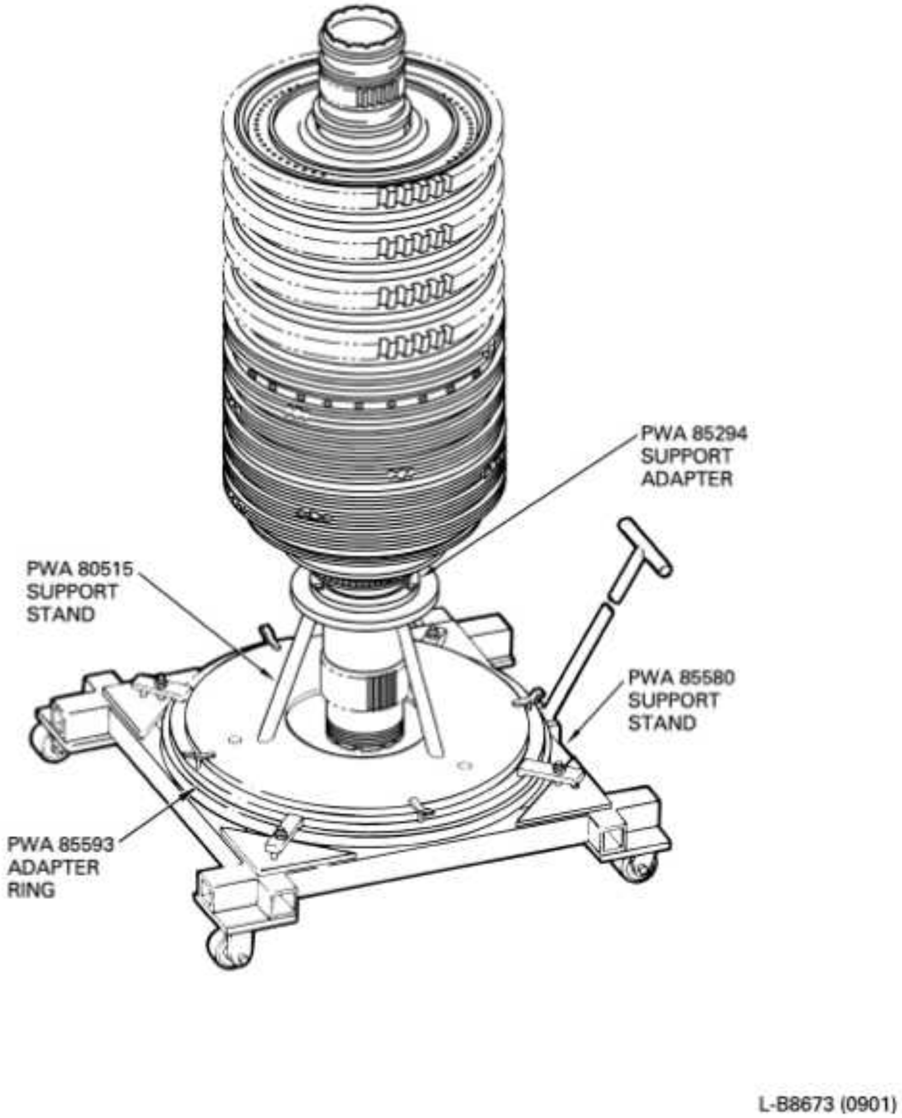
(1) Disassemble the drum rotor (rear) assembly.

(a) Disassemble The Drum Rotor And Blades (Rear) Assembly. Refer to 72−35−39, Disassembly−01, CONFIG−1 (Task 72−35−39−040−001), steps 1.C.(1) to 1.C.(9).

(b) Disassemble The Drum Rotor And Blades (Rear) Assembly Rear Shaft Removal − Method 1. Refer to 72−35−39, Disassembly−01, CONFIG−2 (Task 72−35−39−040−002−001) steps 1.C.(1) to 1.C.(8).

(c) Disassemble The Drum Rotor And Blades (Rear) Assembly Rear Shaft Removal − Method 2. Refer to (Task 72−35−39−040−002−002), steps 1.C.(1) to 1.C.(14).

AXIAL COMPRESSOR ROTOR ASSEMBLY − DISASSEMBLY−21


PWA 85294
SUPPORT
ADAPTER
PWA 80515
SUPPORT
STAND
PWA 85580
SUPPORT
STAND
PWA 85593
ADAPTER
RING
L-B8673 (0901)

Axial Compressor Rotor Assembly
Figure 501
(Task 72−35−01−040−004)

AXIAL COMPRESSOR ROTOR ASSEMBLY - INSPECTION/CHECK-00

Task 72-35-01-990-001:

1. Inspection/Check Part Number Index - Axial Compressor Rotor Assembly - Deleted

   A. Inspection Functional Arrangement

      (1) This task has been deleted.

AXIAL COMPRESSOR ROTOR ASSEMBLY - INSPECTION/CHECK-03

Task 72-35-01-200-003:

1. Visual Inspection - Axial Compressor Rotor Assembly

A. Prerequisites

(1) See Inspection/Check-00 Task 72-35-01-990-001 for functional arrangement and part number applicability.

B. Equipment And Materials Required - None

C. Procedure
See Figure 801 and Figure 802.

Subtask 72-35-01-220-051:

(1) Accomplish inspection requirements whenever extent of engine disassembly permits. It is not necessary to remove any parts for the purpose of inspection unless inspection reveals that additional disassembly is required.

(2) Visually inspect rotor assembly for obvious surface damage and/or deformations which will preclude proper functioning of rotor.

(a) You can use a fluorescent (white) light and a 10X magnifying glass to examine all areas for cracks.

(b) Pay special attention to the spacer areas between the 5th and 6th stages and between the 6th and 7th stages.

(c) If no cracks are found using visual inspection, make a local fluorescent inspection of the spacer areas using SPOP 70.

(d) No cracks are permitted.

(3) HPC rotor assemblies that pass all inspection/check requirements may be returned to service. Assemblies that do not pass inspection requirements must be repaired per its applicable manual section.

Subtask 72-35-01-220-052:

(4) Inspect HPC front hub for:

(a) Indications of cracks, nicks, dents, scratches or corrosion pits.

(b) Security of counterweights.

(c) Damaged threads or splines.

Subtask 72-35-01-220-053:

(5) Inspect blades for:

(a) Indications of blade rub and excessive looseness.

(b) Indications of foreign object damage. If foreign object damage is found, and the rotor assembly is not scheduled for disassembly and the blades are not scheduled for overhaul, you can blend repair the damaged blades by 72-35-01, Repair-01 Task 72-35-01-300-001.

(c) Security of silicone rubber sealant around blade slots (Stages 5 through 8).

(d) Indications of missing blade tip coating due to chipping or disbonding, Stages 9 through 15. See Figure 802. (Post SB PW4ENG 72-484 - Aluminum Oxide Tip Coating, Stages 9 - 15) (Post SB PW4ENG 72-575 - Zirconium Oxide (ZrOx) Tip Coating, Stages 13 - 15)

R
R
R 1 Each blade can have chipped coating to 0.020 inch (0.508 mm) maximum in length at either the leading or trailing edge.

R 2 Chipping at the leading and/or the trailing edges of the blade tip is permitted on 50 percent of the blades in any one stage (both corners) up to a maximum of 0.075 inch (1.905 mm).

R 3 Up to 10 percent of the blades in any one stage may be chipped up to 0.250 inch (6.35 mm) chordwise length down to the base metal at the leading or trailing edge or mid-chord.

R 4 Four blades in any one stage can have chips up to 0.375 inch at the leading and trailing edges for ZrOx tip blades only.

R 5 Two blades in any one stage can have chips up to 1.000 inch long anywhere on the tip for ZrOx tipped blades only.

R 6 Blades which exhibit loss of tip coating due to disbonding are to be treated the same as chipped blades if no visible separation exists between the base metal and the remaining coating.

R 7 Blades with visual separation must be replaced.

Subtask 72−35−01−220−054:

(6) Inspect drum rotors and 5th disk for:

(a) Cracks or bent knife−edge seals.

(b) All accessable surfaces for cracks, dents, nicks, scratches or corrosion pits.

(7) If blades are removed from the 13th, 14th and 15th stages and the rear drum is not undergoing full fluorescent penetrant inspection, locally inspect the blade locking slots and the blade loading slots using 10X magnification and SPOP 70 (Ultra High Sensitivity), refer to the Standard Practices Manual, PN 585005. No cracks are permitted.

(8) If blades are removed from all or any of the 9th thru 15th stages and the HPC rotor is not planned for complete disassembly, nicks, dents, scratches are permitted without repair to the limits specified in Figure 803.

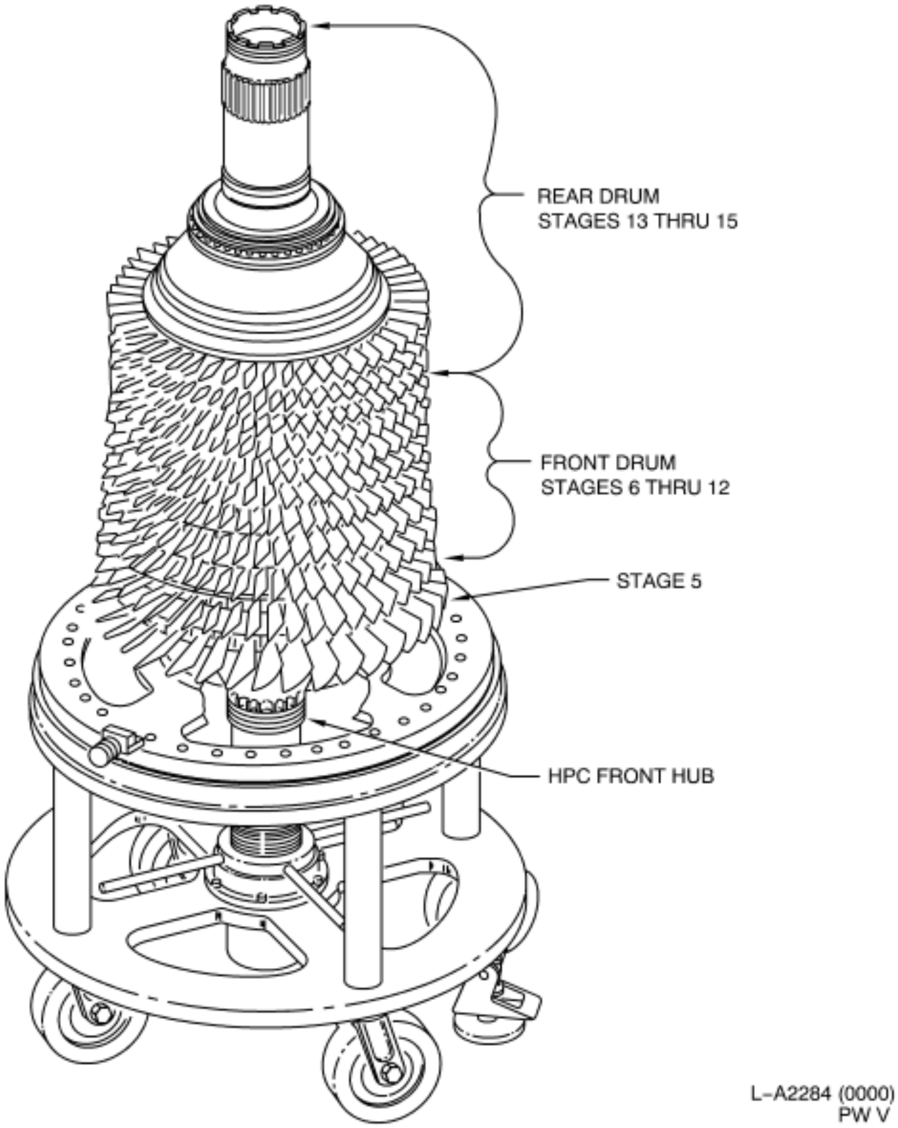
Subtask 72−35−01−220−055:

(9) Inspect all blade locks for broken, missing or loose locks.

(10) Inspect all blade lock set screws to verify that screws are flush or below blade platform surface.

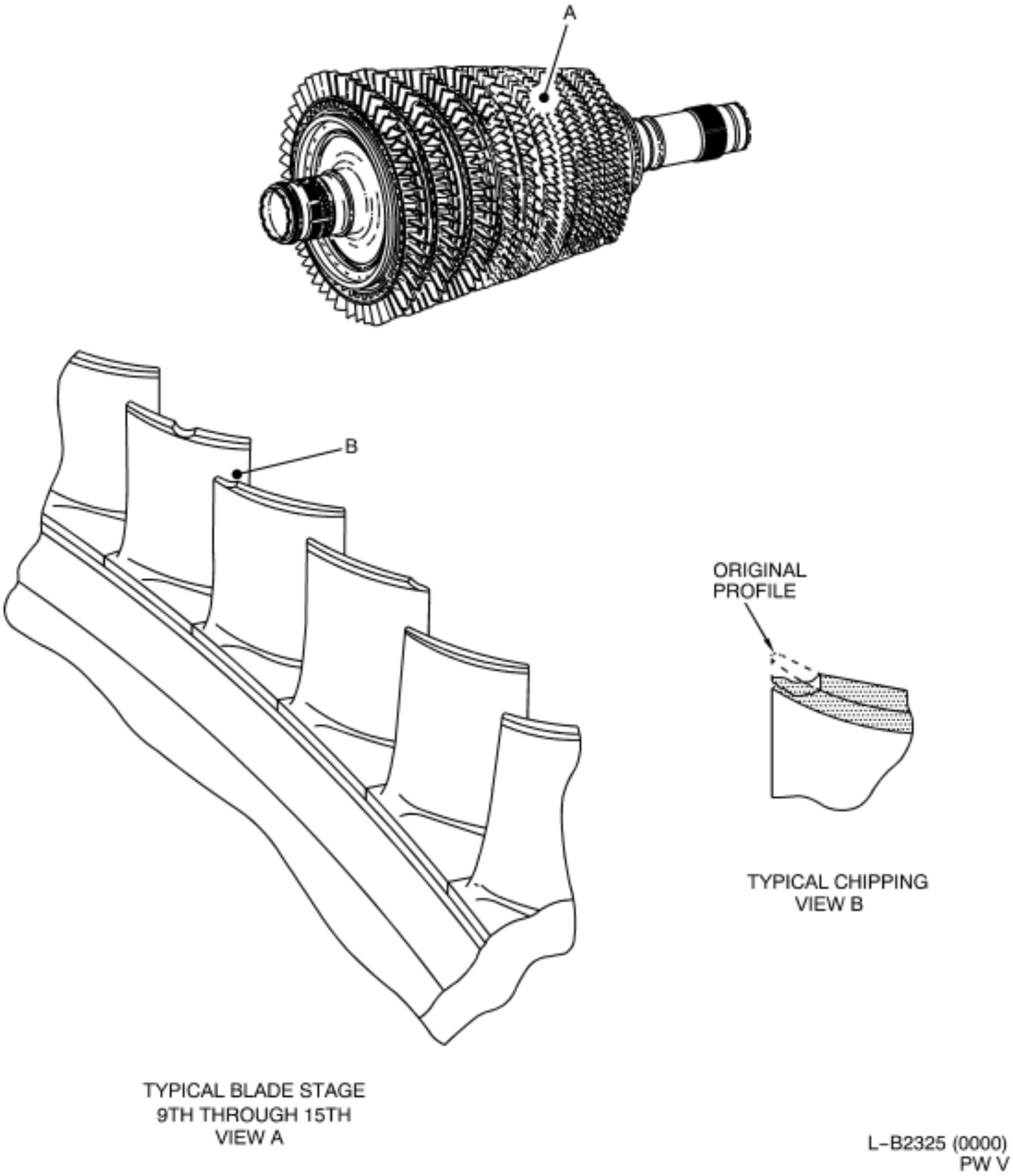
Subtask 72−35−01−220−056:

(11) Inspect rear stages of blades, 9 thru 15, for platform space gap. A gap of 0.075 inch (1.905 mm) is permitted if HPC rotor assembly is not scheduled for disassembly.


REAR DRUM
STAGES 13 THRU 15
FRONT DRUM
STAGES 6 THRU 12
STAGE 5
HPC FRONT HUB
L−A2284 (0000)
PW V

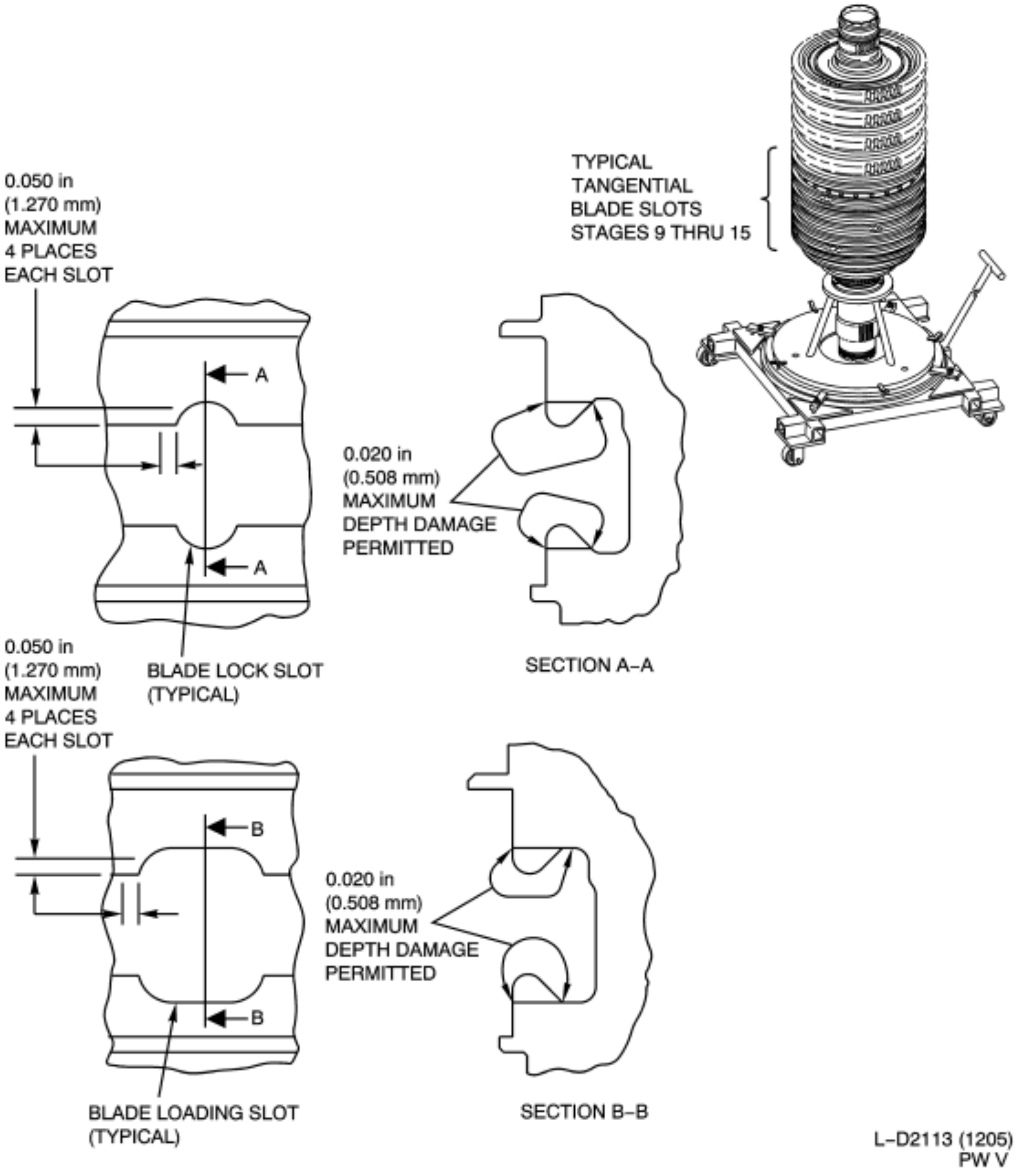
Axial Compressor Rotor Assembly − Visual Inspection
Figure 801
(Task 72−35−01−200−003)

AXIAL COMPRESSOR ROTOR ASSEMBLY − INSPECTION/CHECK−03


A
B
ORIGINAL
PROFILE
TYPICAL CHIPPING
VIEW B
TYPICAL BLADE STAGE
9TH THROUGH 15TH
VIEW A
L−B2325 (0000)
PW V

Axial Compressor Rotor Assembly − Visual Inspection
Figure 802
(Task 72−35−01−200−003)

AXIAL COMPRESSOR ROTOR ASSEMBLY - INSPECTION/CHECK-03


TYPICAL TANGENTIAL BLADE SLOTS STAGES 9 THRU 15
0.050 in (1.270 mm) MAXIMUM 4 PLACES EACH SLOT
A
A
0.020 in (0.508 mm) MAXIMUM DEPTH DAMAGE PERMITTED
0.050 in (1.270 mm) MAXIMUM 4 PLACES EACH SLOT
BLADE LOCK SLOT (TYPICAL)
SECTION A-A
B
B
0.020 in (0.508 mm) MAXIMUM DEPTH DAMAGE PERMITTED
BLADE LOADING SLOT (TYPICAL)
SECTION B-B
L-D2113 (1205)
PW V

Tangential Blade Lock Slots And Loading Slots - Visual Inspection
Figure 803
(Task 72-35-01-200-003)

Previous Pageblock Return to Previous Menu Next Pageblock

AXIAL COMPRESSOR ROTOR ASSEMBLY − REPAIR−01

Task 72−35−01−300−001:

1. Blend Installed HPC Blade Airfoils Stages 5 Through 15

A. Equipment And Materials Required − None

B. General Requirements

(1) This procedure is applicable for a bladed rotor assembly that is not scheduled for disassembly with blades that are not scheduled for overhaul. If the following steps and limitations are followed, glass bead peening is not necessary.

C. Procedure
See Figures 901, 902 and 903.

Subtask 72−35−01−350−051:

(1) Blend airfoil damage by the limits that follow:

NOTE: Compressor blade limits, specified below, are evaluated from the standpoint of performance and structural integrity. The greater the number of stages blended to the maximum limits the more likely it can adversely change compressor efficiency and engine performance.

(a) Blades with crack indications cannot be repaired and must be removed.

(b) Limits are applied to damaged areas after blending and not to the quantity of damage measured before blending.

(c) Nicks in the leading and trailing edges become more critical closer to the blade root. Damage on the inner half of the airfoil must be thought of for repair only after the most careful inspection.

1 Stage 5 leading edge blending in Area E is not permitted on installed blades (See Figure 902). Stage 5 blades with damage in this area must be removed and subsequently inspected and repaired by the information given in 72−35−11, PW4000 Series CIR, PN 51A357.

(d) Blade areas, that have damage (which have blade material compressed and edges raised) and damage with small radii or ragged edges, must be blended.

(e) The total blend length on all rear compressor blade edges must not be more than one−quarter of the total edge length.

(f) Blends on both edges (leading and trailing) must not be directly opposite and must be isolated diagonally by a minimum distance equal to the mean chordal length of the blade. See Figure 901.

(g) The length of a blend must be four times its depth.

(h) Limit the number of blades blended more than 80 percent of the maximum permitted length and depth in each stage to 20 percent.

(i) Only one corner can be blended on each blade. Minor burrs on the leading or trailing edge corners can be blended on all stages and are not considered as full corner blends. Blend limits for Area C apply to resultant edges. See Figure 902 and Figure 903.

(j) Leading and trailing edges must be free of roughness, sharp or blunt edges and curled edges. Smooth edges as necessary with 240 grit or finer emery cloth. Finish with 320 grit emery cloth or crocus cloth. Minimize material removal as the decrease in chord width decreases the stability margin.

(k) All material removal must be done in a radial direction. Do not use a chordwise motion while blending.

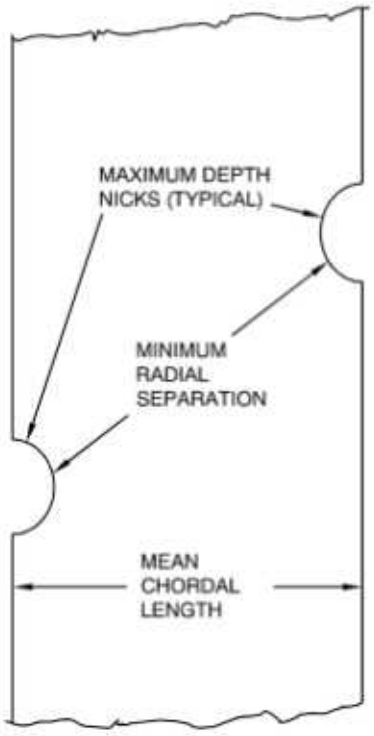
(l) One blend to the maximum permitted depth is permitted for each blade. Any number of lesser blends in the specified limits is permitted.

(m) Make a fluorescent penetrant inspection of the repaired blades by 72−35−00, Inspection/Check−02 Task 72−35−00−230−000, PW4000 Series CIR, PN 51A357. Make sure that all indications of damage are removed. No cracks are permitted.

(2) Polish Area D of the airfoil by the limits that follow:

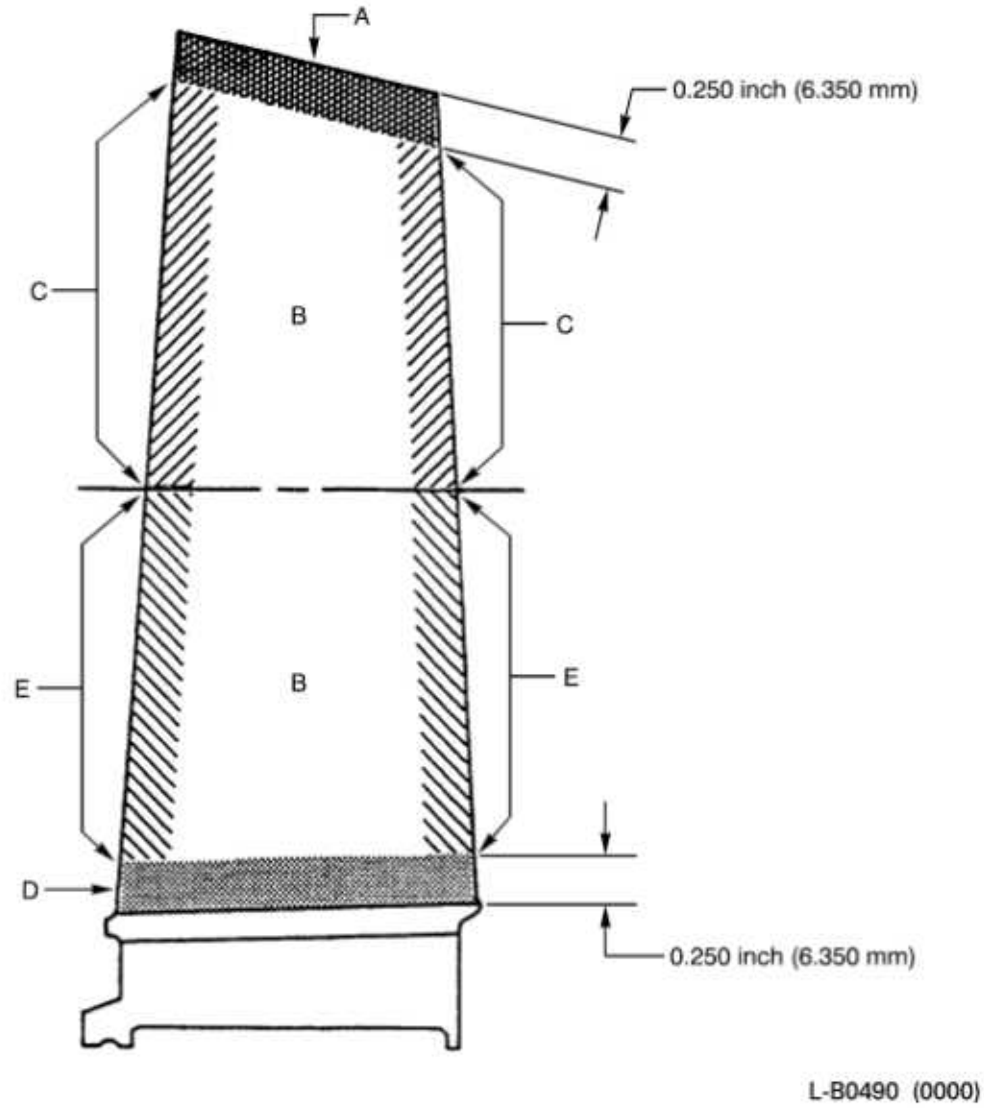
(a) Small imperfections can be polished smooth in Area D.

(b) If the surface imperfections cannot be removed by the polish procedure, the blade must be rejected. Blend repairs are not permitted in Area D. See Figure 902 and Figure 903.


MAXIMUM DEPTH NICKS (TYPICAL)
MINIMUM RADIAL SEPARATION
MEAN CHORDAL LENGTH

L−B0085 (0000)
PW V

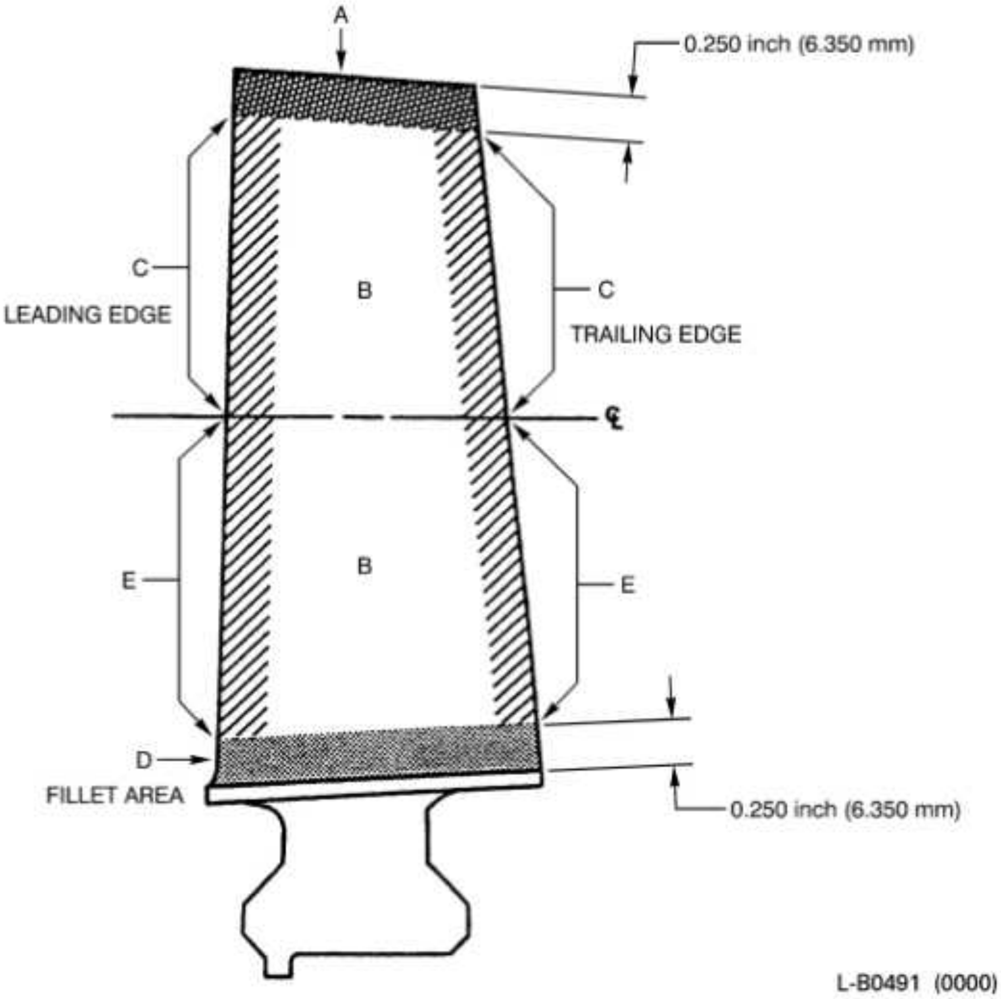
Proximity of Blends Between Leading And Trailing Edges
Figure 901
(Task 72−35−01−300−001)


A
0.250 inch (6.350 mm)
C
B
C
E
B
E
D
0.250 inch (6.350 mm)
L-B0490 (0000)

BLADE AREA	BLEND LIMIT
A	None Permitted Except As Defined In Text
B	0.031 Inch (0.794 mm) Deep
C	0.094 Inch (2.388 mm) Deep
D	None Permitted
E	Stage 5, None (See Text) Stages 6 Through 8, 0.031 Inch (0.794 mm) Deep

Airfoil Blend Areas Stages 5 Through 8
Figure 902
(Task 72-35-01-300-001)

AXIAL COMPRESSOR ROTOR ASSEMBLY − REPAIR−01


A
0.250 inch (6.350 mm)
C
LEADING EDGE
B
C
TRAILING EDGE
℄
B
E
E
D
FILLET AREA
0.250 inch (6.350 mm)
L-B0491 (0000)

BLADE AREA	BLEND LIMIT
A	None Permitted Except As Defined In Text
B	0.031 Inch (0.794 mm) Deep
C	0.094 Inch (2.388 mm) Deep
D	None Permitted
E	For Stages 9 Through 12, 0.031 Inch (0.794 mm) Deep For Stages 13 Through 15, 0.0625 Inch (1.588 mm) Deep

Airfoil Blend Areas Stages 9 Through 15
Figure 903
(Task 72−35−01−300−001)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-01

Task 72-35-01-440-001:

1. Assemble (Bladed) Axial Compressor Rotor Assembly

A. Prerequisites

(1) Complete stage 5 HPC disk and blades assembly. See 72-35-37, Assembly-03 Task 72-35-37-440-003.

(2) Complete drum rotor and blades (front) assembly. See 72-35-38, Assembly-11 Task 72-35-38-440-011.

(3) Complete drum rotor and blades (rear) assembly. See 72-35-39, Assembly-08 Task 72-35-39-440-008.

B. Equipment And Materials Necessary

Standard Tools:

Name	Manufacturer
Clements Cadillac Flameless Torch Model FT 1000	Clements Manufacturing Co. 6650 S. Narraganset Avenue Chicago, IL 60638

NOTE: The flameless torch specified above is optional to the heaters specified in the special tools list, and the optional flame torch.

Special Tools:

PWA 12632	Nut
PWA 12633	Ram
PWA 29389	Pump
PWA 29754	Heater Control
PWA 75028	Gage
PWA 76154	Adapter (2 Necessary)
PWA 80513	Rod
PWA 85086	Lift Arm (2 Necessary)
PWA 85124	Adapter, Lift
PWA 85127	Adapter, Lift And Trunnion
PWA 85133	Adapter, Lift And Trunnion
PWA 85161	Adapter, Lift
PWA 85163	Adapter
PWA 85255	Adapter Plate
PWA 85256	Pin, Guide
PWA 85304	Wrench (Optional to PWA 86215)
PWA 85313	Heater (Optional Tools)
PWA 85314	Heater (Optional Tools)
PWA 85315	Heater (Optional Tools)

Special Tools:

(CONTINUED)

PWA 85337	Stand, Transport And Storage (Optional)
PWA 85337	PWA 85337 PWA 85427 Protector (Optional)
PWA 85580	Stand, Support
PWA 85593	Ring, Adapter
PWA 85596	Adapter, Threaded
PWA 86060	Console, Data Acquire
PWA 86061	Test Stand, Calibration
PWA 86215	Wrench System, Torque
.PWA 86062	Assembly, Gearbox
.PWA 86063	Module, Software
.PWA 86064	Assembly, Gearbox
.PWA 86065	Module, Software
.PWA 86066	Adapter, Calibration
.PWA 86067	Module, Software
.PWA 86068	Cabinet, Storage
.PWA 101501	Locator, Bolt
PWA 87775	Holder, Manual
PWA 87800	Tool, Retension
PWA 88643	Sling (Optional to PWA 88673)
PWA 88673	Sling
PWA 88700	Adapter, Lift

NOTE: The PWA 86215 Wrench System has all the tools indicated below the system.

Consumable Materials:

Item No.	Designation
P06−054	Paste, Antiseize (PWA 36246)

C. General Assembly Requirements

(1) Where heating is required for assembly, use minimum temperature differential of 125°F (52°C) between parts being assembled. Do not exceed 300°F (149°C) on any part.

(2) Where heating is required for assembly, special heaters are specified in the following procedure. However, you can use an optional flameless torch or flame torch as specified in the following steps.

(3) In locations where heating of a component in an oven is not practical or only a flange of the component requires heating, the use of Clements Cadillac Quic Heat flameless torch, Model FT 1000 is recommended.

(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

CAUTION: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: TITANIUM HEATS UP MORE RAPIDLY THAN OTHER MATERIALS. TAKE EXTREME CARE WHEN HEATING TITANIUM PARTS. DO NOT EXCEED THE THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE FLAME WILL DAMAGE OR BURN NON−METAL PARTS.

CAUTION: DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

D. Procedure

(1) Install PWA 85127 Adapter to the tierod end of the drum rotor and blades (rear) assembly. Use PWA 88643 Sling or PWA 88673 Sling with two PWA 76154 Adapters to lift the drum rotor from the support.

(2) Assemble PWA 85593 Adapter Ring to PWA 85580 Support Stand. Place stand with ring adapter to set on adapter ring. Secure stand to adapter ring with clamps. Lower drum rotor to rest on ring adapter. Remove hoist, sling, adapters and adapter from drum rotor. See Figure 1001.

(3) Install PWA 85596 Threaded Adapter to drum rotor hub. Secure adapter to hub with clamp details. Install PWA 85427 Protector to rear hub airseal.

(4) Install PWA 85133 Adapter to the front flange of the drum rotor and blades (front) assembly. Use a Sling PWA 88643 Sling or PWA 88673 Sling with the PWA 76154 Adapters to lift the drum rotor.

(5) Position PWA 85313 Heater with PWA 29754 Control on bench heating element up. Lower drum rotor to rest on heater. Heat drum rotor rear flange to temperature not to exceed 300°F (148.9°C). See Figure 1002.

(6) Apply Antiseize Paste P06−054, to tierod threads on drum rotor (rear). Wipe off unwanted paste.

NOTE: In order to obtain proper prevailing torque, it is necessary to preassemble tierods and nuts prior to final assembly. Use PWA 87775 Manual Holder to lock tierods in place when nuts are run on tierods.

(7) When temperature of drum rotor is achieved, shut off heater and raise drum rotor (front) to position over drum rotor (rear) in assembly stand.

(8) Locate circled triangle denoting high point runout on front and rear drum snaps. Position both 180 degrees apart. Lower drum rotor, aligning tierods with tierod holes, to seat on drum rotor (rear). Remove hoist and sling with adapters.

(9) Install PWA 85255 Adapter Plate to rest on adapter on front flange of drum rotor (front). Install PWA 80513 Rod down through drums and secure to adapter in hub. Install PWA 12633 Ram and secure with PWA 12632 Nut. Using PWA 75028 Gage and PWA 29389 Pump attached to
R ram, apply load of 1448 psi (9983.6 kPa) maximum and allow parts to cool to touch. See Figure 1003.

(10) Remove pump and gage, nut, ram, rod, adapter plate and adapter.

(11) Apply Antiseize Paste P06−054, to contact face of 12th stage tierod nuts. Wipe off unwanted paste.

(12) Use the PWA 86215 Torque Wrench System (replaces PWA 85304 Data Acquisition Console with the PWA 86060 Data Acquisition Console and the PWA 86061 Calibration Test Stand to torque the 42 tierod nuts that hold the front drum rotor to the rear drum rotor. (See the manufacturers data for complete use instructions of the torque wrench system).

NOTE: See manufacturers data for complete use instructions.

(a) Install nuts into wrench and one by one place nuts onto each tierod.

(b) Run nuts down snug.

(13) FOR THESE MODELS: 4152, 4156A, 4158
(Reference 1550) Tighten and torque nuts in following sequence:

(a) FOR THESE MODELS: 4152, 4156A, 4158
Torque tierod nuts in pairs approximately 180 degrees apart, to 215 − 235 lb−in. (24.292 − 26.551 N.m). Then, in pairs approximately 90 degrees apart, to 215 − 235 lb−in. (24.292 − 26.551 N.m). Then, in pairs approximately 45 degrees apart, to 215 − 235 lb−in. (24.292 − 26.551 N.m) until all nuts have been torqued to 215 − 235 lb−in. (24.292 − 26.551 N.m).

(b) FOR THESE MODELS: 4152, 4156A, 4158
Using same sequence loosen nuts and tighten to 20 − 30 lb−in. (2.260 − 3.390 N.m) plus prevailing torque (torque required to turn nut due to self−locking feature of nut). Prevailing torque is 9.5 − 40 lb−in. (1.073 − 4.519 N.m). Then, apply angle of turn of 74 − 78 degrees. Bolt and nut must be replaced if final torque exceeds 700 lb−in. (79.089 N.m). Remove wrench.

(14) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
(Reference 1560) Tighten and torque nuts in the following sequence:

(a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Torque tierod nuts in pairs approximately 180 degrees apart, to 215 − 235 lb−in. (24.292 − 26.551 N.m). Then, in pairs approximately 90 degrees apart, to 215 − 235 lb−in. (24.292 − 26.551 N.m). Then, in pairs approximately 45 degrees apart, to 215 − 235 lb−in. (24.292 − 26.551 N.m) until all nuts have been torqued to 215 − 235 lb−in. (24.292 − 26.551 N.m).

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Using same sequence loosen nuts and tighten to 20 − 30 lb−in. (2.260 − 3.390 N.m) plus prevailing torque (torque required to turn nut due to self−locking feature of nut). Prevailing torque is 9.5 − 40 lb−in. (1.073 − 4.519 N.m). Then, apply angle of turn of 74 − 78 degrees. Bolt and nut must be replaced if final torque exceeds 700 lb−in. (79.089 N.m). Remove wrench.

(15) Position PWA 85314 Heater, connected to PWA 29754 Control, on bench heating element up.

(16) Install PWA 85161 Adapter to front hub on storage rack. Attach PWA 85086 Arm to adapter. Using hoist attached to arm, raise hub.

(17) Lower hub to rest on heater. Heat rear snap to temperature not to exceed 300°F (148.9°C). See Figure 1004.

(18) When temperature of from hub is achieved, shut off heater and raise front hub to position hub over assembly in assembly stand. Locate circled triangle denoting high point runout on front drum and front hub. Position both 180 degrees apart. Using two PWA 85256 Guide Pin, lower hub to rest on assembly. Remove pins, hoist, arm and adapter from hub.

(19) Install PWA 80513 Rod down through hub and drums and secure to adapter in rear hub. Install PWA 85255 Adapter Plate to rest on front hub tierod flange. Install PWA 12633 Ram and secure with PWA 12632 Nut. Using PWA 75028 Gage and PWA 29389 Pump attached to
R ram, apply load of 1448 psi (9983.6 kPa) maximum and allow parts to cool to touch. See Figure 1005.

(20) Remove pump and gage, nut, ram, rod and adapter plate.

(21) Install PWA 85315 Heater, connected to PWA 29754 Control, on front hub tierod flange. Heat snap to temperature not to exceed 300°F (148.9°C). See Figure 1006.

(22) Install PWA 85163 Adapter to blades on 5th stage disk. Using hoist and PWA 88643 Sling or PWA 88673 Sling with PWA 76154 Adapters raise 5th stage assembly from storage rack.

(23) Apply Antiseize Paste P06-054, to threads of tierods on 5th stage. Wipe off unwanted paste.

NOTE: In order to obtain proper prevailing torque, it is necessary to preassemble tierods and nuts prior to final assembly. Use PWA 87775 Manual Holder to lock tierods in place when nuts are run on tierods.

(24) When temperature of front hub is achieved, shut off heater and remove from hub. Raise 5th stage assembly and install over hub. Locate circled triangle denoting high point runout on front hub and 5th stage disk. Position both 180 degrees apart. Lower disk aligning tierods with tierod holes. Remove hoist, sling, adapters and adapter from assembly.

(25) Install PWA 80513 Rod down through hub and drums and secure to adapter in rear hub. Install PWA 87800 Retension Tool to rest on 5th stage disk. Install PWA 12633 Ram and secure with PWA 12632 Nut. Using PWA 75028 Gage and PWA 29389 Pump attached to ram, apply
R load of 1448 psi (9983.6 kPa) maximum and allow parts to cool to touch. See Figure 1007.

(26) Remove pump and gage, nut, ram, rod and retension tool.

(27) Apply Antiseize Paste P06-054, to contact face of 6th stage tierod nuts. Wipe off unwanted paste.

(28) Use the PWA 86215 Torque Wrench System (replaces PWA 85304 Data Acquisition Console with the PWA 86060 Data Acquisition Console and the PWA 86061 Calibration Test Stand to torque the 42 tieord nuts that hold the front drum rotor to the rear drum rotor. (See the manufacturers data for complete use instructions of the torque wrench system).

NOTE: See manufacturers data for complete use instructions.

(a) Install nuts into wrench and one by one place nuts onto each tierod.

(b) Run nuts down snug.

(29) (Reference 1550) Tighten and torque nuts in following sequence.

(a) Torque tierod nuts in pairs approximately 180 degrees apart, to 215 - 235 lb-in. (24.292 - 26.551 N.m). Then, in pairs approximately 90 degrees apart, to 215 - 235 lb-in. (24.292 - 26.551 N.m). Then, in pairs approximately 45 degrees apart, to 215 - 235 lb-in. (24.292 - 26.551 N.m) until all nuts have been torqued to 215 - 235 lb-in. (24.292 - 26.551 N.m).

(b) Using same sequence loosen nuts and tighten to 20 − 30 lb−in. (2.260 − 3.390 N.m) plus prevailing torque (torque required to turn nut due to self−locking feature of nut). Prevailing torque is 9.5 − 40 lb−in. (1.073 − 4.519 N.m). Then, apply angle of turn of 72 − 76 degrees. Bolt and nut must be replaced if final torque exceeds 700 lb−in. (79.089 N.m). Remove wrench.

(30) Install PWA 85161 Adapter to front hub threads and attach PWA 85086 Arm. Install hoist to arm and raise rotor.

(31) FOR THESE MODELS: 4152, 4156A, 4158
Install PWA 85124 Adapter to rear hub threads and attach PWA 85086 Arm. Using second hoist trunnion axial compressor rotor to horizontal. See Figure 1008.

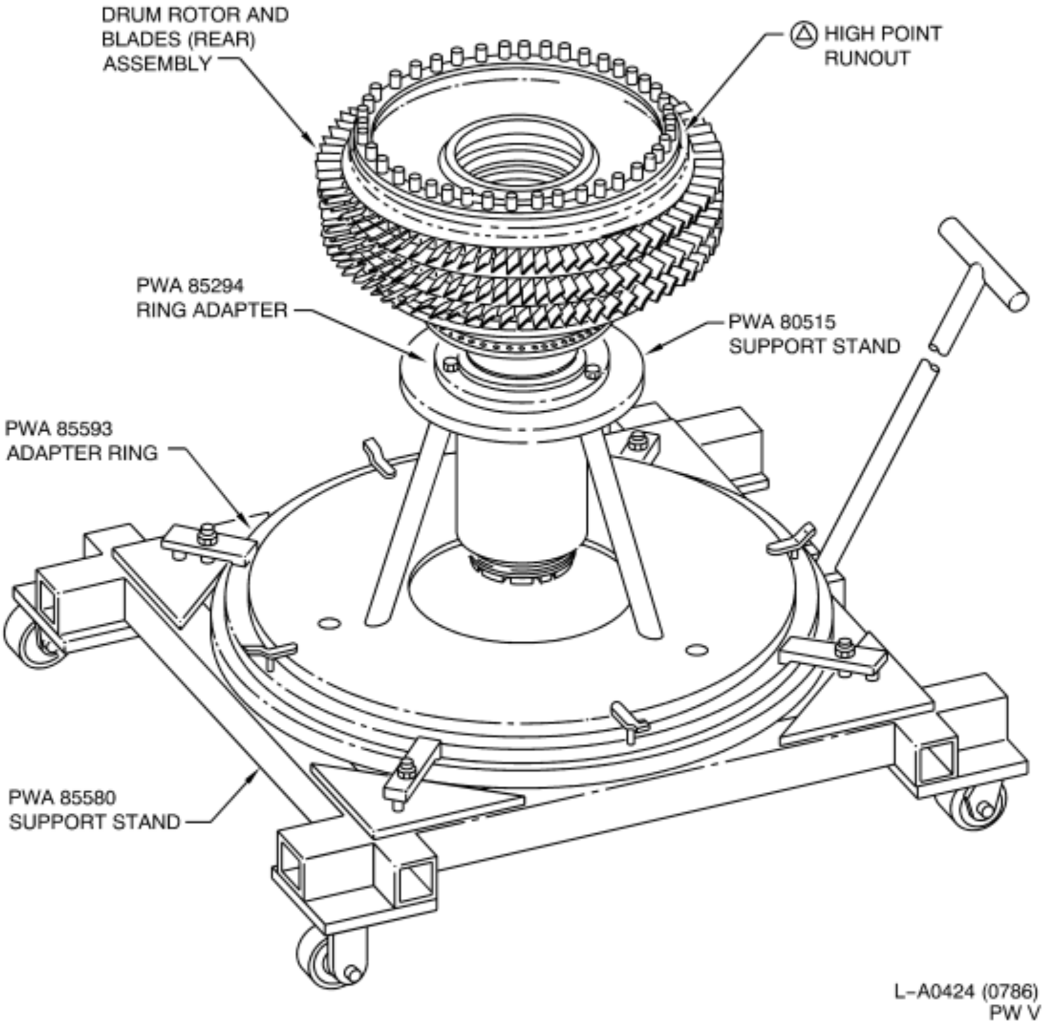
(32) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
(Pre SB PW4ENG 72−562) Install the PWA 85124 Adapter to the rear hub threads and attach the PWA 85056 Arm. Use a second hoist and trunnion the axial compressor rotor to the horizontal position. See Figure 1008A.

(33) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
(Post SB PW4ENG 72−562) Install the PWA 88700 Adapter to the rear hub threads and attach the PWA 85056 Arm. Use a second hoist and trunnion the axial compressor rotor to the horizontal position. See Figure 1008A.

(34) Lower rotor on PWA 85337 Transport Stand. Remove hoist, arms and adapters. See Figure 1009.

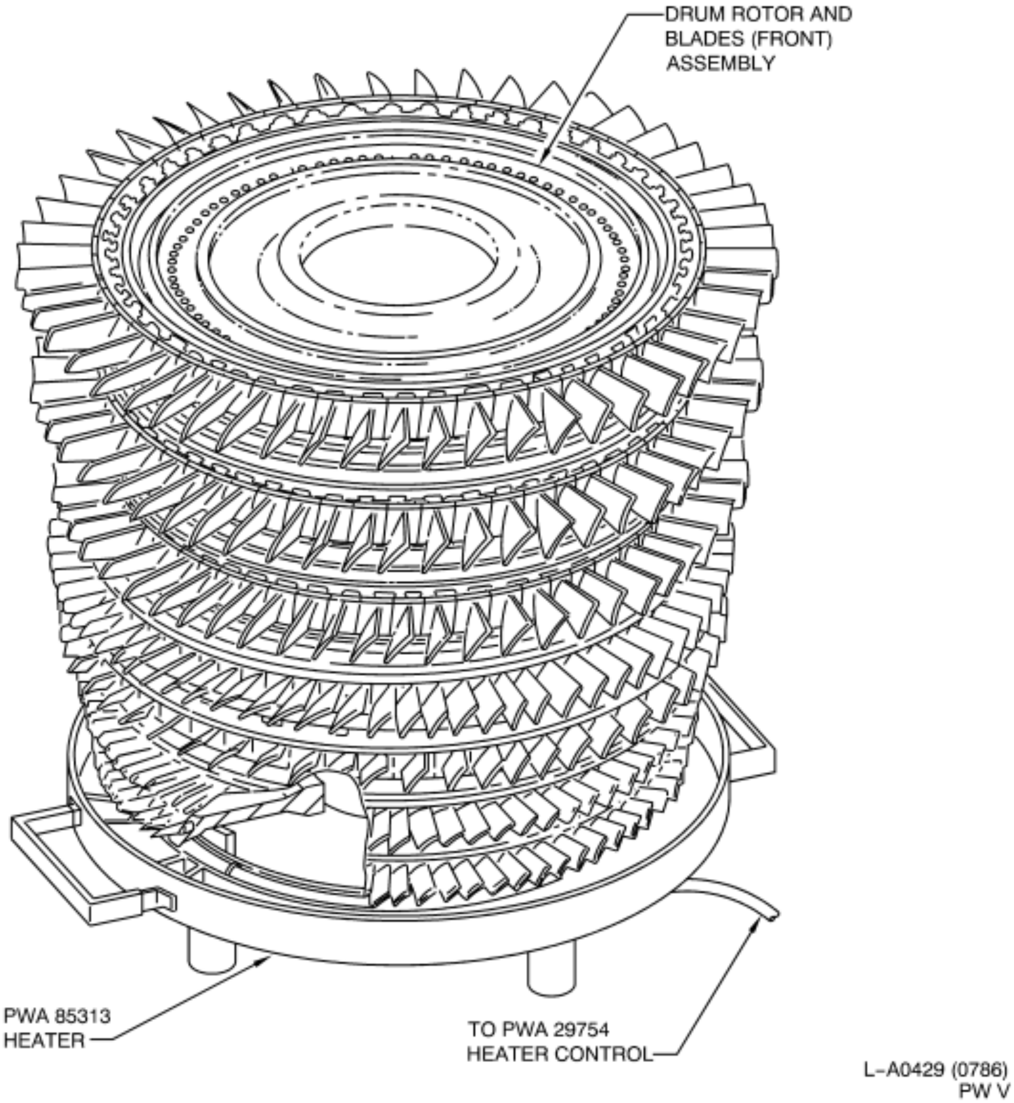
E. Postrequisites

(1) Accomplish runouts and balance per Assembly−02 Task 72−35−01−440−002.

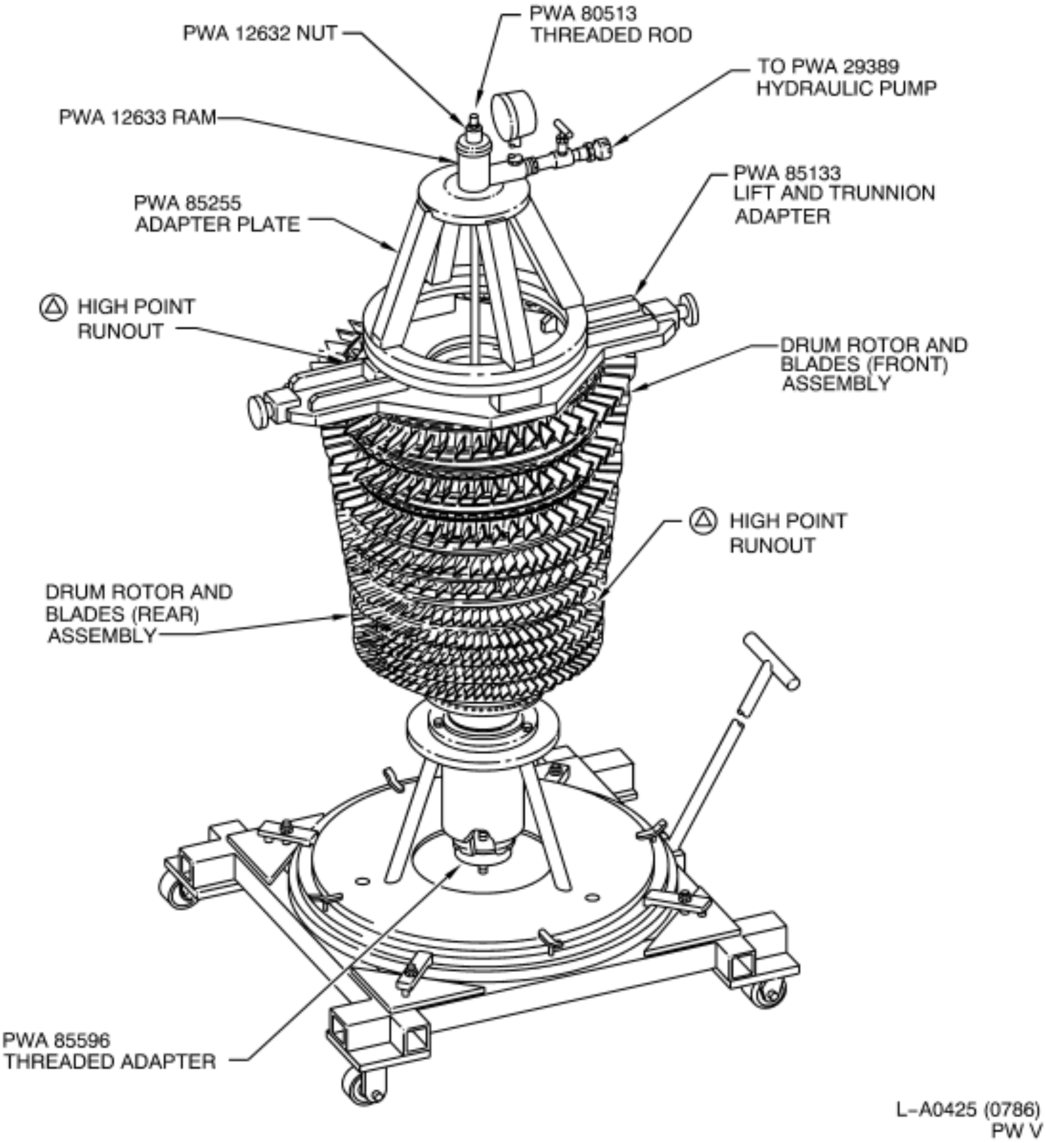

DRUM ROTOR AND BLADES (REAR) ASSEMBLY
△ HIGH POINT RUNOUT
PWA 85294 RING ADAPTER
PWA 80515 SUPPORT STAND
PWA 85593 ADAPTER RING
PWA 85580 SUPPORT STAND
L-A0424 (0786)
PW V

Rear Drum Rotor In Assembly Stand And Runouts
Figure 1001
(Task 72-35-01-440-001)

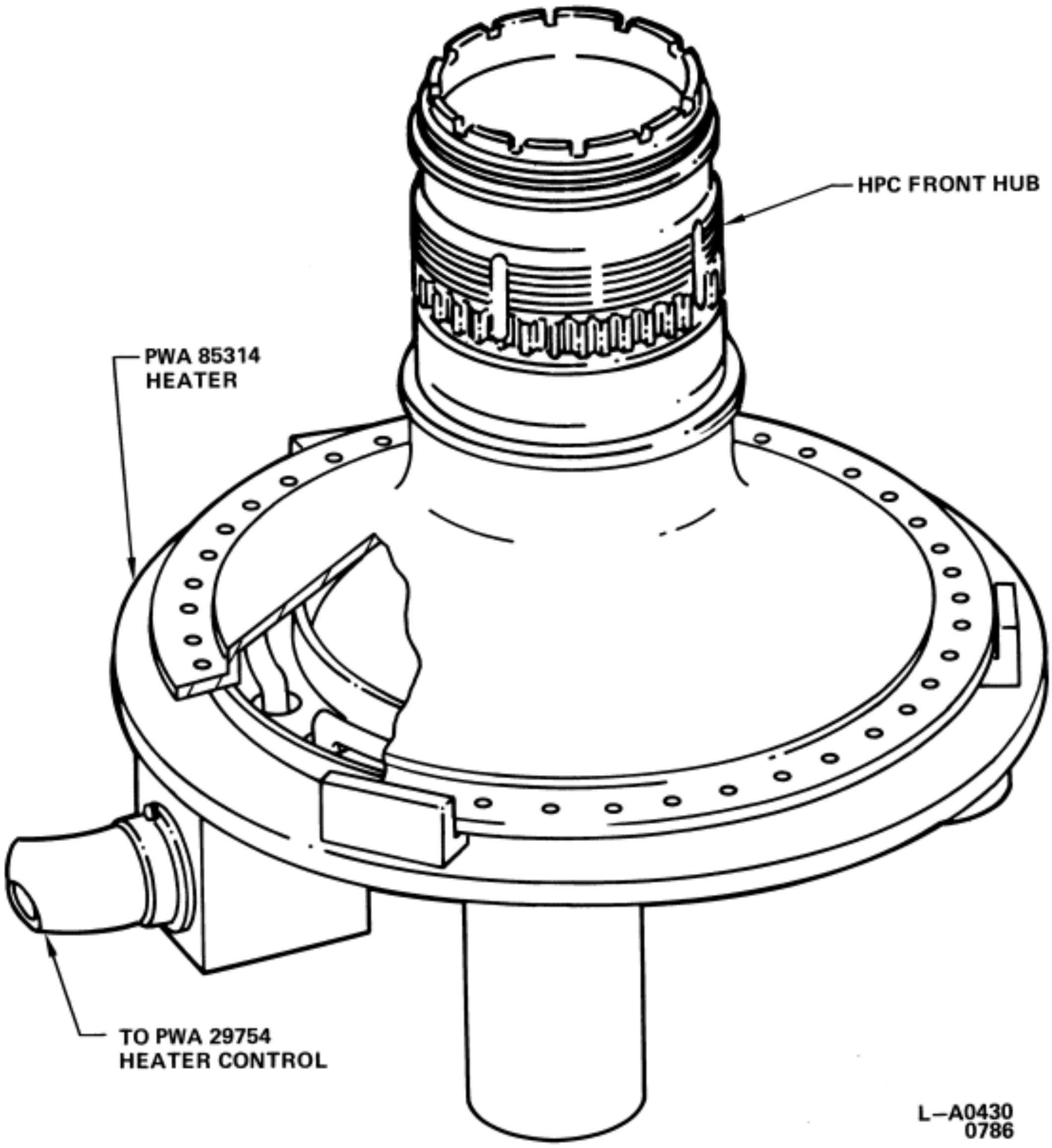
AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−01


DRUM ROTOR AND BLADES (FRONT) ASSEMBLY
PWA 85313 HEATER
TO PWA 29754 HEATER CONTROL
L−A0429 (0786)
PW V

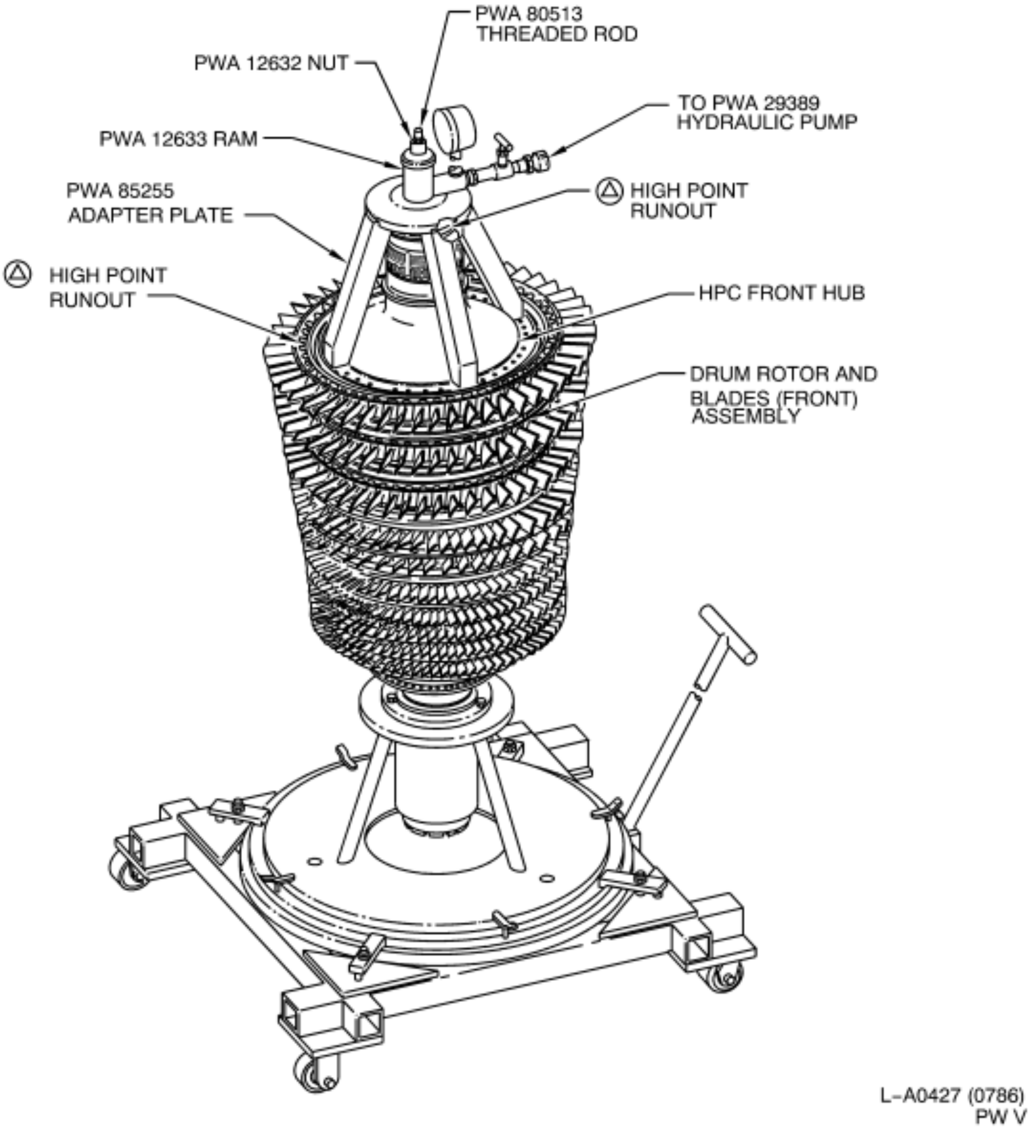
Inner Snap Diameter Heating
Figure 1002
(Task 72−35−01−440−001)


PWA 12632 NUT
PWA 80513 THREADED ROD
TO PWA 29389 HYDRAULIC PUMP
PWA 12633 RAM
PWA 85255 ADAPTER PLATE
PWA 85133 LIFT AND TRUNNION ADAPTER
△ HIGH POINT RUNOUT
DRUM ROTOR AND BLADES (FRONT) ASSEMBLY
△ HIGH POINT RUNOUT
DRUM ROTOR AND BLADES (REAR) ASSEMBLY
PWA 85596 THREADED ADAPTER
L-A0425 (0786)
PW V

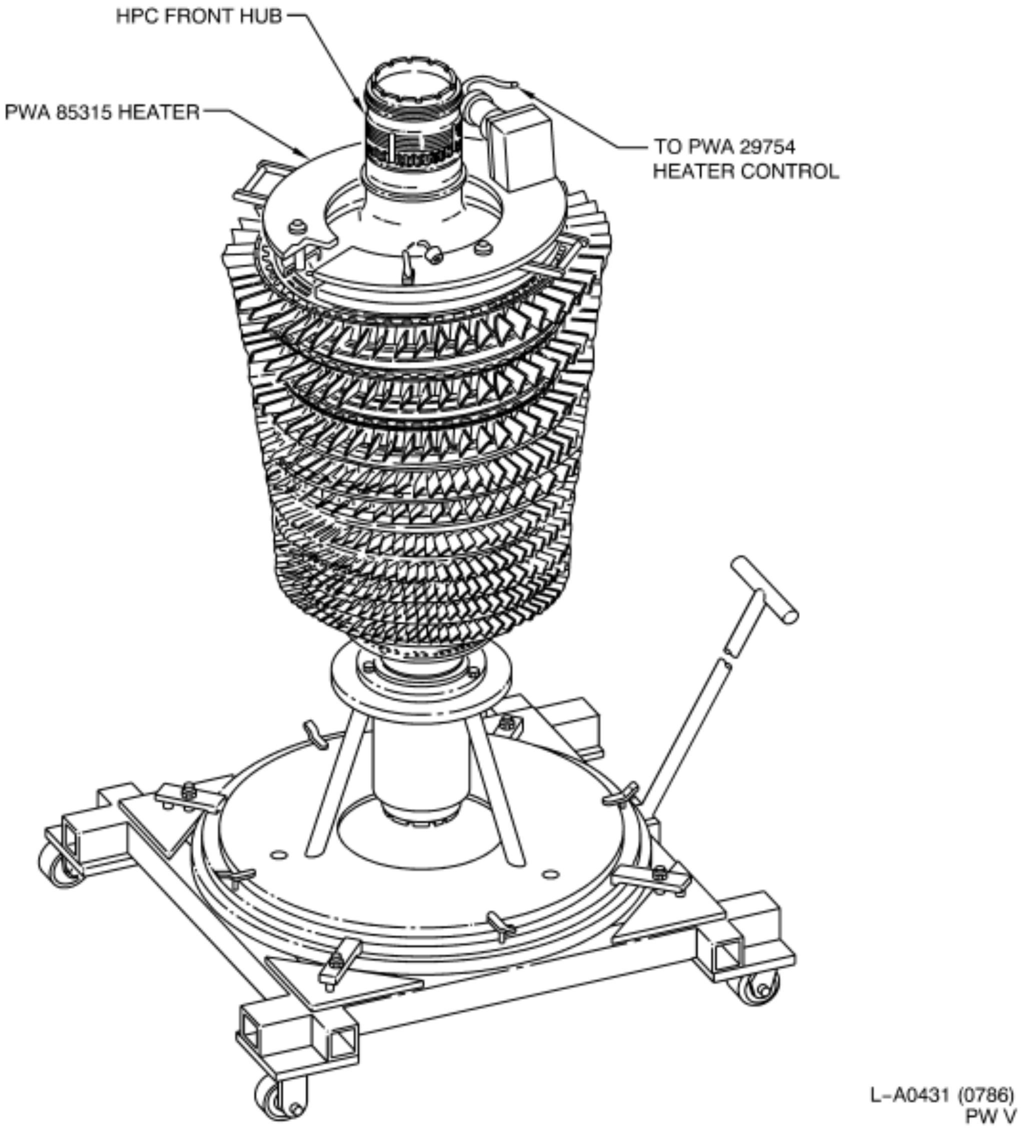
Front Drum To Rear Drum Seating
Figure 1003
(Task 72-35-01-440-001)


HPC FRONT HUB
PWA 85314
HEATER
TO PWA 29754
HEATER CONTROL
L−A0430
0786

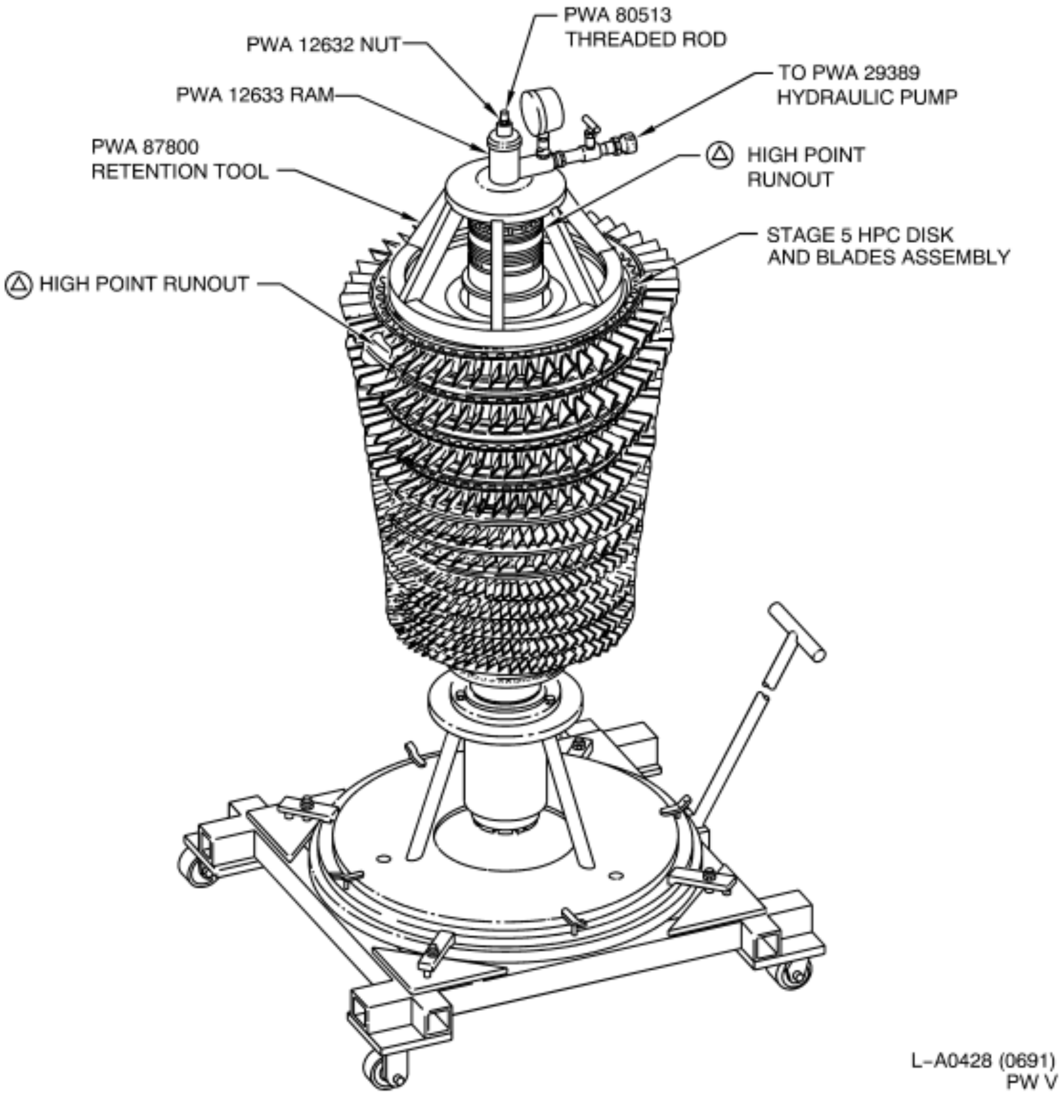
Front Hub Inner Snap Heating
Figure 1004
(Task 72−35−01−440−001)


PWA 80513
THREADED ROD
PWA 12632 NUT
TO PWA 29389
HYDRAULIC PUMP
PWA 12633 RAM
PWA 85255
ADAPTER PLATE
△ HIGH POINT
RUNOUT
△ HIGH POINT
RUNOUT
HPC FRONT HUB
DRUM ROTOR AND
BLADES (FRONT)
ASSEMBLY
L-A0427 (0786)
PW V

Front Hub To Front Drum Seating
Figure 1005
(Task 72-35-01-440-001)

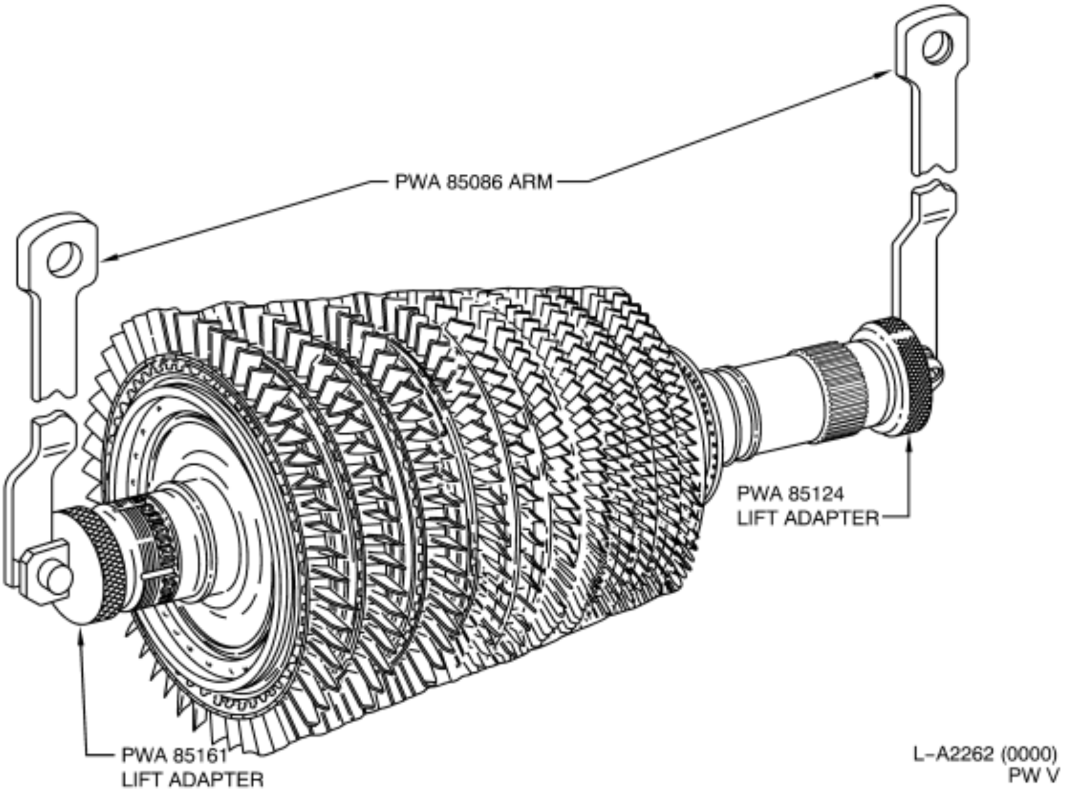

HPC FRONT HUB
PWA 85315 HEATER
TO PWA 29754
HEATER CONTROL
L-A0431 (0786)
PW V

Front Drum Snap Diameter Heating
Figure 1006
(Task 72-35-01-440-001)


PWA 80513
THREADED ROD
PWA 12632 NUT
TO PWA 29389
HYDRAULIC PUMP
PWA 12633 RAM
PWA 87800
RETENTION TOOL
△ HIGH POINT
RUNOUT
STAGE 5 HPC DISK
AND BLADES ASSEMBLY
△ HIGH POINT RUNOUT
L-A0428 (0691)
PW V

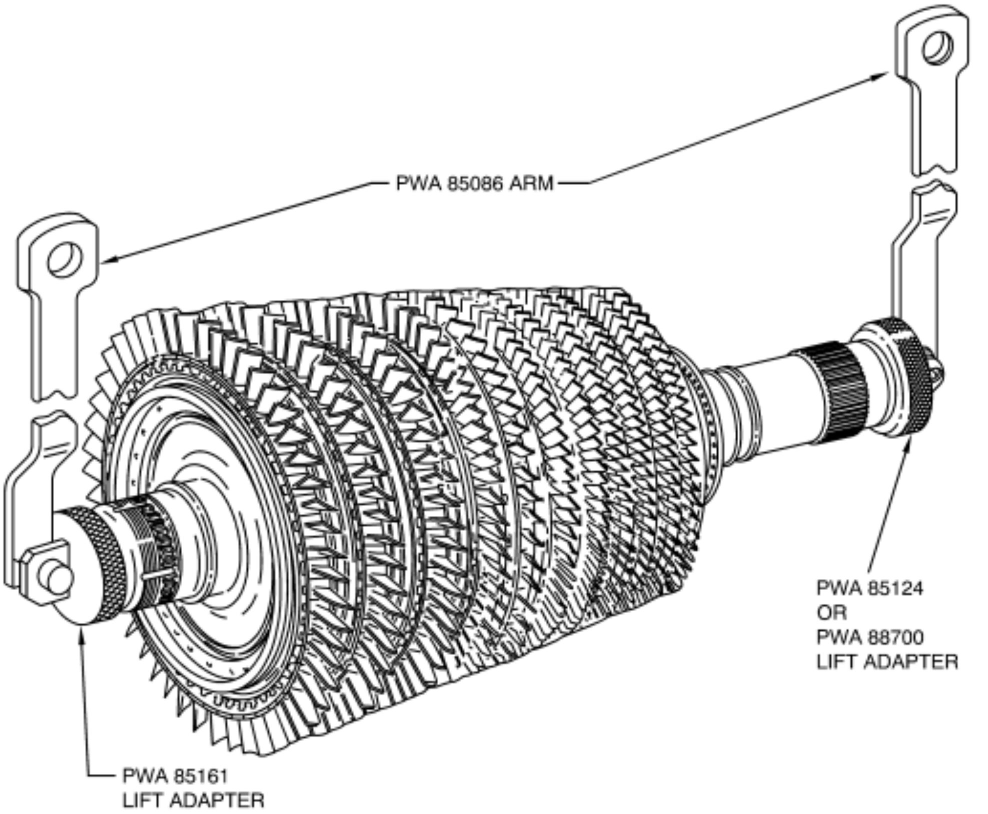
Stage 5 Disk To Front Drum Seating
Figure 1007
(Task 72-35-01-440-001)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−01


PWA 85086 ARM
PWA 85124
LIFT ADAPTER
PWA 85161
LIFT ADAPTER
L-A2262 (0000)
PW V

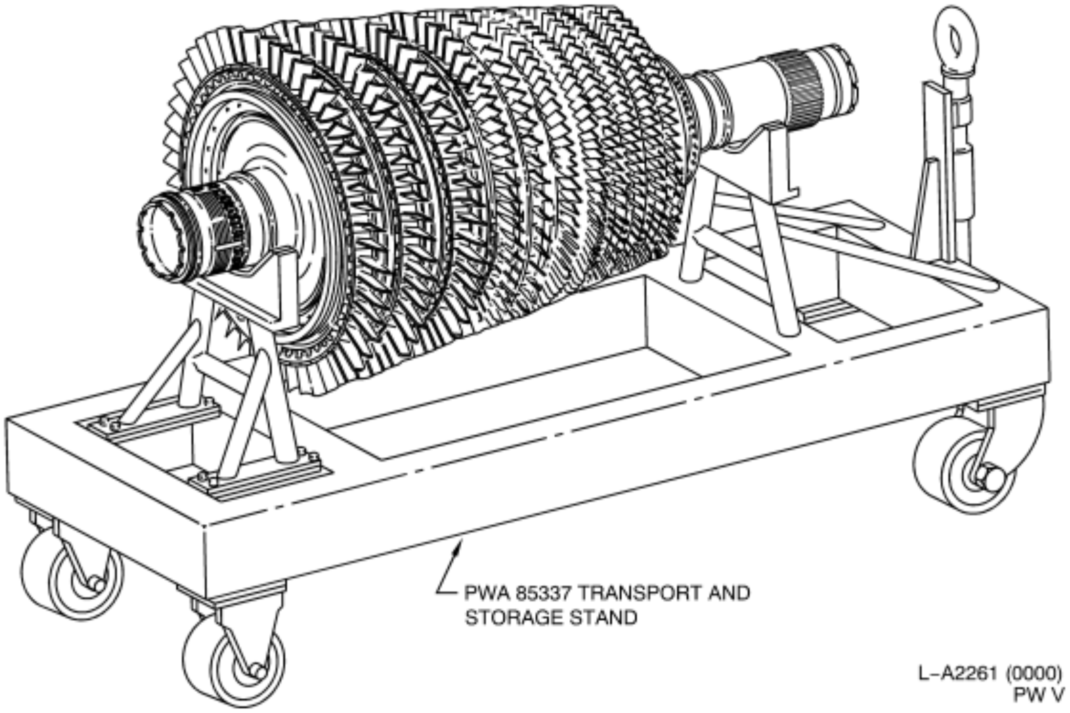
Trunnion Axial Compressor Rotor Assembly
Figure 1008
(Task 72−35−01−440−001)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−01


PWA 85086 ARM
PWA 85124
OR
PWA 88700
LIFT ADAPTER
PWA 85161
LIFT ADAPTER

L−B1736 (0000)
PW V

Trunnion Axial Compressor Rotor Assembly
Figure 1008A
(Task 72−35−01−440−001)


PWA 85337 TRANSPORT AND STORAGE STAND
L−A2261 (0000)
PW V

Transport Axial Compressor Rotor Assembly
Figure 1009
(Task 72−35−01−440−001)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-02

Task 72-35-01-440-002:

1. Accomplish Runouts And Balance Rotor Assembly - Before Rotor Blade Tip Grinding - Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble axial compressor rotor assembly per Assembly-01 Task 72-35-01-440-001.

B. Equipment And Materials Required

Special Tools:

PWA 85086	Lift Arm (2 Necessary)
PWA 85124	Adapter, Lift
PWA 85159	Thread Protector
PWA 85160	Thread Protector
PWA 85161	Adapter, Lift
PWA 85403	Shroud
PWA 85406	Adapter, Drive (Optional to PWA 101714 Adapter, Drive)
PWA 85410	Weight, Front Calibration (For Balance Machines Without Electronic Calibration)
PWA 85411	Weight, Rear Calibration (For Balance Machines Without Electronic Calibration)
PWA 87959	Weight, Clamp-On (Use As Necessary, See Tables 1001 and 1002)
PWA 88575	Weight, Front Calibration (For Balance Machines Without Electronic Calibration)
PWA 101714	Adapter, Drive

C. Procedure

NOTE: Installation of HPC blade seals (ladder seals) is optional for the pre-grind balancing of the rotor assembly.

(1) Install PWA 85403 Shroud to base of HL-50 balancer. Attach PWA 85161 Adapter to front hub and PWA 85124 Adapter to rear shaft.

(2) Install two PWA 85086 Lifting Arms to HPC front and to rear adapters. Attach hoist to arms. See Figure 1001.

(3) Raise rotor from transport stand and position over cradles of balance machine with rear shaft to drive end of balance machine. Lower rotor onto cradles. Remove hoists, hub/shaft arms and adapters from rotor. Secure rotor to cradles. Remove rear shaft airseal protector.

(4) Using indicator, check runouts where indicated. See Figure 1002.

(5) Install PWA 101714 Drive Adapter onto HPC rear shaft so that splines on adapter engage splines on shaft and adapter is bottomed out against shaft. Actuate screw(s) to tighten adapter on shaft and torque screw(s) 10 - 30 lb-in. (1.130 - 3.390 N.m). Secure balance machine driveshaft to drive adapter. Cover rotor with shroud.

(6) Calibrate balance machine to 4.0 oz-in. (2880 g.mm) in Plane AL and 5.0 oz-in. (3600 g.mm) in Plane AJ.

(a) For balance machines without electronic calibration, do a check of the static balance machine.

R R R 1 Install the PWA 88575 Calibration Weight on the Front HPC Rotor at Plane AL. Plane AL balance is moved to the location shown in Figure 1003.

R R 2 Install the PWA 85411 Calibration Weight at Plane AJ Stage 15 disk. See Figure 1003.

3 Calibrate balance machine.

4 After you calibrate the balance machine, remove the calibration weights.

(b) For balance machines with electronic calibration, use the manufacturer's instructions to do a check of the static balance machine.

(7) Measure the initial unbalance.

(a) Balance the axial compressor rotor assembly at 900 RPM minimum in Planes AL and AJ when mounted on Diameters F and C.

(b) The initial unbalance must not be more than 30 oz-in. (21600 g.mm) for Plane AL and 30 oz-in. (21600 g.mm) for Plane AJ if the unbalance vectors are not within 30 degrees of each other. However, if the unbalance vectors are within 30 degrees of each other, the intial unbalance must not be more than 16 oz-in. (11520 g.mm) for Plane AL and 16 oz-in. (11520 g.mm) for Plane AJ.

(c) If initial unbalance is not met, recheck runout. Runout must be within allowable limits. If it is not, check bolted joints for proper seating. If, after check, initial unbalance is not met, subassemblies may be rotated to meet this requirement. In addition, Stage 15 blades can be removed and installed light to heavy to meet the requirement.

(8) When the initial unbalance requirement is satisfied, balance the axial compressor rotor at 900 rpm minimum to less than 0.4 oz−in. (288. g.mm) in Planes AL and AJ when mounted on Diameters F and C.

APPROXIMATE CLAMP−ON WEIGHT MOMENT VALUES

CLASS	MEASURED WEIGHT	MOMENT WEIGHT
1	0.162 OZ (4593. mg)	1.600 oz−in. (1152. g.mm)
2	0.209 OZ (5925. mg)	2.100 oz−in. (1512. g.mm)
3	0.307 OZ (3.000 mg)	3.000 oz−in. (2160. g.mm)
4	0.190 OZ (1.850 mg)	1.850 oz−in. (1332. g.mm)
6	0.194 OZ (5500. mg)	1.900 oz−in. (1368. g.mm)
8	0.256 OZ (7257. mg)	2.500 oz−in. (1800. g.mm)
10	0.272 OZ (7711. mg)	2.700 oz−in. (1944. g.mm)
12	0.293 OZ (8306. mg)	2.900 oz−in. (2088. g.mm)
14	0.384 OZ (10886. mg)	3.800 oz−in. (2736. g.mm)

Moment Weight Values For PWA 87959 Clamp−On
Counterweight When Used At Plane AL
Table 1001

APPROXIMATE CLAMP−ON WEIGHT MOMENT VALUES

CLASS	MEASURED WEIGHT	MOMENT WEIGHT
1	0.162 OZ (4593. mg)	1.600 oz−in. (1152. g.mm)
2	0.209 OZ (5925. mg)	2.000 oz−in. (1440. g.mm)
3	0.307 OZ (3.000 mg)	2.950 oz−in. (2124. g.mm)
4	0.190 OZ (1.850 mg)	1.800 oz−in. (1296. g.mm)
6	0.194 OZ (5500. mg)	1.900 oz−in. (1368. g.mm)
8	0.256 OZ (7257. mg)	2.500 oz−in. (1800. g.mm)
10	0.272 OZ (7711. mg)	2.700 oz−in. (1944. g.mm)
12	0.293 OZ (8306. mg)	2.900 oz−in. (2088. g.mm)
14	0.384 OZ (10886. mg)	3.700 oz−in. (2664. g.mm)

Moment Weight Values For PWA 87959 Clamp−On
Counterweight When Used At Plane AJ
Table 1002

(a) Use the method that follows to correct the balance at Plane AL by the installation of PWA 87959 Clamp−On Balance Weights to the 5th stage airseal.

1 Find the number of clamp−on counterweights that are necessary to correct the unbalance of Plane AL. Refer to Table 1001.

R 2 Install and tighten the clamp−on weights on the 5th stage airseal. See Figure 1003.

NOTE: Install the weights with the cap screw between the airseals and the weight clamped against the ID wall of the 5th stage airseal.

(b) Use the method that follows to correct the balance at Plane AJ by the installation of PWA 87959 Clamp−On Balance Weights to the balance flange on the rear drum.

1 Find the number of clamp−on counterweights that are necessary to correct the unbalance of Plane AJ. Refer to Table 1002.

R 2 Install and tighten the clamp−on weights on the rear counterweight flange. See Figure 1003.

NOTE: Install the weights with the cap screw on the OD of the flange and the weight clamped against the ID wall of the rear counterweight flange.

(9) Make a record of the total number of clamp−on weights that are installed on each plane (Planes AL and AJ).

(10) Disconnect drive unit and remove from shaft.

(11) Remove the machine details that hold the rotor in the balance machine.

(12) Install PWA 85124 Lift Adapter to rear shaft and PWA 85161 Lift Adapter to front hub.

(13) Install PWA 85086 Arm to HPC front hub. Attach hoist to arm. Install PWA 85086 Arm to rear shaft. Attach hoist to arm. See Figure 1001.

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−02

(14) Raise rotor from balance machine and lower into PWA 85337 Transport Stand. Remove hoists, arms and adapters. See Figure 1004.

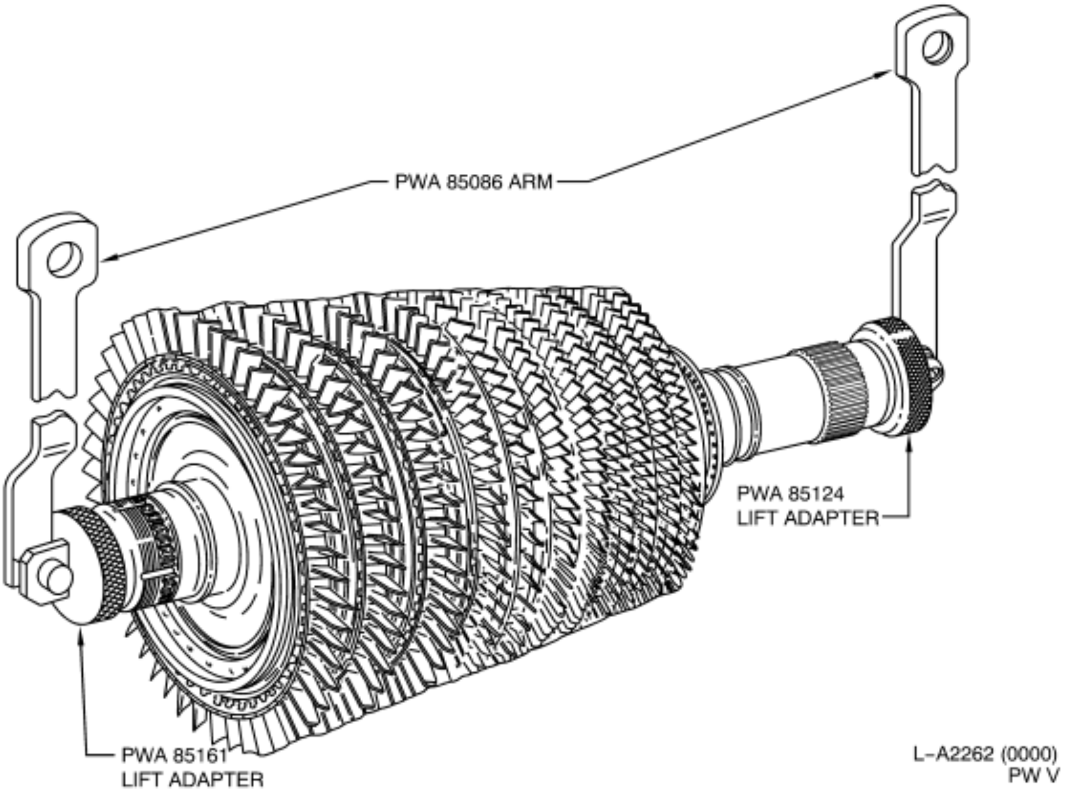
(15) Install PWA 85160 Thread Protector to front hub and PWA 85159 Thread Protector to rear shaft.

(16) Install PWA 85428 Protector on rear shaft airseal.

D. Postrequisites

(1) For operators that elect to blade tip grind the HPC rotor assembly, grind the rotor by 72−35−01, Assembly−03Task 72−35−01−440−003.

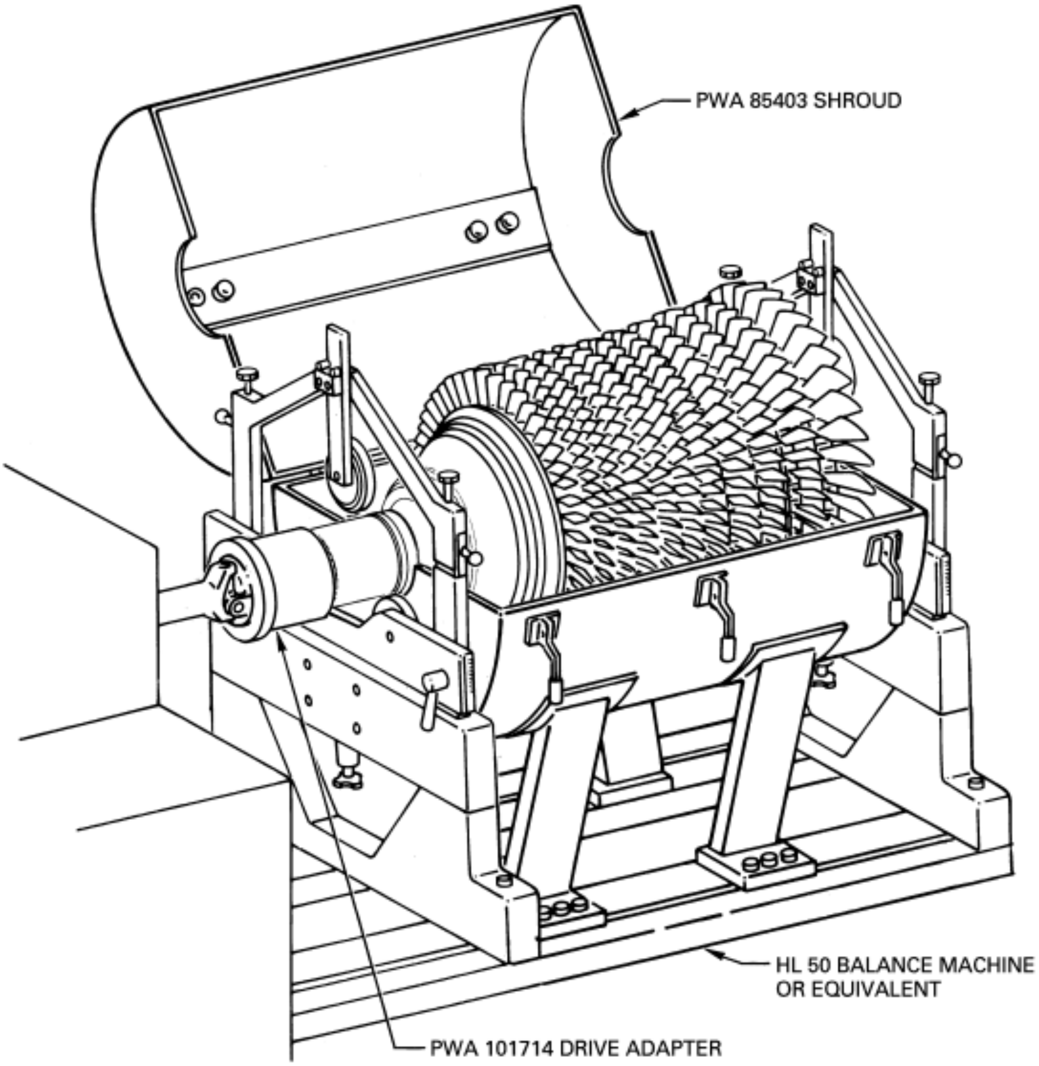
AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−02


PWA 85086 ARM
PWA 85124
LIFT ADAPTER
PWA 85161
LIFT ADAPTER
L−A2262 (0000)
PW V

Lift Axial Compressor Rotor Assembly
Figure 1001
(Task 72−35−01−440−002)

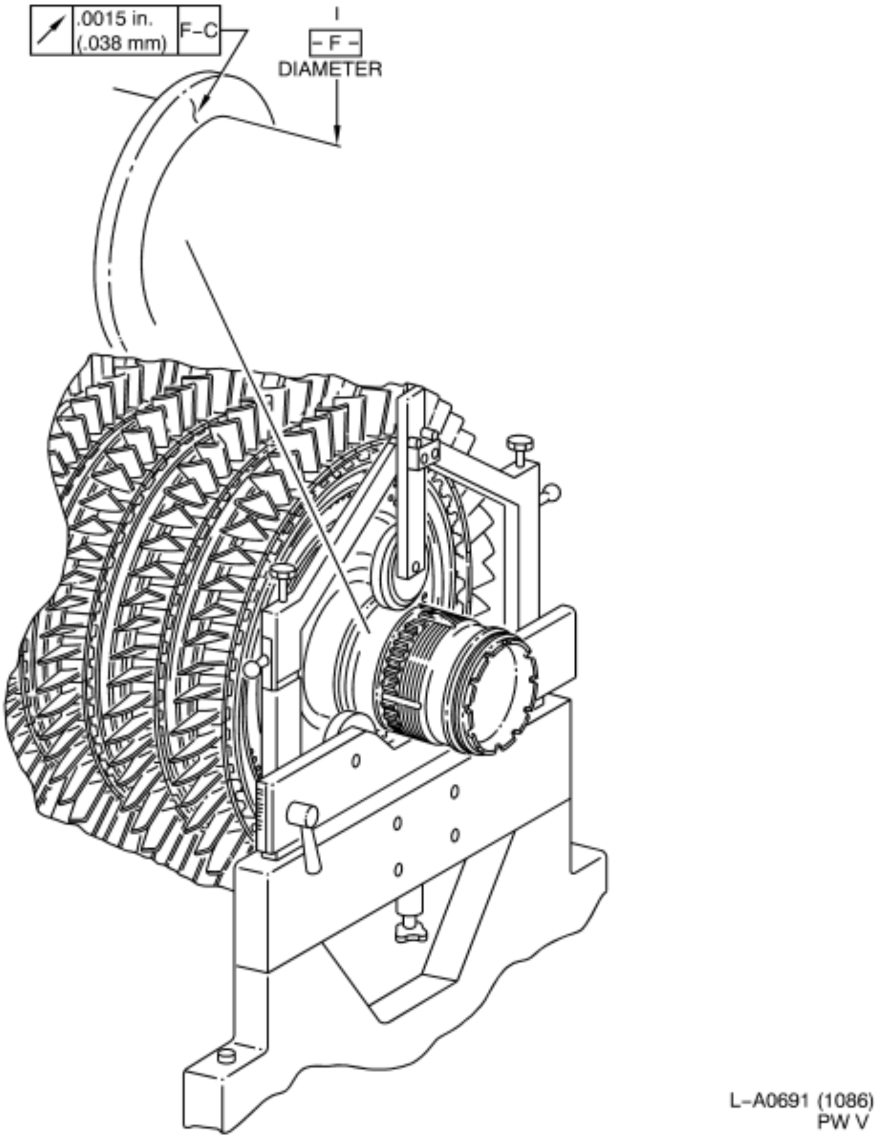
R

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−02


PWA 85403 SHROUD
HL 50 BALANCE MACHINE OR EQUIVALENT
PWA 101714 DRIVE ADAPTER

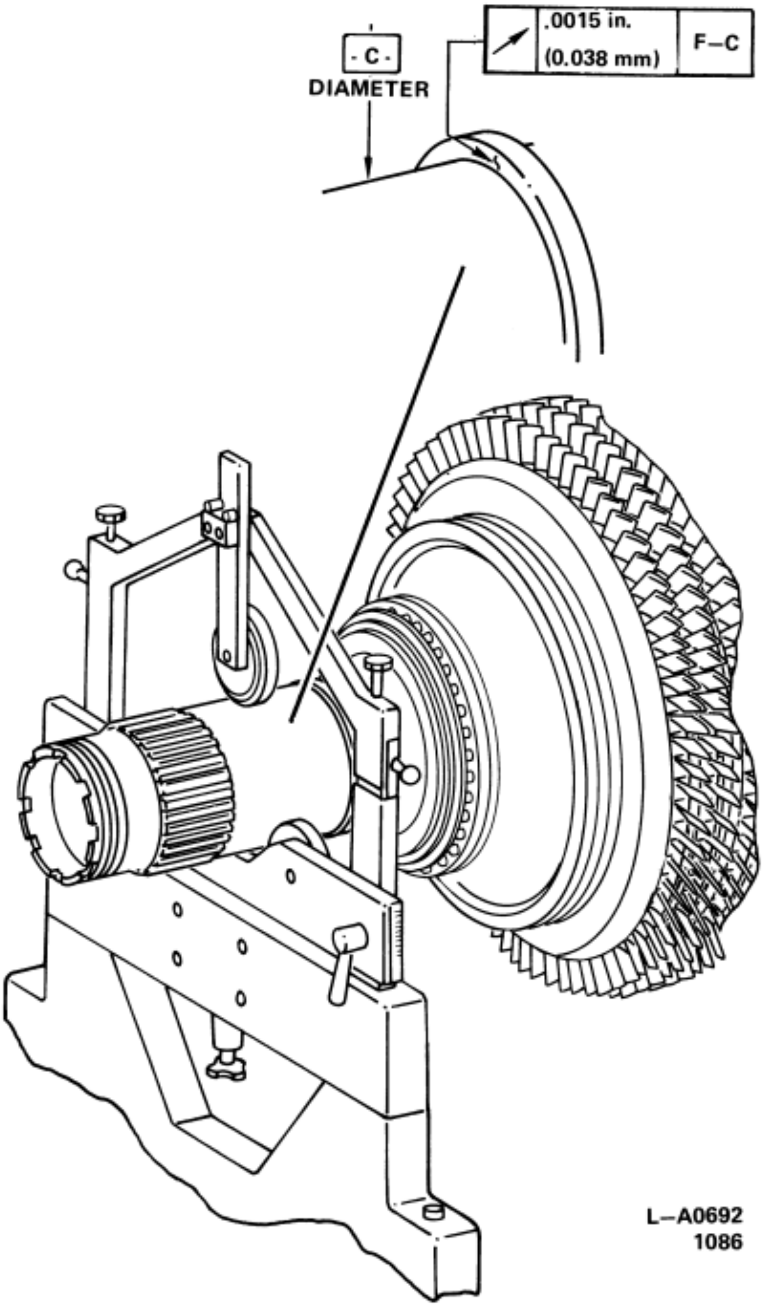
L-B3504 (0000)

Axial Compressor Rotor Assembly In Balance Machine
Figure 1002 (Sheet 1)
(Task 72−35−01−440−002)


.0015 in.
(.038 mm)
F−C
− F −
DIAMETER
L−A0691 (1086)
PW V

Axial Compressor Rotor Assembly In Balance Machine
Figure 1002 (Sheet 2)
(Task 72−35−01−440−002)

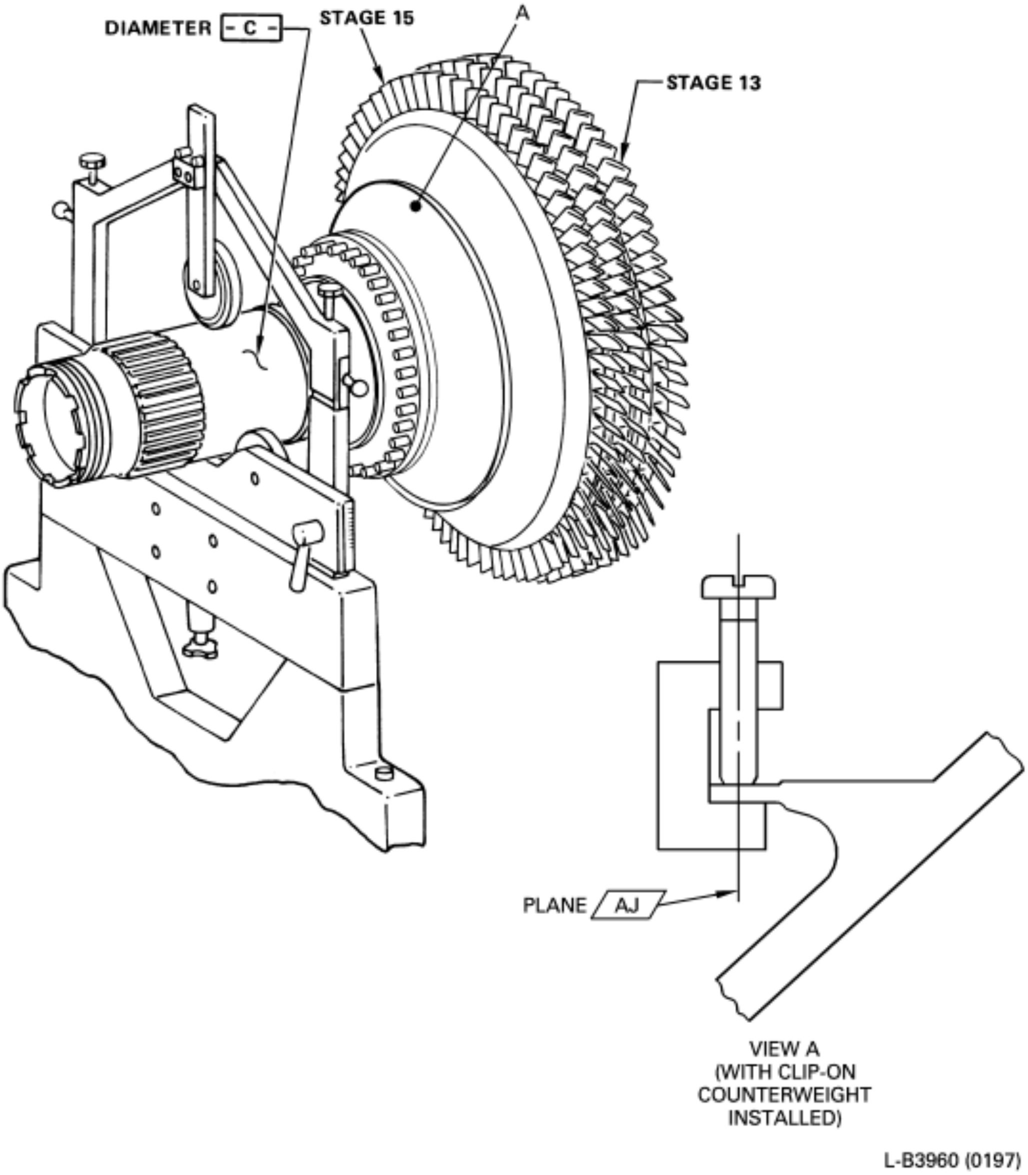
AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-02


-C-
DIAMETER
.0015 in.
(0.038 mm)
F-C
L-A0692
1086

Axial Compressor Rotor Assembly In Balance Machine
Figure 1002 (Sheet 3)
(Task 72-35-01-440-002)

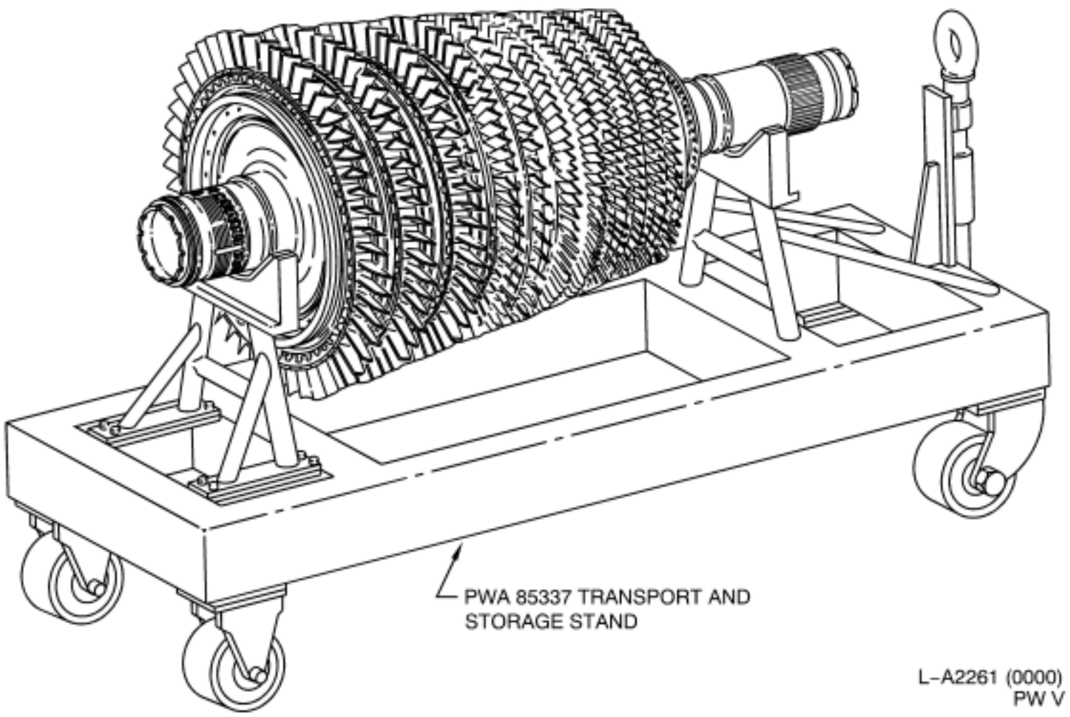
R
R

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−02


DIAMETER - C -
STAGE 15
A
STAGE 13
PLANE AJ
VIEW A
(WITH CLIP-ON
COUNTERWEIGHT
INSTALLED)
L-B3960 (0197)

Axial Compressor Rotor Assembly Balance
R Figure 1003
(Task 72−35−01−440−002)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−02


PWA 85337 TRANSPORT AND STORAGE STAND
L−A2261 (0000)
PW V

Transport Axial Compressor Rotor Assembly
Figure 1004
(Task 72−35−01−440−002)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-02

Task 72-35-01-440-005:

1. Accomplish Runouts And Balance Rotor Assembly - Before Rotor Blade Tip Grinding - Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble axial compressor rotor assembly by Assembly-01 Task 72-35-01-440-001.

B. Equipment And Materials Required

Special Tools:

PWA 85086	Lift Arm (2 Necessary)
PWA 85124	Adapter, Lift
PWA 85159	Thread Protector
PWA 85160	Thread Protector
PWA 85161	Adapter, Lift
PWA 85403	Shroud
PWA 87959	Weight, Clamp-On (Use As Necessary, See Tables 1001 And 1002)
PWA 88575	Weight, Front Calibration (For Balance Machines Without Electronic Calibration)
PWA 88576	Weight, Rear Calibration (For Balance Machines Without Electronic Calibration)
PWA 88700	Adapter, Lift
PWA 101714	Adapter, Drive

C. Procedure

NOTE: Installation of HPC blade seals (ladder seals) is optional for the pre-grind balancing of the rotor assembly.

R (1) Install the PWA 85403 Shroud to the base of the HL-50
R balancer. Attach the PWA 85161 Adapter to the front
R hub and PWA 85124 Adapter and PWA 88700 Adapter to the
R rear shaft.

(2) Install two PWA 85086 Lifting Arms to the HPC front and to the rear adapters. Attach hoist to arms. See Figure 1001.

(3) Lift the rotor from the transport stand and position over the cradles of the balance machine with the rear shaft to the drive end of the balance machine. Lower the rotor to the cradles. Remove hoists, hub/shaft arms and adapters from the rotor. Attach the rotor to the cradles. Remove the rear shaft airseal protector.

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-02

(4) Use an indicator and check the runouts where shown. See Figure 1002.

(5) Install the PWA 101714 Drive Adapter to the HPC rear shaft so that the splines on the adapter engage the splines on the shaft and the adapter is seated against the shaft. Actuate the screw(s) to tighten the adapter on the shaft. Torque the screw(s) to 10 - 30 lb-in. (1.130 - 3.390 N.m). Install the balance machine driveshaft to the drive adapter. Cover the rotor with the shroud.

(6) Calibrate balance machine to 4.0 oz-in. (2880 g.mm) in Plane AL and 5.0 oz-in. (3600 g.mm) in Plane AJ.

(a) For balance machines without electronic calibration, do a check of the static balance machine.

1 Install PWA 88575 Front HPC Rotor Calibration Weight over the front knife-edge seal at Plane AL, Stage 5 disk, with screw outboard. Balance Plane AL on Stage 5 disk is shown in Figure 1003. R R

2 Install PWA 88576 Calibration Weight to the balance flange at Plane AJ on the Stage 15 disk. See Figure 1003. R

3 Calibrate balance machine.

4 After you calibrate the balance machine, remove the calibration weights.

(b) For balance machines with electronic calibration, use the manufacturer's instructions to do a check of the static balance machine.

(7) Measure the initial unbalance.

(a) Balance the axial compressor rotor assembly at 900 RPM minimum in Planes AL and AJ when mounted on Diameters F and C.

(b) The initial unbalance must not be more than 30 oz−in. (21600 g.mm) for Plane AL and 30 oz−in. (21600 g.mm) for Plane AJ if the unbalance vectors are not within 30 degrees of each other. However, if the unbalance vectors are within 30 degrees of each other, the intial unbalance must not be more than 16 oz−in. (11520 g.mm) for Plane AL and 16 oz−in. (11520 g.mm) for Plane AJ.

(c) If the initial unbalance is not met, check the runout again. The runout must be within permitted limits. If it is not, check the bolted joints for correct seating. If, after you check the runout again and you still cannot get the initial unbalance, subassemblies can be turned to get the initial unbalance. Stage 15 blades can be removed and installed, light to heavy, to get the initial unbalance.

(8) When the initial unbalance requirement is satisfied, balance the axial compressor rotor at 900 rpm minimum to less than 0.4 oz−in. (288. g.mm) in Planes AL and AJ when mounted on Diameters F and C.

APPROXIMATE CLAMP−ON WEIGHT MOMENT VALUES

CLASS	MEASURED WEIGHT	MOMENT WEIGHT
1	0.162 OZ (4593. mg)	1.600 oz−in. (1152. g.mm)
2	0.209 OZ (5925. mg)	2.100 oz−in. (1512. g.mm)
3	0.307 OZ (3.000 mg)	3.000 oz−in. (2160. g.mm)
4	0.190 OZ (1.850 mg)	1.850 oz−in. (1332. g.mm)
6	0.194 OZ (5500. mg)	1.900 oz−in. (1368. g.mm)
8	0.256 OZ (7257. mg)	2.500 oz−in. (1800. g.mm)
10	0.272 OZ (7711. mg)	2.700 oz−in. (1944. g.mm)
12	0.293 OZ (8306. mg)	2.900 oz−in. (2088. g.mm)
14	0.384 OZ (10886. mg)	3.800 oz−in. (2736. g.mm)

Moment Weight Values For PWA 87959 Clamp−On
Counterweight When Used At Plane AL
Table 1001

APPROXIMATE CLAMP-ON WEIGHT MOMENT VALUES

CLASS	MEASURED WEIGHT	MOMENT WEIGHT
1	0.162 OZ (4593. mg)	1.600 oz-in. (1152. g.mm)
2	0.209 OZ (5925. mg)	2.000 oz-in. (1440. g.mm)
3	0.307 OZ (3.000 mg)	2.950 oz-in. (2124. g.mm)
4	0.190 OZ (1.850 mg)	1.800 oz-in. (1296. g.mm)
6	0.194 OZ (5500. mg)	1.900 oz-in. (1368. g.mm)
8	0.256 OZ (7257. mg)	2.500 oz-in. (1800. g.mm)
10	0.272 OZ (7711. mg)	2.700 oz-in. (1944. g.mm)
12	0.293 OZ (8306. mg)	2.900 oz-in. (2088. g.mm)
14	0.384 OZ (10886. mg)	3.700 oz-in. (2664. g.mm)

Moment Weight Values For PWA 87959 Clamp-On
Counterweight When Used At Plane AJ
Table 1002

(a) Use the method that follows to correct the balance at Plane AL by the installation of PWA 87959 Clamp-On Balance Weights to the 5th stage airseal.

1 Find the number of clamp-on counterweights that are necessary to correct the unbalance of Plane AL. Refer to Table 1001.

R 2 Install and tighten the clamp-on weights on the 5th stage airseal. See Figure 1003.

NOTE: Install the weights with the cap screw between the airseals and the weight clamped against the ID wall of the 5th stage airseal.

(b) Use the method that follows to correct the balance at Plane AJ by the installation of PWA 87959 Clamp-On Balance Weights to the balance flange on the rear drum.

1 Find the number of clamp-on counterweights that are necessary to correct the unbalance of Plane AJ. Refer to Table 1002.

R 2 Install and tighten the clamp-on weights on the rear counterweight flange. See Figure 1003.

NOTE: Install the weights with the cap screw on the OD of the flange and the weight clamped against the ID wall of the rear counterweight flange.

(9) Make a record of the total number of clamp-on weights that are installed on each plane (Planes AL and AJ).

(10) Disconnect drive unit and remove from shaft.

(11) Remove the machine details that hold the rotor in the balance machine.

(12) Disconnect the drive unit and remove from the shaft. (Pre SB PW4ENG 72-562) Install PWA 85124 Adapter to the rear shaft and PWA 85161 Adapter to the front hub. (Post SB PW4ENG 72-562) Install the PWA 88700 Adapter to the rear shaft and the PWA 85161 Adapter to the front hub.

(13) Install PWA 85086 Arm to HPC front hub. Attach hoist to arm. Install PWA 85086 Arm to rear shaft. Attach hoist to arm. See Figure 1001.

(14) Raise rotor from balance machine and lower into PWA 85337 Transport Stand. Remove hoists, arms and adapters. See Figure 1004.

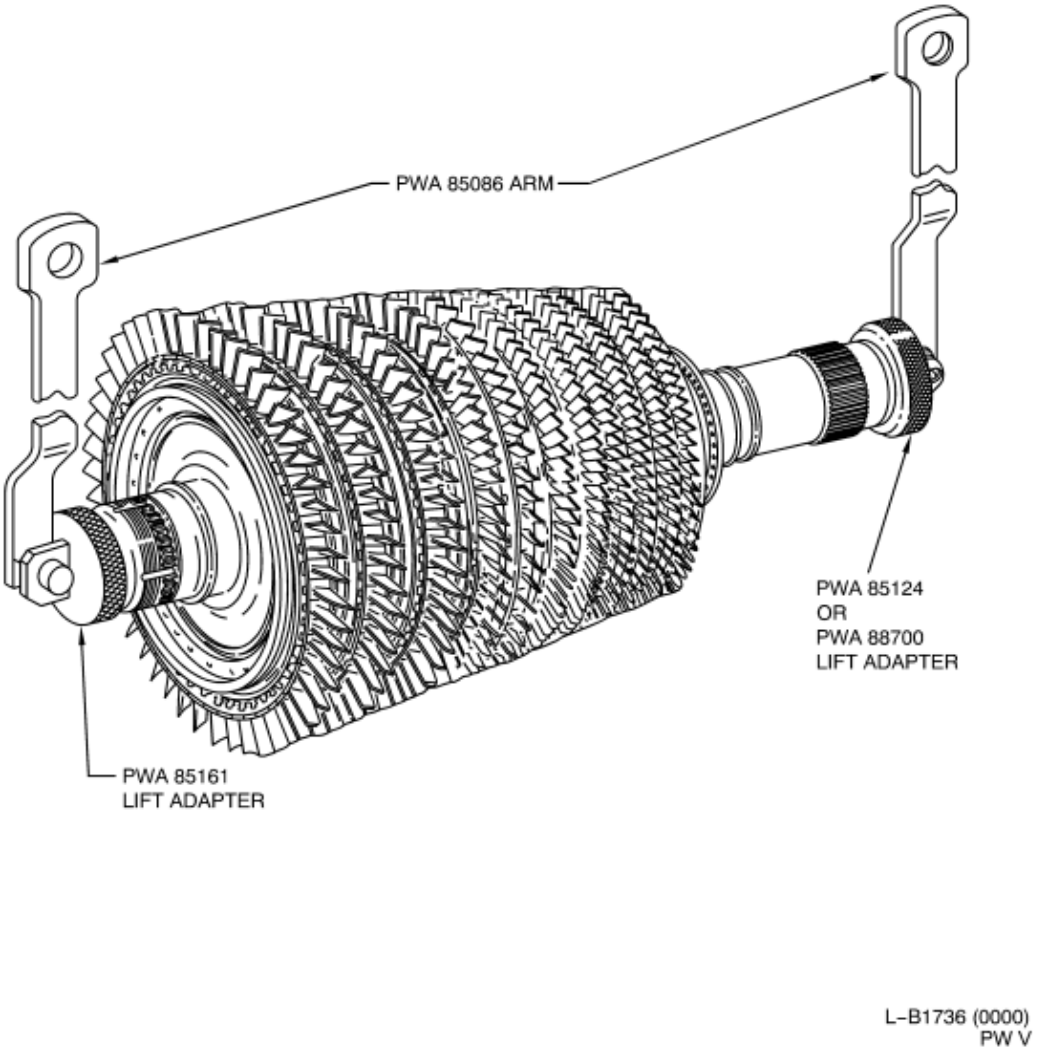
(15) Install PWA 85160 Thread Protector to the front hub and PWA 85159 Thread Protector to the rear shaft.

(16) Install PWA 85428 Protector on the rear shaft airseal.

D. Postrequisites

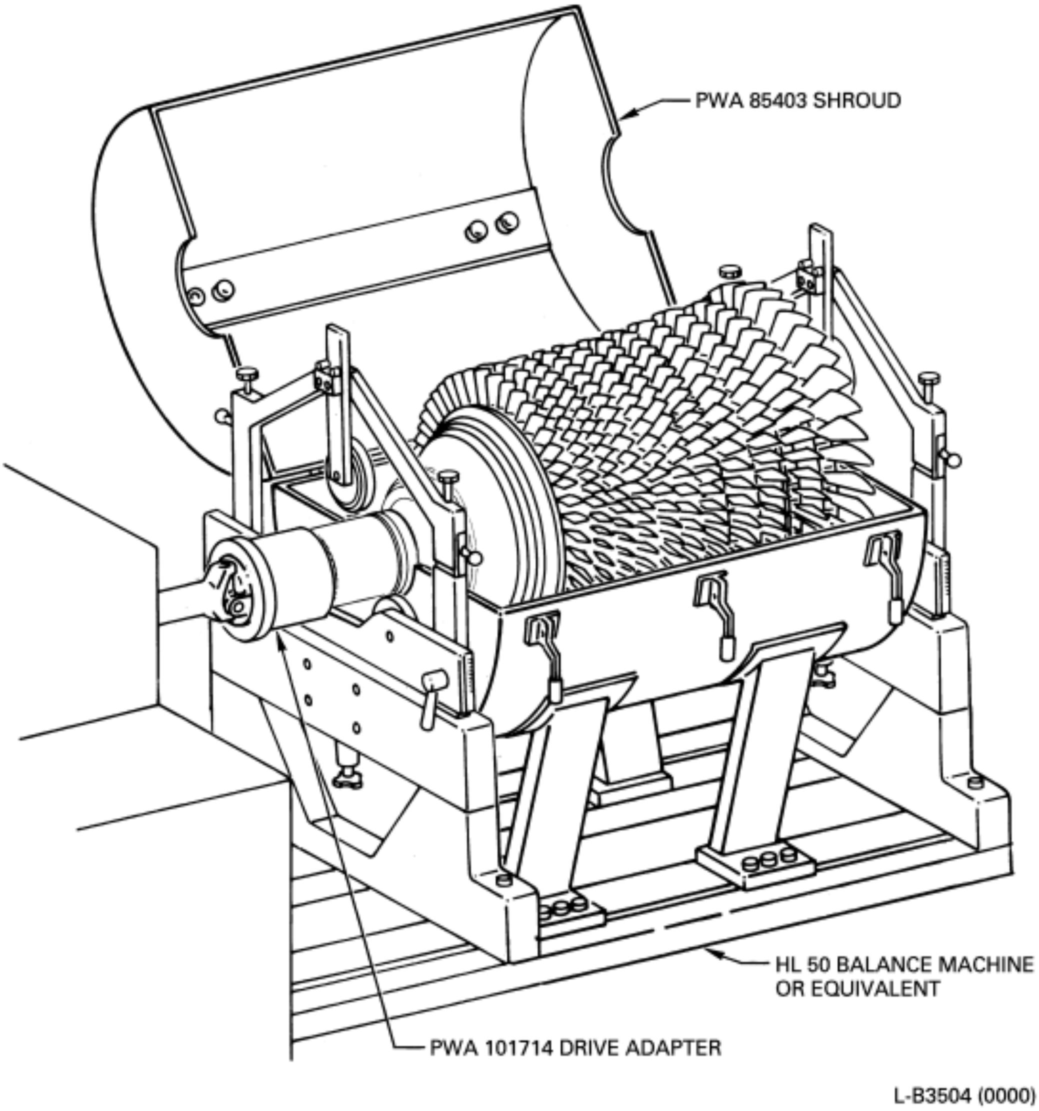
(1) For operators that want to blade tip grind the HPC rotor assembly, grind the rotor by 72-35-01, Assembly-03 Task 72-35-01-440-003.

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-02


PWA 85086 ARM
PWA 85124
OR
PWA 88700
LIFT ADAPTER
PWA 85161
LIFT ADAPTER
L-B1736 (0000)
PW V

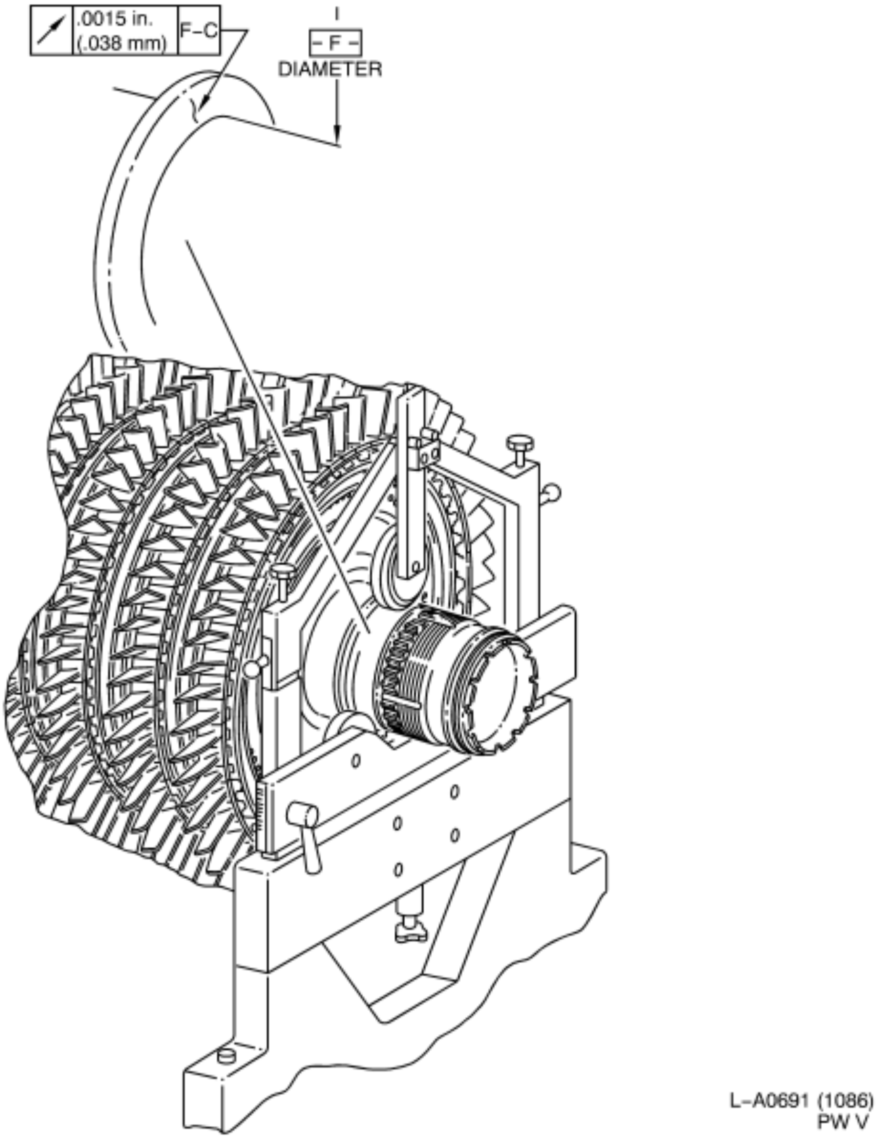
Lift Axial Compressor Rotor Assembly
Figure 1001
(Task 72-35-01-440-005)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−02


PWA 85403 SHROUD
HL 50 BALANCE MACHINE OR EQUIVALENT
PWA 101714 DRIVE ADAPTER
L-B3504 (0000)

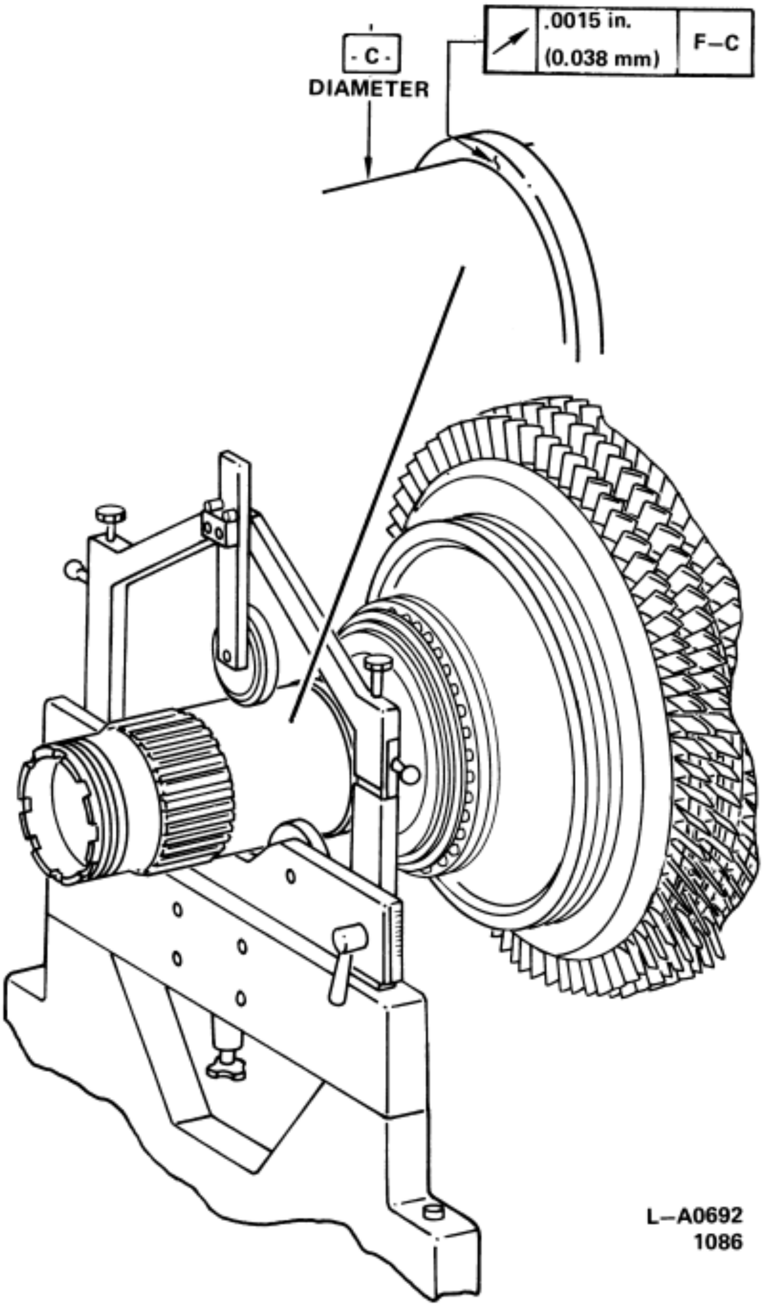
Axial Compressor Rotor Assembly In Balance Machine
Figure 1002 (Sheet 1)
(Task 72−35−01−440−005)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−02


.0015 in.
(.038 mm)
F−C
− F −
DIAMETER
L−A0691 (1086)
PW V

Axial Compressor Rotor Assembly In Balance Machine
Figure 1002 (Sheet 2)
(Task 72−35−01−440−005)

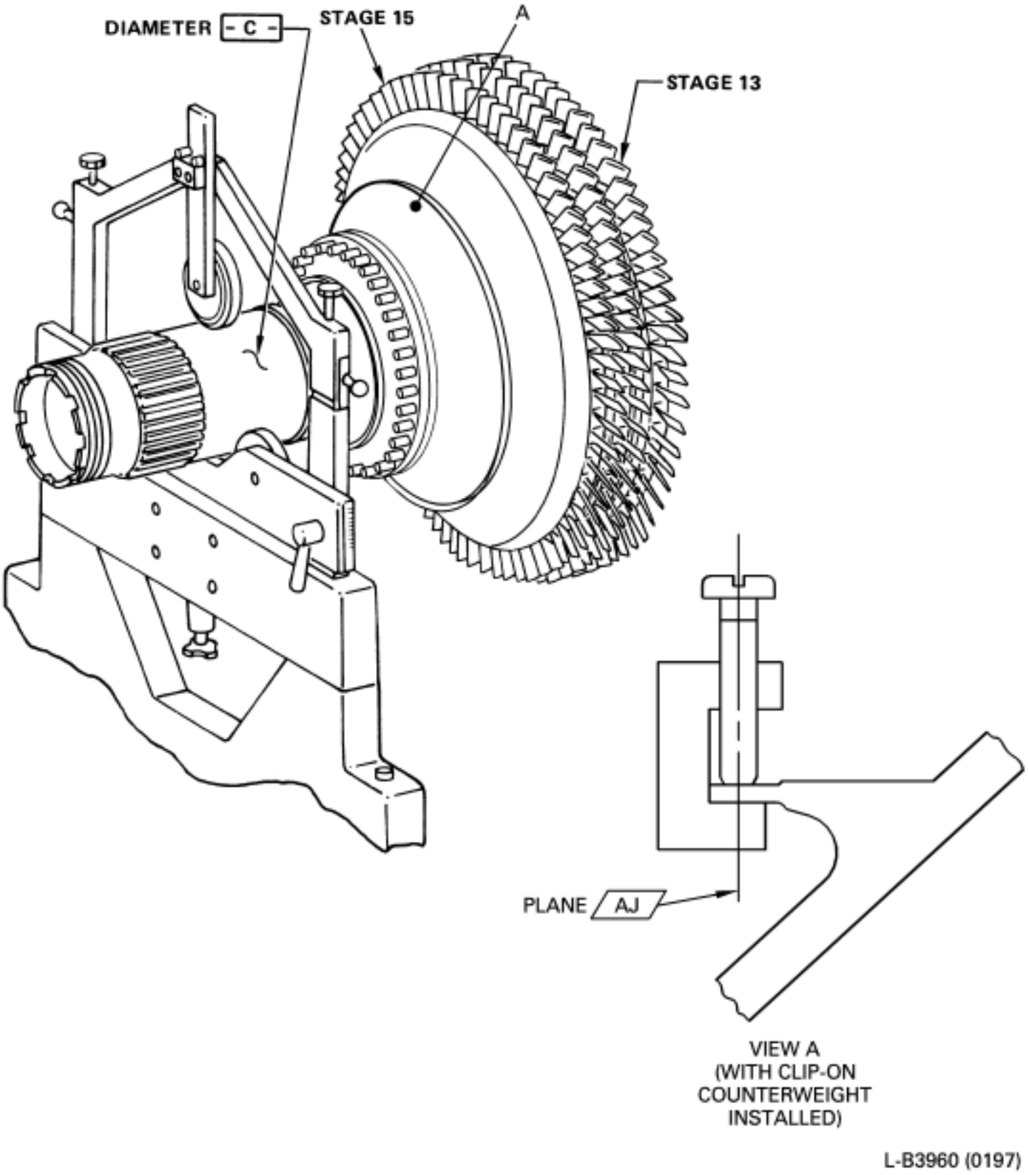
AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-02


- C -
DIAMETER
.0015 in.
(0.038 mm)
F-C
L-A0692
1086

Axial Compressor Rotor Assembly In Balance Machine
Figure 1002 (Sheet 3)
(Task 72-35-01-440-005)

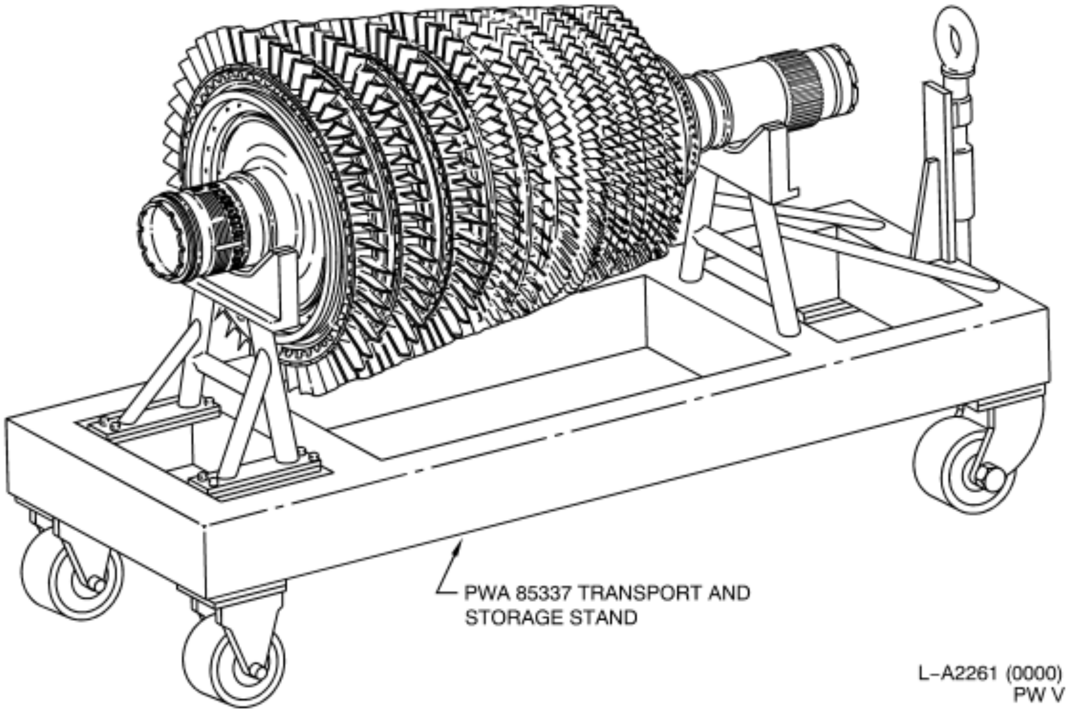
R
R

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−02


DIAMETER -C-
STAGE 15
A
STAGE 13
PLANE AJ
VIEW A
(WITH CLIP-ON
COUNTERWEIGHT
INSTALLED)
L-B3960 (0197)

Axial Compressor Rotor Assembly Balance
R Figure 1003
(Task 72−35−01−440−005)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−02


PWA 85337 TRANSPORT AND STORAGE STAND
L−A2261 (0000)
PW V

Transport Axial Compressor Rotor Assembly
Figure 1004
(Task 72−35−01−440−005)

Task 72-35-01-440-003:

1. Grind And Measure The Axial Compressor Rotor Assembly Blade Tips (Vendor Application - Informational Release)

A. Purpose

(1) The purpose of this procedure is to control HPC rotor blade tip clearances by grinding rotor blade tip diameters.

NOTE: The measurements of the blade tip diameters provided by this procedure can be used to find the continued serviceability of the rotor assembly. These measurements are used to calculate blade tip clearances in 72-35-00, Inspection/Check-05, CONFIG-01 (Task 72-35-00-200-005).

B. Prerequisites

(1) Balance axial compressor rotor assembly by 72-35-01, Assembly-02 Task 72-35-01-440-002 or Task 72-35-01-440-005.

C. Procedure

CAUTION: EXCEPT FOR WORK OR SUPPLIES TO BE PERFORMED
R OR FURNISHED BY PRATT & WHITNEY, PRATT & WHITNEY DOES NOT ENDORSE THE WORK PERFORMED BY THE COMPANY OR COMPANIES NAMED HEREIN OR ANY OTHER COMPANY AND DOES NOT ACCEPT RESPONSIBILITY TO ANY DEGREE FOR THE SELECTION OF SUCH COMPANY OR COMPANIES FOR THE PERFORMANCE OF ANY WORK OR PROCUREMENT OF SUPPLIES.

R (1) This is a source demonstration procedure. Send
R repairable parts to an approved source licensed for
R this repair. The list that follows identifies sources
R approved and licensed for this repair by source code
R number. Refer to the source code list in Section
R 70-40-00, General-01 (Task 70-40-00-990-001) in
R the Pratt & Whitney Standard Practices Manual (PN
R 585005) and the supplemental repair source list in the
R Introduction section of this manual for the company

R name, address and contact information identified by
R each source code.

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C0040

C0087

C0081

C0092

R (2) Due to the critical nature of this repair, repair
R sources must demonstrate to Pratt & Whitney their
R capabilities to perform this repair and be licensed
R by Pratt & Whitney. Write to the address below about
R the qualification program to become an approved and
R licensed source.

Pratt & Whitney
R Materials & Processes Engineering
R Manager, Repair Licensing And Audit
R 400 Main Street, Mail Stop 169−04
R East Hartford, CT 06108−0969

R (FAX 860−557−2515)

(3) The vendor shall provide a record that shows the average size, number of blades, minimum and maximum blades identified and the variations from the blade average tip radius.

Acceptable Blade Tip Radius Measurements:

Stage No.	Nom. Blade Tip Radius Inches (Millimeters)	Dev. Of Avg. Blade Tip Radius From Nominal Inches (Millimeters)	Max. Dev. Of Indiv. Blades From Avg. Inches (Millimeters)	Min. Dev. Of Indiv. Blades From Avg. Inches (Millimeters)
5	16.360 (415.544)	Accept As Is (c)		
6	15.443 (392.252)	Accept As Is (c)		

Acceptable Blade Tip Radius Measurements:

Stage No.	Nom. Blade Tip Radius Inches (Millimeters)	Dev. Of Avg. Blade Tip Radius From Nominal Inches (Millimeters)	Max. Dev. Of Indiv. Blades From Avg. Inches (Millimeters)	Min. Dev. Of Indiv. Blades From Avg. Inches (Millimeters)
7	14.9426 (379.542)	Accept As Is (c)		
8	14.5549 (369.694)	Accept As Is (c)		
9	14.347 (364.414)	+0.011/-0.004 (+0.279/-0.102)	+0.003(a) (+0.076)(a)	-0.003(b)(c) (-0.076)(b)(c)
10	14.1454 (359.293)	+0.012/-0.005 (+0.305/-0.127)	+0.003(a) (+0.076)(a)	-0.003(b)(c) (-0.076)(b)(c)
11	13.9457 (354.221)	+0.012/-0.005 (+0.305/-0.127)	+0.003(a) (+0.076)(a)	-0.003(b)(c) (-0.076)(b)(c)
12(e)	13.7876 (350.205)	+0.012/-0.005 (+0.305/-0.127)	+0.003(a) (+0.076)(a)	-0.003(b)(c) (-0.076)(b)(c)
12(d)	13.7893 (350.248)	+0.012/-0.005 (+0.305/-0.127)	+0.003(a) (+0.076)(a)	-0.003(b)(c) (-0.076)(b)(c)
13	13.6096 (345.684)	+/-0.001(a) (+/-0.025)(a)	+0.001 (+0.025)	-0.001 (-0.025)
14	13.5523 (344.228)	+/-0.001(a) (+/-0.025)(a)	+0.001 (+0.025)	-0.001 (-0.025)
15	13.5109 (343.177)	+/-0.001(a) (+/-0.025)(a)	+0.001 (+0.025)	-0.001 (-0.025)

(a) This tolerance is from the measured and calculated average blade tip radius. A maximum of seven blades for each stage can be at this maximum.

(b) This tolerance is from the measured and calculated average blade tip radius.

(c) Extended minimum radius limit:

(1) A maximum of five blades for each stage can be -0.003 inch (-0.077 mm) to -0.007 inch (-0.177 mm) shorter than the measured and calculated average blade tip radius.

Acceptable Blade Tip Radius Measurements:

Stage No.	Nom. Blade Tip Radius Inches (Millimeters)	Dev. Of Avg. Blade Tip Radius From Nominal Inches (Millimeters)	Max. Dev. Of Indiv. Blades From Avg. Inches (Millimeters)	Min. Dev. Of Indiv. Blades From Avg. Inches (Millimeters)

(CONTINUED)

(2) If five blades fall within the -0.003 inch (-0.077 mm) to -0.007 inch (-0.177 mm) range, the sixth shortest blade will be reported as the new minimum blade.

(3) If less than five blades fall within the -0.003 inch (-0.077 mm) to -0.007 inch (-0.177 mm) range, the next shortest blade above this range will be reported as the new minimum blade.

(4) In the event there are three short blades adjacent to one another that fall within the -0.003 inch (-0.077 mm) to -0.007 inch (-0.177 mm) range, the longest of the three blades will be reported as the new minimum blade.

(d) PN 57H478, 56H378, 58H578

(e) PN 57H678, 54H668

NOTE: For Stages 9 through 12, the measured average can vary up to the limits shown if the minimum local, maximum local and average clearances are within the engine manual limits. In the event that the minimum local and/or average clearances are under the minimum limits, the mating rubstrip can be skim cut to remove up to 0.007 inch (0.178 mm) radially. See 72-35-00, Repair-01 (Task 72-35-00-300-001).

(4) For permitted damage after grind refer to 72-35-01, Inspection/Check-03 (Task 72-35-01-200-003) for limits.

D. Postrequisites

(1) Final balance axial compressor rotor assembly by 72-35-01, Assembly-04 (Task 72-35-01-440-004).

Task 72-35-01-440-026:

1. Grind And Measure The Axial Compressor Rotor Assembly Blade Tips (Ring Case Configuration, Post SB PW4ENG 72-756 Or Post SB PW4ENG 72-759) (Vendor Application - Informational Release)

A. Purpose

(1) The purpose of this procedure is to control HPC rotor blade tip clearances by grinding rotor blade tip diameters.

NOTE: The measurements of the blade tip diameters provided by this procedure can be used to find the continued serviceability of the rotor assembly. These measurements are used to calculate blade tip clearances in 72-35-00, Inspection/Check-05, CONFIG-2 (Task 72-35-00-990-012).

B. Prerequisites

(1) Balance Axial Compressor Rotor Assembly. Refer to 72-35-01, Assembly-02 (Task 72-35-01-440-002) or (Task 72-35-01-440-005).

C. Procedure

CAUTION: EXCEPT FOR WORK OR SUPPLIES TO BE PERFORMED OR FURNISHED BY PRATT & WHITNEY, IT IS UNDERSTOOD THAT PRATT & WHITNEY DOES NOT ENDORSE THE WORK PERFORMED BY THE COMPANY OR COMPANIES NAMED HEREIN OR ANY OTHER COMPANY AND DOES NOT ACCEPT RESPONSIBILITY TO ANY DEGREE FOR THE SELECTION OF SUCH COMPANY OR COMPANIES FOR THE PERFORMANCE OF ANY WORK OR PROCUREMENT OF SUPPLIES.

R (1) This is a source demonstration procedure. Send
R repairable parts to an approved source licensed for
R this repair. The list that follows identifies sources
R approved and licensed for this repair by source code
R number. Refer to the source code list in Section
R 70-40-00, General-01 (Task 70-40-00-990-001) in
R the Pratt & Whitney Standard Practices Manual (PN
R 585005) and the supplemental repair source list in the
R Introduction section of this manual for the company

R name, address and contact information identified by
R each source code.

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R (2) Due to the critical nature of this repair, repair
R sources must demonstrate to Pratt & Whitney their
R capabilities to perform this repair and be licensed
R by Pratt & Whitney. Write to the address below about
R the qualification program to become an approved and
R licensed source.

Pratt & Whitney
R Materials & Processes Engineering
R Manager, Repair Licensing And Audit
R 400 Main Street, Mail Stop 169−04
R East Hartford, CT 06108

R (FAX 860−557−2515)

R (3) The vendor must provide a record that shows the average size, number of blades, minimum and maximum blades identified and the variations from the blade average tip radius. See Table 1001.

Stage	Nominal Blade Tip Radius Inches (mm)	Re−Target Allowance From The Nominal Radius Inches (mm)	Maximum Deviation Of Individual Blades From Aveage Inch (mm)	Minimum Deviation Of Individual Blades From Aveage Inch (mm)
5	16.360 (415.544)	Not Applicable	Not Applicable	Not Applicable (a)
6	15.443 (392.252)	Not Applicable	Not Applicable	Not Applicable (a)

Blade Tip Radius Measurements (For Compressors With The Ring Case Configuration)
Table 1001

Stage	Nominal Blade Tip Radius Inches (mm)	Re−Target Allowance From The Nominal Radius Inches (mm)	Maximum Deviation Of Individual Blades From Aveage Inch (mm)	Minimum Deviation Of Individual Blades From Aveage Inch (mm)
7	14.943 (379.552)	Not Applicable	Not Applicable	Not Applicable (a)
8	14.538 (369.265)	Not Applicable	Not Applicable	Not Applicable (a)
9	14.338 (364.185)	+0.010/−0.005 +(0.254)/ −(0.127)	+0.001 +(0.025)	−0.001 (b) −(0.025) (b)
10	14.139 (359.131)	+0.010/−0.005 +(0.254)/ −(0.127)	+0.001 +(0.025)	−0.001 (b) −(0.025) (b)
11	13.950 (354.330)	+0.010/−0.005 +(0.254)/ −(0.127)	+0.001 +(0.025)	−0.001(b) −(0.025)(b)
12	13.797 (350.444)	+0.010/−0.005 +(0.254)/ −(0.127)	+0.001 +(0.025)	−0.001(b) −(0.025)(b)
13	13.609 (345.669)	±0.005 ±(0.127)	+0.001 +(0.025)	−0.001(b) −(0.025)(b)
14	13.556 (344.322)	±0.005 ±(0.127)	+0.001 +(0.025)	−0.001(b) −(0.025)(b)
15	13.515 (343.281)	±0.005 ±(0.127)	+0.001 +(0.025)	−0.001(b) −(0.025)(b)

(a) Extended minimum radius limit (Stages 5 Through 8):

(1) A maximum of five blades for each stage can be −0.004 inch (−0.102 mm) to −0.007 inch (−0.177 mm) shorter than the measured and calculated average blade tip radius.

(2) If five blades fall within the −0.004 inch (−0.102 mm) to −0.007 inch (−0.177 mm) range,

Blade Tip Radius Measurements (For Compressors With The Ring Case Configuration)
Table 1001 (Continued)

Stage	Nominal Blade Tip Radius Inches (mm)	Re−Target Allowance From The Nominal Radius Inches (mm)	Maximum Deviation Of Individual Blades From Aveage Inch (mm)	Minimum Deviation Of Individual Blades From Aveage Inch (mm)
(CONTINUED)				

the sixth shortest blade will be reported as the new minimum blade.

(3) If less than five blades fall within the −0.004 inch (−0.102 mm) to −0.007 inch (−0.177 mm) range, the next shortest blade above this range will be reported as the new minimum blade.

(4) In the event there are three short blades adjacent to one another that fall within the −0.004 inch (−0.102 mm) to −0.007 inch (−0.177 mm) range, the longest of the three blades will be reported as the new minimum blade.

(b) Extended minimum radius limit (Stages 9 Through 15):

(1) A maximum of five blades for each stage can be −0.002 inch (−0.051 mm) to −0.010 inch (−0.254 mm) shorter than the nominal blade tip radius specified above.

(2) If five blades fall within the −0.002 inch (−0.051 mm) to −0.010 inch (−0.254 mm) range, the sixth shortest blade will be reported as the new minimum blade.

(3) If less than five blades fall within the −0.002 inch (−0.051 mm) to −0.010 inch (−0.254 mm) range, the next shortest blade above this range will be reported as the new minimum blade.

(4) In the event there are three short blades adjacent to one another that fall within the −0.002 inch (−0.051 mm) to −0.010 inch (−0.254 mm) range, the longest of the three blades will be reported as the new minimum blade.

NOTE: For Stages 9 through 15, the nominal rotor grind dimension can be re−targeted by the amount shown in

Blade Tip Radius Measurements (For
Compressors With The Ring Case Configuration)
Table 1001 (Continued)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-03

Stage	Nominal Blade Tip Radius Inches (mm)	Re-Target Allowance From The Nominal Radius Inches (mm)	Maximum Deviation Of Individual Blades From Aveage Inch (mm)	Minimum Deviation Of Individual Blades From Aveage Inch (mm)

(CONTINUED)

Table 1001 provided the mating air seal rub-strips are re-targeted by the same amount. Refer to 72-35-04, Assembly-02 (Task 72-35-04-440-002).

Blade Tip Radius Measurements (For Compressors With The Ring Case Configuration)
Table 1001 (Continued)

(4) For permitted damage after grind, refer to 72-35-01, Inspection/Check-03 (Task 72-35-01-200-003) for limits.

D. Postrequisites

(1) Final Balance The Axial Compressor Rotor Assembly. Refer to 72-35-01, Assembly-04 (Task 72-35-01-440-004).

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-04

Task 72-35-01-440-004:

1. Final Balance Axial Compressor Rotor Assembly (After The Blade Tip Grinding Operation)

A. Prerequisites

(1) Grind the axial compressor rotor assembly blade tips per Assembly-03 Task 72-35-01-440-003.

B. Equipment And Materials Required

Special Tools:

PWA 76154	Adapters (2 Required)
PWA 78064	Gage
PWA 80515	Stand
PWA 85086	Arm (2 Required)
PWA 85124	Adapter, Lift
PWA 85159	Thread Protector
PWA 85160	Thread Protector
PWA 85161	Adapter
PWA 85294	Adapter
PWA 85337	Stand
PWA 85403	Shroud
PWA 85406	Adapter, Drive (Optional to PWA 101714 Adapter, Drive)
PWA 85410	Weight, Front Calibration (For Balance Machines Without Electronic Calibration)
PWA 85411	Weight, Rear Calibration (For Balance Machines Without Electronic Calibration)
PWA 85428	Thread Protector
PWA 85528	Adapter, Handling
PWA 85529	Nut
PWA 85530	Wrench
PWA 85531	Adapter
PWA 85537	Fixture, Handling
PWA 85580	Stand, Support
PWA 85593	Ring, Adapter
PWA 87022	Stand, Build And Storage
PWA 88575	Weight, Front Calibration (For Balance Machines Without Electronic Calibration)
PWA 88643	Sling (Optional to PWA 88673)
PWA 88673	Sling
PWA 88700	Adapter, Lift
PWA 101714	Adapter, Drive

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04

Consumable Materials:

Item No.	Designation
P09−014	Sealant, Silicone Rubber (PWA 36003)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Rivet	A/R	79−35−00/10/20

C. Procedure

NOTE: Installation of HPC blade seals (ladder seals) was optional for the pre−grind balancing of the rotor assembly.

(1) Remove all clamp−on weights that were installed for the initial balance operation (before blade tip grind).

  (a) Check the record to find how many weights were installed at the before blade tip grind balance operation and, if any, during the blade tip grind operation.

  (b) Be sure that the same number of weights that were installed are also removed.

(2) Attach PWA 85161 Adapter to front hub and PWA 85124 Adapter to rear shaft. Install two PWA 85086 Lifting Arms to HPC front and to rear adapters. Attach hoist to arms. See Figure 1001.

(3) Install PWA 85403 Shroud to base of HL−50 balancer. See Figure 1002 (Sheet 1).

(4) Raise rotor from transport stand and position over cradles of balance machine with rear shaft to drive end of balance machine. Lower rotor onto cradles. Remove hoists, hub/shaft arms and adapters from rotor. Install the machine details that hold the rotor in the balance machine. Secure rotor to cradles. Remove rear shaft airseal protector.

(5) Using indicator, check runouts where indicated. See Figure 1002.

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04

(6) Install PWA 101714 Drive Adapter onto HPC rear shaft so that splines on adapter engage splines on shaft and adapter is bottomed out against shaft. Actuate screw(s) to tighten adapter on shaft and torque screw(s) 10 − 30 lb−in. (1.130 − 3.390 N.m). Secure balance machine driveshaft to drive adapter. Cover rotor with shroud.

(7) Calibrate balance machine to 4.0 oz−in. (2880 g.mm) in Plane AL and 5.0 oz−in. (3600 g.mm) in Plane AJ.

(a) For balance machines without electronic calibration, do a check of the static balance machine.

1 Install PWA 88575 Calibration Weight on Front HPC Rotor at Plane AL. Balance Plane AL is moved to the location shown on Figure 1003 (Sheet 1).

2 Install PWA 85411 Calibration Weight at Plane AJ Stage 15 disk. See Figure 1003 (Sheet 2).

3 Calibrate balance machine.

4 After you calibrate the balance machine, remove the calibration weights.

(b) For balance machines with electronic calibration, use the manufacturer's instructions to do a check of the static balance machine.

(8) Balance axial compressor rotor assembly at 900 rpm minimum in Planes AL and AJ when mounted on Diameters F and C.

(a) Initial unbalance shall not exceed 30 oz−in. (21600 g.mm) per plane or 15 oz−in. (10800 g.mm) per plane, if unbalance vectors are within 30 degrees of each other.

(b) If initial unbalance is not met, recheck runout. Runout must be within allowable limits. If it is not, check bolted joints for proper seating. If, after check, initial unbalance is not met, subassemblies may be rotated to meet this requirement. In addition, Stage 15 blades can be removed and installed light to heavy to meet the requirement.

(c) Once the initial unbalance requirement is satisfied, balance the rotor at 900 rpm minimum to the following requirements:

1 For final dynamic balancing of the rotor, either after rotor tip grinding (for operators that elect to tip grind the HPC rotor assembly) or for final rotor dynamic balance when rotor is not being ground, the remaining unbalance must be within 0.2 oz−in. (144 g.mm) at the front Plane AL and within 0.5 oz−in. (360 g.mm) at the rear Plane AJ.

(d) Balance correction at Plane AL (HPC forward end):

1 Balance Plane AL shown in Figure 1003 (Sheet 1). Correct balance by addition of one counterweight PN 54H737, PN 54H738 or PN 54H739 to the bottom of a 5th stage blade, at as many blade locations as necessary. Remove sealant from around 5th stage blade lock and remove lock with a non−metallic drift and discard. Remove 5th stage blade and remove sealant from 5th stage blade root to permit installation of the counterweight. Also, remove sealant from slot in 5th stage disk in the area where the blade was removed. Apply Silicone Rubber Sealant P09−014 as shown in Figure 1003 (Sheet 1) to counterweight. Place counterweight with sealant to the bottom of the blade root. Sealant cure is waived. Apply Silicone Rubber Sealant P09−014 to the blade lock groove in the blade and the disk. Install the blade and secure with a new blade lock. Apply Silicone Rubber Sealant P09−014 to cover the blade lock bent end.

CAUTION: COUNTERWEIGHTS MUST NOT BE INSTALLED AT LOADING SLOT LOCATIONS. BLADES MAY BE DAMAGED AT THESE LOCATIONS. TOTAL QUANTITY OF COUNTERWEIGHTS ALLOWED INCLUDES QUANTITY USED IN SUBASSEMBLY BALANCING.

(e) Balance correction at Plane AJ (HPC aft end): Correct balance by adding counterweights PN 51H476 at Stage 15 within quantities specified. See Figure 1003 (Sheet 2). In addition to adding counterweights to Stage 15, counterweights can be installed to Stage 13, see Figure 1003 (Sheet 3). After the counterweights have been added remeasure balance in Plane AJ.

CAUTION: SETSCREW CHANGE LETTER C AND LOCK CHANGE LETTER C AND LOCK AND SETSCREW ASSEMBLY CHANGE LETTER A MUST BE SECURED BY LOCKING SETSCREW TO RUNNING TORQUE PLUS 4 − 8 LB−IN. (0.452 − 0.904 N.m).

(9) Blade lock screws must not rotate under 10 lb−in. (1.130 N.m) of applied torque. If screw rotates then retorque setscrew to running torque plus 8 − 12 lb−in. (0.904 − 1.356 N.m).

(10) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure height clearance between blade lock and top of blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

1 If these limits are not kept, check the lock for correct assembly in the disk.

(11) Disconnect drive unit and remove from shaft. Install PWA 85124 Adapter to rear shaft and PWA 85161 Adapter to front hub.

(12) Install PWA 85086 Arm to HPC front hub. Attach hoist to arm. Install PWA 85086 Arm to rear shaft. Attach hoist to arm. See Figure 1001.

(13) If rotor is to be stored for a period of time, raise rotor from balance machine and lower into PWA 85337 Transport Stand. Remove hoists, arms and adapters. See Figure 1004.

(a) Install PWA 85160 Thread Protector to front hub and PWA 85159 Thread Protector to rear shaft.

(b) Install PWA 85428 Protector on rear shaft airseal.

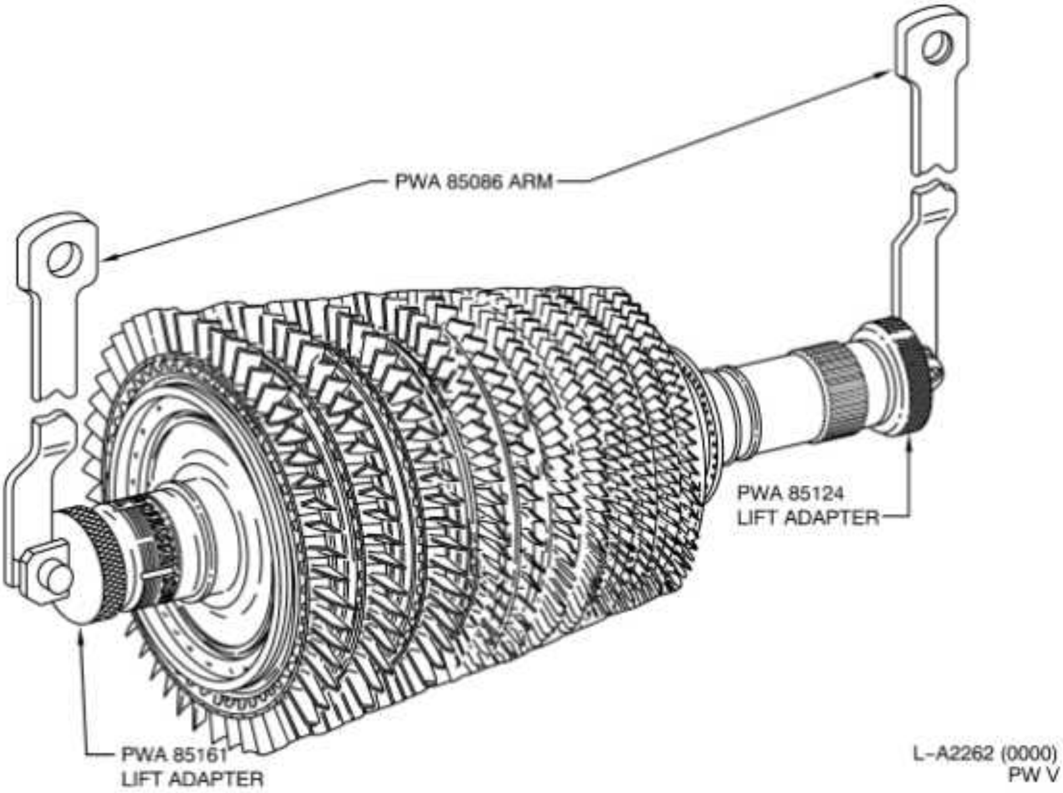
(14) If rotor is not to be stored, trunnion rotor assembly to front end up position. Remove hoist, arm, and adapter from rear shaft. Lower rotor assembly into PWA 85580 Stand with PWA 80515 Stand, PWA 85294 Adapter and PWA 85593 Adapter. Remove hoist, arm, and adapter from front hub. See Figure 1005.

(15) Install PWA 85528 Adapter with PWA 85537 Fixture to HPC front hub. Secure fixture and adapter with PWA 85529 Nut. Using PWA 85530 Wrench and PWA 85531 Adapter, torque nut to 300 lb−in. (33.895 N.m). See Figure 1006.

(16) Install PWA 88643 Sling or PWA 88673 Sling with two PWA 76154 Adapters to spools of fixture and raise rotor from stand. Install PWA 85124 Adapter to rear shaft. Install PWA 85086 Arm to adapter and using hoist trunnion rotor to front end down. See Figure 1007.

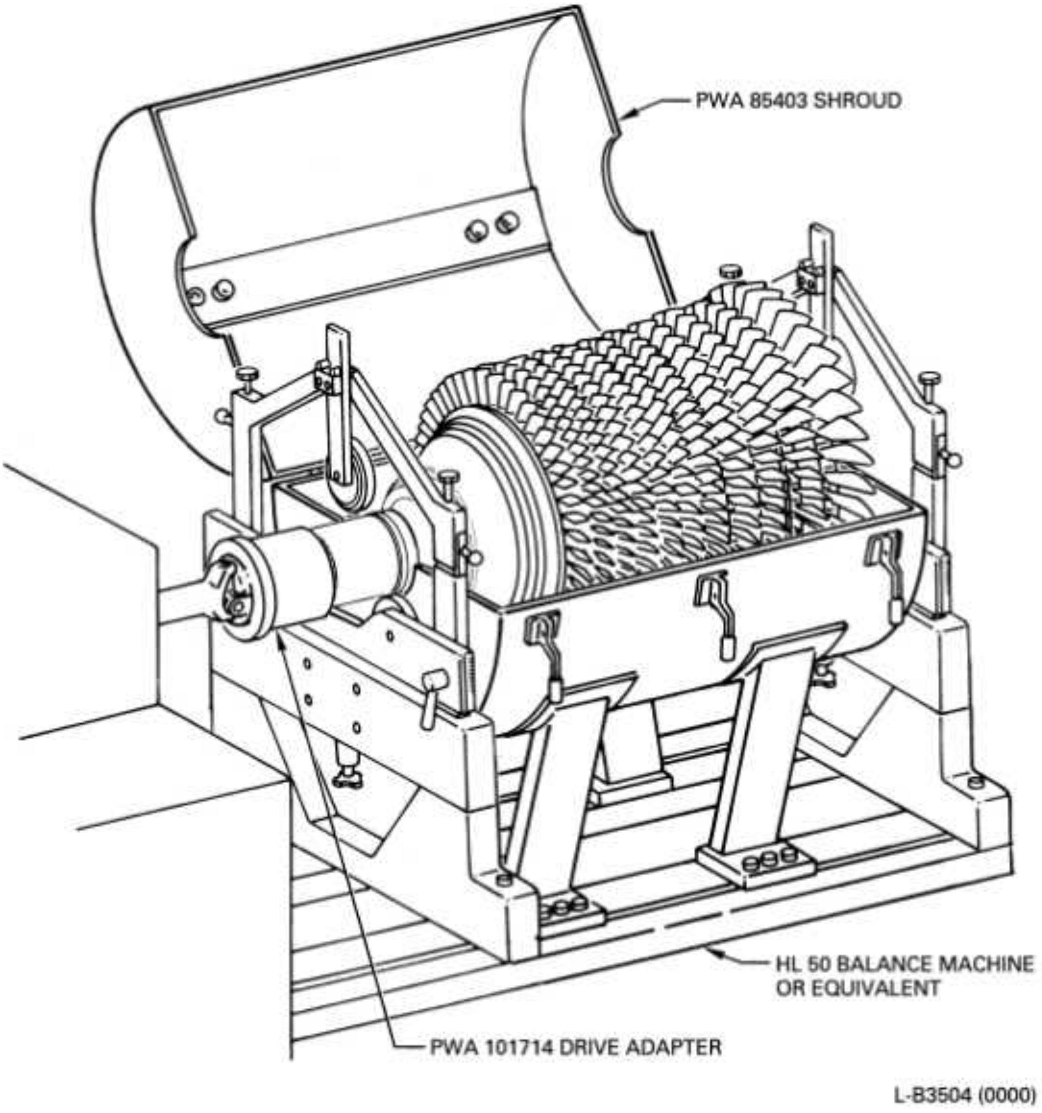
(17) Lower rotor assembly onto PWA 87022 Stand. Remove hoist, arm and adapter from rear hub. See Figure 1008.

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04


PWA 85086 ARM
PWA 85124
LIFT ADAPTER
PWA 85161
LIFT ADAPTER
L-A2262 (0000)
PW V

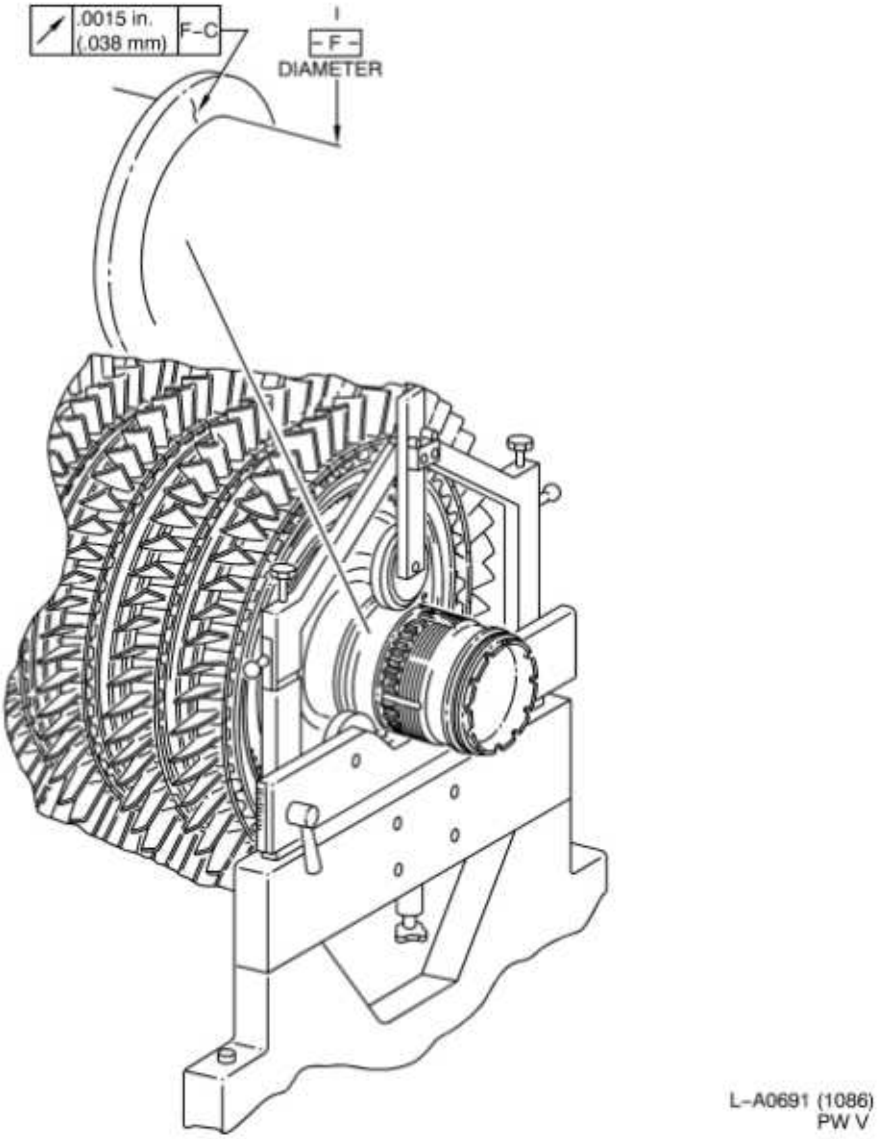
Lift Axial Compressor Rotor Assembly
Figure 1001
(Task 72−35−01−440−004)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-04

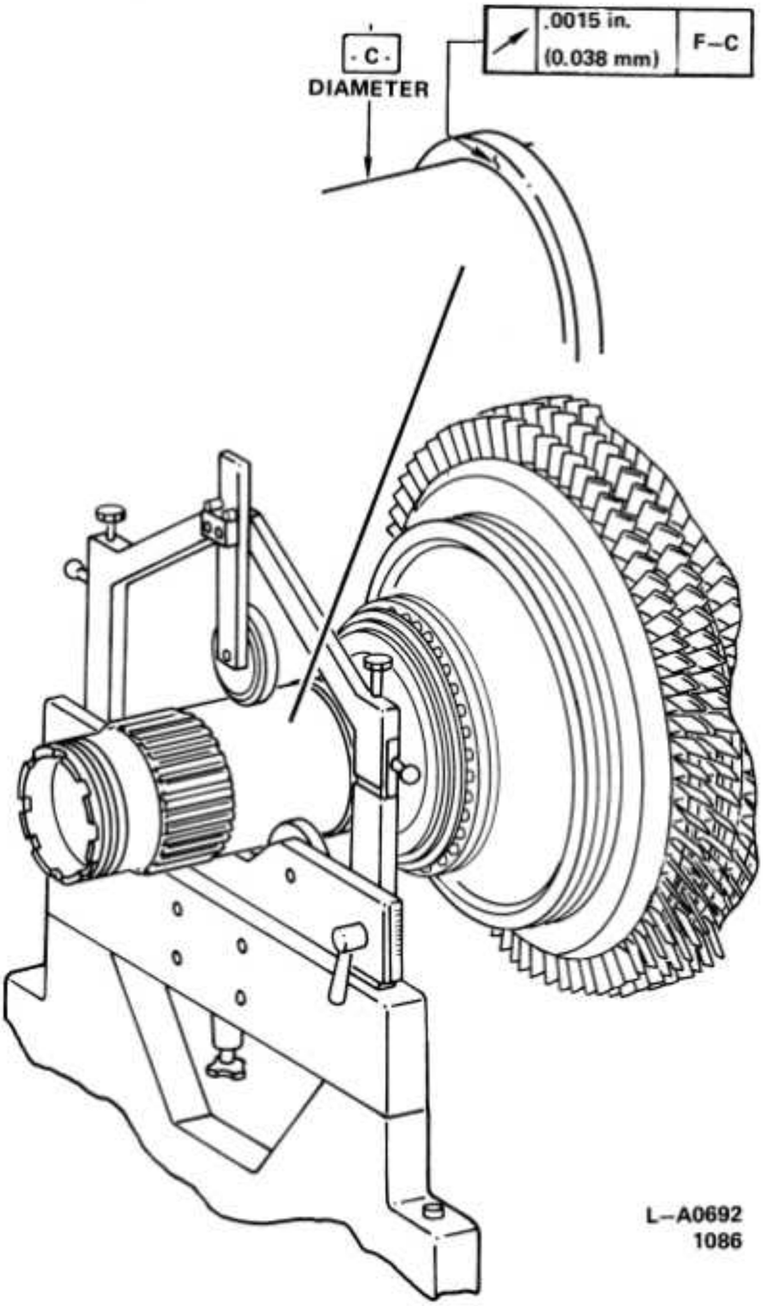

PWA 85403 SHROUD
HL 50 BALANCE MACHINE OR EQUIVALENT
PWA 101714 DRIVE ADAPTER
L-B3504 (0000)

Axial Compressor Rotor Assembly In Balance Machine
Figure 1002 (Sheet 1)
(Task 72-35-01-440-004)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04

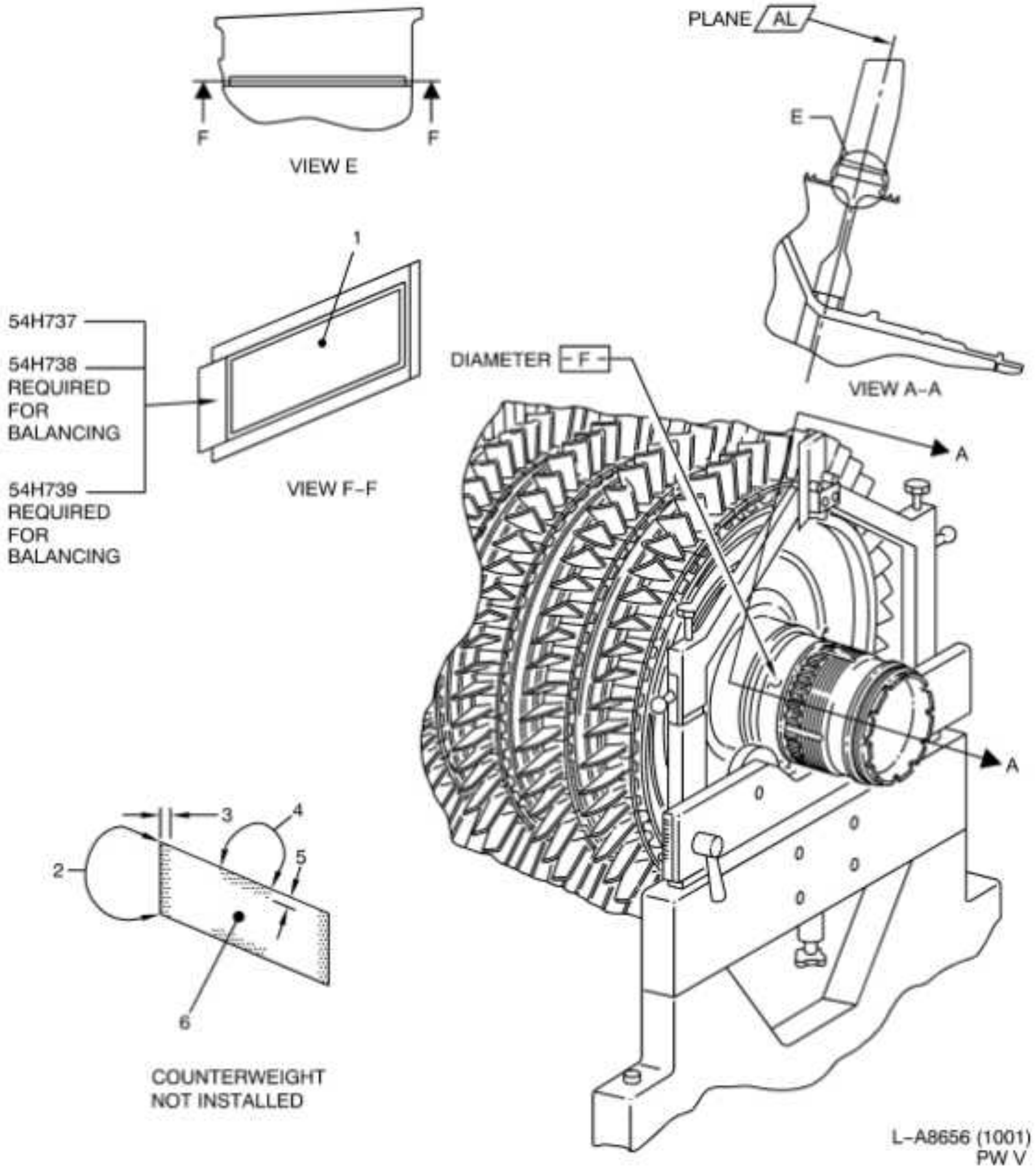

.0015 in.
(.038 mm)
F−C
- F -
DIAMETER
L−A0691 (1086)
PW V

Axial Compressor Rotor Assembly In Balance Machine
Figure 1002 (Sheet 2)
(Task 72−35−01−440−004)


-C-
DIAMETER
.0015 in.
(0.038 mm)
F–C
L–A0692
1086

Axial Compressor Rotor Assembly In Balance Machine
Figure 1002 (Sheet 3)
(Task 72−35−01−440−004)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-04


VIEW E
F
F
PLANE AL
E
VIEW A-A
1
54H737
54H738
REQUIRED
FOR
BALANCING
54H739
REQUIRED
FOR
BALANCING
VIEW F-F
DIAMETER F
A
A
2
3
4
5
6
COUNTERWEIGHT
NOT INSTALLED
L-A8656 (1001)
PW V

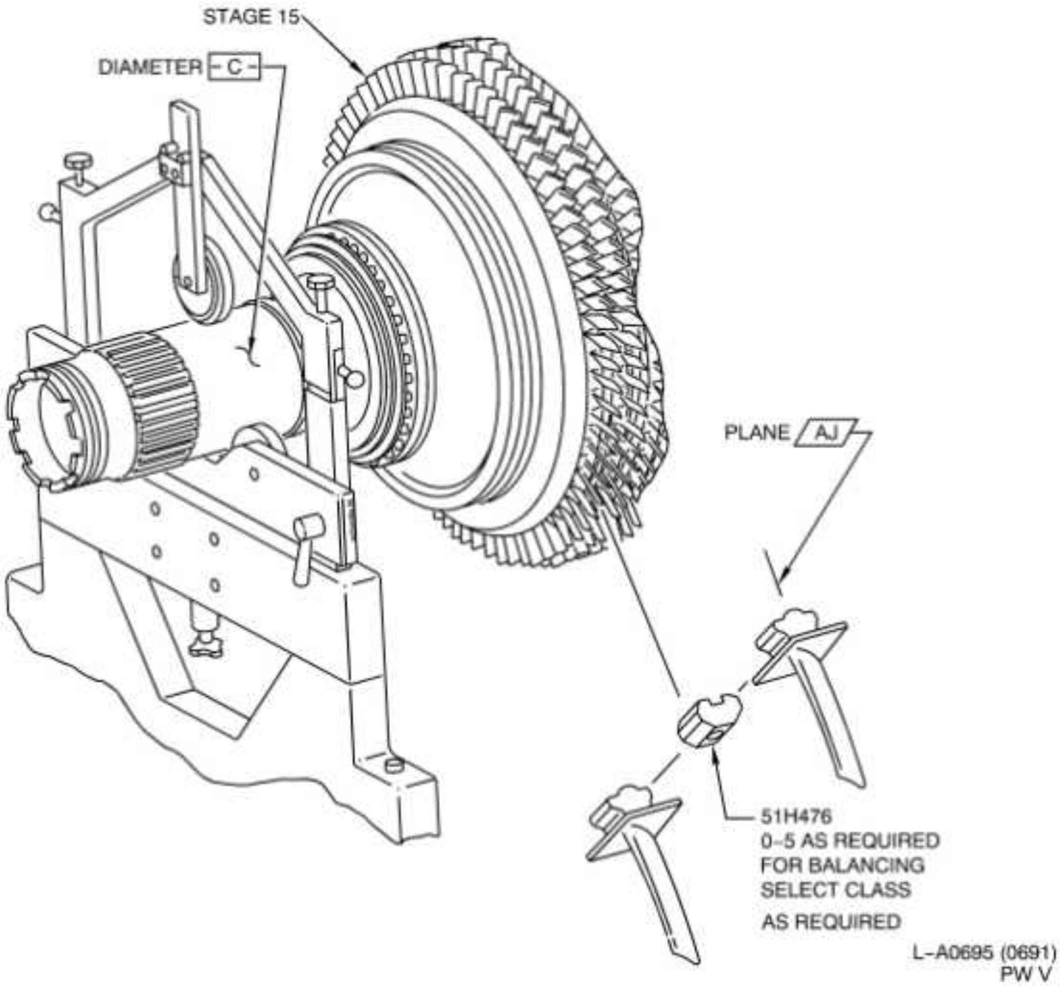
Axial Compressor Rotor Assembly Balance
Figure 1003 (Sheet 1)
(Task 72-35-01-440-004)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04

1. Counterweight Shown As Put On The Blade Root
2. Apply Sealant Here, Both Edges
3. 0.200 Inch (5.080 mm) Maximun, Forward and Aft Edges
4. Apply Sealant Here, Both Sides In Center 1/3 Of Each Side
5. 0.150 Inch (3.810 mm) Maximum, Both Sides
6. Counterweight Shown Not Put On The Blade Root

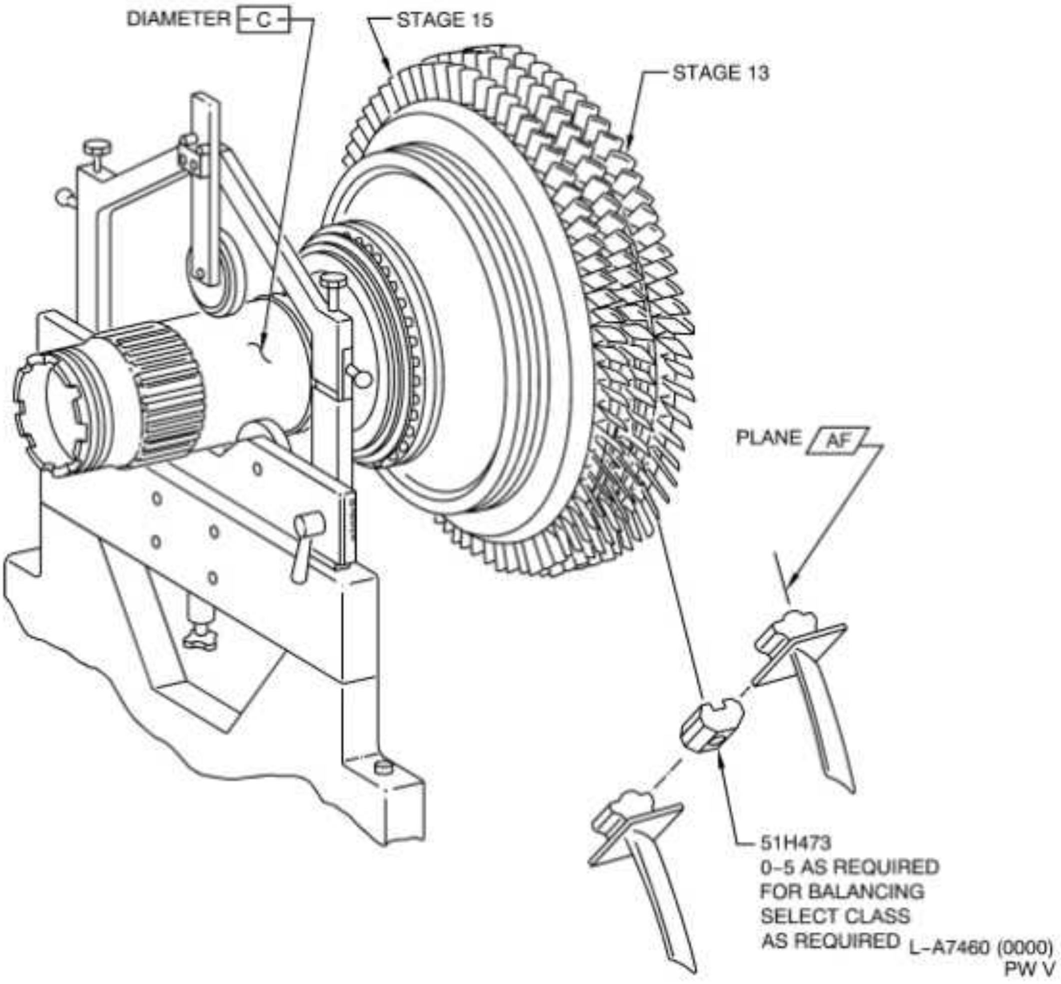
Key to Figure 1003 (Sheet 1)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04


STAGE 15
DIAMETER -C-
PLANE AJ
51H476
0-5 AS REQUIRED
FOR BALANCING
SELECT CLASS
AS REQUIRED
L-A0695 (0691)
PW V

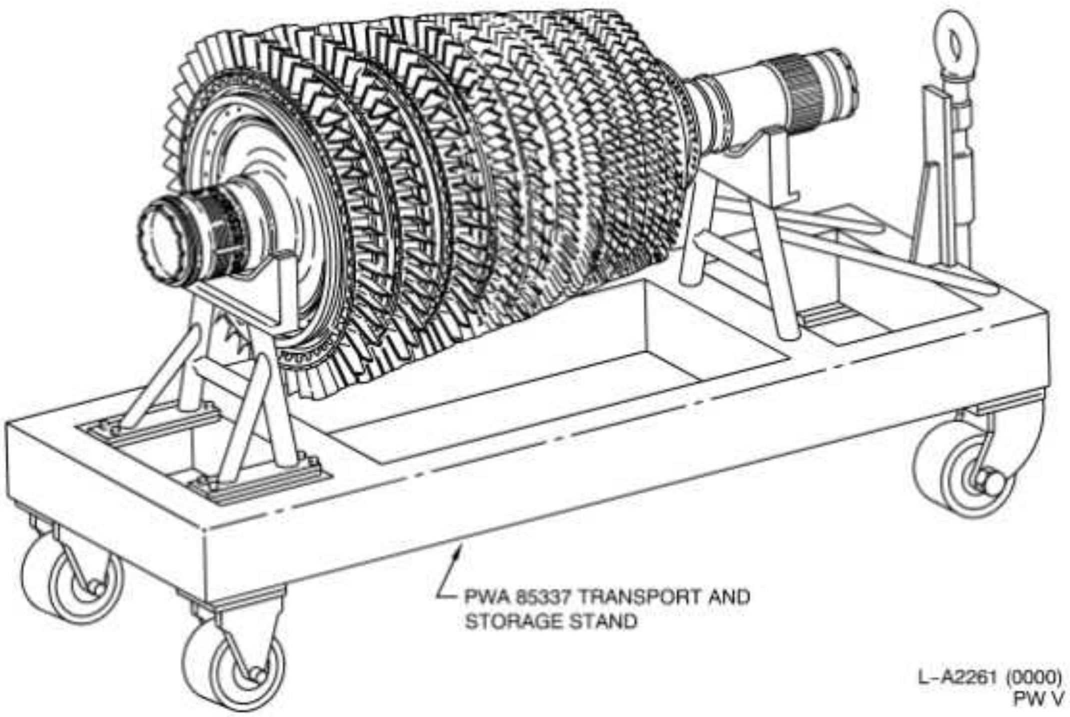
Axial Compressor Rotor Assembly Balance
Figure 1003 (Sheet 2)
(Task 72−35−01−440−004)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04


DIAMETER -C-
STAGE 15
STAGE 13
PLANE AF
51H473
0−5 AS REQUIRED
FOR BALANCING
SELECT CLASS
AS REQUIRED
L-A7460 (0000)
PW V

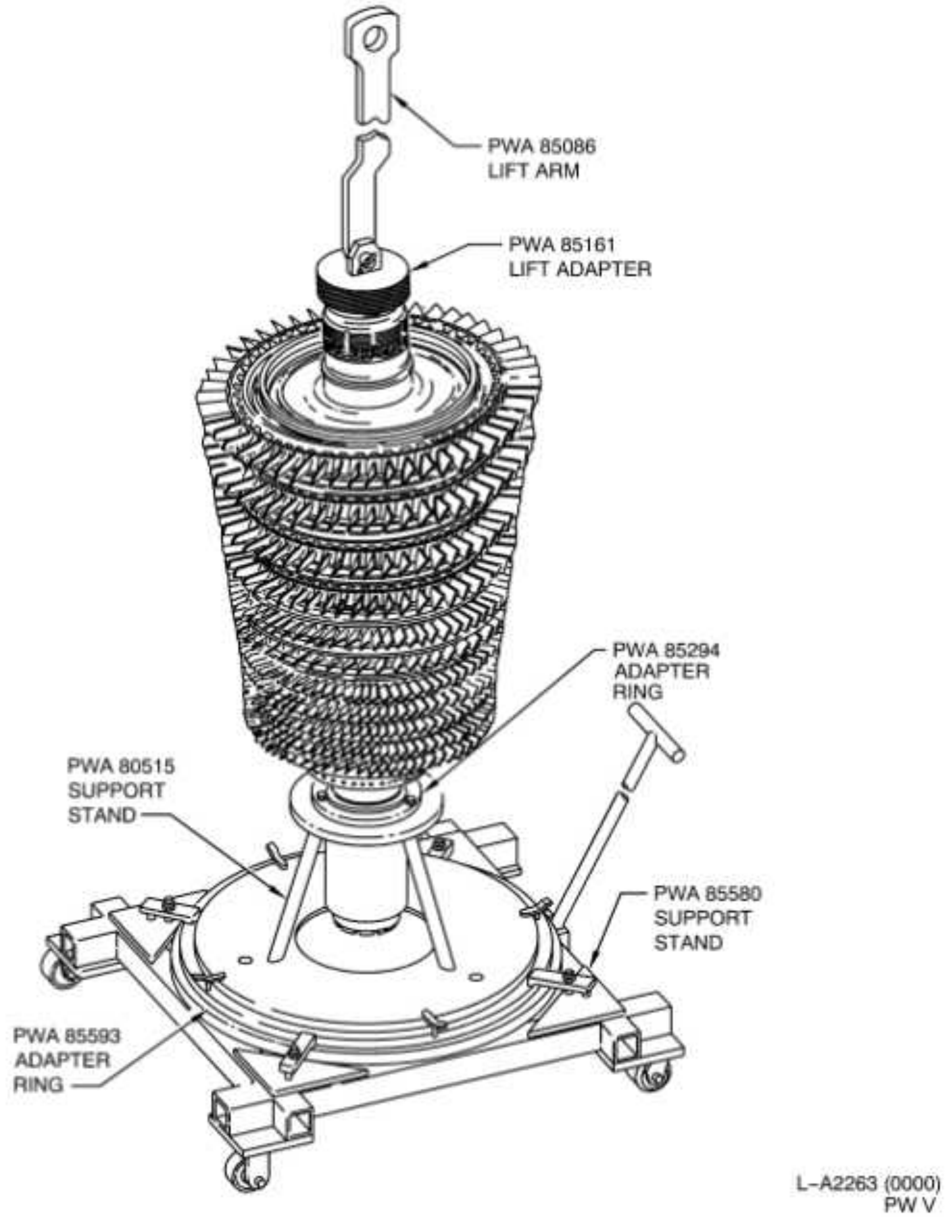
Axial Compressor Rotor Assembly Balance
Figure 1003 (Sheet 3)
(Task 72−35−01−440−004)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04


PWA 85337 TRANSPORT AND STORAGE STAND
L−A2261 (0000)
PW V

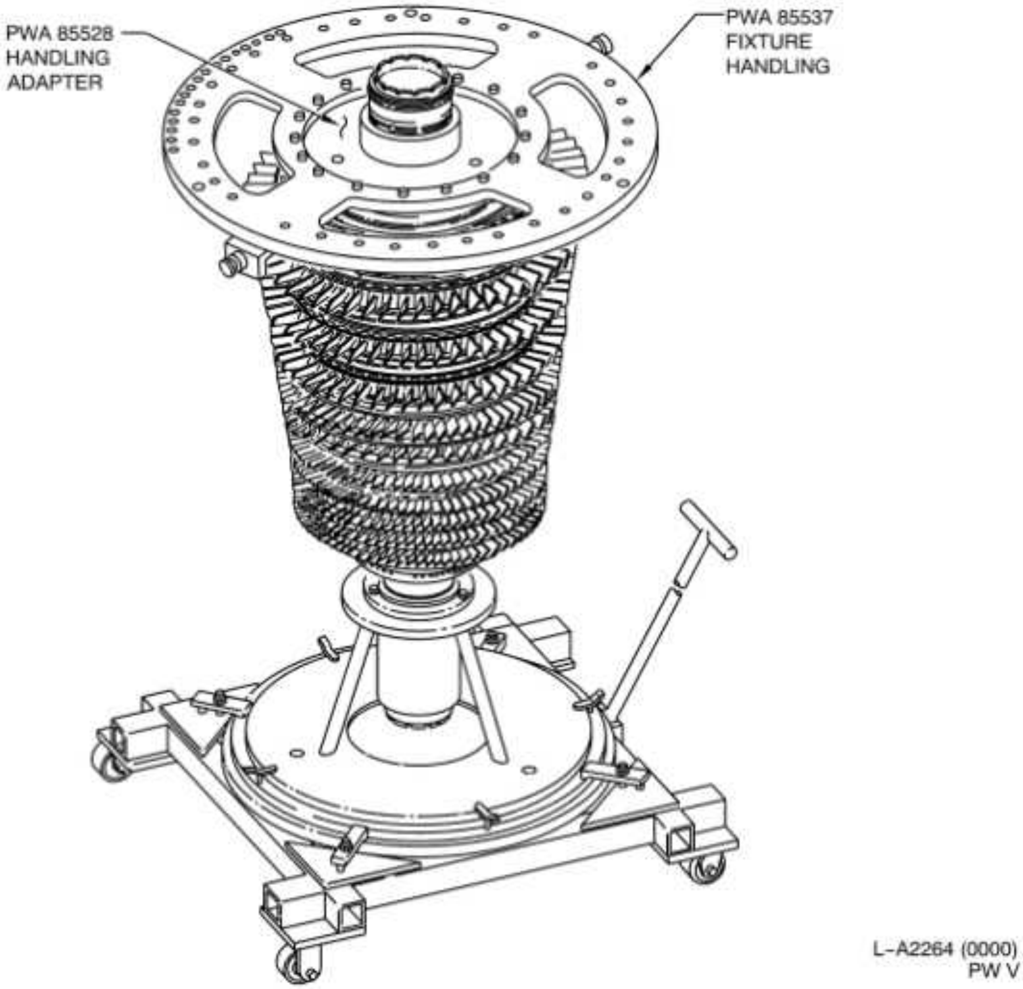
Transport Axial Compressor Rotor Assembly
Figure 1004
(Task 72−35−01−440−004)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04


PWA 85086
LIFT ARM
PWA 85161
LIFT ADAPTER
PWA 85294
ADAPTER
RING
PWA 80515
SUPPORT
STAND
PWA 85580
SUPPORT
STAND
PWA 85593
ADAPTER
RING
L−A2263 (0000)
PW V

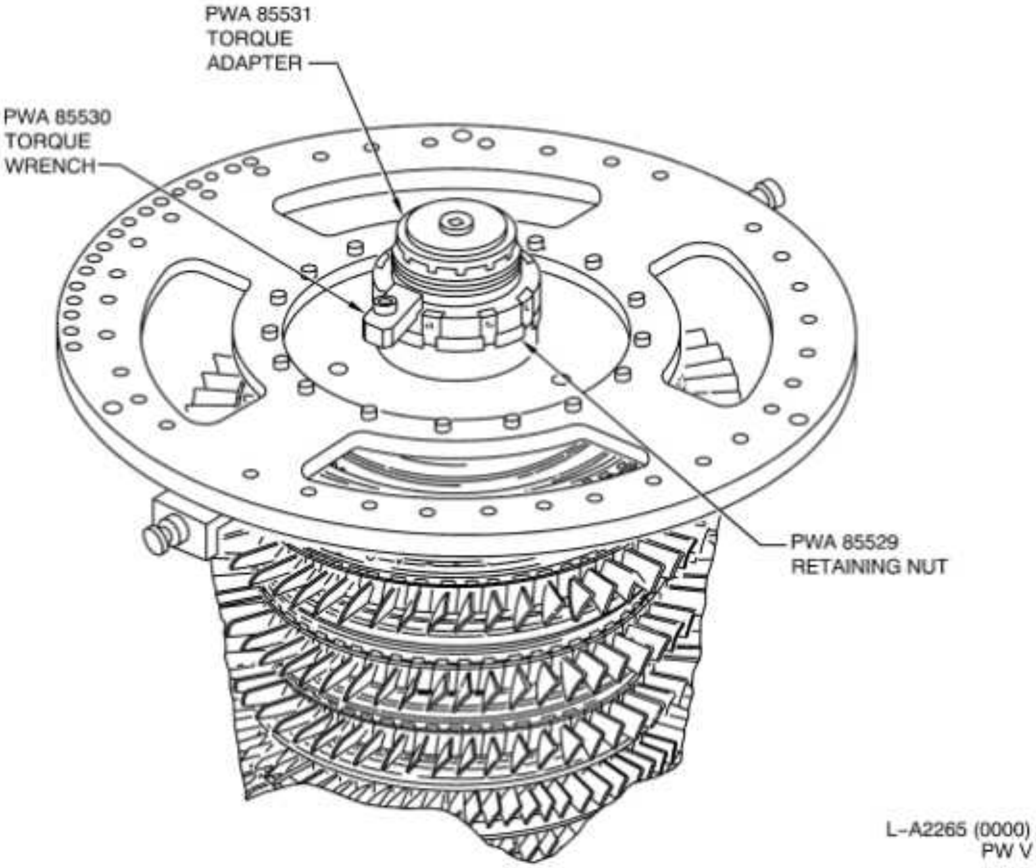
Install Rotor In Support Stand
Figure 1005
(Task 72−35−01−440−004)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-04

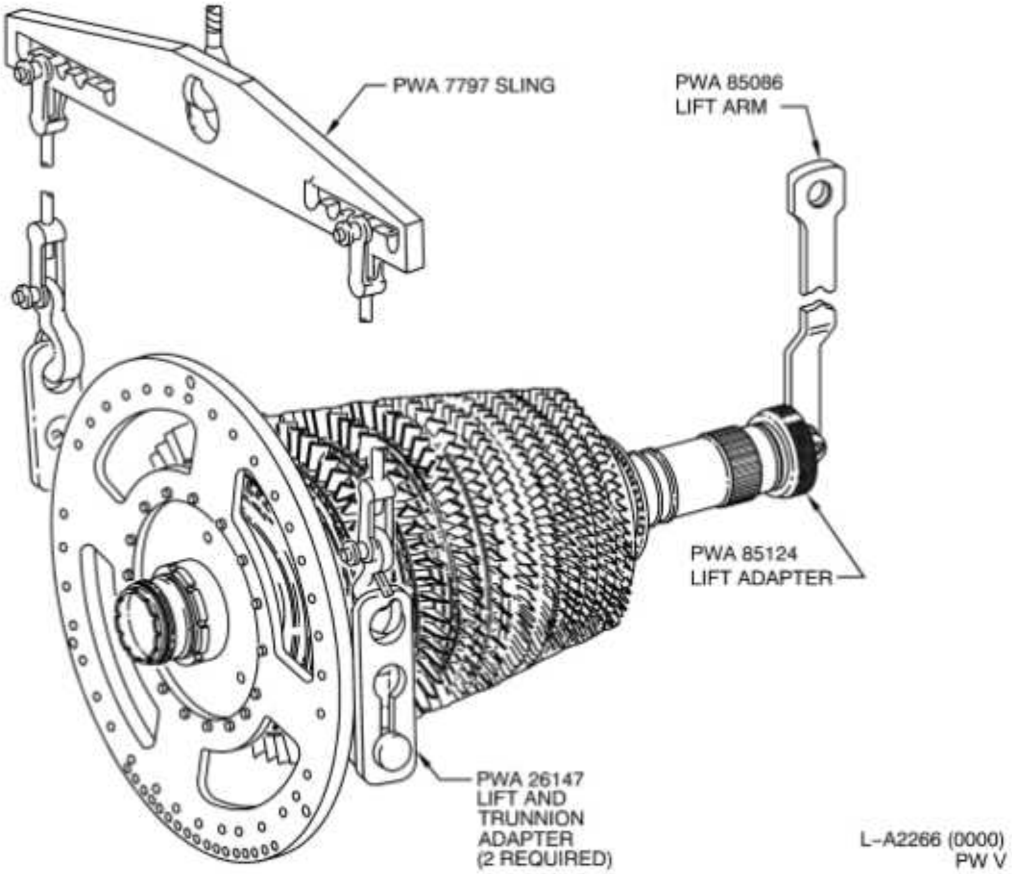

PWA 85528
HANDLING
ADAPTER
PWA 85537
FIXTURE
HANDLING
L-A2264 (0000)
PW V

Install PWA 85537 Adapter To Rotor
Figure 1006 (Sheet 1)
(Task 72-35-01-440-004)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-04

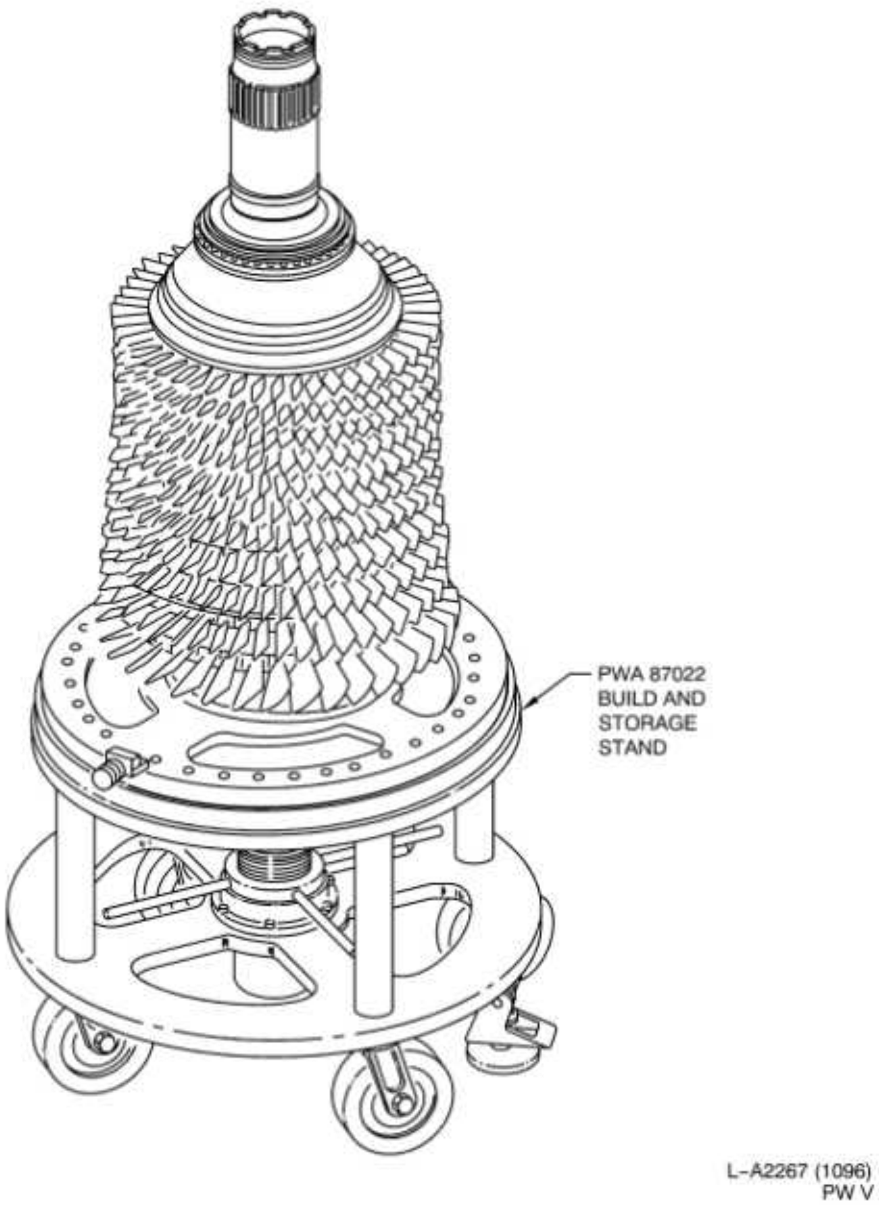

PWA 85531
TORQUE
ADAPTER
PWA 85530
TORQUE
WRENCH
PWA 85529
RETAINING NUT
L-A2265 (0000)
PW V

Install PWA 85537 Adapter To Rotor
Figure 1006 (Sheet 2)
(Task 72-35-01-440-004)


PWA 7797 SLING
PWA 85086
LIFT ARM
PWA 85124
LIFT ADAPTER
PWA 26147
LIFT AND
TRUNNION
ADAPTER
(2 REQUIRED)
L−A2266 (0000)
PW V

Trunnion Rotor Assembly
Figure 1007
(Task 72−35−01−440−004)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04


PWA 87022
BUILD AND
STORAGE
STAND
L-A2267 (1096)
PW V

Position Rotor Assembly In PWA 87022 Stand
Figure 1008
(Task 72−35−01−440−004)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04

Task 72−35−01−440−006:

1. Final Balance Axial Compressor Rotor Assembly (After The Blade Tip Grinding Operation)

A. Prerequisites

(1) Grind the axial compressor rotor assembly blade tips by Assembly−03 Task 72−35−01−440−003.

B. Equipment And Materials Necessary

Special Tools:

PWA 76154	Adapters (2 Necessary)
PWA 78064	Gage
PWA 80515	Stand
PWA 85086	Arm (2 Necessary)
PWA 85124	Adapter, Lift
PWA 85159	Thread Protector
PWA 85160	Thread Protector
PWA 85161	Adapter
PWA 85294	Adapter
PWA 85337	Stand
PWA 85403	Shroud
PWA 85428	Thread Protector
PWA 85528	Adapter, Handling
PWA 85529	Nut
PWA 85530	Wrench
PWA 85531	Adapter
PWA 85537	Fixture, Handling (For Compressors With A Symmetric Case)
PWA 85580	Stand, Support
PWA 85593	Ring, Adapter
PWA 87022	Stand, Build And Storage
PWA 87492	Riveter (Optional to PWA 100002)
PWA 88560	Fixture, Handling (For Compressors With An Asymmetric Case)
PWA 88575	Weight, Front Calibration (For Balance Machines Without Electronic Calibration)
PWA 88576	Weight, Rear Calibration (For Balance Machines Without Electronic Calibration)
PWA 88643	Sling (Optional to PWA 88673)
PWA 88673	Sling
PWA 88700	Adapter, Lift
PWA 100002	Riveter
PWA 101714	Adapter, Drive

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04

Consumable Materials:

Item No.	Designation
P09−014	Sealant, Silicone Rubber (PWA 36003)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Rivet	A/R	79−35−00/10/20

C. Procedure

NOTE: Installation of HPC blade seals (ladder seals) was optional for the pre−grind balancing of the rotor assembly.

(1) Remove all clamp−on weights that were installed for the initial balance operation (before blade tip grind).

(a) Check the record to find how many weights were installed at the before blade tip grind balance operation and, if any, during the blade tip grind operation.

(b) Be sure that the same number of weights that were installed are also removed.

(2) (Pre SB PW4ENG 72−562) Attach PWA 85161 Adapter to the front hub and PWA 85124 Adapter to the rear shaft. (Post SB PW4ENG 72−562) Attach the PWA 85161 Adapter to the front hub and the PWA 88700 Adapter to the rear shaft. See Figure 1001.

(3) Install two PWA 85086 Lifting Arms to the HPC front and to the rear adapters. Attach hoist to arms. See Figure 1001.

(4) Install PWA 85403 Shroud to base of HL−50 balancer. See Figure 1002 (Sheet 1).

(5) Lift the rotor from the transport stand and position over the cradles of the balance machine with the rear shaft to the drive end of the balance machine. Lower the rotor to the cradles. Remove hoists, hub/shaft arms and adapters from the rotor. Attach the rotor to the cradles. Remove the rear shaft airseal protector.

(6) Use an indicator and check the runouts where shown. See Figure 1002.

(7) Install the PWA 101714 Drive Adapter to the HPC rear shaft so that the splines on the adapter engage the splines on the shaft and the adapter is seated against the shaft. Actuate the screw(s) to tighten the adapter on the shaft. Torque the screw(s) to 10 − 30 lb−in. (1.130 − 3.390 N.m). Install the balance machine driveshaft to the drive adapter. Cover the rotor with the shroud.

(8) Calibrate balance machine to 4.0 oz−in. (2880 g.mm) in Plane AL and 5.0 oz−in. (3600 g.mm) in Plane AJ.

(a) For balance machines without electronic calibration, do a check of the static balance machine.

1 Install PWA 88575 Front HPC Rotor Calibration Weight over the front knife−edge seal, with screw outboard. Balance Plane AL is shown on Figure 1003 (Sheet 1).

2 Install PWA 88576 Calibration Weight to the balance flange at Plane AJ on the Stage 15 disk. See Figure 1003 (Sheet 2).

3 Calibrate balance machine.

4 After you calibrate the balance machine, remove the calibration weights.

(b) For balance machines with electronic calibration, use the manufacturer's instructions to do a check of the static balance machine.

(9) Balance the axial compressor rotor assembly at 900 rpm minimum in Planes AL and AJ when mounted on Diameters F and C.

(a) Initial unbalance must not be more than 30 oz−in. (21600.0 g.mm) for each plane or 16 oz−in. (11520.0 g.mm) for each plane if the unbalance vectors are within 30 degrees of each other.

(b) If the initial unbalance is not met, check the runout again. The runout must be within permitted limits. If it is not, check the bolted joints for correct seating. If, after you check the runout again and you still cannot get the initial unbalance, subassemblies can be turned to get the initial unbalance. Stage 15 blades can be removed and installed, light to heavy, to get the initial unbalance.

(c) When you get the initial unbalance, balance the rotor at 900 rpm minimum to the limits that follow:

1 For final dynamic balancing of the rotor, after rotor tip grinding (for operators that want to tip grind the HPC rotor assembly) or for final rotor dynamic balance when the rotor will not be ground, the remaining unbalance must be within 0.20 oz−in. (144.0 g.mm) at the front Plane AL and within 0.50 oz−in. (360.0 g.mm) at the rear Plane AJ.

(d) (Post SB PW4ENG 72−515) Engines with an integrated inlet airseal and Stage 5 disk, (with balance flange removed) balance correction at Plane AL (HPC forward end) as follows:

NOTE: Balance Plane AL is moved to the location shown in Figure 1003 (Sheet 1).

1 Correct the balance by the installation of one counterweight (PN 54H737, PN 54H738 or PN 54H739) to the bottom of a 5th stage blade, at as many blade locations as necessary.

2 Remove sealant from around 5th stage blade lock and remove lock with a non−metallic drift and discard.

3 Remove the 5th stage blade. Remove the sealant from the 5th stage blade root to permit installation of the counterweight. Remove the sealant from the slot in the 5th stage disk in the area where the blade was removed.

4 Apply Silicone Rubber Sealant P09−014 as shown in Figure 1003 (Sheet 1) to counterweight. Place counterweight with sealant to the bottom of the blade root. Sealant cure is waived. Apply Silicone Rubber Sealant P09−014 to the blade lock groove in the blade and the disk. Install the blade and secure with a new blade lock. Apply Silicone Rubber Sealant P09−014 to cover the blade lock bent end.

CAUTION: COUNTERWEIGHTS MUST NOT BE INSTALLED AT LOADING SLOT LOCATIONS. BLADES MAY BE DAMAGED AT THESE LOCATIONS. TOTAL QUANTITY OF COUNTERWEIGHTS ALLOWED INCLUDES QUANTITY USED IN SUBASSEMBLY BALANCING.

(e) Balance correction at Plane AJ (HPC aft end): Correct balance by the installation of counterweights (PN 53H472) to the balance flange on the rear drum in the quantities specified. See Figure 1003 (Sheet 2). Use PWA 87492 Riveter or PWA 100002 Riveter to attach the counterweights to the balance flange with rivets.

(f) If unbalance cannot be corrected to within 0.20 oz−in. (144.0 g.mm), or less in Plane AL and 0.50 oz−in. (360.0 g.mm), or less in Plane AJ by the installation of the maximum quantity of counterweights in Planes AL and AJ, then install counterweights to Plane AF, Stage 13, and measure the balance in Plane AJ again. See Figure 1003 (Sheet 3).

CAUTION: SETSCREW CHANGE LETTER C AND LOCK CHANGE LETTER C AND LOCK AND SETSCREW ASSEMBLY CHANGE LETTER A MUST BE INSTALLED BY LOCKING SETSCREW TO RUNNING TORQUE PLUS 4 − 8 LB−IN. (0.452 − 0.904 N.m).

(10) Blade lock screws must not turn under 10 lb−in. (1.130 N.m) of applied torque. If the screw turns then torque the setscrew to the running torque plus 8 − 12 lb−in. (0.904 − 1.356 N.m).

(11) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04

(a) Method 1: Measure height clearance between blade lock and top of blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

1 If these limits are not kept, check the lock for correct assembly in the disk.

(12) Disconnect the drive unit and remove from the shaft. (Pre SB PW4ENG 72−562) Install PWA 85124 Adapter to the rear shaft and PWA 85161 Adapter to the front hub. (Post SB PW4ENG 72−562) Install the PWA 88700 Adapter to the rear shaft and the PWA 85161 Adapter to the front hub. See Figure 1001.

(13) Install PWA 85086 Arm to HPC front hub. Attach hoist to arm. Install PWA 85086 Arm to rear shaft. Attach hoist to arm. See Figure 1001.

(14) If rotor is to be stored for a period of time, raise rotor from balance machine and lower into PWA 85337 Transport Stand. Remove hoists, arms and adapters. See Figure 1004.

(a) Install PWA 85160 Thread Protector to front hub and PWA 85159 Thread Protector to rear shaft.

(b) Install PWA 85428 Protector on rear shaft airseal.

(15) If rotor is not to be stored, trunnion rotor assembly to front end up position. Remove hoist, arm, and adapter from rear shaft. Lower rotor assembly into PWA 85580 Support Stand with PWA 80515 Stand, PWA 85294 Adapter and PWA 85593 Adapter. Remove hoist, arm, and adapter from front hub. See Figure 1005.

(16) Install the handling fixture to the HPC front hub.

(a) For compressors with the symmetric case, install the PWA 85528 Adapter with the PWA 85537 Fixture to the HPC front hub. See Figure 1006 (Sheet 1).

(b) For compressors with the asymmetric case, install the PWA 85528 Adapter with the PWA 88560 Fixture to the HPC front hub.

(c) Attach the Fixture and Adapter with the PWA 85529 Nut.

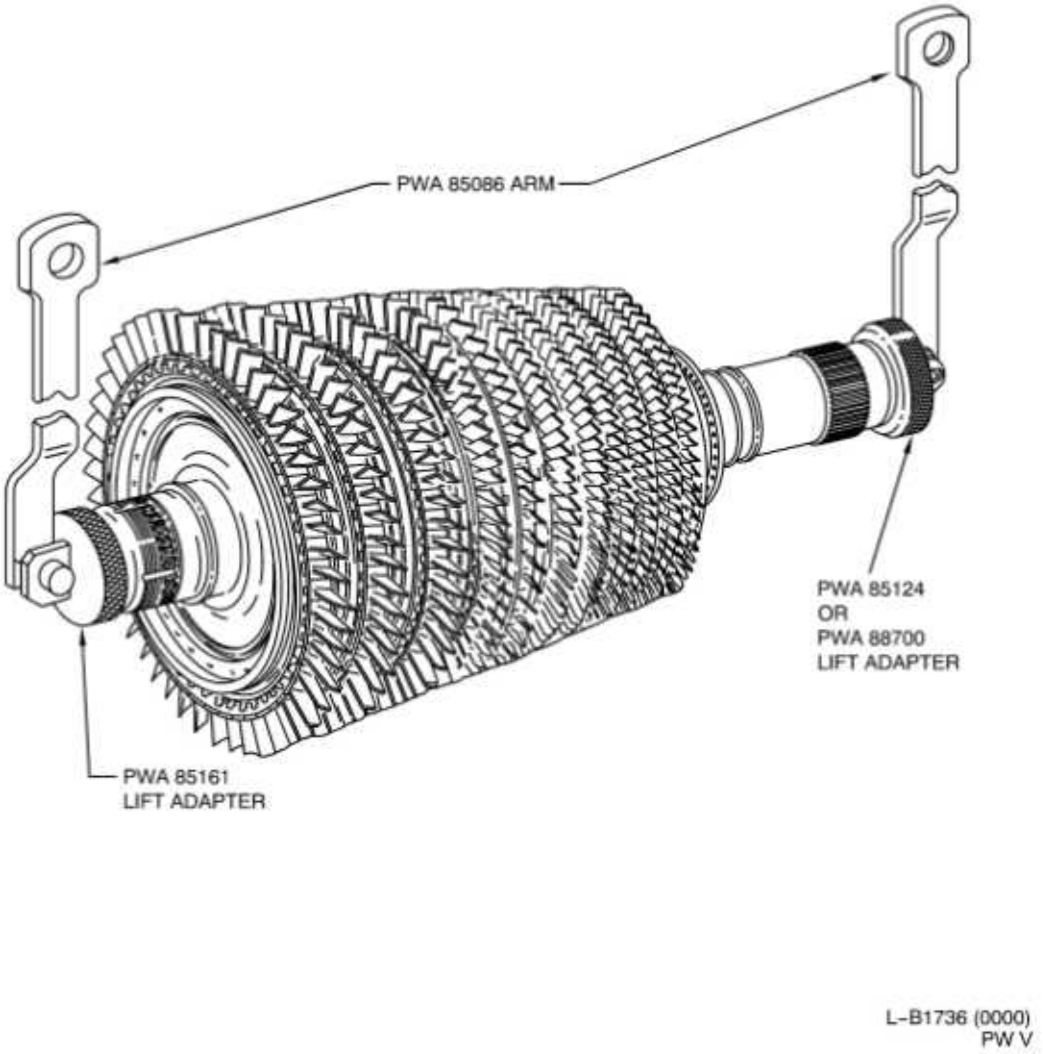
(d) Use the PWA 85530 Wrench and PWA 85531 Adapter to torque the Nut to 300 lb−in.(33.895 N.m).

(17) (Pre SB PW4ENG 72−562) Install the PWA 88643 Sling or PWA 88673 Sling with two PWA 76154 Adapters to the spools of the fixture and raise the rotor from the stand. Install the PWA 85124 Adapter to the rear shaft. Install the PWA 85086 Arm to the adapter and use the hoist to trunnion the rotor to the front end down position. See Figure 1007.

(18) (Post SB PW4ENG 72−562) Install the PWA 88643 Sling or PWA 88673 Sling with two PWA 76154 Adapters to the spools of the fixture and raise the rotor from the stand. Install the PWA 88700 Adapter to the rear shaft. Install the PWA 85086 Arm to the adapter and use the hoist to trunnion the rotor to the front end down position. See Figure 1007.

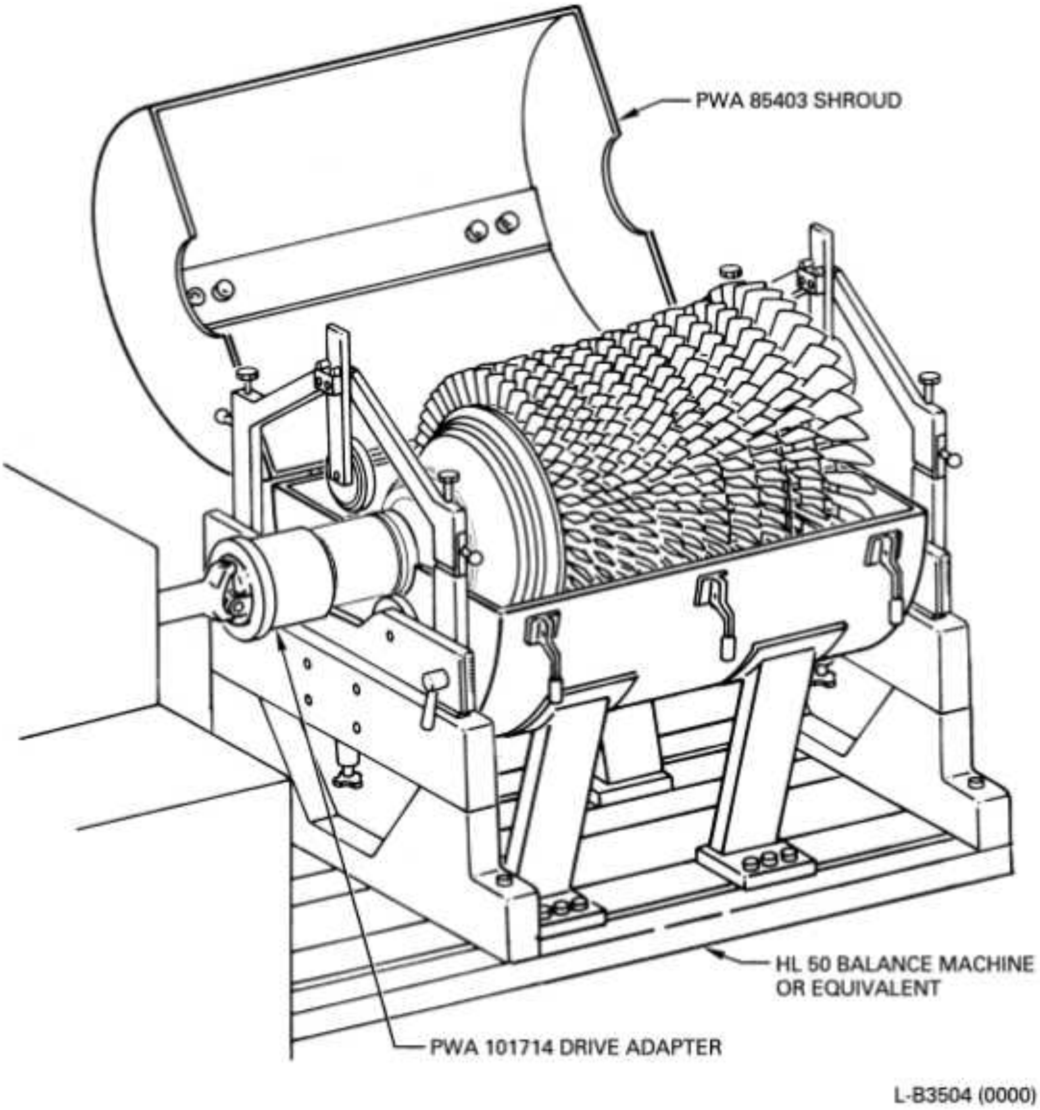
(19) Lower rotor assembly onto PWA 87022 Stand. Remove hoist, arm and adapter from rear hub. See Figure 1008.

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04


PWA 85086 ARM
PWA 85124
OR
PWA 88700
LIFT ADAPTER
PWA 85161
LIFT ADAPTER
L−B1736 (0000)
PW V

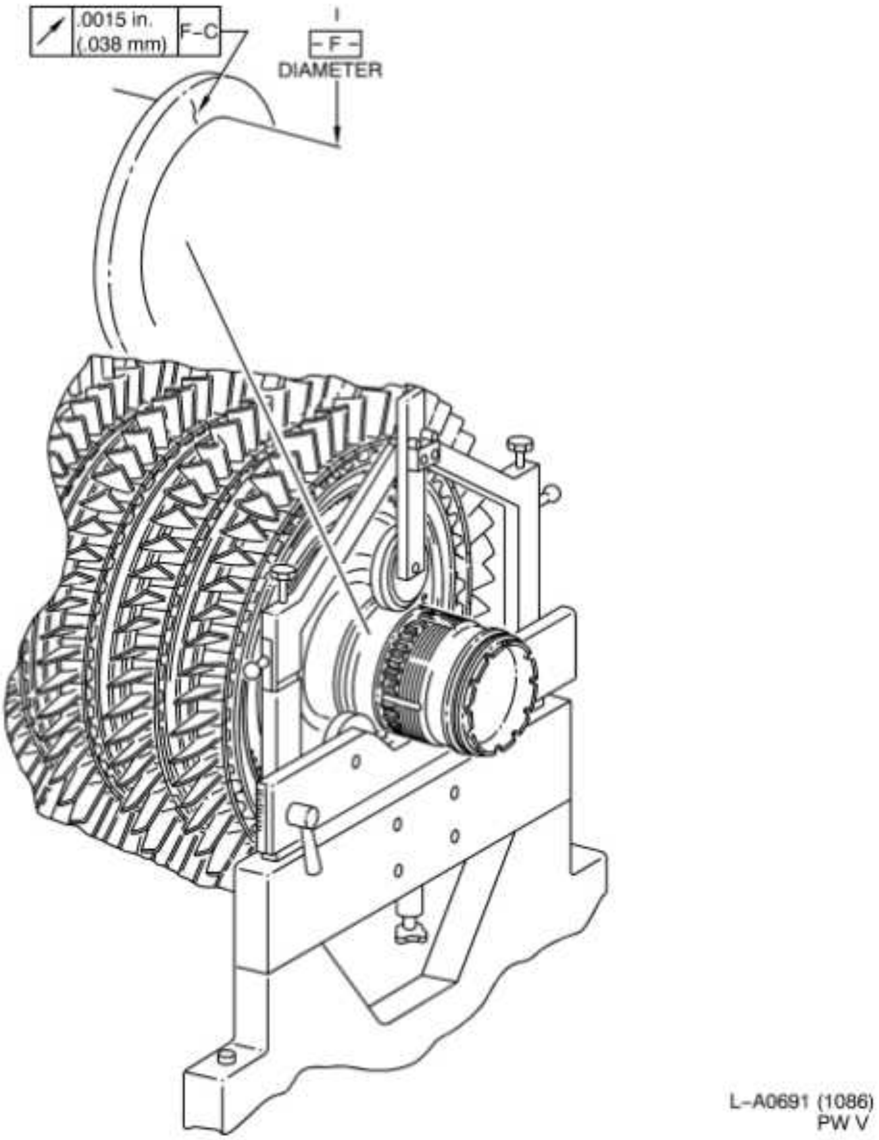
Lift Axial Compressor Rotor Assembly
Figure 1001
(Task 72−35−01−440−006)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-04


PWA 85403 SHROUD
HL 50 BALANCE MACHINE OR EQUIVALENT
PWA 101714 DRIVE ADAPTER
L-B3504 (0000)

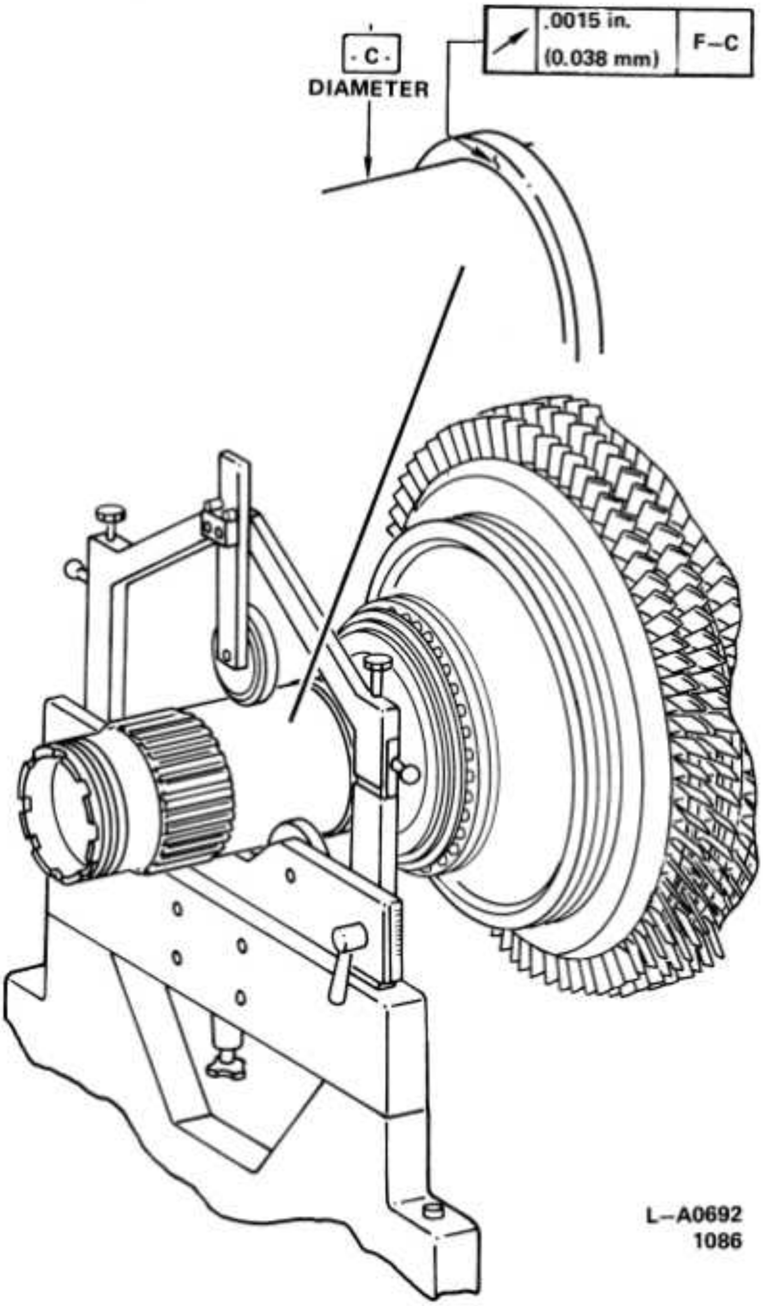
Axial Compressor Rotor Assembly In Balance Machine
Figure 1002 (Sheet 1)
(Task 72-35-01-440-006)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04


.0015 in.
(.038 mm)
F−C
− F −
DIAMETER
L−A0691 (1086)
PW V

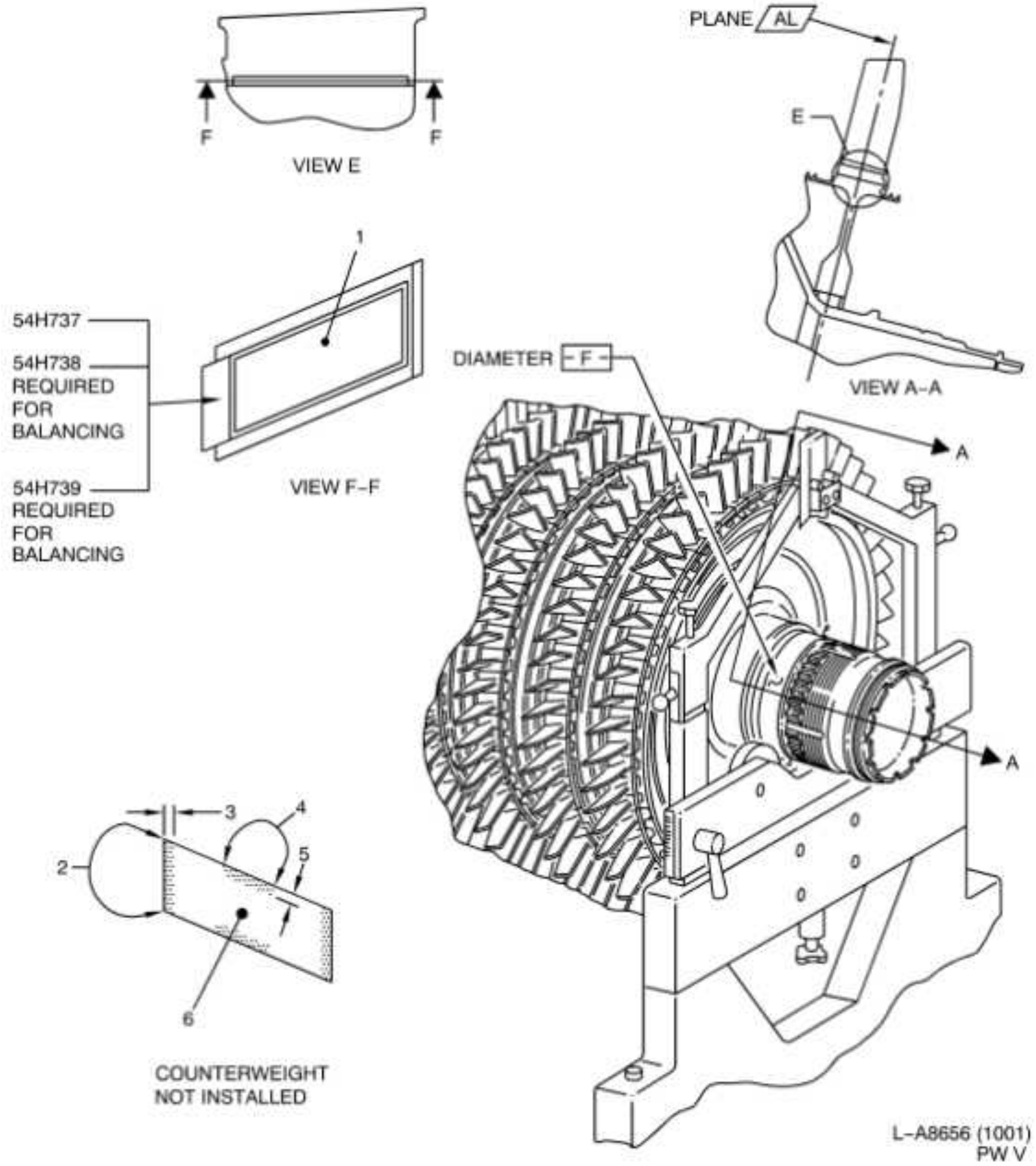
Axial Compressor Rotor Assembly In Balance Machine
Figure 1002 (Sheet 2)
(Task 72−35−01−440−006)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04


-C-
DIAMETER
.0015 in.
(0.038 mm)
F–C
L–A0692
1086

Axial Compressor Rotor Assembly In Balance Machine
Figure 1002 (Sheet 3)
(Task 72−35−01−440−006)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04

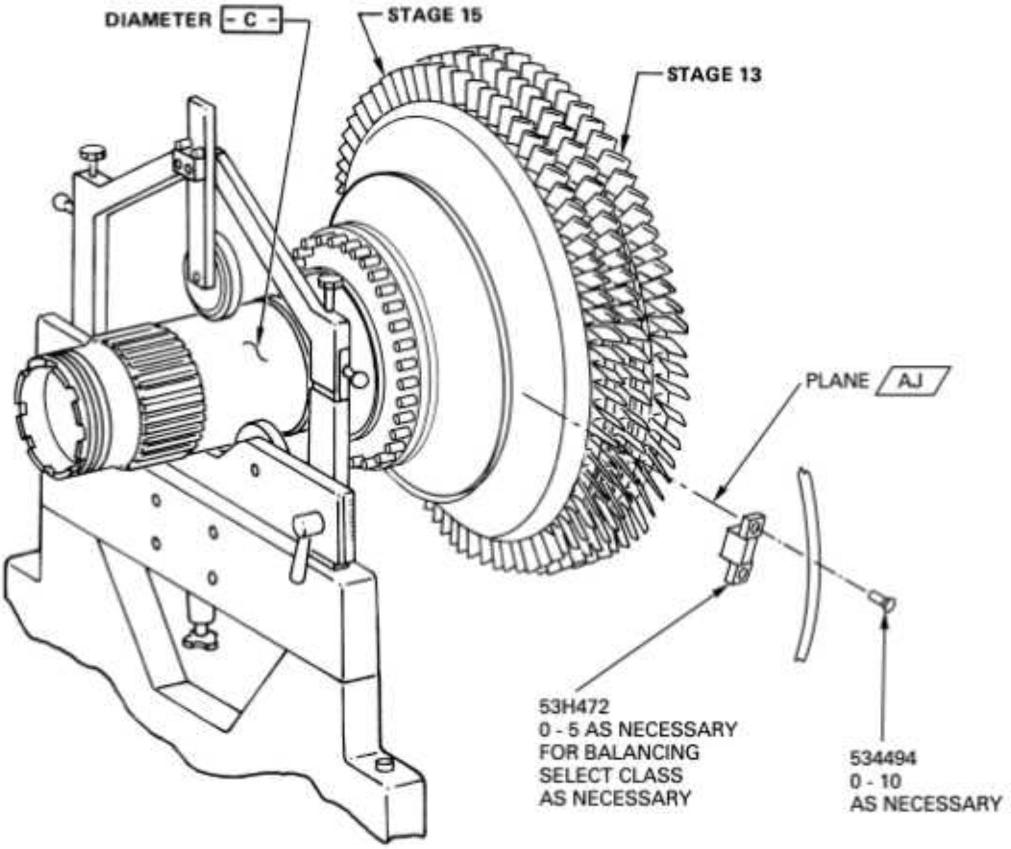

F
F
VIEW E
PLANE AL
E
VIEW A-A
1
54H737
54H738 REQUIRED FOR BALANCING
54H739 REQUIRED FOR BALANCING
VIEW F-F
DIAMETER F
A
A
2
3
4
5
6
COUNTERWEIGHT NOT INSTALLED
L-A8656 (1001)
PW V

Axial Compressor Rotor Assembly Balance
Figure 1003 (Sheet 1)
(Task 72−35−01−440−006)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-04

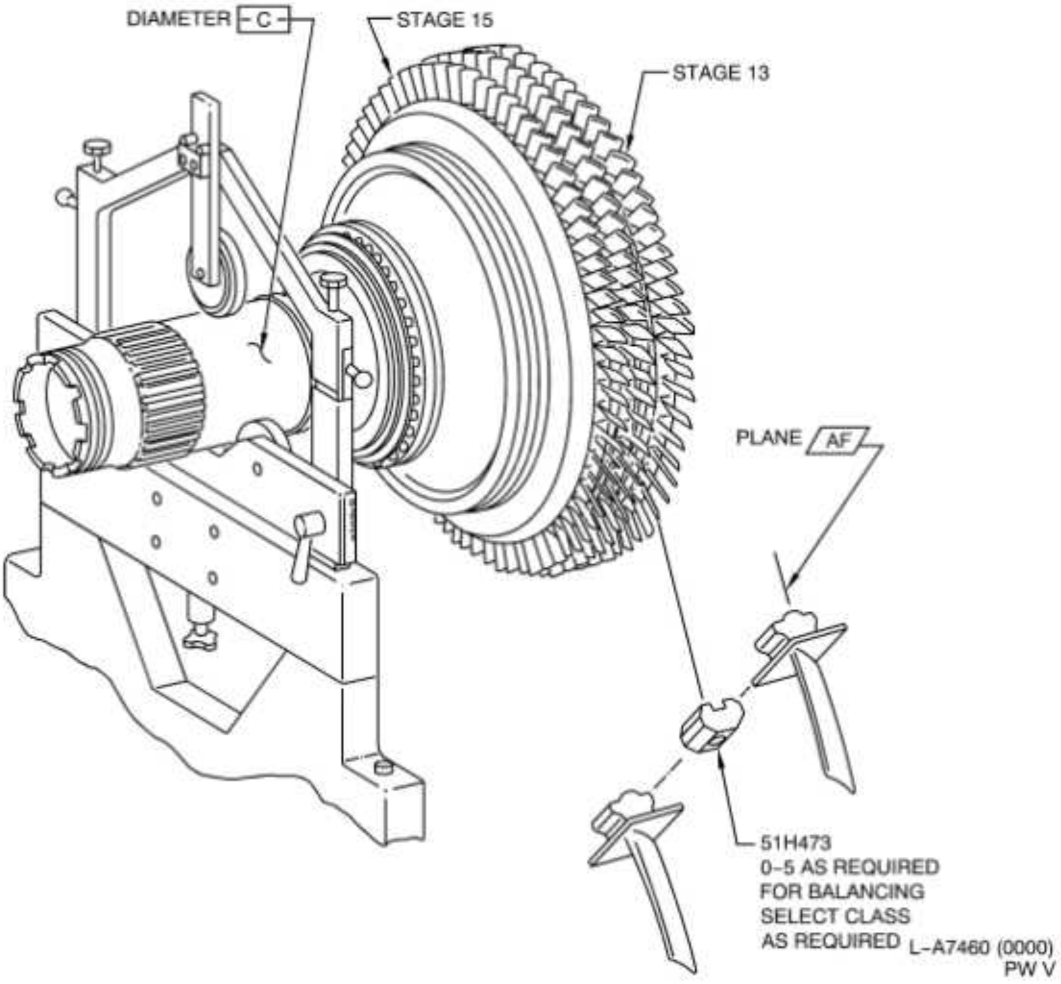
1. Counterweight Shown As Put On The Blade Root
2. Apply Sealant Here, Both Edges
3. 0.200 Inch (5.080 mm) Maximun, Forward and Aft Edges
4. Apply Sealant Here, Both Sides In Center 1/3 Of Each Side
5. 0.150 Inch (3.810 mm) Maximum, Both Sides
6. Counterweight Shown Not Put On The Blade Root

Key to Figure 1003 (Sheet 1)


DIAMETER -C-
STAGE 15
STAGE 13
PLANE AJ
53H472
0 - 5 AS NECESSARY
FOR BALANCING
SELECT CLASS
AS NECESSARY
534494
0 - 10
AS NECESSARY

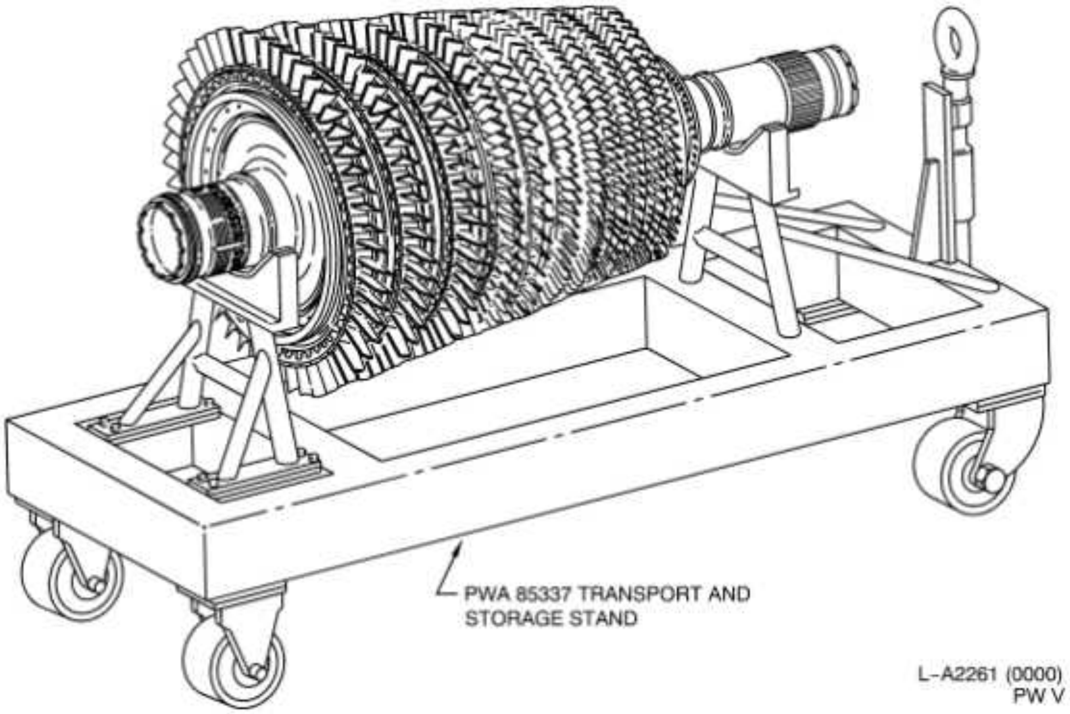
L-B0533 (0000)

Axial Compressor Rotor Assembly Balance
Figure 1003 (Sheet 2)
(Task 72−35−01−440−006)


DIAMETER -C-
STAGE 15
STAGE 13
PLANE AF
51H473
0-5 AS REQUIRED
FOR BALANCING
SELECT CLASS
AS REQUIRED
L-A7460 (0000)
PW V

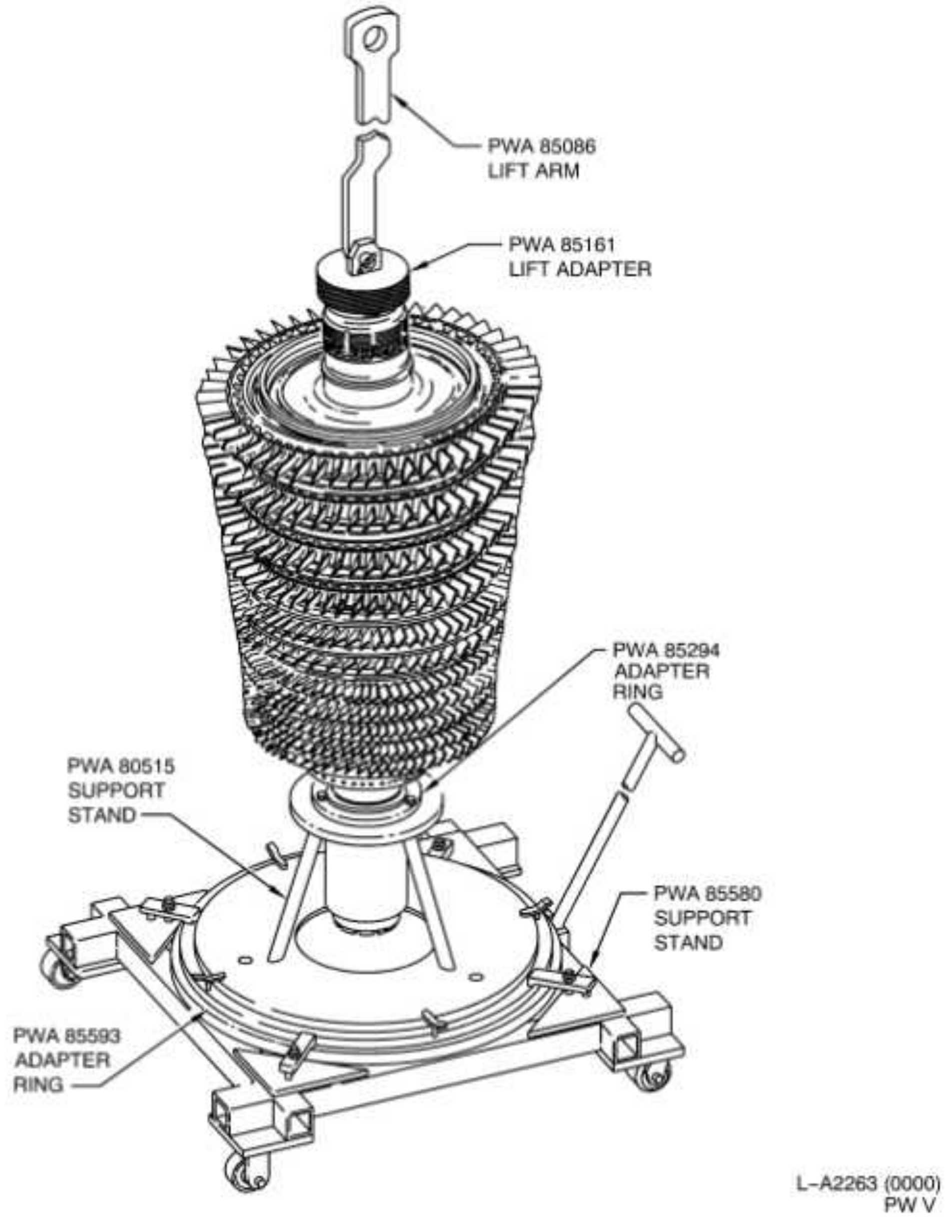
Axial Compressor Rotor Assembly Balance
Figure 1003 (Sheet 3)
(Task 72-35-01-440-006)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04

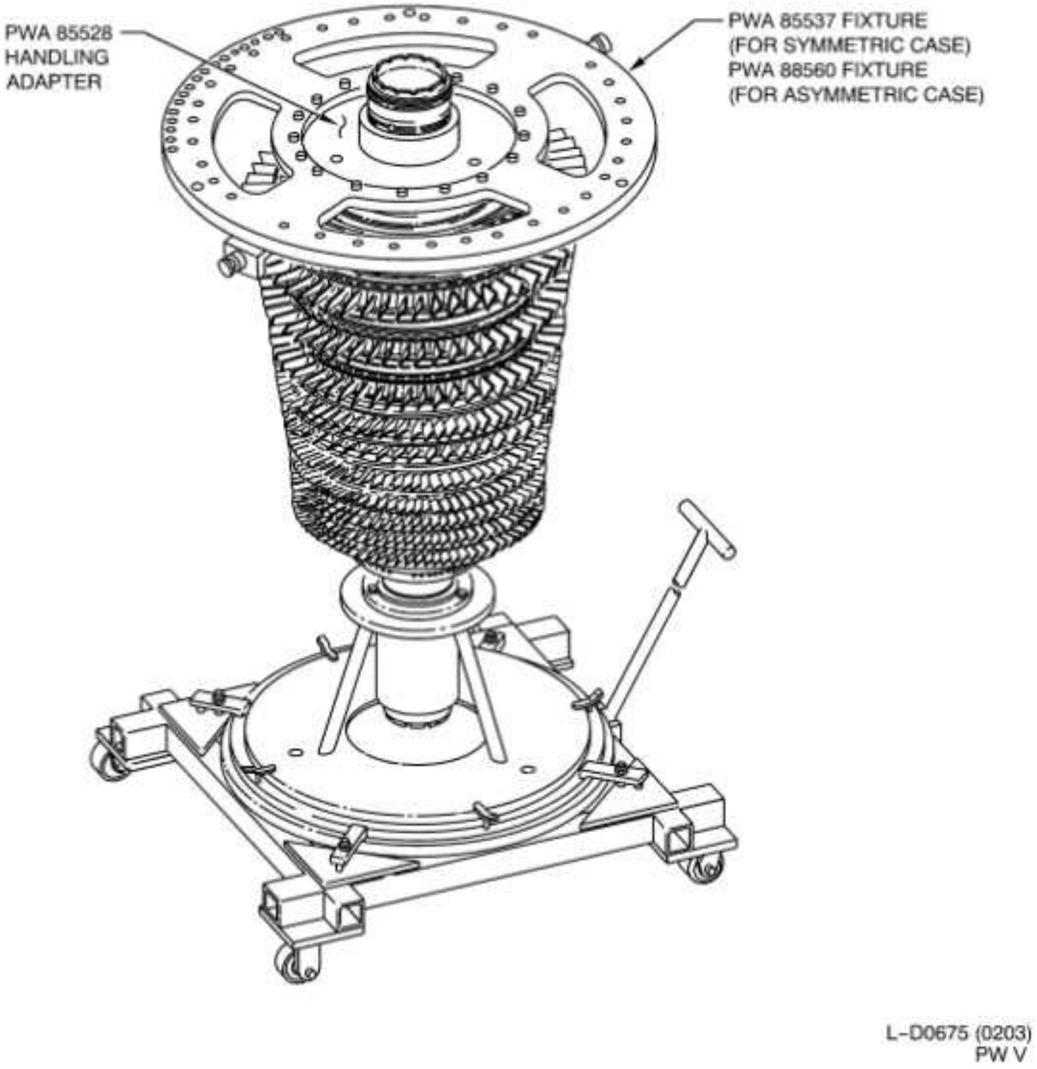

PWA 85337 TRANSPORT AND STORAGE STAND
L−A2261 (0000)
PW V

Transport Axial Compressor Rotor Assembly
Figure 1004
(Task 72−35−01−440−006)

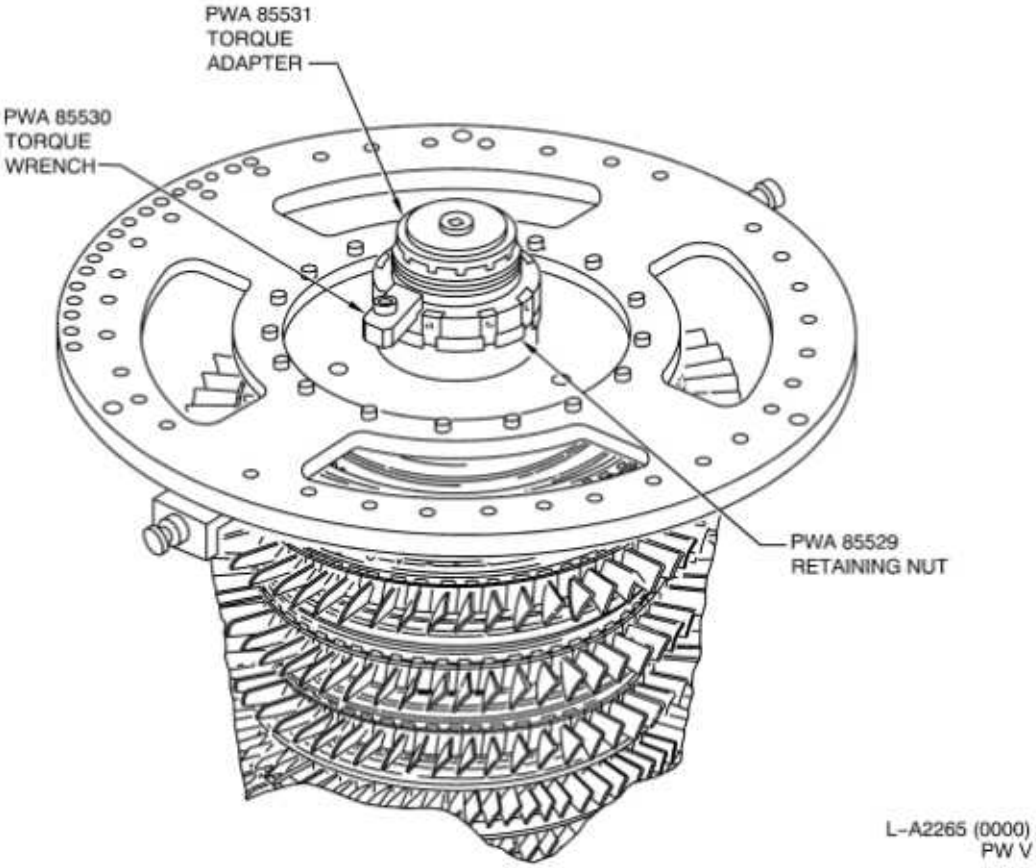
AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04


PWA 85086
LIFT ARM
PWA 85161
LIFT ADAPTER
PWA 85294
ADAPTER
RING
PWA 80515
SUPPORT
STAND
PWA 85580
SUPPORT
STAND
PWA 85593
ADAPTER
RING
L−A2263 (0000)
PW V

Install Rotor In Support Stand
Figure 1005
(Task 72−35−01−440−006)

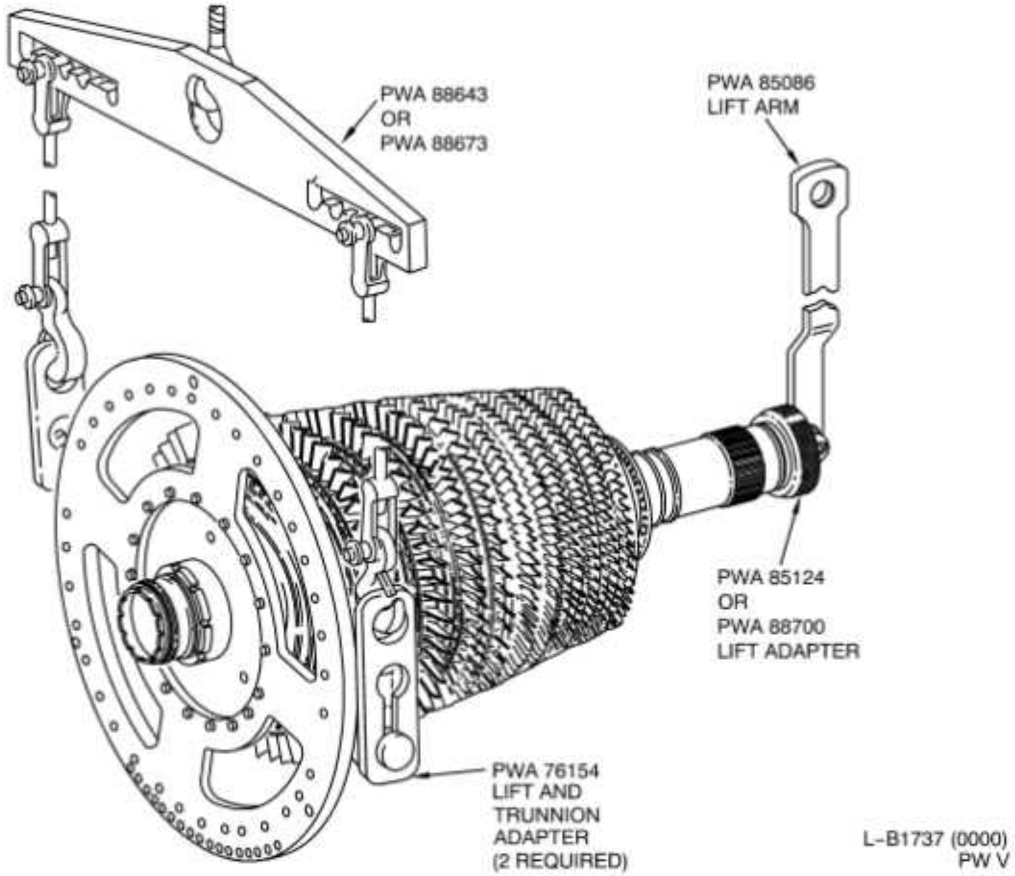

PWA 85528 HANDLING ADAPTER
PWA 85537 FIXTURE (FOR SYMMETRIC CASE)
PWA 88560 FIXTURE (FOR ASYMMETRIC CASE)
L-D0675 (0203)
PW V

Front Handling Fixture Installation
Figure 1006 (Sheet 1)
(Task 72−35−01−440−006)


PWA 85531
TORQUE
ADAPTER
PWA 85530
TORQUE
WRENCH
PWA 85529
RETAINING NUT
L−A2265 (0000)
PW V

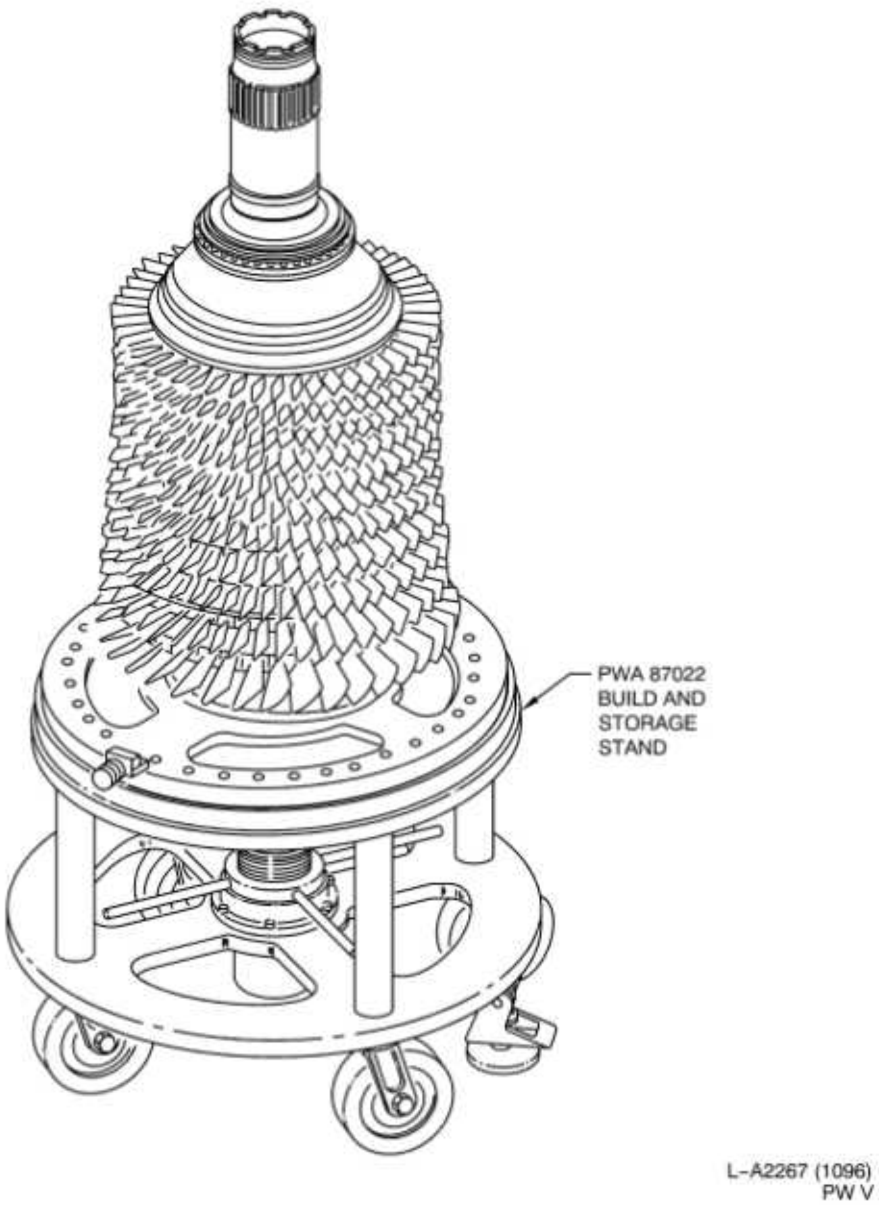
Front Handling Fixture Installation
Figure 1006 (Sheet 2)
(Task 72−35−01−440−006)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-04


PWA 88643
OR
PWA 88673
PWA 85086
LIFT ARM
PWA 85124
OR
PWA 88700
LIFT ADAPTER
PWA 76154
LIFT AND
TRUNNION
ADAPTER
(2 REQUIRED)
L-B1737 (0000)
PW V

Trunnion Rotor Assembly
Figure 1007
(Task 72-35-01-440-006)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−04


PWA 87022
BUILD AND
STORAGE
STAND
L-A2267 (1096)
PW V

Position Rotor Assembly In PWA 87022 Stand
Figure 1008
(Task 72−35−01−440−006)

Task 72-35-01-440-007:

1. Assemble (Debladed) Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble 9th stage bleed air tubes to drum rotor (front) assembly. See 72-35-38, Assembly-13 Task 72-35-38-440-014, Task 72-35-38-440-014-A00 or Task 72-35-38-440-014-B00.

(2) Assemble heatshield, shaft and airseal as required to drum rotor (rear) assembly. See 72-35-39, Assembly-01 Task 72-35-39-440-001, Task 72-35-39-440-001-A00 or Task 72-35-39-440-001-B00.

B. Equipment And Materials Necessary

Standard Tools:

Name	Manufacturer
Clements Cadillac Flameless Torch Model FT 1000	Clements Manufacturing Co. 6650 S. Narraganset Avenue Chicago, IL 60638

NOTE: The flameless torch specified above is optional to the heaters specified in the special tools list, and the optional flame torch.

Special Tools:

PWA 12632	Nut
PWA 12633	Ram
PWA 29389	Pump
PWA 29754	Heater Control
PWA 75028	Gage
PWA 76154	Adapter (2 Necessary)
PWA 80513	Rod
PWA 80763	Inserter, Tierod
PWA 85086	Lift Arm (2 Necessary)
PWA 85127	Adapter, Lift And Trunnion
PWA 85129	Support
PWA 85133	Adapter, Lift And Trunnion
PWA 85161	Adapter, Lift
PWA 85162	Adapter, Lift And Trunnion
PWA 85255	Adapter Plate
PWA 85256	Pin, Guide
PWA 85304	Wrench (Optional To PWA 86215)
PWA 85313	Heater (Optional Tools)

Special Tools:

(CONTINUED)

PWA 85314	Heater (Optional Tools)
PWA 85315	Heater (Optional Tools)
PWA 85328	Stand, Storage
PWA 85335	Heater (Optional Tools)
PWA 85426	Protector (Optional)
PWA 85427	Protector (Optional)
PWA 85580	Stand, Support
PWA 85593	Ring, Adapter
PWA 85596	Adapter, Threaded
PWA 86060	Console, Data Acquire
PWA 86061	Test Stand, Calibration
PWA 86215	Wrench System, Torque
.PWA 86062	Assembly, Gearbox
.PWA 86063	Module, Software
.PWA 86064	Assembly, Gearbox
.PWA 86065	Module, Software
.PWA 86066	Adapter, Calibration
.PWA 86067	Module, Software
.PWA 86068	Cabinet, Storage
.PWA 101501	Locator, Bolt
PWA 87775	Holder, Manual
PWA 87800	Tool, Retension
PWA 88643	Sling (Optional To PWA 88673)
PWA 88673	Sling

NOTE: The PWA 86215 Wrench System has all the tools indicated below the system.

Consumable Materials:

Item No.	Designation
P03-001	Engine Oil
P06-054	Paste, Antiseize (PWA 36246)

C. General Assembly Requirements

(1) Where heating is required for assembly, use minimum temperature differential of 125°F (52°C) between parts being assembled. Do not exceed 300°F (149°C) on any part.

(2) Where heating is required for assembly, special heaters are specified in the following procedure. However, you can use an optional flameless torch or flame torch as specified in the following steps.

(3) In locations where heating of a component in an oven is not practical or only a flange of the component requires heating, the use of Clements Cadillac Quick Heat flameless torch, Model FT 1000 is recommended.

(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: TITANIUM HEATS UP MORE RAPIDLY THAN OTHER MATERIALS. TAKE EXTREME CARE WHEN HEATING TITANIUM PARTS. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE FLAME WILL DAMAGE OR BURN NON−METAL PARTS.

CAUTION: DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

D. Procedure

(1) Install PWA 85127 Adapter to the tierod end of the drum rotor (rear) assembly. Use PWA 88643 Sling or PWA 88673 Sling with two PWA 76154 Adapters to lift the drum rotor from the support.

(2) Assemble PWA 85593 Adapter Ring to PWA 85580 Support Stand. Place stand with ring adapter to set on adapter ring. Secure stand to adapter ring with clamps. Lower drum rotor to rest on ring adapter. Remove hoist, sling, adapters and adapter from drum rotor. See Figure 1001.

(3) Install PWA 85596 Threaded Adapter to drum rotor hub. Secure adapter to hub with clamp details. Install PWA 85427 Protector to rear hub airseal.

(4) Install PWA 85133 Adapter to the front flange of the drum rotor (front) assembly. Use a PWA 88643 Sling or PWA 88673 Sling with the PWA 76154 Adapters to lift the drum rotor (front). See Figure 1002.

(5) Position PWA 85313 Heater with PWA 29754 Control on bench heating element up. Lower drum rotor (front) to rest on heater. Heat drum rotor rear flange to temperature not to exceed 300°F (148.9°C). See Figure 1003.

(6) Install tierods in the front flange of the rear drum with PWA 80763 Tierod Inserter. See Figure 1004.

(7) Apply Antiseise Paste P06-054, to tierod threads on drum rotor (rear). Wipe off unwanted paste.

NOTE: In order to obtain proper prevailing torque, it is necessary to preassemble tierods and nuts prior to final assembly. Use PWA 87775 Manual Holder to lock tierods in place when nuts are run on tierods.

(8) When temperature of drum rotor is achieved, shut off heater and raise drum rotor (front) to position over drum rotor (rear) in assembly stand.

(9) Locate circled triangle denoting high point runout on front and rear drum snaps. Position both 180 degrees apart. Lower drum rotor, aligning tierods with tierod holes, to seat on drum rotor (rear). Remove hoist and sling with adapters.

(10) Install PWA 85255 Adapter Plate to rest on adapter on front flange of drum rotor (front). Install PWA 80513 Rod down through drums and secure to adapter in hub. Install PWA 12633 Ram and secure with PWA 12632 Nut. Using PWA 75028 Gage and PWA 29389 Pump attached to
R ram, apply load of 1448 psi (9983.6 kPa) maximum and allow parts to cool to touch. See Figure 1005.

(11) Remove pump and gage, nut, ram, rod, adapter plate and adapter.

(12) Apply Antiseise Paste P06-054, to contact face of 12th stage tierod nuts. Wipe off unwanted paste.

(13) Use the PWA 86215 Torque Wrench System (replaces PWA 85304 Wrench) with the PWA 86060 Data Acquisition Console and the PWA 86061 Calibration Test Stand to torque the 42 tierod nuts that hold the front drum rotor to the rear drum rotor. (See the manufacturers data for complete use instructions of the torque wrench system).

NOTE: See manufacturers data for complete use instructions.

(a) Install nuts into wrench and one by one place nuts onto each tierod.

(b) Run nuts down snug.

(14) FOR THESE MODELS: 4152, 4156A, 4158
(Reference 1550) Tighten and torque nuts in following sequence:

(a) FOR THESE MODELS: 4152, 4156A, 4158
Torque tierod nuts in pairs approximately 180 degrees apart, to 215 − 235 lb−in. (24.292 − 26.551 N.m). Then, in pairs approximately 90 degrees apart, to 215 − 235 lb−in. (24.292 − 26.551 N.m). Then, in pairs approximately 45 degrees apart, to 215 − 235 lb−in. (24.292 − 26.551 N.m) until all nuts have been torqued to 215 − 235 lb−in. (24.292 − 26.551 N.m).

(b) FOR THESE MODELS: 4152, 4156A, 4158
Using same sequence loosen nuts and tighten to 20 − 30 lb−in. (2.260 − 3.390 N.m) plus prevailing torque (torque required to turn nut due to self−locking feature of nut). Prevailing torque is 9.5 − 40 lb−in. (1.073 − 4.519 N.m). Then, apply angle of turn of 74 − 78 degrees. Bolt and nut must be replaced if final torque exceeds 700 lb−in. (79.089 N.m). Remove wrench.

(15) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
(Reference 1560) Tighten and torque nuts in following sequence:

(a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Torque tierod nuts in pairs approximately 180 degrees apart, to 215 − 235 lb−in. (24.292 − 26.551 N.m). Then, in pairs approximately 90 degrees apart, to 215 − 235 lb−in. (24.292 − 26.551 N.m). Then, in pairs approximately 45 degrees apart, to 215 − 235 lb−in. (24.292 − 26.551 N.m) until all nuts have been torqued to 215 − 235 lb−in. (24.292 − 26.551 N.m).

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Using same sequence loosen nuts and tighten to 20 − 30 lb−in. (2.260 − 3.390 N.m) plus prevailing torque (torque required to turn nut due to self−locking feature of nut). Prevailing torque is 9.5 − 40 lb−in. (1.073 − 4.519 N.m). Then, apply angle of turn of 74 − 78 degrees. Bolt and nut must be replaced if final torque exceeds 700 lb−in. (79.089 N.m). Remove wrench.

(16) Position PWA 85314 Heater, connected to PWA 29754 Control, on bench heating element up.

(17) Install PWA 85161 Adapter to front hub on storage rack. Attach PWA 85086 Arm to adapter. Using hoist attached to arm, raise hub.

(18) Lower hub to rest on heater. Heat rear snap to temperature not to exceed 300°F (148.9°C). See Figure 1006.

(19) When temperature of front hub is achieved, shut off heater and raise front hub to position hub over assembly in assembly stand. Locate circled triangle denoting high point runout on front drum and front hub. Position both 180 degrees apart. Using two PWA 85256 Guide Pin, lower hub to rest on assembly. Remove pins, hoist, arm and adapter from hub.

(20) Install PWA 80513 Rod down through hub and drums and secure to adapter in rear hub. Install PWA 85255 Adapter Plate to rest on front hub tierod flange. Install PWA 12633 Ram and secure with PWA 12632 Nut. Using PWA 75028 Gage and PWA 29389 Pump attached to
R ram, apply load of 1448 psi (9983.6 kPa) maximum and allow parts to cool to touch. See Figure 1007.

(21) Remove pump and gage, nut, ram, rod and adapter plate.

(22) Install PWA 85315 Heater, connected to PWA 29754 Control, on front hub tierod flange. Heat snap to temperature not to exceed 300°F (148.9°C). See Figure 1008.

(23) Install PWA 85162 Adapter to disk blade slots. Using hoist with PWA 88643 Sling or PWA 88673 Sling and PWA 76154 Adapters attached to adapter place disk on PWA 85129 Support, flange end down. Remove sling, hoist and adapter. See Figure 1009.

(24) For engines not incorporating integral inlet airseal and 5th stage disk (Pre SB PW4ENG 72-290), install inlet airseal.

  (a) Install PWA 85335 Heater to rest on Stage 5 disk. Connect PWA 29754 Control and heat snap to temperature not to exceed 300°F (148.9°C). See Figure 1010.

(b) When temperature of disk flange is achieved shut off heater and remove from hub. Install airseal to disk flange aligning bolt holes. Allow area to cool to touch. See Figure 1011.

(c) Install 40 bolts, threads lubricated with Engine Oil P03-001, and nuts. Install bolts, heads up, and tighten and torque nuts to 32 - 36 lb-in. (3.616 - 4.067 N.m). Install PWA 85426 Protector on airseal.

(25) For engines incorporating integral inlet airseal and 5th stage disk (Post SB PW4ENG 72-290), install PWA 85426 Protector on airseal.

(26) Install hoist with PWA 88643 or PWA 88673 Sling and PWA 76154 Adapters on the adapter (installed around blade slots). Raise and trunnion disk so tiebolt flange faces up and lower onto PWA 85328 Storage Stand.

(27) Install 42 tiebolts to flange using PWA 80763 Inserter. See Figure 1012.

(28) Apply Antiseise Paste P06-054, to threads of tierods on 5th stage. Wipe off unwanted paste.

NOTE: In order to obtain proper prevailing torque, it is necessary to preassemble tierods and nuts prior to final assembly. Use PWA 87775 Manual Holder to lock tierods in place when nuts are run on tierods.

(29) When temperature of front hub is achieved, shut off heater and remove from hub. Raise 5th stage assembly and install over hub. Locate circled triangle denoting high point runout on front hub and 5th stage disk. Position both 180 degrees apart. Lower disk aligning tierods with tierod holes. Remove hoist, sling, adapters and adapter from assembly.

(30) Install Rod PWA 80513 down through hub and drums and secure to adapter in rear hub. Install PWA 87800 Retention Tool to rest on 5th stage disk. Install PWA 12633 Ram and secure with PWA 12632 Nut. Using PWA 75028 Gage and PWA 29389 Pump attached to ram, apply
R load of 1448 psi (9983.6 kPa) maximum and allow parts to cool to touch. See Figure 1013.

(31) Remove pump and gage, nut, ram, rod and retention tool.

(32) Apply Antiseise Paste P06-054 , to contact face of 6th stage tierod nuts. Wipe off unwanted paste.

(33) Use the PWA 86215 Torque Wrench System (replaces PWA 85304 Wrench) with the PWA 86060 Data Acquisition Console and the PWA 86061 Calibration Test Stand to torque the 42 tierod nuts that hold the front drum rotor to the rear drum rotor. (See the manufacturers data for complete use instructions of the torque wrench system).

NOTE: See manufacturers data for complete use instructions.

(a) Install nuts into wrench and one by one place nuts onto each tierod.

(b) Run nuts down snug.

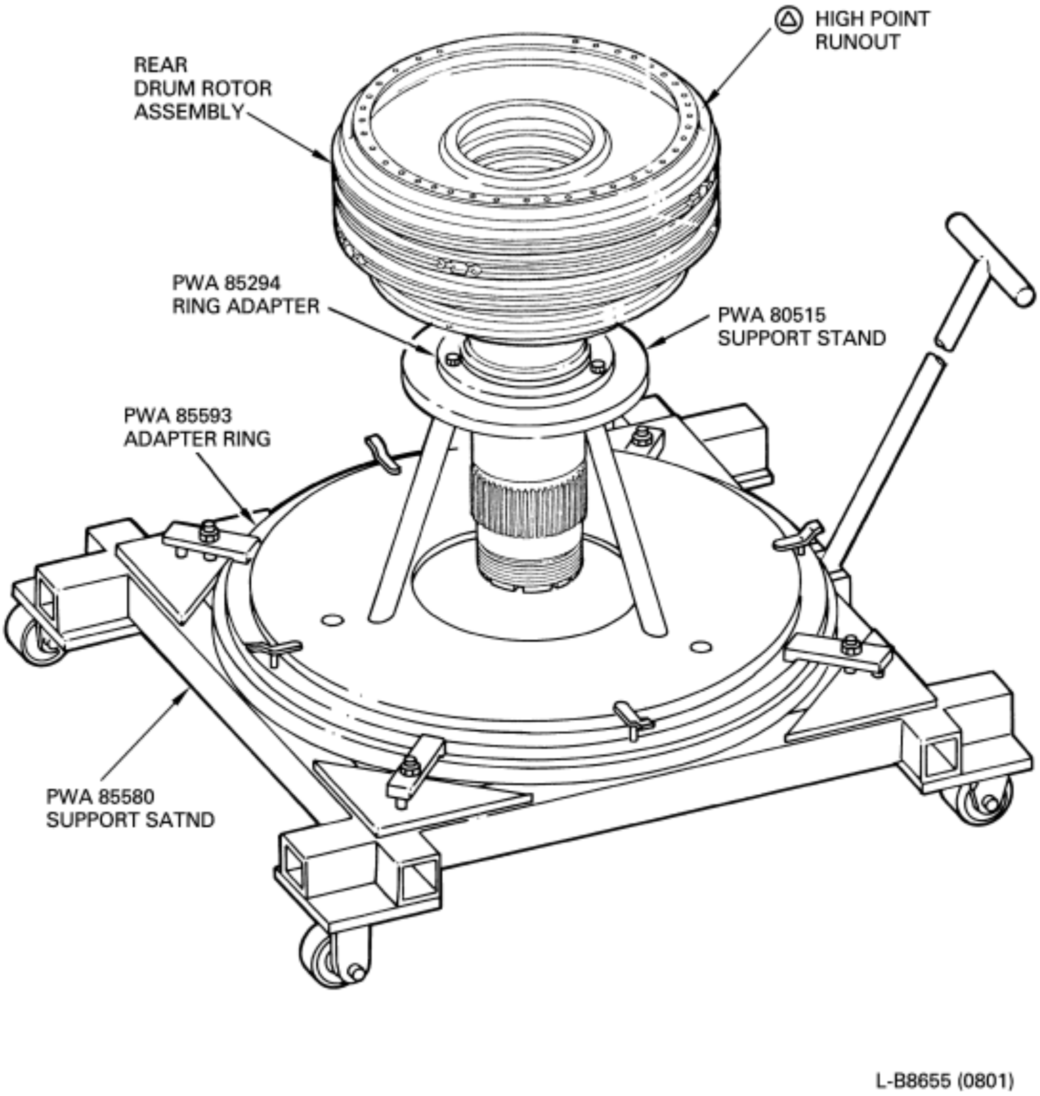
(34) (Reference 1550) Tighten and torque nuts in the following sequence.

(a) Torque tierod nuts in pairs approximately 180 degrees apart, to 215 - 235 lb-in. (24.292 - 26.551 N.m). Then, in pairs approximately 90 degrees apart, to 215 - 235 lb-in. (24.292 - 26.551 N.m). Then, in pairs approximately 45 degrees apart, to 215 - 235 lb-in. (24.292 - 26.551 N.m) until all nuts have been torqued to 215 - 235 lb-in. (24.292 - 26.551 N.m).

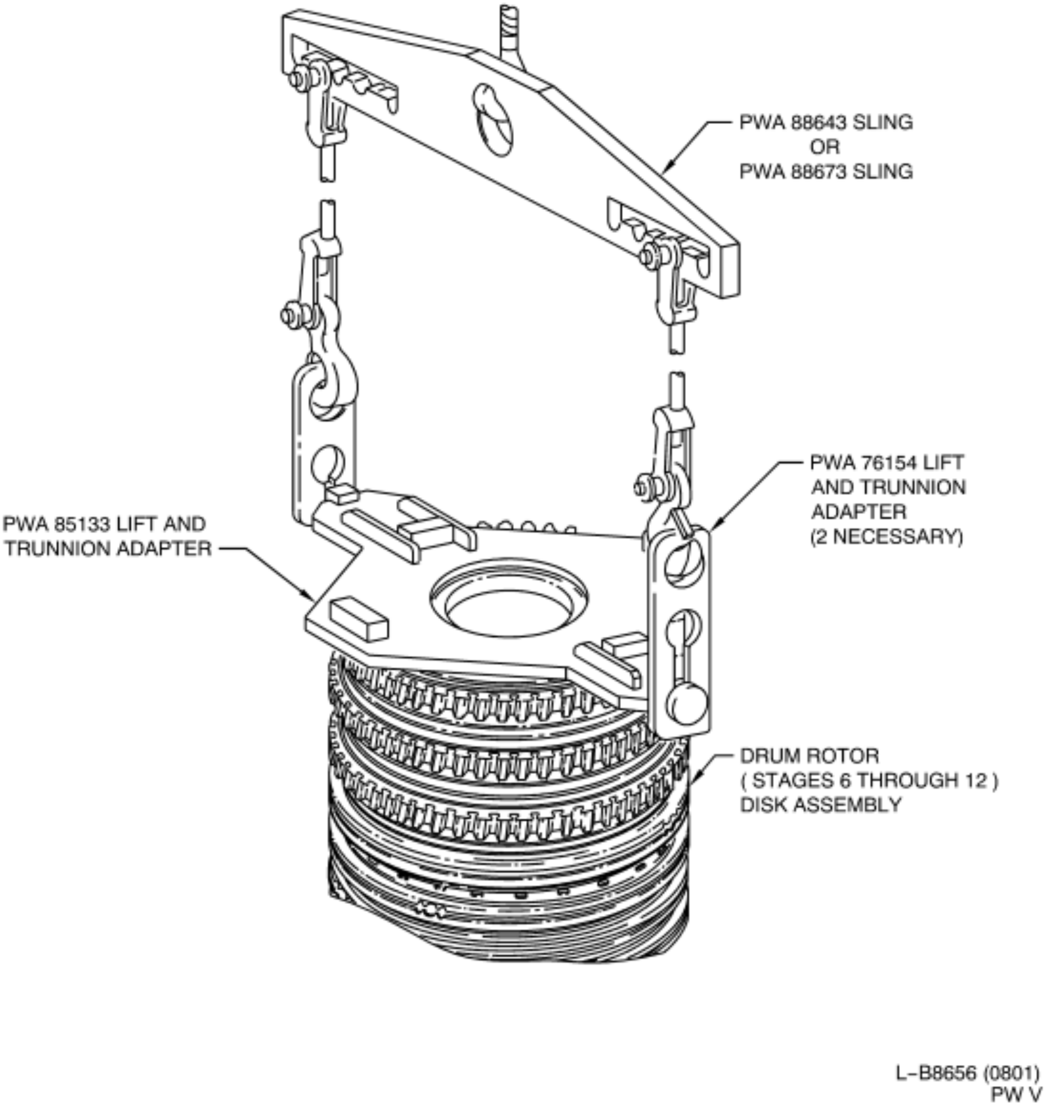
(b) Using same sequence loosen nuts and tighten to 20 - 30 lb-in. (2.260 - 3.390 N.m) plus prevailing torque (torque required to turn nut due to self-locking feature of nut). Prevailing torque is 9.5 - 40 lb-in. (1.073 - 4.519 N.m). Then, apply angle of turn of 72 - 76 degrees. Bolt and nut must be replaced if final torque exceeds 700 lb-in. (79.089 N.m). Remove wrench.

E. Postrequisites

(1) Install 15th stage blades in the (debladed) axial compressor rotor assembly. See Assembly-21, CONFIG-1 (Task 72-35-01-440-008) or Assembly-21, CONFIG-2 (Task 72-35-01-440-009).

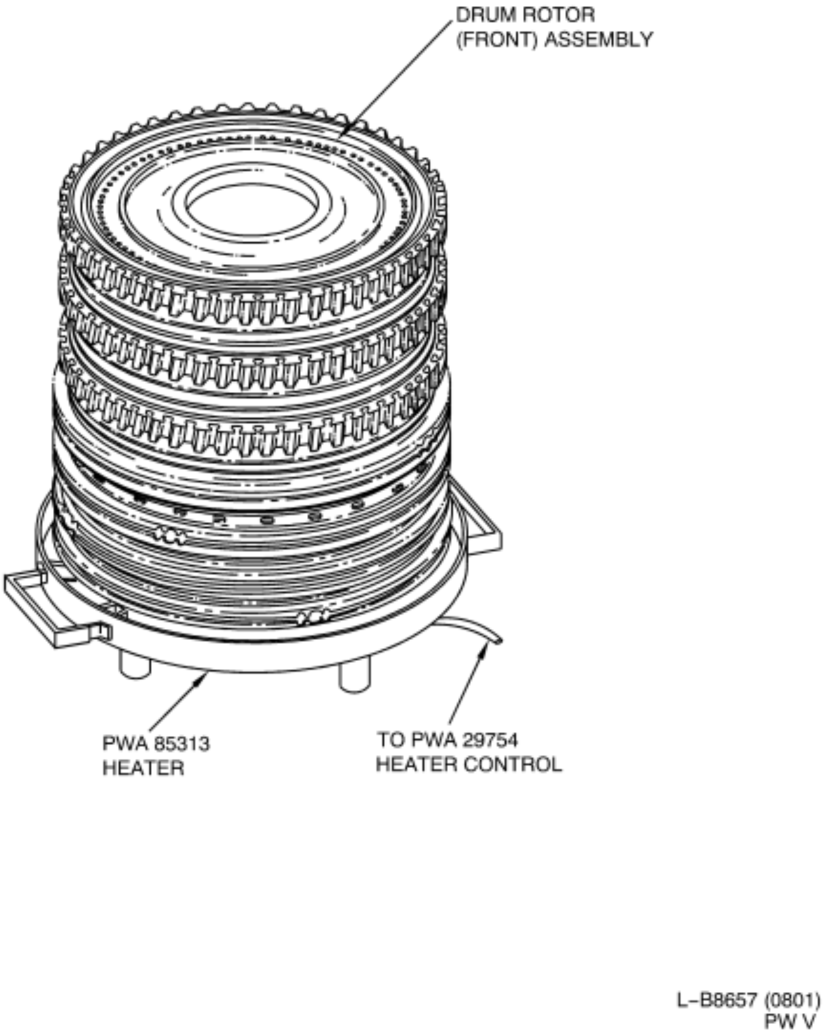

Ⓐ HIGH POINT RUNOUT
REAR DRUM ROTOR ASSEMBLY
PWA 85294 RING ADAPTER
PWA 80515 SUPPORT STAND
PWA 85593 ADAPTER RING
PWA 85580 SUPPORT SATND
L-B8655 (0801)

Rear Drum Rotor In The Assembly Stand
Figure 1001
(Task 72−35−01−440−007)


PWA 88643 SLING
OR
PWA 88673 SLING
PWA 76154 LIFT
AND TRUNNION
ADAPTER
(2 NECESSARY)
PWA 85133 LIFT AND
TRUNNION ADAPTER
DRUM ROTOR
(STAGES 6 THROUGH 12)
DISK ASSEMBLY
L−B8656 (0801)
PW V

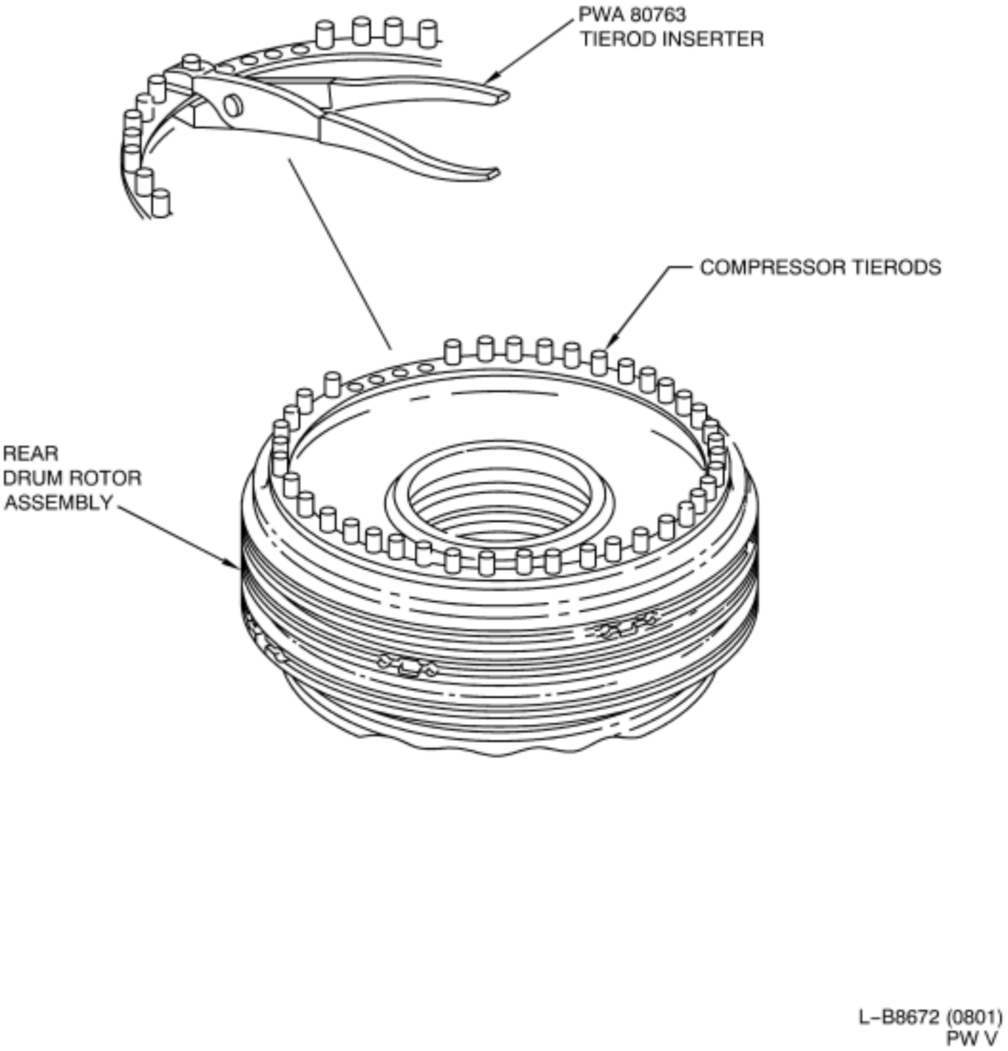
Front Drum Rotor Handling Tools
Figure 1002
(Task 72−35−01−440−007)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−20

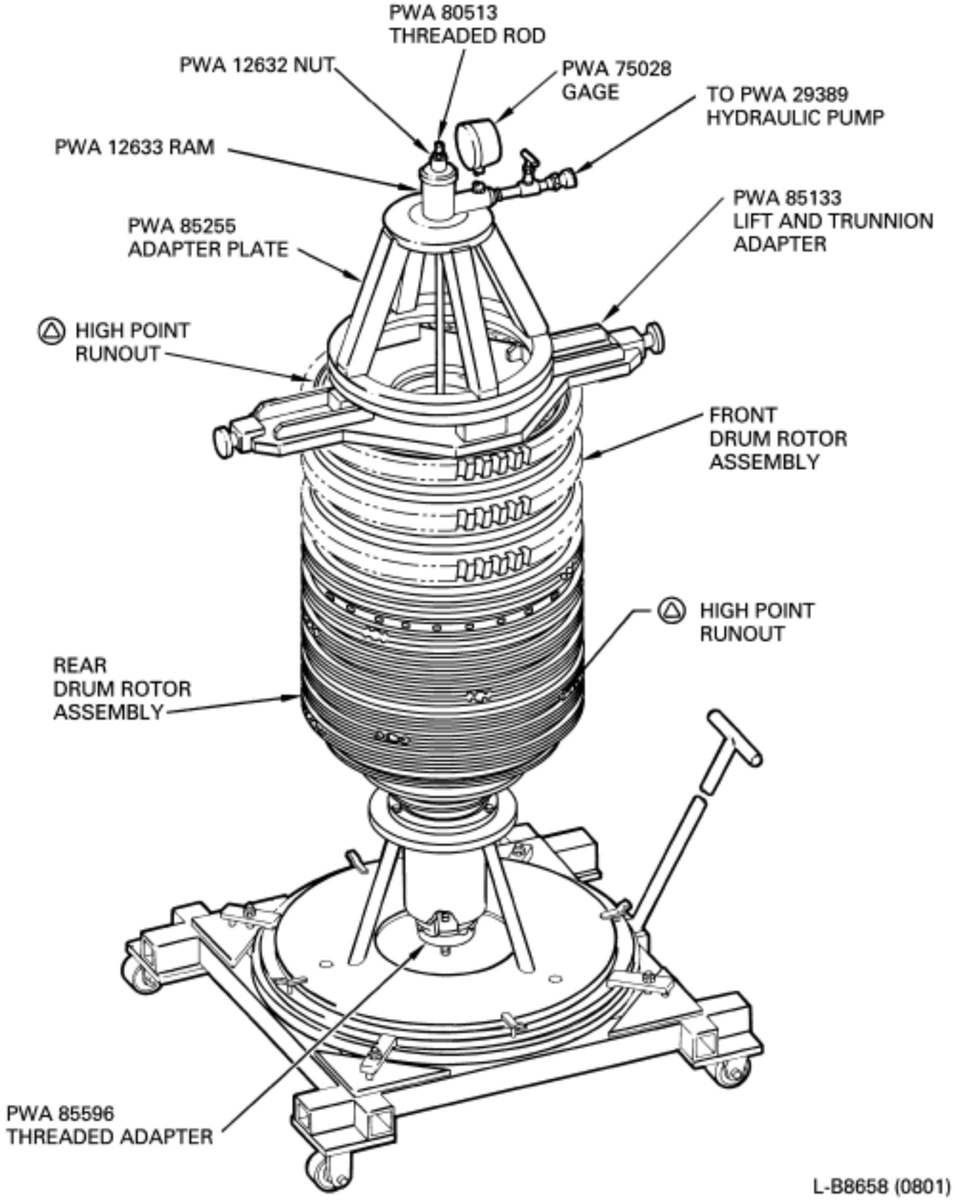

DRUM ROTOR
(FRONT) ASSEMBLY
PWA 85313
HEATER
TO PWA 29754
HEATER CONTROL
L−B8657 (0801)
PW V

Front Drum To Rear Drum Seating
Figure 1003
(Task 72−35−01−440−007)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−20

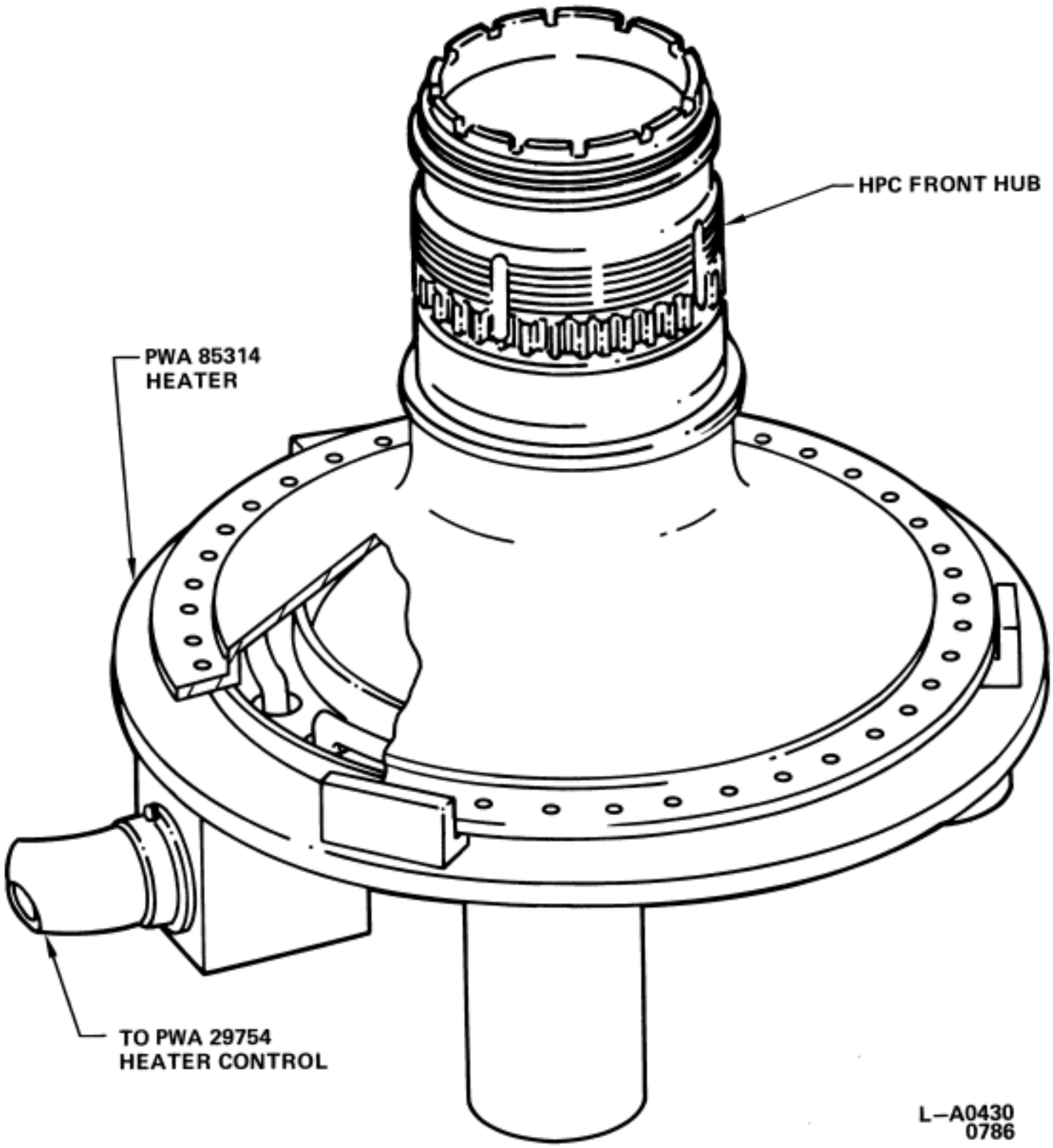

PWA 80763
TIEROD INSERTER
COMPRESSOR TIERODS
REAR
DRUM ROTOR
ASSEMBLY
L−B8672 (0801)
PW V

Tierod Installation
Figure 1004
(Task 72−35−01−440−007)

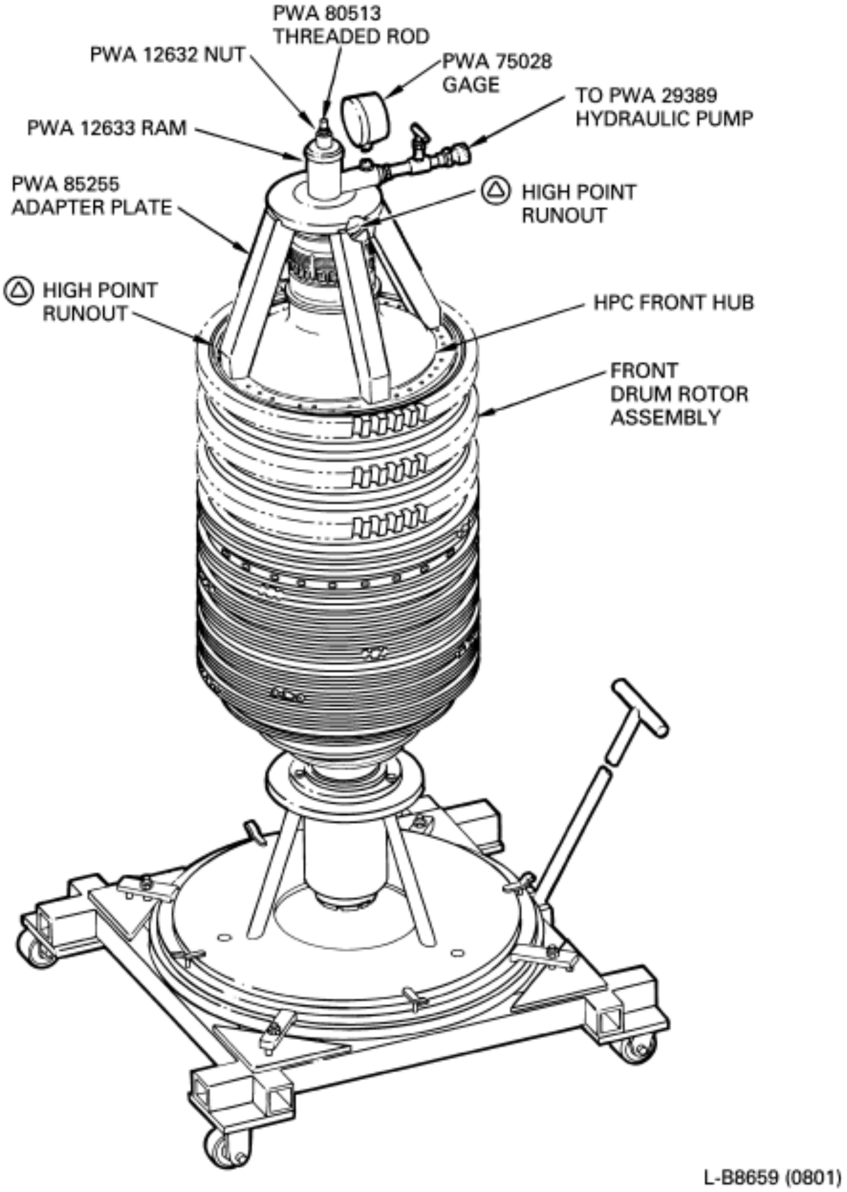

PWA 80513
THREADED ROD
PWA 12632 NUT
PWA 75028
GAGE
TO PWA 29389
HYDRAULIC PUMP
PWA 12633 RAM
PWA 85133
LIFT AND TRUNNION
ADAPTER
PWA 85255
ADAPTER PLATE
Ⓐ HIGH POINT
RUNOUT
FRONT
DRUM ROTOR
ASSEMBLY
Ⓐ HIGH POINT
RUNOUT
REAR
DRUM ROTOR
ASSEMBLY
PWA 85596
THREADED ADAPTER
L-B8658 (0801)

Front Drum To Rear Drum Seating
Figure 1005
(Task 72-35-01-440-007)

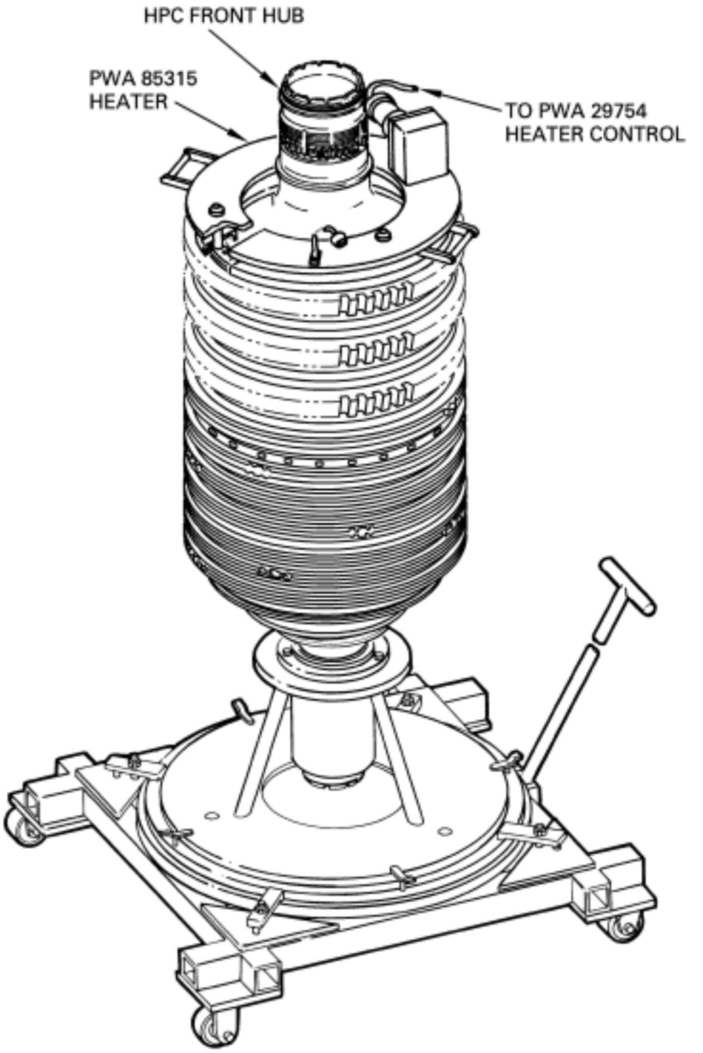
AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−20


HPC FRONT HUB
PWA 85314 HEATER
TO PWA 29754 HEATER CONTROL
L−A0430
0786

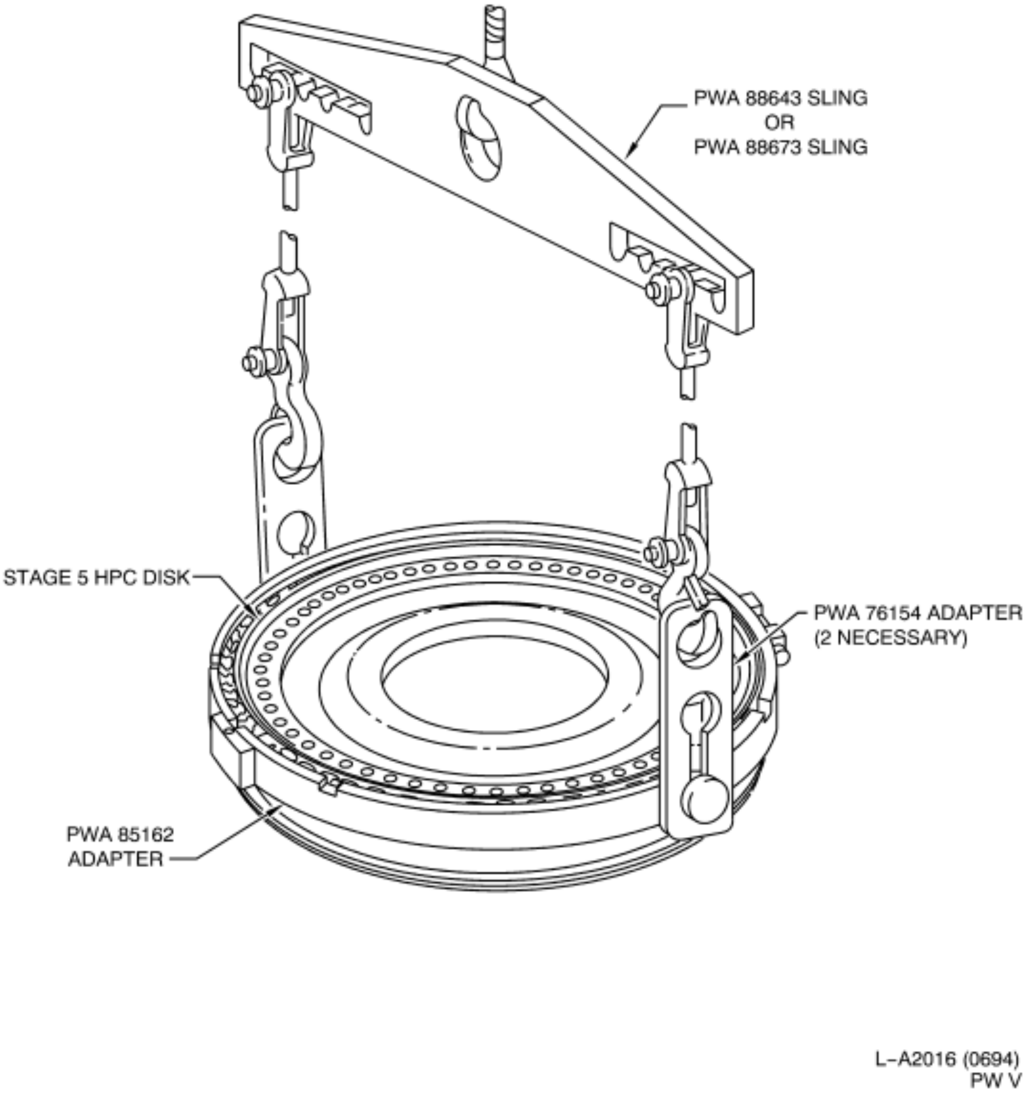
Front Hub Inner Snap Heating
Figure 1006
(Task 72−35−01−440−007)


PWA 80513
THREADED ROD
PWA 12632 NUT
PWA 75028
GAGE
TO PWA 29389
HYDRAULIC PUMP
PWA 12633 RAM
PWA 85255
ADAPTER PLATE
HIGH POINT
RUNOUT
HIGH POINT
RUNOUT
HPC FRONT HUB
FRONT
DRUM ROTOR
ASSEMBLY
L-B8659 (0801)

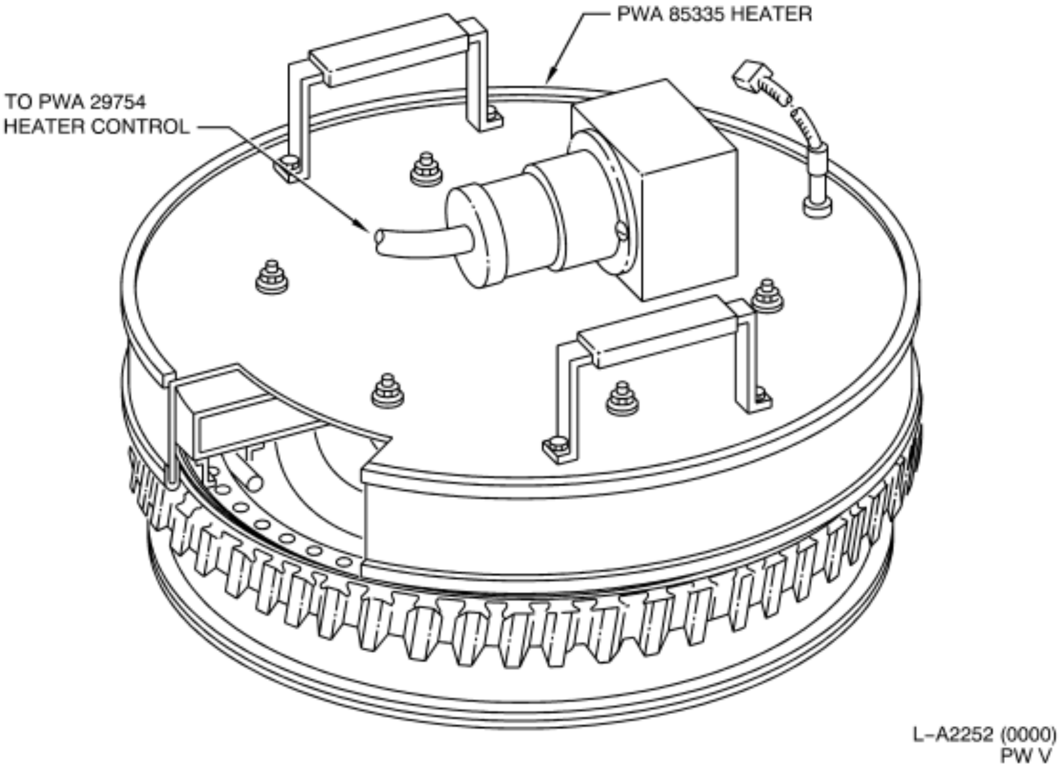
Front Hub To Front Drum Seating
Figure 1007
(Task 72−35−01−440−007)


HPC FRONT HUB
PWA 85315 HEATER
TO PWA 29754 HEATER CONTROL
L-B8660 (0801)

Front Hub Snap Diameter Heating
Figure 1008
(Task 72−35−01−440−007)

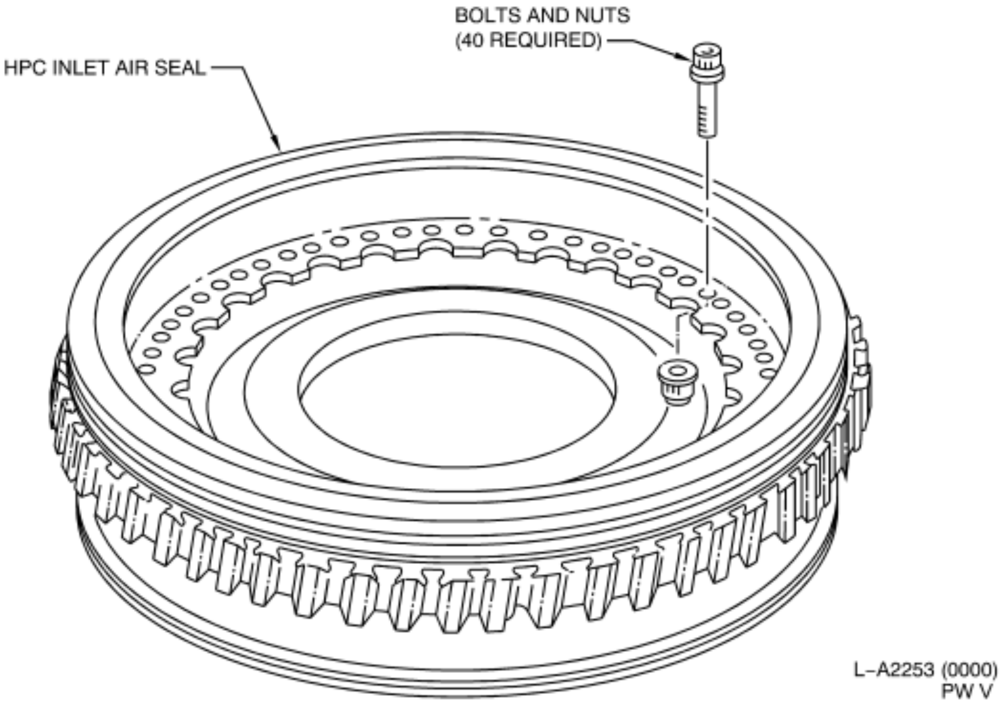

PWA 88643 SLING
OR
PWA 88673 SLING
STAGE 5 HPC DISK
PWA 76154 ADAPTER
(2 NECESSARY)
PWA 85162
ADAPTER
L−A2016 (0694)
PW V

Stage 5 Disk Installed On Support
Figure 1009
(Task 72−35−01−440−007)


PWA 85335 HEATER
TO PWA 29754
HEATER CONTROL
L−A2252 (0000)
PW V

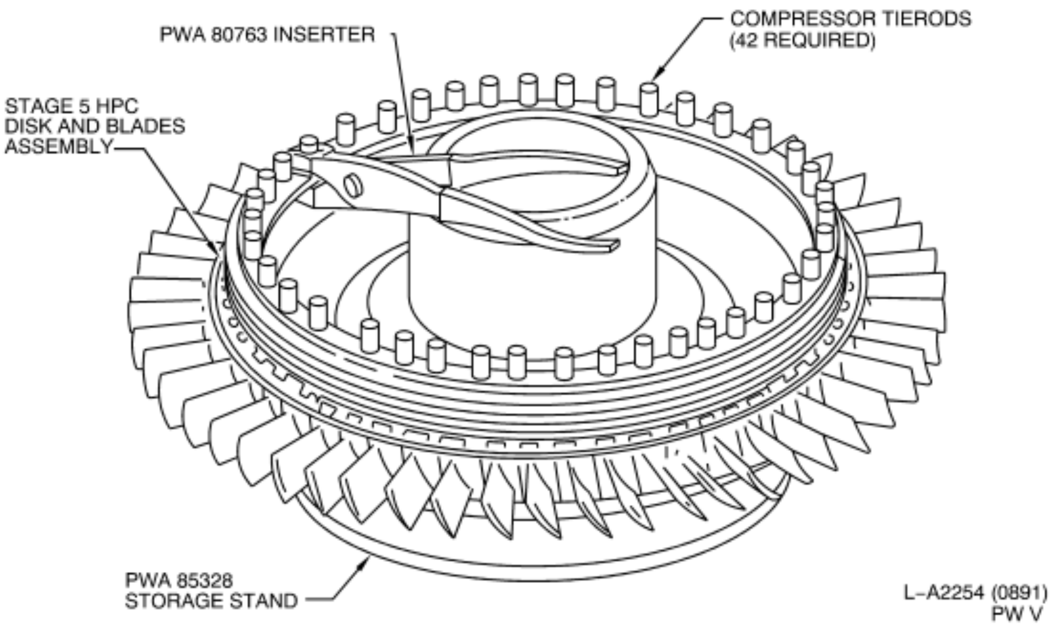
Heat Disk Flange
Figure 1010
(Task 72−35−01−440−007)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−20


BOLTS AND NUTS
(40 REQUIRED)
HPC INLET AIR SEAL
L−A2253 (0000)
PW V

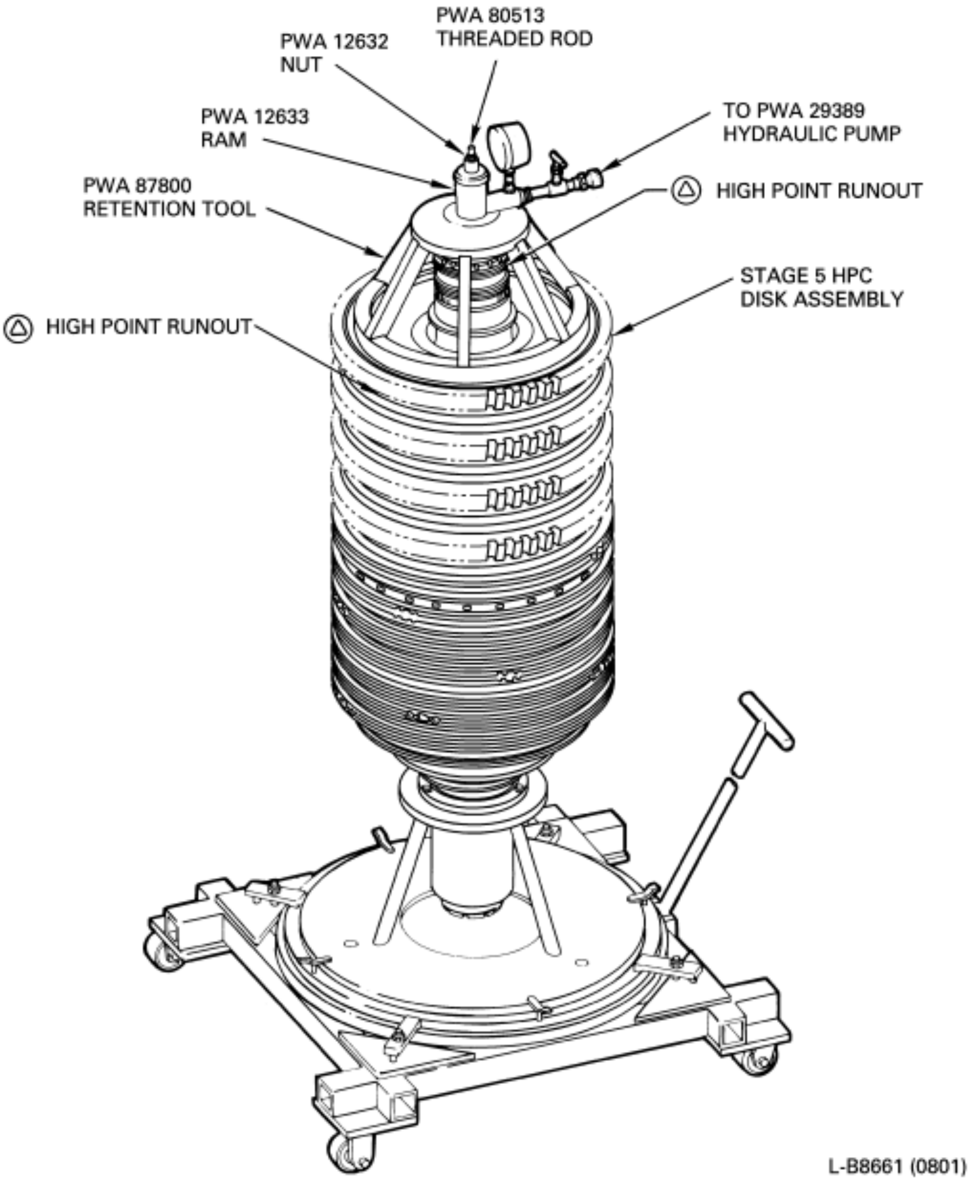
Airseal Installation
Figure 1011
(Task 72−35−01−440−007)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−20


PWA 80763 INSERTER
COMPRESSOR TIERODS (42 REQUIRED)
STAGE 5 HPC DISK AND BLADES ASSEMBLY
PWA 85328 STORAGE STAND
L−A2254 (0891)
PW V

Tierod Installation
Figure 1012
(Task 72−35−01−440−007)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−20


PWA 80513
THREADED ROD
PWA 12632
NUT
TO PWA 29389
HYDRAULIC PUMP
PWA 12633
RAM
△ HIGH POINT RUNOUT
PWA 87800
RETENTION TOOL
STAGE 5 HPC
DISK ASSEMBLY
△ HIGH POINT RUNOUT
L-B8661 (0801)

Installation Of The 5Th Stage Disk
Figure 1013
(Task 72−35−01−440−007)

Task 72-35-01-440-008:

1. Assemble 15Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble (debladed) axial compressor rotor assembly. See Assembly-20 (Task 72-35-01-440-007).

B. Equipment And Materials Necessary

Special Tools:

PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader, Manual
PWA 86448	Drift
PWA 86571	Gage Set

Consumable Materials:

Item No.	Designation
P06-009	Antiseize Compound (PMC 9523)

C. Procedure

See Figure 1001, Figure 1002, Figure 1003, Figure 1004, Figure 1005, and Figure 1006.

NOTE: There are three part numbers (sets) of blades provided for this stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type A is also used for fitting and may require platform grinding. SB PW4ENG 72-434 provides blades with platforms that are 0.015 inch (0.381 mm) oversize. For ease of assembly, blades in this procedure will be referred to as Types A, B and C.

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

CAUTION: DO NOT OVERTIGHTEN GAGE SET SCREWS DURING INSTALLATION OF GAGES. DAMAGE TO THE DRUM CAN RESULT.

(1) Measure Z-Plane diameter for Stage 15.This procedure is optional and can only be used where blades have been removed. Select the pair of gages, marked for that stage, from the PWA 86571 Z-Plane Diameter Gage Set. Install gages, 180 degrees apart, in blade slots. Turn gage set screws clockwise to move the gages radially out to their most outward position. Use OD micrometers to measure four diameters, every 45 degrees, over the gage tool balls. Calculate Z-Plane diameter of the stage by subtracting twice the reference dimension, marked on each pair of gages, from the average diameter measured over the gage tool balls. Refer to minimum, maximum and nominal Z-Plane diameters listed, for reference only, in Table 1001.

Stage	Minimum Diameter (Reference)	Maximum Diameter (Reference)	Nominal Diameter (Reference)
15	23.190 inch (589.026 mm)	23.198 inch (589.229 mm)	23.194 inch (589.128 mm)

HPC Front Drum Z-Plane Diameters
Table 1001

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(2) Remove 15th stage blades from storage rack and place them on bench. Segregate eight Types B and C blades having notches in their platforms and move to one side. See Figure 1001.

(3) Optional, weigh the 15th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70-11-00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps

are not required if subsequent rotor balance procedures are carefully done.

(4) Optional, arrange Type A blade in four columns, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. Lightest blade will be at bottom of Column 2. See Figure 1002.

NOTE: One or more Type A blade may have been used as a fitting blade. Blade will be identified by a square in the service time marking area.

(5) Select two sets of four blades (two Types B and C per set) such that weights of sets are as nearly equal as possible. See Figure 1003.

NOTE: Weights must be nearly equal as sets will be positioned opposite each other after assembly.

(6) Selecting one of the blade sets, and with loading slot of disk facing operator, install one Type C blade, leading edge up, into slot. Move blade to right. Install one lock and setscrew and move to right. Install one Type B blade into slot. Move to right. See Figure 1004 (Sheet 1).

(7) From the same set, install remaining Type B blade into slot and move to left. Install one lock and setscrew and move to left. Install remaining Type C blade and move to left. See Figure 1004 (Sheet 2).

(8) Locate locking slot to left of blade loading slot. Move left lock to left locking slot and tighten and torque setscrew to running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi-spline setscrews.

(9) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

1 If these limits are not kept, check the lock for correct assembly in the disk.

(10) Using approved marking pen, mark OD platform of drum in line with lock with "V" for future reference.

(11) Move Type C blade (right side of lock) to the left to rest against lock. See Figure 1004 (Sheet 3).

(12) Move Type B blade and right lock to left and lock setscrew to running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi-spline setscrews.

(13) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

1 If these limits are not kept, check the lock for correct assembly in the disk.

(14) Push two remaining Types B and C blades to butt against just-installed locks. See Figure 1004 (Sheet 3).

(15) Rotate drum 180 degrees. Position open blade slot toward operator.

(16) Starting at bottom of 4th column of weight−ordered Type A blade, and proceeding vertically from bottom of column to top, position each blade into loading slot and move to right to rest against previously installed blades and lock. When 4th column of blades is used, start at bottom of 2nd column and position each blade into loading slot and to right until all blades from Column 2 are inserted.

(17) Starting at top of 3rd column of blades, position each blade into loading slot and move to left to rest against blades at opposite end. When 3rd column of blades is used, start at top of 1st column and position each blade into loading slot and to left until all blades except one from Column 1 are inserted.

(18) Install two blades from remaining Types B and C sets into loading slot and move to left. Install remaining two blades from Types B and C sets to slot and move to right. Remaining blade should be one Type A blade which will be used for fitting. Load all blades tangentially so as to form widest possible gap at disk loading slot. Measure gap using PWA 85595 Spreader. See Figure 1005.

(a) Place spreader into vacant blade space. Expand spreader with torque handle and measure blade gap with a vernier caliper. Record this dimension.

(b) Measure platform width of Type A blade, not installed in drum, with vernier caliper. Record this dimension.

(c) Compare the gap dimension with the blade platform width dimension.

(d) The width of the blade platform must measure 0.020 − 0.055 inch (0.51 − 1.40 mm) smaller than the gap measured at the drum loading slot between the blades.

(e) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

(19) Do the procedure that follows to get the correct blade platform width for the measured gap.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type A blades with oversized blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.020 - 0.055 inch (0.51 - 1.40 mm).

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). If the 0.055 inch (1.397 mm) maximum gap limit is not met, replace the standard Type A blades with the modified blades with wider platforms or the Type A blades with the narrower platform as necessary to get the 0.020 - 0.055 inch (0.51 - 1.40 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

(20) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

(a) If blade platform width is larger than the gap, determine the difference. If the total material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type A blade not installed. If total amount of material to be removed exceeds of 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type A blade not installed. Maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

(b) If total amount of material to be removed exceeds 0.010 inch (0.254 mm), remove additional Type A blade to obtain proper fit and remove material in approximately equal amounts from both sides of Type A blade platform.

(c) If total amount of material to be removed exceeds 0.080 inch (2.032 mm), remove additional Type A blades as required to obtain the 0.020 − 0.055 inch (0.51 − 1.40 mm) fit. Remove material in equal amounts from both sides of platform on these blades. Maximum material removal per platform side must not exceed 0.005 inch (0.127 mm). Type A blades with trimmed platforms must be identified with a square symbol in their respective service time marking areas. See 70−11, Standard Practices Manual, PN 585005.

(d) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). SB PW4ENG 72−434 provides blades with platforms that are 0.015 inch (0.381 mm) oversize. If the 0.055 inch (1.397 mm) maximum gap limit is not met, interchange these wider platform blades with Type A blades as needed to meet the 0.020 − 0.055 inch (0.51 − 1.40 mm) limit.

(21) If necessary, grind HPC 15th stage blade platforms per 72−35−39, Assembly−03 (Task 72−35−39−440−003). As an alternate to grinding platforms on Type A blades, PN 52H315−04 blades may be used in their place. These blades have platforms which are preground to 0.010 inch (0.254 mm) undersize. Replace one or more Type A blades with the preground blade as required to obtain the 0.020 − 0.055 inch (0.51 − 1.40 mm) fit.

(22) If grinding of blade platforms was required, install Type A blades in slot and check gap. Continue grinding and checking gap until 0.020 − 0.055 inch (0.51 − 1.40 mm) limit is met.

(23) After gap limits have been met, remove all blades from right side of slot and place them in order of removal on bench. Remove all blades from left side of slot and place them in order of removal on bench.

NOTE: Four blades are to remain in disk. These are the first set of four blades (two Types B and C) and two blade locks installed at beginning of this procedure.

(24) Apply Antiseize Compound P06-009 to seals (side opposite flat side) and to drum groove.

(25) Aligning slots, prepare to install blade seal to drum, flat side out. Seal will be installed from left to right. Selecting blades from bench in same order in which they were previously installed in right side of drum, install blades to seal and drum, and move (slide) blade and seal to right. See Figure 1005.

NOTE: Use nonmetalic drift and mallet to move blades and seals around drum.

(26) Install remaining right side blades into seal and drum per schematic view Figure 1006. Install reworked Type A blade equally.

(27) When blades and seal have been installed at right side, install left side blades and seal per instructions above except moving blades and seal from right to left. See Figure 1006. Install reworked Type A blades equally spaced.

(28) At this point, four (two Types B and C) blades of the second set should remain on bench. Install Type C blade into drum slot and move to right. Install Type B blade into slot and move left.

(29) Install blade lock and move to right. Install remaining Type B blade and move to right. The last Type C blade and lock can only be inserted in drum by shifting all blades to right. Therefore, rotate drum 180 degrees and loosen blade lock screws. Move all blades and seals to right. Install blade lock in drum slot and move left. Install Type C blade in drum.

(30) Move all blades and seals to left, aligning one blade lock with "V" mark made on drum at beginning of this procedure. Tighten and torque all blade locks to running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multispline setscrews.

(31) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

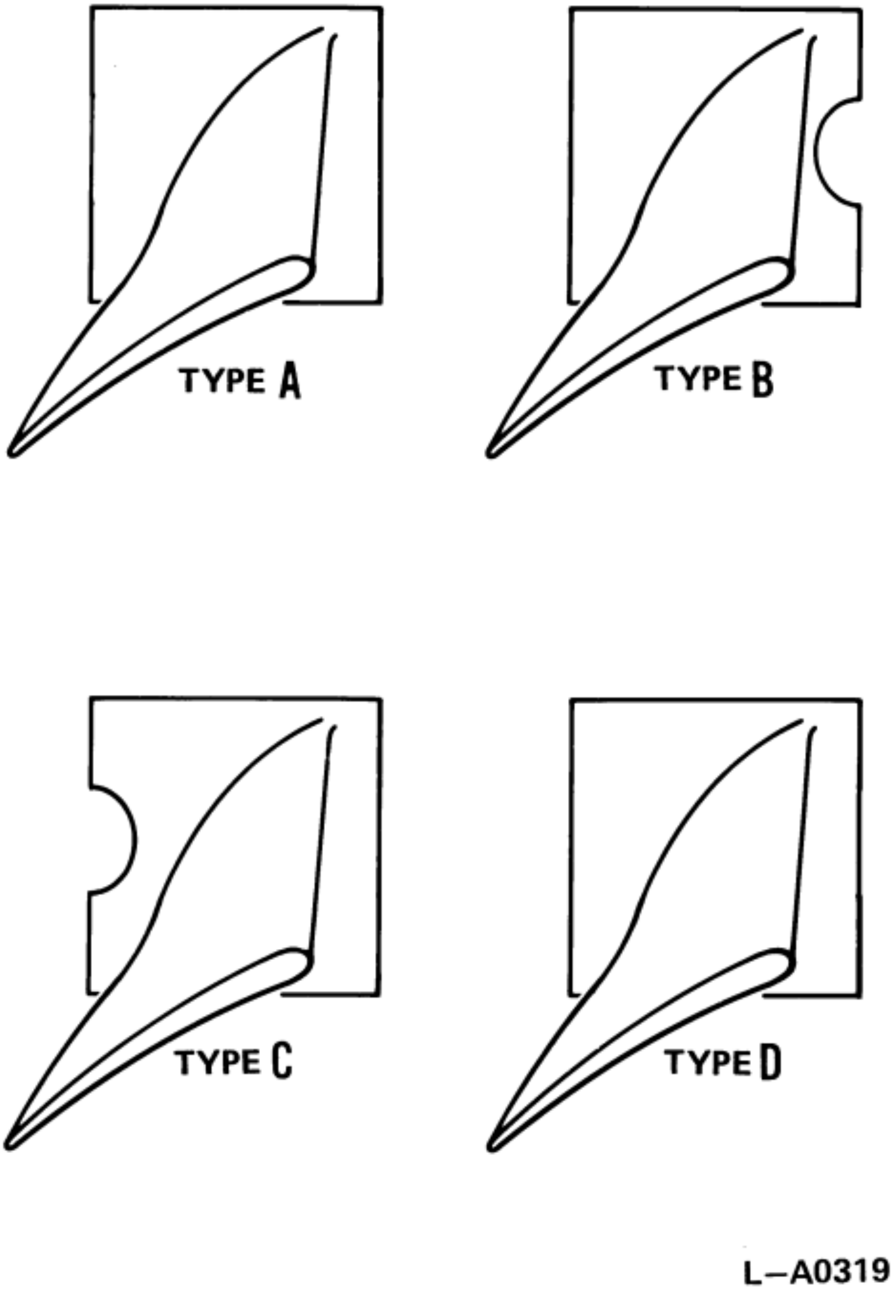
(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

1 If these limits are not kept, check the lock for correct assembly in the disk.

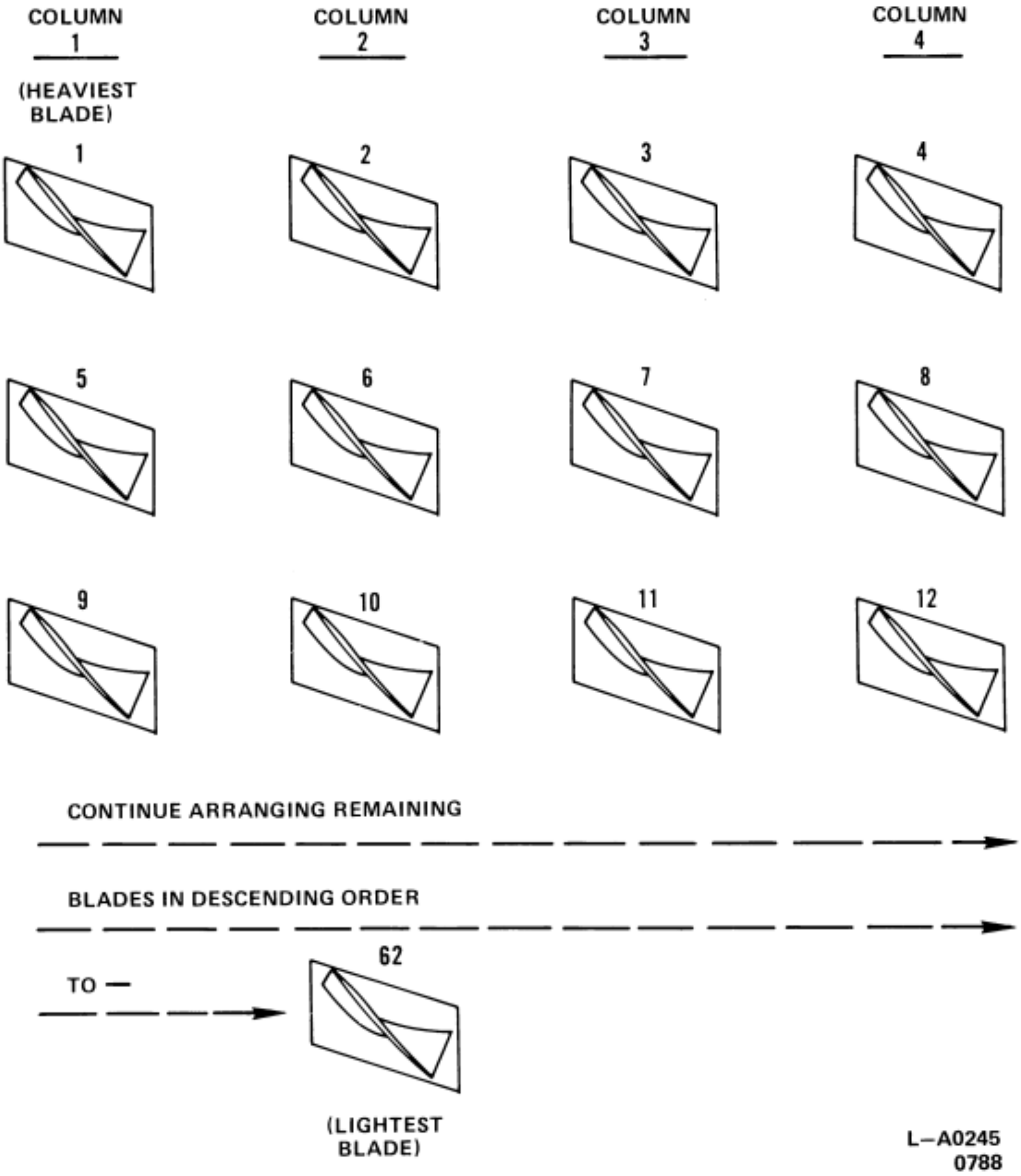
(32) Use a feeler gage to measure the gap, which extends between the loading slots, in each 180 degree arc on the two sides of the drum. Each arc must have a 0.010 - 0.030 inch (0.25 - 0.76 mm) gap, measure both sides at the same time. If the gap in not in limit, you must change blades from one side of the rotor to the other, or additional material can be removed from the blade platforms on the side that is too tight. If material is removed you must also keep the 0.020 - 0.055 inch (0.51 - 1.40 mm) gap limit.

D. Postrequisites

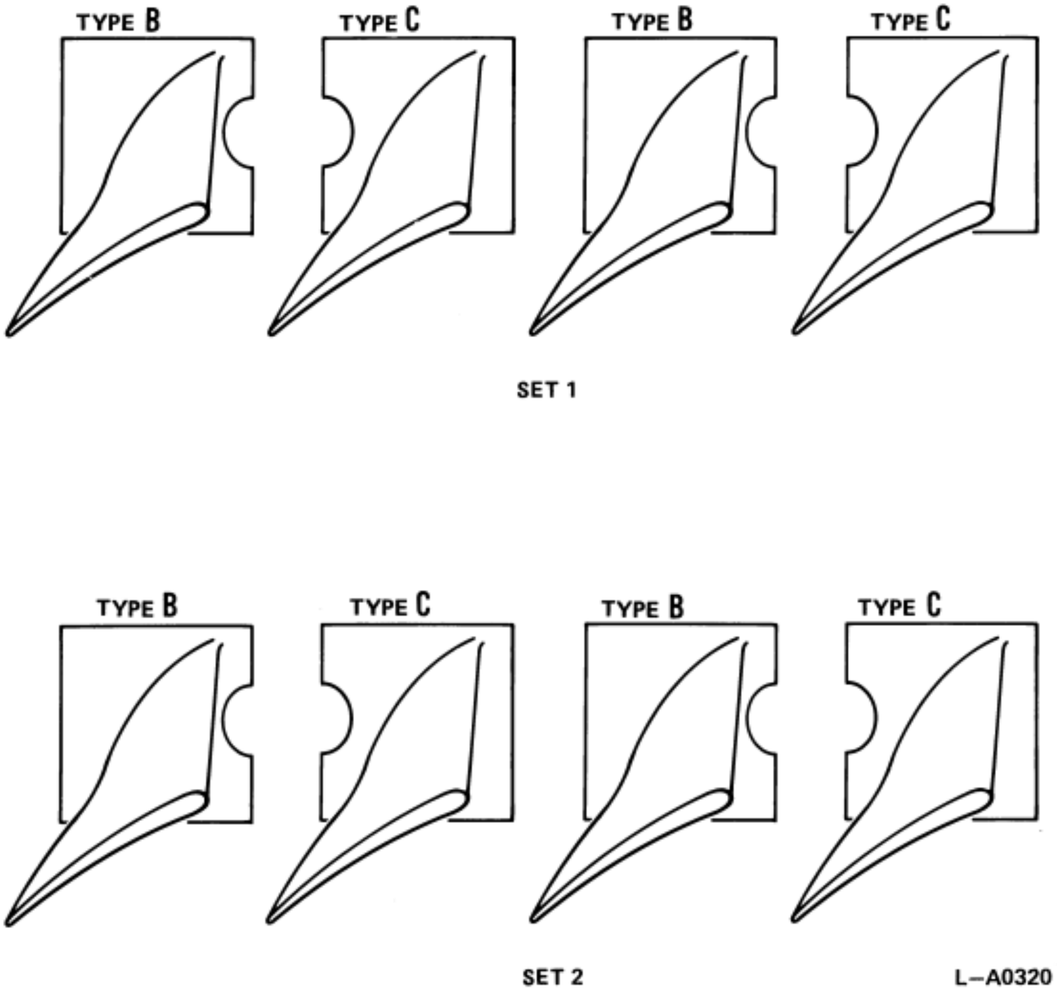
(1) Assemble 14th stage blades to (debladed) axial compressor rotor assembly. See Assembly-22, CONFIG-1 (Task 72-35-01-440-010).


TYPE A
TYPE B
TYPE C
TYPE D
L−A0319

Blade Identification
Figure 1001
(Task 72−35−01−440−008)

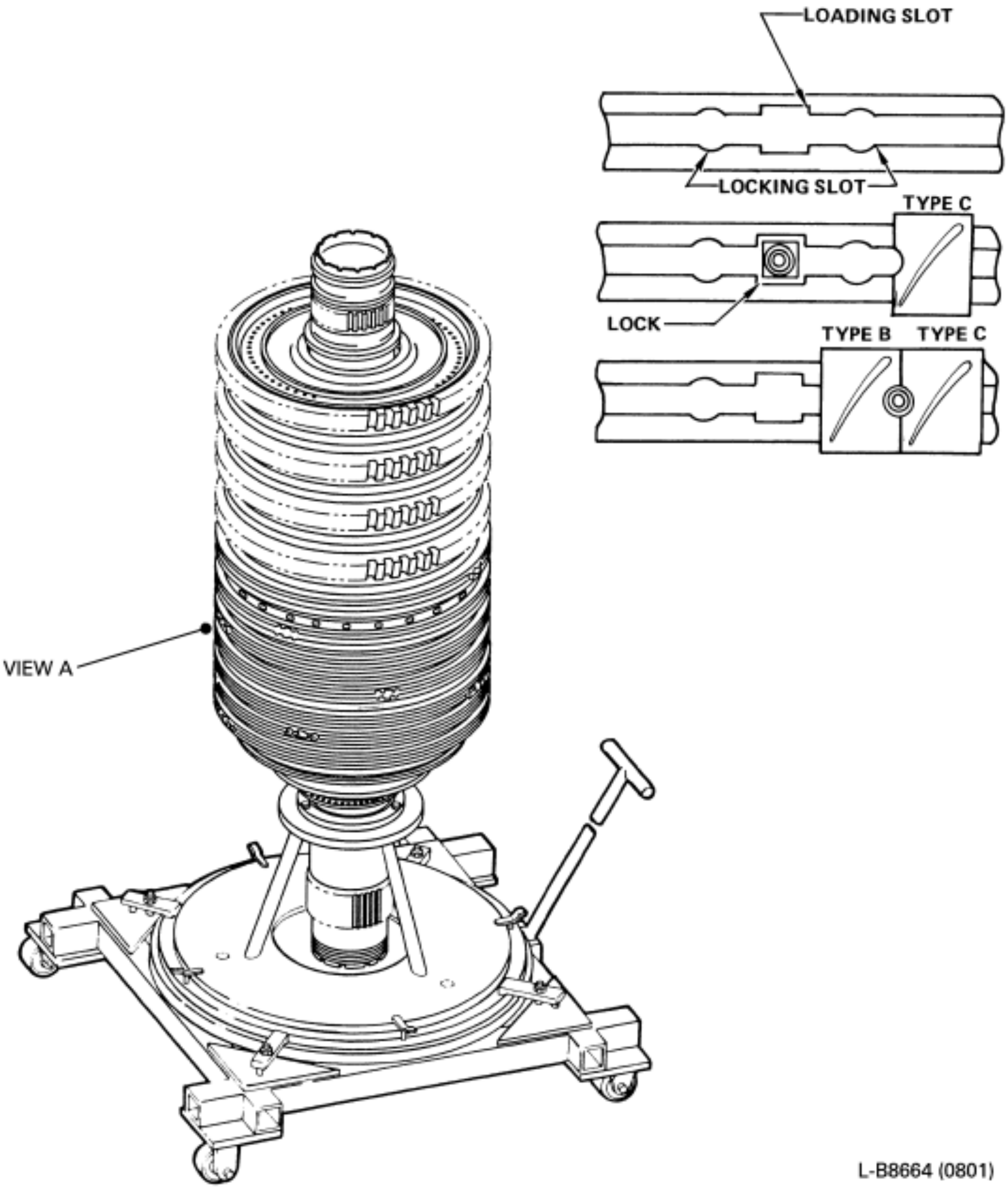

COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
COLUMN 3
COLUMN 4
1
2
3
4
5
6
7
8
9
10
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO —
62
(LIGHTEST BLADE)
L-A0245
0788

Blade Weight Arrangement
Figure 1002
(Task 72-35-01-440-008)

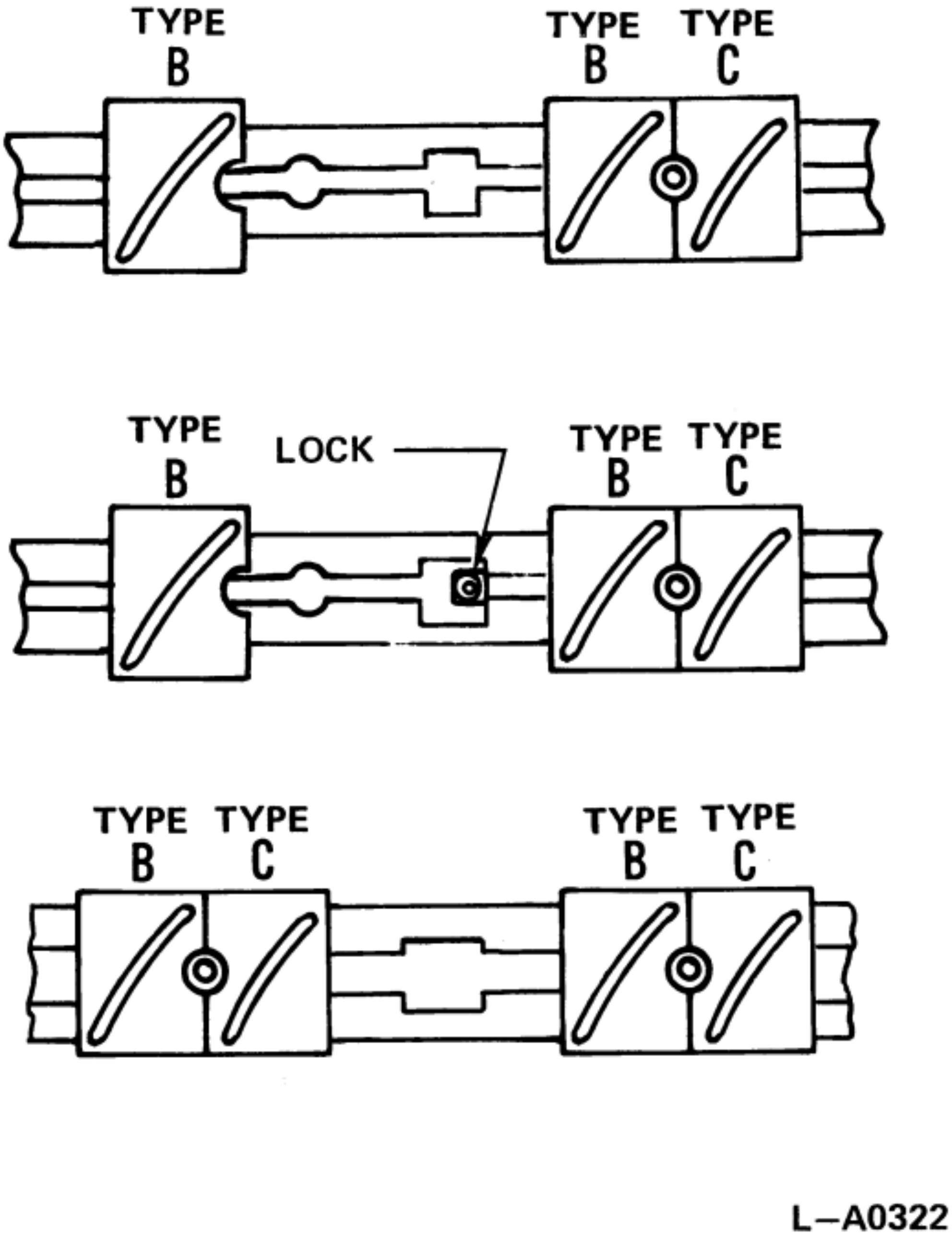

TYPE B
TYPE C
TYPE B
TYPE C
SET 1
TYPE B
TYPE C
TYPE B
TYPE C
SET 2
L-A0320

Blade Sets
Figure 1003
(Task 72-35-01-440-008)

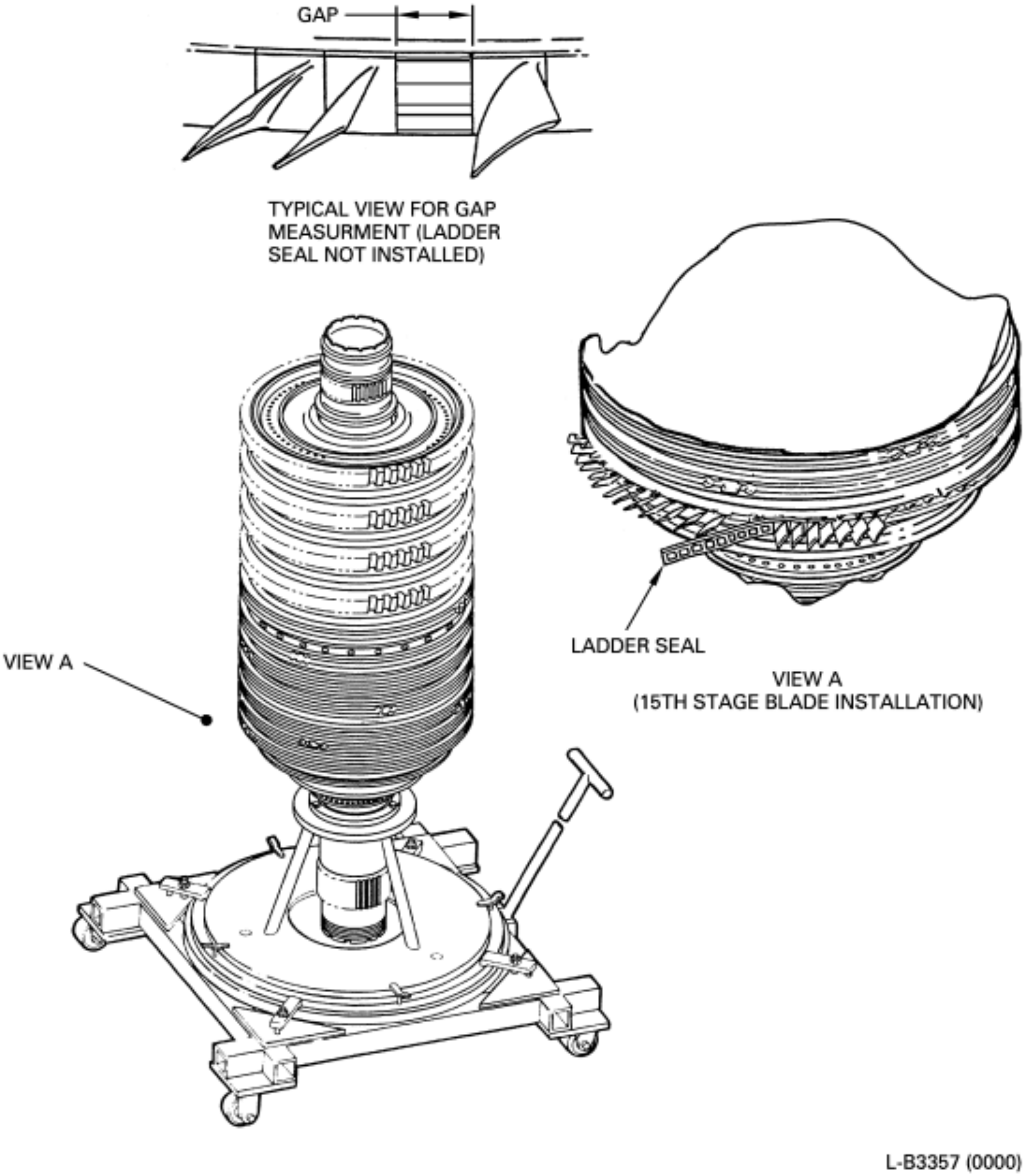
AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−21


LOADING SLOT
LOCKING SLOT
TYPE C
LOCK
TYPE B
TYPE C
VIEW A
L-B8664 (0801)

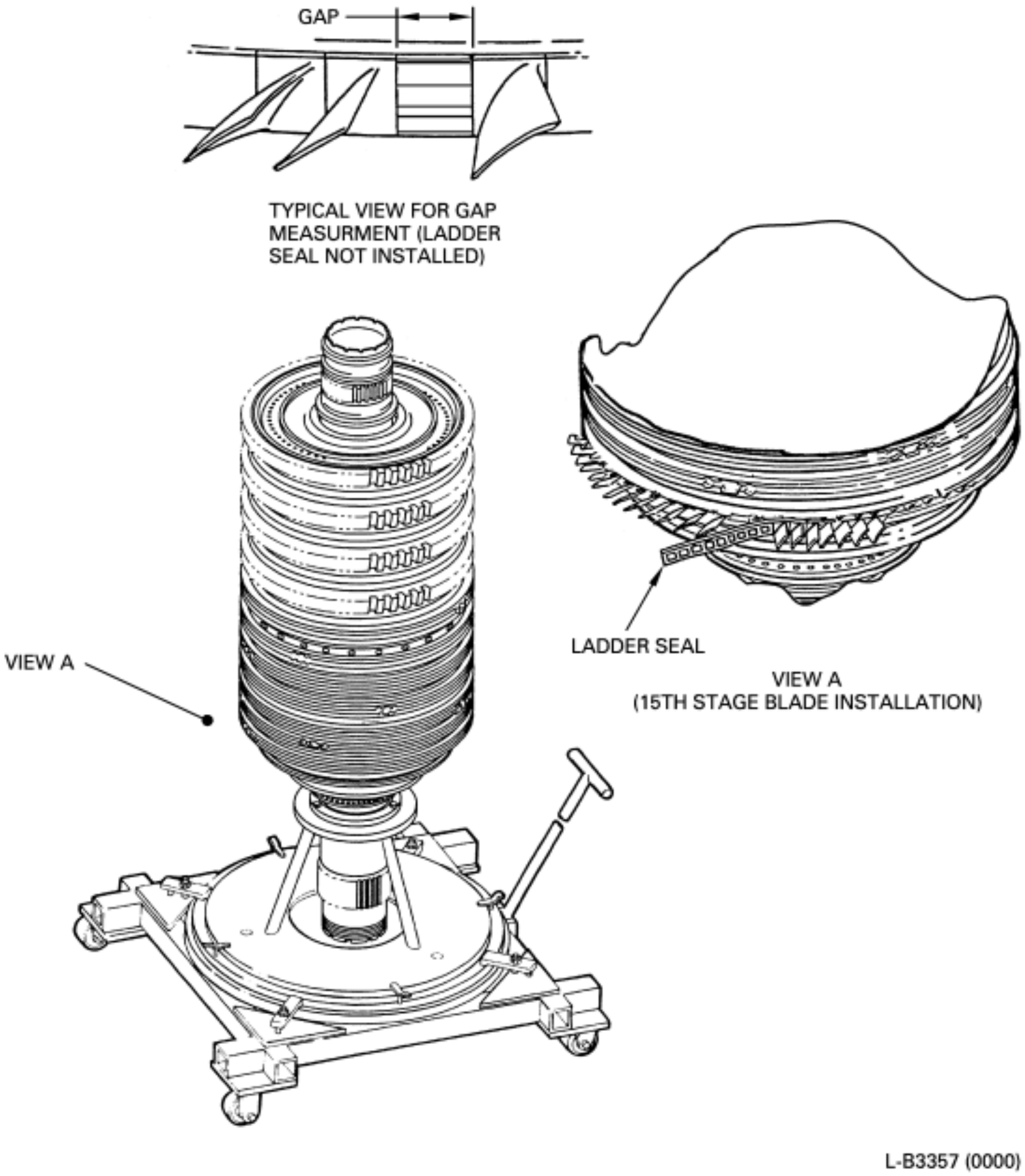
Blade And Lock Installation
Figure 1004 (Sheet 1)
(Task 72−35−01−440−008)


TYPE B
TYPE B
TYPE C
TYPE B
LOCK
TYPE B
TYPE C
TYPE B
TYPE C
TYPE B
TYPE C
L-A0322

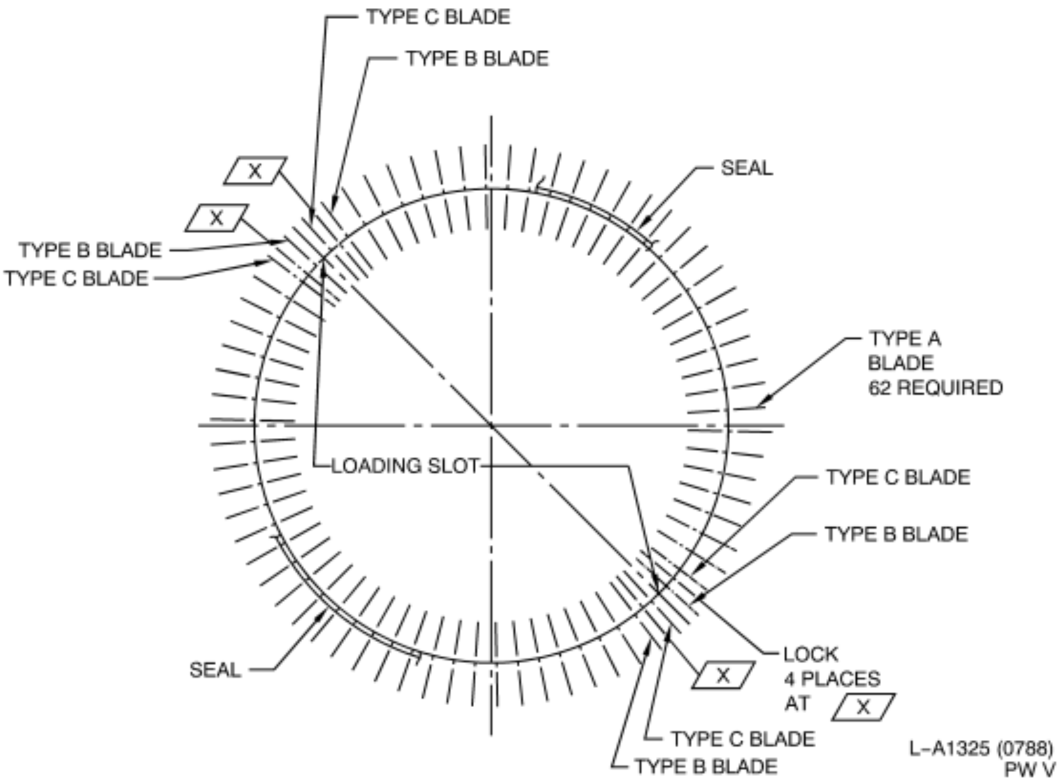
Blade And Lock Installation
Figure 1004 (Sheet 2)
(Task 72-35-01-440-008)


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
VIEW A
LADDER SEAL
VIEW A
(15TH STAGE BLADE INSTALLATION)
L-B3357 (0000)

Blade And Lock Installation
Figure 1004 (Sheet 3)
(Task 72-35-01-440-008)


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A (15TH STAGE BLADE INSTALLATION)
VIEW A
L-B3357 (0000)

Gap Measurement And Seal Installation
Figure 1005
(Task 72-35-01-440-008)


TYPE C BLADE
TYPE B BLADE
X
X
SEAL
TYPE B BLADE
TYPE C BLADE
TYPE A
BLADE
62 REQUIRED
LOADING SLOT
TYPE C BLADE
TYPE B BLADE
LOCK
4 PLACES
AT
X
X
SEAL
TYPE C BLADE
TYPE B BLADE
L−A1325 (0788)
PW V

Blade And Lock Installation Schematic View
Figure 1006
(Task 72−35−01−440−008)

Task 72−35−01−440−009:

1. Assemble 15Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Equipment And Materials Necessary

Special Tools:

PWA 86571	Gage Set

B. Measurement of Z−Plane for Stage 15.

CAUTION: DO NOT OVERTIGHTEN GAGE SET SCREWS DURING INSTALLATION OF GAGES. DAMAGE TO THE DRUM CAN RESULT.

(1) Measure Z−Plane diameter for Stage 15. This procedure is optional and can only be used where blades have been removed. Select the pair of gages, marked for that stage, from the PWA 86571 Z−Plane Diameter Gage Set. Install gages, 180 degrees apart, in blade slots. Turn gage set screws clockwise to move the gages radially out to their most outward position. Use OD micrometers to measure four diameters, every 45 degrees, over the gage tool balls. Calculate Z−Plane diameter of the stage by subtracting twice the reference dimension, marked on each pair of gages, from the average diameter measured over the gage tool balls. Refer to minimum, maximum and nominal Z−Plane diameters listed, for reference only, in Table 1001.

Stage	Minimum Diameter (Reference)	Maximum Diameter (Reference)	Nominal Diameter (Reference)
15	23.190 inch (589.026 mm)	23.198 inch (589.229 mm)	23.194 inch (589.128 mm)

HPC Front Drum Z−Plane Diameters
Table 1001

C. General

(1) Use one of the three procedures that follow to install the 15th stage blades.

R (a) Use (Task 72-35-01-440-009-A) of this procedure to install the 15th stage blades for engines with drum rotor disk assembly (called drum rotor) PN 53H973-01 or 54H803-01 (Pre SB PW4ENG 72-565).

R (b) Use (Task 72-35-01-440-009-B) of this procedure to install the 15th stage blades for engines with (modified) drum rotor disk assembly (called drum rotor) PN 53H973-001 or 54H803-001 (Post SB PW4ENG 72-565), or PN 54H803-002 (Post SB PW4ENG 72-750).

R (c) Use (Task 72-35-01-440-009-C) of this procedure to install the 15th stage blades for engines with drum rotor disk assembly (called drum rotor) PN 56H013-01 (Post SB PW4ENG 72-565), PN 56H013-001 or 58H236-01 (Post SB PW4ENG 72-750).

Task 72-35-01-440-009-A:

2. Assemble 15Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly For Engines With Drum Rotor PN 53H973-01 Or 54H803-01 (Pre SB PW4ENG 72-565) R

A. Prerequisites

(1) Assemble (debladed) axial compressor rotor assembly. See Assembly-20 (Task 72-35-01-440-007).

B. Equipment And Materials Necessary

Special Tools:

PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader, Manual
PWA 86448	Drift

Consumable Materials:

Item No.	Designation
P06-009	Antiseize Compound (PMC 9523)

C. Procedure

See Figure 1001, Figure 1002, Figure 1003, Figure 1004, Figure 1005 and Figure 1006.

NOTE: There are three part numbers (sets) of blades provided for this stage. Set Type A contains the

majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together. clearance is formed for a blade lock. Set Type A is also used to get the correct platform gap and may require platform grinding. A modified Type A blade is also available with a 0.015 inch (0.381 mm) oversized platform width to help you get the correct platform gap. For ease of assembly, blades in this procedure will be referred to as Types A, B and C. See Figure 1001.

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(1) Remove 15th stage blades from the storage rack and place them on a bench. Segregate four Types B and C blades having notches in their platforms and move them to one side. See Figure 1001.

(2) Optional, weigh the 15th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70-11-00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

(3) Optional, arrange Type A blades in two (2) columns. Start with the heaviest blade at the top left (Column 1), and proceed from left to right in descending order of weight. Lightest blade (blade No. 62) will be at the bottom of Column 2. See Figure 1002.

NOTE: One or more Type A blade may have been used as a fitting blade. These blades will be identified by a square that is marked in the service time marking area.

(4) Divide the Types B and C blades into two (2) sets of four (4) blades (two (2) Type B and two (2) Type C blades make a set) such that weights of the sets are as nearly equal as possible. See Figure 1003.

NOTE: The weights must be nearly equal as these blade sets will be positioned opposite each other after assembly.

(5) Install one of the two Types B and C blade sets (two Types B and C blades make a set), two lock and setscrew assemblies and five Type A blades. See Figure 1002, Figure 1003, Figure 1004 (Sheets 1 and 2), Figure 1005 (Sheets 1 and 2) and Figure 1006.

(a) Find one of two 15th stage loading slots that has locking slots on each side of it.

(b) Select one of the Types B and C blade sets. Install one Type B blade, leading edge up, into the slot. Move the blade to the left and past the locking slot.

(c) Install one lock and setscrew assembly and move it to the left.

(d) Move the lock and setscrew assembly into the left locking slot and tighten. Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(e) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(f) Use an approved marking pen to mark the outside diameter platform of the drum, in line with the lock, with a "V" for future reference.

(g) Install a Type C blade and move it to the left until it touches the lock.

(h) Install the remaining Type C blade and move it to the right and past the locking slot.

(i) Insert one lock and setscrew assembly and move it to the right.

NOTE: Do not tighten the lock.

(j) Install the remaining Type B blade from the set into the loading slot and move it to the right.

(k) Install 12 Type A blades to fill the area between the two blade locks.

1 Start with the blades from Column 1. Install blade number 1 and move it fully to the left. Install blades 3, 5, 7 and 9, in sequence, and move them fully to the left.

2 Start with the blades from Column 1. Install blade number 23 and move it to the right sufficiently to permit further installation. Install blades 21, 19, 17, 15, 13 and 11, in sequence.

3 When blades 1 through 23 are installed, move all the blades fully to the left so they all touch.

(6) Rotate the drum 180 degrees. Position the open blade loading slot toward the operator.

(7) Install the remaining Type A blades (numbers 25 through 61) from Column 1, in sequence, and move them to the left so they touch the blades you just installed.

(8) Install the right side blades and lock and setscrew assemblies. See Figure 1002, Figure 1003, Figure 1004 (Sheets 1 and 2), Figure 1005 (Sheets 1 and 2) and Figure 1006.

(a) Find the Type A blades to be installed. Start at the bottom of Column 2 (blade number 62, the lightest blade) and continue up to the top of the column (blade number 2).

(b) Install 19 Type A blades in sequence (numbers 62 through 26). Start with the lightest blade (blade number 62). Install it in the loading slot and move it to the right until it touches the blade that was installed before.

(c) Take a Type C blade from the Types B and C blade set and put it in the loading slot and move it to the right until it touches the blade that was installed before.

(d) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before. Do not tighten the lock.

(e) Take a Type B blade from the Types B and C blade set and put it in the loading slot and move it to the right until it touches the lock and setscrew assembly.

(f) Install the next five Type A blades (numbers 24 through 16) in sequence and move them fully to the right.

(g) Install the remaining Type B blade and move it fully to the left.

(h) Install a lock and setscrew assembly in the loading slot and move it to the left until it touches the blade that was installed before. Do not tighten the lock.

(i) Install the remaining Type C blade and move it fully to the left.

NOTE: Seven Type A blades remain.

(j) Install the next six blades in sequence. Install blade number 2, then 4, 6, 8, 10 and 12. Do not install blade number 14 which will be used for fitting.

(9) Measure the gap dimension. See Figure 1006.

NOTE: Put the blades in a radially outward direction to prevent a circumferential serpentine shape to the blades.

(a) Use a PWA 85595 Spreader to load all blades, in the arc, tangentially.

(b) When it is installed, expand the spreader and get the widest possible gap between the blade platforms. If you need help to move the blades, it is permissible to tap lightly on the base of the airfoil with the PWA 86448 Drift.

(c) Measure and make a record of the gap dimension.

(d) Find the Type A blade (number 14) that will be installed in the gap you measured. Use a vernier caliper to measure the platform width of the blade. Record this dimension.

(e) Compare the gap dimension with the blade platform width dimension.

(f) The width of the blade platform must measure 0.000 − 0.010 inch (0.00 − 0.25 mm) smaller than the gap measured at the drum loading slot between the blades.

(g) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

(10) Do the procedure that follows to get the correct blade platform width for the measured gap.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type A blades with oversized Type A blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.000 - 0.010 inch (0.00 - 0.25 mm).

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.010 inch (0.25 mm). If the 0.010 inch (0.25 mm) maximum gap limit is not met, replace the standard Type A blades with the modified blades with wider platforms or the Type A blades with the narrower platform as necessary to get the 0.000 - 0.010 inch (0.00 - 0.25 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

(11) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.010 inch (0.25 mm). If the 0.010 inch (0.25 mm) maximum gap limit is not met, replace the standard Type A blades with the modified Type A blades with wider platforms as needed to meet the 0.000 - 0.010 inch (0.00 - 0.25 mm) limit.

(b) If the blade platform width is larger than the gap, determine the difference. If the total amount of material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type A blade not installed. If the total amount of material to be removed exceeds of 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type A blade not installed. Maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

(c) If the total amount of material to be removed exceeds 0.010 inch (0.254 mm), remove an additional Type A blade to obtain the proper fit and remove material in approximately equal amounts from both sides of the Type A blade platforms. Repeat this procedure for additional Type A blades, as necessary, to obtain the correct gap.

(d) If it is necessary to remove material, machine the HPC 15th stage blade platforms per 72−35−39, Assembly−03 (Task 72−35−39−440−003).

(e) Type A blades with trimmed platforms must be identified with a square symbol in their respective service time marking areas. See 70−11, Standard Practices Manual, PN 585005.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(12) After the gap limits have been met, remove all blades and locks from the right side of the slot and put them in order of removal on the work bench. Remove all blades and locks from the left side of slot and also put them in order of removal on the work bench.

NOTE: Do not remove the Types B and C blades and lock that were first installed (where the V mark was made on the Drum).

(13) Rotate the drum 180 degrees so that the two installed blades and the installed and tightened lock and setscrew assembly are to your left.

(14) Apply Antiseize Compound P06−009 to the blade ladder seals (side opposite flat side) and to the drum groove.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(15) Install the ladder seal and blades, numbers 1 through 9. See Figure 1006.

NOTE: The blades will be installed in the order that they were removed.

(a) Put the appropriate ladder seal over the loading slot with the flat surface out.

(b) Align the first opening in the seal with the loading slot in the drum.

(c) Install blade number 1, leading edge up, through the seal and into the loading slot.

(d) Move the blade and seal to the left until the second opening is aligned with the slot.

NOTE: Be sure that the seal is correctly installed between the 15th stage drum rails.

(e) Continue the blade installation instructions above until blades 1 through 9 are installed, moved fully to the left and touch the Type C blade that was installed before.

(f) Install the next Type C blade, a lock, then the next Type B blade. move them to the right to make room for blades, numbers 11 through 23.

NOTE: Do not tighten the lock and setscrew assembly.

(16) Follow the method above to install blades, numbers 23 through 15, and the appropriate ladder seal.

(17) Install blades, numbers 13 and 11, then move all the blades and seals fully to the left until they touch the tightened blade and lock assembly.

(18) Rotate the drum 180 degrees so that the open loading slot is in front of you.

(19) Follow the method given before to install blades, numbers 25 through 61, and the appropriate ladder seal. Move the blades and seal as an assembly fully to the left until they touch the blades that were installed before.

(20) When the blades, locks and seals are fully installed on the left side, install the right side blades, numbers 2 through 62, seals and locks.

(a) Put the appropriate ladder seal over the loading slot with the flat surface out.

(b) Align the first opening in the seal with the loading slot in the disk.

(c) Install blade number 62, leading edge up, through the seal and into the loading slot.

(d) Move the blade and seal to the right until the second opening is aligned with the loading slot.

NOTE: Be sure that the seal is correctly installed between the 15th stage drum rails.

(e) Continue the blade installation until blades, numbers 62 through 26, are installed, moved fully to the right and touch the Type C blade that was installed before.

(f) Install the next Type C blade, the lock, then the next Type B blade. Move them fully to the right until they touch the blades that were installed before.

NOTE: Do not tighten the lock and setscrew assembly.

(g) Follow the method given before to install blades, numbers 24 through 16, and the appropriate seal. Move them fully to the right until they touch the blades that were installed before.

(h) Install the remaining Type B blade, lock and the Type C blade. Move them fully to the left until they touch the blades that were installed before.

NOTE: Do not tighten the lock and setscrew assembly.

(i) Follow the method you used before to install blades, numbers 2 through 10, and the appropriate seal. Move them fully to the left until they touch the blades that were installed before.

(j) Install blade number 12. Blade number 14 has not yet been installed.

(k) Loosen the lock and setscrew assembly that is located by the V mark. Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(l) Move the blades, seals and locks to the right, sufficiently to permit the installation of blade number 14. Install blade number 14.

(21) Move all blades, seals and locks to the left. Align the blade lock with the V mark made on the drum at the beginning of this procedure.

(22) Tighten and torque the four lock and setscrew assemblies.

(a) Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(b) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

D. Postrequisites

(1) Assemble 14th stage blades to (debladed) axial compressor rotor assembly. See Assembly-22, CONFIG-2 (Task 72-35-01-440-020).

Task 72-35-01-440-009-B:

3. Assemble 15Th Stage Blades In The (Debladed) Axial Compressor
R Rotor Assembly For Engines With Modified Drum Rotor PN
R 53H973-001 Or 54H803-001 (Post SB PW4ENG 72-565), Or PN
R 54H803-002 (Post SB PW4ENG 72-750)

A. Prerequisites

(1) Assemble (debladed) axial compressor rotor assembly. See Assembly-20 (Task 72-35-01-440-007).

B. Equipment And Materials Necessary

Special Tools:

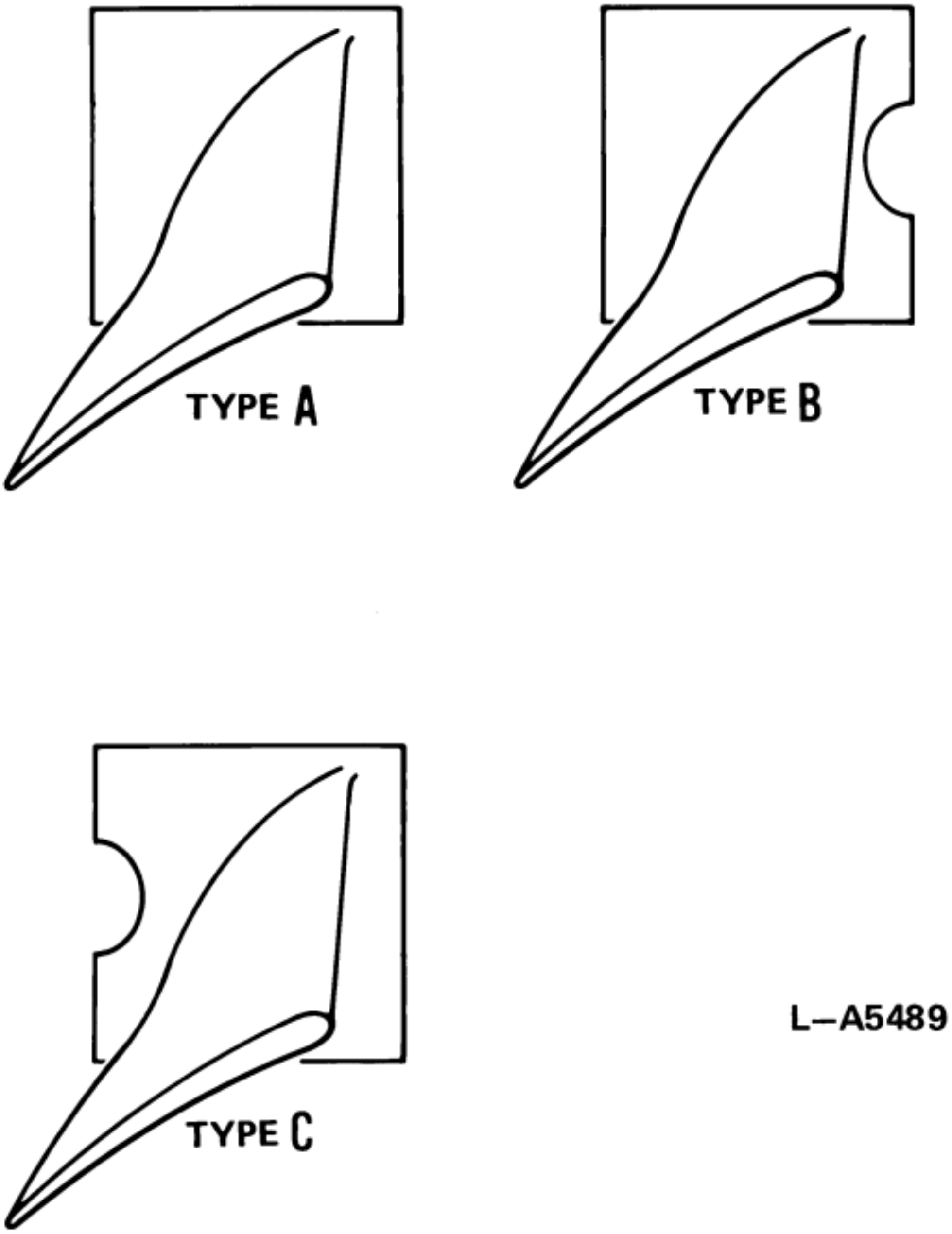
PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader, Manual
PWA 86448	Drift

Consumable Materials:

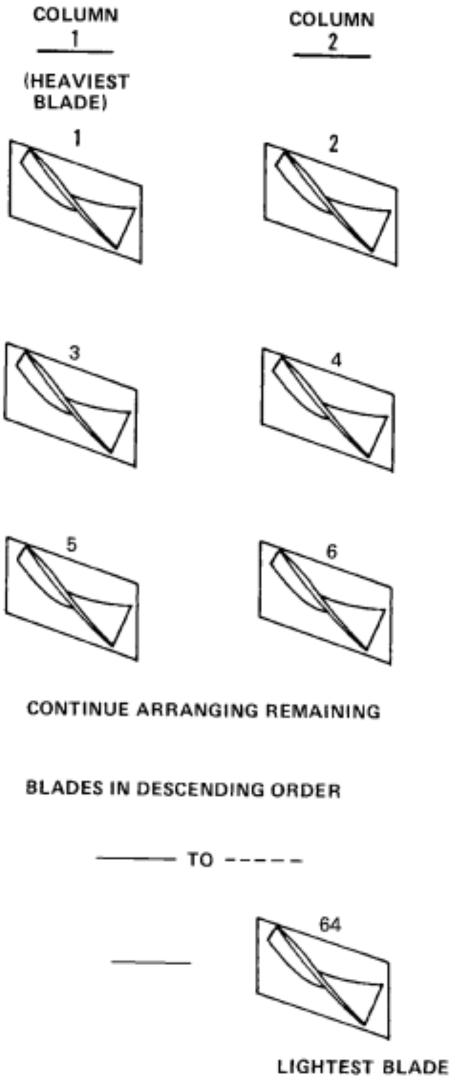
Item No.	Designation
P06-009	Antiseize Compound (PMC 9523)

C. Procedure
See Figure 1007,Figure 1008, Figure 1009, Figure 1010, Figure 1011 and Figure 1012.

NOTE: There are three part numbers (sets) of blades provided for this stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type A is also used to get the correct platform gap and may require platform grinding. A

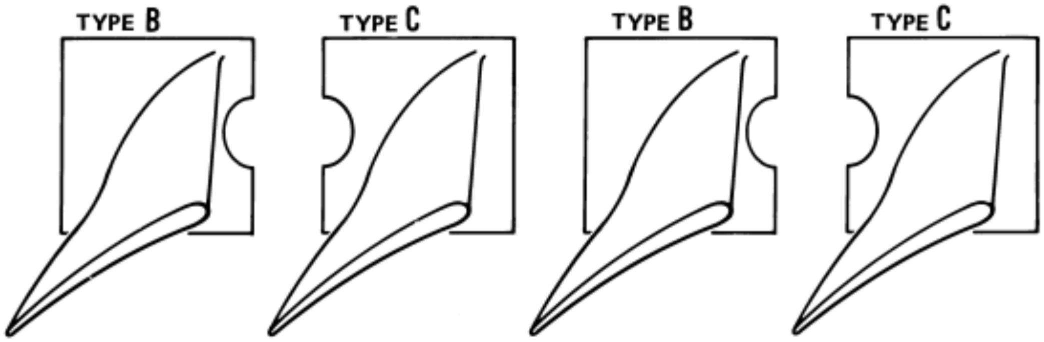


Blade Identification
Figure 1001
(Task 72-35-01-440-009-A)

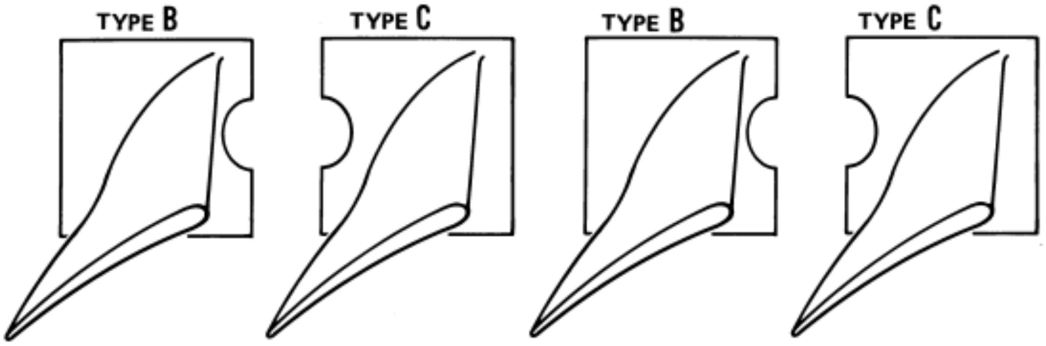

COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
1
2
3
4
5
6
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
——— TO - - - - -
64
LIGHTEST BLADE

L−B3353 (0000)
PW C

Type A Blade Weight Arrangement
Figure 1002
(Task 72−35−01−440−009−A)


TYPE B
TYPE C
TYPE B
TYPE C

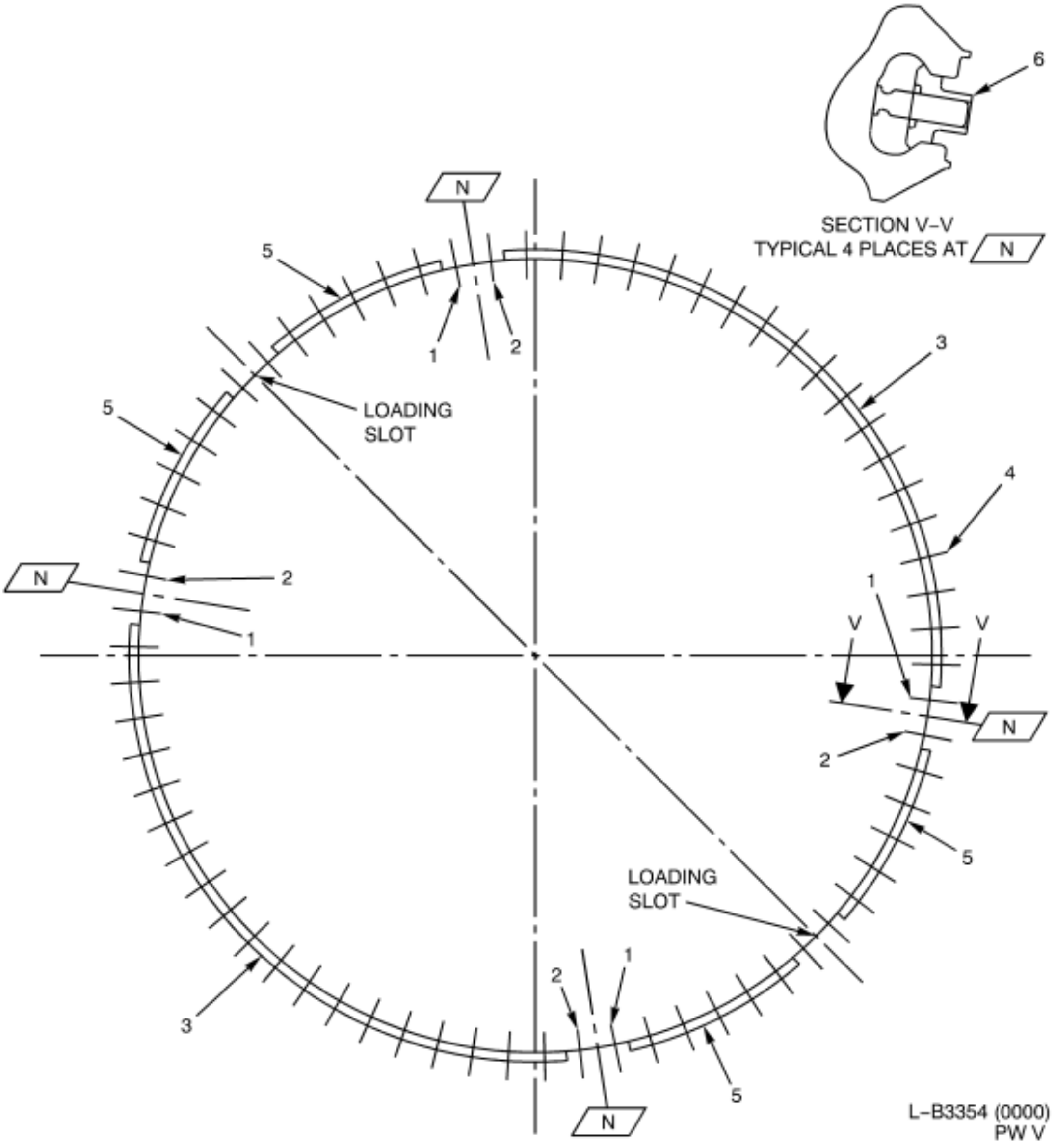
SET 1


TYPE B
TYPE C
TYPE B
TYPE C

SET 2

L−A0320

Types B And C Blade Set Arrangement
Figure 1003
(Task 72−35−01−440−009−A)


6
SECTION V-V
TYPICAL 4 PLACES AT N
N
5
1
2
3
5
LOADING
SLOT
4
N
2
1
1
V
V
N
2
5
LOADING
SLOT
3
2
1
5
N
L-B3354 (0000)
PW V

Schematic View Of 15th Stage Blade And Lock
R Installation (Drum Rotor PN 53H973-01 And 54H803-01)
Figure 1004 (Sheet 1)
(Task 72-35-01-440-009-A)

1. Type C Blades
2. Type B Blades
3. Ladder Seals, PN 54H335, Two Necessary.
4. Type A Blades
5. Ladder Seals, PN 54H334, Four Necessary.
6. Lock And Setscrew Assembly

Key to Figure 1004 (Sheet 1)

modified Type A blade is also available with a 0.015 inch (0.381 mm) oversized platform width to help you get the correct platform gap. For ease of assembly, blades in this procedure will be referred to as Types A, B and C. See Figure 1007.

NOTE: For modified HPC drum rotor, PN 54H803-001 or 53H973-001, the original four locking slots are not used. There are now eight (8) lock setscrews at eight (8) new locking slot locations.

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

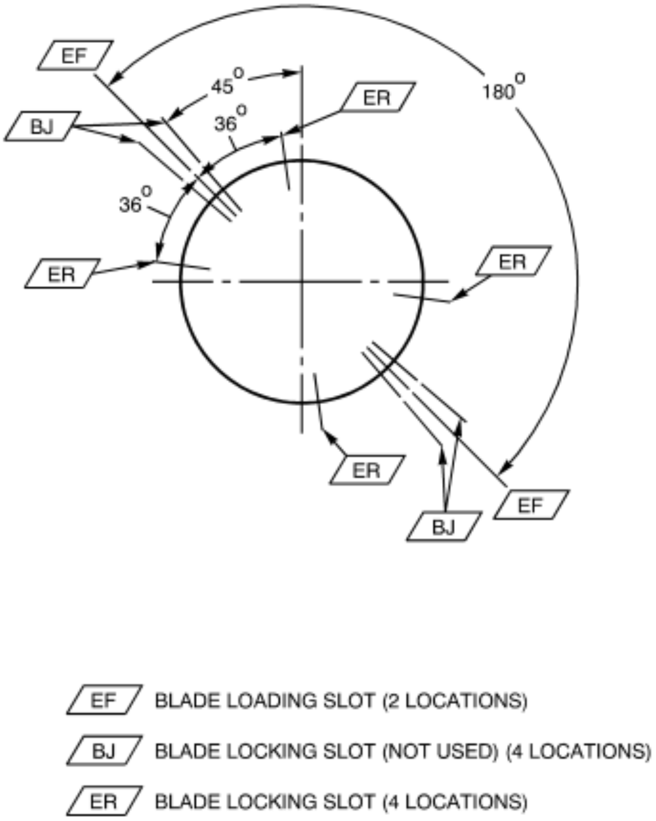
CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(1) Remove 15th stage blades from the storage rack and place them on a bench. Segregate eight Types B and C blades having notches in their platforms and move them to one side. See Figure 1007.

(2) Optional, weigh the 15th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70-11-00.

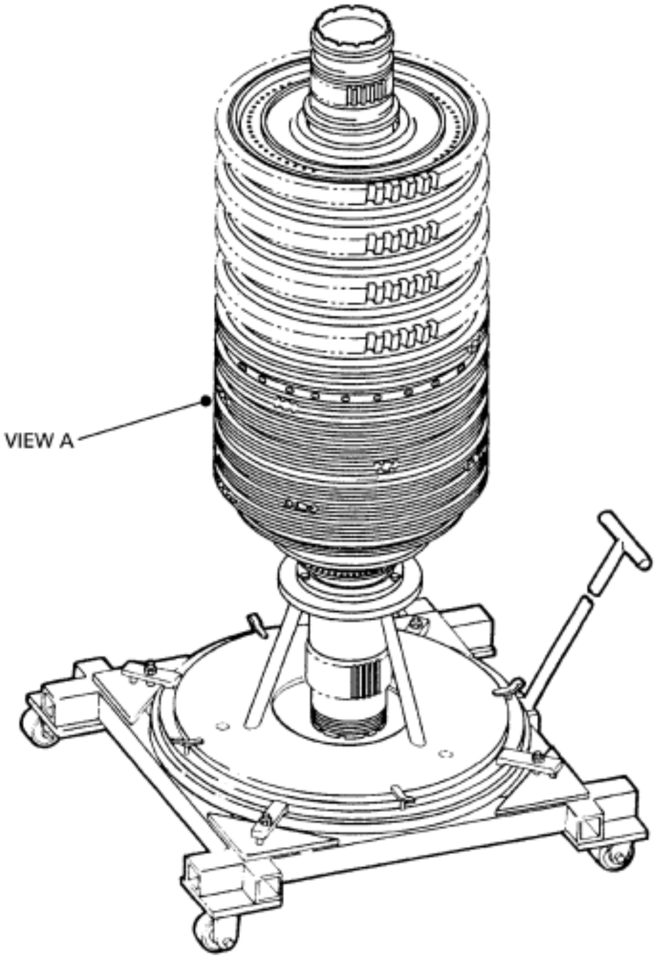
NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

R
R


EF
BJ
45°
36°
ER
180°
36°
ER
ER
ER
BJ
EF
EF BLADE LOADING SLOT (2 LOCATIONS)
BJ BLADE LOCKING SLOT (NOT USED) (4 LOCATIONS)
ER BLADE LOCKING SLOT (4 LOCATIONS)

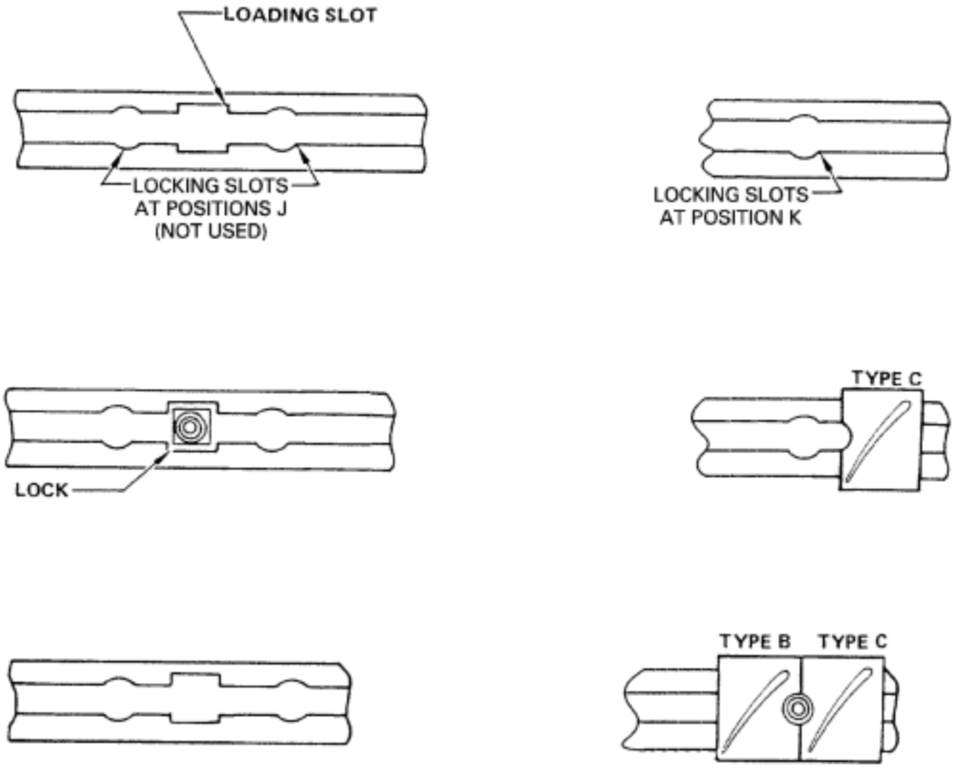
L−B8084 (0600)
PW V

Schematic View Of 15th Stage Blade Loading And Lock
R Slot Locations (Drum Rotor PN 53H973−01 And 54H803−01)
Figure 1004 (Sheet 2)
(Task 72−35−01−440−009−A)



Blade And Lock Installation
Figure 1005 (Sheet 1)
(Task 72-35-01-440-009-A)

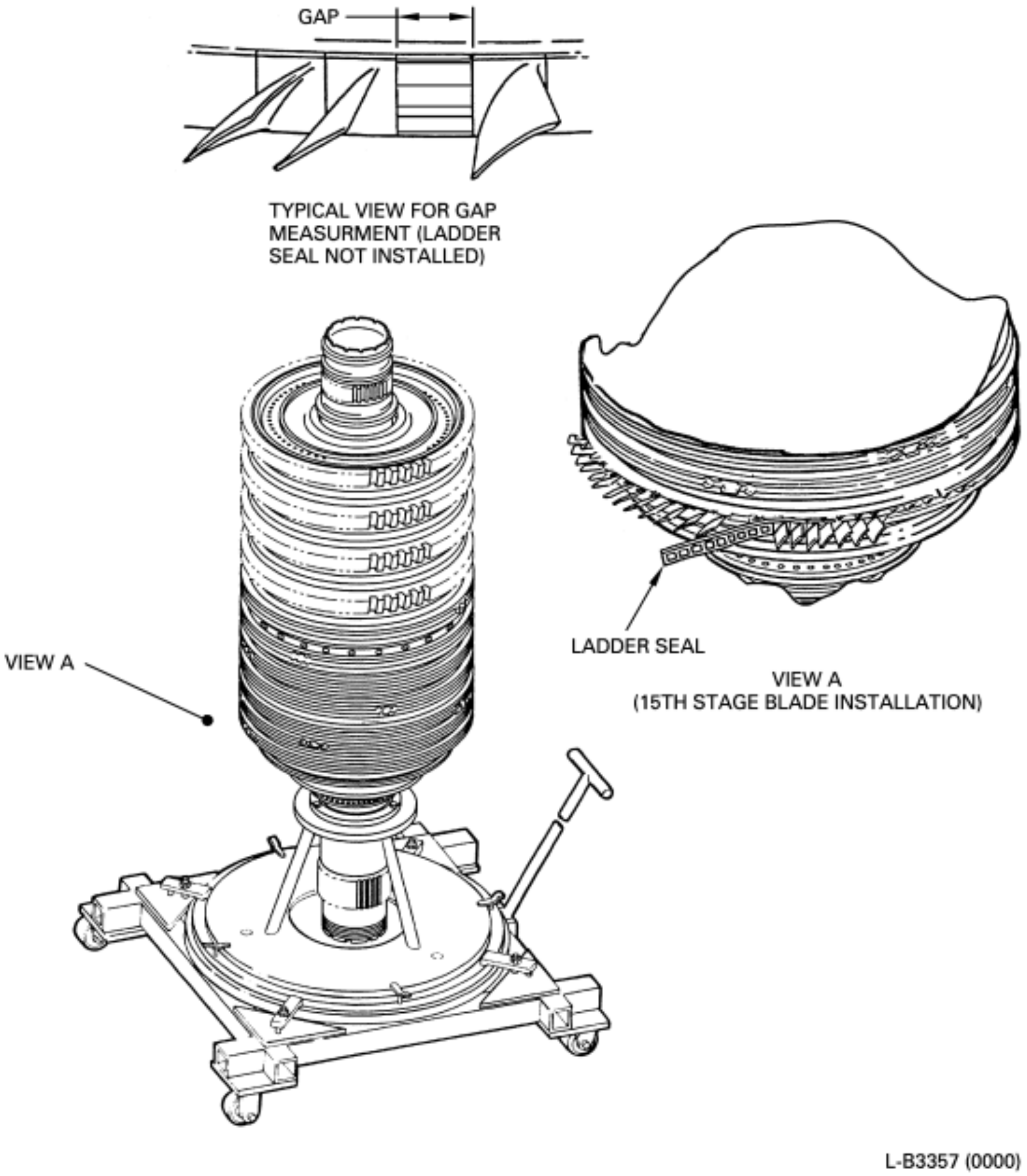
R
R


LOADING SLOT
LOCKING SLOTS AT POSITIONS J (NOT USED)
LOCKING SLOTS AT POSITION K
LOCK
TYPE C
TYPE B
TYPE C

VIEW A

L−B3356 (0000)
PW C

Blade And Lock Installation
Figure 1005 (Sheet 2)
(Task 72−35−01−440−009−A)


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A (15TH STAGE BLADE INSTALLATION)
VIEW A
L-B3357 (0000)

Gap Measurement And Ladder Seal Installation
Figure 1006
(Task 72−35−01−440−009−A)

(3) (Optional) arrange Type A blades in two (2) columns. Start with the heaviest blade at the top left (Column 1), and proceed from left to right in descending order of weight. Lightest blade (blade number 54) will be at the bottom of Column 2. See Figure 1008.

NOTE: One or more Type A blade may have been used as a fitting blade. These blades will be identified by a square that is marked in the service time marking area.

(4) Divide the Types B and C blades into four (4) sets of four (4) blades (two (2) Type B and two (2) Type C blades make a set) such that weights of the sets are as nearly equal as possible. See Figure 1009.

NOTE: The weights must be nearly equal as these blade sets will be positioned opposite each other after assembly.

(5) Install one of the four Types B and C blade sets (two Types B and C blades make a set), two lock and setscrew assemblies and Type A blades, numbers 1 and 54. See Figure 1008, Figure 1009, Figure 1010, Figure 1011 and Figure 1012.

(a) Find one of two 15th stage loading slots that has locking slots on each side of it.

(b) Select one of the Types B and C blade sets. Install one Type C blade, leading edge up, into the slot. Move the blade to the right.

(c) Install one lock and setscrew assembly and move it to the right. Do not tighten the lock.

(d) Install one Type B blade into the slot and move it to the right.

(e) Install the remaining Type B blade into the loading slot and move it to the left.

(f) Inset one lock and setscrew assembly and move it to the left. Do not tighten the lock.

(g) Install the remaining Type C blades and move it to the left.

(h) Install blade number 54 (the lightest Type A blade) and move it to the right.

(i) Install blade number 1 (the heaviest Type A blade) and move it to the left.

(j) Locate the locking slot on the left of the blade loading slot. Move the left lock and setscrew assembly into the left locking slot and tighten. Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(k) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

  1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

  2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

    a If these limits are not kept, check the lock for correct assembly in the disk.

(l) Use an approved marking pen to mark the outside diameter platform of the drum, in line with the lock, with a "V" for future reference.

(m) Move the remaining installed blades and locks to the left until they touch the tightened lock.

(n) Move the right lock so it is positioned in the locking slot and tighten. Torque the lock setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(o) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(6) Rotate the drum 180 degrees. Position the open loading slot toward the operator.

(7) Install blades and lock and setscrew assemblies in Arc CV (right side). See Figure 1008, Figure 1009, Figure 1010, Figure 1011 and Figure 1012.

(a) Find the Type A blades to be installed. Start at the top of Column 1 (blade number 3, the heaviest blade) and continue to the bottom of the column (blade number 53).

(b) Install eight (8) Type A blades in sequence (3 through 17). Start with the heaviest blade (blade number 3). Install it in the loading slot and move it to the right until it touches the blade that was installed before.

(c) Take a Type C blade from the second Types B and C blade set and put it in the loading slot and move it to the right until it touches the blade that was installed before.

(d) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before. Do not tighten the lock.

(e) Take a Type B blade from the second Types B and C blade set and put it in the loading slot and move it to the right until it touches the lock and setscrew assembly.

(f) Install nine Type A blades (19 through 35). Start with the heaviest blade in the loading slot and move it to the right until it touches the blade that was installed before.

(g) Take a Type C blade from the second Types B and C blade set and put it in the loading slot and move it to the right until it touches the blade that was installed before.

(h) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before. Do not tighten the lock.

(i) Take a Type B blade from the second Types B and C blade set and put it in the loading slot and move it to the right until it touches the lock and setscrew assembly.

(j) Install seven Type A blades (37 through 49). Start with the heaviest blade in the loading slot and move it to the right until it touches the blade that was installed before.

(k) Do not install blade numbers 51 and 53 at this time. Blade number 51 will be used as a fitting blade in a later step.

(8) Install blades and lock and setscrew assemblies in Arc CR. See Figure 1008, Figure 1009, Figure 1010, Figure 1011 and Figure 1012.

(a) Find the Type A blades to be installed. Start at the bottom of Column 2 (blade number 52, the lightest blade) and continue up to the top of the column (blade number 2).

(b) Install eight (8) Type A blades in sequence (52 through 38). Start with the lightest blade (blade number 52). Install it in the loading slot and move it to the left until it touches the blade that was installed before.

(c) Take a Type B blade from the third Types B and C blade set and put it in the loading slot and move it to the left until it touches the blade that was installed before.

(d) Install a lock and setscrew assembly in the loading slot and move it to the left until it touches the blade that was installed before. Do not tighten the lock.

(e) Take a Type C blade from the third Types B and C blade set and put it in the loading slot and move it to the left until it touches the lock and setscrew assembly.

(f) Install nine Type A blades (36 through 20). Start with the lightest blade in the loading slot and move it to the left until it touches the blade that was installed before.

(g) Start with the heaviest blade and put each blade in the loading slot and move it to the left until it touches the blade that was installed before.

(h) Take a Type B blade from the third Types B and C blade set and put it in the loading slot and move it to the left until it touches the blade that was installed before.

(i) Install a lock and setscrew assembly in the loading slot and move it to the left until it touches the blade that was installed before. Do not tighten the lock.

(j) Take a Type C blade from the third Types B and C blade set and put it in the loading slot and move it to the left until it touches the lock and setscrew assembly.

(k) Install seven Type A blades (18 through 6). Start with the lightest blade in the loading slot and move it to the left until it touches the blade that was installed before.

(l) Do not install blade numbers 4 and 2 at this time. Blade number 4 will be used as a fitting blade in a later step.

(9) Install a Type B blade from the remaining Types B and C blade set into the loading slot and move it to the left until it touches the blade that was installed before.

(10) Install a lock and setscrew assembly in the loading slot and move it to the left.

(11) Locate the locking slot on the left of the blade loading slot. Move the lock and setscrew assembly into the left locking slot and tighten. Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(a) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(12) Install a Type C blade from the remaining Types B and C blade set into the loading slot and move it to the right until it touches the blade that was installed before.

(13) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before.

(14) Install the remaining Type B blade in the loading slot and move it to the right until it touches the blade that was installed before.

(15) Install blade number 53 and move it to the right.

(16) Install the remaining Type C blade in the loading slot and move it to the left until it touches the tightened lock assembly.

(17) Install blade number 2 and move it fully to the left.

(18) Move blade number 53 and the Type B blade that is to the right of the loading slot to the left until they touch blade number 2.

(19) Locate the locking slot on the right of the blade loading slot. Move the lock and setscrew assembly into the locking slot and tighten. Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(a) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(20) Select two positions that are approximately 90 degrees from the loading slots. These positions will be measured and used to compute the specified gap for each of the two arcs (Arcs CR and CV). See Figure 1010 (Sheets 1 and 2), Figure 1011 and Figure 1012.

NOTE: Put the blades in a radially outward direction to prevent a circumferential serpentine shape to the blades.

(a) Use a PWA 85595 Spreader to load all blades, in the arc, tangentially.

(b) When it is installed, expand the spreader and get the widest possible gap between the blade platforms. If you need help to move the blades, it is permissible to tap lightly on the base of the airfoil with the PWA 86448 Drift.

(c) Measure and make a record of the gap dimension.

(d) Find the Type A blade number 4 that will be installed to fill the measured gap in Arc CV. Use a vernier caliper to measure the platform width of the blade. Record this dimension.

(e) Find the Type A blade number 51 which will be installed to fill the measured gap in Arc CR. Use a vernier caliper to measure the platform width of the blade. Record this dimension.

(f) Compare the gap dimension with the blade platform width dimension.

(g) The width of the blade platform must measure 0.060 - 0.080 inch (1.52 - 2.03 mm) smaller than the gap measured at the drum loading slot between the blades.

(h) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

(21) Do the procedure that follows for both gap positions.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type A blades with oversized Type A blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.060 - 0.080 inch (1.52 - 2.03 mm).

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.080 inch (2.03 mm). If the 0.080 inch (2.03 mm) maximum gap limit is not met, replace the standard Type A blades with the modified blades with wider platforms or the Type A blades with the narrower platform as necessary to get the 0.060 - 0.080 inch (1.52 - 2.03 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

(22) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

(a) If the blade platform width is larger than the gap, determine the difference. If the total amount of material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type A blade not installed. If the total amount of material to be removed exceeds of 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type A blade not installed. Maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

(b) If the total amount of material to be removed exceeds 0.010 inch (0.254 mm), remove an additional Type A blade from the arc and remove material in approximately equal amounts from both sides of the Type A blade platforms. Repeat this procedure for additional Type A blades, as necessary, to obtain the correct gap.

(c) If it is necessary to remove material, machine the HPC 15th stage blade platforms per 72−35−39, Assembly−03 (Task 72−35−39−440−003).

(d) Type A blades with trimmed platforms must be identified with a square symbol in their respective service time marking areas. See 70−11, Standard Practices Manual, PN 585005.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(23) After the gap limits have been met, loosen the lock and setscrew assemblies that were last to be installed. Remove all blades from the right side of the slot and put them in order of removal on the work bench. Remove

all blades from the left side of slot and also put them in order of removal on the work bench.

NOTE: Six blades will stay in the drum. These are the first six blades, (two Types A, B and C blades) and two blade locks installed at the start of this procedure at the V mark.

(24) Apply Antiseize Compound P06−009 to the blade ladder seals (side opposite flat side) and to the drum groove.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(25) Install the appropriate ladder seal and blades 3 through 17. See Figure 1008, Figure 1009, Figure 1010, Figure 1011 and Figure 1012.

NOTE: The blades are to be installed in the order that they were removed.

(a) Put one ladder seal over the loading slot with the flat surface out.

(b) Align the first opening in the seal with the loading slot in the disk.

(c) Install blade number 3, leading edge up, through the seal and into the loading slot.

(d) Move the blade and seal to the right until the second opening is aligned with the loading slot.

NOTE: Be sure that the seal is correctly installed between the 15th stage drum rails.

(e) Continue the blade installation until blades number 17 is installed, moved fully to the right and touches the Type B blade that was installed before.

(f) Install the next Type C blade, the lock, then the next Type B blade. Move them fully to the right until they touch the blades that were installed before.

NOTE: Do not tighten the lock and setscrew assembly.

(26) Use the steps above to complete the installation of the remaining right side blades and locks. Do not install blade number 53 and the last locking blades and lock at this time.

(27) When the blades, locks and ladder seals are fully installed on the right side, install the left side blades, seals and locks by the instructions above except move the blades, seals and locks to the left.

(28) When the steps above are complete, you will have two Type A blades (numbers 2 and 53), two Types B and C blades and two lock and setscrew assemblies that remain on the bench.

(29) Install the remaining blades and locks.

(a) Install the appropriate Type C blade into the drum slot and move it fully to the right.

(b) Install the appropriate Type B blade into the drum slot and move it fully to the left.

(c) Install the appropriate blade lock into the drum slot and move it fully to the right.

(d) Install the appropriate blade lock into the drum slot and move it fully to the left.

(e) Install the remaining Type B blade and move it to the right.

(f) Install the remaining Type C blade and move it to the left.

(g) Blades 2 and 53 can only be inserted into the drum by moving all the blades to the right. To do this, you must rotate the drum 180 degrees and loosen the blade lock screws (at the V mark). Move all blades, seals and locks to the right.

(h) Install blades 2 and 53 in the drum.

(30) Move the blades, seals and locks to the final positions.

(a) Move all blades, seals and locks to the left. Align the blade lock with the V mark made on the drum at the beginning of this procedure.

(b) Check all gaps over Arcs CR and CV. All gaps over Arc CR should be approximately equal. All gaps over Arc CV should be approximately equal.

(c) Tighten and torque the four lock and setscrew assemblies that are located at the two loading slots.

1 Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(d) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(31) Tighten and torque the remaining lock and setscrew assemblies.

(a) Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(b) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

D. Postrequisites

(1) Assemble 14th stage blades to (debladed) axial compressor rotor assembly. See Assembly-22, CONFIG-2 (Task 72-35-01-440-020).

Task 72-35-01-440-009-C:

4. Assemble 15Th Stage Blades In The (Debladed) Axial Compressor
R Rotor Assembly For Engines With Drum Rotor PN 56H013-01 (Post
R SB PW4ENG 72-565), PN 56H013-001 Or 58H236-01 (Post SB PW4ENG
R 72-750)

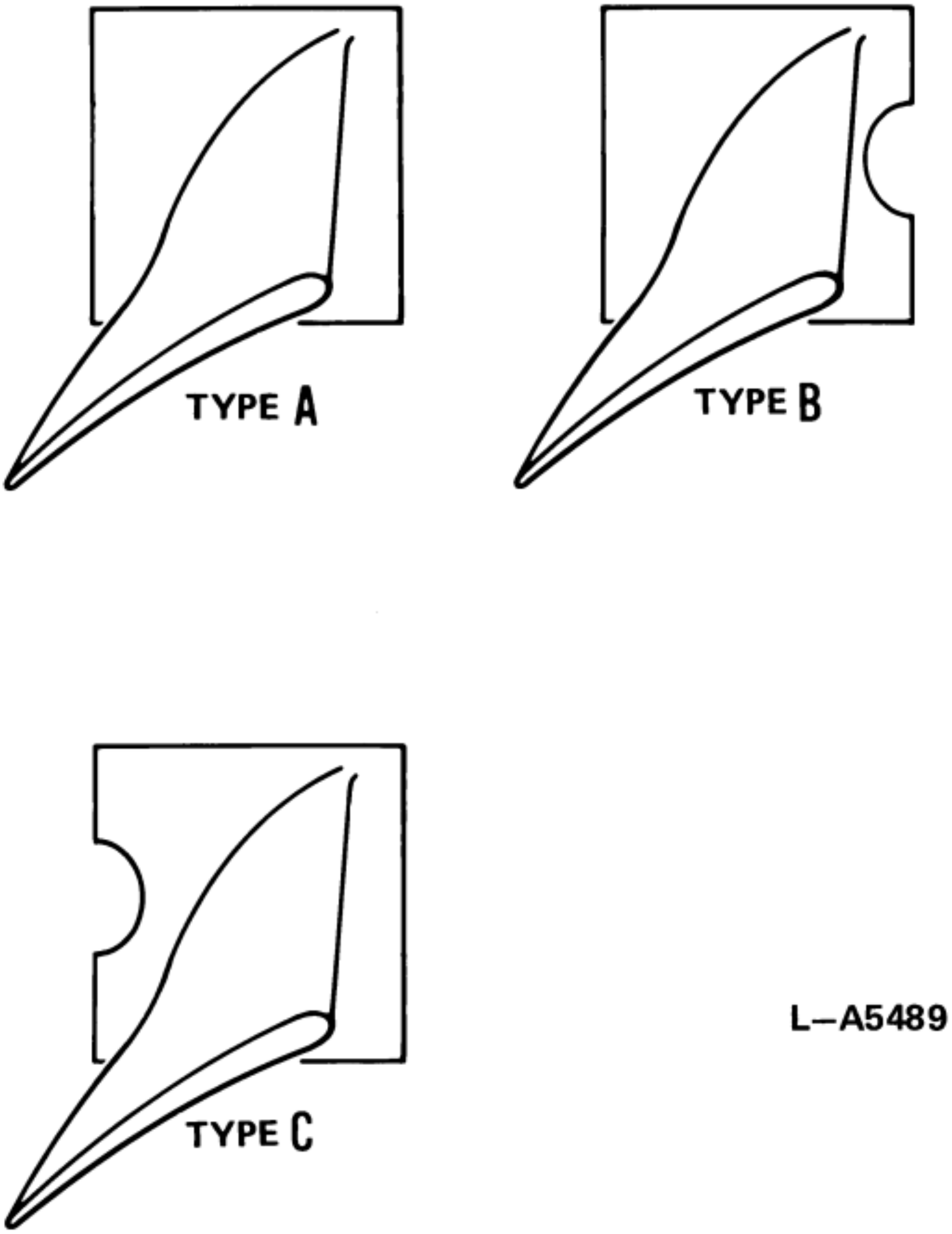
A. Prerequisites

(1) Assemble (debladed) axial compressor rotor assembly. See Assembly-20 (Task 72-35-01-440-007).

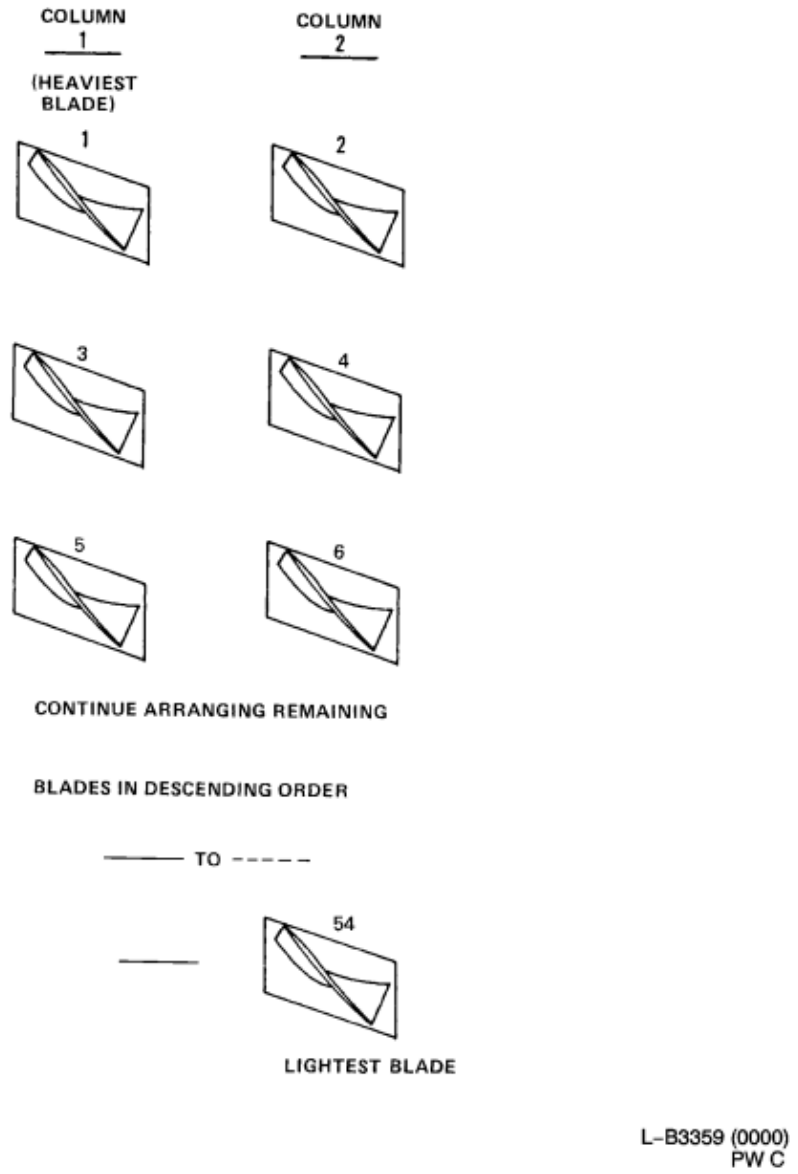
B. Equipment And Materials Necessary

Special Tools:

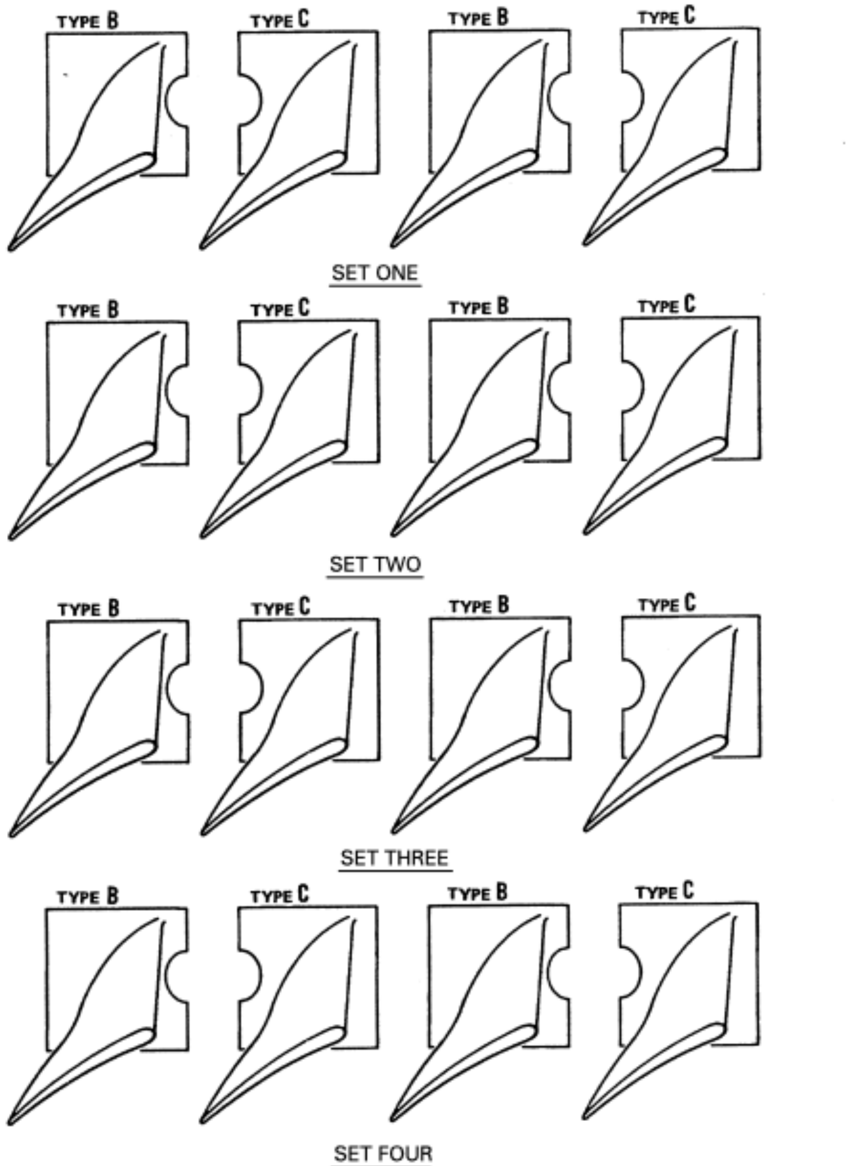
PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader, Manual
PWA 86448	Drift



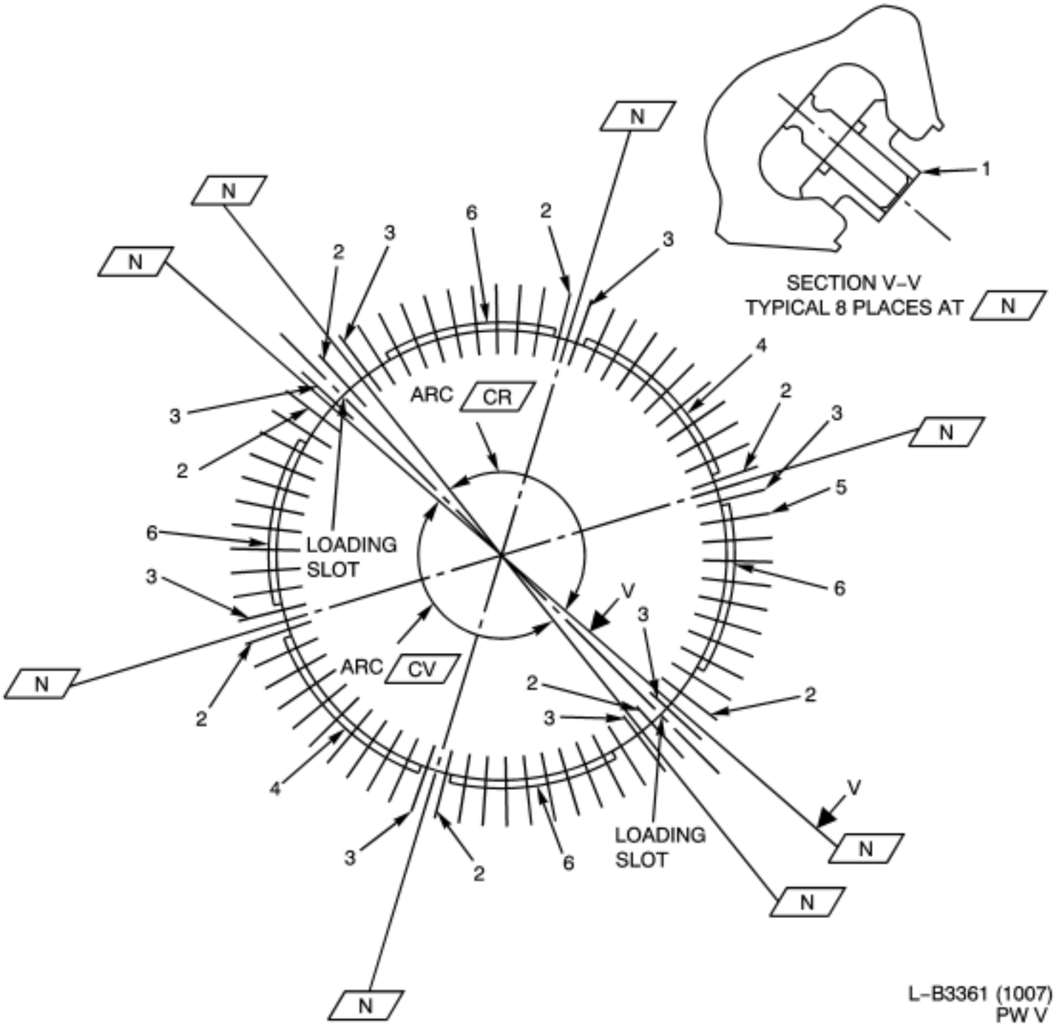
Blade Identification
Figure 1007
(Task 72-35-01-440-009-B)


COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
1
2
3
4
5
6
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
——— TO - - - - -
54
LIGHTEST BLADE
L–B3359 (0000)
PW C

Type A Blade Weight Arrangement
Figure 1008
(Task 72−35−01−440−009−B)

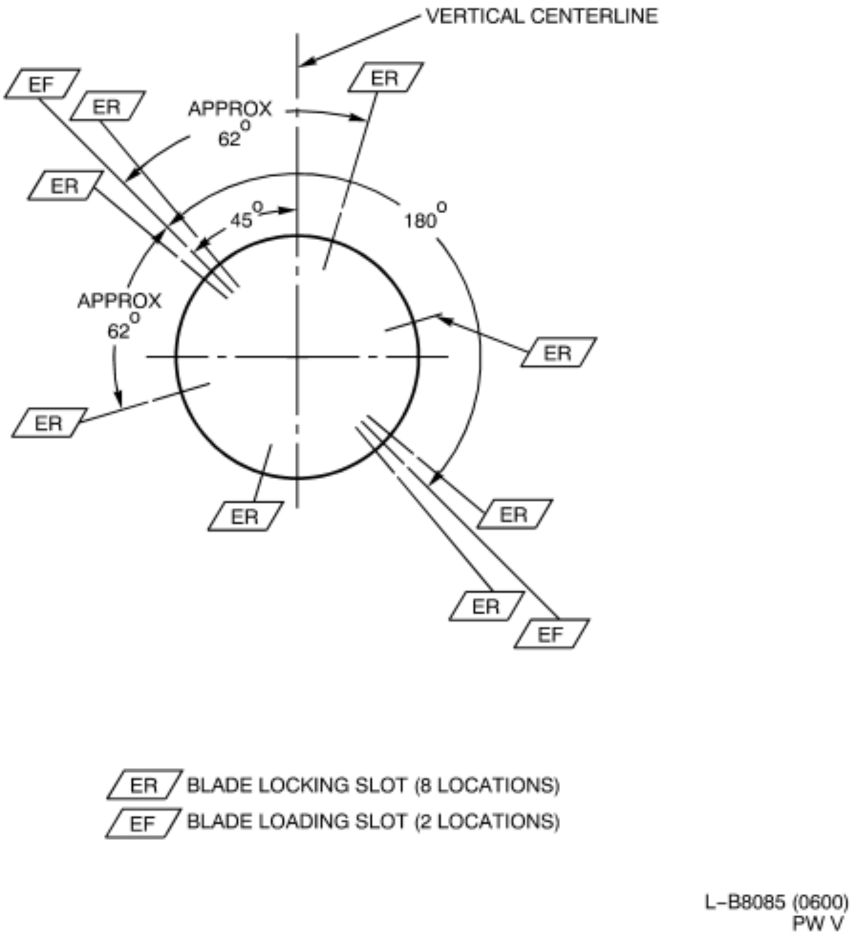

TYPE B
TYPE C
TYPE B
TYPE C
SET ONE
TYPE B
TYPE C
TYPE B
TYPE C
SET TWO
TYPE B
TYPE C
TYPE B
TYPE C
SET THREE
TYPE B
TYPE C
TYPE B
TYPE C
SET FOUR
L-B3360 (0000)

Types B And C Blade Set Arrangement
Figure 1009
(Task 72−35−01−440−009−B)


SECTION V-V
TYPICAL 8 PLACES AT N
N
N
N
N
N
N
N
N
ARC CR
ARC CV
LOADING SLOT
LOADING SLOT
V
V
1
2
3
4
5
6
L-B3361 (1007)
PW V

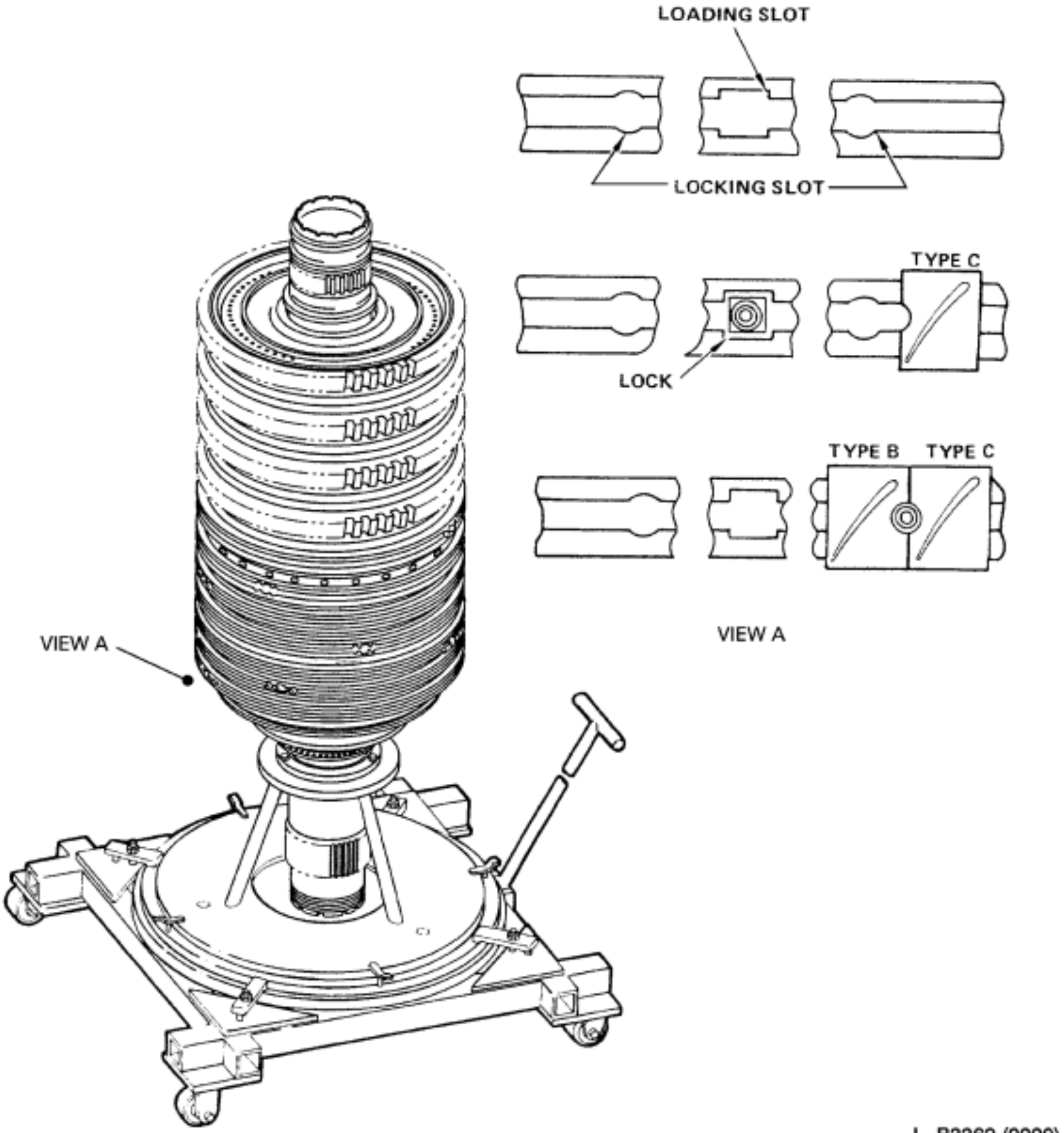
1. Lock And Setscrew Assembly
2. Type C Blades
3. Type B Blades
4. Ladder Seals, PN 55H588, Two Necessary.
5. Type A Blades
6. Ladder Seals, PN 54H335-001, Four Necessary.

Schematic View Of 15th Stage Blade And Lock Installation
R (Drum Rotor PN 53H973-001, 54H803-001, And 54H803-002)
Figure 1010 (Sheet 1)
(Task 72-35-01-440-009-B)

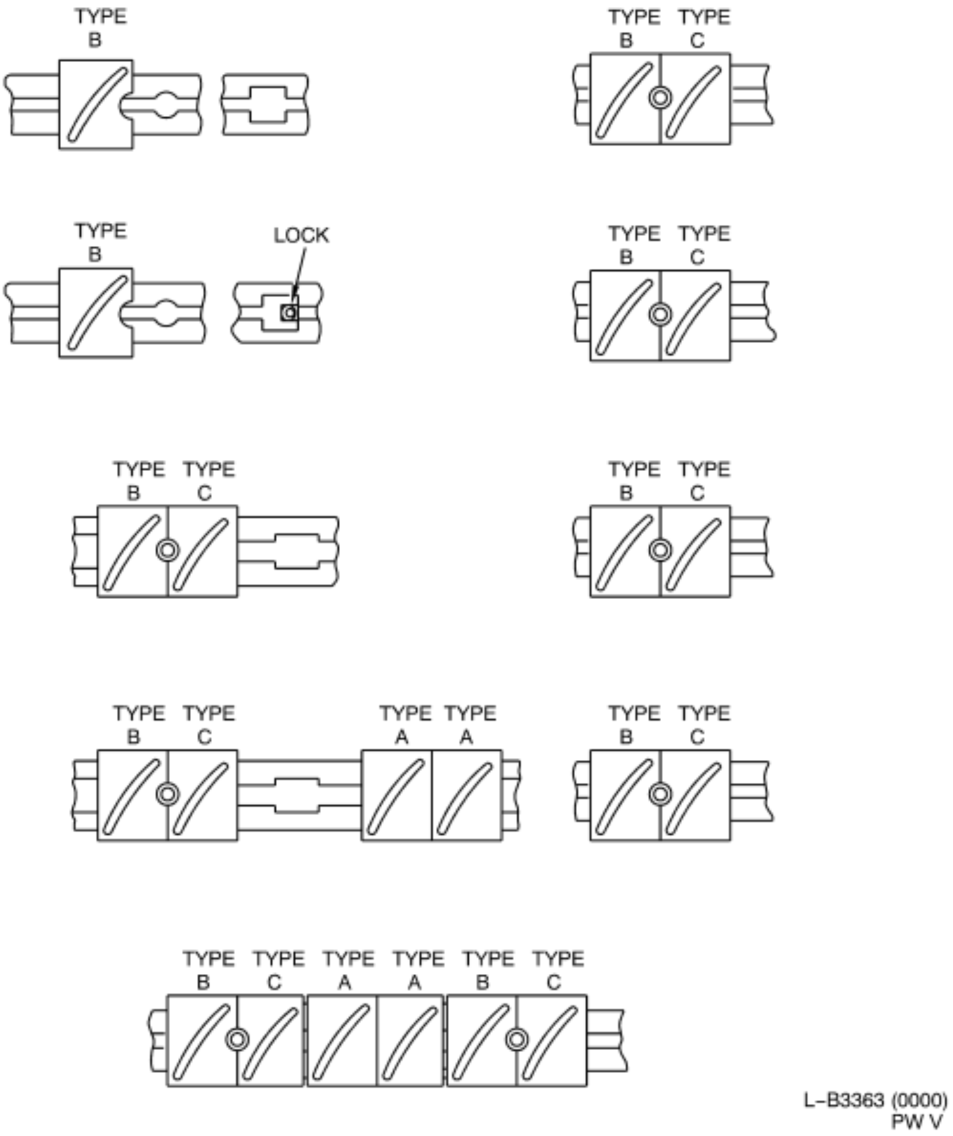

VERTICAL CENTERLINE
EF
ER
APPROX
62°
ER
ER
45°
180°
APPROX
62°
ER
ER
ER
ER
ER
EF
ER BLADE LOCKING SLOT (8 LOCATIONS)
EF BLADE LOADING SLOT (2 LOCATIONS)
L−B8085 (0600)
PW V

Schematic View Of 15th Stage Blade Loading And Lock Slot Locations
R (Drum Rotor PN 53H973−001, 54H803−001, And 54H803−002)
Figure 1010 (Sheet 2)
(Task 72−35−01−440−009−B)

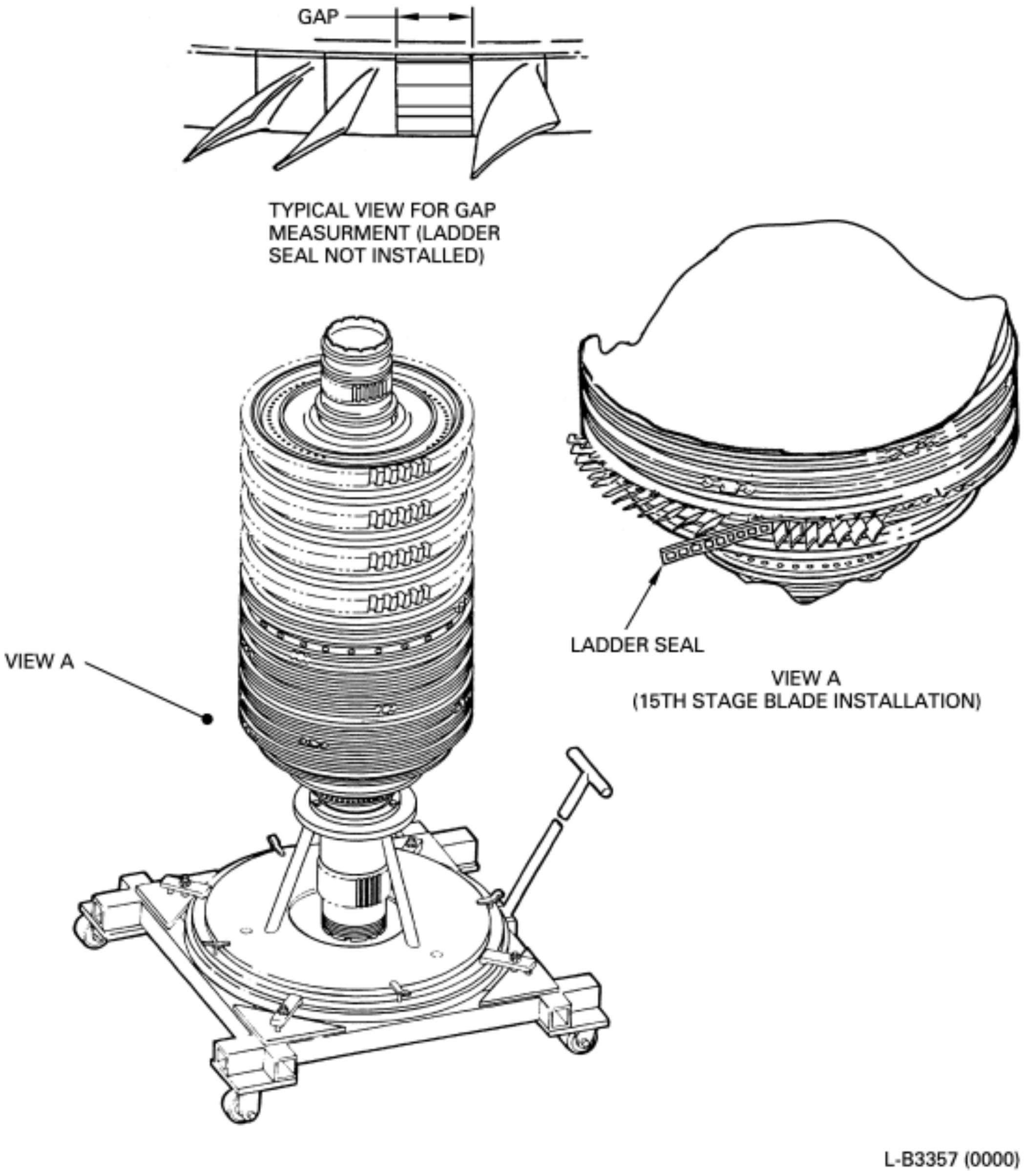
AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-21


LOADING SLOT
LOCKING SLOT
TYPE C
LOCK
TYPE B
TYPE C
VIEW A
VIEW A
L-B3362 (0000)
PW C

Blade And Lock Installation
Figure 1011 (Sheet 1)
(Task 72-35-01-440-009-B)


TYPE B
TYPE B
TYPE C
TYPE B
LOCK
TYPE B
TYPE C
TYPE B
TYPE C
TYPE B
TYPE C
TYPE B
TYPE C
TYPE A
TYPE A
TYPE B
TYPE C
TYPE B
TYPE C
TYPE A
TYPE A
TYPE B
TYPE C
L−B3363 (0000)
PW V

Blade And Lock Installation
Figure 1011 (Sheet 2)
(Task 72−35−01−440−009−B)


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
VIEW A
LADDER SEAL
VIEW A (15TH STAGE BLADE INSTALLATION)
L-B3357 (0000)

Gap Measurement And Ladder Seal Installation
Figure 1012
(Task 72-35-01-440-009-B)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-21

Consumable Materials:

Item No.	Designation
P06-009	Antiseize Compound (PMC 9523)

C. Procedure
See Figure 1013, Figure 1014, Figure 1015, Figure 1016, Figure 1017, and Figure 1018.

NOTE: There are three part numbers (sets) of blades provided for this stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type A is also used to get the correct platform gap and may require platform grinding. A modified Type A blade is also available with a 0.015 inch (0.381 mm) oversized platform width to help you get the correct platform gap. For ease of assembly, blades in this procedure will be referred to as Types A, B and C. See Figure 1013.

NOTE: For the new HPC drum rotor, PN 56H013-01, there are four (4) correctly located loading slots and eight (8) lock setscrew assemblies at eight (8) correctly located locking slots. There are no unused loading slots or unused locking slots.

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(1) Remove 15th stage blades from the storage rack and place them on a bench. Segregate eight Types B and C blades having notches in their platforms and move them to one side. See Figure 1013.

(2) Optional, weigh the 15th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70−11−00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

(3) Optional, arrange Type A blades in six (6) columns. Start with the heaviest blade (blade number 1) at the top of Column 1, and proceed from left to right in descending order of weight. The lightest blade (blade number 54) will be at the bottom of Column 6. See Figure 1014.

NOTE: One or more Type A blade may have been used as a fitting blade. These blades will be identified by a square that is marked in the service time marking area.

(4) Divide the Types B and C blades into four (4) sets of four (4) blades (two (2) Type B and two (2) Type C blades make a set) such that weights of the sets are as nearly equal as possible. See Figure 1015.

NOTE: The weights must be nearly equal as these blade sets will be positioned opposite each other after assembly.

(5) Install one of the four Types B and C blade sets (two Types B and C blades make a set), two lock and setscrew assemblies and Type A blades, numbers 1 and 54. See Figure 1013, Figure 1014, Figure 1015, Figure 1016, Figure 1017 and Figure 1018.

(a) Find one of two 15th stage loading slots that has locking slots on each side of it.

(b) Select one of the Types B and C blade sets. Install one Type C blade, leading edge up, into the slot. Move the blade to the right.

(c) Install one lock and setscrew assembly and move it to the right. Do not tighten the lock.

(d) Install one Type B blade into the slot and move it to the right.

(e) Install the remaining Type B blade into the loading slot and move it to the left.

(f) Inset one lock and setscrew assembly and move it to the left. Do not tighten the lock.

(g) Install the remaining Type C blades and move it to the left.

(h) Locate the locking slot on the left of the blade loading slot. Move the left lock and setscrew assembly into the left locking slot and tighten. Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(i) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

  1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

  2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

    a If these limits are not kept, check the lock for correct assembly in the disk.

(j) Use an approved marking pen to mark the outside diameter platform of the drum, in line with the lock, with a "V" for future reference.

(k) Move the Type C blade to the left until it touches the lock.

(l) Move the Type B blade to the left until it touches the Type C blade.

(m) Move the right lock to the left so it is positioned in the locking slot and tighten. Torque the lock setscrew to the running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi-spline setscrews.

(n) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(6) Rotate the drum 180 degrees. Position the open loading slot toward the operator.

(7) Install blades and lock and setscrew assemblies in Arc CV (right side). See Figure 1013, Figure 1014, Figure 1015, Figure 1016, Figure 1017 and Figure 1018.

(a) Find the Type A blades to be installed. Start at the bottom of Column 6 (blade number 54, the lightest blade) and continue up to the top of the column (blade number 6).

(b) Put each blade, start with the lightest blade (blade number 54), in the loading slot and move it to the right until it touches the blade that was installed before.

(c) Take a Type C blade from the second Types B and C blade set and put it in the loading slot and move it to the right until it touches the blade that was installed before.

(d) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before. Do not tighten the lock.

(e) Take a Type B blade from the second Types B and C blade set and put it in the loading slot and move it to the right until it touches the lock and setscrew assembly.

(f) Find the Type A blades to be installed. Start at the bottom of Column 4 (blade nuber 52) and continue up to the top of the column (blade number 4).

(g) Put each blade, start with the lightest blade (blade number 52), in the loading slot and move it to the right until it touches the blade that was installed before.

(h) Take a Type C blade from the second Types B and C blade set and put it in the loading slot and move it to the right until it touches the blade that was installed before.

(i) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before. Do not tighten the lock.

(j) Take a Type B blade from the second Types B and C blade set and put it in the loading slot and move it to the right until it touches the lock and setscrew assembly.

(k) Find the Type A blades to be installed. Start at the bottom of Column 2 (blade number 50) and continue up the column to blade number 8. Do not install blade number 2 (the last blade in Column 2). Blade number 2 will be used as a fitting blade in a later step.

(l) Put each blade, start with the lightest blade (blade number 50), in the loading slot and move it to the right until it touches the blade that was installed before to complete Arc CV.

(8) Install blades and lock and setscrew assemblies in Arc CR. See Figure 1013, Figure 1014, Figure 1015, Figure 1016, Figure 1017 and Figure 1018.

(a) Find the Type A blades to be installed. Start at the bottom of Column 1 (blade number 1, the heaviest blade) and continue down to the bottom of the column (blade number 49).

(b) Put each blade, start with the heaviest blade (blade number 1), in the loading slot and move it to the left until it touches the blade that was installed before.

(c) Take a Type B blade from the third Types B and C blade set and put it in the loading slot and move it to the left until it touches the blade that was installed before.

(d) Install a lock and setscrew assembly in the loading slot and move it to the left until it touches the blade that was installed before. Do not tighten the lock.

(e) Take a Type C blade from the third Types B and C blade set and put it in the loading slot and move it to the left until it touches the lock and setscrew assembly.

(f) Find the Type A blades to be installed. Start at the top of Column 3 (blade number 3) and continue down to the bottom of the column (blade number 51).

(g) Put each blade, start with the heaviest blade, Blade number 3), in the loading slot and move it to the left until it touches the blade that was installed before.

(h) Take a Type B blade from the third Types B and C blade set and put it in the loading slot and move it to the left until it touches the blade that was installed before.

(i) Install a lock and setscrew assembly in the loading slot and move it to the left until it touches the blade that was installed before. Do not tighten the lock.

(j) Take a Type C blade from the third Types B and C blade set and put it in the loading slot and move it to the left until it touches the lock and setscrew assembly.

(k) Find the Type A blades to be installed. Start at the top of Column 5 (blade number 5) and continue down the column to blade number 47. Do not install blade number 53 (the last blade in Column 5) at this time. Blade number 53 will be used as a fitting blade in a later step.

(l) Put each blade, start with with the heaviest blade (blade number 5), in the loading slot and move it to the left until it touches the blade that was installed before to complete Arc CR.

(9) Install a Type B blade from the remaining Types B and C blade set into the loading slot and move it to the left until it touches the blade that was installed before.

(10) Install a lock and setscrew assembly in the loading slot and move it to the left.

(11) Locate the locking slot on the left of the blade loading slot. Move the lock and setscrew assembly into the left locking slot and tighten. Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(a) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(12) Install a Type C blade from the remaining Types B and C blade set into the loading slot and move it to the right until it touches the blade that was installed before.

(13) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before.

(14) Install the remaining Type B blade in the loading slot and move it to the right until it touches the blade that was installed before.

(15) Install the remaining Type C blade in the loading slot and move it to the left until it touches the tightened lock assembly.

(16) Move the Type B blade that is to the right of the loading slot to the left until it touches the Type C blade.

(17) Locate the locking slot on the right of the blade loading slot. Move the lock and setscrew assembly into the locking slot and tighten. Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(a) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(18) Select two positions that are approximately 90 degrees from the loading slots. These positions will be measured and used to compute the specified gap for each of the two arcs (Arcs CR and CV). See Figure 1013, Figure 1014, Figure 1015, Figure 1016, Figure 1017 and Figure 1018.

NOTE: Put the blades in a radially outward direction to prevent a circumferential serpentine shape to the blades.

(a) Use a PWA 85595 Spreader to load all blades, in the arc, tangentially.

(b) When it is installed, expand the spreader and get the widest possible gap between the blade platforms. If you need help to move the blades, it is permissible to tap lightly on the base of the airfoil with the PWA 86448 Drift.

(c) Measure and make a record of the gap dimension.

(d) Find Type A blade number 2 that will be installed to fill the measured gap in Arc CV. Use a vernier caliper to measure the platform width of this blade. Record this dimension.

(e) Find Type A blade number 53 that will be installed to fill the measured gap in Arc CR. Use a vernier caliper to measure the platform width of this blade. Record this dimension.

(f) Compare the gap dimension with the blade platform width dimension.

(g) The width of the blade platform must measure 0.060 - 0.080 inch (1.52 - 2.03 mm) smaller than the gap measured at the drum loading slot between the blades.

(h) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

(19) Do the procedure that follows for both gap positions.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type A blades with oversized Type A blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.060 − 0.080 inch (1.52 − 2.03 mm).

NOTE: (Post SB PW4ENG 72−703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.080 inch (2.03 mm). If the 0.080 inch (2.03 mm) maximum gap limit is not met, replace the standard Type A blades with the modified blades with wider platforms or the Type A blades with the narrower platform as necessary to get the 0.060 − 0.080 inch (1.52 − 2.03 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

(20) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

(a) If the blade platform width is larger than the gap, determine the difference. If the total amount of material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type A blade not installed. If the total amount of material to be removed exceeds of 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type A blade not installed. Maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

(b) If the total amount of material to be removed exceeds 0.010 inch (0.254 mm), remove an additional Type A blade from the arc and remove material in approximately equal amounts from both sides of the Type A blade platforms. Repeat this procedure for additional Type A blades, as necessary, to obtain the correct gap.

(c) If it is necessary to remove material, machine the HPC 15th stage blade platforms by 72-35-39, Assembly-03 (Task 72-35-39-440-003).

(d) Type A blades with trimmed platforms must be identified with a square symbol in their respective service time marking areas. See 70-11, Standard Practices Manual, PN 585005.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(21) After the gap limits have been met, loosen the lock and setscrew assemblies that were last to be installed. Remove all blades from the right side of the slot and put them in order of removal on the work bench. Remove all blades from the left side of slot and also put them in order of removal on the work bench.

NOTE: Four blades will stay in the drum. These are the first set of four blades, (two Types B and C blades) and two blade locks installed at the start of this procedure at the V mark.

(22) Apply Antiseize Compound P06-009 to the blade ladder seals (side opposite flat side) and to the drum groove.

(23) Install the appropriate ladder seal and the blades from Column 6, the first locking blade pair and one lock and setscrew assembly, again. See Figure 1013, Figure 1014, Figure 1015, Figure 1016, Figure 1017 and Figure 1018.

NOTE: The blades are to be installed in the order that they were removed.

(a) Put one ladder seal over the loading slot with the flat surface out.

(b) Align the first opening in the seal with the loading slot in the disk.

(c) Install blade number 54, leading edge up, through the seal and into the loading slot.

(d) Move the blade and seal to the right until the second opening is aligned with the loading slot.

NOTE: Be sure that the seal is correctly installed between the 15th stage drum rails.

(e) Continue the blade installation until all the blades from Column 6 are installed, moved fully to the right and touches the Type C blade that was installed before.

(f) Install the next Type B blade, the lock, then the next Type C blade. Move them fully to the right until they touch the blades that were installed before.

NOTE: Do not tighten the lock and setscrew assembly.

(24) Use the steps above to complete the installation of the remaining right side blades and locks. Do not install the last locking blades and lock at this time.

(25) When the blades, locks and ladder seals are fully installed on the right side, install the left side blades, seals and locks by the instructions above except move the blades, seals and locks to the left.

(26) When the steps above are complete, you will have two Types B and C blades and two lock and setscrew assemblies that remain on the bench. Install the appropriate Type C blade into the drum slot and move it fully to the right. Install the appropriate Type B blade into the slot and move it fully to the left.

(27) Install the remaining blades and locks.

(a) Install the blade lock and move it fully to the right.

(b) Install the remaining Type B blade into the drum slot and move it fully to the right.

R
R

(c) The last Type C blade and lock can only be inserted into the drum by moving all blades to the right. To do this, you must rotate the drum 180 degrees and loosen the blade lock screws. Move all blades, seals and locks fully to the right.

(d) Install the last blade lock and setscrew assembly into the drum slot and move it fully to the left.

(e) Install the last Type C blade in the drum.

(28) Move the blades, seals and locks to the final positions.

(a) Move all blades, seals and locks to the left. Align one blade lock with the V mark made on the drum at the beginning of this procedure.

(b) Check all gaps over Arcs CR and CV. All gaps over Arc CR should be approximately equal. All gaps over Arc CV should be approximately equal.

(c) Tighten and torque the four lock and setscrew assemblies that are located at the two loading slots.

1 Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(d) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(29) Tighten and torque the remaining lock and setscrew assemblies.

(a) Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(b) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

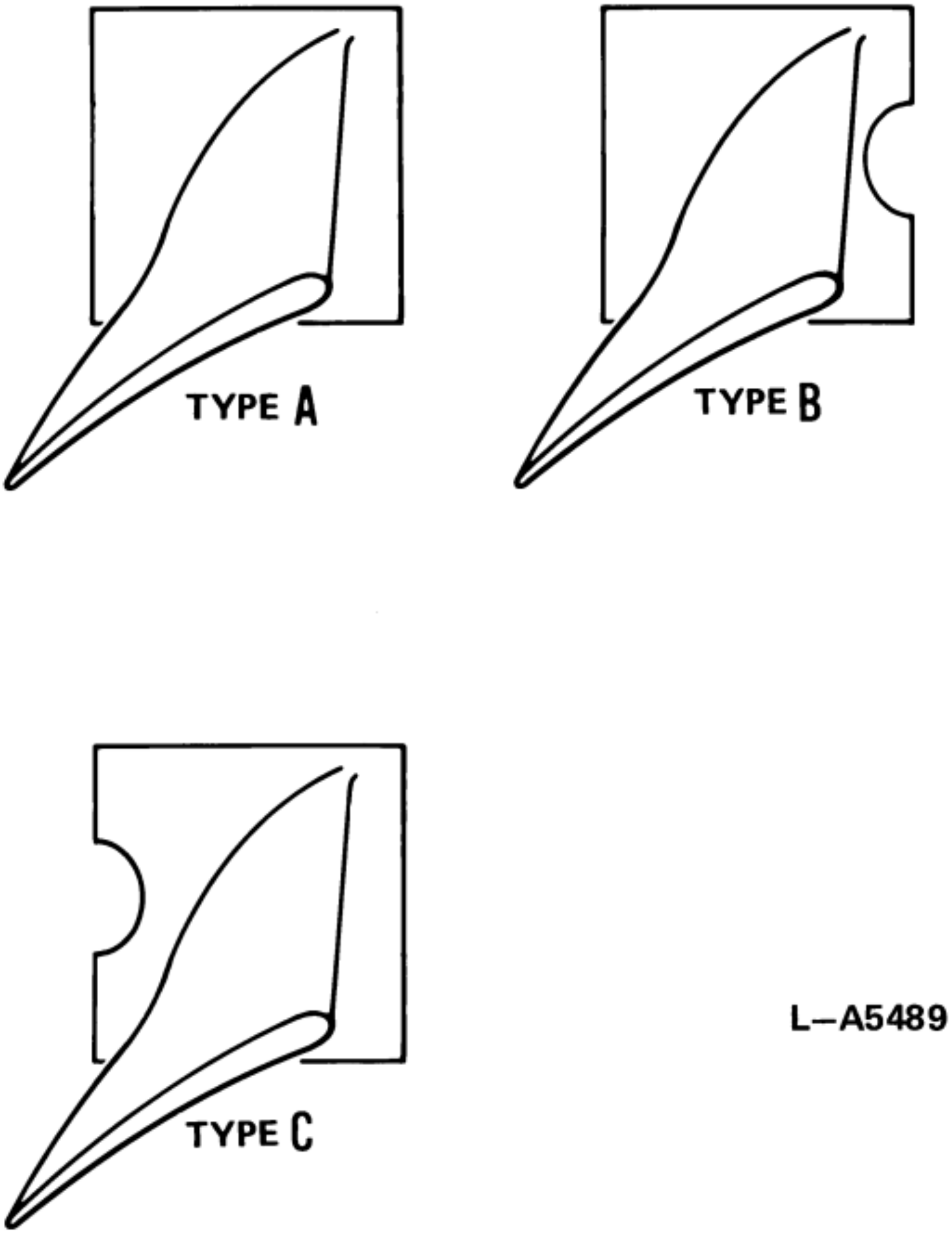
1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

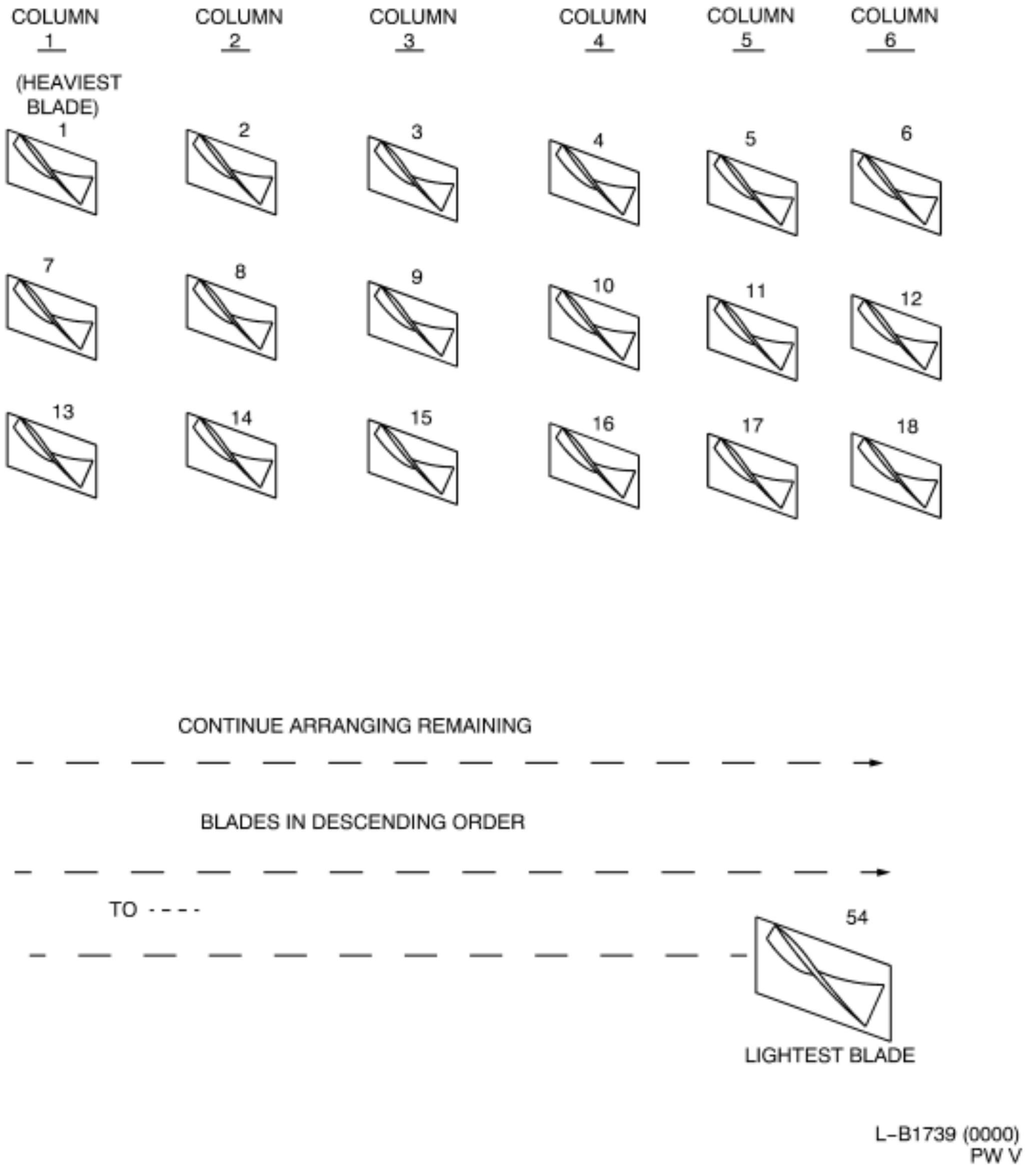
D. Postrequisites

(1) Assemble 14th stage blades to (debladed) axial compressor rotor assembly. See Assembly−22, CONFIG−2 (Task 72−35−01−440−020).



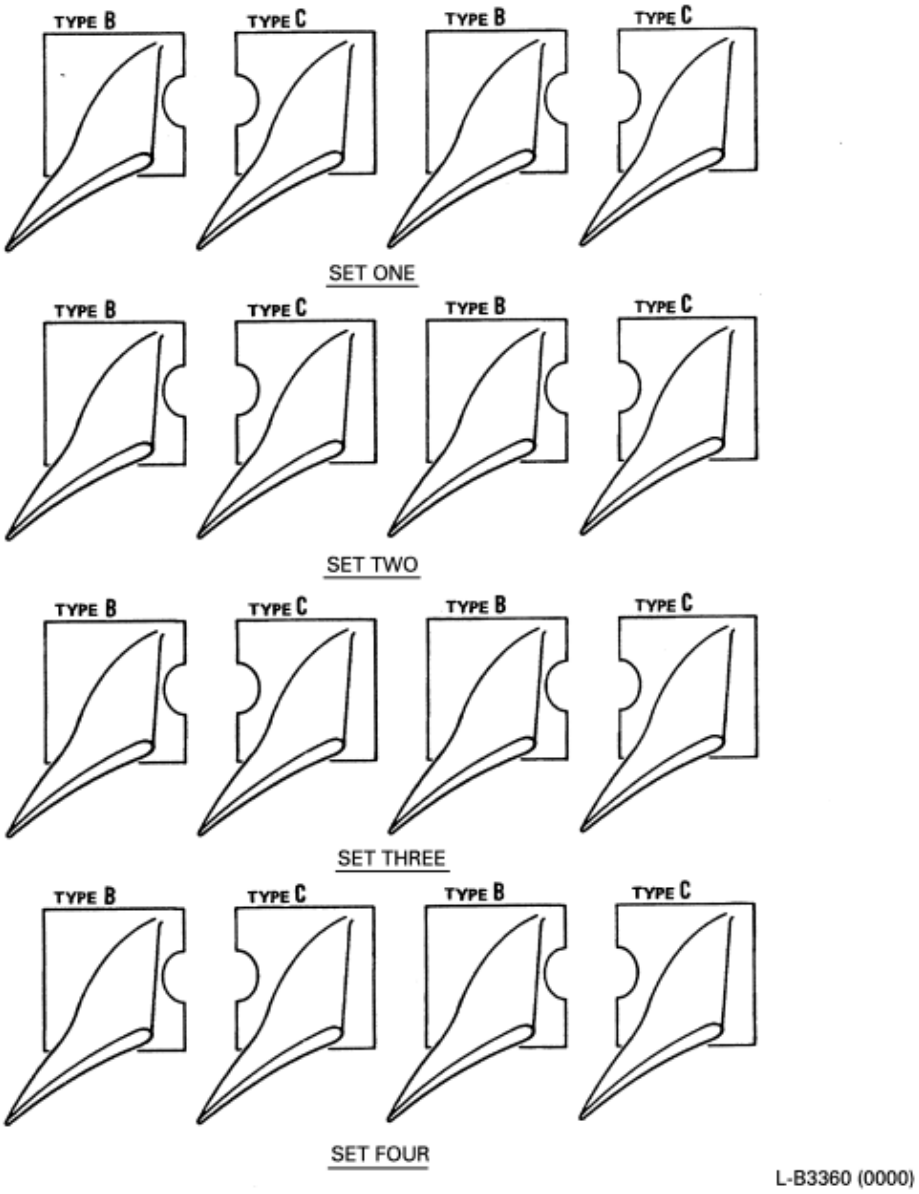
Blade Identification
Figure 1013
(Task 72-35-01-440-009-C)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−21


COLUMN 1
COLUMN 2
COLUMN 3
COLUMN 4
COLUMN 5
COLUMN 6
(HEAVIEST BLADE)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO - - - -
54
LIGHTEST BLADE
L−B1739 (0000)
PW V

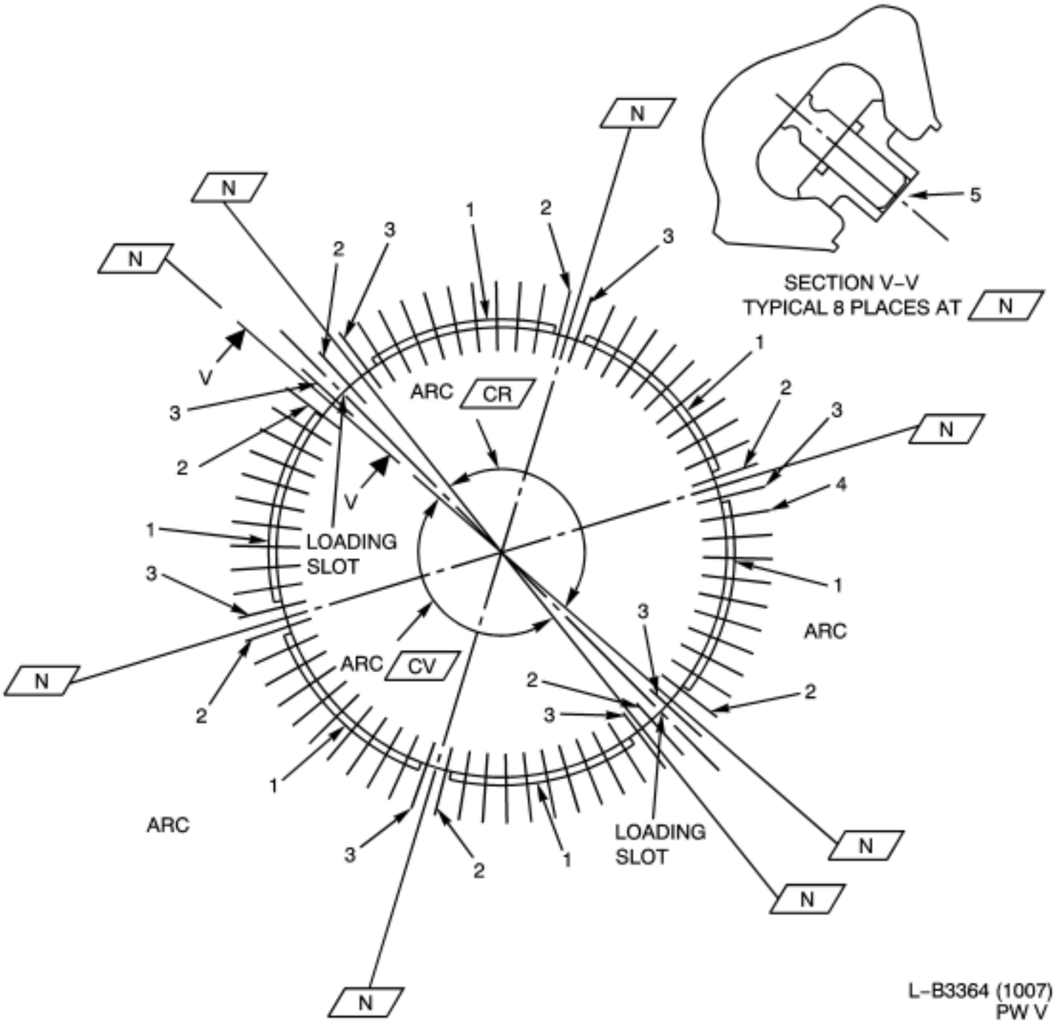
Type A Blade Weight Arrangement
Figure 1014
(Task 72−35−01−440−009−C)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−21


TYPE B
TYPE C
TYPE B
TYPE C
SET ONE
TYPE B
TYPE C
TYPE B
TYPE C
SET TWO
TYPE B
TYPE C
TYPE B
TYPE C
SET THREE
TYPE B
TYPE C
TYPE B
TYPE C
SET FOUR
L-B3360 (0000)

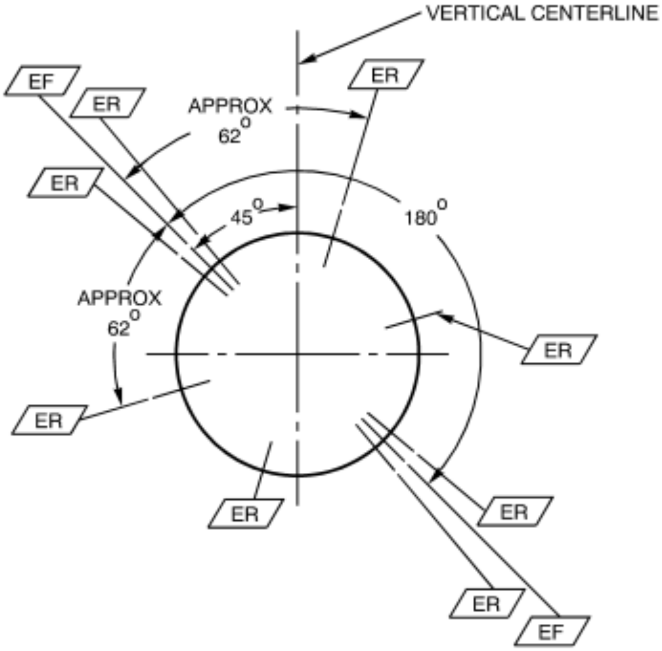
Types B And C Blade Set Arrangement
Figure 1015
(Task 72−35−01−440−009−C)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-21


SECTION V-V
TYPICAL 8 PLACES AT N
5
N
1
2
3
4
V
ARC
CR
CV
LOADING SLOT
L-B3364 (1007)
PW V

1. Ladder Seals, PN 55H588, Six Necessary.
2. Type B Blades
3. Type C Blades
4. Type A Blades
5. Lock And Setscrew Assembly

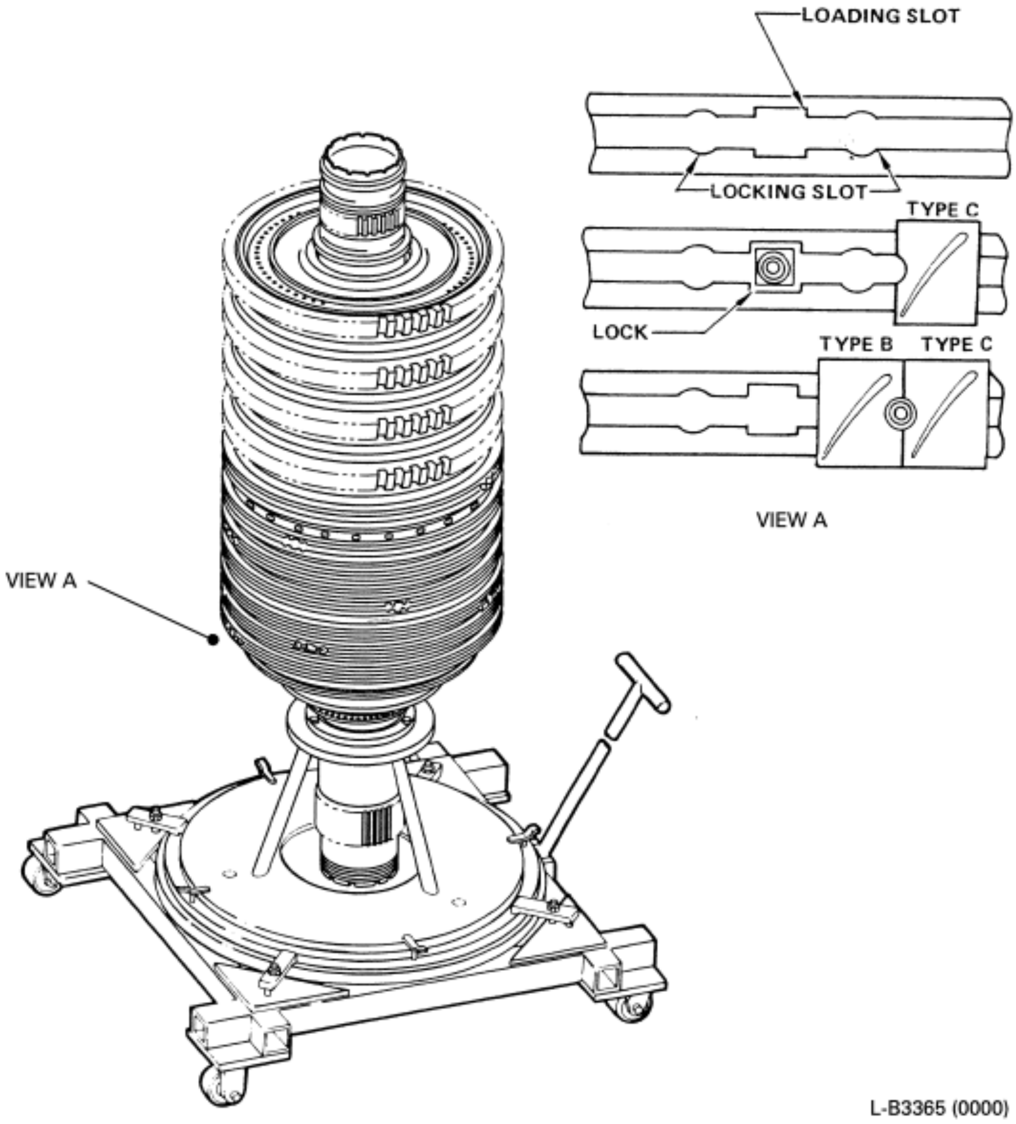
Schematic View Of 15th Stage Blade And Lock Installation
R (Drum Rotor PN 56H013-01, 56H013-001, And 58H236-01)
Figure 1016 (Sheet 1)
(Task 72-35-01-440-009-C)


VERTICAL CENTERLINE
EF
ER
ER
ER
APPROX
62°
45°
180°
APPROX
62°
ER
ER
ER
ER
ER
EF

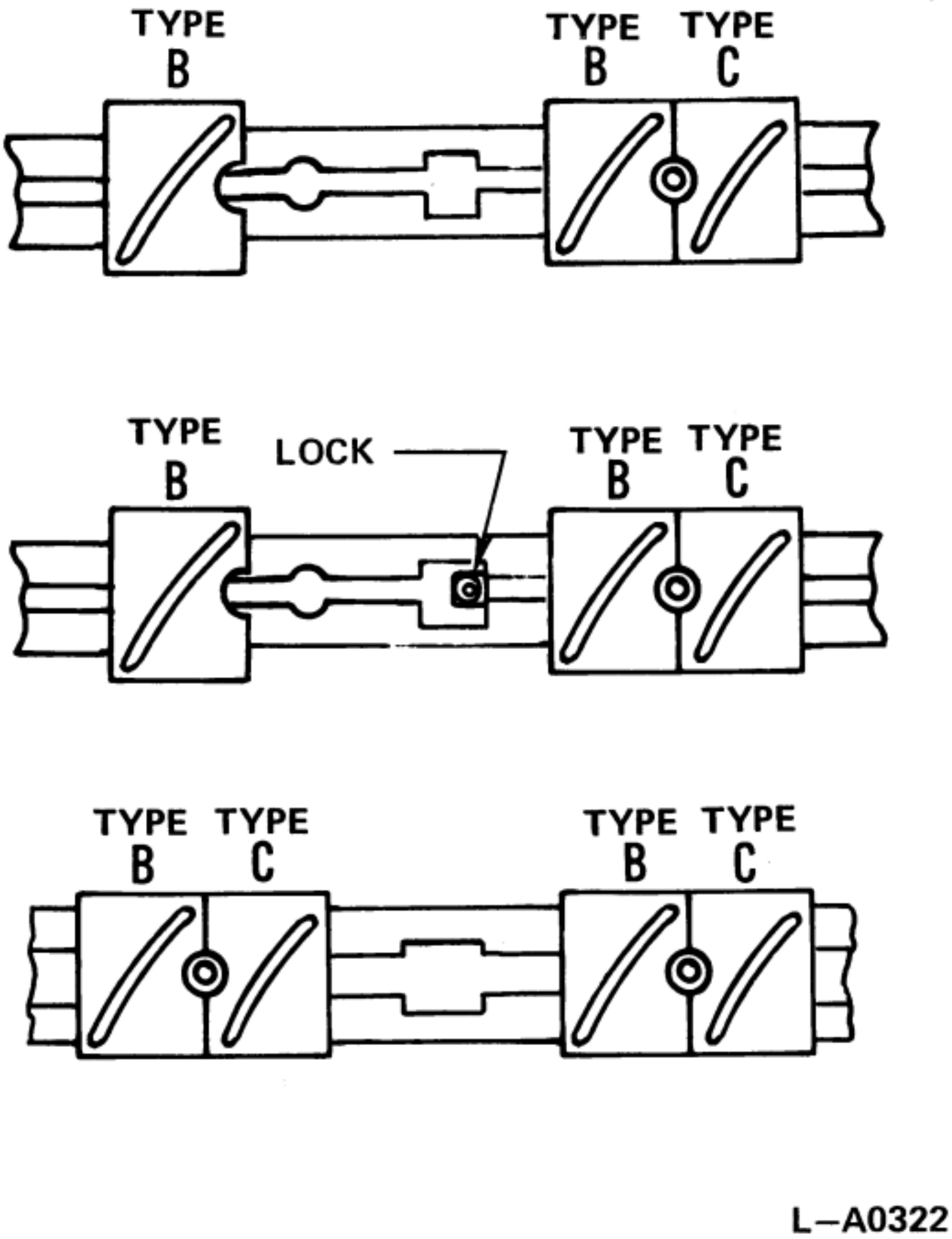
ER BLADE LOCKING SLOT (8 LOCATIONS)
EF BLADE LOADING SLOT (2 LOCATIONS)

L-B8082 (0600)
PW V

Schematic View Of 15th Stage Blade Loading And Lock Slot
R Locations (Drum Rotor PN 56H013-01, 56H013-001, And 58H236-01)
Figure 1016 (Sheet 2)
(Task 72-35-01-440-009-C)

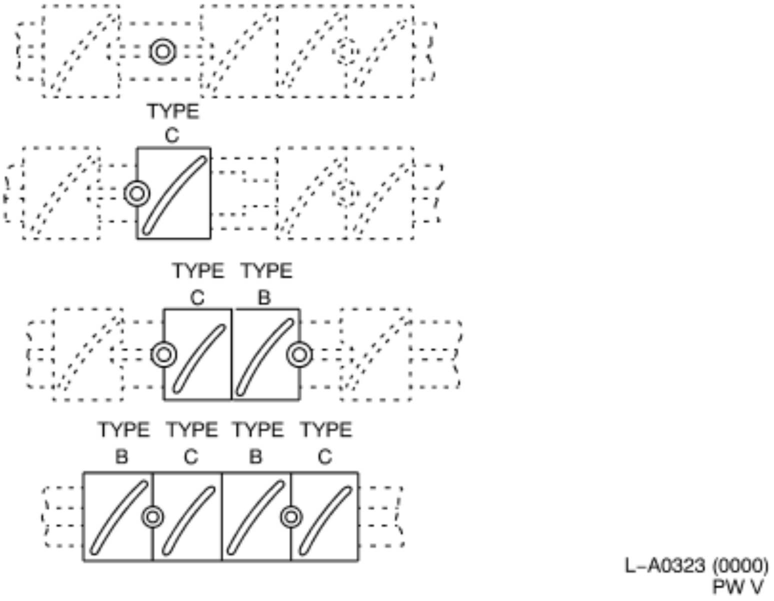

LOADING SLOT
LOCKING SLOT
TYPE C
LOCK
TYPE B
TYPE C
VIEW A
VIEW A
L-B3365 (0000)

Blade And Lock Installation
Figure 1017 (Sheet 1)
(Task 72-35-01-440-009-C)


TYPE B
TYPE B
TYPE C
TYPE B
LOCK
TYPE B
TYPE C
TYPE B
TYPE C
TYPE B
TYPE C
L-A0322

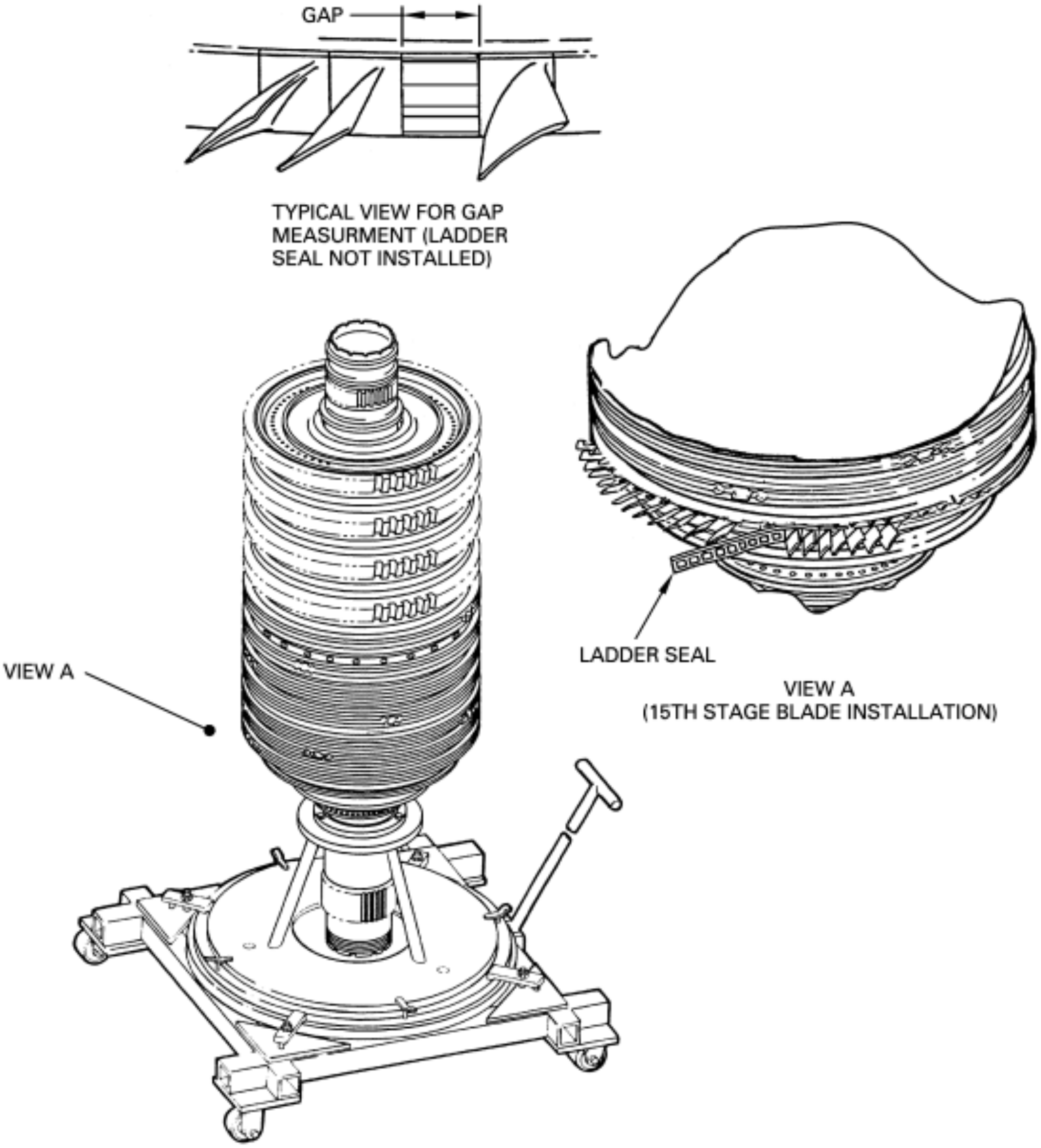
Blade And Lock Installation
Figure 1017 (Sheet 2)
(Task 72-35-01-440-009-C)

R
R


TYPE
C
TYPE
C
TYPE
B
TYPE
B
TYPE
C
TYPE
B
TYPE
C
L-A0323 (0000)
PW V

Blade And Lock Installation
Figure 1017 (Sheet 3)
(Task 72-35-01-440-009-C)

R
R


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A
(15TH STAGE BLADE INSTALLATION)
VIEW A
L-B3357 (0000)

Gap Measurement And Ladder Seal Installation
Figure 1018
(Task 72-35-01-440-009-C)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-35-01-440-010:

1. Assemble 14Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble 15th stage blades to (debladed) axial compressor rotor assembly. See Assembly-21, CONFIG-1 (Task 72-35-01-440-008).

B. Equipment And Materials Necessary

Special Tools:

PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader, Manual
PWA 86448	Drift
PWA 86571	Gage Set

Consumable Materials:

Item No.	Designation
P06-009	Antiseize Compound (PMC 9523)

C. Procedure
See Figure 1001, Figure 1002, Figure 1003, Figure 1004, Figure 1005 and Figure 1006.

NOTE: There are three part numbers (sets) of blades provided for this stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type A is also used for fitting and may require platform grinding. SB PW4ENG 72-434 provides blades with platforms that are 0.015 inch (0.381 mm) oversize. For ease of assembly, blades in this procedure will be referred to as Types A, B and C.

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−22

CAUTION: DO NOT OVERTIGHTEN GAGE SET SCREWS DURING INSTALLATION OF GAGES. DAMAGE TO THE DRUM CAN RESULT.

(1) Measure Z−Plane diameter for Stage 14. This procedure is optional and can only be used for blades have been removed. Select the pair of gages, marked for that stage, from the PWA 86571 Z−Plane Diameter Gage Set. Install gages, 180 degrees apart, in blade slots. Turn gage set screws clockwise to move the gages radially out to their most outward position. Use OD micrometers to measure four diameters, every 45 degrees, over the gage tool balls. Calculate Z−Plane diameter of the stage by subtracting twice the reference dimension, marked on each pair of gages, from the average diameter measured over the gage tool balls. Refer to minimum, maximum and nominal Z−Plane diameters listed, for reference only, in Table 1001.

Stage	Minimum Diameter (Reference)	Maximum Diameter (Reference)	Nominal Diameter (Reference)
14	23.192 inch (589.077 mm)	23.200 inch (589.280 mm)	23.196 inch (589.178 mm)

HPC Front Drum Z−Plane Diameters
Table 1001

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(2) Remove 14th stage blades from storage rack and place them on bench. Segregate eight Types B and C blades having notches in their platforms and move to one side. See Figure 1001.

(3) Optional, weigh the 14th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70−11−00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps

are not required if subsequent rotor balance procedures are carefully done.

(4) Optional, arrange Type A blade in four columns, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. Lightest blade will be at bottom of Column 2. See Figure 1002.

NOTE: One or more Type A blade may have been used as a fitting blade. Blade will be identified by a square in the service time marking area.

(5) Select two sets of four blades (two Types B and C per set) such that weights of sets are as nearly equal as possible. See Figure 1003.

NOTE: Weights must be nearly equal as sets will be positioned opposite each other after assembly.

(6) Selecting one of the blade sets, and with loading slot of disk facing operator, install one Type C blade, leading edge up, into slot. Move blade to right. Install one lock and setscrew and move to right. Install one Type B blade into slot. Move to right. See Figure 1004 (Sheet 1).

(7) From the same set, install remaining Type B blade into slot and move to left. Install one lock and setscrew and move to left. Install remaining Type C blade and move to left. See Figure 1004 (Sheet 2).

(8) Locate locking slot to left of blade loading slot. Move left lock to left locking slot and tighten and torque setscrew to running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(9) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

1 If these limits are not kept, check the lock for correct assembly in the disk.

(10) Using approved marking pen, mark OD platform of drum in line with lock with "V" for future reference.

(11) Move Type C blade (right side of lock) to the left to rest against lock. See Figure 1004 (Sheet 3).

(12) Move Type B blade and right lock to left and lock setscrew to running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(13) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

1 If these limits are not kept, check the lock for correct assembly in the disk.

(14) Push two remaining Types B and C blades to butt against just−installed locks. See Figure 1004 (Sheet 3).

(15) Rotate drum 180 degrees. Position open blade slot toward operator.

(16) Starting at bottom of 4th column of weight−ordered Type A blade, and proceeding vertically from bottom of column to top, position each blade into loading slot and move to right to rest against previously installed blades and lock. When 4th column of blades is used, start at bottom of 2nd column and position each blade into loading slot and to right until all blades from Column 2 are inserted.

(17) Starting at top of 3rd column of blades, position each blade into loading slot and move to left to rest against blades at opposite end. When 3rd column of blades is used, start at top of 1st column and position each blade into loading slot and to left until all blades except one from Column 1 are inserted.

(18) Install two blades from remaining Types B and C sets into loading slot and move to left. Install remaining two blades from Types B and C sets to slot and move to right. Remaining blade should be one Type A blade which will be used for fitting. Load all blades tangentially so as to form widest possible gap at disk loading slot. Measure gap using PWA 85595 Spreader. See Figure 1005.

   (a) Place spreader into vacant blade space. Expand spreader with torque handle and measure blade gap with a vernier caliper. Record this dimension.

   (b) Measure platform width of Type A blade, not installed in drum, with vernier caliper. Record this dimension.

   (c) Compare the gap dimension with the blade platform width dimension.

   (d) The width of the blade platform must measure 0.020 − 0.055 inch (0.51 − 1.40 mm) smaller than the gap measured at the drum loading slot between the blades.

   (e) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

(19) Do the procedure that follows to get the correct blade platform width for the measured gap.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type A blades with oversized blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.020 − 0.055 inch (0.51 − 1.40 mm).

NOTE: (Post SB PW4ENG 72−703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). If the 0.055 inch (1.397 mm) maximum gap limit is not met, replace the standard Type A blades with the modified blades with wider platforms or the Type A blades with the narrower platform as necessary to get the 0.020 − 0.055 inch (0.51 − 1.40 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

(20) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

(a) If blade platform width is larger than the gap, determine the difference. If the total material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type A blade not installed. If total amount of material to be removed exceeds of 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type A blade not installed. Maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

(b) If total amount of material to be removed exceeds 0.010 inch (0.254 mm), remove additional Type A blade to obtain proper fit and remove material in approximately equal amounts from both sides of Type A blade platform.

(c) If total amount of material to be removed exceeds 0.080 inch (2.032 mm), remove additional Type A blades as required to obtain the 0.020 − 0.055 inch (0.51 − 1.40 mm) fit. Remove material in equal amounts from both sides of platform on these blades. Maximum material removal per platform side must not exceed 0.005 inch (0.127 mm). Type A blades with trimmed platforms must be identified with a square symbol in their respective service time marking areas. See 70−11, Standard Practices Manual, PN 585005.

(d) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). SB PW4ENG 72−434 provides blades with platforms that are 0.015 inch (0.381 mm) oversize. If the 0.055 inch (1.397 mm) maximum gap limit is not met, interchange these wider platform blades with Type A blades as needed to meet the 0.020 − 0.055 inch (0.51 − 1.40 mm) limit.

(21) If necessary, grind HPC 14th stage blade platforms per 72−35−39, Assembly−03 (Task 72−35−39−440−003). As an alternate to grinding platforms on Type A blades, PN 52H614−04 blades may be used in their place. These blades have platforms which are preground to 0.010 inch (0.254 mm) undersize. Replace one or more Type A blades with the preground blade as required to obtain the 0.020 − 0.055 inch (0.51 − 1.40 mm) fit.

(22) If grinding of blade platforms was required, install Type A blades in slot and check gap. Continue grinding and checking gap until 0.020 − 0.055 inch (0.51 − 1.40 mm) limit is met.

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−22

(23) After gap limits have been met, remove all blades from right side of slot and place them in order of removal on bench. Remove all blades from left side of slot and place them in order of removal on bench.

NOTE: Four blades are to remain in disk. These are the first set of four blades (two Types B and C) and two blade locks installed at beginning of this procedure.

(24) Apply Antiseize Compound P06−009 to seals (side opposite flat side) and to drum groove.

(25) Aligning slots, prepare to install blade seal to drum, flat side out. Seal will be installed from left to right. Selecting blades from bench in same order in which they were previously installed in right side of drum, install blades to seal and drum, and move (slide) blade and seal to right. See Figure 1005.

NOTE: Use nonmetallic drift and mallet to move blades and seals around drum.

(26) Install remaining right side blades into seal and drum per schematic view Figure 1006. Install reworked Type A blade equally.

(27) When blades and seal have been installed at right side, install left side blades and seal per instructions above except moving blades and seal from right to left. See Figure 1006. Install reworked Type A blades equally spaced.

(28) At this point, four (two Types B and C) blades of the second set should remain on bench. Install Type C blade into drum slot and move to right. Install Type B blade into slot and move left.

(29) Install blade lock and move to right. Install remaining Type B blade and move to right. The last Type C blade and lock can only be inserted in drum by shifting all blades to right. Therefore, rotate drum 180 degrees and loosen blade lock screws. Move all blades and seals to right. Install blade lock in drum slot and move left. Install Type C blade in drum.

(30) Move all blades and seals to left, aligning one blade lock with "V" mark made on drum at beginning of this procedure. Tighten and torque all blade locks to running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multispline setscrews.

(31) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

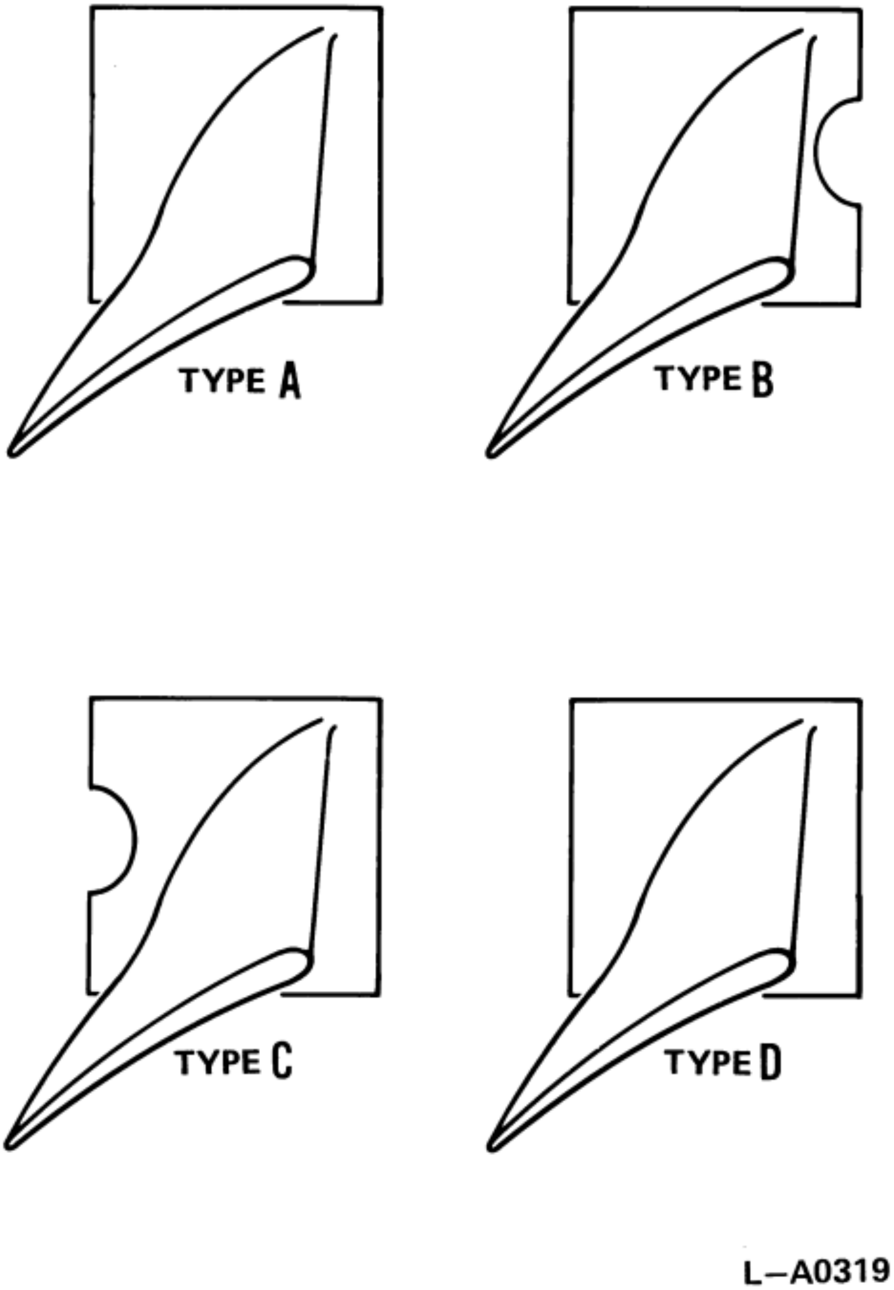
(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

1 If these limits are not kept, check the lock for correct assembly in the disk.

(32) Use a feeler gage to measure the gap, which extends between the loading slots, in each 180 degree arc on
R the two sides of the drum. Each arc must have a 0.010
R − 0.030 inch (0.25 − 0.76 mm) gap, measure both sides at the same time. If the gap in not in limit, you must change blades from one side of the rotor to the other, or additional material can be removed from the blade platforms on the side that is too tight. If material is removed you must also keep the 0.020 − 0.055 inch (0.51 − 1.40 mm) gap limit.

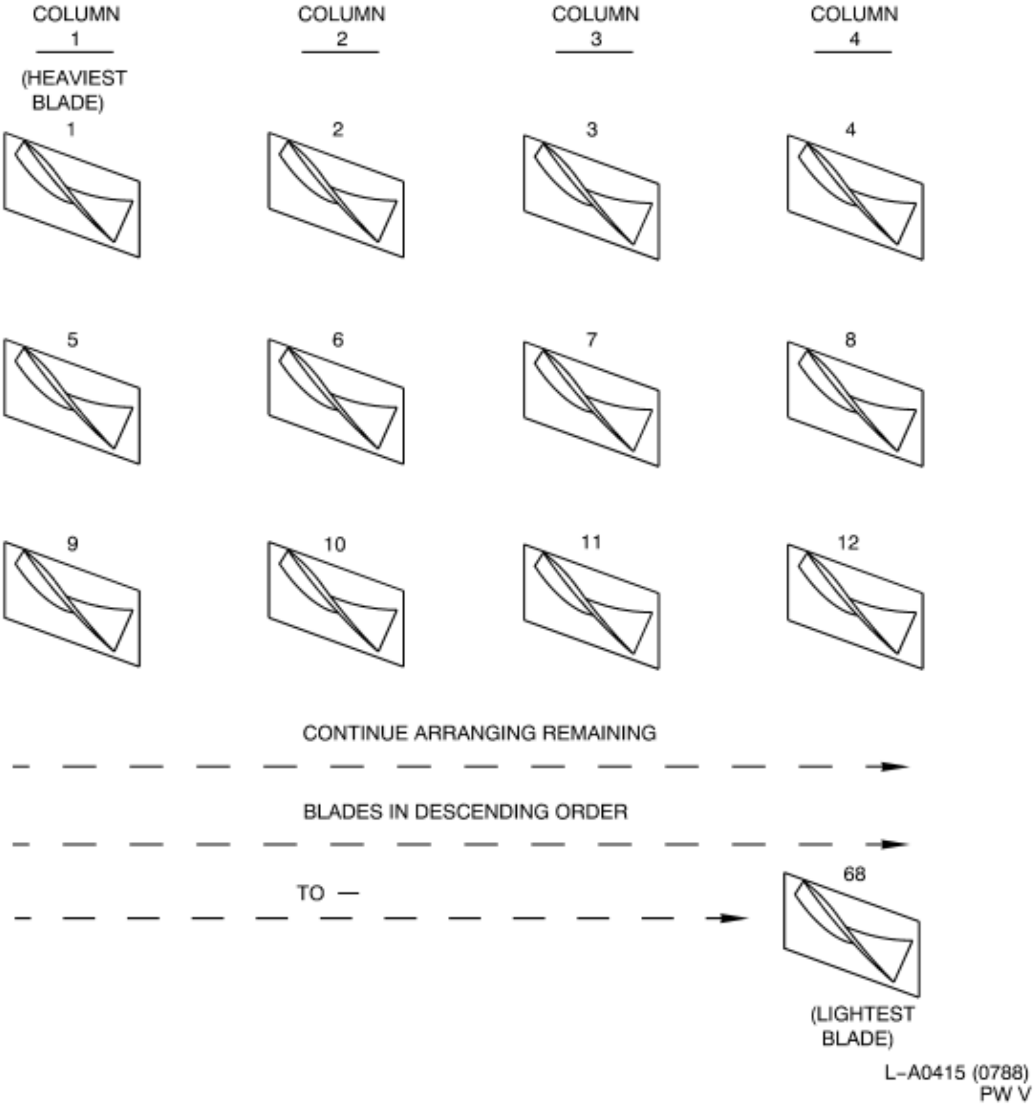
D. Postrequisites

(1) Assemble 13th stage blades to (debladed) axial compressor rotor assembly. See Assembly−23, CONFIG−1 (Task 72−35−01−440−011).

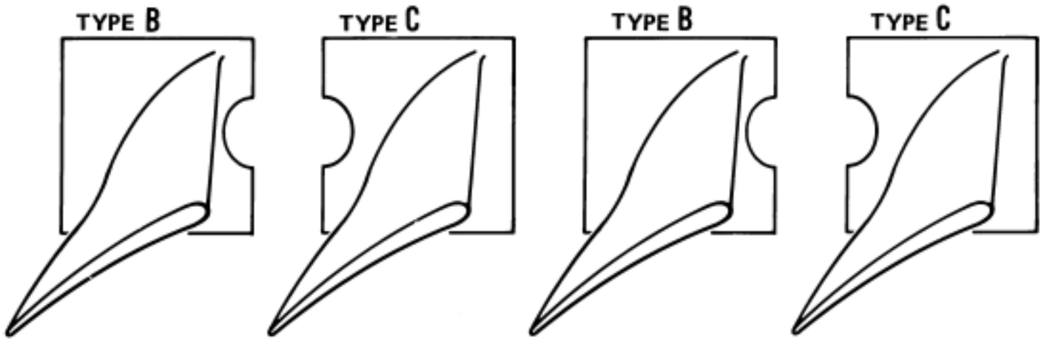

TYPE A
TYPE B
TYPE C
TYPE D
L−A0319

Blade Identification
Figure 1001
(Task 72−35−01−440−010)

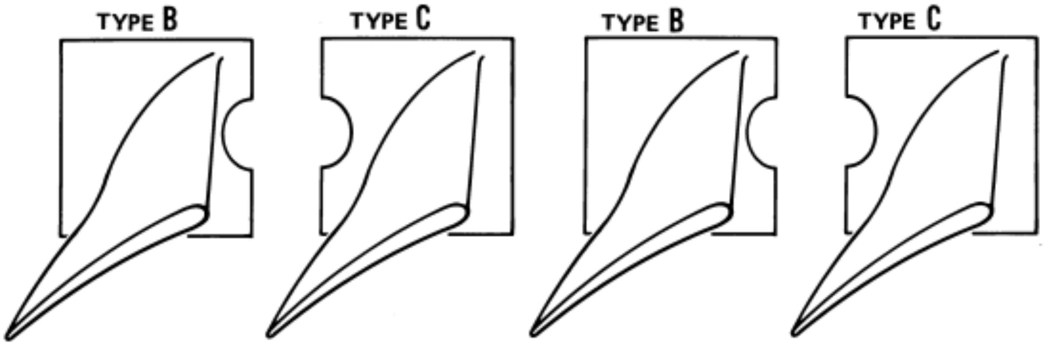
AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−22


COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
COLUMN 3
COLUMN 4
1
2
3
4
5
6
7
8
9
10
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO —
68
(LIGHTEST BLADE)
L−A0415 (0788)
PW V

Blade Weight Arrangement
Figure 1002
(Task 72−35−01−440−010)


TYPE B
TYPE C
TYPE B
TYPE C

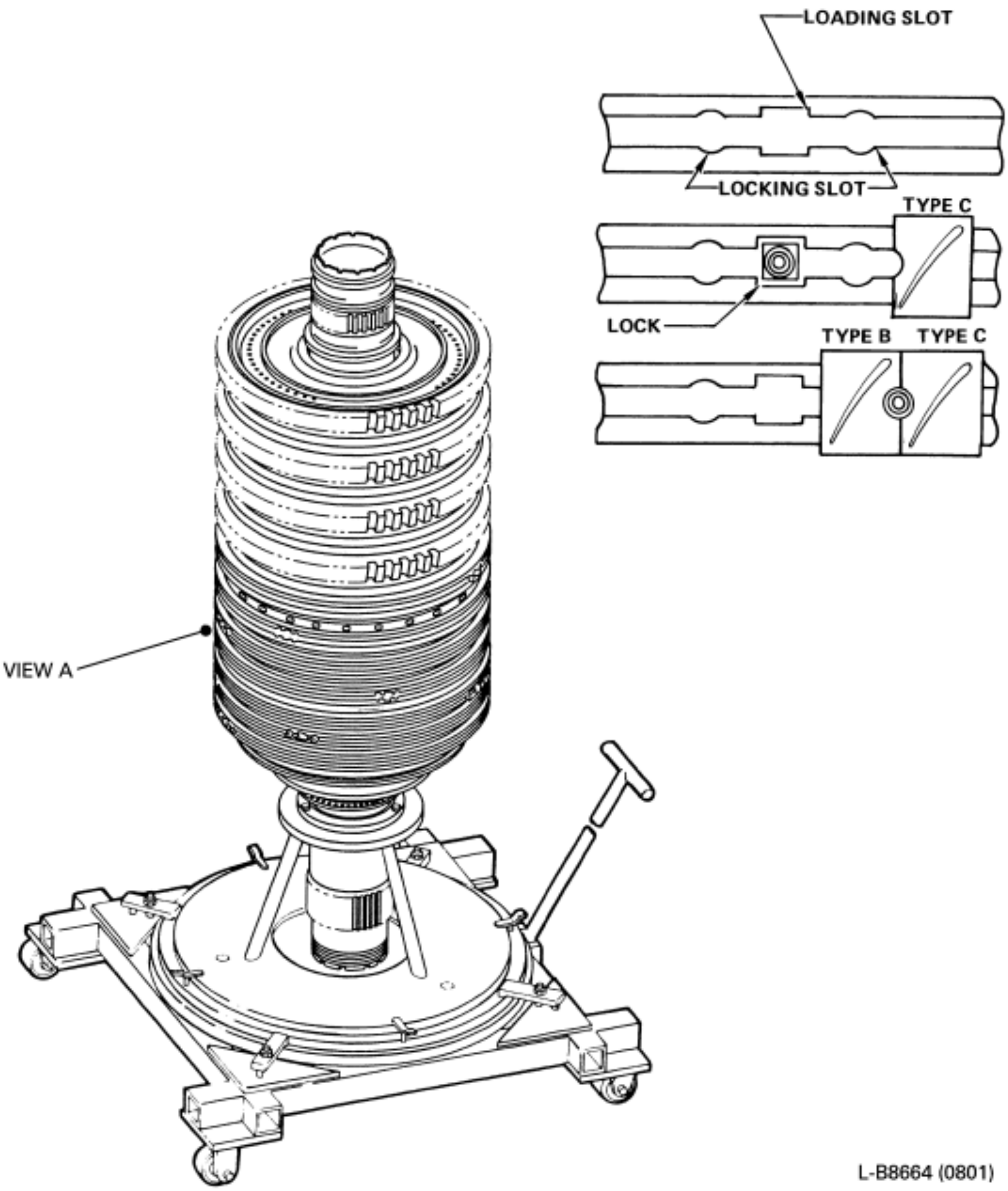
SET 1


TYPE B
TYPE C
TYPE B
TYPE C

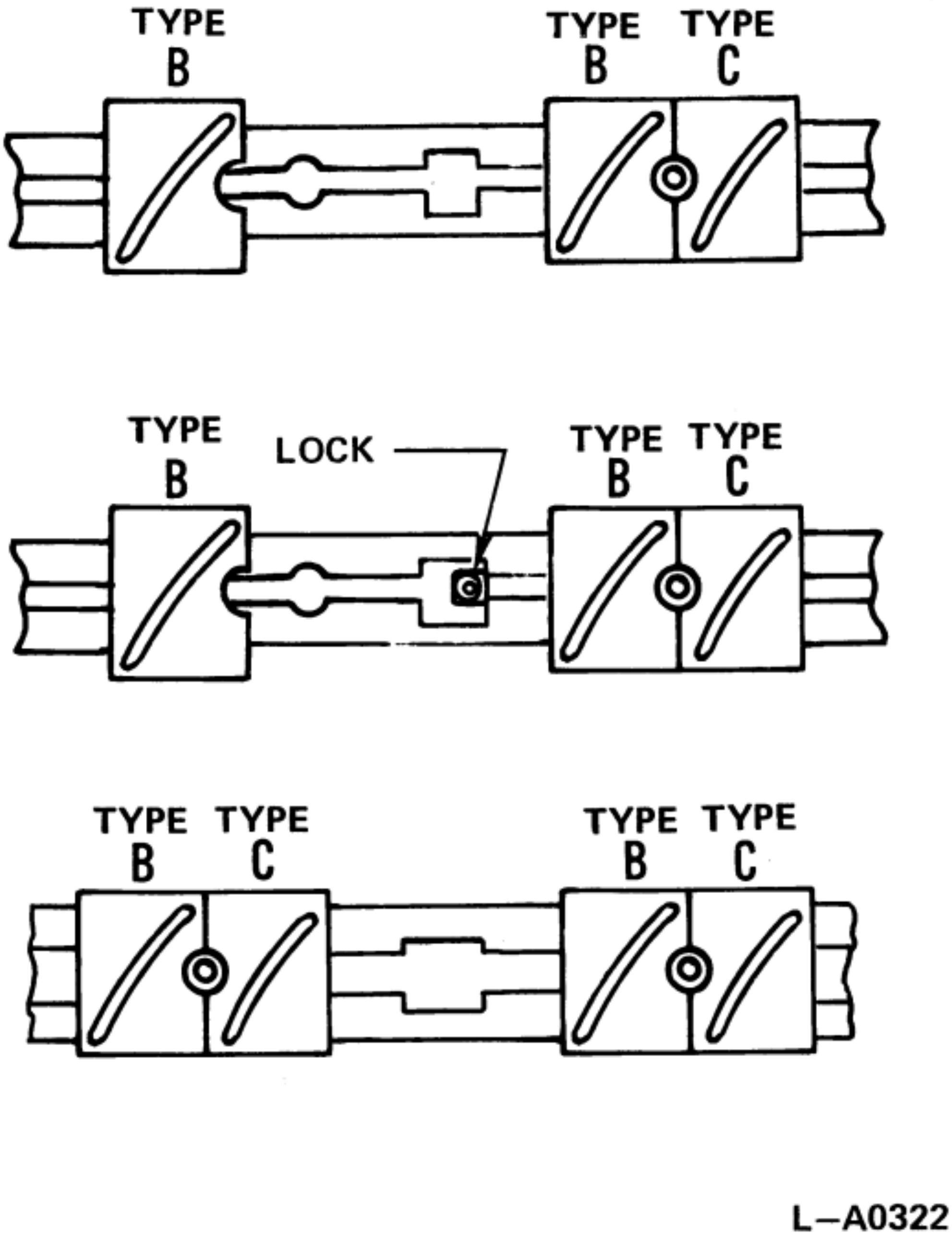
SET 2

L-A0320

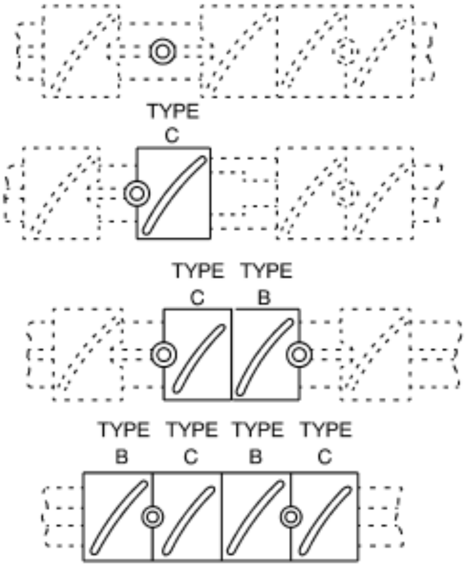
Blade Sets
Figure 1003
(Task 72-35-01-440-010)


LOADING SLOT
LOCKING SLOT
TYPE C
LOCK
TYPE B
TYPE C
VIEW A
L-B8664 (0801)

Blade And Lock Installation
Figure 1004 (Sheet 1)
(Task 72-35-01-440-010)

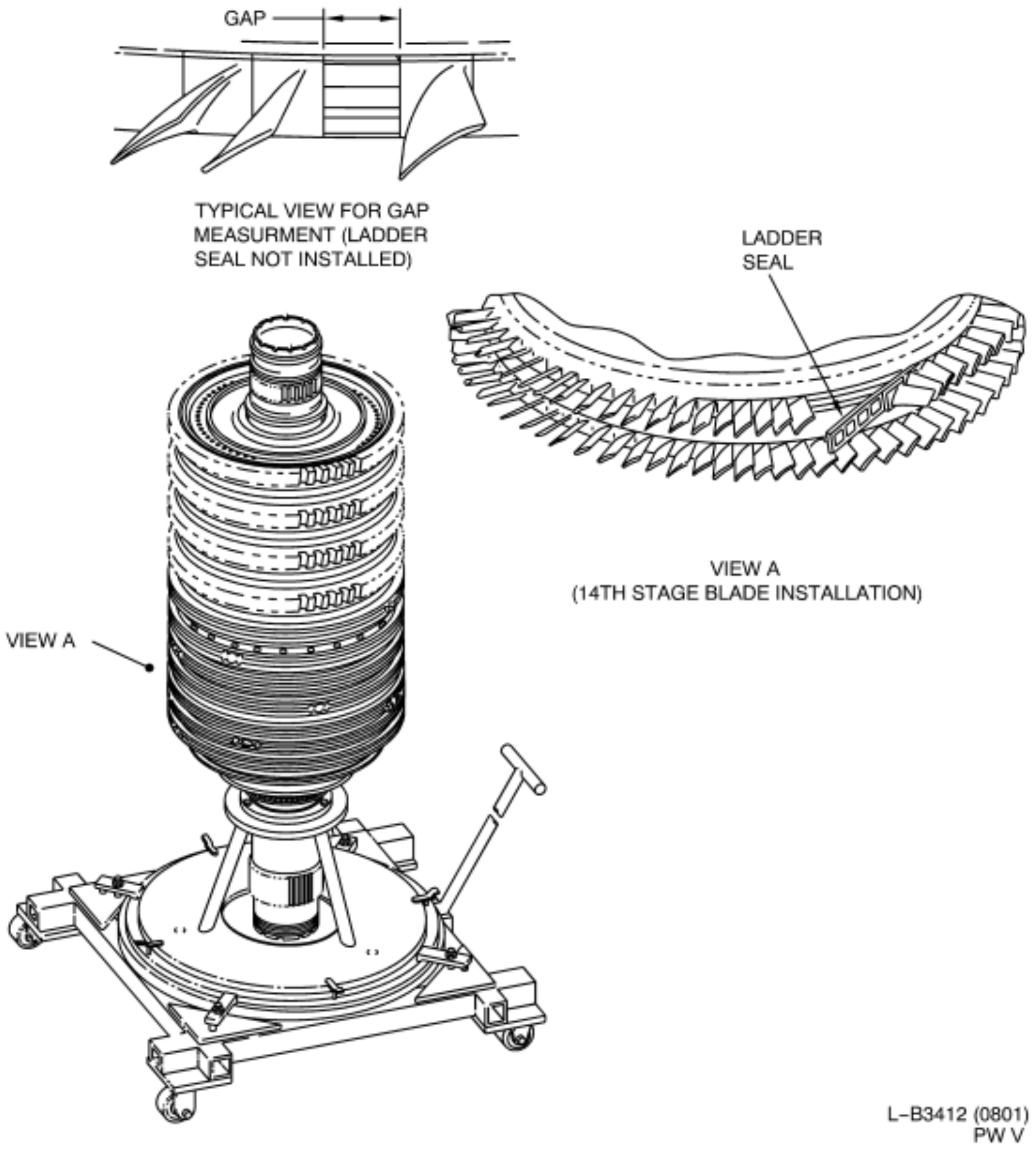

TYPE B
TYPE B
TYPE C
TYPE B
LOCK
TYPE B
TYPE C
TYPE B
TYPE C
TYPE B
TYPE C
L-A0322

Blade And Lock Installation
Figure 1004 (Sheet 2)
(Task 72-35-01-440-010)


TYPE
C
TYPE
C
TYPE
B
TYPE
B
TYPE
C
TYPE
B
TYPE
C

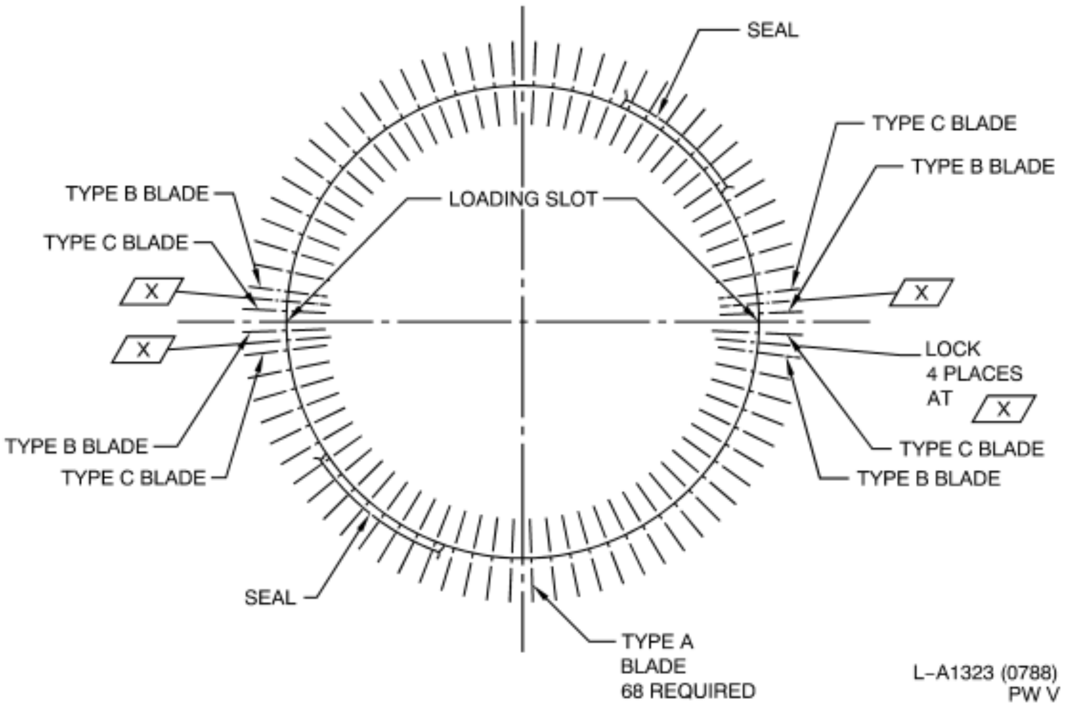
L-A0323 (0000)
PW V

Blade And Lock Installation
Figure 1004 (Sheet 3)
(Task 72-35-01-440-010)


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A (14TH STAGE BLADE INSTALLATION)
VIEW A
L−B3412 (0801)
PW V

Gap Measurement And Seal Installation
Figure 1005
(Task 72−35−01−440−010)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−22


SEAL
TYPE C BLADE
TYPE B BLADE
TYPE B BLADE
LOADING SLOT
TYPE C BLADE
X
X
X
X
LOCK
4 PLACES
AT X
TYPE B BLADE
TYPE C BLADE
TYPE C BLADE
TYPE B BLADE
SEAL
TYPE A
BLADE
68 REQUIRED
L−A1323 (0788)
PW V

Blade And Lock Installation Schematic View
Figure 1006
(Task 72−35−01−440−010)

Task 72-35-01-440-020:

1. Assemble 14Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Equipment And Materials Necessary

Special Tools:

PWA 86571	Gage Set

B. Measurement of Z-Plane for Stage 14.

CAUTION: DO NOT OVERTIGHTEN GAGE SET SCREWS DURING INSTALLATION OF GAGES. DAMAGE TO THE DRUM CAN RESULT.

(1) Measure Z-Plane diameter for Stage 14. This procedure is optional and can only be used where blades have been removed. Select the pair of gages, marked for that stage, from the PWA 86571 Z-Plane Diameter Gage Set. Install gages, 180 degrees apart, in blade slots. Turn gage set screws clockwise to move the gages radially out to their most outward position. Use OD micrometers to measure four diameters, every 45 degrees, over the gage tool balls. Calculate Z-Plane diameter of the stage by subtracting twice the reference dimension, marked on each pair of gages, from the average diameter measured over the gage tool balls. Refer to minimum, maximum and nominal Z-Plane diameters listed, for reference only, in Table 1001.

Stage	Minimum Diameter (Reference)	Maximum Diameter (Reference)	Nominal Diameter (Reference)
14	23.192 inch (589.077 mm)	23.200 inch (589.280 mm)	23.196 inch (589.178 mm)

HPC Front Drum Z-Plane Diameters
Table 1001

C. General

(1) Use one of the procedures that follow to install the 14th stage blades.

(a) Use Task 2. (Task 72-35-01-440-020-A00) of this procedure to install the 14th stage blades in pre SB PW4ENG 72-565 HPC assemblies.

(b) Use Task 3. (Task 72-35-01-440-020-B00) of this procedure to install the 14th stage blades in post SB PW4ENG 72-565 HPC assemblies.

Task 72-35-01-440-020-A:

2. Assemble 14Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly (Pre SB PW4ENG 72-565 Only)

A. Prerequisites

(1) Assemble 15th stage blades (debladed) axial compressor rotor assembly. See Assembly-21, CONFIG-2 (Task 72-35-01-440-009).

B. Equipment And Materials Necessary

Special Tools:

PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader, Manual (Optional to PWA 88739)
PWA 86448	Drift
PWA 88739	Spreader, Manual

Consumable Materials:

Item No.	Designation
P06-009	Antiseize Compound (PMC 9523)

C. Procedure
See Figure 1001, Figure, 1002, Figure 1003, Figure 1004, Figure 1005, and Figure 1006.

NOTE: There are three part numbers (sets) of blades provided for this stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type A is also used to get the correct platform gap and may require platform grinding. A modified Type A blade is also available with a 0.015 inch (0.381 mm) oversized platform width to help you get the correct platform gap. For ease of assembly, blades in this procedure will be referred to as Types A, B and C.

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-22

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(1) Remove the 14th stage blades from their storage rack and place them on a work bench. Segregate four (4) each of Types B and C blades having notches in their platforms and move the blades to one side. See Figure 1001.

(2) Optional, weigh the 14th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70-11-00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

(3) Optional, arrange Type A blades in four (4) columns. Start with the heaviest blade at the top left (Column 1), and proceed from left to right in descending order of weight. Lightest blade will be at the bottom of Column 4. See Figure 1002.

NOTE: One or more Type A blade(s) may have been used as a fitting blade. Blade will be identified by a square in the service time marking area.

(4) Divide the Types B and C blades into two sets of four blades (two (2) Type B and two (2) Type C per set) such that the weights of the sets are as nearly equal as possible. See Figure 1003.

NOTE: The weights must be nearly equal as the sets will be positioned opposite each other after assembly.

(5) Install one Types B and C blade set and two lock and setscrew assemblies. See Figure 1002, Figure 1003, Figure 1004, Figure 1005 and Figure 1006.

(a) Find one of the two 14th stage blade loading slots.

(b) Select one of the Types B and C blade sets. Install one Type C blade, leading edge up, into the loading slot. Move the blade to the right.

(c) Install one lock and setscrew assembly and move it to the right.

(d) Install one Type B blade into the slot. Move the blade to the right.

(e) Install the remaining Type B blade in the loading slot and move it to the left.

(f) Install one lock and setscrew assembly and move it to the left.

(g) Install the remaining Type C blade and move it to the left.

(h) Locate the locking slot to the left of the blade loading slot. Move the left lock and setscrew assembly into the left locking slot and tighten. Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(i) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(j) Use an approved marking pen to mark the OD platform of the drum, in line with the lock, with a "V" for future reference.

(k) Move the Type C blade to the left until it touches the lock.

(l) Move the Type B blade to the left until it touches the Type C blade.

(m) Move the right lock to the left so that it is positioned in the loading slot and tighten. Torque the lock and setscrew assembly to the running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi-spline setscrews.

(n) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(o) Push the two remaining Types B and C blades so they touch the just-installed locks.

(6) Rotate the drum 180 degrees. Position the open blade slot toward the operator.

(7) Install the right side blades and lock and setscrew assemblies. See Figure 1002, Figure 1003, Figure 1004, Figure 1005 and Figure 1006.

(a) Find the Type A blades to be installed. Start at the bottom of column four (blade number 68) and continue up to the top of the column (blade number 4).

(b) Put each blade, start with blade number 68, in the loading slot and move it to the right until it touches the blade that was installed before.

(c) Continue to install Type A blades, start at the bottom of Column 2 (blade number 66) and continue up to the top of the column (blade number 2).

(d) Put each blade, start with blade number 66, in the loading slot and move it to the right until it touches the blade that was installed before.

(8) Install the left side blades and lock and setscrew assemblies. See Figure 1002, Figure 1003, Figure 1004, Figure 1005 and Figure 1006.

(a) Find the Type A blades to be installed. Start at the top of Column 3 (blade number 3) and continue down to the bottom of the column (blade number 67).

(b) Put each blade, start with the heaviest blade, in the loading slot and move it to the left until it touches the blade that was installed before.

(c) Continue to install Type A blades. Start at the bottom of Column 1 (blade number 1) and continue down the column.

(d) Put each blade, start with the heaviest blade, in the loading slot and move it to the left until it touches the blade that was installed before. Do not install the last blade (blade number 65) at this time.

(9) Install the remaining Types B and C blade set and two lock and setscrew assemblies.

(a) Install a Type C blade into the loading slot. Move the blade to the right until it touches the blade that was installed before.

(b) Install a lock and setscrew assembly and move it to the right until it touches the blade that was installed before. Do not tighten the lock at this time.

(c) Install a Type B blade into the slot. Move the blade to the right until it touches the lock and setscrew assembly that was installed before.

(d) Install the remaining Type B blade in the loading slot and move it to the left until it touches the blade that was installed before.

(e) Install the last lock and setscrew assembly and move it to the left until it touches the blade that was installed before. Do not tighten the lock at this time.

(f) Install the remaining Type C blade and move it to the left until it touches the blade that was installed before.

(10) Move the blades tangentially to make the widest possible gap between the last installed Type B blade and the last Type A blade. This gap will be measured and used to compute the specified gap for between the blades.

NOTE: Put the blades in a radially outward direction to prevent a circumferential serpentine shape to the blades.

(a) Use a PWA 85595 Spreader to load all the blades tangentially so as to form the widest possible gap in each arc.

(b) Place the spreader into the vacant Type A blade space. Expand the spreader with the torque handle and measure the blade gap between the blade platforms with a vernier caliper. If you need help to move the blades, it is permissible to tap lightly on the base of the airfoil with a PWA 86448 Drift.

(c) Measure and record this gap dimension.

(d) Find the Type A blade (blade number 65) that will be installed in the arc you measured. Use a vernier caliper to measure the platform width of the blade. Record this dimension.

(e) Compare the gap dimension with the blade platform width dimension.

(f) The width of the blade platform must measure 0.000 − 0.010 inch (0.00 − 0.25 mm) smaller than the gap measured at the drum loading slot between the blades.

(g) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

(11) Do the procedure that follows to get the correct blade platform width for the measured gap.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type A blades with oversized Type A blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.000 − 0.010 inch (0.00 − 0.25 mm).

NOTE: (Post SB PW4ENG 72−703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.010 inch (0.25 mm). If the 0.010 inch (0.25 mm) maximum gap limit is not met, replace the standard Type A blades with the modified Type A blades with wider platforms or the Type A blades with the narrower platform as necessary to get the 0.000 − 0.010 inch (0.00 − 0.25 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

(12) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

(a) If the blade platform width is larger than the gap, determine the difference. If the total amount of material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type A blade not installed. If the total amount of material to be removed exceeds of 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type A blade not installed. Maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

(b) If the total amount of material to be removed exceeds 0.010 inch (0.254 mm), remove an additional Type A blade to obtain the proper fit and remove material in approximately equal amounts from both sides of the Type A blade platforms. Repeat this procedure for additional Type A blades, as necessary, to obtain the correct gap.

(c) If it is necessary to remove material, machine the HPC 14th stage blade platforms per 72−35−39, Assembly−03 (Task 72−35−39−440−003).

(d) Type A blades with trimmed platforms must be identified with a square symbol in their respective service time marking areas. See 70−11, Standard Practices Manual, PN 585005.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE THAT FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(13) After the gap limits have been met, remove all blades from the right side of the slot and place them in the order of removal on the work bench. Remove all blades from the left side of the slot and also place them in order of removal on the bench.

NOTE: Four (4) blades and two (2) blade locks are to remain in the disk. These are the first set of four (4) blades (two (2) Type B and two (2)

Type C) and two (2) blade locks installed at the start of this procedure.

(14) Apply Antiseize Compound P06−009 to the blade ladder seals (side opposite flat side) and to the drum groove.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE THAT FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(15) Install the right side ladder seals and blades. See Figure 1006.

NOTE: The blades will be installed in the order that they were removed.

(a) Put one ladder seal over the loading slot with the flat surface out.

(b) Align the first opening in the ladder seal with the loading slot in the disk.

(c) Install the blade that was first removed (blade number 68), leading edge up, through the seal and into the loading slot.

(d) Move the blade and seal to the right until the second opening is aligned with the loading slot.

NOTE: Be sure that the seal is correctly installed between the disk rails.

(e) Continue the blade installation instructions above until all the right side blades are installed, moved fully to the right and touch the Type C blade that was installed before.

(f) Install a Type B blade, a lock and then the next Type C blade. Move them fully to the right until they touch the blades that were installed before. Do not tighten the lock and setscrew assembly at this time.

(16) When the blades, seals and locks have been fully installed on the right side, install the left side blades, seals and locks by the instructions above except move the blades, seals and locks to the left.

NOTE: The last Type C blade and lock will not be installed during this step.

(17) Install the remaining blades and locks.

(a) The last Type C blade and lock can only be inserted in the drum by moving all the blades to the right. To do this, you must rotate the drum 180 degrees and loosen the blade lock screws. Move all blades, seals and locks to the right.

(b) Install the last lock and setscrew assembly in the drum slot and move it to the left.

(c) Install the last Type C blade in the slot.

(18) Move the blades, seals and locks to the final position.

(a) Move all the blades, seals and locks to the left. Align the blade lock with the V mark made on the drum at the start of this procedure.

(b) Tighten and torque the two blade lock and setscrew assemblies that are located at the loading slot near the V mark.

1 Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(c) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(d) Check the gaps, make all gaps over Arcs CR and CV approximately equal.

(19) Tighten and torque the remaining lock and setscrew assemblies.

(a) Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(b) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

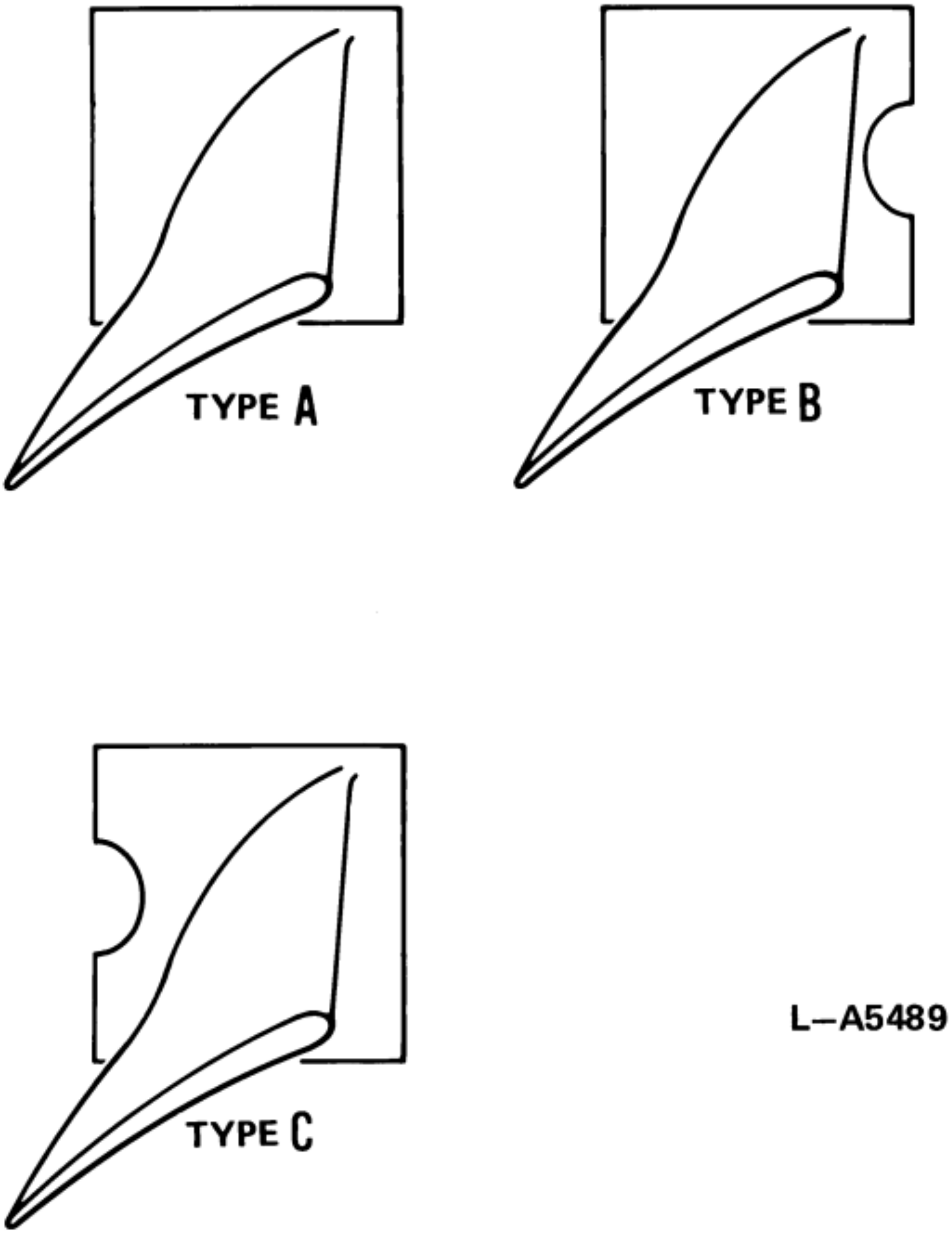
1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

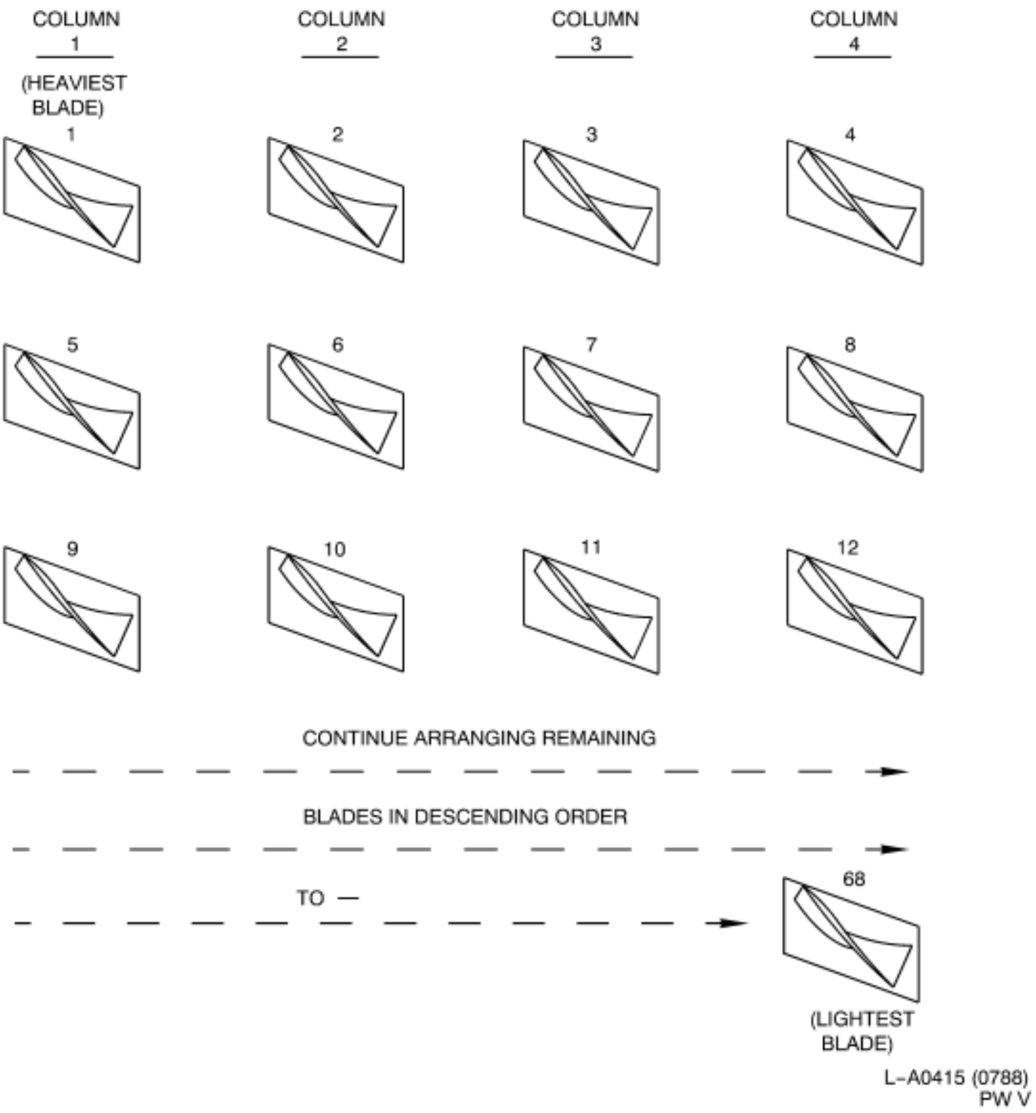
a If these limits are not kept, check the lock for correct assembly in the disk.

D. Postrequisites

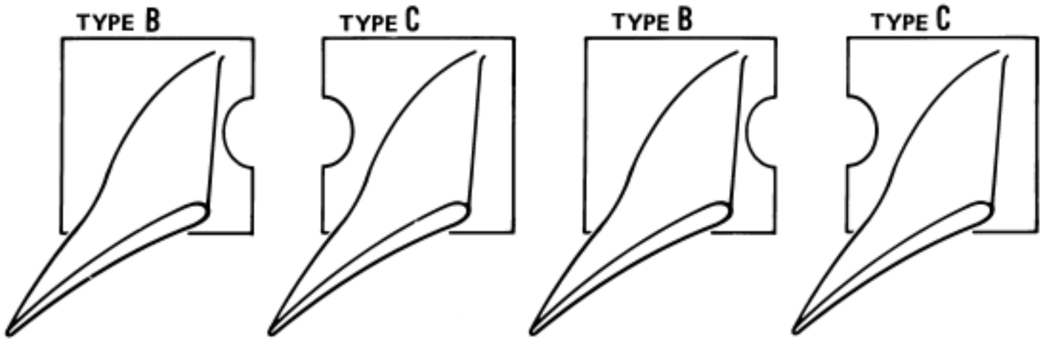
(1) Assemble 13th stage blades to (debladed) axial compressor rotor assembly. See Assembly−23, CONFIG−2 (Task 72−35−01−440−021).



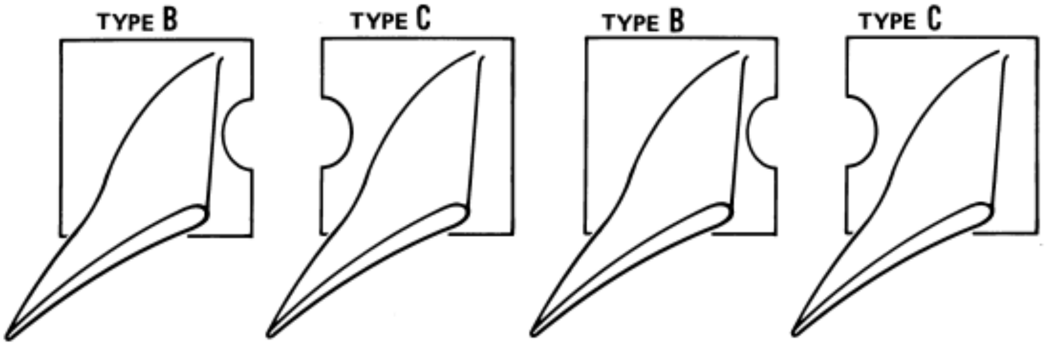
Blade Identification
Figure 1001
(Task 72-35-01-440-020-A)


COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
COLUMN 3
COLUMN 4
1
2
3
4
5
6
7
8
9
10
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO —
68
(LIGHTEST BLADE)
L−A0415 (0788)
PW V

Type A Blade Weight Arrangement
Figure 1002
(Task 72−35−01−440−020−A)


TYPE B
TYPE C
TYPE B
TYPE C

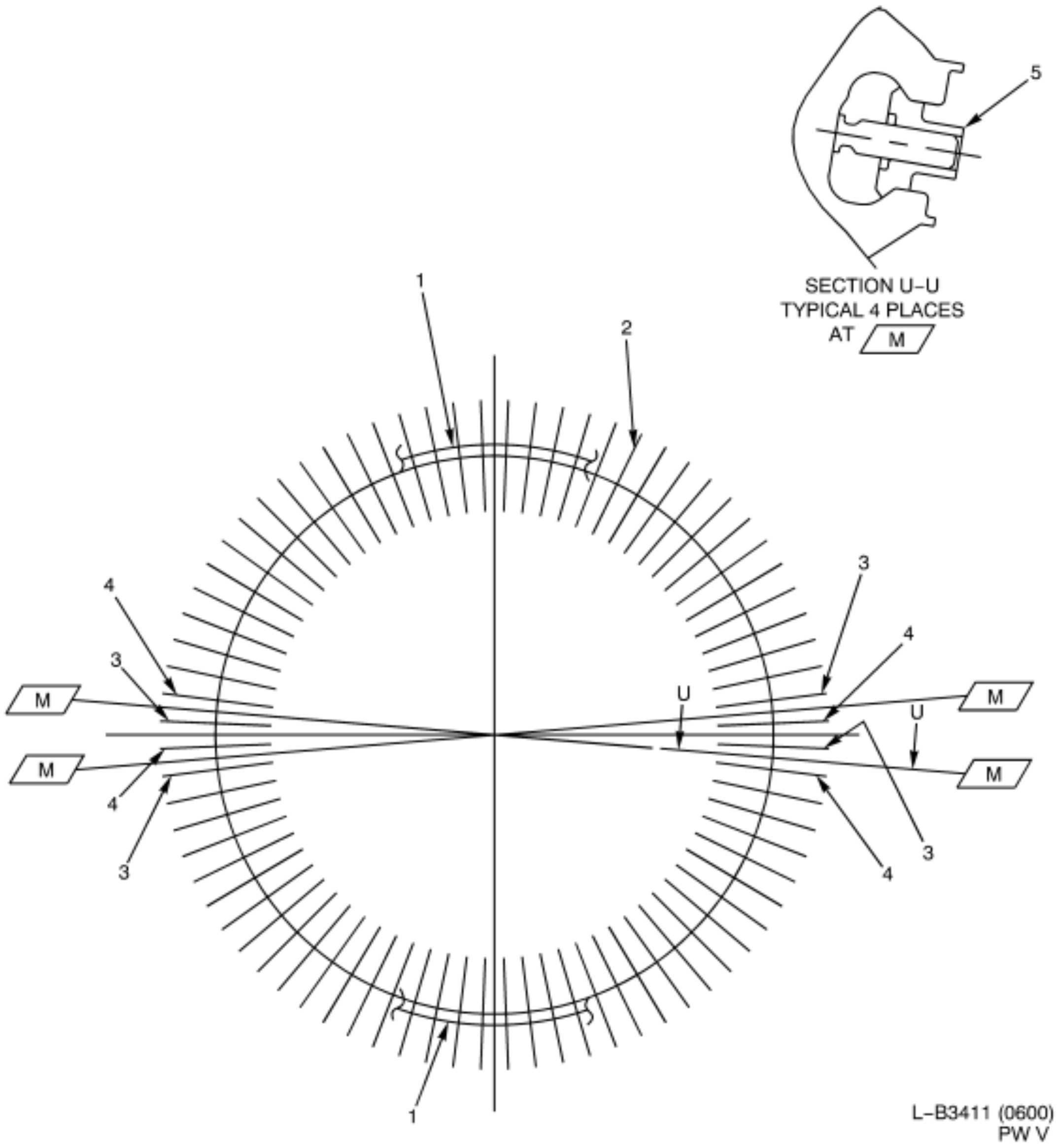
SET 1


TYPE B
TYPE C
TYPE B
TYPE C
L-A0320

SET 2

Types B And C Blade Set Arrangement
Figure 1003
(Task 72-35-01-440-020-A)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−22


5
SECTION U−U
TYPICAL 4 PLACES
AT M
1
2
3
4
4
3
M
M
U
U
M
M
4
3
4
3
1
L−B3411 (0600)
PW V

Schematic View Of 14th Stage Blade And
Lock Installation (Pre SB PW4ENG 72−565)
Figure 1004 (Sheet 1)
(Task 72−35−01−440−020−A)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−22

1. Ladder Seals, PN 50H654, Two Necessary.
2. Type A Blades
3. Type C Blades
4. Type B Blades
5. Lock And Setscrew Assembly

Key to Figure 1004 (Sheet 1)

Task 72−35−01−440−020−B:

3. Assemble 14Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly (Post SB PW4ENG 72−565 Only)

A. Prerequisites

(1) Assemble 15th stage blades (debladed) axial compressor rotor assembly. See Assembly−21, CONFIG−2 (Task 72−35−01−440−009).

B. Equipment And Materials Necessary

Special Tools:

PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader, Manual (Optional To PWA 88739)
PWA 86448	Drift
PWA 88739	Spreader, Manual

Consumable Materials:

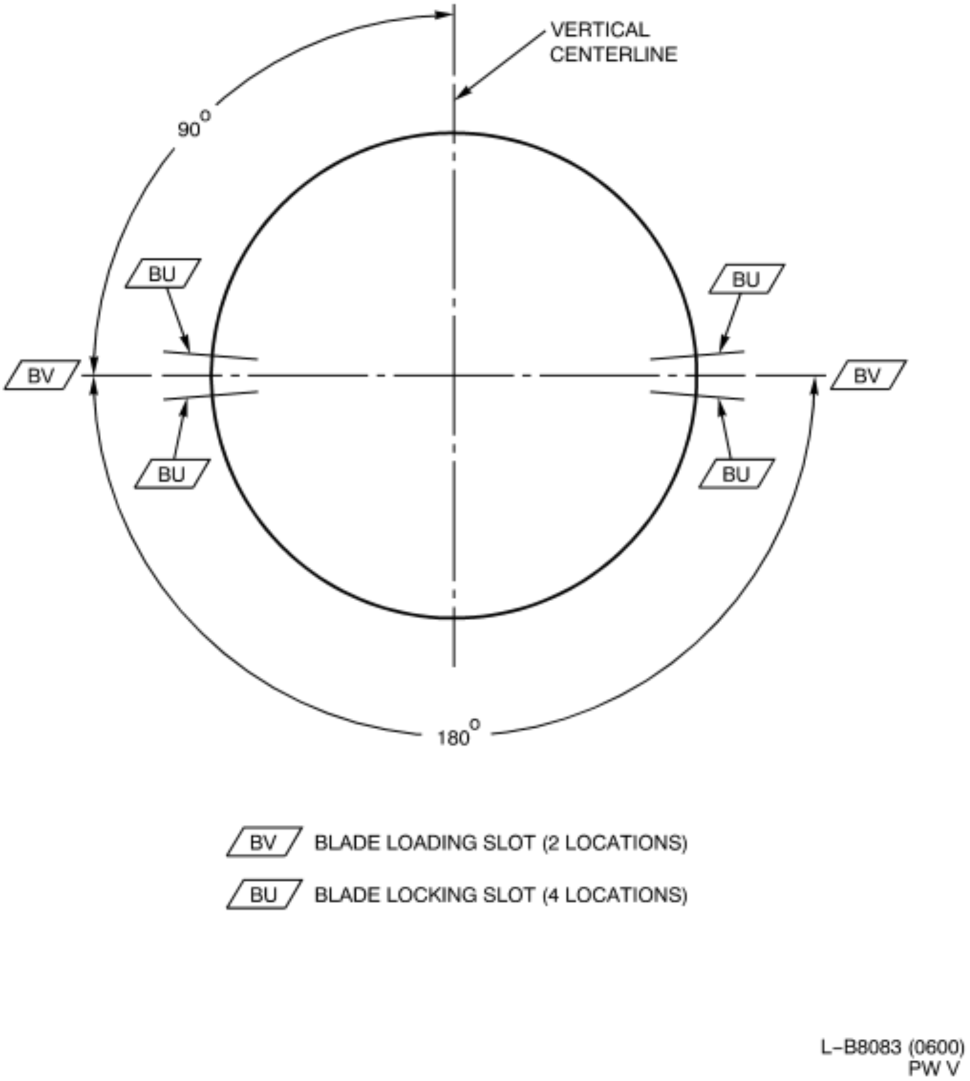
Item No.	Designation
P06−009	Antiseize Compound (PMC 9523)

C. Procedure

See Figure 1007, Figure 1008, Figure 1009, Figure 1010, Figure 1011 and Figure 1012.

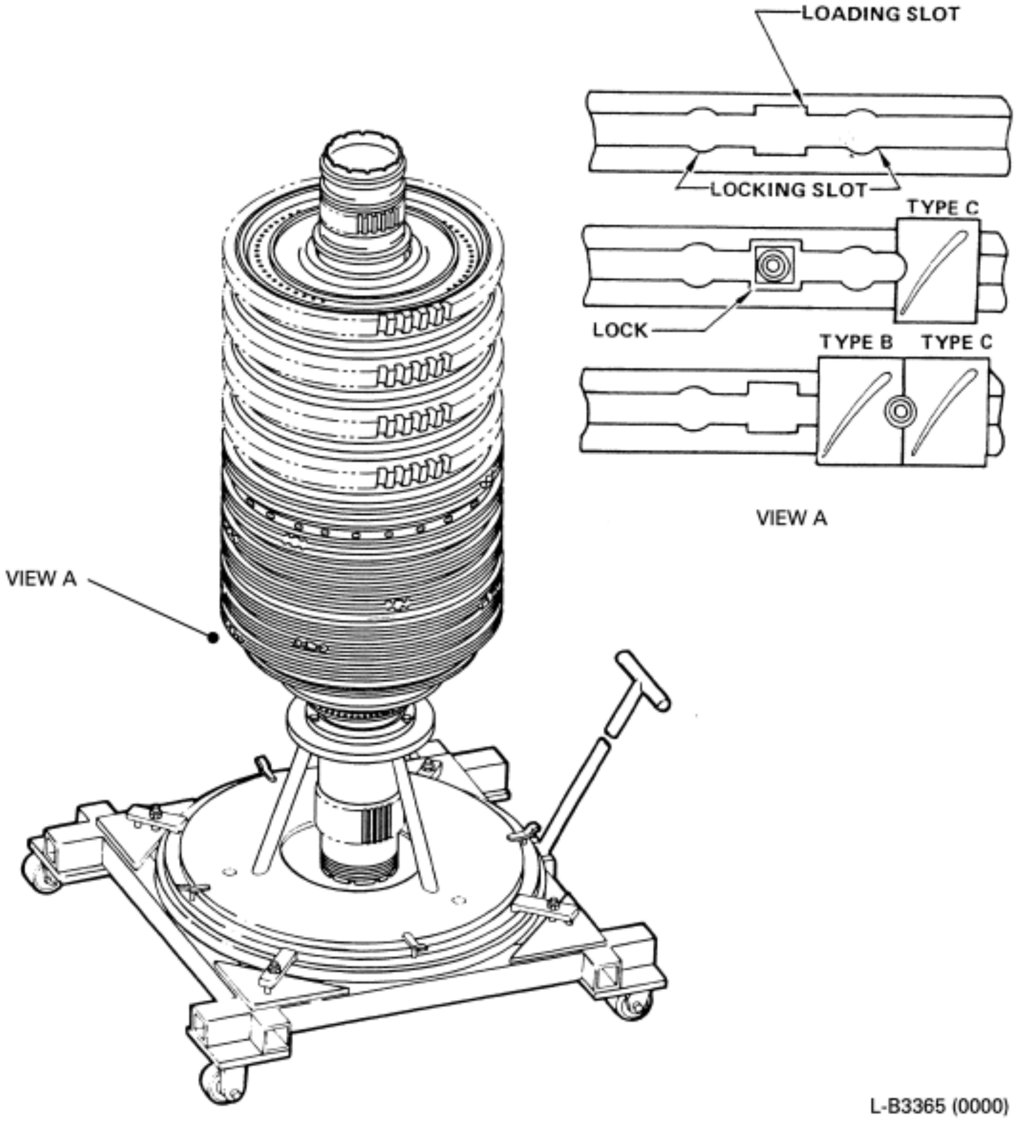
NOTE: There are three part numbers (sets) of blades provided for this stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type A is also used to get the correct platform gap and may require platform grinding. A modified Type A blade is also available with a 0.015

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−22

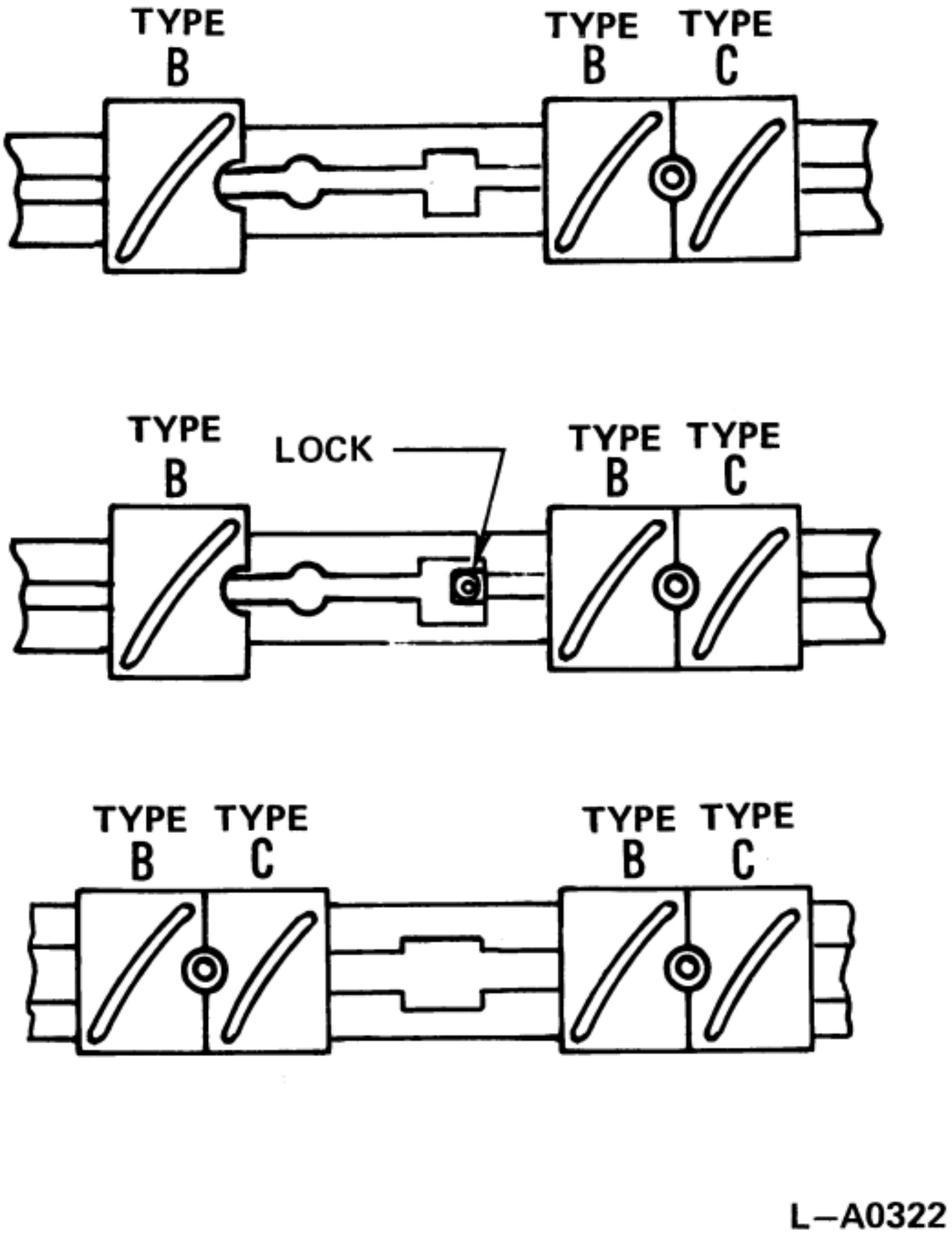

VERTICAL CENTERLINE
90°
BU
BU
BV
BV
BU
BU
180°
BV BLADE LOADING SLOT (2 LOCATIONS)
BU BLADE LOCKING SLOT (4 LOCATIONS)
L−B8083 (0600)
PW V

Schematic View Of 14th Stage Blade Loading And
Lock Slot Locations (Pre SB PW4ENG 72−565)
Figure 1004 (Sheet 2)
(Task 72−35−01−440−020−A)

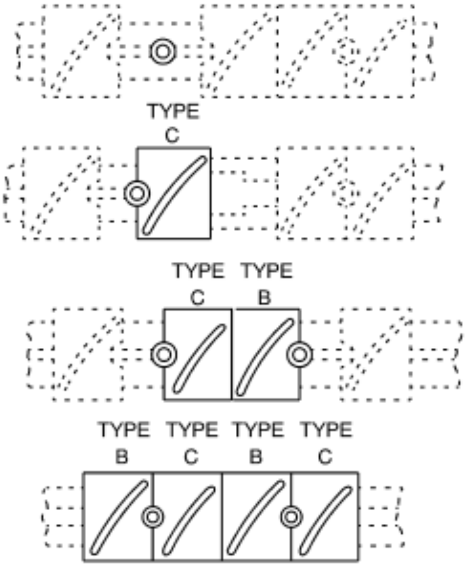
AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−22


LOADING SLOT
LOCKING SLOT
TYPE C
LOCK
TYPE B
TYPE C
VIEW A
VIEW A
L-B3365 (0000)

Blade And Lock Installation
Figure 1005 (Sheet 1)
(Task 72−35−01−440−020−A)


TYPE B
TYPE B
TYPE C
TYPE B
LOCK
TYPE B
TYPE C
TYPE B
TYPE C
TYPE B
TYPE C
L-A0322

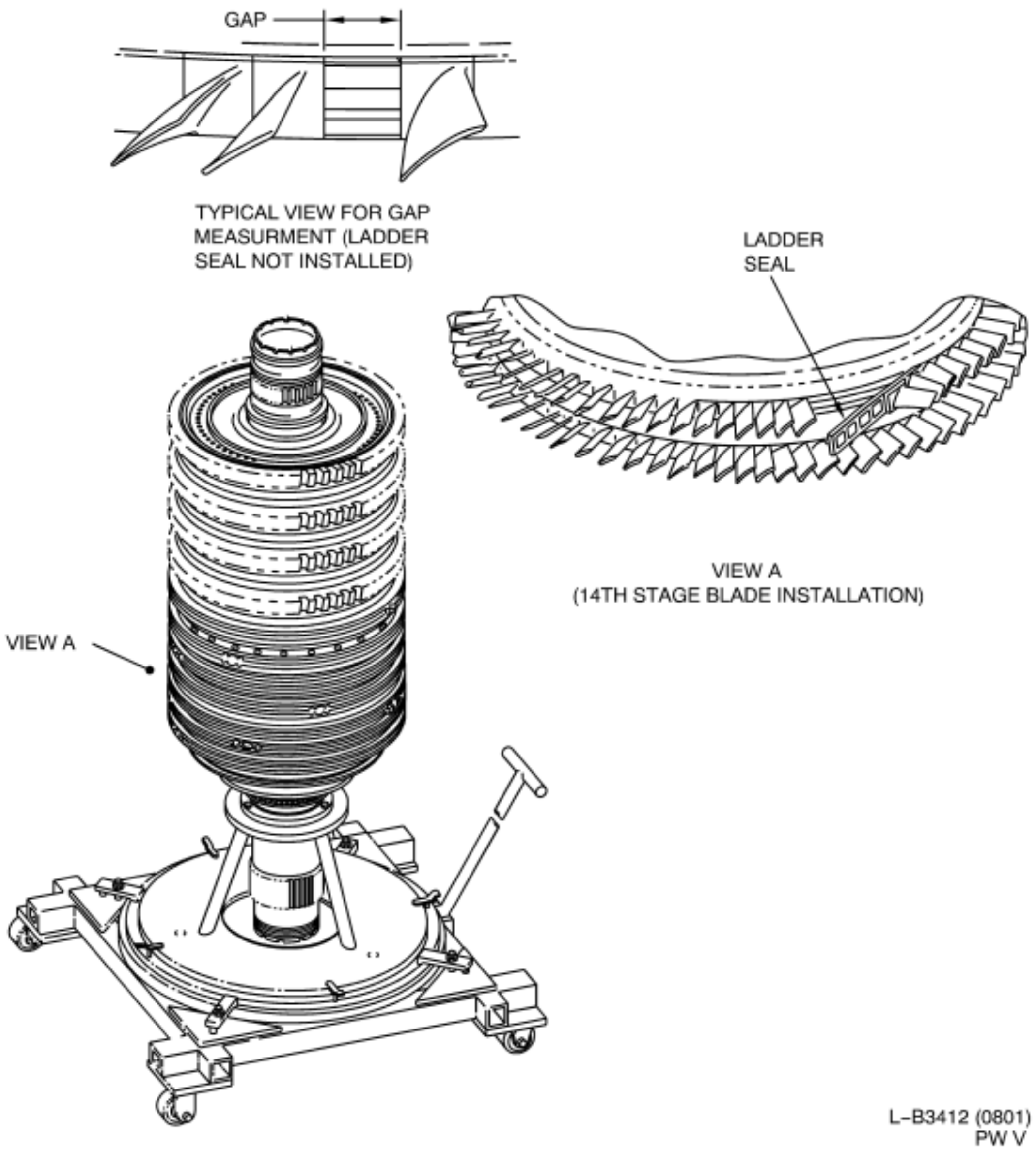
Blade And Lock Installation
Figure 1005 (Sheet 2)
(Task 72-35-01-440-020-A)


TYPE
C
TYPE
C
TYPE
B
TYPE
B
TYPE
C
TYPE
B
TYPE
C

L-A0323 (0000)
PW V

Blade And Lock Installation
Figure 1005 (Sheet 3)
(Task 72-35-01-440-020-A)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−22


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A (14TH STAGE BLADE INSTALLATION)
VIEW A
L−B3412 (0801)
PW V

Gap Measurement And Ladder Seal Installation
Figure 1006
(Task 72−35−01−440−020−A)

inch (0.381 mm) oversized platform width to help you get the correct platform gap. For ease of assembly, blades in this procedure will be referred to as Types A, B and C.

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(1) Remove the 14th stage blades from their storage rack and place them on a work bench. Segregate eight (8) each of Types B and C blades having notches in their platforms and move the blades to one side. See Figure 1007.

NOTE: For engines that incorporate SB PW4ENG 72-565, old and new parts are interchangeable in full sets, however it is permissible to mix new and modified blades in the same rotor stage.

(2) Optional, weigh the 14th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70-11-00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

(3) Optional, arrange Type A blades in six (6) columns. Start with the heaviest blade at the top left (Column 1), and proceed from left to right in descending order of weight. Lightest blade will be at the bottom of Column 6. See Figure 1008.

NOTE: One or more Type A blade(s) may have been used as a fitting blade. These blades will be identified by a square in the service time marking area.

(4) Divide the Types B and C blades into four sets of four blades (two (2) Type B and two (2) Type C per set) such that the weights of the sets are as nearly equal as possible. See Figure 1009.

NOTE: The weights must be nearly equal as the sets will be positioned opposite each other after assembly.

(5) Install one of the four Types B and C blade sets and two lock and setscrew assemblies. See Figure 1008, Figure 1009, Figure 1010,Figure 1011 and Figure 1012.

(a) Find one of the two 14th stage blade loading slots that has locking slots on each side of it.

(b) Select one of the Types B and C blade sets. Install one Type C blade, leading edge up, into the loading slot. Move the blade to the right.

(c) Install one lock and setscrew assembly and move it to the right.

(d) Install one Type B blade into the slot. Move the blade to the right.

(e) Install the remaining Type B blade in the loading slot and move it to the left.

(f) Install one lock and setscrew assembly and move it to the left.

(g) Install the remaining Type C blade and move it to the left.

(h) Locate the locking slot to the left of the blade loading slot. Move the left lock and setscrew assembly into the left locking slot and tighten. Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(i) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(j) Use an approved marking pen to mark the OD platform of the drum, in line with the lock, with a "V" for future reference.

(k) Move the Type C blade to the left until it touches the lock.

(l) Move the Type B blade to the left until it touches the Type C blade.

(m) Move the right lock to the left so that it is positioned in the loading slot and tighten. Torque the lock and setscrew assembly to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(n) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(o) Push the two remaining Types B and C blades so they touch the just installed locks.

(6) Rotate the drum 180 degrees. Position the open blade slot toward the operator.

(7) Install the right side blades and lock and setscrew assemblies in Arc CV. See Figure 1008, Figure 1009, Figure 1010, Figure 1011 and Figure 1012.

(a) Find the Type A blades to be installed. Start at the bottom of column six (blade number 60, the lightest blade) and continue up to the top of the column (blade number 6).

(b) Put each blade, start with the lightest blade, blade number 60, in the loading slot and move it to the right until it touches the blade that was installed before.

(c) Take a Type C blade from the second Types B and C blade set and put it in the loading slot and move it to the right until it touches the blade that was installed before.

(d) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before. Do not tighten the lock at this time.

(e) Take a Type B blade from the second Types B and C blade set and put it in the loading slot and move it to the right until it touches the lock and setscrew assembly.

(f) Find the Type A blades to be installed. Start at the bottom of column four (blade number 58) and continue up to the top of the column (blade number 4).

(g) Put each blade, start with the lightest blade, in the loading slot and move it to the right until it touches the blade that was installed before.

(h) Take a Type C blade from the second Types B and C blade set and put it in the loading slot and move it to the right until it touches the blade that was installed before.

(i) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before. Do not tighten the lock at this time.

(j) Take a Type B blade from the second Types B and C blade set and put it in the loading slot and move it to the right until it touches the lock and setscrew assembly.

(k) Find the Type A blades to be installed. Start at the bottom of column two (blade number 56) and continue up to the top of the column to blade number 8 (blade number 2 is not installed at this time).

(l) Put each blade, start with the lightest blade, in the loading slot and move it to the right until it touches the blade that was installed before to complete Arc CV.

(8) Install the left side blades and lock and setscrew assemblies in Arc CR. See Figure 1008, Figure 1009, Figure 1010,Figure 1011 and Figure 1012.

(a) Find the Type A blades to be installed. Start at the top of column one (blade number 1, the heaviest blade) and continue down to the bottom of the column (blade number 49).

(b) Put each blade, start with the heaviest blade, in the loading slot and move it to the left until it touches the blade that was installed before.

(c) Take a Type B blade from the third Types B and C blade set and put it in the loading slot and move it to the right until it touches the blade that was installed before.

(d) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before. Do not tighten the lock at this time.

(e) Take a Type C blade from the third Types B and C blade set and put it in the loading slot and move it to the right until it touches the lock and setscrew assembly.

(f) Find the Type A blades to be installed. Start at the top of Column 3 (blade number 3) and continue down to the bottom of the column (blade number 51).

(g) Put each blade, start with the heaviest blade, in the loading slot and move it to the left until it touches the blade that was installed before.

(h) Take a Type B blade from the third Types B and C blade set and put it in the loading slot and move it to the left until it touches the blade that was installed before.

(i) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before. Do not tighten the lock at this time.

(j) Take a Type C blade from the third Types B and C blade set and put it in the loading slot and move it to the left until it touches the lock and setscrew assembly.

(k) Find the Type A blades to be installed. Start at the top of Column 5 (blade number 5) and continue down the column (blade number 53 (blade number 59 is not installed at this time).

(l) Put each blade, start with the heaviest blade, in the loading slot and move it to the left until it touches the blade that was installed before to complete Arc CR.

(9) Install a Type B blade, from the remaining B and C blade set, in the loading slot and move it to the left until it touches the blade that was installed.

(10) Install a lock and setscrew assembly in the loading slot and move it to the left.

(11) Locate the locking slot on the left of the blade loading slot. Move the lock and setscrew assembly into the left locking slot and tighten. Torque the lock and setscrew assembly to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

  (a) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

    1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

    2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

      a If these limits are not kept, check the lock for correct assembly in the disk.

(12) Install the C blade from the remaining Types B and C blade set into the loading slot and move it to the right until it touches the blade that was installed before.

(13) Install a lock and setscrew assembly and move it to the right until it touches the blade that was installed before. Do not tighten the lock at this time.

(14) Install the remaining B blade from the Types B and C blade set into the loading slot and move it to the right until it touches the blade that was installed before.

(15) Install the remaining C blade from the Types B and C blade set into the loading slot and move it to the left until it touches the tightened lock and setscrew assembly.

(16) Move the Type B blade that is to the right of the loading slot to the left until it touches the Type C blade.

(17) Locate the locking slot on the right of the blade loading slot. Move the lock and setscrew assembly into the locking slot and tighten. Torque the lock and setscrew assembly to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

  (a) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

    1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

    2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

      a If these limits are not kept, check the lock for correct assembly in the disk.

(18) Select two positions that are approximately 90 degree from the loading slots. These positions will be measured and used to compute the specified gap for each of the two arcs (Arcs CR and CV). See Figure 1008, Figure 1009, Figure 1010, Figure 1011 and Figure 1012.

  NOTE: Put the blades in a radially outward direction to prevent a circumferential serpentine shape to the blades.

  (a) Use a PWA 85595 Spreader to load all the blades tangentially so as to form the widest possible gap in each arc.

(b) Place the spreader into the vacant Type A blade space. Expand the spreader with the torque handle and measure the blade gap between the blade platforms with a vernier caliper. If you need help to move the blades, it is permissible to tap lightly on the base of the airfoil with a PWA 86448 Drift.

(c) Measure and record this gap dimension.

(d) Find the Type A blade that will be installed in the arc you measured. Use a vernier caliper to measure the platform width of the blade. Record this dimension.

NOTE: Type A blade number 2 will be used to fill the gap in Arc CV. Blade number 59 will be used to fill the gap in Arc CR.

(e) Compare the gap dimension with the blade platform width dimension.

(f) The width of the blade platform must measure 0.030 − 0.050 inch (0.51 − 0.055 mm) smaller than the gap measured at the drum loading slot between the blades.

(g) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

(19) Do the procedure that follows for both gap positions.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type A blades with oversized Type A blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.030 − 0.050 inch (0.76 − 1.27 mm).

NOTE: (Post SB PW4ENG 72−703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in an arc is 0.050 inch (1.27 mm). If the 0.050 inch (1.27 mm) maximum gap limit is not met, replace the standard Type A blades with the modified Type A blades with wider platforms or the Type A blades with the narrower platform as necessary to get the 0.030 − 0.050 inch (0.76 − 1.27 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

(20) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

(a) If the blade platform width is larger than the gap, determine the difference. If the total amount of material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type A blade not installed. If the total amount of material to be removed exceeds of 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type A blade not installed. Maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

(b) If the total amount of material to be removed exceeds 0.010 inch (0.254 mm), remove an additional Type A blade from the arc and remove material in approximately equal amounts from both sides of the Type A blade platforms. Repeat this procedure for additional Type A blades, as necessary, to obtain the correct gap.

(c) If it is necessary to remove material, machine the HPC 14th stage blade platforms per 72−35−39 Assembly−03 (Task 72−35−39−440−003).

(d) Type A blades with trimmed platforms must be identified with a square symbol in their respective service time marking areas. See 70−11, Standard Practices Manual, PN 585005.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE THAT FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(21) After the gap limits have been met, loosen the lock and setscrew assemblies that were last to be installed. Remove all blades from the right side of the slot and place them in the order of removal on the work bench. Remove all blades from the left side of the slot and also place them in order of removal on the bench.

NOTE: Four (4) blades and two (2) blade locks are to remain in the disk. These are the first set of four (4) blades (two (2) Type B and two (2) Type C) and two (2) blade locks installed at the start of this procedure.

(22) Apply Antiseize Compound P06−009 to the blade ladder seals (side opposite flat side) and to the drum groove.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE THAT FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(23) Install the ladder seals and blades from Column 6, the first locking blade pair and one lock and setscrew assembly, again. See Figure 1008, Figure 1009, Figure 1010, Figure 1011 and Figure 1012.

NOTE: The blades will be installed in the order that they were removed.

(a) Put one ladder seal over the loading slot with the flat surface out.

(b) Align the first opening in the ladder seal with the loading slot in the disk.

(c) Install the blade that was first removed (blade number 60), leading edge up, through the seal and into the loading slot.

(d) Move the blade and seal to the right until the second opening is aligned with the loading slot.

NOTE: Be sure that the seal is correctly installed between the disk rails.

(e) Continue the blade installation instructions above until all the right side blades from Column 6 are installed, moved fully to the right and touch the Type C blade that was installed before.

(f) Install a Type B blade, a lock and then the next Type C blade. Move them fully to the right until they touch the blades that were installed before. Do not tighten the lock and setscrew assembly at this time.

(24) Use the steps above to complete the installation of the remaining right side blades and locks. Do not install the last locking blades and lock.

(25) When the blades, seals and locks have been fully installed on the right side, install the left side blades, seals and locks by the instructions above except move the blades, seals and locks to the left.

(26) When the steps above are complete, you will have two Types B and C blades and two lock and setscrew assemblies remaining on the work bench. Install the appropriate Type C blade into the drum loading slot and move it fully to the right. Install the appropriate Type B blade into the slot and move it fully to the left.

(27) Install the remaining blades and locks.

(a) Install the blade lock and move it to the right.

(b) Install the remaining Type B blade and move it to the right.

(c) The last Type C blade and lock can only be inserted in the drum by moving all the blades to the right. To do this, you must rotate the drum 180 degrees and loosen the blade lock screws. Move all blades, seals and locks to the right.

(d) Install the last lock and setscrew assembly in the drum slot and move it to the left.

(e) Install the last Type C blade in the drum.

(28) Move the blades, seals and locks to the final position.

(a) Move all blades, seals and locks to the left. Align one blade lock with the V mark you made on the drum at the beginning of this procedure.

(b) Check all gaps over Arcs CR and CV. All gaps over Arc CR should be approximately equal. All gaps over Arc CV should be approximately equal.

(c) Tighten and torque the four lock and setscrews assemblies that are located at the two loading slots.

1 Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(d) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(29) Tighten and torque the remaining lock and setscrew assemblies.

(a) Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(b) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

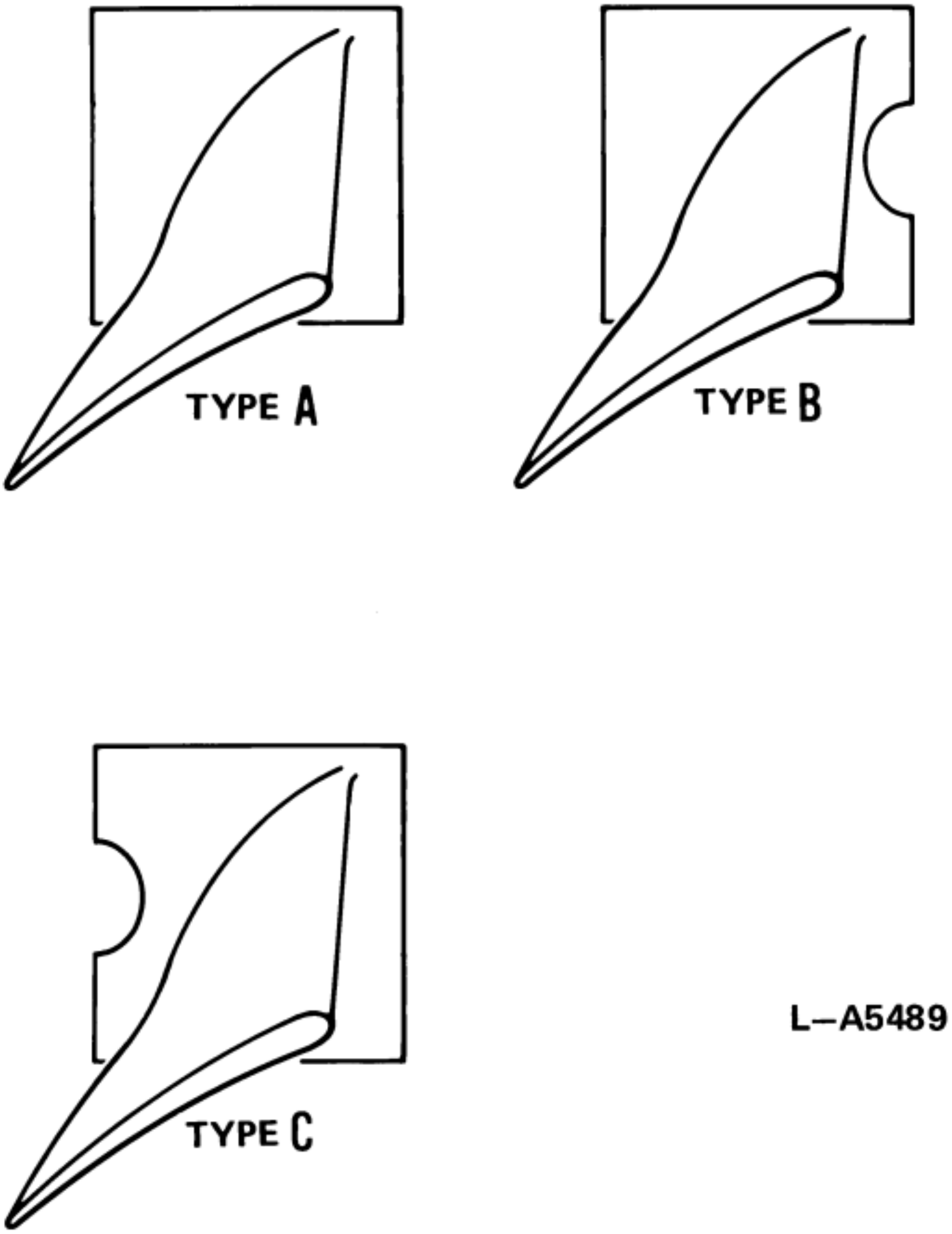
1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

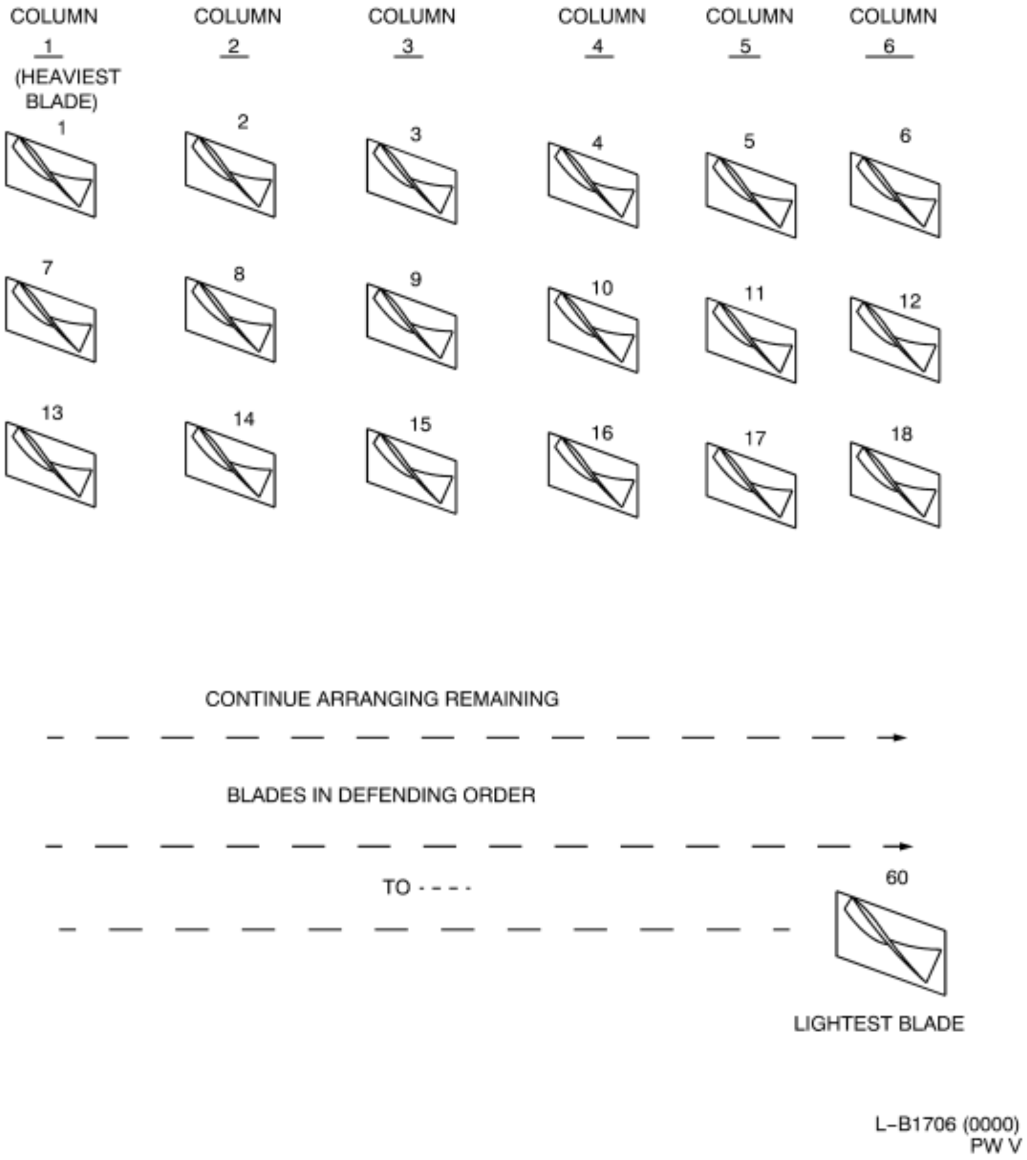
D. Postrequisites

(1) Assemble 13th stage blades to (debladed) axial compressor rotor assembly. See Assembly−23, CONFIG−2 (Task 72−35−01−440−021).



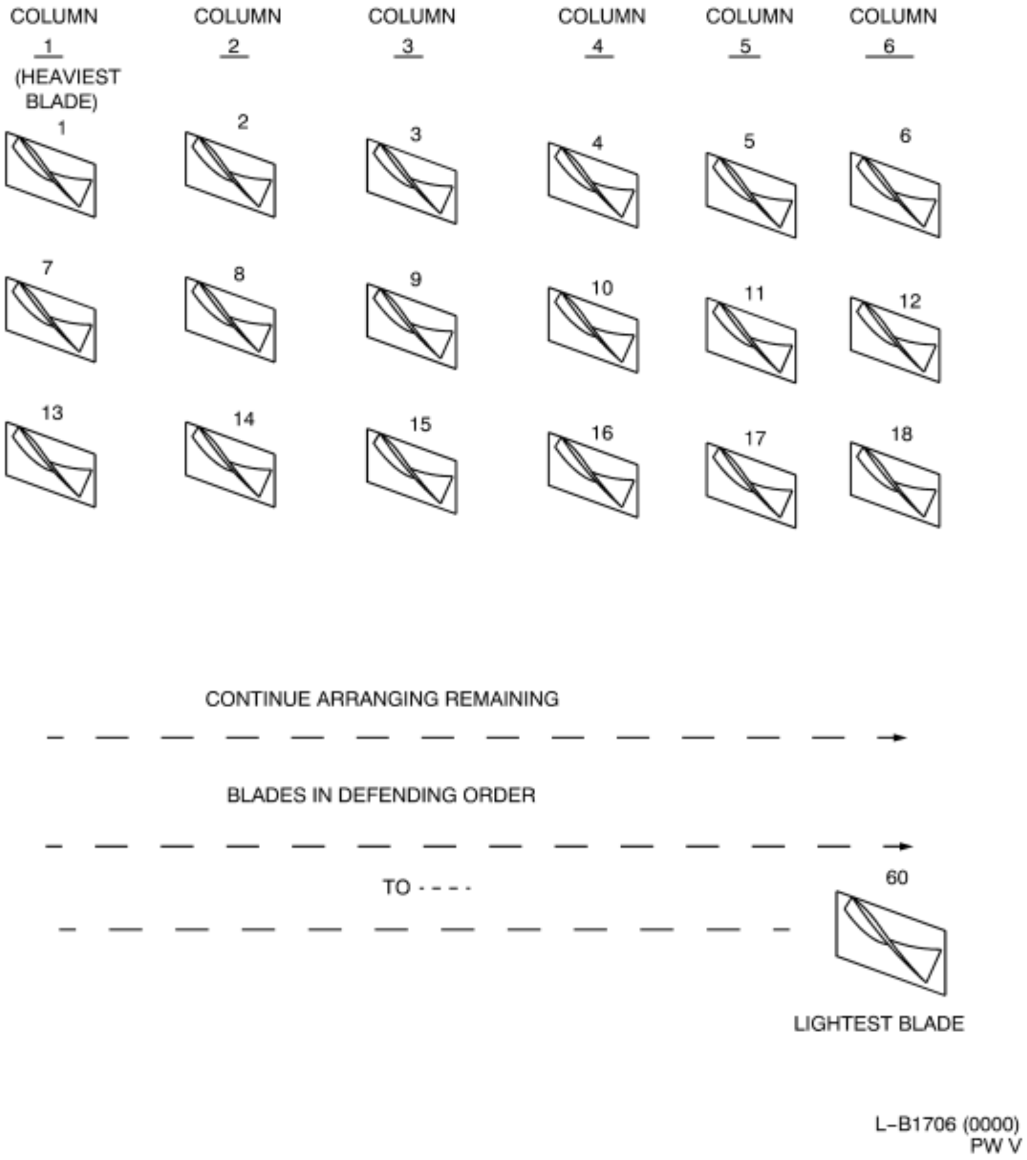
Blade Identification
Figure 1007
(Task 72−35−01−440−020−B)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−22


COLUMN 1 (HEAVIEST BLADE)
COLUMN 2
COLUMN 3
COLUMN 4
COLUMN 5
COLUMN 6
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
CONTINUE ARRANGING REMAINING
BLADES IN DEFENDING ORDER
TO - - - -
60
LIGHTEST BLADE
L−B1706 (0000)
PW V

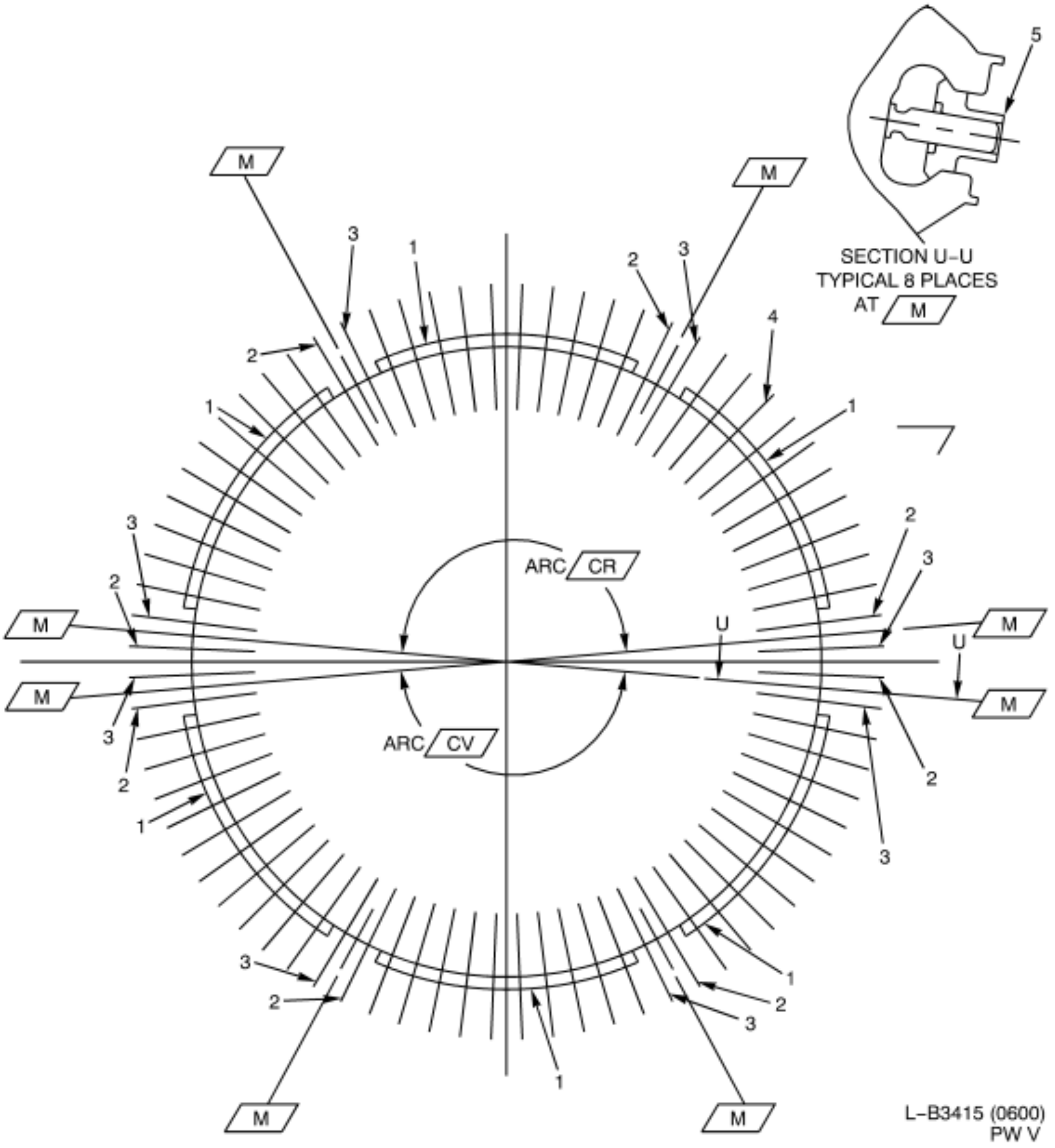
Type A Blade Weight Arrangement
Figure 1008
(Task 72−35−01−440−020−B)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−22


COLUMN 1 (HEAVIEST BLADE)
COLUMN 2
COLUMN 3
COLUMN 4
COLUMN 5
COLUMN 6
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
CONTINUE ARRANGING REMAINING
BLADES IN DEFENDING ORDER
TO - - - -
60
LIGHTEST BLADE
L−B1706 (0000)
PW V

Types B And C Blade Set Arrangement
Figure 1009
(Task 72−35−01−440−020−B)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-22

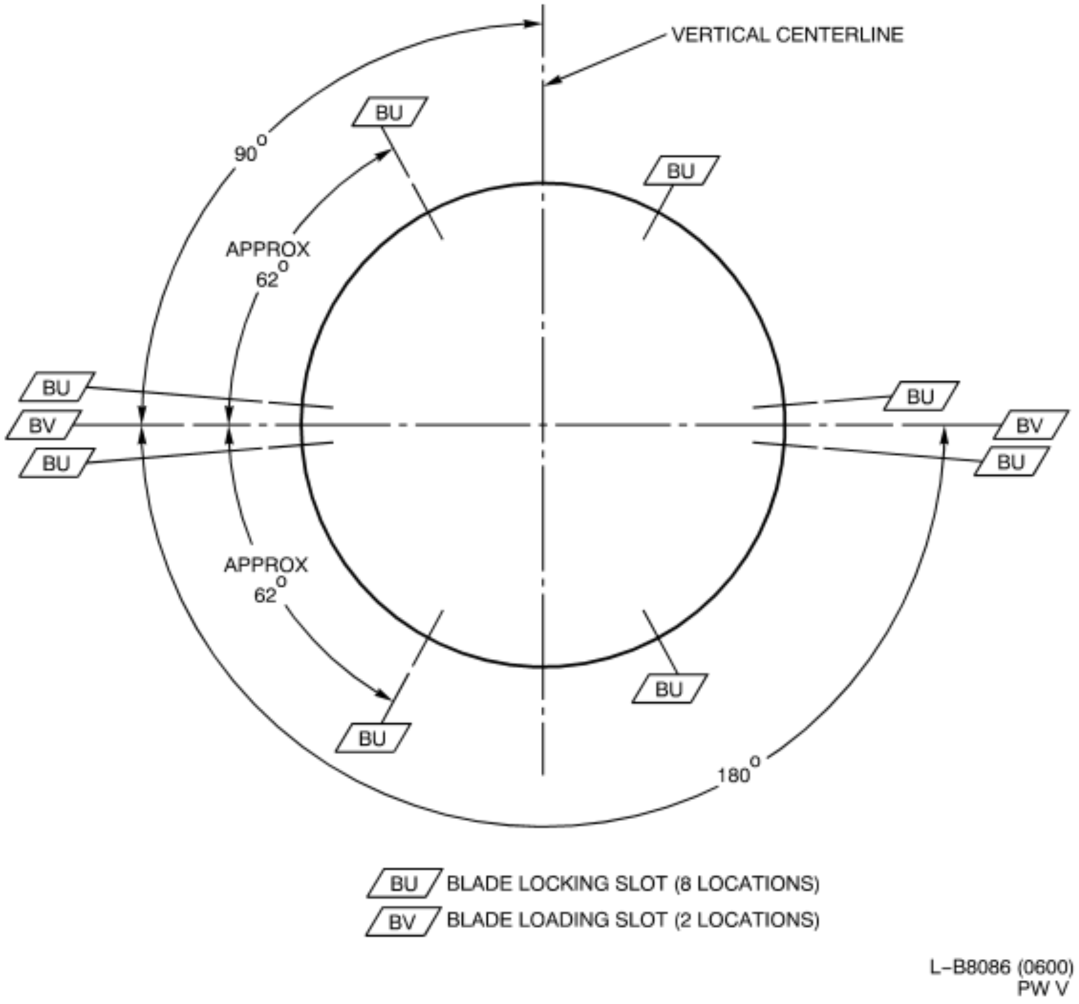

SECTION U-U
TYPICAL 8 PLACES
AT M
M
ARC CR
ARC CV
U
1
2
3
4
5
L-B3415 (0600)
PW V

Schematic View Of 14th Stage Blade And
Lock Installation (Post SB PW4ENG 72-565)
Figure 1010 (Sheet 1)
(Task 72-35-01-440-020-B)

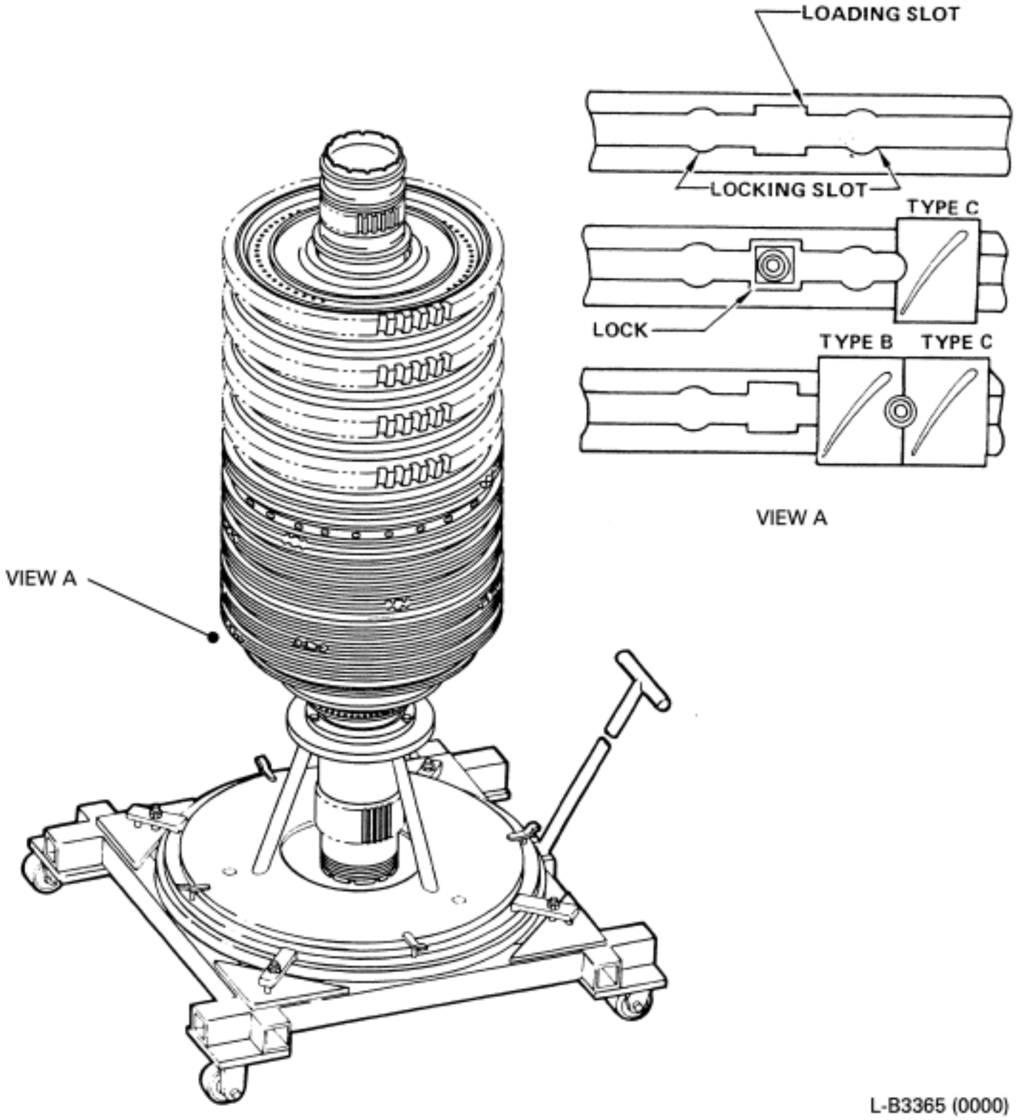
AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−22

1. Ladder Seals, PN 55H587, Six Necessary.
2. Type C Blades
3. Type B Blades
4. Type A Blades
5. Lock And Setscrew Assembly

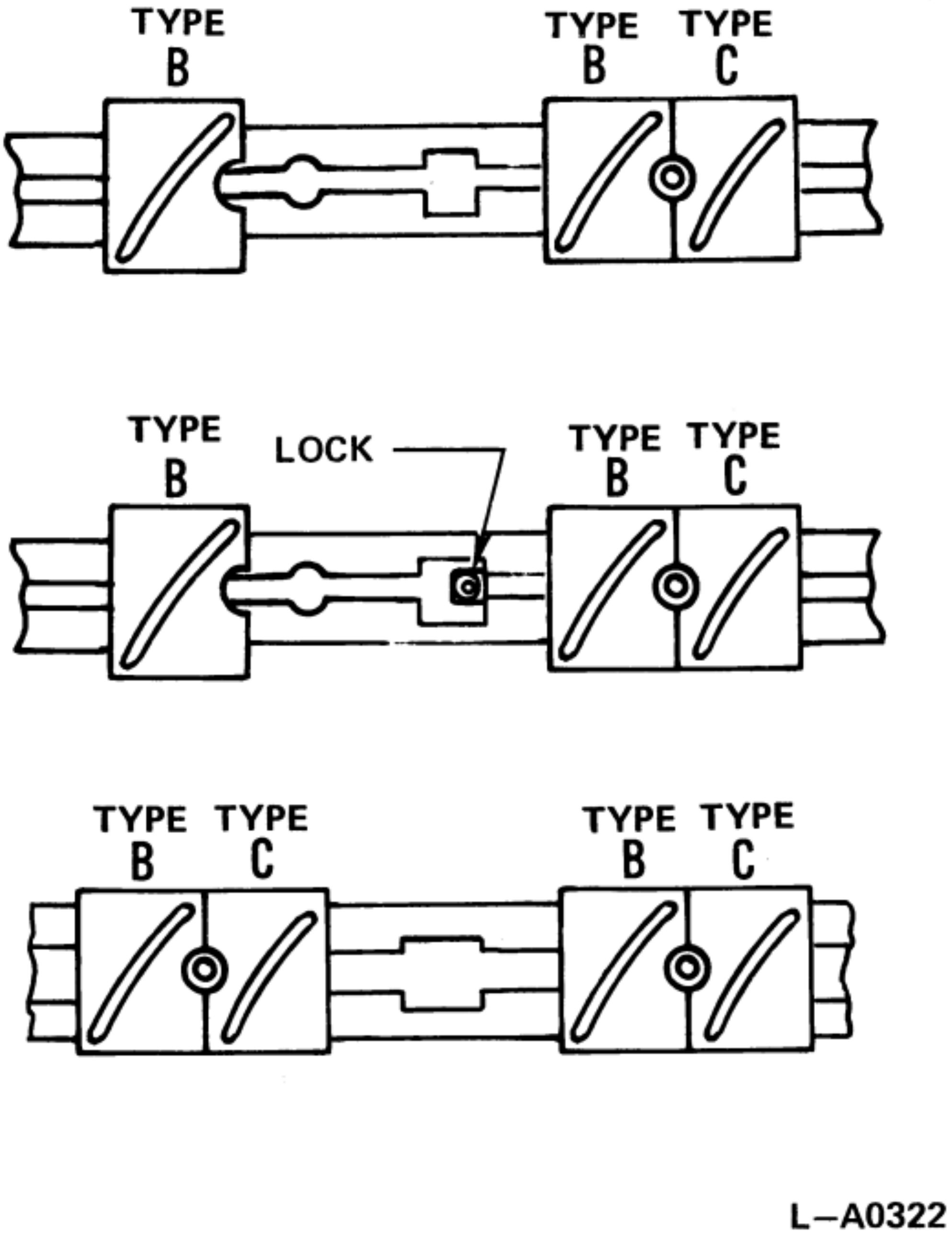
Key to Figure 1010 (Sheet 1)


VERTICAL CENTERLINE
BU
BU
90°
APPROX 62°
BU
BV
BU
BU
BV
BU
APPROX 62°
BU
BU
180°
BU BLADE LOCKING SLOT (8 LOCATIONS)
BV BLADE LOADING SLOT (2 LOCATIONS)
L-B8086 (0600)
PW V

Schematic View Of 14th Stage Blade Loading
And Lock Slot Locations (Post SB PW4ENG 72-565)
Figure 1010 (Sheet 2)
(Task 72-35-01-440-020-B)

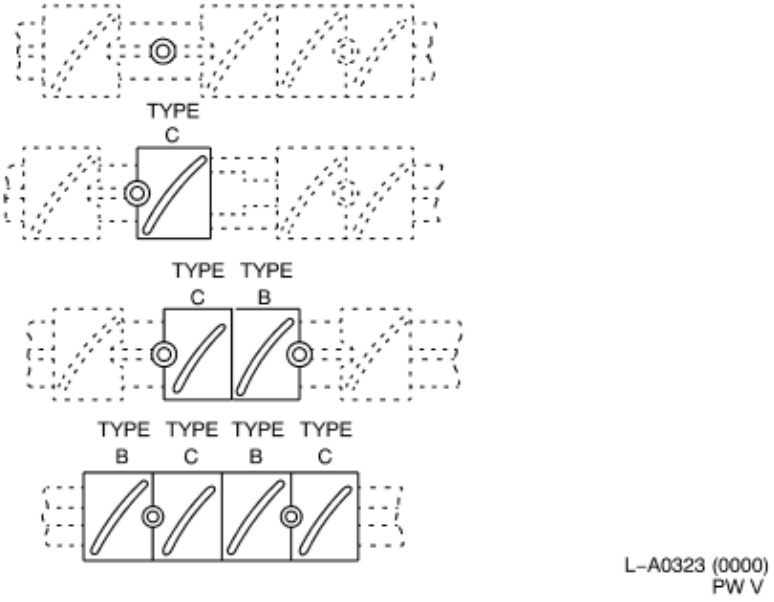

LOADING SLOT
LOCKING SLOT
TYPE C
LOCK
TYPE B
TYPE C
VIEW A
VIEW A
L-B3365 (0000)

Blade And Lock Installation
Figure 1011 (Sheet 1)
(Task 72-35-01-440-020-B)

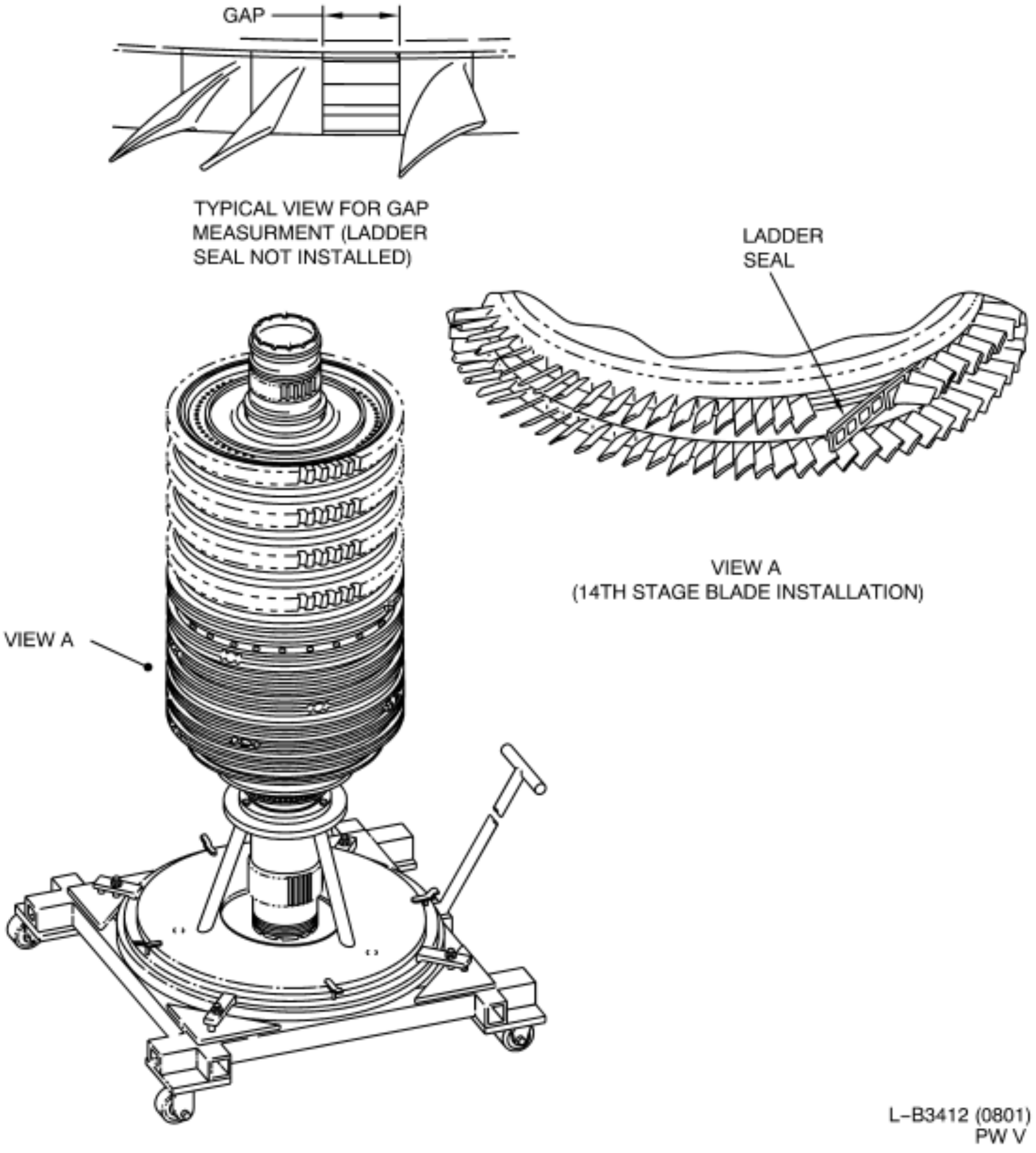

TYPE B
TYPE B
TYPE C
TYPE B
LOCK
TYPE B
TYPE C
TYPE B
TYPE C
TYPE B
TYPE C
L-A0322

Blade And Lock Installation
Figure 1011 (Sheet 2)
(Task 72-35-01-440-020-B)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−22


TYPE
C
TYPE
C
TYPE
B
TYPE
B
TYPE
C
TYPE
B
TYPE
C
L−A0323 (0000)
PW V

Blade And Lock Installation
Figure 1011 (Sheet 3)
(Task 72−35−01−440−020−B)


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A (14TH STAGE BLADE INSTALLATION)
VIEW A
L−B3412 (0801)
PW V

Gap Measurement And Ladder Seal Installation
Figure 1012
(Task 72−35−01−440−020−B)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72−35−01−440−011:

1. Assemble 13Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble 14th stage blades to (debladed) axial compressor rotor assembly. See Assembly−22, CONFIG−1 (Task 72−35−01−440−010).

B. Equipment And Materials Necessary

Special Tools:

PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader, Manual
PWA 86448	Drift
PWA 86571	Gage Set

Consumable Materials:

Item No.	Designation
P06−009	Antiseize Compound (PMC 9523)

C. Procedure

See Figure 1001, Figure 1002, Figure 1003, Figure 1004, Figure 1005 and Figure 1006.

NOTE: There are three part numbers (sets) of blades provided for this stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type A is also used to get the correct platform gap and may require platform grinding. A modified Type A blade is also available with a 0.015 inch (0.381 mm) oversized platform width to help you get the correct platform gap. For ease of assembly, blades in this procedure will be referred to as Types A, B and C.

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-23

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

CAUTION: DO NOT OVERTIGHTEN GAGE SET SCREWS DURING INSTALLATION OF GAGES. DAMAGE TO THE DRUM CAN RESULT.

(1) Measure Z-Plane diameters for Stage 13. This procedure is optional and can only be used where blades have been removed. Select the pair of gages, marked for that stage, from the PWA 86571 Z-Plane Diameter Gage Set. Install gages, 180 degrees apart, in blade slots. Turn gage set screws clockwise to move the gages radially out to their most outward position. Use OD micrometers to measure four diameters, every 45 degrees, over the gage tool balls. Calculate Z-Plane diameter of the stage by subtracting twice the reference dimension, marked on each pair of gages, from the average diameter measured over the gage tool balls. Refer to minimum, maximum and nominal Z-Plane diameters listed, for reference only, in Table 1001.

Stage	Minimum Diameter (Reference)	Maximum Diameter (Reference)	Nominal Diameter (Reference)
13	23.196 inch (589.178 mm)	23.204 inch (589.382 mm)	23.200 inch (589.280 mm)

HPC Front Drum Z-Plane Diameters
Table 1001

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(2) Remove 13th stage blades from storage rack and place them on bench. Segregate eight Types B and C blades having notches in their platforms and move to one side. See Figure 1001.

(3) Optional, weigh the 13th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70−11−00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

(4) Optional, arrange Type A blade in four columns, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. Lightest blade will be at bottom of Column 2. See Figure 1002.

NOTE: One or more Type A blade may have been used as a fitting blade. Blade will be identified by a square in the service time marking area.

(5) Select two sets of four blades (two Type B and two Type C per set) such that weights of sets are as nearly equal as possible. See Figure 1003.

NOTE: Weights must be nearly equal as sets will be positioned opposite each other after assembly.

(6) Selecting one of the blade sets, and with loading slot of disk facing operator, install one Type C blade, leading edge up, into slot. Move blade to right. Install one lock and setscrew and move to right. Install one Type B blade into slot. Move to right. See Figure 1004 (Sheet 1).

(7) From the same set, install remaining Type B blade into slot and move to left. Install one lock and setscrew and move to left. Install remaining Type C blade and move to left. See Figure 1004 (Sheet 2).

(8) Locate locking slot to left of blade loading slot. Move left lock to left locking slot and tighten and torque setscrew to running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(9) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

1 If these limits are not kept, check the lock for correct assembly in the disk.

(10) Using approved marking pen, mark OD platform of drum in line with lock with "V" for future reference.

(11) Move Type C blade (right side of lock) to the left to rest against lock. See Figure 1004 (Sheet 3).

(12) Move Type B blade and right lock to left and lock setscrew to running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(13) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

1 If these limits are not kept, check the lock for correct assembly in the disk.

(14) Push two remaining Types B and C blades to butt against just−installed locks. See Figure 1004 (Sheet 3).

(15) Rotate drum 180 degrees. Position open blade slot toward operator.

(16) Starting at bottom of 4th column of weight−ordered Type A blade, and proceeding vertically from bottom of column to top, position each blade into loading slot and move to right to rest against previously installed blades and lock. When 4th column of blades is used, start at bottom of 2nd column and position each blade into loading slot and to right until all blades from Column 2 are inserted.

(17) Starting at top of 3rd column of blades, position each blade into loading slot and move to left to rest against blades at opposite end. When 3rd column of blades is used, start at top of 1st column and position each blade into loading slot and to left until all blades except one from Column 1 are inserted.

(18) Install two blades from remaining Types B and C sets into loading slot and move to left. Install remaining two blades from Types B and C set to slot and move to right. Remaining blade should be one Type A blade which will be used for fitting. Load all blades tangentially so as to form widest possible gap at disk loading slot. Measure gap using PWA 85595 Spreader. See Figure 1005.

 (a) Place spreader into vacant blade space. Expand spreader with torque handle and measure blade gap with a vernier caliper. Record this dimension.

 (b) Measure platform width of Type A blade, not installed in drum, with vernier caliper. Record this dimension.

 (c) Compare the gap dimension with the blade platform width dimension.

 (d) The width of the blade platform must measure 0.020 − 0.055 inch (0.51 − 1.40 mm) smaller than the gap measured at the drum loading slot between the blades.

 (e) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

(19) Do the procedure that follows to get the correct blade platform width for the measured gap.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type A blades with the oversized Type A blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.020 - 0.055 inch (0.51 - 1.40 mm).

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.40 mm). If the 0.055 inch (1.40 mm) maximum gap limit is not met, replace the standard Type A blades with the modified Type A blades with wider platform or the Type A blades with the narrower platform as necessary to get the 0.020 - 0.055 inch (0.51 - 1.40 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

(20) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

(a) If the blade platform width is larger than the gap, determine the difference. If the total material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type A blade not installed. If total amount of material to be removed exceeds of 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type A blade not installed. Maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

(b) If the total amount of material to be removed exceeds 0.010 inch (0.254 mm), remove an additional Type A blade to obtain the proper fit and remove material in approximately equal amounts from both sides of Type A blade platforms.

(c) Remove additional Type A blades as required to obtain the 0.020 - 0.055 inch (0.51 - 1.40 mm) fit. Remove material in equal amounts from both sides of the platform on these blades. Maximum material removal per platform side must not exceed 0.005 inch (0.127 mm).

(d) If it is necessary to remove material, machine the HPC 13th stage blade platforms per 72-35-39, Assembly-03 (Task 72-35-39-440-003).

(e) Type A blades with trimmed platforms must be identified with a square symbol in their respective service time marking areas. See 70-11, Standard Practices Manual, PN 585005.

(21) If grinding of blade platforms was required, install Type A blades in slot and check gap. Continue grinding and checking gap until 0.020 - 0.055 inch (0.51 - 1.40 mm) limit is met.

(22) After gap limits have been met, remove all blades from right side of slot and place them in order of removal on bench. Remove all blades from left side of slot and place them in order of removal on bench.

NOTE: Four blades are to remain in disk. These are the first set of four blades (two Type B and two Type C) and two blade locks installed at beginning of this procedure.

(23) Apply Antiseize Compound P06-009 to seals (side opposite flat side) and to drum groove.

(24) Aligning slots, prepare to install blade seal to drum, flat side out. Seal will be installed from left to right. Selecting blades from bench in same order in which they were previously installed in right side of drum, install blades to seal and drum, and move (slide) blade and seal to right. See Figure 1005.

NOTE: Use nonmetallic drift and mallet to move blades and seals around drum.

(25) Install remaining right side blades into seal and drum per schematic view Figure 1006. Install reworked Type A blades equally spaced.

(26) When blades and seal have been installed at right side, install left side blades and seal per instructions above except moving blades and seal from right to left. See Figure 1006. Install reworked Type A blades equally spaced.

(27) At this point, four (two Type B and two Type C) blades of the second set should remain on bench. Install Type C blade into drum slot and move to right. Install Type B blade into slot and move left.

(28) Install blade lock and move to right. Install remaining Type B blade and move to right. The last Type C blade and lock can only be inserted in drum by shifting all blades to right. Therefore, rotate drum 180 degrees and loosen blade lock screws. Move all blades and seals to right. Install blade lock in drum slot and move left. Install Type C blade in drum.

(29) Move all blades and seals to left, aligning one blade lock with "V" mark made on drum at beginning of this procedure. Tighten and torque all blade locks to running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multispline setscrews.

(30) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

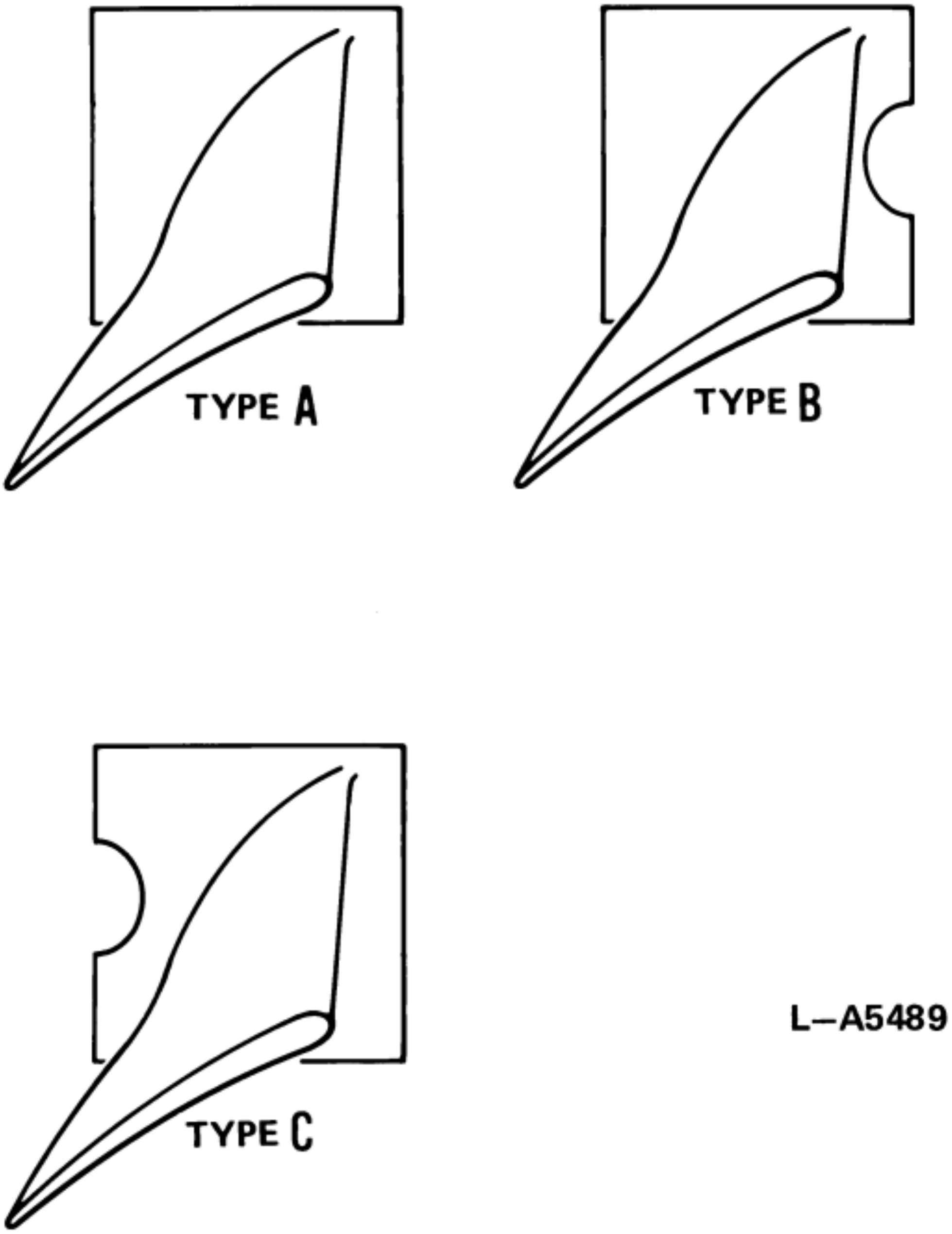
(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

1 If these limits are not kept, check the lock for correct assembly in the disk.

(31) Use a feeler gage to measure the gap, which extends between the loading slots, in each 180 degree arc on the two sides of the drum. Each arc must have a 0.010 − 0.030 inch (0.254 − 0.762 mm) gap, measure both sides at the same time. If the gap in not in limit, you must change blades from one side of the rotor to the other, or additional material can be removed from the blade platforms on the side that is too tight. If material is removed you must also keep the 0.020 − 0.055 inch (0.51 − 1.40 mm) gap limit.

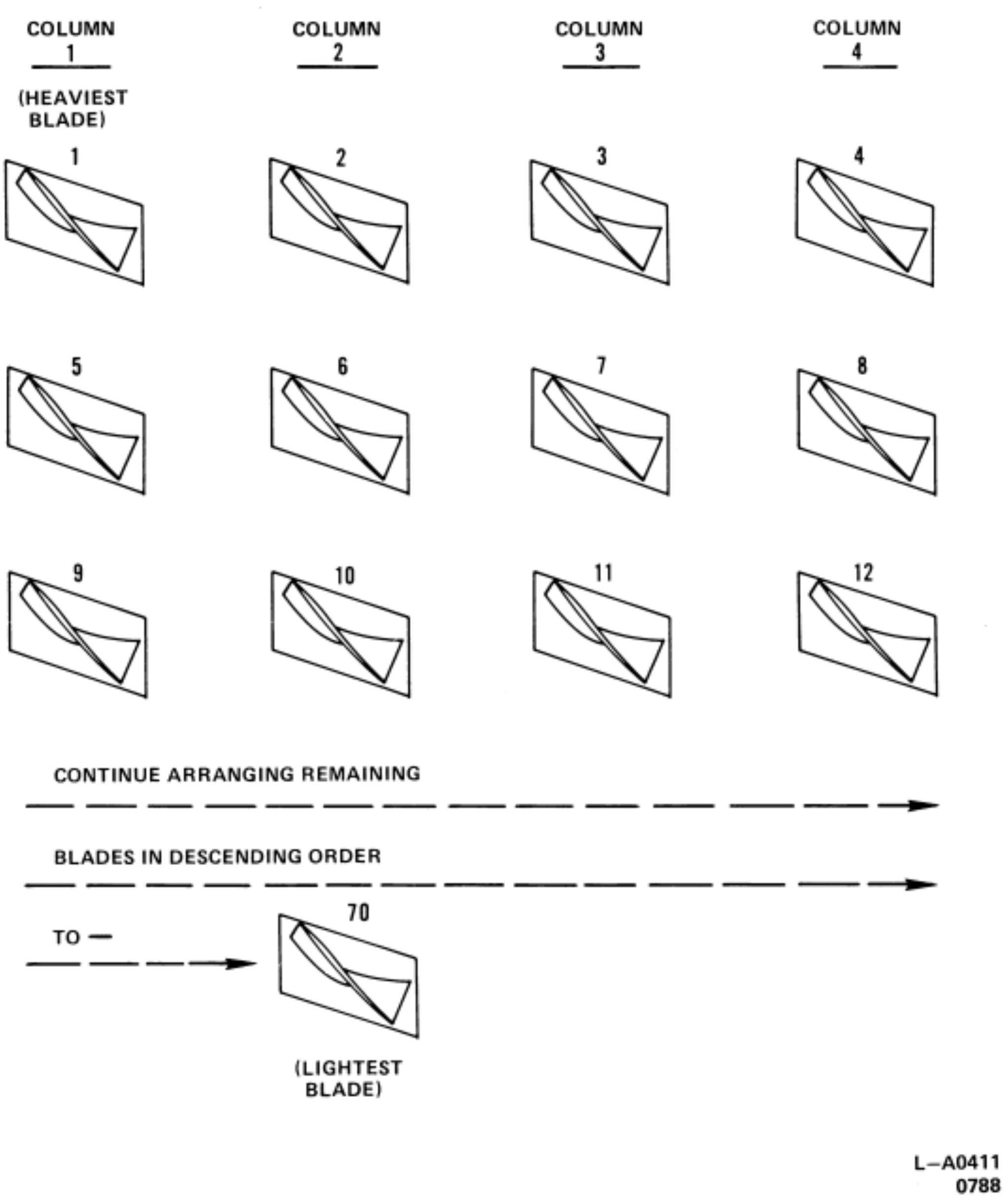
D. Postrequisites

(1) Assemble 12th stage blades to (debladed) axial compressor rotor assembly. See CONFIG−1, Assembly−24 (Task 72−35−01−440−012).

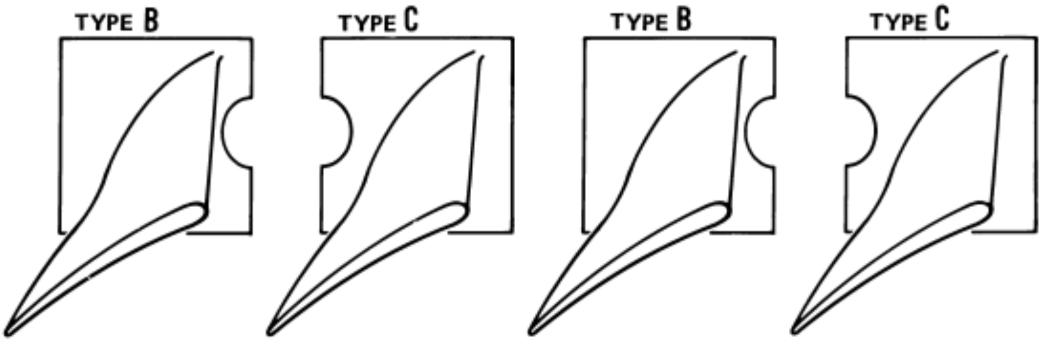


Blade Identification
Figure 1001
(Task 72-35-01-440-011)

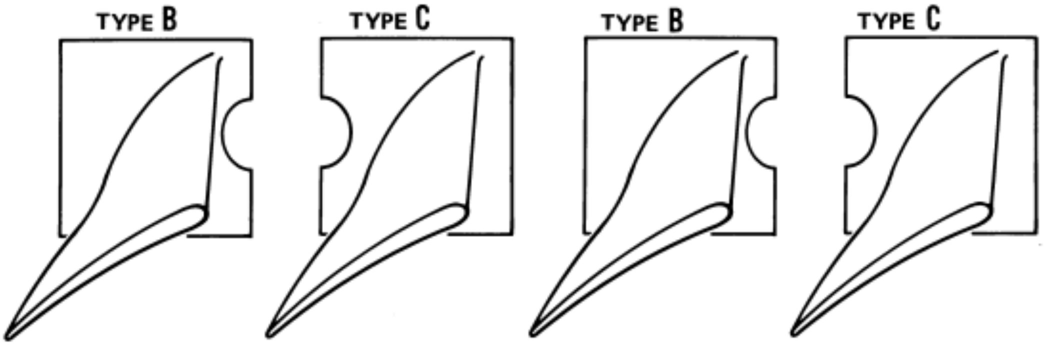
AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−23


COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
COLUMN 3
COLUMN 4
1
2
3
4
5
6
7
8
9
10
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO —
70
(LIGHTEST BLADE)
L−A0411
0788

Blade Weight Arrangement
Figure 1002
(Task 72−35−01−440−011)


TYPE B
TYPE C
TYPE B
TYPE C

SET 1

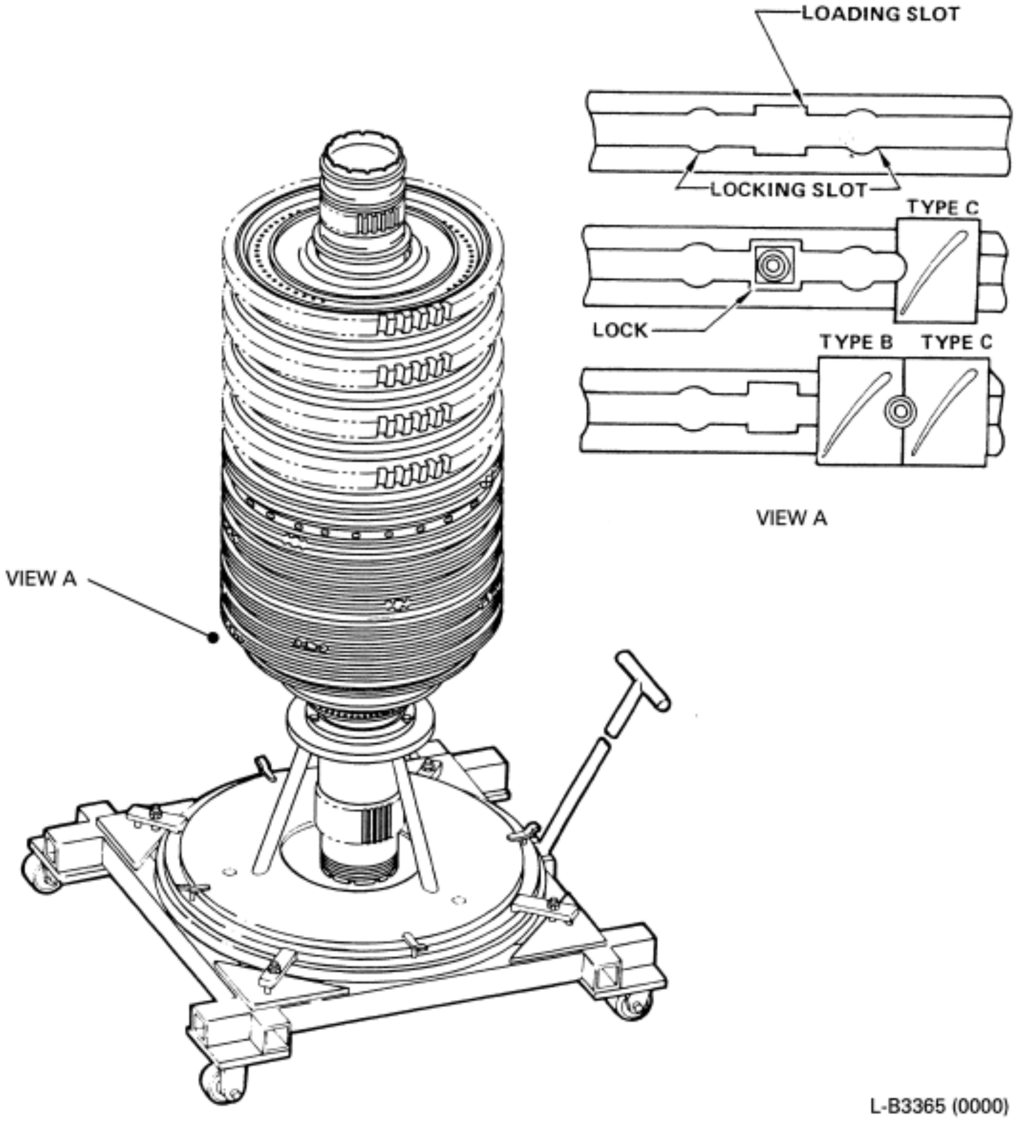

TYPE B
TYPE C
TYPE B
TYPE C

SET 2

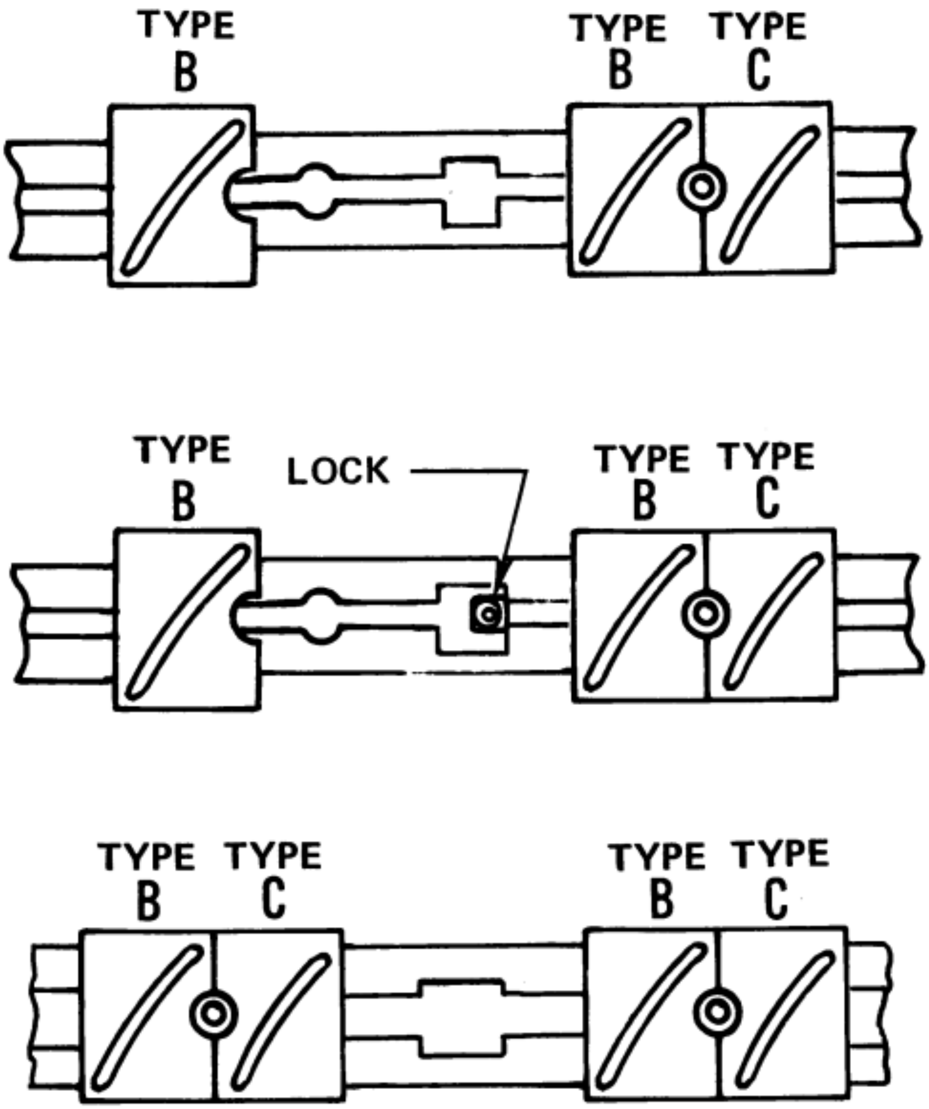
L-A0320

Blade Sets
Figure 1003
(Task 72-35-01-440-011)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-23

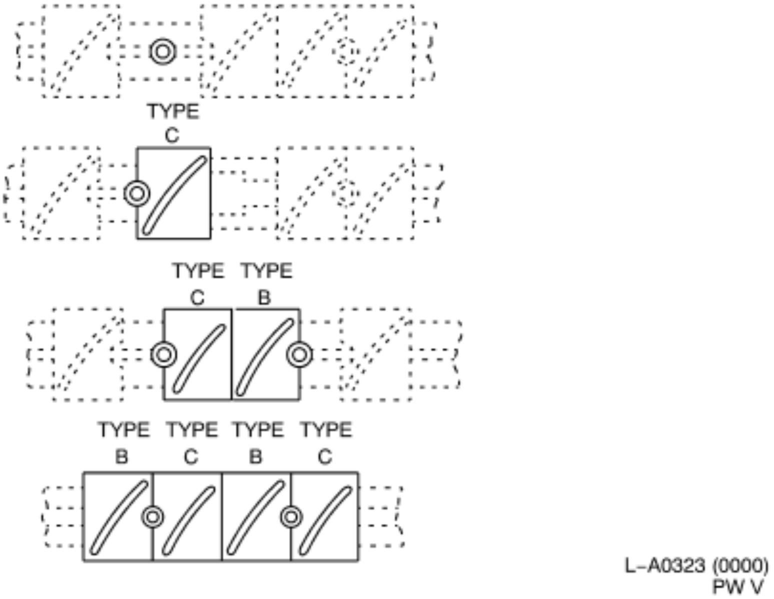

LOADING SLOT
LOCKING SLOT
TYPE C
LOCK
TYPE B
TYPE C
VIEW A
VIEW A
L-B3365 (0000)

Blade And Lock Installation
Figure 1004 (Sheet 1)
(Task 72-35-01-440-011)

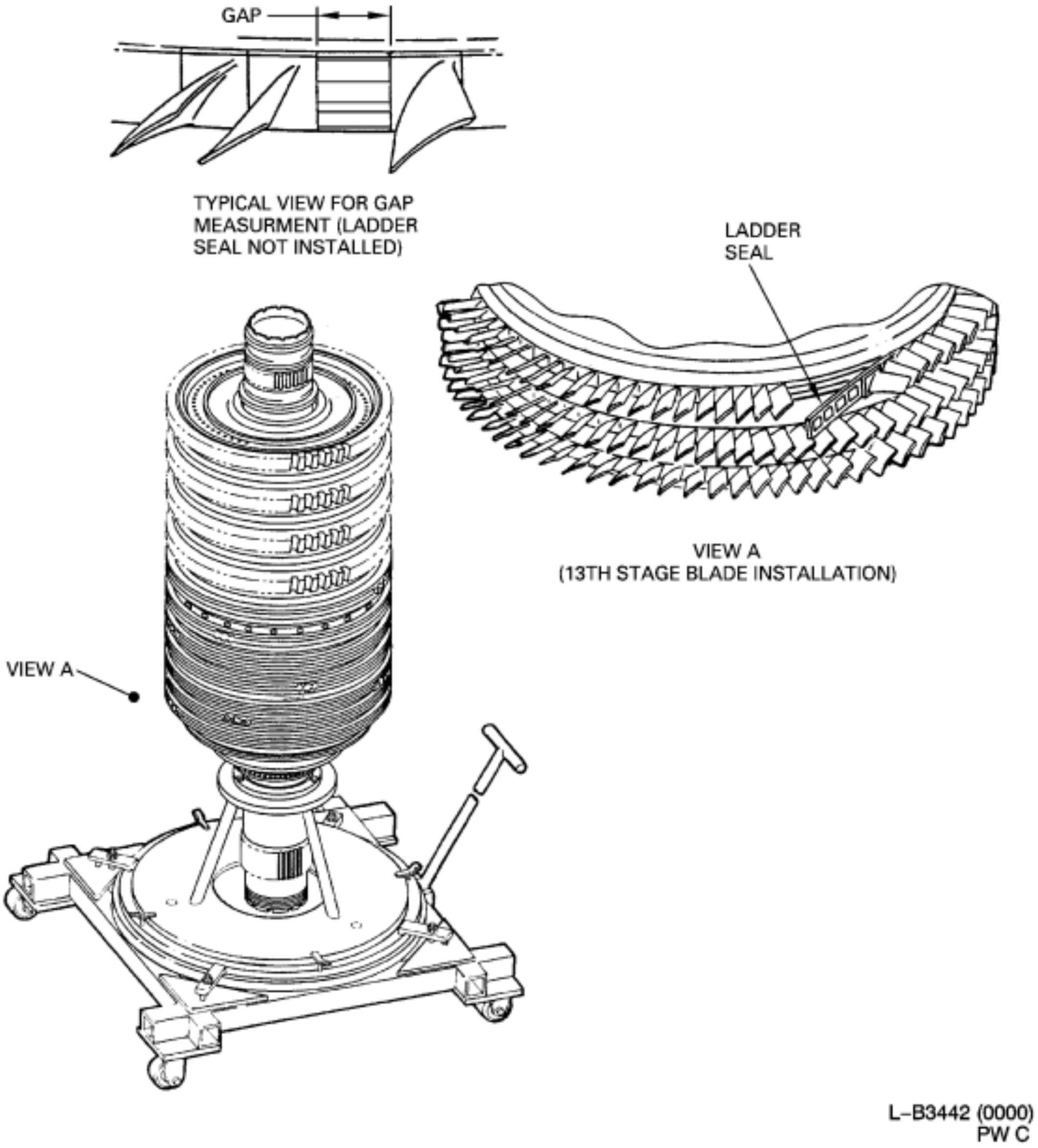

TYPE B
TYPE B
TYPE C
TYPE B
LOCK
TYPE B
TYPE C
TYPE B
TYPE C
TYPE B
TYPE C

L-A0322

Blade And Lock Installation
Figure 1004 (Sheet 2)
(Task 72-35-01-440-011)

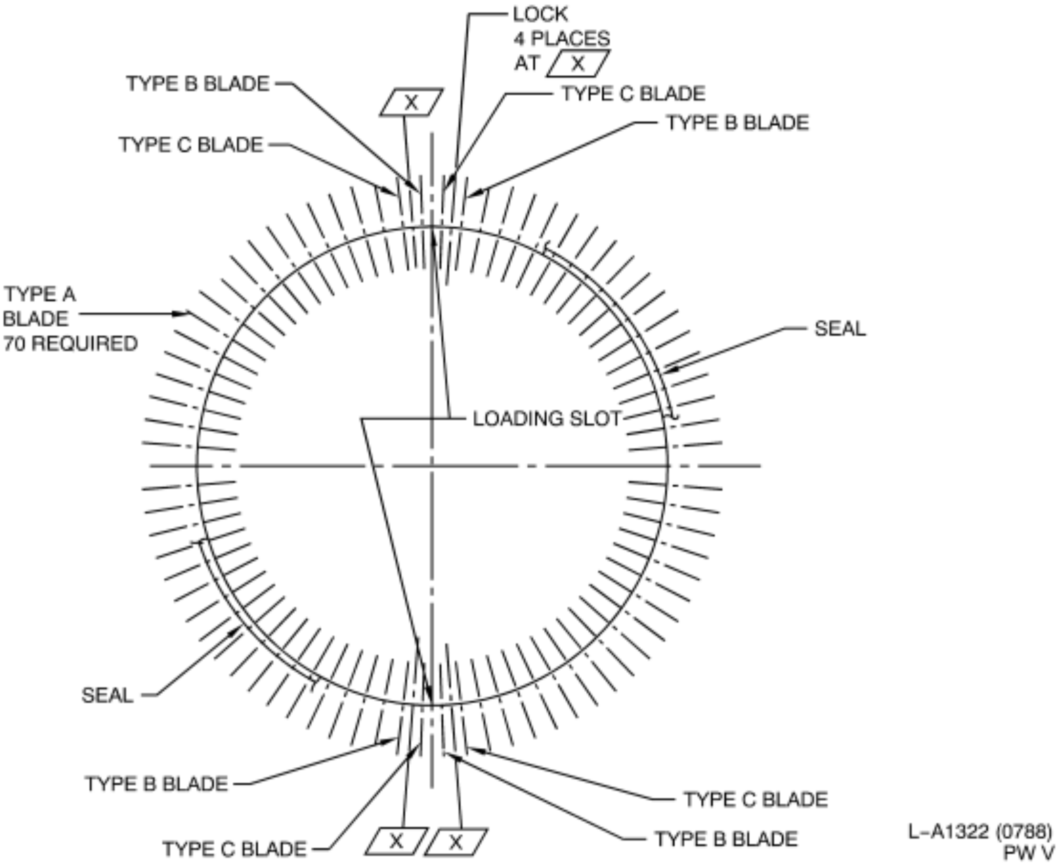

TYPE
C
TYPE
C
TYPE
B
TYPE
B
TYPE
C
TYPE
B
TYPE
C
L−A0323 (0000)
PW V

Blade And Lock Installation
Figure 1004 (Sheet 3)
(Task 72−35−01−440−011)


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A (13TH STAGE BLADE INSTALLATION)
VIEW A
L−B3442 (0000)
PW C

Gap Measurement And Seal Installation
Figure 1005
(Task 72−35−01−440−011)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−23


LOCK
4 PLACES
AT X
X
TYPE B BLADE
TYPE C BLADE
TYPE C BLADE
TYPE B BLADE
TYPE A
BLADE
70 REQUIRED
SEAL
LOADING SLOT
SEAL
TYPE B BLADE
TYPE C BLADE
TYPE C BLADE
TYPE B BLADE
X
X
L−A1322 (0788)
PW V

Blade And Lock Installation Schematic View
Figure 1006
(Task 72−35−01−440−011)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-23

Task 72-35-01-440-021:

1. Assemble 13Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Equipment And Materials Necessary

Special Tools:

PWA 86571	Gage Set

B. Measurement of Z-Plane for HPC Stage 13.

CAUTION: DO NOT OVERTIGHTEN GAGE SET SCREWS DURING INSTALLATION OF GAGES. DAMAGE TO THE DRUM CAN RESULT.

(1) Measure Z-Plane diameter for Stage 13. This procedure is optional and can only be used where blades have been removed. Select the pair of gages, marked for that stage, from the PWA 86571 Z-Plane Diameter Gage Set. Install gages, 180 degrees apart, in blade slots. Turn gage set screws clockwise to move the gages radially out to their most outward position. Use OD micrometers to measure four diameters, every 45 degrees, over the gage tool balls. Calculate Z-Plane diameter of the stage by subtracting twice the reference dimension, marked on each pair of gages, from the average diameter measured over the gage tool balls. Refer to minimum, maximum and nominal Z-Plane diameters listed, for reference only, in Table 1001.

Stage	Minimum Diameter (Reference)	Maximum Diameter (Reference)	Nominal Diameter (Reference)
13	23.196 inch (589.178 mm)	23.204 inch (589.382 mm)	23.200 inch (589.280 mm)

HPC Front Drum Z-Plane Diameters
Table 1001

C. General

(1) Use one of the procedures that follow to install the 13th stage blades.

R (a) Use (Task 72-35-01-440-021-A) of this procedure to
R install the 13th stage blades for engines with
R drum rotor disk assembly (called drum rotor) PN
R 53H973-01 or 54H803-01 (Pre SB PW4ENG 72-565),
R modified drum rotor PN 53H973-001 or 54H803-001
R (Post SB PW4ENG 72-565), or PN 54H803-002 (Post SB
R PW4ENG 72-750).

R (b) Use (Task 72-35-01-440-021-B) of this procedure to
R install the 13th stage blades for engines with
R drum rotor disk assembly (called drum rotor) PN
R 56H013-01 (Post SB PW4ENG 72-565), PN 56H013-001
R Or 58H236-01 (Post SB PW4ENG 72-750)

Task 72-35-01-440-021-A:

2. Assemble 13Th Stage Blades In The (Debladed) Axial Compressor
R Rotor Assembly For Engines With Drum Rotor PN 53H973-01,
R 54H803-01 (Pre SB PW4ENG 72-565), Modified Drum Rotor PN
R 53H973-001 Or 54H803-001 (Post SB PW4ENG 72-565), Or PN
R 54H803-002 (Post SB PW4ENG 72-750)

A. Prerequisites

(1) Assemble 14th stage blades to (debladed) axial compressor rotor assembly. See Assembly-22, CONFIG-2 (Task 72-35-01-440-020).

B. Equipment And Materials Necessary

Special Tools:

PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader, Manual
PWA 86448	Drift

Consumable Materials:

Item No.	Designation
P06-009	Antiseize Compound (PMC 9523)

C. Procedure
See Figure 1001, Figure 1002, Figure 1003, Figure 1004, Figure 1005 and Figure 1006.

NOTE: There are three part numbers (sets) of blades provided for this stage. Set Type A contains the

majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type A is also used to get the correct platform gap and may require platform grinding. A modified Type A blade is also available with a 0.015 inch (0.381 mm) oversized platform width to help you get the correct platform gap. For ease of assembly, blades in this procedure will be referred to as Types A, B and C.

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(1) Remove the 13th stage blades from their storage rack and place them on a work bench. Find the four Types B and C blades having notches in their platforms and move them to one side. See Figure 1001.

(2) Optional, weigh the 13th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70-11-00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

(3) Optional, arrange the Type A blades in four columns, start with the heaviest blade at top left (Column 1), and proceed from left to right in descending order of weight. Lightest blade will be at bottom of Column 2 (blade number 70. See Figure 1002.

NOTE: One or more Type A blades may have been used as a fitting blade. These blades will be identified by a square that is marked in the service time marking area.

(4) Divide the Types B and C blades into two sets of four blades (two Types B and C blades per set) such that the weights of sets are as near to equal as possible. See Figure 1003.

NOTE: Weights must be nearly equal as sets will be positioned opposite each other after assembly.

(5) Install one Types B and C blade set, two Type A blades, and two lock and setscrew assemblies. See Figure 1002 through Figure 1005.

(a) Find one of the two 13th stage loading slots.

(b) Select one of the Types B and C blade sets. Install one Type C blade, leading edge up, into the slot. Move the blade to right.

(c) Install one lock and setscrew assembly and move to the right.

(d) Install one Type B blade into the slot and move it to the right.

(e) Install the remaining Type B blade into the loading slot and move it to the left.

(f) Install one lock and setscrew assembly and move it to the left.

(g) Install the remaining Type C blade and move it to the left.

(h) Install the Type A blade from the bottom of Column 4 (blade number 68) and move it to the left.

(i) Install the Type A blade from the top of Column 3 (blade number 3) and move it to the right.

(j) Locate the locking slot on the left of the blade loading slot. Move the left lock and setscrew assembly into the left locking slot and tighten. Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(k) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

  1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

  2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

    a If these limits are not kept, check the lock for correct assembly in the disk.

(l) Use an approved marking pen to make a "V" mark on the outside diameter platform of the drum and in line with the lock. This mark will be used for future reference.

(m) Move the Type C blade to the left until it touches the lock.

(n) Move the two Type A blades fully to the left until they touch the Type C blades.

(o) Move the Type B blade to the left until it touches the Type A blade.

(p) Move the right lock and setscrew assembly so that it is positioned in the locking slot and tighten. Torque the lock setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(q) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(r) Push the two remaining Types B and C blades to the left so that they touch the just installed locks.

(6) Rotate the drum 180 degrees.Position the open blade loading slot toward the operator.

(7) Install the right side blades and lock and setscrew assemblies. See Figure 1002, Figure 1003, Figure 1004 (Sheets 1 and 2) and Figure 1005.

(a) Find the Type A blades to be installed. Start at the bottom of Column 4 (blade number 64, blade number 68 is installed) and continue up to the top of the column (blade number 4).

(b) Put each blade, start with blade number 64, in the loading slot and move it to the right until it touches the blade that was installed before.

(c) Find more Type A blades to be installed. Start at the bottom of Column 2 (blade number 70) and continue up the column to blade number 6. Do not install blade number 2 at this time.

(d) Put each blade, start with blade number 70, in the loading slot and move it to the right until it touches the blade that was installed before.

(8) Install the left side blades and lock and setscrew assemblies. See Figure 1002, Figure 1003, Figure 1004 (Sheets 1 and 2) and Figure 1005.

(a) Find the Type A blades to be installed. Start at the top of Column 3 (blade number 7, blade number 3 is installed) and continue down to the bottom of the column (blade number 67).

(b) Put each blade, start with blade number 7 (the heaviest blade), in the loading slot and move it to the left until it touches the blade that was installed before.

(c) Find more Type A blades to be installed. Start at the top of Column 1 (blade number 1) and continue down the column.

(d) Put each blade, start with the heaviest blade, in the loading slot and move it to the left until it touches the blade that was installed before. Do not install the last two blades (blades number 65 and 69) at this time.

NOTE: Blade number 65 will be used as a fitting blade in a step that follows.

(9) Install the remaining Types B and C blade set, two Type A blades, and two lock and setscrew assemblies.

(a) Install a Type C blade and move it to the right until it touches the blade that was installed.

(b) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before. Do not tighten the lock.

(c) Install a Type B blade in the loading slot and move it to the right until it touches the lock and setscrew assembly that was installed before.

(d) Install Type A blade number 2 and move it to the right.

(e) Install the last Type B blade and move it to the left until it touches the blade that was installed before.

(f) Install the last lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before. Do not tighten the lock at this time.

(g) Install the last Type C blade and move it to the left until it touches the blade that was installed before.

(h) Install Type A blade number 69 and move it to the left.

(10) Move the blades tangentially to make the widest possible gap at the blade number 65 position. This gap will be measured and used to compute the necessary gap between the blades. See Figure 1006.

NOTE: Put the blades in a radially outward direction to prevent a circumferential serpentine shape to the blades.

(a) Use a PWA 85595 Spreader to load all blades tangentially.

(b) When it is installed, expand the spreader and get the widest possible gap between the blade platforms. If you need help to move the blades, it is permissible to tap lightly on the base of the airfoil with a PWA 86448 Drift.

(c) Measure and make a record of the gap dimension.

(d) Find the Type A blade (blade number 65) that will be installed in the gap you measured. Use a vernier caliper to measure the platform width of the blade. Record this dimension.

(e) Compare the gap dimension with the blade platform width dimension.

(f) The width of the blade platform must measure 0.020 - 0.055 inch (0.51 - 1.40 mm) smaller than the gap measured at the drum loading slot between the blades.

(g) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

(11) Do the procedure that follows to get the correct blade platform width for the measured gap.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type A blades with the oversized Type A blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.020 − 0.055 inch (0.51 − 1.40 mm).

NOTE: (Post SB PW4ENG 72−703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). If the 0.055 inch (1.397 mm) maximum gap limit is not met, replace the standard Type A blades with the modified Type A blades with wider platforms or the Type A blades with the narrower platform as necessary to get the 0.020 − 0.055 inch (0.51 − 1.40 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

(12) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

(a) If the blade platform width is larger than the gap, determine the difference. If the total material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type A blade not installed. If the total amount of material to be removed exceeds 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type A blade not installed. Maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

(b) If the total amount of material to be removed exceeds 0.010 inch (0.254 mm), remove an additional Type A blade to obtain the proper fit and remove material in approximately equal amounts from both sides of the Type A blade platforms. Repeat this procedure for additional Type A blades, as necessary, to obtain the correct gap.

(c) If it is necessary to remove material, machine the HPC 13th stage blade platforms per 72-35-39 Assembly-03 (Task 72-35-39-440-003).

(d) Type A blades with trimmed platforms must be identified with a square symbol in their respective service time marking areas. See 70-11, Standard Practices Manual, PN 585005.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(13) After the gap limits have been met, remove the blades and one lock from right side of the loading slot and place them in order of removal on the work bench. Remove the blades and one lock from left side of the slot and also place them in order of removal on the work bench.

NOTE: Six blades and two blade locks will stay in the disk. These are the six blades, (two Types A, B and C) and two blade locks that were installed at beginning of this procedure.

(14) Apply Antiseize Compound P06-009 to seals (side opposite flat side) and to drum groove.

(15) Install the right side blades, seals and lock. See Figure 1006.

NOTE: The blades and lock will be installed in the order that they were removed.

(a) Put the ladder seal over the loading slot with the flat surface out.

(b) Align the first opening in the seal with the loading slot in the disk.

(c) Install the blade that was first removed (blade number 64), leading edge up, through the seal and into the loading slot.

(d) Move the blade and seal to the right until the second ladder seal opening is aligned with the loading slot.

NOTE: Make sure that the ladder seal is correctly installed between the disk rails.

(e) Continue with the blade installation instructions above and install the right side blades, seal and lock. Do not install blade number 2. Move all blades to the right until they touch the Type C blade that was installed before. Do not tighten the lock you just installed.

NOTE: Do not install blade number 2 at this time.

(16) When the blades, lock and seal are installed on the right side, install the left side blades, seal and lock by the instructions above except move the blades, seal and lock to the left. Do not install blade number 69 at this time.

(17) Install the remaining blades.

(a) The last two blades can only be installed in the disk by moving all the blades to the right. To do this, you must rotate the drum 180 degrees and loosen the blade lock screws. Move all blades, seals and locks to the right.

(b) Rotate the drum 180 degrees again.

(c) Install blade number 2 and move it to the right.

(d) Move the blades and seals more to the right. Then install blade number 69.

(18) Move the blades, seals and locks to the final positions.

(a) Move all blades, seals and locks to the left. Align the blade lock with the "V" mark made on the drum at the start of this procedure.

(b) Tighten and torque the two lock and setscrew assemblies that are located at the loading slot near the "V" mark.

1 Torque the lock setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(c) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(d) Check the gaps, all gaps over Arc BG must be approximately equal.

(19) Tighten and torque the remaining lock and setscrew assemblies.

(a) Torque the lock setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(b) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

D. Postrequisites

(1) Assemble 12th stage blades to (debladed) axial compressor rotor assembly. See Assembly-24, CONFIG-2 (Task 72-35-01-440-022).

Task 72-35-01-440-021-B:

3. Assemble 13Th Stage Blades In The (Debladed) Axial Compressor
R Rotor Assembly For Engines With Drum Rotor PN 56H013-01 (Post
R SB PW4ENG 72-565), PN 56H013-001 Or 58H236-01 (Post SB PW4ENG
R 72-750)

A. Prerequisites

(1) Assemble 14th stage blades to (debladed) axial compressor rotor assembly. See Assembly-22, CONFIG-2 (Task 72-35-01-440-020).

B. Equipment And Materials Necessary

Special Tools:

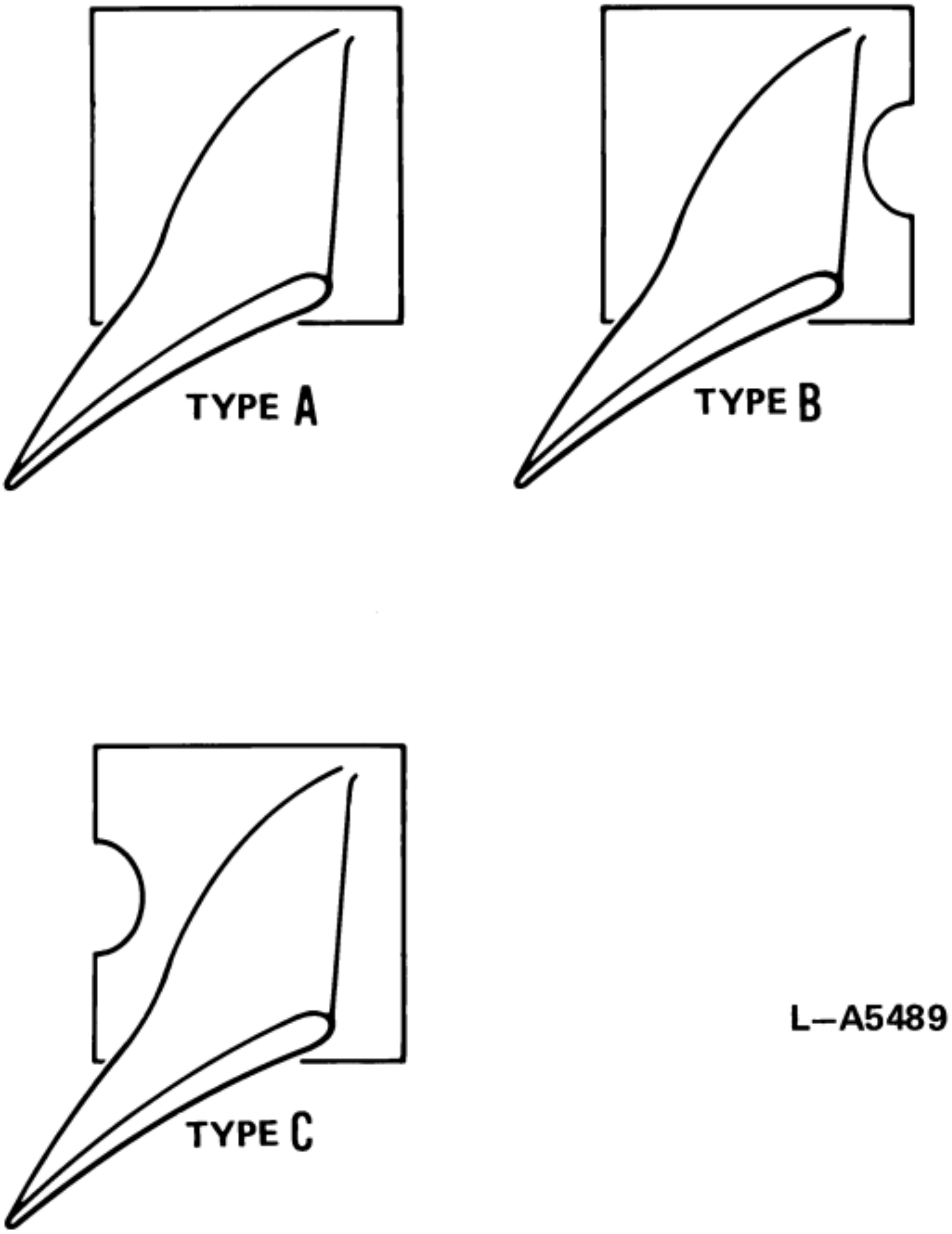
PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader, Manual
PWA 86448	Drift

Consumable Materials:

Item No.	Designation
P06-009	Antiseize Compound (PMC 9523)

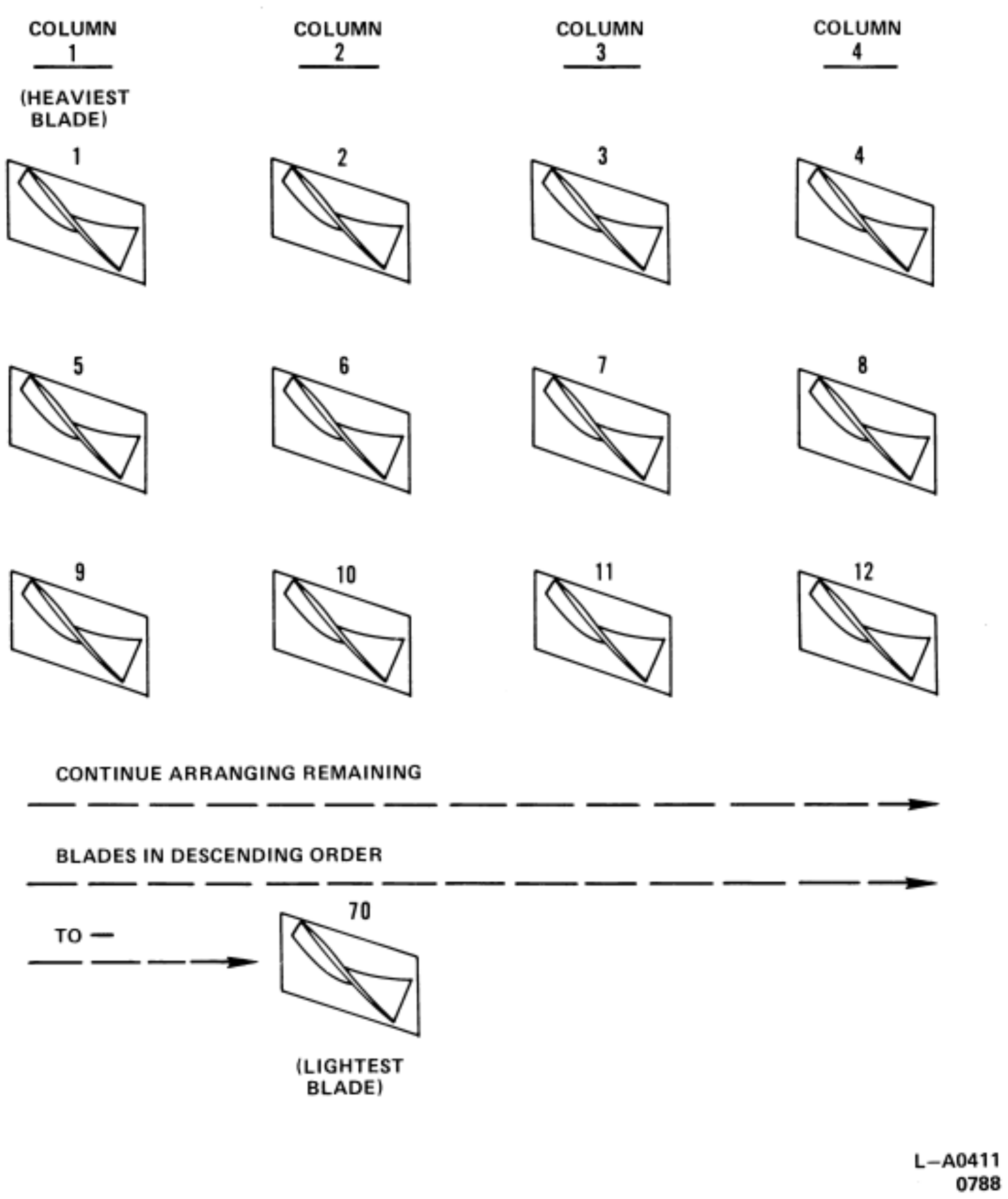
C. Procedure
See Figure 1007, Figure 1008, Figure 1009, Figure 1010, Figure 1011 and Figure 1012.

NOTE: There are three part numbers (sets) of blades provided for this stage. Set Type A contains the

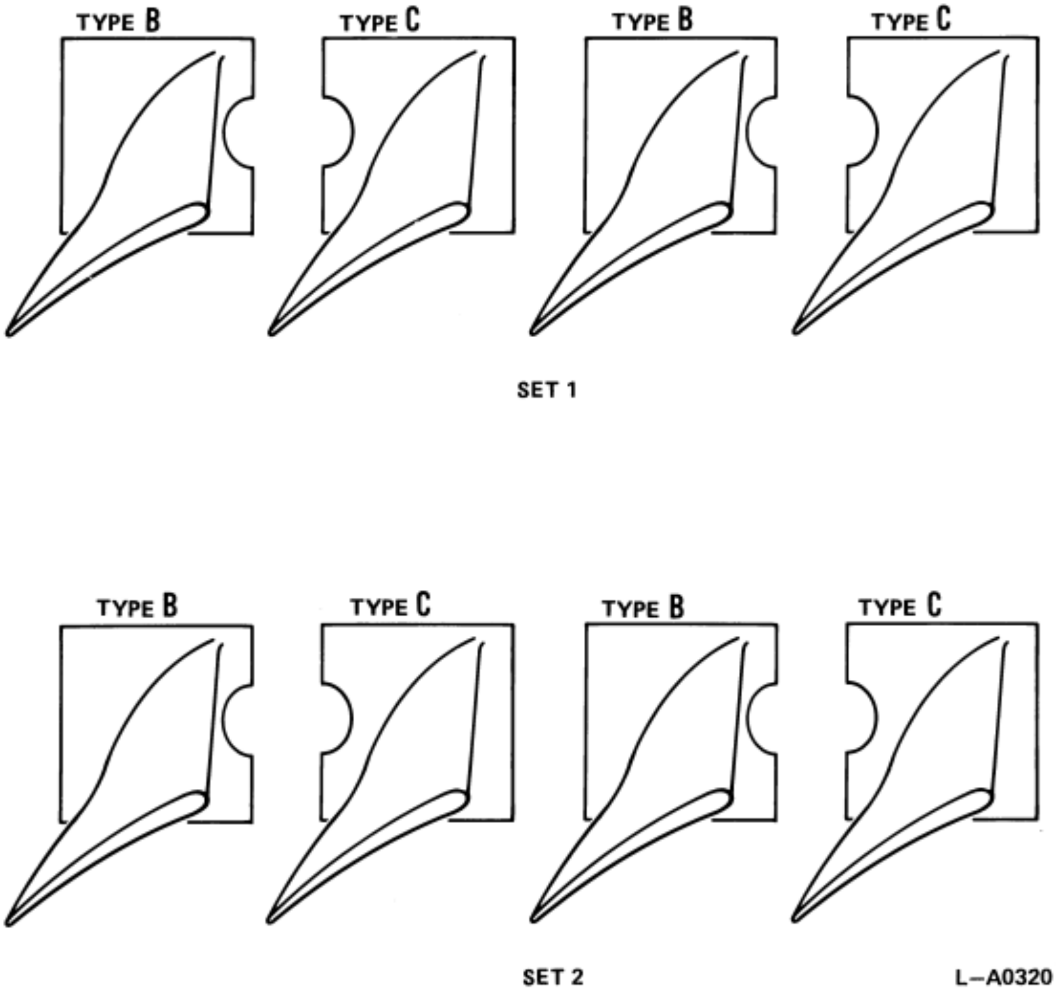


Blade Identification
Figure 1001
(Task 72-35-01-440-021-A)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-23

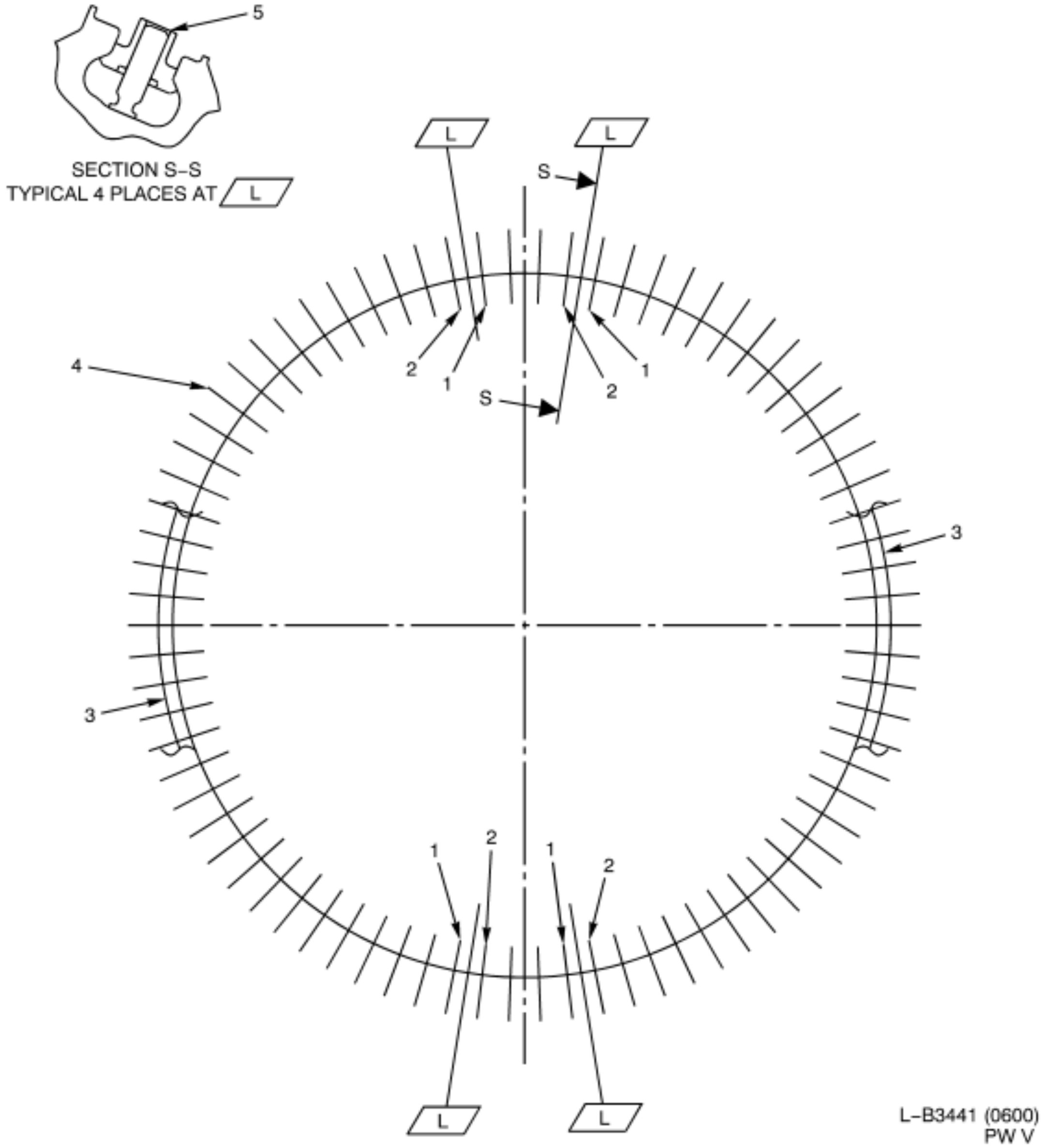

COLUMN 1
COLUMN 2
COLUMN 3
COLUMN 4
(HEAVIEST BLADE)
1
2
3
4
5
6
7
8
9
10
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO —
70
(LIGHTEST BLADE)
L-A0411
0788

Type A Blade Weight Arrangement
Figure 1002
(Task 72-35-01-440-021-A)


TYPE B
TYPE C
TYPE B
TYPE C
SET 1
TYPE B
TYPE C
TYPE B
TYPE C
SET 2
L-A0320

Types B And C Blade Set Arrangement
Figure 1003
(Task 72-35-01-440-021-A)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-23


5
SECTION S-S
TYPICAL 4 PLACES AT L
L
L
S
S
4
2
1
2
1
3
3
1
2
1
2
L
L
L-B3441 (0600)
PW V

R Thirteenth Stage Blade And Lock Installation (Rear
R Drum PN 53H973-001, 54H803-001, And 54H803-002)
Figure 1004 (Sheet 1)
(Task 72-35-01-440-021-A)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-23

1. Type B Blades
2. Type C Blades
3. Ladder Seals, PN 54H054, Two Necessary.
4. Type A Blades
5. Lock And Setscrew Assemblies

Key to Figure 1004 (Sheet 1)

majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type A is also used to get the correct platform gap and may require platform grinding. A modified Type A blade is also available with a 0.015 inch (0.381 mm) oversized platform width to help you get the correct platform gap. For ease of assembly, blades in this procedure will be referred to as Types A, B and C.

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

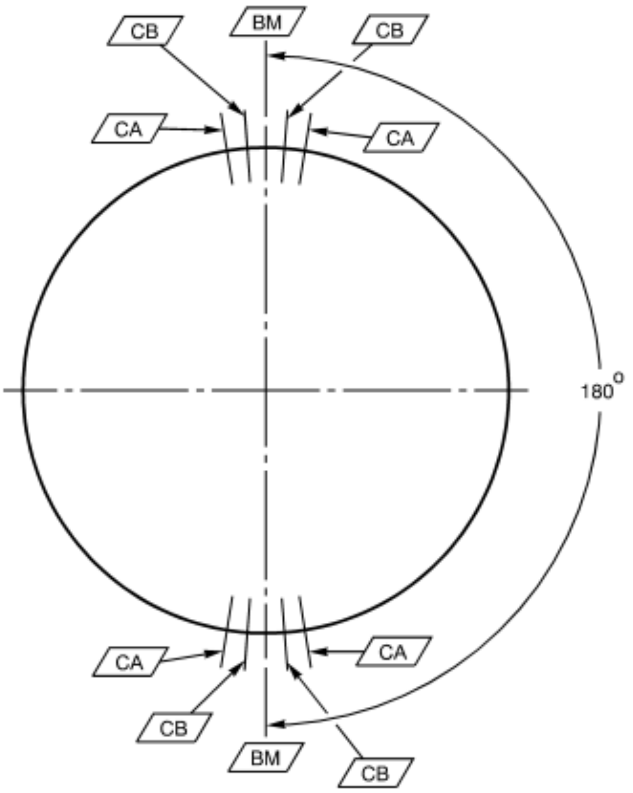
CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(1) Remove the 13th stage blades from their storage rack and place them on a work bench. Find the four Types B and C blades having notches in their platforms and move them to one side. See Figure 1007.

(2) Optional, weigh the 13th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70-11-00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−23

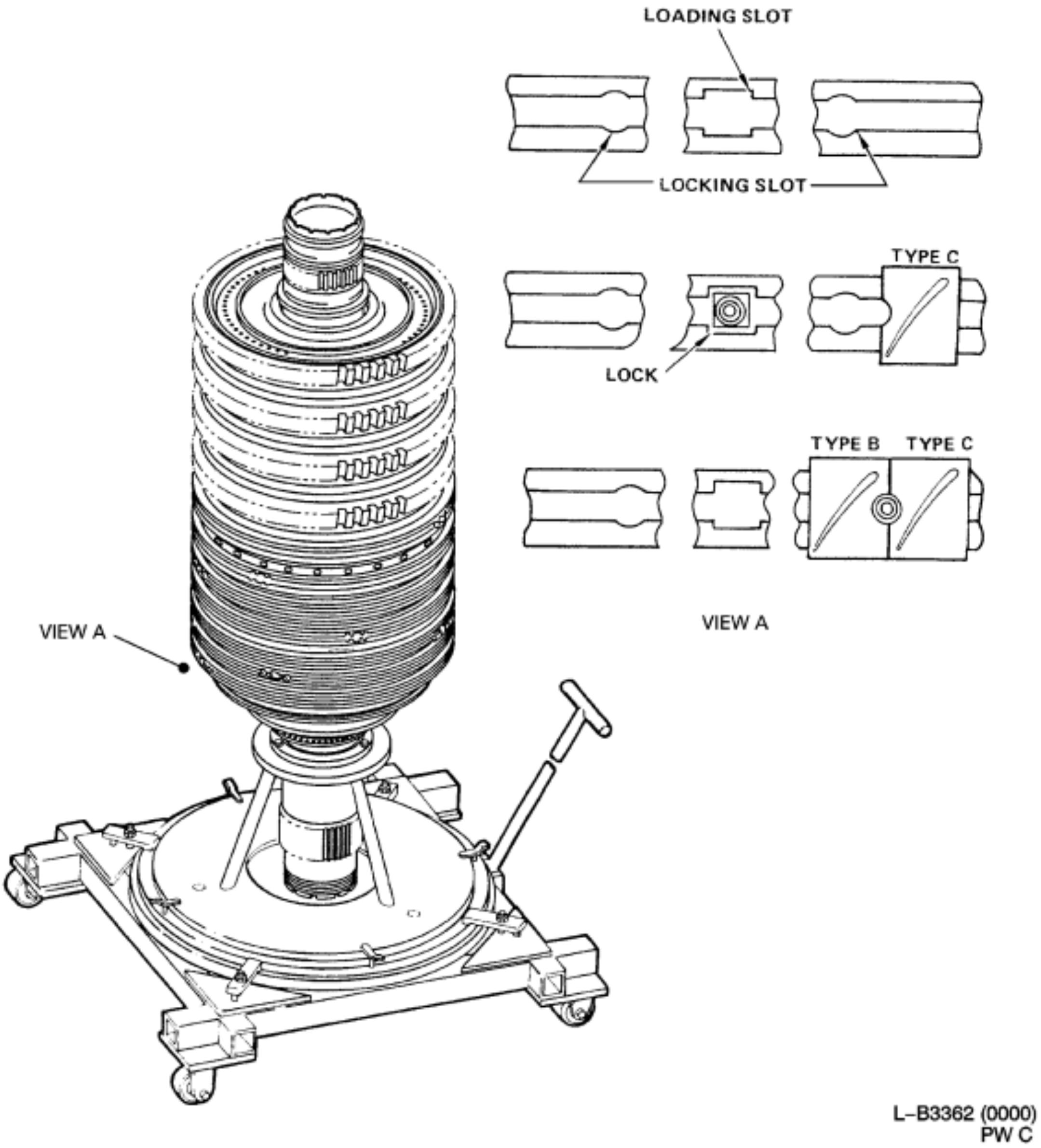


BM	BLADE LOADING SLOT (2 LOCATIONS)
CB	BLADE LOCKING SLOT (NOT USED) (4 LOCATIONS)
CA	BLADE LOCKING SLOT (4 LOCATIONS)

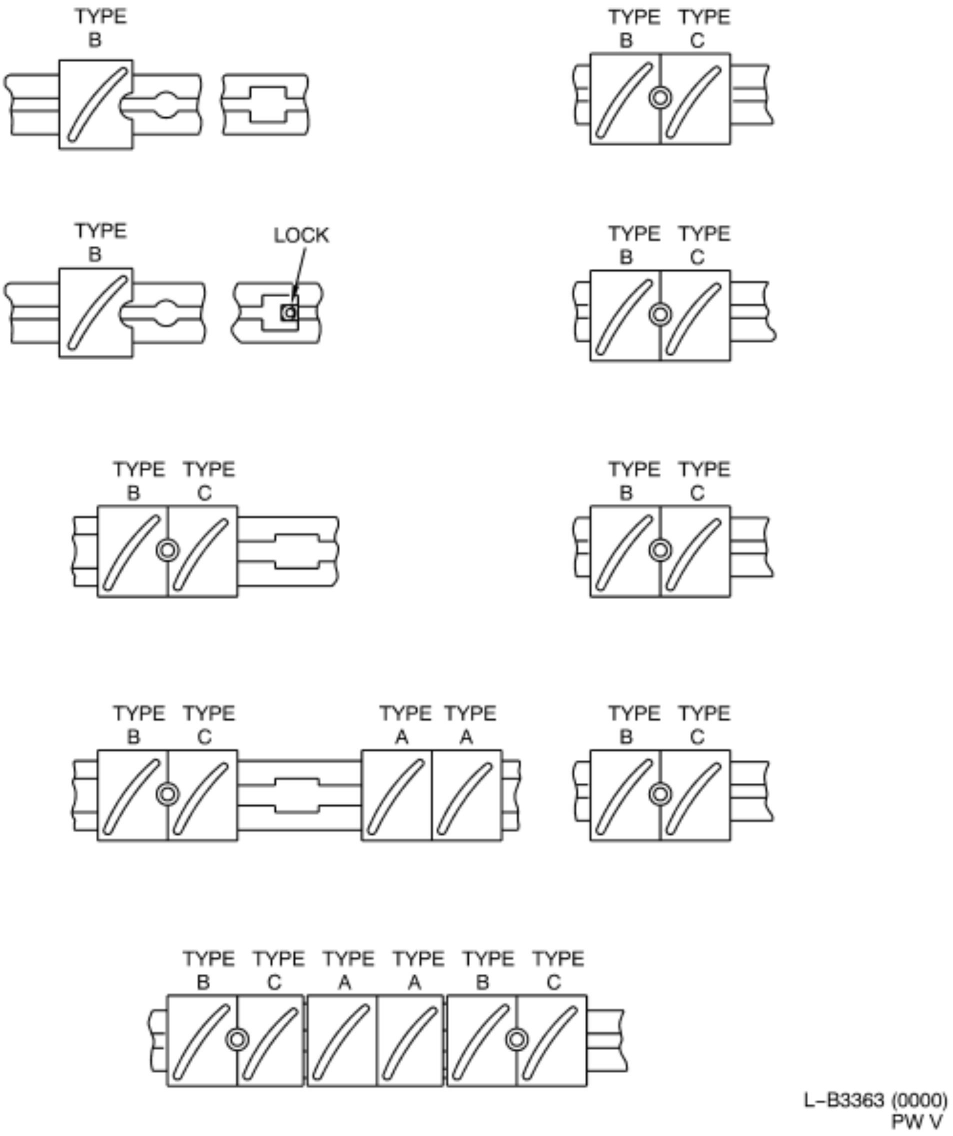
L−B8080 (0600)
PW V

R Thirteenth Stage Blade And Lock Locations (Rear
R Drum PN 53H973−001, 54H803−001, And 54H803−002)
Figure 1004 (Sheet 2)
(Task 72−35−01−440−021−A)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-23

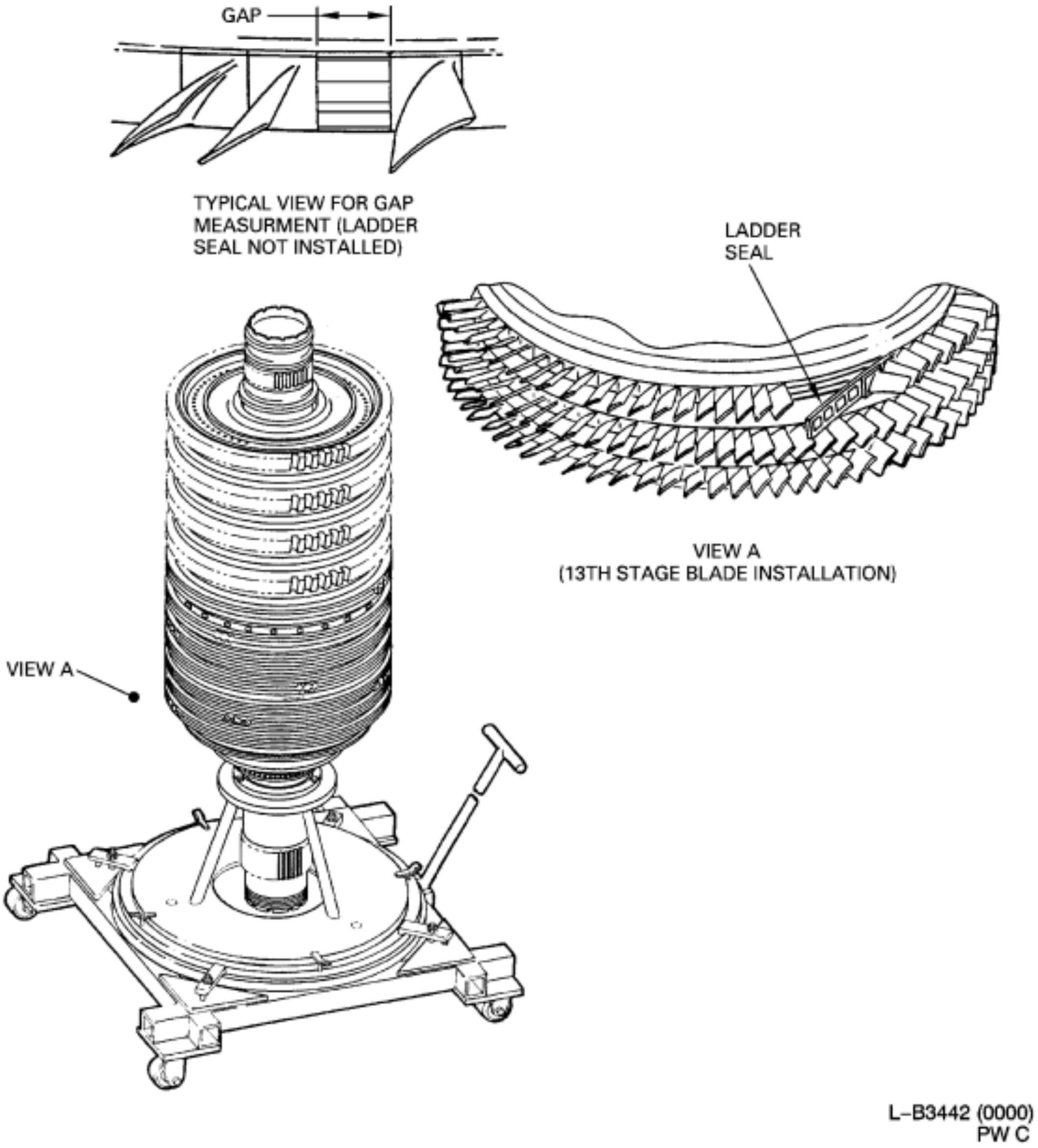

LOADING SLOT
LOCKING SLOT
TYPE C
LOCK
TYPE B
TYPE C
VIEW A
VIEW A
L-B3362 (0000)
PW C

Blade And Lock Installation
Figure 1005 (Sheet 1)
(Task 72-35-01-440-021-A)


TYPE B
TYPE B
TYPE C
TYPE B
LOCK
TYPE B
TYPE C
TYPE B
TYPE C
TYPE B
TYPE C
TYPE B
TYPE C
TYPE A
TYPE A
TYPE B
TYPE C
TYPE B
TYPE C
TYPE A
TYPE A
TYPE B
TYPE C
L−B3363 (0000)
PW V

Blade And Lock Installation
Figure 1005 (Sheet 2)
(Task 72−35−01−440−021−A)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−23


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A
(13TH STAGE BLADE INSTALLATION)
VIEW A
L−B3442 (0000)
PW C

Gap Measurement And Ladder Seal Installation
Figure 1006
(Task 72−35−01−440−021−A)

(3) Optional, arrange the Type A blades in four columns, start with the heaviest blade at top left (Column 1), and proceed from left to right in descending order of weight. Lightest blade will be at bottom of Column 2 (blade number 70. See Figure 1008.

NOTE: One or more Type A blades may have been used as a fitting blade. These blades will be identified by a square that is marked in the service time marking area.

(4) Divide the Types B and C blades into two sets of four blades (two Types B and C blades per set) such that the weights of sets are as near to equal as possible. See Figure 1009.

NOTE: Weights must be nearly equal as sets will be positioned opposite each other after assembly.

(5) Install one Types B and C blade set and two lock and setscrew assemblies. See Figure 1008, Figure 1009, Figure 1010 and Figure 1011.

(a) Find one of the two 13th stage loading slots.

(b) Select one of the Types B and C blade sets. Install one Type C blade, leading edge up, into the slot. Move the blade to right.

(c) Install one lock and setscrew assembly and move to right.

(d) Install one Type B blade into the slot and move it to the right.

(e) Install the remaining Type B blade into the loading slot and move it to the left.

(f) Install one lock and setscrew assembly and move it to the left.

(g) Install the remaining Type C blade and move it to the left.

(h) Locate the locking slot on the left of the blade loading slot. Move the left lock and setscrew assembly into the left locking slot and tighten. Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(i) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

  1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

  2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

    a If these limits are not kept, check the lock for correct assembly in the disk.

(j) Use an approved marking pen to make a "V" mark on the outside diameter platform of the drum and in line with the lock. This mark will be used for future reference.

(k) Move the Type C blade to the left until it touches the lock.

(l) Move the Type B blade to the left until it touches the Type C blade.

(m) Move the right lock and setscrew assembly to the left so that it is positioned in the locking slot and tighten. Torque the lock setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(n) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(o) Push the two remaining Types B and C blades to the left so that they touch the just installed locks.

(6) Rotate the drum 180 degrees. Position the open blade loading slot toward the operator.

(7) Install the right side blades and lock and setscrew assemblies. See Figure 1008, Figure 1009, Figure 1010 and Figure 1011.

(a) Find the Type A blades to be installed. Start at the bottom of Column 4 (blade number 68) and continue up to the top of the column (blade number 4).

(b) Put each blade, start with blade number 68, in the loading slot and move it to the right until it touches the blade that was installed before.

(c) Find more Type A blades to be installed. Start at the bottom of Column 2 (blade number 70) and continue up the column to blade number 2.

(d) Put each blade, start with blade number 70, in the loading slot and move it to the right until it touches the blade that was installed before.

(8) Install the left side blades and lock and setscrew assemblies. See Figure 1008, Figure 1009, Figure 1010 and Figure 1011.

(a) Find the Type A blades to be installed. Start at the top of Column 3 (blade number 3) and continue down to the bottom of the column (blade number 67).

(b) Put each blade, start with blade number 3 (the heaviest blade), in the loading slot and move it to the left until it touches the blade that was installed before.

(c) Find more Type A blades to be installed. Start at the top of Column 1 (blade number 1) and continue down the column.

(d) Put each blade, start with blade number 1, in the loading slot and move it to the left until it touches the blade that was installed before. Do not install the last blade (blade number 69) at this time.

NOTE: Blade number 69 will be used as a fitting blade in a step that follows.

(9) Install the remaining Types B and C blade set and two lock and setscrew assemblies.

(a) Install a Type C blade and move it to the right until it touches the blade that was installed.

(b) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before. Do not tighten the lock.

(c) Install a Type B blade in the loading slot and move it to the right until it touches the lock and setscrew assembly that was installed before.

(d) Install the last Type C blade and move it to the right until it touches the blade that was installed before.

(e) Install the last Type B blade and move it to the left until it touches the blade that was installed before.

(f) Install the last lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before. Do not tighten the lock at this time.

(g) Move the last Type B blade to the left until it touches the lock and setscrew assembly that was installed before.

(10) Move the blades tangentially to make the widest possible gap between the last installed Type B blade and the last Type A blade. This gap will be measured and used to compute the necessary gap between the blades. See Figure 1012.

NOTE: Put the blades in a radially outward direction to prevent a circumferential serpentine shape to the blades.

(a) Use a PWA 85595 Spreader to load all blades, in the arc, tangentially.

(b) When it is installed, expand the spreader and get the widest possible gap between the blade platforms. If you need help to move the blades, it is permissible to tap lightly on the base of the airfoil with a PWA 86448 Drift.

(c) Measure and make a record of the gap dimension.

(d) Find the Type A blade (blade number 69) that will be installed in the gap you measured. Use a vernier caliper to measure the platform width of the blade. Record this dimension.

(e) Compare the gap dimension with the blade platform width dimension.

(f) The width of the blade platform must measure 0.020 − 0.055 inch (0.51 − 1.40 mm) smaller than the gap measured at the drum loading slot between the blades.

(g) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

(11) Do the procedure that follows to get the correct blade platform width for the measured gap.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type A blades with oversized Type A blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.020 − 0.055 inch (0.51 − 1.40 mm).

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). If the 0.055 inch (1.397 mm) maximum gap limit is not met, replace the standard Type A blades with the modified Type A blades with wider platforms or the Type A blades with the narrower platform as necessary to get the 0.020 - 0.055 inch (0.51 - 1.40 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

(12) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

(a) If the blade platform width is larger than the gap, determine the difference. If the total amount of material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type A blade not installed. If the total amount of material to be removed exceeds of 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type A blade not installed. Maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

(b) If the total amount of material to be removed exceeds 0.010 inch (0.254 mm), remove an additional Type A blade to obtain the proper fit and remove material in approximately equal amounts from both sides of the Type A blade platforms. Repeat this procedure for additional Type A blades, as necessary, to obtain the correct gap.

(c) If it is necessary to remove material, machine the HPC 13th stage blade platforms per 72-35-39 Assembly-03 (Task 72-35-39-440-003).

(d) Type A blades with trimmed platforms must be identified with a square symbol in their respective service time marking areas. See 70-11, Standard Practices Manual, PN 585005.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(13) After the gap limits have been met, remove the Type A blades from right side of the loading slot and place them in order of removal on the work bench. Remove the Type A blades from left side of the slot and also place them in order of removal on the work bench.

NOTE: Four blades and two blade locks will stay in the disk. These are the four blades, (two Types B and C) and two blade locks that were installed at the start of this procedure.

(14) Apply Antiseize Compound P06-009 to seals (side opposite flat side) and to drum groove.

(15) Install the right side blades and seals. See Figure 1012.

NOTE: The blades and lock will be installed in the order that they were removed.

(a) Put one ladder seal over the loading slot with the flat surface out.

(b) Align the first opening in the seal with the loading slot in the disk.

(c) Install the blade that was first removed (blade number 68), leading edge up, through the seal and into the loading slot.

(d) Move the blade and seal to the right until the second ladder seal opening is aligned with the loading slot.

NOTE: Make sure that the ladder seal is correctly installed between the disk rails.

(e) Continue with the blade installation instructions above until all the right side blades are installed, moved fully to the right and touch the Type C blade that was installed before. Do not tighten the lock you just installed.

(f) Install a Type B blade, a lock and the next Type C blade. Move them fully to the right until they touch the blades that were installed before.

NOTE: Do not tighten the lock and setscrew assembly.

(16) When the blades, locks and seals are fully installed on the right side, install the left side blades, seals and locks by the instructions above except move the blades, seals and locks to the left.

NOTE: The last Type C blade and lock will not be installed at this time.

(17) Install the remaining blade and lock.

(a) The last Type C blade and lock can only be installed in the disk by moving all the blades to the right. To do this, you must rotate the drum 180 degrees and loosen the blade lock screws. Move all blades, seals and locks to the right.

(b) Install the last lock and setscrew assembly in the loading slot and move it to the left.

(c) Install the last Type C blade in the drum.

(18) Move the blades, seals and locks to the final positions.

(a) Move all blades, seals and locks to the left. Align the blade lock with the "V" mark made on the drum at the start of this procedure.

(b) Tighten and torque the two lock and setscrew assemblies that are located at the loading slot near the "V" mark.

1 Torque the lock setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(c) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

(d) Check the gaps, all gaps over Arc BG must be approximately equal.

(19) Tighten and torque the remaining lock and setscrew assemblies.

(a) Torque the lock setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(b) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

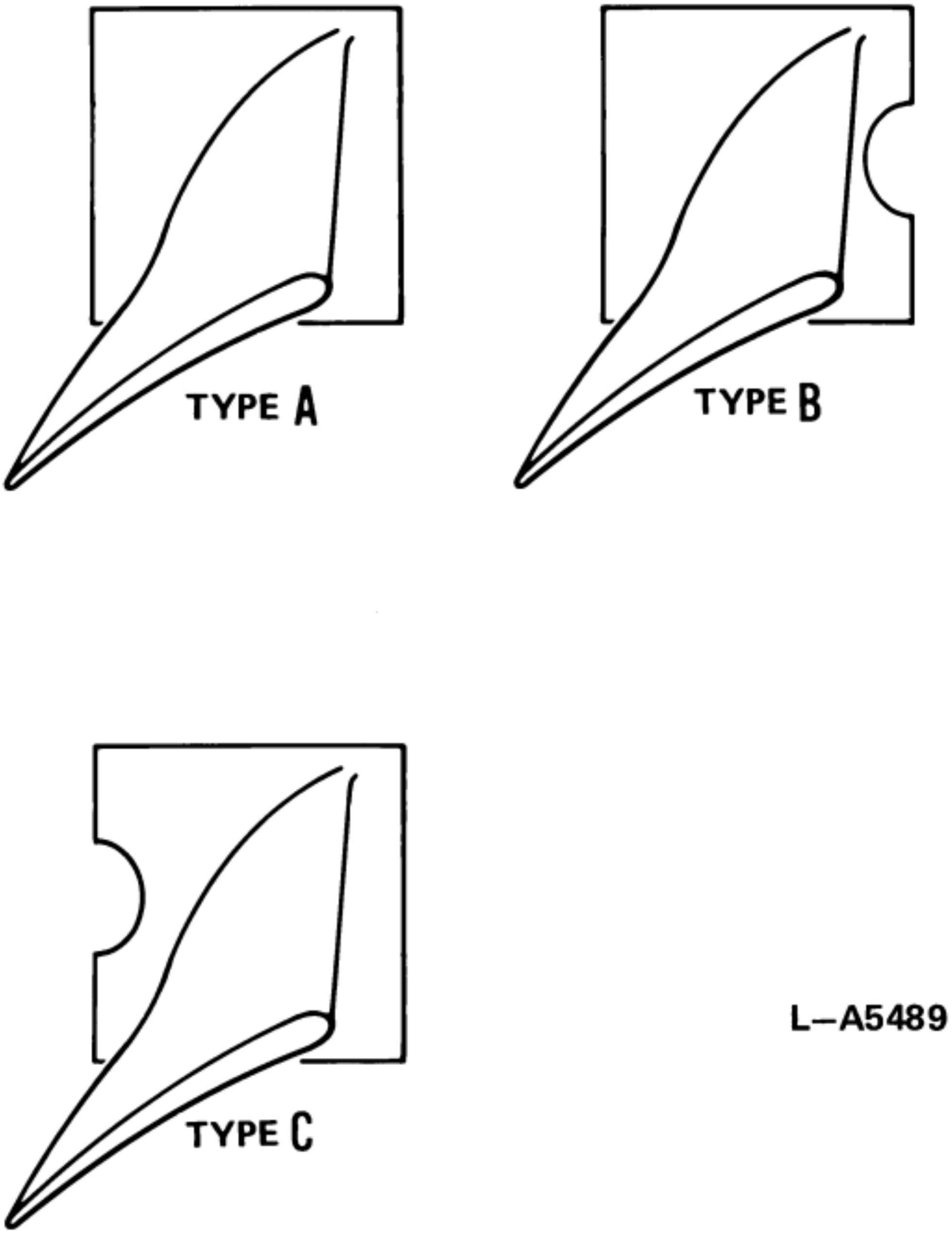
2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

a If these limits are not kept, check the lock for correct assembly in the disk.

D. Postrequisites

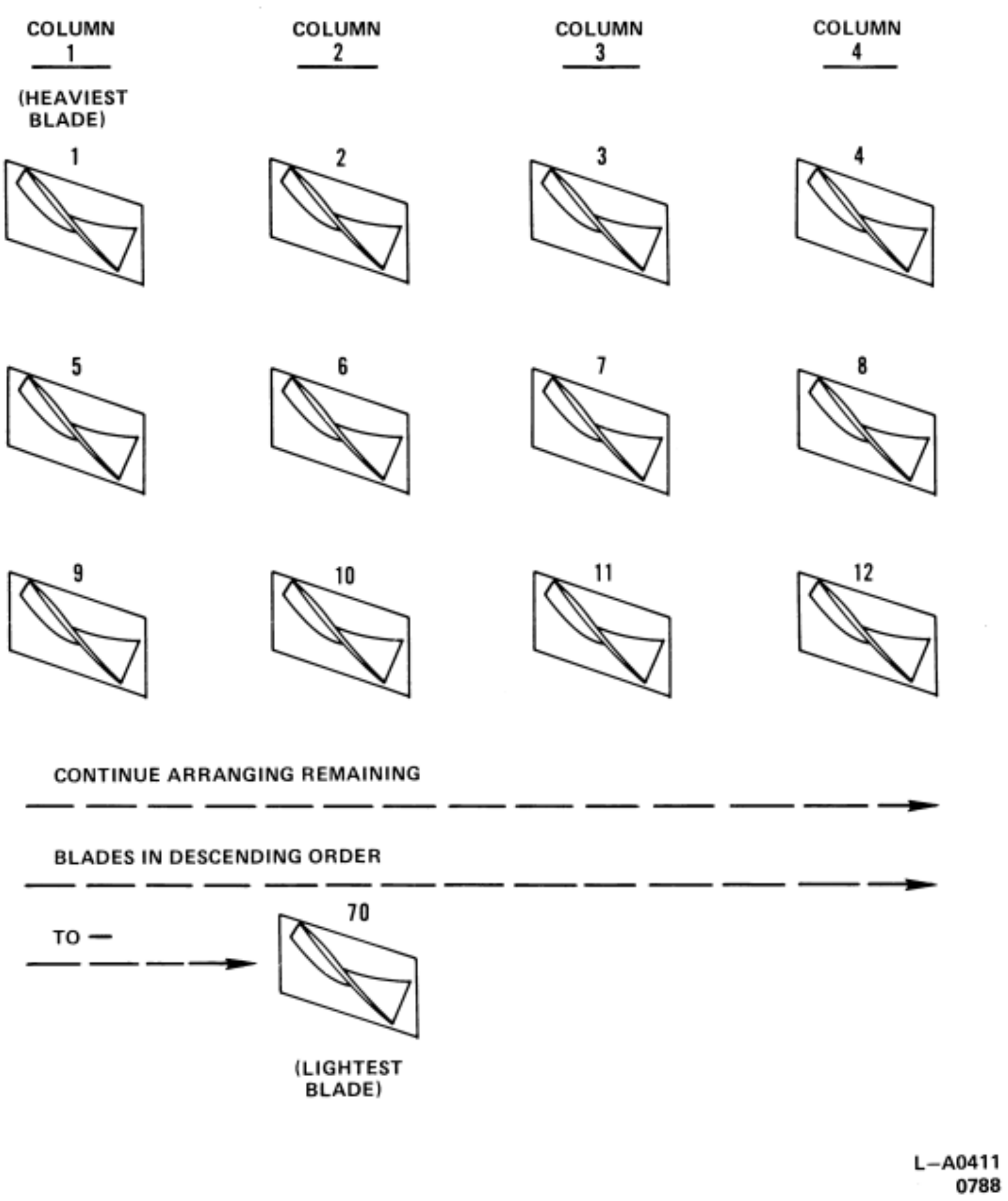
AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−23

(1) Assemble 12th stage blades to (debladed) axial compressor rotor assembly. See Assembly−24, CONFIG−2 (Task 72−35−01−440−022).

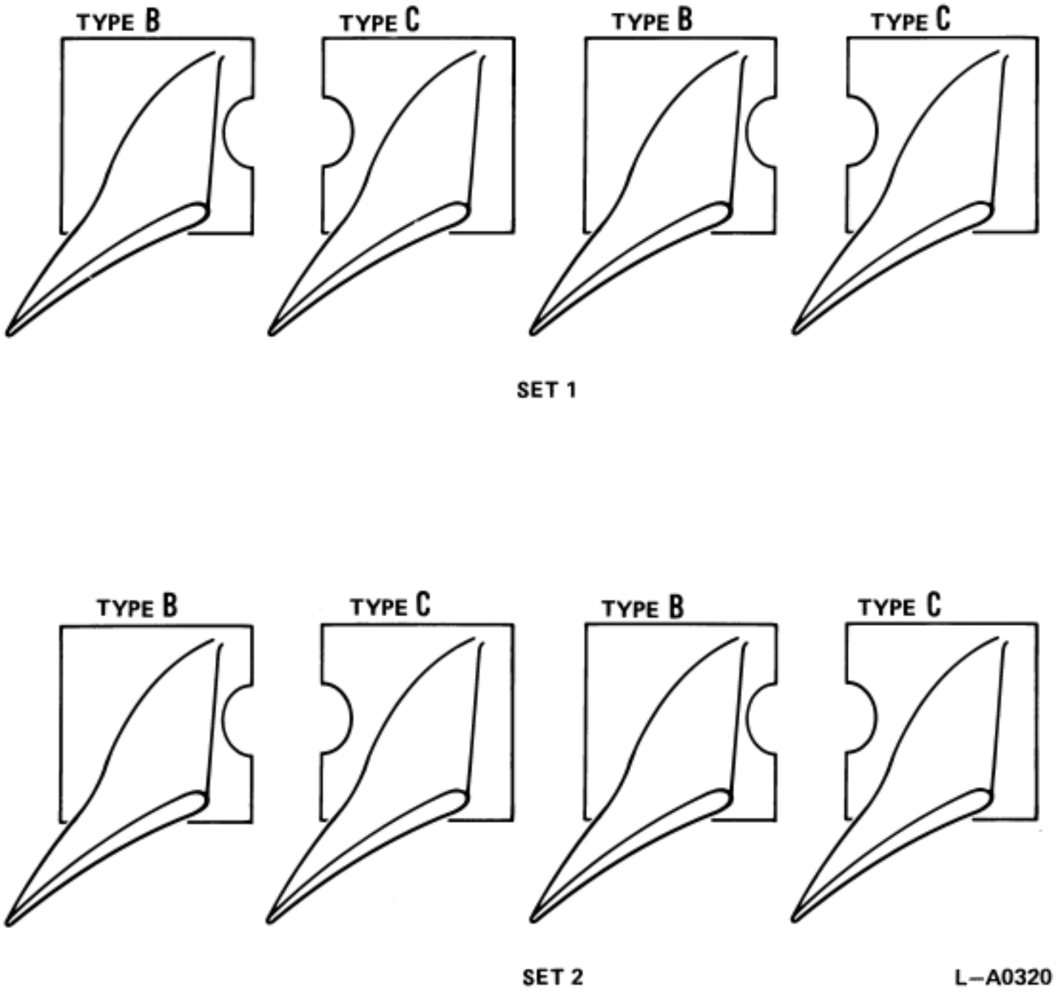


Blade Identification
Figure 1007
(Task 72−35−01−440−021−B)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-23

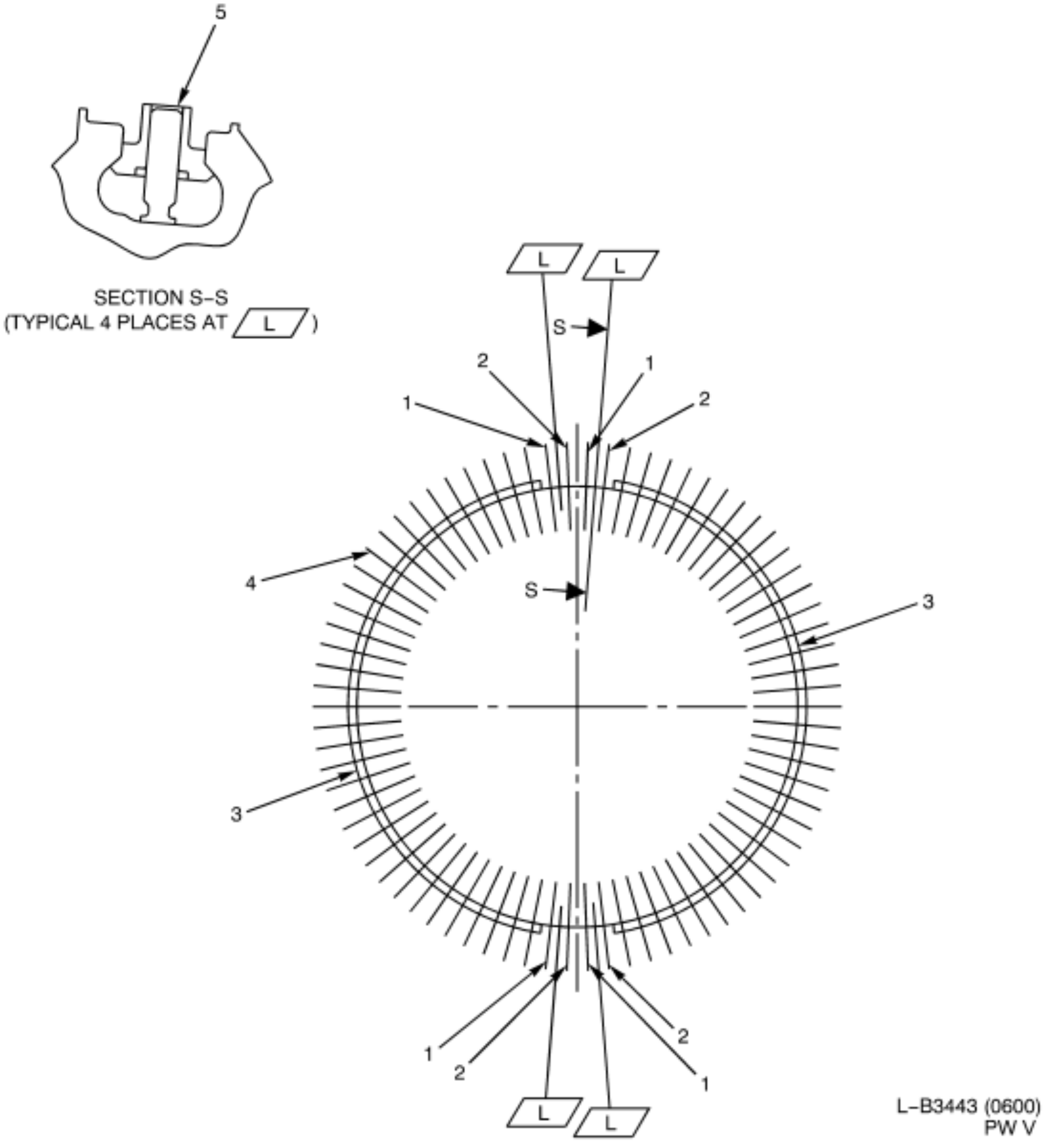

COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
COLUMN 3
COLUMN 4
1
2
3
4
5
6
7
8
9
10
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO —
70
(LIGHTEST BLADE)
L-A0411
0788

Type A Blade Weight Arrangement
Figure 1008
(Task 72-35-01-440-021-B)


TYPE B
TYPE C
TYPE B
TYPE C
SET 1
TYPE B
TYPE C
TYPE B
TYPE C
SET 2
L-A0320

Types B And C Blade Set Arrangement
Figure 1009
(Task 72-35-01-440-021-B)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-23


5
SECTION S-S
(TYPICAL 4 PLACES AT L)
L
L
S
2
1
1
2
4
S
3
3
1
2
2
1
L
L
L-B3443 (0600)
PW V

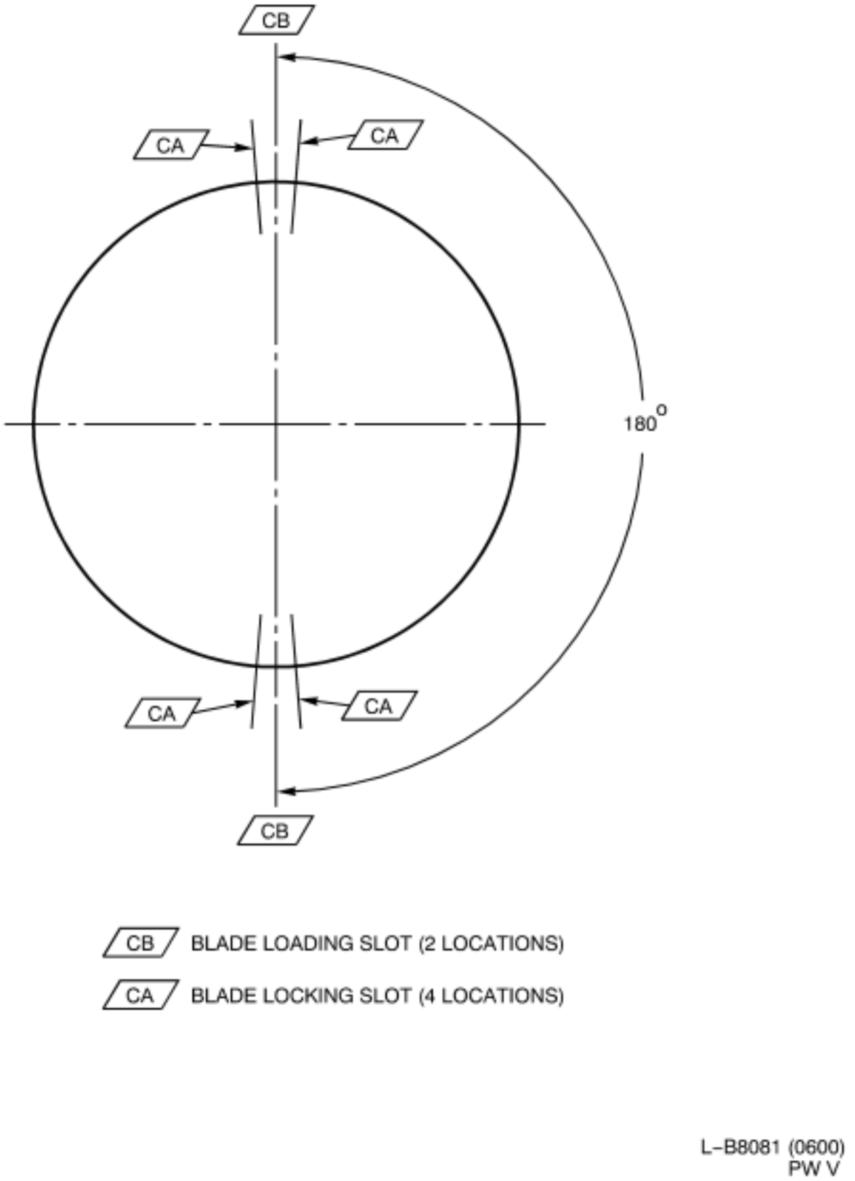
R Thirteenth Stage Blade And Lock Installation (Rear
R Drum PN 56H013-01, 56H013-001, And 58H236-01)
Figure 1010 (Sheet 1)
(Task 72-35-01-440-021-B)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-23

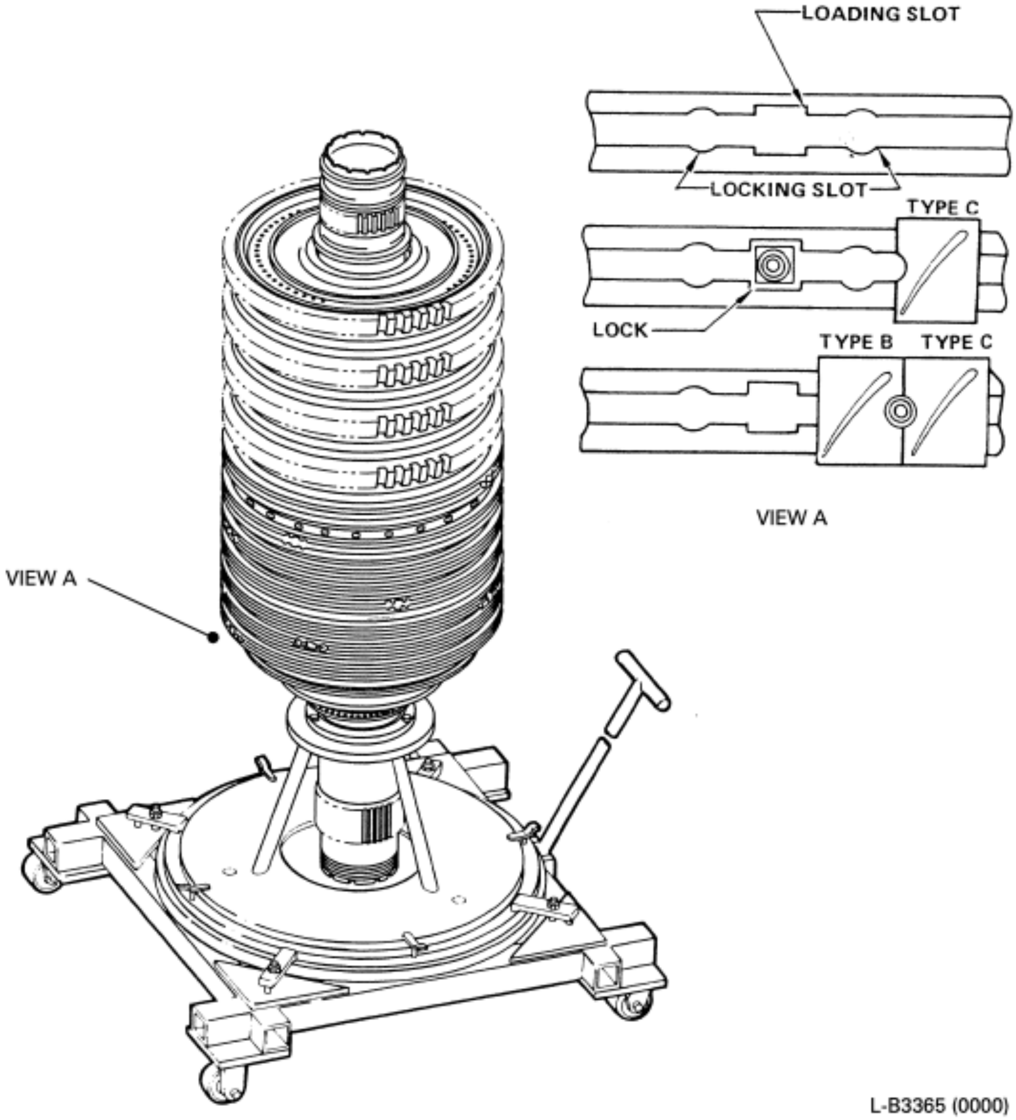
1. Type B Blades
2. Type C Blades
3. Ladder Seals, PN 50H935, Two Necessary.
4. Type A Blades
5. Lock And Setscrew Assemblies

Key to Figure 1010 (Sheet 1)

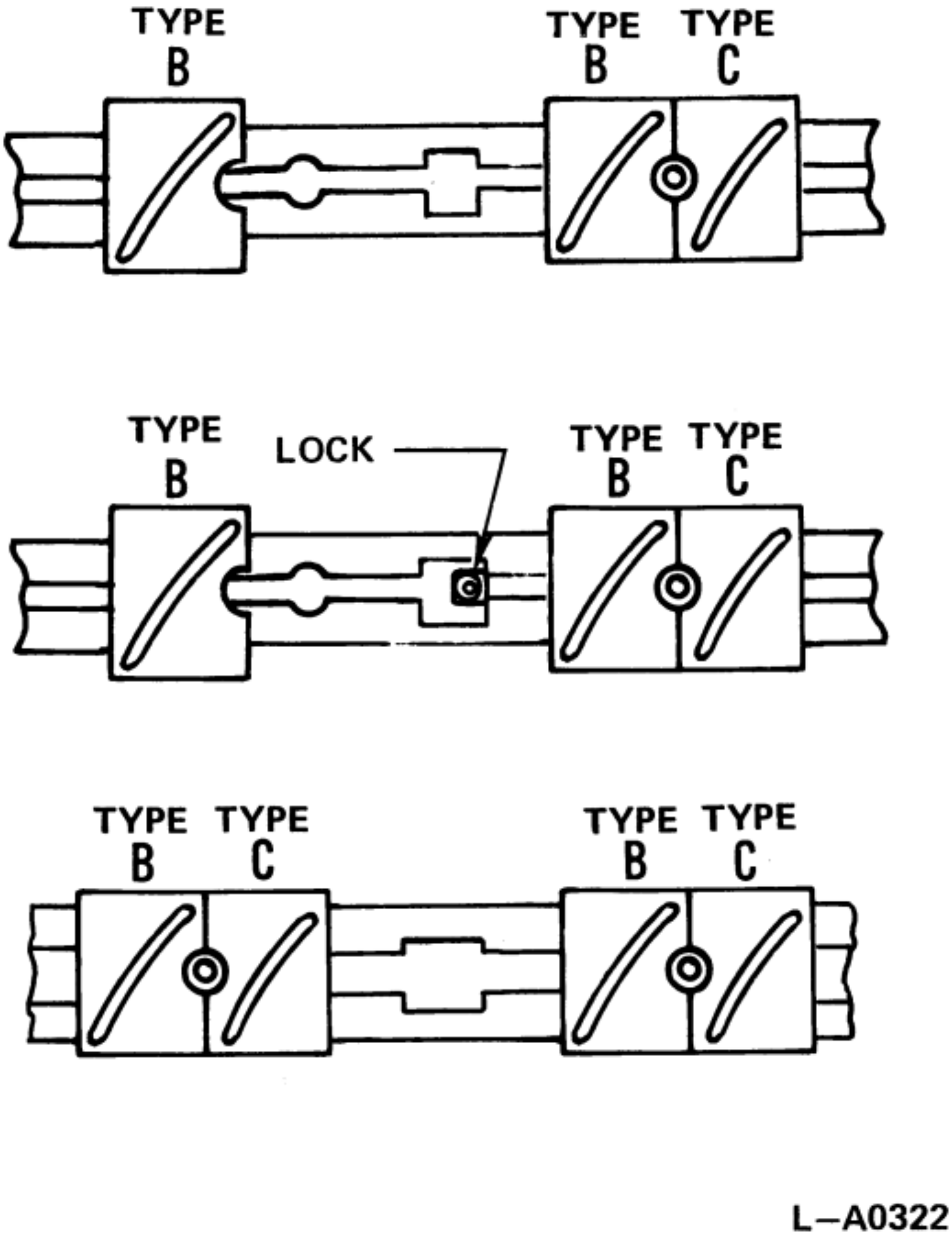
AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-23


CB
CA
CA
180°
CA
CA
CB
CB BLADE LOADING SLOT (2 LOCATIONS)
CA BLADE LOCKING SLOT (4 LOCATIONS)
L-B8081 (0600)
PW V

R Thirteenth Stage Blade And Lock Installation (Rear
R Drum PN 56H013-01, 56H013-001, And 58H236-01)
Figure 1010 (Sheet 2)
(Task 72-35-01-440-021-B)

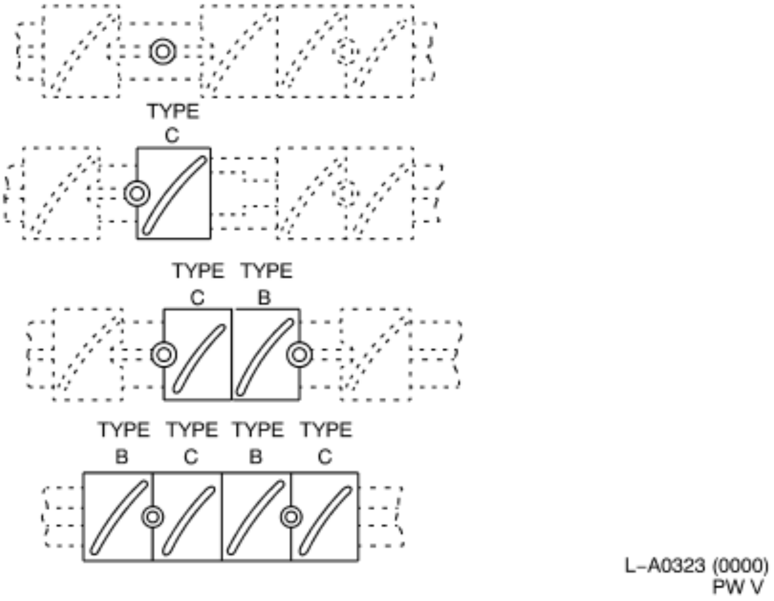

LOADING SLOT
LOCKING SLOT
TYPE C
LOCK
TYPE B
TYPE C
VIEW A
VIEW A
L-B3365 (0000)

Blade And Lock Installation
Figure 1011 (Sheet 1)
(Task 72-35-01-440-021-B)

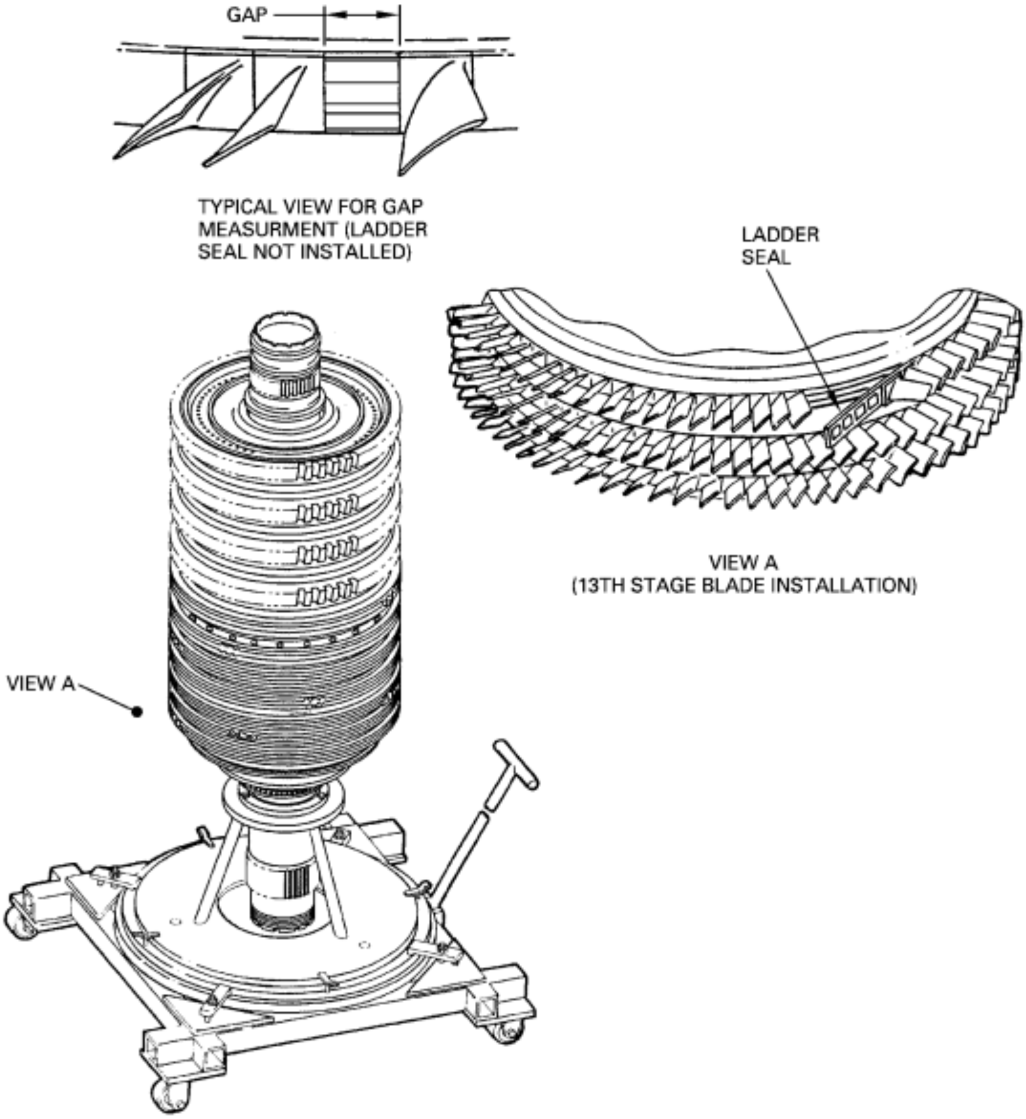

TYPE B
TYPE B
TYPE C
TYPE B
LOCK
TYPE B
TYPE C
TYPE B
TYPE C
TYPE B
TYPE C
L-A0322

Blade And Lock Installation
Figure 1011 (Sheet 2)
(Task 72-35-01-440-021-B)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−23


TYPE C
TYPE C
TYPE B
TYPE B
TYPE C
TYPE B
TYPE C
L−A0323 (0000)
PW V

Blade And Lock Installation
Figure 1011 (Sheet 3)
(Task 72−35−01−440−021−B)


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A (13TH STAGE BLADE INSTALLATION)
VIEW A

L−B3442 (0000)
PW C

Gap Measurement And Ladder Seal Installation
Figure 1012
(Task 72−35−01−440−021−B)

Task 72-35-01-440-012:

1. Assemble 12Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble 13th stage blades to (debladed) axial compressor rotor assembly. See Assembly-23, CONFIG-1 (Task 72-35-01-440-011).

B. Equipment And Materials Necessary

Special Tools:

PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader
PWA 86447	Drift
PWA 86571	Gage Set
PWA 86652	Drift (Optional To PWA 86447)

Consumable Materials:

Item No.	Designation
P06-036	Compound, Antigallant (PWA 36035)
P06-041	Lubricant, Dry Film (PWA 36221)

C. Procedure
See Figure 1001, Figure 1002, Figure 1003, Figure 1004, Figure 1005, Figure 1006 and Figure 1007.

CAUTION: DO NOT OVERTIGHTEN GAGE SET SCREWS DURING INSTALLATION OF GAGES. DAMAGE TO THE DRUM CAN RESULT.

(1) Measure Z-Plane diameters for Stage 12. This procedure is optional and can only be used where blades have been removed. Select the pair of gages, marked for that stage, from the PWA 86571 Z-Plane Diameter Gage Set. Install gages, 180 degrees apart, in blade slots. Turn gage set screws clockwise to move the gages radially out to their most outward position. Use OD micrometers to measure four diameters, every 45 degrees, over the gage tool balls. Calculate Z-Plane diameter of the stage by subtracting twice the reference dimension, marked on each pair of gages, from the average diameter measured over the gage tools balls. Refer to minimum,

maximum and nominal Z−Plane diameters listed, for reference only, in Table 1001.

Stage	Minimum Diameter (Reference)	Maximum Diameter (Reference)	Nominal Diameter (Reference)
12	23.208 inch (589.483 mm)	23.216 inch (589.686 mm)	23.212 inch (589.585 mm)

HPC Front Drum Z−Plane Diameters
Table 1001

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86447 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(2) Remove 12th stage blades from storage rack and place them on bench. Segregate eight Types B and C blades having notches in their platforms and move to one side. See Figure 1001.

NOTE: There are three part numbers (sets) of blades provided for this stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type A is also used to get the correct platform gap and may require platform grinding. A modified Type A blade is also available with a 0.015 inch (0.381 mm) oversized platform width to help you get the correct platform gap. For ease of assembly, blades in this procedure will be referred to as Types A, B and C.

NOTE: (Post SB PW4ENG 72−703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

R (3) Optional, weigh the 12th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70−11−00.

R NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

R (4) Optional, arrange Type A blade in four columns, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. Lightest blade will be at bottom of Column 4. See Figure 1002.

NOTE: One or more Type A blade may have been used as a fitting blade. Blade will be identified by a square in the service time marking area.

R (5) Select two sets of four blades (two Types B and C per set) such that weights of sets are as nearly equal as possible. See Figure 1003.

NOTE: Weights must be nearly equal as sets will be positioned opposite each other after assembly.

R (6) Selecting one of the blade sets, and with loading slot of disk facing operator, install one Type C blade leading edge up, into slot. Move blade to right. Install one lock and setscrew and move to right. Install one Type B blade into slot. Move to right. See Figure 1004 (Sheet 1).

R (7) From the same set, install remaining Type B blade into slot and move to left. Install one lock and setscrew and move to left. Install remaining Type C blade and move to left. See Figure 1004Figure 1004 (Sheet 2).

R (8) Locate locking slot to left of blade loading slot. Move left lock to left locking slot and tighten and torque setscrew to running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

R (9) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure height clearance between blade lock and top of blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

R (10) Using approved marking pen, mark OD platform of drum in line with lock with "V" for future reference.

R (11) Move Type C blade (right side of lock) to the left to rest against lock. See Figure 1004 (Sheet 3).

R (12) Move Type B blade and right lock to left and lock setscrew to running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

R (13) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure height clearance between blade lock and top of blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

R (14) Push two remaining Types B and C blades to butt against just−installed locks. See Figure 1004 (Sheet 3).

R (15) Rotate drum 180 degrees. Position open blade slot toward operator.

R (16) Starting at bottom of 4th column of weight−ordered Type A blade, and proceeding vertically from bottom of column to top, position each blade into loading slot and move to right to rest against previously installed blades and lock. When 4th column of blades is used, start at bottom of 2nd column and position each blade into loading slot and to right until all blades from Column 2 are inserted.

R (17) Starting at top of 3rd column of blades, position each blade into loading slot and move to left to rest against blades at opposite end. When 3rd column of blades is used, start at top of 1st column and position each blade into loading slot and to left until all blades from Column 1 are inserted.

R (18) Install two blades from remaining Types B and C sets into loading slot and move to left. Install remaining two blades from Types B and C sets to slot and move to right. Remaining blades should be eight Type A blades. Install seven of the Type A blades in slot and load all blades tangentially so as to form widest possible gap at disk loading slot. Measure gap using PWA 85595 Spreader. See Figure 1005.

(a) Place spreader into vacant blade space. Expand spreader with torque handle and measure blade gap with a vernier caliper. Record this dimension.

(b) Measure platform width of the remaining Type A blade, not installed in drum, with vernier caliper. Record this dimension.

(c) Compare the gap dimension with the blade platform width dimension.

(d) The width of the blade platform must measure 0.020 − 0.055 inch (0.51 − 1.40 mm) smaller than the gap measured at the drum loading slot between the blades.

(e) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

R (19) Do the procedure that follows to get the correct blade platform width for the measured gap.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type A blades with oversized Type A blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.020 - 0.055 inch (0.51 - 1.40 mm).

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). If the 0.055 inch (1.397 mm) maximum gap limit is not met, replace the standard Type A blades with the modified Type A blades with wider platforms or the Type A blades with the narrower platform as necessary to get the 0.020 - 0.055 inch (0.51 - 1.40 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

R (20) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

(a) If the blade platform width is larger than the gap, determine the difference. If the total amount of material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type A blade not installed. If the total amount of material that must be removed is more than 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type A blade not installed. Maximum material that can be removed per platform side must not be more than 0.005 inch (0.127 mm).

(b) If the total amount of material to be removed exceeds 0.010 inch (0.254 mm), remove an additional Type A blade to obtain the proper fit and remove material in approximately equal amounts from both sides of the Type A blade platforms. Repeat this procedure for additional Type A blades, as necessary, to obtain the correct gap.

(c) If it is necessary to remove material, machine the HPC 12th stage blade platforms per 72−35−38, Assembly−02 (Task 72−35−38−440−002).

(d) Type A blades with trimmed platforms must be identified with a square symbol in their respective service time marking areas. See 70−11, Standard Practices Manual, PN 585005.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE THAT FOLLOWS, USE THE PWA 86447 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

R (21) After gap limits have been met, remove all blades from right side of slot and place them in order of removal on bench. Remove all blades from left side of slot and place them in order of removal on bench.

NOTE: Four blades are to remain in disk. These are the first set of four blades (two Types B and C) and two blade locks installed at beginning of this procedure.

R (22) Apply Antigallant Compound P06−036 or Dry Film Lubricant P06−041 to seals (side opposite flat side) and to drum groove. See Figure 1007.

R (23) Aligning slots, prepare to install blade seal to drum, flat side out. Seal will be installed from left to right. Selecting blades from bench in same order in which they were previously installed in right side of drum, install blades to seal and drum, and move (slide) blade and seal to right. See Figure 1005.

NOTE: Use nonmetalic drift and mallet to move blades and seals around drum.

R (24) Install remaining right side blades into seal and drum per schematic view Figure 1006.

R (25) When blades and seal have been installed at right side, install left side blades and seal per instructions above except moving blades and seal from right to left. See Figure 1006.

R (26) At this point, four (two Types B and C) blades of the second set should remain on bench. Install Type C blade into drum slot and move to right. Install Type B blade into slot and move left.

R (27) Install blade lock and move to right. Install remaining Type B blade and move to right. The last Type C blade and lock can only be inserted in drum by shifting all blades to right. Therefore, rotate drum 180 degrees and loosen blade lock screws using PWA 83135 Driver and PWA 83136 Extension. Move all blades and seals to right. Install blade lock in drum slot and move left. Install Type C blade in drum.

R (28) Move all blades and seals to left, aligning one blade lock with "V" mark made on drum at beginning of this procedure. Tighten and torque all blade locks to running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multispline setscrews.

R (29) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

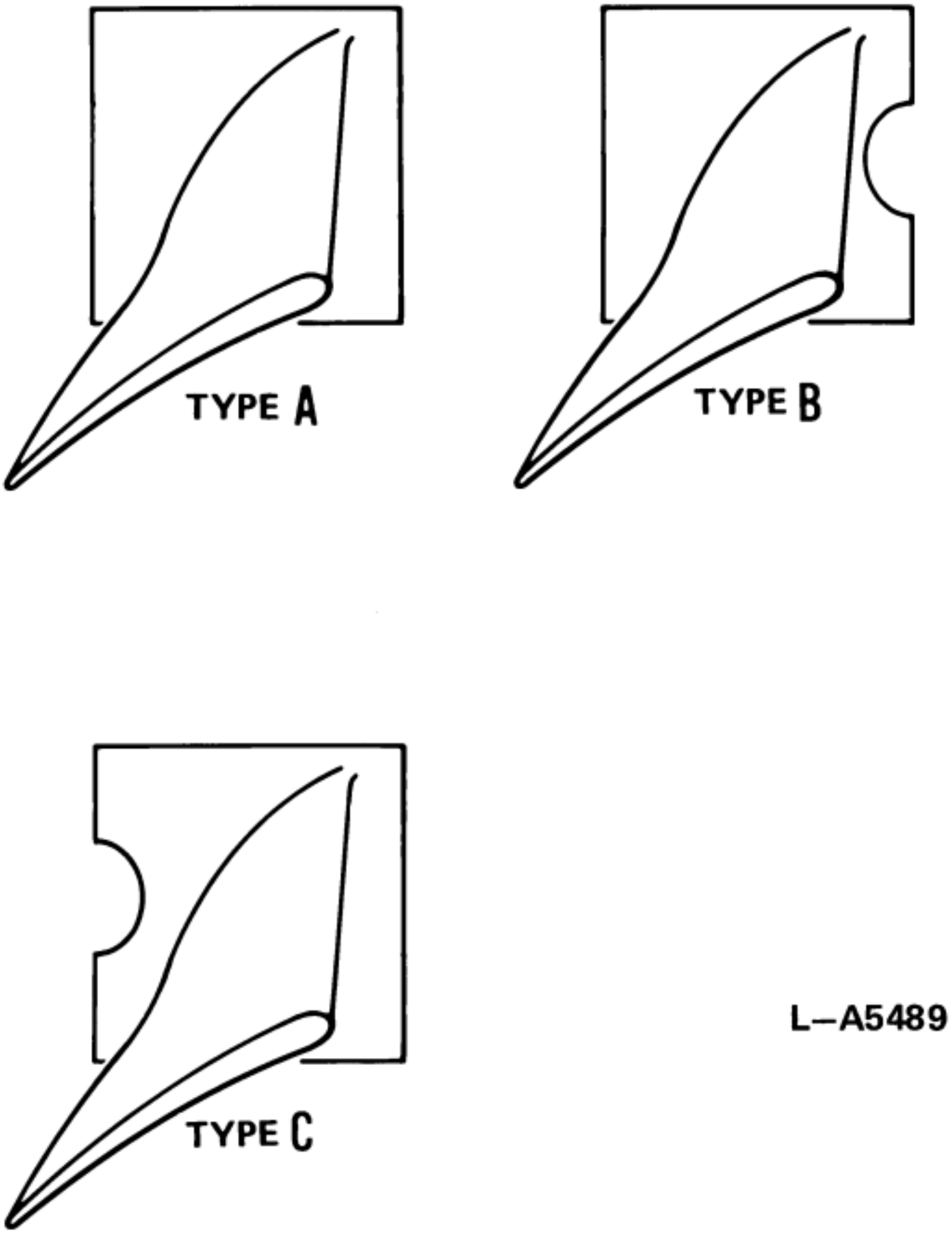
(a) Method 1: Measure height clearance between blade lock and top of blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

R (30) Use a feeler gage to measure the gap, which extends between the loading slots, in each 180 degree arc on the two sides of the drum. Each arc must have a 0.010 - 0.030 inch (0.254 - 0.762 mm) gap, measure both sides at the same time. If the gap is not in limit, you must change blades from one side of the rotor to the other, or additional material can be removed from the blade platforms on the side that is too tight. You must keep the 0.020 - 0.055 inch (0.51 - 1.40 mm) gap limit.

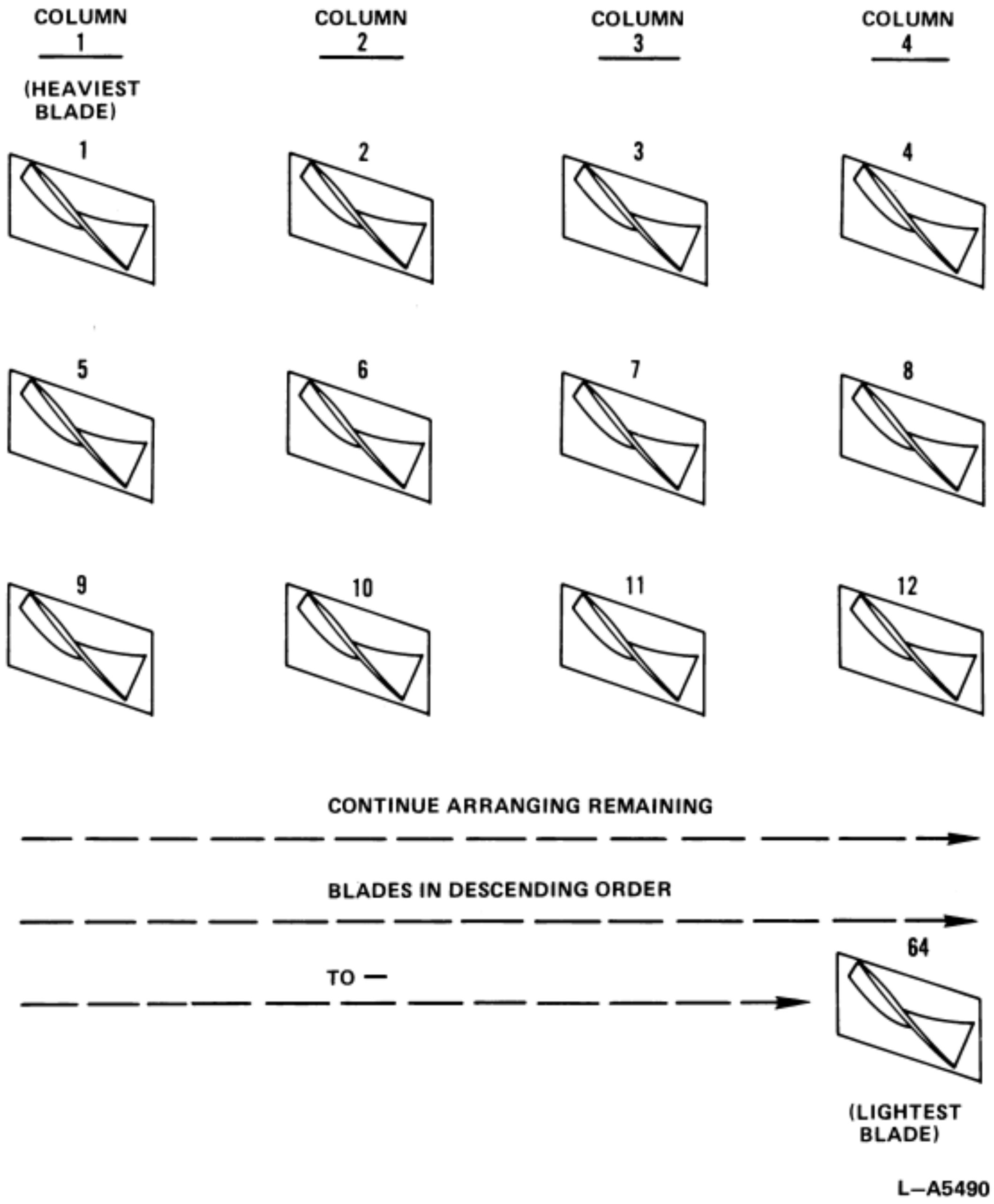
D. Postrequisites

(1) Assemble 11th stage blades to (debladed) axial compressor rotor assembly. See Assembly-25, CONFIG-1 (Task 72-35-01-440-013).

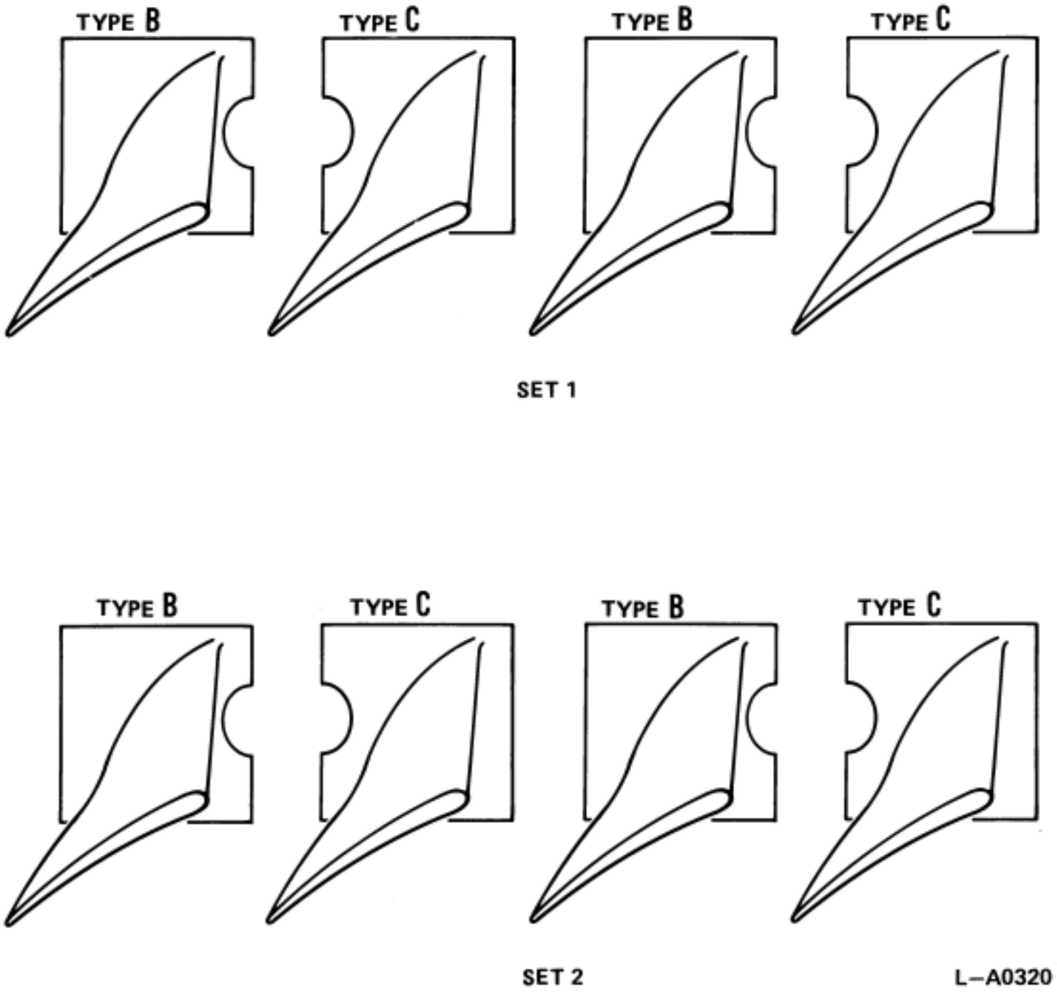


Blade Identification
Figure 1001
(Task 72-35-01-440-012)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−24

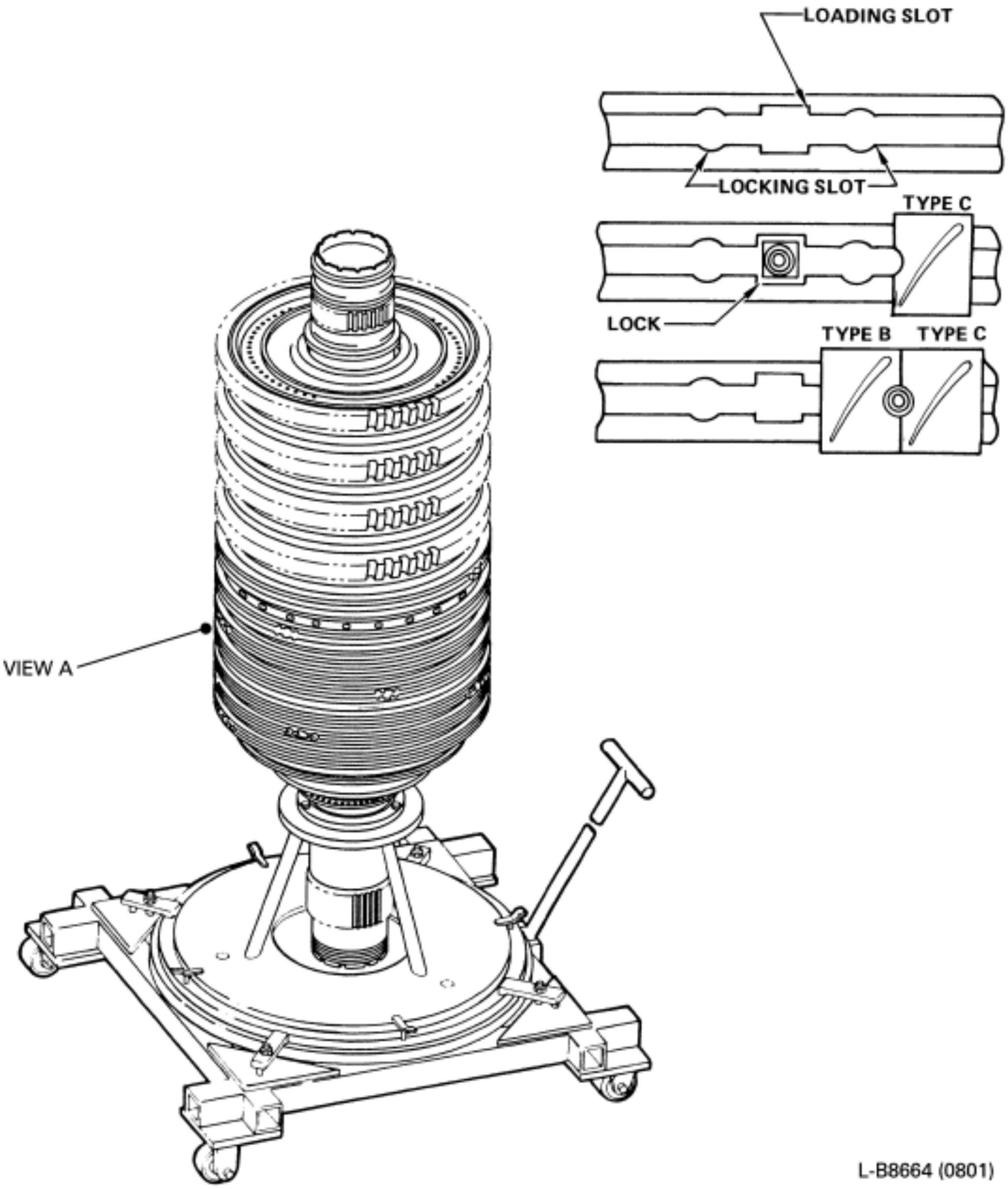

COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
COLUMN 3
COLUMN 4
1
2
3
4
5
6
7
8
9
10
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO —
64
(LIGHTEST BLADE)
L—A5490

Blade Weight Arrangement
Figure 1002
(Task 72−35−01−440−012)

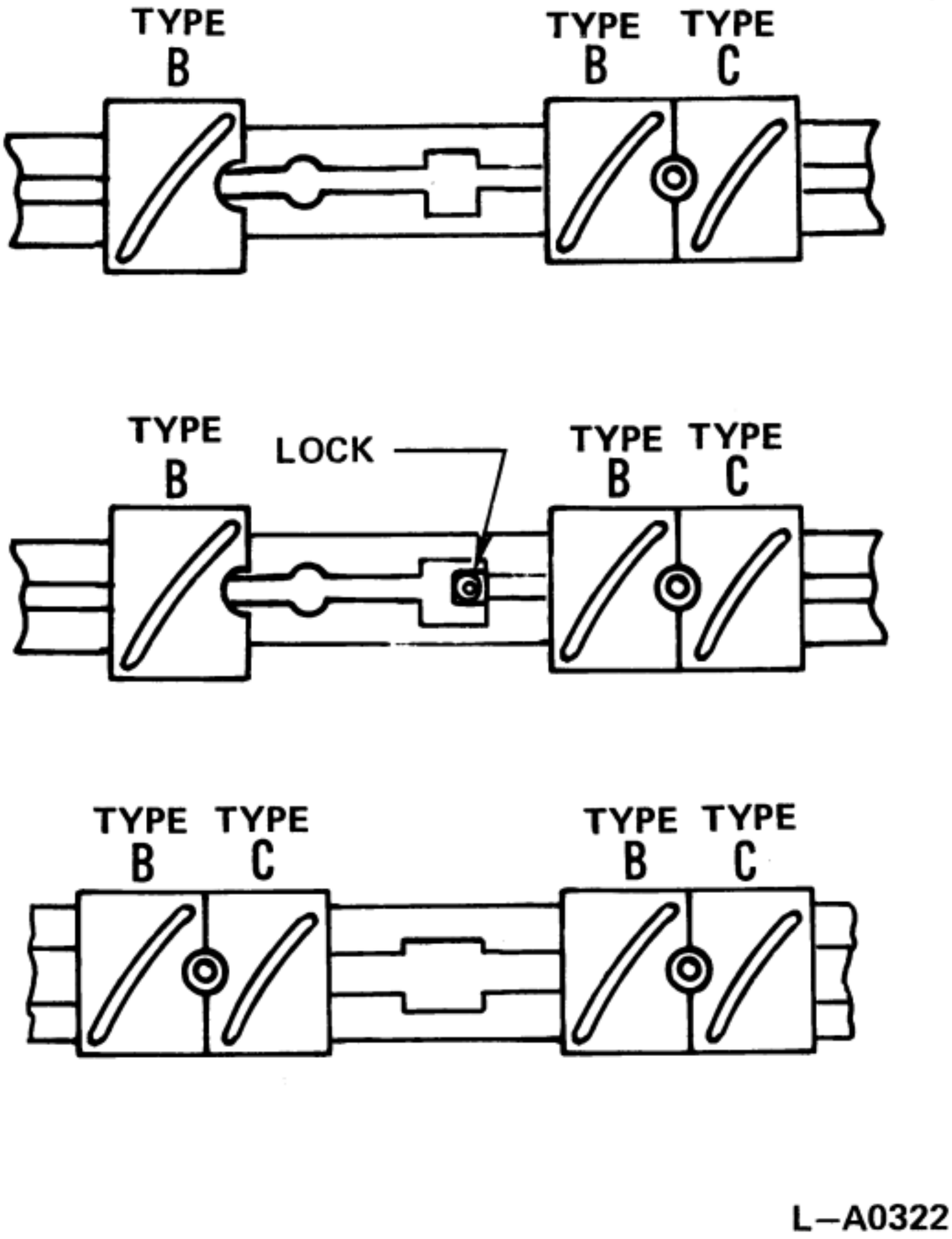

TYPE B
TYPE C
TYPE B
TYPE C
SET 1
TYPE B
TYPE C
TYPE B
TYPE C
SET 2
L−A0320

Blade Sets
Figure 1003
(Task 72−35−01−440−012)

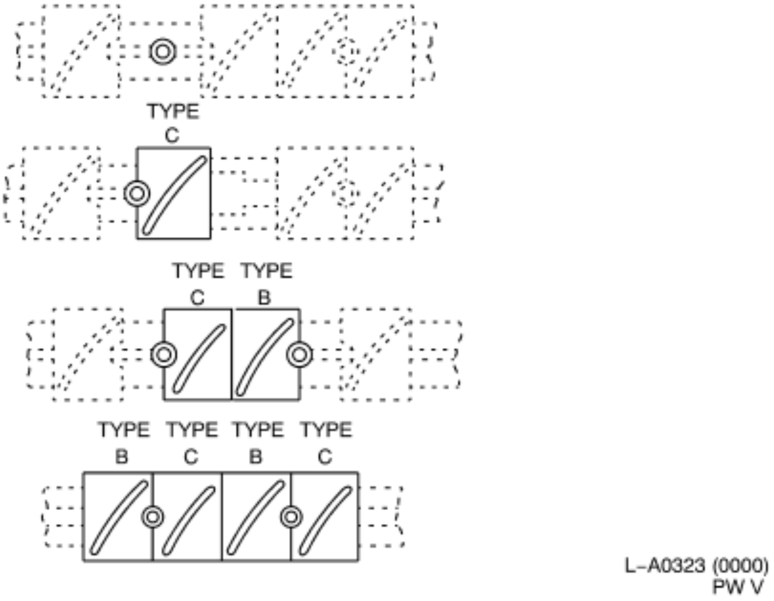
AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−24


LOADING SLOT
LOCKING SLOT
TYPE C
LOCK
TYPE B
TYPE C
VIEW A
L-B8664 (0801)

Blade And Lock Installation
Figure 1004 (Sheet 1)
(Task 72−35−01−440−012)

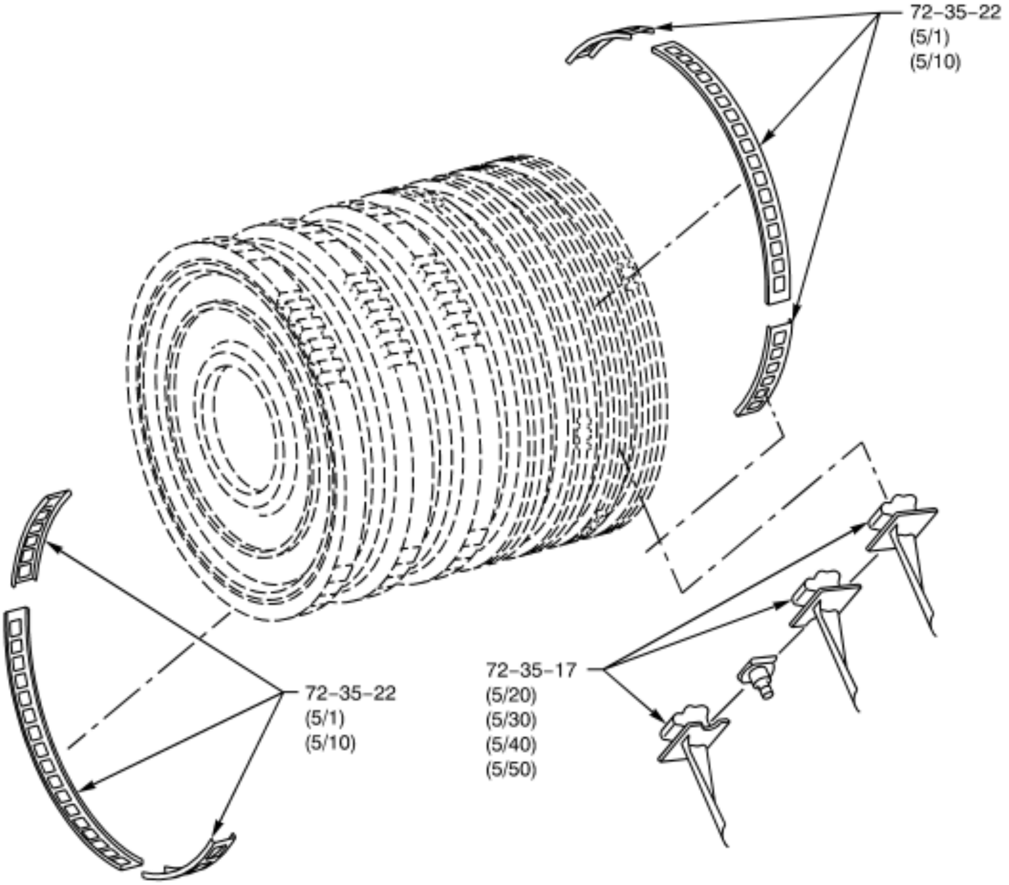

TYPE B
TYPE B
TYPE C
TYPE B
LOCK
TYPE B
TYPE C
TYPE B
TYPE C
TYPE B
TYPE C
L-A0322

Blade And Lock Installation
Figure 1004 (Sheet 2)
(Task 72-35-01-440-012)


TYPE
C
TYPE
C
TYPE
B
TYPE
B
TYPE
C
TYPE
B
TYPE
C
L−A0323 (0000)
PW V

Blade And Lock Installation
Figure 1004 (Sheet 3)
(Task 72−35−01−440−012)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−24

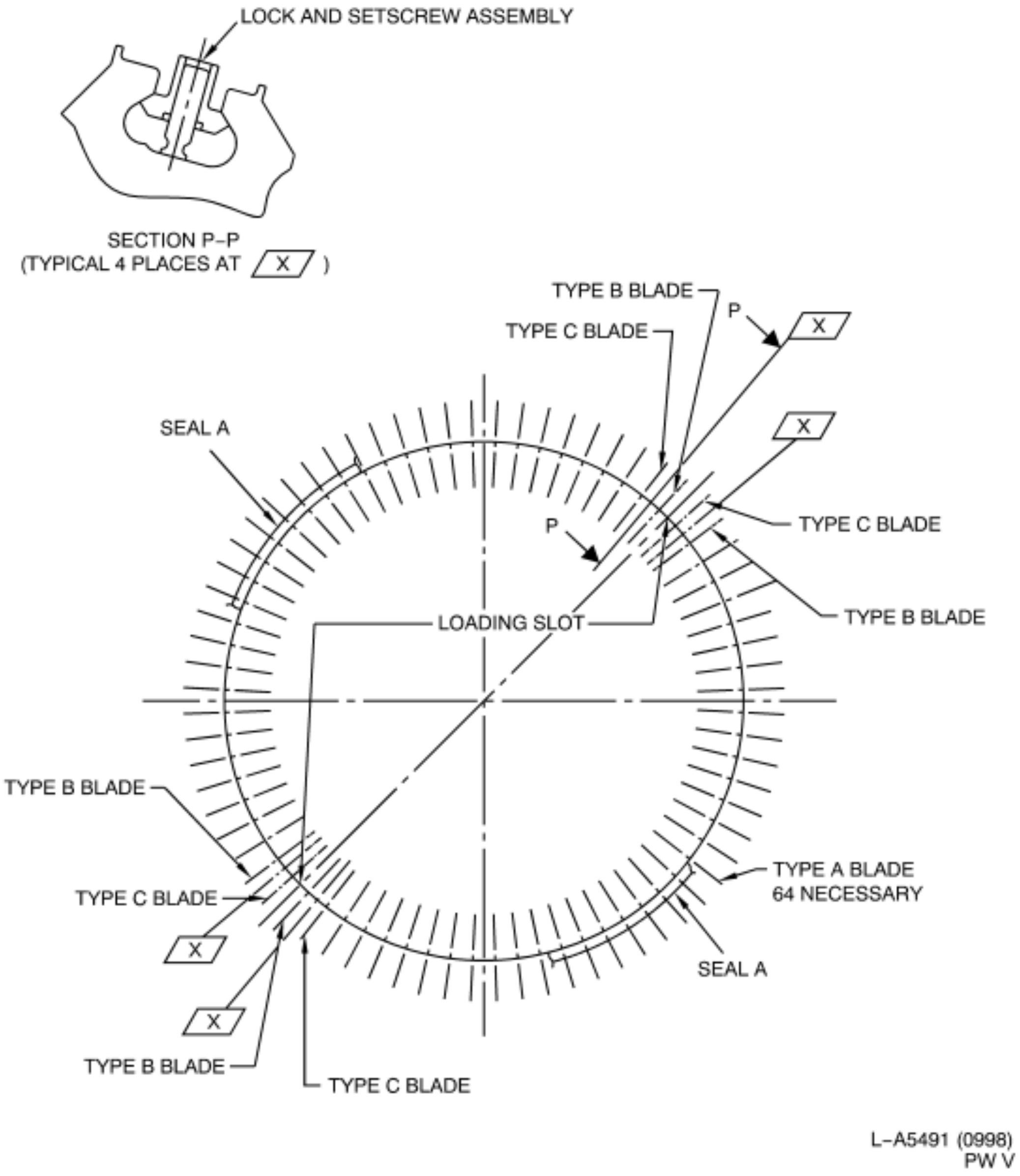

72−35−22
(5/1)
(5/10)
72−35−22
(5/1)
(5/10)
72−35−17
(5/20)
(5/30)
(5/40)
(5/50)

NUMBERS IN ( )
REFER TO IPC
72−35−00
(FIGURE NO./ITEM NO.)

L−B3681 (0000)
PW V

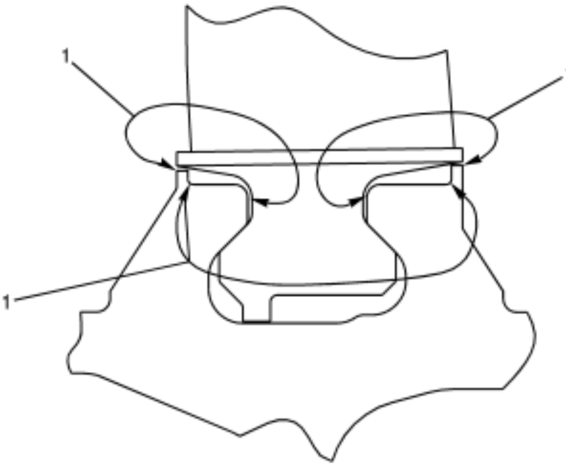
Gap Measurement And Seal Installation
Figure 1005
(Task 72−35−01−440−012)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−24


LOCK AND SETSCREW ASSEMBLY
SECTION P−P
(TYPICAL 4 PLACES AT X)
TYPE B BLADE
P
X
TYPE C BLADE
X
SEAL A
P
TYPE C BLADE
TYPE B BLADE
LOADING SLOT
TYPE B BLADE
TYPE A BLADE
64 NECESSARY
TYPE C BLADE
X
SEAL A
X
TYPE B BLADE
TYPE C BLADE
L−A5491 (0998)
PW V

Blade And Lock Installation Schematic View
Figure 1006
(Task 72−35−01−440−012)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−24



L−B3582 (0000)
PW V

1. Antigallant Treatment Areas

Antigallant Application Areas
Figure 1007
(Task 72−35−01−440−012)

Task 72-35-01-440-022:

1. Assemble 12Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Equipment And Materials Necessary

Special Tools:

PWA 101165	Gage Set

B. Measurement of Z-Plane for HPC Stage 12.

CAUTION: DO NOT OVERTIGHTEN GAGE SET SCREWS DURING INSTALLATION OF GAGES. DAMAGE TO THE DRUM CAN RESULT.

(1) Measure Z-Plane diameter for Stage 12. This procedure is optional and can only be used where blades have been removed. Select the pair of gages from the PWA 101165 Z-Plane Diameter Gage Set. Install gages 180 degrees apart, in blade slots. Turn gage set screws clockwise to move the gages radially out to their most outward position. Use OD micrometers to measure four diameters, every 45 degrees, over the gage tool balls. Calculate Z-Plane diameter of the stage by subtracting twice the reference dimension, marked on each pair of gages, from the average diameter measured over the gage tools balls. Refer to minimum, maximum and nominal Z-Plane diameters listed, for reference only, in Table 1001.

Stage	Minimum Diameter (Reference)	Maximum Diameter (Reference)	Nominal Diameter (Reference)
12	23.208 inch (589.483 mm)	23.216 inch (589.686 mm)	23.212 inch (589.585 mm)

HPC Front Drum Z-Plane Diameters
Table 1001

C. General

(1) Use one of the procedures that follow to install the 12th stage blades.

(a) Use Task 2. (Task 72-35-01-440-022-A) of this procedure to install the 12th stage blades in Pre SB PW4ENG 72-586 HPC assemblies.

(b) Use Task 3. (Task 72-35-01-440-022-B) of this procedure to install the 12th stage blades in Post SB PW4ENG 72-586 HPC assemblies.

Task 72-35-01-440-022-A:

2. Assemble 12Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly (Pre SB PW4ENG 72-586 Only)

A. Prerequisites

(1) Assemble 13th stage blades to (debladed) axial compressor rotor assembly. See Assembly-23, CONFIG-2 (Task 72-35-01-440-021).

B. Equipment And Materials Necessary

Special Tools:

PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader
PWA 86448	Drift

Consumable Materials:

Item No.	Designation
P06-036	Compound, Antigallant (PWA 36035)
P06-041	Lubricant, Dry Film (PWA 36221)

C. Procedure
See Figure 1001, Figure 1002, Figure 1003, Figure 1004, Figure 1005, Figure 1006 and Figure 1007.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(1) Remove the 12th stage blades from their storage rack and place them on a work bench. Segregate four (4) each of Types B and C blades having notches in their platforms and move the blades to one side. See Figure 1001.

NOTE: There are three part numbers (sets) of blades provided for this stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type A is also used to get the correct platform gap and may require platform grinding. A modified Type A blade is also available with a 0.015 inch (0.381 mm) oversized platform width to help you get the correct platform gap. For ease of assembly, blades in this procedure will be referred to as Types A, B and C.

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

R (2) Optional, weigh the 12th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70-11-00.

R NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

R (3) Optional, arrange Type A blades in two (2) columns. Start with the heaviest blade at the top left (Column 1), and proceed from left to right in descending order of weight. Lightest blade will be at the bottom of Column 2. See Figure 1002.

NOTE: One or more Type A blade(s) may have been used as a fitting blade. These blades are identified by a square that is marked in the service time marking area.

R (4) Divide the Types B and C blades into two sets of four blades (two (2) Types B and C per set) such that the weights of the sets are as nearly equal as possible. See Figure 1003.

NOTE: The weights must be nearly equal as the sets will be positioned opposite each other after assembly.

R (5) Install one Types B and C blade set and two lock and setscrew assemblies. See Figure 1002, Figure 1003, Figure 1004 (Sheets 1 and 2) and Figure 1005.

(a) Find one of the two 12th stage blade loading slots.

(b) Select one of the Types B and C blade sets. Install one Type C blade, leading edge up, into the loading slot. Move the blade to the right.

(c) Install one lock and setscrew assembly and move it to the right.

(d) Install one Type B blade into the slot. Move the blade to the right.

(e) Install the remaining Type B blade in the loading slot and move it to the left.

(f) Install one lock and setscrew assembly and move it to the left.

(g) Install the remaining Type C blade and move it to the left.

(h) Locate the locking slot to the left of the blade loading slot. Move the left lock and setscrew assembly into the left locking slot and tighten. Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

1 Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

_a_ Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

_b_ Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

(i) Use an approved marking pen to mark the OD platform of the drum, in line with the lock, with a "V" for future reference.

(j) Move the Type C blade to the left until it touches the lock.

(k) Move the Type B blade to the left until it touches the Type C blade.

(l) Move the right lock to the left so that it is positioned in the loading slot and tighten. Torque the lock and setscrew assembly to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multispline setscrews.

_1_ Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

_a_ Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

_b_ Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

(m) Push the two remaining Types B and C blades so they touch the just−installed locks.

R (6) Rotate the drum 180 degrees. Position the open blade loading slot toward the operator.

R (7) Install the right side Type A blades.

(a) Find the Type A blades to be installed. Start at the bottom of Column 2 (blade number 64) and continue up to the top of the column (blade number 2).

(b) Put each blade, start with blade number 64, in the loading slot and move it to the right until it touches the blade that was installed before.

R (8) Install the left side Type A blades. See Figure 1002 through Figure 1005.

(a) Find the Type A blades to be installed. Start at the top of Column 1 (blade number 1) and continue down to the bottom of the column (blade number 63).

(b) Put each blade, start with the heaviest blade, blade number 1, in the loading slot and move it to the left until it touches the blade that was installed before. Do not install the last blade (blade number 63) at this time.

R (9) Install the remaining Types B and C blade set and two lock and setscrew assemblies.

(a) Install a Type C blade into the loading slot. Move the blade to the right until it touches the blade that was installed before.

(b) Install a lock and setscrew assembly and move it to the right until it touches the blade that was installed before. Do not tighten the lock at this time.

(c) Install a Type B blade into the slot. Move the blade to the right until it touches the lock and setscrew assembly that was installed before.

(d) Install the remaining Type B blade in the loading slot and move it to the left until it touches the blade that was installed before.

(e) Install the last lock and setscrew assembly and move it to the left until it touches the blade that was installed before. Do not tighten the lock at this time.

(f) Install the remaining Type C blade and move it to the left until it touches the blade that was installed before.

R (10) Move the blades tangentially to make the widest possible gap between the last installed Type B blade and the last Type A blade. This gap will be measured and used to compute the specified gap for between the blades. See Figure 1006.

NOTE: Put the blades in a radially outward direction to prevent a circumferential serpentine shape to the blades.

(a) Use a PWA 85595 Spreader to load all the blades tangentially so as to form the widest possible gap in each arc.

(b) Place the spreader into the vacant Type A blade space. Expand the spreader with the torque handle and measure the blade gap between the blade platforms with a vernier caliper. If you need help to move the blades, it is permissible to tap lightly on the base of the airfoil with a PWA 86448 Drift.

(c) Measure and record this gap dimension.

(d) Find the Type A blade (blade number 63) that will be installed in the arc you measured. Use a vernier caliper to measure the platform width of the blade. Record this dimension.

(e) Compare the gap dimension with the blade platform width dimension.

(f) The width of the blade platform must measure 0.020 − 0.055 inch (0.51 − 1.40 mm) smaller than the gap measured at the drum loading slot between the blades.

(g) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

R (11) Do the procedure that follows to get the correct blade platform width for the measured gap.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type A blades with oversized Type A blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.020 − 0.055 inch (0.51 − 1.40 mm).

NOTE: (Post SB PW4ENG 72−703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). If the 0.055 inch (1.397 mm) maximum gap limit is not met, replace the standard Type A blades with the modified Type A blades with wider platforms or the Type A blades with the narrower platform as necessary to get the 0.020 − 0.055 inch (0.51 − 1.40 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

R (12) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

(a) If the blade platform width is larger than the gap, determine the difference. If the total amount of material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type A blade not installed. If the total amount of material that must be removed is more than 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type A blade not installed. Maximum material that can be removed per platform side must not be more than 0.005 inch (0.127 mm).

(b) If the total amount of material to be removed exceeds 0.010 inch (0.254 mm), remove an additional Type A blade to obtain the proper fit and remove material in approximately equal amounts from both sides of the Type A blade platforms. Repeat this procedure for additional Type A blades, as necessary, to obtain the correct gap.

(c) If it is necessary to remove material, machine the HPC 12th stage blade platforms per 72−35−38 Assembly−02 (Task 72−35−38−440−002).

(d) Type A blades with trimmed platforms must be identified with a square symbol in their respective service time marking areas. See 70−11, Standard Practices Manual, PN 585005.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE THAT FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

R (13) After the gap limits have been met, remove all blades from the right side of the slot and place them in the order of removal on the work bench. Remove all blades from the left side of the slot and also place them in order of removal on the bench.

NOTE: Four (4) blades and two (2) blade locks are to remain in the disk. These are the first set of four (4) blades (two (2) Types B and C) and two (2) blade locks installed at the start of this procedure.

R (14) Apply Antigallant Compound P06−036 or Dry Film Lubricant P06−041 to the blade ladder seals (side opposite flat side) and to the drum groove in the areas shown to ease the assembly operation. See Figure 1007.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE THAT FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT

METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

R (15) Install the right side ladder seal and blades. See Figure 1006.

NOTE: The blades will be installed in the order that they were removed.

(a) Put the ladder seal over the loading slot with the flat surface out.

(b) Align the first opening in the ladder seal with the loading slot in the disk.

(c) Install the blade that was first removed (blade number 64), leading edge up, through the seal and into the loading slot.

(d) Move the blade and seal to the right until the second opening is aligned with the loading slot.

NOTE: Be sure that the seal is correctly installed between the disk rails.

(e) Continue the blade installation instructions above until all the right side blades are installed, moved fully to the right and touch the Type B blade that was installed before.

(f) Install a Type C blade, a lock and then the next Type B blade. Move them fully to the right until they touch the blades that were installed before. Do not tighten the lock and setscrew assembly at this time.

R (16) When the blades, seals and locks have been fully installed on the right side, install the left side blades, seal and lock by the instructions above except move the blades, seal and lock to the left.

NOTE: The last Type C blade and lock will not be installed during this step.

R (17) Install the remaining blade and lock.

(a) The last Type C blade and lock can only be inserted in the drum by moving all the blades to the right. To do this, you must rotate the drum 180 degrees and loosen the blade lock screws. Move all blades, seals and locks to the right.

(b) Install the last lock and setscrew assembly in the drum slot and move it to the left.

(c) Install the last Type C blade in the slot.

R (18) Move the blades, seals and locks to the final position.

(a) Move all the blades, seals and locks to the left. Align the blade lock with the V mark made on the drum at the start of this procedure.

(b) Tighten and torque the two blade lock and setscrew assemblies that are located at the loading slot near the V mark.

1 Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

2 Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

a Method 1: Measure height clearance between blade lock and top of blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

b Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

(c) Check the gaps, make the left side and the right side gaps approximately equal.

R (19) Tighten and torque the remaining lock and setscrew assemblies.

(a) Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

R (20) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure height clearance between blade lock and top of blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

1 If these limits are not kept, check the lock for correct assembly in the disk.

D. Postrequisites

(1) Assemble 11th stage blades to (debladed) axial compressor rotor assembly. See Assembly−25, CONFIG−2 (Task 72−35−01−440−023).

Task 72−35−01−440−022−B:

3. Assemble 12Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly (Post SB PW4ENG 72−586 Only)

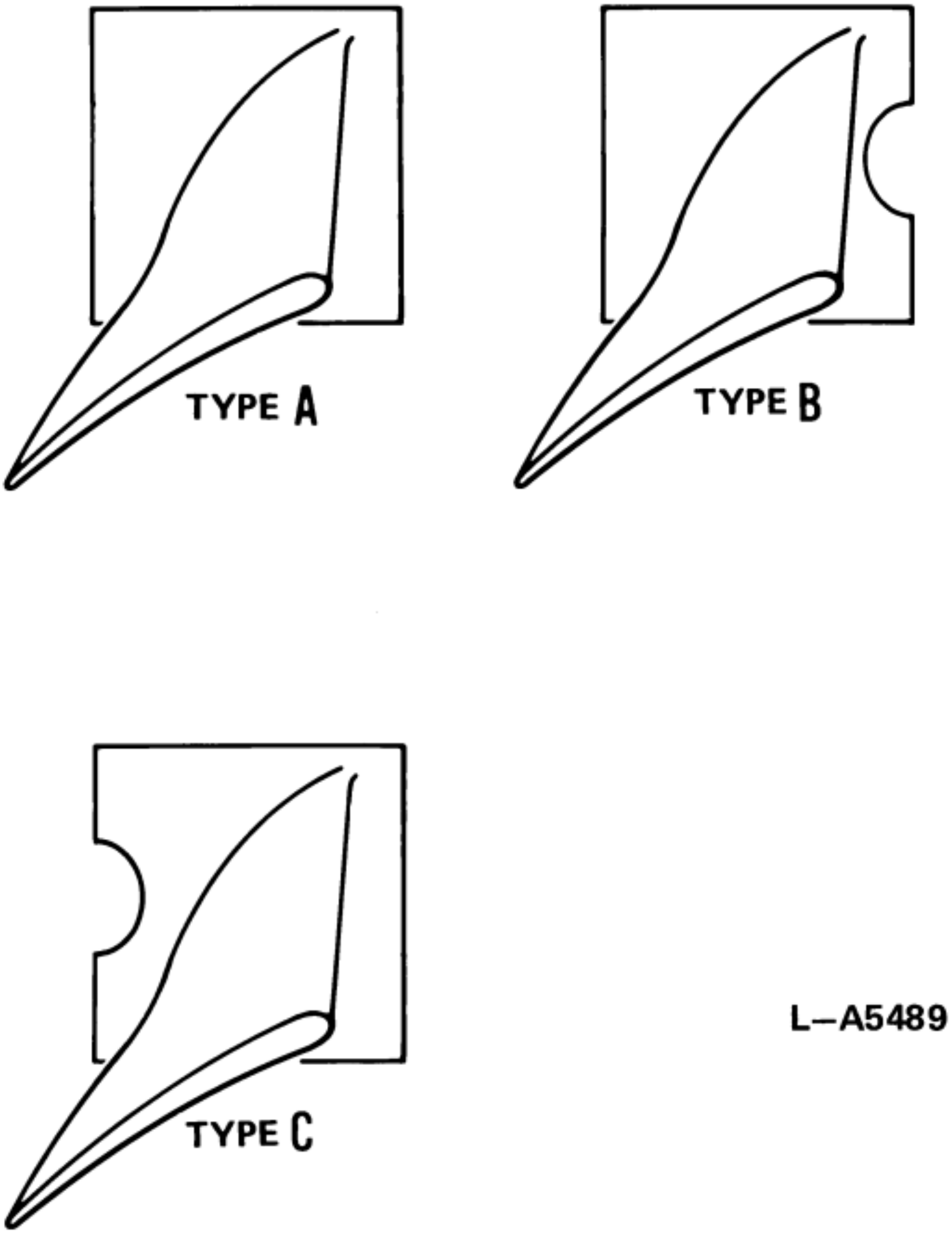
A. Prerequisites

(1) Assemble 13th stage blades to (debladed) axial compressor rotor assembly. See Assembly−23, CONFIG−2 (Task 72−35−01−440−021).

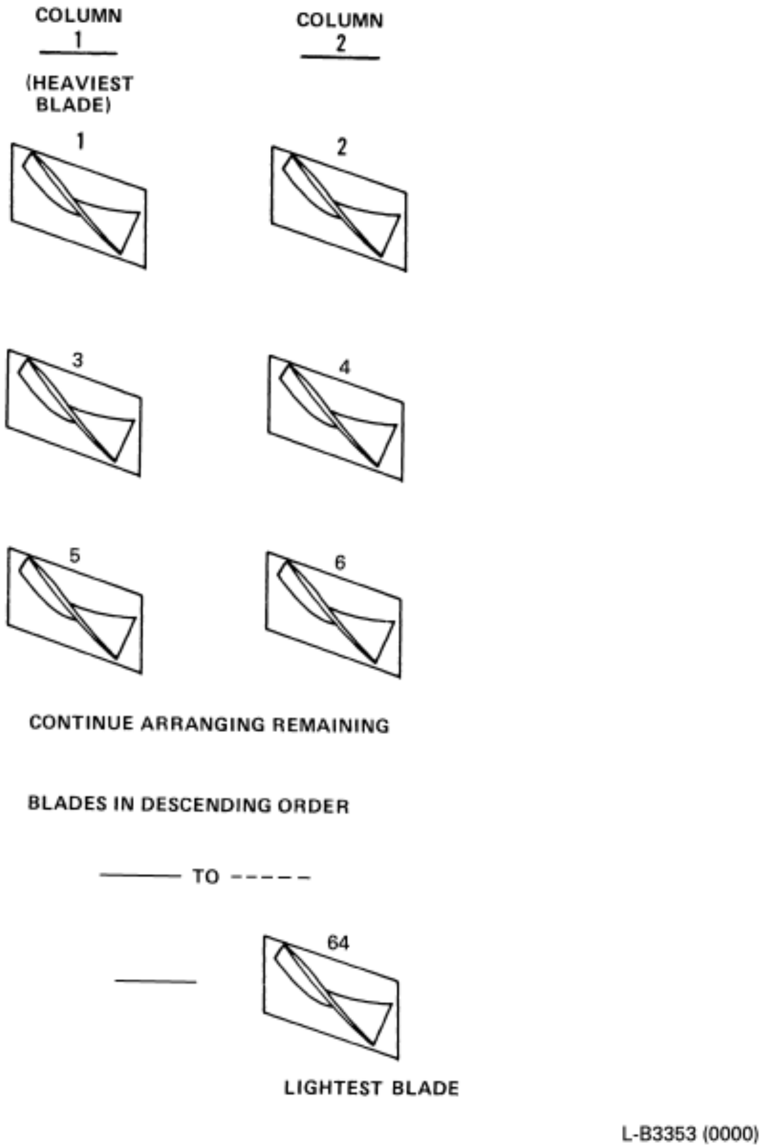
B. Equipment And Materials Necessary

Special Tools:

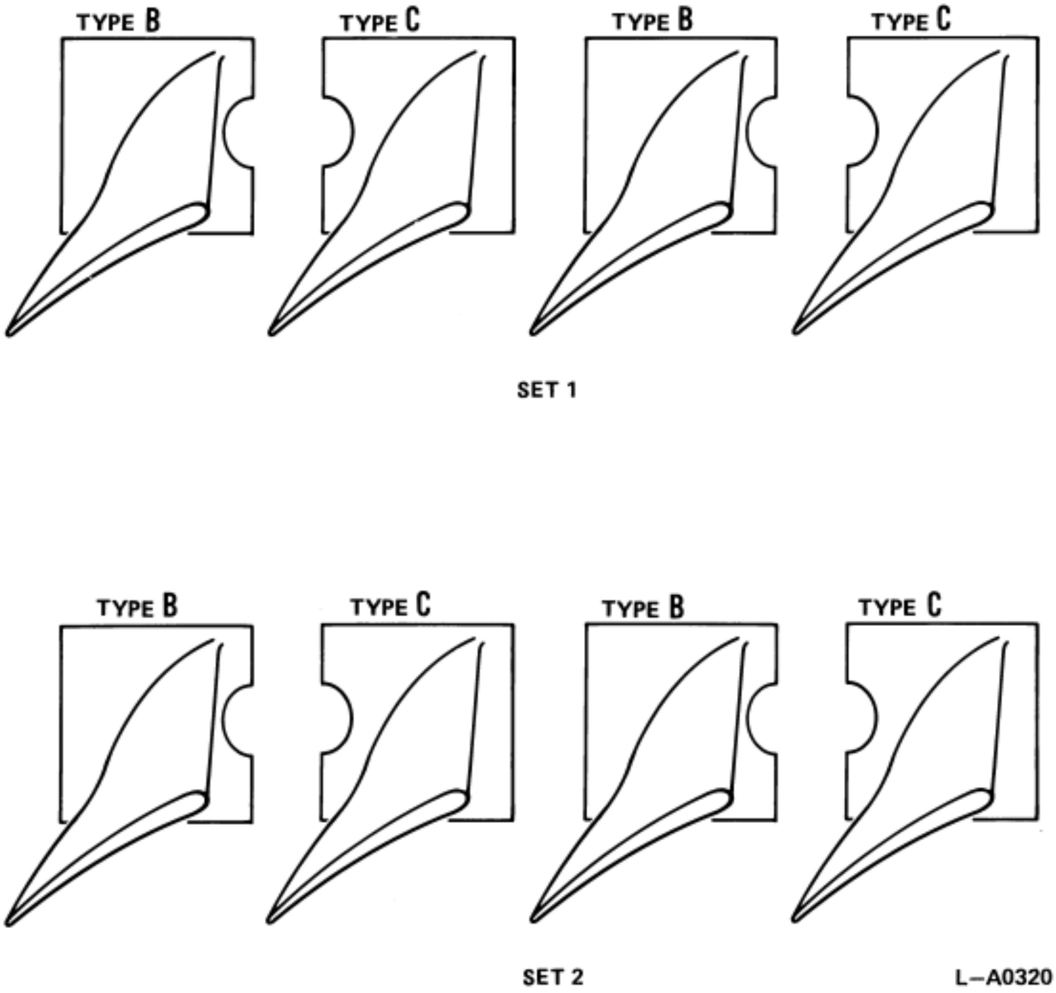
PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader
PWA 86448	Drift



Blade Identification
Figure 1001
(Task 72-35-01-440-022-A)

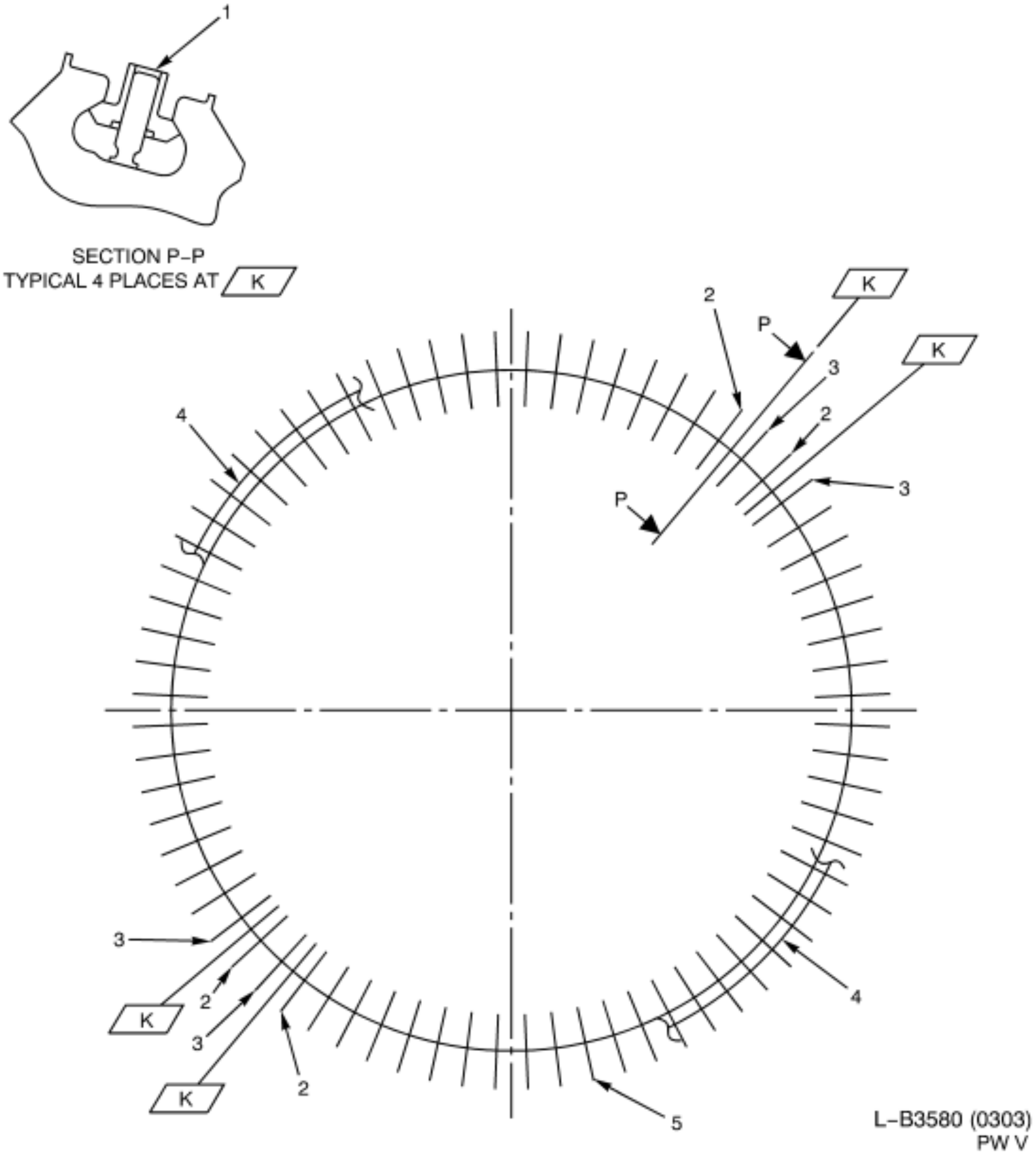

COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
1
2
3
4
5
6
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO
64
LIGHTEST BLADE
L-B3353 (0000)

Type A Blade Weight Arrangement
Figure 1002
(Task 72-35-01-440-022-A)


TYPE B
TYPE C
TYPE B
TYPE C
SET 1
TYPE B
TYPE C
TYPE B
TYPE C
SET 2
L-A0320

Types B And C Blade Set Arrangement
Figure 1003
(Task 72-35-01-440-022-A)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-24

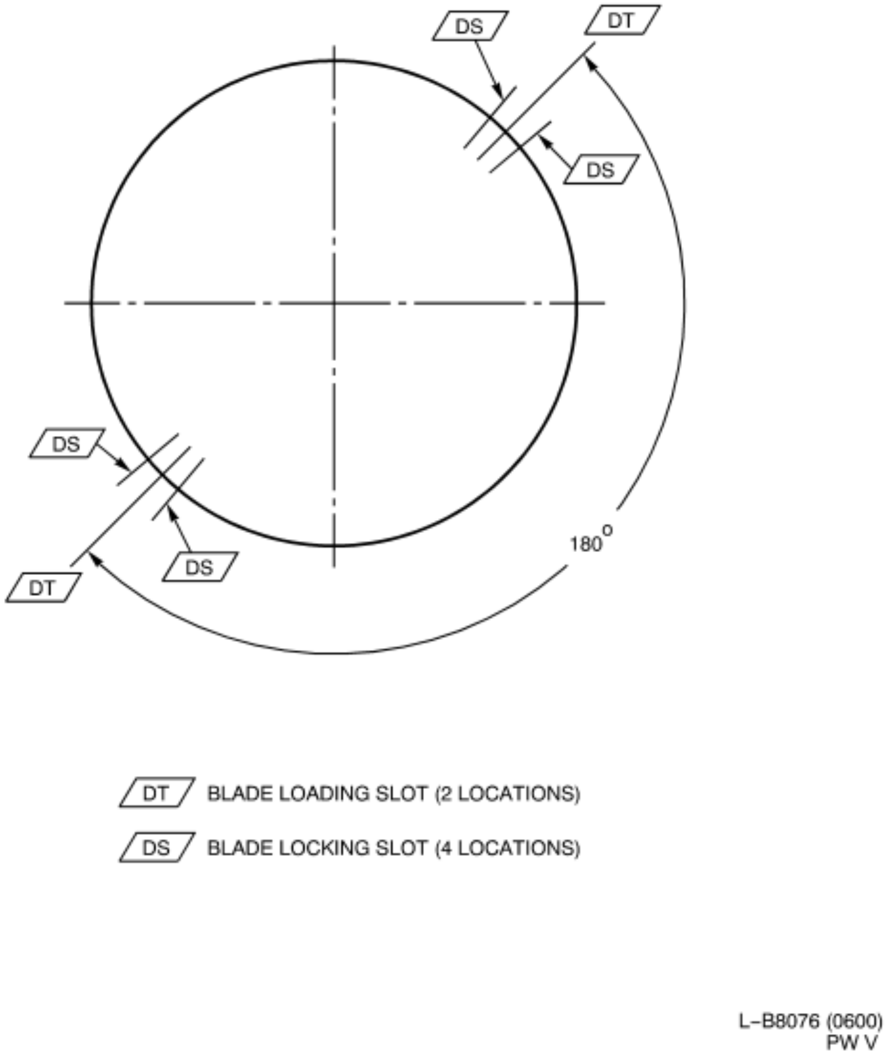

1
SECTION P-P
TYPICAL 4 PLACES AT K
K
K
2
P
3
2
3
P
4
3
4
K
2
3
K
2
5
L-B3580 (0303)
PW V

Schematic View Of 12th Stage Blade And
Lock Installation (Pre SB PW4ENG 72-586)
Figure 1004 (Sheet 1)
(Task 72-35-01-440-022-A)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−24

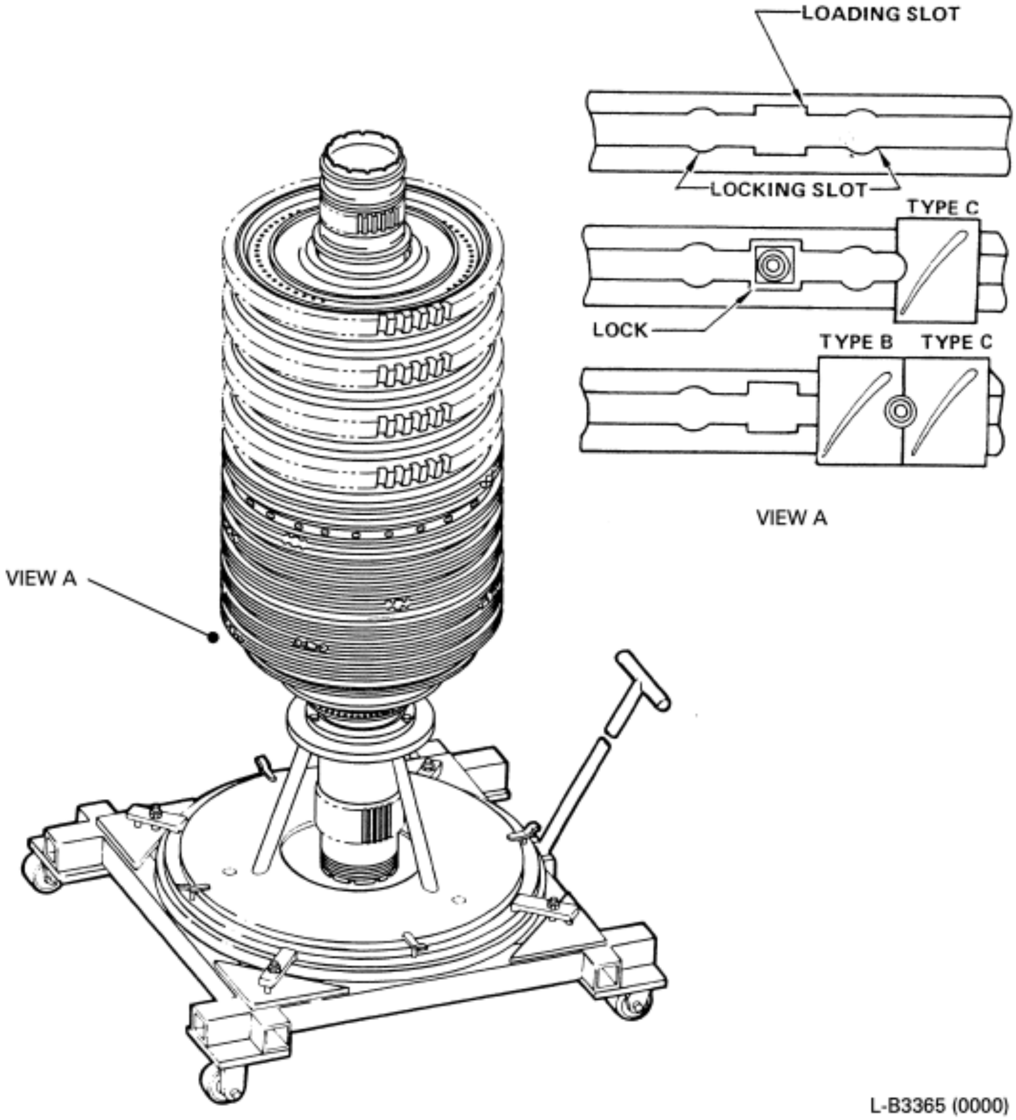
1. Lock And Setscrew Assembly
2. Type C Blades
3. Type B Blades
4. Ladder Seals, PN 53H052, Two Necessary.
5. Type A Blades

Key to Figure 1004 (Sheet 1)

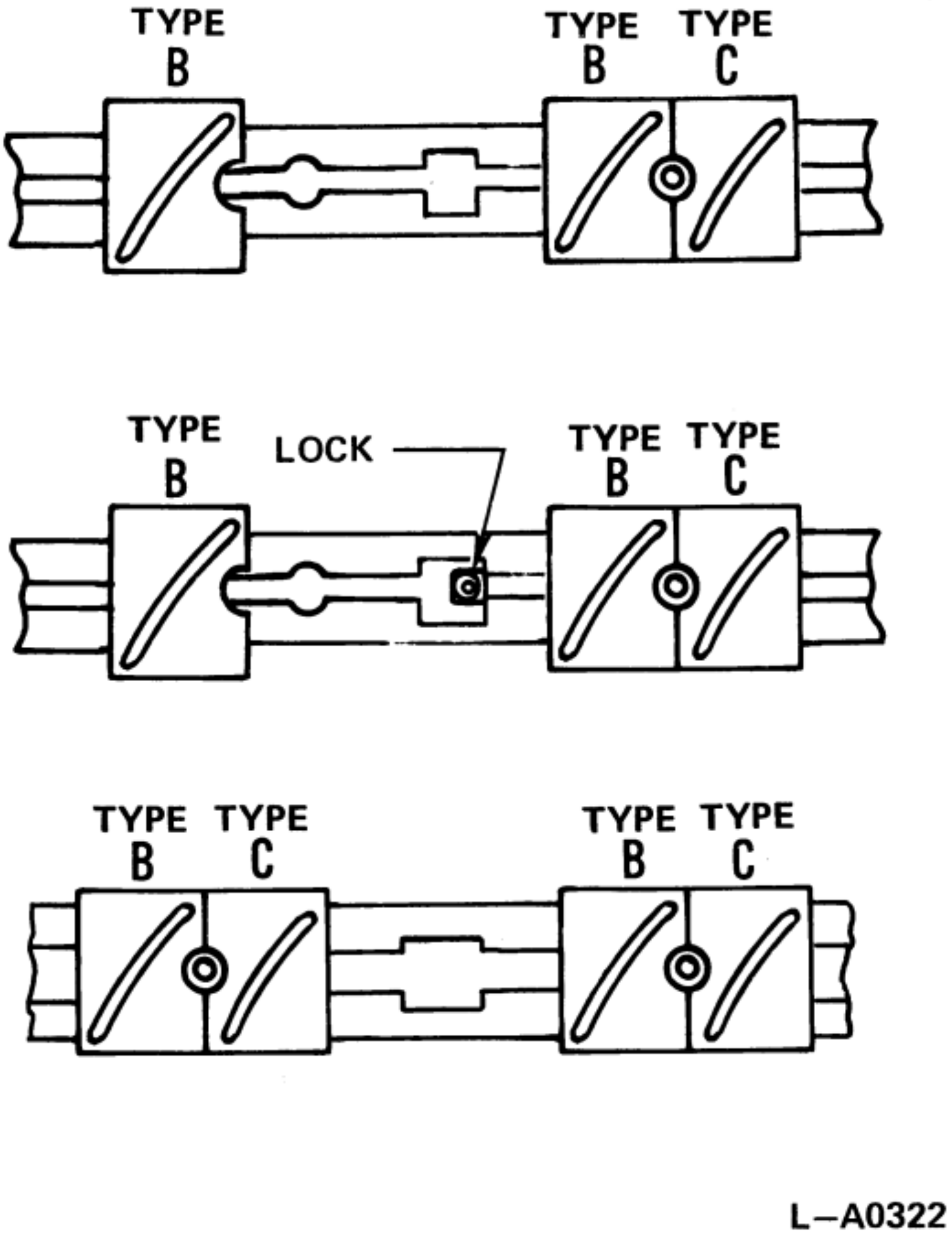

DS
DT
DS
180°
DS
DS
DT
DT BLADE LOADING SLOT (2 LOCATIONS)
DS BLADE LOCKING SLOT (4 LOCATIONS)
L−B8076 (0600)
PW V

Schematic View Of 12th Stage Blade And
Lock Locations (Pre SB PW4ENG 72−586)
Figure 1004 (Sheet 2)
(Task 72−35−01−440−022−A)

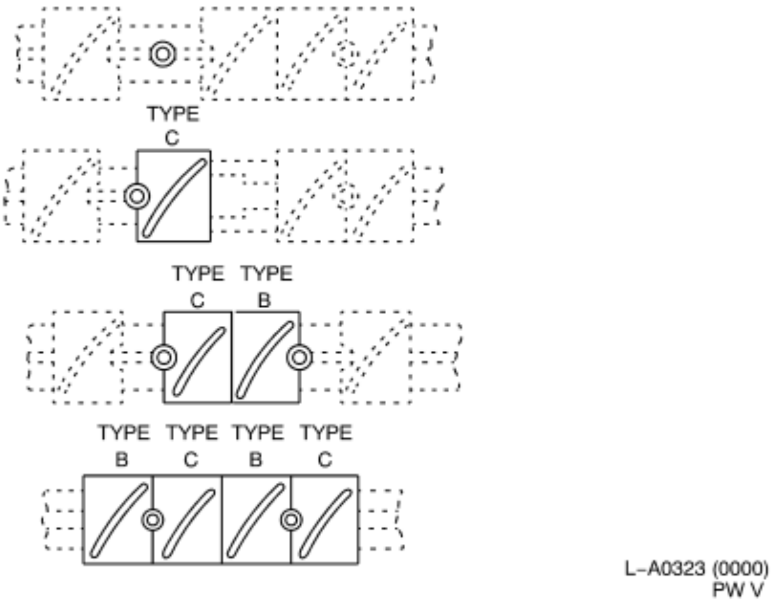
AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-24


LOADING SLOT
LOCKING SLOT
TYPE C
LOCK
TYPE B
TYPE C
VIEW A
VIEW A
L-B3365 (0000)

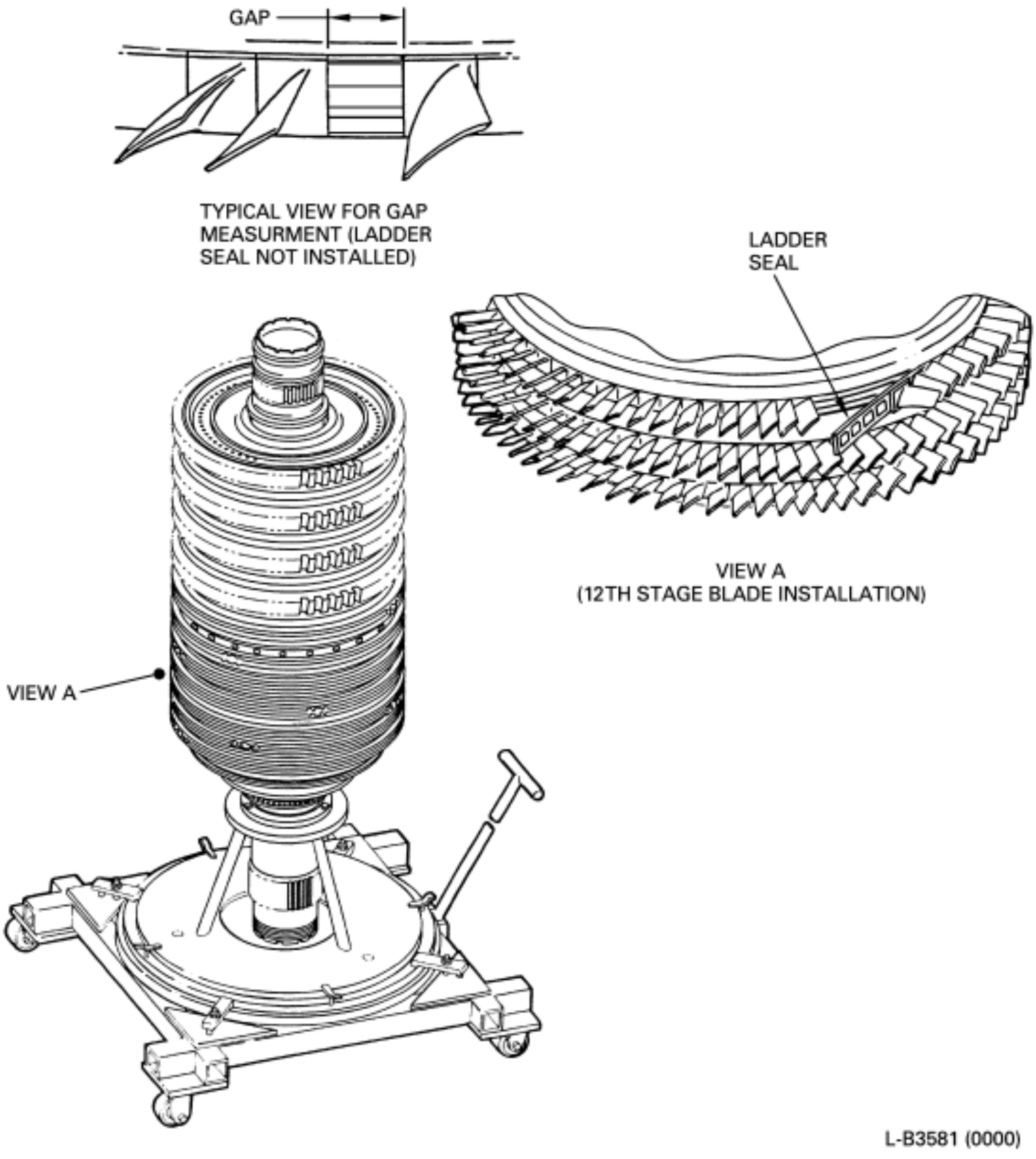
Blade And Lock Installation
Figure 1005 (Sheet 1)
(Task 72-35-01-440-022-A)


TYPE B
TYPE B
TYPE C
TYPE B
LOCK
TYPE B
TYPE C
TYPE B
TYPE C
TYPE B
TYPE C
L-A0322

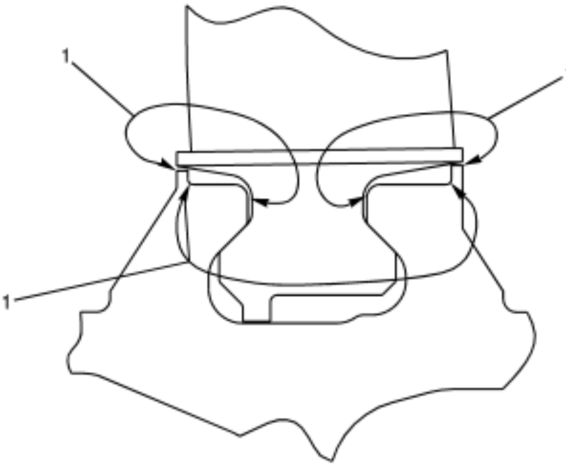
Blade And Lock Installation
Figure 1005 (Sheet 2)
(Task 72-35-01-440-022-A)


TYPE
C
TYPE
C
TYPE
B
TYPE
B
TYPE
C
TYPE
B
TYPE
C
L-A0323 (0000)
PW V

Blade And Lock Installation
Figure 1005 (Sheet 3)
(Task 72-35-01-440-022-A)


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A
(12TH STAGE BLADE INSTALLATION)
VIEW A
L-B3581 (0000)

Gap Measurement And Ladder Seal Installation
Figure 1006
(Task 72−35−01−440−022−A)



L−B3582 (0000)
PW V

1. Antigallant Treatment Areas

Antigallant Application Areas
Figure 1007
(Task 72−35−01−440−022−A)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−24

Consumable Materials:

Item No.	Designation
P06−036	Compound, Antigallant (PWA 36035)
P06−041	Lubricant, Dry Film (PWA 36221)

C. Procedure
See Figure 1008, Figure 1009, Figure 1010, Figure 1011, Figure 1012, Figure 1013 and Figure 1014.

CAUTION: DO NOT OVERTIGHTEN GAGE SET SCREWS DURING INSTALLATION OF GAGES. DAMAGE TO THE DRUM CAN RESULT.

(1) Measure Z−Plane diameter for Stage 12. This procedure is optional and can only be used where blades have been removed. Select the pair of gages, marked for that stage, from the PWA 86571 Z−Plane Diameter Gage Set. Select the pair of gages from the PWA 101165 Z−Plane Diameter Gage Set. Install gages 180 degrees apart, in blade slots. Turn gage set screws clockwise to move the gages radially out to their most outward position. Use OD micrometers to measure four diameters, every 45 degrees, over the gage tool balls. Calculate Z−Plane diameter of the stage by subtracting twice the reference dimension, marked on each pair of gages, from the average diameter measured over the gage tools balls. Refer to minimum, maximum and nominal Z−Plane diameters listed, for reference only, in Table 1002.

Stage	Minimum Diameter (Reference)	Maximum Diameter (Reference)	Nominal Diameter (Reference)
12	23.208 inch (589.483 mm)	23.216 inch (589.686 mm)	23.212 inch (589.585 mm)

HPC Front Drum Z−Plane Diameters
Table 1002

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(2) Remove the 12th stage blades from their storage rack and place them on a work bench. Segregate four (4)

each of Types B and C blades having notches in their platforms and move the blades to one side. See Figure 1008.

NOTE: There are three part numbers (sets) of blades provided for this stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type A is also used to get the correct platform gap and may require platform grinding. A modified Type A blade is also available with a 0.015 inch (0.381 mm) oversized platform width to help you get the correct platform gap. For ease of assembly, blades in this procedure will be referred to as Types A, B and C.

NOTE: (Post SB PW4ENG 72−703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

R (3) Optional, weigh the 12th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70−11−00.

R NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

R (4) Optional, arrange Type A blades in two (2) columns. Start with the heaviest blade at the top left (Column 1), and proceed from left to right in descending order of weight. Lightest blade will be at the bottom of Column 2. See Figure 1009.

NOTE: One or more Type A blade(s) may have been used as a fitting blade. These blades will be identified by a square in the service time marking area.

R (5) Divide the Types B and C blades into two sets of four blades (two (2) Types B and C per set) such that the weights of the sets are as nearly equal as possible. See Figure 1010.

NOTE: The weights must be nearly equal as the sets will be positioned opposite each other after assembly.

R (6) Install the blades and lock and setscrew assemblies on the right side. See Figure 1009, Figure 1010, Figure 1011 (Sheets 1 and 2) and Figure 1012 (Sheets 1 and 2).

(a) Find one of the two 12th stage blade loading slots.

(b) Select one of the Types B and C blade sets. Install one Type C blade, leading edge up, into the loading slot. Move the blade to the right.

(c) Install one lock and setscrew assembly and move it to the right.

(d) Locate the locking slot, at Position K, on the right of the blade loading slot. Move the lock and setscrew assembly into the locking slot and tighten. Torque the setscrew to the running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multispline setscrews.

NOTE: There are four locking slots that are not used. These slots are for a new tandem blade lock configuration (Post SB PW4ENG 72-586) to allow the option of a different blade quantity for future aerodynamic design potential. They are located at Position J on the left and right sides of both loading slots.

(e) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure height clearance between blade lock and top of blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

(f) Use an approved marking pen to mark the OD platform of the drum, in line with the lock, with a "V" for future reference.

(g) Install one Type B blade into the slot. Move the blade to the right until it touches the lock and setscrew assembly.

(h) Rotate the drum 180 degrees. Position the open loading slot toward the operator.

(i) Find the Type A blades to be installed. Start at the bottom of Column 2 (blade number 64, the lightest blade) and continue up to the top of the column (blade number 2).

(j) Install 10 Type A blades, start with blade number 64, in the loading slot and move each blade to the right until it touches the blade that was installed before.

(k) Install the remaining Type C blade and move it to the right until it touches the last Type A blade.

(l) Insert one lock and setscrew assembly and move it to the right until it touches the Type C blade. Do not tighten the lock at this time.

(m) Install the remaining Type B blade into the loading slot and move it to the right until it touches the lock and setscrew assembly.

(n) Install the 22 remaining Type A blades from Column 2 in the loading slot and move them to the right until each one touches the blade that was installed before.

R (7) Install blades and lock and setscrew assemblies on the left side. See Figure 1009, Figure 1010, Figure 1011 (Sheets 1 and 2) and Figure 1012 (Sheets 1 and 2).

(a) Get a Type C blade from the remaining Types B and C blade set. Install it in the loading slot and move it to the right until it touches the blade that was installed before.

(b) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before. Do not tighten the lock at this time.

(c) Install a Type B blade in the loading slot and move it to the right until it touches the lock.

(d) Find the Type A blades to be installed. Start at the top of Column 1 (blade number 1) and continue down to the bottom of the column (blade number 63).

(e) Install 22 Type A blades, start with blade number 1, in the loading slot and move it to the left until it touches the blade that was installed before.

NOTE: Ten Type A blades remain that are not to be installed at this time.

(f) Get a Type B blade from the remaining Types B and C blade set. Install it in the loading slot and move it to the left until it touches the blade that was installed before.

(g) Install a lock and setscrew assembly in the loading slot and move it to the left until it touches the blade that was installed before. Do not tighten the lock at this time.

(h) Install a Type C blade in the loading slot and move it to the left until it touches the lock.

(i) Install, in the order that follows, blade numbers 63, 61, 59, then 57 in the loading slot and move them fully to the right.

(j) Install, in the order that follows, blade numbers 45, 47, 49, 51, then 53 in the loading slot and move them fully to the left. Blade number 55 is not installed at this time.

R (8) Move the blades tangentially to make the widest possible gap between the last installed Type A blades. This gap will be measured and used to compute the specified gap for between the blades. See Figure 1013.

NOTE: Put the blades in a radially outward direction to prevent a circumferentially serpentine shape to the blades.

(a) Use a PWA 85595 Spreader to load all blades, in the arc, tangentially.

(b) When it is installed, expand the spreader and get the widest possible gap between the blade platforms. If you need help to move the blades, it is permissible to tap lightly on the base of the airfoil with a PWA 86448 Drift.

(c) Measure and make a record of the gap dimension.

(d) Find the Type A blade (blade number 55) that will be installed in the gap you measured. Use a vernier caliper to measure the platform width of the blade. Record this dimension.

(e) Compare the gap dimension with the blade platform width dimension.

(f) The width of the blade platform must measure 0.020 − 0.055 inch (0.51 − 1.40 mm) smaller than the gap measured at the drum loading slot between the blades.

(g) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

R (9) Do the procedure that follows to get the correct blade platform width for both measured gap positions.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type A blades with oversized Type A blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.020 − 0.055 inch (0.51 − 1.40 mm).

NOTE: (Post SB PW4ENG 72−703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). If the 0.055 inch (1.397 mm) maximum gap limit is not met, replace the standard Type A blades with the modified Type A blades with wider platforms or the Type A blades with the narrower platform as necessary to get the 0.020 − 0.055 inch (0.51 − 1.40 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

R (10) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

(a) If the blade platform width is larger than the gap, determine the difference. If the total amount of material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type A blade not installed. If the total amount of material to be removed exceeds of 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type A blade not installed. Maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

(b) If the total amount of material to be removed exceeds 0.010 inch (0.254 mm), remove an additional Type A blade to obtain the proper fit and remove material in approximately equal amounts from both sides of the Type A blade platforms. Repeat this procedure for additional Type A blades, as necessary, to obtain the correct gap.

(c) If it is necessary to remove material, machine the HPC 12th stage blade platforms per 72−35−38 Assembly−02 (Task 72−35−38−440−002).

(d) Type A blades with trimmed platforms must be identified with a square symbol in their respective service time marking areas. See 70−11, Standard Practices Manual, PN 585005.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE THAT FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

R (11) After the gap limits have been met, remove all blades from the right side of the slot and place them in the order of removal on the work bench. Remove all blades from the left side of the slot and also place them in order of removal on the bench.

NOTE: Two (2) blades and one (1) blade lock are to remain in the disk. These are Types B and C blades and the blade lock that were installed and tightened at the start of this procedure.

R (12) Apply Antigallant Compound P06−036 or Dry Film Lubricant P06−041 to the blade ladder seals (side opposite flat side) and to the drum groove in the areas shown to ease the assembly operation. See Figure 1014.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE THAT FOLLOWS, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

R (13) Install the right side ladder seals, blades and lock and setscrew assembly. See Figure 1013.

NOTE: The blades will be installed in the order that they were removed.

(a) Put the first ladder seal over the loading slot with the flat surface out.

(b) Align the first opening in the ladder seal with the loading slot in the disk.

(c) Install the blade that was last removed from the right side (blade number 64), leading edge up, through the seal and into the loading slot.

(d) Move the blade and seal to the right until the second opening is aligned with the loading slot.

NOTE: Be sure that the seal is correctly installed between the disk rails.

(e) Install the next three Type A blades to complete assembly of the first ladder seal. Move this blade and seal assembly fully to the right until it touches the Type B blade that is installed.

(f) Install the next two Type A blades and move them fully to the right until they touch the blade and seal assembly that was installed.

(g) Put the second ladder seal over the loading slot with the flat surface out.

(h) Install the next four Type A blades in the ladder seal by the method used above and move the assembly fully to the right until it touches the last Type A blade that was installed.

(i) Install a Type C blade, a lock then the next Type B blade. Move them fully to the right until they touch the blades that were installed before. Do not tighten the lock and setscrew assembly at this time.

(j) Put the third ladder seal over the loading slot with the flat surface out.

(k) Install the remaining 22 Type A blades, from Column 2, in the ladder seal by the method used for the first seal and move the assembly fully to the right until it touches the Type B blade that was installed.

R (14) Install partial left side seals, blades and a lock and a setscrew assembly.

NOTE: The blades will be installed in the order that they were removed.

(a) Put the first ladder seal over the loading slot with the flat surface out.

(b) Align the first opening in the ladder seal with the loading slot in the disk.

(c) Install the blade that was last removed (blade number 1), leading edge up, through the seal and into the loading slot.

(d) Move the blade and seal to the left until the second opening is aligned with the loading slot.

NOTE: Be sure that the seal is correctly installed between the disk rails.

(e) Install the next 21 Type A blades to complete assembly of the first ladder seal. Move this blade and seal assembly fully to the left until it touches the Type C blade that is installed.

NOTE: Ten Type A blades remain that are not installed at this time.

(f) Install a Type B blade and a lock and then the next Type C blade. Move them fully to the left until they touch the blade and seal assembly that was installed before. Do not tighten the lock and setscrew assembly at this time.

(g) Put the second ladder seal over the loading slot with the flat surface out.

(h) Install the next four Type A blades in the ladder seal by the method used for the first seal and move the assembly fully to the left until it touches the Type C blade that is installed.

NOTE: Six Type A blades, one Type B blade, one Type C blade and one lock assembly remain.

R (15) Install the remaining blades and lock and setscrew assembly.

(a) Install the remaining Type C blade and move it fully to the right until it touches the blade that was installed before.

(b) Install the last lock and setscrew assembly in the drum slot and move it to the left. Do not tighten the lock at this time.

(c) Install the remaining Type B blade and move it fully to the right until it touches the blade that was installed before.

(d) Put the ladder seal over the loading slot with the flat surface out.

(e) Align the first opening in the ladder seal with the loading slot in the disk.

(f) Install, in the order that follows, blade numbers 63, 61, 59, then 57 through the seal opening and into the loading slot and move them fully to the right.

NOTE: Two Type A blades have not been installed at this time.

(g) The last Type A blades can only be inserted in the drum by moving all blades to the right. To do this, you must rotate the drum 180 degrees and loosen the blade lock screw.

(h) Rotate the drum 180 degrees again to the opposite loading slot.

(i) Move all blades, seals and locks to the right, as necessary, to install blades Nos. 55 and 53.

R (16) Move the blades, seals and locks to the final positions.

(a) Move all the blades, seals and locks to the left. Align the blade lock with the V mark made on the drum at the start of this procedure.

(b) Position, tighten and torque the blade lock and setscrew assembly that is located at the loading slot near the V mark.

1 Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

R (17) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure height clearance between blade lock and top of blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

1 If these limits are not kept, check the lock for correct assembly in the disk.

R (18) Position, tighten and torque the remaining lock and setscrew assemblies.

(a) Check the gaps, make the left side and the right side gaps approximately equal. All gaps between the ladder seals should be approximately equal.

(b) Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

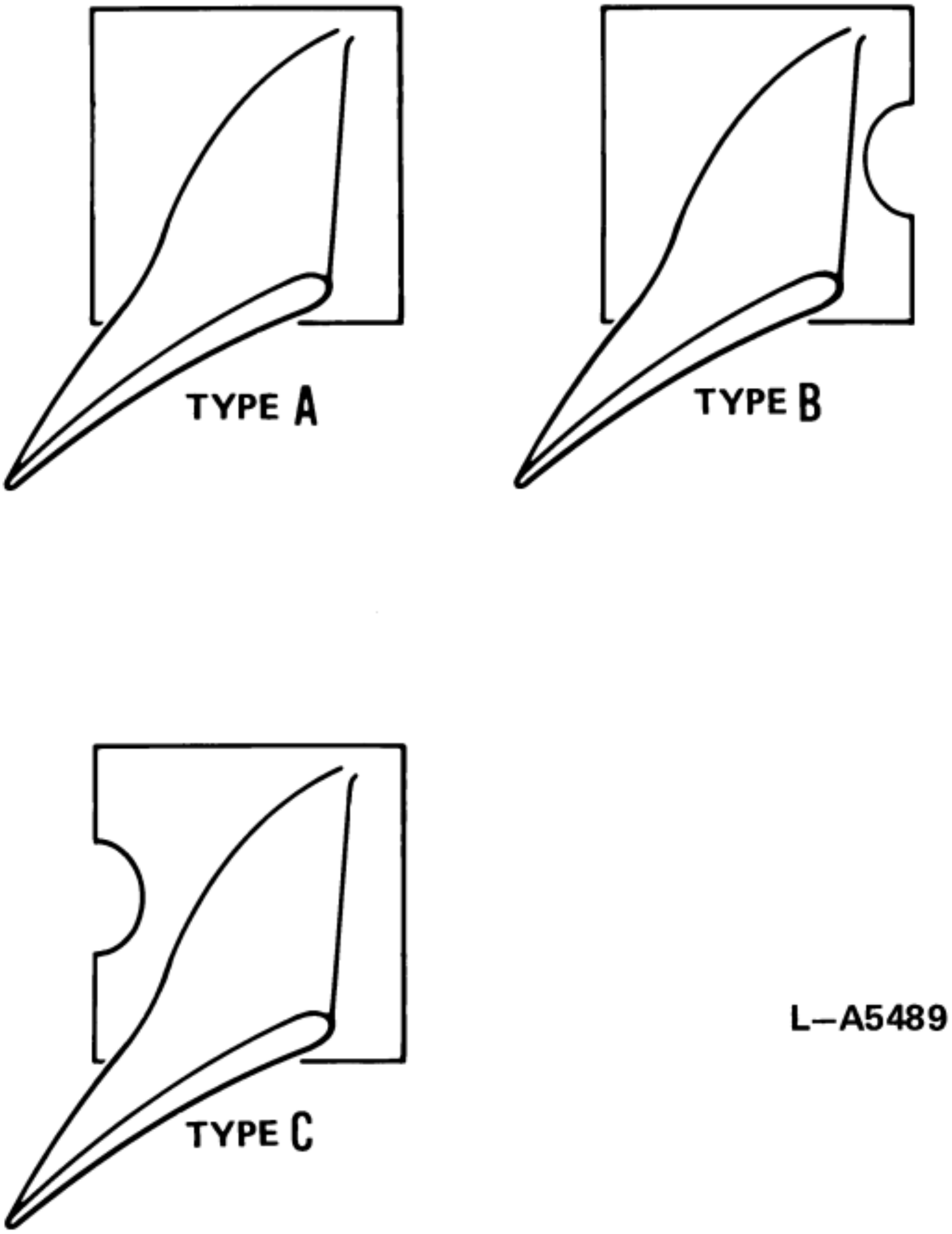
(c) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure height clearance between blade lock and top of blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

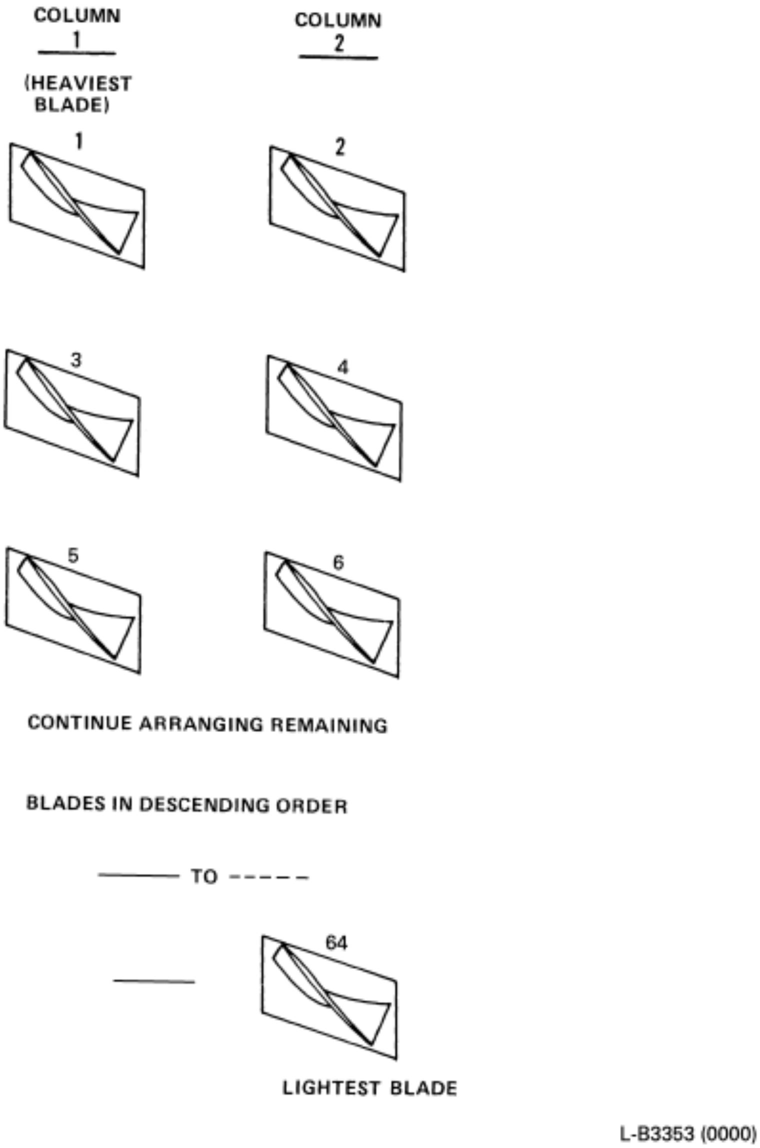
2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

D. Postrequisites

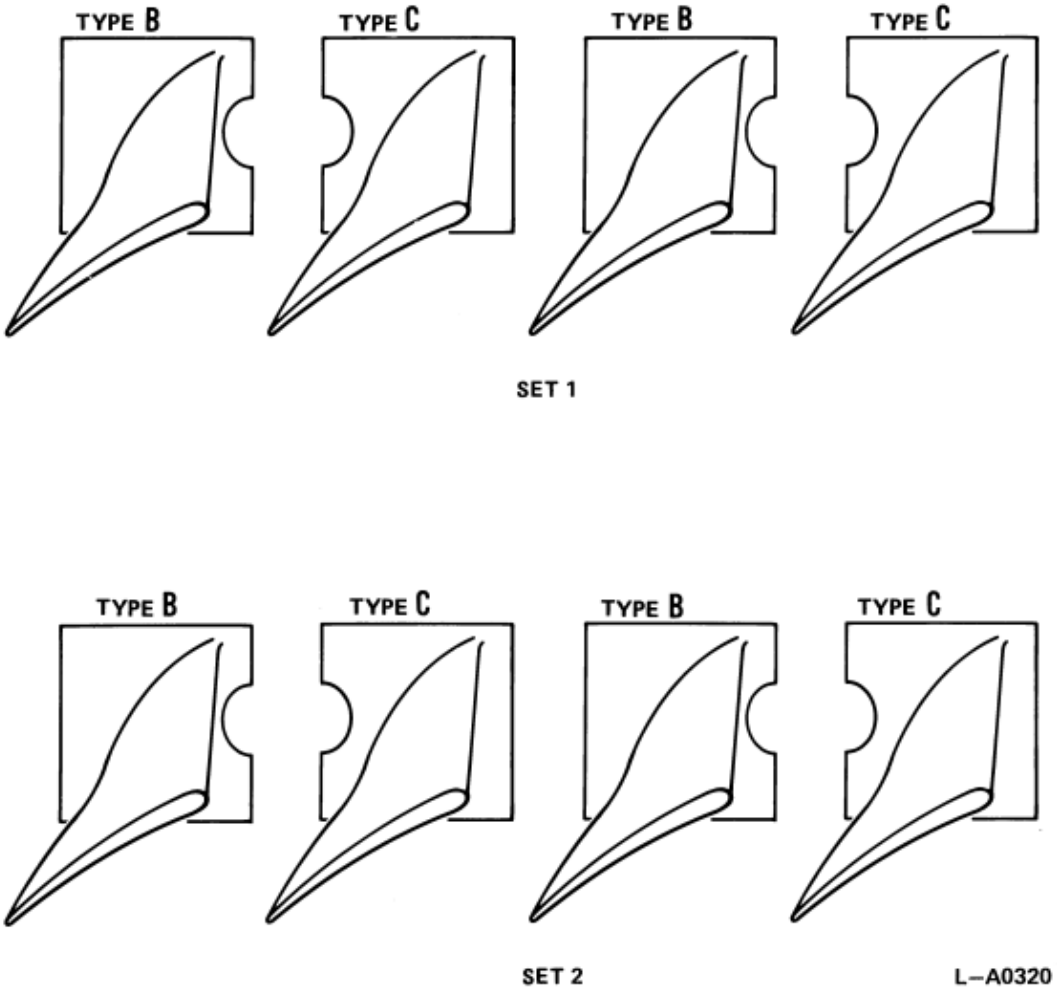
(1) Assemble 11th stage blades to (debladed) axial compressor rotor assembly. See Assembly−25, CONFIG−2 (Task 72−35−01−440−023).



Blade Identification
Figure 1008
(Task 72-35-01-440-022-B)

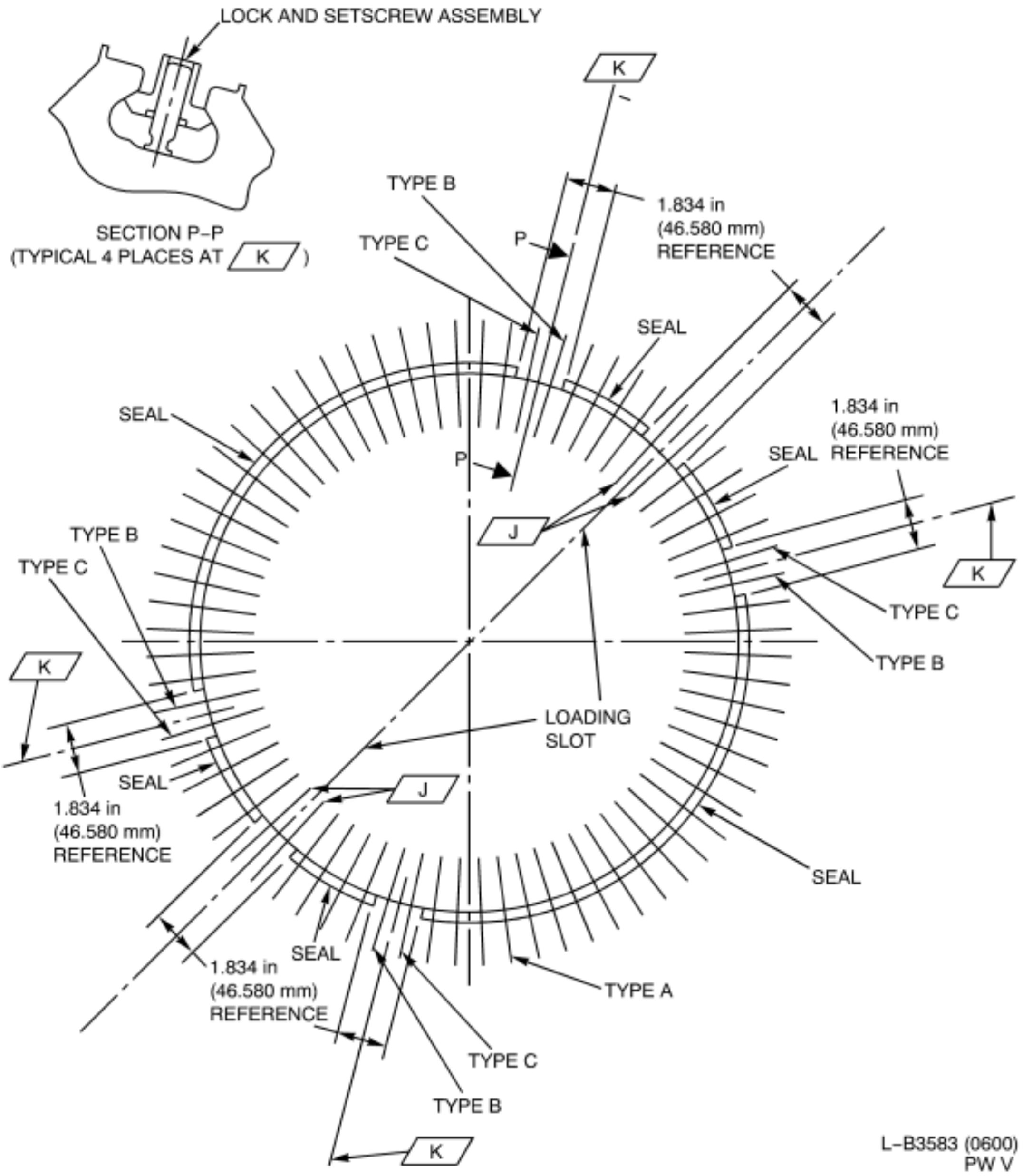

COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
1
2
3
4
5
6
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO
64
LIGHTEST BLADE
L-B3353 (0000)

Type A Blade Weight Arrangement
Figure 1009
(Task 72−35−01−440−022−B)


TYPE B
TYPE C
TYPE B
TYPE C
SET 1
TYPE B
TYPE C
TYPE B
TYPE C
SET 2
L-A0320

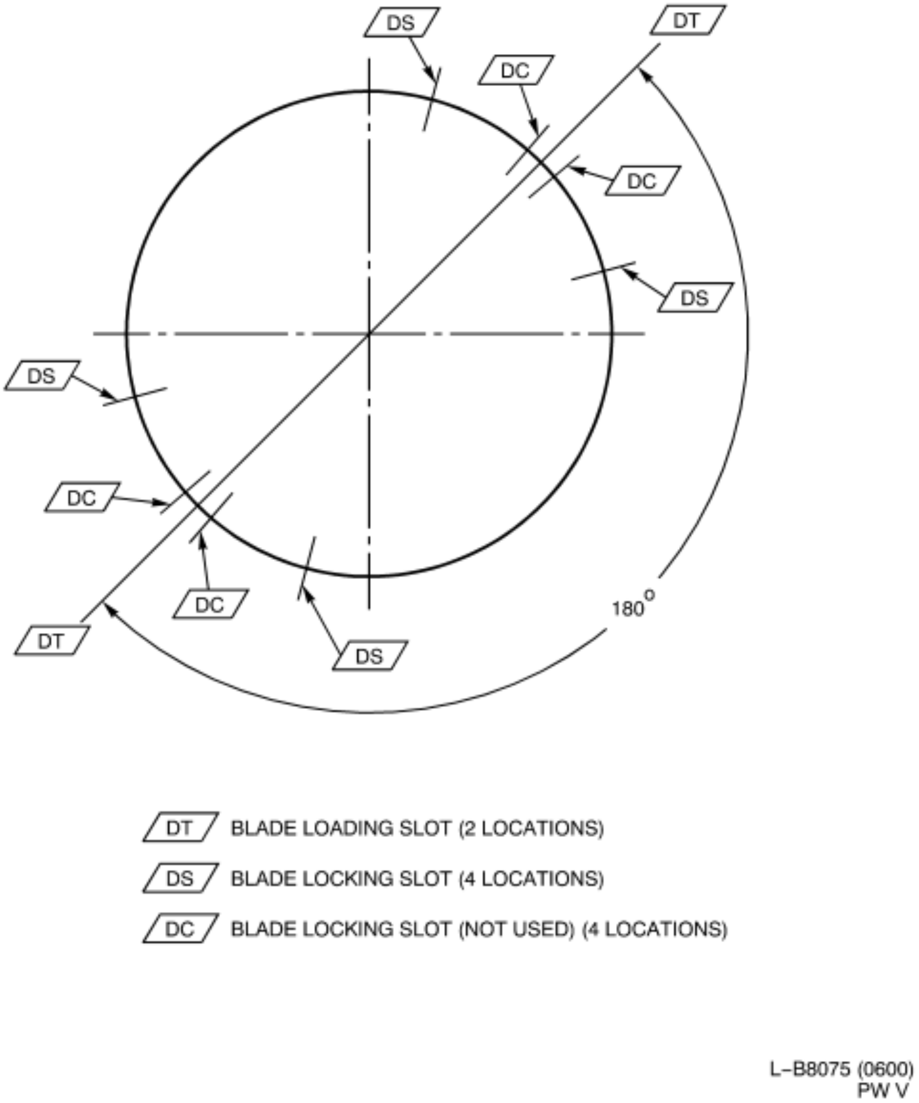
Types B And C Blade Set Arrangement
Figure 1010
(Task 72-35-01-440-022-B)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-24


LOCK AND SETSCREW ASSEMBLY
SECTION P-P
(TYPICAL 4 PLACES AT K)
K
TYPE B
TYPE C
P
1.834 in
(46.580 mm)
REFERENCE
SEAL
SEAL
P
J
1.834 in
(46.580 mm)
SEAL REFERENCE
TYPE B
TYPE C
K
TYPE C
TYPE B
K
LOADING
SLOT
J
SEAL
1.834 in
(46.580 mm)
REFERENCE
SEAL
SEAL
1.834 in
(46.580 mm)
REFERENCE
TYPE A
TYPE C
TYPE B
K
L-B3583 (0600)
PW V

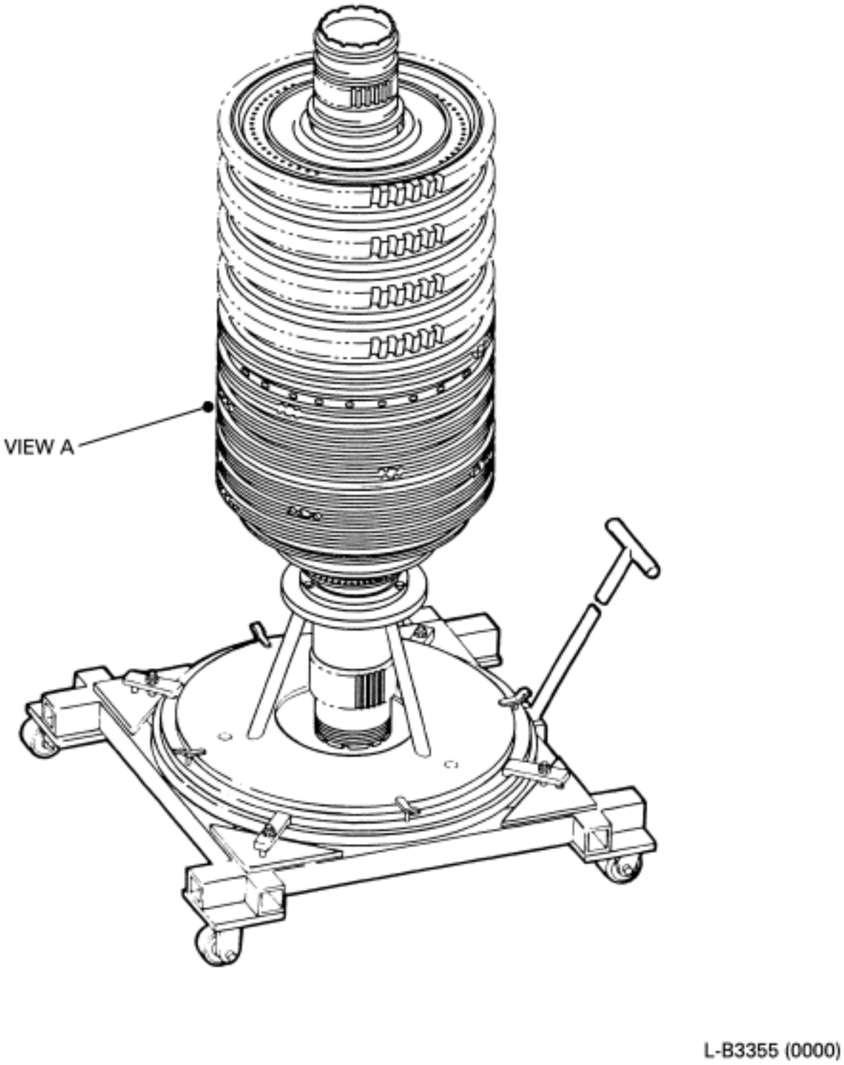
Schematic View Of 12th Stage Blade And
Lock Installation (Post SB PW4ENG 72-586)
Figure 1011 (Sheet 1)
(Task 72-35-01-440-022-B)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-24

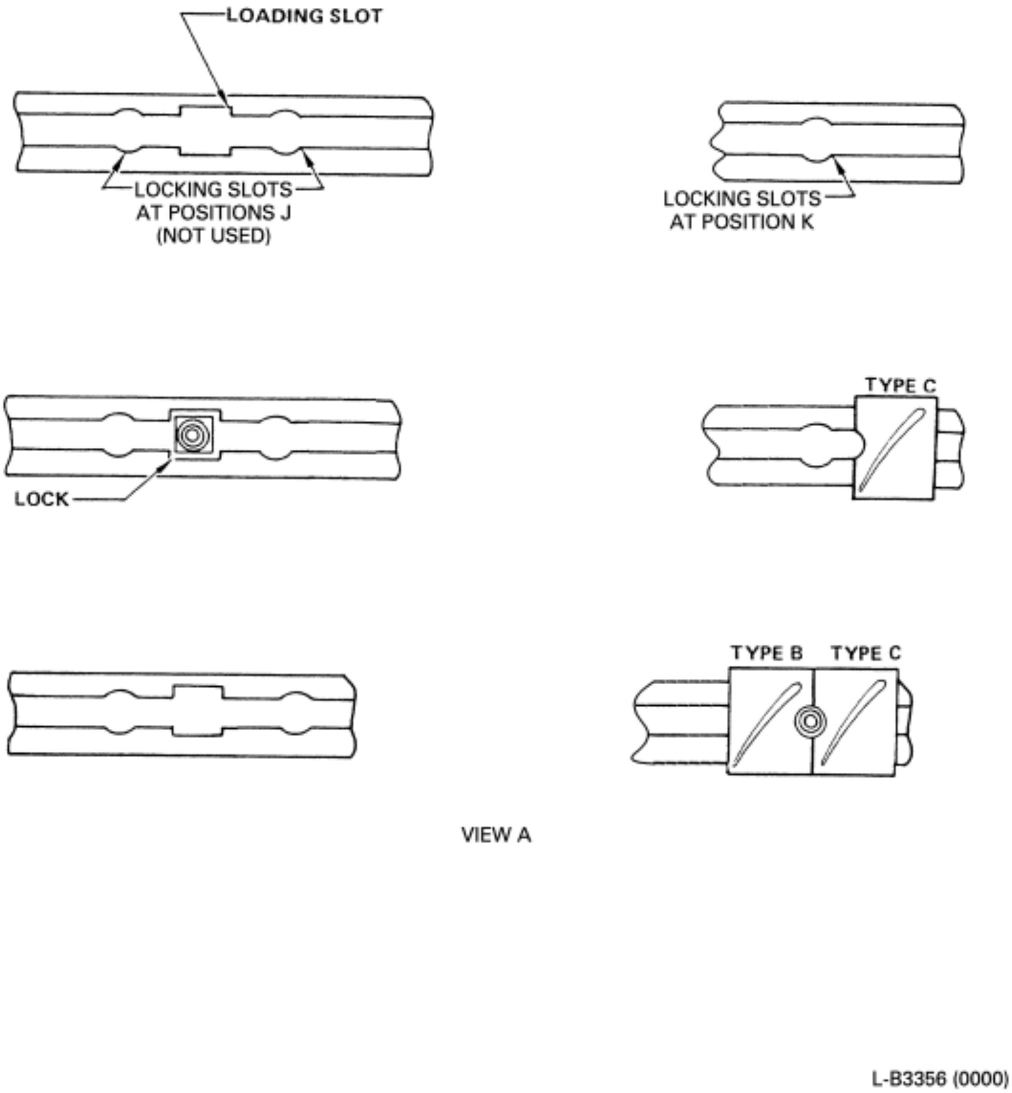

DS
DT
DC
DC
DS
DS
DC
DT
DC
DS
180°
DT BLADE LOADING SLOT (2 LOCATIONS)
DS BLADE LOCKING SLOT (4 LOCATIONS)
DC BLADE LOCKING SLOT (NOT USED) (4 LOCATIONS)
L-B8075 (0600)
PW V

Schematic View Of 12th Stage Blade Loading
And Lock Slot Locations (Post SB PW4ENG 72-586)
Figure 1011 (Sheet 2)
(Task 72-35-01-440-022-B)

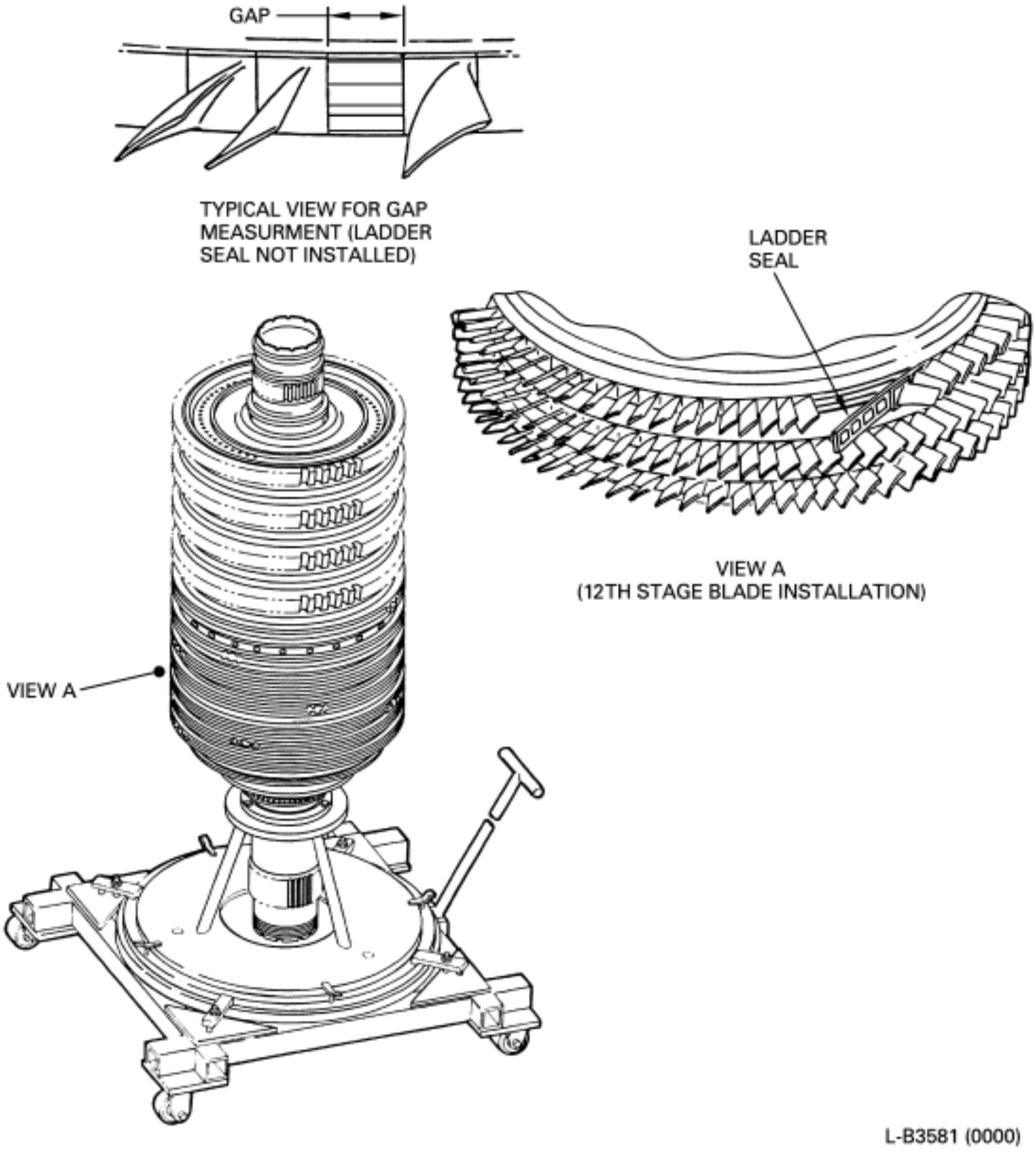
AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-24



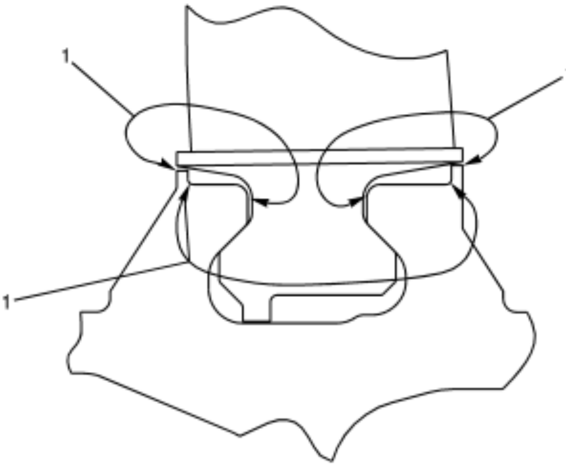
Blade And Lock Installation
Figure 1012 (Sheet 1)
(Task 72-35-01-440-022-B)


LOADING SLOT
LOCKING SLOTS AT POSITIONS J (NOT USED)
LOCKING SLOTS AT POSITION K
LOCK
TYPE C
TYPE B
TYPE C
VIEW A
L-B3356 (0000)

Blade And Lock Installation
Figure 1012 (Sheet 2)
(Task 72−35−01−440−022−B)


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A
(12TH STAGE BLADE INSTALLATION)
VIEW A
L-B3581 (0000)

Gap Measurement And Ladder Seal Installation
Figure 1013
(Task 72-35-01-440-022-B)



L−B3582 (0000)
PW V

1. Antigallant Treatment Areas

Antigallant Application Areas
Figure 1014
(Task 72−35−01−440−022−B)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−25

Task 72−35−01−440−013:

1. Assemble 11Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble 12th stage blades to (debladed) axial compressor rotor assembly. See Assembly−24, CONFIG−1 (Task 72−35−01−440−012).

B. Equipment And Materials Necessary

Special Tools:

PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader
PWA 86447	Drift
PWA 86571	Gage Set
PWA 86652	Drift (Optional To PWA 86447)

Consumable Materials:

Item No.	Designation
P06−036	Compound, Antigallant (PWA 36035)
P06−041	Lubricant, Dry Film (PWA 36221)

C. Procedure

See Figure 1001, Figure 1002, Figure 1003, Figure 1004, Figure 1005 and Figure 1006.

NOTE: There are four part numbers (sets) of blades provided for this stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type D is used for fitting and may require platform grinding. SB PW4ENG 72−434 provides blades with platforms that are 0.015 inch (0.381 mm) oversize. For ease of assembly, blades in this procedure will be referred to as Types A, B, C and D.

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-25

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

CAUTION: DO NOT OVERTIGHTEN GAGE SET SCREWS DURING INSTALLATION OF GAGES. DAMAGE TO THE DRUM CAN RESULT.

(1) Measure Z-Plane diameters for Stage 11. This procedure is optional and can only be used where blades have been removed. Select the pair of gages, marked for that stage, from the PWA 86571 Z-Plane Diameter Gage Set. Install gages, 180 degrees apart, in blade slots. Turn gage set screws clockwise to move the gages radially out to their most outward position. Use OD micrometers to measure four diameters, every 45 degrees, over the gage tool balls. Calculate Z-Plane diameter of the stage by subtracting twice the reference dimension, marked on each pair of gages, from the average diameter measured over the gage tools balls. Refer to minimum, maximum and nominal Z-Plane diameters listed, for reference only, in Table 1001.

Stage	Minimum Diameter (Reference)	Maximum Diameter (Reference)	Nominal Diameter (Reference)
11	23.226 inch (589.940 mm)	23.234 inch (590.144 mm)	23.230 inch (590.042 mm)

HPC Front Drum Z-Plane Diameters
Table 1001

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86652 DRIFT OR THE PWA 86447 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(2) Remove 11th stage blades from storage rack and place them on bench. Segregate eight Types B and C blades having notches in their platforms and move to one side. Also locate eight Type D blade and move to one side. See Figure 1001.

(3) Optional, weigh the 11th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70−11−00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

(4) Optional, arrange Type A blade in four columns, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. Lightest blade will be at bottom of Column 4. See Figure 1002.

NOTE: One or more Type A blade may have been used as a fitting blade. Blade will be identified by a square in the service time marking area.

(5) Select two sets of four blades (two Types B and C per set) such that weights of sets are as nearly equal as possible. See Figure 1003.

NOTE: Weights must be nearly equal as sets will be positioned opposite each other after assembly.

(6) Selecting one of the blade sets, and with loading slot of disk facing operator, install one Type C blade, leading edge up, into slot. Move blade to right. Install one lock and setscrew and move to right. Install one Type B blade into slot. Move to right. See Figure 1004 (Sheet 1).

(7) From the same set, install remaining Type B blade into slot and move to left. Install one lock and setscrew and move to left. Install remaining Type C blade and move to left. See Figure 1004 (Sheet 2).

(8) Locate locking slot to left of blade loading slot. Move left lock to left locking slot and tighten and torque setscrew to running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(9) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

(10) Using approved marking pen, mark OD platform of drum in line with lock with "V" for future reference.

(11) Move Type C blade (right side of lock) to the left to rest against lock. See Figure 1004 (Sheet 3).

(12) Move Type B blade and right lock to left and lock setscrew to running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi-spline setscrews.

(13) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

(14) Push two remaining Types B and C blades to butt against just-installed locks. See Figure 1004 (Sheet 3).

(15) Rotate drum 180 degrees. Position open blade slot toward operator.

(16) Starting at bottom of 4th column of weight−ordered Type A blade, and proceeding vertically from bottom of column to top, position each blade into loading slot and move to right to rest against previously installed blades and lock. When 4th column of blades is used, start at bottom of 2nd column and position each blade into loading slot and to right until all blades from Column 2 are inserted.

(17) Starting at top of 3rd column of blades, position each blade into loading slot and move to left to rest against blades at opposite end. When 3rd column of blades is used, start at top of 1st column and position each blade into loading slot and to left until all blades from Column 1 are inserted.

(18) Install two blades from remaining Types B and C sets into loading slot and move to left. Install remaining two blades from Types B and C sets to slot and move to right. Remaining blades should be eight Type D blades which will be used for fitting. Install seven of the Type D blade in slot and load all blades tangentially so as to form widest possible gap at disk loading slot. Measure gap using PWA 85595 Spreader. See Figure 1005.

  (a) Place spreader into vacant blade space. Expand spreader with torque handle and measure blade gap with a vernier caliper. Record this dimension.

  (b) Measure platform width of Type D blade, not installed in drum, vernier caliper. Record this dimension.

  (c) Compare the gap dimension with the blade platform width dimension.

  (d) The width of the blade platform must measure 0.020 − 0.055 inch (0.51 − 1.40 mm) smaller than the gap measured at the drum loading slot between the blades.

  (e) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

(19) Do the procedure that follows to get the correct blade platform width for the measured gap.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type D blades with oversized blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.020 - 0.055 inch (0.51 - 1.40 mm).

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). If the 0.055 inch (1.397 mm) maximum gap limit is not met, replace the standard Type D blades with the modified blades with wider platforms or the Type A blades with the narrower platform as necessary to get the 0.020 - 0.055 inch (0.51 - 1.40 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

(20) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

(a) If the blade platform width is larger than the gap, determine the difference. If the total material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type D blade not installed. If total amount of material to be removed exceeds of 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type D blade not installed. Maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

(b) If total amount of material to be removed exceeds 0.010 inch (0.254 mm), remove additional Type D blade to obtain proper fit and remove material in approximately equal amounts from both sides of Type D blade platform.

(c) If total amount of material to be removed exceeds 0.080 inch (2.032 mm), remove additional Type A blades in addition to Type D blades as required to obtain the 0.020 − 0.055 inch (0.51 − 1.397 mm) fit. Remove material in equal amounts from both sides of platform on these Types D and A blades. Maximum material removal per platform side must not exceed 0.005 inch (0.127 mm). Type A blades with trimmed platforms must be identified with a square symbol in their respective service time marking areas. See Chapter 70−11, Standard Practices Manual, PN 585005.

(d) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). SB PW4ENG 72−434 provides blades with platforms that are 0.015 inch (0.381 mm) oversize. If the 0.055 inch (1.397 mm) maximum gap limit is not met, interchange these wider platform blades with Type A blades as needed to meet the 0.020 − 0.055 inch (0.51 − 1.397 mm) limit.

(21) If necessary, grind HPC 11th stage blade platforms per 72−35−38, Assembly−02 (Task 72−35−38−440−002). As an alternate to grinding platforms on Type A and/or Type D blades, PN 53H111 blades may be used in their place. These blades have platforms which are preground to 0.010 inch (0.254 mm) undersize. Replace one or more Type A and/or Type D blades with the preground blade as required to obtain the 0.020 − 0.055 inch (0.51 − 1.397 mm) fit.

(22) If grinding of blade platforms was required, install Type D blade in slot and check gap. Continue grinding and checking gap until 0.020 − 0.055 inch (0.51 − 1.397 mm) limit is met.

(23) After gap limits have been met, remove all blades from right side of slot and place them in order of removal on bench. Remove all blades from left side of slot and place them in order of removal on bench.

NOTE: Four blades are to remain in disk. These are the first set of four blades (two Types B and C) and two blade locks installed at beginning of this procedure.

(24) Apply Antigallant Compound P06-036 or Dry Film Lubricant P06-041 to seals (side opposite flat side) and to drum groove.

(25) Aligning slots, prepare to install blade seal to drum, flat side out. Seal will be installed from left to right. Selecting blades from bench in same order in which they were previously installed in right side of drum, install blades to seal and drum, and move (slide) blade and seal to right. See Figure 1005.

NOTE: Use nonmetallic drift and mallet to move blades and seals around drum.

(26) Install remaining right side blades into seal and drum per schematic view Figure 1006. Install four Type D blade equally spaced as per figure.

(27) When blades and seal have been installed at right side, install left side blades and seal per instructions above except moving blades and seal from right to left. See Figure 1006. Install four Type D blades equally spaced as per figure.

(28) At this point, four (two Types B and C) blades of the second set should remain on bench. Install Type C blade into drum slot and move to right. Install Type B blade into slot and move left.

(29) Install blade lock and move to right. Install remaining Type B blade and move to right. The last Type C blade and lock can only be inserted in drum by shifting all blades to right. Therefore, rotate drum 180 degrees and loosen blade lock screws. Move all blades and seals to right. Install blade lock in drum slot and move left. Install Type C blade in drum.

(30) Move all blades and seals to left, aligning one blade lock with "V" mark made on drum at beginning of this procedure. Tighten and torque all blade locks to running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multispline setscrews.

(31) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

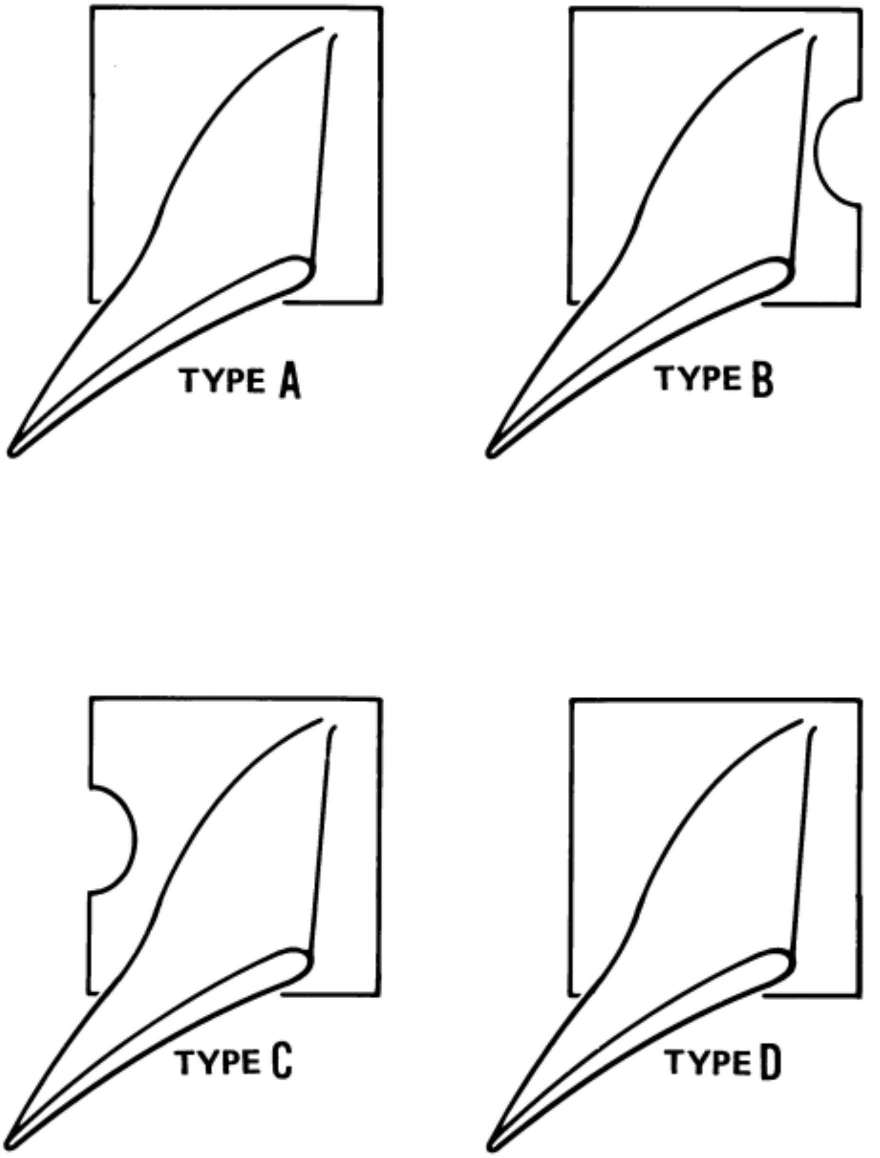
(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

(32) Use a feeler gage to measure the gap, which extends between the loading slots, in each 180 degree arc on the two sides of the drum. Each arc must have a 0.010 − 0.030 inch (0.254 − 0.762 mm) gap, measure both sides at the same time. If the gap in not in limit, you must change blades from one side of the rotor to the other, or additional material can be removed from the blade platforms on the side that is too tight. If material is removed you must also keep the 0.020 − 0.055 inch (0.51 − 1.40 mm) gap limit.

D. Postrequisites

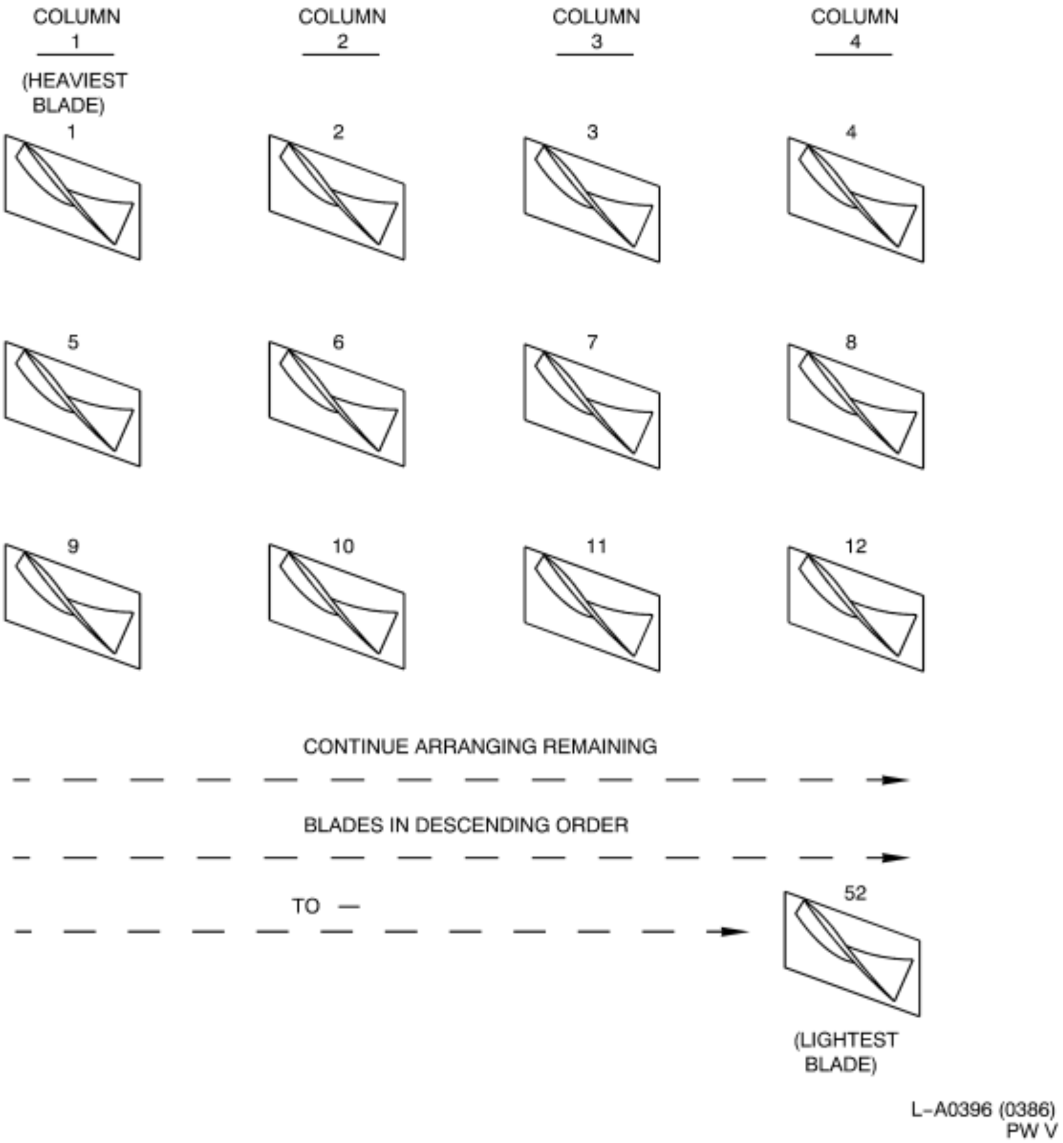
(1) Assemble 10th stage blades to (debladed) axial compressor rotor assembly. See Assembly−26, CONFIG−1 Task 72−35−01−440−014).



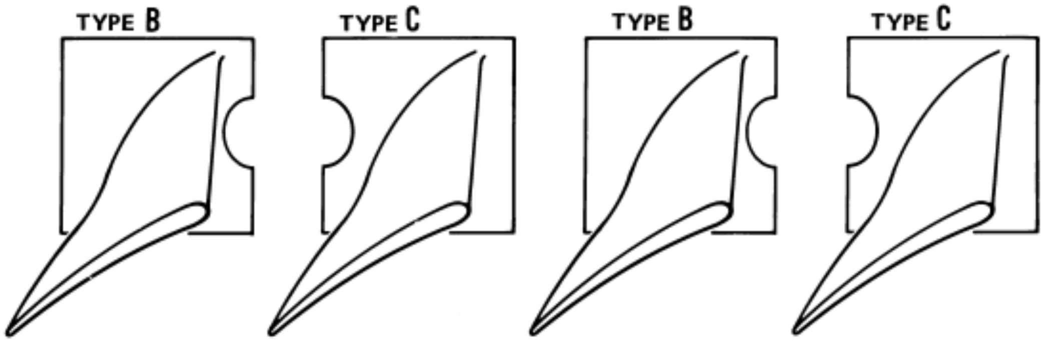
L−A0319

Blade Identification
Figure 1001
(Task 72−35−01−440−013)

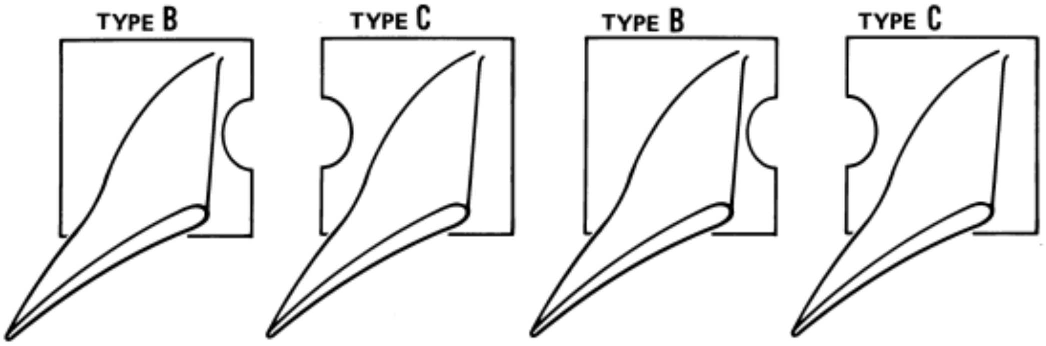
AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−25


COLUMN 1
COLUMN 2
COLUMN 3
COLUMN 4
(HEAVIEST BLADE)
1
2
3
4
5
6
7
8
9
10
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO —
52
(LIGHTEST BLADE)
L−A0396 (0386)
PW V

Blade Weight Arrangement
Figure 1002
(Task 72−35−01−440−013)


TYPE B
TYPE C
TYPE B
TYPE C

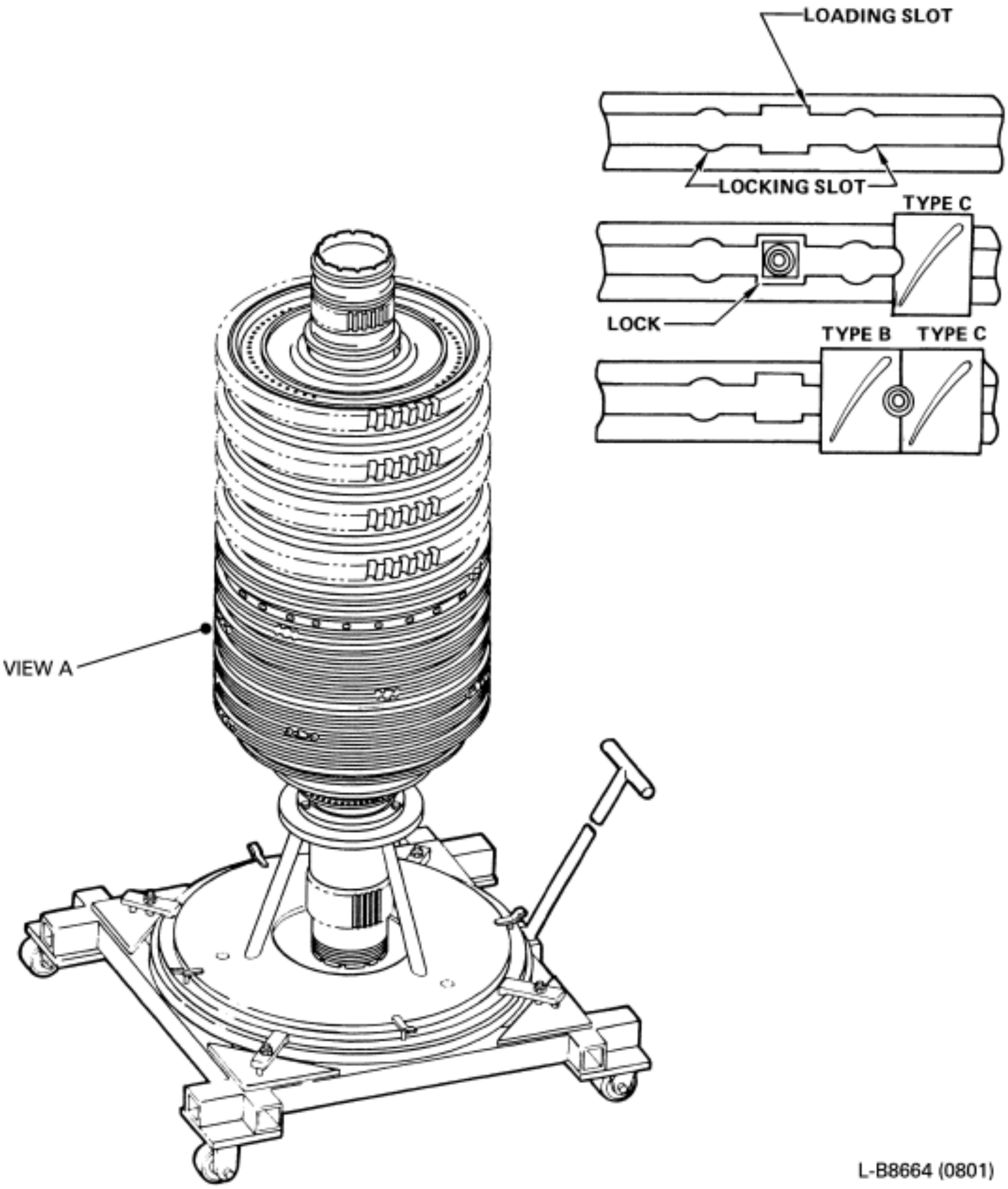
SET 1


TYPE B
TYPE C
TYPE B
TYPE C

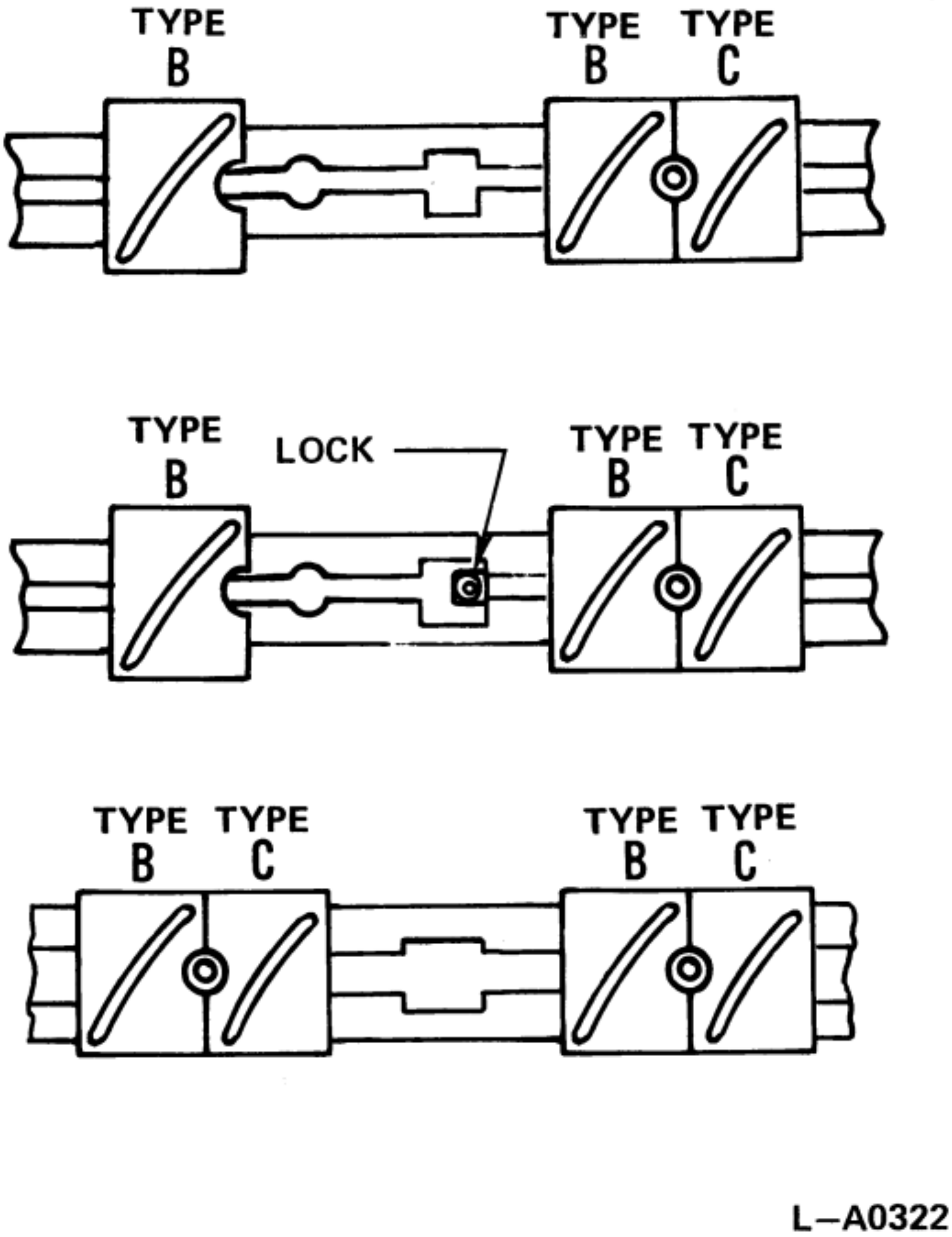
SET 2

L-A0320

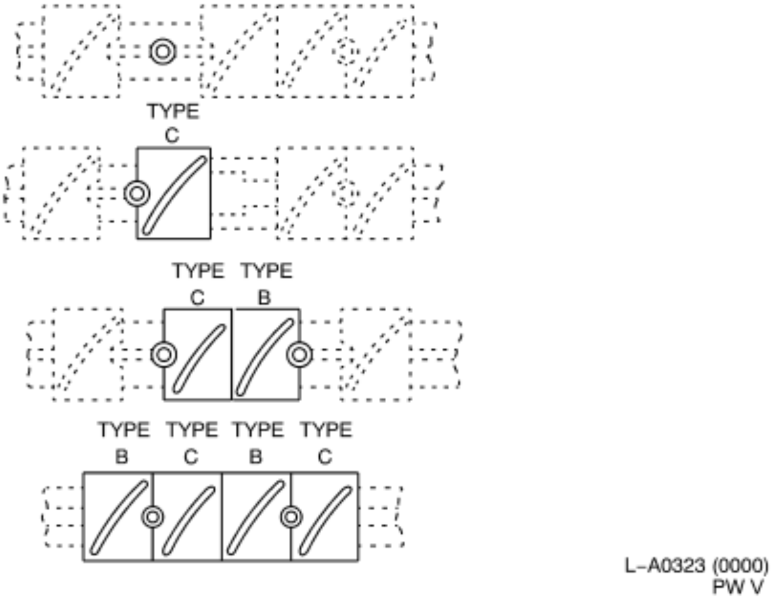
Blade Sets
Figure 1003
(Task 72-35-01-440-013)


LOADING SLOT
LOCKING SLOT
TYPE C
LOCK
TYPE B
TYPE C
VIEW A
L-B8664 (0801)

Blade And Lock Installation
Figure 1004 (Sheet 1)
(Task 72-35-01-440-013)

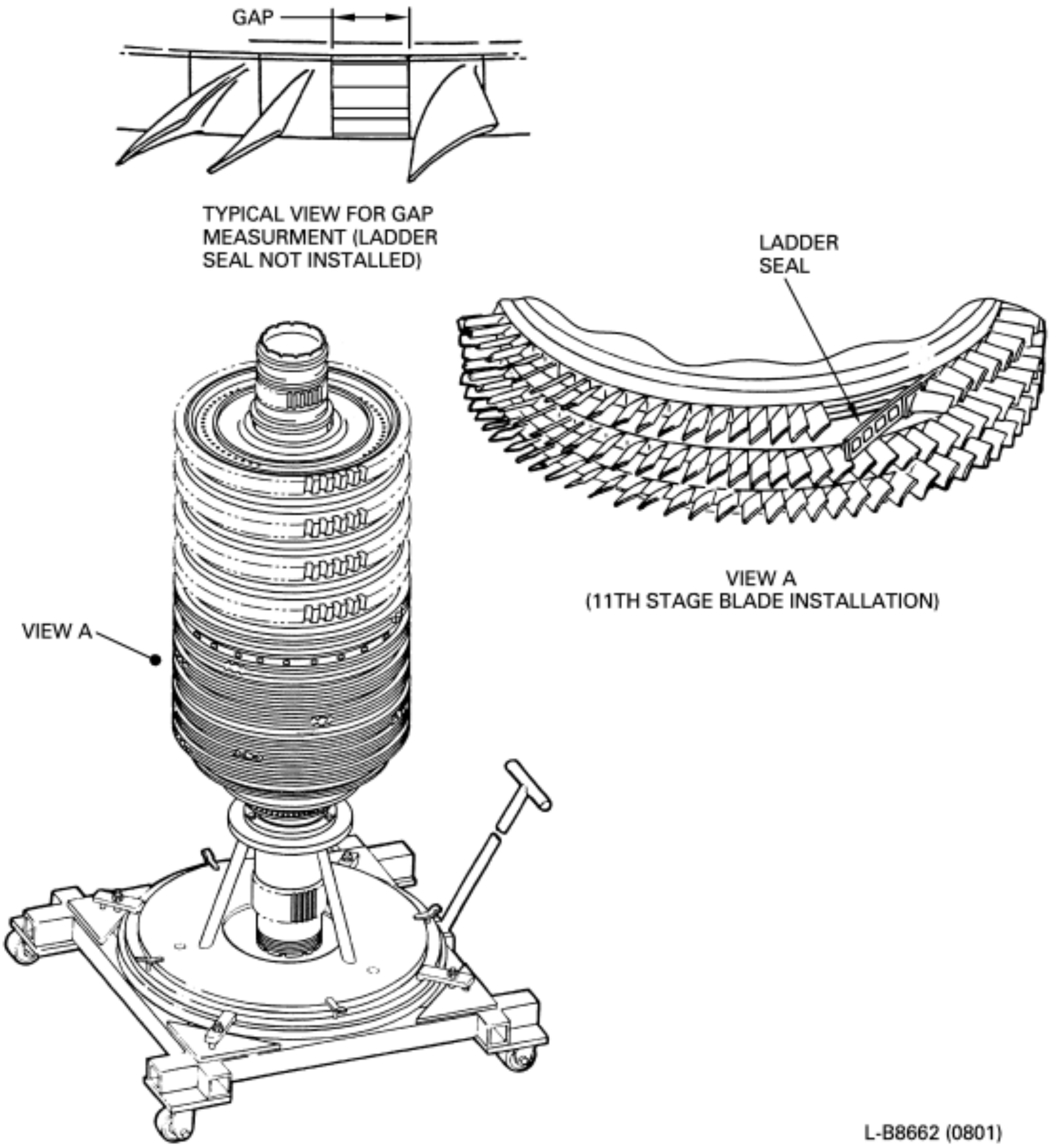

TYPE B
TYPE B
TYPE C
TYPE B
LOCK
TYPE B
TYPE C
TYPE B
TYPE C
TYPE B
TYPE C
L-A0322

Blade And Lock Installation
Figure 1004 (Sheet 2)
(Task 72-35-01-440-013)


TYPE
C
TYPE
C
TYPE
B
TYPE
B
TYPE
C
TYPE
B
TYPE
C
L-A0323 (0000)
PW V

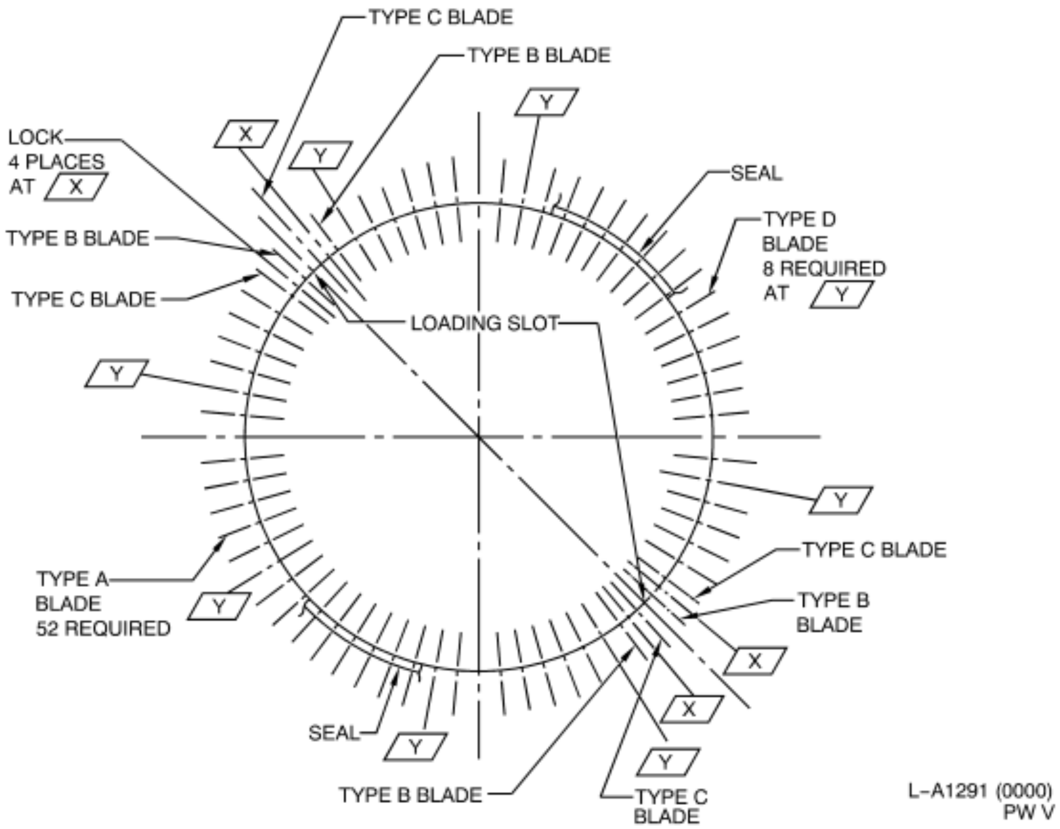
Blade And Lock Installation
Figure 1004 (Sheet 3)
(Task 72-35-01-440-013)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−25


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A (11TH STAGE BLADE INSTALLATION)
VIEW A
L-B8662 (0801)

Gap Measurement And Seal Installation
Figure 1005
(Task 72−35−01−440−013)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−25


TYPE C BLADE
TYPE B BLADE
Y
X
Y
LOCK
4 PLACES
AT X
TYPE B BLADE
TYPE C BLADE
SEAL
TYPE D
BLADE
8 REQUIRED
AT Y
LOADING SLOT
Y
Y
TYPE C BLADE
TYPE B
BLADE
TYPE A
BLADE
52 REQUIRED
Y
X
X
SEAL
Y
Y
TYPE B BLADE
TYPE C
BLADE
L−A1291 (0000)
PW V

Blade And Lock Installation Schematic View
Figure 1006
(Task 72−35−01−440−013)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−25

Task 72−35−01−440−023:

1. Assemble 11Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble 12th stage blades to (debladed) axial compressor rotor assembly. See Assembly−24, CONFIG−2 (Task 72−35−01−440−022).

B. Equipment And Materials Necessary

Special Tools:

PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader
PWA 86447	Drift
PWA 86571	Gage Set
PWA 86652	Drift (Optional To PWA 86447)

Consumable Materials:

Item No.	Designation
P06−036	Compound, Antigallant (PWA 36035)
P06−041	Lubricant, Dry Film (PWA 36221)

C. Measurement of Z−Plane for HPC Stage 11.

CAUTION: DO NOT OVERTIGHTEN GAGE SET SCREWS DURING INSTALLATION OF GAGES. DAMAGE TO THE DRUM CAN RESULT.

(1) Measure Z−Plane diameter for Stage 11. This procedure is optional and can only be used where blades have been removed. Select the pair of gages from the PWA 86571 Z−Plane Diameter Gage Set. Install gages 180 degrees apart, in blade slots. Turn gage set screws clockwise to move the gages radially out to their most outward position. Use OD micrometers to measure four diameters, every 45 degrees, over the gage tool balls. Calculate Z−Plane diameter of the stage by subtracting twice the reference dimension, marked on each pair of gages, from the average diameter measured over the gage tools balls. Refer to minimum, maximum and nominal Z−Plane diameters listed, for reference only, in Table 1001.

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−25

Stage	Minimum Diameter (Reference)	Maximum Diameter (Reference)	Nominal Diameter (Reference)
11	23.226 inch (589.940 mm)	23.234 inch (590.144 mm)	23.230 inch (590.042 mm)

HPC Front Drum Z−Plane Diameters
Table 1001

D. Procedure

NOTE: There are three part numbers (sets) of blades provided for this stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type A is used for fitting and may require platform grinding. For ease of assembly, blades in this procedure will be referred to as Types A, B and C. See Figure 1001. R

NOTE: (Post SB PW4ENG 72−703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86652 DRIFT OR THE PWA 86447 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(1) Remove 11th stage blades from storage rack and place them on bench. Segregate four each of Type B and Type C blades having notches in their platforms and move to one side. See Figure 1001. R R

(2) Optional, weigh the 11th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70−11−00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

(3) Optional, arrange Type A blade in two columns, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. Lightest blade will be at bottom of Column 2. See Figure 1002.

NOTE: One or more Type A blade may have been used as a fitting blade. Blade will be identified by a square in the service time marking area.

(4) Select two sets of four blades (two Types B and C per set) such that weights of sets are as nearly equal as possible. See Figure 1003.

NOTE: Weights must be nearly equal as sets will be positioned opposite each other after assembly.

(5) Install blades and lock and setscrew assemblies on the right side. See Figure 1002, Figure 1003, Figure 1004, Figure 1005, and Figure 1006.

(a) Find one of two 11th stage loading slots.

(b) Select one of the Type B and C blade sets. Install one Type C blade, leading edge up, into the slot. Move the blade to the right.

(c) Install one lock and setscrew assembly and move it to the right.

(d) Locate the locking slot, at Position K, on the right of the blade loading slot. Move the lock and setscrew assembly into the locking slot and tighten. Torque the setscrew to the running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi-spline setscrews. See Figure 1004.

NOTE: There are four slots that are not used. They are located at, Positions J, on the left and right sides of both loading slots.

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−25

R (e) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

R 1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

R 2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

R 3 If these limits are not kept, check the lock for correct assembly in the disk.

R (f) Use an approved marking pen to make a V mark on the outside diameter platform of the drum and in line with the lock. This mark will be used for future reference.

R (g) Install one Type B blade into slot and move it to the right until it touches the lock and setscrew assembly.

R (h) Rotate the drum 180 degrees. Position the open loading slot toward the operator.

R (i) Find the Type A blades to be installed. Start at the bottom of Column 2 (blade Number 60) and continue up to the top of the column (blade Number 2).

R (j) Install 12 Type A blades, start with blade Number 60, in the loading slot and move each blade to the right until it touches the blade that was installed before.

R (k) Install the remaining Type C blade and move it to the right until it touches the last Type A blade.

R (l) Insert one lock and setscrew assembly and move it to the right until it touches the Type C blade.

R NOTE: Do not tighten the lock.

(m) Install the remaining Type B blade into the loading slot and move it to the right until it touches the lock and setscrew assembly.

(n) Install the 18 remaining Type A blades from Column 2 in the loading slot and move them to the right until each one touches the blade that was installed before.

(6) Install blades and lock and setscrew assemblies on the left side. See Figure 1002, Figure 1003, Figure 1004, Figure 1005, and Figure 1006.

(a) Get a Type C blade from the remaining Type B and C blade set. Install it in the loading slot and move it to the right until it touches the blade that was installed before.

(b) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before.

NOTE: Do not tighten the lock.

(c) Install a Type B blade in the loading slot and move it to the right until it touches the lock.

(d) Find the Type A blades to be installed. Start at the top of Column 1 (blade Number 1) and continue down to the bottom of the column (blade Number 59).

(e) Install 18 Type A blades, start with blade Number 1, in the loading slot and move it to the left until it touches the blade that was installed before.

NOTE: Twelve Type A blades remain that are not installed.

(f) Get a Type B blade from the remaining Type B and C blade set. Install it in the loading slot and move it to the left until it touches the blade that was installed before.

(g) Install a lock and setscrew assembly in the loading slot and move it to the left until it touches the blade that was installed before.

NOTE: Do not tighten the lock.

(h) Install a Type C blade in the loading slot and move it to the left until it touches the lock.

(i) Install, in the order that follows, blade Numbers 59, 57, 55, 53, then Number 51 in the loading slot and move them fully to the right.

(j) Install, in the order that follows, blade Numbers 37, 39, 41, 43, 45, then Number 47 in the loading slot and move them fully to the left.

NOTE: Blade Number 49 is not installed.

(7) Move the blades tangentially to make the widest possible gap between the last installed Type A blades. This gap will be measured and used to compute the specified gap for between the blades.

NOTE: Put the blades in a radially outward direction to prevent a circumferentially serpentine shape to the blades.

(a) Use a PWA 85595 Spreader to load all blades, in the arc, tangentially.

(b) When it is installed, expand the spreader and get the widest possible gap between the blade platforms. If you need help to move the blades, it is permissible to tap lightly on the base of the airfoil with a PWA 86447 or PWA 86652 Drift.

(c) Measure and record the gap dimension.

(d) Find the last blade to be installed. Measure and record the width of the blade platform using a vernier caliper.

(e) Compare the gap dimension with the blade platform width.

(f) The width of the blade platform must measure 0.020 − 0.055 inch (0.51 − 1.40 mm) smaller than the gap dimension.

R (g) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

R (8) Do the procedure that follows to get the correct blade platform width for the measured gap.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type A blades with Type A blades with the narrower platform width to get the correct blade platform gap of 0.020 - 0.055 inch (0.51 - 1.40 mm).

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). If the 0.055 inch (1.397 mm) maximum gap limit is not met, replace the standard Type A blades with the Type A blades with the narrower platform as necessary to get the 0.020 - 0.055 inch (0.51 - 1.40 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

R (9) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

R (a) If blade platform width is larger than the gap, determine the difference.

R (b) If the total material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type A blade not installed.

R (c) If total amount of material to be removed exceeds of 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type A blade not installed. The maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

R (d) If total amount of material to be removed is more than 0.010 inch (0.254 mm), remove additional Type A blades to get the proper fit and remove material in approximately equal amounts from both sides of Type A blade platforms.

R (e) If total amount of material to be removed is more than 0.080 inch (2.032 mm) do as follows:

R 1 Remove additional Type A blades as necessary to get the 0.020 - 0.055 inch (0.51 - 1.40 mm) fit.

R 2 Remove material in equal amounts from both sides of platform on these Types A blades.

R 3 The maximum material removal for each platform side must not be more than 0.005 inch (0.127 mm).

R (f) Type A blades with trimmed platforms must be identified with a square symbol in their
R respective service time marking areas. Refer to
R Standard Practices Manual, PN 585005, Section
R 70-11-00 for approved marking pens.

R (g) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm).

R (10) If necessary, grind the HPC 11th stage blade platforms by 72-35-38 Assembly-02 (Task 72-35-38-440-002).

R (11) If grinding of blade platforms was required, install Type A blade in slot and check gap. Continue grinding and checking gap until 0.020 - 0.055 inch (0.51 - 1.397 mm) limit is met.

R CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86447 OR PWA 86652 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

R (12) After gap limits have been met, remove all blades from right side of slot and place them in order of removal on bench. Remove all blades from left side of slot and place them in order of removal on bench.

R NOTE: Two blades and one blade lock are to remain in disk. These are the Type B and Type C blades and the blade lock that were installed and tightened at start of this procedure.

R (13) Apply Antigallant Compound P06-036 or Dry Film Lubricant P06-041 to ladder seals (side opposite flat side) and to drum groove in the area shown to ease the assembly operation. See Figure 1007.

R (14) Install the right side ladder seals, blades and lock and setscrew assemblies. See Figure 1006.

R NOTE: The blades will be installed in the order that they were removed.

R (a) Put the first ladder seal over the loading slot with the flat surface out.

R (b) Align the first opening in the ladder seal with the loading slot in the disk.

R (c) Install the blade that was last removed from the right side (blade Number 60), leading edge up, through the ladder seal and into the loading slot.

R (d) Move the blade and ladder seal to the right until the second opening is aligned with the loading slot.

R NOTE: Be sure that the ladder seal is correctly installed between the disk rails.

R (e) Install the next four Type A blades to complete the assembly of the first ladder seal. Move this blade and ladder seal assembly fully to the right until it touches the Type B blade that is installed.

R (f) Install the next two Type A blades and move them fully to the right until they touch the blade and ladder seal assembly that was installed.

R (g) Put the second ladder seal over the loading slot with the flat surface out.

R (h) Install the next five Type A blades in the ladder seal by the method used above and move the assembly fully to the right until it touches the last Type A blade that is installed.

R (i) Install a Type C blade, a lock and setscrew assembly, then the next Type B blade. Move them fully to the right until they touch the blades that were installed before.

R NOTE: Do not tighten the lock and setscrew assembly.

R (j) Put the third ladder seal over the loading slot with the flat surface out.

R (k) Install the remaining 18 Type A blades, from Column 2, in the ladder seal by the method used for the first ladder seal and move the assembly fully to the right until it touches the Type B blade that is installed.

R (15) Install partial left side ladder seals, blades and a lock and setscrew assembly. See Figure 1006.

R NOTE: The blades will be installed in the order that they were removed.

R (a) Put the first ladder seal over the loading slot with the flat surface out.

R (b) Align the first opening in the ladder seal with the loading slot in the disk.

R (c) Install the blade that was last removed (blade Number 1), leading edge up, through the ladder seal and into the loading slot.

(d) Move the blade and ladder seal to the left until the second opening is aligned with the loading slot.

NOTE: Be sure that the ladder seal is correctly installed between the disk rails.

(e) Install the next 17 Type A blades to complete the assembly of the first ladder seal. Move this assembly fully to the left until it touches the Type C blade that is installed.

NOTE: Twelve Type A blades remain that are not installed.

(f) Install a Type B blade, a lock and setscrew assembly, then the next Type C blade. Move them fully to the left until they touch the blade and ladder seal assembly that was installed before.

NOTE: Do not tighten the lock and setscrew assembly.

(g) Put the second ladder seal over the loading slot with the flat surface out.

(h) Install the next five Type A blades in the ladder seal by the method used for the first ladder seal and move the assembly fully to the left until it touches the Type C blade that is installed.

NOTE: Seven Type A blades, one Type B blade, one Type C blade and one lock assembly remain.

(16) Install the remaining blades and lock and setscrew assembly.

(a) Install the remaining Type C blade and move it fully to the right until it touches the blade that was installed before.

(b) Install the last lock and setscrew assembly in the drum slot and move it to the left.

NOTE: Do not tighten the lock.

(c) Install the remaining Type B blade and move it fully to the right until it touches the blade that was installed before.

(d) Put the ladder seal over the loading slot with the flat surface out.

(e) Align the first opening in the ladder seal with the loading slot in the disk.

(f) Install, in the order that follows, blade Numbers 59, 57, 55, 53, then Number 51 through the ladder seal opening and into the loading slot. Move the assembly fully to the right.

NOTE: Two Type A blades have not been installed.

(g) The last Type A blades can only be inserted in the drum by moving all blades to the right. To do this, you must rotate the drum 180 degrees and loosen the blade lock screw.

(h) Rotate the drum 180 degrees again to the opposite loading slot.

(i) Move all blades, ladder seals and locks to the right, as necessary to install blade Number 49 then Number 47.

(17) Move the blades, ladder seals and locks to the final positions.

(a) Move all blades, ladder seals and locks to the left. Align the blade lock with the V mark you made on the drum at beginning of this procedure.

(b) Position, tighten and torque the lock and setscrew assembly that is located at the locking slot near the V mark.

1 Torque the setscrew to the running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi-spline setscrews.

(18) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow: See Figure 1004 (Sheet 1).

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

R (b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

R (c) If these limits are not kept, check the lock for correct assembly in the disk.

R (19) Position, tighten and torque the remaining lock and setscrew assemblies.

R (a) Check the gaps, all gaps between the ladder seals should be approximately equal.

R (b) Torque the setscrew to the running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi-spline setscrews.

R (20) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow: See Figure 1004 (Sheet 1).

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1005. R

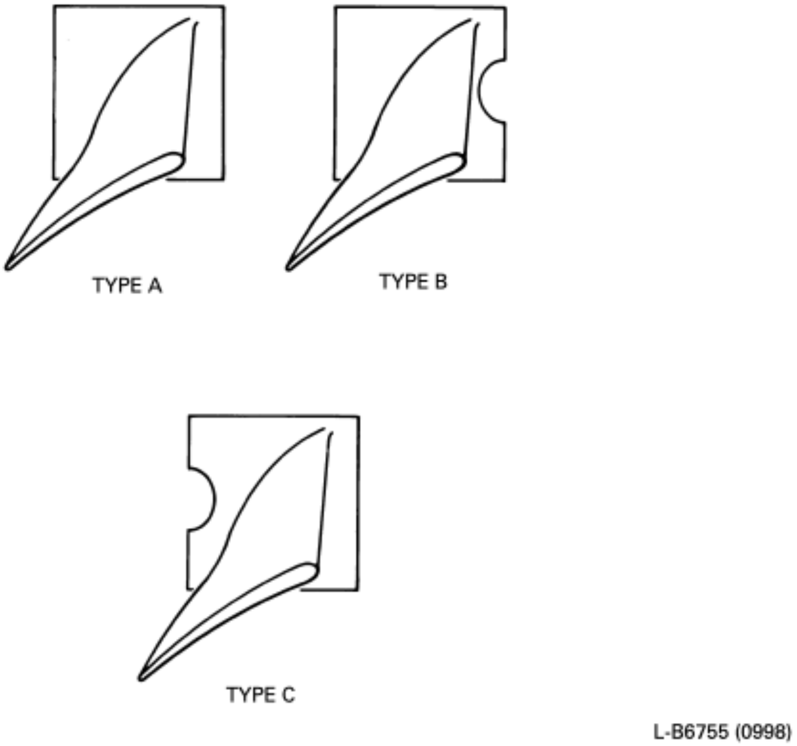
(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

R (c) If these limits are not kept, check the lock for correct assembly in the disk.

E. Postrequisites

(1) Assemble 10th stage blades to (debladed) axial compressor rotor assembly. See Assembly-26, CONFIG-2 (Task 72-35-01-440-024).

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-25


TYPE A
TYPE B
TYPE C
L-B6755 (0998)

Blade Identification
Figure 1001
(Task 72-35-01-440-023)

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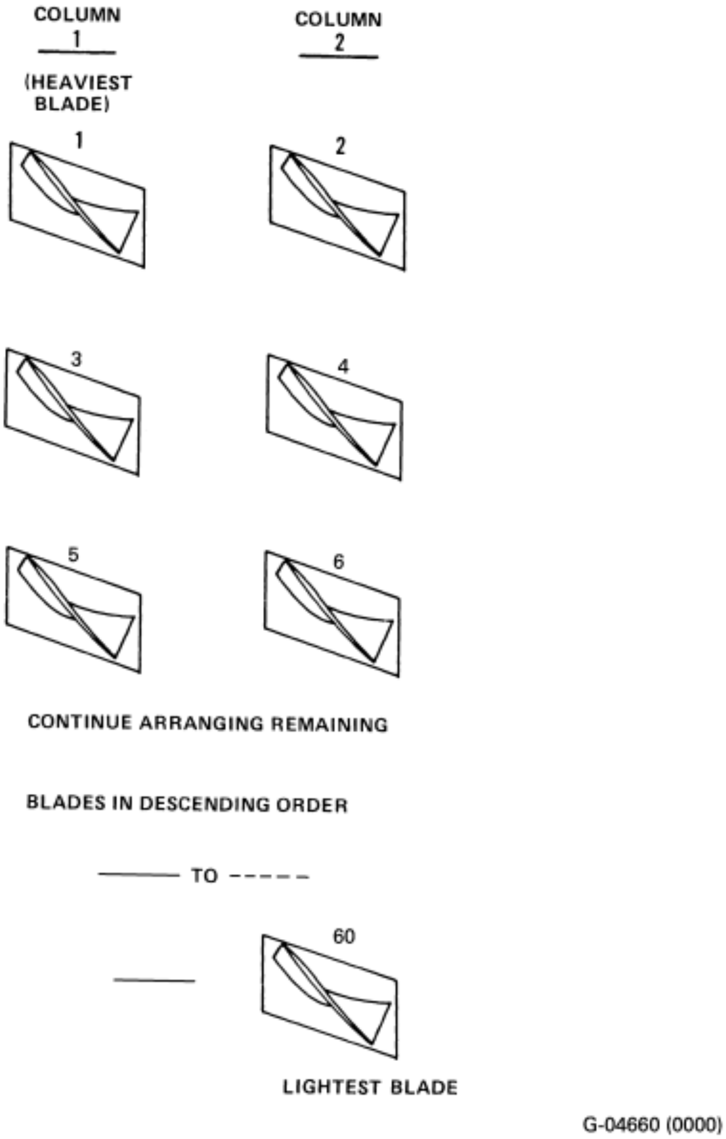
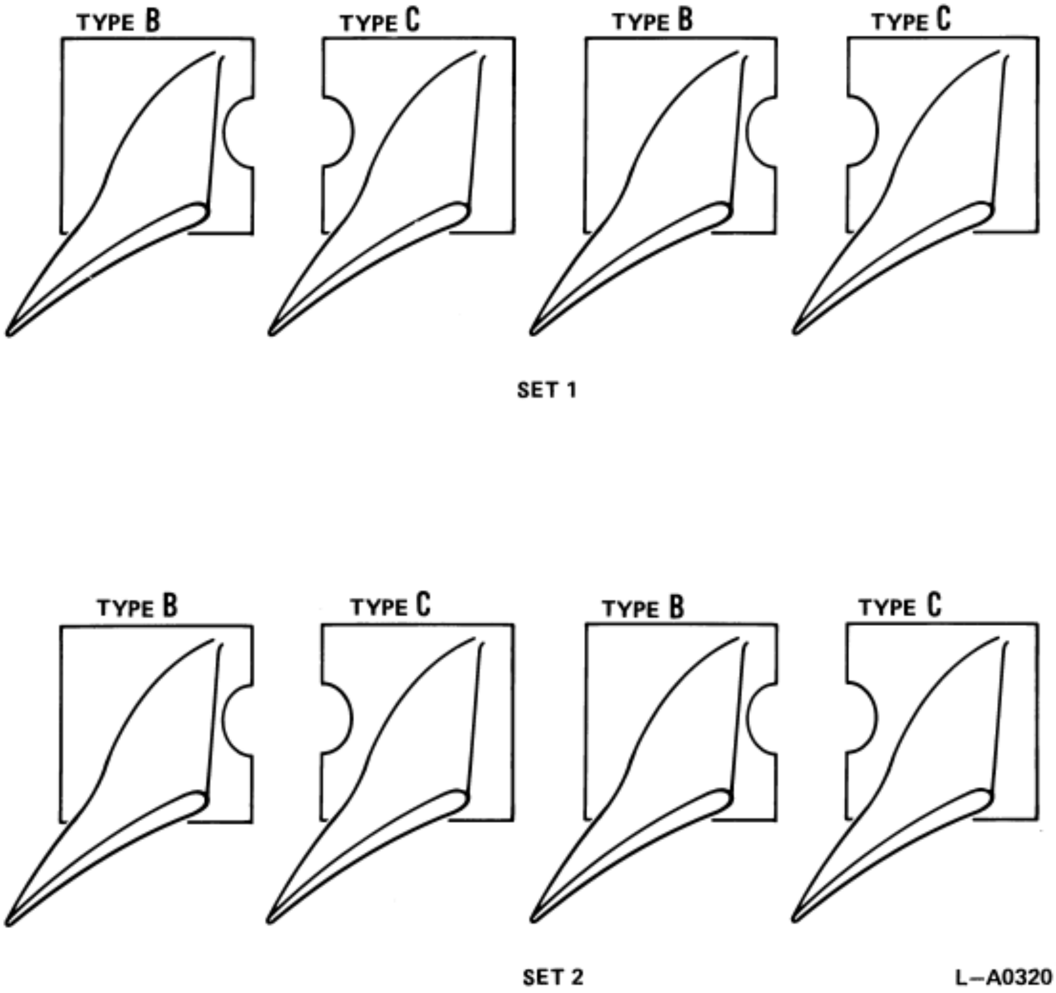
AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−25


COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
1
2
3
4
5
6
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
——— TO - - - - -
60
LIGHTEST BLADE
G-04660 (0000)

Blade Weight Arrangement
Figure 1002
(Task 72−35−01−440−023)


TYPE B
TYPE C
TYPE B
TYPE C
SET 1
TYPE B
TYPE C
TYPE B
TYPE C
SET 2
L−A0320

R Type B And Type C Blade Set Arrangement
Figure 1003
(Task 72−35−01−440−023)

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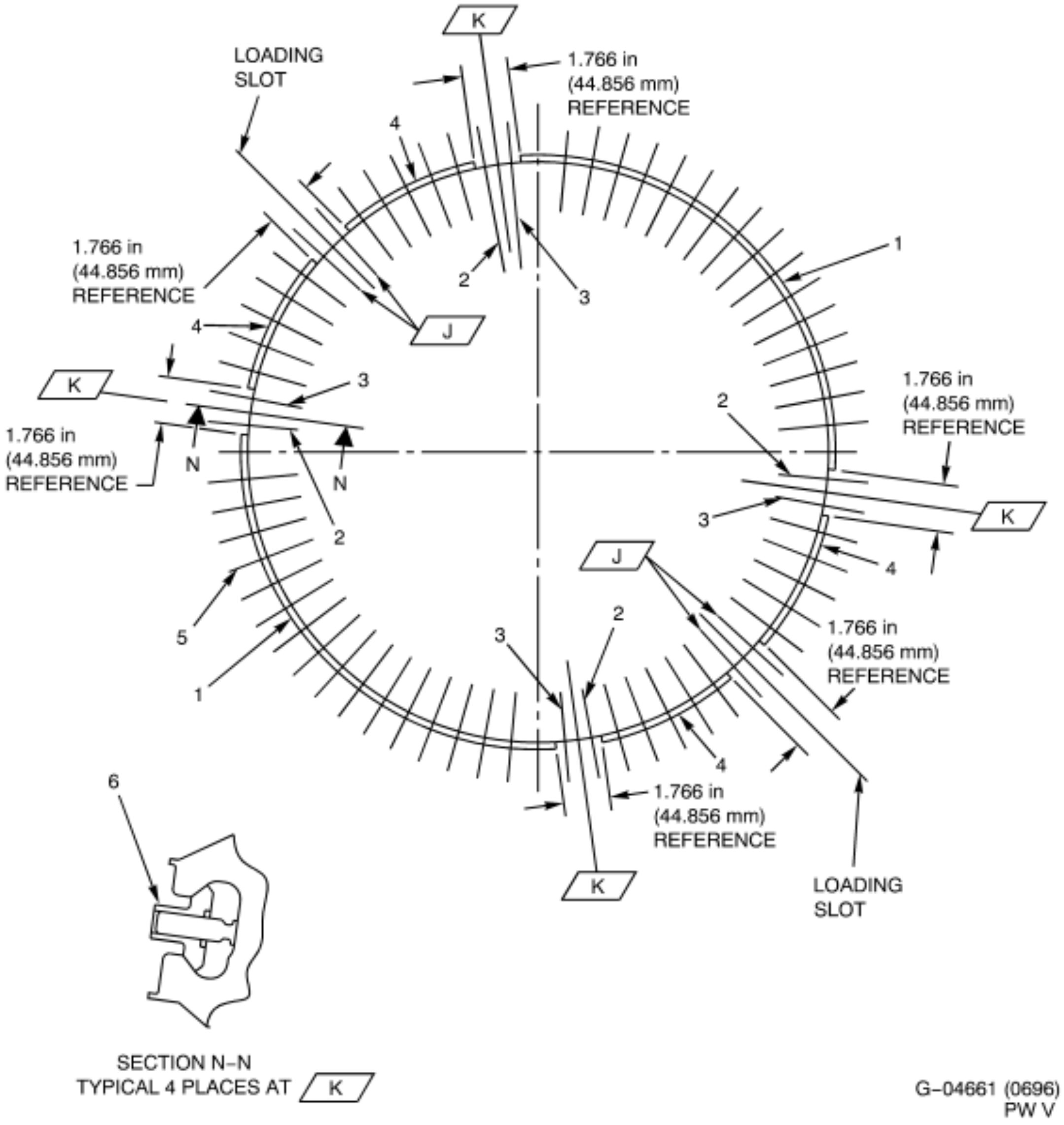
K
LOADING SLOT
1.766 in (44.856 mm) REFERENCE
4
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J
1.766 in (44.856 mm) REFERENCE
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K
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1.766 in (44.856 mm) REFERENCE
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1.766 in (44.856 mm) REFERENCE
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K
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J
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1.766 in (44.856 mm) REFERENCE
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1.766 in (44.856 mm) REFERENCE
K
LOADING SLOT
6
SECTION N-N
TYPICAL 4 PLACES AT K
G-04661 (0696)
PW V

Blade And Lock Installation Schematic View

R Figure 1004 (Sheet 1)

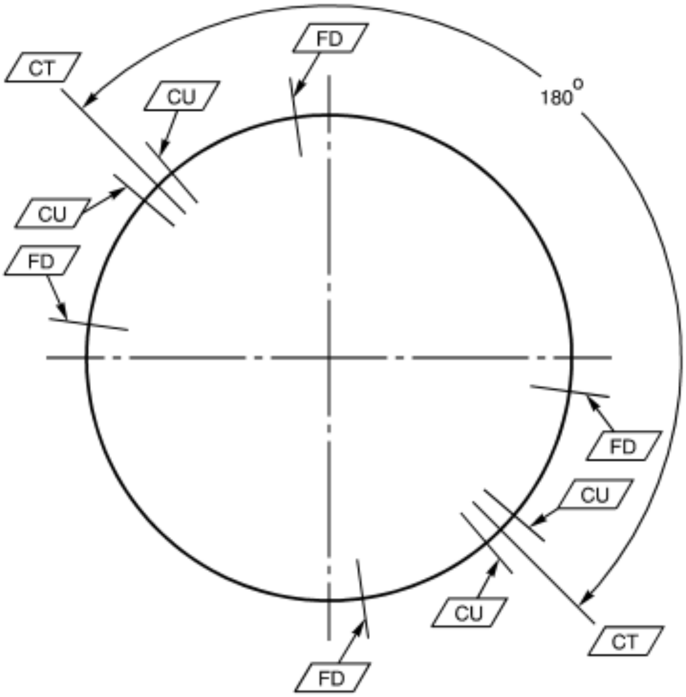
(Task 72-35-01-440-023)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-25

R 1. Ladder Seals (Covers 18 Blades)
R 2. Type C Blades
R 3. Type B Blades
R 4. Ladder Seals (Covers Four Blades)
R 5. Type A Blades
R 6. Lock And Setscrew Assembly

R Key to Figure 1004 (Sheet 1)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−25



CT	BLADE LOADING SLOT (2 LOCATIONS)
FD	BLADE LOCKING SLOT (4 LOCATIONS)
CU	BLADE LOCKING SLOT (NOT USED) (4 LOCATIONS)

L−B8077 (0600)
PW V

Blade Loading And Lock Slot Locations Schematic View
R Figure 1004 (Sheet 2)
(Task 72−35−01−440−023)

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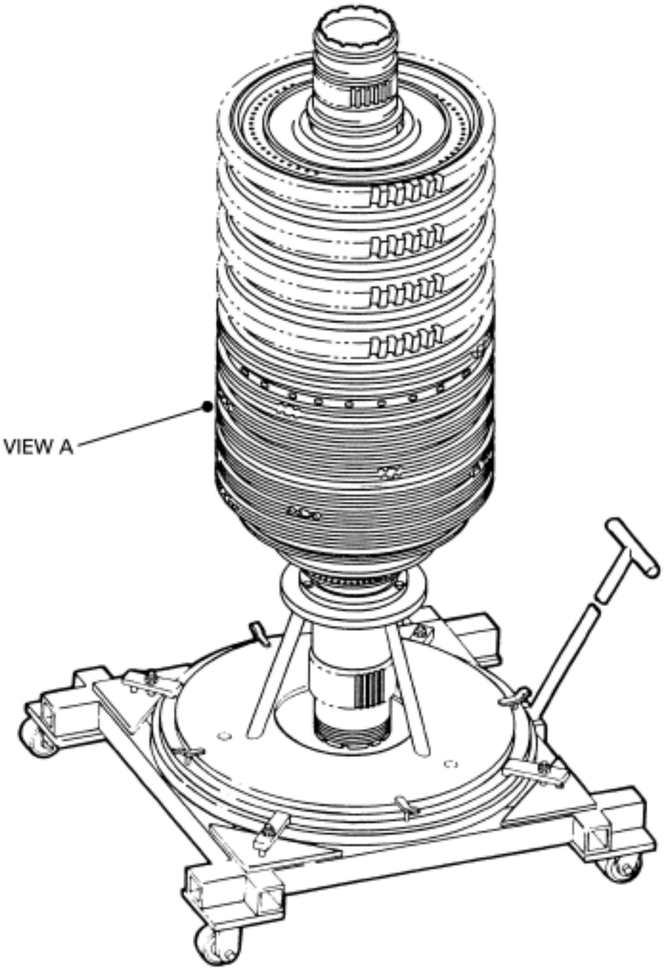

G-04616 (0000)

Blade And Lock Installation
R Figure 1005 (Sheet 1)
(Task 72-35-01-440-023)

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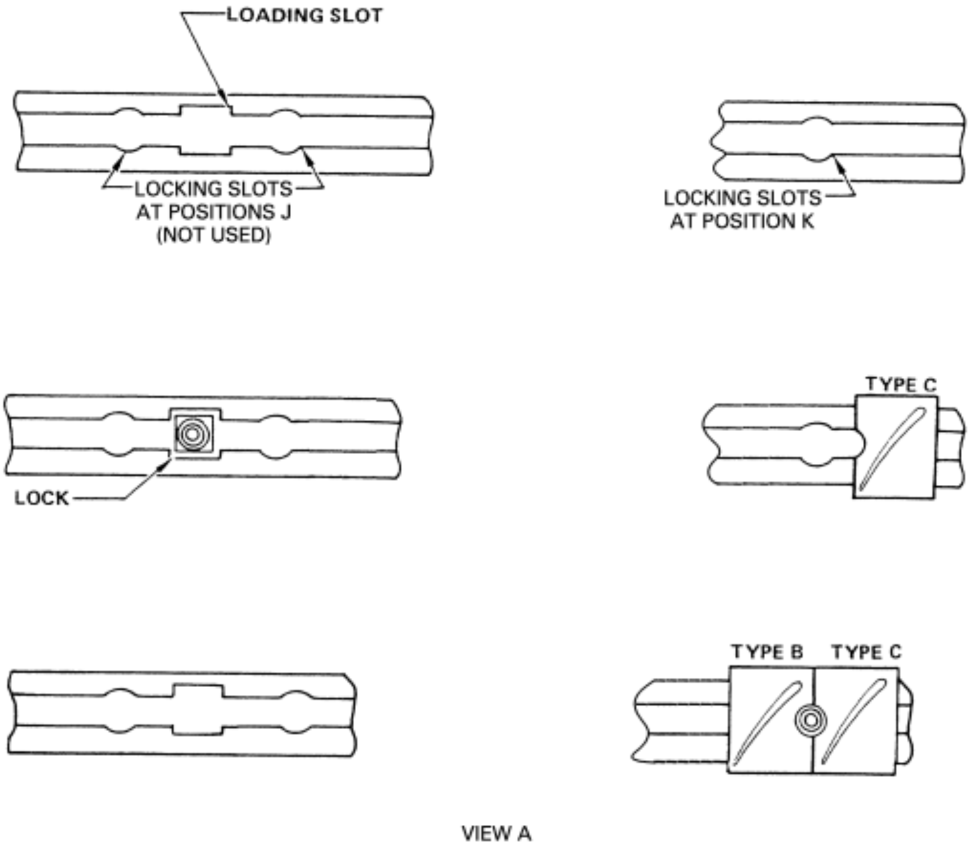
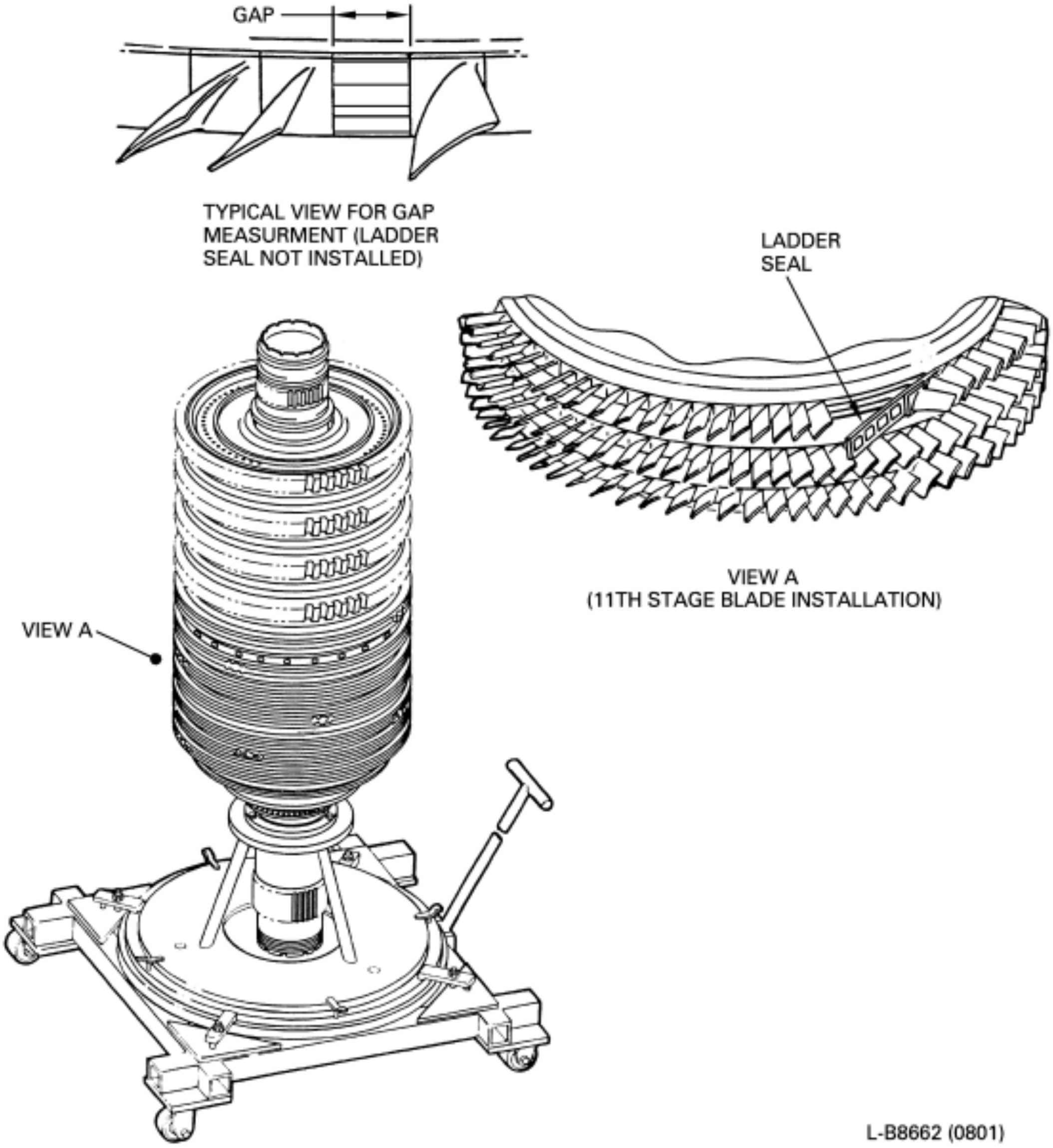

LOADING SLOT
LOCKING SLOTS AT POSITIONS J (NOT USED)
LOCKING SLOTS AT POSITION K
TYPE C
LOCK
TYPE B
TYPE C
VIEW A

G-04617 (0000)

Blade And Lock Installation
R Figure 1005 (Sheet 2)
(Task 72-35-01-440-023)


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A
(11TH STAGE BLADE INSTALLATION)
VIEW A
L-B8662 (0801)

Gap Measurement And Ladder Seal Installation
R Figure 1006
(Task 72−35−01−440−023)

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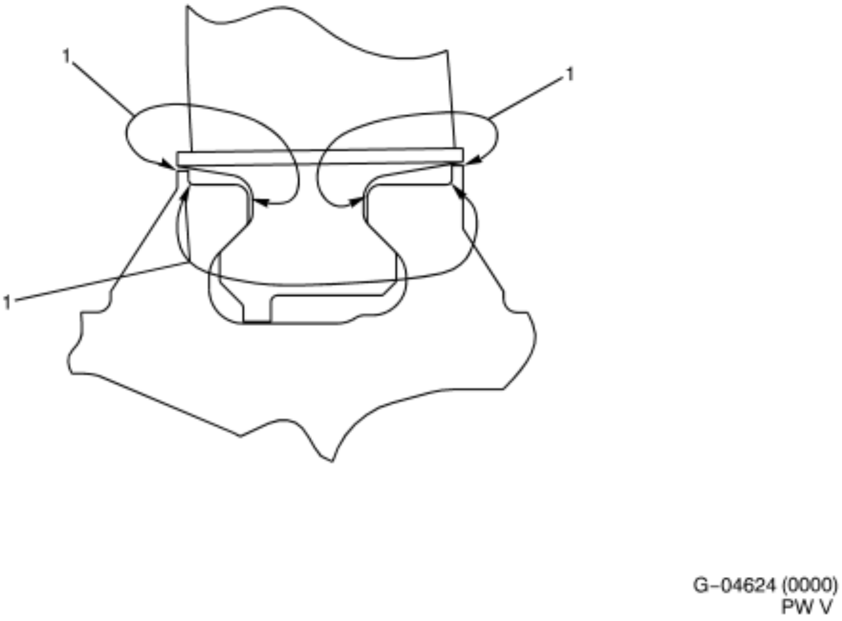


R 1. Antigallant Treatment Areas

R Antigallant Application Areas
R Figure 1007
R (Task 72-35-01-440-023)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-26

Task 72-35-01-440-014:

1. Assemble 10Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble 11th stage blades to (debladed) axial compressor rotor assembly. See Assembly-25, CONFIG-1 (Task 72-35-01-440-013).

B. Equipment And Materials Necessary

Special Tools:

PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader
PWA 86447	Drift
PWA 86571	Gage Set
PWA 86652	Drift (Optional To PWA 86447)

Consumable Materials:

Item No.	Designation
P06-036	Compound, Antigallant (PWA 36035)
P06-041	Lubricant, Dry Film (PWA 36221)

C. Procedure
See Figure 1001, Figure 1002, Figure 1003, Figure 1004, Figure 1005 and Figure 1006.

NOTE: There are four part numbers (sets) of blades provided for this stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type D is used for fitting and may require platform grinding. SB PW4ENG 72-434 provides blades with platforms that are 0.015 inch (0.381 mm) oversize. For ease of assembly, blades in this procedure will be referred to as Types A, B, C and D.

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-26

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

CAUTION: DO NOT OVERTIGHTEN GAGE SET SCREWS DURING INSTALLATION OF GAGES. DAMAGE TO THE DRUM CAN RESULT.

(1) Measure Z-Plane diameters for Stage 10. This procedure is optional and can only be used where blades have been removed. Select the pair of gages, marked for that stage, from the PWA 86571 Z-Plane Diameter Gage Set. Install gages, 180 degrees apart, in blade slots. Turn gage set screws clockwise to move the gages radially out to their most outward position. Use OD micrometers to measure four diameters, every 45 degrees, over the gage tool balls. Calculate Z-Plane diameter of the stage by subtracting twice the reference dimension, marked on each pair of gages, from the average diameter measured over the gage tools balls. Refer to minimum, maximum and nominal Z-Plane diameters listed, for reference only, in Table 1001.

Stage	Minimum Diameter (Reference)	Maximum Diameter (Reference)	Nominal Diameter (Reference)
10	23.112 inch (587.045 mm)	23.120 inch (587.248 mm)	23.116 inch (587.146 mm)

HPC Front Drum Z-Plane Diameters
Table 1001

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86652 DRIFT OR THE PWA 86447 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(2) Remove 10th stage blades from storage rack and place them on bench. Segregate eight Types B and C blades having notches in their platforms and move to one side. Also locate eight Type D blade and move to one side. See Figure 1001.

(3) Optional, weigh the 10th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70-11-00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

(4) Optional, arrange Type A blade in four columns, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. Lightest blade will be at bottom of Column 2. See Figure 1002.

NOTE: One or more Type A blade may have been used as a fitting blade. Blade will be identified by a square in the service time marking area.

(5) Select two sets of four blades (two Types B and C per set) such that weights of sets are as nearly equal as possible. See Figure 1003.

NOTE: Weights must be nearly equal as sets will be positioned opposite each other after assembly.

(6) Selecting one of the blade sets, and with loading slot of disk facing operator, install one Type C blade, leading edge up, into slot. Move blade to right. Install one lock and setscrew and move to right. Install one Type B blade into slot. Move to right. See Figure 1004 (Sheet 1).

(7) From the same set, install remaining Type B blade into slot and move to left. Install one lock and setscrew and move to left. Install remaining Type C blade and move to left. See Figure 1004 (Sheet 2).

(8) Locate locking slot to left of blade loading slot. Move left lock to left locking slot and tighten and torque setscrew to running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi-spline setscrews.

(9) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

(10) Using approved marking pen, mark OD platform of drum in line with lock with "V" for future reference.

(11) Move Type C blade (right side of lock) to the left to rest against lock. See Figure 1004 (Sheet 3).

(12) Move Type B blade and right lock to left and lock setscrew to running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(13) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

(14) Push two remaining Types B and C blades to butt against just−installed locks. See Figure 1004 (Sheet 3).

(15) Rotate drum 180 degrees. Position open blade slot toward operator.

(16) Starting at bottom of 4th column of weight−ordered Type A blade, and proceeding vertically from bottom of column to top, position each blade into loading slot and move to right to rest against previously installed blades and lock. When 4th column of blades is used, start at bottom of 2nd column and position each blade into loading slot and to right until all blades from Column 2 are inserted.

(17) Starting at top of 3rd column of blades, position each blade into loading slot and move to left to rest against blades at opposite end. When 3rd column of blades is used, start at top of 1st column and position each blade into loading slot and to left until all blades from Column 1 are inserted.

(18) Install two blades from remaining Types B and C sets into loading slot and move to left. Install remaining two blades from Types B and C sets to slot and move to right. Remaining blades should be eight Type D blade which will be used for fitting. Install seven of the Type D blades in slot and load all blades tangentially so as to form widest possible gap at disk loading slot. Measure gap using PWA 85595 Spreader. See Figure 1005.

   (a) Place spreader into vacant blade space. Expand spreader with torque handle and measure blade gap with a vernier caliper. Record this dimension.

   (b) Measure platform width of Type D blade, not installed in drum, with vernier caliper. Record this dimension.

   (c) Compare the gap dimension with the blade platform width dimension.

   (d) The width of the blade platform must measure 0.020 − 0.055 inch (0.51 − 1.40 mm) smaller than the gap measured at the drum loading slot between the blades.

   (e) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

(19) Do the procedure that follows to get the correct blade platform width for the measured gap.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type D blades with oversized blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.020 − 0.055 inch (0.51 − 1.40 mm).

NOTE: (Post SB PW4ENG 72−703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). If the 0.055 inch (1.397 mm) maximum gap limit is not met, replace the standard Type D blades with the modified blades with wider platforms or the Type A blades with the narrower platform as necessary to get the 0.020 − 0.055 inch (0.51 − 1.40 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

(20) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

(a) If blade platform width is larger than the gap, determine the difference. If the total material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type D blade not installed. If total amount of material to be removed exceeds of 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type D blade not installed. Maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

(b) If total amount of material to be removed exceeds 0.010 inch (0.254 mm), remove additional Type D blade to obtain proper fit and remove material in approximately equal amounts from both sides of Type D blade platform.

(c) If total amount of material to be removed exceeds 0.080 inch (2.032 mm), remove additional Type A blades in addition to Type D blades as required to obtain the 0.020 − 0.055 inch (0.51 − 1.40 mm) fit. Remove material in equal amounts from both sides of platform on these Types D and A blades. Maximum material removal per platform side must not exceed 0.005 inch (0.127 mm). Type A blades with trimmed platforms must be identified with a square symbol in their respective service time marking areas. See 70−11, Standard Practices Manual, PN 585005.

(d) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). SB PW4ENG 72−434 provides blades with platforms that are 0.015 inch (0.381 mm) oversize. If the 0.055 inch (1.397 mm) maximum gap limit is not met, interchange these wider platform blades with Type A blades as needed to meet the 0.020 − 0.055 inch (0.51 − 1.40 mm) limit.

(21) If necessary, grind HPC 10th stage blade platforms per 72−35−38, Assembly−02 (Task 72−35−38−440−002). As an alternate to grinding platforms on Type A and/or Type D blades, PN 52H410 blades may be used in their place. These blades have platforms which are preground to 0.010 inch (0.254 mm) undersize. Replace one or more Type A and/or Type D blades with the preground blade as required to obtain the 0.020 − 0.055 inch (0.51 − 1.40 mm) fit.

(22) If grinding of blade platforms was required, install Type D blade in slot and check gap. Continue grinding and checking gap until 0.020 − 0.055 inch (0.51 − 1.40 mm) limit is met.

(23) After gap limits have been met, remove all blades from right side of slot and place them in order of removal on bench. Remove all blades from left side of slot and place them in order of removal on bench.

NOTE: Four blades are to remain in disk. These are the first set of four blades (two Types B and C) and two blade locks installed at beginning of this procedure.

(24) Apply Antigallant Compound P06−036 or Dry Film Lubricant P06−041 to seals (side opposite flat side) and to drum groove.

(25) Aligning slots, prepare to install blade seal to drum, flat side out. Seal will be installed from left to right. Selecting blades from bench in same order in which they were previously installed in right side of drum, install blades to seal and drum, and move (slide) blade and seal to right. See Figure 1005.

NOTE: Use nonmetallic drift and mallet to move blades and seals around drum.

(26) Install remaining right side blades into seal and drum per schematic view Figure 1006. Install four Type D blades equally spaced as per figure.

(27) When blades and seal have been installed at right side, install left side blades and seal per instructions above except moving blades and seal from right to left. See Figure 1006. Install four Type D blade equally spaced as per figure.

(28) At this point, four (two Types B and C) blades of the second set should remain on bench. Install Type C blade into drum slot and move to right. Install Type B blade into slot and move left.

(29) Install blade lock and move to right. Install remaining Type B blade and move to right. The last Type C blade and lock can only be inserted in drum by shifting all blades to right. Therefore, rotate drum 180 degrees and loosen blade lock screws. Move all blades and seals to right. Install blade lock in drum slot and move left. Install Type C blade in drum.

(30) Move all blades and seals to left, aligning one blade lock with "V" mark made on drum at beginning of this procedure. Tighten and torque all blade locks to running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multispline setscrews.

(31) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

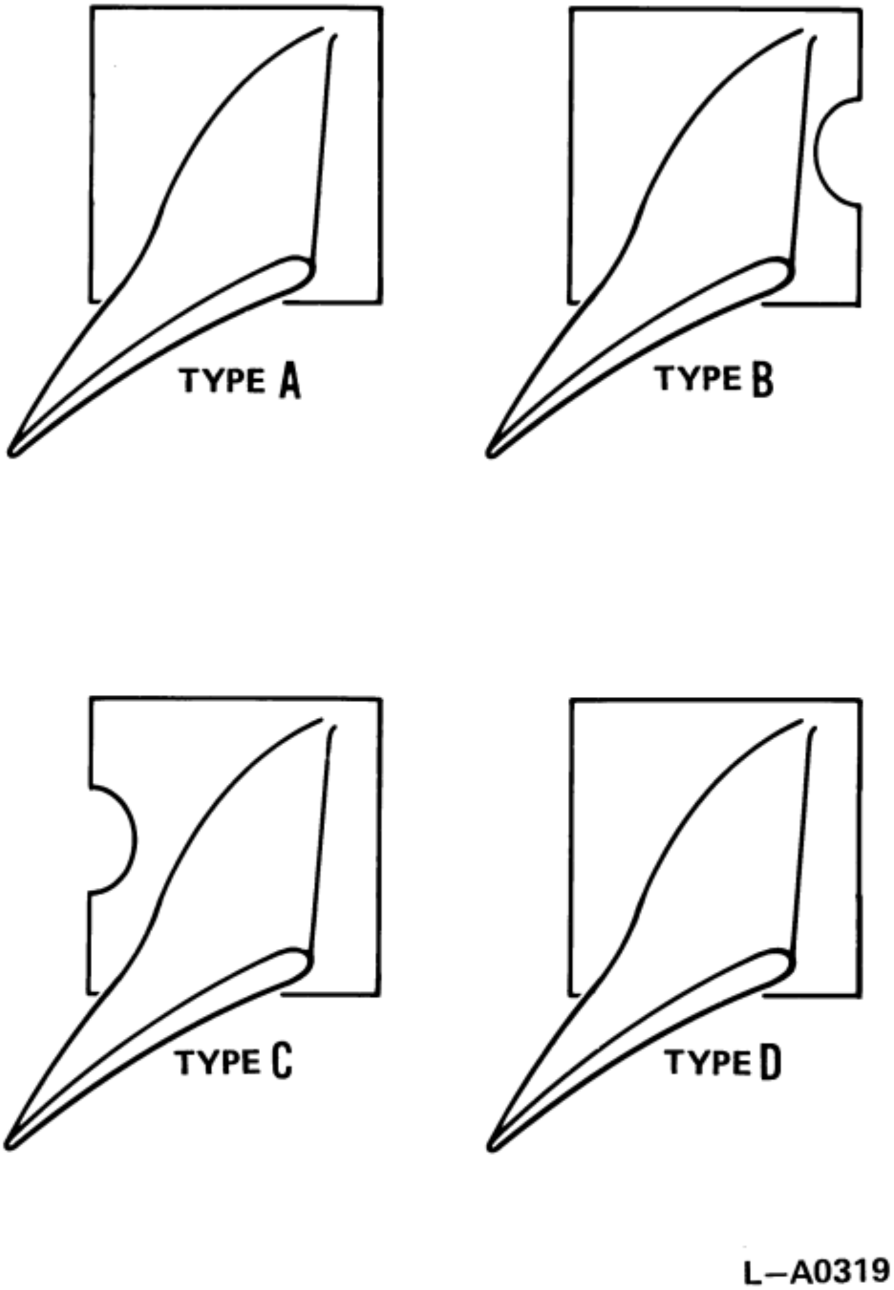
(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

(32) Use a feeler gage to measure the gap, which extends between the loading slots, in each 180 degree arc on the two sides of the drum. Each arc must have a 0.010 − 0.030 inch (0.254 − 0.762 mm) gap, measure both sides at the same time. If the gap in not in limit, you must change blades from one side of the rotor to the other, or additional material can be removed from the blade platforms on the side that is too tight. If material is removed you must also keep the 0.020 − 0.055 inch (0.51 − 1.40 mm) gap limit.

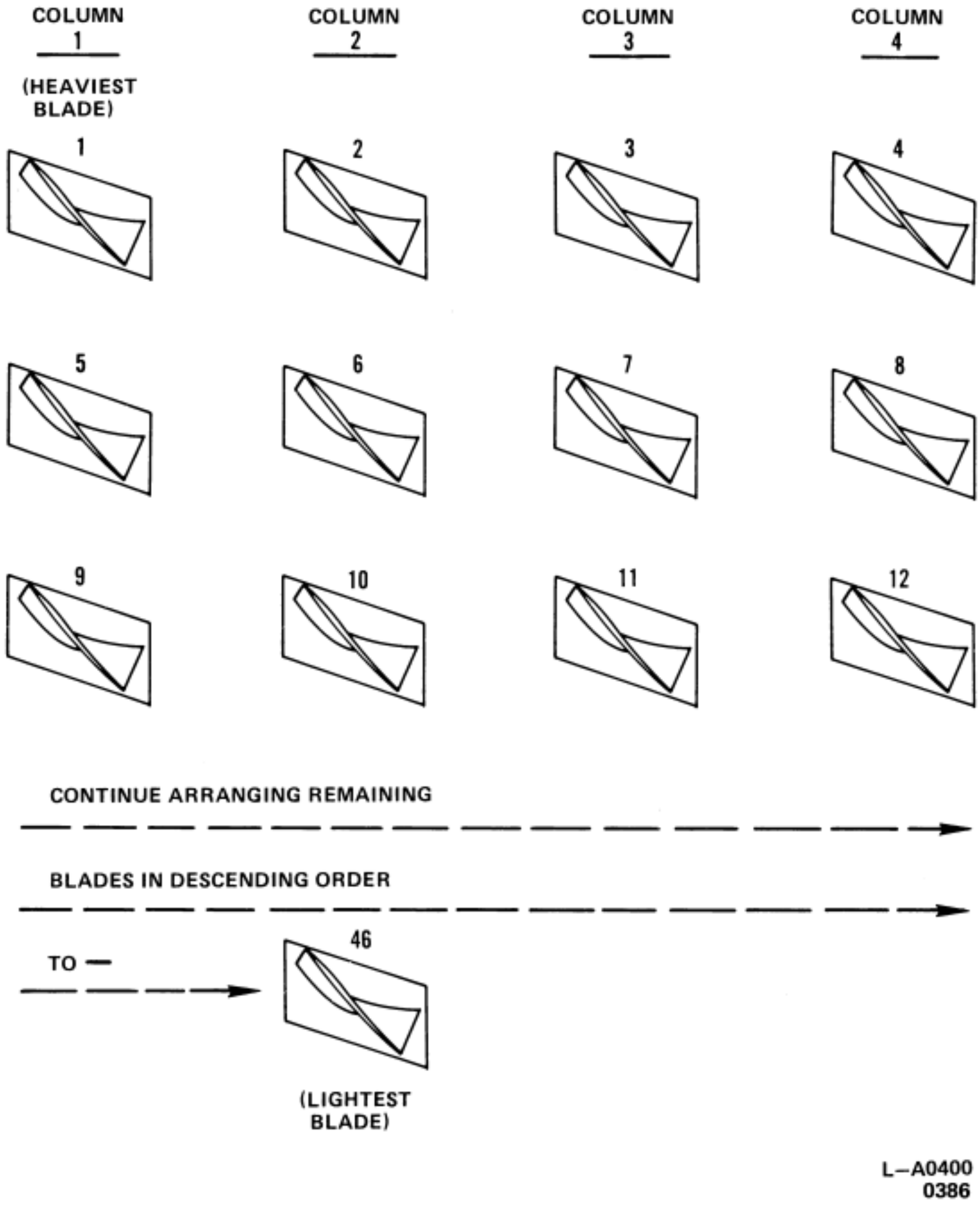
D. Postrequisites

(1) Assemble 9th stage blades to (debladed) axial compressor rotor assembly. See Assembly−27, CONFIG−1 (Task 72−35−01−440−015).

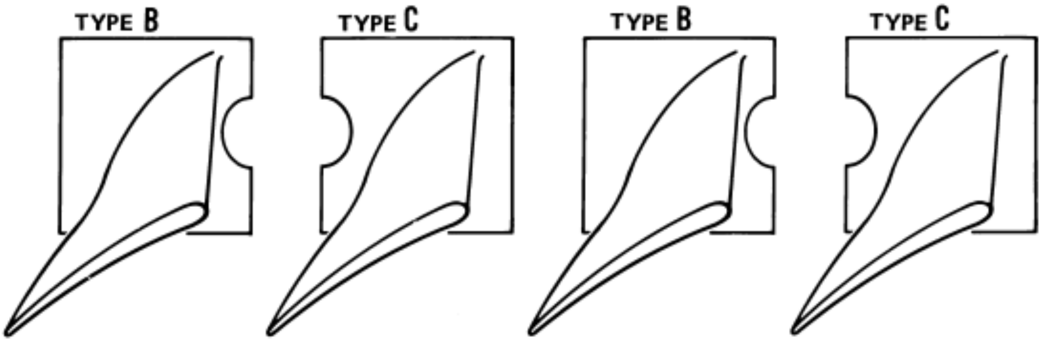

TYPE A
TYPE B
TYPE C
TYPE D
L-A0319

Blade Identification
Figure 1001
(Task 72-35-01-440-014)

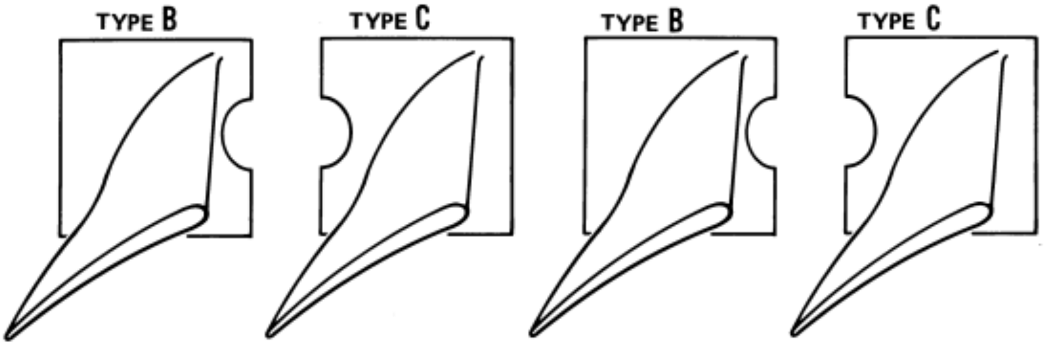
AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-26


COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
COLUMN 3
COLUMN 4
1
2
3
4
5
6
7
8
9
10
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO —
46
(LIGHTEST BLADE)
L-A0400
0386

Blade Weight Arrangement
Figure 1002
(Task 72-35-01-440-014)

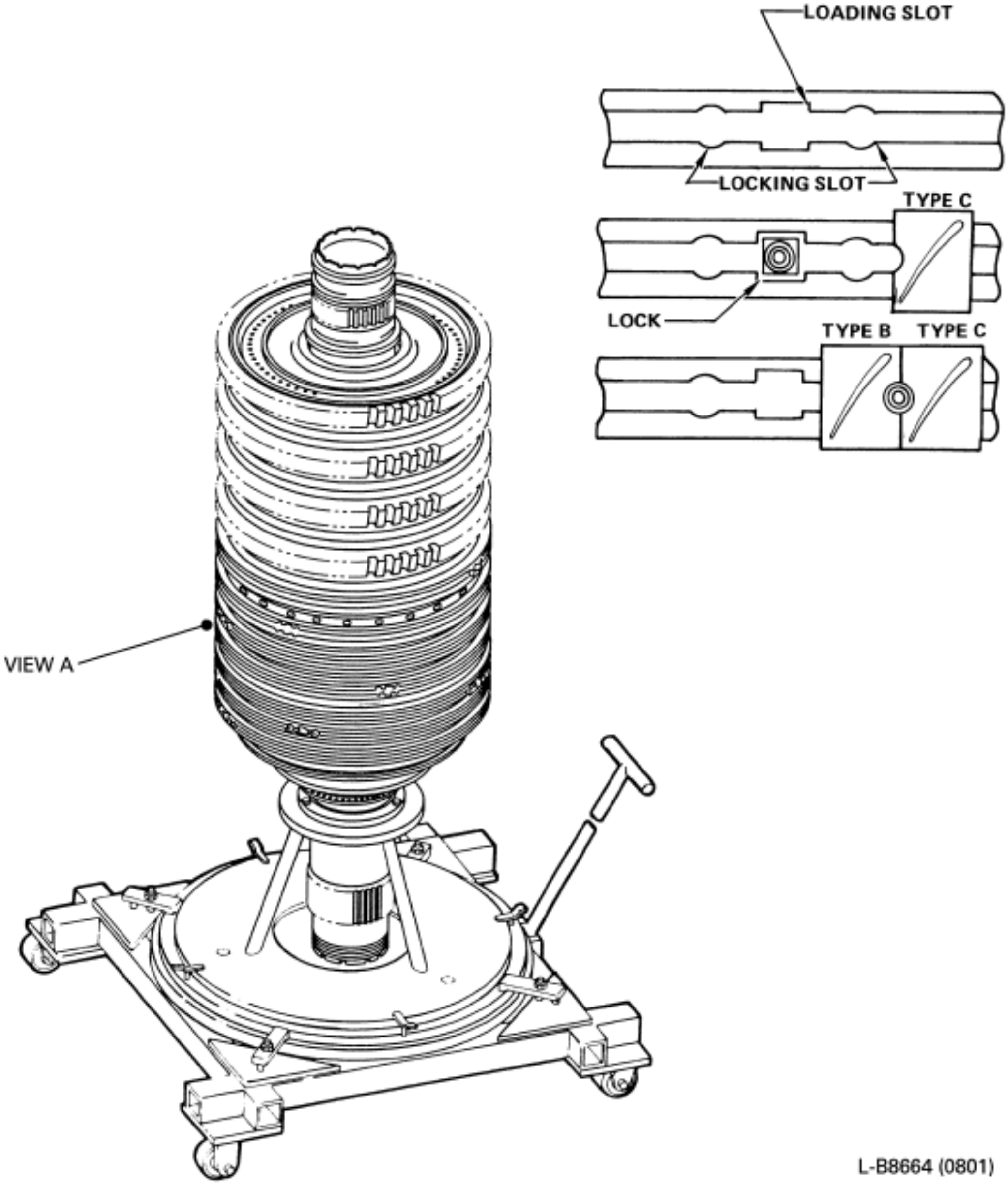

TYPE B
TYPE C
TYPE B
TYPE C

SET 1

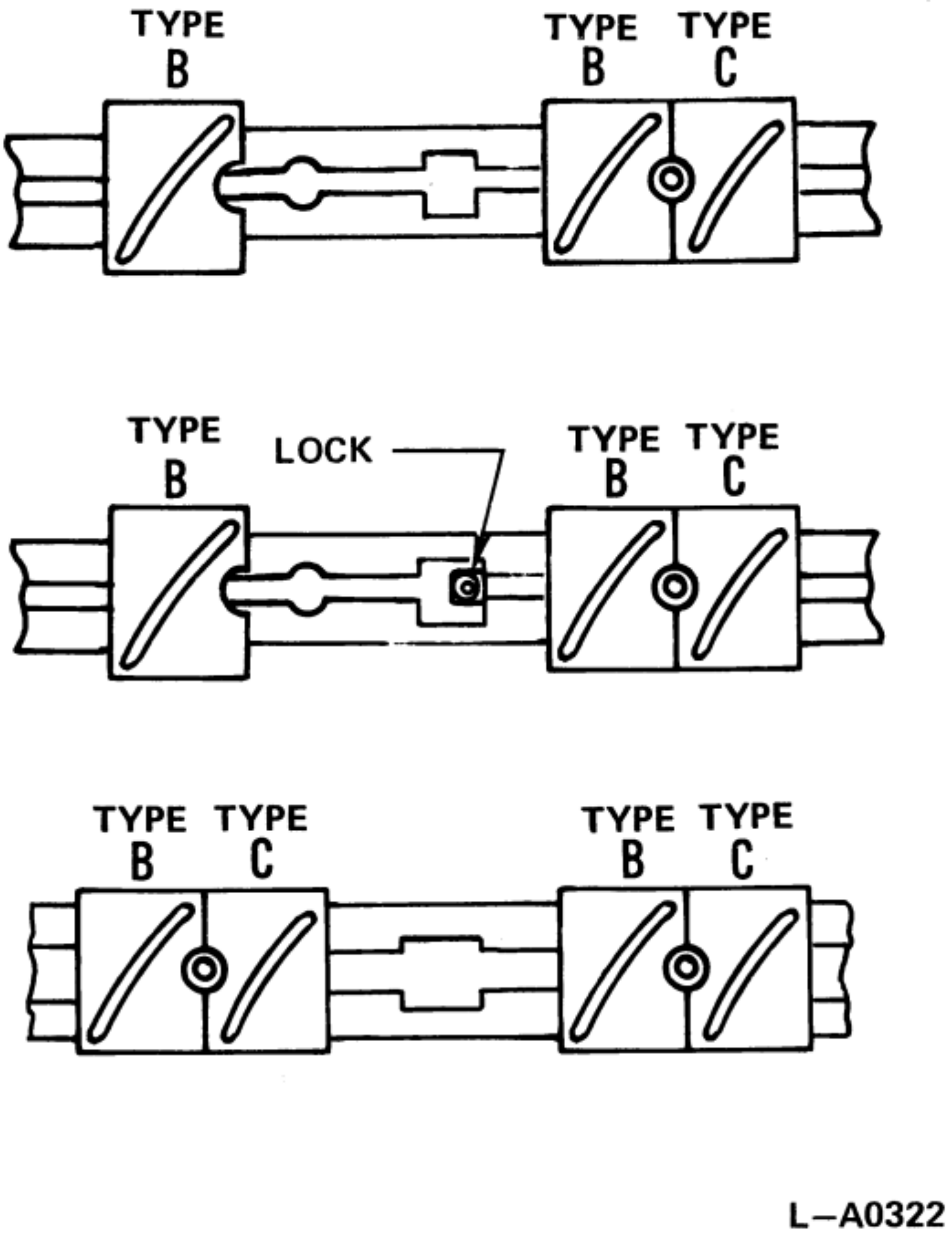

TYPE B
TYPE C
TYPE B
TYPE C
L-A0320

SET 2

Blade Sets
Figure 1003
(Task 72-35-01-440-014)

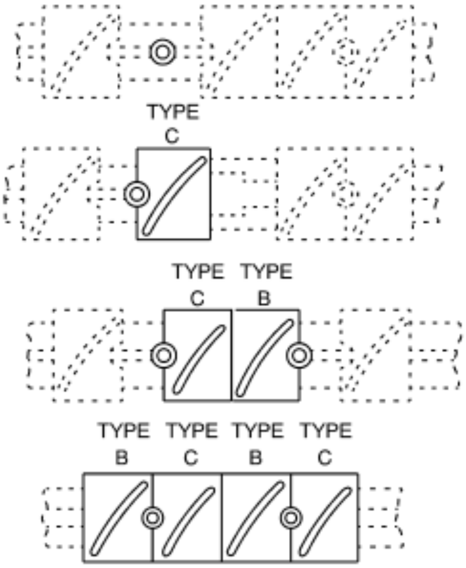

LOADING SLOT
LOCKING SLOT
TYPE C
LOCK
TYPE B
TYPE C
VIEW A
L-B8664 (0801)

Blade And Lock Installation
Figure 1004 (Sheet 1)
(Task 72-35-01-440-014)


TYPE B
TYPE B
TYPE C
TYPE B
LOCK
TYPE B
TYPE C
TYPE B
TYPE C
TYPE B
TYPE C
L-A0322

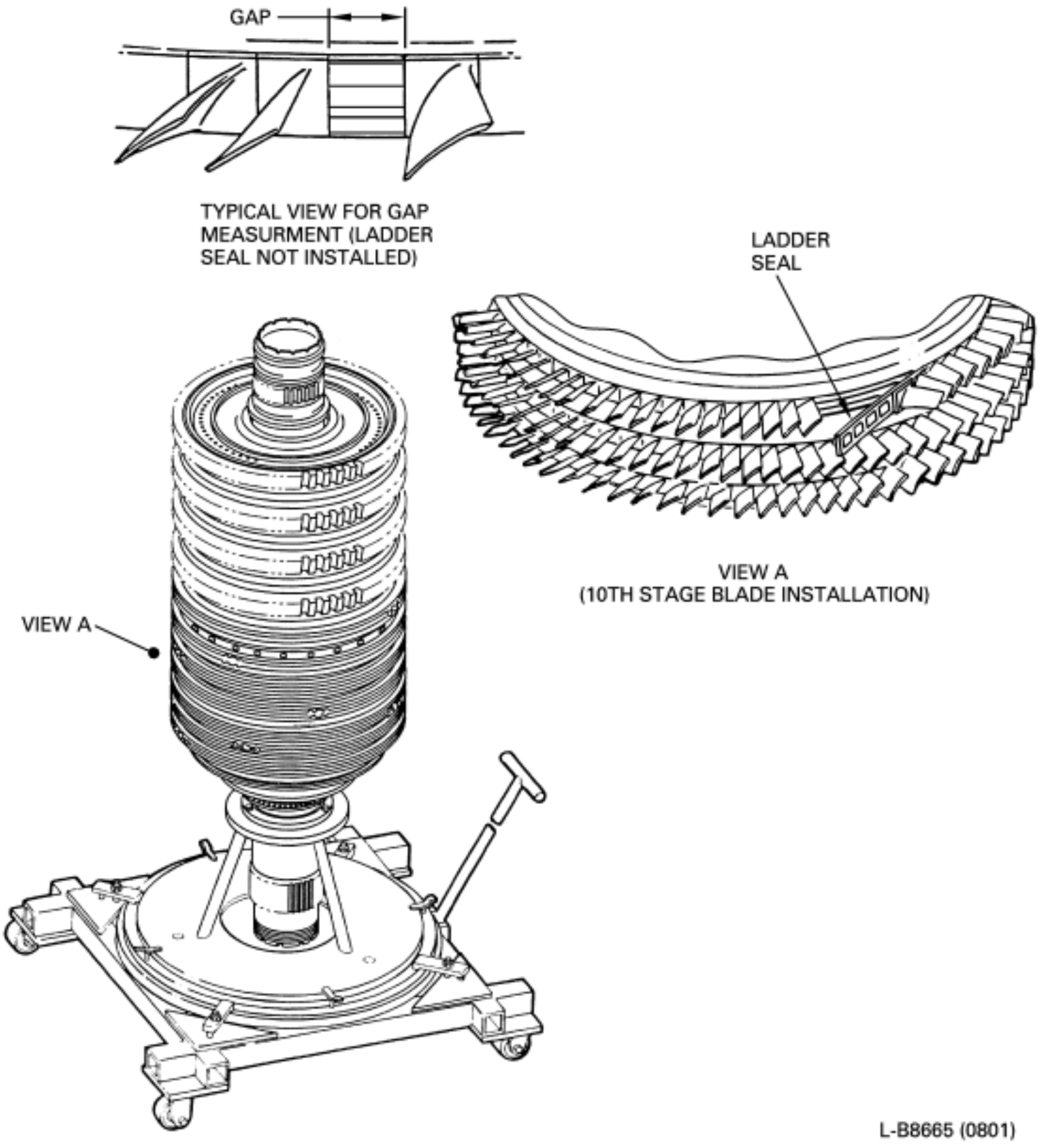
Blade And Lock Installation
Figure 1004 (Sheet 2)
(Task 72-35-01-440-014)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−26


TYPE
C
TYPE
C
TYPE
B
TYPE
B
TYPE
C
TYPE
B
TYPE
C

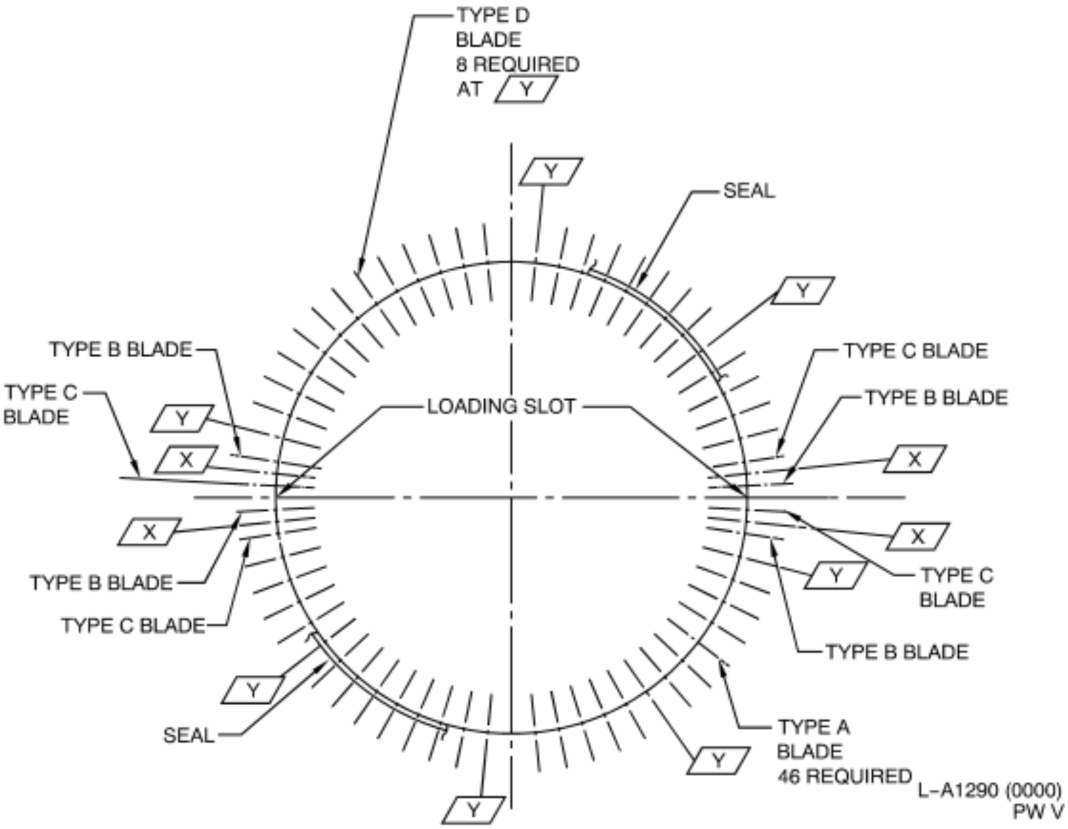
L−A0323 (0000)
PW V

Blade And Lock Installation
Figure 1004 (Sheet 3)
(Task 72−35−01−440−014)


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A
VIEW A
(10TH STAGE BLADE INSTALLATION)
L-B8665 (0801)

Gap Measurement And Seal Installation
Figure 1005
(Task 72−35−01−440−014)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−26


TYPE D
BLADE
8 REQUIRED
AT Y
Y
SEAL
Y
TYPE C BLADE
TYPE B BLADE
X
X
TYPE C
BLADE
Y
TYPE B BLADE
TYPE A
BLADE
46 REQUIRED
Y
Y
SEAL
Y
TYPE C BLADE
TYPE B BLADE
X
X
Y
TYPE C
BLADE
TYPE B BLADE
LOADING SLOT
L−A1290 (0000)
PW V

Blade And Lock Installation Schematic View
Figure 1006
(Task 72−35−01−440−014)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-26

Task 72-35-01-440-024:

1. Assemble 10Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble 11th stage blades to (debladed) axial compressor rotor assembly. See Assembly-25, CONFIG-2 (Task 72-35-01-440-023).

B. Equipment And Materials Necessary

Special Tools:

PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader
PWA 86447	Drift
PWA 86571	Gage Set
PWA 86652	Drift (Optional To PWA 86447)

Consumable Materials:

Item No.	Designation
P06-036	Compound, Antigallant (PWA 36035)
P06-041	Lubricant, Dry Film (PWA 36221)

C. Measurement of Z-Plane for HPC Stage 10.

CAUTION: DO NOT OVERTIGHTEN GAGE SET SCREWS DURING INSTALLATION OF GAGES. DAMAGE TO THE DRUM CAN RESULT.

(1) Measure Z-Plane diameter for Stage 10. This procedure is optional and can only be used where blades have been removed. Select the pair of gages from the PWA 86571 Z-Plane Diameter Gage Set. Install gages 180 degrees apart, in blade slots. Turn gage set screws clockwise to move the gages radially out to their most outward position. Use OD micrometers to measure four diameters, every 45 degrees, over the gage tool balls. Calculate Z-Plane diameter of the stage by subtracting twice the reference dimension, marked on each pair of gages, from the average diameter measured over the gage tools balls. Refer to minimum, maximum and nominal Z-Plane diameters listed, for reference only, in Table 1001.

R
R

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-26

Stage	Minimum Diameter (Reference)	Maximum Diameter (Reference)	Nominal Diameter (Reference)
10	23.112 inch (587.045 mm)	23.120 inch (587.248 mm)	23.116 inch (587.146 mm)

HPC Front Drum Z-Plane Diameters
Table 1001

D. Procedure

NOTE: There are three part numbers (sets) of blades provided for this stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type A is used for fitting and may require platform grinding. For ease of assembly, blades in this procedure will be referred to as Types A, B and C.

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86652 DRIFT OR THE PWA 86447 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(1) Remove 10th stage blades from storage rack and place them on bench. Segregate four each of Types B and C blades having notches in their platforms and move to one side. See Figure 1001. R

(2) Optional, weigh the 10th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70-11-00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

R (3) Optional, arrange Type A blade in two columns, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. Lightest blade will be at bottom of Column 2. See Figure 1002.

NOTE: One or more Type A blade may have been used as a fitting blade. Blade will be identified by a square in the service time marking area.

(4) Select two sets of four blades (two Types B and C per set) such that weights of sets are as nearly equal as possible. See Figure 1003.

NOTE: Weights must be nearly equal as sets will be positioned opposite each other after assembly.

R (5) Install blades and lock and setscrew assemblies on the right side. See Figure 1002, Figure 1003, Figure 1004, Figure 1005, and Figure 1006.

R (a) Find one of two 10th stage loading slots.

R (b) Select one of the Type B and C blade sets. Install one Type C blade, leading edge up, into the slot. Move the blade to the right.

R (c) Install one lock and setscrew assembly and move it to the right.

R (d) Locate the locking slot, at Position K, on the right of the blade loading slot. Move the lock and setscrew assembly into the locking slot and tighten. Torque the setscrew to the running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi-spline setscrews.

R NOTE: There are four locking slots that are not used. They are located at, Positions J, on the left and right sides of both loading slots.

(e) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

  1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

  2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

  3 If these limits are not kept, check the lock for correct assembly in the disk.

(f) Use an approved marking pen to make a V mark on the outside diameter platform of the drum and in line with the lock. This mark will be used for future reference.

(g) Install one Type B blade into slot and move it to the right until it touches the lock and setscrew assembly.

(h) Rotate the drum 180 degrees. Position the open loading slot toward the operator.

(i) Find the Type A blades to be installed. Start at the bottom of Column 2 (blade Number 54) and continue up to the top of the column (blade Number 2).

(j) Install 8 Type A blades, start with blade Number 54, in the loading slot and move each blade to the right until it touches the blade that was installed before.

(k) Install the remaining Type C blade and move it to the right until it touches the last Type A blade.

(l) Insert one lock and setscrew assembly and move it to the right until it touches the Type C blade.

NOTE: Do not tighten the lock.

(m) Install the remaining Type B blade into the loading slot and move it to the right until it touches the lock and setscrew assembly.

(n) Install the 19 remaining Type A blades from Column 2 in the loading slot and move them to the right until each one touches the blade that was installed before.

(6) Install blades and lock and setscrew assemblies on the left side. See Figure 1002, Figure 1003, Figure 1004, Figure 1005, and Figure 1006.

(a) Get a Type C blade from the remaining Type B and C blade set. Install it in the loading slot and move it to the right until it touches the blade that was installed before.

(b) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before.

NOTE: Do not tighten the lock.

(c) Install a Type B blade in the loading slot and move it to the right until it touches the lock.

(d) Find the Type A blades to be installed. Start at the top of Column 1 (blade Number 1) and continue down to the bottom of the column (blade Number 53).

(e) Install 19 Type A blades, start with blade Number 1, in the loading slot and move it to the left until it touches the blade that was installed before.

NOTE: Ten Type A blades remain that are not installed.

(f) Get a Type B blade from the remaining Type B and C blade set. Install it in the loading slot and move it to the left until it touches the blade that was installed before.

R (g) Install a lock and setscrew assembly in the loading slot and move it to the left until it touches the blade that was installed before.

R NOTE: Do not tighten the lock.

R (h) Install a Type C blade in the loading slot and move it to the left until it touches the lock.

R (i) Install, in the order that follows, blade Numbers 53, 51, 49, then Number 47 in the loading slot and move them fully to the right.

R (j) Install, in the order that follows, blade Numbers 39, 41, then Number 43 in the loading slot and move them fully to the left.

R NOTE: Blade Number 45 is not installed.

R (7) Move the blades tangentially to make the widest possible gap between the last installed Type A blades. This gap will be measured and used to compute the specified gap for between the blades.

R NOTE: Put the blades in a radially outward direction to prevent a circumferentially serpentine shape to the blades.

R (a) Use a PWA 85595 Spreader to load all blades, in the arc, tangentially.

R (b) When it is installed, expand the spreader and get the widest possible gap between the blade platforms. If you need help to move the blades, it is permissible to tap lightly on the base of the airfoil with a PWA 86447 or PWA 86652 Drift.

R (c) Measure and record the gap dimension.

R (d) Find the last blade to be installed. Measure and record the width of the blade platform using a vernier caliper.

R (e) Compare the gap dimension with the blade platform width.

R (f) The width of the blade platform must measure 0.020 − 0.055 inch (0.51 − 1.40 mm) smaller than the gap dimension.

R (g) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

R (8) Do the procedure that follows to get the correct blade platform width for the measured gap.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type A blades with Type A blades with the narrower platform width to get the correct blade platform gap of 0.020 - 0.055 inch (0.51 - 1.40 mm).

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). If the 0.055 inch (1.397 mm) maximum gap limit is not met, replace the standard Type A blades with the Type A blades with the narrower platform as necessary to get the 0.020 - 0.055 inch (0.51 - 1.40 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

R (9) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

R (a) If blade platform width is larger than the gap, determine the difference.

R (b) If the total material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type A blade not installed.

R (c) If total amount of material to be removed exceeds of 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type A blade not installed. The maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

R (d) If total amount of material to be removed is more than 0.010 inch (0.254 mm), remove additional Type A blades to get the proper fit and remove material in approximately equal amounts from both sides of Type A blade platforms.

R (e) If total amount of material to be removed is more than 0.080 inch (2.032 mm) do as follows:

R 1 Remove additional Type A blades as necessary to get the 0.020 − 0.055 inch (0.51 − 1.40 mm) fit.

R 2 Remove material in equal amounts from both sides of platform on these Types A blades.

R 3 The maximum material removal for each platform side must not be more than 0.005 inch (0.127 mm).

R (f) Type A blades with trimmed platforms must be identified with a square symbol in their
R respective service time marking areas. Refer to
R Standard Practices Manual, PN 585005, Section
R 70−11−00 for approved marking pens.

R (g) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm).

R (10) If necessary, grind HPC 10th stage blade platforms per 72−35−38 Assembly−02 (Task 72−35−38−440−002).

R (11) If grinding of blade platforms was required, install Type A blades in slot and check gap. Continue grinding and checking gap until 0.020 − 0.055 inch (0.51 − 1.40 mm) limit is met.

R CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86447 OR PWA 86652 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

R (12) After gap limits have been met, remove all blades from right side of slot and place them in order of removal on bench. Remove all blades from left side of slot and place them in order of removal on bench.

R NOTE: Two blades and one blade lock are to remain in the disk. These are the Type B and C blades and the blade lock that were installed and tightened at the start of this procedure.

R (13) Apply Antigallant Compound P06-036 or Dry Film Lubricant P06-041 to ladder seals (side opposite flat side) and to drum groove in the areas shown to ease the assembly operation. See Figure 1007.

R (14) Install the right side ladder seals, blades, and lock and setscrew assembly. See Figure 1006.

R NOTE: The blades will be installed in the order that they were removed.

R (a) Put the first ladder seal over the loading slot with the flat surface out.

R (b) Align the first opening in the ladder seal with the loading slot in the disk.

R (c) Install the blade that was last removed from the right side (blade Number 54), leading edge up, through the ladder seal and into the loading slot.

R (d) Move the blade and ladder seal to the right until the second opening is aligned with the loading slot.

R NOTE: Be sure that the ladder seal is correctly installed between the disk rails.

R (e) Install the next two Type A blades to complete the assembly of the first ladder seal. Move this blade and seal assembly fully to the right until it touches the Type B blade that is installed.

R (f) Install the next two Type A blades and move them
R fully to the right until they touch the blade and
R ladder seal assembly that was installed.

R (g) Put the second ladder seal over the loading slot
R with the flat surface out.

R (h) Install the next three Type A blades in the
R ladder seal by the method used above and move the
R assembly fully to the right until it touches the
R last Type A blade that is installed.

R (i) Install a Type C blade, a lock and setscrew
R assembly, then the next Type B blade. Move them
R fully to the right until they touch the blades
R that were installed before.

R NOTE: Do not tighten the lock and setscrew
R assembly.

R (j) Put the third ladder seal over the loading slot
R with the flat surface out.

R (k) Install the remaining 19 Type A blades, from
R Column 2, in the ladder seal by the method used
R for the first ladder seal and move the assembly
R fully to the right until it touches the Type B
R blade that is installed.

R (15) Install partial left side ladder seals, blades and a
R lock and setscrew assembly. See Figure 1006.

R NOTE: The blades will be installed in the order that
R they were removed.

R (a) Put the first ladder seal over the loading slot
R with the flat surface out.

R (b) Align the first opening in the ladder seal with
R the loading slot in the disk.

R (c) Install the blade that was last removed (blade
R Number 1), leading edge up, through the ladder
R seal and into the loading slot.

R (d) Move the blade and ladder seal to the left until the second opening is aligned with the loading slot.

R NOTE: Be sure that the ladder seal is correctly installed between the disk rails.

R (e) Install the next 18 Type A blades to complete the assembly of the first ladder seal. Move this assembly fully to the left until it touches the Type C blade that is installed.

R NOTE: Eight Type A blades remain that are not installed.

R (f) Install a Type B blade, a lock and setscrew assembly, then the next Type C blade. Move them fully to the left until they touch the blade and ladder seal assembly that was installed before.

R NOTE: Do not tighten the lock and setscrew assembly.

R (g) Put the second ladder seal over the loading slot with the flat surface out.

R (h) Install the next three Type A blades in the ladder seal by the method used for the first ladder seal and move the assembly fully to the left until it touches the Type C blade that is installed.

R NOTE: Five Type A blades, one Type B blade, one Type C blade and one lock assembly remain.

R (16) Install the remaining blades and lock and setscrew assembly.

R (a) Install the remaining Type C blade and move it fully to the right until it touches the blade that was installed before.

R (b) Install the last lock and setscrew assembly in the drum slot and move it to the left.

R NOTE: Do not tighten the lock.

R (c) Install the remaining Type B blade and move it fully to the right until it touches the blade that was installed before.

(d) Put the ladder seal over the loading slot with the flat surface out.

(e) Align the first opening in the ladder seal with the loading slot in the disk.

(f) Install, in the order that follows, blade Numbers 53, 51, then Number 49 through the ladder seal opening and into the loading slot. Move the assembly fully to the right.

NOTE: Two Type A blades have not been installed.

(g) The last Type A blades can only be inserted in the drum by moving all blades to the right. To do this, you must rotate the drum 180 degrees and loosen the blade lock screw.

(h) Rotate the drum 180 degrees again to the opposite loading slot.

(i) Move all blades, ladder seals and locks to the right, as necessary to install blade Number 47 then Number 45.

(17) Move the blades, ladder seals and locks to the final positions.

(a) Move all blades, ladder seals and locks to the left. Align the blade lock with the V mark you made on the drum at beginning of this procedure.

(b) Position, tighten and torque the lock and setscrew assembly that is located at the locking slot near the V mark.

1 Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(18) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform with the PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

R (b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

R (c) If these limits are not kept, check the lock for correct assembly in the disk.

R (19) Position, tighten and torque the remaining lock and setscrew assemblies.

R (a) Check the gaps, all gaps between the ladder seals should be approximately equal.

R (b) Torque the setscrew to the running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi-spline setscrews.

R (20) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow: See Figure 1004 (Sheet 1).

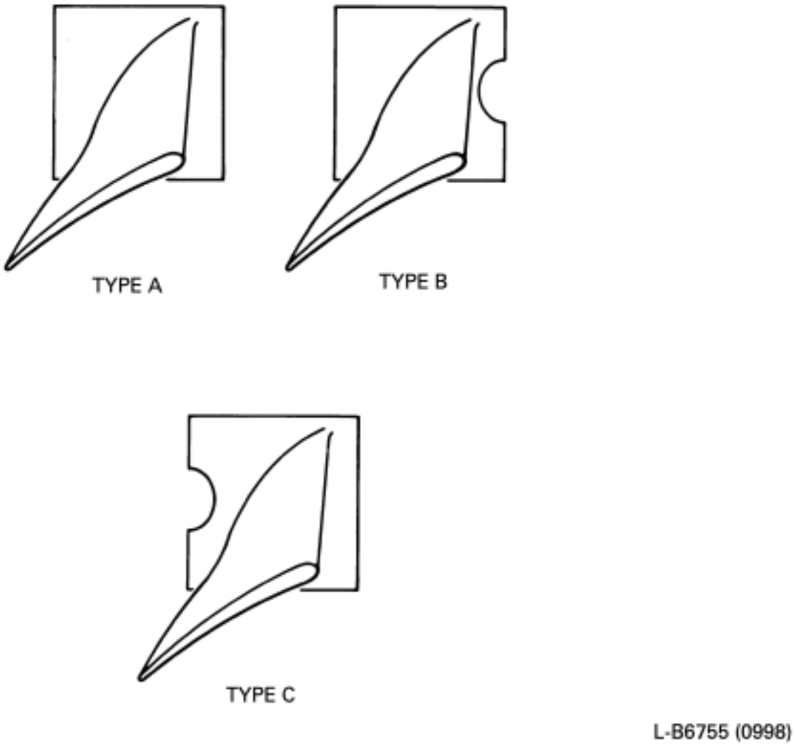
(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

R (c) If these limits are not kept, check the lock for correct assembly in the disk.

E. Postrequisites

(1) Assemble 9th stage blades to (debladed) axial compressor rotor assembly. See Assembly-27, CONFIG-2 (Task 72-35-01-440-025).


TYPE A
TYPE B
TYPE C
L-B6755 (0998)

Blade Identification
Figure 1001
(Task 72−35−01−440−024)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-26

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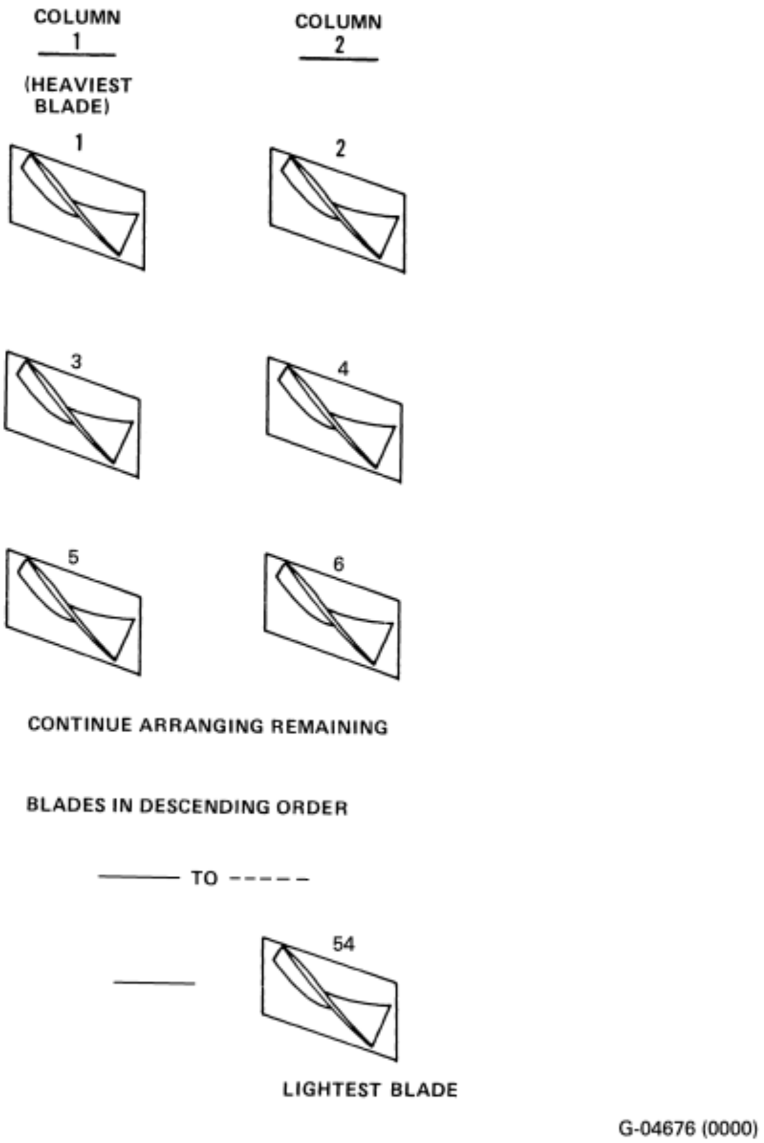
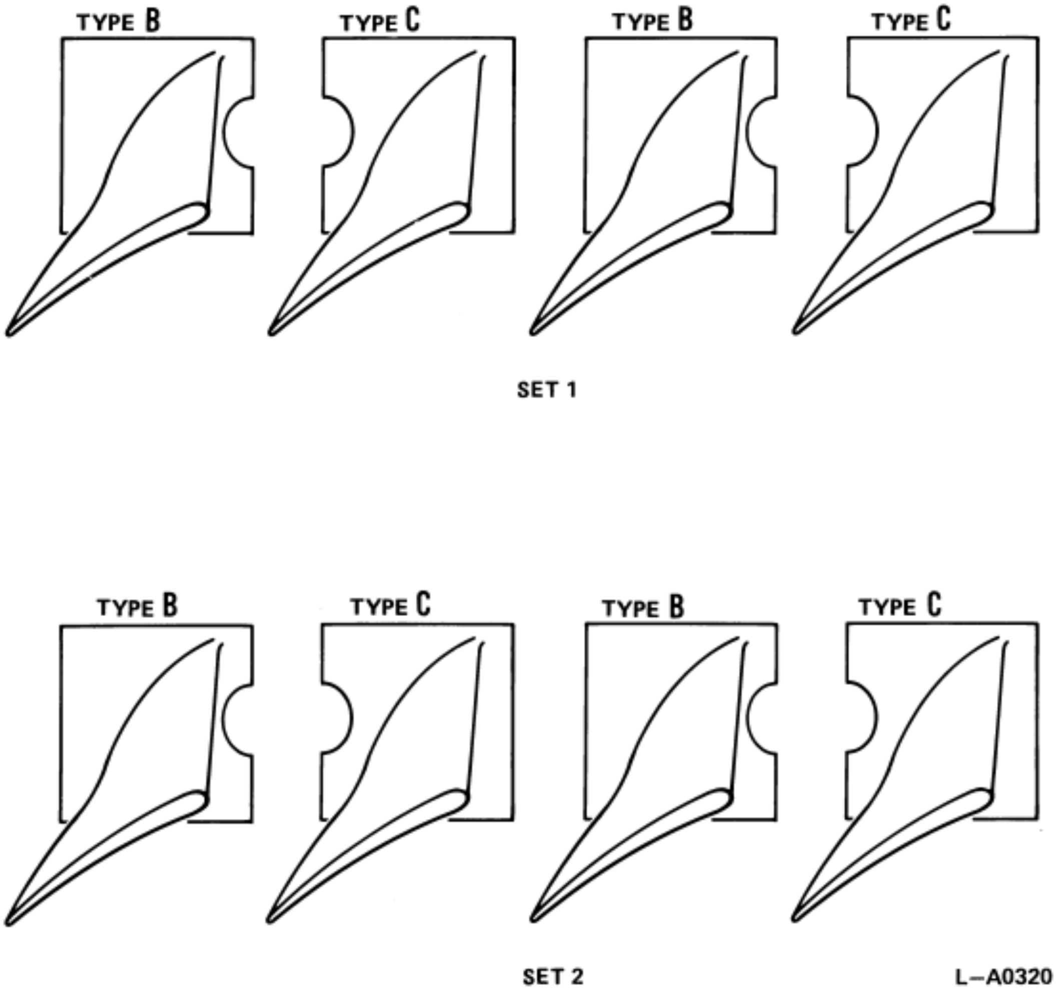
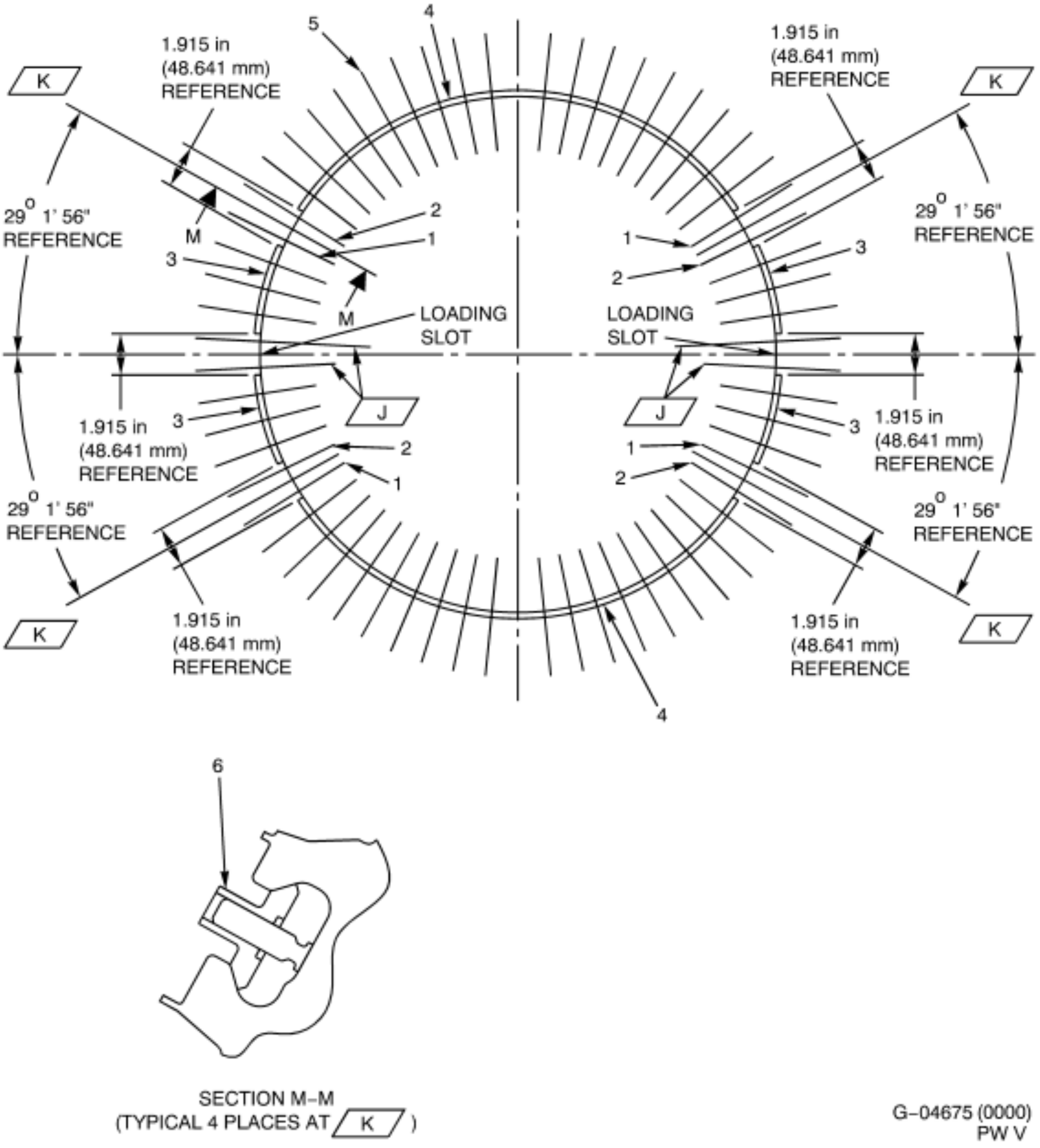

COLUMN 1
COLUMN 2
(HEAVIEST BLADE)
1
2
3
4
5
6
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO
54
LIGHTEST BLADE
G-04676 (0000)

Blade Weight Arrangement
Figure 1002
(Task 72-35-01-440-024)


TYPE B
TYPE C
TYPE B
TYPE C
SET 1
TYPE B
TYPE C
TYPE B
TYPE C
SET 2
L−A0320

R Type B And Type C Blade Set Arrangement
Figure 1003
(Task 72−35−01−440−024)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-26


5
4
1.915 in
(48.641 mm)
REFERENCE
K
29° 1' 56"
REFERENCE
M
3
2
1
M
LOADING
SLOT
J
1.915 in
(48.641 mm)
REFERENCE
4
6
SECTION M-M
(TYPICAL 4 PLACES AT K)
G-04675 (0000)
PW V

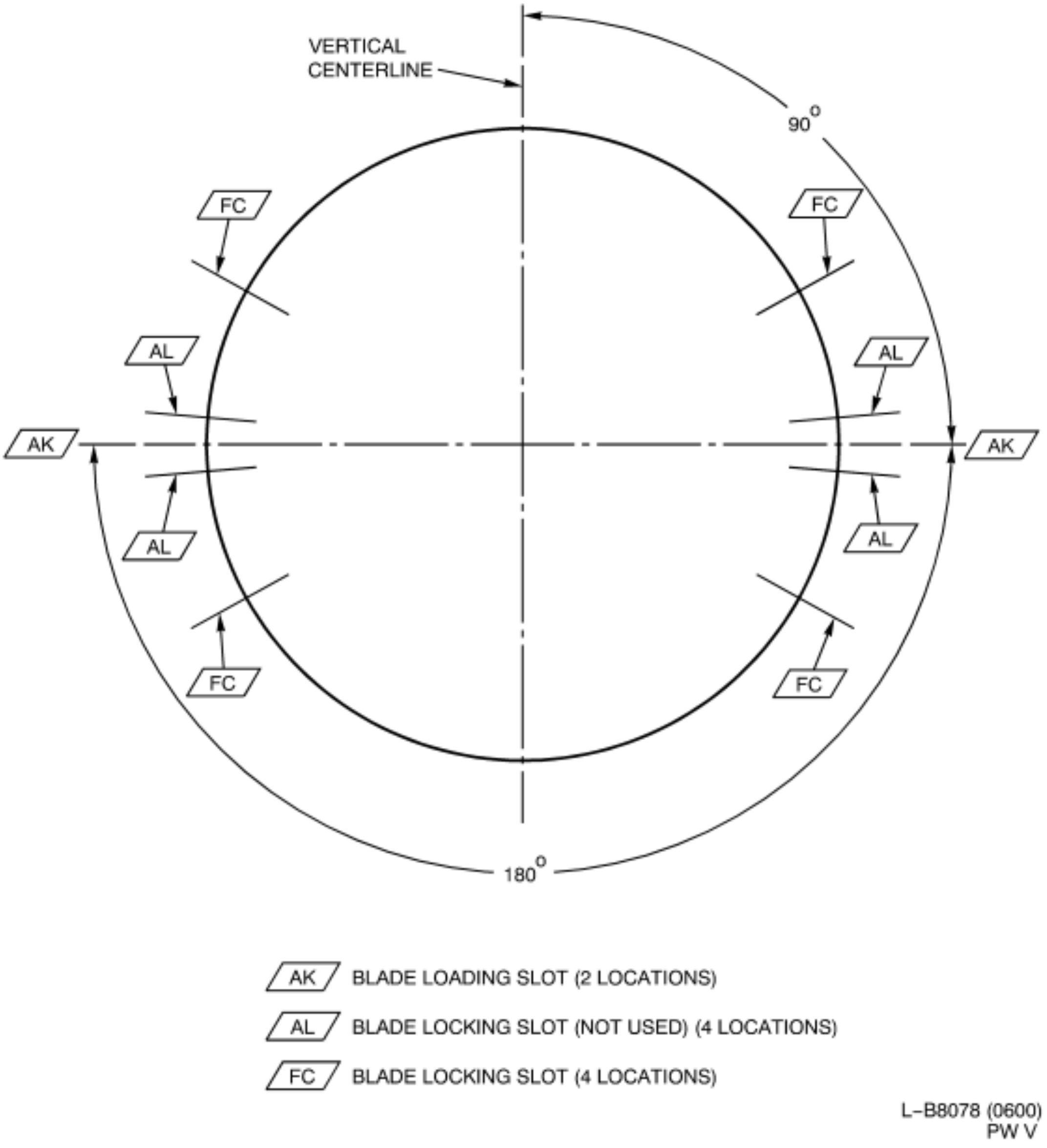
Blade And Lock Installation Schematic View
Figure 1004 (Sheet 1)
(Task 72-35-01-440-024)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-26

R 1. Ladder Seals (Covers 18 Blades)
R 2. Type C Blades
R 3. Type B Blades
R 4. Ladder Seals (Covers Four Blades)
R 5. Type A Blades
R 6. Lock And Setscrew Assembly

R Key to Figure 1004 (Sheet 1)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-26


VERTICAL CENTERLINE
90°
180°
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FC
AL
AL
AK
AK
AL
AL
FC
FC
AK BLADE LOADING SLOT (2 LOCATIONS)
AL BLADE LOCKING SLOT (NOT USED) (4 LOCATIONS)
FC BLADE LOCKING SLOT (4 LOCATIONS)
L-B8078 (0600)
PW V

Blade Loading And Lock Slot Locations Schematic View
R Figure 1004 (Sheet 2)
(Task 72-35-01-440-024)

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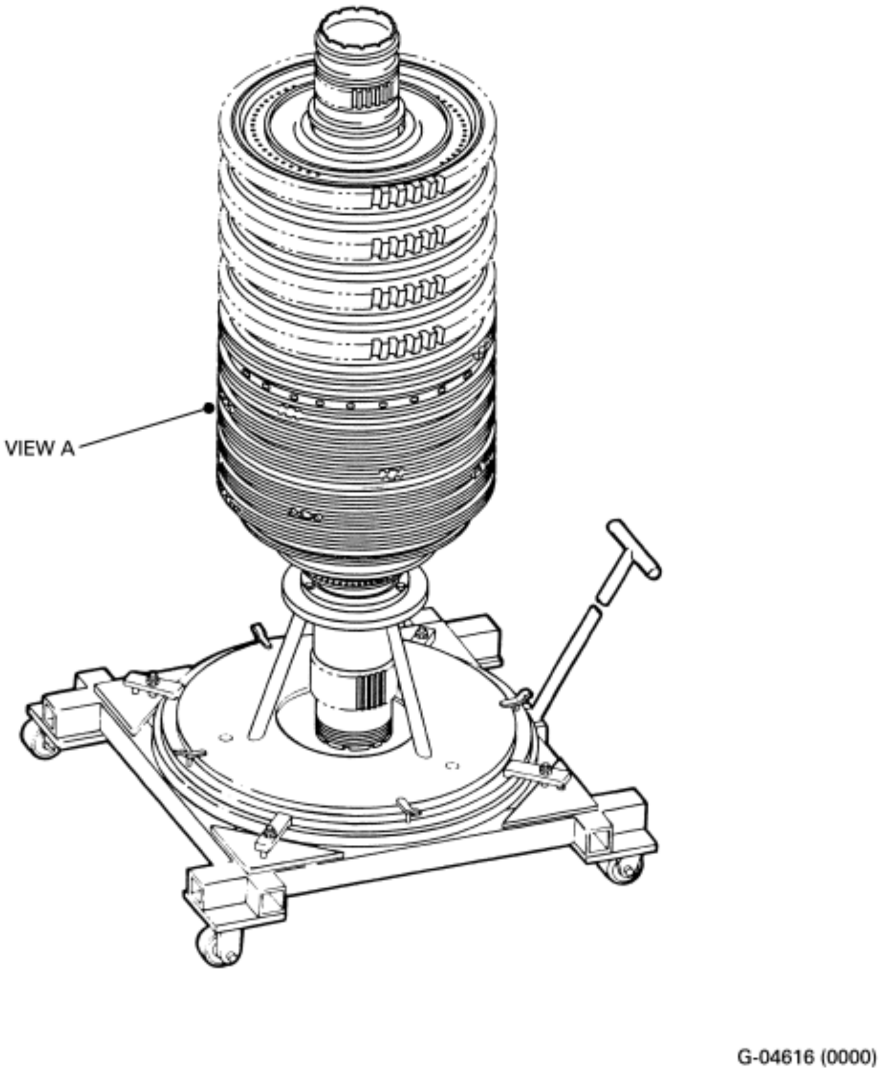

Blade And Lock Installation
R Figure 1005 (Sheet 1)
(Task 72-35-01-440-024)

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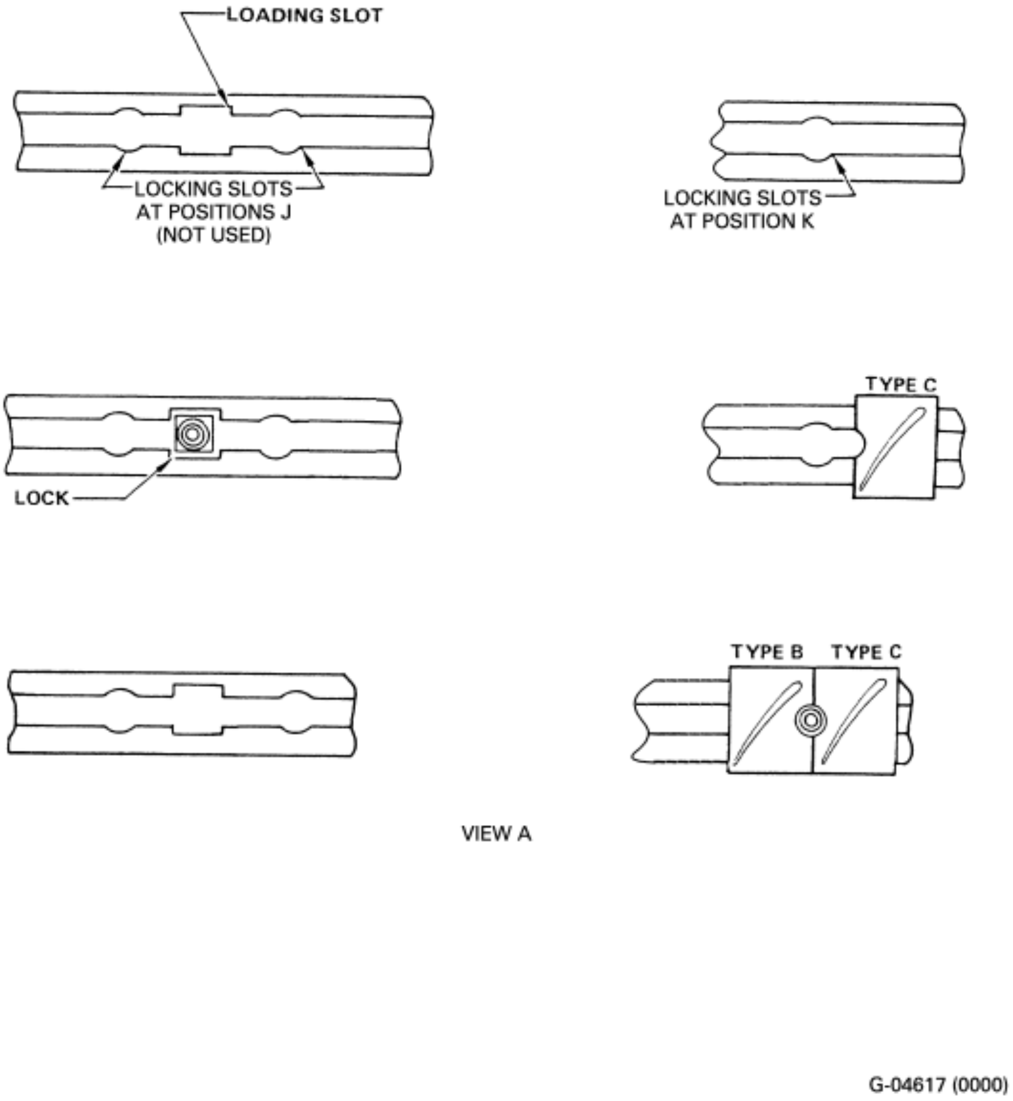
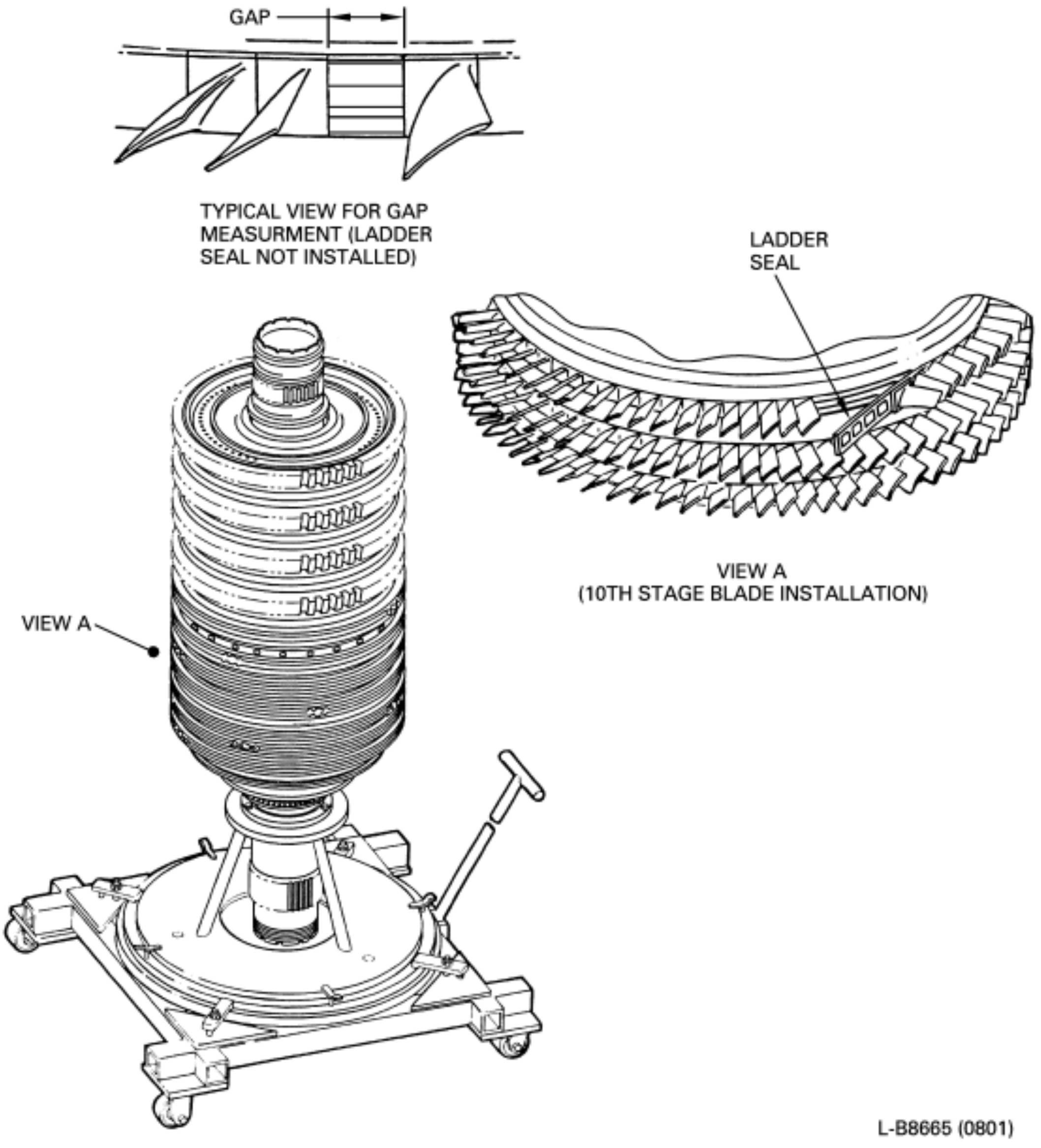
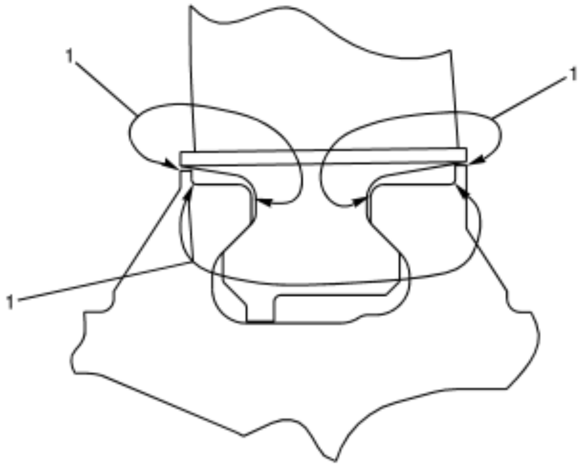

LOADING SLOT
LOCKING SLOTS AT POSITIONS J (NOT USED)
LOCKING SLOTS AT POSITION K
TYPE C
LOCK
TYPE B
TYPE C
VIEW A
G-04617 (0000)

Blade And Lock Installation
R Figure 1005 (Sheet 2)
(Task 72-35-01-440-024)


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A
VIEW A (10TH STAGE BLADE INSTALLATION)
L-B8665 (0801)

Gap Measurement And Seal Installation
R Figure 1006
(Task 72−35−01−440−024)



G-04624 (0000)
PW V

R 1. Antigallant Treatment Areas

R Antigallant Treatment Areas
R Figure 1007
R (Task 72-35-01-440-024)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72−35−01−440−015:

1. Assemble 9Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble 10th stage blades to (debladed) axial compressor rotor assembly. See Assembly−26, CONFIG−1 (Task 72−35−01−440−014).

B. Equipment And Materials Necessary

Special Tools:

PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 86571	Gage Set
PWA 85595	Spreader
PWA 86652	Drift (Optional To PWA 86447)

Consumable Materials:

Item No.	Designation
P06−036	Compound, Antigallant (PWA 36035)
P06−041	Lubricant, Dry Film (PWA 36221)

C. Procedure
See Figure 1001, Figure 1002, Figure 1003, Figure 1004, Figure 1005 and Figure 1006.

NOTE: There are four part numbers (sets) of blades provided for this stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type D is used for fitting and may require platform grinding. SB PW4ENG 72−434 provides blades with platforms that are 0.015 inch (0.381 mm) oversize. For ease of assembly, blades in this procedure will be referred to as Types A, B, C and D.

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-27

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

CAUTION: DO NOT OVERTIGHTEN GAGE SET SCREWS DURING INSTALLATION OF GAGES. DAMAGE TO THE DRUM CAN RESULT.

(1) Measure Z-Plane diameters for Stage 9. This procedure is optional and can only be used where blades have been removed. Select the pair of gages, marked for that stage, from the PWA 86571 Z-Plane Diameter Gage Set. Install gages, 180 degrees apart, in blade slots. Turn gage set screws clockwise to move the gages radially out to their most outward position. Use OD micrometers to measure four diameters, every 45 degrees, over the gage tool balls. Calculate Z-Plane diameter of the stage by subtracting twice the reference dimension, marked on each pair of gages, from the average diameter measured over the gage tools balls. Refer to minimum, maximum and nominal Z-Plane diameters listed, for reference only, in Table 1001.

Stage	Minimum Diameter (Reference)	Maximum Diameter (Reference)	Nominal Diameter (Reference)
9	22.844 inch (580.238 mm)	22.852 inch (580.441 mm)	22.848 inch (580.339 mm)

HPC Front Drum Z-Plane Diameters
Table 1001

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86652 DRIFT OR THE PWA 86447 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(2) Remove 9th stage blades from storage rack and place them on bench. Segregate eight Types B and C blades having notches in their platforms and move to one side. Also locate eight Type D blades and move to one side. See Figure 1001.

(3) Optional, weigh the 9th stage blades. Use an approved marking pen to make marks temporary on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70−11−00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

(4) Optional, arrange Type A blades in four columns, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. Lightest blade will be at bottom of Column 2. See Figure 1002.

NOTE: One or more Type A blade may have been used as a fitting blade. Blade will be identified by a square in the service time marking area.

(5) Select two sets of four blades (two Types B and C per set) such that weights of sets are as nearly equal as possible. See Figure 1003.

NOTE: Weights must be nearly equal as sets will be positioned opposite each other after assembly.

(6) Selecting one of the blade sets, and with loading slot of disk facing operator, install one Type C blade leading edge up, into slot. Move blade to right. Install one lock and setscrew and move to right. Install one Type B blade into slot. Move to right. See Figure 1004 (Sheet 1).

(7) From the same set, install remaining Type B blade into slot and move to left. Install one lock and setscrew and move to left. Install remaining Type C blade and move to left. See Figure 1004 (Sheet 2).

(8) Locate locking slot to left of blade loading slot. Move left lock to left locking slot and tighten and torque setscrew to running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(9) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

(10) Using approved marking pen, mark OD platform of drum in line with lock with "V" for future reference.

(11) Move Type C blade (right side of lock) to the left to rest against lock. See Figure 1004 (Sheet 3).

(12) Move Type B blade and right lock to left and lock setscrew to running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multi-spline setscrews.

(13) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

(14) Push two remaining Types B and C blades to butt against just-installed locks. See Figure 1004 (Sheet 3).

(15) Rotate drum 180 degrees. Position open blade slot toward operator.

(16) Starting at bottom of 4th column of weight−ordered Type A blades, and proceeding vertically from bottom of column to top, position each blade into loading slot and move to right to rest against previously installed blades and lock. When 4th column of blades is used, start at bottom of 2nd column and position each blade into loading slot and to right until all blades from Column 2 are inserted.

(17) Starting at top of 3rd column of blades, position each blade into loading slot and move to left to rest against blades at opposite end. When 3rd column of blades is used, start at top of 1st column and position each blade into loading slot and to left until all blades from Column 1 are inserted.

(18) Install two blades from remaining Types B and C sets into loading slot and move to left. Install remaining two blades from set Types B and C to slot and move to right. Remaining blades should be eight Type D blades which will be used for fitting. Install seven of the Type D blades in slot and load all blades tangentially so as to form widest possible gap at disk loading slot. Measure gap using PWA 85595 Spreader. See Figure 1005.

- (a) Place spreader into vacant blade space. Expand spreader with torque handle and measure blade gap with a vernier caliper. Record this dimension.
- (b) Measure platform width of Type D blade, not installed in drum, with vernier caliper. Record this dimension.
- (c) Compare the gap dimension with the blade platform width dimension.
- (d) The width of the blade platform must measure 0.020 − 0.055 inch (0.51 − 1.40 mm) smaller than the gap measured at the drum loading slot between the blades.
- (e) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

(19) Do the procedure that follows to get the correct blade platform width for the measured gap.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type D blades with oversized blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.020 - 0.055 inch (0.51 - 1.40 mm).

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). If the 0.055 inch (1.397 mm) maximum gap limit is not met, replace the standard Type D blades with the modified blades with wider platforms or the Type A blades with the narrower platform as necessary to get the 0.020 - 0.055 inch (0.51 - 1.40 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

(20) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

(a) If blade platform width is larger than the gap, determine the difference. If the total material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type D blade not installed. If total amount of material to be removed exceeds of 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type D blade not installed. Maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

(b) If total amount of material to be removed exceeds 0.010 inch (0.254 mm), remove additional Type D blade to obtain proper fit and remove material in approximately equal amounts from both sides of Type D blade platform.

(c) If total amount of material to be removed exceeds 0.080 inch (2.032 mm), remove additional Type A blades in addition to Type D blades as required to obtain the 0.020 - 0.055 inch (0.51 - 1.40 mm) fit. Remove material in equal amounts from both sides of platform on these Types D and A blades. Maximum material removal per platform side must not exceed 0.005 inch (0.127 mm). Type A blades with trimmed platforms must be identified with a square symbol in their respective service time marking areas. See 70-11, Standard Practices Manual, PN 585005.

(d) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). SB PW4ENG 72-434 provides blades with platforms that are 0.015 inch (0.381 mm) oversize. If the 0.055 inch (1.397 mm) maximum gap limit is not met, interchange these wider platform blades with Type A blades as needed to meet the 0.020 - 0.055 inch (0.51 - 1.40 mm) limit.

(21) If necessary, grind HPC 9th stage blade platforms per 72-35-38, Assembly-02 (Task 72-35-38-440-002). As an alternate to grinding platforms on Type A and/or Type D blades, PN 52H409 blades may be used in their place. These blades have platforms which are preground to 0.010 inch (0.254 mm) undersize. Replace one or more Type A and/or Type D blades with the preground blade as required to obtain the 0.020 - 0.055 inch (0.51 - 1.40 mm) fit.

(22) If grinding of blade platforms was required, install Type D blades in slot and check gap. Continue grinding and checking gap until 0.020 - 0.055 inch (0.51 - 1.40 mm) limit is met.

(23) After gap limits have been met, remove all blades from right side of slot and place them in order of removal on bench. Remove all blades from left side of slot and place them in order of removal on bench.

NOTE: Four blades are to remain in disk. These are the first set of four blades (two Types B and C) and two blade locks installed at beginning of this procedure.

(24) Apply Antigallant Compound P06-036 or Dry Film Lubricant P06-041 to seals (side opposite flat side) and to drum groove.

(25) Aligning slots, prepare to install blade seal to drum, flat side out. Seal will be installed from left to right. Selecting blades from bench in same order in which they were previously installed in right side of drum, install blades to seal and drum, and move (slide) blade and seal to right. See Figure 1005.

NOTE: Use nonmetallic drift and mallet to move blades and seals around drum.

(26) Install remaining right side blades into seal and drum per schematic view Figure 1006. Install four Type D blades equally spaced as per figure.

(27) When blades and seal have been installed at right side, install left side blades and seal per instructions above except moving blades and seal from right to left. See Figure 1006. Install four Type D blades equally spaced as per figure.

(28) At this point, four (two Types B and C) blades of the second set should remain on bench. Install Type C blade into drum slot and move to right. Install Type B blade into slot and move left.

(29) Install blade lock and move to right. Install remaining Type B blade and move to right. The last Type C blade and lock can only be inserted in drum by shifting all blades to right. Therefore, rotate drum 180 degrees and loosen blade lock screws. Move all blades and seals to right. Install blade lock in drum slot and move left. Install Type C blade in drum.

(30) Move all blades and seals to left, aligning one blade lock with "V" mark made on drum at beginning of this procedure. Tighten and torque all blade locks to running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use PWA 83135 Driver and PWA 83136 Extension for multispline setscrews.

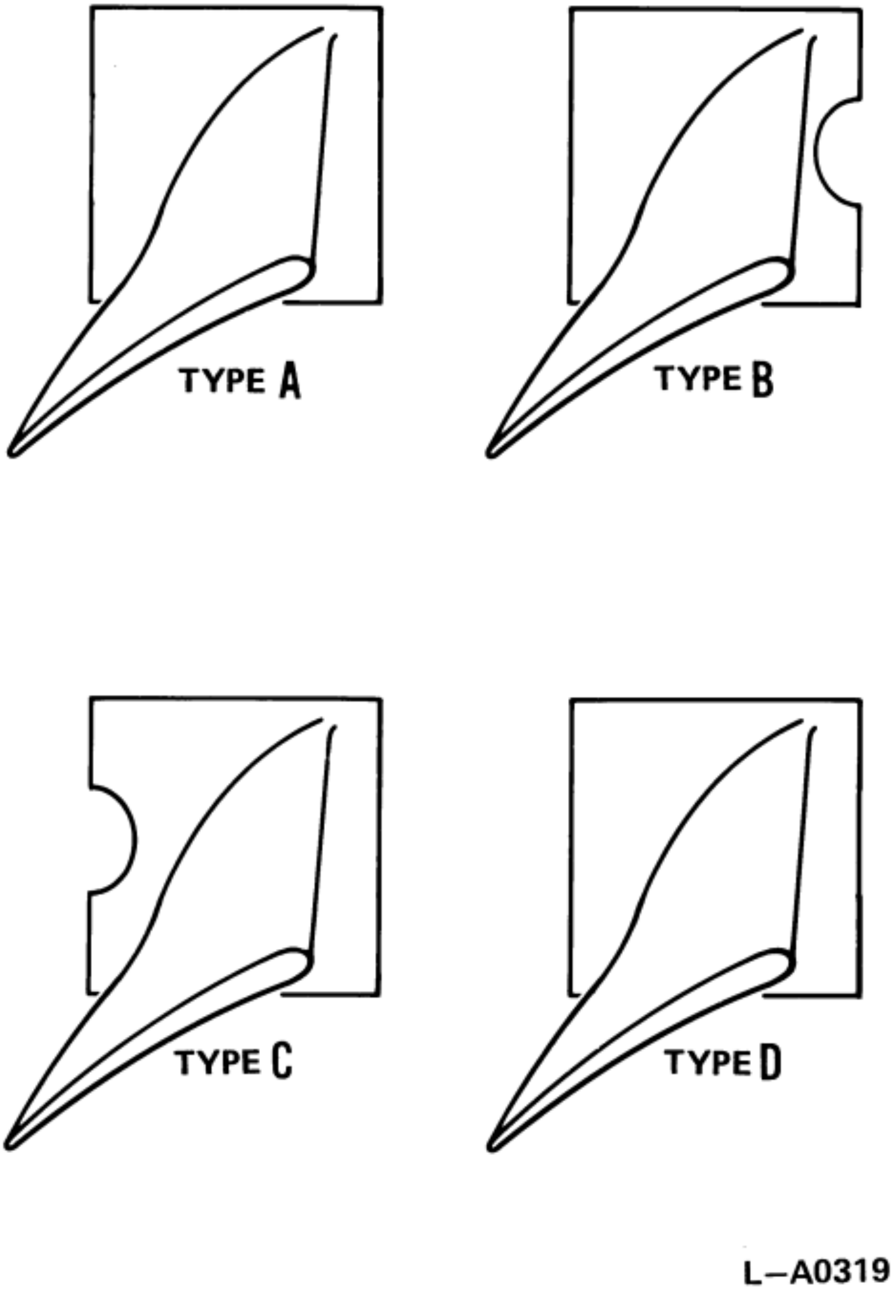
(31) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

- (a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform. See Figure 1004 (Sheet 3).
- (b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank. If these limits are not kept, check the lock for correct assembly in the disk.

(32) Use a feeler gage to measure the gap, which extends between the loading slots, in each 180 degree arc on the two sides of the drum. Each arc must have a 0.010 - 0.030 inch (0.254 - 0.762 mm) gap, measure both sides at the same time. If the gap in not in limit, you must change blades from one side of the rotor to the other, or additional material can be removed from the blade platforms on the side that is too tight. If material is removed you must also keep the 0.020 - 0.055 inch (0.51 - 1.40 mm) gap limit.

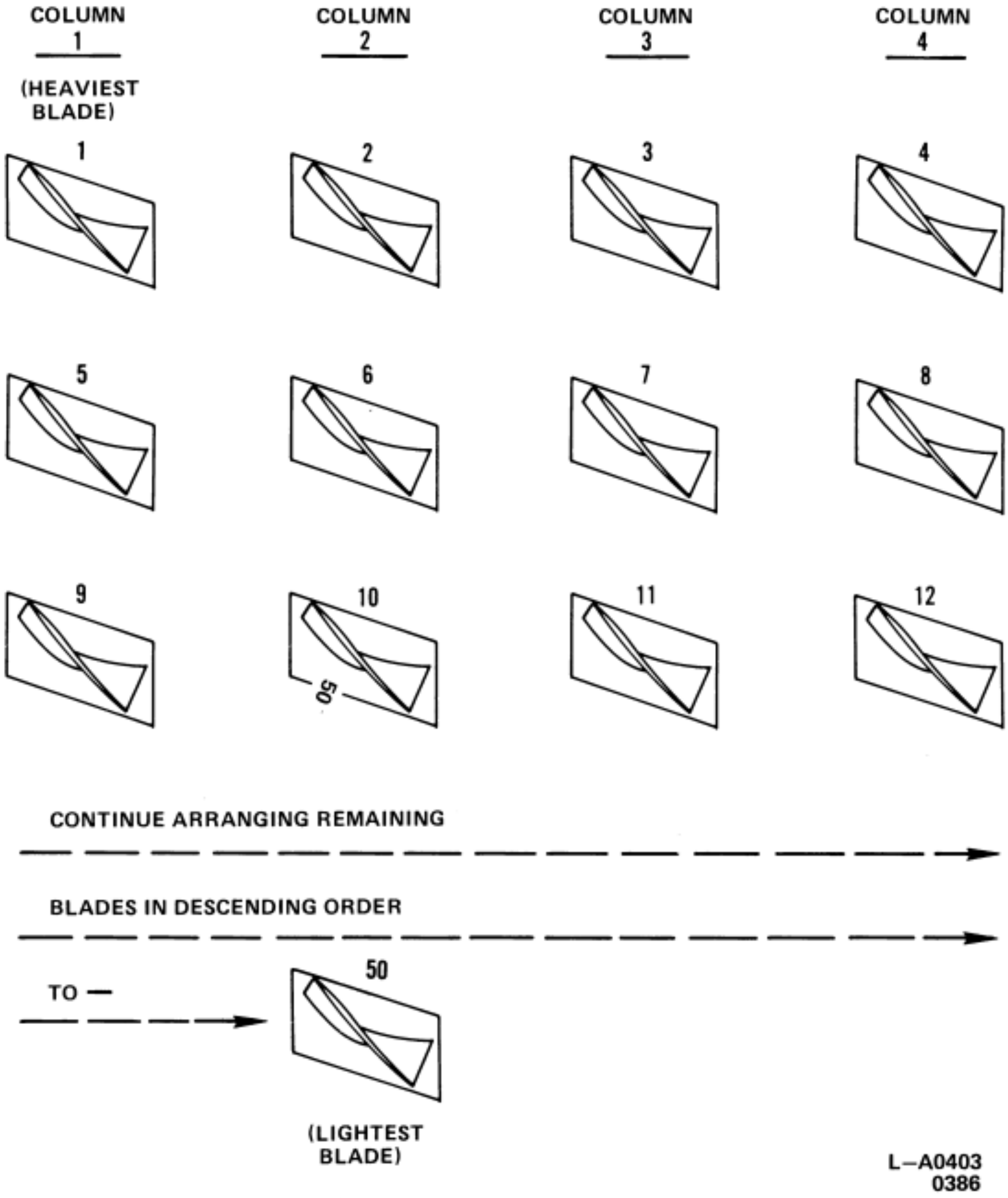
D. Postrequisites

(1) Assemble 8th stage blades to (debladed) axial compressor rotor assembly. See Assembly-28 (Task 72-35-01-440-016).

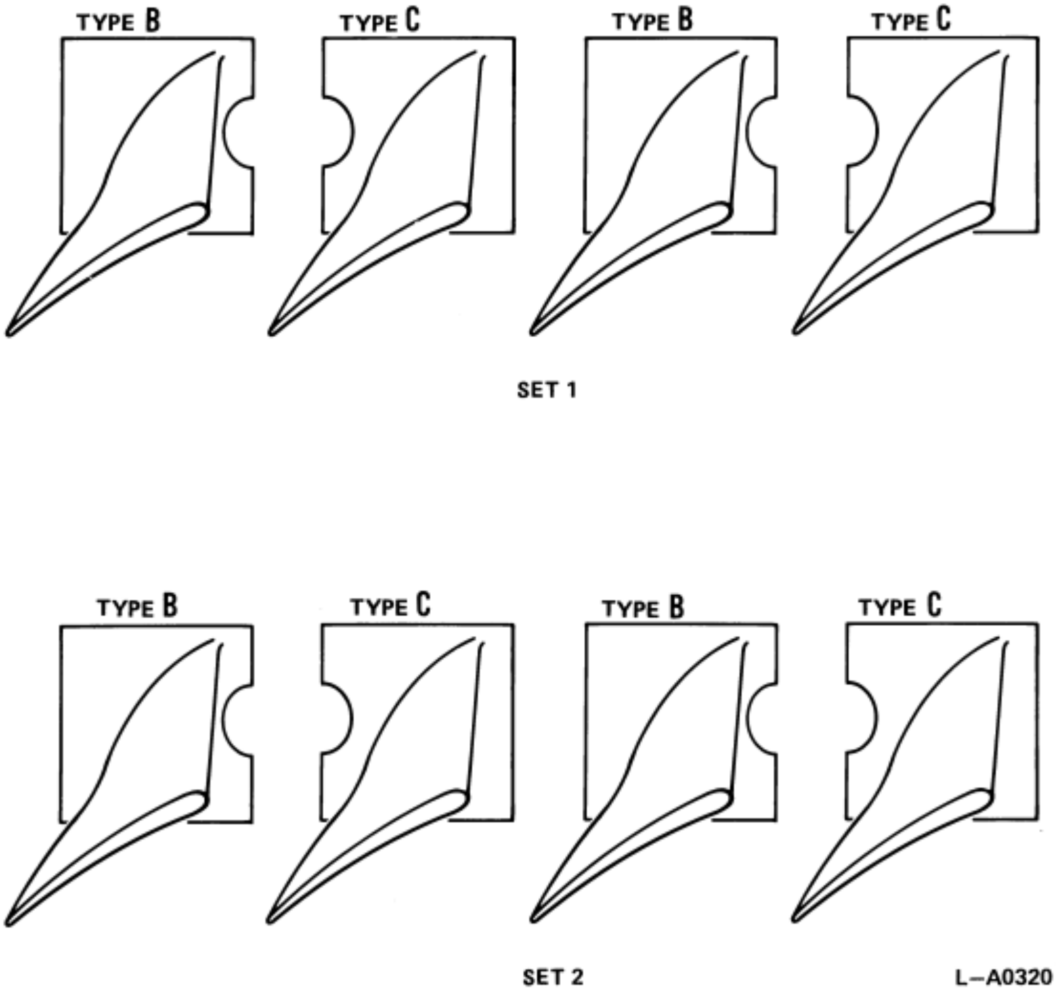

TYPE A
TYPE B
TYPE C
TYPE D
L-A0319

Blade Identification
Figure 1001
(Task 72-35-01-440-015)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-27

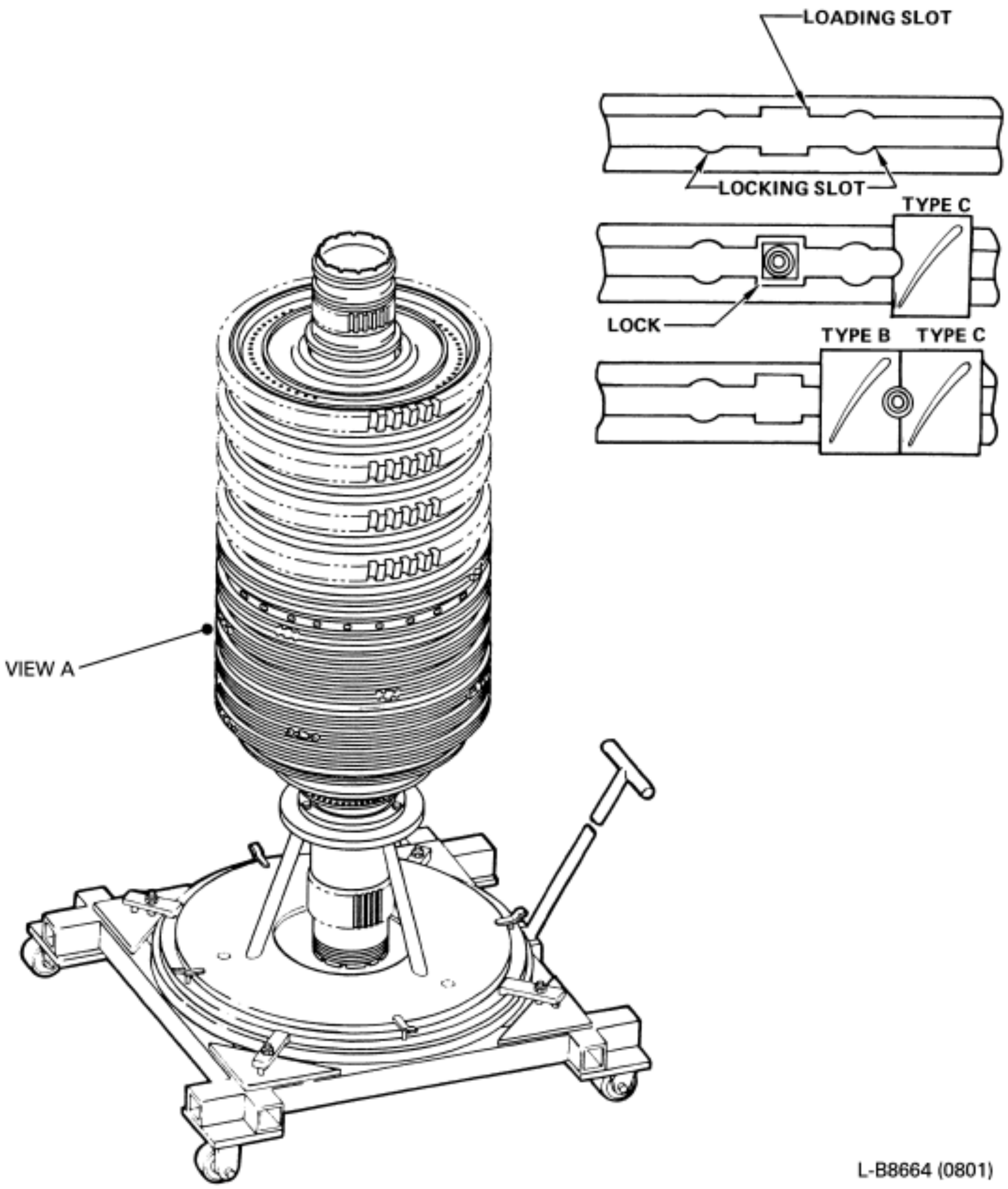

COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
COLUMN 3
COLUMN 4
1
2
3
4
5
6
7
8
9
10
50
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO —
50
(LIGHTEST BLADE)
L-A0403
0386

Blade Weight Arrangement
Figure 1002
(Task 72-35-01-440-015)

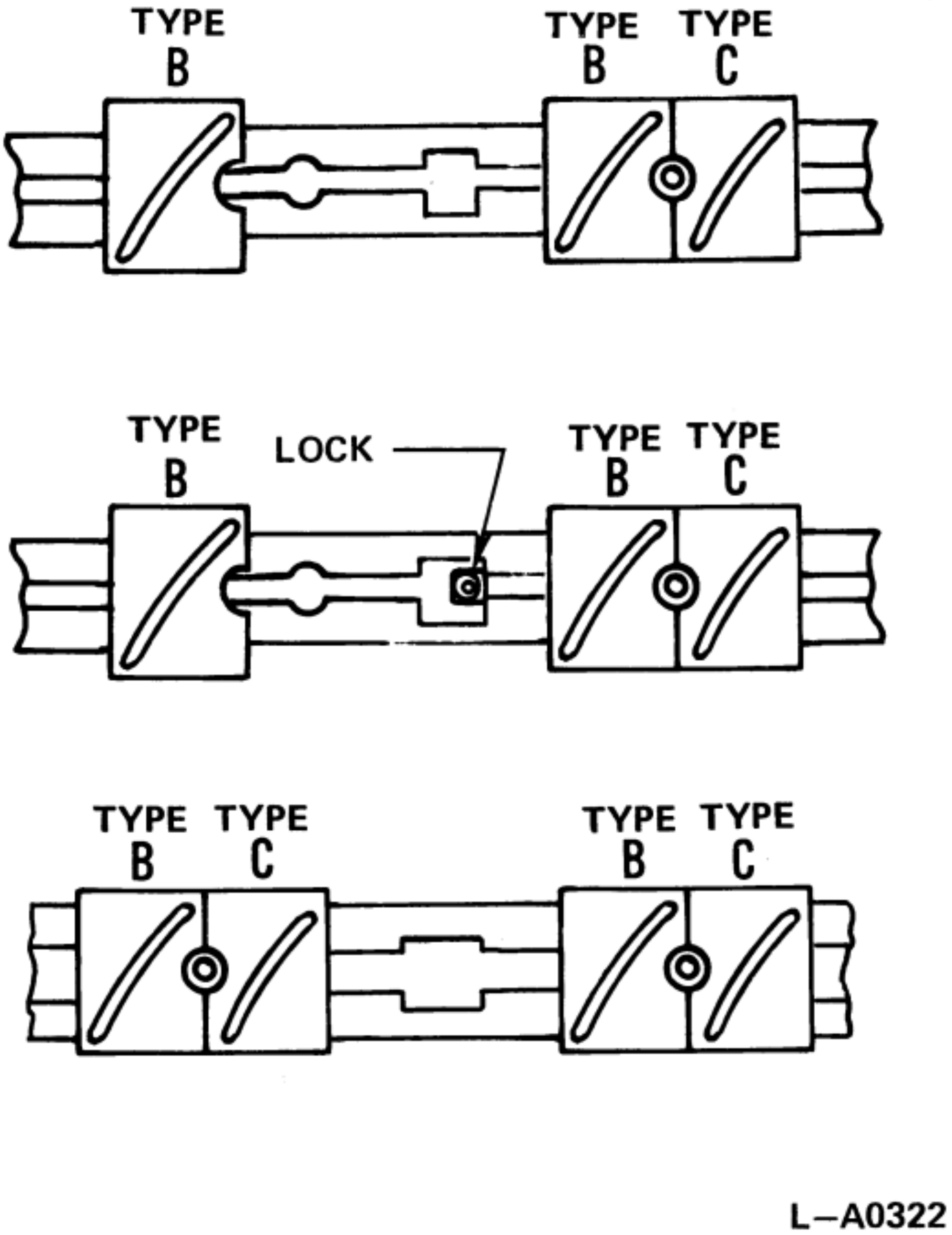

TYPE B
TYPE C
TYPE B
TYPE C
SET 1
TYPE B
TYPE C
TYPE B
TYPE C
SET 2
L−A0320

Blade Sets
Figure 1003
(Task 72−35−01−440−015)

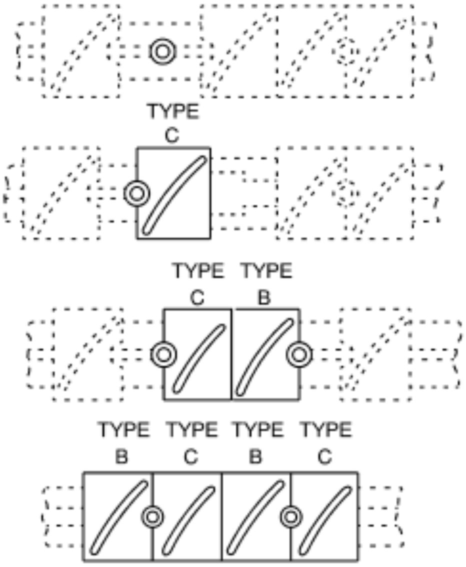
AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-27


LOADING SLOT
LOCKING SLOT
TYPE C
LOCK
TYPE B
TYPE C
VIEW A
L-B8664 (0801)

Blade And Lock Installation
Figure 1004 (Sheet 1)
(Task 72-35-01-440-015)


TYPE B
TYPE B
TYPE C
TYPE B
LOCK
TYPE B
TYPE C
TYPE B
TYPE C
TYPE B
TYPE C
L-A0322

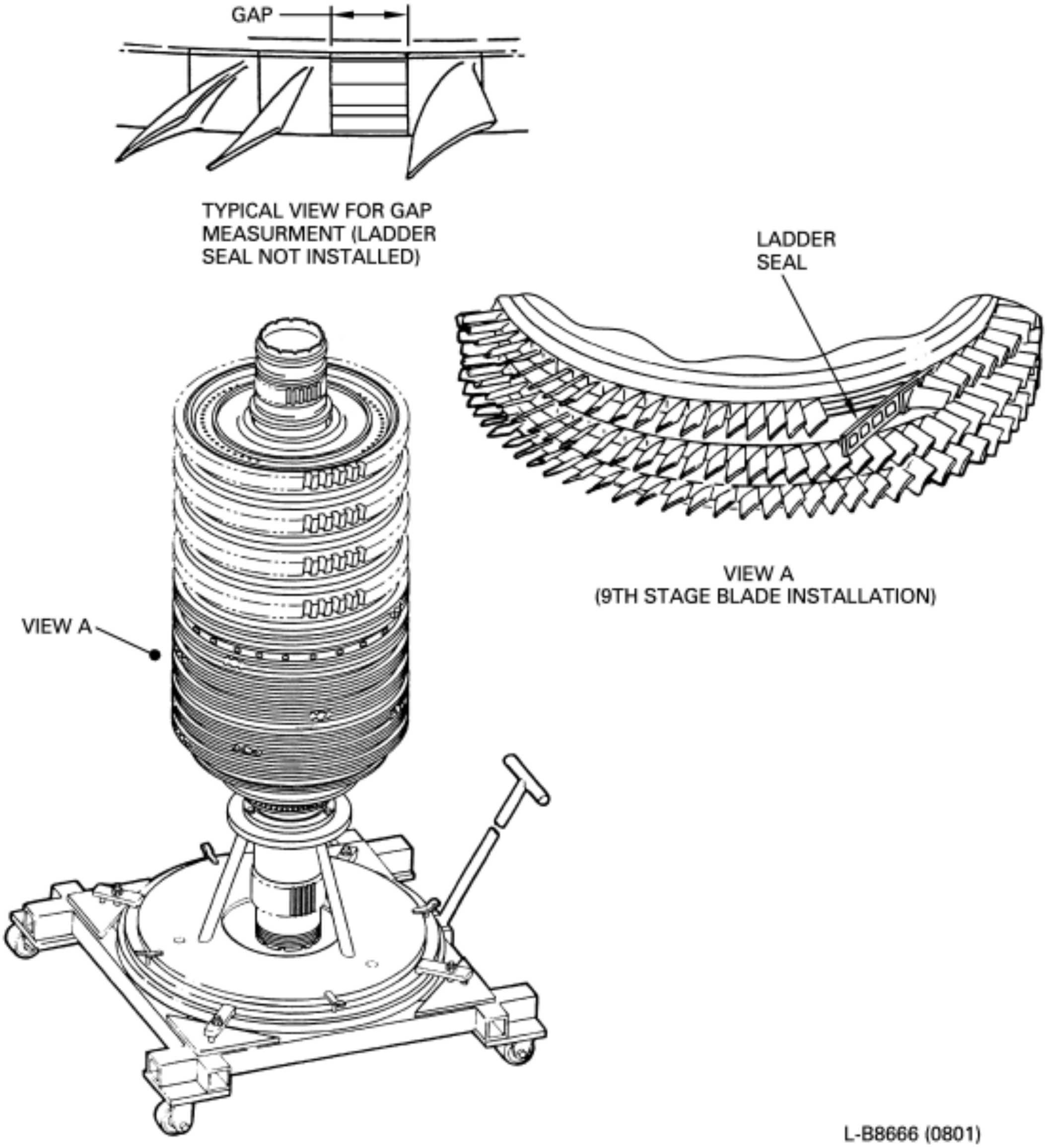
Blade And Lock Installation
Figure 1004 (Sheet 2)
(Task 72-35-01-440-015)


TYPE
C
TYPE
C
TYPE
B
TYPE
B
TYPE
C
TYPE
B
TYPE
C

L−A0323 (0000)
PW V

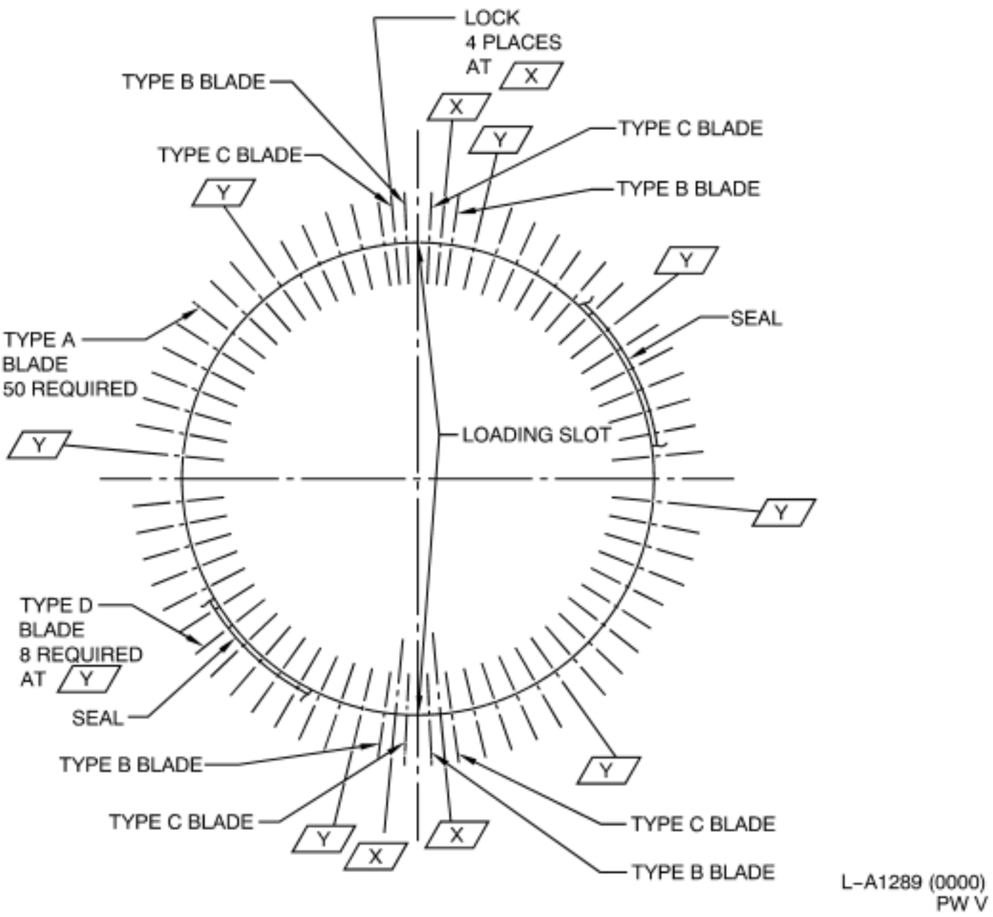
Blade And Lock Installation
Figure 1004 (Sheet 3)
(Task 72−35−01−440−015)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−27


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A
VIEW A (9TH STAGE BLADE INSTALLATION)
L-B8666 (0801)

Gap Measurement And Seal Installation
Figure 1005
(Task 72−35−01−440−015)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−27


LOCK
4 PLACES
AT X
TYPE B BLADE
X
Y
TYPE C BLADE
TYPE C BLADE
TYPE B BLADE
Y
Y
SEAL
TYPE A
BLADE
50 REQUIRED
Y
LOADING SLOT
Y
TYPE D
BLADE
8 REQUIRED
AT Y
SEAL
TYPE B BLADE
Y
TYPE C BLADE
TYPE C BLADE
Y
X
X
TYPE B BLADE
L−A1289 (0000)
PW V

Blade And Lock Installation Schematic View
Figure 1006
(Task 72−35−01−440−015)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-27

Task 72-35-01-440-025:

1. Assemble 9Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble 10th stage blades to (debladed) axial compressor rotor assembly. See Assembly-26, CONFIG-2 (Task 72-35-01-440-024).

B. Equipment And Materials Necessary

Special Tools:

PWA 78064	Gage
PWA 83135	Driver
PWA 83136	Extension
PWA 85595	Spreader
PWA 86447	Drift
PWA 86571	Gage Set
PWA 86652	Drift (Optional To PWA 86447)

Consumable Materials:

Item No.	Designation
P06-036	Compound, Antigallant (PWA 36035)
P06-041	Lubricant, Dry Film (PWA 36221)

C. Measurement of Z-Plane for HPC Stage 9.

CAUTION: DO NOT OVERTIGHTEN GAGE SET SCREWS DURING INSTALLATION OF GAGES. DAMAGE TO THE DRUM CAN RESULT.

(1) Measure Z-Plane diameter for Stage 9. This procedure is optional and can only be used where blades have been removed. Select the pair of gages from the PWA 86571 Z-Plane Diameter Gage Set. Install gages 180 degrees apart, in blade slots. Turn gage set screws clockwise to move the gages radially out to their most outward position. Use OD micrometers to measure four diameters, every 45 degrees, over the gage tool balls. Calculate Z-Plane diameter of the stage by subtracting twice the reference dimension, marked on each pair of gages, from the average diameter measured over the gage tools balls. Refer to minimum, maximum and nominal Z-Plane diameters listed, for reference only, in Table 1001.

Stage	Minimum Diameter (Reference)	Maximum Diameter (Reference)	Nominal Diameter (Reference)
9	22.844 inch (580.238 mm)	22.852 inch (580.441 mm)	22.848 inch (580.339 mm)

HPC Front Drum Z−Plane Diameters
Table 1001

D. Procedure

NOTE: There are three part numbers (sets) of blades provided for this stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. For ease of assembly, blades in this procedure will be referred to as Types A, B and C.

NOTE: (Post SB PW4ENG 72−703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN THE ASSEMBLY PROCEDURE WHICH FOLLOWS, USE THE PWA 86652 DRIFT OR THE PWA 86447 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(1) Remove 9th stage blades from storage rack and place them on bench. Segregate four each of Types B and C blades having notches in their platforms and move to one side. See Figure 1001. R

(2) Optional, weigh the 9th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70−11−00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps

are not required if subsequent rotor balance procedures are carefully done.

R (3) Optional, arrange Type A blades in two columns, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. The lightest blade will be at bottom of Column 2. See Figure 1002.

NOTE: One or more Type A blade may have been used as a fitting blade. Blade will be identified by a square in the service time marking area.

(4) Select two sets of four blades (two Types B and C per set) such that weights of sets are as nearly equal as possible. See Figure 1003.

NOTE: Weights must be nearly equal as sets will be positioned opposite each other after assembly.

R (5) Install blades and lock and setscrew assemblies on the right side. See Figure 1002, Figure 1003, Figure 1004, Figure 1005 and Figure 1006.

R (a) Find one of two 9th stage loading slots.

R (b) Select one of the Type B and C blade sets. Install one Type C blade, leading edge up, into the slot. Move the blade to the right.

R (c) Install one lock and setscrew assembly and move it to the right.

R (d) Locate the locking slot, at Position K, on the right of the blade loading slot. Move the lock and setscrew assembly into the locking slot and tighten. Torque the setscrew to the running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi-spline setscrews.

R NOTE: There are four locking slots that are not used. They are located at, Positions J, on the left and right sides of both loading slots.

R (e) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

1 Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

2 Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

3 If these limits are not kept, check the lock for correct assembly in the disk.

(f) Use an approved marking pen to make a V mark on the outside diameter platform of the drum and in line with the lock. This mark will be used for future reference.

(g) Install one Type B blade into slot and move it to the right until it touches the lock and setscrew assembly.

(h) Rotate the drum 180 degrees. Position the open loading slot toward the operator.

(i) Find the Type A blades to be installed. Start at the bottom of Column 2 (blade Number 58) and continue up to the top of the column (blade Number 2).

(j) Install 20 Type A blades, start with blade Number 58, in the loading slot and move each blade to the right until it touches the blade that was installed before.

(k) Install the remaining Type C blade and move it to the right until it touches the last Type A blade.

(l) Insert one lock and setscrew assembly and move it to the right until it touches the Type C blade.

NOTE: Do not tighten the lock.

(m) Install the remaining Type B blade into the loading slot and move it to the right until it touches the lock and setscrew assembly.

(n) Install the 9 remaining Type A blades from Column 2 in the loading slot and move them to the right until each one touches the blade that was installed before.

(6) Install blades and lock and setscrew assemblies on the left side. See Figure 1002, Figure 1003, Figure 1004, Figure 1005 and Figure 1006.

(a) Get a Type C blade from the remaining Type B and C blade set. Install it in the loading slot and move it to the right until it touches the blade that was installed before.

(b) Install a lock and setscrew assembly in the loading slot and move it to the right until it touches the blade that was installed before.

NOTE: Do not tighten the lock.

(c) Install a Type B blade in the loading slot and move it to the right until it touches the lock.

(d) Find the Type A blades to be installed. Start at the top of Column 1 (blade Number 1) and continue down to the bottom of the column (blade Number 57).

(e) Install 9 Type A blades, start with blade Number 1, in the loading slot and move it to the left until it touches the blade that was installed before.

NOTE: Twenty Type A blades remain that are not installed.

(f) Get a Type B blade from the remaining Type B and C blade set. Install it in the loading slot and move it to the left until it touches the blade that was installed before.

(g) Install a lock and setscrew assembly in the loading slot and move it to the left until it touches the blade that was installed before.

NOTE: Do not tighten the lock.

(h) Install a Type C blade in the loading slot and move it to the left until it touches the lock.

R (i) Install, in the order that follows, blade Numbers 57, 55, 53, 51, 49, 47, 45, 43, then Number 41 in the loading slot and move them fully to the right.

R (j) Install, in the order that follows, blade Numbers 19, 21, 23, 25, 27, 29, 31, 33, 35, then Number 37 in the loading slot and move them fully to the left.

R NOTE: Blade Number 39 is not installed.

R (7) Move the blades tangentially to make the widest possible gap between the last installed Type A blades. This gap will be measured and used to compute the specified gap for between the blades.

R NOTE: Put the blades in a radially outward direction to prevent a circumferentially serpentine shape to the blades.

R (a) Use a PWA 85595 Spreader to load all blades, in the arc, tangentially.

R (b) When it is installed, expand the spreader and get the widest possible gap between the blade platforms. If you need help to move the blades, it is permissible to tap lightly on the base of the airfoil with a PWA 86447 or PWA 86652 Drift.

R (c) Measure and record the gap dimension.

R (d) Find the last blade to be installed. Measure and record the width of the blade platform using a vernier caliper.

R (e) Compare the gap dimension with the blade platform width.

R (f) The width of the blade platform must measure 0.020 − 0.055 inch (0.51 − 1.40 mm) smaller than the gap dimension.

R (g) If the blade platform width is larger than the gap, subtract the gap dimension from the blade platform width to find the difference.

R (8) Do the procedure that follows to get the correct blade platform width for the measured gap.

NOTE: If the measured gap at the blade loading slot is larger than the measured blade platform, replace the necessary number of Type A blades or Type A blades with the narrower platform width to get the correct blade platform gap of 0.020 - 0.055 inch (0.51 - 1.40 mm).

NOTE: (Post SB PW4ENG 72-703) A Type A blade with a 0.010 inch (0.254 mm) narrower platform width is available to help you get the correct platform gap. One or more of these blades can be used to get the correct platform gap.

(a) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm). If the 0.055 inch (1.397 mm) maximum gap limit is not met, replace the Type A blades or the Type A blades with the narrower platform as necessary to get the 0.020 - 0.055 inch (0.51 - 1.40 mm) limit.

(b) If more than one of the narrow platform blades is used, equally space them around the disk during reassembly.

R (9) If it is necessary to remove material from the blade platform to get the correct gap dimension do the following.

R (a) If blade platform width is larger than the gap,
R determine the difference.

R (b) If the total material to be removed does not exceed 0.005 inch (0.127 mm), remove material from either or both sides of the one Type A blade not installed.

R (c) If total amount of material to be removed exceeds of 0.005 inch (0.127 mm) but is no more than 0.010 inch (0.253 mm), remove material in approximately equal amounts from both sides of the Type A blade not installed. The maximum material removed per platform side must not exceed 0.005 inch (0.127 mm).

R (d) If total amount of material to be removed is more than 0.010 inch (0.254 mm), remove additional Type A blades to get the proper fit and remove material in approximately equal amounts from both sides of Type A blade platforms.

R (e) If total amount of material to be removed is more than 0.080 inch (2.032 mm) do as follows:

R 1 Remove additional Type A blades as necessary to get the 0.020 - 0.055 inch (0.51 - 1.40 mm) fit.

R 2 Remove material in equal amounts from both sides of platform on these Types A blades.

R 3 The maximum material removal for each platform side must not be more than 0.005 inch (0.127 mm).

R (f) Type A blades with trimmed platforms must be identified with a square symbol in their
R respective service time marking areas. Refer to
R Standard Practices Manual, PN 585005, Section
R 70-11-00 for approved marking pens.

R (g) The maximum permissible combined loose fit between all blade platforms in a stage is 0.055 inch (1.397 mm).

R (10) If necessary, grind HPC 9th stage blade platforms per 72-35-38 Assembly-02 (Task 72-35-38-440-002).

R (11) If grinding of blade platforms was required, install Type A blades in slot and check gap. Continue grinding and checking gap until 0.020 - 0.055 inch (0.51 - 1.40 mm) limit is met.

R (12) After gap limits have been met, remove all blades from right side of slot and place them in order of removal on bench. Remove all blades from left side of slot and place them in order of removal on bench.

R NOTE: Two blades and one blade lock are to remain in
R disk. These are the first Types B and C blades
R and blade lock that were installed and tightened
R at the start of this procedure.

R (13) Apply Antigallant Compound P06-036 or Dry Film Lubricant P06-041 to ladder seals (side opposite flat side) and to drum groove in the area shown to ease assembly. See Figure 1007.

R (14) Install the right side seals, blades and lock and setscrew assembly. See Figure 1006.

R NOTE: The blades will be installed in the order that they were removed.

R (a) Put the first ladder seal over the loading slot with the flat surface out.

R (b) Align the first opening in the seal with the loading slot in the disk.

R (c) Install the blade that was last removed from the right side (blade Number 58), leading edge up, through the seal and into the loading slot.

R (d) Move the blade and seal to the right until the second opening is aligned with the loading slot.

R NOTE: Be sure that the seal is correctly installed between the disk rails.

R (e) Install the next eight Type A blades to complete the assembly of the first ladder seal. Move this blade and seal assembly fully to the right until it touches the Type B blade that is installed.

R (f) Install the next two Type A blades and move them fully to the right until they touch the blade and seal assembly that was installed.

R (g) Put the second ladder seal over the loading slot with the flat surface out.

R (h) Install the next nine Type A blades in the ladder seal by the method used above and move the assembly fully to the right until it touches the last Type A blade that is installed.

(i) Install a Type C blade, a lock and setscrew assembly, then the next Type B blade. Move them fully to the right until they touch the blades that were installed before.

NOTE: Do not tighten the lock and setscrew assembly.

(j) Put the third ladder seal over the loading slot with the flat surface out.

(k) Install the remaining nine Type A blades, from Column 2, in the ladder seal by the method used for the first seal and move the assembly fully to the right until it touches the Type B blade that is installed.

(15) Install partial left side seals, blades and a lock and setscrew assembly.

NOTE: The blades will be installed in the order that they were removed.

(a) Put the first ladder seal over the loading slot with the flat surface out.

(b) Align the first opening in the seal with the loading slot in the disk.

(c) Install the blade that was last removed (blade Number 1), leading edge up, through the seal and into the loading slot.

(d) Move the blade and seal to the left until the second opening is aligned with the loading slot.

NOTE: Be sure that the seal is correctly installed between the disk rails.

(e) Install the next eight Type A blades to complete the assembly of the first ladder seal. Move this assembly fully to the left until it touches the Type C blade that is installed.

NOTE: Twenty Type A blades remain that are not installed.

(f) Install a Type B blade, a lock and setscrew assembly, then the next Type C blade. Move them fully to the left until they touch the blade and seal assembly that was installed before.

NOTE: Do not tighten the lock and setscrew assembly.

(g) Put the second ladder seal over the loading slot with the flat surface out.

(h) Install the next nine Type A blades in the ladder seal by the method used for the first seal and move the assembly fully to the left until it touches the Type C blade that is installed.

NOTE: Eleven Type A blades, One Type B blade, one Type C blade and one lock assembly remain.

(16) Install the remaining blades and lock and setscrew assembly.

(a) Install the remaining Type C blade and move it fully to the right until it touches the blade that was installed before.

(b) Install the last lock and setscrew assembly in the drum slot and move it to the left.

NOTE: Do not tighten the lock.

(c) Install the remaining Type B blade and move it fully to the right until it touches the blade that was installed before.

(d) Put the ladder seal over the loading slot with the flat surface out.

(e) Align the first opening in the seal with the loading slot in the disk.

(f) Install, in the order that follows, blade Numbers 57, 55, 53, 51, 49, 47, 45, 43, then Number 41 through the seal opening and into the loading slot. Move the assembly fully to the right.

NOTE: Two Type A blades have not been installed.

(g) The last Type A blades can only be inserted in the drum by moving all blades to the right. To do this, you must rotate the drum 180 degrees and loosen the blade lock screw.

(h) Rotate the drum 180 degrees again to the opposite loading slot.

(i) Move all blades, seals and locks to the right, as necessary to install blade Number 39 then Number 37.

(17) Move the blades, seals and locks to the final positions.

(a) Move all blades, seals and locks to the left. Align the blade lock with the V mark you made on the drum at beginning of this procedure.

(b) Position, tighten and torque the lock and setscrew assembly that is located at the locking slot near the V mark.

1 Torque the setscrew to the running torque plus 4 − 8 lb−in. (0.452 − 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi−spline setscrews.

(18) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow:

(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

(c) If these limits are not kept, check the lock for correct assembly in the disk.

(19) Position, tighten and torque the remaining lock and setscrew assemblies.

R (a) Check the gaps, all gaps between the ladder seals should be approximately equal.

R (b) Torque the setscrew to the running torque plus 4 - 8 lb-in. (0.452 - 0.904 N.m). Use a PWA 83135 Driver and PWA 83136 Extension for multi-spline setscrews.

R (20) Check the clearance of the blade lock and the top of the blade platform by one of the methods that follow: See Figure 1004.

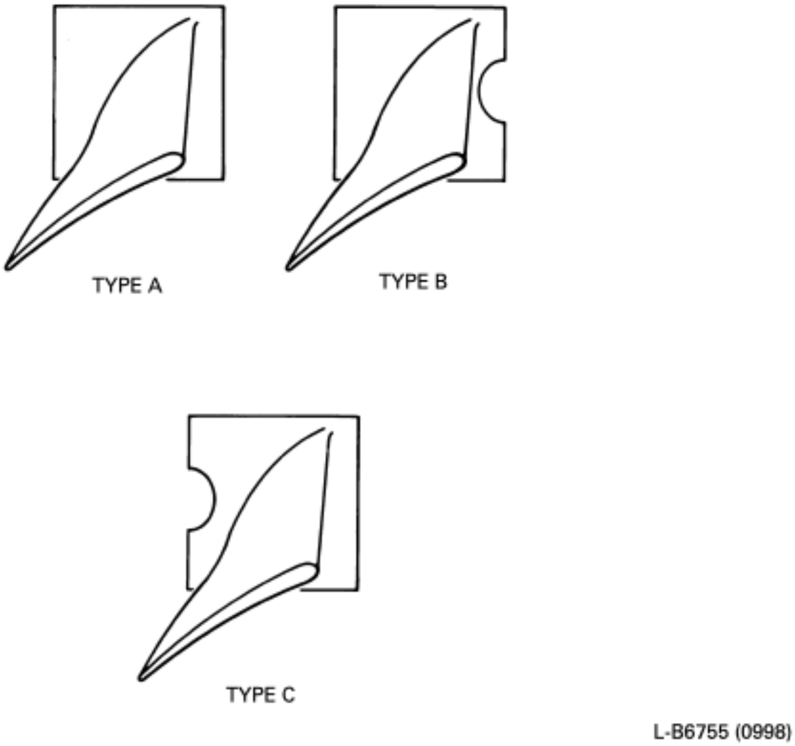
(a) Method 1: Measure the height clearance between blade lock and the top of the blade platform, with PWA 78064 Gage. Lock shank must be flush to 0.035 inch (0.889 mm) below blade platform.

(b) Method 2: The lock shank top surface must be approximately flush with or below the blade platform. The top of the setscrew can have up to one full thread exposed above or recessed below the face of the lock shank.

R (c) If these limits are not kept, check the lock for correct assembly in the disk.

E. Postrequisites

(1) Assemble 8th stage blades to (debladed) axial compressor rotor assembly. See Assembly-28 (Task 72-35-01-440-016).


TYPE A
TYPE B
TYPE C
L-B6755 (0998)

Blade Identification
Figure 1001
(Task 72−35−01−440−025)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-27

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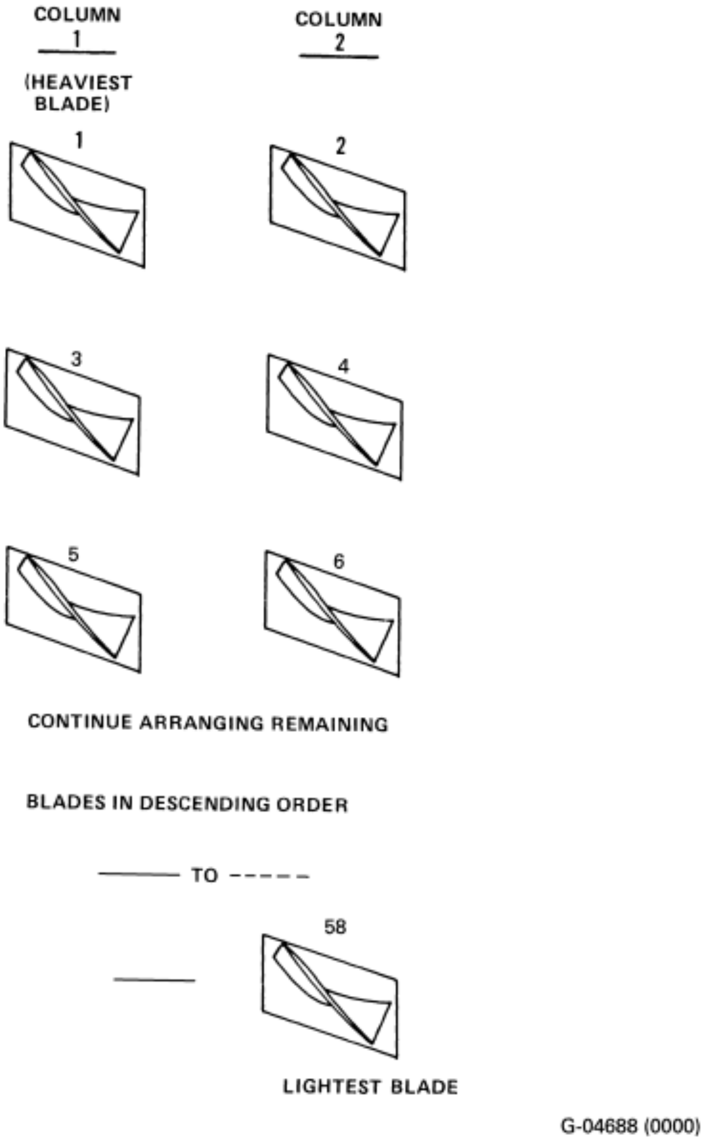
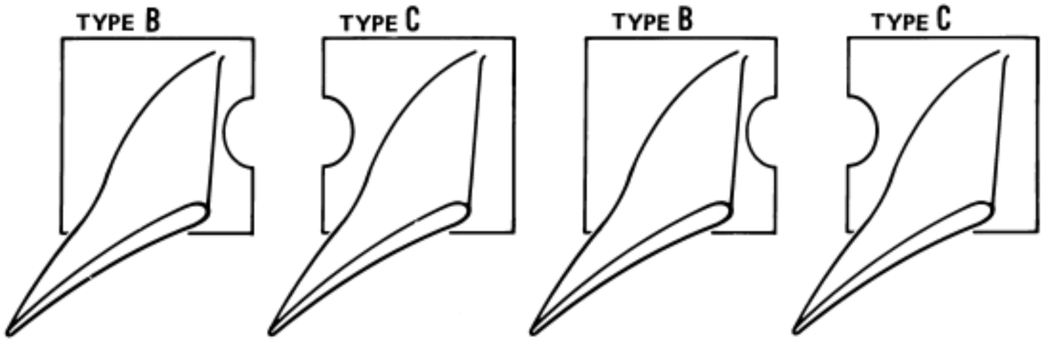
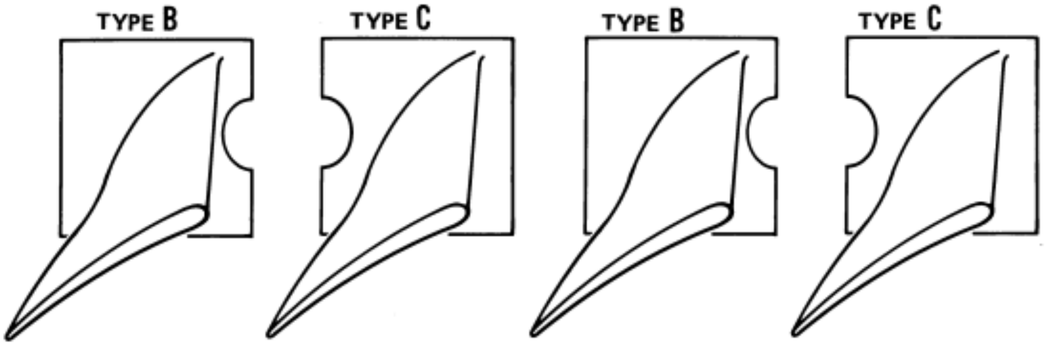

COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
1
2
3
4
5
6
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO
58
LIGHTEST BLADE
G-04688 (0000)

Blade Weight Arrangement
Figure 1002
(Task 72-35-01-440-025)


TYPE B
TYPE C
TYPE B
TYPE C

SET 1


TYPE B
TYPE C
TYPE B
TYPE C

SET 2

L−A0320

R Type B And C Blade Set Arrangement
Figure 1003
(Task 72−35−01−440−025)

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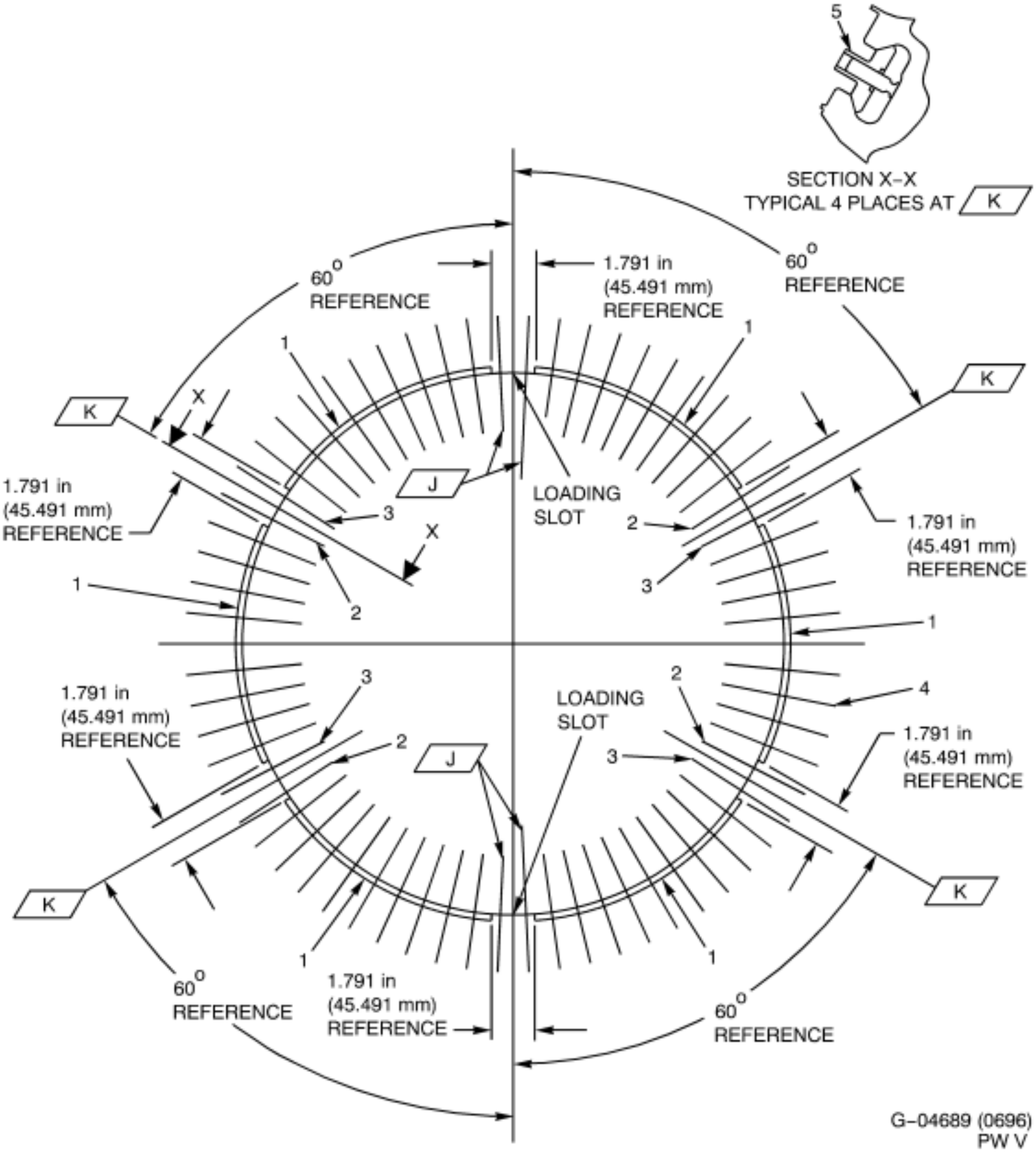
5
SECTION X-X
TYPICAL 4 PLACES AT K
60°
REFERENCE
1.791 in
(45.491 mm)
REFERENCE
60°
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1
K
K
X
J
LOADING
SLOT
1.791 in
(45.491 mm)
REFERENCE
3
X
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1.791 in
(45.491 mm)
REFERENCE
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1.791 in
(45.491 mm)
REFERENCE
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LOADING
SLOT
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J
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1.791 in
(45.491 mm)
REFERENCE
K
K
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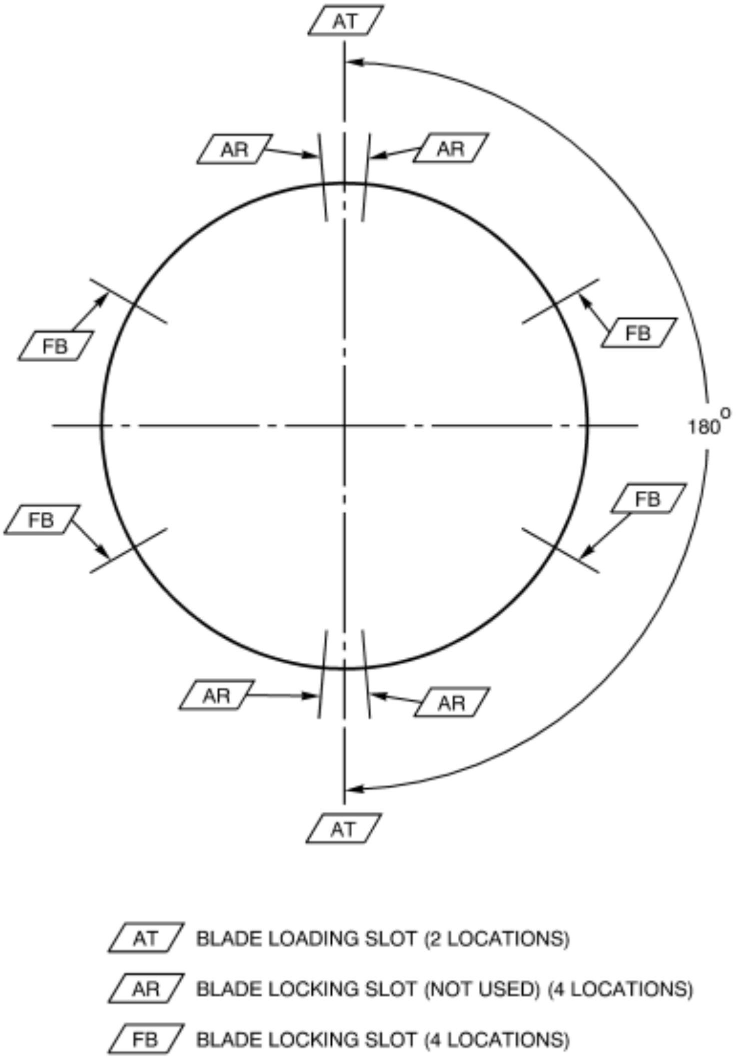
60°
REFERENCE
1.791 in
(45.491 mm)
REFERENCE
60°
REFERENCE
G-04689 (0696)
PW V

Blade And Lock Installation Schematic View
R Figure 1004 (Sheet 1)
(Task 72-35-01-440-025)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-27

R 1. Ladder Seals
R 2. Type C Blades
R 3. Type B Blades
R 4. Type A Blades
R 5. Lock And Setscrew Assembly

R Key to Figure 1004 (Sheet 1)


AT
AR
AR
FB
FB
180°
FB
FB
AR
AR
AT
AT BLADE LOADING SLOT (2 LOCATIONS)
AR BLADE LOCKING SLOT (NOT USED) (4 LOCATIONS)
FB BLADE LOCKING SLOT (4 LOCATIONS)

L−B8079 (0600)
PW V

Blade Loading And Lock Slot Locations Schematic View
R Figure 1004 (Sheet 2)
(Task 72−35−01−440−025)

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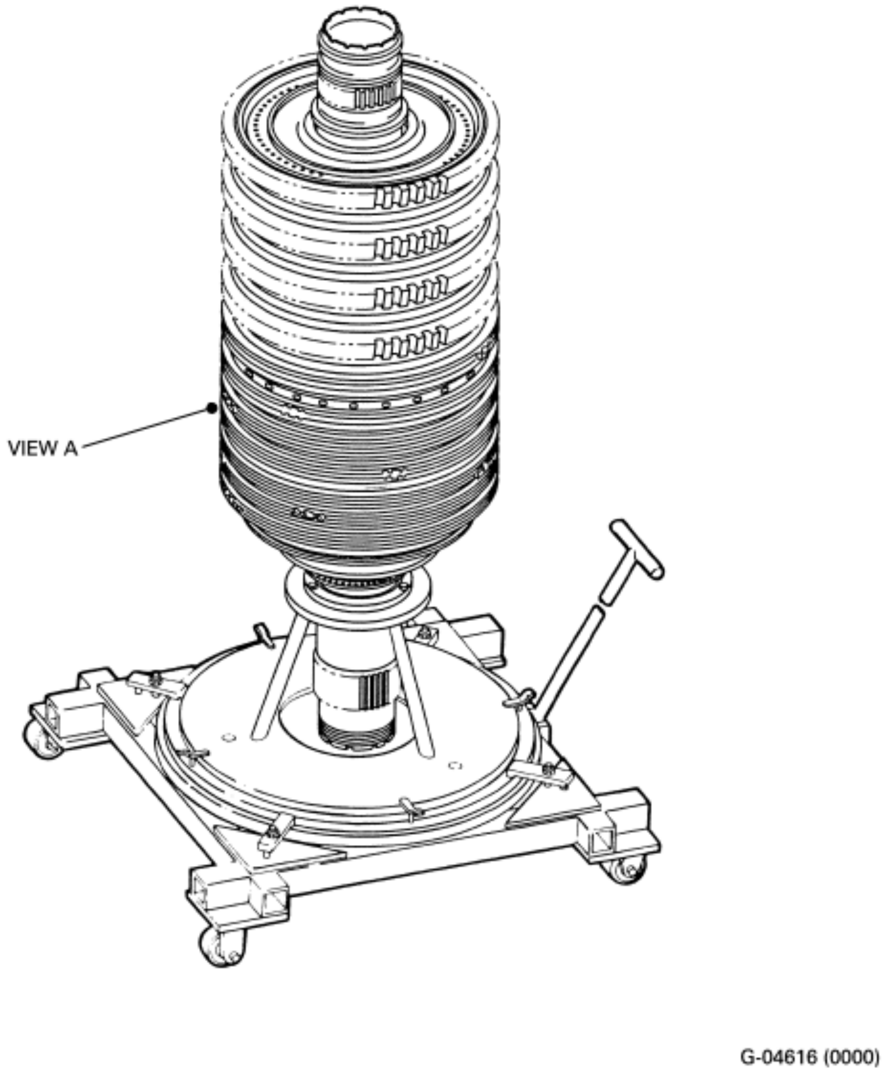

Blade And Lock Installation
R Figure 1005 (Sheet 1)
(Task 72−35−01−440−025)

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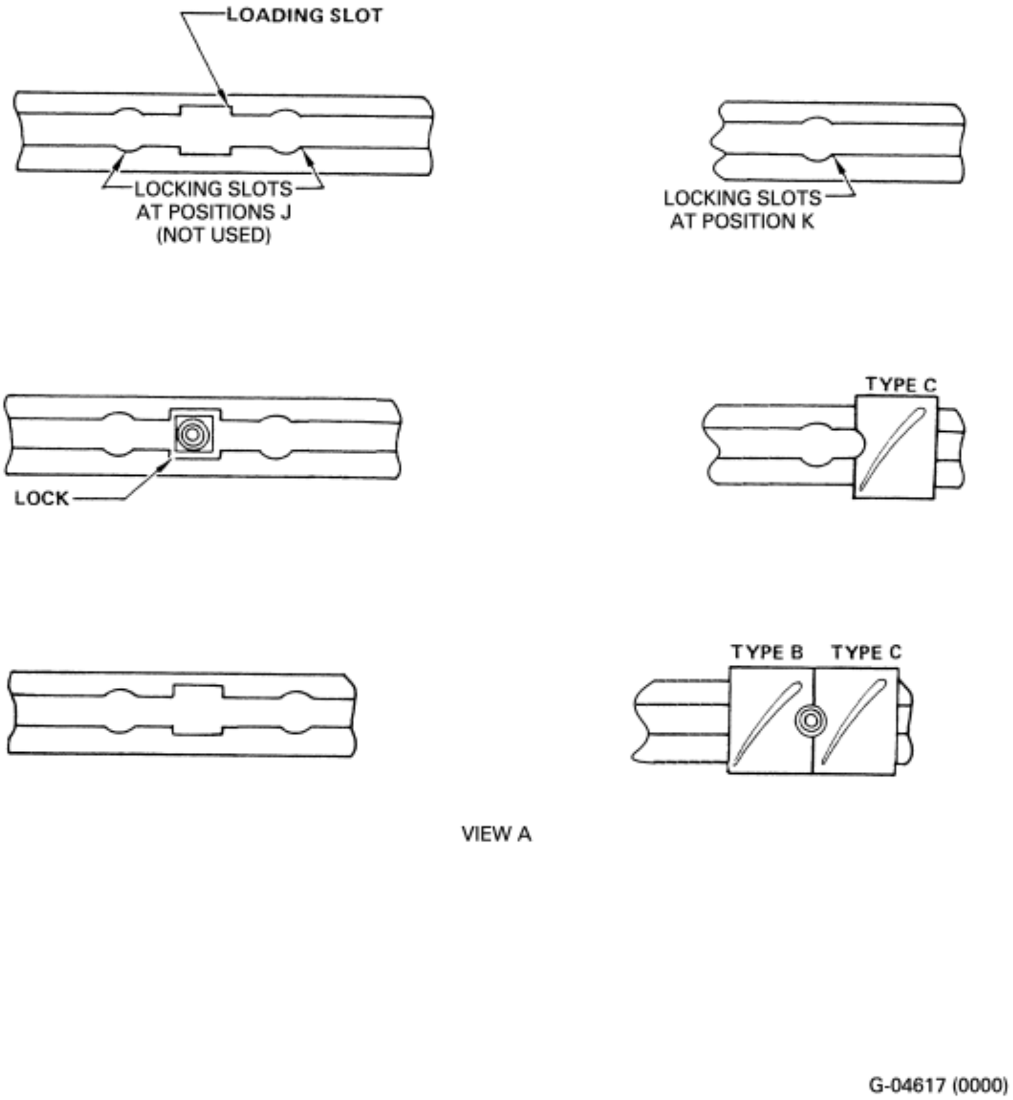
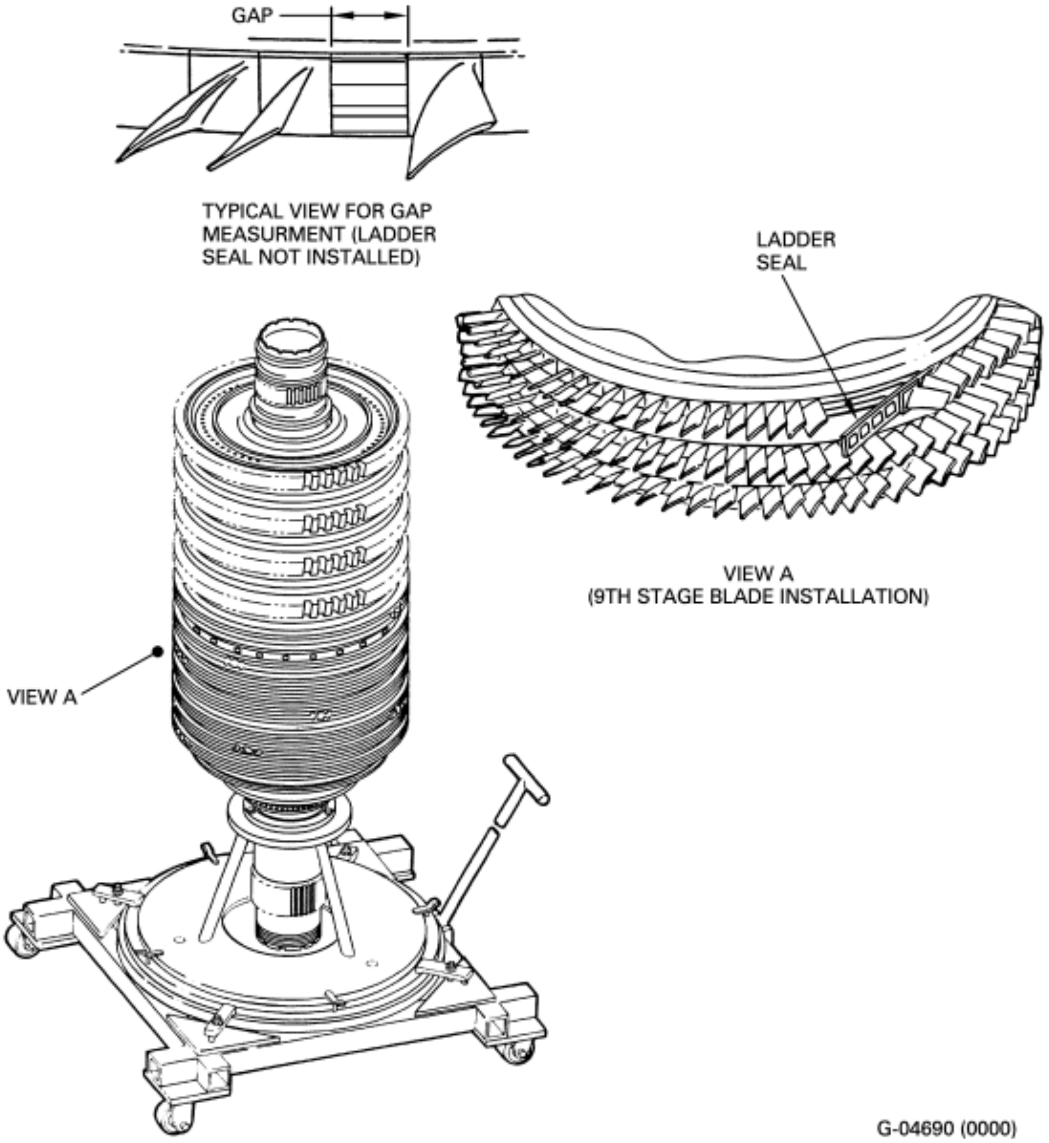

LOADING SLOT
LOCKING SLOTS AT POSITIONS J (NOT USED)
LOCKING SLOTS AT POSITION K
LOCK
TYPE C
TYPE B
TYPE C
VIEW A
G-04617 (0000)

Blade And Lock Installation
R Figure 1005 (Sheet 2)
(Task 72-35-01-440-025)


GAP
TYPICAL VIEW FOR GAP MEASURMENT (LADDER SEAL NOT INSTALLED)
LADDER SEAL
VIEW A (9TH STAGE BLADE INSTALLATION)
VIEW A
G-04690 (0000)

R Gap Measurement And Ladder Seal Installation
R Figure 1006
(Task 72−35−01−440−025)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-27

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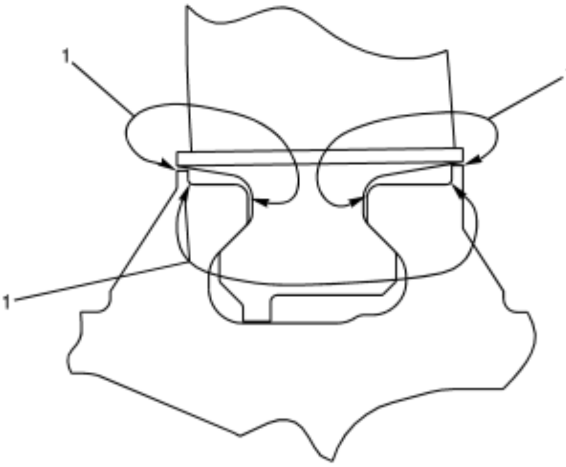


G-04624 (0000)
PW V

R 1. Antigallant Treatment Area

R Antigallant Treatment Area
R Figure 1007
R (Task 72-35-01-440-025)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-35-01-440-016:

1. Assemble 8Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble 9th stage blades to (debladed) axial compressor rotor assembly. See Assembly-27, CONFIG-1 (Task 72-35-01-440-015) or CONFIG-2 (Task 72-35-01-440-025).

B. Equipment And Materials Necessary

Special Tools:

	PWA 78014	Bender, Pneumatic (Replaced By PWA 100013 Change Letter B)
	PWA 85198	Ring, Retaining
	PWA 86520	Bender, Mechanical (Optional to PWA 78014)
	PWA 86571	Gage Set
	PWA 87123	Bender, Mechanical (Optional to PWA 86520)
R R	PWA 100013	Bender Change Letter B, Pneumatic (Initial Bend) (Replaces PWA 78014) (Optional To PWA 106226)
	PWA 102171	Bender, Pneumatic (Final Bend) (Optional to PWA 106227)
R	PWA 106226	Bender, Pneumatic (Initial Bend)
	PWA 106227	Bender, Pneumatic (Final Bend)

Consumable Materials:

Item No.	Designation
P09-015	Sealing Compound (PWA 544)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lock	53	72-35-00/2/90

C. Procedure

CAUTION: DO NOT OVERTIGHTEN GAGE SET SCREWS DURING INSTALLATION OF GAGES. DAMAGE TO THE DRUM CAN RESULT.

(1) Measure Z-Plane diameters for Stage 8. This procedure is optional and can only be used where blades have been

removed. Select the pair of gages, marked for that stage, from the PWA 86571 Z-Plane Diameter Gage Set. Install gages, 180 degrees apart, in blade slots. Turn gage set screws clockwise to move the gages radially out to their most outward position. Use OD micrometers to measure four diameters, every 45 degrees, over the gage tool balls. Add the two reference dimensions and subtract from the average diameter, measured over the gage balls. Refer to minimum, maximum and nominal Z-Plane diameters listed, for reference only, in Table 1001.

Stage	Minimum Diameter (Reference)	Maximum Diameter (Reference)	Nominal Diameter (Reference)
8	22.750 inch (577.850 mm)	22.762 inch (578.115 mm)	22.756 inch (578.002 mm)

HPC Front Drum Z-Plane Diameters
Table 1001

(2) Prepare Sealing Compound P09-015.

(a) Sealant must be stirred vigorously immediately prior to application.

(b) Sealant must be kept covered in airtight polyethylene container when not being mixed or used.

(c) Usable working life of sealant is limited to maximum of 14 days. Unused material must not be used beyond this time limit.

(d) After preparation, surfaces to be coated must be handled only with clean gloves. Extreme care must be exercised to avoid contamination with oil, grease, and other foreign materials. If sealant application is not performed immediately after cleaning, prepared surfaces should be suitably protected against contaminants.

(e) Sealed and assembled parts must not be subjected to any mechanical stressing until cure has been completed.

(f) Surfaces to be sealed must not exceed 100°F (37.8°C) during application of sealant.

(g) Sealed surfaces of parts must be suitably protected against damage during handling and shipping.

(3) Optional, weigh the 8th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70-11-00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

(4) Optional, arrange 8th stage blades in four columns of 13 blades, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. Remaining lightest blade will be at bottom left (Column 1). See Figure 1001.

(5) Prior to applying sealant, wipe blade areas to be sealed by SPOP 208 Wipe Method Standard Practices Manual, PN 585005, 70-21-00.

CAUTION: CARE SHOULD BE TAKEN TO ENSURE THAT ANY PRESSURE OR FORCE REQUIRED TO INSTALL BLADE IN DRUM, BE APPLIED TO ROOT PLATFORM AREA OF BLADE AND NOT TO LEADING OR TRAILING EDGE OF AIRFOIL. AIRFOIL SECTION OF BLADES ARE EASILY DAMAGED BY ANY KIND OF FORCE.

(6) Install PWA 85198 Retaining Ring just below blade slots. Starting with lightest (bottom) blade in Column 4, apply Sealing Compound P09-015, in areas shown in Figure 1002, and install blade in drum slot, leading edge up.

(7) Grasp blade and pull outward to load blade against bearing surface of drum slot. Slowly seat blade completely in drum.

(8) Remove excess sealant from blade lock area and around blade root area. Fill in any voids.

R
R

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−28

(9) Repeating sealant application procedure, install remaining blades from Column 4 continuing vertically upward from lighter blades to heavier blades. Install blades to drum in order selected, and in a counterclockwise direction.

(10) After all blades in Column 4 are installed, move to bottom of Column 2, repeat compound application procedure, and install blades from Column 2, selecting blades vertically upward from lighter blades to heavier blades. Install blades in counterclockwise direction.

(11) After all blades in Column 2 are installed, move to bottom of Column 3, and repeat compound application and blade installation procedures.

(12) After all blades in Column 3 are installed, move to bottom of Column 1, and repeat compound application and blade installation procedures.

(13) Check that all of the Stage 8 blades are installed in drum, then retain the blades by inserting wire locks in the wire lock grooves in a clockwise direction when viewed from the front. Bend the blade locks. Use a PWA 86520 Bender or a PWA 87123 Mechanical Bender for the initial and final bend. Use a PWA 78014 Bender or
R a PWA 100013 Pneumatic Bender Change Letter B or a PWA
R 106226 Pneumatic Bender for the initial bend and a PWA 102171 or PWA 106227 Pneumatic Bender for the final bend to crimp the locks. No tangential motion of the lock is allowed in the installed position. Measure the bend dimension with a dial caliper. See Figure 1003.

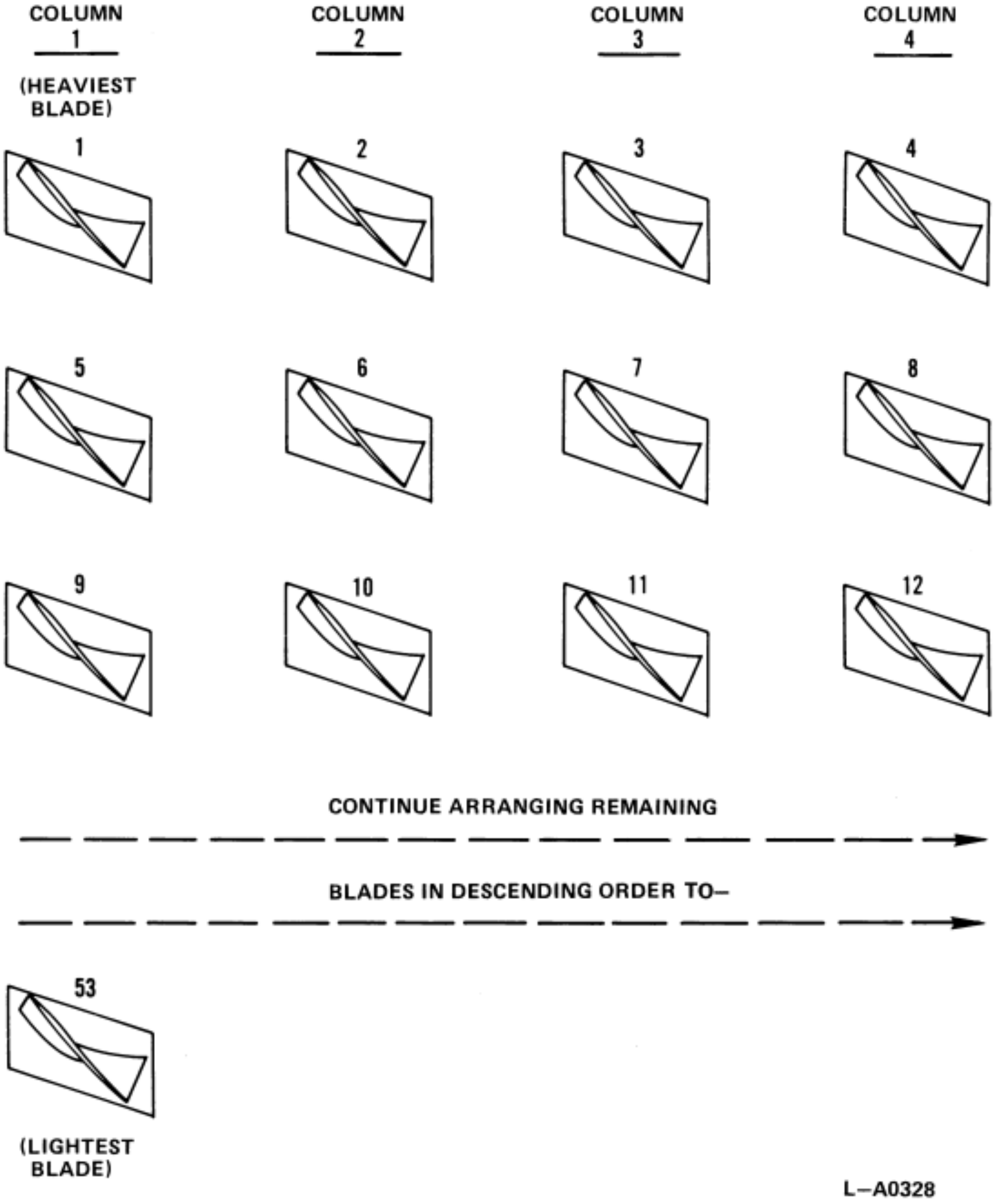
NOTE: If you use the PWA 78014 Bender, you must use the pre bend and final bend jaws.

(14) Remove PWA 85198 Retaining Ring from around drum. Remove excess sealant from blade root area. Fill in any voids.

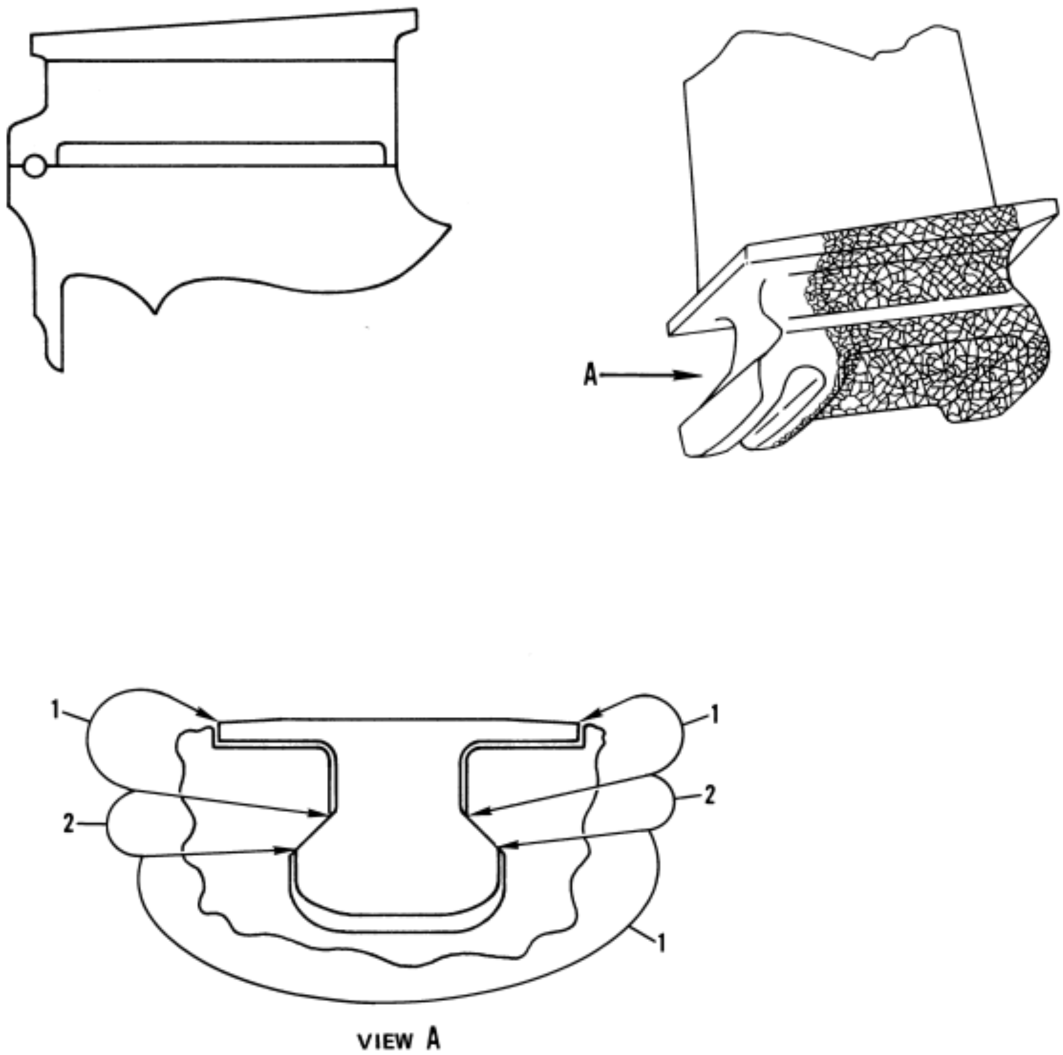
D. Postrequisites

(1) Assemble 7th stage blades to (debladed) axial compressor rotor assembly. See Assembly−29 (Task 72−35−01−440−017).

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-28


COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
COLUMN 3
COLUMN 4
1
2
3
4
5
6
7
8
9
10
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER TO–
53
(LIGHTEST BLADE)
L–A0328

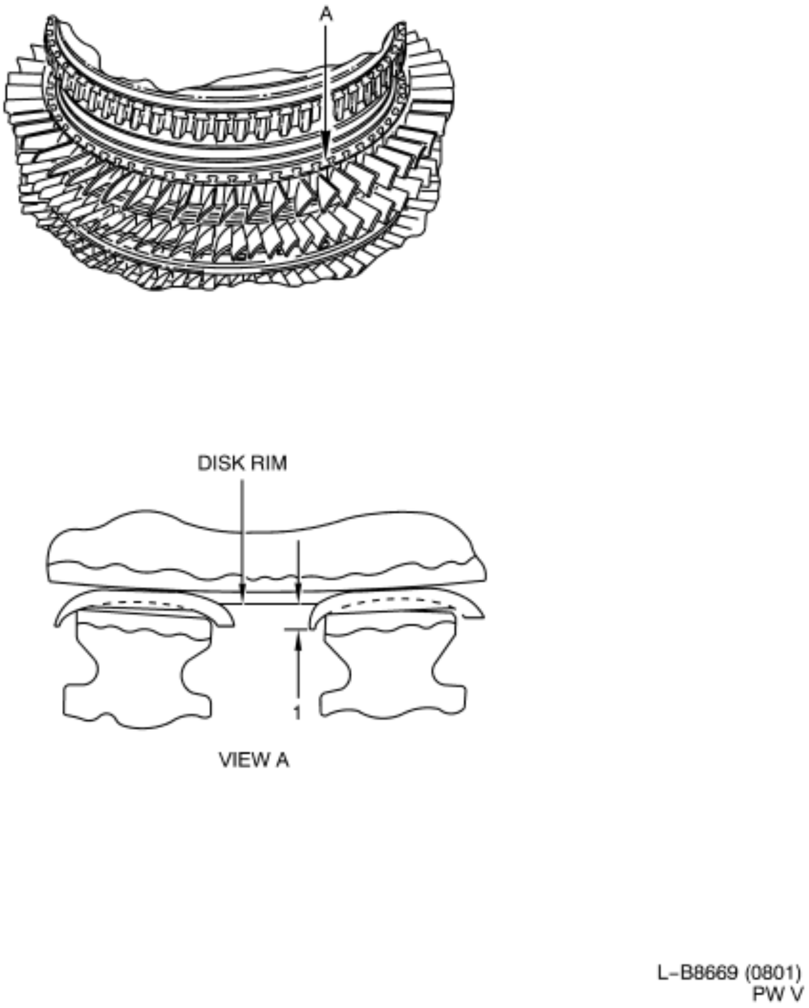
Blade Arrangement
Figure 1001
(Task 72-35-01-440-016)



L-A7000

1. Apply Sealant (P09−015) In Areas Shown For Entire Length Of Blade Root.
2. No Sealant To Be Applied In This Area But Traces Are Permissible After Assembly Of Blade To Disk.

Sealant Application
Figure 1002
(Task 72−35−01−440−016)


A
DISK RIM
1
VIEW A
L−B8669 (0801)
PW V

1. 0.150 Inch (3.810 mm) Minimum

Blade Lock Tab Bending
Figure 1003
(Task 72−35−01−440−016)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-35-01-440-017:

1. Assemble 7Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble 8th stage blades to (debladed) axial compressor rotor assembly. See Assembly-28 (Task 72-35-01-440-016).

B. Equipment And Materials Required

Special Tools:

	PWA 78014	Bender, Pneumatic (Replaced By PWA 100013 Change Letter B)
	PWA 85197	Ring, Retaining
	PWA 86520	Bender, Mechanical (Optional to PWA 78014)
	PWA 87123	Bender, Mechanical (Optional to PWA 86520)
R R	PWA 100013	Bender, Pneumatic Change Letter B (Initial Bend) (Replaces PWA 78014) (Optional To PWA 106226)
	PWA 102171	Bender, Pneumatic (Final Bend) (Optional to PWA 106227)
R	PWA 106226	Bender, Pneumatic (Initial Bend)
	PWA 106227	Bender, Pneumatic (Final Bend)

Consumable Materials:

Item No.	Designation
P09-015	Sealing Compound (PWA 544)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lock	56	72-35-00/2/60

C. Procedure

(1) Prepare Sealing Compound P09-015.

(a) Sealant must be stirred vigorously immediately prior to application.

(b) Sealant must be kept covered in airtight polyethylene container when not being mixed or used.

(c) Usable working life of sealant is limited to maximum of 14 days. Unused material must not be used beyond this time limit.

(d) After preparation, surfaces to be coated must be handled only with clean gloves. Extreme care must be exercised to avoid contamination with oil, grease, and other foreign materials. If sealant application is not performed immediately after cleaning, prepared surfaces should be suitably protected against contaminants.

(e) Sealed and assembled parts must not be subjected to any mechanical stressing until cure has been completed.

(f) Surfaces to be sealed must not exceed 100°F (37.8°C) during application of sealant.

(g) Sealed surfaces of parts must be suitably protected against damage during handling and shipping.

(2) Optional, weigh the 7th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70-11-00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

(3) Optional, arrange 7th stage blades in four columns of 14 blades, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. Remaining lightest blade will be at bottom right (Column 4). See Figure 1001.

(4) Prior to applying sealant, wipe blade areas to be sealed by SPOP 208 Wipe Method Standard Practices Manual, PN 585005, 70-21-00.

CAUTION: CARE SHOULD BE TAKEN TO ENSURE THAT ANY PRESSURE OR FORCE REQUIRED TO INSTALL BLADE IN DRUM, BE APPLIED TO ROOT PLATFORM AREA OF BLADE AND NOT TO LEADING OR TRAILING EDGE OF AIRFOIL. AIRFOIL SECTION OF BLADES ARE EASILY DAMAGED BY ANY KIND OF FORCE.

(5) Install PWA 85197 Retaining Ring just below blade slots. Starting with lightest (bottom) blade in Column 4, apply Sealing Compound P09-015, in areas shown in Figure 1002, and install blade in drum slot, leading edge up.

(6) Grasp blade and pull outward to load blade against bearing surface of drum slot. Slowly seat blade completely in drum.

(7) Remove excess sealant from blade lock area and around blade root area. Fill in any voids.

(8) Repeating sealant application procedure, install remaining blades from Column 4 continuing vertically upward from lighter blades to heavier blades. Install blades to drum in order selected, and in a counterclockwise direction.

(9) After all blades in Column 4 are installed, move to bottom of Column 2, repeat compound application procedure, and install blades from Column 2, selecting blades vertically upward from lighter blades to heavier blades. Install blades in counterclockwise direction.

(10) After all blades in Column 2 are installed, move to bottom of Column 3, and repeat compound application and blade installation procedures.

(11) After all blades in Column 3 are installed, move to bottom of Column 1, and repeat compound application and blade installation procedures.

(12) Check that all of the Stage 7 blades are installed in drum, then retain the blades by inserting the wire locks into the wire lock grooves in a clockwise direction when viewed from the front. Bend the blade locks. Use a PWA 86520 Bender or a PWA 87123 Mechanical Bender for the initial and final bend. Use a PWA 78014 Bender or a PWA 100013 Pneumatic Bender
R Change Letter B or a PWA 106226 Pneumatic Bender
for the initial bend and a PWA 102171 or PWA 106227

Pneumatic Bender for the final bend to crimp the locks. No tangential motion of the lock is allowed in the installed position. Measure the bend dimension with a dial caliper. See Figure 1003.

NOTE: If you use the PWA 78014 Bender, you must use the pre bend and final bend jaws.

(13) Remove PWA 85197 Retaining Ring from around drum. Remove excess sealant from blade root area. Fill in any voids.

(14) Use one of the following methods to cure the sealing compound. It is better to use the oven method.

(a) Let the sealant cure at room temperature for 48 hours minimum.

(b) Put the assembly in a oven and heat to cure as follows:

1 Preheat the oven to 135° − 165°F (57.3° − 73.9°C).

2 Use appropriate tooling to remove the rotor assembly from the build stand and support it in the oven during the curing operation.

3 Heat the rotor in the oven to 135° − 165°F (57.3° − 73.9°C). Hold at this heat for one hour minimum. The time necessary to make the part this temperature is not included in the cure time.

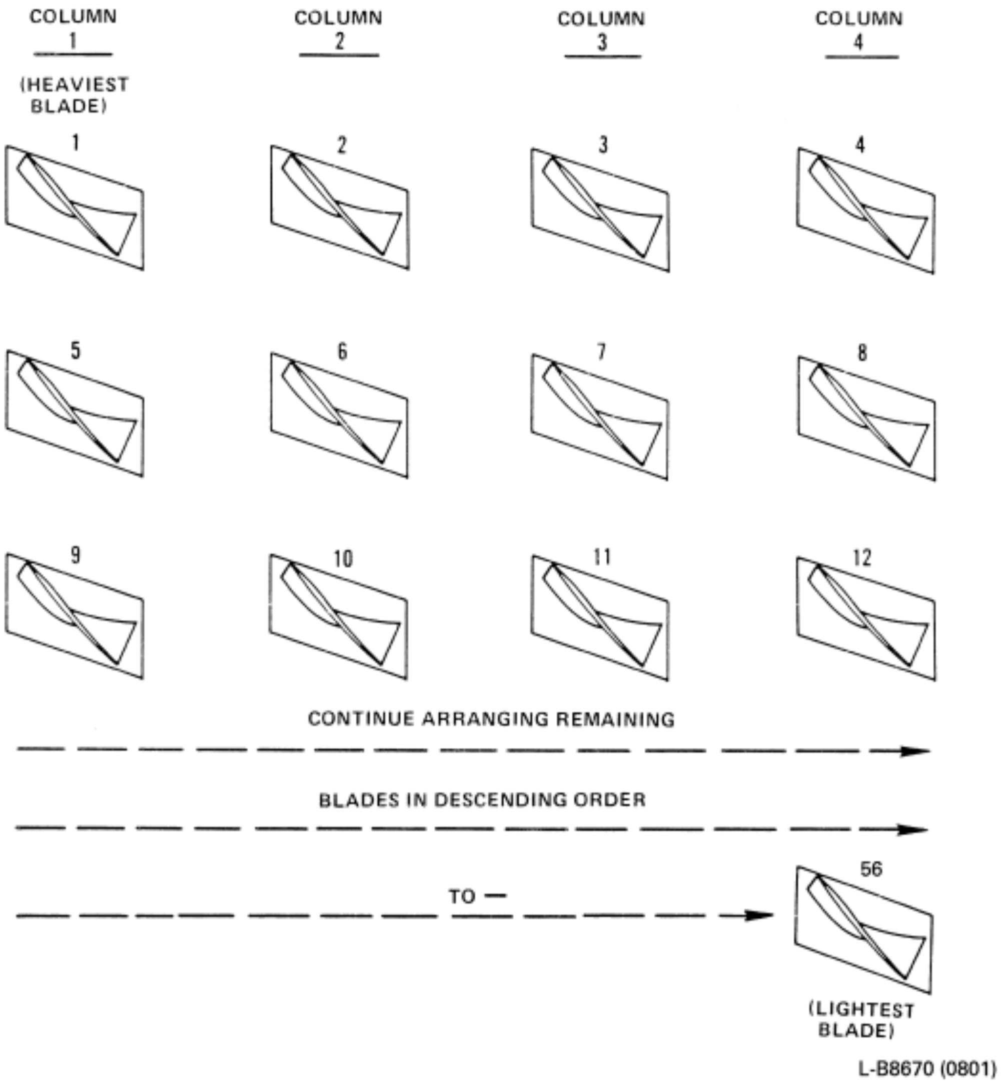
4 Raise the temperature to 375° − 425°F (190.5° − 218.3°C). Hold at this heat for one hour minimum. The time necessary to make the part this temperature is not included in the cure time.

5 Air cool to room temperature.

D. Postrequisites

(1) Assemble 6th stage blades to (debladed) axial compressor rotor assembly. See Assembly−30 (Task 72−35−01−440−018).

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−29


COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
COLUMN 3
COLUMN 4
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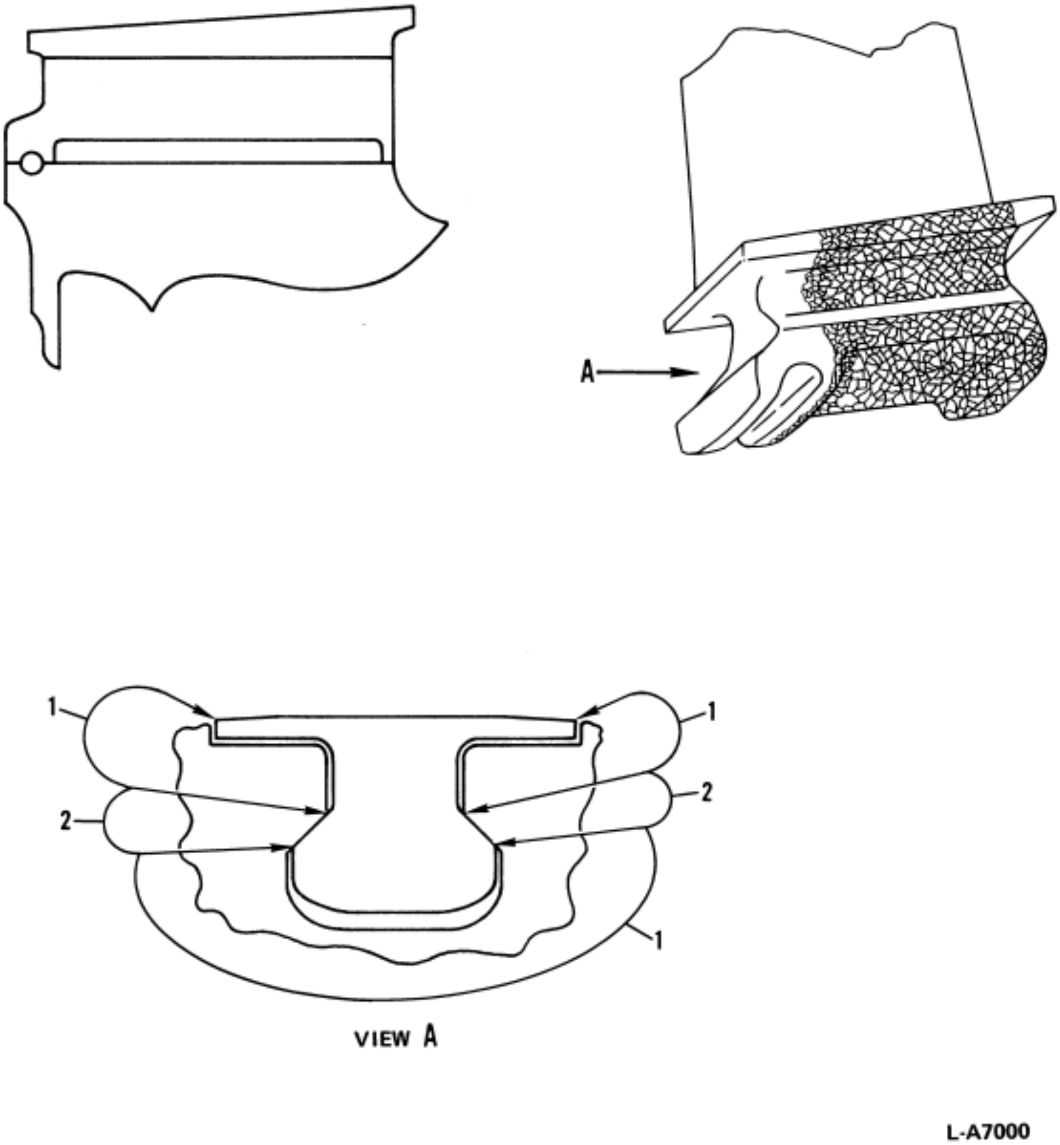
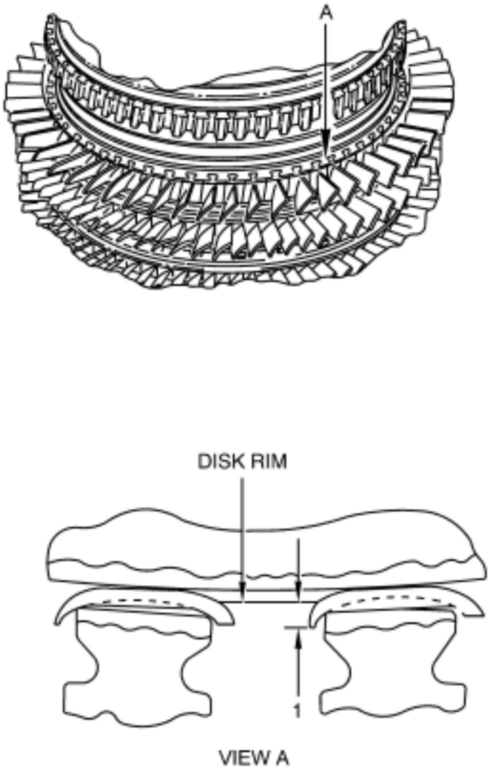
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO —
56
(LIGHTEST BLADE)
L-B8670 (0801)

Blade Arrangement
Figure 1001
(Task 72−35−01−440−017)



1. Apply Sealant (P09-015) In Areas Shown For Entire Length Of Blade Root.
2. No Sealant To Be Applied In This Area But Traces Are Permissible After Assembly Of Blade To Disk.

Sealant Application
Figure 1002
(Task 72-35-01-440-017)



L−B8669 (0801)
PW V

1. 0.150 Inch (3.810 mm) Minimum

Blade Lock Tab Bending
Figure 1003
(Task 72−35−01−440−017)

Task 72-35-01-440-018:

1. Assemble 6Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble 7th stage blades to (debladed) axial compressor rotor assembly. See Assembly-29 (Task 72-35-01-440-017).

B. Equipment And Materials Necessary

Special Tools:

	PWA 78013	Bender, Pneumatic (Optional to PWA 100013) (Replaced By PWA 100014 Change Letter A)
	PWA 85196	Ring, Retaining
	PWA 86519	Bender, Mechanical (Optional to PWA 78013)
	PWA 87129	Bender, Mechanical (Optional to PWA 86519)
	PWA 100013	Bender, Pneumatic (Replaced By PWA 100014 Change Letter A)
R	PWA 100014	Bender, Pneumatic Change Letter A (Initial Bend) (Replaces PWA 78013 and Options) (Replaced By PWA 106293)
R	PWA 100096	Bender, Pneumatic (Final Bend) (Replaced By PWA 106294)
R	PWA 106293	Bender, Pneumatic (Initial Bend) (Replaces PWA 100014)
R	PWA 106294	Bender, Pneumatic (Final Bend) (Replaces PWA 100096

Consumable Material:

Item No.	Designation
P09-014	Sealant, Silicone Rubber (PWA 36003)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lock	51	72-35-00/2/30

C. Procedure

(1) Optional, weigh the 6th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70-11-00.

NOTE: Mass weighing and arranging blades by weight in columns is optional and is intended as a good maintenance practice that will result in optimal rotor balance results. However, these steps are not required if subsequent rotor balance procedures are carefully done.

CAUTION: (PRE SB PW4ENG 72-322 AND POST SB PW4ENG 72-322) BLADES ARE DIRECTLY INTERCHANGEABLE AND CAN BE MIXED WITH BLADES, PN 52H306 (SB PW4ENG 72-304).

(2) Optional, arrange 6th stage blades in four columns, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. Lightest blade will be at bottom of Column 3. See Figure 1001.

(3) Prior to applying sealant, wipe blade areas to be sealed by SPOP 208 Wipe Method Standard Practices Manual, PN 585005, 70-21-00.

(4) Install PWA 85196 Retaining Ring around drum just below blade slots.

(5) Immediately before installing each blade, apply Silicone Rubber Sealant P09-014 to the blade root as shown in Figure 1002. Coat blades thickly enough to fill in voids between blade root and disk slot when blade is in the installed position. Also, apply sealant to the lock groove of blades and of the disk at blade locations. See Figure 1002.

CAUTION: CARE SHOULD BE TAKEN TO ENSURE THAT ANY PRESSURE OR FORCE REQUIRED TO INSTALL BLADE IN DISK, BE APPLIED TO ROOT PLATFORM AREA OF BLADE AND NOT TO LEADING OR TRAILING EDGE OF AIRFOIL. AIRFOIL SECTION OF BLADES ARE EASILY DAMAGED BY ANY KIND OF FORCE.

(6) Starting with lightest (bottom) blade in Column 4, install blades in drum, with leading edge up.

(a) Grasp blade and pull outward to load blade against bearing surface of drum slot. Slowly seat blade completely in drum.

(b) Install the blade lock, from right to left, in the lock groove.

(c) Remove excess sealant from blade lock groove area and from blade root area. Fill in any voids.

(d) Repeating sealant application procedure, install remaining blades from Column 4 continuing vertically upward from lighter blades to heavier blades. Install blades to drum in counterclockwise direction.

(e) After all blades in Column 4 are installed, move to bottom of Column 2, repeat sealant application procedure and install blades from Column 2, relocating blade vertically upward from lighter blades to heavier blades. Install blades in counterclockwise direction.

(f) After all blades in Column 2 are installed, move to bottom of Column 3, and repeat sealant application and blade installation procedure.

(g) After all blades in Column 3 are installed, move to bottom of Column 1, and repeat sealant application and blade installation procedure.

NOTE: When you install the last lock, if it is necessary, you can lightly hit the lock into position.

(7) Bend the blade locks. Use a PWA 86519 Bender or PWA 87129 Mechanical Bender for pre and final bend. Use a
R PWA 78013 Bender or a PWA 100013 Bender or a PWA 106293
R Pneumatic Bender or the PWA 100014 Mechanical Bender
R for the initial bend and a PWA 106294 Pneumatic Bender
R or the PWA 100096 Pneumatic Bender for the final bend
to crimp the locks. See Figure 1003.

NOTE: If you use the PWA 78013 Bender, you must use the pre bend and final bend jaws.

(a) Keep the dimension shown between the rim of the disk and the tip of the lock.

(b) Tangential movement is not permitted in the installed position.

(8) Remove the PWA 85196 Retaining Ring from around the drum.

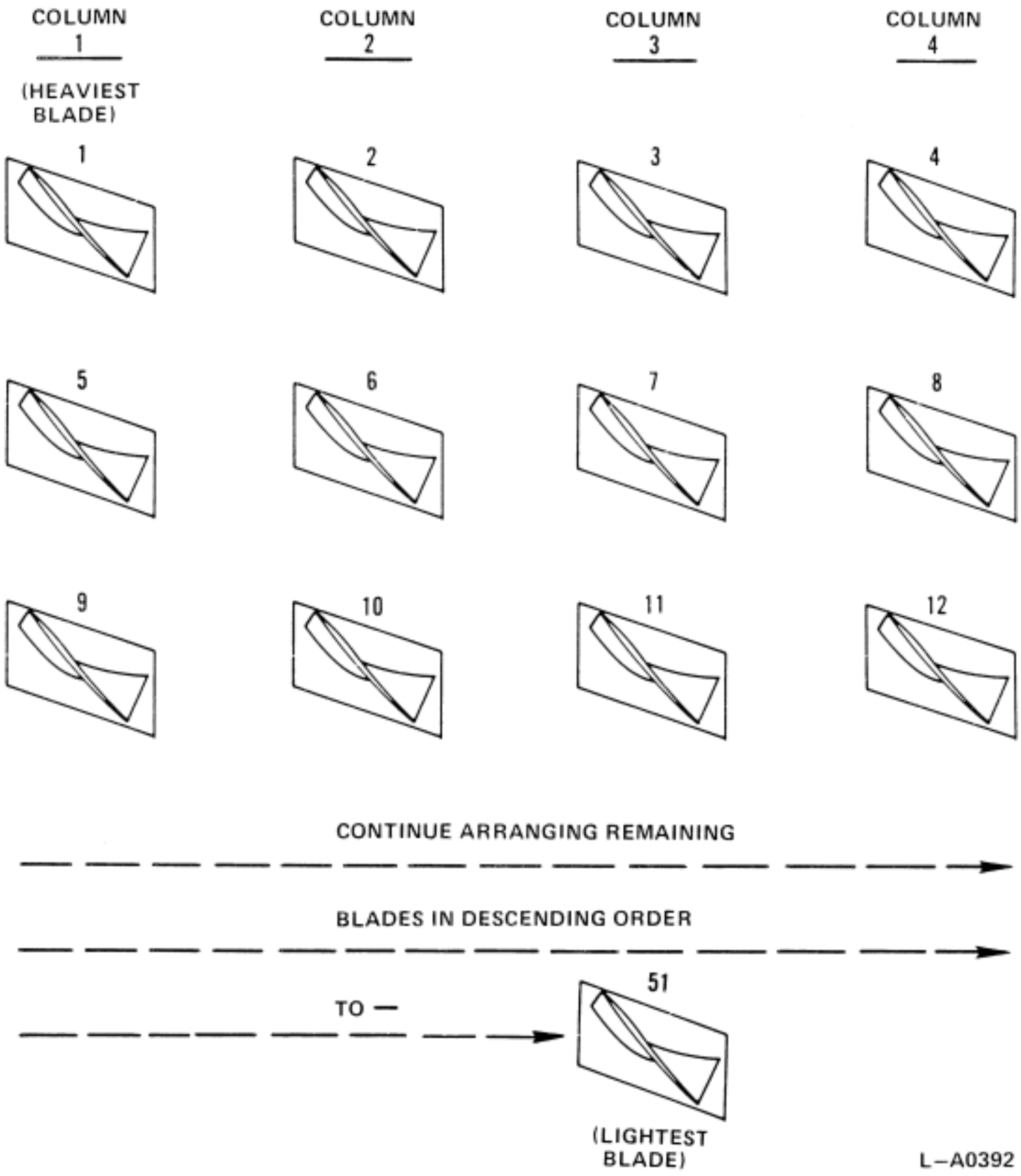
(9) Remove the unwanted sealant from the blade root, disk slot and blade platform outer face areas. Fill in all voids.

(10) Apply Silicone Rubber Sealant P09-014 to the bent end of all blade locks. All the blade lock ends must be covered. See Figure 1003.

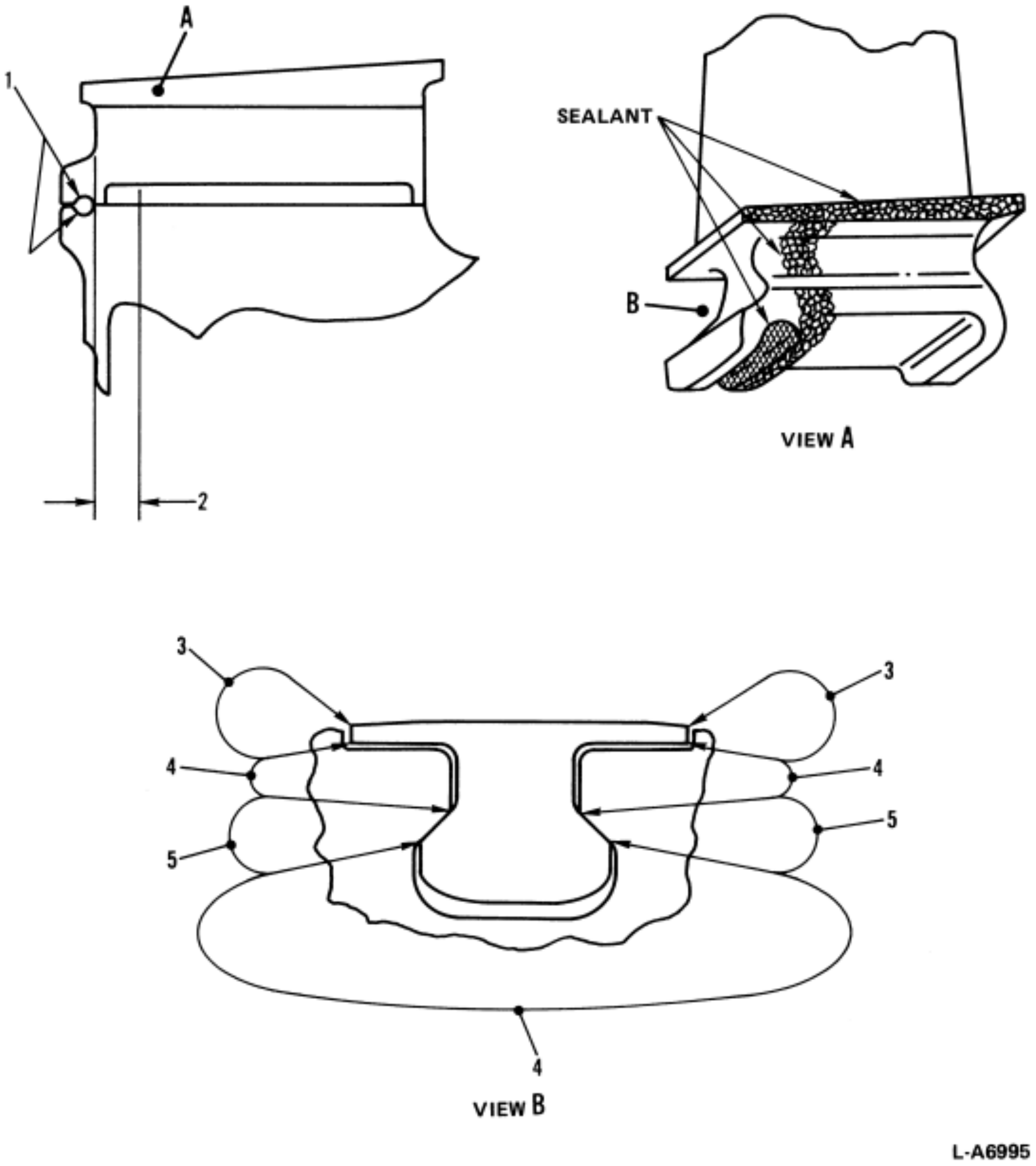
(11) Allow sealant to cure at 20 percent minimum relative humidity and at room temperature for eight hours prior to rotor balance operation and 24 hours prior to engine test.

D. Postrequisites

(1) Assemble 5th stage blades to (debladed) axial compressor rotor assembly. See Assembly-31 (Task 72-35-01-440-019).


COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
COLUMN 3
COLUMN 4
1
2
3
4
5
6
7
8
9
10
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO —
51
(LIGHTEST BLADE)
L-A0392

Blade Arrangement
Figure 1001
(Task 72-35-01-440-018)

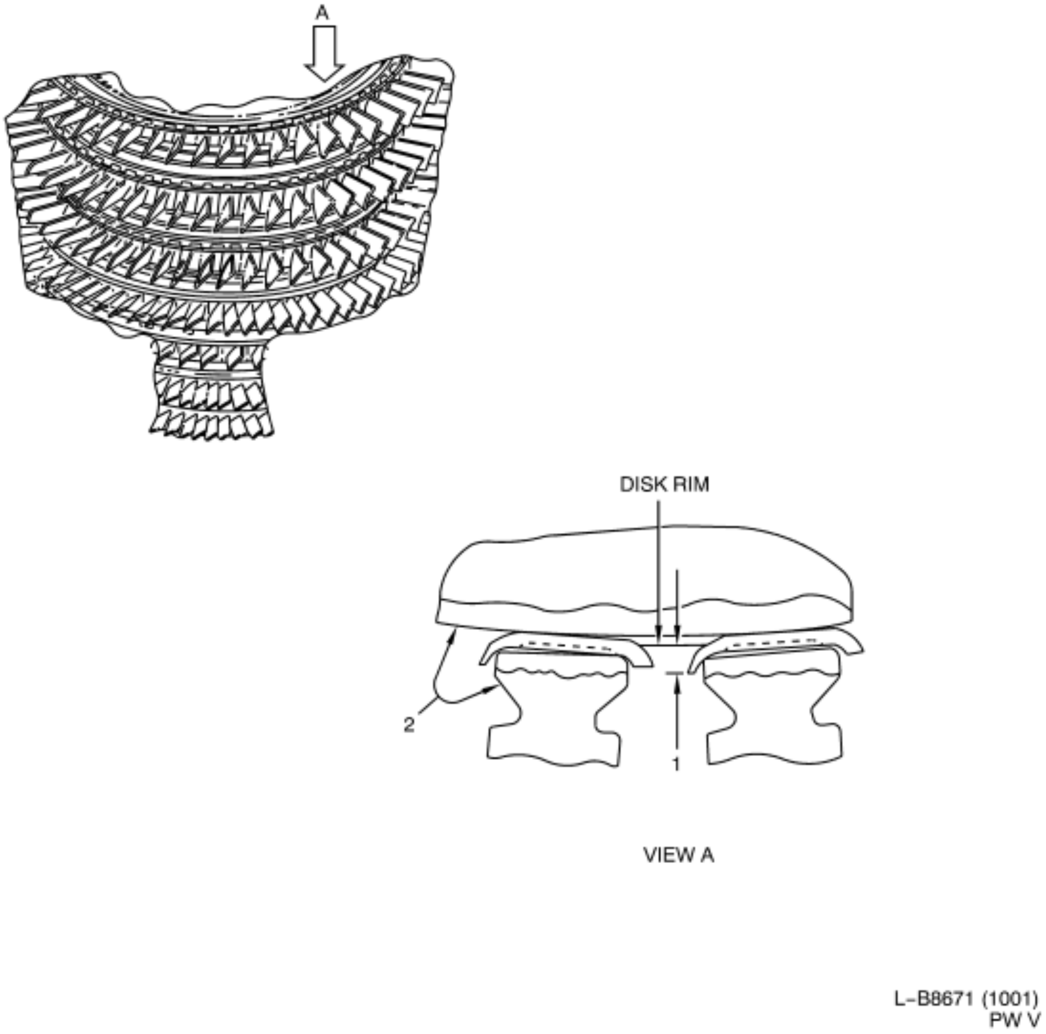

A
1
2
SEALANT
B
VIEW A
3
3
4
4
5
5
4
VIEW B
L-A6995

Sealant Application
Figure 1002
(Task 72−35−01−440−018)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-30

1. Sealant Application Area - 51 Places
2. 0.200 - 0.400 Inch (5.1 - 10.2 mm)
3. Apply Sealant (P09-014) In Areas Shown For Entire Length Of Blade Platform.
4. Apply Sealant (P09-014) In Areas Shown For Distance Index 2.
5. No Sealant To Be Applied In This Area But Traces Are Permissible After Assembly Of Blade To Disk.

Key to Figure 1002


A
DISK RIM
2
1
VIEW A
L−B8671 (1001)
PW V

1. 0.150 Inch (3.810 mm) Minimum
2. Apply Sealant (P09−014) In Areas Shown To Cover All Bent Ends

Blade Lock Tab Bending
Figure 1003
(Task 72−35−01−440−018)

Task 72-35-01-440-019:

1. Assemble 5Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly

A. Prerequisites

(1) Assemble 6th stage blades to (debladed) axial compressor rotor assembly. See Assembly-30 (Task 72-35-01-440-018).

B. Equipment And Materials Necessary

Special Tools:

	PWA 76154	Adapter (2 Necessary)
	PWA 78012	Bender, Pneumatic (Optional to PWA 100012 Change Letter A and PWA 102146)
	PWA 85164	Ring, Retaining
	PWA 85196	Ring, Retaining
	PWA 86518	Bender, Mechanical (Optional to PWA 78012)
	PWA 87128	Bender, Mechanical (Optional to PWA 86518)
R	PWA 100012A	Bender, Pneumatic (Prebend) (With PWA 102146, Optional to PWA 78012, Replaced BY PWA 106291)
R	PWA 102146	Bender, Pneumatic (Final bend) (With PWA 100012A, Optional to PWA 78012, Replaced BY PWA 106292)
R	PWA 106291	Bender, Pneumatic (Initial bend) (Replaces PWA 100012A)
R	PWA 106292	Bender, Pneumatic (Final bend) (Replaces PWA 102146)

Consumable Material:

Item No.	Designation
P09-014	Sealant, Silicone Rubber (PWA 36003)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Blade Locks	40	72-35-00/2/10

NOTE: (Post SB PW4ENG 72-373)

C. Procedure

(1) Weigh the 5th stage blades. Use an approved marking pen to make temporary marks on the individual blade airfoils to show the blade weight. See Standard Practices Manual, PN 585005, Section 70-11-00.

CAUTION: STAGE 5 HPC BLADES MUST BE INSTALLED IN COMPLETE SETS ONLY.

CAUTION: THE THICKER 5TH STAGE BLADE (SB PW4ENG 72-174) CAN BE USED WITH THE ORIGINAL SIX STATOR VANE SCHEDULE OR THE LATER 19 STATOR VANE SCHEDULE (SB PW4ENG 72-197). THE ORIGINAL CONFIGURATION 5TH STAGE BLADE (PRE SB PW4ENG 72-174) CAN ONLY BE USED WITH THE ORIGINAL CONFIGURATION SIX STATOR VANE SCHEDULE (PRE SB PW4ENG 72-197).

(2) Arrange 5th stage blades in four columns of 10 blades, starting with heaviest blade at top left (Column 1), and proceeding from left to right in descending order of weight. Lightest blade will be at bottom right (Column 4). See Figure 1001.

(3) Install PWA 85164 Retaining Ring or PWA 85196 Retaining Ring between the airseal and the 5th stage blade slots.

CAUTION: CARE SHOULD BE TAKEN TO ENSURE THAT ANY PRESSURE OR FORCE REQUIRED TO INSTALL BLADE IN DISK, BE APPLIED TO ROOT PLATFORM AREA OF BLADE AND NOT TO LEADING OR TRAILING EDGE OF AIRFOIL. AIRFOIL SECTION OF BLADES ARE EASILY DAMAGED BY ANY KIND OF FORCE.

(4) Prepare the blades and rotor assembly for the application of PWA 36003, Silicone Rubber Sealant P09-014. Refer to the Standard Practices Manual, PN 585005, Section 70-48.

(5) Use the method that follows to install the blades. Start at the bottom of column 4 (blade number 40) and continue up to the top of the column (blade number 4). Install the blades in counterclockwise direction.

  (a) Use the PWA 83-B2 method to wipe clean the blade areas the will be sealed.

  (b) Apply Silicone Rubber Sealant P09-014, on the areas shown in Figure 1002.

R
R

(c) Install the blade, with the locking groove up, from the front (top) of the blade slot. While you install the blade, pull the blade radially outward to be sure the blade has full contact with the bearing surface of the blade slot.

(d) Install the blade lock, from right to left, in the lock groove. Be sure the lock under the blade is coated with sealant to make sure lock will not roll over after sealant cure.

(e) Remove the unwanted sealant from the blade root, disk slot and blade platform outer face areas. Fill in all voids.

(6) After all blades in Column 4 are installed, use the steps given above and install the blades from Column 2. Start at the bottom and move up the column to heavier blade.

(7) After all blades in Column 2 are installed, use the steps given above and install the blades from Column 3. Start at the bottom and move up the column to heavier blade.

(8) After all blades in Column 3 are installed, use the steps given above and install the blades from Column 1. Start at the bottom and move up the column to heavier blade.

NOTE: When you install the last lock, if it is necessary, you can lightly hit the lock into position.

(9) Bend the blade locks. Use the PWA 78012 Pneumatic Bender or the PWA 86518 Pneumatic Bender or PWA 87128 Mechanical Bender to crimp the wire lock. These bending tools have separate jaws for initial and final bends. After making the initial bend, replace the initial bend jaw with the final bend jaw and compress handles until the blade lock is fully bent. As an option to the PWA 78012 Pneumatic Bender with separate
R jaws for initial and final bends, the PWA 106291
R Pneumatic Bender or the PWA 100012A Pneumatic Bender
R is used for the prebend of the blade lock and the PWA
R 106292 Pneumatic Bender or the PWA 102146 Pneumatic
Bender is used for the final bend of the blade lock. See Figure 1003.

(a) Keep the dimension shown between the rim of the disk and the tip of the lock.

(b) Tangential movement is not permitted in the installed position.

(10) Remove the Retaining Ring from around the drum.

(11) Apply Silicone Rubber Sealant P09−014 to the bent end of all blade locks. All the blade lock ends must be covered. See Figure 1003.

(12) Cure the sealant at 20 percent minimum relative humidity and at room temperature for eight hours before the rotor balance operation and 24 hours before the engine test.

(13) After the sealant has cured, install the rotor assembly in the storage and transport stand. See Figure 1004 and Figure 1005.

(a) Install a PWA 85161 Adapter to the front hub threads and a PWA 85086 Lifting Arm on the adapter.

(b) Use a hoist, that is installed on the lifting arm, to lift the rotor assembly from the build stand.

(c) Install a PWA 85124 or PWA 88700 Adapter to the rear hub threads and a PWA 85086 Lifting Arm on the adapter.

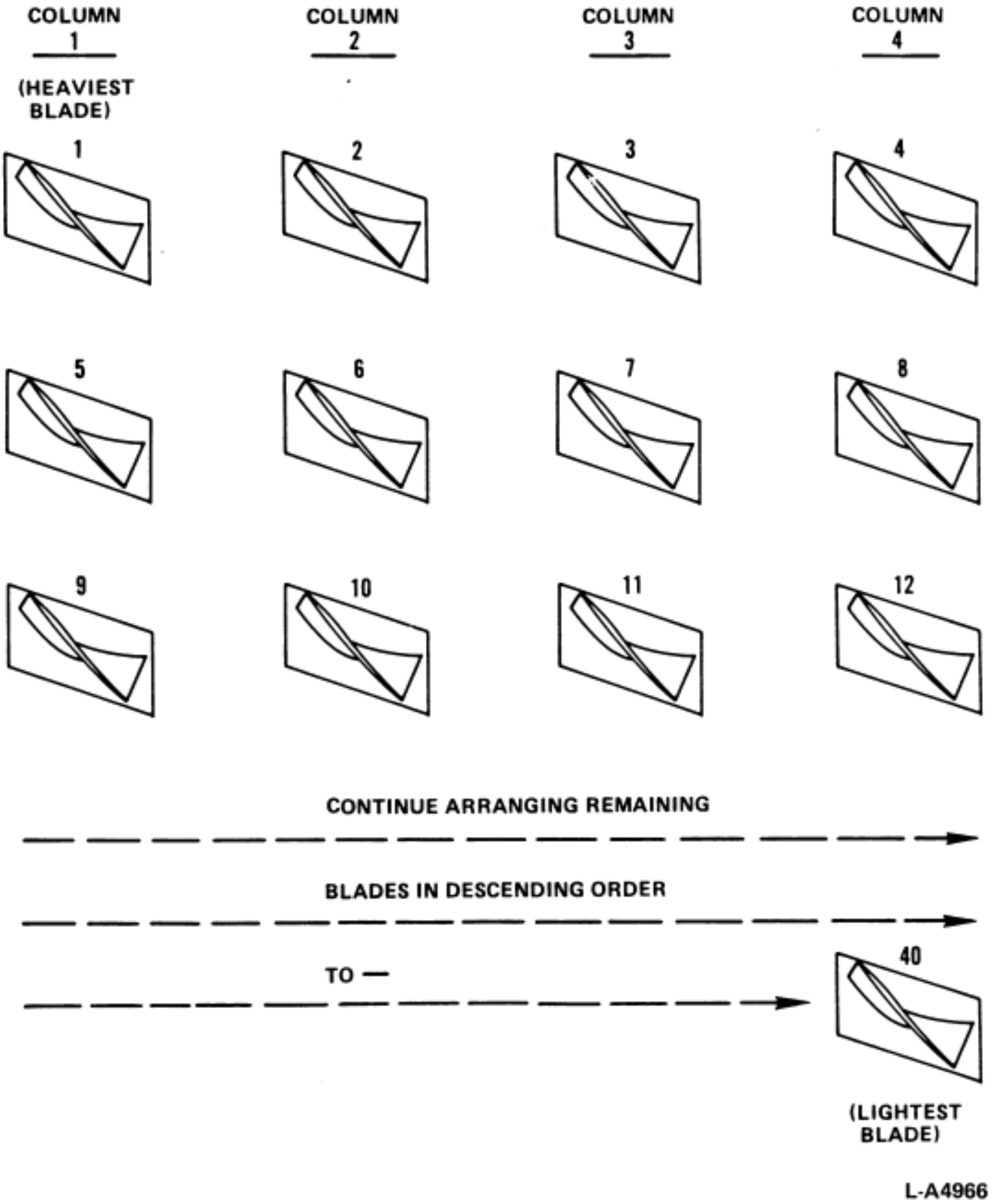
(d) Use a second hoist to trunnion the rotor assembly to horizontal.

(e) Lower the rotor onto a PWA 85337 Transport Stand, then remove the hoists, arms and adapters.

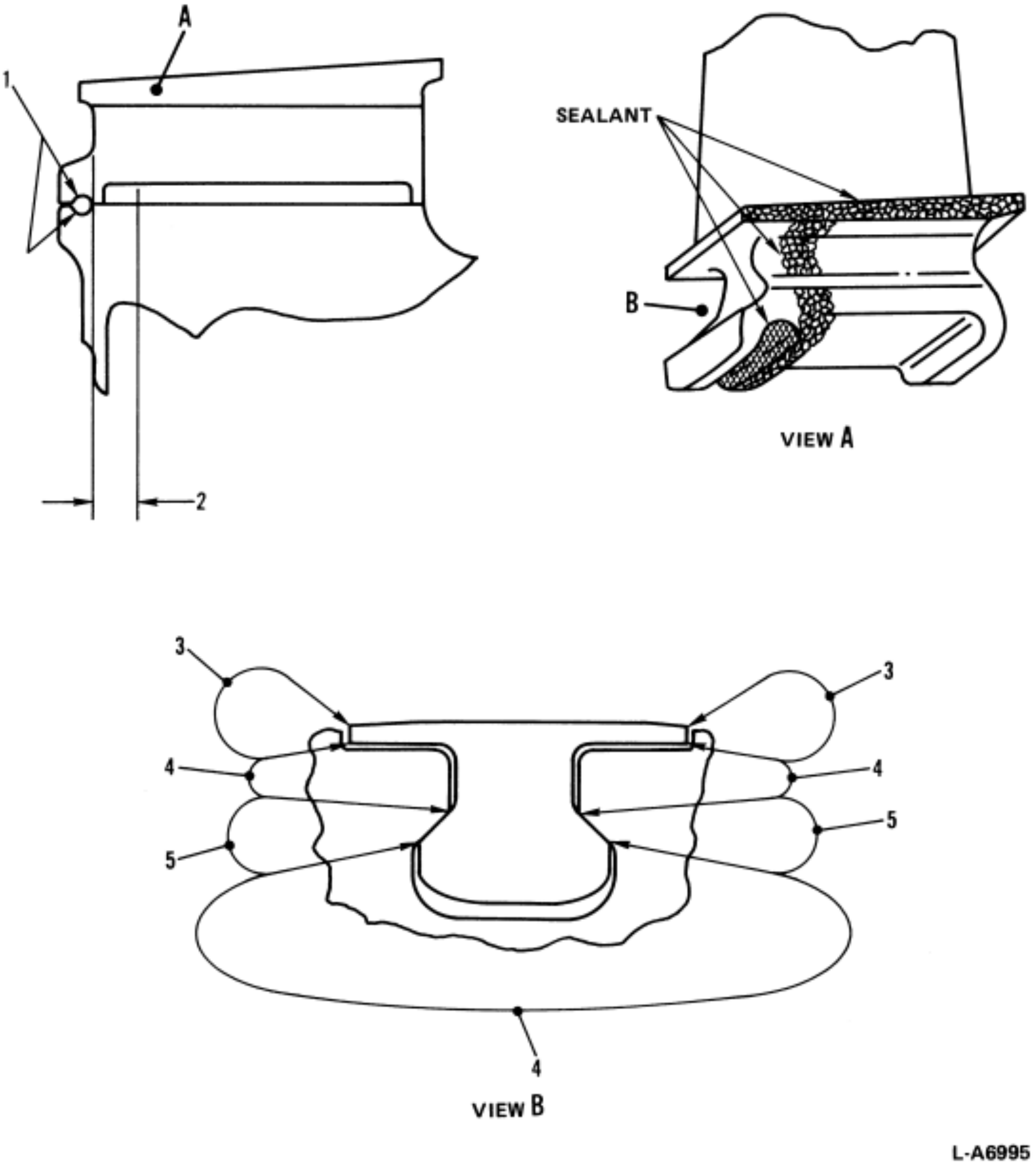
(f) Install a PWA 87383 Plastic Protector to protect the bladed rotor assembly during storage.

D. Postrequisites

(1) Accomplish runouts and balance. See Assembly−02 CONFIG−1 (Task 72−35−01−440−002) or CONFIG−2(Task 72−35−01−440−005).


COLUMN 1
(HEAVIEST BLADE)
COLUMN 2
COLUMN 3
COLUMN 4
1
2
3
4
5
6
7
8
9
10
11
12
CONTINUE ARRANGING REMAINING
BLADES IN DESCENDING ORDER
TO —
40
(LIGHTEST BLADE)
L-A4966

Blade Arrangement
Figure 1001
(Task 72-35-01-440-019)

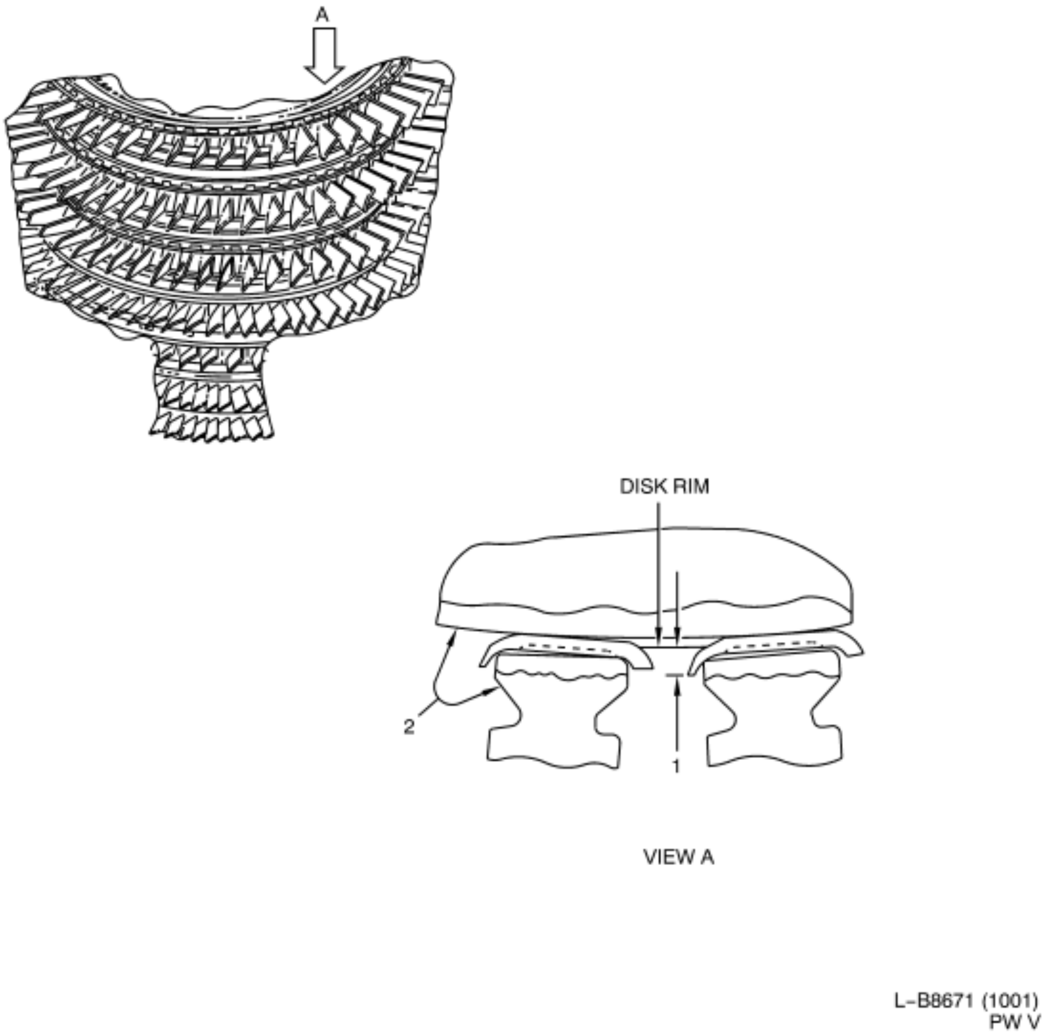

A
1
2
SEALANT
B
VIEW A
3
3
4
4
5
5
4
VIEW B
L-A6995

Sealant Application
Figure 1002
(Task 72−35−01−440−019)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−31

1. Sealant Application Area − 40 Places
2. 0.200 − 0.400 Inch (5.1 − 10.2 mm)
3. Apply Sealant (P09−014) In Areas Shown For Entire Length Of Blade Platform.
4. Apply Sealant (P09−014) In Areas Shown For Distance Index 2.
5. No Sealant To Be Applied In This Area But Traces Are Permissible After Assembly Of Blade To Disk.

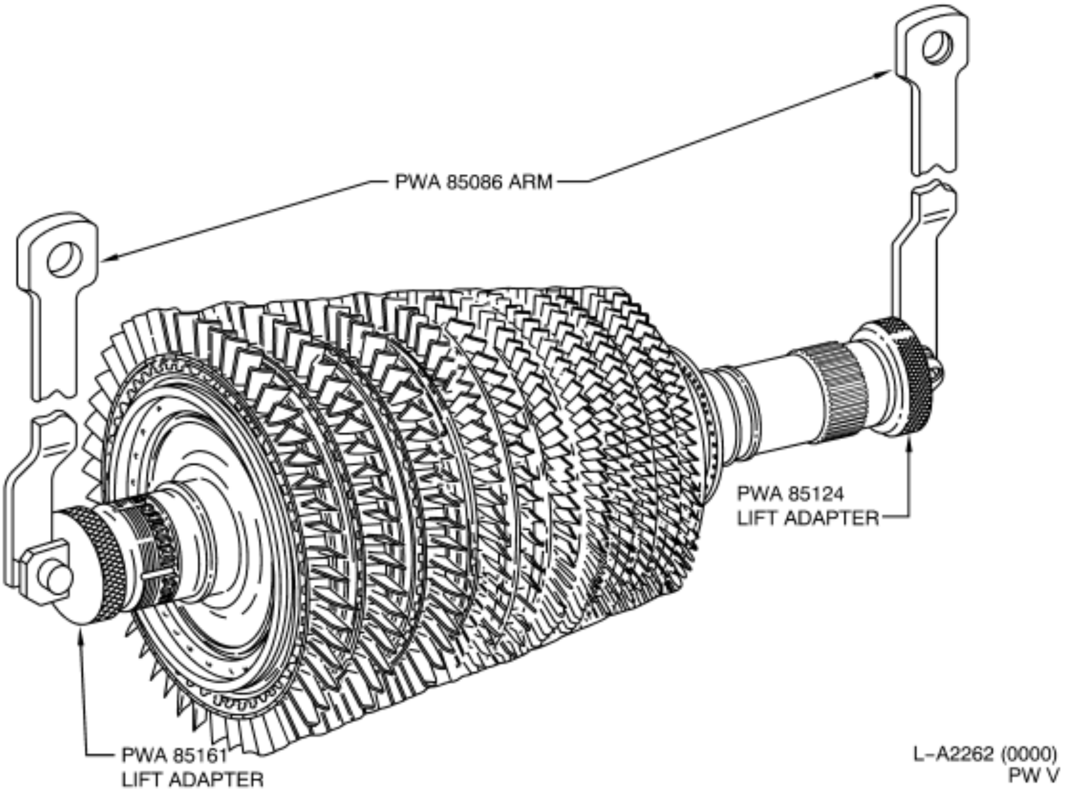
Key to Figure 1002


A
DISK RIM
2
1
VIEW A
L-B8671 (1001)
PW V

1. 0.190 Inch (4.826 mm) Minimum
2. Apply Sealant (P09-014) In Areas Shown To Cover All Bent Ends

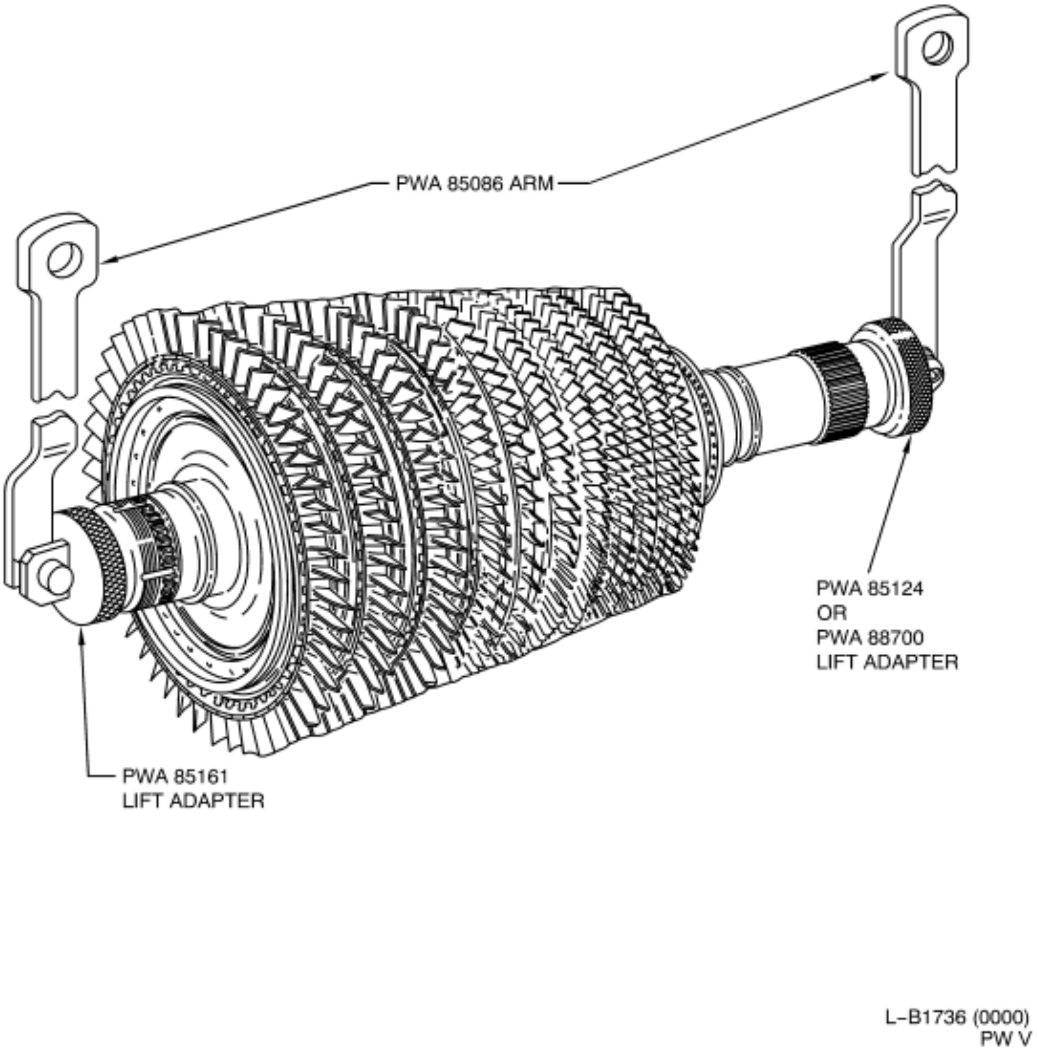
Blade lock Installation
Figure 1003
(Task 72-35-01-440-019)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−31


PWA 85086 ARM
PWA 85124
LIFT ADAPTER
PWA 85161
LIFT ADAPTER
L−A2262 (0000)
PW V

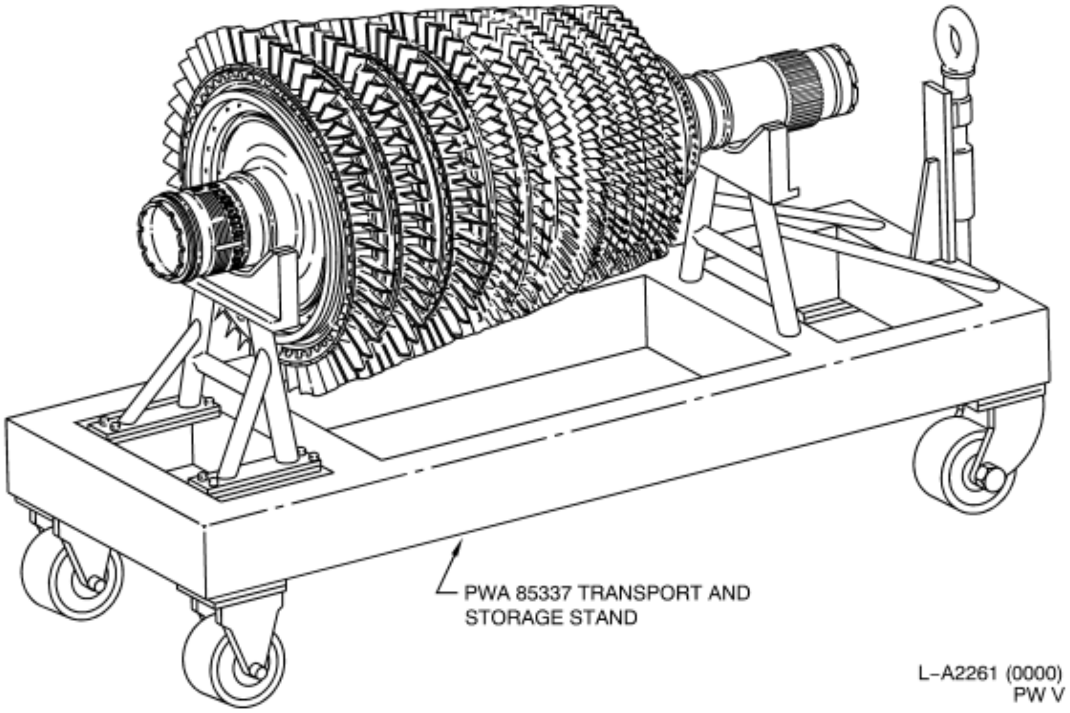
Trunnion Axial Compressor Rotor Assembly
Figure 1004 (Sheet 1)
(Task 72−35−01−440−019)

AXIAL COMPRESSOR ROTOR ASSEMBLY - ASSEMBLY-31


PWA 85086 ARM
PWA 85124
OR
PWA 88700
LIFT ADAPTER
PWA 85161
LIFT ADAPTER
L-B1736 (0000)
PW V

Trunnion Axial Compressor Rotor Assembly
Figure 1004 (Sheet 2)
(Task 72-35-01-440-019)

AXIAL COMPRESSOR ROTOR ASSEMBLY − ASSEMBLY−31


PWA 85337 TRANSPORT AND STORAGE STAND
L−A2261 (0000)
PW V

Transport Axial Compressor Rotor Assembly
Figure 1005
(Task 72−35−01−440−019)

Previous Pageblock Return to Previous Menu Next Pageblock

TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 85 DATED JANUARY 1, 2008

HIGHLIGHTS - HIGH PRESSURE COMPRESSOR (HPC)

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-35-00 ASSEMBLY-06	1009	Revised Figure 1002 to add marking area. (EDITORIAL)	CONFIG-1 4152 4152-3 4156A 4156A-3 4158 4158-3
72-35-01 INSP/CHK-03	802 -803	Added new blade tip coating chip limits. Items re-numbered. (IEN07KC150, 07KC163, Reference)	ALL
72-35-01 ASSEMBLY-02	1002 1004 1010	Revised the balance procedure to delete the service bulletin application and Figure 1003 (Sheet 1) and renumbered Figure 1003. (IEN95KCF45)	CONFIG-1 4152 4156A 4158
72-35-01 ASSEMBLY-02	1001 -1002 1004 1010	Revised the balance procedure to delete the service bulletin application and Figure 1003 (Sheet 1) and renumbered Figure 1003. (IEN95KCF45)	CONFIG-2 4152-3 4156A-3 4158-3

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-35-01 ASSEMBLY-21	1002 1013 1017 1019 1035 1039 -1040 1061 -1062	Added drum rotors PN 54H803-002, 56H013-001, and 58H236-01 (Post PW4ENG 72-750). Revised the text and figure captions. Revised Figure 1010 (Sheet 1) and Figure 1016 (Sheet 1) to relocate Index 2 at the 10 o'clock position. (Editorial)	CONFIG-2 4152-3 4156A-3 4158-3
72-35-01 ASSEMBLY-23	1002 1013 1017 1019 1036 1038	Added drum rotors PN 54H803-002, 56H013-001, and 58H236-01. (Post PW4ENG 72-750) Revised the text and figure captions. (Editorial)	CONFIG-2 4152-3 4156A-3 4158-3
72-35-02 ASSEMBLY-01	1001 1022 1024 1026 -1028	Revised the text and related figure to add the PWA 102728 Gage (Post SB PW4ENG 72-743) to check that the vane arm is assembled correctly. (TDS 102728) Revised the text. (Editorial)	CONFIG-2 4152 4152-3 4156A 4156A-3 4158 4158-3

Previous Pageblock Return to Previous Menu Next Pageblock

VARIABLE STATOR VANE AND HPC FRONT CASE ASSEMBLY - DISASSEMBLY-01

Task 72-35-02-040-001:

1. Disassemble Variable Stator Vane And HPC Front Case Assembly
   A. Equipment And Materials Required - None
   B. Procedure
      (1) Place both halves of HPC front case assembly, front end down, on work bench.
      (2) Unbend tabs at each vane arm bolt securing 7th stage arm bolts. Loosen and remove bolts from vanes. Remove key washer and washers. Discard key washers.
      (3) Slide vane arms from vane trunnion and remove ring segment and arms from case. Slide spacers from selected vanes.
      (4) Repeat above steps for Stages 6, 5 and inlet.
      (5) Unbend tabs at each bolt securing runners to front case. Loosen and remove bolts securing runners. Remove and discard key washers. Remove shims and runners from 33 places.
      (6) Remove borescope plugs from 5th and 6th stage on "lower" case.
      (7) Loosen nuts and remove nuts and bolts securing inner shrouds. Remove inner shrouds from case assembly. Remove keys from selected vane bearings.
      (8) Remove all bearings from ID trunnions of vanes and place in container.

CAUTION: (POST SB PW4ENG 72-485) THE 5TH THROUGH 7TH STAGE (OUTER) SHROUD SETS AND HPC FRONT CASE SET WERE ASSEMBLED AND MACHINED AS A MATCHED SET. THESE PARTS MUST BE KEPT TOGETHER AS A SET. IF THE SHROUD SEGMENTS REQUIRE REFURBISHMENT, THEY CAN BE MACHINED IN A DIFFERENT FRONT CASE AND IDENTIFIED WITH THE MATING NUMBER.

      (9) Remove vanes from case assembly. Remove packing and discard. Remove thrust washer from each vane root.

NOTE: It is not necessary to disassemble the HPC front case/outer shroud set for routine cleaning and inspection procedures. The shroud segments must be installed in the mating case for dimensional inspection of the shroud rubstrip for wear in the Engine CIR Manual (PN 51A357), 72-35-40, Inspection/Check-04 (Task 72-35-40-200-004).

Task 72-35-02-440-001:

1. Assemble Variable Stator Vane And HPC Front Case Assembly

A. Equipment And Materials Required

Special Tools:

PWA 87888	Gage

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P06-021	Antigalling Compound (PWA 550-3)
P06-041	Lubricant, Dry Film (PWA 36221)
P06-054	Paste, Antiseize (PWA 36246)
P09-014	Sealant, Silicone Rubber (Red) (PWA 36003-1)
P09-027	Sealant, Silicone Rubber (Gray) (PWA 36003-2) (Optional For The Ring Case Configuration)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	22	72-35-00/12/30
Key Washer	22	72-35-00/13/20
Key Washer	22	72-35-00/14/20
Key Washer	124	72-35-00/12/320
Key Washer	46	72-35-00/14/320
Key Washer	60	72-35-00/15/320
Packing	76	72-35-00/12/130
Packing	48	72-35-00/13/130
Packing	46	72-35-00/14/130
Packing	60	72-35-00/15/150
Bearing-Washer	76	72-35-00/12/120 or
Bearing-Washer	76	72-35-00/12/120A
Bearing-Washer	48	72-35-00/13/120 or
Bearing-Washer	48	72-35-00/13/120A
Bearing-Washer	46	72-35-00/14/20 or
Bearing-Washer	46	72-35-00/14/120A
Bearing-Washer	60	72-35-00/15/140 or
Bearing-Washer	60	72-35-00/15/140A

B. Procedure
See Figure 1001.

CAUTION: (POST SB PW4ENG 72-485) THE 5TH THROUGH 7TH STAGE OUTER SHROUD SETS AND HPC FRONT CASE SET WERE ASSEMBLED, MACHINED, AND IDENTIFIED AS A MATCHED SET. MAKE SURE THAT BOTH HALVES OF THE HPC FRONT CASE HAVE THE SAME MATING NUMBER.

(1) Place both halves of HPC front case assembly, large OD down, on bench.

CAUTION: SHROUD SETS AND HPC FRONT CASES WITH FLANGE LOCATING PINS FOR SHROUD SET (PRE SB PW4ENG 72-220) MUST BE USED IN COMPLETE SETS ONLY.

CAUTION: (POST SB PW4ENG 72-485) NEW OR REPAIRED 5TH AND/OR 6TH AND 7TH STAGE SHROUD SETS MUST BE ASSEMBLED IN THE HPC FRONT CASE SET, FINISH MACHINED (TO PROVIDE TRENCHES IN THE SHROUD RUBSTRIPS), AND IDENTIFIED AS A MATCHED SET.

CAUTION: FELTMETAL RUBSTRIPS MUST NOT BE EXPOSED TO ANY LUBRICANT PRIOR TO ENGINE INSTALLATION.

(2) For the symmetric case configuration, install Stage 6 and 7 shroud set to case halves engaging lip in shroud to groove in case. Install 20 bolts, threads lubricated with Engine Oil P03-001 to secure one half of shroud set to one half of front case. Tighten and torque bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). See Figure 1001 (Sheet 1).

NOTE: (Post SB PW4ENG 72-485) Finish machine new or repaired 5th stage and/or 6th and 7th stage shroud sets as required. Refer to the PW4000 Series CIR, PN 51A357 as follows:

NOTE: For case and shroud sets that have 6th and 7th stage shroud sets with feltmetal rubstrips, refer to PW4000 Series CIR, PN 51A357, 72-35-40, Repair-21 . For the 6th and 7th stage shroud sets with plasma coated rubstrips, refer to PW4000 Series CIR, PN 51A357, 72-35-40, Repair-22.

(3) For the symmetric case configuration, clean areas to be filled by Standard Practices Manual, PN 585005, 70-21-00, SPOP 208 Wipe Method.

NOTE: Solvent wiped surfaces shall be thoroughly dried in air at ambient temperature or in oven at 250°F (121°C) maximum. Drying time shall be sufficient to remove traces of solvent detrimental to filling process.

(4) For the non-ring case compressor configuration, apply Silicone Rubber Sealant P09-014 to areas and dimensions shown in Figure 1001 (Sheet 7). Cure in ambient air of 25 percent minimum relative humidity for three hours prior to handling.

(5) (POST SB PW4ENG 72-756) For the symmetric case with the ring case compressor configuration, apply Silicone Rubber Sealant P09-027 or Silicone Rubber Sealant P09-014 to areas around the HPC spacer shown in Figure 1001 (Sheet 7). Cure in ambient air of 25 percent minimum relative humidity for eight hours prior to handling.

(6) Install thrust washer on 7th stage vane trunnion at grooved end. Install packing on vane trunnion to seat in groove. Remove roll from packing. Apply Dry Film Lubricant P06-041 to area of packing per Figure 1001 (Sheet 1).

(7) Insert vane, thickest part of airfoil down, through upper set of bearings in ID of HPC front case. Complete installation of remaining 7th stage vanes, with packings and washers, until total of 60 vanes are installed in both halves of HPC front case assembly.

NOTE: Install five special vanes into each case segment as follows. With assembler facing the ID of either case segment, install the special vanes into hole Locations 2, 3, 16, 28 and 29, starting from the case split line and counting from left to right. Repeat same procedure for remaining case segment. See also Figure 1001 (Sheet 5).

(8) Install thrust washer on 6th stage vane trunnion at grooved end. Install packing on vane trunnion to seat in groove. Remove roll from packing. Apply Dry Film Lubricant P06-041 to area of packing per figure.

(9) Insert vane, thickest part of airfoil down, through set of bearings immediately below previously installed 7th stage vanes in HPC front case. Complete installation of remaining 6th stage vanes, with packings and washers, until total of 46 vanes are installed in both halves of HPC front case assembly.

NOTE: Install five special vanes into each case segment as follows. With assembler facing the ID of either case segment, install the special vanes into hole Locations 2, 3, 12, 21 and 22, starting from the case split line and counting from left to right. Repeat same procedure for remaining case segment. See also Figure 1001 (Sheet 5).

(10) Install thrust washer on 5th stage vane trunnion at grooved end. Install packing on vane trunnion to seat in groove. Remove roll from packing. Apply Dry Film Lubricant P06-041, to area of packing.

(11) Insert vane, thickest part of airfoil down, through set of bearings immediately below previously installed 6th stage vanes in HPC front case. Complete installation of remaining 5th stage vanes, with packings and washers, until total of 48 vanes are installed in both halves of HPC front case assembly.

NOTE: Install five special vanes into each case segment as follows. With assembler facing the ID of either case segment, install the special vanes into hole Locations 2, 3, 13, 22 and 23, starting from the case split line and counting from left to right. Repeat same procedure for remaining case segment. See also Figure 1001 (Sheet 5).

(12) Install thrust washer on HPC inlet vane trunnion at grooved end. Install packing on vane trunnion to seat in groove. Remove roll from packing. Apply Dry Film Lubricant P06-041, to area of packing per figure.

(13) Insert vane, thickest part of airfoil down, through set of bearings immediately below previously installed 5th stage vanes in HPC front case. Complete installation of remaining HPC inlet vanes, with packings and

washers, until total of 76 vanes are installed in both halves of HPC front case assembly.

NOTE: Install five special vanes into each case segment as follows. With assembler facing the ID of either case segment, install the special vanes into hole Locations 2, 4, 20, 35 and 37, starting from the case split line and counting from left to right. Repeat same procedure for remaining case segment. See also Figure 1001 (Sheet 5).

(14) Install bearings to each vane trunnion exposed at ID of HPC front case as follows:

(a) If you install new sleeve bearings, install bearings to each vane trunnion exposed at ID of HPC front case. Install bearings with slots to the selected vanes.

(b) If you do not install new sleeve bearings, you must measure the distance between the sleeve bearings and the shroud as follows: See Figure 1001 (Sheet 8).

NOTE: The following sleeve bearing height check is not required if you install new sleeve bearings.

1 Temporarily assemble the shroud set. Make sure the part numbers agree with the mating parts.

2 Install each sleeve bearing into the mating holes in the shroud set.

3 Measure the distance between the sleeve bearings and the shroud. The sleeve bearing height must be in the limits specified in the referenced figure.

4 Remove the bearings from the shroud set.

5 Disassemble the shroud set.

6 Install bearings to each vane trunnion exposed at ID of HPC front case. Install bearings with slots to the selected vanes.

(15) Install 7th stage shroud on 7th stage vanes so that shroud half with seal land is positioned above bearings and other half of shroud is below bearings. Install keys to special vanes and bearings installed on case. Keys will fit recesses of inner shrouds. Seat both halves of shroud and install 15 bolts (heads up) and nuts. Torque nuts to 27 − 30 lb−in. (3.051 − 3.390 N.m). Complete installation of shroud on both halves of HPC front case assembly. See Figure 1001 (Sheet 2).

(16) Install 6th stage shroud on 6th stage vanes so that shroud half with seal land is positioned above bearings and other half of shroud is below bearings. Install keys to special vanes and bearings installed on case. Keys will fit recesses of inner shrouds. Seat both halves of shroud and install 10 bolts (heads up) and nuts. Torque nuts to 27 − 30 lb−in. (3.051 − 3.390 N.m). Complete installation of shroud on both halves of HPC front case assembly. See Figure 1001 (Sheet 2).

CAUTION: FIFTH STAGE SHROUD SET WITH FIBERMETAL OUTER AIRSEAL DUCTS (SB PW4ENG 72−212) MUST BE USED IN SETS WITH 5TH STAGE BLADES.

(17) Install 5th stage shroud on 5th stage vanes so that shroud half with seal land is positioned above bearings and other half of shroud is below bearings. Install keys to special vanes and bearings installed on case. Keys will fit recesses of inner shrouds. Seat both halves of shroud and install 12 bolts (heads up) and nuts. Torque nuts to 27 − 30 lb−in. (3.051 − 3.390 N.m). Complete installation of shroud on both halves of HPC front case assembly. See Figure 1001 (Sheet 2).

(18) Install IGV stage shroud on IGV stage vanes so that shroud half with rubber seal land is positioned above bearings and other half of shroud is below bearings. Install keys to special vanes and bearings installed on case. Keys will fit recesses of inner shrouds. Seat both halves of shroud and install 10 bolts (heads up) and nuts. Torque nuts to 27 − 30 lb−in. (3.051 − 3.390 N.m). Complete installation of shroud on both halves of HPC front case assembly. See Figure 1001 (Sheet 2).

(19) Secure 11 6th stage runners without shims to case bosses (below 7th stage vanes) with key washers and bolts, threads lubricated with Engine Oil P03−001. Secure bolts fingertight. See Figure 1001 (Sheet 3).

(20) Secure 11 5th stage runners without shims to case bosses (below 6th stage vanes) with key washers and bolts, threads lubricated with Engine Oil P03-001. Secure bolts fingertight.

(21) Secure 11 IGV stage runners without shims to case bosses (below 5th stage vanes) with key washers and bolts, threads lubricated with Engine Oil P03-001. Secure bolts fingertight.

NOTE: For HPC front cases incorporating "short" IGV bosses (Pre SB PW4ENG 72-168), install spacers between the synchronizing ring runners and the case bosses and use longer bolts. See Figure 1001 (Sheet 3).

(22) Install stepped spacers onto ends of the special vanes at Locations 2, 4, 20, 35, and 37 on either case segment, counting from right to left on the OD of the case segment with the large OD down. Refer to Figure 1001 (Sheet 5). Use the Class 1 spacer for the initial measurement.

CAUTION: FAILURE TO CORRECTLY ALIGN THE OFFSET EDGES OF VANE ARM CLAW WITH THE OFFSET SLOTS IN THE VANE TRUNNIONS DURING ASSEMBLY WILL ORIENT THE VANE UP TO 180 DEGREES OUT OF POSITION, WHICH WILL PRODUCE SEVERE VIBRATORY EXCITATION IN THE HPC AND CAN LEAD TO COMPRESSOR BLADE FRACTURE.

(23) Install inlet guide vane synchronizing ring assembly (vane arms downward) to the five special vanes that have stepped spacers installed. Align the offset edges of the vane arms with the offset slots in the vane shafts and tap lightly until holes in vane arms line up with holes in vane trunnions. Following assembly of vane arms onto vane trunnions, check the outside width of the vane arm claws with PWA 87888 Gage to insure there is no deformation of the claw and that vane arm has been assembled correctly to vane trunnion. Temporarily secure vane arms to vane trunnions with washers and lubed bolts. Tighten bolts with a torque of 35 - 40 lb-in. (3.954 - 4.519 N.m). Repeat for other case segment.

(24) Install stepped spacers at the special vane locations.

(a) (Reference 1401) (Pre SB PW4ENG 72−477) Measure the gap between vane arms and stepped spacers at the special vane locations while the vane is pulled outward and the stepped spacer is seated against the boss. The gap must be 0.005 − 0.016 inch (0.127 − 0.406 mm). If the gap is not within limits, try different class spacers until the desired gap is obtained.

(b) (Post SB PW4ENG 72−477) Install a single spacer which is the same size as the previous Class 1 spacer.

NOTE: SB PW4ENG 72−477 stops the requirement to measure the gap between vane arms and stepped spacers at the special vane locations and select the correct spacer class.

(25) Align holes in arms with threaded holes in vane trunnions. Install 76 bolts, threads lubricated with Engine Oil P03−001, key washers and washers to secure arms to vanes.

(26) (Reference 1551) Tighten and torque the bolts to 35 − 40 lb−in. (3.954 − 4.519 N.m). Bend the tabs of the washers to safety the bolts.

(27) Apply a tangential load, up to 100 lbs. (45.4 kg), to unison ring clevis when vane arms are parallel to engine axis. Vane arms must move through a minimum angle of 5 degrees from their initial position (parallel to engine axis), but in no case should this angle exceed 20 degrees. Loading to be applied in both directions (vanes closing and opening).

(28) Install stepped spacers onto ends of the special vanes at Locations 2, 3, 13, 22, and 23 on either case segment, counting from right to left on the OD of the case segment with the large OD down. Refer to Figure 1001 (Sheet 5). Use the Class 1 spacer for the initial measurement.

CAUTION: FAILURE TO CORRECTLY ALIGN THE OFFSET EDGES OF VANE ARM CLAW WITH THE OFFSET SLOTS IN THE VANE TRUNNIONS DURING ASSEMBLY WILL ORIENT THE VANE UP TO 180 DEGREES OUT OF POSITION, WHICH WILL PRODUCE SEVERE VIBRATORY

EXCITATION IN THE HPC AND CAN LEAD TO COMPRESSOR BLADE FRACTURE.

(29) Install Stage 5 vane synchronizing ring assembly (vane arms downward) to the five special vanes that have stepped spacers installed. Align the offset edges of the vane arms with the offset slots in the vane shafts and tap lightly until holes in vane arms line up with holes in vane trunnions. Following assembly of vane arms onto vane trunnions, check the outside width of the vane arm claws with PWA 87888 Gage to insure there is no deformation of the claw and that vane arm has been assembled correctly to vane trunnion. Temporarily secure vane arms to vane trunnions with washers and lubed bolts. Tighten bolts with a torque of 35 - 40 lb-in. (3.954 - 4.519 N.m). Repeat for other case segment.

(30) Install stepped spacers at the special vane locations.

(a) (Reference 1401) (Pre SB PW4ENG 72-477) Measure the gap between vane arms and stepped spacers at the special vane locations while the vane is pulled outward and the stepped spacer is seated against the boss. The gap must be 0.005 - 0.016 inch (0.127 - 0.406 mm). If the gap is not within limits, try different class spacers until the desired gap is obtained.

(b) (Post SB PW4ENG 72-477) Install a single spacer which is the same size as the previous Class 1 spacer.

NOTE: SB PW4ENG 72-477 stops the requirement to measure the gap between vane arms and stepped spacers at the special vane locations and select the correct spacer class.

(31) Align holes in arms with threaded holes in vane trunnions. Install 48 bolts, threads lubricated with Engine Oil P03-001, key washers and washers to secure arms to vanes.

(32) (Reference 1551) Tighten and torque the bolts to 35 - 40 lb-in. (3.954 - 4.519 N.m). Bend the tabs of the washers to safety the bolts.

(33) Apply a tangential load, up to 100 lbs. (45.4 kg), to unison ring clevis when vane arms are parallel to engine axis. Vane arms must move through a minimum angle of 5 degrees from their initial position (parallel to engine axis), but in no case should this angle exceed 20 degrees. Loading to be applied in both directions (vanes closing and opening).

(34) Install stepped spacers onto ends of the special vanes at Locations 2, 3, 12, 21, and 22 on either case segment, counting from right to left on the OD of the case segment with the large OD down. Refer to Figure 1001 (Sheet 5). Use the Class 1 spacer for the initial measurement.

CAUTION: FAILURE TO CORRECTLY ALIGN THE OFFSET EDGES OF VANE ARM CLAW WITH THE OFFSET SLOTS IN THE VANE TRUNNIONS DURING ASSEMBLY WILL ORIENT THE VANE UP TO 180 DEGREES OUT OF POSITION, WHICH WILL PRODUCE SEVERE VIBRATORY EXCITATION IN THE HPC AND CAN LEAD TO COMPRESSOR BLADE FRACTURE.

(35) Install Stage 6 vane synchronizing ring assembly (vane arms downward) to the five special vanes that have stepped spacers installed. Align the offset edges of the vane arms with the offset slots in the vane shafts and tap lightly until holes in vane arms line up with holes in vane trunnions. Following assembly of vane arms onto vane trunnions, check the outside width of the vane arm claws with PWA 87888 Gage to insure there is no deformation of the claw and that vane arm has been assembled correctly to vane trunnion. Temporarily secure vane arms to vane trunnions with washers and lubed bolts. Tighten bolts with a torque of 35 - 40 lb-in.(3.954 - 4.519 N.m). Repeat for other case segment.

(36) Install stepped spacers at the special vane locations.

(a) (Reference 1401) (Pre SB PW4ENG 72-477) Measure the gap between vane arms and stepped spacers at the special vane locations while the vane is pulled outward and the stepped spacer is seated against the boss. The gap must be 0.005 - 0.016 inch (0.127 - 0.406 mm). If the gap is not within limits, try different class spacers until the desired gap is obtained.

(b) (Post SB PW4ENG 72-477) Install a single spacer which is the same size as the previous Class 1 spacer.

NOTE: SB PW4ENG 72-477 stops the requirement to measure the gap between vane arms and stepped spacers at the special vane locations and select the correct spacer class.

(37) Align holes in arms with threaded holes in vane trunnions. Install 46 bolts, threads lubricated with Engine Oil P03-001, key washers and washers to secure arms to vanes.

(38) (Reference 1551) Tighten and torque the bolts to 35 - 40 lb-in. (3.954 - 4.519 N.m). Bend the tabs of the washers to safety the bolts.

(39) Apply a tangential load, up to 100 lbs. (45.4 kg), to unison ring clevis when vane arms are parallel to engine axis. Vane arms must move through a minimum angle of 5 degrees from their initial position (parallel to engine axis), but in no case should this angle exceed 20 degrees. Loading to be applied in both directions (vanes closing and opening).

CAUTION: FIFTH AND SIXTH STAGE SYNCHRONIZING RING CLEVISES AND 7TH STAGE SYNCHRONIZING RING MUST BE USED IN SETS FOR SIX STATOR VANE SCHEDULE OR 19 STATOR VANE SCHEDULE (SB PW4ENG 72-197).

(40) Install stepped spacers onto ends of the special vanes at Locations 2, 3, 16, 28, and 29 on either case segment, counting from right to left on the OD of the case segment with the large OD down. Refer to Figure 1001 (Sheet 5). Use the Class 1 spacer for the initial measurement.

CAUTION: FAILURE TO CORRECTLY ALIGN THE OFFSET EDGES OF VANE ARM CLAW WITH THE OFFSET SLOTS IN THE VANE TRUNNIONS DURING ASSEMBLY WILL ORIENT THE VANE UP TO 180 DEGREES OUT OF POSITION, WHICH WILL PRODUCE SEVERE VIBRATORY

EXCITATION IN THE HPC AND CAN LEAD TO COMPRESSOR BLADE FRACTURE.

(41) Install Stage 7 vane synchronizing ring assembly (vane arms downward) to the five special vanes that have stepped spacers installed. Align the offset edges of the vane arms with the offset slots in the vane shafts and tap lightly until holes in vane arms line up with holes in vane trunnions. Following assembly of vane arms onto vane trunnions, check the outside width of the vane arm claws with PWA 87888 Gage to insure there is no deformation of the claw and that vane arm has been assembled correctly to vane trunnion. Temporarily secure vane arms to vane trunnions with washers and lubed bolts. Tighten bolts with a torque of 35 - 40 lb-in. (3.954 - 4.519 N.m). Repeat for other case segment.

(42) Install stepped spacers at the special vane locations.

(a) (Reference 1401) (Pre SB PW4ENG 72-477) Measure the gap between vane arms and stepped spacers at the special vane locations while the vane is pulled outward and the stepped spacer is seated against the boss. The gap must be 0.005 - 0.016 inch (0.127 - 0.406 mm). If the gap is not within limits, try different class spacers until the desired gap is obtained.

(b) (Post SB PW4ENG 72-477) Install a single spacer which is the same size as the previous Class 1 spacer.

NOTE: SB PW4ENG 72-477 stops the requirement to measure the gap between vane arms and stepped spacers at the special vane locations and select the correct spacer class.

(43) Align holes in arms with threaded holes in vane trunnions. Install 60 bolts, threads lubricated with Engine Oil P03-001, key washers and washers to secure arms to vanes.

(44) (Reference 1551) Tighten and torque bolts to 35 - 40 lb-in. (3.954 - 4.519 N.m). Bend tabs to secure bolts.

(45) Apply a tangential load, up to 100 lbs. (45.4 kg), to unison ring clevis when vane arms are parallel to engine axis. Vane arms must move through a minimum angle of 5 degrees from their initial position (parallel to engine axis), but in no case should this angle exceed 20 degrees. Loading to be applied in both directions (vanes closing and opening).

CAUTION: SIXTH STAGE BORESCOPE PLUG AP3, PN 50H485 MUST BE USED IN CASES INCORPORATING SELF-LOCKING INSERTS (PRE SB PW4ENG 72-326).

(46) (Reference 1552) (Pre SB PW4ENG 72-326) For HPC front case incorporating self-locking helical coil inserts in 6th stage borescope port, remove excess baked on compound from borescope plug threads using a nylon brush. Apply Antiseize Paste P06-054 to threads and washer face of plug. Wipe off unwanted paste. Do not use Engine Oil P03-001. Install plug to "lower" case, to rear of 6th stage vanes. Run plug in to be sure plug is seated. Tighten and torque plug to 175 - 190 lb-in. (19.8 - 21.5 N.m). See Figure 1001 (Sheet 4).

NOTE: Install the plug until it contacts the locking coil of the insert. With a torque wrench, turn the plug in with a steady uniform motion. Check that the torque is less than 32 lb-in. (3.616 N.m). Replace the insert if torque exceeds limit.

CAUTION: NEW 6TH STAGE BORESCOPE PLUG AND KEY WASHER CONFIGURATION (POST SB PW4ENG 72-326 AND/OR SB PW4ENG 72-468 AND/OR SB PW4ENG 72-518) MAY BE USED IN CASES INCORPORATING STANDARD SELF-HELICAL INSERTS OR IN CASES INCORPORATING LOCKING HELICAL INSERTS.

(47) (Reference 1552) (Post SB PW4ENG 72-326 and/or SB PW4ENG 72-468 and/or SB PW4ENG 72-518) For HPC front case incorporating self-locking or standard helical coil inserts in 6th stage borescope port, remove excess baked on compound from borescope plug threads using nylon brush. Apply Antiseize Paste P06-054 to threads and washer face of plug. Wipe off unwanted paste. Do not use Engine Oil P03-001. Install plug and key washer to "lower" case, to rear of 6th stage vanes. Torque plug to 175 - 190 lb-in. (19.8 - 21.5 N.m). Bend tabs to secure plug, see Standard Practices Manual, PN 585005, 70-53.

CAUTION: FIFTH STAGE BORESCOPE PLUG AP2, PN 50H271 MUST BE USED IN CASES INCORPORATING SELF-LOCKING INSERTS (PRE SB PW4ENG 72-326).

(48) (Reference 1554) (Pre SB PW4ENG 72-326) For HPC front case incorporating self-locking helical coil inserts in 5th stage borescope port, remove excess baked on compound from borescope plug threads using a nylon brush. Apply Antiseize Paste P06-054 to threads and washer face of plug. Wipe off unwanted paste. Do not use Engine Oil P03-001. Install plug to "lower" case, to rear of 5th stage vanes. Run plug in to be sure plug is seated. Tighten and torque plug to 175 - 190 lb-in. (19.8 - 21.5 N.m). See Figure 1001 (Sheet 4).

NOTE: Install the plug until it contacts the locking coil of the insert. With a torque wrench, turn the plug in with a steady uniform motion. Check that the torque is less than 24 lb-in. (2.712 N.m). Replace the insert if torque exceeds limit.

CAUTION: NEW 5TH STAGE BORESCOPE PLUG AND KEY WASHER CONFIGRATION (POST SB PW4ENG 72-326 AND/OR SB PW4ENG 72-468 AND/OR SB PW4ENG 72-518) MAY BE USED IN CASES INCORPORATING STANDARD SELF-HELICAL INSERTS OR IN CASES INCORPORATING LOCKING HELICAL INSERTS.

(49) (Reference 1554) (Post SB PW4ENG 72-326 and/or SB PW4ENG 72-468 and/or SB PW4ENG 72-518) For HPC front case incorporating self-locking or standard helical coil inserts in 5th stage borescope port, remove excess baked on compound from borescope plug threads using nylon brush. Apply Antiseize Paste P06-054 to threads and washer face of plug. Wipe off unwanted paste. Do not use Engine Oil P03-001. Install plug and key washer to "lower" case, to rear of 5th stage vanes. Torque plug to 175 - 190 lb-in. (19.8 - 21.5 N.m). Bend tabs to secure plug, see Standard Practices Manual, PN 585005, 70-53.

CAUTION: (POST SB PW4ENG 72-485) THE 5TH THROUGH 7TH STAGE OUTER SHROUD SETS AND HPC FRONT CASE SET WERE ASSEMBLED, MACHINED, AND IDENTIFIED AS A MATCHED SET. MAKE SURE THAT ALL SHROUD

SEGMENTS HAVE THE SAME MATING NUMBER AS THE HPC FRONT CASE IN WHICH THEY WERE MACHINED.

CAUTION: (POST SB PW4ENG 72-485) NEW OR REPAIRED 5TH STAGE SHROUD SET MUST BE ASSEMBLED AND FINISH MACHINED (TO PROVIDE A TRENCH IN THE SHROUD RUBSTRIPS). MAKE SURE THAT THE SHROUD SET HAS A TRENCH MACHINED INTO THE RUBSTRIP.

CAUTION: FELTMETAL RUBSTRIPS MUST NOT BE EXPOSED TO ANY LUBRICANT PRIOR TO ENGINE INSTALLATION.

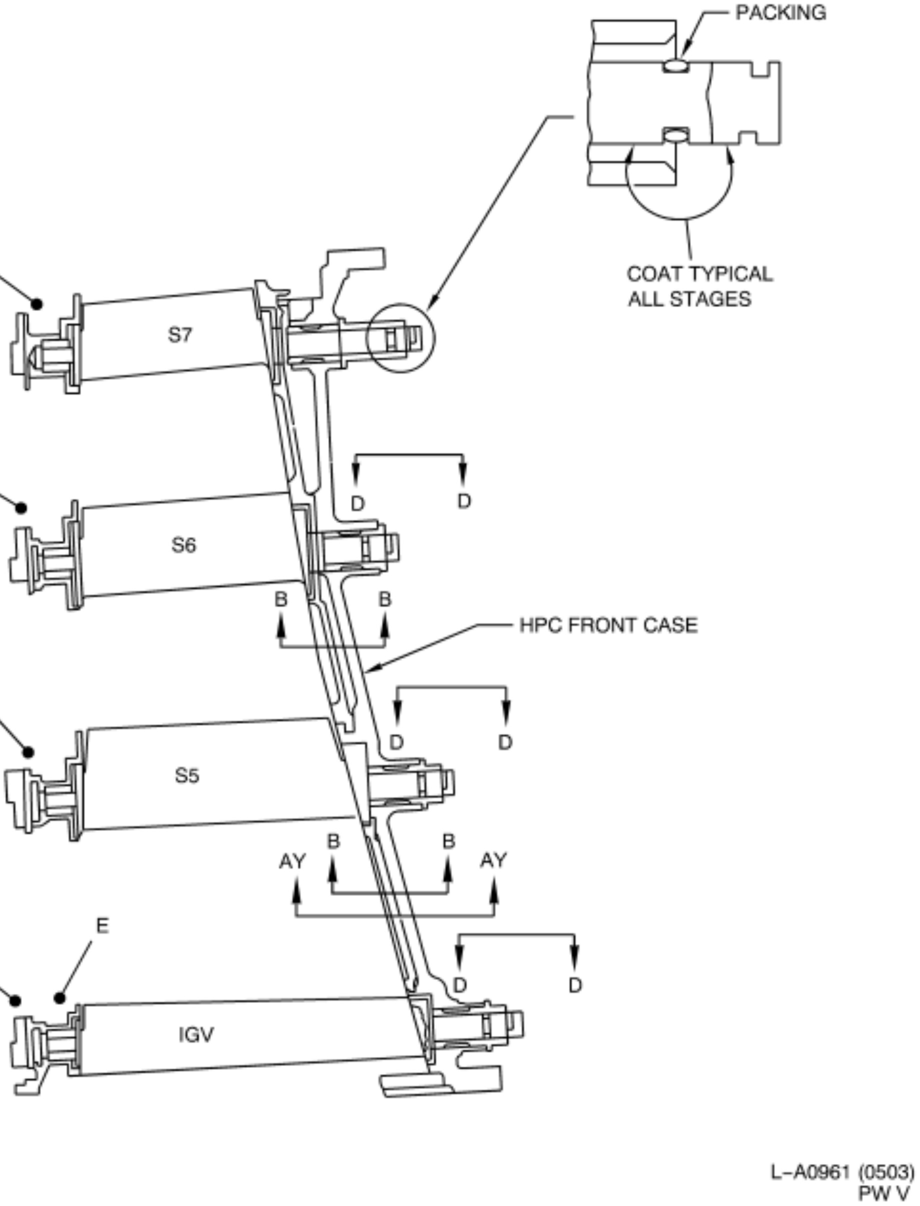
(50) Put the HPC Stage 5 shroud set into the HPC front case.

NOTE: Engines incorporating 5th stage HPC blades and a shroud set featuring and increased diameter flowpath and a pretrench for improved blade tip to shroud/outer airseal clearance (Post SB PW4ENG 72-215) must use 5th stage shroud set PN 53H555-01.

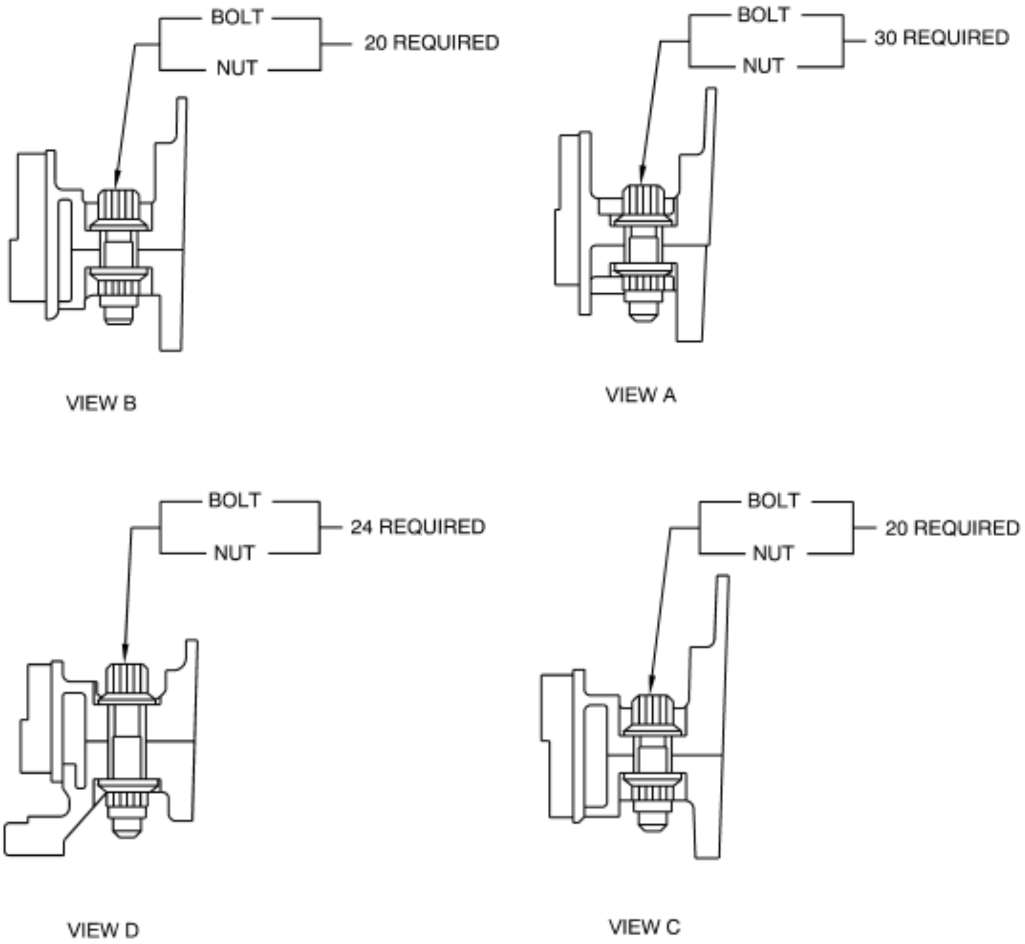
(a) Apply Antigalling Compound P06-021 to the 5th stage HPC shroud set in the areas shown in Figure 1002.

(b) The shroud-set segment connecting Ends AA and DD must locate as shown. See Figure 1001 (Sheet 6).

VARIABLE STATOR VANE AND HPC FRONT CASE ASSEMBLY − ASSEMBLY−01

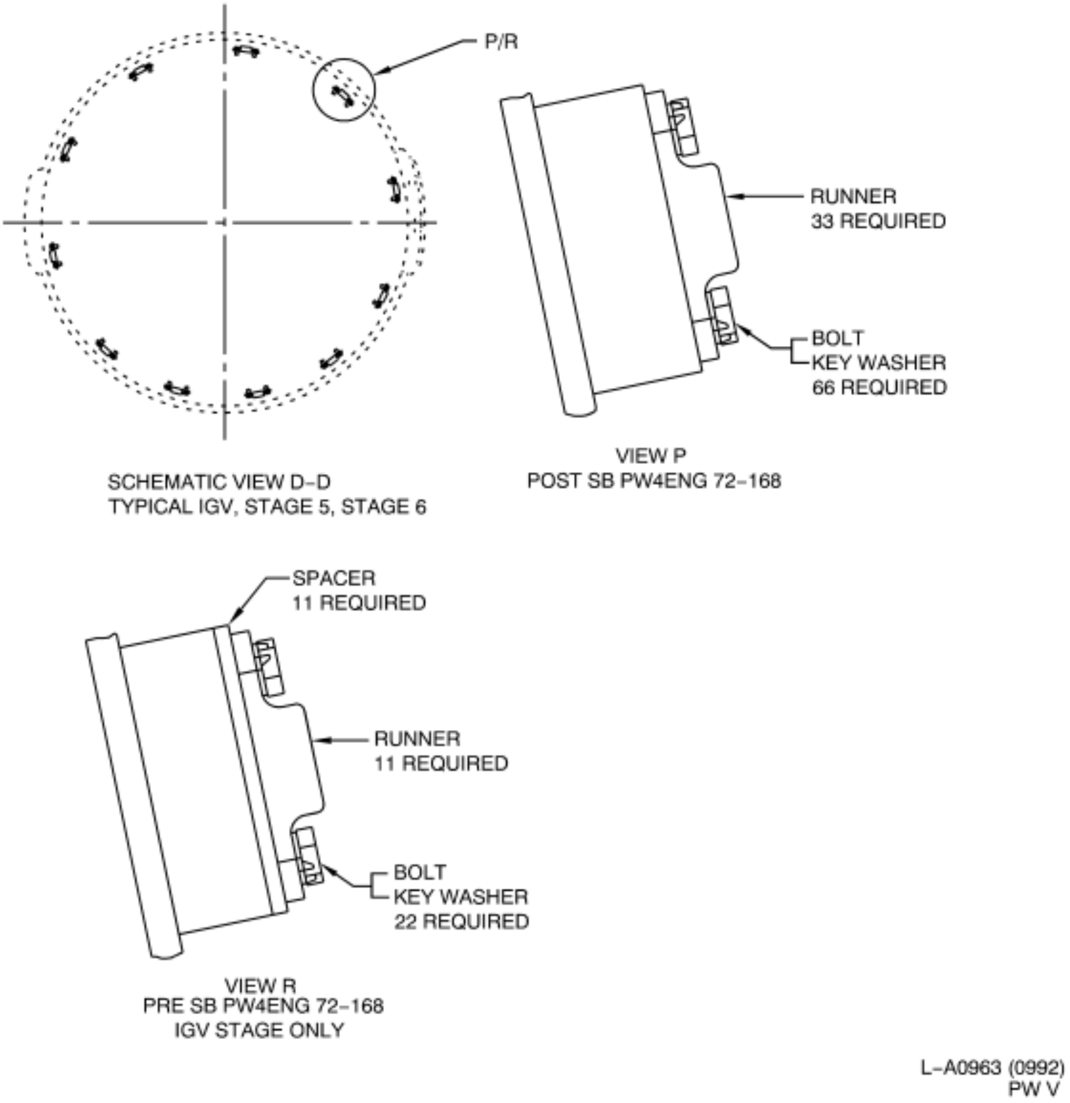

PACKING
COAT TYPICAL ALL STAGES
A
S7
B
D
D
S6
B
B
HPC FRONT CASE
C
D
D
S5
AY
B
B
AY
E
D
D
D
IGV
L−A0961 (0503)
PW V

Variable Stator Vane And HPC Front Case Assembly
Figure 1001 (Sheet 1)
(Task 72−35−02−440−001)

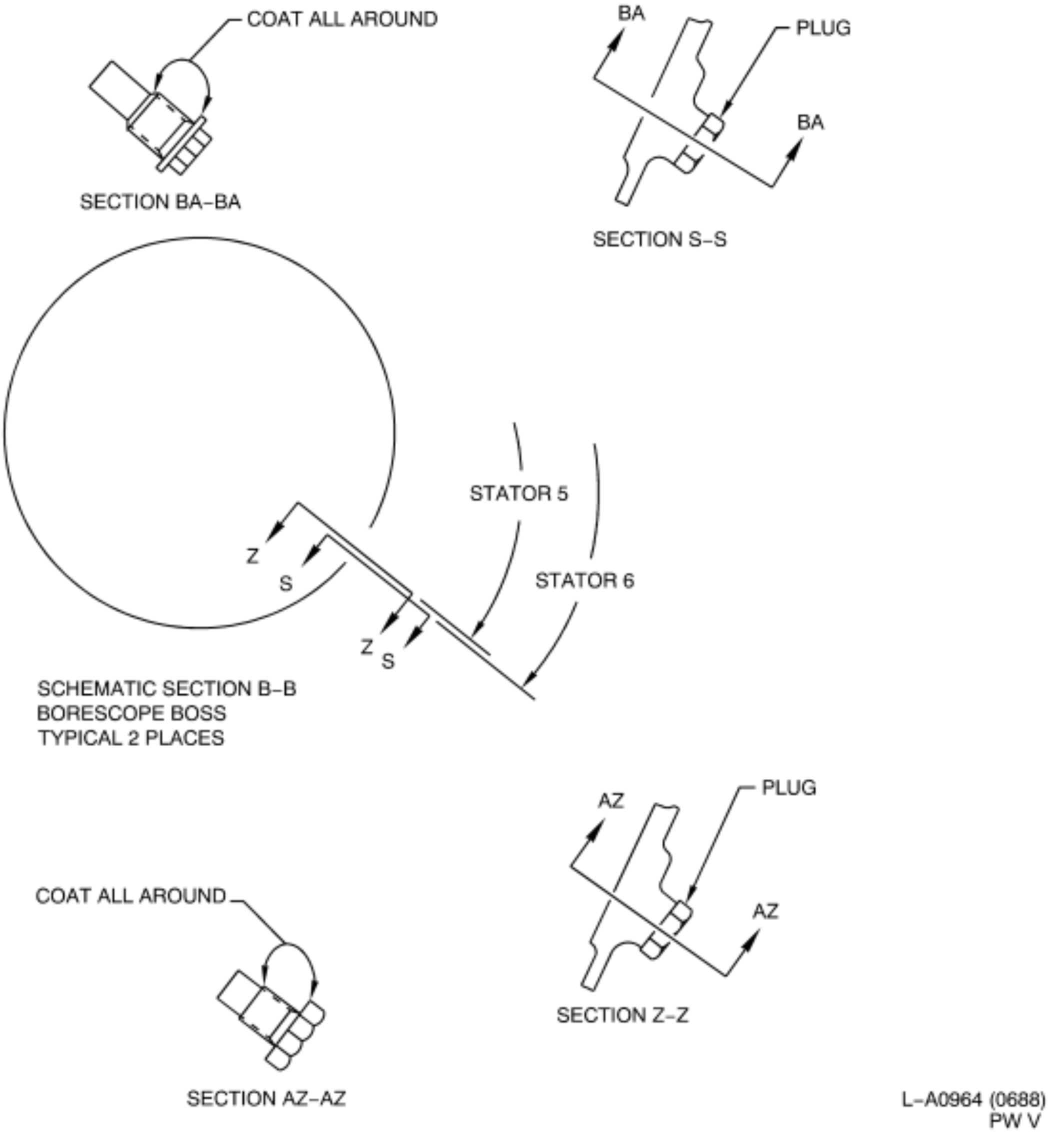

BOLT
NUT
20 REQUIRED
VIEW B
BOLT
NUT
30 REQUIRED
VIEW A
BOLT
NUT
24 REQUIRED
VIEW D
BOLT
NUT
20 REQUIRED
VIEW C

L−A0962 (0688)
PW V

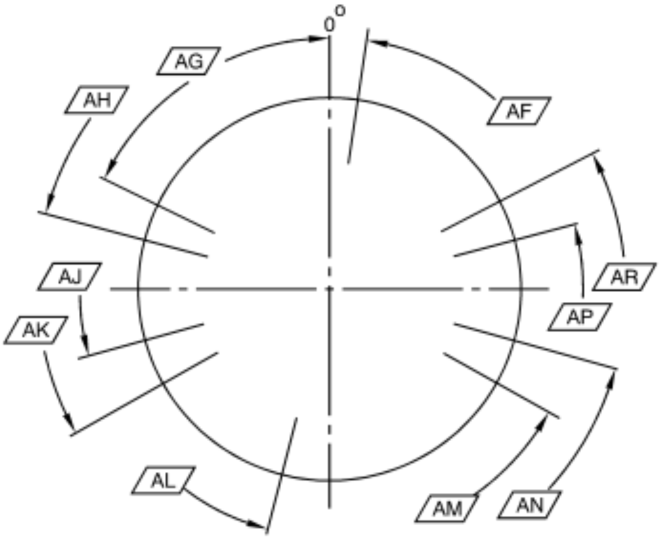
Variable Stator Vane And HPC Front Case Assembly
Figure 1001 (Sheet 2)
(Task 72−35−02−440−001)


P/R
RUNNER
33 REQUIRED
BOLT
KEY WASHER
66 REQUIRED
SCHEMATIC VIEW D−D
TYPICAL IGV, STAGE 5, STAGE 6
VIEW P
POST SB PW4ENG 72−168
SPACER
11 REQUIRED
RUNNER
11 REQUIRED
BOLT
KEY WASHER
22 REQUIRED
VIEW R
PRE SB PW4ENG 72−168
IGV STAGE ONLY
L−A0963 (0992)
PW V

Variable Stator Vane And HPC Front Case Assembly
Figure 1001 (Sheet 3)
(Task 72−35−02−440−001)


COAT ALL AROUND
SECTION BA−BA
BA
PLUG
BA
SECTION S−S
STATOR 5
STATOR 6
Z
S
Z
S
SCHEMATIC SECTION B−B
BORESCOPE BOSS
TYPICAL 2 PLACES
AZ
PLUG
AZ
COAT ALL AROUND
SECTION Z−Z
SECTION AZ−AZ
L−A0964 (0688)
PW V

Variable Stator Vane And HPC Front Case Assembly
Figure 1001 (Sheet 4)
(Task 72−35−02−440−001)



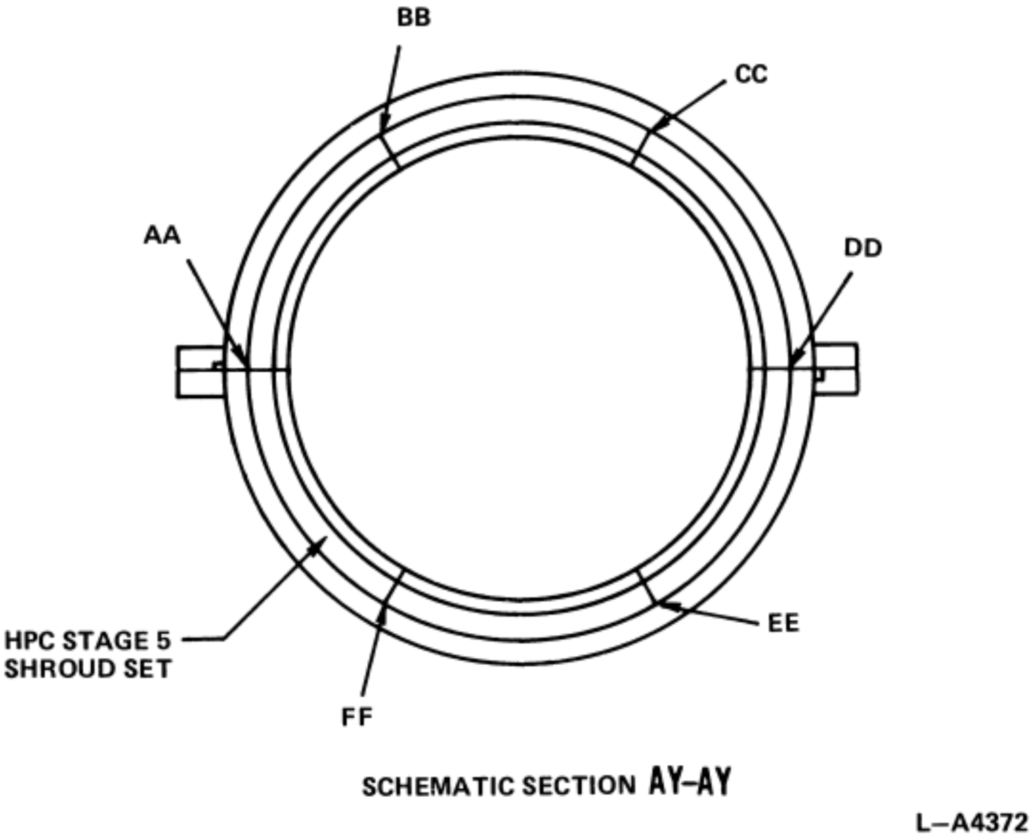
SCHEMATIC REAR VIEW
TYP IGV, S5, S6, & S7 SEE TABLE

STAGE	AF	AG	AH	AJ	AK
IGV	357° 37' 54"	73° 25' 16"	82° 53' 41"	97° 6' 19"	106° 34' 44'
S5	356° 15'	71° 15'	78° 45'	101° 15'	108° 45'
S6	0°	70° 26' 05"	78° 15' 39"	101° 44' 21"	109° 33' 55"
S7	357°	75°	81°	99°	105°

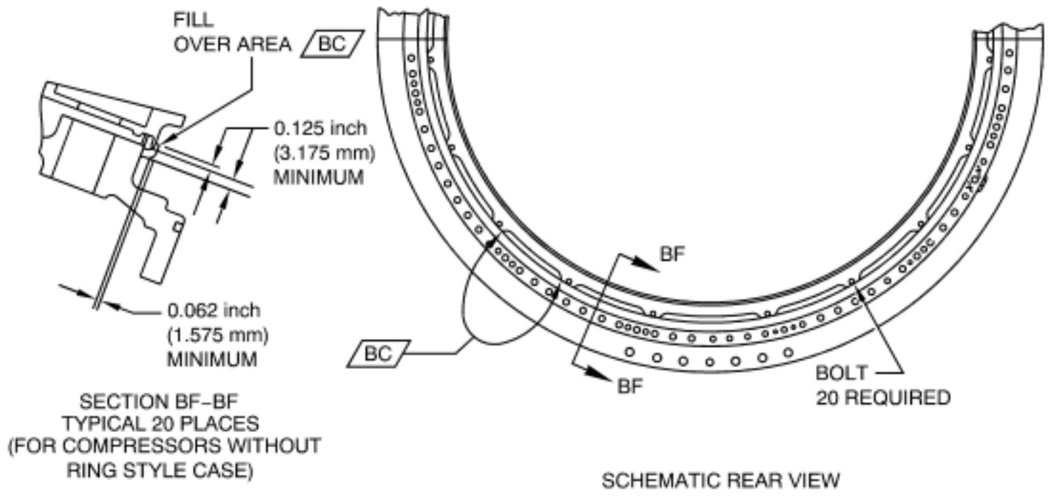
STAGE	AL	AM	AN	AP	AR
IGV	177° 37' 54"	253° 25' 16"	262° 53' 41"	277° 6' 19"	286° 34' 44"
S5	176° 45'	251° 15'	258° 45'	281° 15'	288° 45'
S6	180°	250° 26' 07"	258° 15' 39"	281° 44' 21"	289° 33' 55"
S7	177°	255°	261°	279°	285°

L−A3425 (0000)
PW V

Variable Stator Vane And HPC Front Case Assembly
Figure 1001 (Sheet 5)
(Task 72−35−02−440−001)

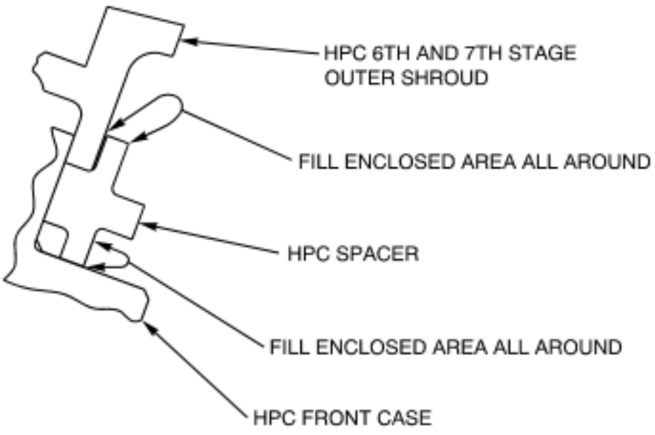

BB
CC
AA
DD
HPC STAGE 5
SHROUD SET
EE
FF
SCHEMATIC SECTION AY-AY
L-A4372

Variable Stator Vane And HPC Front Case Assembly
Figure 1001 (Sheet 6)
(Task 72-35-02-440-001)


FILL
OVER AREA
BC
0.125 inch
(3.175 mm)
MINIMUM
0.062 inch
(1.575 mm)
MINIMUM
BF
BC
BF
BOLT
20 REQUIRED

SECTION BF-BF
TYPICAL 20 PLACES
(FOR COMPRESSORS WITHOUT
RING STYLE CASE)

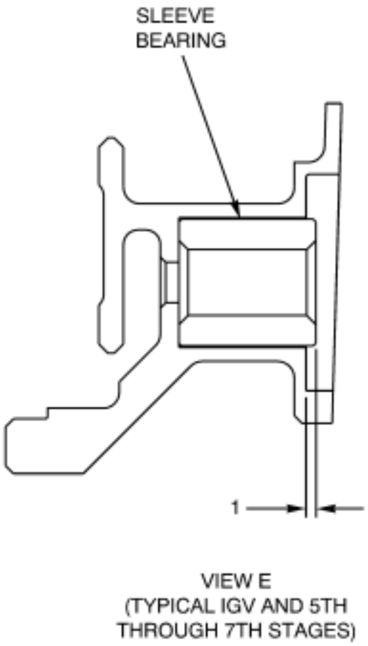
SCHEMATIC REAR VIEW


HPC 6TH AND 7TH STAGE
OUTER SHROUD
FILL ENCLOSED AREA ALL AROUND
HPC SPACER
FILL ENCLOSED AREA ALL AROUND
HPC FRONT CASE

SECTION BF-BF
(FOR COMPRESSORS WITH THE
RING SYLE CASE)

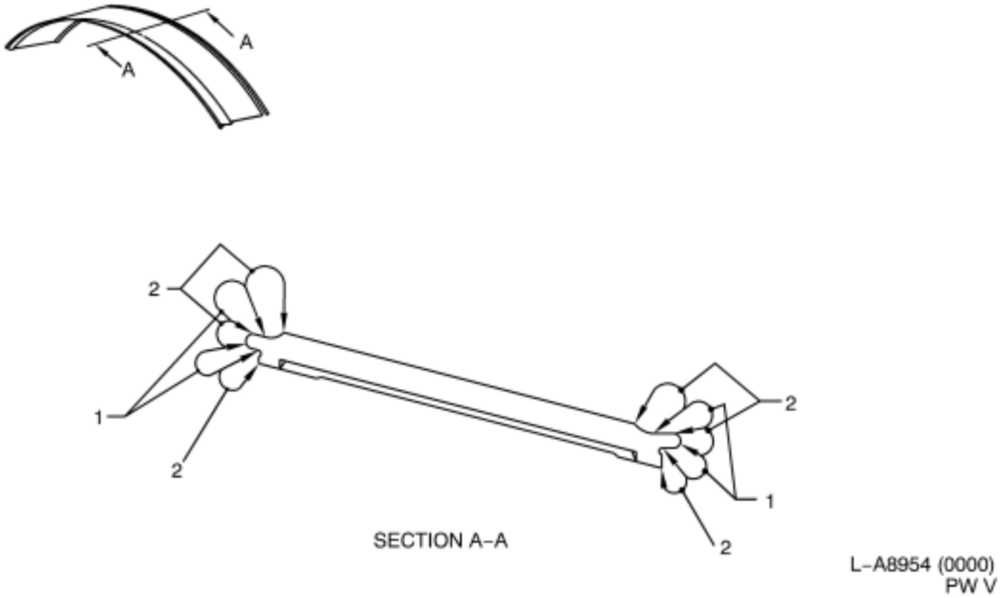
L-D0032 (0603)
PW V

Variable Stator Vane And HPC Front Case Assembly
(For The Symmetric Case Configuration)
Figure 1001 (Sheet 7)
(Task 72-35-02-440-001)


SLEEVE BEARING
1
VIEW E
(TYPICAL IGV AND 5TH THROUGH 7TH STAGES)
L−D0881 (0503)
PW V

1. 0.006 Inch (0.152 mm) Minimum

Variable Stator Vane And HPC Front Case Assembly
Figure 1001 (Sheet 8)
(Task 72−35−02−440−001)



1. Apply Antigalling Compound To The Enclosed Area. See The Text.
2. Antigalling Compound Optional And Can Be Incomplete.

Stage 5 HPC Shroud Set Antigalling Compound Application
Figure 1002
(Task 72−35−02−440−001)

VARIABLE STATOR VANE AND HPC FRONT CASE ASSEMBLY - ASSEMBLY-01

Task 72-35-02-440-002:

1. (For The Asymmetric (HPC) Case Configuration) Assemble The Variable Stator Vane And HPC Front Case Assembly

A. Equipment And Materials Required

Special Tools:

R	PWA 87888	Gage, Go (Variable Vane Arm) (Pre SB PW4ENG 72-743)
R	PWA 102728	Gage, Go (Variable Vane Arm) (Post SB PW4ENG 72-743)

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P06-021	Antigalling Compound (PWA 550-3)
P06-041	Lubricant, Dry Film (PWA 36221)
P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Bearing-Washer	74	72-35-00/12A/80
Bearing-Washer	49	72-35-00/13A/80
Bearing-Washer	45	72-35-00/14A/80
Bearing-Washer	61	72-35-00/15A/80
Key Washer	74	72-35-00/12A/300
Key Washer	49	72-35-00/13A/230
Key Washer	45	72-35-00/14A/220
Key Washer	61	72-35-00/15A/220
Packing	74	72-35-00/12A/90
Packing	49	72-35-00/13A/90
Packing	45	72-35-00/14A/90
Packing	61	72-35-00/15A/90

B. Procedure

CAUTION: THE 5TH THROUGH 7TH STAGE OUTER SHROUD SETS AND HPC FRONT CASE SET WERE ASSEMBLED, MACHINED, AND IDENTIFIED AS A MATCHED SET. MAKE SURE THAT BOTH HALVES OF THE HPC FRONT CASE HAVE THE SAME MATING NUMBER.

(1) Place both halves of the HPC front case assembly, large OD down, on a work bench.

(2) Install the HPC inlet vanes to the HPC front case as follows: See Figure 1001 (Sheet 1) or Figure 1001 (Sheet 2) as applicable.

(a) Install the thrust bearing washer (1001/2) on each HPC inlet vane trunnion at the grooved end. See Figure 1001 (Sheet 3).

(b) Install a new packing (1001/1) on each vane trunnion to seat in the groove.

(c) Make sure that the packing (1001/1) is correctly installed and is not twisted.

(d) Apply Dry Film Lubricant P06-041 to area of the packing (1001/1) as shown in the referenced figure.

(e) In the following steps, insert the vane, thickest part of airfoil down, through the lowest set of bearings in HPC front case.

(f) (For Post SB PW4ENG 72-743 except the UPS configuration) Install the ten special IGV stage vanes that will have inner shroud keys installed at the locations specified.

1 Stand so you look at the ID of either case segment.

2 Install the special vanes so the thickest part of airfoil, leading edge, is down.

3 For the upper HPC front case half, insert the vane shaft, with the thrust washer and packing installed, into holes 2, 4, 20, 35, and 37. Start the count of holes from the split line and from left to right.

4 For the lower HPC front case half, insert the shaft, with the thrust washer and packing installed, into holes 2, 4, 19, 33, and 35. Start the count of holes from the split line and from left to right.

5 Complete the installation of remaining HPC inlet vanes, with packings and washers, until a total of 74 vanes are installed in both halves of the HPC front case assembly.

(g) (For the UPS configuration) Install the IGV stage vanes.

1 Stand so you look at the ID of either case segment.

2 Install the vanes so the thickest part of airfoil, leading edge, is down.

3 Install the inlet vanes, with packings and washers, until a total of 74 vanes are installed in both halves of the HPC front case assembly.

(3) Procedure to measure the distance between the sleeve bearings and the inner shroud.

(a) If you do not install new sleeve bearings in the following steps, you must measure the distance between the sleeve bearings and the shroud as follows: See Figure 1001 (Sheet 4).

NOTE: The following sleeve bearing height check is not required if you install new sleeve bearings.

1 Temporarily assemble the shroud set. Make sure the part numbers agree with the mating parts.

2 Install each sleeve bearing into the mating holes in the shroud set.

3 Measure the distance between the sleeve bearings and the shroud. The sleeve bearing height must be in the limits specified in the referenced figure.

4 Remove the bearings from the shroud set.

5 Disassemble the shroud set.

(4) (For Post SB PW4ENG 72-743 except the UPS Configuration) Install the IGV stage shroud to the IGV stage vanes as follows:

(a) Install ten special sleeve bearings that have key slots (1001/4) on the inner trunnions of the IGV vanes that have mating key slots. See Figure 1001 (Sheet 3).

NOTE: If you do not install new sleeve bearings, you must measure the distance between the sleeve bearings and the shroud as specified above.

(b) Install sleeve bearings without key slots (1001/5) on the inner trunnions of the other 64 IGV vanes.

NOTE: If you do not install new sleeve bearings, you must measure the distance between the sleeve bearings and the shroud as specified above.

(c) Place the shroud segment assemblies on a work bench.

(d) Locate the mating number at the approximate center of the upper and lower surface of the outer ring and make sure that the mating number is the same on both ring details for each shroud assembly.

(e) Separate the upper segment details from the lower details and place on a work bench with the mating face up.

(f) With the lower shroud details mating face up on the work bench, put the five keys (curved edges down) to fit the contour on the slots in the shroud. The flat edge will be flush with the face of the shroud. See Figure 1001 (Sheet 5).

NOTE: At the two key slots at each end of the segments, the flat of the key must go toward the bolt hole.

(g) Make sure that there are five keys in each shroud segment.

(h) Make sure that there are 74 bearing sleeves present on the ID end of the vane trunnions.

(i) Check for the correct sleeve bearing installation as follows:

1 For the upper front case half, count the vanes from left to right. Make sure that the vanes at Locations 2, 4, 20, 35, and 37 have sleeves installed that are slotted, with the slotted ends of the sleeves positioned inward (toward the center of the case segment) and downward.

2 For the lower front case half, count the vanes from left to right. Make sure that the vanes at Locations 2, 4, 19, 33, and 35 have sleeves installed that are slotted, with the slotted ends of the sleeves positioned inward (toward the center of the case segment) and downward.

(j) Apply Engine Oil P03-001 to the 18 bolts you will use to install the shroud set.

(k) Mating cut-outs in the upper shroud detail (detail with larger OD) with the installed bearing sleeves, install the shroud to the upper side of the vane bearing sleeves for each case half.

(l) Mating cut-outs, keys with slots in the bearing sleeves, and dowel pins with the dowel holes, install the lower shroud (detail without the guide assembly support) to the lower side of the vane bearing sleeves for each case half.

(m) Install both shroud halves with 18 bolts (heads up) and nuts. See Figure 1001 (Sheet 8).

(n) Torque the nuts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(o) Complete the installation of the shroud on both halves of the HPC front case assembly.

(p) Check for vane freedom of movement of the special vanes as follows:

1 For the upper front case half, count the vanes from left to right. Check the vanes at the Locations 2, 4, 20, 35, and 37 for freedom of movement.

2 For the lower front case half, count the vanes from left to right. Check the vanes at the Locations 2, 4, 19, 33, and 35 for freedom of movement.

3 If any vane does not move freely, disassemble the shroud and check the bearing for damage.

(5) (For the UPS configuration) Install the IGV stage shroud to the IGV stage vanes as follows:

(a) If you do not install new sleeve bearings in the following steps, you must measure the distance between the sleeve bearings and the specified in a preceding step. See Figure 1001 (Sheet 4).

(b) Install sleeve bearings (1001/5) on the inner trunnions of the 74, IGV stage vanes. See Figure 1001 (Sheet 3).

NOTE: The sleeve bearing height check is not required if you install new sleeve bearings.

(c) Place the shroud segment assemblies on a work bench.

(d) Locate the mating number at the approximate center of the upper and lower surface of the outer ring and make sure that the mating number is the same on both ring details for each shroud assembly.

(e) Make sure that there are 74 bearing sleeves present on the ID end of the vane trunnions.

(f) Apply Engine Oil P03-001 to the 18 bolts you will use to install the shroud set.

(g) Install the IGV stage shroud on IGV stage vanes so that shroud half with the larger OD is positioned above the bearings and other half of the shroud is below the bearings.

(h) Install both shroud halves with 18 lubricated bolts (heads up) and nuts. See Figure 1001 (Sheet 8).

(i) Torque the nuts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(j) Complete the installation of the shroud on both halves of the HPC front case assembly.

(6) Install the 5th stage vanes to the HPC front case as follows: See Figure 1001 (Sheet 1) or Figure 1001 (Sheet 2) as applicable.

  (a) Install the thrust washer (1001/2) on each 5th stage vane trunnion at the grooved end. See Figure 1001 (Sheet 3).

  (b) Install a new packing (1001/1) on each vane trunnion to seat in the groove.

  (c) Make sure that the packing (1001/1) is correctly installed and is not twisted.

  (d) Apply Dry Film Lubricant P06-041 to area of the packing (1001/1) as shown in the referenced figure.

  (e) In the following steps, insert the vane, thickest part of airfoil down, through the set of bearings immediately above previously installed IGV stage vanes in HPC front case.

  (f) (For Post SB PW4ENG 72-743 except the UPS) Install the ten 5th stage vanes that will have inner shroud keys installed at the locations specified.

    1 Stand so you look at the ID of either case segment.

    2 Install these special vanes so the thickest part of airfoil, leading edge, is down.

    3 For the upper front case half, insert the shaft, with the thrust washer and packing installed, into holes 2, 3, 13, 22 and 23. Start the count of holes from the split line and from left to right.

    4 For the lower front case half, insert the shaft, with the thrust washer and packing installed, into holes 2, 3, 13, 23, and 24. Start the count of holes from the split line and from left to right.

    5 Complete the installation of remaining 5th stage vanes, with packings and washers, until a total of 49 vanes are installed in both halves of the HPC front case assembly.

(g) (For the UPS configuration) Install the 5th stage vanes as follows:

1 Stand so you look at the ID of either case segment.

2 Install the vanes so the thickest part of airfoil, leading edge, is down.

3 Install the 5th stage vanes, with packings and washers, until a total of 49 vanes are installed in both halves of the HPC front case assembly.

(7) (For Post SB PW4ENG 72-743 except the UPS Configuration) Install the 5th stage shroud to the 5th stage vanes as follows:

(a) If you do not install new sleeve bearings in the following steps, you must measure the distance between the sleeve bearings and the specified in a preceding step. See Figure 1001 (Sheet 4).

(b) Install ten special sleeve bearings that have key slots (1001/4) on the inner trunnions of the 5th stage vanes that have mating key slots. See Figure 1001 (Sheet 3).

NOTE: The sleeve bearing height check is not required if you install new sleeve bearings.

(c) Install sleeve bearings without key slots (1001/5) on the inner trunnions of the other 39, 5th stage vanes.

NOTE: The sleeve bearing height check is not required if you install new sleeve bearings.

(d) Place the shroud segment assemblies on a work bench.

(e) Locate the mating number at the approximate center of the upper and lower surface of the outer ring and make sure that the mating number is the same on both ring details for each shroud assembly.

(f) Separate the upper segment details from the lower details and place on a work bench with the mating face up.

(g) With the lower shroud details mating face up on the work bench, put the five keys (curved edges down) to fit the contour on the slots in the shroud. The flat edge will be flush with the face of the shroud. See Figure 1001 (Sheet 5).

(h) Make sure that there are five keys in each shroud segment.

(i) Make sure that there are 49 bearing sleeves present on the ID end of the vane trunnions.

(j) Check for the correct sleeve bearing installation as follows:

1 For the upper front case half, count the vanes from left to right. Make sure that the vanes at Locations 2, 3, 13, 22, and 23 have sleeves installed that are slotted, with the slotted ends of the sleeves positioned inward (toward the center of the case segment) and downward.

2 For the lower front case half, count the vanes from left to right. Make sure that the vanes at Locations 2, 3, 13, 23, and 24 have sleeves installed that are slotted, with the slotted ends of the sleeves positioned inward (toward the center of the case segment) and downward.

(k) Apply Engine Oil P03-001 to the 16 bolts you will use to install the shroud set.

(l) Mating cut-outs in the upper shroud detail (detail with the larger OD) with the installed bearing sleeves, install the shroud to the upper side of the vane bearing sleeves for each case half.

(m) Mating cut-outs, keys with slots in the bearing sleeves, and dowel pins with the dowel holes, install the lower shroud to the lower side of the vane bearing sleeves for each case half.

(n) Install both shroud halves with 16 bolts (heads up) and nuts. See Figure 1001 (Sheet 8).

(o) Torque the nuts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(p) Complete the installation of the shroud on both halves of the HPC front case assembly.

(q) Check for vane freedom of movement of the special vanes as follows:

1 For the upper front case half, count the vanes from left to right. Check the vanes at the Locations 2, 3, 13, 22, and 23 for freedom of movement.

2 For the lower front case half, count the vanes from left to right. Check the vanes at the Locations 2, 3, 13, 23, and 24 for freedom of movement.

3 If any vane does not move freely, disassemble the shroud and check the bearing for damage.

(8) (For the UPS configuration) Install the 5th stage shroud to the 5th stage vanes as follows:

(a) If you do not install new sleeve bearings in the following steps, you must measure the distance between the sleeve bearings and the specified in a preceding step. See Figure 1001 (Sheet 4).

(b) Install sleeve bearings (1001/5) on the inner trunnions of the 49, 5th stage vanes. See Figure 1001 (Sheet 3).

NOTE: The sleeve bearing height check is not required if you install new sleeve bearings.

(c) Place the shroud segment assemblies on a work bench.

(d) Locate the mating number at the approximate center of the upper and lower surface of the outer ring and make sure that the mating number is the same on both ring details for each shroud assembly.

(e) Make sure that there are 49 bearing sleeves present on the ID end of the vane trunnions.

(f) Apply Engine Oil P03-001 to the 16 bolts you will use to install the shroud set.

(g) Install the 5th stage shroud on 5th stage vanes so that shroud half with larger OD is positioned above the bearings and other half of the shroud is below the bearings.

(h) Install both shroud halves with 16 bolts (heads up) and nuts. See Figure 1001 (Sheet 8).

(i) Torque the nuts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(j) Complete the installation of the shroud on both halves of the HPC front case assembly.

(9) Install the 6th stage vanes to the HPC front case as follows: See Figure 1001 (Sheet 1) or Figure 1001 (Sheet 2) as applicable.

(a) Install the thrust washer (1001/2) on the 6th stage vane trunnion at the grooved end. See Figure 1001 (Sheet 3).

(b) Install a new packing (1001/1) on each vane trunnion to seat in the groove.

(c) Make sure that the packing is correctly installed and is not twisted.

(d) Apply Dry Film Lubricant P06-041 to area of the packing (1001/1) as shown in the referenced figure.

(e) In the following steps, insert the vanes, thickest part of airfoil down, through the set of bearings immediately above the previously installed 5th stage vanes in HPC front case.

(f) (For Post SB PW4ENG 72-743 except the UPS) Install the ten 6th stage vanes that will have inner shroud keys installed at the locations specified.

1 Stand so you look at the ID of either case segment.

2 Install these special vanes so the thickest part of airfoil, leading edge, is down.

3 For the upper HPC front case half, insert the shaft, with the thrust washer and packing installed, into holes 2, 3, 12, 21 and 22. Start the count of holes from the split line and from left to right.

4 For the lower HPC front case half, insert the shaft, with the thrust washer and packing installed, into holes 2, 3, 11, 20, and 21. Start the count of holes from the split line and from left to right.

5 Complete the installation of remaining 6th stage vanes, with packings and washers, until a total of 45 vanes are installed in both halves of the HPC front case assembly.

(g) (For the UPS configuration) Install the 6th stage vanes.

1 Stand so you look at the ID of either case segment.

2 Install the vanes so the thickest part of airfoil, leading edge, is down.

3 Install the 6th stage vanes, with packings and washers, until a total of 45 vanes are installed in both halves of the HPC front case assembly.

(10) (For Post SB PW4ENG 72-743 except the UPS Configuration) Install the 6th stage shroud to the 6th stage vanes.

(a) If you do not install new sleeve bearings in the following steps, you must measure the distance between the sleeve bearings and the specified in a preceding step. See Figure 1001 (Sheet 4).

(b) Install ten special sleeve bearings that have key slots (1001/4) on the inner trunnions of the 6th stage vanes that have mating key slots. See Figure 1001 (Sheet 3).

NOTE: The sleeve bearing height check is not required if you install new sleeve bearings.

(c) Install sleeve bearings without key slots (1001/5) on the inner trunnions of the other 35, 6th stage vanes.

NOTE: The sleeve bearing height check is not required if you install new sleeve bearings.

(d) Place the shroud segment assemblies on a work bench.

(e) Locate the mating number at the approximate center of the upper and lower surface of the outer ring and make sure that the mating number is the same on both ring details for each shroud assembly.

(f) Separate the upper segment details from the lower details and place on a work bench with the mating face up.

(g) With the lower shroud details mating face up on the work bench, put the five keys (curved edges down) to fit the contour on the slots in the shroud. The flat edge will be flush with the face of the shroud. See Figure 1001 (Sheet 5).

(h) Make sure that there are five keys in each shroud segment.

(i) Make sure that there are 45 bearing sleeves present on the ID end of the vane trunnions.

(j) Check for the correct sleeve bearing installation as follows:

1 For the upper front case half, count the vanes from left to right. Make sure that the vanes at Locations 2, 3, 12, 21, and 22 have sleeves installed that are slotted, with the slotted ends of the sleeves positioned inward (toward the center of the case segment) and downward.

2 For the lower front case half, count the vanes from left to right. Make sure that the vanes at Locations 2, 3, 11, 20, and 21 have sleeves installed that are slotted, with the slotted ends of the sleeves positioned inward (toward the center of the case segment) and downward.

(k) Apply Engine Oil P03-001 to the 16 bolts you will use to install the shroud set.

(l) Mating cut-outs in the upper shroud detail (detail with the larger OD) with the installed bearing sleeves, install the shroud to the upper side of the vane bearing sleeves for each case half.

(m) Mating cut-outs, keys with slots in the bearing sleeves, and dowel pins with the dowel holes, install the lower shroud with the keys to the lower side of the vane bearing sleeves for each case half.

(n) Install both shroud halves with 16 bolts (heads up) and nuts. See Figure 1001 (Sheet 8).

(o) Torque the nuts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(p) Complete installation of the shroud on both halves of the HPC front case assembly.

(q) Check for vane freedom of movement of the 6th stage special vanes as follows:

1 For the upper front case half, count the vanes from left to right. Check the vanes at the Locations 2, 3, 12, 21, and 22 for freedom of movement.

2 For the lower front case half, count the vanes from left to right. Check the vanes at the Locations 2, 3, 11, 20, and 21 for freedom of movement.

3 If any vane does not move freely, disassemble the shroud and check the bearing for damage.

(11) (For the UPS configuration) Install the 6th stage shroud to the 6th stage vanes as follows:

(a) If you do not install new sleeve bearings in the following steps, you must measure the distance between the sleeve bearings and the specified in a preceding step. See Figure 1001 (Sheet 4).

(b) Install sleeve bearings (1001/5) on the inner trunnions of the 45, 6th stage vanes. See Figure 1001 (Sheet 3).

NOTE: The sleeve bearing height check is not required if you install new sleeve bearings.

(c) Place the shroud segment assemblies on a work bench.

(d) Locate the mating number at the approximate center of the upper and lower surface of the outer ring and make sure that the mating number is the same on both ring details for each shroud assembly.

(e) Make sure that there are 45 bearing sleeves present on the ID end of the vane trunnions.

(f) Apply Engine Oil P03-001 to the 16 bolts you will use to install the shroud set.

(g) Install the 6th stage shroud on 6th stage vanes so that shroud half with the larger OD is positioned above the bearings and other half of the shroud is below the bearings.

(h) Install both shroud halves with 16 bolts (heads up) and nuts. See Figure 1001 (Sheet 8).

(i) Torque the nuts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(j) Complete installation of the shroud on both halves of the HPC front case assembly.

(12) Install the 7th stage vanes to the HPC front case as follows: See Figure 1001 (Sheet 1) or Figure 1001 (Sheet 2) as applicable.

(a) Install the thrust washer (1001/2) on the 7th stage vane trunnion at the grooved end. See Figure 1001 (Sheet 3).

(b) Install a new packing (1001/1) on each vane trunnion to seat in the groove.

(c) Make sure that the packing is correctly installed and is not twisted.

(d) Apply Dry Film Lubricant P06-041 to area of the packing (1001/1) as shown in the referenced figure.

(e) In the following steps, insert the vanes, thickest part of airfoil down, through upper set of bearings in ID of the HPC front case.

(f) (For Post SB PW4ENG 72-743 except the UPS) Install the ten 7th stage vanes that will have inner shroud keys installed at the locations specified.

1 Stand so you look at the ID of either case segment.

2 Install these special vanes so the thickest part of airfoil, leading edge, is down.

3 For the upper front case half, insert the shaft, with the thrust washer and packing installed, into holes 2, 3, 16, 28 and 29. Start the count of holes from the split line and from left to right.

4 For the lower front case half, insert the shaft, with the thrust washer and packing installed, into holes 2, 3, 16, 29 and 30. Start the count of holes from the split line and from left to right.

5 Complete installation of remaining 7th stage vanes, with packings and washers, until a total of 61 vanes are installed in both halves of the HPC front case assembly.

(g) (For the UPS configuration) Install the 7th stage vanes as follows:

1 Stand so you look at the ID of either case segment.

2 Install the vanes so the thickest part of airfoil, leading edge, is down.

3 Install the 7th stage vanes, with packings and washers, until a total of 61 vanes are installed in both halves of the HPC front case assembly.

(13) (For Post SB PW4ENG 72-743 except the UPS configuration) Install the 7th stage shroud to the 7th stage vanes as follows:

(a) If you do not install new sleeve bearings in the following steps, you must measure the distance between the sleeve bearings and the specified in a preceding step. See Figure 1001 (Sheet 4).

(b) Install ten special sleeve bearings that have key slots (1001/4) on the inner trunnions of the 7th stage vanes that have mating key slots. See Figure 1001 (Sheet 3).

NOTE: The sleeve bearing height check is not required if you install new sleeve bearings.

(c) Install sleeve bearings without key slots (1001/5) on the inner trunnions of the other 51, 7th stage vanes.

NOTE: The sleeve bearing height check is not required if you install new sleeve bearings.

(d) Place the shroud segment assemblies on a work bench.

(e) Locate the mating number at the approximate center of the upper and lower surface of the outer ring and make sure that the mating number is the same on both ring details for each shroud assembly.

(f) Separate the upper segment details from the lower details and place on a work bench with the mating face up.

(g) With the lower shroud details mating face up on the work bench, put ten keys (curved edges down) to fit the contour on the slots in the shroud. The flat edge will be flush with the face of the shroud. See Figure 1001 (Sheet 5).

(h) Make sure that there are five keys in each shroud segment.

(i) Make sure that there are 61 bearing sleeves present on the ID end of the vane trunnions.

(j) Check for the correct sleeve bearing installation as follows:

1 For the upper front case half, count the vanes from left to right. Make sure that the vanes at Locations 2, 3, 16, 28, and 29 have sleeves installed that are slotted, with the slotted ends of the sleeves positioned inward (toward the center of the case segment) and downward.

2 For the lower front case half, count the vanes from left to right. Make sure that the vanes at Locations 2, 3, 16, 29, and 30 have sleeves installed that are slotted, with the slotted ends of the sleeves positioned inward (toward the center of the case segment) and downward.

(k) Apply Engine Oil P03-001 to the 18 bolts you will use to install the shroud set.

(l) Mating cut-outs in the upper shroud detail (detail with the larger OD) with the installed bearing sleeves, install the shroud to the upper side of the vane bearing sleeves for each case half.

(m) Mating cut-outs, keys with slots in the bearing sleeves, and dowel pins with the dowel holes, install the lower shroud with the keys to the lower side of the vane bearing sleeves for each case half.

(n) Install both shroud halves with 18 bolts (heads up) and nuts. See Figure 1001 (Sheet 8).

(o) Torque the nuts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(p) Complete installation of the shroud on both halves of the HPC front case assembly.

(q) Check for vane freedom of movement of the 7th stage special vanes as follows:

1 For the upper front case half, count the vanes from left to right. Check the vanes at the Locations 2, 3, 16, 28, and 29 for freedom of movement.

2 For the lower front case half, count the vanes from left to right. Check the vanes at the Locations 2, 3, 16, 29, and 30 for freedom of movement.

3 If any vane does not move freely, disassemble the shroud and check the bearing for damage.

(14) (For the UPS configuration) Install the 7th stage shroud to the 7th stage vanes as follows:

(a) If you do not install new sleeve bearings in the following steps, you must measure the distance between the sleeve bearings and the specified in a preceding step. See Figure 1001 (Sheet 4).

(b) Install sleeve bearings (1001/5) on the inner trunnions of the 61, 7th stage vanes. See Figure 1001 (Sheet 3).

NOTE: The sleeve bearing height check is not required if you install new sleeve bearings.

(c) Place the shroud segment assemblies on a work bench.

(d) Locate the mating number at the approximate center of the upper and lower surface of the outer ring and make sure that the mating number is the same on both ring details for each shroud assembly.

(e) Make sure that there are 61 bearing sleeves present on the ID end of the vane trunnions.

(f) Apply Engine Oil P03-001 to the 16 bolts you will use to install the shroud set.

(g) Install the 7th stage shroud on 7th stage vanes so that shroud half with the larger OD is positioned above the bearings and other half of the shroud is below the bearings.

(h) Install both shroud halves with 16 lubricated bolts (heads up) and nuts. See Figure 1001 (Sheet 8).

(i) Torque the nuts to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(j) Complete installation of the shroud on both halves of the HPC front case assembly.

(15) Install the HPC shroud guide assemblies on each stage as shown in Figure 1001 (Sheet 8) and (Sheet 9).

CAUTION: THE 6TH STAGE BORESCOPE PLUG AND KEY WASHER CONFIGURATION (POST SB PW4ENG 72-326 AND/OR SB PW4ENG 72-468 AND/OR SB PW4ENG 72-518) CAN BE USED IN CASES INCORPORATING STANDARD SELF-HELICAL INSERTS OR IN CASES INCORPORATING LOCKING HELICAL INSERTS.

(16) Install the 6th the stage borescope plug. See Figure 1001 (Sheet 10).

(a) (Reference 1552) (Post SB PW4ENG 72-326 and/or SB PW4ENG 72-468 and/or SB PW4ENG 72-518) For the HPC front case incorporating self-locking or standard helical coil inserts in 6th the stage borescope port, remove excess baked on compound from the borescope plug threads using nylon brush.

(b) Apply Antiseize Paste P06-054 to threads and washer face of plug.

(c) Wipe off unwanted paste. Do not use Engine Oil P03-001.

(d) Install the plug and key washer to the "lower" case, to rear of the 6th stage vanes.

(e) Torque the plug to 175 - 190 lb-in. (19.8 - 21.5 N.m).

(f) Bend the tabs to safety the plug. See Standard Practices Manual, PN 585005, 70-53.

CAUTION: THE 5TH STAGE BORESCOPE PLUG AND KEY WASHER CONFIGURATION (POST SB PW4ENG 72-326 AND/OR SB PW4ENG 72-468 AND/OR SB PW4ENG 72-518) CAN BE USED IN CASES INCORPORATING STANDARD SELF-HELICAL INSERTS OR IN CASES INCORPORATING LOCKING HELICAL INSERTS.

(17) Install the 5th the stage borescope plug. See Figure 1001 (Sheet 10).

(a) (Reference 1554) (Post SB PW4ENG 72-326 and/or SB PW4ENG 72-468 and/or SB PW4ENG 72-518) For the HPC front case incorporating self-locking or standard helical coil inserts in the 5th stage borescope port, use a nylon brush to remove excess baked on compound from the borescope plug threads.

(b) Apply Antiseize Paste P06-054 to threads and washer face of plug.

(c) Wipe off unwanted paste. Do not use Engine Oil P03-001.

(d) Install the plug and key washer to the "lower" case, to rear of the 5th stage vanes.

(e) Torque the plug to 175 - 190 lb-in. (19.8 - 21.5 N.m).

(f) Bend the tabs to safety the plug. Refer to Standard Practices Manual, PN 585005, 70-53.

(18) Install the synchronizing ring runners. See Figure 1001 (Sheet 11).

(a) Install the synchronizing ring runners (without shims) to the IGV, 5th, 6th, and 7th stage synchronizing rings.

(b) Apply Engine Oil P03-001 to the bolts you will use to install the runners.

(c) Attach each runner with two lubricated bolts and key washers.

(d) Tighten the bolts fingertight.

(19) (For Post SB PW4ENG 72-743 except the UPS configuration) Install the inlet guide vane synchronizing ring assembly as follows:

(a) Install stepped spacers onto the ends of the special vanes as follows:

1 In the following steps the locations are numbered as viewed from the OD of the specified case segment. Start the count of holes from the split line and from right to left.

2 For the upper HPC front case half, install stepped spacers onto the ends of the special vanes at Locations 2, 4, 20, 35, and 37.

3 For the lower HPC front case half, install stepped spacers onto the ends of the special vanes at Locations 2, 4, 19, 33, and 35.

CAUTION: BE SURE THAT THE LEADING EDGE OF THE VANES ARE POINTED DOWN. VANES THAT ARE POINTED 180 DEGREES IN THE WRONG DIRECTION WILL CAUSE VIBRATIONS IN THE HPC AND CAN CAUSE COMPRESSOR BLADE FRACTURE.

(b) Make sure that the leading edge of all vanes are installed with the leading edge pointed down.

CAUTION: FAILURE TO CORRECTLY ALIGN THE OFFSET EDGES OF THE VANE ARM CLAW WITH THE OFFSET SLOTS IN THE VANE TRUNNIONS DURING ASSEMBLY WILL ORIENT THE VANE UP TO 180 DEGREES OUT OF POSITION, WHICH WILL PRODUCE SEVERE VIBRATORY EXCITATION IN THE HPC AND CAN LEAD TO COMPRESSOR BLADE FRACTURE.

(c) Install inlet guide vane synchronizing ring assembly (vane arms downward) to the five special vanes that have stepped spacers installed.

(d) Align the offset edges of the vane arms with the offset slots in the vane shafts.

(e) Tap lightly until holes in vane arms line up with holes in vane trunnions.

(f) Following assembly of the vane arms onto the vane trunnions, check the outside width of the vane arm
R claws with PWA 87888 Gage (Pre SB PW4ENG 72-743),
R or PWA 102728 Gage (Post SB PW4ENG 72-743) to make sure there is no deformation of the claw and that vane arm has been assembled correctly to the vane trunnion. See Figure 1001 (Sheet 13).

(g) Apply Engine Oil P03-001 to the 74 bolts you will use to attach the vane arms to the vanes.

(h) Temporarily attach the vane arms to the vane trunnions with washers and lubricated work bolts.

(i) Tighten and torque the work bolts to 35 - 40 lb-in. (3.954 - 4.519 N.m).

(j) Repeat the above steps for other case half.

(k) Remove the work bolts and washers from the special IGV stage vanes and install 74 lubricated bolts (1001/1), flat washers (1001/3), and key washers (1001/2) to attach the arms to the vanes. See Figure 1001 (Sheet 12).

(l) Tighten and torque the bolts to 35 - 40 lb-in. (3.954 - 4.519 N.m).

(m) Bend the tabs of the washers to safety the bolts.

(20) (For Post SB PW4ENG 72-743 except the UPS configuration) Install the Stage 5 vane synchronizing ring assembly as follows:

(a) Install stepped spacers onto the ends of the special vanes as follows:

1 In the following steps the locations are numbered as viewed from the OD of the specified case segment. Start the count of holes from the split line and from right to left.

2 For the upper front case half, install stepped spacers onto the ends of the special vanes at Locations 2, 3, 13, 22 and 23.

3 For the lower front case half, install stepped spacers onto the ends of the special vanes at Locations 2, 3, 13, 23, and 24.

CAUTION: BE SURE THAT THE LEADING EDGE OF THE VANES ARE POINTED DOWN. VANES THAT ARE POINTED 180 DEGREES IN THE WRONG DIRECTION WILL CAUSE VIBRATIONS IN THE HPC AND CAN CAUSE COMPRESSOR BLADE FRACTURE.

(b) Make sure that the leading edge of all vanes are installed with the leading edge pointed down.

CAUTION: FAILURE TO CORRECTLY ALIGN THE OFFSET EDGES OF THE VANE ARM CLAW WITH THE OFFSET SLOTS IN THE VANE TRUNNIONS DURING ASSEMBLY WILL ORIENT THE VANE UP TO 180 DEGREES OUT OF POSITION, WHICH WILL PRODUCE SEVERE VIBRATORY EXCITATION IN THE HPC AND CAN LEAD TO COMPRESSOR BLADE FRACTURE.

(c) Install the Stage 5 vane synchronizing ring assembly (vane arms downward) to the five special vanes that have stepped spacers installed.

(d) Align the offset edges of the vane arms with the offset slots in the vane shafts.

(e) Tap lightly until holes in vane arms line up with holes in vane trunnions.

(f) Following assembly of the vane arms onto the vane trunnions, check the outside width of the vane arm
R claws with PWA 87888 Gage (Pre SB PW4ENG 72-743),
R or PWA 102728 Gage (Post SB PW4ENG 72-743) to make
sure there is no deformation of the claw and that vane arm has been assembled correctly to the vane trunnion. See Figure 1001 (Sheet 13).

(g) Apply Engine Oil P03-001 to the 49 bolts you will use to attach the vane arms to the vanes.

(h) Temporarily attach the vane arms to the vane trunnions with washers and lubricated work bolts.

(i) Tighten and torque the work bolts to 35 - 40 lb-in. (3.954 - 4.519 N.m).

(j) Repeat the above steps for other case half.

(k) Remove the work bolts and washers from the special 5th stage vanes and install 49 lubricated bolts (1001/1), flat washers (1001/3), and key washers (1001/2) to attach the arms to the vanes. See Figure 1001 (Sheet 12).

(l) (Reference 1551) Tighten and torque the bolts to 35 - 40 lb-in. (3.954 - 4.519 N.m). Bend the tabs of the washers to safety the bolts.

(m) Bend the tabs of the washers to safety the bolts.

(21) (For Post SB PW4ENG 72-743 except the UPS configuration) Install the Stage 6 vane synchronizing ring assembly.

(a) Install stepped spacers onto the ends of the special vanes as follows:

1 In the following steps the locations are numbered as viewed from the OD of the specified case segment. Start the count of holes from the split line and from right to left.

2 For the upper HPC front case half, install stepped spacers onto the ends of the special vanes at Locations 2, 3, 12, 21 and 22.

3 For the lower HPC front case half, install stepped spacers onto the ends of the special vanes at Locations 2, 3, 11, 20, and 21.

CAUTION: BE SURE THAT THE LEADING EDGE OF THE VANES ARE POINTED DOWN. VANES THAT ARE POINTED 180 DEGREES IN THE WRONG DIRECTION WILL CAUSE VIBRATIONS IN THE HPC AND CAN CAUSE COMPRESSOR BLADE FRACTURE.

(b) Make sure that the leading edge of all vanes are installed with the leading edge pointed down.

CAUTION: FAILURE TO CORRECTLY ALIGN THE OFFSET EDGES OF THE VANE ARM CLAW WITH THE OFFSET SLOTS IN THE VANE TRUNNIONS DURING ASSEMBLY WILL ORIENT THE VANE UP TO 180 DEGREES OUT OF POSITION, WHICH WILL PRODUCE SEVERE VIBRATORY EXCITATION IN THE HPC AND CAN LEAD TO COMPRESSOR BLADE FRACTURE.

(c) Install the Stage 6 vane synchronizing ring assembly (vane arms downward) to the five special vanes that have stepped spacers installed.

(d) Align the offset edges of the vane arms with the offset slots in the vane shafts.

(e) Tap lightly until holes in vane arms line up with holes in vane trunnions.

(f) Following assembly of the vane arms onto the vane trunnions, check the outside width of the vane arm
R claws with PWA 87888 Gage (Pre SB PW4ENG 72-743)
R or PWA 102728 Gage (Post SB PW4ENG 72-743) to make sure there is no deformation of the claw and that vane arm has been assembled correctly to the vane trunnion. See Figure 1001 (Sheet 13).

(g) Apply Engine Oil P03-001 to the 45 bolts you will use to install the vanes arms to the vanes.

(h) Temporarily attach the vane arms to the vane trunnions with washers and lubricated work bolts.

(i) Tighten and torque the work bolts to 35 - 40 lb-in.(3.954 - 4.519 N.m).

(j) Repeat the above steps for other case half.

(k) Remove the work bolts and washers from the special 6th stage vanes and install 45 lubricated bolts (1001/1), flat washers (1001/3), and key washers (1001/2) to attach the arms to the vanes. See Figure 1001 (Sheet 12).

(l) (Reference 1551) Tighten and torque the 45 bolts to 35 - 40 lb-in. (3.954 - 4.519 N.m).

(m) Bend the tabs of the washers to safety the bolts.

(22) (For Post SB PW4ENG 72-743 except the UPS configuration) Install the Stage 7 vane synchronizing ring assembly as follows:

(a) Install stepped spacers onto the ends of the special vanes as follows:

1 In the following steps the locations are numbered as viewed from the OD of the specified case segment. Start the count of holes from the split line and from right to left.

2 For the upper front case half, install stepped spacers onto the ends of the special vanes at Locations 2, 3, 16, 28 and 29.

3 For the lower front case half, install stepped spacers onto the ends of the special vanes at Locations 2, 3, 16, 29 and 30.

CAUTION: BE SURE THAT THE LEADING EDGE OF THE VANES ARE POINTED DOWN. VANES THAT ARE POINTED 180 DEGREES IN THE WRONG DIRECTION WILL CAUSE VIBRATIONS IN THE HPC AND CAN CAUSE COMPRESSOR BLADE FRACTURE.

(b) Make sure that the leading edge of all vanes are installed with the leading edge pointed down.

CAUTION: FAILURE TO CORRECTLY ALIGN THE OFFSET EDGES OF THE VANE ARM CLAW WITH THE OFFSET SLOTS IN THE VANE TRUNNIONS DURING ASSEMBLY WILL ORIENT THE VANE UP TO 180 DEGREES OUT OF POSITION, WHICH WILL PRODUCE SEVERE VIBRATORY EXCITATION IN THE HPC AND CAN LEAD TO COMPRESSOR BLADE FRACTURE.

(c) Install the Stage 7 vane synchronizing ring assembly (vane arms downward) to the five special vanes that have stepped spacers installed.

(d) Align the offset edges of the vane arms with the offset slots in the vane shafts.

(e) Tap lightly until holes in vane arms line up with holes in vane trunnions.

(f) Following assembly of the vane arms onto the vane trunnions, check the outside width of the vane arm
R claws with PWA 87888 Gage (Pre SB PW4ENG 72-743)
R or PWA 102728 Gage (Post SB PW4ENG 72-743) to make sure there is no deformation of the claw and that vane arm has been assembled correctly to the vane trunnion. See Figure 1001 (Sheet 13).

(g) Apply Engine Oil P03-001 to the 61 bolts (1001/1) you will use to attach the vane arms to the vanes. See Figure 1001 (Sheet 12).

(h) Temporarily attach the vane arms to the vane trunnions with washers and lubricated work bolts.

(i) Tighten and torque the work bolts to 35 - 40 lb-in. (3.954 - 4.519 N.m).

(j) Repeat the above steps for other case half.

(k) Remove the work bolts and washers from the special 7th stage vanes and install 61 lubricated bolts (1001/1), flat washers (1001/3), and key washers (1001/2) to attach the arms to the vanes. See Figure 1001 (Sheet 12).

(l) (Reference 1551) Tighten and torque the 61 bolts (1001/1) to 35 - 40 lb-in. (3.954 - 4.519 N.m).

(m) Bend the tabs of the key washers to safety bolts.

(23) (For the UPS configuration) Install the IGV, 5th, 6th, and 7th stage vane synchronizing ring assemblies as follows:

NOTE: Do the steps that follow one stage at a time.

(a) Stand so you face the OD of either HPC front case half.

CAUTION: BE SURE THAT THE LEADING EDGE OF THE VANES ARE POINTED DOWN. VANES THAT ARE POINTED 180 DEGREES IN THE WRONG DIRECTION WILL CAUSE VIBRATIONS IN THE HPC AND CAN CAUSE COMPRESSOR BLADE FRACTURE.

(b) Make sure that the leading edge of all vanes are installed with the leading edge pointed down.

(c) Install the synchronizing ring assembly, vane arms pointed down.

1 Align the offset edge edges of the vane arms with the offset slots in the vane shafts.

2 Hit the ring assembly lightly until the holes in the vane arms line up with the holes in the vane shafts.

3 Following assembly of the vane arms onto the vane trunnions, check the outside width of
R the vane arm claws with PWA 87888 Gage (Pre
R SB PW4ENG 72-743) or PWA 102728 Gage (Post
R SB PW4ENG 72-743) to make sure there is no
deformation of the claw and that vane arm has been assembled correctly to the vane trunnion. See Figure 1001 (Sheet 13).

4 Apply Engine Oil P03-001 to the 229 bolts you will use to attach the vane arms to the vanes.

5 Install the flat washers, key washers, and lubricated bolts to hold the vane arms.

6 Do the above steps, again for the other case segment.

7 (Reference 1551) Tighten and torque bolts to 35 - 40 lb-in. (3.954 - 4.519 N.m).

8 Bend the tabs of the key washers to safety bolts.

(d) Move the vane arms by hand to be sure that they can move through a minimum angle of 5 degrees from their starting position (parallel to the engine axis), but not more than 20 degrees in either direction.

(e) Do the steps again to install the synchronizing rings on each stage.

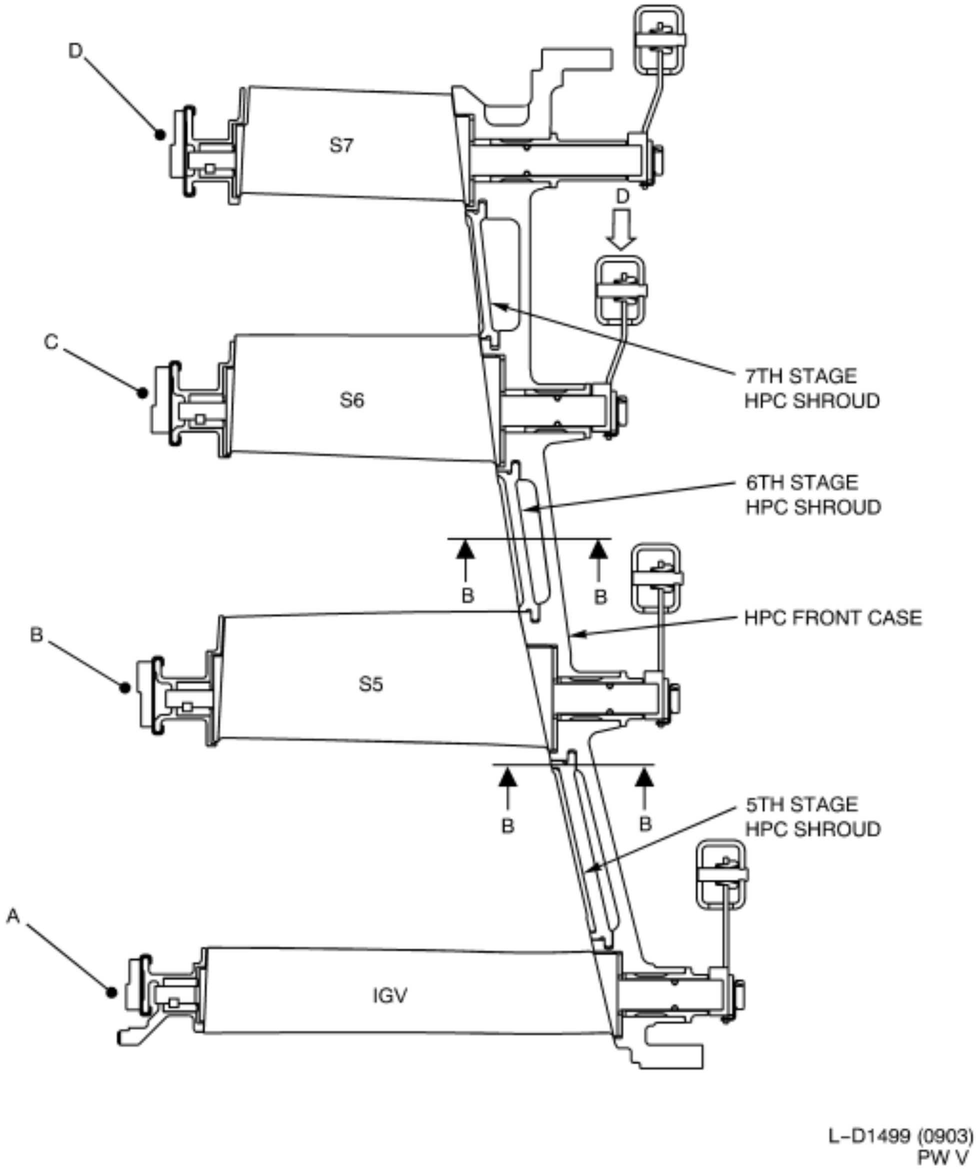
CAUTION: FELTMETAL RUBSTRIPS MUST NOT BE EXPOSED TO ANY LUBRICANT PRIOR TO ENGINE INSTALLATION.

(24) If they are not there, install the HPC Stage 5 through 7th stage shroud sets into the HPC front case as follows:

(a) Apply Antigalling Compound P06-021 to the HPC shroud set in the areas shown. Figure 1001 (Sheet 14).

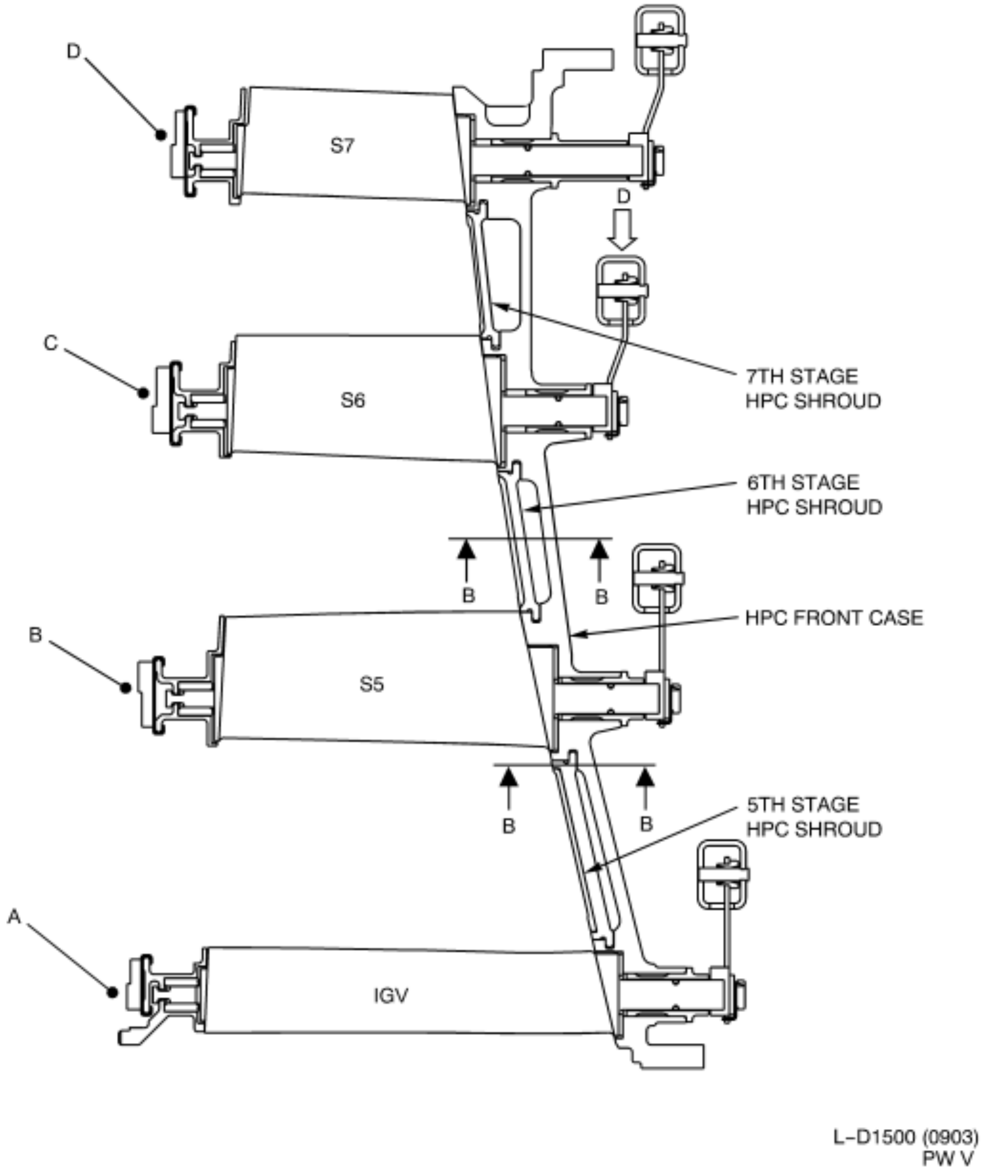
(b) The shroud-set segment connecting Ends AA and DD must locate as shown. See Figure 1001 (Sheet 15).

VARIABLE STATOR VANE AND HPC FRONT CASE ASSEMBLY - ASSEMBLY-01


D
S7
D
7TH STAGE HPC SHROUD
C
S6
6TH STAGE HPC SHROUD
B
B
HPC FRONT CASE
B
S5
B
B
5TH STAGE HPC SHROUD
A
IGV
L-D1499 (0903)
PW V

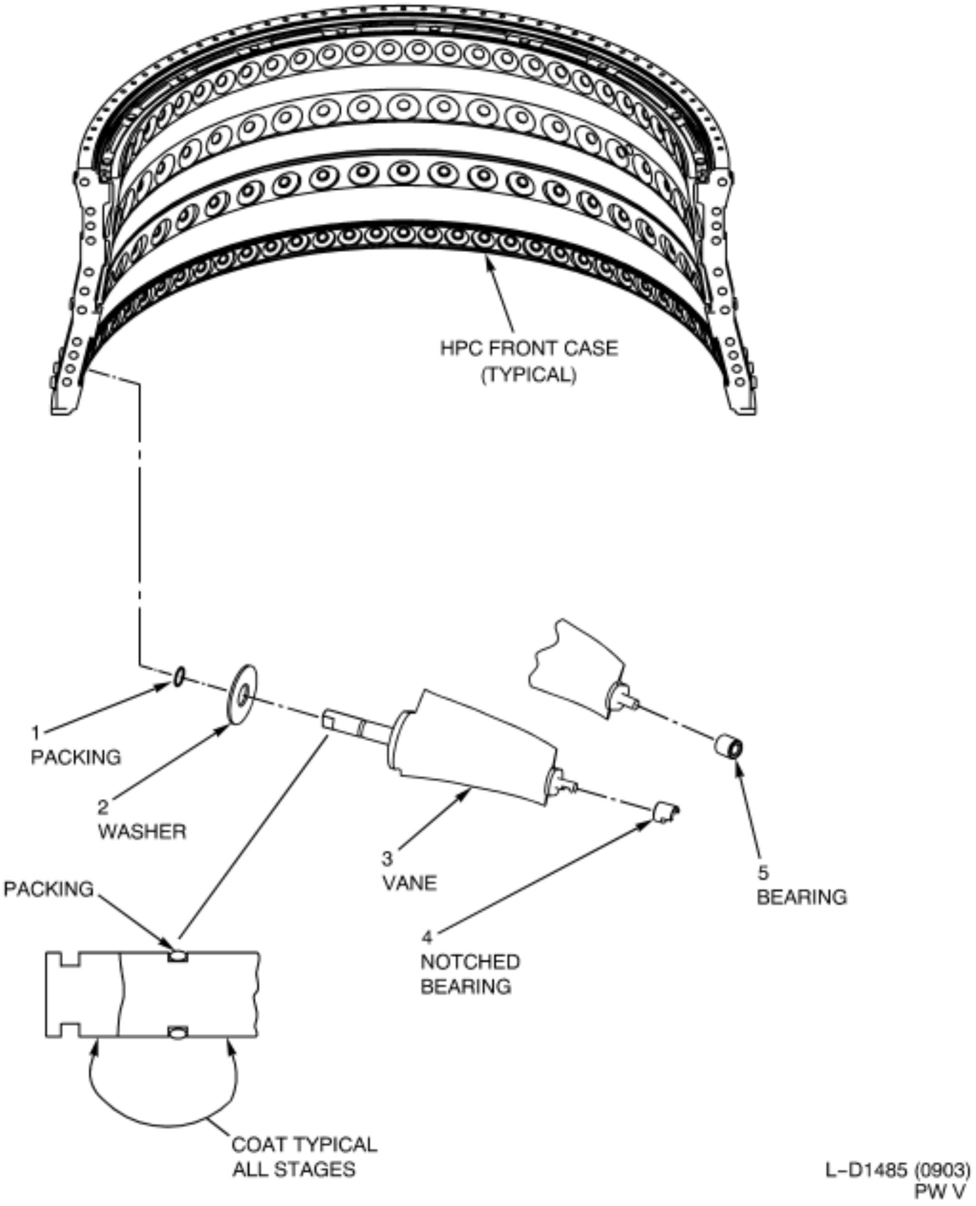
Variable Stator Vane And HPC Front Case
Assembly (Except UPS Configuration)
Figure 1001 (Sheet 1)
(Task 72-35-02-440-002)

VARIABLE STATOR VANE AND HPC FRONT CASE ASSEMBLY − ASSEMBLY−01

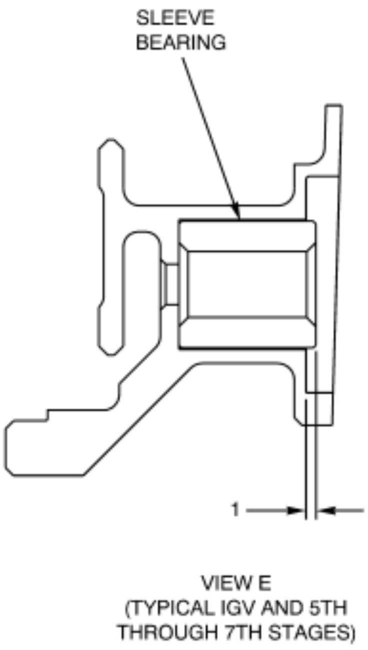

D
S7
D
C
S6
7TH STAGE HPC SHROUD
6TH STAGE HPC SHROUD
B
B
B
HPC FRONT CASE
S5
B
B
5TH STAGE HPC SHROUD
A
IGV
L−D1500 (0903)
PW V

Variable Stator Vane And HPC Front Case Assembly (UPS Configuration)
Figure 1001 (Sheet 2)
(Task 72−35−02−440−002)

VARIABLE STATOR VANE AND HPC FRONT CASE ASSEMBLY − ASSEMBLY−01


HPC FRONT CASE
(TYPICAL)
1
PACKING
2
WASHER
3
VANE
4
NOTCHED
BEARING
5
BEARING
PACKING
COAT TYPICAL
ALL STAGES
L−D1485 (0903)
PW V

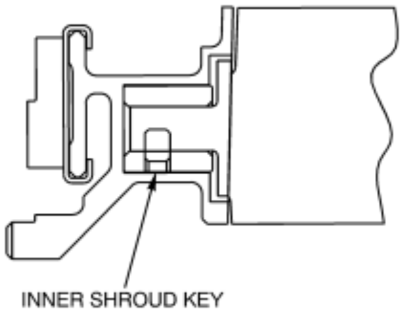
Variable Stator Vane And HPC Front Case Assembly
Figure 1001 (Sheet 3)
(Task 72−35−02−440−002)


SLEEVE
BEARING
1
VIEW E
(TYPICAL IGV AND 5TH
THROUGH 7TH STAGES)

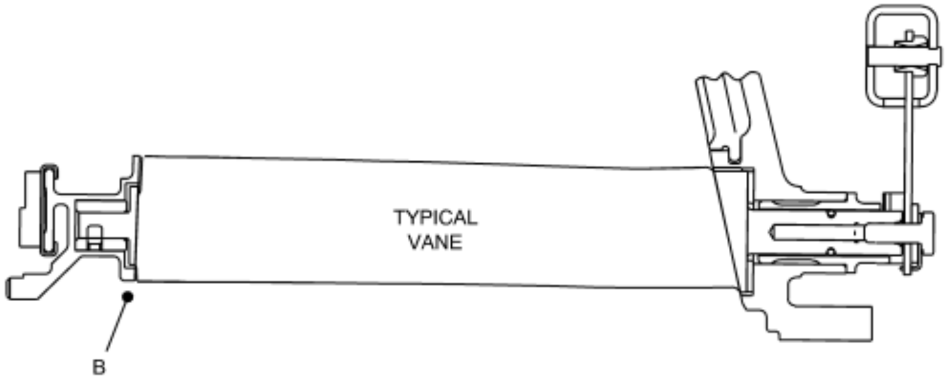
L−D0881 (0503)
PW V

1. 0.006 Inch (0.152 mm) Minimum (Except UPS Configuration)
   0.005 Inch (0.127 mm) Minimum (UPS Configuration)

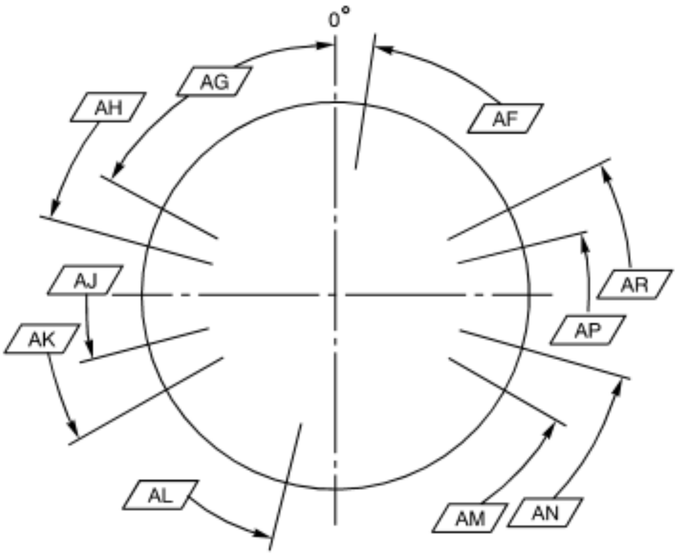
Variable Stator Vane And HPC Front Case Assembly
Figure 1001 (Sheet 4)
(Task 72−35−02−440−002)


INNER SHROUD KEY

VIEW B


TYPICAL
VANE
B
L−D1487 (0903)
PW V

Variable Stator Vane And HPC Front Case
Assembly (Inner Shroud Key Installation)
Figure 1001 (Sheet 5)
(Task 72−35−02−440−002)



SCHEMATIC REAR VIEW
TYPICAL IGV, S5, S6 AND S7
SEE TABLE

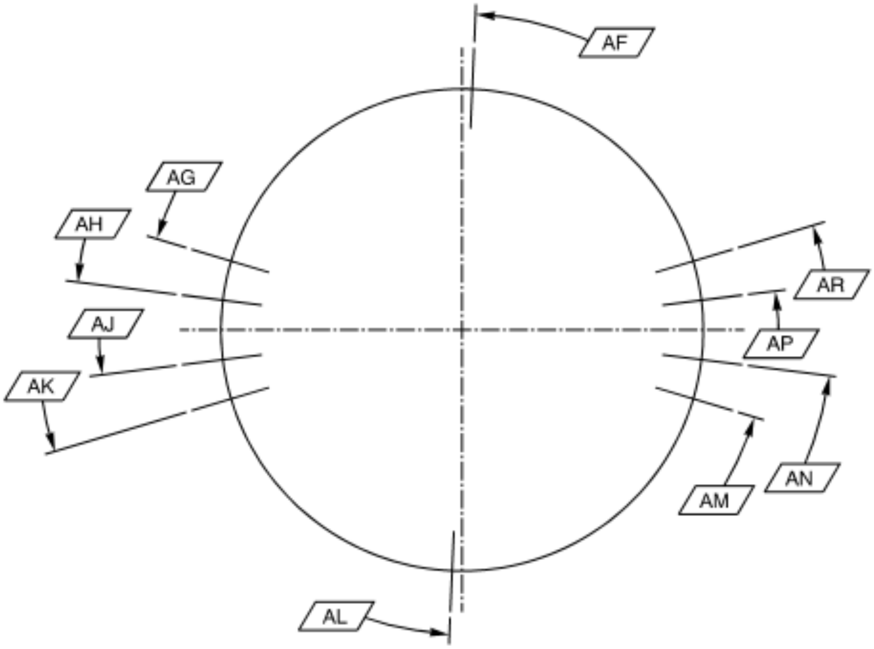
STAGE	AF	AG	AH	AJ	AK
IGV	357°37'54"	73°25'16"	82°53'41"	97°30'	107°30'
S5	356°15'	71°15'	78°45'	100°48'	108°
S6	0°	70°26'05"	78°15'39"	102°16'22"	110°27'16"
S7	357°	75°	81°	98°42'35"	104°30'58"

STAGE	AL	AM	AN	AP	AR
IGV	177°30'	252°30'	262°30'	277°06'19"	286°34'44"
S5	108°	252°	259°12'	281°15'	288°45'
S6	175°54'33"	249°32'44"	257°43'38"	281°44'21"	289°33'55"
S7	180°	255°29'2"	261°17'25"	279°	285°

L-D1502 (0903)
PW V

Variable Stator Vane And HPC Front
Case Assembly (Pre SB PW4ENG 72-759)
Figure 1001 (Sheet 6)
(Task 72-35-02-440-002)

VARIABLE STATOR VANE AND HPC FRONT CASE ASSEMBLY − ASSEMBLY−01



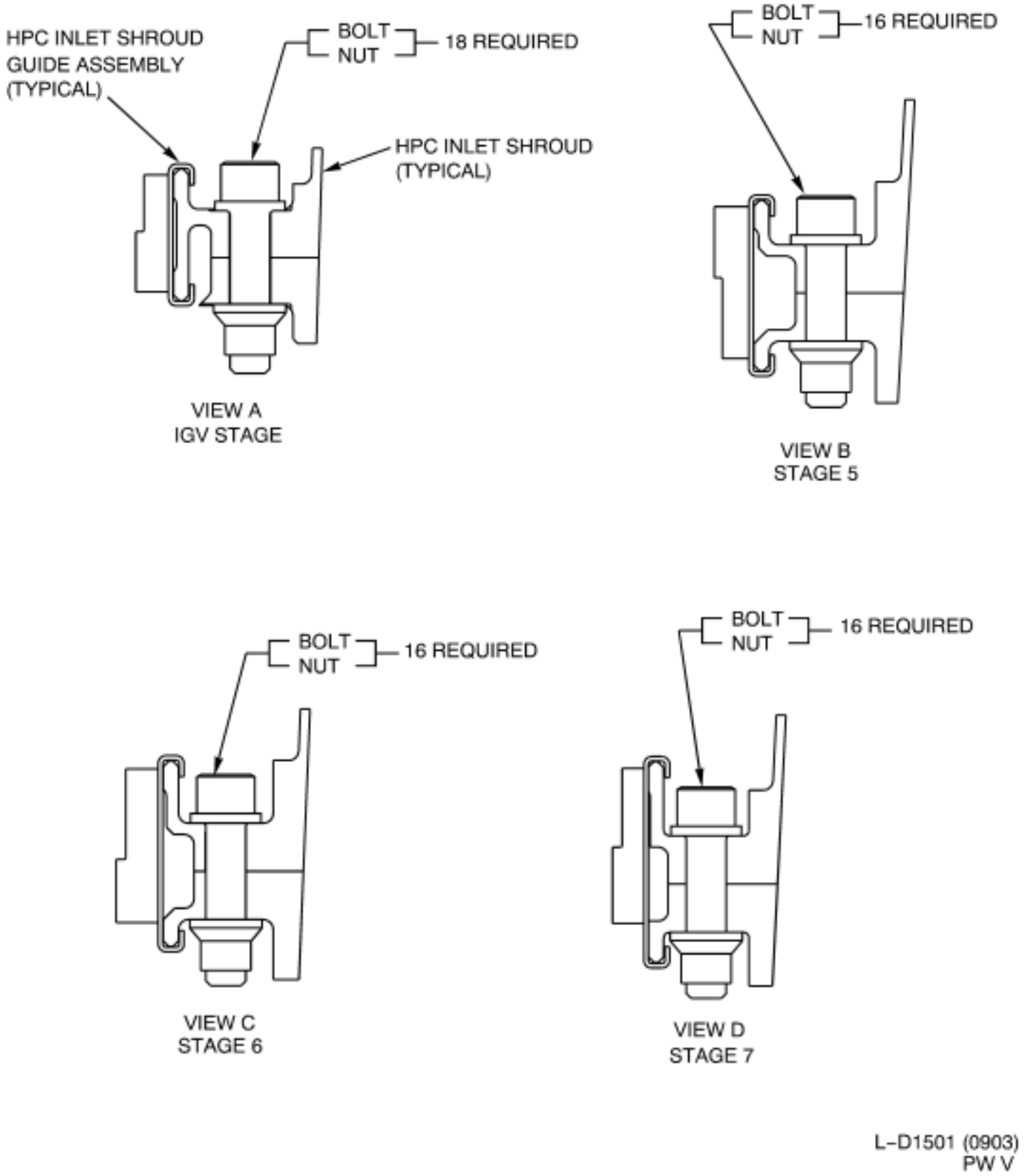
SCHEMATIC REAR VIEW
TYPICAL IGV, S5, S6 AND S7
SEE TABLE

STAGE	AF	AG	AH	AJ	AK
IGV	357.6°	73.4°	82.9°	97.1°	106.6°
S5	356.3°	71.3°	78.8°	101.3°	108.8°
S6	0.0 °	70.4°	78.3°	101.7°	109.6°
S7	357.0°	75.0°	81.0°	99.0°	105.0°

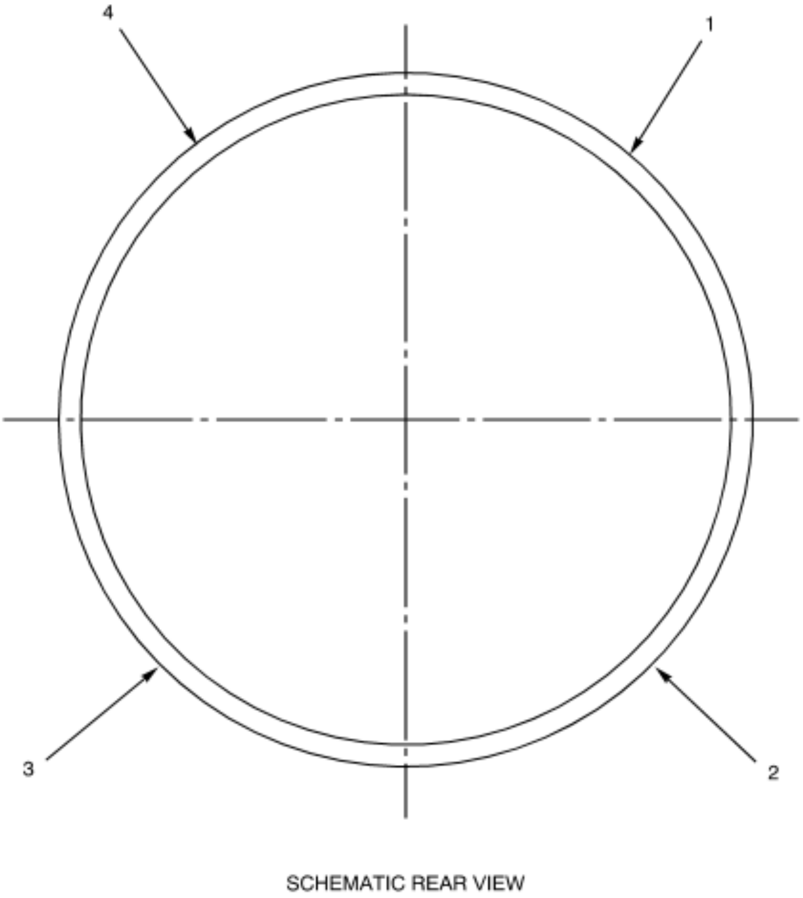
STAGE	AL	AM	AN	AP	AR
IGV	177.6 °	253.4°	262.9 °	277.1 °	286.6 °
S5	176.6 °	251.3°	258.8 °	281.3 °	288.8 °
S6	180.0 °	250.4°	258.3 °	281.7°	289.6°
S7	177.0 °	255.0°	261.0 °	279.0°	285.0°

L−D1504 (0903)
PW V

Variable Stator Vane And HPC Front
Case Assembly (Post SB PW4ENG 72−759)
Figure 1001 (Sheet 7)
(Task 72−35−02−440−002)


HPC INLET SHROUD GUIDE ASSEMBLY (TYPICAL)
BOLT
NUT
18 REQUIRED
HPC INLET SHROUD (TYPICAL)
VIEW A
IGV STAGE
BOLT
NUT
16 REQUIRED
VIEW B
STAGE 5
BOLT
NUT
16 REQUIRED
VIEW C
STAGE 6
BOLT
NUT
16 REQUIRED
VIEW D
STAGE 7
L-D1501 (0903)
PW V

Variable Stator Vane And HPC Front Case Assembly
Figure 1001 (Sheet 8)
(Task 72-35-02-440-002)



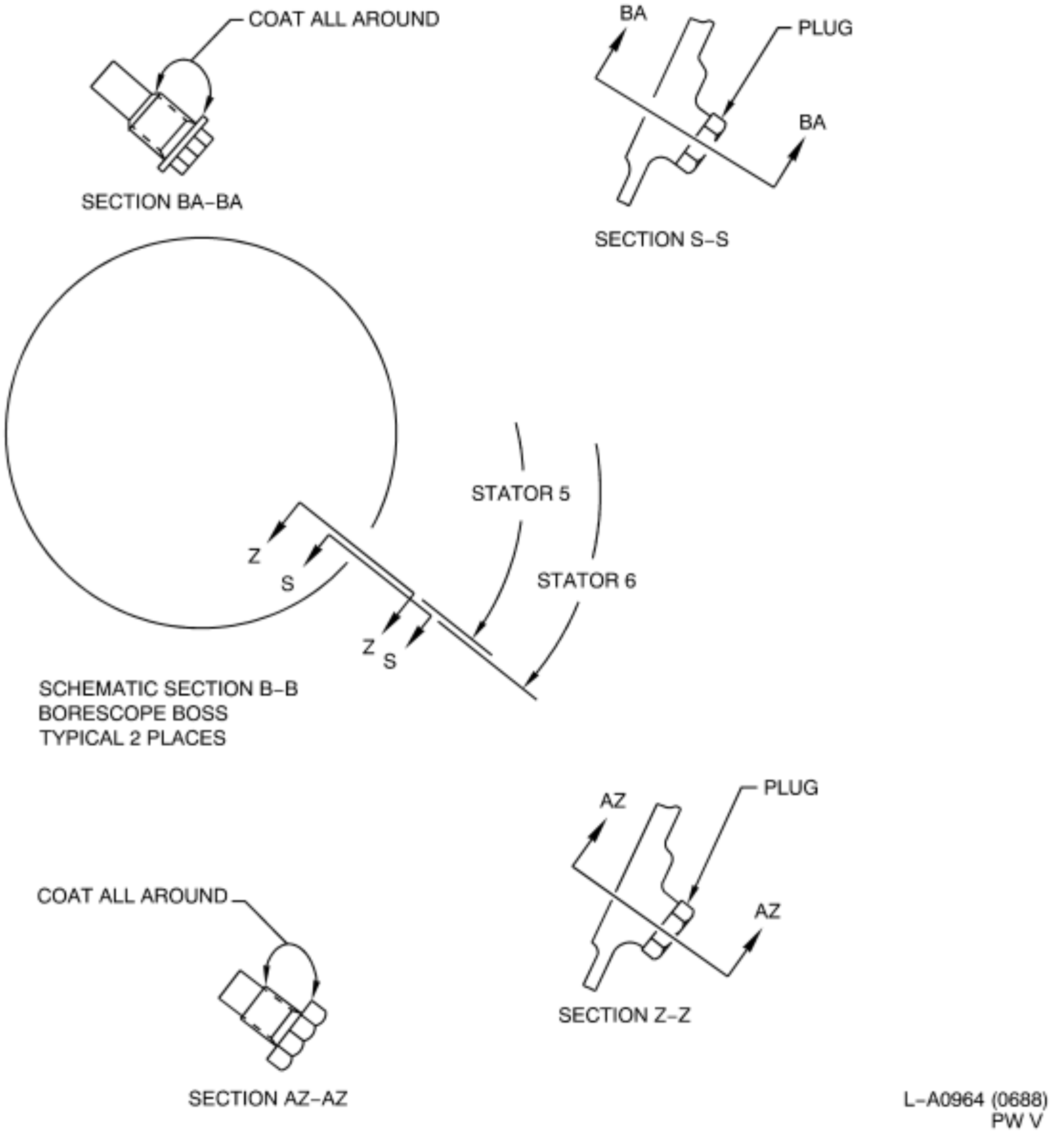
L−D1505 (1003)
PW V

HPC Shroud Guide Assembly Installation
Figure 1001 (Sheet 9)
(Task 72−35−02−440−002)

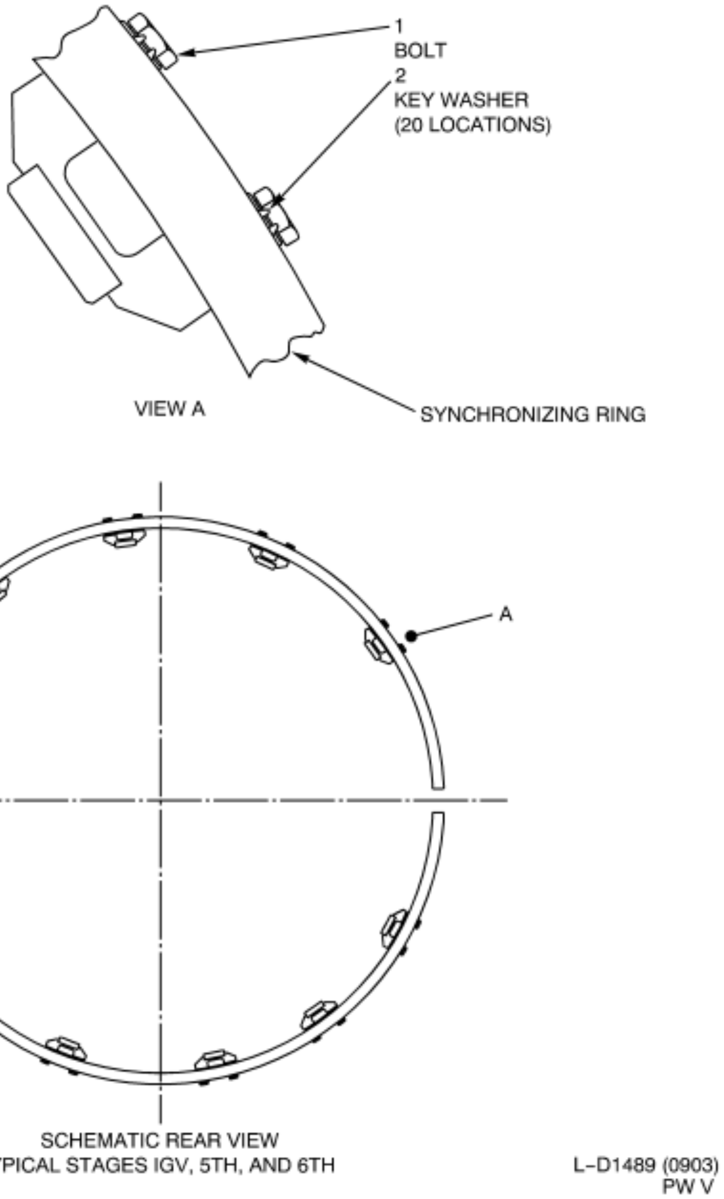
VARIABLE STATOR VANE AND HPC FRONT CASE ASSEMBLY - ASSEMBLY-01

1. Compressor Air Sealing Ring Segment Assembly
   IGV PN 54H775-01
   5th Stage PN 54H827-01
   6th Stage PN 54H829-01
   7th Stage PN 54H831-01
2. Compressor Air Sealing Ring Segment Assembly
   IGV PN 54H774-01
   5th Stage PN 54H826-01
   6th Stage PN 54H828-01
   7th Stage PN 54H830-01
3. Compressor Air Sealing Ring Segment Assembly
   IGV PN 54H775-01
   5th Stage PN 54H827-01
   6th Stage PN 54H829-01
   7th Stage PN 54H831-01
4. Compressor Air Sealing Ring Segment Assembly
   IGV PN 54H774-01
   5th Stage PN 54H826-01
   6th Stage PN 54H828-01
   7th Stage PN 54H830-01

Key to Figure 1001 (Sheet 9)

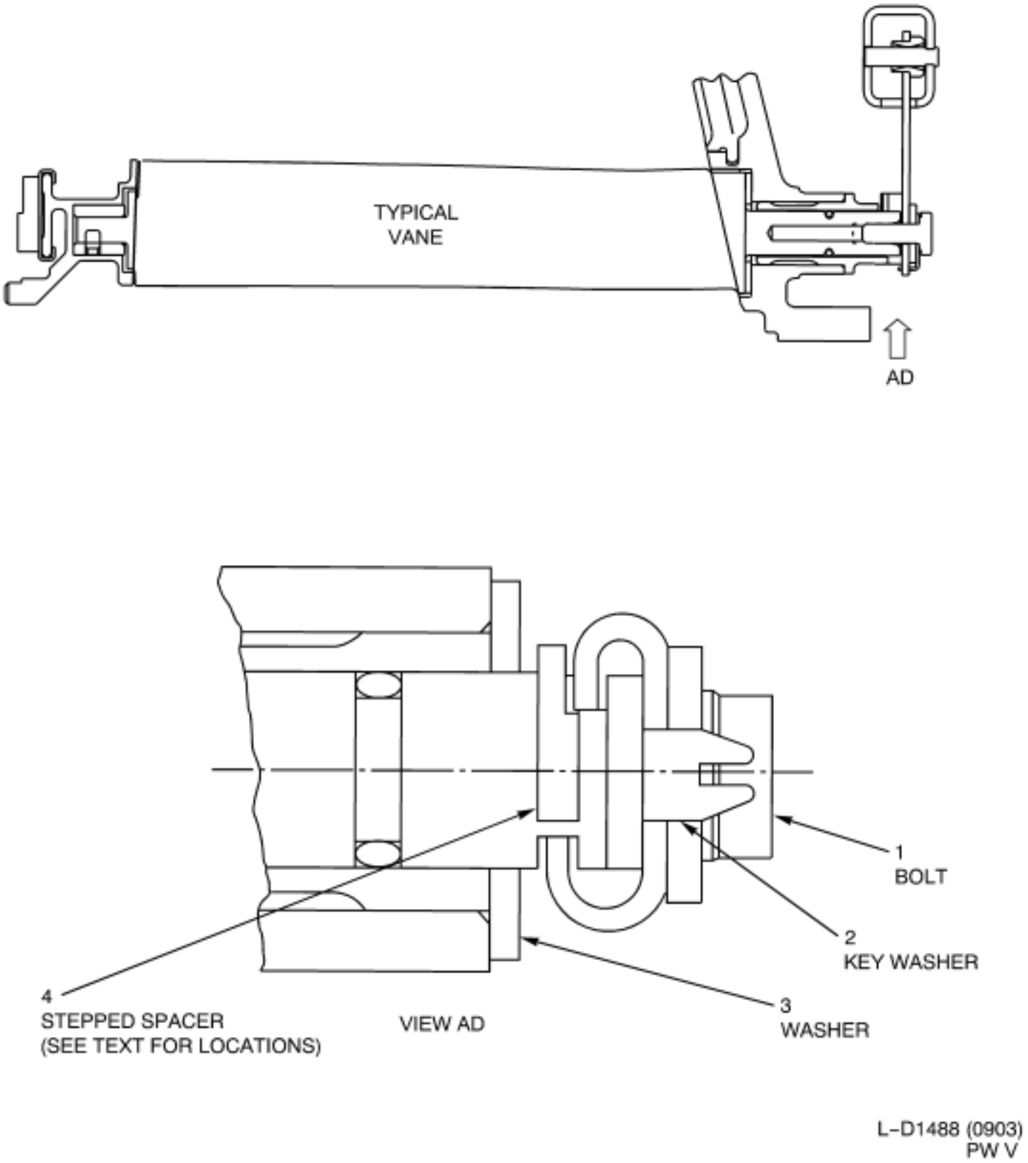

COAT ALL AROUND
SECTION BA-BA
BA
PLUG
BA
SECTION S-S
STATOR 5
STATOR 6
Z
S
Z
S
SCHEMATIC SECTION B-B
BORESCOPE BOSS
TYPICAL 2 PLACES
AZ
PLUG
AZ
COAT ALL AROUND
SECTION Z-Z
SECTION AZ-AZ
L-A0964 (0688)
PW V

Variable Stator Vane And HPC Front Case Assembly (Borescope Plugs)
Figure 1001 (Sheet 10)
(Task 72-35-02-440-002)


1
BOLT
2
KEY WASHER
(20 LOCATIONS)
VIEW A
SYNCHRONIZING RING
A
SCHEMATIC REAR VIEW
TYPICAL STAGES IGV, 5TH, AND 6TH
L−D1489 (0903)
PW V

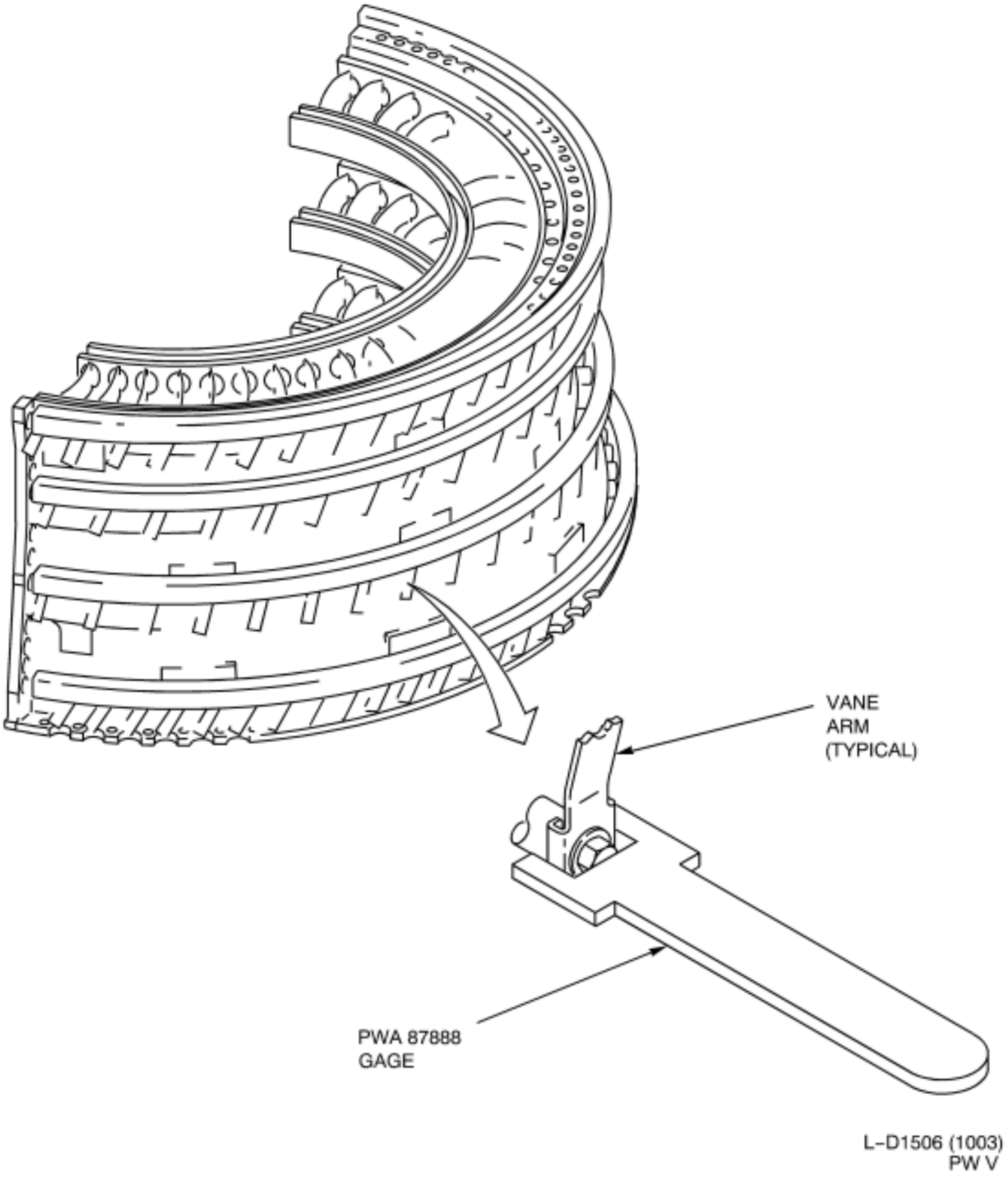
Variable Stator Vane And HPC Front Case Assembly
(Synchronizing Ring Runner Installation)
Figure 1001 (Sheet 11)
(Task 72−35−02−440−002)

VARIABLE STATOR VANE AND HPC FRONT CASE ASSEMBLY − ASSEMBLY−01

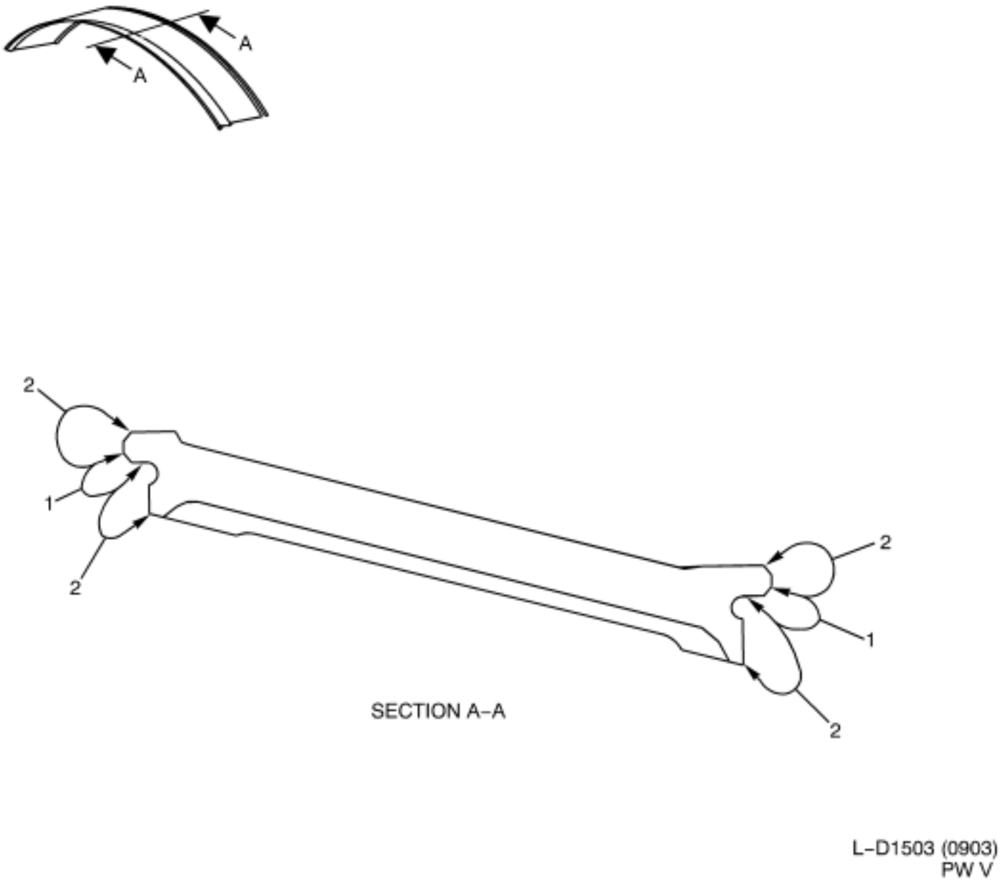

TYPICAL VANE
AD
1 BOLT
2 KEY WASHER
3 WASHER
4 STEPPED SPACER (SEE TEXT FOR LOCATIONS)
VIEW AD
L−D1488 (0903)
PW V

Variable Stator Vane And HPC Front Case
Assembly (Synchronizing Ring Installation)
Figure 1001 (Sheet 12)
(Task 72−35−02−440−002)

VARIABLE STATOR VANE AND HPC FRONT CASE ASSEMBLY − ASSEMBLY−01

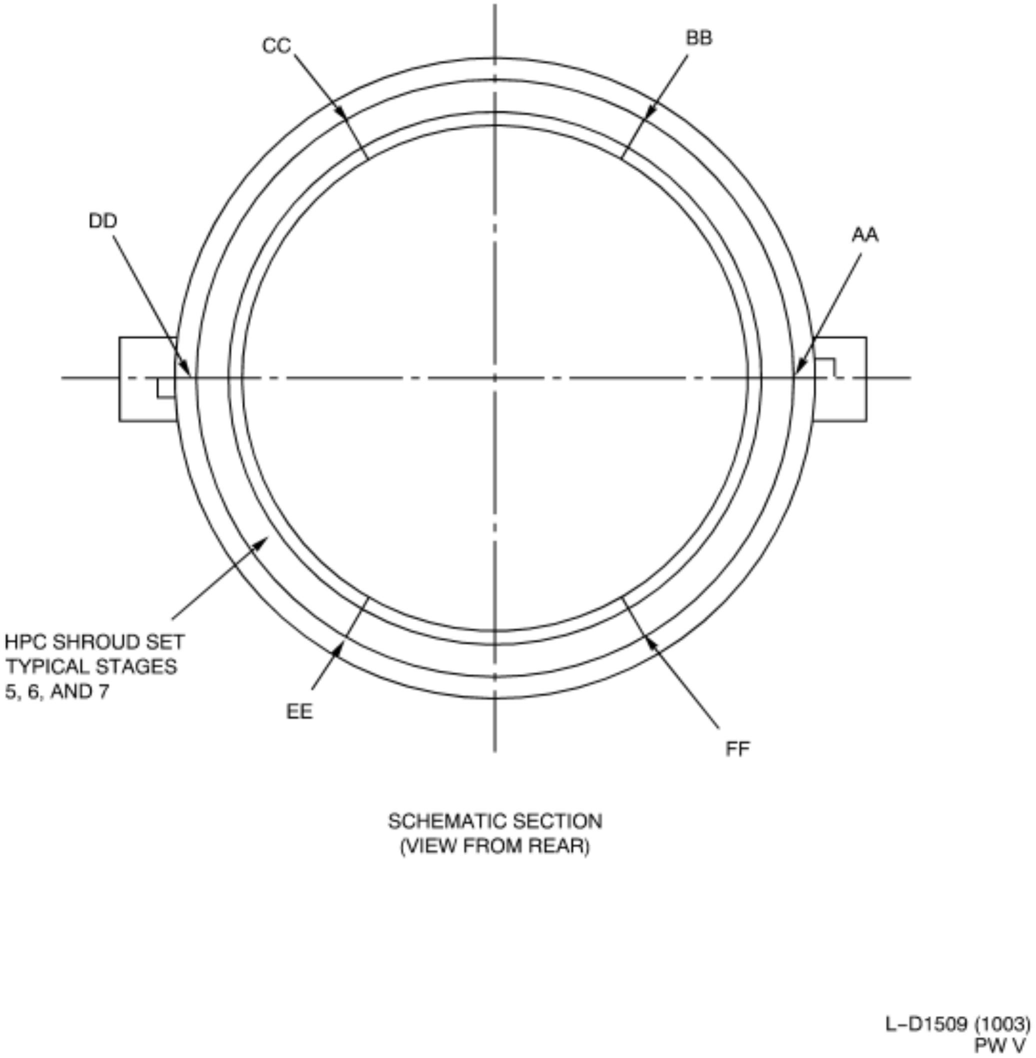

VANE
ARM
(TYPICAL)
PWA 87888
GAGE
L−D1506 (1003)
PW V

Variable Stator Vane And HPC Front
Case Assembly (Vane Arm Claw Check)
Figure 1001 (Sheet 13)
(Task 72−35−02−440−002)



1. Apply Antigalling Compound To The Enclosed Area. See The Text.
2. Antigalling Compound Optional And Can Be Incomplete.

Variable Stator Vane And HPC Front Case Assembly
(Shroud Set Antigalling Compound Application)
Figure 1001 (Sheet 14)
(Task 72−35−02−440−002)


CC
BB
DD
AA
HPC SHROUD SET
TYPICAL STAGES
5, 6, AND 7
EE
FF
SCHEMATIC SECTION
(VIEW FROM REAR)
L−D1509 (1003)
PW V

Variable Stator Vane And HPC Front Case Assembly
(Stages 5, 6, And 7 Outer Airseal Installation)
Figure 1001 (Sheet 15)
(Task 72−35−02−440−002)

Previous Pageblock Return to Previous Menu Next Pageblock

CHAPTER 72

HIGH PRESSURE COMPRESSOR (HPC)

TABLE OF CONTENTS

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HIGH PRESSURE COMPRESSOR (HPC)	72-35-00		
How To Use		001	ALL
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	Assembly-25		1001	CONFIG-2 4152-3 4156A-3 4158-3
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	Assembly-26		1001	CONFIG-1 4152 4156A 4158
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	Assembly-26		1001	CONFIG-2 4152-3 4156A-3 4158-3
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Assembly-03		1001	ALL
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Assembly-03		1001	CONFIG-1 4152 4156A 4158
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Assembly-04		1001	CONFIG-2 4152-3 4156A-3 4158-3
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Task 72-35-39-440-010-B: Assemble The Drum Rotor And Blades (Rear) Assembly (Stage 13) (Drum Rotor, PN 56H013-01, Post SB PW4ENG 72-565 Only)		1002	
Assembly-03		1001	ALL
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Assembly-04		1001	CONFIG-1
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Task 72-35-39-440-011-A: Assemble Drum Rotor And Blades (Rear) Assembly (Stage 14), (Pre SB PW4ENG 72-565 Only)		1001	
Task 72-35-39-440-011-B: Assemble Drum Rotor And Blades (Rear) Assembly (Stage 14), (Post SB PW4ENG 72-565 Only)		1002	
Assembly-05		1001	CONFIG-1 4152 4156A 4158
Task 72-35-39-440-005: Assemble Drum Rotor And Blades (Rear) Assembly (Stage 15)		1001	
Assembly-05		1001	CONFIG-2 4152-3 4156A-3 4158-3
Task 72-35-39-440-012: Assemble Drum Rotor And Blades (Rear) Assembly (Stage 15)		1001	
Task 72-35-39-440-012-A: Assemble drum Rotor And Blades (Rear) Assembly (Stage 15) (Drum Rotor, PN 54H803-01 Or 53H973-01, Pre SB PW4ENG 72-565 Only)		1001	
Task 72-35-39-440-012-B: Assemble Drum Rotor And Blades (Rear) Assembly (Stage 15) (Modified Drum Rotor, PN 54H803-001 Or 53H973-001, Post SB PW4ENG 72-565 Only)		1002	
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Task 72-35-39-440-006: Assemble Drum Rotor And Blades (Rear) Assembly For Balance - Deleted		1001	
Assembly-07		1001	ALL
Task 72-35-39-440-007: Balance Drum Rotor And Blades (Rear) Assembly - Deleted		1001	
Assembly-08		1001	ALL

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Task 72-35-39-440-008: Post Balance Procedures - Drum Rotor And Blades (Rear) Assembly - Deleted		1001	
Assembly-09		1001	ALL
Task 72-35-39-440-009: Assemble Drum Rotor And Blades (Rear) Assembly (Stages 13, 14 And 15) With Limited Number Of Replacement Blades Of Pre-Ground Zirconium Oxide Tips (Post SB PW4ENG 72-599)		1001	
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Assembly-01		1001	ALL
Task 72-35-61-440-001: Assemble Stages 11 And 12 Compressor Stator Set, Shroud Sets, And Springs		1001	
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HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY - DISASSEMBLY-01

Task 72-35-03-040-001:

1. Disassemble HPC Stator Vane Actuator And Lever Assembly

A. Equipment And Materials Necessary

Special Tools:
PWA 85688 Puller, Jackscrew
PWA 86322 Puller, HPC Lever Bearing

B. Procedure
See Figure 501, Figure 502, Figure 503, Figure 504, Figure 505 and Figure 506.

(1) Unbend tabs of washers and remove seals, rod end bearings, washers, nuts, and adjusters from rod end bearings on lever clevises. Discard key washers and seals.

(2) (Pre SB PW4ENG 72-506) Remove cotter pins, nuts, washers, and bolts securing rod end bearings to clevises. Discard cotter pins.

(3) (Post SB PW4ENG 72-506) Remove cotter pins, nuts, and bolts securing rod end bearings to clevises. Discard cotter pins.

(4) Remove cotter pin, nut, washer, and bolt securing actuator rod to stator lever. Discard cotter pin.

(5) Remove cotter pins, nuts, spacers, and bolts retaining actuator bearings in support. Discard cotter pins.

(6) Install PWA 85688 Puller to pins in actuator and remove pins. Remove bearings and actuator from support.

(7) Remove seal and unbend tabs of washer on actuator rod. Remove rod end bearing washer and nut from actuator rod. Remove adapters from actuator. Discard key washer and packings.

(8) Unbend tab of key washer and remove bolt and washer securing 7th stage lever (506/2) to lever (506/5). Remove lever and discard key washer.

(9) Remove cotter pin, nut, and bolt securing inlet lever (506/6) to lever (506/5). Remove inlet lever with bearing. Remove bearing (506/4) from inlet lever (506/6). Discard cotter pin.

(10) Remove bearing (506/4) from support (506/1) and lever (506/5).

  (a) Remove snap ring (506/3) from support (506/1).

  (b) Install PWA 86322 Puller detail−2 inboard of support (506/1) and against lever (506/5) at the 6th stage location. Ensure the puller is in contact with the bearing (506/4) and that the threaded hole, in puller, is aligned with the axial hole in the lever (506/5).

  (c) Insert PWA 86322 Screw detail−1 through lever (506/5) and into detail−2 puller.

  (d) Turn screw to push bearing from the lever (506/5).

  (e) Remove lever (506/5) from support (506/1).

HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY - DISASSEMBLY-01

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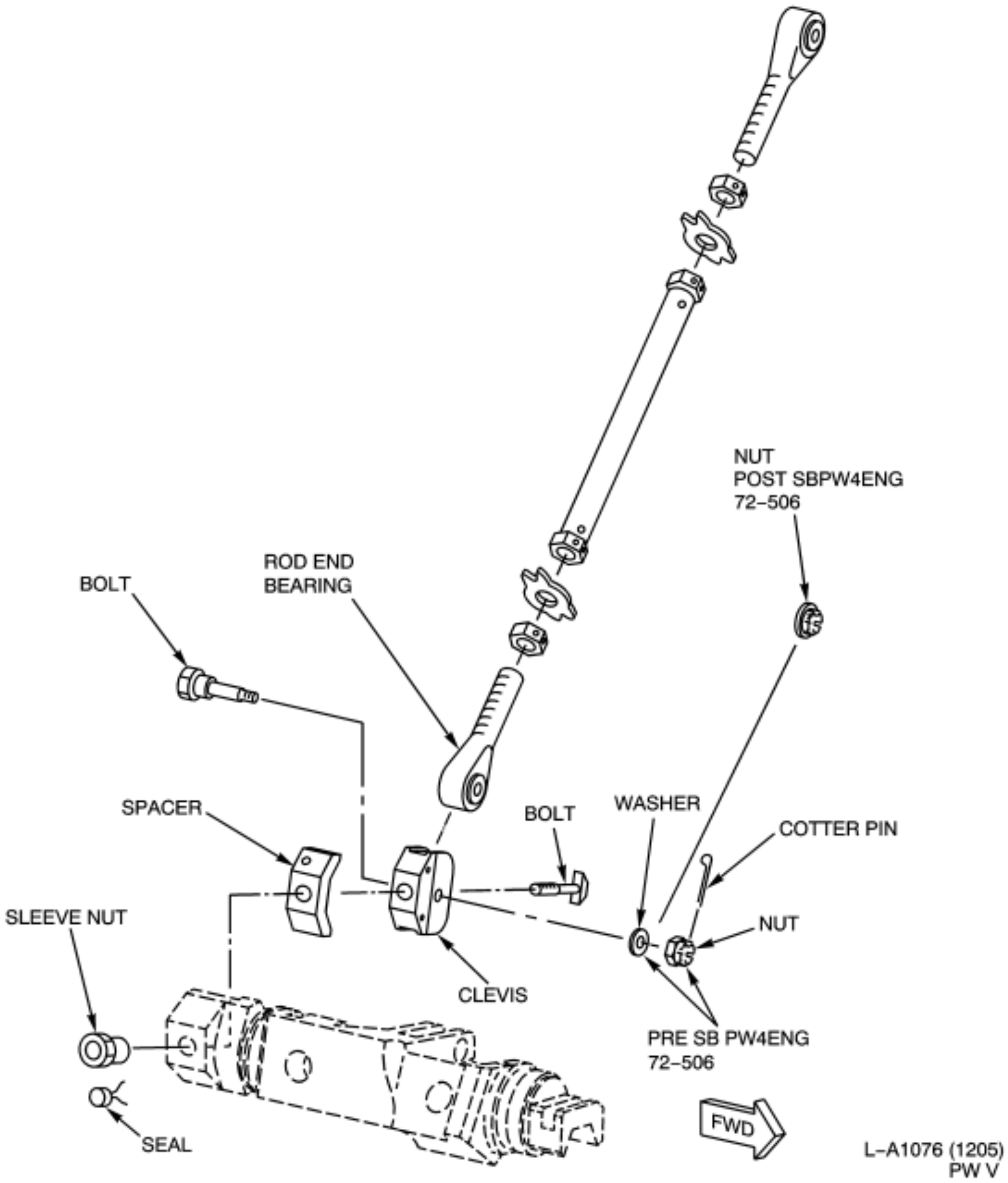
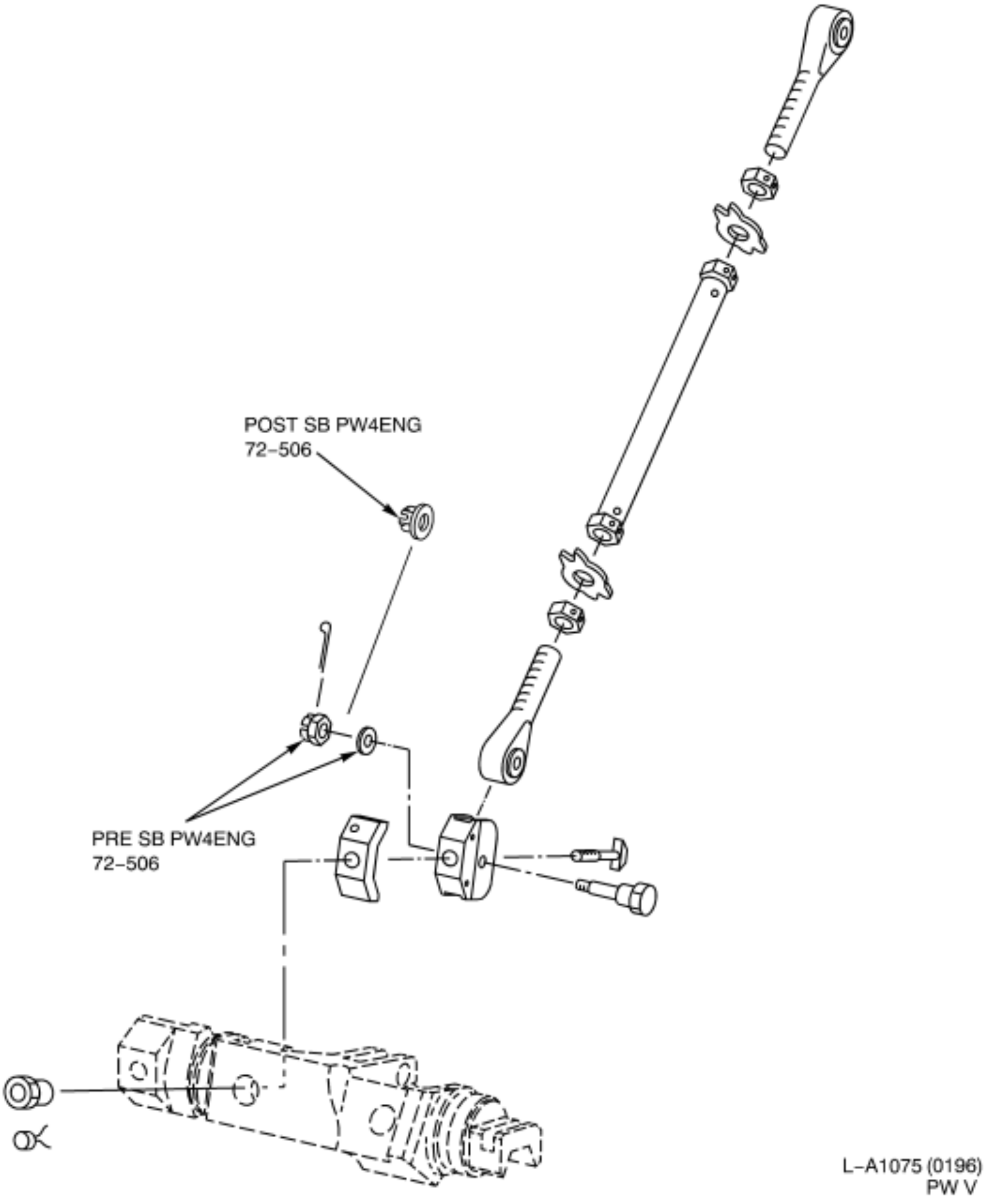

NUT
POST SBPW4ENG
72-506
ROD END
BEARING
BOLT
SPACER
BOLT
WASHER
COTTER PIN
SLEEVE NUT
NUT
CLEVIS
PRE SB PW4ENG
72-506
SEAL
FWD
L-A1076 (1205)
PW V

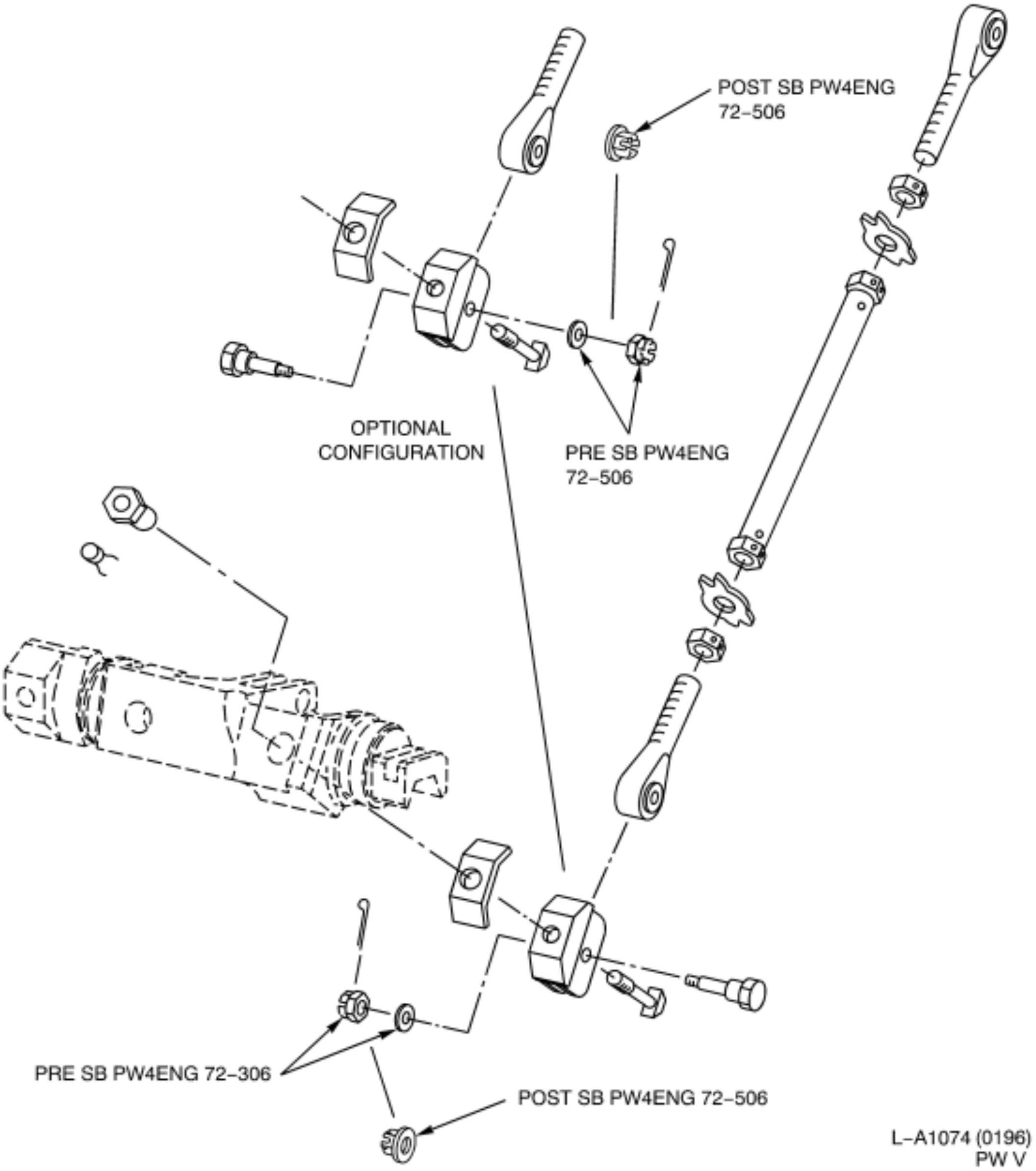
Seventh Stage Variable Stator Linkage
Figure 501
(Task 72-35-03-040-001)

HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY - DISASSEMBLY-01


POST SB PW4ENG
72-506
PRE SB PW4ENG
72-506
L-A1075 (0196)
PW V

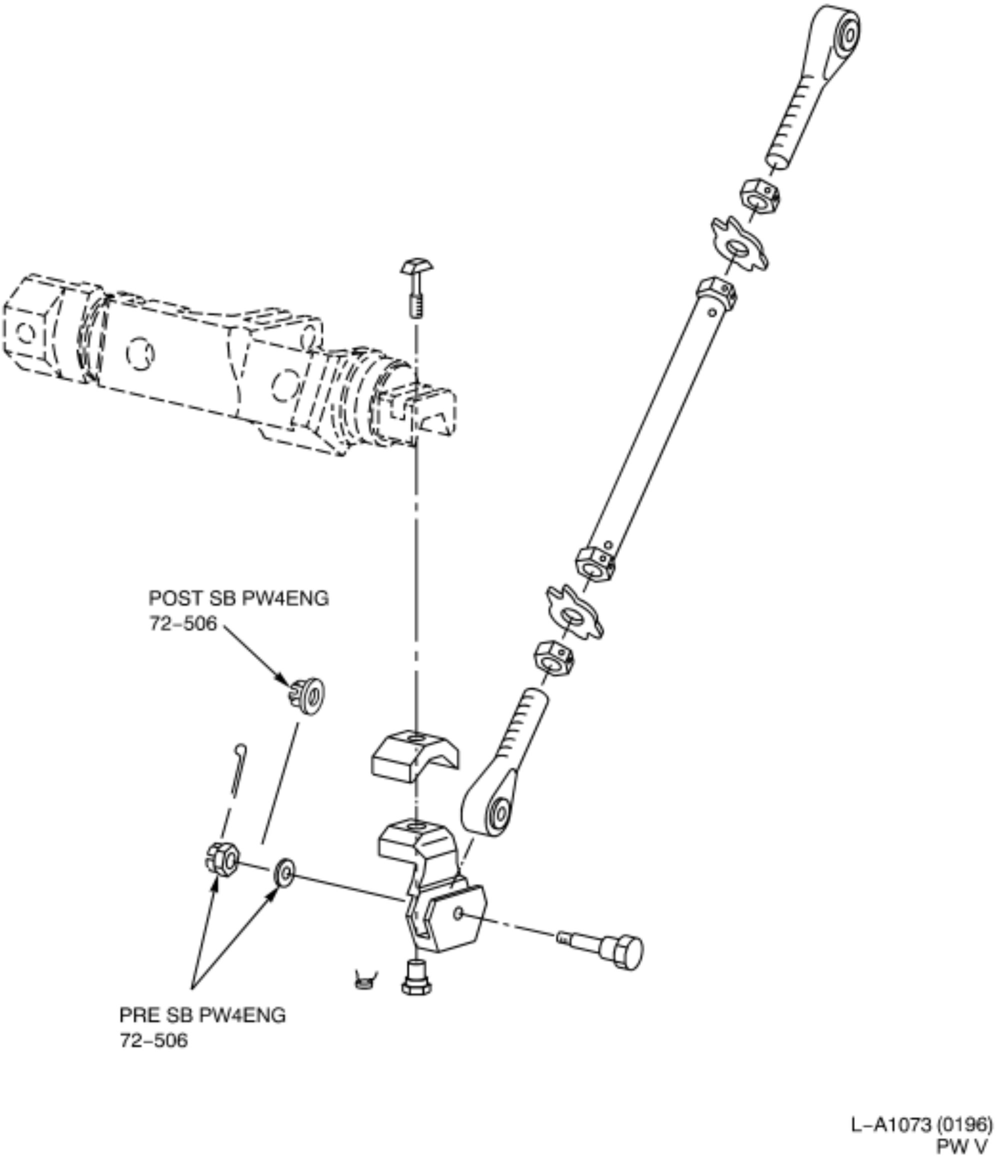
Sixth Stage Variable Stator Linkage
Figure 502
(Task 72-35-03-040-001)

HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY − DISASSEMBLY−01

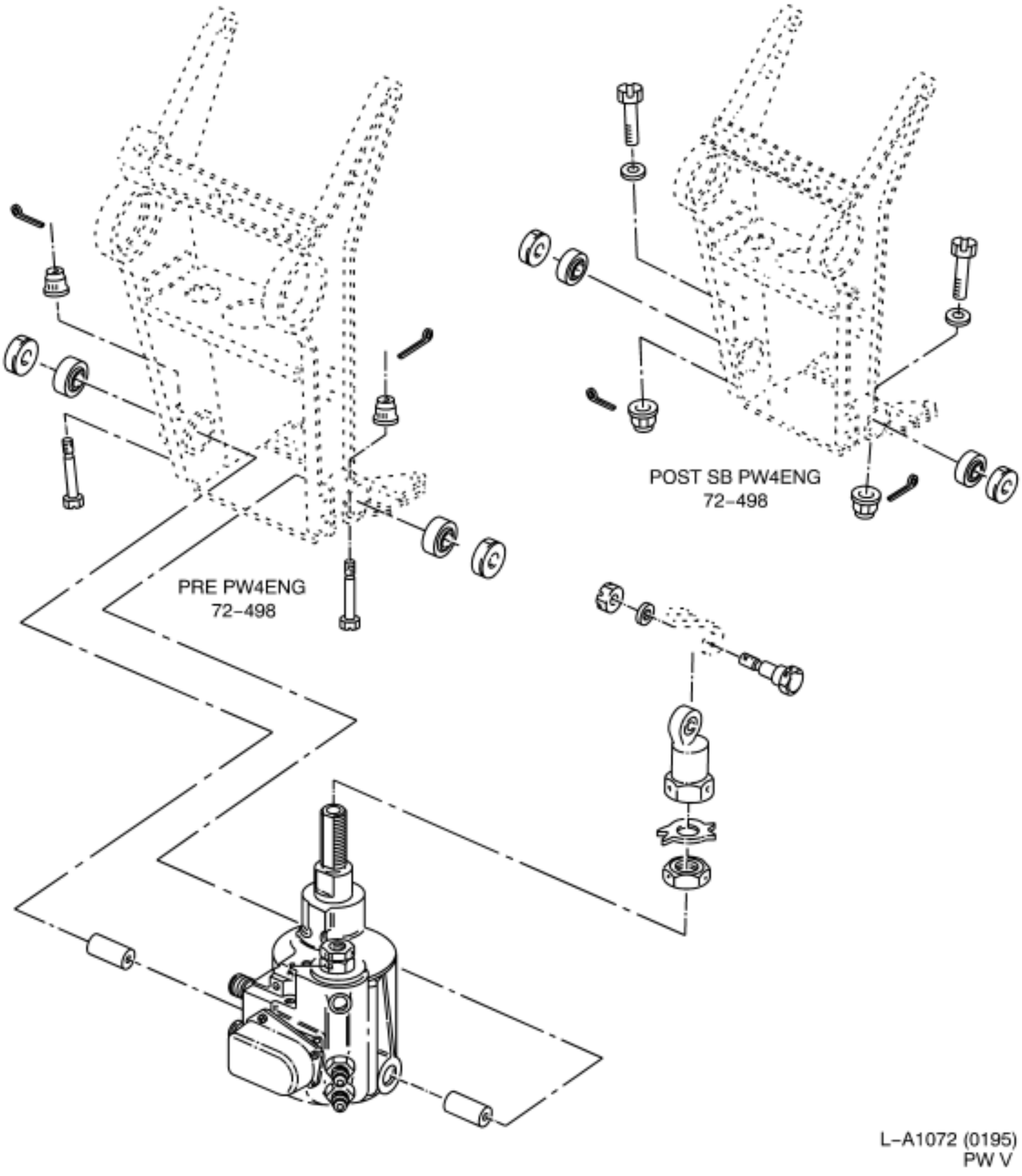

POST SB PW4ENG 72−506
OPTIONAL CONFIGURATION
PRE SB PW4ENG 72−506
PRE SB PW4ENG 72−306
POST SB PW4ENG 72−506
L−A1074 (0196)
PW V

Fifth Stage Variable Stator Linkage
Figure 503
(Task 72−35−03−040−001)

HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY − DISASSEMBLY−01

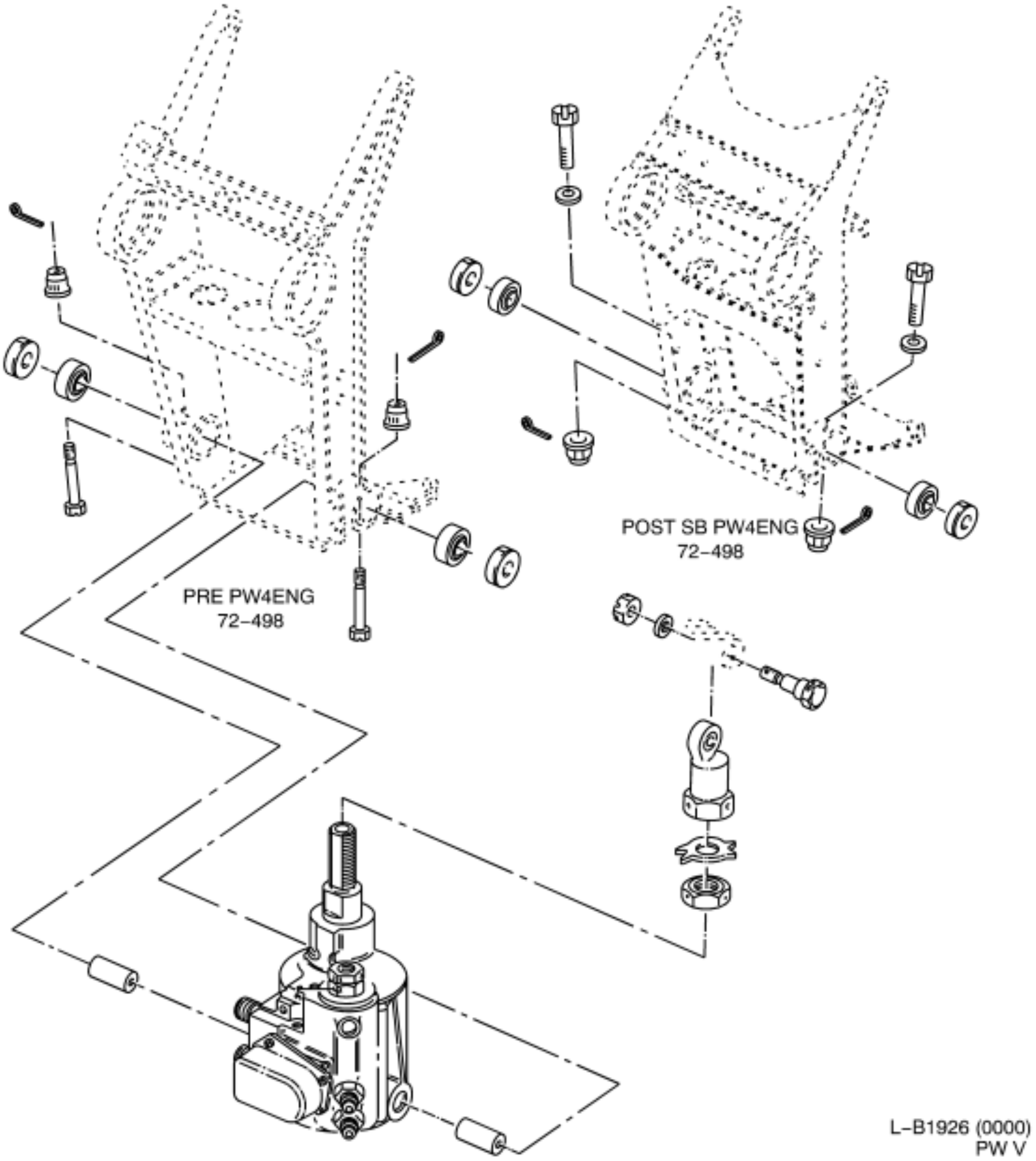

POST SB PW4ENG
72−506
PRE SB PW4ENG
72−506
L−A1073 (0196)
PW V

Inlet Guide Vane Linkage
Figure 504
(Task 72−35−03−040−001)


POST SB PW4ENG
72-498
PRE PW4ENG
72-498
L-A1072 (0195)
PW V

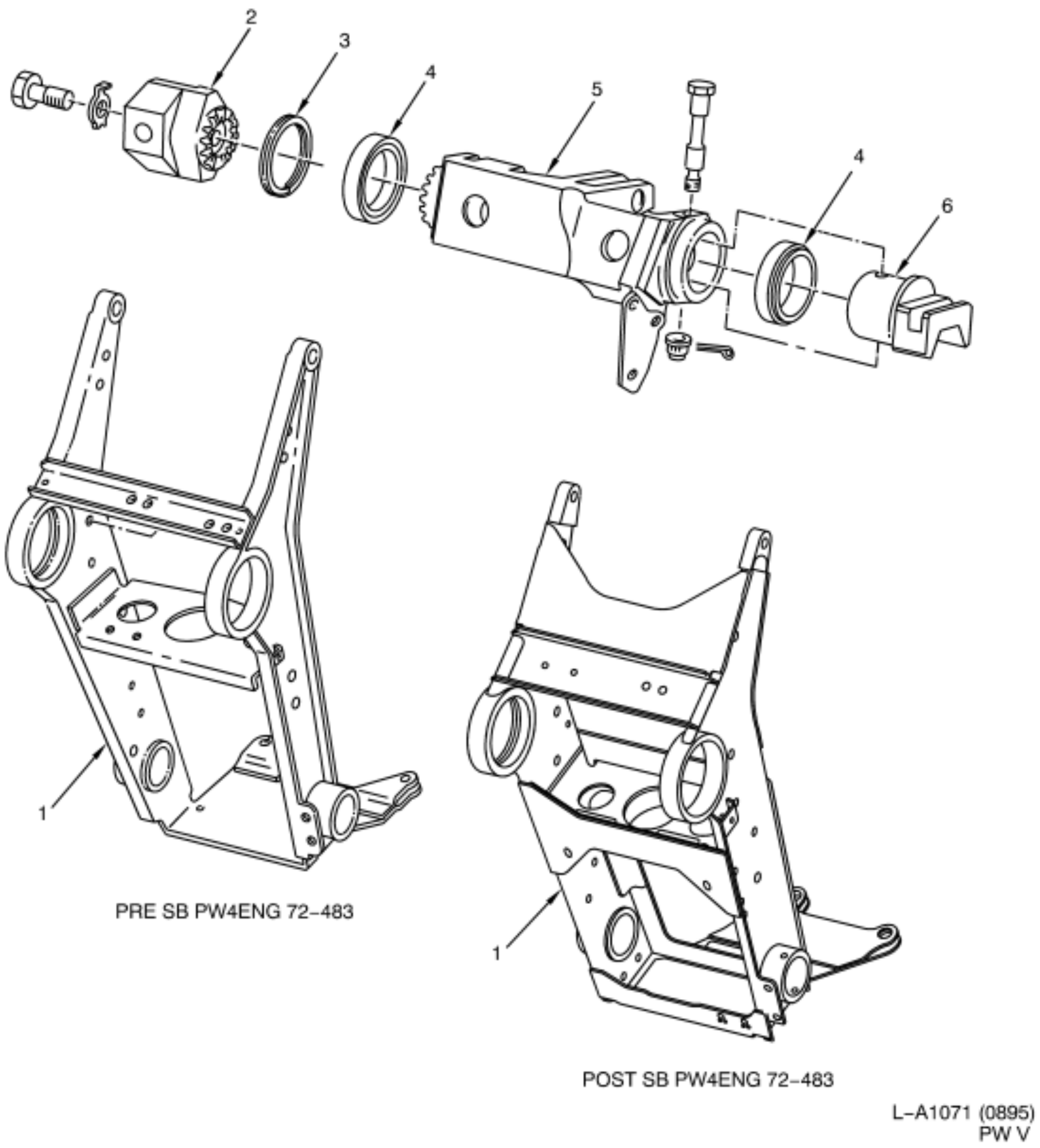
Stator Vane Actuator Removal (Pre SB PW4ENG 72-483)
Figure 505
(Task 72-35-03-040-001)

HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY - DISASSEMBLY-01


POST SB PW4ENG
72-498
PRE PW4ENG
72-498
L-B1926 (0000)
PW V

Stator Vane Actuator Removal (Post SB PW4ENG 72-483)
Figure 505A
(Task 72-35-03-040-001)

HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY − DISASSEMBLY−01


2
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1
PRE SB PW4ENG 72−483
1
POST SB PW4ENG 72−483
L−A1071 (0895)
PW V

Lever and Support Disassembly
Figure 506
(Task 72−35−03−040−001)

HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY - ASSEMBLY-01

Task 72-35-03-440-001:

1. Assemble HPC Stator Vane Actuator And Lever Assembly

A. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 86141	Indicator, Stretch
PWA 88742	Drift

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
R	P05-292	Ferrule, Safety Cable (Optional)
	P06-005	Lubricant (PWA 587)
	P06-021	Compound, Antigalling (PWA 550-3)
	P06-037	Compound, Anti-seize (PWA 36053-4)
R	P06-053	Lubricant, Sealing Ring (PWA 36500)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Cotter Pin	1	72-35-00/24/160
Cotter Pin	1	72-35-00/25/160
Cotter Pin	1	72-35-00/26/160
Cotter Pin	1	72-35-00/27/180
Cotter Pin	1	72-35-00/28/160
Cotter Pin	2	75-31-00/1/100
Key Washer	1	72-35-00/24/120
Key Washer	2	72-35-00/25/90
Key Washer	2	72-35-00/26/90
Key Washer	2	72-35-00/27/90
Key Washer	2	72-35-00/28/90
Key Washer	1	75-31-00/1/120
Packing	1	75-31-00/1/10
Packing	1	75-31-00/1/30
Seal	1	72-35-00/25/50
Seal	1	72-35-00/26/50

HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY - ASSEMBLY-01

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
(CONTINUED)		
Seal	1	72-35-00/27/50
Seal	1	72-35-00/28/50

B. Procedure
See Figures 1001 thru Figure 1006.

(1) Place compressor stator cylinder support assembly (1001/1) on bench with the four attaching support legs down.

(2) Install a bearing (1001/4) on HPC inlet lever (1001/6) as follows.

(a) Chill the inlet lever (1001/6) and bolt for approximately ten minutes.

(b) Put the HPC inlet lever (1001/6) hollow end up on a standard arbor press.

(c) Put the bearing (1001/4) (part number side down) over the HPC inlet lever (1001/6).

(d) Put the PWA 88742 Drift over the bearing and press the bearing so that it touches the shoulder on the lever assembly.

(3) Position HPC 5th and 6th stage lever assembly (1001/5) to support assembly (1001/1).

(4) Install bearing (1001/4) to lever assembly (1001/5) and support assembly (1001/6) in opening having provision for a snap ring. Push bearing to seat against lever shoulder. Retain bearing with a snap ring (1001/3).

(5) Install HPC inlet lever (1001/6) to HPC 5th and 6th stage lever assembly. Align holes in lever and lever assembly and secure with bolt, threads lubricated with Engine Oil P03-001 and nut. Tighten and torque nut to 65 - 85 lb-in. (7.344 - 9.604 N.m) to align slot and bolt hole for cotter pin installation. Install cotter pin and bend tangs around nut. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

R
R

(6) (Reference 734) Position HPC 7th stage lever (1001/2) aligning teeth with HPC 5th and 6th stage lever assembly. Secure HPC 7th stage lever with bolt, threads lubricated with Antigalling Compound P06-021, and key washer. Tighten and torque bolt to 505 - 565 lb-in. (57.057 - 63.836 N.m). Bend tabs of washer to secure bolt. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolt head.

R R R (7) Install the new packings, lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 on the adapters. Remove the protective closures from the stator vane actuator ports and install adapters, threads lubricated with Engine Oil P03-001. Torque adapter or return port to 110 - 120 lb-in. (12.428 - 13.558 N.m). Torque adapter on pressure port to 150 - 170 lb-in. (16.948 - 19.207 N.m).

(8) Install nut, key washer and rod end bearing to actuator rod. Do not tighten nut or bend tab of key washer.

(9) Position actuator to support with rod end bearing through hole in support. Install bearings to support and align side mount holes with openings in support bearings. Apply Lubricant P06-005 or Anti-seize Compound P06-037 to the bearing pins and insert pins through support bracket bearings to engage the actuator. Tap to seat.

(10) Install bearing stops to support aligning bolt holes.

- (a) (Pre SB PW4ENG 72-498) Secure stops with bolts, threads lubricated with Engine Oil P03-001, and nuts.

- (b) (Post SB PW4ENG 72-498) Secure stops with bolts, threads lubricated with Engine Oil P03-001, washers and nuts. Install washers between the head of the bolts and the bearing housing of the support assembly.

(11) Tighten and torque nuts to 36 - 40 lb-in. (4.067 - 4.519 N.m). Install cotter pins to nuts and bend to secure.

(12) Temporarily install bolt, threads lubricated with Engine Oil P03-001, through lever and rod end bearing. Install washer and nut to bolt.

CAUTION: INLET, 5TH, 6TH AND 7TH STAGE SPACERS MUST BE USED IN SETS FOR SIX STATOR VANE SCHEDULE OR 19 STATOR VANE SCHEDULE (SB PW4ENG 72-197).

(13) Install bolt, threads lubricated with Engine Oil P03-001, through lever and secure spacer and inlet clevis to lever with nut fingertight. See Figure 1003.

CAUTION: INLET, 5TH, 6TH AND 7TH STAGE SPACERS MUST BE USED IN SETS FOR SIX STATOR VANE SCHEDULE OR 19 STATOR VANE SCHEDULE (SB PW4ENG 72-197).

(14) Install bolt, threads lubricated with Engine Oil P03-001, through fifth clevis and secure spacer and fifth clevis to lever with nut fingertight. See Figure 1004.

CAUTION: INLET, 5TH, 6TH AND 7TH STAGE SPACERS MUST BE USED IN SETS FOR SIX STATOR VANE SCHEDULE OR 19 STATOR VANE SCHEDULE (SB PW4ENG 72-197).

(15) Install bolt, threads lubricated with Engine Oil P03-001, through sixth clevis and secure spacer and sixth clevis to lever with nut fingertight. See Figure 1005.

CAUTION: INLET, 5TH, 6TH AND 7TH STAGE SPACERS MUST BE USED IN SETS FOR SIX STATOR VANE SCHEDULE OR 19 STATOR VANE SCHEDULE (SB PW4ENG 72-197).

(16) Install bolt, threads lubricated with Engine Oil P03-001, through seventh clevis and secure spacer and seventh clevis to lever with nut fingertight. See Figure 1006.

(17) (Pre SB PW4ENG 72-506) Install rod end bearing to each installed clevis and secure with bolt, washer and nut.

(18) (Post SB PW4ENG 72-506) Install rod end bearing to each installed clevis and secure with bolt and nut.

(19) (Reference 730) Tighten nuts to 15 - 22 lb-in. (1.695 - 2.486 N.m) plus additional torque required to turn the bolt through the nut threads. Install cotter pins to secure nuts.

(20) (Reference 731 and 732) Stretch the bolts which attach the clevises and the spacers to the bellcrank as follows:

CAUTION: THE MAXIMUM STRETCH OF 0.006 INCH (0.152 MM) ON THE BOLT MUST NOT BE EXCEEDED. IF THE STRETCH IS EXCEEDED, THE BOLT MUST BE REMOVED AND DISCARDED AND REPLACED WITH A NEW BOLT.

(a) With the bolts installed hand tight, use a PWA 86141 Stretch Indicator and measure the length of the bolts (top of the bolt head to the end of the bolt shank) and record the length dimension for each stage on a piece of paper.

(b) Tighten the nut until the parts touch.

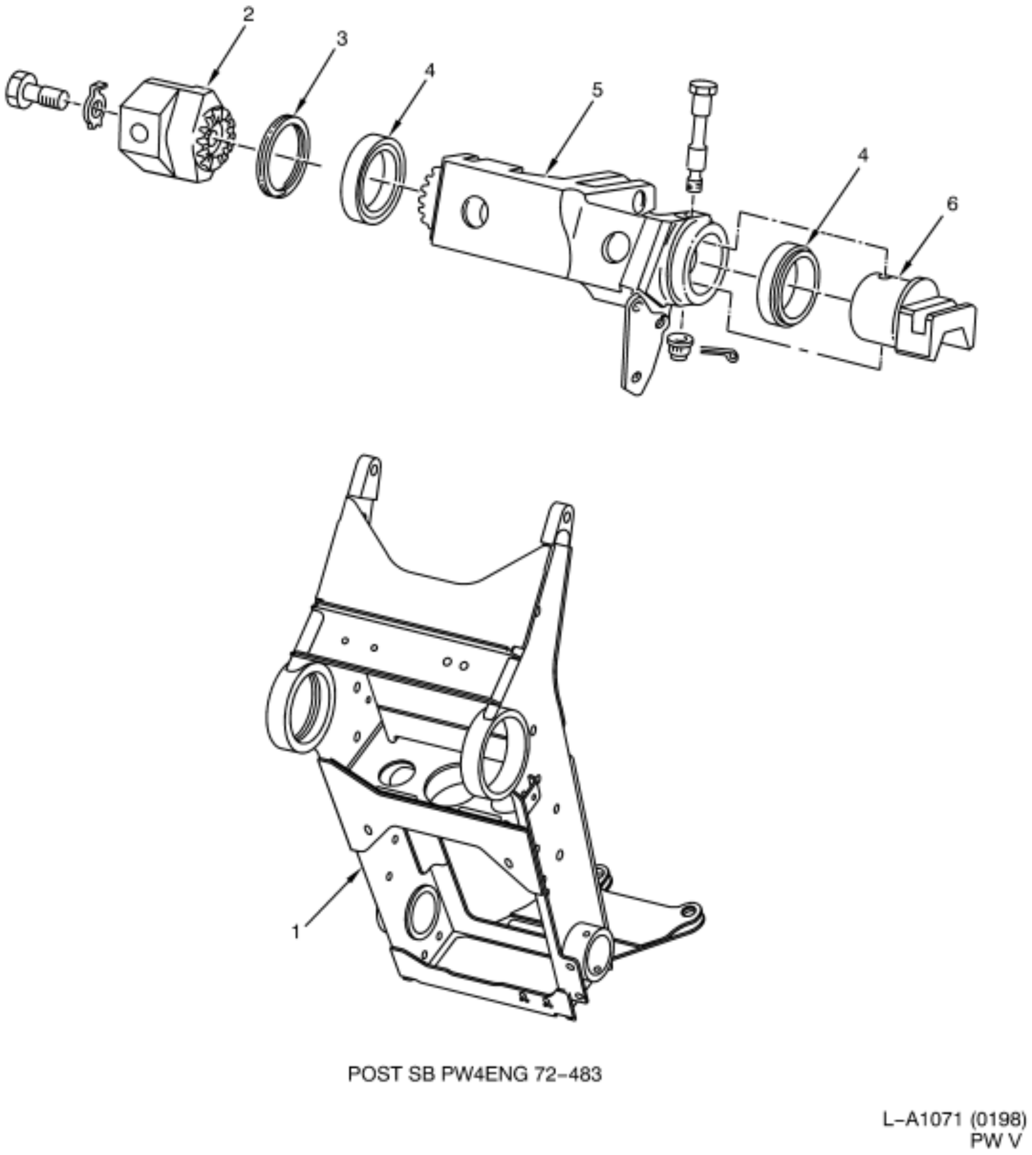
NOTE: An eighth of a turn of the nut will stretch the bolt approximately 0.0026 inch (0.066 mm).

(c) Tighten the nut in eighths (1/8) of a turn and measure the bolt length.

(d) Repeat this procedure until the bolt for each stage is stretched 0.005 − 0.006 inch (0.127 − 0.152 mm) longer than its first measurement previously recorded.

(21) Install the Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the nuts and seal.

(22) Install nuts and key washers to each rod end bearing. Install rod end bearing, nut and key washer to each adjuster. Install each adjuster to rod end bearing or stator lever. Do not tighten nuts at this time.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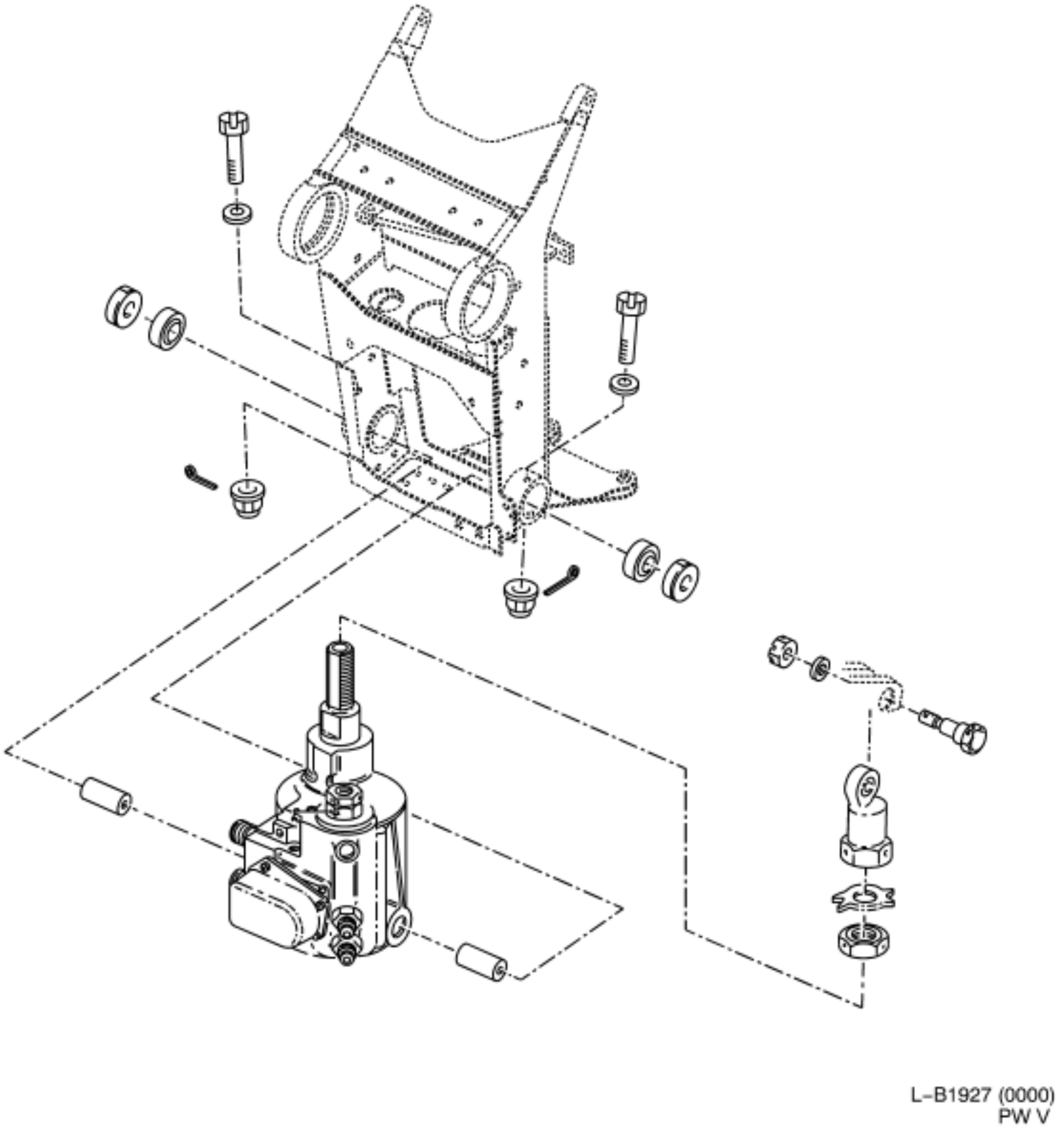
POST SB PW4ENG 72-483
L-A1071 (0198)
PW V

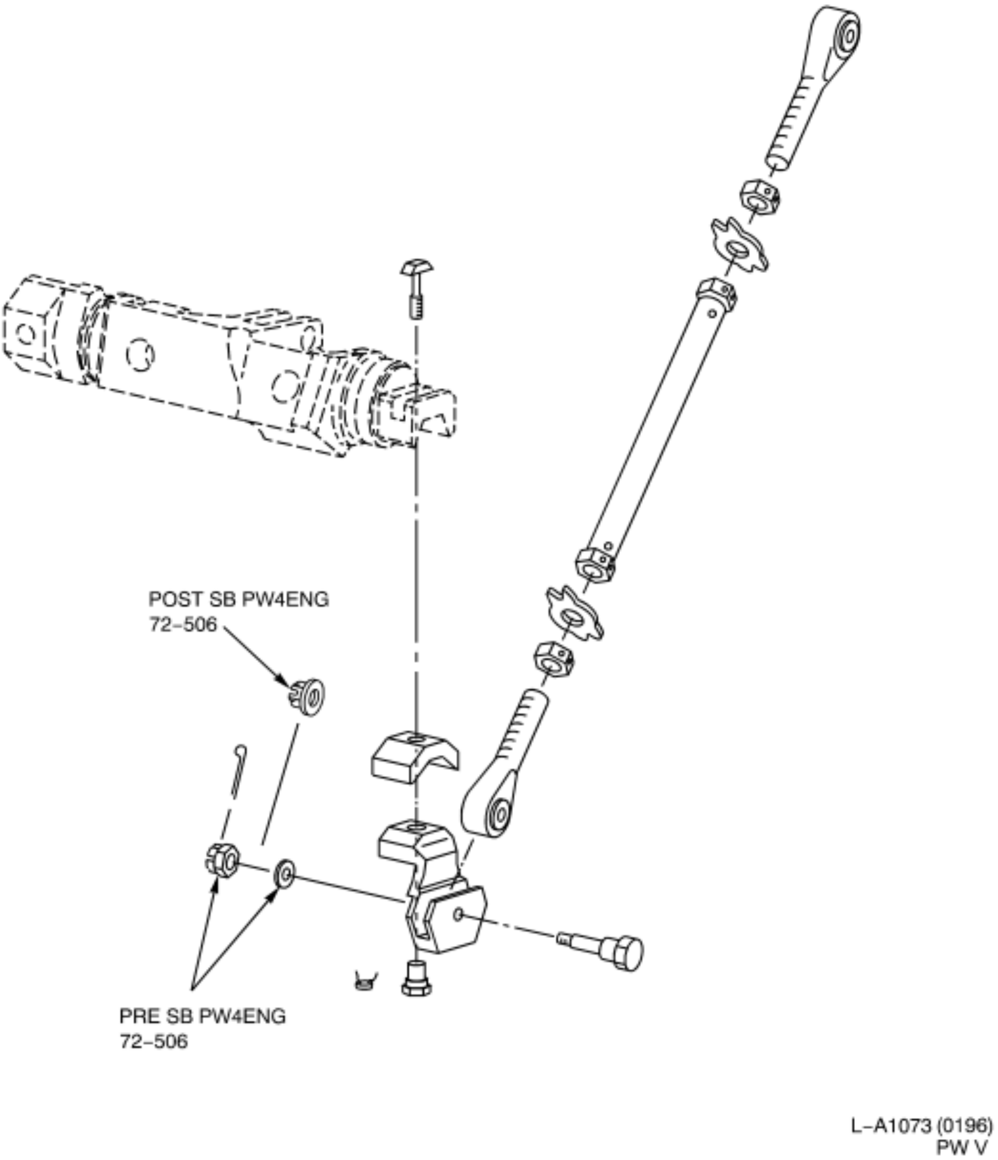
Lever And Support Installation
Figure 1001
(Task 72-35-03-440-001)

HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY - ASSEMBLY-01



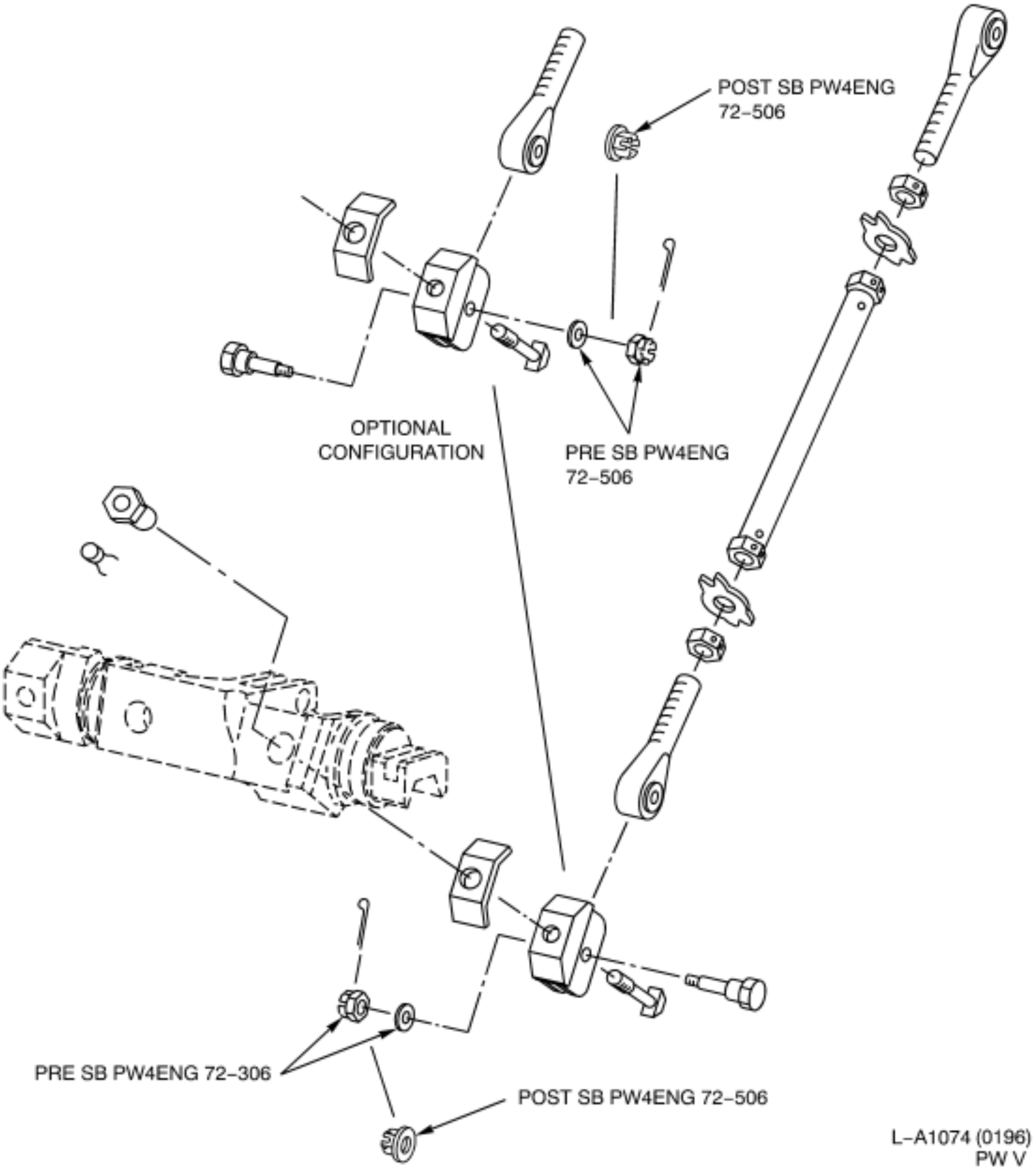
Stator Vane Actuator Assembly (Post SB PW4ENG 72-483)
Figure 1002
(Task 72-35-03-440-001)

HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY − ASSEMBLY−01


POST SB PW4ENG
72−506
PRE SB PW4ENG
72−506
L−A1073 (0196)
PW V

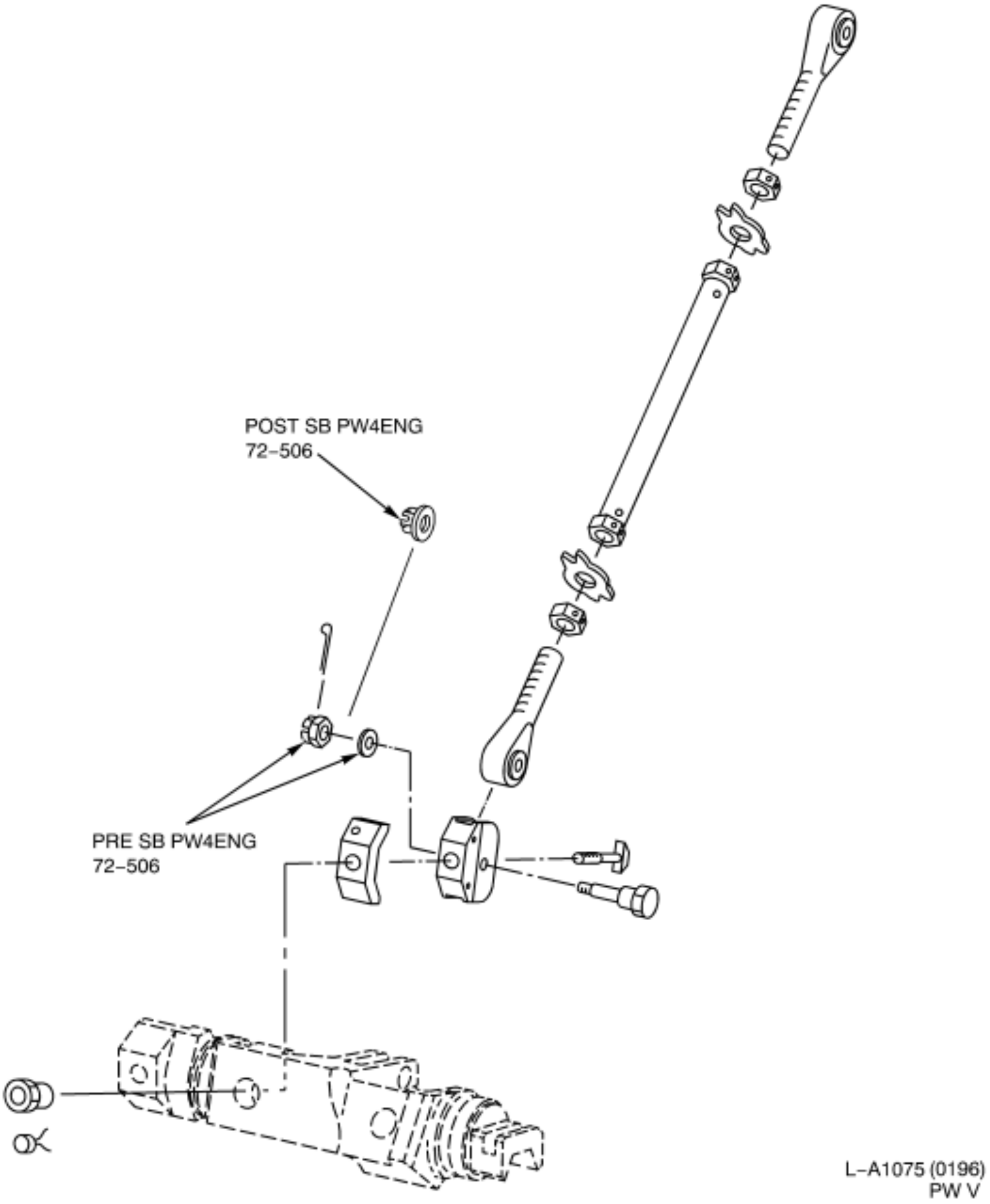
Inlet Guide Vane Linkage
Figure 1003
(Task 72−35−03−440−001)

HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY - ASSEMBLY-01


POST SB PW4ENG
72-506
OPTIONAL
CONFIGURATION
PRE SB PW4ENG
72-506
PRE SB PW4ENG 72-306
POST SB PW4ENG 72-506
L-A1074 (0196)
PW V

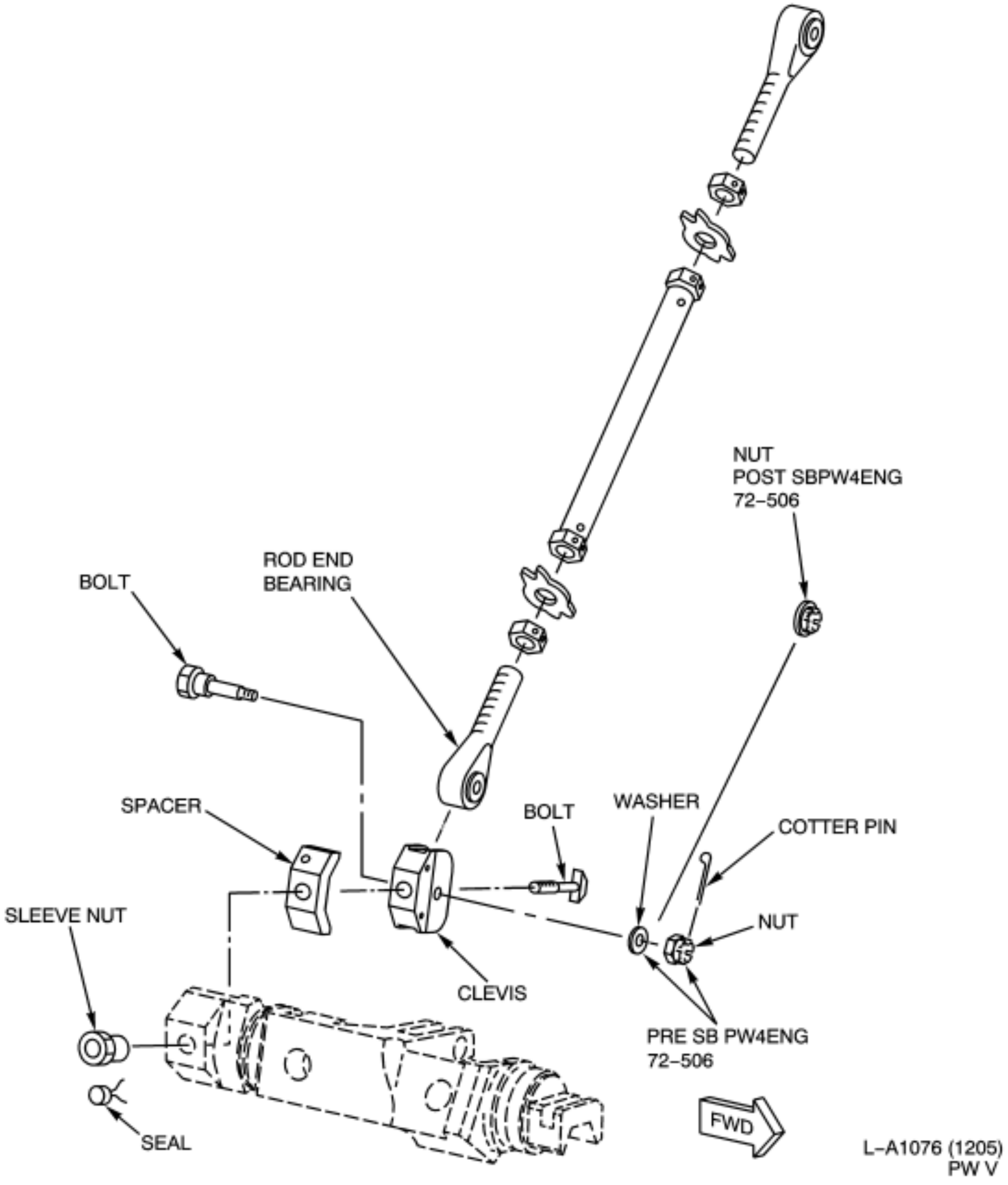
Fifth Stage Variable Stator Linkage
Figure 1004
(Task 72-35-03-440-001)

HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY - ASSEMBLY-01


POST SB PW4ENG
72-506
PRE SB PW4ENG
72-506
L-A1075 (0196)
PW V

Sixth Stage Variable Stator Linkage
Figure 1005
(Task 72-35-03-440-001)

HPC STATOR VANE ACTUATOR AND LEVER ASSEMBLY - ASSEMBLY-01


NUT
POST SBPW4ENG
72-506
ROD END
BEARING
BOLT
SPACER
BOLT
WASHER
COTTER PIN
SLEEVE NUT
NUT
CLEVIS
PRE SB PW4ENG
72-506
SEAL
FWD
L-A1076 (1205)
PW V

Seventh Stage Variable Stator Linkage
Figure 1006
(Task 72-35-03-440-001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - DISASSEMBLY-01

Task 72-35-04-040-001:

1. Disassemble The HPC Outer Air Seal Set, Stages 5 Through 15

A. Prerequisites

(1) Machine The HPC Outer Air Seal Set. Refer to 72-35-04, Assembly-02 (Task 72-35-04-440-002).

B. Equipment And Materials Necessary

Standard Tools:

Optional, Wrench (Extended Socket) Part No. QCL 5/16-2D-3/16 Used With Optional Cleco Air Gun	Brimatco Corporation P.O. Box 88 1486 Highland Ave. Cheshire, CT 06410 USA
Optional Cleco Air Gun (Nutrunner) PN 44RNAL-2-H-3, or PN 44RNAL-2RA8 Or Equivalent	Local Distributor Or, Cooper Tools Sales and Service P.O. Box 1410 Lexington, SC 29071-1410 USA
Optional, Flexible Extension Part No. GSYMU101 Or Equivalent	Snap-On Technologies Inc. P.O. Box 1430 Kenosha, WI 53141-1430 USA

NOTE: The optional Brimatco wrench (extended socket) PN QCL 5/16-2D-3/16 can be use with the Cleco Air Gun to help remove the flange nuts on the 8th through 14th stage compressor cases.

Special Tools:

	PWA 76154	Adapter (4 Necessary)
R	PWA 86536	Adapter, Torque (HPC Front Case Split Flange Nuts) (Optional To PWA 107300)
	PWA 88673	Sling, (2 Necessary)
	PWA 102260	Adapter, Torque (9th Through 14th Stage Compressor Case Flange Nuts)
	PWA 105504	Adapter, Lift
	PWA 105588	Puller, Jackscrew (3 Necessary) (8th Stage Compressor Case Removal)
	PWA 107299	Adapter, Breakaway (HPC Case Flange Nuts)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − DISASSEMBLY−01

Special Tools:

(CONTINUED)

R	PWA 107300	Adapter, Breakaway (HPC Front Case Split Flange Nuts) (Optional To PWA 86536)

C. Procedure

NOTE: The detail parts of the HPC outer air seal set (Stages 5 through 15) were assembled and machined as a matched set. These parts are identified by the Letter M followed by the last five digits of the HPC rear case and must be kept together as a matched set.

Subtask 72−35−04−040−001:

(1) Trunnion the case set to the front end down position. See Figure 501.

(a) Use a hoist to connect the PWA 88673 Sling with two PWA 76154 Adapters to the PWA 105565 Fixture.

(b) Use the hoist to lift the case assembly.

(c) If necessary, remove and install the trunnion spools of PWA 100221 Machining Fixture in the REMOVE/INSTALL position.

(d) Use a second hoist to connect PWA 88673 Sling with two PWA 76154 Adapters to the PWA 100221 Machining Fixture.

(e) Use both hoists to trunnion the case assembly to the HPC front case end down position.

(f) Remove the lower Adapters, Sling, and hoist.

(g) Lower the assembly on a suitable support.

Subtask 72−35−04−040−002:

(2) Remove the PWA 100221 Machining Fixture. See Figure 501.

(a) Remove the 12 bolts (501/1), spacers (501/2), and nuts (501/3) that attach Fixture to the rear flange of the HPC rear case.

(b) Install four jackscrews into the rear flange of the HPC rear case.

(c) Turn the jackscrews evenly to loosen the Fixture from the case.

(d) Remove the jackscrews.

(e) Use the hoist to remove the Fixture.

(3) Remove the HPC rear support (502/3). See Figure 502.

(a) Remove the bolts (502/1) and washers (502/2) and nuts (502/5) and washers (502/6) that attach the HPC rear support (502/3) to the HPC rear case.

NOTE: You can use the PWA 107299 Adapter or the PWA 102260 Torque Adapter with a 3/8 inch drive to loosen the case flange nuts in the steps that follow.

(b) Remove the bolts (502/7), washers (502/8), nuts (502/5), and washers (502/6) that attach the HPC rear support (502/3) to the 15th stage air seal.

(c) Install 12 (.250-28) jackscrews in equally spaced threaded holes in the inner flange of the HPC rear support (502/3).

(d) Evenly tighten the jackscrews to remove the rear support (502/3) and the 15th stage air seal from the 14th stage case.

(e) Remove the jackscrews.

(f) Remove the HPC rear support (502/3) from the case.

(g) Remove the eight spacers (502/4).

(h) Use a suitable mallet to lightly tap the 15th stage air seal to remove it from the HPC rear support.

Subtask 72-35-04-040-003:

(4) Remove the HPC rear case (503/1). See Figure 503.

(a) Remove the bolts, washers, and nuts that attach the HPC rear case (503/1) to the rear flange of the HPC front case.

(b) Install four .250−28 jackscrews in the threaded holes in the front flange of the rear case (503/1).

(c) Evenly tighten the jackscrews to loosen the rear case. Remove the jackscrews.

(d) Attach a hoist to the lift hole in PWA 105504 Adapter.

(e) Use the hoist to lift the Adapter and put it over the HPC rear case (503/1).

(f) Align the boltholes in the Adapter with the boltholes in the case. Install the Adapter to the HPC rear case (503/1) with eight detail screw assemblies and four nut plates.

NOTE: The Adapter has a scribed line on the OD of the outer ring. Align this line with the offset hole in the rear flange of the HPC rear case. The offset hole is at the approximate 6 o'clock (180 degree) position.

(g) Use the hoist to remove the HPC rear case (503/1).

(h) Put the case on a pallet.

(i) Remove the screw assemblies and nut plates that attach the Adapter to the case.

(j) Remove the Adapter from the case.

Subtask 72−35−04−040−005:

(5) Remove The 14th stage compressor case assembly.

(a) Remove the nuts, bolts, and washers that attach the 14th stage case and air seal to the 13th stage compressor case.

(b) Install six .250−28 jackscrews in equally spaced threaded holes in the front flange of the 14th stage case.

(c) Evenly tighten the jackscrews to loosen the case.

(d) Remove the jackscrews and the 14th stage case.

(6) Remove the 14th stage compressor air seal.

(a) Install six .250−28 jackscrews in equally spaced threaded holes in the rear flange of the 13th stage case.

(b) Evenly tighten the jackscrews to loosen the 14th stage air seal.

(c) Remove the jackscrews.

(d) Remove the air seal.

Subtask 72−35−04−040−006:

(7) Remove The 13th stage compressor case assembly.

(a) Remove the nuts, bolts, and washers that attach the 13th stage case and air seal to the 12th stage compressor case.

(b) Install six .250−28 jackscrews in equally spaced threaded holes in the front (lower) flange of the 13th stage case.

(c) Evenly tighten the jackscrews to loosen the case.

(d) Remove the jackscrews and the 13th stage case.

(8) Remove the 13th stage compressor air seal.

(a) Install six .250−28 jackscrews in equally spaced threaded holes in the rear (upper) flange of the 12th stage case.

(b) Evenly tighten the jackscrews to loosen the 13th stage air seal.

(c) Remove the jackscrews.

(d) Remove the air seal.

Subtask 72−35−04−040−007:

(9) Remove the 12th stage compressor case assembly.

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − DISASSEMBLY−01

(a) Remove the nuts and bolts that attach the 12th stage case and air seal to the 11th stage case.

(b) Install six .250−28 jackscrews in equally spaced threaded holes in the front flange of the 12th stage case.

(c) Evenly tighten the jackscrews to loosen the case.

(d) Remove the jackscrews.

(e) Remove the case.

(10) Remove the 12th stage compressor air seal.

(a) Install six .250−28 jackscrews in equally spaced threaded holes in the rear (upper) flange of the 11th stage case.

(b) Evenly tighten the jackscrews to loosen the 12th stage air seal.

(c) Remove the jackscrews.

(d) Remove the air seal.

Subtask 72−35−04−040−008:

(11) Remove the 11th stage compressor case assembly.

(a) Use the PWA 102260 Torque Adapter with a 3/8 inch drive to loosen and remove the nuts that attach the 11th stage case and air seal to the 10th stage case.

(b) Remove the bolts. Remove the washers from the dowel bolts.

(c) Install six .250−28 jackscrews in equally spaced threaded holes in the front flange of the 11th stage case.

(d) Evenly tighten the jackscrews to loosen the case.

(e) Remove the jackscrews.

(f) Remove the case.

(12) Remove the 11th stage compressor air seal.

(a) Install six .250−28 jackscrews in equally spaced threaded holes in the rear flange of the 10th stage case.

(b) Evenly tighten the jackscrews to loosen the 11th stage air seal.

(c) Remove the jackscrews.

(d) Remove the air seal.

Subtask 72−35−04−040−009:

(13) Remove the 10th stage compressor case assembly.

(a) Remove the nuts and bolts that attach the 10th stage case and air seal to the 9th stage case.

(b) Install six .250−28 jackscrews in equally spaced threaded holes in the front (lower) flange of the 10th stage case.

(c) Evenly tighten the jackscrews to loosen the case.

(d) Remove the jackscrews.

(e) Remove the case.

(14) Remove the 10th compressor stage air seal.

(a) Install six .250−28 jackscrews in equally spaced threaded holes in the rear flange of the 9th stage case.

(b) Evenly tighten the jackscrews to loosen the 10th stage air seal.

(c) Remove the jackscrews.

(d) Remove the air seal.

Subtask 72−35−04−040−010:

(15) Remove the 9th stage compressor case assembly.

(a) Remove the nuts and bolts that attach the 9th stage case and air seal to the 8th stage case.

(b) Install six .250−28 jackscrews in equally spaced threaded holes in the front (lower) flange of the 9th stage case.

(c) Evenly tighten the jackscrews to loosen the case.

(d) Remove the jackscrews.

(e) Remove the case.

(16) Remove the 9th stage compressor air seal.

(a) Install six .250−28 jackscrews in equally spaced threaded holes in the rear flange of the 8th stage case.

(b) Evenly tighten the jackscrews to loosen the 9th stage air seal.

(c) Remove the jackscrews.

(d) Remove the air seal.

Subtask 72−35−04−040−011:

(17) Remove the 8th stage compressor case assembly. See Figure 505 (Sheet 1) for the symmetric case configuration, or Figure 505 (Sheet 2) for the asymmetric case configuration.

(a) Remove the nuts or bolts, as applicable, and washers that attach the 8th stage case to the 8th stage air seal.

NOTE: You can use a flexible extension (such as a Snap−On GSYMU101) to remove the nuts.

(b) Put three PWA 105588 Jackscrew Pullers equally spaced at through hole positions in the front (lower) flange of the 8th stage case.

(c) Put the detail pin of the Puller in the through hole in the front (lower) flange of the 8th stage case, and the flat plate against the rear (upper) flange of the case.

(d) Use a standard wrench to turn the detail driver of the three Pullers approximately one turn each, one at a time, to remove the case from the air seal. If necessary, remove and reposition the three Pullers to another three equally spaced locations and repeat the above procedure to remove the case.

(e) Remove the Pullers.

(f) Remove the case.

Subtask 72−35−04−040−012:

(18) Remove the HPC front case segments from the PWA 105565 Support Fixture. See Figure 506.

R (a) Use the PWA 86536 Adapter and/or PWA 107300
R Adapters to remove the 22 nuts (506/1) and bolts (506/2) that attach the HPC front case set upper and lower segments.

(b) Remove the screw assemblies that attach the front (lower) flange of the HPC front case segments to the Fixture.

(c) Remove the 8th stage air seal from the upper flange of the HPC front case segments.

(d) Remove the upper and lower HPC front case segments from the Fixture.

(e) Remove the tape from the case halves.

(f) Remove any remaining tape adhesive. Use the SPOP 208 (Task 70−21−00−110−040) wipe method, Standard Practices Manual, PN 585005.

(19) If necessary, remove the locks and the 5th stage shroud set segments.

(20) If necessary for the asymmetric case configuration, remove the locks and the 6th and 7th stage shroud set segments.

Subtask 72−35−04−040−013:

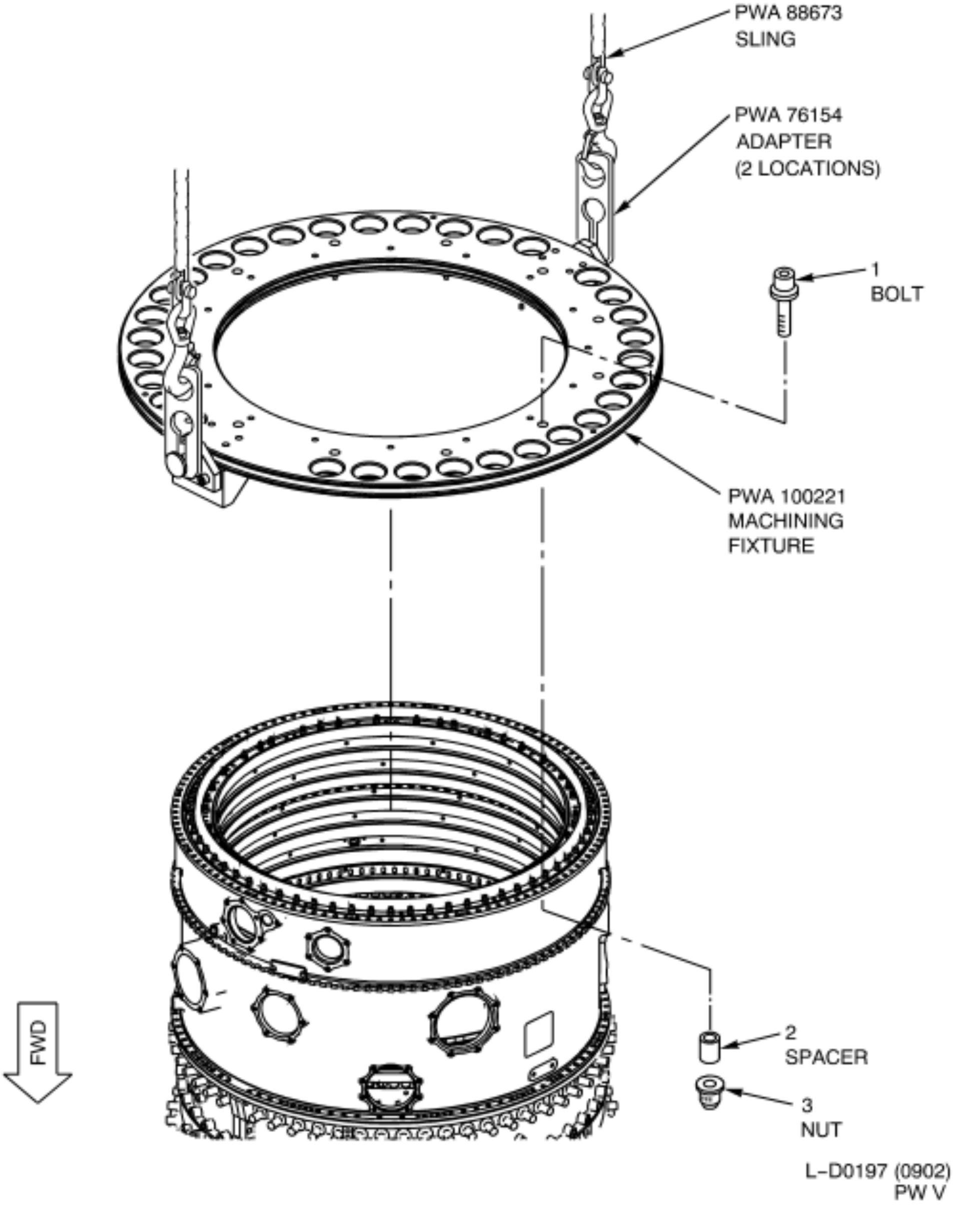
(21) Remove all raised material from the front and rear edges of the 8th through 15th stage air seal rubstrips. Break edges 0.003 − 0.015 inch (0.08 − 0.38 mm).

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − DISASSEMBLY−01

(22) Use a vacuum to clean the detail air seal set parts.

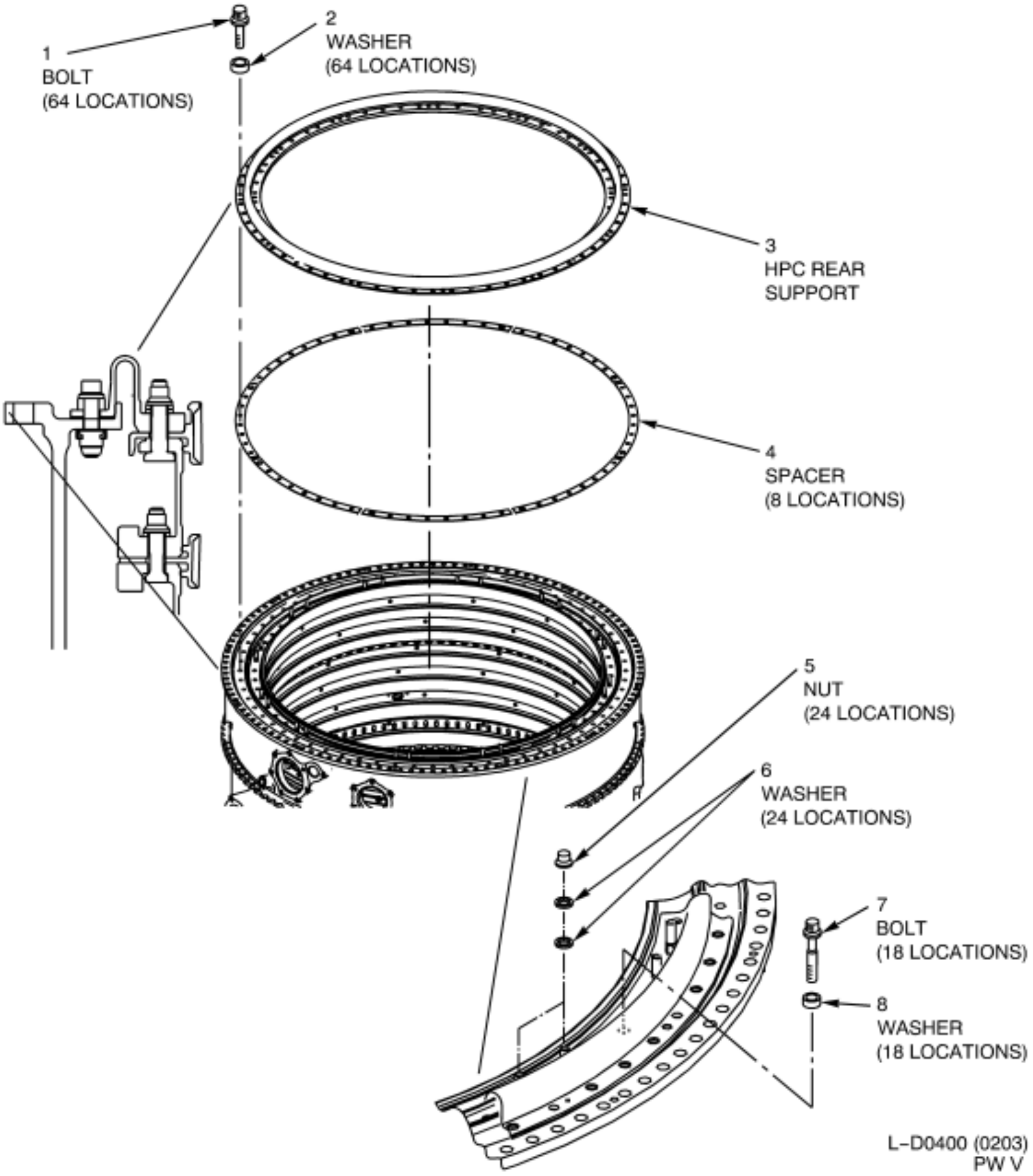
(23) Clean the detail parts of the HPC outer air seal set (Stages 5 through 15). Refer to 72−35−00, Cleaning−01, PW4000 Series CIR, PN 51A357.

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - DISASSEMBLY-01


PWA 88673
SLING
PWA 76154
ADAPTER
(2 LOCATIONS)
1
BOLT
PWA 100221
MACHINING
FIXTURE
FWD
2
SPACER
3
NUT
L-D0197 (0902)
PW V

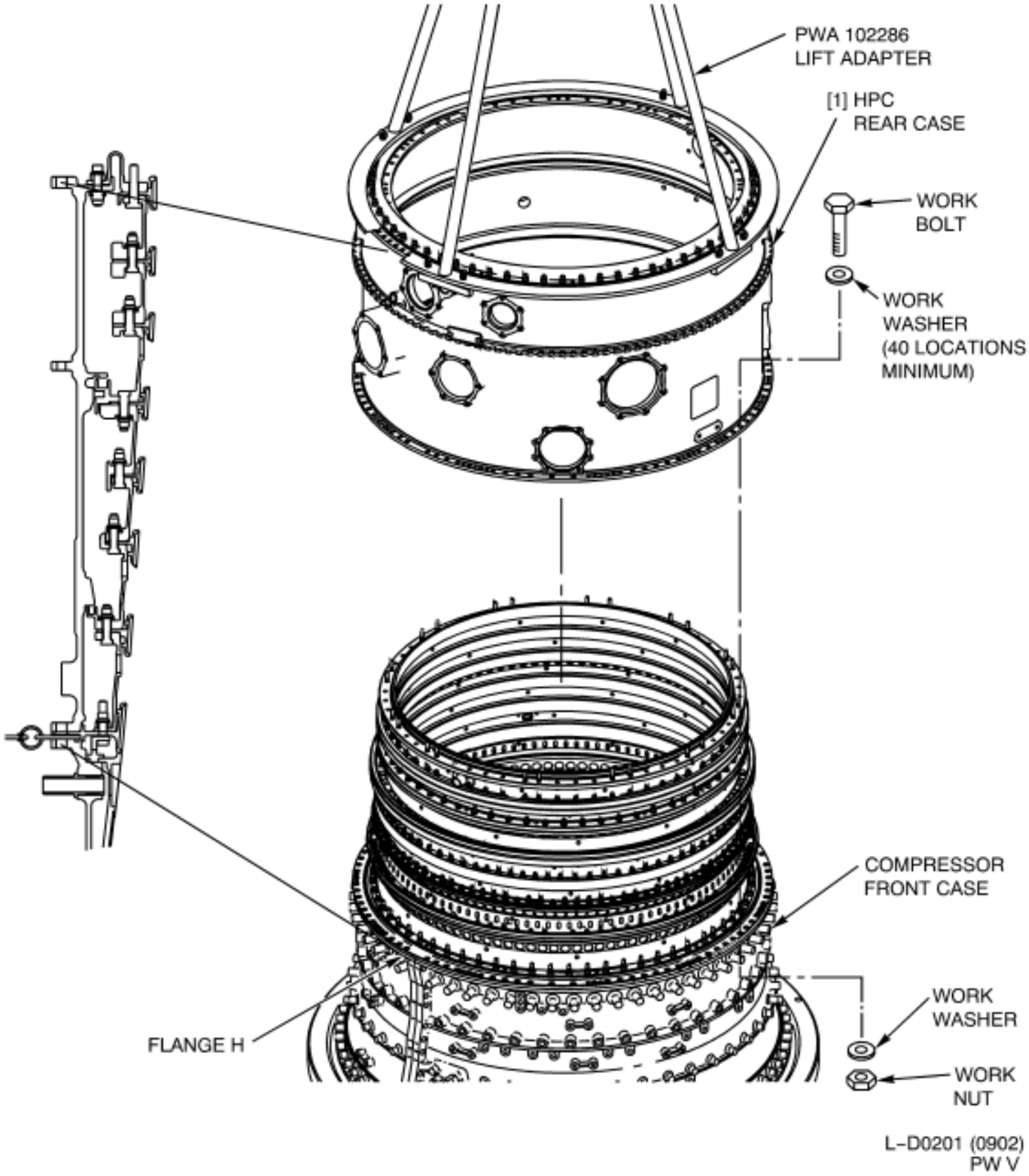
Machining Fixture Removal
Figure 501
(Task 72-35-04-040-001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - DISASSEMBLY-01


1
BOLT
(64 LOCATIONS)
2
WASHER
(64 LOCATIONS)
3
HPC REAR
SUPPORT
4
SPACER
(8 LOCATIONS)
5
NUT
(24 LOCATIONS)
6
WASHER
(24 LOCATIONS)
7
BOLT
(18 LOCATIONS)
8
WASHER
(18 LOCATIONS)
L-D0400 (0203)
PW V

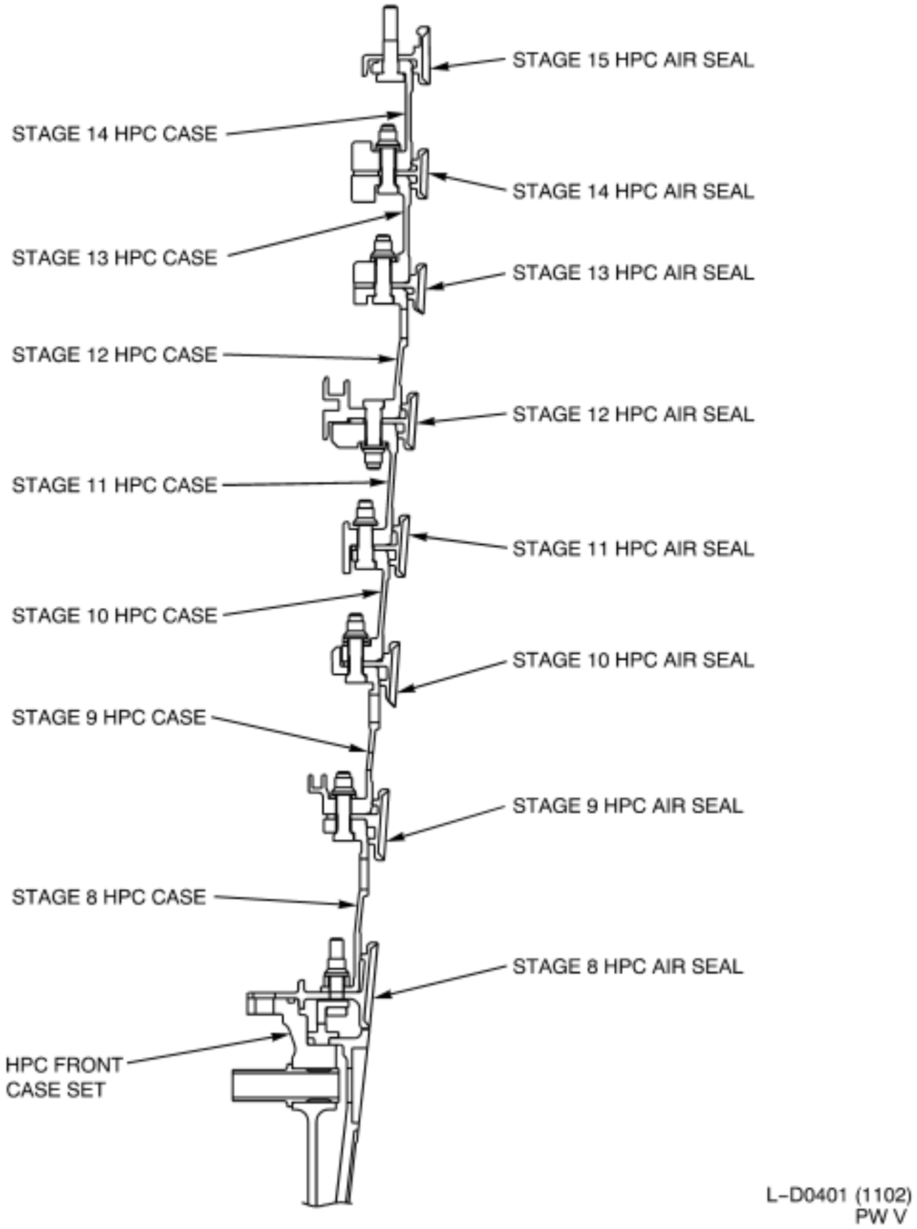
HPC Rear Support Removal
Figure 502
(Task 72-35-04-040-001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - DISASSEMBLY-01

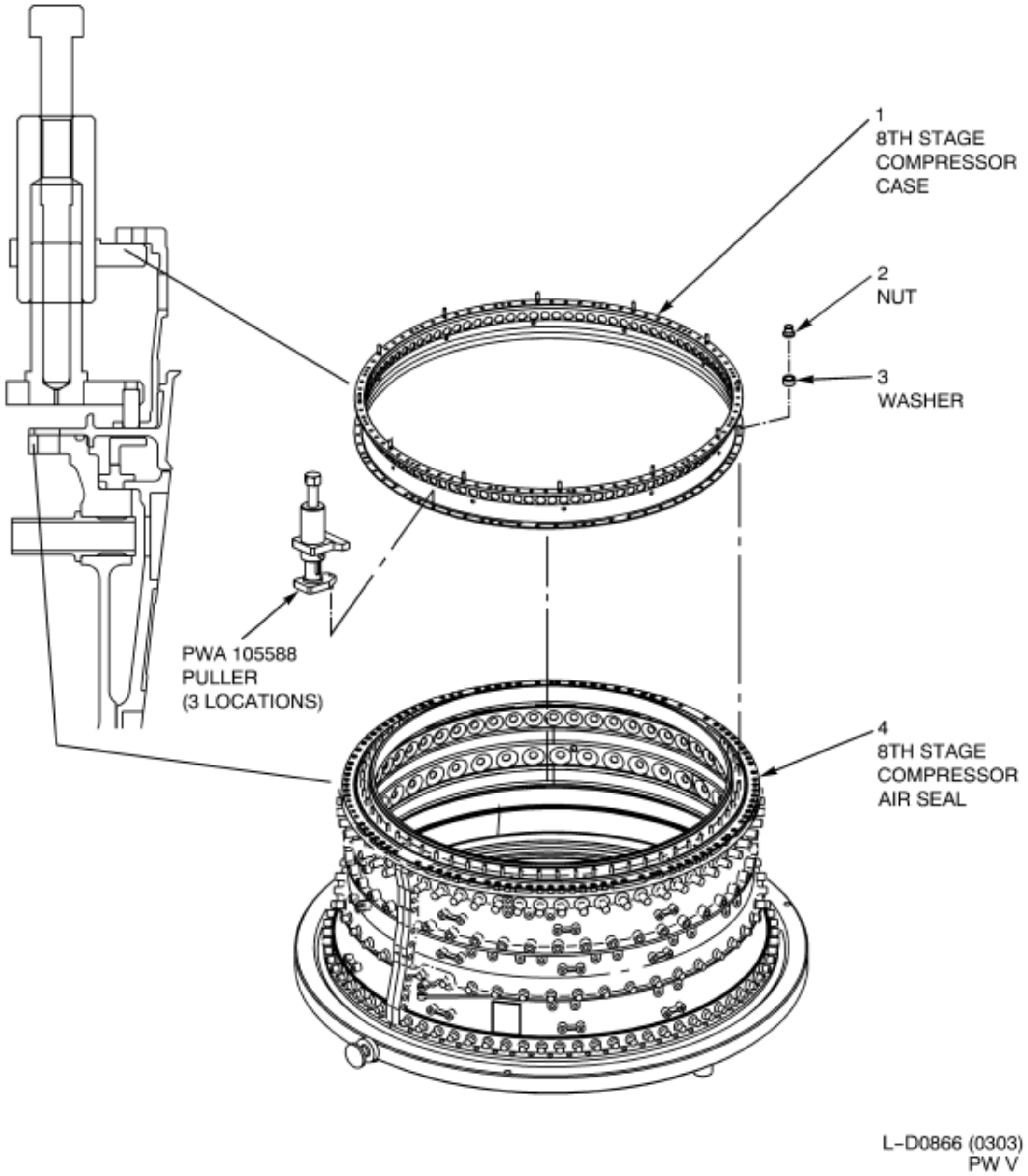

PWA 102286
LIFT ADAPTER
[1] HPC
REAR CASE
WORK
BOLT
WORK
WASHER
(40 LOCATIONS
MINIMUM)
COMPRESSOR
FRONT CASE
WORK
WASHER
WORK
NUT
FLANGE H
L-D0201 (0902)
PW V

HPC Rear Case Removal
Figure 503
(Task 72-35-04-040-001)

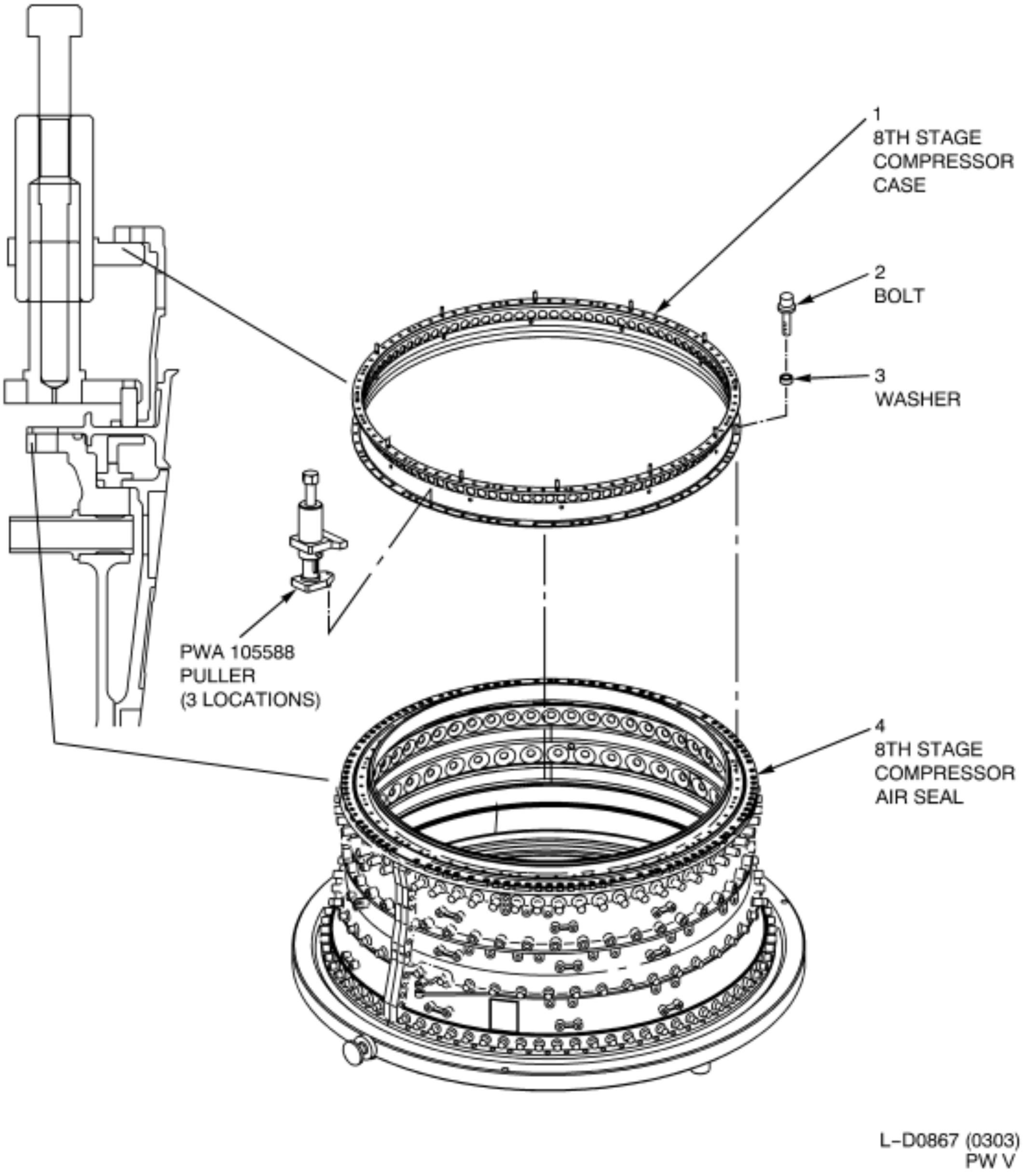
STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - DISASSEMBLY-01


STAGE 15 HPC AIR SEAL
STAGE 14 HPC CASE
STAGE 14 HPC AIR SEAL
STAGE 13 HPC CASE
STAGE 13 HPC AIR SEAL
STAGE 12 HPC CASE
STAGE 12 HPC AIR SEAL
STAGE 11 HPC CASE
STAGE 11 HPC AIR SEAL
STAGE 10 HPC CASE
STAGE 10 HPC AIR SEAL
STAGE 9 HPC CASE
STAGE 9 HPC AIR SEAL
STAGE 8 HPC CASE
STAGE 8 HPC AIR SEAL
HPC FRONT CASE SET
L-D0401 (1102)
PW V

HPC Outer Air Seal Set Cross Section
Figure 504
(Task 72-35-04-040-001)

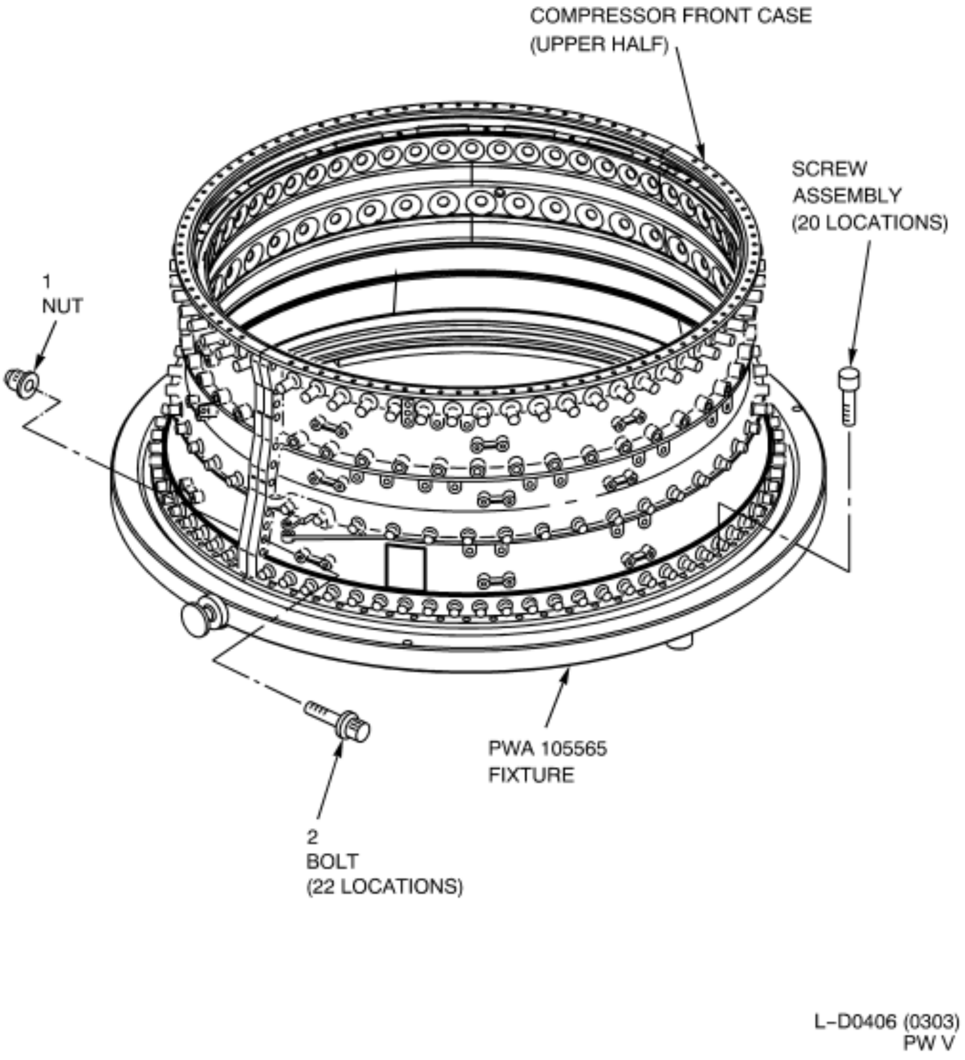

1
8TH STAGE
COMPRESSOR
CASE
2
NUT
3
WASHER
PWA 105588
PULLER
(3 LOCATIONS)
4
8TH STAGE
COMPRESSOR
AIR SEAL
L-D0866 (0303)
PW V

8th Stage Compressor Case Removal (Symmetric Case Configuration)
Figure 505 (Sheet 1)
(Task 72-35-04-040-001)


1
8TH STAGE
COMPRESSOR
CASE
2
BOLT
3
WASHER
PWA 105588
PULLER
(3 LOCATIONS)
4
8TH STAGE
COMPRESSOR
AIR SEAL
L-D0867 (0303)
PW V

8th Stage Compressor Case Removal (Asymmetric Case Configuration)
Figure 505 (Sheet 2)
(Task 72-35-04-040-001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − DISASSEMBLY−01


COMPRESSOR FRONT CASE
(UPPER HALF)
SCREW
ASSEMBLY
(20 LOCATIONS)
1
NUT
PWA 105565
FIXTURE
2
BOLT
(22 LOCATIONS)
L−D0406 (0303)
PW V

HPC Front Case Removal
Figure 506
(Task 72−35−04−040−001)

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STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-01

Task 72-35-04-440-001:

1. Assemble The HPC Outer Air Seal Set, Stages 5 Through 15

A. Prerequisites

(1) See 72-35-00, Inspection/Check-04, CONFIG-2 (Task 72-35-00-990-010) or, CONFIG-4 (Task 72-35-00-990-011) as applicable for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Necessary

Standard Tools:

Optional, Wrench (Extended Socket) Part No. QCL 5/16-2D-3/16 Used With Optional Cleco Air Gun	Brimatco Corporation P.O. Box 88 1486 Highland Ave. Cheshire, CT 06410 USA
Optional Cleco Air Gun (Nutrunner) PN 44RNAL-2-H-3, or PN 44RNAL-2RA8 Or Equivalent	Local Distributor Or, Cooper Tools Sales and Service P.O. Box 1410 Lexington, SC 29071-1410 USA
Optional, Flexible Extension Part No. GSYMU101 Or Equivalent	Snap-On Technologies Inc. P.O. Box 1430 Kenosha, WI 53141-1430 USA

NOTE: The optional Brimatco wrench (extended socket) PN QCL 5/16-2D-3/16 can be use with the Cleco Air Gun to help install the flange nuts on the 8th through 14th stage compressor cases.

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01

Special Tools:

PWA 76154	Adapter (2 Necessary)
PWA 86536	Adapter, Torque (HPC Front Case, Split Flange)
PWA 87485	Gage, Indicating (Concentricity Check)
PWA 88673	Sling
PWA 100221 "A"	Fixture, Machining
PWA 100379	Pin, Alignment (12th Stage Compressor Air Seal Installation)
PWA 102260	Adapter, Torque (9th Through 14th Stage Compressor Case Flange Nuts)
PWA 105504	Adapter, Lift (HPC Rear Case (Rear)
PWA 105506	Ring, Constraint (Concentricity Check)
PWA 105528	Spacer, Build (8th Stage Air Seal) (For The Symmetric Case C onfiguration)
PWA 105565	Fixture, Support
PWA 105609	Pin, Alignment (2 Necessary) (HPC Rear Case Installation)
PWA 105768	Spacer, Positioning (40 Necessary)

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−135	Tape, Reflective (PMC 4235)
P05−341	Tape, Plastic (Yellow) (PMC 4134)
P05−395	Beeswax
P05−396	Paraffin Wax Blend
P05−448	Masking Tape (Heavy) (PMC 4170)

C. Procedure

NOTE: The HPC outer air seal set (Stages 5 through 15) (called seal set) consists of the HPC front case set, 5th through 7th stage HPC shroud sets, 8th through 15th stage HPC air seal assemblies, 8th through 14th stage compressor case assemblies, and the HPC rear case set. These parts will be assembled and the air seals machined as a set. The seal set detail parts are identified by the Letter M followed by the last five digits of the HPC rear case serial number.

Subtask 72−35−04−440−001:

(1) Put the HPC rear case on a bench.

(a) Attach a hoist to the lift hole in PWA 105504 Adapter. Use the hoist to lift the Adapter and put it over the rear flange of the HPC rear case. Align the boltholes in the Adapter with the boltholes in the case. Install the Adapter to the HPC rear case with eight detail screw assemblies and four nut plates.

NOTE: The Adapter has a scribed line on the OD of the Adapter. Align this line with the offset hole in the HPC rear case (rear flange).

(b) Use the hoist to put the HPC rear case on a bench, rear (smaller ID flange) end up. Remove the screw assemblies and nut plates that attach the Adapter to the case. Remove the adapter from the case.

(2) Mark the outer air seal set part number and the mating number on the HPC rear case. See Figure 1001 (Sheet 1).

(a) Locate the 2 inch by 2 inch (50.800 mm by 50.800 mm) marking area on the outside wall of the case.

(b) If it is not there, write "SET" followed by the part number of the HPC outer air seal set. Use deep electrolytic etch by SPOP 401 (Task 70−11−00−280−006). or manual vibration peening. See 70−11−00, Standard Practices Manual, PN 585005.

(c) The seal set mating number is the Letter M followed by the last five digits of the HPC rear case serial number. If it is not on the marking area, deep electrolytic etch or manual vibration peen the Letter M followed by the last five digits of the HPC rear case serial number.

NOTE: The seal set mating number will be marked on all details of the seal set.

(3) If necessary, remove the work bolts that attach the upper and lower halves of the HPC front case assembly. Attach a suitable sling to a hoist and the rear flange of the HPC front case segment. Put both halves of the HPC front case assembly on a workbench, with the larger diameter flange end down, and the outer diameter toward the assembler. Remove the sling and hoist.

(4) Check the front case set for the same compressor case set mating number on the "UPPER and "LOWER" case segments. See Figure 1002.

NOTE: All markings are located on the outer face of the vertical mating flange or, on the OD of the case above the larger OD bolt flange.

(5) If it is not there, mark the seal set mating number on the HPC front case upper and lower segments adjacent to the part numbers.

NOTE: The seal set mating number is "M" followed by the last five digits of the HPC rear case serial number.

(a) If necessary, mark the mating number adjacent to the part number. Use the deep electrolytic etch method by SPOP 401 (Task 70−11−00−280−006) or manual vibration peening. Marks must be 0.090 inch (2.286 mm) minimum in height.

(6) If it is not there, put marks on the 5th stage shroud set details (all six pieces) to show the seal set mating number as follows:

NOTE: All markings are located on the convex side of the liner segments. The seal set mating number is "M" followed by the last five digits of the HPC rear case serial number.

(a) If necessary, put a mark to show the seal set mating number adjacent to the segment mating letters. Use deep electrolytic etch by SPOP 401 (Task 70−11−00−280−006) or manual vibration peening. See 70−11−00, Standard Practices Manual, PN 585005.

(b) Marks must be 0.090 inch (2.286 mm) minimum in height.

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01

(7) For the asymmetric case configuration, if they are not there, put marks on the 6th and 7th shroud set details (all 12 pieces) to show the seal set mating number as follows:

NOTE: All markings are located on the convex side of the liner segments. The seal set mating number is "M" followed by the last five digits of the HPC rear case serial number.

(a) If necessary, put a mark to show the seal set mating number adjacent to the segment mating letters. Use deep electrolytic etch by SPOP 401 (Task 70−11−00−280−006) or manual vibration peening. See 70−11−00, Standard Practices Manual, PN 585005.

(b) Marks must be 0.090 inch (2.286 mm) minimum in height.

(8) If it is not there, put a mark on each of the 8th through 15th stage compressor air seals to show the seal set mating number. See Figure 1003 (Sheet 1).

(a) If necessary, make a mark to show the seal set mating number. Put the mark on the rear side of the bolt flange between bolt holes adjacent to the prior part number mark.

NOTE: The HPC rear case mating number is "M" followed by the last five digits of the HPC rear case serial number.

(b) Use the deep electrolytic etch method by SPOP 401 (Task 70−11−00−280−006) or manual vibration peening. The marks must be 0.090 inch (2.286 mm) minimum in height. See 70−11−00, Standard Practices Manual, PN 585005.

(c) If you used the vibration peen method in the above step, you must remove any raised material.

(9) If it is not there, put a mark on each of the 8th through 14th stage compressor case assemblies to show the seal set mating number. See Figure 1003 (Sheet 1).

(a) If necessary, make a mark to show the seal set mating number. Put the mark on the rear side of the rear bolt hole flange, between bolt holes, in line with the prior part number mark.

NOTE: The HPC rear case mating number is "M" followed by the last five digits of the HPC rear case serial number.

NOTE: The rear flange of the case assemblies is the flange with dowel bolts.

(b) Use deep electrolytic etch method by SPOP 401 (Task 70−11−00−280−006) or manual vibration peening. The marks must be 0.090 inch (2.286 mm) minimum in height. See 70−11−00, Standard Practices Manual, PN 585005.

(10) If it is not there, put a mark on the HPC rear support to show the seal set mating number. See Figure 1003 (Sheet 1).

(a) Apply Masking Tape P05−448 to the radius surface of the HPC rear support to protect the aluminum coating.

(b) Put the mating number between boltholes adjacent to the part number. The mark must be 0.125 inch (3.175 mm) minimum from the edge of holes and the flange edge. Use deep electrolytic etch by SPOP 401 (Task 70−11−00−280−006) or manual vibration peening. Refer to 70−11−00, Standard Practices Manual, PN 585005.

NOTE: The HPC rear case mating number is "M" followed by the last five digits of the HPC rear case serial number.

(11) For the symmetric case configuration, if it is not there, put a mark on the HPC spacer set to show the seal set mating number. See Figure 1003 (Sheet 2).

(a) Put the mating number on the rear side (narrow mid flange) of the spacer set (both halves) between boltholes adjacent to the part number. Use deep electrolytic etch by SPOP 401 (Task 70−11−00−280−006) or manual vibration peening. The marks must be 0.090 inch (2.286 mm) minimum in height. Refer to 70−11−00, Standard Practices Manual, PN 585005.

NOTE: The HPC rear case mating number is "M" followed by the last five digits of the HPC rear case serial number.

(12) For the symmetric case configuration, if it is not there, put marks on the air seal support segment set to show the seal set mating number. See Figure 1003 (Sheet 3).

(a) Put the mating number on the OD of each of the support segments (four pieces) adjacent to the existing marks. The marks must be 0.090 inch (2.286 mm) minimum in height. Use deep electrolytic etch by SPOP 401 (Task 70−11−00−280−006) or manual vibration peening. Refer to 70−11−00, Standard Practices Manual, PN 585005.

NOTE: The HPC rear case mating number is "M" followed by the last five digits of the HPC rear case serial number.

Subtask 72−35−04−440−002:

(13) (For the symmetric and asymmetric case configurations) Install the 5th stage shroud set in the front case. See Figure 1004 (Sheet 1).

(a) Put the front case segments on a workbench, with the larger diameter bolt flange diameter down, and the inner diameter toward the assembler, with the upper segment on the assembler's right and the lower segment on the left.

NOTE: The segments are marked "UPPER" and "LOWER" on a pad on the outside of the case or on the edge of the split flange.

(b) Obtain the 5th stage shroud set. Make sure that all shroud segments have the same mating number and location letters are marked on the ends of the segments.

(c) Put the liner segments on the bench to form two semi−circles.

1 The semi−circle on the left (for the lower case) has segments with marks (from left to right) A−F, F−E, E−D.

2 The semi−circle on the right (for the upper case) has segments with marks (from left to right) D−C, C−B, B−A.

(d) Install the segments from the right semi−circle into the lower most slot in the ID of the case segment marked "UPPER". Start with the liner segment with the notched end, and insert the liner segment into the lower most slot in the ID of the case until the liner segment with the notched end is flush with the right vertical flange.

NOTE: The liner segments must be installed so that the mated ends are together (i.e. AA, BB, CC, etc.).

(e) Install the next liner segment so that the mating end will mate with the first liner segment. If necessary use a nylon drift to lightly tap on the end of the liner segment. Install the remaining liner segment.

(f) Make sure that the notched end of the liner segment at the right vertical flange is in the limit specified in Figure 1004 (Sheet 2).

(g) Install the segments from the left semi−circle into the lower most slot in the ID of the case segment marked "LOWER". Start with the liner segment with the notched end, and insert the liner segment into the lower most slot in the ID of the case until the liner segment is flush with the right vertical flange.

NOTE: The liner segments must be installed so that the mated ends are together (i.e. AA, BB, CC, etc.).

(h) Install the next liner segment so that the mating end will mate with the first liner segment. If necessary use a nylon drift to lightly tap on the end of the liner segment. Install the remaining liner segment.

(i) Make sure that the notched end of the liner segment at the right vertical flange is in the limit specified in Figure 1004.

(j) Install a lock, longer, bent end down and conferred side toward the liner segment (with the lock ends pointing inward) to fit into the groove on the right side of the case segment and press to install the lock. The lock must be flush with the vertical flange of the case segment. Repeat this procedure to install the remaining lock in the upper case segment. If necessary, use Beeswax P05−395 or Paraffin Wax Blend P05−396 to hold the locks in position.

(14) (For the asymmetric case configuration) Install the 6th stage shroud set in the front case. See Figure 1004 (Sheet 3).

(a) Put the front case segments on a workbench, with the larger diameter bolt flange diameter down, and the inner diameter toward the assembler, with the upper segment on the assembler's right and the lower segment on the left.

NOTE: The segments are marked "UPPER" and "LOWER" on a pad on the outside of the case or on the edge of the split flange.

(b) Obtain the 6th stage shroud set. Make sure that all shroud segments have the same mating number and location letters are marked on the ends of the segments.

(c) Put the liner segments on the bench to form two semi−circles.

1 The semi−circle on the left (for the lower case) has segments with marks (from left to right) A−F, F−E, E−D.

2 The semi−circle on the right (for the upper case) has segments with marks (from left to right) D−C, C−B, B−A.

(d) Install the segments from the right semi-circle into the lower most slot in the ID of the case segment marked "UPPER". Start with the liner segment with the notched end, and insert the liner segment into the lower most slot in the ID of the case until the liner segment with the notched end is flush with the right vertical flange.

NOTE: The liner segments must be installed so that the mated ends are together (i.e. AA, BB, CC, etc.).

(e) Install the next liner segment so that the mating end will mate with the first liner segment. If necessary use a nylon drift to lightly tap on the end of the liner segment. Install the remaining liner segment.

(f) Make sure that the notched end of the liner segment at the right vertical flange is in the limit specified in Figure 1004 (Sheet 2).

(g) Install the segments from the left semi-circle into the lower most slot in the ID of the case segment marked "LOWER". Start with the liner segment with the notched end, and insert the liner segment into the lower most slot in the ID of the case until the liner segment is flush with the right vertical flange.

NOTE: The liner segments must be installed so that the mated ends are together (i.e. AA, BB, CC, etc.).

(h) Install the next liner segment so that the mating end will mate with the first liner segment. If necessary use a nylon drift to lightly tap on the end of the liner segment. Install the remaining liner segment.

(i) Make sure that the notched end of the liner segment at the right vertical flange is in the limit specified in Figure 1004 (Sheet 2).

(j) Install a lock, longer, bent end down and conferred side toward the liner segment (with the lock ends pointing inward) to fit into the groove on the right side of the case segment and press to install the lock. The lock must be flush with the vertical flange of the case segment. Repeat this procedure to install the remaining lock in the upper case segment. If necessary, use Beeswax P05−395 or Paraffin Wax Blend P05−396 to hold the locks in position.

(15) (For the asymmetric case configuration) Install the 7th stage shroud set in the front case. See Figure 1004 (Sheet 4).

(a) Put the front case segments on a workbench, with the larger diameter bolt flange diameter down, and the inner diameter toward the assembler, with the upper segment on the assembler's right and the lower segment on the left.

NOTE: The segments are marked "UPPER" and "LOWER" on a pad on the outside of the case or on the edge of the split flange.

(b) Obtain the 7th stage shroud set. Make sure that all shroud segments have the same mating number and location letters are marked on the ends of the segments.

(c) Put the liner segments on the bench to form two semi−circles.

1 The semi−circle on the left (for the lower case) has segments with marks (from left to right) A−F, F−E, E−D.

2 The semi−circle on the right (for the upper case) has segments with marks (from left to right) D−C, C−B, B−A.

(d) Install the segments from the right semi−circle into the lower most slot in the ID of the case segment marked "UPPER". Start with the liner segment with the notched end, and insert the liner segment into the lower most slot in the ID of the case until the liner segment with the notched end is flush with the right vertical flange.

NOTE: The liner segments must be installed so that the mated ends are together (i.e. AA, BB, CC, etc.).

(e) Install the next liner segment so that the mating end will mate with the first liner segment. If necessary use a nylon drift to lightly tap on the end of the liner segment. Install the remaining liner segment.

(f) Make sure that the notched end of the liner segment at the right vertical flange is in the limit specified in Figure 1004 (Sheet 2).

(g) Install the segments from the left semi−circle into the lower most slot in the ID of the case segment marked "LOWER". Start with the liner segment with the notched end, and insert the liner segment into the lower most slot in the ID of the case until the liner segment is flush with the right vertical flange.

NOTE: The liner segments must be installed so that the mated ends are together (i.e. AA, BB, CC, etc.).

(h) Install the next liner segment so that the mating end will mate with the first liner segment. If necessary use a nylon drift to lightly tap on the end of the liner segment. Install the remaining liner segment.

(i) Make sure that the notched end of the liner segment at the right vertical flange is in the limit specified in Figure 1004 (Sheet 3).

(j) Install a lock, longer, bent end down and conferred side toward the liner segment (with the lock ends pointing inward) to fit into the groove on the right side of the case segment and press to install the lock. The lock must be flush with the vertical flange of the case segment. Repeat this procedure to install the remaining lock in the upper case segment. If necessary, use Beeswax P05−395 or Paraffin Wax Blend P05−396 to hold the locks in position.

CAUTION: THE FELTMETAL RUBSTRIPS MUST NOT BE EXPOSED TO ANY LUBRICANT PRIOR TO ENGINE INSTALLATION.

(16) (For the symmetric case configuration) install the 6th and 7th stage shroud set and the HPC spacer set to the HPC front case halves. See Figure 1005 (Sheet 1).

(a) Install the 6th and 7th stage shroud set (lower half) (1005/4) to the HPC front case (lower half) (1005/7), engaging the lip in shroud to groove in the HPC front case.

(b) Align the holes in the bolt flanges with the holes in the HPC front case and lower the spacer set (lower half) segment, wide mid−flange down, on the 6th and 7th stage shroud segment (1005/4).

(c) Apply Engine Oil P03−001 to ten bolts (1005/3).

(d) Install the ten lubricated bolts (1005/3) fingertight.

(e) Tighten and torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Repeat the above steps to install the 6th and 7th stage shroud (upper half) (1005/5) in the upper HPC front case half.

(g) Measure from the rear face of the front case rear flange to the upper face of the spacer at eight equally spaced locations. See Figure 1005 (Sheet 2).

(h) Record the average Dimension Y.

(17) Use Tape P05−135 to cover all variable vane trunnion holes on the ID surface of split case halves. Do not apply tape to any portion of the 5th through 7th stage liner segments or to the face and snap ID of the case at either end.

Subtask 72−35−04−440−003:

(18) Install the front case assembly on the PWA 105565 Support Fixture. See Figure 1006.

(a) Use a hoist to connect PWA 88673 Sling, with two PWA 76154 Adapters, to PWA 105565 Support Fixture. Use the hoist to put the Fixture, with the four support feet down, on a suitable build stand.

(b) Make sure that the locks are fully installed on the 5th stage shroud segments.

(c) Put the "UPPER" case segment over the support Fixture. Align the boltholes and lower the case onto the Fixture, with the split in the case at 90 and 270 degrees, and the top of the case at the top dead center 0 degree mark on the Fixture.

(d) Put the "LOWER" case segment over the support Fixture. Align the boltholes and lower the case onto the Fixture, with the split in the case at 90 and 270 degrees, and the bottom dead center of the case at the 180 degrees mark on the Fixture.

(e) Apply Engine Oil P03-001 to the 20 detail bolt assemblies of the PWA 105565 Support Fixture.

(f) Assemble the case segments to the Fixture with a minimum of three lubricated bolt assemblies (bolt heads up). Install the bolts in each half section (one at each end and one at the approximate center). Tighten the bolts fingertight.

(19) (Reference 1553) Assemble the two halves of the HPC front case set. See Figure 1006.

(a) Install 22 bolts (1006/2), bolt heads against the flange of the case marked "UPPER", and nuts (1006/1) to the vertical flanges of the case halves. Tighten the bolts fingertight.

NOTE: See Figure 1006 for the preferred bolt position. The bolts can be installed in a different direction to if necessary.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(b) Use PWA 86536 Adapter to torque the axial flange bolts (1006/2) to 565 - 595 lb-in. (63.836 - 67.226 N.m) in the following sequence.

(c) Start at Hole 1L and torque the bolts in the following sequence: 1L, 1R, 2L, 2R, 3L, 3R, 4L, 4R, 5L, 5R, 6L, 6R, 7L, 7R, 8L, 8R, 9L, 9R, 10L, 10R, 11L, 11R.

R NOTE: The flange bolt hole sequence starts at the middle as shown. The Letter L refers to the left axial flange. The Letter R refers to the right axial flange, aft, looking forward.

(d) Make sure that each axial flange is properly installed. A gap of 0.005 inch (0.127 mm) is permitted if the gap does not extend through the flange.

(e) Install the remaining Fixture detail bolts, threads lubricated with Engine Oil P03−001, through the case flange and into the Fixture. Assemble the nuts to install the case.

(f) Use an alternating pattern to tighten and torque the nuts that attach the case to the support to 250 − 270 lb−in. (28.246 − 30.506 N.m).

Subtask 72−35−04−440−004:

(20) For the symmetric case configuration, instal the air seal support segment set to the 8th stage compressor air seal. See Figure 1007 (Sheet 1).

(a) Obtain the 8th stage compressor (duct) air seal (1007/2) and the air seal support segment set (1007/5).

(b) Verify that the mating number on the parts is correct.

(c) Put the air seal (1007/2) on the work bench rear (longer flange end) up.

(d) Move in a clockwise direction and instal the support segment with the (−02) to the right of the timing mark on the air seal at the top (12 o'clock) position.

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01

(e) Align the holes and attach the support segment with two machine screws (1007/2) at Location K. See Figure 1007 (Sheets 2 and 4).

(f) Repeat the above steps and install the remaining three segments (−03), (−04), and (−05).

(g) Use a 0.001 inch (0.025 mm) feeler stock to check for gaps at the interface between the air seal support segments (1007/5) and the air seal (1007/2). See Figure 1007 (Sheet 1).

(h) If gaps are found, install up to eight PWA 105528 Spacers with nuts (1007/1), lubricated with Engine Oil P03−001, onto the bolts at the affected support segment. Tighten the nuts to 150 lbf−in. (16.948 N.m) maximum to close the gap. See Figure 1007 (Sheet 1).

(i) Turn the air seal assembly to the rear end down position. See Figure 1007 (Sheet 3).

(j) Measure the Distance D, at eight equally spaced locations.

(k) Record the average as Dimension D.

(l) Obtain the previously recorded Dimension Y.

(m) Subtract the Dimension D from the Dimension Y and record the result as Dimension M.

(n) Select the spacer class AF from Table 1001.

Dimension M	Spacer AF Class
0.019 − 0.020 Inch (0.483 − 0.508 mm)	1
0.021 − 0.023 Inch (0.534 − 0.584 mm)	2
0.024 − 0.026 Inch (0.610 − 0.660 mm)	3
0.027 − 0.029 Inch (0.686 − 0.736 mm)	4

Determine Spacer Class
Table 1001

(CONTINUED)

Dimension M	Spacer AF Class
0.030 - 0.032 Inch (0.762 - 0.812 mm)	5
0.033 Inch (0.838 mm)	6

Determine Spacer Class
Table 1001 (Continued)

(o) Starting at the (-05) segment, disassemble each support segment and install the correct classified spacer (1007/3) (ovalized hole to the assemblers left) and reassemble with two machine screws (1007/2) in each segment. See Figure 1007 (Sheet 4).

(21) Install the 8th stage compressor air seal onto the HPC front case assembly. See Figure 1008 (Sheet 1 or 2) as applicable.

(a) Make sure that the air seal (1008/1) has the correct seal set mating number.

(b) Locate the reference line on the OD of the air seal flange.

NOTE: The 8th stage air seal Flange OD has a reference line at the approximate 12 o'clock position.

(c) Put the air seal (shorter leg of rubstrip down) on the rear flange of the HPC front case.

(d) Align the offset hole in the air seal inner bolt hole pattern with the offset hole in the HPC front case rear flange. This is at approximately the 12 o'clock (0 degree) position.

(e) Install a minimum of 40 PWA 105768 Spacers, equally spaced, between the 8th stage air seal (1008/1) and the rear flange of the HPC front case.

(22) Install the 8th stage compressor case. See Figure 1009 (Sheet 1 or 2) as applicable.

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01

(a) Make sure that the case (1009/1) has the correct seal set mating number.

(b) Install the case (1009/1), rear flange with bolts up, on the 8th stage air seal. Align the offset hole in the front flange of the case with the offset hole in the 8th stage air seal.

NOTE: The 8th stage case rear Flange OD has a reference line at the approximate 12 o'clock position. Align the offset hole in the front flange of the case with the offset hole in the 8th stage air seal.

(c) Make sure that the mating surfaces are clean. If necessary, use shop air to remove unwanted material.

(d) For the symmetric case configuration, apply Engine Oil P03−001 to the 32 nuts (1009/2). See Figure 1009 (Sheet 1).

(e) For the symmetric case configuration, install 16 lubricated nuts (1009/2) and washers (1009/3), eight pairs equally spaced, to the bolts through the front flange of the 8th stage case (1009/1).

NOTE: If necessary you can use a Snap−On Extended Socket PN GSYMU101 to install the nuts.

(f) For the asymmetric case configuration, apply Engine Oil P03−001 to the 32 bolts (1009/2). See Figure 1009 (Sheet 1).

(g) For the asymmetric case configuration, install 16 lubricated bolts (1009/2) and washers (1009/3), eight pairs equally spaced, to the through the boltsholes in the front flange of the 8th stage case (1009/1).

(h) Tighten and torque 16 nuts (1009/2) or bolts (1009/2) total as applicable, eight pairs at Location R, in the special sequence shown in Figure 1010 to 140 − 150 lb−in. (15.818 − 16.948 N.m).

(i) Install the remaining 16 lubricated nuts (1009/2), and washers (1009/3), equally spaced, to the bolts through the front flange of the 8th stage case (1009/1).

(j) Use an alternating pattern (180 degrees apart) to tighten and torque the remaining nuts (1009/2) to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten the nuts until no loss of torque occurs.

(k) Apply Tape P05−341 to the OD of the case to cover all through holes.

Subtask 72−35−04−440−005:

(23) Install the 9th stage compressor air seal assembly. See Figure 1011.

(a) Make sure that the air seal has the correct seal set mating number.

(b) Install the 9th stage air seal (1011/1), longer leg of air seal down, onto the 8th stage compressor case. Align the offset hole of the air seal with the offset hole in the rear flange of the 8th stage case at approximately the 12 o'clock position.

NOTE: The 9th stage air seal Flange OD has a reference line at the approximate 12 o'clock position. Align the air seal reference line with the reference line on the OD of the 8th stage case.

(c) Apply Engine Oil P03−001 to a minimum of 30 work bolts.

(d) Install a minimum of 30 lubricated work bolts (boltheads down), washers (1011/3), and work nuts (1011/2) equally spaced into the 9th stage air seal flange.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(e) Use an alternating pattern (180 degrees apart) to tighten and torque the nuts to 140 − 150 lb−in.

(15.818 − 16.948 N.m) to seat the air seal. Continue to tighten the nuts until no loss of torque occurs.

NOTE: You can use the PWA 102260 Adapter to torque the case flange nuts for all stages.

(f) Remove the work bolts, washers, and nuts.

(24) Install the 9th stage compressor case assembly. See Figure 1012.

(a) Make sure that the case has the correct seal set mating number.

(b) Install the case (1012/1), rear flange with bolts up, on the 9th stage air seal. Align the offset hole in the front flange of the case with the offset hole in the 9th stage air seal.

NOTE: The 9th stage case rear Flange OD has a reference line at the approximate 12 o'clock position. Align the reference line on the case with the reference line on the OD of the 9th stage air seal.

(c) Make sure that the mating surfaces are clean. If necessary, use shop air to remove unwanted material.

(d) Apply Engine Oil P03−001 to the 32 bolts.

(e) Install 32 lubricated bolts (boltheads down), washers (1012/3), and nuts (1012/2), 16 pairs equally spaced through the boltholes in the front flange of the 9th stage case.

(f) Tighten and torque 16 nuts, eight pairs at Location R, in the sequence shown in Figure 1010 to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten nuts until no loss of torque occurs.

NOTE: You can use the PWA 102260 Adapter to torque the flange nuts for all stages.

(g) Use an alternating pattern 180 degrees apart to tighten and torque the remaining nuts to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten the nuts until no loss of torque occurs.

(h) Apply Tape P05−341 to the OD of the case to cover all through holes.

Subtask 72−35−04−440−006:

(25) Install Install the 10th stage compressor air seal assembly.

(a) Make sure that the air seal has the correct seal set mating number.

(b) Install the 10th stage air seal, longer leg of the air seal down, on the 9th stage case. Align the offset hole in the air seal, at the approximate 12 o'clock position, with the offset hole in the rear flange of the 9th stage case.

NOTE: The 10th stage air seal Flange OD has a reference line at the approximate 12 o'clock position. Align the air seal reference line with the reference line on the OD of the 9th stage case.

(c) Apply Engine Oil P03−001 to a minimum of 30 work bolts.

(d) Install a minimum of 30 lubricated work bolts (boltheads down), washers, and nuts equally spaced into the 10th stage air seal flange.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(e) Use an alternating pattern (180 degrees apart) to tighten and torque the nuts to 140 − 150 lb−in. (15.818 − 16.948 N.m) to seat the air seal. Continue to tighten the nuts until no loss of torque occurs.

(f) Remove the work bolts, washers, and nuts.

(26) Install the 10th stage compressor case assembly.

(a) Make sure that the case has the correct seal set mating number.

(b) Install the case, rear flange with bolts up, on the 10th stage air seal. Align the offset hole in the front flange of the case with the offset hole in the 10th stage air seal.

NOTE: The 10th stage case rear Flange OD has a reference line at the approximate 12 o'clock position. Align the reference line on the case with the reference line on the OD of the 10th stage air seal.

(c) Make sure that the mating surfaces are clean. If necessary, use shop air to remove unwanted material.

(d) Apply Engine Oil P03−001 to the 32 bolts you will use to install the 10th stage case.

(e) Install 32 lubricated bolts (boltheads down), washers (two under each nut), and nuts, 16 pairs equally spaced through the boltholes in the front flange of the 10th stage case.

NOTE: Do not install a bolt in the bolthole just to the left of the borescope boss and the bolthole just to the right clockwise of the 6th stage anti−rotation lug at this time.

(f) Tighten and torque 16 nuts, eight pairs at Location R, in the sequence shown in Figure 1010 to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten nuts until no loss of torque occurs.

(g) Use an alternating pattern 180 degrees apart to tighten and torque the remaining nuts to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten the nuts until no loss of torque occurs.

(h) Apply Tape P05−341 to the OD of the case to cover all through holes.

Subtask 72−35−04−440−007:

(27) Install the 11th stage compressor air seal assembly.

(a) Make sure that the air seal has the correct seal set mating number.

(b) Install the 11th stage air seal, larger OD and shorter leg of the air seal down, on the 10th stage case. Align the offset hole in the 11th stage air seal with the offset hole in the rear flange of the 10th stage case.

NOTE: The 11th stage air seal Flange OD has a reference line at the approximate 12 o'clock position. Align the reference line on the air seal with the reference line on the rear Flange OD of the 10th stage case.

(c) Apply Engine Oil P03−001 to a minimum of 30 work bolts.

(d) Install a minimum of 30 work bolts (boltheads down), washers, and nuts equally spaced into the 11th stage air seal flange.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(e) Use an alternating pattern (180 degrees apart) to tighten and torque the nuts to 140 − 150 lb−in. (15.818 − 16.948 N.m) to seat the air seal. Continue to tighten the nuts until no loss of torque occurs.

(f) Remove the work bolts, nuts and washers.

(28) Install the 11th stage compressor case assembly.

(a) Make sure that the case has the correct seal set mating number.

(b) Install the case, rear (larger OD) flange up, on the 11th stage air seal. Align the offset hole in the front flange of the case with the offset hole in the 11th stage air seal.

NOTE: The 11th stage case rear Flange OD has a reference line at the approximate 12 o'clock position. Align the reference line on the case with the reference line on the OD of the 11th stage air seal.

(c) Make sure that the mating surfaces are clean. If necessary, use shop air to remove unwanted material.

(d) Apply Engine Oil P03−001 to the 32 bolts you will use to install the 11th stage case.

(e) Install 32 lubricated bolts (boltheads down), washers, and nuts, 16 pairs equally spaced through the boltholes in the front flange of the 11th stage case.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(f) Use a PWA 102260 Torque Adapter with a 3/8 inch drive to tighten and torque 16 nuts, eight pairs at Location R, in the sequence shown in Figure 1010 to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten nuts until no loss of torque occurs.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(g) With the Torque Adapter, use an alternating pattern 180 degrees apart to tighten and torque the remaining nuts to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten the nuts until no loss of torque occurs.

(h) Apply Tape P05−341 to the OD of the case to cover all through holes.

Subtask 72−35−04−440−008:

(29) Install the 12th stage compressor air seal assembly. See Figure 1013.

(a) Install three PWA 100379 Alignment Pins equally spaced in the larger, 0.300 inch (7.620 mm), boltholes in the rear flange of the 11th stage case.

(b) Make sure that the air seal has the correct seal set mating number.

(c) Install the 12th stage air seal (1013/1) (larger OD of the air seal down) on the 11th stage compressor case. Align the offset hole in the air seal with the offset hole in the rear flange of the 11th stage case.

NOTE: The 12th stage compressor air seal Flange OD has a reference line at the approximate 12 o'clock position. Align the reference line on the air seal with the reference line on the rear Flange OD of the 11th stage case.

(d) Apply Engine Oil P03−001 to a minimum of 30 work bolts.

(e) Install a minimum of 30 work bolts (boltheads up), washers, and nuts equally spaced into boltholes in the 12th stage air seal flange.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(f) Use an alternating pattern (180 degrees apart) to tighten and torque the nuts to 140 − 150 lb−in. (15.818 − 16.948 N.m) to seat the air seal. Continue to tighten the nuts until no loss of torque occurs.

(g) Remove the Alignment Pins, work bolts, washers, and nuts.

(30) Install the 12th stage compressor case assembly.

(a) Make sure that the case has the correct seal set mating number.

(b) Install the case, larger OD flange down, on the 12th stage air seal. Align the offset hole in the front flange of the case with the offset hole in the air seal.

NOTE: The 12th stage compressor rear Flange OD has a reference line at the approximate 12 o'clock position. Align the reference line on the case with the reference line on the OD of the 12th stage air seal.

(c) Make sure that the mating surfaces are clean. If necessary, use shop air to remove unwanted material.

(d) Apply Engine Oil P03−001 to the 32 bolts you will use to install the 12th stage case.

(e) Install the 32 lubricated bolts (boltheads up), washers, and nuts, 16 pairs equally spaced through the boltholes in the front flange of the 12th stage case.

(f) Tighten and torque 16 nuts, eight pairs at Location R, in the sequence shown in Figure 1010 to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten nuts until no loss of torque occurs.

(g) Use an alternating pattern 180 degrees apart to tighten and torque the remaining nuts to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten the nuts until no loss of torque occurs.

(h) Apply Tape P05−341 to the OD of the case to cover all through holes.

Subtask 72−35−04−440−009:

(31) Install the 13th stage compressor air seal assembly.

(a) Make sure that the air seal has the correct seal set mating number.

(b) Place the 13th stage compressor air seal (larger ID and longer leg of the rubstrip down) on the 12th stage compressor case. Align the offset hole of the 13th stage air seal with the offset hole in the rear flange of the 12th stage case.

NOTE: The 13th stage compressor air seal Flange OD has a reference line at the approximate 12 o'clock position. Align the reference line on the air seal with the reference line on the rear Flange OD of the 12th stage case.

(c) Apply Engine Oil P03−001 to a minimum of 30 work bolts.

(d) Install a minimum of 30 work bolts (boltheads down), washers, and nuts equally spaced into boltholes in the 13th stage air seal flange.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(e) Use an alternating pattern (180 degrees apart) to tighten and torque the nuts to 140 − 150 lb−in. (15.818 − 16.948 N.m) to seat the air seal. Continue to tighten the nuts until no loss of torque occurs.

(f) Remove the work bolts, nuts, and washers.

(32) Install the 13th stage compressor case assembly.

(a) Make sure that the case has the correct seal set mating number.

(b) Install the case, rear flange with bolts up, on the 13th stage air seal. Align the offset hole in the front flange of the case with the offset hole in the air seal.

NOTE: The 13th stage compressor case rear Flange OD has a reference line at the approximate 12 o'clock position. Align the reference line on the case with the reference line on the OD of the 13th stage air seal.

(c) Make sure that the mating surfaces are clean. If necessary, use shop air to remove unwanted material.

(d) Apply Engine Oil P03−001 to the 24 bolts you will use to install the 13th stage case.

(e) Install 24 lubricated bolts (boltheads down), washers, and nuts, 16 pairs equally spaced through the boltholes in the front flange of the 13th stage case.

(f) Apply Engine Oil P03−001 to the 12 nuts you will use to install the 13th stage case.

(g) Install 12 washers and lubricated nuts to the dowel bolts in the front flange of the 13th stage case fingertight.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(h) Tighten and torque the 16 nuts, eight pairs at Location R, in the sequence shown in Figure 1010 to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten the nuts until no loss of torque occurs.

(i) Use an alternating pattern 180 degrees apart to tighten and torque the remaining nuts to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten the nuts until no loss of torque occurs.

(j) Apply Tape P05−341 to the OD of the case to cover all through holes.

Subtask 72−35−04−440−010:

(33) Install the 14th stage compressor air seal assembly.

(a) Make sure that the air seal has the correct seal set mating number.

(b) Place the 14th stage compressor air seal (larger ID rubstrip down) on the 13th stage compressor case. Align the offset hole of the 14th stage air seal with the offset hole in the rear flange of the 13th stage case.

NOTE: The 14th stage air seal Flange OD has a reference line at the approximate 12 o'clock position. Align the reference line on the air seal with the reference line on the rear Flange OD of the 13th stage case.

(c) Apply Engine Oil P03−001 to a minimum of 30 work bolts.

(d) Install a minimum of 30 work bolts (boltheads down), washers and nuts equally spaced into boltholes in the 14th stage air seal flange.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(e) Use an alternating pattern (180 degrees apart) to tighten and torque the nuts to 140 − 150 lb−in. (15.818 − 16.948 N.m) to seat the air seal. Continue to tighten the nuts until no loss of torque occurs.

(f) Remove the work bolts, washers, and nuts.

(34) Install the 14th stage compressor case assembly.

(a) Make sure that the case has the correct seal set mating number.

(b) Install the case, rear flange with bolts up, on the 14th stage air seal. Align the offset hole in the front flange of the case with the offset hole in the 14th stage air seal.

NOTE: The 14th stage case rear Flange OD has a reference line at the approximate 12 o'clock position. Align the reference line on the case with the reference line on the OD of the 14th stage air seal.

(c) Make sure that the mating surfaces are clean. If necessary, use shop air to remove unwanted material.

(d) Apply Engine Oil P03−001 to the 32 bolts you will use to install the 14th stage case.

(e) Install 32 lubricated bolts (boltheads down), washers (above the flange) and nuts, 16 pairs equally spaced, to the boltholes in the front flange of the 14th stage case.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(f) Tighten and torque the 16 nuts, eight pairs at Location R, in the sequence shown in Figure 1010 to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten the nuts until no loss of torque occurs.

(g) Use an alternating pattern (180 degrees apart), to tighten and torque the remaining nuts to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten the nuts until there is no loss of torque.

(h) Apply Tape P05−341 to the OD of the case to cover all through holes.

Subtask 72−35−04−440−011:

(35) Install the 15th stage compressor air seal assembly.

(a) Make sure that the air seal has the correct seal set mating number.

(b) Install the 15th stage air seal, heat shield retaining leg down, onto the 14th stage case. Align the offset hole in the air seal with the offset hole in the rear flange of the 14th stage case, at the approximate 12 o'clock position.

NOTE: The 15th stage air seal Flange OD has a reference line at the approximate 12 o'clock position. Align the reference line on the air seal with the reference line on the rear Flange OD of the 14th stage case.

(c) Apply Engine Oil P03−001 to a minimum of 30 work bolts.

(d) Install a minimum of 30 equally spaced lubricated work bolts, washers, under boltheads, into the 15th stage air seal flange.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(e) Use an alternating pattern (180 degrees apart) to tighten and torque the bolts to 140 − 150 lb−in. (15.818 − 16.948 N.m) to seat the air seal. Continue to tighten the nuts until no loss of torque occurs.

(f) Remove the work bolts and washers.

(g) At the 15th stage air seal Flange OD reference line location, make a temporary mark on the inner flange face of the air seal. Refer to 70−11−00, Standard Practices Manual, PN 585005.

NOTE: The 15th stage air seal Flange OD has a reference line at the approximate 12 o'clock position.

Subtask 72−35−04−440−012:

(36) Temporarily assemble the HPC rear support to the HPC rear case. See Figure 1014 (Sheet 1).

(a) Attach a hoist to the lift hole in the PWA 105504 Adapter.

(b) Use the hoist to lift the Adapter and put it over the rear flange of HPC rear case (1014/3) (smaller ID flange with nut plates).

(c) Align the boltholes in the Adapter with the boltholes in the HPC rear case (1014/3).

NOTE: The Adapter has a scribed line on the OD of the outer ring. Align this line with the offset hole in the rear flange of the HPC rear case.

(d) Install the Adapter to the HPC rear case (1014/3) with eight detail screw assemblies and four nut plates.

(e) Use the hoist to put the HPC rear case (1014/3) on a bench, with the case rear flange (smaller ID flange with nut plates) end up.

(f) Remove the screw assemblies and nut plates that attach the Adapter to the HPC rear case (1014/3), and remove the Adapter from the case.

(g) Make sure that the HPC rear support (1014/1) has the correct seal set mating number.

CAUTION: YOU CAN MIS−ASSEMBLE THE REAR SUPPORT ON THE HPC REAR CASE AND DAMAGE TO THE CASE AND/OR SUPPORT CAN OCCUR.

(h) Find the "X" mark on the rear inner flange of the HPC rear case (1014/3). This is at approximately the 12 o'clock position.

(i) Make a temporary mark on the outer flange of the case at the "X" location. Refer to 70−11−00, Standard Practices Manual, PN 585005.

(j) Find the reference 0.125 inch (3.175 mm) diameter non−through hole in the outer flange, rear face, of the HPC rear support (1014/1). This reference diameter is approximately at the 12 o'clock position.

(k) Use the reference diameter on the HPC rear support and the reference mark on the HPC rear case flange to align the boltholes in the HPC rear case rear flange and lower the rear support (1014/1) onto the HPC rear case (1014/3). See Figure 1014 (Sheet 1).

(l) Apply Engine Oil P03−001 to eight work bolts (.250−28), approximately 1 inch (25.400 mm) long, you will use to temporarily install in the HPC rear support (1014/1) to the HPC rear case (1014/3).

CAUTION: DO NOT USE AIR TOOLS TO TIGHTEN BOLTS INTO NUT PLATES OR DAMAGE TO THE MATING PARTS CAN OCCUR.

(m) Install the eight lubricated work bolts (1014/2) and washers equally spaced at Positions BD in the HPC rear support outer flange. Run down the bolts to just touch the flange face of the HPC rear support (1014/1). See Figure 1014 (Sheet 1) and Figure 1014 (Sheet 2).

NOTE: Based on operators experience, additional bolts and washers can be used to install the HPC rear support outer flange to the HPC rear case.

(37) Install two PWA 105609 Alignment Pins to the front flange of the HPC rear case. See Figure 1014 (Sheet 3).

  (a) Install one pin at the jackscrew hole at the 4 o'clock position, and the second pin at the 7 o'clock position.

  (b) To install the pin, remove the detail pin from the detail plate.

  (c) Position the screw and plate into the jackscrew hole at the front (lower) side of the rear flange of the HPC front case rear flange.

  (d) Align the threaded hole with the bolthole next to the jackscrew hole, and install the detail pin through the bolthole and thread it into the threaded hole in the detail plate.

  (e) Tighten the knurled screw to attach the pin to the case.

(38) Install the HPC rear case to the 8th stage compressor.

  (a) Install the PWA 105504 Adapter to the HPC rear case. See Figure 1014 (Sheet 4).

    1 Attach a hoist to the lift hole in the PWA 105504 Adapter.

    2 Use the hoist to lift and put the Adapter over the HPC rear case.

    NOTE: The Adapter has a scribed line on the OD of the outer ring. Align this line with the offset hole in the rear flange of the HPC rear case.

    3 Align the boltholes in the Adapter with the boltholes in the case.

    4 Install the Adapter to the HPC rear case with eight detail screw assemblies and four nut plates.

CAUTION: YOU CAN MIS−ASSEMBLE THE HPC REAR SUPPORT ON THE 15TH STAGE OUTER AIR SEAL IF YOU DO NOT PROPERLY ALIGN THE 12 O'CLOCK MARKS.

(b) Use the hoist to carefully lower the HPC rear case and rear support assembly over the 8th through 15th stage case assembly.

(c) Use the rear support as a guide to align the 12 o'clock position on the HPC rear case with the top dead center (TDC) on the 15th stage compressor air seal.

(d) Align the hole next to the reference hole in the OD flange of the rear support with the line on the 15th stage air seal OD, and lower the HPC rear case front flange onto the 8th stage air seal.

(e) Remove the screw assemblies and nut plates that attach the Adapter to the HPC rear case.

(f) Remove the Adapter from the case.

CAUTION: YOU CAN DAMAGE THE HPC REAR SUPPORT IF YOU DO NOT REMOVE BOLTS THAT ATTACH THE HPC REAR SUPPORT TO THE HPC REAR CASE.

(g) Remove all bolts that were used to attach the HPC rear support to the HPC rear case.

(h) Apply Engine Oil P03−001 to 89 work bolts (5/16−18 X 1 1/2 L) you will install in the boltholes in Flange H.

(i) Install a minimum of 40 equally spaced lubricated work bolts (bolt heads up), with washers, into the boltholes in Flange H. Install washers and nuts to the work bolts. See Figure 1014 (Sheet 5).

(j) Make sure that there is a minimum of one PWA 105768 Spacer next to each work bolt before you install the HPC rear case front flange to the 8th stage compressor air seal.

CAUTION: YOU CAN DAMAGE THE HPC REAR SUPPORT IF YOU DO NOT TIGHTEN THE WORK BOLTS EVENLY.

(k) You must monitor the HPC rear support while you tighten the bolts to make sure you install the HPC rear case evenly.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TOO MUCH TORQUE CAN DAMAGE THE PARTS.

(l) Use an alternating pattern (180 degrees apart) to tighten and torque the work bolts to 190 − 210 lb−in. (21.467 − 23.727 N.m). Continue to tighten the bolts until no loss of torque occurs.

(m) Loosen all of the work bolts used to install the HPC rear case front flange to the 8th stage air seal.

NOTE: Do not remove the bolts, washers, and nuts from Flange H.

(n) Remove all of the PWA 105768 Spacers located between the HPC front (split) case and the 8th stage air seal.

NOTE: You can use jackscrews in the HPC front (split) case to lift the seal set assembly weight off of the assembly Spacers. This can help you remove the assembly Spacers. Remove the jackscrews.

(39) Install the 8th stage air seal and HPC rear case to the HPC front case.

(a) Remove the two Alignment Pins from Flange H.

(b) Install the 49 remaining lubricated work bolts (bolt heads up), with washers, into the remaining boltholes in Flange H. Install washers and nuts to the work bolts.

(c) Use an alternating pattern (180 degrees apart) to tighten and torque all of the bolts in Flange H to 190 − 210 lb−in. (21.467 − 23.727 N.m). Continue to tighten the bolts until no loss of torque occurs.

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01

Subtask 72−35−04−440−013:

(40) Remove the HPC rear support from the HPC rear case assembly. If necessary, you can use jackscrews to remove the rear support from the HPC rear case.

(41) Inspect the air seal set for concentricity. See Figure 1015 (Sheet 1).

(a) Use a suitable sling to put the PWA 105506 Constraint Ring (step side down) over the rear flange of the HPC rear case.

(b) Align the dowel pin in the ring with the offset (dowel pin) hole in the HPC rear case rear flange at the 180 degree position of the HPC rear case, and lower the ring onto the case.

NOTE: The dowel pin in the Constraint Ring is at the 180 degree position.

(c) Use 12 cap screws (boltheads up), washers (under nuts), and nuts to install the Ring to the case.

(d) Use an alternating pattern (180 degrees apart) to tighten the bolts to install the Ring onto the case.

(e) Make sure that the Ring is against the rear flange of the HPC rear case.

(42) Put the PWA 87485 Gage on the rear of the Constraint Ring, with the two dowel pins on the bottom of the Gage against the outside diameter of the Constraint Ring. See Figure 1015 (Sheet 1).

(a) Adjust the detail indicator so it touches the OD snap diameter of the 15th stage air seal.

(b) Take measurements at 12 equally spaced locations on the OD of the 15th stage air seal.

(c) Make sure that the snap diameter of the 15th stage air seal is concentric to the HPC rear case within 0.020 inch (0.508 mm) at all 12 locations. See Figure 1015 (Sheet 2).

(d) Remove the Gage.

(43) Remove the Constraint Ring from the HPC rear case.

(a) Remove the cap screws, nuts, and washers that attach the Constraint Ring to the HPC rear case.

(b) Install jackscrews into six equally spaced threaded hole locations in the rear flange of the HPC rear case.

(c) Turn the jackscrews equally and evenly to loosen the Constraint Ring.

(d) Use a suitable sling and hoist to remove the Constraint Ring from the HPC rear case.

(e) Remove the jackscrews form the rear flange of the HPC rear case.

Subtask 72−35−04−440−014:

(44) Determine the rear support spacer thickness.

(a) Put a parallel bar across the rear face of the HPC rear case. See Figure 1016.

(b) Use a depth micrometer to measure the distance from the parallel bar to the rear face of the HPC rear case inner flange (inner bolt hole pattern) at eight equally spaced locations. Record the average of the eight distances as Dimension D.

(c) Use the same parallel bar to measure the distance from the parallel bar to the rear face of the 15th stage air seal bolt hole flange at eight equally spaced locations. Record the average of the eight readings as Dimension E.

(d) (Reference 1580) Subtract the Dimension D from Dimension E and record the result as Dimension M.

(e) Use Dimension M to determine the correct class of Spacer AB. Refer to Table 1002.

Dimension M	Spacer AB Class
0.236 − 0.241 inch (5.995 − 6.121 mm)	1
0.230 − 0.235 inch (5.842 − 5.969 mm)	2
0.224 − 0.229 inch (5.690 − 5.816 mm)	3
0.218 − 0.223 inch (5.538 − 5.664 mm)	4
0.212 − 0.217 inch (5.385 − 5.511 mm)	5
0.206 − 0.211 inch (5.233 − 5.359 mm)	6
0.200 − 0.205 inch (5.080 − 5.207 mm)	7
0.194 − 0.199 inch (4.928 − 5.054 mm)	8
0.188 − 0.193 inch (4.776 − 4.902 mm)	9

Determine Spacer Class
Table 1002

Subtask 72−35−04−440−015:

(45) Install the HPC rear support (1017/3). See Figure 1017 (Sheet 1).

(a) Install one of the correct spacer class Spacer AB (1017/4) with the ovalizied hole at the bottom (6 o'clock) position of the HPC rear case inner rear flange, then install the seven remaining spacers onto the flange.

(b) Make sure that the HPC rear support (1017/3) has the correct seal set mating number.

CAUTION: YOU CAN MIS−ASSEMBLE THE HPC REAR SUPPORT ON THE 15TH STAGE COMPRESSOR AIR SEAL IF THE HOLES WITH THE MARKINGS ARE NOT PROPERLY ALIGNED.

(c) Align the offset bolt hole in the HPC rear support (1017/3) with the bolt hole in the HPC rear case and 15th stage air seal.

NOTE: The HPC rear support has a reference spherical radius at the approximate 12 o'clock position.

(d) With the boltholes aligned, lower the HPC rear support (1017/3) onto the inner flange of the HPC rear case and the 15th stage air seal.

(e) Apply Engine Oil P03−001 to the 64 work bolts (1017/1).

CAUTION: DO NOT USE AIR TOOLS TO TIGHTEN NUTS ON DOWEL BOLTS OR BOLTS INTO NUT PLATES OR DAMAGE TO THE MATING PARTS CAN OCCUR.

(f) Install eight lubricated work bolts (1017/1) and washers (1017/2) equally spaced at Positions BD in the HPC rear support outer flange. Run down the bolts to just touch the flange face. See Figure 1017 (Sheets 1 and 2).

(g) Apply Engine Oil P03−001 to 18 bolts (1017/7).

(h) Install 18 lubricated work bolts (1017/7) and washers (1017/8) to the HPC rear support inner flange. Bolts are not necessary at Locations AU. See Figure 1017 (Sheets 1 and 3).

(i) Apply Engine Oil P03−001 to 24 work nuts (1017/5).

(j) Install 48 washers (1017/6) two on each dowel bolt, and work nuts (1017/5) to the 24 dowel bolts in the inner flange of the HPC rear support (1017/3). Tighten the nuts fingertight.

NOTE: You can use non−self locking work nuts to prevent over stressing the bill of material parts.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TOO MUCH TORQUE CAN DAMAGE THE PARTS.

(k) Use an alternating pattern 180 degrees apart to tighten and torque the inner flange work bolts (1017/7) to 140 − 150 lb−in. (15.818 − 16.948 N.m). Continue to tighten the bolts until no loss torque occurs.

(l) Install the remaining lubricated work bolts (1017/1) and washers (1017/2) to the HPC rear support outer flange.

CAUTION: WITH A TORQUE ADAPTER, ADJUST THE ACTUAL TORQUE WRENCH READING. TWO MUCH TORQUE CAN DAMAGE THE PARTS.

(m) Torque the 64 outer flange bolts (1017/1) to 105 − 115 lb−in. (11.863 − 12.993 N.m) using an alternating pattern 180 degrees apart. Continue to tighten the bolts until no loss torque occurs.

Subtask 72−35−04−440−016:

(46) Install PWA 100221 Machining Fixture. See Figure 1018.

(a) Make sure that the trunnion spools of the PWA 100221 Machining Fixture are in the INSTALL/REMOVE position.

(b) If necessary, remove the trunnion spool assembly and move them to the INSTALL/REMOVE position, torque the bolts.

(c) Use a hoist to attach the PWA 88673 Sling with two PWA 76154 Adapters to the Fixture.

(d) Use the hoist to put the Fixture (flat side up) over the case assembly.

CAUTION: USE CARE WHEN YOU INSTALL THIS FIXTURE TO PREVENT DAMAGE TO THE HPC REAR SUPPORT.

(e) Align the "TDC" mark on the Fixture with the 12 o'clock position of the case. Make sure that the dowel bolts in the 15th stage air seal are aligned with the mating holes in the Fixture. Align the boltholes and carefully lower the Fixture onto the case assembly.

(f) Install the 12 detail bolts (heads up) (1018/1) through the Fixture and into the HPC rear case. Install the detail spacers (1018/2) (under nuts) and nuts (1018/3).

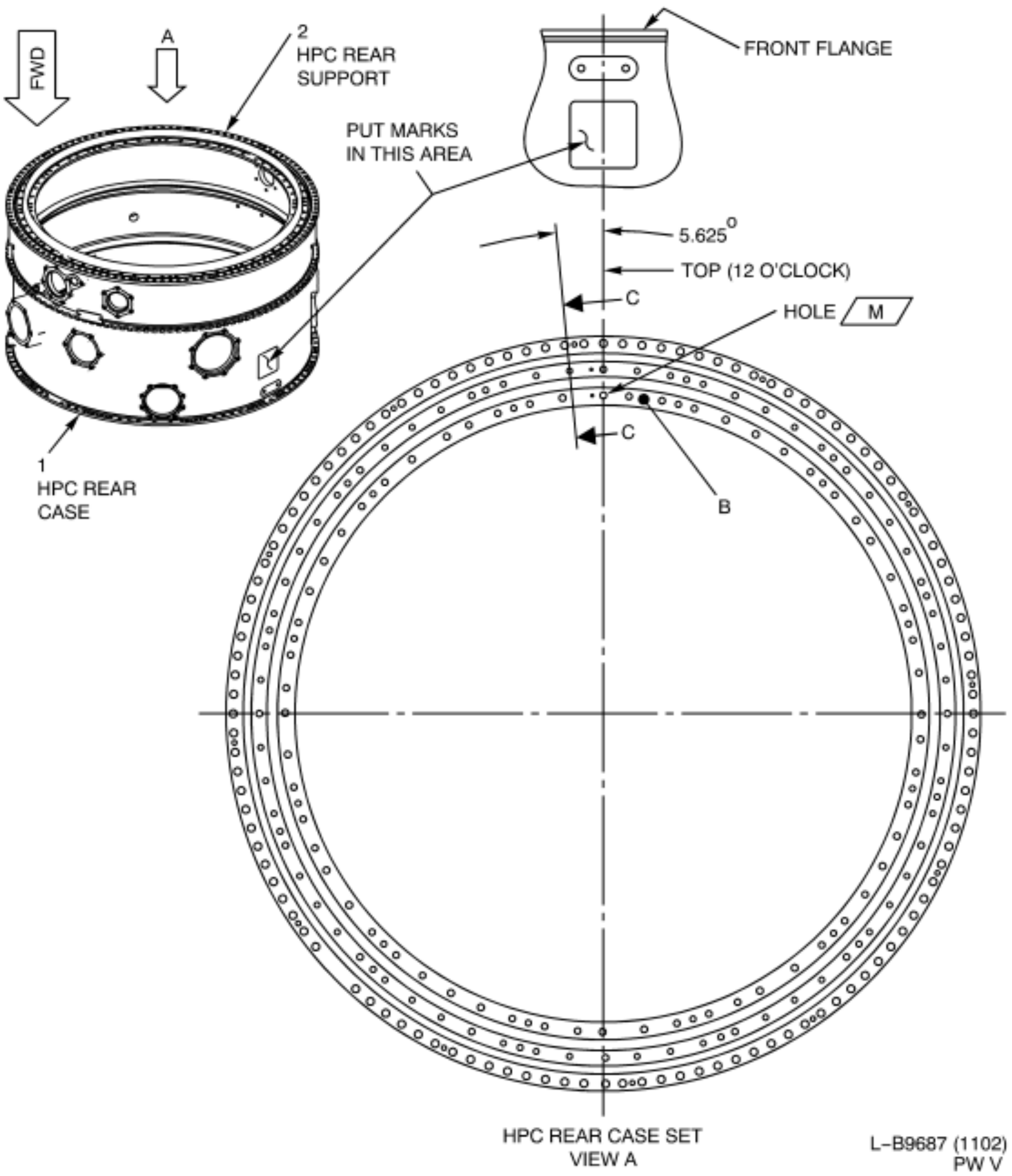
(g) Use an alternating pattern (180 degrees apart) to tighten and torque the bolts to 160 - 175 lb-in. (18.078 - 19.772 N.m). Continue to tighten the bolts until no loss of torque occurs.

(h) Make sure that the Fixture is against the rear flange of the HPC rear case.

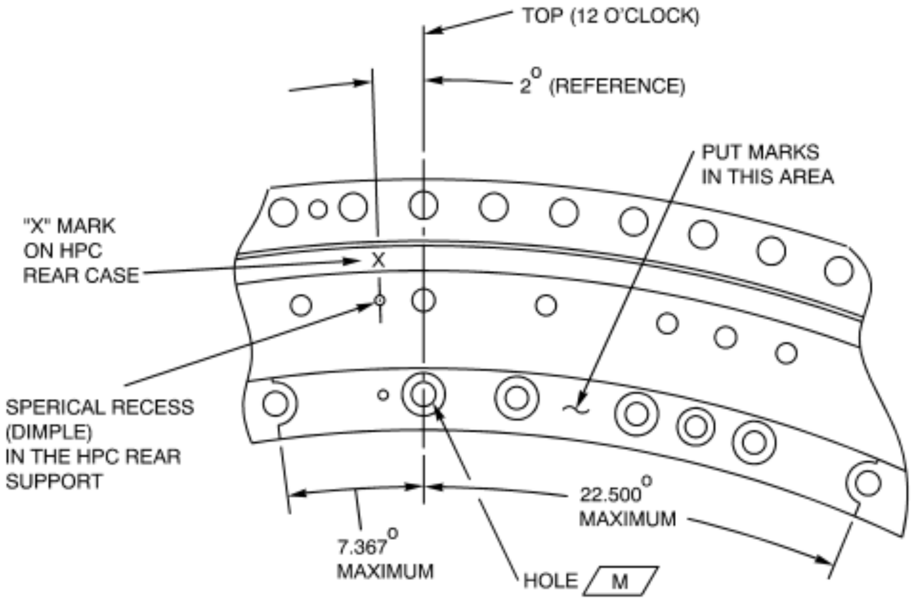
D. Postrequisites

(1) Machine the HPC Air Seal Set (Stages 5 Through 15). Refer to 72-35-04, Assembly-02 (Task 72-35-04-440-002).

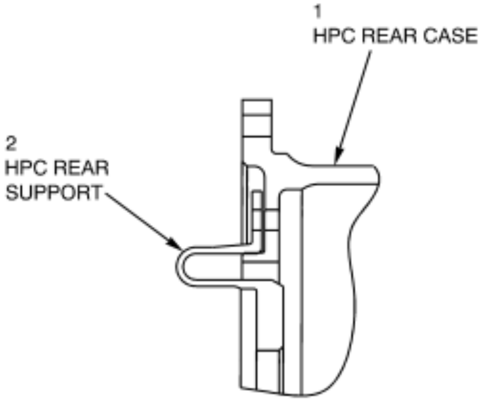
STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01


FWD
A
2
HPC REAR
SUPPORT
PUT MARKS
IN THIS AREA
FRONT FLANGE
5.625°
TOP (12 O'CLOCK)
C
HOLE M
C
B
1
HPC REAR
CASE
HPC REAR CASE SET
VIEW A
L−B9687 (1102)
PW V

HPC Rear Case Marking Areas
Figure 1001 (Sheet 1)
(Task 72−35−04−440−001)


TOP (12 O'CLOCK)
2° (REFERENCE)
PUT MARKS IN THIS AREA
"X" MARK ON HPC REAR CASE
X
SPERICAL RECESS (DIMPLE) IN THE HPC REAR SUPPORT
22.500° MAXIMUM
7.367° MAXIMUM
HOLE M

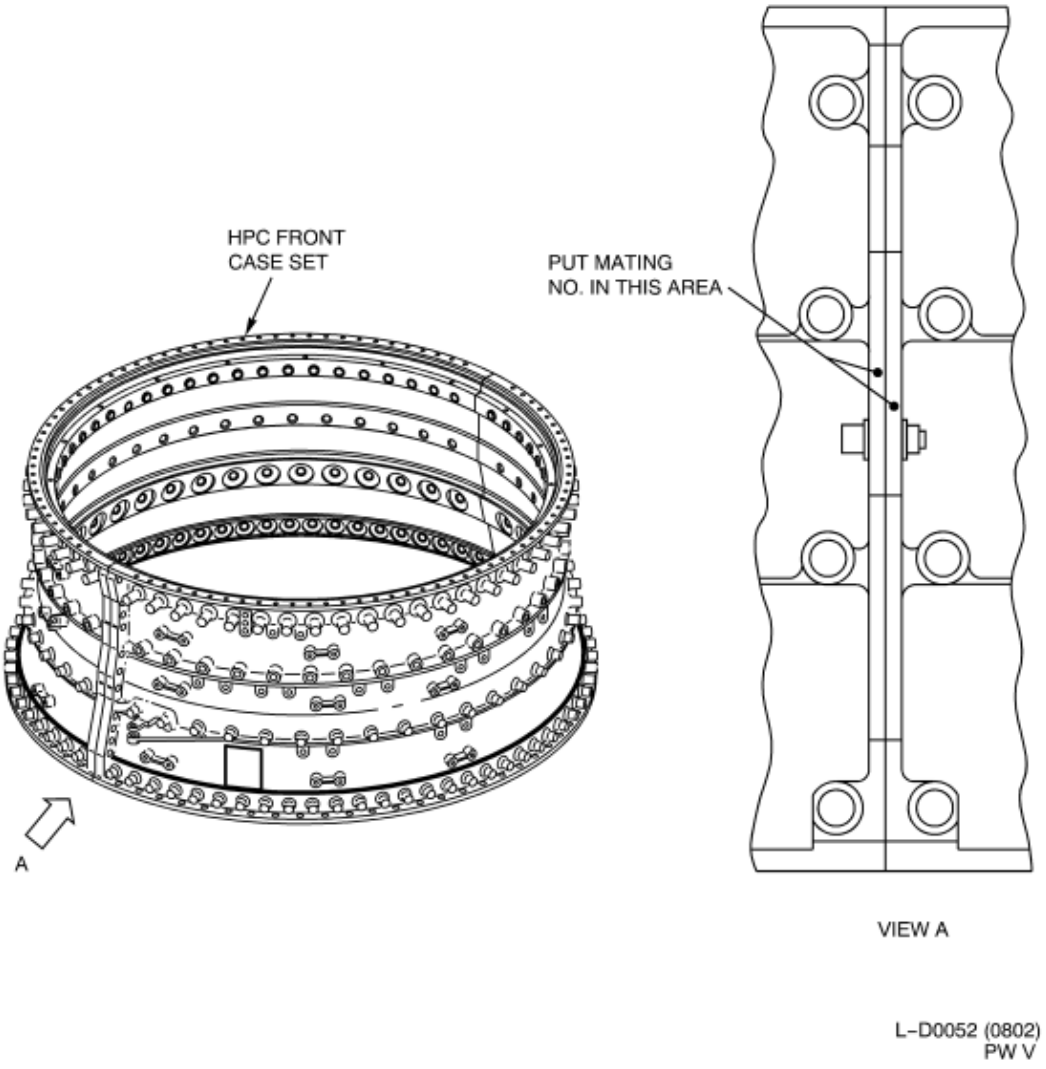
VIEW B


1
HPC REAR CASE
2
HPC REAR SUPPORT

SECTION C-C

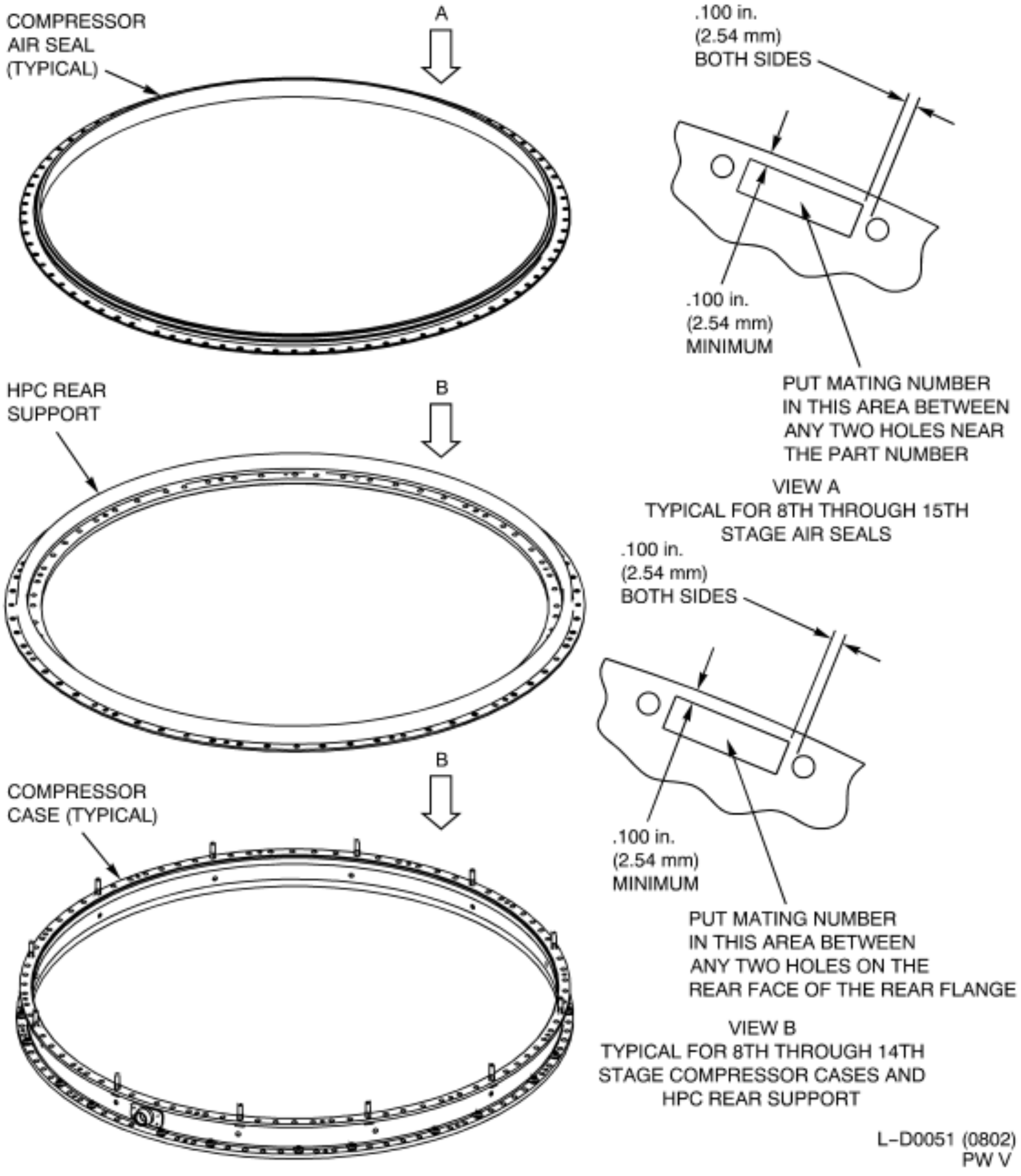
L-D0047 (0203)
PW V

HPC Rear Case Marking Areas
Figure 1001 (Sheet 2)
(Task 72-35-04-440-001)


HPC FRONT
CASE SET
PUT MATING
NO. IN THIS AREA
A
VIEW A
L−D0052 (0802)
PW V

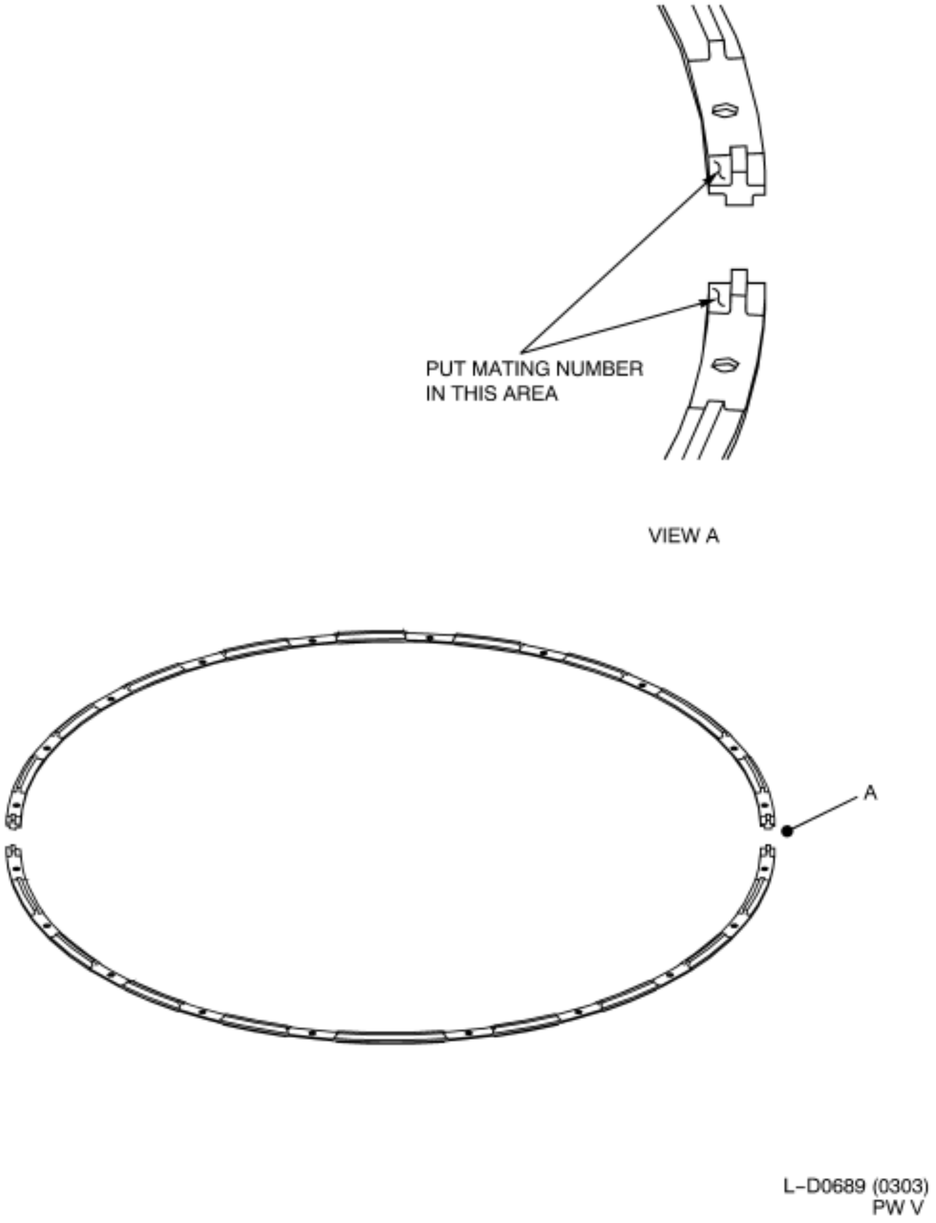
HPC Front Case Marking Areas
Figure 1002
(Task 72−35−04−440−001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-01


COMPRESSOR
AIR SEAL
(TYPICAL)
A
.100 in.
(2.54 mm)
BOTH SIDES
.100 in.
(2.54 mm)
MINIMUM
PUT MATING NUMBER
IN THIS AREA BETWEEN
ANY TWO HOLES NEAR
THE PART NUMBER
VIEW A
TYPICAL FOR 8TH THROUGH 15TH
STAGE AIR SEALS
HPC REAR
SUPPORT
B
.100 in.
(2.54 mm)
BOTH SIDES
.100 in.
(2.54 mm)
MINIMUM
PUT MATING NUMBER
IN THIS AREA BETWEEN
ANY TWO HOLES ON THE
REAR FACE OF THE REAR FLANGE
VIEW B
TYPICAL FOR 8TH THROUGH 14TH
STAGE COMPRESSOR CASES AND
HPC REAR SUPPORT
COMPRESSOR
CASE (TYPICAL)
B
L-D0051 (0802)
PW V

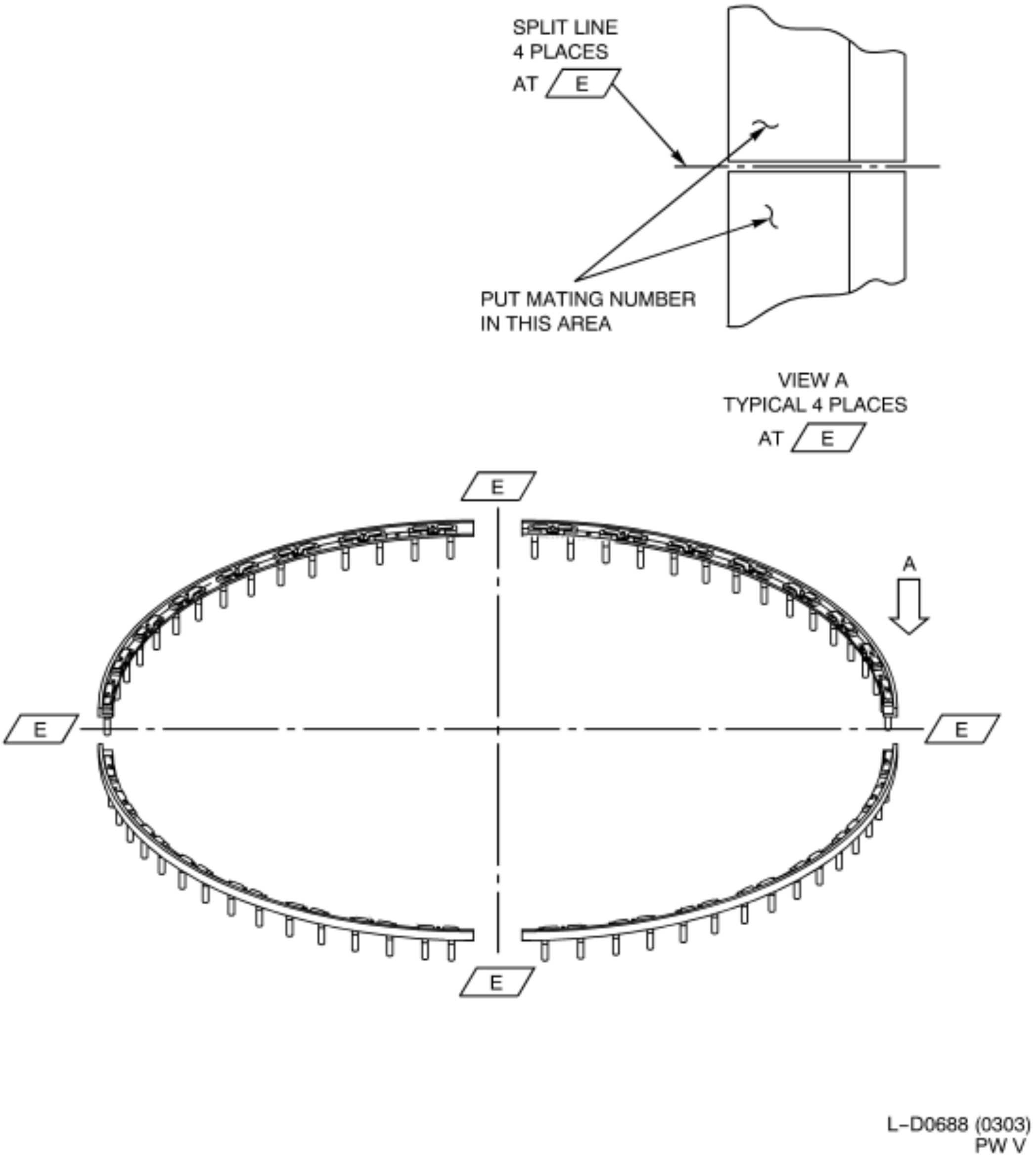
Compressor Air Seals, Cases, And HPC Rear Support Marking Areas
Figure 1003 (Sheet 1)
(Task 72-35-04-440-001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-01


PUT MATING NUMBER
IN THIS AREA
VIEW A
A
L-D0689 (0303)
PW V

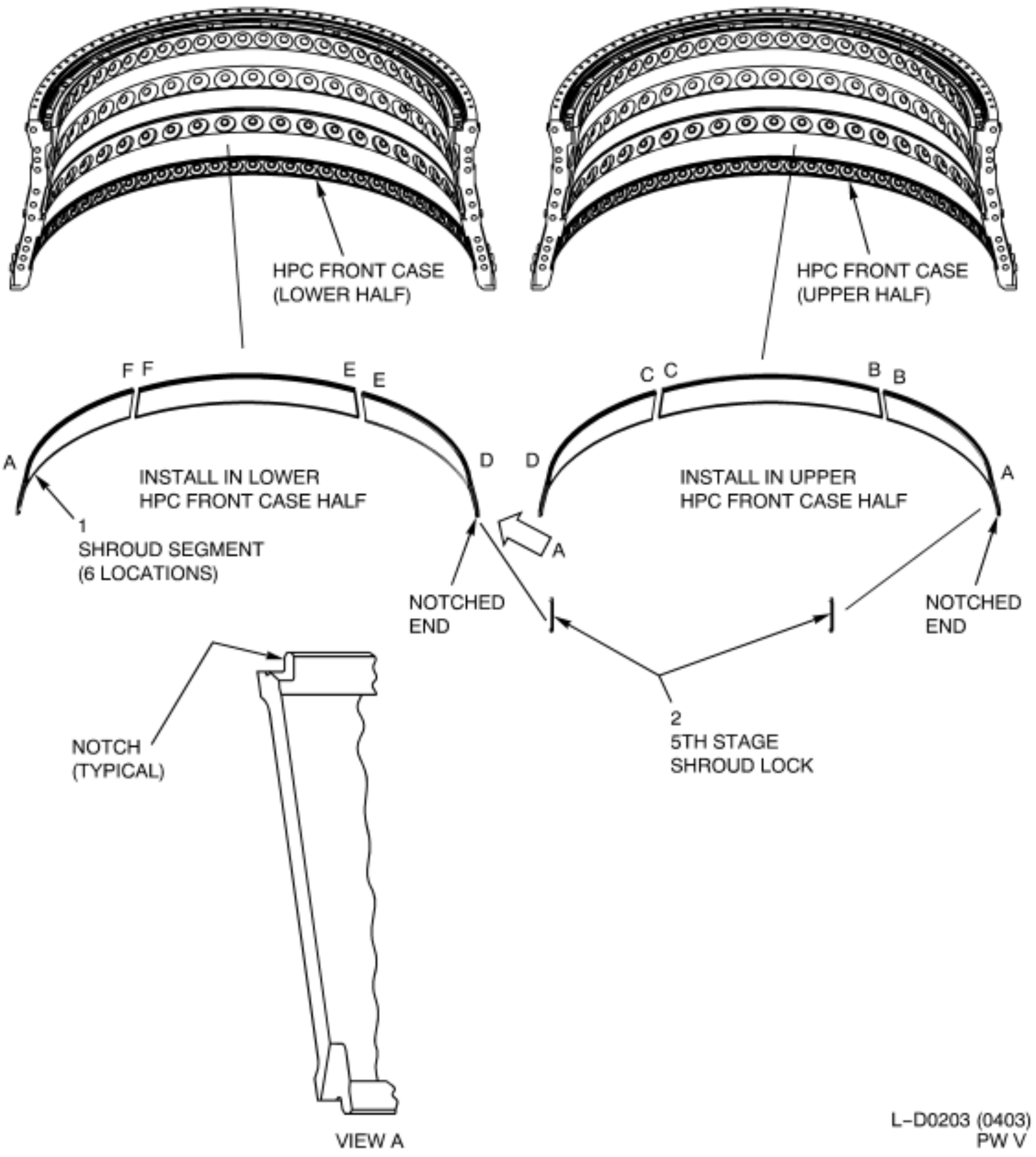
HPC Spacer Set Marking Areas (Symmetric Case Configuration)
Figure 1003 (Sheet 2)
(Task 72-35-04-440-001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-01


SPLIT LINE
4 PLACES
AT E
PUT MATING NUMBER
IN THIS AREA
VIEW A
TYPICAL 4 PLACES
AT E
E
A
E
E
E
L-D0688 (0303)
PW V

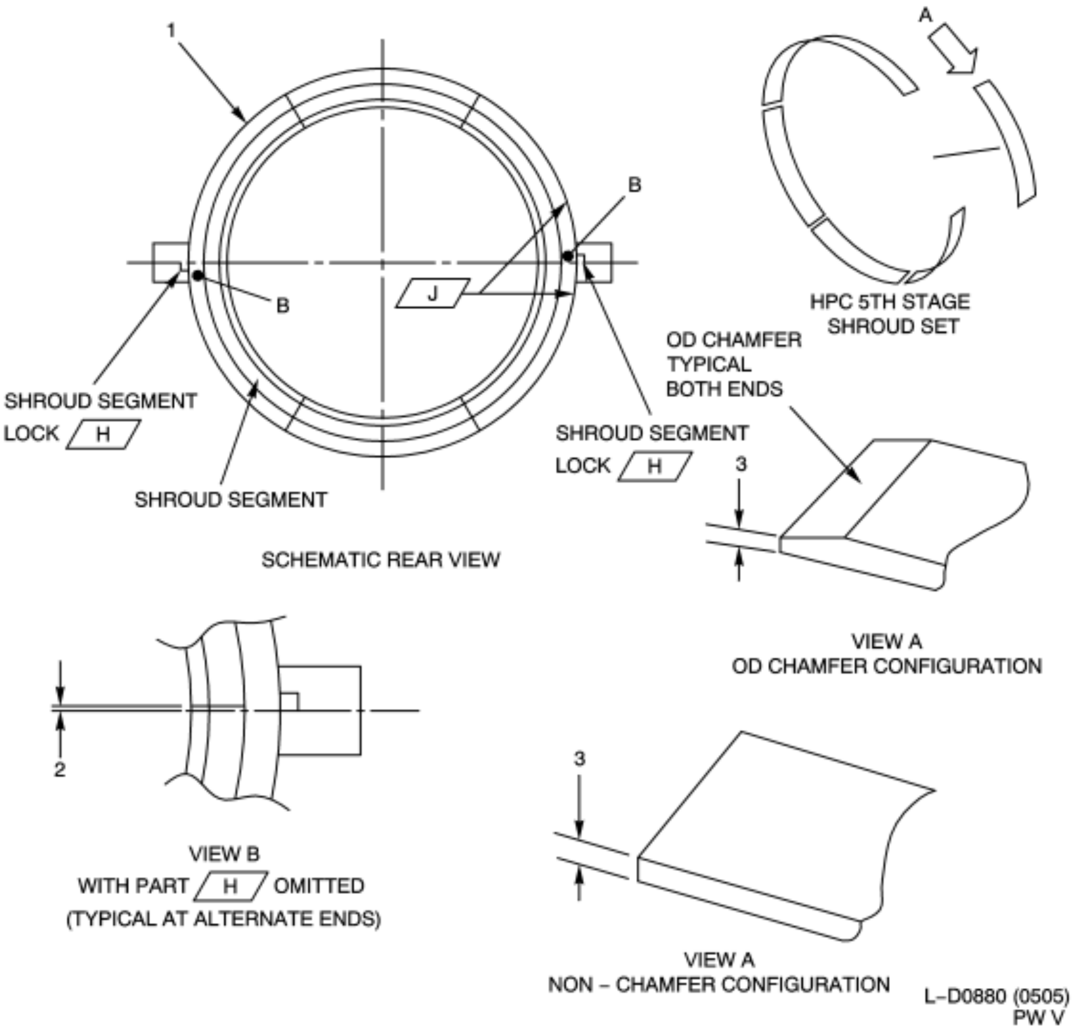
Eighth Stage Compressor Air Seal Support Segment
Set Marking Areas (Symmetric Case Configuration)
Figure 1003 (Sheet 3)
(Task 72-35-04-440-001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01


HPC FRONT CASE (LOWER HALF)
HPC FRONT CASE (UPPER HALF)
F F
E E
C C
B B
A
D
D
A
INSTALL IN LOWER HPC FRONT CASE HALF
INSTALL IN UPPER HPC FRONT CASE HALF
1 SHROUD SEGMENT (6 LOCATIONS)
A
NOTCHED END
NOTCHED END
NOTCH (TYPICAL)
2 5TH STAGE SHROUD LOCK
VIEW A
L−D0203 (0403) PW V

Fifth Stage Shroud Set Installation
Figure 1004 (Sheet 1)
(Task 72−35−04−440−001)

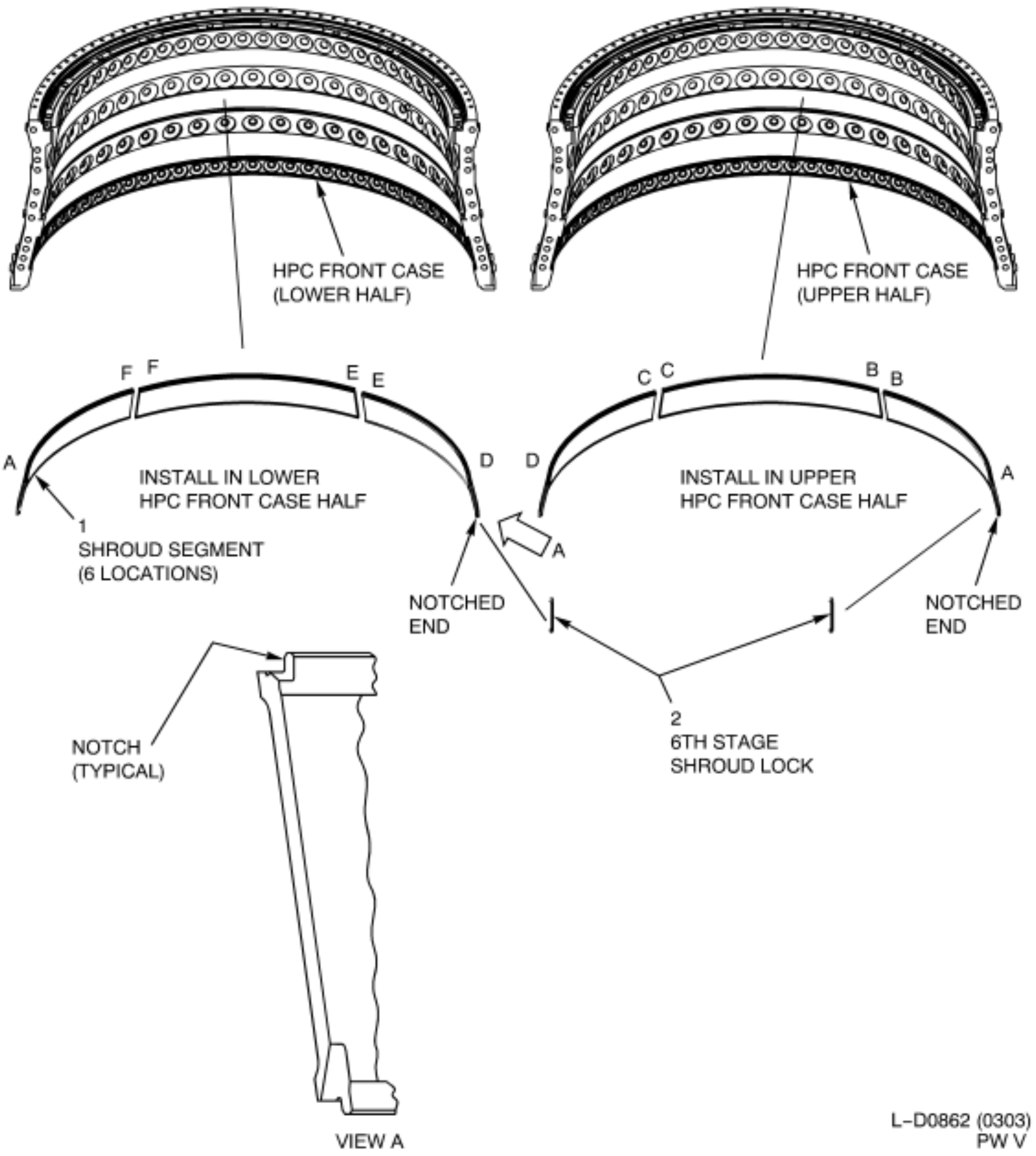
STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01


1
B
B
J
SHROUD SEGMENT LOCK H
SHROUD SEGMENT
SHROUD SEGMENT LOCK H
SCHEMATIC REAR VIEW
A
HPC 5TH STAGE SHROUD SET
OD CHAMFER TYPICAL BOTH ENDS
3
VIEW A
OD CHAMFER CONFIGURATION
2
VIEW B
WITH PART H OMITTED
(TYPICAL AT ALTERNATE ENDS)
3
VIEW A
NON − CHAMFER CONFIGURATION
L−D0880 (0505)
PW V

1. Assemble the Air Seals In The Order Specified In The Text
2. OD Chamfer Configuration: 0.021 − 0.100 Inch (0.53 − 2.54 mm)
   Non−Chamfer Configuration: 0.021 − 0.125 Inch (0.5 − 3.2 mm)
   In Each 180° Arc With Total Gaps Up To 0.220 Inch (5.588 mm)
3. OD Chamfer Configuration: 0.081 Inch (2.057 mm) Minimum
   Reference. Non−Chamfer Configuration: 0.123 Inch (3.124 mm)
   Minimum Reference

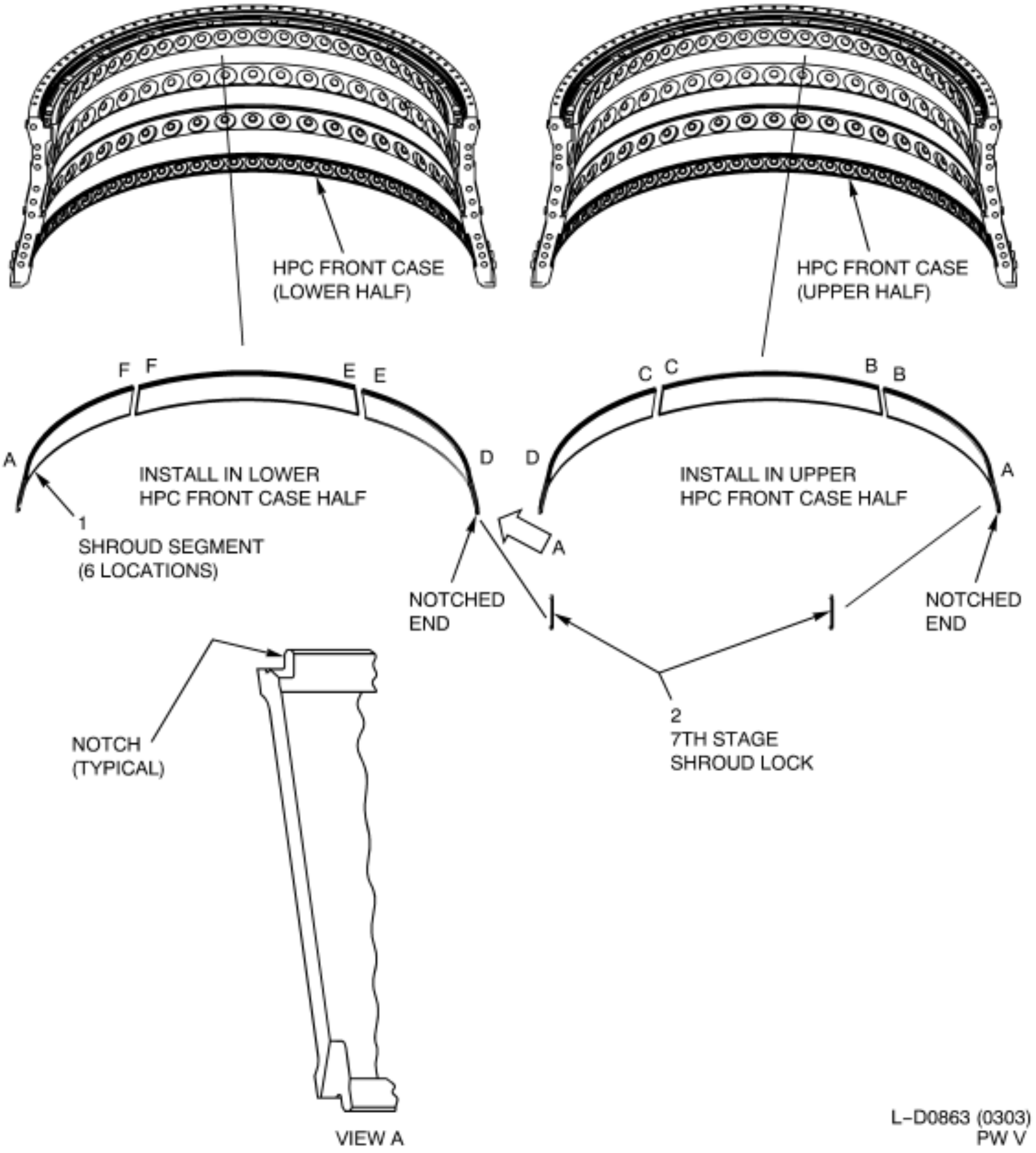
Fifth Stage Shroud Set Installation
Figure 1004 (Sheet 2)
(Task 72−35−04−440−001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-01


HPC FRONT CASE (LOWER HALF)
HPC FRONT CASE (UPPER HALF)
F
F
E
E
C
C
B
B
A
D
D
A
INSTALL IN LOWER HPC FRONT CASE HALF
INSTALL IN UPPER HPC FRONT CASE HALF
1
SHROUD SEGMENT (6 LOCATIONS)
A
NOTCHED END
NOTCHED END
NOTCH (TYPICAL)
2
6TH STAGE SHROUD LOCK
VIEW A
L-D0862 (0303)
PW V

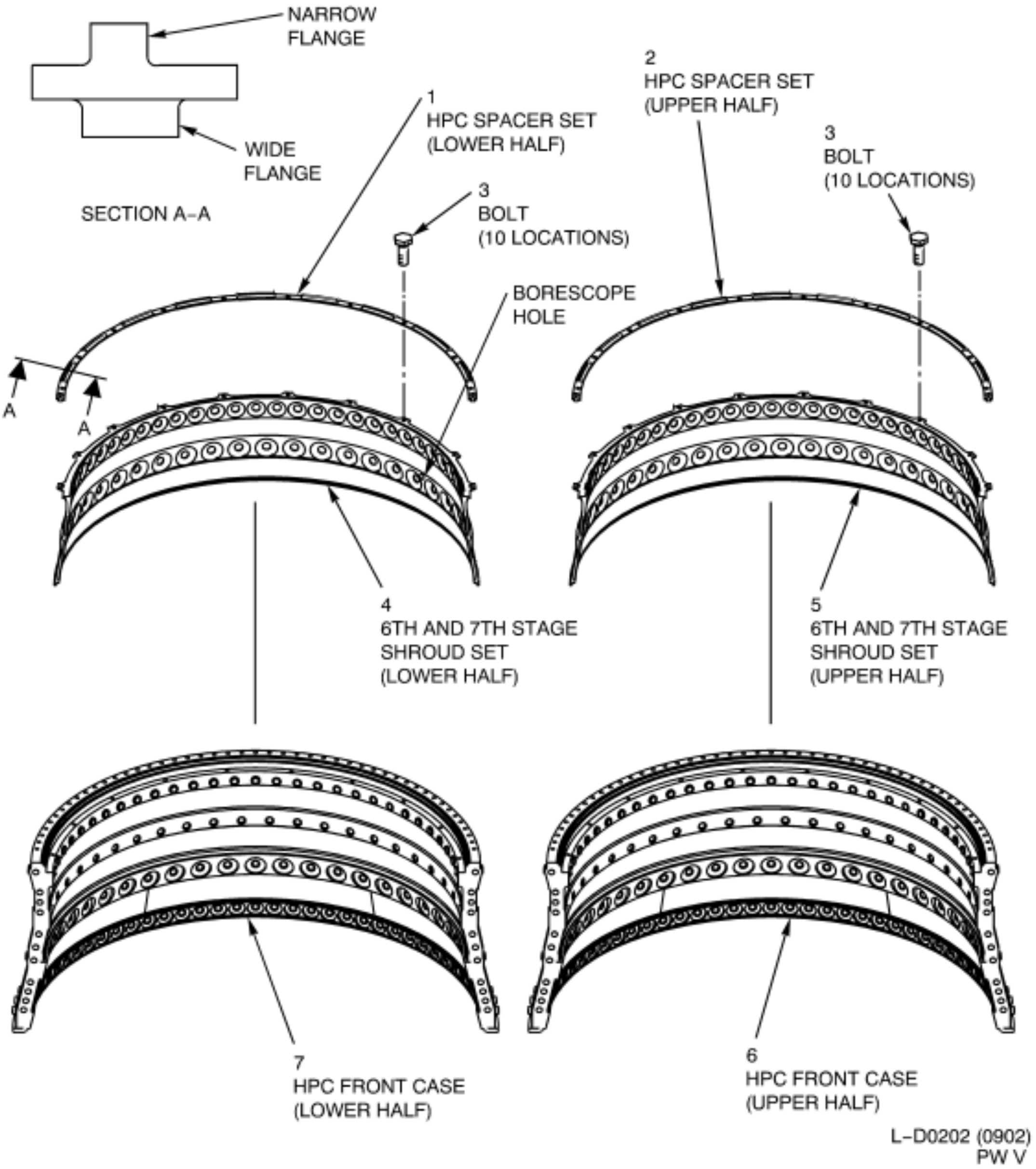
Sixth Stage Shroud Set Installation (Asymmetric Case Configuration)
Figure 1004 (Sheet 3)
(Task 72-35-04-440-001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01

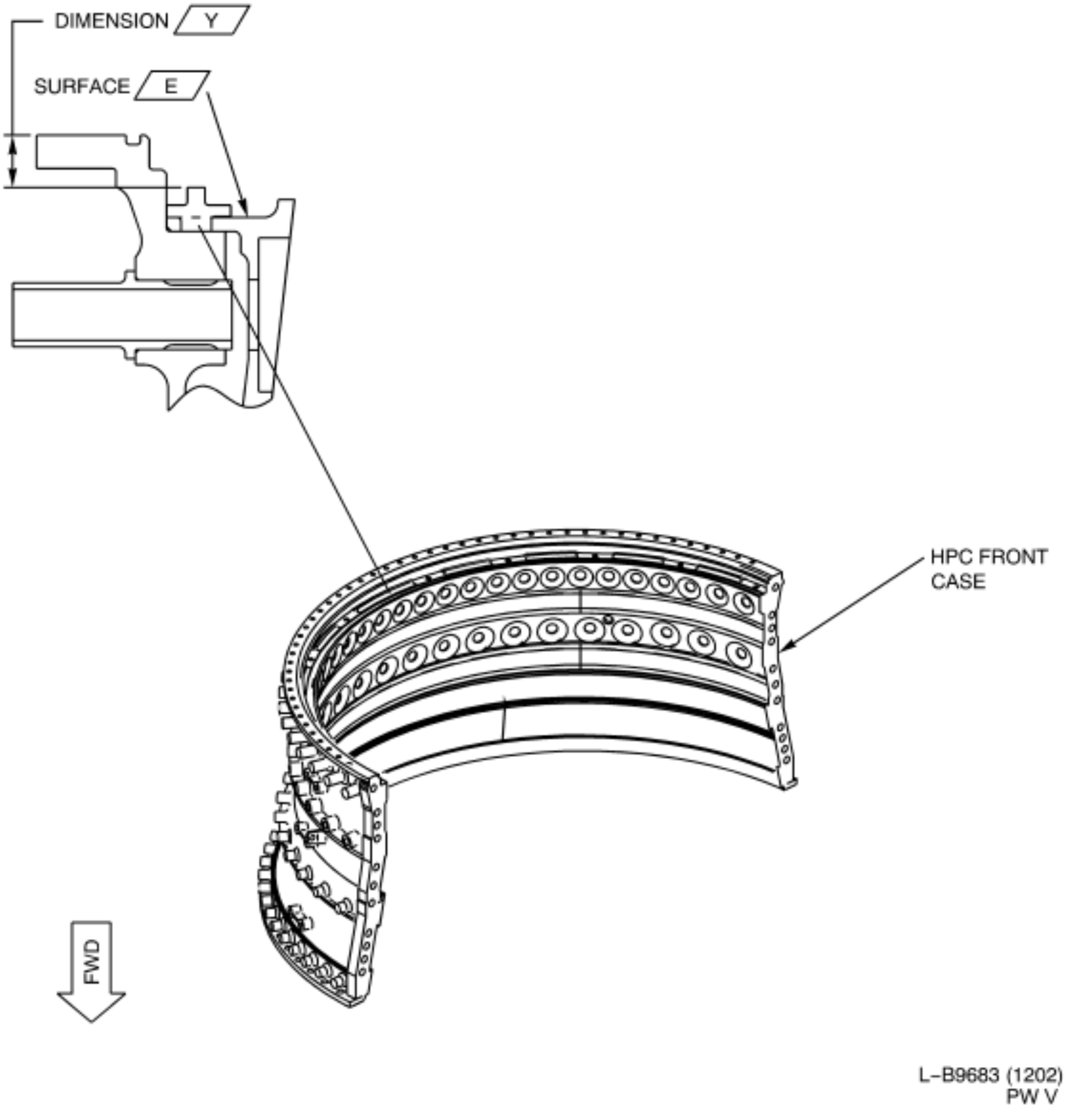

HPC FRONT CASE
(LOWER HALF)
HPC FRONT CASE
(UPPER HALF)
F
F
E
E
C
C
B
B
A
D
D
A
INSTALL IN LOWER
HPC FRONT CASE HALF
INSTALL IN UPPER
HPC FRONT CASE HALF
1
SHROUD SEGMENT
(6 LOCATIONS)
A
NOTCHED
END
NOTCHED
END
NOTCH
(TYPICAL)
2
7TH STAGE
SHROUD LOCK
VIEW A
L−D0863 (0303)
PW V

Seventh Stage Shroud Set Installation
(Asymmetric Case Configuration)
Figure 1004 (Sheet 4)
(Task 72−35−04−440−001)

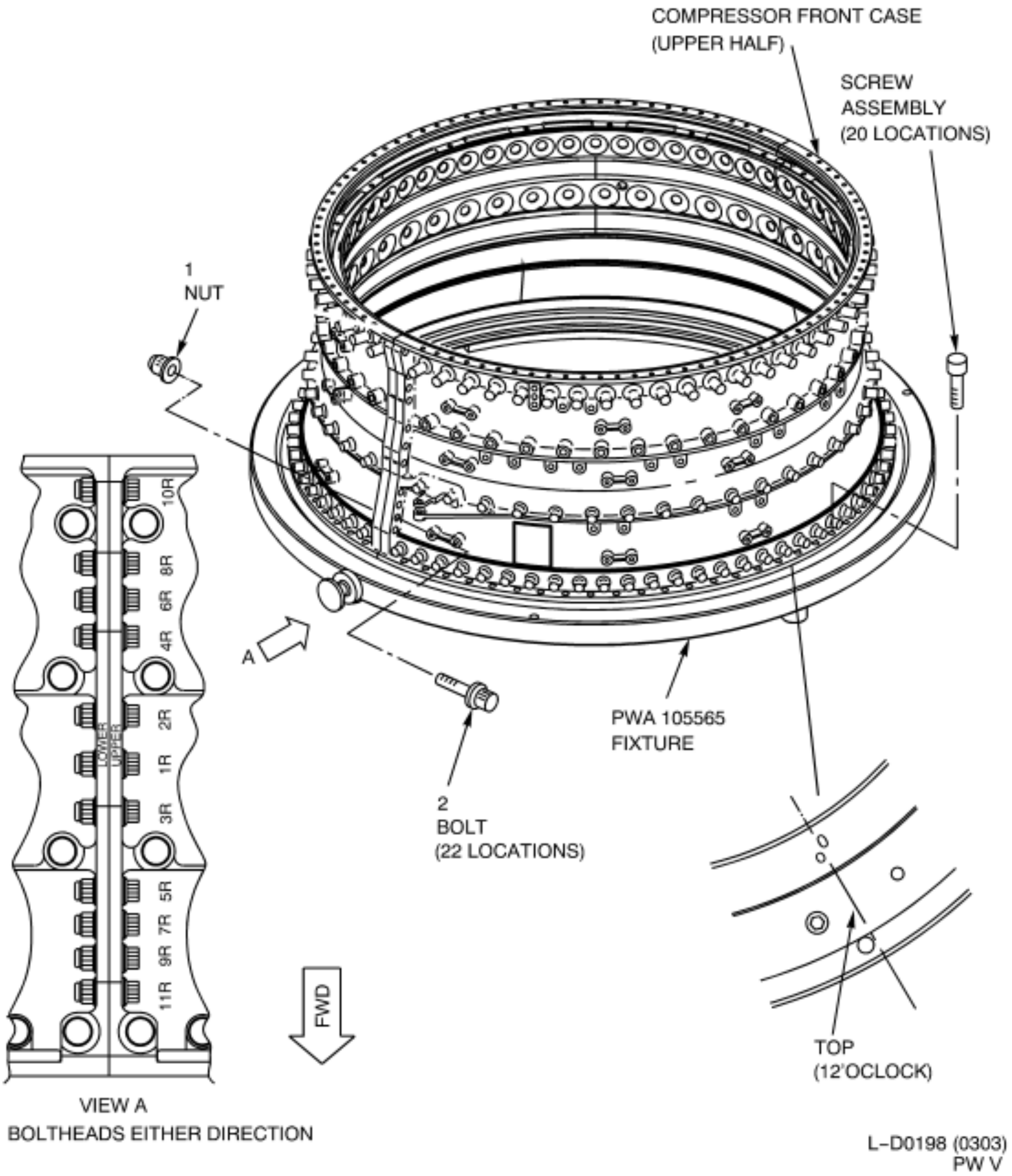
STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-01


NARROW FLANGE
WIDE FLANGE
SECTION A-A
1
HPC SPACER SET
(LOWER HALF)
2
HPC SPACER SET
(UPPER HALF)
3
BOLT
(10 LOCATIONS)
3
BOLT
(10 LOCATIONS)
BORESCOPE HOLE
A
A
4
6TH AND 7TH STAGE
SHROUD SET
(LOWER HALF)
5
6TH AND 7TH STAGE
SHROUD SET
(UPPER HALF)
7
HPC FRONT CASE
(LOWER HALF)
6
HPC FRONT CASE
(UPPER HALF)
L-D0202 (0902)
PW V

HPC Spacer Set, And 6th And 7th Stage Shroud
Set Installation (Symmetric Case Configuration)
Figure 1005 (Sheet 1)
(Task 72-35-04-440-001)

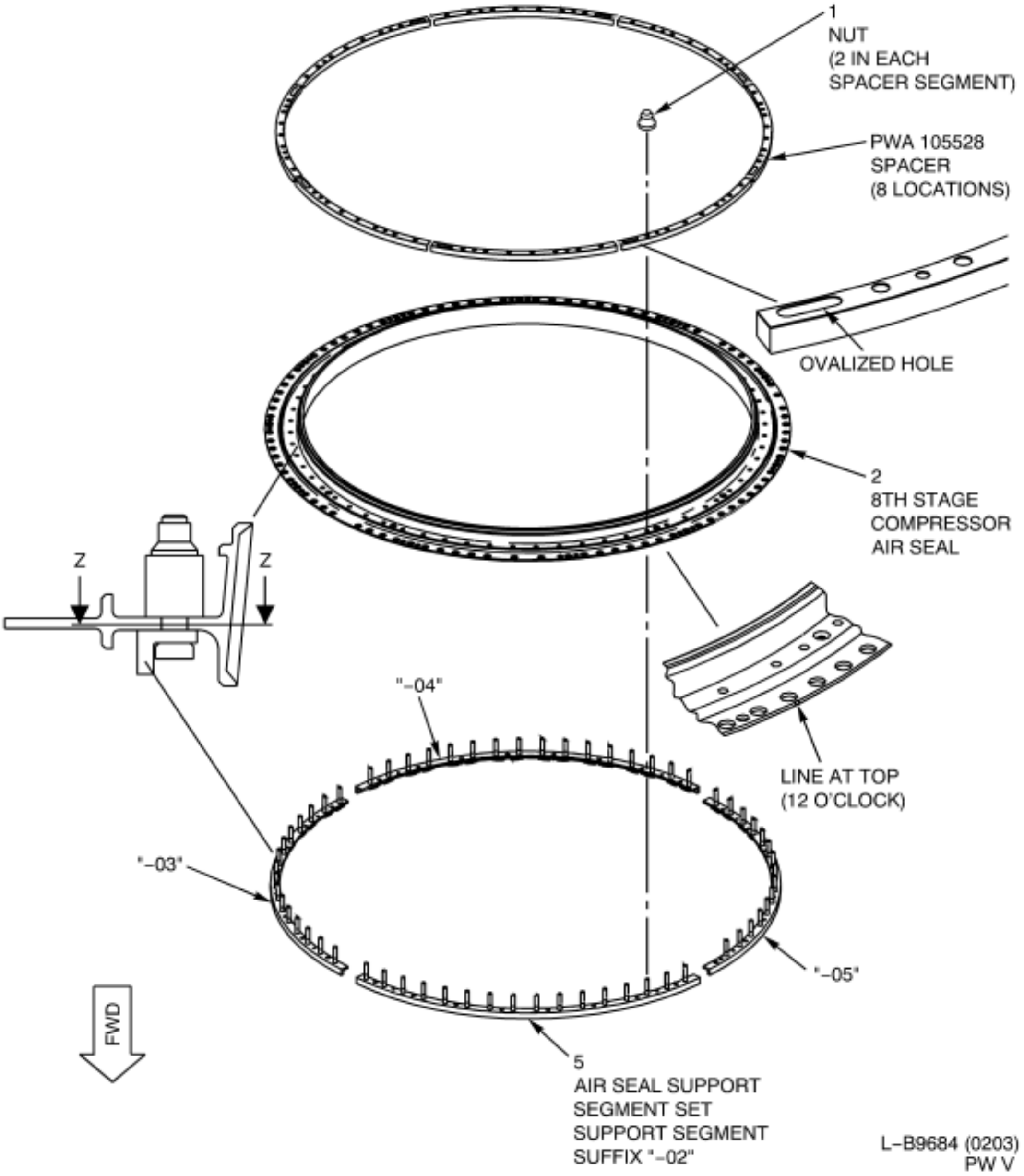

DIMENSION Y
SURFACE E
HPC FRONT CASE
FWD
L-B9683 (1202)
PW V

HPC Spacer Set, And 6th And 7th Stage Shroud
Set Installation (Symmetric Case Configuration)
Figure 1005 (Sheet 2)
(Task 72-35-04-440-001)


COMPRESSOR FRONT CASE
(UPPER HALF)
SCREW
ASSEMBLY
(20 LOCATIONS)
1
NUT
10R
8R
6R
4R
2R
LOWER
UPPER
1R
3R
5R
7R
9R
11R
A
FWD
PWA 105565
FIXTURE
2
BOLT
(22 LOCATIONS)
TOP
(12'OCLOCK)
VIEW A
BOLTHEADS EITHER DIRECTION
L−D0198 (0303)
PW V

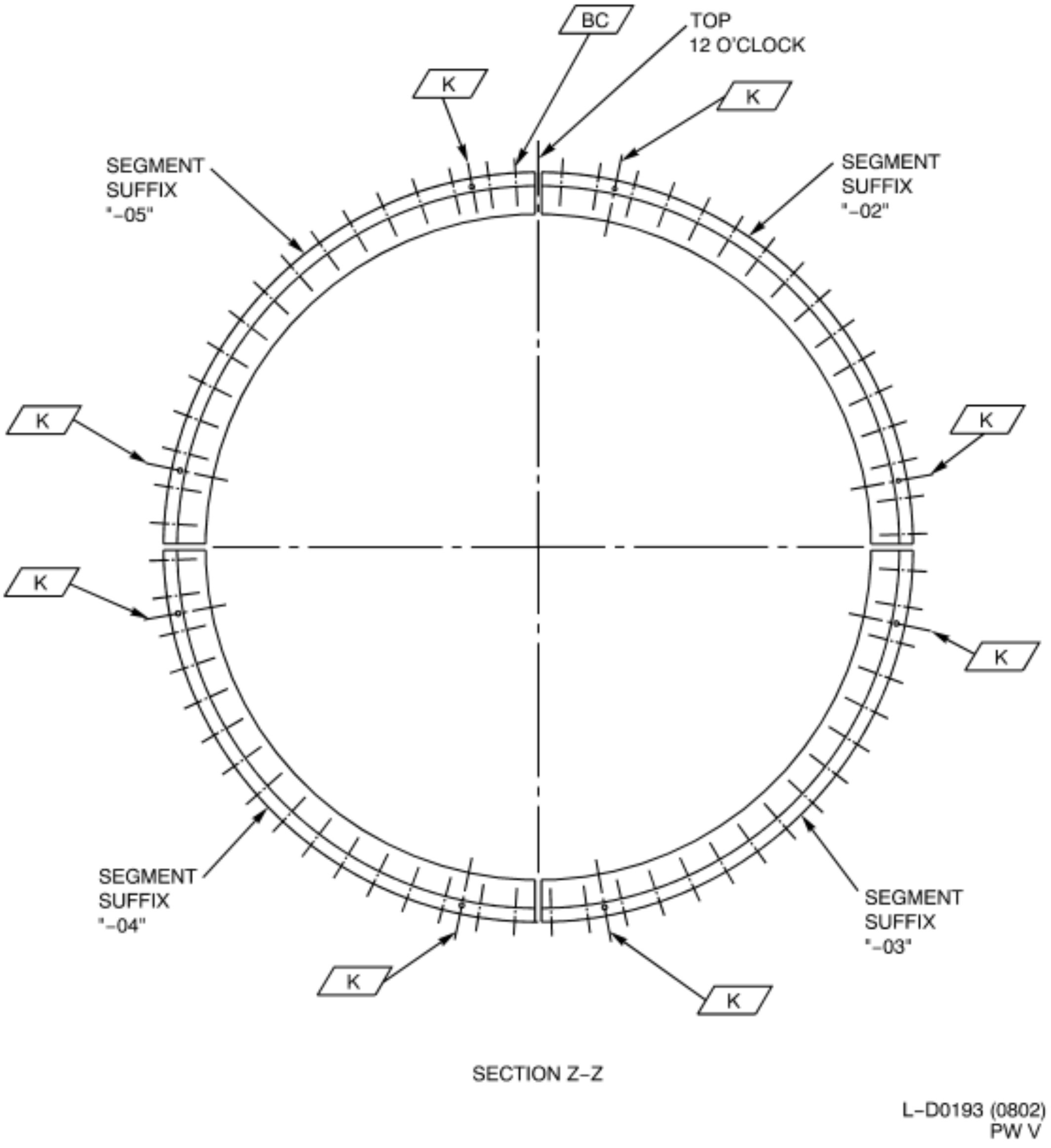
HPC Front Case To Support Fixture Installation
Figure 1006
(Task 72−35−04−440−001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01


1
NUT
(2 IN EACH
SPACER SEGMENT)
PWA 105528
SPACER
(8 LOCATIONS)
OVALIZED HOLE
2
8TH STAGE
COMPRESSOR
AIR SEAL
Z
Z
LINE AT TOP
(12 O'CLOCK)
"−04"
"−03"
"−05"
FWD
5
AIR SEAL SUPPORT
SEGMENT SET
SUPPORT SEGMENT
SUFFIX "−02"
L−B9684 (0203)
PW V

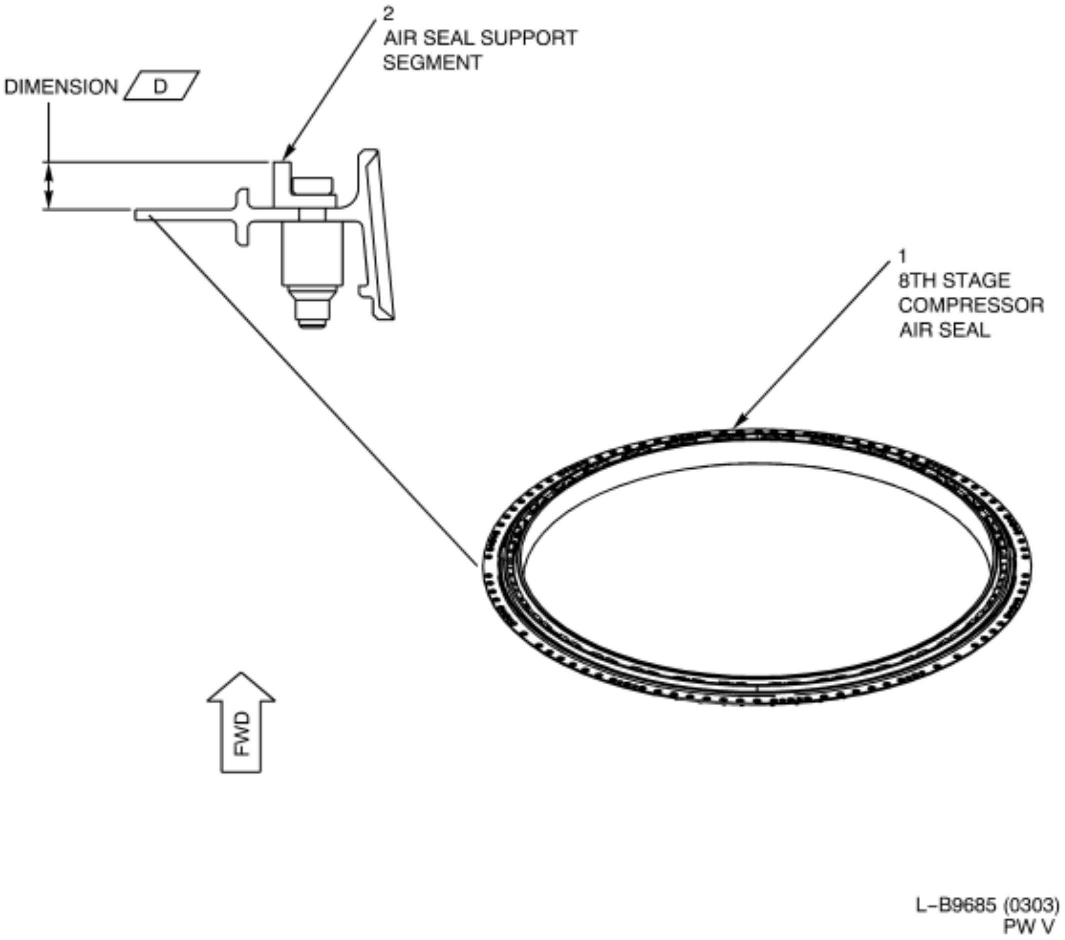
Air Seal Support To 8th Stage Compressor Air
Seal Installation (Symmetric Case Configuration)
Figure 1007 (Sheet 1)
(Task 72−35−04−440−001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-01


BC
TOP
12 O'CLOCK
K
K
K
K
K
K
K
K
K
K
SEGMENT
SUFFIX
"-05"
SEGMENT
SUFFIX
"-02"
SEGMENT
SUFFIX
"-04"
SEGMENT
SUFFIX
"-03"
SECTION Z-Z
L-D0193 (0802)
PW V

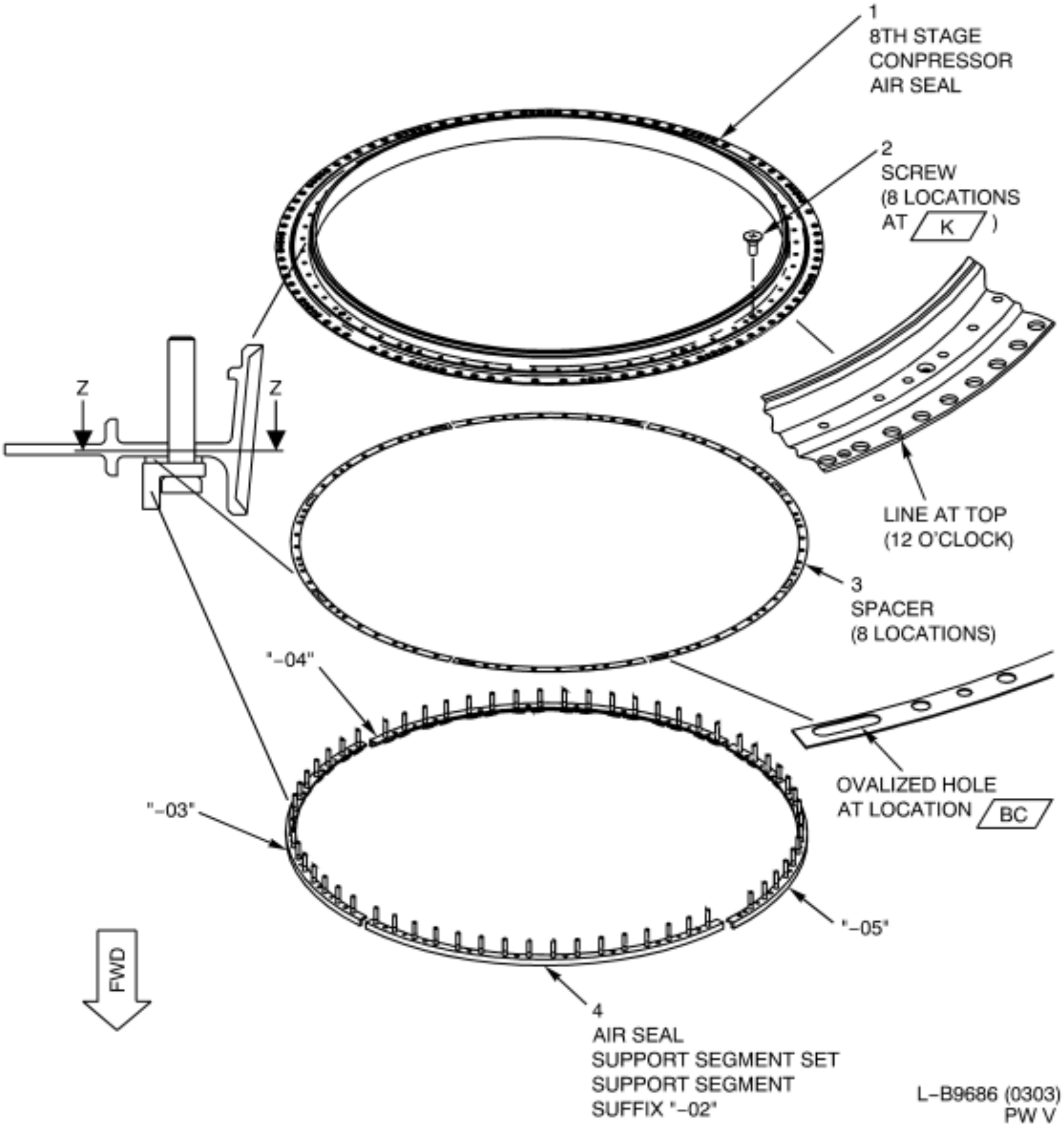
Air Seal Support To 8th Stage Compressor Air
Seal Installation (Symmetric Case Configuration)
Figure 1007 (Sheet 2)
(Task 72-35-04-440-001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-01


2
AIR SEAL SUPPORT
SEGMENT
DIMENSION D
1
8TH STAGE
COMPRESSOR
AIR SEAL
FWD
L-B9685 (0303)
PW V

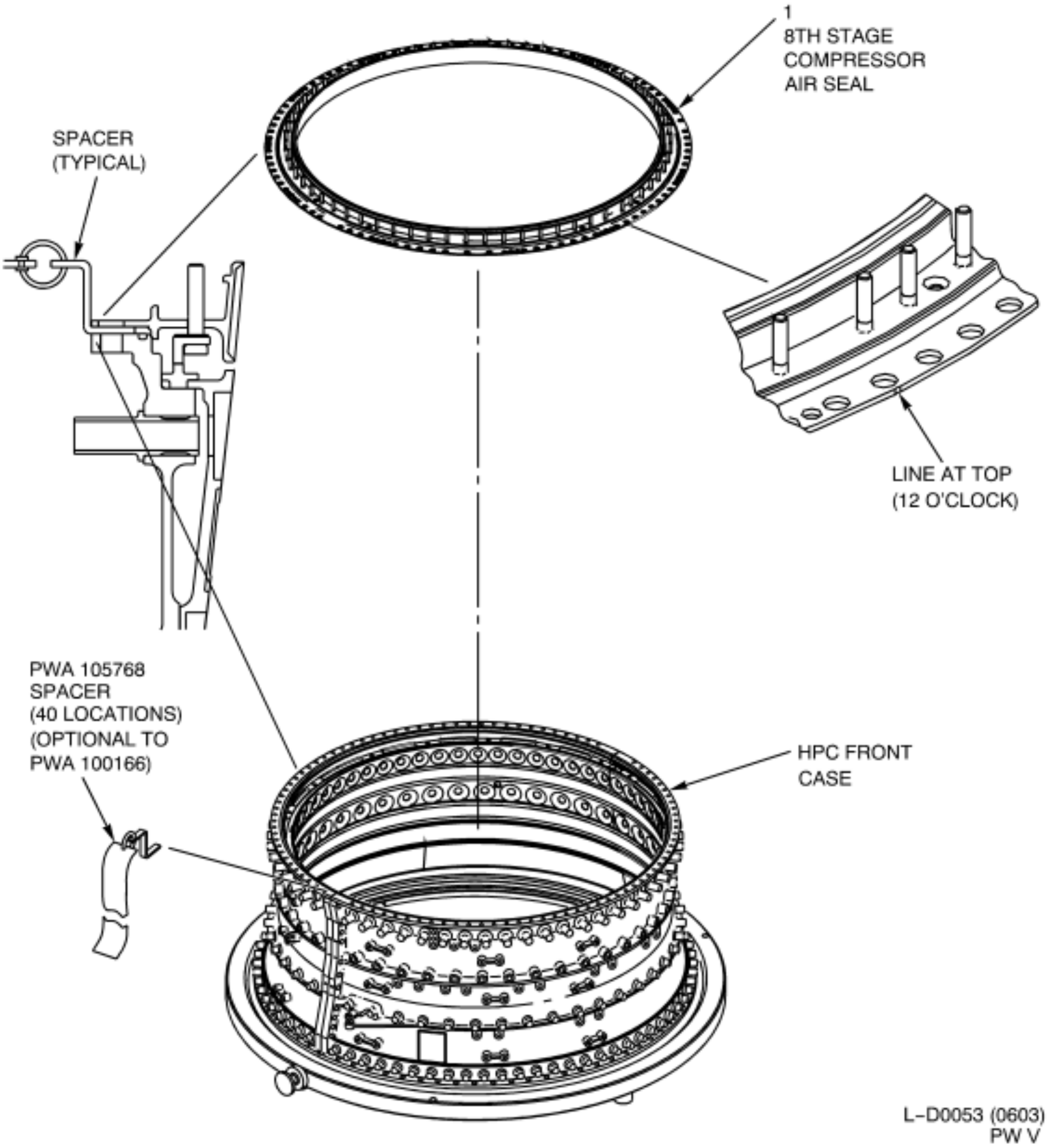
Air Seal Support To 8th Stage Compressor Air
Seal Installation (Symmetric Case Configuration)
Figure 1007 (Sheet 3)
(Task 72-35-04-440-001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01


1
8TH STAGE
CONPRESSOR
AIR SEAL
2
SCREW
(8 LOCATIONS
AT K)
LINE AT TOP
(12 O'CLOCK)
3
SPACER
(8 LOCATIONS)
OVALIZED HOLE
AT LOCATION BC
Z
Z
"−04"
"−03"
"−05"
FWD
4
AIR SEAL
SUPPORT SEGMENT SET
SUPPORT SEGMENT
SUFFIX "−02"
L−B9686 (0303)
PW V

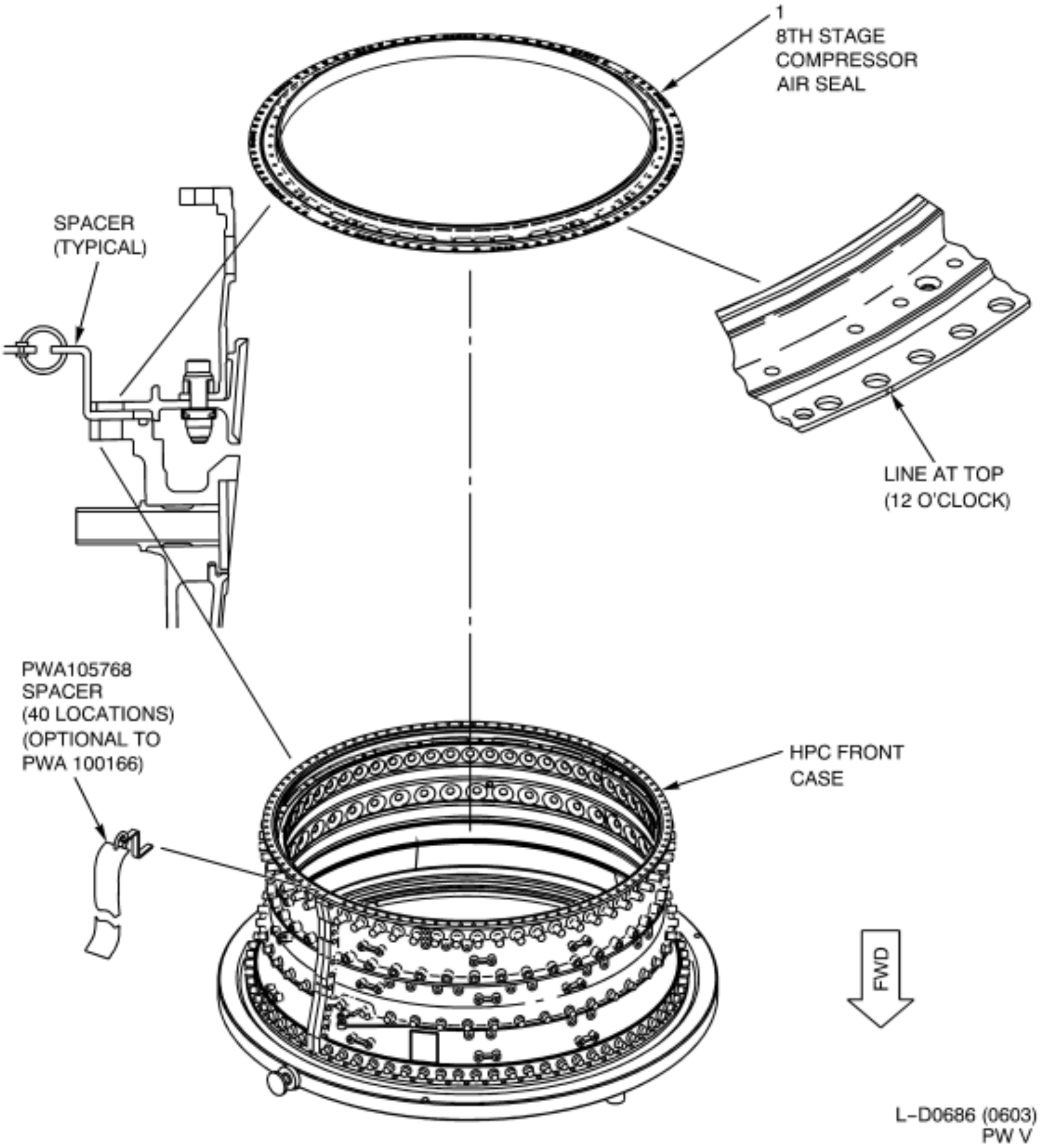
Air Seal Support To 8th Stage Compressor Air
Seal Installation (Symmetric Case Configuration)
Figure 1007 (Sheet 4)
(Task 72−35−04−440−001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01

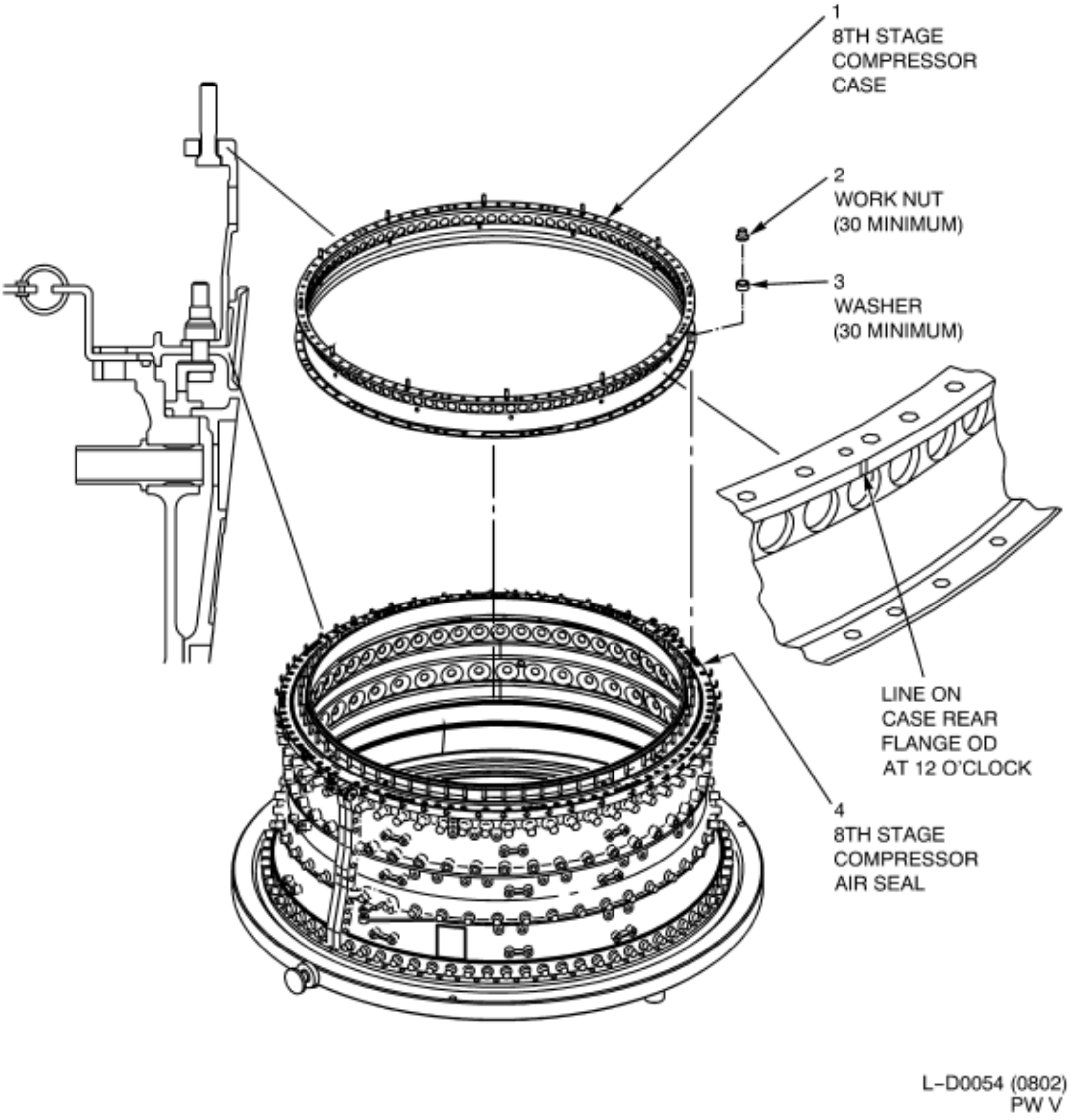

1
8TH STAGE
COMPRESSOR
AIR SEAL
SPACER
(TYPICAL)
LINE AT TOP
(12 O'CLOCK)
PWA 105768
SPACER
(40 LOCATIONS)
(OPTIONAL TO
PWA 100166)
HPC FRONT
CASE
L−D0053 (0603)
PW V

Eighth Stage Compressor Air Seal
Installation (Symmetric Case Configuration)
Figure 1008 (Sheet 1)
(Task 72−35−04−440−001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-01

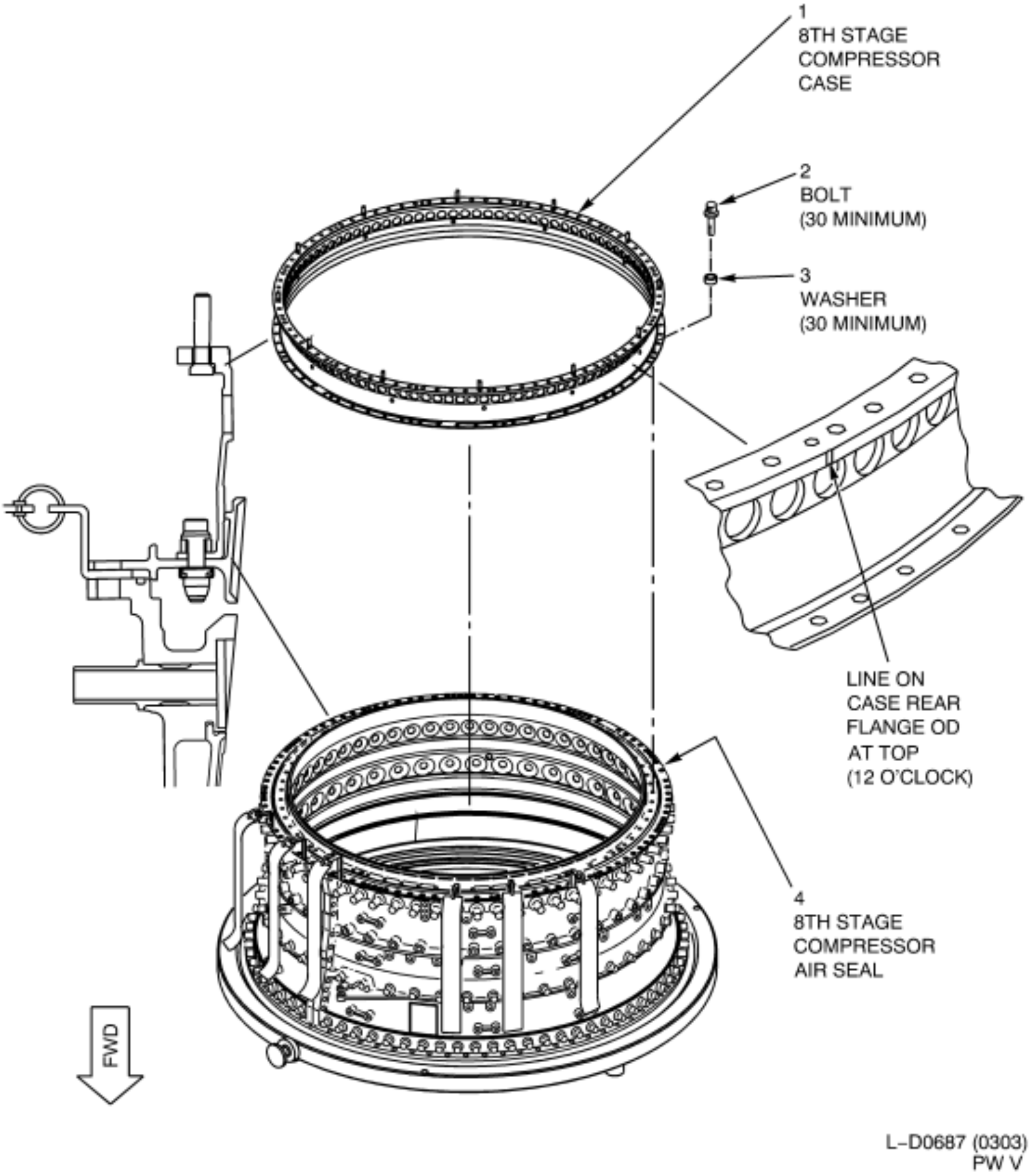

1
8TH STAGE
COMPRESSOR
AIR SEAL
SPACER
(TYPICAL)
LINE AT TOP
(12 O'CLOCK)
PWA105768
SPACER
(40 LOCATIONS)
(OPTIONAL TO
PWA 100166)
HPC FRONT
CASE
FWD
L-D0686 (0603)
PW V

Eighth Stage Compressor Air Seal
Installation (Asymmetric Case Configuration)
Figure 1008 (Sheet 2)
(Task 72-35-04-440-001)


1
8TH STAGE
COMPRESSOR
CASE
2
WORK NUT
(30 MINIMUM)
3
WASHER
(30 MINIMUM)
LINE ON
CASE REAR
FLANGE OD
AT 12 O'CLOCK
4
8TH STAGE
COMPRESSOR
AIR SEAL
L−D0054 (0802)
PW V

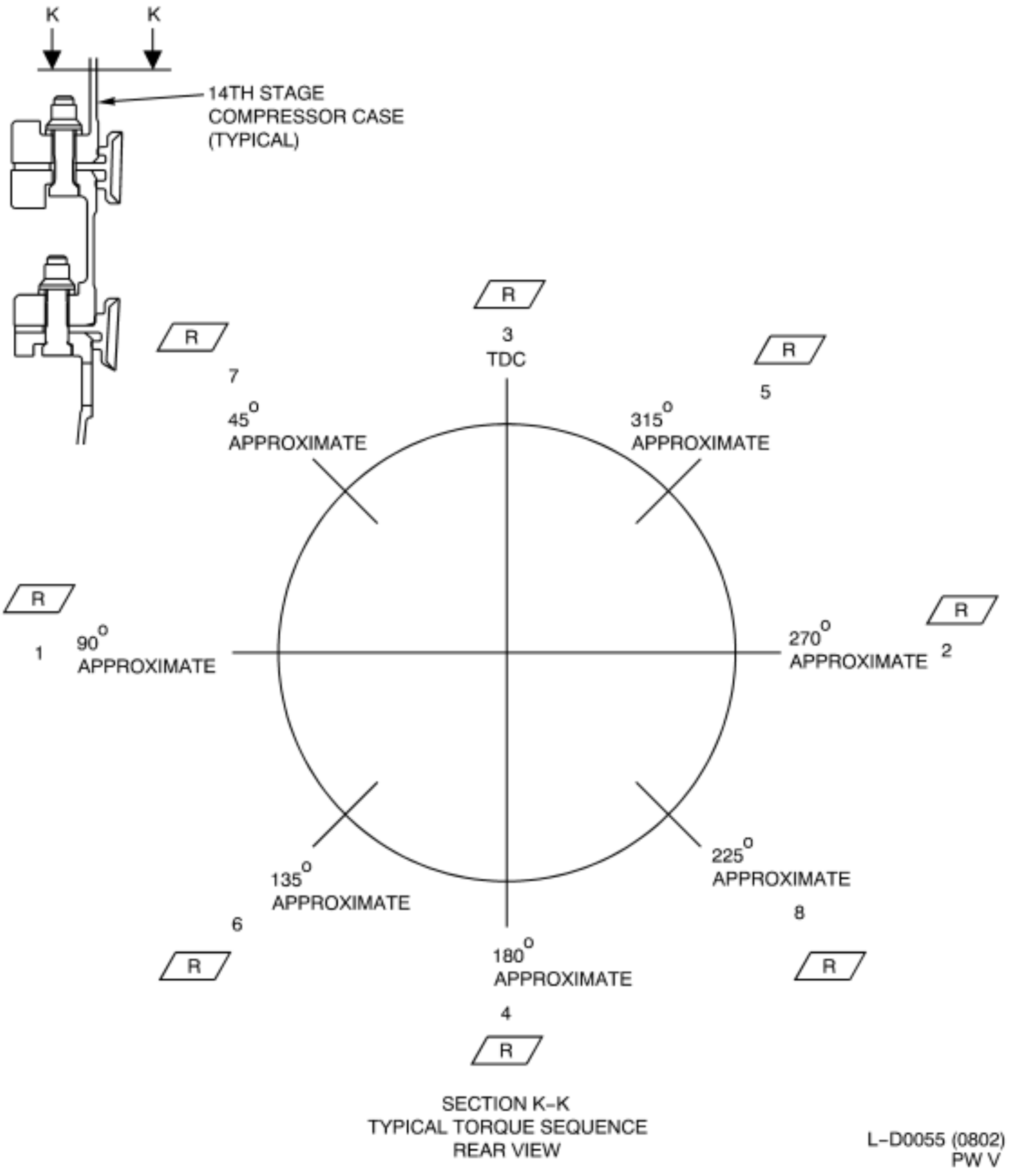
Eighth Stage Compressor Case Installation
(Symmetric Case Configuration)
Figure 1009 (Sheet 1)
(Task 72−35−04−440−001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01

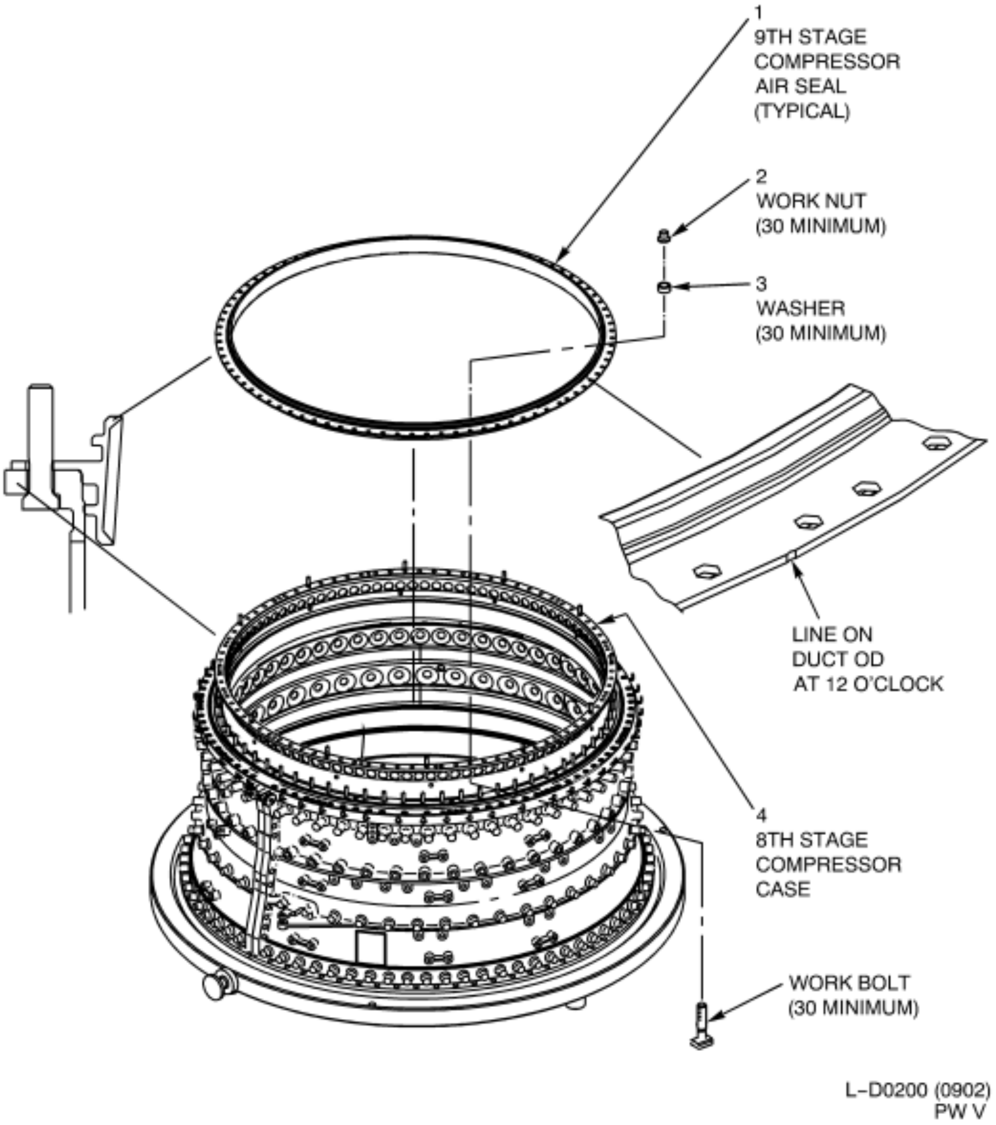

1
8TH STAGE
COMPRESSOR
CASE
2
BOLT
(30 MINIMUM)
3
WASHER
(30 MINIMUM)
LINE ON
CASE REAR
FLANGE OD
AT TOP
(12 O'CLOCK)
4
8TH STAGE
COMPRESSOR
AIR SEAL
FWD
L−D0687 (0303)
PW V

Eighth Stage Compressor Case Installation
(Asymmetric Case Configuration)
Figure 1009 (Sheet 2)
(Task 72−35−04−440−001)

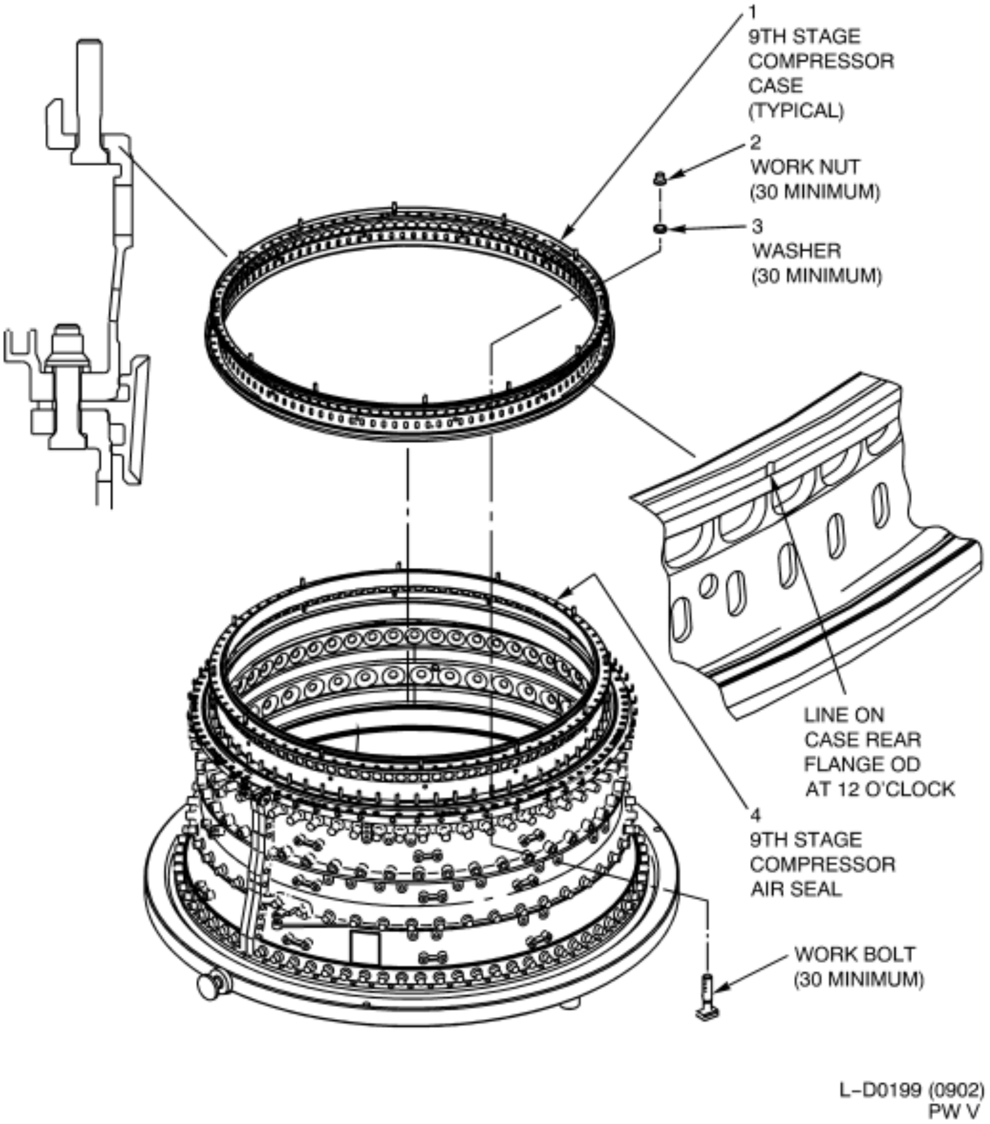
STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-01


K
K
14TH STAGE COMPRESSOR CASE (TYPICAL)
R
3
TDC
R
7
45°
APPROXIMATE
R
5
315°
APPROXIMATE
R
1
90°
APPROXIMATE
R
270°
APPROXIMATE
2
135°
APPROXIMATE
6
R
225°
APPROXIMATE
8
R
180°
APPROXIMATE
4
R
SECTION K-K
TYPICAL TORQUE SEQUENCE
REAR VIEW
L-D0055 (0802)
PW V

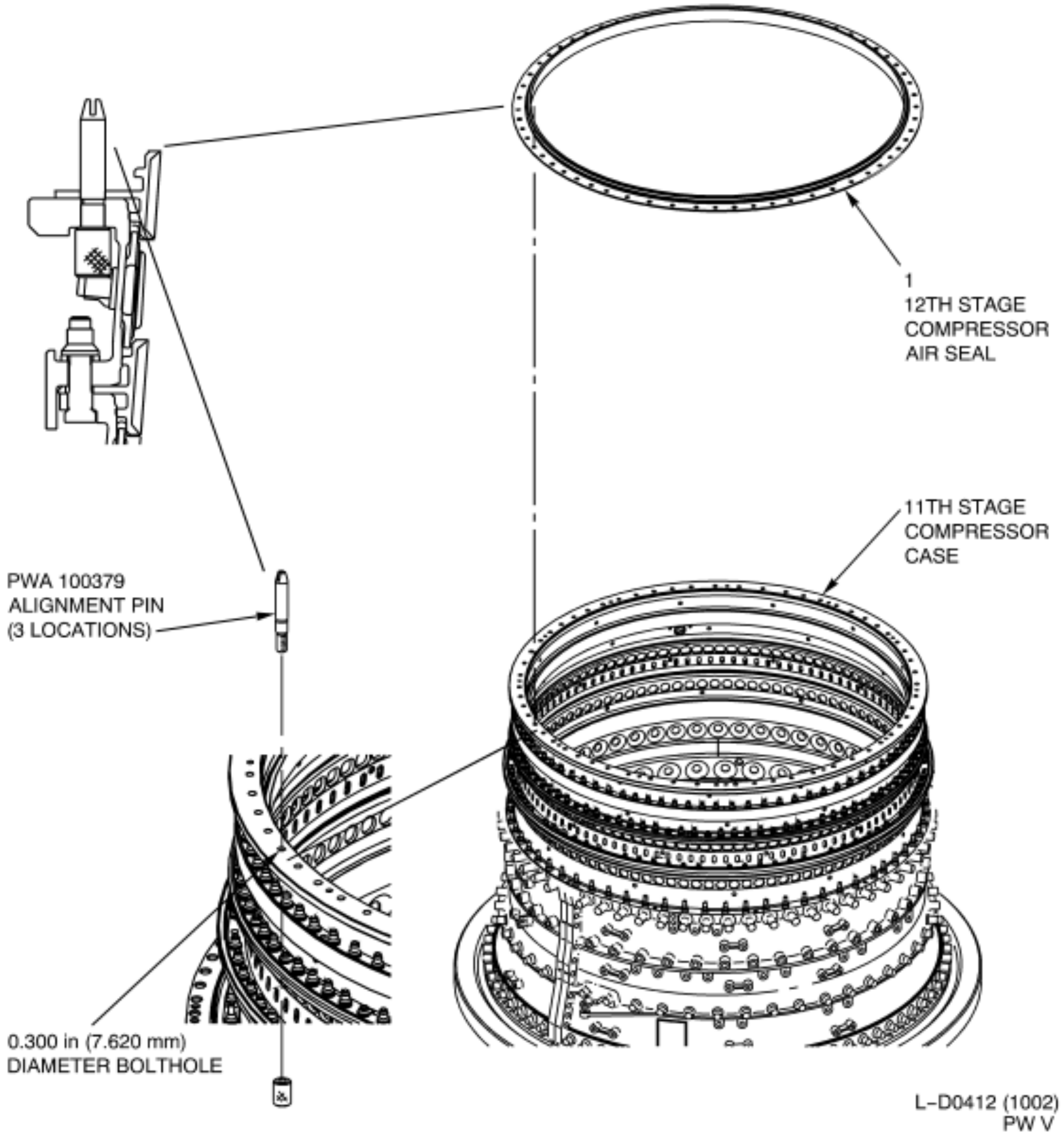
Special Torque Sequence
Figure 1010
(Task 72-35-04-440-001)


1
9TH STAGE
COMPRESSOR
AIR SEAL
(TYPICAL)
2
WORK NUT
(30 MINIMUM)
3
WASHER
(30 MINIMUM)
LINE ON
DUCT OD
AT 12 O'CLOCK
4
8TH STAGE
COMPRESSOR
CASE
WORK BOLT
(30 MINIMUM)
L−D0200 (0902)
PW V

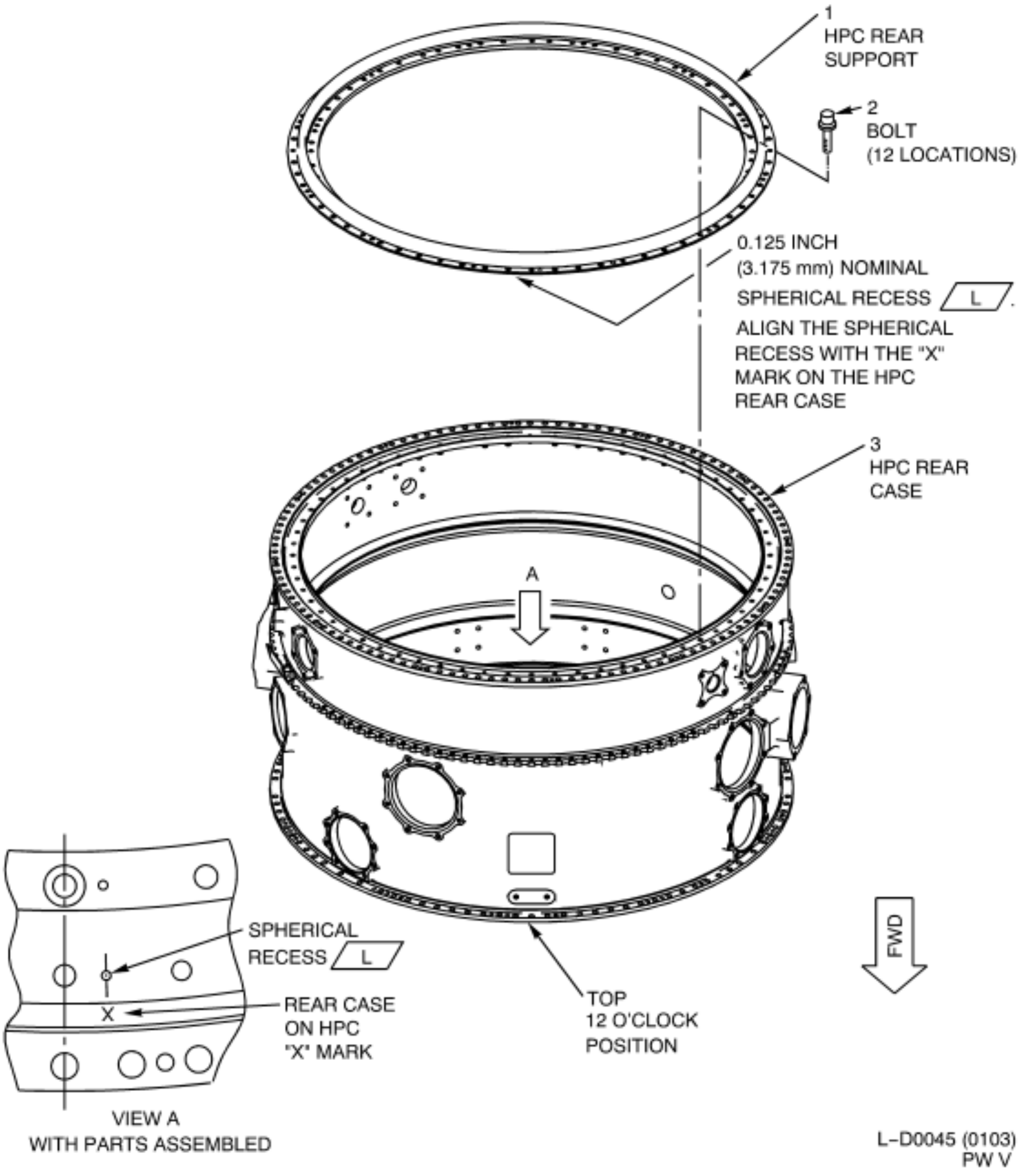
Ninth Stage Compressor Air Seal
Installation (Typical Stages 9 Through 15)
Figure 1011
(Task 72−35−04−440−001)


1
9TH STAGE COMPRESSOR CASE (TYPICAL)
2
WORK NUT (30 MINIMUM)
3
WASHER (30 MINIMUM)
LINE ON CASE REAR FLANGE OD AT 12 O'CLOCK
4
9TH STAGE COMPRESSOR AIR SEAL
WORK BOLT (30 MINIMUM)
L−D0199 (0902)
PW V

Ninth Stage Compressor Case Installation
(Typical Stages 9 Through 14)
Figure 1012
(Task 72−35−04−440−001)

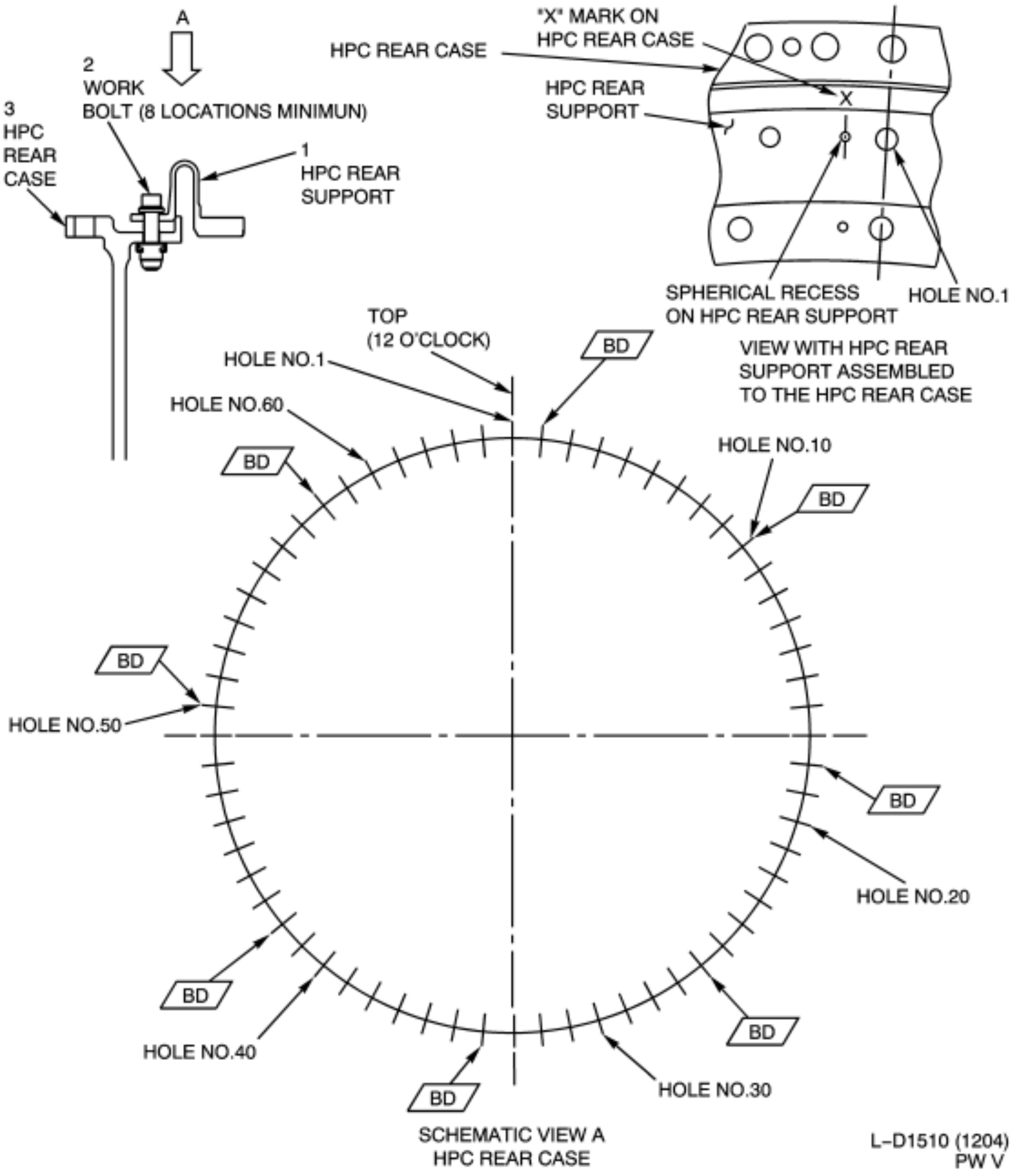

1
12TH STAGE
COMPRESSOR
AIR SEAL
11TH STAGE
COMPRESSOR
CASE
PWA 100379
ALIGNMENT PIN
(3 LOCATIONS)
0.300 in (7.620 mm)
DIAMETER BOLTHOLE
L−D0412 (1002)
PW V

Twelfth Stage Compressor Air Seal Installation
Figure 1013
(Task 72−35−04−440−001)


1
HPC REAR
SUPPORT
2
BOLT
(12 LOCATIONS)
0.125 INCH
(3.175 mm) NOMINAL
SPHERICAL RECESS L.
ALIGN THE SPHERICAL
RECESS WITH THE "X"
MARK ON THE HPC
REAR CASE
3
HPC REAR
CASE
A
FWD
SPHERICAL
RECESS L
X
REAR CASE
ON HPC
"X" MARK
TOP
12 O'CLOCK
POSITION
VIEW A
WITH PARTS ASSEMBLED
L-D0045 (0103)
PW V

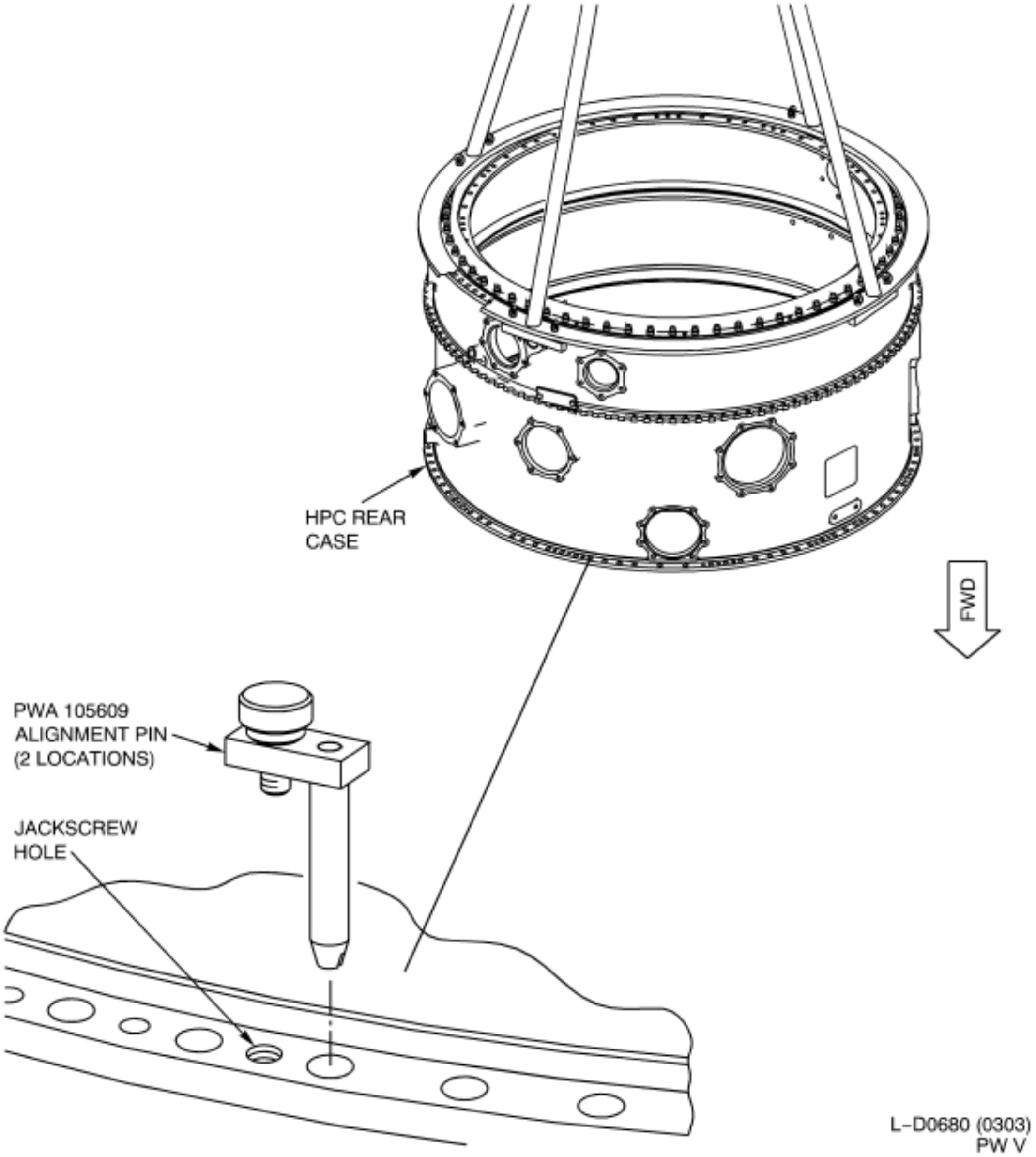
HPC Rear Case Installation
Figure 1014 (Sheet 1)
(Task 72-35-04-440-001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-01

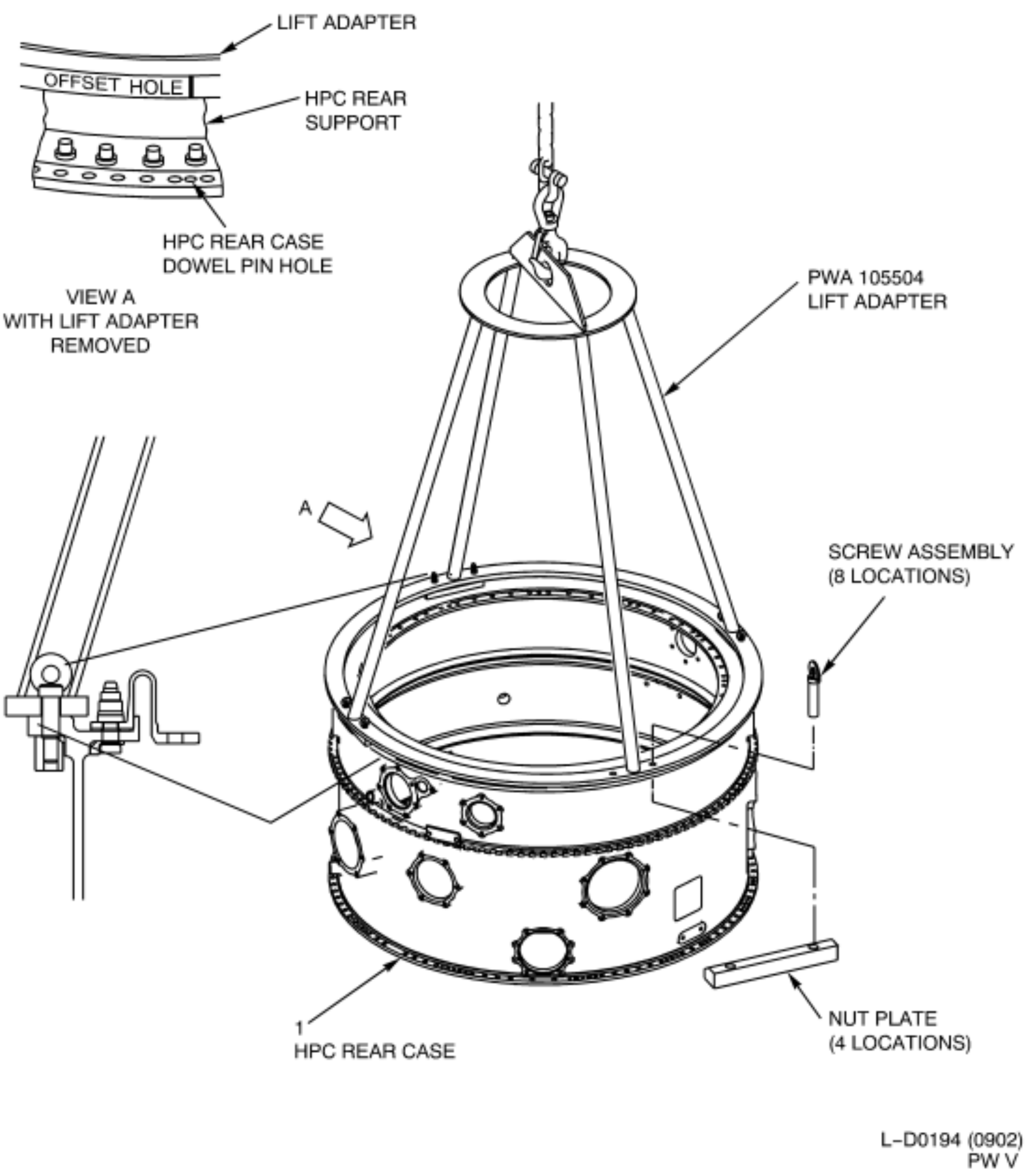

A
2
WORK
BOLT (8 LOCATIONS MINIMUN)
3
HPC
REAR
CASE
1
HPC REAR
SUPPORT
HPC REAR CASE
"X" MARK ON
HPC REAR CASE
HPC REAR
SUPPORT
X
SPHERICAL RECESS
ON HPC REAR SUPPORT
HOLE NO.1
VIEW WITH HPC REAR
SUPPORT ASSEMBLED
TO THE HPC REAR CASE
TOP
(12 O'CLOCK)
HOLE NO.1
HOLE NO.60
BD
HOLE NO.10
BD
BD
BD
HOLE NO.50
BD
HOLE NO.20
BD
HOLE NO.40
BD
BD
HOLE NO.30
SCHEMATIC VIEW A
HPC REAR CASE
L-D1510 (1204)
PW V

HPC Rear Case Installation
Figure 1014 (Sheet 2)
(Task 72-35-04-440-001)

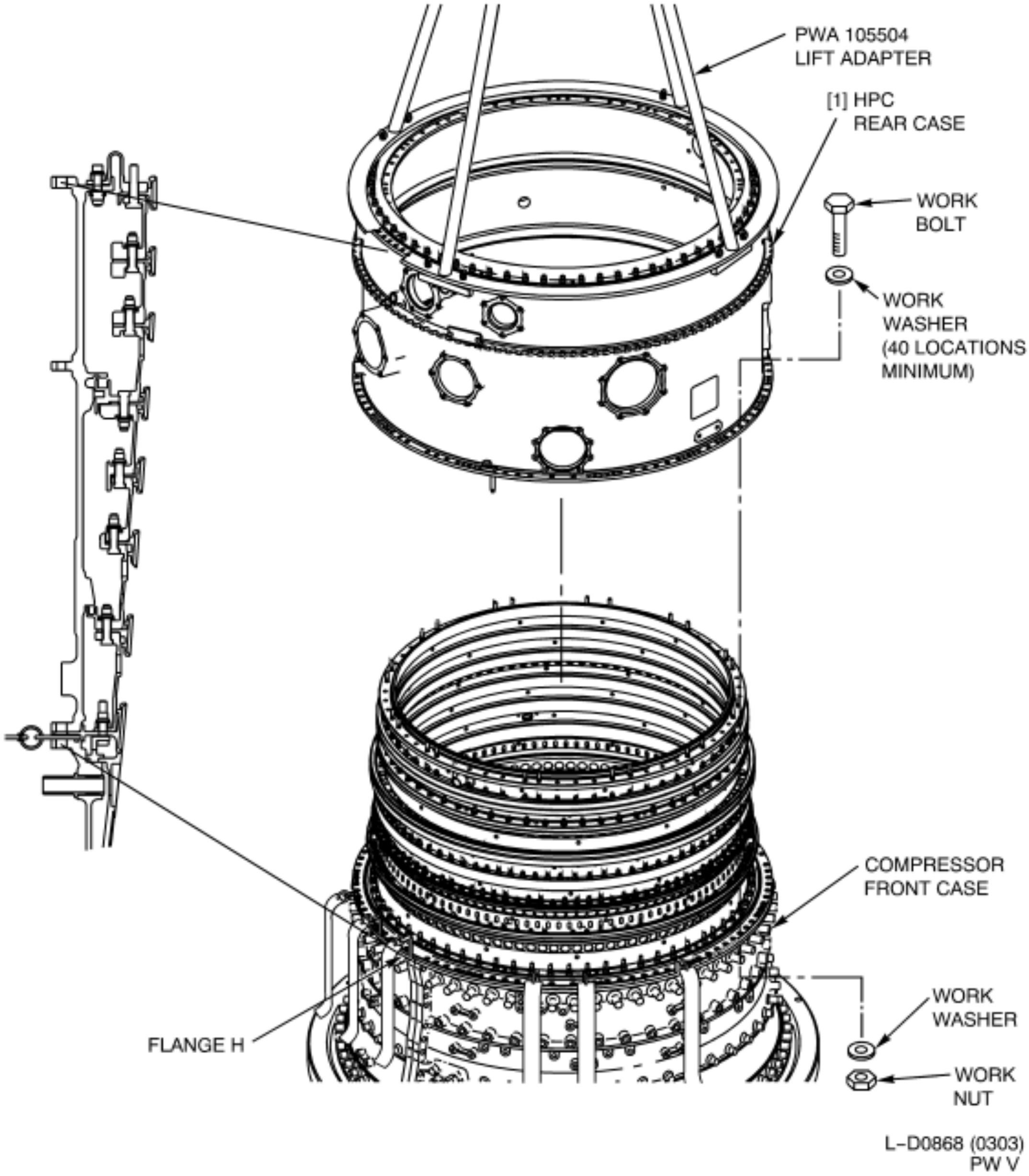
STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01


HPC REAR CASE
FWD
PWA 105609 ALIGNMENT PIN (2 LOCATIONS)
JACKSCREW HOLE
L−D0680 (0303)
PW V

HPC Rear Case Installation
Figure 1014 (Sheet 3)
(Task 72−35−04−440−001)

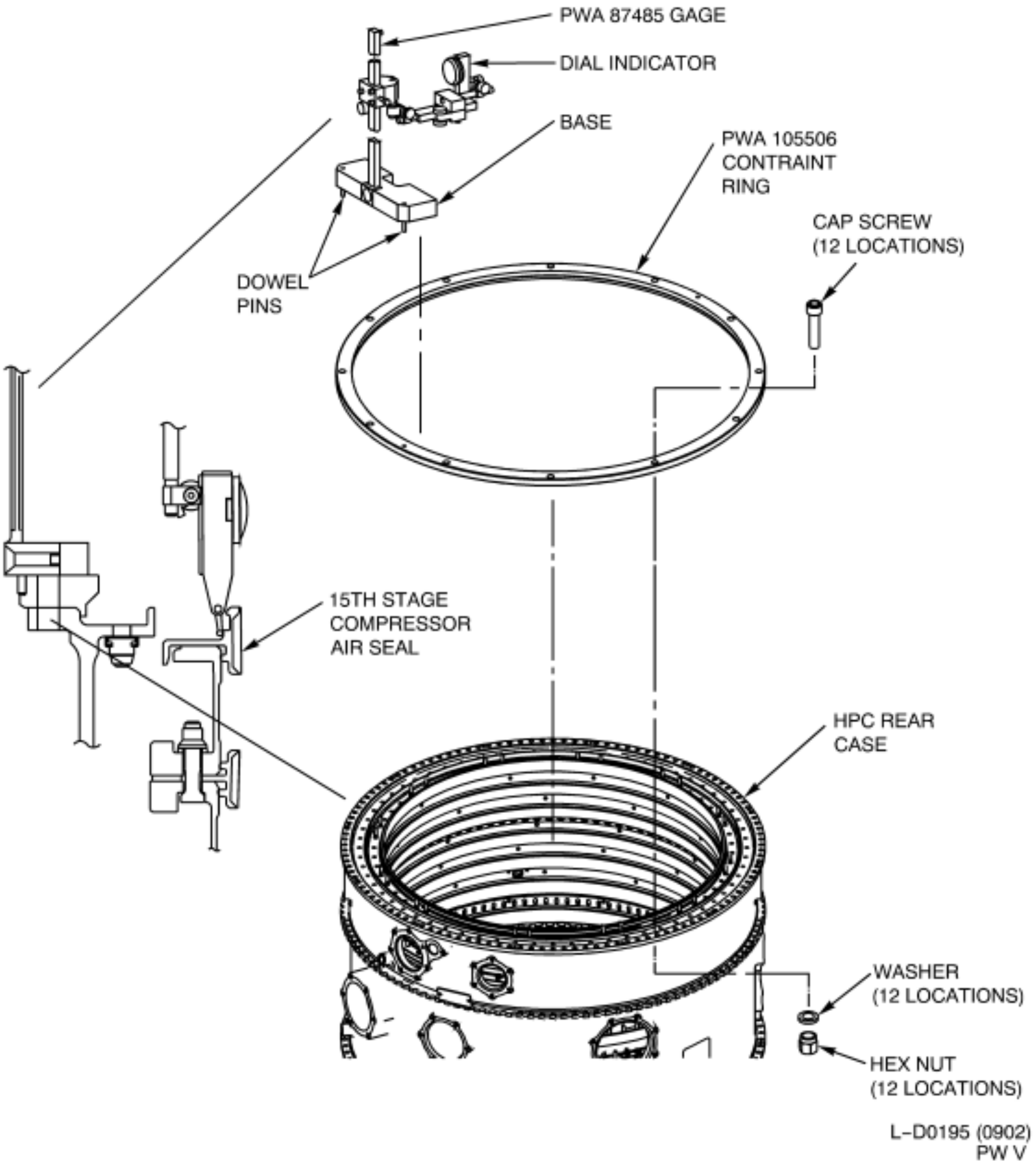

LIFT ADAPTER
OFFSET HOLE
HPC REAR SUPPORT
HPC REAR CASE DOWEL PIN HOLE
VIEW A WITH LIFT ADAPTER REMOVED
PWA 105504 LIFT ADAPTER
A
SCREW ASSEMBLY (8 LOCATIONS)
1
HPC REAR CASE
NUT PLATE (4 LOCATIONS)
L-D0194 (0902)
PW V

HPC Rear Case Installation
Figure 1014 (Sheet 4)
(Task 72-35-04-440-001)


PWA 105504
LIFT ADAPTER
[1] HPC
REAR CASE
WORK
BOLT
WORK
WASHER
(40 LOCATIONS
MINIMUM)
COMPRESSOR
FRONT CASE
FLANGE H
WORK
WASHER
WORK
NUT
L-D0868 (0303)
PW V

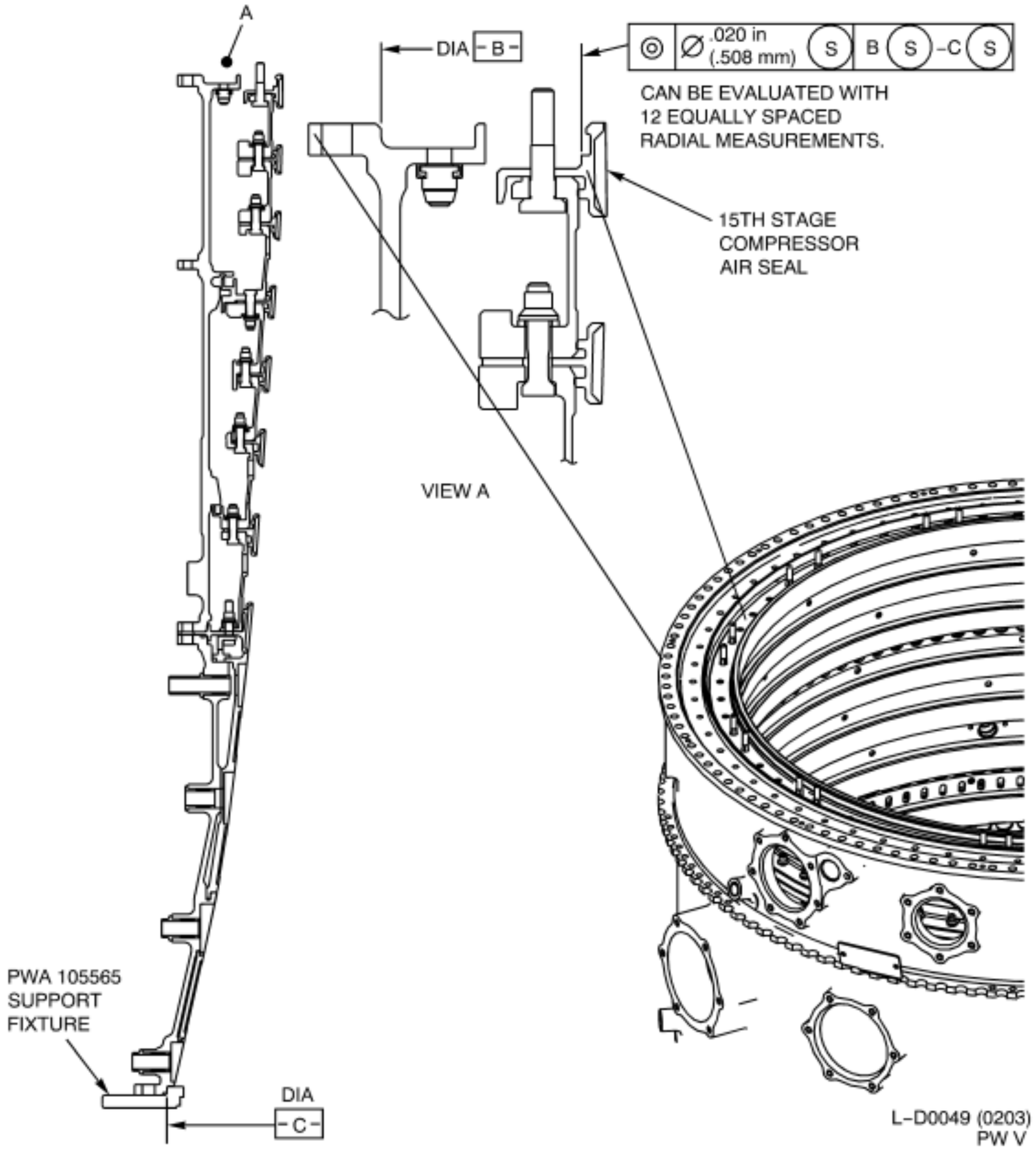
HPC Rear Case Installation
Figure 1014 (Sheet 5)
(Task 72-35-04-440-001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01


PWA 87485 GAGE
DIAL INDICATOR
BASE
PWA 105506 CONTRAINT RING
CAP SCREW (12 LOCATIONS)
DOWEL PINS
15TH STAGE COMPRESSOR AIR SEAL
HPC REAR CASE
WASHER (12 LOCATIONS)
HEX NUT (12 LOCATIONS)
L−D0195 (0902) PW V

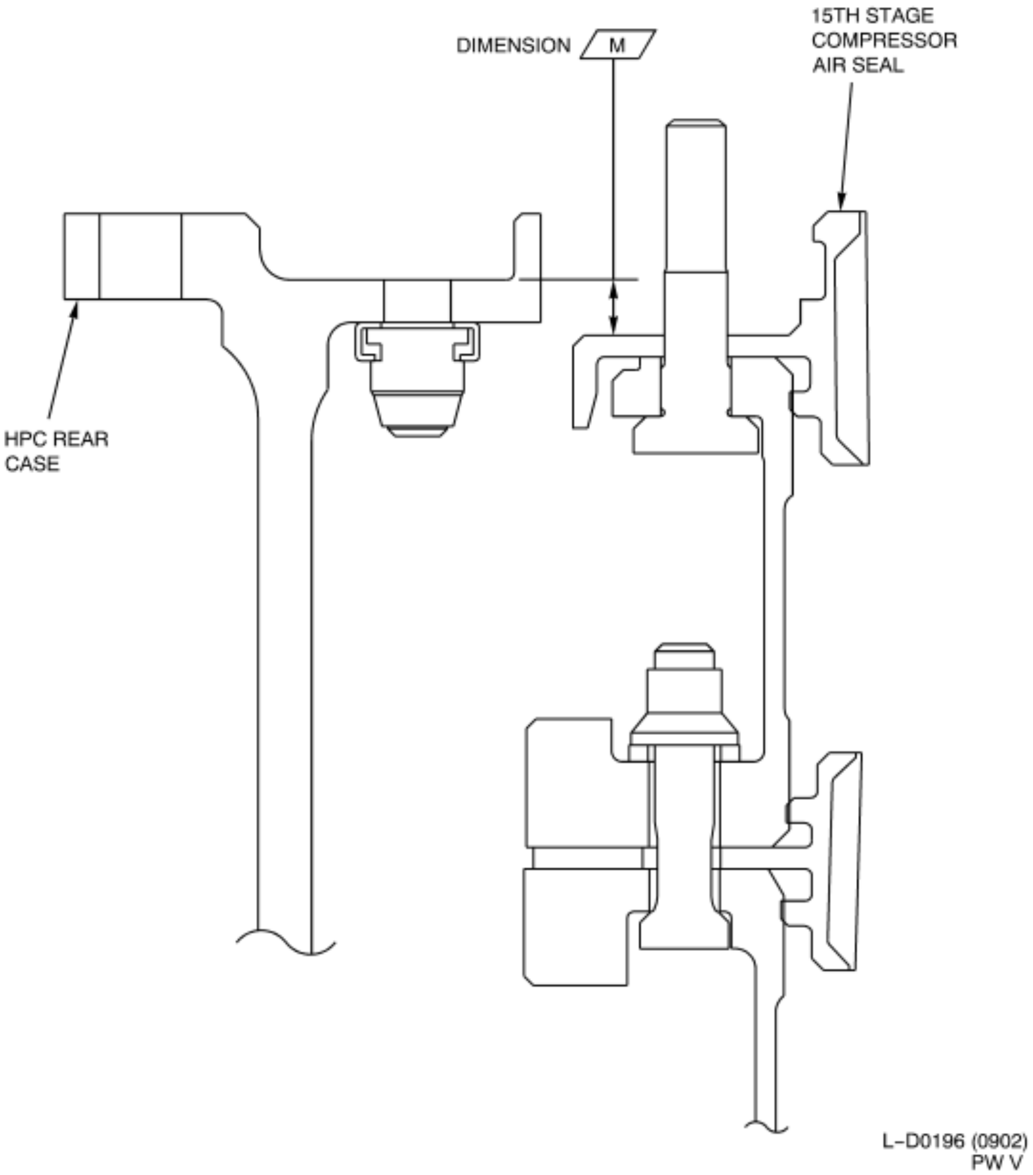
HPC Rear Case And 15th Stage Air Seal Concentricity Check
Figure 1015 (Sheet 1)
(Task 72−35−04−440−001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-01


A
DIA -B-
◎ ∅ .020 in (.508 mm) Ⓢ B Ⓢ -C Ⓢ
CAN BE EVALUATED WITH 12 EQUALLY SPACED RADIAL MEASUREMENTS.
15TH STAGE COMPRESSOR AIR SEAL
VIEW A
PWA 105565 SUPPORT FIXTURE
DIA -C-
L-D0049 (0203)
PW V

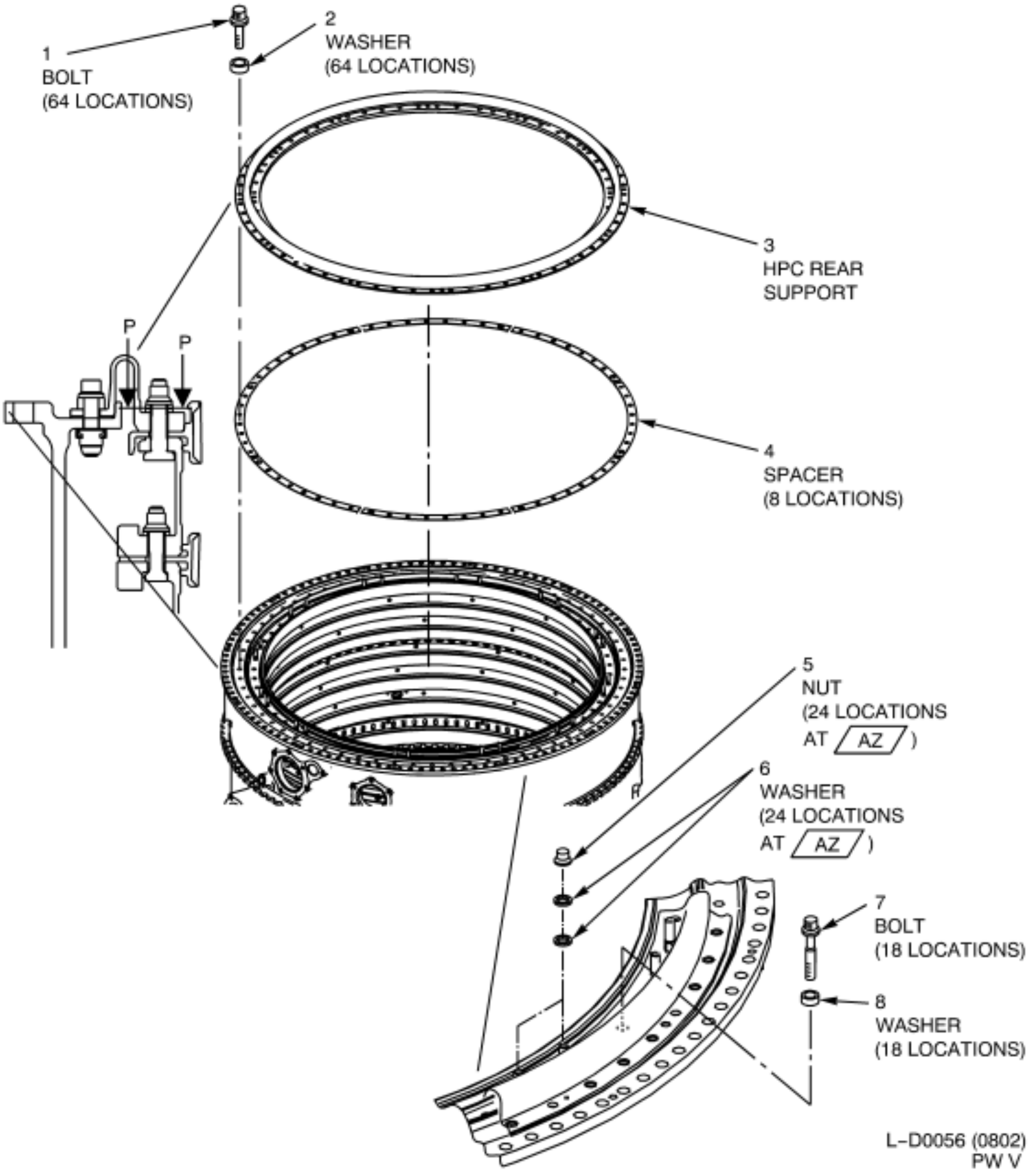
HPC Rear Case And 15th Stage Air Seal Concentricity Check
Figure 1015 (Sheet 2)
(Task 72-35-04-440-001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-01


DIMENSION M
15TH STAGE COMPRESSOR AIR SEAL
HPC REAR CASE
L-D0196 (0902)
PW V

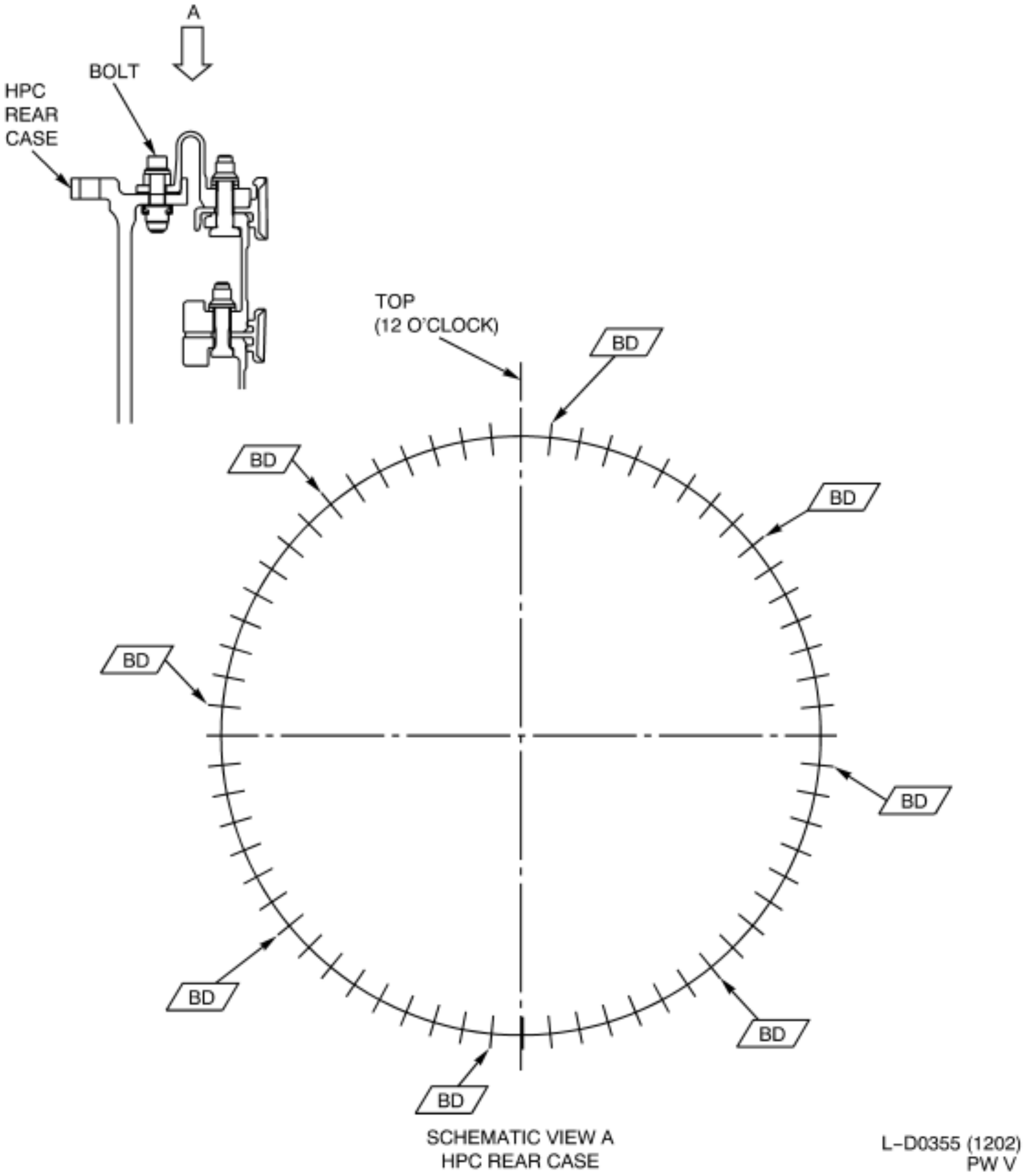
HPC Rear Support Spacer Measurement
Figure 1016
(Task 72-35-04-440-001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01


1
BOLT
(64 LOCATIONS)
2
WASHER
(64 LOCATIONS)
3
HPC REAR
SUPPORT
P
P
4
SPACER
(8 LOCATIONS)
5
NUT
(24 LOCATIONS
AT AZ)
6
WASHER
(24 LOCATIONS
AT AZ)
7
BOLT
(18 LOCATIONS)
8
WASHER
(18 LOCATIONS)
L-D0056 (0802)
PW V

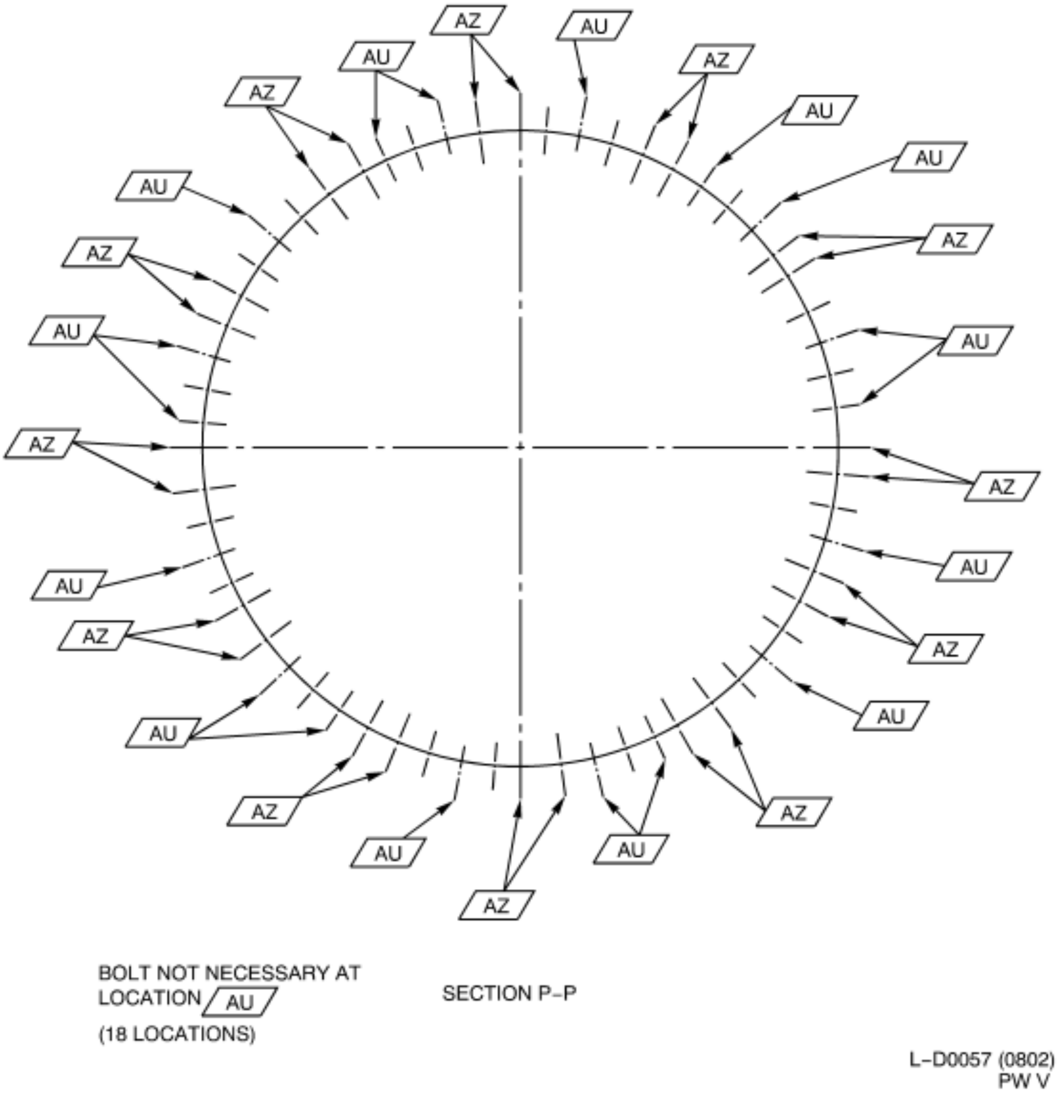
HPC Rear Support Installation
Figure 1017 (Sheet 1)
(Task 72−35−04−440−001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-01


A
BOLT
HPC
REAR
CASE
TOP
(12 O'CLOCK)
BD
BD
BD
BD
BD
BD
BD
BD
SCHEMATIC VIEW A
HPC REAR CASE
L-D0355 (1202)
PW V

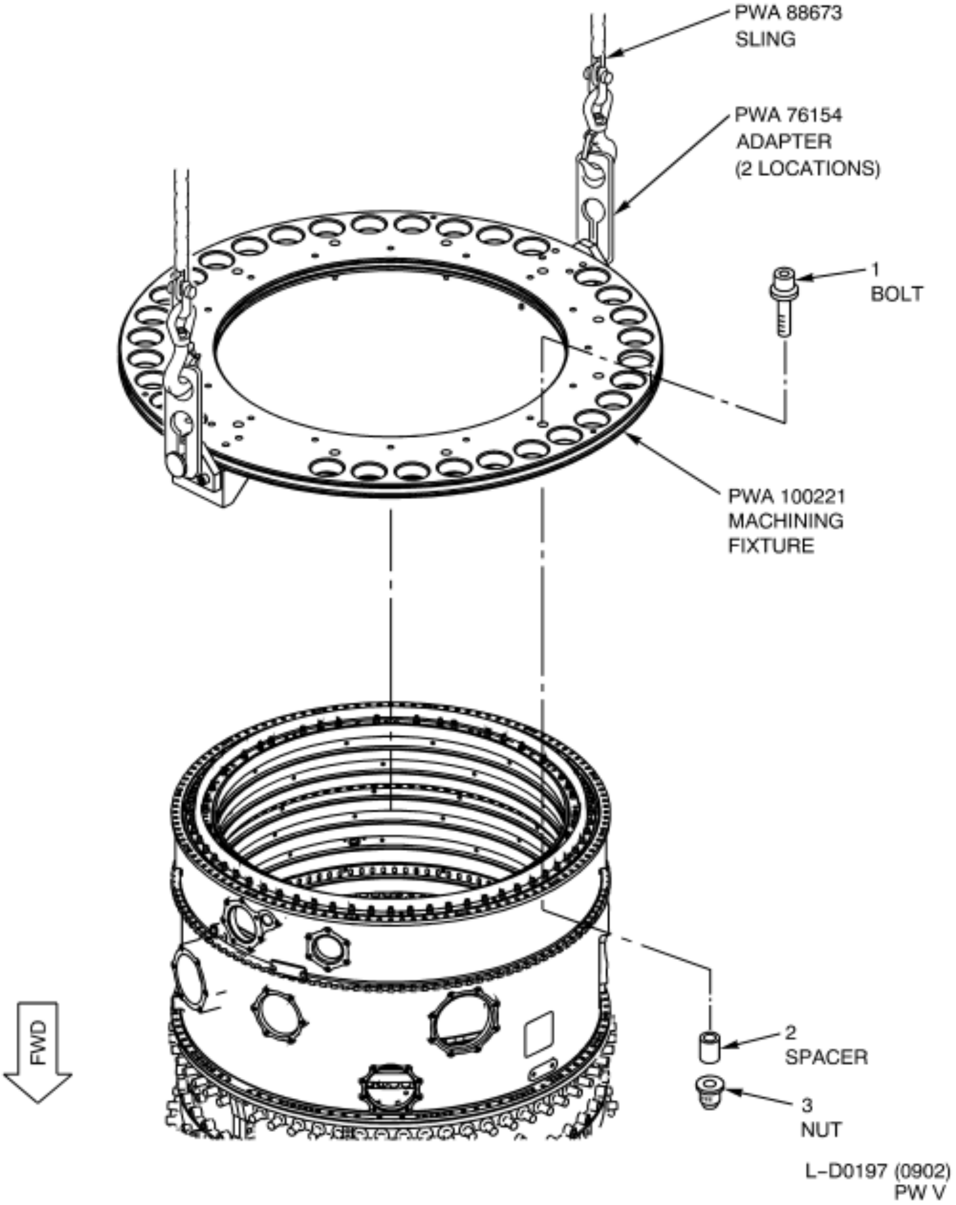
HPC Rear Support Installation (Outer Flange Bolt Torque Sequence)
Figure 1017 (Sheet 2)
(Task 72-35-04-440-001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−01


AZ
AU
AZ
AU
AZ
AU
AU
AZ
AU
AZ
AU
AZ
AU
AZ
AU
AZ
AU
AZ
AU
AZ
AU
AZ
AU
AZ
AU
AZ
AU
AZ
AU
AZ
AU
AZ
AU
AZ
AU
AZ
BOLT NOT NECESSARY AT LOCATION AU
(18 LOCATIONS)
SECTION P−P
L−D0057 (0802)
PW V

HPC Rear Support Installation
Figure 1017 (Sheet 3)
(Task 72−35−04−440−001)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-01


PWA 88673
SLING
PWA 76154
ADAPTER
(2 LOCATIONS)
1
BOLT
PWA 100221
MACHINING
FIXTURE
FWD
2
SPACER
3
NUT
L-D0197 (0902)
PW V

Machining Fixture Installation
Figure 1018
(Task 72-35-04-440-001)

Previous Pageblock   Return to Previous Menu   Next Pageblock

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-02

Task 72-35-04-440-002:

1. Machine The Stages 5 Through 15 Outer Air Seal Set

   A. Prerequisites

      (1) Assemble the Stages 5 Through 15 Outer Air Seal Set (for outer air seal machine). Refer to 72-35-04, Assembly-01 (Task 72-35-04-440-001).

      (2) Obtain the blade tip gage point radii dimensions for the 5th through 15th stage rotors. Refer to 72-35-01, Assembly-03, CONFIG-2 (Task 72-35-01-440-026).

      NOTE: The blade tip gage point radii dimensions are necessary to determine if the blade tip radii were re-targeted for blade tip machining requirements. The seal set must be retargeted by the same amount as the rotor radii.

      NOTE: Dimension K in the following figures and tables is the allowable retargeting range at each corresponding stage. This is an allowable deviation from the nominal radius in order to target nominal tip clearances. It is not a manufacturing tolerance. For manufacturing tolerances, the profile tolerances as shown in the corresponding figures apply.

   B. Equipment And Materials Necessary

      Special Tools:
      PWA 76154 Adapter (4 Necessary)
      PWA 88673 Sling (2 Necessary)

   C. Procedure

      (1) Install the case assembly to the machine tool bed as follows.

         (a) Use a hoist to attach a PWA 88673 Sling with two PWA 76154 Adapters to the PWA 100221 Machining Fixture.

         (b) Use the hoist to lift the case assembly.

         (c) Use a second hoist to connect a PWA 88673 Sling with two PWA 76154 Adapters to the PWA 105565 Fixture.

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−02

(d) Use both hoists to trunnion the case assembly to put the Machining Fixture end down.

(e) Remove the hoist, Sling, and Adapters from the lower Machining Fixture.

(f) Move the two Machining Fixture trunnion spools to the MACHINE/INSPECT position as follows.

  1 Remove the two bolts that attach the both trunnion spools.

  2 Turn the trunnion spools so that they are in the MACHINE/INSPECT position.

  3 Attach the trunnion spools with the Fixture bolts.

(g) Lower the assembly on the machine tool bed.

(h) Use the Machining Fixture base precision outside diameter or precision inside diameter and detail gage pads to align the Fixture to the VTL.

(i) Use the 12 outer holes of the of the Fixture base to attach the Fixture to the VTL.

(j) Remove the Adapters, Slings, and hoists.

NOTE: Do not remove the Fixture from the front (upper) end of the case assembly.

(2) For the 5th through 8th stage compressor air seals, the abradable rubstrip machining parameters are as follows.

R (a) For PWA 279−1, Tool specifications, speeds and
R feeds are as follows:

Tool: Single point Carboloy or Equivalent Carbide Tool

Radius 0.015 − 0.031 inch (0.38 − 0.79 mm)
Rake: 5° positive rake

Feed: 0.005 inch/revolution
(0.127 mm/revolution)

Speed: 450 feet surface feet/minute
(137.16 surface m/minute)

Depth of cut:
Rough Cut: 0.009 − 0.015 inch
(0.229 − 0.381 mm)
Finish Cut: 0.009 − 0.015 inch
(0.229 − 0.381 mm)

Lubricants: None Allowed

R (b) For PWA 24−1, Tool specifications, speeds and feeds are as follows:

R Tool: Single point Carboloy or Equivalent Carbide Tool
R Radius 0.015 − 0.031 inch (0.38 − 0.79 mm)
R Rake: 5° positive rake

R Feed: 0.006 − 0.008 inch/revolution
R (0.153 − 0.203 mm/revolution);
R the initial can be done at
R 0.003 inch/revolution (0.076 mm/revolution)
R Speed: 150 − 275 surface ft./minute
R (45.72 − 83.82 surface meters/minute)

R Depth of cut: 0.005 − 0.030 inch (0.13 − 0.76 mm)
R A 0.010 inch (0.254 mm) depth of
R cut is recommended

R Lubricants: None Allowed

(3) For the 9th through 15th stage compressor air seals, the abradable rubstrip machining parameters are as follows.

R (a) For PWA 284, Tool specifications, speeds and feeds are as follows:

Tool: Single point Carboloy or Equivalent Carbide Tool

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−02

Radius 0.031 inch (0.787 mm)
Rake: 5° positive side rake

Feed: 0.003 − 0.005 inch/revolution
(0.077 − 0.127 mm/revolution)

Speed: 300 surface feet/minute
(91.44 surface m/minute)

Depth of cut:
Rough Cut: 0.005 − 0.030 inch
(0.13 − 0.76 mm)
Finish Cut: 0.005 − 0.010 inch
(0.127 − 0.254 mm)

Lubricants: None Allowed

(4) Machine each air seal as shown in Figure 1001 (Sheets 1 through 6), and as follows.

NOTE: Tools dull at a higher rate than they do if solid material is machined. Dull tools produce a glazed surface which is unacceptable for an abradable seal. Attempts at high removal rates have tended to gouge the material and result in an unacceptable condition.

(a) For rough cuts, no more than six cuts for each insert.

(b) For semi−finish and finish cuts, a new cutting edge is required for each cut.

(c) Cutting should be as smooth, continuous, and uninterrupted as possible.

(d) Brush chips/dust away after each pass and prior to any measuring of the abradable rub strips by the machine probe or other measuring device. This will ensure correct inspection dimensions.

(e) If you cut the base material at either end of the abradable surface, the cuts should start in the middle of the abradable surface and machine towards the outside so that a metal burr will not be rolled into the abradable.

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−02

(5) Measure and record the air seal rubstrip diameters for each stage.

R NOTE: It is recommended that the air seal rubstrip profiles be measured on a separate Coordinate Measuring Machine (CMM) as required to make sure that the VTL is accurate.

NOTE: The rubstrip diameters will be used to calculate the blade tip clearances in 72−35−00, Inspection/Check−05, CONFIG−2 (Task 72−35−00−990−012).

(a) Take measurements in at least 18 equally spaced locations.

(b) Calculate and record the 5th through 15th stage average and local maximum and minimum radii for each stage from the measured data.

(6) If you retargeted the airseal from the nominal dimensions you must identify the HPC seal set and the HPC axial rotor as a matched set.

(7) Move the two Machining Fixture trunnion spools to the REMOVE/INSTALL position as follows.

(a) Remove the two bolts that attach the both trunnion spools.

(b) Turn the trunnion spools so that they are in the REMOVE/INSTALL position.

(c) Attach the trunnion spools with the Fixture bolts.

(8) Install the assembly to a suitable pallet (front end down) as follows.

(a) Use a hoist to attach the PWA 88673 Sling with two PWA 76154 Adapters to the Support Fixture.

(b) Lift the assembly from the tool bed.

(c) Use a second hoist to connect the PWA 88673 Sling with two PWA 76154 Adapters to the Machining Fixture.

(d) Use both hoists to trunnion the case assembly to front end down.

(e) Remove the hoist, Sling, and Adapters from the Support Fixture.

(f) Lower the case assembly onto a suitable pallet.

(g) Remove the Adapters, Slings, and hoists.

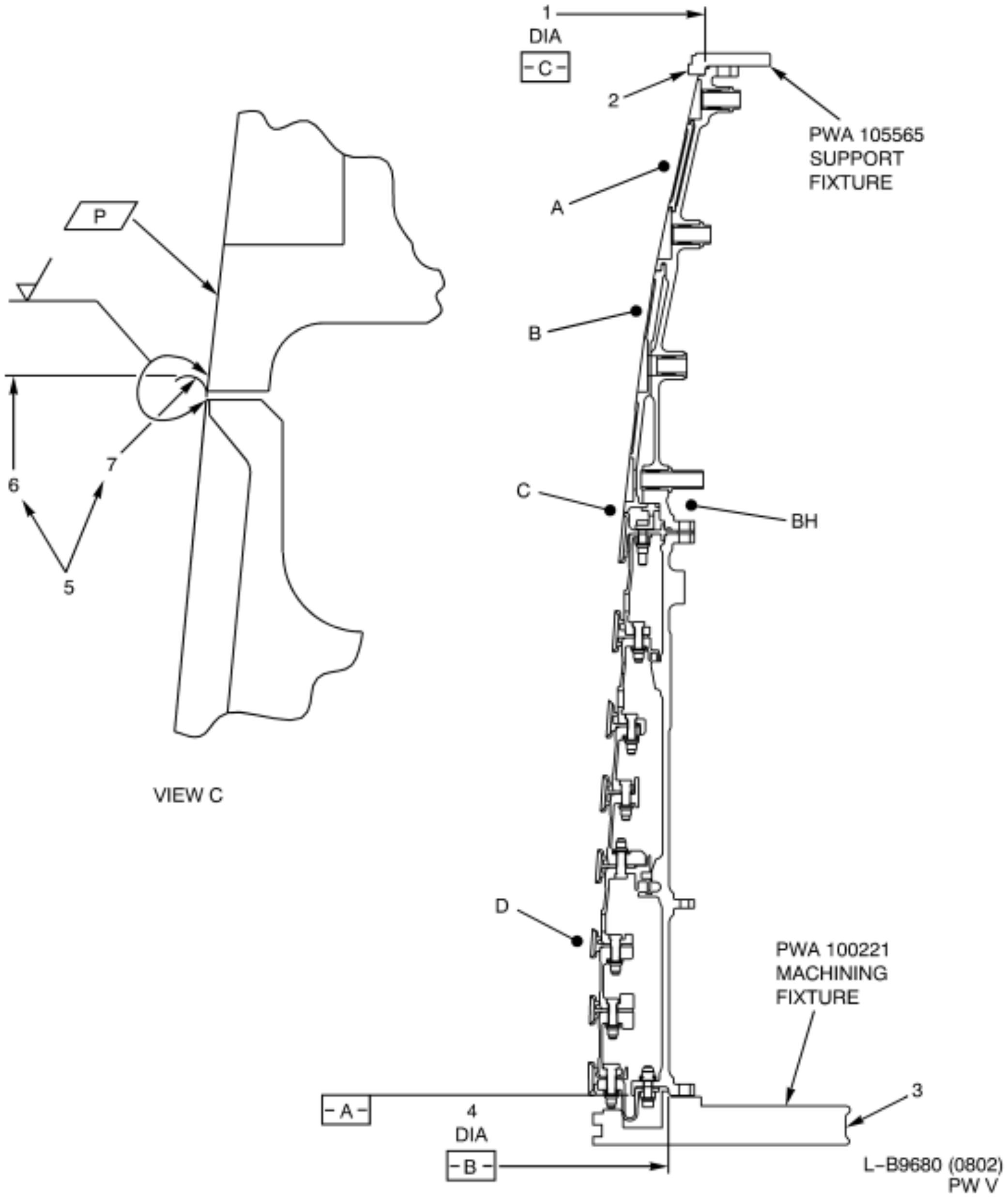
(9) Examine the assembly for foreign objects, damage, and correct assembly.

(10) Make sure that you install all the necessary protection covers.

D. Postrequisites

(1) Disassemble The Stages 5 Through 15 Outer Air Seal Set. Refer to 72−35−04, Disassembly−01 (Task 72−35−04−040−001).

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−02


1
DIA
-C-
2
PWA 105565
SUPPORT
FIXTURE
A
B
C
BH
P
6
7
5
VIEW C
D
PWA 100221
MACHINING
FIXTURE
3
-A-
4
DIA
-B-
L-B9680 (0802)
PW V

Outer Air Seal Machining (Typical)
Figure 1001 (Sheet 1)
(Task 72−35−04−440−002)

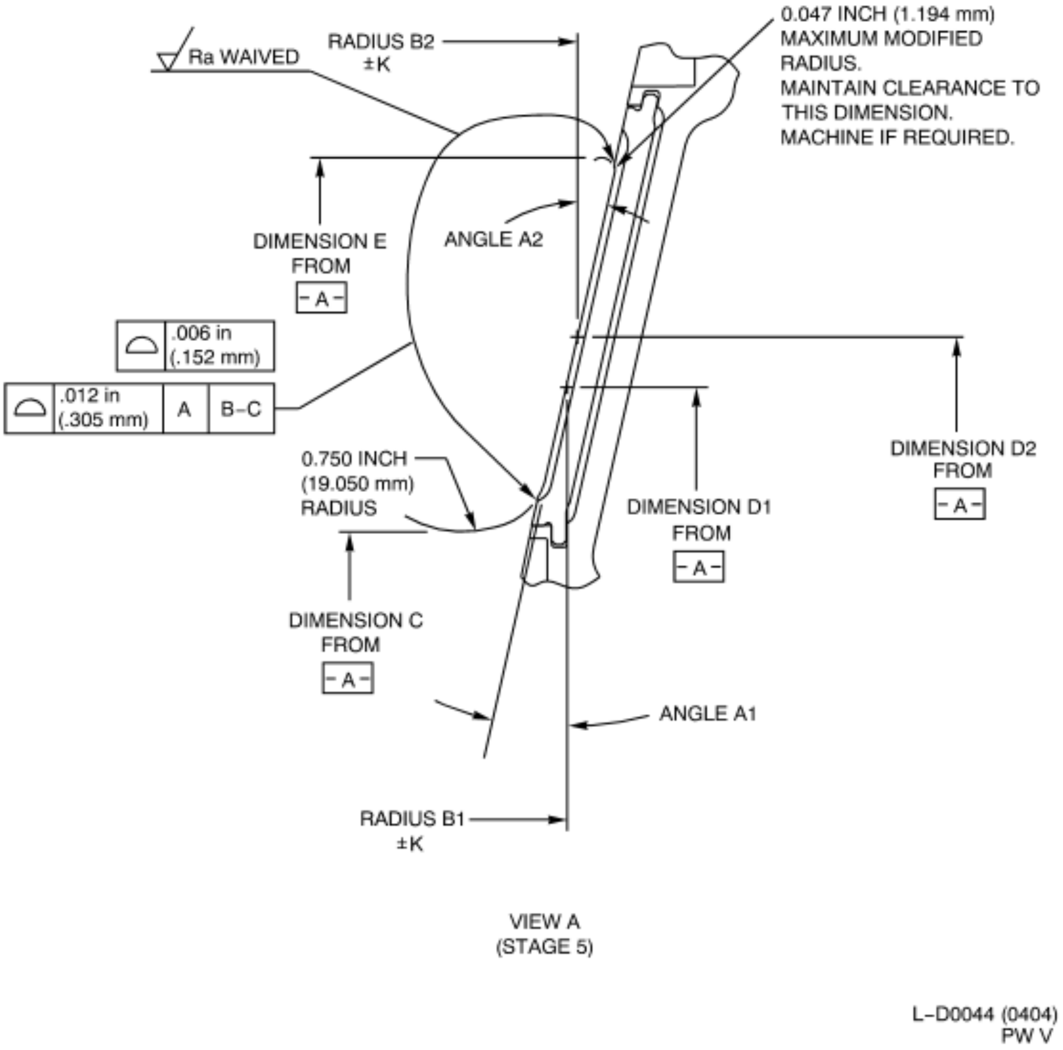
STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−02

1. 34.568 − 34.572 Inch (878.028 − 878.128 mm) Diameter C, Reference.
2. Indicate To Within 0.004 Inch (0.102 mm) FIR. See The NOTE.
3. Indicate To Within 0.002 Inch (0.051 mm) FIR. This Can Be Up To 0.004 Inch (0.102 mm) FIR If Required To Balance The Seal Set On The Tool Bed To Obtain The Upper Runout Within 0.004 Inch (0.102 mm) FIR. See The NOTE.
4. 32.234 − 32.238 Inch (818.744 − 818.845 mm) Diameter B, Reference.
5. Maintain Clearance To This Dimension. Machining Of Surface P Is Permitted But May Not Be Required To Meet This Dimension.
6. 18.640 − 18.660 Inches (473.46 − 473.96 mm) From Datum A
7. 0.047 Inch (1.194 mm) Modified Radius Maximum

NOTE: These are recommended set−up requirements to make sure that the outer air seal machining dimensions meet the location tolerance requirements relative to the datums.

Key to Figure 1001 (Sheet 1)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−02


0.047 INCH (1.194 mm)
MAXIMUM MODIFIED
RADIUS.
MAINTAIN CLEARANCE TO
THIS DIMENSION.
MACHINE IF REQUIRED.
Ra WAIVED
RADIUS B2
±K
DIMENSION E
FROM
-A-
ANGLE A2
.006 in
(.152 mm)
.012 in
(.305 mm)
A
B−C
0.750 INCH
(19.050 mm)
RADIUS
DIMENSION D2
FROM
-A-
DIMENSION D1
FROM
-A-
DIMENSION C
FROM
-A-
ANGLE A1
RADIUS B1
±K
VIEW A
(STAGE 5)
L−D0044 (0404)
PW V

Outer Air Seal Machining (Stage 5)
Figure 1001 (Sheet 2)
(Task 72−35−04−440−002)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-02

Dim C In. (mm)	Dim D1 * In. (mm)	Radius B1 *	Angle A1	Retarget Allowance K Inch (mm)
28.115 - 28.135 (714.12 - 714.63)	29.315 (744.601)	16.348 (415.239)	12° 0'	+0.010/ -0.005 (+0.254/ -0.127)

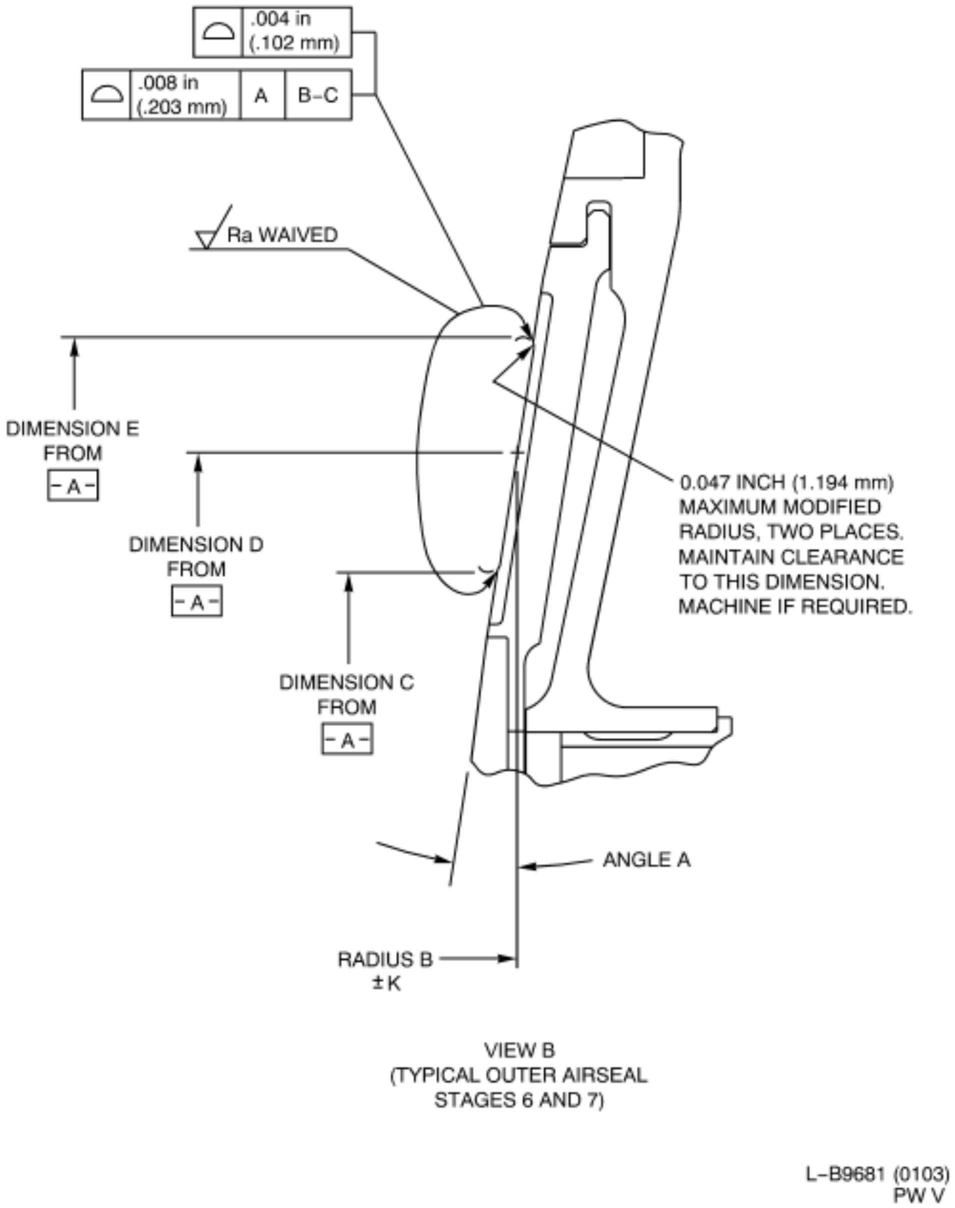
Dim E In. (mm)	Dim D2 * In. (mm) See NOTE.	Radius B2 *	Angle A2	Retarget Allowance K Inch (mm)
30.646 - 30.666 (778.41 - 778.92)	29.675 (753.745)	16.427 (417.246)	12° 45'	+0.010/ -0.005 (+0.254/ -0.127)

NOTE: * The axial location of the flowpath gage points corresponds to the HPC rotor assembly grind axial stations.

NOTE: * The blade tip gage point radii dimensions for the 5th through 15th stage rotors were determined in 72-35-01, Assembly-03, CONFIG-2 (Task 72-35-01-440-026). If the rotor grind dimensions have been re-targeted, you must re-target both corresponding air seal radii by the same amount.

NOTE: For Dimensions C and E, maintain clearance to the dimensions shown. Machine if required.

Key to Figure 1001 (Sheet 2)


.004 in
(.102 mm)
.008 in
(.203 mm)
A
B-C
Ra WAIVED
DIMENSION E
FROM
-A-
DIMENSION D
FROM
-A-
DIMENSION C
FROM
-A-
0.047 INCH (1.194 mm)
MAXIMUM MODIFIED
RADIUS, TWO PLACES.
MAINTAIN CLEARANCE
TO THIS DIMENSION.
MACHINE IF REQUIRED.
ANGLE A
RADIUS B
±K
VIEW B
(TYPICAL OUTER AIRSEAL
STAGES 6 AND 7)
L-B9681 (0103)
PW V

Outer Air Seal Machining (Stages 6
And 7) (Symmetric Case Configuration)
Figure 1001 (Sheet 3)
(Task 72-35-04-440-002)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−02

Stage	Dim. D * Inch (mm)	Radius B * Inch (mm)	Angle A	Dim. C ±0.010 Inch ±(0.254 mm) Inch (mm)	Dim. E ±0.010 Inch ±(0.254 mm) Inch (mm)	Radius Retarget Allowance K Inch (mm)
6	25.168 (639.267)	15.500 (393.700)	8° 53'	24.495 (622.173)	25.800 (655.320)	+0.012/ −0.005 +(0.305)/ −(0.127)
7	21.319 (541.503)	15.003 (381.076)	6° 27'	20.695 (525.653)	21.875 (555.625)	+0.012/ −0.005 +(0.305)/ −(0.127)

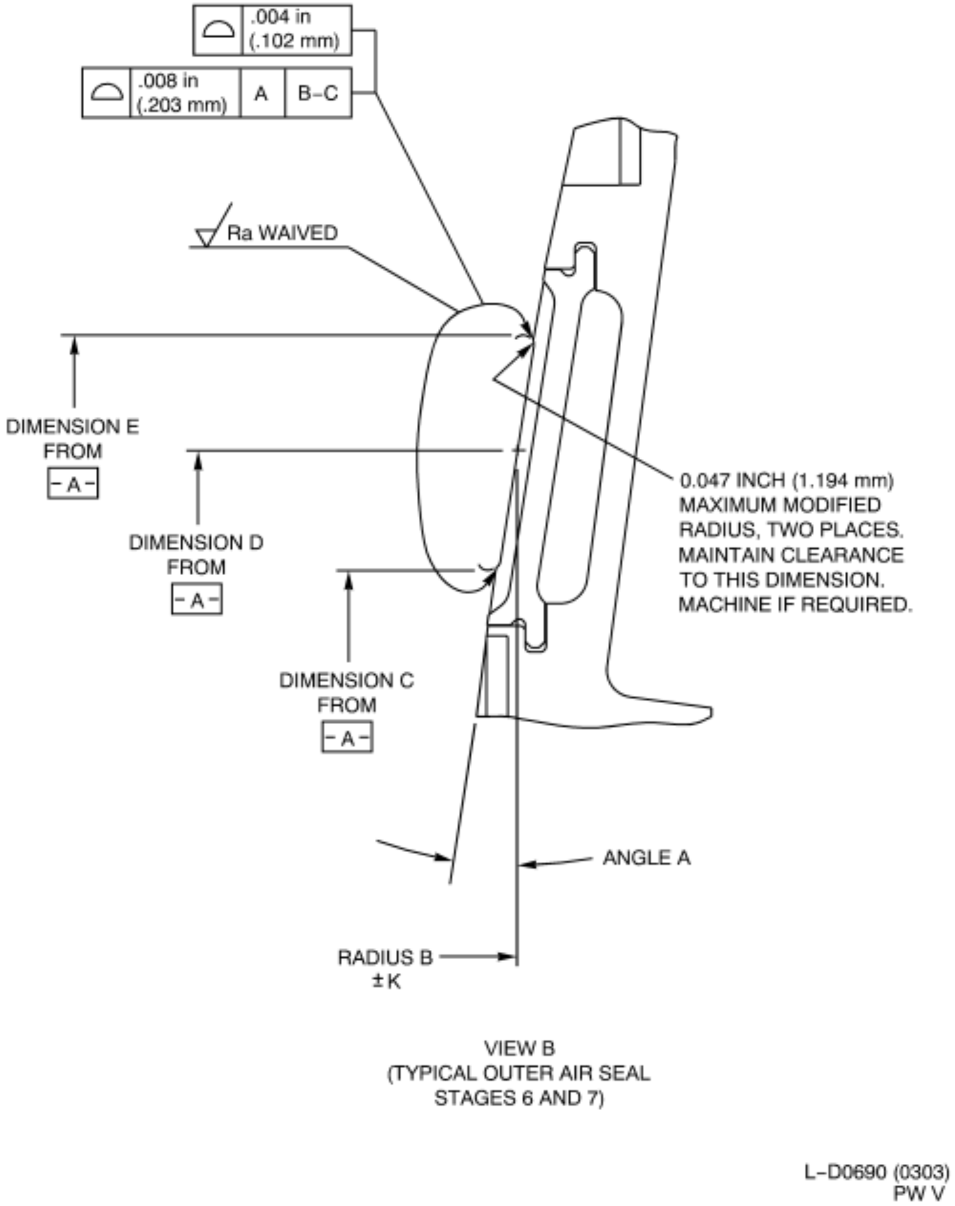
NOTE: * The axial location of the flowpath gage points corresponds to the HPC rotor assembly grind axial stations.

NOTE: * The blade tip gage point radii dimensions for the 5th through 15th stage rotors were determined in 72−35−01, Assembly−03, CONFIG−2 (Task 72−35−01−440−026). If the rotor grind dimensions have been re−targeted, you must re−target the corresponding air seal radius by the same amount.

NOTE: For Dimensions C and E, maintain clearance to the dimensions shown. Machine if required.

Key to Figure 1001 (Sheet 3)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−02


.004 in
(.102 mm)
.008 in
(.203 mm)
A
B−C
Ra WAIVED
DIMENSION E
FROM
-A-
DIMENSION D
FROM
-A-
DIMENSION C
FROM
-A-
0.047 INCH (1.194 mm)
MAXIMUM MODIFIED
RADIUS, TWO PLACES.
MAINTAIN CLEARANCE
TO THIS DIMENSION.
MACHINE IF REQUIRED.
ANGLE A
RADIUS B
±K
VIEW B
(TYPICAL OUTER AIR SEAL
STAGES 6 AND 7)
L−D0690 (0303)
PW V

Outer Air Seal Machining (Stages 6 And 7) (Asymmetric Case Configuration)
Figure 1001 (Sheet 4)
(Task 72−35−04−440−002)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-02

Stage	Dim. D * Inch (mm)	Radius B * Inch (mm)	Angle A	Dim. C ±0.010 Inch ±(0.254 mm) Inch (mm)	Dim. E ±0.010 Inch ±(0.254 mm) Inch (mm)	Radius Retarget Allowance K Inch (mm)
6	25.168 (639.267)	15.500 (393.700)	8° 53'	24.495 (622.173)	25.800 (655.320)	+0.012/ -0.005 +(0.305)/ -(0.127)
7	21.319 (541.503)	15.003 (381.076)	6° 27'	20.695 (525.653)	21.875 (555.625)	+0.012/ -0.005 +(0.305)/ -(0.127)

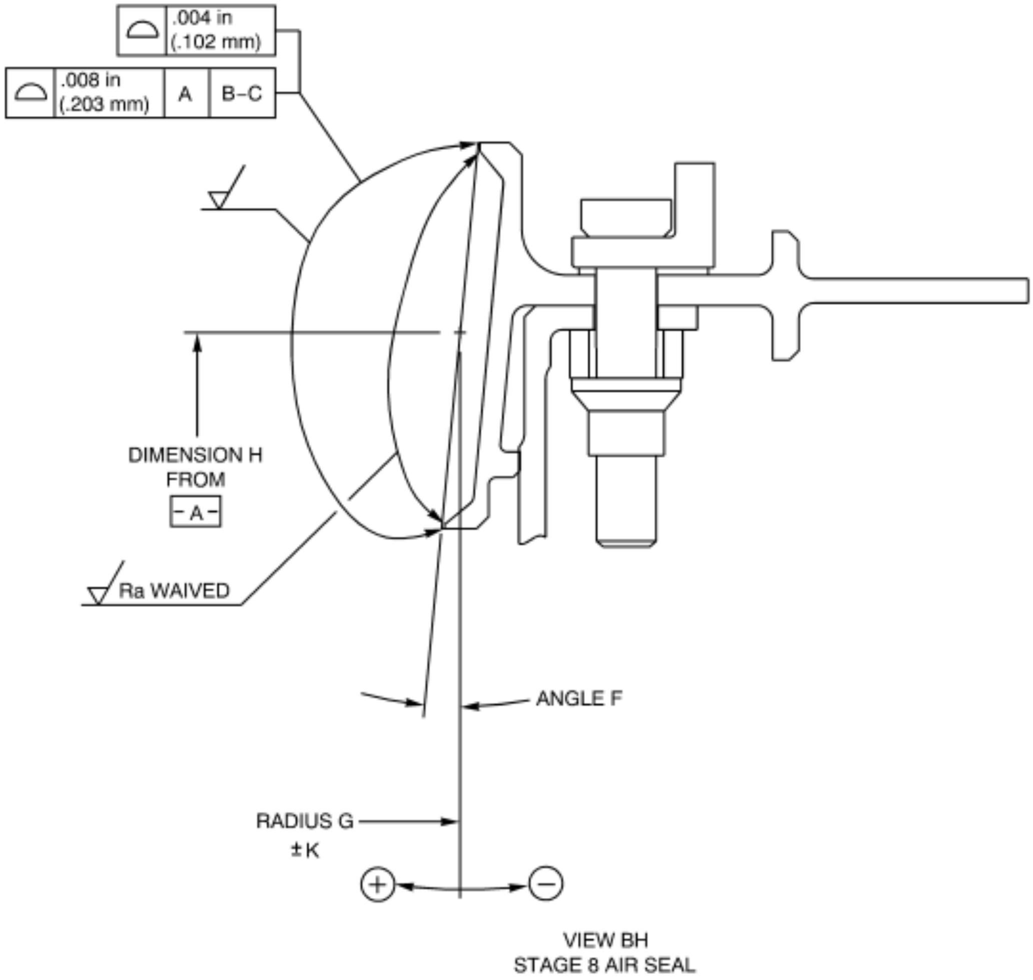
NOTE: * The axial location of the flowpath gage points corresponds to the HPC rotor assembly grind axial stations.

NOTE: * The blade tip gage point radii dimensions for the 5th through 15th stage rotors were determined in 72-35-01, Assembly-03, CONFIG-2 (Task 72-35-01-440-026). If the rotor grind dimensions have been re-targeted, you must re-target the corresponding air seal radius by the same amount.

NOTE: * For Dimensions C and E, maintain clearance to the dimensions shown. Machine if required.

Key to Figure 1001 (Sheet 4)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET − ASSEMBLY−02


.004 in
(.102 mm)
.008 in
(.203 mm)
A
B−C
DIMENSION H
FROM
-A-
Ra WAIVED
ANGLE F
RADIUS G
±K
+
−
VIEW BH
STAGE 8 AIR SEAL
L−D0669 (0103)
PW V

Outer Air Seal Machining (Stage 8)
Figure 1001 (Sheet 5)
(Task 72−35−04−440−002)

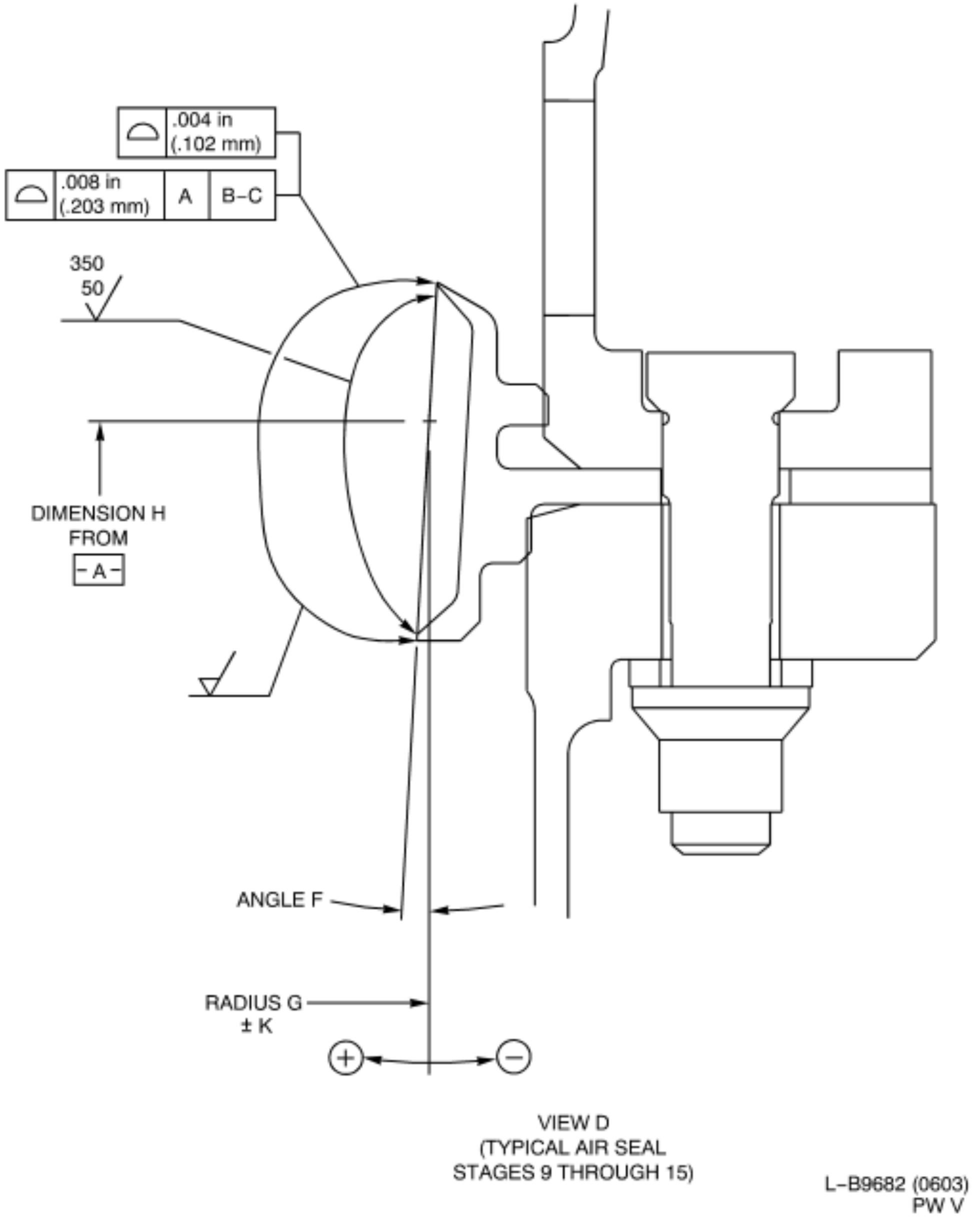
STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-02

Stage	Dimension H * Inch (mm)	Radius G * Inch (mm)	Angle F	Radius Retarget Allowance K Inch (mm)
8	17.803 (452.196)	14.605 (370.967)	5° 26'	+0.012/ -0.005 +(0.305)/ -(0.127)

NOTE: * The axial location of the flowpath gage points corresponds to the HPC rotor assembly grind axial stations.

NOTE: * The blade tip gage point radii dimensions for the 5th through 15th stage rotors were determined in 72-35-01, Assembly-03, CONFIG-2 (Task 72-35-01-440-026). If the rotor grind dimensions have been re-targeted, you must re-target the corresponding air seal radius by the same amount.

Key to Figure 1001 (Sheet 5)


.004 in
(.102 mm)
.008 in
(.203 mm)
A
B−C
350
50
DIMENSION H
FROM
A
ANGLE F
RADIUS G
± K
+
−
VIEW D
(TYPICAL AIR SEAL
STAGES 9 THROUGH 15)
L−B9682 (0603)
PW V

Outer Air Seal Machining (Stages 9 Through 15)
Figure 1001 (Sheet 6)
(Task 72−35−04−440−002)

STAGES 5 THROUGH 15 HPC OUTER AIR SEAL SET - ASSEMBLY-02

Stage	Dimension H * Inch (mm)	Radius G * Inch (mm)	Angle F	Radius Retarget Allowance K Inch (mm)
9	14.901 (378.485)	14.371 (365.023)	3° 55'	+0.010/-0.005 +(0.254)/-(0.127)
10	12.157 (308.788)	14.169 (359.893)	3° 55'	+0.010/-0.005 +(0.254)/-(0.127)
11	9.748 (247.599)	13.988 (355.295)	4° 25'	+0.010/-0.005 +(0.254)/-(0.127)
12	7.399 (187.935)	13.827 (351.206)	4° 6'	+0.010/-0.005 +(0.254)/-(0.127)
13	4.967 (126.162)	13.656 (346.862)	3° 16'	±0.005 ±(0.127)
14	2.782 (70.663)	13.603 (345.516)	1° 44'	±0.005 ±(0.127)
15	0.628 (15.951)	13.562 (344.475)	- 0° 40'	±0.005 ±(0.127)

NOTE: * The axial location of the flowpath gage points corresponds to the HPC rotor assembly grind axial stations.

NOTE: * The blade tip gage point radii dimensions for the 5th through 15th stage rotors were determined in 72-35-01, Assembly-03, CONFIG-2 (Task 72-35-01-440-026). If the rotor grind dimensions have been re-targeted, you must re-target the corresponding air seal radius by the same amount.

Key to Figure 1001 (Sheet 6)

STAGE 5 HPC DISK AND BLADES ASSEMBLY - DISASSEMBLY-01

Task 72-35-37-040-001:

1. Disassemble Stage 5 HPC Disk And Blades Assembly

A. Equipment And Materials Required

Special Tools:

PWA 76154	Adapter (2 Necessary)
PWA 85162	Adapter, Lift And Trunnion
PWA 85163	Adapter, Lift And Trunnion
PWA 85165	Puller, Airseal
PWA 85328	Stand, Storage
PWA 88643	Sling (Optional to PWA 88673)
PWA 88673	Sling
PWA 102107	Pusher, Manual

B. Procedure

(1) Install PWA 85163 Adapter to blade tips. Attach PWA 88643 or PWA 88673 Sling and PWA 76154 Adapters to the Adapter PWA 85163 and remove the disk and blade assembly from the storage stand. Place PWA 85328 Storage Stand on bench. Lower disk and blades to rest on storage stand, tierods down. Remove hoist, sling, and adapters. See Figure 501.

(2) Remove 40 nuts and bolts securing airseal to Stage 5 HPC disk and blades. Using PWA 85165 Airseal Puller, remove airseal from disk. See Figure 502.

(3) Reinstall Sling PWA 88643 or PWA 88673 with Adapters PWA 76154 and hoist to adapter on blade tips. Raise disk and blades and trunnion to tierod up. Lower disk and blades on stand. See Figure 503.

(4) Using PWA 102107 Pusher, remove tierods from disk flange. See Figure 504.

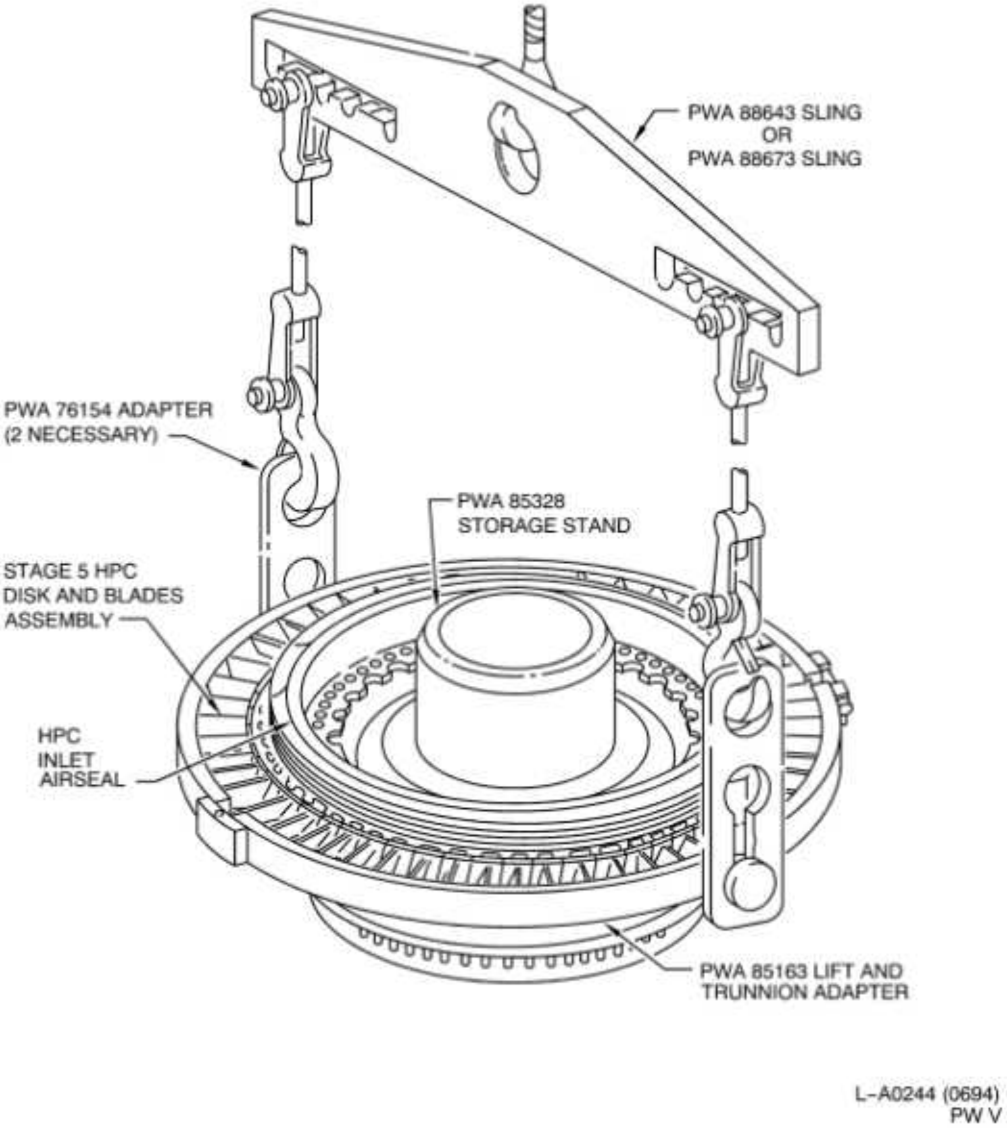
(5) Raise disk and blades from support and trunnion to flange side down on stand. Remove hoist, sling and adapters from adapter. Remove adapter from disk and blades assembly.

(6) Remove the 5th stage blades from the stage 5 HPC disk.

(a) Refer to Disassemble (Deblade) The Axial Compressor Rotor Assembly per 72-35-01, Disassembly-20 (Task 72-35-01-040-003).

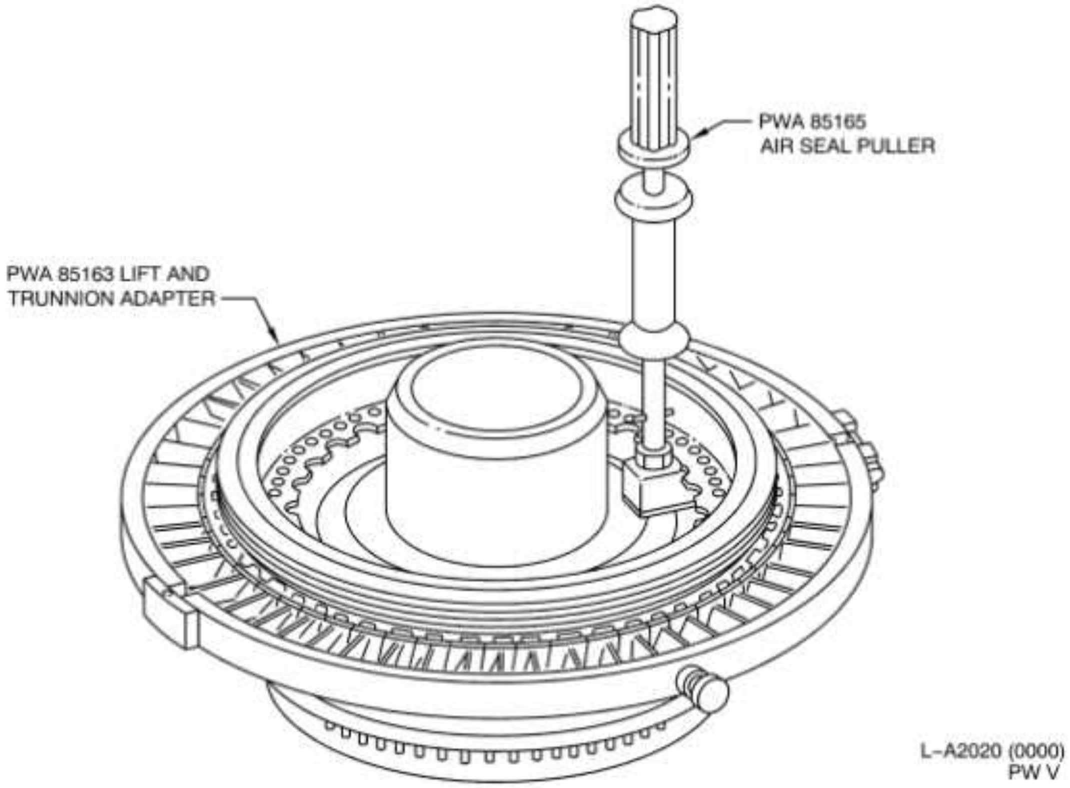
(7) Install PWA 85162 Adapter to the hub. Use Sling PWA 88643 or PWA 88673 with Adapters PWA 76154 and put the disk onto the storage stand. Remove the hoist, sling and adapter. See Figure 505.

STAGE 5 HPC DISK AND BLADES ASSEMBLY − DISASSEMBLY−01


PWA 88643 SLING
OR
PWA 88673 SLING
PWA 76154 ADAPTER
(2 NECESSARY)
PWA 85328
STORAGE STAND
STAGE 5 HPC
DISK AND BLADES
ASSEMBLY
HPC
INLET
AIRSEAL
PWA 85163 LIFT AND
TRUNNION ADAPTER
L-A0244 (0694)
PW V

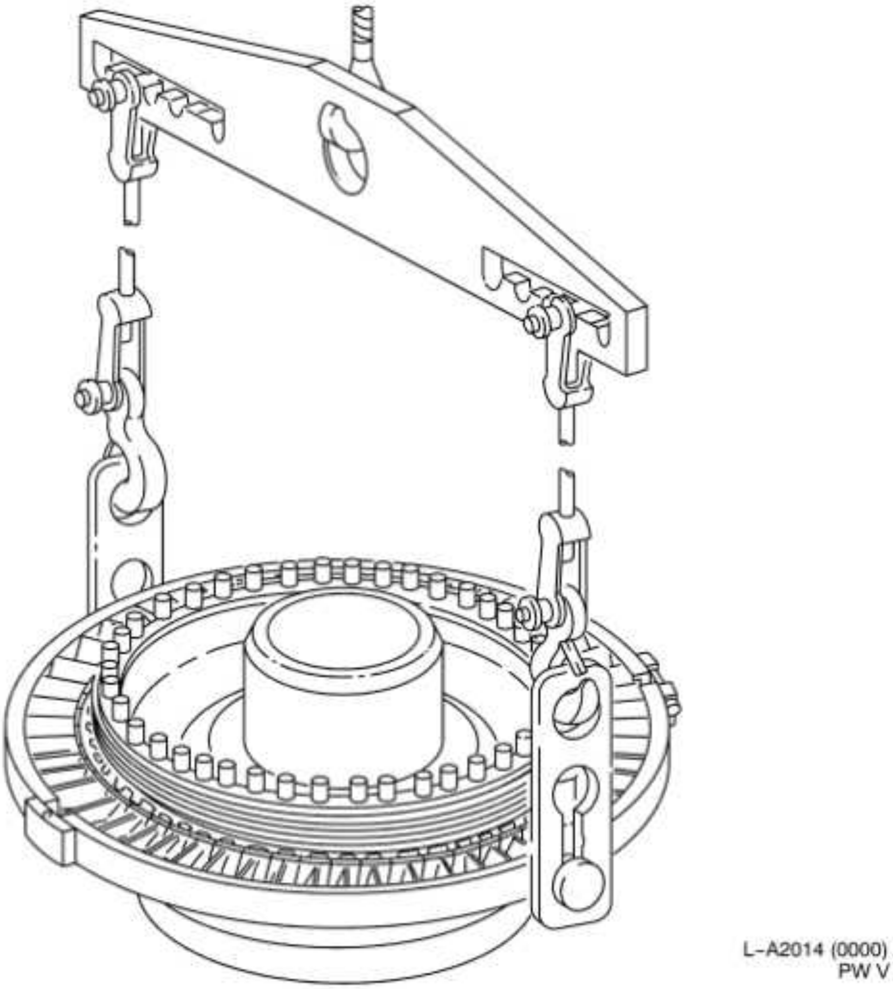
Install Disk And Blade On Stand
Figure 501
(Task 72−35−37−040−001)

STAGE 5 HPC DISK AND BLADES ASSEMBLY − DISASSEMBLY−01


PWA 85165
AIR SEAL PULLER
PWA 85163 LIFT AND
TRUNNION ADAPTER
L−A2020 (0000)
PW V

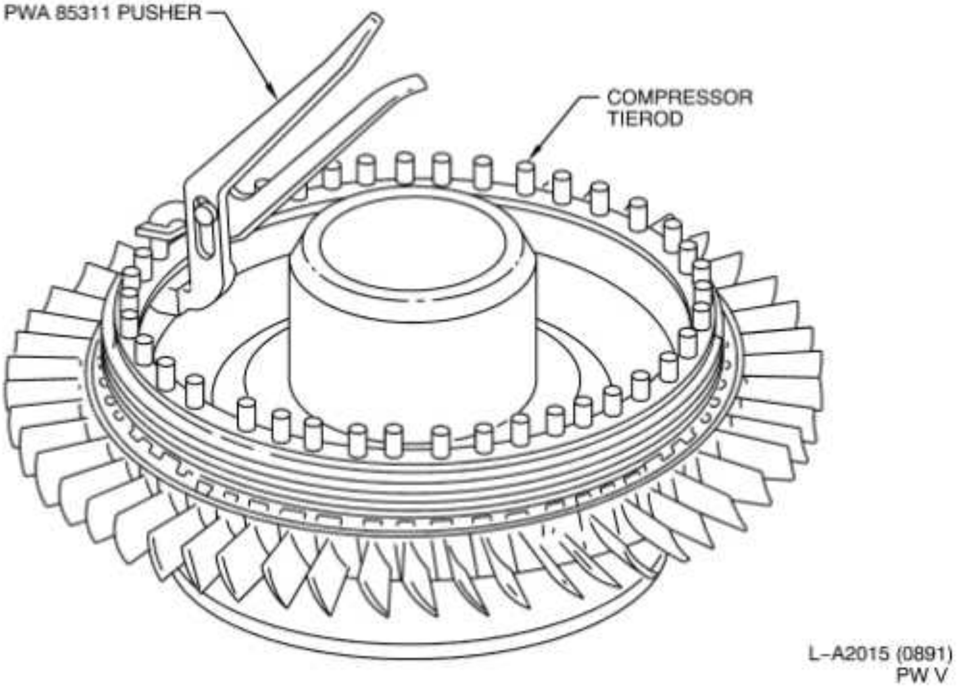
Airseal Removal
Figure 502
(Task 72−35−37−040−001)

STAGE 5 HPC DISK AND BLADES ASSEMBLY - DISASSEMBLY-01



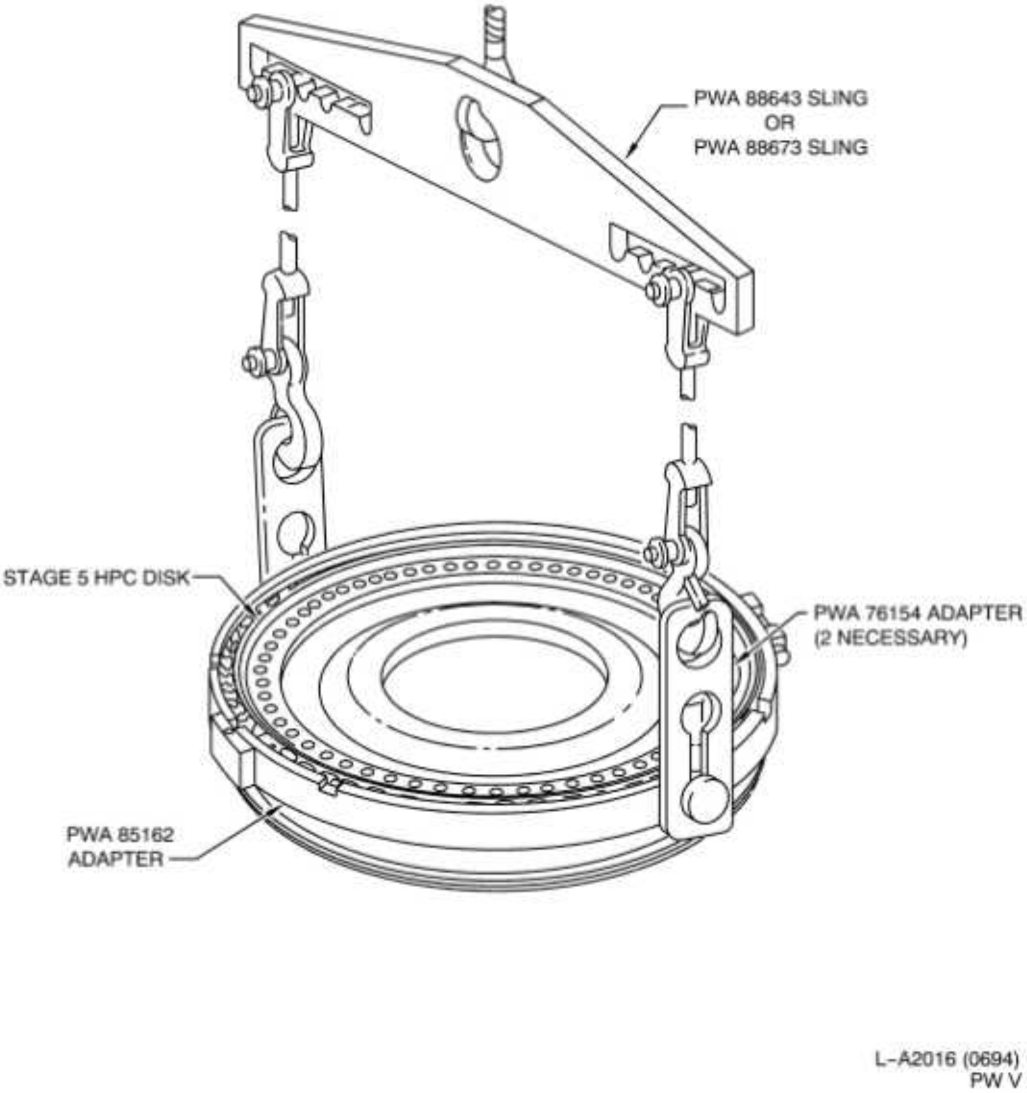
Trunnion Disk And Blade On Stand
Figure 503
(Task 72-35-37-040-001)

STAGE 5 HPC DISK AND BLADES ASSEMBLY − DISASSEMBLY−01


PWA 85311 PUSHER
COMPRESSOR TIEROD
L−A2015 (0891)
PW V

Tierod Removal
Figure 504
(Task 72−35−37−040−001)

STAGE 5 HPC DISK AND BLADES ASSEMBLY − DISASSEMBLY−01


PWA 88643 SLING
OR
PWA 88673 SLING
STAGE 5 HPC DISK
PWA 76154 ADAPTER
(2 NECESSARY)
PWA 85162
ADAPTER
L−A2016 (0694)
PW V

Disk Handling Tools
Figure 505
(Task 72−35−37−040−001)

STAGE 5 HPC DISK AND BLADES ASSEMBLY - ASSEMBLY-01

Task 72-35-37-440-001:

1. Assemble Stage 5 HPC Disk And Blades Assembly

A. Equipment And Materials Necessary

Standard Tools:

Name	Manufacturer
Clements Cadillac Flameless Torch Model FT 1000	Clements Manufacturing Co. 6650 S. Narraganset Avenue Chicago, IL 60638

NOTE: The flameless torch specified above is optional to the heaters specified in the special tools list, and the optional flame torch.

Special Tools:

PWA 29754	Control
PWA 76154	Adapter (2 Necessary)
PWA 85129	Support
PWA 85162	Adapter, Lift And Trunnion
PWA 85335	Heater (Optional)
PWA 85426	Protector (Optional)
PWA 88643	Sling (Optional to PWA 88673)
PWA 88673	Sling

Consumable Materials:

Item No.	Designation
P03-001	Engine, Oil (PWA 521B)

B. General Assembly Requirements

(1) Where heating is required for assembly, use minimum temperature differential of 125°F (52°C) between parts being assembled. Do not exceed 300°F (149°C) on any part.

(2) Where heating is required for assembly, special heaters are specified in the following procedure. However, you can use an optional flameless torch or flame torch as specified in the following steps.

(3) In locations where heating of a component in an oven is not practical or only a flange of the component requires heating, the use of Clements Cadillac Quic Heat flameless torch, Model FT 1000 is recommended.

(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: TITANIUM HEATS UP MORE RAPIDLY THAN OTHER MATERIALS. TAKE EXTREME CARE WHEN HEATING TITANIUM PARTS. DO NOT EXCEED THE THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE FLAME WILL DAMAGE OR BURN NON−METAL PARTS.

CAUTION: DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

STAGE 5 HPC DISK AND BLADES ASSEMBLY − ASSEMBLY−01

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

C. Procedure

(1) Install PWA 85162 Adapter to disk blade slots. Using hoist with PWA 88643 Sling or PWA 88673 Sling and PWA 76154 Adapters attached to adapter place disk on PWA 85129 Support, flange end down. Remove sling, hoist and adapter. See Figure 1001.

(2) For engines not incorporating integral inlet airseal and 5th stage disk (Pre SB PW4ENG 72−290), install inlet airseal.

(a) Install PWA 85335 Heater to rest on Stage 5 disk. Connect PWA 29754 Control and heat snap to temperature not to exceed 300°F (148.9°C). See Figure 1002.

(b) When temperature of disk flange is achieved shut off heater and remove from hub. Install airseal to disk flange aligning bolt holes. Allow area to cool to touch. See Figure 1003.

(c) Install 40 bolts, threads lubricated with Engine Oil P03−001, and nuts. Install bolts, heads up, and tighten and torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m). Install PWA 85426 Protector on airseal.

(3) For engines incorporating integral inlet airseal and 5th stage disk (Post SB PW4ENG 72-290), install PWA 85426 Protector on airseal.

(4) Assemble the 5th stage blades in the disk.

  (a) Refer to Assemble The 5th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly per 72-35-01, Assembly-31 (Task 72-35-01-440-019).

(5) Remove retaining ring from around disk.

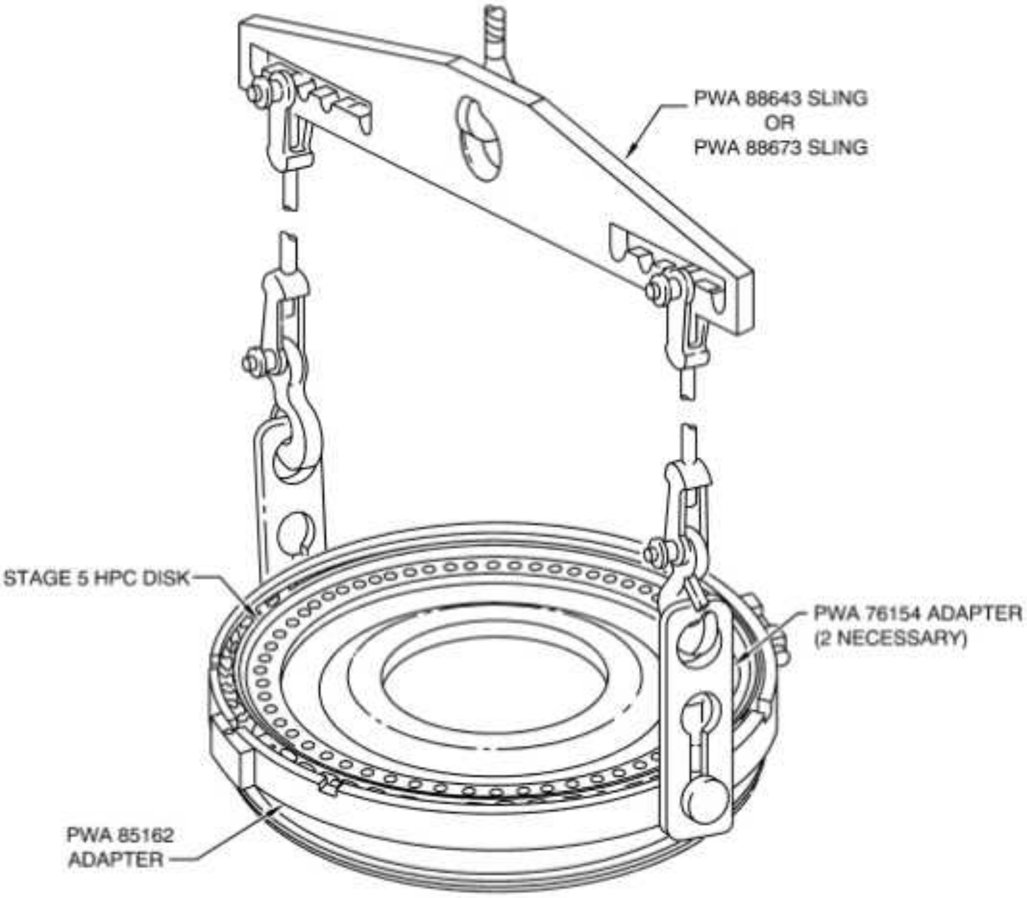
(6) Temporarily add small strip of tape to each blade lock end to prevent lock from moving during balancing.

D. Postrequisites

(1) (Optional) Static Balance Disk And Blades Assembly. Refer to Assembly-02 (Task 72-35-37-440-002).

(2) Final Assemble The Stage 5 HPC Disk And Blades Assembly. Refer to 72-35-37, Assembly-03 (Task 72-35-37-440-003).

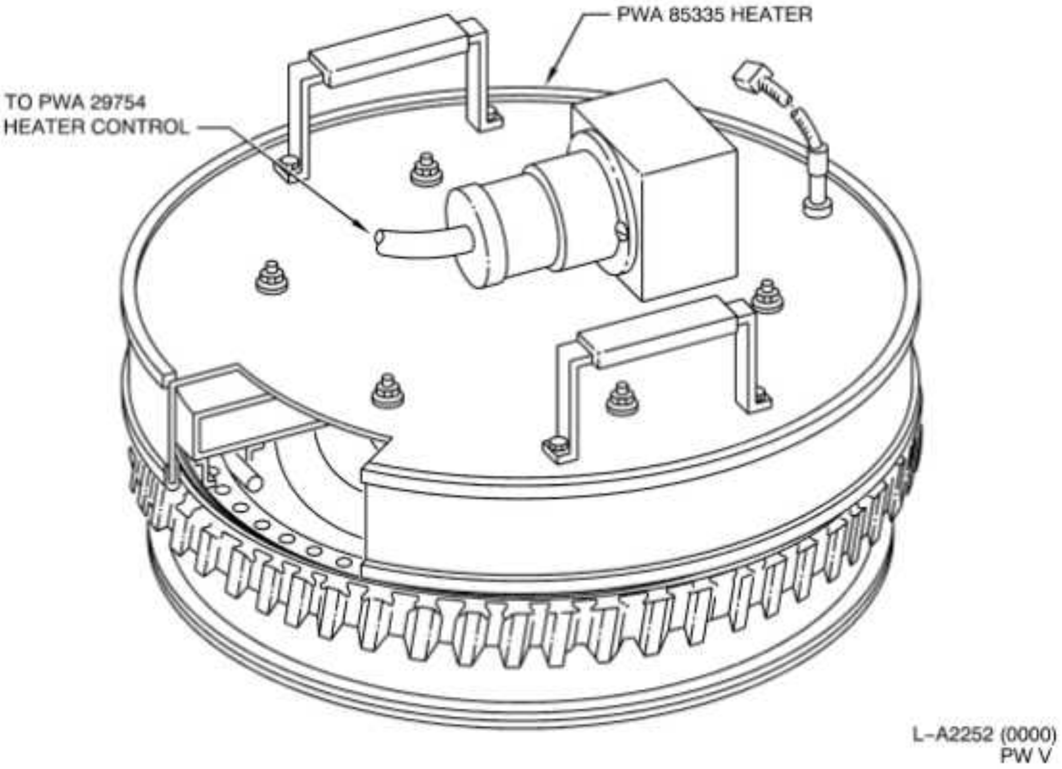
STAGE 5 HPC DISK AND BLADES ASSEMBLY − ASSEMBLY−01


PWA 88643 SLING
OR
PWA 88673 SLING
STAGE 5 HPC DISK
PWA 76154 ADAPTER
(2 NECESSARY)
PWA 85162
ADAPTER

L−A2016 (0694)
PW V

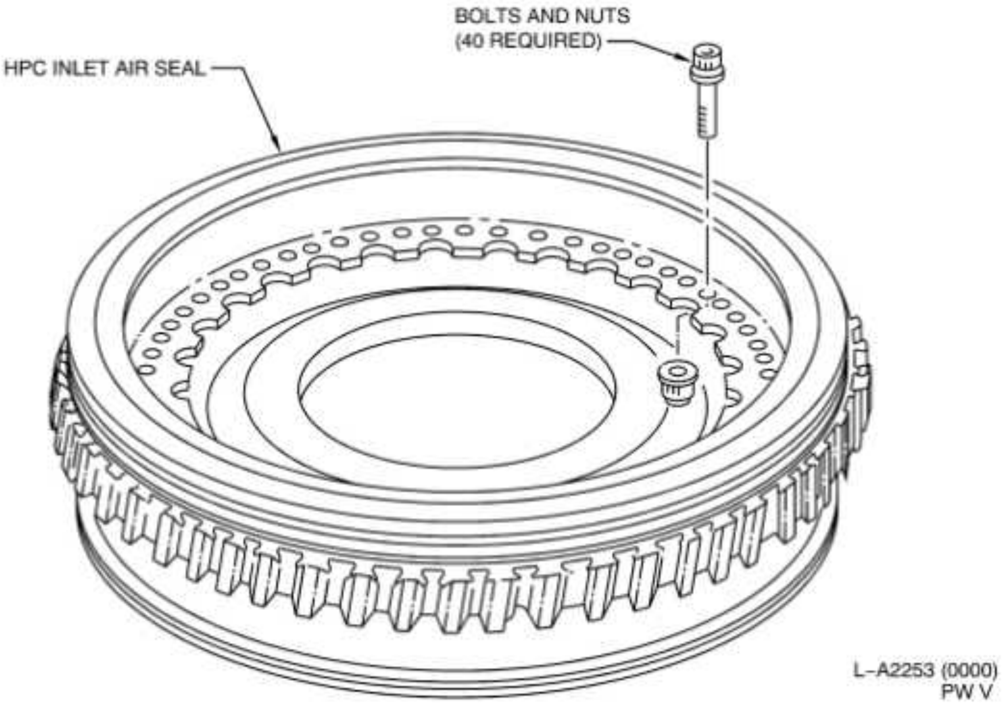
Stage 5 Disk Installed On Bench
Figure 1001
(Task 72−35−37−440−001)

STAGE 5 HPC DISK AND BLADES ASSEMBLY − ASSEMBLY−01


PWA 85335 HEATER
TO PWA 29754 HEATER CONTROL
L−A2252 (0000)
PW V

Heat Disk Flange
Figure 1002
(Task 72−35−37−440−001)

STAGE 5 HPC DISK AND BLADES ASSEMBLY − ASSEMBLY−01


BOLTS AND NUTS
(40 REQUIRED)
HPC INLET AIR SEAL
L−A2253 (0000)
PW V

Airseal Installation
Figure 1003
(Task 72−35−37−440−001)

STAGE 5 HPC DISK AND BLADES ASSEMBLY - ASSEMBLY-02

Task 72-35-37-440-002:

1. Balance Stage 5 HPC Disk And Blades Assembly

NOTE: This procedure is optional. It is not necessary to balance Stage 5 HPC disk and blade assembly if you assemble an axial compressor rotor.

A. Prerequisites

(1) Assemble Stage 5 HPC disk and blades assembly per Assembly-01 Task 72-35-37-440-001.

B. Equipment And Materials Required

Special Tools:

PWA 25648	Hold-Down Screws (4 Necessary)
PWA 32492	Screw Set (2 Necessary)
PWA 76154	Adapter (2 Necessary)
PWA 80258	Locating Plugs (4 Necessary)
PWA 85163	Adapter, Lift And Trunnion
PWA 85190	Adapter
PWA 85191	Hold-Down Plugs (4 Necessary)
PWA 85192	Washers (4 Necessary)
PWA 85328	Stand, Storage
PWA 85460	Calibration Weight (Check Weight)
PWA 87213	Pin, Alignment (4 Necessary)
PWA 88643	Sling (Optional to PWA 88673)
PWA 88673	Sling

Consumable Materials:

Item No.	Designation
P04-005	Grease (Extreme Pressure) (PMC 9630)
P05-045	Marker (PMC 4092-1 or PMC 4092-2)
P05-323	Tape, Pressure Sensitive Sealing

C. Procedure

NOTE: Balance of Stage 5 HPC disk and blade assembly is only necessary if the fifth disk has been removed from the HPC drum rotor assembly, otherwise the Stage 5 blades are to be installed into the disk by means of the light to heavy procedure.

(1) Prepare the static balance locating adapter as follows: See Figure 1001.

STAGE 5 HPC DISK AND BLADES ASSEMBLY − ASSEMBLY−02

(a) Use a hoist and sling and attach the PWA 85190 Locating Adapter to the spindle of the balance machine with the four detail bolts.

1 Use an opposite bolt pattern and tighten the four bolts equally. Torque the bolts to 50 lb−in. (5.649 N.m) maximum.

CAUTION: SCREWS ARE IN SETS IN RELATION TO MASS WEIGHT. YOU MUST PUT SCREWS OF ONE SET DIAMETRICALLY OPPOSITE EACH OTHER. SCREWS OF ONE SET SHOULD NOT BE INTERCHANGED WITH SCREWS OF ANOTHER SET.

(b) Install the PWA 80258 Locating Plugs in the four locations on the adapter marked 5HPC. Attach the plug set to the balance adapter with the two PWA 32492 Screw Sets.

(c) Insert four PWA 85191 Hold−Down Plugs in the four threaded holes on the balance adapter marked 5HPC. Tighten the holding plugs hand tight.

(d) Put the four PWA 87213 Alignment Pins in the threaded holes of the four holding plugs.

(2) Adjustment of static balance adapter with hub snap diameter known (preferred method).

(a) Loosen each of four locating plugs and turn adjusting collars to "O" on scribed radial lines passing through center of adapter. Set "O" away from snap diameter to be engaged by locating plug button. Retighten locating plugs at this setting.

NOTE: Set "O" toward OD of adapter.

(b) Using dial indicator gage or micrometer caliper, measure snap contact diameter across diametrically opposite locating plug buttons. Record this dimension for reference.

(c) Subtract diameter of snap (as measured at inspection) from reference diameter in step above.

(d) Add pinch fit desired between locating plug buttons and hub to difference in diameters obtained in step above. This pinch fit may be from 0.0005T − 0.0040T inch (0.013T − 0.102T mm). A fit of 0.0020T inch (0.051T mm) will usually be satisfactory. Divide this sum by two.

(e) Loosen each of four locating plugs, set adjusting collars to result obtained in step above, and retighten four locating plugs.

NOTE: All four plugs should be set to same numerical marking.

(3) Adjustment of static balance adapter with hub snap diameter unknown (optional method).

(a) Loosen each of four locating plugs and turn adjusting collars to "O" on the scribed radial lines passing through center of adapter. Set "O" away from snap diameter to be engaged by locating plug button. Retighten locating plugs at this setting.

NOTE: Set "O" toward OD of adapter.

(b) Put the PWA 85163 Lift And Turn Adapter around the OD of the rotor assembly. Move the swivel bolt in the adapter slot and tighten the hand knob.

(c) Attach a hoist to the lift eye of the PWA 88643 Sling or PWA 88673 Sling. Attach the eyes of the sling to the lift arms of the adapter.

(d) Lift the assembly and put the assembly on the adapter. Align the tierod holes with the alignment pins on the holding plugs.

(e) Install center post and clamp dial indicator in position to measure radial movement of disk against locating plug buttons.

(f) Add pinch fit desired between locating plug buttons and disk to radial clearance obtained in step above. This pinch fit may be from 0.0005T − 0.0040T inch (0.013T − 0.102T mm). A fit of 0.0020 inch (0.051 mm) will usually be satisfactory. Divide this sum by two.

(g) Remove disk and blades assembly from adapter.

(h) Loosen four locating plugs, set adjusting collars to result obtained in step above, and retighten four locating plugs.

NOTE: All four plugs should be set to same numerical marking.

(4) Installation of disk and blades assembly in adapter. See Figure 1002.

(a) Apply small amount of Grease P04−005 to locating plug button, if desired.

(b) Turn adapter so that one of hold−down plugs is directly in front of operator. Mark hold−down plug nearest operator for reference with a Marker P05−045.

(c) Install hub and blades assembly on adapter using PWA 85163 Adapter, rear face toward adapter, by first letting it rest on locating plugs with snap diameter of disk engaging locating plug buttons on side away from operator.

(d) Turn disk on adapter until one of tierod holes is centered directly over hold−down plug button.

(e) With far side of disk snap diameter engaging locating plug buttons, press near side of disk down so that it snaps into a light pinch fit of locating plugs.

(f) To ensure locating plug buttons have firmly seated against snap diameter of disk, carefully lift disk on operators side until it breaks free. Again press down into light press fit.

(g) Mark the disk in line with referenced mark on hold down plug with a Marker P05−045.

(h) Insert four PWA 25648 Hold−Down Screws with PWA 85192 Washers through tierod holes of disk into hold−down plugs and secure disk.

NOTE: Tierod holes must be centered over hold−down plugs so that hold−down screws can be installed fingertight without interference before being torqued to nominal value. Torque each screw to same value.

(5) Operate the balance machine.

(a) Find the static unbalance of the rotor assembly while it turns at 900 rpm minimum.

(b) Get three unbalance readings. For balance machines that do not have an automatic recording feature, record the average angle and the average amount of unbalance.

(6) Turn the rotor assembly on the balance adapter 180 degrees from the original balance location as follows:

(a) Remove the screw sets and the washer set that attaches the rotor assembly to the adapter.

(b) Put the four PWA 87213 Alignment Pins in the threaded holes of the four holding plugs.

(c) Put the PWA 85163 Lift And Turn Adapter around the OD of the rotor assembly. Move the swivel bolt in the adapter slot and tighten the hand knob.

(d) Attach a hoist to the lift eye of the PWA 88643 Sling or PWA 88673 Sling. Attach the eyes of the sling to the lift arms of the adapter.

(e) Carefully lift the rotor off the adapter, turn it 180 degrees. Put the assembly on the balance adapter. Align the tierod holes with the alignment pins on the holding plugs.

(f) Make sure that the rotor assembly is tightly engaged against the four locating plugs. Remove the alignment pins.

(g) Attach the rotor assembly with a PWA 85192 Washer Set and two PWA 25648 Screw Sets.

1 Matching screws must be used at diametrically opposite positions.

2 Tierod holes must be centered over hold down plugs to prevent interference with screw installation.

(7) Operate the balance machine.

(a) Static balance the rotor assembly while it turns at 900 rpm minimum. The residual unbalance must not be more than 0.25 oz-in. (180.0 g.mm).

(b) For balance machines that have an automatic recording feature, get three unbalance readings. Average the readings. Use the machine to determine the unbalance amount and angle of the assembly.

(c) For balance machines that do not have an automatic recording feature, get three unbalance readings. Average and record the three unbalance readings. Use the average readings from the first and second balance runs to do a polar plot to get the assembly unbalance angle and amount.

(8) If the static unbalance is equal to 0.25 oz-in. (180.0 g.mm) or less continue as follows:

(a) Record the angle and the amount of unbalance.

(b) If necessary, remove all ink markings of unbalance symbols (triangle) that were done before.

(9) If the static unbalance is more than 0.25 oz-in. (180.0 g.mm), continue as follows:

NOTE: It is desirable to reduce residual unbalance to lowest value possible in practical amount of time.

(a) Use the PWA 85163 Lift And Turn Adapter to remove the rotor assembly from the balance adapter.

(b) Move the blades selected to correct the unbalance condition.

(c) Put the assembly on the balance adapter.

STAGE 5 HPC DISK AND BLADES ASSEMBLY - ASSEMBLY-02

(d) Static balance the rotor assembly as described above until the residual unbalance is not more than 0.25 oz-in. (180.0 g.mm).

(e) Record the heavy angle and the amount of assembly unbalance.

(f) Make a record of the last blade positions.

(10) Optional process based on the experience of the operator, do a check of the balance machine by Figure 1002 as follows:

(a) Install the PWA 85460 Calibration Weight (Check Weight) in one of the bolt holes on the disk as close as possible to the angle of residual unbalance.

(b) Attach the check weight to the disk with Pressure Sensitive Sealing Tape P05-323.

(c) The check weight pulls 3.0 oz-in. (2160.0 g.mm).

(d) Do a check of the balance machine at 900 rpm minimum.

(e) The amount of unbalance should pull 3.0 oz-in. (2160.0 g.mm) plus the remaining residual unbalance +/- 0.1 oz-in. (72.0 g.mm).

(f) Remove the check weight.

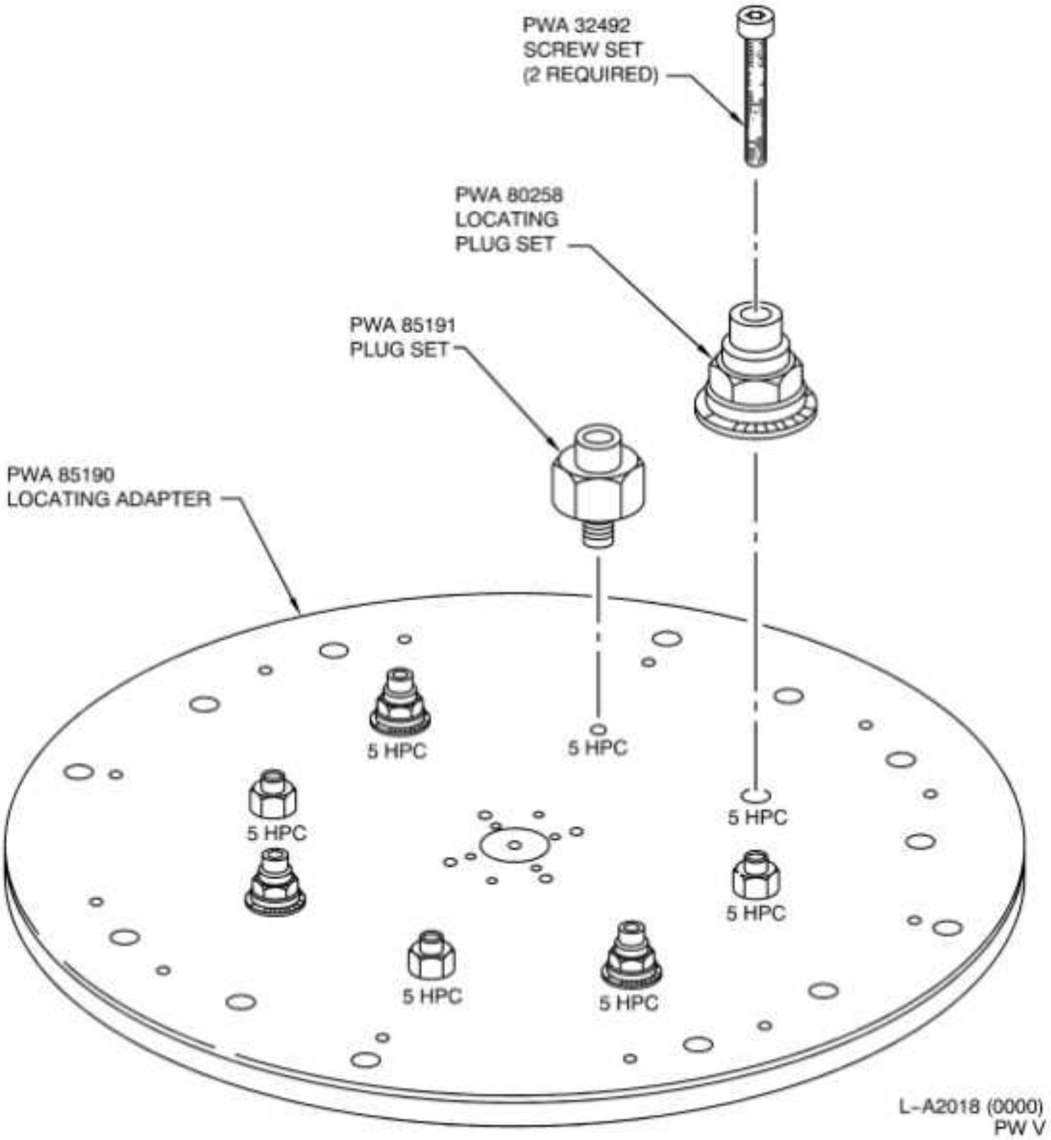
(11) Remove the disk and blade assembly from the adapters. Use PWA 85163 Adapter, hoist, PWA 88643 Sling or PWA 88673 Sling and PWA 76154 Adapter.

(12) Place disk and blades assembly on PWA 85328 Storage Stand. Remove hoist, sling, and adapters.

D. Postrequisites

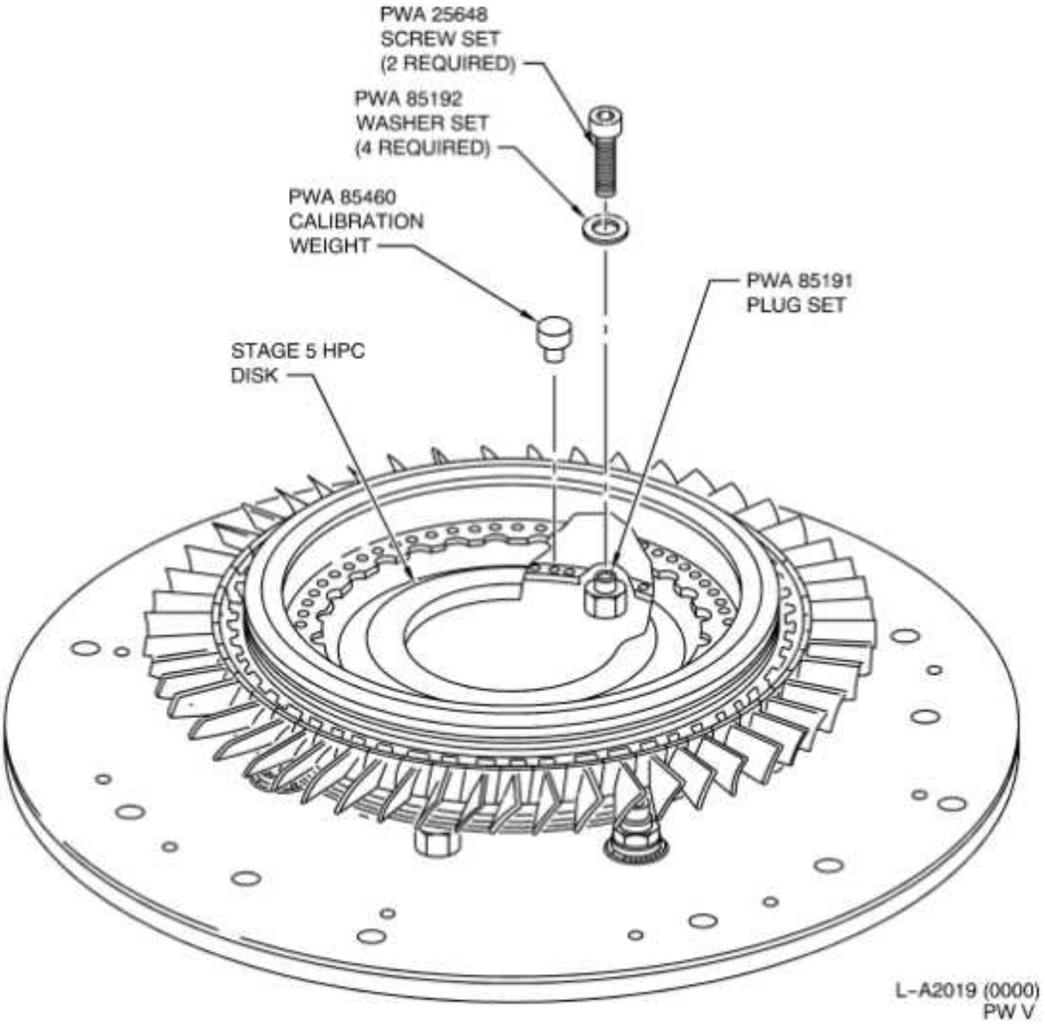
(1) Final assemble Stage 5 HPC disk and blades assembly by Assembly-03 Task 72-35-37-440-003.

STAGE 5 HPC DISK AND BLADES ASSEMBLY - ASSEMBLY-02


PWA 32492
SCREW SET
(2 REQUIRED)
PWA 80258
LOCATING
PLUG SET
PWA 85191
PLUG SET
PWA 85190
LOCATING ADAPTER
5 HPC
5 HPC
5 HPC
5 HPC
5 HPC
5 HPC
5 HPC
L-A2018 (0000)
PW V

Adapter Installation
Figure 1001
(Task 72-35-37-440-002)

STAGE 5 HPC DISK AND BLADES ASSEMBLY - ASSEMBLY-02


PWA 25648
SCREW SET
(2 REQUIRED)
PWA 85192
WASHER SET
(4 REQUIRED)
PWA 85460
CALIBRATION
WEIGHT
PWA 85191
PLUG SET
STAGE 5 HPC
DISK
L-A2019 (0000)
PW V

Balance Disk And Blade Assembly
Figure 1002
(Task 72-35-37-440-002)

STAGE 5 HPC DISK AND BLADES ASSEMBLY - ASSEMBLY-03

Task 72-35-37-440-003:

1. Final Assemble Stage 5 HPC Disk And Blades Assembly

A. Prerequisites

(1) (Optional) balance Stage 5 HPC disk and blades assembly. Refer to Assembly-02 (Task 72-35-37-440-002).

B. Equipment And Materials Necessary

Special Tools:

PWA 76154	Adapter (2 Necessary)
PWA 78012	Bender, Pneumatic (Optional to PWA 100012 Change Letter A and PWA 102146)
PWA 80763	Inserter, Tierod
PWA 85196	Ring, Retaining
PWA 85328	Stand, Storage
PWA 86518	Bender, Mechanical (Optional to PWA 78012)
PWA 87128	Bender, Mechanical (Optional to PWA 86518)
PWA 88643	Sling (Optional to PWA 88673)
PWA 88673	Sling
PWA 100012	Change Letter A Bender, Pneumatic (Prebend) (With PWA 102146, Optional to PWA 78012)
PWA 102146	Bender, Pneumatic (Final Bend) (With PWA 100012 Change Letter A, Optional to PWA 78012)

Consumable Materials:

Item No.	Designation
P09-014	Sealant, Silicone Rubber (PWA 36003)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lock (Post SB PW4ENG 72-373)	40	72-35-00/2/10

C. Procedure

(1) Install hoist with PWA 88643 or PWA 88673 Sling and PWA 76154 Adapters on adapter (installed around blade tips). Raise and trunnion disk and blades so tiebolt flange faces up and lower onto PWA 85328 Storage Stand.

STAGE 5 HPC DISK AND BLADES ASSEMBLY - ASSEMBLY-03

(2) Install 42 tiebolts to flange using PWA 80763 Inserter. See Figure 1001.

(3) Raise disk and blades assembly and trunnion so tierods face down onto Support (PWA 85328). Remove hoist, sling, adapters and adapter from disk and blades. See Figure 1002.

(4) Install PWA 85196 Retaining Ring around HPC disk just below blade slots.

CAUTION: CARE SHOULD BE TAKEN TO ENSURE THAT ANY PRESSURE OR FORCE REQUIRED TO REMOVE OR INSTALL BLADE IN DISK, BE APPLIED TO ROOT PLATFORM AREA OF BLADE AND NOT TO LEADING OR TRAILING EDGE OF AIRFOIL. AIRFOIL SECTION OF BLADES ARE EASILY DAMAGED BY ANY KIND OF FORCE.

(5) Remove tape from ends of blade locks. Move blade lock to align cut-outs in lock with blade slots. Remove one blade from disk at a time. This will ensure that balance will not be affected when blades are returned to proper location.

NOTE: Ensure that blades are repositioned on disk as they were when disk and blade assembly was static balanced per Assembly-02 (Task 72-35-37-440-002).

(6) Remove PWA 85196 Retaining Ring from HPC disk.

(7) Remove all blade locks from the stage 5 disk.

(8) Wipe blade root areas to be sealed and the blade lock groove of disk by SPOP 208 Wipe Method (Task 70-21-00-110-040), prior to applying sealant.

(9) Immediately before installing each blade, apply Silicone Rubber Sealant P09-014 to the blade root as shown in Figure 1003. Coat blades thickly enough to fill in voids between blade root and disk slot when blade is in the installed position. Also, apply sealant to the blade lock groove of blades and of disk at blade locations. See Figure 1003.

(10) When a blade is assembled into the disk, hold the blade radially outward against the disk slot bearing surface, while the blade is moved to the installed position. Remove excess sealant from around the blade root area and fill in any voids.

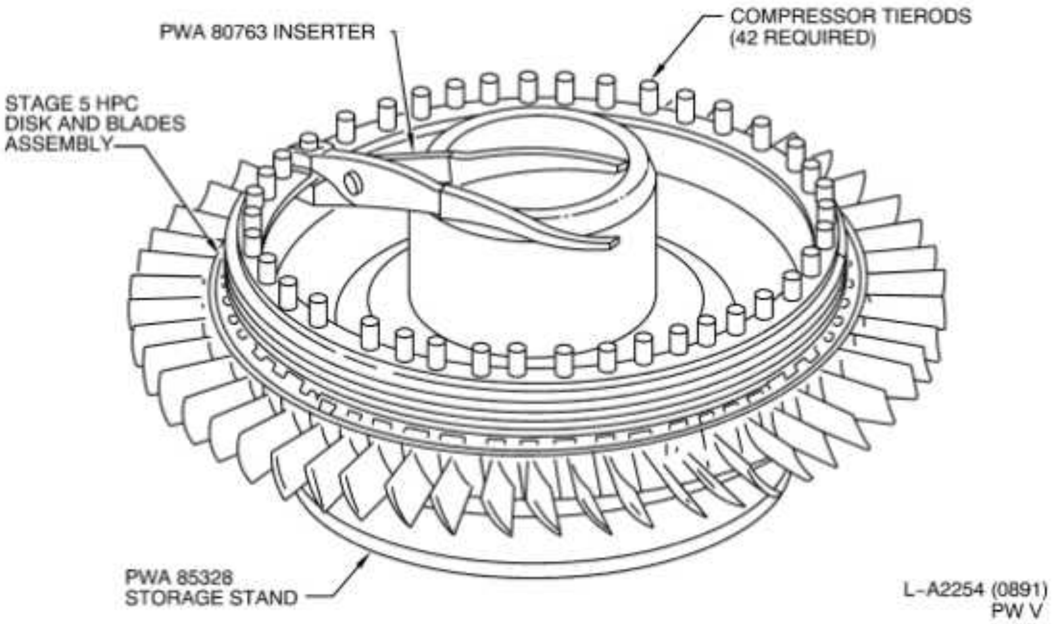
NOTE: If disassembly is required and the sealant coating is damaged, it must be repaired before reassembly.

(11) Retain the blades by inserting the blade locks into the blade lock grooves in a clockwise direction when viewed from the front. Be sure the lock under the blade is coated with sealant to make sure lock will not roll over after sealant cure. Use the PWA 78012 Pneumatic Bender or the PWA 86518 or PWA 87128 Mechanical Bender to crimp the blade lock. These bending tools have separate jaws for initial and final bends. After making the initial bend, replace the initial bend jaw with the final bend jaw and compress handles until the blade lock is fully bent. As an option to the PWA 78012 Pneumatic Bender with separate jaws for initial and final bends, the PWA 100012 Pneumatic Bending Tool Change Letter A is used for the prebend of the blade lock and the Pneumatic Bending Tool (PWA 102146) is used for the final bend of the blade lock. No tangential motion of the lock is allowed in the installed position. Measure the bend dimension with a dial caliper. See Figure 1004.

(12) Apply Silicone Rubber Sealant P09−014 to the bent end of all blade locks. All the blade lock ends must be covered. See Figure 1004.

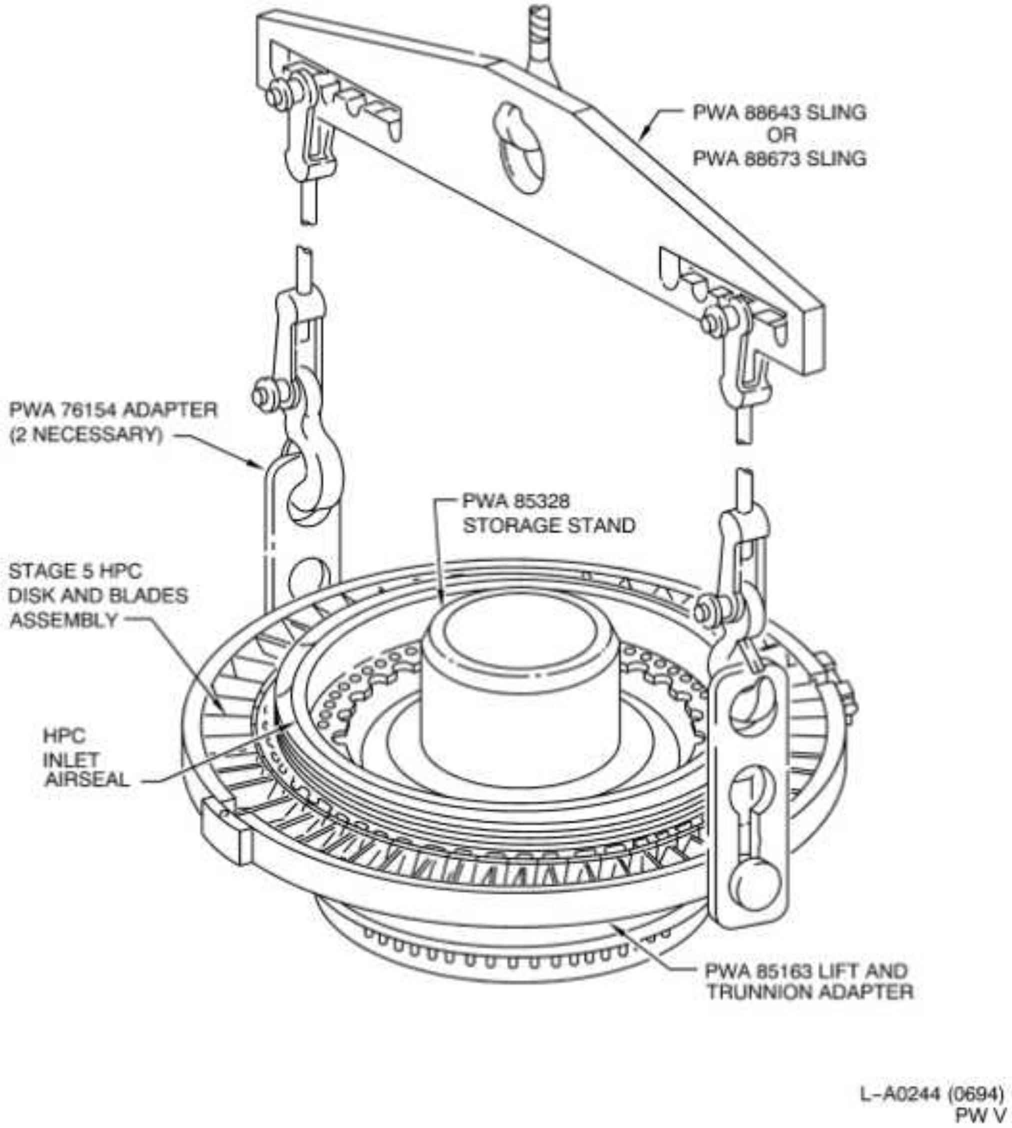
(13) Allow sealant to cure at room temperature and 20 percent minimum humidity for eight hours prior to the balance operation. Total curing time before engine test is 24 hours minimum. See Figure 1005.

STAGE 5 HPC DISK AND BLADES ASSEMBLY − ASSEMBLY−03

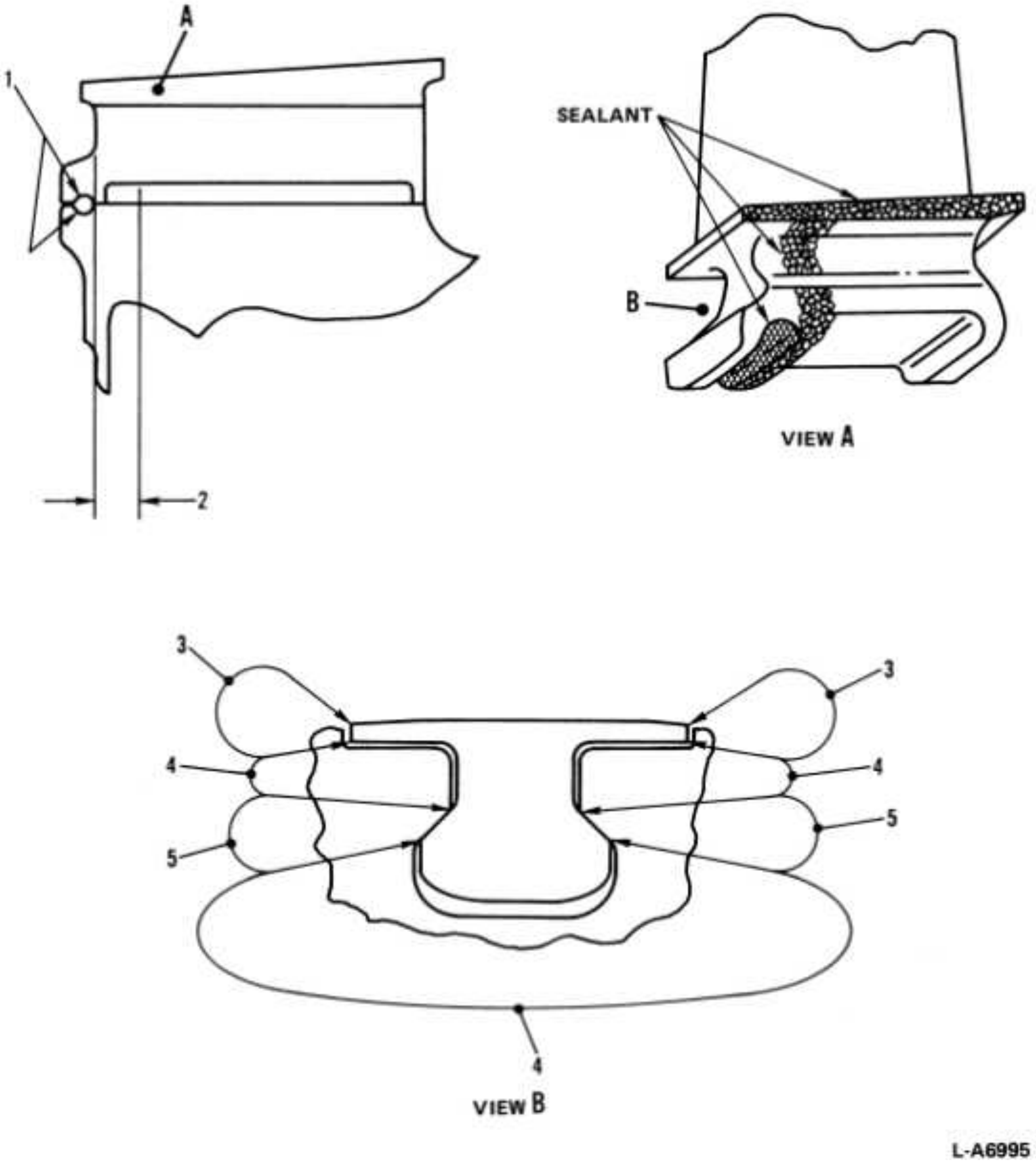

PWA 80763 INSERTER
COMPRESSOR TIERODS (42 REQUIRED)
STAGE 5 HPC DISK AND BLADES ASSEMBLY
PWA 85328 STORAGE STAND
L-A2254 (0891)
PW V

Tiebolt Installation
Figure 1001
(Task 72−35−37−440−003)

STAGE 5 HPC DISK AND BLADES ASSEMBLY - ASSEMBLY-03


PWA 88643 SLING
OR
PWA 88673 SLING
PWA 76154 ADAPTER
(2 NECESSARY)
PWA 85328
STORAGE STAND
STAGE 5 HPC
DISK AND BLADES
ASSEMBLY
HPC
INLET
AIRSEAL
PWA 85163 LIFT AND
TRUNNION ADAPTER
L-A0244 (0694)
PW V

Trunnion Assembly Tierods Down
Figure 1002
(Task 72-35-37-440-003)

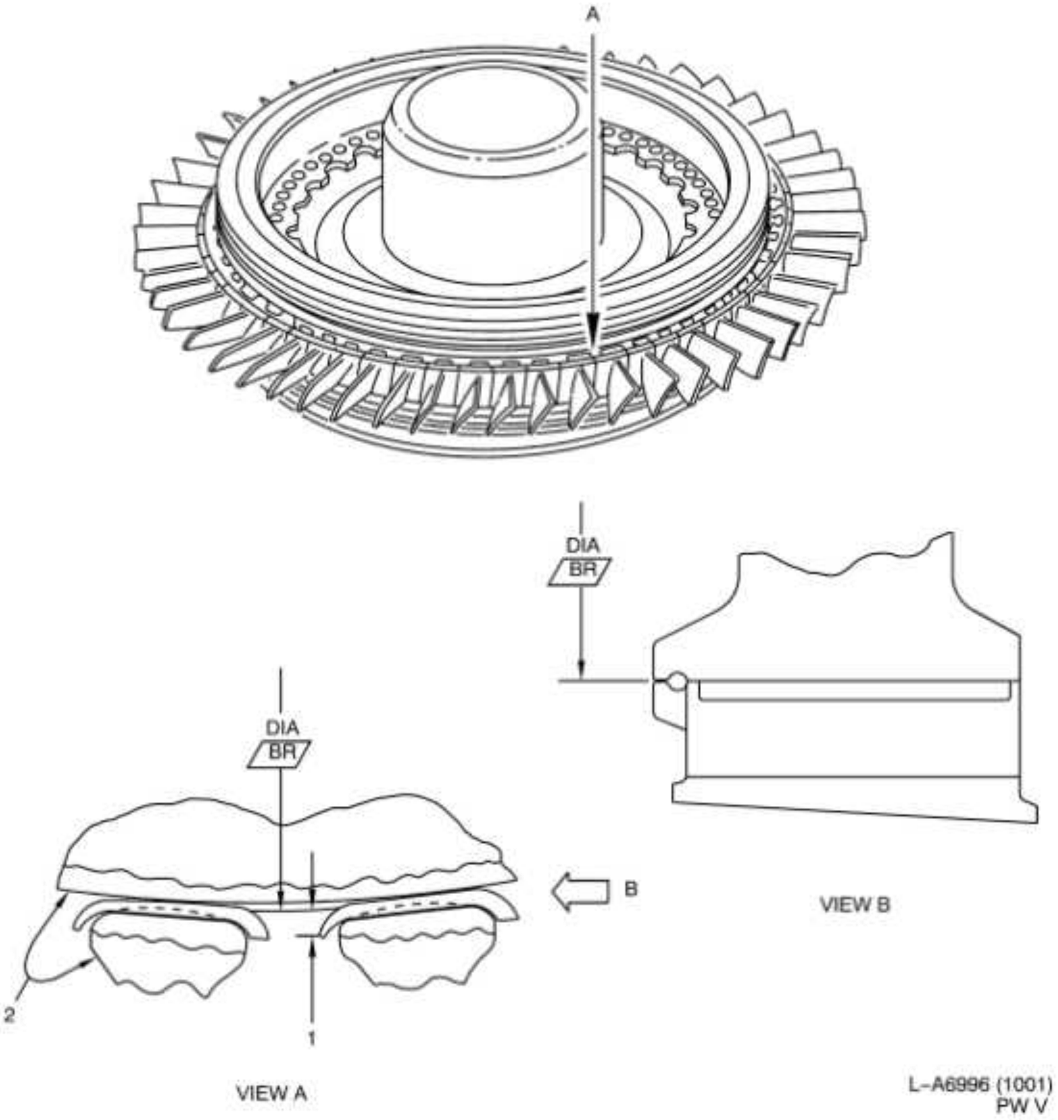

A
1
2
SEALANT
B
VIEW A
3
3
4
4
5
5
4
VIEW B
L-A6995

Sealant Application
Figure 1003
(Task 72-35-37-440-003)

STAGE 5 HPC DISK AND BLADES ASSEMBLY − ASSEMBLY−03

1. Sealant Application Area − 40 Places
2. 0.200 − 0.400 Inch (5.1 − 10.2 mm)
3. Apply Sealant (P09−014) In Areas Shown For Entire Length Of Blade Platform.
4. Apply Sealant (P09−014) In Areas Shown For Distance Index 2.
5. No Sealant To Be Applied In This Area But Traces Are Permissible After Assembly Of Blade To Disk.

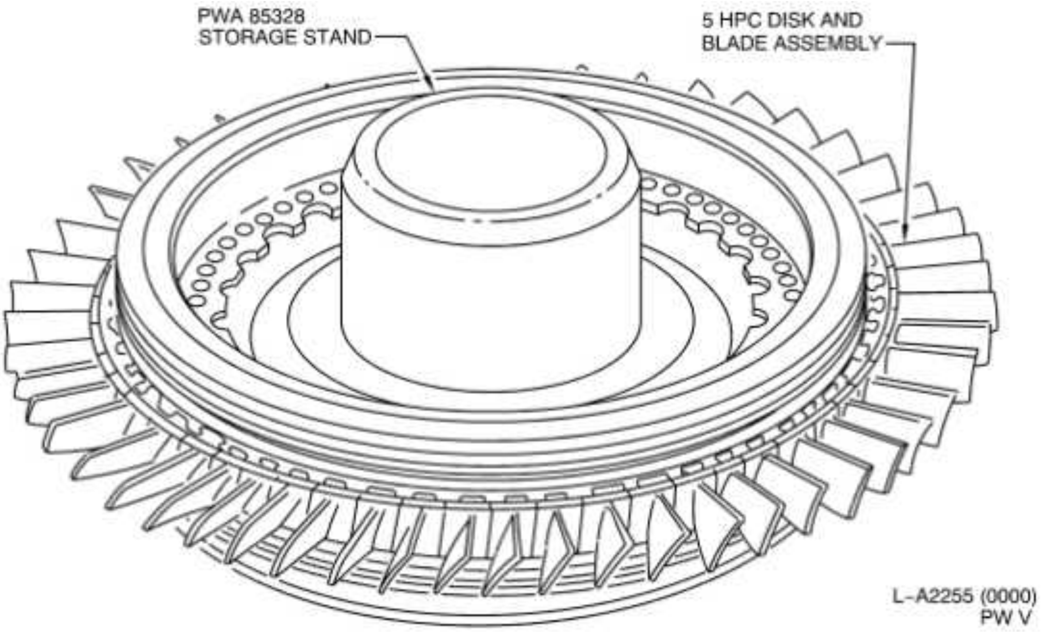
Key to Figure 1003


A
DIA
BR
DIA
BR
B
VIEW B
2
1
VIEW A
L−A6996 (1001)
PW V

1. 0.190 Inch (4.826 mm) Minimum
2. Apply Sealant (P09−014) In Areas Shown To Cover All Bent Ends

Blade Lock Installation
Figure 1004
(Task 72−35−37−440−003)

STAGE 5 HPC DISK AND BLADES ASSEMBLY − ASSEMBLY−03


PWA 85328
STORAGE STAND
5 HPC DISK AND
BLADE ASSEMBLY
L−A2255 (0000)
PW V

Completed Stage 5 Disk And Blade Assembly
Figure 1005
(Task 72−35−37−440−003)

Previous Pageblock Return to Previous Menu Next Pageblock

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY - DISASSEMBLY-01

Task 72-35-38-040-001:

1. Disassemble Drum Rotor And Blades (Front) Assembly

A. Prerequisites

(1) Disassemble axial compressor rotor assembly by 72-35-01, Disassembly-01 Task 72-35-01-040-001.

B. Equipment And Materials Required

Special Tools:

PWA 76154	Adapter (2 Necessary)
PWA 85129	Support, Drum And Disk
PWA 85133	Adapter, Lift And Trunnion
PWA 88643	Sling (Optional To PWA 88673)
PWA 88673	Sling (Optional To PWA 88643)

C. Procedure

See Figure 501.

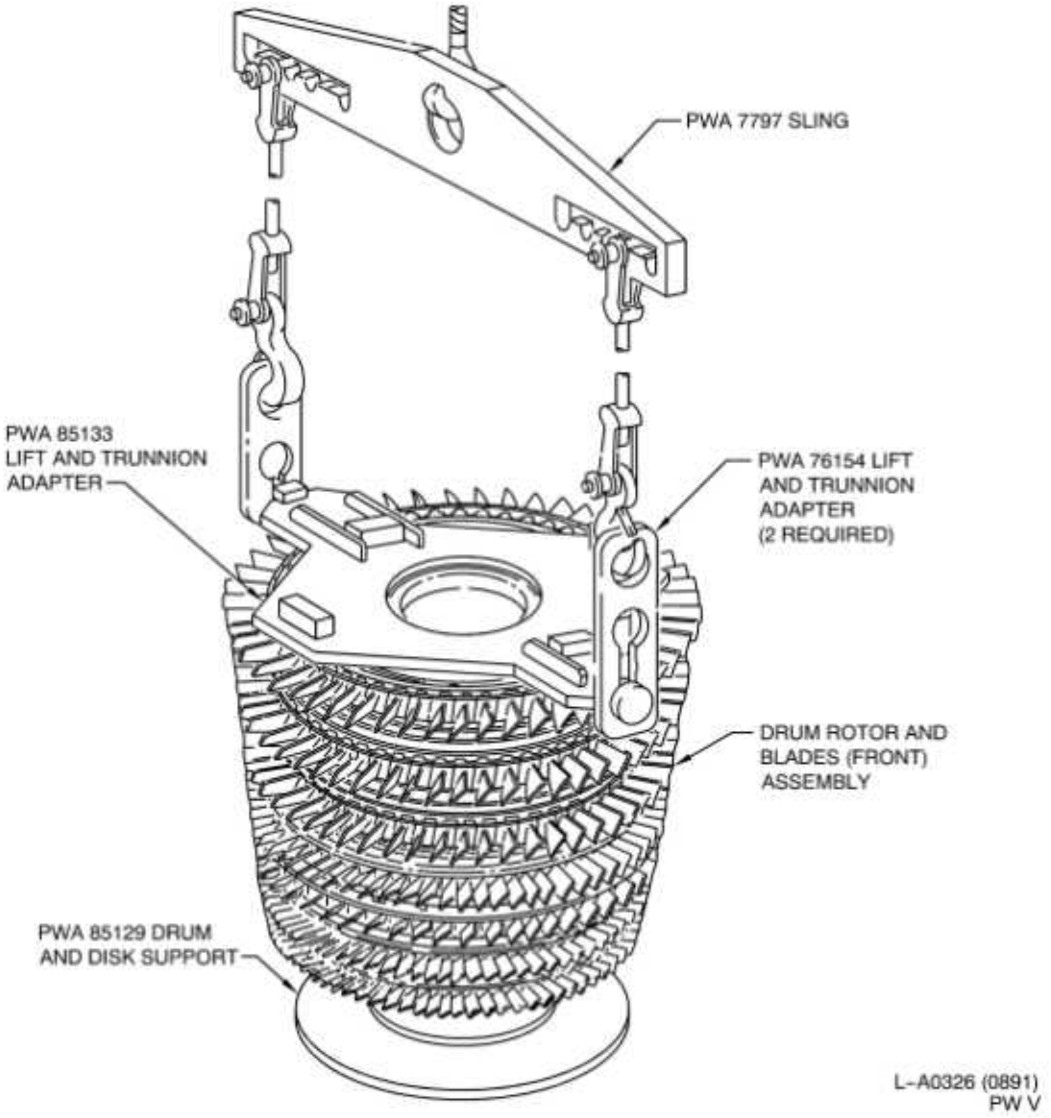
(1) Install PWA 85133 Adapter on drum and blades assembly (longer blades up). Attach PWA 88643 Sling or PWA 88673 Sling with PWA 76154 Adapters to spools of adapter and raise assembly from storage rack. Lower drum and blades assembly on PWA 85129 Support. Remove sling, adapter, and adapter from drum assembly. See Figure 501.

(2) Remove the 6th through 12th stage blades from the drum rotor. Refer to Disassemble (Deblade) the Axial Compressor Rotor Assembly by 72-35-01, Disassembly-20 (Task 72-35-01-040-003).

NOTE: It is not necessary to remove the 9th stage bleed air tubes from the front drum assembly.

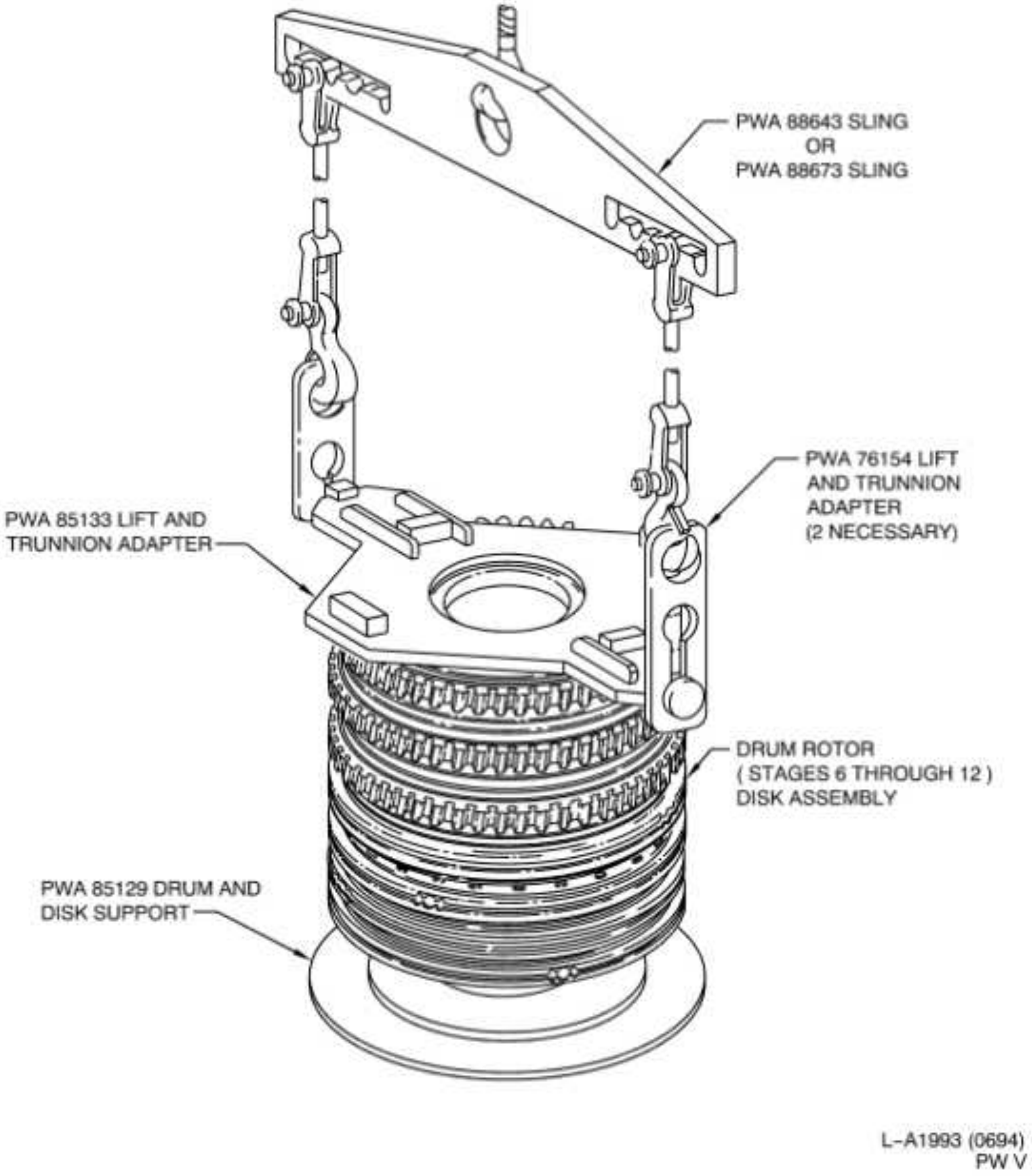
(3) Install PWA 85133 Adapter on drum upper flange. Attach PWA 88643 Sling or PWA 88673 Sling with PWA 76154 Adapters to spools of adapter and place drum on storage rack. Remove sling, adapters, and adapter from drum. See Figure 503.

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY − DISASSEMBLY−01


PWA 7797 SLING
PWA 85133 LIFT AND TRUNNION ADAPTER
PWA 76154 LIFT AND TRUNNION ADAPTER (2 REQUIRED)
DRUM ROTOR AND BLADES (FRONT) ASSEMBLY
PWA 85129 DRUM AND DISK SUPPORT
L-A0326 (0891)
PW V

Drum Rotor And Blades (Front) Assembly
Figure 501
(Task 72−35−38−040−001)

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY − DISASSEMBLY−01


PWA 88643 SLING
OR
PWA 88673 SLING
PWA 76154 LIFT AND TRUNNION ADAPTER (2 NECESSARY)
PWA 85133 LIFT AND TRUNNION ADAPTER
DRUM ROTOR (STAGES 6 THROUGH 12) DISK ASSEMBLY
PWA 85129 DRUM AND DISK SUPPORT
L-A1993 (0694)
PW V

Drum Rotor (Front) Assembly
Figure 502
(Task 72−35−38−040−001)

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY − ASSEMBLY−01

Task 72−35−38−440−001:

1. Assemble The Drum Rotor And Blades (Front) Assembly (Stage 12)

A. Equipment And Materials Required

Special Tools:

PWA 76154	Adapter, Lift And Trunnion (2 Necessary)
PWA 85129	Support
PWA 85133	Adapter, Lift And Trunnion
PWA 88643	Sling (Optional to PWA 88673)
PWA 88673	Sling

B. Procedure

CAUTION: THE 9TH STAGE BLEED TUBES MUST BE INSTALLED BEFORE YOU ASSEMBLE THE HPC ROTOR ASSEMBLY. IF THE HPC DRUM IS ASSEMBLED AND THE ENGINE IS OPERATED WITHOUT THESE TUBES DAMAGE TO THE ENGINE CAN OCCUR.

(1) Examine the HPC front drum for the presence of the 9th stage HPC bleed tubes. Look for the bleed tubes just behind the 9th stage bleed ports on the OD of the drum.

(a) If the bleed tubes are not there, install the bleed tubes. If the drum rotor was refurbished, refer to 72−35−07, Repair−12 or Repair−18, PW4000 Series CIR, PN 51A357 for the applicable repair.

(b) If the drum rotor is new, refer to 72−35−38, Assembly−13 (Task 72−35−38−440−014).

(2) Put the drum rotor, rear end down, on the PWA 85129 Support. See Figure 1001.

(a) Install PWA 85133 Adapter on drum and attach PWA 88643 Sling or PWA 88673 Sling with PWA 76154 Adapters to hoist and to spools on adapter.

(b) Raise drum from storage rack and lower drum on PWA 85129 Support, smaller OD up.

(c) Remove sling, adapters, and adapter from drum.

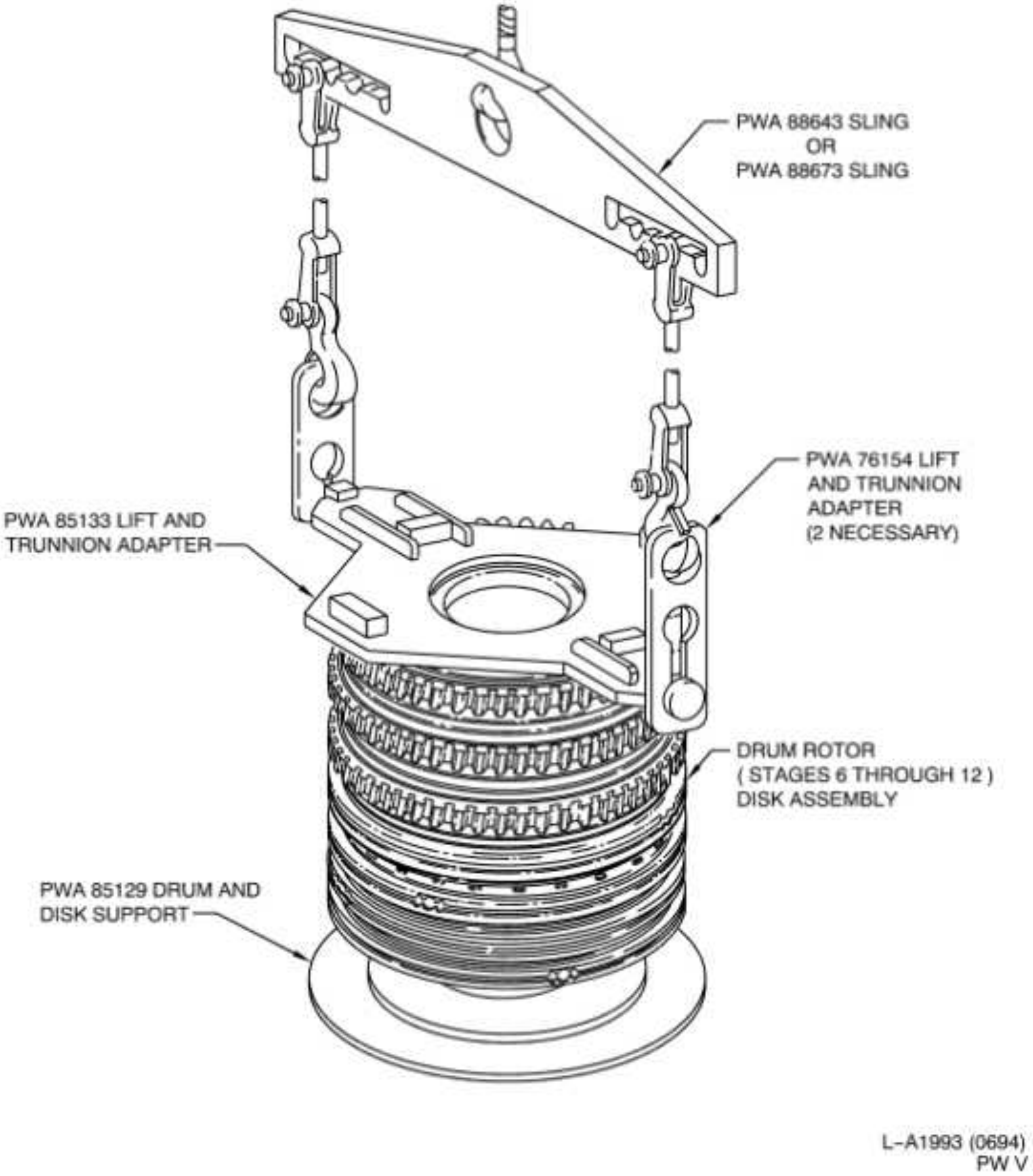
(3) Assemble the 12th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 12th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly per 72−35−01, Assembly−24, CONFIG−1 (Task 72−35−01−440−012).

C. Postrequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 11). Refer to 72−35−38, Assembly−03, CONFIG−1 (Task 72−35−38−440−003).

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY - ASSEMBLY-01


PWA 88643 SLING
OR
PWA 88673 SLING
PWA 76154 LIFT AND TRUNNION ADAPTER (2 NECESSARY)
PWA 85133 LIFT AND TRUNNION ADAPTER
DRUM ROTOR (STAGES 6 THROUGH 12) DISK ASSEMBLY
PWA 85129 DRUM AND DISK SUPPORT
L-A1993 (0694)
PW V

Drum Rotor Installed On Support
Figure 1001
(Task 72-35-38-440-001)

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY - ASSEMBLY-01

Task 72-35-38-440-013:

1. Assemble The Drum Rotor And Blades (Front) Assembly (Stage 12)

A. General

(1) Use one of the procedures that follow to install the 12th stage blades.

(a) Use Task 2 (Task 72-35-38-440-013-A) of this procedure to install the 12th stage blades in Pre SB PW4ENG 72-586 HPC assemblies.

(b) Use Task 3 (Task 72-35-38-440-013-B) of this procedure to install the 12th stage blades in Post SB PW4ENG 72-586 HPC assemblies.

Task 72-35-38-440-013-A:

2. Assemble Drum Rotor And Blades (Front) Assembly (Stage 12), (Pre SB PW4ENG 72-586 Only)

A. Equipment And Materials Required

Special Tools:

PWA 76154	Adapter, Lift And Trunnion (2 Necessary)
PWA 85129	Support
PWA 85133	Adapter, Lift And Trunnion
PWA 88643	Sling (Optional To PWA 88673)
PWA 88673	Sling

B. Procedure

CAUTION: THE 9TH STAGE BLEED TUBES MUST BE INSTALLED BEFORE YOU ASSEMBLE THE HPC ROTOR ASSEMBLY. IF THE HPC DRUM IS ASSEMBLED AND THE ENGINE IS OPERATED WITHOUT THESE TUBES DAMAGE TO THE ENGINE CAN OCCUR.

(1) Examine the HPC front drum for the presence of the 9th stage HPC bleed tubes. Look for the bleed tubes just behind the 9th stage bleed ports on the OD of the drum.

(a) If the bleed tubes are not there, install the bleed tubes. If the drum rotor was refurbished, refer to 72-35-07, Repair-12 or Repair-18, PW4000 Series CIR, PN 51A357 for the applicable repair.

(b) If the drum rotor is new, refer to 72-35-38, Assembly-13 (Task 72-35-38-440-014).

(2) Put the drum rotor, rear end down, on the PWA 85129 Support. See Figure 1001.

(a) Install PWA 85133 Adapter on drum and attach PWA 88643 Sling or PWA 88673 Sling with PWA 76154 Adapters to hoist and to spools on adapter.

(b) Raise drum from storage rack and lower drum on PWA 85129 Support, smaller OD up.

(c) Remove sling, adapters, and adapter from drum.

(3) Assemble the 12th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 12th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly (Pre SB PW4ENG 72-586 Only) per 72-35-01, Assembly-24, CONFIG-2 (Task 72-35-01-440-022-A).

C. Postrequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 11). Refer to 72-35-38, Assembly-03, CONFIG-2 (Task 72-35-38-440-017).

Task 72-35-38-440-013-B:

3. Assemble Drum Rotor And Blades (Front) Assembly (Stage 12), (Post SB PW4ENG 72-586 Only)

A. Equipment And Materials Required

Special Tools:

PWA 76154	Adapter, Lift And Trunnion (2 Necessary)
PWA 85129	Support
PWA 85133	Adapter, Lift And Trunnion
PWA 88643	Sling (Optional To PWA 88673)
PWA 88673	Sling

B. Procedure

CAUTION: THE 9TH STAGE BLEED TUBES MUST BE INSTALLED BEFORE YOU ASSEMBLE THE HPC ROTOR ASSEMBLY. IF THE HPC DRUM IS ASSEMBLED AND THE ENGINE IS OPERATED WITHOUT THESE TUBES DAMAGE TO THE ENGINE CAN OCCUR.

(1) Examine the HPC front drum for the presence of the 9th stage HPC bleed tubes. Look for the bleed tubes just behind the 9th stage bleed ports on the OD of the drum.

(a) If the bleed tubes are not there, install the bleed tubes. If the drum rotor was refurbished, refer to 72-35-07, Repair-12 or Repair-18, PW4000 Series CIR, PN 51A357 for the applicable repair.

(b) If the drum rotor is new, refer to 72-35-38, Assembly-13 (Task 72-35-38-440-014).

(2) Put the drum rotor, rear end down, on the PWA 85129 Support. See Figure 1001.

(a) Install PWA 85133 Adapter on drum and attach PWA 88643 Sling or PWA 88673 Sling with PWA 76154 Adapters to hoist and to spools on adapter.

(b) Raise drum from storage rack and lower drum on PWA 85129 Support, smaller OD up.

(c) Remove sling, adapters, and adapter from drum.

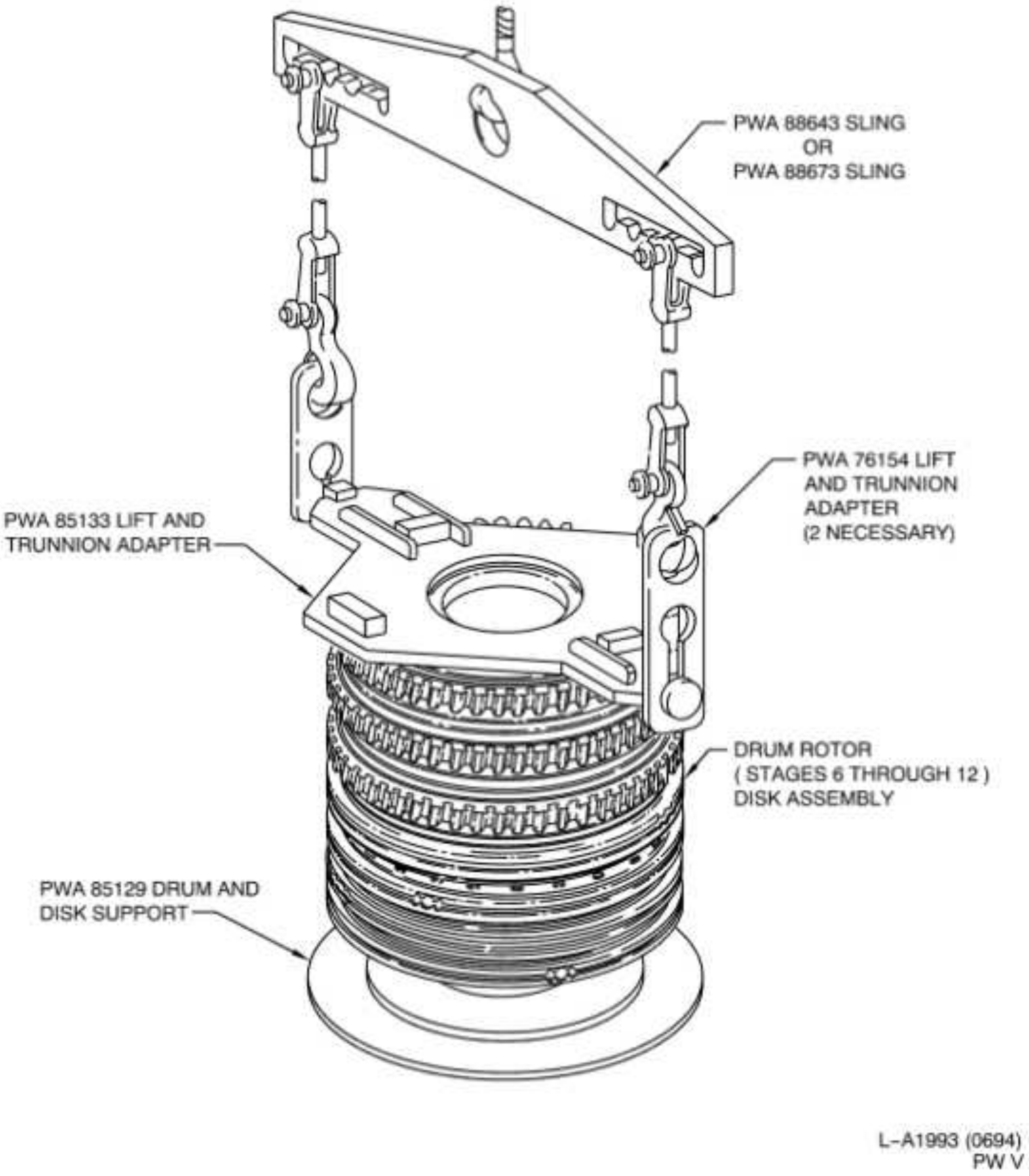
(3) Assemble the 12th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 12th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly (Post SB PW4ENG 72-586 Only) per 72-35-01, Assembly-24, CONFIG-2 (Task 72-35-01-440-022-B).

C. Postrequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 11). Refer to 72-35-38, Assembly-03, CONFIG-2 (Task 72-35-38-440-017).

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY − ASSEMBLY−01


PWA 88643 SLING
OR
PWA 88673 SLING
PWA 76154 LIFT AND TRUNNION ADAPTER (2 NECESSARY)
PWA 85133 LIFT AND TRUNNION ADAPTER
DRUM ROTOR (STAGES 6 THROUGH 12) DISK ASSEMBLY
PWA 85129 DRUM AND DISK SUPPORT
L−A1993 (0694)
PW V

Drum Rotor Installed On Support
Figure 1001
(Task 72−35−38−440−013−B)

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY - ASSEMBLY-02

Task 72-35-38-440-002:

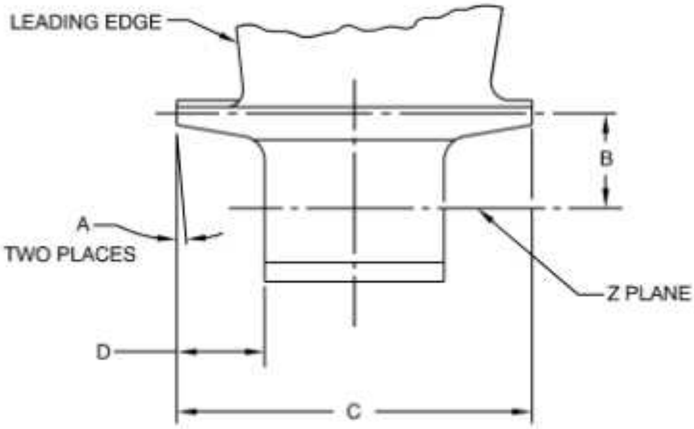
1. Grind Stage 9 Through 12 HPC Blade Platforms
   A. Equipment And Materials Required

      Special Tools:
      PWA 17019 Holder
      PWA 85597 Fixture, Grinding (9th Stage)
      PWA 85598 Fixture, Grinding (10th Stage)
      PWA 85599 Fixture, Grinding (11th Stage)
      PWA 85600 Fixture, Grinding (12th Stage)
      PWA 101965 Fixture, Grinding (12th Stage)

   B. Procedure
      See Figure 1001 and 1002.
      (1) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
      Before you install the blades into the fixture, measure the platform of all of the blades. Refer to Figure 1001.
         (a) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
         The blade platform width must be equal to or greater than the Dimension C shown in Figure 1001. Blades which are less than the minimum value shown in the specified figure must be removed from service.
         (b) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
         You can install and grind blades with equal platform width together (Dimensions C and D).
         (c) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
         You can install and grind blades with equal platform widths separately (Dimensions C and D).
         (d) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
         You must maintain the platform dimensions shown in Figure 1001 after all grinding is completed.
      (2) FOR THESE MODELS: 4152, 4156A, 4158
      Install and secure PWA 85597 (for 9th stage) or PWA 85598 (for 10th stage) or PWA 85599 (for 11th stage) or PWA 85600 (for 12th stage) Fixture to surface plate of a surface grinding machine.

      CAUTION: FOR THESE MODELS: 4152, 4156A, 4158
      MAXIMUM MATERIAL REMOVAL PER PLATFORM SIDE MUST NOT EXCEED 0.005 INCH (0.127 mm).

      (3) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
      Install and secure PWA 85597 (for 9th stage) or PWA 85598 (for 10th stage) or PWA 85599 (for 11th stage) or PWA 101965 (for 12th stage) Fixture to surface plate of a surface grinding machine.



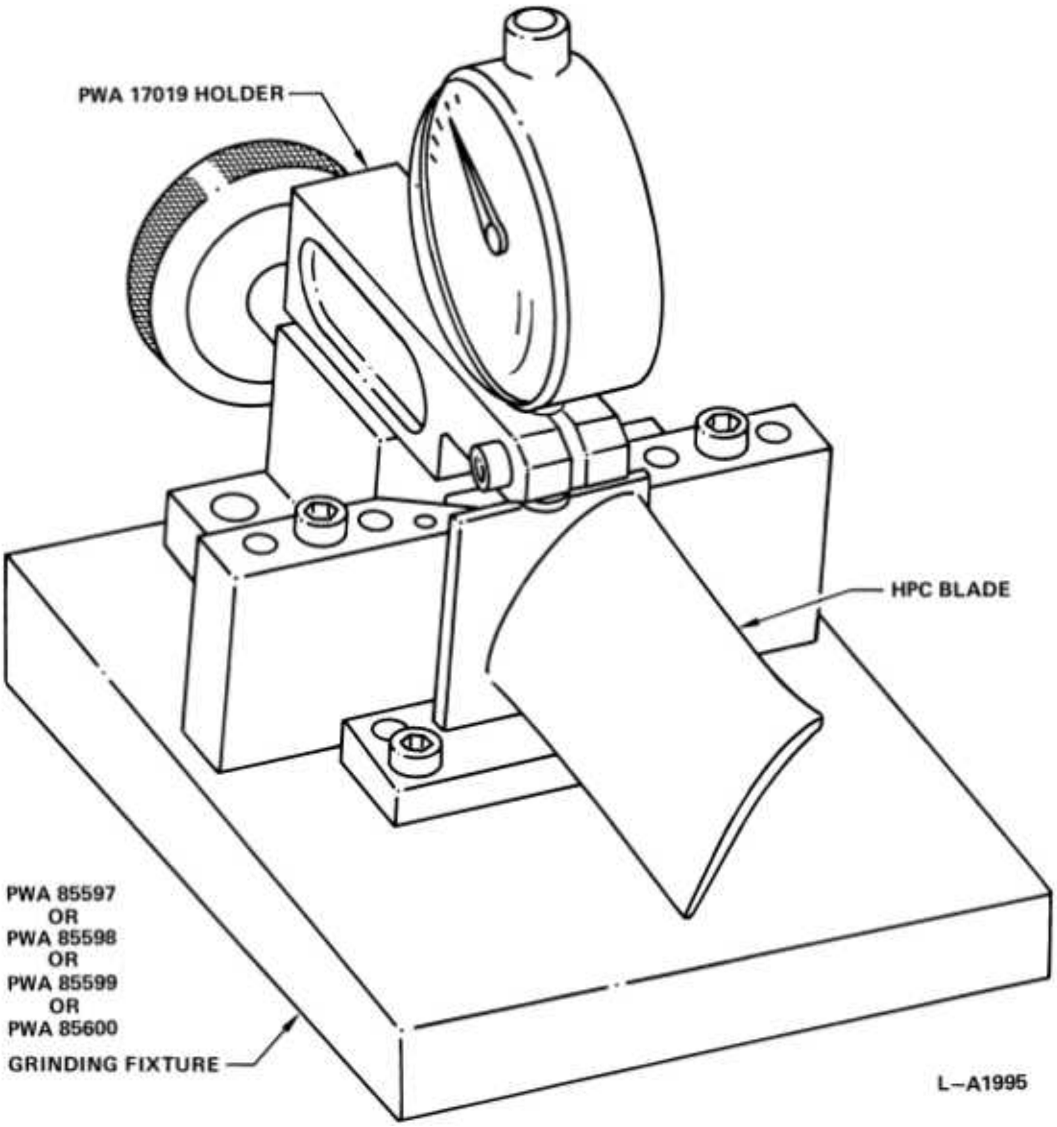
BLADE PLATFORM AREA
FRONT VIEW

STAGE	A±0° 30'	B GAGE	C MINIMUM*	D MINIMUM*
9	2° 44'	0.349 inch (8.865mm)	1.112 inch (28.245mm)	0.273 inch (6.934mm)
10	2° 54'	0.303 inch (7.696mm)	1.192 inch (30.277mm)	0.293 inch (7.442mm)
11	2° 39'	0.295 inch (7.493mm)	1.091 inch (27.711mm)	0.268 inch (6.807mm)
12	2° 30'	0.294 inch (7.468mm)	1.029 inch (26.137mm)	0.246 inch (6.248mm)
13	2° 18'	0.291 inch (7.391mm)	0.9485 inch (24.092mm)	0.231 inch (5.867mm)
14	2° 34'	0.291 inch (7.391mm)	0.9730 inch (24.714mm)	0.238 inch (6.045mm)
15	2° 34'	0.288 inch (7.315mm)	1.058 inch (26.875mm)	0.258 inch (6.553mm)

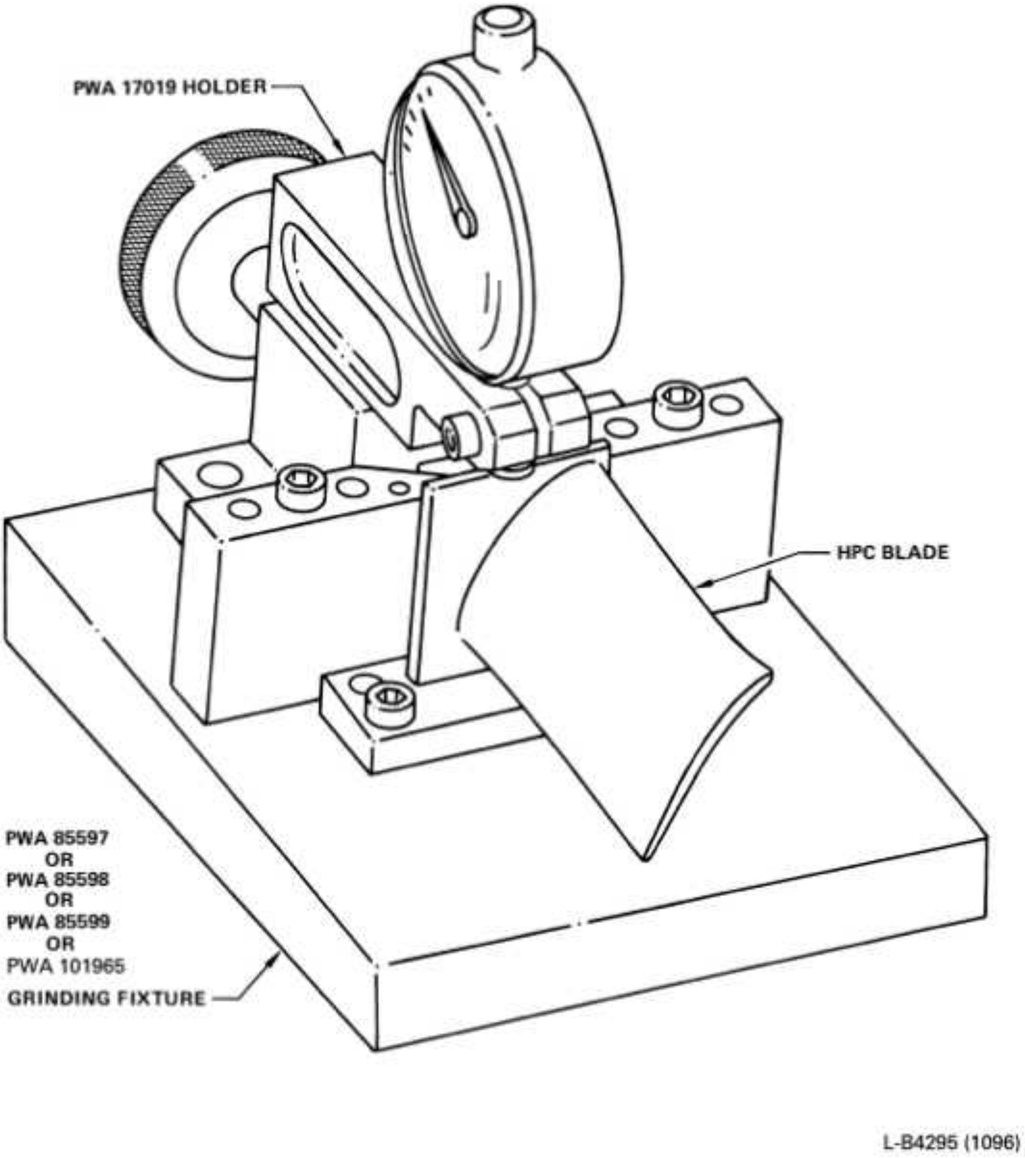
*NOTE: BLADES CANNOT BE GROUND BEYOND THESE LIMITS.

L-A7463 (0000)
PW V

Blade Platform Measurement
Figure 1001
(Task 72-35-38-440-002)


PWA 17019 HOLDER
HPC BLADE
PWA 85597
OR
PWA 85598
OR
PWA 85599
OR
PWA 85600
GRINDING FIXTURE
L-A1995

Grind And Measure Blade Platforms
Figure 1002 (Sheet 1)
(Task 72-35-38-440-002)


PWA 17019 HOLDER
HPC BLADE
PWA 85597
OR
PWA 85598
OR
PWA 85599
OR
PWA 101965
GRINDING FIXTURE
L-B4295 (1096)

Grind And Measure Blade Platforms
Figure 1002 (Sheet 2)
(Task 72-35-38-440-002)

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY - ASSEMBLY-02

CAUTION: FOR THESE MODELS: 4152-3, 4156A-3, 4158-3 MAXIMUM MATERIAL REMOVAL PER PLATFORM SIDE MUST NOT EXCEED 0.005 INCH (0.127 mm).

(4) Install blade Types D or A, if applicable, into fixture and secure. Grind required amount of material from blade platform. Each blade must have an equal amount of material removed. On any one blade, material removed must be in approximately equal amounts from both sides of platform.

(5) Remove blade from fixture and reinstall with ground platform down. Grind other platform to required amount removed from first grind. Remove blade from fixture. Blades with trimmed platforms must be identified with a square symbol in the time marking area. Use vibration peening as the marking method. See 70-11, Standard Practices Manual.

(6) Grind remaining blade platforms as required per previous instructions.

(7) Measure platform width using PWA 17019 Holder. If blade needs additional grinding repeat above steps. If blade is acceptable continue with procedure in Assembly-01 (Task 72-35-38-440-001) or Assembly-03 (Task 72-35-38-440-003) or Assembly-04 (Task 72-35-38-440-004) or Assembly-05 (Task 72-35-38-440-005).

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY − ASSEMBLY−03

Task 72−35−38−440−003:

1. Assemble The Drum Rotor And Blades (Front) Assembly (Stage 11)

A. Prerequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 12). Refer to 72−35−38, Assembly−01, CONFIG−1 (Task 72−35−38−440−001).

B. Equipment And Materials Required − None

C. Procedure

(1) Assemble the 11th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 11th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly per 72−35−01, Assembly−25, CONFIG−1 (Task 72−35−01−440−013).

D. Postrequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 10). Refer to Assembly−04, CONFIG−1 (Task 72−35−38−440−004).

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY − ASSEMBLY−03

Task 72−35−38−440−017:

1. Assemble The Drum Rotor And Blades (Front) Assembly (Stage 11)

A. Prerequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 12). Refer to Assembly−01, CONFIG−2 (Task 72−35−38−440−013).

B. Equipment And Materials Required − None

C. Procedure

(1) Assemble the 11th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 11th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly per 72−35−01, Assembly−25, CONFIG−2 (Task 72−35−01−440−023).

D. Postrequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 10). Refer to Assembly−04, CONFIG−2 (Task 72−35−38−440−016).

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DRUM ROTOR AND BLADES (FRONT) ASSEMBLY − ASSEMBLY−04

Task 72−35−38−440−004:

1. Assemble Drum Rotor And Blades (Front) Assembly (Stage 10)

A. Prerequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 11). Refer to 72−35−38, Assembly−03, CONFIG−1 (Task 72−35−38−440−003).

B. Equipment And Materials Required − None

C. Procedure

(1) Assemble the 10th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 10th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly per 72−35−01, Assembly−26, CONFIG−1 (Task 72−35−01−440−014).

D. Postrequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 9). Refer to 72−35−38, Assembly−05, CONFIG−1 (Task 72−35−38−440−005).

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY - ASSEMBLY-04

Task 72-35-38-440-016:

1. Assemble The Drum Rotor And Blades (Front) Assembly (Stage 10)

A. Prerequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 11). Refer to 72-35-38, Assembly-03, CONFIG-2 (Task 72-35-38-440-017).

B. Equipment And Materials Required - None

C. Procedure

(1) Assemble the 10th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble 10th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly per 72-35-01, Assembly-26, CONFIG-2 (Task 72-35-01-440-024).

D. Postrequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 9). Refer to 72-35-38, Assembly-05, CONFIG-2 (Task 72-35-38-440-015).

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DRUM ROTOR AND BLADES (FRONT) ASSEMBLY − ASSEMBLY−05

Task 72−35−38−440−005:

1. Assemble Drum Rotor And Blades (Front) Assembly (Stage 9)

A. Prerequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 10). Refer to 72−35−38, Assembly−04, CONFIG−1 (Task 72−35−38−440−004).

B. Equipment And Materials Required − None

C. Procedure

(1) Assemble the 9th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 9th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly per 72−35−01, Assembly−27, CONFIG−1 (Task 72−35−01−440−015).

D. Postrequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 8). Refer to 72−35−38, Assembly−06 (Task 72−35−38−440−006).

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY - ASSEMBLY-05

Task 72-35-38-440-015:

1. Assemble The Drum Rotor And Blades (Front) Assembly (Stage 9)

A. Prerequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 10). Refer to 72-35-38, Assembly-04, CONFIG-2 (Task 72-35-38-440-016).

B. Equipment And Materials Required - None

C. Procedure

(1) Assemble the 9th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 9th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly per 72-35-01, Assembly-27, CONFIG-2 (Task 72-35-01-440-025).

D. Postrequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 8). Refer to 72-35-38, Assembly-06 (Task 72-35-38-440-006).

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DRUM ROTOR AND BLADES (FRONT) ASSEMBLY − ASSEMBLY−06

Task 72−35−38−440−006:

1. Assemble Drum Rotor And Blades (Front) Assembly (Stage 8)

   A. Prerequisites

      (1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 9). Refer to 72−35−38, Assembly−05, CONFIG−1 (Task 72−35−38−440−005) or Assembly−05, CONFIG−2 (Task 72−35−38−440−015).

   B. Equipment And Materials Necessary − None

   C. Procedure

      (1) Assemble the 8th stage blades and attaching parts in the drum rotor.

         (a) Refer to Assemble The 8th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly per 72−35−01, Assembly−28, (Task 72−35−01−440−016).

   D. Postrequisites

      (1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 7). Refer to 72−35−38, Assembly−07 (Task 72−35−38−440−007).

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DRUM ROTOR AND BLADES (FRONT) ASSEMBLY - ASSEMBLY-07

Task 72-35-38-440-007:

1. Assemble Drum Rotor And Blades (Front) Assembly (Stage 7)

A. Prerequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 8). Refer to 72-35-38, Assembly-06 (Task 72-35-38-440-006).

B. Equipment And Materials Necessary

Special Tools:

PWA 76154	Adapter, Lift And Trunnion (2 Necessary)
PWA 85133	Adapter, Lift And Trunnion
PWA 88643	Sling, Lifting (Optional to PWA 88673)
PWA 88673	Sling, Lifting (Optional to PWA 88643)

C. Procedure

(1) Assemble the 7th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 7Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly per 72-35-01, Assembly-29 (Task 72-35-01-440-017).

(2) Attach PWA 85133 Adapter to the front flange of the drum rotor. Use a hoist with PWA 88643 Sling or PWA 88673 Sling and two PWA 76154 Adapters to lift the drum rotor.

(3) Move drum rotor adjacent to oven for sealant curing. Lower rotor onto suitable support. Remove sling, adapters and adapter from drum rotor.

(4) Cure the blade root sealant.

(a) Refer to Assemble The 7Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly per 72-35-01, Assembly-29 (Task 72-35-01-440-017).

(5) After curing remove rotor from oven and allow to air cool to room temperature.

D. Postrequisites

(1) Assemble The Drum Rotor And Blades Assembly (Stage 6). Refer to 72-35-38, Assembly-08 (Task 72-35-38-440-008).

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY - ASSEMBLY-08

Task 72-35-38-440-008:

1. Assemble Drum Rotor And Blades Assembly (Stage 6)

A. Prerequisites

(1) Assemble The Drum Rotor And Blades (Front) Assembly (Stage 7). Refer to 72-35-38, Assembly-07 (Task 72-35-38-440-007).

B. Equipment And Materials Required - None

C. Procedure

(1) Assemble the 6th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 6th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly per 72-35-01, Assembly-30 (Task 72-35-01-440-018).

D. Postrequisites

(1) Assemble The Axial Compressor Rotor Assembly. Refer to 72-35-01, Assembly-01 (Task 72-35-01-440-001).

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY - ASSEMBLY-09

Task 72-35-38-440-009:

1. Assemble Drum Rotor And Blades (Front) Assembly For Balance

This Procedure Has Been Deleted

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY - ASSEMBLY-10

Task 72-35-38-440-010:

1. Balance Drum Rotor And Blades (Front) Assembly

This Procedure Has Been Deleted

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY - ASSEMBLY-11

Task 72-35-38-440-011:

1. Post Balance Procedures - Drum Rotor And Blades (Front) Assembly

This Procedure Has Been Deleted

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY - ASSEMBLY-12

Task 72-35-38-440-012:

1. Seal Drum Rotor And Blades Assembly (Stage 6)

This Procedure Has Been Deleted

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY − ASSEMBLY−13

Task 72−35−38−440−014:

1. Assemble 9th Stage Bleed Air Tubes To The Drum Rotor (Front)

A. General

(1) Use one of the procedures that follow to install the 9th stage bleed air tubes to a new drum rotor (front) only.

(a) Use Task 72−35−38−440−014−A of this procedure to install the 9th stage bleed air tubes (flared tube end type) to a new drum rotor.

(b) Use Task 72−35−38−440−014−B of this procedure to install the 9th stage bleed air tubes (flared tube stop type) to a new drum rotor.

Task 72−35−38−440−014−A:

2. Assemble 9th Stage Bleed Air Tubes To The Drum Rotor (Front) (Flared Tube End Type)

A. Equipment And Materials Necessary

Standard Tools:

Name	Manufacture
Clements Cadillac Flameless Torch Model FT 1000	Clements Manufacturing Co. 6650 S. Narraganset Avenue Chicago, IL 60658

Special Tools:

PWA 84866	Expander, Tube
PWA 85815	Mandrel, Forming (Optional to PWA 84866)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Tube Assembly	24	72−35−00/1/160

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine
P06−009	Compound, Antiseize

B. Procedure

(1) Put the tubes in sequence (by weight) in four columns of six rows. See Table 1001.

	COLUMN			
ROW	I	II	III	IV
1	HEAVIEST −−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−>			
2	<−−−			
3	−−−>			
4	<−−−			
5	−−−>			
6	LIGHTEST<−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−			

Tube Sequence By Weight
Table 1001

(2) Put the heaviest tube first. Continue until all tubes are used. The last tube is the lightest.

(3) Make a sequence mark in ink on the tubes. See Table 1002.

	COLUMN			
ROW	I	II	III	IV
1	1	7	13	19
2	2	8	14	20
3	3	9	15	21
4	4	10	16	22
5	5	11	17	23
6	6	12	18	24

Tube Sequence Marking
Table 1002

(4) Make a sequence mark in ink on the drum rotor. Start at any hole and mark it number one.

(5) Mark remaining holes 2 through 24 in a clockwise direction.

(6) Install tubes into ID of drum. Align number on tube with number on drum.

(7) Mix 2/3 volume of Compound P06−009 and 1/3 volume of Engine Oil P03−001.

(8) Apply the mixture to ID of the tube at the OD end. Apply the mixture to the PWA 84866 Mandrel or PWA 85815 Mandrel flare detail.

(9) Lubricate the threads of the tool with Engine Oil P03−001.

(10) Install the shaft of the mandrel (PWA 84866 or PWA 85815) through the No. 1 tube from the ID of the drum rotor. Install flare over shaft and secure with the nut assembly.

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IT WILL CAUSE DAMAGE TO THE PART.

(11) Start at the No. 1 Position and from the outside of the drum, heat the hole and the installed tube to 225° − 275°F (107° − 135°C). Do not exceed 300°F (149°C) on any part.

(12) Hold the ID of the tool with a wrench and turn the OD nut to flare the tube into the drum rotor.

(13) Do the same procedure to install the remaining tubes in the following sequence until all the tubes have been flared.

1, 13, 2, 14, 3, 15 ....11, 23, 12, 24

(14) When the flaring operation is complete and the tubes are cool, examine the flare on the 9 stage bleed tubes as follows. See Figure 1001.

(a) From the outside of the drum, push each tube in as far as the tube will move. Measure the distance from the flared end of the tube to the outside surface of the drum. The distance can be 0.040 inch (1.016 mm) maximum.

(b) From the inside of the drum, push each tube out as far as the tube will move. Make sure the tube is flush to below the outer surface of the drum.

(c) For tubes that are not in the limits given above, do the flaring operation again.

(15) Do a fluorescent penetrant inspection on the flared area of the tube. See SPOP 82 (Task 70−33−00−230−005), Standard Practices Manual, PN 585005. Replace the tube when you find cracks.

Task 72−35−38−440−014−B:

3. Assemble 9th Stage Bleed Air Tubes To The Drum Rotor (Front) (Flared Tube Stop Type)

A. Equipment And Materials Necessary

Special Tools:

PWA 87482	Expander, Manual
PWA 87493	Drift, Hand

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Tube Assembly, Bleed Stage 9	24	72−35−00/1/160A

B. Procedure

(1) Install the tubes to the drum rotor as follows:

(a) Put the 24 tubes in sequence (by weight) in four columns of six rows. See Table 1003.

(b) Put the heaviest tube first. Continue until all tubes are used. The last tube is the lightest.

(c) Make a sequence mark in ink on the tubes. See Table 1004.

(d) Make a sequence mark in ink on the drum rotor. Start at any hole and mark it number one.

(e) Mark remaining holes 2 through 24 in a clockwise direction.

	COLUMN			
ROW	I	II	III	IV
1	HEAVIEST ------------------------------------->			
2	<--			
3	-->			
4	<--			
5	-->			
6	LIGHTEST<--------------------------------------			

Tube Sequence By Weight
Table 1003

	COLUMN			
ROW	I	II	III	IV
1	1	7	13	19
2	2	8	14	20
3	3	9	15	21
4	4	10	16	22
5	5	11	17	23
6	6	12	18	24

Tube Sequence Marking
Table 1004

(2) Install the tube assemblies in their appropriate position in the ID of the drum.

(a) With the bleed tube positioned correctly in the drum rotor, install a PWA 87482 Expander into the threads of the stop detail.

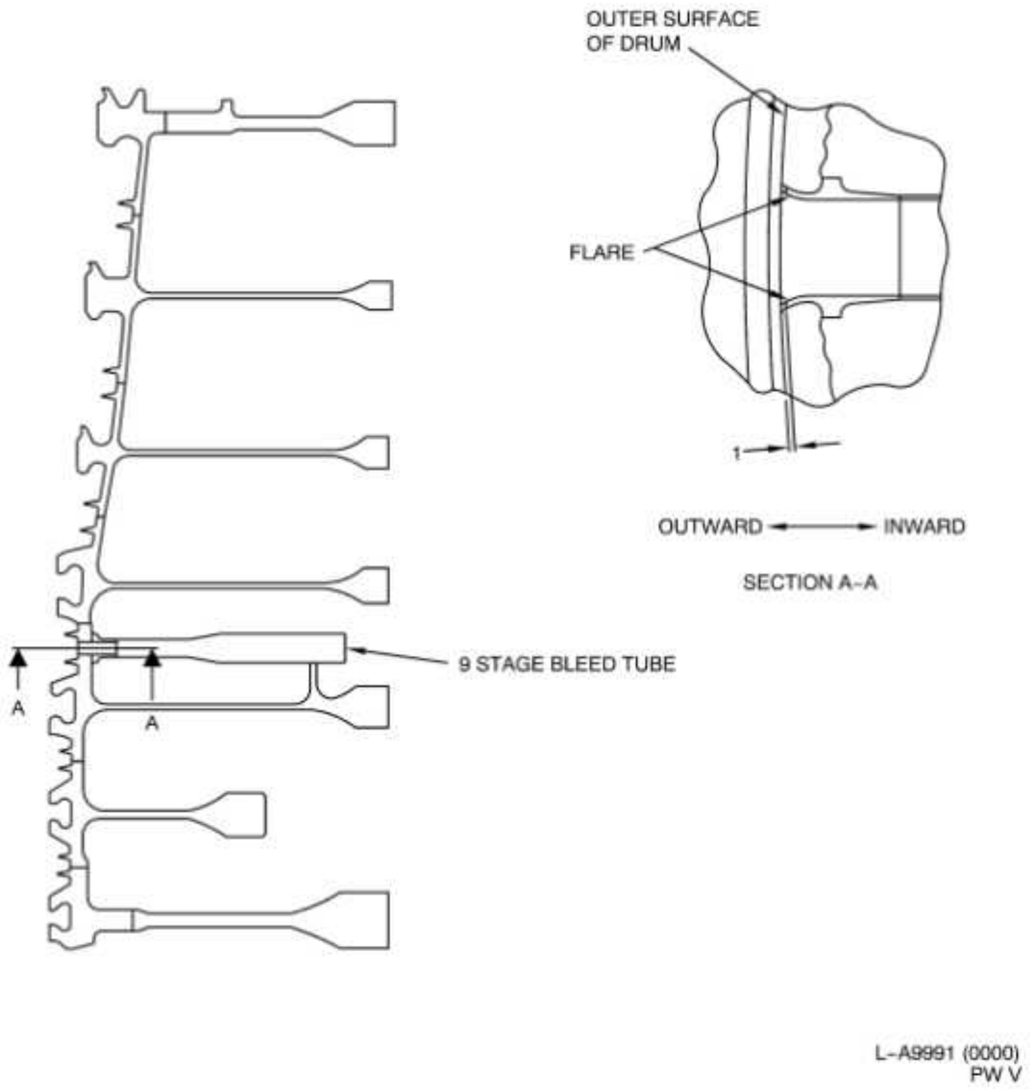
(b) Turn the tool detail coupling nut until the stop is correctly flared into position and the tube is held tight. See Figure 1002.

1 Diameter of the flare opening must be as shown in the figure.

2 The flare must not have cracks.

(c) Repeat the steps above until all tubes are installed.

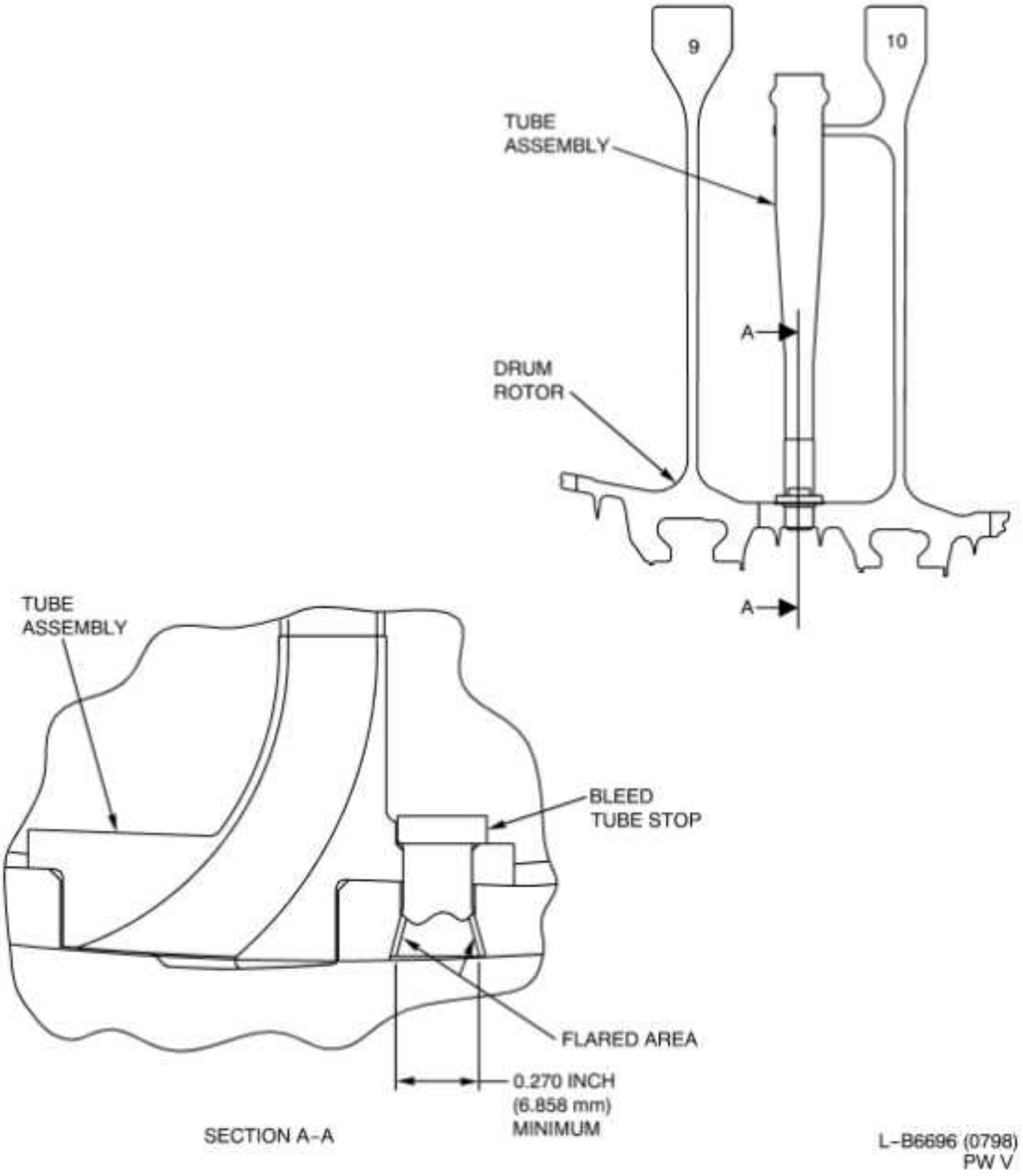
DRUM ROTOR AND BLADES (FRONT) ASSEMBLY - ASSEMBLY-13


OUTER SURFACE OF DRUM
FLARE
1
OUTWARD
INWARD
SECTION A-A
9 STAGE BLEED TUBE
A
A
L-A9991 (0000)
PW V

1. 0.000 - 0.040 Inch (0.00 - 1.02 mm) Below The Adjacent Surface.

Stage 9 Bleed Tube Installation
Figure 1001
(Task 72-35-38-440-014-A)

DRUM ROTOR AND BLADES (FRONT) ASSEMBLY − ASSEMBLY−13


9
10
TUBE ASSEMBLY
A
DRUM ROTOR
A
TUBE ASSEMBLY
BLEED TUBE STOP
FLARED AREA
0.270 INCH (6.858 mm) MINIMUM
SECTION A-A
L-B6696 (0798)
PW V

Stage 9 Bleed Tube Installation
Figure 1002
(Task 72−35−38−440−014−B)

Previous Pageblock Return to Previous Menu Next Pageblock

DRUM ROTOR AND BLADES (REAR) ASSEMBLY - DISASSEMBLY-01

Task 72-35-39-040-001:

1. Disassemble Drum Rotor And Blades (Rear) Assembly

A. Prerequisites

(1) Disassemble axial compressor rotor assembly by 72-35-01, Disassembly-01 Task 72-35-01-040-001.

B. Equipment And Materials Required

Special Tools:

PWA 29389 Pump, Hand
PWA 76154 Adapter (2 Necessary)
PWA 85086 Lift Arm
PWA 85124 Adapter, Lift
PWA 85127 Adapter, Lift And Trunnion
PWA 85129 Support
PWA 85159 Protector, Thread
PWA 85801 Puller, Airseal
PWA 86221 Puller, Hydraulic
PWA 88643 Sling (Optional to PWA 88673)
PWA 88673 Sling
PWA 102107 Pusher, Manual

C. Procedure

(1) With drum rotor and blades (rear) assembly (hub end down) in Support PWA 85125 remove spiral retaining ring from hub ID.

(2) Install PWA 86221 Puller jaws in the heat shield puller groove. Turn adjustable nut to move jaws into puller groove. Install plate and hydraulic ram and secure. See Figure 501.

(3) Install PWA 29389 Hand Pump and actuate puller to remove heat shield. Remove puller from drum rotor and blades.

(4) Remove 42 tierods from drum using PWA 102107 Pusher. See Figure 502.

(5) Install PWA 85127 Adapter to flange end of rear drum. Attach PWA 88643 or PWA 88673 Sling with PWA 76154 Adapters to spools on adapter on rear drum. Attach hoist and lift assembly out of support. See Figure 503.

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − DISASSEMBLY−01

(6) Install PWA 85124 Adapter to hub threads. Attach PWA 85086 Lift Arm to installed adapter. Attach hoist and trunnion drum rotor to hub end up.

(7) Remove hoist, sling, adapters and adapter from drum rotor. Lower drum rotor down onto PWA 85129 Support. Remove hoist, adapter and lift arm from hub.

(8) Remove diffuser airseal as follows. See Figure 504.

  (a) Remove 50 bolts and nuts which attaches airseal to the hub.

  (b) Position PWA 85801 Puller locator over the end of the hub.

  (c) Position jaws of the puller over and in front of the largest diameter of the airseal knife edge.

  (d) Position retaining ring over jaws and remove airseal with PWA 29389 Pump.

  (e) Remove puller. Remove damper from airseal.

(9) Install PWA 85159 Protector to hub threads.

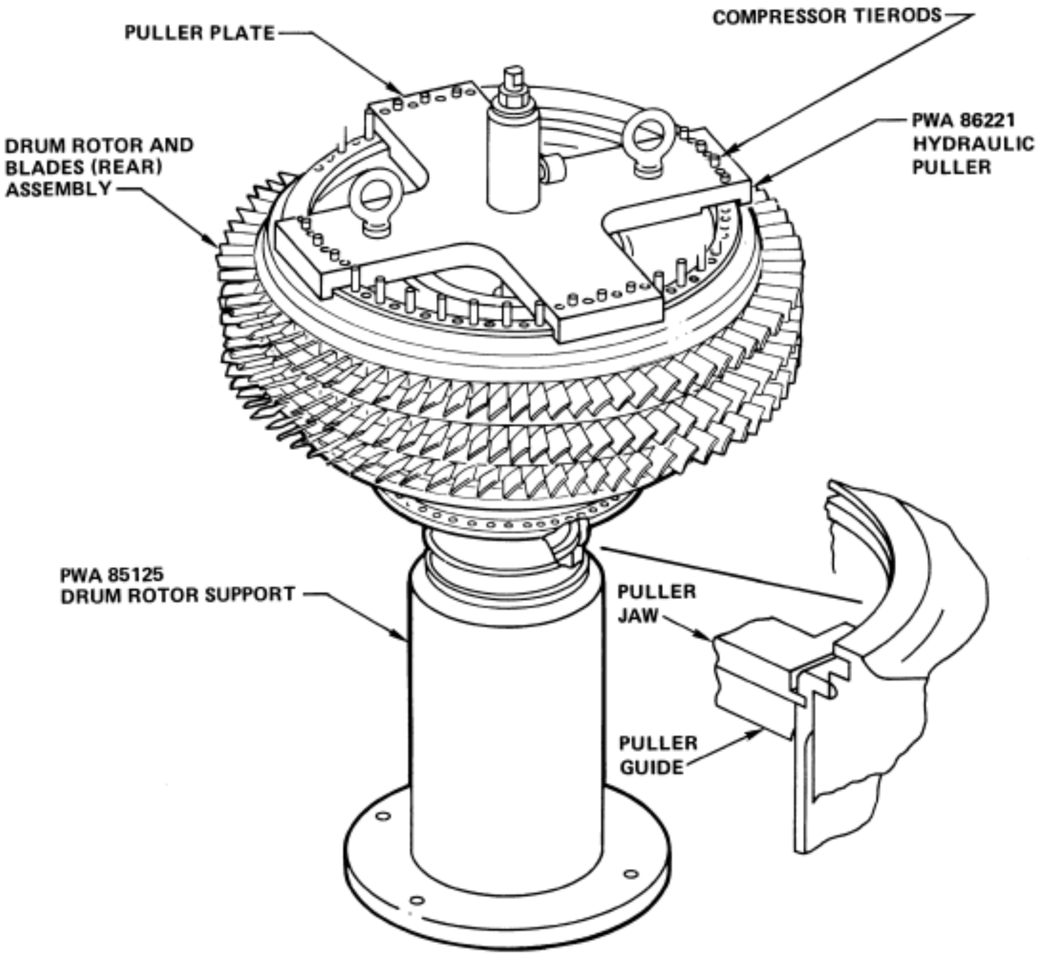
(10) Remove the 13th through 15th stage blades from the drum rotor.

  (a) Refer to Disassemble (Deblade) The Axial Compressor Rotor Assembly per 72−35−01, Disassembly−20 (Task 72−35−01−040−003).

(11) Remove protector from hub threads and install Adapter PWA 85124. Attach PWA 85086 Lift Arm to installed adapter and attach hoist. Raise drum rotor from support.

(12) Place drum rotor on storage rack. Remove hoist, adapter, and lift arm. Install Protector PWA 85159 to hub threads. Install protective covers to all airseals.

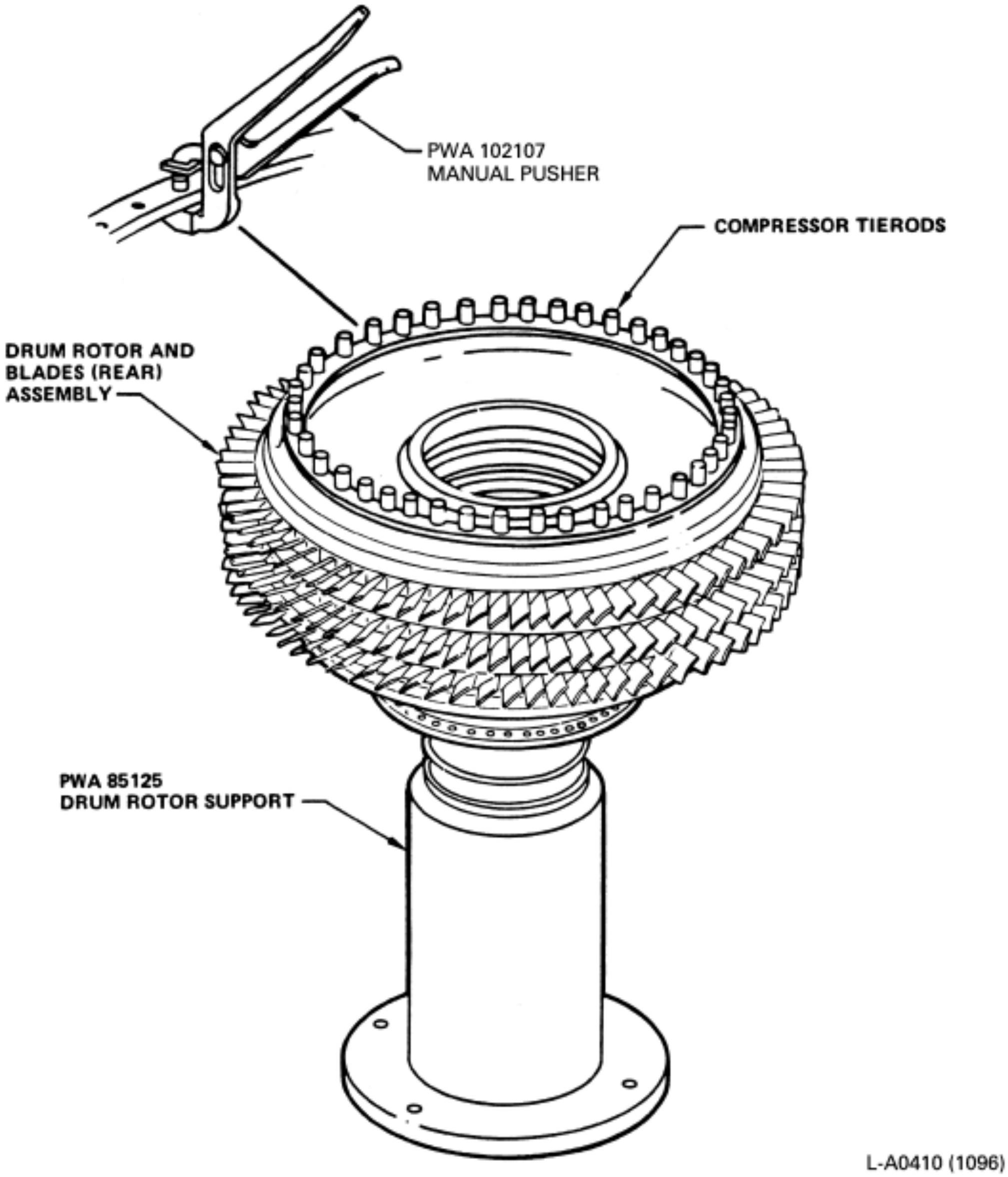
DRUM ROTOR AND BLADES (REAR) ASSEMBLY − DISASSEMBLY−01


PULLER PLATE
COMPRESSOR TIERODS
DRUM ROTOR AND BLADES (REAR) ASSEMBLY
PWA 86221 HYDRAULIC PULLER
PWA 85125 DRUM ROTOR SUPPORT
PULLER JAW
PULLER GUIDE

L-A7710 (0794)

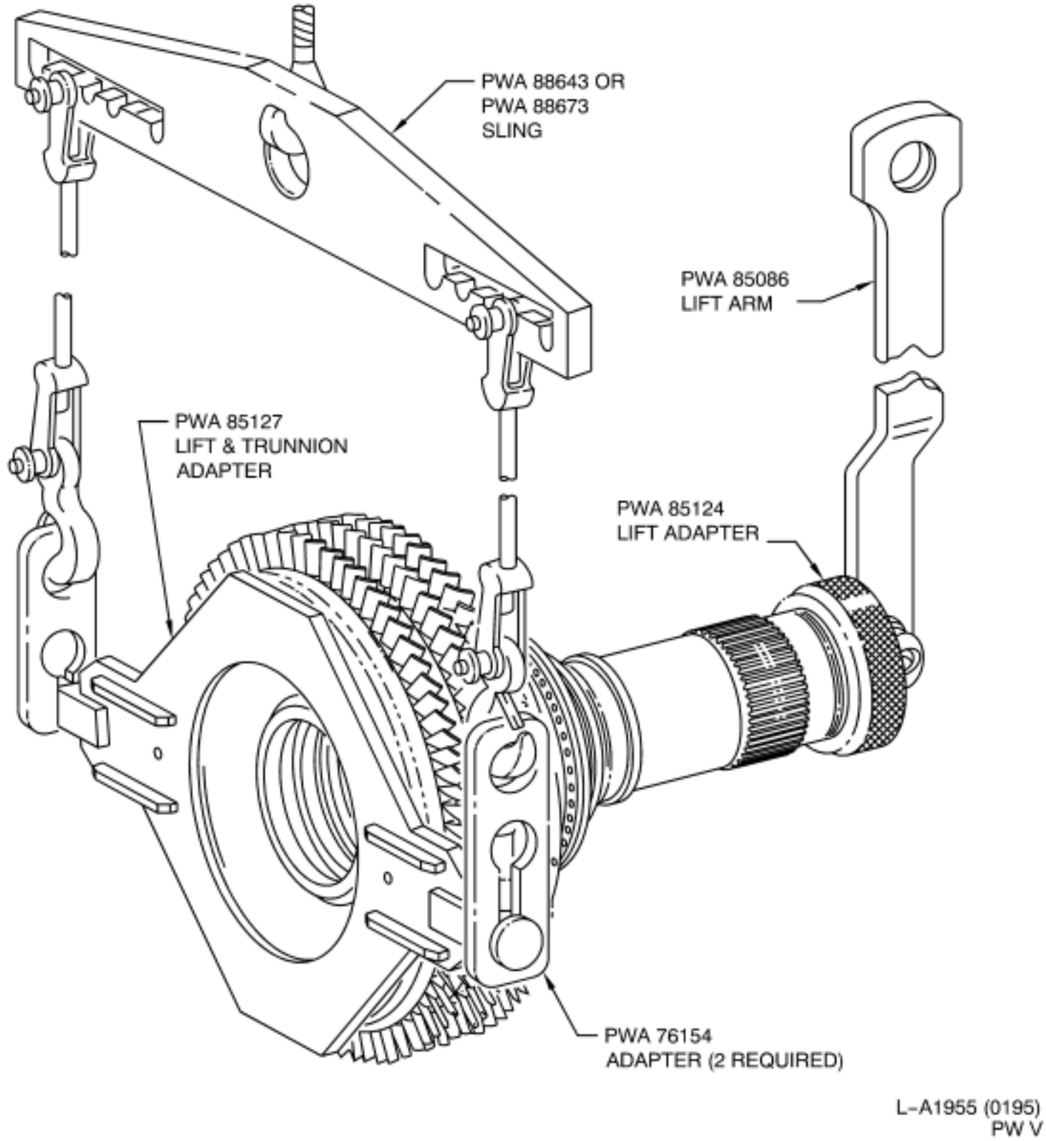
Heat Shield Removal
Figure 501
(Task 72−35−39−040−001)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − DISASSEMBLY−01


PWA 102107
MANUAL PUSHER
COMPRESSOR TIERODS
DRUM ROTOR AND
BLADES (REAR)
ASSEMBLY
PWA 85125
DRUM ROTOR SUPPORT
L-A0410 (1096)

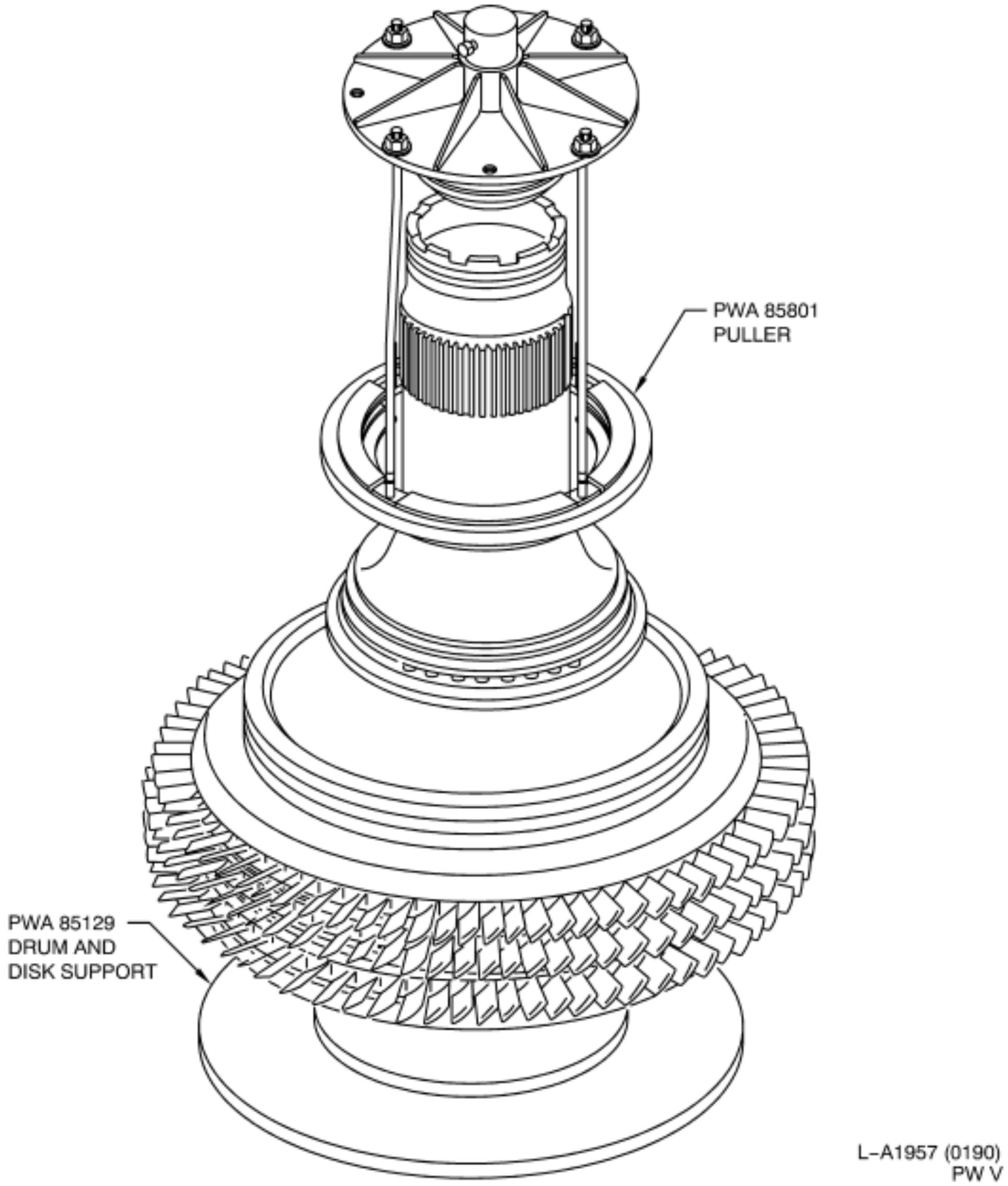
Drum Rotor And Blades (Rear) Assembly
Figure 502
(Task 72−35−39−040−001)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − DISASSEMBLY−01


PWA 88643 OR
PWA 88673
SLING
PWA 85086
LIFT ARM
PWA 85127
LIFT & TRUNNION
ADAPTER
PWA 85124
LIFT ADAPTER
PWA 76154
ADAPTER (2 REQUIRED)
L−A1955 (0195)
PW V

Trunnion Drum Rotor And Blades (Rear) Assembly
Figure 503
(Task 72−35−39−040−001)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY - DISASSEMBLY-01


PWA 85801
PULLER
PWA 85129
DRUM AND
DISK SUPPORT
L-A1957 (0190)
PW V

Remove Diffuser Airseal
Figure 504
(Task 72-35-39-040-001)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − DISASSEMBLY−01

Task 72−35−39−040−002−001:

1. Disassemble The Drum Rotor And Blades (Rear) Assembly (Rear Shaft Removal Method 1)

A. Prerequisites

(1) Disassemble axial compressor rotor assembly by 72−35−01, Disassembly−01 (Task 72−35−01−040−001).

B. Equipment And Materials Necessary

Special Tools:

PWA 29389	Pump, Hand
PWA 76154	Adapter (4 Necessary)
PWA 85086	Lift Arm
PWA 85124	Adapter, Lift
PWA 85125	Support, Drum Rotor
PWA 85127	Adapter, Lift And Trunnion
PWA 85159	Protector, Thread
PWA 86221	Puller, Hydraulic
PWA 87180	Puller, Hydraulic
PWA 87192	Puller, Jackscrew
PWA 87194	Fixture, Handling
PWA 88643	Sling (Optional to PWA 88673)
PWA 88673	Sling
PWA 88700	Adapter, Lift
PWA 88723	Puller, Hydraulic
PWA 101610	Spreader
PWA 102107	Pusher, Manual

C. Procedure
See Figure 501, Figure 502, Figure 503, Figure 504 and Figure 505.

(1) Attach PWA 85127 Lift And Trunnion Adapter to front face of rear drum. Use PWA 88643 Sling or PWA 88673 Sling and PWA 76154 Adapters to raise the drum rotor and blades (rear) assembly. Remove 50 tiebolt nuts and bolts that attach the HPC shaft to the HPC rear drum rotor. Install PWA 101610 Spreader into the HPC tiebolt retaining clips to spread the clips outward. Push the tiebolt through the clip and remove the
R tiebolts from the retaining clips. Discard the
R retaining clips. It is not permitted to use the 50 tiebolts or tiebolt nuts again. The 50 tiebolts and tiebolt nuts must be discarded.

(2) Install the drum rotor and blades (rear) assembly to the PWA 85125 Support, shaft end down. Remove the adapter. Remove the spiral retaining ring that holds the No. 3 bearing heat shield. (Pre SB PW4ENG 72−562) Install the PWA 86221 Hydraulic Puller to the front flange and connect the PWA 29389 Hand Pump. (Post SB PW4ENG 72−562) Install the PWA 87180 Hydraulic Puller to the front flange and connect the PWA 29389 Hand Pump. Actuate the puller to remove the No. 3 bearing heat shield.

(3) Use PWA 102107 Pusher and remove the 42 tierods from the drum rotor. See Figure 502.

(4) Install the PWA 88723 Hydraulic Puller to the front flange of the HPC rear drum and use PWA 29389 Hand Pump to disengage the rear shaft from the rear drum.

(5) Remove puller and attach PWA 85127 Lift And Trunnion Adapter and PWA 76154 Adapters to front face of rear drum. Raise rear drum, attach PWA 87194 Handling Fixture and PWA 76154 Adapters to rear face of rear drum. Lift rear drum and trunnion so that it can be placed, front face down, on work table.

(6) Install PWA 87194 Handling Fixture on front face of rear shaft flange. (Pre SB PW4ENG 72−562) Raise shaft and attach PWA 85124 Lift Adapter and PWA 85086 Lifting Arm on threads at rear end of shaft. (Post SB PW4ENG 72−562) Raise the shaft and attach the PWA 88700 Lift Adapter and the PWA 85086 Lifting Arm on the threads at rear end of the shaft. Trunnion shaft and place on work table flange end down. See Figure 505.

(7) Install PWA 87192 Jackscrew Puller and remove the diffuser airseal from the HPC shaft as follows:

    (a) Install the puller to the HPC shaft.

    (b) Engage the four pullers to the airseal.

    (c) Turn the four hex head screw details equally to remove the airseal from the shaft.

    (d) Remove the puller from the HPC shaft. Remove the damper from the airseal.

(8) Install PWA 85159 Protector to hub threads.

(9) Remove the 13th through 15th stage blades from the drum rotor.

(a) Refer to Disassemble (Deblade) The Axial Compressor Rotor Assembly per 72-35-01, Disassembly-20 (Task 72-35-01-040-003).

(10) Place drum rotor on storage rack. Remove hoist, adapter, and lift arm. Install protective covers to all airseals.

Task 72-35-39-040-002-002:

2. Disassemble Drum Rotor And Blades (Rear) Assembly (Rear Shaft Removal Method 2)

A. Prerequisites

(1) Disassemble axial compressor rotor assembly by 72-35-01, Disassembly-01 (Task 72-35-01-040-001).

(2) Remove the 13th through 15th stage blades from the drum rotor. Refer to Disassemble (Deblade) The Axial Compressor Rotor Assembly by 72-35-01, Disassembly-20 (Task 72-35-01-040-003).

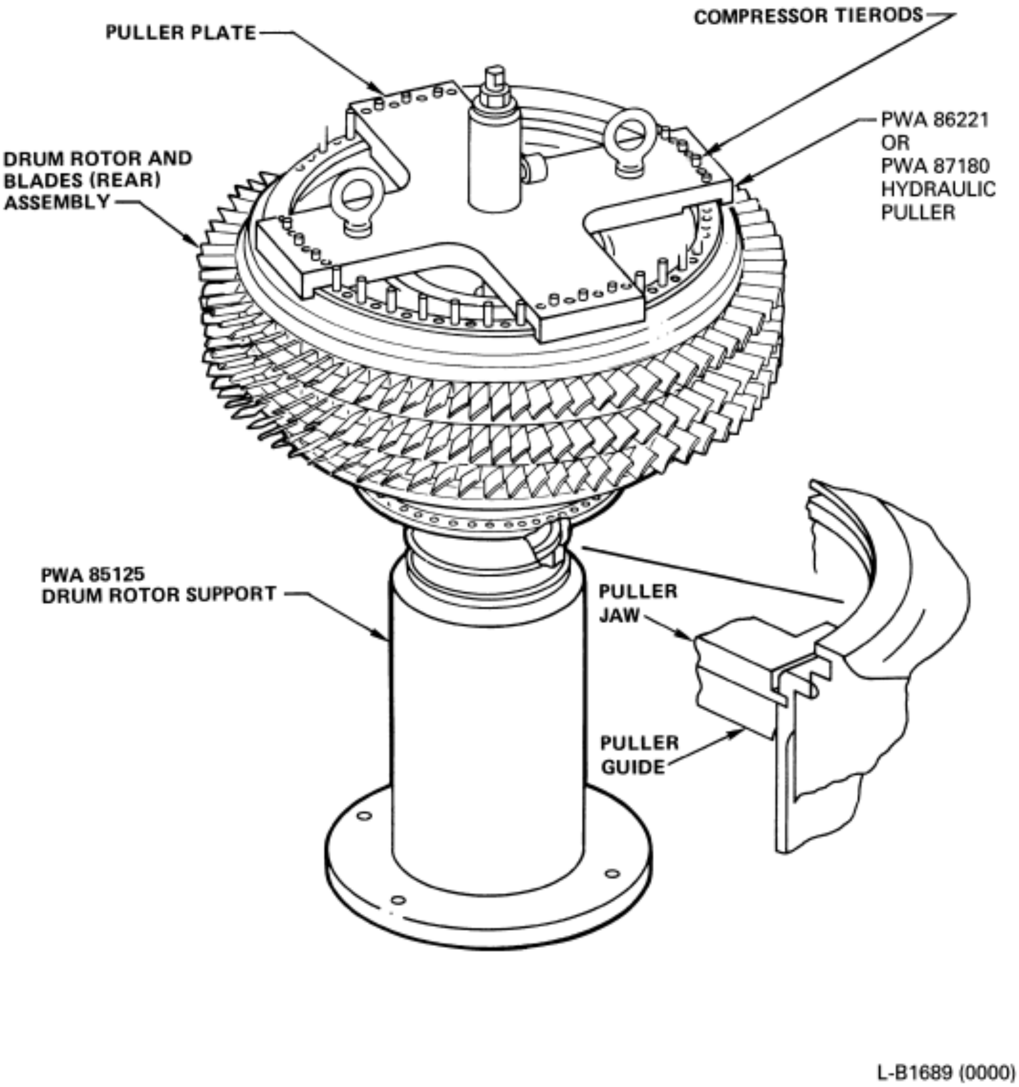
B. Equipment And Materials Necessary

Special Tools:

PWA 29389	Pump, Hand
PWA 76154	Adapter (4 Necessary)
PWA 85086	Arm, Lift
PWA 85124	Adapter, Lift
PWA 85125	Support, Drum Rotor
PWA 85127	Adapter, Lift And Trunnion
PWA 85159	Protector, Thread
PWA 86221	Puller, Hydraulic
PWA 87180	Puller, Hydraulic
PWA 87192	Puller, Jackscrew
PWA 87211	Puller, Hydraulic
PWA 88643	Sling (Optional To PWA 88673)
PWA 88673	Sling
PWA 88700	Adapter, Lift
PWA 101610	Spreader
PWA 102107	Pusher, Manual

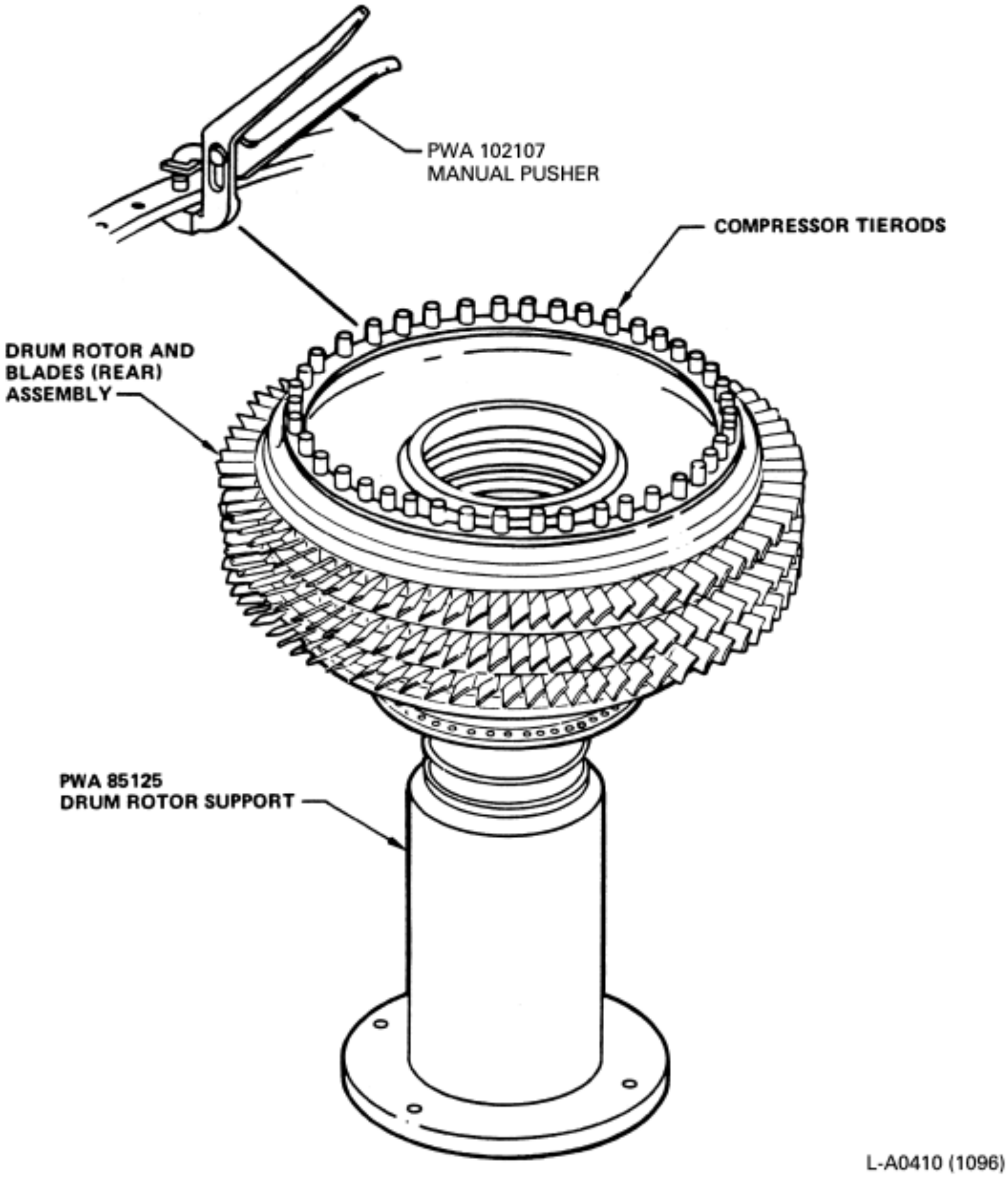
C. Procedure

DRUM ROTOR AND BLADES (REAR) ASSEMBLY - DISASSEMBLY-01


PULLER PLATE
COMPRESSOR TIERODS
PWA 86221 OR PWA 87180 HYDRAULIC PULLER
DRUM ROTOR AND BLADES (REAR) ASSEMBLY
PWA 85125 DRUM ROTOR SUPPORT
PULLER JAW
PULLER GUIDE
L-B1689 (0000)

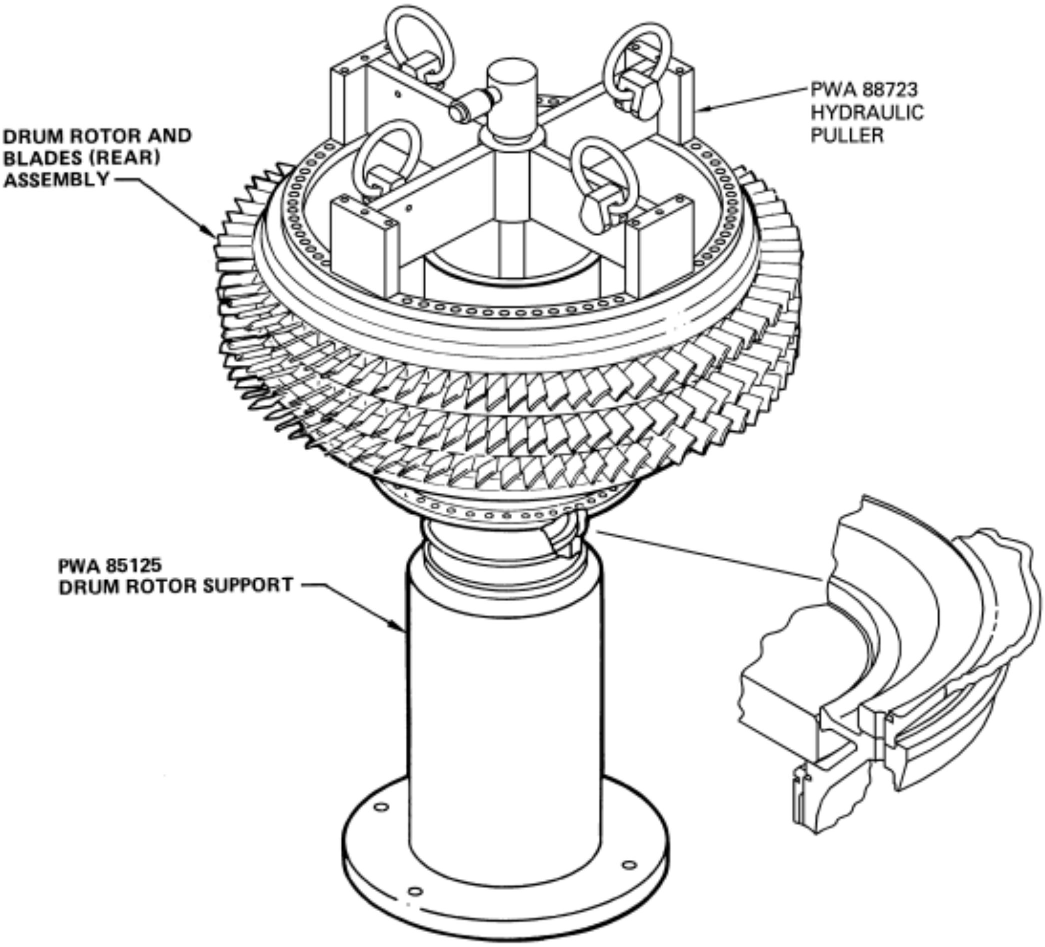
Heat Shield Removal
Figure 501
(Task 72-35-39-040-002-001)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − DISASSEMBLY−01


PWA 102107
MANUAL PUSHER
COMPRESSOR TIERODS
DRUM ROTOR AND
BLADES (REAR)
ASSEMBLY
PWA 85125
DRUM ROTOR SUPPORT
L-A0410 (1096)

Drum Rotor And Blades (Rear) Assembly
Figure 502
(Task 72−35−39−040−002−001)

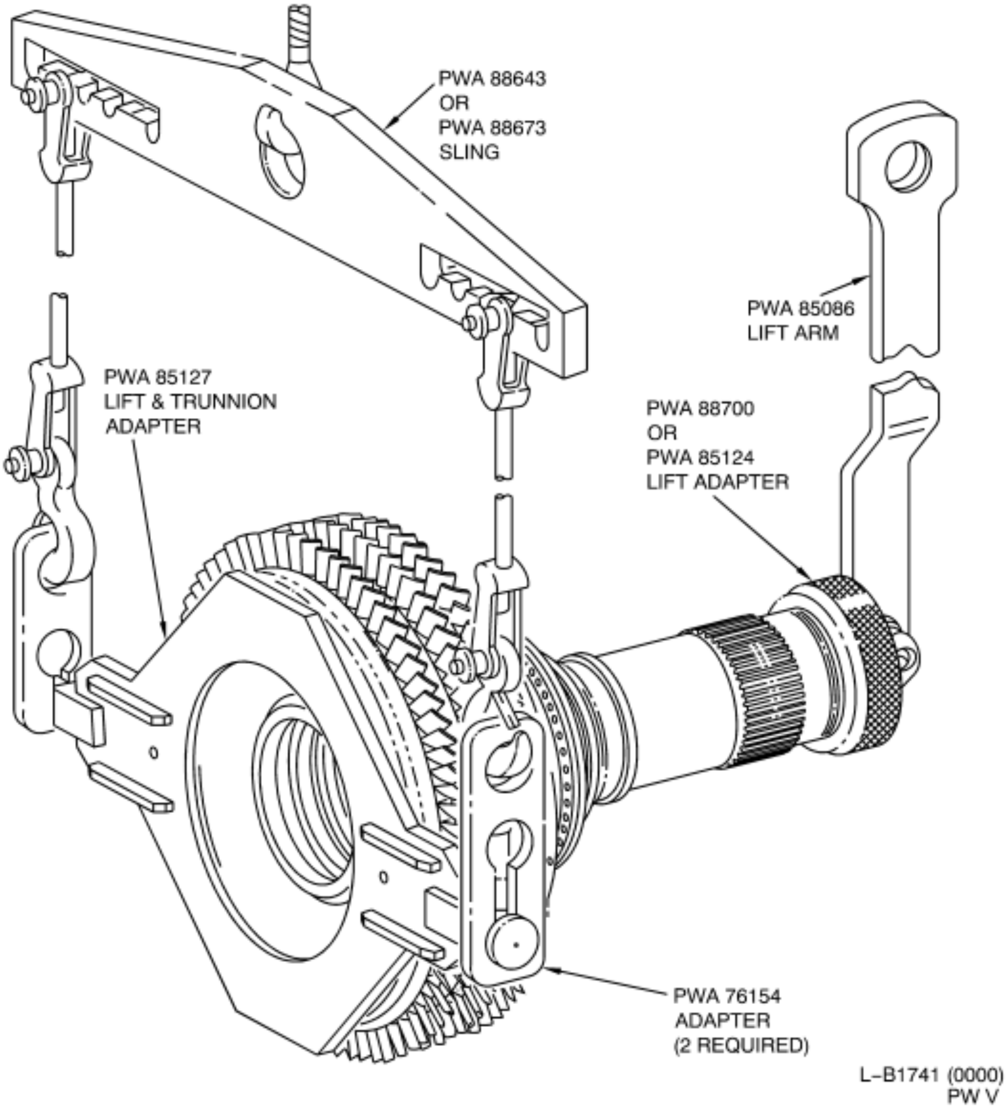
DRUM ROTOR AND BLADES (REAR) ASSEMBLY − DISASSEMBLY−01


PWA 88723
HYDRAULIC
PULLER
DRUM ROTOR AND
BLADES (REAR)
ASSEMBLY
PWA 85125
DRUM ROTOR SUPPORT

L-B0406 (0000)

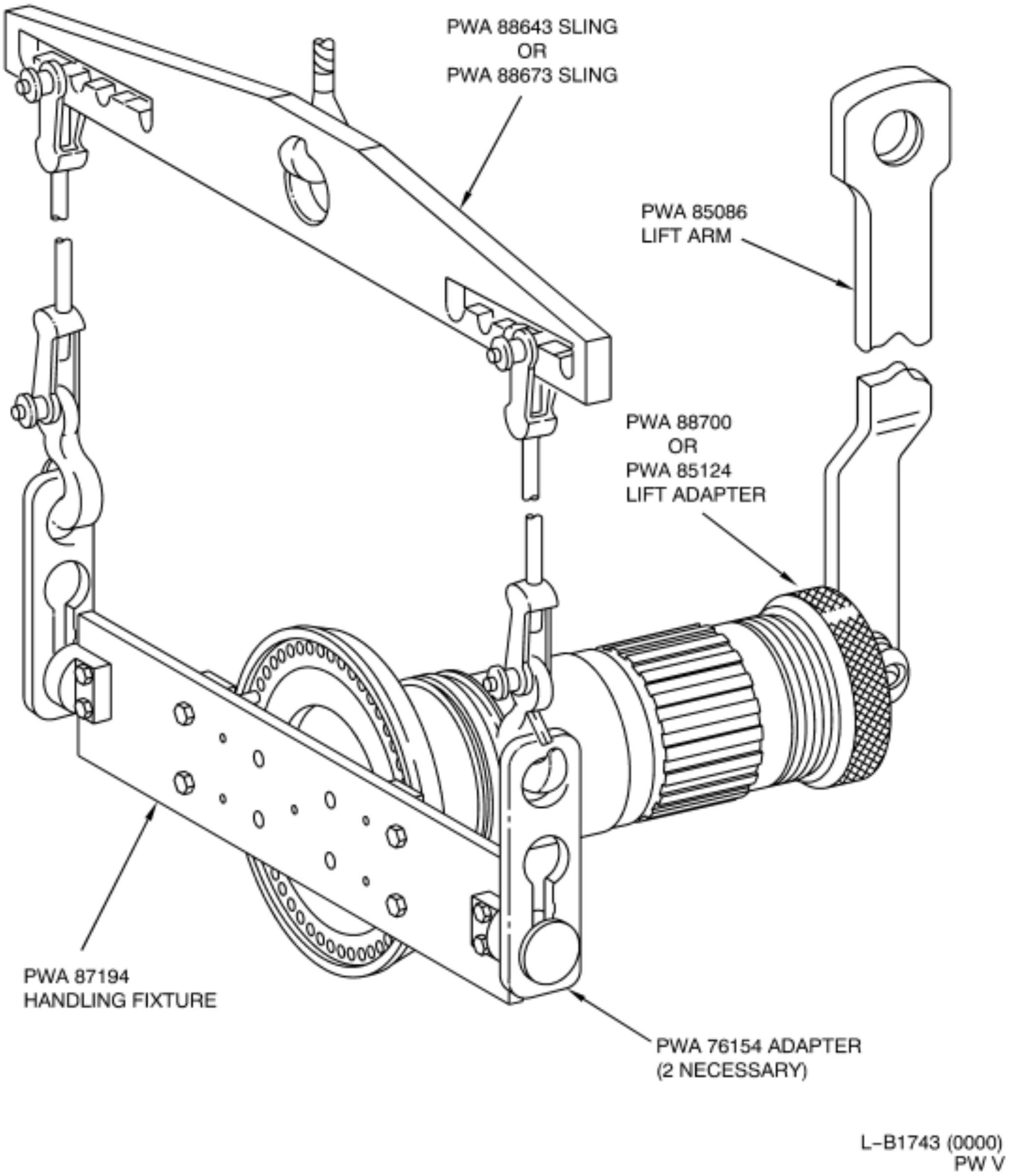
Drum Rotor And Blades (Rear) Assembly
Figure 503
(Task 72−35−39−040−002−001)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − DISASSEMBLY−01


PWA 88643
OR
PWA 88673
SLING
PWA 85086
LIFT ARM
PWA 85127
LIFT & TRUNNION
ADAPTER
PWA 88700
OR
PWA 85124
LIFT ADAPTER
PWA 76154
ADAPTER
(2 REQUIRED)
L−B1741 (0000)
PW V

Trunnion Drum Rotor And Blades (Rear) Assembly
Figure 504
(Task 72−35−39−040−002−001)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY - DISASSEMBLY-01


PWA 88643 SLING
OR
PWA 88673 SLING
PWA 85086
LIFT ARM
PWA 88700
OR
PWA 85124
LIFT ADAPTER
PWA 87194
HANDLING FIXTURE
PWA 76154 ADAPTER
(2 NECESSARY)
L-B1743 (0000)
PW V

Trunnion Rear Shaft
Figure 505
(Task 72-35-39-040-002-001)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − DISASSEMBLY−01

(1) Attach the PWA 85127 Lift And Trunnion Adapter to the front face of the rear drum. Use PWA 88643 Sling or PWA 88673 Sling and PWA 76154 Adapters to raise the drum rotor (rear) assembly and install the drum rotor (rear) assembly to the PWA 85125 Support, shaft end down. Remove the adapter.

(2) Remove the spiral retaining ring that holds the No. 3 bearing heat shield. (Pre SB PW4ENG 72−562) Install the PWA 86221 Hydraulic Puller to the front flange and connect the PWA 29389 Hand Pump. (Post SB PW4ENG 72−562) Install the PWA 87180 Hydraulic Puller to the front flange and connect the PWA 29389 Hand Pump. Actuate the puller to disengage the No. 3 bearing heat shield. Remove the puller and heat shield from the drum rotor. See Figure 506.

(3) Use the PWA 102107 Pusher and remove the 42 tierods from the drum rotor front face. See Figure 507.

(4) Attach the PWA 85127 Lift And Trunnion Adapter and PWA 76154 Adapters to the front face of rear drum.

(5) (Pre SB PW4ENG 72−562) Raise the drum rotor and shaft and attach the PWA 85124 Lift Adapter and PWA 85086 Lifting Arm on the threads at the rear end of the shaft. (Post SB PW4ENG 72−562) Raise the drum rotor and shaft and attach the PWA 88700 Lift Adapter and the PWA 85086 Lifting Arm on the threads at the end of the shaft. Trunnion the drum rotor and shaft to the front flange down on a suitable pallet. Remove the Lifting Arm (PWA85086). See Figure 508.

(6) Remove the 50 tiebolt nuts that attach the HPC shaft to the HPC rear drum rotor. It is not permitted to use the 50 tiebolt nuts again. The 50 tiebolt nuts must be discarded.

(7) Install the PWA 87211 Hydraulic Puller, with a three cable sling, over the Lift Adapter and the Lifting Arm to the HPC rear drum so that the Puller is positioned on the HPC 15th stage knife edge seal and the puller body assembly is centered on the No.3 bearing shoulder of the HPC rear shaft.

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − DISASSEMBLY−01

(8) Connect the PWA 29389 Hydraulic Pump to the Puller (PWA 87211) and actuate to raise the body of the puller so that the detail clamps can be positioned under the front face of the rear shaft. Lock the 12 clamps in position and actuate the hydraulic pump until the rear shaft disengages from the drum rotor.

(9) Release the pressure from the puller and retract the 12 detail clamps from under the front face of the rear shaft. Carefully remove the Puller (PWA 87211) from the drum rotor. Make sure the rear shaft is still partially engaged by the tierod bolts.

(10) Install the Lifting Arm (PWA 85086) to the Lift Adapter (PWA85124 or PWA 88700). Attach a hoist to the Lifting Arm (PWA 85086) and remove the rear shaft from the drum rotor. Place the rear shaft on a suitable pallet and remove the tooling.

(11) Install PWA 87192 Jackscrew Puller and remove the diffuser airseal from the HPC shaft as follows:

  (a) Install the puller to the HPC shaft.

  (b) Engage the four pullers to the airseal.

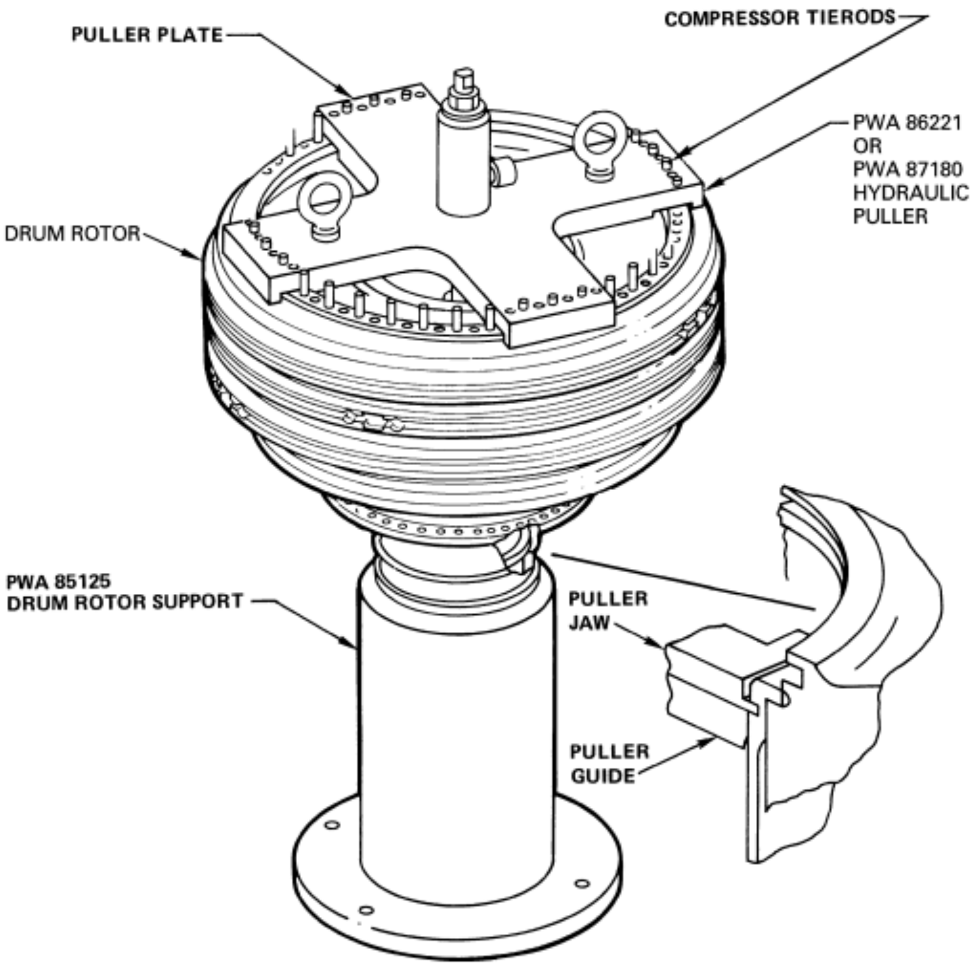
  (c) Turn the four hex head screw details equally to remove the airseal from the shaft.

  (d) Remove the puller from the HPC shaft. Remove the damper from the airseal.

(12) Install PWA 85159 Protector to the shaft threads.

(13) Remove the 50 tiebolts from the HPC rear drum rotor that attach the HPC shaft. Install PWA 101610 Spreader into the HPC tiebolt retaining clips to spread the clips outward. Push the tiebolt through the clip and remove the tiebolts from the retaining clips and the rear drum. Discard the retaining clips. It is not permitted to use the 50 tiebolts again. The 50 tiebolts must be discarded.

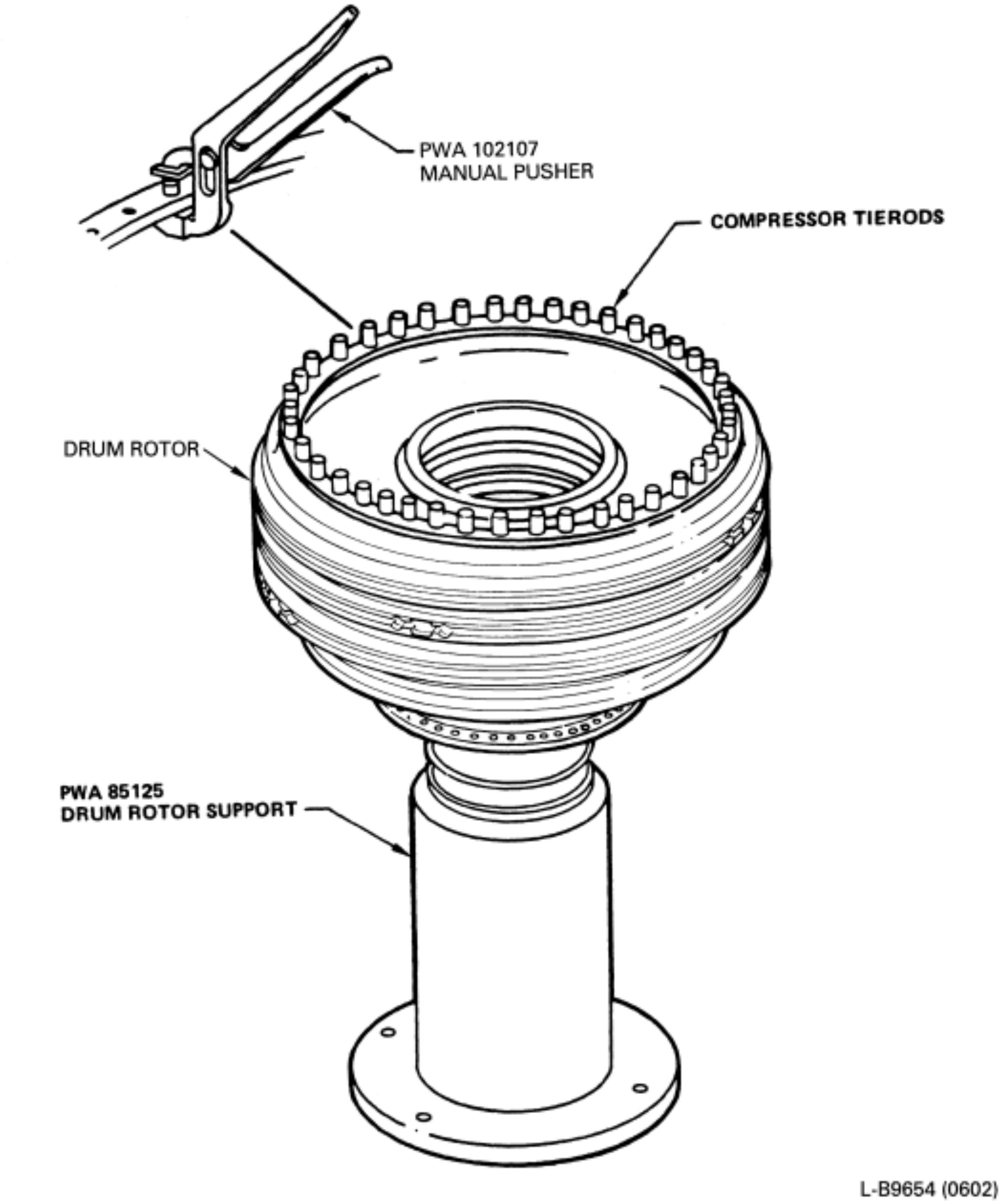
(14) Place the drum rotor on a storage rack. Remove the hoist and the adapter. Install protective covers to all airseals.


PULLER PLATE
COMPRESSOR TIERODS
PWA 86221
OR
PWA 87180
HYDRAULIC
PULLER
DRUM ROTOR
PWA 85125
DRUM ROTOR SUPPORT
PULLER
JAW
PULLER
GUIDE

L-B9653 (0602)

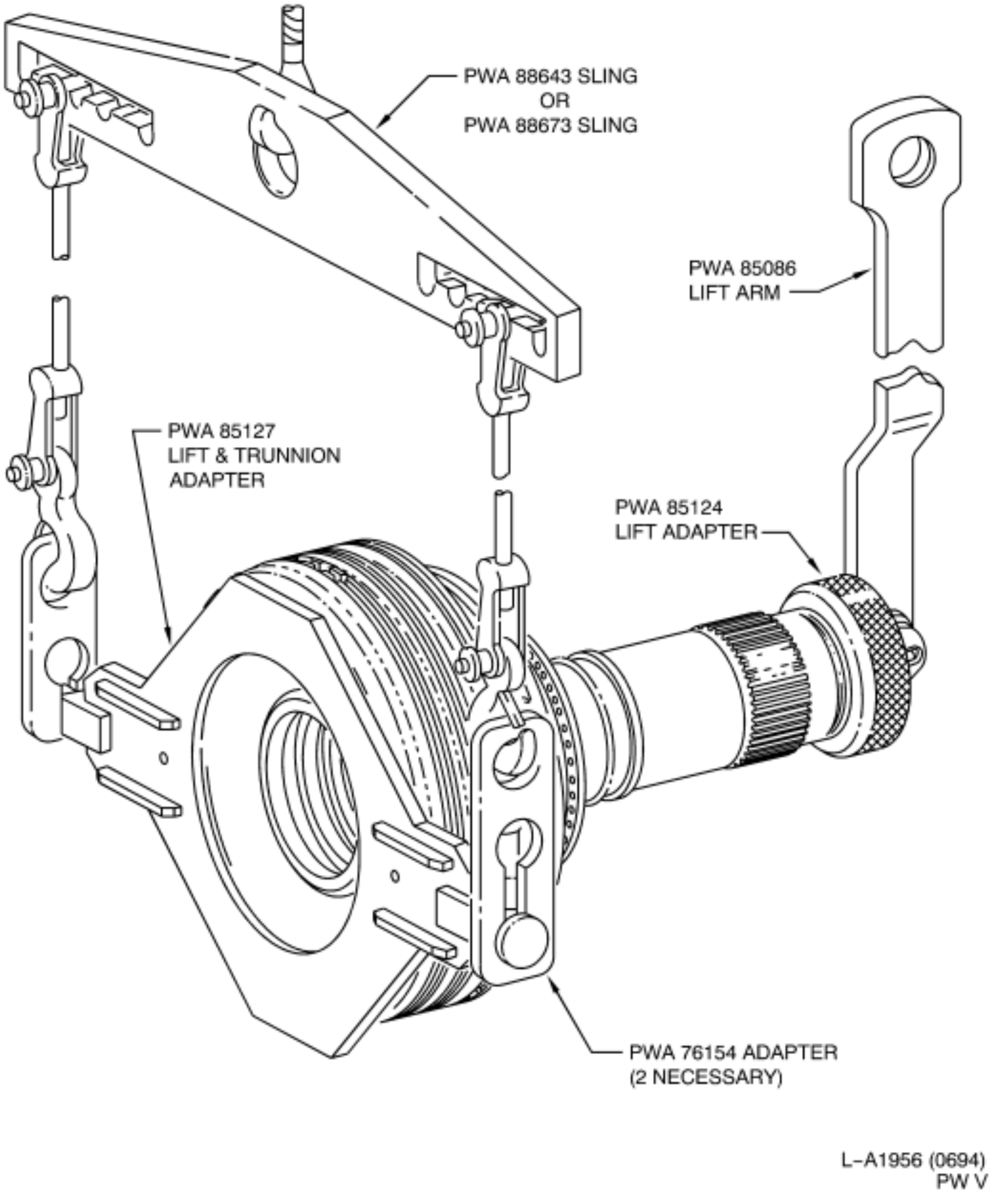
Heat Shield Removal
Figure 506
(Task 72-35-39-040-002-002)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − DISASSEMBLY−01


PWA 102107
MANUAL PUSHER
COMPRESSOR TIERODS
DRUM ROTOR
PWA 85125
DRUM ROTOR SUPPORT
L-B9654 (0602)

Drum Rotor (Rear) Assembly
Figure 507
(Task 72−35−39−040−002−002)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY - DISASSEMBLY-01


PWA 88643 SLING
OR
PWA 88673 SLING
PWA 85086
LIFT ARM
PWA 85127
LIFT & TRUNNION
ADAPTER
PWA 85124
LIFT ADAPTER
PWA 76154 ADAPTER
(2 NECESSARY)
L-A1956 (0694)
PW V

Trunnion Drum Rotor (Rear) Assembly
Figure 508
(Task 72-35-39-040-002-002)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−01

Task 72−35−39−440−001:

1. Install No. 3 Bearing Heat Shield

A. Equipment And Materials Necessary

Standard Tools:

Name	Manufacturer
Clements Cadillac Flameless Torch Model FT 1000	Clements Manufacturing Co. 6650 S. Narraganset Avenue Chicago, IL 60638

NOTE: The flameless torch specified above is optional to the heaters specified in the special tools list, and the optional flame torch.

Special Tools:

PWA 29754	Control, Heater
PWA 76154	Adapter (2 Necessary)
PWA 85086	Lift Arm (2 Necessary)
PWA 85124	Adapter, Lift
PWA 85125	Support, Drum Rotor
PWA 85126	Drift, Hand
PWA 85127	Adapter, Lift And Trunnion
PWA 85129	Support Drum And Disk
PWA 85312	Heater, Airseal (Optional)
PWA 85428	Protector, Plastic (Optional)
PWA 88643	Sling (Optional to PWA 88673)
PWA 88673	Sling (Optional to PWA 88643)

Consumable Material:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)

B. General Assembly Requirements

(1) Where heating is required for assembly, use minimum temperature differential of 125°F (52°C) between parts being assembled.Do not exceed 300°F (149°C) on any part.

(2) Where heating is required for assembly, special heaters are specified in the following procedure.However, you can use an optional flameless torch or flame torch as specified in the following steps.

(3) In locations where heating of a component in an oven is not practical or only a flange of the component requires heating, the use of Clements Cadillac Quic Heat flameless torch, Model FT 1000 is recommended.

(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE FLAME WILL DAMAGE OR BURN NON−METAL PARTS.

CAUTION: DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

C. Procedure

(1) Install PWA 85124 Adapter to hub threads. Attach PWA 85086 Lift Arm to installed adapter. Using hoist attached to arm, raise drum rotor from storage rack and install on PWA 85129 Support. See Figure 1001.

(2) Remove hoist, arm, and adapter from hub.

(3) Install PWA 85312 Heater to rest on hub seal flange. Using PWA 29754 Controller, heat flange to temperature not to exceed 300°F (148°C). See Figure 1002.

(4) When temperature of seal flange is achieved shut off heater and remove from rear hub. Install airseal, with damper to hub flange, aligning bolt holes. Allow area to cool to touch.

(5) Install heat shield into freezer and chill for approximately 20 minutes.

(6) Install 50 bolts, threads lubricated with Engine Oil P03−001 and nuts. Install bolts, heads up, and tighten and torque nuts to 85 − 95 lb−in. (9.604 − 10.734 N.m). Install PWA 85428 Protector on airseal.

(7) Reinstall PWA 85124 Adapter to hub threads. Attach PWA 85086 Lift Arm to installed adapter. Using hoist attached to lift arm raise drum rotor from support.

(8) Install PWA 85127 Adapter to flange end (bottom) of rear drum. Attach hoist and PWA 88643 Sling or PWA 88673 Sling with PWA 76154 Adapters to spools on adapter. Trunnion, drum rotor to hub end down. Remove hoist, lift arm and adapter from hub. See Figure 1003.

(9) Lower drum rotor into PWA 85125 Support. Remove hoist, sling, adapters and adapter from drum rotor. See Figure 1004.

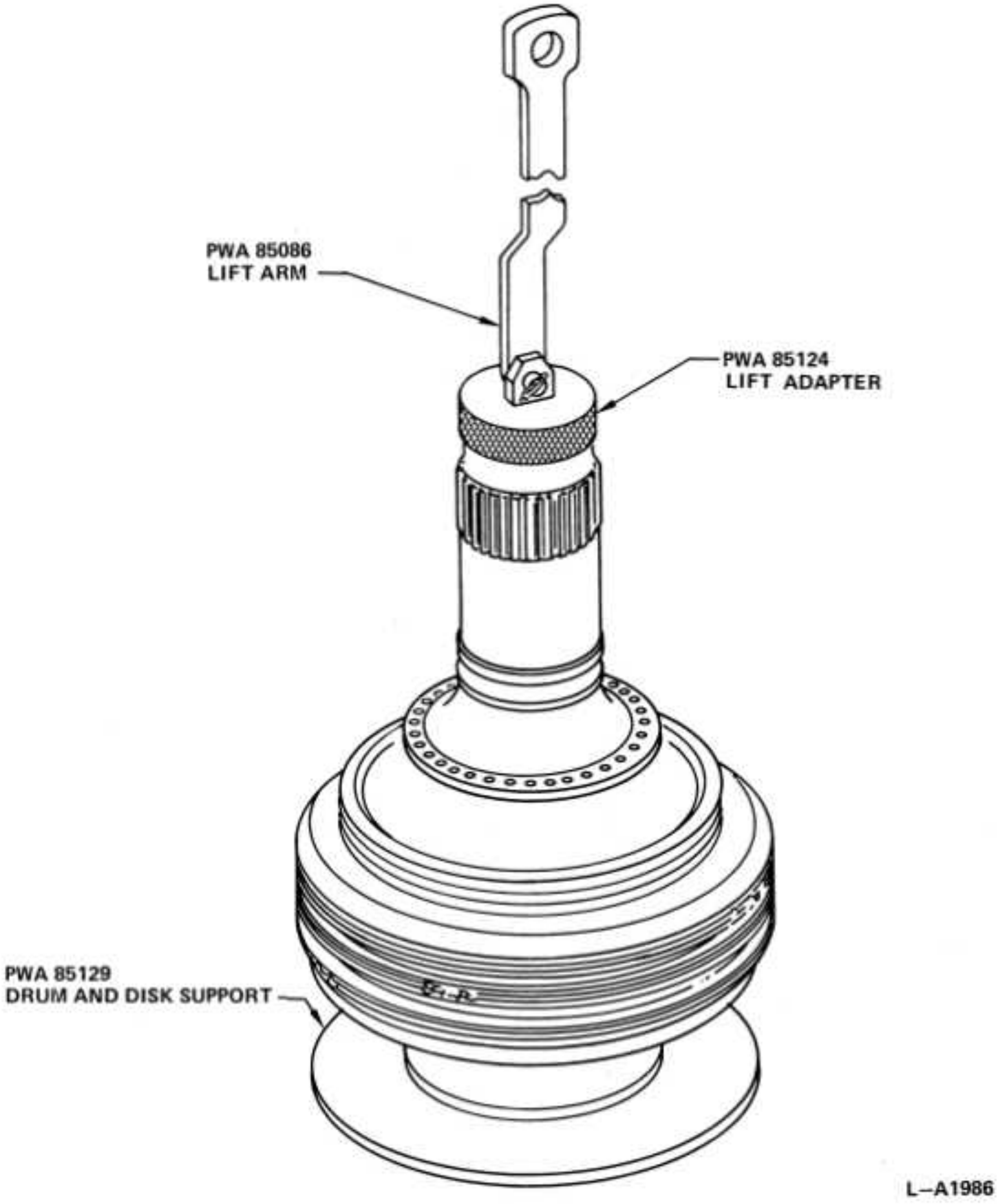
(10) Install chilled heat shield into ID of rear drum. Align tabs of heat shield with slots in drum. Using PWA 85126 Drift and mallet seat heat shield in rear drum.

(11) Install retaining ring into groove in rear drum to retain heat shield.

D. Postrequisites

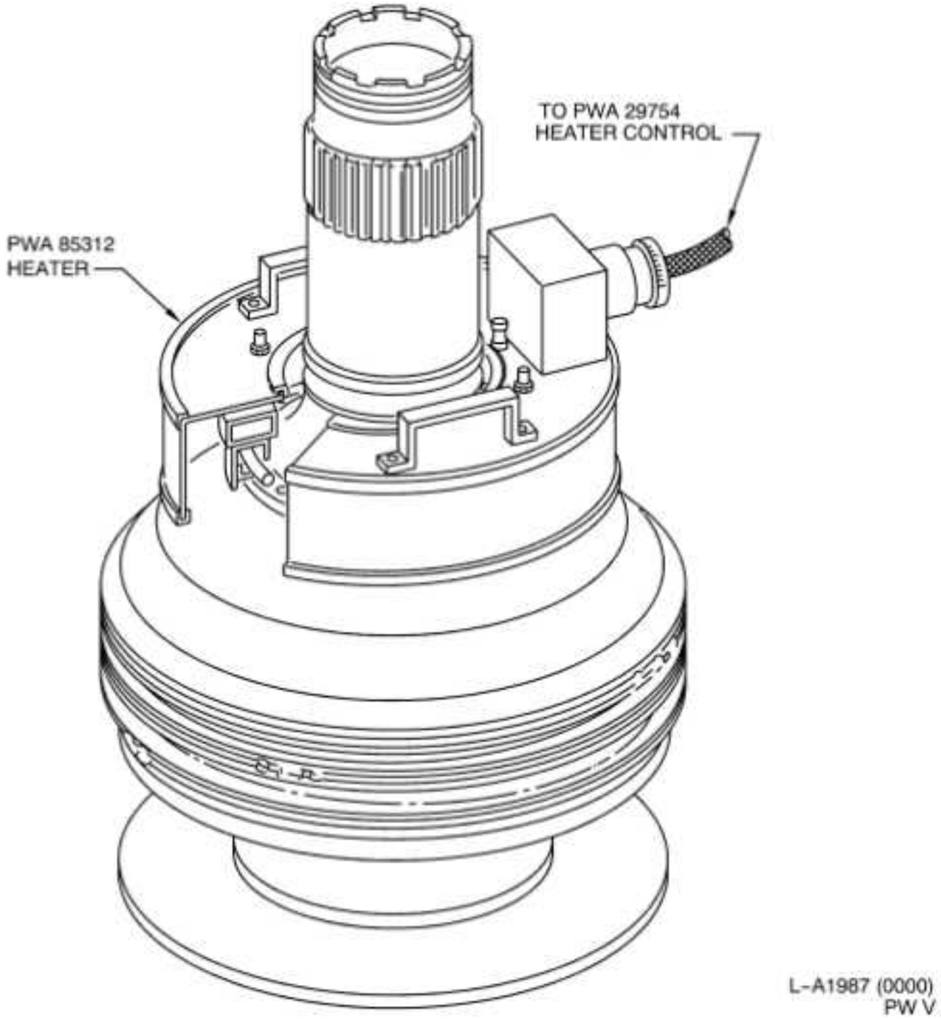
(1) Assemble drum rotor and blades (rear) assembly (Stage 13) by Assembly−02 Task 72−35−39−440−002.

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−01


PWA 85086
LIFT ARM
PWA 85124
LIFT ADAPTER
PWA 85129
DRUM AND DISK SUPPORT
L−A1986

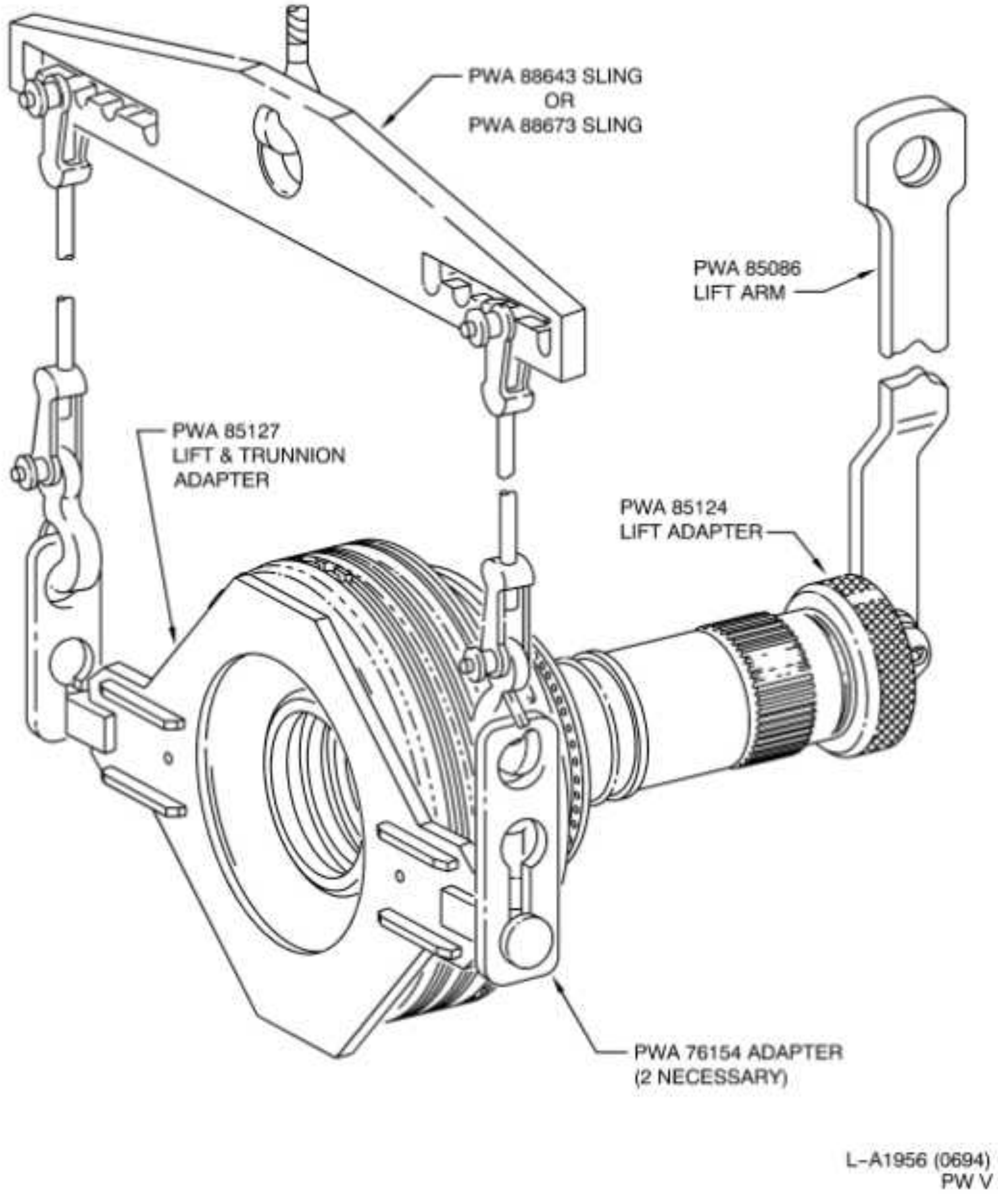
Install Drum Rotor On Support
Figure 1001
(Task 72−35−39−440−001)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−01


TO PWA 29754
HEATER CONTROL
PWA 85312
HEATER
L-A1987 (0000)
PW V

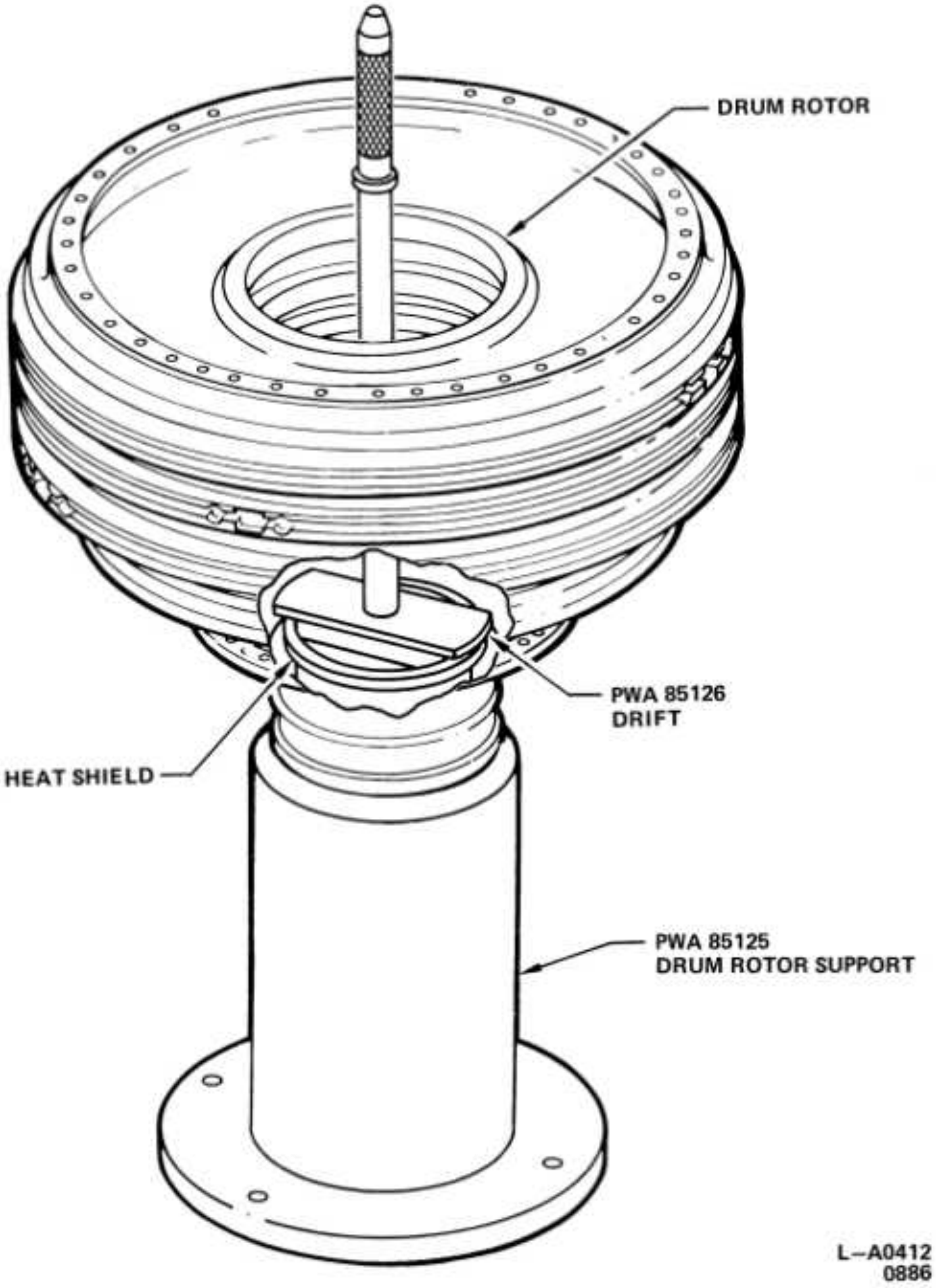
Heat Drum Rotor Seal Flange
Figure 1002
(Task 72−35−39−440−001)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−01


PWA 88643 SLING
OR
PWA 88673 SLING
PWA 85086
LIFT ARM
PWA 85127
LIFT & TRUNNION
ADAPTER
PWA 85124
LIFT ADAPTER
PWA 76154 ADAPTER
(2 NECESSARY)
L-A1956 (0694)
PW V

Trunnion Drum Rotor
Figure 1003
(Task 72−35−39−440−001)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY - ASSEMBLY-01


DRUM ROTOR
PWA 85126
DRIFT
HEAT SHIELD
PWA 85125
DRUM ROTOR SUPPORT
L-A0412
0886

Heat Shield Installation
Figure 1004
(Task 72-35-39-440-001)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−01

Task 72−35−39−440−001−A:

1. Install No. 3 Bearing Heat Shield, Rear Shaft And Diffuser Airseal − Drum Rotor And Blades (Rear) Assembly (Pre SB PW4ENG 72−562)

A. Equipment And Materials Necessary

Special Tools:

PWA 12632	Nut
PWA 12633	Hydraulic Ram
PWA 29754	Control, Heater
PWA 76154	Adapter (2 Necessary)
PWA 85086	Lift Arm
PWA 85124	Adapter, Lift
PWA 85125	Support, Drum Rotor
PWA 85126	Drift, Hand
PWA 87179	Drift, Hand
PWA 87200	Heater
PWA 87193	Pusher, Hydraulic
PWA 87194	Handling Fixture
PWA 87379	Fixture, Angle Of Turn
PWA 88643	Sling (Optional to PWA 88673)
PWA 88673	Sling (Optional to PWA 88643)
PWA 88700	Adapter, Lift

Standard Tools:

Name	Manufacturer
Clements Cadillac Flameless Torch Model FT 1000	Clements Manufacturing Co. 6650 S. Narraganset Avenue Chicago, IL 60638

NOTE: The flameless torch specified above is optional to the heaters specified in the special tools list, and the optional flame torch.

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−102	Dry Ice

B. General Assembly Requirements

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−01

(1) Where heating is necessary for assembly, use minimum temperature differential of 125°F (52°C) between parts being assembled. Do not exceed 300°F (149°C) on any part.

(2) Where heating is required for assembly, special heaters are specified in the following procedure. However, you can use an optional flameless torch or flame torch as specified in the following steps.

(3) In locations where heating of a component in an oven is not practical or only a flange of the component requires heating, the use of Clements Cadillac Quic Heat flameless torch, Model FT 1000 is recommended.

(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE FLAME WILL DAMAGE OR BURN NON−METAL PARTS.

CAUTION: DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

C. Procedure
See Figures 1001, 1002 and 1003.

(1) Place No. 3 bearing heat shield in freezer and chill for approximately 20 minutes.

(2) Attach the PWA 87194 Handling Fixture to the front end flange of the HPC rear shaft. Attach PWA 88643 Sling or PWA 88673 Sling and PWA 76154 Adapters to the PWA 87194 Fixture. Lift and trunnion the assembly, smaller end down. Install the shaft to the PWA 85125 Support. Remove the sling and PWA 87194 Handling Fixture. Find the high point runout symbol (triangle within a circle) and make a line mark with ink on the slanted surface closest to the tierod hole in line with it.

(3) Install chilled No. 3 bearing heat shield into ID of rear shaft. (Pre SB PW4ENG 72-562) Align tabs of heat shield with slots in shaft ID and seat heat shield in rear shaft with the use of PWA 85126 Drift. (Post SB PW4ENG 72-562) Align tabs of heat shield with slots in shaft ID and seat heat shield in rear shaft with the use of PWA 87179 Drift. Install the spiral retaining ring to the groove above the heat shield.

(4) Place diffuser airseal on work bench, smaller diameter up. Install the damper to the ID of the diffuser airseal. Find the unbalance symbol (triangle with unbalance value) on bolt hole flange. Locate bolt hole approximately 180 degrees opposite unbalance symbol and place ink mark on flange in line with that bolt hole.

(5) Set the diffuser airseal on Dry Ice P05−102 in the dry ice chest for a minimum of 25 minutes. Set the airseal so that the damper on the ID of the seal will not move.

(6) Attach PWA 87194 Handling Fixture to rear flange of rear drum. Lower the drum, front flange down, to PWA 87193 Hydraulic Pusher base detail and remove handling fixture. Locate the high point runout symbol (triangle within a circle). Locate bolt hole approximately 180 degrees opposite the high point runout symbol and place ink mark on slanted surface near tierod holes.

(7) Put PWA 87200 Heater on work table. Attach PWA 87194 Handling Fixture to front flange end of HPC rear shaft. (Pre SB PW4ENG 72−562) Raise the shaft so that PWA 85124 Adapter can be installed on threads at smaller end of shaft. (Post SB PW4ENG 72−562) Raise the shaft so that the PWA 88700 Adapter can be installed on the threads at the smaller end of the shaft. Install PWA 85086 Lift Arm to adapter and hoist. Trunnion assembly, large diameter down and remove handling fixture. See Figure 1002.

CAUTION: SHAFT TEMPERATURE MUST NOT EXCEED 300°F (148.9°C).

(8) Lower shaft onto PWA 87200 Heater, resting shaft front flange onto plate inside heater ID. Heat shaft front flange to 275° − 300°F (135° − 149°C).

(9) Install retaining clips under rear flange of rear drum at all bolt holes, with radius edge inside drum ID groove. Install new tierods (head down) through the clip and bolthole. Push the tierods upward to snap into clip. Lightly lube the tierod threads with Engine Oil P03−001 or Antiseize Compound P06−054 and remove the unwanted lubricant or excess antiseize compound.

NOTE: Do not engine oil to mix with PWA 36246 antiseize paste, testing has shown that it reduces the effectiveness of the antiseize paste as assembly lubricant.

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−01

CAUTION: WHEN SHAFT ASSEMBLY IS LOWERED ONTO REAR DRUM, TAKE EXTREME CARE NOT TO PUSH TIERODS (INSTALLED IN REAR DRUM) OUT OF POSITION.

(10) After shaft front flange reaches 270° − 300°F (132° − 149°C), remove from heater and lower onto rear drum, aligning ink marks and tierods with tierod holes until mating flanges contact each other. Remove hoist and adapters.

(11) Install threaded rod to the pusher base detail of PWA 87193 Hydraulic Pusher. Install the plate detail of PWA 87193 Hydraulic Pusher over the rod to set on the end of the shaft. Install PWA 12633 Hydraulic Ram and attach with the nut. Apply a hydraulic pressure of 3000 psi (20684.3 kPa) to the ram and keep this pressure until the shaft has cooled to approximately 70°F (21.1°C). Remove the press tooling.

(12) Locate shaft unbalance symbol (triangle with unbalance value), marked on upper flange OD of shaft. Ink mark face of tierod which is closest to the unbalance symbol.

(13) Remove airseal from freezer and install over shaft, large diameter down, aligning line on airseal with ink marked tierod. Use a nylon drift, tap airseal to seat.

NOTE: Exercise care not to push tierods out of position while installing airseal.

(14) Lightly lube the tierod threads with Engine Oil P03−001 or Antiseize Compound P06−054 and remove the unwanted lubricant or excess antiseize compound. Install four washers and new tierod nuts at approximately 90 degrees apart and, in an alternating pattern (first the tierod nut at the 90 degree location, then 180, then 270, then 360), tighten the tierod nuts to seat. Next install additional washers and new tierod nuts at approximately the 45, 135, 225 and 315 degree location. In an alternating pattern, tighten the tierod nuts to seat. Install the remaining new tierod nuts and washers and tighten to seat.

NOTE: Do not engine oil to mix with PWA 36246 antiseize paste, testing has shown that it reduces the effectiveness of the antiseize paste as assembly lubricant.

(15) (Reference 1561) Install PWA 87379 Torque Fixture. Apply torques as follows, use an alternating sequence as marked on the index plate of torque fixture.

(a) Apply initial torque of 240 - 260 lb-in. (27.116 - 29.376 N.m) to all 50 nuts.

(b) Using same sequence, loosen nuts. Check prevailing (run-on) torque.

NOTE: Prevailing torque must be a minimum of 9.5 lb-in. (1.073 N.m) or a maximum of 40 lb-in. (4.519 N.m). If prevailing torque limits are not met, replace nut.

(c) Torque nuts to 20 - 30 lb-in. (2.260 - 3.390 N.m) plus the prevailing torque.

(d) Apply 98 - 102 degrees angle of turn, while monitoring torque with torque wrench. Final torque value must not exceed 700 lb-in. (79.089 N.m). If final torque exceeds this maximum, replace nut and bolt.

D. Postrequisites

(1) Assemble drum rotor and blades (rear) assembly (Stage 13) by Assembly-02 Task 72-35-39-440-002.

Task 72-35-39-440-001-B:

2. Install No. 3 Bearing Heat Shield, Rear Shaft And Diffuser Airseal - Drum Rotor And Blades (Front And Rear) Assembly (Post SB PW4ENG 72-562)

A. Equipment And Materials Necessary

Special Tools:

PWA 12632	Nut
PWA 12633	Hydraulic Ram
PWA 29754	Control, Heater
PWA 76154	Adapter (2 Necessary)
PWA 85125	Support, Drum Rotor
PWA 87179	Drift, Hand
PWA 87200	Heater
PWA 87193	Pusher, Hydraulic
PWA 87194	Handling Fixture
PWA 87379	Fixture, Angle Of Turn
PWA 88643	Sling (Optional to PWA 88673)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−01

Special Tools:

(CONTINUED)

PWA 88673	Sling (Optional to PWA 88643)
PWA 88712	Pusher, Hydraulic

Standard Tools:

Name	Manufacturer
Clements Cadillac Flameless Torch Model FT 1000	Clements Manufacturing Co. 6650 S. Narraganset Avenue Chicago, IL 60638

NOTE: The flameless torch specified above is optional to the heaters specified in the special tools list, and the optional flame torch.

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−102	Dry Ice

B. General Assembly Requirements

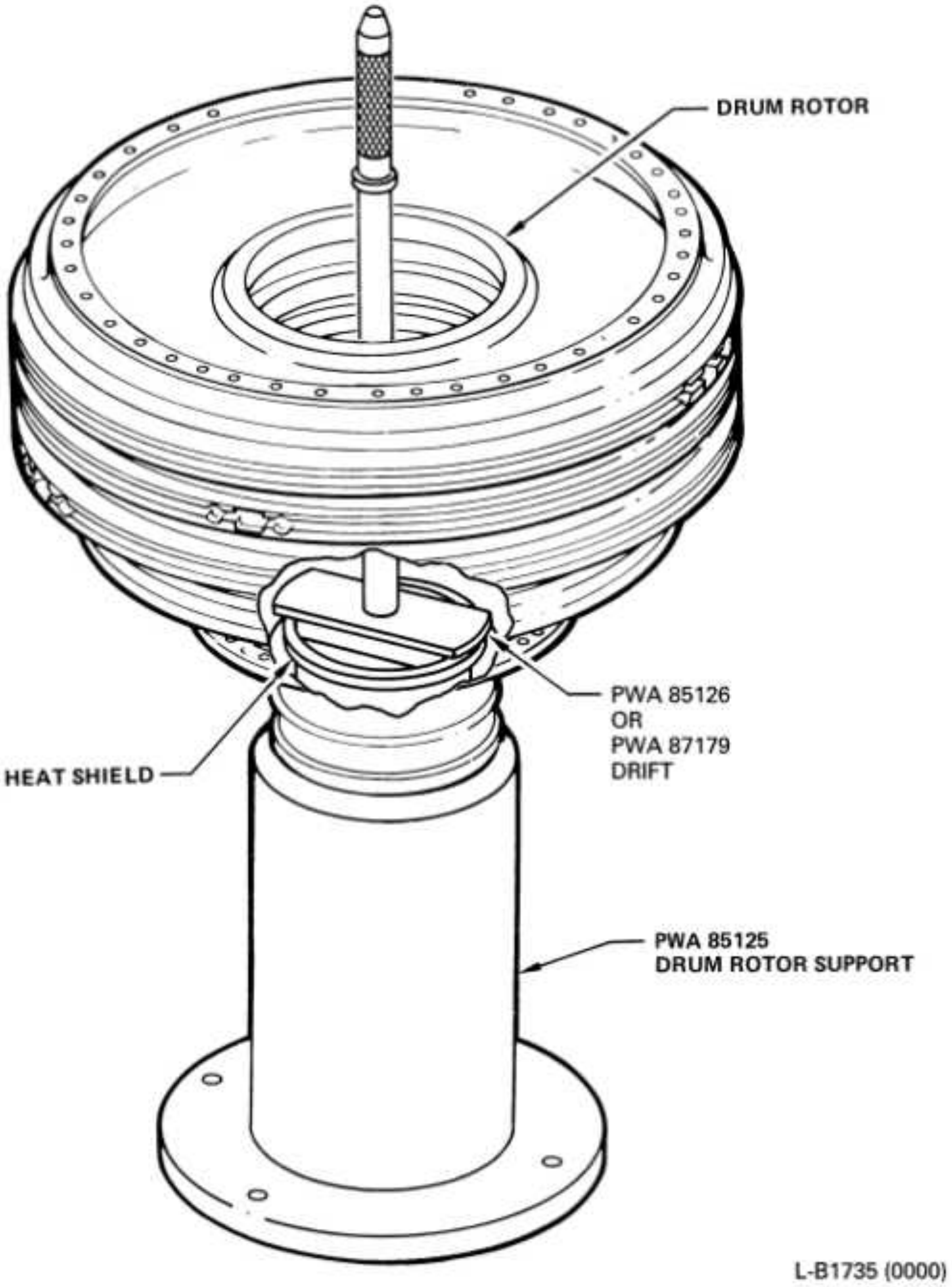
(1) Where heating is necessary for assembly, use minimum temperature differential of 125°F (52°C) between parts being assembled. Do not exceed 300°F (149°C) on any part.

(2) Where heating is required for assembly, special heaters are specified in the following procedure. However, you can use an optional flameless torch or flame torch as specified in the following steps.

(3) In locations where heating of a component in an oven is not practical or only a flange of the component requires heating, the use of Clements Cadillac Quic Heat flameless torch, Model FT 1000 is recommended.

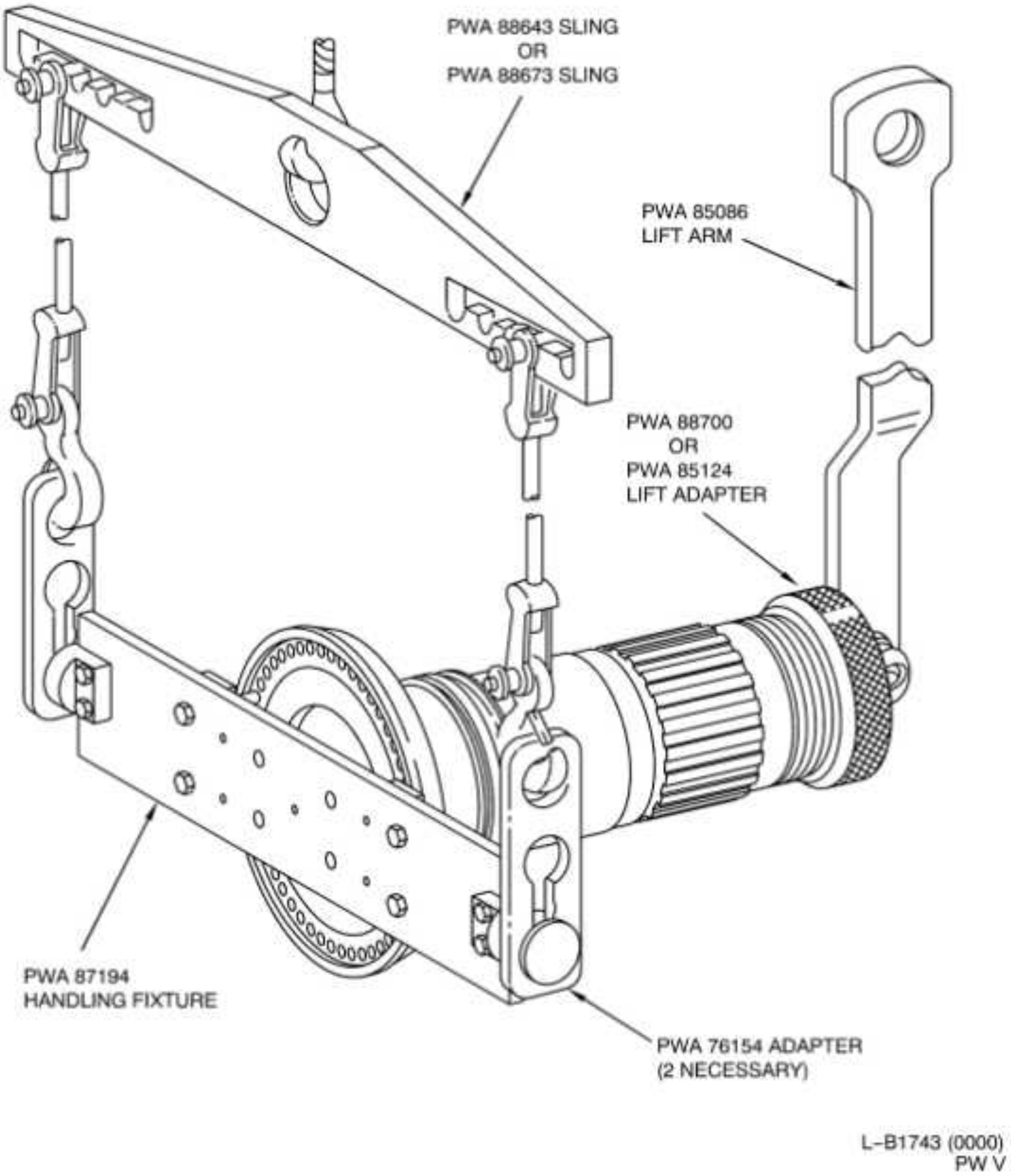
(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−01


DRUM ROTOR
PWA 85126
OR
PWA 87179
DRIFT
HEAT SHIELD
PWA 85125
DRUM ROTOR SUPPORT
L-B1735 (0000)

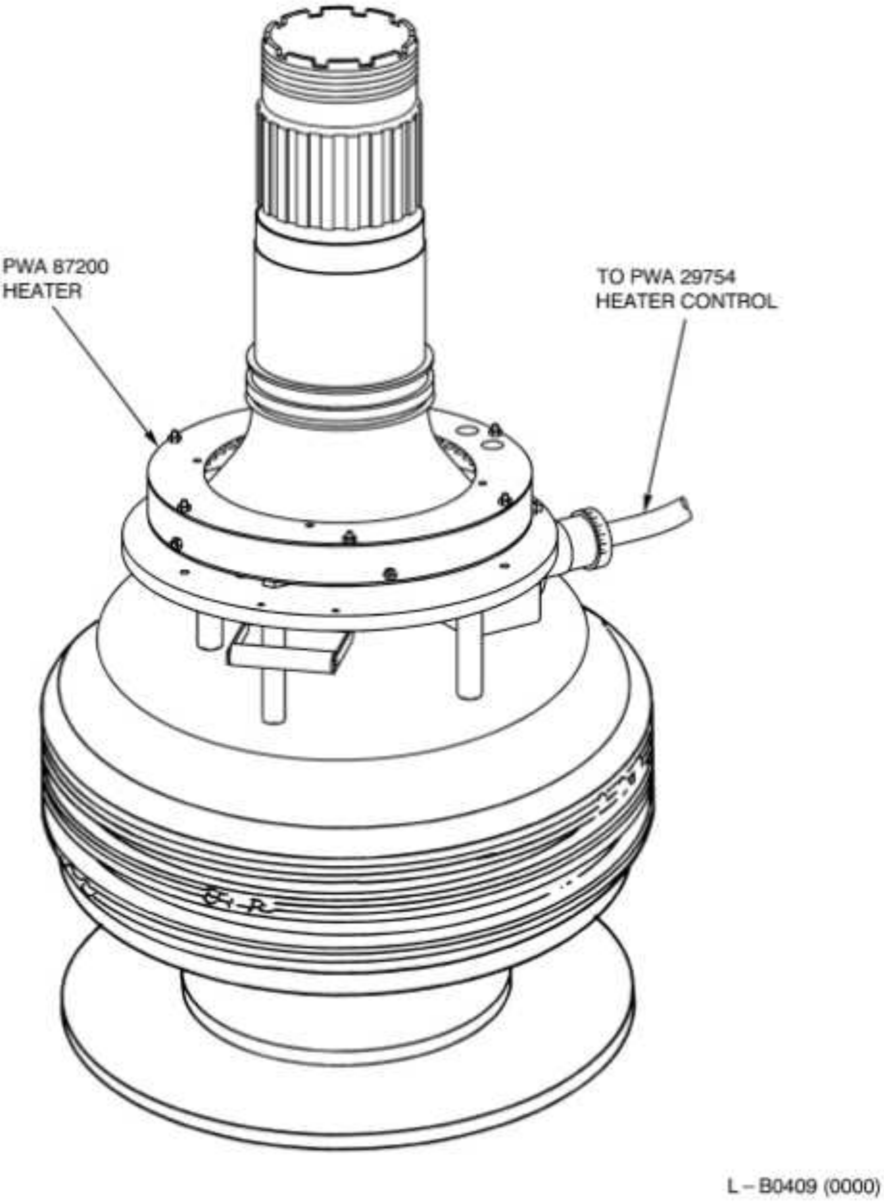
Heat Shield Installation
Figure 1001
(Task 72−35−39−440−001−A)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY - ASSEMBLY-01


PWA 88643 SLING
OR
PWA 88673 SLING
PWA 85086
LIFT ARM
PWA 88700
OR
PWA 85124
LIFT ADAPTER
PWA 87194
HANDLING FIXTURE
PWA 76154 ADAPTER
(2 NECESSARY)
L-B1743 (0000)
PW V

Trunnion Rear Shaft
Figure 1002
(Task 72-35-39-440-001-A)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY - ASSEMBLY-01


PWA 87200
HEATER
TO PWA 29754
HEATER CONTROL
L-B0409 (0000)

Heat Drum Rotor Seal Flange
Figure 1003
(Task 72-35-39-440-001-A)

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE FLAME WILL DAMAGE OR BURN NON−METAL PARTS.

CAUTION: DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

C. Procedure
See Figures 1004, 1005, 1006 and 1007.

(1) Place No. 3 bearing heat shield in freezer and chill for approximately 20 minutes.

(2) Attach the PWA 87194 Handling Fixture to the front end flange of the HPC rear shaft. Attach PWA 88643 Sling or PWA 88673 Sling and PWA 76154 Adapters to the PWA 87194 Fixture. Lift and trunnion the assembly, smaller end down. Install the shaft to the PWA 85125 Support. Remove the sling and PWA 87194 Handling Fixture. Find the high point runout symbol (triangle within a circle) and make a line mark with ink on the slanted surface closest to the tierod hole in line with it.

(3) Install chilled No. 3 bearing heat shield into ID of rear shaft. Align tabs of heat shield with slots in shaft ID and seat heat shield in rear shaft with the use of PWA 87179 Drift. Install the spiral retaining ring to the groove above the heat shield. See Figure 1004.

(4) Place diffuser airseal on work bench, smaller diameter up. Install the damper to the ID of the diffuser airseal. Find the unbalance symbol (triangle with unbalance value) on bolt hole flange. Locate bolt hole approximately 180 degrees opposite unbalance symbol and place ink mark on flange in line with that bolt hole.

(5) Set the diffuser airseal on Dry Ice P05−102 in the dry ice chest for a minimum of 25 minutes. Set the airseal so that the damper on the ID of the seal will not move.

(6) Attach PWA 87194 Handling Fixture to rear flange of rear drum. Lower the drum, front flange down, to PWA 87193 Hydraulic Pusher base detail and remove handling fixture. Locate the high point runout symbol (triangle within a circle). Locate bolt hole approximately 180 degrees opposite the high point runout symbol and place ink mark on slanted surface near tierod holes.

(7) Put PWA 87200 Heater on work table. Attach PWA 87194 Handling Fixture to front flange end of HPC rear shaft. Raise the shaft so that the nut and lift ring details of PWA 88712 Pusher can be installed on the threads at the smaller end of the shaft. Trunnion assembly, large diameter down and remove handling fixture. See Figure 1005.

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−01

CAUTION: SHAFT TEMPERATURE MUST NOT EXCEED 300°F (148.9°C).

(8) Lower shaft onto PWA 87200 Heater, resting shaft front flange onto plate inside heater ID. Heat shaft front flange to 275° − 300°F (135° − 149°C). See Figure 1006.

(9) Install retaining clips under rear flange of rear drum at all bolt holes, with radiused edge inside drum ID groove. Install tierods (head down) through clip and bolthole. Push tierods upward to snap into clip. Lightly lube tierod threads with Engine Oil P03−001 and remove the unwanted lubricant.

CAUTION: WHEN SHAFT ASSEMBLY IS LOWERED ONTO REAR DRUM, TAKE EXTREME CARE NOT TO PUSH TIERODS (INSTALLED IN REAR DRUM) OUT OF POSITION.

(10) After shaft front flange reaches 270° − 300°F (132° − 149°C), remove from heater and lower onto rear drum, aligning ink marks and tierods with tierod holes until mating flanges contact each other.

(11) Install the plate assembly detail of PWA 88712 Pusher into the rear hub shaft and locate the plate assembly against the HPC rear drum flange. Install PWA 12633 Hydraulic Ram and attach PWA 12632 Nut. See Figure 1007. Apply a hydraulic pressure of 3000 psi (20684.3 kPa) to the ram and keep this pressure until the shaft has cooled to approximately 70°F (21.1°C). Remove the press tooling.

(12) Locate shaft unbalance symbol (triangle with unbalance value), marked on upper flange OD of shaft. Ink mark face of tierod which is closest to the unbalance symbol.

(13) Remove airseal from freezer and install over shaft, large diameter down, aligning line on airseal with ink marked tierod. Use a nylon drift, tap airseal to seat.

NOTE: Exercise care not to push tierods out of position while installing airseal.

(14) Install four washers and nuts at approximately 90 degrees apart and, in an alternating pattern (first the nut at the 90 degree location, then 180, then 270, then 360), tighten nuts to seat. Next install additional nuts and washers at approximately 45, 135, 225 and 315 degree location. In an alternating pattern, tighten nuts to seat. Install remaining nuts and washers and tighten to seat.

(15) (Reference 1561) Install PWA 87379 Torque Fixture. Apply torques as follows, use an alternating sequence as marked on the index plate of torque fixture.

  (a) Apply initial torque of 240 - 260 lb-in. (27.116 - 29.376 N.m) to all 50 nuts.

  (b) Using same sequence, loosen nuts. Check prevailing (run-on) torque.

  NOTE: Prevailing torque must be a minimum of 9.5 lb-in. (1.073 N.m) or a maximum of 40 lb-in. (4.519 N.m). If prevailing torque limits are not met, replace nut.

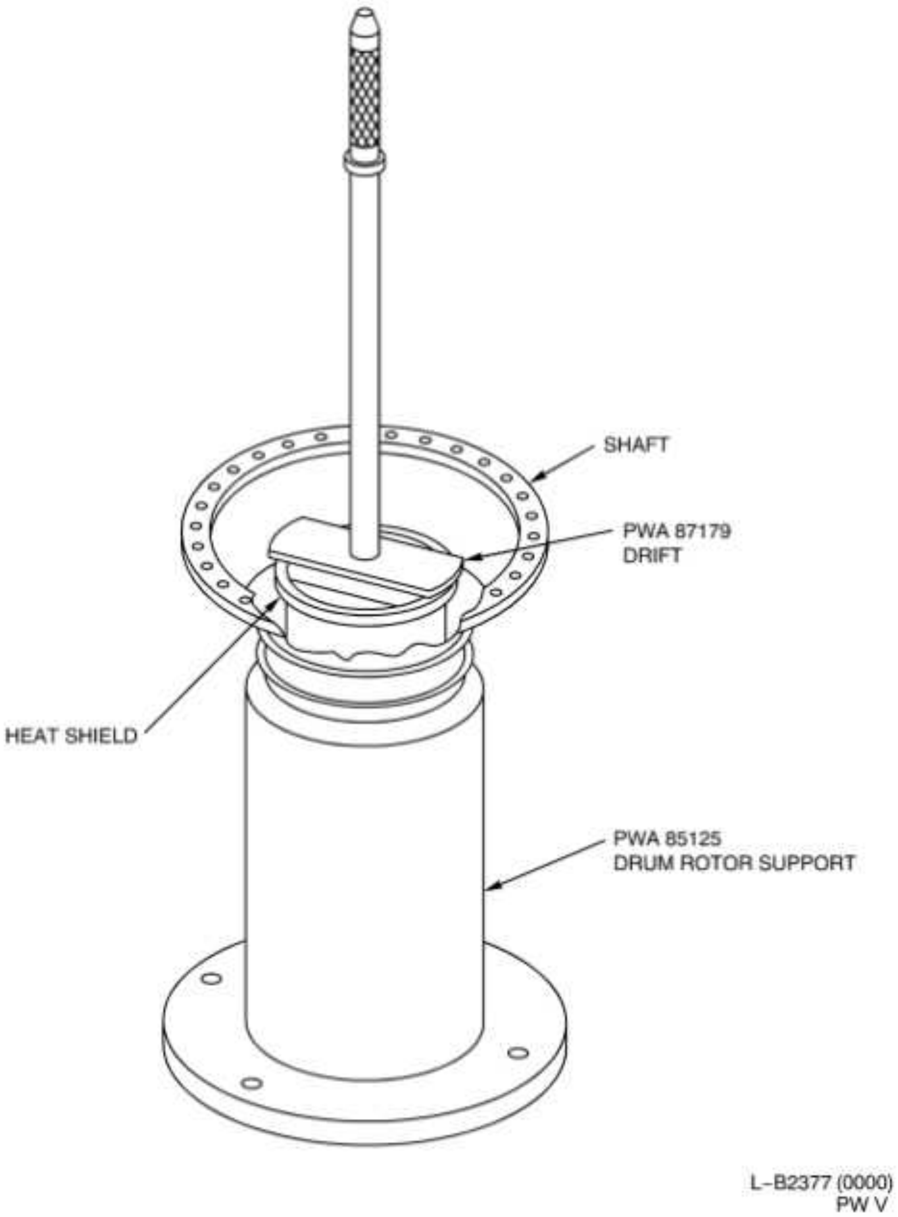
  (c) Torque nuts to 20 - 30 lb-in. (2.260 - 3.390 N.m) plus the prevailing torque.

  (d) Apply 98 - 102 degrees angle of turn, while monitoring torque with torque wrench. Final torque value must not exceed 700 lb-in. (79.089 N.m). If final torque exceeds this maximum, replace nut and bolt.

D. Postrequisites

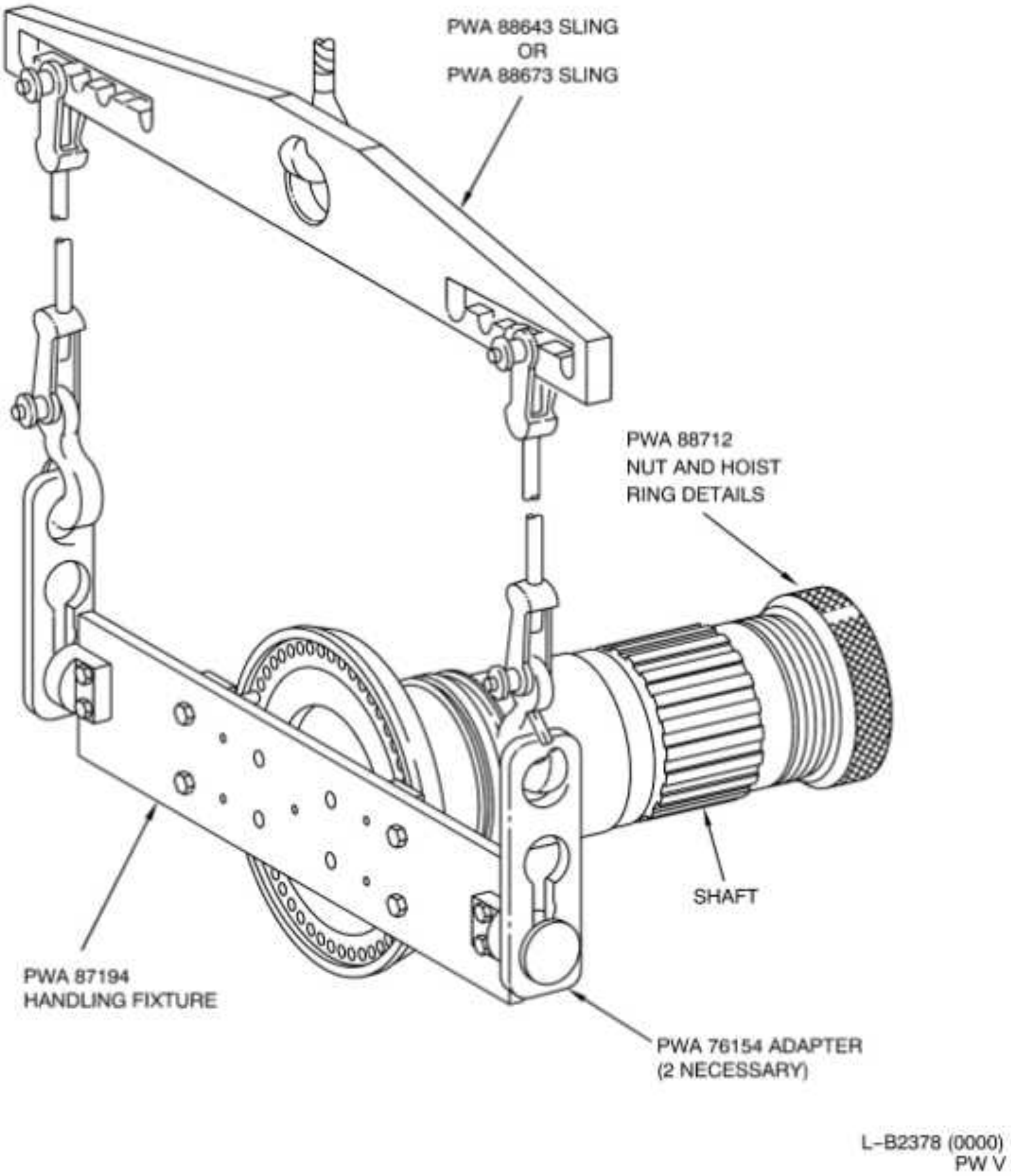
(1) Assemble drum rotor and blades (rear) assembly (Stage 13) by Assembly-02 Task 72-35-39-440-002.

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−01

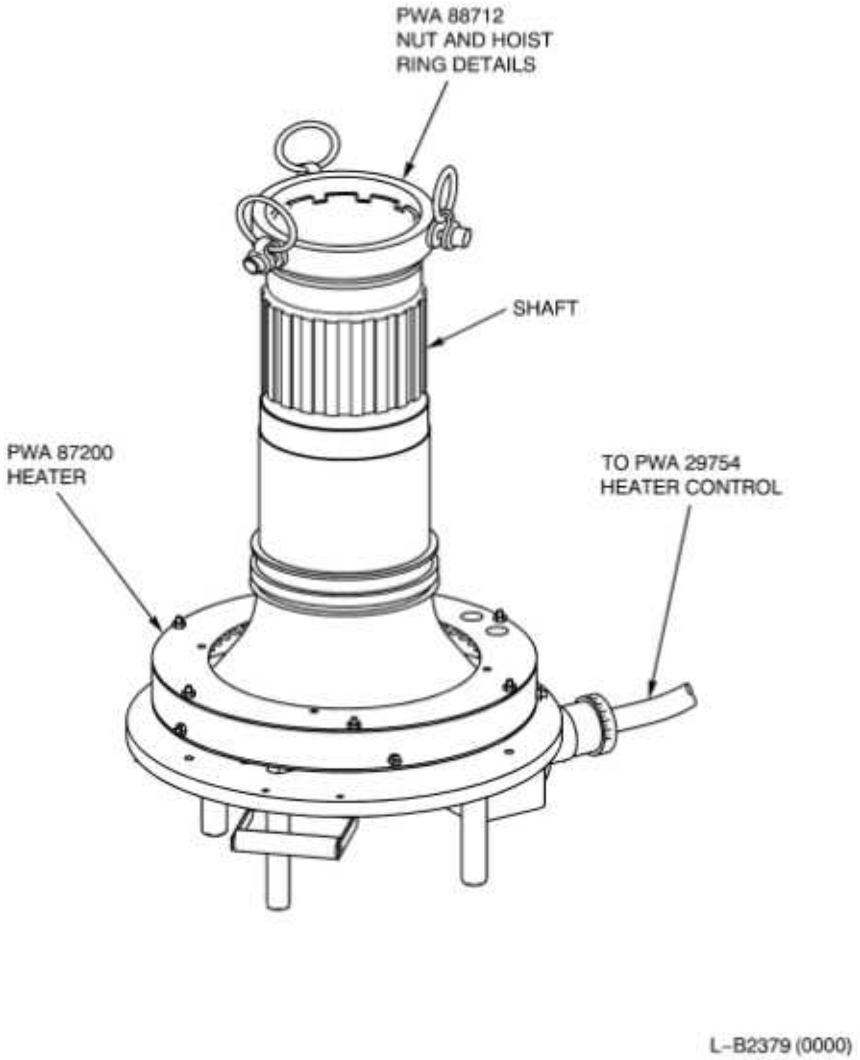

SHAFT
PWA 87179
DRIFT
HEAT SHIELD
PWA 85125
DRUM ROTOR SUPPORT
L−B2377 (0000)
PW V

Heat Shield Installation
Figure 1004
(Task 72−35−39−440−001−B)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−01

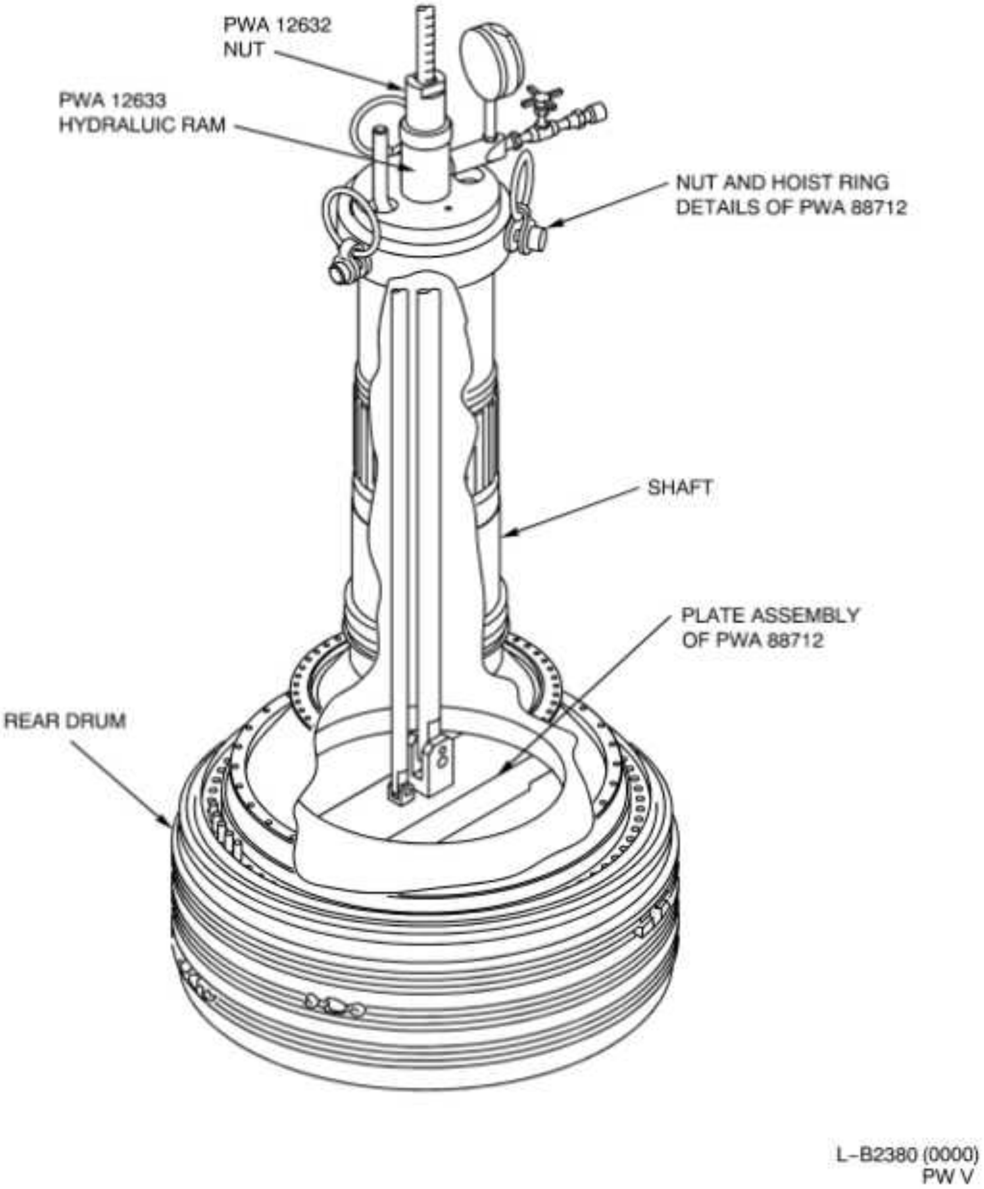

PWA 88643 SLING
OR
PWA 88673 SLING
PWA 88712
NUT AND HOIST
RING DETAILS
SHAFT
PWA 87194
HANDLING FIXTURE
PWA 76154 ADAPTER
(2 NECESSARY)
L−B2378 (0000)
PW V

Trunnion Rear Shaft
Figure 1005
(Task 72−35−39−440−001−B)


PWA 88712
NUT AND HOIST
RING DETAILS
SHAFT
PWA 87200
HEATER
TO PWA 29754
HEATER CONTROL
L−B2379 (0000)

Heat Drum Rotor Seal Flange
Figure 1006
(Task 72−35−39−440−001−B)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−01


PWA 12632
NUT
PWA 12633
HYDRALUIC RAM
NUT AND HOIST RING
DETAILS OF PWA 88712
SHAFT
PLATE ASSEMBLY
OF PWA 88712
REAR DRUM
L−B2380 (0000)
PW V

Shaft To Rear Drum Installation
Figure 1007
(Task 72−35−39−440−001−B)

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DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−02

Task 72−35−39−440−002:

1. Assemble The Drum Rotor And Blades (Rear) Assembly (Stage 13)

A. Equipment And Materials Necessary − None

B. Procedure

(1) Assemble the 13th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 13th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly per 72−35−01, Assembly−23, CONFIG−1 (Task 72−35−01−440−011).

C. Postrequisites

(1) Assemble The Drum Rotor And Blades (Rear) Assembly (Stage 14). Refer to 72−35−39, Assembly−04, CONFIG−1 (Task 72−35−39−440−004).

DRUM ROTOR AND BLADES (REAR) ASSEMBLY - ASSEMBLY-02

Task 72-35-39-440-010:

1. Assemble The Drum Rotor And Blades (Rear) Assembly (Stage 13)

A. General

(1) Use one of the procedures that follow to install the 13th stage blades.

(a) Use Task 2 (Task 72-35-39-440-010-A) of this procedure to install the 13th stage blades (drum rotor, PN 54H803-01 or 53H973-01, pre SB PW4ENG 72-565 or modified drum rotor, PN 54H803-001 or 53H973-001, post SB PW4ENG 72-565 only).

(b) Use Task 3 (Task 72-35-39-440-010-B) of this procedure to install the 13th stage blades (drum rotor, PN 56H013-01, post SB PW4ENG 72-565 only).

Task 72-35-39-440-010-A:

2. Assemble Drum Rotor And Blades (Rear) Assembly (Stage 13) (Drum Rotor, PN 54H803-01 Or 53H973-01, Pre SB PW4ENG 72-565 Or Modified Drum Rotor, PN 54H803-001 Or 53H973-001, Post SB PW4ENG 72-565 Only)

A. Equipment And Materials Necessary - None

B. Procedure

(1) Assemble the 13th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 13th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly (Drum Rotor, PN 54H803-01 Or 53H973-01, Pre SB PW4ENG 72-565 Or Modified Drum Rotor, PN 54H803-001 Or 53H973-001, Post SB PW4ENG 72-565 Only) per 72-35-01, Assembly-23, CONFIG-2 (Task 72-35-01-440-021-A).

C. Postrequisites

(1) Assemble The Drum Rotor And Blades (Rear) Assembly (Stage 14). Refer to 72-35-39, Assembly-04, CONFIG-2 (Task 72-35-39-440-011).

DRUM ROTOR AND BLADES (REAR) ASSEMBLY - ASSEMBLY-02

Task 72-35-39-440-010-B:

3. Assemble The Drum Rotor And Blades (Rear) Assembly (Stage 13) (Drum Rotor, PN 56H013-01, Post SB PW4ENG 72-565 Only)

   A. Equipment And Materials Necessary - None

   B. Procedure

      (1) Assemble the 13th stage blades and attaching parts in the drum rotor.

         (a) Refer to Assemble The 13th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly (Drum Rotor, PN 56H013-01, Post SB PW4ENG 72-565 Only) per 72-35-01, Assembly-23, CONFIG-2 (Task 72-35-01-440-021-B).

   C. Postrequisites

      (1) Assemble The Drum Rotor And Blades (Rear) Assembly (Stage 14). Refer to 72-35-39, Assembly-04, CONFIG-2 (Task 72-35-39-440-011).

DRUM ROTOR AND BLADES (REAR) ASSEMBLY - ASSEMBLY-03

Task 72-35-39-440-003:

1. Grind Stage 13 Through 15 HPC Blade Platforms

A. Equipment And Materials Required

Special Tools:
PWA 17019 Holder
PWA 85601 Fixture, Grinding (13th Stage)
PWA 85602 Fixture, Grinding (14th Stage)
PWA 85603 Fixture, Grinding (15th Stage)

B. Procedure

See Figure 1001.

(1) Install and secure PWA 85601 or PWA 85602 or PWA 85603 Fixture to surface plate of a surface grinding machine.

CAUTION: MAXIMUM MATERIAL REMOVAL PER PLATFORM SIDE MUST NOT EXCEED 0.005 INCH (0.127 mm).

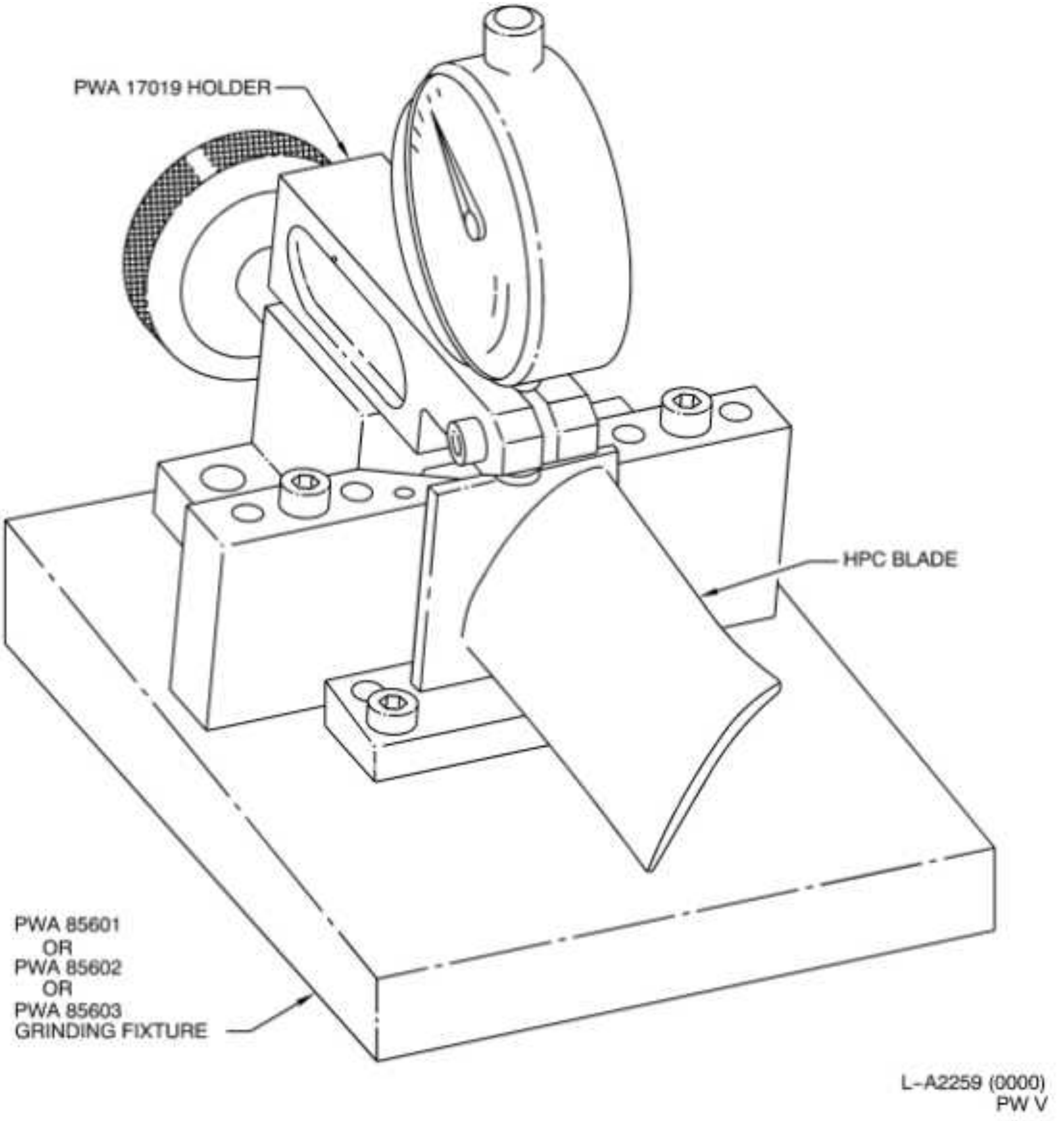
(2) Install blade Type D or Type A, if applicable, into fixture and secure. Grind required amount of materials from blade platform. Each blade must have an equal amount of material removed. On any one blade, material removed must be in approximately equal amounts from both sides of platform.

(3) Remove blade from fixture and reinstall with ground platform down. Grind other platform to required amount removed from first grind. Remove blade from fixture. Blades with trimmed platforms must be identified with a square symbol in the time marking area. Use vibration peening as the marking method. See 70-11, Standard Practices Manual.

(4) Grind remaining blade platforms as required per previous instructions.

(5) Measure platform width using PWA 17019 Holder. If blade needs additional grinding repeat above steps. If blade is acceptable continue with procedure in Assembly-02 (Task 72-35-39-440-002) or Assembly-04 (Task 72-35-39-440-004) or Assembly-05 (Task 72-35-39-440-005).

DRUM ROTOR AND BLADES (REAR) ASSEMBLY - ASSEMBLY-03


PWA 17019 HOLDER
HPC BLADE
PWA 85601
OR
PWA 85602
OR
PWA 85603
GRINDING FIXTURE
L-A2259 (0000)
PW V

Grind And Measure Blade Platforms
Figure 1001
(Task 72-35-39-440-003)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−04

Task 72−35−39−440−004:

1. Assemble Drum Rotor And Blades (Rear) Assembly (Stage 14)

A. Prerequisites

(1) Assemble The Drum Rotor And Blades (Rear) Assembly (Stage 13). Refer to 72−35−39, Assembly−02, CONFIG−1 (Task 72−35−39−440−002).

B. Equipment And Materials Required − None

C. Procedure

(1) Assemble the 14th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 14th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly per 72−35−01, Assembly−22, CONFIG−1 (Task 72−35−01−440−010).

D. Postrequisites

(1) Assemble The Drum Rotor And Blades (Rear) Assembly (Stage 15). Refer to 72−35−39, Assembly−05, CONFIG−1 (Task 72−35−39−440−005).

DRUM ROTOR AND BLADES (REAR) ASSEMBLY - ASSEMBLY-04

Task 72-35-39-440-011:

1. Assemble Drum Rotor And Blades (Rear) Assembly (Stage 14)

A. Prerequisites

(1) Assemble The Drum Rotor And Blades (Rear) Assembly (Stage 13). Refer to 72-35-39, Assembly-02 (Task 72-35-39-440-010).

B. Equipment And Materials Required - None

C. General

(1) Use one of the procedures that follow to install the 14th stage blades.

(a) Use Task 2. (Task 72-35-39-440-011-A) of this procedure to install the 14th stage blades in pre SB PW4ENG 72-565 HPC assemblies.

(b) Use Task 3. (Task 72-35-39-440-011-B) of this procedure to install the 14th stage blades in post SB PW4ENG 72-565 HPC assemblies.

Task 72-35-39-440-011-A:

2. Assemble Drum Rotor And Blades (Rear) Assembly (Stage 14), (Pre SB PW4ENG 72-565 Only)

A. Procedure

(1) Assemble the 14th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 14th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly per 72-35-01, Assembly-22, CONFIG-2 (Task 72-35-01-440-020-A).

B. Postrequisites

(1) Assemble The Drum Rotor And Blades (Rear) Assembly (Stage 15). Refer to 72-35-39, Assembly-05, CONFIG-2 (Task 72-35-39-440-012).

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−04

Task 72−35−39−440−011−B:

3. Assemble Drum Rotor And Blades (Rear) Assembly (Stage 14), (Post SB PW4ENG 72−565 Only)

A. Procedure

(1) Assemble the 14th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 14th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly (Post SB PW4ENG 72−565 Only) per 72−35−01, Assembly−22, CONFIG−2 (Task 72−35−01−440−020−B).

B. Postrequisites

(1) Assemble The Drum Rotor And Blades (Rear) Assembly (Stage 15). Refer to 72−35−39, Assembly−05, CONFIG−2 (Task 72−35−39−440−012).

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DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−05

Task 72−35−39−440−005:

1. Assemble Drum Rotor And Blades (Rear) Assembly (Stage 15)

A. Prerequisites

(1) Assemble The Drum Rotor And Blades (Rear) Assembly (Stage 14). Refer to 72−35−39, Assembly−04, CONFIG−1 (Task 72−35−39−440−004).

B. Equipment And Materials Required

Special Tools:

PWA 80763	Inserter, Tierod

C. Procedure

(1) Assemble the 15th stage blades and attaching parts in the drum rotor.

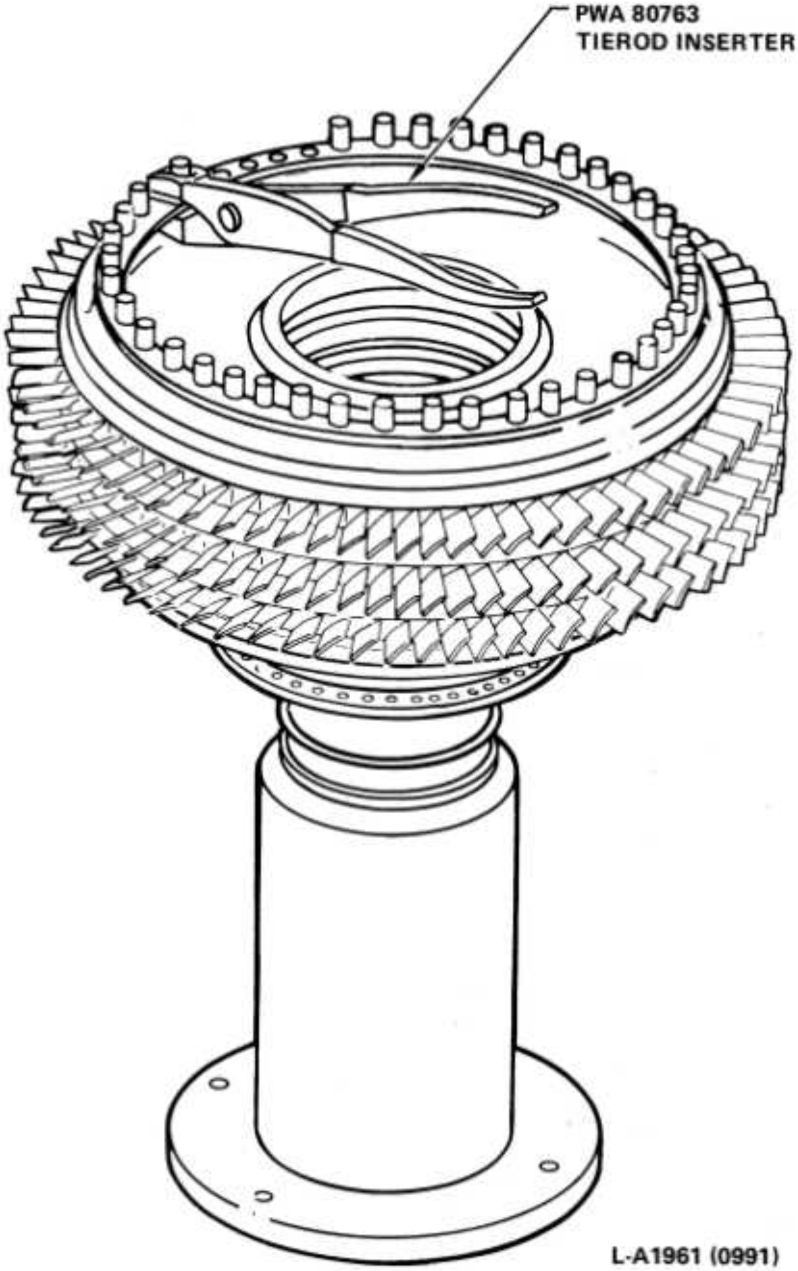
(a) Refer to Assemble The 15th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly per 72−35−01, Assembly−21, CONFIG−1 (Task 72−35−01−440−008).

(2) Install tierods to tierod holes of drum rotor. Using PWA 80763 Inserter secure tierods to drum flange. See Figure 1001.

D. Postrequisites

(1) Assemble The (Bladed) Axial Compressor Rotor Assembly. Refer to 72−35−01, Assembly−01 (Task 72−35−01−440−001).

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−05


PWA 80763
TIEROD INSERTER
L-A1961 (0991)

Tierod Installation
Figure 1001
(Task 72−35−39−440−005)

DRUM ROTOR AND BLADES (REAR) ASSEMBLY - ASSEMBLY-05

Task 72-35-39-440-012:

1. Assemble Drum Rotor And Blades (Rear) Assembly (Stage 15)

A. General

(1) Use one of the three procedures that follow to install the 15th stage blades.

(a) Use Task 2. (Task 72-35-39-440-012-A) of this procedure to install the 15th stage blades (drum rotor, PN 54H803-01 or 53H973-01, pre SB PW4ENG 72-565 only).

(b) Use Task 3. (Task 72-35-39-440-012-B) of this procedure to install the 15th stage blades (modified drum rotor, PN 54H803-001 or 53H973-001, post SB PW4ENG 72-565 only).

(c) Use Task 4. (Task 72-35-39-440-012-C) of this procedure to install the 15th stage blades (new drum rotor, PN 56H013-01, post SB PW4ENG 72-565 only).

Task 72-35-39-440-012-A:

2. Assemble drum Rotor And Blades (Rear) Assembly (Stage 15) (Drum Rotor, PN 54H803-01 Or 53H973-01, Pre SB PW4ENG 72-565 Only)

A. Prerequisites

(1) Assemble The Drum Rotor And Blades (Rear) Assembly (Stage 14). Refer to 72-35-39, Assembly-04, CONFIG-2 (Task 72-35-39-440-011).

B. Equipment And Materials Necessary

Special Tools:

PWA 80763	Inserter, Tierod

C. Procedure

(1) Assemble the 15th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 15Th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly (Drum Rotor, PN 54H803-01 Or 53H973-01, Pre SB PW4ENG 72-565 Only) per 72-35-01, Assembly-21, CONFIG-2 (Task 72-35-01-440-009-A).

(2) Install the tierods to the tierod holes of the drum rotor. Use PWA 80763 Inserter to secure the tierods to the drum flange. See Figure 1001.

D. Postrequisites

(1) Assemble The (Bladed) Axial Compressor Rotor Assembly. Refer to 72-35-01, Assembly-01 (Task 72-35-01-440-001).

Task 72-35-39-440-012-B:

3. Assemble Drum Rotor And Blades (Rear) Assembly (Stage 15) (Modified Drum Rotor, PN 54H803-001 Or 53H973-001, Post SB PW4ENG 72-565 Only)

A. Prerequisites

(1) Assemble The Drum Rotor And Blades (Rear) Assembly (Stage 14) (Post SB PW4ENG 72-565 Only). Refer to 72-35-39, Assembly-04, CONFIG-2 (Task 72-35-39-440-011).

B. Equipment And Materials Required

Special Tools:

PWA 80763	Inserter, Tierod

C. Procedure

(1) Assemble the 15th stage blades and attaching parts in the drum rotor.

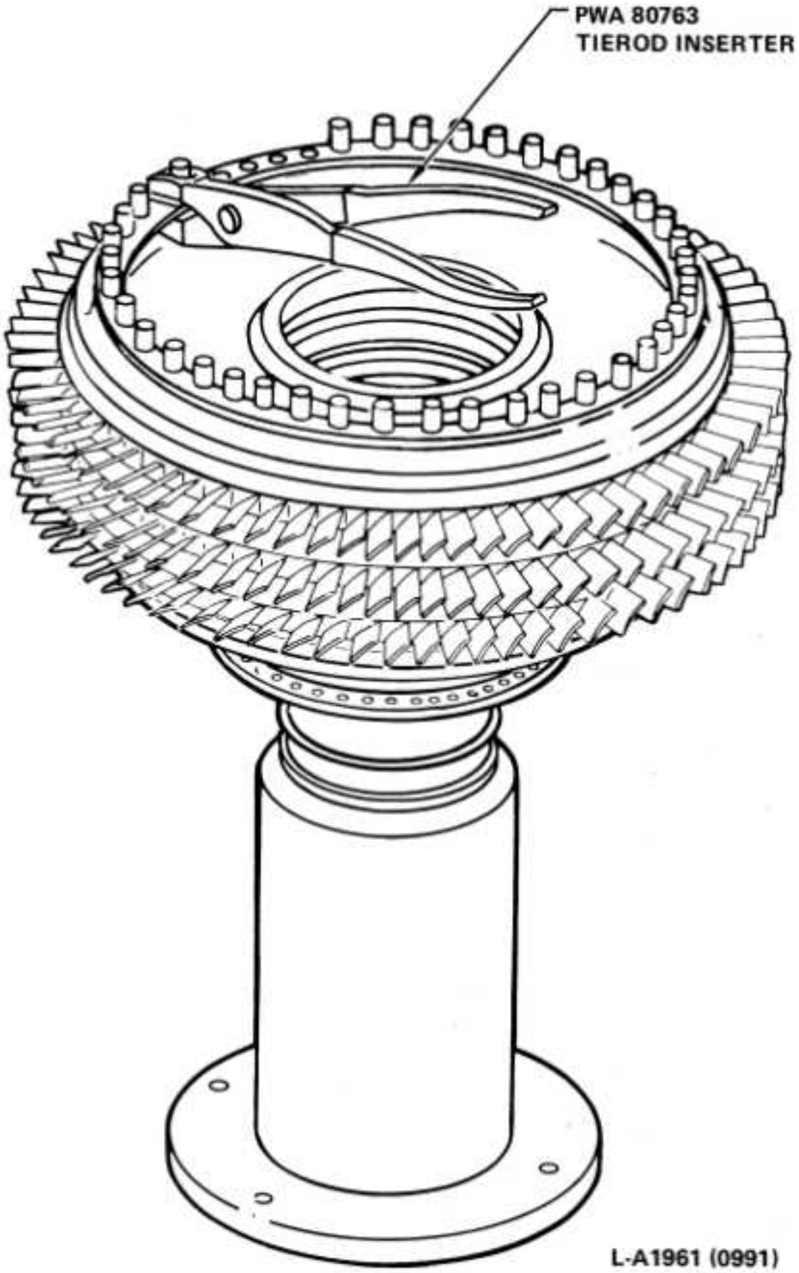
(a) Refer to Assemble The 15th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly (Modified Drum Rotor, PN 54H803-001 Or 53H973-001, Post SB PW4ENG 72-565 Only) per 72-35-01, Assembly-21, CONFIG-2 (Task 72-35-01-440-009-B).

(2) Install the tierods to the tierod holes of the drum rotor. Use PWA 80763 Inserter to secure the tierods to the drum flange. See Figure 1001.

D. Postrequisites

(1) Assemble The (Bladed) Axial Compressor Rotor Assembly. Refer to 72-35-01, Assembly-01 (Task 72-35-01-440-001).

DRUM ROTOR AND BLADES (REAR) ASSEMBLY − ASSEMBLY−05


PWA 80763
TIEROD INSERTER
L-A1961 (0991)

Tierod Installation
Figure 1001
(Task 72−35−39−440−012−A)

Task 72-35-39-440-012-C:

4. Assemble Drum Rotor And Blades (Rear) Assembly (Stage 15) (New Drum Rotor, PN 56H013-01, Post SB PW4ENG 72-565 Only)

A. Prerequisites

(1) Assemble The Drum Rotor And Blades (Rear) Assembly (Stage 14) (Post SB PW4ENG 72-565 Only). Refer to 72-35-39, Assembly-04, CONFIG-2 (Task 72-35-39-440-011).

B. Equipment And Materials Required

Special Tools:

PWA 80763	Inserter, Tierod

C. Procedure

(1) Assemble the 15th stage blades and attaching parts in the drum rotor.

(a) Refer to Assemble The 15th Stage Blades In The (Debladed) Axial Compressor Rotor Assembly (New Drum Rotor, PN 56H013-01, Post SB PW4ENG 72-565 Only) per 72-35-01, Assembly-21, CONFIG-2 (Task 72-35-01-440-009-C).

(2) Install the tierods to the tierod holes of the drum rotor. Use PWA 80763 Inserter to secure the tierods to the drum flange. See Figure 1001.

D. Postrequisites

(1) Assemble The (Bladed) Axial Compressor Rotor Assembly. Refer to 72-35-01, Assembly-01 (Task 72-35-01-440-001).

DRUM ROTOR AND BLADES (REAR) ASSEMBLY - ASSEMBLY-06

Task 72-35-39-440-006:

1. Assemble Drum Rotor And Blades (Rear) Assembly For Balance

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DRUM ROTOR AND BLADES (REAR) ASSEMBLY- ASSEMBLY-07

Task 72-35-39-440-007:

1. Balance Drum Rotor And Blades (Rear) Assembly

This Procedure Has Been Deleted

DRUM ROTOR AND BLADES (REAR) ASSEMBLY - ASSEMBLY-08

Task 72-35-39-440-008:

1. Post Balance Procedure - Drum Rotor And Blades (Rear) Assembly

This Procedure Has Been Deleted

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DRUM ROTOR AND BLADES (REAR) ASSEMBLY - ASSEMBLY-09

Task 72-35-39-440-009:

1. Assemble Drum Rotor And Blades (Rear) Assembly (Stages 13, 14 And 15) With Limited Number Of Replacement Blades Of Pre-Ground Zirconium Oxide Tips (Post SB PW4ENG 72-599)

A. Prerequisites

(1) Assemble drum rotor and blades (rear) assembly (Stage 13) per Assembly-02 (Task 72-35-39-440-002).

(2) Assemble drum rotor and blades (rear) assembly (Stage 14) per Assembly-04 (Task 72-35-39-440-004).

(3) Assemble drum rotor and blades (rear) assembly (Stage 15) per Assembly-05 (Task 72-35-39-440-005).

B. Equipment And Materials Required

Special Tools:
PWA 86448 Drift

Consumable Materials:

Item No.	Designation
P06-009	Antiseize Compound (PMC 9523)

C. Procedure

(1) This procedure provides for the replacement of a limited number of blades in HPC Stages 13, 14 and 15 with pre-ground zirconium oxide tip blades per SB PW4ENG 72-599 which do not require additional rotor grind to meet the engine manual rotor diameter. These blades can be used for individual blade replacement in a rotor that has previously been rotor ground.

NOTE: There are three part numbers (sets) of blades provided for each stage. Set Type A contains the majority of blades to be installed around the drum. Set Type B has notches in the right edge of blade platforms. Set Type C has notches in the left edge of blade platforms. When Types B and C blades are placed together, clearance is formed for a blade lock. Set Type A is also used for fitting and may require platform grinding. For ease of assembly, blades in the referenced assembly procedures will be referred to as Types A, B and C.

CAUTION: WHEN YOU NEED TO MOVE AND SET THE BLADES IN ONE OF THE REFERENCED ASSEMBLY PROCEDURES, USE THE PWA 86448 DRIFT. THE USE OF A DIFFERENT METHOD TO MOVE AND SET THE BLADES CAN CAUSE AIRFOIL DAMAGE.

(2) Replacement HPC blades with thin pre−ground zirconium coated tips can be used in any or all rotor Stages 13 through 15, up to a seven blade per stage limit in any combination of Type A, B or C blades.

(3) The thin zirconium tip blades can replace either ground aluminum oxide or zirconium tip blades.

(4) No more than three new pre−ground thin zirconium tip replacement blades can be installed adjacent to each other.

(5) FOR THESE MODELS: 4152, 4156A, 4158
HPC blades, Stages 13 through 15, which have root chamfers may be mixed with those that do not have root chamfers as long as they are equally spaced around the rotor at assembly to minimize rotor unbalance.

D. Postrequisites

(1) Assemble axial compressor rotor assembly 72−35−01, Assembly−01 (Task 72−35−01−440−001).

STAGE 11 AND 12 COMPRESSOR STATOR SET - ASSEMBLY-01

Task 72-35-61-440-001:

1. Assemble Stages 11 And 12 Compressor Stator Set, Shroud Sets, And Springs

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P06-058	Lubricant, Fatty Alcohol-Type (PMC 9264)

Special Tools:

PWA 86507	Fixture, Assembly

B. Procedure

See Figure 1001, Figure 1002 and Figure 1003.

(1) Assemble the 12th stage HPC compressor stator shroud set and four springs as follows.

NOTE: Make sure that the four stator segments have the same serial number. Make sure that the 12 shroud segments have the same serial number. See Figure 1001.

(a) Position the stator segment with mating No. 1 and 2 in PWA 86705 Fixture, front end down, in the groove on the fixture base and locate angularly against the fixture stop. Position the clamp cover assembly over the stator set and tighten it into place. Engage the two (2) quick release clamps. See Figure 1003.

(b) Arrange shroud sets on bench in four sets of three. See Table 1001.

	SET 1	SET 2	SET 3	SET 4
PART NUMBER	52H992-05	52H992-05	52H992-05	52H992-05
SECTION	A - B	D - E	G - H	J - K
PART NUMBER	52H992-06	52H992-06	52H992-06	52H992-06
SECTION	B - C	E - F	H - I	K - L
PART NUMBER	52H992-07	52H992-07	52H992-07	52H992-07
SECTION	C - D	F - G	I - J	L - A

Arrange The Shroud Sets - Stage 12
Table 1001

STAGE 11 AND 12 COMPRESSOR STATOR SET − ASSEMBLY−01

SET 1	SET 2	SET 3	SET 4

NOTE: If an individual shroud segment is damaged, and that segment is not serviceable, that segment together with the two adjacent shroud segments that are contained within a stator segment, can be replaced with three adjacent segments from another segment set. With this procedure, each damper spring will interface with three matched shroud segments. Surplus details can be retained for similar replacement requirements.

Arrange The Shroud Sets − Stage 12
Table 1001 (Continued)

(c) Install the 12th stage insert into the insert holder, top slot, and tighten the knurled screws.

(d) Apply Fatty Alcohol−Type Lubricant P06−058 to the spring and shroud set surfaces as necessary to help in the assembly process. See Figure 1002.

(e) Place a Spring, PN52H876, in ID slot of 12th stage stator segment, with slotted end of the spring contacting the stop pin of the stator. Hold the end of the spring in place with the torque clamp.

(f) As indicated in Table 1001, insert shroud, C−D from Set 1, into the ID slot of the 12th stage over the spring, engaging legs of shroud in slot in vanes, with the arrow on rear of shroud pointing down. See Figure 1001.

(g) Apply pressure with the pivot arm assembly until the shroud segment end engages pin in slot. See Figure 1003.

(h) Make sure that the spring is engaged against the pin and that the recessed end of the shroud is engaged over the pin.

(i) Insert shroud, B−C from Set 1, into the ID slot of the 12th stage using previous instructions with the arrow on rear of shroud pointing down.

(j) Using the pivot arm assembly, position shroud segment until angled end of shroud is approximately 0.025 inch (0.635 mm) from mating angled end of previously installed shroud. Check position of segment using 0.025 inch (0.635 mm) feeler stock.

(k) Insert shroud, A−B from Set 1, into the ID slot of the 12th stage using previous instructions with the arrow on rear of shroud pointing down.

(l) Using the pivot arm assembly, position shroud segment until angled end of shroud is approximately 0.025 inch (0.635 mm) from mating angled end of previously installed shroud. Check position of segment using 0.025 inch (0.635 mm) feeler stock.

(m) Make sure that the flat end of the shroud does not overhang the end of the stator assembly and angular ends of shrouds are approximately equally spaced.

(n) Repeat the above procedure for the three remaining 12th stage stator assemblies installing the shrouds in Set 2 in stator assembly 2 − 3, Set 3 in stator assembly 3 − 4 and Set 4 in stator assembly 4 − 1. See Table 1001.

(2) Assemble the 11th stage HPC compressor stator shroud set and four springs as follows.

NOTE: Make sure that the 12 shroud segments have the same serial number. See Figure 1001.

(a) Arrange shrouds on the bench in four sets of three. See Table 1002.

	SET 1	SET 2	SET 3	SET 4
PART NUMBER	53H391−5	53H391−5	53H391−5	53H391−5
SECTION	A − B	D − E	G − H	J − K
PART NUMBER	53H391−6	53H391−6	53H391−6	53H391−6
SECTION	B − C	E − F	H − I	K − L
PART NUMBER	53H391−7	53H391−7	53H391−7	53H391−7
SECTION	C − D	F − G	I − J	L − A

Arrange The Shroud Sets − Stage 11
Table 1002

STAGE 11 AND 12 COMPRESSOR STATOR SET − ASSEMBLY−01

SET 1	SET 2	SET 3	SET 4

NOTE: If an individual shroud segment is damaged, and that segment is not serviceable, that segment together with the two adjacent shroud segments that are contained within a stator segment, can be replaced with three adjacent segments from another segment set. With this procedure, each damper spring will interface with three matched shroud segments. Surplus details can be retained for similar replacement requirements.

Arrange The Shroud Sets − Stage 11
Table 1002 (Continued)

(b) Position the stator segment with mating No. 1 and 2 in PWA 86507 Fixture, front end down, in the groove on the fixture base and locate angularly against the fixture stop. Position the clamp cover assembly over the stator set and tighten it into place. Engage the two (2) quick release clamps. See Figure 1003.

(c) Install the 11th stage insert into the insert holder, bottom slot, and tighten knurled screws.

(d) Apply Fatty Alcohol−Type Lubricant P06−058 to the spring and shroud set surfaces as necessary to help in the assembly process. See Figure 1002.

(e) Place a Spring, PN52H875, in ID slot of 11th stage stator segment, with slotted end of the spring contacting the stop pin of the stator. Hold the end of the spring in place with the torque clamp.

(f) As indicated in Table 1002, insert shroud, C−D from Set 1, into the ID slot of the 11th stage over spring, engaging legs of shroud in slot in vanes, with the arrow on rear of shroud pointing down. See Figure 1001.

(g) Apply pressure with the pivot arm assembly until the shroud segment end engages pin in slot. See Figure 1003.

(h) Make sure that the spring is engaged against the pin and that the recessed end of the shroud is engaged over the pin.

(i) Insert shroud, B−C from Set 1, into the ID slot of the 11th stage using previous instructions with the arrow on rear of shroud pointing down.

(j) Using the pivot arm assembly, position shroud segment until angled end of shroud is approximately 0.025 inch (0.635 mm) from mating angled end of previously installed shroud. Check position of the segment using 0.025 inch (0.635 mm) feeler stock.

(k) Insert shroud, A−B from Set 1, into the ID slot of the 11th stage using previous instructions with the arrow on rear of shroud pointing down.

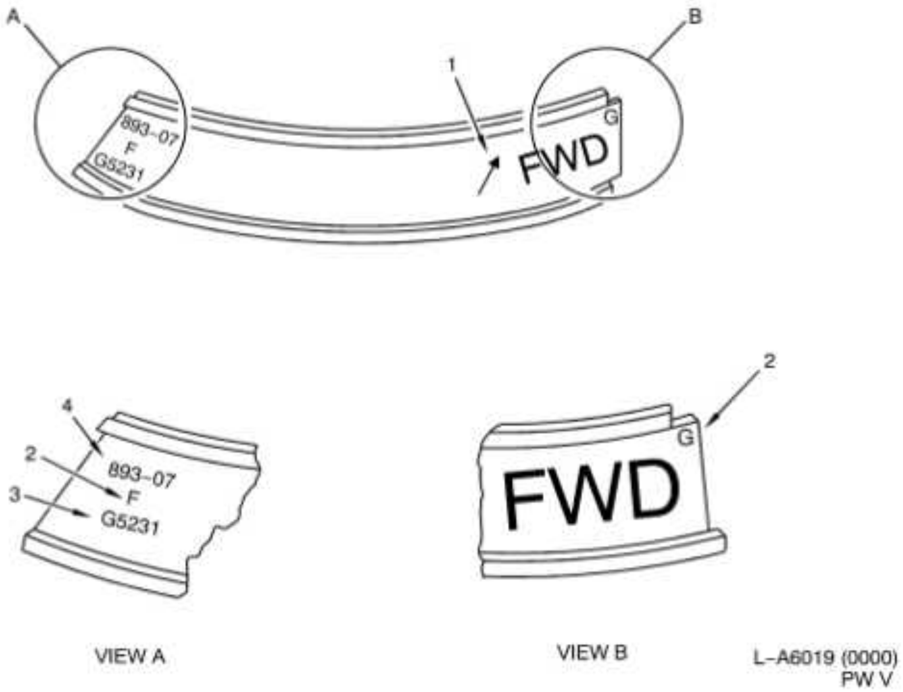
(l) Using the pivot arm assembly, position shroud segment until angled end of shroud is approximately 0.025 inch (0.635 mm) from mating angled end of previously installed shroud. Check position of the segment using 0.025 inch (0.635 mm) feeler stock.

(m) Make sure that the flat end of the shroud does not overhang the end of the stator assembly and angular ends of shrouds are approximately equally spaced.

(n) Repeat the above procedure for the three remaining 11th stage stator assemblies installing the shrouds in Set 2 in stator assembly 2 − 3, Set 3 in stator assembly 3 − 4 and Set 4 in stator assembly 4 − 1. See Table 1002.

(3) Visually check completed assembly for correct assembly, security of details, absence of damage and absence of foreign material. Particular attention should be directed to mating surfaces.

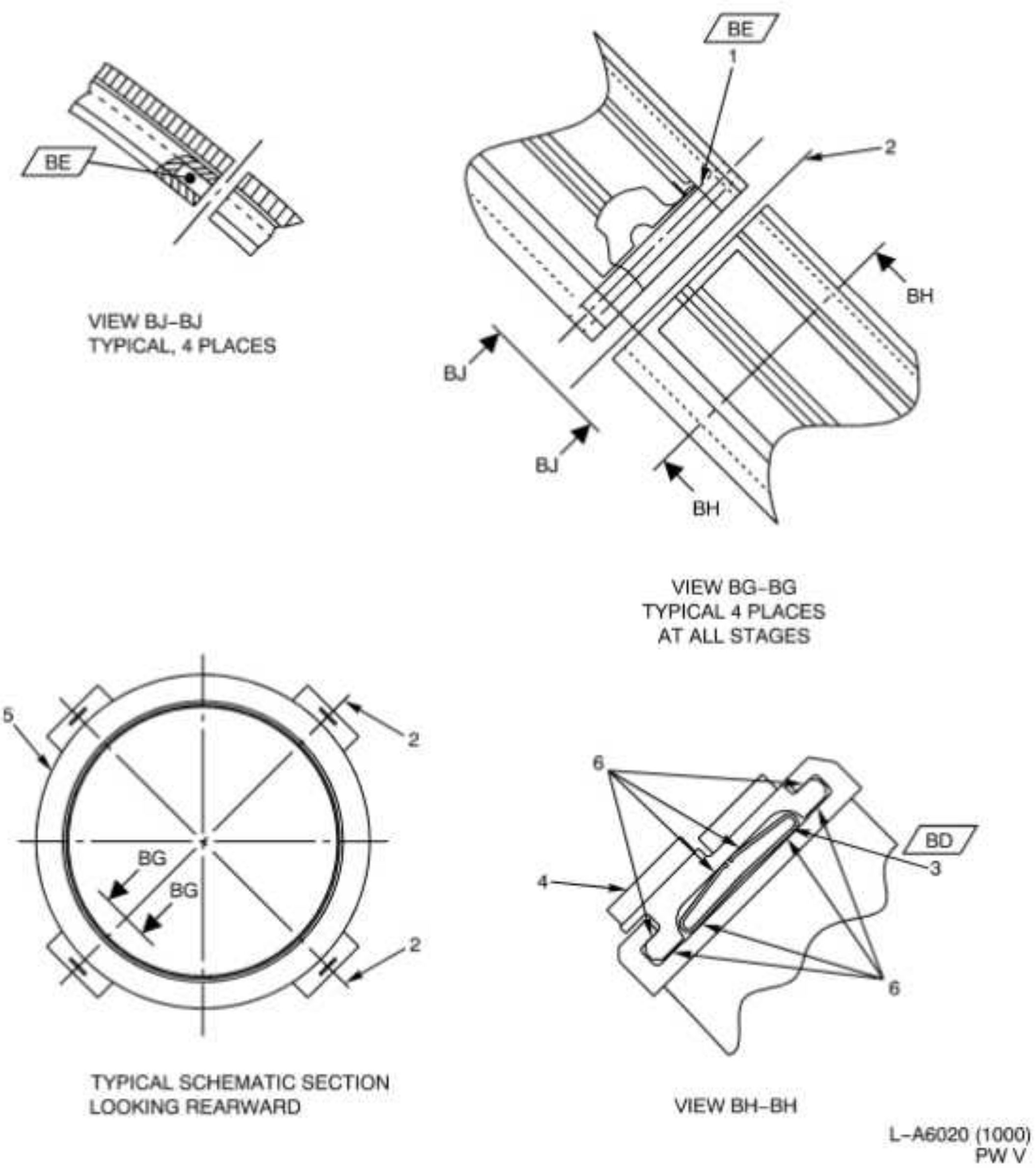
STAGE 11 AND 12 COMPRESSOR STATOR SET − ASSEMBLY−01


A
B
1
893-07
F
G5231
G
FWD
4
2
3
893-07
F
G5231
VIEW A
2
G
FWD
VIEW B
L-A6019 (0000)
PW V

1. Arrow For Orientation On Bottom Of Segments.
2. Shroud Segment F−G
3. Shroud Serial Number
4. Shroud Set Detail Number

Typical Shroud Segment Markings
Figure 1001
(Task 72−35−61−440−001)

STAGE 11 AND 12 COMPRESSOR STATOR SET − ASSEMBLY−01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VIEW BJ-BJ
TYPICAL, 4 PLACES
BE
1
2
BH
BJ
BJ
BH
VIEW BG-BG
TYPICAL 4 PLACES
AT ALL STAGES
5
2
BG
BG
2
TYPICAL SCHEMATIC SECTION
LOOKING REARWARD
6
BD
3
4
6
VIEW BH-BH
L-A6020 (1000)
PW V

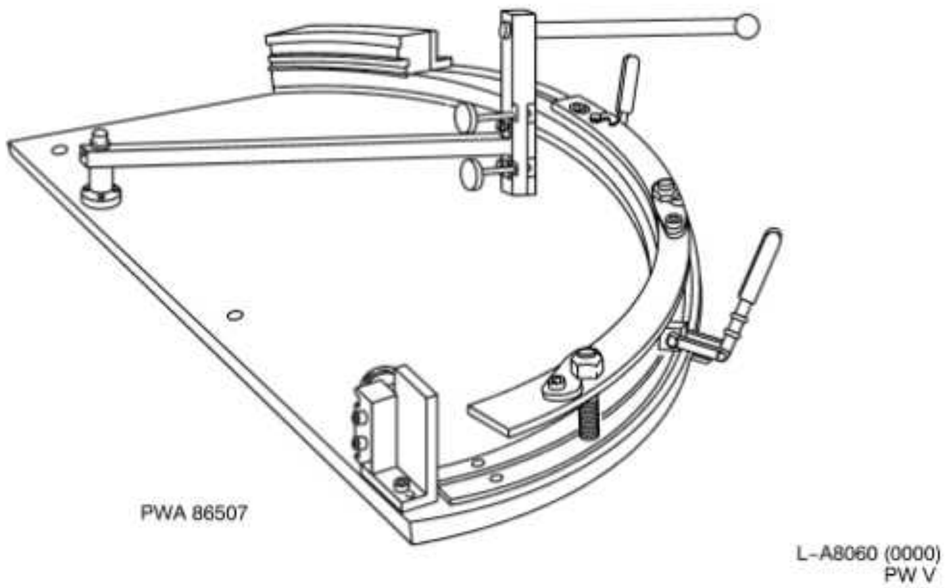
Stator Set With Shroud Sets And Springs
Figure 1002
(Task 72−35−61−440−001)

STAGE 11 AND 12 COMPRESSOR STATOR SET − ASSEMBLY−01

1. Pin, Reference
2. Split Line, Reference
3. Spring
4. Shroud Set
5. Stator Set
6. Apply Lubricant, These Locations

Key to Figure 1002

STAGE 11 AND 12 COMPRESSOR STATOR SET − ASSEMBLY−01


PWA 86507
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PW V

Assembly Fixture
Figure 1003
(Task 72−35−61−440−001)

Previous Pageblock   Return to Previous Menu   Next Pageblock

STAGE 13 AND 14 COMPRESSOR STATOR SET - ASSEMBLY-01

Task 72-35-62-440-001:

1. Assemble Stages 13 And 14 Compressor Stator Set, Shroud Sets, And Springs

A. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P06-058	Lubricant, Fatty Alcohol-Type (PMC 9264)

Special Tools:

PWA 87856	Fixture, Assembly

B. Procedure
See Figure 1001, Figure 1002 and Figure 1003.

(1) Assemble the 14th stage HPC compressor stator shroud set and four springs as follows.

NOTE: Make sure that the four stator segments have the same serial number. Make sure that the 12 shroud segments have the same serial number. See Figure 1001.

(a) Position the stator segment with mating No. 1 and 2 in PWA 87856 Fixture, front end down, in the groove on the fixture base and locate angularity against the fixture stop. Position the clamp cover assembly over the stator set and tighten it into place. Engage the two (2) quick release clamps. See Figure 1003.

(b) Arrange shroud sets on bench in four sets of three. See Table 1001.

	SET 1	SET 2	SET 3	SET 4
PART NUMBER	52H893-05	52H893-05	52H893-05	52H893-05
SECTION	A - B	D - E	G - H	J - K
PART NUMBER	52H893-06	52H893-06	52H893-06	52H893-06
SECTION	B - C	E - F	H - I	K - L
PART NUMBER	52H893-07	52H893-07	52H893-07	52H893-07
SECTION	C - D	F - G	I - J	L - A

Arrange The Shroud Sets
Table 1001

STAGE 13 AND 14 COMPRESSOR STATOR SET − ASSEMBLY−01

SET 1	SET 2	SET 3	SET 4

NOTE: If an individual shroud segment is damaged, and that segment is not serviceable, that segment together with the two adjacent shroud segments that are contained within a stator segment, can be replaced with three adjacent segments from another segment set. With this procedure, each damper spring will interface with three matched shroud segments. Surplus details can be retained for similar replacement requirements.

Arrange The Shroud Sets
Table 1001 (Continued)

(c) Install the 14th stage insert into the insert holder, top slot, and tighten the knurled screws.

(d) Apply Fatty Alcohol−Type Lubricant P06−058 to all the spring and shroud set surfaces as necessary to help in the assembly process. See Figure 1002 for applicable areas.

(e) Place a Spring, PN52H878, in ID slot of 14th stage stator segment, with slotted end of the spring contacting the stop pin of the stator. Hold the end of the spring in place with the torque clamp.

(f) As indicated in Table 1001, insert shroud, C−D from Set 1, into the ID slot of the 14th stage over the spring, engaging legs of shroud in slot in vanes, with the arrow on rear of shroud pointing down. See Figure 1001.

(g) Apply pressure with the pivot arm assembly until the shroud segment end engages pin in slot. See Figure 1003.

(h) Make sure that the spring is engaged against the pin and that the recessed end of the shroud is engaged over the pin.

(i) Insert shroud, B−C from Set 1, into the ID slot of the 14th stage using previous instructions with the arrow on rear of shroud pointing down.

(j) Using the pivot arm assembly, position shroud segment until angled end of shroud is approximately 0.025 inch (0.635 mm) from mating angled end of previously installed shroud. Check position of segment using 0.025 inch (0.635 mm) feeler stock.

(k) Insert shroud, A−B from Set 1, into the ID slot of the 14th stage using previous instructions with the arrow on rear of shroud pointing down.

(l) Using the pivot arm assembly, position shroud segment until angled end of shroud is approximately 0.025 inch (0.635 mm) from mating angled end of previously installed shroud. Check position of segment using 0.025 inch (0.635 mm) feeler stock.

(m) Make sure that the flat end of the shroud does not overhang the end of the stator assembly and angular ends of shrouds are approximately equally spaced.

(n) Repeat the above procedure for the three remaining 14th stage stator assemblies installing the shrouds in Set 2 in stator assembly 2 − 3, Set 3 in stator assembly 3 − 4 and Set 4 in stator assembly 4 − 1. See Table 1001.

(2) Assemble the 13th stage HPC compressor stator shroud set and four springs as follows.

NOTE: Make sure that the 12 shroud segments have the same serial number. See Figure 1001.

(a) Arrange shrouds on the bench in four sets of three. See Table 1001.

(b) Position the stator segment with mating No. 1 and 2 inPWA 87856 Fixture, front end down, in the groove on the fixture base and locate angularity against the fixture stop. Position the clamp cover assembly over the stator set and tighten it into place. Engage the two (2) quick release clamps. See Figure 1003.

(c) Install the 13th stage insert into the insert holder, bottom slot, and tighten knurled screws.

(d) Apply Fatty Alcohol−Type Lubricant P06−058 to all the spring and shroud set surfaces as necessary to help in the assembly process. See Figure 1002 for applicable areas.

(e) Place a Spring, PN52H877, in ID slot of 13th stage stator segment, with slotted end of the spring contacting the stop pin of the stator. Hold the end of the spring in place with the torque clamp.

(f) As indicated in Table 1001, insert shroud, C−D from Set 1, into the ID slot of the 13th stage over spring, engaging legs of shroud in slot in vanes, with the arrow on rear of shroud pointing down. See Figure 1001.

(g) Apply pressure with the pivot arm assembly until the shroud segment end engages pin in slot. See Figure 1003.

(h) Make sure that the spring is engaged against the pin and that the recessed end of the shroud is engaged over the pin.

(i) Insert shroud, B−C from Set 1, into the ID slot of the 13th stage using previous instructions with the arrow on rear of shroud pointing down.

(j) Using the pivot arm assembly, position shroud segment until angled end of shroud is approximately 0.025 inch (0.635 mm) from mating angled end of previously installed shroud. Check position of the segment using 0.025 inch (0.635 mm) feeler stock.

(k) Insert shroud, A−B from Set 1, into the ID slot of the 11th stage using previous instructions with the arrow on rear of shroud pointing down.

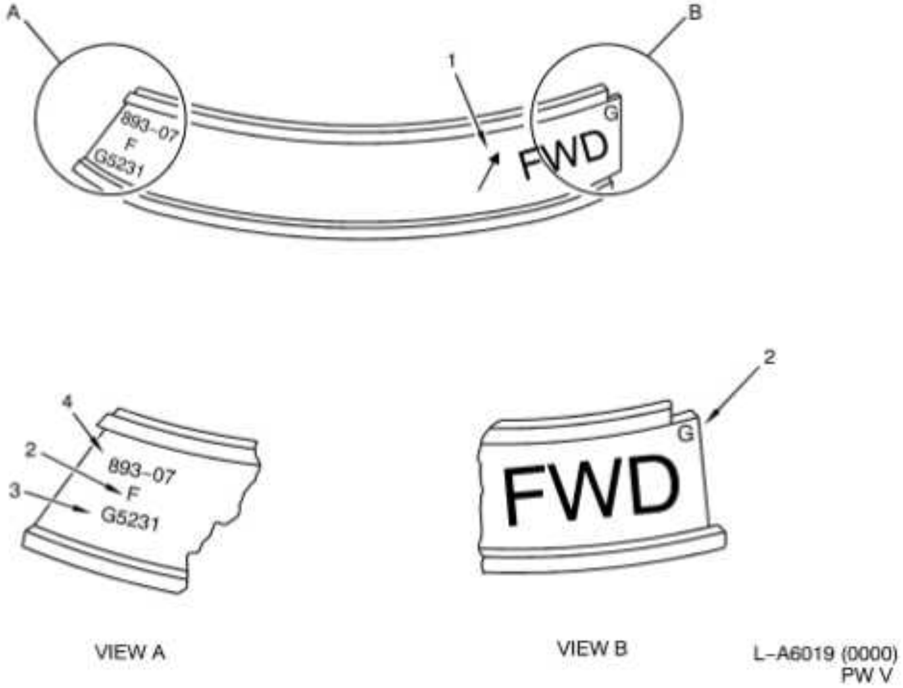
(l) Using the pivot arm assembly, position shroud segment until angled end of shroud is approximately 0.025 inch (0.635 mm) from mating angled end o previously installed shroud. Check position of the segment using 0.025 inch (0.635 mm) feeler stock.

(m) Make sure that the flat end of the shroud does not overhang the end of the stator assembly and angular ends of shrouds are approximately equally spaced.

(n) Repeat the above procedure for the three remaining 13th stage stator assemblies installing the shrouds in Set 2 in stator assembly 2 − 3, Set 3 in stator assembly 3 − 4 and Set 4 in stator assembly 4 − 1. See Table 1001.

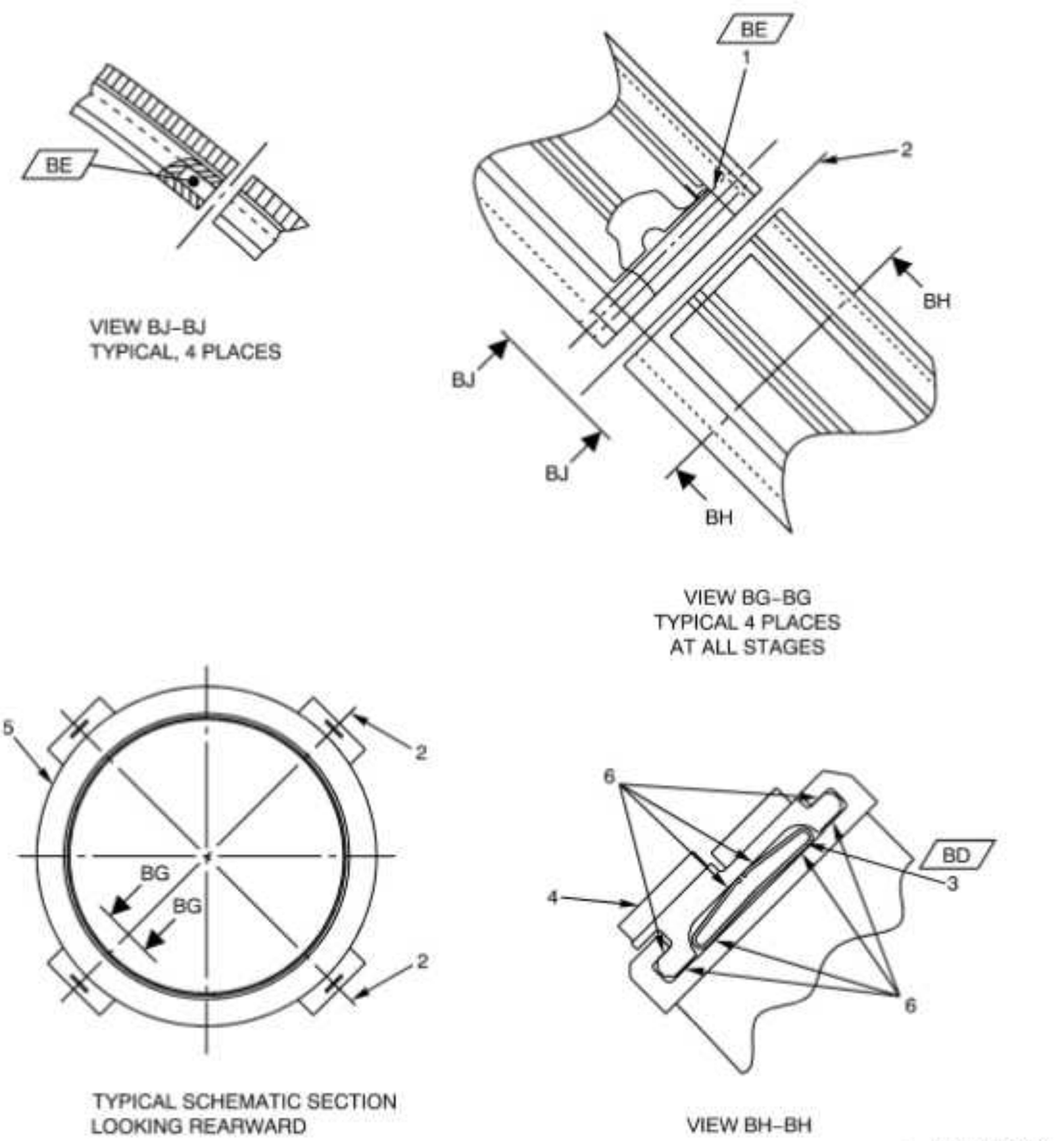
(3) Visually check completed assembly for correct assembly, security of details, absence of damage and absence of foreign material. Particular attention should be directed to mating surfaces.

STAGE 13 AND 14 COMPRESSOR STATOR SET − ASSEMBLY−01


A
B
1
893-07
F
G5231
FWD
G
4
2
3
2
VIEW A
VIEW B
L−A6019 (0000)
PW V

1. Arrow For Orientation On Bottom Of Segments.
2. Shroud Segment F−G
3. Shroud Serial Number
4. Shroud Set Detail Number

Typical Shroud Segment Markings
Figure 1001
(Task 72−35−62−440−001)


BE
VIEW BJ-BJ
TYPICAL, 4 PLACES
BE
1
2
BH
BJ
BJ
BH
VIEW BG-BG
TYPICAL 4 PLACES
AT ALL STAGES
5
2
BG
BG
2
TYPICAL SCHEMATIC SECTION
LOOKING REARWARD
6
BD
3
4
6
VIEW BH-BH

L-A6020 (1000)
PW V

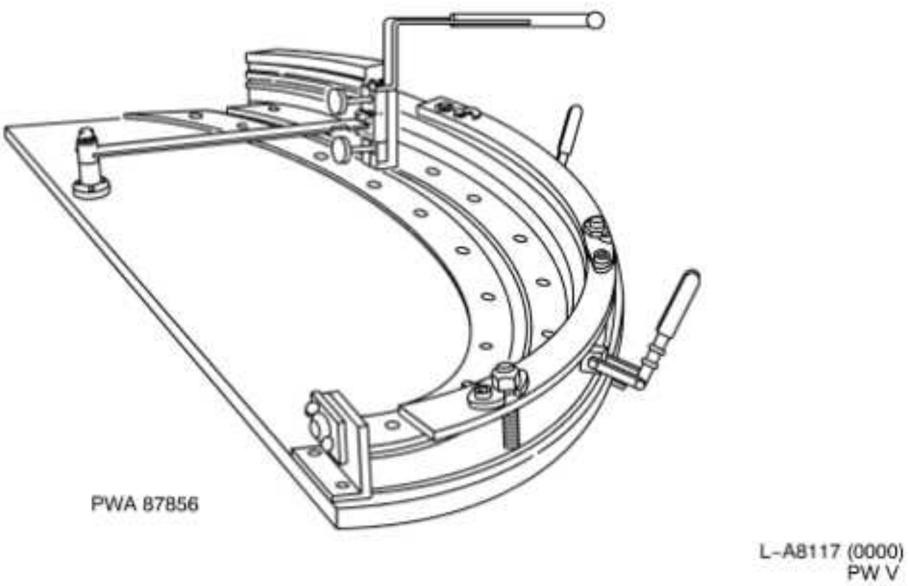
Stator Set With Shroud Sets And Springs
Figure 1002
(Task 72−35−62−440−001)

STAGE 13 AND 14 COMPRESSOR STATOR SET − ASSEMBLY−01

1. Pin, Reference
2. Split Line, Reference
3. Spring
4. Shroud Set
5. Stator Set
6. Apply Lubricant, These Locations

Key to Figure 1002

STAGE 13 AND 14 COMPRESSOR STATOR SET − ASSEMBLY−01


PWA 87856
L−A8117 (0000)
PW V

Assembly Fixture
Figure 1003
(Task 72−35−62−440−001)

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72−41−00	DIFFUSER AND COMBUSTOR − REMOVAL−01 • 72−41−00−030−004: Remove The No. 3 Roller Bearing Outer Race − Diffuser And Combustor
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72−41−00	DIFFUSER AND COMBUSTOR − DISASSEMBLY−02 • 72−41−00−030−002: Disassemble Diffuser And Combustor Internals • 72−41−00−030−005: Disassemble Diffuser And Combustor Internals
72−41−00	DIFFUSER AND COMBUSTOR − DISASSEMBLY−03 • 72−41−00−030−003−001: Disassemble No. 3 Bearing Duct And Housing (Hydraulic Wrench Method)
72−41−00	DIFFUSER AND COMBUSTOR − DISASSEMBLY−04 • 72−41−00−030−003−002: Disassemble No. 3 Bearing Duct And Housing (Mechanical Wrench Method)
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72−41−00	DIFFUSER AND COMBUSTOR − ASSEMBLY−01 • 72−41−00−400−001: Assemble The Diffuser And Combustor • 72−41−00−400−001−A: Assemble The Diffuser And Combustor
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72−41−00	DIFFUSER AND COMBUSTOR − ASSEMBLY−05 • 72−41−00−400−004: Assemble No. 3 Bearing Duct And Housing − Procedure Not Requiring No. 3 Bearing Outer Race Installation
72−41−07	NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY − DISASSEMBLY−01 • 72−41−07−040−001: Disassemble No. 3 Bearing Front (Carbon) Seal Assembly
72−41−07	NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY − ASSEMBLY−01 • 72−41−07−440−001: Assemble No. 3 Bearing Front (Carton) Seal Assembly
72−41−07	NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY − TESTING−01 • 72−41−07−790−001: Leak Check No. 3 Bearing Front (Carbon) Seal Assembly
72−41−08	NO. 3 BEARING (FRONT) SEAL RING HOLDER ASSEMBLY − DISASSEMBLY−01 • 72−41−08−040−001: Disassemble The No. 3 Bearing (Front) Seal Ring Holder Assembly
72−41−08	NO. 3 BEARING (FRONT) SEAL RING HOLDER ASSEMBLY − ASSEMBLY−01 • 72−41−08−440−001: Assemble The No. 3 Bearing (Front) Seal Ring Holder Assembly

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72−41−85	NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY − ASSEMBLY−01 • 72−41−85−440−001: Assemble No. 3 Bearing Rear (Carbon) Seal Assembly
72−41−85	NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY − TESTING−01 • 72−41−85−790−001: Leak Check − No. 3 Bearing Rear (Carbon) Seal Assembly

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DIFFUSER AND COMBUSTOR - HOW TO USE MANUAL

Task 72-41-00-990-003:

1. Chapter/Section/Subject Numbering Outline

See Figure 1.

NOTE: See the tab separated How To Use Manual section located at the beginning of this manual set for information concerning Data Location Guidelines and a complete Chapter/Section/Subject numbering outline for all manual sections.

A. The following is a complete listing of the individual Chapter/Section/Subject numbers and specific nomenclatures which have been assigned to the significant Diffuser And Combustor parts.

(1) Numbers which are not assigned are indicated in the list by one of the following terms:

UNASSIGNED - This designation is for numbers intentionally omitted and reserved for possible future use.

NOT USED - This designation is applied to numbers used in other related engine model programs which are not, at this time, applicable to the engine models represented by this manual.

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NOT USED .... 72−41−14

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NO. 3 BEARING PACKING TRANSFER (OIL PRESSURE) TUBE .... 72−41−21

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NO. 3 BEARING (SCAVENGE) TUBE ASSEMBLY .... 72−41−25

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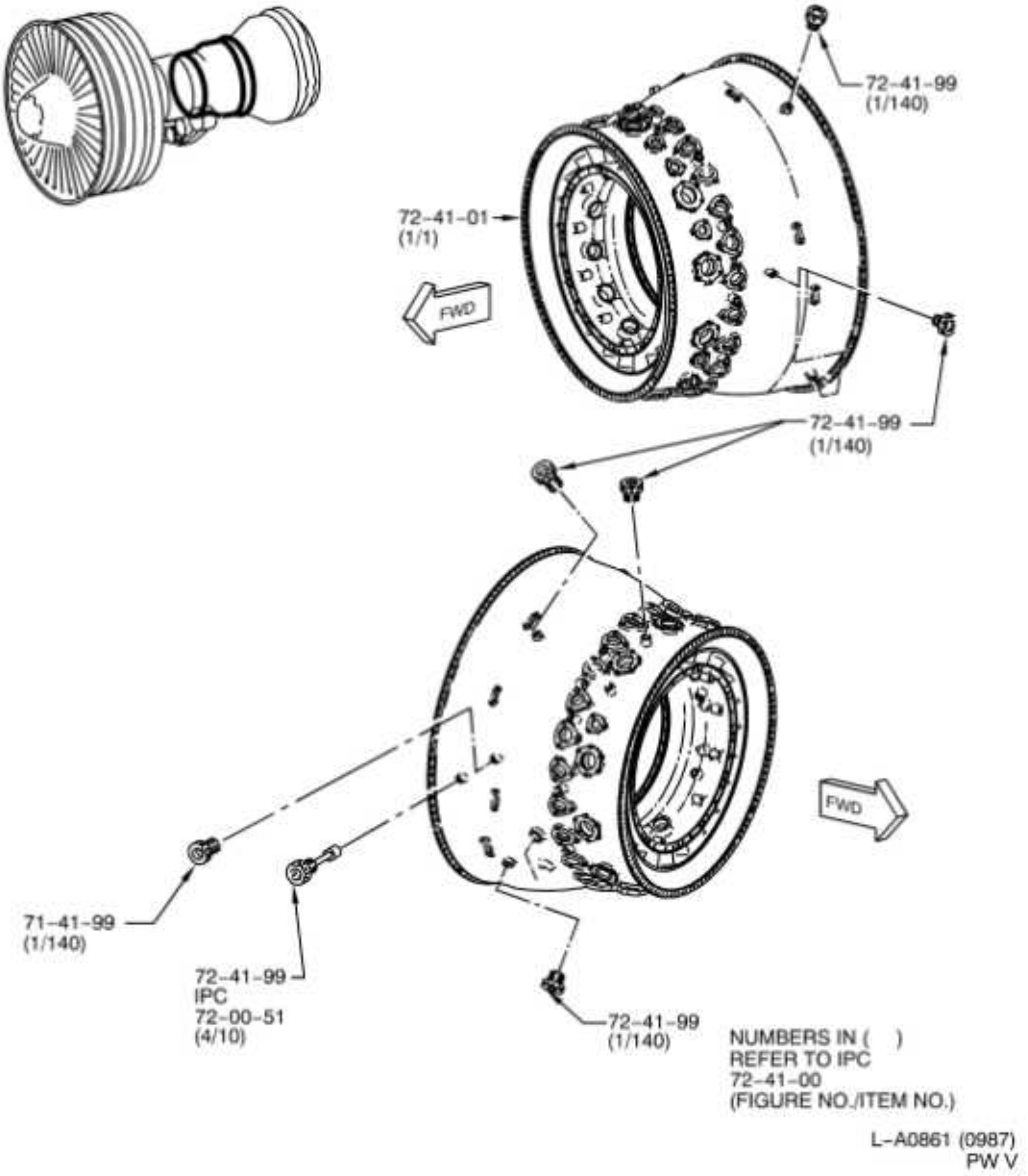
DIFFUSER AND COMBUSTOR − HOW TO USE MANUAL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(FIGURE NO./ITEM NO.)
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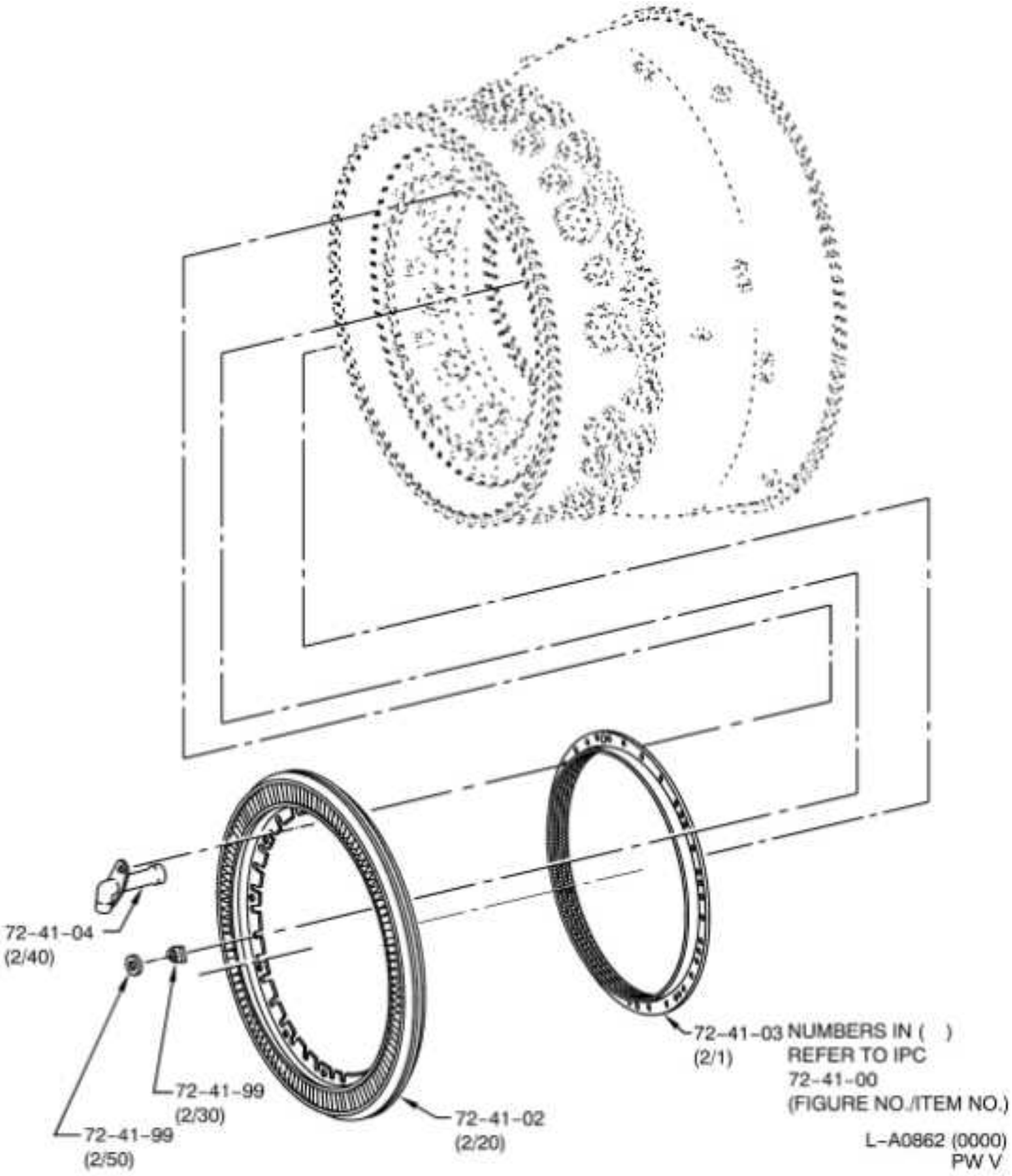
Diffuser And Combustor
Figure 1 (Sheet 1)
(Task 72−41−00−990−003)

DIFFUSER AND COMBUSTOR − HOW TO USE MANUAL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L-A0862 (0000)
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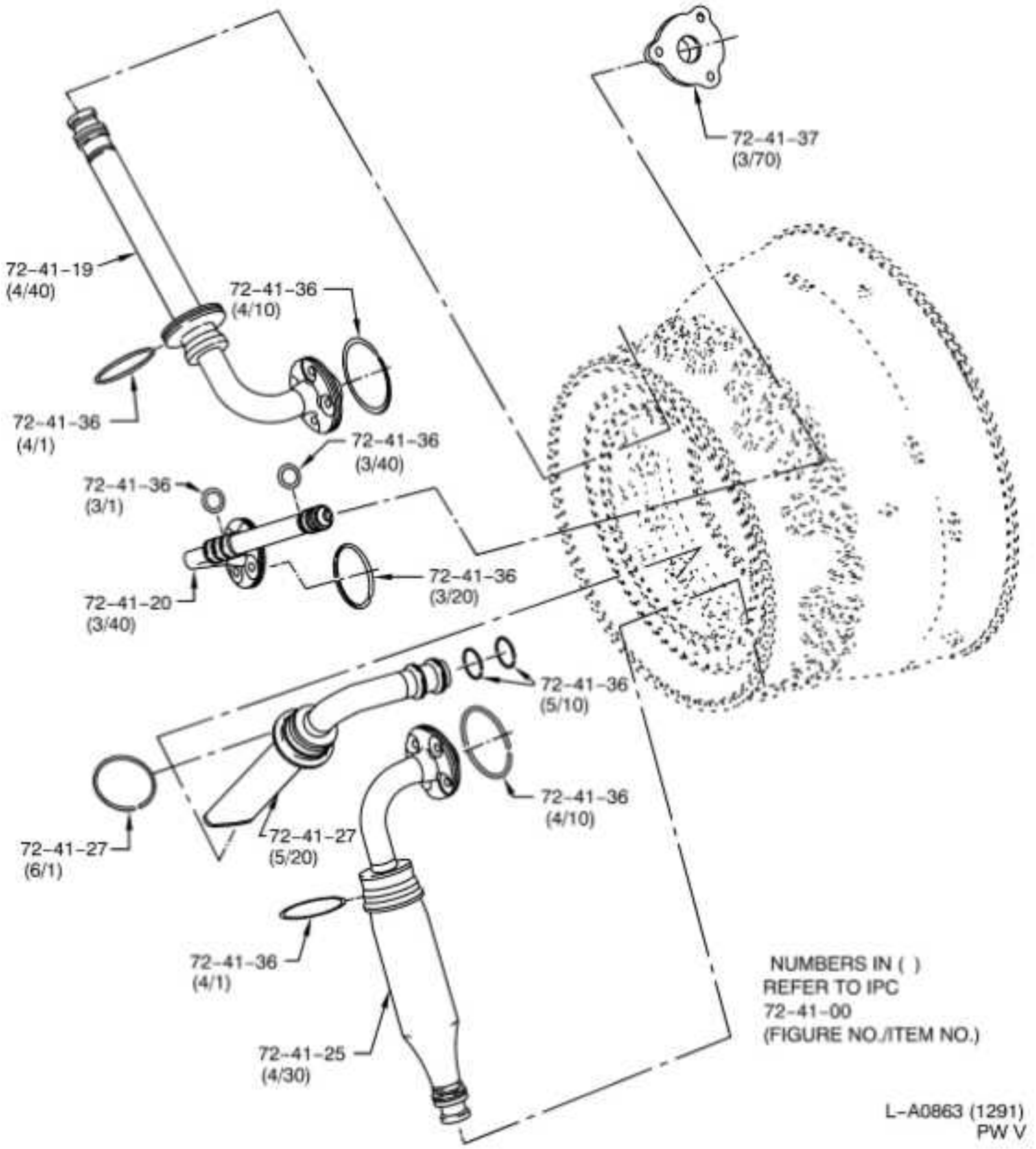
Diffuser And Combustor
Figure 1 (Sheet 2)
(Task 72−41−00−990−003)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L-A0863 (1291)
PW V

NUMBERS IN ( )
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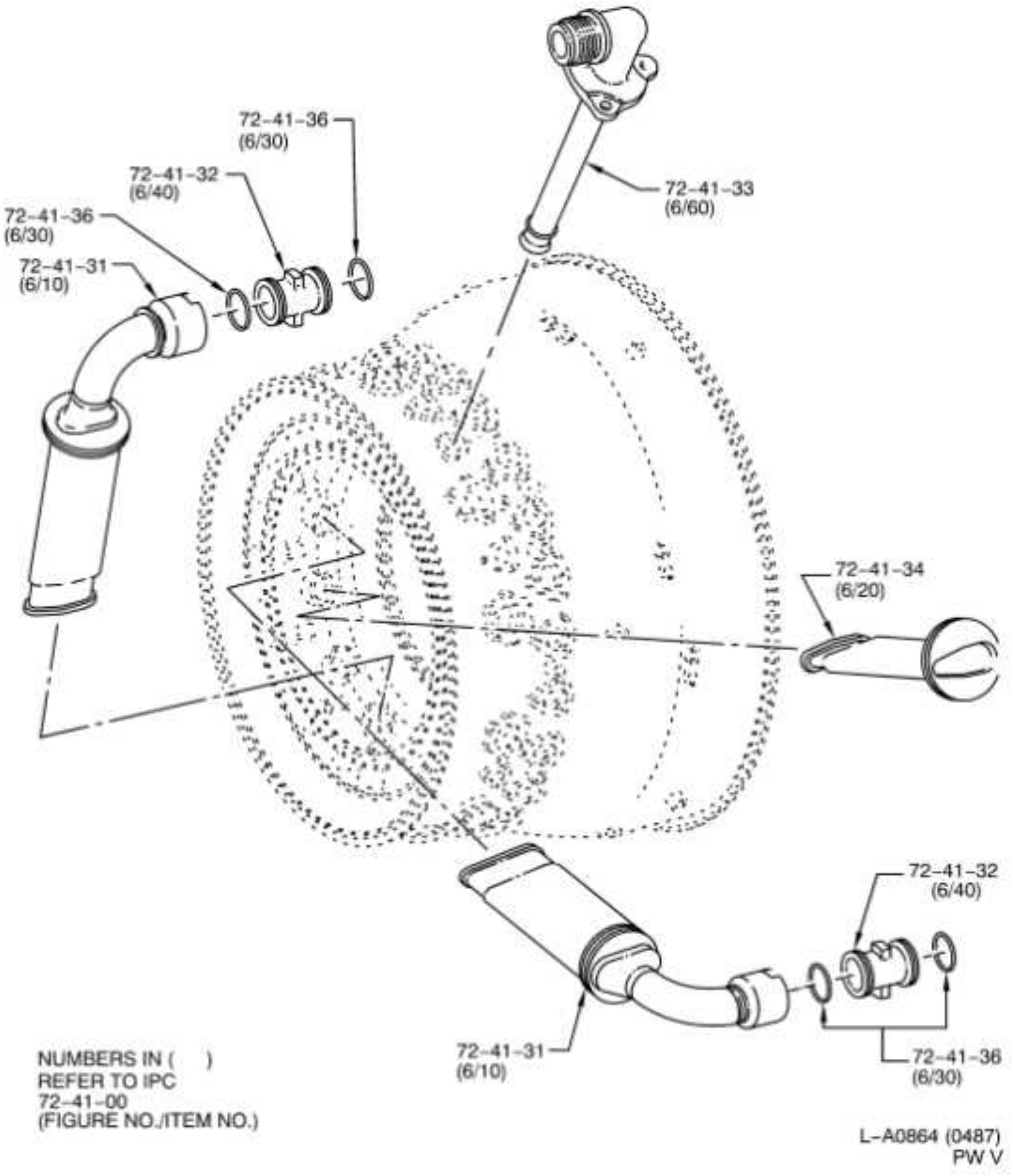
72-41-00
(FIGURE NO./ITEM NO.)

Diffuser And Combustor
Figure 1 (Sheet 3)
(Task 72-41-00-990-003)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(6/30)
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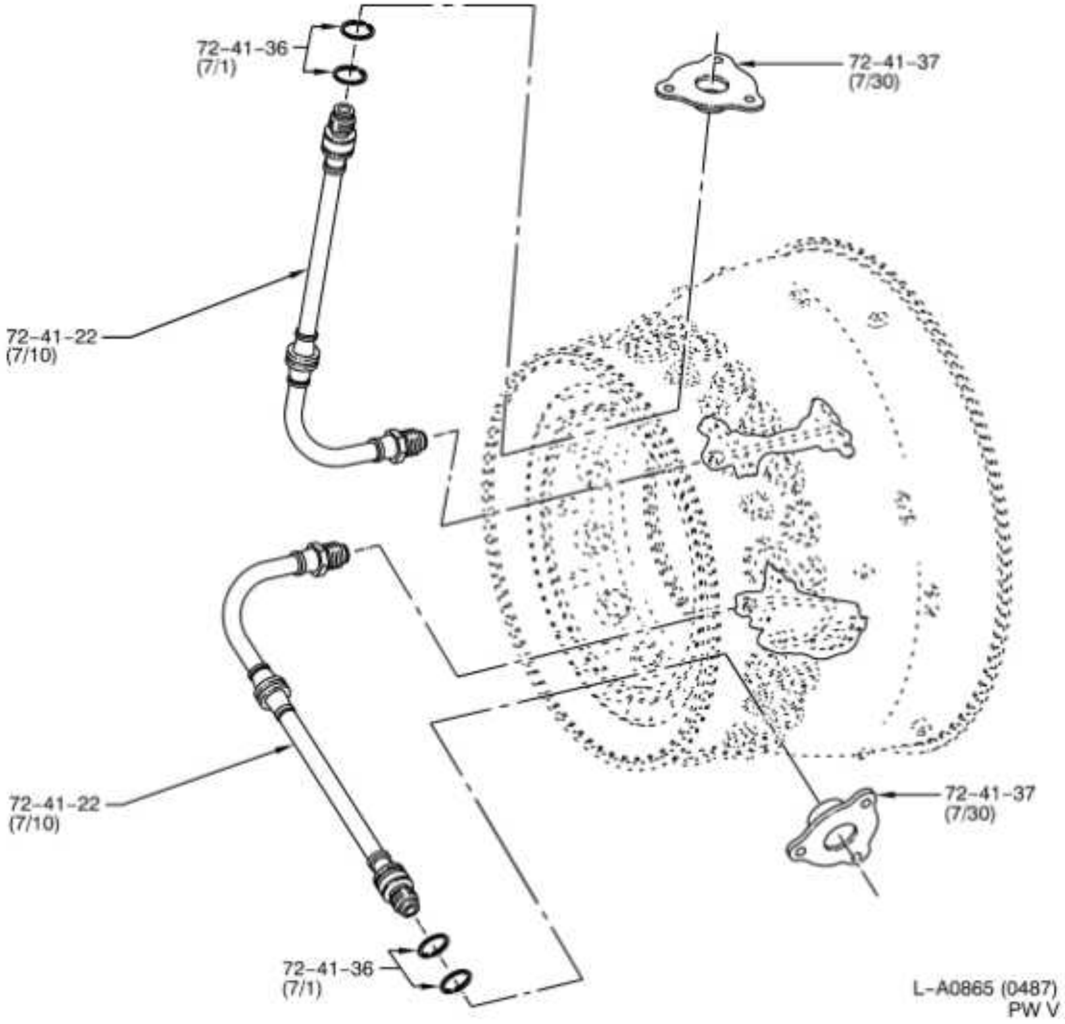
REFER TO IPC
72-41-00
(FIGURE NO./ITEM NO.)
L-A0864 (0487)
PW V

Diffuser And Combustor
Figure 1 (Sheet 4)
(Task 72-41-00-990-003)

DIFFUSER AND COMBUSTOR − HOW TO USE MANUAL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(7/10)
72-41-37
(7/30)
72-41-36
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L-A0865 (0487)
PW V

Diffuser And Combustor
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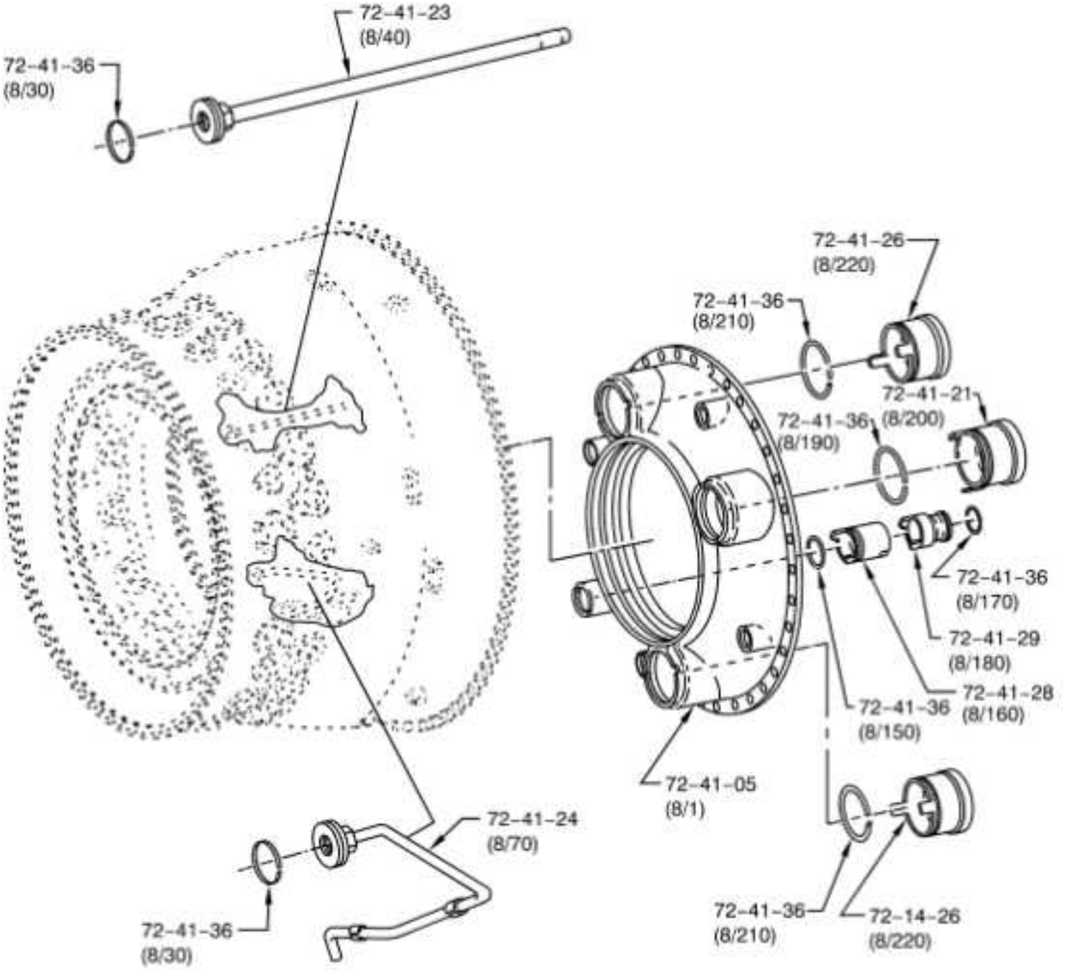
(Task 72−41−00−990−003)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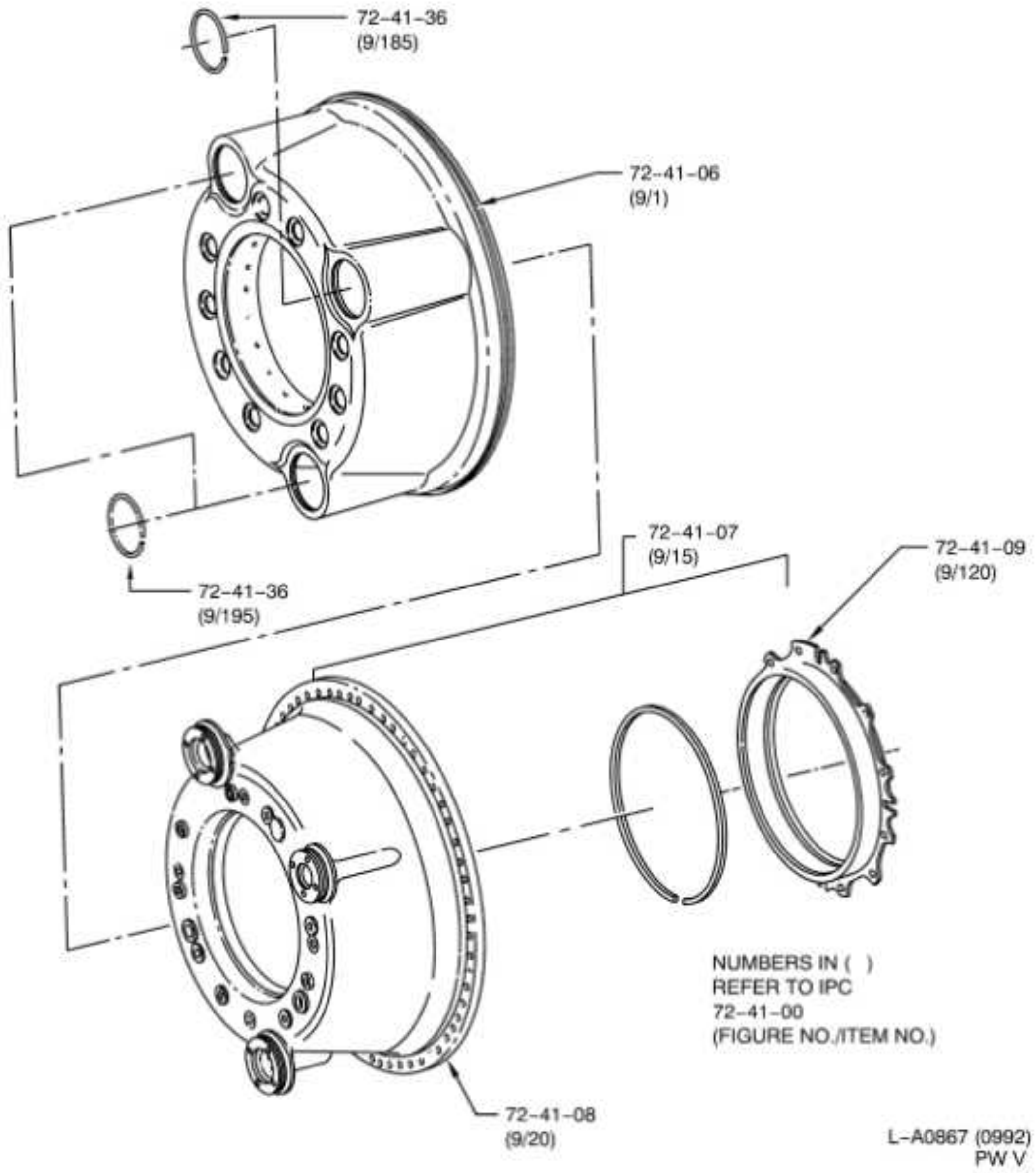
72-41-36
(8/210)
72-14-26
(8/220)

NUMBERS IN ( )
REFER TO IPC
72-41-00
(FIGURE NO./ITEM NO.)

L-A0866 (0487)
PW V

Diffuser And Combustor
Figure 1 (Sheet 6)
(Task 72-41-00-990-003)

DIFFUSER AND COMBUSTOR − HOW TO USE MANUAL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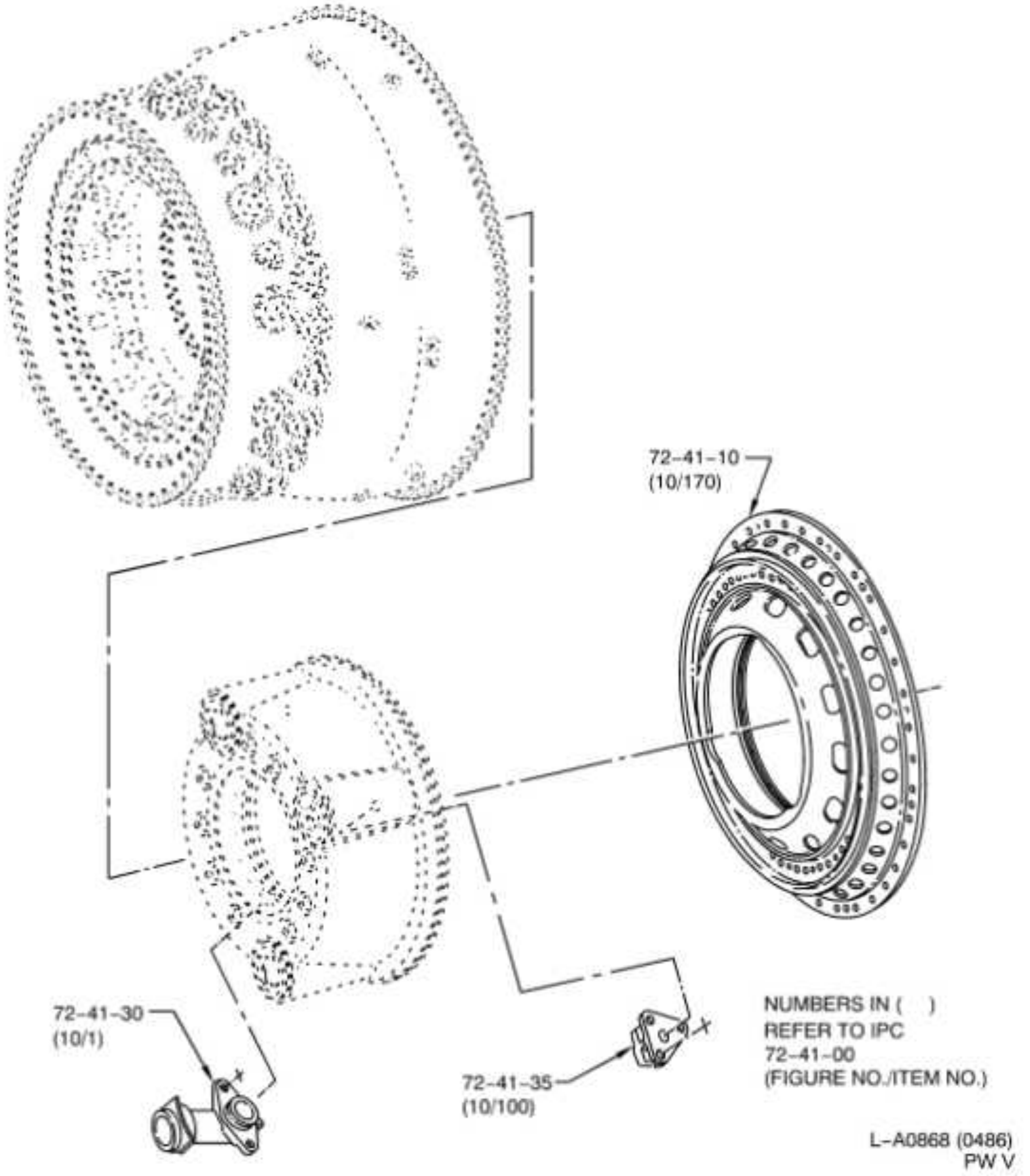
(9/185)
72−41−06
(9/1)
72−41−36
(9/195)
72−41−07
(9/15)
72−41−09
(9/120)
NUMBERS IN ( )
REFER TO IPC
72−41−00
(FIGURE NO./ITEM NO.)
72−41−08
(9/20)
L−A0867 (0992)
PW V

Diffuser And Combustor
Figure 1 (Sheet 7)
(Task 72−41−00−990−003)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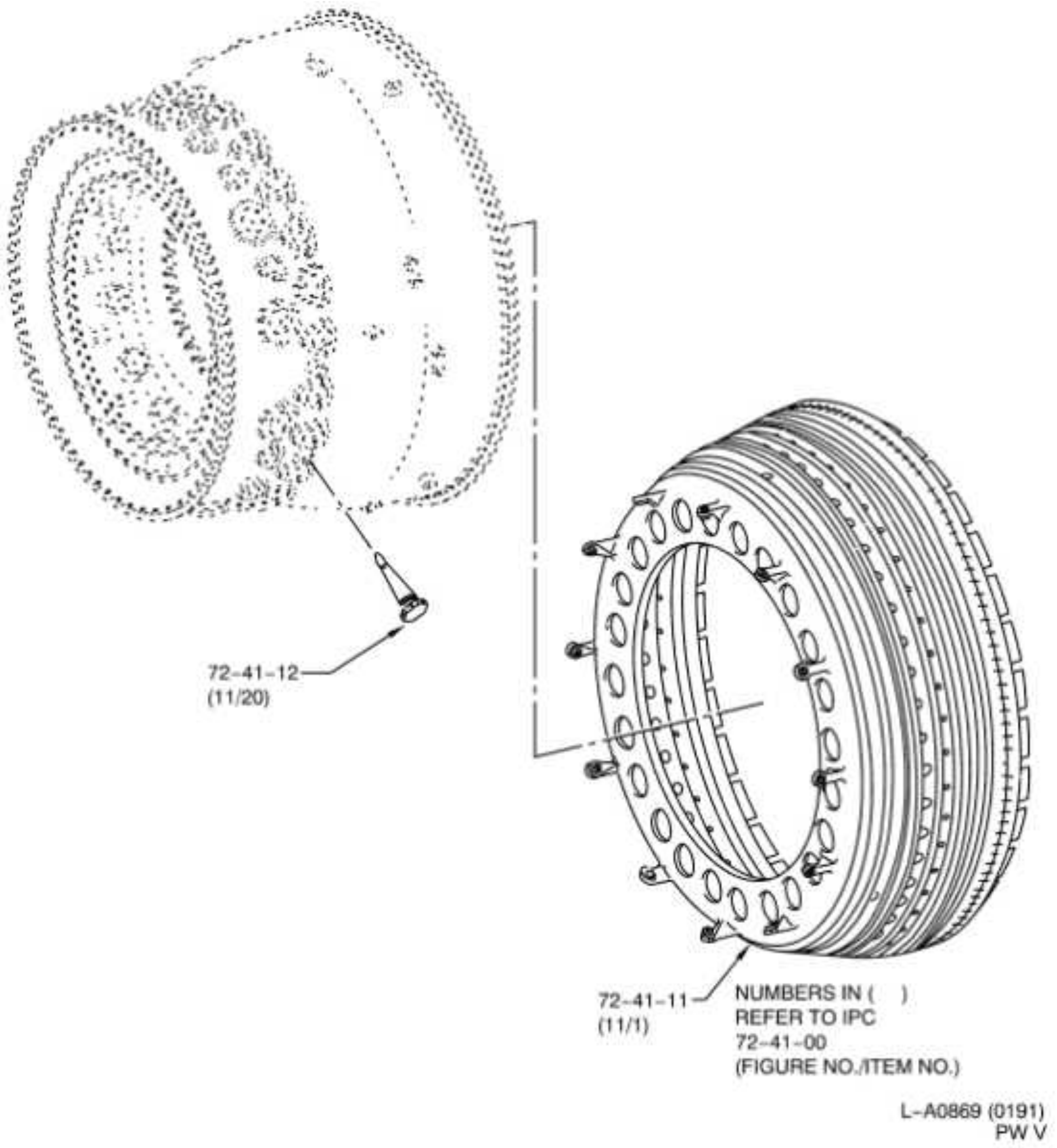
(10/170)
72−41−30
(10/1)
72−41−35
(10/100)
NUMBERS IN ( )
REFER TO IPC
72−41−00
(FIGURE NO./ITEM NO.)
L−A0868 (0486)
PW V

Diffuser And Combustor
Figure 1 (Sheet 8)
(Task 72−41−00−990−003)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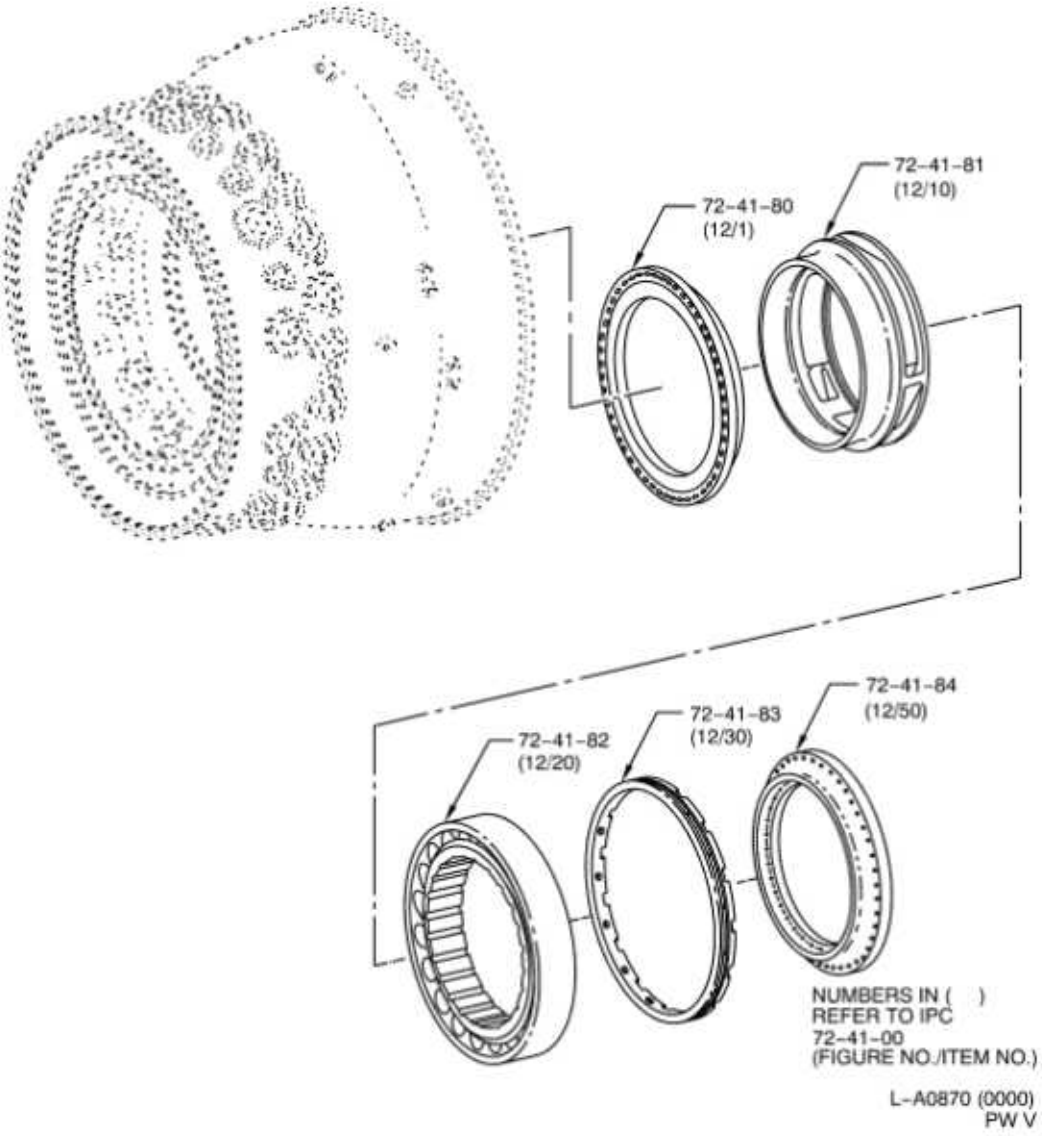
(11/20)
72-41-11
(11/1)
NUMBERS IN ( )
REFER TO IPC
72-41-00
(FIGURE NO./ITEM NO.)
L-A0869 (0191)
PW V

Diffuser And Combustor
Figure 1 (Sheet 9)
(Task 72−41−00−990−003)

DIFFUSER AND COMBUSTOR − HOW TO USE MANUAL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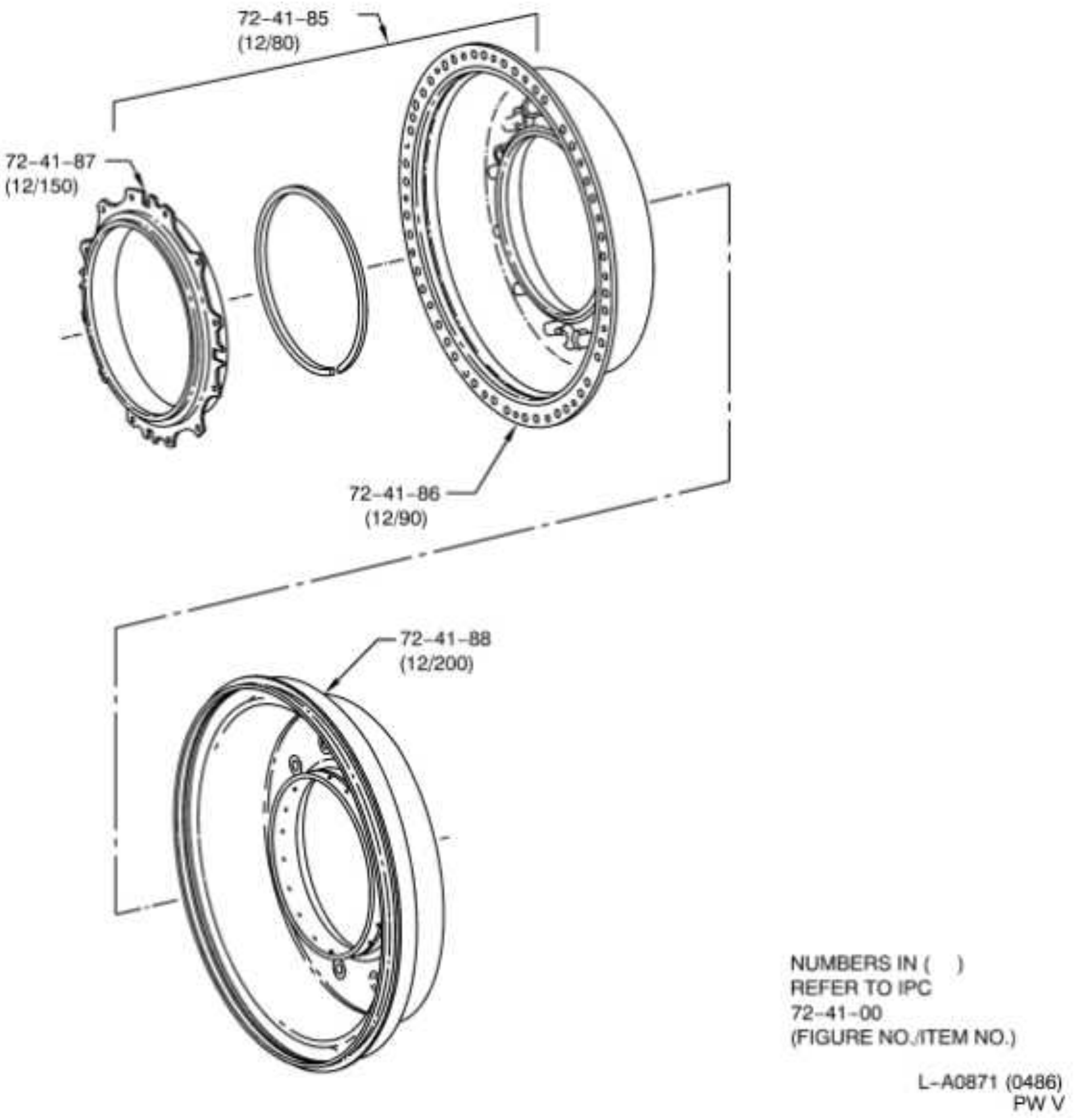
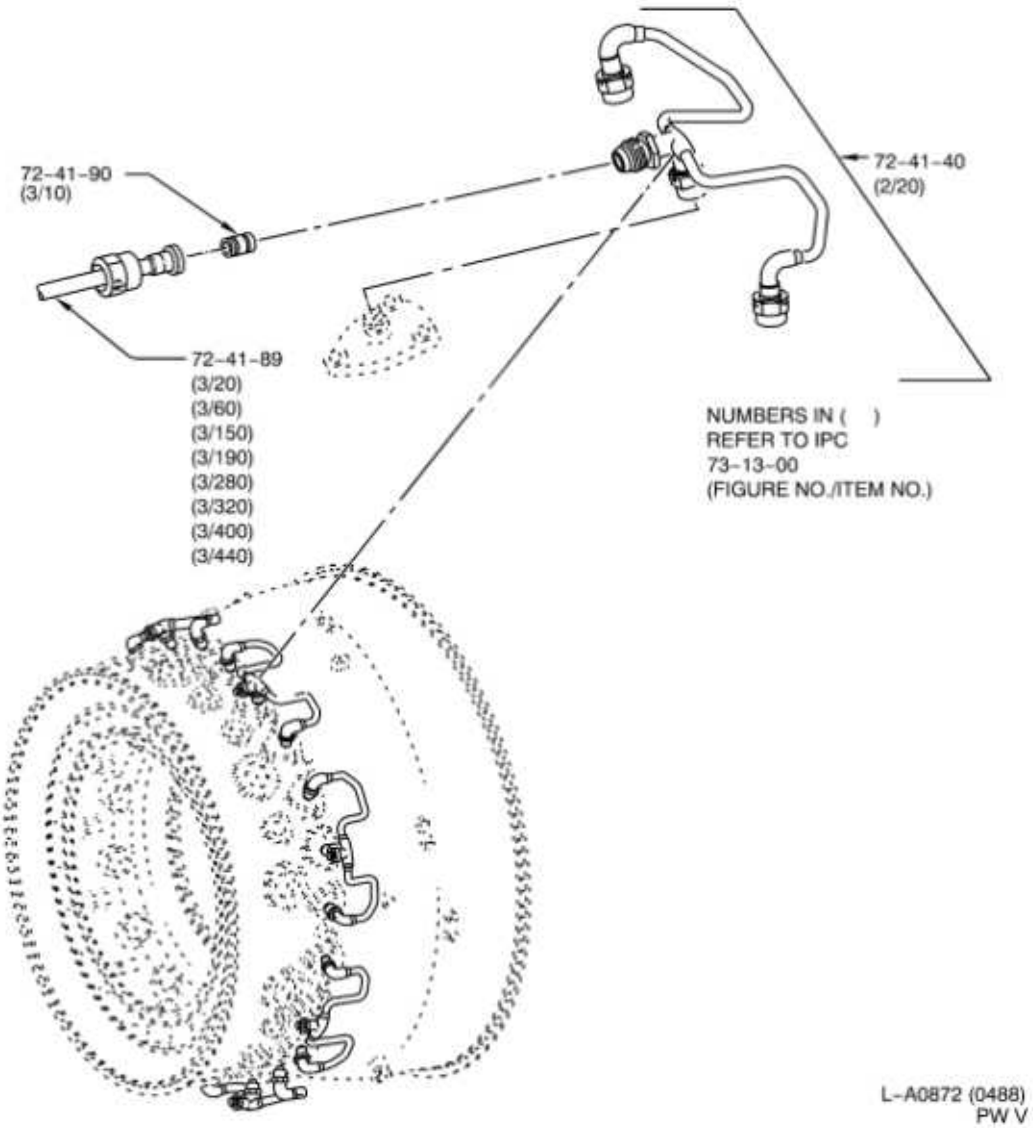
(12/10)
72-41-80
(12/1)
72-41-84
(12/50)
72-41-83
(12/30)
72-41-82
(12/20)
NUMBERS IN ( )
REFER TO IPC
72-41-00
(FIGURE NO./ITEM NO.)
L-A0870 (0000)
PW V

Diffuser And Combustor
Figure 1 (Sheet 10)
(Task 72−41−00−990−003)


72−41−85
(12/80)
72−41−87
(12/150)
72−41−86
(12/90)
72−41−88
(12/200)
NUMBERS IN ( )
REFER TO IPC
72−41−00
(FIGURE NO./ITEM NO.)
L−A0871 (0486)
PW V

Diffuser And Combustor
Figure 1 (Sheet 11)
(Task 72−41−00−990−003)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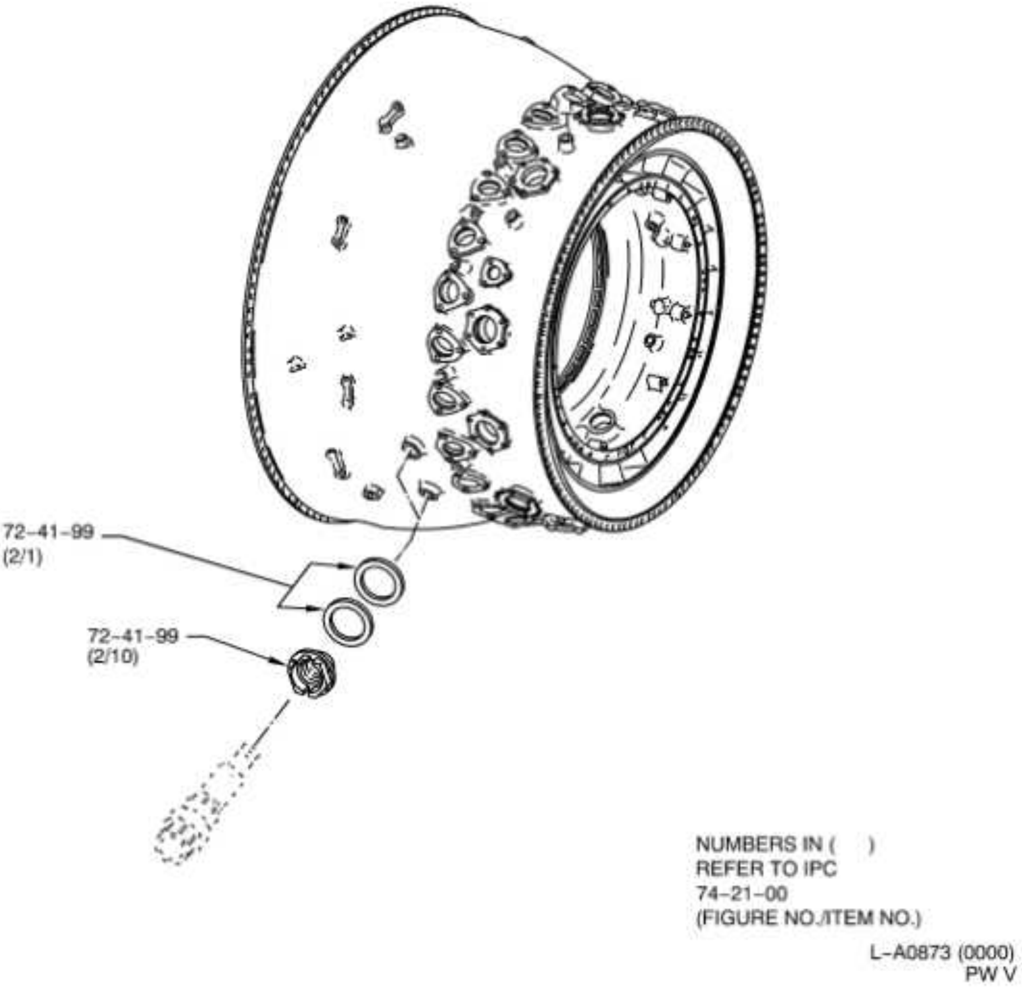
72-41-40
(2/20)
72-41-89
(3/20)
(3/60)
(3/150)
(3/190)
(3/280)
(3/320)
(3/400)
(3/440)
NUMBERS IN ( )
REFER TO IPC
73-13-00
(FIGURE NO./ITEM NO.)
L-A0872 (0488)
PW V

Diffuser And Combustor
Figure 1 (Sheet 12)
(Task 72-41-00-990-003)

DIFFUSER AND COMBUSTOR − HOW TO USE MANUAL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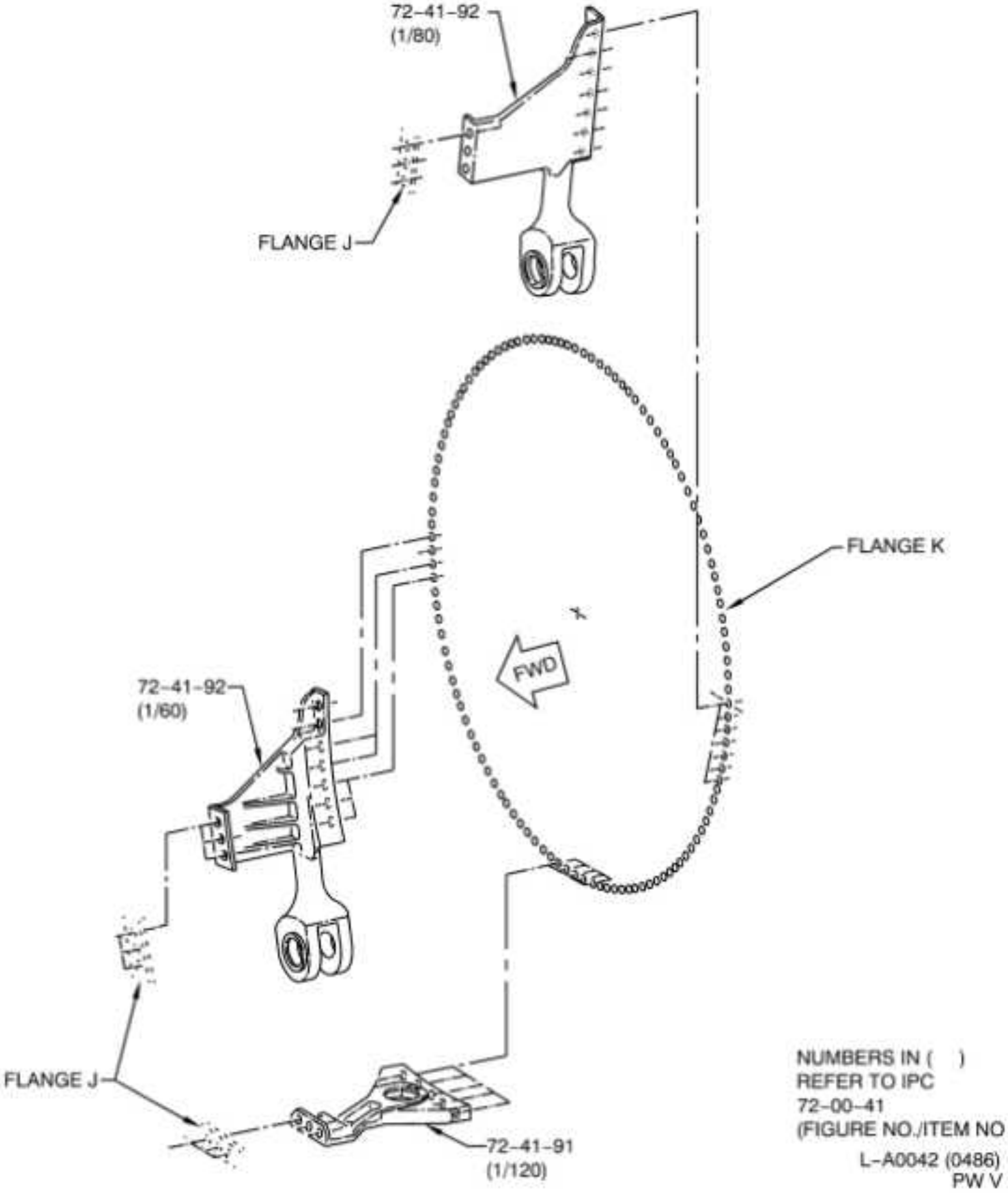
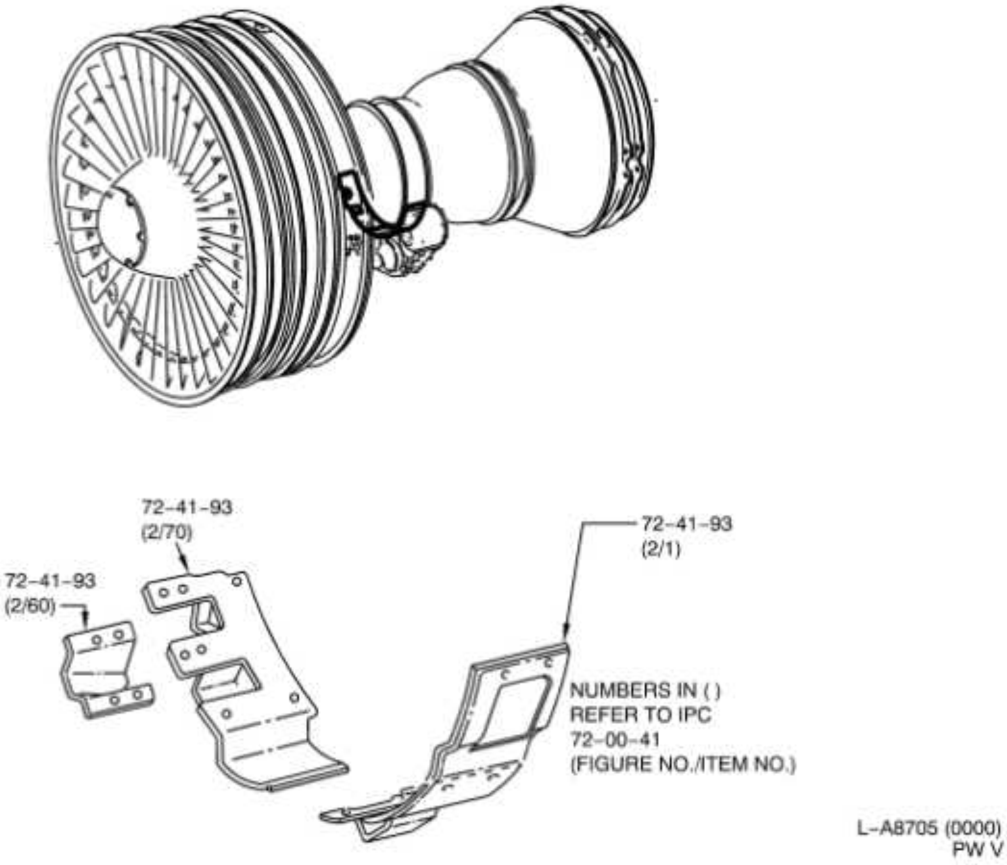
72−41−99
(2/10)
NUMBERS IN ( )
REFER TO IPC
74−21−00
(FIGURE NO./ITEM NO.)
L−A0873 (0000)
PW V

Diffuser And Combustor
Figure 1 (Sheet 13)
(Task 72−41−00−990−003)

DIFFUSER AND COMBUSTOR − HOW TO USE MANUAL


72-41-92
(1/80)
FLANGE J
FLANGE K
FWD
72-41-92
(1/60)
FLANGE J
72-41-91
(1/120)
NUMBERS IN ( )
REFER TO IPC
72-00-41
(FIGURE NO./ITEM NO
L-A0042 (0486)
PW V

Diffuser And Combustor
Figure 1 (Sheet 14)
(Task 72−41−00−990−003)


72−41−93
(2/70)
72−41−93
(2/60)
72−41−93
(2/1)
NUMBERS IN ( )
REFER TO IPC
72−00−41
(FIGURE NO./ITEM NO.)
L−A8705 (0000)
PW V

Diffuser And Combustor
Figure 1 (Sheet 15)
(Task 72−41−00−990−003)

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DIFFUSER AND COMBUSTOR - DESCRIPTION/OPERATION-00

Task 72-41-00-990-002:

1. General

See Figure 1 and Figure 2.

A. Description

(1) The compressed air flows from the exit of the high pressure compressor into the diffuser and combustor section. The airflow is straightened and diffused (allowed to expand) which reduces the velocity and raises the pressure of the airflow prior to entering the combustion chamber. Metered fuel is provided to the combustion chamber through fuel injectors. The fuel and air mixture is burned within the combustion chamber. The heat of the combustion process causes the airflow to expand and accelerate rearward to drive the turbines and produce thrust at the exhaust (jet) nozzle.

(2) The diffuser and combustor section consists of; a cast nickel alloy case, a cast compressor exit (Stage 15) stator assembly, twenty four fuel injector (nozzle) and support assemblies, two igniter plugs, the No. 3 bearing compartment, and the outer combustion chamber (liner) assembly.

B. Operation

(1) Diffuser Case Assembly

(a) The diffuser case is a main structural element for the engine, supporting the No. 3 bearing and rear of the high pressure rotor system. The case is a housing for all of the detail parts of the diffuser and combustor section. The outer wall of the case forms the outer contour of the diffused (expanded) gaspath. This outer wall also contains mounting provisions for the externally removable fuel injectors and the two igniter plugs.

(b) Eight removable plugs in the outer wall of the case provide access for borescope inspection of the compressor exit stator vanes, combustion chamber liners, fuel injectors, stage 1 HPT vane cluster assemblies, and stage 1 HPT blades. Four mounting bosses are provided for connecting to the aircraft pneumatic (service bleed) system.

(c) The inner structure of the case is supported by twenty four integrally cast hollow struts at the forward end. This structure consists of the wall which forms the inner contour of the diffused gaspath and the attachment flange for the No. 3 bearing housing. The structure provides radial load carrying support for the bearing compartment through the struts.

(d) The hollow struts provide radial passages across the gaspath for oil supply, breather, and scavenge tubes and for tubes suppling cooling air to the No. 3 bearing compartment and the high pressure turbine.

(2) Compressor Exit Stator Assembly

(a) The compressor exit stator assembly is bolted to a flange in the diffuser case forward of the struts and divergent diffuser airflow nozzle. The stator is an integrally cast vane, shroud, and transition duct assembly.

(b) The vanes straighten the rotational motion of the airflow from the compressor (Stage 15) rotor and direct the airflow axially rearward. The inner and outer shrouds form a transition duct for high pressure compressor discharge gaspath into the diffuser airflow nozzle.

(3) Combustion Chamber (Liner) Assemblies

(a) The combustion chamber assemblies are fabricated in two sections. The inner combustion chamber (liner) assembly is a part of the turbine nozzle section (See 72−51−00, Description And Operation) for assembly purposes. The outer combustion chamber (liner) assembly is a part of this diffuser and combustor section. The two combustor chamber assemblies form a short double pass flow type burner utilizing a welded rolled ring construction for the liner sections and a cast forward bulkhead. The inner surfaces which are exposed to combustion gasses are coated with a magnesium zirconate material as a thermal barrier protection.

(b) The outer chamber is retained to the outer wall of the diffuser case at the forward end by twelve doweled end bolts. The rear of the chamber is positioned and retained to the turbine nozzle by a guide and circumferential clamp assembly. The guide and clamp assembly is adjusted during assembly to provide a slip−fit sealing feature with the outer diameter of the combustion chamber.

(c) The combustion chamber provides mixing of the fuel from the fuel injectors with the proper amount of air for optimum combustion. Combustion of the fuel is contained within the forward and middle section of the chamber, rearward of the fuel injector nozzles. The rear portion of the chamber allows for complete mixing of the remaining airflow with the hot combustion gases and for the transition to the turbine nozzle.

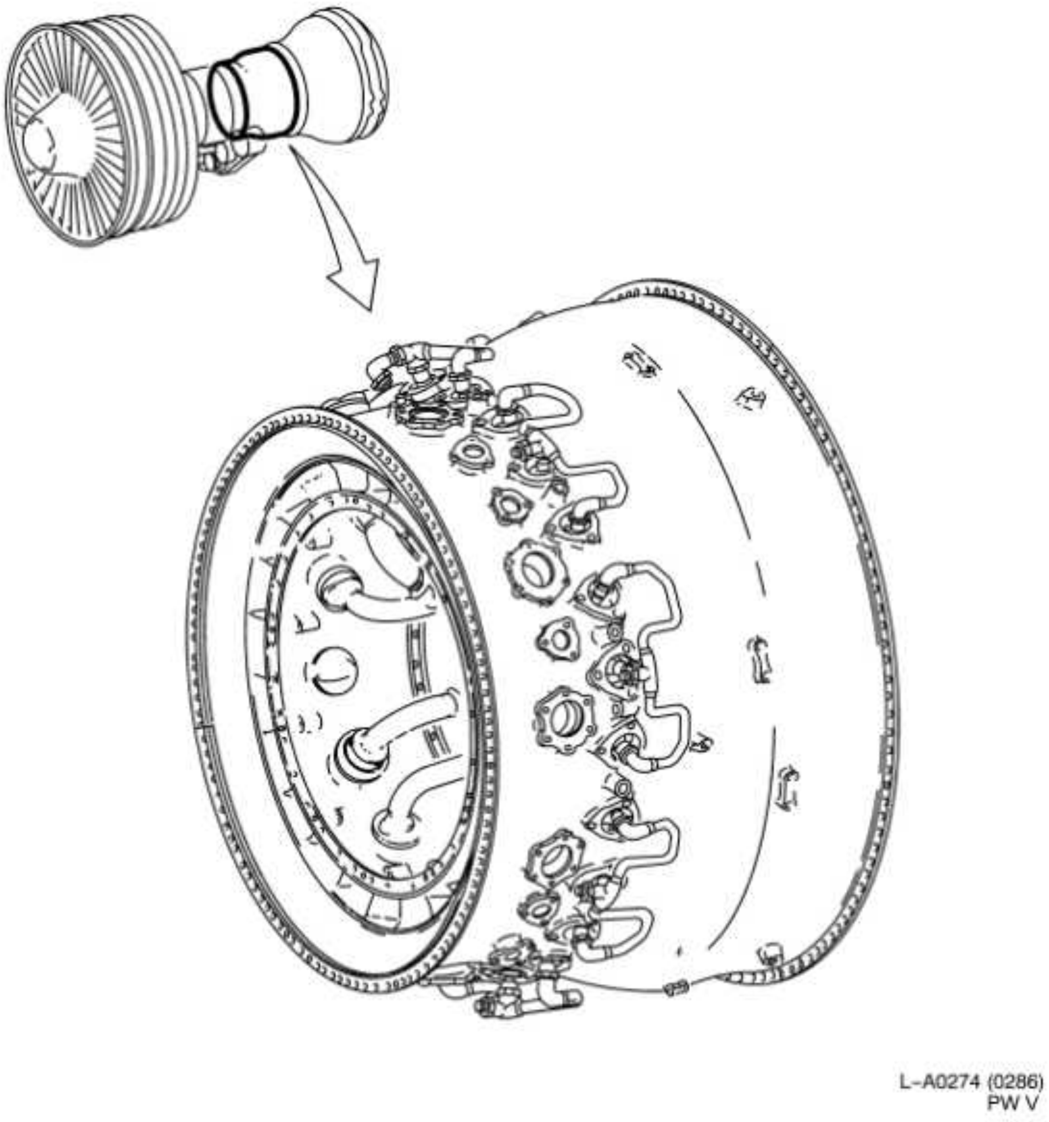
(4) No. 3 Bearing And Compartment

(a) The No. 3 bearing is a roller type bearing with a one piece inner and one piece outer race. The individual rollers are positioned to the inner race by a retainer device.

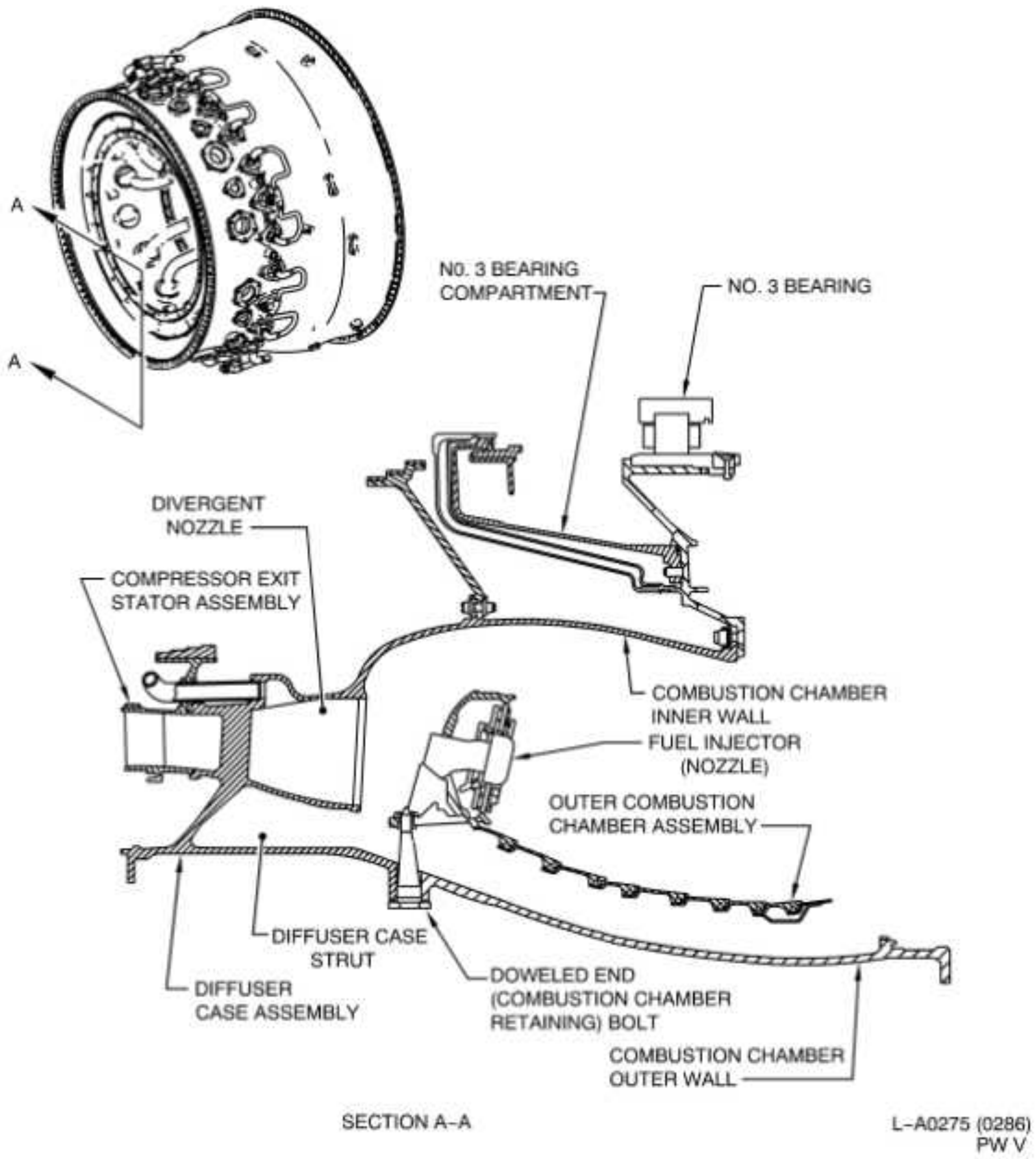
(b) The No. 3 bearing compartment consists of the front (spring loaded) carbon seal assembly, the bearing housing, and the rear (spring loaded) carbon seal assembly. The bearing housing is attached to the inner rear flange of the diffuser case. The front and rear carbon seal assemblies are bolted to the bearing housing.

(c) The carbon seal assemblies form the compartment oil sump. The nozzle which supplies oil to the bearing and seals is attached to the front seal assembly.

(d) The bearing compartment is provided with a heat shield duct which is supplied with precooled stage 12 high compressor air.



Diffuser And Combustor
Figure 1
(Task 72−41−00−990−002)


A
A
N0. 3 BEARING COMPARTMENT
NO. 3 BEARING
DIVERGENT NOZZLE
COMPRESSOR EXIT STATOR ASSEMBLY
COMBUSTION CHAMBER INNER WALL
FUEL INJECTOR (NOZZLE)
OUTER COMBUSTION CHAMBER ASSEMBLY
DIFFUSER CASE STRUT
DIFFUSER CASE ASSEMBLY
DOWELED END (COMBUSTION CHAMBER RETAINING) BOLT
COMBUSTION CHAMBER OUTER WALL
SECTION A−A
L−A0275 (0286)
PW V

Diffuser And Combustor
Figure 2
(Task 72−41−00−990−002)

Previous Pageblock Return to Previous Menu Next Pageblock

DIFFUSER AND COMBUSTOR - REMOVAL-01

Task 72-41-00-030-004:

1. Remove The No. 3 Roller Bearing Outer Race - Diffuser And Combustor

A. Equipment And Materials Required

Special Tools:

PWA 25039	Stand
PWA 28657	Sling
PWA 76154	Adapter (Two Necessary)
PWA 80178	Multiplier, Torque
PWA 85044	Stand, Build (Optional To PWA 86508)
PWA 85168	Protector
PWA 85751	Bracket (Two Necessary)
PWA 86489	Puller
PWA 86491	Driver, Torque
PWA 86508	Stand, Build
PWA 102743	Adapter, Torque
PWA 102744	Adapter, Holder

B. Procedure

Subtask 72-41-00-030-072:

(1) Install the case in a stand as follows. See Figure 301 and Figure 302.

(a) Install two PWA 85751 Handling Brackets on the diffuser case as follows.

1 With a hoist, lift a bracket. Install the detail pins of the bracket in boltholes in the front flange of the diffuser case at 3 or 9 o'clock. Attach the rear flange of the bracket to the rear flange of the diffuser case with the detail nuts and bolts.

2 Attach the spool to the bracket in the "MODULE" holes.

3 Install the other bracket at 3 or 9 o'clock, as applicable.

WARNING: TWO OPERATORS ARE NECESSARY WHEN YOU TRUNNION THE CASE IN THE STAND. WHEN YOU REMOVE THE BALL LOCK PIN, IT IS POSSIBLE

FOR THE CASE TO TRUNNION BY ITSELF AND CAUSE INJURY.

(b) With a hoist, PWA 28657 Sling, and two PWA 76154 Adapters at the outer spools of PWA 85751 Brackets, install the diffuser and combustor in PWA 25039 Stand, PWA 85044 Stand or PWA 86508 Stand.

Subtask 72−41−00−030−073:

(2) Remove the No. 3 bearing (outer race) retaining nut as follows. See Figure 303.

(a) Install six workbolts, lubricated with Engine Oil P03−001, in the boltholes in the OD flange of the bearing housing. Install them at equal distances from each other. Torque the workbolts to 290 − 325 lb−in. (32.766 − 36.720 N.m).

NOTE: The workbolts must be quality standard bolts that are .375−24 X 1.00 inch (25.400 mm).

(b) Install PWA 85168 Protector in the diffuser and combustor. Install the small end first.

(c) Remove and discard the rivet from the nut.

(d) Install PWA 86491 Driver on the No. 3 bearing housing, with the teeth of the tool in the slots of the nut. Attach the driver to the housing with the detail cap screws.

(e) Mechanical Wrench Method (Optional) − See Figure 303, Sheet 2.

1 Install PWA 102743 Torque Adapter (303/3) to engage the slots in the retaining nut.

2 Install PWA 102744 Holder Adapter (303/4) over PWA 102743 Torque Adapter (303/3) and attach it to the bearing housing with the four detail bolts. Tighten the bolts.

3 Install PWA 80187 Torque Multiplier (303/5) to engage both PWA 102743 Torque Adapter (303/3) and PWA 102744 Holder Adapter (303/4).

(f) Loosen the bearing retaining nut. Remove the nut.

Subtask 72−41−00−030−074:

(3) Remove the No. 3 roller bearing outer race. Use PWA 86489 Puller as follows.

(a) Turn the large hex head cap screw clockwise for the full length of the screw.

(b) Turn the three hand knobs counterclockwise for the full length of the stems of the knobs.

(c) Install the puller in the bearing housing. The jaws must align with the scallops in the housing.

(d) Carefully and equally, turn the hand knobs clockwise until the jaws fully engage the scallops of the bearing housing.

(e) Turn the large hex head cap screw counterclockwise until the outer race is free.

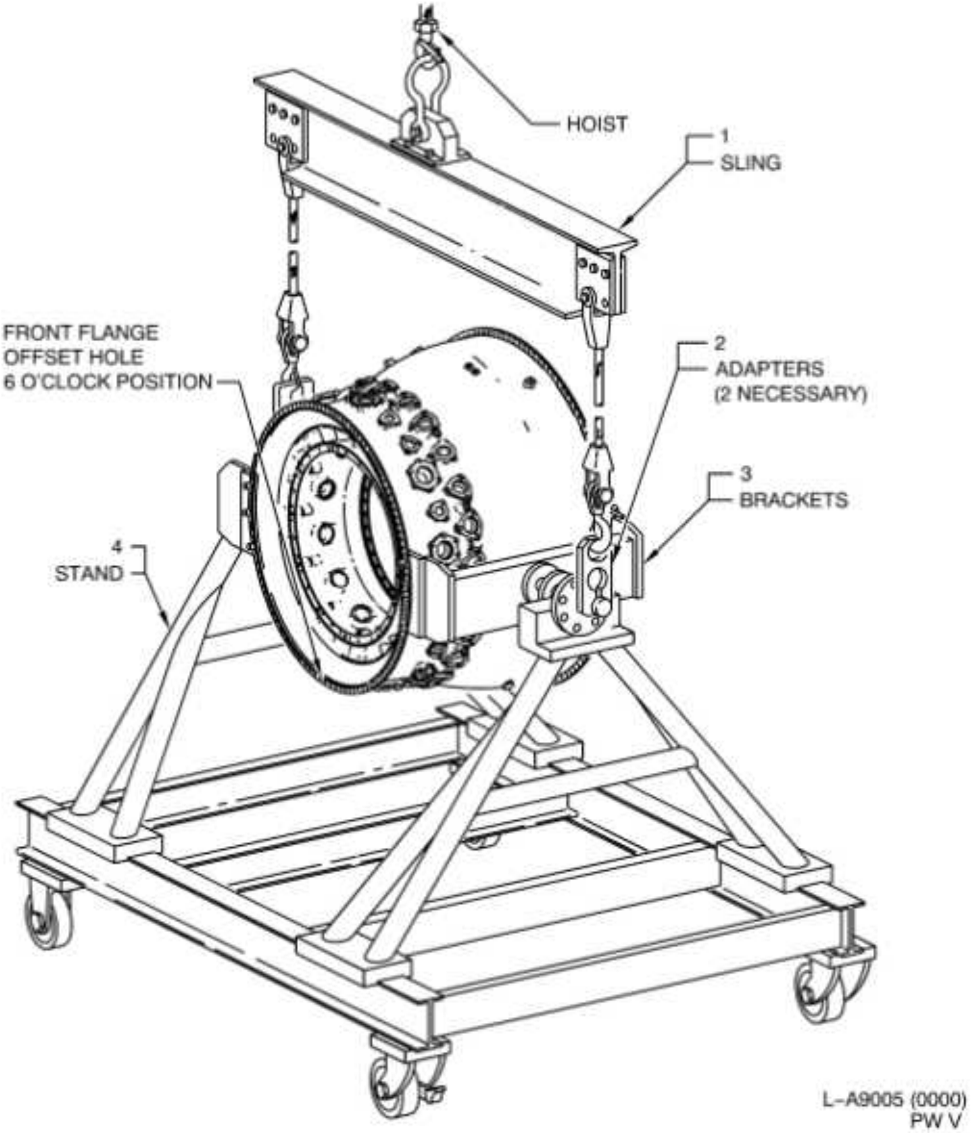
CAUTION: YOU MUST WEAR CLEAN, LINT FREE GLOVES WHEN YOU TOUCH BEARINGS. IF NOT YOU WILL CAUSE DAMAGE TO THE BEARINGS.

CAUTION: YOU MUST KEEP THE BEARING OUTER RACE WITH THE MATING BEARING INNER RACE AND ROLLERS IN A CONTAINER.

(f) Remove the bearing outer race.

(4) Remove the protector and the workbolts. Install the protector.

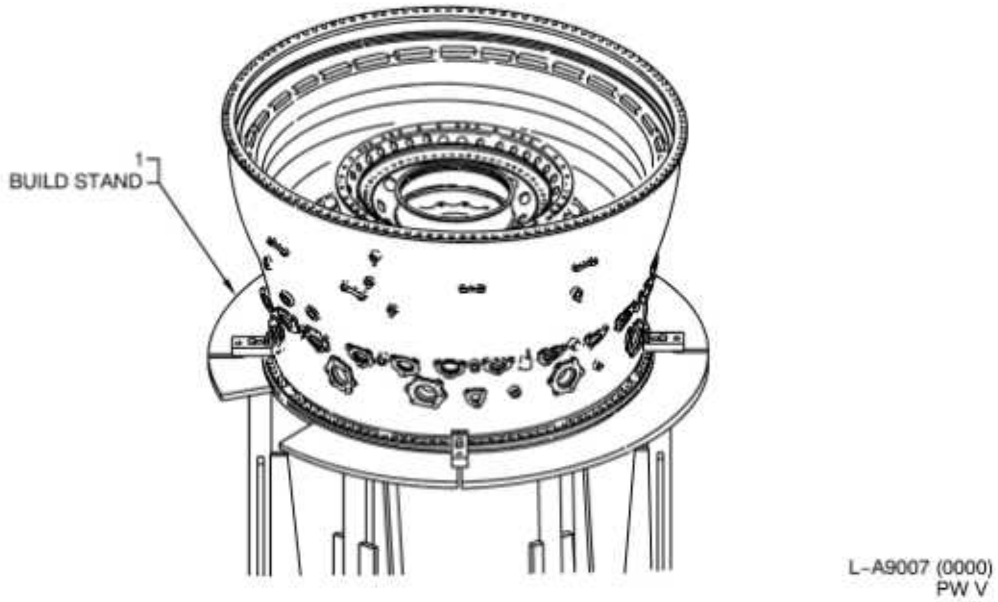
DIFFUSER AND COMBUSTOR - REMOVAL-01


HOIST
1
SLING
FRONT FLANGE
OFFSET HOLE
6 O'CLOCK POSITION
2
ADAPTERS
(2 NECESSARY)
3
BRACKETS
4
STAND
L-A9005 (0000)
PW V

1. PWA 28657
2. PWA 76154
3. PWA 85751
4. PWA 25039

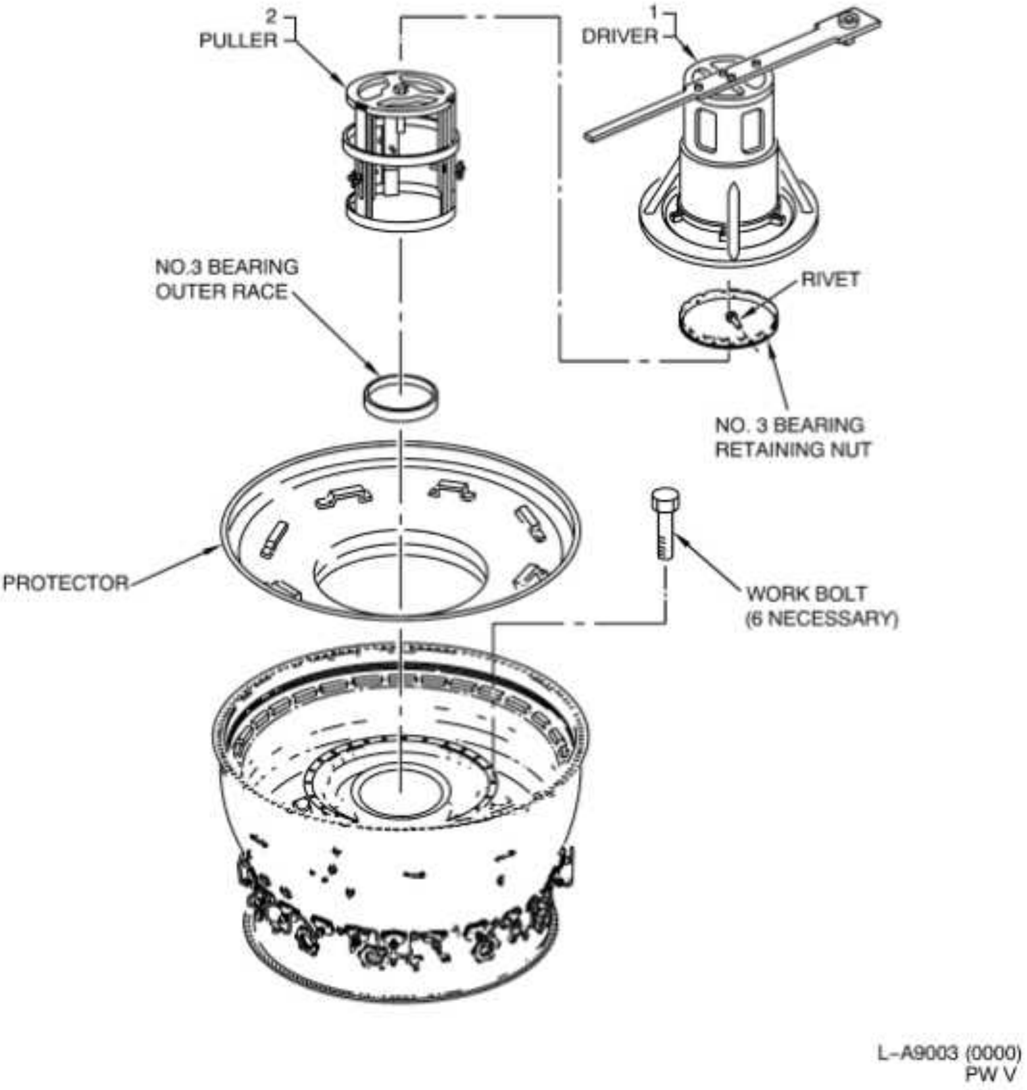
Removal Of The No. 3 Bearing Outer Race
Figure 301
(Task 72-41-00-030-004)

DIFFUSER AND COMBUSTOR − REMOVAL−01


1
BUILD STAND
L−A9007 (0000)
PW V

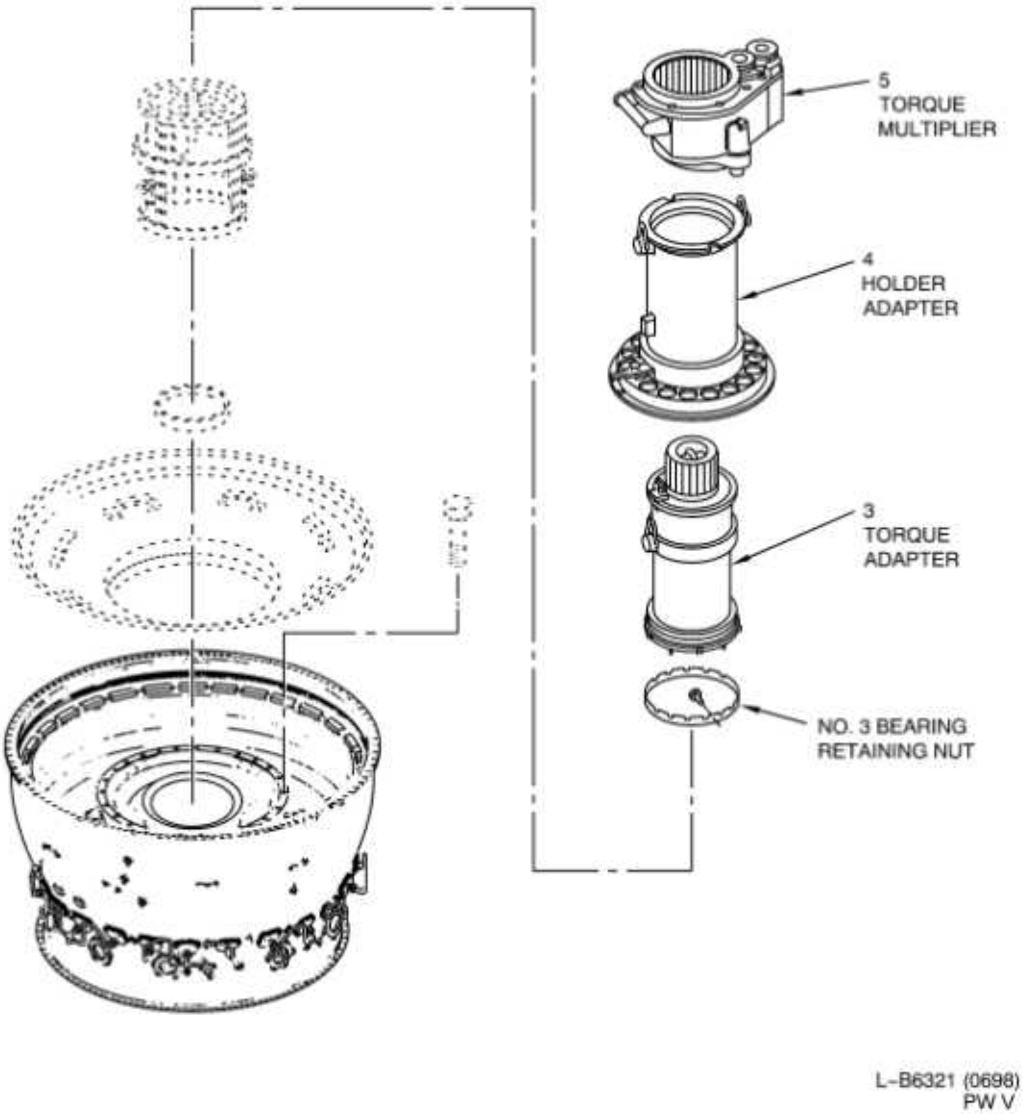
1. PWA 85044 Or PWA 86508

Removal Of The No. 3 Bearing Outer Race
Figure 302
(Task 72−41−00−030−004)


2
PULLER
1
DRIVER
RIVET
NO.3 BEARING
OUTER RACE
NO. 3 BEARING
RETAINING NUT
PROTECTOR
WORK BOLT
(6 NECESSARY)
L−A9003 (0000)
PW V

1. PWA 86491
2. PWA 86489

Removal Of The No. 3 Bearing Outer Race
Figure 303 (Sheet 1)
(Task 72−41−00−030−004)


5
TORQUE
MULTIPLIER
4
HOLDER
ADAPTER
3
TORQUE
ADAPTER
NO. 3 BEARING
RETAINING NUT
L-B6321 (0698)
PW V

3. PWA 102743
4. PWA 102744
5. PWA 80187

Removal Of The No. 3 Bearing Outer Race
Figure 303 (Sheet 2)
(Task 72-41-00-030-004)

DIFFUSER AND COMBUSTOR - INSTALLATION-01

Task 72-41-00-430-001:

1. Install The No. 3 Roller Bearing Outer Race - Diffuser And Combustor

A. Prerequisites

(1) See 72-41-00, Inspection/Check-04 Task 72-41-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a referenced number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials

Special Tools:

PWA 25039	Stand
PWA 28657	Sling
PWA 29754	Control, Heater
PWA 76154	Adapter (Two Necessary)
PWA 80187	Multiplier, Torque
PWA 85044	Stand (Optional to PWA 86508)
PWA 85168	Protector
PWA 85679	Heater (Optional To PWA 85795)
PWA 85751	Bracket (Two Necessary)
PWA 85795	Heater
PWA 85901	Riveter, Hand
PWA 86491	Driver, Torque
PWA 86508	Build Stand
PWA 87433	Drift
PWA 102743	Adapter, Torque
PWA 102744	Adapter, Holder

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-026	Ink, Marking (PMC 4057-1)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Rivet	1	72-41-00/12/40

C. Procedure

DIFFUSER AND COMBUSTOR − INSTALLATION−01

(1) Install the case in a stand as follows. See Figure 401 and Figure 402.

(a) Install two PWA 85751 Handling Brackets on the diffuser case as follows.

1 With a hoist, lift a bracket. Install the four pins in the front flange of the bracket in holes in the front flange of the diffuser case at 3 or 9 o'clock. Attach the rear flange of the bracket to the rear flange of the diffuser case with the detail nuts and bolts.

2 Put the double spool bracket in the "MODULE" holes.

3 Install the other handling bracket at 3 or 9 o'clock, as applicable.

WARNING: TWO OPERATORS ARE NECESSARY WHEN YOU TRUNNION THE CASE IN THE STAND. WHEN YOU REMOVE THE BALL LOCK PIN, IT IS POSSIBLE FOR THE CASE TO TRUNNION BY ITSELF AND CAUSE INJURY.

(b) With a hoist, PWA 28657 Sling, and two PWA 76154 Adapters at the outer spools of PWA 85751 Brackets, install the diffuser and combustor in PWA 25039 Stand, PWA 86508 Stand or PWA 85044 Stand.

CAUTION: THE BEARING OUTER RACE AND THE BEARING INNER RACE AND ROLLERS MUST BE DETAILS OF THE SAME BEARING ASSEMBLY. BE SURE THAT THE OUTER RACE YOU INSTALL NOW AND THE INNER RACE AND ROLLERS THAT YOU WILL INSTALL IN LATER PROCEDURE ARE DETAILS OF THE SAME BEARING ASSEMBLY.

CAUTION: TO PREVENT BEARING DAMAGE, YOU MUST WEAR CLEAN, LINT−FREE GLOVES WHEN YOU TOUCH THE OUTER RACE.

(2) (Dimension D) Measure the thickness of the No. 3 bearing outer race (called outer race). Write this dimension. See Figure 403.

(3) (Dimension E) Measure the distance from the top of the No. 3 bearing housing (called bearing housing) to the shoulder of the housing. Write this dimension.

(4) Find two dimples on the top surface of the threaded ID of the bearing housing. With Marking Ink P05−026, make a mark between the dimples.

(5) Heat the bearing housing as follows.

NOTE: If you use PWA 85679 Heater, you must make and use a heat shield that protects the inner race and rollers.

(a) Install either PWA 85795 Heater or PWA 85679 Heater on the rear flange of the bearing housing. Connect the power and thermocouple cables to PWA 29754 Control.

(b) Set the heater to 300°F (149°C). Heat the housing for 55 − 60 minutes. When the No. 3 bearing housing is at 300°F (148.9°C), turn off the heater. Disconnect the control and remove the heater from the housing.

CAUTION: YOU MUST WEAR CLEAN GLOVES WHEN YOU TOUCH THE OUTER RACE. IF NOT, YOU WILL CAUSE DAMAGE TO TO THE BEARING.

(6) (Reference 1006) Install the outer race, part number up, in the bearing housing. Align the "X" mark on the outer race with the ink mark between the two dimples on the top of the housing.

CAUTION: DO NOT HIT THE BEARING ROLLERS WITH THE DRIFT WHEN YOU INSTALL THE OUTER RACE.

(7) Install PWA 87433 Drift on the outer race and over the bearing housing. Hit the drift lightly with a mallet. Make sure the outer race touches the shoulder of the bearing housing. Remove the drift.

DIFFUSER AND COMBUSTOR − INSTALLATION−01

CAUTION: TO PREVENT AN INCORRECT BEARING OUTER RACE DIMENSIONAL CHECK, THE NO. 3 BEARING HOUSING MUST BE AT ROOM TEMPERATURE. IT IS PERMITTED TO USE SHOP AIR TO COOL THE ASSEMBLY. DO NOT USE DRY ICE.

(8) When the No. 3 roller bearing is at room temperature, do a dimensional check of the location of the outer race.

(a) (Distance F) Measure from the top of the bearing housing to the top of the outer race. Dimension F >= Dimension E − Dimension D

(b) If the equation is not true, the outer race is not correctly installed.

(9) Install six workbolts, lubricated with Engine Oil P03−001, into boltholes in the OD flange of the bearing housing. Install them at equal distances from each other. Torque the workbolts to 290 − 325 lb−in. (32.766 − 36.720 N.m).

NOTE: The workbolts must be quality standard bolts that are .375−24 X 1.00 inch (25.400 mm).

(10) Install PWA 85168 Protector in the diffuser case.

CAUTION: IF THE NUT YOU INSTALL IS NOT NEW, YOU MUST PUT NEW SILVER PLATE ON IT BEFORE YOU INSTALL IT. IF YOU DO NOT, IT WILL CAUSE DAMAGE TO MATING PARTS. TO PLATE THE NUT, REFER TO PW4000 SERIES CIR, PN 51A357.

(11) Install the No. 3 bearing (outer race) retaining nut (called nut) as follows.

(a) Lubricate the No. 3 bearing (outer race) retaining nut (called nut) with Engine Oil P03−001.

(b) Install the nut, slots up, in the bearing housing. Tighten the nut with your hand.

(c) Install PWA 86491 Driver on the bearing housing, with the teeth of the tool in the slots of the nut. Attach the driver to the bearing housing with the detail cap screws.

(d) Mechanical Wrench Method (Optional) − See Figure 403, Sheet 2.

1 Install PWA 102743 Torque Adapter (403/4) to engage the slots in the retaining nut.

2 Install PWA 102744 Holder Adapter (403/4) and attach it to the bearing housing with the four detail bolts. Tighten the bolts.

3 Install PWA 80187 Torque Multiplier (403/6) to engage both PWA 102743 Torque Adapter (403/5) and PWA 102744 Holder Adapter (403/5).

CAUTION: IF, TO INSTALL THIS NUT, YOU MUST TORQUE THE NUT MORE THAN THREE TIMES, YOU MUST REMOVE THE NUT AND PLATE IT AGAIN BEFORE YOU TORQUE IT THE FOURTH TIME. THE MAXIMUM NUMBER OF TIMES YOU CAN TORQUE THE NUT BEFORE IT IS NECESSARY TO REPLATE IT IS THREE. TO PLATE THE NUT, REFER TO PW4000 SERIES CIR, PN 51A357.

(e) (Reference 975) Torque the nut to 3600 − 4400 lb−in. (406.745 − 497.133 N.m).

NOTE: Use a torque wrench with the driver.

(f) (Reference 975) Turn the nut through an angle of 16° − 17° 30'.

NOTE: Use a mallet with the driver.

(g) (Reference 975) Loosen the nut to 0 lb−in. (0 N.m).

(h) (Reference 975) Torque the nut to 3600 − 4400 lb−in. (406.745 − 497.133 N.m).

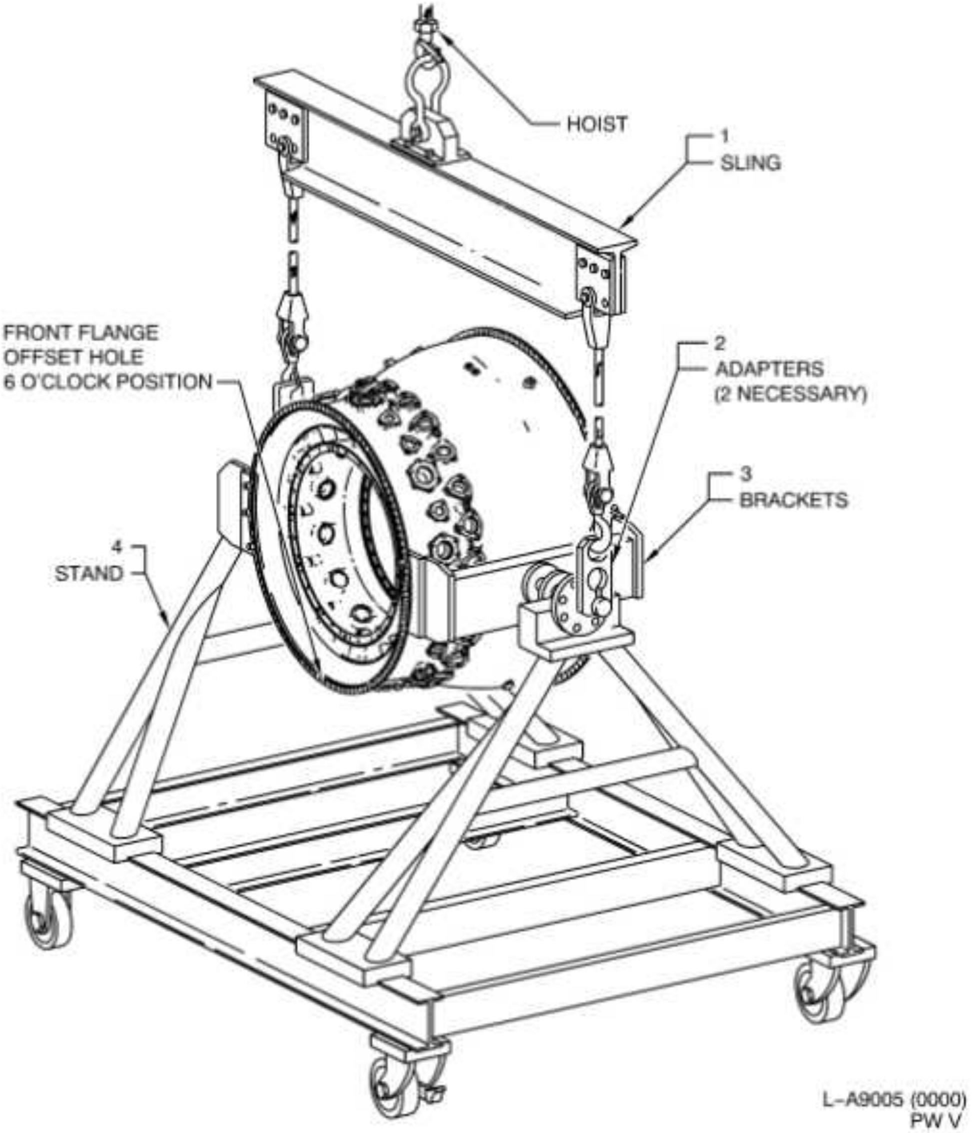
NOTE: Use a torque wrench with the driver.

(i) (Reference 975) Turn the nut through an angle of 16° − 17° 30'. At the same time, align the rivet hole in the nut with the rivet hole in the bearing housing.

(j) Remove the driver. Remove the workbolts.

(k) Install a rivet in the nut. Use PWA 85901 Riveter to flare the rivet.

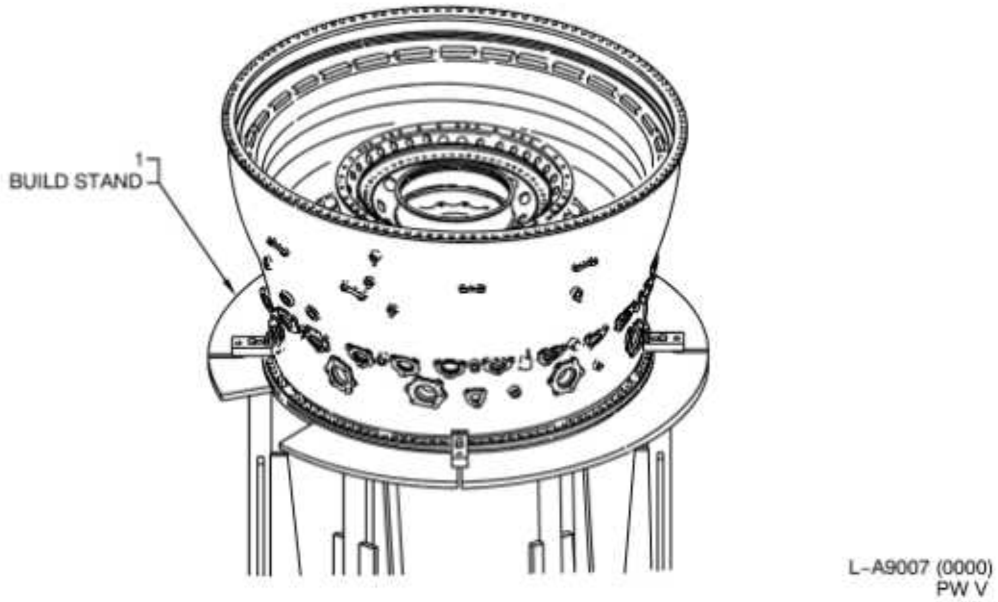
DIFFUSER AND COMBUSTOR − INSTALLATION−01


HOIST
1
SLING
FRONT FLANGE
OFFSET HOLE
6 O'CLOCK POSITION
2
ADAPTERS
(2 NECESSARY)
3
BRACKETS
4
STAND
L−A9005 (0000)
PW V

1. PWA 28657
2. PWA 76154
3. PWA 85751
4. PWA 25039

Diffuser Case Installed In A Stand
Figure 401
(Task 72−41−00−430−001)

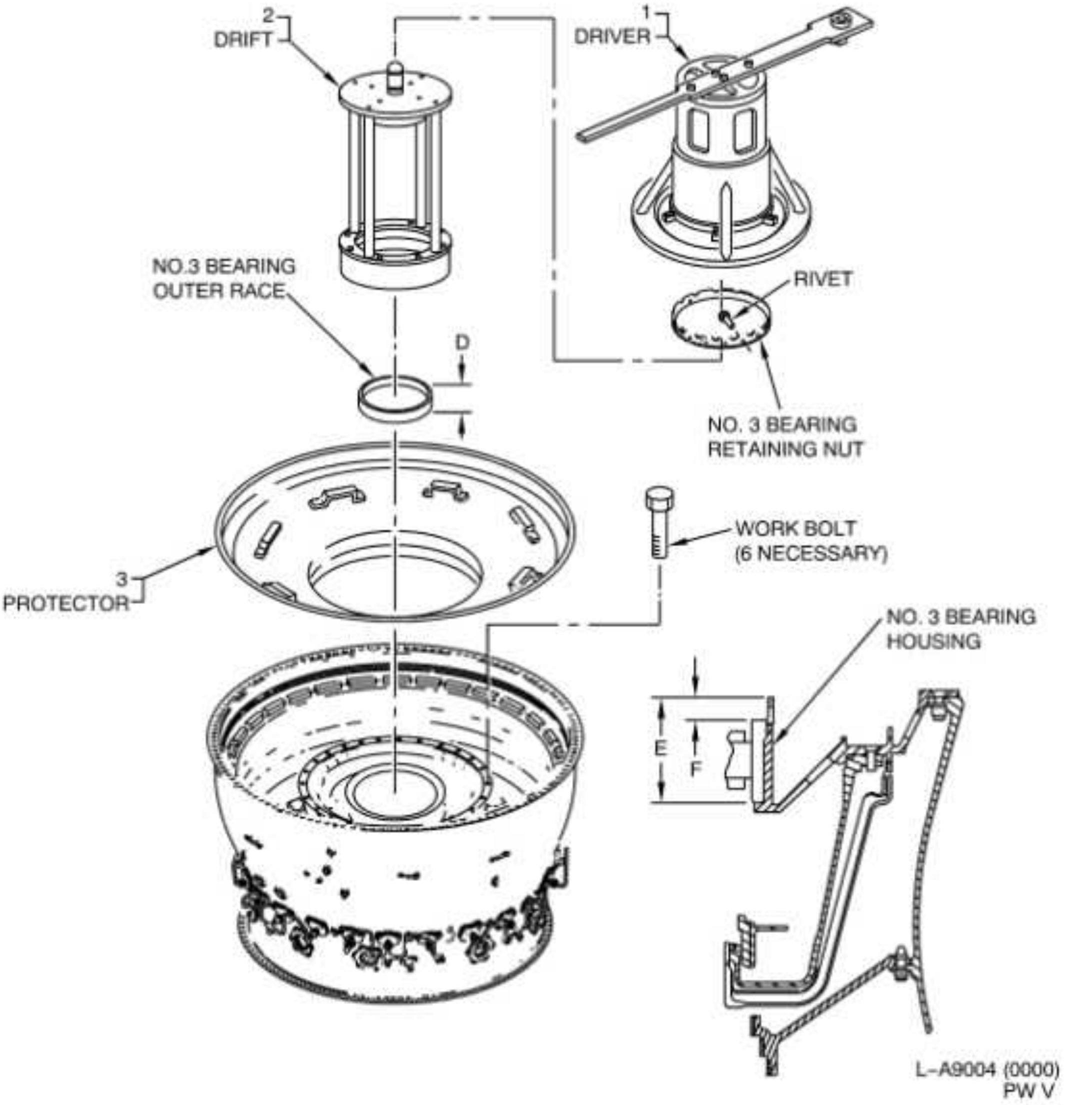
DIFFUSER AND COMBUSTOR − INSTALLATION−01


BUILD STAND
1
L-A9007 (0000)
PW V

1. PWA 85044 or PWA 86508

Diffuser Case Installed In A Stand
Figure 402
(Task 72−41−00−430−001)

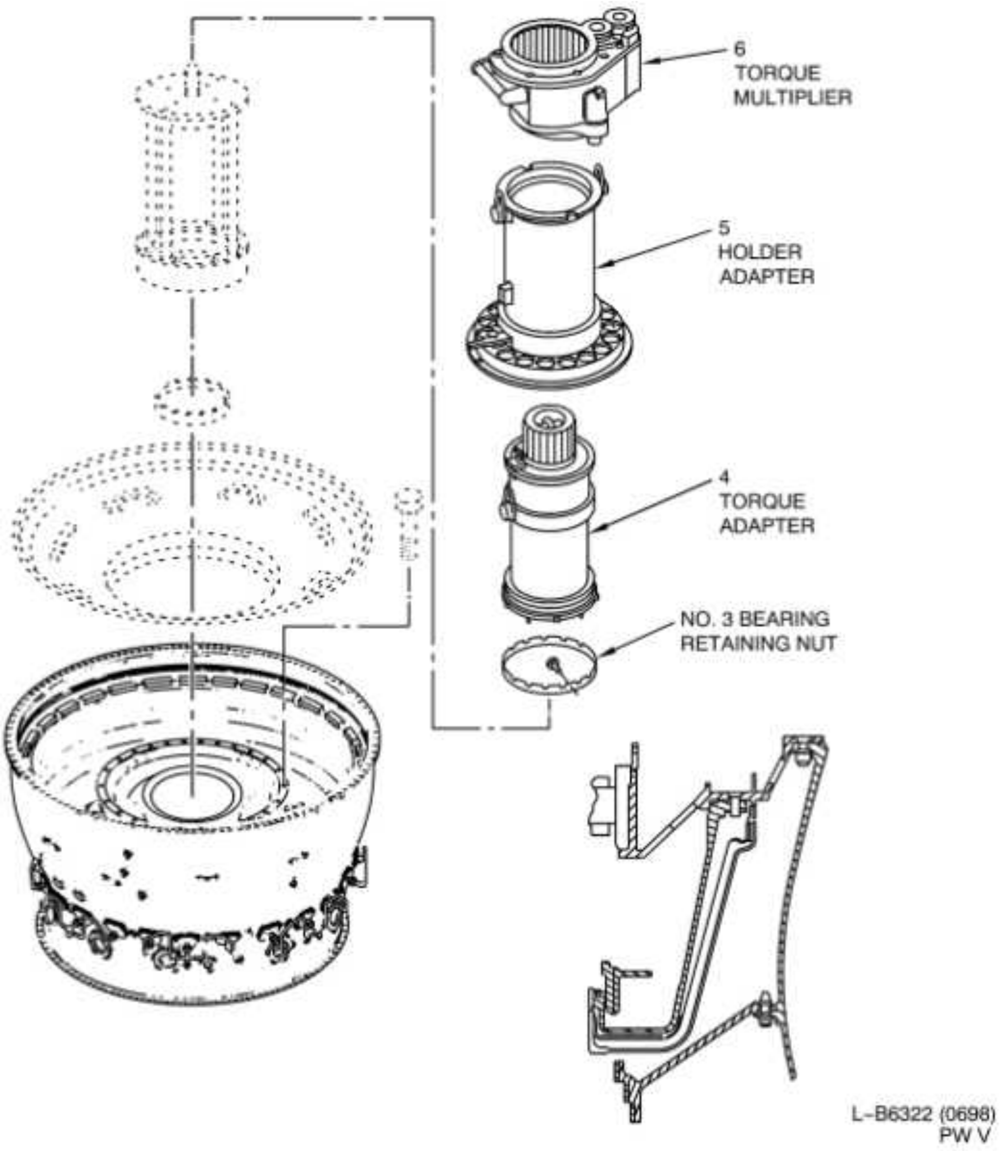
DIFFUSER AND COMBUSTOR - INSTALLATION-01


2
DRIFT
1
DRIVER
NO.3 BEARING OUTER RACE
RIVET
D
NO. 3 BEARING RETAINING NUT
WORK BOLT (6 NECESSARY)
3
PROTECTOR
NO. 3 BEARING HOUSING
E
F
L-A9004 (0000)
PW V

1. PWA 86491
2. PWA 87433
3. PWA 85168

No. 3 Bearing Outer Race Installation
Figure 403 (Sheet 1)
(Task 72-41-00-430-001)

DIFFUSER AND COMBUSTOR - INSTALLATION-01


6
TORQUE
MULTIPLIER
5
HOLDER
ADAPTER
4
TORQUE
ADAPTER
NO. 3 BEARING
RETAINING NUT
L-B6322 (0698)
PW V

4. PWA 102743
5. PWA 102744
6. PWA 80187

No. 3 Bearing Outer Race Installation
Figure 403 (Sheet 2)
(Task 72-41-00-430-001)

DIFFUSER AND COMBUSTOR - DISASSEMBLY-01

Task 72-41-00-030-001:

1. Remove Fuel Distribution Valve And Fuel Supply Tubes

A. Equipment And Materials Necessary

Standard Tools:

Jackscrews 0.190-32 (Two Necessary)

Special Tools:

PWA 28657	Sling
PWA 76154	Adapter
PWA 85044	Build Stand (Optional to PWA 86508)
PWA 85751	Bracket (2 Necessary)
PWA 86508	Build Stand
PWA 104096	Puller

B. Procedure

Subtask 72-41-00-030-069:

(1) Install PWA 85751 Brackets to diffuser case. With PWA 76154 Adapter on PWA 28657 Sling and hoist, attach to Brackets (PWA 85751) on diffuser case. Raise diffuser case and position over PWA 86508 or PWA 85044 Build Stand. Align fuel distribution valve and bracket with large clearance slot in support detail of build stand. Lower case to build stand and secure with clamp details. Remove sling, adapter and brackets.

(2) Remove fuel distribution valve. See Figure 501.

(a) Install two work bolts (501/1), washers (501/2) and nuts (501/3) to secure bracket (501/8) to diffuser case at Flange K (501/10).

CAUTION: BE PREPARED TO SUPPORT WEIGHT OF FUEL DISTRIBUTION VALVE WHEN BOLTS ARE REMOVED. USE CARE WHEN REMOVING VALVE FROM BRACKET TO ENSURE THAT EIGHT SMALL TRANSFER TUBES BETWEEN VALVE AND FUEL TUBES ARE NOT DROPPED OR DAMAGED.

(b) Remove four bolts (501/9) securing fuel distribution valve (501/7) and bracket (501/11) (Post SB PW4ENG 73-164) to bracket (501/8). Using two jackscrews installed in threaded holes in valve, remove valve from bracket.

(c) Remove each of the eight transfer tubes (501/5) from the fuel distribution valve (501/7) as follows:

1 Remove and discard the packing (501/4) from the exposed end of each of the eight transfer tubes (501/5).

2 Engage PWA 104096 Puller with the exposed packing groove on the transfer tube to be removed.

3 Apply hand pressure to the puller handles and pull the transfer tube out of the distribution valve (501/7).

4 Remove and discard the remaining packing (501/6) from each transfer tube (501/5).

(d) Place fuel distribution valve (501/7) in protective closure.

(e) Remove jackscrews.

Subtask 72−41−00−030−070:

(3) Remove Flange K brackets and fuel supply tube clamps.

(a) Remove bolts and nuts from clamps securing eight brackets to fuel supply tubes around diffuser case and remove brackets.

(b) Remove all clamps from fuel supply tubes around diffuser case.

(4) Remove fuel supply tubes.

(a) Remove lockwire and eight nuts (502/5) securing fuel supply tubes to fuel flow divider bracket (502/4). See Figure 502.

(b) Remove lockwire from each fuel supply tube nut (502/3) and fuel manifold assembly nut (502/1) and carefully remove each of eight fuel supply tubes (502/6).

(c) Remove each of the eight transfer tubes (502/10) from the fuel supply tubes as follows:

1 Remove and discard the packing (502/2) from the exposed end of each of the eight transfer tubes (502/10).

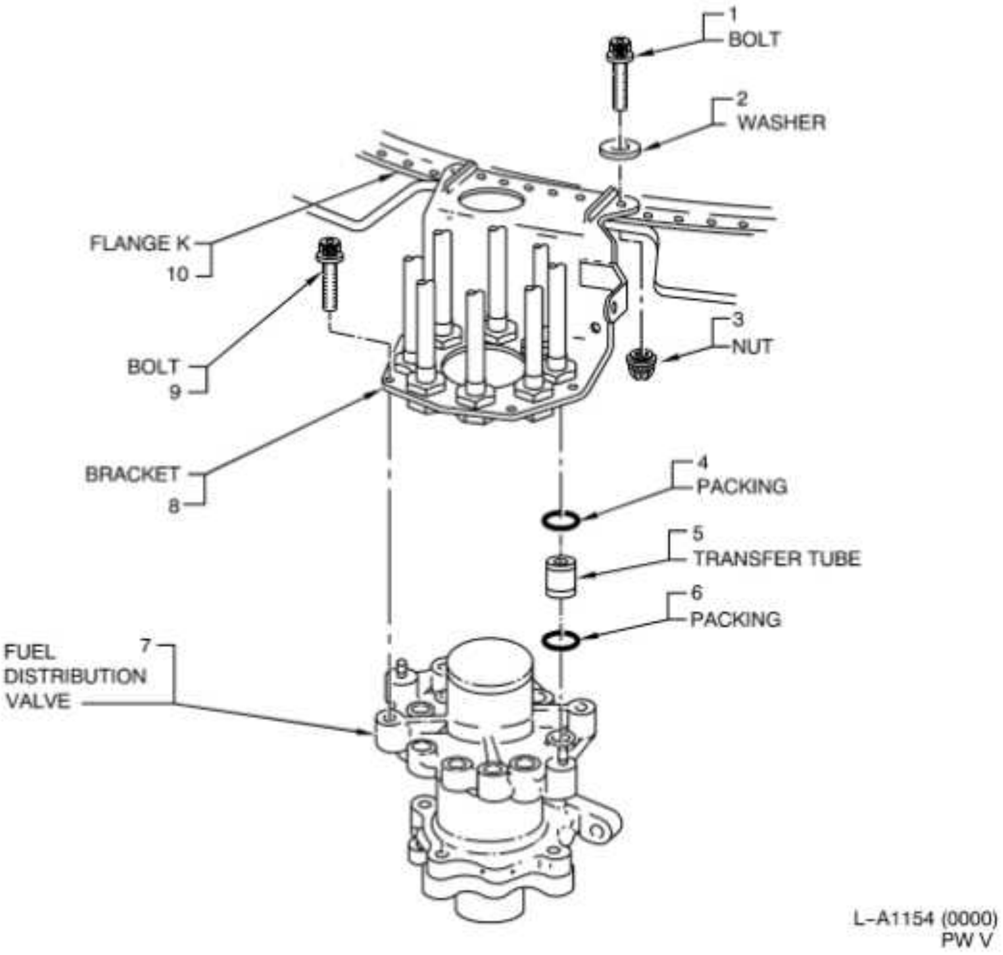
2 Engage PWA 104096 Puller with the exposed packing groove on the transfer tube to be removed.

3 Apply hand pressure to the puller handles and pull the transfer tube out of the fuel supply tube.

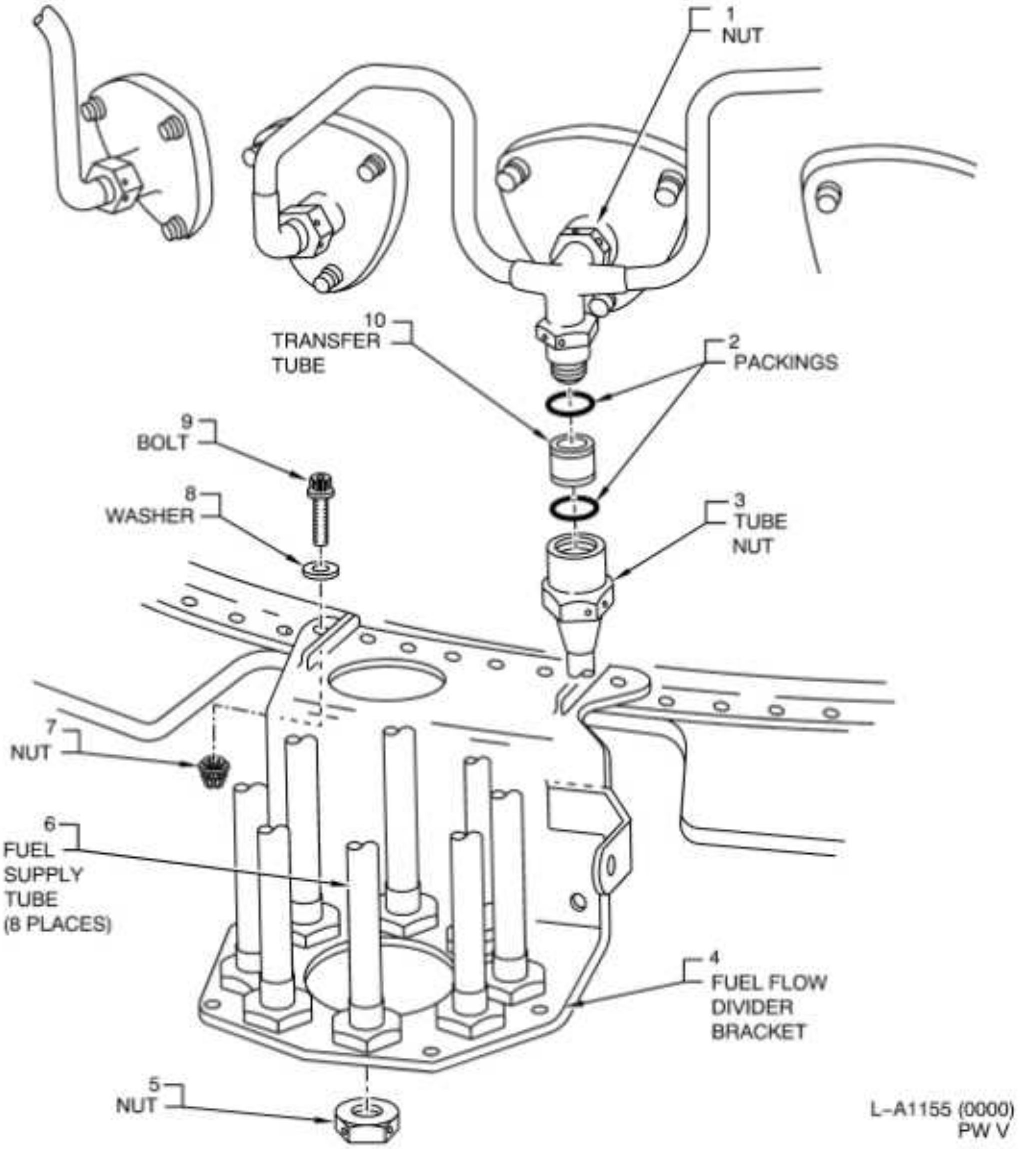
4 Remove and discard the remaining packing (502/2) from each transfer tube (502/10).

(5) Remove two bolts (502/9), washers (502/8) and nuts (502/7) securing fuel flow divider bracket to Flange K and remove bracket.

DIFFUSER AND COMBUSTOR - DISASSEMBLY-01


1 BOLT
2 WASHER
FLANGE K 10
BOLT 9
3 NUT
BRACKET 8
4 PACKING
5 TRANSFER TUBE
6 PACKING
FUEL DISTRIBUTION VALVE 7
L-A1154 (0000)
PW V

Fuel Distribution Valve Removal
Figure 501
(Task 72-41-00-030-001)


1 NUT
10 TRANSFER TUBE
2 PACKINGS
9 BOLT
8 WASHER
3 TUBE NUT
7 NUT
6 FUEL SUPPLY TUBE (8 PLACES)
4 FUEL FLOW DIVIDER BRACKET
5 NUT
L−A1155 (0000)
PW V

Fuel Flow Divider Bracket And Fuel Supply Tube Removal
Figure 502
(Task 72−41−00−030−001)

DIFFUSER AND COMBUSTOR - DISASSEMBLY-02

Task 72-41-00-030-002:

1. Disassemble Diffuser And Combustor Internals

A. Prerequisites

(1) Remove fuel distribution valve and fuel supply tubes. See Disassembly-01 (Task 72-41-00-030-001).

B. Equipment And Materials Required

Standard Tools:
0.190-32 UNF-2B Jackscrews, 6 Necessary
0.250-28 UNF-3B Jackscrews, 4 Necessary

Special Tools:

PWA 25039	Stand
PWA 27918	Sling (Optional To PWA 80555)
PWA 28657	Sling
PWA 76154	Adapter
PWA 80555	Sling
PWA 85044	Stand (Optional To PWA 86508)
PWA 85047	Puller (Optional To PWA 86103 Or PWA 85627)
PWA 85627	Puller, Knocker (Optional To PWA 86103)
PWA 85751	Brackets (Two Necessary)
PWA 85983	Adapter, Stabilizer (Two Necessary, Twin Overhead Rail System Only)
PWA 86103	Puller, Knocker
PWA 86508	Build Stand
PWA 87006	Adapter, Wrench
PWA 88725	Puller, Knocker
PWA 103081	Adapter, Torque

C. Procedure

Subtask 72-41-00-030-051:

(1) Remove fuel injector supply manifold assemblies as follows. See Figure 501.

(a) Remove lockwire or safety cable and loosen tube nuts (501/1) securing fuel injector supply manifold assemblies (501/2) to fuel injectors. Carefully remove eight manifold assemblies from around case. Discard packings (501/3).

Subtask 72-41-00-030-052:

(2) Remove fuel injector and support assemblies as follows. See Figure 502.

(a) Remove lockwire or safety cable, loosen and remove bolts securing fuel injector assemblies and brackets to diffuser case. Continue around diffuser case and remove all 24 fuel injector assemblies and brackets. Discard injector gaskets.

NOTE: Rotate and/or tilt injector as required to disengage injector from diffuser case. Mark location of removed injectors and brackets to facilitate reassembly.

(3) Remove diffuser case externals as follows. See Figure 503.

(a) Remove the lockwire or safety cable and bolts that attach the brackets to the case. Remove the brackets.

NOTE: You can mark the brackets with the reference numbers, per Figure 503, for ease of assembly.

(b) Remove the lockwire or safety cable, two bolts.

(c) Remove the lockwire or safety cable, four bolts (503/13) and washers (503/12) at 10 and 11:30 o'clock positions.

(d) Remove the lockwire or safety cable, six borescope plugs (503/18) or (503/18A) and gaskets (503/17) at 1:30, 4:30, 5:30, 7:30, 9 and 11 o'clock positions.

(e) Remove the two adapters (503/15) and gaskets (503/16) at 12:30 and 1:30 o'clock positions.

(f) Remove the lockwire or safety cable and six bolts (503/21) that attach the two covers (503/23) at 2 and 7:30 o'clock positions. Remove the covers and gaskets (503/22). Remove the plug (503/27) and adapter (503/19) from the covers.

(g) (Pre SB PW4ENG 72−699) Remove the lockwire, bolts (503/30), cover (503/29) and gasket (503/28) that are at 9:30 o'clock. Discard the gasket.

(4) Remove EEC thermocouple probe (503/25) as follows.

(a) Remove lockwire or safety cable securing probe body nut to diffuser case. Do not remove lockwire securing coupling nut to probe body nut (see note). Loosen body nut from diffuser case boss and remove probe. Remove and discard gasket.

NOTE: To avoid loss of small detail washer, do not remove body nut from probe.

Subtask 72−41−00−030−053:

(5) Remove igniter plugs as follows.

(a) Remove two igniter plugs (504/1) and igniter bosses (504/3), spacers (504/4) and key washers (504/2) from diffuser case. Discard key washers. See Figure 504.

Subtask 72−41−00−030−054:

(6) Remove outer combustion chamber as follows. See Figure 505.

(a) Attach PWA 27918 Sling or PWA 80555 Sling (505/1) and hoist to outer combustion chamber assembly (505/2) engaging three holes in the rear of the chamber. Take up strain on hoist to support weight of combustion chamber eliminating slack in cables.

CAUTION: ENSURE BORESCOPE PLUG HAS BEEN REMOVED FROM DIFFUSER CASE. FAILURE TO REMOVE BORESCOPE PLUG WILL RESULT IN DAMAGE TO OUTER LINER AND PLUG.

(b) Loosen and remove bolts (505/3) and washers (505/4) at twelve locations around diffuser case.

(c) Remove combustion chamber assembly vertically from diffuser case and place on pallet. Remove hoist and sling.

Subtask 72−41−00−030−055:

(7) Install the diffuser case in a stand.

(a) Install two PWA 85751 Handling Brackets to diffuser case as follows. See Figure 506.

NOTE: If you have a twin overhead rail system you must use PWA 85983 Stabilizer Adapter with PWA 85751 Brackets.

1 Using hoist, position longer front flange of brackets to rear of front flange of diffuser case at 3 and 9 o'clock locations, locating four pins in front flange of bracket into four boltholes in diffuser case front flange. Position shorter rear flange of bracket to front of diffuser case rear flange and secure with detail nuts and bolts.

2 Position double spool bracket in front most two holes as marked on bracket.

WARNING: USE TWO OPERATORS WHEN INSTALLING OR TRUNNIONING CASE IN STAND. WHEN QUICK RELEASE PIN IS REMOVED, CASE MAY TRUNNION BY ITSELF, AND POSSIBLY CAUSE INJURY.

(b) Using hoist, PWA 28657 Sling and PWA 76154 Adapters, remove diffuser case from PWA 86508 or PWA 85044 Stand. Trunnion case and install into PWA 25039 Stand. Secure with quick release pin.

(c) Remove hoist, PWA 28657 Sling and PWA 76154 Adapters.

(8) (Pre SB PW4ENG 72−572) Remove Stage 15 HPC stator as follows. See Figure 507 (Sheet 1).

(a) Loosen and remove bolts (507/6), washers (507/3), spacer plates (507/5), injectors (507/4) and nuts (507/7).

(b) For engines which have stator assembly with outer shroud hook (Pre SB PW4ENG 72−234) installed. Remove stator assembly (507/2) with PWA 85047 Puller. Discard gasket if gasket has not been removed as stated in SB PW4ENG 72−141.

CAUTION: USE CARE NOT TO DAMAGE STAGE 15 HPC AIRSEALING RING WITH PWA 85627 PULLER.

(c) For engines which have stator assembly without outer shroud hook (Post SB PW4ENG 72−234) installed. Remove stator assembly and Stage 15 HPC airsealing ring assembly together with PWA 86103 Puller or PWA 85627 Puller as follows.

1 Hook the puller under the airsealing ring. Make sure the puller is engaged at 90 degrees to the airsealing ring.

2 Quickly move the puller hammer away from ring at different locations around the inner diameter of the airsealing ring until the ring is loosened.

3 Separate stator from airsealing ring and discard gasket if gasket has not been removed as stated in SB PW4ENG 72−141.

(d) (Post SB PW4ENG 72−464) Remove the stator assembly. Use six 0.190−32 UNF−2B jackscrews.

(e) For engines which have the stator assembly removed before this step. Remove Stage 15 HPC airsealing ring assembly (507/1) from diffuser case with PWA 86103 Puller or PWA 85627 Puller as follows.

1 Hook the puller under the airsealing ring. Make sure the puller is engaged at 90 degrees to the airsealing ring.

2 Quickly move the puller hammer away from ring at different locations around the inner diameter of the airsealing ring until the ring is loosened.

(9) (Post SB PW4ENG 72−572) Remove HPC exit brush seal support assembly and HPC exit stator assembly as follows. See Figure 507 (Sheet 2).

(a) Loosen and remove bolts (507/6), washers (507/3), spacer plates (507/5), injectors (507/4) and nuts (507/7).

(b) (Stator without jackscrew holes). Remove the stator assembly (510/2) with PWA 88725 Puller Knocker.

(c) (Stator with jackscrew holes). Remove the stator assembly (510/2). Use six 0.190−32 UNF−2B jackscrews.

(d) Remove the HPC exit brush seal support assembly (510/1). Use six 0.190−32 UNF−2B jackscrews.

Subtask 72−41−00−030−056:

(10) Remove No. 3 bearing pressure tube and airframe manifold assembly plate locks and gaskets as follows. See Figure 508.

(a) (Pre SB PW4ENG 72−570) No No. 3 bearing weep tube heat shield assembly installed.

1 Remove lockwire or safety cable.

2 Loosen and remove bolts (508/6) and (508/15), lockplate (508/8), sleeve (508/7) and gasket (508/9) that attach the manifold assembly to the diffuser case.

(b) (Post SB PW4ENG 72−570) No. 3 bearing weep tube heat shield assembly installed.

1 Remove lockwire or safety cable.

2 Loosen and remove bolts (508/17) and (508/18), heat shield (508/16), lockplate (508/8), sleeve (508/7) and gasket (508/9) that attach the manifold assembly to the diffuser case.

(c) Remove lockwire or safety cable, loosen and remove bolts (508/2), cap (508/1), lock plate (508/3), sleeve (508/4) and gasket (508/5).

(d) Remove lockwire or safety cable, loosen and remove bolts (508/13), shield (508/12), lock plate (508/11), sleeve (508/14) and gasket (508/10).

Subtask 72−41−00−030−057:

(11) (Pre SB PW4ENG 72−567) Remove the mating parts for the No. 3 bearing (breather) tube (509/1), the No. 3 bearing (compartment) cooling tube (509/2), and the No. 3 bearing (scavenge) tube. See Figure 509.

(a) At the No. 3 bearing (breather) tube location (509/1), remove the thrust wire, tube nut, and plate. If applicable, remove the sleeve and gasket. Discard the gasket. Remove the packing holder.

(b) At the No. 3 bearing (compartment) cooling tube location (509/2), remove the adapter and washer. Remove the lockwire and bolts from the elbow. Remove the two gaskets and the lock. Discard the gaskets.

(c) At the No. 3 bearing (scavenge) tube location (509/3), remove the thrust wire, tube nut, plate, sleeve, gasket, and packing holder. Discard the gasket.

(12) (Post SB PW4ENG 72−567) Remove the mating parts for the No. 3 bearing (breather) tube, the No. 3 bearing (compartment) cooling tube, and the No. 3 bearing (scavenge) tube. See Figure 510.

(a) (Pre SB PW4ENG 72−569) Remove thrust wire (510/1) and tube nut (510/2), lockwire or safety cable and bolts (510/3), plate−lock (510/4), sleeve (510/5) and gasket (510/6). Discard the gasket.

(b) (Post SB PW4ENG 72−569) Remove the thrust wire (510/1) and the tube nut (510/2), lockwire or safety cable and bolts (510/21), heat shield (510/20), plate−lock (510/4), sleeve (510/5), and gasket (510/6). Discard the gasket.

(c) Remove the adapter (510/19) and washer (510/18, lockwire or safety cable and bolts (510/13), elbow (510/14), two gaskets (510/15 and 510/17), and locks (510/16). Discard the gaskets.

(d) Remove the thrust wire (510/11) and tube nut (510/10), lockwire or safety cable and bolts (510/12), plate (510/9), sleeve (510/8), and gasket (510/7). Discard the gasket.

(13) (Pre SB PW4ENG 72−567) Remove the diffuser seal air vent (elbow) tube assembly. See Figure 511.

(a) Remove lockwire or safety cable, loosen and remove the bolts and bracket that are installed in the flange of the tube.

(b) Remove the tube and the gasket. Discard the gasket.

Subtask 72−41−00−030−058:

(14) Remove the heat shields from the No. 3 bearing (breather) tube (512/1), No. 3 bearing (compartment) cooling tube (512/2), No. 3 bearing (oil) pressure tube (512/3), and No. 3 bearing (scavenge) tube assemblies as follows. See Figure 512.

(a) Remove lockwire from the middle and both ends of the (outer) heat shields.

(b) Remove the (outer) heat shield halves. Remove the (inner) heat shield halves.

(c) Remove the (flange) heat shield halves.

(d) Remove the lockwire and bolts that attach three of the tubes to the airsealing ring.

Subtask 72−41−00−030−059:

(15) Remove No. 3 bearing front seal, cooling duct and housing as follows. See Figure 513.

(a) Remove four screws securing duct and housing to diffuser case.

(b) Install four 0.250−28 UNF−3B Jackscrews to the housing flange and tighten until the housing is loosened from the diffuser case.

(c) Remove duct and housing from diffuser case.

Subtask 72−41−00−030−060:

(16) Remove No. 3 bearing oil vent (inner) tube assembly as follows. See Figure 514.

(a) Remove lockwire and loosen tube nut (514/9) on No. 3 bearing oil vent (inner) tube assembly (514/3).

NOTE: Hold connector on mating tube with PWA 87006 Wrench while you loosen tube nut (514/9)) with PWA 103081 Torque Adapter.

(b) Remove screws (514/7), nuts (514/8), brackets (513/6) and clamps (514/5) from two locations on tube assembly (514/3).

(c) Remove tube assembly from diffuser case and remove seal ring (514/4) from tube assembly.

Subtask 72−41−00−030−066:

(17) Remove turbine cooling duct sensing (inner airframe) tube assembly as follows. See Figure 514.

(a) Remove lockwire and loosen tube nut (514/10) on turbine cooling duct sensing (inner airframe) tube assembly (514/1). Remove tube assembly from diffuser case.

NOTE: Hold connector on mating tube with PWA 87006 Wrench while you loosen tube nut (514/10)) with PWA 103081 Torque Adapter.

(b) Remove seal ring (514/2) from tube assembly (514/1).

Subtask 72−41−00−030−061:

(18) Remove diffuser airsealing ring assembly as follows. See Figure 515.

(a) Remove No. 3 bearing packing transfer (breather and scavenge) tubes (515/2) at two locations in airsealing ring (515/10). Remove seal ring (515/5) from transfer tubes.

(b) Remove packing transfer (oil pressure) tube (515/9) from airsealing ring. Remove seal ring (515/8) from transfer tube.

(c) Remove seal ring transfer (No. 3 bearing cooling rear) tube (515/3). Remove seal ring (515/7) from transfer tube.

(d) Remove seal ring transfer (No. 3 bearing cooling front) tube (515/6). Remove seal ring (515/4) from transfer tube.

(e) Remove 36 bolts (515/1) and nuts (515/11) securing airsealing ring assembly to diffuser case and remove airsealing ring assembly.

Subtask 72−41−00−030−062−A:

(19) (Pre SB PW4ENG 72−567) Remove No. 3 bearing (oil) pressure tube assembly as follows. See Figure 516.

(a) Carefully remove tube assembly (516/10) from diffuser case.

(b) Remove seal rings, (516/1), (516/2), and (516/3) and gasket (516/4) from tube assembly (516/10).

Subtask 72−41−00−030−063−A:

(20) (Pre SB PW4ENG 72−567) Remove No. 3 bearing and airframe (oil vent and turbine cooling air duct sensing outer) manifold assemblies as follows. See Figure 516.

(a) Carefully remove manifold assemblies (516/6) from two locations in diffuser case.

(b) Remove seal rings (516/5) from manifold assemblies (516/6).

Subtask 72−41−00−030−065−A:

(21) (Pre SB PW4ENG 72−567) Remove No. 3 bearing (compartment) cooling tube assembly as follows. See Figure 516.

(a) Carefully remove tube assembly (516/9) from diffuser case.

(b) Remove seal rings (516/7) and (516/8).

Subtask 72−41−00−030−067−A:

(22) (Pre SB PW4ENG 72−567) Remove the turbine blade cooling tube assemblies (517/1) and (517/4), diffuser seal air vent tube assembly (517/2), No. 3 bearing (scavenge) tube assembly (517/3), and No. 3 bearing (breather) tube assembly (517/5).

(a) Carefully remove the tube assemblies from the diffuser case.

(b) Remove the gaskets.

(c) Remove the seal rings.

Subtask 72−41−00−030−062−B:

(23) (Post SB PW4ENG 72−567) Remove No. 3 bearing (oil) pressure tube assembly as follows. See Figure 518.

(a) Carefully remove tube assembly (518/3) from diffuser case.

(b) Remove seal rings, (518/1), (518/2), (518/6) and (518/4) from tube assembly (518/3).

Subtask 72−41−00−030−063−B:

(24) (Post SB PW4ENG 72−567) Remove No. 3 bearing and airframe (oil vent and turbine cooling air duct sensing outer) manifold assemblies as follows. See Figure 518.

(a) Carefully remove manifold assemblies (518/5) from two locations in diffuser case.

(b) Remove seal rings (518/6) from manifold assemblies (518/5).

Subtask 72−41−00−030−064:

(25) (Post SB PW4ENG 72−567) Remove No. 3 bearing (breather and scavenge) tube assemblies as follows. See Figure 519.

(a) Carefully remove tube assemblies (519/1) from diffuser case.

(b) Remove seal rings (519/5) and (519/3).

(c) Remove and discard gaskets (519/4).

Subtask 72−41−00−030−065−B:

(26) (Post SB PW4ENG 72−567) Remove No. 3 bearing (compartment) cooling tube assembly as follows. See Figure 519.

(a) Carefully remove tube assembly (519/8) from diffuser case.

(b) Remove seal rings (519/6) and (519/7).

Subtask 72−41−00−030−094:

(27) (Post SB PW4ENG 72−567) Remove diffuser seal air vent tube assemblies as follows. See Figure 519.

(a) Carefully remove diffuser seal air vent tube assemblies (519/9) from diffuser case.

(b) Remove seal rings (519/10) from tube assemblies.

Subtask 72−41−00−030−067−B:

(28) (Post SB PW4ENG 72−567) Remove turbine blade cooling tubes as follows. See Figure 520.

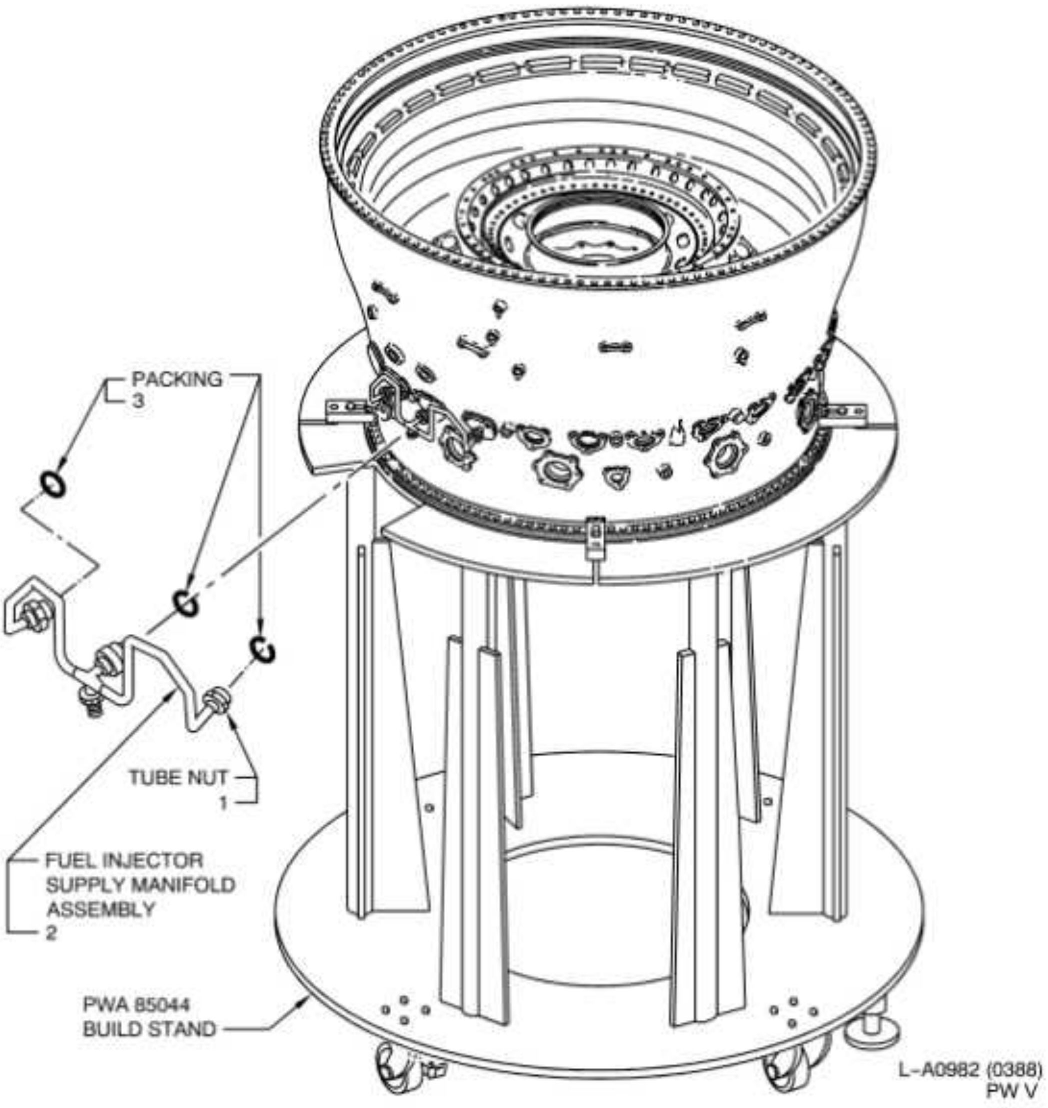
(a) Carefully remove turbine blade cooling tubes (520/1) from two locations in diffuser case.

(b) Remove transfer tubes (520/4) from cooling tubes (520/1). Remove seal rings (520/3) from both ends of each transfer tube (520/4).

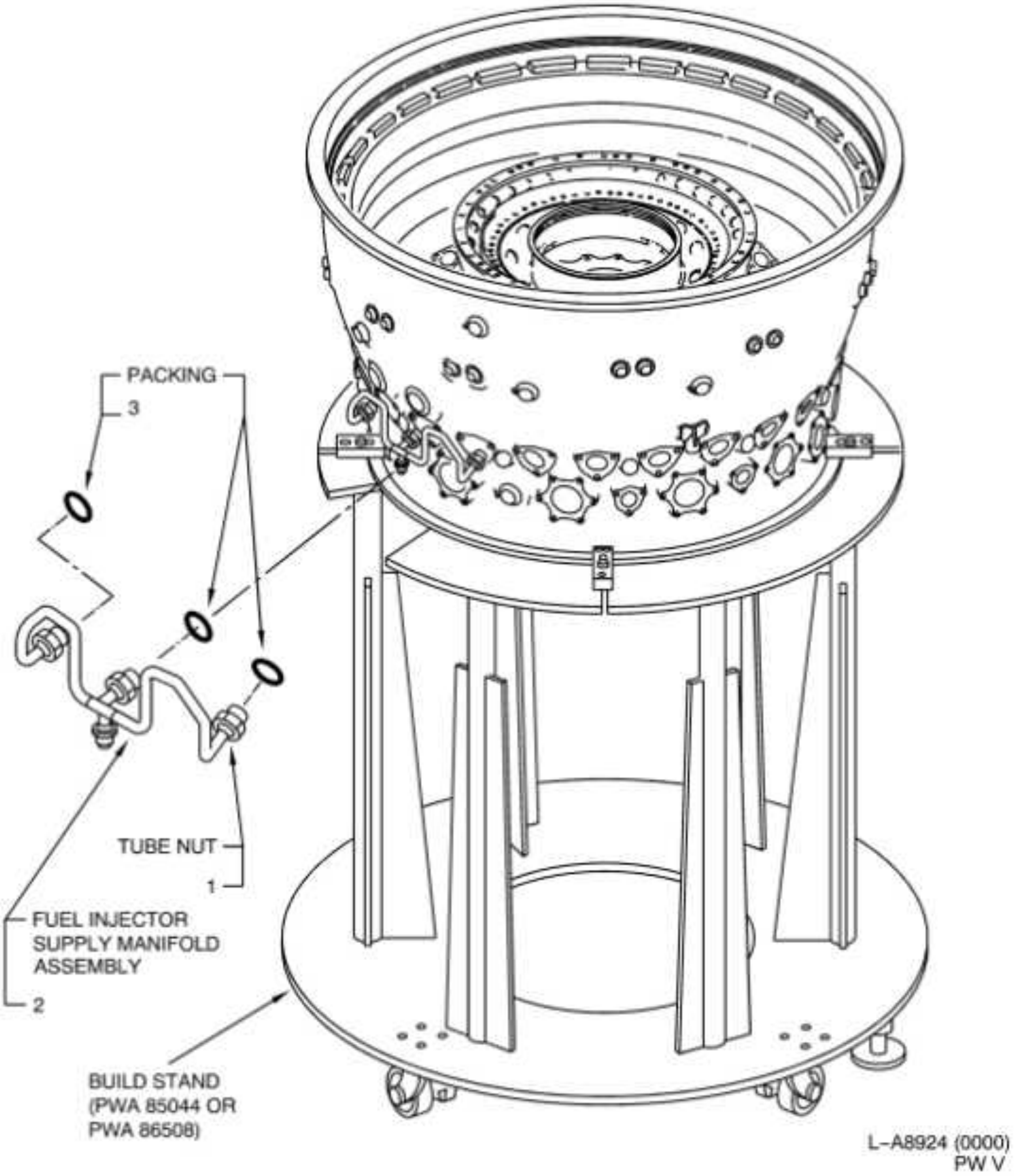
(c) Remove seal rings (520/2) from each cooling tube.

(29) Position diffuser case on pallet, front end down Remove two PWA 85751 Handling Brackets from case.

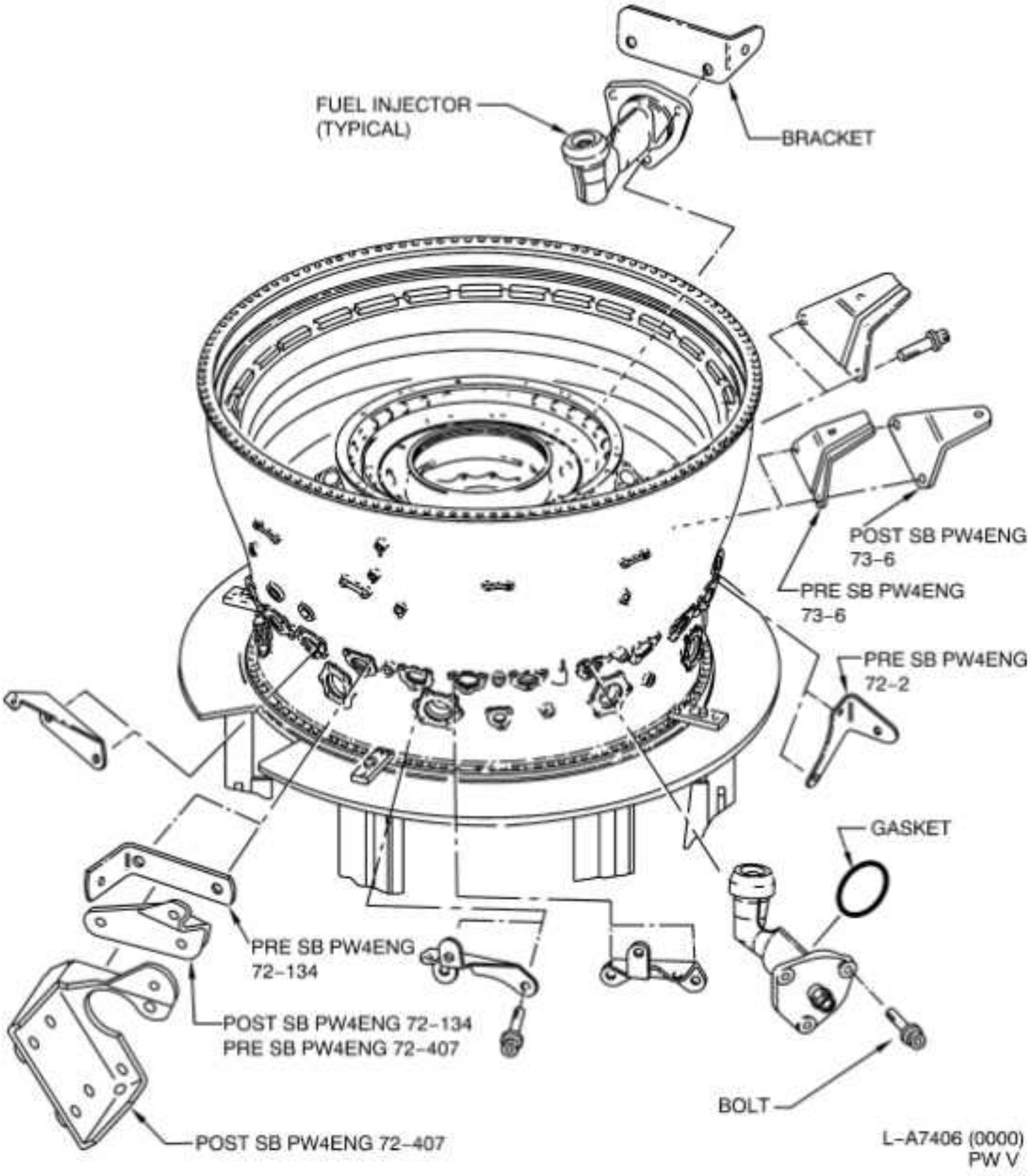
DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


PACKING
3
TUBE NUT
1
FUEL INJECTOR
SUPPLY MANIFOLD
ASSEMBLY
2
PWA 85044
BUILD STAND
L-A0982 (0388)
PW V

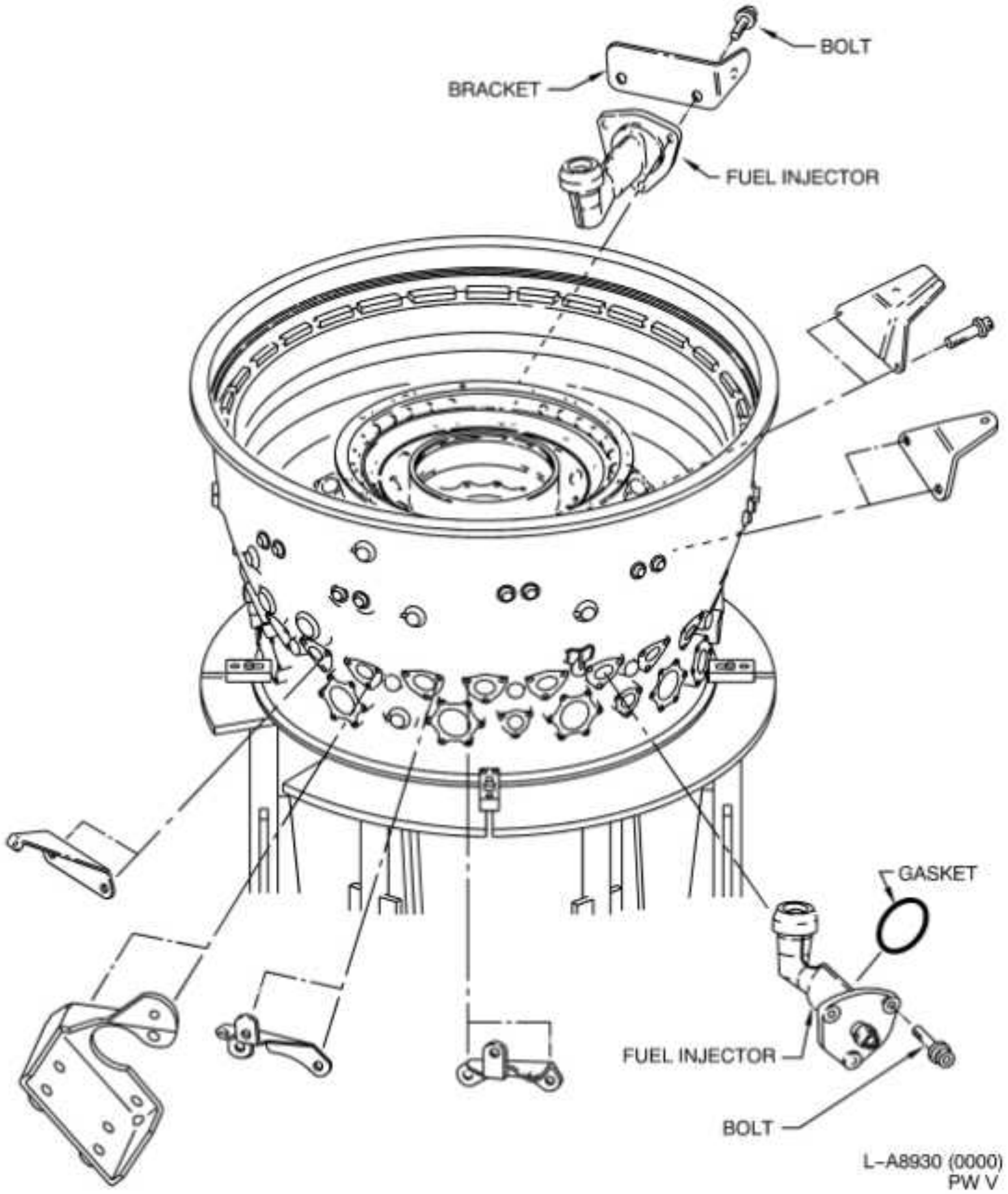
Fuel Injector Supply Manifold Disassembly
Diffuser Case (Pre SB PW4ENG 72−567)
Figure 501 (Sheet 1)
(Task 72−41−00−030−002)


PACKING
3
TUBE NUT
1
FUEL INJECTOR SUPPLY MANIFOLD ASSEMBLY
2
BUILD STAND (PWA 85044 OR PWA 86508)
L-A8924 (0000)
PW V

Fuel Injector Supply Manifold Disassembly
Diffuser Case (Post SB PW4ENG 72-567)
Figure 501 (Sheet 2)
(Task 72-41-00-030-002)

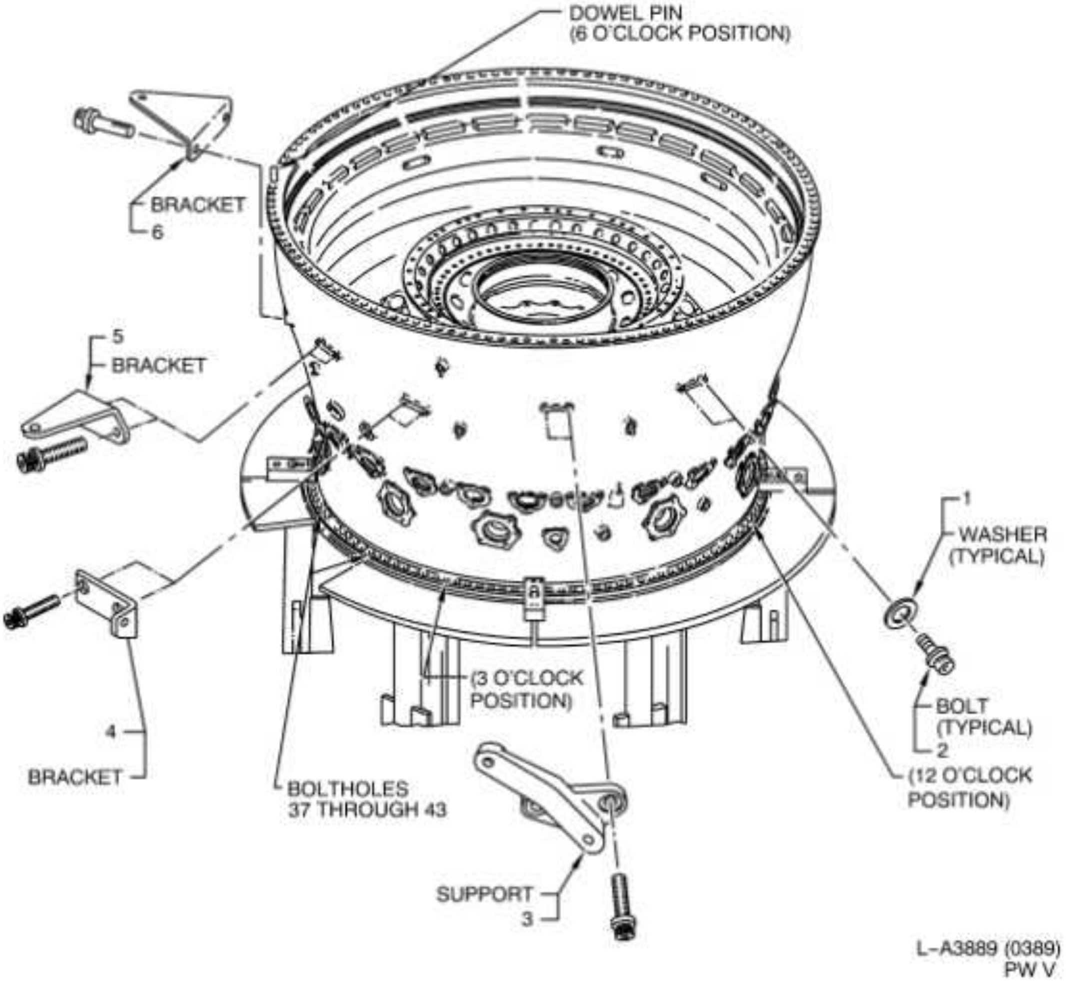

FUEL INJECTOR
(TYPICAL)
BRACKET
POST SB PW4ENG
73−6
PRE SB PW4ENG
73−6
PRE SB PW4ENG
72−2
GASKET
PRE SB PW4ENG
72−134
POST SB PW4ENG 72−134
PRE SB PW4ENG 72−407
POST SB PW4ENG 72−407
BOLT
L−A7406 (0000)
PW V

Fuel Injector And Support Assembly Removal
Diffuser Case (Pre SB PW4ENG 72−567)
Figure 502 (Sheet 1)
(Task 72−41−00−030−002)

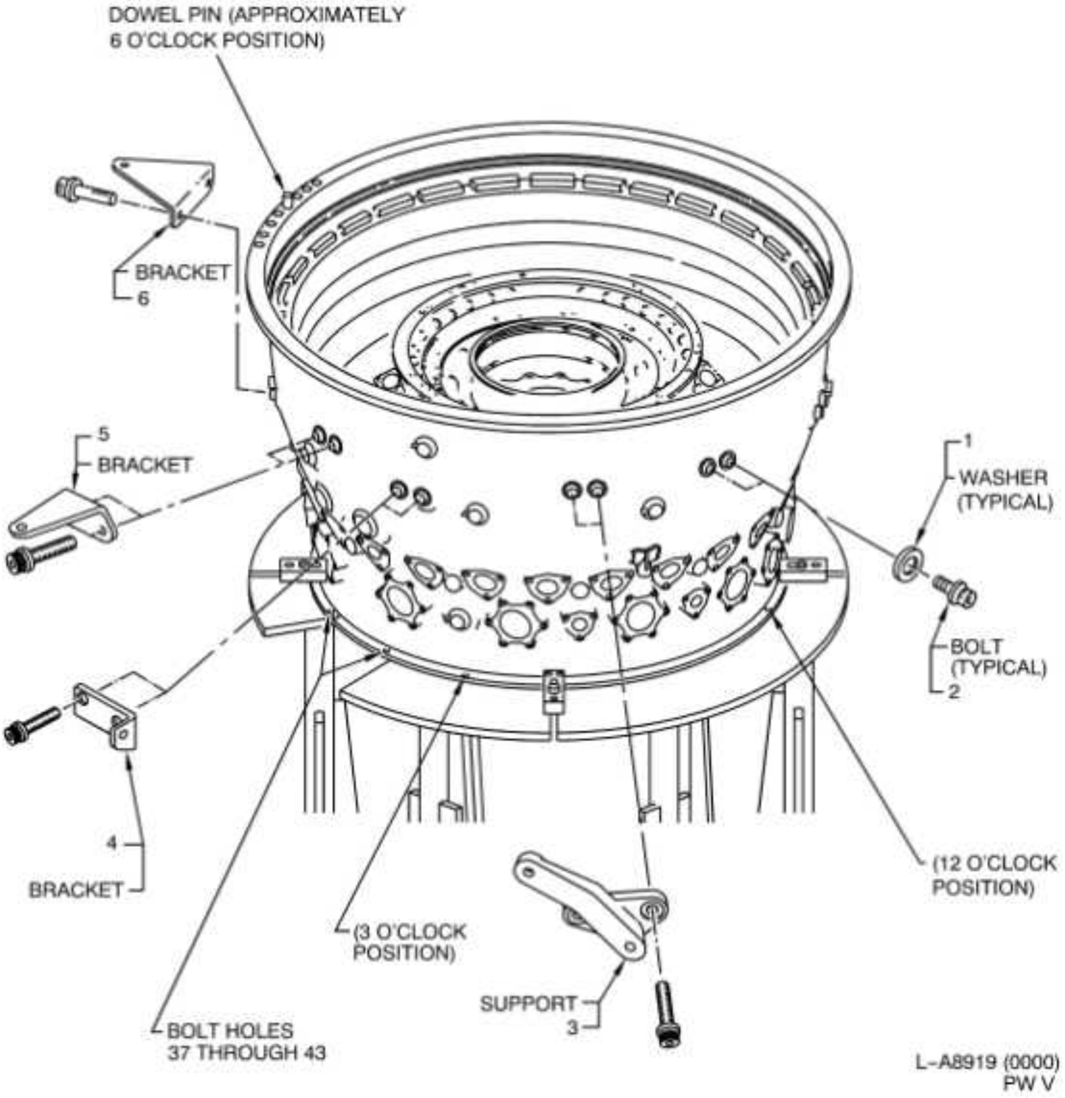

BOLT
BRACKET
FUEL INJECTOR
GASKET
FUEL INJECTOR
BOLT
L-A8930 (0000)
PW V

Fuel Injector And Support Assembly Removal
Diffuser Case (Post SB PW4ENG 72-567)
Figure 502 (Sheet 2)
(Task 72-41-00-030-002)

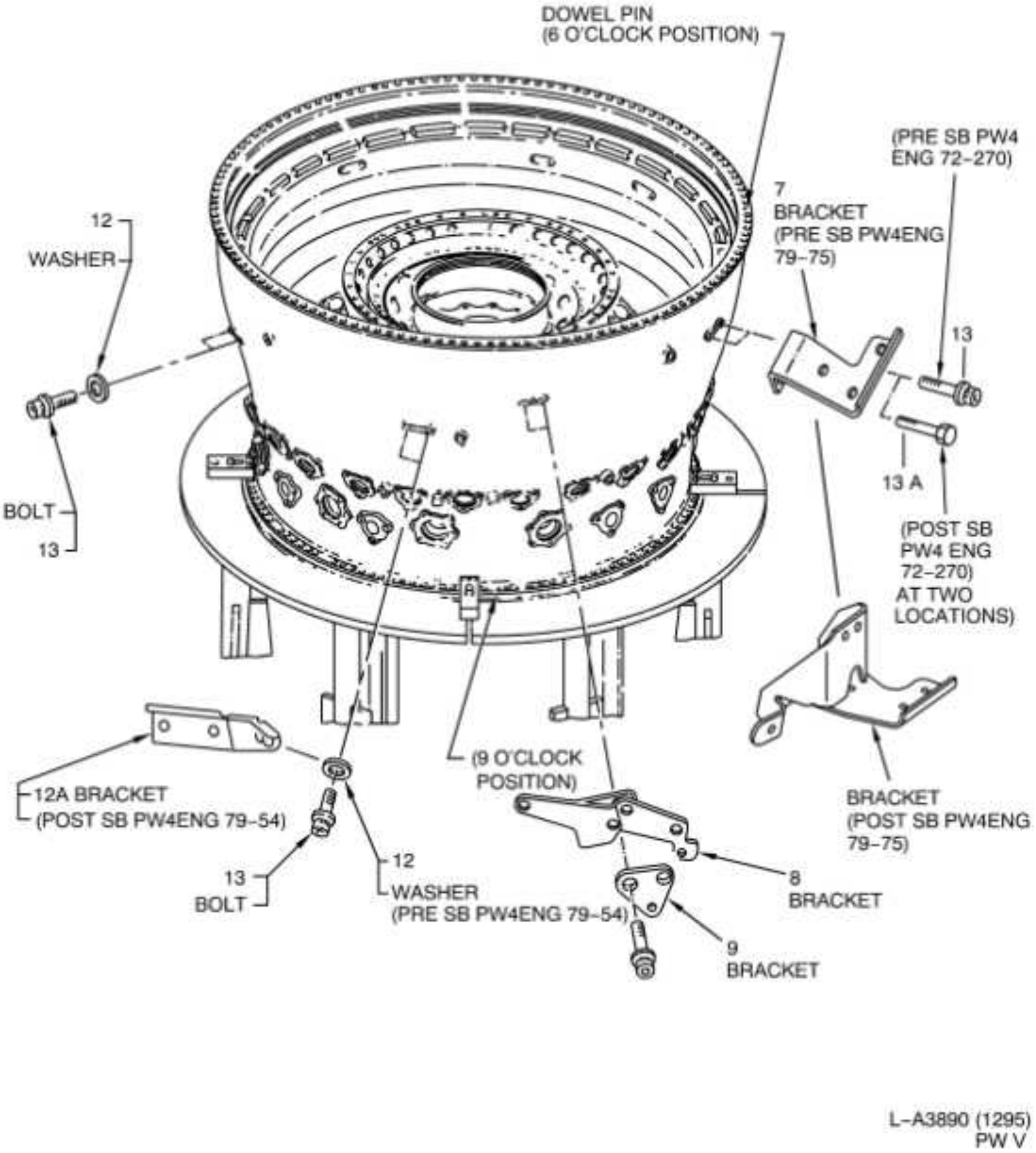
DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


DOWEL PIN
(6 O'CLOCK POSITION)
BRACKET
6
5
BRACKET
1
WASHER
(TYPICAL)
(3 O'CLOCK
POSITION)
BOLT
(TYPICAL)
2
4
BRACKET
BOLTHOLES
37 THROUGH 43
(12 O'CLOCK
POSITION)
SUPPORT
3
L-A3889 (0389)
PW V

Diffuser Case Externals Removal (Pre SB PW4ENG 72−567)
Figure 503 (Sheet 1)
(Task 72−41−00−030−002)

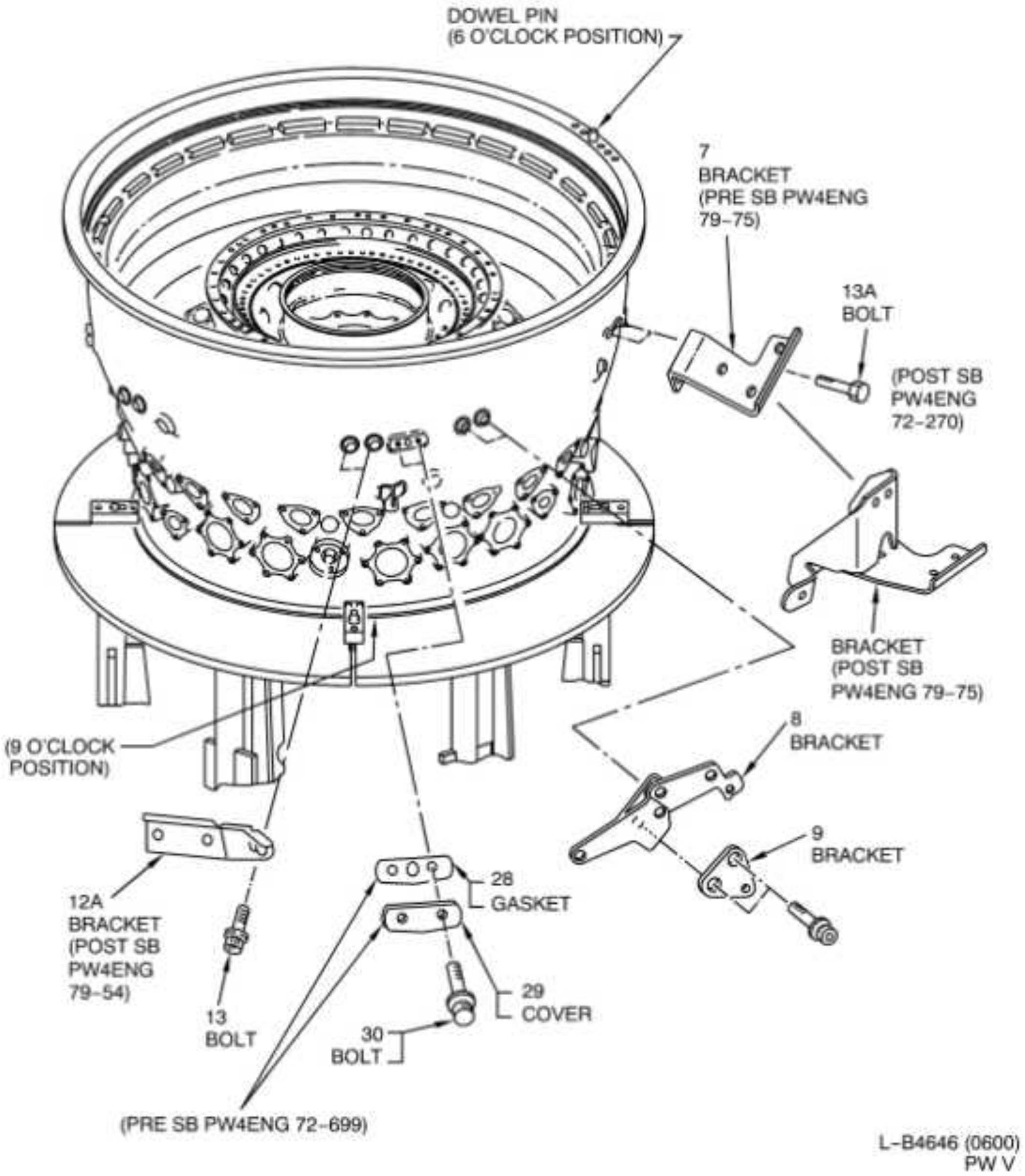

DOWEL PIN (APPROXIMATELY 6 O'CLOCK POSITION)
BRACKET
6
5
BRACKET
1
WASHER (TYPICAL)
BOLT (TYPICAL)
2
4
BRACKET
(12 O'CLOCK POSITION)
(3 O'CLOCK POSITION)
SUPPORT
3
BOLT HOLES 37 THROUGH 43
L-A8919 (0000)
PW V

Diffuser Case Externals Removal (Post SB PW4ENG 72−567)
Figure 503 (Sheet 2)
(Task 72−41−00−030−002)

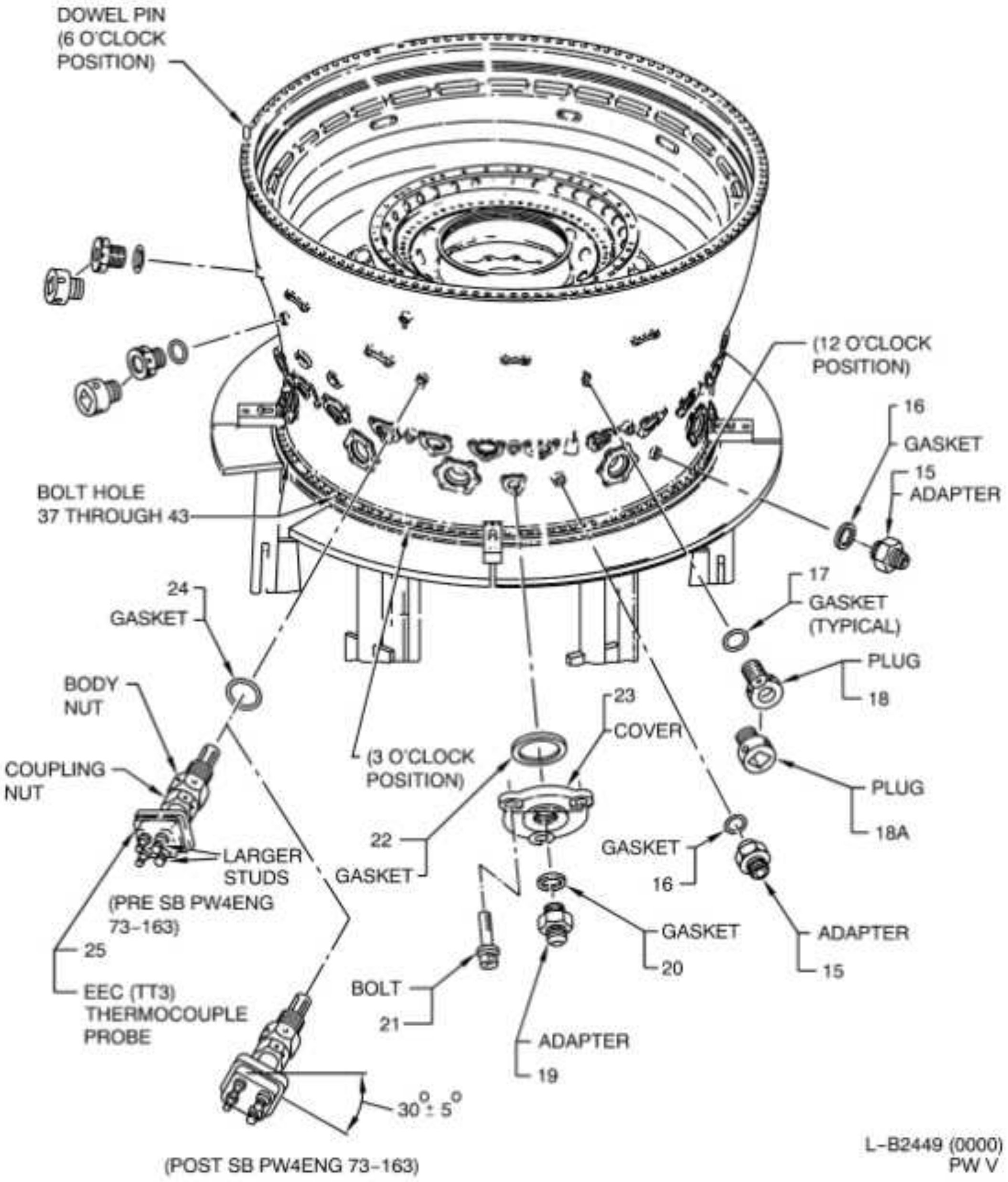

DOWEL PIN
(6 O'CLOCK POSITION)
(PRE SB PW4
ENG 72-270)
7
BRACKET
(PRE SB PW4ENG
79-75)
12
WASHER
13
13 A
BOLT
13
(POST SB
PW4 ENG
72-270)
AT TWO
LOCATIONS)
12A BRACKET
(POST SB PW4ENG 79-54)
(9 O'CLOCK
POSITION)
BRACKET
(POST SB PW4ENG
79-75)
12
WASHER
(PRE SB PW4ENG 79-54)
13
BOLT
8
BRACKET
9
BRACKET
L-A3890 (1295)
PW V

Diffuser Case Externals Removal Diffuser Case
Externals Removal (Pre SB PW4ENG 72−567)
Figure 503 (Sheet 3)
(Task 72−41−00−030−002)

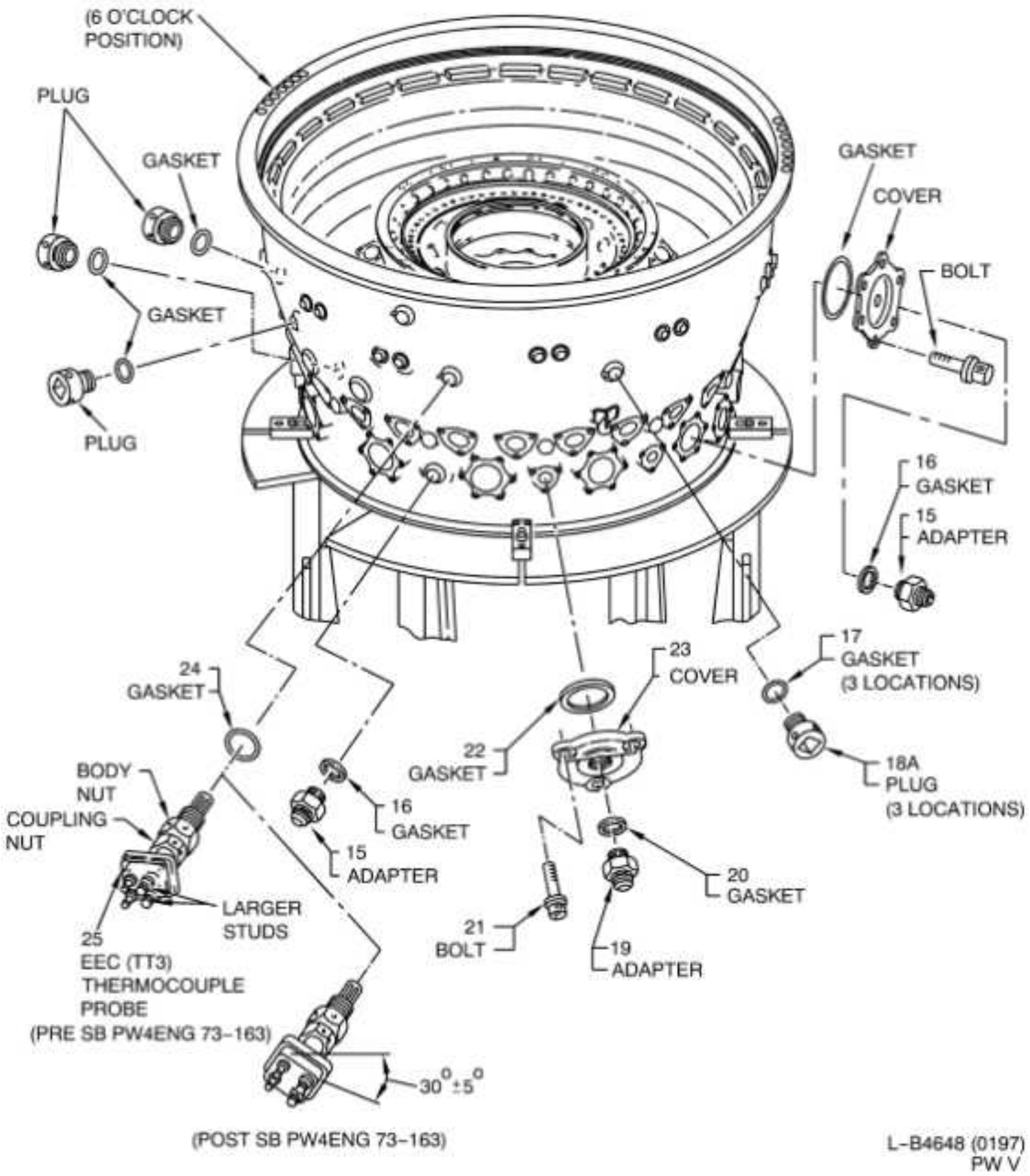
DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


DOWEL PIN
(6 O'CLOCK POSITION)
7
BRACKET
(PRE SB PW4ENG
79-75)
13A
BOLT
(POST SB
PW4ENG
72-270)
BRACKET
(POST SB
PW4ENG 79-75)
8
BRACKET
9
BRACKET
(9 O'CLOCK
POSITION)
12A
BRACKET
(POST SB
PW4ENG
79-54)
13
BOLT
28
GASKET
29
COVER
30
BOLT
(PRE SB PW4ENG 72-699)
L-B4646 (0600)
PW V

Diffuser Case Externals Removal (Post SB PW4ENG 72−567)
Figure 503 (Sheet 4)
(Task 72−41−00−030−002)

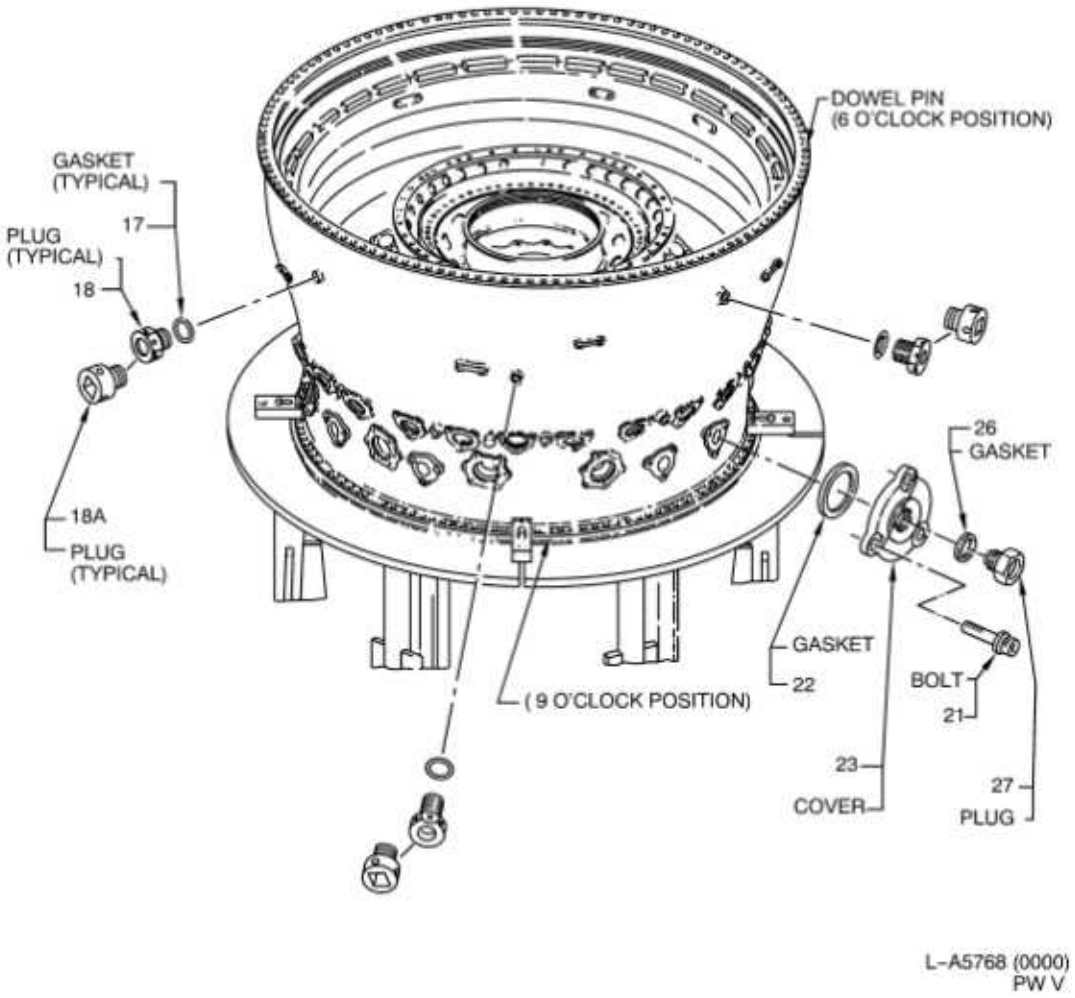

DOWEL PIN (6 O'CLOCK POSITION)
(12 O'CLOCK POSITION)
16
GASKET
15
ADAPTER
BOLT HOLE 37 THROUGH 43
17
GASKET (TYPICAL)
24
GASKET
PLUG
18
BODY NUT
23
COVER
COUPLING NUT
(3 O'CLOCK POSITION)
PLUG
18A
22
GASKET
GASKET
16
LARGER STUDS
(PRE SB PW4ENG 73-163)
GASKET
20
ADAPTER
15
25
EEC (TT3) THERMOCOUPLE PROBE
BOLT
21
ADAPTER
19
30° ± 5°
(POST SB PW4ENG 73-163)
L-B2449 (0000)
PW V

Diffuser Case Externals Removal (Pre SB PW4ENG 72−567)
Figure 503 (Sheet 5)
(Task 72−41−00−030−002)


(6 O'CLOCK POSITION)
PLUG
GASKET
GASKET
PLUG
GASKET
COVER
BOLT
16 GASKET
15 ADAPTER
17 GASKET (3 LOCATIONS)
23 COVER
24 GASKET
22 GASKET
18A PLUG (3 LOCATIONS)
BODY NUT
COUPLING NUT
16 GASKET
15 ADAPTER
LARGER STUDS
21 BOLT
20 GASKET
19 ADAPTER
25 EEC (TT3) THERMOCOUPLE PROBE (PRE SB PW4ENG 73-163)
30°±5°
(POST SB PW4ENG 73-163)
L-B4648 (0197)
PW V

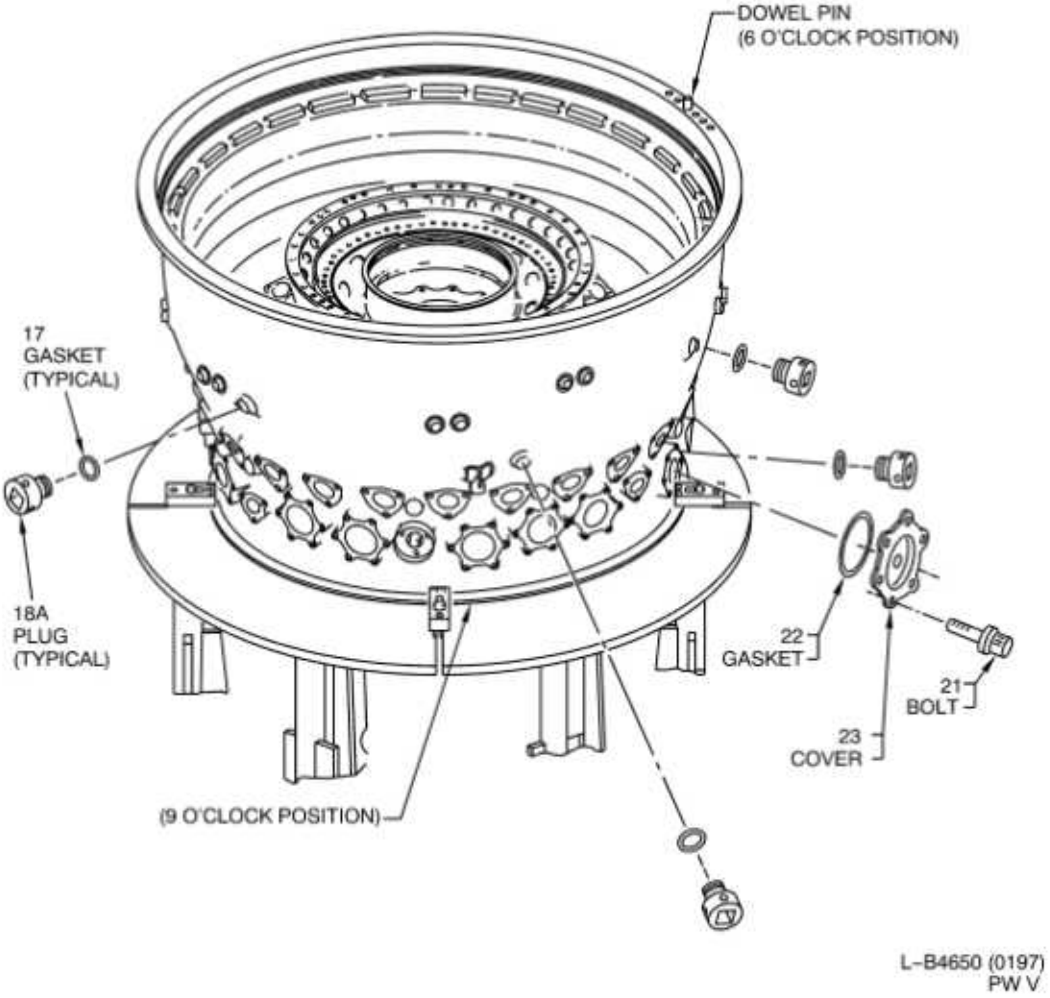
Diffuser Case Externals Removal (Post SB PW4ENG 72-567)
Figure 503 (Sheet 6)
(Task 72-41-00-030-002)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

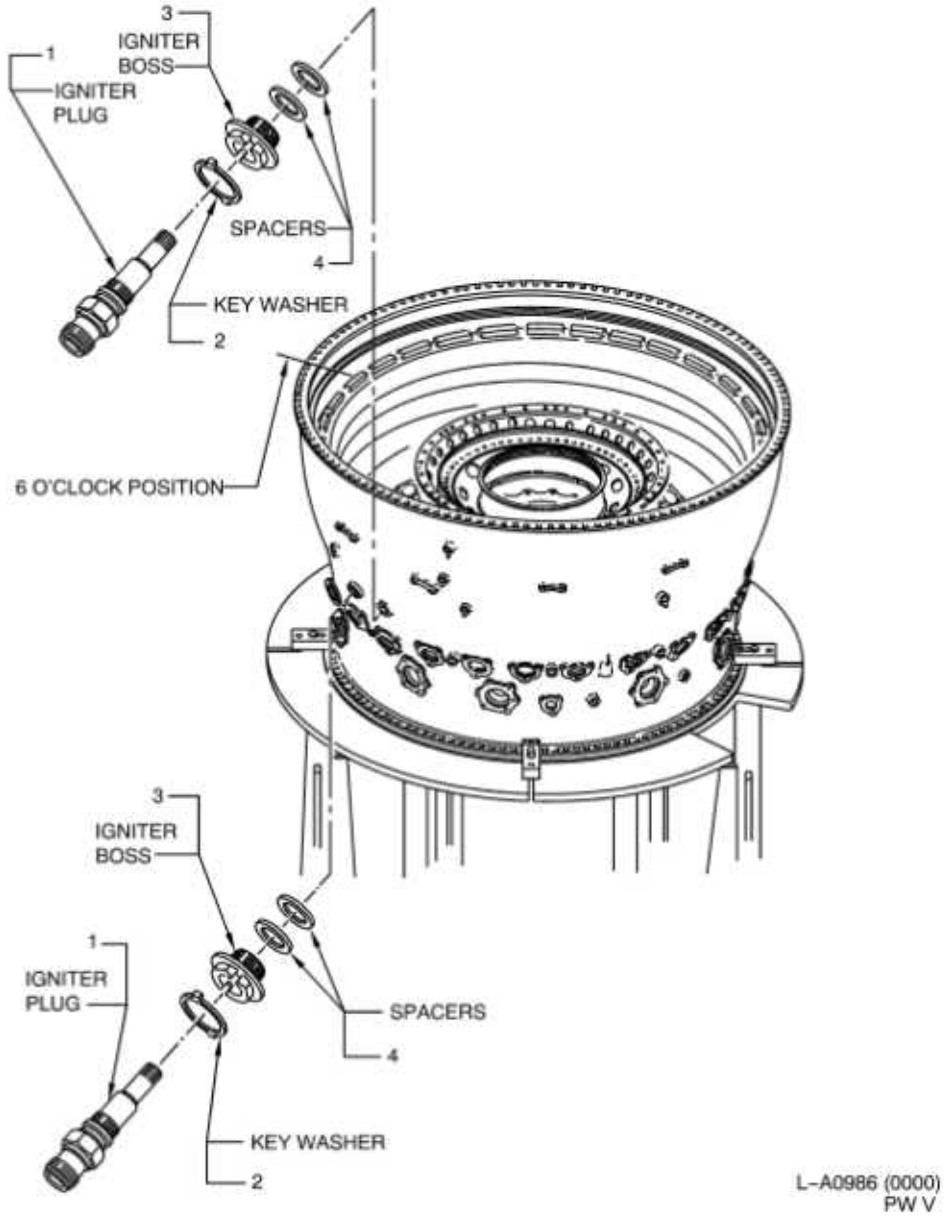

DOWEL PIN
(6 O'CLOCK POSITION)
GASKET
(TYPICAL)
17
PLUG
(TYPICAL)
18
18A
PLUG
(TYPICAL)
26
GASKET
GASKET
22
BOLT
21
(9 O'CLOCK POSITION)
23
COVER
27
PLUG
L-A5768 (0000)
PW V

Diffuser Case Externals Removal (Pre SB PW4ENG 72−567)
Figure 503 (Sheet 7)
(Task 72−41−00−030−002)

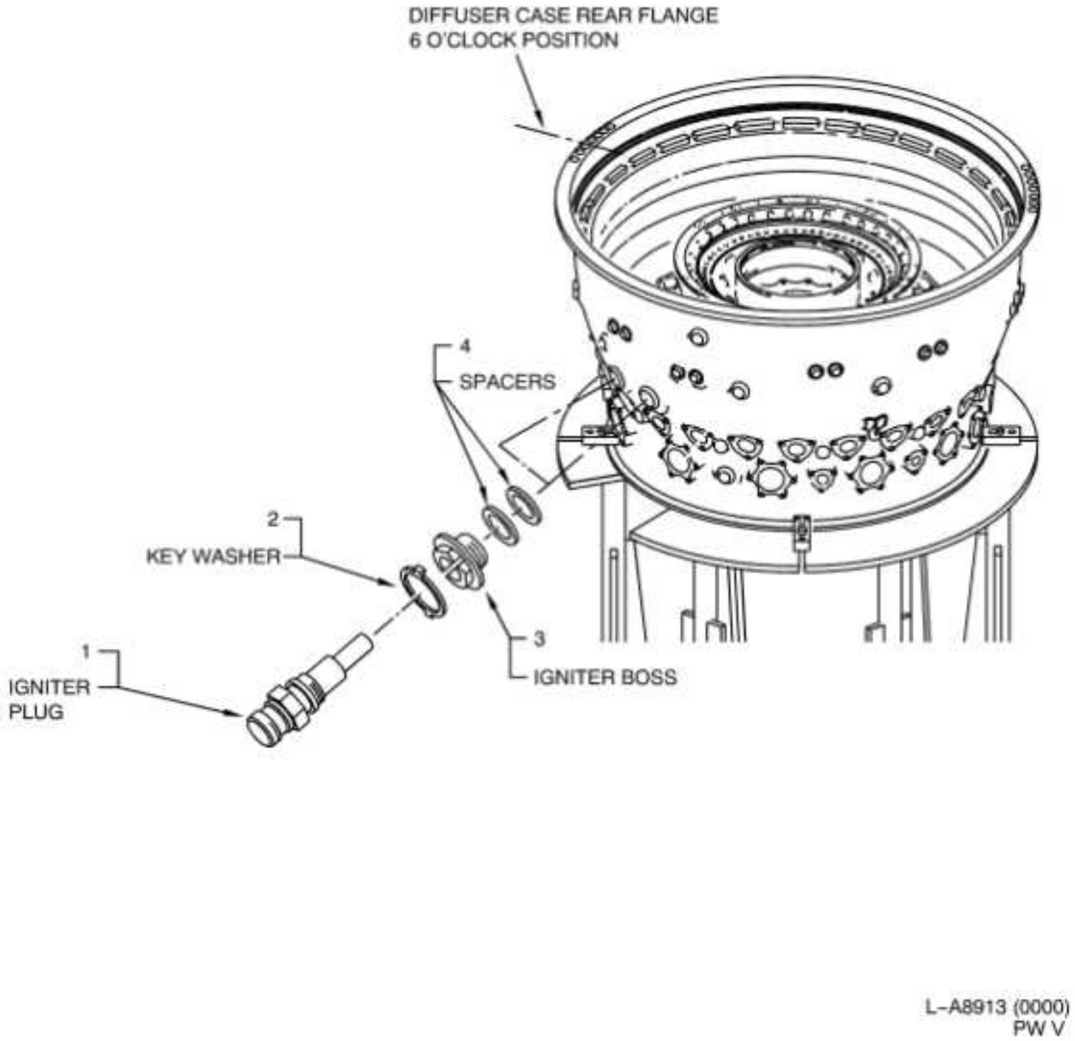
DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


DOWEL PIN
(6 O'CLOCK POSITION)
17
GASKET
(TYPICAL)
18A
PLUG
(TYPICAL)
22
GASKET
21
BOLT
23
COVER
(9 O'CLOCK POSITION)
L−B4650 (0197)
PW V

Diffuser Case Externals Removal (Post SB PW4ENG 72−567)
Figure 503 (Sheet 8)
(Task 72−41−00−030−002)

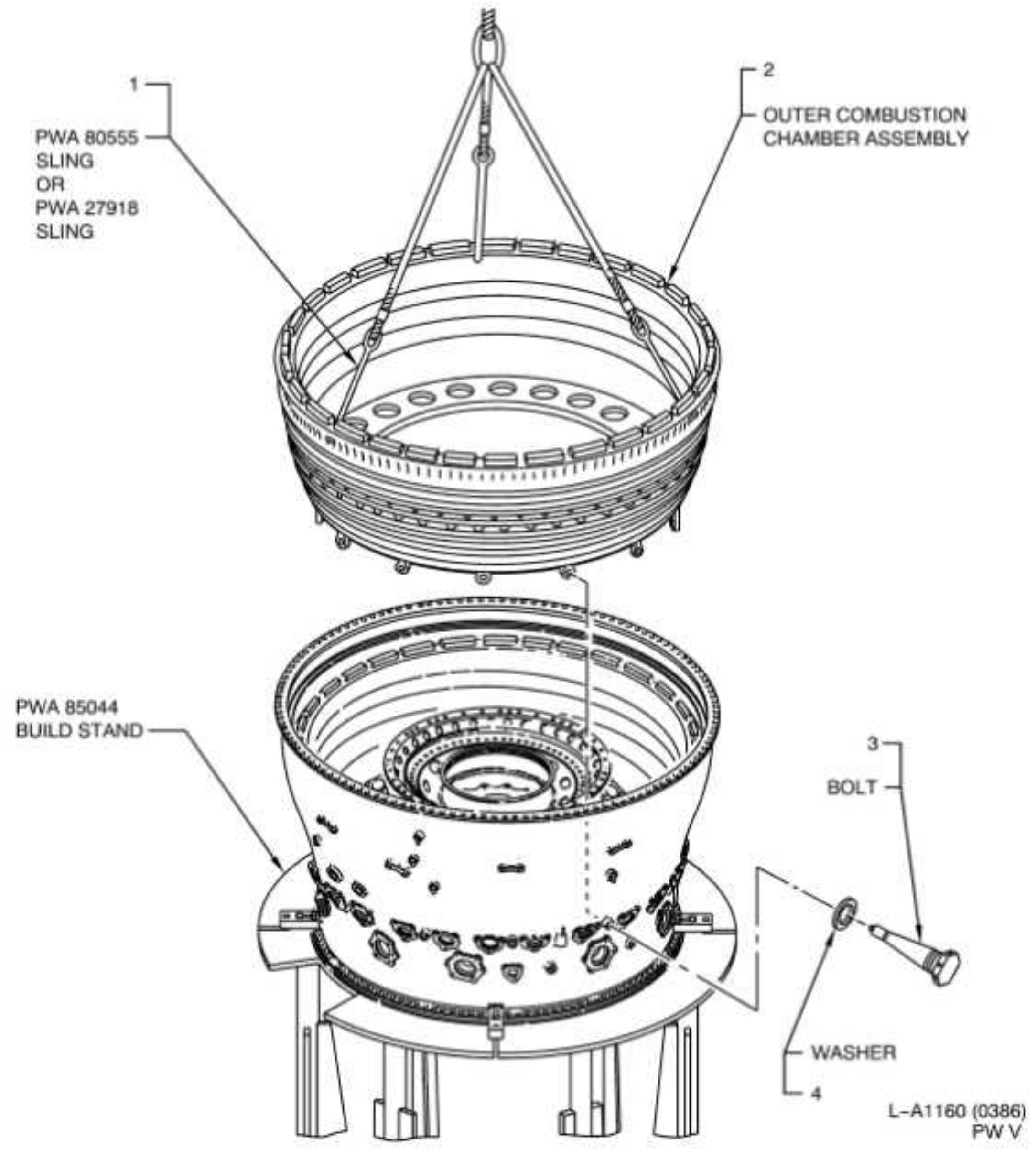

3
IGNITER BOSS
1
IGNITER PLUG
SPACERS
4
KEY WASHER
2
6 O'CLOCK POSITION
3
IGNITER BOSS
1
IGNITER PLUG
SPACERS
4
KEY WASHER
2
L−A0986 (0000)
PW V

Diffuser Case Igniter Plug Removal (Pre SB PW4ENG 72−567)
Figure 504 (Sheet 1)
(Task 72−41−00−030−002)


DIFFUSER CASE REAR FLANGE
6 O'CLOCK POSITION
4
SPACERS
2
KEY WASHER
1
IGNITER
PLUG
3
IGNITER BOSS
L−A8913 (0000)
PW V

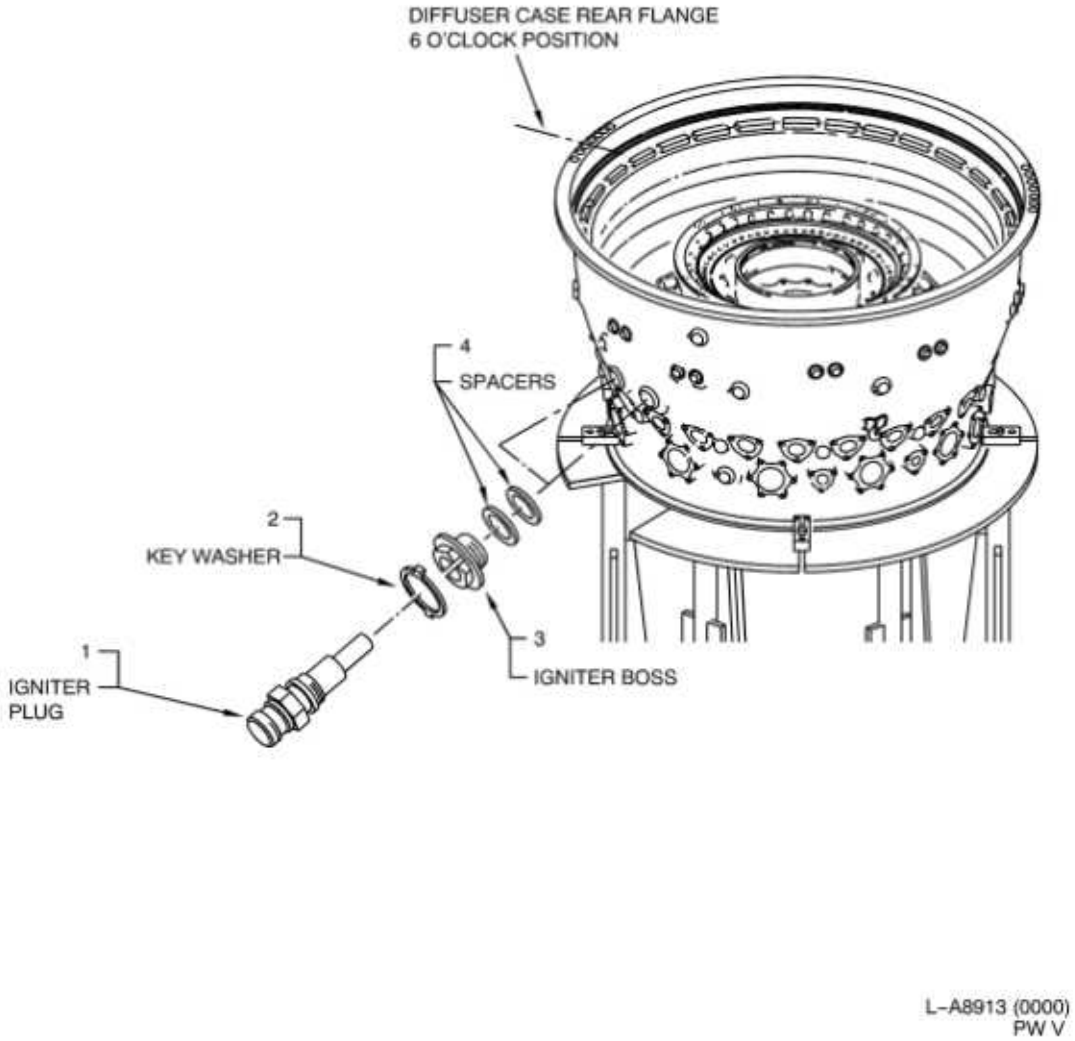
Diffuser Case Igniter Plug Removal (Post SB PW4ENG 72−567)
Figure 504 (Sheet 2)
(Task 72−41−00−030−002)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


1
PWA 80555
SLING
OR
PWA 27918
SLING
2
OUTER COMBUSTION
CHAMBER ASSEMBLY
PWA 85044
BUILD STAND
3
BOLT
WASHER
4
L−A1160 (0386)
PW V

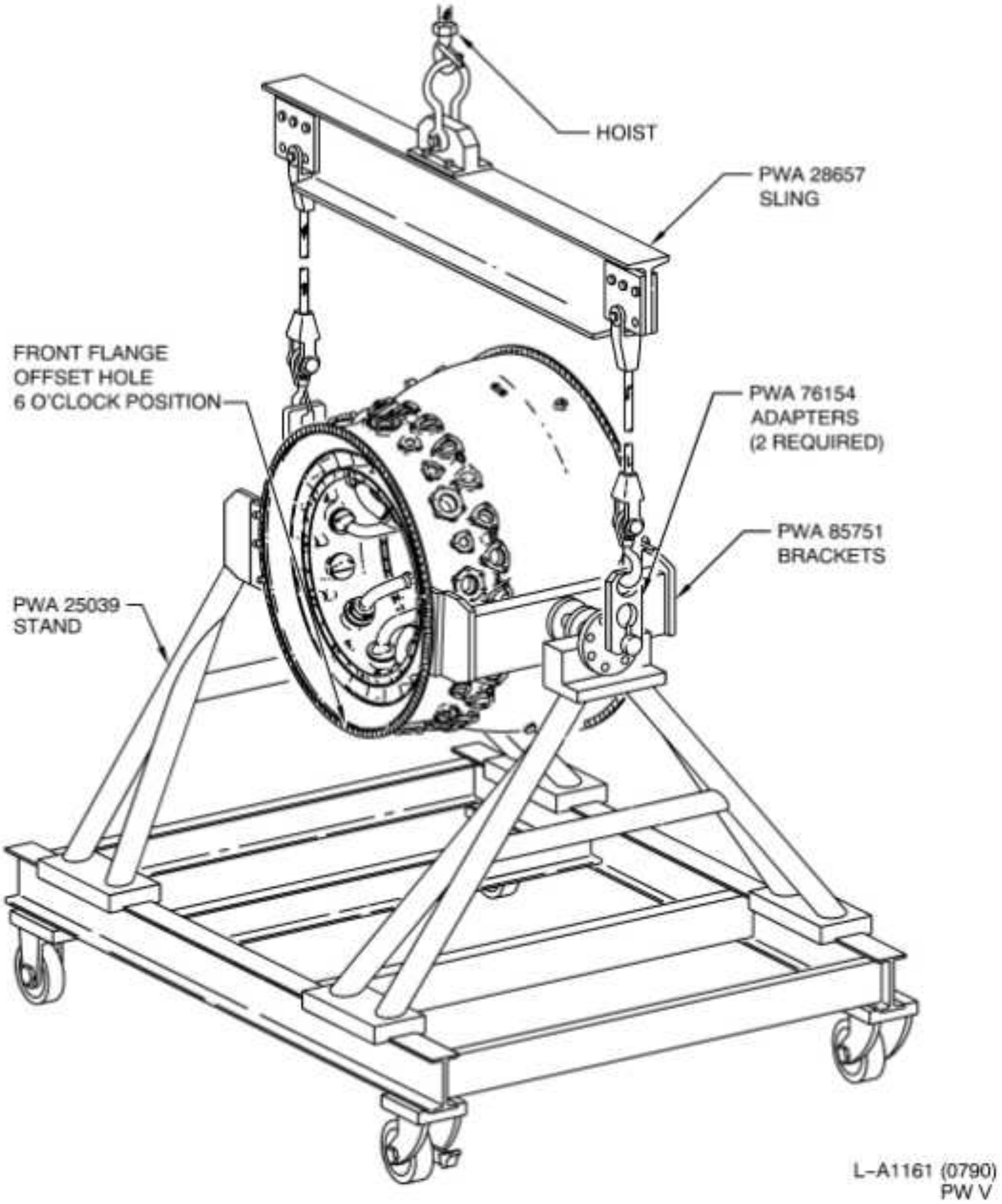
Outer Combustion Chamber Assembly Removal
Diffuser Case (Pre SB PW4ENG 72−567)
Figure 505 (Sheet 1)
(Task 72−41−00−030−002)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

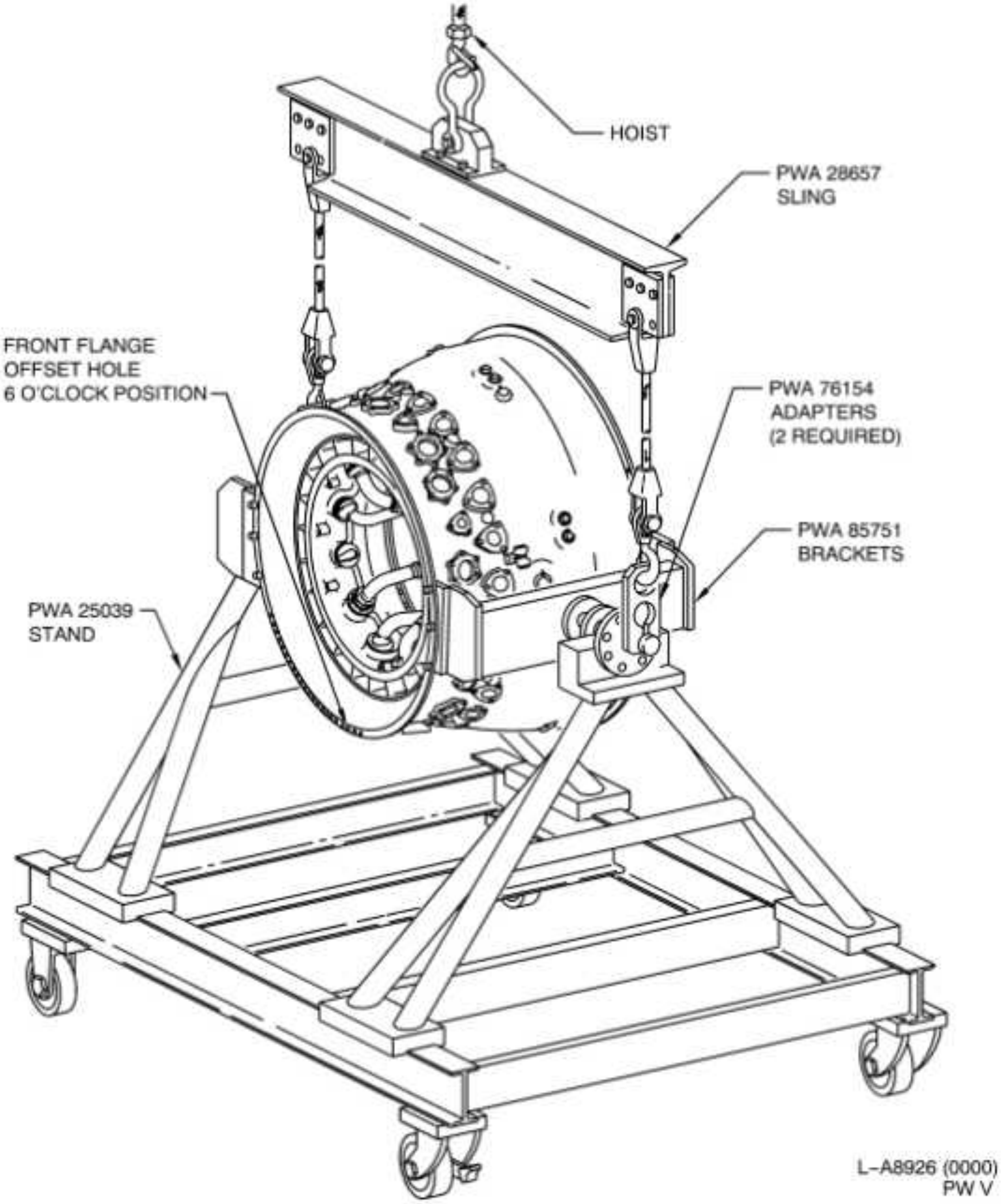

DIFFUSER CASE REAR FLANGE
6 O'CLOCK POSITION
4
SPACERS
2
KEY WASHER
1
IGNITER
PLUG
3
IGNITER BOSS
L−A8913 (0000)
PW V

Outer Combustion Chamber Assembly Removal
Diffuser Case (Post SB PW4ENG 72−567)
Figure 505 (Sheet 2)
(Task 72−41−00−030−002)

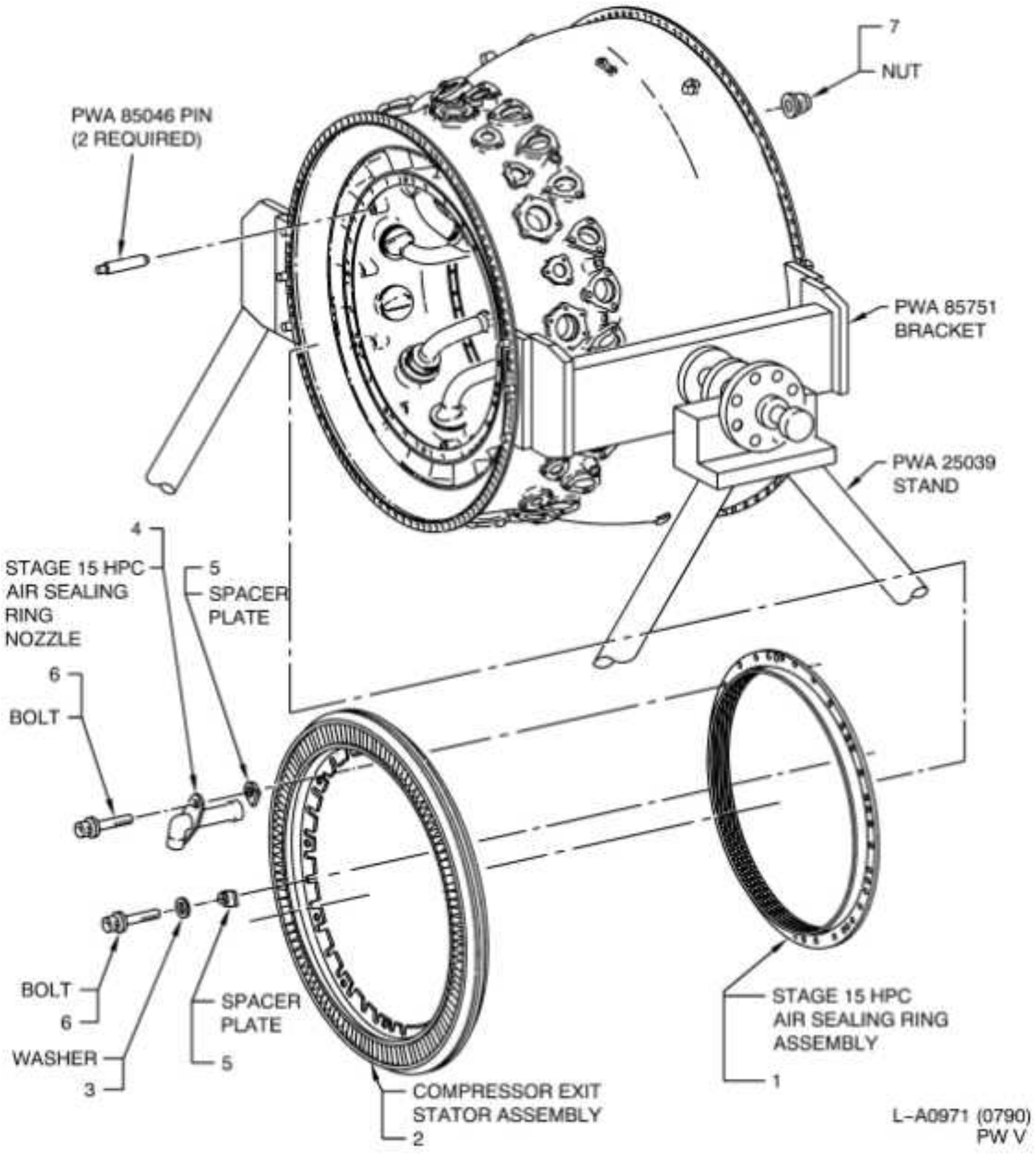
DIFFUSER AND COMBUSTOR - DISASSEMBLY-02


HOIST
PWA 28657
SLING
FRONT FLANGE
OFFSET HOLE
6 O'CLOCK POSITION
PWA 76154
ADAPTERS
(2 REQUIRED)
PWA 85751
BRACKETS
PWA 25039
STAND
L-A1161 (0790)
PW V

Diffuser Case And PWA 25039 Build Stand (Pre SB PW4ENG 72-567)
Figure 506 (Sheet 1)
(Task 72-41-00-030-002)

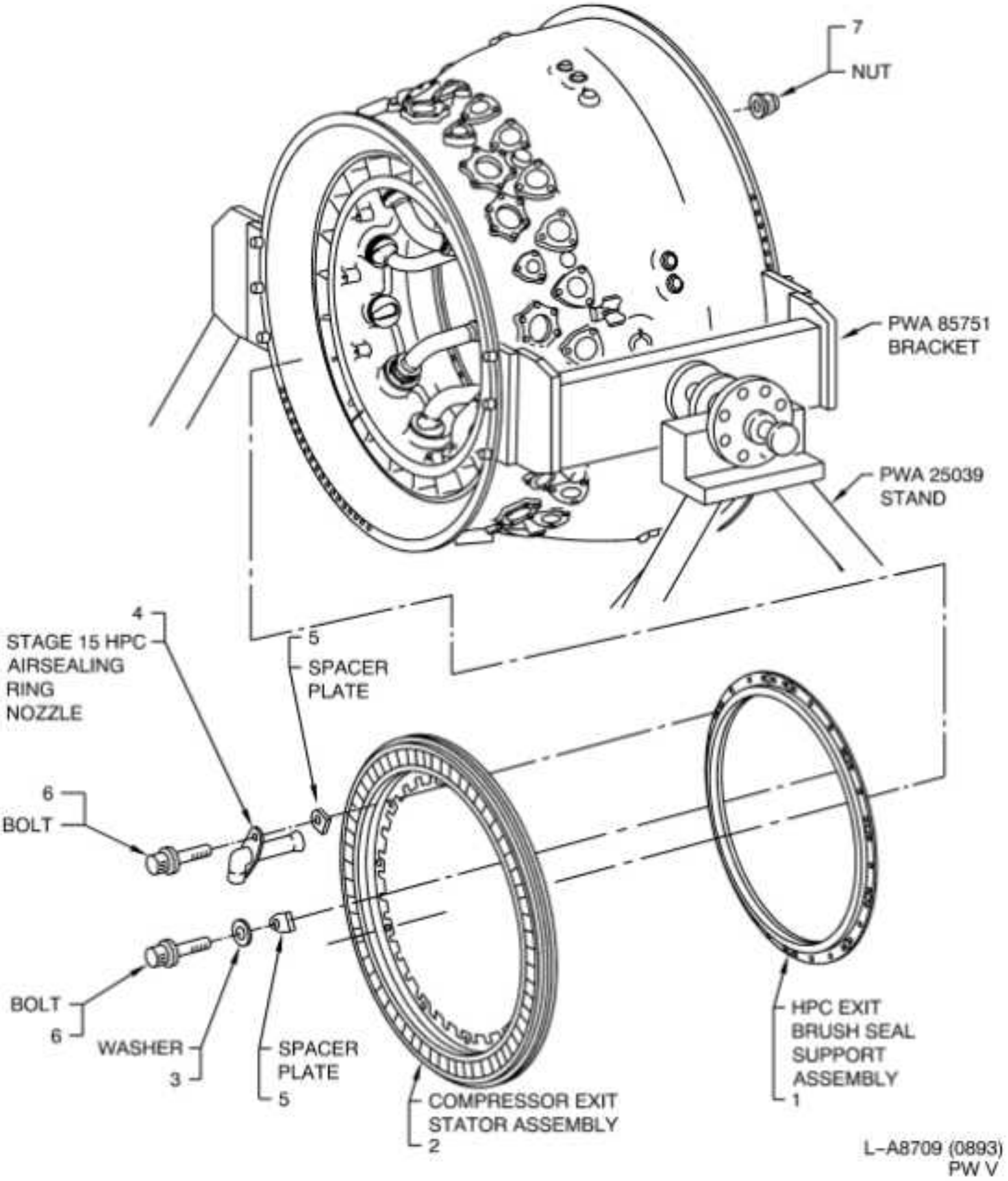

HOIST
PWA 28657 SLING
FRONT FLANGE OFFSET HOLE 6 O'CLOCK POSITION
PWA 76154 ADAPTERS (2 REQUIRED)
PWA 85751 BRACKETS
PWA 25039 STAND
L-A8926 (0000)
PW V

Diffuser Case And PWA 25039 Build Stand (Post SB PW4ENG 72−567)
Figure 506 (Sheet 2)
(Task 72−41−00−030−002)

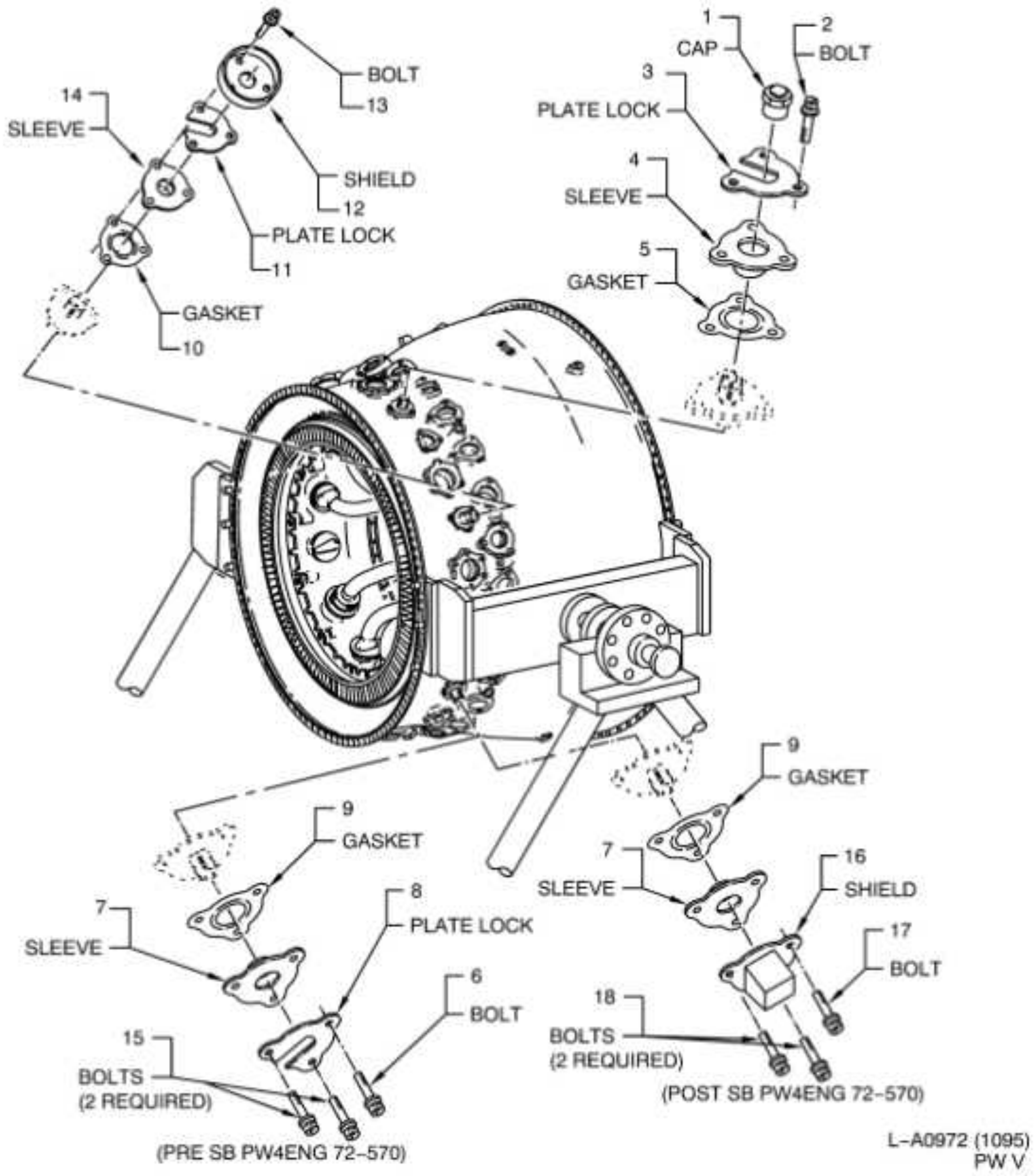

7
NUT
PWA 85046 PIN
(2 REQUIRED)
PWA 85751
BRACKET
PWA 25039
STAND
4
STAGE 15 HPC
AIR SEALING
RING
NOZZLE
5
SPACER
PLATE
6
BOLT
BOLT
6
WASHER
3
SPACER
PLATE
5
COMPRESSOR EXIT
STATOR ASSEMBLY
2
STAGE 15 HPC
AIR SEALING RING
ASSEMBLY
1
L−A0971 (0790)
PW V

Stage 15 HPC Stator Removal Diffuser Case
(Pre SB PW4ENG 72−572 And SB PW4ENG 72−567)
Figure 507 (Sheet 1)
(Task 72−41−00−030−002)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

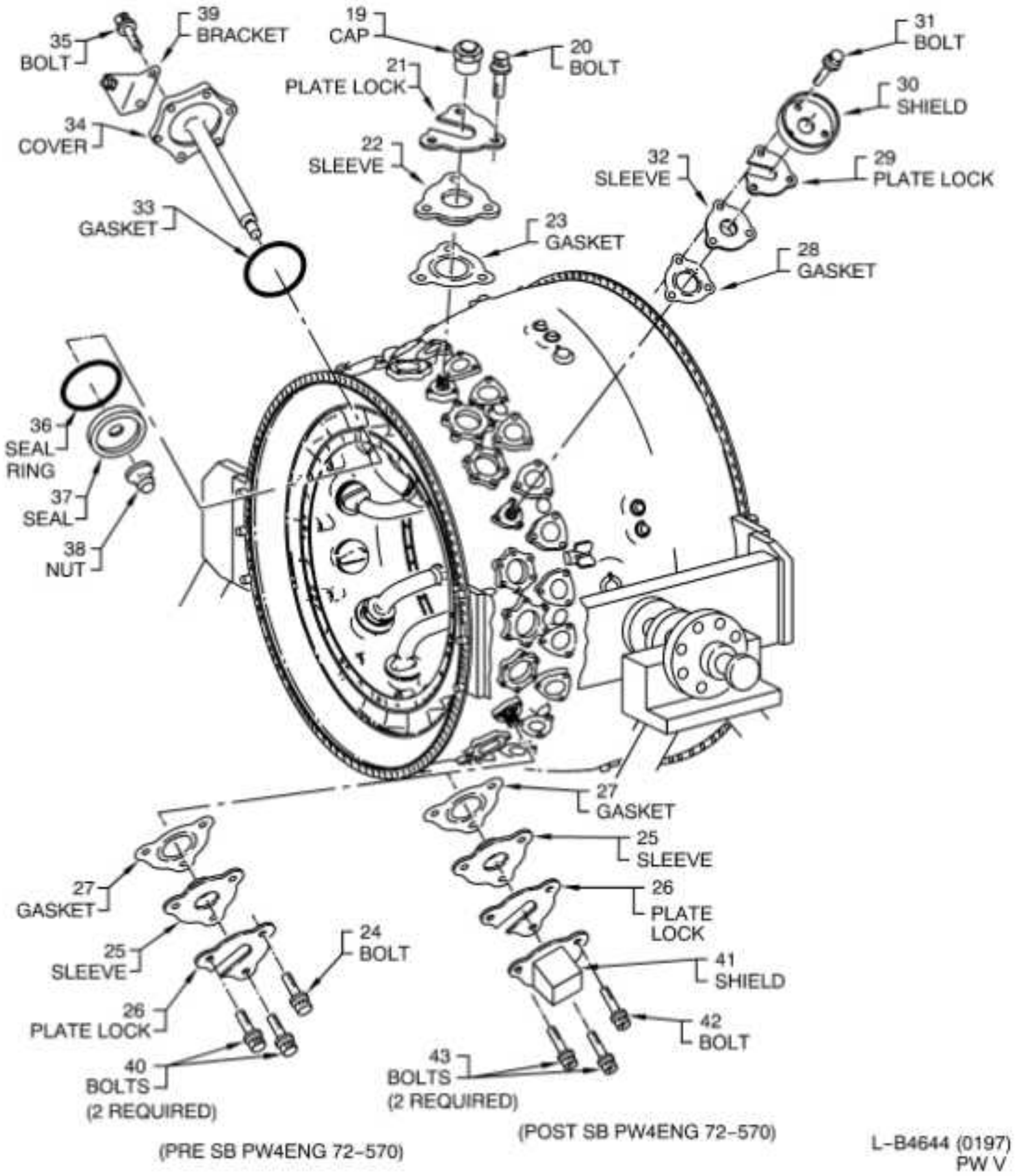

7
NUT
PWA 85751
BRACKET
PWA 25039
STAND
4
STAGE 15 HPC
AIRSEALING
RING
NOZZLE
5
SPACER
PLATE
6
BOLT
BOLT
6
WASHER
3
SPACER
PLATE
5
COMPRESSOR EXIT
STATOR ASSEMBLY
2
HPC EXIT
BRUSH SEAL
SUPPORT
ASSEMBLY
1
L-A8709 (0893)
PW V

Brush Seal Support And Stage 15 HPC Stator Removal
Diffuser Case (Post SB PW4ENG 72−572 And SB PW4ENG 72−567)
Figure 507 (Sheet 2)
(Task 72−41−00−030−002)

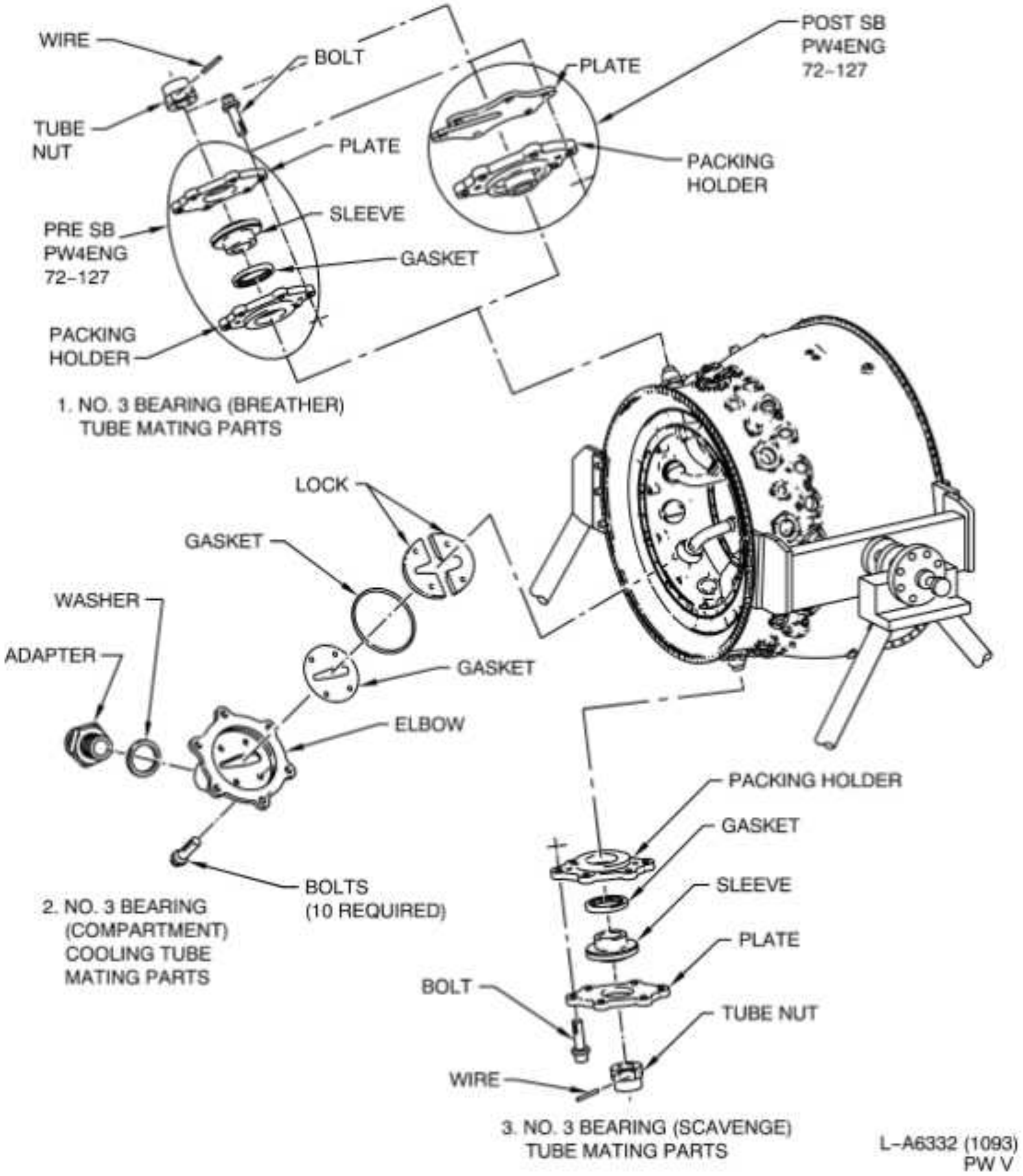

1
CAP
2
BOLT
3
PLATE LOCK
4
SLEEVE
5
GASKET
BOLT
13
14
SLEEVE
SHIELD
12
PLATE LOCK
11
GASKET
10
9
GASKET
9
GASKET
7
SLEEVE
16
SHIELD
7
SLEEVE
8
PLATE LOCK
17
BOLT
6
BOLT
18
BOLTS
(2 REQUIRED)
15
BOLTS
(2 REQUIRED)
(POST SB PW4ENG 72-570)
(PRE SB PW4ENG 72-570)
L-A0972 (1095)
PW V

No. 3 Bearing Pressure Tube And Airframe Manifold Assembly
Diffuser Case Plate Locks And Gaskets (Pre SB PW4ENG 72−567)
Figure 508 (Sheet 1)
(Task 72−41−00−030−002)

DIFFUSER AND COMBUSTOR - DISASSEMBLY-02

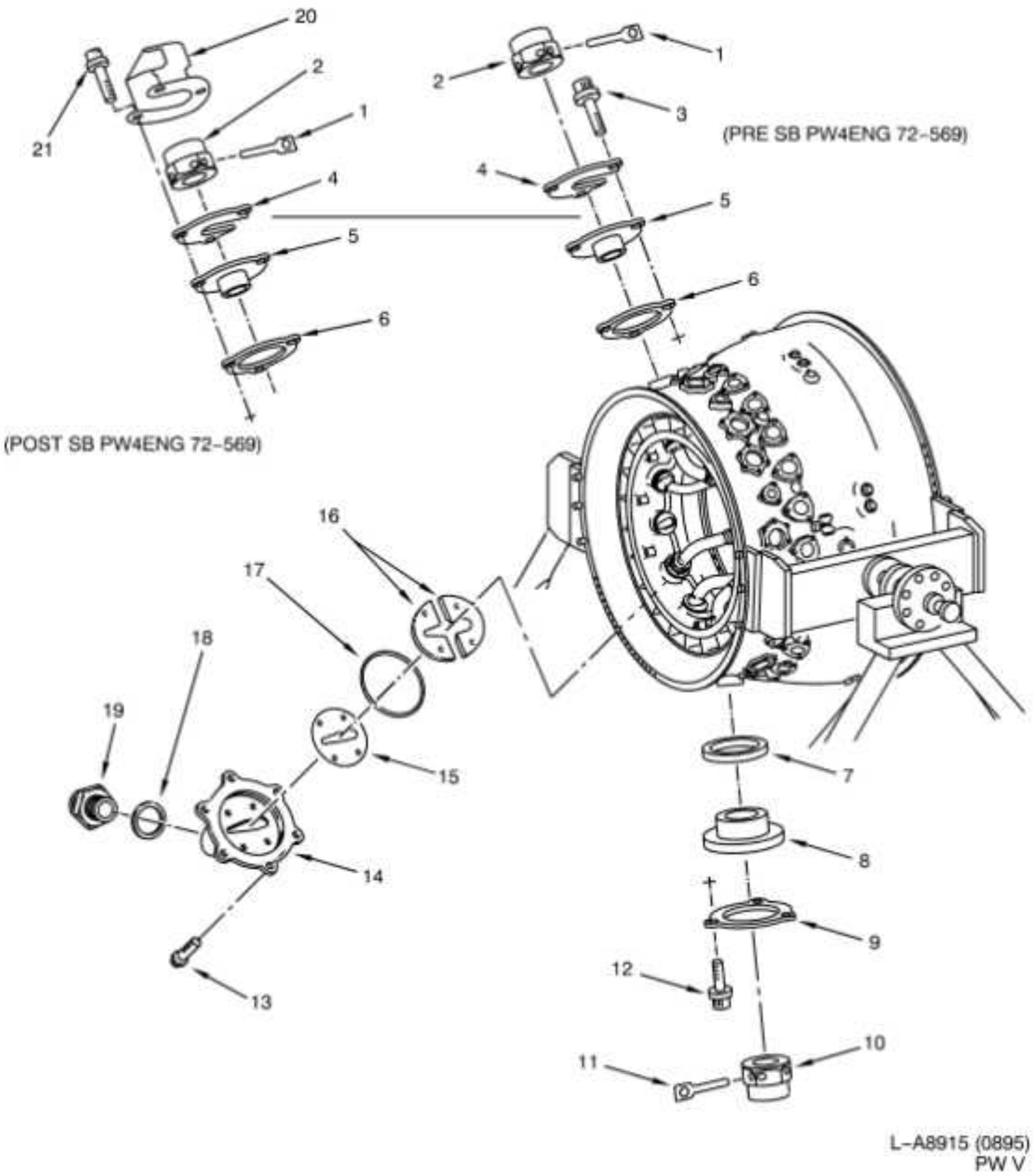

39 BRACKET
35 BOLT
19 CAP
21 PLATE LOCK
20 BOLT
31 BOLT
30 SHIELD
34 COVER
22 SLEEVE
32 SLEEVE
29 PLATE LOCK
33 GASKET
23 GASKET
28 GASKET
36 SEAL RING
37 SEAL
38 NUT
27 GASKET
25 SLEEVE
26 PLATE LOCK
27 GASKET
25 SLEEVE
24 BOLT
26 PLATE LOCK
41 SHIELD
42 BOLT
40 BOLTS (2 REQUIRED)
43 BOLTS (2 REQUIRED)
(PRE SB PW4ENG 72-570)
(POST SB PW4ENG 72-570)
L-B4644 (0197)
PW V

No. 3 Bearing Pressure Tube And Airframe Manifold
Assembly Diffuser Case Plate Locks And Gaskets
(Post SB PW4ENG 72-567 And SB PW4ENG 72-559)
Figure 508 (Sheet 2)
(Task 72-41-00-030-002)


WIRE
BOLT
TUBE NUT
PLATE
POST SB PW4ENG 72-127
PLATE
PACKING HOLDER
SLEEVE
PRE SB PW4ENG 72-127
GASKET
PACKING HOLDER
1. NO. 3 BEARING (BREATHER) TUBE MATING PARTS
LOCK
GASKET
WASHER
ADAPTER
GASKET
ELBOW
BOLTS (10 REQUIRED)
2. NO. 3 BEARING (COMPARTMENT) COOLING TUBE MATING PARTS
PACKING HOLDER
GASKET
SLEEVE
PLATE
BOLT
TUBE NUT
WIRE
3. NO. 3 BEARING (SCAVENGE) TUBE MATING PARTS
L-A6332 (1093)
PW V

No. 3 Bearing Breather, Scavenge And Compartment Cooling Tube Mating Parts Diffuser Case (Pre SB PW4ENG 72−567)
Figure 509
(Task 72−41−00−030−002)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

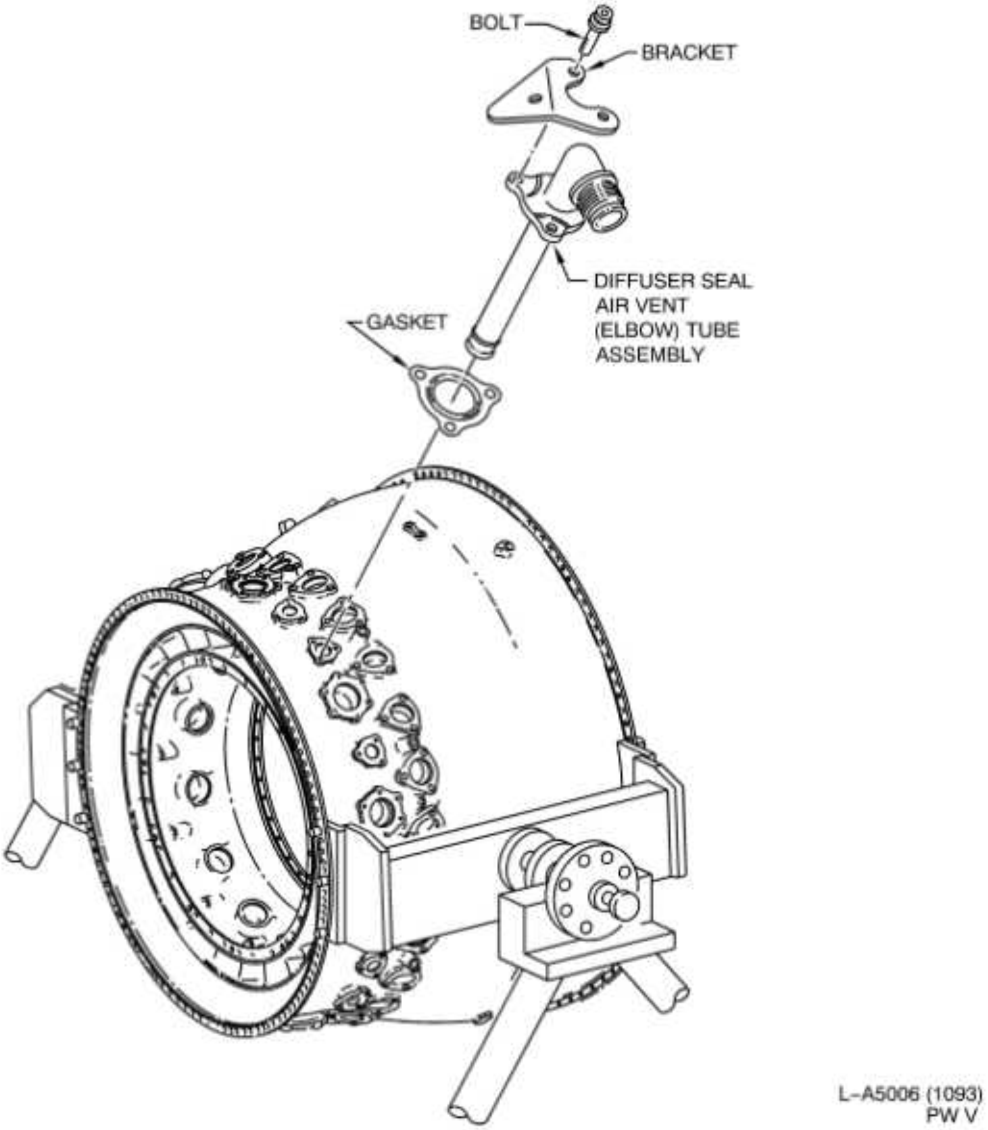

20
2
1
21
4
5
6
(POST SB PW4ENG 72-569)
1
2
3
(PRE SB PW4ENG 72-569)
4
5
6
16
17
18
19
15
14
13
7
8
9
12
10
11
L-A8915 (0895)
PW V

No. 3 Bearing Breather, Scavenge And Compartment Cooling
Tube Mating Parts Diffuser Case (Post SB PW4ENG 72−567)
Figure 510
(Task 72−41−00−030−002)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

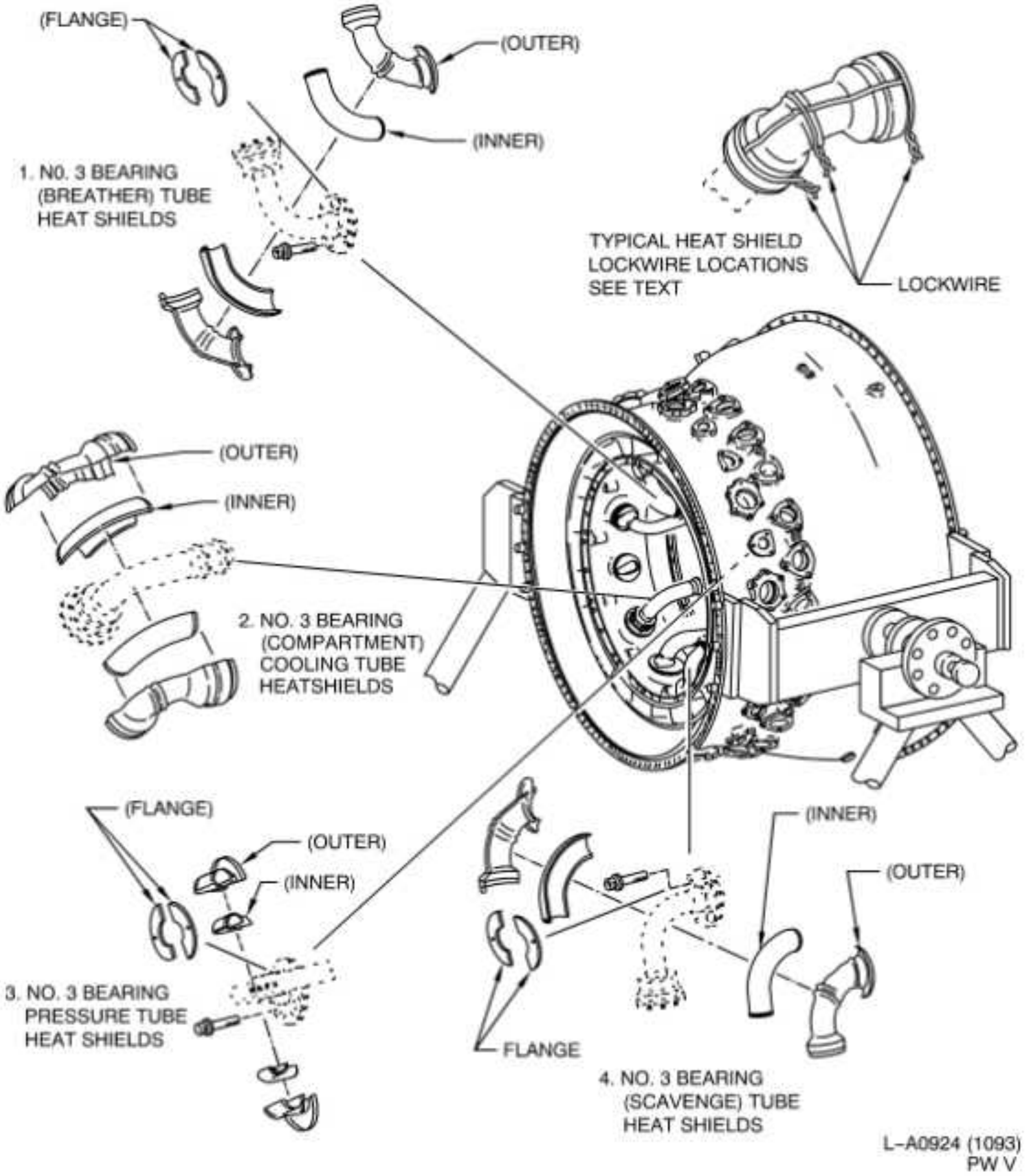
1. Wire
2. Tube Nut
3. Bolt (Shorter − 3 Necessary)
4. Plate Lock
5. Sleeve
6. Gasket
7. Gasket
8. Sleeve
9. Plate
10. Tube Nut
11. Wire
12. Bolt
13. Bolt (10 Necessary)
14. Elbow
15. Gasket
16. Lock
17. Gasket
18. Washer
19. Adapter
20. Heat Shield
21. Bolt (Longer − 3 Necessary)

Key to Figure 510


BOLT
BRACKET
DIFFUSER SEAL AIR VENT (ELBOW) TUBE ASSEMBLY
GASKET
L−A5006 (1093)
PW V

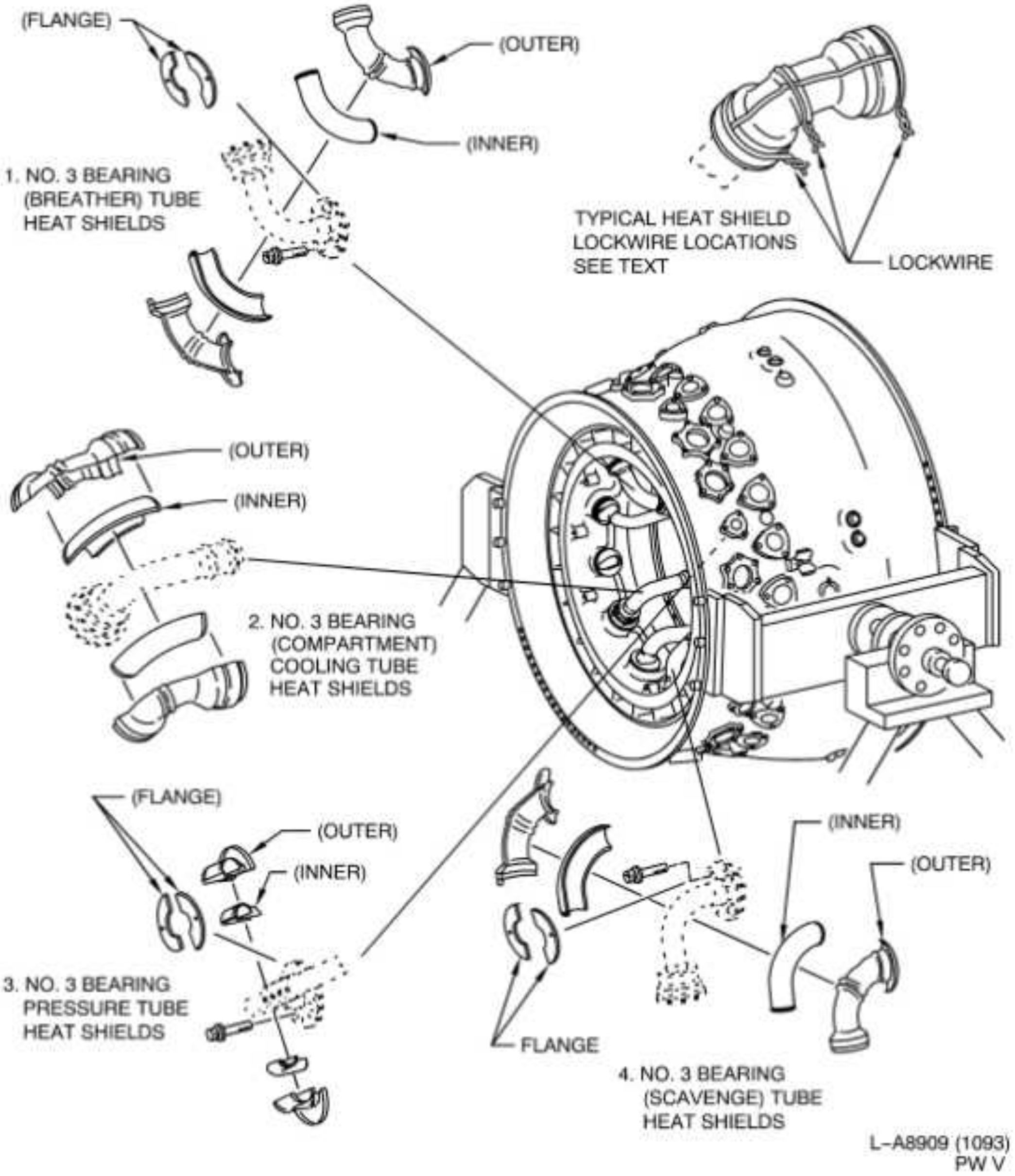
Diffuser Seal Air Vent Tube Assembly Removal (Pre SB PW4ENG 72−567)
Figure 511
(Task 72−41−00−030−002)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


(FLANGE)
(OUTER)
(INNER)
1. NO. 3 BEARING (BREATHER) TUBE HEAT SHIELDS
TYPICAL HEAT SHIELD LOCKWIRE LOCATIONS SEE TEXT
LOCKWIRE
(OUTER)
(INNER)
2. NO. 3 BEARING (COMPARTMENT) COOLING TUBE HEATSHIELDS
(FLANGE)
(OUTER)
(INNER)
3. NO. 3 BEARING PRESSURE TUBE HEAT SHIELDS
FLANGE
(INNER)
(OUTER)
4. NO. 3 BEARING (SCAVENGE) TUBE HEAT SHIELDS
L−A0924 (1093)
PW V

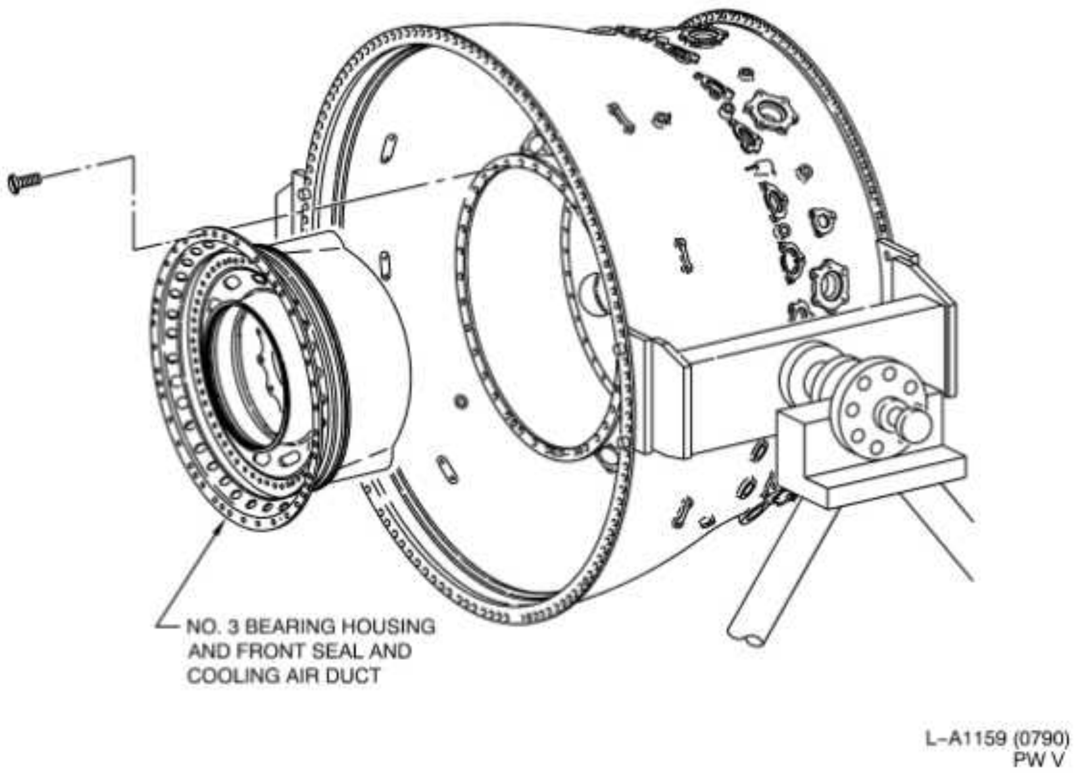
Removal Of The No. 3 Bearing Tube Heat
Shields Diffuser Case (Post SB PW4ENG 72−567)
Figure 512 (Sheet 1)
(Task 72−41−00−030−002)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


(FLANGE)
(OUTER)
(INNER)
1. NO. 3 BEARING (BREATHER) TUBE HEAT SHIELDS
TYPICAL HEAT SHIELD LOCKWIRE LOCATIONS SEE TEXT
LOCKWIRE
(OUTER)
(INNER)
2. NO. 3 BEARING (COMPARTMENT) COOLING TUBE HEAT SHIELDS
(FLANGE)
(OUTER)
(INNER)
3. NO. 3 BEARING PRESSURE TUBE HEAT SHIELDS
(INNER)
(OUTER)
FLANGE
4. NO. 3 BEARING (SCAVENGE) TUBE HEAT SHIELDS
L−A8909 (1093)
PW V

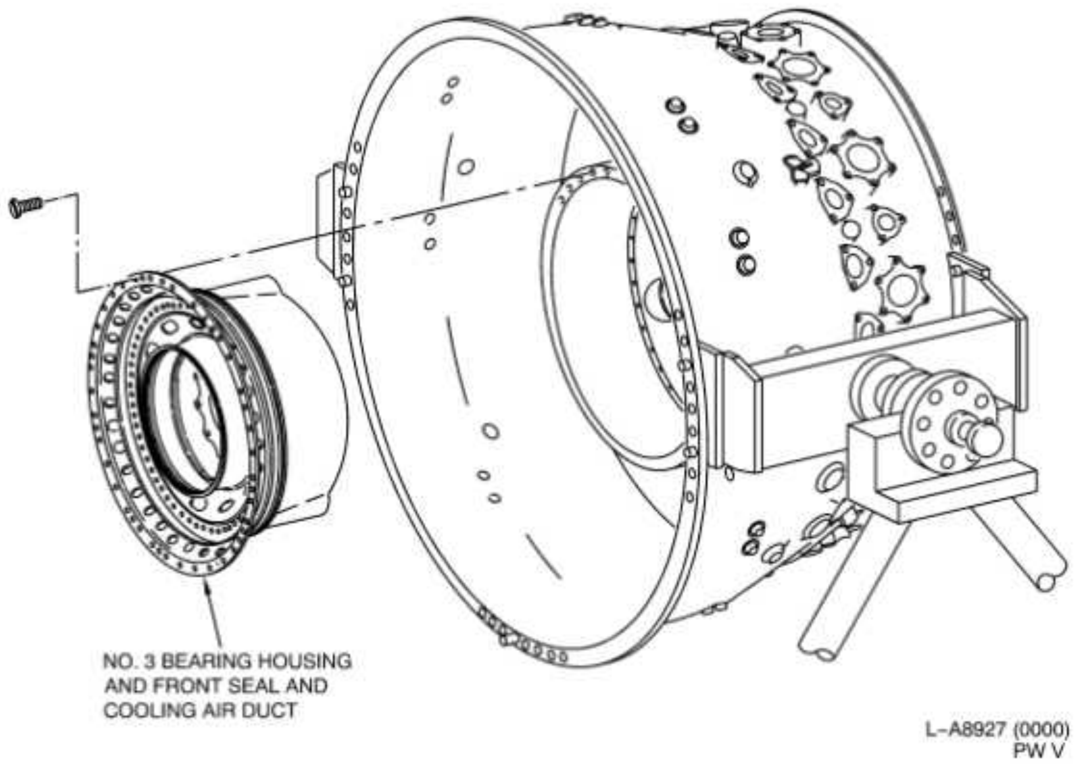
Removal Of The No. 3 Bearing Tube Heat
Shields Diffuser Case (Post SB PW4ENG 72−567)
Figure 512 (Sheet 2)
(Task 72−41−00−030−002)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

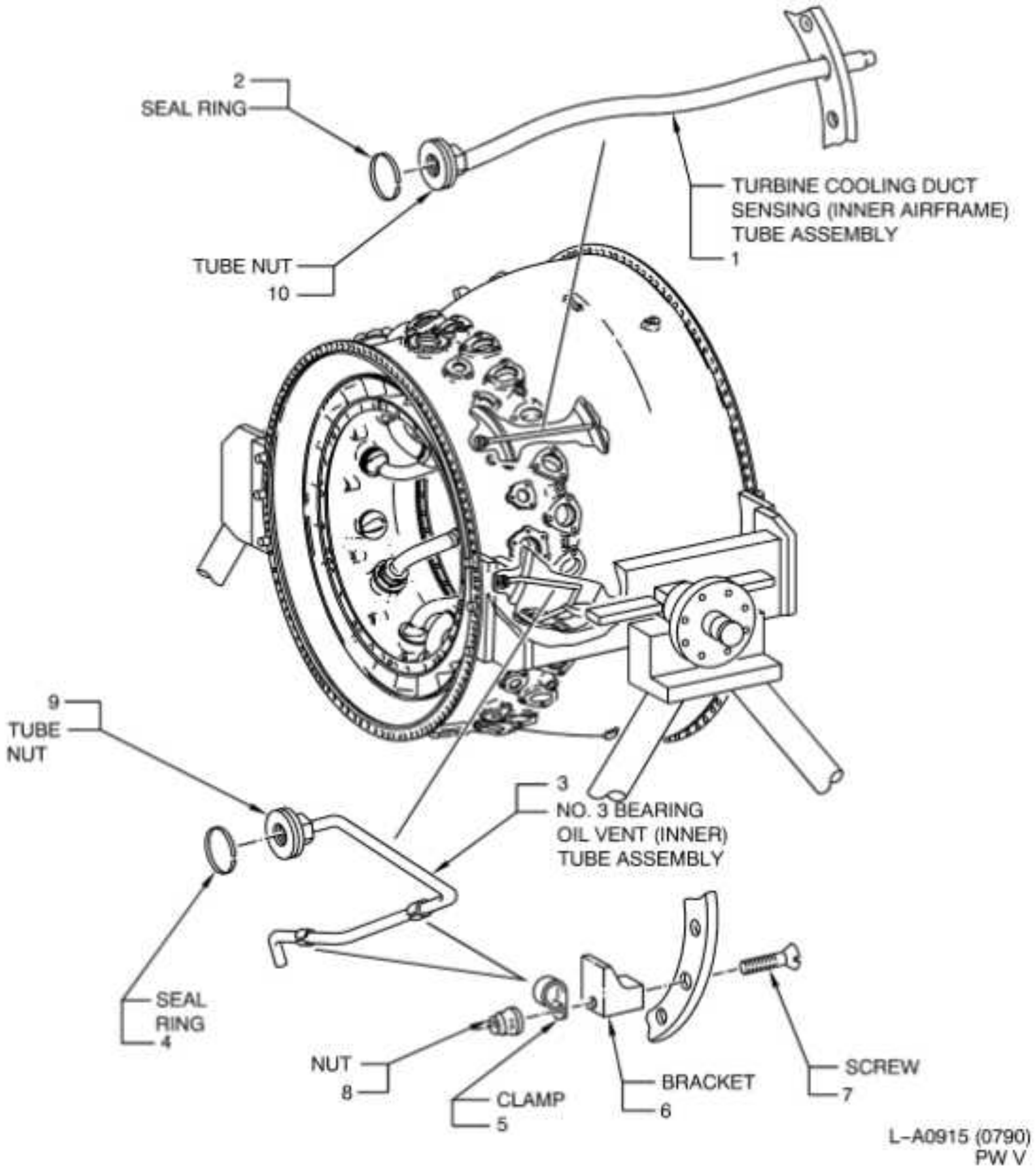

NO. 3 BEARING HOUSING AND FRONT SEAL AND COOLING AIR DUCT
L−A1159 (0790)
PW V

No. 3 Bearing Duct, Seal And Housing
Removal Diffuser Case (Pre SB PW4ENG 72−567)
Figure 513 (Sheet 1)
(Task 72−41−00−030−002)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

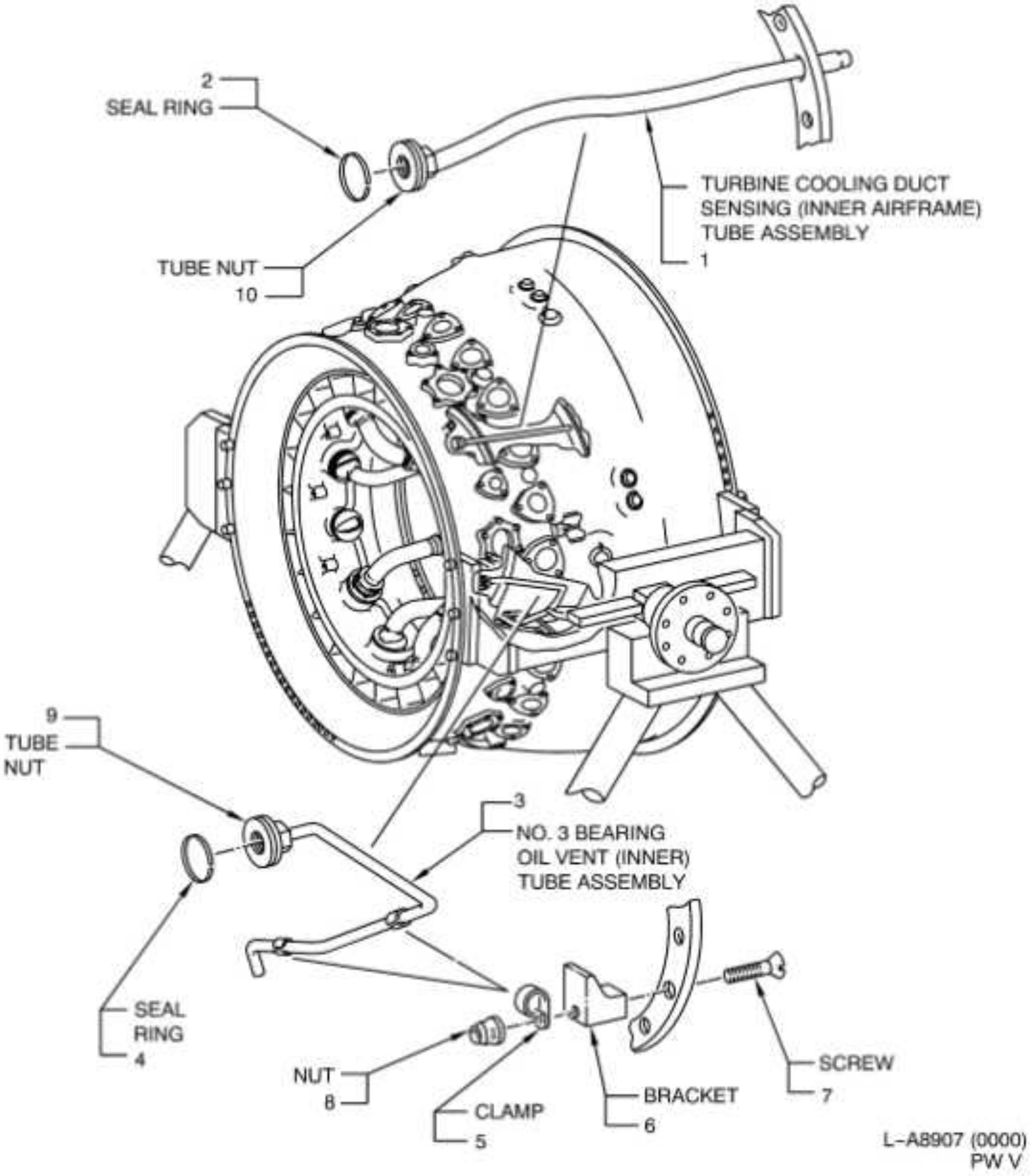

NO. 3 BEARING HOUSING AND FRONT SEAL AND COOLING AIR DUCT
L−A8927 (0000)
PW V

No. 3 Bearing Duct, Seal And Housing Removal
Diffuser Case (Post SB PW4ENG 72−567)
Figure 513 (Sheet 2)
(Task 72−41−00−030−002)


2
SEAL RING
TURBINE COOLING DUCT SENSING (INNER AIRFRAME) TUBE ASSEMBLY
1
TUBE NUT
10
9
TUBE NUT
3
NO. 3 BEARING OIL VENT (INNER) TUBE ASSEMBLY
SEAL RING
4
NUT
8
CLAMP
5
BRACKET
6
SCREW
7
L−A0915 (0790)
PW V

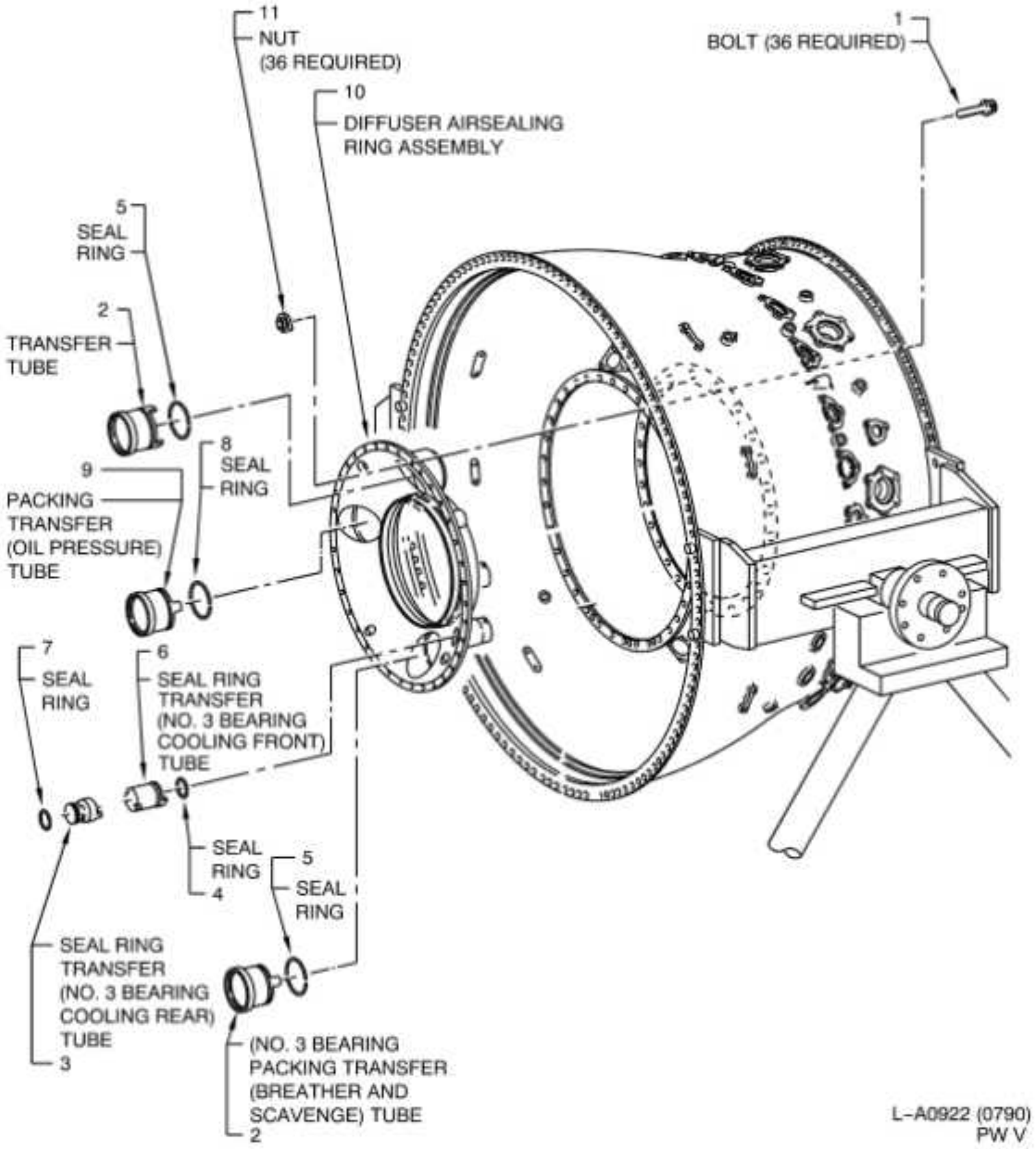
Oil Vent And Cooling Duct Tube Assembly
Removal Diffuser Case (Pre SB PW4ENG 72−567)
Figure 514 (Sheet 1)
(Task 72−41−00−030−002)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


2
SEAL RING
TURBINE COOLING DUCT SENSING (INNER AIRFRAME) TUBE ASSEMBLY
1
TUBE NUT
10
9
TUBE NUT
3
NO. 3 BEARING OIL VENT (INNER) TUBE ASSEMBLY
SEAL RING
4
NUT
8
CLAMP
5
BRACKET
6
SCREW
7
L−A8907 (0000)
PW V

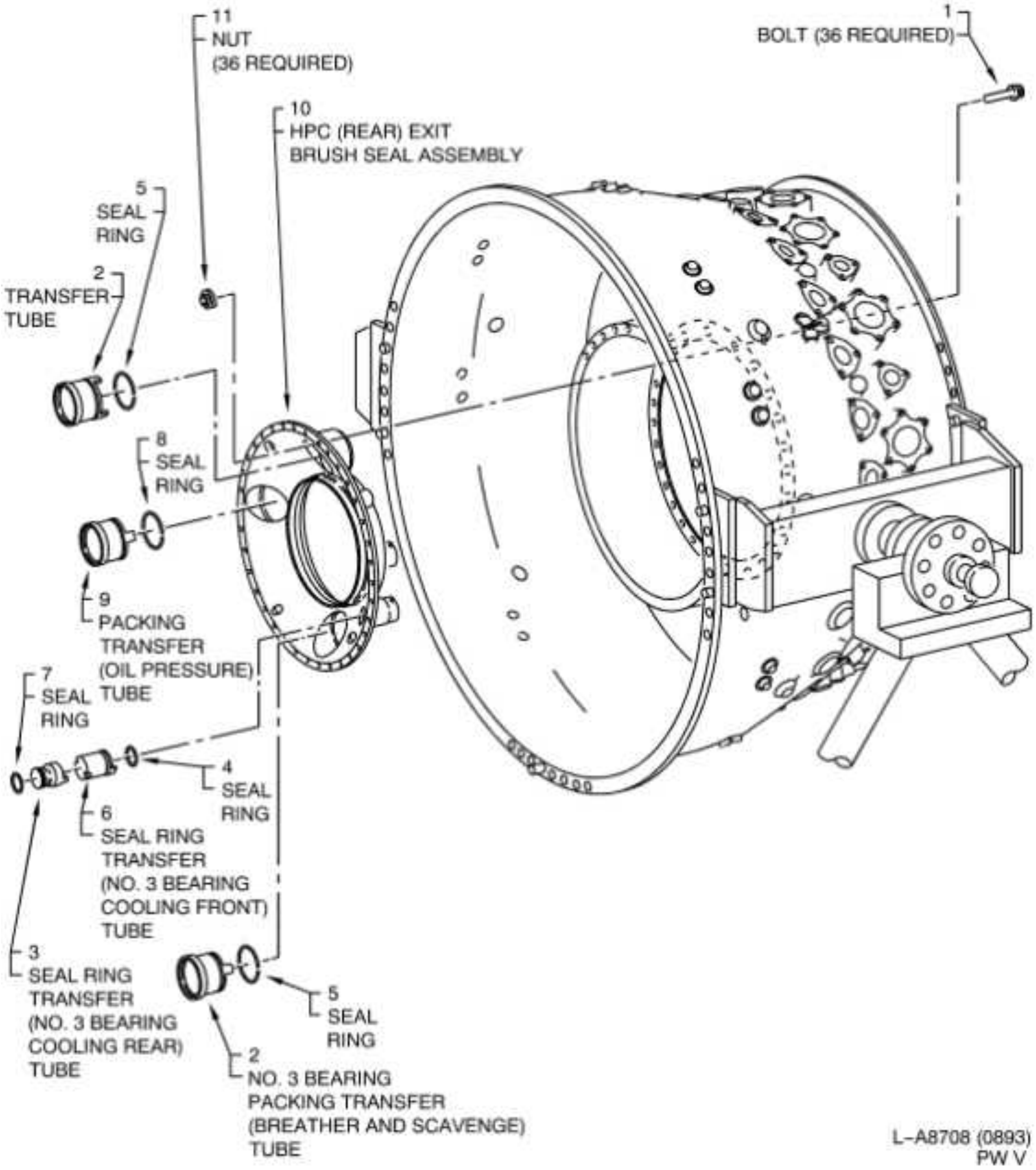
Oil Vent And Cooling Duct Tube Assembly
Removal Diffuser Case (Post SB PW4ENG 72−567)
Figure 514 (Sheet 2)
(Task 72−41−00−030−002)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

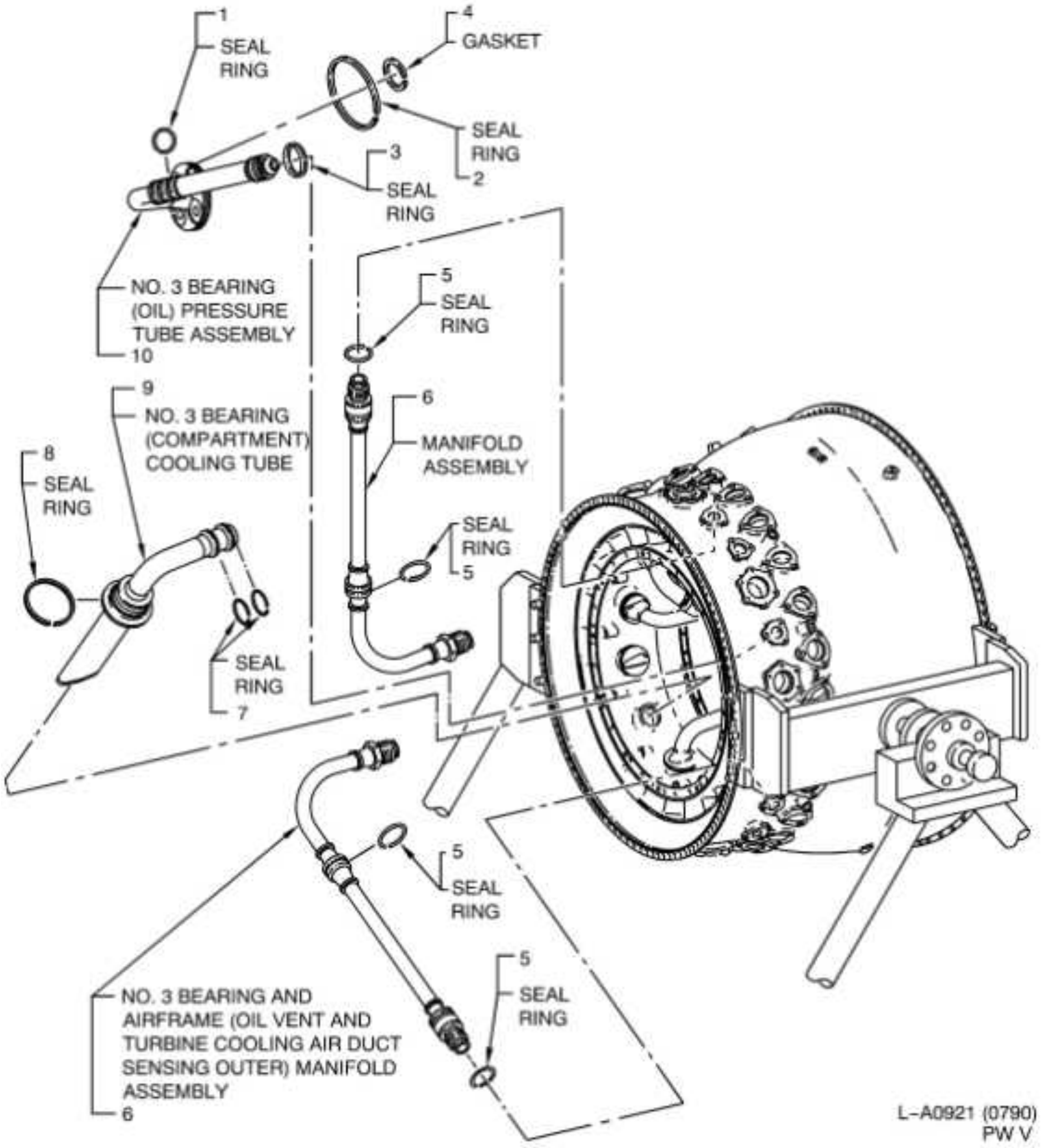

11
NUT
(36 REQUIRED)
10
DIFFUSER AIRSEALING RING ASSEMBLY
1
BOLT (36 REQUIRED)
5
SEAL RING
2
TRANSFER TUBE
8
SEAL RING
9
PACKING TRANSFER (OIL PRESSURE) TUBE
7
SEAL RING
6
SEAL RING TRANSFER (NO. 3 BEARING COOLING FRONT) TUBE
SEAL RING
4
5
SEAL RING
SEAL RING TRANSFER (NO. 3 BEARING COOLING REAR) TUBE
3
(NO. 3 BEARING PACKING TRANSFER (BREATHER AND SCAVENGE) TUBE
2
L−A0922 (0790)
PW V

Diffuser Airsealing Ring Assembly Removal (Pre SB PW4ENG 72−567)
Figure 515 (Sheet 1)
(Task 72−41−00−030−002)

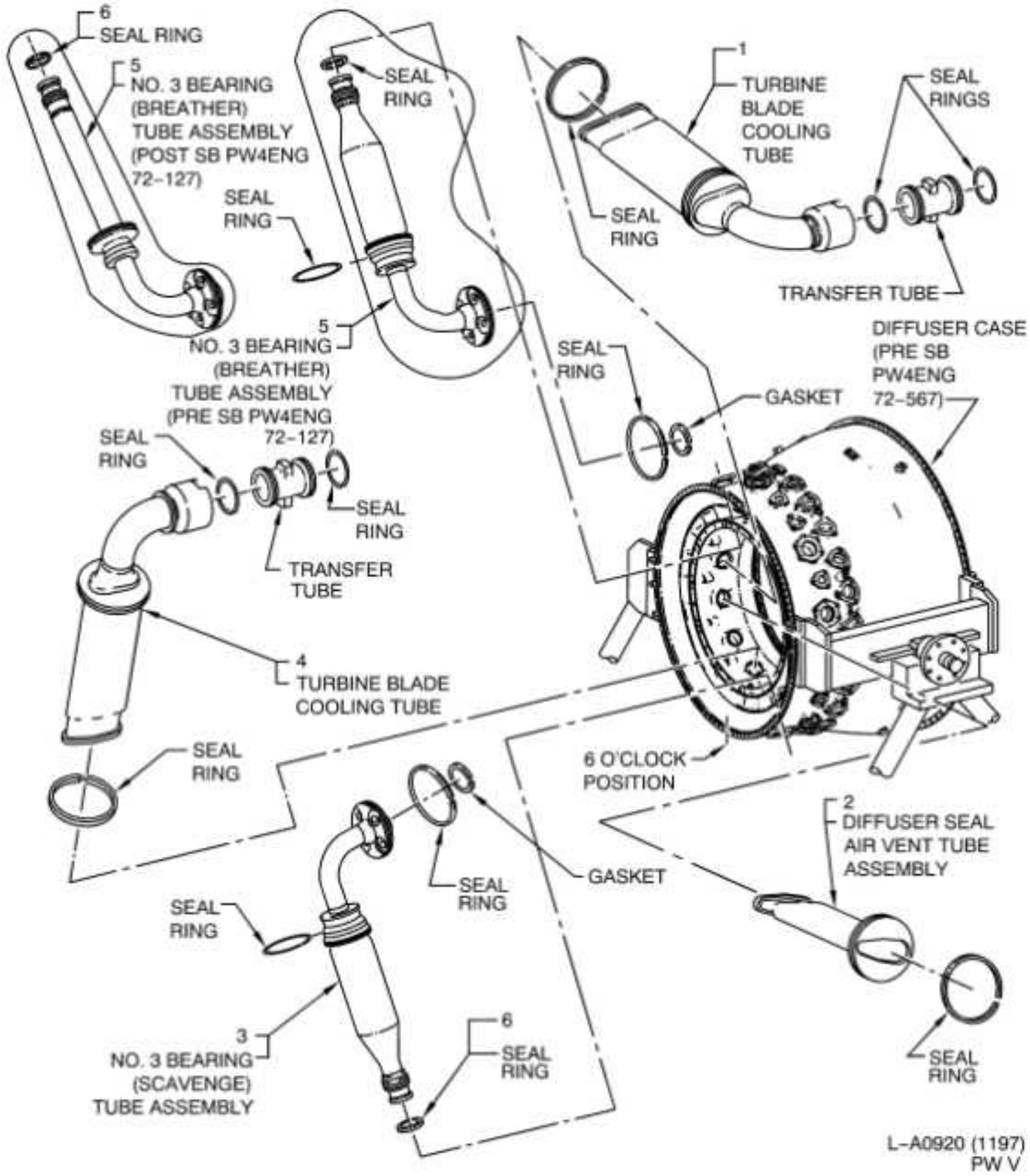
DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


11
NUT
(36 REQUIRED)
1
BOLT (36 REQUIRED)
10
HPC (REAR) EXIT
BRUSH SEAL ASSEMBLY
5
SEAL
RING
2
TRANSFER
TUBE
8
SEAL
RING
9
PACKING
TRANSFER
(OIL PRESSURE)
TUBE
7
SEAL
RING
4
SEAL
RING
6
SEAL RING
TRANSFER
(NO. 3 BEARING
COOLING FRONT)
TUBE
3
SEAL RING
TRANSFER
(NO. 3 BEARING
COOLING REAR)
TUBE
5
SEAL
RING
2
NO. 3 BEARING
PACKING TRANSFER
(BREATHER AND SCAVENGE)
TUBE
L-A8708 (0893)
PW V

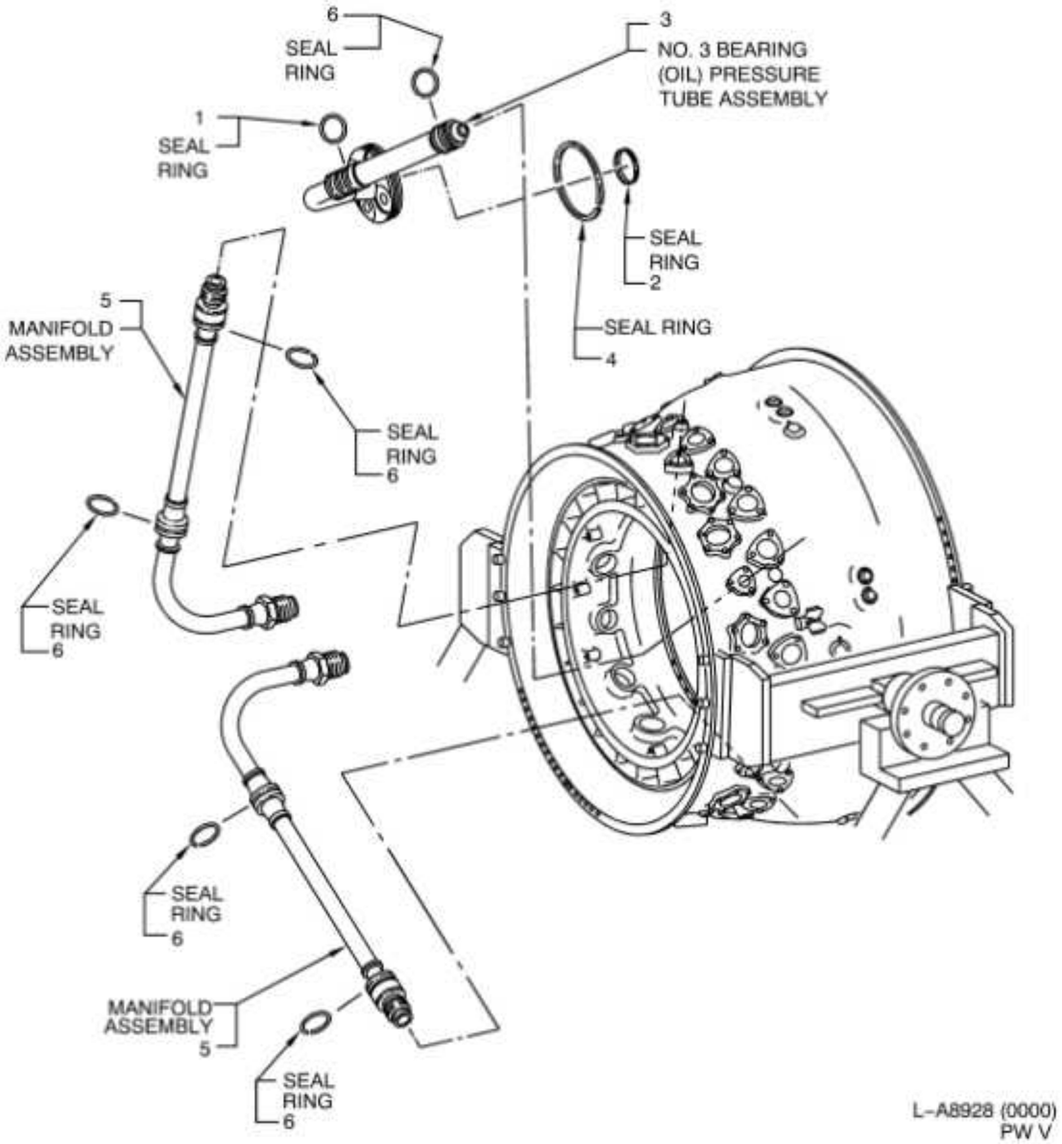
Diffuser Airsealing Ring Assembly Removal (Post SB PW4ENG 72−567)
Figure 515 (Sheet 2)
(Task 72−41−00−030−002)


1
SEAL RING
4
GASKET
SEAL RING
2
3
SEAL RING
NO. 3 BEARING (OIL) PRESSURE TUBE ASSEMBLY
10
5
SEAL RING
9
NO. 3 BEARING (COMPARTMENT) COOLING TUBE
6
MANIFOLD ASSEMBLY
8
SEAL RING
SEAL RING
5
SEAL RING
7
5
SEAL RING
5
SEAL RING
NO. 3 BEARING AND AIRFRAME (OIL VENT AND TURBINE COOLING AIR DUCT SENSING OUTER) MANIFOLD ASSEMBLY
6
L−A0921 (0790)
PW V

Removal Of The No. 3 Bearing Pressure Tube, Compartment Cooling Tube And The Manifold Assemblies Diffuser Case (Pre SB PW4ENG 72−567
Figure 516
(Task 72−41−00−030−002)

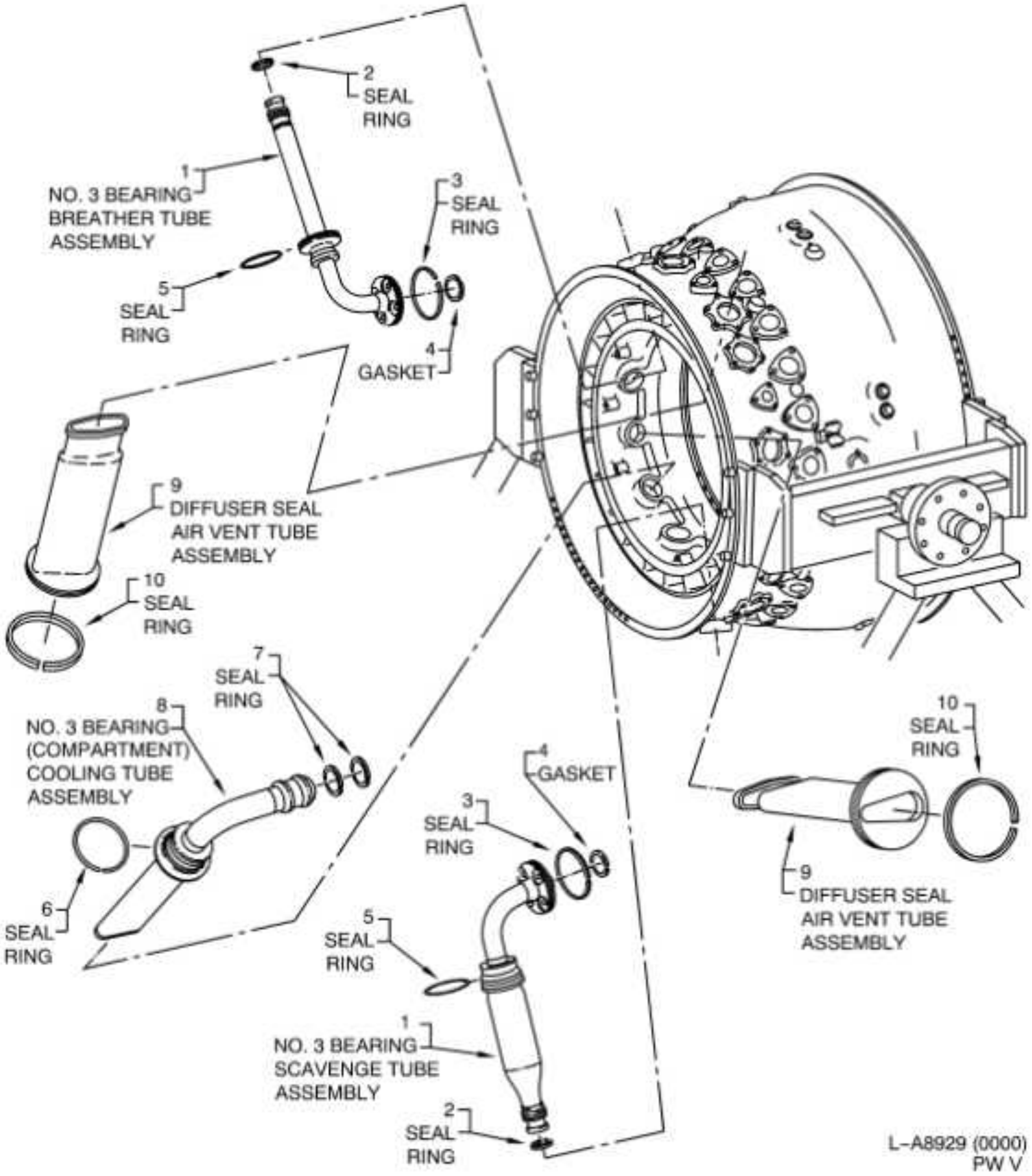

6
SEAL RING
5
NO. 3 BEARING (BREATHER) TUBE ASSEMBLY (POST SB PW4ENG 72-127)
SEAL RING
SEAL RING
1
TURBINE BLADE COOLING TUBE
SEAL RINGS
SEAL RING
TRANSFER TUBE
5
NO. 3 BEARING (BREATHER) TUBE ASSEMBLY (PRE SB PW4ENG 72-127)
SEAL RING
GASKET
DIFFUSER CASE (PRE SB PW4ENG 72-567)
SEAL RING
SEAL RING
TRANSFER TUBE
4
TURBINE BLADE COOLING TUBE
SEAL RING
6 O'CLOCK POSITION
2
DIFFUSER SEAL AIR VENT TUBE ASSEMBLY
SEAL RING
GASKET
SEAL RING
3
NO. 3 BEARING (SCAVENGE) TUBE ASSEMBLY
6
SEAL RING
SEAL RING
L-A0920 (1197)
PW V

Removal Of The Turbine Blade Cooling Tubes, Diffuser Seal Air Vent Tube And No. 3 Bearing (Scavenge) And (Breather) Tubes Diffuser Case (Pre SB PW4ENG 72-567)
Figure 517
(Task 72-41-00-030-002)

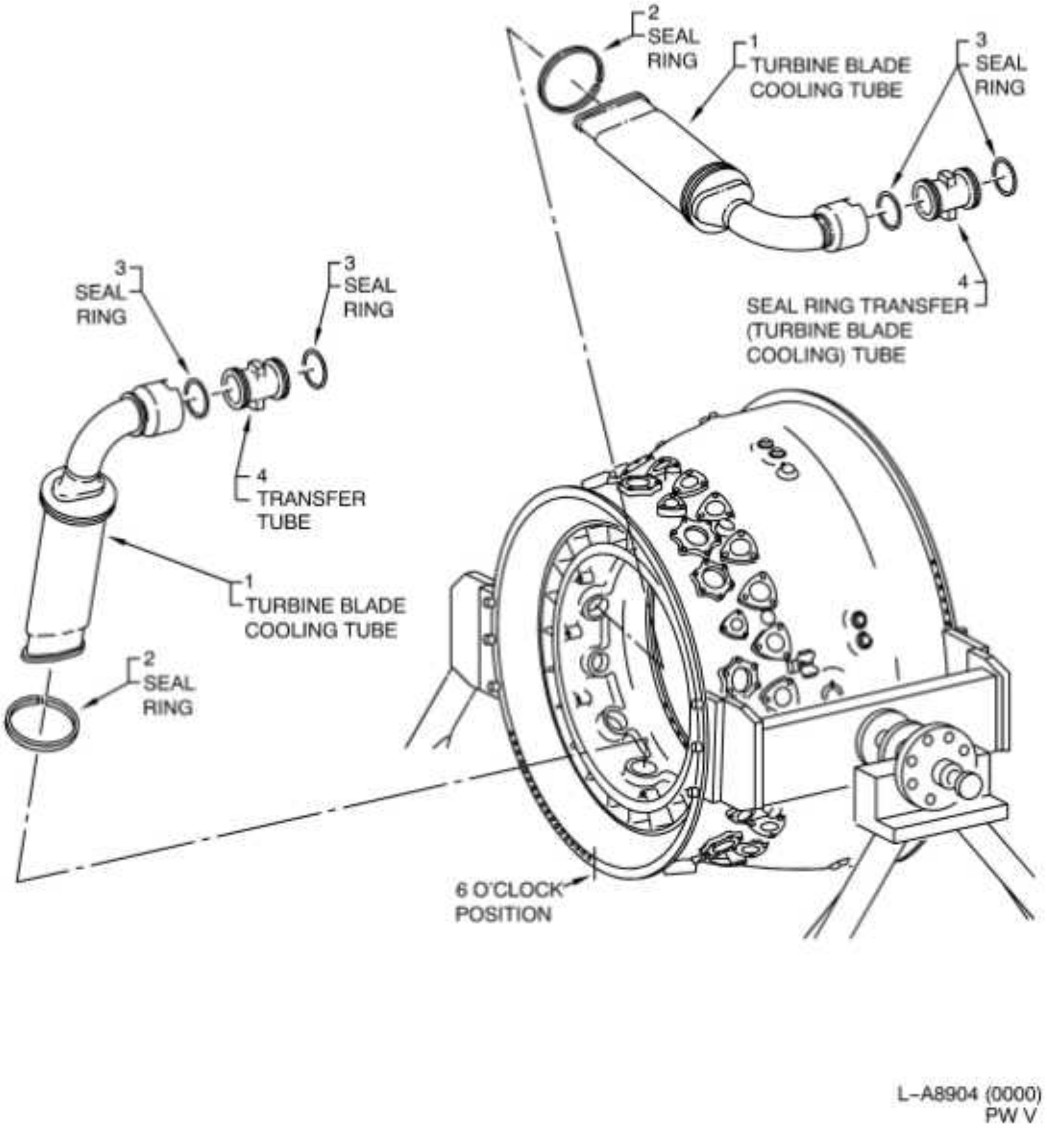

6
SEAL
RING
3
NO. 3 BEARING
(OIL) PRESSURE
TUBE ASSEMBLY
1
SEAL
RING
SEAL
RING
2
SEAL RING
4
5
MANIFOLD
ASSEMBLY
SEAL
RING
6
SEAL
RING
6
SEAL
RING
6
MANIFOLD
ASSEMBLY
5
SEAL
RING
6
L−A8928 (0000)
PW V

No. 3 Bearing Pressure Tube And Airframe Manifold
Assembly Removal Diffuser Case (Post SB PW4ENG 72−567)
Figure 518
(Task 72−41−00−030−002)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


2 SEAL RING
1 NO. 3 BEARING BREATHER TUBE ASSEMBLY
3 SEAL RING
5 SEAL RING
4 GASKET
9 DIFFUSER SEAL AIR VENT TUBE ASSEMBLY
10 SEAL RING
7 SEAL RING
8 NO. 3 BEARING (COMPARTMENT) COOLING TUBE ASSEMBLY
6 SEAL RING
4 GASKET
3 SEAL RING
5 SEAL RING
1 NO. 3 BEARING SCAVENGE TUBE ASSEMBLY
2 SEAL RING
10 SEAL RING
9 DIFFUSER SEAL AIR VENT TUBE ASSEMBLY
L-A8929 (0000)
PW V

No. 3 Bearing Breather, Scavenge And Cooling Tubes And Diffuser Seal Air Vent Tubes Diffuser Case (Post SB PW4ENG 72−567)
Figure 519
(Task 72−41−00−030−002)


2 SEAL RING
1 TURBINE BLADE COOLING TUBE
3 SEAL RING
4 SEAL RING TRANSFER (TURBINE BLADE COOLING) TUBE
3 SEAL RING
3 SEAL RING
4 TRANSFER TUBE
1 TURBINE BLADE COOLING TUBE
2 SEAL RING
6 O'CLOCK POSITION
L−A8904 (0000)
PW V

Remove The Turbine Blade Cooling Tubes
Diffuser Case (Post SB PW4ENG 72−567)
Figure 520
(Task 72−41−00−030−002)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

Task 72−41−00−030−005:

1. Disassemble Diffuser And Combustor Internals

A. Prerequisites

(1) Remove fuel distribution valve and fuel supply tubes. See Disassembly−01 (Task 72−41−00−030−001).

B. Equipment And Materials Required

Standard Tools:
0.190−32 UNF−2B Jackscrews, 6 Necessary
0.250−28 UNF−3B Jackscrews, 4 Necessary

Special Tools:

PWA 25039	Stand
PWA 27918	Sling (Optional To PWA 80555)
PWA 28657	Sling
PWA 76154	Adapter
PWA 80555	Sling
PWA 85044	Stand (Optional To PWA 86508)
PWA 85047	Puller (Optional To PWA 86103 Or PWA 85627)
PWA 85751	Brackets (Two Necessary)
PWA 85983	Adapter, Stabilizer (Two Necessary, Twin Overhead Rail System Only)
PWA 86508	Build Stand
PWA 87006	Adapter, Wrench
PWA 88725	Puller, Knocker
PWA 103081	Adapter, Torque

C. Procedure

Subtask 72−41−00−030−075:

(1) Remove fuel injector supply manifold assemblies as follows. See Figure 501.

(a) Remove lockwire and loosen tube nuts (501/1) securing fuel injector supply manifold assemblies (501/2) to fuel injectors. Carefully remove eight manifold assemblies from around case. Discard packings (501/3).

Subtask 72−41−00−030−076:

(2) Remove fuel injector and support assemblies as follows. See Figure 502.

NOTE: Clock positions are clockwise from the rear.

(a) Remove lockwire, loosen and remove bolts securing fuel injector assemblies and brackets to diffuser case. Continue around diffuser case and remove all 24 fuel injector assemblies and brackets. Discard injector gaskets.

NOTE: Rotate and/or tilt injector as required to disengage injector from diffuser case. Mark location of removed injectors and brackets to facilitate reassembly.

(3) Remove diffuser case externals as follows.

NOTE: Clock positions are clockwise from the rear.

(a) Remove the lockwire and bolts that attach the brackets and cover to the case. Remove the brackets. See Figure 503 and Figure 504.

NOTE: You can mark the brackets with the reference numbers, Figures 503 and 504, for ease of assembly.

(b) Remove the lockwire, two bolts (503/2) and washers (503/1) at 1 o'clock position.

(c) (Pre SB PW4ENG 72−699) Remove the lockwire, bolts (504/7), cover (504/6) and gasket (504/5) that are at 9:30 o'clock. Discard the gasket.

(d) (Pre SB PW4ENG 72−559 only) Remove the adapter (505/4) and gasket (505/3), lockwire and bolts (505/5), cover (505/2) and gasket (505/1) from the case at 12:30 o'clock. Discard the gaskets. See Figure 505.

(e) Remove the adapter (505/10) and gasket (505/9), lockwire and bolts (505/11), cover (505/8) and gasket (505/12) that are at 2:00 o'clock. Discard the gaskets.

(f) Remove the adapter (505/14) and gasket (505/13) that are at 3:00 o'clock. Discard the gasket.

(g) (Pre SB PW4ENG 72−559) Remove the lockwire, three borescope plugs (505/7) and gaskets (505/6) at 1:30, 4:15 and 5:45 o'clock positions. Discard the gaskets. Remove the lockwire, three borescope plugs (506/7) and gaskets (506/6) that are at the 7:30, 9:15 and the 11 o'clock positions. Discard the gaskets. See Figure 505 and Figure 506.

(h) (Post SB PW4ENG 72−559) Remove the lockwire, two borescope plugs (505/7) and gaskets (505/6) at 1:30 and 4:15 o'clock positions. Discard the gaskets. Remove the lockwire, three borescope plugs (506/7) and gaskets (506/6) that are at the 7:30, 9:15 and 11 o'clock positions. Discard the gaskets. See Figure 505 and Figure 506.

(i) Remove the lockwire and two additional plugs (505/18) and (506/2) and gaskets (505/17) and (506/1), one at 5:00 o'clock and the other at 7:00 o'clock.

(j) Remove the lockwire, bolts (506/3), cover (506/4) and gasket (506/5) that are at 7:30 o'clock. See Figure 506.

(4) Remove EEC thermocouple probe (505/15) as follows. See Figure 505.

(a) Remove lockwire securing probe body nut to diffuser case. Do not remove lockwire securing coupling nut to probe body nut (see note). Loosen body nut from diffuser case boss and remove probe. Remove and discard gasket (505/16).

NOTE: To avoid loss of small detail washer, do not remove body nut from probe.

Subtask 72−41−00−030−077:

(5) Remove igniter plugs as follows. See Figure 507.

(a) Remove two igniter plugs (507/1) and igniter bosses (507/3), spacers (507/4) and key washers (507/2) from diffuser case. Discard key washers.

Subtask 72−41−00−030−078:

(6) Remove outer combustion chamber as follows. See Figure 508.

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

(a) Attach PWA 27918 Sling or PWA 80555 Sling (508/1) and hoist to outer combustion chamber assembly (508/2) engaging three holes in the rear of the chamber. Take up strain on hoist to support weight of combustion chamber eliminating slack in cables.

CAUTION: ENSURE BORESCOPE PLUGS HAVE BEEN REMOVED FROM DIFFUSER CASE. FAILURE TO REMOVE BORESCOPE PLUGS WILL RESULT IN DAMAGE TO OUTER LINER AND PLUGS.

(b) Loosen and remove bolts (508/3) and washers (508/4) at twelve locations around diffuser case.

(c) Remove combustion chamber assembly vertically from diffuser case and place on pallet. Remove hoist and sling.

(7) Install the diffuser case on PWA 25039 Stand as follows. See Figure 509.

(a) Install two PWA 85751 Handling Brackets to diffuser case as follows.

NOTE: If you have a twin overhead rail system you must use PWA 85983 Stabilizer Adapter with Brackets PWA 85751.

1 Using hoist, position longer front flange of brackets to rear of front flange of diffuser case at 3 and 9 o'clock locations, locating four pins in front flange of bracket into four boltholes in diffuser case front flange. Position shorter rear flange of bracket to front of diffuser case rear flange and secure with detail nuts and bolts.

2 Position double spool bracket in front most two holes as marked on bracket.

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

WARNING: USE TWO OPERATORS WHEN INSTALLING OR TRUNNIONING CASE IN STAND. WHEN QUICK RELEASE PIN IS REMOVED, CASE MAY TRUNNION BY ITSELF, AND POSSIBLY CAUSE INJURY.

(b) Using hoist, PWA 28657 Sling and PWA 76154 Adapters, remove diffuser case from PWA 86508 or PWA 85044 Stand. Trunnion case and install into PWA 25039 Stand. Secure with quick release pin.

(c) Remove hoist, PWA 28657 Sling and PWA 76154 Adapters.

Subtask 72−41−00−030−079:

(8) Remove the compressor exit stator assembly as follows. See Figure 510.

(a) Loosen and remove bolts (510/6), washers (510/3), spacer plates (510/5), injectors (510/4) and nuts (510/7).

(b) (Stators without jackscrew holes). Remove the stator with PWA 88725 Puller Knocker.

(c) (Stators with jackscrew holes). Remove the stator assembly (510/2). Use six 0.190−32 UNF−2B jackscrews.

Subtask 72−41−00−030−080:

(9) Remove the HPC exit brush seal support assembly (510/1). Use six 0.190−32 UNF−2B jackscrews.

Subtask 72−41−00−030−081:

(10) Remove No. 3 bearing pressure tube, airframe manifold assemblies and covers as follows. See Figure 511.

(a) (Pre SB PW4ENG 72−570) No No. 3 bearing weep tube heat shield assembly installed.

1 Remove lockwire.

2 Loosen and remove bolts (511/6) and (511/22), lockplate (511/8), sleeve (511/7) and gasket (511/9) that attach the manifold assembly to the diffuser case.

(b) (Post SB PW4ENG 72−570) No. 3 bearing weep tube heat shield assembly installed.

1 Remove lockwire.

2 Loosen and remove bolts (511/24) and (511/25), heat shield (511/23), lockplate (511/8), sleeve (511/7) and gasket (511/9) that attach the manifold assembly to the diffuser case.

(c) Remove lockwire, loosen and remove bolts (511/2), cap (511/1), plate lock (511/3), sleeve (511/4) and gasket (511/5). Discard the gasket.

(d) Remove lockwire, loosen and remove bolts (511/13), shield (511/12), plate lock (511/11), sleeve (511/14) and gasket (511/10). Discard the gasket.

(e) (Pre SB PW4ENG 72−559) At two locations, remove the nuts (511/20) and seals (511/19). Remove the seal rings (511/18) from the seals. Remove the lockwire, bolts (511/17), bracket (511/21) (at one location), covers (511/16) and gaskets (511/15). Discard the gaskets.

(f) (Post SB PW4ENG 72−559) Remove the nut (511/20) and seal (511/19). Remove the seal ring (511/18) from the seal. Remove the lockwire, bolts (511/17), bracket (511/21), cover (511/16) and gasket (511/15). Discard the gasket.

Subtask 72−41−00−030−082:

(11) Remove No. 3 bearing breather, scavenge, and cooling tube assembly locks. See Figure 512.

(a) (Pre SB PW4ENG 72−569) Remove thrust wire (512/1) and tube nut (512/2), lockwire or safety cable and bolts (512/3), plate−lock (512/4), sleeve (512/5) and gasket (512/6). Discard the gasket.

(b) (Post SB PW4ENG 72−569) Remove the thrust wire (512/1) and tube nut (512/2), lockwire or safety cable and bolts (512/21), heat shield (512/20), plate−lock (512/4), sleeve (512/5) and gasket (512/6). Discard the gasket.

(c) Remove the adapter (512/19) and washer (512/18), lockwire or safety cable and bolts (512/13), elbow (512/14), two gaskets (512/15) and (512/17) and locks (512/16). Discard the gaskets.

(d) Remove thrust wire (512/11) and tube nut (512/10), lockwire or safety cable and bolts (512/12), plate (512/9), sleeve (512/8) and gasket (512/7). Discard the gasket.

Subtask 72−41−00−030−083:

(12) Remove the heat shields from the No. 3 bearing (breather) tube (513/1), No. 3 bearing (compartment) cooling tube (513/2), No. 3 bearing (oil) pressure tube (513/3) and No. 3 bearing (scavenge) tube assemblies as follows (513/4). See Figure 513.

(a) Remove lockwire from the middle and both ends of the (outer) heat shields.

(b) Remove the (outer) heat shield halves. Remove the (inner) heat shield halves.

(c) Remove the (flange) heat shield halves.

(d) Remove the lockwire and bolts that attach three of the tubes to the airsealing ring.

Subtask 72−41−00−030−084:

(13) Remove No. 3 bearing front seal, cooling duct and housing as follows. See Figure 514.

(a) Remove four screws securing duct and housing to diffuser case.

(b) Install four 0.250−28 UNF−3B Jackscrews to the housing flange and tighten until the housing is loosened from the diffuser case.

(c) Remove duct and housing from diffuser case.

Subtask 72−41−00−030−085:

(14) Remove No. 3 bearing oil vent (inner) tube assembly as follows. See Figure 515.

(a) Remove lockwire and loosen tube nut (515/9) on No. 3 bearing oil vent (inner) tube assembly (515/3).

NOTE: Hold connector on mating tube with PWA 87006 Wrench while you loosen tube nut (515/9) with PWA 103081 Torque Adapter.

(b) Remove screws (515/7), nuts (515/8), brackets (515/6) and clamps (515/5) from two locations on tube assembly (515/3).

(c) Remove tube assembly from diffuser case and remove seal ring (515/4) from tube assembly.

Subtask 72−41−00−030−086:

(15) Remove turbine cooling duct sensing (inner airframe) tube assembly as follows.

(a) Remove lockwire and loosen tube nut (515/10) on turbine cooling duct sensing (inner airframe) tube assembly (515/1). Remove tube assembly from diffuser case.

NOTE: Hold connector on mating tube with PWA 87006 Wrench while you loosen tube nut (515/10) with PWA 103081 Torque Adapter.

(b) Remove seal ring (515/2) from tube assembly (515/1).

Subtask 72−41−00−030−087:

(16) Remove the HPC (rear) exit brush seal assembly as follows. See Figure 516.

(a) Remove No. 3 bearing packing transfer (breather and scavenge) tubes (516/2) at two locations in the brush seal (516/10). Remove seal ring (516/5) from transfer tubes.

(b) Remove packing transfer (oil pressure) tube (516/9) from the brush seal. Remove seal ring (516/8) from transfer tube.

(c) Remove seal ring transfer (No. 3 bearing cooling rear) tube (516/3). Remove seal ring (516/7) from transfer tube.

(d) Remove seal ring transfer (No. 3 bearing cooling front) tube (516/6). Remove seal ring (516/4) from transfer tube.

(e) Remove 36 bolts (516/1) and nuts (516/11) securing brush seal assembly to diffuser case. Remove the brush seal assembly (516/10).

Subtask 72−41−00−030−088:

(17) Remove No. 3 bearing (oil) pressure tube assembly as follows. See Figure 517.

(a) Carefully remove tube assembly (517/3) from diffuser case.

(b) Remove seal rings, (517/1), (517/2), (517/6) and (517/4) from tube assembly (517/3).

Subtask 72−41−00−030−089:

(18) Remove No. 3 bearing and airframe (oil vent and turbine cooling air duct sensing outer) manifold assemblies as follows. See Figure 517.

(a) Carefully remove manifold assemblies (517/5) from two locations in diffuser case.

(b) Remove seal rings (517/6) from manifold assemblies (517/5).

Subtask 72−41−00−030−090:

(19) Remove No. 3 bearing (breather and scavenge) tube assemblies as follows. See Figure 518.

(a) Carefully remove tube assemblies (518/1) from diffuser case.

(b) Remove seal rings (518/5) and (518/3).

(c) Remove and discard gaskets (518/4).

Subtask 72−41−00−030−091:

(20) Remove No. 3 bearing (compartment) cooling tube assembly as follows. See Figure 518.

(a) Carefully remove tube assembly (518/8) from diffuser case.

(b) Remove seal rings (518/6) and (518/7).

Subtask 72−41−00−030−092:

(21) Remove diffuser seal air vent tube assemblies as follows. See Figure 518.

(a) Carefully remove diffuser seal air vent tube assemblies (518/9) from diffuser case.

(b) Remove seal rings (518/10) from tube assemblies.

Subtask 72−41−00−030−093:

(22) Remove turbine blade cooling tubes as follows. See Figure 519.

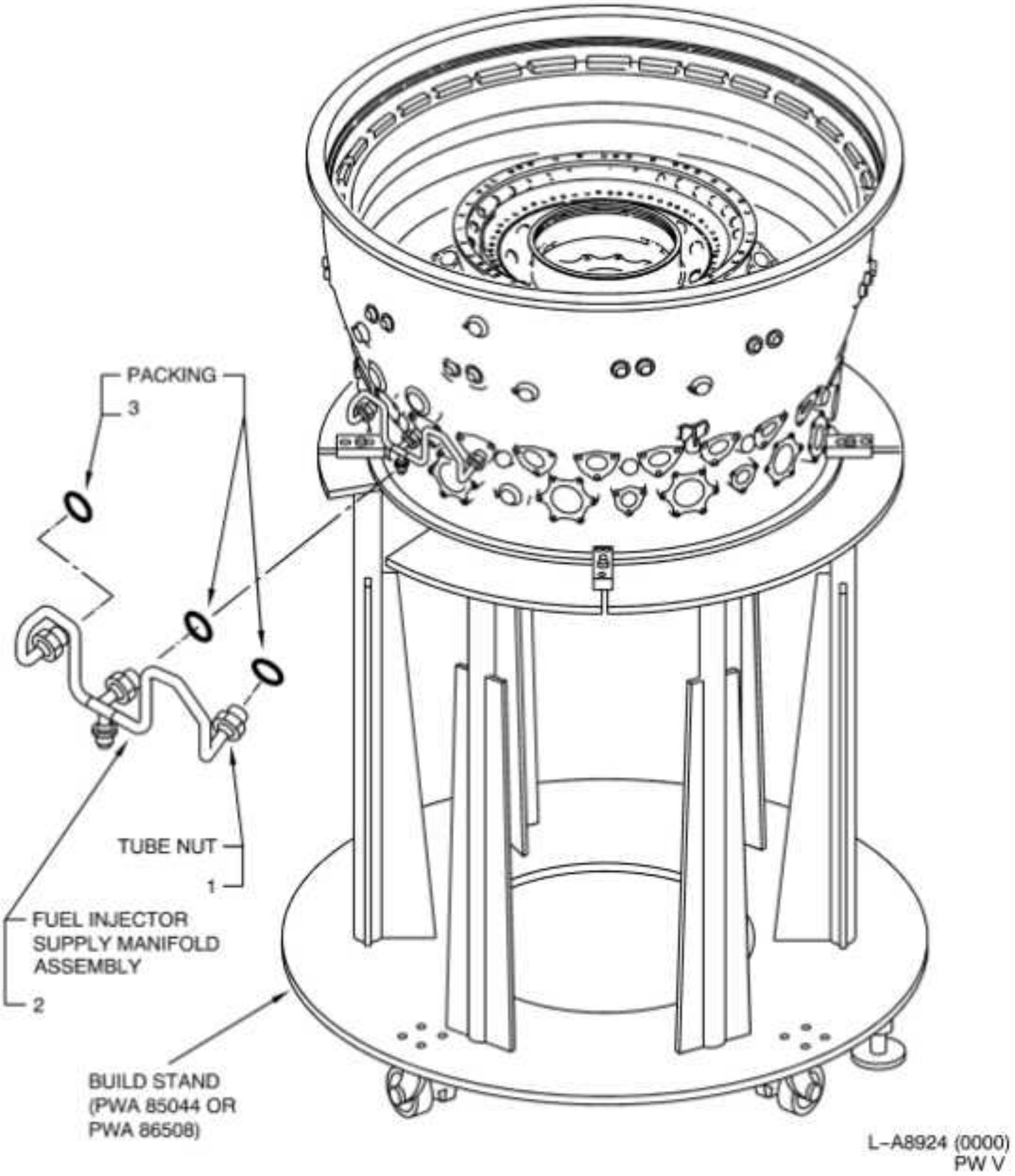
(a) Carefully remove turbine blade cooling tubes (519/1) from two locations in diffuser case.

(b) Remove transfer tubes (519/4) from cooling tubes (519/1). Remove seal rings (519/3) from both ends of each transfer tube (519/4).

(c) Remove seal rings (519/2) from each cooling tube.

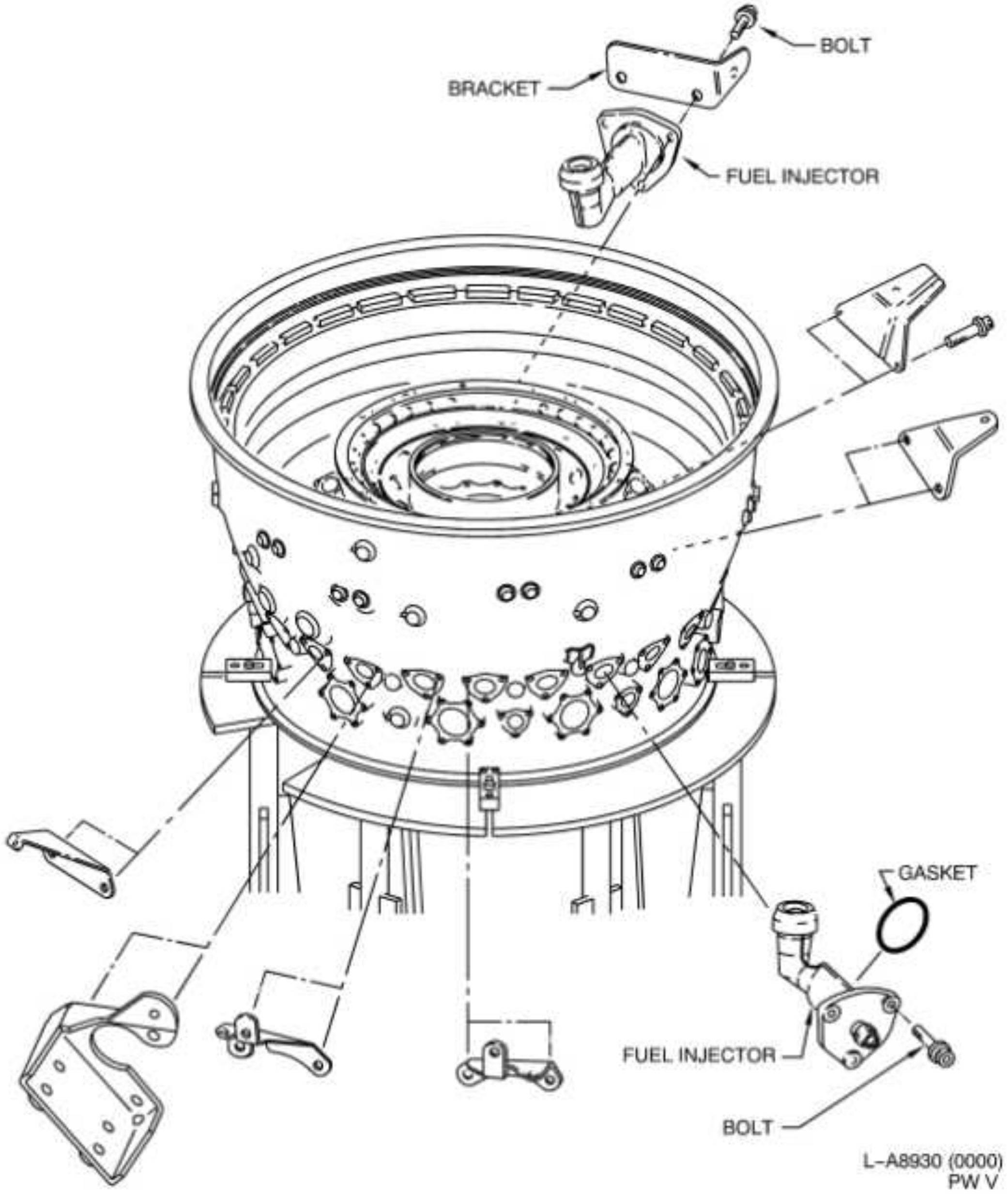
(23) Position diffuser case on pallet, front end down. Remove two Handling Brackets PWA 85751 from case.

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


PACKING
3
TUBE NUT
1
FUEL INJECTOR SUPPLY MANIFOLD ASSEMBLY
2
BUILD STAND (PWA 85044 OR PWA 86508)
L−A8924 (0000)
PW V

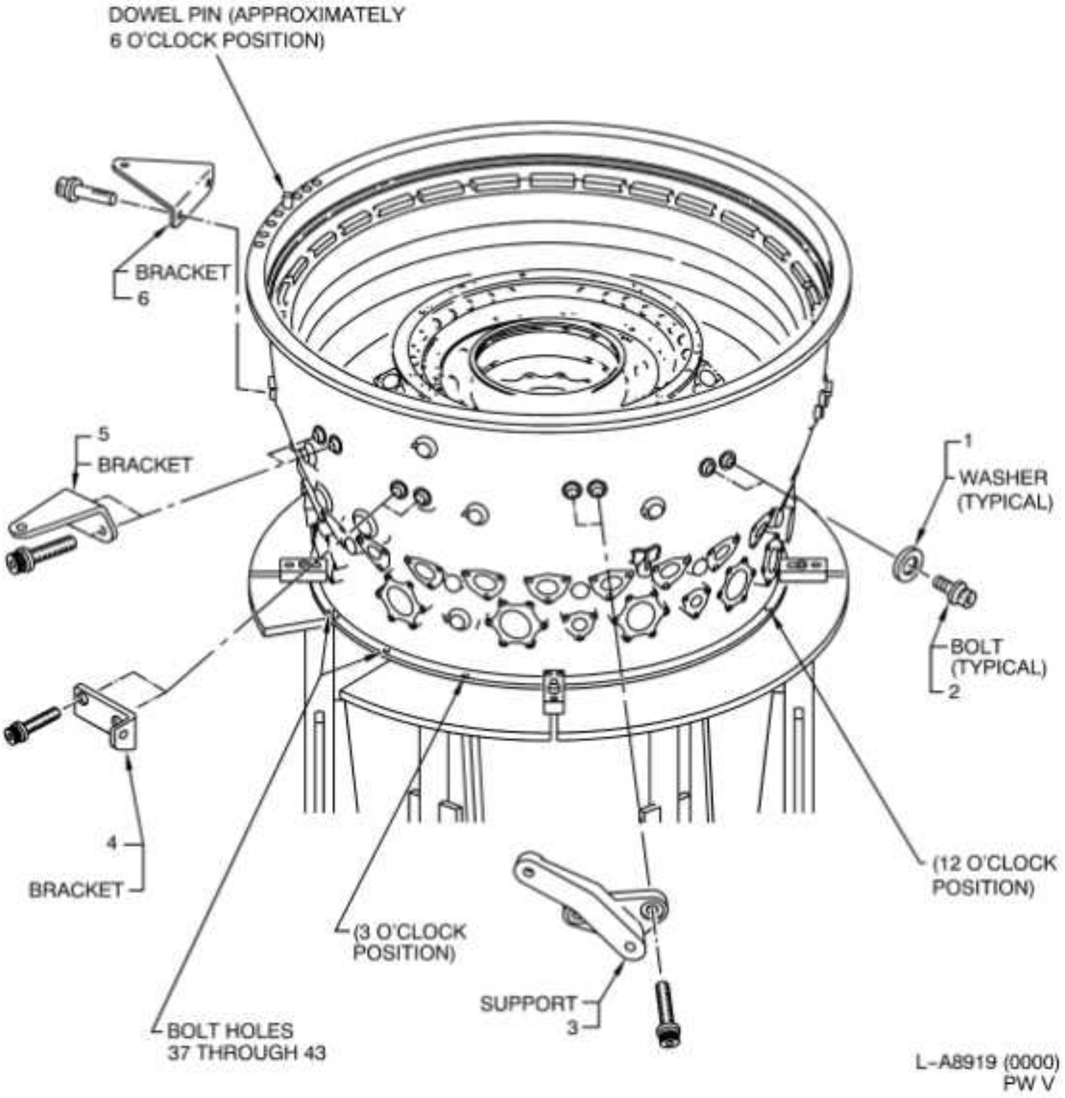
Fuel Injector Supply Manifold Disassembly
Figure 501
(Task 72−41−00−030−005)

DIFFUSER AND COMBUSTOR - DISASSEMBLY-02


BOLT
BRACKET
FUEL INJECTOR
GASKET
FUEL INJECTOR
BOLT
L-A8930 (0000)
PW V

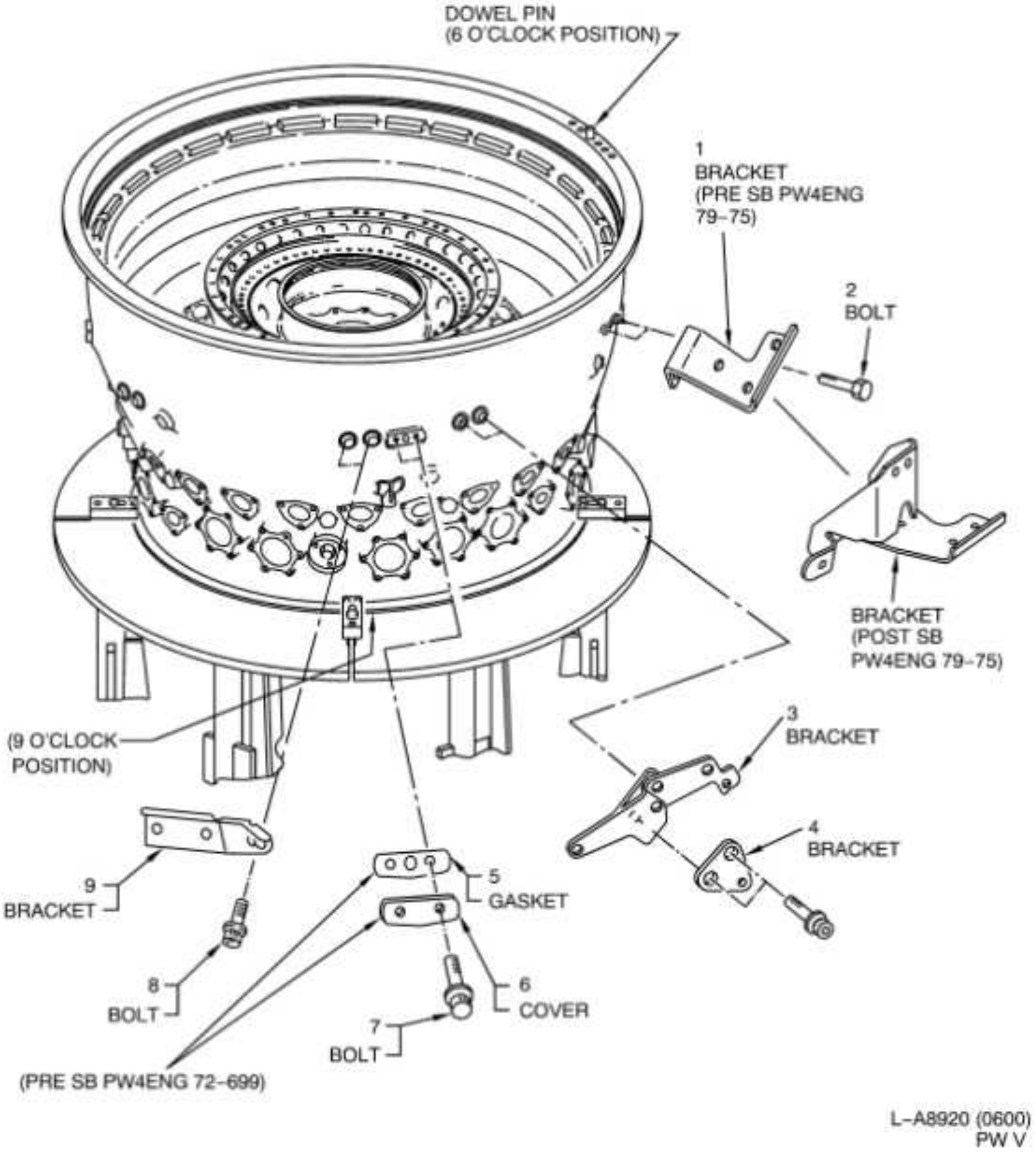
Fuel Injector And Support Assembly Removal
Figure 502
(Task 72-41-00-030-005)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


DOWEL PIN (APPROXIMATELY
6 O'CLOCK POSITION)
BRACKET
6
5
BRACKET
1
WASHER
(TYPICAL)
BOLT
(TYPICAL)
2
4
BRACKET
(12 O'CLOCK
POSITION)
(3 O'CLOCK
POSITION)
SUPPORT
3
BOLT HOLES
37 THROUGH 43
L−A8919 (0000)
PW V

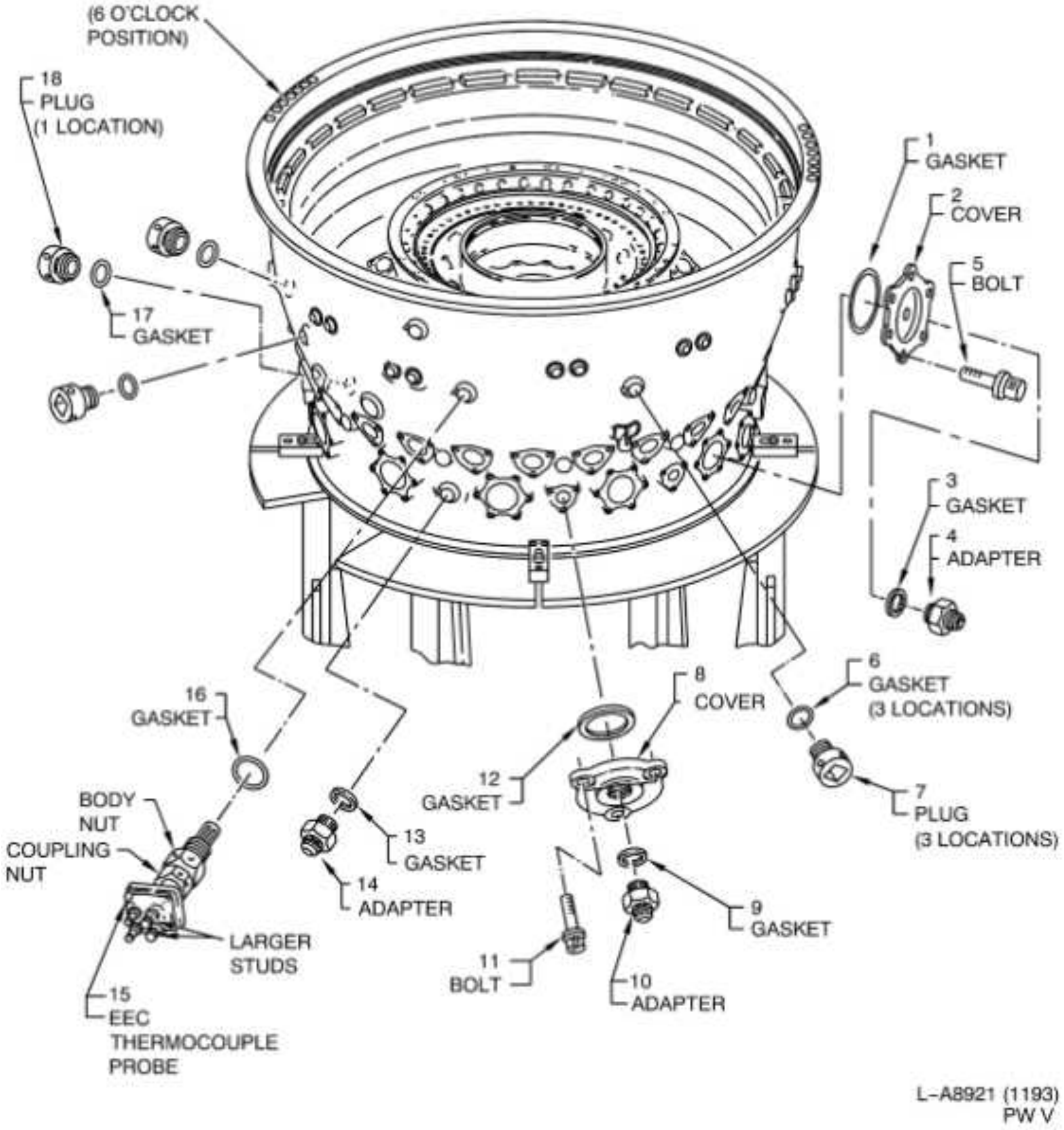
Diffuser Case Externals Removal
Figure 503
(Task 72−41−00−030−005)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


DOWEL PIN
(6 O'CLOCK POSITION)
1
BRACKET
(PRE SB PW4ENG
79-75)
2
BOLT
BRACKET
(POST SB
PW4ENG 79-75)
3
BRACKET
4
BRACKET
(9 O'CLOCK
POSITION)
9
BRACKET
5
GASKET
8
BOLT
6
COVER
7
BOLT
(PRE SB PW4ENG 72-699)
L-A8920 (0600)
PW V

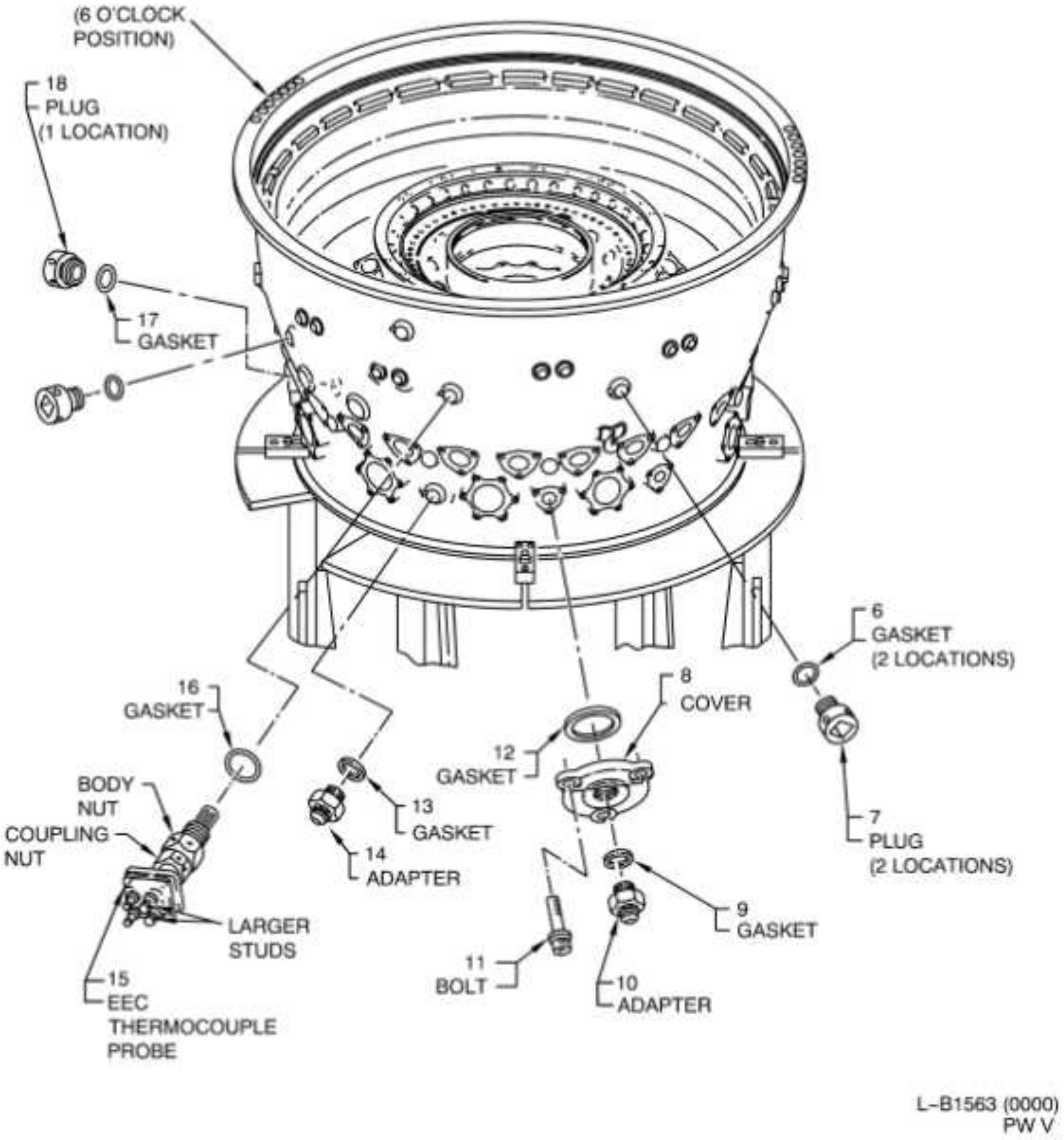
Diffuser Case Externals Removal
Figure 504
(Task 72−41−00−030−005)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

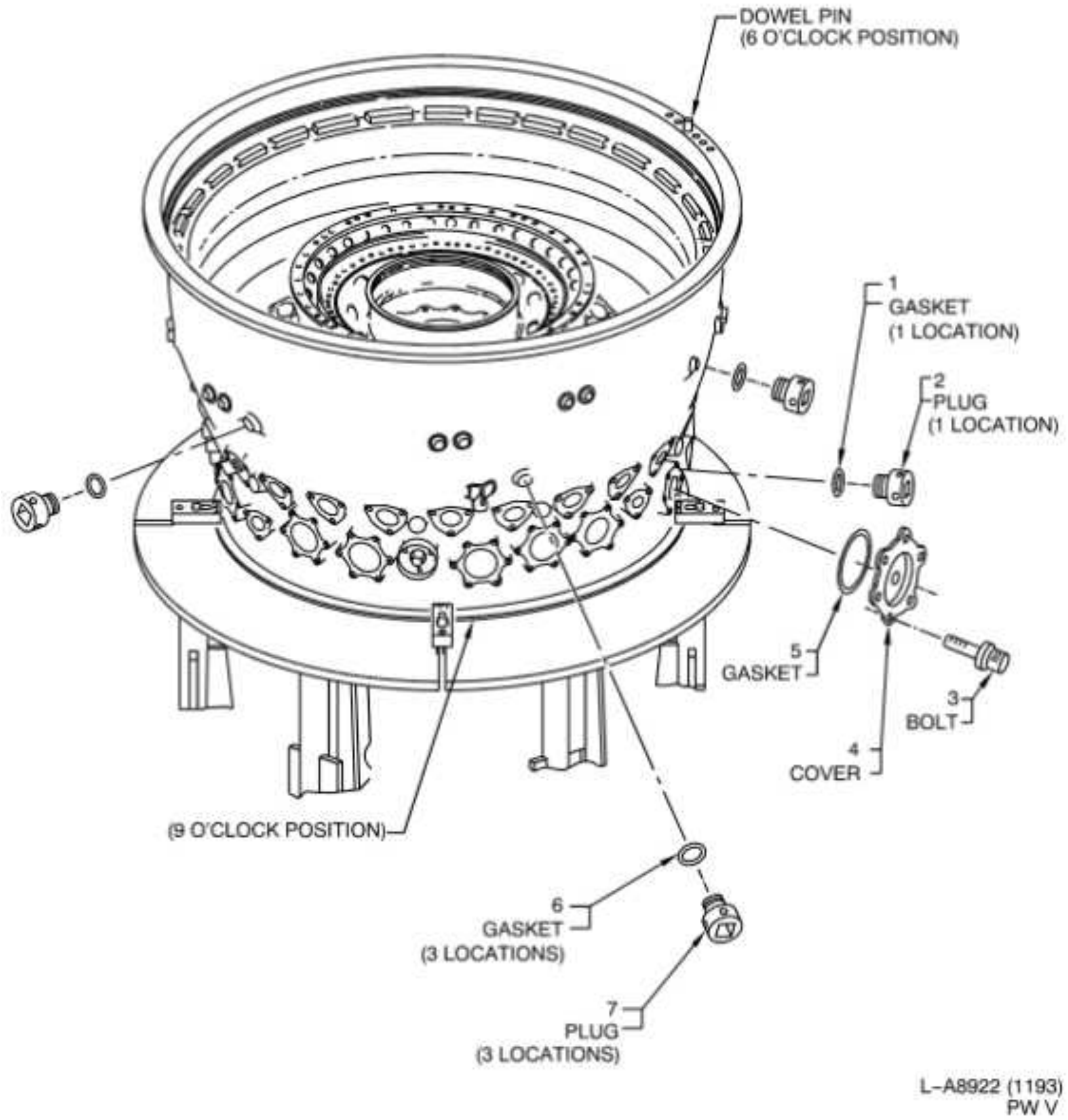

(6 O'CLOCK POSITION)
18 PLUG (1 LOCATION)
17 GASKET
1 GASKET
2 COVER
5 BOLT
3 GASKET
4 ADAPTER
6 GASKET (3 LOCATIONS)
7 PLUG (3 LOCATIONS)
8 COVER
12 GASKET
16 GASKET
BODY NUT
COUPLING NUT
13 GASKET
14 ADAPTER
9 GASKET
LARGER STUDS
11 BOLT
10 ADAPTER
15 EEC THERMOCOUPLE PROBE
L−A8921 (1193)
PW V

Diffuser Case Externals Removal (Pre SB PW4ENG 72−559)
Figure 505 (Sheet 1)
(Task 72−41−00−030−005)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

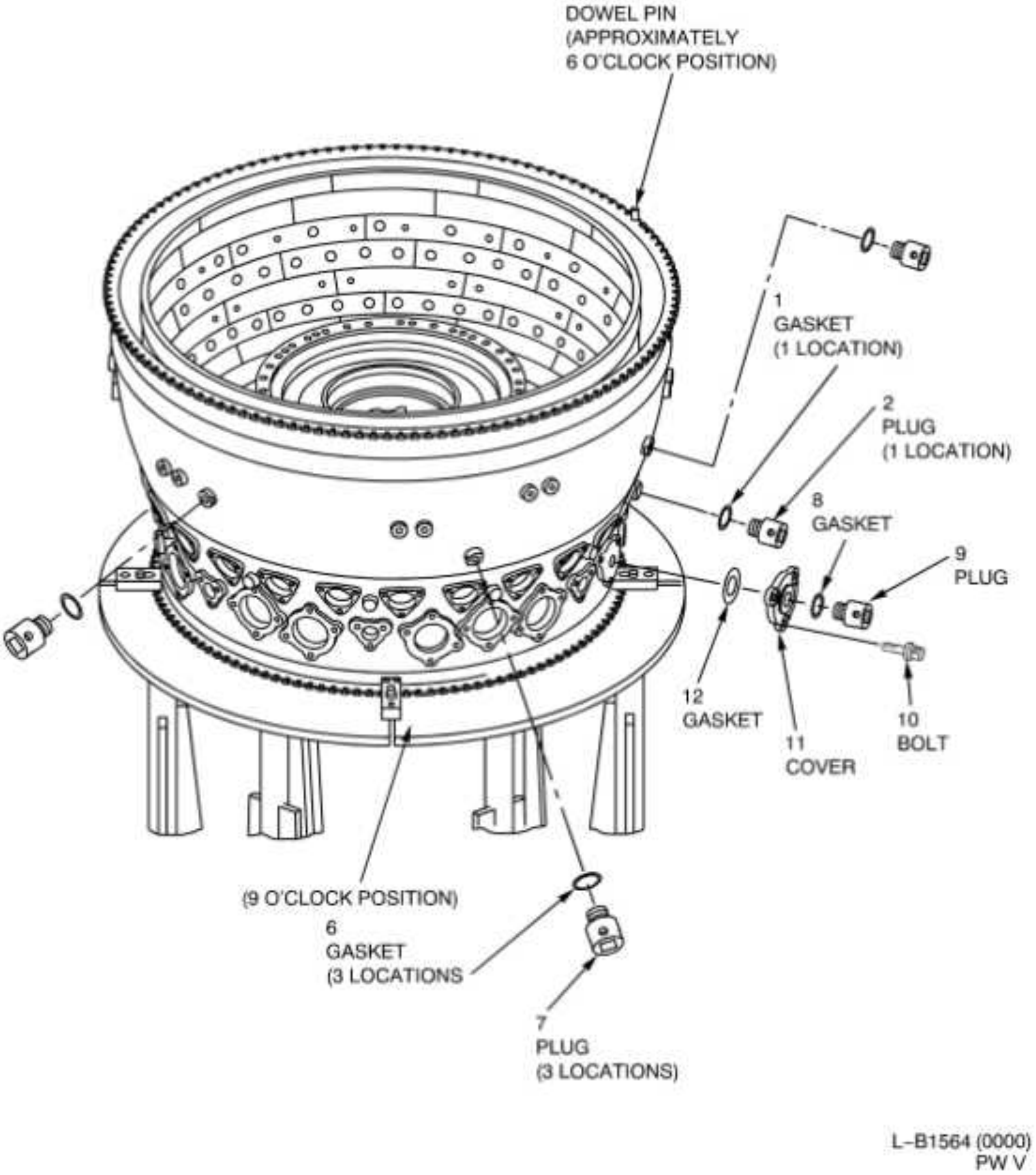

(6 O'CLOCK POSITION)
18 PLUG (1 LOCATION)
17 GASKET
6 GASKET (2 LOCATIONS)
8 COVER
16 GASKET
12 GASKET
BODY NUT
COUPLING NUT
13 GASKET
14 ADAPTER
7 PLUG (2 LOCATIONS)
LARGER STUDS
9 GASKET
11 BOLT
10 ADAPTER
15 EEC THERMOCOUPLE PROBE
L−B1563 (0000)
PW V

Diffuser Case Externals Removal (Post SB PW4ENG 72−559)
Figure 505 (Sheet 2)
(Task 72−41−00−030−005)

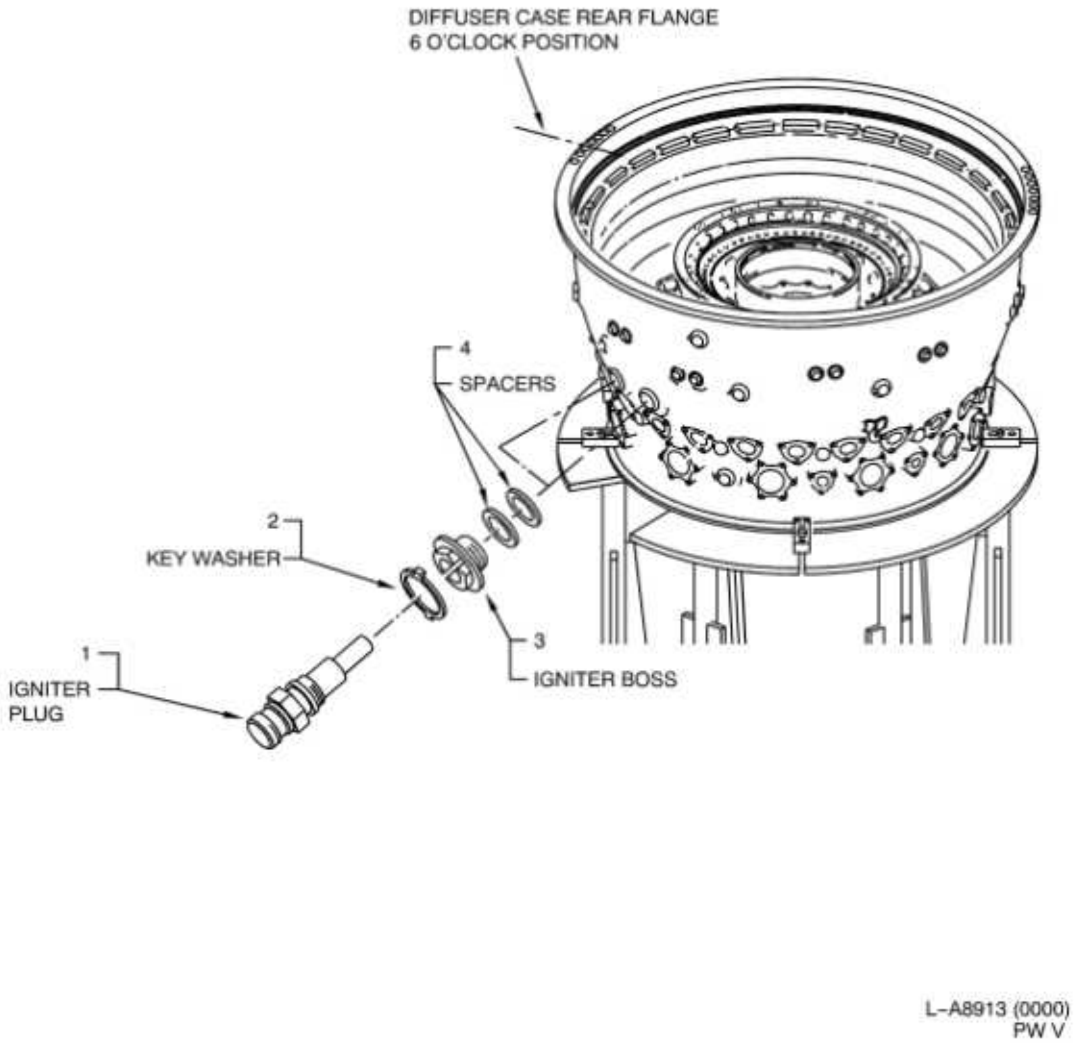

DOWEL PIN
(6 O'CLOCK POSITION)
1
GASKET
(1 LOCATION)
2
PLUG
(1 LOCATION)
5
GASKET
3
BOLT
4
COVER
(9 O'CLOCK POSITION)
6
GASKET
(3 LOCATIONS)
7
PLUG
(3 LOCATIONS)
L-A8922 (1193)
PW V

Diffuser Case Externals Removal (Pre SB PW4ENG 72-559)
Figure 506 (Sheet 1)
(Task 72-41-00-030-005)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

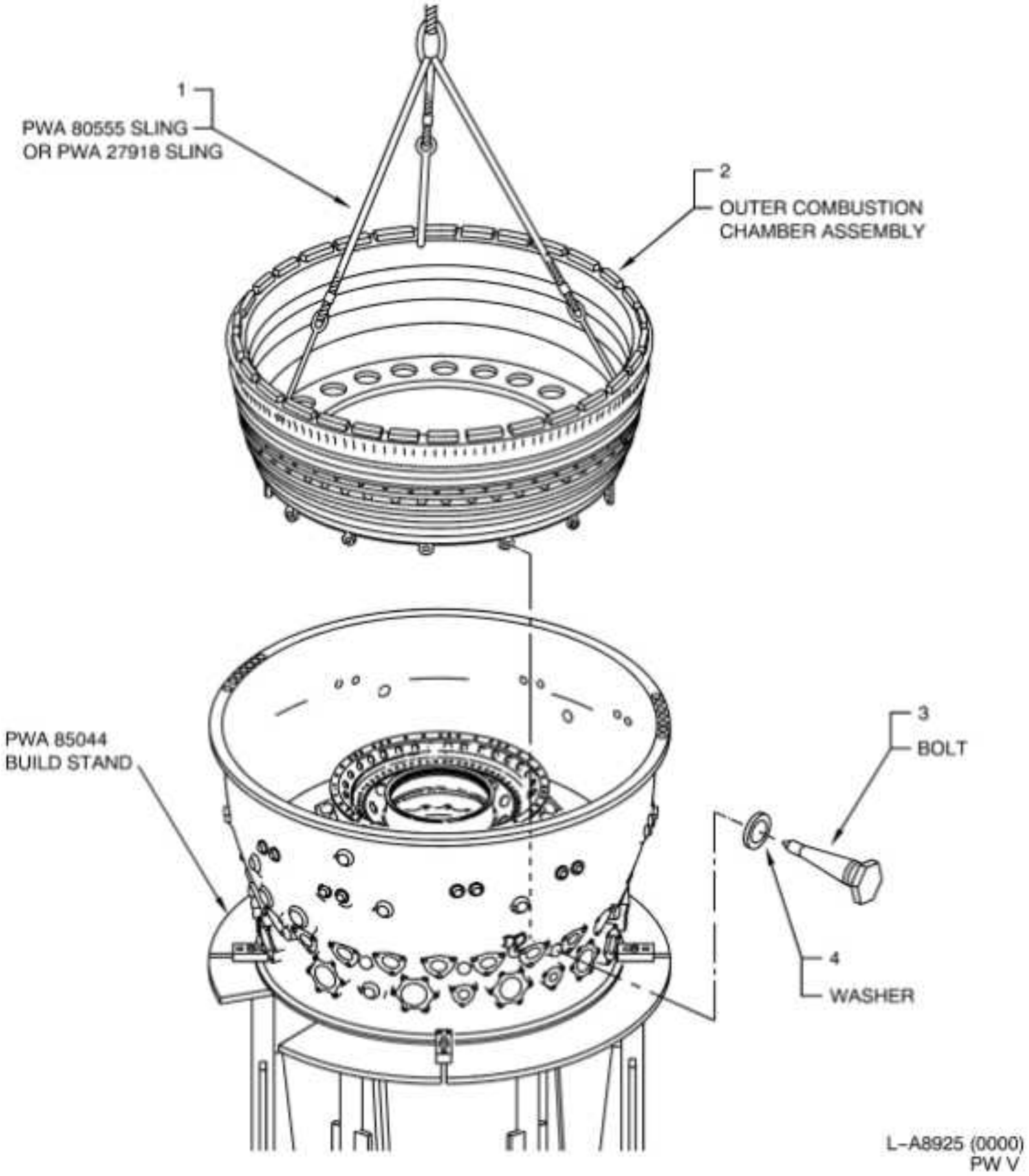

DOWEL PIN
(APPROXIMATELY
6 O'CLOCK POSITION)
1
GASKET
(1 LOCATION)
2
PLUG
(1 LOCATION)
8
GASKET
9
PLUG
12
GASKET
11
COVER
10
BOLT
(9 O'CLOCK POSITION)
6
GASKET
(3 LOCATIONS
7
PLUG
(3 LOCATIONS)
L−B1564 (0000)
PW V

Diffuser Case Externals Removal (Post SB PW4ENG 72−559)
Figure 506 (Sheet 2)
(Task 72−41−00−030−005)


DIFFUSER CASE REAR FLANGE
6 O'CLOCK POSITION
4
SPACERS
2
KEY WASHER
3
IGNITER BOSS
1
IGNITER
PLUG
L−A8913 (0000)
PW V

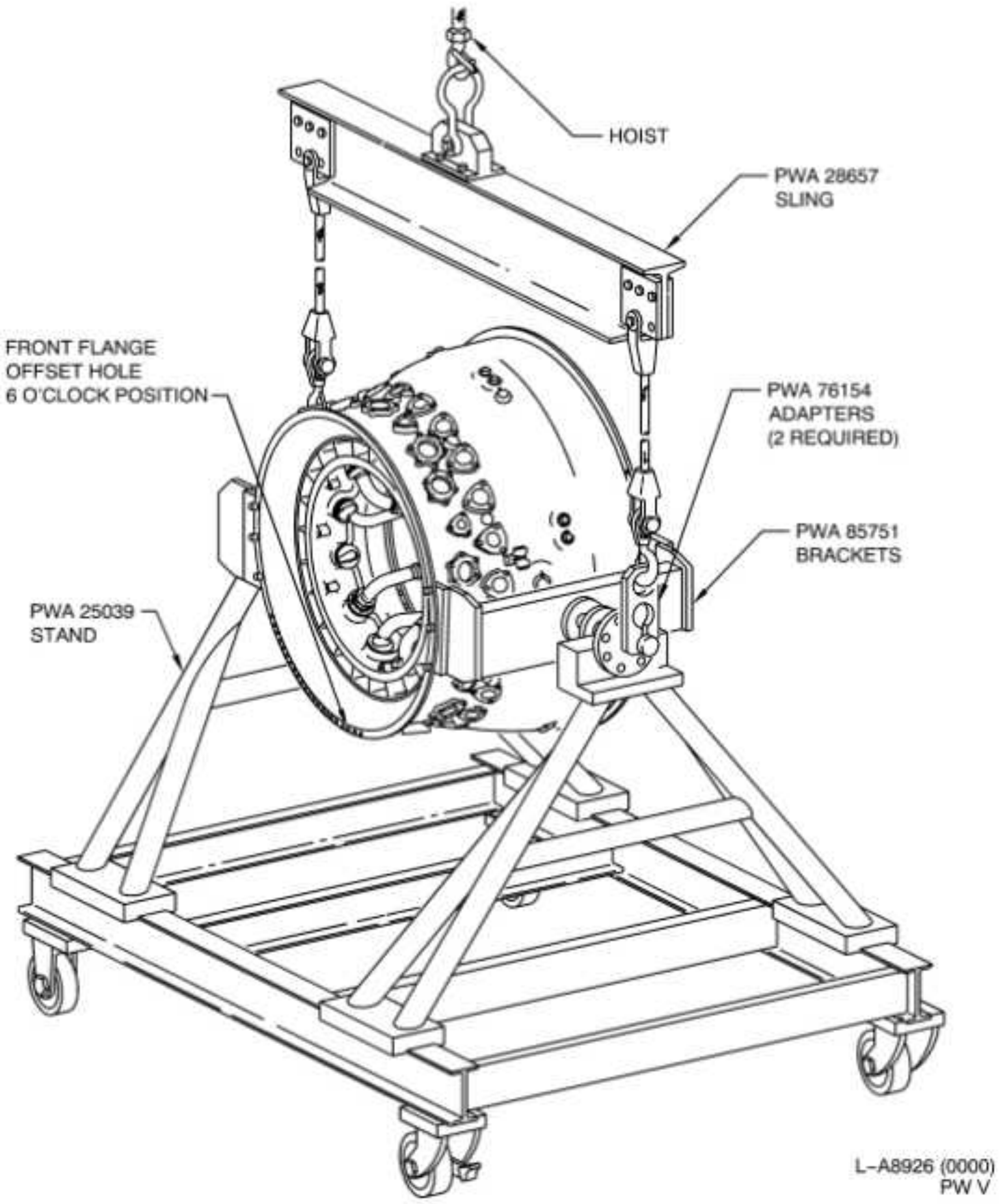
Diffuser Case Igniter Plug Removal
Figure 507
(Task 72−41−00−030−005)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


1
PWA 80555 SLING
OR PWA 27918 SLING
2
OUTER COMBUSTION
CHAMBER ASSEMBLY
PWA 85044
BUILD STAND
3
BOLT
4
WASHER
L−A8925 (0000)
PW V

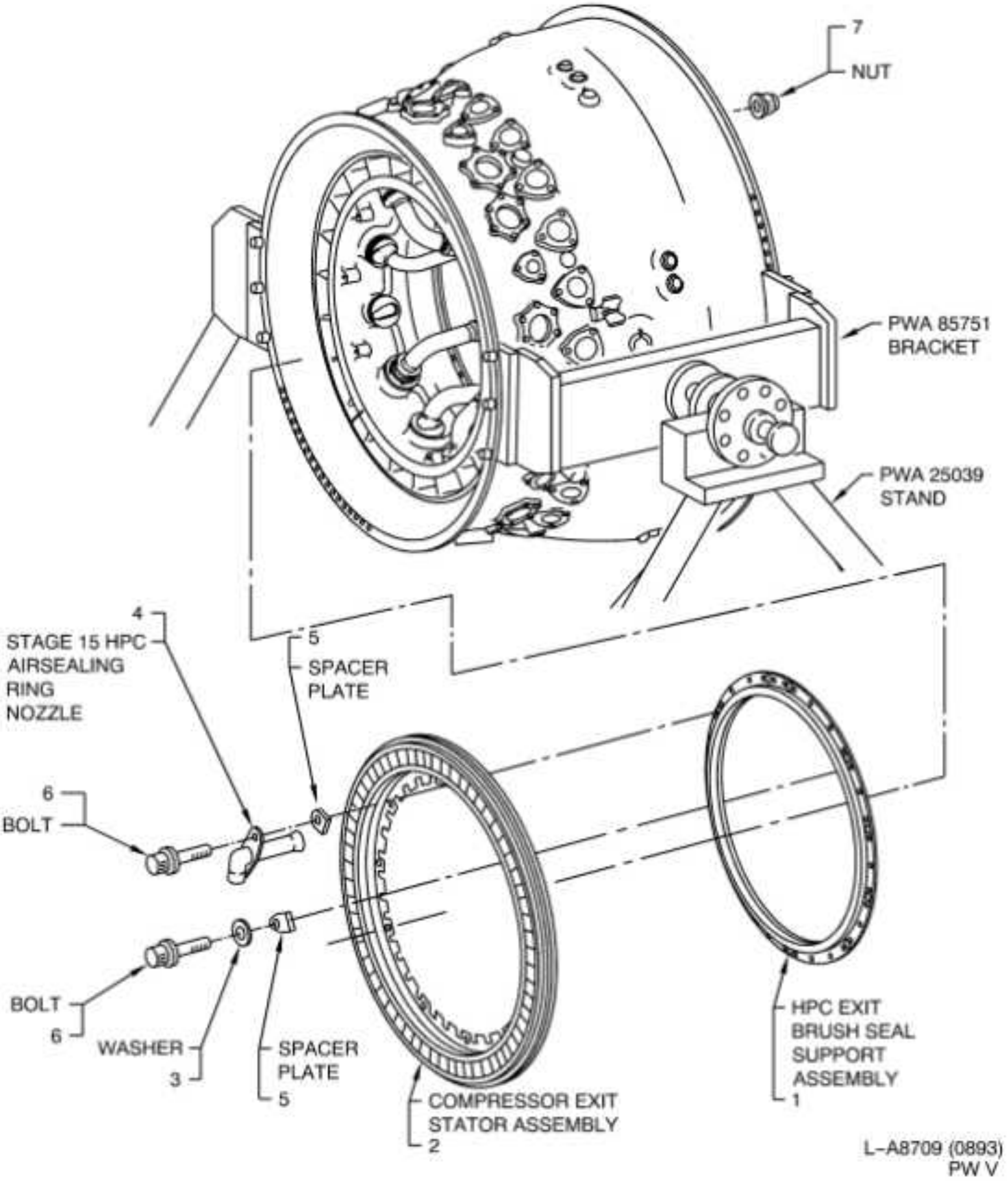
Outer Combustion Chamber Assembly Removal
Figure 508
(Task 72−41−00−030−005)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

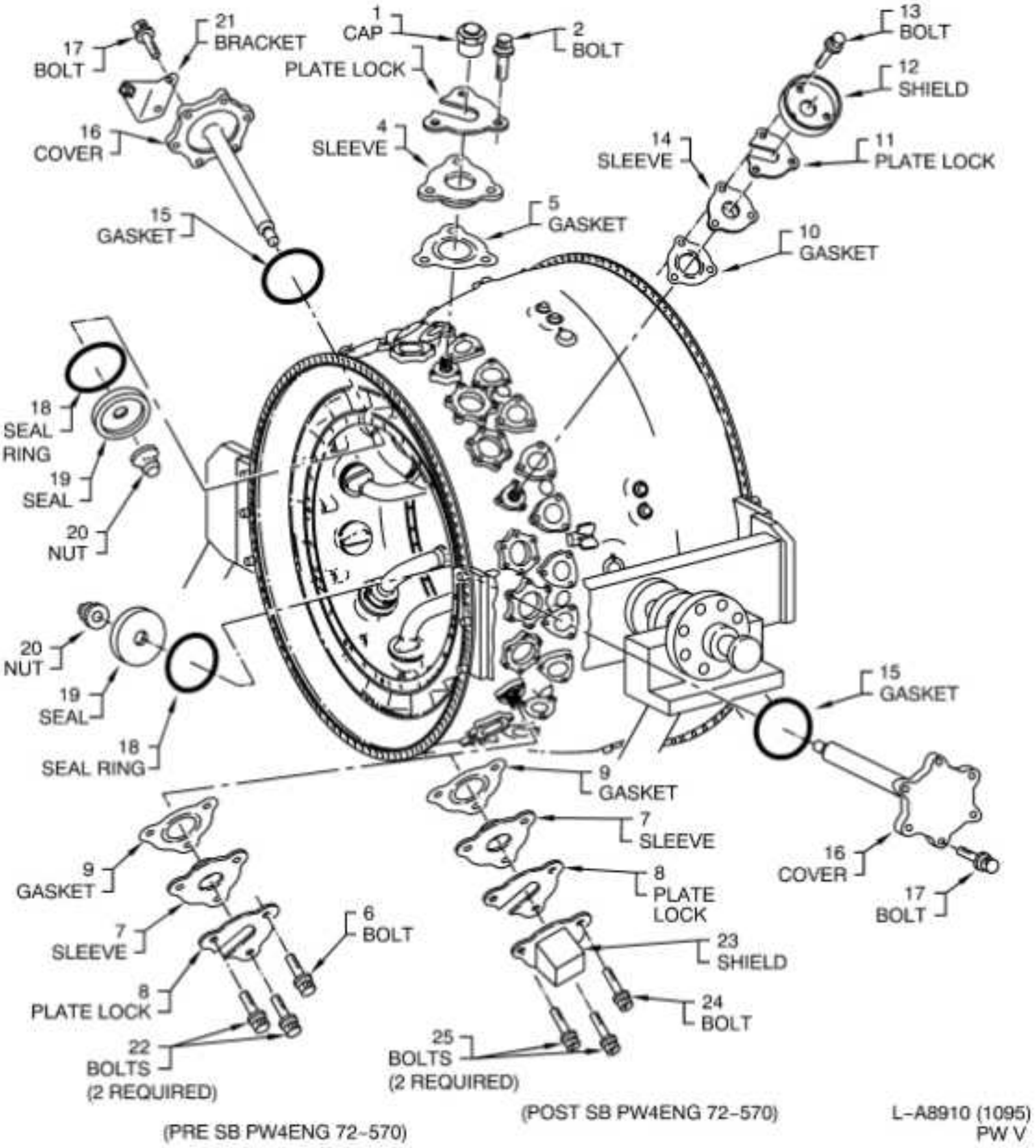

HOIST
PWA 28657 SLING
FRONT FLANGE OFFSET HOLE 6 O'CLOCK POSITION
PWA 76154 ADAPTERS (2 REQUIRED)
PWA 85751 BRACKETS
PWA 25039 STAND
L−A8926 (0000)
PW V

Diffuser Case And PWA 25039 Build Stand
Figure 509
(Task 72−41−00−030−005)

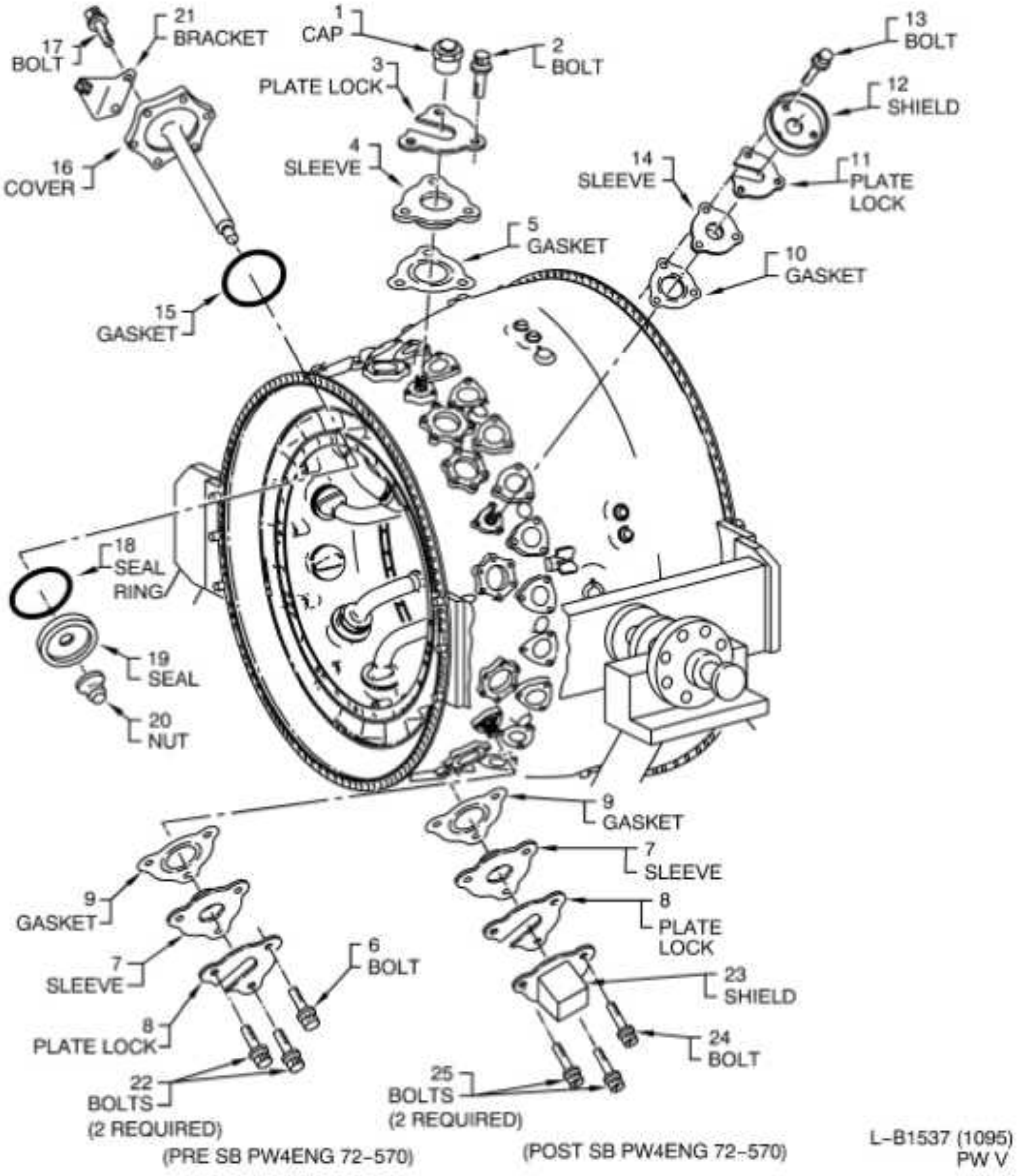
DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


7
NUT
PWA 85751
BRACKET
PWA 25039
STAND
4
STAGE 15 HPC
AIRSEALING
RING
NOZZLE
5
SPACER
PLATE
6
BOLT
BOLT
6
WASHER
3
SPACER
PLATE
5
COMPRESSOR EXIT
STATOR ASSEMBLY
2
HPC EXIT
BRUSH SEAL
SUPPORT
ASSEMBLY
1
L-A8709 (0893)
PW V

Compressor Exit Stator And Brush Seal Support Removal
Figure 510
(Task 72−41−00−030−005)

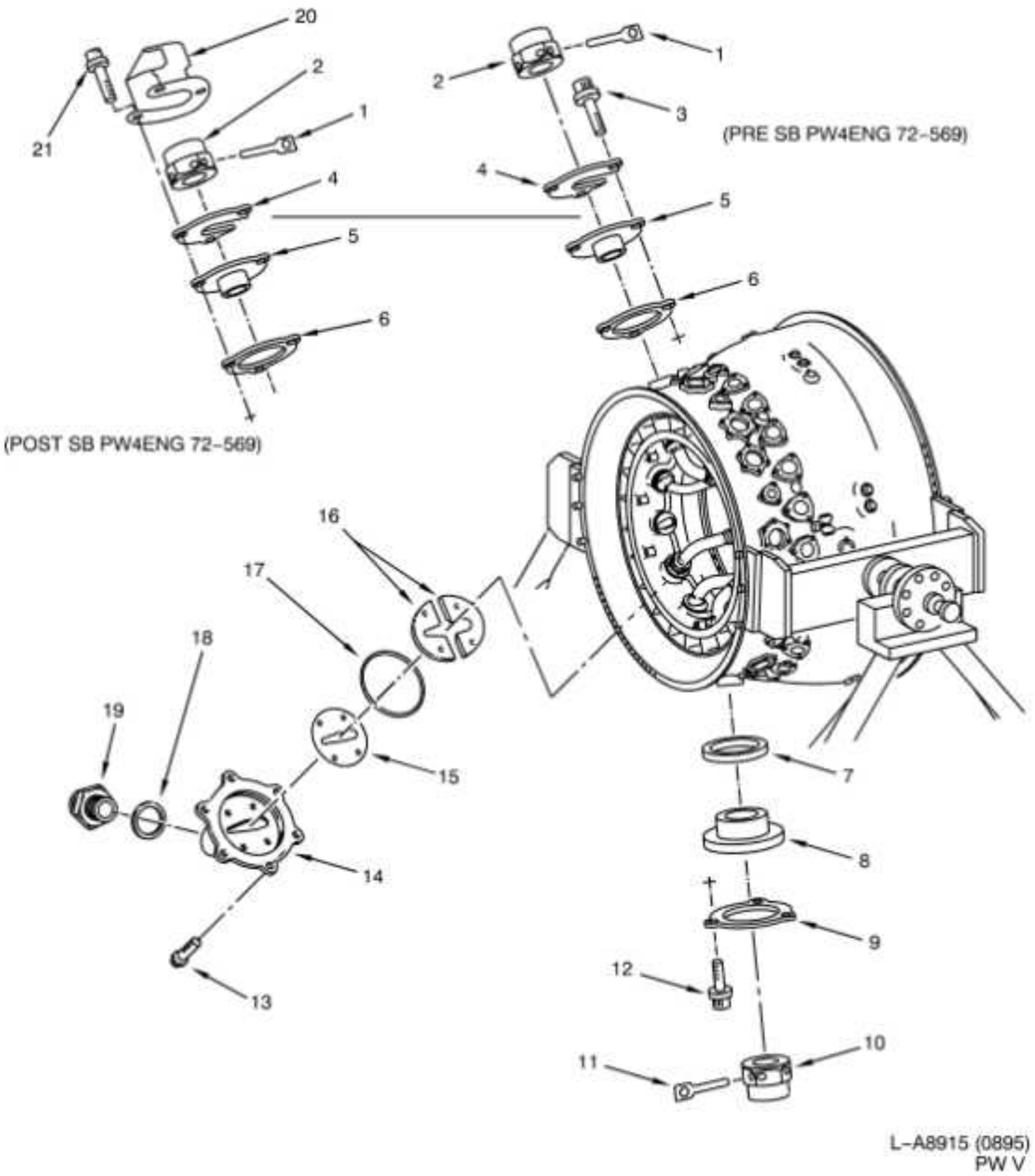

17 BOLT
21 BRACKET
1 CAP
2 BOLT
13 BOLT
12 SHIELD
PLATE LOCK
16 COVER
4 SLEEVE
14 SLEEVE
11 PLATE LOCK
5 GASKET
15 GASKET
10 GASKET
18 SEAL RING
19 SEAL
20 NUT
20 NUT
19 SEAL
18 SEAL RING
15 GASKET
9 GASKET
7 SLEEVE
16 COVER
9 GASKET
8 PLATE LOCK
17 BOLT
6 BOLT
7 SLEEVE
23 SHIELD
8 PLATE LOCK
24 BOLT
22 BOLTS (2 REQUIRED)
25 BOLTS (2 REQUIRED)
(POST SB PW4ENG 72−570)
L−A8910 (1095) PW V
(PRE SB PW4ENG 72−570)

No. 3 Bearing Pressure Tube And Manifold
Assembly Removal (Pre SB PW4ENG 72−559)
Figure 511 (Sheet 1)
(Task 72−41−00−030−005)


1 CAP
2 BOLT
3 PLATE LOCK
4 SLEEVE
5 GASKET
21 BRACKET
17 BOLT
16 COVER
15 GASKET
13 BOLT
12 SHIELD
11 PLATE LOCK
14 SLEEVE
10 GASKET
18 SEAL RING
19 SEAL
20 NUT
9 GASKET
7 SLEEVE
8 PLATE LOCK
6 BOLT
22 BOLTS (2 REQUIRED)
(PRE SB PW4ENG 72-570)
9 GASKET
7 SLEEVE
8 PLATE LOCK
23 SHIELD
24 BOLT
25 BOLTS (2 REQUIRED)
(POST SB PW4ENG 72-570)
L-B1537 (1095)
PW V

No. 3 Bearing Pressure Tube And Manifold
Assembly Removal (Post SB PW4ENG 72−559)
Figure 511 (Sheet 2)
(Task 72−41−00−030−005)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


20
2
1
21
4
5
6
(POST SB PW4ENG 72-569)
2
1
3
(PRE SB PW4ENG 72-569)
4
5
6
16
17
18
19
15
14
13
7
8
9
12
10
11
L-A8915 (0895)
PW V

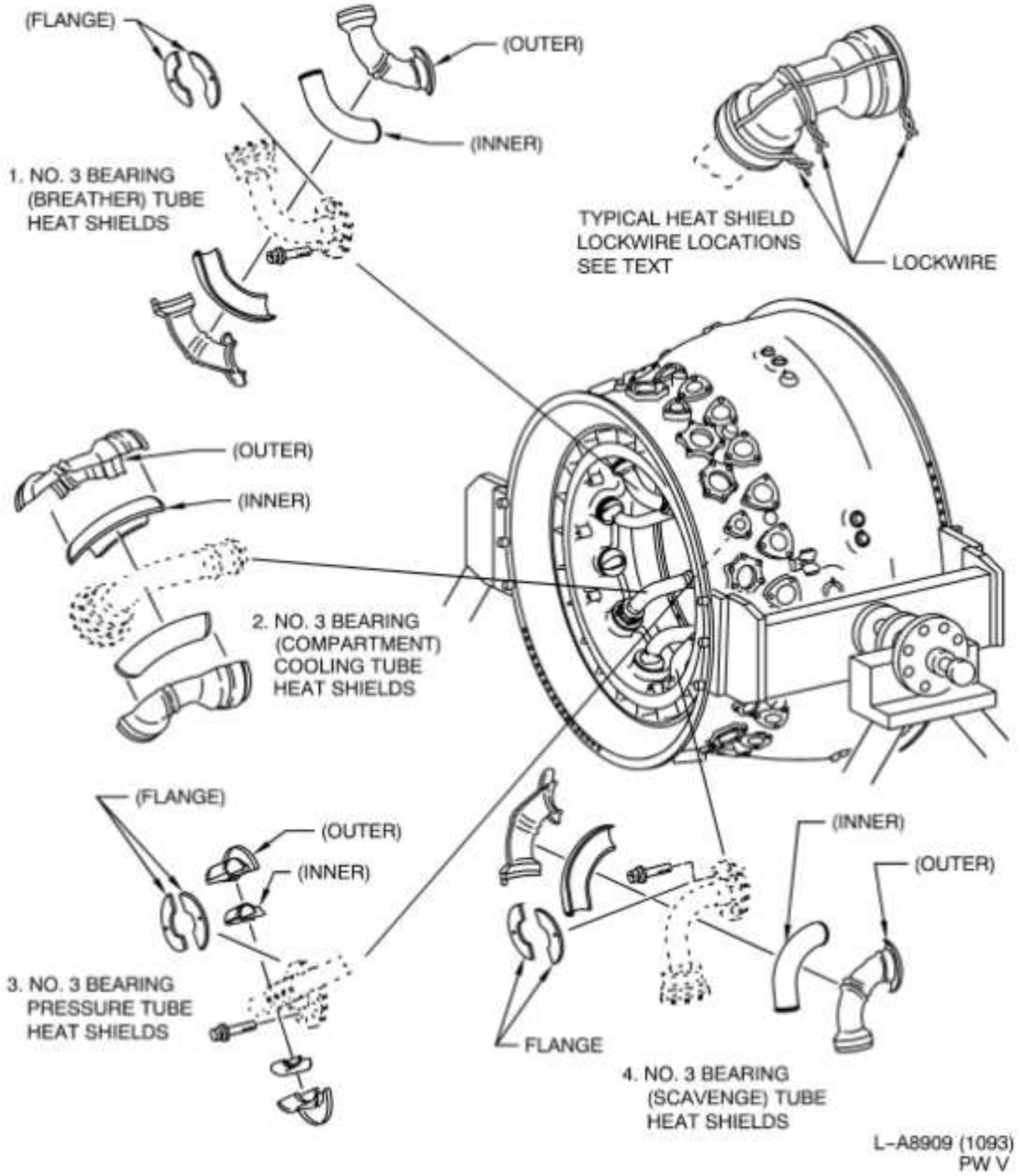
Remove The No. 3 Bearing Scavenge, Breather, And Cooling Tube Locks
Figure 512
(Task 72−41−00−030−005)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

1. Wire
2. Tube Nut
3. Bolt (Shorter − 3 Necessary)
4. Plate Lock
5. Sleeve
6. Gasket
7. Gasket
8. Sleeve
9. Plate
10. Tube Nut
11. Wire
12. Bolt
13. Bolt (10 Necessary)
14. Elbow
15. Gasket
16. Lock
17. Gasket
18. Washer
19. Adapter
20. Heat Shield
21. Bolt (Longer − 3 Necessary)

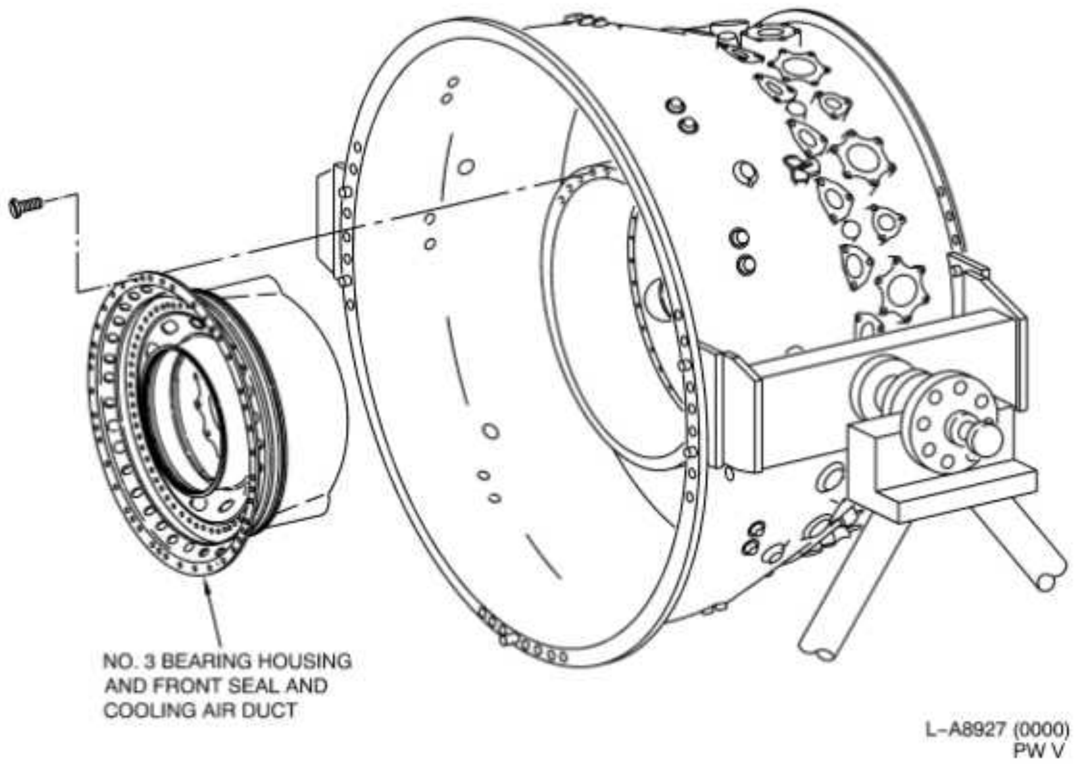
Key to Figure 512

DIFFUSER AND COMBUSTOR - DISASSEMBLY-02


(FLANGE)
(OUTER)
(INNER)
1. NO. 3 BEARING (BREATHER) TUBE HEAT SHIELDS
TYPICAL HEAT SHIELD LOCKWIRE LOCATIONS SEE TEXT
LOCKWIRE
(OUTER)
(INNER)
2. NO. 3 BEARING (COMPARTMENT) COOLING TUBE HEAT SHIELDS
(FLANGE)
(OUTER)
(INNER)
3. NO. 3 BEARING PRESSURE TUBE HEAT SHIELDS
FLANGE
(INNER)
(OUTER)
4. NO. 3 BEARING (SCAVENGE) TUBE HEAT SHIELDS
L-A8909 (1093)
PW V

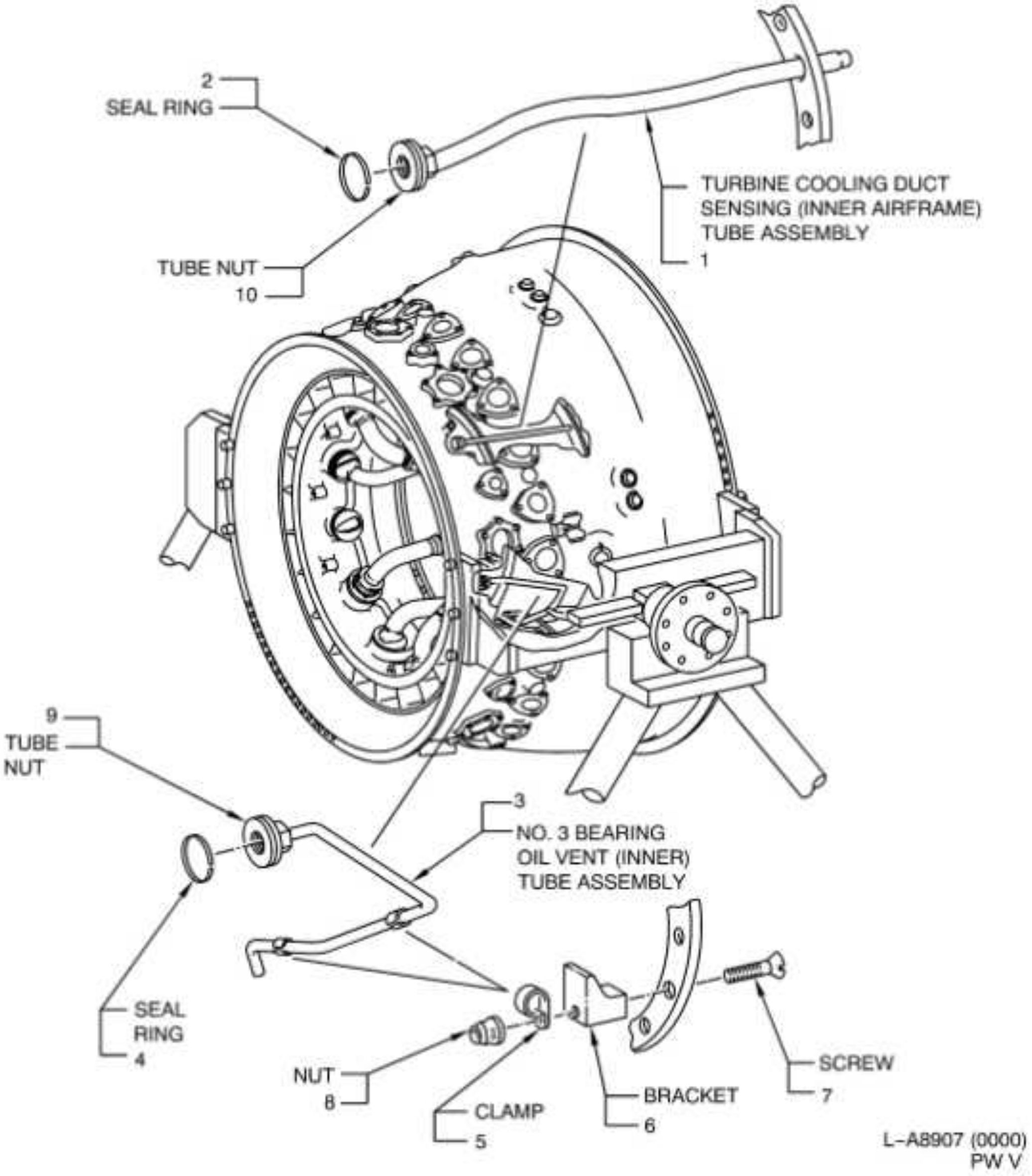
Remove The Heat Shields
Figure 513
(Task 72-41-00-030-005)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02

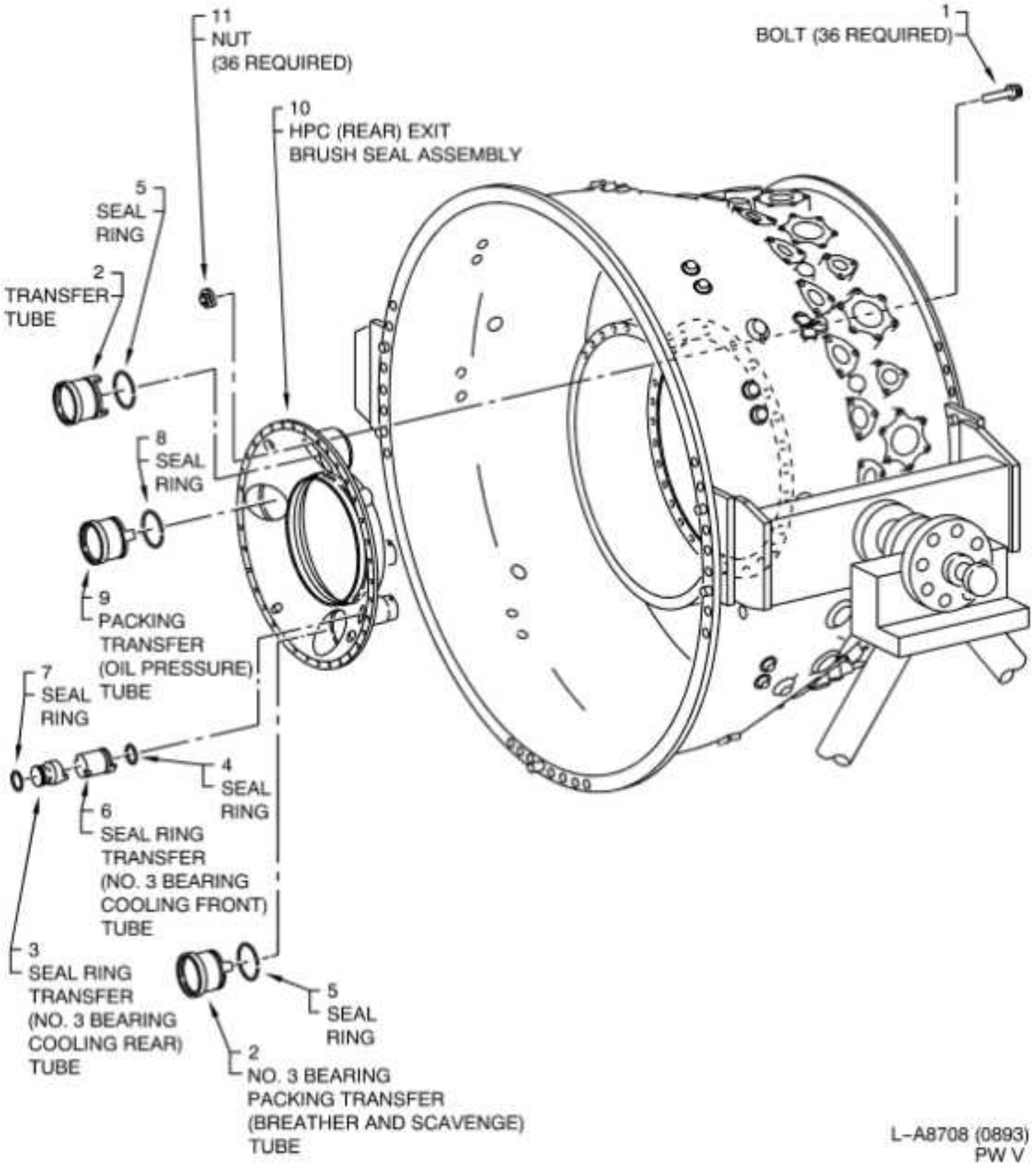

NO. 3 BEARING HOUSING
AND FRONT SEAL AND
COOLING AIR DUCT
L−A8927 (0000)
PW V

No. 3 Bearing Duct, Seal And Housing Removal
Figure 514
(Task 72−41−00−030−005)

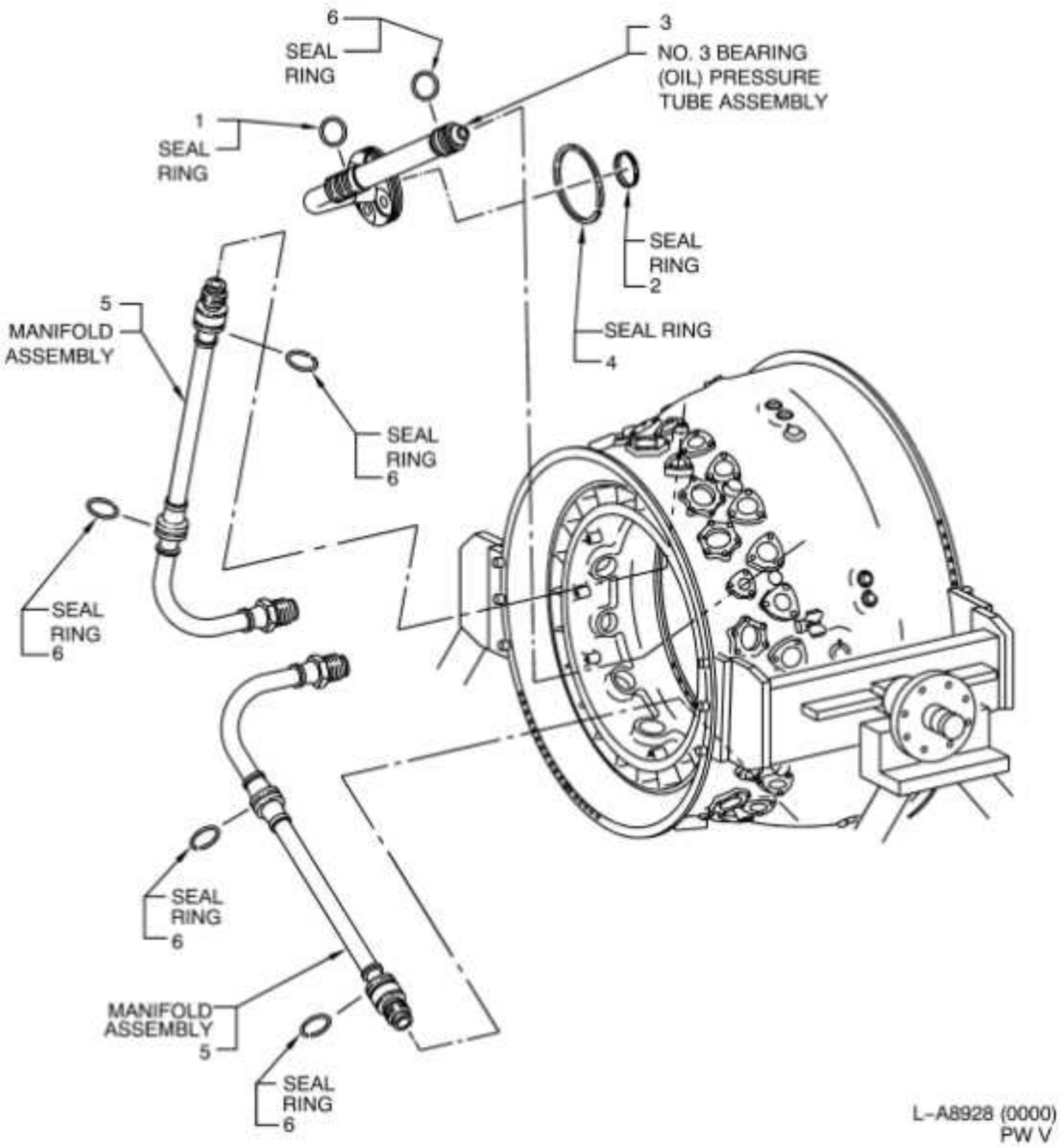
DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


2
SEAL RING
TURBINE COOLING DUCT SENSING (INNER AIRFRAME) TUBE ASSEMBLY
1
TUBE NUT
10
9
TUBE NUT
3
NO. 3 BEARING OIL VENT (INNER) TUBE ASSEMBLY
SEAL RING
4
NUT
8
CLAMP
5
BRACKET
6
SCREW
7
L−A8907 (0000)
PW V

Oil Vent And Cooling Duct Tube Assembly Removal
Figure 515
(Task 72−41−00−030−005)

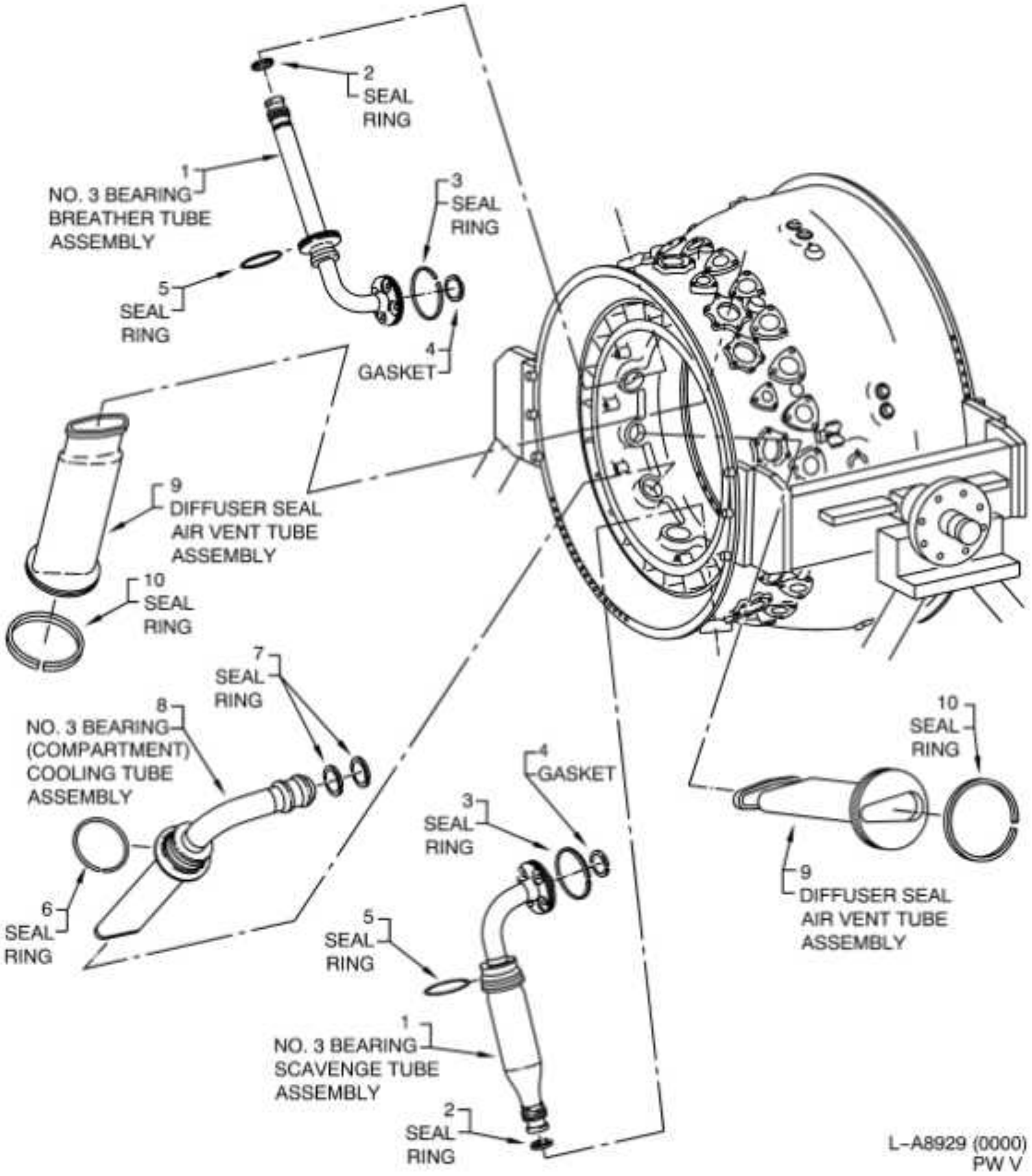

11
NUT
(36 REQUIRED)
1
BOLT (36 REQUIRED)
10
HPC (REAR) EXIT
BRUSH SEAL ASSEMBLY
5
SEAL
RING
2
TRANSFER
TUBE
8
SEAL
RING
9
PACKING
TRANSFER
(OIL PRESSURE)
TUBE
7
SEAL
RING
4
SEAL
RING
6
SEAL RING
TRANSFER
(NO. 3 BEARING
COOLING FRONT)
TUBE
3
SEAL RING
TRANSFER
(NO. 3 BEARING
COOLING REAR)
TUBE
5
SEAL
RING
2
NO. 3 BEARING
PACKING TRANSFER
(BREATHER AND SCAVENGE)
TUBE
L−A8708 (0893)
PW V

Remove The HPC (Rear) Exit Brush Seal Assembly
Figure 516
(Task 72−41−00−030−005)

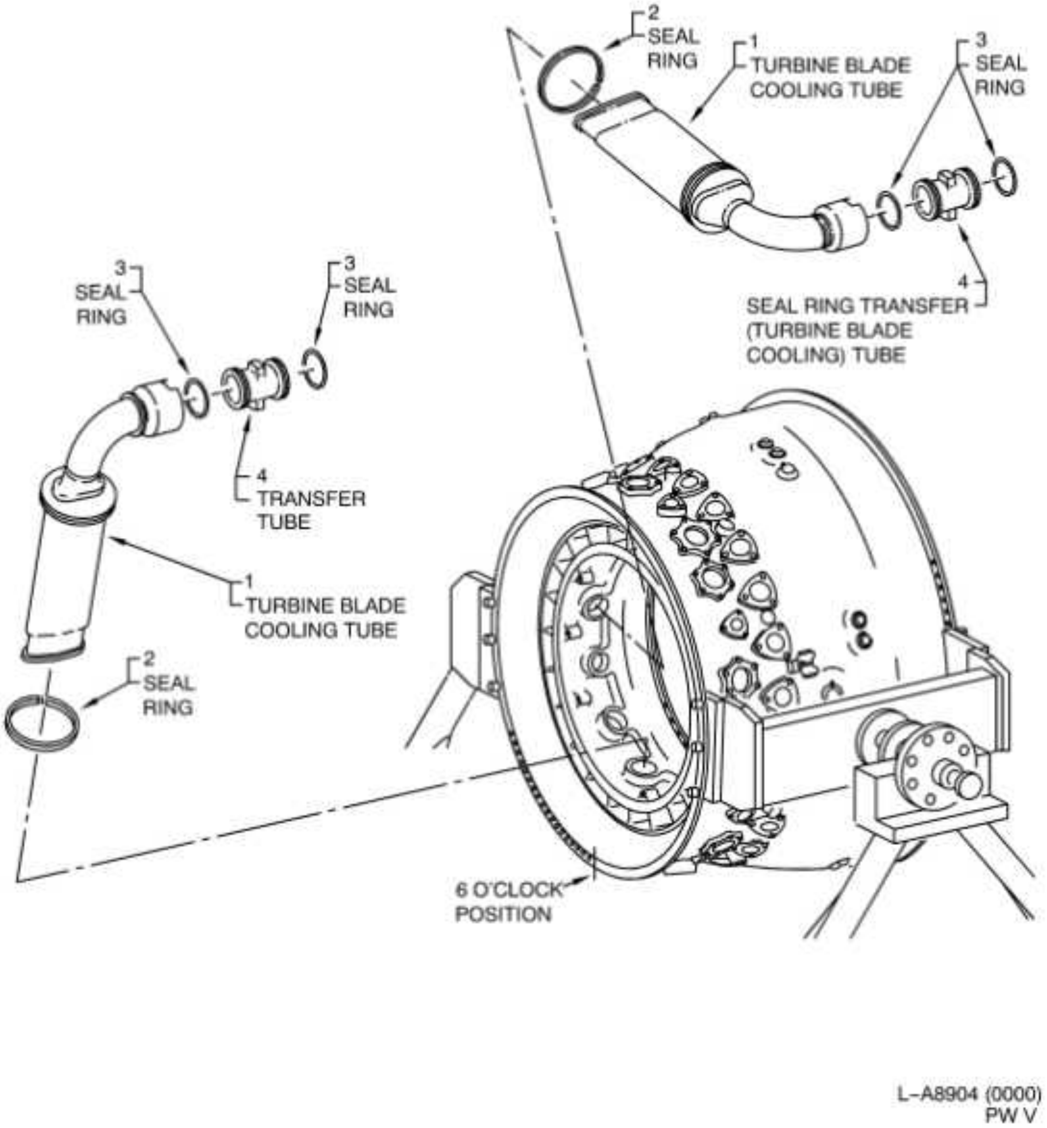

6
SEAL RING
3
NO. 3 BEARING (OIL) PRESSURE TUBE ASSEMBLY
1
SEAL RING
SEAL RING
2
SEAL RING
4
5
MANIFOLD ASSEMBLY
SEAL RING
6
SEAL RING
6
SEAL RING
6
MANIFOLD ASSEMBLY
5
SEAL RING
6
L−A8928 (0000)
PW V

No. 3 Bearing Pressure Tube And Airframe Manifold Assembly Removal
Figure 517
(Task 72−41−00−030−005)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−02


2
SEAL RING
1
NO. 3 BEARING BREATHER TUBE ASSEMBLY
3
SEAL RING
5
SEAL RING
4
GASKET
9
DIFFUSER SEAL AIR VENT TUBE ASSEMBLY
10
SEAL RING
7
SEAL RING
8
NO. 3 BEARING (COMPARTMENT) COOLING TUBE ASSEMBLY
6
SEAL RING
4
GASKET
3
SEAL RING
5
SEAL RING
1
NO. 3 BEARING SCAVENGE TUBE ASSEMBLY
2
SEAL RING
10
SEAL RING
9
DIFFUSER SEAL AIR VENT TUBE ASSEMBLY
L-A8929 (0000)
PW V

No. 3 Bearing Breather, Scavenge And Cooling
Tubes And Diffuser Seal Air Vent Tubes
Figure 518
(Task 72−41−00−030−005)


2 SEAL RING
1 TURBINE BLADE COOLING TUBE
3 SEAL RING
4 SEAL RING TRANSFER (TURBINE BLADE COOLING) TUBE
3 SEAL RING
3 SEAL RING
4 TRANSFER TUBE
1 TURBINE BLADE COOLING TUBE
2 SEAL RING
6 O'CLOCK POSITION
L−A8904 (0000)
PW V

Remove The Turbine Blade Cooling Tubes
Figure 519
(Task 72−41−00−030−005)

DIFFUSER AND COMBUSTOR - DISASSEMBLY-03

Task 72-41-00-030-003-001:

1. Disassemble No. 3 Bearing Duct And Housing (Hydraulic Wrench Method)

NOTE: To disassemble No. 3 bearing duct and housing by means of mechanical wrench method, see Disassembly-04 (Task 72-41-00-030-003-002).

A. Prerequisites
  (1) Remove fuel distribution valve and fuel supply tubes. See Disassembly-01 (Task 72-41-00-030-001).
  (2) Remove diffuser and combustor externals. See Disassembly-02 (Task 72-41-00-030-002).

B. Equipment And Materials Required

Special Tools:
PWA 18872 Wrench, Hydraulic*
PWA 28814 Pump, Electric*
PWA 28815 Cart*
PWA 29510 Pump, Hydraulic*
PWA 33732 Wrench, Hydraulic*
PWA 75046 Cart*
PWA 80070 Wrench, Hydraulic*
PWA 85048 Base
PWA 85050 Drift
PWA 85051 Adapter, Wrench*
PWA 85052 Wrench, Torque*
PWA 85053 Wrench, Torque*
PWA 85054 Adapter, Wrench*
PWA 85058 Puller
PWA 85059 Eye
PWA 85167 Adapter
PWA 85199 Fixture
PWA 85541 Wrench
PWA 85542 Wrench
PWA 86546 Adapter (Optional To PWA 85199)
PWA 87354 Wrench, Hydraulic*

*Refer to Table 501 for tool options. Only Table 501 shows the correct combination of tools for removal of the No. 3 bearing (outer race) retaining nut.

NOTE: The PWA 86546 Adapter is an optional tool that will permit PWA 85167 Adapter to be mounted to an approved bench positioner when the electric motorized PWA 85199 Fixture is not available.

C. Procedure

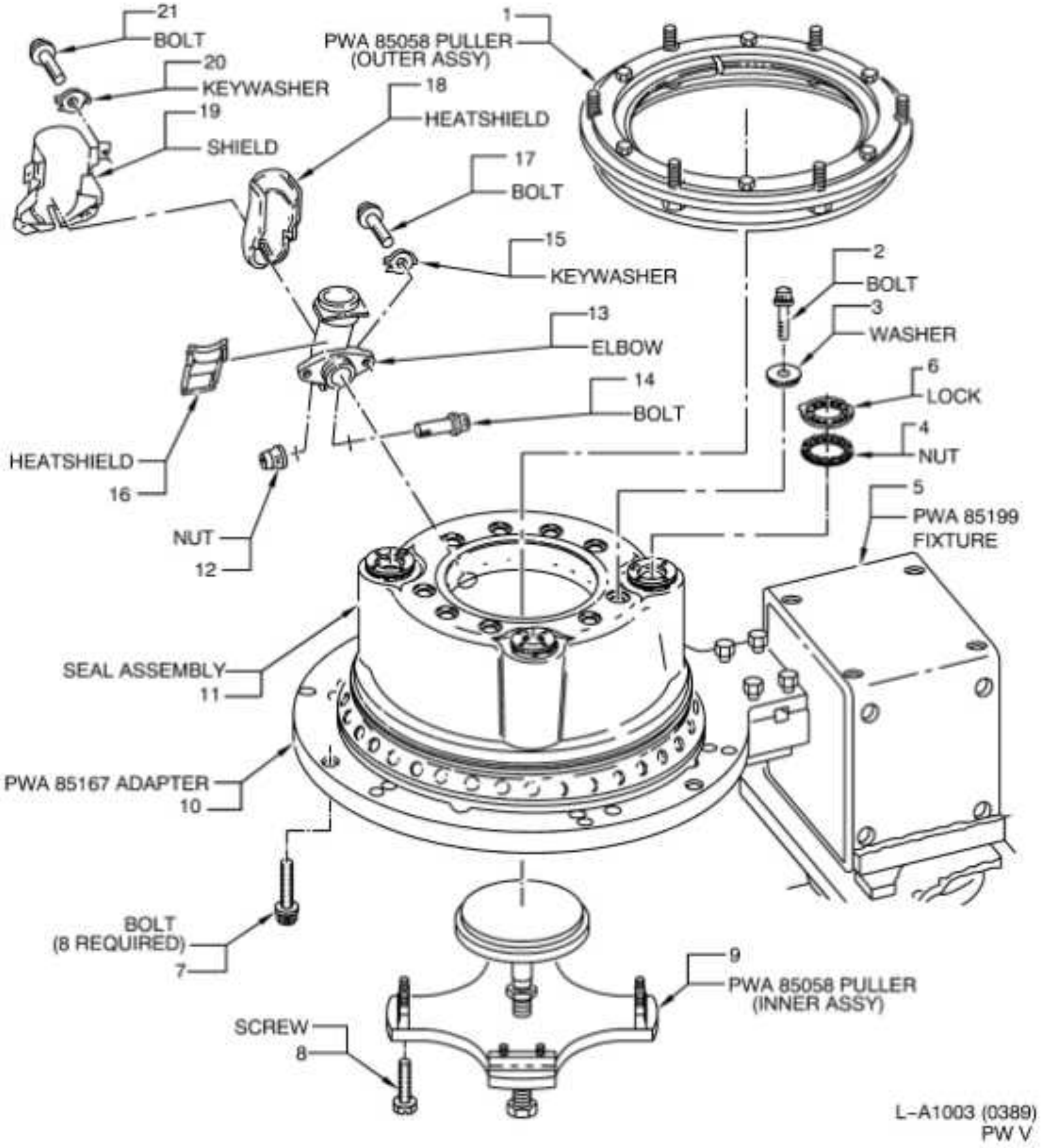
Subtask 72−41−00−030−068:

(1) Disassemble No. 3 bearing seal assembly and front cooling duct assembly. See Figure 501.
  (a) Remove Protective Cover (PWA 85056) over No. 3 bearing outer race and attach PWA 85059 Lifting Eye.
  (b) Install seal assembly (501/11) in PWA 85167 Adapter (501/10) attached to PWA 85199 Fixture (501/5). Secure with eight bolts (501/7) and remove lifting eye.
  (c) Attach PWA 85058 Puller (inner assembly) (501/9) to seal assembly. Secure with eight screws (501/8).
  (d) Remove four bolts (501/21) and key washers (501/20) securing shield (501/19) to seal assembly. Remove shield and discard key washers.
  (e) Remove heat shield (501/18) from elbow (501/13).
  (f) Remove bolt (501/14) and nut (501/12) securing elbow (501/13) lug to clevis on seal assembly.
  (g) Remove two bolts (501/17) and key washers (501/15) securing elbow (501/13) and heat shield (501/16) to seal assembly (501/11). Remove elbow and discard key washers.
  (h) Remove locks (501/6) at three locations on seal assembly (501/11).
  (i) With PWA 85541 Wrench remove the two large nuts (501/4) and with PWA 85542 Wrench remove the small nut (501/4) on seal assembly (501/11).
  (j) Remove nine bolts (501/2) and washers (501/3) securing cooling duct to seal assembly (501/11).
  (k) Attach PWA 85058 Puller (outer assembly) (501/1) split ring to duct outer flange.
  (l) Tighten the puller, jamnuts and the center bolt of the toggle pad evenly to remove the cooling duct from the bearing housing.
  (m) Rotate adapter (501/10) to large OD up position and remove puller (inner assembly) (501/9).

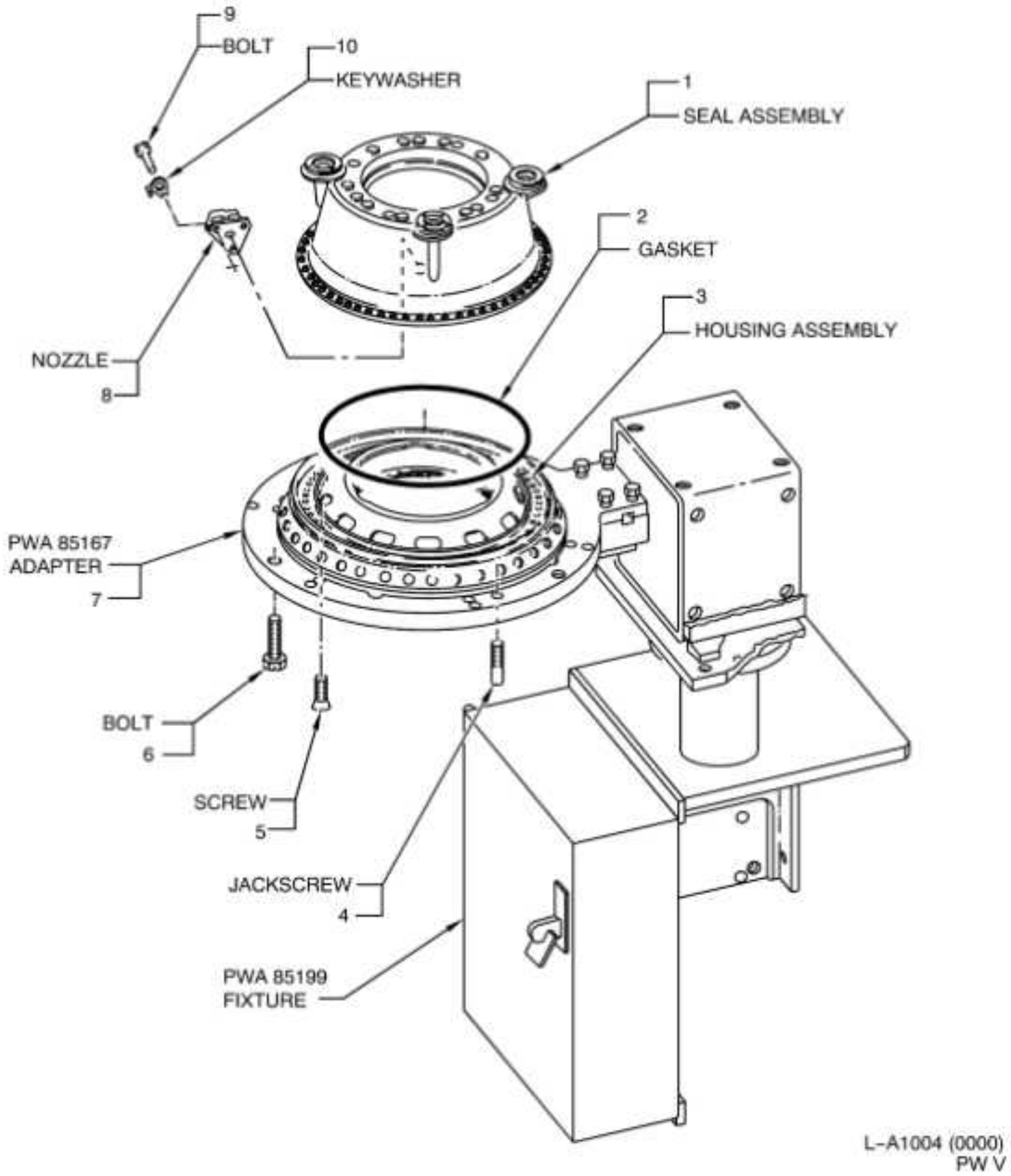
(2) Remove seal assembly from housing.
  (a) Remove four screws (502/5) securing seal assembly (502/1) to housing assembly (502/3). See Figure 502.
  (b) Using four jackscrews (502/4) installed in housing (502/3) remove seal assembly (502/1) from housing and place on bench large OD up.

NOTE: One or more repaired jackscrew holes may be present in the No. 3 bearing housing which will require an oversized jackscrew with a 0.3125−24 UNF−2B modified minor diameter thread.

DIFFUSER AND COMBUSTOR - DISASSEMBLY-03


21
BOLT
20
KEYWASHER
19
SHIELD
1
PWA 85058 PULLER
(OUTER ASSY)
18
HEATSHIELD
17
BOLT
15
KEYWASHER
2
BOLT
3
WASHER
13
ELBOW
6
LOCK
14
BOLT
4
NUT
HEATSHIELD
16
NUT
12
5
PWA 85199
FIXTURE
SEAL ASSEMBLY
11
PWA 85167 ADAPTER
10
BOLT
(8 REQUIRED)
7
9
PWA 85058 PULLER
(INNER ASSY)
SCREW
8
L-A1003 (0389)
PW V

No. 3 Bearing Seal And Duct Disassembly
Figure 501
(Task 72-41-00-030-003-001)


9
BOLT
10
KEYWASHER
1
SEAL ASSEMBLY
2
GASKET
3
HOUSING ASSEMBLY
NOZZLE
8
PWA 85167
ADAPTER
7
BOLT
6
SCREW
5
JACKSCREW
4
PWA 85199
FIXTURE
L-A1004 (0000)
PW V

No. 3 Bearing Seal And Duct Disassembly
Figure 502
(Task 72-41-00-030-003-001)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−03

(c) Locate nozzle (502/8) inside seal assembly (502/1) and remove bolts (502/9) and key washers (502/10) securing nozzle. Remove nozzle and discard key washers.

(d) Remove gasket (502/2) from housing (502/3).

(e) Rotate adapter (502/7) and housing (502/3) to large OD up position.

(f) Remove bolts (502/6) securing housing (502/3) to adapter (502/7) and using Lifting Eye (PWA 85059) remove housing from adapter.

(3) Remove the No. 3 bearing (outer race) retaining nut. Refer to Table 501 for the correct combination of tools. Refer to Figure 503.

NOTE: See 72−00−41, Removal−01 for removal of retaining nut from diffuser and combustor installed on high pressure compressor.

(a) (Method 1)

1 Install housing (503/3) in PWA 85048 Base (503/4), large OD up, aligning four pins in base with bolt holes in housing.

2 Remove rivet (503/1) from retaining nut (503/5) in housing (503/3) and discard rivet.

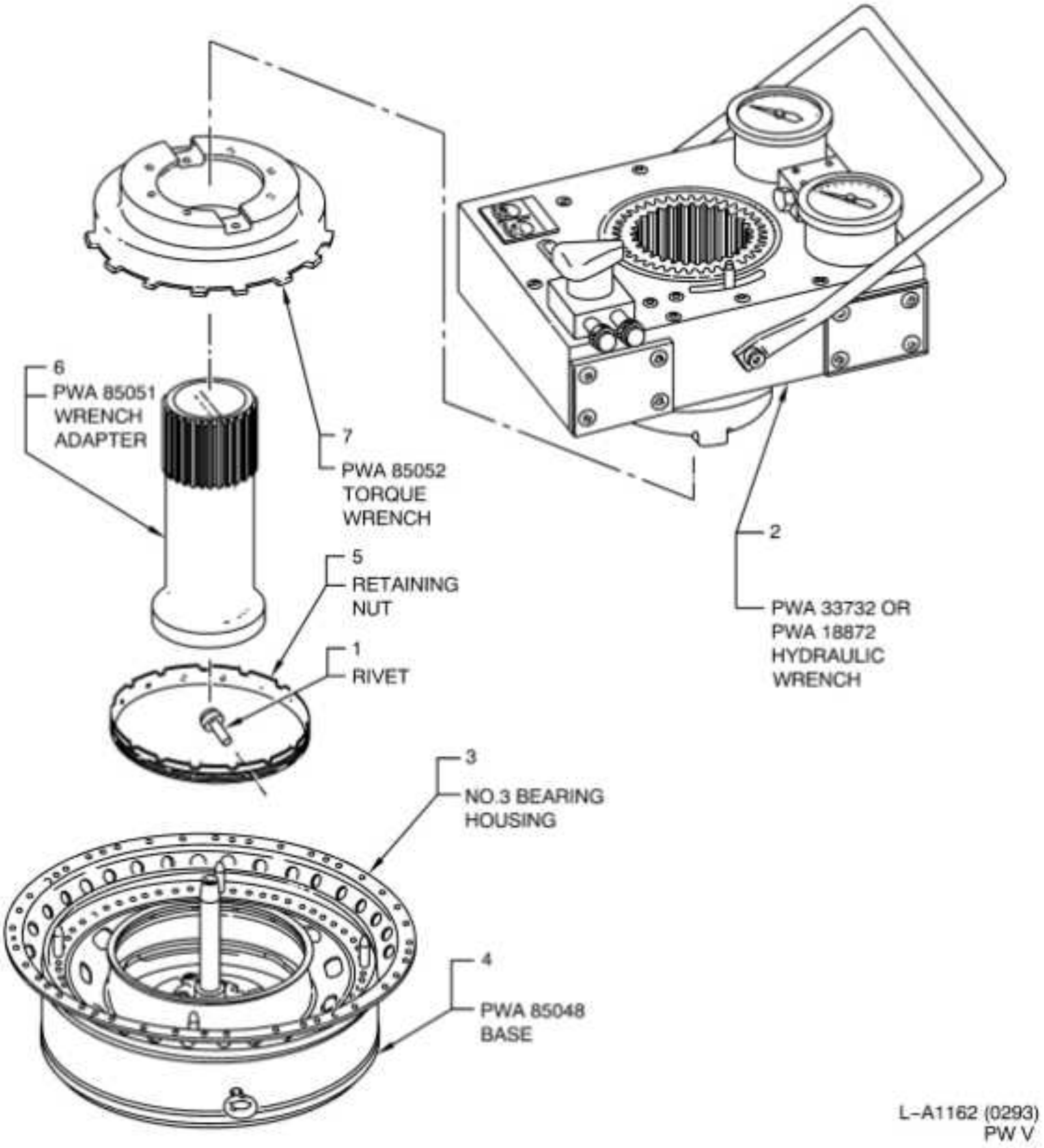
3 Install PWA 85051 Adapter (503/6), spline end up, over the pilot of base (503/4) and rotate to engage the four slots of the adapter (503/6) with four keys of the base (503/4).

4 Secure PWA 85052 Wrench (503/7) to a hydraulic wrench (503/2). Install them together over the adapter (503/6), engaging the slots on the outer race retaining nut (503/5).

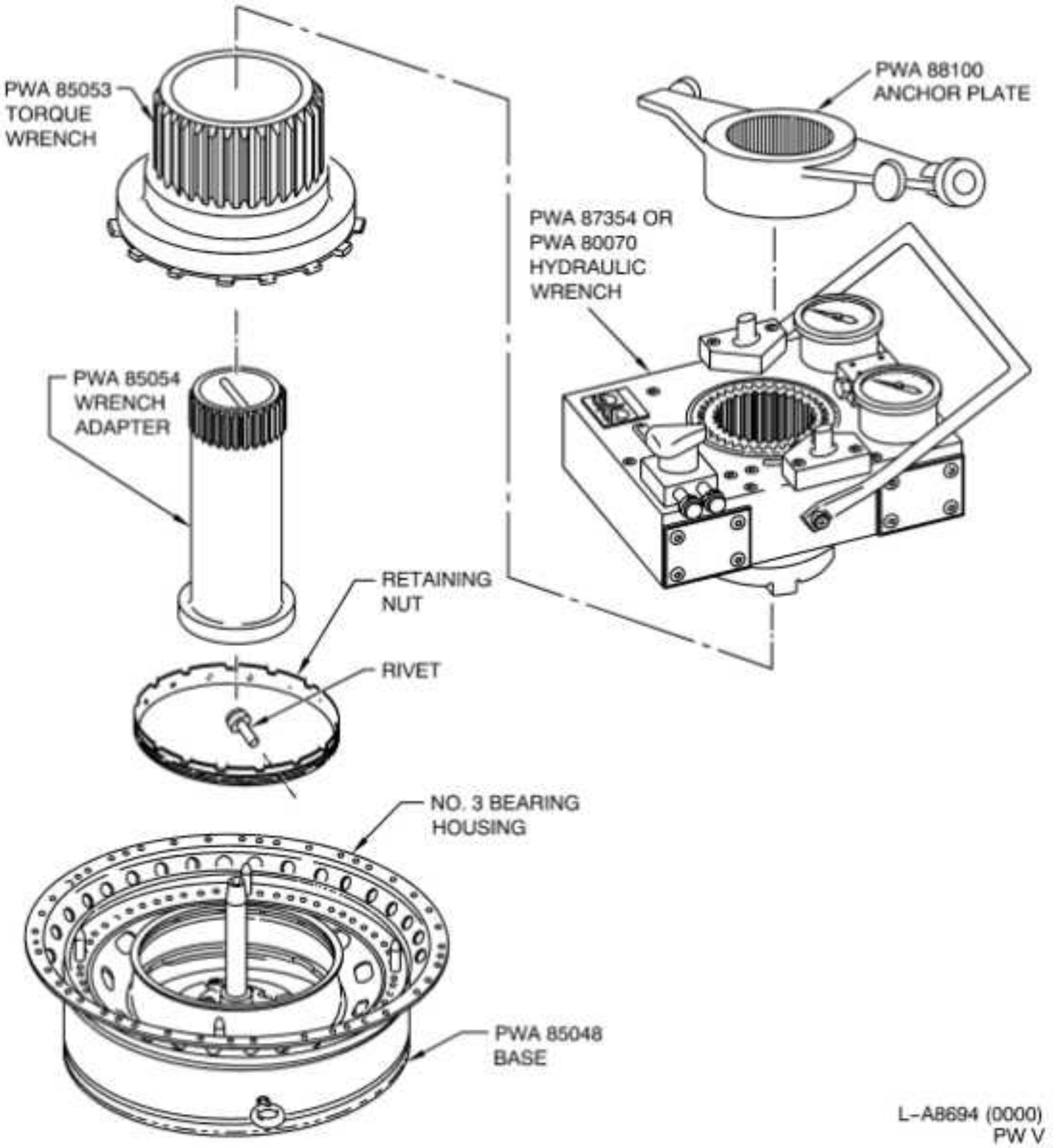
PWA Torque Wrench Or Hand Wrench	PWA Wrench Adapter or Holding Adapter	PWA Hydraulic Wrench	PWA Anchor Plate	PWA Pump	PWA Cart
85052	85051	33732	-----	28814 or 29510	75046
85052	85051	18872	-----	28814 or 29510	75046 or 28815
85053	85054	87354	88100	28814 or 29510	75046
85053	85054	80070	88100	28814 or 29510	75046

Matrix Of Tools Used To Remove The No. 3 Bearing Retaining Nut
Table 501

5 Using hydraulic wrench loosen and remove retaining nut from housing.


6
PWA 85051
WRENCH
ADAPTER
7
PWA 85052
TORQUE
WRENCH
5
RETAINING
NUT
1
RIVET
3
NO.3 BEARING
HOUSING
4
PWA 85048
BASE
2
PWA 33732 OR
PWA 18872
HYDRAULIC
WRENCH
L−A1162 (0293)
PW V

No. 3 Bearing Retaining Nut Disassembly
(Method 1)
Figure 503 (Sheet 1)
(Task 72−41−00−030−003−001)


PWA 85053
TORQUE
WRENCH
PWA 88100
ANCHOR PLATE
PWA 87354 OR
PWA 80070
HYDRAULIC
WRENCH
PWA 85054
WRENCH
ADAPTER
RETAINING
NUT
RIVET
NO. 3 BEARING
HOUSING
PWA 85048
BASE
L-A8694 (0000)
PW V

No. 3 Bearing Retaining Nut Disassembly
(Method 2)
Figure 503 (Sheet 2)
(Task 72-41-00-030-003-001)

6 Remove the adapter from Base PWA 85048.

(b) (Method 2)

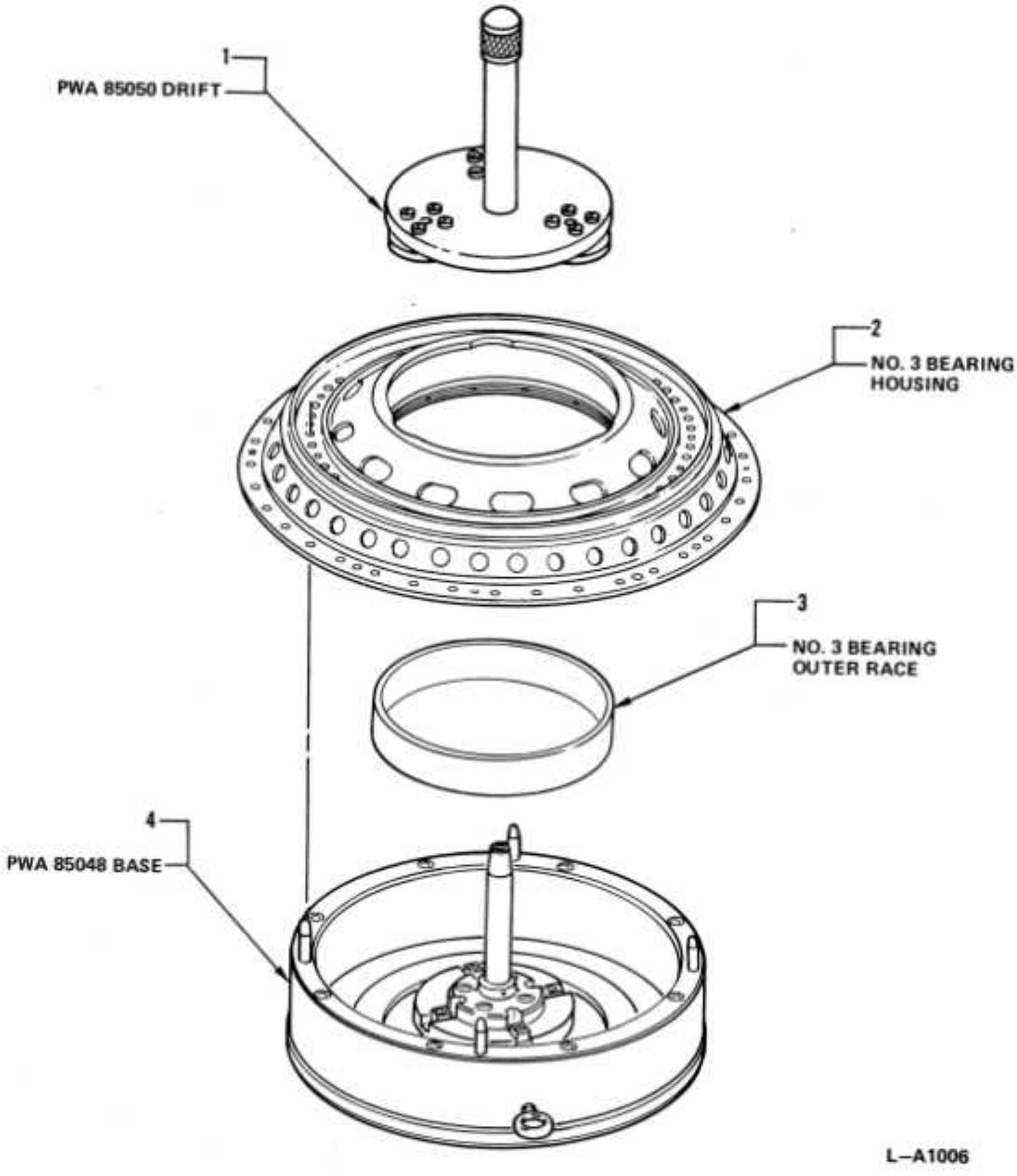
1 Install the No. 3 bearing housing in PWA 85048 Base, large OD up, aligning the four pins in the base with the bolt holes in the housing.
2 Remove the rivet from the retaining nut. Discard the rivet.
3 Install PWA 85054 Adapter in the slots of the retaining nut.
4 Install PWA 85053 Torque Wrench over the adapter and on the nut, engaging the teeth of the wrench in the slots of the nut.
5 With a hoist, lift a hydraulic wrench from a cart.
6 Install the hydraulic wrench on the torque wrench.
7 Install PWA 88100 Anchor Plate on the hydraulic wrench, engaging the pins of the wrench in the holes of the anchor plate.
8 Attach the hoses of a pump on the hydraulic wrench.
9 Loosen and remove the nut.
10 Remove the wrenches and adapters.

CAUTION: WHEN YOU REMOVE THE NO. 3 BEARING OUTER RACE, YOU MUST EXAMINE THE NO. 3 BEARING HOUSING FOR SIGNS OF WEAR ON THE HOUSING SHOULDER AND JOURNAL SURFACES. SEE 72−41−10, INSPECTION/CHECK−03 AND −04 FOR SPECIFIC INSPECTION LIMITS.

(4) Remove the No. 3 bearing outer race as follows. See Figure 504.

NOTE: See 72−00−41, Removal−01, for removal of the outer race when the diffuser and combustor is installed on the high pressure compressor.

(a) Rotate housing (504/2) in Base (PWA 85048), large OD down, aligning four pins in base with bolt holes in housing.
(b) Install PWA 85050 Drift (504/1) onto housing (504/2) with three pads locating in three scallops of the housing and the bearing outer race (504/3).
(c) Using drift and standard arbor press, drift outer race from housing.
(d) Remove housing (504/2) from base and place outer race (504/3) in protective closure with mating inner race and rollers.


1
PWA 85050 DRIFT
2
NO. 3 BEARING HOUSING
3
NO. 3 BEARING OUTER RACE
4
PWA 85048 BASE
L-A1006

No. 3 Bearing Outer Race Disassembly
Figure 504
(Task 72-41-00-030-003-001)

Previous Pageblock Return to Previous Menu Next Pageblock

DIFFUSER AND COMBUSTOR - DISASSEMBLY-04

Task 72-41-00-030-003-002:

1. Disassemble No. 3 Bearing Duct And Housing (Mechanical Wrench Method)

NOTE: To disassemble No. 3 bearing duct and housing by means of hydraulic wrench method, see Disassembly-03 (Task 72-41-00-030-003-001).

A. Prerequisites
   (1) Remove fuel distribution valve and fuel supply tubes. See Disassembly-01 (Task 72-41-00-030-001).
   (2) Remove diffuser and combustor externals. See Disassembly-02 (Task 72-41-00-030-002).

B. Equipment And Materials Required

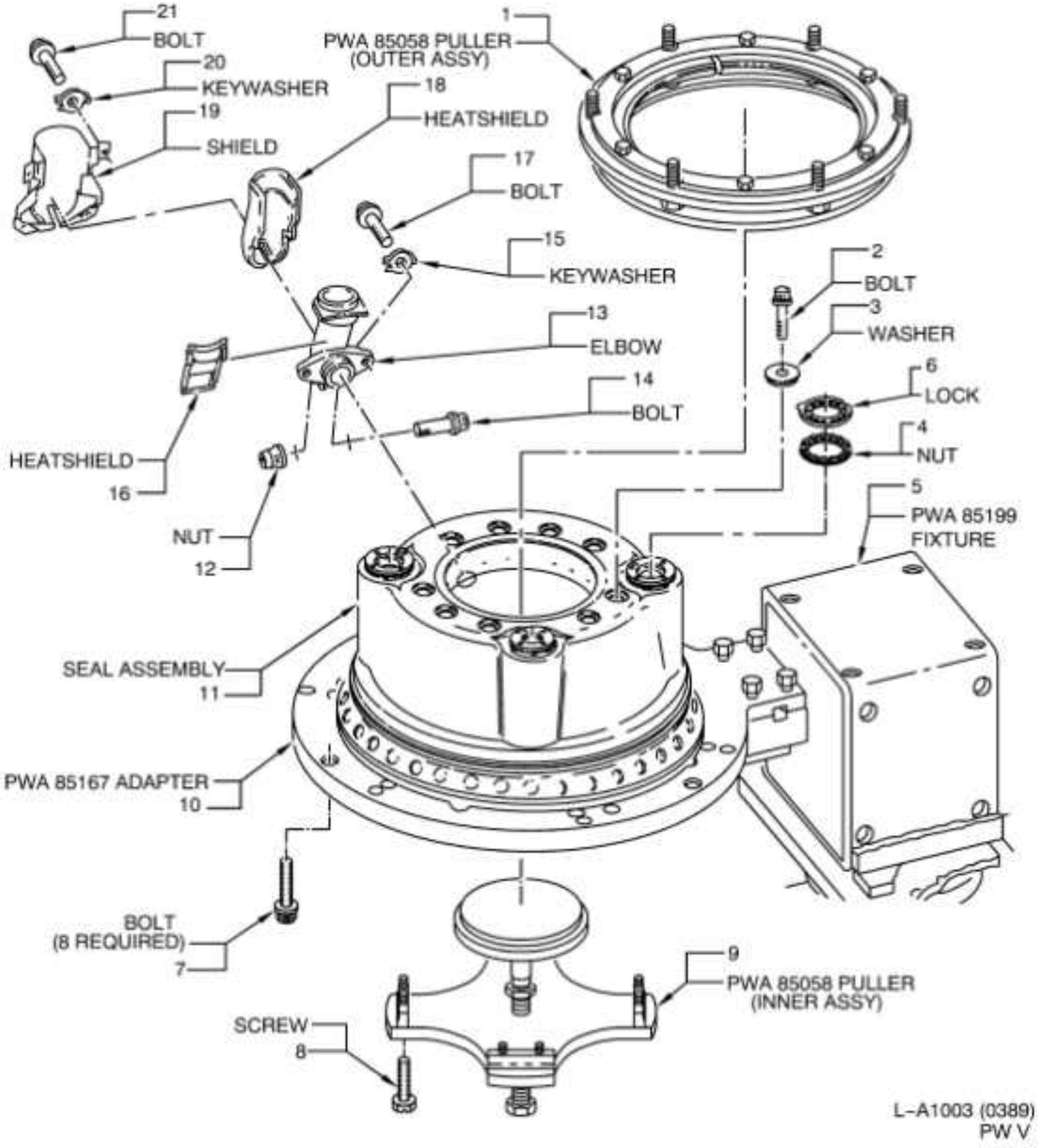
Special Tools:
PWA 45418 Wrench, Mechanical*
PWA 45419 Multiplier, Pneumatic*
PWA 80071 Multiplier, Torque*
PWA 80187 Wrench, Mechanical*
PWA 80651 Multiplier, Pneumatic*
PWA 85048 Base
PWA 85050 Drift
PWA 85053 Wrench, Torque*
PWA 85054 Adapter, Wrench*
PWA 85058 Puller
PWA 85059 Eye
PWA 85167 Adapter
PWA 85199 Fixture
PWA 85375 Plate, Anchor*
PWA 85541 Wrench
PWA 85542 Wrench
PWA 86546 Adapter (Optional To PWA 85199)
PWA 88100 Plate, Anchor*

*Refer to Table 501 for tool options. Only Table 501 shows the correct combination of tools for removal of the No. 3 bearing (outer race) retaining nut.

NOTE: The PWA 86546 Adapter is an optional tool that will permit PWA 85167 Adapter to be mounted to an approved bench positioner when the electric motorized PWA 85199 Fixture is not available.

C. Procedure

Subtask 72-41-00-030-071:
   (1) Disassemble No. 3 bearing seal assembly and front cooling duct assembly. See Figure 501.

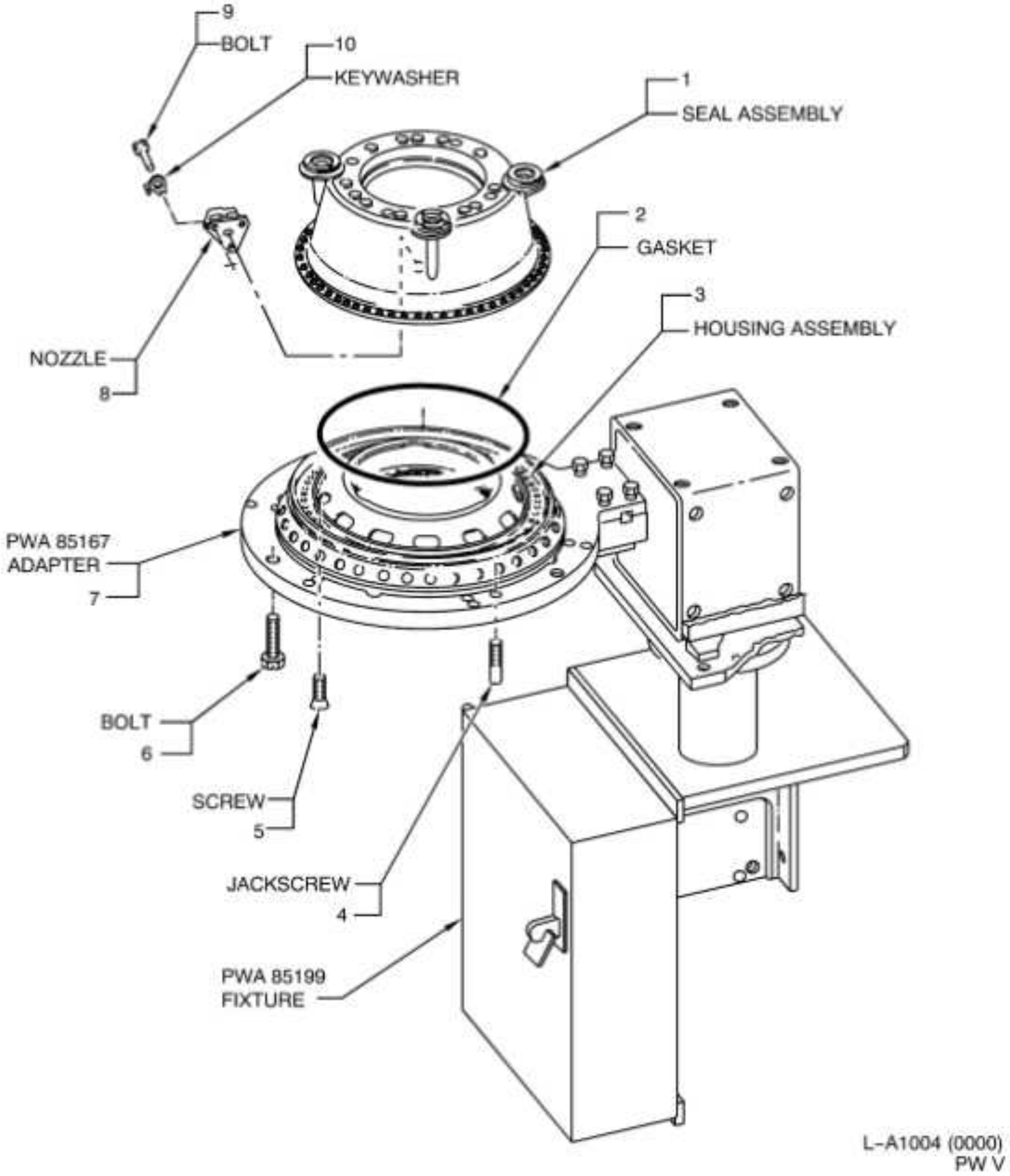

21
BOLT
20
KEYWASHER
19
SHIELD
1
PWA 85058 PULLER
(OUTER ASSY)
18
HEATSHIELD
17
BOLT
15
KEYWASHER
2
BOLT
3
WASHER
13
ELBOW
6
LOCK
14
BOLT
4
NUT
HEATSHIELD
16
5
PWA 85199
FIXTURE
NUT
12
SEAL ASSEMBLY
11
PWA 85167 ADAPTER
10
BOLT
(8 REQUIRED)
7
9
PWA 85058 PULLER
(INNER ASSY)
SCREW
8
L-A1003 (0389)
PW V

No. 3 Bearing Seal And Duct Disassembly
Figure 501
(Task 72-41-00-030-003-002)

   - (a) Remove Protective Cover (PWA 85056) over No. 3 bearing outer race and attach PWA 85059 Lifting Eye.
   - (b) Install seal assembly (501/11) in PWA 85167 Adapter (501/10) attached to PWA 85199 Fixture (501/5). Secure with eight bolts (501/7) and remove lifting eye.
   - (c) Attach PWA 85058 Puller (inner assembly) (501/9) to seal assembly. Secure with eight screws (501/8).
   - (d) Remove four bolts (501/21) and key washers (501/20) securing shield (501/19) to seal assembly. Remove shield and discard key washers.
   - (e) Remove heat shield (501/18) from elbow (501/13).
   - (f) Remove bolt (501/14) and nut (501/12) securing elbow (501/13) lug to clevis on seal assembly.
   - (g) Remove two bolts (501/17) and key washers (501/15) securing elbow (501/13) and heat shield (501/16) to seal assembly (501/11). Remove elbow and discard key washers.
   - (h) Remove locks (501/6) at three locations on seal assembly (501/11).
   - (i) With PWA 85541 Wrench remove the two large nuts (501/4) and with PWA 85542 Wrench remove the small nut (501/4) on seal assembly (501/11).
   - (j) Remove nine bolts (501/2) and washers (501/3) securing cooling duct to seal assembly (501/11).
   - (k) Attach PWA 85058 Puller (outer assembly) (501/1) split ring to duct outer flange.
   - (l) Tighten the puller, jamnuts and the center bolt of the toggle pad evenly to remove the cooling duct from the bearing housing.
   - (m) Rotate adapter (501/10) to large OD up position and remove puller (inner assembly) (501/9).

- (2) Remove seal assembly from housing.
   - (a) Remove four screws (502/5) securing seal assembly (502/1) to housing assembly (502/3). See Figure 502.
   - (b) Using four jackscrews (502/4) installed in housing (502/3) remove seal assembly (502/1) from housing and place on bench large OD up.
   - (c) Locate nozzle (502/8) inside seal assembly (502/1) and remove bolts (502/9) and key washers (502/10) securing nozzle. Remove nozzle and discard key washers.
   - (d) Remove gasket (502/2) from housing (502/3).
   - (e) Rotate adapter (502/7) and housing (502/3) to large OD up position.

DIFFUSER AND COMBUSTOR - DISASSEMBLY-04


9
BOLT
10
KEYWASHER
1
SEAL ASSEMBLY
2
GASKET
3
HOUSING ASSEMBLY
NOZZLE
8
PWA 85167
ADAPTER
7
BOLT
6
SCREW
5
JACKSCREW
4
PWA 85199
FIXTURE
L-A1004 (0000)
PW V

No. 3 Bearing Seal And Duct Disassembly
Figure 502
(Task 72-41-00-030-003-002)

DIFFUSER AND COMBUSTOR − DISASSEMBLY−04

(f) Remove bolts (502/6) securing housing (502/3) to adapter (502/7) and using Lifting Eye (PWA 85059) remove housing from adapter.

(3) Remove the No. 3 bearing (outer race) retaining nut as follows. Refer to Table 501 for the correct combinations of tools. Refer to Figure 503.

NOTE: See 72−00−41, Removal−01, for removal of the retaining nut when the diffuser and combustor is installed on the high pressure compressor.

PWA Torque Wrench Or Hand Wrench	PWA Wrench Adapter	PWA Mechanical Wrench or Torque Multiplier	PWA Pneumatic Multiplier	PWA Anchor Plate
85053	85054	80187	80651 or 45419	88100 or 85375
85053	85054	45418	45419	88100 or 85375
85053	85054	80071	80651 or 45419	88100

Matrix Of Tools Used To Remove The No. 3 Bearing Retaining Nut
Table 501

(a) Install housing (503/5) in PWA 85048 Base (503/4), large OD up, aligning four pins in base with bolt holes in housing. See Figure 503.

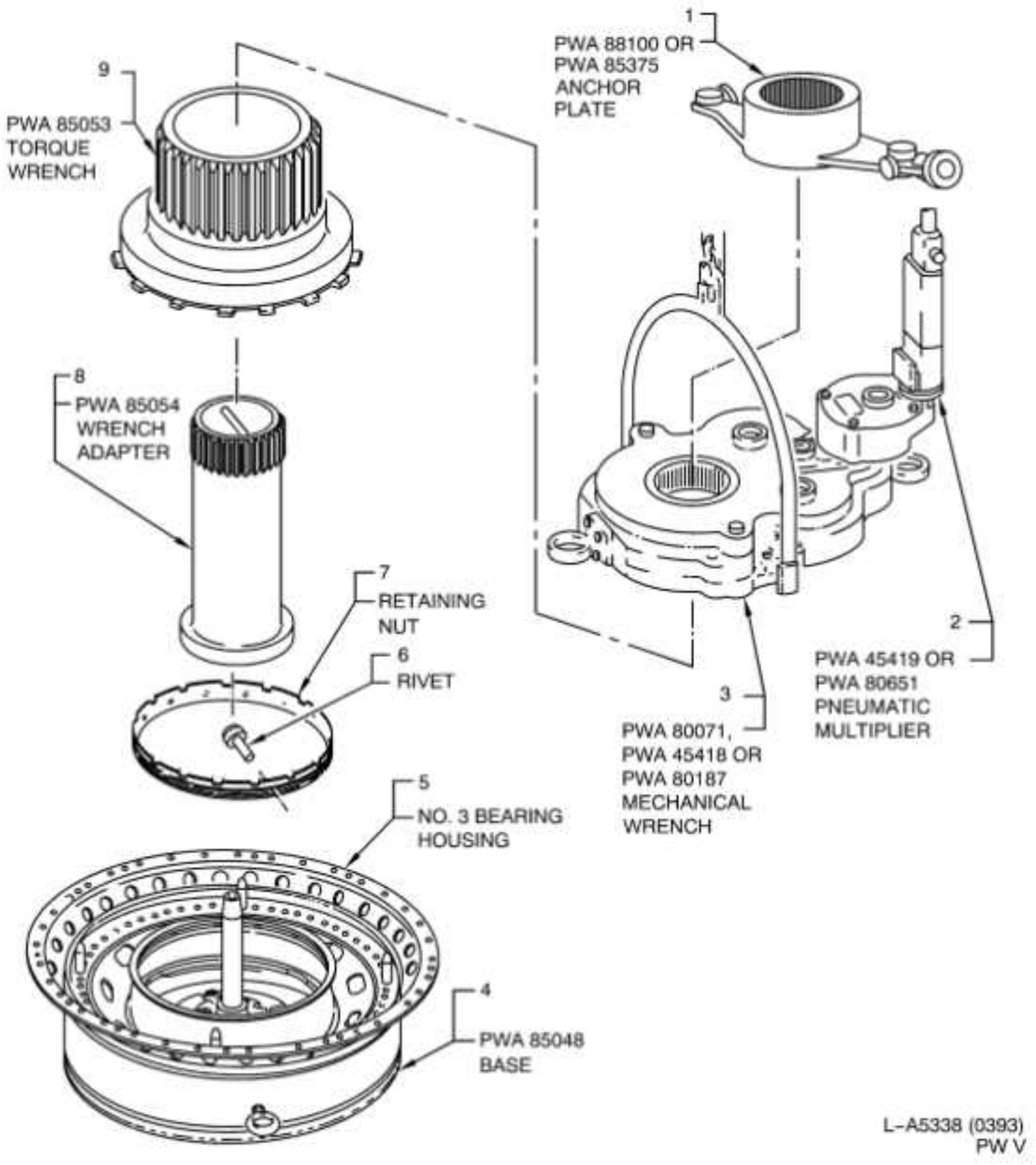
(b) Remove rivet (503/6) from retaining nut (503/7) in housing (503/5) and discard rivet.

(c) Install PWA 85054 Wrench Adapter (503/8), spline end up, over the pilot of base (503/4) and rotate to engage the four slots of the adapter (503/8) with four keys of the base (503/4).

(d) Install PWA 85053 Wrench (503/9) over wrench adapter (503/8), engaging the slots on the outer race retaining nut (503/7).

(e) Install a mechanical wrench (503/3) onto the torque wrench (503/9).

(f) Install an anchor plate (503/1) on the adapter (503/8) and engage the splines. Align and engage the two holes in the anchor plate with the two pins of the mechanical wrench.


1
PWA 88100 OR
PWA 85375
ANCHOR
PLATE
9
PWA 85053
TORQUE
WRENCH
8
PWA 85054
WRENCH
ADAPTER
7
RETAINING
NUT
6
RIVET
2
PWA 45419 OR
PWA 80651
PNEUMATIC
MULTIPLIER
3
PWA 80071,
PWA 45418 OR
PWA 80187
MECHANICAL
WRENCH
5
NO. 3 BEARING
HOUSING
4
PWA 85048
BASE
L−A5338 (0393)
PW V

No. 3 Bearing Retaining Nut Disassembly
Figure 503
(Task 72−41−00−030−003−002)

CAUTION: PWA 80651 TORQUE MULTIPLIER MUST NOT BE USED WITH PWA 45418 WRENCH OR DAMAGE TO WRENCH CAN OCCUR.

(g) With the mechanical wrench, loosen and remove retaining nut from housing.

NOTE: Wrenches can be actuated with a pneumatic multiplier.

(h) Remove wrench adapter from Base (PWA 85048).

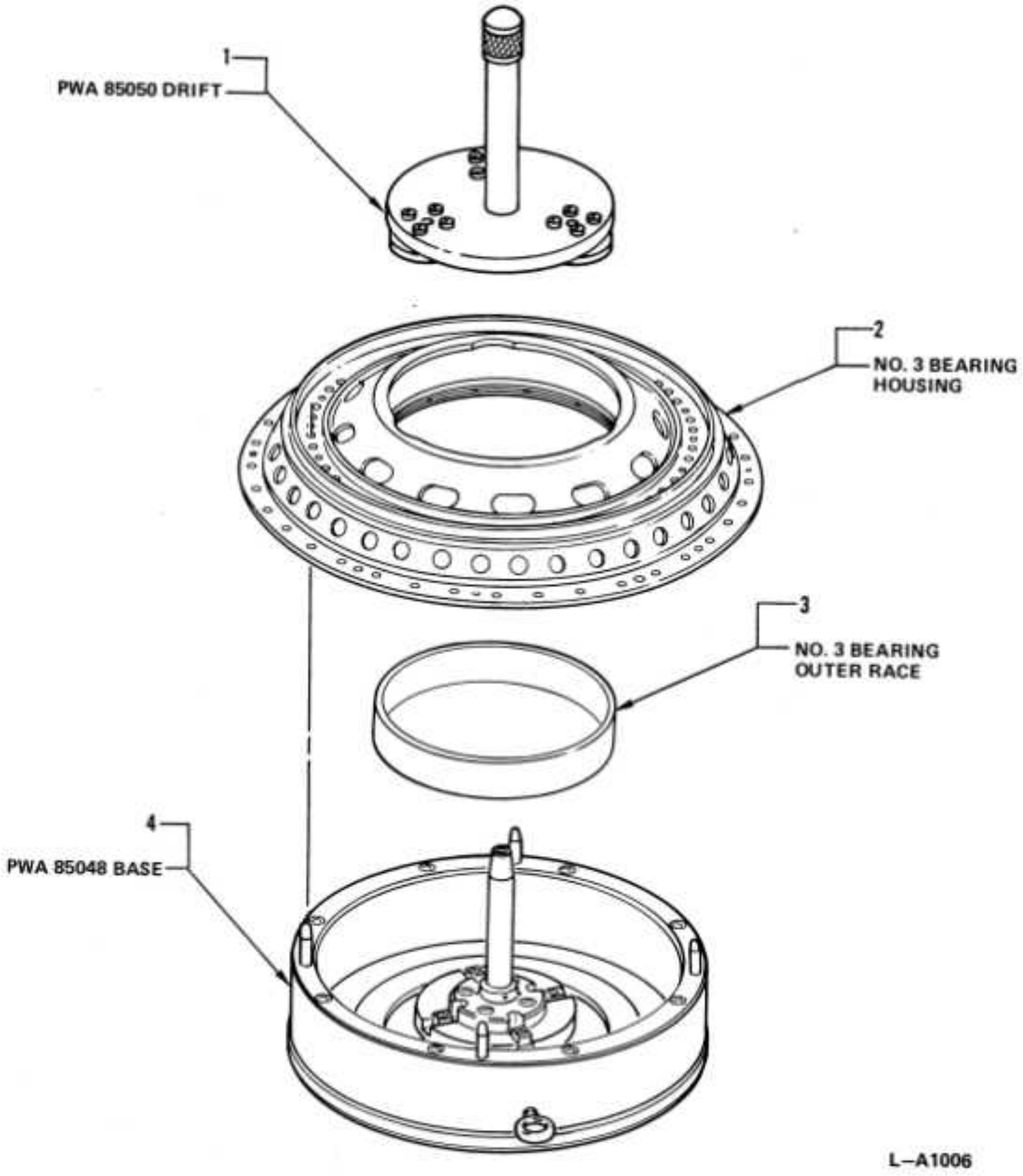
CAUTION: WHEN YOU REMOVE THE NO. 3 BEARING OUTER RACE, YOU MUST EXAMINE THE NO. 3 BEARING HOUSING FOR SIGNS OF WEAR ON THE HOUSING SHOULDER AND JOURNAL SURFACES. SEE 72−41−10, INSPECTION/ CHECK−03 AND −04 FOR SPECIFIC INSPECTION LIMITS.

(4) If applicable, remove the No. 3 bearing outer race as follows. See Figure 504.

NOTE: See 72−00−41, Removal−01, for removal of the outer race when the diffuser and combustor is installed on the high pressure compressor.

(a) Rotate housing (504/2) in Base (PWA 85048) (504/4), large OD down, aligning four pins in base with bolt holes in housing.
(b) Install PWA 85050 Drift (504/1) onto housing (504/2) with three pads locating in three scallops of the housing and the bearing outer race (504/3).
(c) Using drift and standard arbor press, drift outer race from housing.
(d) Remove housing (504/2) from base and place outer race (504/3) in protective closure with mating inner race and rollers.

DIFFUSER AND COMBUSTOR − DISASSEMBLY−04


1
PWA 85050 DRIFT
2
NO. 3 BEARING HOUSING
3
NO. 3 BEARING OUTER RACE
4
PWA 85048 BASE
L−A1006

No. 3 Bearing Outer Race Disassembly
Figure 504
(Task 72−41−00−030−003−002)

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DIFFUSER AND COMBUSTOR - INSPECTION/CHECK-01

Task 72-41-00-990-004:

1. General Inspection Requirements - Diffuser And Combustor

A. Organization Of Individual Part Or Subassembly Inspection Data

(1) Specific inspection functions for all significant parts/subassemblies are provided in individual Inspection/Check sections. Application of each inspection function is shown in Inspection/Check-00 for part/subassembly. Section designations and function descriptions are as follows.

(2) Inspection/Check-00 section contains, where applicable:

(a) Part number(s) for which the inspection data is applicable.

(b) Service Bulletin numbers applicable to part number(s).

(c) Inspection/Check numbers, data categories and applicability data.

(3) Inspection/Check-01, Preinspection Preparation, contains, where applicable:

(a) General inspection comments, notes, CAUTIONS, etc., which supplement data contained in this section.

(b) Identification of mechanical disassembly required prior to inspection.

(c) Identification of any surface treatment or coating removal, or other actions required prior to inspection.

(d) Identification of part/subassembly cleaning required prior to inspection.

(4) Inspection/Check-02, Nondestructive Inspection, contains the following nondestructive inspection methods, part/subassembly special attention areas and damage limits (as applicable):

(a) Fluorescent Penetrant Method

(b) Eddy Current Method

(c) Magnetic Particle Method

(d) X−ray Method

(e) Ultrasonic Method

(f) Hardness Check

(g) Other − As specified.

(5) Inspection/Check−03, Visual Inspection contains, where applicable:

(a) Visual inspection requirements which can be accomplished with or without magnification or special lighting (as specified).

NOTE: Use of inspection tools may be required as a supplement to visual inspection process.

(b) Allowable blending for visual damage, which may be accomplished within the inspection area.

NOTE: Blending requirement will also be shown in applicable repairs.

(6) Inspection/Check−04, Dimensional Inspection, contains, where applicable:

(a) Dimensional inspection requirements other than visual inspection. The requirements will include applicable fits and clearances, and other dimensional inspections necessary to ensure the part integrity and proper functioning.

(7) Inspection/Check−05, Functional Check Inspection contains, where applicable:

(a) Procedures, limits, and equipment used with any required functional checks (oil flow, air flow, leak, etc.).

(8) Inspection/Check−06, Inspection Postrequisites contains, references to procedures required to return part/subassembly to serviceable condition. References include the following, as required.

(a) Reassembly

(b) Protective coatings, sealants and/or lubricant reapplication

B. Thorough and intelligent part/subassembly inspection is of major importance in achieving efficient engine operation and satisfactory service life. Inspection personnel should be thoroughly familiar with inspection procedures, inspection tooling, limits associated with normal and, where applicable, unusual operating conditions, limits associated with repairs, and with inspection procedures published in Standard Practices Manual.

C. During preliminary inspection of part/subassembly, comparison with mating or adjacent parts may provide indication of source of wear or damage. This procedure may indicate requirement for additional disassembly and inspection.

D. During inspection, records should be kept of deviations beyond serviceable limits to determine: (a) if part/subassembly will be repaired or replaced, and (b) if part is reparable, which repairs are required. Suitable documentation should accompany part/subassembly with results of this determination.

E. Inspection of individual part/subassembly dimensions which are also in Fits and Clearances will include Fits and Clearance Reference Numbers and will show new part/subassembly dimension unless specifically stated otherwise. Inspection Frequency Requirements (IFR) codes (for IFR Code A parts only) are included with Reference Number data. If acceptable dimensional deviations or results of repair affect Fits and Clearances, suitable documentation should accompany part/subassembly to ensure check of fit or clearance at final assembly.

NOTE: Parts/subassemblies which deviate dimensionally from new part/subassembly values may be acceptable provided required fit or clearance is achieved at final assembly.

F. Dimensional inspection requirements will be accompanied by part/subassembly constraint data if such constraint requirements are required during part/subassembly manufacture. Adherence to constraint requirements when inspecting service operated parts/subassemblies should be dictated by experience. It is recommended that parts/subassemblies which do not meet dimensional inspection requirements in free state be constrained and re−measured prior to initiation of any repair or re−use activity.

G. Dimensional inspections of one detail of a subassembly, prior to removal from subassembly, may produce incorrect data due to constraint forces from mating details. If questionable data is obtained, subassembly should be disassembled and inspections repeated.

H. Dimensional inspection limits in inspection text provide continued use (as is) and, if applicable, repair limits. Parts/subassemblies which exceed both limits and nonreparable parts/subassemblies which exceed (as is) limits are unserviceable.

I. Inspections required to verify integrity of repair are contained within repair procedure. Unless otherwise stated, repaired part is expected to meet all inspection requirements contained in inspection text for part/subassembly.

J. Parts/subassemblies which do not require repairs except for those provided in Standard Practices Manual are identified by Chapter/Section/Subject Number 72−41−99 in cleaning table (Cleaning−01) and nondestructive inspection table (Inspection/Check−02). Determination of serviceability for those parts listed in 72−41−99 is limited to cleaning, non−destructive inspection, and the following:

(1) Visually inspect parts/subassemblies for surface defects, deformations, cuts, improper threads or wrenching surfaces, incomplete or missing protective coatings or other damage which will prevent proper functioning and make part/subassembly unserviceable. Unserviceable parts/subassemblies should not be reinstalled. Repair unserviceable parts/subassemblies per Standard Practices Manual, as applicable.

(2) Parts/subassemblies with crack indications to any length or depth detected by listed nondestructive inspection are unserviceable, and should not be reinstalled.

K. When new part/subassembly is to be installed and it is important that it be identified as to engine number or position in engine, mark it by appropriate method described in Marking of Parts, 70−11, Standard Practices Manual.

L. In order to eliminate confusion and to maintain consistent terminology, various physical conditions which might be encountered during inspection of parts/subassemblies and explanation of unusual causes of such conditions are defined in Physical Inspection, 70−31, Standard Practices Manual.

M. If inspection reveals it necessary to replace fitted spacer, tag spacer to indicate that replacement must be made with spacer of correct classification at assembly.

N. If text refers to superficial or shallow imperfection, following definitions apply:

   (1) A superficial imperfection is defined as a nick, dent, scratch, toolmark, etc., which disrupts the surface but does not appear to penetrate surface roughness texture.

   (2) A shallow imperfection appears to penetrate surface finish texture, but does not have a dark bottom and would not cause a 0.007 inch (.178 mm) radius stylus to hesitate if passed over it.

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Task 72-41-00-990-001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508	0.512		
			(12.903)	(13.005)		
		Support	0.517	0.527	0.005	0.019
			(13.131)	(13.385)	(0.126)	(0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (-) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (-) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508	0.512		
			(12.903)	(13.005)		
		Support	0.517	0.527	0.005	0.020*
			(13.131)	(13.385)	(0.126)	(0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
		FOR THESE MODELS: 4152, 4156A, 4158				
270	B	Diffuser Air Sealing Ring Assembly (72-41-05) Diffuser Case Assembly (72-41-01) (See Figure 801, Sheet 2)				
		Ring/Seal	18.853 (478.867)	18.857 (478.967)		
		Case	18.847 (478.714)	18.853 (478.866)	.010T (0.25T)	.003* (0.076)*
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
270	B	HPC (Rear) Exit Brush Seal Assembly (72-41-41) Diffuser Case Assembly (72-41-01) (See Figure 801, Sheet 3)				
		Seal	18.853 (478.867)	18.857 (478.967)		
		Case	18.847 (478.714)	18.853 (478.866)	.010T (0.25T)	.003* (0.076)*

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
		FOR THESE MODELS: 4152, 4156A, 4158				
271	B	Stage 15 HPC Airsealing Ring Assembly (72-41-03) Diffuser Case Assembly (72-41-01) (See Figure 801, Sheet 2)				
		Ring	21.961 (557.809)	21.967 (557.962)		
		Case	21.959 (557.759)	21.961 (557.809)	.008T (0.203T)	.002* (0.051)*
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
271	B	Requirement Deleted				
272	B	No. 3 Bearing Housing (72-41-10) Diffuser Case Assembly (72-41-01) (See Figure 801, Sheet 4)				
		Housing	19.743 (501.473)	19.747 (501.573)		
		Case	19.738 (501.346)	19.742 (501.446)	.009T (0.229T)	.001* (0.025)*
		FOR THESE MODELS: 4152, 4156A, 4158				
273	B	Compressor Exit Stator Assembly (72-41-02) Diffuser Case Assembly (72-41-01) (See Figure 801, Sheet 2)				
		Stator	27.542 (699.567)	27.546 (699.668)		
		Case	27.538 (699.466)	27.542 (699.566)	.008T (0.203T)	.002* (0.051)*
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
273	B	Compressor Exit Stator Assembly (72-41-02) Diffuser Case Assembly (72-41-01) (See Figure 801, Sheet 3)				
		Stator	27.542 (699.567)	27.546 (699.668)		
		Case	27.538 (699.466)	27.542 (699.566)	.008T (0.203T)	.002* (0.051)*

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
		FOR THESE MODELS: 4152, 4156A, 4158				
274	B	No. 3 Bearing Housing (72-41-10) No. 3 Bearing Front (Carbon) Seal Assembly (72-41-07) (See Figure 801, Sheet 4)				
		Housing	14.968 (380.188)	14.972 (380.288)		
		Seal Assembly	14.966 (380.137)	14.968 (380.187)	.006T (0.152T)	.000 (0.000)
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
274	B	No. 3 Bearing Housing (72-41-10) No. 3 Bearing Front (Carbon) Seal Assembly (72-41-07) (See Figure 801, Sheet 5)				
		Housing	14.968 (380.188)	14.972 (380.288)		
		Seal Assembly	14.966 (380.137)	14.968 (380.187)	.006T (0.152T)	.000 (0.000)
		FOR THESE MODELS: 4152, 4156A, 4158				
275	A	No. 3 Bearing Front Cooling Duct Assembly (72-41-06) No. 3 Bearing Front (Carbon) Seal Assembly (72-41-07) (See Figure 801, Sheet 2)				
		Duct	8.342 (211.887)	8.344 (211.937)		
		Seal Assembly	8.338 (211.786)	8.342 (211.886)	.006T (0.152T)	.000 (0.000)
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
275	A	No. 3 Bearing Front Cooling Duct Assembly (72-41-06) No. 3 Bearing Front (Carbon) Seal Assembly (72-41-07) (See Figure 801, Sheet 3)				
		Duct	8.342 (211.887)	8.344 (211.937)		
		Seal Assembly	8.338 (211.786)	8.342 (211.886)	.006T (0.152T)	.000 (0.000)
		FOR THESE MODELS: 4152, 4156A, 4158				
276	A	No. 3 Bearing Front Cooling Duct Assembly (72-41-06) No. 3 Bearing Housing (72-41-10) (See Figure 801, Sheet 4)				
		Duct	17.449 (443.205)	17.453 (443.306)		
		Housing	17.443 (443.053)	17.447 (443.153)	.010T (0.254T)	.002T (0.051T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
276	A	No. 3 Bearing Front Cooling Duct Assembly (72-41-06) No. 3 Bearing Housing (72-41-10) (See Figure 801, Sheet 5)				
		Duct	17.449 (443.205)	17.453 (443.306)		
		Housing	17.443 (443.053)	17.447 (443.153)	.010T (0.254T)	.002T (0.051T)
		FOR THESE MODELS: 4152, 4156A, 4158				
277	A	Gap, No. 3 Bearing (Front) Seal Ring (72-41-07) (See Figure 801, Sheet 2)				
		Gap			.045 (1.14)	.055 (1.40)
		Ring Installed In Ring Gage 9.090 (230.886) Diameter (Ring Gage)				
		Gap			.040 (1.02)	.060 (1.52)
		Ring Installed In No. 3 Bearing (Front) Face Seal Assembly 9.0885 (230.848) 9.0915 (230.924) Diameter [(ID, (Front) Face Seal Assembly)]				
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
277	A	Gap, No. 3 Bearing (Front) Seal Ring (72-41-07) (See Figure 801, Sheet 3)				
		Gap			.045 (1.14)	.055 (1.40)
		Ring Installed In Ring Gage 9.090 (230.886) Diameter (Ring Gage)				
		Gap			.040 (1.02)	.060 (1.52)
		Ring Installed In No. 3 Bearing (Front) Face Seal Assembly 9.0885 (230.848) 9.0915 (230.924) Diameter [(ID, (Front) Face Seal Assembly)]				

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
		FOR THESE MODELS: 4152, 4156A, 4158				
278	A	Side Clearance, No. 3 Bearing Seal Ring (72−41−07) No. 3 Bearing Front (Carbon) Seal Assembly (72−41−07) (See Figure 801, Sheet 2)				
		Ring	.119 (3.023)	.122 (3.098)		
		Holder	.124 (3.150)	.128 (3.251)	.002 (0.051)	.009 (0.229)
		FOR THESE MODELS: 4152−3, 4156A−3, 4158−3				
278	A	Side Clearance, No. 3 Bearing Seal Ring (72−41−07) No. 3 Bearing Front (Carbon) Seal Assembly (72−41−07) (See Figure 801, Sheet 3)				
		Ring	.119 (3.023)	.122 (3.098)		
		Holder	.124 (3.150)	.128 (3.251)	.002 (0.051)	.009 (0.229)
		FOR THESE MODELS: 4152, 4156A, 4158				
279	B	Stage 15 HPC Airsealing Ring Nozzle (72−41−04) Stage 15 HPC Airsealing Ring Assembly (72−41−03) (See Figure 801, Sheet 2)				
		Nozzle	.549 (13.945)	.551 (13.995)		
		Ring (PN 50J301, Prior To Change Letter B)	.552 (14.021)	.554 (14.071)	.001 (0.03)	.039* (0.99)*
		Ring (PN 50J301, With Change Letter B)	.578 (14.68)	.588 (14.94)	.027 (0.69)	.039* (0.99)*

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
279	B	Stage 15 HPC Airsealing Ring Nozzle (72-41-04) HPC (Exit) Brush Seal Support Assembly (72-41-39) (See Figure 801, Sheet 3)				
		Nozzle	.549 (13.945)	.551 (13.995)		
		Seal	.578 (14.68)	.588 (14.94)	.027 (0.69)	.039* (0.99)*
		FOR THESE MODELS: 4152, 4156A, 4158				
280	B	Stage 15 HPC Airsealing Ring Nozzle (72-41-04) Diffuser Case Assembly (72-41-01) (See Figure 801, Sheet 2)				
		Nozzle	.542 (13.767)	.544 (13.817)		
		Case	.546 (13.869)	.548 (13.919)	.002 (0.051)	.008* (0.203)*
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
280	B	Stage 15 HPC Airsealing Ring Nozzle (72-41-04) Diffuser Case Assembly (72-41-01) (See Figure 801, Sheet 3)				
		Nozzle	.542 (13.767)	.544 (13.817)		
		Case	.552 (14.021)	.556 (14.122)	.008 (0.204)	.014 (0.355)
		FOR THESE MODELS: 4152, 4156A, 4158				
281	B	Doweled End Combustion Chamber Retaining Bolt (72-41-12) Outer Combustion Chamber Bushing (72-41-11) (See Figure 801, Sheet 4)				
		Bolt	.320 (8.128)	.322 (8.178)		
		Bushing	.329 (8.357)	.331 (8.407)	.007 (0.178)	.011 (0.279)
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
281	B	Requirement Deleted				

DIFFUSER AND COMBUSTOR − INSPECTION/CHECK−04

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
282	B	Igniter Plug (CMM) Outer Combustion Chamber Assembly (72−41−11) (See Figure 802)				
		Plug	.556 (14.122)	.562 (14.275)		
		Chamber	.566 (14.38)	.576 (14.63)	.004 (0.10)	.020 (0.51)
283	B	Fuel Nozzle And Support Assembly (CMM) Outer Combustion Chamber Assembly, Nozzle Stator (72−41−11) (See Figure 804)				
		Support	1.499 (38.075)	1.501 (38.125)		
		Chamber (Nozzle Stator)	1.506 (38.253)	1.510 (38.354)	.005 (0.127)	.011 (0.279)
284	A	Gap, No. 3 Bearing (Compartment) Cooling Tube − Ring (72−41−36) (See Figure 803, Sheet 3)				
		Gap			.005 (0.13)	.015 (0.38)
		Seal Ring Installed In Ring Gage 1.1875 (30.162) Diameter (Ring Gage)				
		Gap			.001T (0.03T)	.021 (0.53)
		Seal Ring Installed In No. 3 Bearing Rear Transfer Tube 1.1855 (30.112) 1.1895 (30.213) Diameter (ID, No. 3 Bearing Rear Transfer Tube)				
285	A	Side Clearance, No. 3 Bearing (Compartment) Cooling Tube − Ring (72−41−36) No. 3 Bearing (Compartment) Cooling Tube Ring Groove (72−41−27) (See Figure 803, Sheet 3)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.082 (2.082)	.002 (0.051)	.005 (0.127)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
286	A	Gap, No. 3 Bearing (Compartment) Cooling Tube - Ring (72-41-36) (See Figure 803, Sheet 3)				
		Gap			.005 (0.13)	.015 (0.38)
		Seal Ring Installed In Ring Gage 1.1875 (30.162) Diameter (Ring Gage)				
		Gap			.001T (0.03T)	.021 (0.53)
		Seal Ring Installed In No. 3 Bearing Front Transfer Tube 1.1855 (30.112) 1.1895 (30.213) Diameter (ID, No. 3 Bearing Front Transfer Tube)				
287	A	Side Clearance, No. 3 Bearing (Compartment) Cooling Tube - Ring (72-41-36) No. 3 Bearing (Compartment) Cooling Tube Ring Groove (72-41-27) (See Figure 803, Sheet 3)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.082 (2.082)	.002 (0.051)	.005 (0.127)
288	A	Gap, Seal Ring Transfer (No. 3 Bearing Cooling Front) Tube - Ring (72-41-36) (See Figure 803, Sheet 3)				
		Gap			.005 (0.13)	.015 (0.38)
		Seal Ring Installed In Ring Gage 1.500 (38.100) Diameter (Ring Gage)				
		Gap			.001T (0.03T)	.021 (0.53)
		Seal Ring Installed In Seal Ring Transfer (No. 3 Bearing Air Sealing Ring) Tube 1.498 (38.050) 1.502 (38.150) Diameter (ID, No. 3 Bearing Air Sealing Ring)				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
289	A	Side Clearance, Seal Ring Transfer (No. 3 Bearing Cooling Front) Tube - Ring (72-41-36) Seal Ring Transfer (No. 3 Bearing Cooling Front) Tube Ring Groove (72-41-28) (See Figure 803, Sheet 3)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.082 (2.082)	.002 (0.051)	.005 (0.127)
290	A	Gap, No. 3 Bearing (Compartment) Cooling Tube Assembly - Ring (72-41-36) (See Figure 803, Sheet 2 and Figure 806)				
		Gap			.005 (0.13)	.020 (0.51)
		Seal Ring Installed In Ring Gage 2.125 (53.975) Diameter (Ring Gage)				
		Gap			.001T (0.03T)	.026 (0.66)
		Seal Ring Installed In Diffuser Case Assembly 2.123 (53.925) 2.127 (54.025) Diameter (ID, Diffuser Case)				
291	A	Side Clearance, No. 3 Bearing (Compartment) Cooling Tube Assembly - Ring (72-41-36) No. 3 Bearing (Compartment) Cooling Tube Assembly Ring Groove (72-41-27), and Diffuser Seal Air Vent Tube Assembly Ring Groove (72-41-34) (See Figure 803, Sheet 2 and Figure 806)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.082 (2.082)	.002 (0.051)	.005 (0.127)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
292	A	Gap, Seal Ring Transfer (No. 3 Bearing Cooling Rear) Tube - Ring (72-41-36) (See Figure 803, Sheet 3)				
		Gap			.005 (0.13)	.015 (0.38)
		Ring Installed In Ring Gage 1.1875 (30.162) Diameter (Ring Gage)				
		Gap			.002 (0.05)	.018 (0.46)
		Ring Installed In (No. 3 Bearing Elbow) 1.1865 (30.138) 1.1885 (30.187) Diameter (ID, No. 3 Bearing Elbow)				
293	A	Side Clearance, Seal Ring Transfer (No. 3 Bearing Cooling Rear) Tube - Ring (72-41-36) Seal Ring Transfer (No. 3 Bearing Cooling Rear) Tube - Ring Groove (72-41-29) (See Figure 803, Sheet 3)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.082 (2.082)	.002 (0.051)	.005 (0.127)
294	B	No. 3 Bearing (Compartment) Cooling Tube Assembly (72-41-27) Seal Ring Transfer (No. 3 Bearing Cooling Rear) Tube (72-41-29) (See Figure 803, Sheet 3)				
		Cooling Tube	1.1795 (29.960)	1.1835 (30.060)		
		Transfer Tube	1.1855 (30.112)	1.1895 (30.213)	.002 (0.051)	.010 (0.254)
295	B	Fuel Nozzle Support (CMM) Diffuser Case Assembly (72-41-01) (See Figure 804)				
		Support	1.818 (46.177)	1.823 (46.304)		
		Case	1.824 (46.330)	1.826 (46.380)	.001 (0.026)	.010* (0.254)*

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
296 (1)	B	Seal Ring Transfer (No. 3 Bearing Cooling Front) Tube (72-41-28) Diffuser Airsealing Ring Assembly (72-41-05)/ HPC (Rear) Exit Brush Seal Assembly (72-41-41) (See Figure 803, Sheet 3)				
		Tube (Pre SB PW4ENG 72-652)	1.492 (37.897)	1.496 (37.998)		
		Ring/Seal	1.498 (38.050)	1.502 (38.150)	.002 (0.051)	.010 (0.254)
296 (2)	B	Seal Ring Transfer (No. 3 Bearing Cooling Front) Tube (72-41-28) Diffuser Airsealing Ring Assembly (72-41-05)/ HPC (Rear) Exit Brush Seal Assembly (72-41-41) (See Figure 803, Sheet 3)				
		Tube (Post SB PW4ENG 72-652)	1.4915 (37.885)	1.4965 (38.011)		
		Ring/Seal	1.498 (38.050)	1.502 (38.150)	.0015 (0.038)	.0105 (0.267)
297 (1)	B	No. 3 Bearing (Compartment) Cooling Tube Assembly (72-41-27) Diffuser Seal Air Vent Tube Assembly (72-41-34) Diffuser Case Assembly (72-41-01) (See Figure 803, Sheet 2 And Figure 806)				
		Tube (Pre SB PW4ENG 72-652)	2.1155 (53.734)	2.1195 (53.835)		
		Case	2.123 (53.925)	2.127 (54.025)	.0035 (0.089)	.0215* (0.55)*
297 (2)	B	No. 3 Bearing (Compartment) Cooling Tube Assembly (72-41-27) Diffuser Seal Air Vent Tube Assembly (72-41-34) Diffuser Case Assembly (72-41-01) (See Figure 803, Sheet 2 And Figure 806)				
		Tube (Post SB PW4ENG 72-652)	2.1125 (53.658)	2.1205 (53.861)		

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)						
		Case	2.123 (53.925)	2.127 (54.025)	.0025 (0.064)	.0145 (0.368)
298 (1)	B	Seal Ring Transfer (No. 3 Bearing Cooling Rear) Tube (72-41-29) No. 3 Bearing Elbow Assembly (No. 3 Bearing Compartment Cooling Tube) (72-41-30) (See Figure 803, Sheet 3)				
		Tube (Pre SB PW4ENG 72-652)	1.1795 (29.960)	1.1835 (30.060)		
		Elbow	1.1865 (30.138)	1.1885 (30.187)	.003 (0.077)	.0095 (0.241)
298 (2)	B	Seal Ring Transfer (No. 3 Bearing Cooling Rear) Tube (72-41-29) No. 3 Bearing Elbow Assembly (No. 3 Bearing Compartment Cooling Tube) (72-41-30) (See Figure 803, Sheet 3)				
		Tube (Post SB PW4ENG 72-652)	1.179 (29.947)	1.184 (30.073)		
		Elbow	1.1865 (30.138)	1.1885 (30.187)	.0025 (0.064)	.0105 (0.267)
299	A	Gap, Turbine Blade Cooling Tube - Ring (72-41-36) (See Figure 805)				
		Gap			.005 (0.13)	.020 (0.51)
		Ring Installed In Ring Gage 2.125 (53.975) Diameter (Ring Gage)				
		Gap			.001T (0.03T)	.026 (0.66)
		Ring Installed In Diffuser Case Assembly 2.123 (53.925) 2.127 (54.025) Diameter (ID, Diffuser Case)				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
300	A	Side Clearance, Turbine Blade Cooling Tube − Ring (72−41−36) Turbine Blade Cooling Tube Ring Groove (72−41−31) (See Figure 805)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.082 (2.082)	.002 (0.051)	.005 (0.127)
301	A	Gap, Ring Transfer (Turbine Blade Cooling Tube − Seal Ring (72−41−36) (See Figure 805)				
		Gap			.005 (0.13)	.015 (0.38)
		Ring Installed In Ring Gage 1.1875 (30.162) Diameter (Ring Gage)				
		Gap			.001T (0.03T)	.021 (0.53)
		Ring Installed In No. 3 Bearing Compartment Cooling) Tube And Seal 1.1855 (30.112) 1.1895 (30.213) Diameter (ID, No. 3 Bearing Compartment Cooling Tube And Seal)				
302	A	Side Clearance, Seal Ring Transfer (Turbine Blade Cooling) Tube − Ring (72−41−36) Seal Ring Transfer (Turbine Blade Cooling) Tube Groove (72−41−32) (See Figure 805)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.082 (2.082)	.002 (0.051)	.005 (0.127)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
305 (1)	B	Turbine Blade Cooling Tube (72-41-31) Diffuser Case Assembly (72-41-01) (See Figure 805)				
		Tube (Pre SB PW4ENG 72-652)	2.1155 (53.734)	2.1195 (53.835)		
		Case	2.123 (53.925)	2.127 (54.025)	.0035 (0.089)	.0215* (0.55)*
305 (2)	B	Turbine Blade Cooling Tube (72-41-31) Diffuser Case Assembly (72-41-01) (See Figure 805)				
		Tube (Post SB PW4ENG 72-652)	2.108 (53.754)	2.1205 (53.86)		
		Case	2.123 (53.925)	2.127 (54.025)	.0025 (0.064)	.019 (0.483)
306 (1)	B	Seal Ring Transfer (Turbine Blade Cooling) Tube (72-41-32) Turbine Blade Cooling Tube (72-41-31) (See Figure 805)				
		Transfer Tube (Pre SB PW4ENG 72-652)	1.1795 (29.960)	1.1835 (30.060)		
		Cooling Tube	1.1855 (30.112)	1.1895 (30.213)	.002 (0.051)	.010 (0.254)
306 (2)	B	Seal Ring Transfer (Turbine Blade Cooling) Tube (72-41-32) Turbine Blade Cooling Tube (72-41-31) (See Figure 805)				
		Transfer Tube (Post SB PW4ENG 72-652)	1.179 (29.947)	1.184 (30.073)		
		Cooling Tube	1.1855 (30.112)	1.1895 (30.213)	.0015 (0.038)	.0105 (0.267)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
307 (1)	B	Seal Ring Transfer (Turbine Blade Cooling) Tube (72-41-32) Diffuser Airsealing Ring Assembly (72-41-05)/ HPC (Rear) Exit Brush Seal Assembly (72-41-41) (See Figure 805)				
		Tube (Pre SB PW4ENG 72-652)	1.1795 (29.960)	1.1835 (30.060)		
		Ring/Seal	1.1855 (30.112)	1.1895 (30.213)	.002 (0.051)	.010 (0.254)
307 (2)	B	Seal Ring Transfer (Turbine Blade Cooling) Tube (72-41-32) Diffuser Airsealing Ring Assembly (72-41-05)/ HPC (Rear) Exit Brush Seal Assembly (72-41-41) (See Figure 805)				
		Tube (Post SB PW4ENG 72-652)	1.179 (29.947)	1.184 (30.073)		
		Ring/Seal	1.1855 (30.112)	1.1895 (30.213)	.0015 (0.038)	.0105 (0.267)
308	A	Side Clearance, No. 3 Bearing Elbow Assembly (No. 3 Bearing Compartment Cooling Tube) (72-41-30) No. 3 Bearing Front Cooling Duct Assembly (72-41-06) (See Figure 803, Sheet 2)				
		Elbow	.188 (4.776)	.192 (4.876)		
		Duct	.197 (5.004)	.205 (5.207)	.005 (0.13)	.017 (0.43)
309 (1)	B	No. 3 Bearing And Airframe Oil Vent And (Turbine Cooling Air Duct Sensing Outer) Manifold Assembly (72-41-22) Diffuser Case Assembly/Sleeve (72-41-01/ 72-41-37) (See Figure 807)				
		Manifold (Pre SB PW4ENG 72-652)	.7435 (18.885)	.7475 (18.986)		
		Sleeve	.752 (19.101)	.756 (19.202)	.0045 (0.114)	.0125 (0.318)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
309 (2)	B	No. 3 Bearing And Airframe Oil Vent And (Turbine Cooling Air Duct Sensing Outer) Manifold Assembly (72-41-22) Diffuser Case Assembly/Sleeve (72-41-01/ 72-41-37) (See Figure 807)				
		Manifold (Post SB PW4ENG 72-652)	.743 (18.873)	.748 (18.999)		
		Sleeve	.752 (19.101)	.756 (19.202)	.004 (0.102)	.013 (0.330)
311 (1)	A	Gap, Airframe (Turbine Cooling Air Duct Sensing Outer) Manifold Assembly - Ring (72-41-36) (See Figure 807)				
		Gap			.005 (0.13)	.015 (0.38)
		Ring Installed In Ring Gage .750 (19.050) Diameter (Ring Gage)				
		Gap (Pre SB PW4ENG 72-652) Ring Installed In Diffuser, Case/Sleeve .752 (19.101) .756 (19.202) Diameter (ID, Diffuser Case/Sleeve)			.001 (0.03)	.033 (0.84)
311 (2)	A	Gap, Airframe (Turbine Cooling Air Duct Sensing Outer) Manifold Assembly - Ring (72-41-36) (See Figure 807)				
		Gap			.005 (0.13)	.015 (0.38)
		Ring Installed In Ring Gage .750 (19.050) Diameter (Ring Gage)				
		Gap (Post SB PW4ENG 72-652) Ring Installed In Diffuser, Case/Sleeve			.011 (0.279)	.034 (0.864)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
(CONTINUED)						
		.752 (19.101) .756 (19.202) Diameter (ID, Diffuser Case/Sleeve)				
312	A	Side Clearance, Airframe (Turbine Cooling Air Duct Sensing Outer) Manifold - Ring (72-41-36) Airframe (Turbine Cooling Air Duct Sensing Outer) Manifold Assembly Groove (72-41-22) (See Figure 807)				
		Ring	.0615 (1.563)	.0625 (1.587)		
		Groove	.0645 (1.639)	.0665 (1.689)	.002 (0.051)	.005 (0.127)
315	A	Gap, Turbine Cooling Duct Sensing (Inner Airframe) Tube - Ring (72-41-36) (See Figure 807)				
		Gap			.005 (0.13)	.015 (0.38)
		Ring Installed In Ring Gage 1.1875 (30.162) Diameter (Ring Gage)				
		Gap			.001T (0.03T)	.021 (0.53)
		Ring Installed In Diffuser Case Airsealing Ring 1.1855 (30.112) 1.1895 (30.213) Diameter (ID, Diffuser Case Airsealing Ring)				
316	A	Side Clearance, Turbine Cooling Duct Sensing (Inner Airframe) Tube - Ring (72-41-36) Turbine Cooling Duct Sensing (Inner Airframe) Tube Assembly Ring Groove (72-41-23) (See Figure 807)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.082 (2.082)	.002 (0.051)	.005 (0.127)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
317 (1)	B	Turbine Cooling Duct Sensing (Inner Airframe) Tube Assembly Nut (72-41-23) Diffuser Air Sealing Ring Assembly (72-41-05)/ HPC (Rear) Exit Brush Seal Assembly (72-41-41) (See Figure 807)				
		Nut (Pre SB PW4ENG 72-652)	1.181 (29.998)	1.185 (30.099)		
		Ring	1.1855 (30.112)	1.1895 (30.213)	.0005 (0.013)	.0085 (0.216)
317 (2)	B	Turbine Cooling Duct Sensing (Inner Airframe) Tube Assembly Nut (72-41-23) Diffuser Air Sealing Ring Assembly (72-41-05)/ HPC (Rear) Exit Brush Seal Assembly (72-41-41) (See Figure 807)				
		Nut (Post SB PW4ENG 72-652)	1.180 (29.972)	1.186 (30.124)		
		Ring	1.1855 (30.112)	1.1895 (30.213)	.0005T (0.013T)	.0095 (0.241)
318	B	Diffuser Seal Air Vent (Elbow) Tube Assembly (72-41-33) Diffuser Case Assembly (72-41-01) (See Figure 802)				
		Tube	.748 (19.000)	.752 (19.100)		
		Case	.748 (19.000)	.752 (19.100)	.004T (0.102T)	.008* (0.203)*
319 (1)	B	No. 3 Bearing (Scavenge) Tube Assembly (72-41-25) No. 3 Bearing (Breather) Tube Assembly (73-41-19) No. 3 Bearing Packing Transfer (Breather And Scavenge) Tubes (72-41-26) (See Figure 809 and Figure 810)				
		Tube (Pre SB PW4ENG 72-652)	2.5625 (65.088)	2.5665 (65.189)		
		Transfer Tube	2.573	2.577	.0065	.0145

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)						
			(65.355)	(65.455)	(0.165)	(0.368)
319 (2)	B	No. 3 Bearing (Scavenge) Tube Assembly (72-41-25) No. 3 Bearing (Breather) Tube Assembly (73-41-19) No. 3 Bearing Packing Transfer (Breather And Scavenge) Tubes (72-41-26) (See Figure 809 and Figure 810)				
		Tube (Post SB PW4ENG 72-652)	2.5595 (65.011)	2.5675 (65.214)		
		Transfer Tube	2.573 (65.355)	2.577 (65.455)	.0055 (0.140)	.0175 (0.444)
320	A	Gap, No. 3 Bearing (Breather And Scavenge) Tube Assembly - Ring (72-41-36) (See Figure 809 and Figure 810)				
		Gap			.005 (0.13)	.020 (0.51)
		Ring Installed In Ring Gage 2.575 (65.405) Diameter (Ring Gage)				
		Gap			.001T (0.03)	.026 (0.66)
		Ring Installed In Transfer Tube 2.573 (65.355) 2.577 (65.455) Diameter (ID, Transfer Tube)				
321	A	Side Clearance, No. 3 Bearing (Breather And Scavenge) Tube Assembly - Ring (72-41-36) No. 3 Bearing (Scavenge) Tube Assembly Ring Groove (72-41-25) No. 3 Bearing (Breather) Tube Assembly Ring Groove (72-41-19) (See Figure 809 and Figure 810)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.082 (2.082)	.002 (0.051)	.005 (0.127)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
322	B	No. 3 Bearing (Scavenge) Tube Assembly (72-41-25) No. 3 Bearing (Breather) Tube Assembly (72-41-19) No. 3 Bearing Front Carbon Seal Assembly (72-41-07) (See Figure 809 and Figure 810)				
		Tube	1.025 (26.035)	1.031 (26.187)		
		Seal Assembly	1.032 (26.213)	1.034 (26.263)	.001 (0.025)	.009 (0.229)
323 (1)	B	No. 3 Bearing Packing Transfer (Pressure And Scavenge Tube (72-41-26) Diffuser Air Sealing Ring Assembly (72-41-05)/ HPC (Rear) Exit Brush Seal Assembly (72-41-41) (See Figure 809 and Figure 810)				
		Tube (Pre SB PW4ENG 72-652)	2.925 (74.295)	2.929 (74.396)		
		Ring	2.9355 (74.562)	2.9395 (74.663)	.0065 (0.165)	.0145 (0.368)
323 (2)	B	No. 3 Bearing Packing Transfer (Pressure And Scavenge Tube (72-41-26) Diffuser Air Sealing Ring Assembly (72-41-05)/ HPC (Rear) Exit Brush Seal Assembly (72-41-41) (See Figure 809 and Figure 810)				
		Tube (Post SB PW4ENG 72-652)	2.924 (74.270)	2.930 (74.422)		
		Ring	2.9355 (74.562)	2.9395 (74.663)	.0055 (0.140)	.0155 (0.394)
324	A	Gap, No. 3 Bearing Packing Transfer (Breather And Scavenge) Tube - Ring (72-41-36) (See Figure 809 and Figure 810)				
		Gap			.005 (0.13)	.020 (0.51)
		Ring Installed In Ring Gage 2.9375 (74.612) Diameter				

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
(CONTINUED)		(Ring Gage)				
		Gap			.001T (0.03T)	.026 (0.66)
		Ring Installed In Diffuser Airsealing Ring Assembly 2.9355 (74.562) 2.9395 (74.663) Diameter (ID, Airsealing Ring)				
325	A	Side Clearance, No. 3 Bearing Packing Transfer (Breather And Scavenge) Tube − Ring (72−41−36) No. 3 Bearing Packing Transfer (Breather And Scavenge) Tube Ring Groove (72−41−26) (See Figure 809 and Figure 810)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.082 (2.082)	.002 (0.051)	.005 (0.127)
326	A	Gap, No. 3 Bearing (Breather And Scavenge) Tube Assembly − Ring (72−41−36) (See Figure 809 and Figure 810)				
		Gap			.005 (0.13)	.020 (0.51)
		Ring Installed In Ring Gage 2.125 (53.975) Diameter (Ring Gage)				
		Gap			.001T (0.03T)	.026 (0.66)
		Ring Installed In Diffuser Case Assembly 2.123 (53.925) 2.127 (54.025 Diameter (ID, Diffuser Case)				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
327 (1)	B	No. 3 Bearing (Scavenge) Tube Assembly (72-41-25) No. 3 Bearing (Breather) Tube Assembly (72-41-19) Diffuser Case Assembly (72-41-01) (See Figure 809 and Figure 810)				
		Tube (Pre SB PW4ENG 72-652)	2.1155 (53.734)	2.1195 (53.835)		
		Case	2.123 (53.925)	2.127 (54.025)	.0035 (0.09)	.0245* (0.62)*
327 (2)	B	No. 3 Bearing (Scavenge) Tube Assembly (72-41-25) No. 3 Bearing (Breather) Tube Assembly (72-41-19) Diffuser Case Assembly (72-41-01) (See Figure 809 and Figure 810)				
		Tube (Post SB PW4ENG 72-652)	2.1125 (53.658)	2.1205 (53.861)		
		Case	2.123 (53.925)	2.127 (54.025)	.0025 (0.064)	.0145 (0.368)
328	A	Side Clearance, No. 3 Bearing (Breather And Scavenge) Tube Assembly - Ring (72-41-36) No. 3 Bearing (Scavenge) Tube Assembly Ring Groove (72-41-25) No. 3 Bearing (Breather) Tube Assembly Ring Groove (72-41-19) (See Figure 809 and Figure 810)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.082 (2.082)	.002 (0.051)	.005 (0.127)
329 (1)	A	Gap, No. 3 Bearing And Airframe (Oil Vent And Turbine Cooling Air Duct Sensing Outer) Manifold Assembly - Ring (72-41-36) (See Figure 811, Sheet 3)				
		Gap			.005 (0.13)	.015 (0.38)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
(CONTINUED)		Ring Installed In Ring Gage .750 (19.050) Diameter (Ring Gage)				
		Gap (Pre SB PW4ENG 72-652) Ring Installed In Diffuser Case Assembly .752 (19.101) .756 (19.202) Diameter (ID, Diffuser Case)			.011 (0.279)	.033 (0.838)
329 (2)	A	Gap, No. 3 Bearing And Airframe (Oil Vent And Turbine Cooling Air Duct Sensing Outer) Manifold Assembly - Ring (72-41-36)				
		(See Figure 811, Sheet 3) Gap			.005 (0.13)	.015 (0.38)
		Ring Installed In Ring Gage .750 (19.050) Diameter (Ring Gage)				
		Gap (Post SB PW4ENG 72-652) Ring Installed In Diffuser Case Assembly .752 (19.101) .756 (19.202) Diameter (ID, Diffuser Case)			.011 (0.279)	.034 (0.864)
330	A	Side Clearance, No. 3 Bearing And Airframe (Oil Vent And Turbine Cooling Air Duct Sensing Outer) Manifold Assembly - Ring (72-41-36)				
		No. 3 Bearing And Airframe (Oil Vent And Turbine Cooling Air Duct Sensing Outer) Manifold Assembly Ring Groove (72-41-22)				
		(See Figure 811, Sheet 3)				
		Ring	.0615 (1.563)	.0625 (1.587)		
		Groove	.0645 (1.639)	.0665 (1.689)	.002 (0.051)	.005 (0.127)

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Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
333	A	Gap, No. 3 Bearing Oil Vent (Inner) Tube Assembly Ring (72-41-36) (See Figure 811, Sheet 2)				
		Gap			.005 (0.13)	.015 (0.38)
		Ring Installed In Ring Gage 1.1875 (30.162) Diameter (Ring Gage)				
		Gap			.001T (0.03T)	.021 (0.53)
		Ring Installed In Diffuser Air Sealing Ring 1.1855 (30.112) 1.1895 (30.213) Diameter (ID, Ring)				
334	A	Side Clearance, No. 3 Bearing Oil Vent (Inner) Tube Assembly - Ring (72-41-36) No. 3 Bearing Oil Vent (Inner) Tube Assembly Ring Groove (72-41-24) (See Figure 811, Sheet 2)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.082 (2.082)	.002 (0.051)	.005 (0.127)
335	B	No. 3 Bearing And Airframe (Oil Vent And Turbine Cooling Air Duct Sensing Outer) Manifold Assembly (72-41-22) Diffuser Case Assembly Sleeve (72-41-37) (See Figure 811, Sheet 3)				
		Manifold	.7435 (18.885)	.7475 (18.986)		
		Sleeve	.752 (19.101)	.756 (19.202)	.0045 (0.114)	.0125 (0.318)

			New Part Reference Dimensions		Limits	
Ref. No.	I F R	Description	Min	Max	Min	Max
337 (1)	B	No. 3 Bearing Oil Vent (Inner) Tube Assembly - Nut (72-41-24) Diffuser Airsealing Ring Assembly (72-41-05)/ HPC (Rear) Exit Brush Seal Assembly (72-41-41) (See Figure 811, Sheet 2)				
		Nut (Pre SB PW4ENG 72-652)	1.181 (29.998)	1.185 (30.099)		
		Ring	1.1855 (30.112)	1.1895 (30.213)	.0005 (0.013)	.0085 (0.216)
337 (2)	B	No. 3 Bearing Oil Vent (Inner) Tube Assembly - Nut (72-41-24) Diffuser Airsealing Ring Assembly (72-41-05)/ HPC (Rear) Exit Brush Seal Assembly (72-41-41) (See Figure 811, Sheet 2)				
		Nut (Post SB PW4ENG 72-652)	1.180 (29.972)	1.186 (30.124)		
		Ring	1.1855 (30.112)	1.1895 (30.213)	.0005T (0.013T)	.0095 (0.241)
338	A	Gap, No. 3 Bearing (Oil) Pressure Tube Assembly Ring (72-41-36) (See Figure 812, Sheet 2)				
		Gap			.005 (0.13)	.015 (0.38)
		Ring Installed In Ring Gage .750 (19.050) Diameter (Ring Gage)				
		Gap			.011 (0.28)	.034 (0.86)
		Ring Installed In Sealing Sleeve .752 (19.101) .756 (19.202) Diameter (ID, Sealing Sleeve)				

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
339	A	Side Clearance, No. 3 Bearing (Oil) Pressure Tube Assembly - Ring (72-41-36) No. 3 Bearing (Oil) Pressure Tube Assembly Ring Groove (72-41-20) (See Figure 812, Sheet 2)				
		Ring	.0615 (1.563)	.0625 (1.587)		
		Groove	.0645 (1.639)	.0665 (1.689)	.002 (0.051)	.005 (0.127)
340	B	No. 3 Bearing (Oil) Pressure Tube Assembly (72-41-20) No. 3 Bearing Front (Carbon) Seal Assembly (72-41-07) (See Figure 812, Sheet 3)				
		Tube	.650 (16.510)	.656 (16.662)		
		Seal Assembly	.657 (16.688)	.659 (16.738)	.001 (0.025)	.009 (0.229)
341 (1)	B	No. 3 Bearing (Oil) Pressure Tube Assembly (72-41-20) Packing Transfer (Oil Pressure) Tube (72-41-21) (See Figure 812, Sheet 3)				
		Tube Assembly (Pre SB PW4ENG 72-652)	2.300 (58.420)	2.304 (58.521)		
		Transfer Tube	2.3105 (58.687)	2.3145 (58.788)	.0065 (0.165)	.0145 (0.368)
341 (2)	B	No. 3 Bearing (Oil) Pressure Tube Assembly (72-41-20) Packing Transfer (Oil Pressure) Tube (72-41-21) (See Figure 812, Sheet 3)				
		Tube Assembly (Post SB PW4ENG 72-652)	2.297 (58.344)	2.305 (58.547)		
		Transfer Tube	2.3105 (58.687)	2.3145 (58.788)	.0055 (0.140)	.0175 (0.444)

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Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
342 (1)	B	Packing Transfer (Oil Pressure) Tube (72-41-21) Diffuser Case Air Seal Ring Assembly (72-41-05) (See Figure 812, Sheet 3)				
		Tube (Pre SB PW4ENG 72-652)	2.675 (67.945)	2.679 (68.046)		
		Ring	2.6855 (68.212)	2.6895 (68.313)	.0065 (0.165)	.0145 (0.368)
342 (2)	B	Packing Transfer (Oil Pressure) Tube (72-41-21) Diffuser Case Air Seal Ring Assembly (72-41-05) (See Figure 812, Sheet 3)				
		Tube (Post SB PW4ENG 72-652)	2.674 (67.920)	2.680 (68.072)		
		Ring	2.6855 (68.212)	2.6895 (68.313)	.0055 (0.140)	.0155 (0.394)
343 (1)	B	No. 3 Bearing (Oil) Pressure Tube Assembly (72-41-20) Diffuser Case Assembly (72-41-01) (See Figure 812, Sheet 3)				
		Tube (Pre SB PW4ENG 72-652)	.803 (20.397)	.807 (20.497)		
		Case	.8105 (20.587)	.8145 (20.688)	.0035 (0.09)	.016* (0.41)*
343 (2)	B	No. 3 Bearing (Oil) Pressure Tube Assembly (72-41-20) Diffuser Case Assembly (72-41-01) (See Figure 812, Sheet 3)				
		Tube (Post SB PW4ENG 72-652)	.8025 (20.384)	.8075 (20.510)		
		Case	.8105 (20.587)	.8145 (20.688)	.003 (0.076)	.012 (0.305)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
344 (1)	B	No. 3 Bearing (Oil) Pressure Tube Assembly (72-41-20) Diffuser Case Sealing Sleeve (72-41-37) (See Figure 812, Sheet 2)				
		Tube (Pre SB PW4ENG 72-652)	.7475 (18.987)	.7515 (19.088)		
		Sleeve	.752 (19.101)	.756 (19.202)	.0005 (0.013)	.0085 (0.216)
344 (2)	B	No. 3 Bearing (Oil) Pressure Tube Assembly (72-41-20) Diffuser Case Sealing Sleeve (72-41-37) (See Figure 812, Sheet 2)				
		Tube (Post SB PW4ENG 72-652)	.747 (18.974)	.752 (19.100)		
		Sleeve	.752 (19.101)	.756 (19.202)	.000 (0.000)	.009 (0.229)
345	A	Gap, No. 3 Bearing (Oil) Pressure Tube Assembly - Ring (72-41-36) (See Figure 812, Sheet 3)				
		Gap			.005 (0.13)	.020 (0.51)
		Ring Installed In Ring Gage 2.3125 (58.738) Diameter (Ring Gage)				
		Gap			.001T (0.03T)	.026 (0.66)
		Ring Installed In Packing Transfer Tube 2.3105 (58.687) 2.3145 (58.788) Diameter (ID, Packing Transfer Tube)				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
346	A	Side Clearance, No. 3 Bearing (Oil) Pressure Tube Assembly - Ring (72-41-36) No. 3 Bearing (Oil) Pressure Tube Assembly Ring Groove (72-41-20) (See Figure 812, Sheet 3)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.082 (2.082)	.002 (0.051)	.005 (0.127)
347	A	Gap, Packing Transfer (Oil Pressure) Tube - Ring (72-41-36) (See Figure 812, Sheet 3)				
		Gap			.005 (0.13)	.020 (0.51)
		Ring Installed In Ring Gage 2.6875 (68.262) Diameter (Ring Gage)				
		Gap			.001T (0.03T)	.026 (0.66)
		Ring Installed In Diffuser Case Airsealing Ring 2.6855 (68.212) 2.6895 (68.313) Diameter (ID, Case Ring)				
348	A	Side Clearance, Packing Transfer (Oil Pressure) Tube - Ring (72-41-36) Packing Transfer (Oil Pressure) Tube Ring Groove (72-41-21) (See Figure 812, Sheet 3)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.082 (2.082)	.002 (0.051)	.005 (0.127)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
349	A	Gap, No. 3 Bearing (Oil) Pressure Tube Assembly - Ring (72-41-36) (See Figure 812, Sheet 3)				
		Gap			.005 (0.13)	.015 (0.38)
		Ring Installed In Ring Gage .8125 (20.638) Diameter (Ring Gage)				
		Gap			.001T (0.03T)	.021 (0.53)
		Ring Installed In Diffuser Case .8105 (20.587) .8145 (20.688) Diameter (ID, Diffuser Case)				
350	A	Side Clearance, No. 3 Bearing (Oil) Pressure Tube Assembly - Ring (72-41-36) No. 3 Bearing (Oil) Pressure Tube Assembly Seal Ring Groove (72-41-20) (See Figure 812, Sheet 3)				
		Ring	.0615 (1.563)	.0625 (1.587)		
		Groove	.0645 (1.639)	.0665 (1.689)	.002 (0.051)	.005 (0.127)
352	B	No. 3 Bearing Elbow Assembly (72-41-30) No. 3 Bearing Front Cooling Duct Assembly (72-41-06) (See Figure 803, Sheet 3)				
		Elbow	1.123 (28.525)	1.124 (28.549)		
		Duct	1.124 (28.550)	1.126 (28.600)	.000 (0.000)	.003 (0.076)
354 (1)	B	No. 3 Bearing And Airframe (Oil Vent And Turbine Cooling Air Duct Sensing Outer) Manifold Assembly (72-41-22) Diffuser Case Assembly (72-41-01) (See Figure 811, Sheet 3)				
		Manifold (Pre SB PW4ENG 72-652)	.7435 (18.885)	.7475 (18.986)		
		Case (Pre SB	.749 (19.025)	.752 (19.100)	.0005 (0.01)	.0125* (0.32)*

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)		PW4ENG 72-652)				
354 (2)	B	No. 3 Bearing And Airframe (Oil Vent And Turbine Cooling Air Duct Sensing Outer) Manifold Assembly (72-41-22) Diffuser Case Assembly (72-41-01) (See Figure 811, Sheet 3)				
		Manifold (Post SB PW4ENG 72-652)	.743 (18.873)	.7475 (18.986)		
		Case (Post SB PW4ENG 72-652)	.749 (19.025)	.752 (19.100)	.0005 (0.013)	.009 (0.229)
355	A	Gap, No. 3 Bearing And Airframe (Oil Vent And Turbine Cooling Air Duct Sensing Outer) Manifold Assembly - Ring (72-41-22) (See Figure 811, Sheet 3)				
		Gap			.005 (0.13)	.015 (0.38)
		Ring Installed In Ring Gage .750 (19.050) Diameter (Ring Gage)				
		Gap			.001T (0.03T)	.021 (0.53)
		Ring Installed In Diffuser Case Assembly .748 (19.000) .752 (19.100 Diameter (Id, Diffuser Case)				
366	A	Side Clearance, Seal Ring (72-41-36) Front Cooling Duct Round Nut Groove (72-41-38) (See Figure 812, Sheet 3)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.085 (2.159)	.002 (0.051)	.008 (0.203)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
367	A	Gap, Seal - Ring (72-41-36) (See Figure 812, Sheet 3)				
		Gap			.005 (0.13)	.020 (0.51)
		Ring Installed In Ring Gage 2.6875 (68.262) Diameter (Ring Gage)				
		Gap			.001T (0.03T)	.026 (0.66)
		Ring Installed In Cooling Duct 2.6855 (68.212) 2.6895 (68.313) Diameter (ID, Front Cooling Duct)				
368	A	Side Clearance, Seal Ring (72-41-36) Front Cooling Duct Round Nut Groove (72-41-38) (See Figure 809 And 810)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.085 (2.159)	.002 (0.051)	.008 (0.203)
369	A	Gap, Seal Ring (72-41-36) (See Figure 809 And 810)				
		Gap			.005 (0.13)	.020 (0.51)
		Ring Installed In Ring Gage 2.9375 (74.612) Diameter (Ring Gage)				
		Gap			.001T (0.03T)	.026 (0.66)
		Ring Installed In Cooling Duct 2.9355 (74.562) 2.9395 (74.663) Diameter (ID, Front Cooling Duct)				

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
371	C	Pin (72-41-07) No. 3 Bearing Front Carbon Seal Assembly (72-41-07) (See Figures 809, And 810)				
		Pin	.1870 (4.7498)	.1871 (4.7523)		
		Seal Assembly	.186 (4.725)	.187 (4.749)	.000 (.000)	.0011T (0.027T)
373 (1)	B	No. 3 Bearing (Breather) Tube Assembly (72-41-19) Sleeve (72-41-37) (See Figure 810, Sheet 5)				
		Tube (Pre SB PW4ENG 72-652)	.8085 (20.536)	.8115 (20.612)		
		Sleeve	.8120 (20.625)	.8160 (20.726)	.0005 (0.013)	.0075 (0.190)
373 (2)	B	No. 3 Bearing (Breather) Tube Assembly (72-41-19) Sleeve (72-41-37) (See Figure 810, Sheet 5)				
		Tube (Post SB PW4ENG 72-652)	.8075 (20.511)	.8125 (20.637)		
		Sleeve	.8120 (20.625)	.8160 (20.726)	.0005T (0.013T)	.0085 (0.216)
374	A	Gap, No. 3 Bearing (Breather And Scavenge) Tube Assembly - Ring (72-41-36) (See Figure 810, Sheet 5)				
		Gap			.005 (0.13)	.015 (0.38)
		Ring Installed In Ring Gage .812 (20.625) Diameter (Ring Gage)				
		Gap			.005 (0.13)	.028 (0.71)
		Ring Installed In Sleeve .812 (20.625) .816 (20.726) Diameter (ID, Sleeve)				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
375	A	Side Clearance, No. 3 Bearing (Breather And Scavenge) Tube Assembly - Ring (72-41-36) No. 3 Bearing (Scavenge) Tube Assembly Ring Groove (72-41-25) No. 3 Bearing (Breather) Tube Assembly (72-41-19) (See Figure 810, Sheet 5)				
		Ring	.0605 (1.537)	.0615 (1.562)		
		Groove	.0655 (1.664)	.0675 (1.714)	.004 (0.102)	.007 (0.177)
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
376	A	Gap, No. 3 Bearing (Compartment) Cooling Tube Assembly - Ring (72-41-36) (See Figure 806A)				
		Gap Seal Ring Installed In Ring Gage 2.125 (53.975) Diameter (Ring Gage)			.005 (0.13)	.020 (0.51)
		Gap Seal Ring Installed In Diffuser Case Assembly 2.123 (53.925) 2.127 (54.025) Diameter (ID, Diffuser Case)			.001T (0.03T)	.026 (0.66)
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
377	A	Side Clearance, No. 3 Bearing (Compartment) Cooling Tube Assembly - Ring (72-41-36) No. 3 Bearing (Compartment) Cooling Tube Assembly Ring Groove (72-41-27), and Diffuser Seal Air Vent Tube Assembly Ring Groove (72-41-34) (See Figure 806A)				
		Ring	.077 (1.956)	.078 (1.981)		
		Groove	.080 (2.032)	.082 (2.082)	.002 (0.051)	.005 (0.127)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
378 (1)	B	No. 3 Bearing (Compartment) Cooling Tube Assembly (72-41-27) Diffuser Seal Air Vent Tube Assembly (72-41-34) Diffuser Case Assembly (72-41-01) (See Figure 806A)				
		Tube (Pre SB PW4ENG 72-652)	2.1155 (53.734)	2.1195 (53.835)		
		Case	2.123 (53.925)	2.127 (54.025)	.0035 (0.089)	.0115 (0.292)
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
378 (2)	B	No. 3 Bearing (Compartment) Cooling Tube Assembly (72-41-27) Diffuser Seal Air Vent Tube Assembly (72-41-34) Diffuser Case Assembly (72-41-01) (See Figure 806A)				
		Tube (Post SB PW4ENG 72-652)	2.1125 (53.658)	2.1205 (53.861)		
		Case	2.123 (53.925)	2.127 (54.025)	.0025 (0.064)	.0145 (0.368)
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
381	B	Doweled End Combustion Chamber Retaining Bolt (72-41-12) Outer Combustion Chamber Bushing (72-41-11) (See Figure 801, Sheet 5)				
		Bolt	.320 (8.128)	.322 (8.178)		
		Bushing	.329 (8.357)	.331 (8.407)	.007 (0.178)	.011 (0.279)

	Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
			FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
	382	B	HPC (Exit) Brush Seal Support Assembly (72-41-39) Diffuser Case Assembly (72-41-01) (See Figure 801, Sheet 3)				
			Seal Support	21.987 (558.470)	21.991 (558.571)		
R R			Case	21.959 (557.759)	21.961 (557.809)	.024T* (0.610T*)	.032T (0.812T)
	383	A	Gap, No. 3 Bearing (Scavenge) Tube Assembly Ring Groove (72-41-25) (See Figure 809, Sheet 5)				
			Gap			.005 (0.13)	.015 (0.38)
			Ring Installed In Ring Gage .812 (20.625) Diameter (Ring Gage)				
			Gap			.005 (0.13)	.028 (0.711)
			Ring Installed In Sleeve .812 (20.625) .826 (20.726) Diameter ID Sleeve				
	384	A	Side Clearance, Seal Ring No. 3 Bearing (Scavenge) Tube Assembly Ring Groove (72-41-25) (See Figure 809, Sheet 5)				
			Seal Ring	.0605 (1.537)	.0615 (1.562)		
			Tube Groove (Post SB PW4ENG 72-652)	.0655 (1.664)	.0675 (1.714)	.004 (0.102)	.007 (0.178)

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Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
385	A	No. 3 Bearing (Scavenge) Tube				
(1)		Assembly (72−41−25)				
		Sleeve (72−41−37)				
		(See Figure 809, Sheet 5)				
		Tube	.807	.810		
		(Pre SB	(20.498)	(20.574)		
		PW4ENG 72−652)				
		Sleeve	.8105	.8145	.0005	.0075
			(20.587)	(20.688)	(0.013)	(0.190)
385	A	No. 3 Bearing (Scavenge) Tube				
(2)		Assembly (72−41−25)				
		Sleeve (72−41−37)				
		(See Figure 809, Sheet 5)				
		Tube	.806	.811		
		(Post SB	(20.473)	(20.599)		
		PW4ENG 72−652)				
		Sleeve	.8105	.8145	.0005T	.0085
			(20.587)	(20.688)	(0.013T)	(0.216)
788	B	Gearbox Lug (72−61−68)				
		Spherical Bearing (72−41−91)				
		(See Figure 813, Sheet 3)				
		Lug	.9985	.9990		
			(25.3619)	(25.3746)		
		Bearing	.9995	1.000	.0005	.0015
			(25.3873)	(25.4000)	(0.013)	(0.038)
789	B	Diffuser Case Assembly (72−41−01)				
(1)		HPC Rear Case Assembly (72−35−69) (Pre Ring Case				
		Configuration SB PW4ENG 72−756 and SB PW4ENG 72−759)				
		(See Figure 813, Sheet 3)				
		Diffuser Case	32.248	32.252		
			(819.100)	(819.200)		
		HPC Case	32.242	32.246	.002T	.010T
			(818.947)	(819.048)	(0.051T)	(0.254T)
789	B	Diffuser Case Assembly (72−41−01)				
(2)		HPC Rear Case Assembly (72−35−69) (Post SB PW4ENG				
		72−756 and SB PW4ENG 72−759)				
		(See Figure 813, Sheet 3)				
		Diffuser Case	32.248	32.252		
			(819.100)	(819.200)		
		HPC Case	32.234	32.238	.018T	.010T
			(818.744)	(818.845)	(0.457T)	(0.254T)

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Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
790	B	Compressor Exit Stator Assembly (72-41-02) HPC (Rear) Stiffener (72-35-70) (See Figure 813, Sheet 3)				
		Stator (Pre SB PW4ENG 72-234)	27.378 (695.402)	27.382 (695.502)		
		Stiffener (Pre SB PW4ENG 72-234)	27.383 (695.529)	27.387 (695.629)	.001 (0.025)	.009 (0.229)
792	A	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) Compressor Exit Stator Assembly (72-41-02) (See Figure 813, Sheet 3)				
		HPC Rotor	23.409 (594.59)	23.421 (594.89)		
		Stator	23.441 (595.401)	23.447 (595.554)	.020 (0.51)	.048* (1.22)*
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
792	A	HPC Turbine Driveshaft (72-35-09) Compressor Exit Stator Assembly (72-41-02) (See Figure 813, Sheet 3)				
		Driveshaft	23.409 (594.59)	23.421 (594.89)		
		Stator	23.441 (595.401)	23.447 (595.554)	.020 (0.51)	.048* (1.22)*
		FOR THESE MODELS: 4152, 4156A, 4158				
793	A	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) Stage 15 HPC Air Sealing Ring Assembly (72-41-03) (See Figure 813, Sheet 1)				
		Radial Gap, Cold			.011 (0.279)	.024* (0.610)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
		FOR THESE MODELS: 4152, 4156A, 4158				
794	A	Diffuser Air Seal (72-35-32) Diffuser Air Sealing Ring Assembly (72-41-05) (See Figure 813, Sheet 1)				
		Radial Gap, Cold			.011 (0.279)	.024* (0.610)*
		FOR THESE MODELS: 4152, 4156A, 4158				
795	A	Drum Rotor (Stages 13, 14, And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Bearing Front Cooling Duct Assembly (72-41-06) (See Figure 813, Sheet 2)				
		HPC Rotor	7.986 (202.84)	7.998 (203.15)		
		Duct	8.098 (205.690)	8.102 (205.790)	.100 (2.54)	.126* (3.20)*
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
795	A	HPC Turbine Driveshaft (72-35-09) No. 3 Bearing Front Cooling Duct Assembly (72-41-06) (See Figure 813, Sheet 2)				
		Driveshaft	7.986 (202.84)	7.998 (203.15)		
		Duct	8.098 (205.690)	8.102 (205.790)	.100 (2.54)	.126* (3.20)*
796	A	No. 3 Bearing (Front) Face Seal Assembly (72-41-09) No. 3 Bearing (Rear) Face Seal Assembly (72-41-87) (See Figure 813, Sheet 2)				
		Height Of Step			.075* (1.905)*	.147 (3.73)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
		FOR THESE MODELS: 4152, 4156A, 4158				
797	B	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Bearing Front Seal Seat (72-41-80) (See Figure 813, Sheet 2)				
		HPC Rotor	7.229 (183.617)	7.231 (183.667)		
		Seal Seat	7.232 (183.693)	7.234 (183.743)	.001 (0.026)	.005 (0.127)
		FOR THESE MODELS: 4152, 4156A, 4158				
798	B	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Bearing Seal Spacer (72-41-81) (See Figure 813, Sheet 2)				
		HPC Rotor	7.209 (183.109)	7.211 (183.159)		
		Spacer	7.212 (183.185)	7.214 (183.235)	.001 (0.026)	.005 (0.127)
		FOR THESE MODELS: 4152, 4156A, 4158				
799 (1)	A	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Roller Bearing (72-41-82) (See Figure 813, Sheet 2)				
		HPC Rotor	7.2076 (183.0731)	7.2080 (183.0832)		
		Bearing (Pre SB PW4ENG 72-611)	7.2040 (182.9816)	7.2047 (182.9993)	.004T (0.101T)	.0029T (0.074T)
		FOR THESE MODELS: 4152, 4156A, 4158				
799 (2)	A	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Roller Bearing (72-41-82) (See Figure 813, Sheet 2)				
		HPC Rotor	7.2076 (183.0731)	7.2080 (183.0832)		
		Bearing (Post SB PW4ENG 72-611)	7.2060 (183.0324)	7.2067 (183.0501)	.002T (0.051T)	.0009T (0.023T)

Ref. No.	IFR	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
		FOR THESE MODELS: 4152, 4156A, 4158				
800	B	Drum Rotor (Stages 13, 14 And 15) Disk (Rear Hub) Assembly (72-35-08) No. 3 Bearing Rear Seal Seat (72-41-84) (See Figure 813, Sheet 2)				
		HPC Rotor	7.1455 (181.496)	7.1465 (191.521)		
		Seal Seat	7.1475 (181.547)	7.1505 (181.622)	.001 (0.026)	.005 (0.127)
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
797	B	HPC Turbine Driveshaft (72-35-09) No. 3 Bearing Front Seal Seat (72-41-80) (See Figure 813, Sheet 2)				
		Driveshaft	7.229 (183.617)	7.231 (183.667)		
		Seal Seat	7.232 (183.693)	7.234 (183.743)	.001 (0.026)	.005 (0.127)
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
798	B	HPC Turbine Driveshaft (72-35-09) No. 3 Bearing Seal Spacer (72-41-81) (See Figure 813, Sheet 2)				
		Driveshaft	7.209 (183.109)	7.211 (183.159)		
		Spacer	7.212 (183.185)	7.214 (183.235)	.001 (0.026)	.005 (0.127)
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
799 (1)	A	HPC Turbine Driveshaft (72-35-09) No. 3 Roller Bearing (72-41-82) (See Figure 813, Sheet 2)				
		Driveshaft	7.2076 (183.0731)	7.2080 (183.0832)		
		Bearing (Pre SB PW4ENG 72-611)	7.2040 (182.9816)	7.2047 (182.9993)	.004T (0.101T)	.0029T (0.074T)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
799	A	HPC Turbine Driveshaft (72-35-09)				
(2)		No. 3 Roller Bearing (72-41-82)				
		(See Figure 813, Sheet 2)				
		Driveshaft	7.2076	7.2080		
			(183.0731)	(183.0832)		
		Bearing	7.2060	7.2067	.002T	.0009T
		(Post SB	(183.0324)	(183.0501)	(0.051T)	(0.023T)
		PW4ENG 72-611)				
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
800	B	HPC Turbine Driveshaft (72-35-09)				
		No. 3 Bearing Rear Seal Seat (72-41-84)				
		(See Figure 813, Sheet 2)				
		Driveshaft	7.1455	7.1465		
			(181.496)	(191.521)		
		Seal Seat	7.1475	7.1505	.001	.005
			(181.547)	(181.622)	(0.026)	(0.127)
801	A	No. 3 Bearing Housing (72-41-10)				
		No. 3 Bearing Rear (Carbon) Seal Assembly (72-41-85)				
		(See Figure 813, Sheet 2)				
		Housing	14.968	14.972		
			(380.188)	(380.288)		
		Seal	14.966	14.968	.000T	.006T
			(380.137)	(380.187)	(0.000T)	(0.152T)
803	A	No. 3 Bearing Rear Cooling Duct Assembly (72-41-88)				
		No. 3 Bearing (Rear) Seal Ring Holder Assembly (72-41-86)				
		(See Figure 813, Sheet 2)				
		Duct	8.342	8.344		
			(211.887)	(211.937)		
		Seal	8.338	8.342	.000T	.006T
			(211.786)	(211.886)	(0.000T)	(0.152T)

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Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
804	A	No. 3 Bearing Rear Cooling Duct Assembly (72-41-88) No. 3 Bearing Housing (72-41-10) (See Figure 813, Sheet 2)				
		Duct	17.449 (443.205)	17.453 (443.306)		
		Housing	17.443 (443.053)	17.447 (443.153)	.002T (0.051T)	.010T (0.254T)
805	B	Stage 1 HPT (Blade) Cooling Duct Assembly (72-51-03) No. 3 Bearing Housing (72-41-10) (See Figure 813, Sheet 2)				
		Duct	19.198 (487.630)	19.202 (487.730)		
		Housing	19.193 (487.503)	19.197 (487.603)	.001T (0.025T)	.009T (0.229T)
806	A	Inner Combustion Chamber Assembly (72-51-05) Outer Combustion Chamber Assembly (72-41-11) (See Figure 813, Sheet 1)				
		Chamber (Inner)	23.233 (590.12)	23.243 (590.37)		
		Chamber (Outer)	23.224 (589.89)	23.234 (590.14)	.001 (0.03)	.019T (0.48T)
808	B	Turbine Cooling Duct Sensing (Inner Airframe) Tube Assembly (72-41-23) Stage 1 HPT (Blade) Cooling Duct Assembly (72-51-03) (See Figure 808)				
		Tube	.373 (9.474)	.377 (9.576)		
		Duct	.378 (9.602)	.380 (9.652)	.001 (0.025)	.007 (0.178)

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Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
809	B	Stage 1 (Vane) HPT Support Assembly (72-51-01) Diffuser Case Assembly (72-41-01) (See Figure 813, Sheet 3)				
		Support	38.383 (974.93)	38.395 (975.23)		
		Case	38.377 (974.776)	38.383 (974.928)	.011* (0.28)*	.018T (0.46T)
811	B	Turbine Front Hub (Stage 1) (72-52-05) No. 3 Bearing Rear Cooling Duct Assembly (72-41-88) (See Figure 813, Sheet 2)				
		Hub	7.988 (202.90)	7.998 (203.15)		
		Duct	8.098 (205.690)	8.102 (205.790)	.100 (2.54)	.114 (2.90)
815	B	Turbine Case Assembly (72-52-30) Diffuser Case Assembly (72-41-01) (See Figure 813, Sheet 3)				
		Turbine Case	38.833 (986.358)	38.845 (986.663)		
		Diffuser Case	38.827 (986.206)	38.833 (986.358)	.000 (0.00)	.018T (0.46T)
831 (1)	A	No. 3 Roller Bearing (72-41-82) No. 3 Bearing Housing (72-41-10) (See Figure 813, Sheet 2)				
		Bearing (Pre SB PW4ENG 72-611)	10.256 (260.503)	10.257 (260.527)		
		Housing	10.255 (260.477)	10.256 (260.502)	.000T (0.000T)	.002T (0.050T)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
831 (2)	A	No. 3 Roller Bearing (72−41−82) No. 3 Bearing Housing (72−41−10) (See Figure 813, Sheet 2)				
		Bearing (Post SB PW4ENG 72−611)	10.257 (260.528)	10.258 (260.553)		
		Housing	10.255 (260.477)	10.256 (260.502)	.001T (0.026T)	.003T (0.076T)
832	B	Gearbox Support Link Upper Pin Spacers (OD) (72−61−90) Gearbox Support Clevis (72−41−92) (See Figure 814, Sheet 2)				
		Spacer OD	1.124 (28.550)	1.125 (28.575)		
		Clevis	1.126 (28.601)	1.128 (28.651)	.001 (0.026)	.004 (0.101)
833	B	Gearbox Support Link Upper Hollow Pin (72−61−86) Gearbox Support Clevis (72−41−92) (See Figure 814, Sheet 2)				
		Pin	.9985 (25.3619)	.9990 (25.3746)		
		Clevis	.9995 (25.3873)	1.0000 (25.40000)	.0005 (0.013)	.0015 (0.038)
845	A	Gap, No. 3 Bearing (Rear) Seal Ring (72−41−85) (See Figure 813, Sheet 2)				
		Gap			.045 (1.14)	.055 (1.40)
		Ring Installed In Ring Gage 9.090 (230.886) Diameter (Ring Gage)				
		Gap			.040 (1.02)	.060 (1.52)
		Ring Installed In (Rear) Face Seal Assembly 9.0885 (230.848) 9.0915 (230.924) Diameter (ID, Rear Face Seal Assembly)				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
846	A	Side Clearance, No. 3 Bearing (Rear) Seal Ring (72-41-85) No. 3 Bearing (Rear) Seal Ring Holder Assembly (72-41-86) (See Figure 813, Sheet 2)				
		Ring	.119 (3.023)	.122 (3.098)		
		Groove	.124 (3.150)	.128 (3.251)	.002 (0.051)	.009 (0.229)
852	A	Drum Rotor (Stages 13,14,15) Disk Assembly (72-35-10) HPC Exit Brush Seal Support Assembly (72-41-39) (See Figure 813, Sheet 1) Radial Gap Cold - Measurement Not Required At Assembly. Inspect Detail Parts To Limits In CIR Manual Sections As Referenced.				
853	A	Diffuser Case HPC - Diffuser Airseal (72-35-32) HPC (Rear) Exit Brush Seal Support Assembly (72-41-41) (See Figure 813, Sheet 1) Radial Gap Cold - Measurement Not Required At Assembly. Inspect Detail Parts To Limits In CIR Manual Sections As Referenced.				

G. Special Assembly Procedure

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
365	A	Igniter Plug Fitting (See Figure 802) See 72-41-00, Assembly-01 (Task 72-41-00-400-001)				
386	A	Igniter Plug Fitting (See Figure 802) See 72-41-00, Assembly-01 (Task 72-41-00-400-001)				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1006	A	Procedure For Aligning "X" Mark On No. 3 Bearing Outer Race With Machined Dots On No. 3 Bearing Housing (See Figure 813, Sheet 2) See 72-41-00, Assembly-02 R (Task 72-41-00-400-002-001)				
1990	A	Procedure For Assembling Diffuser Case Tube Locks See 72-41-00, Assembly-01 (Task 72-41-00-400-001)				

H. Special Torques

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
400	A	Igniter Plug Boss (See Figure 802) See 72-41-00, Assembly-01 Task 72-41-00-400-001				
401	A	Igniter Plug (See Figure 802) See 72-41-00, Assembly-01 Task 72-41-00-400-001				
		FOR THESE MODELS: 4152, 4156A, 4158				
402	A	Doweled End Combustion Chamber Retaining Bolt (See Figure 801, Sheet 4) See 72-41-00, Assembly-01 Task 72-41-00-400-001				
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
402	A	Doweled End Combustion Chamber Retaining Bolt (See Figure 801, Sheet 5) See 72-41-00, Assembly-01 Task 72-41-00-400-001				

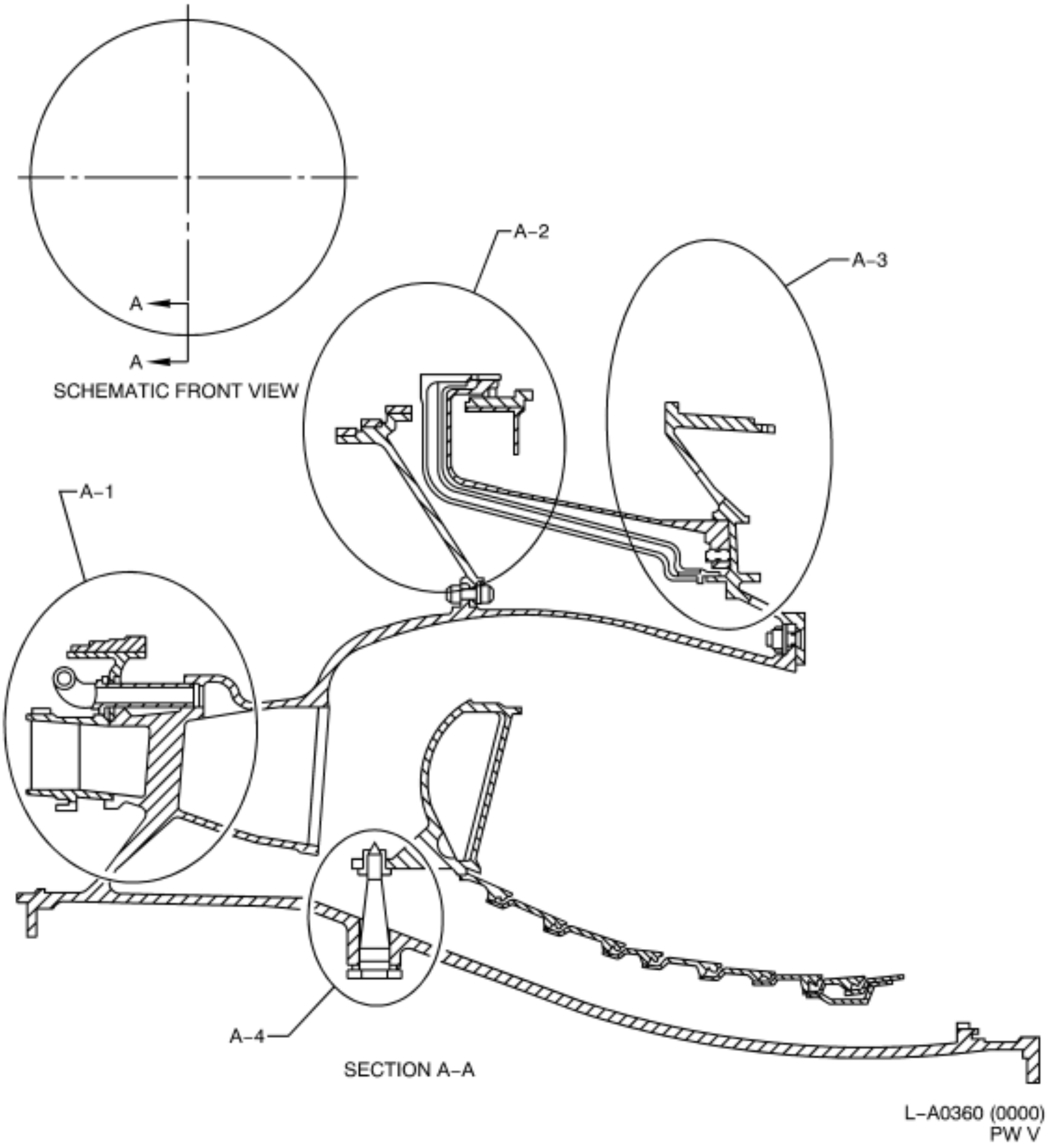
DIFFUSER AND COMBUSTOR - INSPECTION/CHECK-04

	Ref. No.	IFR	Description	New Part Reference Dimensions		Limits	
				Min	Max	Min	Max
	403	A	Metering Plug (See Figure 804) See 72-41-00, Assembly-01 Task 72-41-00-400-001				
	404	A	Strainer Element Assembly (See Figure 804) See 72-41-00, Assembly-01 Task 72-41-00-400-001				
	407	A	Fuel Nozzle Supply Manifold Assembly Nuts (See Figure 815, Sheet 1) See 72-41-00, Assembly-01 Task 72-41-00-400-001 See 72-41-00, Assembly-03 Task 72-41-00-400-003				
R	408	A	Front Cooling Duct Round Nut (See Figure 812, Sheet 3) See 72-41-00, Assembly-02 (Task 72-41-00-400-002-001)				
R	409	A	Front Cooling Duct Round Nuts (2 Locations) (See Figure 809 and Figure 810) See 72-41-00, Assembly-02 (Task 72-41-00-400-002-001)				
	410	A	EEC Thermocouple Probe (TT3) Locknut (See Figure 816) See 72-41-00, Assembly-01 Task 72-41-00-400-001				
	411	A	EEC Thermocouple Probe (TT3) Nut (See Figure 816) See 72-41-00, Assembly-01 Task 72-41-00-400-001				
R	975	A	No. 3 Bearing Outer Race Retaining Nut (See Figure 813, Sheet 2) See 72-41-00, Assembly-02 (Task 72-41-00-400-002-001)				

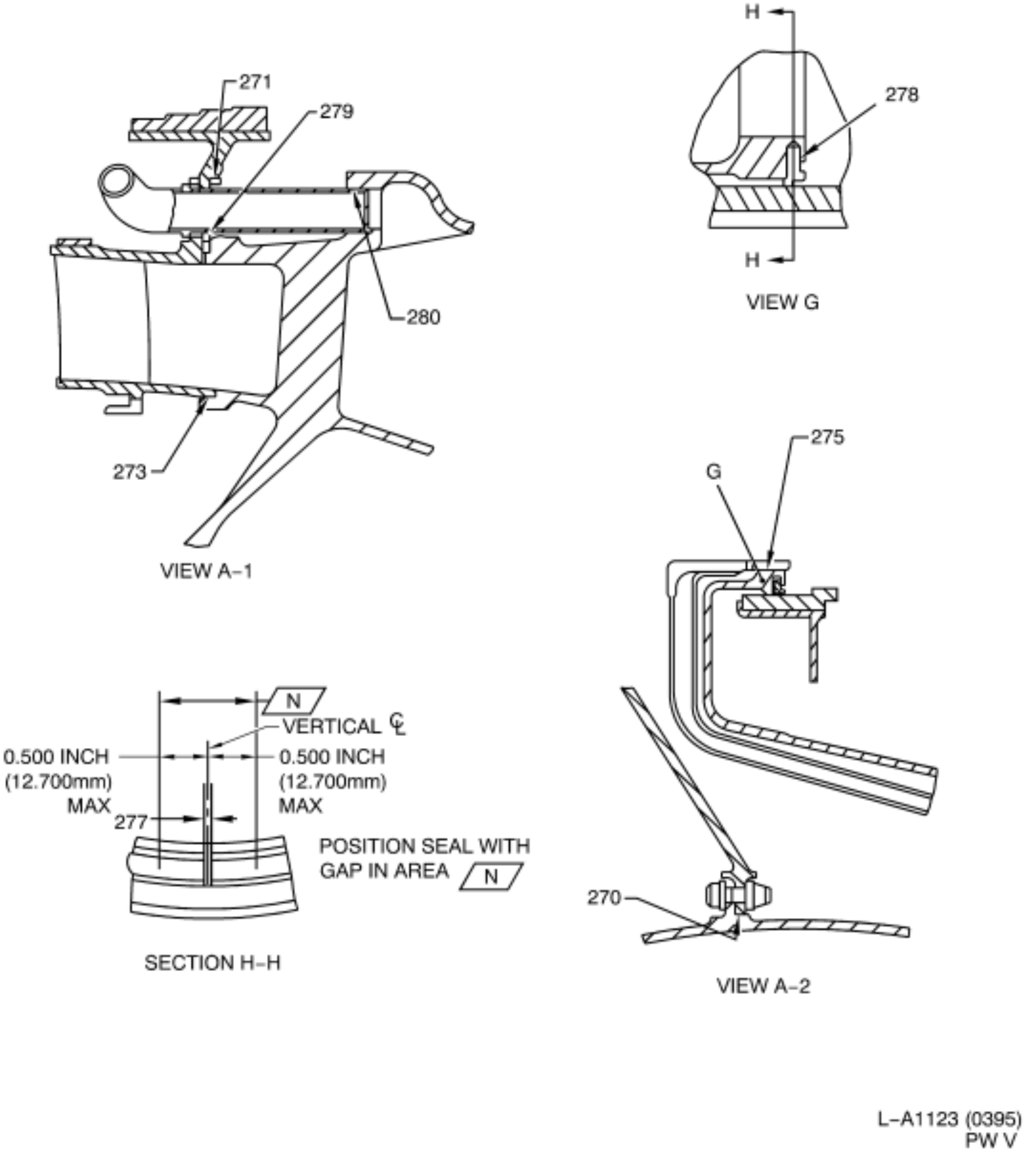
Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
2152	A	Fuel Supply Tubes Coupling Nuts (Attach To Fuel Nozzle Supply Manifold Assemblies) (See Figure 815, Sheet 2) See 72-41-00, Assembly-03 Task 72-41-00-400-003				

I. Spring Loads

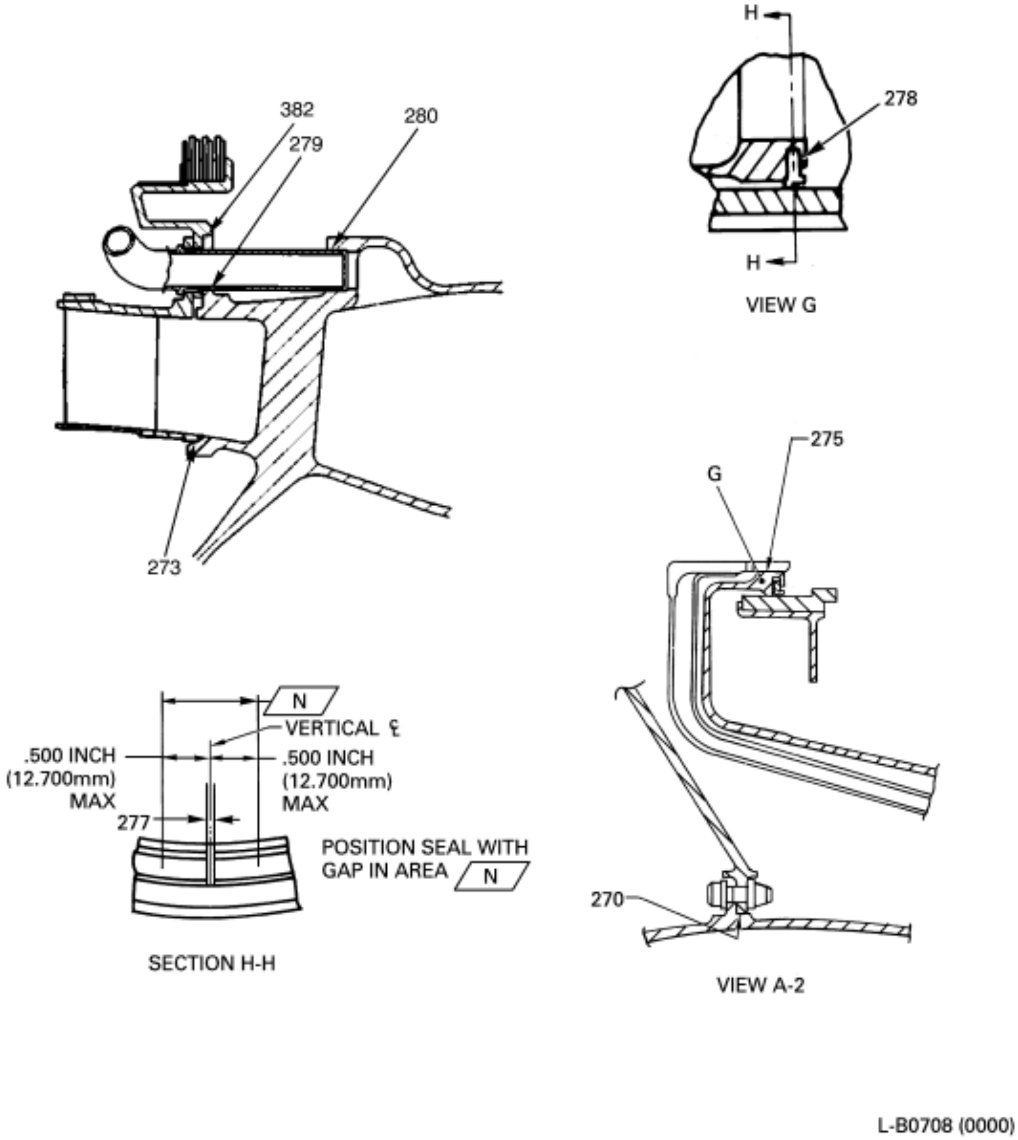
Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
430	A	No. 3 Bearing Seal Compression Spring, PN 50A527 (See Figure 803, Sheet 3)				
			1.577 Inches (40.056 mm)		2.000 lbs (0.91 kg)	2.188 lbs (0.99 kg)
			0.827 Inch (21.006 mm)		6.500 lbs (2.95 kg)	6.750 lbs (3.06 kg)


A
A
SCHEMATIC FRONT VIEW
A−2
A−3
A−1
A−4
SECTION A−A
L−A0360 (0000)
PW V

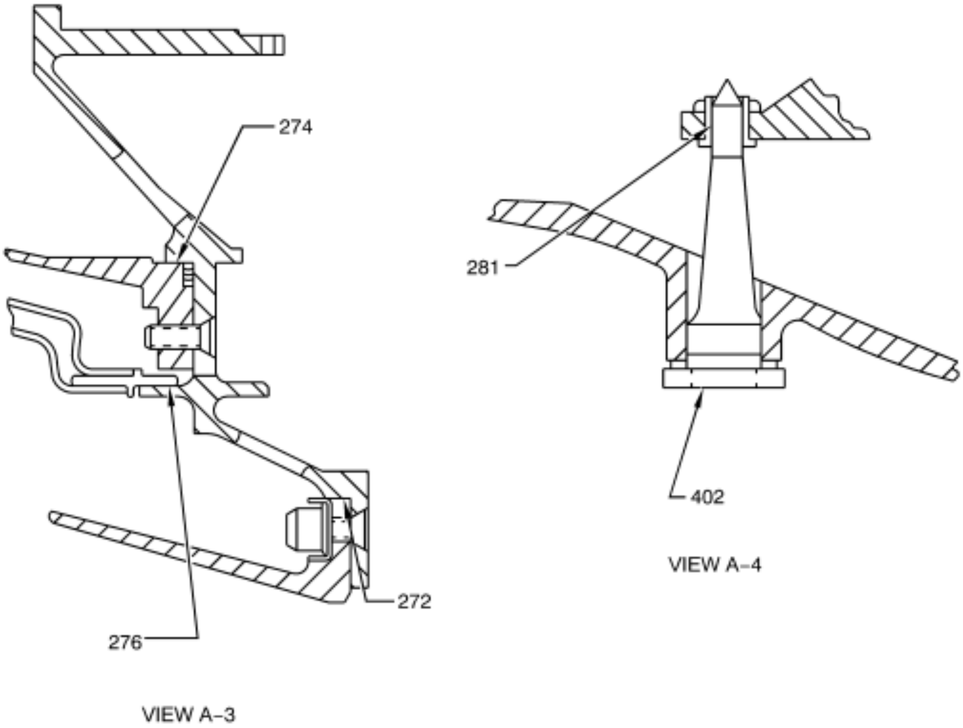
Diffuser And Combustion
Figure 801 (Sheet 1)
(Task 72−41−00−990−001)


271
279
280
273
VIEW A−1
H
H
278
VIEW G
N
VERTICAL ℄
0.500 INCH
(12.700mm)
MAX
0.500 INCH
(12.700mm)
MAX
277
POSITION SEAL WITH
GAP IN AREA N
SECTION H−H
275
G
270
VIEW A−2
L−A1123 (0395)
PW V

Diffuser And Combustion
Figure 801 (Sheet 2)
(Task 72−41−00−990−001)


382
279
280
273
H
278
H
VIEW G
N
VERTICAL ℄
.500 INCH (12.700mm) MAX
.500 INCH (12.700mm) MAX
277
POSITION SEAL WITH GAP IN AREA N
SECTION H-H
275
G
270
VIEW A-2
L-B0708 (0000)

Diffuser And Combustion
Figure 801 (Sheet 3)
(Task 72-41-00-990-001)

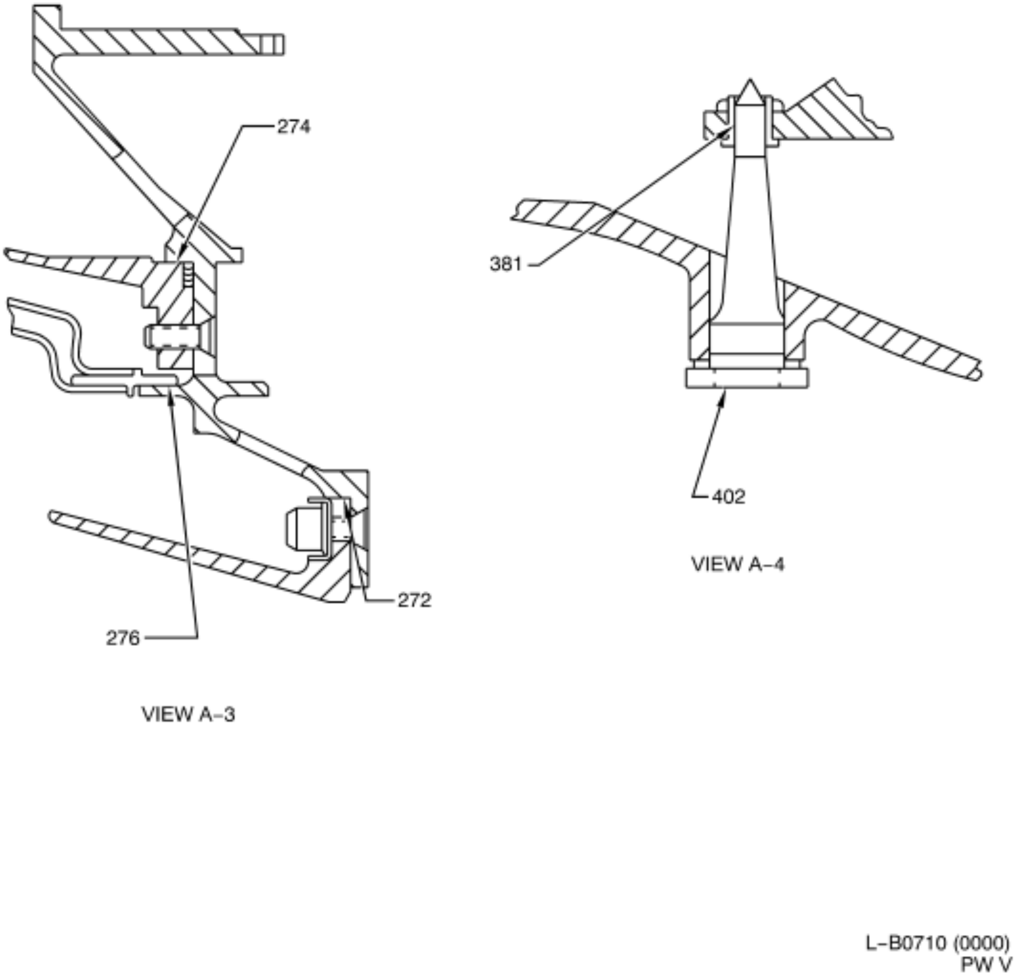


VIEW A-3

VIEW A-4

L-A0362 (0195)
PW V

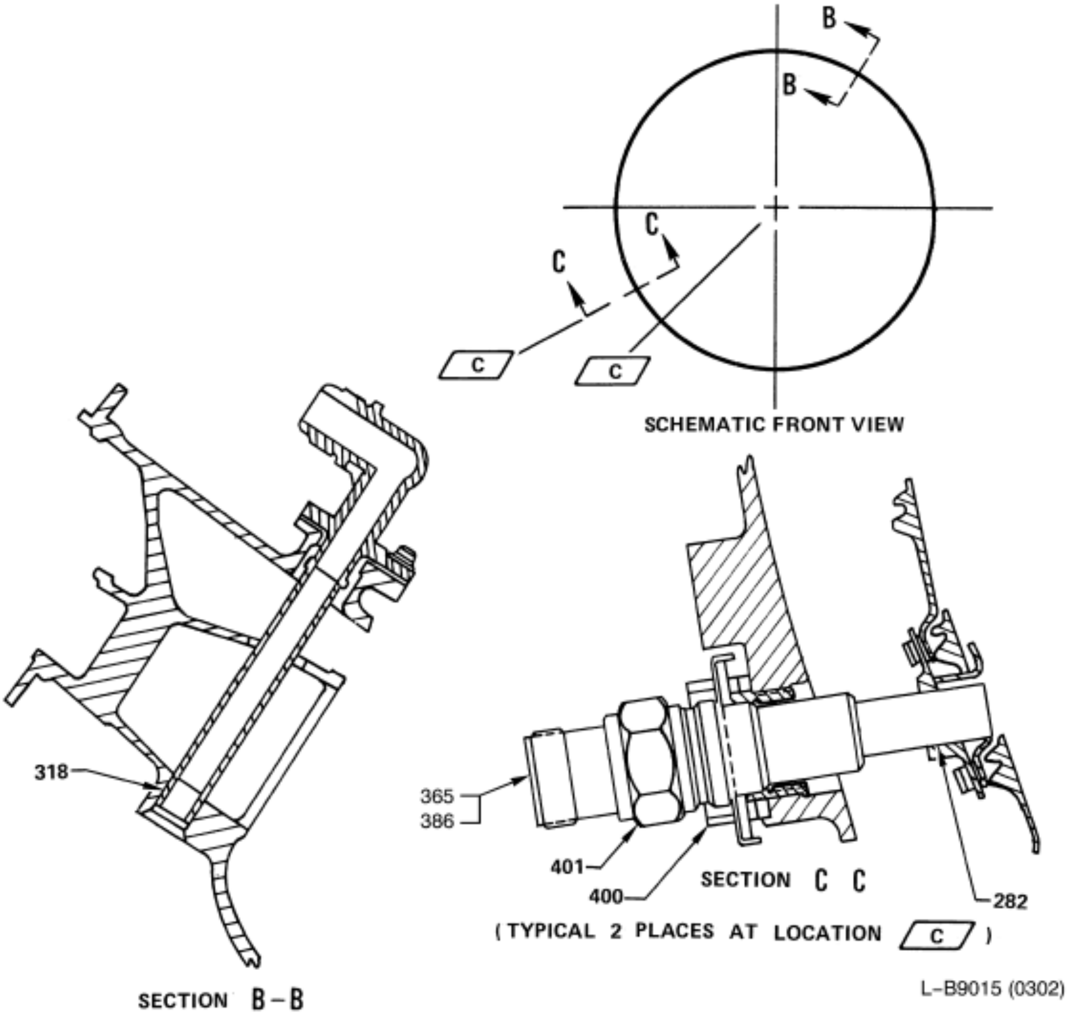
Diffuser And Combustion
Figure 801 (Sheet 4)
(Task 72-41-00-990-001)


274
276
272
381
402
L−B0710 (0000)
PW V

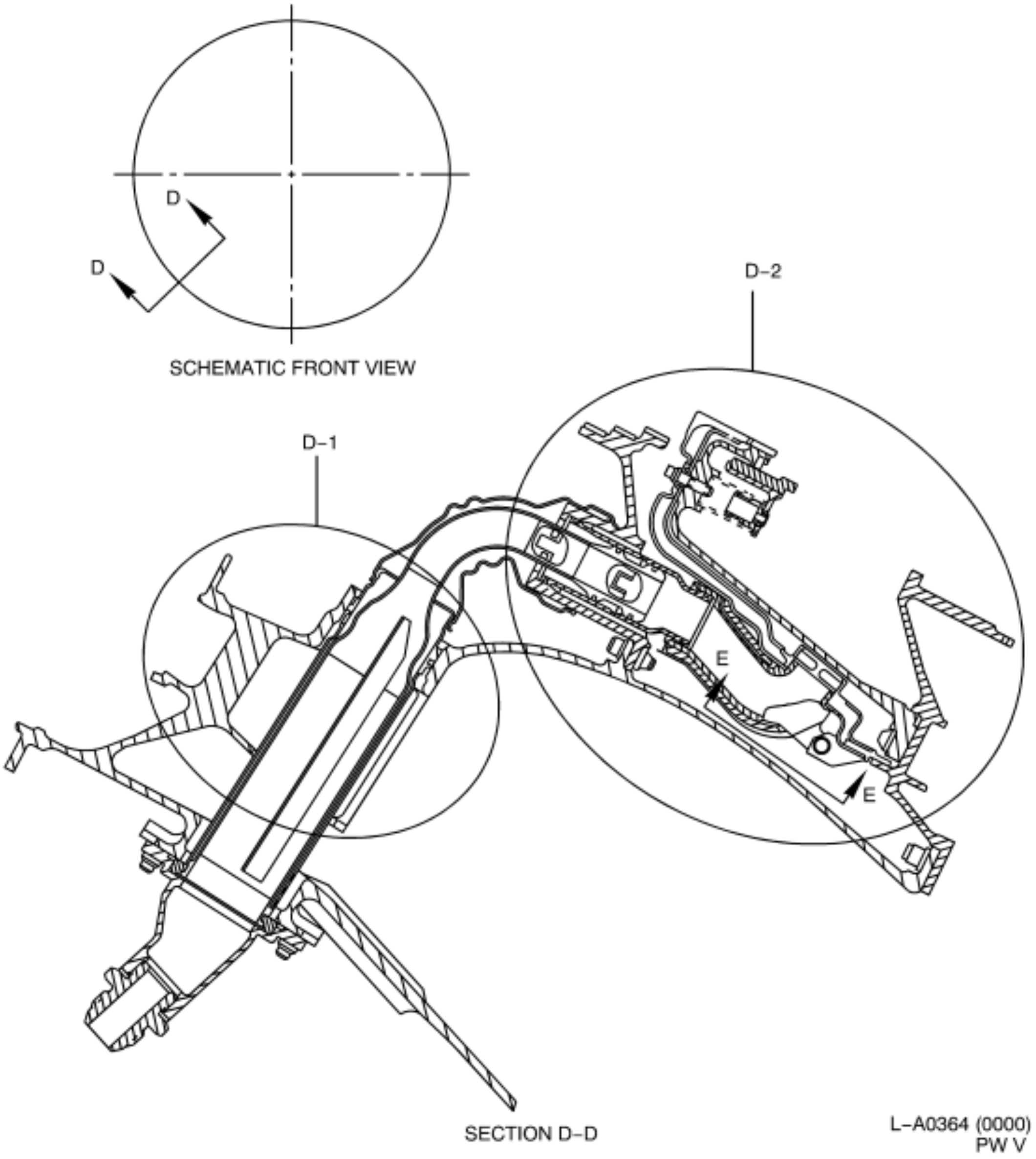
VIEW A−3

VIEW A−4

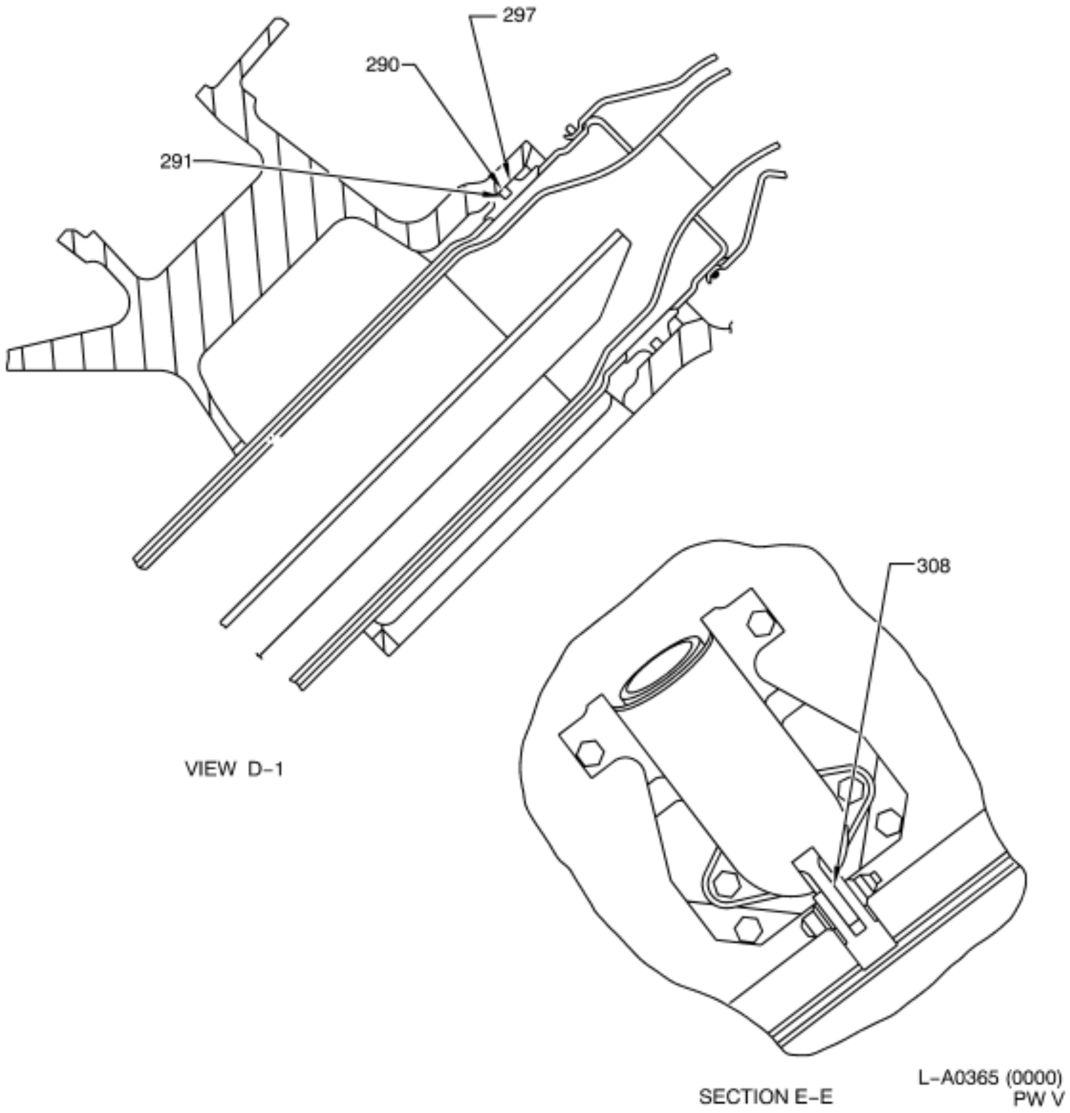
Diffuser And Combustion
Figure 801 (Sheet 5)
(Task 72−41−00−990−001)


B
B
C
C
C
C
SCHEMATIC FRONT VIEW
318
SECTION B-B
365
386
401
400
SECTION C C
282
(TYPICAL 2 PLACES AT LOCATION C)
L-B9015 (0302)

Diffuser And Combustion
Figure 802
(Task 72-41-00-990-001)

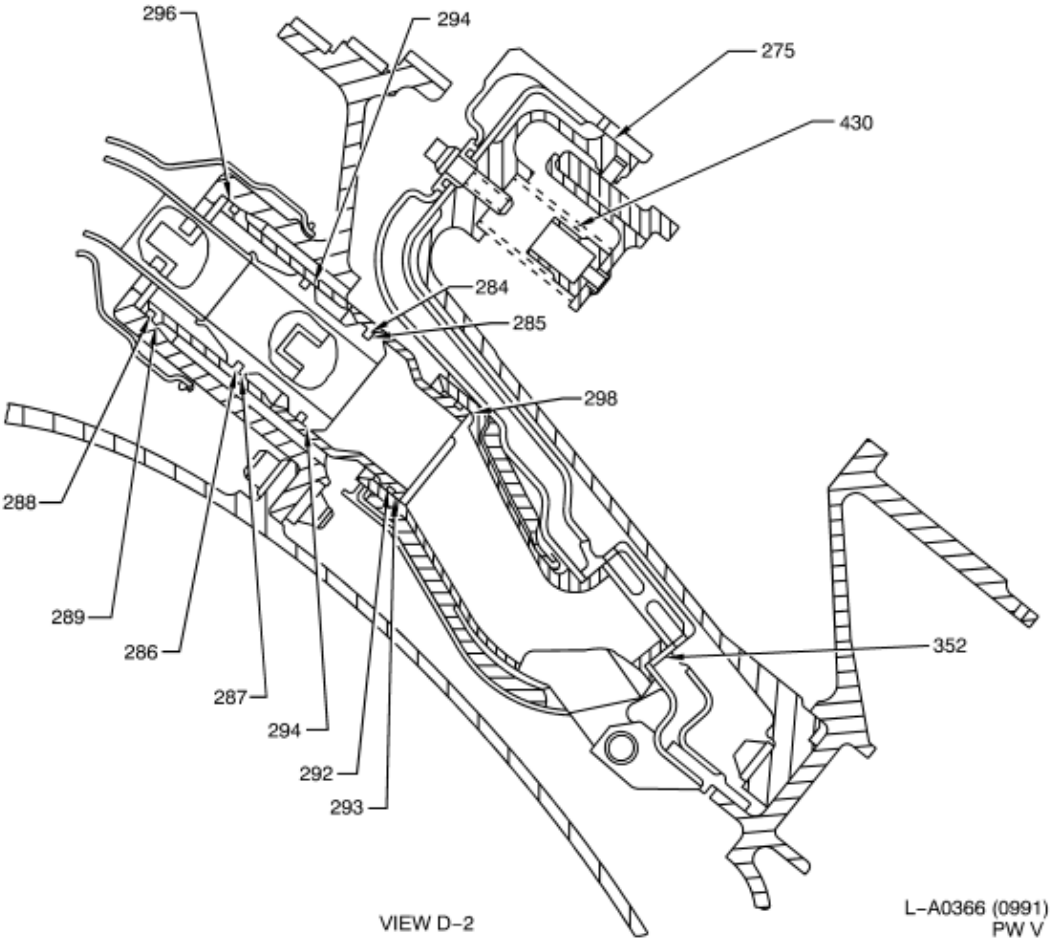

D
D
SCHEMATIC FRONT VIEW
D−2
D−1
E
E
SECTION D−D
L−A0364 (0000)
PW V

Diffuser And Combustion
Figure 803 (Sheet 1)
(Task 72−41−00−990−001)

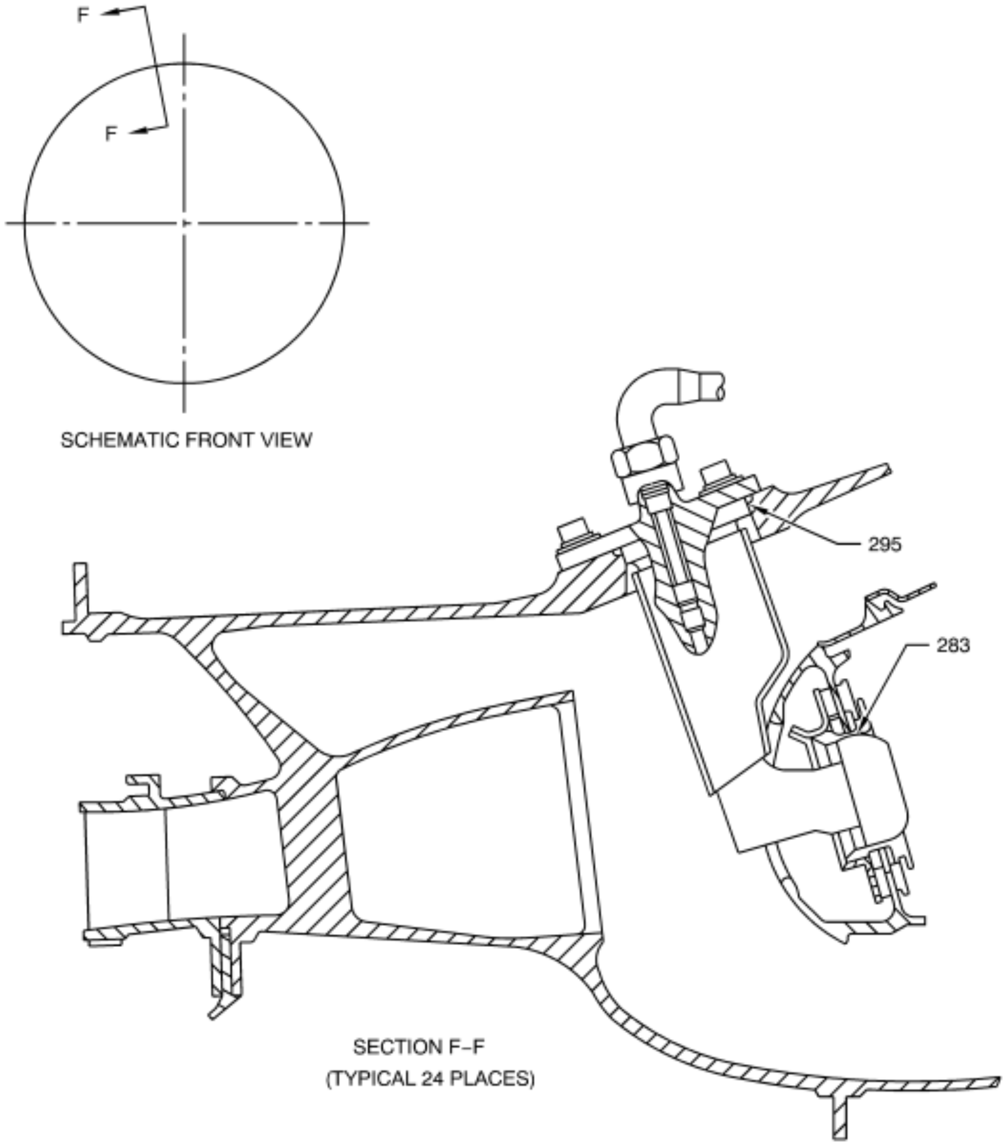

297
290
291
VIEW D−1
308
SECTION E−E
L−A0365 (0000)
PW V

Diffuser And Combustion
Figure 803 (Sheet 2)
(Task 72−41−00−990−001)

DIFFUSER AND COMBUSTOR − INSPECTION/CHECK−04

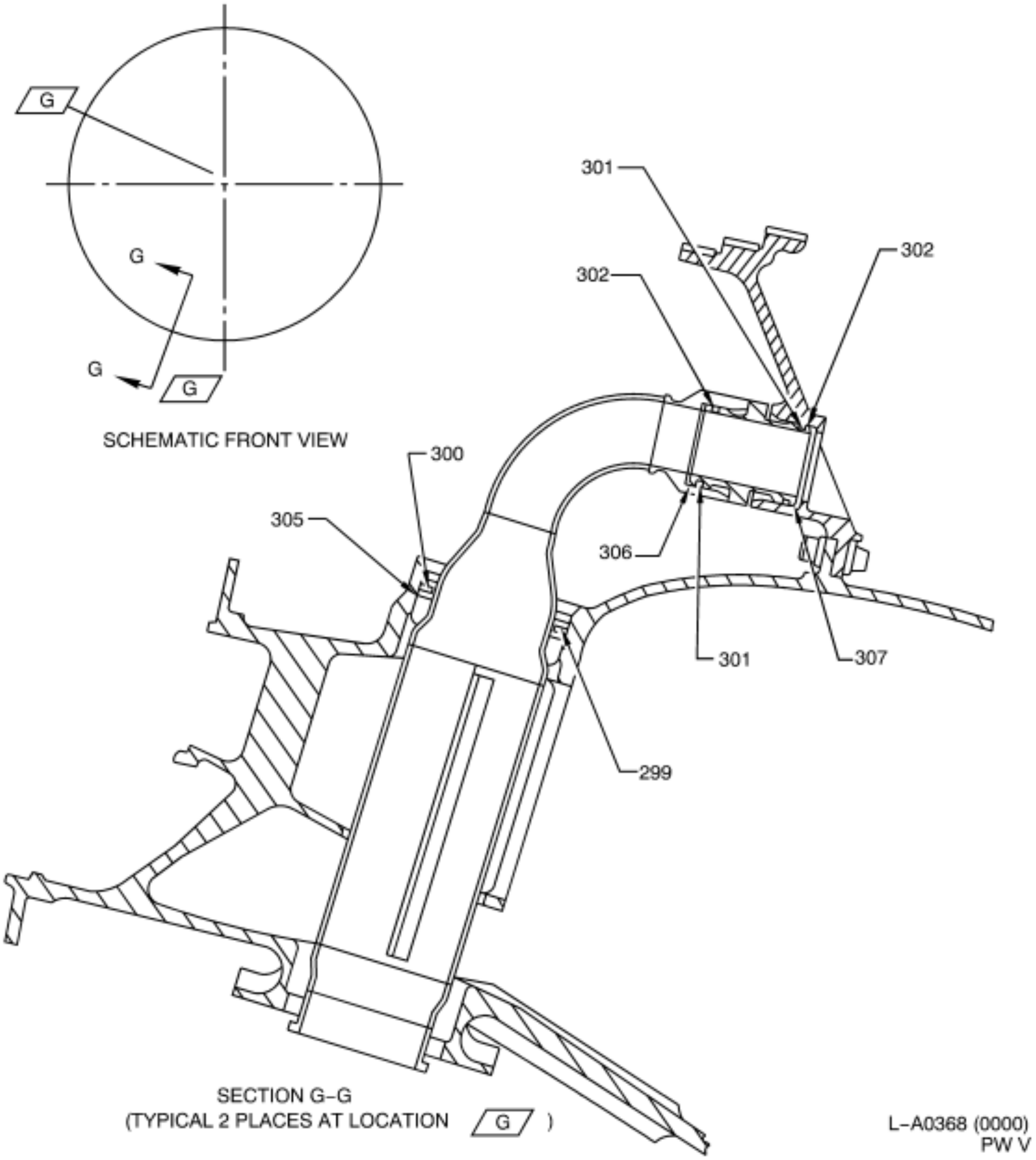

296
294
275
430
284
285
298
288
289
286
287
294
292
293
352
VIEW D−2
L−A0366 (0991)
PW V

Diffuser And Combustion
Figure 803 (Sheet 3)
(Task 72−41−00−990−001)

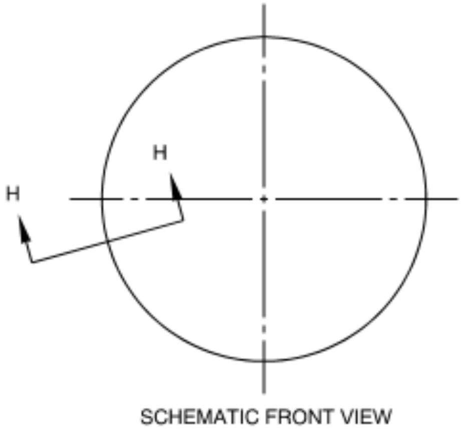

F
F
SCHEMATIC FRONT VIEW
295
283
SECTION F−F
(TYPICAL 24 PLACES)

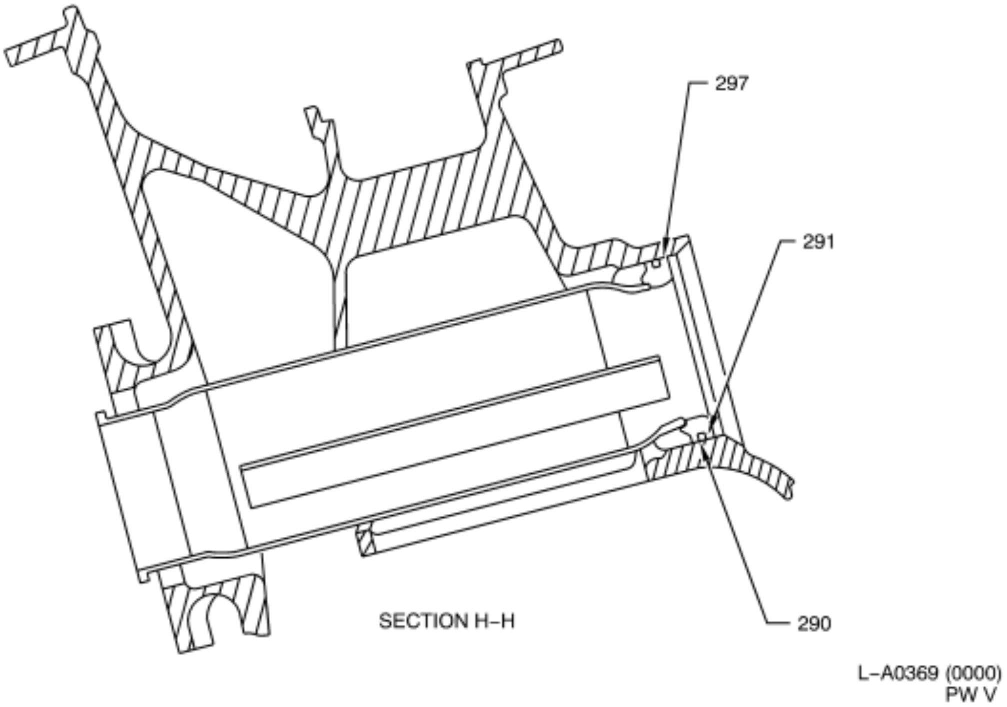
L−A0367 (0686)
PW V

Diffuser And Combustion
Figure 804
(Task 72−41−00−990−001)

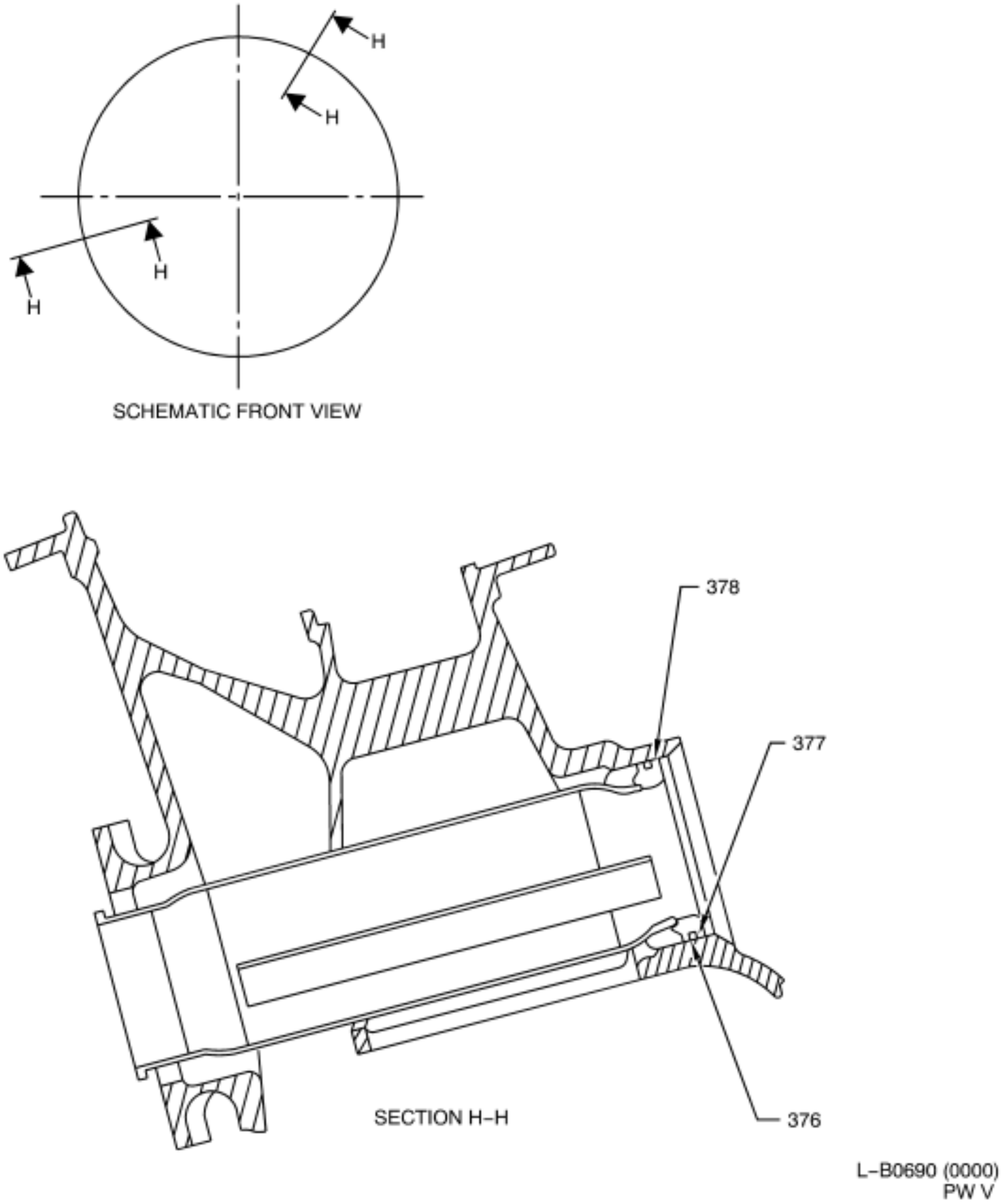

G
G
G
G
SCHEMATIC FRONT VIEW
301
302
302
300
305
306
301
307
299
SECTION G−G
(TYPICAL 2 PLACES AT LOCATION G)
L−A0368 (0000)
PW V

Diffuser And Combustion
Figure 805
(Task 72−41−00−990−001)


H
H
SCHEMATIC FRONT VIEW


297
291
290
SECTION H−H
L−A0369 (0000)
PW V

Diffuser And Combustion
Figure 806
(Task 72−41−00−990−001)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H
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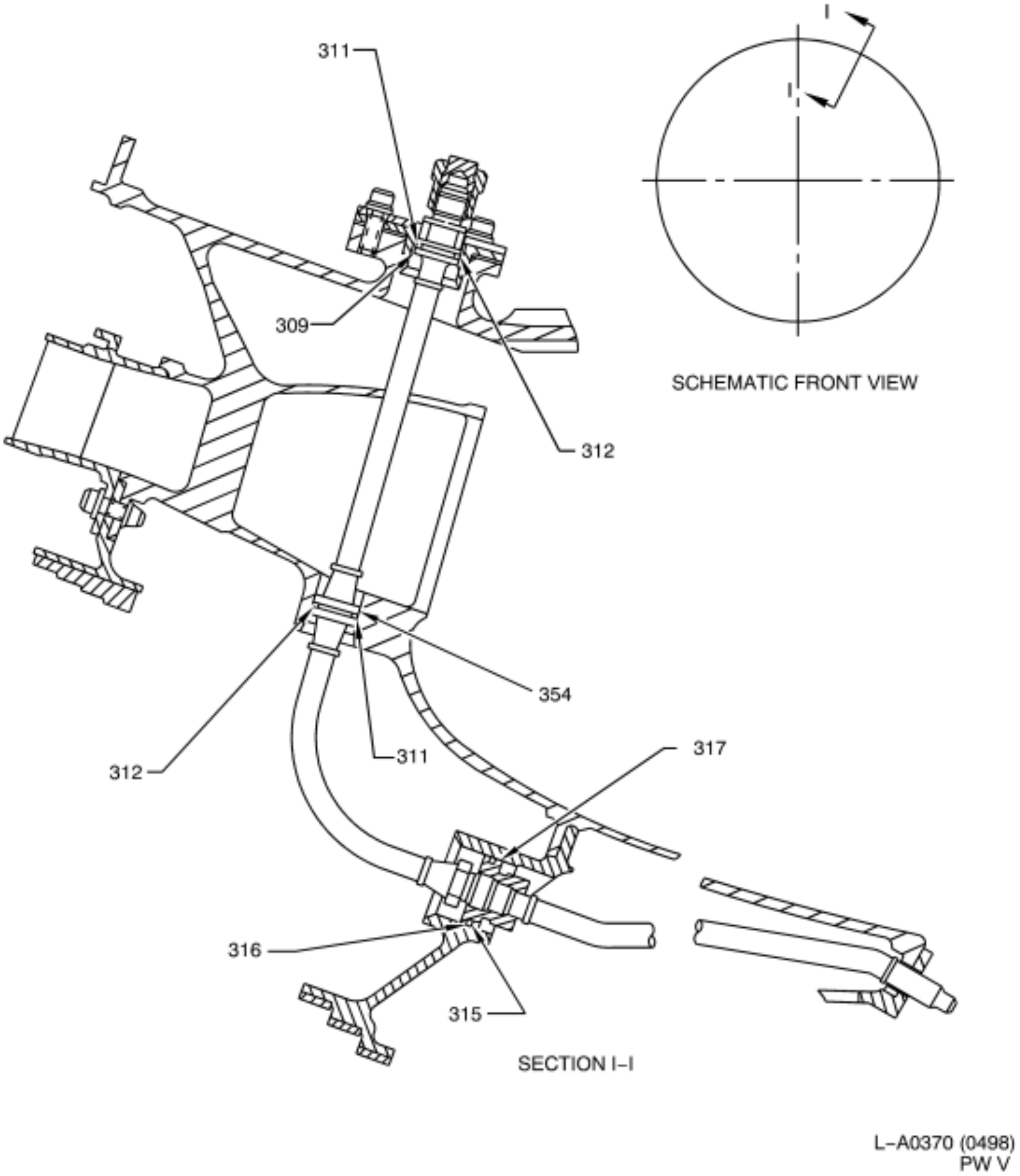
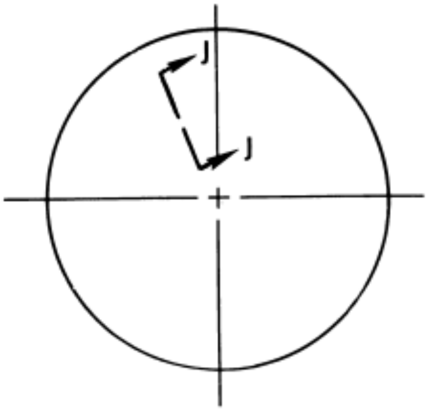
H
SCHEMATIC FRONT VIEW
378
377
376
SECTION H-H
L-B0690 (0000)
PW V

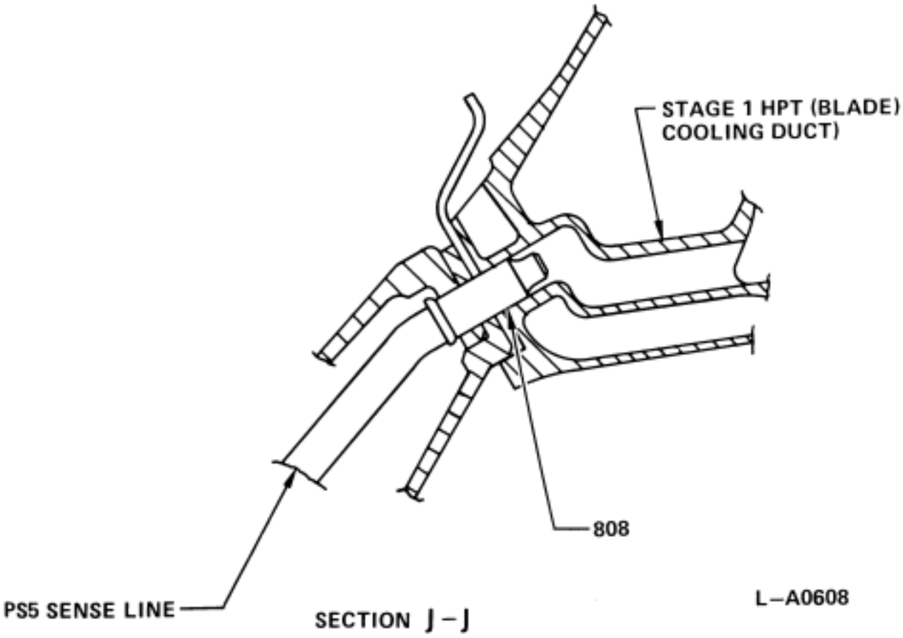
Diffuser And Combustion
Figure 806A
(Task 72-41-00-990-001)


I
I
SCHEMATIC FRONT VIEW
311
309
312
354
312
311
317
316
315
SECTION I–I
L–A0370 (0498)
PW V

Diffuser And Combustion
Figure 807
(Task 72−41−00−990−001)

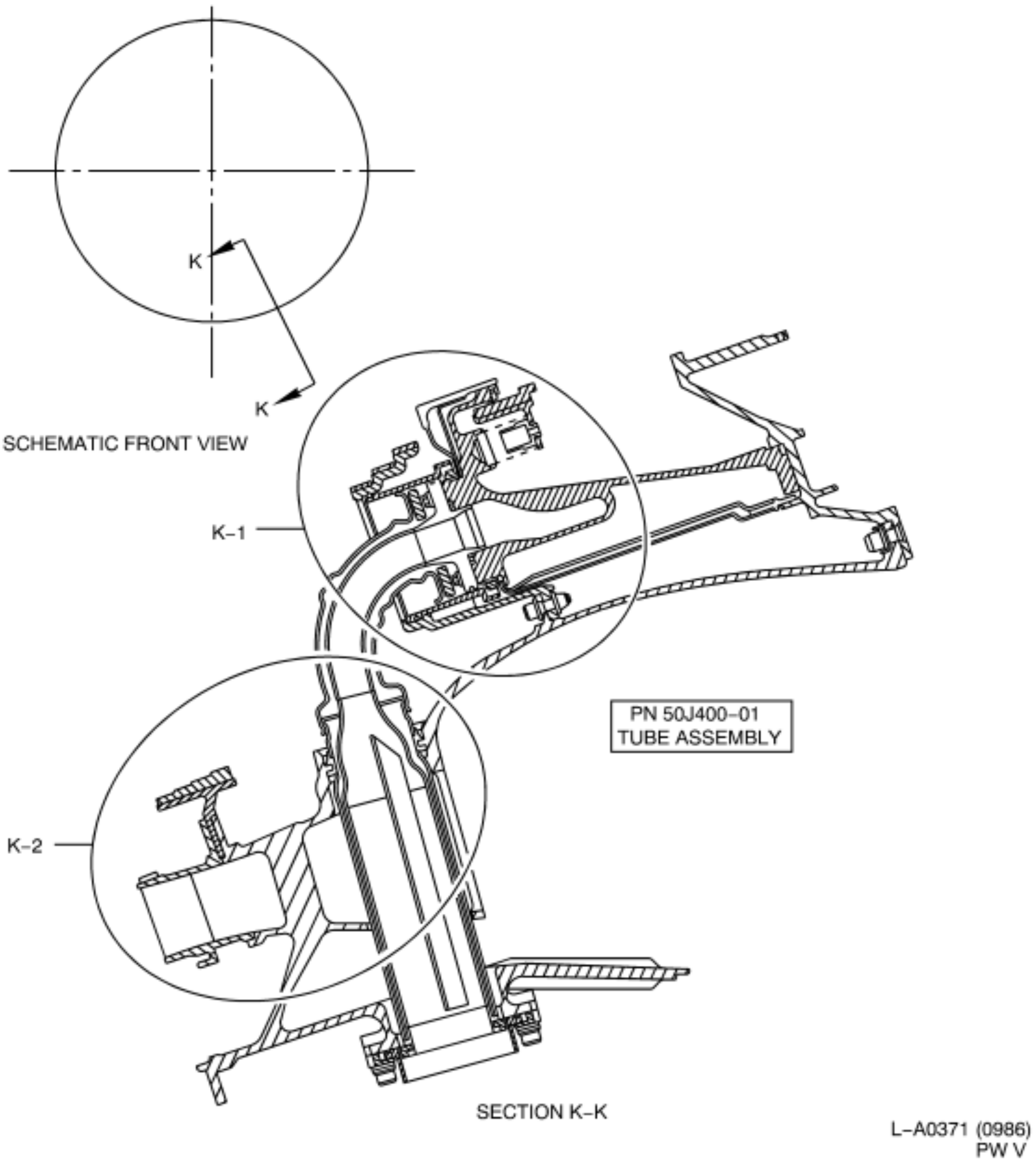


SCHEMATIC REAR VIEW

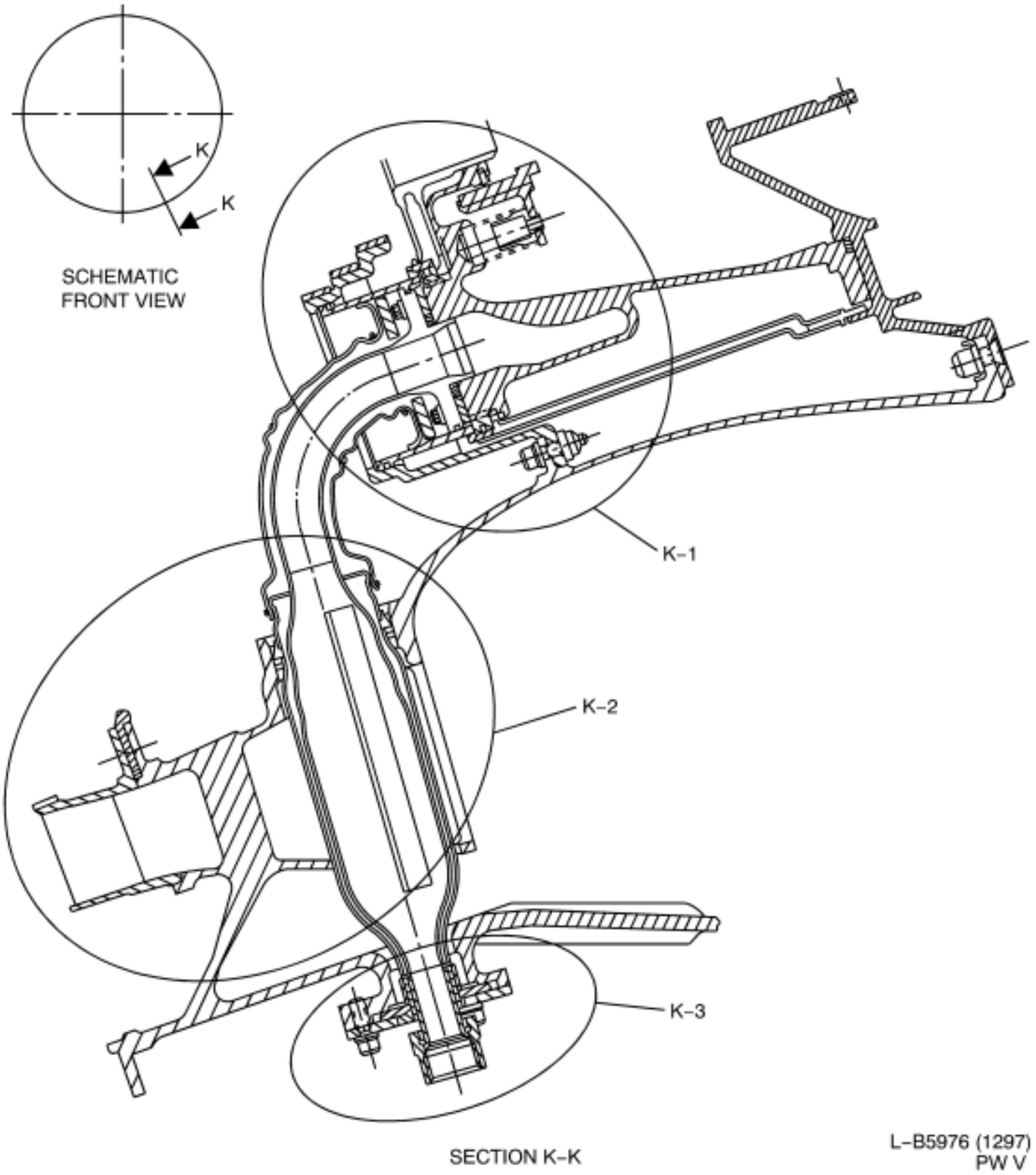

STAGE 1 HPT (BLADE) COOLING DUCT)
808
PS5 SENSE LINE
L-A0608

SECTION J-J

Diffuser And Combustion
Figure 808
(Task 72-41-00-990-001)


K
K
SCHEMATIC FRONT VIEW
K−1
K−2
PN 50J400−01
TUBE ASSEMBLY
SECTION K−K
L−A0371 (0986)
PW V

Diffuser And Combustion (Pre SB PW4ENG 72−652)
Figure 809 (Sheet 1)
(Task 72−41−00−990−001)


K
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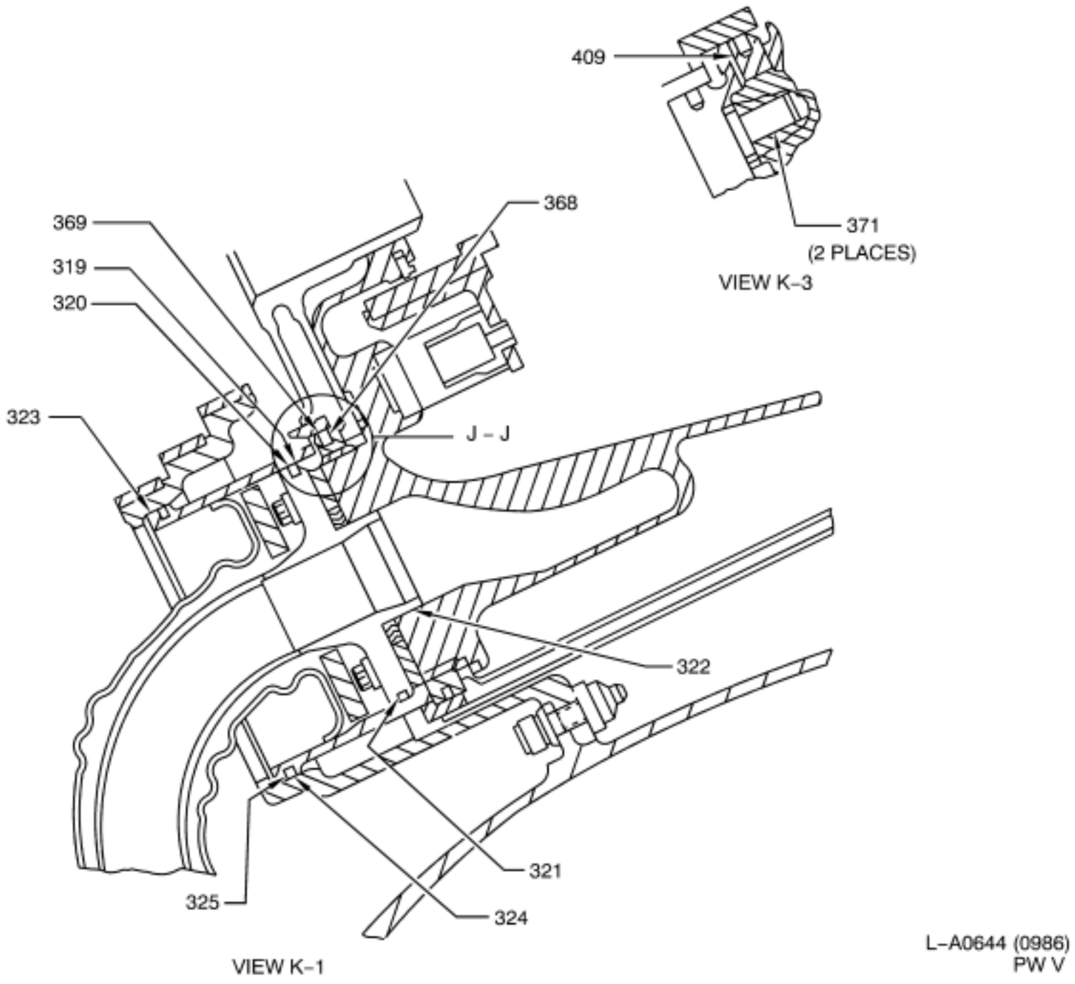
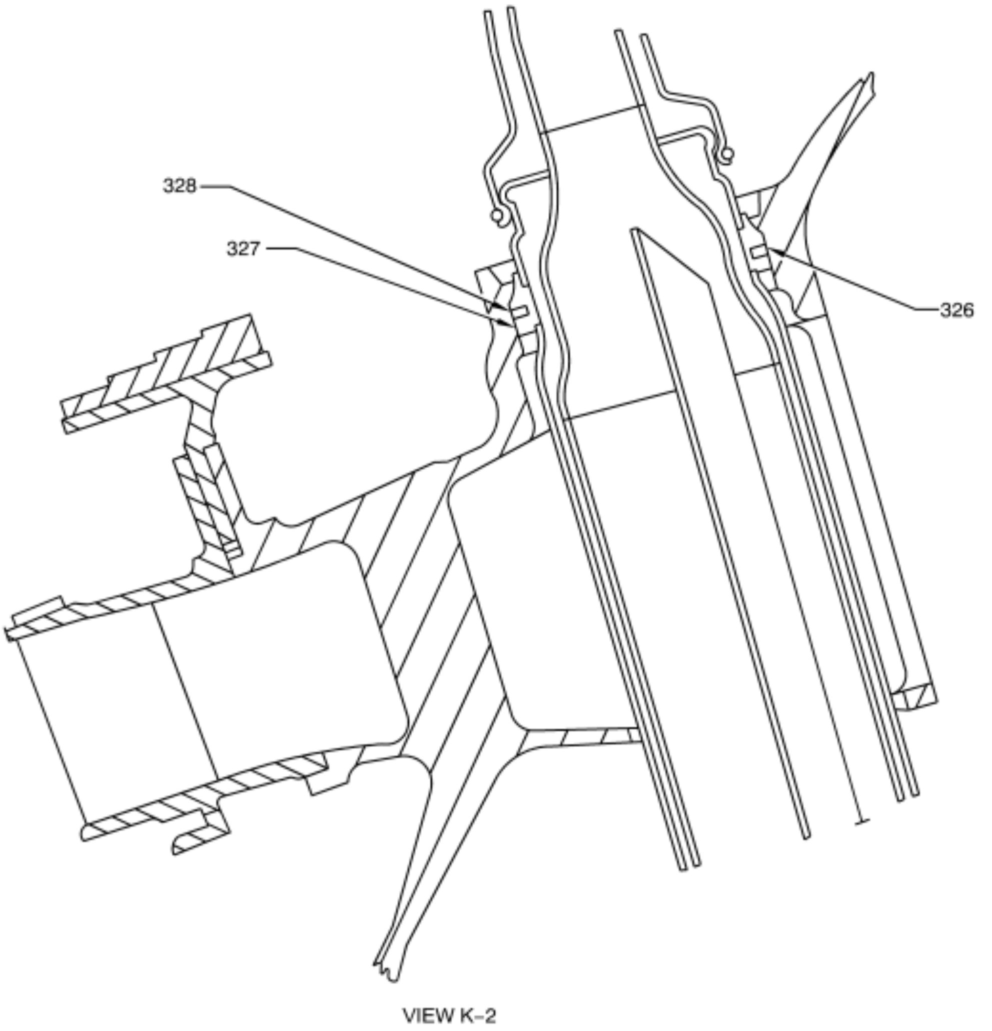
SCHEMATIC FRONT VIEW
K-1
K-2
K-3
SECTION K-K
L-B5976 (1297)
PW V

Diffuser And Conbuster (Post SB PW4ENG 72-652)
Figure 809 (Sheet 2)
(Task 72-41-00-990-001)

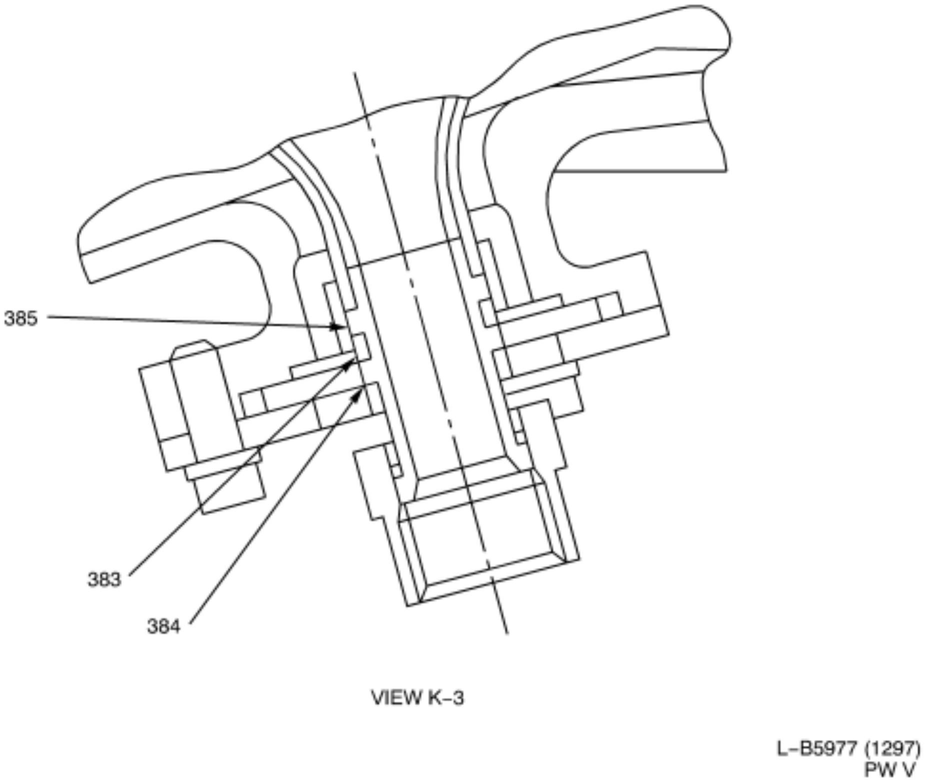

409
371
(2 PLACES)
VIEW K−3
369
368
319
320
323
J − J
322
321
325
324
VIEW K−1
L−A0644 (0986)
PW V

Diffuser And Combustion
Figure 809 (Sheet 3)
(Task 72−41−00−990−001)

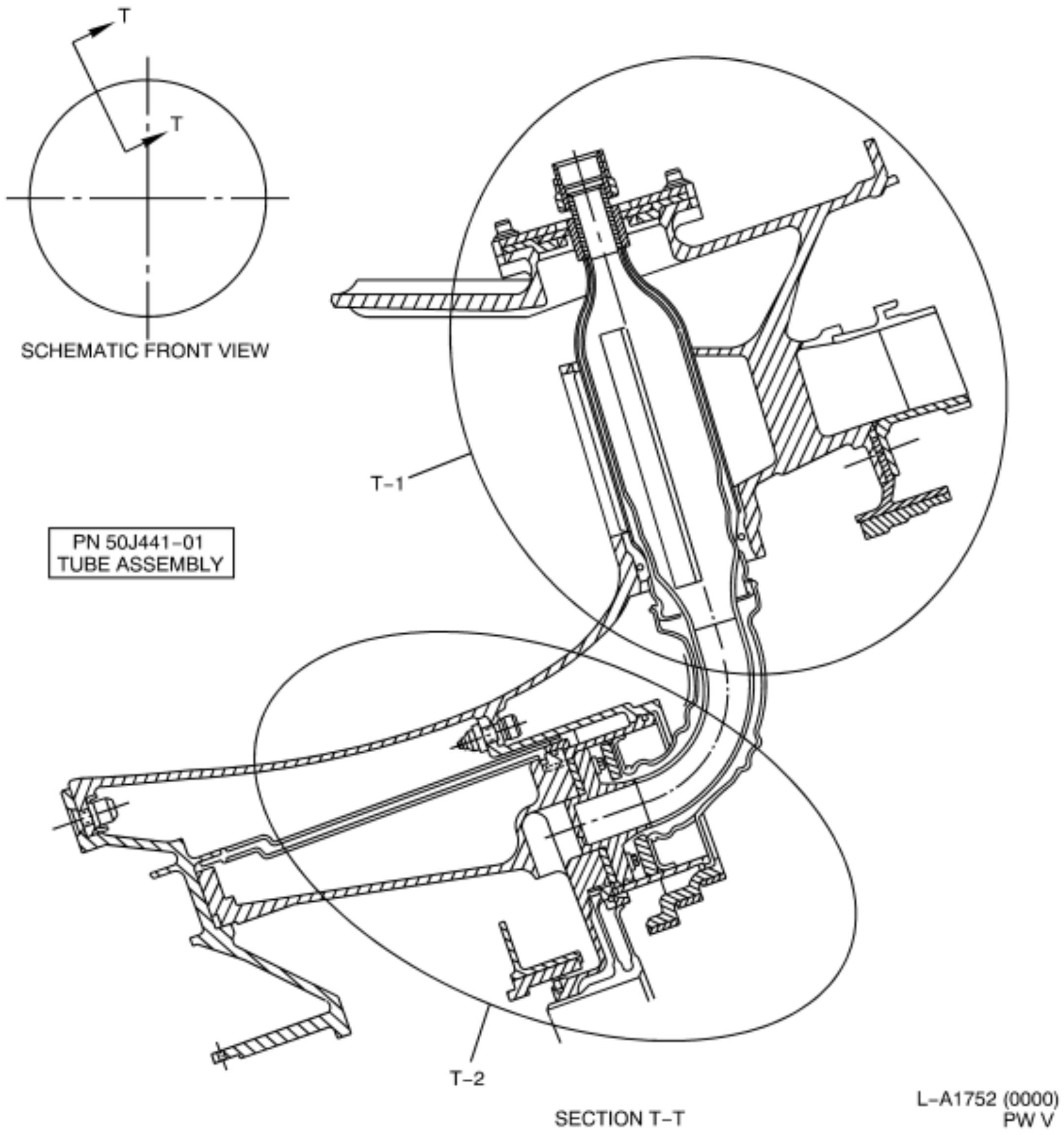


L−A0373 (0000)
PW V

Diffuser And Combustion
Figure 809 (Sheet 4)
(Task 72−41−00−990−001)


385
383
384
VIEW K−3
L−B5977 (1297)
PW V

Diffuser And Combustion (Post SB PW4ENG 72−652)
Figure 809 (Sheet 5)
(Task 72−41−00−990−001)


T
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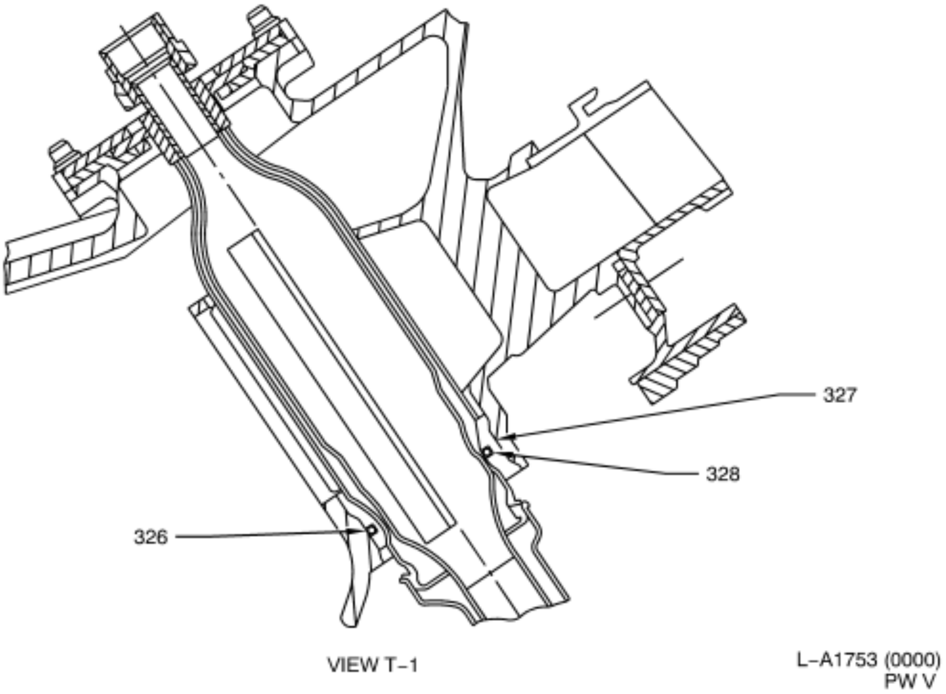
SCHEMATIC FRONT VIEW
T−1
PN 50J441−01
TUBE ASSEMBLY
T−2
SECTION T−T
L−A1752 (0000)
PW V

Diffuser And Combustion
Figure 810 (Sheet 1)
(Task 72−41−00−990−001)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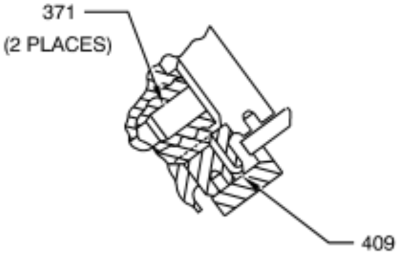
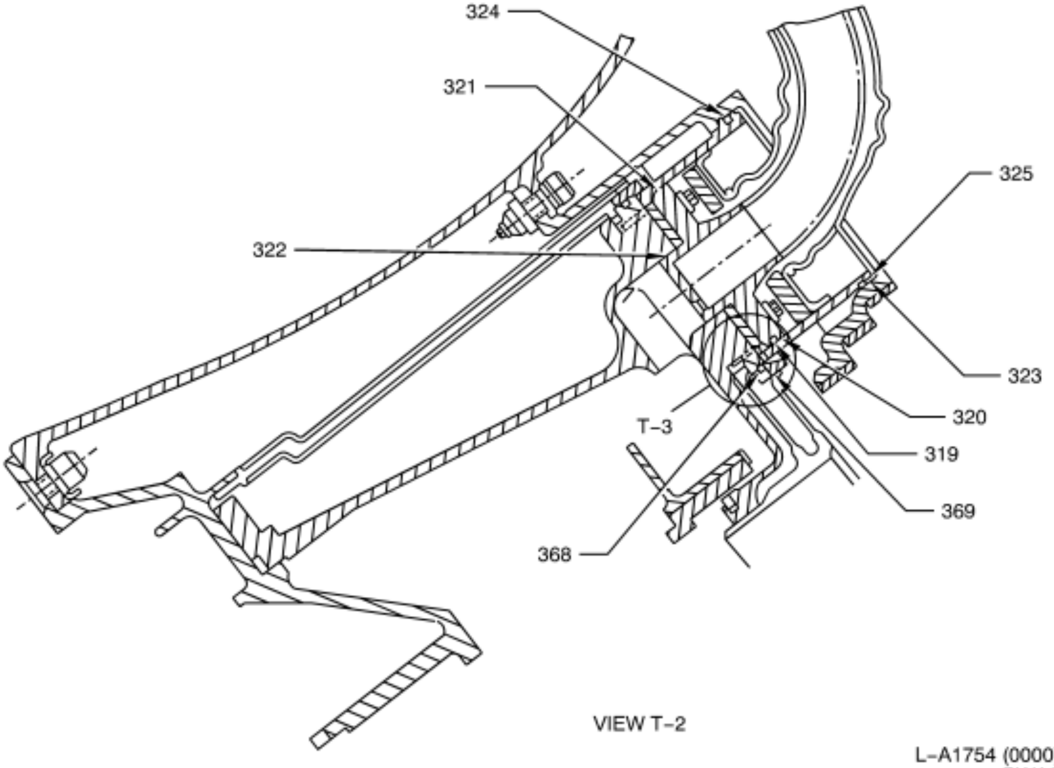
328
326
VIEW T−1
L−A1753 (0000)
PW V

Diffuser And Combustion
Figure 810 (Sheet 2)
(Task 72−41−00−990−001)


371
(2 PLACES)
409

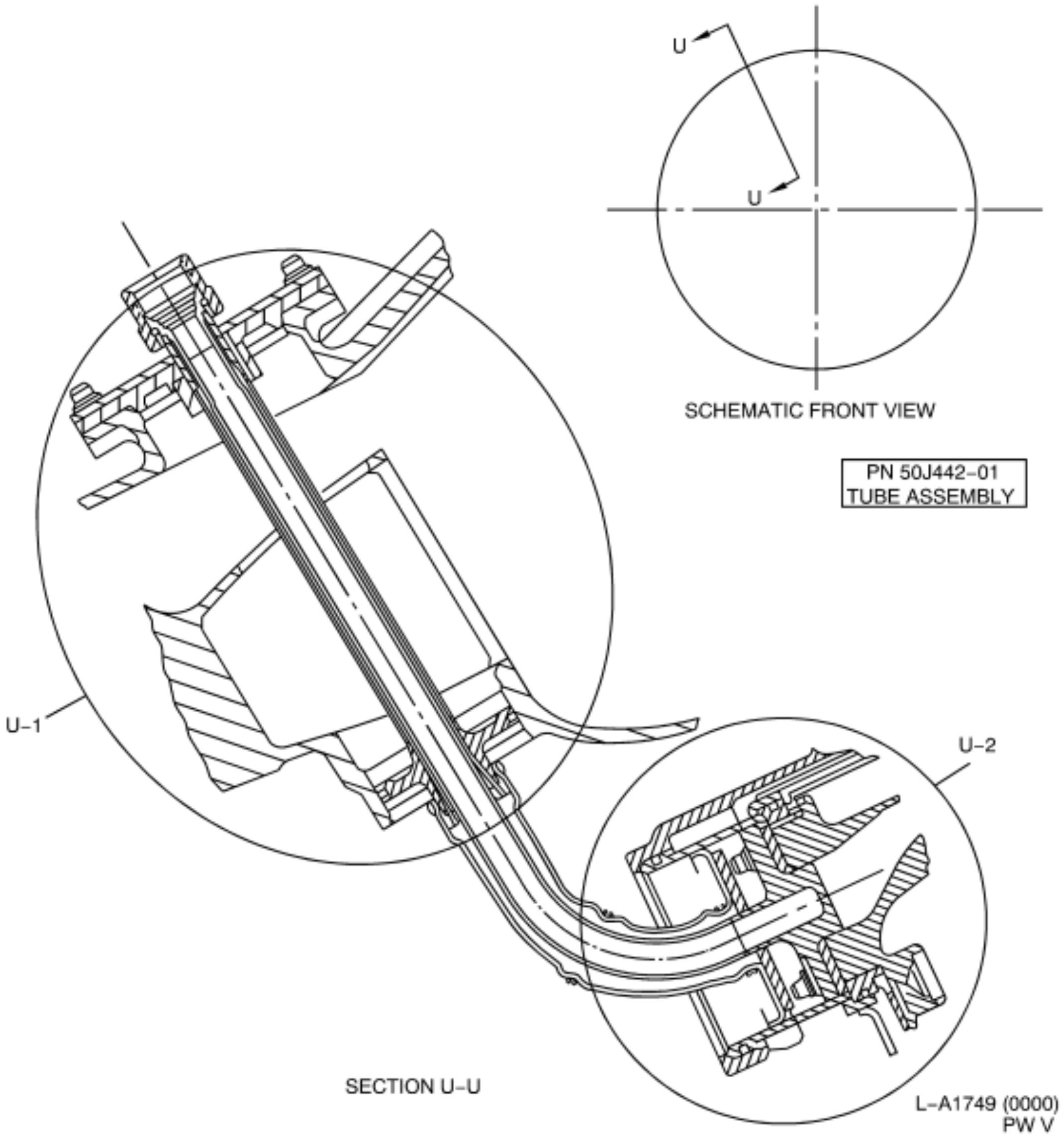
VIEW T−3


324
321
322
325
323
320
T−3
319
369
368

VIEW T−2

L−A1754 (0000)
PW V

Diffuser And Combustion
Figure 810 (Sheet 3)
(Task 72−41−00−990−001)


U
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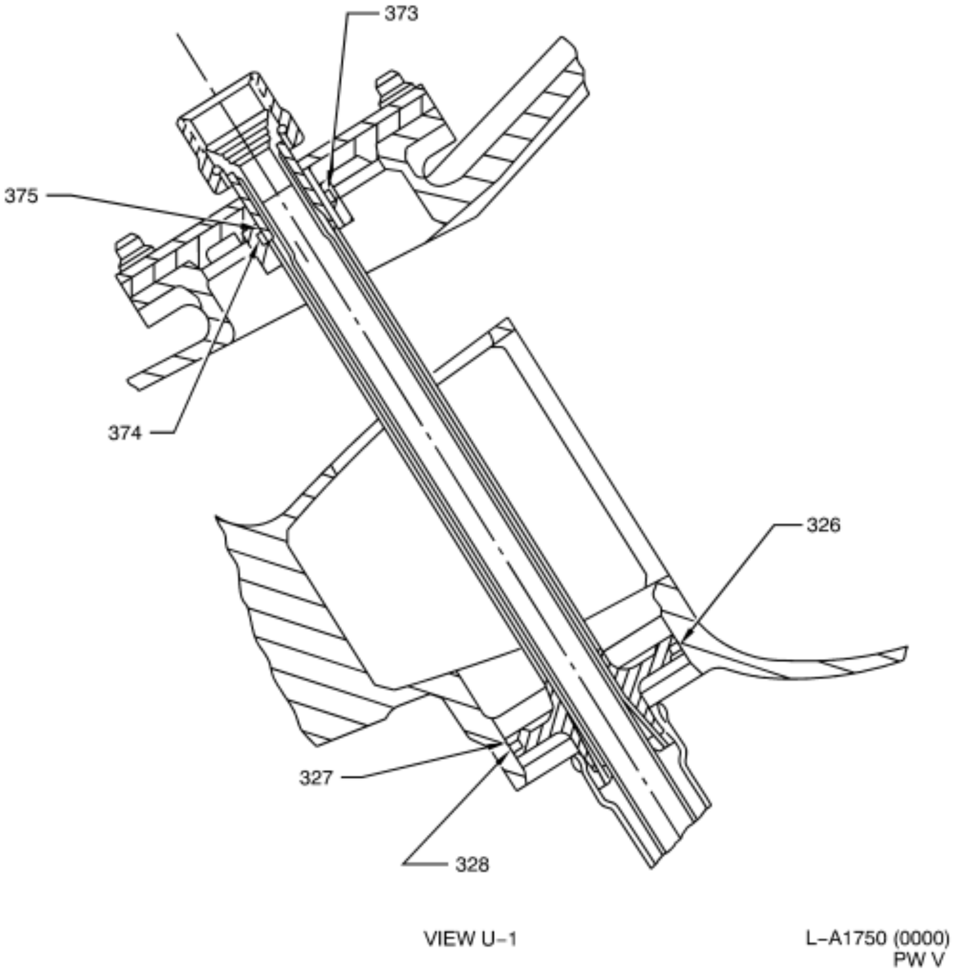
SCHEMATIC FRONT VIEW
PN 50J442−01
TUBE ASSEMBLY
U−1
U−2
SECTION U−U
L−A1749 (0000)
PW V

Diffuser And Combustion
Figure 810 (Sheet 4)
(Task 72−41−00−990−001)


373
375
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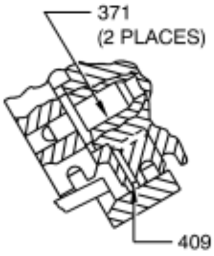
326
327
328
VIEW U-1
L-A1750 (0000)
PW V

Diffuser And Combustion
Figure 810 (Sheet 5)
(Task 72-41-00-990-001)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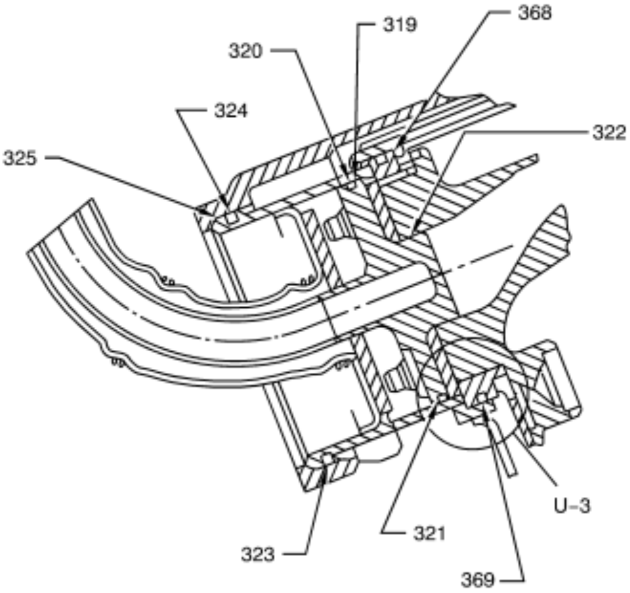
(2 PLACES)
409

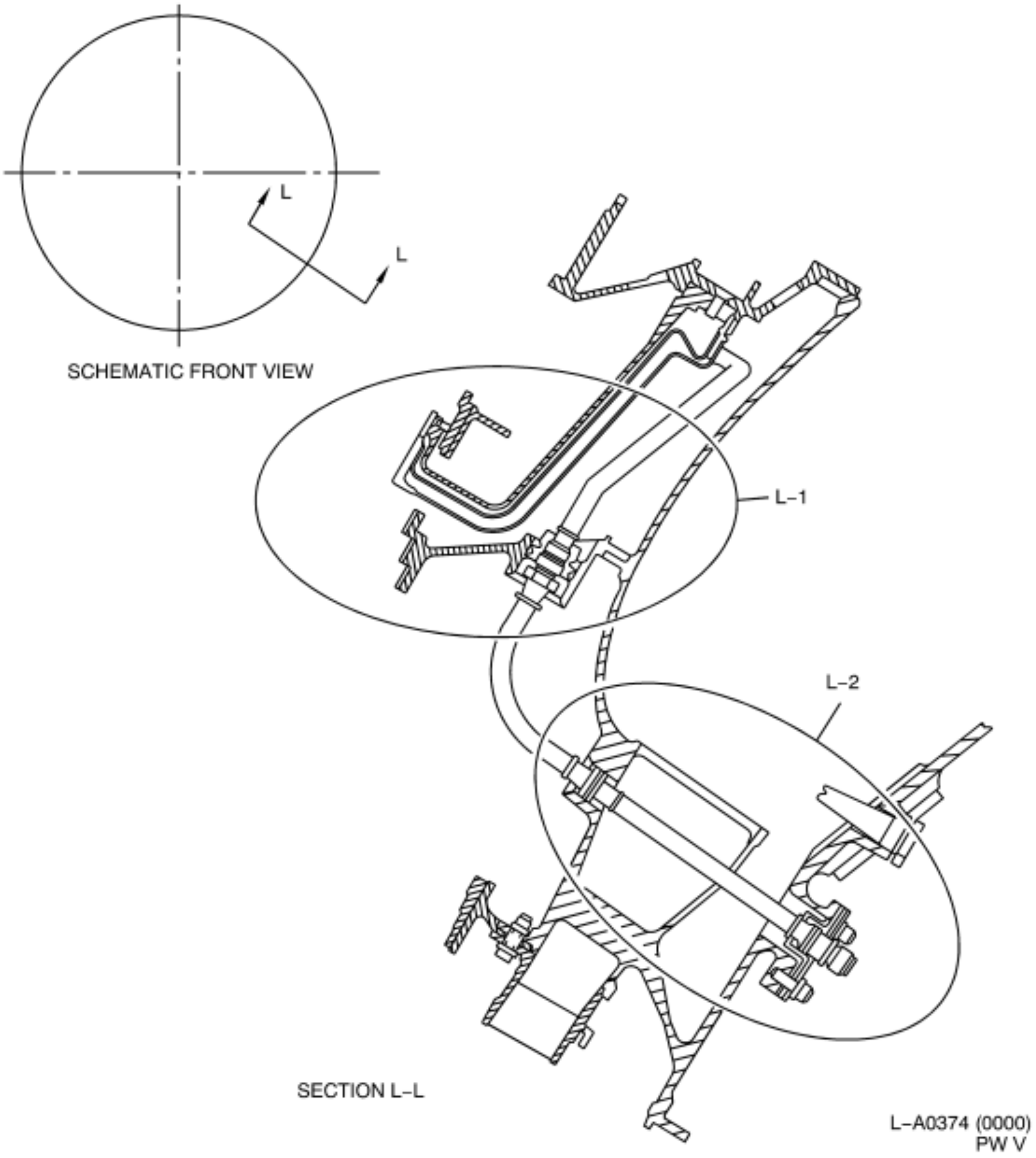
VIEW U−3


368
319
320
324
325
322
U−3
321
323
369

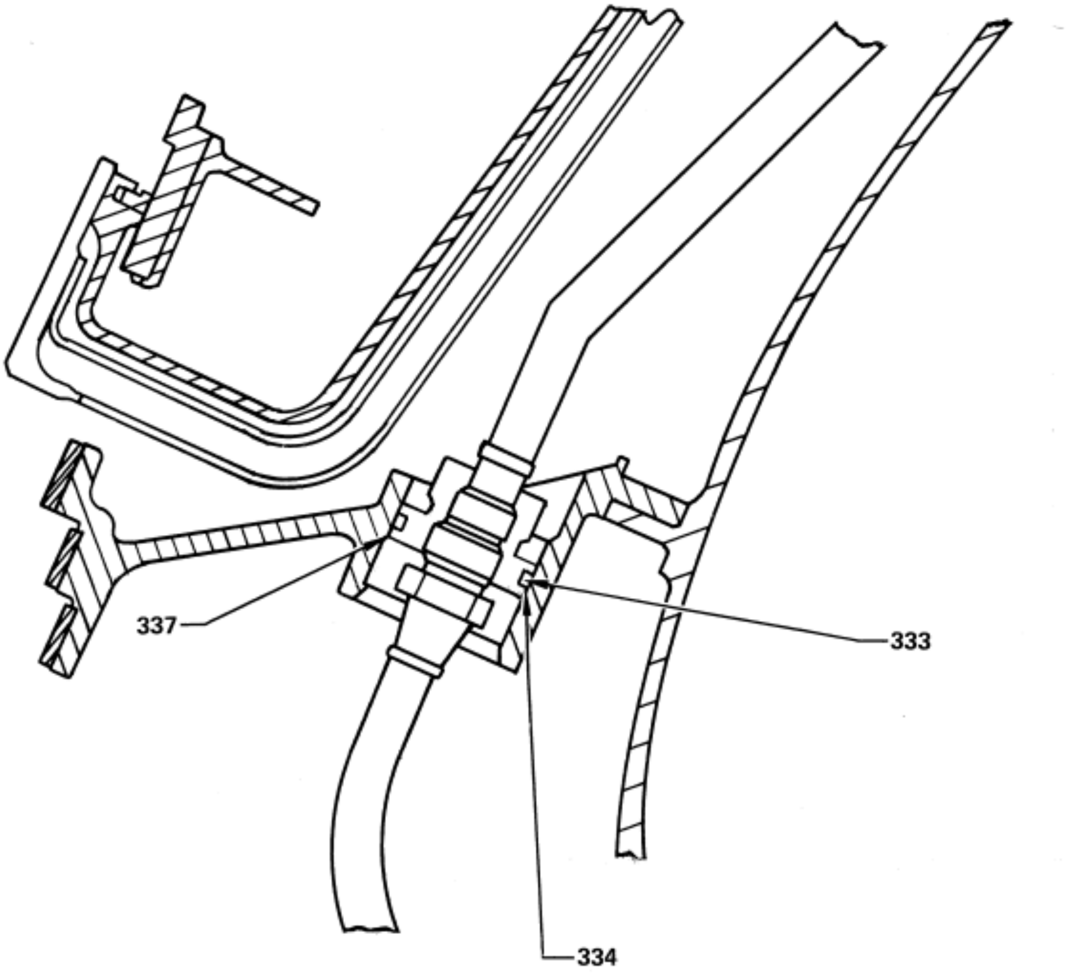
VIEW U−2

L−A1751 (0000)
PW V

Diffuser And Combustion
Figure 810 (Sheet 6)
(Task 72−41−00−990−001)


L
L
SCHEMATIC FRONT VIEW
L−1
L−2
SECTION L−L
L−A0374 (0000)
PW V

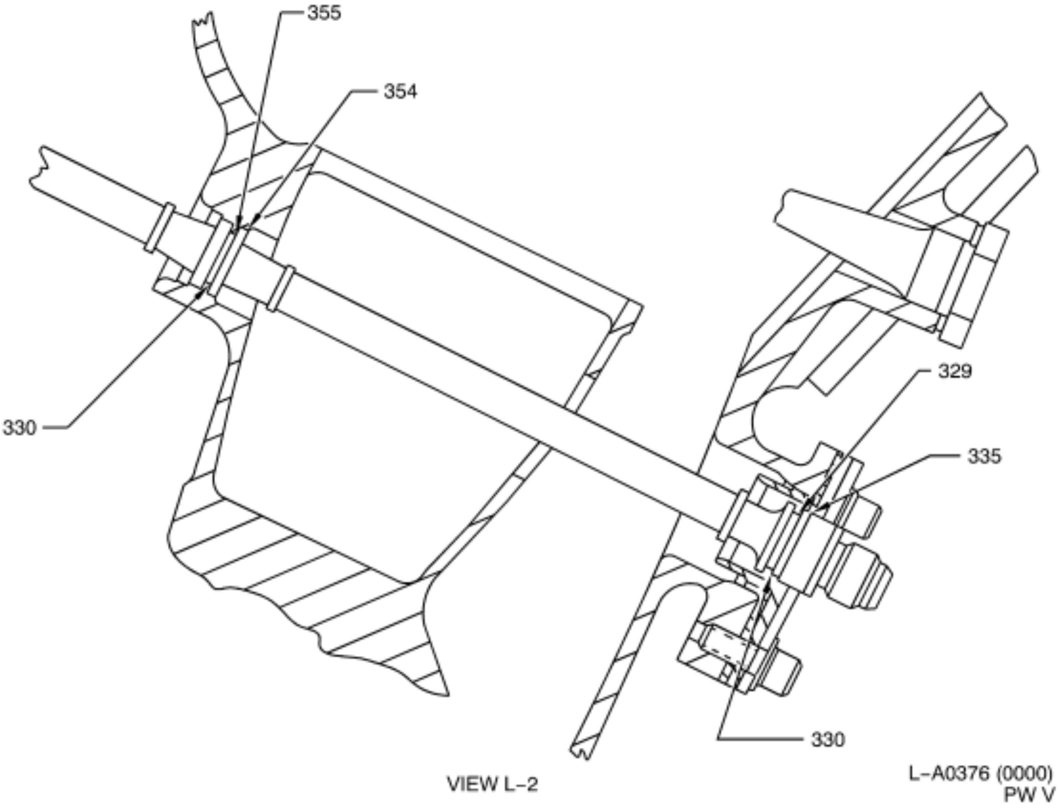
Diffuser And Combustion
Figure 811 (Sheet 1)
(Task 72−41−00−990−001)



VIEW L−1

L−A0375

Diffuser And Combustion
Figure 811 (Sheet 2)
(Task 72−41−00−990−001)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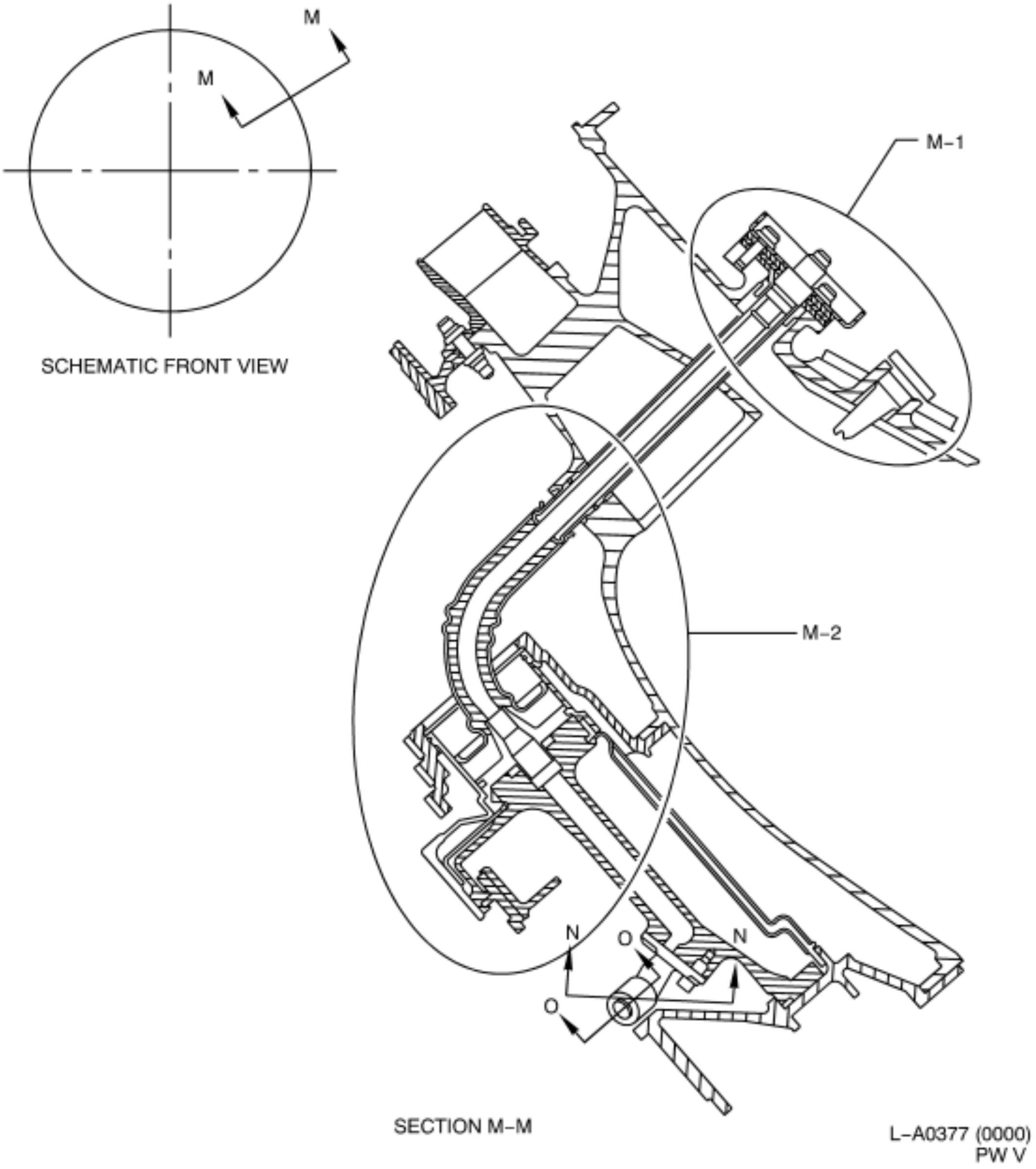
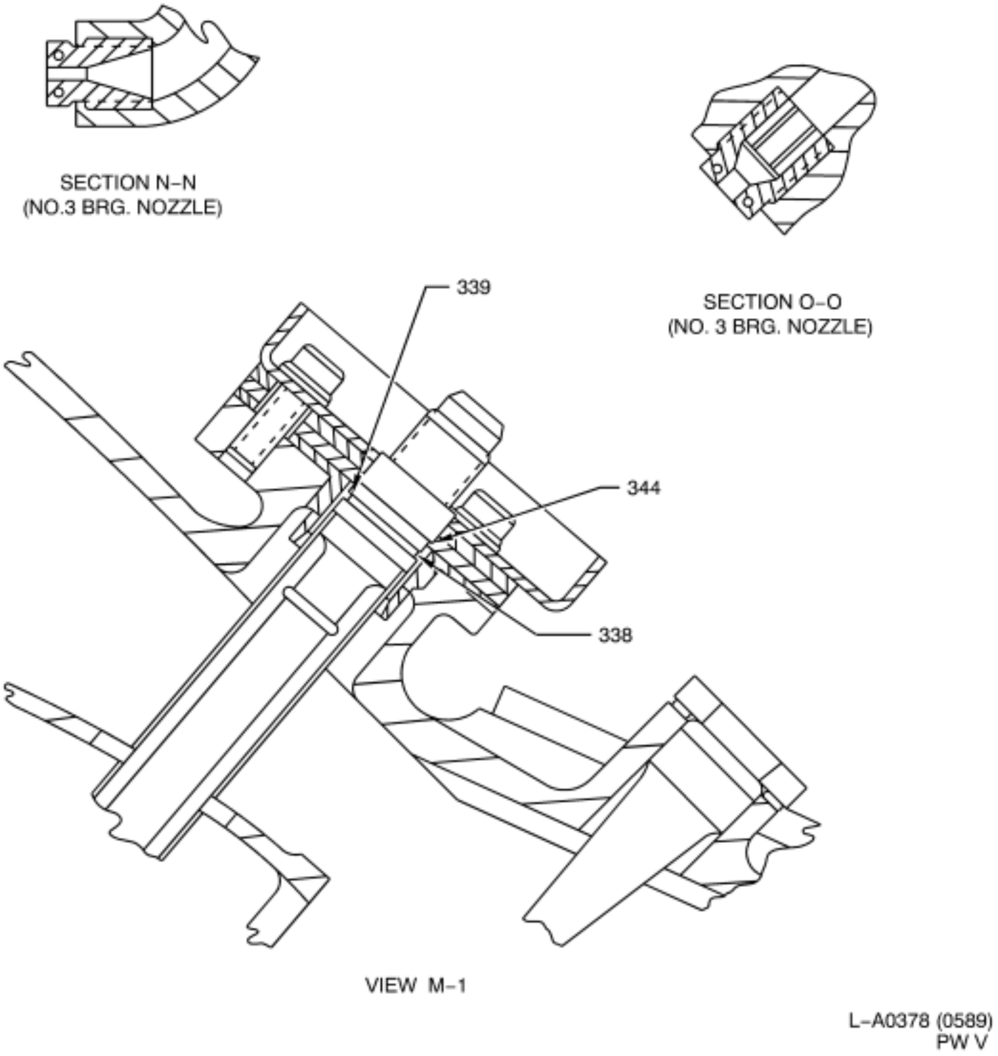
VIEW L−2
L−A0376 (0000)
PW V

Diffuser And Combustion
Figure 811 (Sheet 3)
(Task 72−41−00−990−001)


M
M
SCHEMATIC FRONT VIEW
M−1
M−2
N
O
N
O
SECTION M−M
L−A0377 (0000)
PW V

Diffuser And Combustion
Figure 812 (Sheet 1)
(Task 72−41−00−990−001)

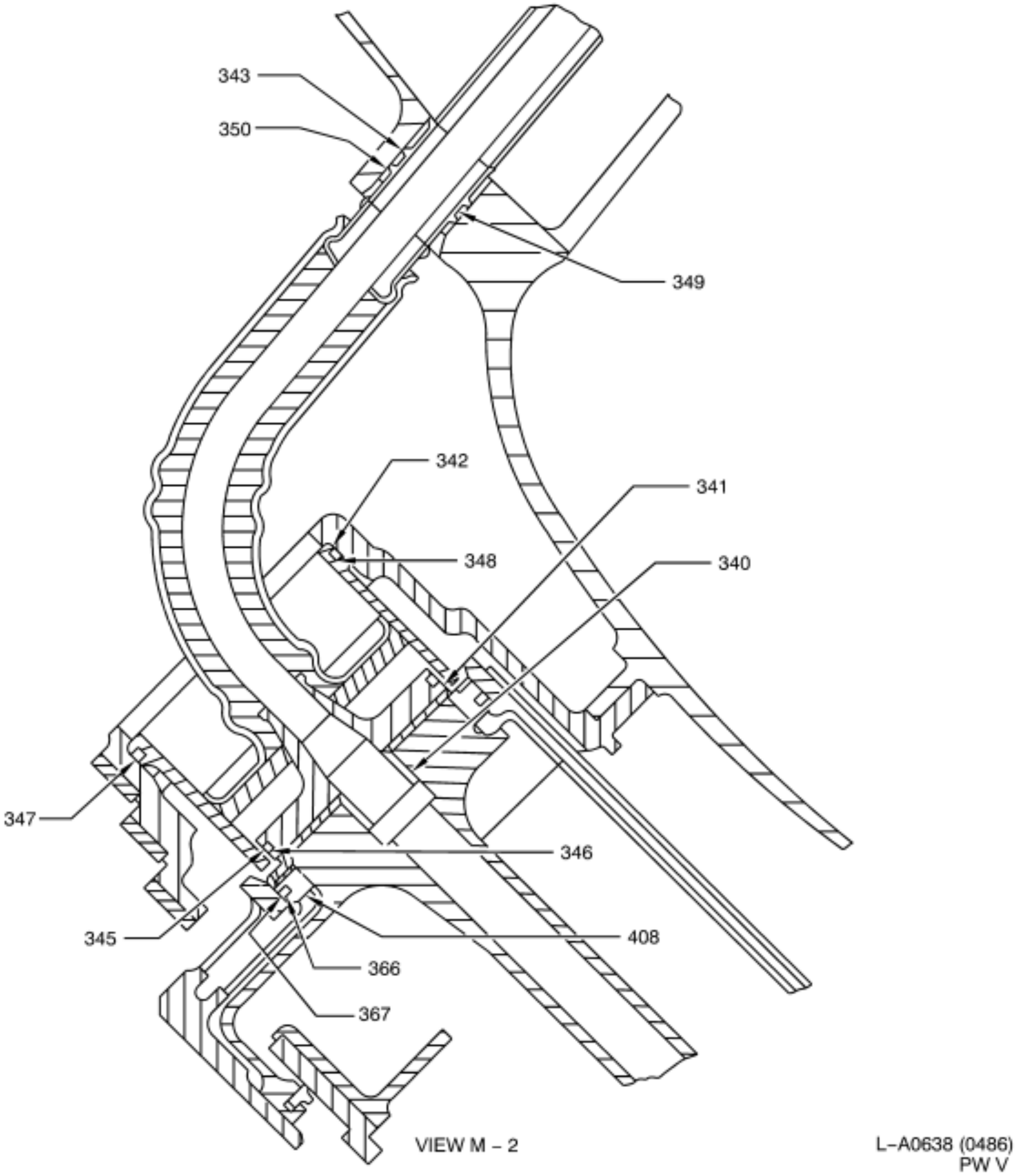


SECTION N-N
(NO.3 BRG. NOZZLE)

SECTION O-O
(NO. 3 BRG. NOZZLE)

VIEW M-1

Diffuser And Combustion
Figure 812 (Sheet 2)
(Task 72-41-00-990-001)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350
349
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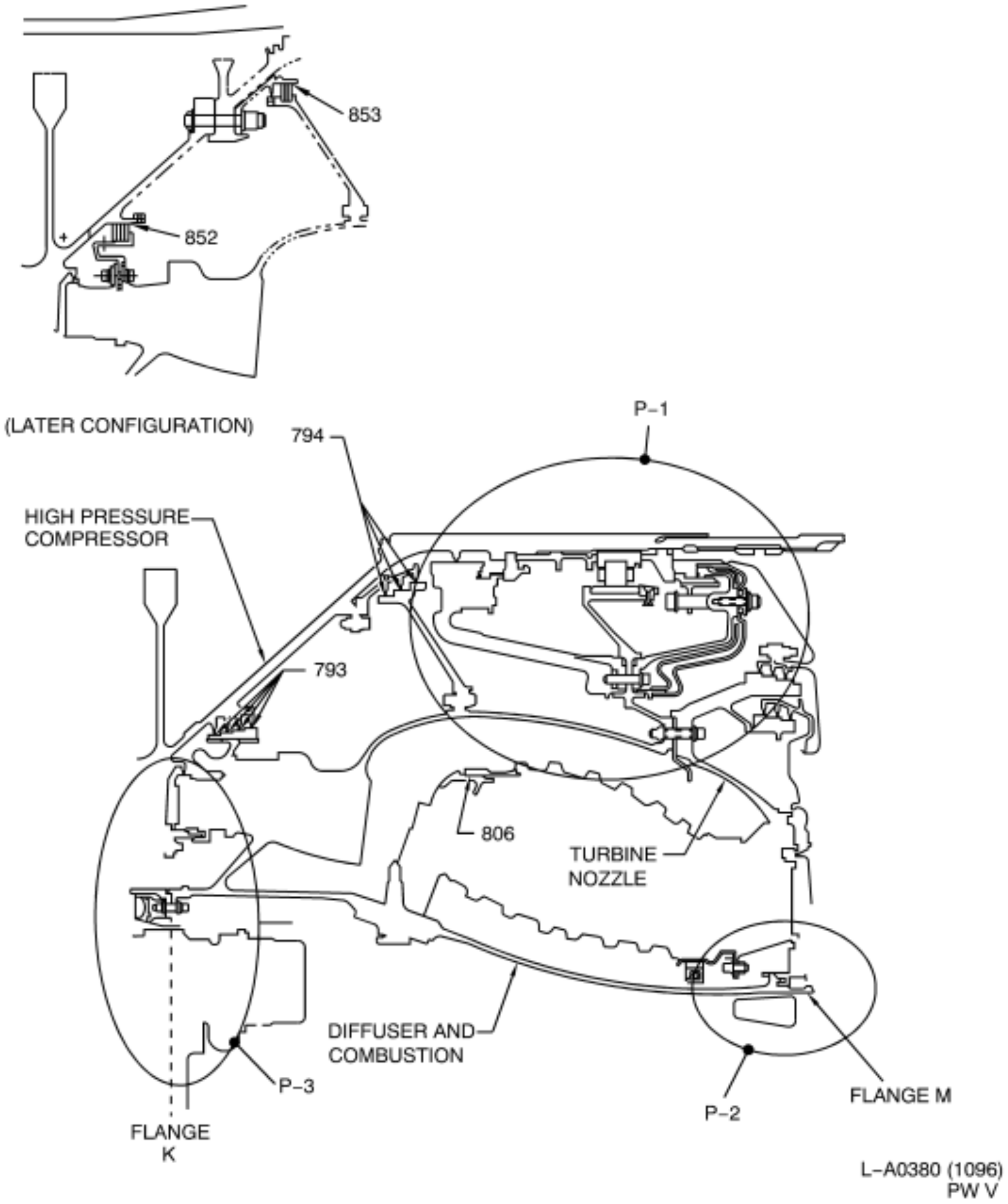
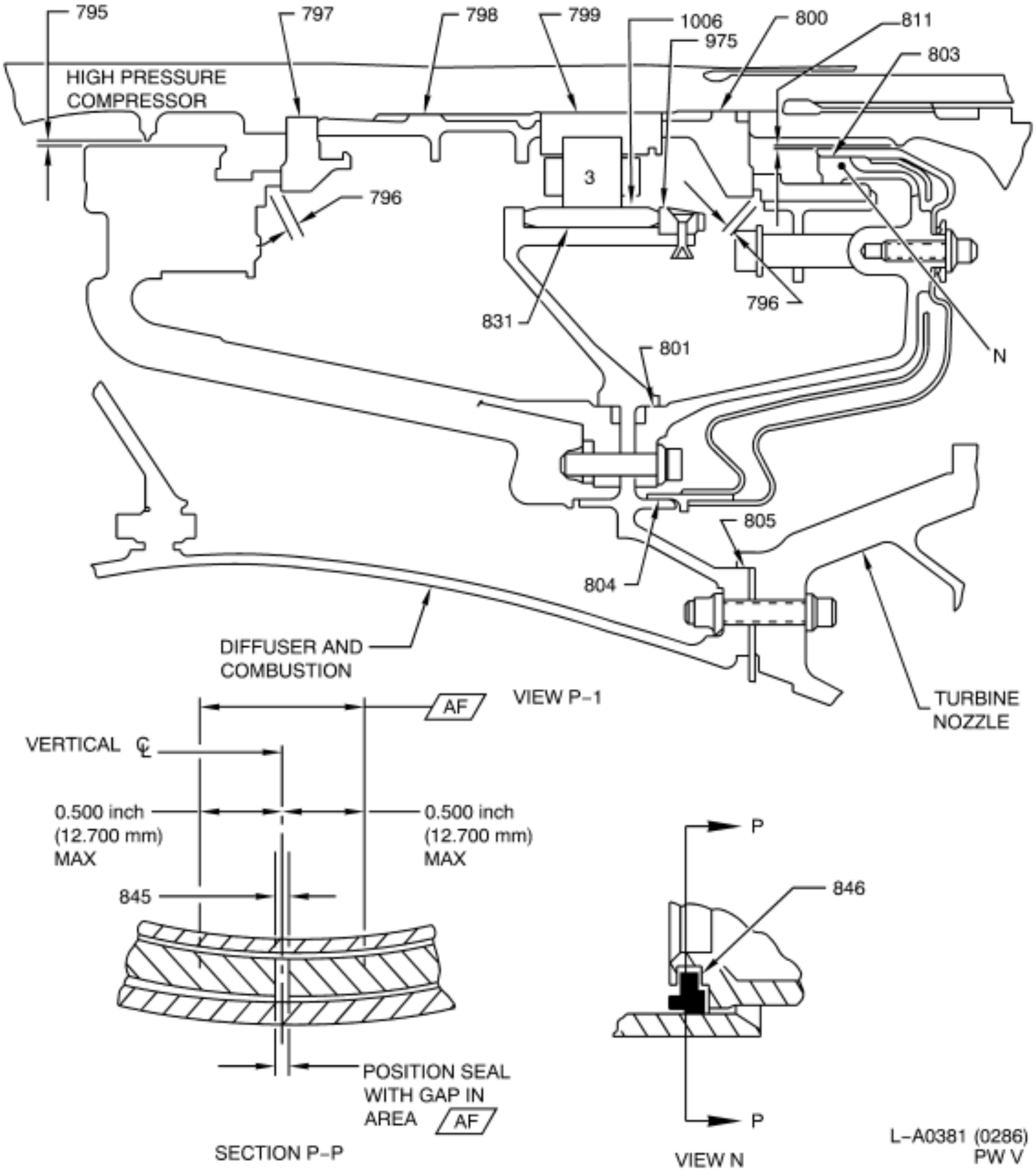
408
366
367
VIEW M - 2
L-A0638 (0486)
PW V

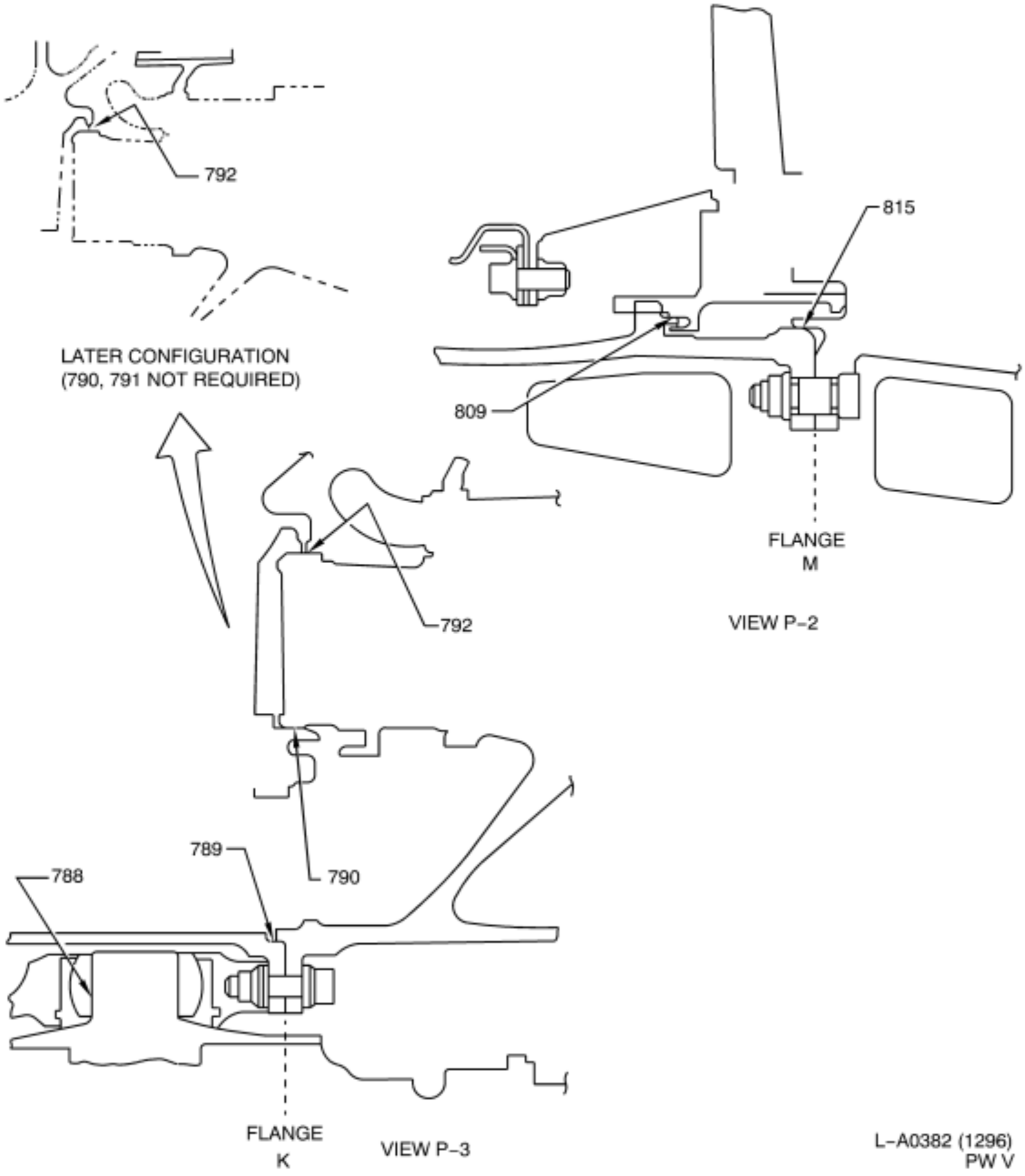
Diffuser And Combustion
Figure 812 (Sheet 3)
(Task 72-41-00-990-001)


853
852
(LATER CONFIGURATION)
794
P-1
HIGH PRESSURE COMPRESSOR
793
806
TURBINE NOZZLE
DIFFUSER AND COMBUSTION
P-3
FLANGE K
P-2
FLANGE M
L-A0380 (1096)
PW V

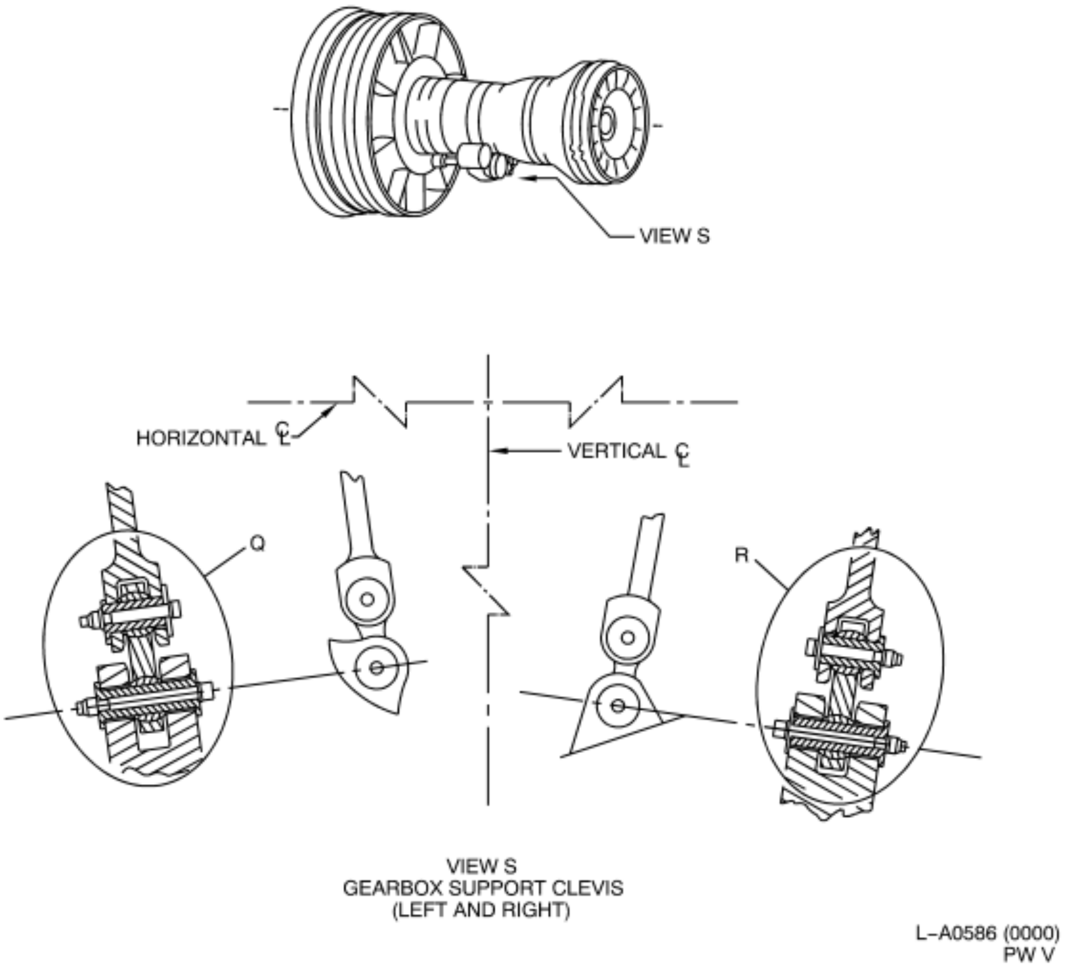
Diffuser And Combustion
Figure 813 (Sheet 1)
(Task 72-41-00-990-001)


795
797
798
799
1006
975
800
811
803
HIGH PRESSURE COMPRESSOR
3
796
796
831
801
N
805
804
DIFFUSER AND COMBUSTION
VIEW P-1
TURBINE NOZZLE
AF
VERTICAL ℄
0.500 inch (12.700 mm) MAX
0.500 inch (12.700 mm) MAX
845
P
846
P
POSITION SEAL WITH GAP IN AREA AF
SECTION P-P
VIEW N
L-A0381 (0286)
PW V

Diffuser And Combustion
Figure 813 (Sheet 2)
(Task 72−41−00−990−001)

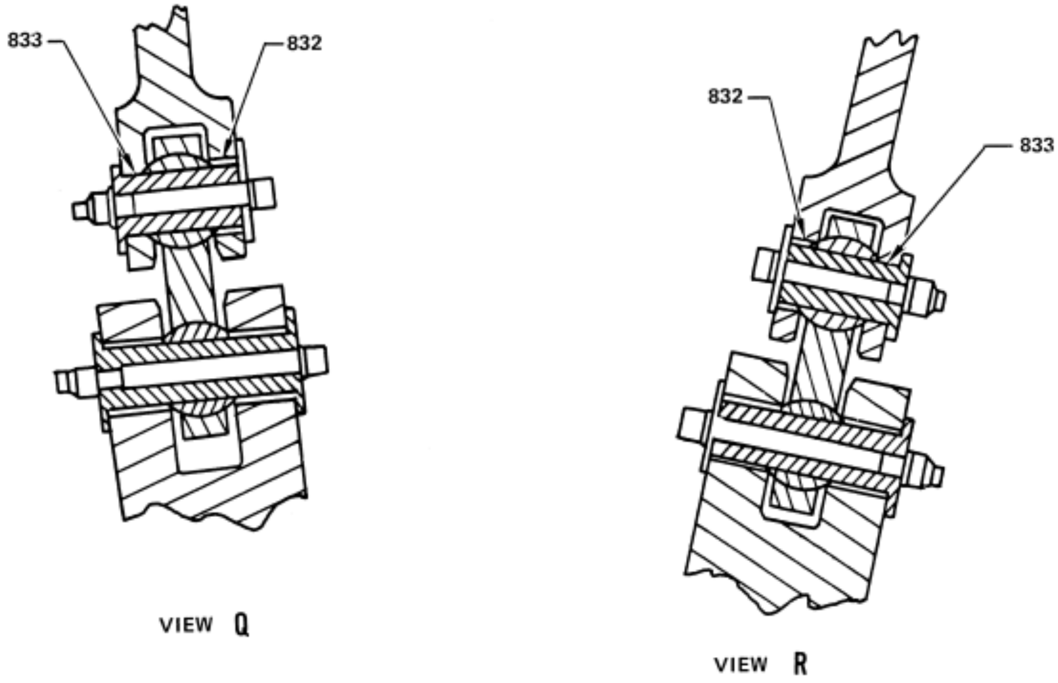

792
LATER CONFIGURATION
(790, 791 NOT REQUIRED)
815
809
FLANGE
M
VIEW P−2
792
789
788
790
FLANGE
K
VIEW P−3
L−A0382 (1296)
PW V

Diffuser And Combustion
Figure 813 (Sheet 3)
(Task 72−41−00−990−001)


VIEW S
HORIZONTAL ℄
VERTICAL ℄
Q
R
L−A0586 (0000)
PW V

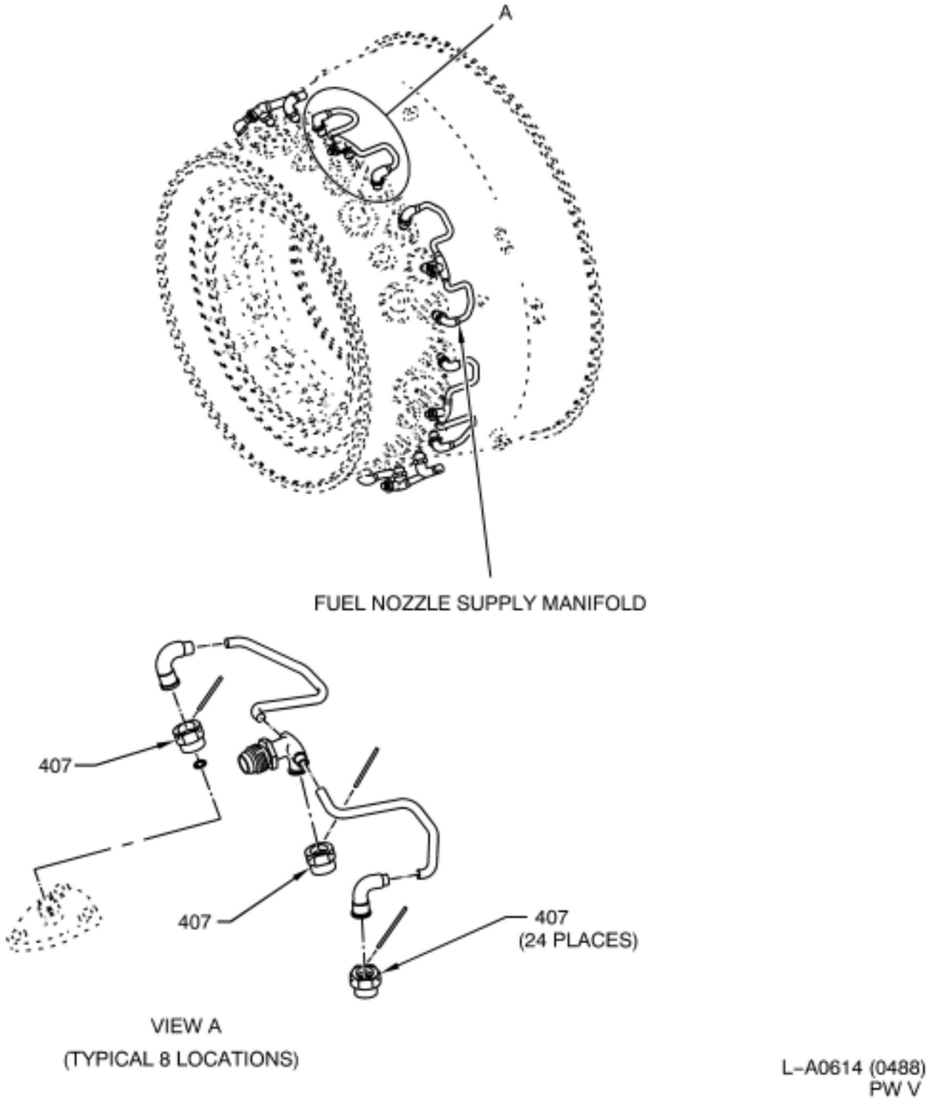
VIEW S
GEARBOX SUPPORT CLEVIS
(LEFT AND RIGHT)

Diffuser And Combustion
Figure 814 (Sheet 1)
(Task 72−41−00−990−001)

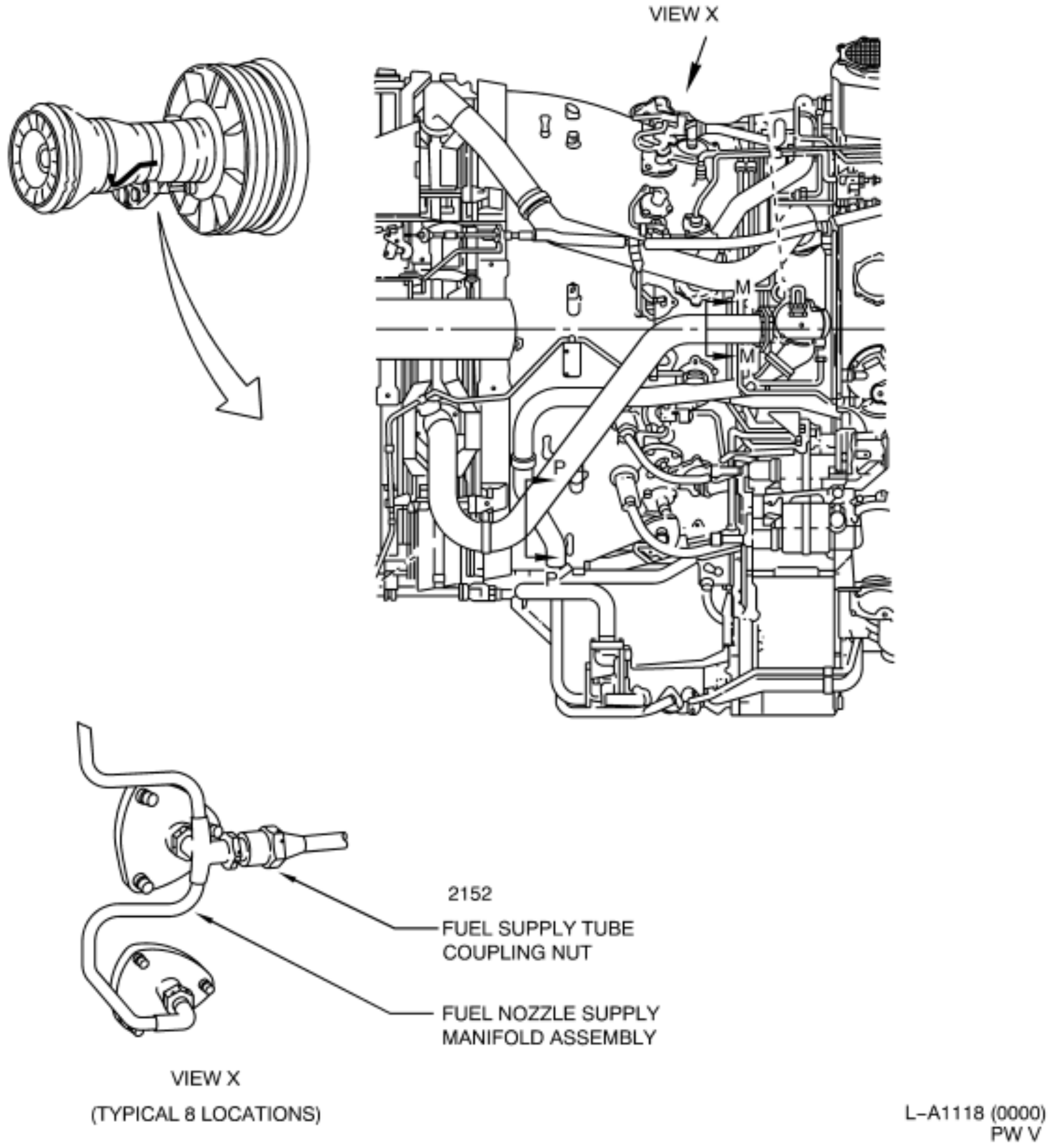

833
832
VIEW Q
832
833
VIEW R

L-A0602

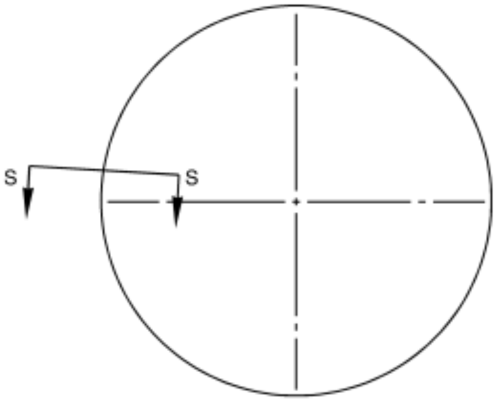
Diffuser And Combustion
Figure 814 (Sheet 2)
(Task 72-41-00-990-001)


A
FUEL NOZZLE SUPPLY MANIFOLD
407
407
407
(24 PLACES)
VIEW A
(TYPICAL 8 LOCATIONS)
L−A0614 (0488)
PW V

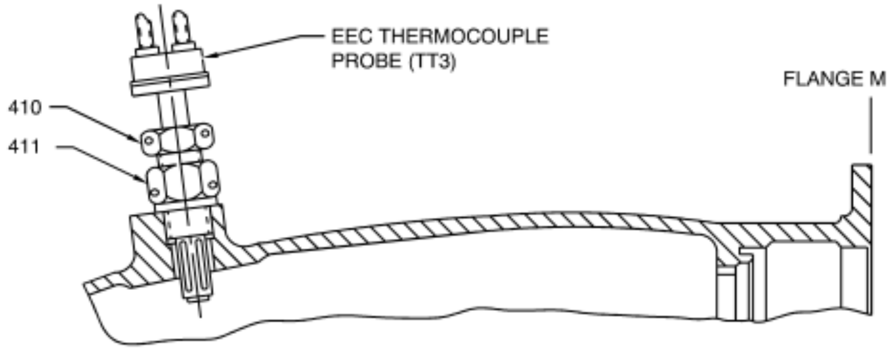
Diffuser And Combustion
Figure 815 (Sheet 1)
(Task 72−41−00−990−001)


VIEW X
M
M
P
P
2152
FUEL SUPPLY TUBE COUPLING NUT
FUEL NOZZLE SUPPLY MANIFOLD ASSEMBLY
VIEW X
(TYPICAL 8 LOCATIONS)
L−A1118 (0000)
PW V

Diffuser And Combustion
Figure 815 (Sheet 2)
(Task 72−41−00−990−001)



SCHEMATIC FRONT VIEW


EEC THERMOCOUPLE PROBE (TT3)
410
411
FLANGE M

SECTION S−S
(ROTATED 90 DEGREES)

L−A1724 (0000)
PW V

Diffuser And Combustion
Figure 816
(Task 72−41−00−990−001)

Previous Pageblock   Return to Previous Menu   Next Pageblock

DIFFUSER AND COMBUSTOR - INSPECTION/CHECK-05

Task 72-41-00-200-005:

1. Functional Check - Vacuum Check No. 3 Bearing Compartment

A. Equipment And Materials Required

Standard Tools:
PN AN929-8 Cap
PN MS24404-01 Plugs (Two Required)

Special Tools:
PWA 85482 Fixture, Vacuum Check

B. Procedure

Subtask 72-41-00-720-052:

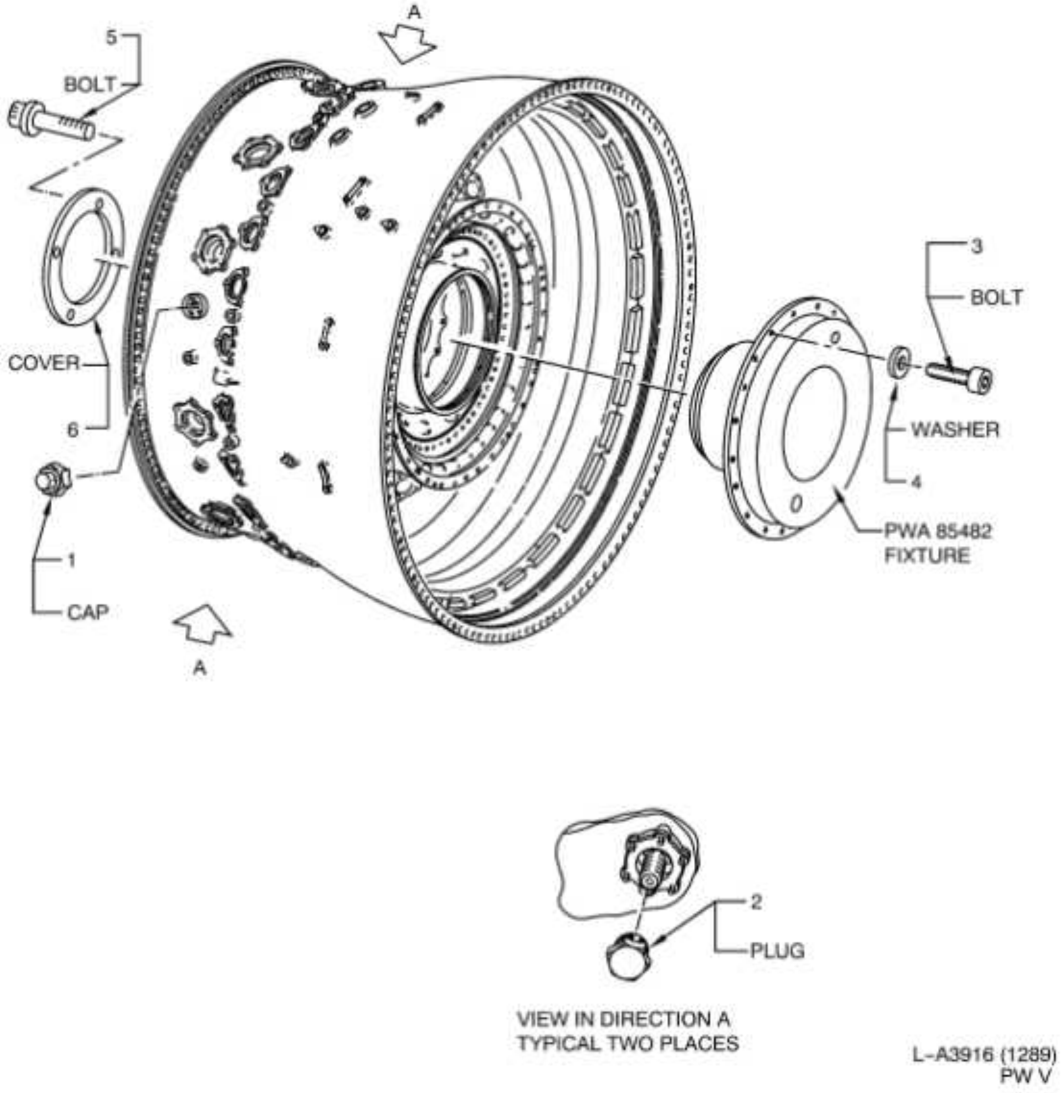
(1) Install PWA 85482 Fixture into diffuser combustor. See Figure 801.
  (a) Prior to installation of fixture, inspect spacer micro finish faces for damage. Repair as required.
  (b) Align boltholes and install fixture, small end first, into rear end of diffuser case, and seal on rear flange of No. 3 bearing housing. Secure fixture with ten detail cap screws (801/3) and washers (801/4).
  (c) Align boltholes and install front cover (801/6) to fixture and secure with four bolts (801/5).

(2) Install AN929-8 Cap (801/1) to No. 3 bearing pressure tube at 10 o'clock position. Tighten cap.

(3) Install two MS24404-01 Plugs (801/2) to No. 3 bearing breather tube at one o'clock position and No. 3 bearing scavenge tube at 6:30 o'clock position. Tighten plugs.

(4) Attach vacuum hose and pressure sense line from CTE vacuum cart to cover. Vacuum check No. 3 bearing compartment with the vacuum cart pressure set at PAMB minus 10 psi (69 kPa), or PAMB minus 20 inches (508 mm) HG. At sea level this is 5.0 psia (34.5 kPa absolute). Airflow must not exceed eight lb. (3.63 kg) per hour.

(5) Shut off vacuum and disconnect lines from fixture. Remove all tooling from diffuser case. Install protective closures on tubes.


A
5
BOLT
COVER
6
1
CAP
A
3
BOLT
WASHER
4
PWA 85482
FIXTURE
2
PLUG
VIEW IN DIRECTION A
TYPICAL TWO PLACES
L−A3916 (1289)
PW V

Vacuum Check No. 3 Bearing Compartment
Figure 801
(Task 72−41−00−200−005)

Previous Pageblock Return to Previous Menu Next Pageblock

DIFFUSER AND COMBUSTOR - INSPECTION/CHECK-06

Task 72-41-00-990-006:

1. Visual Inspection - Diffuser And Combustion

   A. For inspection requirements applicable to installed (accessible) parts of the diffuser and combustion areas see 72-00-41, Inspection/Check-08 (Task 72-00-41-210-008).

   B. Visually inspect the diffuser and combustion areas for obvious surface defects and/or deformations which will preclude proper functioning of any of the parts. If defects are noted on any of the parts see the individual part section for damage limits.

Task 72-41-00-400-001:

1. Assemble The Diffuser And Combustor

A. Prerequisites

(1) See Inspection/Check-04 Task 72-41-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a referenced number. For example: (Reference 1234) Torque retaining nut as follows.

(2) Assemble No. 3 bearing duct and housing. See Assembly-02 Task 72-41-00-400-002-001 or Assembly-04 Task 72-41-00-400-002-002.

B. Equipment And Materials Necessary

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

CTE 5070	Cart, Airflow (Optional To PWA 6070)
CTE 6070	Cart, Airflow
PWA 24524	Tap
PWA 25039	Stand
PWA 25450	Aligning Pin (Two Necessary)
PWA 27641	Tap
PWA 27918	Sling (Optional To PWA 80555)
PWA 28657	Sling
PWA 29754	Control, Heater
PWA 75509	Gage, Immersion
PWA 76154	Adapter (Two Necessary)
PWA 80555	Sling
PWA 85044	Stand (Optional to PWA 86508)
PWA 85046	Pin, Two Necessary
PWA 85060	Pin
PWA 85565	Adapter
PWA 85626	Gage, Immersion
PWA 85751	Bracket (Two Necessary)
PWA 85983	Adapter, Stabilizer (Two Necessary, Twin Overhead Rail System Only)
PWA 86508	Build Stand
PWA 87006	Adapter, Wrench
PWA 87153	Heater, Electrical
PWA 87154	Pin, Guide

DIFFUSER AND COMBUSTOR - ASSEMBLY-01

Special Tools:

(CONTINUED)

PWA 87649	Gage, Angle
PWA 101455	Clamp, Installation
PWA 101456	Clamp, Installation
PWA 101863	Pin, Alignment
PWA 103081	Adapter, Torque

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire (AS3214-02)
	P05-291	Cable, Safety (Optional)
	P05-292	Ferrule, Safety Cable (Optional)
	P05-365	Lockwire (AS3214-03)
	P05-395	Beeswax
	P05-396	Paraffin Wax Blend
	P06-023	Lubricant, Silvergoop (PWA 36001)
	P06-053	Lubricant, Sealing Ring (PWA 36500)
R	P06-054	Anti-seize, Paste (PWA 36246)
	P11-027	Solvent, Petroleum (PMC 9001)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	6	72-41-00/1/130
Gasket	7	72-41-00/1A/100
Gasket	2	72-41-00/4/20
Gasket	1	72-41-00/3/30
Gasket	1	72-41-00/3/60
Gasket	1	72-41-00/6/50
Gasket	2	72-41-00/7/20
Gasket	1	72-41-00/2/10
Gasket	2	72-41-00/4/70
Gasket	1	72-41-00/5/50
Gasket	2	72-41-00/5/150
Gasket	1	72-41-00/5/60
Gasket	2	72-41-00/5/180
Gasket	24	73-13-00/1/1
Gasket	1	73-23-00/3/10
Key Washer	2	74-21-00/2/20
Packing	24	73-13-00/2/1
Seal Ring	1	72-41-00/3/1
Seal Ring	1	72-41-00/3/10
Seal Ring	1	72-41-00/3/20

DIFFUSER AND COMBUSTOR - ASSEMBLY-01

Expendable Parts:

(CONTINUED)

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Seal Ring	2	72-41-00/4/1
Seal Ring	2	72-41-00/4/10
Seal Ring	1	72-41-00/4/160
Seal Ring	1	72-41-00/4/165
Seal Ring	1	72-41-00/4/165A
Seal Ring	1	72-41-00/5/1
Seal Ring	2	72-41-00/5/10
Seal Ring	3	72-41-00/6/1
Seal Ring	4	72-41-00/6/30
Seal Ring	4	72-41-00/7/1
Seal Ring	2	72-41-00/8/30
Seal Ring	1	72-41-00/8/150
Seal Ring	1	72-41-00/8/170
Seal Ring	1	72-41-00/8/190
Seal Ring	2	72-41-00/8/210

C. Procedure
See Figure 1001.

Subtask 72-41-00-430-051:

(1) Install diffuser case in PWA 25039 Build Stand.

NOTE: If you have a twin overhead rail system you must use PWA 85983 Stabilizer Adapter with PWA 85751 Brackets.

(a) Install two PWA 85751 Handling Brackets (1001/4) to diffuser case.

1 Using hoist, position longer front flange of brackets to rear of front flange of diffuser case at 3 and 9 o'clock locations, locating four pins in front flange of bracket into four boltholes in diffuser case front flange. Position shorter rear flange of bracket to front of diffuser case rear flange and secure with detail nuts and bolts.

2 Position double spool bracket in rear most two holes as marked on bracket.

R
R

WARNING: USE TWO OPERATORS WHEN INSTALLING OR TRUNNIONING CASE IN STAND. WHEN BALL LOCK PIN IS REMOVED, CASE MAY TRUNNION BY ITSELF, AND POSSIBLY CAUSE INJURY.

(b) Using hoist (1001/1) PWA 28657 Sling (1001/2) and two PWA 76154 Adapters (1001/3) trunnion and install diffuser case into PWA 25039 Stand (1001/5). Secure with ball lock pin.

(c) Remove hoist PWA 28657 Sling and two PWA 76154 Adapters.

(d) Facing rear of diffuser case and using tape mark rear flange in line with first hole to left of dowel pin.

(e) Facing front of diffuser case mark flange at offset hole. These marks will indicate bottom center line and 6 o'clock position of diffuser case.

Subtask 72−41−00−430−052:

(2) Install No. 3 bearing (breather) tube assembly (1002/5). See Figure 1002.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Remove all protective closures from the No. 3 bearing (breather) tube assembly. Blow shop air through the tube assembly to assure absence of foreign material.

CAUTION: BE SURE THAT THE SEAL RINGS YOU USE HAVE THE CORRECT PART NUMBERS. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 72−127 and SB PW4ENG 72−648.

(b) Install seal rings.

1 Install seal rings in the grooves at the center of the tube.

2 Install seal rings at each end of the tube.

a (Post PW4ENG 72-127 and Pre SB PW4ENG 72-648) The two-piece seal ring (1002/6) that is at the end of the tube that does not have a flange has special assembly instructions. Assemble it with the inner ring joint 180° ± 20° from the outer ring joint.

b (Post SB PW4ENG 72-648) Install the one-piece seal ring (1002/6) at the end of the tube that does not have a flange.

c Install seal rings at the flanged end of the tube.

(c) Install a gasket with a small quantity of Beeswax P05-395 or Paraffin Wax Blend P05-396 on the end of the tube.

(d) Install the tube assembly in the diffuser case at 11 o'clock (viewed from the front).

(3) Install No. 3 bearing (scavenge) tube assembly (1002/3). See Figure 1002.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Remove all protective closures from the No. 3 bearing (scavenge) tube assembly. Blow shop air through the tube assembly to assure absence of foreign material.

CAUTION: BE SURE THAT THE SEAL RINGS YOU USE HAVE THE CORRECT PART NUMBERS. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 72-127 and SB PW4ENG 72-648.

(b) Install seal rings.

1 Install seal rings in the grooves at the center of the tube.

2 Install seal rings at each end of the tube.

a (Post PW4ENG 72−127 and Pre SB PW4ENG 72−648) The two−piece seal ring (1002/6) that is at the end of the tube that does not have a flange has special assembly instructions. Assemble it with the inner ring joint 180° ± 20° from the outer ring joint.

b (Post SB PW4ENG 72−648) Install the one−piece seal ring (1002/6) at the end of the tube that does not have a flange.

c Install seal rings at the flanged end of the tube.

(c) Install a gasket with a small quantity of Beeswax P05−395 or Paraffin Wax Blend P05−396 on the end of the tube.

(d) Install the tube assembly in the diffuser case at 5:30 o'clock (viewed from the front).

(4) Install turbine blade cooling tubes (1002/1) and (1002/4). See Figure 1002.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Remove all protective closures from two turbine blade cooling tubes. Blow shop air through tubes to assure absence of foreign material.

(b) Install a seal ring in the groove at the end of each tube.

(c) Install a seal ring in the grooves at each end of two seal ring transfer tubes.

(d) Install the transfer tubes in the cooling tubes. Be sure you engage the tabs on the transfer tubes with the slots on the cooling tubes.

(e) Install the assemblies through the struts of the case at 6:30 and 9:30 o'clock (as viewed from the front).

(5) (Pre SB PW4ENG 72-567) Install a diffuser seal air vent tube assembly (1002/2). See Figure 1002 (Sheet 1).

NOTE: Attach a temporary safety wire around the air vent tube so that the tube will not fall back into the diffuser case and cause unnecessary engine disassembly at a later engine assembly procedure.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Remove all protective closures from diffuser seal air vent tube assembly. Blow shop air through tube to assure absence of foreign material.

(b) Install a seal ring in the groove at the end of the tube assembly.

(c) Install the tube assembly through the strut of the case at 8:30 o'clock (as viewed from the front).

(6) (Post SB PW4ENG 72-567) Install a diffuser seal air vent tube assembly (1002/2). See Figure 1002 (Sheet 2).

NOTE: Attach a temporary safety wire around the air vent tube so that the tube will not fall back into the diffuser case and cause unnecessary engine disassembly at a later engine assembly procedure.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Remove all protective closures from diffuser seal air vent tube assembly. Blow shop air through tube to assure absence of foreign material.

(b) Install the seal rings in the grooves at the end of the two tube assemblies.

(c) Install the tube assemblies through the case struts at the 1:00 and 8:30 o'clock positions (as viewed from the front).

Subtask 72−41−00−430−053:

(7) Install No. 3 bearing (compartment) cooling tube.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Remove all protective closures from No. 3 bearing (compartment) cooling tube (1003/9) and blow shop air through tube to assure absence of foreign material. See Figure 1003.

(b) Install large seal ring (1003/8) in ring groove on tube (1003/9).

(c) Install small seal ring (1003/7) in rear groove on tube (1003/9).

(d) Install tube (1003/9) through case strut at 7:30 o'clock position (as viewed from the front).

(8) Install No. 3 bearing and airframe (oil vent and turbine cooling) manifold assemblies.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Remove all protective closures from No. 3 bearing and airframe (oil vent and turbine cooling air duct sensing outer) manifold assemblies (1003/6) and blow shop air through manifolds to assure absence of foreign material.

(b) Install seal rings (1003/5) in grooves on both manifold assemblies.

(c) Install manifold assemblies (1003/6) through case struts at 12:30 and 4 o'clock positions (as viewed from the front).

(9) Install No. 3 bearing (oil) pressure tube assembly.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Remove all protective closures from No. 3 bearing (oil) pressure tube assembly (1003/10) and blow shop air through tube assembly to assure absence of foreign material.

(b) Install seal ring (1003/1) in center groove on tube assembly.

(c) Install seal ring (1003/3) at end groove on tube assembly.

(d) Install large seal ring (1003/2) in large ring groove on tube.

(e) Install gasket (1003/4) with small amount of wax onto tube (1003/10).

(f) Install tube assembly through case strut at 2 o'clock position (as viewed from the front).

Subtask 72−41−00−430−054:

(10) Install airsealing ring assembly and transfer tubes. See Figure 1004.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Install diffuser airsealing ring assembly (1004/10) carefully aligning previously installed tubes. Insure that seal rings on tubes are properly engaged.

NOTE: Use two assemblers if necessary.

(b) Secure ring assembly to diffuser case with bolts (1004/1) lubricated with Engine Oil P03−001, and nuts (1004/11).

(c) Seat airsealing ring by gradually tightening bolts and nuts using 180 degree opposite pattern, until ring is fully seated against diffuser case flange.

(d) Torque nuts (1004/11) to 85 − 95 lb−in. (9.604 − 10.734 N.m) loosen and retorque to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(e) Install seal ring (1004/4) in groove on seal ring transfer (No. 3 bearing cooling front) tube (1004/6).

(f) Facing rear of diffuser case, locate tube protruding through airsealing ring at 4:30 o'clock position. Ensure that seal ring is present in ring groove on tube.

(g) Carefully install transfer tube (1004/6) over tube at 4:30 o'clock position, with tabs toward airsealing ring. Engage tabs with slots in airsealing ring. Ensure transfer tube is fully seated in airsealing ring.

(h) Install seal ring (1004/7) in groove on seal ring transfer (No. 3 bearing cooling rear) tube (1004/3).

(i) Carefully install transfer tube (1004/3) over tube at 4:30 o'clock position, engaging tabs in slots of previously installed transfer tube. Ensure transfer tubes are fully seated.

(j) Install seal ring (1004/5) in groove on two No. 3 bearing packing transfer (breather and scavenge) tubes (1004/2).

(k) Carefully install transfer tubes (1004/2) over tubes at 1 and 6:30 o'clock positions, with tabs toward airsealing ring. Engage tabs with slots in airsealing ring. Insure transfer tubes are fully seated in airsealing ring.

(l) Install seal ring (1004/8) in groove on packing transfer (oil pressure) tube (1004/9).

(m) Carefully install transfer tube (1004/9) over tube at 10 o'clock position with tabs toward airsealing ring. Engage tabs with slots in airsealing ring. Ensure transfer tube is fully seated in airsealing ring.

Subtask 72−41−00−430−055:

(11) Install turbine cooling duct sensing tube and oil vent tube.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Remove all protective closures from turbine cooling duct sensing (inner airframe) tube assembly (1005/1) and blow shop air through tube assembly to assure absence of foreign material. See Figure 1005.

(b) Install seal ring (1005/2) in groove on OD of tube nut (1005/10).

(c) Facing rear of diffuser case install tube assembly (1005/1) to previously installed cooling manifold at 11:30 o'clock position in airsealing ring. Rear end of tube assembly should pass through diffuser case flange. Handtighten tube nut (1005/10).

(d) Remove all protective closures from No. 3 bearing oil vent (inner) tube assembly (1005/3) and blow shop air through tube assembly to assure absence of foreign material.

(e) Install seal ring (1005/4) to groove on OD of tube nut (1005/9).

(f) Facing rear of diffuser case install tube assembly (1005/3) to previously installed cooling manifold at 8 o'clock position in airsealing ring. Do not tighten tube nut at this time.

(g) Locate two countersunk holes in diffuser case flange at approximately 7 o'clock position and secure tube assembly (1005/3) at two places with clamps (1005/5), brackets (1005/6), screws (1005/7) lubricated with Engine Oil P03−001, and nuts (1005/8).

(h) Torque both tube nuts to 200 − 225 lb−in. (22.597 − 25.422 N.m). Loosen and retorque to 200 − 225 lb−in. (22.597 − 25.422 N.m). Install the Lockwire P05−289 to safety the tube nuts.

NOTE: Hold connector on mating tube with PWA 87006 Wrench while torquing with PWA 103081 Torque Adapter.

(i) Torque screws, securing clamps at two locations to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(12) Install No. 3 bearing cooling duct in diffuser case. See Figure 1006.

(a) Rotate diffuser case, rear end up, on PWA 85751 Brackets and lock in position.

(b) Looking down into the rear of diffuser case, install two PWA 25450 Aligning Pins (1006/4) 180 degrees apart to inner flange of case.

(c) Install three eye bolts, equally spaced, in the outer flange of the No. 3 bearing front cooling duct assembly and housing.

(d) With a three cable sling, lift and lower the No. 3 bearing front cooling duct assembly and housing into the diffuser case.

(e) Install No. 3 bearing front cooling duct assembly and housing (1006/5) to flange in diffuser case, carefully aligning tubes and seal rings previously installed. Remove the sling and eye bolts.

(f) Align four countersunk holes in housing flange with four smaller holes in case inner flange. Secure with four screws (1006/3) lubricated with Engine Oil P03-001. Do not tighten screws.

NOTE: Assure that dowel pin in assembly, engages dowel pin hole in previously installed tube at approximately 1 o'clock position.

(g) Ensure all tubes are properly aligned and seal rings are still in place.

(h) Install eight work bolts (1006/1) and washers (1006/2), one to each side of last four installed screws (1006/3).

(i) Carefully tighten work bolts (1006/1) in a 180 degree opposite pattern until assembly is fully seated. Torque work bolts to 290 lb-in. (32.766 N.m) maximum.

(j) Remove two alignment pins (1006/4).

(k) Run down four screws (1006/3) until bottomed, then back off screws one full turn. Torque screws 22 - 95 lb-in. (2.486 - 10.734 N.m).

(l) Remove eight work bolts (1006/1) and washers (1006/2).

(m) Rotate diffuser case to the horizontal position and lock in place.

Subtask 72-41-00-430-057:

CAUTION: BE SURE THAT THE HEAT SHIELDS YOU USE WITH THE NO. 3 BEARING (BREATHER) TUBE ASSEMBLY HAVE THE CORRECT PART NUMBERS. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 72-127.

(13) Install the No. 3 bearing (breather) tube (1007/1), (oil) pressure tube (1007/3), and (scavenge) tube (1007/4). Also install the heat shields for these tubes and the (compartment) cooling tube (1007/2). See Figure 1007.

(a) Facing front of diffuser case, locate three large bosses (at 2:00, 5:30, and 11 o'clock) on airsealing ring. Attach the tubes (breather, pressure, and scavenge) at these locations using bolts, lubricated with Engine Oil P03-001.

(b) Torque the bolts to 125 - 170 lb-in. (14.123 - 19.207 N.m). Without loosening, continue to tighten to same limits until torque is maintained. Lockwire P05-289 to safety the bolts.

(c) Install the heat shield halves over the oil pressure tube at 2:00 o'clock and the oil breather tube at 11 o'clock as follows:

1 Install the heat shield flange halves into the boss on the airsealing ring. Put the largest flat side of the heat shield flange against the bolts.

2 Install the inner heat shield halves around the tube assembly.

3 Install the outer heat shield halves over the inner heat shield halves. Use PWA 101455 Installation Clamp to hold the heat shield in position around the tube for the lockwire installation.

4 (Post SB PW4ENG 72-623) Attach the heat shield assembly with Lockwire P05-365 at both ends and middle. Wrap the lockwire three full turns around the heat shield and make safe with three full twists. The twist must be outward away from the rotor.

5 Remove the installation clamp (PWA 101455).

(d) Install the heat shield halves over the oil scavenge tube at 5:30 o'clock and the compartment cooling tube at 7:30 o'clock as follows:

1 Install the heat shield flange halves into the boss on the airsealing ring for the oil scavenge tube. Put the largest flat side of the heat shield flange against the bolts.

2 Install the inner heat shield halves around the tube assembly.

3 Install the outer heat shield halves over the inner heat shield halves. Use PWA 101456 Installation Clamp to hold the heat shield in position around the tube for the lockwire installation.

4 (Post SB PW4ENG 72-623) Attach the heat shield assembly with the Lockwire P05-365 at both ends and middle. Wrap the lockwire three full turns around the heat shield and make safe with three full twists. The twist must be outward away from the rotor.

5 Remove the installation clamp (PWA 101456).

Subtask 72-41-00-430-058-A:

CAUTION: THE INSTALLATION OF PN 50J685 COMPRESSOR STATOR EXIT ASSEMBLY IS OPTIONAL WITH PN 50H879 SUPPORT AND PN 50H883 HEAT SHIELD. PN 51J285-01, PN 51J385-01 OR PN 51J685-01 COMPRESSOR STATOR EXIT ASSEMBLY CANNOT BE INSTALLED WITH PN 50H879 SUPPORT AND PN 50H883 HEAT SHIELD.

(14) Install Stage 15 HPC stator.

(a) (Pre SB PW4ENG 72-572) Place Stage 15 HPC airsealing ring assembly (1008/1) on clean paper on bench with large ID facing up. See Figure 1008 (Sheet 1).

(b) Locate two larger flange holes with five smaller holes in between. Mark a reference line on flange in line with two large holes using marking crayon.

(c) Chill airsealing ring (1008/1) assembly for ten minutes.

(d) Facing front of diffuser case, locate two large holes with five smaller holes in between on case flange. Mark a reference line in line with two large holes using marking crayon.

(e) Place compressor exit stator assembly (1008/2) on clean paper on bench with slotted flange down.

(f) Locate two larger flange holes with five slots in between. Mark a reference line in line with two large holes using marking crayon.

(g) Chill stator assembly (1008/2) for ten minutes.

(h) Install two PWA 85046 Align Pins 180 degrees apart in diffuser case inner flange. Allow pins to pilot into inner flange holes.

(i) Install chilled airsealing ring assembly (1008/1) in diffuser case, aligning marks at two large flange holes. If necessary tap to seat.

(j) Install chilled compressor exit stator assembly (1008/2) in case over gasket and airsealing ring, aligning crayon marks at two large flange holes. If necessary tap to seat.

(k) Remove two PWA 85046 Align Pins.

(l) Remove protective closures from ten Stage 15 HPC airsealing ring nozzles (1008/4) and blow shop air through nozzles to assure absence of foreign material.

(m) Install spacer plates (1008/5) to 34 slots on stator assembly (1008/2).

(n) Install ten nozzle assemblies (1008/4) to large holes in stator flange, through to bosses on diffuser case. Nozzle openings to point in a counterclockwise direction.

(o) Secure with bolts (1008/6), lubricated with Engine Oil P03-001, and nuts (1008/7) fingertight. Install 14 lubricated bolts (1008/6) washers (1008/3) and nuts (1008/7) to remaining holes.

(p) Torque bolts to 85 - 95 lb-in (9.604 - 10.734 N.m) loosen and retorque to 85 - 95 lb-in. (9.604 - 10.734 N.m).

Subtask 72-41-00-430-058-B:

(15) (Post SB PW4ENG 72-572) Install the HPC exit brush seal support assembly (called brush seal support) (1008/1) and the compressor exit stator assembly (called stator) (1008/2). See Figure 1008 (Sheet 2).

(a) Put the brush seal support on clean paper on a bench with the OD surface down.

(b) Find the two larger flange holes with the six smaller holes in between. Mark a reference line on the front of the flange in line with the two large holes with a marking crayon.

NOTE: The threaded hole is at 12:30 o'clock and one of the two large holes is at 11:00 o'clock.

(c) Chill the brush seal support for approximately ten minutes.

(d) Put the stator on clean paper on the bench with the slotted flange down.

(e) Find the two larger flange holes with the five slots in between. Mark a reference line in line with the two large holes with a marking crayon.

(f) Chill the stator for approximately ten minutes.

(g) Install PWA 87153 Heater on the inner front flange of the diffuser case as follows:

1 The heater thermocouple must touch the flange.

2 Attach the PWA 29754 Heater Control to the receptacle and the thermocouple.

3 Start the heater element to increase the temperature of the diffuser case flange to 350° − 375°F (176.7° − 190.6°C).

4 Remove the heater and heater control.

(h) Look at the front of the diffuser case. Find the two large holes with the five smaller holes in between on the inner front flange. Mark a reference line in line with the two large holes with a marking crayon.

(i) Install PWA 87154 Guide Pin on the brush seal support as follows:

1 Put the guide pin called 12 o'clock into the bolt hole at the 12 o'clock location.

NOTE: The 12 o'clock hole is adjacent to the threaded hole that is in between the two alignment marks.

2 Turn the knurled knob of the threaded rod to attach the guide pin to the brush seal support assembly.

(j) With marks aligned, install the chilled brush seal support in the diffuser case. If necessary, tap to seat.

(k) Remove the guide pin from the brush seal support.

(l) Install the PWA 101863 Alignment Pin on the compressor exit stator assembly as follows:

1 Put the alignment pin specified as 12 o'clock into the bolt slot adjacent to the jack screw hole near the 12 o'clock location.

2 Turn the knurled knob of the threaded rod to attach the alignment pin to the compressor exit stator assembly.

(m) With marks aligned, install the chilled stator in the case over the brush seal support. If necessary, tap to seat.

(n) Remove the alignment pin from the compressor exit stator assembly.

Subtask 72-41-00-430-059:

(16) (Pre SB PW4ENG 72-567) Install No. 3 bearing manifold and (oil) pressure tube gaskets and lock plates. See Figure 1009 (Sheet 1).

(a) Facing front of diffuser case, locate pad at 2 o'clock with manifold protruding through the outside of diffuser case.

(b) Install gasket (1009/10) to case pad.

(c) Install sleeve (1009/14) with small ID over seal ring.

(d) Install plate lock (1009/11) with slot upward.

(e) Install shield (1009/12) with open end outward, aligning bolt holes.

(f) Secure with bolts (1009/13) lubricated with Engine Oil P03-001. Tighten bolts fingertight.

(g) Torque bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Without loosening continue to tighten to same limits until torque is maintained. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(h) Locate pad at 4 o'clock position with manifold protruding through the outside of diffuser case.

(i) Install gasket (1009/9) to case pad.

(j) Install sleeve (1009/7) with small ID over seal ring.

(k) Install plate lock (1009/8) with slot upward.

(l) (Pre SB PW4ENG 72-570) No No. 3 bearing weep tube heat shield assembly installed.

1 Attach with bolts (1009/6) and (1009/15), lubricated with Engine Oil P03-001. Tighten the bolts with your fingers.

2 Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Do not loosen the bolts. Continue to tighten the bolts to the same limits until the torque is maintained.

3 Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(m) (Post SB PW4ENG 72-570) No. 3 bearing weep tube heat shield assembly installed.

1 Install the heat shield (1009/16) over the plate lock (1009/8).

2 Attach with bolts (1009/17) and (1009/18), lubricated with Engine Oil P03-001. Tighten the bolts with your fingers.

3 Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Do not loosen the bolts. Continue to tighten the bolts to the same limits until the torque is maintained.

4 Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(n) Locate pad at 1 o'clock position with tube protruding through the outside of diffuser case.

(o) Install gasket (1009/5) to case pad.

(p) Install sleeve (1009/4) with small ID over seal ring.

(q) Install plate lock (1009/3) with slot upward.

(r) Secure with bolts (1009/2) lubricated with Engine Oil P03-001. Tighten bolts fingertight.

(s) Torque bolts 65 - 85 lb-in. (7.344 - 9.604 N.m). Without loosening continue to tighten to same limits until torque is maintained. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(t) Install cap assembly (1009/1). Torque to 270 − 300 lb−in. (30.506 − 33.895 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the cap assembly.

(17) (Post SB PW4ENG 72−567) Install No. 3 bearing manifold and (oil) pressure tube gaskets and lock plates. See Figure 1009 (Sheet 2).

(a) Find the pad at 2 o'clock where a manifold comes out of the side of diffuser case.

(b) Install the gasket (1009/28) to the case pad.

(c) Install the sleeve (1009/32) with small ID over the seal ring.

(d) Install the plate lock (1009/29) with slot upward.

(e) Install the shield (1009/30) with open end outward, aligning bolt holes.

(f) Attach with bolts (1009/31) lubricated with Engine Oil P03−001. Tighten bolts fingertight.

(g) Torque the bolts to 65 − 85 lb−in. (7.344 − 9.604 N.m). Do not loosen the bolts. Continue to tighten them to the same limits until the torque is kept. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(18) (Post SB PW4ENG 72−567) Install the No. 3 bearing and airframe manifold assembly lock plates and gaskets. See Figure 1009 (Sheet 2).

(a) Find the pad at the 4 o'clock position with the manifold that extends through the outside of the diffuser case.

(b) Install the gasket (1009/27) to the case pad.

(c) Install the sleeve (1009/25) with small ID over the seal ring.

(d) Install the plate lock (1009/26) with slot upward.

(e) Attach with bolts (1009/24) lubricated with Engine Oil P03-001. Tighten bolts fingertight.

(f) Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Do not loosen the bolts. Continue to tighten them to the same limits until the torque is kept. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(g) Find the pad at the 1 o'clock position with the tube that extends through the outside of the diffuser case.

(h) Install the gasket (1009/23) to the case pad.

(i) Install the sleeve (1009/22) with small ID over the seal ring.

(j) Install the plate lock (1009/21) with slot upward.

(k) (Pre SB PW4ENG 72-570) No No. 3 bearing weep tube heat shield assembly installed.

1 Attach with bolts (1009/6) and (1009/22), lubricated with Engine Oil P03-001. Tighten the bolts with your fingers.

2 Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Do not loosen the bolts. Continue to tighten the bolts to the same limits until the torque is maintained.

3 Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(l) (Post SB PW4ENG 72-570) No. 3 bearing weep tube heat shield assembly installed.

1 Install the heat shield (1009/41) over the plate lock (1009/26).

2 Attach with bolts (1009/42) and (1009/43), lubricated with Engine Oil P03-001. Tighten the bolts with your fingers.

3 Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Do not loosen the bolts. Continue to tighten the bolts to the same limits until the torque is maintained.

4 Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(m) Install the cap assembly (1009/19). Torque to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the cap assembly.

(19) (Post PW4ENG 72-567) Install the cover (1009/34) and seal (1009/37). See Figure 1009 (Sheet 2).

(a) Put a gasket (1009/33) on the six hole pad at 10:30 o'clock.

(b) Install the cover (1009/34) on the gasket. Install the bracket (1009/39) on the two forward holes of the cover. Install six bolts (1009/17), threads lubricated with Engine Oil P03-001, in the cover. Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(c) Install the seal ring (1009/36) on the seal (1009/37).

(d) Install the seal (1009/37) on the rod of the cover (1009/34) in the ID of the diffuser case. Install the nut (1009/20), threads lubricated with
R Lubricant P06-023 0r Antiseize Paste P06-054, on
R the rod. Torque the nut to 190 - 215 lb-in.
R (21.467 - 24.292 N.m).

Subtask 72-41-00-430-060-A:

CAUTION: BE SURE THAT YOU USE PARTS WITH THE CORRECT PART NUMBERS. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 72-127.

(20) (Pre SB PW4ENG 72-567) Install No. 3 bearing (breather) tube mating parts (1010/1). The pad is at 11 o'clock on the diffuser case (viewed from the front). See Figure 1010.

(a) Install a packing holder.

(b) If applicable, install a gasket and sleeve in the packing holder, with the small ID of the sleeve over the seal ring of the tube.

(c) Install a retaining plate.

(d) Install bolts, lubricated with Engine Oil P03-001. Tighten the bolts with your fingers.

(e) Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Do not loosen the bolts. Continue to tighten them to the same limits until the torque is maintained. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(f) Install a tube nut over the end of the tube. Install thrust wire, lubricated with Engine Oil P03-001, in the tube nut.

(21) (Pre SB PW4ENG 72-567) Install No. 3 bearing (scavenge) tube mating parts (1010/3). The pad is at 6 o'clock on the diffuser case (viewed from the front). See Figure 1010.

(a) Install a packing holder.

(b) Install a gasket and sleeve in the packing holder, with the small ID of the sleeve over the seal ring of the tube.

(c) Install a retaining plate.

(d) Install bolts, lubricated with Engine Oil P03-001. Tighten the bolts with your fingers.

(e) Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Do not loosen the bolts. Continue to tighten them to the same limits until the torque is maintained. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(f) Install a tube nut over the end of the tube. Install thrust wire, lubricated with Engine Oil P03-001, in the tube nut.

(22) (Pre SB PW4ENG 72-567) Install No. 3 bearing (compartment) cooling tube mating parts (1010/2).

CAUTION: INSTALL THE LOCKS WITH THE SLOT GROOVE OUTWARD AND THE PIN (IF EQUIPPED) INWARD. BE SURE THE LOCKS ENGAGE THE GROOVE OF THE TUBE.

(a) Install the locks in the groove at the end of the (compartment) cooling tube.

(b) (Reference 1990) Hold the locks outward against the internal face of the groove. Do a measurement of the distance from the end of the tube to the surface of the locks. The end of the tube must be 0.000 - 0.020 inch (0.000 - 0.508 mm) above the locks. If the measurement is not within this limit, install the locks again.

(c) Install a gasket around the OD of the locks.

(d) Install a gasket over locks with the raised lip of the gasket against the tube.

(e) Install the elbow. Attach the elbow with ten bolts, lubricated with Engine Oil P03-001. Tighten the bolts with your fingers.

(f) Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Do not loosen the bolts. Continue to tighten them to the same limits until the torque is maintained. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(g) Install a washer on the flat threaded end of the adapter.

(h) Lubricate the flat threaded end of the adapter with Engine Oil P03-001. Install the adapter in the elbow.

(i) Torque the adapter to 450 - 550 lb-in. (50.843 - 62.142 N.m).

Subtask 72-41-00-430-060-B:

(23) (Post SB PW4ENG 72-567) Install the No. 3 bearing (breather) tube lock plate. See Figure 1011.

CAUTION: BE SURE THAT YOU USE PARTS WITH THE CORRECT PART NUMBERS. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 72-127.

(a) Find the pad at 11 o'clock. It has a tube that comes through the boss.

(b) Install a gasket (1011/6) on the pad.

(c) Install a sleeve (1011/5) in the gasket.

(d) Install a plate lock (1011/4) on the sleeve, slot to the rear.

(e) Install three bolts (1011/3), threads lubricated with Engine Oil P03-001. Tighten the bolts with your fingers.

(f) Install a tube nut (1011/2) on the tube. Install thrust wire (1011/1), lubricated with Engine Oil P03-001.

(g) Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Do not loosen the bolts. Continue to tighten them to the same limits until the torque is kept. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(24) (Post SB PW4ENG 72-567) Install the plate for the No. 3 bearing (scavenge) tube, which is at 5:30 o'clock. See Figure 1011.

(a) Install a gasket (1011/7) on the pad.

(b) Install a sleeve(1011/8) in the gasket.

R
R

(c) Install a plate (1011/9) on the sleeve.

(d) Install three bolts (1011/12), threads lubricated with Engine Oil P03-001, in the plate. Tighten the bolts with your fingers.

(e) Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Do not loosen the bolts. Continue to tighten the bolts to the same limit until the torque is kept. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(f) Install a tube nut (1011/10). Install thrust wire (1011/11), lubricated with Engine Oil P03-001, in the tube nut.

(25) (Post SB PW4ENG 72-567) Install the No. 3 bearing cooling tube lock and elbow, which is at 7:30 o'clock. See Figure 1011.

CAUTION: INSTALL LOCK PLATES (1011/16) WITH SLOT GROOVE OUTWARD AND PIN INWARD. MAKE SURE THE LOCK PLATES ENGAGE THE INTERNAL TUBE LIP FLANGE AS SHOWN IN FIGURE 1011.

(a) At the boss at 7:30 o'clock, install the locks (1011/16) to flange lip of the internal tube and align the bolt holes.

(b) (Reference 1990) Hold the tube locks outward against the tube lip. Measure and be sure the end of the internal tube is 0.000 - 0.020 inch (0.000 - 0.508 mm) above the tube locks. If the measurement is not within this limit, install the locks again and be sure you engage the internal tube lip correctly.

(c) Install the gasket (1011/17) around OD of locks.

(d) Install the gasket (1011/15) over the locks with the raised lip against the tube. Align bolt holes.

(e) Install the elbow (1011/14) and align the bolt holes.

(f) Attach the elbow with ten bolts (1011/13), threads lubricated with Engine Oil P03-001. Tighten the bolts with your fingers.

(g) Torque bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Do not loosen the bolts. Continue to tighten them to the same limits until the torque is kept. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(h) Install the washer (1011/18) to flat threaded end of the adapter (1011/19).

(i) Lubricate the flat threaded end of the adapter with Engine Oil P03-001, and install the adapter in the elbow.

(j) Torque the adapter to 450 - 550 lb-in. (50.843 - 62.142 N.m).

(26) (Pre SB PW4ENG 72-567) Remove protective closures from diffuser seal air vent (elbow) tube assembly. Blow shop air through the tube assembly to assure absence of foreign material. See Figure 1012.

(a) Facing front of diffuser case, locate boss at 1 o'clock position.

(b) Install gasket to tube assembly.

(c) Install tube assembly with gasket and bracket to case boss using bolts, threads lubricated with Engine Oil P03-001.

(d) Torque bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Without loosening continue to tighten to the same limits until torque is maintained. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

Subtask 72-41-00-720-051:

(27) Vacuum check the No. 3 bearing compartment. See Inspection/Check-05 Task 72-41-00-200-005.

Subtask 72-41-00-720-055:

(28) Airflow check No. 3 bearing oil nozzle. See Figure 1013.

NOTE: Airflow check is to ensure that passages are not obstructed or misassembled.

(a) Locate outside end of No. 3 bearing pressure tube assembly. Secure PWA 85565 Adapter to outside end of No. 3 bearing pressure tube diffuser and combustor.

(b) Secure air inlet hose from CTE 6070 Airflow Cart or CTE 5070 Airflow Cart to larger threaded hole of adapter.

(c) Secure pressure sensing line to smaller threaded hole.

(d) Airflow check nozzle at 10 psig (68.9 kPa). Airflow rate must be 40 - 50 lb/hr (18.14 - 22.68 kg/hr).

(e) After airflow rate limits have been met, remove adapter and airflow cart.

Subtask 72-41-00-430-061:

CAUTION: WHEN PN 50J488 OUTER COMBUSTION CHAMBER IS INSTALLED, PN 50K488 INNER COMBUSTION CHAMBER MUST ALSO BE INSTALLED.

(29) Install outer combustion chamber assembly.

(a) Install diffuser case to front end down position in PWA 86508 Build Stand or PWA 85044 Build Stand and secure. See Figure 1014.

(b) Remove two PWA 85751 Handling Brackets from diffuser case.

(c) Visually check interior of diffuser case for correct assemblies, absence of foreign material or damage and that all details are secure. Pay particular attention to mating surfaces of carbon seal.

(d) Locate 12 threaded bosses located around OD of diffuser case. Install PWA 85060 Alignment Pins to three equally spaced bosses in the case and retract the inner portion of the pins.

(e) Using PWA 27918 Sling or PWA 80555 Sling (1014/1) lift outer combustion chamber assembly (1014/2) and position over diffuser case. Align two igniter holes in combustion chamber with igniter bosses in diffuser case located at 4 o'clock position.

(f) Carefully lower combustion chamber into diffuser case while keeping igniter bosses aligned. Lower combustion chamber so that lugs on bottom of chamber are even with bosses on diffuser case. Push the inner portion of the pins in to align the combustion chamber mount lugs with the diffuser case at three places.

(g) Lubricate the threads and seating surface of the twelve doweled end retaining bolts (1014/3) with Lubricant P06−023 and wipe clean any lubricant from other bolt surfaces before you installation. Install nine lubricated bolts (1014/3) and washers (1014/4) through the outside of diffuser case to locate the combustion chamber mount lugs. Wipe clean any excess lubricant from the case and/or bolt surfaces.

(h) Remove one aligning pin at a time and install the three remaining bolts and washers.

(i) (Reference 402) Remove sling. Torque bolts (1014/3) 500 − 600 lb−in. (56.492 − 67.791 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

Subtask 72−41−00−430−062:

(30) Install the igniter plugs. See Figure 1015 and Figure 1016.

NOTE: Presently there are (3) three igniter plug guide configurations installed in the outer combustion chamber. (Pre SB PW4ENG 72−152) chambers have an extended sleeve (1015/7) and no shield. (Post SB PW4ENG 72−152) chambers have a short sleeve and a shield. (Post SB PW4ENG 72-601) Chambers have an extended, necked-out sleeve and a lock.

(a) There are two PWA Immersion Gages now in use to measure igniter plug immersion depth.

1 PWA 85626 Immersion Gage can only be used on combustion chambers with the extended sleeve (1015/7) and no shield (Pre SB PW4ENG 72-152). See Figure 1015 (Sheet 1).

2 PWA 75509 Immersion Gage can be used on each of the two combustion chamber configurations now in use (Post SB PW4ENG 72-152). See Figure 1015 (Sheets 2 and 3).

(b) To measure igniter plug immersion depth with PWA 85626 Immersion Gage, follow these instructions.

NOTE: This procedure pertains to the two igniter plug locations.

1 Install the key washer (1015/2) to the igniter plug boss (1015/3) with the tabs to the boss. Do not bend the tabs.

2 Install the boss and key washer to the igniter plug (1015/1) and tighten by hand.

3 Install the PWA 85626 Immersion Gage (1015/8), contoured surface first, against the inner surface of the outer combustion chamber (1015/6) at the igniter plug location. Adjust the gage by touching the axial cutout surface of the gage against the extended sleeve (1015/7) of the chamber, at the same time the contoured surface of the gage touches the second chamber liner. Hold the gage firmly in this position.

4 Install the igniter plug, key washer, and boss assembly into the diffuser case until the plug touches the bottom of the immersion gage pin.

5 Measure the distance between the igniter plug boss and the diffuser case boss with a feeler gauge and/or shim stock. This measurement is the necessary spacer thickness. Remove the gage.

6 Use a classified spacer (1015/4) or a combination of spacers to get the distance measurement in step 5 plus or minus 0.010 inch (0.254 mm). Use a maximum of two spacers for each plug. The total combined thickness of spacer(s) is not to exceed 0.300 inch (7.620 mm). See Figure 1015 and Figure 1016.

7 Remove the igniter plug, key washer, plug boss, and spacer(s) from the diffuser case.

8 Fully clean the igniter plug, igniter boss, and diffuser case threads with Petroleum Solvent P11-027.

9 Install the key washer to the plug boss with the tabs to the boss. Bend the tabs over to attach the key washer to the boss.

10 Lubricate the outer threads of the plug boss with Lubricant P06-023.

11 (Reference 400) Install the classified spacer(s) to the boss. Install the boss to the diffuser case. Torque the boss to 375 - 440 lb-in. (42.369 - 49.713 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the boss.

12 Apply Thread Lubricant P06-023 to the igniter plug threads.

13 (Reference 401) Install the igniter plug to the boss. Torque the plug to 300 - 360 lb-in. (33.895 - 40.675 N.m).

(c) Measure igniter plug immersion depth using PWA 75509 Immersion Gage

1 If necessary, clean threads of boss with the PWA 24524 Tap.

2 Install a new key washer to igniter boss with tabs toward boss.

3 Install boss and key washer to igniter plug fingertight.

4 (Reference 365 or 386) Measure Dimension A from plug tip to bottom face of boss. See Figure 1015 (Sheet 2, 3, 4 or 5). Record Dimension A.

5 Disassemble key washer and boss from igniter plug and place on bench.

6 Using a strong light, look in the igniter boss hole in the diffuser case and determine which igniter plug guide configuration (shielded or unshielded) is installed in the outer combustion chamber. See Figure 1015 (Sheet 2, 3, 4 or 5).

  a Using detail gage master place the master between the gage hook and the gage base. Set gage indicator level to zero.

  b Insert gage into the igniter boss hole in diffuser case until gage base is seated on face of case boss.

  c Rotate gage base to obtain an uninterrupted view of dial gage face.

  d Holding gage base, rotate probe until notch in probe disk is pointing to rear of engine.

  e Depress probe and slide gage towards rear of engine to seat gage hook against rear ID surface of outer combustion chamber.

  f Release probe and record dial gage reading. Add the gage reading to 2.200 inches (55.880 mm) if reading is a plus reading. Subtract the gage reading from 2.200 inches (55.880 mm) if reading is a minus reading. Result is Dimension B.

g (Pre SB PW4ENG 72-152) For engines incorporating combustion chambers with extended sleeve and no shield, add 0.025 inch (0.635 mm) to Dimension B and subtract that total from Dimension A. The resulting dimension, Dimension C, is the desired spacer thickness.

h Select a classified spacer or combination of spacers to obtain Dimension C plus or minus 0.010 inch (0.254 mm). Use a maximum of two spacers per plug. Total combined thickness of spacer(s) not to exceed 0.300 inch (7.620 mm). See Figure 1015 (Sheet 2).

i (Post SB PW4ENG 72-152 and Post SB PW4ENG 72-601) For engines incorporating combustion chambers with flush sleeve and a shield or a lock add 0.125 inch (3.175 mm) to Dimension B and subtract that total from Dimension A. The resulting dimension, Dimension C, is the desired spacer thickness.

j Select a classified spacer or combination of spacers to obtain Dimension C plus or minus 0.010 inch (0.254 mm). Use a maximum of two spacers per plug. Total combined thickness of spacers(s) not to exceed 0.300 inch (7.620 mm). See Figure 1015 (Sheet 3 or 4).

k For engines with Talon Low Emission combustion chambers there is a flush sleeve and a lock. Add 0.075 inch (1.905 mm) to Dimension B and subtract that total from Dimension A. The resulting dimension, Dimension C, is the desired spacer thickness.

l Select a classified spacer or combination of spacers to obtain Dimension C plus or minus 0.010 inch (0.254 mm). Use a maximum of two spacers per plug. Total combined thickness of spacer(s) not to exceed 0.300 inch (7.620 mm). See Figure 1015 (Sheet 5).

7 If necessary, clean threads in diffuser case port using PWA 27641 Tap.

8 Fully clean the igniter plug, igniter boss and diffuser case threads with Petroleum Solvent P11-027.

9 Install key washer to igniter boss and bend tabs over to secure.

10 Lubricate OD threads of boss with Lubricant P06-023.

11 (Reference 400) Install previously selected classified spacer(s) to boss and install boss to diffuser case. Torque boss to 375 - 440 lb-in. (42.369 - 49.713 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to the boss.

12 Apply Thread Lubricant P06-023 to threads of igniter plug.

13 (Reference 401) Install igniter plug to boss. Torque plug to 300 - 360 lb-in. (33.895 - 40.675 N.m).

NOTE: Keep igniter plug boss from turning while torquing plug.

Subtask 72-41-00-430-063:

(31) Install fuel injectors and support assemblies. See Figure 1017.

(a) Using tape above each fuel injector boss, identify each boss beginning with first boss to right of bottom centerline as No. 12 and first boss to left of bottom centerline as No. 13. Continue numbering bosses in a clockwise direction to 24.

(b) Place 24 fuel injectors (1017/7) on bench and install gasket (1017/5) lubricated with Beeswax P05-395 or Paraffin Wax Blend P05-396, to each injector.

(c) Install fuel injectors at bosses marked No. 1, 2, 3 and 4 through diffuser case with nozzle pointing upward. Secure with bolts (1017/6) lubricated with Engine Oil P03-001, fingertight.

(d) At injector boss marked No. 5, install fuel injector and bracket (1017/8). Secure with bolts lubricated with Engine Oil P03-001, fingertight.

(e) At boss No. 6 install fuel injector and bracket (1017/10). Secure with lubricated bolts fingertight.

(f) At boss No. 7 install fuel injector and bracket (1017/11). Secure with lubricated bolts fingertight.

(g) At boss No. 8 install fuel injector and bracket (1017/12). Secure with lubricated bolts fingertight.

(h) Install nine fuel injectors at bosses No. 9 through 17 and secure with lubricated bolts fingertight.

(i) At boss No. 18 install fuel injector and bracket (1017/1). Secure with lubricated bolts fingertight.

(j) Install fuel injector at boss No. 19 and secure with lubricated bolts fingertight.

(k) At boss No. 20 install fuel injector and bracket (1017/2). Secure with lubricated bolts fingertight.

(l) At boss No. 21 install fuel injector and bracket (1017/3). Secure with bolts lubricated with Engine Oil P03-001.

(m) Install fuel injectors at bosses No. 22 and 23 and secure with lubricated bolts fingertight.

(n) At boss No. 24:

  1 Pre SB PW4ENG 72-2: Install a fuel injector and bracket (1017/4). Secure with bolts lubricated with Engine Oil P03-001.

  2 Post SB PW4ENG 72-2: Install a fuel injector and secure with bolts lubricated with Engine Oil P03-001.

(o) Ensure all fuel injectors (1017/7) are properly installed and torque bolts (1017/6) evenly around case 65 - 85 lb-in. (7.344 - 9.604 N.m). Without loosening continue to torque 65 - 85 lb-in. (7.344 - 9.604 N.m) until no loss of torque occurs.

(p) Lockwire two upper bolts together on fuel injectors at Locations No. 1, 3, 4, 6, 7, 9, 10, 12, 13, 15, 16, 18, 19, 21, 22 and 24.

NOTE: The lower bolt at the above locations will be lockwired to fuel manifold nuts in a later assembly operation.

(q) Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the three bolts together on fuel injectors at Locations No. 2, 5, 8, 11, 14, 17, 20 and 23.

NOTE: Do not remove tape used to indicate fuel injector location numbers at this time.

Subtask 72-41-00-430-064:

(32) Install diffuser case externals.

(33) Position diffuser case in PWA 86508 Build Stand or PWA 85044 Build Stand to align flange holes No. 37 through 43 with cut out in build stand. See Figure 1018.

Bracket Reference Number	Position On Diffuser Case	Bolt Torque lb-in. (N.m)	Service Bulleting Reference
3	2 o'clock	65 - 85 (7.344 - 9.604)	
4	3:30 o'clock	125 - 170 (14.123 - 14.207)	
5	4 o'clock	65 - 85 (7.344 - 9.604)	
6	5 o'clock	65 - 85 (7.344 - 9.604)	
7	7 o'clock	65 - 85	

Table 1018

(CONTINUED)

Bracket Reference Number	Position On Diffuser Case	Bolt Torque lb−in. (N.m)	Service Bulleting Reference
		(7.344 − 9.604)	
8	8:30 o'clock	65 − 85 (7.344 − 9.604)	
9	8:30 o'clock	65 − 85 (7.344 − 9.604)	

Table 1018 (Continued)

(a) Install the four bolts (1018/13), lubricated with Engine Oil P03−001, and washers (1018/12) to the pads at 10 and 11:30 o'clock positions. Torque the bolts to 125 − 170 lb−in. (14.123 − 19.207 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety all the bolts after the torque.

(b) Install the six borescope plugs (1018/18) or (1018/18A), lubricated with Lubricant P06−023, and gaskets (1018/17) at 1:30, 4:30, 5:30, 7:30, 9 and 11 o'clock positions. Torque the plugs to 40 − 50 lb−in. (4.519 − 5.649 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(c) Install the two adapters (1018/5), lubricated with Engine Oil P03−001, and gaskets (1018/16), to the bosses forward of the fuel injector bosses at 12:30 and 1:30 o'clock positions. Torque the adapters to 110 − 120 lb−in. (12.428 − 13.558 N.m).

(d) Install the two gaskets (1018/22) and the two covers (1018/23) to the pads at 2 and 7:30 o'clock positions forward of the fuel injector bosses. Attach the covers with six bolts (1018/21), lubricated with Engine Oil P03−001. Torque the bolts to 65 − 85 lb−in. (7.344 − 9.604 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(e) Install the gasket (1018/20) and the adapter (1018/19), lubricated with Engine Oil P03-001, to the cover at 2 o'clock position. Torque the adapter to 110 - 120 lb-in. (12.428 - 13.558 N.m). Install the gasket (1018/26) and the plug (1018/27), lubricated with Engine Oil P03-001, to the cover at 7:30 o'clock position. Torque the plug to 110 - 120 lb-in. (12.428 - 13.558 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the plug.

(f) (Post SB PW4ENG 73-163) Install the EEC thermocouple (TT3) probe (1018/25) as follows:

1 Install the gasket (1018/24) to the probe (1018/25).

2 Lubricate the probe threads with Engine Oil P03-001.

3 Install the probe and gasket to the boss at 2:30 o'clock position behind the fuel injector bosses.

4 (Reference 411) Remove lockwire between the body nut and coupling nut. Loosen the coupling nut from the body nut. Torque the body nut (to the case) to 95 - 100 lb-in. (10.734 - 11.299 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the body nut to the case.

5 Attach the PWA 87649 Angle Gage to the two bolt hole boss of the diffuser case on the right side (horizontal centerline) with hex head screws. Move the gage guide into position.

6 Turn the probe so the two larger studs are to the right as shown. Hold the probe in place.

7 Touch the side of the thermocouple probe with the guide and tighten the hand knob to hold the guide assembly in position. This will correctly position the thermocouple probe for the electrical harness alignment connection.

R
R

8 (Reference 410) Torque the coupling nut to 95 - 100 lb-in. (10.734 - 11.298 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the coupling nut to the body nut.

(g) (Post SB PW4ENG 72-567) (Pre SB PW4ENG 72-699) Install a two hole cover (1018/29) with gasket (1018/28) to the diffuser case at the 9:15 o'clock position with two bolts (1018/30), threads lubricated with Engine Oil P03-001. Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

Subtask 72-41-00-430-065:

(34) (Reference 407) Install fuel injector supply manifold assemblies. See Figure 1019.

CAUTION: FOR ALL PACKING LUBRICANTS, APPLY ONLY A THIN COAT OR THE FUEL SYSTEM CAN BECOME BLOCKED.

(a) Install the packings (1019/3), lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the packing groove on each fuel injector.

(b) Remove closures from manifold assembly (1019/2) and blow shop air through assembly to assure absence of foreign material.

(c) Using Engine Oil P03-001, lubricate threads of tube nuts (1019/1) on manifold assembly (1019/2) at three places.

(d) Install manifold assembly (1019/2) to fuel injectors No. 10, 11 and 12. Secure tube nuts (1019/1) fingertight at three places.

(e) Remove closures from remaining seven manifold assemblies (1019/5) and blow shop air through assembly to assure absence of foreign material.

(f) Using Engine Oil P03-001, lubricate threads of tube nuts on manifold assemblies.

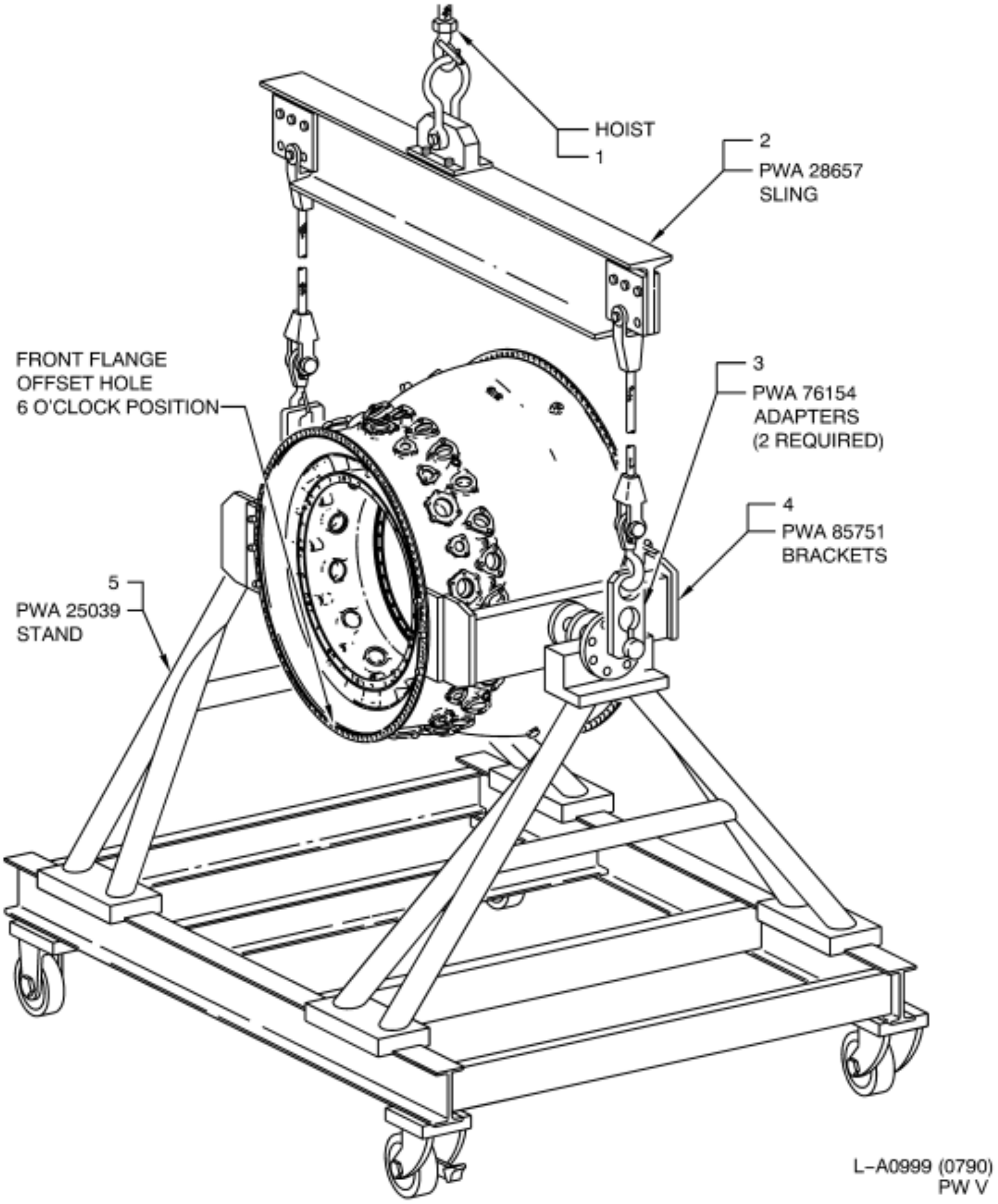
(g) Install manifold assemblies (1019/4) to remaining fuel injectors. Secure tube nuts fingertight.

NOTE: Tube nuts will be torqued after fuel distribution system leak test has been accomplished. Refer to Assembly-03 Task 72-41-00-400-003.

D. Postrequisites

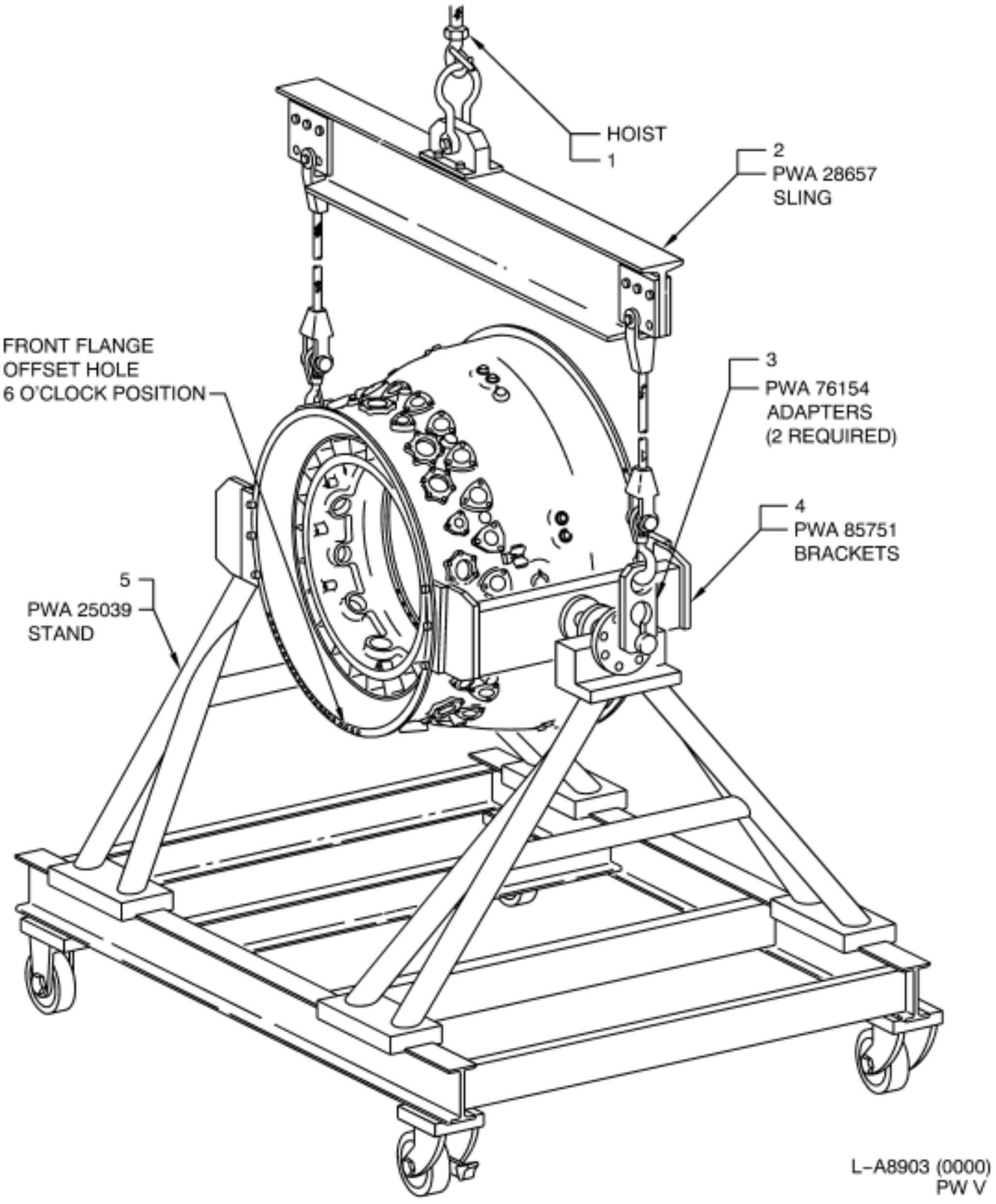
(1) For diffuser combustor assemblies having No. 3 bearing outer race installed see 72-00-41, Installation-01 (Task 72-00-41-420-001) for installation of diffuser combustor onto high pressure compressor. For diffuser combustor assemblies without No. 3 bearing outer race installed see 72-00-41, Installation-14 (Task 72-00-41-420-014) for installation of diffuser combustor onto high pressure compressor.

DIFFUSER AND COMBUSTOR − ASSEMBLY−01


HOIST
1
2
PWA 28657
SLING
FRONT FLANGE
OFFSET HOLE
6 O'CLOCK POSITION
3
PWA 76154
ADAPTERS
(2 REQUIRED)
4
PWA 85751
BRACKETS
5
PWA 25039
STAND
L−A0999 (0790)
PW V

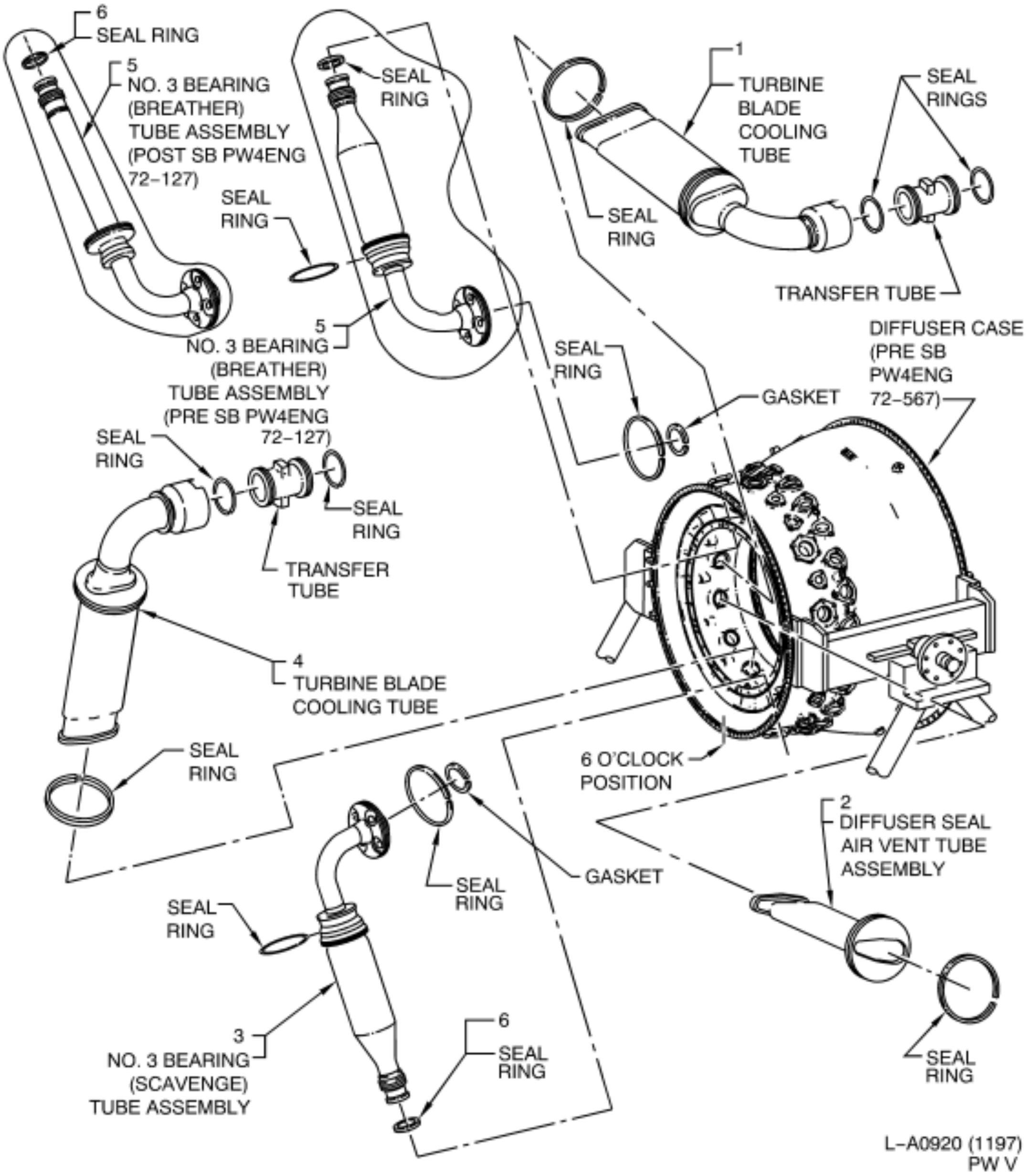
Diffuser Case And Build Stand (Pre SB PW4ENG 72−567)
Figure 1001 (Sheet 1)
(Task 72−41−00−400−001)

DIFFUSER AND COMBUSTOR − ASSEMBLY−01


HOIST
1
2
PWA 28657
SLING
FRONT FLANGE
OFFSET HOLE
6 O'CLOCK POSITION
3
PWA 76154
ADAPTERS
(2 REQUIRED)
4
PWA 85751
BRACKETS
5
PWA 25039
STAND
L−A8903 (0000)
PW V

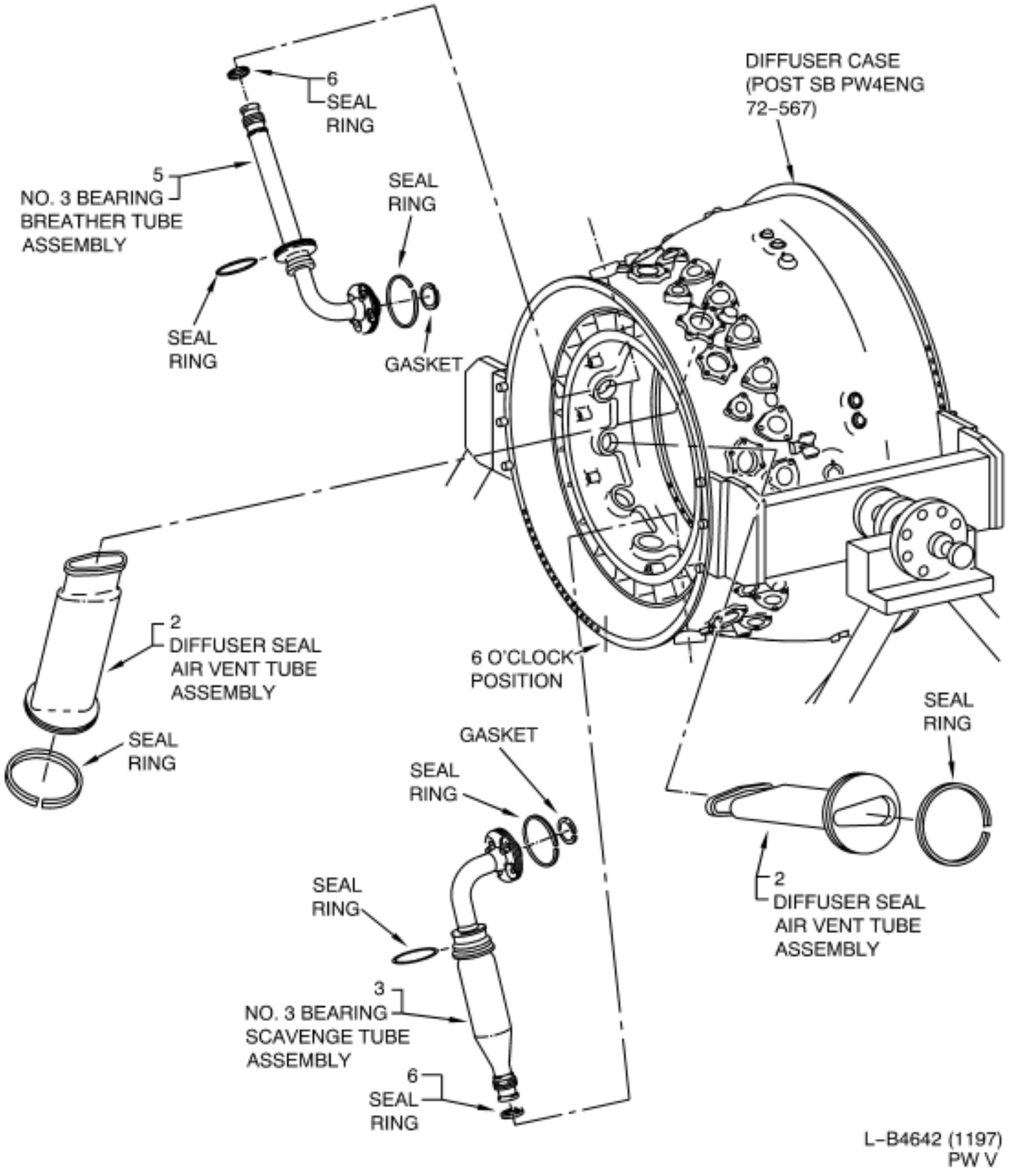
Diffuser Case And Build Stand (Post SB PW4ENG 72−567)
Figure 1001 (Sheet 2)
(Task 72−41−00−400−001)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01

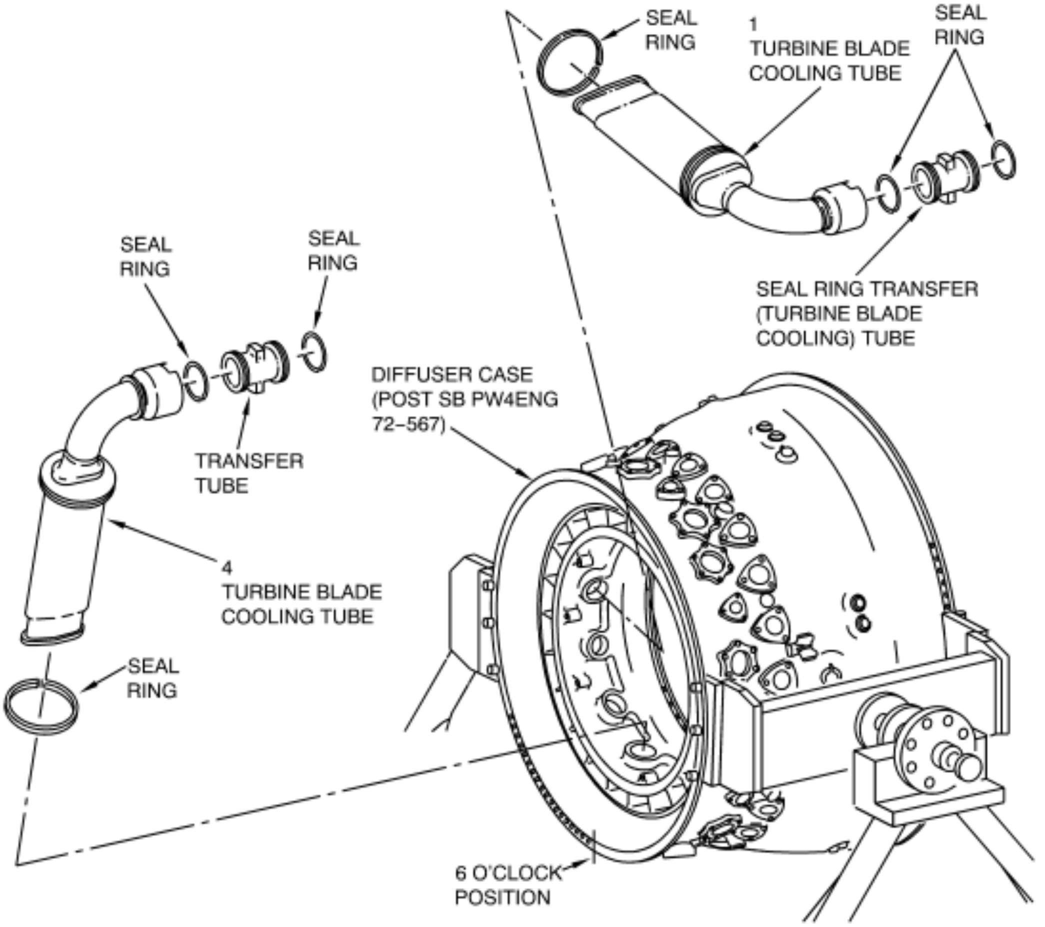

6
SEAL RING
5
NO. 3 BEARING (BREATHER) TUBE ASSEMBLY (POST SB PW4ENG 72-127)
SEAL RING
SEAL RING
SEAL RING
1
TURBINE BLADE COOLING TUBE
SEAL RINGS
SEAL RING
TRANSFER TUBE
5
NO. 3 BEARING (BREATHER) TUBE ASSEMBLY (PRE SB PW4ENG 72-127)
SEAL RING
DIFFUSER CASE (PRE SB PW4ENG 72-567)
GASKET
SEAL RING
SEAL RING
TRANSFER TUBE
4
TURBINE BLADE COOLING TUBE
SEAL RING
6 O'CLOCK POSITION
2
DIFFUSER SEAL AIR VENT TUBE ASSEMBLY
GASKET
SEAL RING
SEAL RING
3
NO. 3 BEARING (SCAVENGE) TUBE ASSEMBLY
6
SEAL RING
SEAL RING
L-A0920 (1197)
PW V

No. 3 Bearing (Breather) And (Scavenge) Tubes, Turbine Blade Cooling Tubes And Diffuser Seal Air Vent Tube
Figure 1002 (Sheet 1)
(Task 72-41-00-400-001)

DIFFUSER AND COMBUSTOR − ASSEMBLY−01

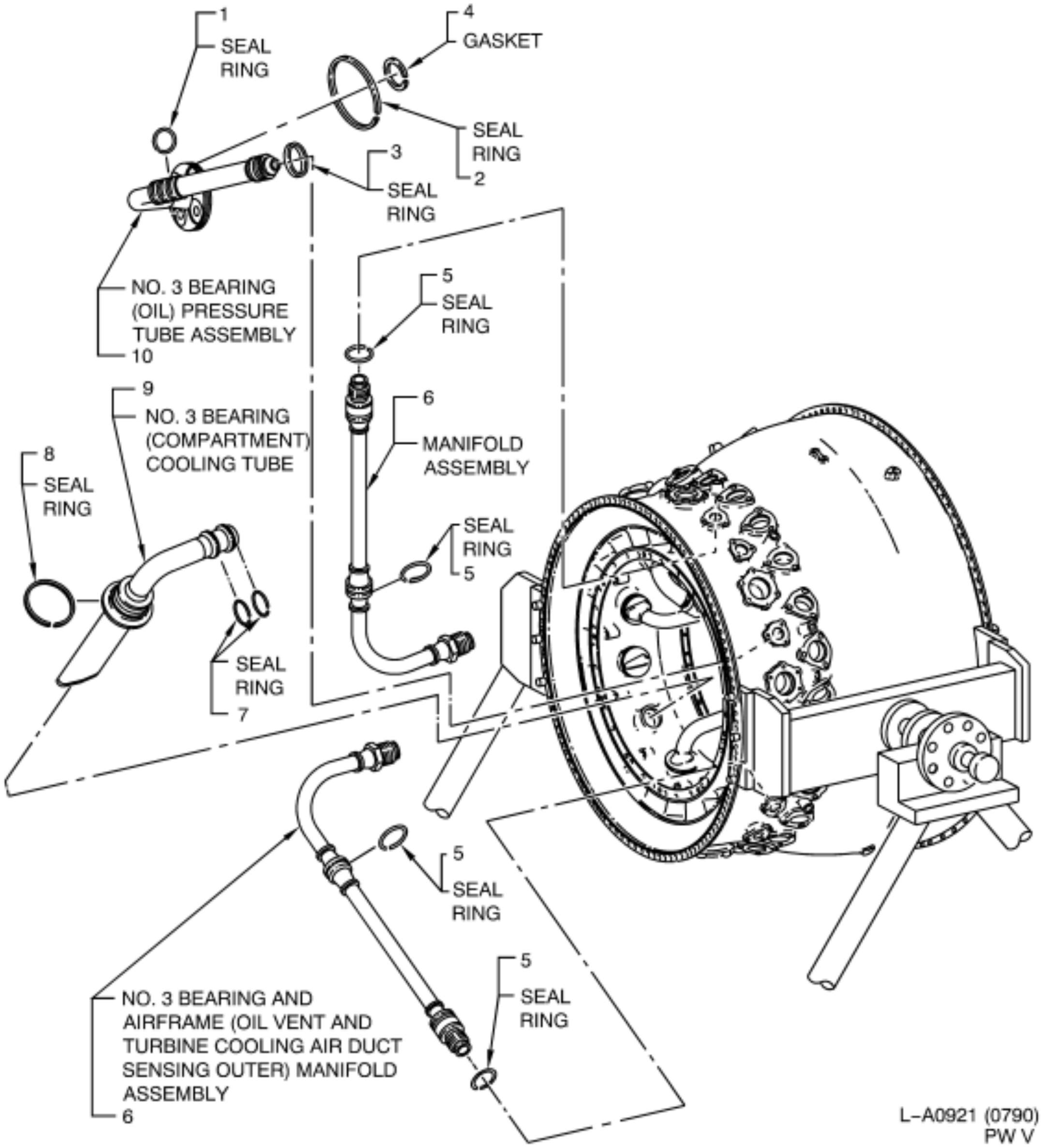

6
SEAL RING
5
NO. 3 BEARING BREATHER TUBE ASSEMBLY
SEAL RING
SEAL RING
GASKET
DIFFUSER CASE (POST SB PW4ENG 72−567)
2
DIFFUSER SEAL AIR VENT TUBE ASSEMBLY
SEAL RING
6 O'CLOCK POSITION
GASKET
SEAL RING
SEAL RING
SEAL RING
2
DIFFUSER SEAL AIR VENT TUBE ASSEMBLY
3
NO. 3 BEARING SCAVENGE TUBE ASSEMBLY
6
SEAL RING
L−B4642 (1197)
PW V

No. 3 Bearing (Breather) And (Scavenge) Tubes, Turbine Blade Cooling Tubes And Diffuser Seal Air Vent Tube
Figure 1002 (Sheet 2)
(Task 72−41−00−400−001)

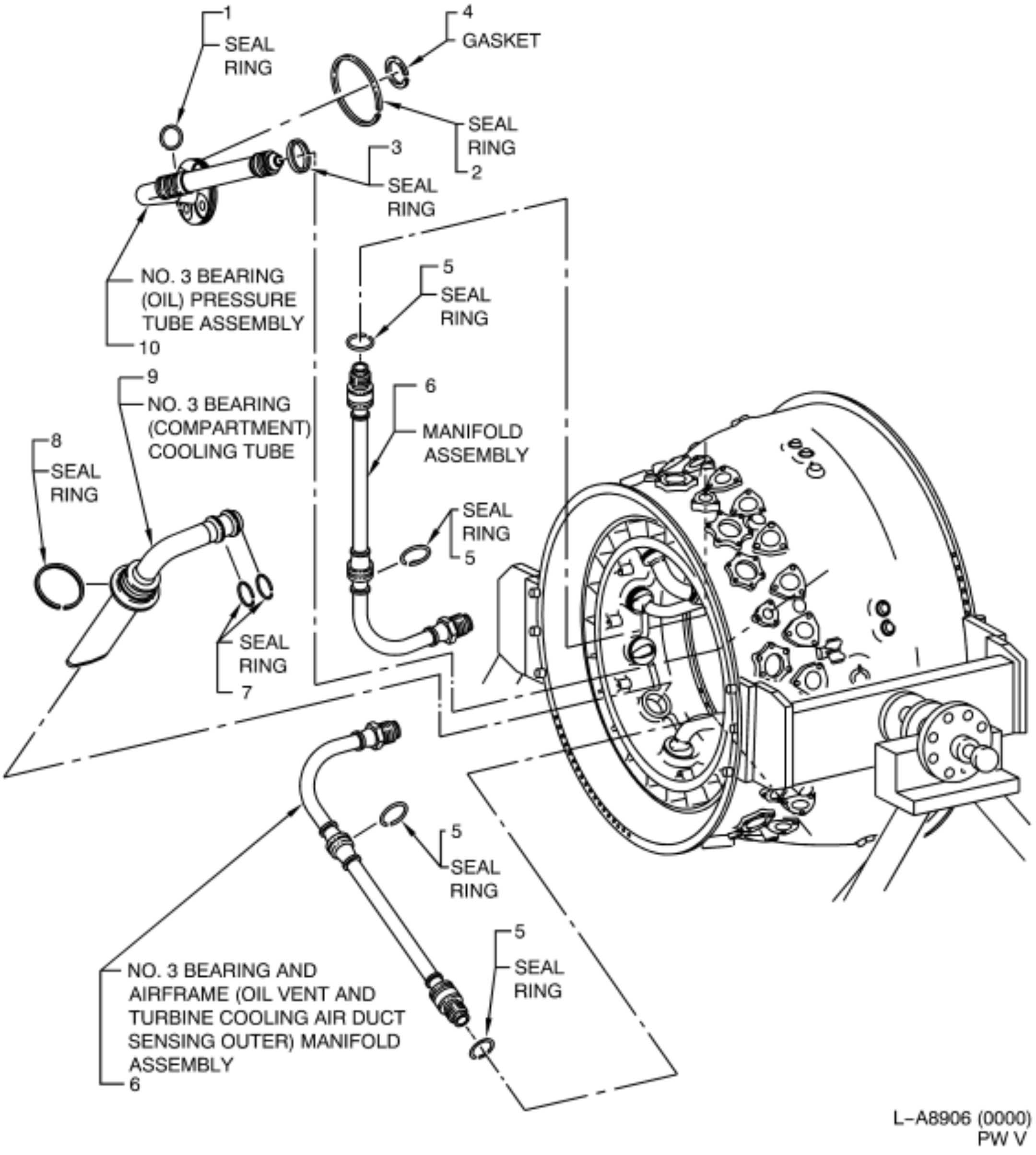

SEAL RING
1
TURBINE BLADE COOLING TUBE
SEAL RING
SEAL RING TRANSFER (TURBINE BLADE COOLING) TUBE
SEAL RING
SEAL RING
DIFFUSER CASE (POST SB PW4ENG 72−567)
TRANSFER TUBE
4
TURBINE BLADE COOLING TUBE
SEAL RING
6 O'CLOCK POSITION

L−B4643 (0197)
PW V

No. 3 Bearing (Breather) And (Scavenge) Tubes, Turbine Blade Cooling Tubes And Diffuser Seal Air Vent Tube
Figure 1002 (Sheet 3)
(Task 72−41−00−400−001)

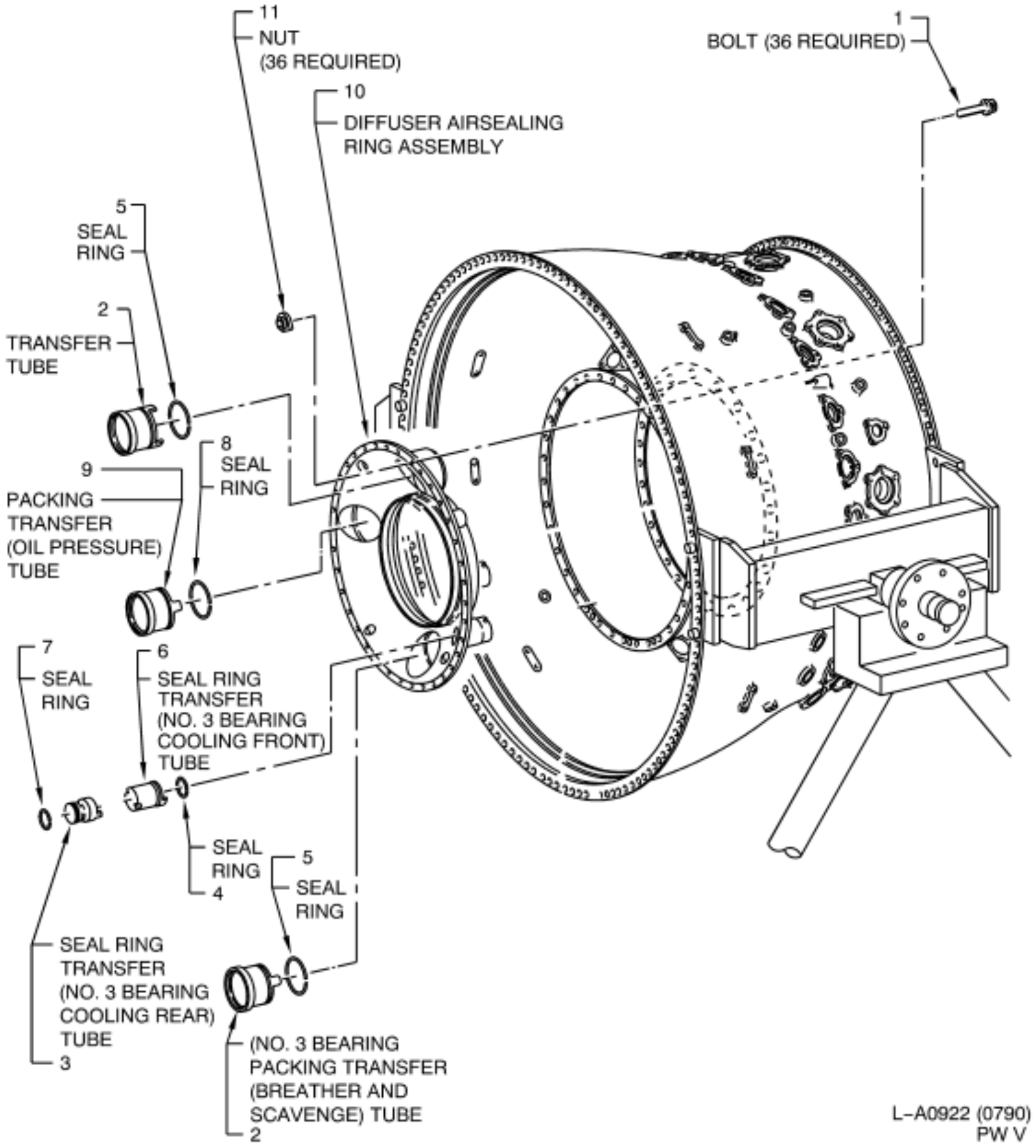

1
SEAL RING
4
GASKET
SEAL RING
2
3
SEAL RING
NO. 3 BEARING (OIL) PRESSURE TUBE ASSEMBLY
10
5
SEAL RING
9
NO. 3 BEARING (COMPARTMENT) COOLING TUBE
6
MANIFOLD ASSEMBLY
8
SEAL RING
SEAL RING
5
SEAL RING
7
5
SEAL RING
5
SEAL RING
NO. 3 BEARING AND AIRFRAME (OIL VENT AND TURBINE COOLING AIR DUCT SENSING OUTER) MANIFOLD ASSEMBLY
6
L-A0921 (0790)
PW V

No. 3 Bearing (Compartment) Cooling Tube And (Oil) Pressure Tube And Airframe Manifold Assemblies - Diffuser Case (Pre SB 72-567)
Figure 1003 (Sheet 1)
(Task 72-41-00-400-001)


1
SEAL RING
4
GASKET
SEAL RING
2
3
SEAL RING
NO. 3 BEARING (OIL) PRESSURE TUBE ASSEMBLY
10
5
SEAL RING
9
NO. 3 BEARING (COMPARTMENT) COOLING TUBE
6
MANIFOLD ASSEMBLY
8
SEAL RING
SEAL RING
5
SEAL RING
7
5
SEAL RING
5
SEAL RING
NO. 3 BEARING AND AIRFRAME (OIL VENT AND TURBINE COOLING AIR DUCT SENSING OUTER) MANIFOLD ASSEMBLY
6
L-A8906 (0000)
PW V

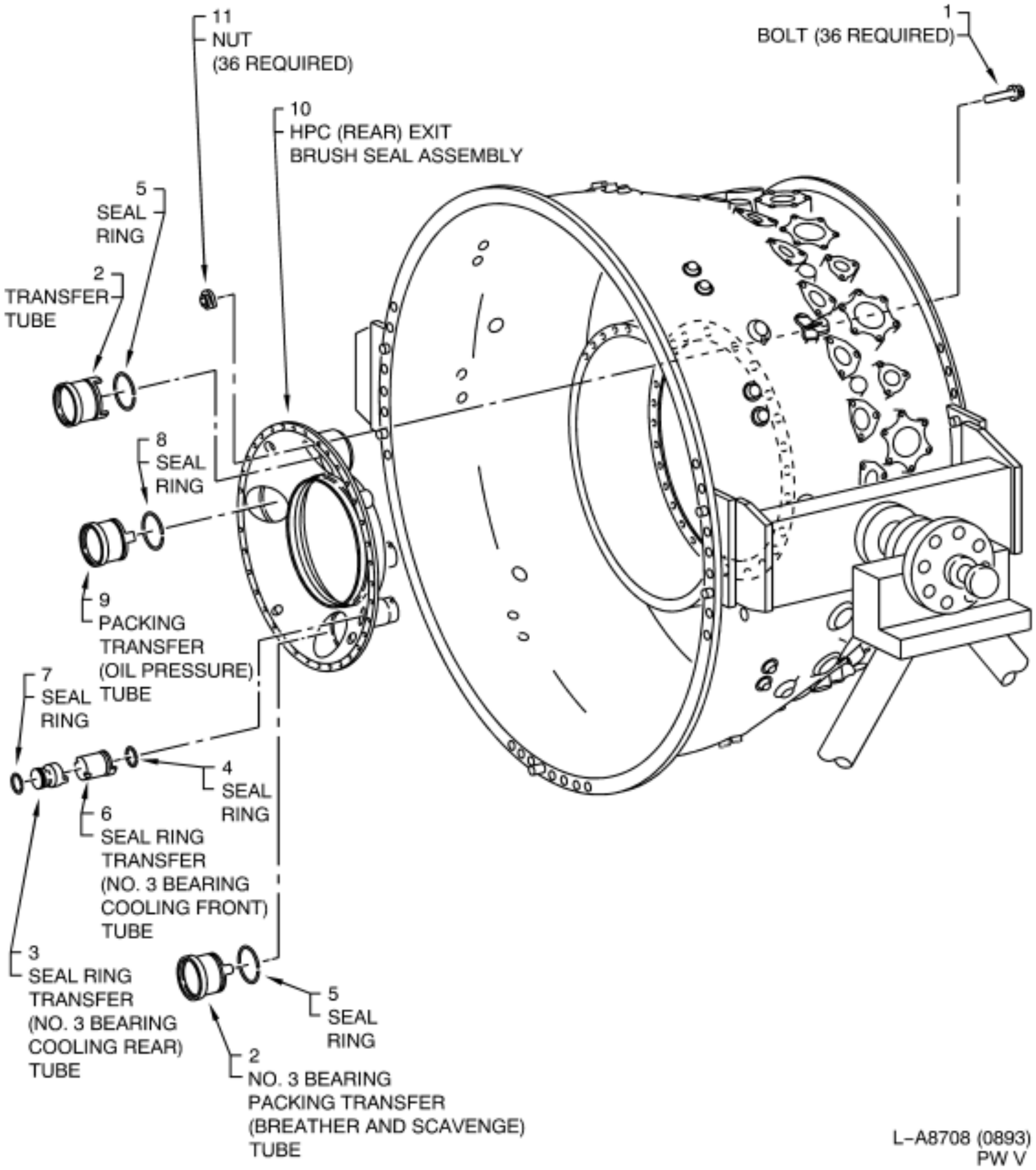
No. 3 Bearing (Compartment) Cooling Tube And (Oil) Pressure Tube And Airframe Manifold Assemblies - Diffuser Case (Post SB 72-567)
Figure 1003 (Sheet 2)
(Task 72-41-00-400-001)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01


11
NUT
(36 REQUIRED)
1
BOLT (36 REQUIRED)
10
DIFFUSER AIRSEALING
RING ASSEMBLY
5
SEAL
RING
2
TRANSFER
TUBE
8
SEAL
RING
9
PACKING
TRANSFER
(OIL PRESSURE)
TUBE
7
SEAL
RING
6
SEAL RING
TRANSFER
(NO. 3 BEARING
COOLING FRONT)
TUBE
SEAL
RING
4
5
SEAL
RING
SEAL RING
TRANSFER
(NO. 3 BEARING
COOLING REAR)
TUBE
3
(NO. 3 BEARING
PACKING TRANSFER
(BREATHER AND
SCAVENGE) TUBE
2
L-A0922 (0790)
PW V

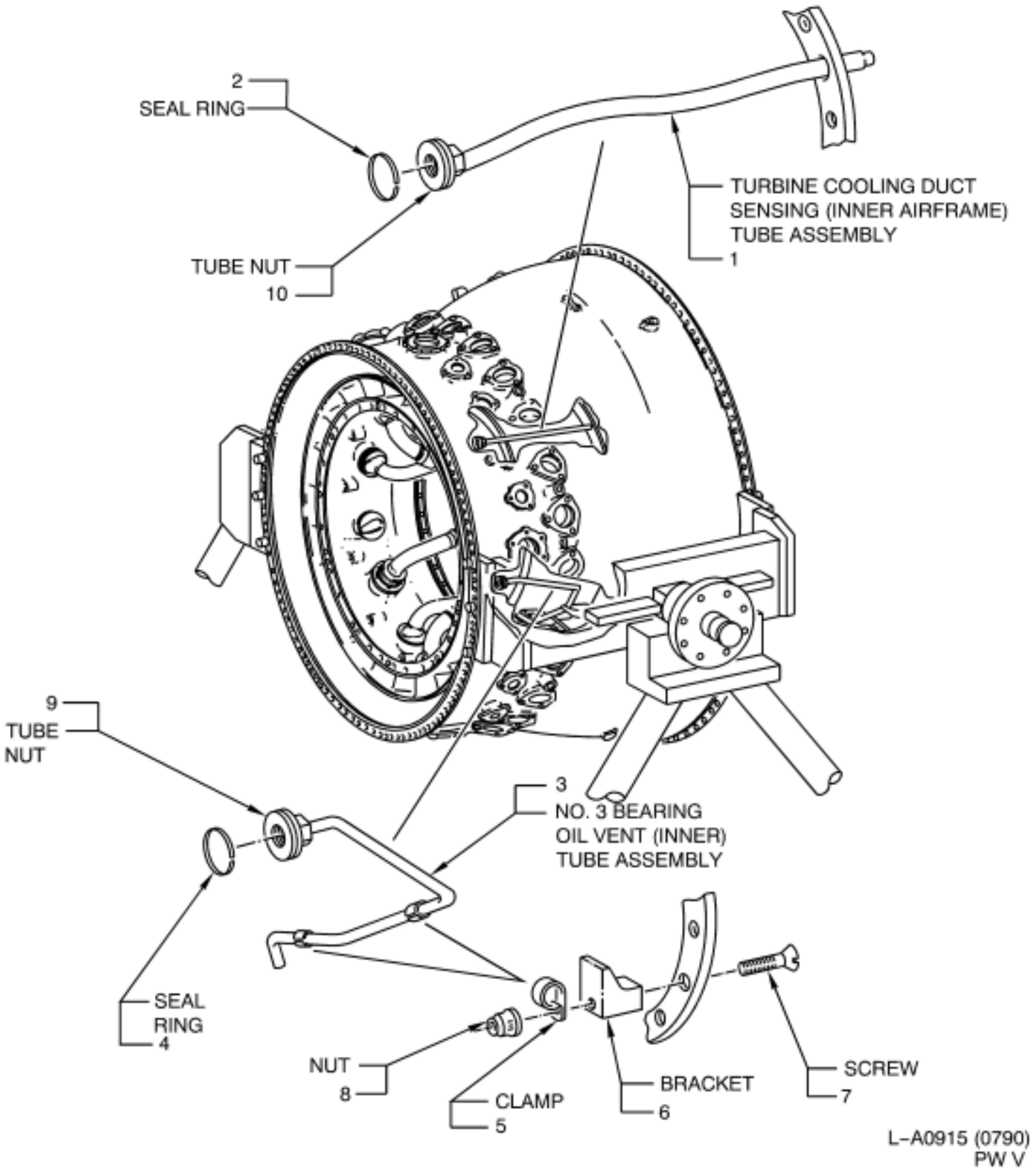
Airsealing Ring Assembly Diffuser Case (Pre SB PW4ENG 72-567)
Figure 1004 (Sheet 1)
(Task 72-41-00-400-001)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01

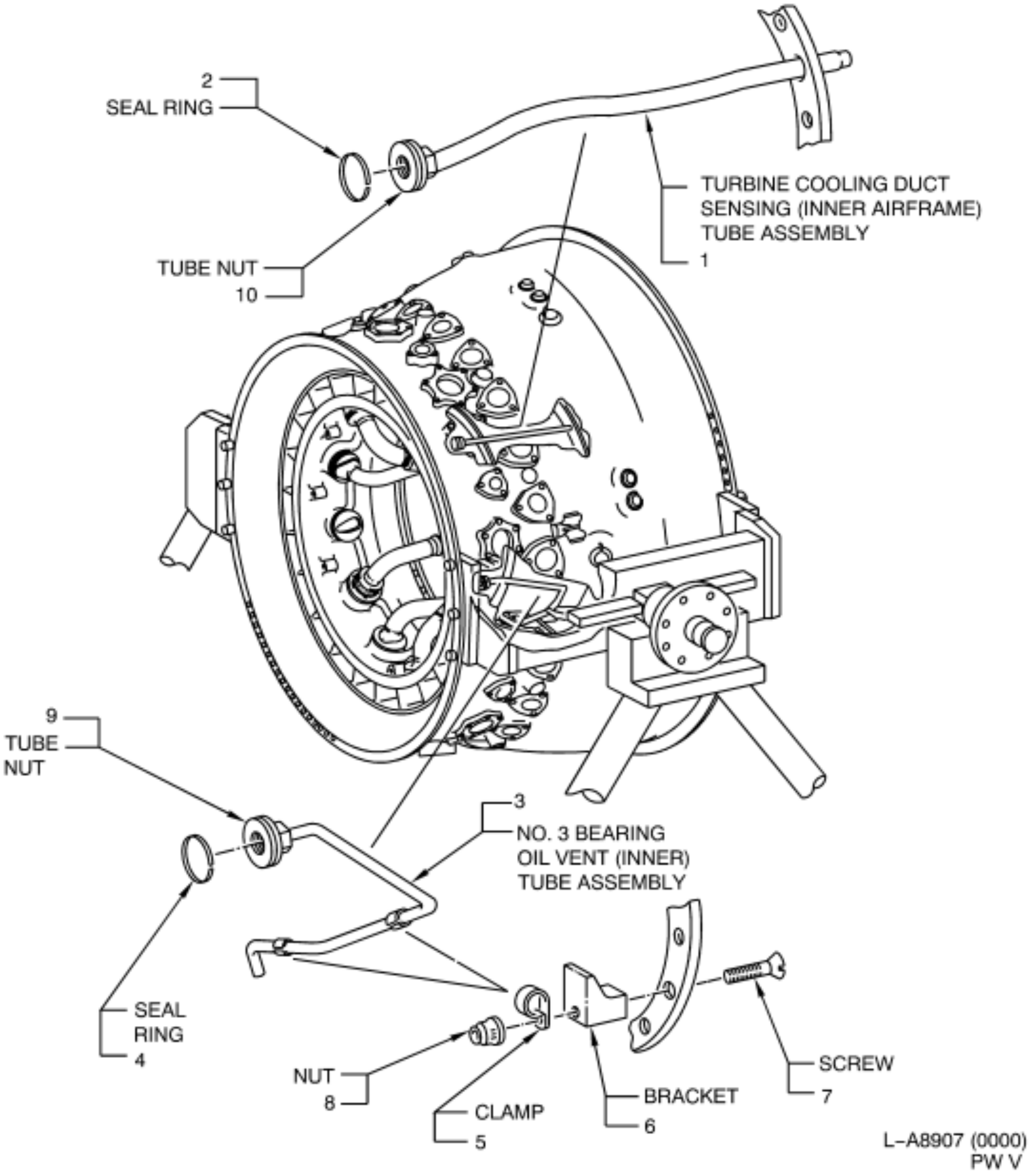

11
NUT
(36 REQUIRED)
1
BOLT (36 REQUIRED)
10
HPC (REAR) EXIT
BRUSH SEAL ASSEMBLY
5
SEAL
RING
2
TRANSFER
TUBE
8
SEAL
RING
9
PACKING
TRANSFER
(OIL PRESSURE)
TUBE
7
SEAL
RING
4
SEAL
RING
6
SEAL RING
TRANSFER
(NO. 3 BEARING
COOLING FRONT)
TUBE
3
SEAL RING
TRANSFER
(NO. 3 BEARING
COOLING REAR)
TUBE
5
SEAL
RING
2
NO. 3 BEARING
PACKING TRANSFER
(BREATHER AND SCAVENGE)
TUBE
L-A8708 (0893)
PW V

Airsealing Ring Assembly Diffuser Case (Post SB PW4ENG 72-567)
Figure 1004 (Sheet 2)
(Task 72-41-00-400-001)

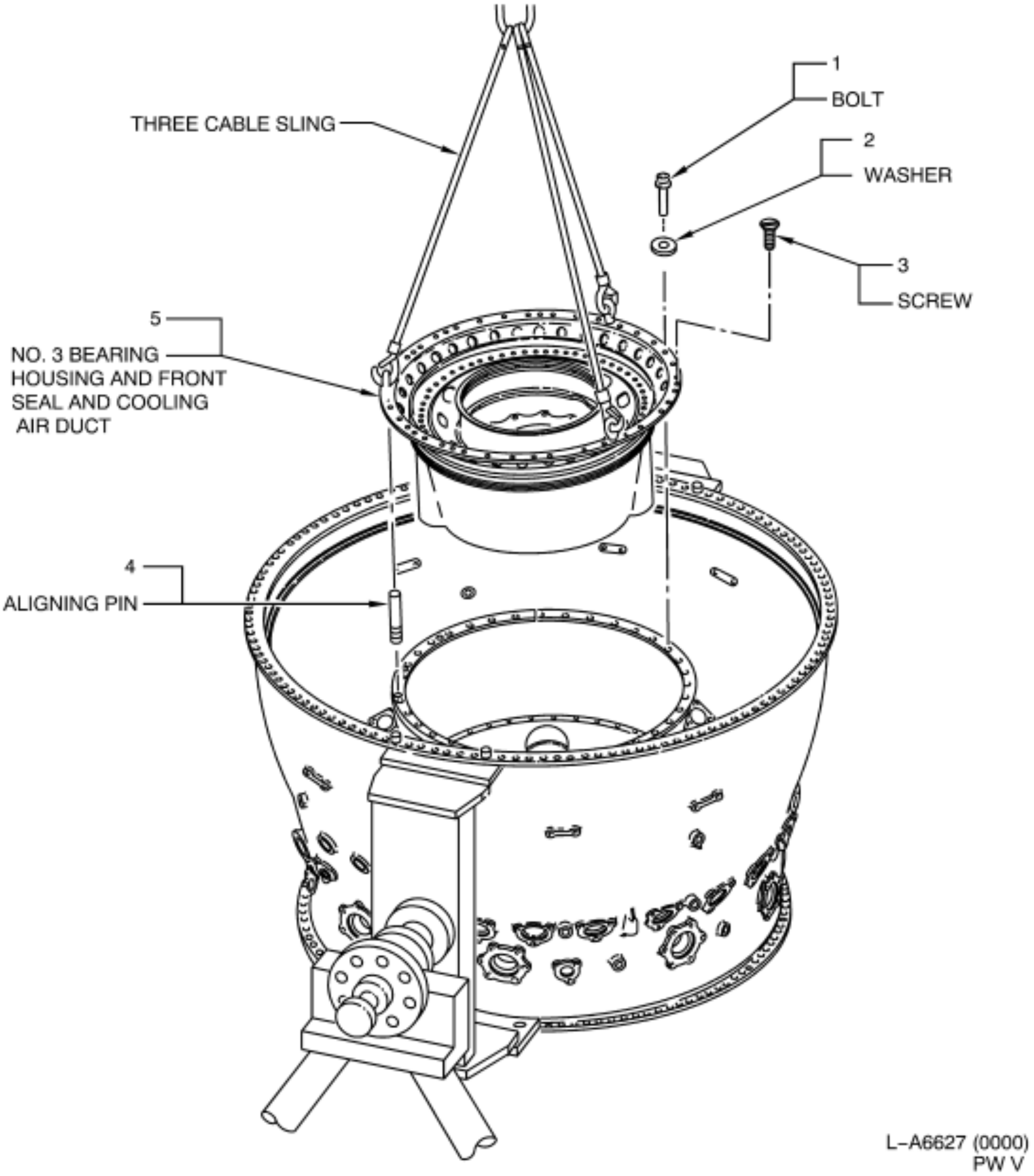
DIFFUSER AND COMBUSTOR − ASSEMBLY−01


2
SEAL RING
TURBINE COOLING DUCT SENSING (INNER AIRFRAME) TUBE ASSEMBLY
1
TUBE NUT
10
9
TUBE NUT
3
NO. 3 BEARING OIL VENT (INNER) TUBE ASSEMBLY
SEAL RING
4
NUT
8
CLAMP
5
BRACKET
6
SCREW
7
L−A0915 (0790)
PW V

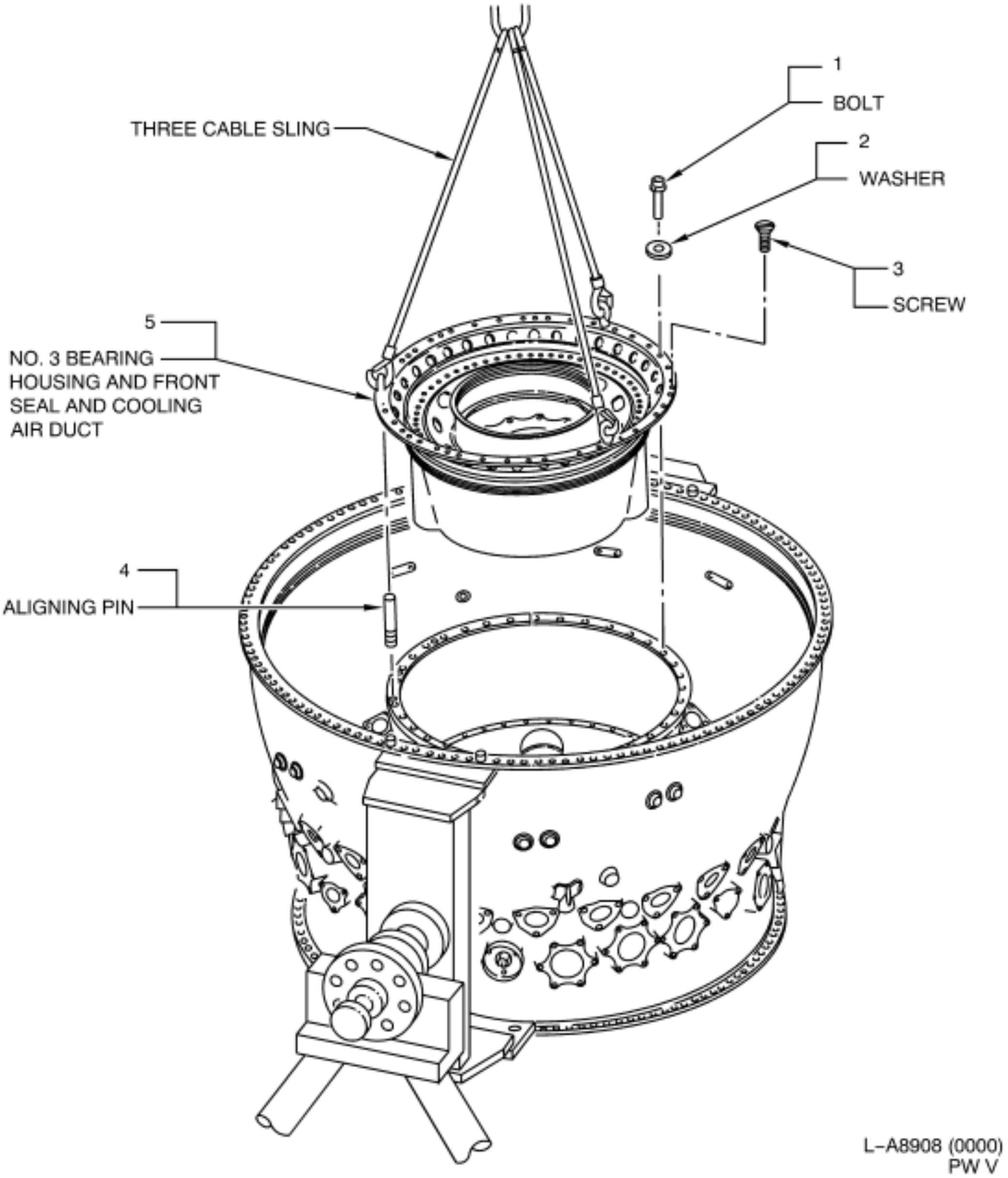
Diffuser Case Internal Tubing Assembly (Pre SB PW4ENG 72−567)
Figure 1005 (Sheet 1)
(Task 72−41−00−400−001)


2
SEAL RING
TURBINE COOLING DUCT SENSING (INNER AIRFRAME) TUBE ASSEMBLY
1
TUBE NUT
10
9
TUBE NUT
3
NO. 3 BEARING OIL VENT (INNER) TUBE ASSEMBLY
SEAL RING
4
NUT
8
CLAMP
5
BRACKET
6
SCREW
7
L-A8907 (0000)
PW V

Diffuser Case Internal Tubing Assembly (Post SB PW4ENG 72-567)
Figure 1005 (Sheet 2)
(Task 72-41-00-400-001)

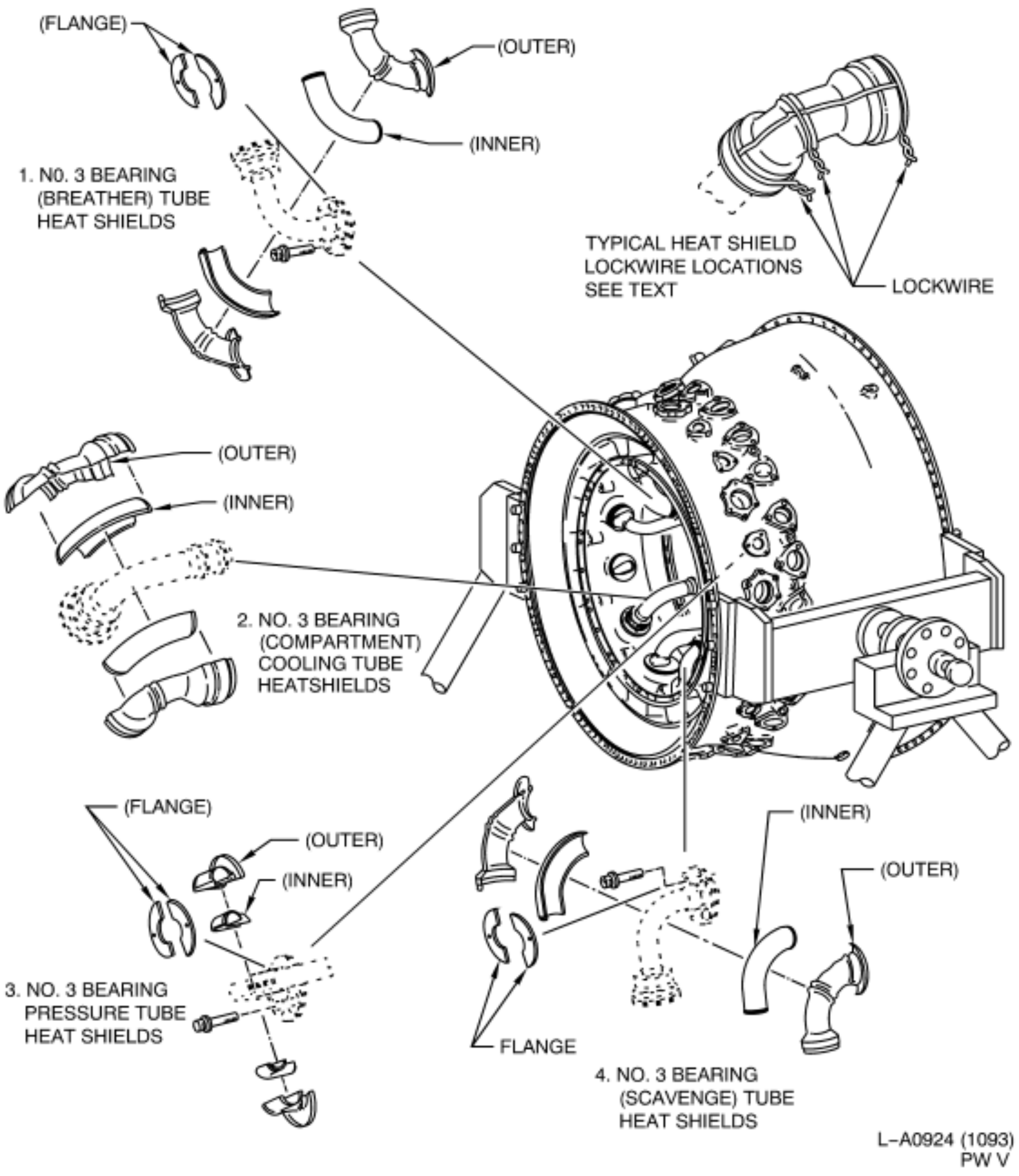

1
BOLT
2
WASHER
3
SCREW
THREE CABLE SLING
5
NO. 3 BEARING HOUSING AND FRONT SEAL AND COOLING AIR DUCT
4
ALIGNING PIN
L-A6627 (0000)
PW V

No. 3 Bearing Cooling Duct Assembly Installation
Diffuser Case (Pre SB PW4ENG 72-567)
Figure 1006 (Sheet 1)
(Task 72-41-00-400-001)

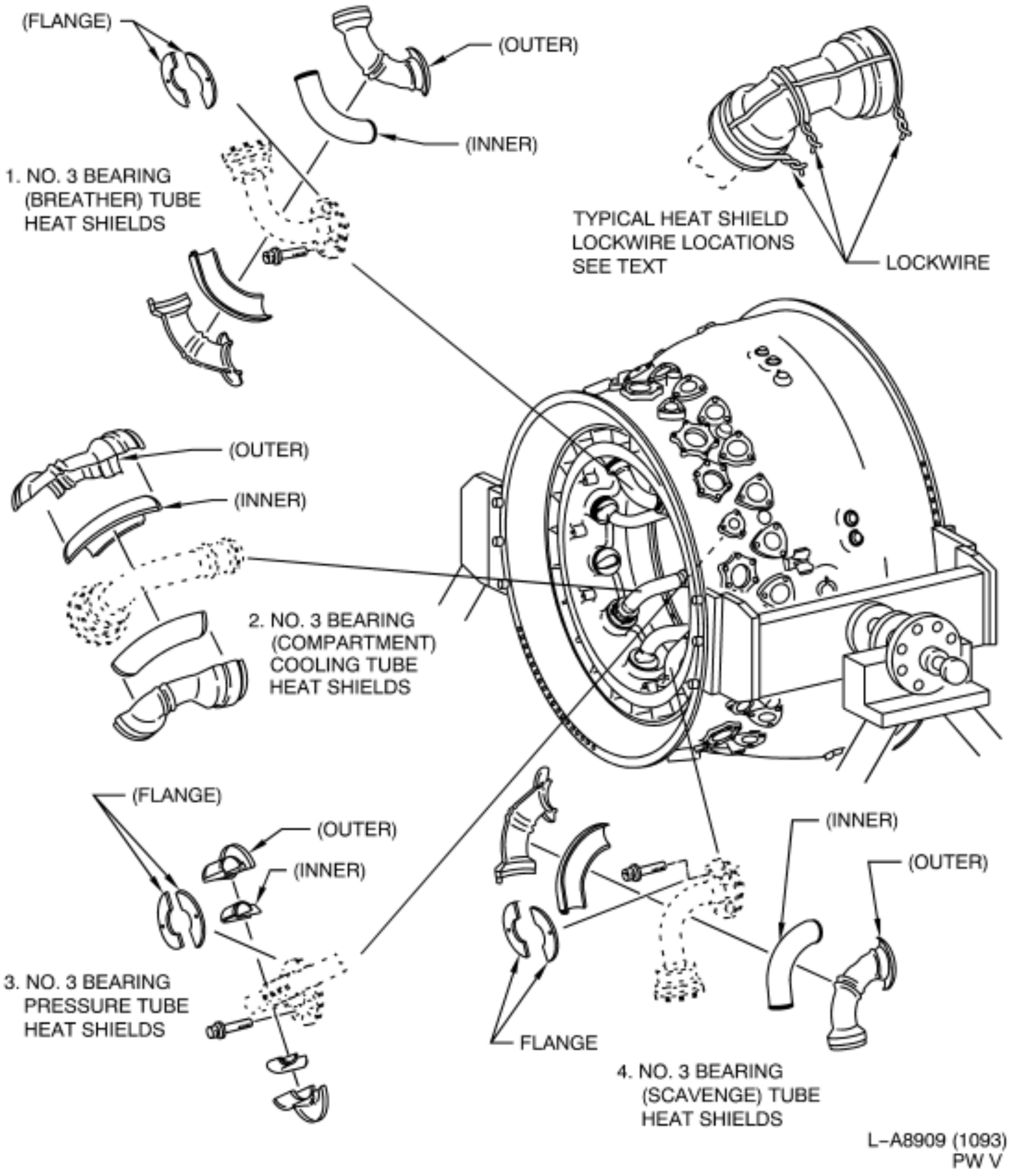

THREE CABLE SLING
1
BOLT
2
WASHER
3
SCREW
5
NO. 3 BEARING HOUSING AND FRONT SEAL AND COOLING AIR DUCT
4
ALIGNING PIN
L-A8908 (0000)
PW V

No. 3 Bearing Cooling Duct Assembly Installation
Diffuser Case (Post SB PW4ENG 72-567)
Figure 1006 (Sheet 2)
(Task 72-41-00-400-001)

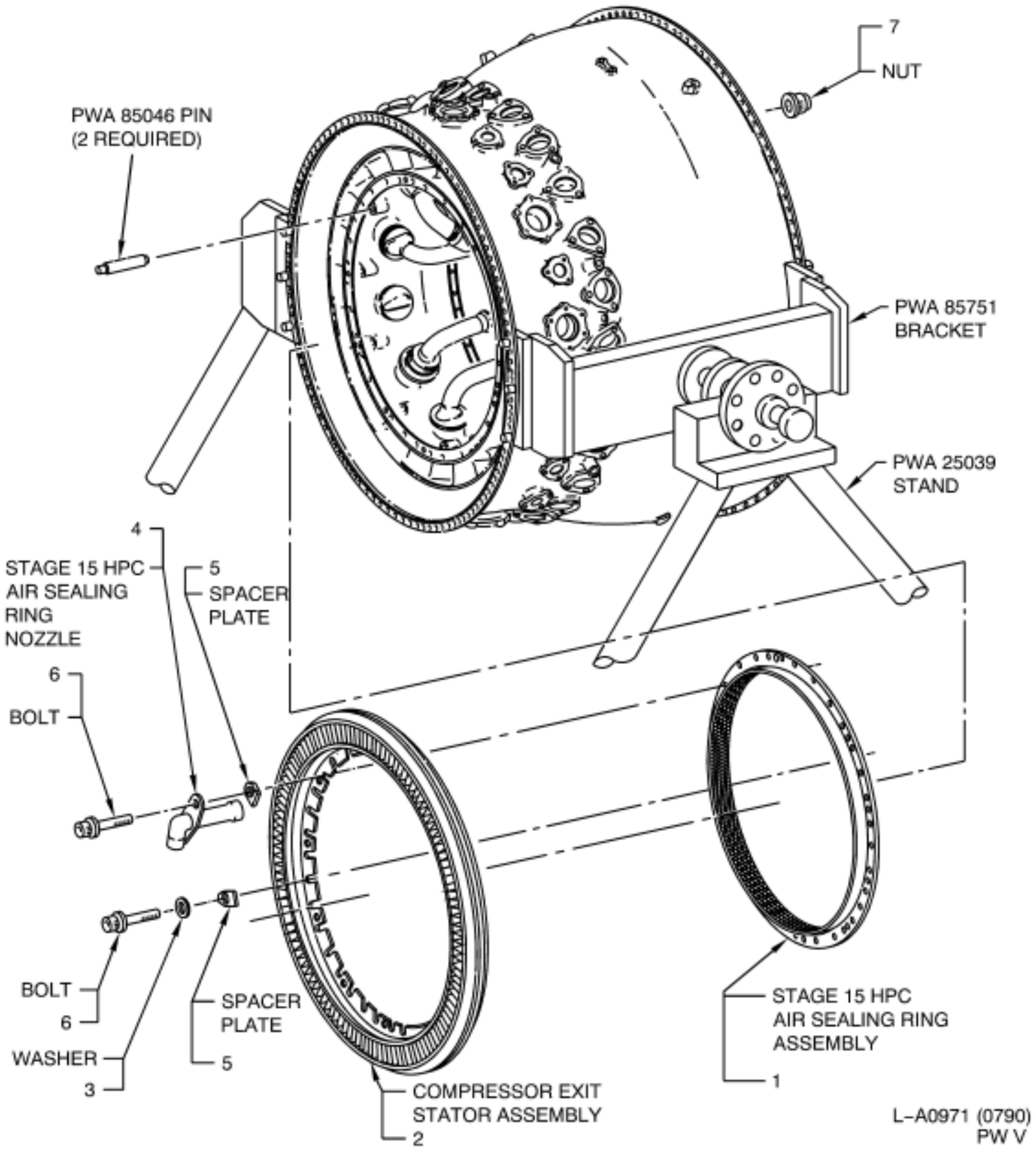
DIFFUSER AND COMBUSTOR - ASSEMBLY-01


(FLANGE)
(OUTER)
(INNER)
1. NO. 3 BEARING (BREATHER) TUBE HEAT SHIELDS
TYPICAL HEAT SHIELD LOCKWIRE LOCATIONS SEE TEXT
LOCKWIRE
(OUTER)
(INNER)
2. NO. 3 BEARING (COMPARTMENT) COOLING TUBE HEATSHIELDS
(FLANGE)
(OUTER)
(INNER)
3. NO. 3 BEARING PRESSURE TUBE HEAT SHIELDS
FLANGE
(INNER)
(OUTER)
4. NO. 3 BEARING (SCAVENGE) TUBE HEAT SHIELDS
L-A0924 (1093)
PW V

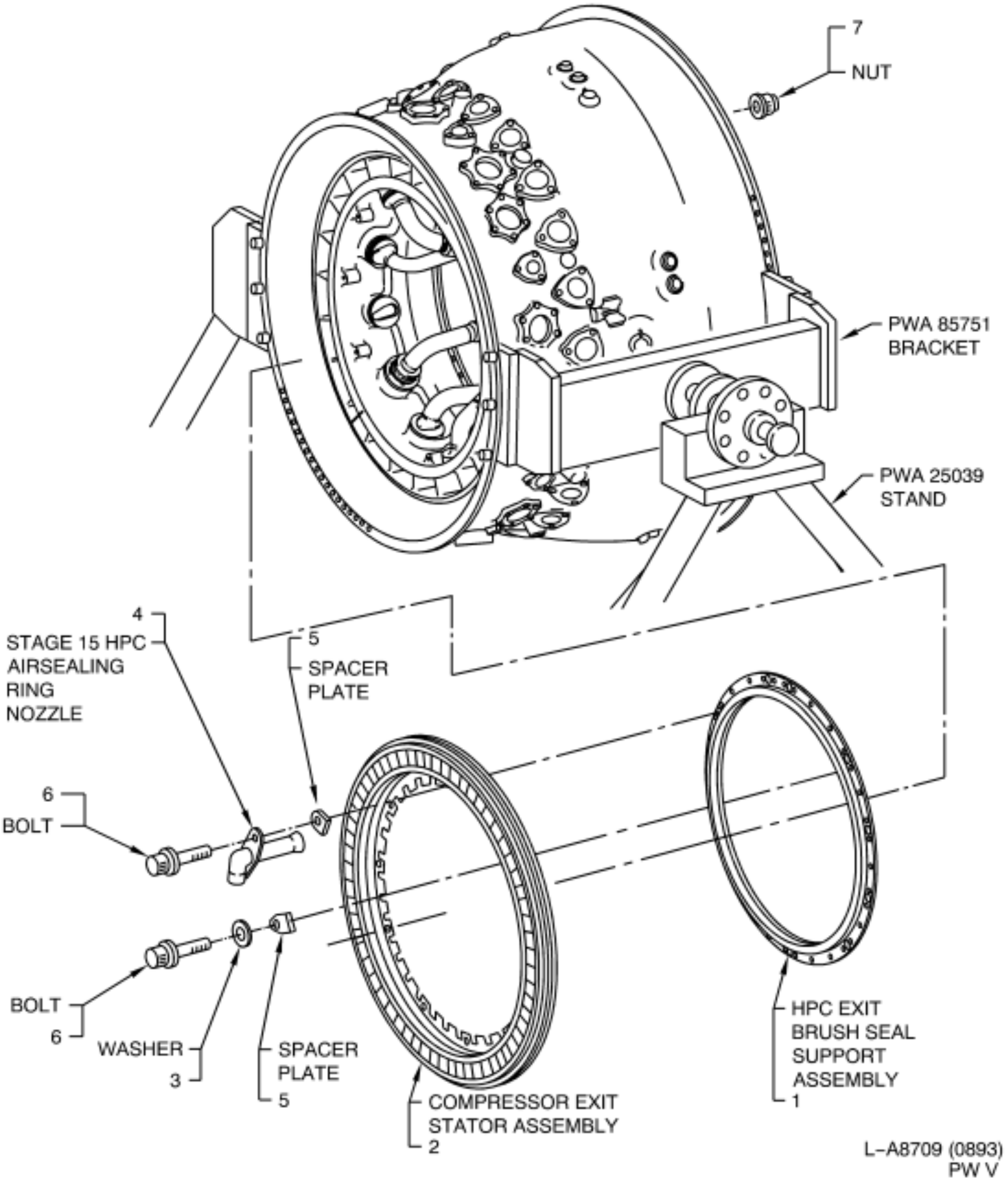
Heat Shields For The No. 3 Bearing Tubes
Diffuser Case (Pre SB PW4ENG 72-567)
Figure 1007 (Sheet 1)
(Task 72-41-00-400-001)


(FLANGE)
(OUTER)
(INNER)
1. NO. 3 BEARING (BREATHER) TUBE HEAT SHIELDS
TYPICAL HEAT SHIELD LOCKWIRE LOCATIONS SEE TEXT
LOCKWIRE
(OUTER)
(INNER)
2. NO. 3 BEARING (COMPARTMENT) COOLING TUBE HEAT SHIELDS
(FLANGE)
(OUTER)
(INNER)
3. NO. 3 BEARING PRESSURE TUBE HEAT SHIELDS
(INNER)
(OUTER)
FLANGE
4. NO. 3 BEARING (SCAVENGE) TUBE HEAT SHIELDS
L-A8909 (1093)
PW V

Heat Shields For The No. 3 Bearing Tubes
Diffuser Case (Post SB PW4ENG 72-567)
Figure 1007 (Sheet 2)
(Task 72-41-00-400-001)

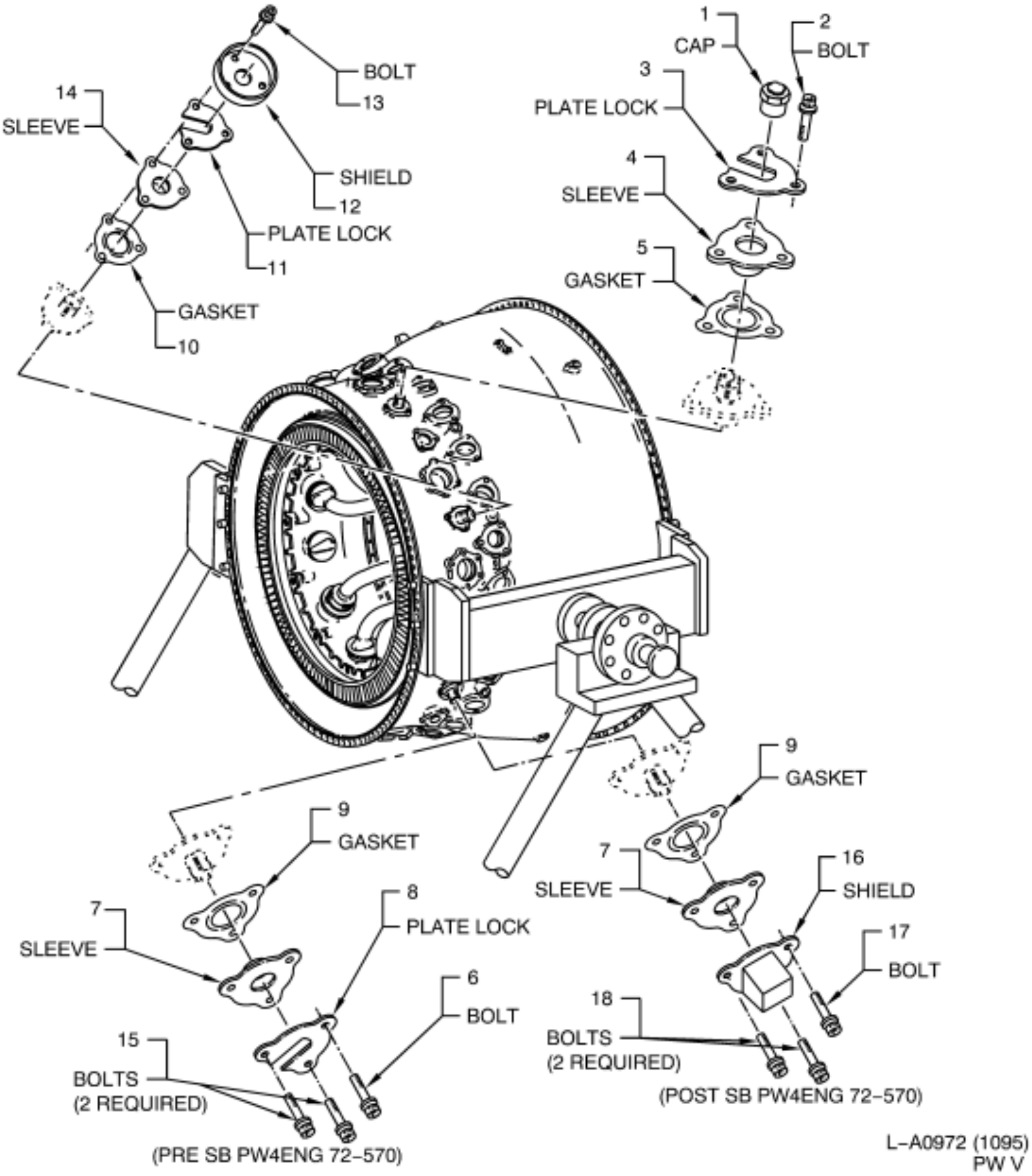

7
NUT
PWA 85046 PIN
(2 REQUIRED)
PWA 85751
BRACKET
PWA 25039
STAND
4
STAGE 15 HPC
AIR SEALING
RING
NOZZLE
5
SPACER
PLATE
6
BOLT
BOLT
6
SPACER
PLATE
5
WASHER
3
COMPRESSOR EXIT
STATOR ASSEMBLY
2
STAGE 15 HPC
AIR SEALING RING
ASSEMBLY
1
L-A0971 (0790)
PW V

Stage 15 HPC Stator Installation Diffuser Case
(Pre SB PW4ENG 72-572 And SB PW4ENG 72-567)
Figure 1008 (Sheet 1)
(Task 72-41-00-400-001)


7
NUT
PWA 85751
BRACKET
PWA 25039
STAND
4
STAGE 15 HPC
AIRSEALING
RING
NOZZLE
5
SPACER
PLATE
6
BOLT
BOLT
6
WASHER
3
SPACER
PLATE
5
COMPRESSOR EXIT
STATOR ASSEMBLY
2
HPC EXIT
BRUSH SEAL
SUPPORT
ASSEMBLY
1
L-A8709 (0893)
PW V

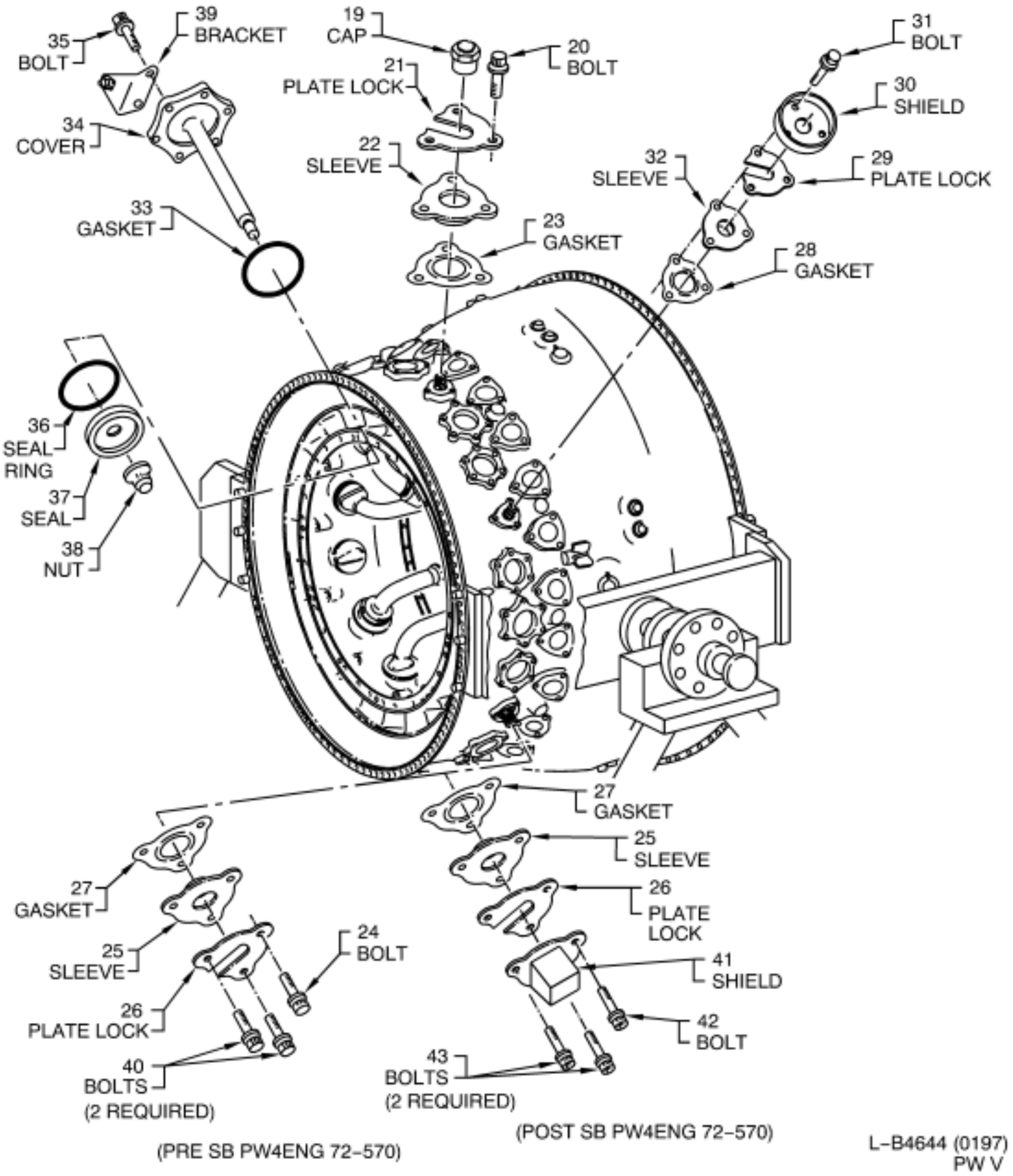
HPC Exit Brush Seal Support Assembly And The Compressor
Exit Stator Assembly Installation Diffuser Case
(Post SB PW4ENG 72-572 And SB PW4ENG 72-567)
Figure 1008 (Sheet 2)
(Task 72-41-00-400-001)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01

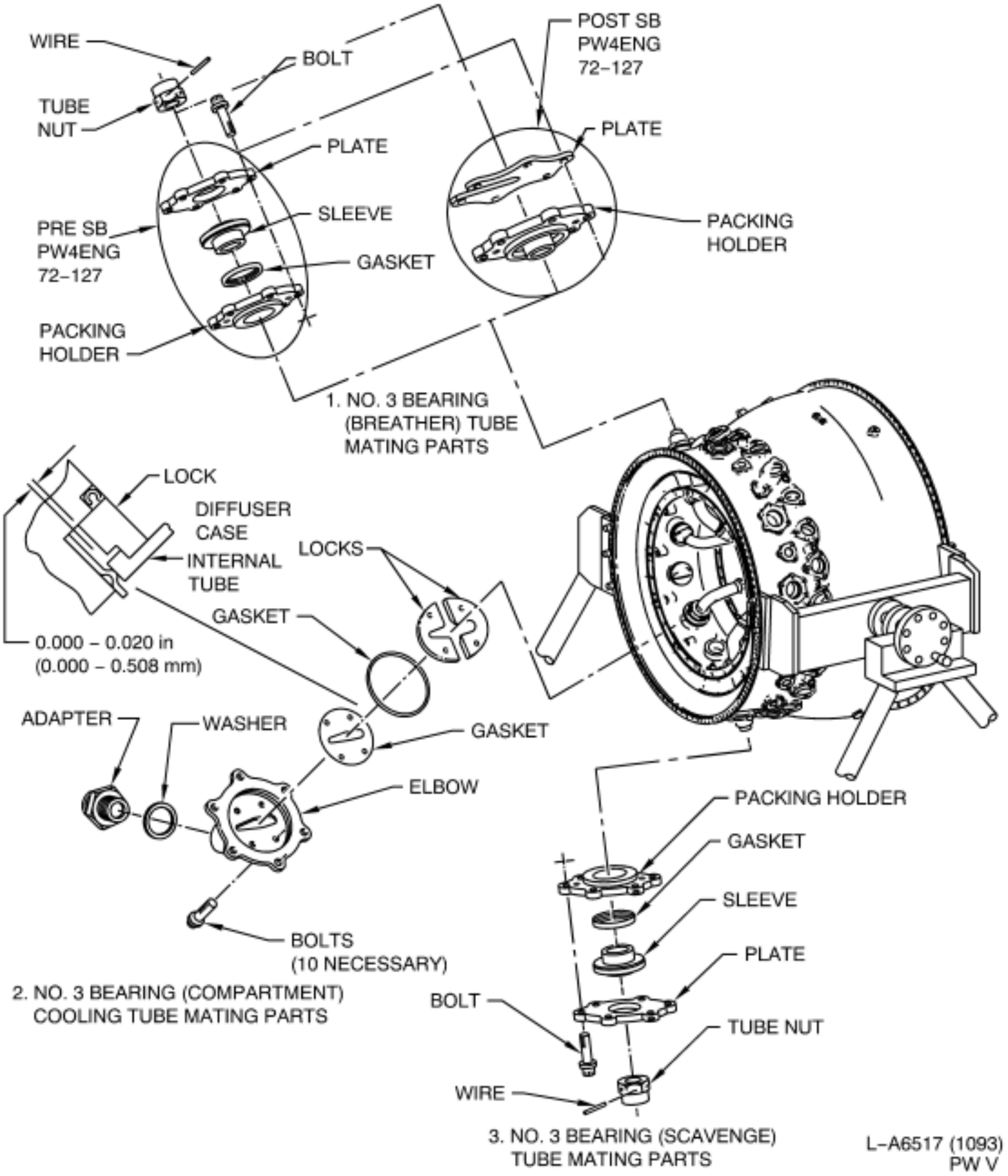

1
CAP
2
BOLT
3
PLATE LOCK
4
SLEEVE
5
GASKET
BOLT
13
14
SLEEVE
SHIELD
12
PLATE LOCK
11
GASKET
10
9
GASKET
7
SLEEVE
16
SHIELD
17
BOLT
18
BOLTS
(2 REQUIRED)
(POST SB PW4ENG 72-570)
9
GASKET
7
SLEEVE
8
PLATE LOCK
6
BOLT
15
BOLTS
(2 REQUIRED)
(PRE SB PW4ENG 72-570)
L-A0972 (1095)
PW V

Diffuser Case Internal Tubing Assembly (Pre SBPW4ENG 72-567)
Figure 1009 (Sheet 1)
(Task 72-41-00-400-001)

DIFFUSER AND COMBUSTOR − ASSEMBLY−01

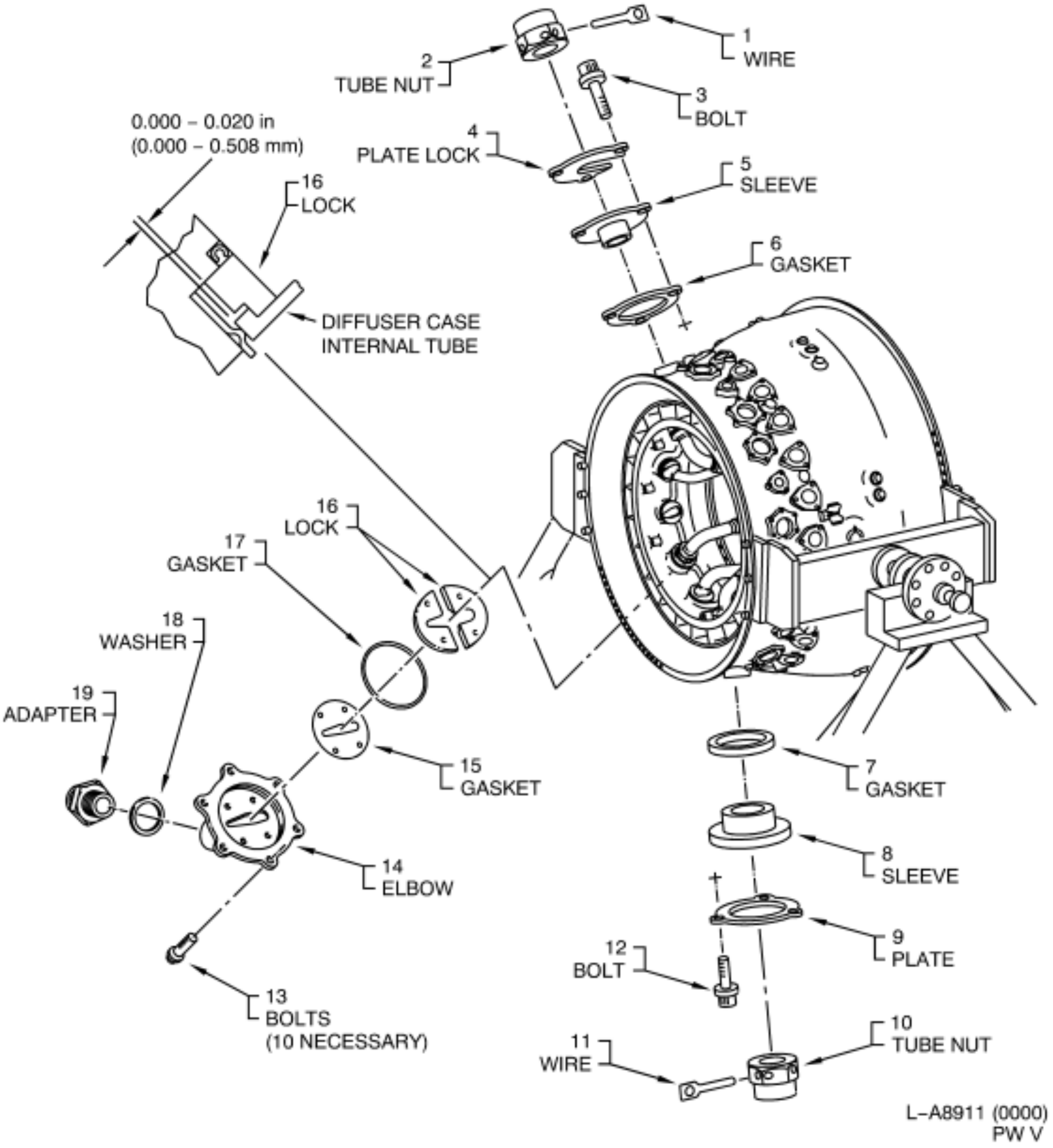

35 BOLT
39 BRACKET
19 CAP
21 PLATE LOCK
20 BOLT
31 BOLT
30 SHIELD
34 COVER
22 SLEEVE
32 SLEEVE
29 PLATE LOCK
33 GASKET
23 GASKET
28 GASKET
36 SEAL RING
37 SEAL
38 NUT
27 GASKET
25 SLEEVE
26 PLATE LOCK
41 SHIELD
42 BOLT
27 GASKET
25 SLEEVE
24 BOLT
26 PLATE LOCK
40 BOLTS (2 REQUIRED)
43 BOLTS (2 REQUIRED)
(PRE SB PW4ENG 72−570)
(POST SB PW4ENG 72−570)
L−B4644 (0197)
PW V

Diffuser Case Internal Tubing Assembly (Post SB PW4ENG 72−567)
Figure 1009 (Sheet 2)
(Task 72−41−00−400−001)

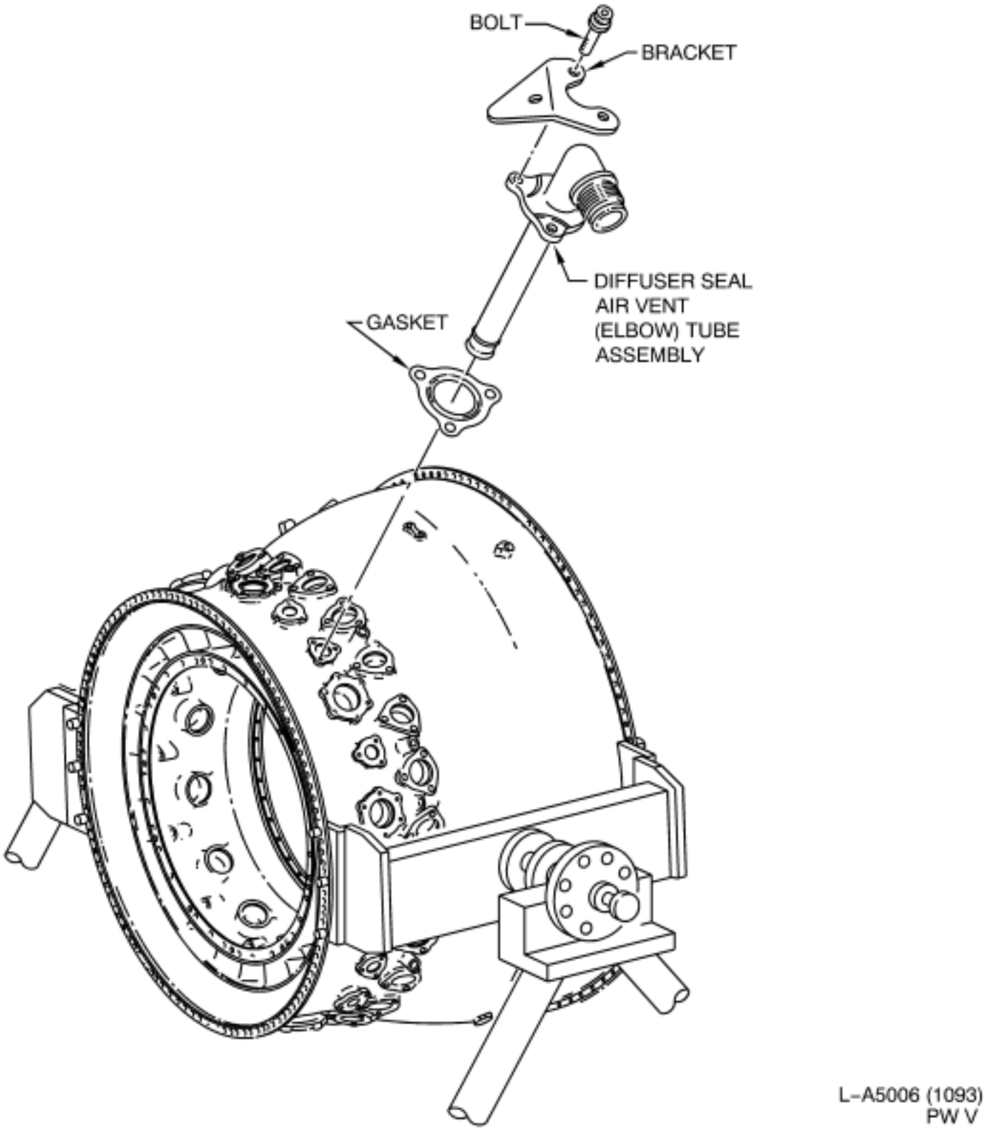

WIRE
BOLT
POST SB PW4ENG 72-127
TUBE NUT
PLATE
PLATE
SLEEVE
PRE SB PW4ENG 72-127
GASKET
PACKING HOLDER
PACKING HOLDER
1. NO. 3 BEARING (BREATHER) TUBE MATING PARTS
LOCK
DIFFUSER CASE
INTERNAL TUBE
LOCKS
GASKET
0.000 - 0.020 in (0.000 - 0.508 mm)
ADAPTER
WASHER
GASKET
ELBOW
BOLTS (10 NECESSARY)
2. NO. 3 BEARING (COMPARTMENT) COOLING TUBE MATING PARTS
PACKING HOLDER
GASKET
SLEEVE
PLATE
BOLT
TUBE NUT
WIRE
3. NO. 3 BEARING (SCAVENGE) TUBE MATING PARTS
L-A6517 (1093)
PW V

No. 3 Bearing Breather, Scavenge And Compartment Cooling Tube Plates And Packing Holders - Diffuser Case (Pre SB PW4ENG 72-567)
Figure 1010
(Task 72-41-00-400-001)

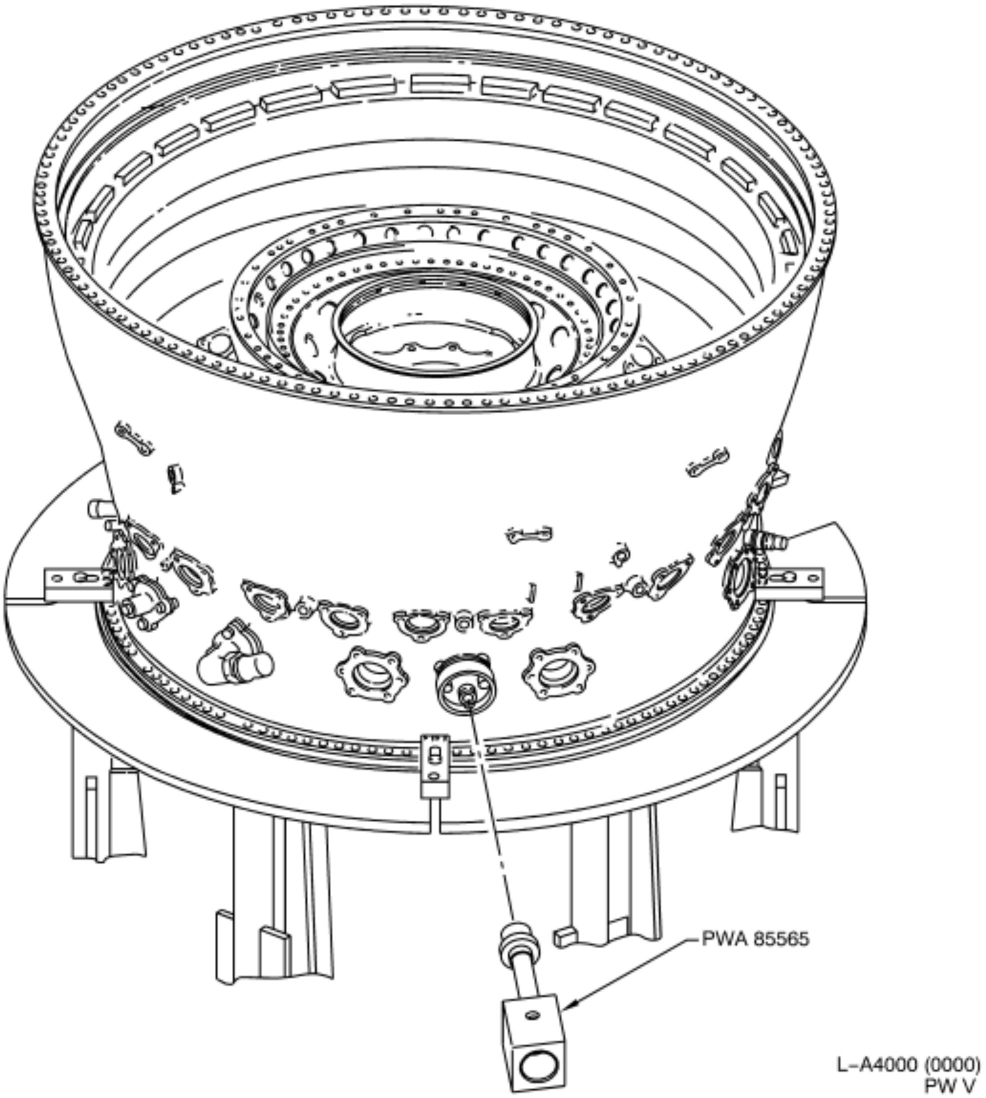
DIFFUSER AND COMBUSTOR − ASSEMBLY−01


1 WIRE
2 TUBE NUT
3 BOLT
4 PLATE LOCK
5 SLEEVE
6 GASKET
0.000 − 0.020 in
(0.000 − 0.508 mm)
16 LOCK
DIFFUSER CASE
INTERNAL TUBE
16 LOCK
17 GASKET
18 WASHER
19 ADAPTER
15 GASKET
14 ELBOW
13 BOLTS
(10 NECESSARY)
7 GASKET
8 SLEEVE
9 PLATE
12 BOLT
10 TUBE NUT
11 WIRE
L−A8911 (0000)
PW V

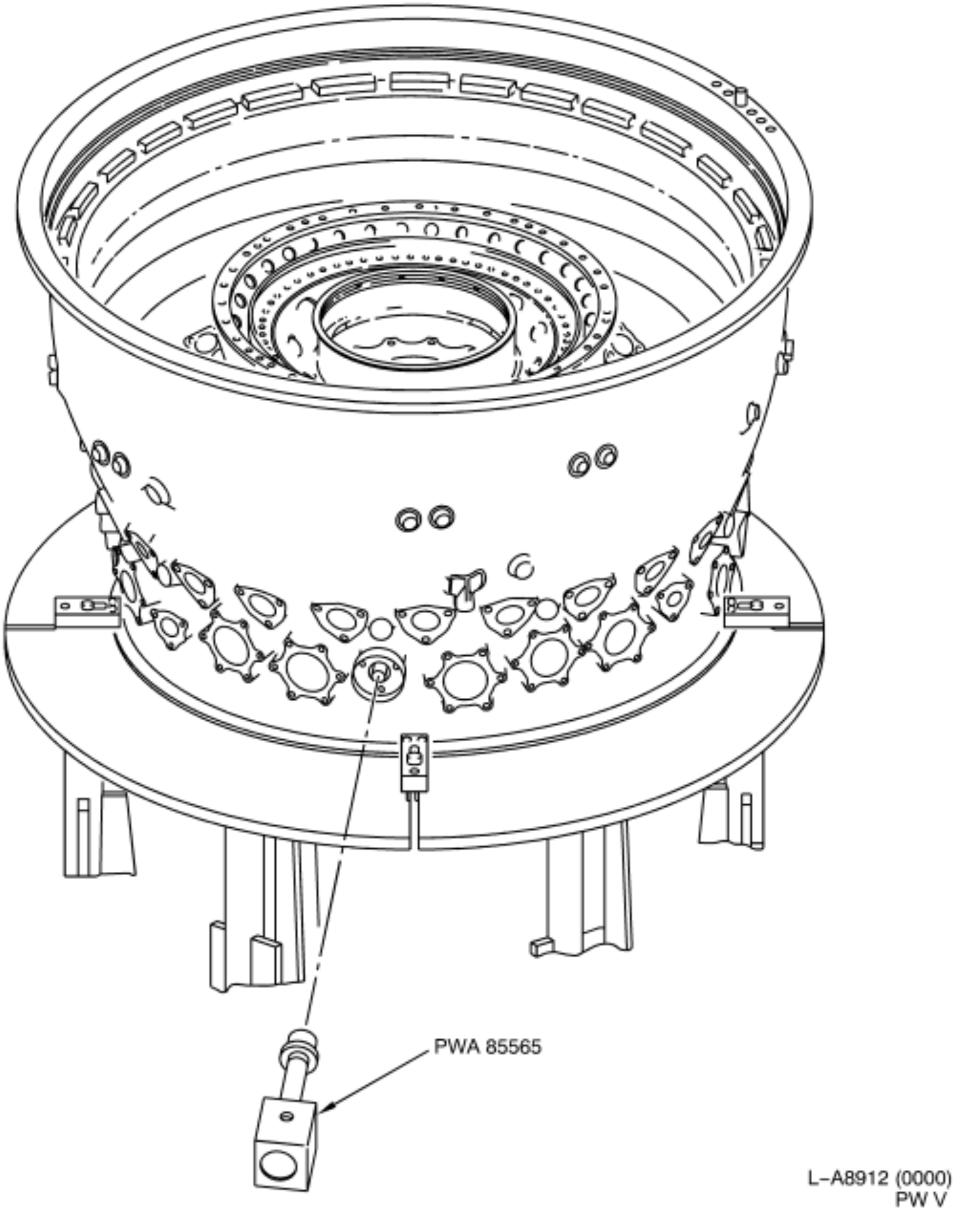
No. 3 Bearing Breather, Scavenge And Compartment Cooling Tube
Plates And Packing Holders − Diffuser Case (Post SB PW4ENG 72−567)
Figure 1011
(Task 72−41−00−400−001)


BOLT
BRACKET
DIFFUSER SEAL AIR VENT (ELBOW) TUBE ASSEMBLY
GASKET
L-A5006 (1093)
PW V

Diffuser Seal Air Vent (Elbow) Tube Assembly (Pre SB PW4ENG 72-567)
Figure 1012
(Task 72-41-00-400-001)

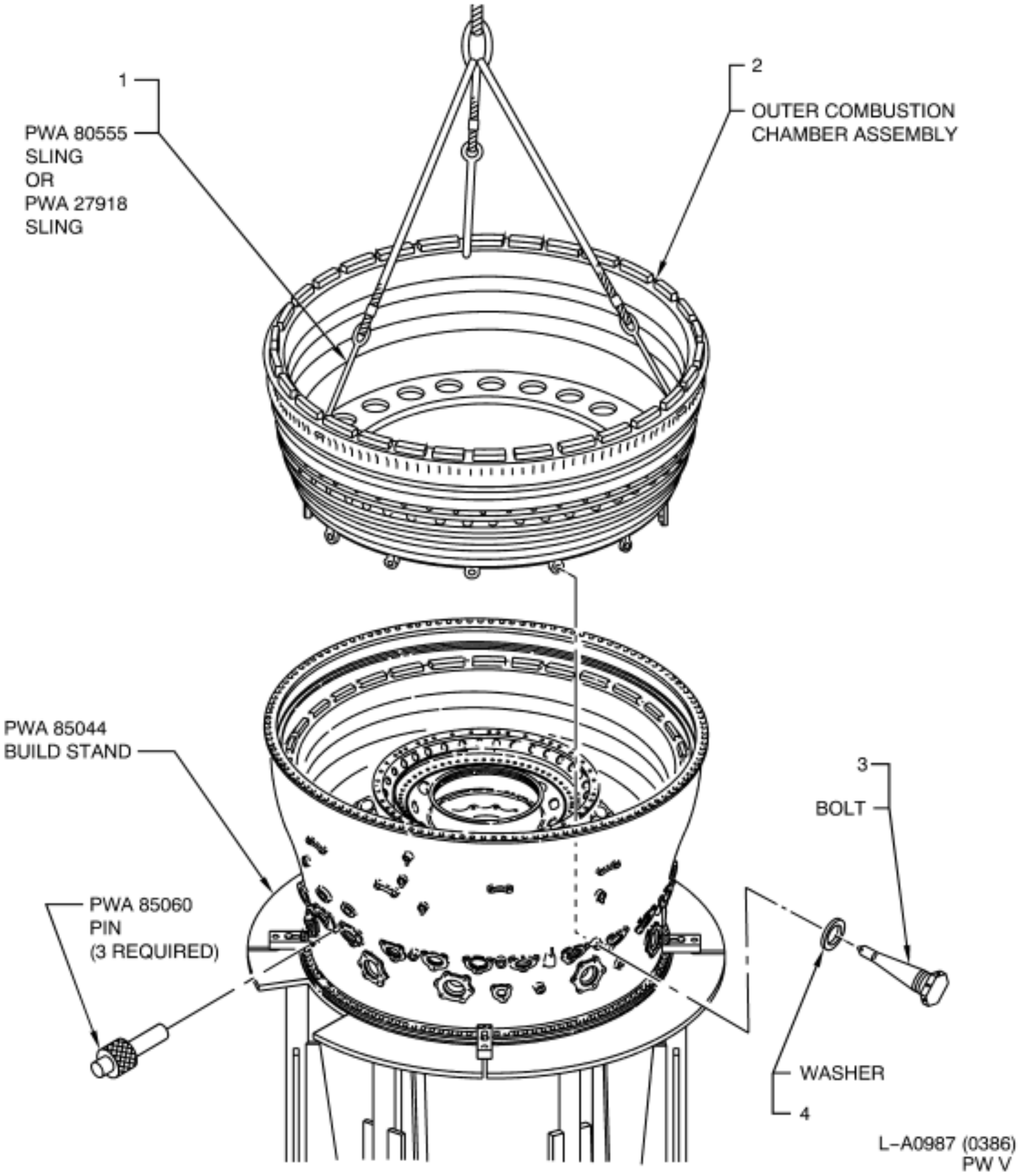


No. 3 Bearing Oil Injector Airflow Check
Diffuser Case (Pre SB PW4ENG 72−567)
Figure 1013 (Sheet 1)
(Task 72−41−00−400−001)



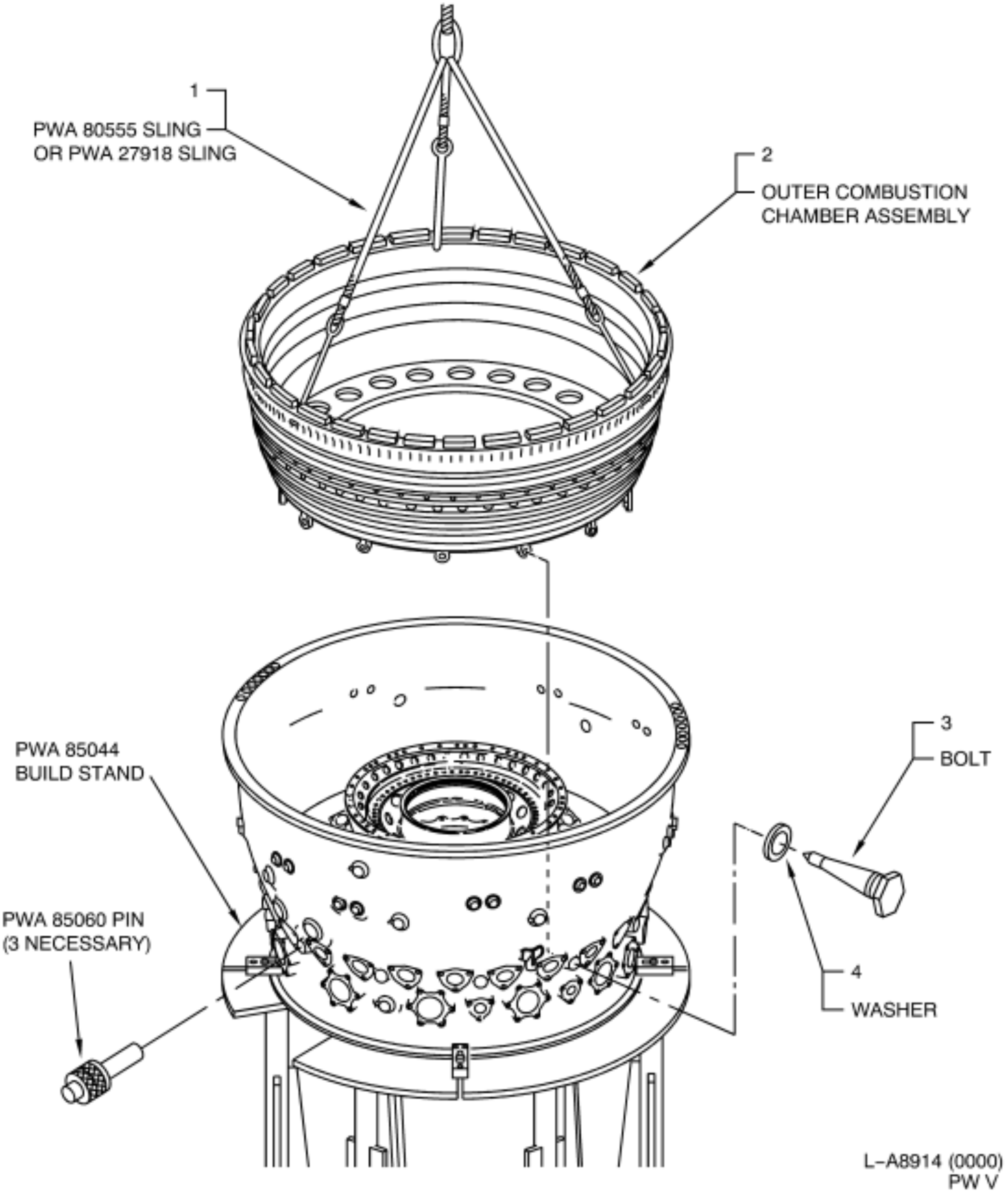
No. 3 Bearing Oil Injector Airflow Check
Diffuser Case (Post SB PW4ENG 72-567)
Figure 1013 (Sheet 2)
(Task 72-41-00-400-001)

DIFFUSER AND COMBUSTOR − ASSEMBLY−01


1
PWA 80555
SLING
OR
PWA 27918
SLING
2
OUTER COMBUSTION
CHAMBER ASSEMBLY
PWA 85044
BUILD STAND
3
BOLT
PWA 85060
PIN
(3 REQUIRED)
WASHER
4
L−A0987 (0386)
PW V

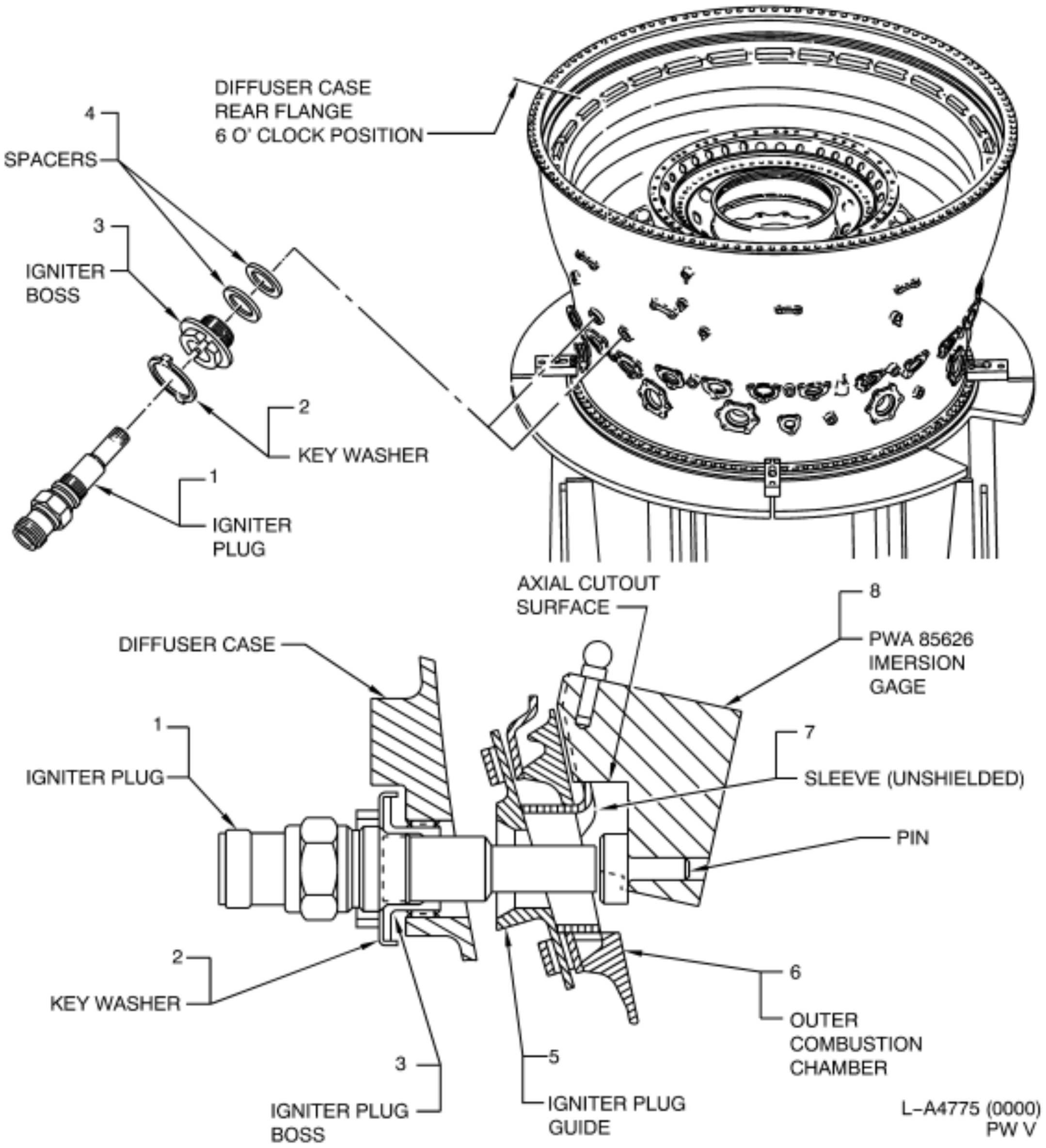
Outer Combustion Chamber Installation
Diffuser Case (Pre SB PW4ENG 72−567)
Figure 1014 (Sheet 1)
(Task 72−41−00−400−001)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01

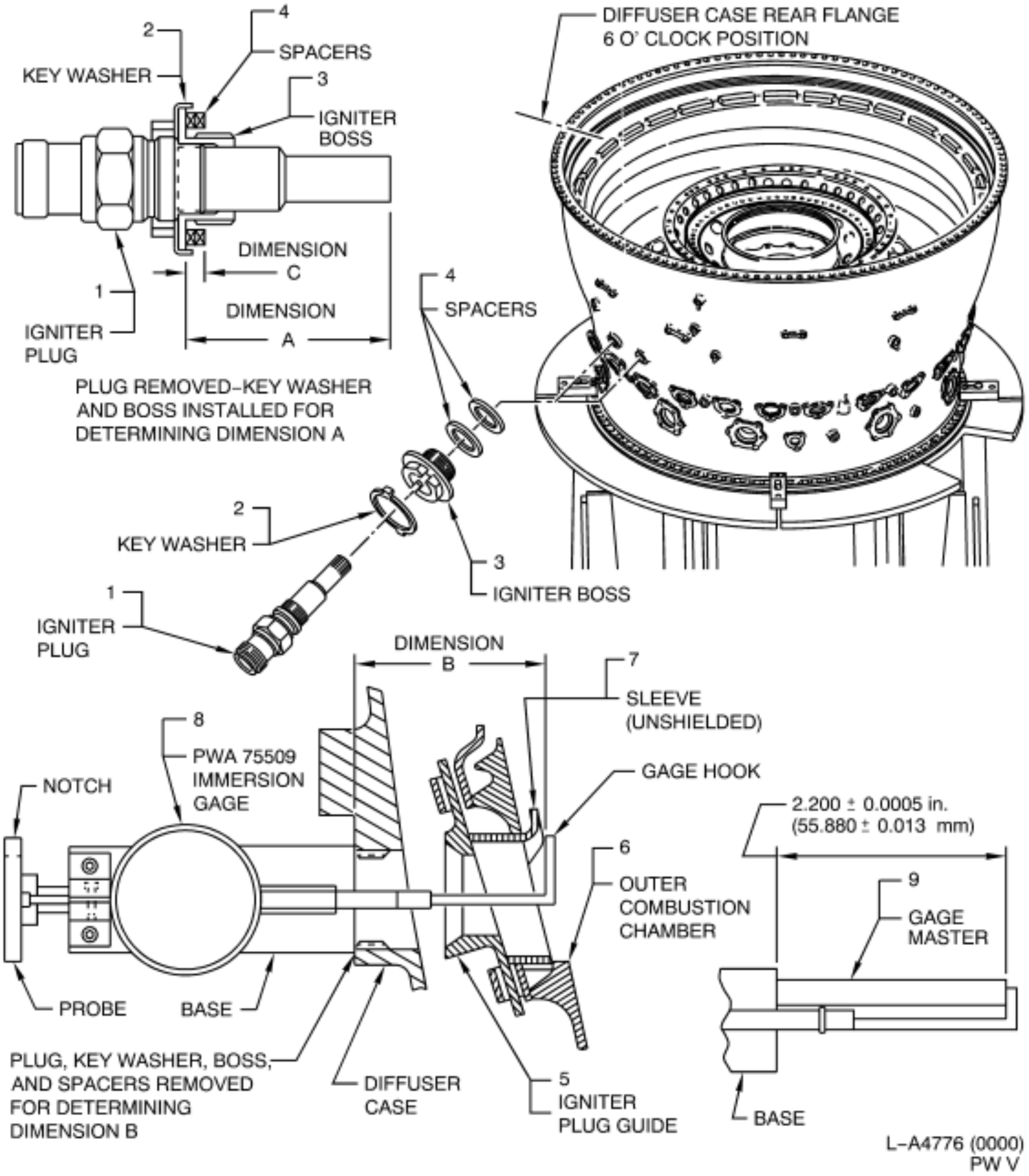

1
PWA 80555 SLING
OR PWA 27918 SLING
2
OUTER COMBUSTION
CHAMBER ASSEMBLY
PWA 85044
BUILD STAND
3
BOLT
PWA 85060 PIN
(3 NECESSARY)
4
WASHER
L-A8914 (0000)
PW V

Outer Combustion Chamber Installation
Diffuser Case (Post SB PW4ENG 72-567)
Figure 1014 (Sheet 2)
(Task 72-41-00-400-001)

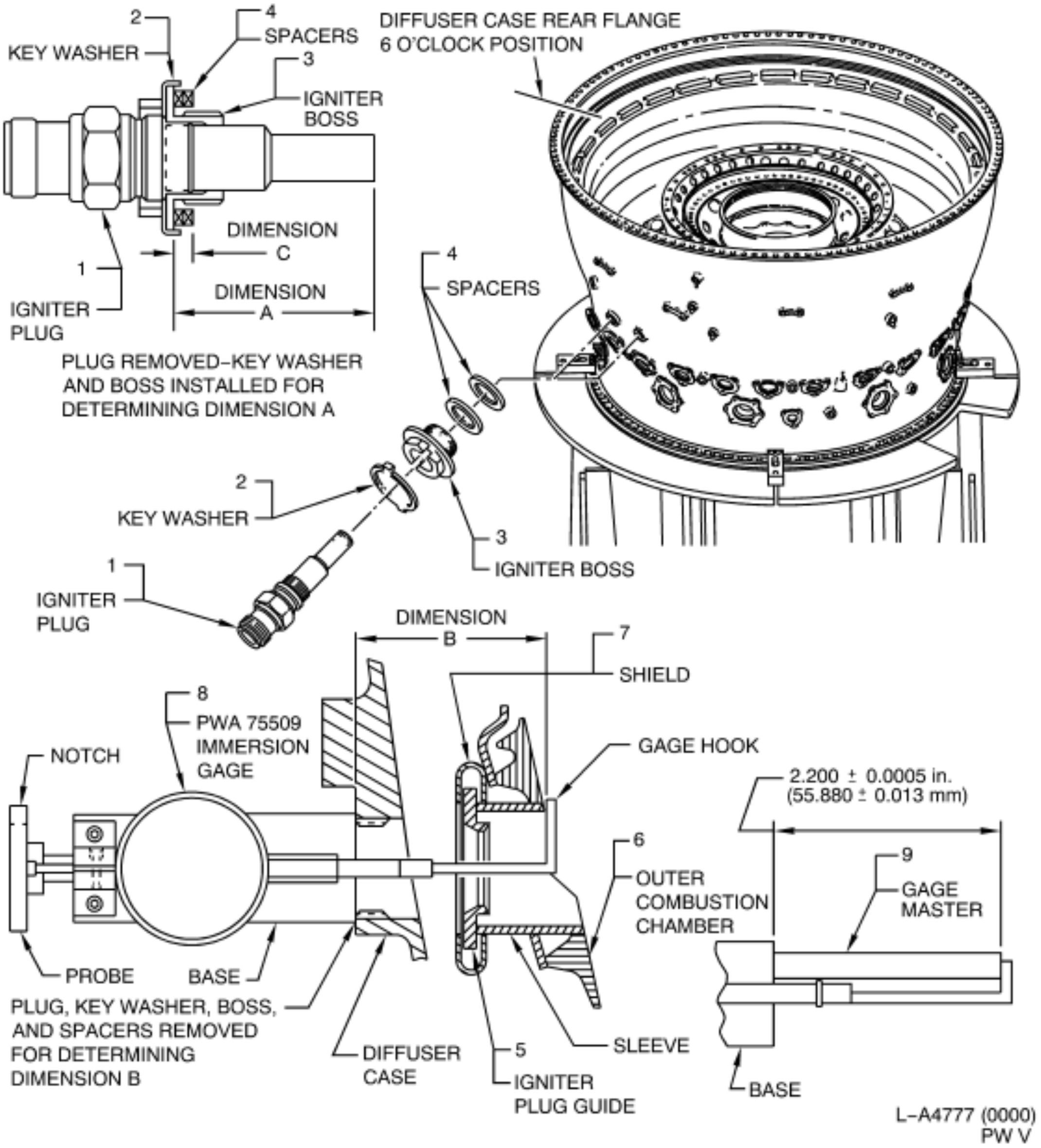
DIFFUSER AND COMBUSTOR - ASSEMBLY-01


DIFFUSER CASE
REAR FLANGE
6 O' CLOCK POSITION
4
SPACERS
3
IGNITER
BOSS
2
KEY WASHER
1
IGNITER
PLUG
AXIAL CUTOUT
SURFACE
8
PWA 85626
IMERSION
GAGE
DIFFUSER CASE
1
IGNITER PLUG
7
SLEEVE (UNSHIELDED)
PIN
2
KEY WASHER
6
OUTER
COMBUSTION
CHAMBER
3
IGNITER PLUG
BOSS
5
IGNITER PLUG
GUIDE
L-A4775 (0000)
PW V

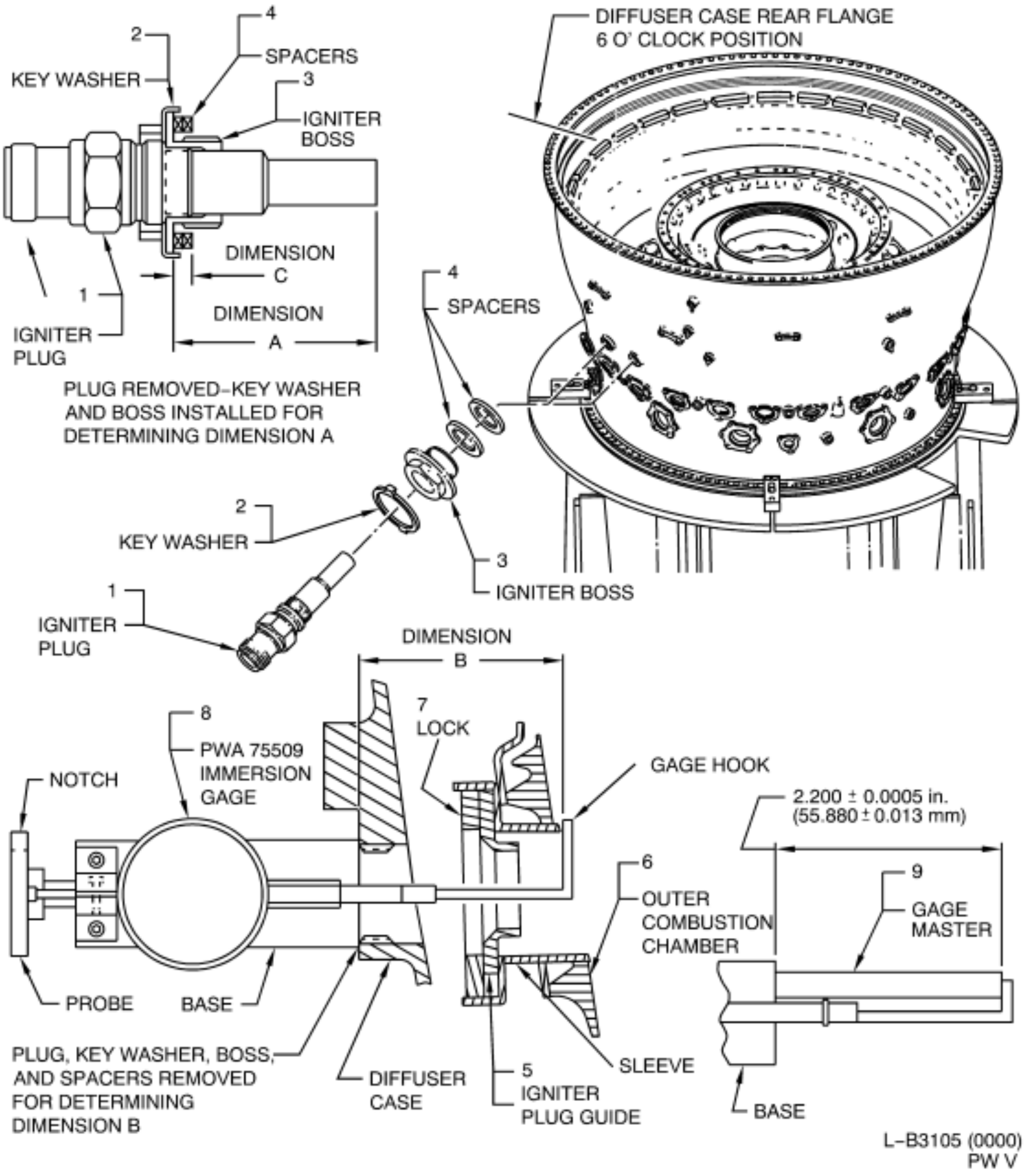
Igniter Plug Installation And PWA 85626 Gage (Pre SB PW4ENG 72-152)
Figure 1015 (Sheet 1)
(Task 72-41-00-400-001)


2
KEY WASHER
4
SPACERS
3
IGNITER BOSS
DIMENSION C
1
IGNITER PLUG
DIMENSION A
PLUG REMOVED-KEY WASHER AND BOSS INSTALLED FOR DETERMINING DIMENSION A
DIFFUSER CASE REAR FLANGE 6 O' CLOCK POSITION
4
SPACERS
2
KEY WASHER
3
IGNITER BOSS
1
IGNITER PLUG
DIMENSION B
7
SLEEVE (UNSHIELDED)
8
PWA 75509 IMMERSION GAGE
NOTCH
GAGE HOOK
2.200 ± 0.0005 in. (55.880 ± 0.013 mm)
6
OUTER COMBUSTION CHAMBER
9
GAGE MASTER
PROBE
BASE
PLUG, KEY WASHER, BOSS, AND SPACERS REMOVED FOR DETERMINING DIMENSION B
DIFFUSER CASE
5
IGNITER PLUG GUIDE
BASE
L-A4776 (0000)
PW V

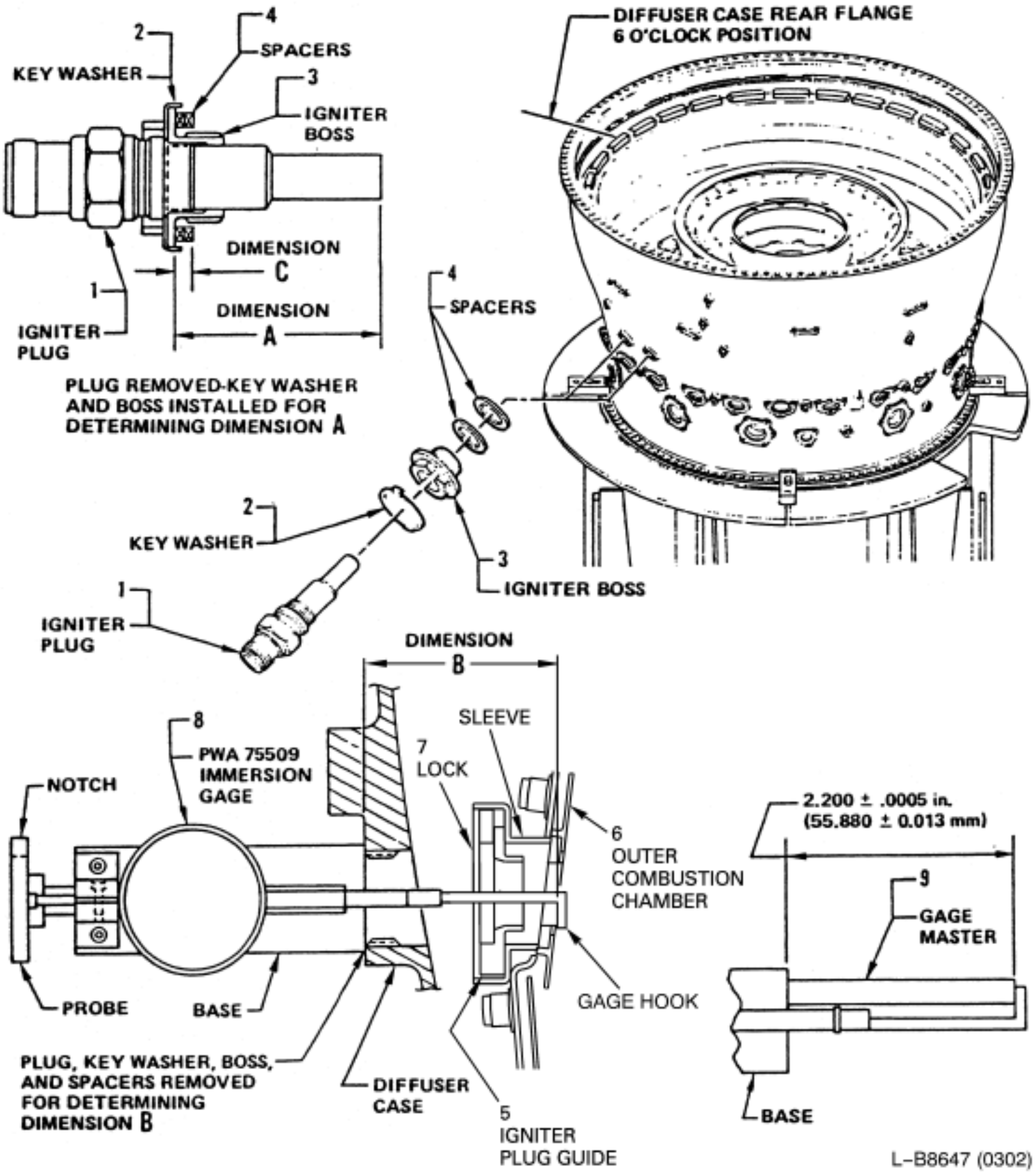
Igniter Plug Installation And PWA 75509 Gage (Pre SB PW4ENG 72-152)
Figure 1015 (Sheet 2)
(Task 72-41-00-400-001)


2
KEY WASHER
4
SPACERS
3
IGNITER BOSS
DIFFUSER CASE REAR FLANGE
6 O'CLOCK POSITION
DIMENSION C
1
IGNITER PLUG
DIMENSION A
PLUG REMOVED−KEY WASHER AND BOSS INSTALLED FOR DETERMINING DIMENSION A
4
SPACERS
2
KEY WASHER
3
IGNITER BOSS
1
IGNITER PLUG
DIMENSION B
7
SHIELD
8
PWA 75509 IMMERSION GAGE
NOTCH
GAGE HOOK
2.200 ± 0.0005 in.
(55.880 ± 0.013 mm)
6
OUTER COMBUSTION CHAMBER
9
GAGE MASTER
PROBE
BASE
PLUG, KEY WASHER, BOSS, AND SPACERS REMOVED FOR DETERMINING DIMENSION B
DIFFUSER CASE
5
IGNITER PLUG GUIDE
SLEEVE
BASE
L−A4777 (0000)
PW V

Igniter Plug Installation And PWA 75509 Gage (Post SB PW4ENG 72−152)
Figure 1015 (Sheet 3)
(Task 72−41−00−400−001)

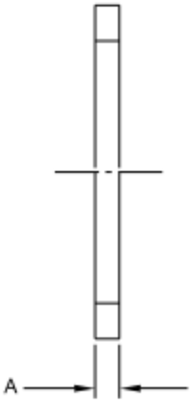

2
KEY WASHER
4
SPACERS
3
IGNITER
BOSS
DIMENSION
C
DIMENSION
A
1
IGNITER
PLUG
PLUG REMOVED-KEY WASHER
AND BOSS INSTALLED FOR
DETERMINING DIMENSION A
DIFFUSER CASE REAR FLANGE
6 O' CLOCK POSITION
4
SPACERS
2
KEY WASHER
3
IGNITER BOSS
1
IGNITER
PLUG
DIMENSION
B
8
PWA 75509
IMMERSION
GAGE
NOTCH
7
LOCK
GAGE HOOK
2.200 ± 0.0005 in.
(55.880 ± 0.013 mm)
6
OUTER
COMBUSTION
CHAMBER
9
GAGE
MASTER
PROBE
BASE
PLUG, KEY WASHER, BOSS,
AND SPACERS REMOVED
FOR DETERMINING
DIMENSION B
DIFFUSER
CASE
5
IGNITER
PLUG GUIDE
SLEEVE
BASE
L-B3105 (0000)
PW V

Igniter Plug Installation And PWA 75509 Gage (Post SB PW4ENG 72-601)
Figure 1015 (Sheet 4)
(Task 72-41-00-400-001)


4
2
SPACERS
KEY WASHER
3
IGNITER
BOSS
DIFFUSER CASE REAR FLANGE
6 O'CLOCK POSITION
DIMENSION
C
1
DIMENSION
A
IGNITER
PLUG
PLUG REMOVED-KEY WASHER
AND BOSS INSTALLED FOR
DETERMINING DIMENSION A
4
SPACERS
2
KEY WASHER
3
IGNITER BOSS
1
IGNITER
PLUG
DIMENSION
B
8
PWA 75509
IMMERSION
GAGE
NOTCH
SLEEVE
7
LOCK
6
OUTER
COMBUSTION
CHAMBER
2.200 ± .0005 in.
(55.880 ± 0.013 mm)
9
GAGE
MASTER
PROBE
BASE
GAGE HOOK
PLUG, KEY WASHER, BOSS,
AND SPACERS REMOVED
FOR DETERMINING
DIMENSION B
DIFFUSER
CASE
5
IGNITER
PLUG GUIDE
BASE
L-B8647 (0302)

Igniter Plug Installation And PWA
75509 Gage (Talon Low Emission Burner)
Figure 1015 (Sheet 5)
(Task 72−41−00−400−001)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01



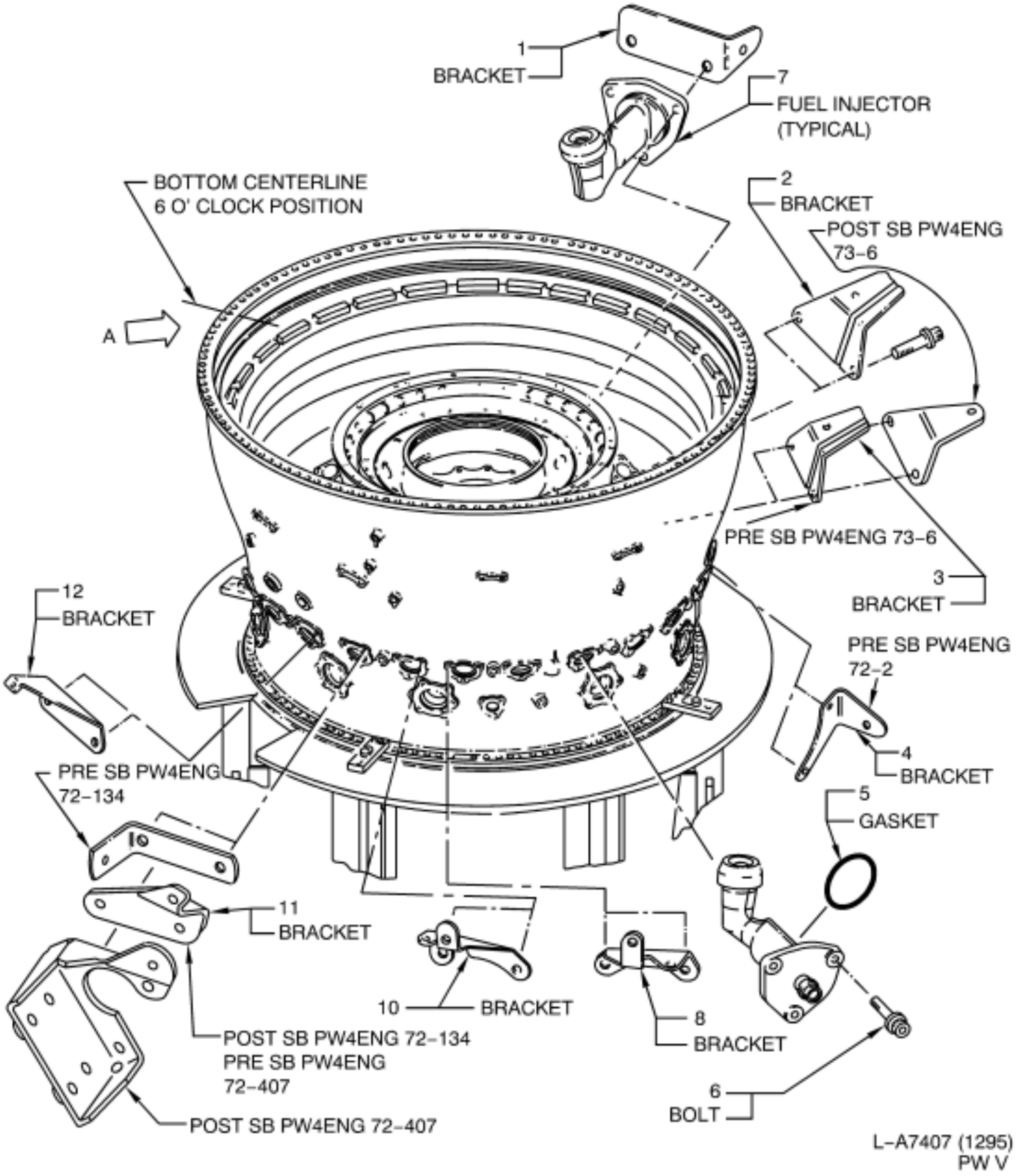
L-90275 (0283)
PW V

Part No.	Dimension A Inches	Dimension A Millimeters
741073 CL 1	0.008 - 0.018	0.20 - 0.46
741073 CL 2	OVER 0.018 - 0.028	OVER 0.46 - 0.71
741073 CL 3	OVER 0.028 - 0.038	OVER 0.71 - 0.97
741073 CL 4	OVER 0.038 - 0.048	OVER 0.97 - 1.22
741073 CL 5	OVER 0.048 - 0.058	OVER 1.22 - 1.47
741073 CL 6	OVER 0.058 - 0.068	OVER 1.47 - 1.73
741073 CL 7	OVER 0.068 - 0.078	OVER 1.73 - 1.98
741073 CL 8	OVER 0.078 - 0.088	OVER 1.98 - 2.24
741073 CL 9	OVER 0.088 - 0.098	OVER 2.24 - 2.49
741073 CL 10	OVER 0.098 - 0.108	OVER 2.49 - 2.74
741073 CL 11	OVER 0.108 - 0.118	OVER 2.74 - 3.00
741073 CL 12	OVER 0.118 - 0.128	OVER 3.00 - 3.25
741073 CL 13	OVER 0.128 - 0.138	OVER 3.25 - 3.51
741073 CL 14	OVER 0.138 - 0.148	OVER 3.51 - 3.76
741073 CL 15	OVER 0.148 - 0.158	OVER 3.76 - 4.01
741073 CL 16	OVER 0.158 - 0.168	OVER 4.01 - 4.27
741073 CL 17	OVER 0.168 - 0.178	OVER 4.27 - 4.52
741073 CL 18	OVER 0.178 - 0.188	OVER 4.52 - 4.78

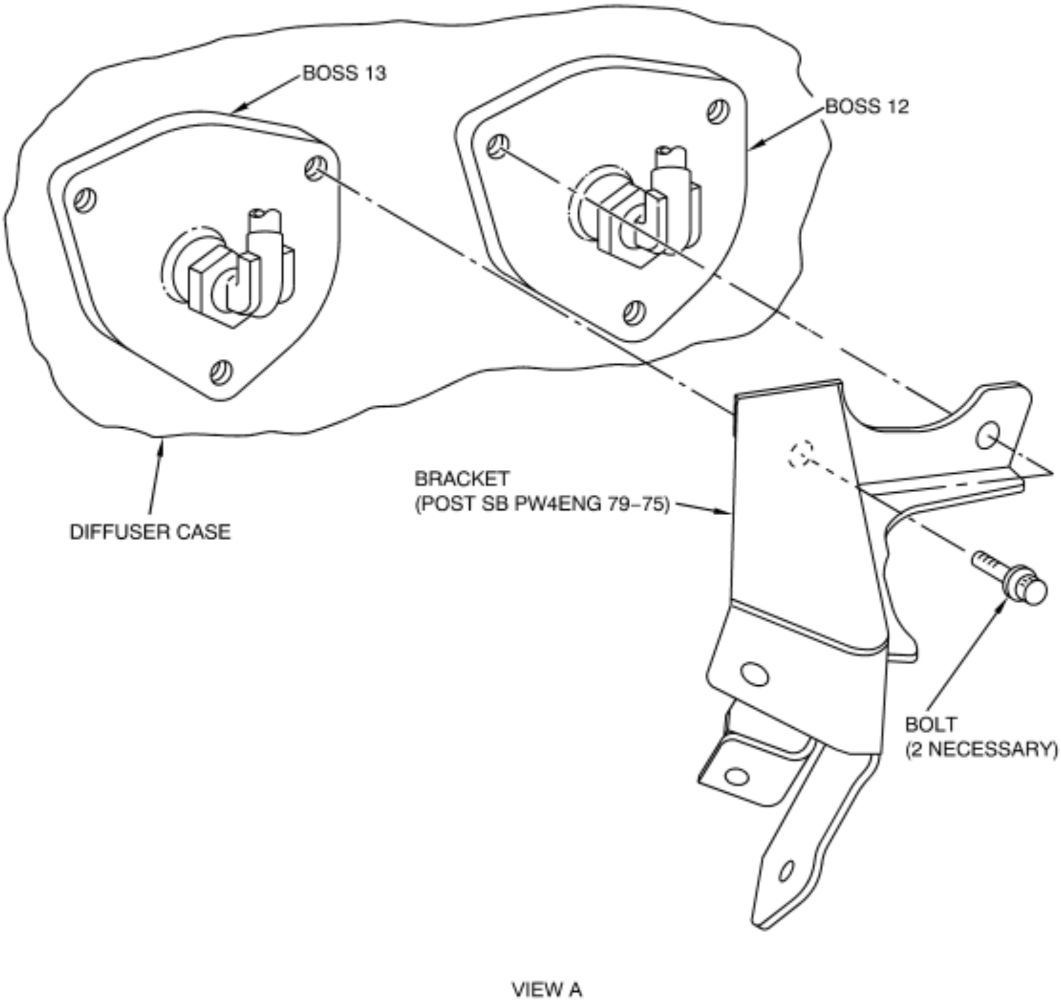
Spacer Classification Data

Igniter Plug Installation
Figure 1016
(Task 72-41-00-400-001)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01


1
BRACKET
7
FUEL INJECTOR
(TYPICAL)
BOTTOM CENTERLINE
6 O' CLOCK POSITION
2
BRACKET
POST SB PW4ENG
73-6
A
PRE SB PW4ENG 73-6
3
BRACKET
PRE SB PW4ENG
72-2
4
BRACKET
12
BRACKET
5
GASKET
PRE SB PW4ENG
72-134
11
BRACKET
10
BRACKET
8
BRACKET
POST SB PW4ENG 72-134
PRE SB PW4ENG
72-407
6
BOLT
POST SB PW4ENG 72-407
L-A7407 (1295)
PW V

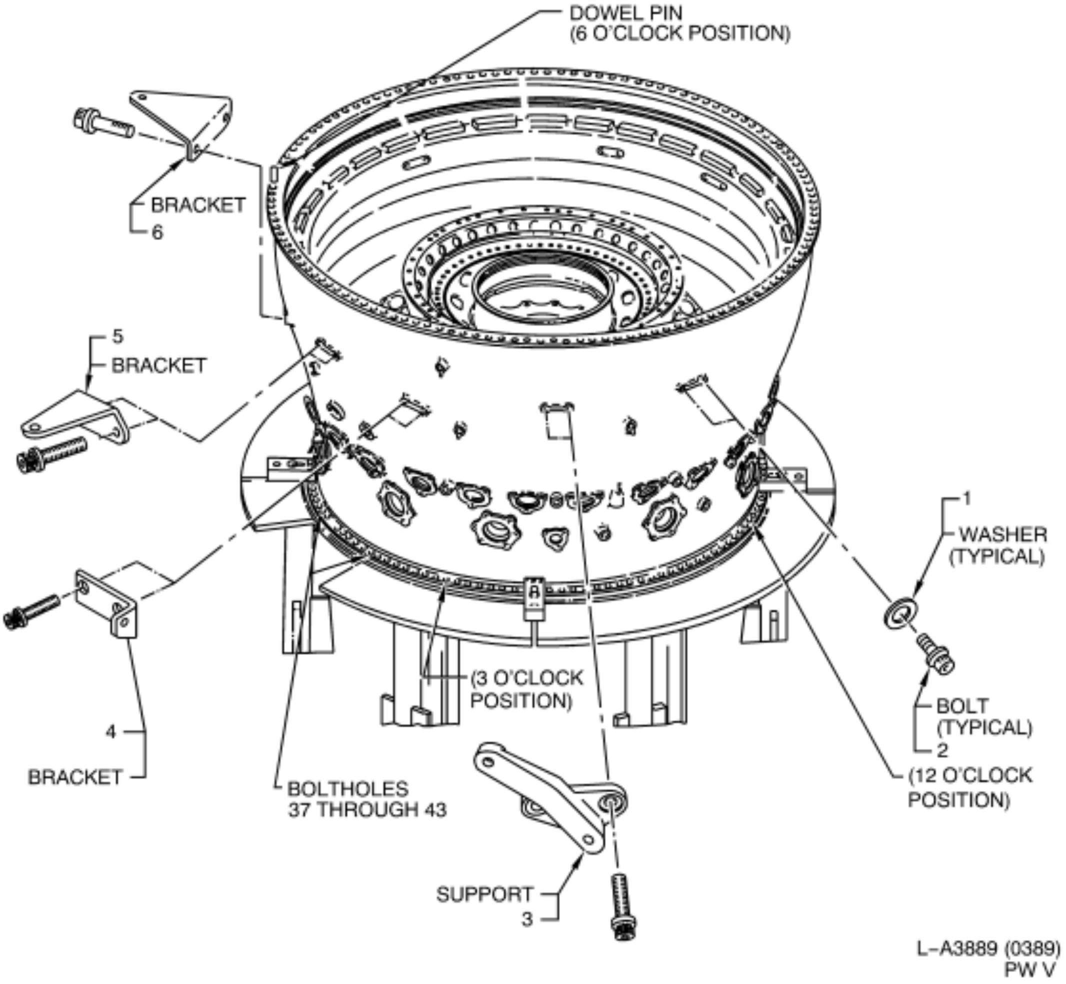
Fuel Injectors And Support Assemblies
Figure 1017 (Sheet 1)
(Task 72-41-00-400-001)


BOSS 13
BOSS 12
DIFFUSER CASE
BRACKET
(POST SB PW4ENG 79−75)
BOLT
(2 NECESSARY)
VIEW A

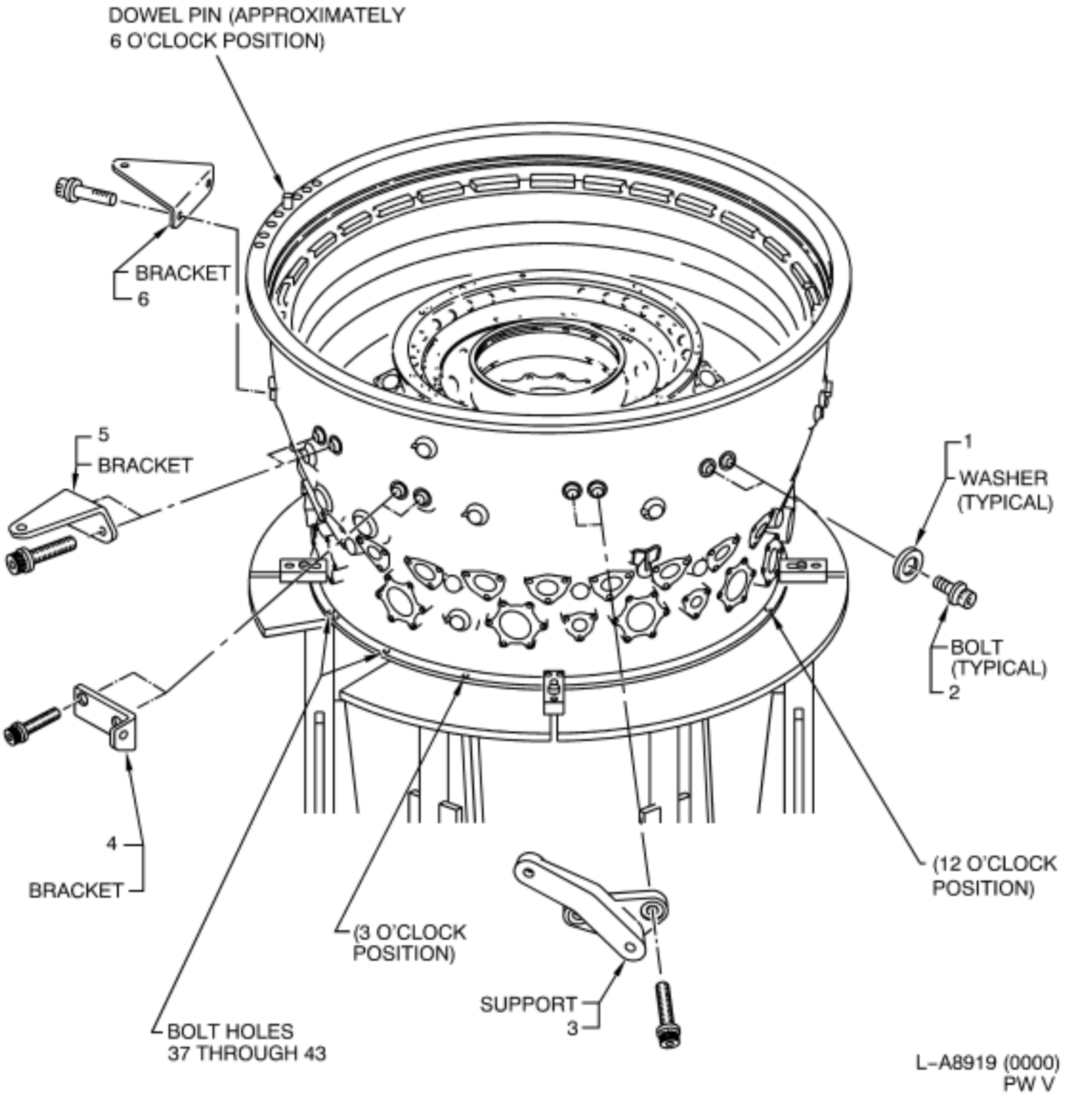
L−B2539 (0000)
PW V

Fuel Injectors And Support Assemblies
Figure 1017 (Sheet 2)
(Task 72−41−00−400−001)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01

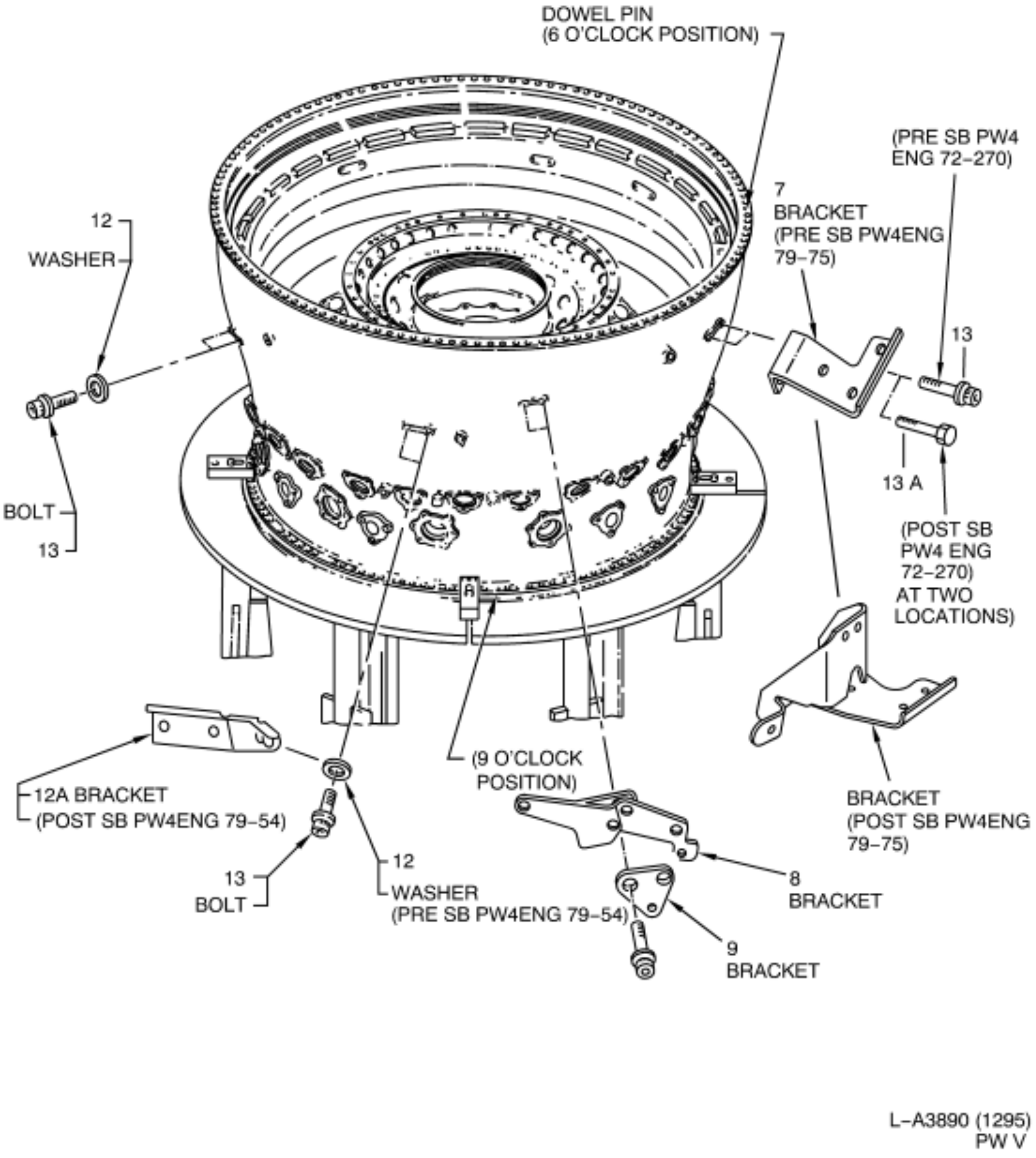

DOWEL PIN
(6 O'CLOCK POSITION)
BRACKET
6
5
BRACKET
1
WASHER
(TYPICAL)
(3 O'CLOCK
POSITION)
BOLT
(TYPICAL)
2
4
BRACKET
BOLTHOLES
37 THROUGH 43
(12 O'CLOCK
POSITION)
SUPPORT
3
L-A3889 (0389)
PW V

Diffuser Case Externals (Pre SB PW4ENG 72-567)
Figure 1018 (Sheet 1)
(Task 72-41-00-400-001)


DOWEL PIN (APPROXIMATELY
6 O'CLOCK POSITION)
BRACKET
6
5
BRACKET
1
WASHER
(TYPICAL)
BOLT
(TYPICAL)
2
4
BRACKET
(12 O'CLOCK
POSITION)
(3 O'CLOCK
POSITION)
SUPPORT
3
BOLT HOLES
37 THROUGH 43
L-A8919 (0000)
PW V

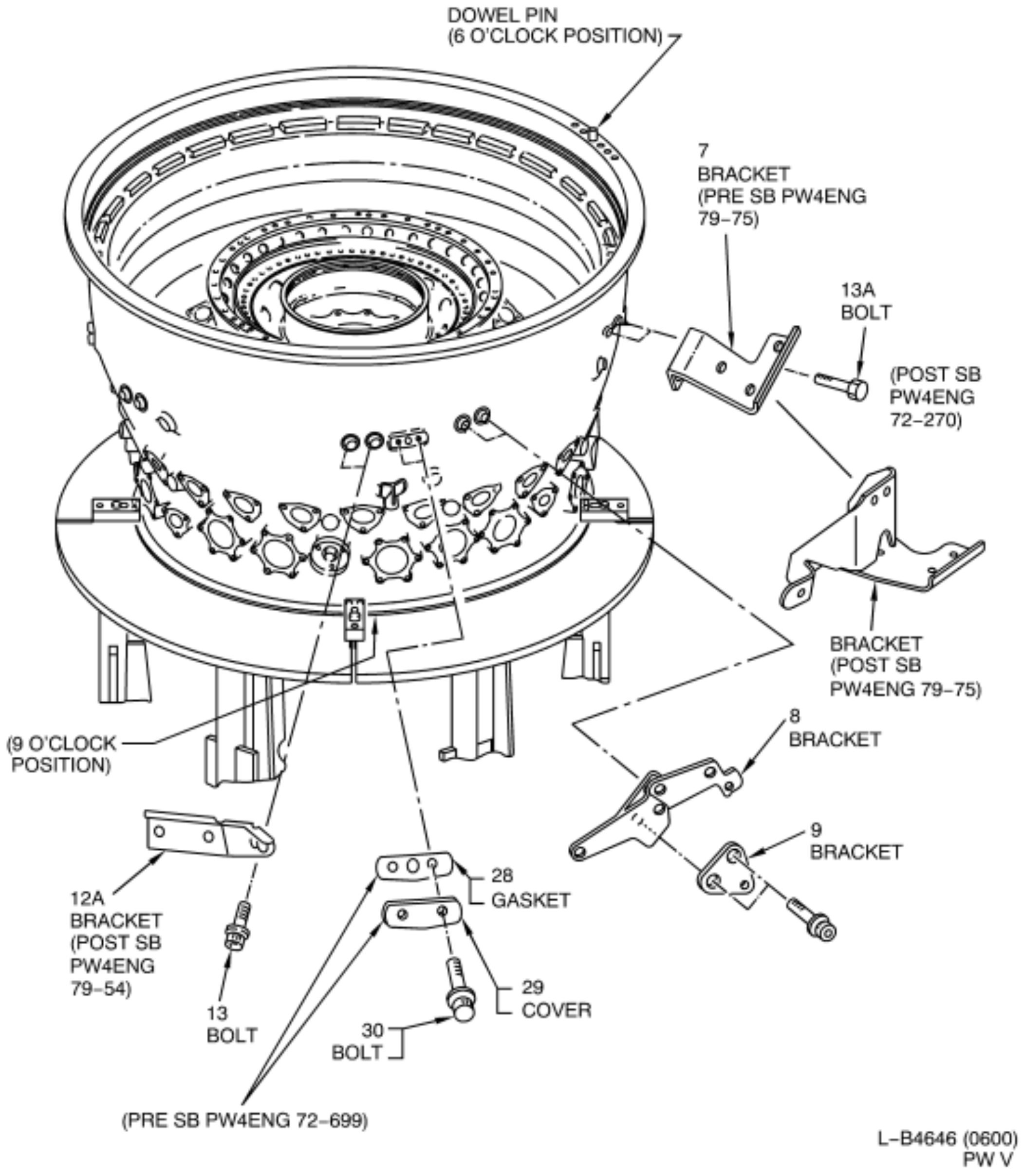
Diffuser Case Externals (Post SB PW4ENG 72-567)
Figure 1018 (Sheet 2)
(Task 72-41-00-400-001)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01

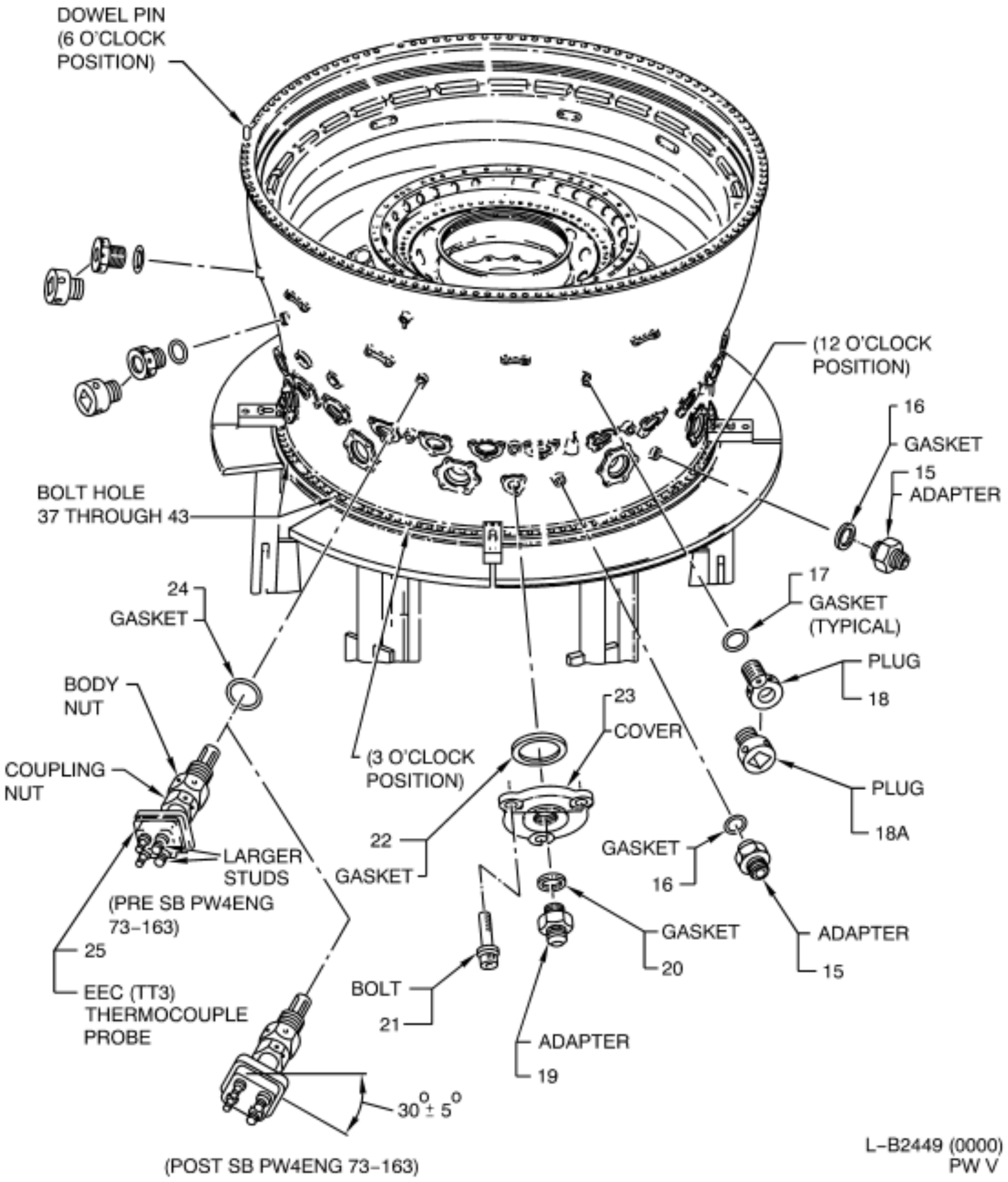

DOWEL PIN
(6 O'CLOCK POSITION)
(PRE SB PW4
ENG 72-270)
7
BRACKET
(PRE SB PW4ENG
79-75)
12
WASHER
13
13 A
(POST SB
PW4 ENG
72-270)
AT TWO
LOCATIONS)
BOLT
13
12A BRACKET
(POST SB PW4ENG 79-54)
(9 O'CLOCK
POSITION)
BRACKET
(POST SB PW4ENG
79-75)
13
BOLT
12
WASHER
(PRE SB PW4ENG 79-54)
8
BRACKET
9
BRACKET
L-A3890 (1295)
PW V

Diffuser Case Externals (Pre SB PW4ENG 72-567)
Figure 1018 (Sheet 3)
(Task 72-41-00-400-001)

DIFFUSER AND COMBUSTOR − ASSEMBLY−01

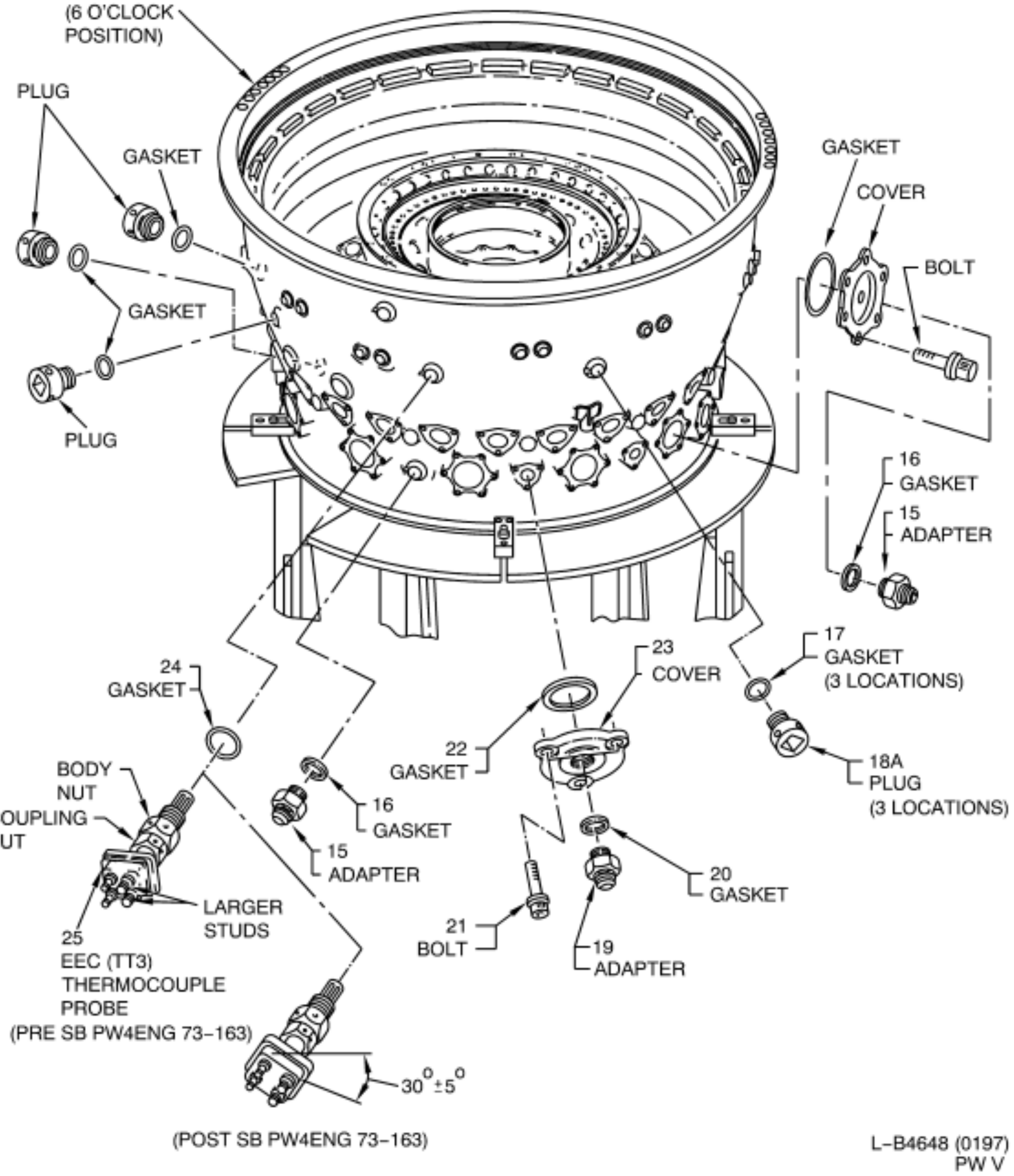

DOWEL PIN
(6 O'CLOCK POSITION)
7
BRACKET
(PRE SB PW4ENG
79−75)
13A
BOLT
(POST SB
PW4ENG
72−270)
BRACKET
(POST SB
PW4ENG 79−75)
8
BRACKET
9
BRACKET
(9 O'CLOCK
POSITION)
12A
BRACKET
(POST SB
PW4ENG
79−54)
13
BOLT
28
GASKET
29
COVER
30
BOLT
(PRE SB PW4ENG 72−699)
L−B4646 (0600)
PW V

Diffuser Case Externals (Post SB PW4ENG 72−567)
Figure 1018 (Sheet 4)
(Task 72−41−00−400−001)

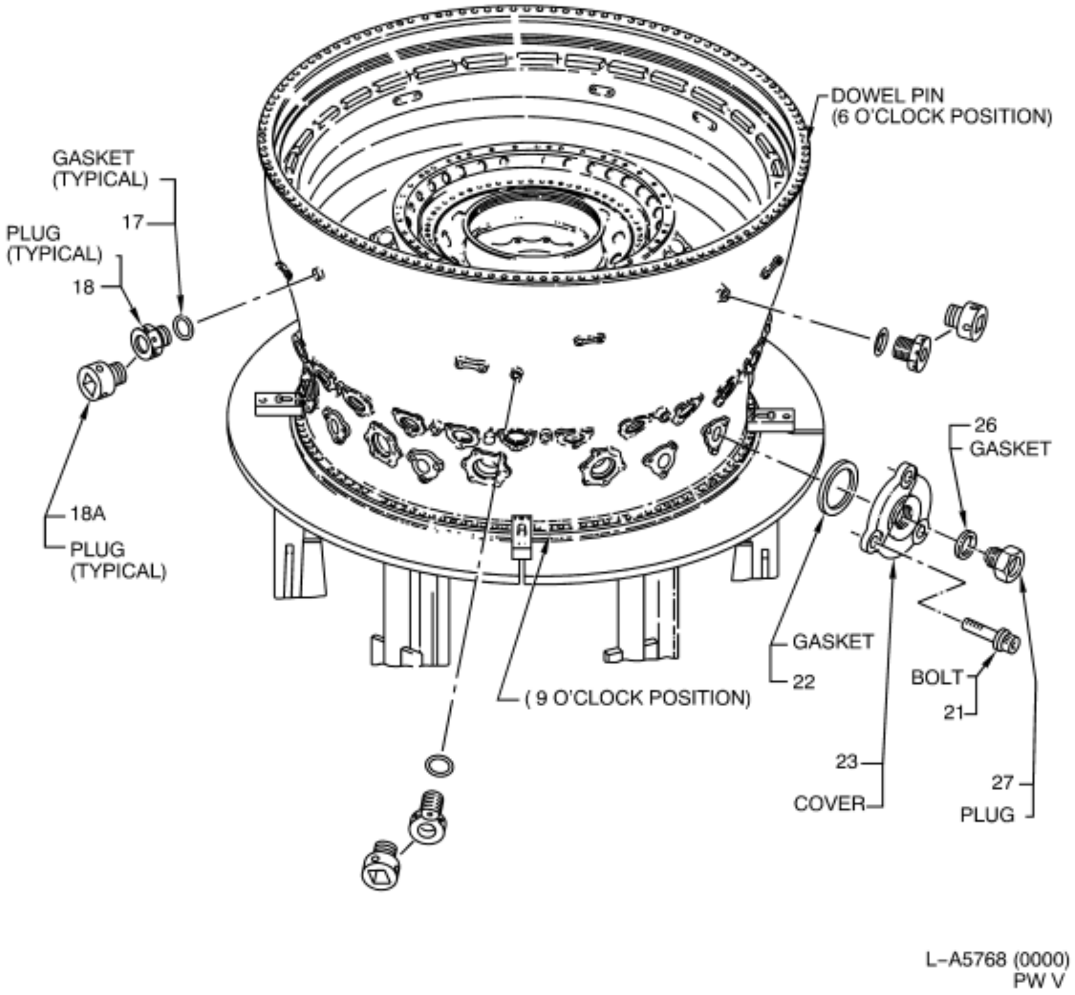

DOWEL PIN
(6 O'CLOCK
POSITION)
(12 O'CLOCK
POSITION)
16
GASKET
15
ADAPTER
BOLT HOLE
37 THROUGH 43
17
GASKET
(TYPICAL)
24
GASKET
PLUG
18
BODY
NUT
23
COVER
COUPLING
NUT
(3 O'CLOCK
POSITION)
PLUG
18A
LARGER
STUDS
22
GASKET
GASKET
16
(PRE SB PW4ENG
73−163)
25
GASKET
20
ADAPTER
15
EEC (TT3)
THERMOCOUPLE
PROBE
BOLT
21
ADAPTER
19
30° ± 5°
L−B2449 (0000)
PW V
(POST SB PW4ENG 73−163)

Diffuser Case Externals (Pre SB PW4ENG 72−567)
Figure 1018 (Sheet 5)
(Task 72−41−00−400−001)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01

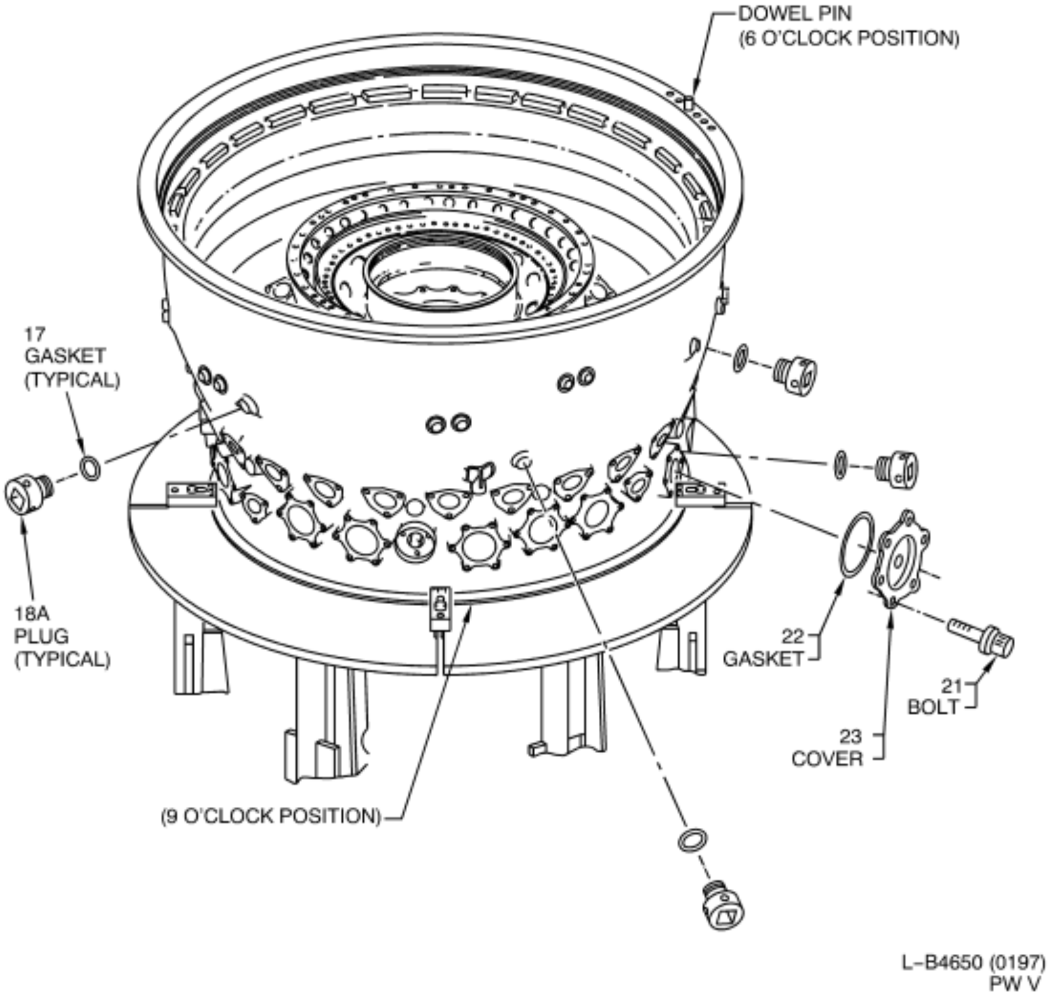

(6 O'CLOCK POSITION)
PLUG
GASKET
GASKET
PLUG
GASKET
COVER
BOLT
16 GASKET
15 ADAPTER
17 GASKET (3 LOCATIONS)
23 COVER
18A PLUG (3 LOCATIONS)
24 GASKET
22 GASKET
16 GASKET
15 ADAPTER
BODY NUT
COUPLING NUT
LARGER STUDS
25 EEC (TT3) THERMOCOUPLE PROBE (PRE SB PW4ENG 73-163)
21 BOLT
19 ADAPTER
20 GASKET
30° ±5°
(POST SB PW4ENG 73-163)
L-B4648 (0197)
PW V

Diffuser Case Externals (Post SB PW4ENG 72-567)
Figure 1018 (Sheet 6)
(Task 72-41-00-400-001)


DOWEL PIN
(6 O'CLOCK POSITION)
GASKET
(TYPICAL)
17
PLUG
(TYPICAL)
18
26
GASKET
18A
PLUG
(TYPICAL)
GASKET
22
BOLT
21
(9 O'CLOCK POSITION)
23
COVER
27
PLUG
L-A5768 (0000)
PW V

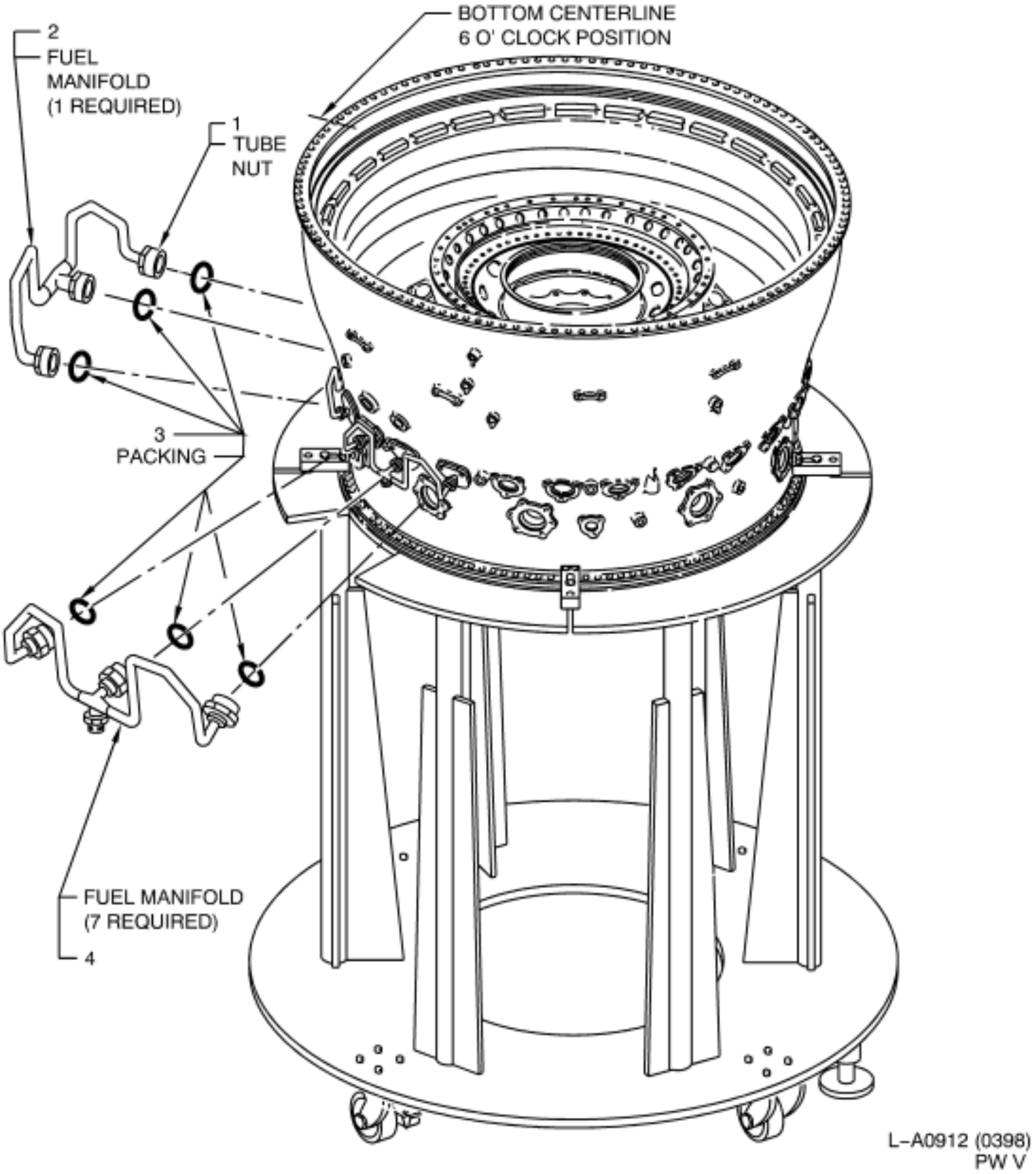
Diffuser Case Externals (Pre SB PW4ENG 72-567)
Figure 1018 (Sheet 7)
(Task 72-41-00-400-001)

DIFFUSER AND COMBUSTOR − ASSEMBLY−01


DOWEL PIN
(6 O'CLOCK POSITION)
17
GASKET
(TYPICAL)
18A
PLUG
(TYPICAL)
22
GASKET
21
BOLT
23
COVER
(9 O'CLOCK POSITION)
L−B4650 (0197)
PW V

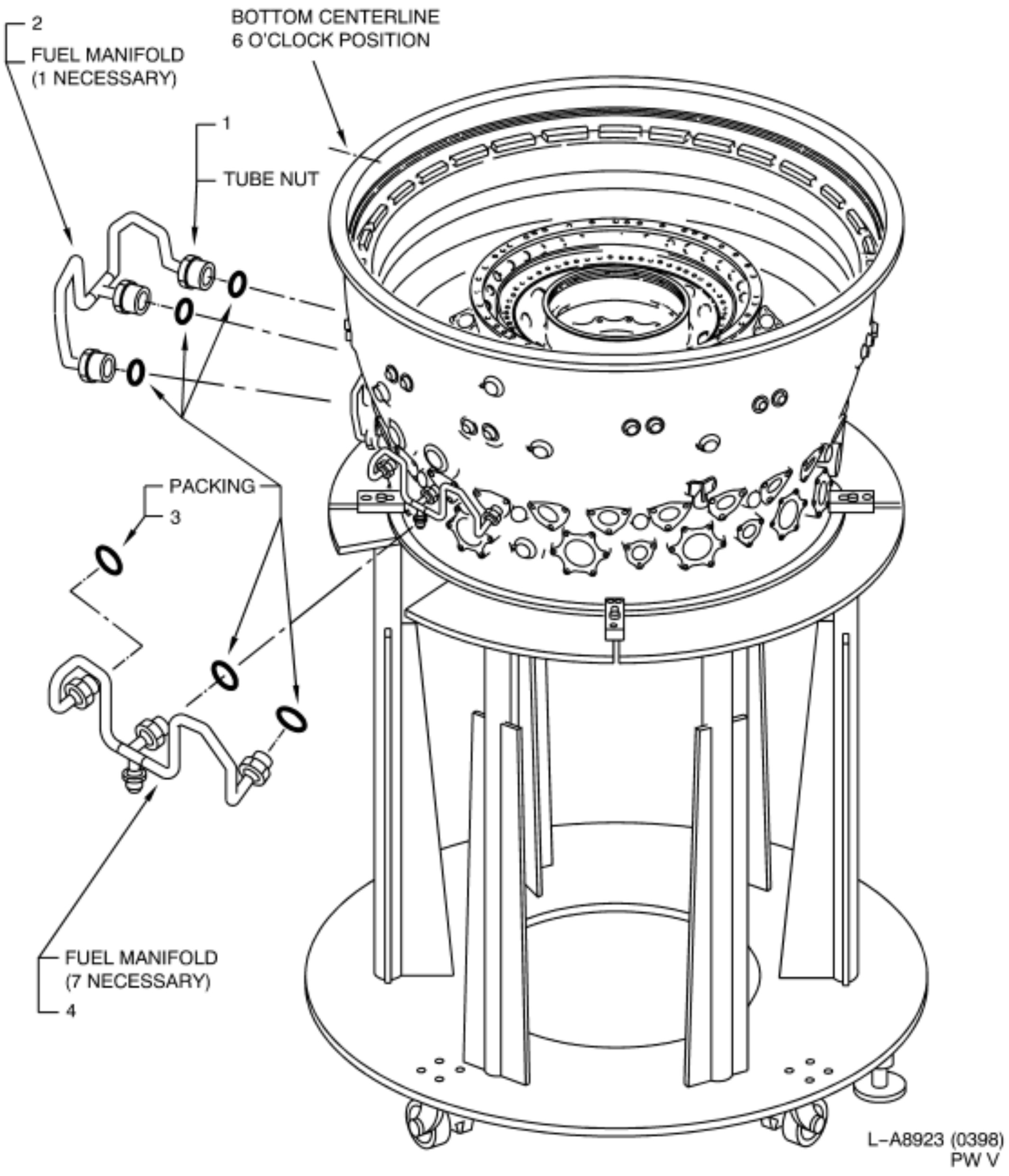
Diffuser Case Externals (Post SB PW4ENG 72−567)
Figure 1018 (Sheet 8)
(Task 72−41−00−400−001)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01


BOTTOM CENTERLINE
6 O' CLOCK POSITION
2
FUEL
MANIFOLD
(1 REQUIRED)
1
TUBE
NUT
3
PACKING
FUEL MANIFOLD
(7 REQUIRED)
4
L-A0912 (0398)
PW V

Fuel Injector Supply Manifolds Diffuser Case (Pre SB PW4ENG 72-567)
Figure 1019 (Sheet 1)
(Task 72-41-00-400-001)

DIFFUSER AND COMBUSTOR − ASSEMBLY−01


2
FUEL MANIFOLD
(1 NECESSARY)
BOTTOM CENTERLINE
6 O'CLOCK POSITION
1
TUBE NUT
PACKING
3
FUEL MANIFOLD
(7 NECESSARY)
4
L−A8923 (0398)
PW V

Fuel Injector Supply Manifolds Diffuser Case (Post SB PW4ENG 72−567)
Figure 1019 (Sheet 2)
(Task 72−41−00−400−001)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01

Task 72-41-00-400-001-A:

1. Assemble The Diffuser And Combustor

A. Prerequisites

(1) See Inspection/Check-04 Task 72-41-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a referenced number. For example: (Reference 1234) Torque retaining nut as follows.

(2) Assemble No. 3 bearing duct and housing. See Assembly-02 Task 72-41-00-400-002-001 or Assembly-04 Task 72-41-00-400-002-002.

B. Equipment And Materials Necessary

Standard Tools:

Name	Manufacturer
Clements Cadillac Flameless Torch Model FT 1000	Clements Manufacturing Co. 6650 S. Narragansett Avenue Chicago, IL 60638

NOTE: The flameless torch specified above is optional to the heaters specified in the special tools list, and the optional flame torch.

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

CTE 5070	Cart, Airflow (Optional To PWA 6070)
CTE 6070	Cart, Airflow
PWA 24524	Tap
PWA 25039	Stand
PWA 25450	Aligning Pin (Two Necessary)
PWA 27641	Tap
PWA 27918	Sling (Optional To PWA 80555)
PWA 28657	Sling
PWA 29754	Control, Heater
PWA 75509	Gage, Immersion
PWA 76154	Adapter (Two Necessary)
PWA 80555	Sling
PWA 85044	Stand (Optional to PWA 86508)
PWA 85060	Pin (Three Necessary)

Special Tools:

(CONTINUED)

PWA 85565	Adapter
PWA 85751	Bracket (Two Necessary)
PWA 85983	Adapter, Stabilizer (Two Necessary, Twin Overhead Rail System Only)
PWA 86508	Build Stand
PWA 87006	Adapter, Wrench
PWA 87153	Heater, Electrical
PWA 87154	Pin, Guide
PWA 87649	Gage, Angle
PWA 101455	Clamp, Installation
PWA 101456	Clamp, Installation
PWA 101863	Pin, Alignment
PWA 103081	Adapter, Torque

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P05-395	Beeswax
P05-396	Paraffin Wax Blend
P06-023	Lubricant, Silvergoop (PWA 36001)
P06-053	Lubricant, Sealing Ring (PWA 36500)
R P06-054	Anti-seize, Paste (PWA 36246)
P11-027	Solvent, Petroleum (PMC 9001)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	7	72-41-00/1/130
Gasket	1	72-41-00/3/30
Gasket	1	72-41-00/3/60
Gasket	2	72-41-00/4/20
Gasket	2	72-41-00/4/70
Gasket	1	72-41-00/5/50
Gasket	1	72-41-00/5/60
Gasket	2	72-41-00/5/150
Gasket	2	72-41-00/5/180
Gasket	2	72-41-00/7/20
Gasket	24	73-13-00/1/1
Gasket	1	73-23-00/3/10
Key Washer	2	74-21-00/2/20

DIFFUSER AND COMBUSTOR - ASSEMBLY-01

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
(CONTINUED)		
Packing	24	73-13-00/2/1
Seal Ring	1	72-41-00/3/1
Seal Ring	1	72-41-00/3/10
Seal Ring	1	72-41-00/3/20
Seal Ring	2	72-41-00/4/1
Seal Ring	2	72-41-00/4/10
Seal Ring	1	72-41-00/4/160
Seal Ring	1	72-41-00/5/1
Seal Ring	2	72-41-00/5/10
Seal Ring	3	72-41-00/6/1
Seal Ring	4	72-41-00/6/30
Seal Ring	4	72-41-00/7/1
Seal Ring	2	72-41-00/8/30
Seal Ring	1	72-41-00/8/150
Seal Ring	1	72-41-00/8/170
Seal Ring	1	72-41-00/8/190
Seal Ring	2	72-41-00/8/210

C. General Assembly Requirements

(1) When it is necessary to apply heat for assembly in this procedure, use a minimum temperature differential of 125°F (51.7°C) between the parts that will be assembled to each other. Do not increase the temperature more than 300°F (148.9°C) on any part.

(2) When it is necessary to apply heat for assembly, special heaters are specified in the procedure which follows. However, you can use an optional flameless torch or flame torch as specified in the steps which follow.

(3) When you cannot increase the temperature of a component in an oven (or it is only necessary to apply heat to the flange of a component) the use of Clements Cadillac flameless electric heat gun, Model FT 1000 is recommended.

(4) As an alternative, apply heat with a flame torch for parts which have a tight fit, such as disks, hubs, seals and shafts.

DIFFUSER AND COMBUSTOR - ASSEMBLY-01

WARNING: WEAR GLOVES WHEN YOU TOUCH HOT PARTS TO PREVENT BURNS.

CAUTION: HEAT PARTS EQUALLY. DO NOT INCREASE THE TEMPERATURE MORE THAN THE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: DO NOT PERMIT THE FLAME TO TOUCH ANY NON-METAL PART. THE FLAME WILL DAMAGE OR BURN NON-METAL PARTS.

CAUTION: DO NOT USE A TORCH HEAD THAT MAKES A PENCIL POINT FLAME.

(a) Use a flame torch with a maximum output of 80,000 BTU an hour, and a torch head with a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY METHOD TO MAKE A MARK THAT PERMITS CARBON, ZINC, COPPER, LEAD (OR SIMILAR RESIDUE) TO STAY ON THE PART. THIS CAN CAUSE A REDUCTION IN FATIGUE STRENGTH. THIS IS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN A LARGE AMOUNT OF HEAT IS APPLIED TO THE PART.

(b) Use the flame torch as follows:

1 Continuously monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a better temperature indicator and recommended. However, you can use a heat sensitive crayon.

2 Equally apply heat to the part in the snap diameter area. Turn the part or move the torch around the part.

3 Continuously monitor the temperature of the part.

4 Apply only enough heat to make the tight fits larger and permit assembly.

D. Procedure

NOTE: Clock positions are clockwise from the front, unless otherwise specified.

Subtask 72−41−00−430−076:

(1) Install diffuser case in PWA 25039 Build Stand. See Figure 1001.

NOTE: If you have a twin overhead rail system you must use PWA 85983 Stabilizer Adapter with PWA 85751 Handling Brackets.

(a) Install two PWA 85751 Handling Brackets (1001/4) to the diffuser case.

1 Use a hoist and install the longer front flange of the brackets to the rear of the front flange of the diffuser case at the 3 and 9 o'clock locations, install the four pins in the front flange of the bracket into the four boltholes in the diffuser case front flange. Install the shorter rear flange of the bracket to the front of the diffuser case rear flange and attach with the detail nuts and bolts.

2 Install the double spool bracket in the rear most two holes as marked on the bracket.

WARNING: USE TWO OPERATORS WHEN YOU INSTALL OR TRUNNION THE CASE IN THE STAND. WHEN THE BALL LOCK PIN IS REMOVED THE CASE CAN TRUNNION BY ITSELF, AND POSSIBLY CAUSE INJURY.

(b) Use a hoist (1001/1), PWA 28657 Sling (1001/2), and two PWA 76154 Adapters (1001/3), trunnion and install the diffuser case into PWA 25039 Stand (1001/5). Hold in position with a ball lock pin.

(c) Remove hoist, PWA 28657 Sling, and two PWA 76154 Adapters.

(d) Face the rear of the diffuser case and use tape to mark the rear flange in line with the first hole to the left of the dowel pin.

(e) Face the front of the diffuser case and mark the flange at the offset hole. These marks will indicate bottom center line and 6 o'clock position of the diffuser case.

Subtask 72−41−00−430−077:

(2) Install the No. 3 bearing (breather) tube assembly. See Figure 1002.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Remove all protective closures from the tube assembly and blow shop air through the tube assemblies to make sure there is no foreign material.

(b) Install the seal ring (1002/4) in the center groove on the assembly.

(c) (Pre SB PW4ENG 72−648) Install the two−piece seal ring (1002/2) at the end groove on the assembly. Assemble it with the inner ring joint 180° ± 20° from the outer ring joint.

(d) (Post SB PW4ENG 72−648) Install the one−piece seal ring (1002/2) at the end groove on the assembly. Assemble it with the inner ring joint 180° ± 20° from the outer ring joint.

(e) Install the large seal ring (1002/5) in the large ring groove at the end of the assembly.

(f) Install the gasket (1002/3) with a small amount of Beeswax P05−395 or Paraffin Wax Blend P05−396 onto the tube end.

(g) Install the tube assembly in the case at the 11 o'clock position (as viewed from the front).

(3) Install the No. 3 bearing (scavenge) tube assembly (1002/11). See Figure 1002.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Remove all protective closures from the tube (1002/11) and blow shop air through the tube assembly to make sure there is no foreign material.

(b) Install the seal ring (1002/12) in the center groove on the assembly.

(c) (Pre SB PW4ENG 72-648) Install the two-piece seal ring (1002/10) at the end groove on the assembly.

(d) (Post SB PW4ENG 72-648) Install the one-piece seal ring (1002/10) at the end groove on the assembly.

(e) Install the large seal ring (1002/9) in the large ring groove at the end of the assembly.

(f) Install the gasket (1002/8) with a small amount of Beeswax P05-395 or Paraffin Wax Blend P05-396 onto the tube end.

(g) Install the tube assembly in the case at the 5:30 o'clock position (as viewed from the front).

(4) Install the diffuser seal air vent tube assemblies (1002/6). See Figure 1002.

NOTE: Attach a temporary safety wire around the air vent tube so that the tube will not fall back into the diffuser case and cause unnecessary engine disassembly at a later engine assembly procedure.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Remove all protective closures from diffuser seal air vent tube assemblies and blow shop air through the tubes to make sure there is no foreign material.

(b) Install the seal rings (1002/7) in the groove on the two tube assemblies.

(c) Install the tube assemblies through the case struts at the 1:00 and 8:30 o'clock positions (as viewed from the front).

(5) Install the turbine blade cooling tubes (1003/1). See Figure 1003.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Remove all protective closures from two turbine blade cooling tubes (1003/1) and blow shop air through the tubes to make sure there is no foreign material.

(b) Install the seal ring (1003/2) in the groove on each tube.

(c) Install the seal ring (1003/3) in the grooves at each end of the two seal ring transfer (turbine blade cooling) tubes (1003/4).

(d) Install the transfer tubes (1003/4) to the cooling tubes (1003/1) while you engage the tabs on the transfer tubes with the slots on the cooling tubes.

(e) Install the cooling tubes with the transfer tubes through the case struts at the 6:30 and 9:30 o'clock positions (as viewed from the front).

Subtask 72−41−00−430−078:

(6) Install the No. 3 bearing (compartment) cooling tube (1004/9). See Figure 1004.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Remove all protective closures from No. 3 bearing (compartment) cooling tube and blow shop air through the tube to make sure there is no foreign material.

(b) Install the large seal ring (1004/8) in the ring groove on the tube (1004/9).

(c) Install the small seal rings (1004/7) in the rear groove on the tube (1004/9).

(d) Install the tube (1004/9) through the case strut at the 7:30 o'clock position (as viewed from the front).

(7) Install the No. 3 bearing and airframe (oil vent and turbine cooling) manifold assemblies (1004/6). See Figure 1004.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Remove all protective closures from the No. 3 bearing and airframe (oil vent and turbine cooling air duct sensing outer) manifold assemblies and blow shop air through the manifolds to make sure there is no foreign material.

(b) Install the seal rings (1004/5) in the grooves on both manifold assemblies.

(c) Install the manifold assemblies through the case struts at the 12:30 and 4 o'clock positions (as viewed from the front).

(8) Install the No. 3 bearing (oil) pressure tube assembly (1004/10). See Figure 1004.

NOTE: Make sure correct seal ring size is used to get correct fit with seal ring groove.

(a) Remove all protective closures from the No. 3 bearing (oil) pressure tube assembly and blow shop air through the tube assembly to make sure there is no foreign material.

(b) Install the seal ring (1004/1) in the center groove on the tube assembly.

(c) Install the seal ring (1004/3) at the end groove on the tube assembly.

(d) Install the large seal ring (1004/2) in the large ring groove on the tube.

(e) Install the gasket (1004/4) with a small amount of Beeswax P05−395 or Paraffin Wax Blend P05−396 onto the tube (1004/10).

(f) Install the tube assembly through the case strut at the 2 o'clock position (as viewed from the front).

Subtask 72−41−00−430−079:

(9) Install the HPC (rear) exit brush seal assembly (called brush seal) (1005/10) and transfer tubes. See Figure 1005.

NOTE: Clock positions are clockwise from the rear. Make sure the correct seal ring size is used to get the correct fit with the seal ring groove.

(a) Install the brush seal (1005/10), carefully while you align the installed tubes. Make sure that the seal rings on the tubes are correctly engaged.

NOTE: Use two assemblers if necessary.

(b) Attach the brush seal to the diffuser case with bolts, (1005/1) lubricated with Engine Oil P03−001, and nuts (1005/11).

(c) Seat the brush seal with bolts, slowly tightened, and nuts. Use a 180 degree opposite bolt pattern until the ring is fully seated against the diffuser case flange.

(d) Torque the nuts (1005/11) to 85 − 95 lb−in. (9.604 − 10.734 N.m). Loosen and torque the nuts again to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(e) Install the seal ring (1005/4) in the groove on the seal ring transfer (No. 3 bearing cooling front) tube (1005/6).

(f) Face the rear of the diffuser case and find the tube that extends through the brush seal at the 4:30 o'clock position. Make sure that the seal ring is engaged in the ring groove on tube.

(g) Carefully install the transfer tube (1005/6) over the tube at the 4:30 o'clock position, with the tabs toward the brush seal. Engage the tabs with the slots in the brush seal. Make sure that the transfer tube is fully seated in the brush seal.

(h) Install the seal ring (1005/7) in the groove on the seal ring transfer (No. 3 bearing cooling rear) tube (1005/3).

(i) Carefully install the transfer tube (1005/3) over the tube at the 4:30 o'clock position, engage the tabs in the slots of the installed transfer tube. Make sure the transfer tubes are fully seated.

(j) Install the seal ring (1005/5) in the groove on two No. 3 bearing packing transfer (breather and scavenge) tubes (1005/2).

(k) Carefully install the transfer tubes (1005/2) over the tubes at the 1 and 6:30 o'clock positions, with tabs toward the brush seal. Engage the tabs with the slots in the brush seal. Make sure the transfer tubes are fully seated in the brush seal.

(l) Install the seal ring (1005/8) in the groove on the transfer (oil pressure) tube (1005/9).

(m) Carefully install the transfer tube (1005/9) over the tube at the 10 o'clock position with tabs toward the brush seal. Engage the tabs with the slots in the brush seal. Make sure the transfer tube is fully seated in the brush seal.

Subtask 72−41−00−430−080:

(10) Install the turbine cooling duct sensing tube and oil vent tube. See Figure 1006.

NOTE: Clock positions are clockwise from the rear. Make sure the correct seal ring size is used to get the correct fit with the seal ring groove.

(a) Remove all protective closures from the turbine cooling duct sensing (inner airframe) tube assembly (1006/1) and blow shop air through the tube assembly to make sure there is no foreign material. See Figure 1006.

(b) Install the seal ring (1006/2) in the groove on the OD of the tube nut (1006/10).

(c) Install the tube assembly (1006/1) to the installed cooling manifold at the 11:30 o'clock position in the brush seal. The rear of the tube assembly should pass through the diffuser case flange. Handtighten the tube nut (1006/10).

(d) Remove all protective closures from the No. 3 bearing oil vent (inner) tube assembly (1006/3) and blow shop air through tube assembly to make sure there is no foreign material.

(e) Install the seal ring (1006/4) to the groove on the OD of the tube nut (1006/9).

(f) Install the tube assembly (1006/3) to the installed cooling manifold at the 8 o'clock position in the brush seal. Do not tighten tube nut at this time.

(g) Locate two countersunk holes in the diffuser case flange at approximately the 7 o'clock position and attach the tube assembly (1006/3) at two places with clamps (1006/5), brackets (1006/6), screws (1006/7) lubricated with Engine Oil P03-001, and nuts (1006/8).

(h) Torque both tube nuts (1006/9) and (1006/10) to 200 - 225 lb-in. (22.597 - 25.422 N.m). Loosen and torque the tube nuts again to 200 - 225 lb-in. (22.597 - 25.422 N.m). Install the Lockwire P05-289 to safety the tube nuts.

NOTE: Hold connector on mating tube with PWA 87006 Wrench while torquing with PWA 103081 Torque Adapter.

(i) Torque the screws that hold the clamps at two locations to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(11) Install the No. 3 bearing housing and front seal and cooling air duct assembly (1007/5) in the diffuser case. See Figure 1007.

(a) Turn the diffuser case, rear end up, on PWA 85751 Handling Brackets and lock in position.

(b) Looking down into the rear of the diffuser case, install two PWA 25450 Aligning Pins (1007/4) 180 degrees apart to the inner flange of the case.

(c) Install three eye bolts, equally spaced, in the outer flange of the No. 3 bearing front cooling duct assembly and housing.

(d) With a three cable sling, lift and lower the No. 3 bearing front cooling duct assembly and housing into the diffuser case.

(e) Install the No. 3 bearing front cooling duct assembly and housing (1007/5) to the flange in the diffuser case while you carefully align the installed tubes and seal rings. Remove the sling and eye bolts.

(f) Align the four countersunk holes in the housing flange with the four smaller holes in the case inner flange. Attach with four screws (1007/3) lubricated with Engine Oil P03−001. Do not tighten screws.

NOTE: Make sure that the dowel pin in the assembly engages the dowel pin hole in the installed tube at approximately the 1 o'clock position.

(g) Make sure all the tubes are correctly aligned and the seal rings are still in place.

(h) Install eight work bolts (1007/1) and washers (1007/2), one to each side of the last four installed screws (1007/3).

(i) Carefully tighten the work bolts (1007/1) in a 180 degree opposite pattern until assembly is fully seated. Torque the work bolts to 290 lb−in. (32.766 N.m) maximum.

(j) Remove the two alignment pins (1007/4).

(k) Run down the four screws (1007/3) until bottomed, then back off screws one full turn. Torque screws 22 − 95 lb−in. (2.486 − 10.734 N.m).

(l) Remove the eight work bolts (1007/1) and washers (1007/2).

(m) Turn the diffuser case to the horizontal position and lock in place.

Subtask 72−41−00−430−081:

(12) Install the No. 3 bearing (breather) tube (1008/1), (oil) pressure tube (1008/3), and (scavenge) tube (1008/4). Also install the heat shields for these tubes and the (compartment) cooling tube (1008/2). See Figure 1008.

(a) Facing front of diffuser case, locate three large bosses (at 2:00, 5:30, and 11 o'clock) on airsealing ring. Attach the tubes (breather, pressure, and scavenge) at these locations using bolts, lubricated with Engine Oil P03−001.

(b) Torque the bolts to 125 − 170 lb−in. (14.123 − 19.207 N.m). Without loosening, continue to tighten to same limits until torque is maintained. Install the Lockwire P05−289 to safety the bolts.

(c) Install the heat shield halves over the oil pressure tube at 2:00 o'clock and the oil breather tube at 11 o'clock as follows:

1 Install the heat shield flange halves into the boss on the airsealing ring. Put the largest flat side of the heat shield flange against the bolts.

2 Install the inner heat shield halves around the tube assembly.

3 Install the outer heat shield halves over the inner heat shield halves. Use PWA 101455 Installation Clamp to hold the heat shield in position around the tube for the lockwire installation.

4 (Post SB PW4ENG 72−623) Attach the heat shield assembly with the Lockwire P05−365 at both ends and middle. Wrap the lockwire three full turns around the heat shield and make safe with three full twists. The twist must be outward away from the rotor.

5 Remove the installation clamp (PWA 101455).

(d) Install the heat shield halves over the oil scavenge tube at 5:30 o'clock and the compartment cooling tube at 7:30 o'clock as follows:

1 Install the heat shield flange halves into the boss on the airsealing ring for the oil scavenge tube. Put the largest flat side of the heat shield flange against the bolts.

2 Install the inner heat shield halves around the tube assembly.

3 Install the outer heat shield halves over the inner heat shield halves. Use PWA 101456 Installation Clamp to hold the heat shield in position around the tube for the lockwire installation.

4 (Post SB PW4ENG 72-623) Attach the heat shield assembly with the Lockwire P05-365 at both ends and middle. Wrap the lockwire three full turns around the heat shield and make safe with three full twists. The twist must be outward away from the rotor.

5 Remove the installation clamp (PWA 101456).

Subtask 72-41-00-430-082:

(13) Install the HPC exit brush seal support assembly (called brush seal support) (1009/1) and the compressor exit stator assembly (called stator) (1009/2). See Figure 1009.

(a) Put the brush seal support on clean paper on a bench with the OD surface down.

(b) Find the two larger flange holes with the six smaller holes in between. Mark a reference line on the front of the flange in line with the two large holes with a marking crayon.

NOTE: The threaded hole is at 12:30 o'clock, and one of the two large holes is at 11:00 o'clock.

(c) Chill the brush seal support for approximately ten minutes.

(d) Put the stator on clean paper on the bench with the slotted flange down.

(e) Find the two larger flange holes with the five slots in between. Mark a reference line in line with the two large holes with a marking crayon.

(f) Chill the stator for approximately ten minutes.

(g) Install PWA 87153 Heater on the inner front flange of the diffuser case as follows:

NOTE: You can use the optional flameless torch or the flame torch as described above to heat the inner front flange of the diffuser case.

1 The heater thermocouple must touch the flange.

2 Attach the PWA 29754 Heater Control to the receptacle and the thermocouple.

3 Start the heater element to increase the temperature of the diffuser case flange to 350° − 375°F (176.7° − 190.6°C).

4 Remove the heater and heater control.

(h) Look at the front of the diffuser case. Find the two large holes with the five smaller holes in between on the inner front flange. Mark a reference line in line with the two large holes with a marking crayon.

(i) Install PWA 87154 Guide Pin on the brush seal support as follows:

1 Put the guide pin called "12 o'clock" into the bolt hole at the 12 o'clock location.

NOTE: The 12 o'clock hole is adjacent to the threaded hole that is in between the two alignment marks.

2 Turn the knurled knob of the threaded rod to attach the guide pin to the brush seal support assembly.

(j) With marks aligned, install the chilled brush seal support in the diffuser case. If necessary, tap to seat.

(k) Remove the guide pin from the brush seal support.

(l) Install the PWA 101863 Alignment Pin on the compressor exit stator assembly as follows:

1 Put the alignment pin specified as 12 o'clock into the bolt slot adjacent to the jackscrew hole near the 12 o'clock location.

2 Turn the knurled knob of the threaded rod to attach the alignment pin to the compressor exit stator assembly.

(m) With marks aligned, install the chilled stator in the case over the brush seal support. If necessary, tap to seat.

(n) Remove the alignment pin from the compressor exit stator assembly.

(14) Install the stage 15 HPC airsealing ring nozzles (1009/4). See Figure 1009.

(a) Remove the protective closures from the ten Stage 15 HPC airsealing ring nozzles. Blow shop air through the nozzles to make sure there is no foreign material in the nozzles.

(b) Install the spacer plates (1009/5) to the 34 slots on the stator.

(c) Install the ten nozzle assemblies to the large holes in the stator flange, through to the bosses on the diffuser case. Nozzle openings must point in a counterclockwise direction.

(d) Attach the nozzles with bolts (1009/6), lubricated with Engine Oil P03-001, and nuts (1009/7) tightened by hand. Install the 14 lubricated bolts (1009/6) washers (1009/3) and nuts (1009/7) to the holes that remain.

(e) Torque the bolts to 85 - 95 lb-in. (9.604 - 10.734 N.m). Loosen them and torque again to 85 - 95 lb-in. (9.604 - 10.734 N.m).

Subtask 72−41−00−430−083:

(15) Install the No. 3 bearing (oil) pressure tube gasket and lock plate. See Figure 1010.

- (a) Find the pad at 2 o'clock where a manifold comes out of the side of diffuser case.
- (b) Install the gasket (1010/10) to the case pad.
- (c) Install the sleeve (1010/14) with small ID over the seal ring.
- (d) Install the plate lock (1010/11) with slot upward.
- (e) Install the shield (1010/12) with open end outward, aligning bolt holes.
- (f) Attach with bolts (1010/13) lubricated with Engine Oil P03−001. Tighten bolts fingertight.
- (g) Torque the bolts to 65 − 85 lb−in. (7.344 − 9.604 N.m). Do not loosen the bolts. Continue to tighten them to the same limits until the torque is kept. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(16) Install the No. 3 bearing and airframe manifold assembly lock plates and gaskets. See Figure 1010.

- (a) Find the pad at the 4 o'clock position with the manifold that extends through the outside of the diffuser case.
- (b) Install the gasket (1010/9) to the case pad.
- (c) Install the sleeve (1010/7) with small ID over the seal ring.
- (d) Install the plate lock (1010/8) with slot upward.
- (e) Attach with bolts (1010/6) lubricated with Engine Oil P03−001. Tighten bolts fingertight.

(f) Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Do not loosen the bolts. Continue to tighten them to the same limits until the torque is kept. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(g) Find the pad at the 1 o'clock position with the tube that extends through the outside of the diffuser case.

(h) Install the gasket (1010/5) to the case pad.

(i) Install the sleeve (1010/4) with small ID over the seal ring.

(j) Install the plate lock (1010/3) with slot upward.

(k) (Pre SB PW4ENG 72-570) No No. 3 bearing weep tube heat shield assembly installed.

1 Attach with bolts (1010/6) and (1010/22), lubricated with Engine Oil P03-001. Tighten the bolts with your fingers.

2 Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Do not loosen the bolts. Continue to tighten the bolts to the same limits until the torque is maintained.

3 Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(l) (Post SB PW4ENG 72-570) No. 3 bearing weep tube heat shield assembly installed.

1 Install the heat shield (1010/23) over the plate lock (1010/8).

2 Attach with bolts (1010/24) and (1010/25), lubricated with Engine Oil P03-001. Tighten the bolts with your fingers.

3 Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Do not loosen the bolts. Continue to tighten the bolts to the same limits until the torque is maintained.

4 Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(m) Install the cap assembly (1010/1). Torque to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the cap assembly.

(17) Install the two covers (1010/16) and seals (1010/19). See Figure 1010.

(a) Put a gasket (1010/15) on the six-hole pads at 3:00 and 10:30 o'clock.

(b) Install a cover (1010/16) on each gasket. At the 10:30 o'clock location, install the bracket (1010/21) on the two forward holes of the cover. Install six bolts (1010/17), threads lubricated with Engine Oil P03-001, in each cover. Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(c) Install a seal ring (1010/18) on each seal (1010/19).

(d) Install the seals (1010/19) on the rods of the covers (1010/16) in the ID of the diffuser case. Install a nut (1010/20), threads lubricated with
R Lubricant P06-023 or Anti-seize Paste P06-054,
R on the rod. Torque the nut to 190 - 215 lb-in.
R (21.467 - 24.292 N.m).

Subtask 72-41-00-430-084:

(18) Install the No. 3 bearing (breather) tube lock plate. See Figure 1011.

(a) Find the pad at 11 o'clock. It has a tube that comes through the boss.

(b) Install a gasket (1011/6) on the pad.

(c) Install a sleeve (1011/5) in the gasket.

(d) Install a plate lock (1011/4) on the sleeve, slot to the rear.

(e) Install three bolts (1011/3), threads lubricated with Engine Oil P03-001. Tighten the bolts with your fingers.

(f) Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Do not loosen the bolts. Continue to tighten them to the same limits until the torque is kept. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(g) Install a tube nut (1011/2) on the tube. Install thrust wire (1011/1), lubricated with Engine Oil P03-001.

(19) Install the plate for the No. 3 bearing (scavenge) tube, which is at 5:30 o'clock. See Figure 1011.

(a) Install a gasket (1011/7) on the pad.

(b) Install a sleeve(1011/8) in the gasket.

(c) Install a plate (1011/9) on the sleeve.

(d) Install three bolts (1011/12), threads lubricated with Engine Oil P03-001, in the plate. Tighten the bolts with your fingers.

(e) Torque the bolts to 65 - 85 lb-in. (7.344 - 9.604 N.m). Do not loosen the bolts. Continue to tighten the bolts to the same limit until the torque is kept. Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(f) Install a tube nut (1011/10). Install thrust wire (1011/11), lubricated with Engine Oil P03-001, in the tube nut.

(20) Install the No. 3 bearing cooling tube lock and elbow, which is at 7:30 o'clock. See Figure 1011.

CAUTION: INSTALL LOCK PLATES (1011/16) WITH SLOT GROOVE OUTWARD AND PIN INWARD. MAKE SURE THE LOCK PLATES ENGAGE THE INTERNAL TUBE LIP FLANGE AS SHOWN IN FIGURE 1011.

(a) At the boss at 7:30 o'clock, install the locks (1011/16) to flange lip of the internal tube and align the bolt holes.

(b) (Reference 1990) Hold the tube locks outward against the tube lip. Measure and be sure the end of the internal tube is 0.000 − 0.020 inch (0.000 − 0.508 mm) above the tube locks. If the measurement is not within this limit, install the locks again and be sure you engage the internal tube lip correctly.

(c) Install the gasket (1011/17) around OD of locks.

(d) Install the gasket (1011/15) over the locks with the raised lip against the tube. Align bolt holes.

(e) Install the elbow (1011/14) and align the bolt holes.

(f) Attach the elbow with ten bolts (1011/13), threads lubricated with Engine Oil P03−001. Tighten the bolts with your fingers.

(g) Torque bolts to 65 − 85 lb−in. (7.344 − 9.604 N.m). Do not loosen the bolts. Continue to tighten them to the same limits until the torque is kept. Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(h) Install the washer (1011/18) to flat threaded end of the adapter (1011/19).

(i) Lubricate the flat threaded end of the adapter with Engine Oil P03−001, and install the adapter in the elbow.

(j) Torque the adapter to 450 − 550 lb−in. (50.843 − 62.142 N.m).

Subtask 72-41-00-720-053:

(21) Vacuum check the No. 3 bearing compartment. See Inspection/Check-05 Task 72-41-00-200-005.

Subtask 72-41-00-720-054:

(22) Airflow check the No. 3 bearing oil pressure system. Figure 1012.

NOTE: Airflow check is to make sure that the passages are not blocked or assembled incorrectly.

(a) Find the outside end of No. 3 bearing pressure tube assembly. Attach PWA 85565 Adapter to the outside end of the tube.

(b) Attach the air inlet hose from CTE 6070 Airflow Cart or CTE 5070 Airflow Cart to the larger threaded hole of the adapter.

(c) Attach the pressure sensing line to the smaller threaded hole.

(d) Airflow check the nozzle at 10 psig (68.9 kPa). Airflow rate must be 40 - 50 lb/hr (18.14 - 22.68 kg/hr).

(e) After airflow rate limits have been met, remove the adapter and airflow cart.

Subtask 72-41-00-430-085:

(23) Install the outer combustion chamber assembly. See Figure 1013.

(a) Install and attach the diffuser case to the front end down position in PWA 86508 Build Stand or PWA 85044 Build Stand.

(b) Remove the two PWA 85751 Handling Brackets from the diffuser case.

(c) Visually check the interior of the diffuser case for correct assemblies, foreign material or damage and that all details are attached. Pay particular attention to mating surfaces of carbon seal.

(d) Locate the 12 threaded bosses located around the OD of the diffuser case. Install PWA 85060 Alignment Pins to three equally spaced bosses in the case and retract the inner portion of the pins.

(e) Use PWA 27918 Sling or PWA 80555 Sling (1013/1) and lift the outer combustion chamber assembly (1013/2) and position over the diffuser case. Align the two igniter holes in the combustion chamber with the igniter bosses on the diffuser case at the 4 o'clock position, as viewed from the rear.

(f) Carefully lower the combustion chamber into the diffuser case while you keep the igniter bosses aligned. Lower the combustion chamber so that the lugs on the bottom of the chamber are even with the bosses on the diffuser case. Push the inner portion of the pins in to align the combustion chamber mount lugs with the diffuser case at three places.

(g) Lubricate the threads and seating surface of the twelve doweled end retaining bolts (1013/3) with Lubricant P06−023 and wipe clean any lubricant from other bolt surfaces before you installation. Install nine lubricated bolts (1013/3) and washers (1013/4) through the outside of diffuser case to locate the combustion chamber mount lugs. Wipe clean any excess lubricant from the case and/or bolt surfaces.

(h) Remove one aligning pin at a time and install the three remaining bolts and washers.

(i) (Reference 402) Remove sling. Torque bolts (1013/3) 500 − 600 lb−in. (56.492 − 67.791 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

Subtask 72−41−00−430−086:

(24) Install the igniter plugs. See Figure 1014 and Figure 1015.

NOTE: Currently there are (2) two igniter plug guide configurations installed in the outer combustion chamber. (Pre SB PW4ENG 72-601) chambers have a short sleeve and a shield. (Post SB PW4ENG 72-601) chambers have an extended, necked-out sleeve and a lock.

(a) Measure the igniter plug immersion depth. Use PWA 75509 Immersion Gage (1014/7).

NOTE: This procedure is applicable to the two igniter plug locations.

1 If necessary, clean threads of boss with the PWA 24524 Tap.

2 Install the key washer (1014/2) to the igniter plug boss (1014/3) with the tabs to the boss. Do not bend the tabs.

3 Install the boss and key washer to the igniter plug (1014/1) and tighten by hand.

4 (Reference 365 or 386) Measure Dimension A from the plug tip to the bottom face of the boss. Write measurement as Dimension A.

5 Remove the igniter plug and key washer from the boss and put them on the bench.

6 Put the gage master (1014/5) between the gage hook and the gage base. Set the gage bezel to zero.

7 Install the gage into the igniter boss hole in the diffuser case until the gage base is seated on the face of the case boss.

8 Turn the gage base to get a clear view of the dial gage face.

9 Hold the gage base. At the same time, turn the probe until the notch in the probe is to the rear of the case.

10 Push in on the probe and slide the gage to the rear of the case to put the gage hook against the rear ID surface of the outer combustion chamber (1014/6).

11 Release the probe and record the dial gage reading. Add the gage reading to 2.200 inches (55.880 mm) if the reading is a plus reading. Subtract the gage reading from 2.200 inches (55.880 mm) if the reading is a minus reading. Result is Dimension B. Remove the gage.

12 (Engines Without Talon Low Emission Combustion Chambers) Add 0.125 inch (3.175 mm) to Dimension B and subtract that total from Dimension A. The result, Dimension C, is the necessary spacer thickness.

13 (Engines with Talon Low Emission combustion chambers) Add 0.075 inch (1.905 mm) to Dimension B and subtract that total from Dimension A. The resulting dimension, Dimension C, is the desired spacer thickness.

(b) Use a classified spacer (1014/4) or a combination of spacers to obtain Dimension C plus or minus 0.010 inch (0.254 mm). Use a maximum of two spacers for each plug. The total combined thickness of spacer(s) must not be more than 0.300 inch (7.620 mm).

(c) If necessary, clean the threads in the diffuser case port using PWA 27641 Tap.

(d) Fully clean the igniter plug, igniter boss and diffuser case threads with Petroleum Solvent P11−027.

(e) Install the key washer to the plug boss with the tabs to the boss. Bend the tabs over to attach the key washer to the boss.

(f) Lubricate the outer threads of the plug boss with Lubricant P06−023.

(g) (Reference 400) Install the classified spacer(s) to the boss. Install the boss to the diffuser case. Torque the boss to 375 − 440 lb−in. (42.869 − 49.713 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the boss.

(h) Apply Thread Lubricant P06−023 to the igniter plug threads.

(i) (Reference 401) Install the igniter plug to the boss. Torque the plug to 300 − 360 lb−in. (33.895 − 40.675 N.m).

Subtask 72−41−00−430−087:

(25) Install the fuel injectors and support assemblies. See Figure 1016.

NOTE: Where brackets are installed with the fuel injectors, they are installed on top of the fuel injectors.

(a) Use tape above each fuel injector boss to identify each boss. The first boss to the right of the bottom centerline is No. 12, and the first boss to left of the bottom centerline is No. 13. Continue to number bosses in a clockwise direction to 24.

(b) Place 24 fuel injectors (1016/7) on the bench and install a gasket (1016/5), lubricated with Beeswax P05−395 or Paraffin Wax Blend P05−396, to each injector.

(c) Install fuel injectors at bosses marked No. 1, 2, 3 and 4 through the diffuser case with the nozzle upward. Attach with bolts (1016/6) lubricated with Engine Oil P03−001, fingertight.

(d) At the injector boss marked No. 5, install the fuel injector and bracket (1016/8). Attach with bolts lubricated with Engine Oil P03−001, fingertight.

(e) At boss No. 6 install the fuel injector and bracket (1016/10). Attach with lubricated bolts fingertight.

(f) At boss No. 7 install the fuel injector and bracket (1016/11). Attach with lubricated bolts fingertight.

(g) At boss No. 8 install the fuel injector and bracket (1016/12). Attach with lubricated bolts fingertight.

(h) Install a fuel injector at bosses No. 9 through 17 and attach with lubricated bolts fingertight.

(i) At boss No. 18 install the fuel injector and bracket (1016/1). Attach with lubricated bolts fingertight.

(j) Install fuel injector at boss No. 19 and attach with lubricated bolts fingertight.

(k) At boss No. 20 install the fuel injector and bracket (1016/2). Attach with lubricated bolts fingertight.

(l) At boss No. 21 install the fuel injector and bracket (1016/3). Attach with bolts lubricated with Engine Oil P03−001.

(m) Install the fuel injectors at bosses No. 22, 23 and 24. Attach with lubricated bolts fingertight.

(n) Make sure all the fuel injectors (1016/7) are correctly installed and torque bolts (1016/6) evenly around the case to 65 − 85 lb−in. (7.344 − 9.604 N.m). Do not loosen the bolts. Continue to torque to the same limits until the torque stays at the limit.

(o) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the two upper bolts together on the fuel injectors at Locations No. 1, 3, 4, 6, 7, 9, 10, 12, 13, 15, 16, 18, 19, 21, 22 and 24.

NOTE: The lower bolt at the above locations will be lockwired to fuel manifold nuts in a later assembly operation.

(p) Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the three bolts together on the fuel injectors at Locations No. 2, 5, 8, 11, 14, 17, 20 and 23.

NOTE: Do not remove tape used to identify the fuel injector location numbers at this time.

Subtask 72−41−00−430−088:

(26) Install the diffuser case in PWA 86508 Build Stand or PWA 85044 Build Stand and align flange holes No. 37 through 43 with cutout in build stand.

NOTE: See the referenced tables for lubricants, torques, and lockwire that are necessary at the different locations.

NOTE: Clock locations are clockwise from the rear.

(a) Install two bolts (1017/2) and washers (1017/1). See Figure 1017 and Figure 1018 and Table 1017 and Table 1018.

Bracket/ Plug/Cover Reference Number	Position On Diffuser Case	Bolt Torque lb−in. (N.m) Lubricant Lockwire	Service Bulletin Reference
2 Bolt	1 o'clock	65 − 85 (7.344 − 9.604) P03−001 Lockwire	
3 Support	2 o'clock	65 − 85 (7.344 − 9.604) P03−001 Lockwire	
4 Bracket	3:15 o'clock	125 − 170 (14.123 − 19.207) P03−001 Lockwire	
5 Bracket	4 o'clock	65 − 85 (7.344 − 9.604) P03−001 Lockwire	

Table 1017

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Bracket/ Plug/Cover Reference Number	Position On Diffuser Case	Bolt Torque lb-in. (N.m) Lubricant Lockwire	Service Bulletin Reference
6 Bracket	5:15 o'clock	65 - 85 (7.344 - 9.604) P03-001 Lockwire	

Table 1017 (Continued)

Bracket/ Plug/Cover Reference Number	Position On Diffuser Case	Bolt Torque lb-in. (N.m) Lubricant Lockwire	Service Bulletin Reference
1 Bracket	7 o'clock	65 - 85 (7.344 - 9.604) P03-001 Lockwire	
3 Bracket	8:45 o'clock	65 - 85 (7.344 - 9.604) P03-001 Lockwire	
6 Cover	9:15 o'clock	65 - 85 (7.344 - 9.604) P03-001 Lockwire	
9 Bracket	9:45 o'clock	125 - 170 (14.123 - 19.207) P03-001 Lockwire	

Table 1018

(b) Install the brackets with bolts to the pads. See Figure 1017 and Figure 1018 and Table 1017 and Table 1018.

(c) (Pre SB PW4ENG 72-699) Install a cover (1018/6) with gasket (1018/5) to the case with two bolts (1018/7).

(d) Install a gasket (1019/1) and cover (1019/2) on the diffuser case and attach with six bolts (1019/5). Install a gasket (1019/3) on the adapter (1019/4). Install the adapter in the cover. See Figure 1019 and Table 1019.

Bracket/ Plug/Cover Reference Number	Position On Diffuser Case	Bolt Torque lb-in. (N.m) Lubricant Lockwire	Adapter Torque lb-in. (N.m) Lubricant	Service Bulletin Reference
2 Cover	12:30 o'clock	65 - 85* (7.344 - 9.604)* P03-001 Lockwire	110 - 120 (12.428 - 13.558) No Lubricant	
7 Plug	1:30, 4:15, 5:45 o'clock	40 - 50 (4.519 - 5.619) P06-023 Lockwire		
8 Cover	2:00 o'clock	65 - 85* (7.344 - 9.604)* P03-001 Lockwire	110 - 120 (12.428 - 13.558) P03-001	
14 Adapter	3:00 o'clock		110 - 120 (12.428 - 13.558) No Lubricant	
18 Plug	5:00 o'clock	40 - 50 (4.519 - 5.619) P06-023 Lockwire		

*Do not loosen the bolts as you tighten them. Continue to tighten them to the same limits until the torque is kept.

Table 1019

(e) Install a gasket (1019/12) and cover (1019/8) on the diffuser case and attach with three bolts (1019/11). Install a gasket (1019/9) on the adapter (1019/10). Install the adapter.

(f) (Post SB PW4ENG 73−163) Install the EEC thermocouple probe (TT3) (1019/15) as follows:

1 Install the gasket (1019/16) to the probe (1019/15).

2 Lubricate the probe threads with Engine Oil P03−001.

3 Install the probe and gasket to the boss at the 2:30 o'clock position behind the fuel injector bosses.

4 (Reference 411) Remove lockwire between the body nut and coupling nut. Loosen the coupling nut from the body nut. Torque the body nut (to the case) to 95 − 100 lb−in. (10.734 − 11.298 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the body nut to the case.

5 Attach the PWA 87649 Angle Gage to the two bolt hole boss of the diffuser case on the right side (horizontal centerline) with hex head screws. Move the gage guide into position.

6 Turn the probe so the two larger studs are to the right as shown. Hold the probe in place.

7 Touch the side of the thermocouple probe with the guide and tighten the hand knob to hold the guide assembly in position. This will correctly position the thermocouple probe for the electrical harness alignment connection.

8 (Reference 410) Torque the coupling nut to 95 − 100 lb−in. (10.734 − 11.298 N.m). Install lockwire from the coupling nut to the body nut.

(g) Install six borescope plugs (1019/7) and (1020/7) with gaskets (1019/6) and (1020/6). See Figure 1019 and Figure 1020 and Table 1019 and Table 1020.

Bracket/ Plug/Cover Reference Number	Position On Diffuser Case	Bolt Torque lb-in. (N.m) Lubricant Lockwire	Adapter Torque lb-in. (N.m) Lubricant	Service Bulletin Reference
3 Plug	7:00 o'clock	40 - 50 (4.519 - 5.619) P06-023 Lockwire		
4 Cover	7:30 o'clock	65 - 85* (7.344 - 9.604)* P03-001 Lockwire		
7 Plug	7:30, 9:15,	40 - 50 (4.519 - 5.619) P06-023 Lockwire		

*Do not loosen the bolts as you tighten them. Continue to tighten them to the same limits until the torque is kept.

Table 1020

(h) Install two additional plugs (1019/18) and (1020/2) with gaskets (1019/17) and (1020/1).

(i) Install a gasket (1020/5) and cover (1020/4) on the diffuser case and attach with six bolts (1020/2). See Figure 1020 and Table 1020.

Subtask 72-41-00-430-089:

(27) (Reference 407) Install the fuel injector supply manifold assemblies. See Figure 1021.

CAUTION: FOR ALL PACKING LUBRICANTS, APPLY ONLY A THIN COAT OR THE FUEL SYSTEM CAN BECOME BLOCKED.

(a) Install the packings (1021/3), lubricated with Engine Oil P03-001 or Sealing Ring Lubricant P06-053 to the packing groove on each fuel injector.

(b) Remove closures from manifold assembly (1021/2) and blow shop air through assembly to make sure there is no foreign material.

(c) Using Engine Oil P03-001, lubricate threads of tube nuts (1021/1) on manifold assembly (1021/2) at three places.

(d) Install the manifold assembly (1021/2) to fuel injectors No. 10, 11 and 12. Attach the tube nuts (1021/1) fingertight at three places.

(e) Remove closures from the remaining seven manifold assemblies (1021/4) and blow shop air through assembly to make sure there is no foreign material.

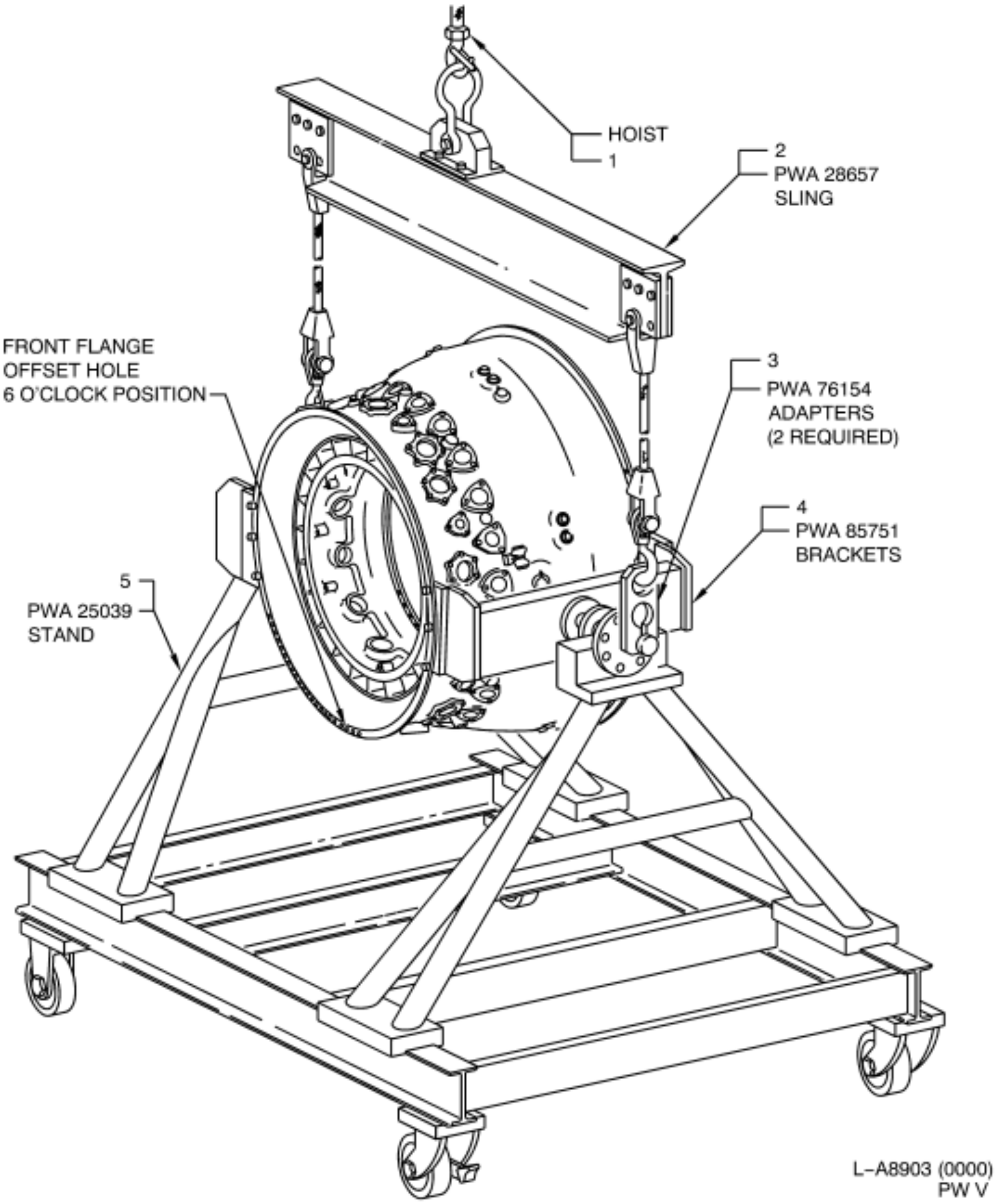
(f) Using Engine Oil P03-001, lubricate threads of tube nuts on manifold assemblies.

(g) Install the manifold assemblies (1021/4) to the remaining fuel injectors. Connect the tube nuts fingertight.

NOTE: Tube nuts are torqued after the fuel distribution system leak test has been accomplished. Refer to Assembly-03 Task 72-41-00-400-003.

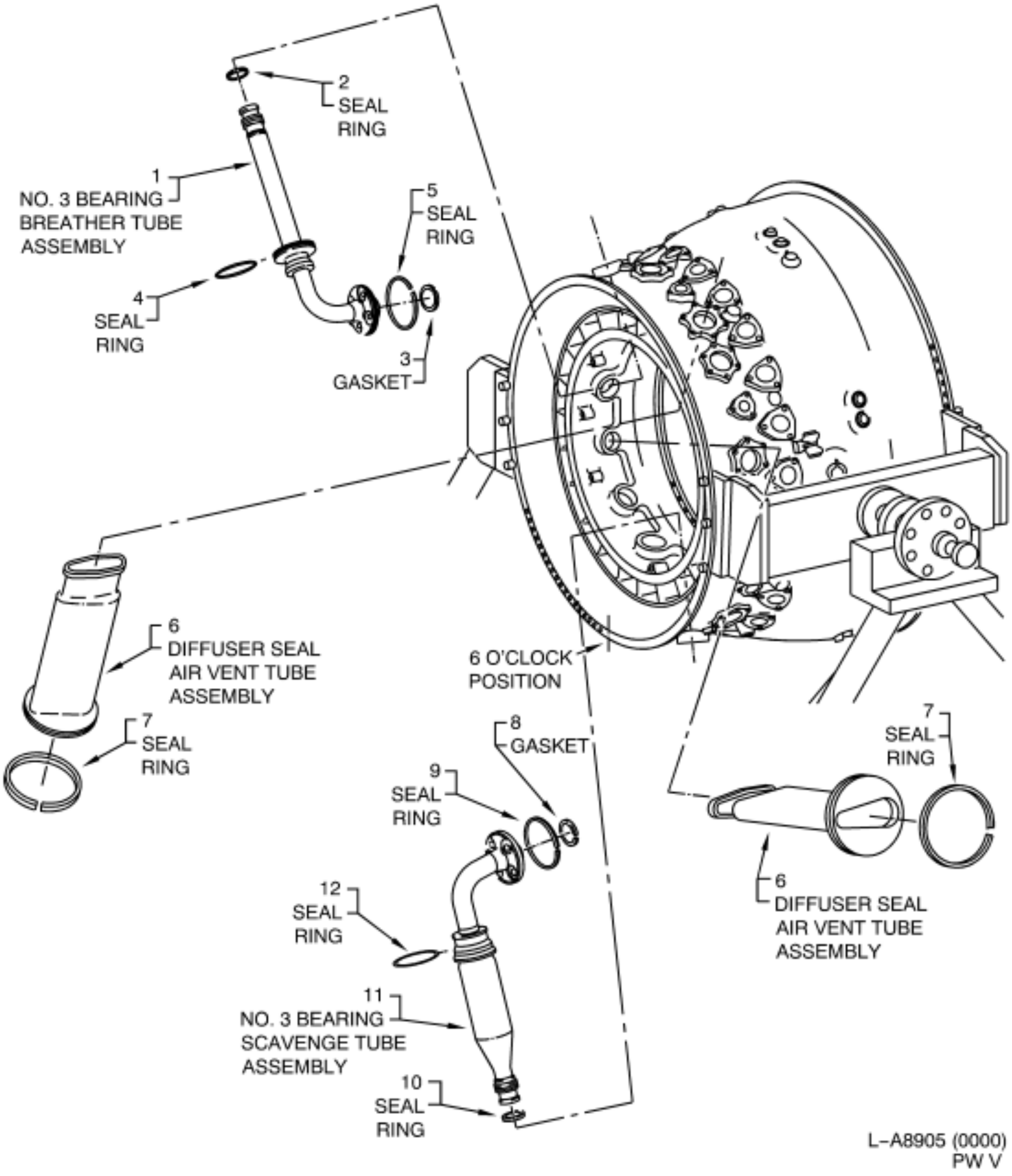
E. Postrequisites

(1) For diffuser combustor assemblies which have the No. 3 bearing outer race installed, see 72-00-41, Installation-01 Task 72-00-41-420-001 for installation of the diffuser combustor onto the high pressure compressor. For diffuser combustor assemblies without the No. 3 bearing outer race installed, see 72-00-41, Installation-14 Task 72-00-41-420-014 for installation of the diffuser combustor onto the high pressure compressor.


HOIST
1
2
PWA 28657
SLING
FRONT FLANGE
OFFSET HOLE
6 O'CLOCK POSITION
3
PWA 76154
ADAPTERS
(2 REQUIRED)
4
PWA 85751
BRACKETS
5
PWA 25039
STAND
L-A8903 (0000)
PW V

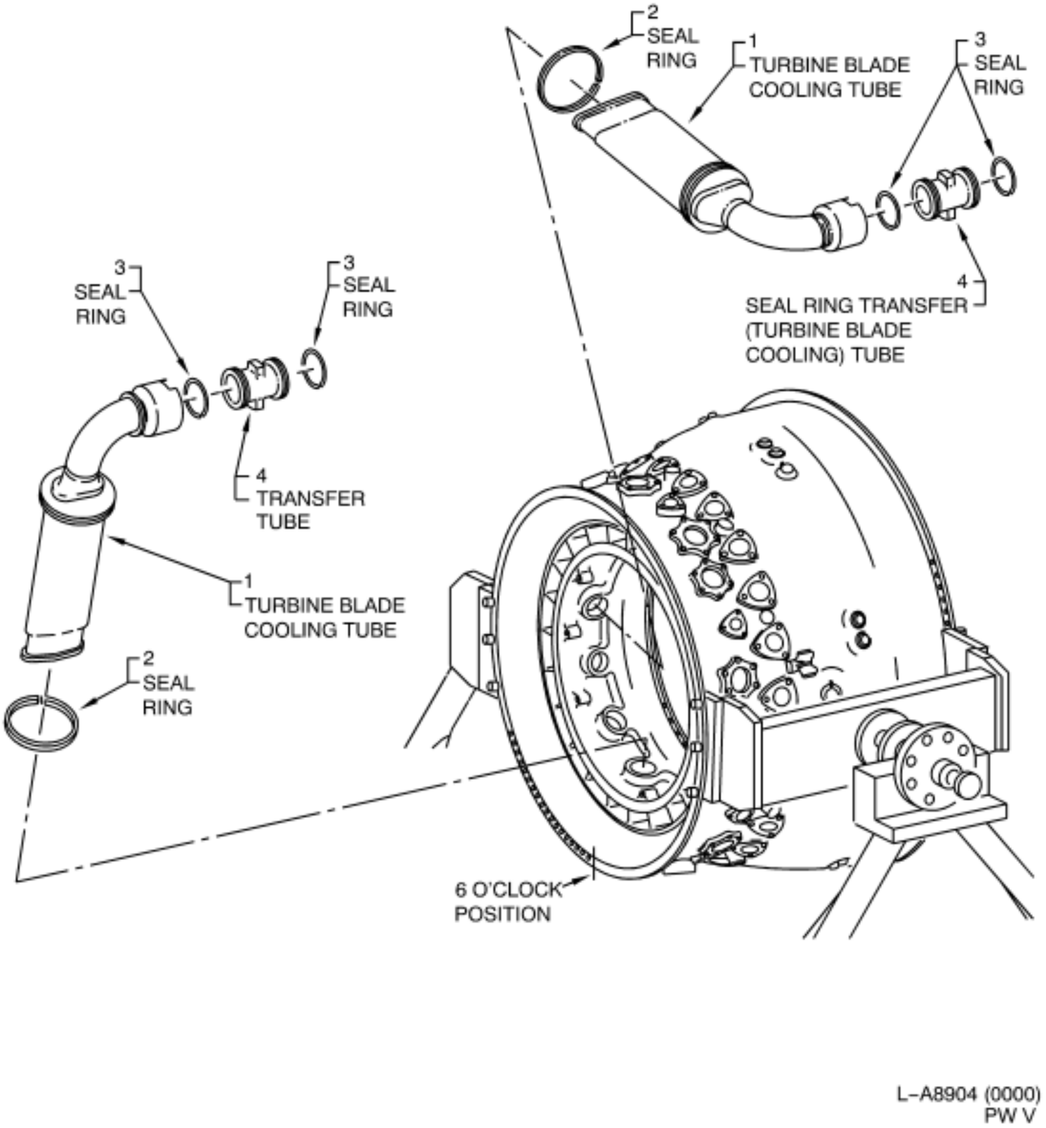
Diffuser Case And Build Stand
Figure 1001
(Task 72-41-00-400-001-A)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01

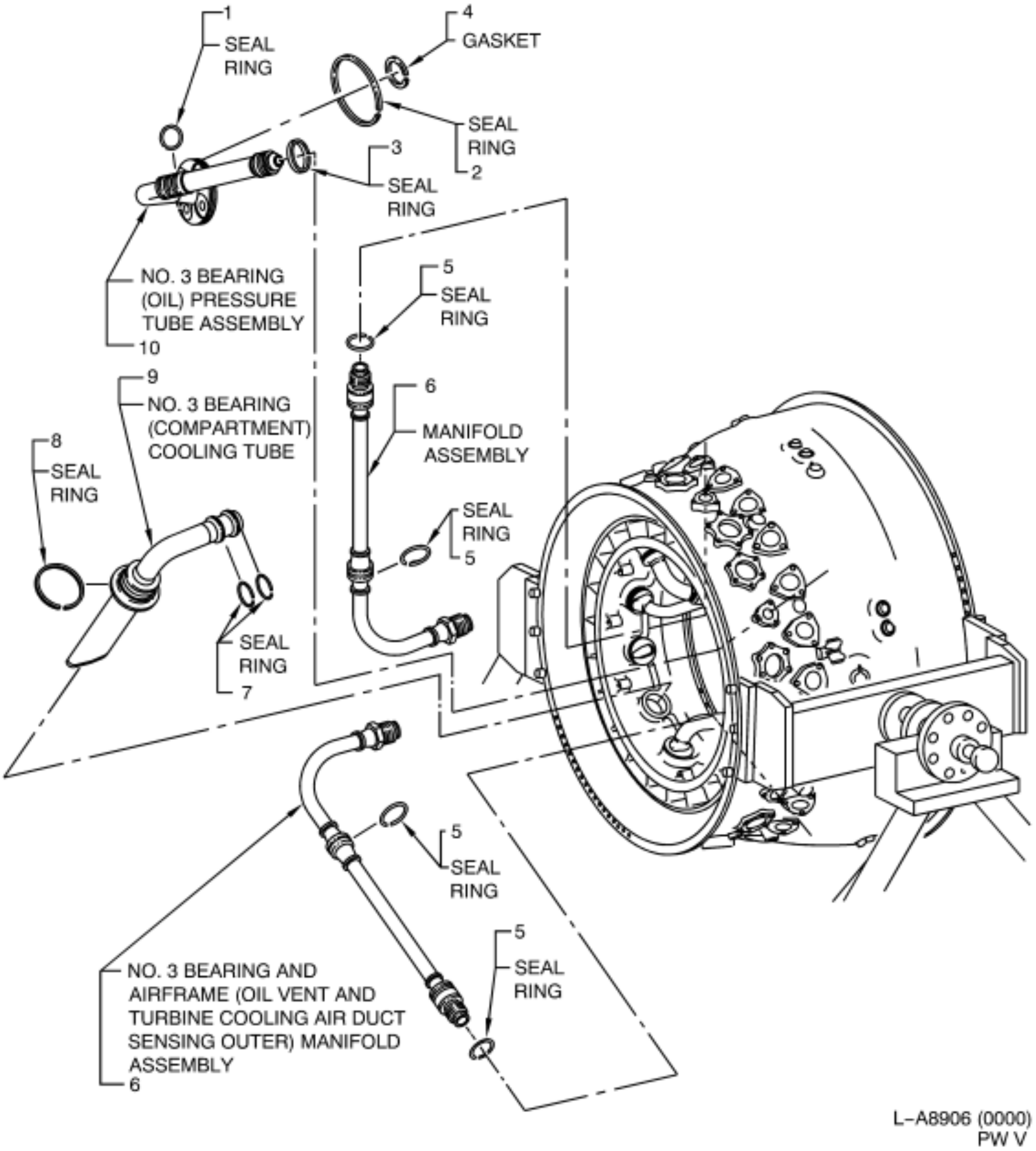

2
SEAL
RING
1
NO. 3 BEARING
BREATHER TUBE
ASSEMBLY
5
SEAL
RING
4
SEAL
RING
3
GASKET
6
DIFFUSER SEAL
AIR VENT TUBE
ASSEMBLY
6 O'CLOCK
POSITION
7
SEAL
RING
8
GASKET
9
SEAL
RING
7
SEAL
RING
12
SEAL
RING
6
DIFFUSER SEAL
AIR VENT TUBE
ASSEMBLY
11
NO. 3 BEARING
SCAVENGE TUBE
ASSEMBLY
10
SEAL
RING
L-A8905 (0000)
PW V

No. 3 Bearing Scavenge, Breather, And Air Vent Tubes
Figure 1002
(Task 72-41-00-400-001-A)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01

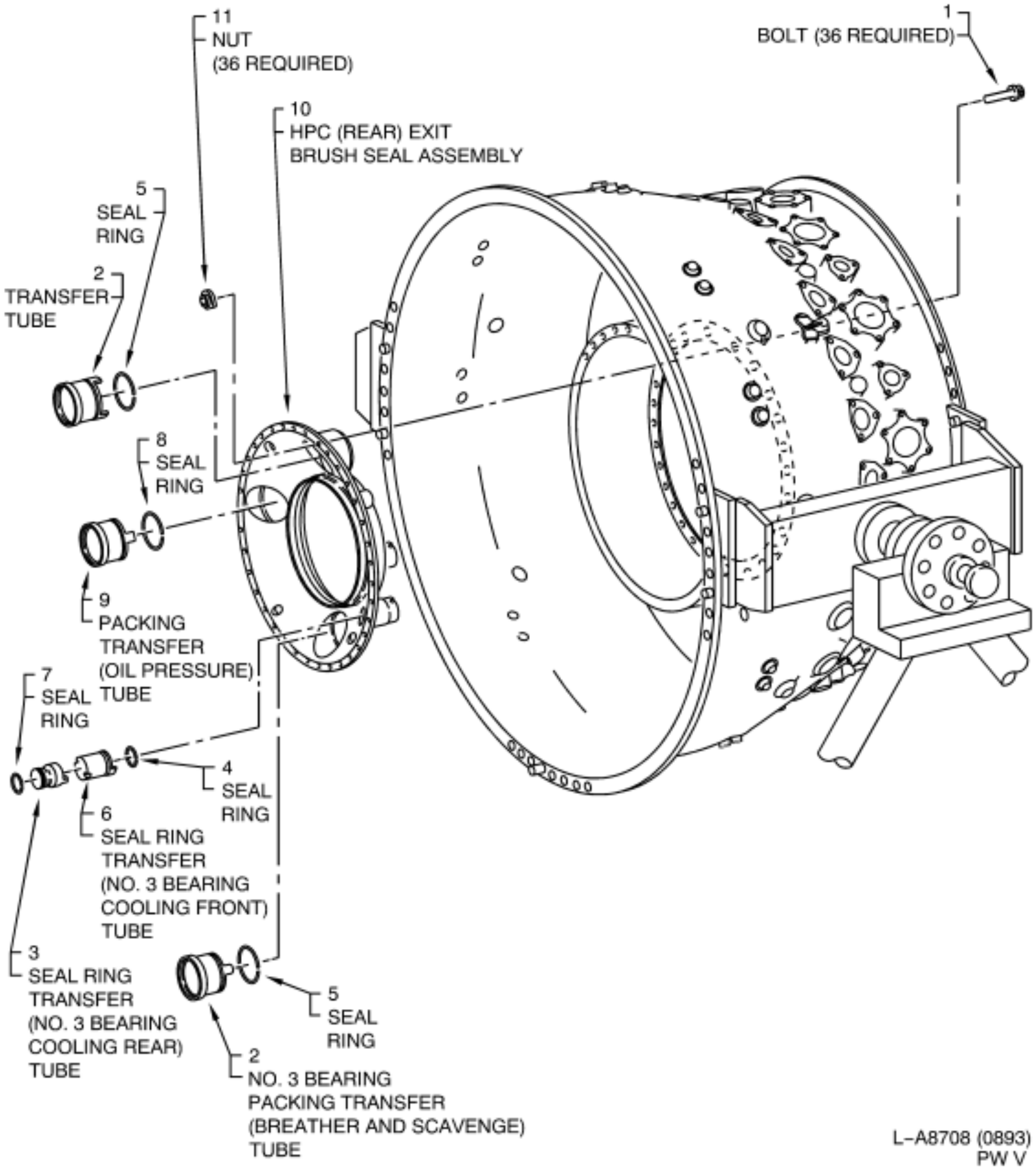

2
SEAL
RING
1
TURBINE BLADE
COOLING TUBE
3
SEAL
RING
4
SEAL RING TRANSFER
(TURBINE BLADE
COOLING) TUBE
3
SEAL
RING
3
SEAL
RING
4
TRANSFER
TUBE
1
TURBINE BLADE
COOLING TUBE
2
SEAL
RING
6 O'CLOCK
POSITION
L-A8904 (0000)
PW V

Turbine Blade Cooling Tubes
Figure 1003
(Task 72-41-00-400-001-A)


1
SEAL RING
4
GASKET
SEAL RING
2
3
SEAL RING
NO. 3 BEARING (OIL) PRESSURE TUBE ASSEMBLY
10
5
SEAL RING
9
NO. 3 BEARING (COMPARTMENT) COOLING TUBE
6
MANIFOLD ASSEMBLY
8
SEAL RING
SEAL RING
5
SEAL RING
7
5
SEAL RING
5
SEAL RING
NO. 3 BEARING AND AIRFRAME (OIL VENT AND TURBINE COOLING AIR DUCT SENSING OUTER) MANIFOLD ASSEMBLY
6
L-A8906 (0000)
PW V

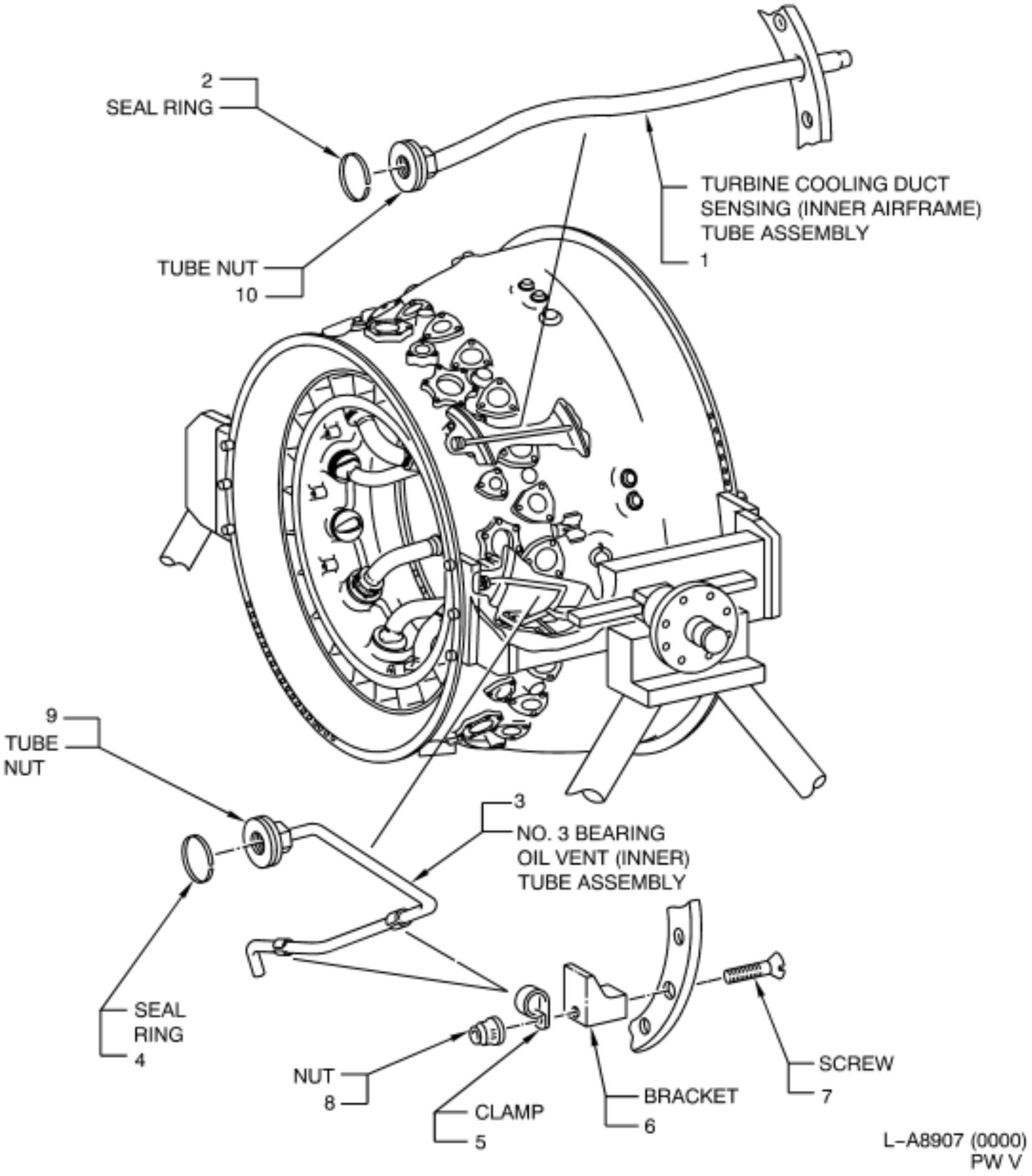
No. 3 Bearing Compartment Pressure, Cooling, And Airframe Tubes
Figure 1004
(Task 72-41-00-400-001-A)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01


11
NUT
(36 REQUIRED)
1
BOLT (36 REQUIRED)
10
HPC (REAR) EXIT
BRUSH SEAL ASSEMBLY
5
SEAL
RING
2
TRANSFER
TUBE
8
SEAL
RING
9
PACKING
TRANSFER
(OIL PRESSURE)
TUBE
7
SEAL
RING
4
SEAL
RING
6
SEAL RING
TRANSFER
(NO. 3 BEARING
COOLING FRONT)
TUBE
3
SEAL RING
TRANSFER
(NO. 3 BEARING
COOLING REAR)
TUBE
5
SEAL
RING
2
NO. 3 BEARING
PACKING TRANSFER
(BREATHER AND SCAVENGE)
TUBE
L-A8708 (0893)
PW V

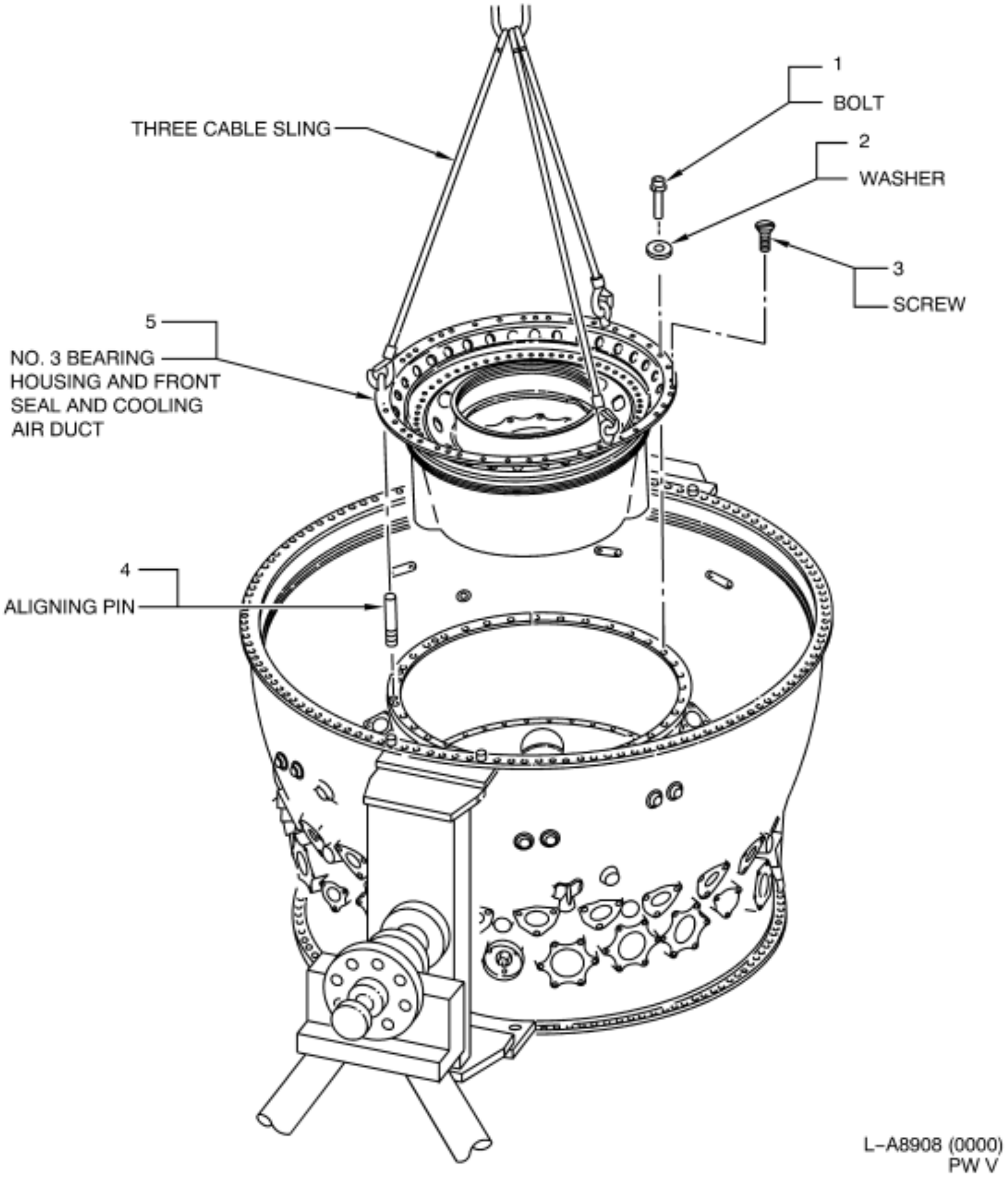
HPC (Rear) Exit Brush Seal Assembly
Figure 1005
(Task 72-41-00-400-001-A)

DIFFUSER AND COMBUSTOR − ASSEMBLY−01


2
SEAL RING
TURBINE COOLING DUCT SENSING (INNER AIRFRAME) TUBE ASSEMBLY
1
TUBE NUT
10
9
TUBE NUT
3
NO. 3 BEARING OIL VENT (INNER) TUBE ASSEMBLY
SEAL RING
4
NUT
8
CLAMP
5
BRACKET
6
SCREW
7
L−A8907 (0000)
PW V

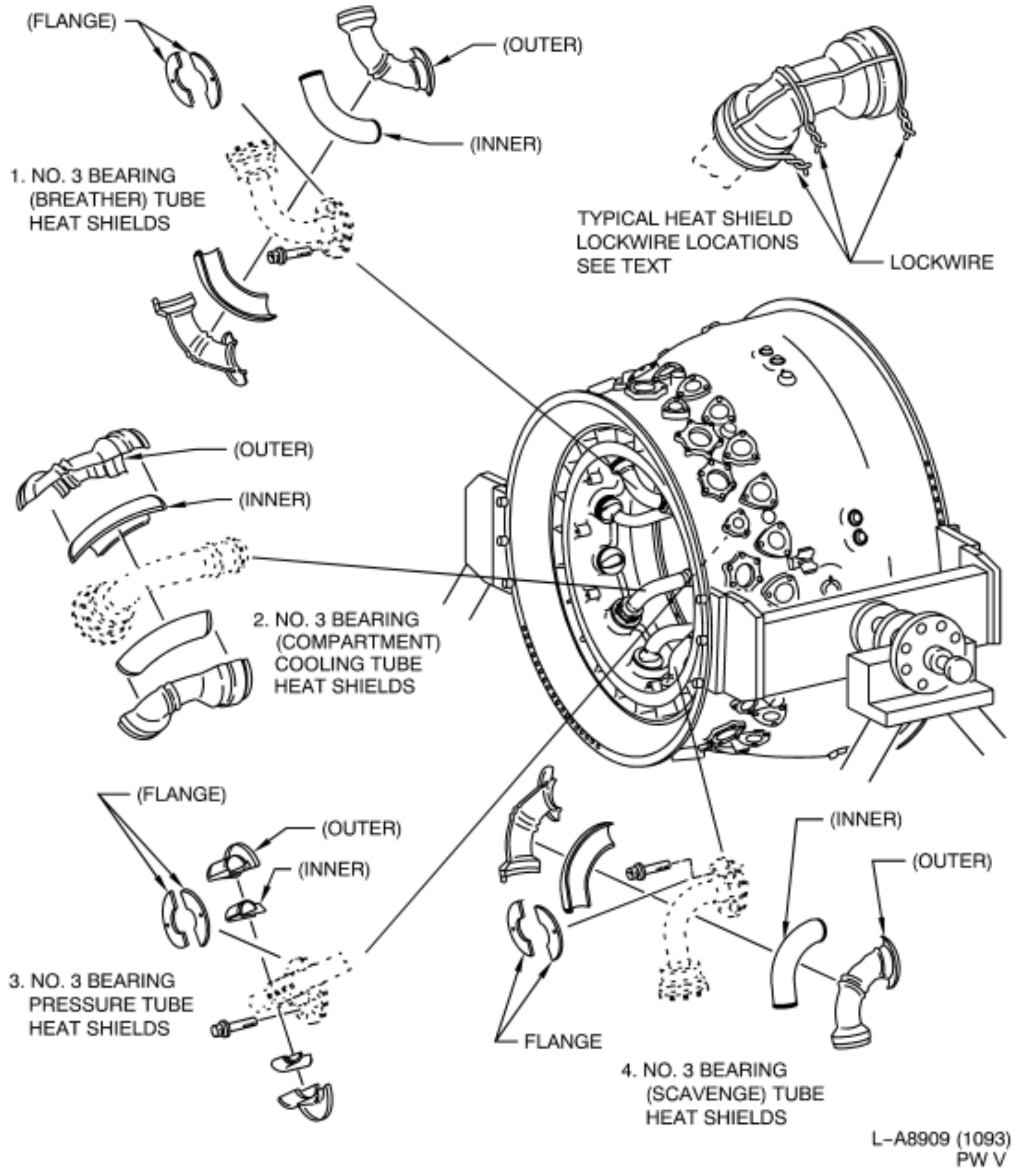
Turbine Cooling Duct Sensing Tube And No. 3 Bearing Oil Vent Tube
Figure 1006
(Task 72−41−00−400−001−A)

DIFFUSER AND COMBUSTOR − ASSEMBLY−01


1
BOLT
2
WASHER
THREE CABLE SLING
3
SCREW
5
NO. 3 BEARING HOUSING AND FRONT SEAL AND COOLING AIR DUCT
4
ALIGNING PIN
L−A8908 (0000)
PW V

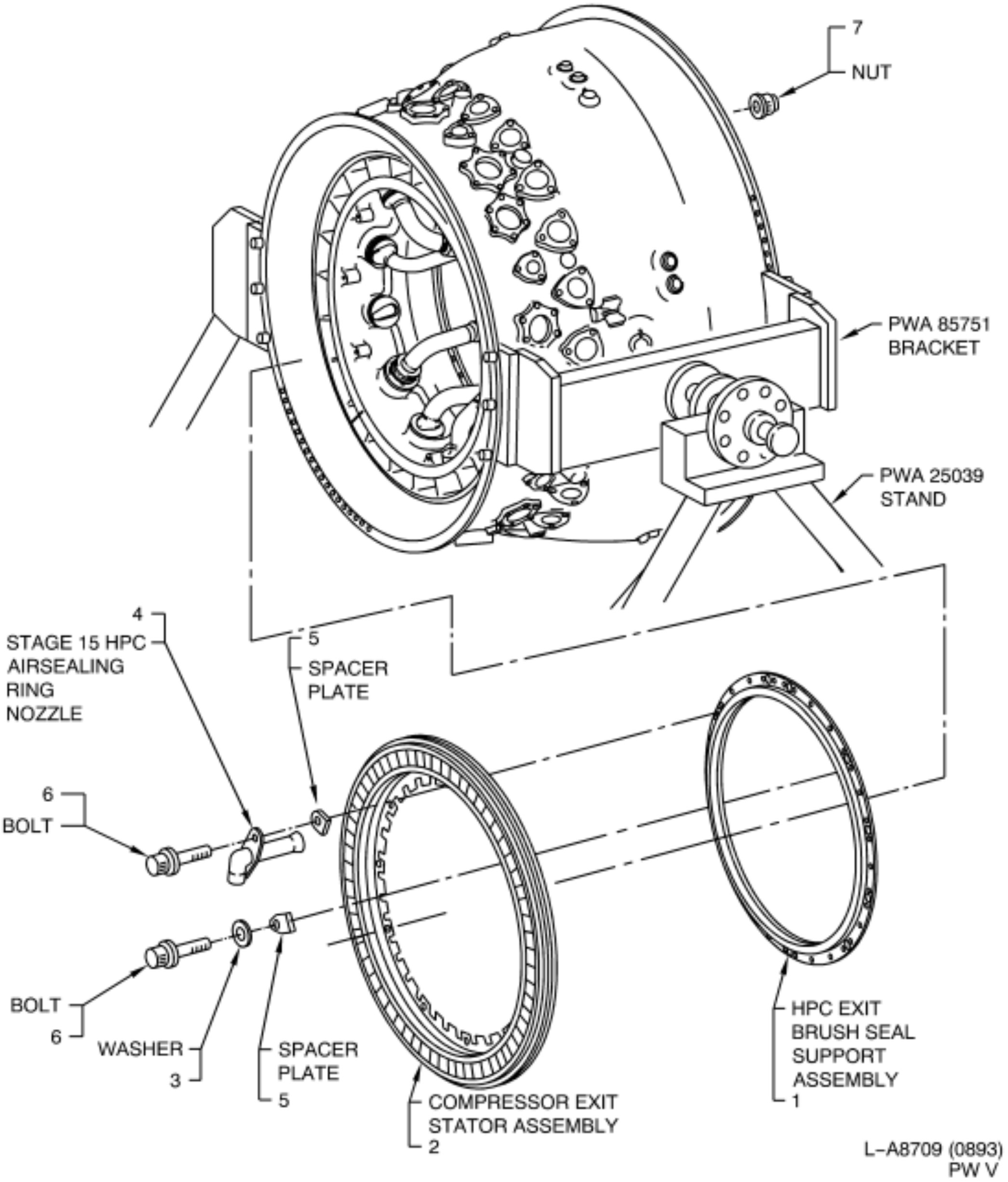
No. 3 Bearing Housing And Seal And Cooling Air Duct Assembly
Figure 1007
(Task 72−41−00−400−001−A)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01


(FLANGE)
(OUTER)
(INNER)
1. NO. 3 BEARING (BREATHER) TUBE HEAT SHIELDS
TYPICAL HEAT SHIELD LOCKWIRE LOCATIONS SEE TEXT
LOCKWIRE
(OUTER)
(INNER)
2. NO. 3 BEARING (COMPARTMENT) COOLING TUBE HEAT SHIELDS
(FLANGE)
(OUTER)
(INNER)
3. NO. 3 BEARING PRESSURE TUBE HEAT SHIELDS
FLANGE
(INNER)
(OUTER)
4. NO. 3 BEARING (SCAVENGE) TUBE HEAT SHIELDS
L-A8909 (1093)
PW V

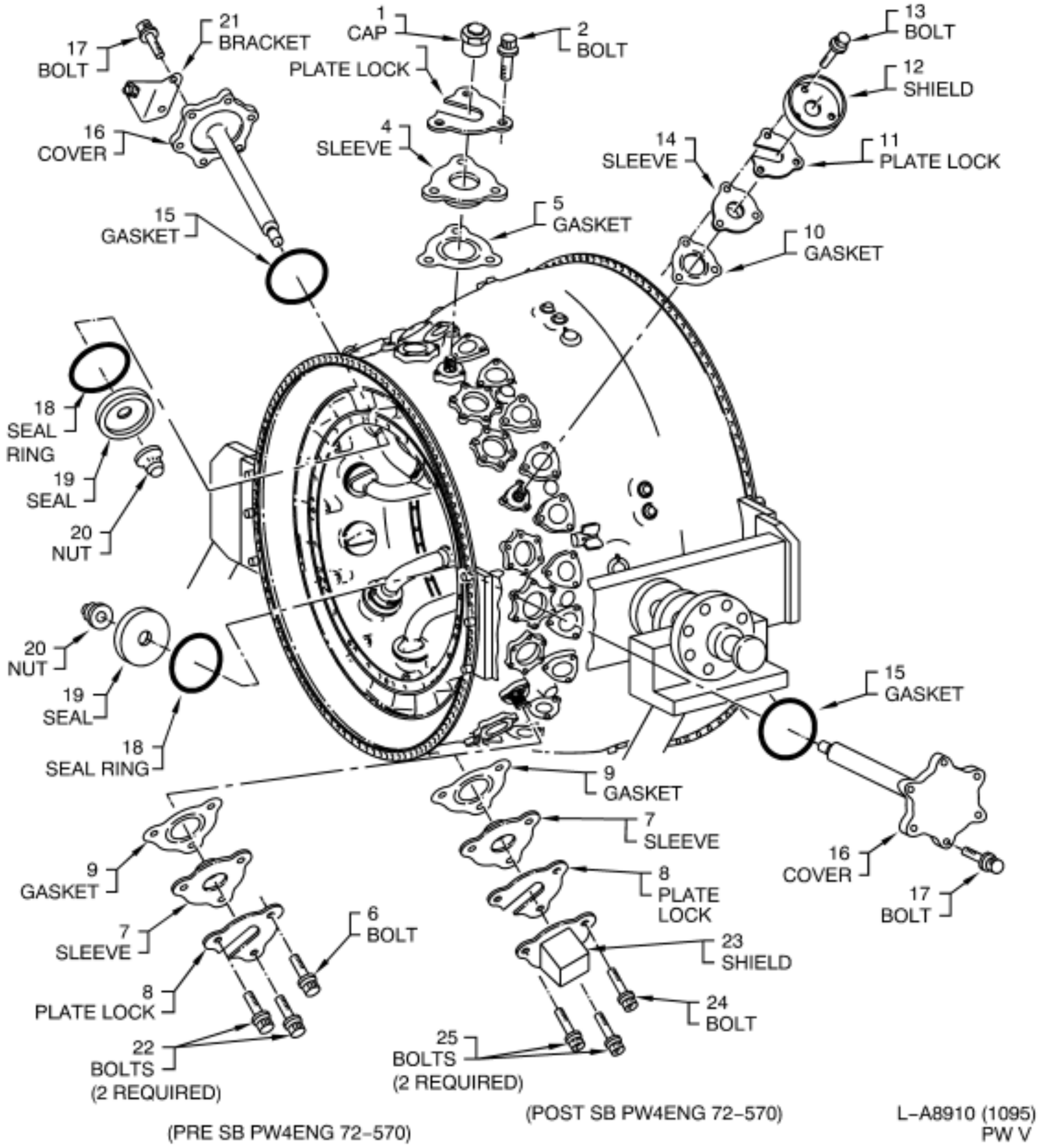
Heat Shields For The No. 3 Bearing Tubes
Figure 1008
(Task 72-41-00-400-001-A)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01

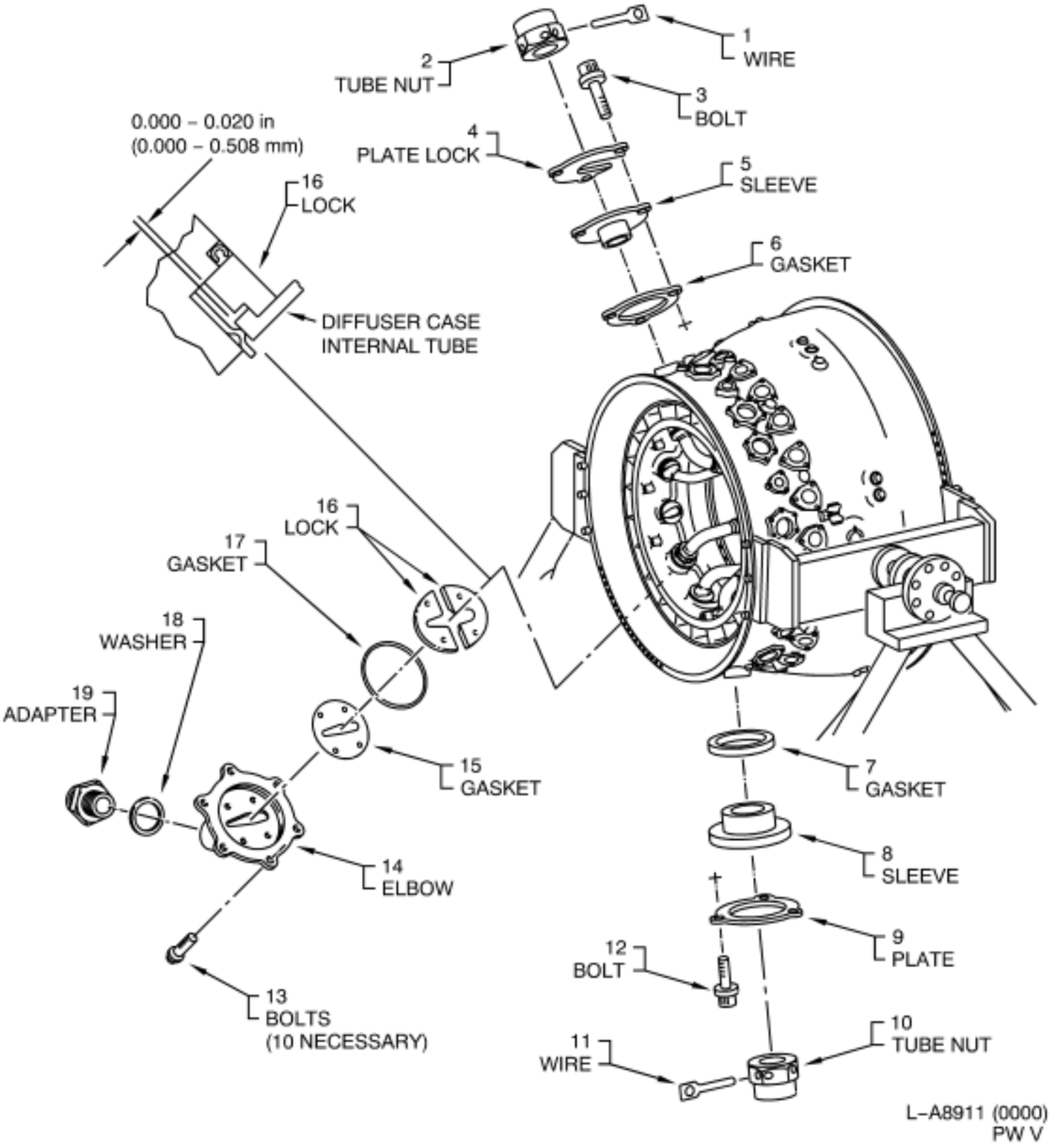

7
NUT
PWA 85751
BRACKET
PWA 25039
STAND
4
STAGE 15 HPC
AIRSEALING
RING
NOZZLE
5
SPACER
PLATE
6
BOLT
BOLT
6
WASHER
3
SPACER
PLATE
5
COMPRESSOR EXIT
STATOR ASSEMBLY
2
HPC EXIT
BRUSH SEAL
SUPPORT
ASSEMBLY
1
L-A8709 (0893)
PW V

The HPC Exit Brush Seal Support Assembly
And The Compressor Exit Stator Assembly
Figure 1009
(Task 72-41-00-400-001-A)

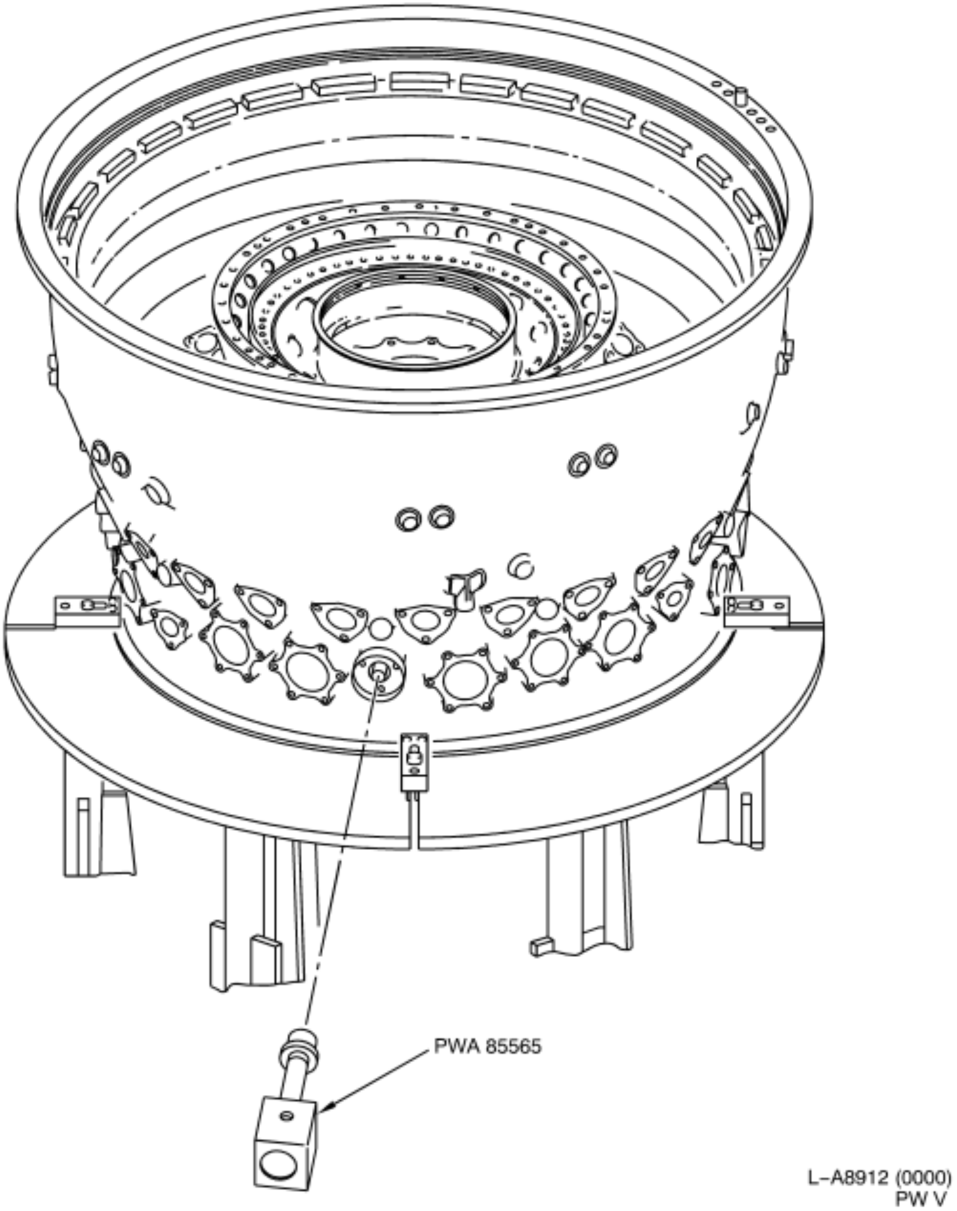
DIFFUSER AND COMBUSTOR - ASSEMBLY-01


17 BOLT
21 BRACKET
1 CAP
PLATE LOCK
2 BOLT
13 BOLT
12 SHIELD
16 COVER
4 SLEEVE
14 SLEEVE
11 PLATE LOCK
15 GASKET
5 GASKET
10 GASKET
18 SEAL RING
19 SEAL
20 NUT
20 NUT
19 SEAL
18 SEAL RING
15 GASKET
9 GASKET
7 SLEEVE
9 GASKET
16 COVER
7 SLEEVE
8 PLATE LOCK
6 BOLT
17 BOLT
23 SHIELD
8 PLATE LOCK
24 BOLT
22 BOLTS (2 REQUIRED)
25 BOLTS (2 REQUIRED)
(PRE SB PW4ENG 72-570)
(POST SB PW4ENG 72-570)
L-A8910 (1095)
PW V

The No. 3 Bearing Pressure Tube And No. 3
Bearing Manifold Lock Plates And Gaskets
Figure 1010
(Task 72-41-00-400-001-A)

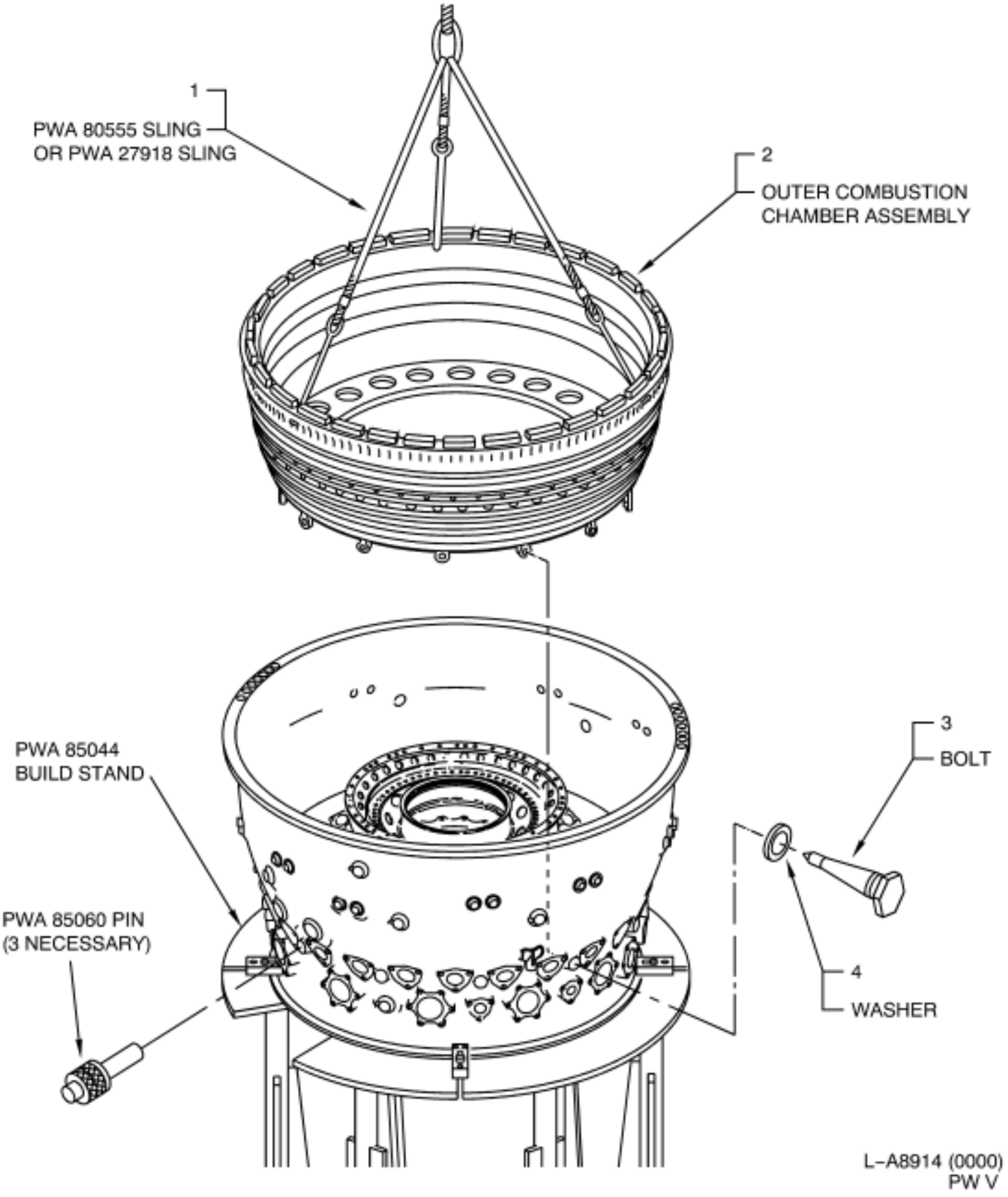

1
WIRE
2
TUBE NUT
3
BOLT
0.000 - 0.020 in
(0.000 - 0.508 mm)
4
PLATE LOCK
5
SLEEVE
16
LOCK
6
GASKET
DIFFUSER CASE
INTERNAL TUBE
16
LOCK
17
GASKET
18
WASHER
19
ADAPTER
15
GASKET
14
ELBOW
13
BOLTS
(10 NECESSARY)
7
GASKET
8
SLEEVE
9
PLATE
12
BOLT
10
TUBE NUT
11
WIRE
L-A8911 (0000)
PW V

No. 3 Bearing Breather, Scavenge, And Cooling Tube Lock Plates
Figure 1011
(Task 72-41-00-400-001-A)

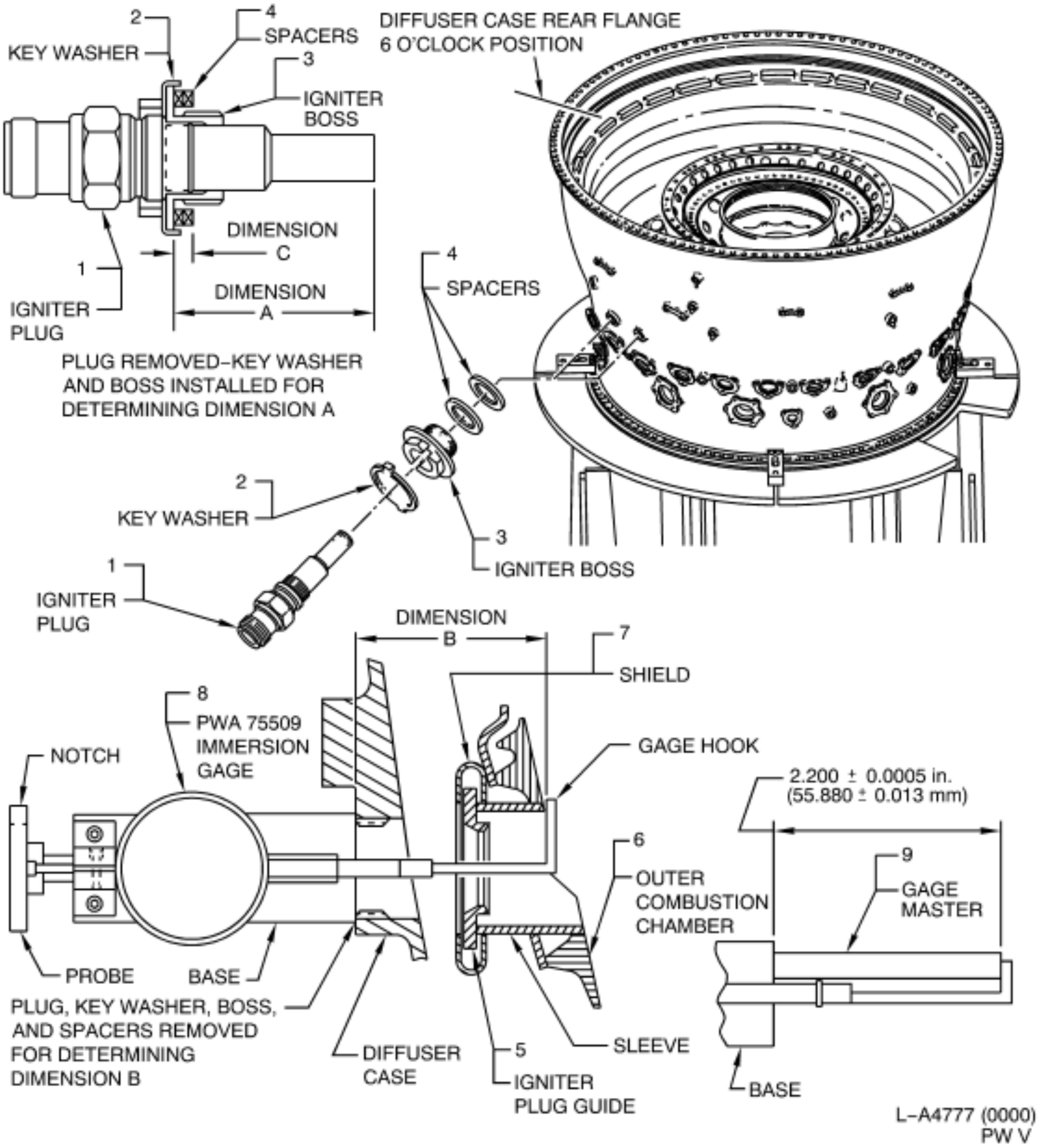


Airflow Check Of The No. 3 Bearing Oil Pressure System
Figure 1012
(Task 72−41−00−400−001−A)

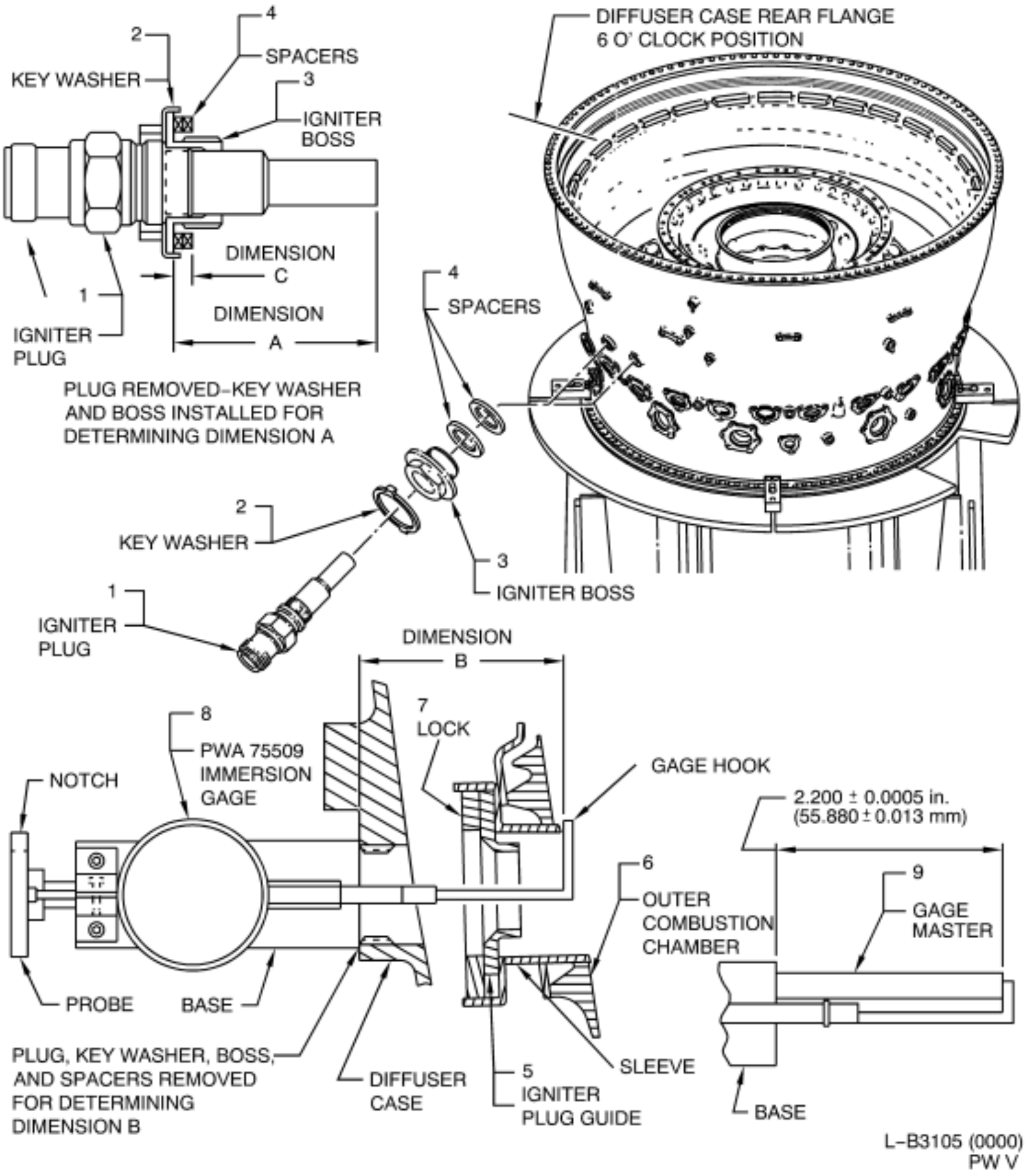
DIFFUSER AND COMBUSTOR − ASSEMBLY−01


1
PWA 80555 SLING
OR PWA 27918 SLING
2
OUTER COMBUSTION
CHAMBER ASSEMBLY
PWA 85044
BUILD STAND
3
BOLT
PWA 85060 PIN
(3 NECESSARY)
4
WASHER
L−A8914 (0000)
PW V

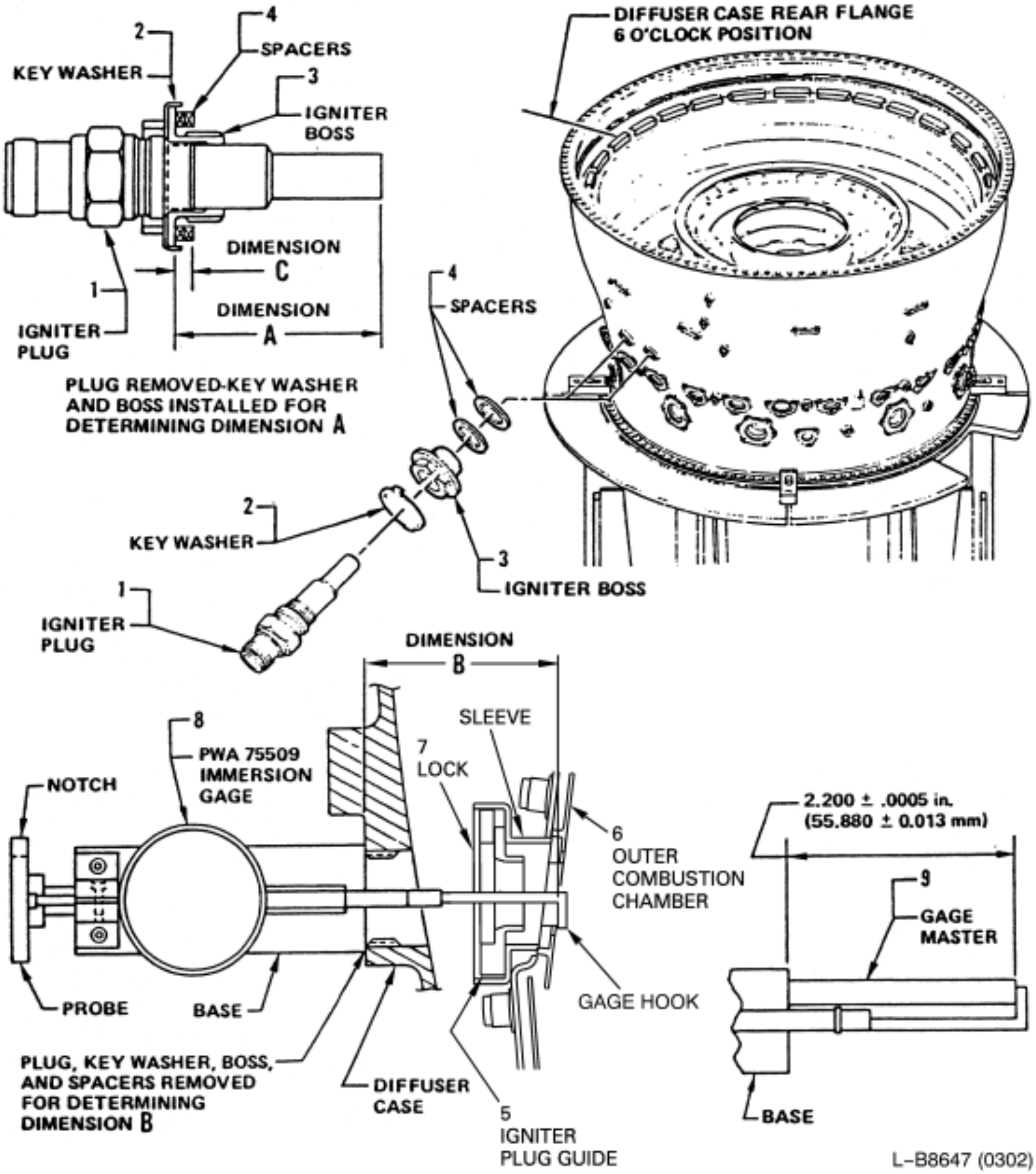
Outer Combustion Chamber Installation
Figure 1013
(Task 72−41−00−400−001−A)


2
KEY WASHER
4
SPACERS
3
IGNITER
BOSS
DIFFUSER CASE REAR FLANGE
6 O'CLOCK POSITION
DIMENSION
C
1
IGNITER
PLUG
DIMENSION
A
PLUG REMOVED-KEY WASHER
AND BOSS INSTALLED FOR
DETERMINING DIMENSION A
4
SPACERS
2
KEY WASHER
3
IGNITER BOSS
1
IGNITER
PLUG
DIMENSION
B
7
SHIELD
8
PWA 75509
IMMERSION
GAGE
NOTCH
GAGE HOOK
2.200 ± 0.0005 in.
(55.880 ± 0.013 mm)
6
OUTER
COMBUSTION
CHAMBER
9
GAGE
MASTER
PROBE
BASE
PLUG, KEY WASHER, BOSS,
AND SPACERS REMOVED
FOR DETERMINING
DIMENSION B
DIFFUSER
CASE
5
IGNITER
PLUG GUIDE
SLEEVE
BASE
L-A4777 (0000)
PW V

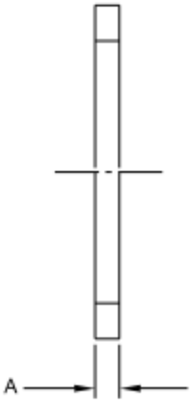
Igniter Plug Installation (Pre SB PW4ENG 72-601 And PWA 75509 Gage)
Figure 1014 (Sheet 1)
(Task 72-41-00-400-001-A)


2
KEY WASHER
4
SPACERS
3
IGNITER BOSS
DIMENSION C
1
IGNITER PLUG
DIMENSION A
PLUG REMOVED-KEY WASHER AND BOSS INSTALLED FOR DETERMINING DIMENSION A
DIFFUSER CASE REAR FLANGE 6 O' CLOCK POSITION
4
SPACERS
2
KEY WASHER
3
IGNITER BOSS
1
IGNITER PLUG
DIMENSION B
8
PWA 75509 IMMERSION GAGE
7
LOCK
NOTCH
GAGE HOOK
2.200 ± 0.0005 in. (55.880 ± 0.013 mm)
6
OUTER COMBUSTION CHAMBER
9
GAGE MASTER
PROBE
BASE
PLUG, KEY WASHER, BOSS, AND SPACERS REMOVED FOR DETERMINING DIMENSION B
DIFFUSER CASE
5
IGNITER PLUG GUIDE
SLEEVE
BASE
L-B3105 (0000)
PW V

Igniter Plug Installation (Post SB PW4ENG 72-601 And PWA 75509 Gage)
Figure 1014 (Sheet 2)
(Task 72−41−00−400−001−A)


KEY WASHER
2
4
SPACERS
3
IGNITER BOSS
DIMENSION C
1
IGNITER PLUG
DIMENSION A
PLUG REMOVED-KEY WASHER AND BOSS INSTALLED FOR DETERMINING DIMENSION A
DIFFUSER CASE REAR FLANGE 6 O'CLOCK POSITION
4
SPACERS
2
KEY WASHER
3
IGNITER BOSS
1
IGNITER PLUG
DIMENSION B
8
PWA 75509 IMMERSION GAGE
NOTCH
SLEEVE
7
LOCK
6
OUTER COMBUSTION CHAMBER
2.200 ± .0005 in. (55.880 ± 0.013 mm)
9
GAGE MASTER
PROBE
BASE
GAGE HOOK
PLUG, KEY WASHER, BOSS, AND SPACERS REMOVED FOR DETERMINING DIMENSION B
DIFFUSER CASE
5
IGNITER PLUG GUIDE
BASE
L-B8647 (0302)

Igniter Plug Installation And PWA
75509 Gage (Talon Low Emission Burner)
Figure 1014 (Sheet 3)
(Task 72−41−00−400−001−A)



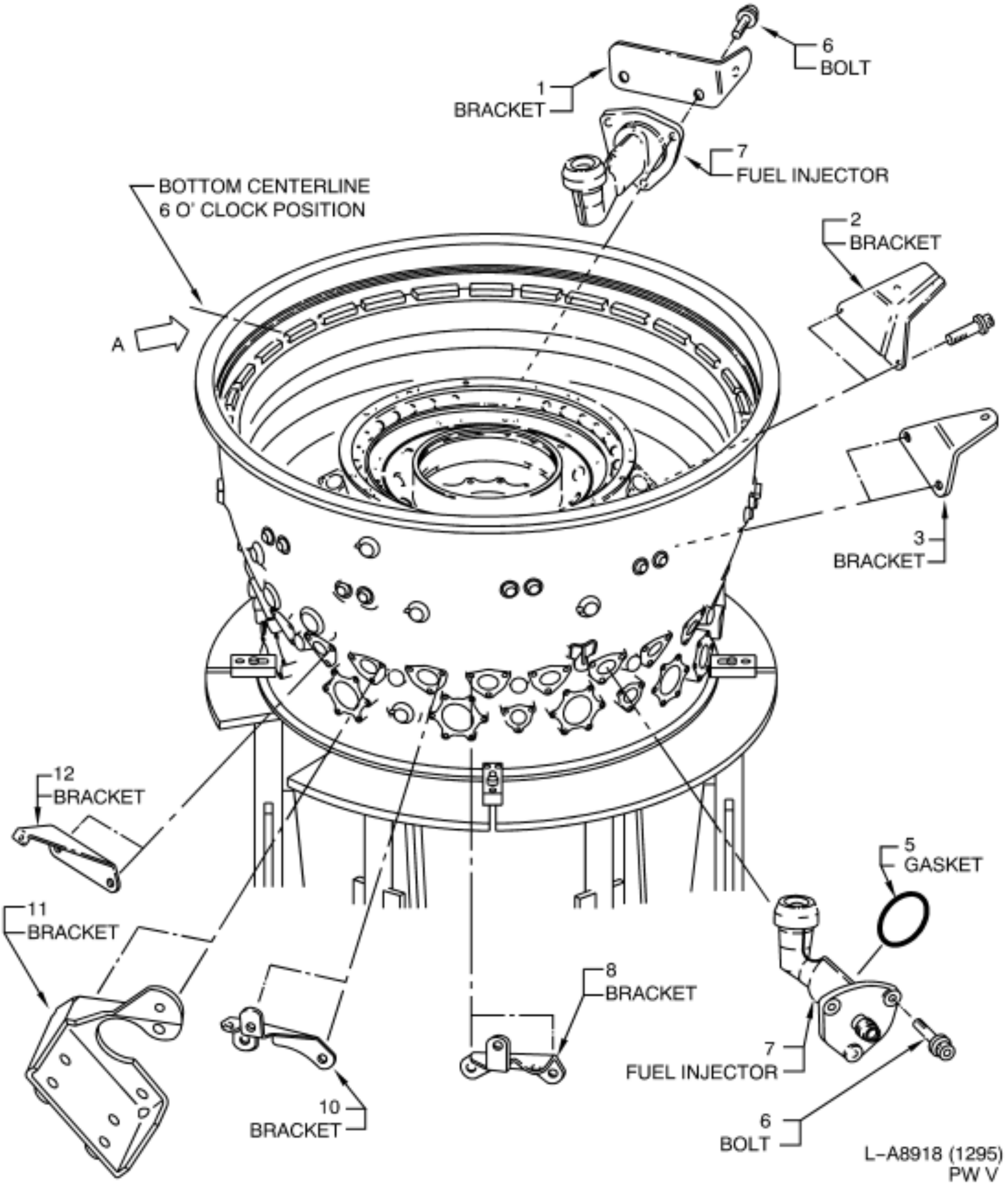
L-90275 (0283)
PW V

Part No.	Dimension A Inches	Millimeters
741073 CL 1	0.008 - 0.018	0.20 - 0.46
741073 CL 2	OVER 0.018 - 0.028	OVER 0.46 - 0.71
741073 CL 3	OVER 0.028 - 0.038	OVER 0.71 - 0.97
741073 CL 4	OVER 0.038 - 0.048	OVER 0.97 - 1.22
741073 CL 5	OVER 0.048 - 0.058	OVER 1.22 - 1.47
741073 CL 6	OVER 0.058 - 0.068	OVER 1.47 - 1.73
741073 CL 7	OVER 0.068 - 0.078	OVER 1.73 - 1.98
741073 CL 8	OVER 0.078 - 0.088	OVER 1.98 - 2.24
741073 CL 9	OVER 0.088 - 0.098	OVER 2.24 - 2.49
741073 CL 10	OVER 0.098 - 0.108	OVER 2.49 - 2.74
741073 CL 11	OVER 0.108 - 0.118	OVER 2.74 - 3.00
741073 CL 12	OVER 0.118 - 0.128	OVER 3.00 - 3.25
741073 CL 13	OVER 0.128 - 0.138	OVER 3.25 - 3.51
741073 CL 14	OVER 0.138 - 0.148	OVER 3.51 - 3.76
741073 CL 15	OVER 0.148 - 0.158	OVER 3.76 - 4.01
741073 CL 16	OVER 0.158 - 0.168	OVER 4.01 - 4.27
741073 CL 17	OVER 0.168 - 0.178	OVER 4.27 - 4.52
741073 CL 18	OVER 0.178 - 0.188	OVER 4.52 - 4.78

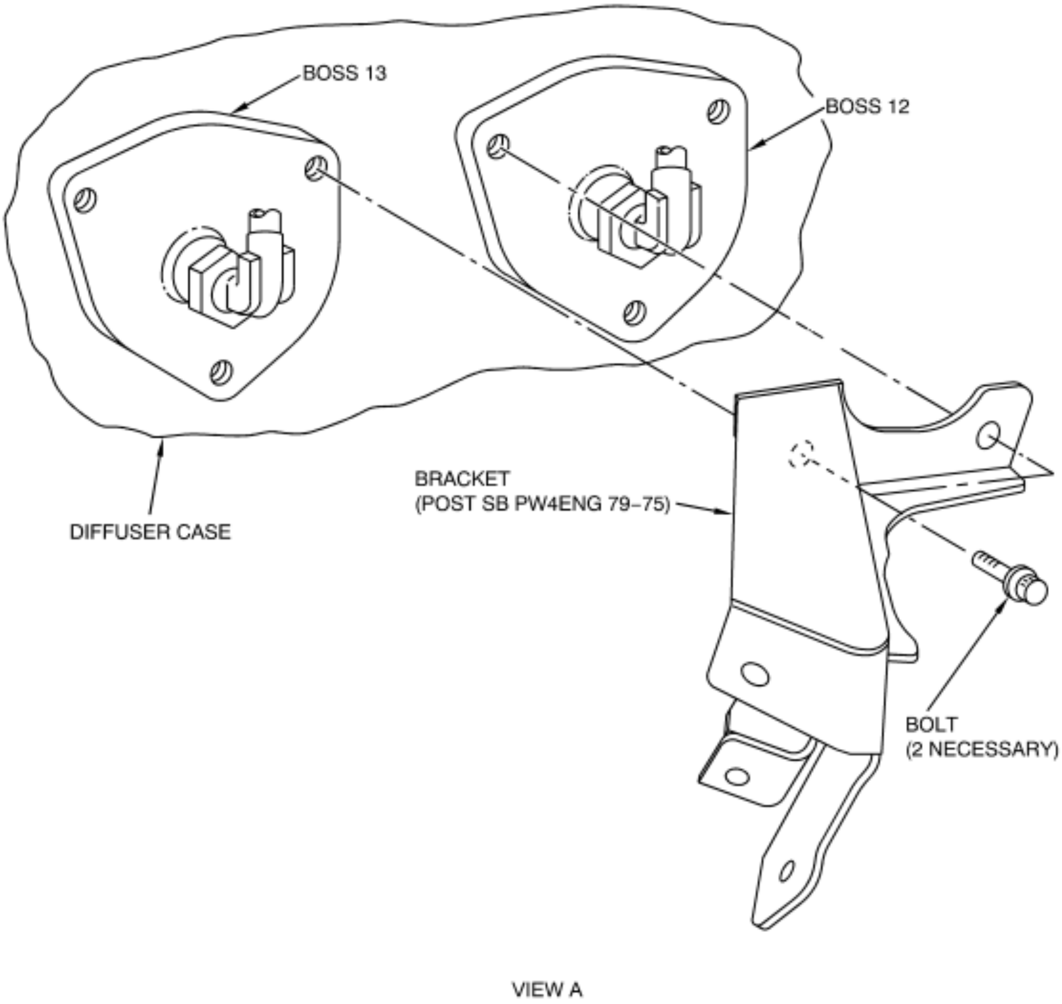
Spacer Classification Data

Igniter Plug Installation
Figure 1015
(Task 72-41-00-400-001-A)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01

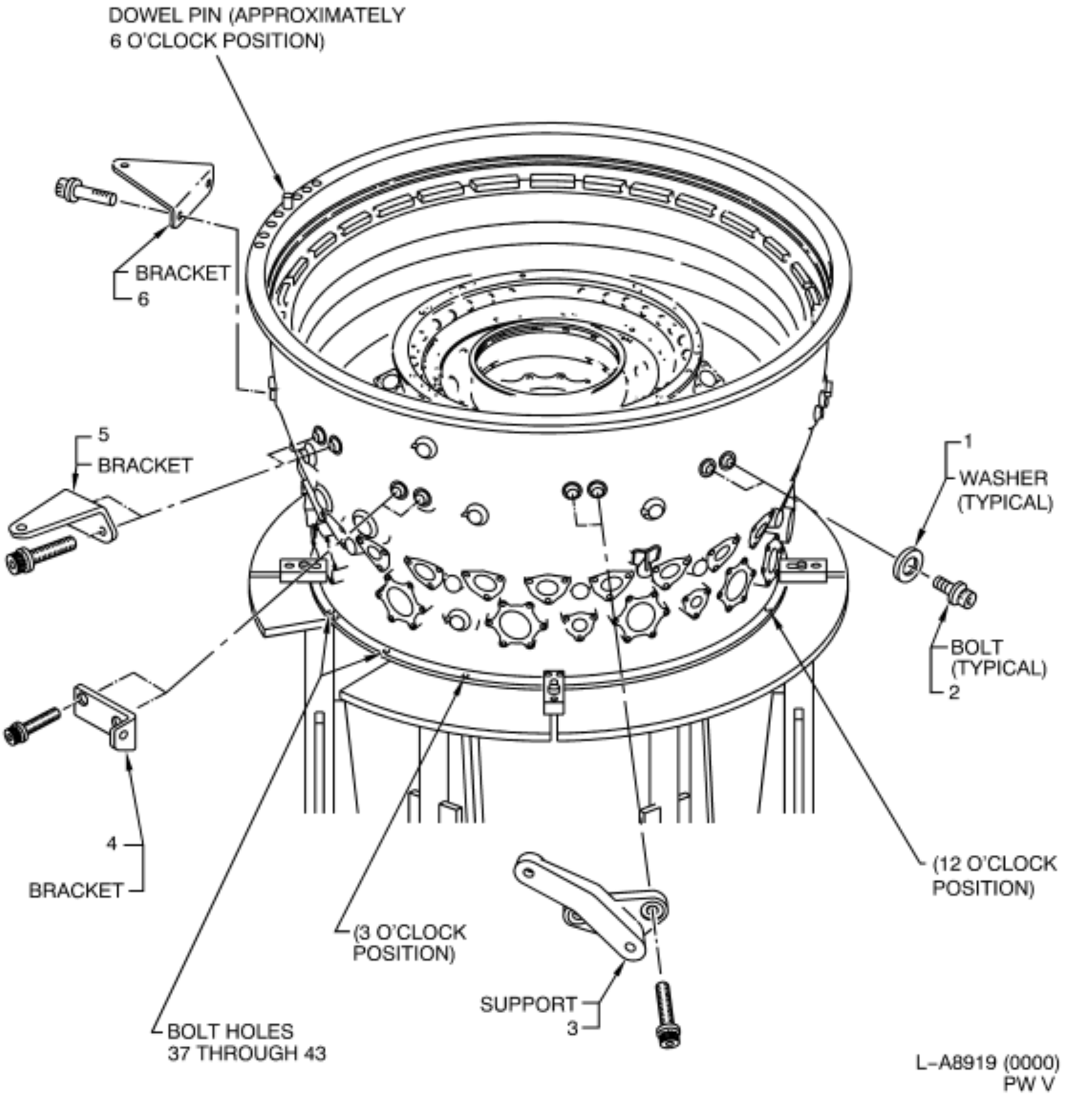

6
BOLT
1
BRACKET
7
FUEL INJECTOR
BOTTOM CENTERLINE
6 O' CLOCK POSITION
2
BRACKET
A
3
BRACKET
12
BRACKET
11
BRACKET
5
GASKET
8
BRACKET
7
FUEL INJECTOR
10
BRACKET
6
BOLT
L-A8918 (1295)
PW V

Fuel Injectors And Support Assemblies
Figure 1016 (Sheet 1)
(Task 72-41-00-400-001-A)


BOSS 13
BOSS 12
DIFFUSER CASE
BRACKET
(POST SB PW4ENG 79−75)
BOLT
(2 NECESSARY)
VIEW A

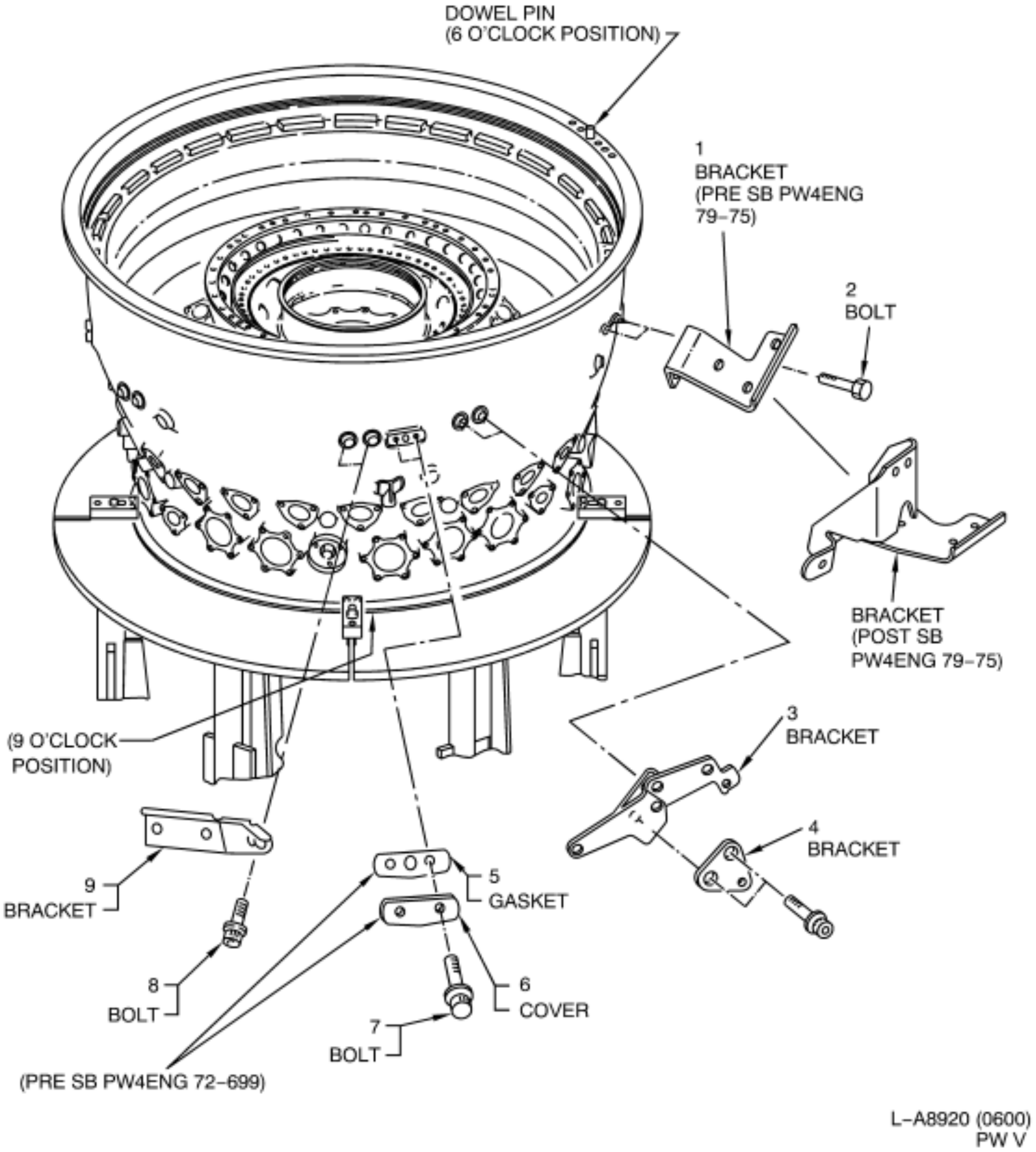
L−B2539 (0000)
PW V

Fuel Injectors And Support Assemblies
Figure 1016 (Sheet 2)
(Task 72−41−00−400−001−A)


DOWEL PIN (APPROXIMATELY 6 O'CLOCK POSITION)
BRACKET
6
5
BRACKET
1
WASHER (TYPICAL)
BOLT (TYPICAL)
2
4
BRACKET
(12 O'CLOCK POSITION)
(3 O'CLOCK POSITION)
SUPPORT
3
BOLT HOLES 37 THROUGH 43
L-A8919 (0000)
PW V

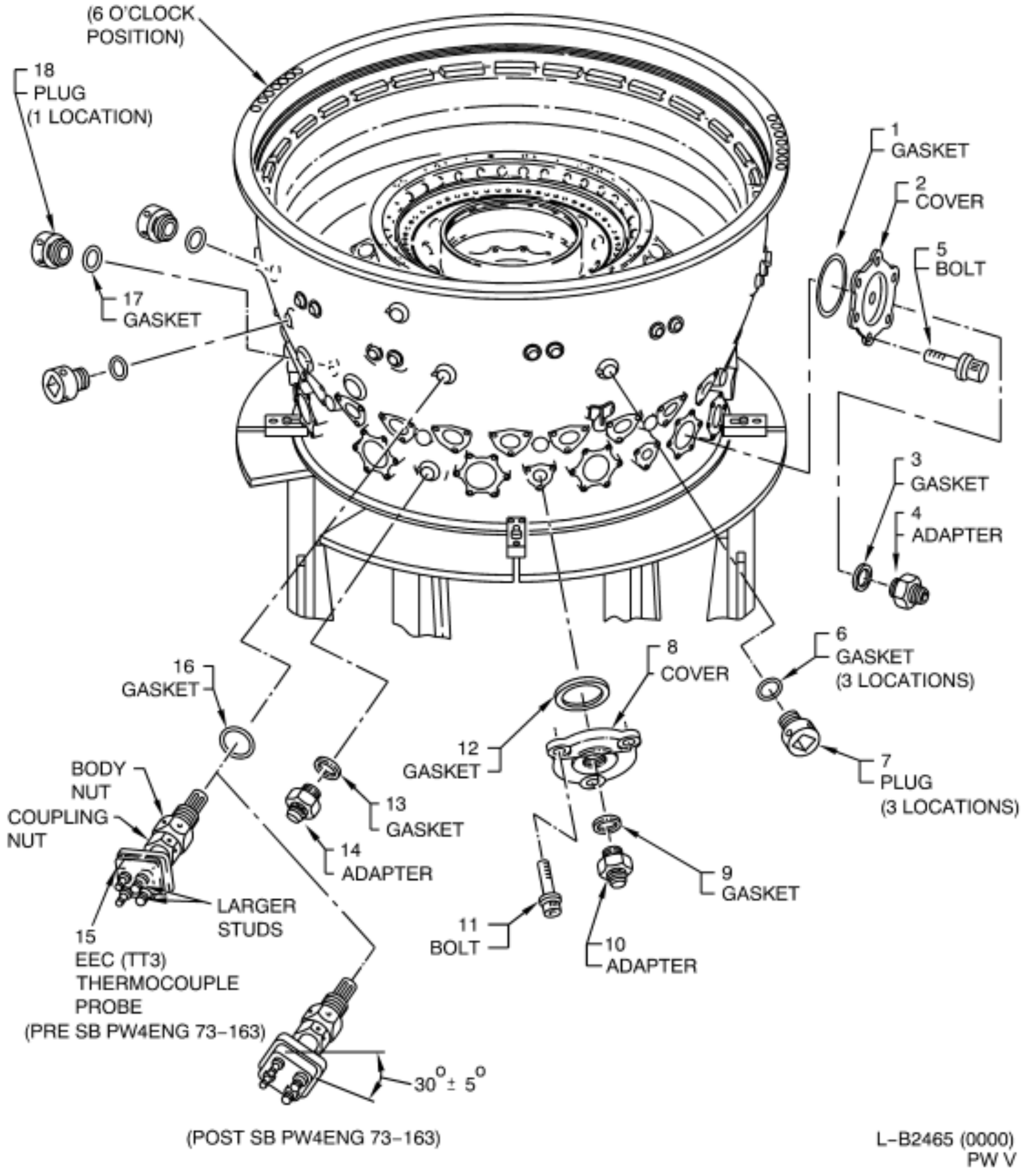
Diffuser Case Externals
Figure 1017
(Task 72-41-00-400-001-A)

DIFFUSER AND COMBUSTOR − ASSEMBLY−01


DOWEL PIN
(6 O'CLOCK POSITION)
1
BRACKET
(PRE SB PW4ENG
79−75)
2
BOLT
BRACKET
(POST SB
PW4ENG 79−75)
3
BRACKET
4
BRACKET
(9 O'CLOCK
POSITION)
9
BRACKET
5
GASKET
8
BOLT
6
COVER
7
BOLT
(PRE SB PW4ENG 72−699)
L−A8920 (0600)
PW V

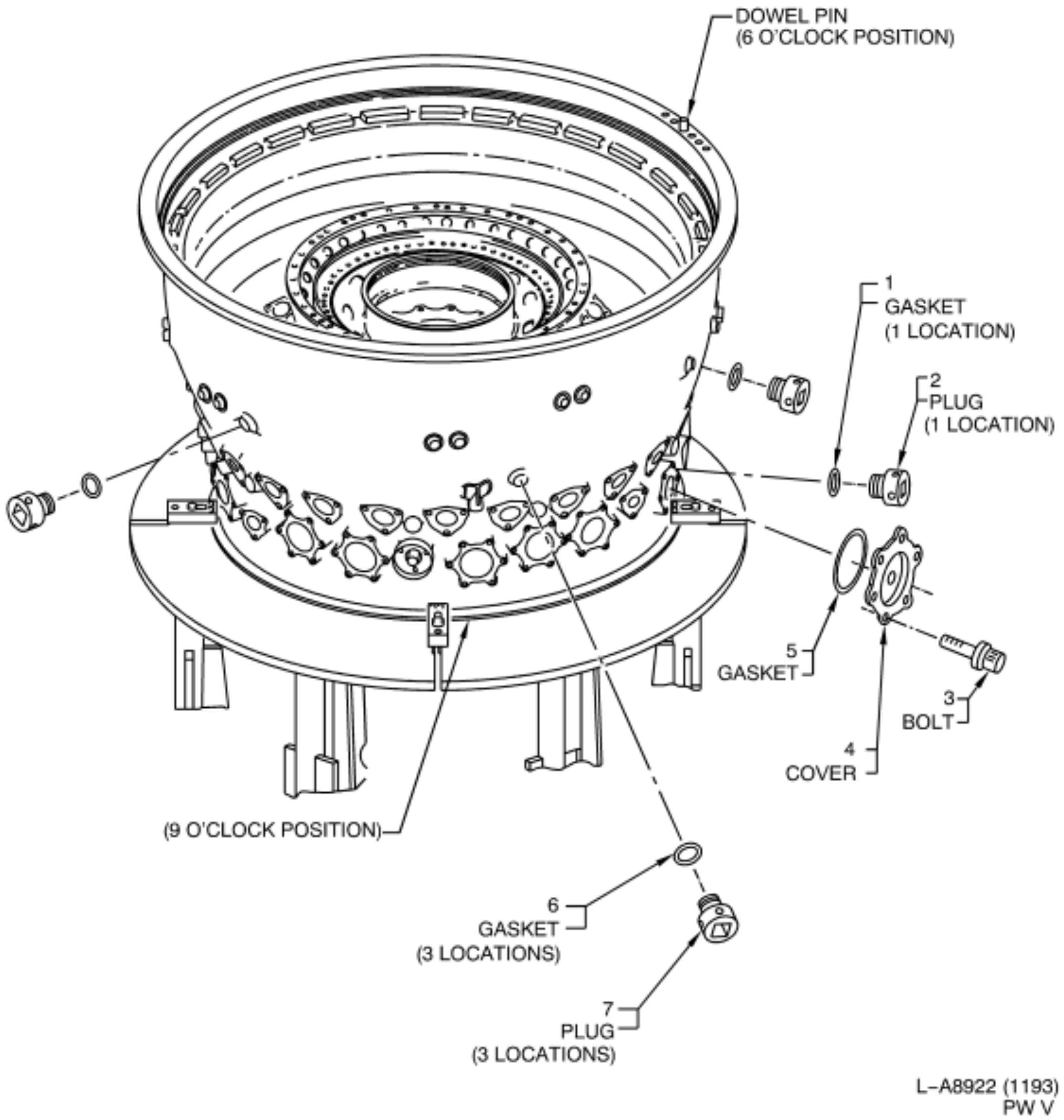
Diffuser Case Externals
Figure 1018
(Task 72−41−00−400−001−A)

DIFFUSER AND COMBUSTOR − ASSEMBLY−01


(6 O'CLOCK POSITION)
18 PLUG (1 LOCATION)
17 GASKET
1 GASKET
2 COVER
5 BOLT
3 GASKET
4 ADAPTER
6 GASKET (3 LOCATIONS)
7 PLUG (3 LOCATIONS)
8 COVER
12 GASKET
13 GASKET
14 ADAPTER
9 GASKET
11 BOLT
10 ADAPTER
16 GASKET
BODY NUT
COUPLING NUT
LARGER STUDS
15 EEC (TT3) THERMOCOUPLE PROBE (PRE SB PW4ENG 73−163)
30° ± 5°
(POST SB PW4ENG 73−163)
L−B2465 (0000)
PW V

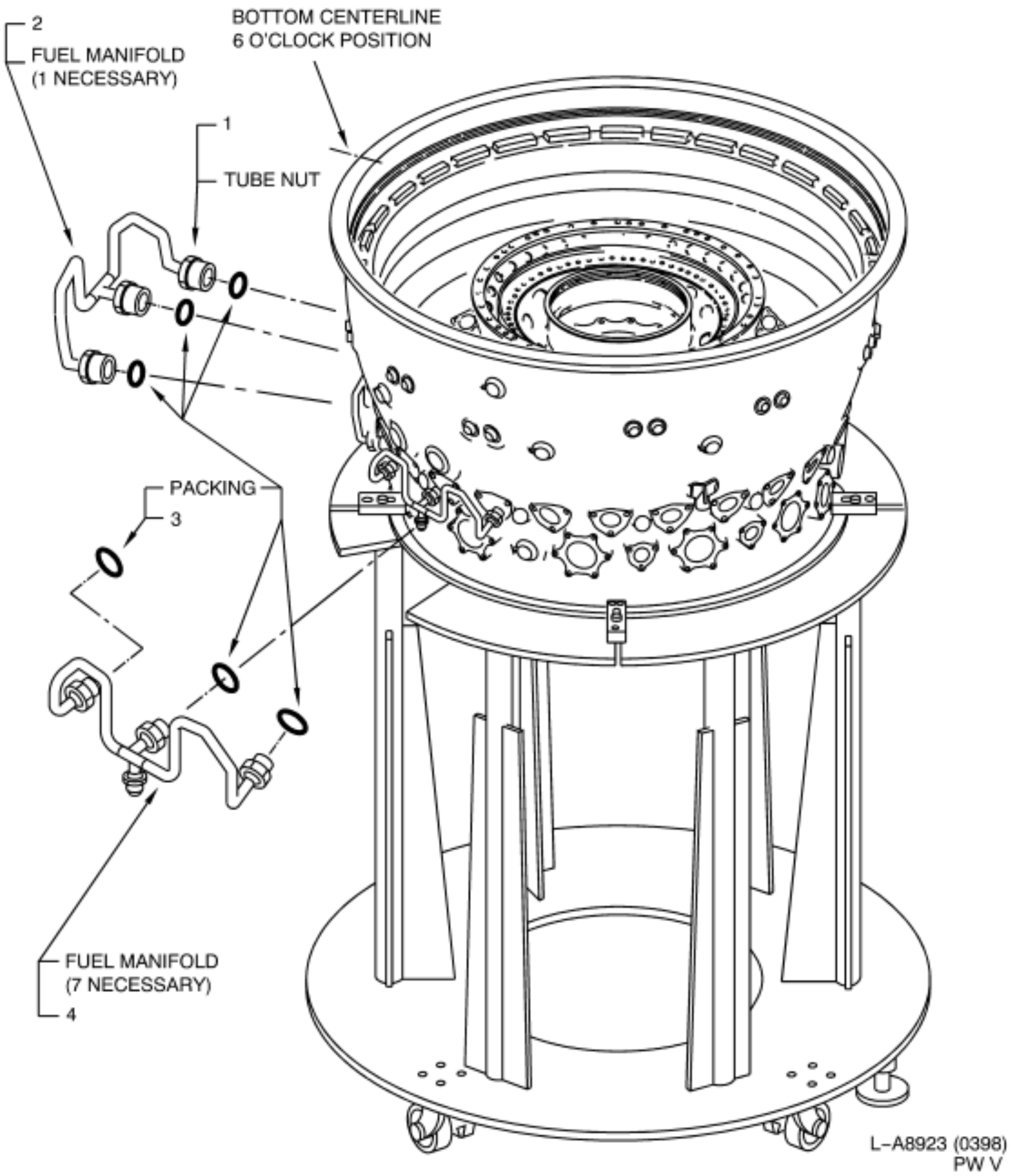
Diffuser Case Externals
Figure 1019
(Task 72−41−00−400−001−A)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01


DOWEL PIN
(6 O'CLOCK POSITION)
1
GASKET
(1 LOCATION)
2
PLUG
(1 LOCATION)
5
GASKET
3
BOLT
4
COVER
(9 O'CLOCK POSITION)
6
GASKET
(3 LOCATIONS)
7
PLUG
(3 LOCATIONS)
L-A8922 (1193)
PW V

Diffuser Case Externals
Figure 1020
(Task 72-41-00-400-001-A)

DIFFUSER AND COMBUSTOR - ASSEMBLY-01


2
FUEL MANIFOLD
(1 NECESSARY)
BOTTOM CENTERLINE
6 O'CLOCK POSITION
1
TUBE NUT
PACKING
3
FUEL MANIFOLD
(7 NECESSARY)
4
L-A8923 (0398)
PW V

Fuel Injector Supply Manifolds
Figure 1021
(Task 72-41-00-400-001-A)

Task 72-41-00-400-002-001:

1. Assemble No. 3 Bearing Duct And Housing Including Bearing Outer Race - (Hydraulic Wrench Method)

NOTE: To assemble No. 3 bearing duct and housing by means of mechanical wrench method, See Assembly-04 Task 72-41-00-400-002-002.

NOTE: For alternate procedure not requiring installation of No. 3 bearing outer race, outer race installed after diffuser combustor group is installed into HPC, See Assembly-05 Task 72-41-00-400-004.

A. Prerequisites

(1) See Inspection/Check-04 Task 72-41-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a referenced number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:

PWA 18872	Wrench, Hydraulic*
PWA 28814	Pump, Electric*
PWA 28815	Cart*
PWA 29510	Pump, Hydraulic*
PWA 29754	Control
PWA 29855-3	Pin
PWA 29855-5	Pin (Two Required)
PWA 33732	Wrench, Hydraulic*
PWA 75046	Cart*
PWA 80070	Wrench, Hydraulic*
PWA 85048	Base
PWA 85049	Drift
PWA 85051	Adapter, Wrench*
PWA 85052	Wrench, Torque*
PWA 85056	Cover (Optional To PWA 85802)
PWA 85057	Storage Stand
PWA 85167	Adapter
PWA 85199	Fixture
PWA 85541	Wrench
PWA 85542	Wrench
PWA 85679	Heater (Optional To PWA 85795)
PWA 85795	Heater
PWA 85802	Cover
PWA 85901	Riveter

DIFFUSER AND COMBUSTOR - ASSEMBLY-02

Special Tools:

(CONTINUED)

PWA 86546	Adapter (Optional To PWA 85199)
PWA 87354	Wrench, Hydraulic*
PWA 88100	Plate, Anchor*

*Refer to Table 1001 for tool options. Only Table 1001 shows the correct combinations of tools for installation of the No. 3 bearing (outer race) retaining nut.

NOTE: The PWA 86546 Adapter is an optional tool that will permit PWA 85167 Adapter to be mounted to an approved bench positioner when the electric motorized PWA 85199 Fixture is not available.

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-026	Ink (Marking) (PMC 4057-1)
P05-395	Beeswax
P05-396	Paraffin Wax Blend

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	2	72-41-00/9/10
Gasket	1	72-41-00/9/5
Gasket	1	72-41-00/10/160
Gasket	9	72-41-00/9/160
Key Washer	2	72-41-00/10/80
Key Washer	4	72-41-00/10/10
Key Washer	3	72-41-00/10/140
Rivet	1	72-41-00/12/40
Seal Ring	1	72-41-00/9/185
Seal Ring	2	72-41-00/9/195

C. Procedure

Subtask 72-41-00-430-068:

(1) Install No. 3 bearing outer race. See Figure 1001.

(a) Using hoist, place PWA 85048 Base (1001/3) on bench. Remove base lifting eye and screw into storage hole on OD of base.

(b) Install No. 3 bearing housing (1001/2), threaded ID up, aligning four pins in PWA 85048 Base (1001/3) with bolt holes in housing (1001/2).

(c) Locate two dimples on top surface (1001/6) of No. 3 bearing housing (1001/2) threaded ID. Mark a line between the dimples using Ink P05−026.

(d) Install PWA 85679 or PWA 85795 Heater (1001/7) to rear flange of housing (1001/2). Connect power and thermocouple cables to PWA 29754 Control or equivalent (1001/1).

(e) Set heater (1001/7) to 300°F (149°C) and heat housing (1001/2) for fifty five to sixty minutes.

(f) Wearing clean gloves, place No. 3 bearing assembly on clean waxed paper on bench.

(g) Separate outer race (1001/4) from inner race and rollers (1001/5) and place them, serial number up on bench.

(h) Verify bearing inner and outer race serial numbers are the same.

(i) Place bearing inner race and rollers (1001/5) in sealed container and retain with diffuser case for future installation.

(j) Turn off heater (1001/7). Disconnect control (1001/1) and remove heater (1001/7) from housing (1001/2).

(k) Install No. 3 bearing outer race (1002/2) into housing (1002/3) with serial number up and aligning "X" on outer race (1002/2) with ink mark (1002/4) on housing (1002/3). See Figure 1002.

(l) With PWA 85049 Drift (1002/1) and standard arbor press, drift outer race (1002/2) into housing (1002/3) and seat.

(m) Using feeler gage verify outer race (1002/2) is seated in housing (1002/3).

DIFFUSER AND COMBUSTOR − ASSEMBLY−02

CAUTION: A NEW OR RE−SILVER PLATED NO. 3 BEARING (OUTER RACE) RETAINING NUT MUST BE INSTALLED AT EACH INSTALLATION OR DAMAGE TO MATING PARTS MAY OCCUR. NUT MAY BE RE−SILVER PLATED BY 72−41−83, REPAIR−01 PW4000 Series CIR, PN 51A357.

(2) Install the No. 3 bearing (outer race) retaining nut as follows. Refer to Figure 1003. Refer to Table 1001 for the correct combination of tools.

PWA Torque Wrench	PWA Wrench Adapter or Holding Adapter	PWA Hydraulic Wrench	PWA Anchor Plate	PWA Pump	PWA Cart
85052	85051	33732	-----	28814 or 29510	75046
85052	85051	18872	-----	28814 or 29510	75046 or 28815
85053	85054	87354	88100	28814 or 29510	75046
85053	85054	80070	88100	28814 or 29510	75046

Matrix Of Tools Used To Install The
No. 3 Bearing (Outer Race) Retaining Nut
Table 1001

(a) (Method 1)

1 Lubricate No. 3 bearing (outer race) retaining nut (1003/6) with Engine Oil P03−001.

2 Install retaining nut (1003/6) in housing (1003/3) with slots up. Handtighten.

3 Install PWA 85051 Wrench Adapter (1003/7), spline end up, over the pilot of PWA 85048 Base (1003/5) and rotate to engage the four slots with the four keys of the base (1003/5).

4 Secure PWA 85052 Torque Wrench (1003/8) to a hydraulic wrench (1003/1) and install over the adapter (1003/7), engaging the slots on the outer race retaining nut (1003/6).

(b) (Method 2)

1 Install the No. 3 bearing housing in PWA 85048 Base, large OD up, aligning the four pins in the base with the bolt holes in the housing.

2 Install PWA 85054 Adapter in the slots of the retaining nut.

3 Install PWA 85053 Torque Wrench over the adapter and on the nut, engaging the teeth of the wrench in the slots of the nut.

4 With a hoist, lift a hydraulic wrench from a cart.

5 Install the hydraulic wrench on the torque wrench.

6 Install PWA 88100 Anchor Plate on the hydraulic wrench, engaging the pins of the wrench in the holes of the anchor plate.

CAUTION: TO AVOID INCORRECT TORQUE READING, RETAINING NUT (1003/6) MUST NOT BE TORQUED UNTIL NO. 3 BEARING HOUSING (1003/3) HAS RETURNED TO ROOM TEMPERATURE. SHOP AIR MAY BE USED FOR COOLING. DO NOT USE DRY ICE.

CAUTION: NO. 3 BEARING (OUTER RACE) RETAINING NUT MUST BE RE−SILVER PLATED AFTER TORQUING NUT A MAXIMUM OF THREE TIMES FOR EACH INSTALLATION PRIOR TO ENGINE BEING OPERATED. NUT MAY BE RE−SILVER PLATED BY 72−41−83, REPAIR−01 PW4000 Series CIR, PN 51A357.

(c) (Reference 975) Torque retaining nut (1003/6) to 3600 − 4400 lb−in. (406.745 − 497.133 N.m). Turn through angle of 16° − 17° 30'. Loosen to 0 lb−in. (0 N.m) then repeat torque sequence aligning one rivet hole in retaining nut (1003/6) with one rivet hole in housing (1003/3).

(d) Remove the tools from the nut.

(e) Install rivet (1003/4) into aligned holes in housing (1003/3) and retaining nut (1003/6) and with PWA 85901 Hand Riveter, flare rivet (1003/4) to secure. See Chapter/Section 70−43, Standard Practices Manual, PN 585005.

(f) Remove housing assembly (1003/3) from base (1003/5) and place on clean paper, on bench large OD up.

(g) Position PWA 85802 or PWA 85056 Protective Cover (1003/2) over retaining nut (1003/6) installed in housing (1003/3). If PWA 85056 Protector Cover is used, slowly rotate cover until the three spring plungers seat in holes in retaining nut (1003/6).

Subtask 72−41−00−430−069:

(3) Assemble No. 3 bearing front (carbon) seal assembly and housing and outer race. See Figure 1004.

(a) Install No. 3 bearing housing and outer race (1004/7) small ID down into PWA 85167 Adapter (1004/6) mounted on PWA 85199 Bench Fixture (1004/4). Secure housing (1004/7) with six bolts (1004/12) wrench tight.

(b) Rotate housing (1004/7) and adapter (1004/6) so small OD is facing up.

(c) Place No. 3 bearing front (carbon) seal assembly (1004/1) on bench large OD up. Locate three hole pad inside seal assembly (1004/1).

(d) Install No. 3 bearing nozzle assembly (1004/11) small nozzle toward carbon seal. Secure fingertight with three key washers (1004/9) and bolts (1004/10) lubricated with Engine Oil P03−001.

(e) Torque bolts (1004/10) 65 − 85 lb−in. (7.344 − 9.604 N.m).

(f) Bend tabs on key washers (1004/9) to secure bolts (1004/10), see locking devices 70−53, Standard Practices Manual, PN 585005.

(g) Install gasket (1004/2) to inner flange on bearing housing (1004/7).

(h) Install two PWA 29855−3 Guide Pins (1004/8) 180 degrees apart to seal assembly (1004/1) flange.

(i) Install seal assembly (1004/1) to housing (1004/7) aligning offset holes. Secure with eight work bolts (1004/3) lubricated with Engine Oil P03−001, placed on each side of four countersunk screw holes fingertight. Rotate seal assembly and housing large OD up and tighten work bolts in a 180 degrees pattern until seal assembly is fully seated against housing. Ensure all bolt holes are aligned.

(j) Remove guide pins (1004/8).

(k) Install four screws (1004/5) lubricated with Engine Oil P03−001, to countersunk holes in housing (1004/7).

(l) Torque screws (1004/5) 22 − 85 lb−in. (2.486 − 9.604 N.m) loosen and retorque 22 − 85 lb−in. (2.486 − 9.604 N.m).

(m) Remove eight work bolts (1004/3) from flange.

Subtask 72−41−00−430−070:

(4) Assemble No. 3 bearing front cooling duct assembly and No. 3 bearing seal assembly and housing. See Figure 1005.

(a) Rotate seal assembly and housing large OD down.

(b) Chill No. 3 bearing front cooling duct assembly (1005/8) for five to ten minutes.

(c) Install nine gaskets (1005/7) to nine washers (1005/6), lightly waxed in place with Beeswax P05−395 or Paraffin Wax Blend P05−396. Lubricate nine bolts (1005/5) with Engine Oil P03−001.

(d) Install two large gaskets (1005/11) to bosses on seal assembly (1005/9), below threaded portion. Lightly wax in place with Beeswax P05−395 or Paraffin Wax Blend P05−396.

(e) Install one small gasket (1005/10) to boss on seal housing (1005/9) below threaded portion. Lightly wax in place with Beeswax P05−395 or Paraffin Wax Blend P05−396.

(f) Install two PWA 29855−5 Guide Pins (1005/12) 180 degrees apart in seal assembly (1005/9).

(g) Install seal ring (1005/2) to ring groove on OD of one nut (1005/1) and lubricate nut threads with Engine Oil P03−001. Place nut aside.

(h) Install seal ring (1005/3) to ring groove on OD of two nuts (1005/4) and lubricate nut threads with Engine Oil P03−001. Place nuts aside.

(i) Install chilled duct assembly (1005/8) over seal assembly (1005/9) aligning nine bolt holes and three large bosses. Lightly tap to seat.

NOTE: Do not disturb gaskets (1005/10) and (1005/11) on seal assembly (1005/9) bosses.

(j) Remove two guide pins (1005/12).

(k) Secure cooling duct assembly (1005/8) with nine bolts (1005/5), washers (1005/6) and gaskets (1005/7) fingertight.

(l) Install two previously assembled nuts (1005/4) and seal rings (1005/3), slotted face up to seal assembly (1005/9) handtight.

(m) Install one previously assembled nut (1005/1) and seal ring (1005/2) slotted face up to seal assembly (1005/9) handtight.

(n) Torque nine bolts (1005/5) 85 − 95 lb−in. (9.604 − 10.734 N.m).

(o) (Reference 409) With PWA 85541 Wrench torque two large nuts (1005/4) 850 − 900 lb−in. (96.037 − 101.686 N.m).

(p) (Reference 408) With PWA 85542 Wrench torque one small nut (1005/1) 675 − 725 lb−in. (76.265 − 81.914 N.m).

(q) Install lock (1005/13) over larger nut (1005/4) at two locations. Position lock to align holes in lock with four holes in boss on seal assembly (1005/9).

(r) Install lock (1005/14) over small nut (1005/1) at one location. Position lock to align holes in lock with four holes in boss on seal assembly (1005/9).

(5) Install No. 3 bearing elbow assembly.

(a) Install elbow (1006/7) to seal assembly (1006/9) engaging lug on elbow (1006/7) with clevis on seal assembly (1006/9). Secure with two key washers (1006/6) and two bolts (1006/5) lubricated with Engine Oil P03−001. Do not run down bolts (1006/5). See Figure 1006.

(b) Install heat shield assembly (1006/13) between elbow (1006/7) and seal assembly (1006/9). Position key washer (1006/6) tabs into elbow (1006/7) and secure bolts (1006/5) fingertight.

(c) Secure elbow lug to clevis on seal assembly (1006/9) with bolt (1006/8), lubricated with Engine Oil P03−001, and nut (1006/12).

(d) Torque bolts (1006/5) 75 − 85 lb−in. (8.474 − 9.604 N.m).

(e) Torque nut (1006/12) 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Bend tabs on key washers (1006/6) to secure bolts (1006/3), see locking devices, 70−53, Standard Practices Manual, PN 585005.

(g) Install heat shield assembly (1006/4) over elbow (1006/7) aligning slot with elbow lug.

(h) Install shield (1006/3) over heat shield assembly (1006/4) aligning bolt holes. Secure with four key washers (1006/2) and four bolts (1006/1) lubricated with Engine Oil P03−001.

(i) Torque bolts (1006/1) 32 - 36 lb-in. (3.616 - 4.067 N.m).

NOTE: Smaller tab on key washers (1006/2) to be down over edge of shield (1006/3).

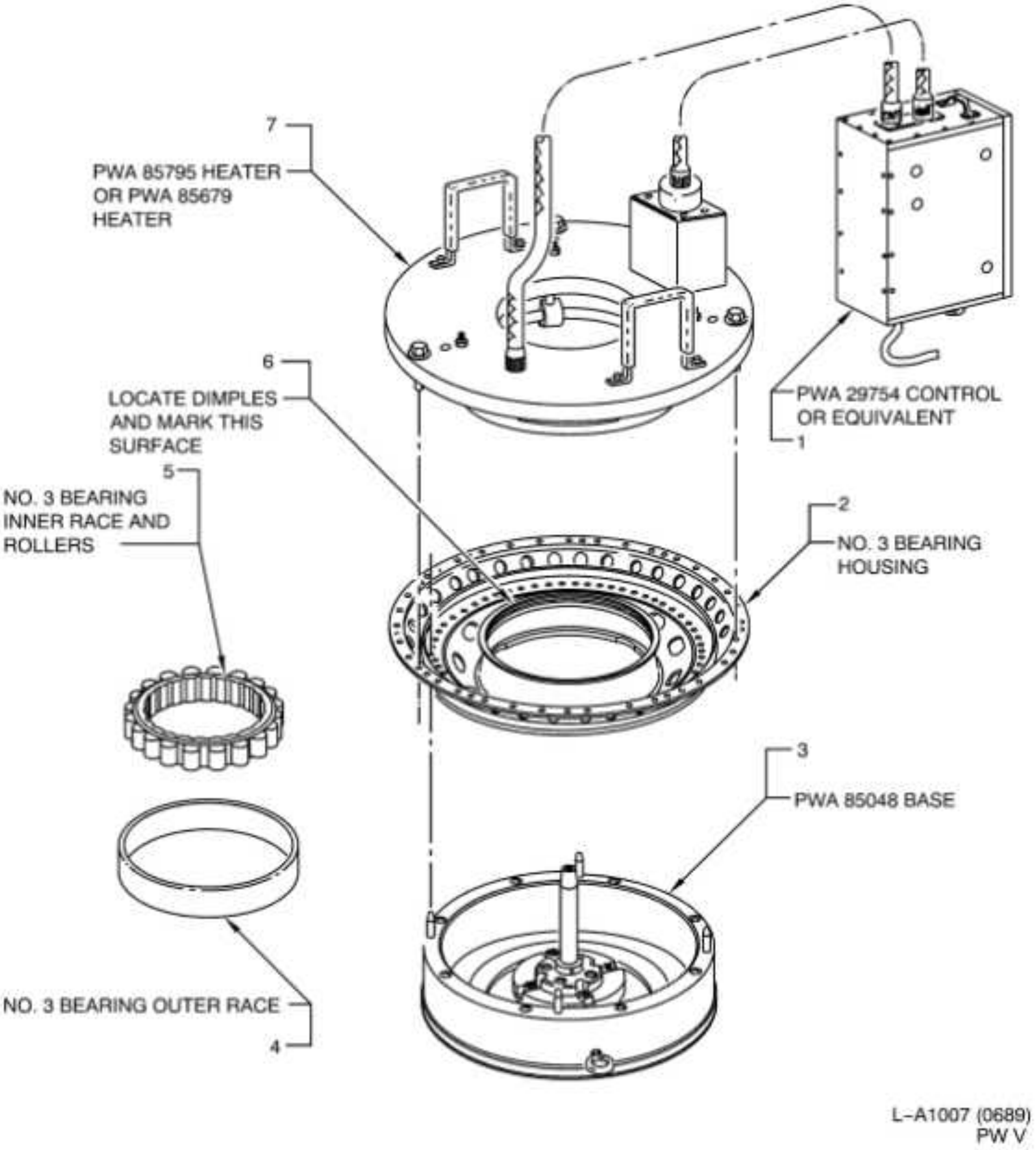
(j) Bend tabs of key washers (1006/2) to secure heat shield to seal assembly (1006/9). See locking devices, 70-53, Standard Practices Manual, PN 585005.

(k) Rotate Adapter (PWA 85167) (1006/11) on Bench Fixture (PWA 85199) (1006/10) so seal assembly (1006/9) is large OD up. Remove assembly from adapter and place on bench.

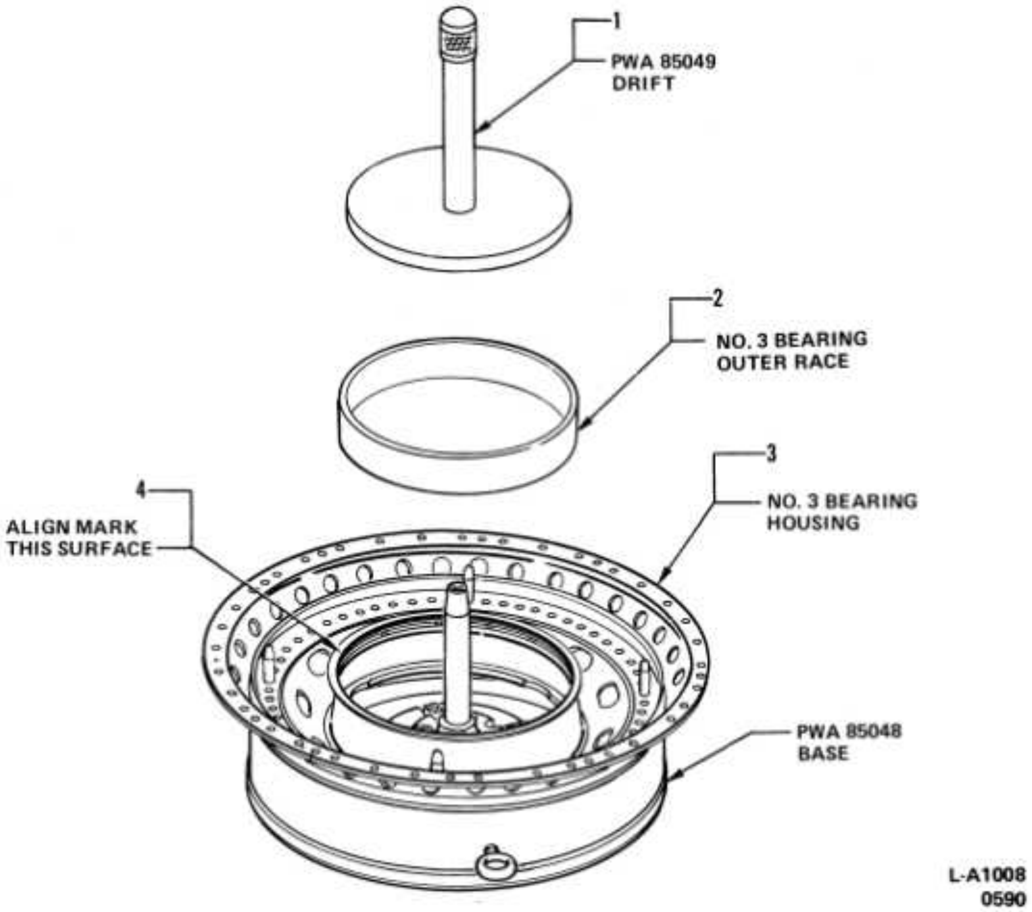
(l) Cover seal assembly with plastic and place in PWA 85057 Storage Stand.

D. Postrequisites

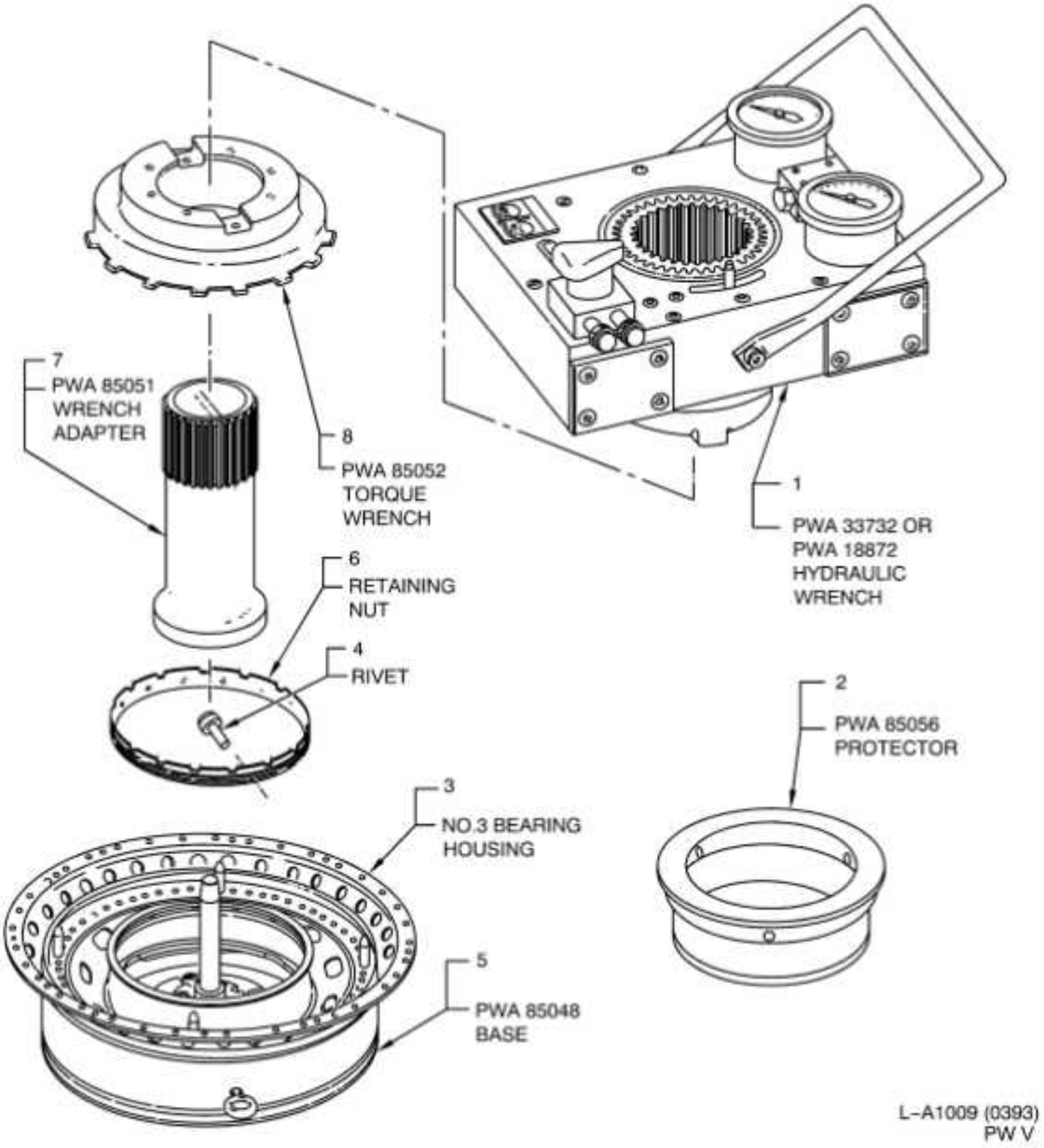
(1) For assembly of diffuser and combustor internals, see Assembly-01 Task 72-41-00-400-001.


7
PWA 85795 HEATER
OR PWA 85679
HEATER
6
LOCATE DIMPLES
AND MARK THIS
SURFACE
5
NO. 3 BEARING
INNER RACE AND
ROLLERS
PWA 29754 CONTROL
OR EQUIVALENT
1
2
NO. 3 BEARING
HOUSING
3
PWA 85048 BASE
NO. 3 BEARING OUTER RACE
4
L-A1007 (0689)
PW V

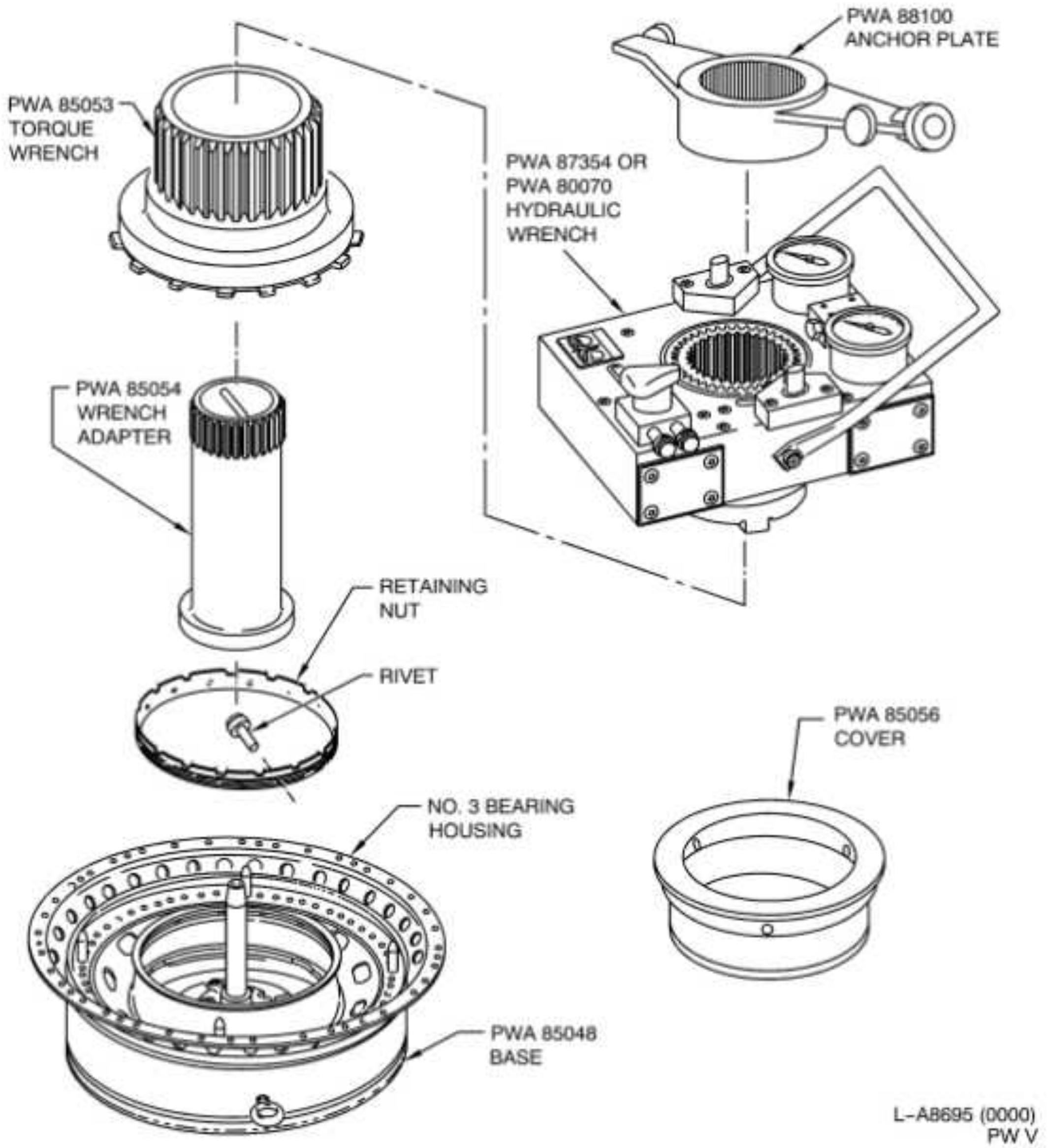
No. 3 Bearing Outer Race Installation
Figure 1001
(Task 72−41−00−400−002−001)


1
PWA 85049
DRIFT
2
NO. 3 BEARING
OUTER RACE
3
NO. 3 BEARING
HOUSING
4
ALIGN MARK
THIS SURFACE
PWA 85048
BASE
L-A1008
0590

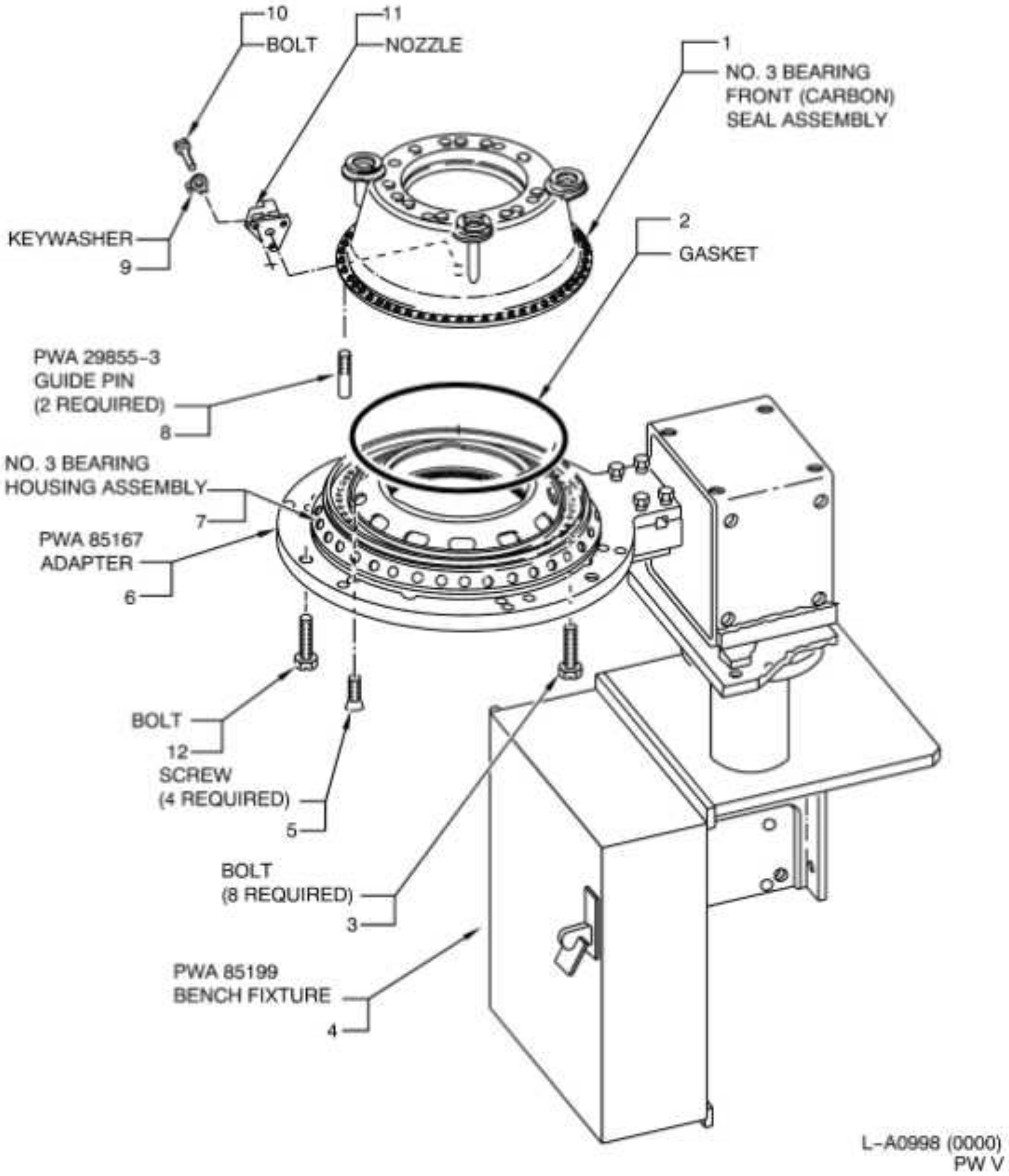
No. 3 Bearing Outer Race Installation
Figure 1002
(Task 72−41−00−400−002−001)


7
PWA 85051
WRENCH
ADAPTER
8
PWA 85052
TORQUE
WRENCH
1
PWA 33732 OR
PWA 18872
HYDRAULIC
WRENCH
6
RETAINING
NUT
4
RIVET
2
PWA 85056
PROTECTOR
3
NO.3 BEARING
HOUSING
5
PWA 85048
BASE
L−A1009 (0393)
PW V

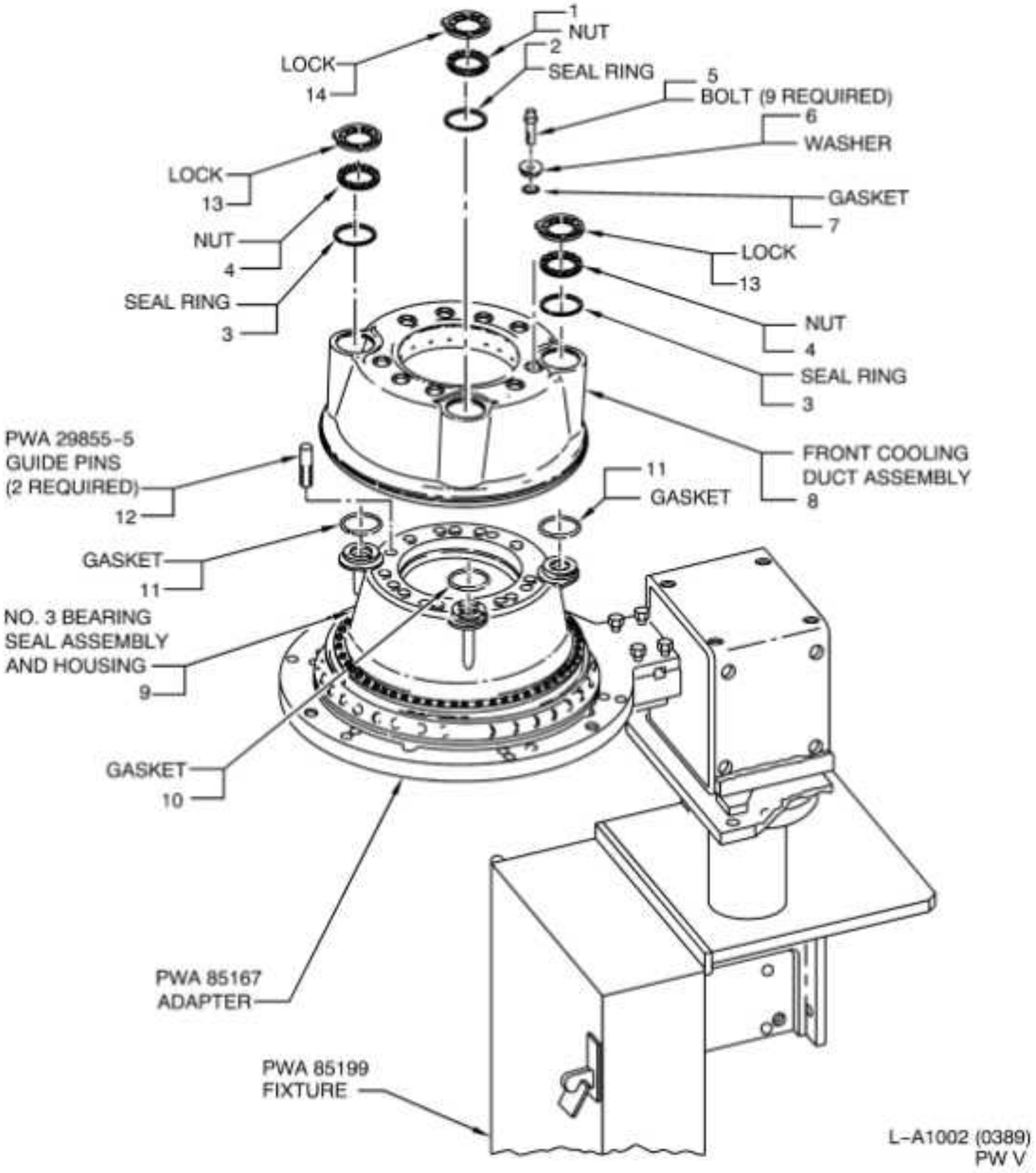
No. 3 Bearing Retaining Nut Installation (Method 1)
Figure 1003 (Sheet 1)
(Task 72−41−00−400−002−001)


PWA 88100
ANCHOR PLATE
PWA 85053
TORQUE
WRENCH
PWA 87354 OR
PWA 80070
HYDRAULIC
WRENCH
PWA 85054
WRENCH
ADAPTER
RETAINING
NUT
RIVET
PWA 85056
COVER
NO. 3 BEARING
HOUSING
PWA 85048
BASE
L-A8695 (0000)
PW V

No. 3 Bearing Retaining Nut Installation (Method 2)
Figure 1003 (Sheet 2)
(Task 72-41-00-400-002-001)

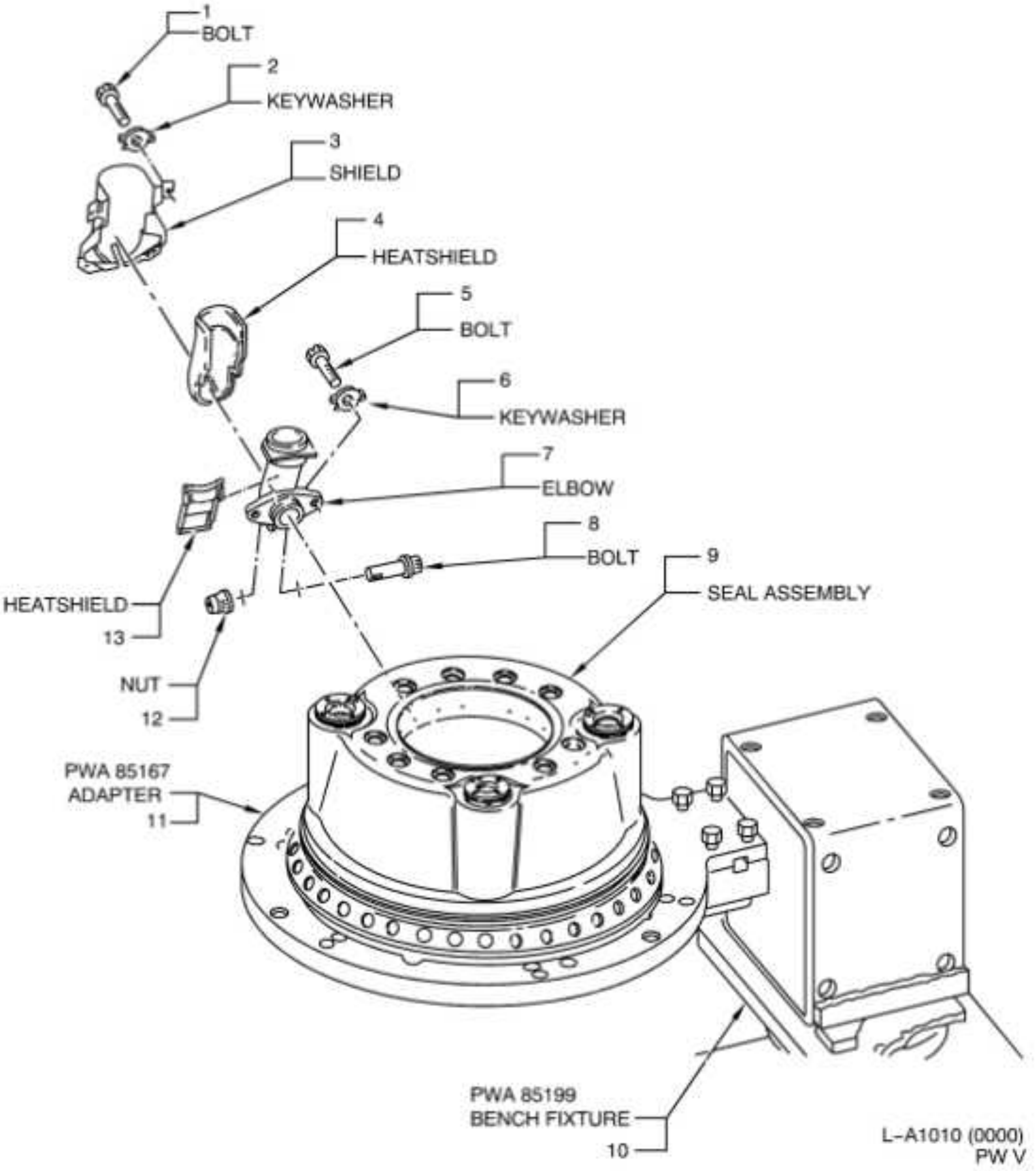

10
BOLT
11
NOZZLE
1
NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY
KEYWASHER
9
2
GASKET
PWA 29855-3 GUIDE PIN (2 REQUIRED)
8
NO. 3 BEARING HOUSING ASSEMBLY
7
PWA 85167 ADAPTER
6
BOLT
12
SCREW (4 REQUIRED)
5
BOLT (8 REQUIRED)
3
PWA 85199 BENCH FIXTURE
4
L-A0998 (0000)
PW V

No. 3 Bearing Front (Carbon) Seal Assembly Installation
Figure 1004
(Task 72-41-00-400-002-001)


1
NUT
2
SEAL RING
LOCK
14
5
BOLT (9 REQUIRED)
6
WASHER
LOCK
13
NUT
4
SEAL RING
3
GASKET
7
LOCK
13
NUT
4
SEAL RING
3
PWA 29855-5
GUIDE PINS
(2 REQUIRED)
12
11
GASKET
FRONT COOLING
DUCT ASSEMBLY
8
GASKET
11
NO. 3 BEARING
SEAL ASSEMBLY
AND HOUSING
9
GASKET
10
PWA 85167
ADAPTER
PWA 85199
FIXTURE
L-A1002 (0389)
PW V

No. 3 Bearing Front Cooling Duct Installation
Figure 1005
(Task 72-41-00-400-002-001)

DIFFUSER AND COMBUSTOR − ASSEMBLY−02


1
BOLT
2
KEYWASHER
3
SHIELD
4
HEATSHIELD
5
BOLT
6
KEYWASHER
7
ELBOW
8
BOLT
9
SEAL ASSEMBLY
HEATSHIELD
13
NUT
12
PWA 85167
ADAPTER
11
PWA 85199
BENCH FIXTURE
10
L−A1010 (0000)
PW V

No. 3 Bearing Elbow Assembly Installation
Figure 1006
(Task 72−41−00−400−002−001)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72−41−00−400−003:

1. Assemble Fuel Tubes And Fuel Distribution Valve

A. Prerequisites

(1) See 72−41−00, Inspection/Check−04 Task 72−41−00−990−001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a referenced number. For example: (Reference 1234) Torque retaining nut as follows.

(2) Assemble internal parts. See 72−41−00, Assembly−01 Task 72−41−00−400−001.

(3) Assemble No. 3 bearing duct and housing. See 72−41−00, Assembly−02 Task 72−41−00−400−002−001.

B. Equipment And Materials Required

Special Tools:

PWA 85579	Adapter

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−007	Fluid, Leak Check (PMC 9569 or PMC 2277)
P06−053	Lubricant, Seal Ring (PWA 36500)
P06−021	Compound, Antigalling (PWA 550−3)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	16	73−13−00/3/1
Packing	16	73−13−00/3/530

C. Procedure

Subtask 72−41−00−430−066:

(1) (Reference 2152) Install fuel flow divider bracket and fuel supply tube assemblies as follows. See Figure 1001 and Table 1001.

DIFFUSER AND COMBUSTOR - ASSEMBLY-03

Fuel Tube Assembly Part Number	Tube Function Number	Fuel Injector Number
51T379, 54T328-01 (POST SB 73-127)	(FM01)	2
51T928, 54T334-01 (POST SB 73-127)	(FM02)	5
51T934, 54T336-01 (POST SB 73-127) 58T076-01 (POST SB 73-133)	(FM08)	23
51T930, 54T335-01 (POST SB 73-127)	(FM04)	11
51T387, 53T657-01 54T339-01 (POST SB 73-127)	(FM05)	14
51T389, 53T658-01 54T340-01 (POST SB 73-127)	(FM06)	17
51T932, 53T659-01 54T341-01 (POST SB 73-127)	(FM07)	20
51T383, 54T331-01 (POST SB 73-127)	(FM03)	8

Table 1001

(a) Install two packings (1001/18) lubricated with Engine Oil P03-001 or Seal Ring Lubricant P06-053, to each of eight transfer tubes (1001/2).

(b) Install transfer tubes (1001/2) to eight fuel manifold assemblies (1001/1). Seat transfer tubes in manifold connectors.

(c) Ensure that diffuser case (1001/17) bolt holes No. 38 - 43 are aligned with cut out in PWA 86508 Build Stand or PWA 85044 Build Stand (1001/4).

(d) Install fuel flow divider bracket assembly (1001/3) above diffuser case flange at holes No. 37 - 43. Secure with two work bolts (1001/15) lubricated with Engine Oil P03-001, and two washers (1001/16) and nuts (1001/14).

(2) Remove closures from fuel supply tube assembly (FM01) and blow shop air through assembly to assure the absence of foreign material. See Table 1001 for tube assembly part number and fuel injector location.

(a) Lubricate threads of tube nut (1001/19) with Antigalling Compound P06-021, and install tube assembly (FM01) to fuel injector No. 2 fingertight. Tube to run in a clockwise direction to hole in bracket assembly (1001/3).

(3) Remove closures from tube assembly (FM02) and blow shop air through assembly to assure the absence of foreign material.

(a) Lubricate threads of tube nut with Antigalling Compound P06-021, and install tube assembly (FM02) to fuel injector No. 5 fingertight. Tube to run in a clockwise direction to bracket (1001/3).

(4) Remove closures from tube assembly (FM08) and blow shop air through assembly to assure the absence of foreign material.

(a) Lubricate threads of tube nut with Antigalling Compound P06-021, and install tube assembly (FM08) to fuel injector No. 23 fingertight. Tube to run in a clockwise direction to bracket (1001/3).

(5) Remove closures from tube assembly (FM04) and blow shop air through assembly to assure the absence of foreign material.

(a) Lubricate threads of tube nut with Antigalling Compound P06-021, and install tube assembly (FM04) to fuel injector No. 11 fingertight. Tube to run in a counterclockwise direction to bracket (1001/3).

(6) Remove closures from tube assembly (FM05) and blow shop air through assembly to assure the absence of foreign material.

(a) Lubricate threads of tube nut with Antigalling Compound P06−021, and install tube assembly (FM05) to fuel injector No. 14 fingertight. Tube to run in a counterclockwise direction to bracket (1001/3).

(7) Remove closures from tube assembly (FM06) and blow shop air through assembly to assure the absence of foreign material.

(a) Lubricate threads of tube nut with Antigalling Compound P06−021, and install tube assembly (FM06) to fuel injector No. 17 fingertight. Tube to run in a counterclockwise direction to bracket (1001/3).

(8) Remove closures from tube assembly (FM07) and blow shop air through assembly to assure the absence of foreign material.

(a) Lubricate threads of tube nut with Antigalling Compound P06−021, and install tube assembly (FM07) to fuel injector No. 20 fingertight. Tube to run in a counterclockwise direction to bracket (1001/3).

(9) Remove closures from tube assembly (FM03) and blow shop air through assembly to assure the absence of foreign material.

(a) Lubricate threads of tube nut (1001/19) with Antigalling Compound P06−021, and install tube assembly (FM03) to fuel injector No. 8 fingertight. Tube to run in a clockwise direction to bracket (1001/3).

(10) Using nuts (1001/5) lubricated with Antigalling Compound P06−021, secure eight tubes to bracket (1001/3) fingertight. Assure connectors on tube ends are fully engaged in holes in bracket (1001/3).

Subtask 72−41−00−430−067:

(11) Install Flange K brackets and fuel supply tube clamps.

(12) Position bracket (1002/9) over Holes 14 and 15 in diffuser case Flange K (1002/3). See Figure 1002.

(a) Install two clamps (1002/1) to fuel tubes and secure to bracket (1002/9) with bolt (1002/10) lubricated with Engine Oil P03-001, and nut (1002/2). Secure fingertight.

(13) Position bracket (1002/8) over Holes 27 and 28 in Flange K (1002/6).

(a) Install two clamps (1002/5) to fuel tubes and secure to bracket (1002/8) with bolts (1002/4) lubricated with Engine Oil P03-001, and nuts (1002/7). Secure fingertight.

(14) Position bracket (1003/2) over Holes 45 and 44 in Flange K (1003/9). See Figure 1003.

(a) Install four clamps (1003/1) to fuel tubes and secure to bracket (1003/2) with two bolts (1003/3), lubricated with Engine Oil P03-001, and two nuts (1003/10). Secure fingertight.

(15) Position bracket (1003/5) over Holes 53 and 54 in Flange K (1003/7).

(a) (Pre SB PW4ENG 73-86) Install three clamps (1003/4) to fuel tubes and secure to bracket (1003/5) with bolt (1003/6) lubricated with Engine Oil P03-001, and nut (1003/8). Secure fingertight.

(b) (Post SB PW4ENG 73-86) Install two clamps (1003/4) and one clamp (1003/11) to fuel tubes and secure to bracket (1003/5) with bolts (1003/6) lubricated with Engine Oil P03-001, and nuts (1003/8). Secure fingertight.

(16) Position bracket (1004/2) over Holes 65 and 66 in Flange K (1004/4). See Figure 1004.

(a) Install three clamps (1004/1) to fuel tubes and secure to bracket (1004/2) with bolt (1004/3) lubricated with Engine Oil P03-001, and nut (1004/10). Secure fingertight.

(17) Position bracket (1004/8) over Holes 73 and 74 in Flange K (1004/7).

(a) Install two clamps (1004/5) to fuel tubes and secure to bracket (1004/8) with bolt (1004/9) lubricated with Engine Oil P03-001, and nut (1004/6). Secure fingertight.

(18) Position bracket (1005/9) over Holes 80 and 81 in Flange K (1005/8). See Figure 1005.

(a) Install two clamps (1005/1) to fuel tubes and secure to bracket (1005/9) with bolt (1005/10) lubricated with Engine Oil P03-001, and nut (1005/2). Secure fingertight.

(19) Position bracket (1005/7) over Holes 118 and 119 in Flange K (1005/6).

(a) Install clamp (1005/4) to fuel tube and secure to bracket (1005/7) with bolt (1005/3) lubricated with Engine Oil P03-001, and nut (1005/5). Secure fingertight.

(20) Tighten nine nuts, securing clamps to brackets several turns to prevent them from falling off.

NOTE: Clamp nuts will be torqued at engine assembly.

(21) (Reference 2152) Torque eight nuts (1006/3) securing fuel tubes to bracket assembly (1006/5) to 200 - 225 lb-in. (22.597 - 25.422 N.m). See Figure 1006.

NOTE: Hold fuel tube connectors (1006/4) when torquing nuts.

(22) Lockwire eight nuts (1006/3) together in pairs as shown per referenced figure.

NOTE: Tube nuts will be torqued after fuel distribution system leak test has been accomplished.

Subtask 72-41-00-430-056:

(23) (Pre SB PW4ENG 73-170) Install fuel distribution valve and leak test. See Figure 1007.

(a) Place fuel distribution valve (1007/6) on workbench.

(b) Install two packings (1007/3) lubricated with Engine Oil P03-001 or Seal Ring Lubricant P06-053, to each of eight transfer tubes (1007/4).

(c) Install transfer tubes (1007/4) with packings to eight parts on valve (1007/6). Seat transfer tubes in valve.

(d) Install fuel distribution valve (1007/6) to bracket (1007/2) aligning two dowel pins (1007/7) on valve with holes in bracket and transfer tubes with fuel manifolds (1007/1). Secure with four work bolts (1007/9) lubricated with Engine Oil P03-001, and four washers (1007/8) fingertight.

(e) Tighten work bolts (1007/9) equally and evenly to seat transfer tubes (1007/4) in fuel supply tubes (1007/1).

(f) Remove four work bolts (1007/9) and washers (1007/8) one at a time and install bolts lubricated with Engine Oil P03-001, at each hole. Secure fingertight.

NOTE: (Pre SB PW4ENG 73-170) bolts are shorter than (Post SB PW4ENG 73-170) bolts and do not have reliable engagement in the helicoil locking feature. Also these bolts do not have antigallant coated threads which would help to improve disassembly.

(g) (Post SB PW4ENG 73-164) Install the EBU harness bracket (1007/10) to the rear of the bracket (1007/2) at the outer right bolt hole.

(h) Torque four bolts 85 - 95 lb-in. (9.604 - 10.734 N.m).

(24) (Post SB PW4ENG 73-170) Install fuel distribution valve and leak test. See Figure 1007.

(a) Place fuel distribution valve (1007/6) on workbench.

(b) Install two packings (1007/3) lubricated with Engine Oil P03-001 or Seal Ring Lubricant P06-053, to each of eight transfer tubes (1007/4).

(c) Install transfer tubes (1007/4) with packings to eight parts on valve (1007/6). Seat transfer tubes in valve.

(d) Install fuel distribution valve (1007/6) to bracket (1007/2) aligning two dowel pins (1007/7) on valve with holes in bracket and transfer tubes with fuel manifolds (1007/1). Secure with four (not lubricated) work bolts (1007/9) and four washers (1007/8) fingertight.

(e) Tighten work bolts (1007/9) equally and evenly to seat transfer tubes (1007/4) in fuel supply tubes (1007/1).

(f) Remove four work bolts (1007/9) and washers (1007/8) one at a time and install bolts at each hole. Secure fingertight.

NOTE: (Post SB PW4ENG 73−170) bolts are longer than (Pre SB PW4ENG 73−170) bolts for improved engagement in the helicoil locking feature. Also these bolts have antigallant coated threads for improved disassembly.

(g) (Post SB PW4ENG 73−164) Install the EBU harness bracket (1007/10) to the rear of the bracket (1007/2) at the outer right bolt hole.

(h) Torque four bolts 62 − 72 lb−in. (7.005 − 8.135 N.m).

(25) Connect PWA 85579 Adapter (1007/5) to fuel distribution valve (1007/6).

(a) Supply filtered air through PWA 85579 Adapter at 95 − 105 psig (655.0 − 723.9 kPa) and check for visible leaks from any surface, joint or connection in the manifold system. Use Leak Check Fluid P05−007 for a minimum of five minutes. Make sure air is flowing from all 24 nozzles.

NOTE: Be sure that all the manifold and tube nuts are loose enough to find a leak in the transfer tube packings.

R NOTE: During pressure test, make sure that the
R leak check fluid is applied to the fuel
R nozzle inlet fitting braze joint and do an
R inspection for all the signs of leakage.
R See Figure 1008.

(b) If leakage is present repair or replace parts as required and repeat leak test.

(c) If no leakage is present reduce pressure and remove PWA 85579 Adapter (1007/5).

(26) Using suitable protective closure, cover end of fuel distribution valve (1007/6) and wrap in plastic secured with tape.

(27) Torque the 24 manifold assembly tube nuts (1008/1) and the eight fuel supply tube nuts (1008/2) as follows:

(a) (Reference 2152) Torque the fuel supply tube nuts (8 places) to 275 - 325 lb-in. (31.071 - 36.720 N.m).

(b) (Reference 2152) Torque the manifold nuts on the fuel injectors (24 places) to 185 - 200 lb-in. (20.902 - 22.597 N.m).

(28) Lockwire (1008/3) the fuel manifold nut (1008/1) to the fuel supply tube nut (1008/2) at fuel nozzle locations No. 2, 5, 8, 11, 14, 17, 20 and 23. See Figure 1008.

(29) Lockwire (1008/5) remaining fuel manifold nuts (1008/6) to lower bolt (1008/4) at fuel injector locations No. 1, 3, 4, 6, 7, 9, 10, 12, 13, 15, 16, 18, 19, 21, 22 and 24. See Figure 1008.

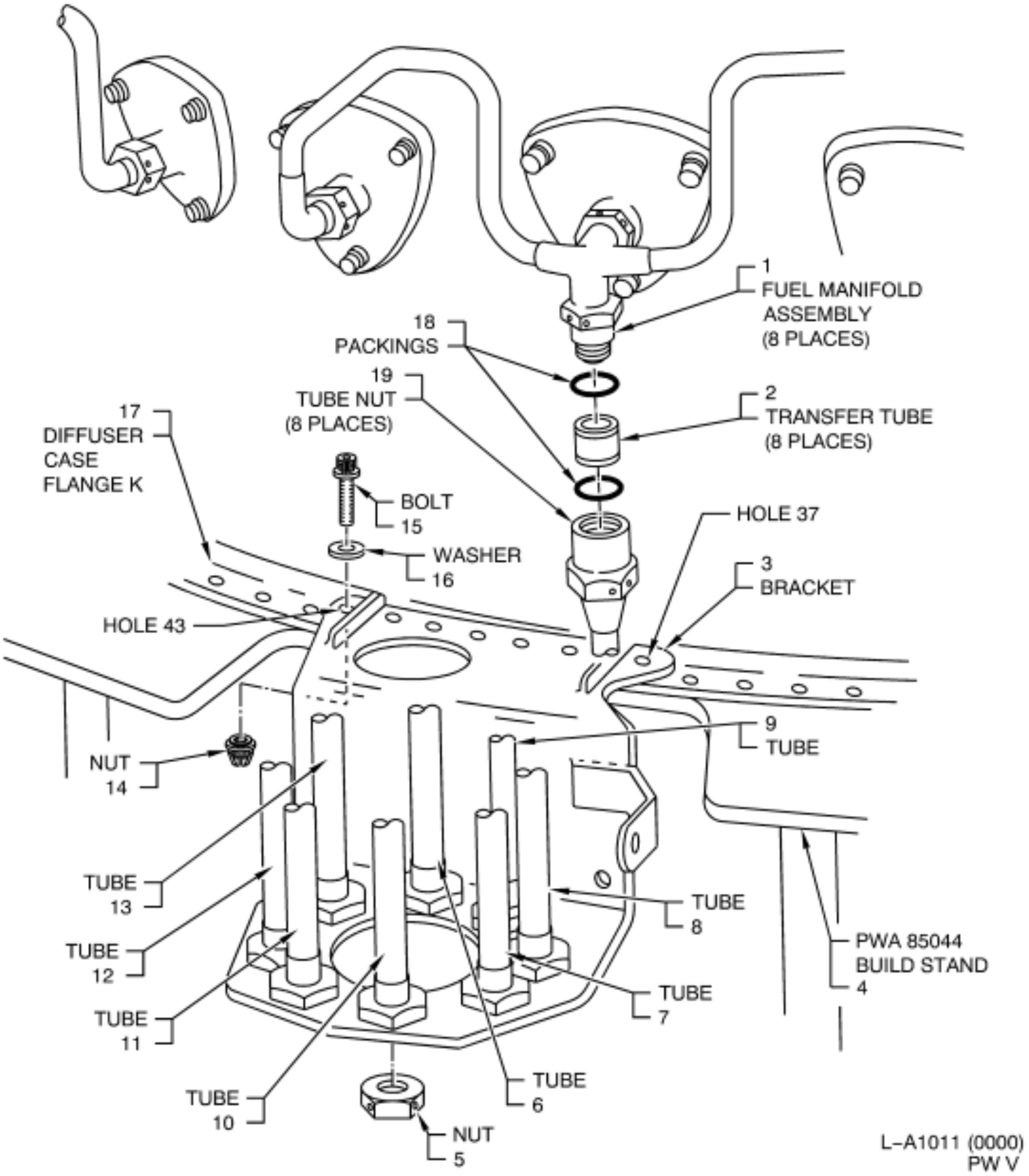
(30) Remove two work bolts (1001/15), washers (1001/16) and nuts (1001/14) securing fuel flow divider bracket (1001/3) to diffuser case.

(31) Remove tape locating fuel injector locations from diffuser case.

(32) Ensure there is a protective cover over No. 3 bearing outer race.

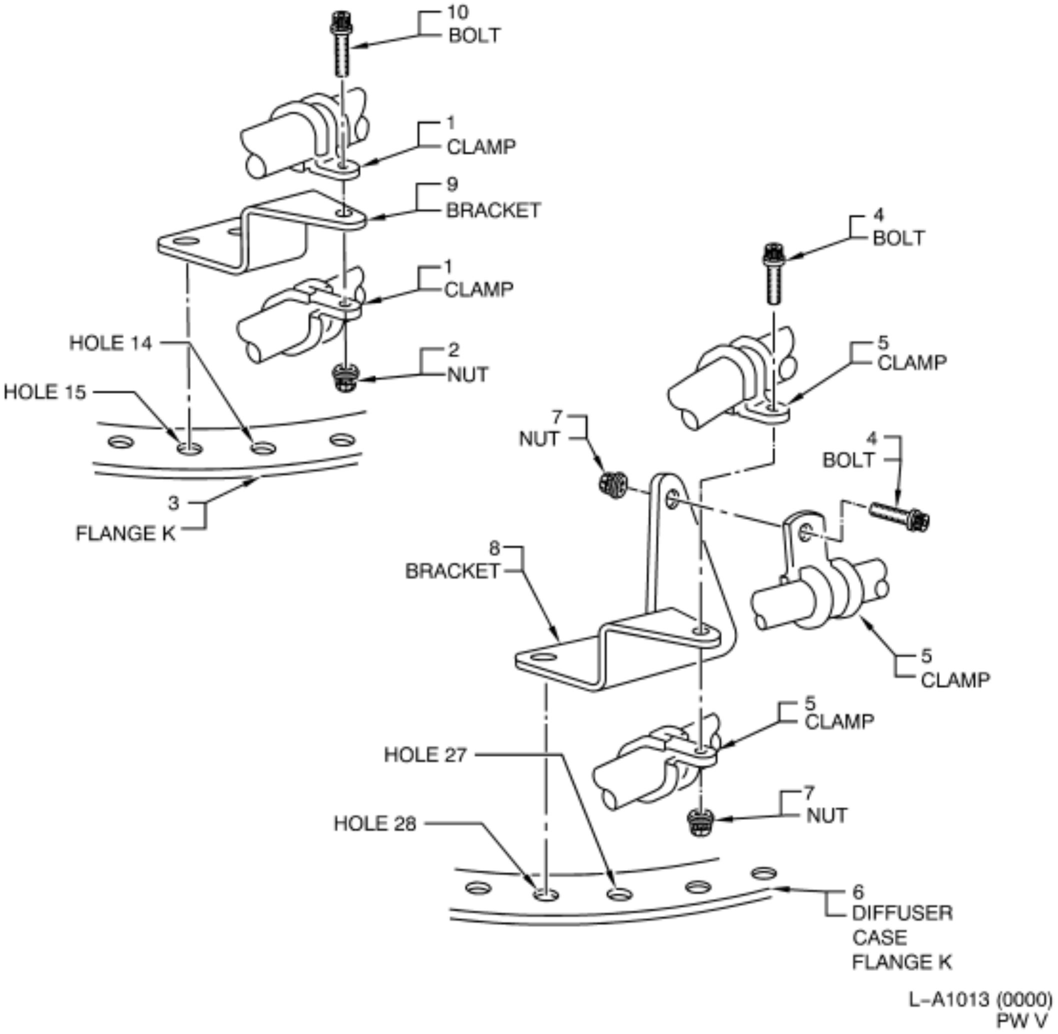
(33) Cover all open ports, tubes and fittings with plastic closures and cover entire assembly with plastic bag.

DIFFUSER AND COMBUSTOR - ASSEMBLY-03

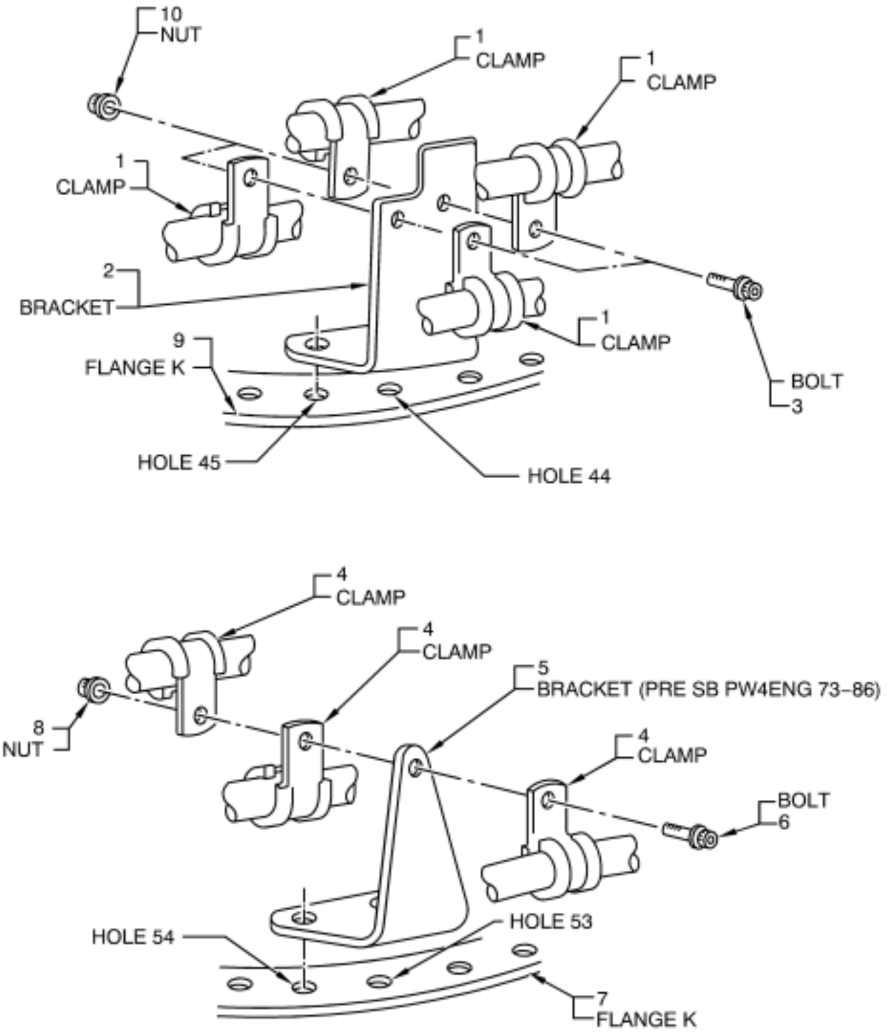

1 FUEL MANIFOLD ASSEMBLY (8 PLACES)
18 PACKINGS
19 TUBE NUT (8 PLACES)
2 TRANSFER TUBE (8 PLACES)
17 DIFFUSER CASE FLANGE K
BOLT 15
HOLE 37
WASHER 16
3 BRACKET
HOLE 43
9 TUBE
NUT 14
TUBE 13
TUBE 8
TUBE 12
PWA 85044 BUILD STAND 4
TUBE 7
TUBE 11
TUBE 6
TUBE 10
NUT 5
L-A1011 (0000)
PW V

Fuel Flow Divider Bracket And Fuel Supply Tubes
Figure 1001
(Task 72-41-00-400-003)

DIFFUSER AND COMBUSTOR - ASSEMBLY-03

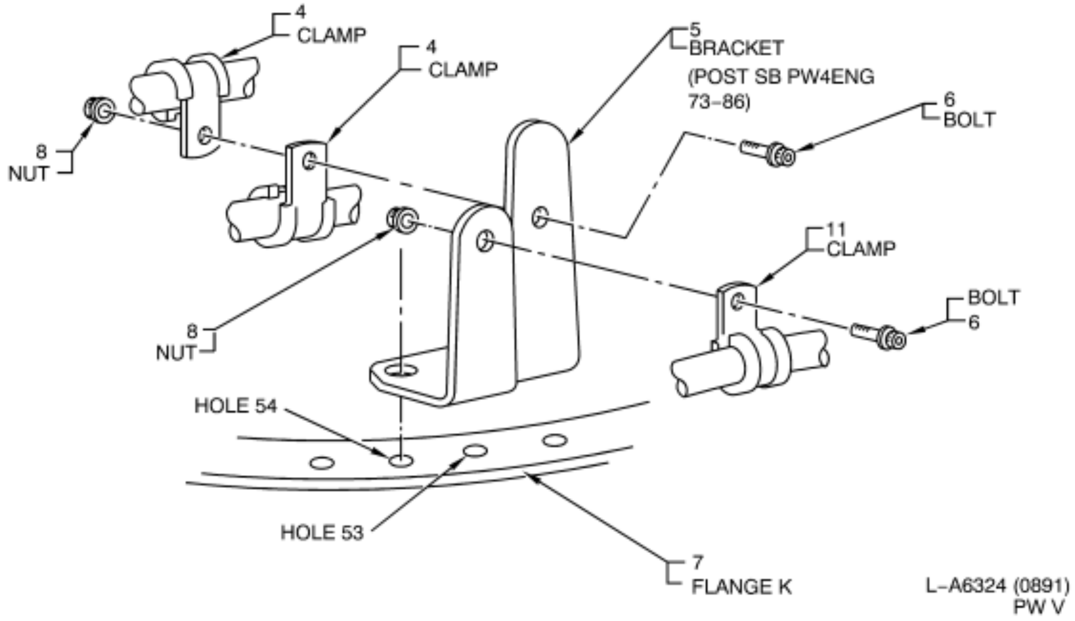

10
BOLT
1
CLAMP
9
BRACKET
1
CLAMP
HOLE 14
HOLE 15
2
NUT
3
FLANGE K
4
BOLT
5
CLAMP
7
NUT
4
BOLT
8
BRACKET
5
CLAMP
5
CLAMP
HOLE 27
HOLE 28
7
NUT
6
DIFFUSER
CASE
FLANGE K
L-A1013 (0000)
PW V

Diffuser Case Flange K
Figure 1002
(Task 72-41-00-400-003)

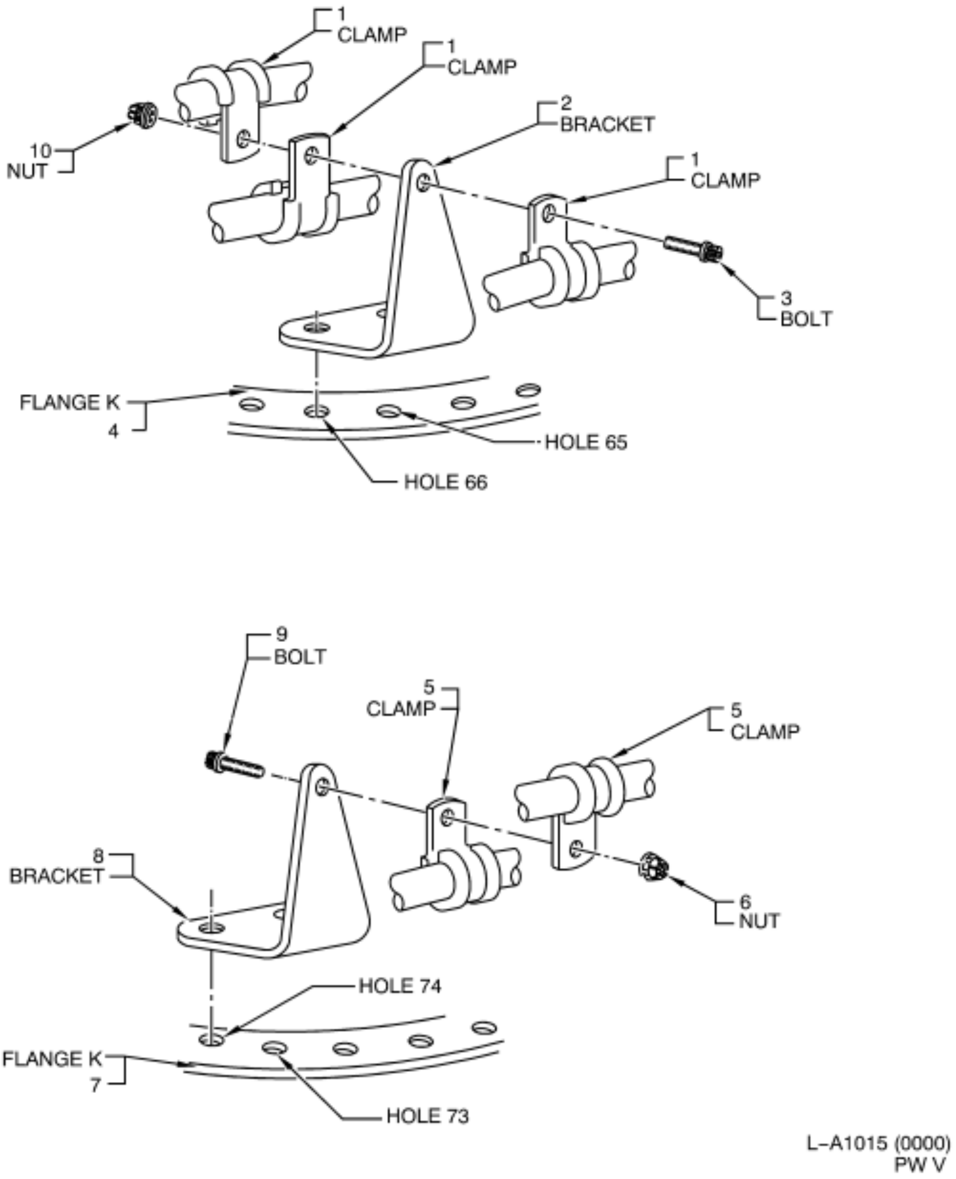

10
NUT
1
CLAMP
1
CLAMP
1
CLAMP
2
BRACKET
1
CLAMP
9
FLANGE K
BOLT
3
HOLE 45
HOLE 44
4
CLAMP
4
CLAMP
5
BRACKET (PRE SB PW4ENG 73-86)
8
NUT
4
CLAMP
BOLT
6
HOLE 53
HOLE 54
7
FLANGE K

L-A1014 (0690)
PW V

Diffuser Case Flange K
Figure 1003 (Sheet 1)
(Task 72-41-00-400-003)

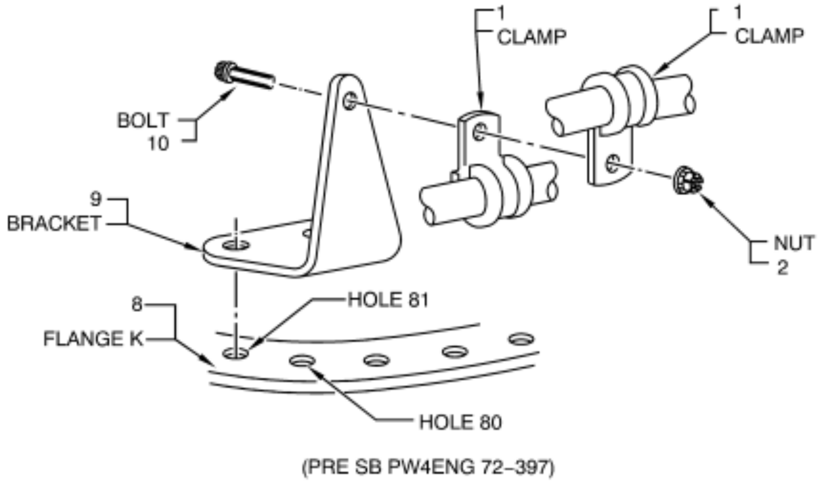

4
CLAMP
4
CLAMP
5
BRACKET
(POST SB PW4ENG
73-86)
6
BOLT
8
NUT
11
CLAMP
BOLT
6
8
NUT
HOLE 54
HOLE 53
7
FLANGE K
L-A6324 (0891)
PW V

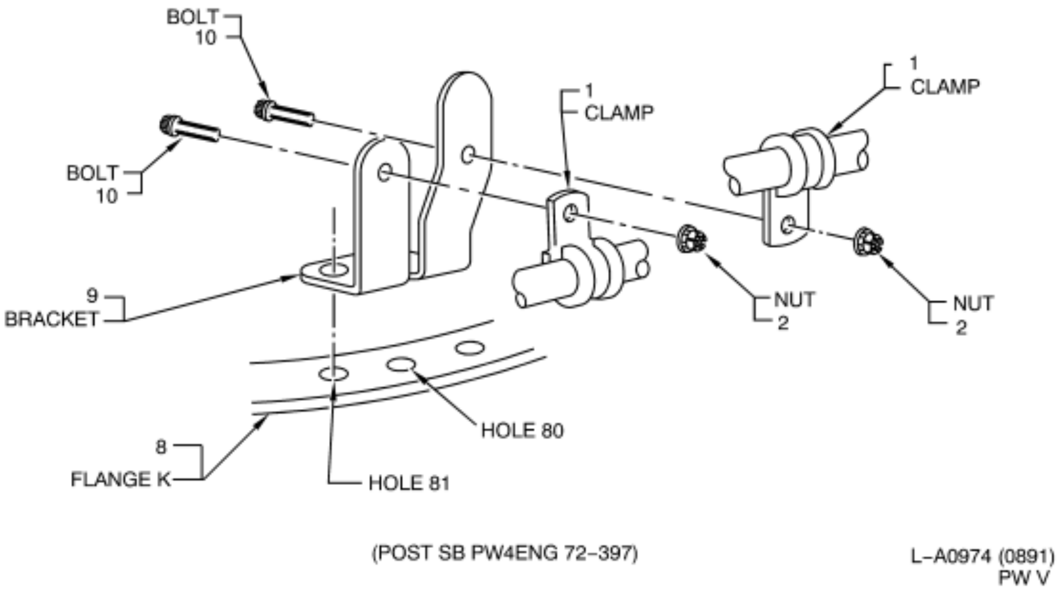
Diffuser Case Flange K
Figure 1003 (Sheet 2)
(Task 72-41-00-400-003)


1
CLAMP
1
CLAMP
2
BRACKET
1
CLAMP
10
NUT
3
BOLT
FLANGE K
4
HOLE 65
HOLE 66
9
BOLT
5
CLAMP
5
CLAMP
8
BRACKET
6
NUT
HOLE 74
FLANGE K
7
HOLE 73
L-A1015 (0000)
PW V

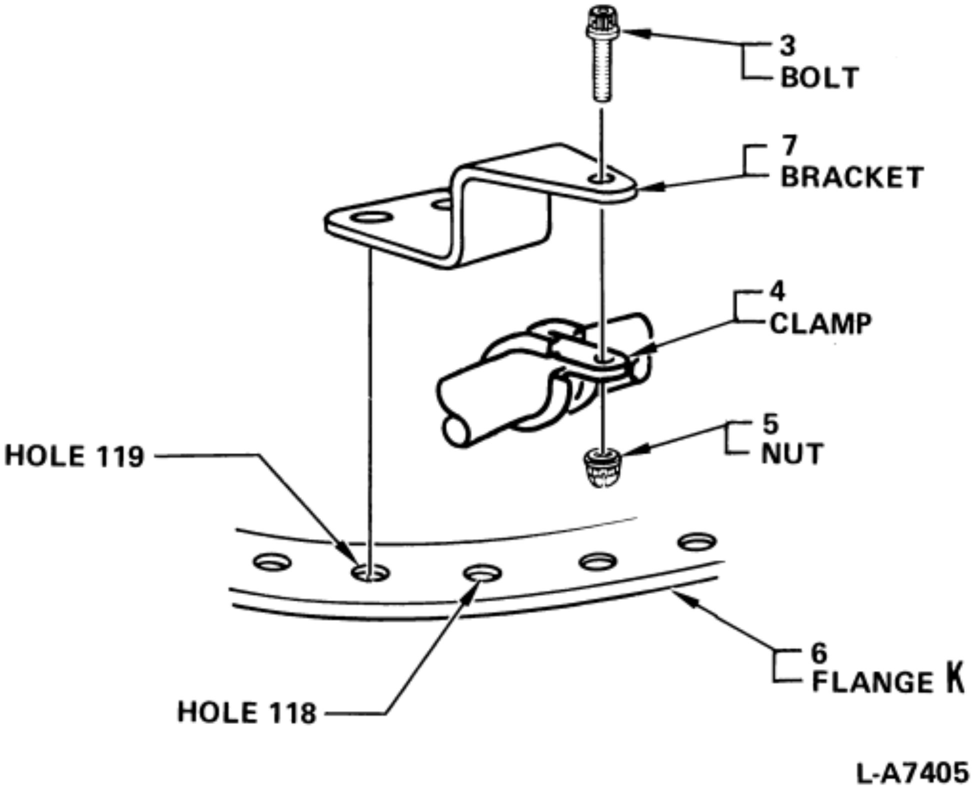
Diffuser Case Flange K
Figure 1004
(Task 72-41-00-400-003)

DIFFUSER AND COMBUSTOR - ASSEMBLY-03

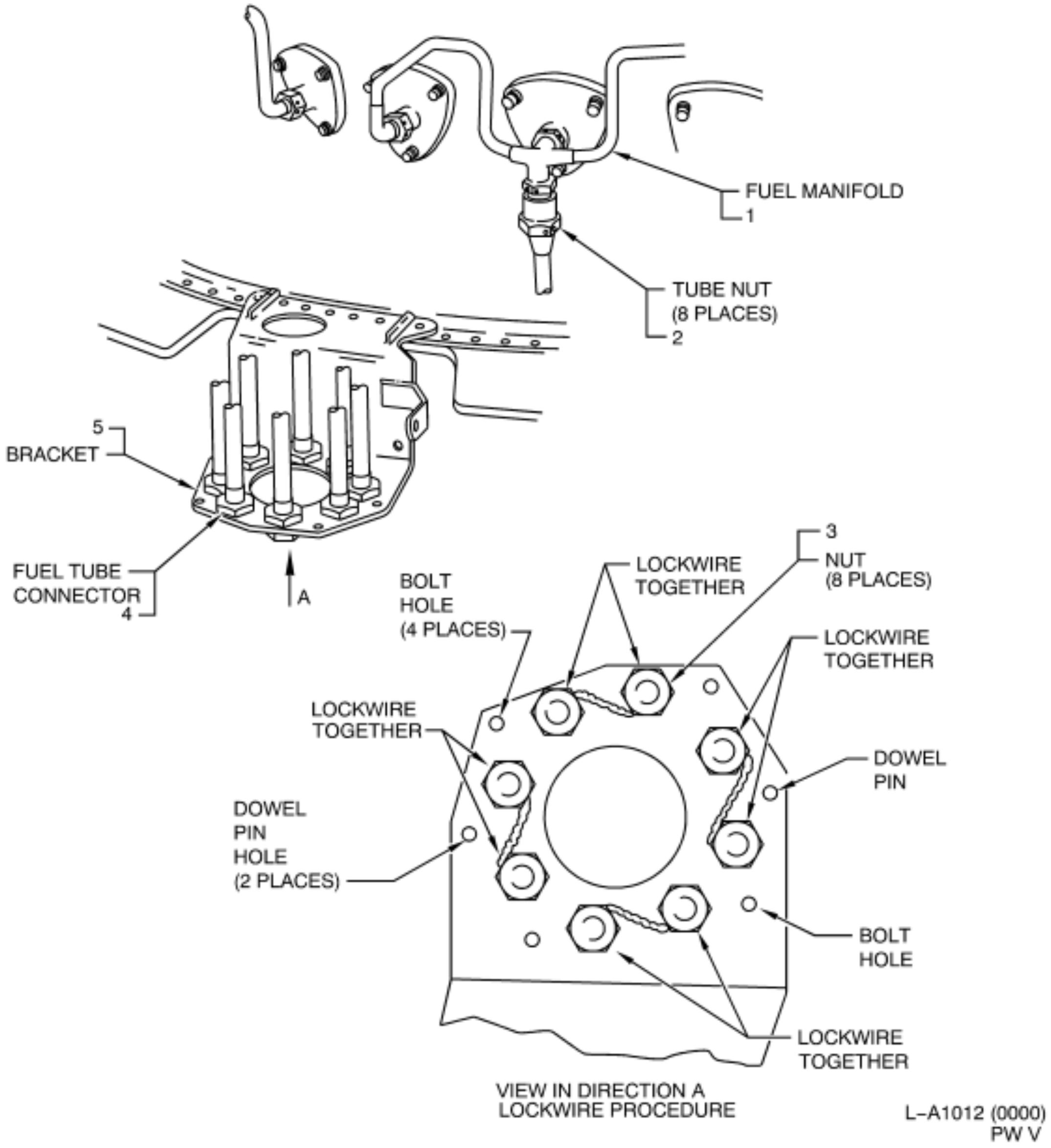

1
CLAMP
1
CLAMP
BOLT
10
9
BRACKET
NUT
2
8
FLANGE K
HOLE 81
HOLE 80
(PRE SB PW4ENG 72-397)


BOLT
10
1
CLAMP
1
CLAMP
BOLT
10
9
BRACKET
NUT
2
NUT
2
HOLE 80
8
FLANGE K
HOLE 81
(POST SB PW4ENG 72-397)
L-A0974 (0891)
PW V

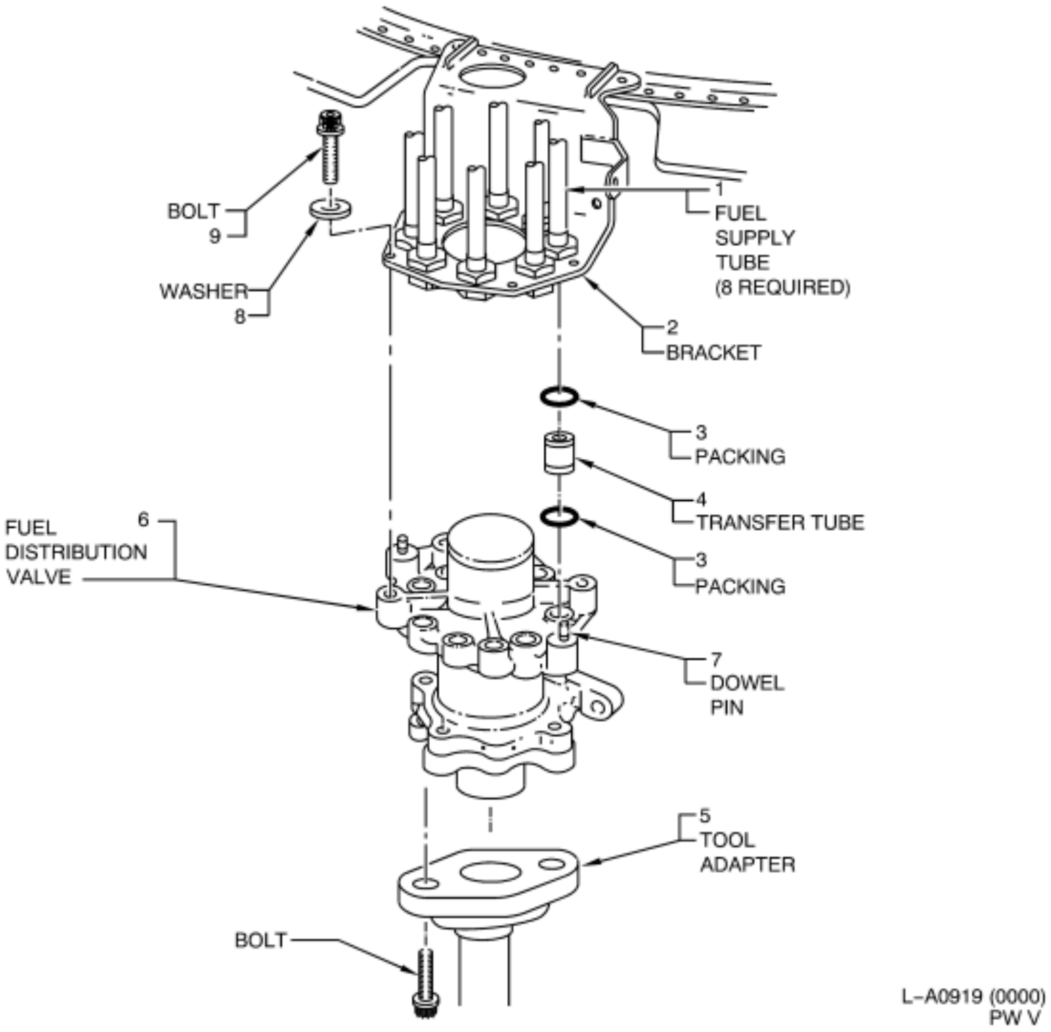
Diffuser Case Flange K
Figure 1005 (Sheet 1)
(Task 72-41-00-400-003)


3
BOLT
7
BRACKET
4
CLAMP
5
NUT
HOLE 119
6
FLANGE K
HOLE 118
L-A7405

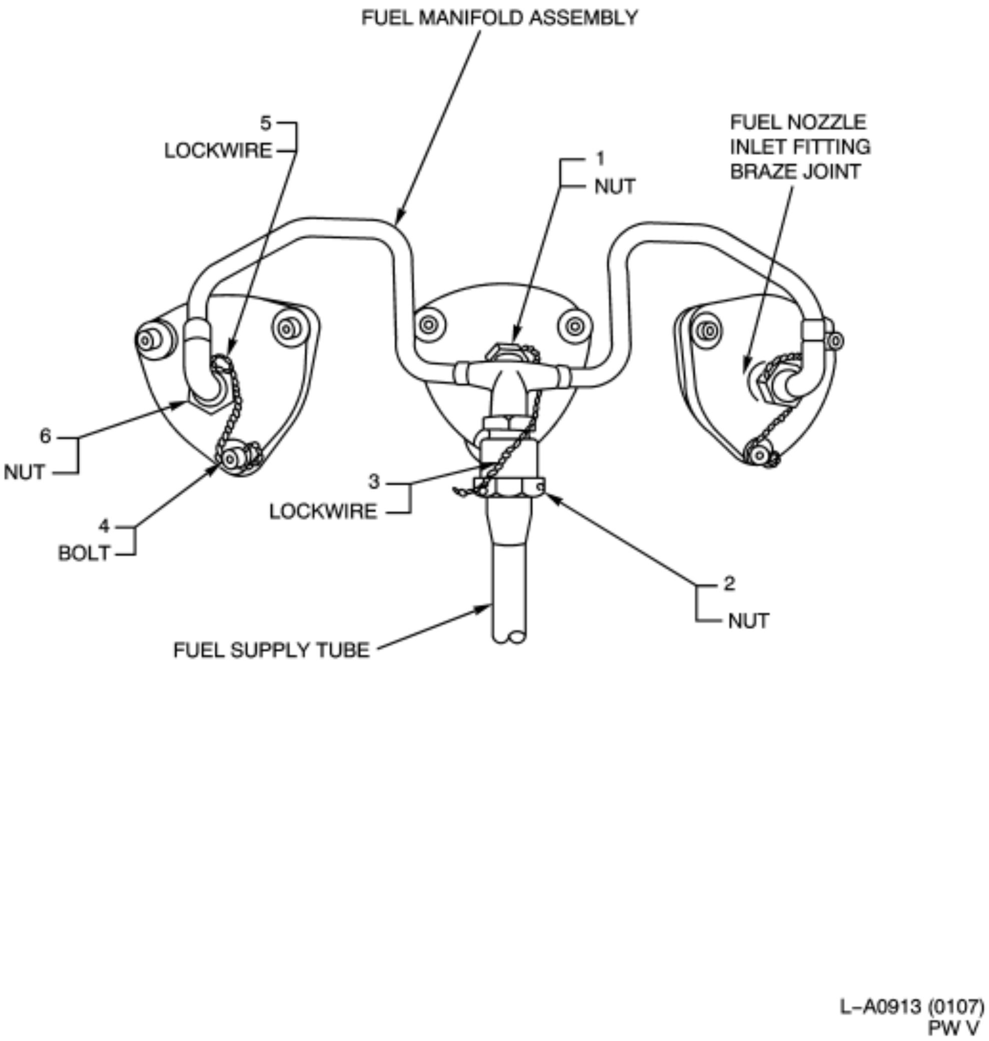
Diffuser Case Flange K
Figure 1005 (Sheet 2)
(Task 72-41-00-400-003)


FUEL MANIFOLD
1
TUBE NUT
(8 PLACES)
2
5
BRACKET
FUEL TUBE
CONNECTOR
4
A
BOLT
HOLE
(4 PLACES)
LOCKWIRE
TOGETHER
3
NUT
(8 PLACES)
LOCKWIRE
TOGETHER
LOCKWIRE
TOGETHER
DOWEL
PIN
DOWEL
PIN
HOLE
(2 PLACES)
BOLT
HOLE
LOCKWIRE
TOGETHER
VIEW IN DIRECTION A
LOCKWIRE PROCEDURE
L−A1012 (0000)
PW V

Diffuser Case Flange K Lockwire Procedure
Figure 1006
(Task 72−41−00−400−003)


BOLT
9
WASHER
8
1
FUEL SUPPLY TUBE (8 REQUIRED)
2
BRACKET
3
PACKING
4
TRANSFER TUBE
3
PACKING
FUEL DISTRIBUTION VALVE
6
7
DOWEL PIN
5
TOOL ADAPTER
BOLT
L-A0919 (0000)
PW V

Fuel Distribution Valve Installation
Figure 1007
(Task 72-41-00-400-003)


FUEL MANIFOLD ASSEMBLY
5
LOCKWIRE
1
NUT
FUEL NOZZLE
INLET FITTING
BRAZE JOINT
6
NUT
4
BOLT
3
LOCKWIRE
2
NUT
FUEL SUPPLY TUBE
L–A0913 (0107)
PW V

Fuel Manifold And Tube Lockwire Procedure
Figure 1008
(Task 72–41–00–400–003)

Task 72-41-00-400-002-002:

1. Assemble No. 3 Bearing Duct And Housing Including Bearing Outer Race - (Mechanical Wrench Method)

NOTE: To assemble No. 3 bearing duct and housing by means of hydraulic wrench method, see Assembly-02 Task 72-41-00-400-002-001.

NOTE: For alternate procedure not requiring installation of No. 3 bearing outer race, outer race installed after diffuser combustor group is installed into HPC, see Assembly-05 Task 72-41-00-400-004.

A. Prerequisites

(1) See Inspection/Check-04 Task 72-41-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a referenced number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:

PWA 29754	Control
PWA 29855-3	Pin
PWA 29855-5	Pin (Two Required)
PWA 45418	Wrench, Mechanical*
PWA 45419	Multiplier, Pneumatic*
PWA 80071	Multiplier, Torque*
PWA 80187	Wrench, Mechanical*
PWA 80651	Multiplier, Pneumatic*
PWA 85048	Base
PWA 85049	Drift
PWA 85053	Wrench, Torque*
PWA 85054	Adapter, Holding*
PWA 85056	Cover (Optional To PWA 85802)
PWA 85057	Storage Stand
PWA 85167	Adapter
PWA 85199	Fixture
PWA 85375	Plate, Anchor*
PWA 85541	Wrench
PWA 85542	Wrench
PWA 85679	Heater (Optional To PWA 85795)
PWA 85795	Heater
PWA 85802	Cover
PWA 85901	Riveter
PWA 86546	Adapter (Optional To PWA 85199)

DIFFUSER AND COMBUSTOR - ASSEMBLY-04

Special Tools:

(CONTINUED)

PWA 88100	Plate, Anchor*

*Refer to Table 1001 for tool options. Only Table 1001 shows the correct combinations of tools for the installation of the No. 3 bearing (outer race) retaining nut.

NOTE: The PWA 86546 Adapter is an optional tool that will permit PWA 85167 Adapter to be mounted to an approved bench positioner when the electric motorized PWA 85199 Fixture is not available.

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-026	Ink (Marking) (PMC 4057-1)
P05-395	Beeswax
P05-396	Paraffin Wax Blend

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	2	72-41-00/9/10
Gasket	1	72-41-00/9/5
Gasket	1	72-41-00/10/160
Gasket	9	72-41-00/9/160
Key Washer	2	72-41-00/10/80
Key Washer	4	72-41-00/10/10
Key Washer	3	72-41-00/10/140
Rivet	1	72-41-00/12/40
Seal Ring	1	72-41-00/9/185
Seal Ring	2	72-41-00/9/195

C. Procedure

Subtask 72-41-00-430-071:

(1) Install No. 3 bearing outer race. See Figure 1001.

(a) Using hoist, place PWA 85048 Base (1001/3) on bench. Remove base lifting eye and screw into storage hole on OD of base.

(b) Install No. 3 bearing housing (1001/2), threaded ID up, aligning four pins in PWA 85048 Base (1001/3) with bolt holes in housing (1001/2).

(c) Locate two dimples on top surface (1001/6) of No. 3 bearing housing (1001/2) threaded ID. Mark a line between the dimples using Ink P05−026.

(d) Install PWA 85679 or PWA 85795 Heater (1001/7) to rear flange of housing (1001/2). Connect power and thermocouple cables to PWA 29754 Control or equivalent (1001/1).

(e) Set heater (1001/7) to 300°F (149°C) and heat housing (1001/2) for fifty five to sixty minutes.

(f) Wearing clean gloves, place No. 3 bearing assembly on clean waxed paper on bench.

(g) Separate outer race (1001/4) from inner race and rollers (1001/5) and place them, serial number up on bench.

(h) Verify bearing inner and outer race serial numbers are the same.

(i) Place bearing inner race and rollers (1001/5) in sealed container and retain with diffuser case for future installation.

(j) Turn off heater (1001/7). Disconnect control (1001/1) and remove heater (1001/7) from housing (1001/2).

(k) Install No. 3 bearing outer race (1002/2) into housing (1002/3) with serial number up and aligning "X" on outer race (1002/2) with ink mark (1002/4) on housing (1002/3). See Figure 1002.

(l) With PWA 85049 Drift (1002/1) and standard arbor press, drift outer race (1002/2) into housing (1002/3) and seat.

(m) Using feeler gage verify outer race (1002/2) is seated in housing (1002/3).

DIFFUSER AND COMBUSTOR − ASSEMBLY−04

CAUTION: A NEW OR RE−SILVER PLATED NO. 3 BEARING (OUTER RACE) RETAINING NUT MUST BE INSTALLED AT EACH INSTALLATION OR DAMAGE TO MATING PARTS MAY OCCUR. NUT MAY BE RE−SILVER PLATED BY 72−41−83, REPAIR−01 PW4000 Series CIR, PN 51A357.

(2) Install the No. 3 bearing (outer race) retaining nut as follows. Refer to Table 1001 for the correct combinations of tools. Refer to Figure 1003.

PWA Hand Wrench or Torque Wrench	PWA Wrench Adapter or Holding Adapter	PWA Mechanical Wrench or Torque Multiplier	PWA Pneumatic Multiplier	PWA Plate Holder or Anchor Plate
85053	85054	80187	80651 or 45419	88100 or 85375
85053	85054	45418	45419	88100 or 85375
85053	85054	80071	80651 or 45419	88100

Matrix Of Tools Used To Install The
No. 3 Bearing (Outer Race) Retaining Nut
Table 1001

(a) Lubricate No. 3 bearing (outer race) retaining nut (1003/8) with Engine Oil P03−001. See Figure 1003.

(b) Install retaining nut (1003/8) in housing (1003/6) with slots up. Handtighten.

(c) Install PWA 85054 Wrench Adapter (1003/9), spline end up over the pilot of PWA 85048 Base (1003/5) and rotate to engage the four slots with the four keys of the base (1003/5).

(d) Install PWA 85053 Torque Wrench (1003/10) over PWA 85054 Wrench Adapter (1003/9) engaging the slots on the outer race retaining nut (1003/8).

(e) Install a mechanical wrench onto the torque wrench.

DIFFUSER AND COMBUSTOR − ASSEMBLY−04

CAUTION: PWA 80651 MULTIPLIER MUST NOT BE USED WITH PWA 45418 WRENCH OR DAMAGE TO WRENCH CAN OCCUR.

(f) Install an anchor plate (1003/1) over the adapter and engage the splines. Align and engage the two holes in the anchor plate with the two pins of the mechanical wrench. Wrenches can be actuated by use of a pneumatic multiplier.

CAUTION: TO AVOID INCORRECT TORQUE READING, RETAINING NUT (1003/6) MUST NOT BE TORQUED UNTIL NO. 3 BEARING HOUSING (1003/3) HAS RETURNED TO ROOM TEMPERATURE. SHOP AIR MAY BE USED FOR COOLING. DO NOT USE DRY ICE.

CAUTION: NO. 3 BEARING (OUTER RACE) RETAINING NUT MUST BE RE−SILVER PLATED AFTER TORQUING NUT A MAXIMUM OF THREE TIMES FOR EACH INSTALLATION PRIOR TO ENGINE BEING OPERATED. NUT MAY BE RE−SILVER PLATED BY 72−41−83, REPAIR−01 PW4000 Series CIR, PN 51A357.

(g) (Reference 975) Torque retaining nut (1003/6) to 3600 − 4400 lb−in. (406.745 − 497.133 N.m). Turn through angle of 16° − 17° 30'. Loosen to 0 lb−in. (0 N.m) then repeat torque sequence, aligning one rivet hole in retaining nut (1003/8) with one rivet hole in housing (1003/6).

(h) Remove the tools from the nut.

(i) Install rivet (1003/7) into aligned holes in housing (1003/6) and retaining nut (1003/8) and with PWA 85901 Hand Riveter, flare rivet (1003/7) to secure. See Chapter/Section 70−43, Standard Practices Manual, PN 585005.

(j) Remove housing assembly (1003/6) from base (1003/5) and place on clean paper, on bench large OD up.

(k) Position PWA 85802 or PWA 85056 Protective Cover (1003/4) over retaining nut (1003/8) installed in housing (1003/6). If PWA 85056 Protective Cover is used, slowly rotate cover until the three spring plungers seat in holes in retaining nut.

Subtask 72−41−00−430−072:

(3) Assemble No. 3 bearing front (carbon) seal assembly and housing and outer race. See Figure 1004.

(a) Install No. 3 bearing housing and outer race (1004/7) small ID down into PWA 85167 Adapter (1004/6) mounted on PWA 85199 Bench Fixture (1004/4). Secure housing (1004/7) with six bolts (1004/12) wrench tight.

(b) Rotate housing (1004/7) and adapter (1004/6) so small OD is facing up.

(c) Place No. 3 bearing front (carbon) seal assembly (1004/1) on bench large OD up. Locate three hole pad inside seal assembly (1004/1).

(d) Install No. 3 bearing nozzle assembly (1004/11) small nozzle toward carbon seal. Secure fingertight with three key washers (1004/9) and bolts (1004/10) lubricated with Engine Oil P03−001.

(e) Torque bolts (1004/10) 65 − 85 lb−in. (7.344 − 9.604 N.m).

(f) Bend tabs on key washers (1004/9) to secure bolts (1004/10), see locking devices 70−53, Standard Practices Manual, PN 585005.

(g) Install gasket (1004/2) to inner flange on bearing housing (1004/7).

(h) Install two PWA 29855−3 Guide Pins (1004/8) 180 degrees apart to seal assembly (1004/1) flange.

(i) Install seal assembly (1004/1) to housing (1004/7) aligning offset holes. Secure with eight work bolts (1004/3) lubricated with Engine Oil P03−001, placed on each side of four countersunk screw holes fingertight. Rotate seal assembly and housing large OD up and tighten work bolts in a 180 degrees pattern until seal assembly is fully seated against housing. Ensure all bolt holes are aligned.

(j) Remove guide pins (1004/8).

(k) Install four screws (1004/5) lubricated with Engine Oil P03−001, to countersunk holes in housing (1004/7).

(l) Torque screws (1004/5) 22 − 85 lb−in. (2.486 − 9.604 N.m) loosen and retorque 22 − 85 lb−in. (2.486 − 9.604 N.m).

(m) Remove eight work bolts (1004/3) from flange.

Subtask 72−41−00−430−073:

(4) Assemble No. 3 bearing front cooling duct assembly and No. 3 bearing seal assembly and housing. See Figure 1005.

(a) Rotate seal assembly and housing large OD down.

(b) Chill No. 3 bearing front cooling duct assembly (1005/8) for five to ten minutes.

(c) Install nine gaskets (1005/7) to nine washers (1005/6), lightly waxed in place with Beeswax P05−395 or Paraffin Wax Blend P05−396. Lubricate nine bolts (1005/5) with Engine Oil P03−001.

(d) Install two large gaskets (1005/11) to bosses on seal assembly (1005/9), below threaded portion. Lightly wax in place with Beeswax P05−395 or Paraffin Wax Blend P05−396.

(e) Install one small gasket (1005/10) to boss on seal housing (1005/9) below threaded portion. Lightly wax in place with Beeswax P05−395 or Paraffin Wax Blend P05−396.

(f) Install two PWA 29855−5 Guide Pins (1005/12) 180 degrees apart in seal assembly (1005/9).

(g) Install seal ring (1005/2) to ring groove on OD of one nut (1005/1) and lubricate nut threads with Engine Oil P03−001. Place nut aside.

(h) Install seal ring (1005/3) to ring groove on OD of two nuts (1005/4) and lubricate nut threads with Engine Oil P03−001. Place nuts aside.

(i) Install chilled duct assembly (1005/8) over seal assembly (1005/9) aligning nine bolt holes and three large bosses. Lightly tap to seat.

NOTE: Do not disturb gaskets (1005/10) and (1005/11) on seal assembly (1005/9) bosses.

(j) Remove two guide pins (1005/12).

(k) Secure cooling duct assembly (1005/8) with nine bolts (1005/5), washers (1005/6) and gaskets (1005/7) fingertight.

(l) Install two previously assembled nuts (1005/4) and seal rings (1005/3), slotted face up to seal assembly (1005/9) handtight.

(m) Install one previously assembled nut (1005/1) and seal ring (1005/2) slotted face up to seal assembly (1005/9) handtight.

(n) Torque nine bolts (1005/5) 85 − 95 lb−in. (9.604 − 10.734 N.m).

(o) (Reference 409) With PWA 85541 Wrench torque two large nuts (1005/4) 850 − 900 lb−in. (96.037 − 101.686 N.m).

(p) (Reference 408) With PWA 85542 Wrench torque one small nut (1005/1) 675 − 725 lb−in. (76.265 − 81.914 N.m).

(q) Install lock (1005/13) over larger nut (1005/4) at two locations. Position lock to align holes in lock with four holes in boss on seal assembly (1005/9).

(r) Install lock (1005/14) over small nut (1005/1) at one location. Position lock to align holes in lock with four holes in boss on seal assembly (1005/9).

(5) Install No. 3 bearing elbow assembly.

(a) Install elbow (1006/7) to seal assembly (1006/9) engaging lug on elbow (1006/7) with clevis on seal assembly (1006/9). Secure with two key washers (1006/6) and two bolts (1006/5) lubricated with Engine Oil P03−001. Do not run down bolts (1006/5). See Figure 1006.

(b) Install heat shield assembly (1006/13) between elbow (1006/7) and seal assembly (1006/9). Position key washer (1006/6) tabs into elbow (1006/7) and secure bolts (1006/5) fingertight.

(c) Secure elbow lug to clevis on seal assembly (1006/9) with bolt (1006/8), lubricated with Engine Oil P03−001, and nut (1006/12).

(d) Torque bolts (1006/5) 75 − 85 lb−in. (8.474 − 9.604 N.m).

(e) Torque nut (1006/12) 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Bend tabs on key washers (1006/6) to secure bolts (1006/3), see locking devices, 70−53, Standard Practices Manual, PN 585005.

(g) Install heat shield assembly (1006/4) over elbow (1006/7) aligning slot with elbow lug.

(h) Install shield (1006/3) over heat shield assembly (1006/4) aligning bolt holes. Secure with four key washers (1006/2) and four bolts (1006/1) lubricated with Engine Oil P03−001.

(i) Torque bolts (1006/1) 32 − 36 lb−in. (3.616 − 4.067 N.m).

NOTE: Smaller tab on key washers (1006/2) to be down over edge of shield (1006/3).

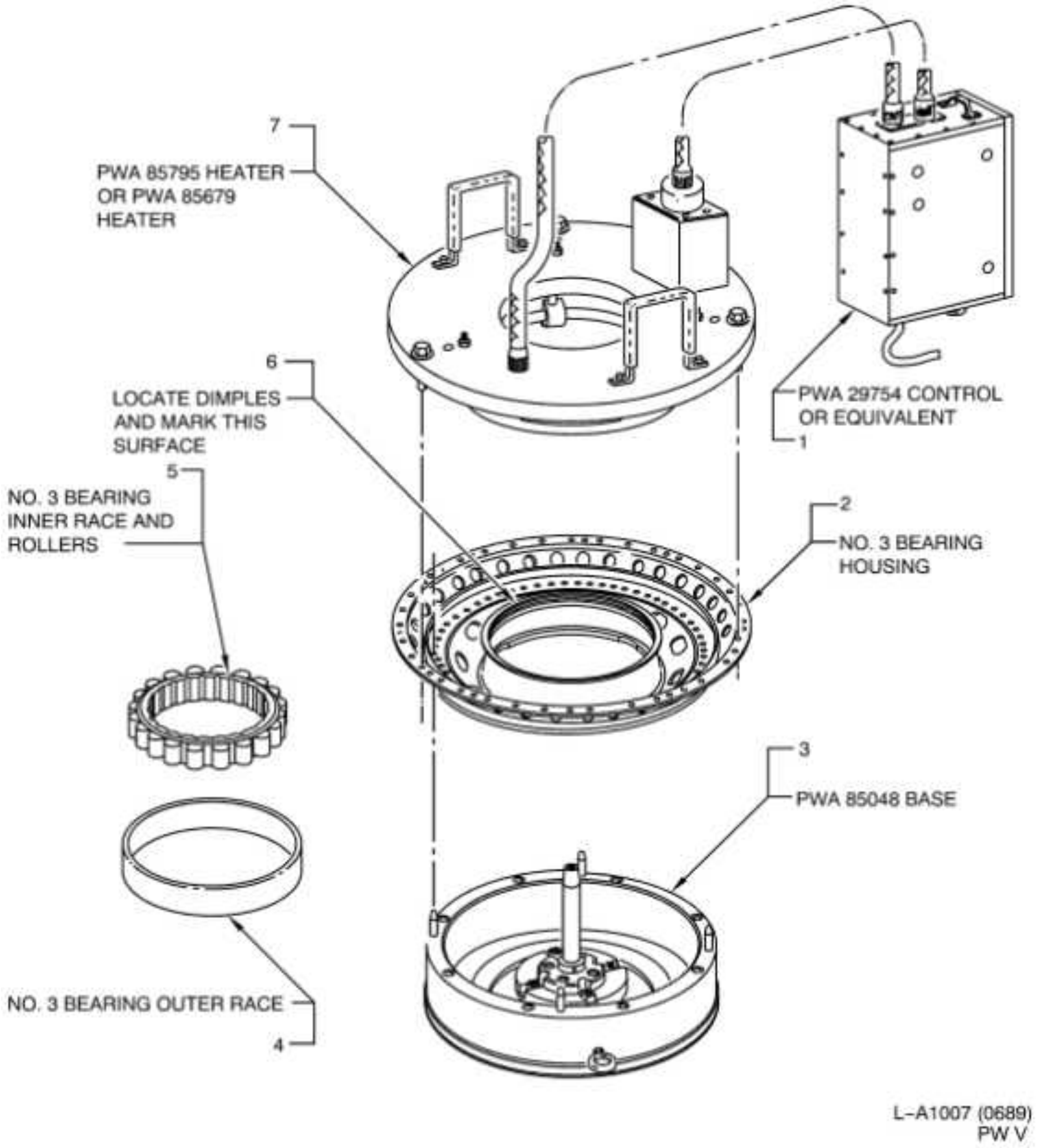
(j) Bend tabs of key washers (1006/2) to secure heat shield to seal assembly (1006/9). See locking devices, 70−53, Standard Practices Manual, PN 585005.

(k) Rotate Adapter (PWA 85167) (1006/11) on Bench Fixture (PWA 85199) (1006/10) so seal assembly (1006/9) is large OD up. Remove assembly from adapter and place on bench.

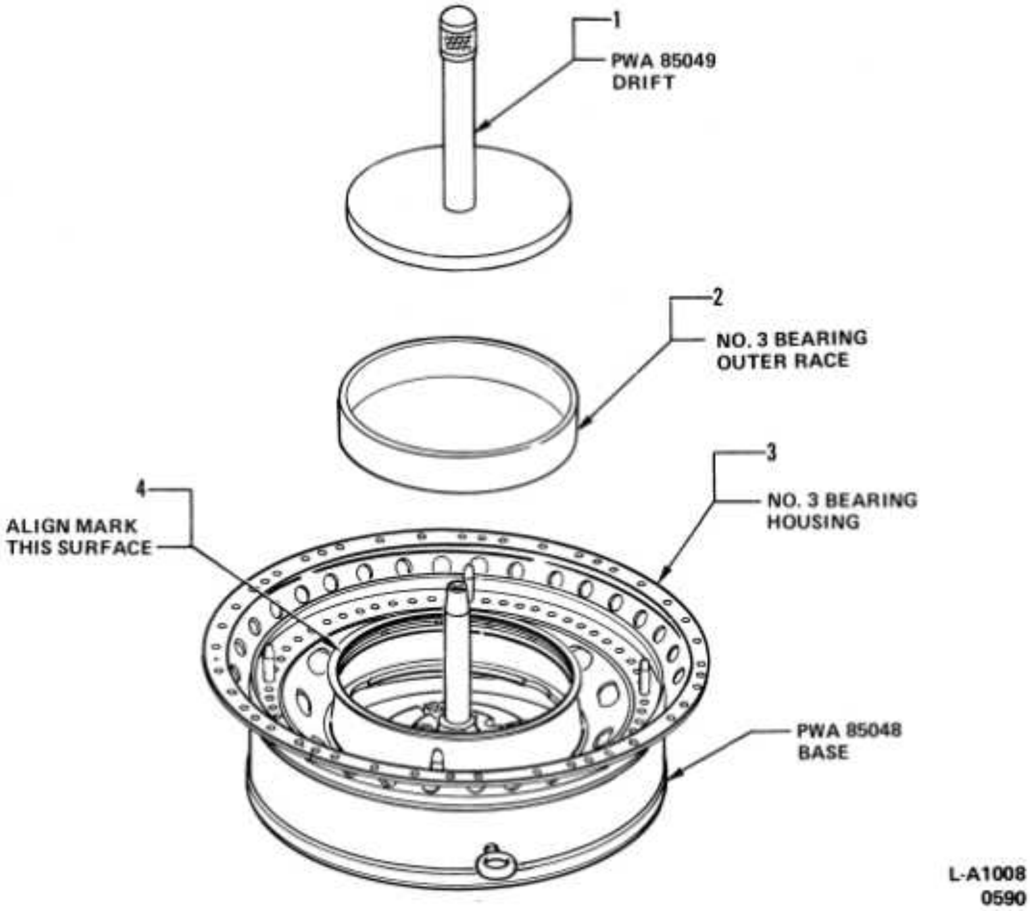
(l) Cover seal assembly with plastic and place in PWA 85057 Storage Stand.

D. Postrequisites

(1) For assembly of diffuser and combustor internals, see Assembly-01 Task 72-41-00-400-001.


7
PWA 85795 HEATER OR PWA 85679 HEATER
6
LOCATE DIMPLES AND MARK THIS SURFACE
5
NO. 3 BEARING INNER RACE AND ROLLERS
PWA 29754 CONTROL OR EQUIVALENT
1
2
NO. 3 BEARING HOUSING
3
PWA 85048 BASE
NO. 3 BEARING OUTER RACE
4
L-A1007 (0689)
PW V

No. 3 Bearing Outer Race Installation
Figure 1001
(Task 72-41-00-400-002-002)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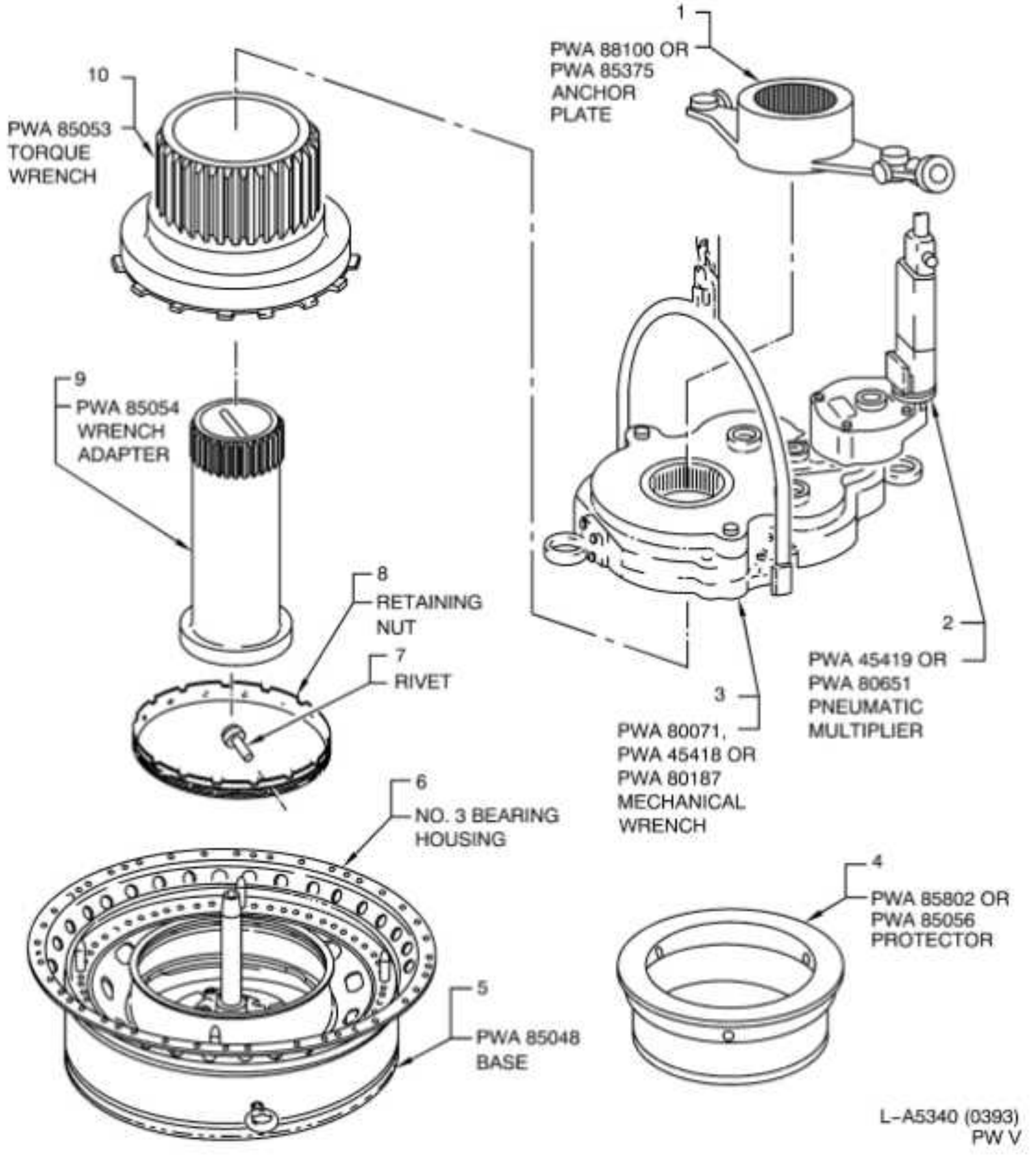
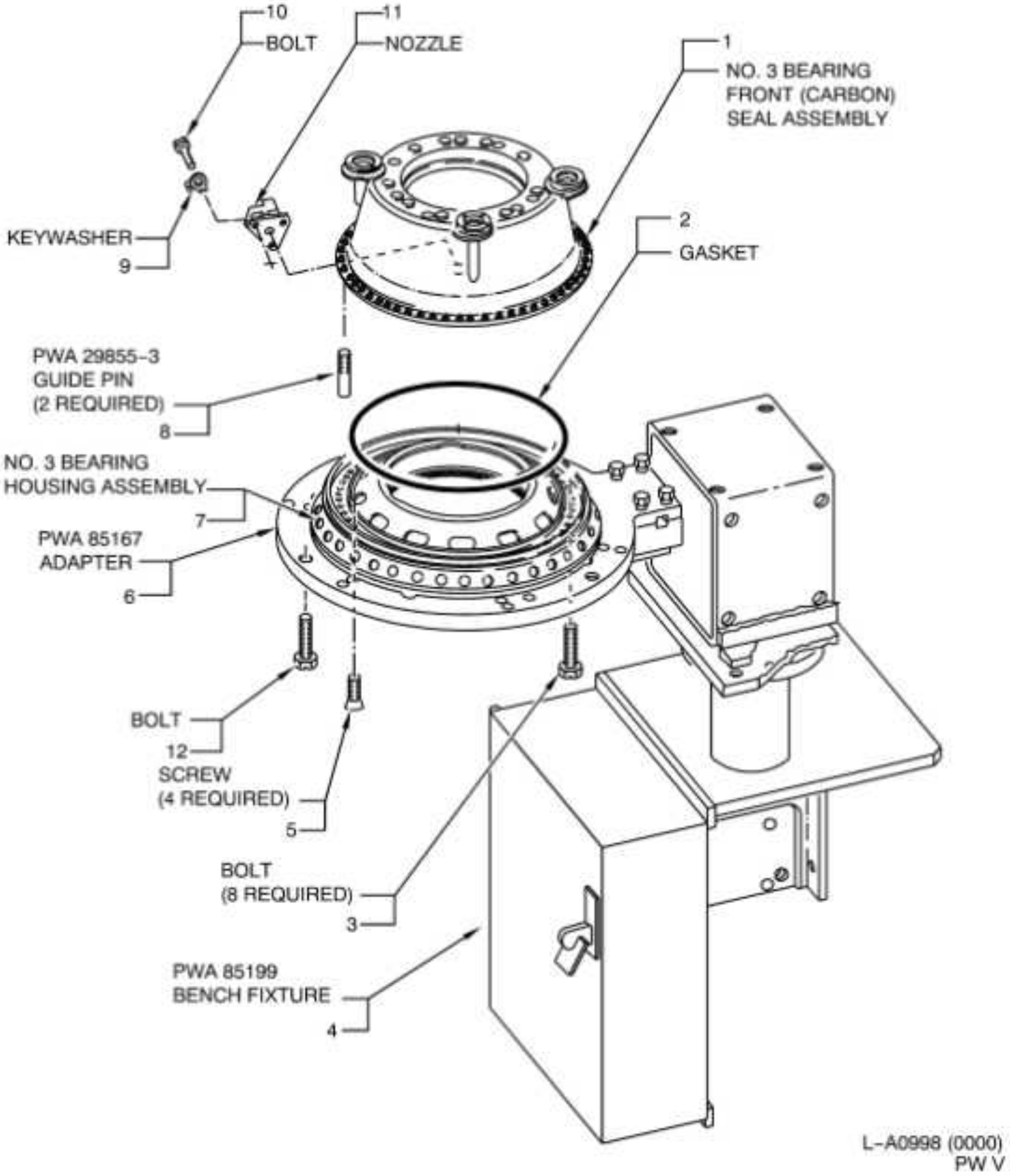
PWA 85049
DRIFT
2
NO. 3 BEARING
OUTER RACE
3
NO. 3 BEARING
HOUSING
4
ALIGN MARK
THIS SURFACE
PWA 85048
BASE
L-A1008
0590

No. 3 Bearing Outer Race Installation
Figure 1002
(Task 72-41-00-400-002-002)


1
PWA 88100 OR
PWA 85375
ANCHOR
PLATE
10
PWA 85053
TORQUE
WRENCH
9
PWA 85054
WRENCH
ADAPTER
8
RETAINING
NUT
7
RIVET
2
PWA 45419 OR
PWA 80651
PNEUMATIC
MULTIPLIER
3
PWA 80071,
PWA 45418 OR
PWA 80187
MECHANICAL
WRENCH
6
NO. 3 BEARING
HOUSING
4
PWA 85802 OR
PWA 85056
PROTECTOR
5
PWA 85048
BASE
L−A5340 (0393)
PW V

No. 3 Bearing Retaining Nut Installation
Figure 1003
(Task 72−41−00−400−002−002)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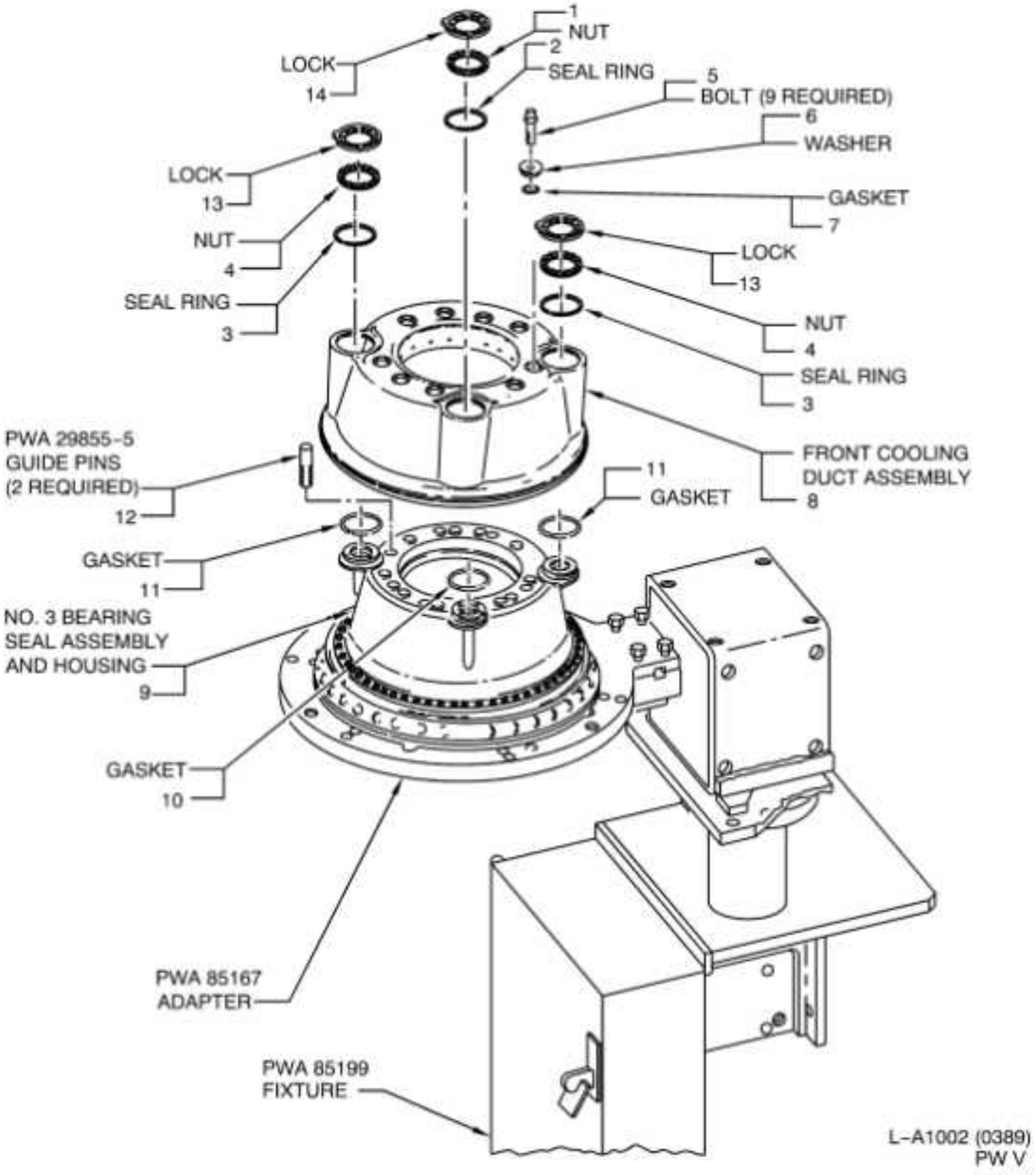
BOLT
11
NOZZLE
1
NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY
KEYWASHER
9
2
GASKET
PWA 29855-3 GUIDE PIN (2 REQUIRED)
8
NO. 3 BEARING HOUSING ASSEMBLY
7
PWA 85167 ADAPTER
6
BOLT
12
SCREW (4 REQUIRED)
5
BOLT (8 REQUIRED)
3
PWA 85199 BENCH FIXTURE
4
L-A0998 (0000)
PW V

No. 3 Bearing Front (Carbon) Seal Assembly Installation
Figure 1004
(Task 72-41-00-400-002-002)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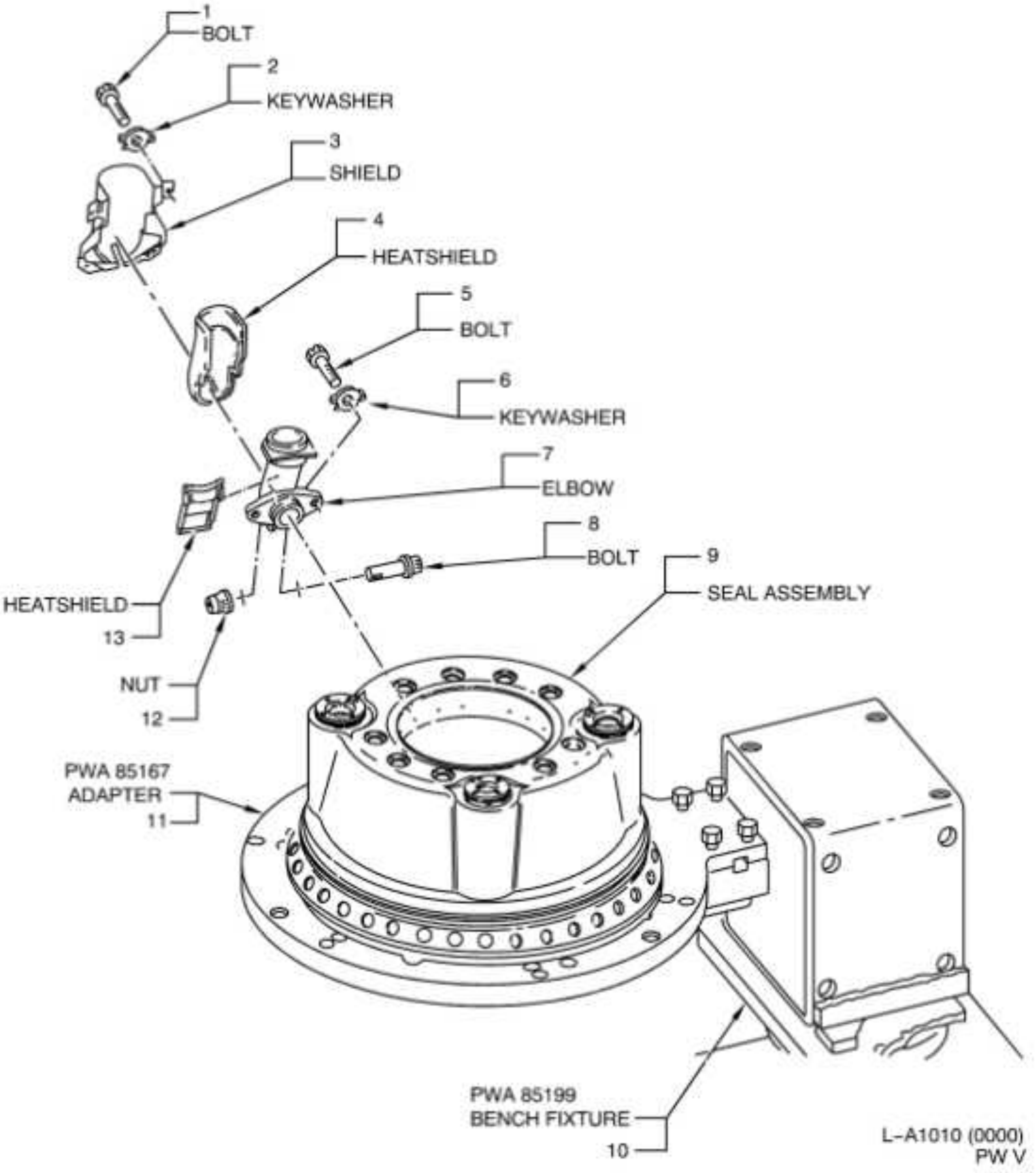
NUT
2
SEAL RING
LOCK
14
5
BOLT (9 REQUIRED)
6
WASHER
LOCK
13
GASKET
7
NUT
4
LOCK
13
SEAL RING
3
NUT
4
SEAL RING
3
PWA 29855-5
GUIDE PINS
(2 REQUIRED)
12
FRONT COOLING
DUCT ASSEMBLY
8
11
GASKET
GASKET
11
NO. 3 BEARING
SEAL ASSEMBLY
AND HOUSING
9
GASKET
10
PWA 85167
ADAPTER
PWA 85199
FIXTURE
L-A1002 (0389)
PW V

No. 3 Bearing Front Cooling Duct Installation
Figure 1005
(Task 72-41-00-400-002-002)


1
BOLT
2
KEYWASHER
3
SHIELD
4
HEATSHIELD
5
BOLT
6
KEYWASHER
7
ELBOW
8
BOLT
9
SEAL ASSEMBLY
HEATSHIELD
13
NUT
12
PWA 85167
ADAPTER
11
PWA 85199
BENCH FIXTURE
10
L-A1010 (0000)
PW V

No. 3 Bearing Elbow Assembly Installation
Figure 1006
(Task 72-41-00-400-002-002)

Task 72-41-00-400-004:

1. Assemble No. 3 Bearing Duct And Housing - Procedure Not Requiring No. 3 Bearing Outer Race Installation

NOTE: For alternate procedure utilizing installation of No. 3 bearing outer race into diffuser combustor group before being installed onto HPC, See Assembly-02 Task 72-41-00-400-002-001 or Assembly-04 Task 72-41-00-400-002-002.

A. Prerequisites

(1) See Inspection/Check-04 Task 72-41-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a referenced number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:

PWA 29855-3	Pin
PWA 29855-5	Pin (Two Required)
PWA 85057	Storage Stand
PWA 85167	Adapter
PWA 85199	Fixture
PWA 85541	Wrench
PWA 85542	Wrench
PWA 86546	Adapter (Optional To PWA 85199)

NOTE: The PWA 86546 Adapter is an optional tool that will permit PWA 85167 Adapter to be mounted to an approved bench positioner when the electric motorized PWA 85199 Fixture is not available.

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-395	Beeswax
P05-396	Paraffin Wax Blend

DIFFUSER AND COMBUSTOR − ASSEMBLY−05

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	2	72−41−00/9/10
Gasket	1	72−41−00/9/5
Gasket	1	72−41−00/10/160
Gasket	9	72−41−00/9/160
Key Washer	2	72−41−00/10/80
Key Washer	4	72−41−00/10/10
Key Washer	3	72−41−00/10/140
Seal Ring	1	72−41−00/9/185
Seal Ring	2	72−41−00/9/195

C. Procedure

Subtask 72−41−00−430−074:

(1) Assemble No. 3 bearing front (carbon) seal assembly and housing. See Figure 1001.

(a) Install No. 3 bearing housing, (1001/7) small ID down into PWA 85167 Adapter (1001/6) mounted on PWA 85199 Bench Fixture (1001/4). Secure housing (1001/7) with six bolts (1001/12) wrench tight.

(b) Rotate housing (1001/7) and adapter (1004/6) so small OD is facing up.

(c) Place No. 3 bearing front (carbon) seal assembly (1001/1) on bench large OD up. Locate three hole pad inside seal assembly (1001/1).

(d) Install No. 3 bearing nozzle assembly (1001/11) small nozzle toward carbon seal. Secure fingertight with three key washers (1001/9) and bolts (1001/10) lubricated with Engine Oil P03−001.

(e) Torque bolts (1001/10) 65 − 85 lb−in. (7.344 − 9.604 N.m).

(f) Bend tabs on key washers (1001/9) to secure bolts (1001/10), see locking devices 70−53, Standard Practices Manual, PN 585005.

(g) Install gasket (1001/2) to inner flange on bearing housing (1001/7).

(h) Install two PWA 29855−3 Guide Pins (1001/8) 180 degrees apart to seal assembly (1001/1) flange.

(i) Install seal assembly (1001/1) to housing (1001/7) aligning offset holes. Secure with eight work bolts (1001/3) lubricated with Engine Oil P03−001, placed on each side of four countersunk screw holes fingertight. Rotate seal assembly and housing large OD up and tighten work bolts in a 180 degrees pattern until seal assembly is fully seated against housing. Ensure all bolt holes are aligned.

(j) Remove guide pins (1001/8).

(k) Install four screws (1001/5) lubricated with Engine Oil P03−001, to countersunk holes in housing (1001/7).

(l) Torque screws (1001/5) 22 − 85 lb−in. (2.486 − 9.604 N.m) loosen and retorque 22 − 85 lb−in. (2.486 − 9.604 N.m).

(m) Remove eight work bolts (1001/3) from flange.

Subtask 72−41−00−430−075:

(2) Assemble No. 3 bearing front cooling duct assembly and No. 3 bearing seal assembly and housing. See Figure 1002.

(a) Rotate seal assembly and housing large OD down.

(b) Chill No. 3 bearing front cooling duct assembly (1002/8) for five to ten minutes.

(c) Install nine gaskets (1002/7) to nine washers (1002/6), lightly waxed in place with Beeswax P05−395 or Paraffin Wax Blend P05−396. Lubricate nine bolts (1002/5) with Engine Oil P03−001.

(d) Install two large gaskets (1002/11) to bosses on seal assembly (1002/9), below threaded portion. Lightly wax in place with Beeswax P05−395 or Paraffin Wax Blend P05−396.

(e) Install one small gasket (1002/10) to boss on seal housing (1002/9) below threaded portion. Lightly wax in place with Beeswax P05−395 or Paraffin Wax Blend P05−396.

(f) Install two PWA 29855−5 Guide Pins (1002/12) 180 degrees apart in seal assembly (1002/9).

(g) Install seal ring (1002/2) to ring groove on OD of one nut (1002/1) and lubricate nut threads with Engine Oil P03−001. Place nut aside.

(h) Install seal ring (1002/3) to ring groove on OD of two nuts (1002/4) and lubricate nut threads with Engine Oil P03−001. Place nuts aside.

(i) Install chilled duct assembly (1002/8) over seal assembly (1002/9) aligning nine bolt holes and three large bosses. Lightly tap to seat.

NOTE: Do not disturb gaskets (1002/10) and (1002/11) on seal assembly (1002/9) bosses.

(j) Remove two guide pins (1002/12).

(k) Secure cooling duct assembly (1002/8) with nine bolts (1002/5), washers (1002/6) and gaskets (1002/7) fingertight.

(l) Install two previously assembled nuts (1002/4) and seal rings (1002/3), slotted face up to seal assembly (1002/9) handtight.

(m) Install one previously assembled nut (1002/1) and seal ring (1002/2) slotted face up to seal assembly (1002/9) handtight.

(n) Torque nine bolts (1002/5) 85 − 95 lb−in. (9.604 − 10.734 N.m).

(o) (Reference 409) Using PWA 85541 Wrench torque two large nuts (1002/4) 850 − 900 lb−in. (96.037 − 101.686 N.m).

(p) (Reference 408) Using PWA 85542 Wrench torque one small nut (1002/1) 675 − 725 lb−in. (76.265 − 81.914 N.m).

(q) Install lock (1002/13) over larger nut (1002/4) at two locations. Position lock to align holes in lock with four holes in boss on seal assembly (1002/9).

(r) Install lock (1002/14) over small nut (1002/1) at one location. Position lock to align holes in lock with four holes in boss on seal assembly (1002/9).

(3) Install No. 3 bearing elbow assembly. See Figure 1003.

(a) Install elbow (1003/7) to seal assembly (1003/9) engaging lug on elbow (1003/7) with clevis on seal assembly (1003/9). Secure with two key washers (1003/6) and two bolts (1003/5) lubricated with Engine Oil P03−001. Do not run down bolts (1003/5). See Figure 1003.

(b) Install heat shield assembly (1003/13) between elbow (1003/7) and seal assembly (1003/9). Position key washer (1003/6) tabs into elbow (1003/7) and secure bolts (1003/5) fingertight.

(c) Secure elbow lug to clevis on seal assembly (1003/9) with bolt (1003/8), lubricated with Engine Oil P03−001, and nut (1003/12).

(d) Torque bolts (1003/5) 75 − 85 lb−in. (8.474 − 9.604 N.m).

(e) Torque nut (1003/12) 85 − 95 lb−in. (9.604 − 10.734 N.m).

(f) Bend tabs on key washers (1003/6) to secure bolts (1003/3), see locking devices, 70−53, Standard Practices Manual, PN 585005.

(g) Install heat shield assembly (1003/4) over elbow (1003/7) aligning slot with elbow lug.

(h) Install shield (1003/3) over heat shield assembly (1003/4) aligning bolt holes. Secure with four key washers (1003/2) and four bolts (1003/1) lubricated with Engine Oil P03−001.

(i) Torque bolts (1003/1) 32 - 36 lb-in. (3.616 - 4.067 N.m).

NOTE: Smaller tab on key washers (1003/2) to be down over edge of shield (1003/3).

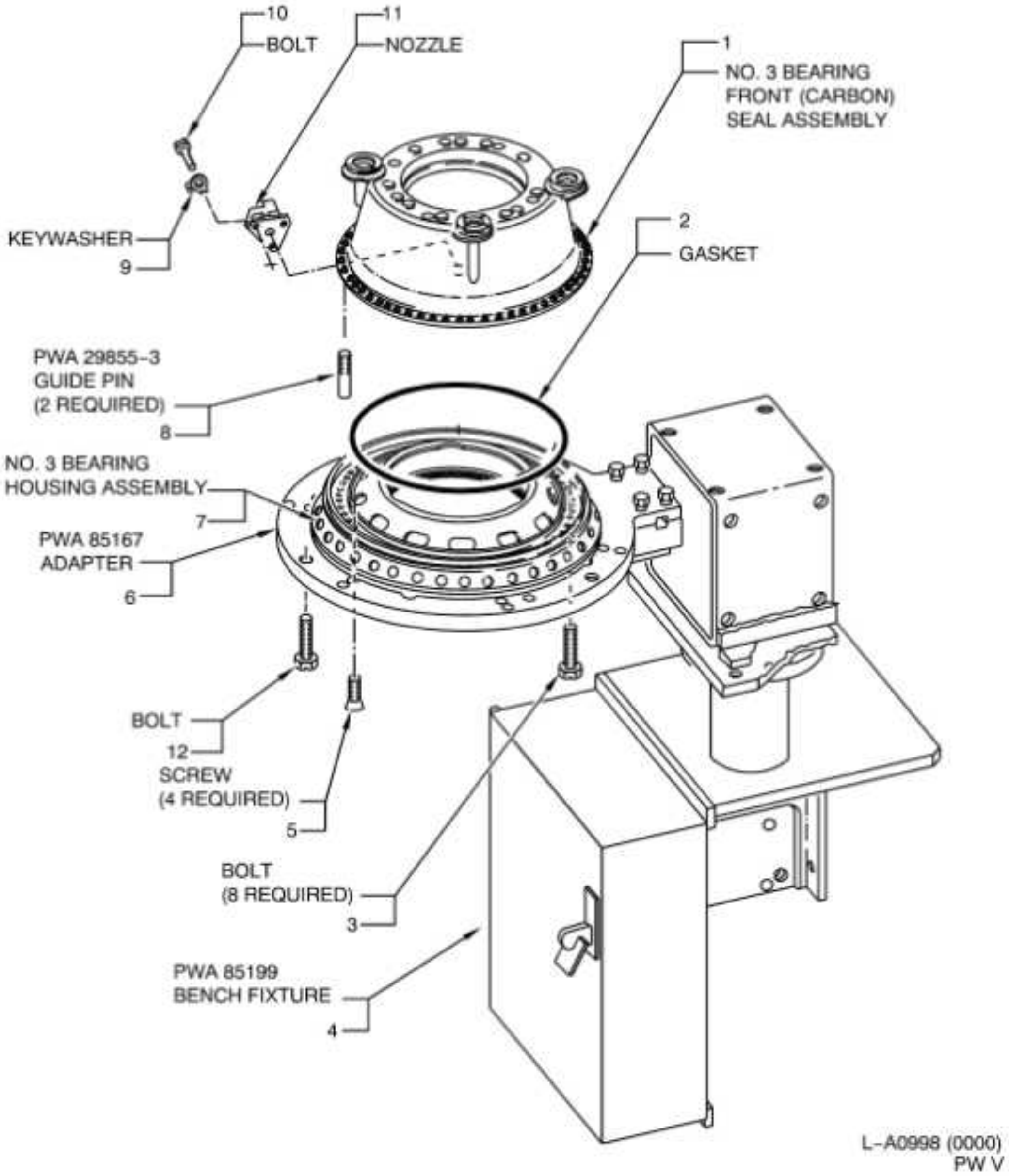
(j) Bend tabs of key washers (1003/2) to secure heat shield to seal assembly (1003/9). See locking devices, 70-53, Standard Practices Manual, PN 585005.

(k) Rotate Adapter (PWA 85167) (1003/11) on Bench Fixture (PWA 85199) (1003/10) so seal assembly (1003/9) is large OD up. Remove assembly from adapter and place on bench.

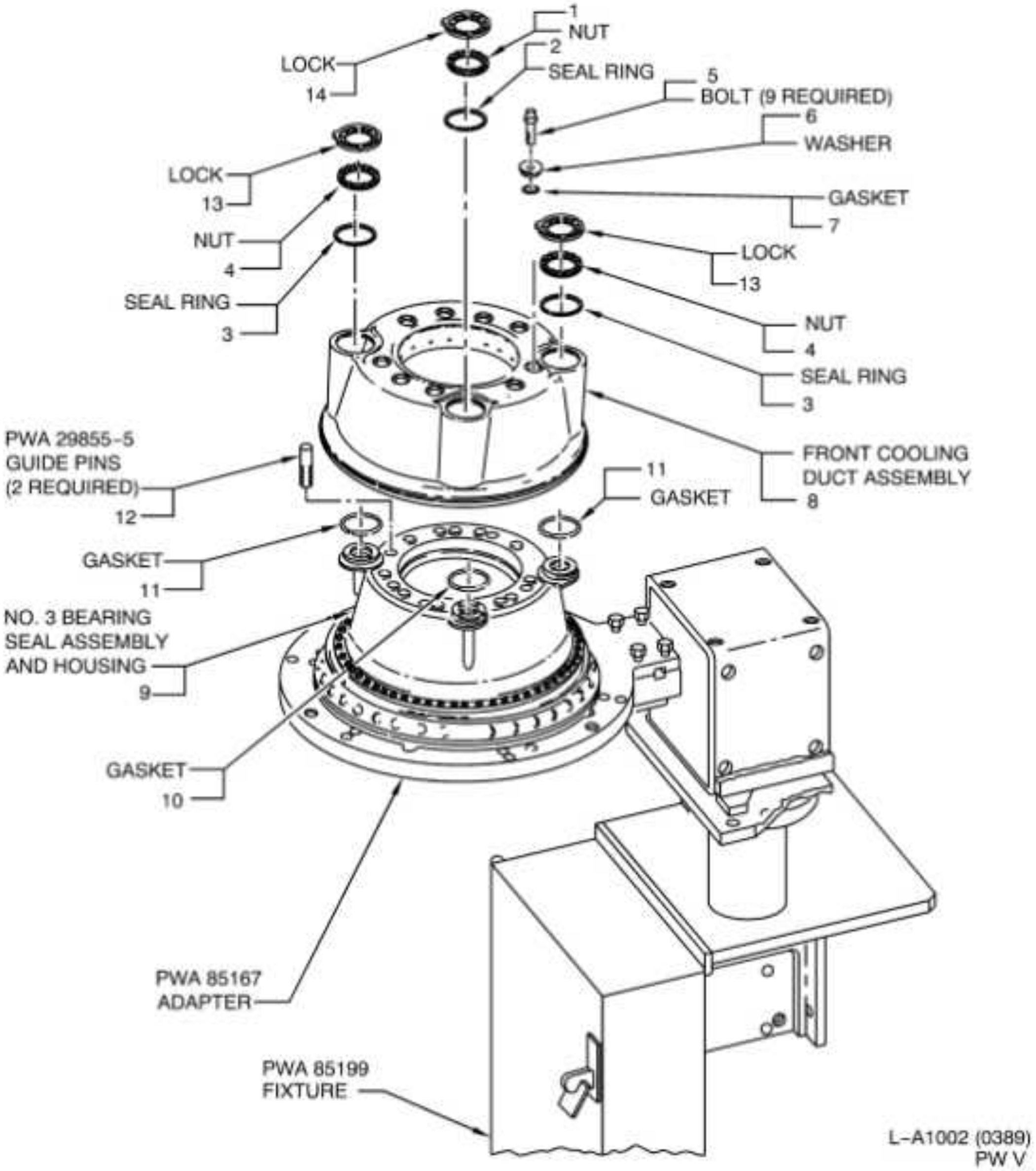
(l) Cover seal assembly with plastic and place in PWA 85057 Storage Stand.

D. Postrequisites

(1) See Assembly-01 Task 72-41-00-400-001 for assembly of diffuser and combustor internals.


10
BOLT
11
NOZZLE
1
NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY
KEYWASHER
9
2
GASKET
PWA 29855-3 GUIDE PIN (2 REQUIRED)
8
NO. 3 BEARING HOUSING ASSEMBLY
7
PWA 85167 ADAPTER
6
BOLT
12
SCREW (4 REQUIRED)
5
BOLT (8 REQUIRED)
3
PWA 85199 BENCH FIXTURE
4
L-A0998 (0000)
PW V

No. 3 Bearing Outer Race Installation
Figure 1001
(Task 72-41-00-400-004)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LOCK
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BOLT (9 REQUIRED)
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WASHER
LOCK
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GASKET
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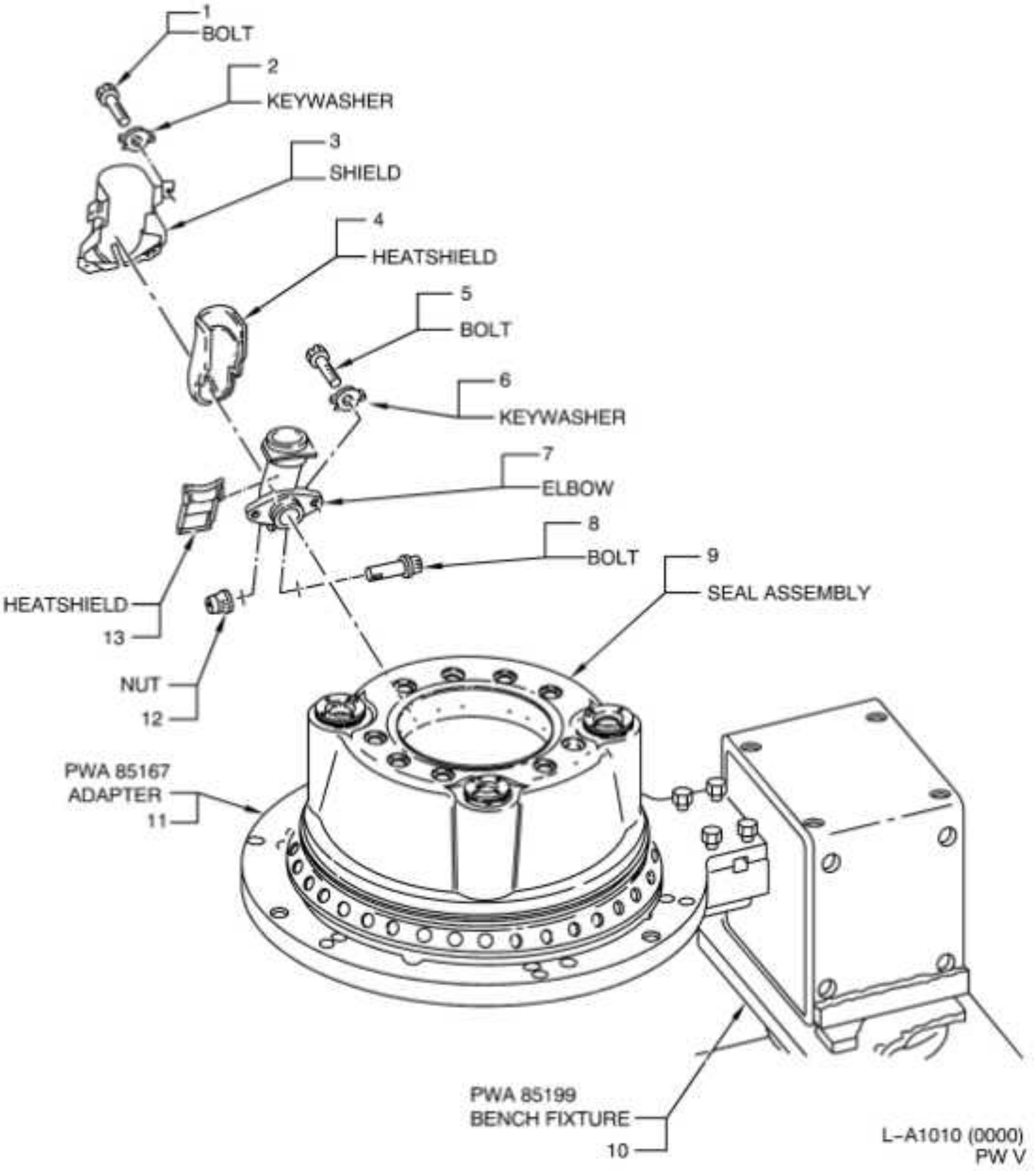
LOCK
13
SEAL RING
3
NUT
4
SEAL RING
3
PWA 29855-5
GUIDE PINS
(2 REQUIRED)
12
11
GASKET
FRONT COOLING
DUCT ASSEMBLY
8
GASKET
11
NO. 3 BEARING
SEAL ASSEMBLY
AND HOUSING
9
GASKET
10
PWA 85167
ADAPTER
PWA 85199
FIXTURE
L-A1002 (0389)
PW V

No. 3 Bearing Outer Race Installation
Figure 1002
(Task 72−41−00−400−004)

DIFFUSER AND COMBUSTOR - ASSEMBLY-05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BOLT
9
SEAL ASSEMBLY
HEATSHIELD
13
NUT
12
PWA 85167
ADAPTER
11
PWA 85199
BENCH FIXTURE
10
L-A1010 (0000)
PW V

No. 3 Bearing Retaining Nut Installation
Figure 1003
(Task 72-41-00-400-004)

Previous Pageblock Return to Previous Menu Next Pageblock

Pratt & Whitney

PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

Tab Separator - Diffuser And Combustor

List of Effective Pages - Diffuser And Combustor
See end of list.

Table of Contents - Diffuser And Combustor

MAY 1/07
850
72-41

72-41-00		01		SEP 15/99
		02		SEP 15/99
		03/ 04		SEP 15/02
72-41-00				
72-41-00		001	ALL	MAR 15/95
	HOW TO USE	002		MAR 15/95
		003		MAR 15/95
		004		MAR 15/95
		005		MAR 15/95
		006		MAR 15/95
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TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
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REVISION NO. 83 DATED MAY 1, 2007

HIGHLIGHTS - DIFFUSER AND COMBUSTOR

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-41-00 INSP/CHK-04	839 850 -851	Revised Reference Number 382 to expand the minimum fit limit. (IEN07KC103) Corrected Task Reference number. (Editiorial)	ALL
72-41-00 ASSEMBLY-01	1002 1022	Revised the Consumable Materials list to add P06-054 Antiseize Paste. Revised the lubricant on a nut and decreased the installation torque. (IEN06KCB08)	CONFIG-1 4152 4156A 4158
72-41-00 ASSEMBLY-01	1002 1020	Revised the Consumable Materials list to add P06-054 Antiseize Paste. Revised the lubricant on a nut and decreased the torque. (IEN06KCB08)	CONFIG-2 4152-3 4156A-3 4158-3
72-41-00 ASSEMBLY-03	1009 1019/ 1020	Added a note fuel nozzle inlet fitting braze joint. (IEN06KA157)	ALL

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DIFFUSER AND COMBUSTOR

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Disassembly-01		501	CONFIG-1 4152 4152-3 4156A 4156A-3 4158 4158-3
Task 72-41-11-040-001: Disassemble The Outer Combustion Chamber Assembly (Talon II Low Emission Burner)		501	
Assembly-01		1001	CONFIG-1 4152 4152-3 4156A 4156A-3 4158 4158-3
Task 72-41-11-440-001: Assemble The Outer Combustion Chamber Assembly (Talon II Low Emission Burner)		1001	
NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY	72-41-85		
Disassembly-01		501	ALL
Task 72-41-85-040-001: Disassemble No. 3 Bearing Rear (Carbon) Seal Assembly		501	
Assembly-01		1001	ALL
Task 72-41-85-440-001: Assemble No. 3 Bearing Rear (Carbon) Seal Assembly		1001	
Testing-01		1301	ALL
Task 72-41-85-790-001: Leak Check - No. 3 Bearing Rear (Carbon) Seal Assembly		1301	

NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY - DISASSEMBLY-01

Task 72-41-07-040-001:

1. Disassemble No. 3 Bearing Front (Carbon) Seal Assembly

   A. Equipment And Materials Required

      Special Tools:
      PWA 85169 Protector, Plastic

   B. Procedure

      See Figure 501.

      (1) Position seal ring holder assembly (501/2) on bench, small diameter down.

      (2) Put PWA 85169 Protector over seal assembly (501/3) which will give protection to the carbon seal while disassembling part.

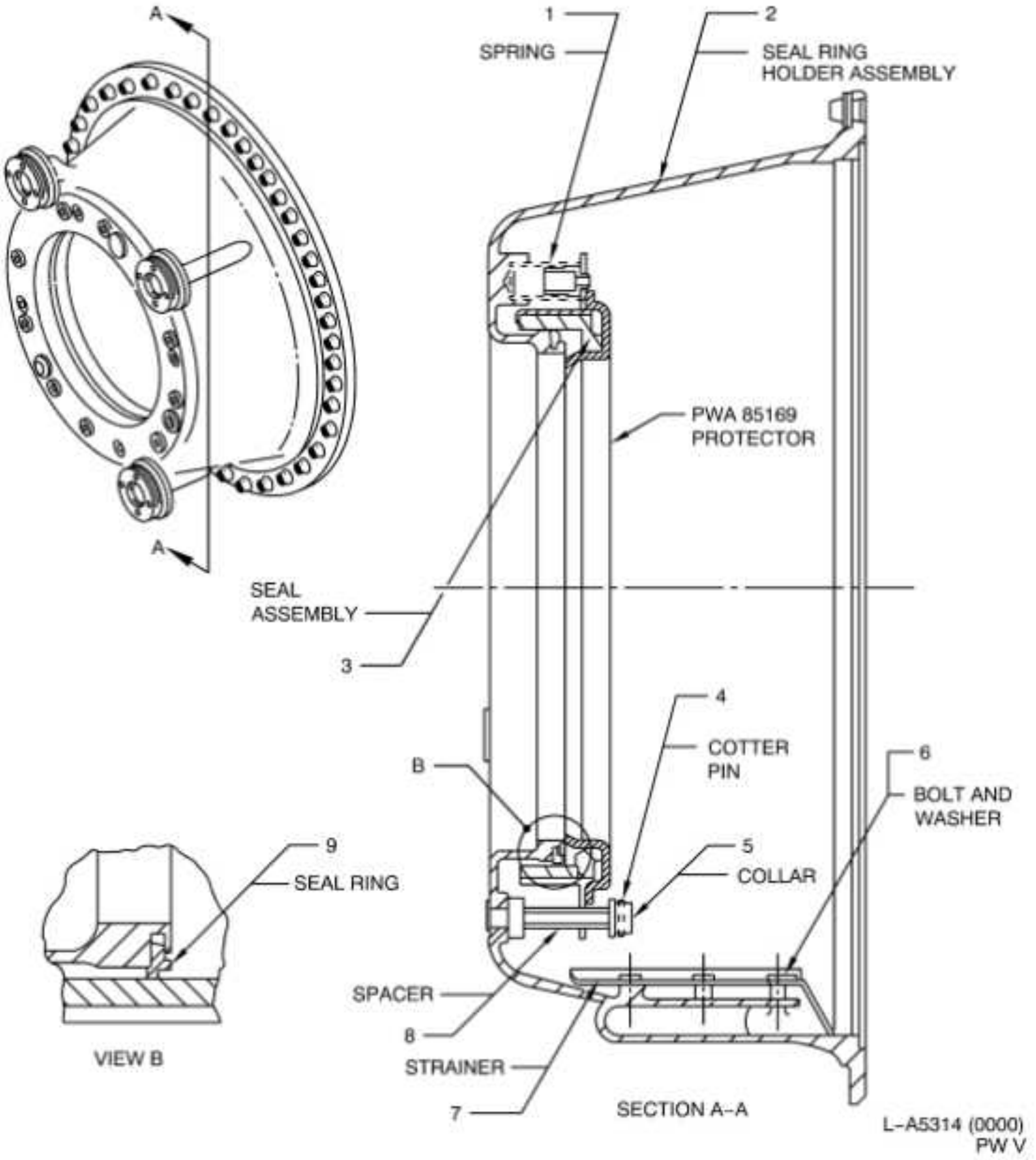
      (3) Push down on protector and seal assembly (501/3) against the springs (501/1).

      (4) Remove cotter pins (501/4), collars (501/5) and spacers (501/8).

      (5) Remove seal assembly (501/3), springs (501/1) and seal ring (501/9).

      (6) Remove bolt washer (501/6) and strainer (501/7).

NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY − DISASSEMBLY−01


A
A
1
SPRING
2
SEAL RING
HOLDER ASSEMBLY
PWA 85169
PROTECTOR
SEAL
ASSEMBLY
3
4
COTTER
PIN
B
6
BOLT AND
WASHER
9
SEAL RING
5
COLLAR
SPACER
8
STRAINER
7
VIEW B
SECTION A−A
L−A5314 (0000)
PW V

Disassembly Of No. 3 Bearing Front
(Carbon) Seal Assembly
Figure 501
(Task 72−41−07−040−001)

Previous Pageblock Return to Previous Menu Next Pageblock

NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY - ASSEMBLY-01

Task 72-41-07-440-001:

1. Assemble No. 3 Bearing Front (Carton) Seal Assembly

A. Equipment And Materials

Special Tools:
PWA 85169 Protector

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (P03-001)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Key Washer	5	72-41-00	9	70
Cotter Pin	4	72-41-00	9	150

B. Procedure

See Figures 1001, 1002 and 1003.

(1) Place seal ring holder assembly on bench, smaller diameter down.

(2) Install strainer in seal ring holder assembly with five key washers and bolts lubricated with Engine Oil (P03-001). Torque the bolts to 32 - 36 lb-in. (3.616 - 4.067 N.m). Bend the tabs of the key washers.

(3) Install seal ring in groove of seal ring holder.

NOTE: The strainer center bolt is located on the assembly vertical centerline.

(4) Install springs in spring housings and sleeve spacers over pins in the seal ring holder assembly.

NOTE: The sleeve spacers are located at 3 and 9 o'clock in the seal ring holder assembly.

If you have much wear on the flat sides of the sleeve spacers, you can install the sleeve spacers with the wear towards the support. See Figure 1002.

NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY - ASSEMBLY-01

(5) Install carbon face seal, aligning spring guides and spacers.

(6) Place PWA 85169 Protector over the carbon seal face assembly.

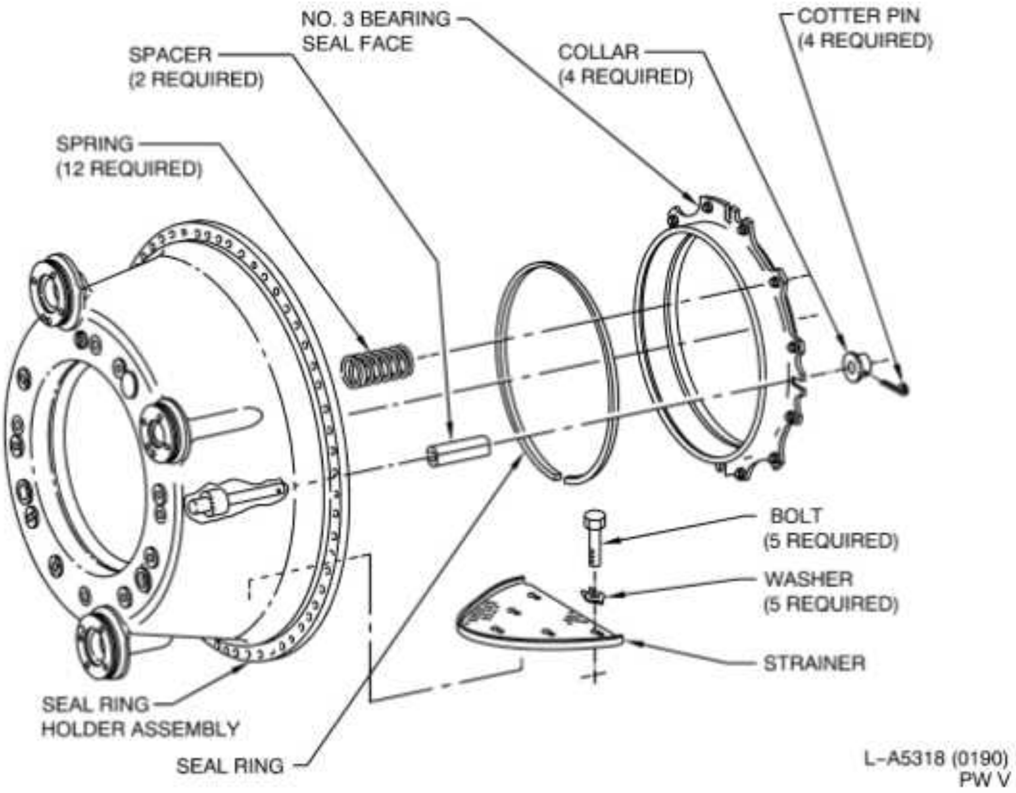
(7) Depress protector and carbon seal face assembly below holes in pins. Install collars and cotter pins. Bend cotter pins.

(8) Remove PWA 85169 Protector.

C. Postrequisites

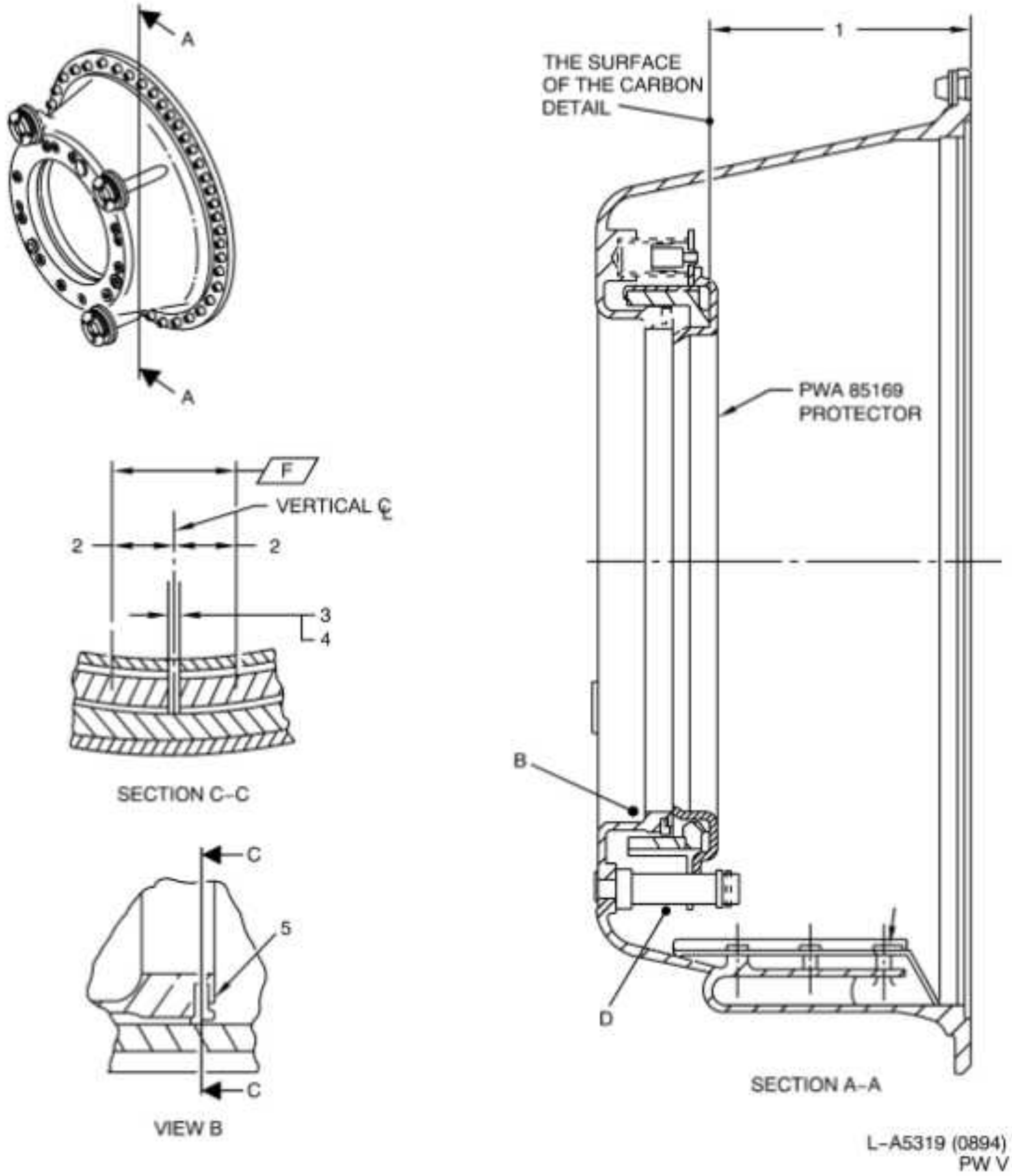
(1) Do leak check on the No. 3 bearing front (carbon) seal assembly. See Testing-01 (Task 72-41-07-790-001).

NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY - ASSEMBLY-01


NO. 3 BEARING SEAL FACE
COTTER PIN (4 REQUIRED)
SPACER (2 REQUIRED)
COLLAR (4 REQUIRED)
SPRING (12 REQUIRED)
BOLT (5 REQUIRED)
WASHER (5 REQUIRED)
STRAINER
SEAL RING HOLDER ASSEMBLY
SEAL RING
L-A5318 (0190)
PW V

Assembly Of No. 3 Bearing Front
(Carbon) Seal Assembly
Figure 1001
(Task 72-41-07-440-001)

NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY − ASSEMBLY−01

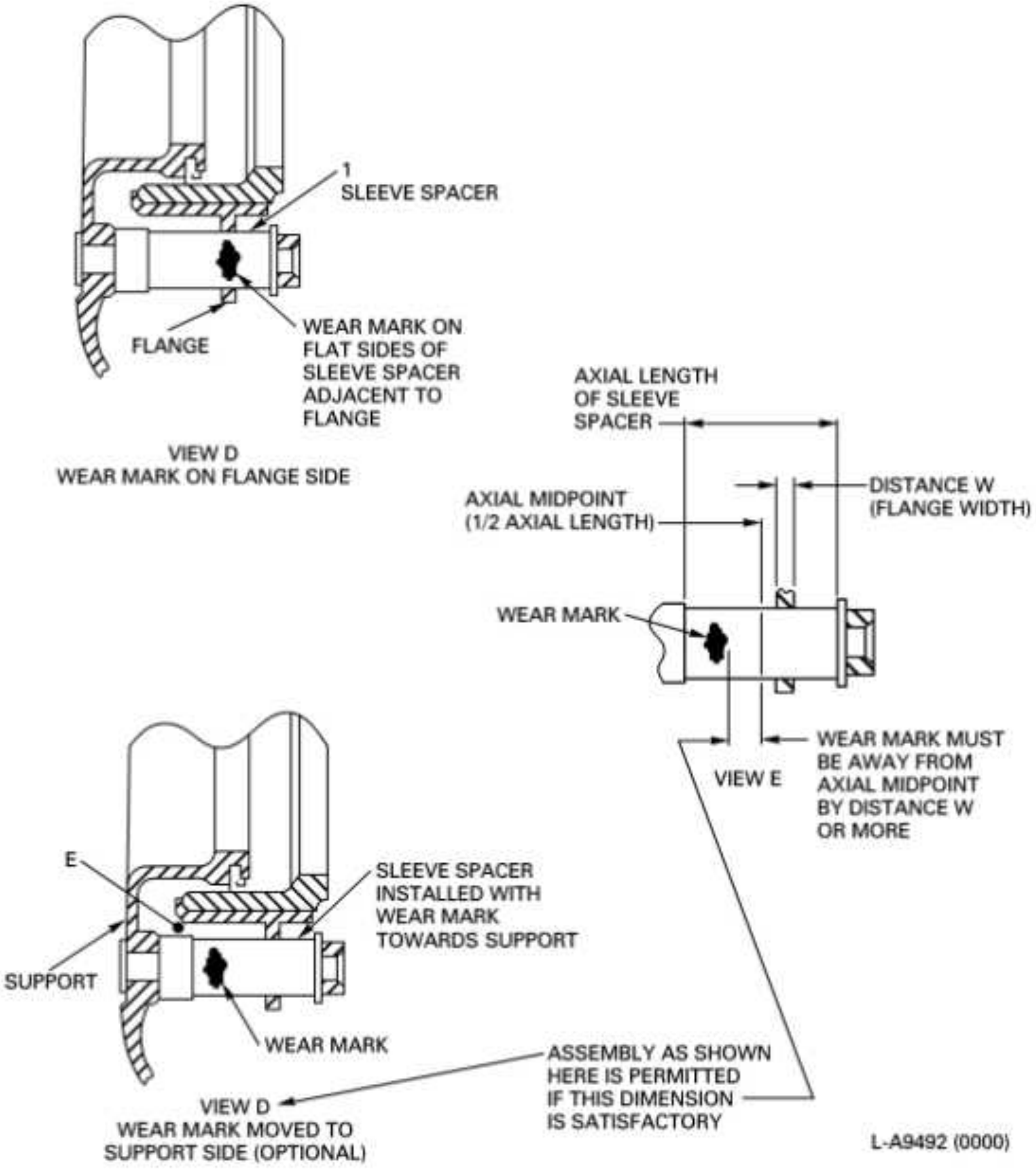

A
A
1
THE SURFACE OF THE CARBON DETAIL
PWA 85169 PROTECTOR
F
VERTICAL ℄
2
2
3
4
SECTION C-C
C
5
C
VIEW B
B
D
SECTION A-A
L-A5319 (0894)
PW V

Assembly Of No. 3 Bearing Front
(Carbon) Seal Assembly
Figure 1002 (Sheet 1)
(Task 72−41−07−440−001)

NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY − ASSEMBLY−01

1. 4.525 − 4.555 Inches (114.94 − 115.70 mm). Lap If Necessary.
2. 0.500 Inch (12.700 mm) Maximum
3. The Empty Space In The Piston Ring Must Be In Area F.
4. (Reference 277) 0.045 − 0.055 Inch (1.14 − 1.40 mm) When Installed In A Ring Gage With An ID Of 9.090 Inches (230.886 mm). 0.040 − 0.060 Inches (1.02 − 1.52 mm) When Installed In The Seal Ring Holder
5. (Reference 278) 0.002 − 0.009 Inch (0.051 − 0.229 mm) Side Clearance.

Key To Figure 1002 (Sheet 1)

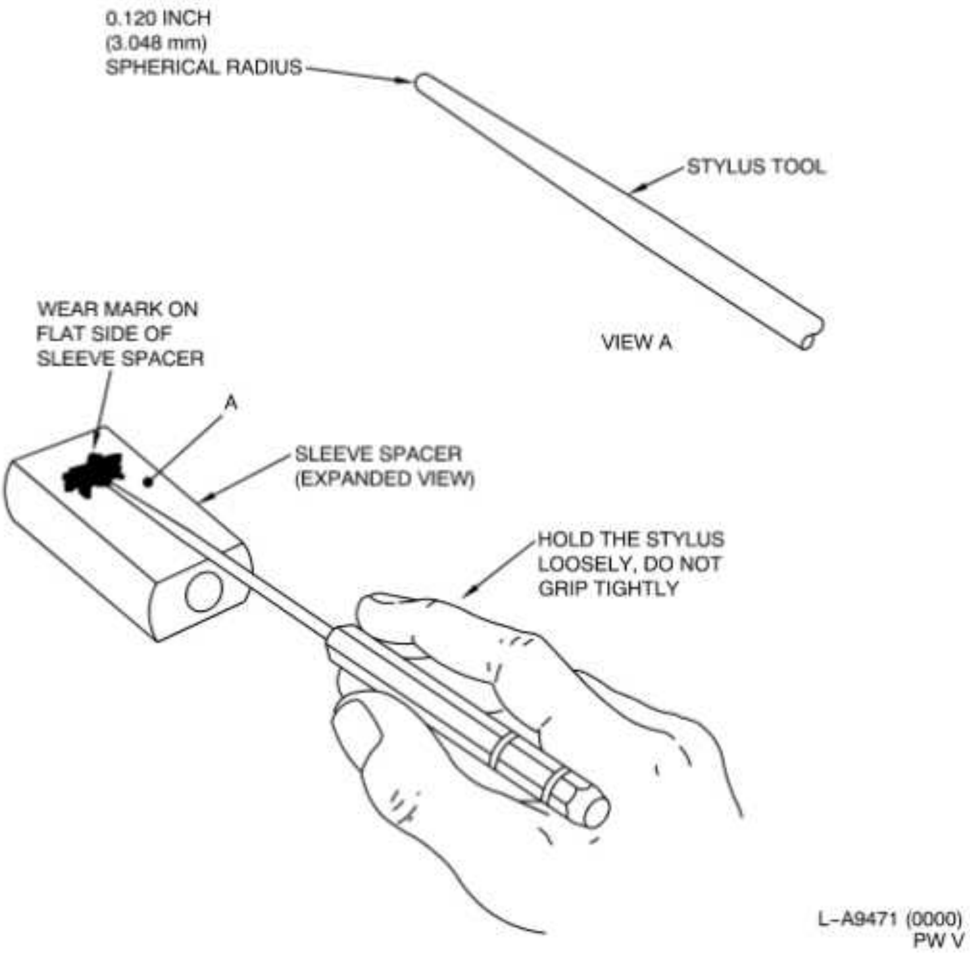

1
SLEEVE SPACER
FLANGE
WEAR MARK ON FLAT SIDES OF SLEEVE SPACER ADJACENT TO FLANGE
VIEW D
WEAR MARK ON FLANGE SIDE
AXIAL LENGTH OF SLEEVE SPACER
DISTANCE W (FLANGE WIDTH)
AXIAL MIDPOINT (1/2 AXIAL LENGTH)
WEAR MARK
VIEW E
WEAR MARK MUST BE AWAY FROM AXIAL MIDPOINT BY DISTANCE W OR MORE
E
SUPPORT
SLEEVE SPACER INSTALLED WITH WEAR MARK TOWARDS SUPPORT
WEAR MARK
ASSEMBLY AS SHOWN HERE IS PERMITTED IF THIS DIMENSION IS SATISFACTORY
VIEW D
WEAR MARK MOVED TO SUPPORT SIDE (OPTIONAL)
L-A9492 (0000)

Assembly Of No. 3 Bearing Front
(Carbon) Seal Assembly
Figure 1002 (Sheet 2)
(Task 72-41-07-440-001)

NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY - ASSEMBLY-01

Inspect	Serviceable Limits
1. Sleeve Spacer For Wear	Examine the flat sides of the sleeve spacer with a hand held stylus tool. See Figure 1003. Hold the stylus loosely at a 30 degree angle to the wear surface. Guide the stylus perpendicular to the lay of the wear. Only use the weight of the stylus, do not force the stylus with your fingers. If the stylus catches on the wear, you must install the sleeve spacer with the wear towards the support, (away from the flange).

Key To Figure 1002 (Sheet 2)


0.120 INCH
(3.048 mm)
SPHERICAL RADIUS
STYLUS TOOL
VIEW A
WEAR MARK ON
FLAT SIDE OF
SLEEVE SPACER
A
SLEEVE SPACER
(EXPANDED VIEW)
HOLD THE STYLUS
LOOSELY, DO NOT
GRIP TIGHTLY
L-A9471 (0000)
PW V

Examination Of Wear On Sleeve Spacers
Figure 1003
(Task 72-41-07-440-001)

NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY - TESTING-01

Task 72-41-07-790-001:

1. Leak Check No. 3 Bearing Front (Carbon) Seal Assembly

A. Equipment And Materials Necessary

Special Tools:

PWA 6507	Flowmeter, Leak Test
PWA 45411	Gage, Differential
PWA 46400	Gage, Measurement (Air Flow)
PWA 85038	Fixture

Consumable Materials:

Item No.	Designation
P06-002	Petrolatum, White (PMC 9609)

B. Procedure
See Figure 1301 and Figure 1302.

(1) Remove cover from PWA 85038 Fixture and inspect rubber seals on fixture, apply Petrolatum White P06-002 as required.

(2) Remove and inspect the ring assembly (1301/4) for nicks and scratches in the micro finish surface.

(3) Install the ring assembly (1301/4) with the micro finish surface up.

NOTE: Engine bill of material seal seat can be used as an alternative to the ring assembly.

(4) Remove the three cap screws and remove the clamp (1301/5) from the fixture base.

(5) Remove the three aluminum plugs stored in the fixture base.

(6) Carefully lower the seal support assembly (1302/3) into the fixture. Seat the carbon seal assembly (1302/2), Surface B (1302/1) on the fixture ring assembly (1301/4) and the seal support flange against the fixture base.

NO. 3 BEARING FRONT (CARBON) SEAL ASSEMBLY − TESTING−01

(7) Install the detail clamp (1301/5) by indexing it to fit over the outside contour of the seal support assembly (1302/3). The clamp (1301/5) must be correctly positioned to fit over the offset clinch nut on the seal support assembly (1302/3).

(8) Attach the detail clamp (1301/5) to the fixture base with the three cap screws.

(9) Install the three aluminum plugs into the oil pressure, oil scavenge and breather port in the seal support assembly (1302/3).

(10) Install the cover and attach with the large center flange nut and eight cap screws and washers.

(11) Connect the hose marked RETURN from the PWA 46400 Gage to the quick disconnect fitting marked FLOWMETER (1301/3) on the fixture.

(12) If applicable, transfer the quick disconnect socket plugs from the fittings marked INLET−SEALS (1301/2) and DELTA P−SEALS (1301/7) to the fittings marked INLET−PINS (1301/1) and DELTA P−PINS (1301/6), respectively.

(13) Connect the hose marked SUPPLY from the PWA 46400 Gage to the fitting marked INLET−SEAL (1301/2) on the fixture.

(14) Connect the hose marked D. P. LOW from the PWA 46400 Gage to the tee fitting marked DELTA P (1301/7).

(15) As an alternate to PWA 46400 Gage you may use PWA 6507 Flowmeter and PWA 45411 Gage to connect the flowmeter and gage to the fixture as follows:

(a) Connect hose from PWA 6507 Flowmeter to larger of two quick−disconnect fittings marked FLOWMETER (1301/3) attached to fixture base.

(b) Attach smaller fitting of PWA 45411 Gage to the remaining fitting on fixture base.

(c) Attach air inlet hose to fitting marked INLET PINS (1301/1) on the cover.

(d) Attach the larger quick−disconnect fitting on the gage to the remaining quick−disconnect fitting on the fixture cover.

(16) Control air pressure to the fixture slowly to 80 psi (551.6 kPa) and permit to stabilize five minutes.

NOTE: Although 80 psi (551.6 kPA) is the recommended air pressure, it is permitted for the air pressure to be 50 psi (344.7 kPa).

(17) Observe leakage on flowmeter. Total leakage must not be greater than 4.5 CFM (0.13 cu m/min.).

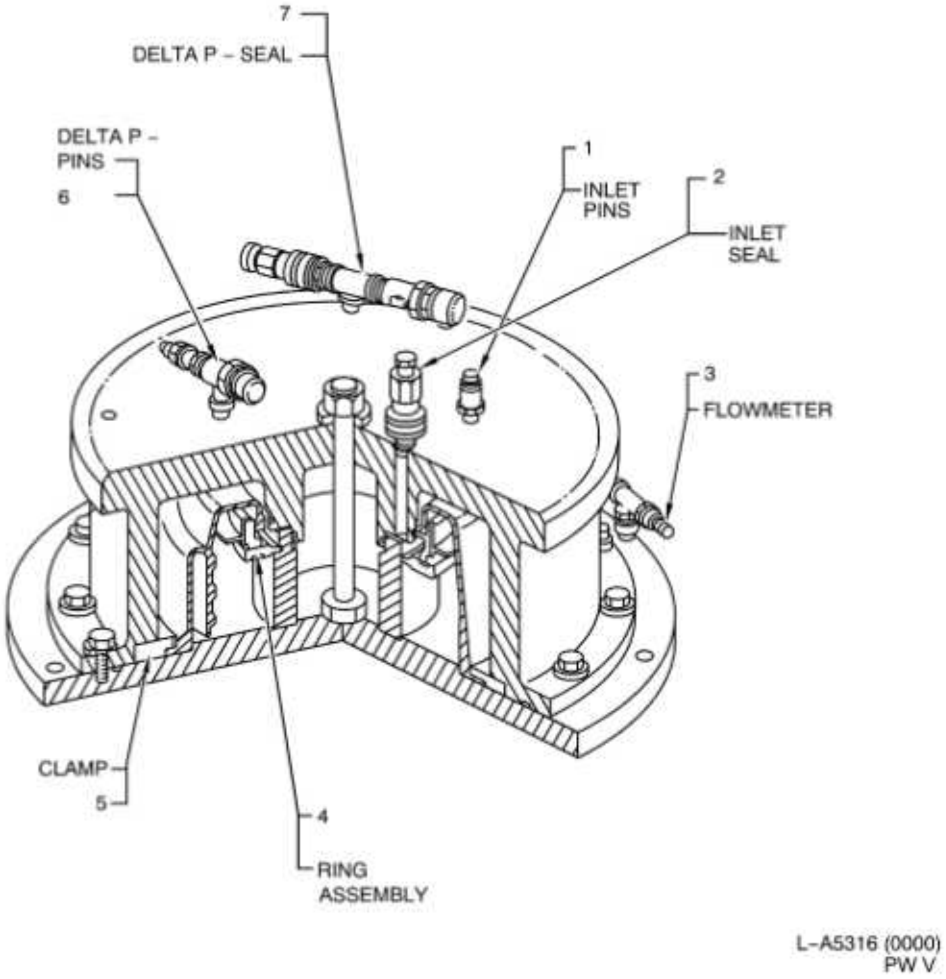
NOTE: If the pressure was at 50 psi (344.7 kPa), the total leakage must not be more than 2.8 CFM (0.08 cu m/min).

(18) If leakage exceeds limits, corrective action must be taken as follows:

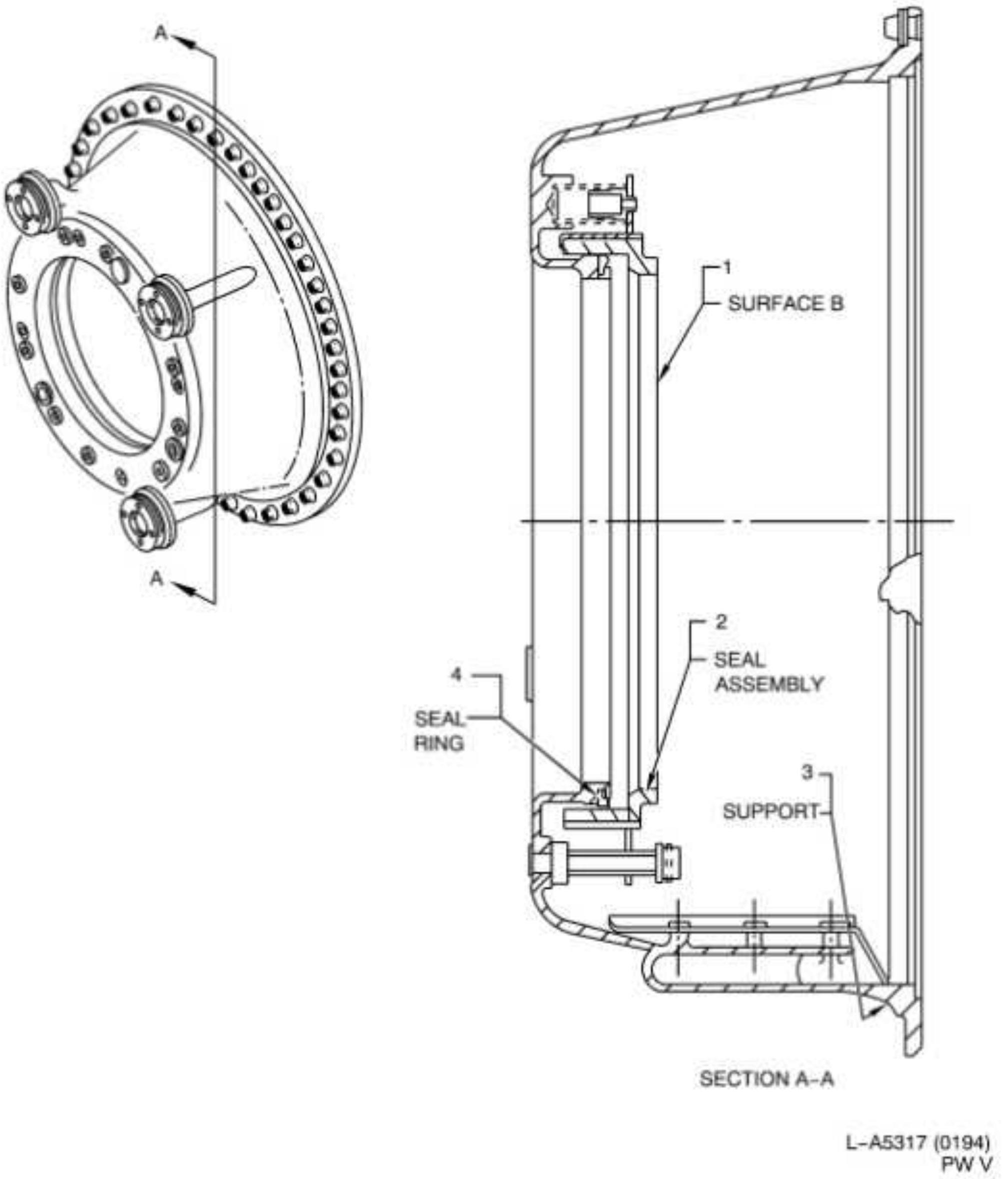
(a) Replace seal ring (1302/4), if necessary.

(b) Lap face of carbon seal (1302/1). Refer to the PW4000 Series CIR, PN 51A357, 72−41−09, Repair−04 (Task 72−41−09−300−004).

(c) Repair piston ring groove. Refer to the PW4000 Series CIR, PN 51A357, 72−41−08, Repair−04 (Task 72−41−08−300−004).


7
DELTA P – SEAL
DELTA P – PINS
6
1
INLET PINS
2
INLET SEAL
3
FLOWMETER
CLAMP
5
4
RING ASSEMBLY
L–A5316 (0000)
PW V

Installation Of Seal Support Assembly
Into PWA 85038 Leak Check Fixture
Figure 1301
(Task 72−41−07−790−001)


A
A
1
SURFACE B
2
SEAL ASSEMBLY
4
SEAL RING
3
SUPPORT
SECTION A-A
L-A5317 (0194)
PW V

No. 3 Bearing Front (Carbon) Seal Support Assembly
Figure 1302
(Task 72-41-07-790-001)

Previous Pageblock Return to Previous Menu Next Pageblock

NO. 3 BEARING (FRONT) SEAL RING HOLDER ASSEMBLY - DISASSEMBLY-01

Task 72-41-08-040-001:

1. Disassemble The No. 3 Bearing (Front) Seal Ring Holder Assembly

NOTE: This procedure is applicable to parts with strainer elements that are made of honeycomb.

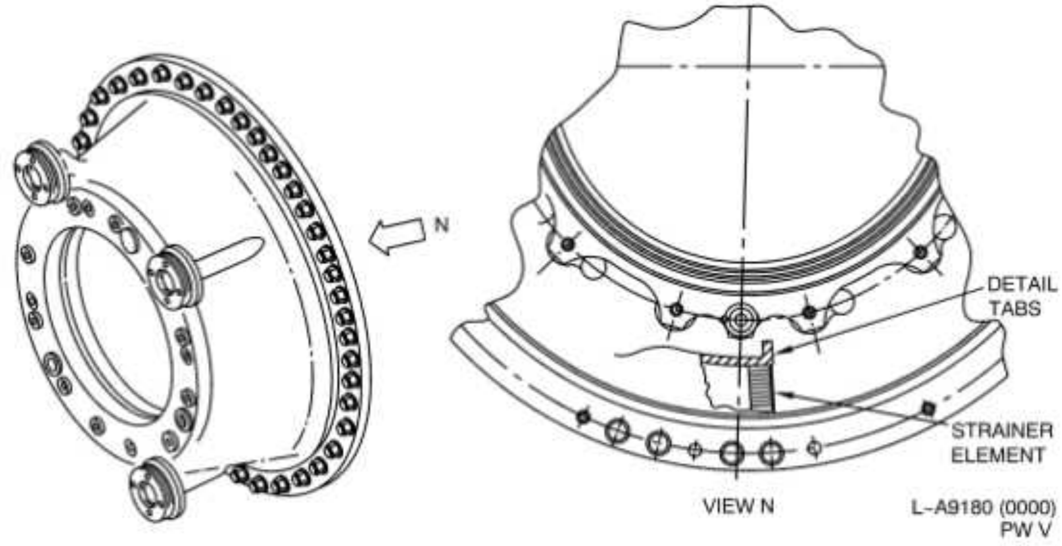
A. Equipment And Materials Required - None

B. Procedure

See Figure 501.

Subtask 72-41-08-040-51:

(1) Unbend the tabs of the strainer element. Remove the strainer element.


N
DETAIL
TABS
STRAINER
ELEMENT
VIEW N
L-A9180 (0000)
PW V

Disassemble The No. 3 Bearing (Front) Seal Ring Holder
Figure 501
(Task 72-41-08-040-001)

Previous Pageblock Return to Previous Menu Next Pageblock

NO. 3 BEARING (FRONT) SEAL RING HOLDER ASSEMBLY - ASSEMBLY-01

Task 72-41-08-440-001:

1. Assemble The No. 3 Bearing (Front) Seal Ring Holder Assembly

NOTE: This procedure is applicable to parts with strainer elements that are made of honeycomb.

A. Equipment And Materials Required - None

B. Procedure
See Figure 1001.

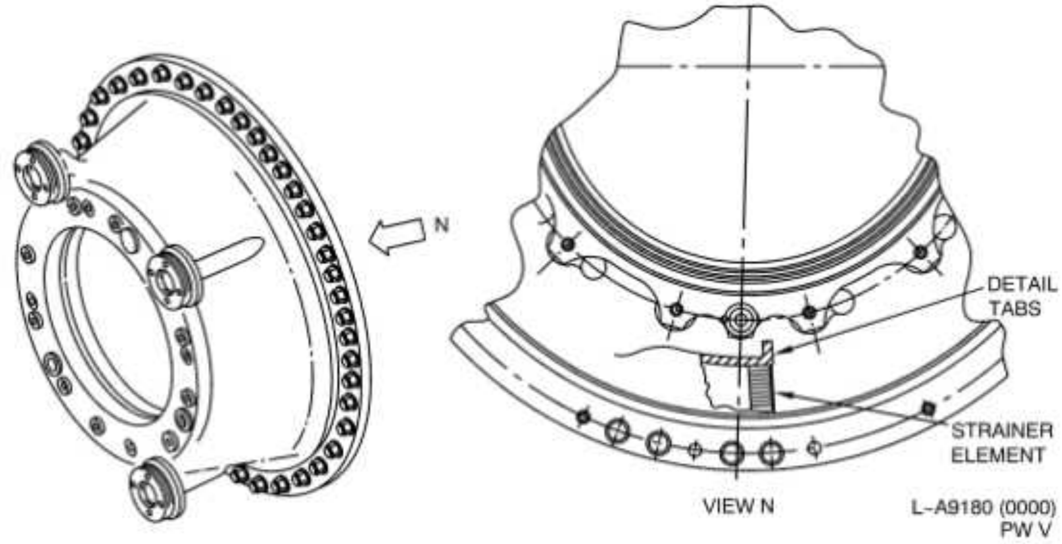
Subtask 72-41-08-440-051:

(1) Install the strainer element in the seal ring holder.

(a) Bend the tabs of the strainer element sufficiently to prevent removal.

(b) Deformation of the honeycomb is permitted.

NO. 3 BEARING (FRONT) SEAL RING HOLDER ASSEMBLY - ASSEMBLY-01


N
DETAIL
TABS
STRAINER
ELEMENT
VIEW N
L-A9180 (0000)
PW V

Assemble The No. 3 Bearing (Front) Seal Ring Holder
Figure 1001
(Task 72-41-08-440-001)

Previous Pageblock Return to Previous Menu Next Pageblock

OUTER COMBUSTION CHAMBER ASSEMBLY − DISASSEMBLY−01

Task 72−41−11−040−001:

1. Disassemble The Outer Combustion Chamber Assembly (Talon II Low Emission Burner)

   A. Prerequisites

      (1) Remove the outer combustion chamber assembly from the diffuser and combustor by 72−41−00, Disassembly−02 (Task 72−41−00−030−005).

   B. Procedure

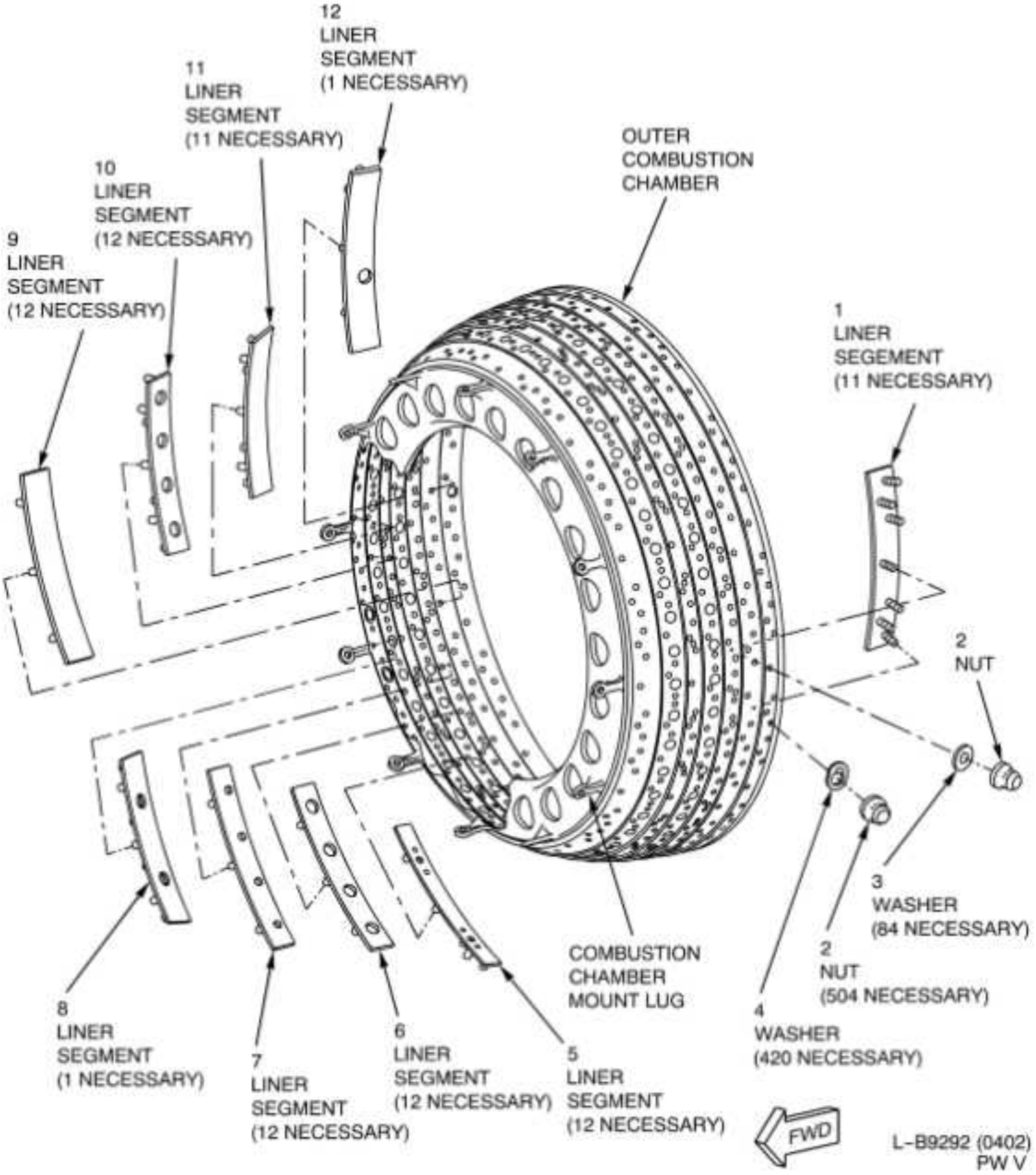
      NOTE: It is necessary to remove the liner segments that are installed closest to the combustion chamber mount lugs first and then work rearward.

      (1) Remove the liner segments from the outer combustion chamber assembly as follows. See Figure 501.

         (a) Loosen and remove the nuts (501/2) and washers (501/3) and (501/4) as necessary for each liner segment. Discard all the nuts and damaged washers.

         (b) Carefully remove each liner segment (501/1), (501/5), (501/6), (501/7), (501/8), (501/9), (501/10), (501/11) and (501/12) from the outer combustion chamber.

OUTER COMBUSTION CHAMBER ASSEMBLY - DISASSEMBLY-01


12
LINER
SEGMENT
(1 NECESSARY)
11
LINER
SEGMENT
(11 NECESSARY)
10
LINER
SEGMENT
(12 NECESSARY)
9
LINER
SEGMENT
(12 NECESSARY)
OUTER
COMBUSTION
CHAMBER
1
LINER
SEGEMENT
(11 NECESSARY)
2
NUT
3
WASHER
(84 NECESSARY)
2
NUT
(504 NECESSARY)
4
WASHER
(420 NECESSARY)
COMBUSTION
CHAMBER
MOUNT LUG
8
LINER
SEGMENT
(1 NECESSARY)
7
LINER
SEGMENT
(12 NECESSARY)
6
LINER
SEGMENT
(12 NECESSARY)
5
LINER
SEGMENT
(12 NECESSARY)
FWD
L-B9292 (0402)
PW V

Outer Combustion Chamber Liner Segment Removal
Figure 501
(Task 72-41-11-040-001)

OUTER COMBUSTION CHAMBER ASSEMBLY - ASSEMBLY-01

Task 72-41-11-440-001:

1. Assemble The Outer Combustion Chamber Assembly (Talon II Low Emission Burner)

R A. Equipment And Materials Necessary - None

B. Procedure
See Figure 1001.

R CAUTION: DO NOT USE ANY LUBRICATION ON THE THREADS.

(1) Install the liner segments to the rearmost outer combustion chamber location as follows.

R NOTE: Installation of the liner segments must begin at the rearmost combustion chamber location (as viewed from the combustion chamber mount lugs) and continue forward.

R (a) Install the liner segment (1001/12) to the rearmost combustion chamber location while you align the hole in the segment with the borescope hole in the chamber.

1 Attach the segment to the chamber with one washer (1001/3), at the center stud location, and one nut (1001/2).

2 Install seven washers (1001/4), with the washer dimple in the slot of the chamber wall, and seven nuts (1001/2) to the remaining studs of the liner segment.

R (b) Install the eleven liner segments (1001/1) to the remaining areas of the rearmost combustion chamber locations.

1 Attach the segments to the chamber with one washer (1001/3), at the center stud location, and one nut (1001/2) for each liner installed.

2 Install seven washers (1001/4), with the washer dimple in the slot of the chamber wall, and seven nuts (1001/2) to the remaining studs of each of the liner segments.

R (c) Torque the liner segment nuts to 25 - 35 lb-in.
R (2.825 - 3.954 N.m).

(2) Install the liner segments to the 2nd rearmost outer combustion chamber location as follows.

R (a) Install the twelve liner segments (1001/9) to the combustion chamber and attach the segments to the chamber with one washer (1001/3), at the center stud location, and one nut (1001/2) for each liner segment installed.

R (b) Install washers (1001/4), with the washer dimple in the slot of the chamber wall, and nuts (1001/2) to the remaining studs of each of the liner segments.

R (c) Torque the liner segment nuts to 25 − 35 lb−in.
R (2.825 − 3.954 N.m).

(3) Install the liner segments to the 3rd rearmost outer combustion chamber location as follows.

R (a) Install the twelve liner segments (1001/7) to the combustion chamber and attach the segments to the chamber with one washer (1001/3), at the center stud location, and one nut (1001/2) for each liner segment installed.

R (b) Install washers (1001/4), with the washer dimple in the slot of the chamber wall, and nuts (1001/2) to the remaining studs of each of the liner segments.

R (c) Torque the liner segment nuts to 25 − 35 lb−in.
R (2.825 − 3.954 N.m).

(4) Install the liner segments to the 4th rearmost outer combustion chamber location as follows.

R (a) Install the twelve liner segments (1001/6) to the combustion chamber and attach the segments to the chamber with one washer (1001/3), at the center stud location, and one nut (1001/2) for each liner segment installed.

R (b) Install washers (1001/4), with the washer dimple in the slot of the chamber wall, and nuts (1001/2) to the remaining studs of each of the liner segments.

R (c) Torque the liner segment nuts to 25 − 35 lb−in. (2.825 − 3.954 N.m).

(5) Install the liner segments to the 5th rearmost outer combustion chamber location as follows.

R (a) Install the twelve liner segments (1001/5) to the combustion chamber and attach the segments to the chamber with one washer (1001/3), at the center stud location, and one nut (1001/2) for each liner segment installed.

R (b) Install washers (1001/4), with the washer dimple in the slot of the chamber wall, and nuts (1001/2) to the remaining studs of each of the liner segments.

R (c) Torque the liner segment nuts to 25 − 35 lb−in. (2.825 − 3.954 N.m).

(6) Install the liner segments to the 6th rearmost outer combustion chamber location as follows.

R (a) Install the twelve liner segments (1001/10) to the combustion chamber and attach the segments to the chamber with one washer (1001/3), at the center stud location, and one nut (1001/2) for each liner segment installed.

R (b) Install washers (1001/4), with the washer dimple in the slot of the chamber wall, and nuts (1001/2) to the remaining studs of each of the liner segments.

R (c) Torque the liner segment nuts to 25 − 35 lb−in. (2.825 − 3.954 N.m).

(7) Install the liner segments to the last remaining (closest to the chamber mount lugs) combustion chamber location as follows.

R (a) Install the liner segment (1001/8) to the most forward combustion chamber location while you align the holes in the segment with the holes in the chamber.

1 Attach the segment to the chamber with one washer (1001/3), at the center stud location, and one nut (1001/2).

2 Install washers (1001/4), with the washer dimple in the slot of the chamber wall, and nuts (1001/2) to the remaining studs of the liner segment.

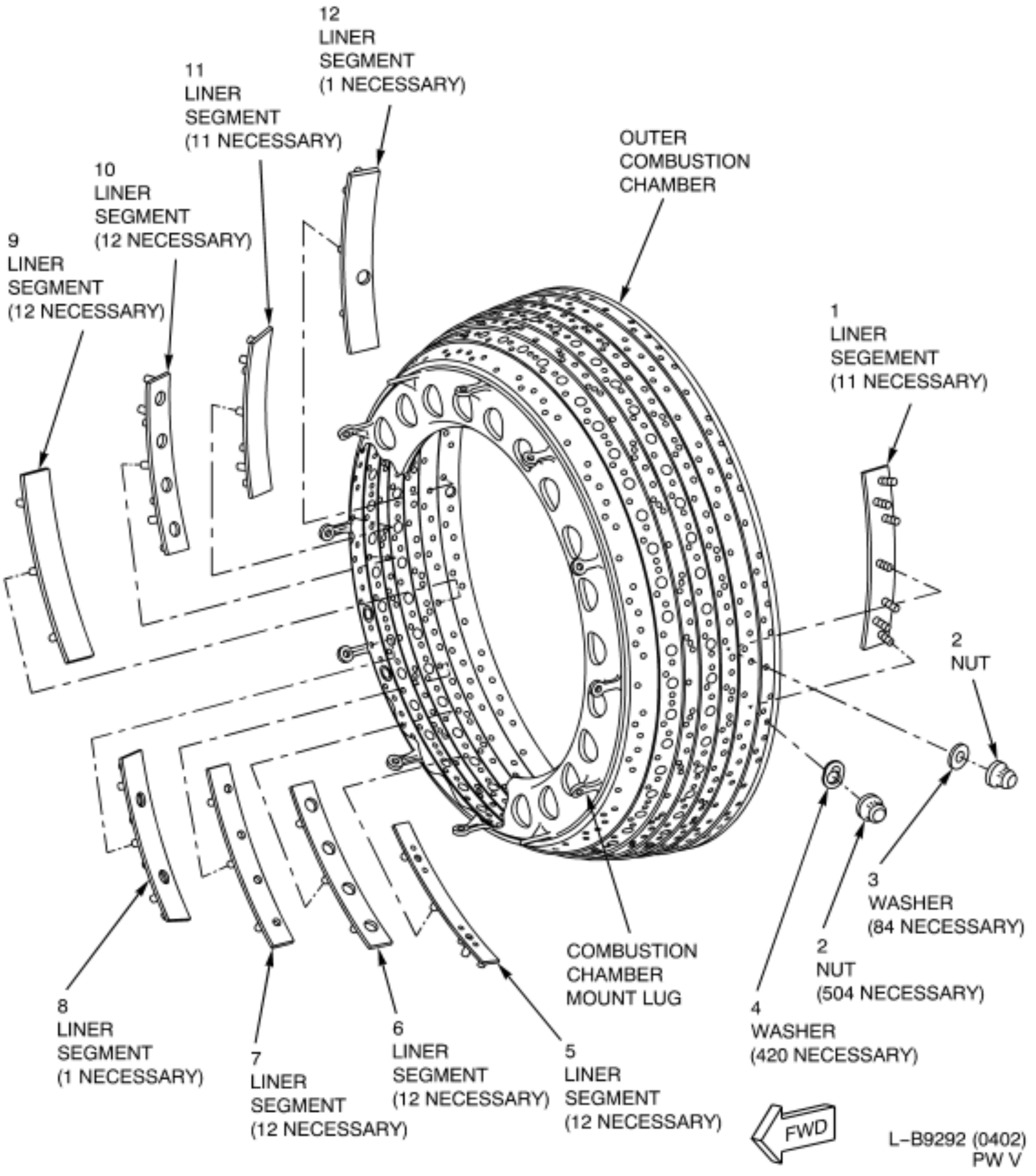
R (b) Install the eleven liner segments (1001/11) to the remaining areas of the most forward combustion chamber locations.

1 Attach the segments to the chamber with one washer (1001/3), at the center stud location, and one nut (1001/2) for each liner installed.

2 Install washers (1001/4), with the washer dimple in the slot of the chamber wall, and nuts (1001/2) to the remaining studs of each of the liner segments.

R (c) Torque the liner segment nuts to 25 − 35 lb−in.
R (2.825 − 3.954 N.m).

OUTER COMBUSTION CHAMBER ASSEMBLY − ASSEMBLY−01


12
LINER
SEGMENT
(1 NECESSARY)
11
LINER
SEGMENT
(11 NECESSARY)
10
LINER
SEGMENT
(12 NECESSARY)
9
LINER
SEGMENT
(12 NECESSARY)
OUTER
COMBUSTION
CHAMBER
1
LINER
SEGEMENT
(11 NECESSARY)
2
NUT
3
WASHER
(84 NECESSARY)
2
NUT
(504 NECESSARY)
4
WASHER
(420 NECESSARY)
COMBUSTION
CHAMBER
MOUNT LUG
8
LINER
SEGMENT
(1 NECESSARY)
7
LINER
SEGMENT
(12 NECESSARY)
6
LINER
SEGMENT
(12 NECESSARY)
5
LINER
SEGMENT
(12 NECESSARY)
FWD
L−B9292 (0402)
PW V

Outer Combustion Chamber Liner Segment Installation
Figure 1001
(Task 72−41−11−440−001)

NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY - DISASSEMBLY-01

Task 72-41-85-040-001:

1. Disassemble No. 3 Bearing Rear (Carbon) Seal Assembly

A. Equipment And Materials Required

Special Tools:
PWA 85169 Protector, Plastic

B. Procedure

See Figure 501.

(1) Position seal ring holder assembly (501/5) on bench, small diameter down.

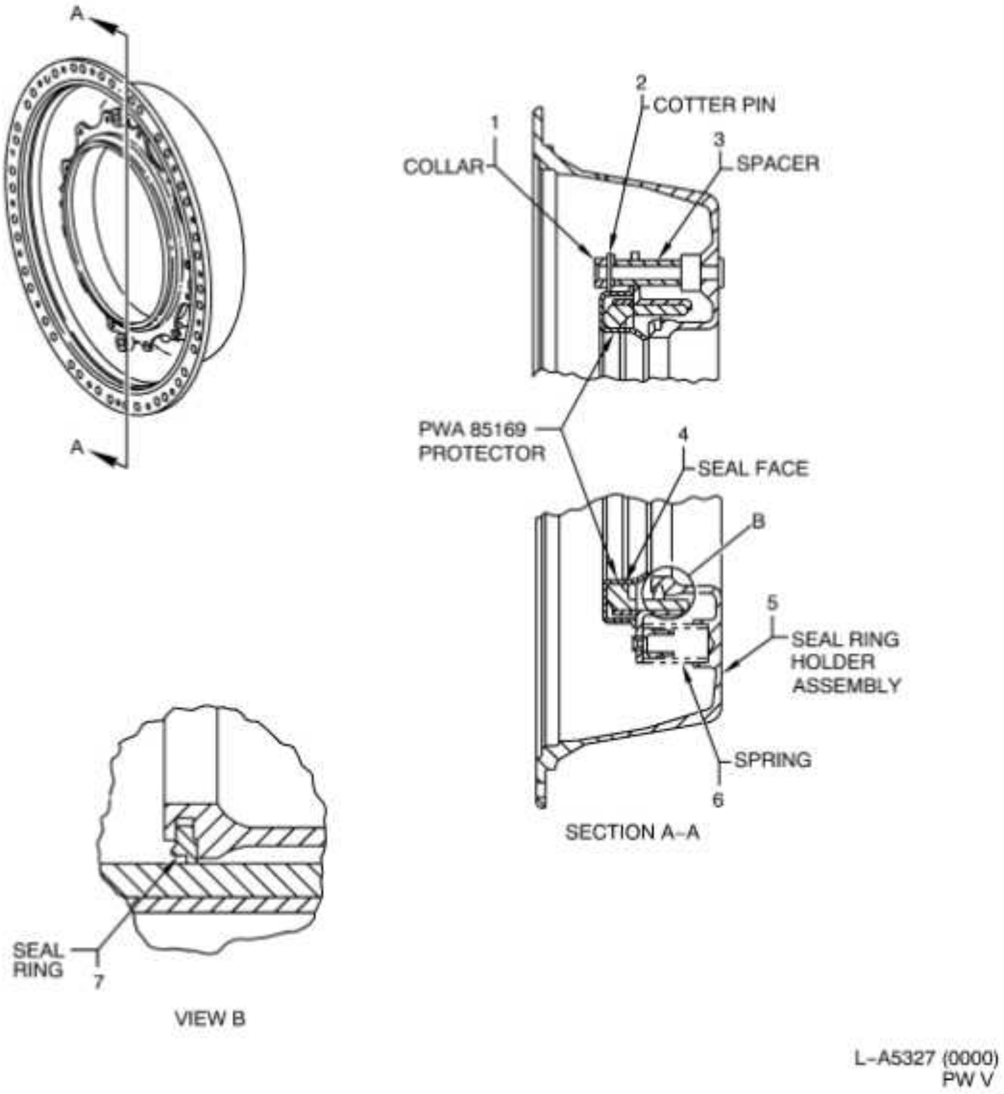
(2) Put PWA 85169 Protector over seal face (501/4) which will give protection to the carbon seal while disassembling part.

(3) Push down on protector and seal face (501/4) against the springs (501/6).

(4) Remove cotter pins (501/2), collars (501/1), and spacers (501/3).

(5) Remove seal face (501/4), springs (501/6), and seal ring (501/7).

NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY − DISASSEMBLY−01


A
A
2
COTTER PIN
1
COLLAR
3
SPACER
PWA 85169
PROTECTOR
4
SEAL FACE
B
5
SEAL RING
HOLDER
ASSEMBLY
SPRING
6
SECTION A-A
SEAL
RING
7
VIEW B
L-A5327 (0000)
PW V

Disassemble No. 3 Bearing Rear
(Carbon) Seal Assembly
Figure 501
(Task 72−41−85−040−001)

NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY - ASSEMBLY-01

Task 72-41-85-440-001:

1. Assemble No. 3 Bearing Rear (Carbon) Seal Assembly

A. Equipment And Materials Required

Special Tools:
PWA 85169 Protector

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Cotter Pin	4	72-41-00	12	180

B. Procedure

See Figures 1001, 1002 and 1003.

(1) Place seal ring holder assembly smaller diameter down.

(2) Install seal ring in groove of seal ring holder assembly. Be sure gap in seal ring is installed as shown in Figure 1002 (Sheet 1).

(3) Install springs in spring housings and sleeve spacers over pins in the seal ring holder assembly.

NOTE: The sleeve spacers are located at 3 and 9 o'clock in the seal ring holder assembly.

If you have much wear on the flat sides of the sleeve spacers, you can install the sleeve spacers with the wear towards the support. See Figure 1002 (Sheet 2).

(4) Install the carbon seal face, aligning spring guide pins and sleeve spacers.

(5) Place PWA 85169 Protector over the carbon seal face assembly.

(6) Depress protector and carbon seal face assembly below holes in pins, install collars and cotter pins. Bend cotter pins.

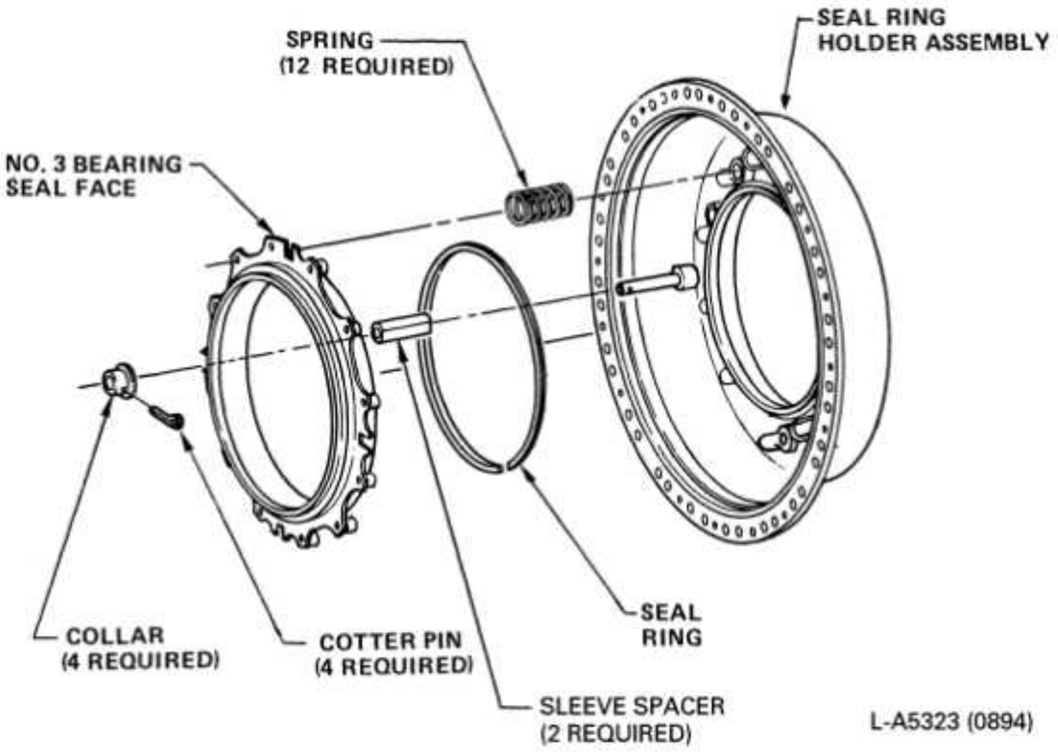
(7) Remove PWA 85169 Protector.

C. Postrequisites

NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY − ASSEMBLY−01

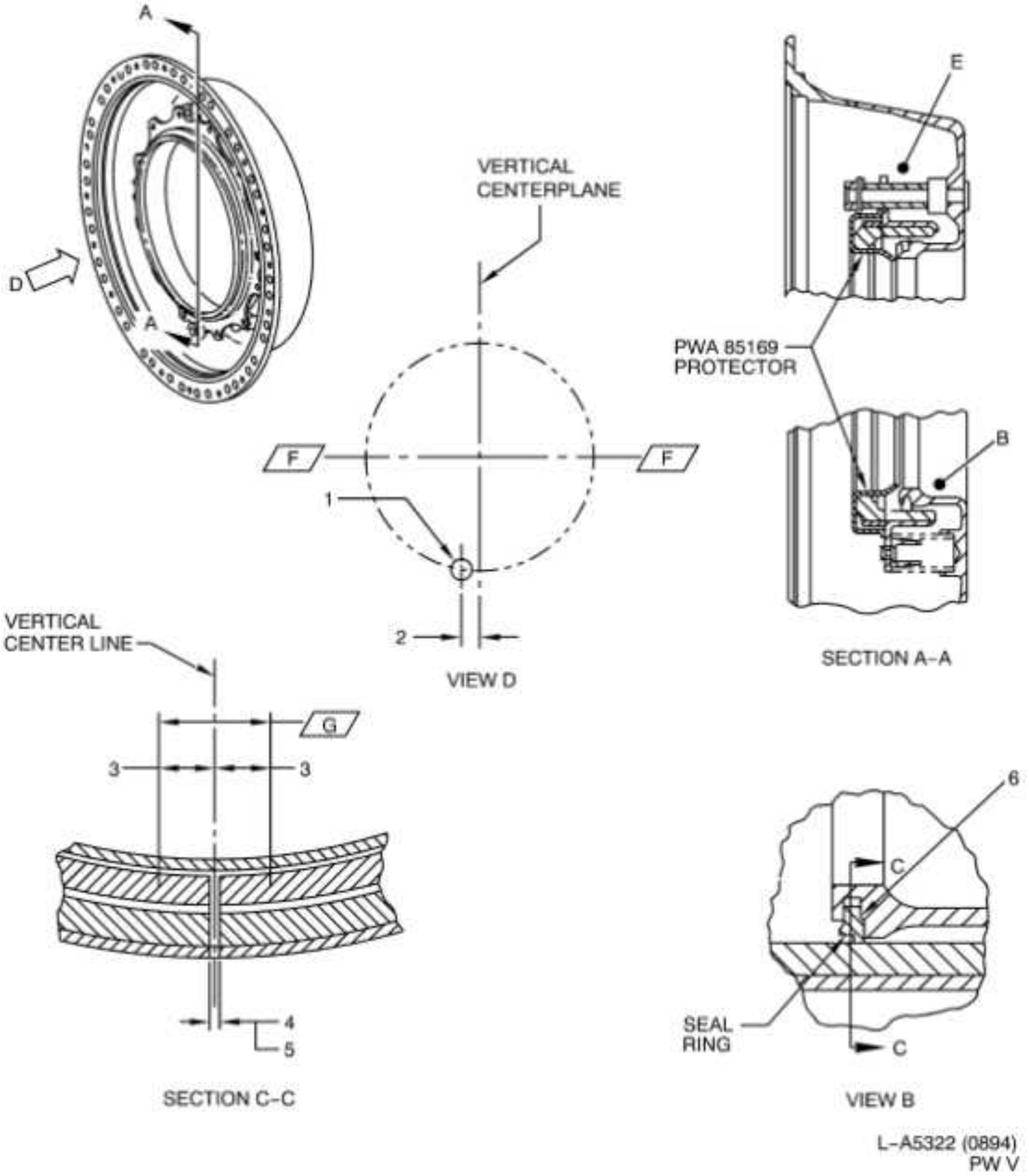
(1) Do leak check on the No. 3 bearing rear (carbon) seal assembly. See Testing−01 (Task 72−41−85−790−001).

NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY - ASSEMBLY-01


SPRING
(12 REQUIRED)
SEAL RING
HOLDER ASSEMBLY
NO. 3 BEARING
SEAL FACE
COLLAR
(4 REQUIRED)
COTTER PIN
(4 REQUIRED)
SEAL
RING
SLEEVE SPACER
(2 REQUIRED)
L-A5323 (0894)

Assembly Of No. 3 Bearing Rear
(Carbon) Seal Assembly
Figure 1001
(Task 72-41-85-440-001)

NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY − ASSEMBLY−01

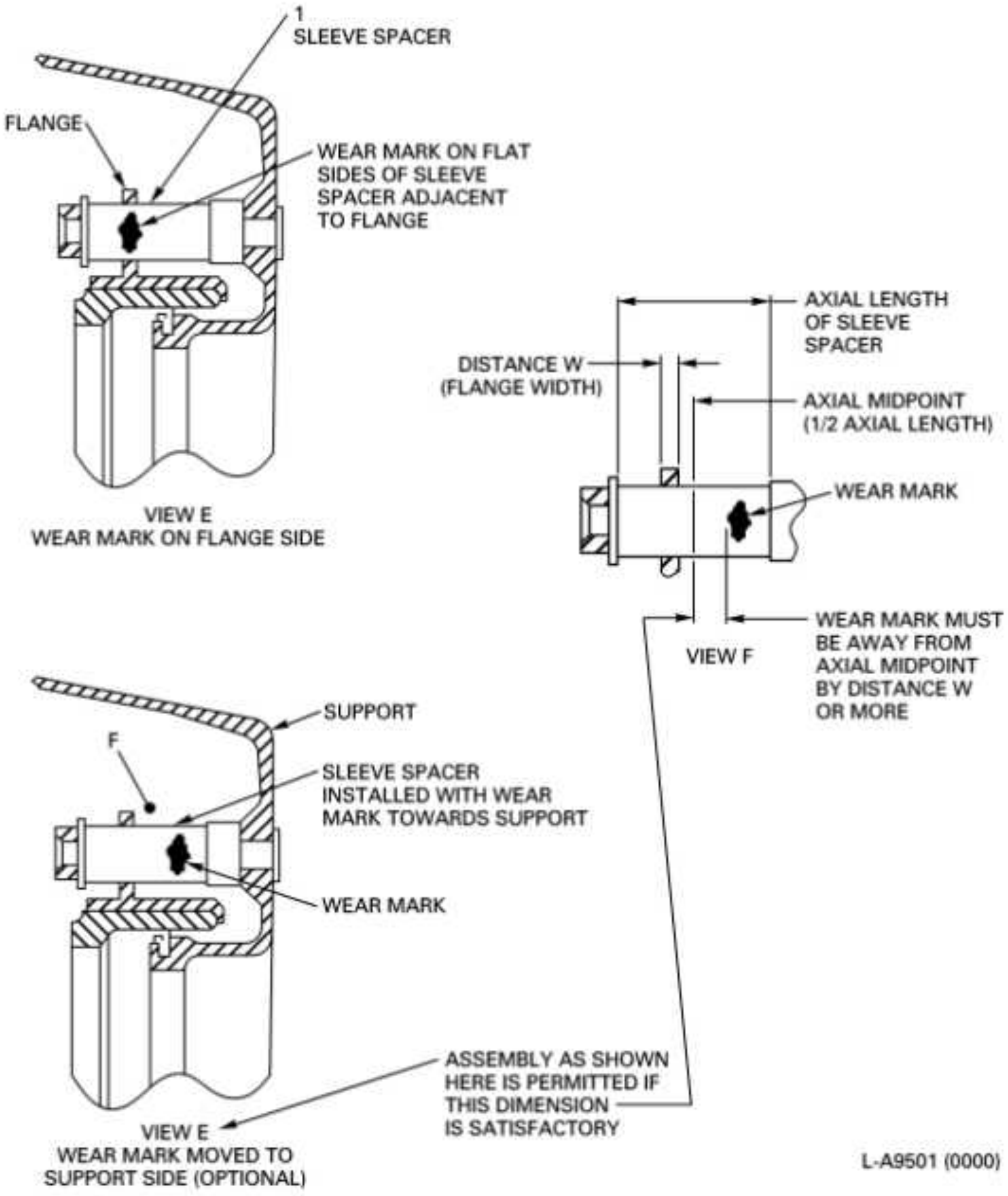

A
A
D
VERTICAL
CENTERPLANE
F
F
1
2
VIEW D
E
PWA 85169
PROTECTOR
B
SECTION A−A
VERTICAL
CENTER LINE
G
3
3
4
5
SECTION C−C
6
C
C
SEAL
RING
VIEW B
L−A5322 (0894)
PW V

Assembly Of No. 3 Bearing Rear
(Carbon) Seal Assembly
Figure 1002 (Sheet 1)
(Task 72−41−85−440−001)

NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY - ASSEMBLY-01

1. 0.344 Inch (8.738 mm) Offset Hole
2. 0.100 Inch (2.540 mm)
3. 0.500 Inch (12.700 mm) Maximum
4. The Seal Gap Must Be In Area G.
5. (Reference 845) 0.045 - 0.055 Inch (1.14 - 1.40 mm) When Installed In A Ring Gage With An ID Of 9.090 Inches (230.886 mm). 0.040 - 0.060 Inch (1.02 - 1.52 mm) When Installed In The Seal Assembly.
6. (Reference 846) 0.002 - 0.009 Inch (0.051 - 0.229 mm) Side Clearance

Key To Figure 1002 (Sheet 1)


1
SLEEVE SPACER
FLANGE
WEAR MARK ON FLAT SIDES OF SLEEVE SPACER ADJACENT TO FLANGE
VIEW E
WEAR MARK ON FLANGE SIDE
AXIAL LENGTH OF SLEEVE SPACER
DISTANCE W (FLANGE WIDTH)
AXIAL MIDPOINT (1/2 AXIAL LENGTH)
WEAR MARK
VIEW F
WEAR MARK MUST BE AWAY FROM AXIAL MIDPOINT BY DISTANCE W OR MORE
SUPPORT
F
SLEEVE SPACER INSTALLED WITH WEAR MARK TOWARDS SUPPORT
WEAR MARK
ASSEMBLY AS SHOWN HERE IS PERMITTED IF THIS DIMENSION IS SATISFACTORY
VIEW E
WEAR MARK MOVED TO SUPPORT SIDE (OPTIONAL)
L-A9501 (0000)

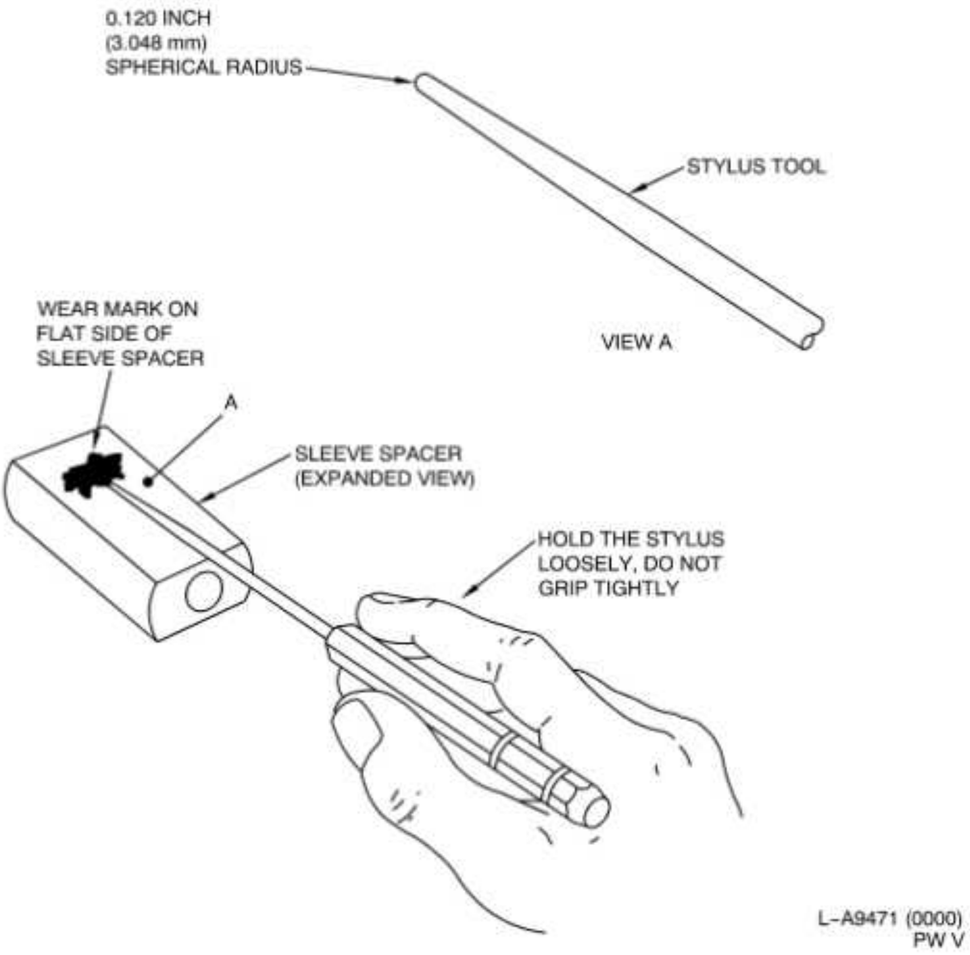
Assembly Of No. 3 Bearing Rear
(Carbon) Seal Assembly
Figure 1002 (Sheet 2)
(Task 72−41−85−440−001)

NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY - ASSEMBLY-01

Inspect	Serviceable Limits
1. Sleeve Spacer For Wear	Examine the flat sides of the sleeve spacer with a hand held stylus tool. See Figure 1003. Hold the stylus loosely at a 30 degree angle to the wear surface. Guide the stylus perpendicular to the lay of the wear. Only use the weight of the stylus, do not force the stylus with your fingers. If the stylus catches on the wear, you must install the sleeve spacer with the wear towards the support, (away from the flange).

Key To Figure 1002 (Sheet 2)

NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY - ASSEMBLY-01


0.120 INCH
(3.048 mm)
SPHERICAL RADIUS
STYLUS TOOL
VIEW A
WEAR MARK ON
FLAT SIDE OF
SLEEVE SPACER
A
SLEEVE SPACER
(EXPANDED VIEW)
HOLD THE STYLUS
LOOSELY, DO NOT
GRIP TIGHTLY
L-A9471 (0000)
PW V

Examination Of Wear On Sleeve Spacers
Figure 1003
(Task 72-41-85-440-001)

NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY - TESTING-01

Task 72-41-85-790-001:

1. Leak Check - No. 3 Bearing Rear (Carbon) Seal Assembly

A. Prerequisites

(1) See 72-41-85, Inspection/Check-00 PW4000 Series CIR, PN 51A357 for functional arrangement and part number applicability.

B. Equipment And Materials Necessary

Special Tools:

PWA 6507 Flowmeter
PWA 45411 Gage, Differential Pressure
PWA 46400 Flowmeter
PWA 85041 Fixture, Base

C. Procedure
See Figure 1301 and Figure 1302.

(1) Remove and inspect the seal plate (1302/5) for nicks and scratches in the micro finish surface.

(2) Install the seal plate (1302/5) in the PWA 85041 Base Fixture with the micro finish surface up.

(3) Connect the hoses from the PWA 46400 Flowmeter to the quick disconnect fittings (1302/3 and 1302/4) attached to the fixture base.

(4) Carefully position seal support assembly (1301/1) onto the fixture to seat the carbon seal assembly (1301/5), Surface B (1301/2) on the seal plate (1302/5).

(5) Attach the seal support assembly outer flange (1301/1) to the fixture base with washers and cap screws (1302/6).

(6) Connect the remaining hose from the PWA 46400 Flowmeter to the fitting on the top of the fixture.

(7) Connect the inlet hose to the inlet fitting (1302/1) on the top of the fixture.

(8) As an alternate to PWA 46400 Gage you may use PWA 6507 Flowmeter and PWA 45411 Gage to connect the flowmeter and gage to the fixture as follows:

NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY − TESTING−01

(a) Connect hose from PWA 6507 Flowmeter to larger of two quick−disconnect fittings marked FLOWMETER (1302/3) attached to fixture base.

(b) Attach smaller fitting of PWA 45411 Gage to the remaining fitting on fixture base.

(c) Attach air inlet hose to fitting marked INLET PINS (1302/1) on the cover.

(d) Attach the larger quick−disconnect fitting on the gage to the remaining quick−disconnect fitting on the fixture cover.

(9) Control the air pressure to the fixture slowly to 80 psi (551.6 kPa) and permit to stabilize five minutes.

NOTE: Although 80 psi (551.6 kPa) is the recommended air pressure, it is permitted for the air pressure to be 50 psi (344.7 kPa).

(10) Observe leakage on flowmeter. Total leakage between Surface B (1301/2), seal plate (1302/5) and seal ring (1301/3) must not exceed 4.5 CFM (0.13 cu m/min.) with 80 psi (551.6 kPa) pressure. Dimension C (1301/4) to be 1.433 − 1.463 inches (36.40 − 37.16 mm).

NOTE: With 50 psi (344.7 kPa) pressure, the leakage must not be more than 2.8 CFM (0.09 cu m/min).

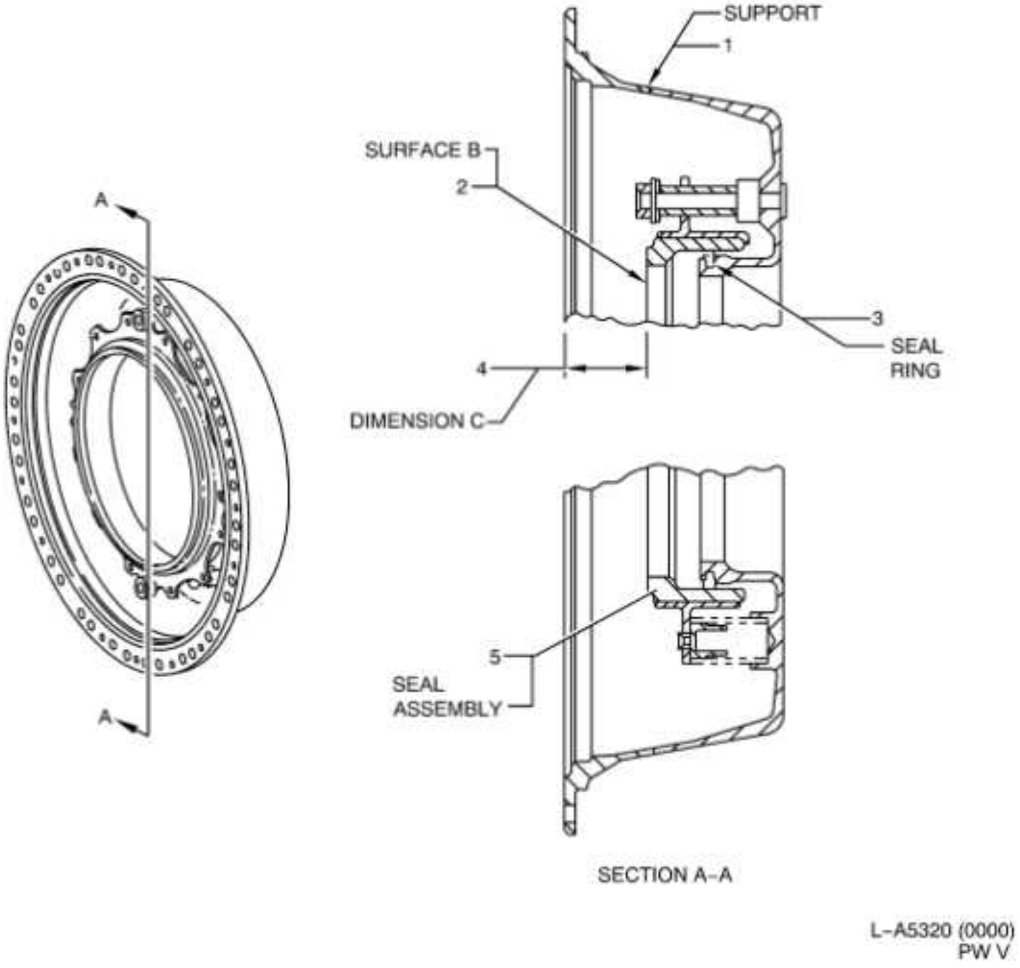
(11) If leakage exceeds limits corrective action must be taken as follows:

(a) Replace seal ring, if necessary.

(b) Lap face of carbon seal. See 72−41−87, Repair−04 PW4000 Series CIR, PN 51A357.

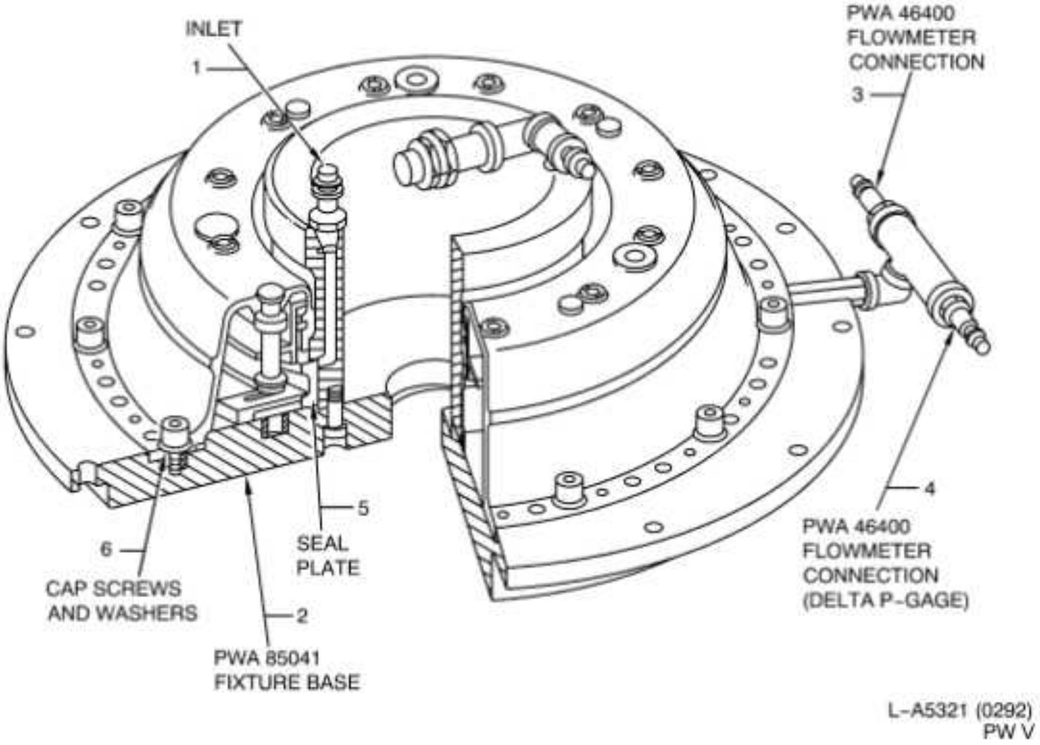
(c) Repair the piston ring groove. See 72−41−86, Repair−02 PW4000 Series CIR, PN 51A357.

NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY - TESTING-01


SUPPORT
1
SURFACE B
2
A
A
3
SEAL
RING
4
DIMENSION C
5
SEAL
ASSEMBLY
SECTION A-A
L-A5320 (0000)
PW V

No. 3 Bearing Rear (Carbon) Seal Support Assembly
Figure 1301
(Task 72-41-85-790-001)

NO. 3 BEARING REAR (CARBON) SEAL ASSEMBLY - TESTING-01


INLET
1
PWA 46400
FLOWMETER
CONNECTION
3
4
PWA 46400
FLOWMETER
CONNECTION
(DELTA P-GAGE)
5
SEAL
PLATE
6
CAP SCREWS
AND WASHERS
2
PWA 85041
FIXTURE BASE
L-A5321 (0292)
PW V

Installation Of Seal Support Assembly Into Leak Check Fixture
Figure 1302
(Task 72-41-85-790-001)

Return to Previous Menu

72−51−00

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	HIGHLIGHTS
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72−51−00	TURBINE NOZZLE − DESCRIPTION/OPERATION−00 • 72−51−00−990−002: Turbine Nozzle − Description And Operation
72−51−00	TURBINE NOZZLE − REMOVAL−01 • 72−51−00−030−002: Remove Inner Combustion Chamber
72−51−00	TURBINE NOZZLE − REMOVAL−02 • 72−51−00−030−003: Remove 1st Stage HPT Vane/Vane Cluster Assemblies
72−51−00	TURBINE NOZZLE − INSTALLATION−01 • 72−51−00−430−001: Install Inner Combustion Chamber
72−51−00	TURBINE NOZZLE − INSTALLATION−02 • 72−51−00−430−002: Install 1st Stage HPT Vane/Vane Cluster Assemblies
72−51−00	TURBINE NOZZLE − DISASSEMBLY−01 • 72−51−00−030−001: Disassemble Turbine Nozzle
72−51−00	TURBINE NOZZLE − INSPECTION/CHECK−01 • 72−51−00−990−004: General Inspection Requirements − Turbine Nozzle
72−51−00	TURBINE NOZZLE − INSPECTION/CHECK−03 • 72−51−00−990−005: Visual Inspection − Turbine Nozzle
72−51−00	TURBINE NOZZLE − INSPECTION/CHECK−04 • 72−51−00−990−001: Specific Fits And Clearances • 72−51−00−990−006: Specific Fits And Clearances
72−51−00	TURBINE NOZZLE − ASSEMBLY−01 • 72−51−00−400−001: Assemble Turbine Nozzle

72−51−01	STAGE 1 (VANE) HPT SUPPORT ASSEMBLY − DISASSEMBLY−01 • 72−51−01−030−001: (Post SB PW4ENG 72−467) Disassemble The Stage 1 (Vane) HPT Support Assembly (PN 50K184) − Stage 1 (Vane) HPT Support Assembly − Deleted
72−51−01	STAGE 1 (VANE) HPT SUPPORT ASSEMBLY − ASSEMBLY−01 • 72−51−01−400−001: (Post SB PW4ENG 72−467) Assemble The Stage 1 (Vane) HPT Support Assembly (PN 50K184) − Stage 1 (Vane) HPT Support Assembly
72−51−05	INNER COMBUSTION CHAMBER ASSEMBLY − DISASSEMBLY−01 • 72−51−05−040−001: Disassemble The Inner Combustion Chamber Assembly (Talon II Low Emission Burner)
72−51−05	INNER COMBUSTION CHAMBER ASSEMBLY − ASSEMBLY−01 • 72−51−05−440−001: Assemble The Inner Combustion Chamber Assembly (Talon II Low Emission Burner)

TURBINE NOZZLE - HOW TO USE MANUAL

Task 72-51-00-990-003:

1. Chapter/Section/Subject Numbering Outline

See Figure 1.

NOTE: See the tab separated How To Use Manual section located at the beginning of this manual set for information concerning Data Location Guidelines and a complete Chapter/Section/Subject numbering outline for all manual sections.

A. The following is a complete listing of the individual Chapter/Section/Subject numbers and specific nomenclatures which have been assigned to the significant Turbine Nozzle parts.

(1) Numbers which are not assigned are indicated in the list by one of the following terms:

UNASSIGNED - This designation is for numbers intentionally omitted and reserved for possible future use.

NOT USED - This designation is applied to numbers used in other related engine model programs which are not, at this time, applicable to the engine models represented by this manual.

TURBINE NOZZLE	72-51-00
STAGE 1 (VANE) HPT SUPPORT ASSEMBLY	72-51-01
STAGE 1 HPT VANE/VANE CLUSTER ASSEMBLY	72-51-02
STAGE 1 HPT (BLADE) COOLING DUCT ASSEMBLY	72-51-03
HPT COOLING DUCT DEFLECTOR	72-51-04
INNER COMBUSTION CHAMBER ASSEMBLY	72-51-05
STAGE 1 HPT DUCT SEGMENT	72-51-06
STAGE 1 HPT DUCT STOP	72-51-07
COMBUSTION CHAMBER GUIDE ASSEMBLY (UPPER SEGMENT)	72-51-08
COMBUSTION CHAMBER GUIDE ASSEMBLY (LOWER SEGMENT)	72-51-09
COMBUSTION CHAMBER GUIDE PLATE ASSEMBLY	72-51-10

TURBINE NOZZLE − HOW TO USE MANUAL

STAGE 1 HPT VANE SEALS .... 72−51−11

STAGE 1 HPT BRUSH SEAL AND SUPPORT ASSEMBLY .... 72−51−12

NOT USED .... 72−51−13

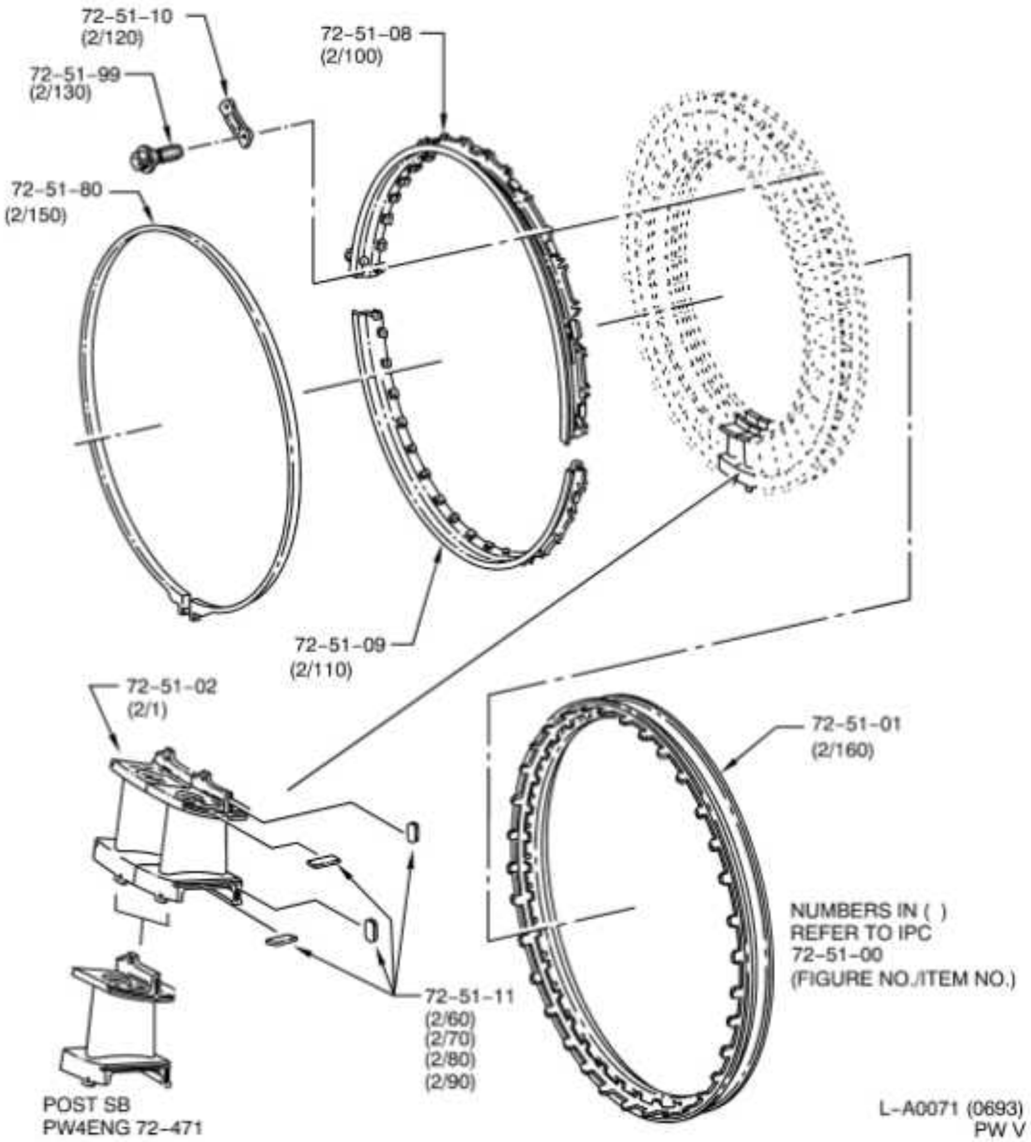
UNASSIGNED .... 72−51−14 through 72−51−79

COMBUSTION CHAMBER CLAMP ASSEMBLY .... 72−51−80

UNASSIGNED .... 72−51−81 through 72−51−98

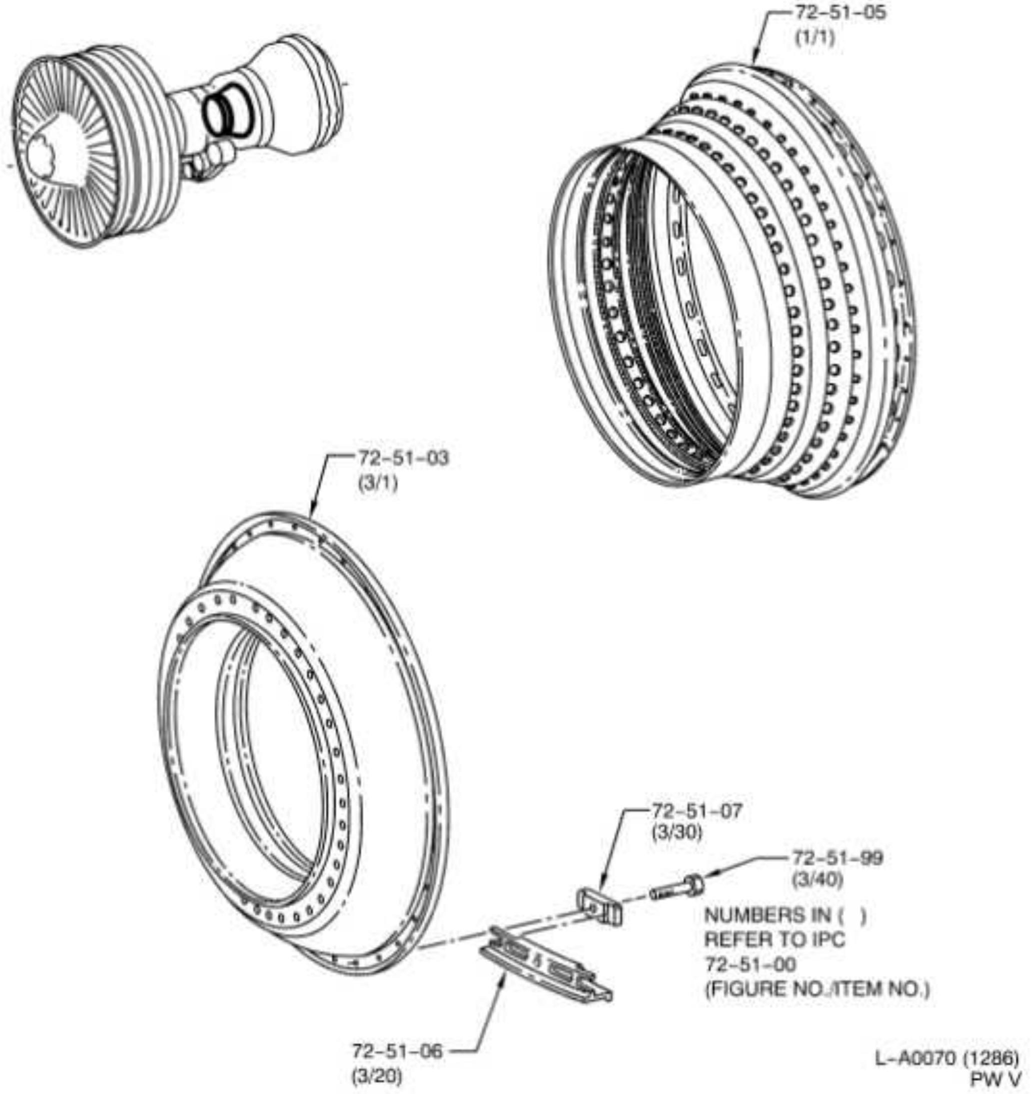
TURBINE NOZZLE MISCELLANEOUS PARTS .... 72−51−99

TURBINE NOZZLE - HOW TO USE MANUAL

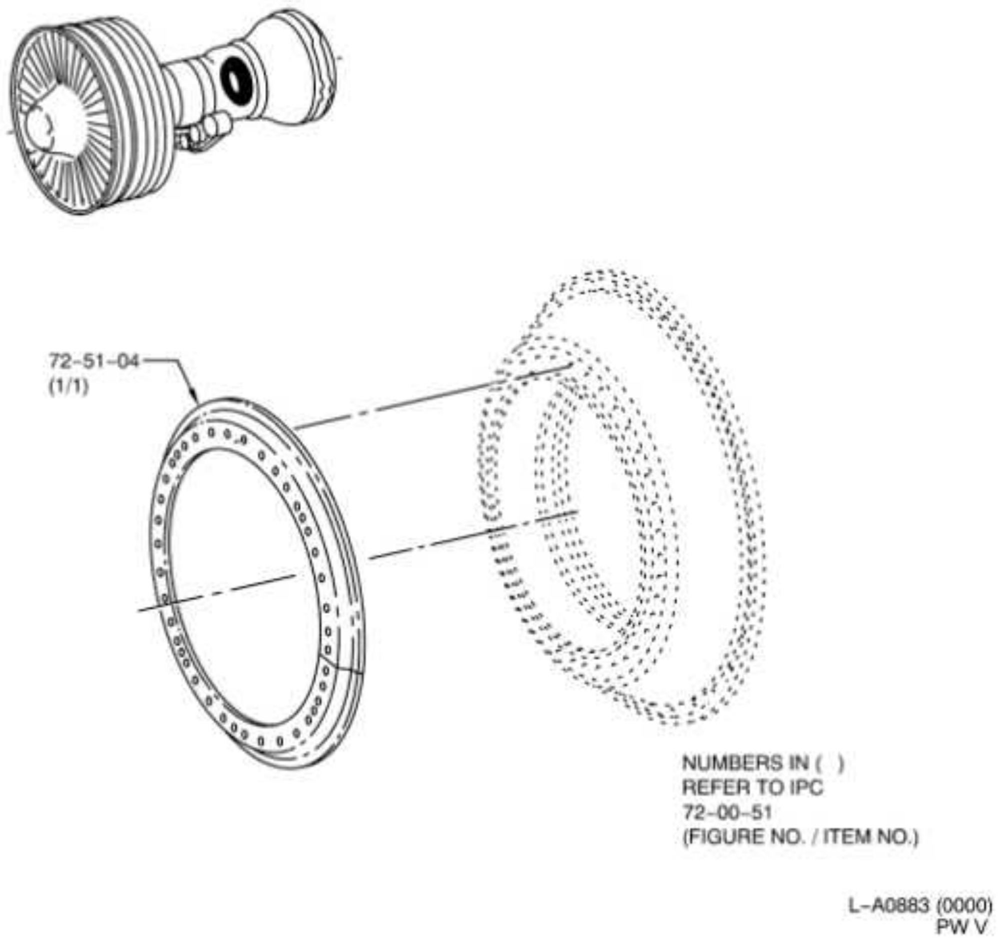

72-51-10
(2/120)
72-51-08
(2/100)
72-51-99
(2/130)
72-51-80
(2/150)
72-51-09
(2/110)
72-51-02
(2/1)
72-51-01
(2/160)
NUMBERS IN ( )
REFER TO IPC
72-51-00
(FIGURE NO./ITEM NO.)
72-51-11
(2/60)
(2/70)
(2/80)
(2/90)
POST SB
PW4ENG 72-471
L-A0071 (0693)
PW V

Turbine Nozzle
Figure 1 (Sheet 1)
(Task 72-51-00-990-003)

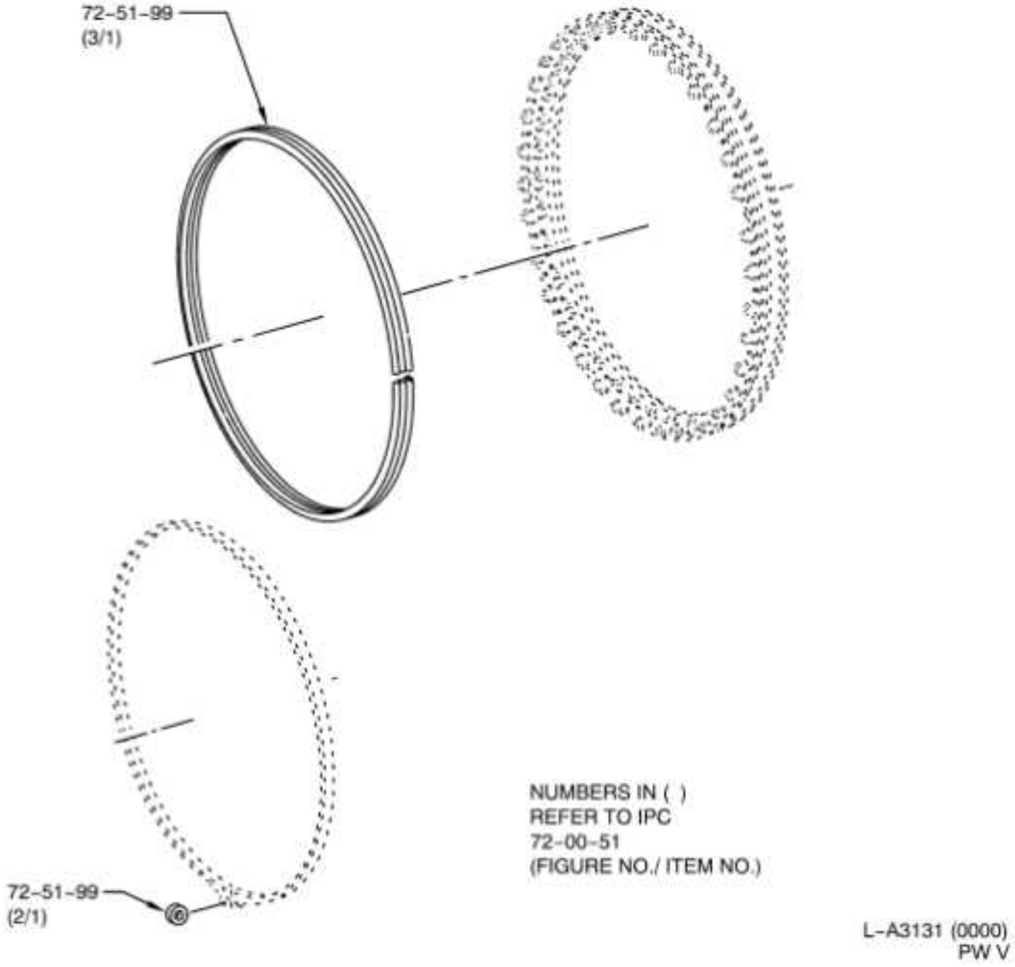
TURBINE NOZZLE − HOW TO USE MANUAL


72-51-05
(1/1)
72-51-03
(3/1)
72-51-07
(3/30)
72-51-99
(3/40)
NUMBERS IN ( )
REFER TO IPC
72-51-00
(FIGURE NO./ITEM NO.)
72-51-06
(3/20)
L-A0070 (1286)
PW V

Turbine Nozzle
Figure 1 (Sheet 2)
(Task 72−51−00−990−003)


72-51-04
(1/1)
NUMBERS IN ( )
REFER TO IPC
72-00-51
(FIGURE NO. / ITEM NO.)
L-A0883 (0000)
PW V

Turbine Nozzle
Figure 1 (Sheet 3)
(Task 72−51−00−990−003)


72-51-99
(3/1)
72-51-99
(2/1)
NUMBERS IN ( )
REFER TO IPC
72-00-51
(FIGURE NO./ ITEM NO.)
L-A3131 (0000)
PW V

Turbine Nozzle
Figure 1 (Sheet 4)
(Task 72-51-00-990-003)

Previous Pageblock Return to Previous Menu Next Pageblock

TURBINE NOZZLE - DESCRIPTION/OPERATION-00

Task 72-51-00-990-002:

1. Turbine Nozzle - Description And Operation

A. The turbine nozzle has been established as a convenient means of assembling and installing, as a package, the inner combustion chamber (liner) assembly, 1st stage HPT vane cluster assemblies (guide vanes), and 1st stage HPT (blade) cooling duct assembly into the engine. The turbine nozzle is positioned at the rear of the diffuser and combustor and forward of the high pressure turbine. The turbine nozzle is housed entirely within the rear section of the diffuser case.

B. The turbine nozzle, inner combustion chamber (liner) assembly along with the outer combustion chamber (liner) assembly provides a chamber where the compressed air from the high pressure compressor HPC is mixed with fuel in the optimum proportions and burned, greatly increasing the energy level and accelerating the hot gasses. The combustor assembly directs the hot gasses to the 1st stage turbine nozzle guide vanes. The turbine nozzle incorporates 17 vane clusters (air-cooled cobalt alloy vanes) bolted around the 1st stage HPT (blade) cooling duct assembly and retained at the OD by a support ring. The ring of vanes forms a series of nozzles that increase the velocity of the gasses exiting the combustion chamber and changes the direction of motion of these gasses to provide the optimum angle, pressure and flow of gasses to the 1st stage turbine blades.

C. The 1st stage HPT cooling duct assembly directs cooler, boundary, air from the interior of the diffuser case through metered nozzles onto the 1st stage turbine rotor to cool the 1st stage turbine blades. See Figure 1, Figure 2 and Figure 3.

D. Inner Combustion Chamber (Liner) Assembly

(1) The inner combustion chamber (liner) assembly is fabricated from rolled ring sections of nickel alloy material, welded together to form the ID portion of the combustion chamber. The forward section or lip of this liner fits into the inner (bulkhead) section of the outer combustion chamber (liner) assembly. This forms the complete burner or combustion chamber (liner). The forward fit of the inner liner to the outer liner is accomplished through a slip joint seal. The inner liner is a short double pass flow type liner for efficient and even airflow and film cooling. The inner surfaces exposed to the combustion gasses are

coated with a magnesium zirconate material as a thermal barrier coating.

E. Stage 1 HPT Vane Cluster Assembly

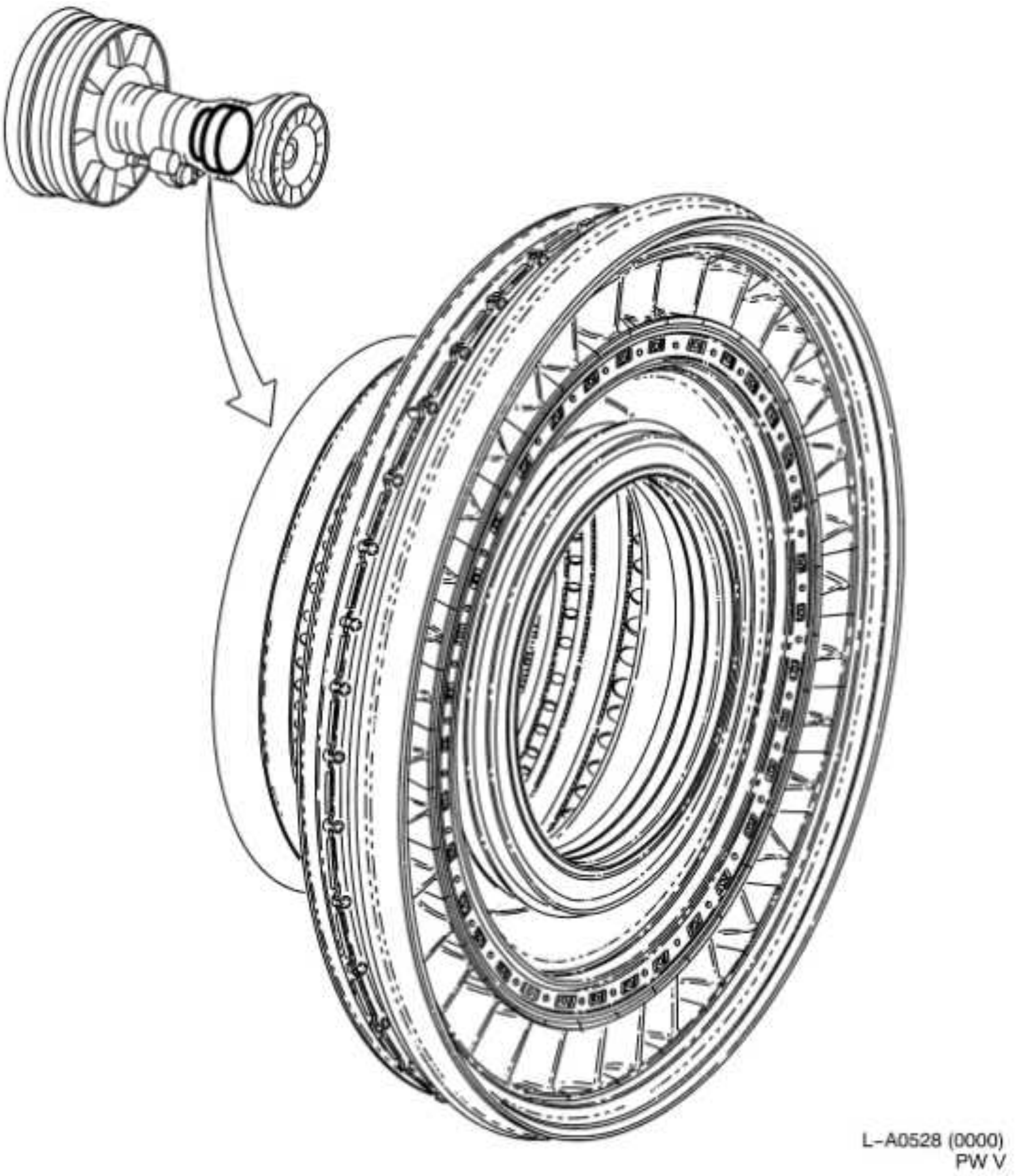
(1) The 1st stage HPT vane clusters are assembled to form a ring of vanes positioned at the rear of the combustion chamber between the inner and outer combustion chamber assemblies (liners). The assembly consists of 17 clustered vane assemblies with two vanes per cluster for a total of 34 vanes. The vane clusters are cast from a nickel cobalt alloy.

(2) Each hollow vane incorporates internal baffles and cooling holes in the airfoil which allow boundary cooling air from the diffuser case to be directed through the vane and over the exterior of the airfoil to reduce metal temperature. Vane airfoils are also coated with heat−resistant material to further improve durability. Sheet metal seals are installed between adjacent vane cluster platforms to reduce gaspath leakage and ensure adequate cooling airflow. See Figure 4 for typical vane internal cooling scheme.

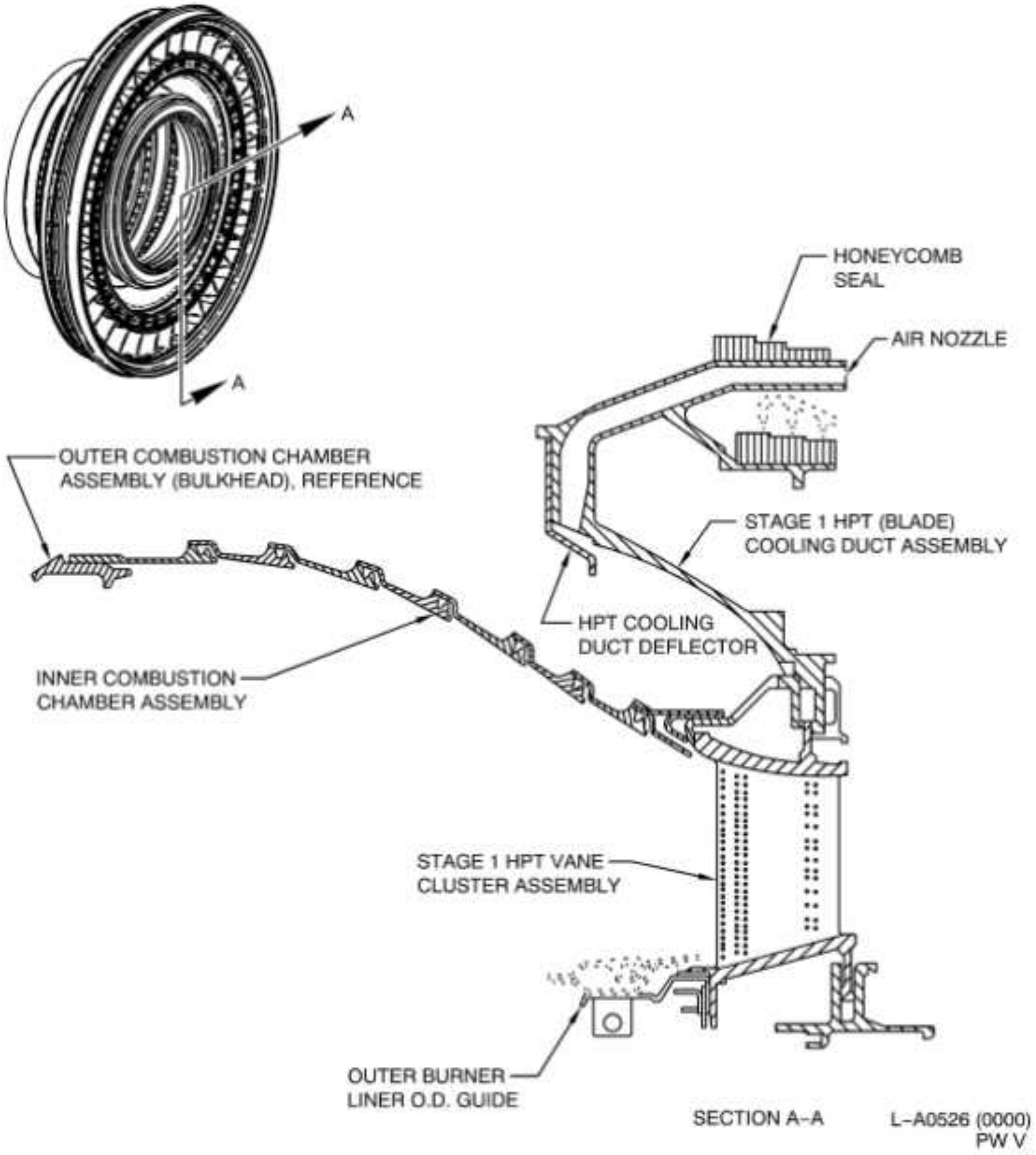
F. Stage 1 HPT (Blade) Cooling Duct Assembly

(1) The 1st stage HPT (blade) cooling duct assembly consists of a cast case and nozzle, with brazed on honeycomb nozzle seals, the cast case also forms the rear of the inner combustion chamber area as well as providing for the cooling air nozzles. The cooling duct is bolted to the rear of the ID wall of the diffuser case and is the main structural support for the ring of 1st stage HPT vane clusters and inner combustion chamber assembly (liner). Both the 1st stage vanes and inner combustion chamber assembly (liner) are retained by the cooling air duct at a flange at the rear OD of the cooling air duct case. The cooling air nozzles on the cooling air nozzle case are sealed by two honeycomb seal lands that align with knife−edge seals on the 1st stage HPT rotor.

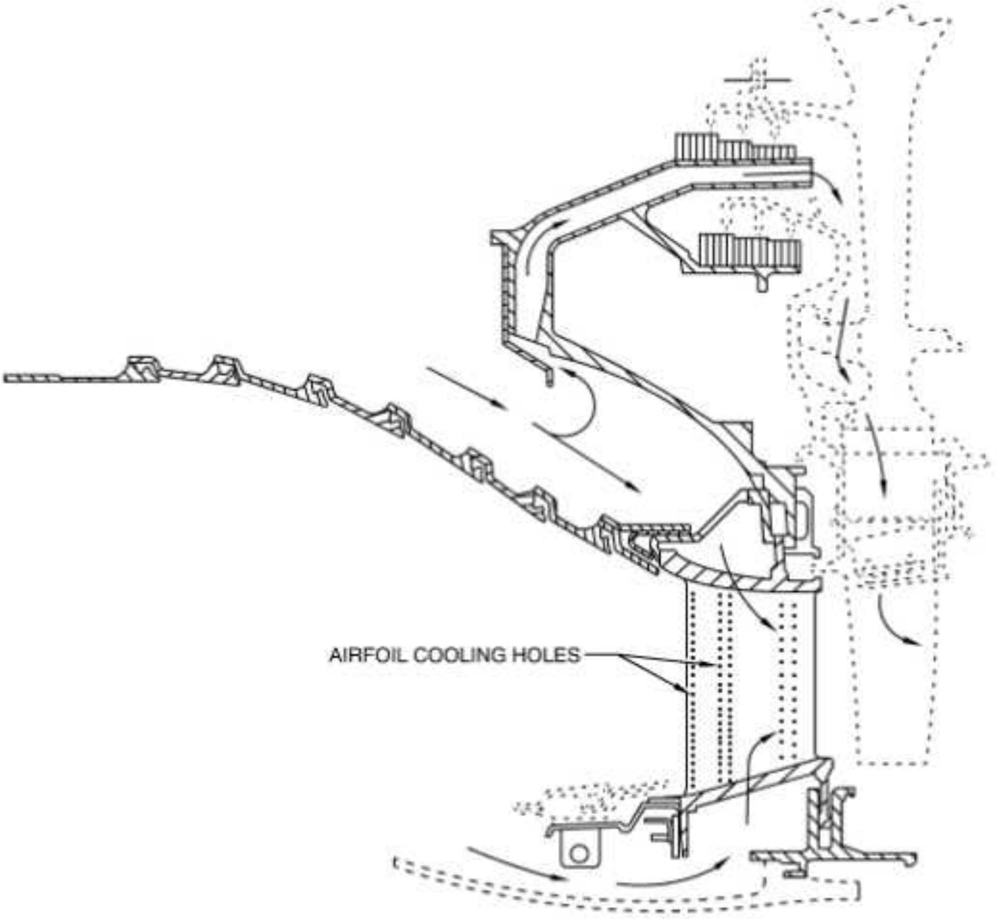
TURBINE NOZZLE − DESCRIPTION/OPERATION−00



Turbine Nozzle
Figure 1
(Task 72−51−00−990−002)

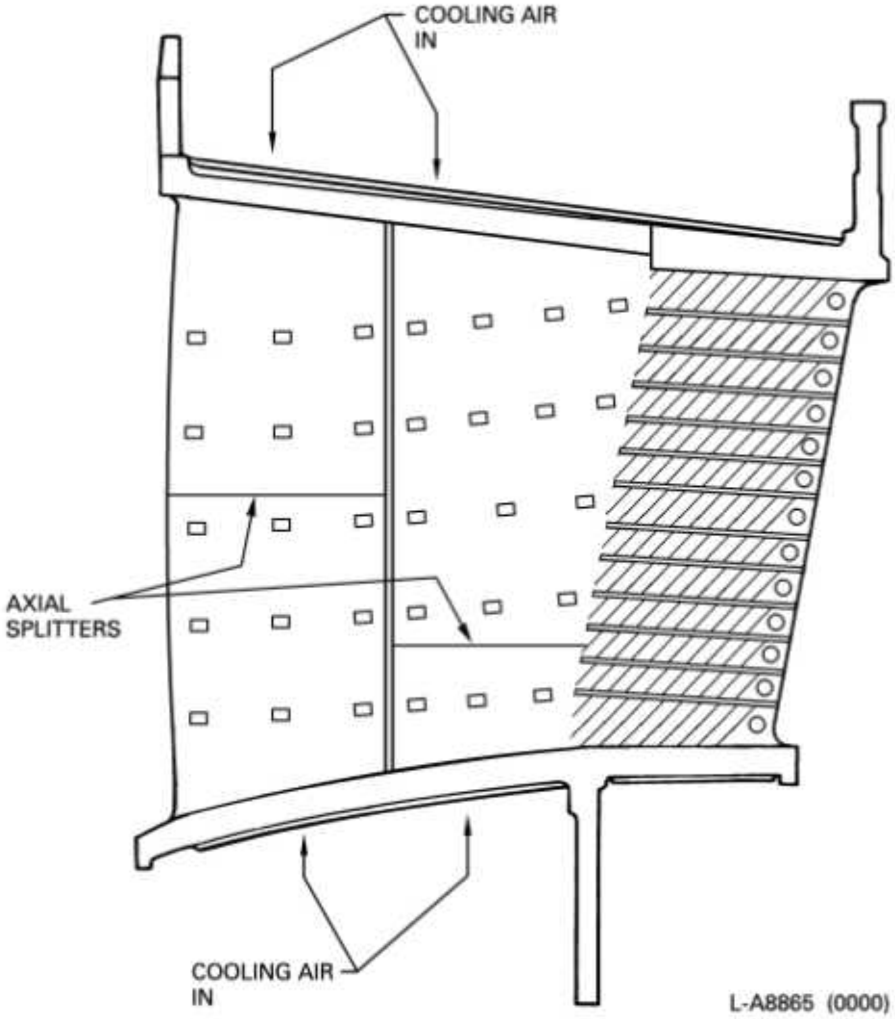

A
A
HONEYCOMB SEAL
AIR NOZZLE
OUTER COMBUSTION CHAMBER ASSEMBLY (BULKHEAD), REFERENCE
STAGE 1 HPT (BLADE) COOLING DUCT ASSEMBLY
HPT COOLING DUCT DEFLECTOR
INNER COMBUSTION CHAMBER ASSEMBLY
STAGE 1 HPT VANE CLUSTER ASSEMBLY
OUTER BURNER LINER O.D. GUIDE
SECTION A−A
L−A0526 (0000)
PW V

Turbine Nozzle
Figure 2
(Task 72−51−00−990−002)



L-A0527 (0000)
PW V

Turbine Nozzle Airflow
Figure 3
(Task 72-51-00-990-002)


COOLING AIR IN
AXIAL SPLITTERS
COOLING AIR IN
L-A8865 (0000)

First Stage HPT Vane Cooling Scheme
Figure 4
(Task 72−51−00−990−002)

Previous Pageblock Return to Previous Menu Next Pageblock

TURBINE NOZZLE - REMOVAL-01

Task 72-51-00-030-002:

1. Remove Inner Combustion Chamber

NOTE: See Figure 301 for part/assembly removal procedure.

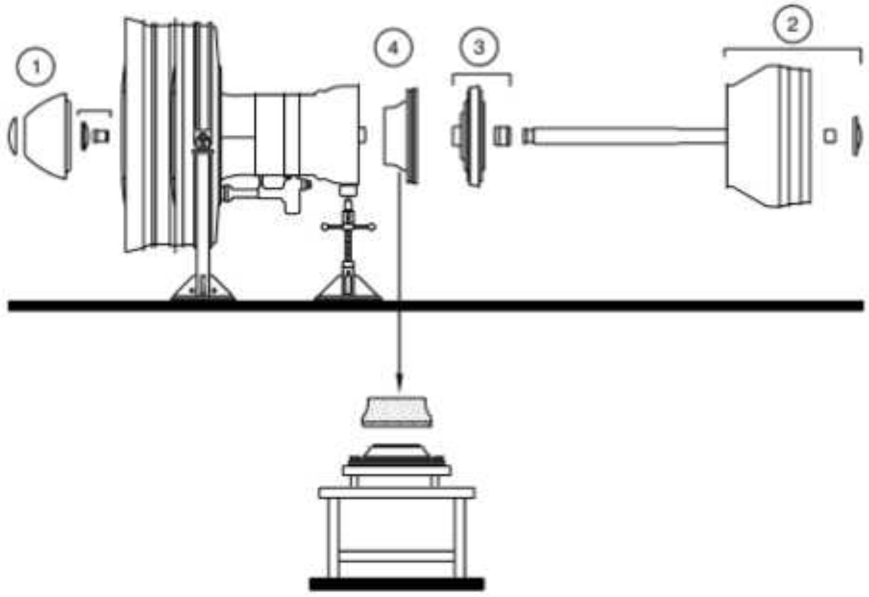
A. Prerequisites
  (1) Remove turbine nozzle per 72-00-51, Removal-01 (Task 72-00-51-020-001).
B. Equipment And Materials Required

Special Tools:

PWA 27918 Sling (Optional To PWA 80555)
PWA 28657 Sling, Strongback
PWA 76154 Adapter (Two Required)
PWA 80555 Sling, Handling
PWA 85078 Fixture, Holding

C. Procedure
  (1) Using two PWA 76154 Adapters, attach hoist with PWA 28657 Sling to trunnion spools on PWA 85078 Fixture. Using hoist lift and trunnion fixture to position with support posts up.
  (2) Loosen and retract clamps and position fixture over rear of turbine nozzle. Slide four clamps (302/11) over OD flange of 1st stage HPT cooling duct (302/9) and secure with hand knobs (302/10). Slide clamps (302/7) over rear lip of 1st stage HPT support (302/8) and secure with bolts (302/6).
  (3) Using hoist position turbine nozzle on bench, inner combustion chamber (302/5) end down.
  (4) Remove bolts (302/2, 302/1) securing 17 1st stage HPT duct stops (302/3) and 1st stage HPT duct segments (302/4) to inner combustion chamber. Remove duct stops and duct segments.
  (5) Using hoist, raise turbine nozzle to separate inner combustion chamber from 1st stage HPT cooling duct (302/9). If required, tap combustion chamber support flange with rawhide mallet to separate combustion chamber.
  (6) Using hoist, sling and adapters, trunnion assembly and position fixture with support posts down on bench.
  (7) Using PWA 80555 or PWA 27918 Sling position inner combustion liner on pallet.

TURBINE NOZZLE - REMOVAL-01

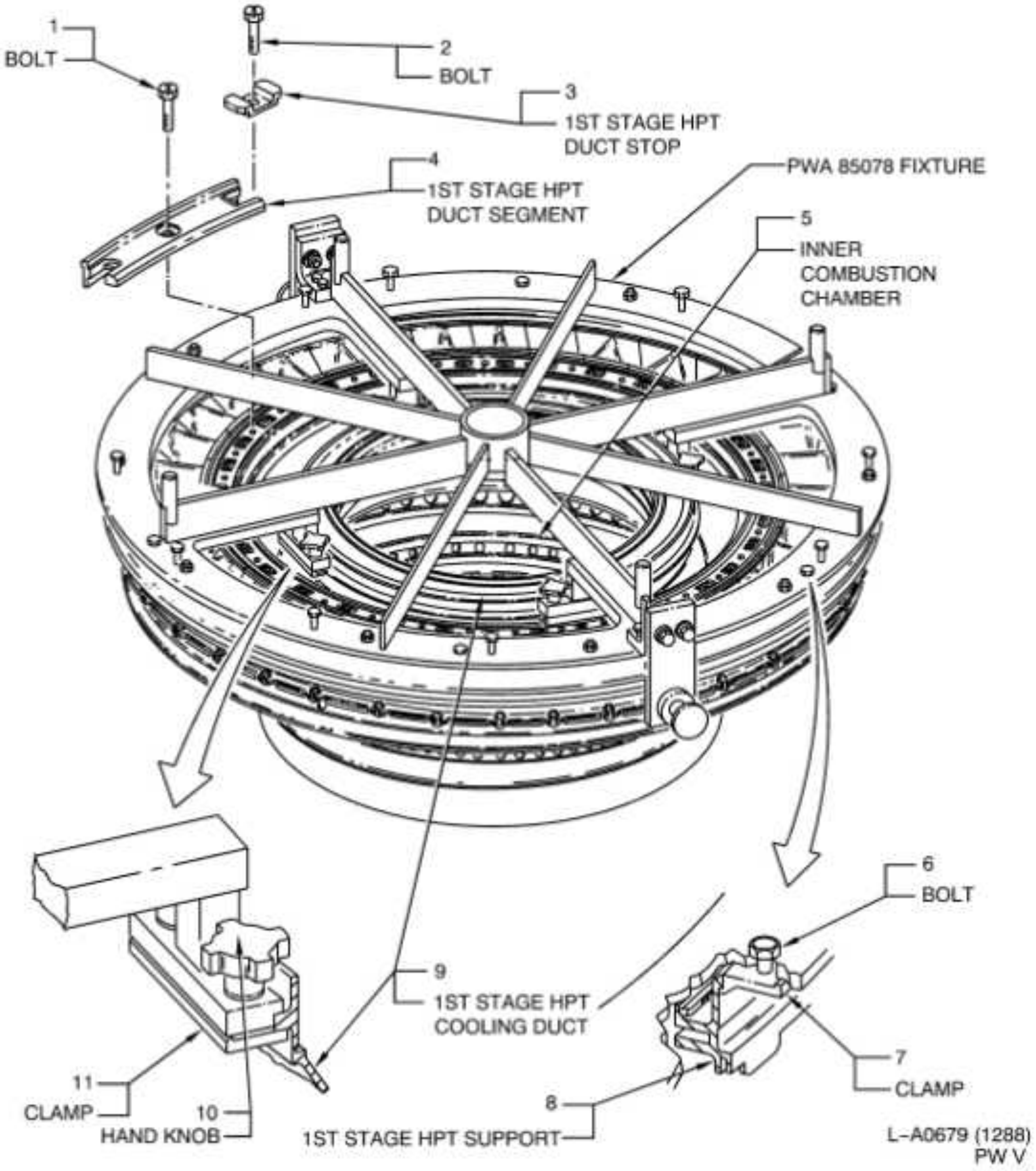


1. REMOVE COMPRESSOR INLET CONE
2. REMOVE LOW PRESSURE TURBINE AND TURBINE EXHAUST CASE WITH SHAFT
3. REMOVE HIGH PRESSURE TURBINE
4. REMOVE TURBINE NOZZLE

L-A1653 (0000)
PW V

Procedure Sequence
Figure 301
(Task 72-51-00-030-002)

TURBINE NOZZLE − REMOVAL−01


1
BOLT
2
BOLT
3
1ST STAGE HPT
DUCT STOP
4
1ST STAGE HPT
DUCT SEGMENT
PWA 85078 FIXTURE
5
INNER
COMBUSTION
CHAMBER
6
BOLT
7
CLAMP
8
1ST STAGE HPT SUPPORT
9
1ST STAGE HPT
COOLING DUCT
10
HAND KNOB
11
CLAMP
L−A0679 (1288)
PW V

Inner Combustion Chamber Removal
Figure 302
(Task 72−51−00−030−002)

Previous Pageblock   Return to Previous Menu   Next Pageblock

TURBINE NOZZLE - REMOVAL-02

Task 72-51-00-030-003:

1. Remove 1st Stage HPT Vane/Vane Cluster Assemblies

NOTE: See Figure 301 for part/assembly removal procedure.

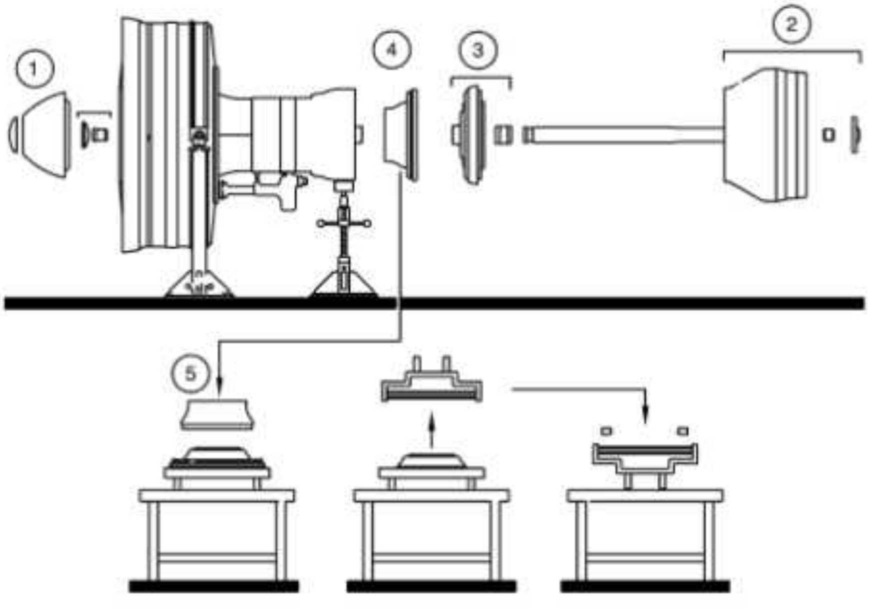
A. Prerequisites
  (1) Remove inner combustion chamber assembly per Removal-01 (Task 72-51-00-030-002).

B. Equipment And Materials Required

Special Tools:
PWA 28657 Sling, Strongback
PWA 76154 Adapter
PWA 85077 Fixture, Assembly

C. Procedure
  (1) If required, remove bolt (302/8), nut (302/9) and spacer (302/4) securing combustion chamber clamp (302/1) to combustion chamber guides. See Figure 302.
  (2) Remove bolts (302/7), nuts (302/5) and combustion chamber guide plates (302/6) securing combustion chamber guide (upper and lower segments) (302/2) and (302/9) to front outer flanges of vanes. Remove guides.
  (3) Using two PWA 76154 Adapters, attach hoist with PWA 28657 Sling to trunnion spools on PWA 85077 Fixture.
  (4) Loosen and retract clamps and position fixture over turbine nozzle vanes and secure with detail clamps. See Figure 303.
  (5) Remove clamps (303/3) securing 1st stage HPT support to (PWA 85078) Fixture.
  (6) Using hoist and sling connected to Fixture (PWA 85077) raise vane and support assembly and trunnion fixture to position with support posts down.
  (7) Carefully separate vane/vane cluster assemblies and remove seals from slots in inner and outer vane platforms. See Figure 304.

D. Postrequisites
  (1) (Post SB PW4ENG 72-467 only) If applicable, disassemble the Stage 1 (vane) HPT support assembly. Refer to 72-51-00, Disassembly-01 (Task 72-51-00-030-001).

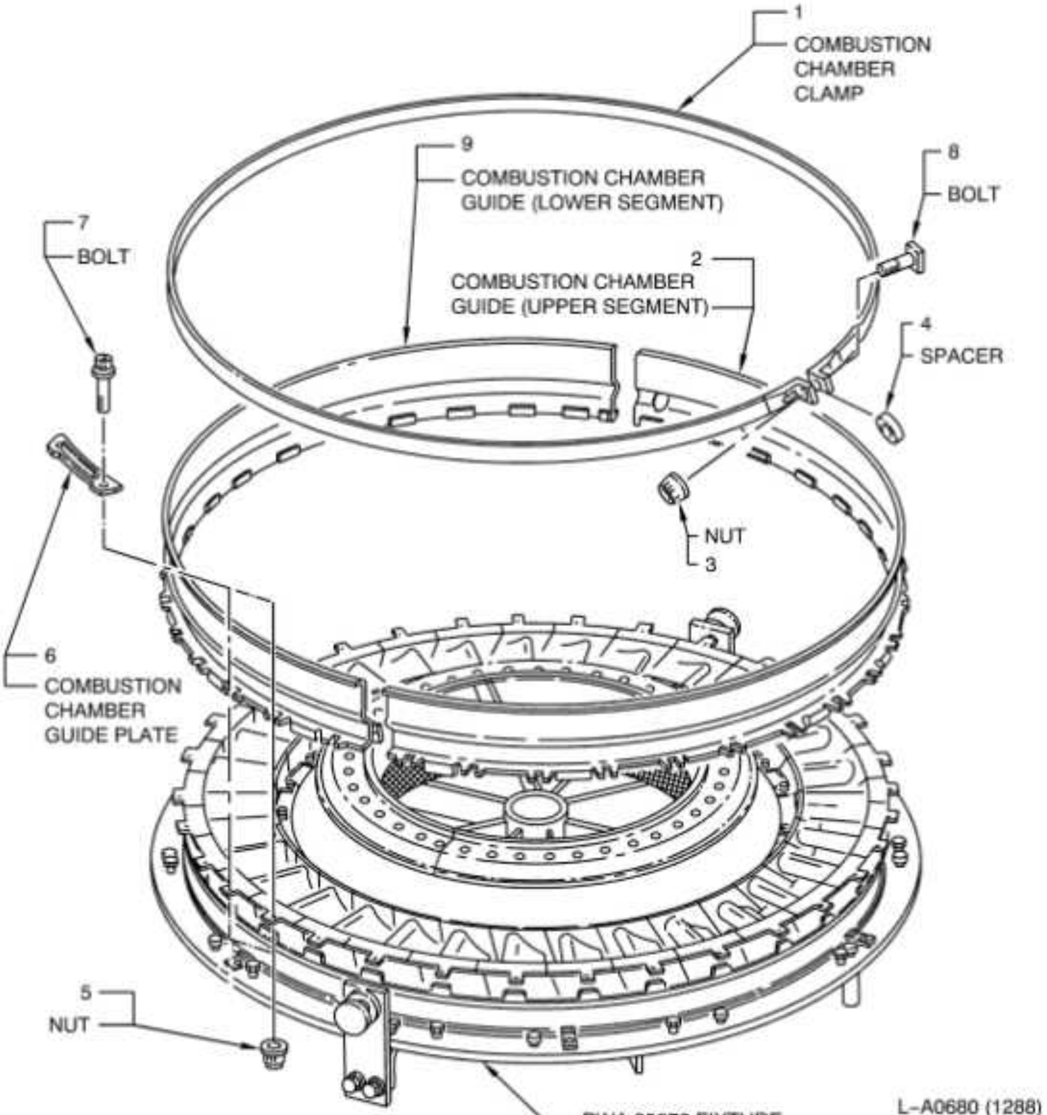


1. REMOVE COMPRESSOR INLET CONE
2. REMOVE LOW PRESSURE TURBINE AND TURBINE EXHAUST CASE WITH SHAFT
3. REMOVE HIGH PRESSURE TURBINE
4. REMOVE TURBINE NOZZLE
5. REMOVE INNER COMBUSTION CHAMBER

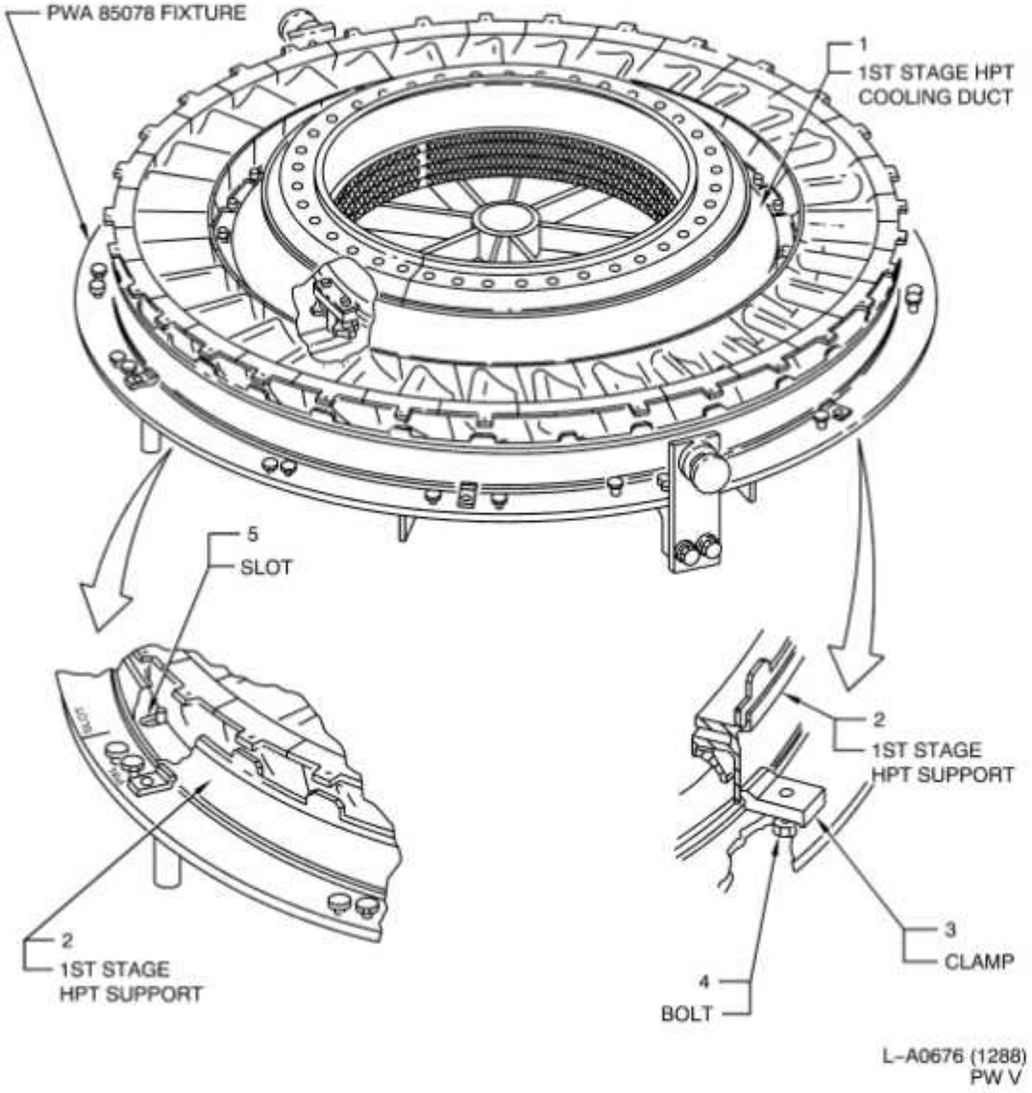
L-A1651 (0000)
PW V

Procedure Sequence
Figure 301
(Task 72−51−00−030−003)

TURBINE NOZZLE − REMOVAL−02

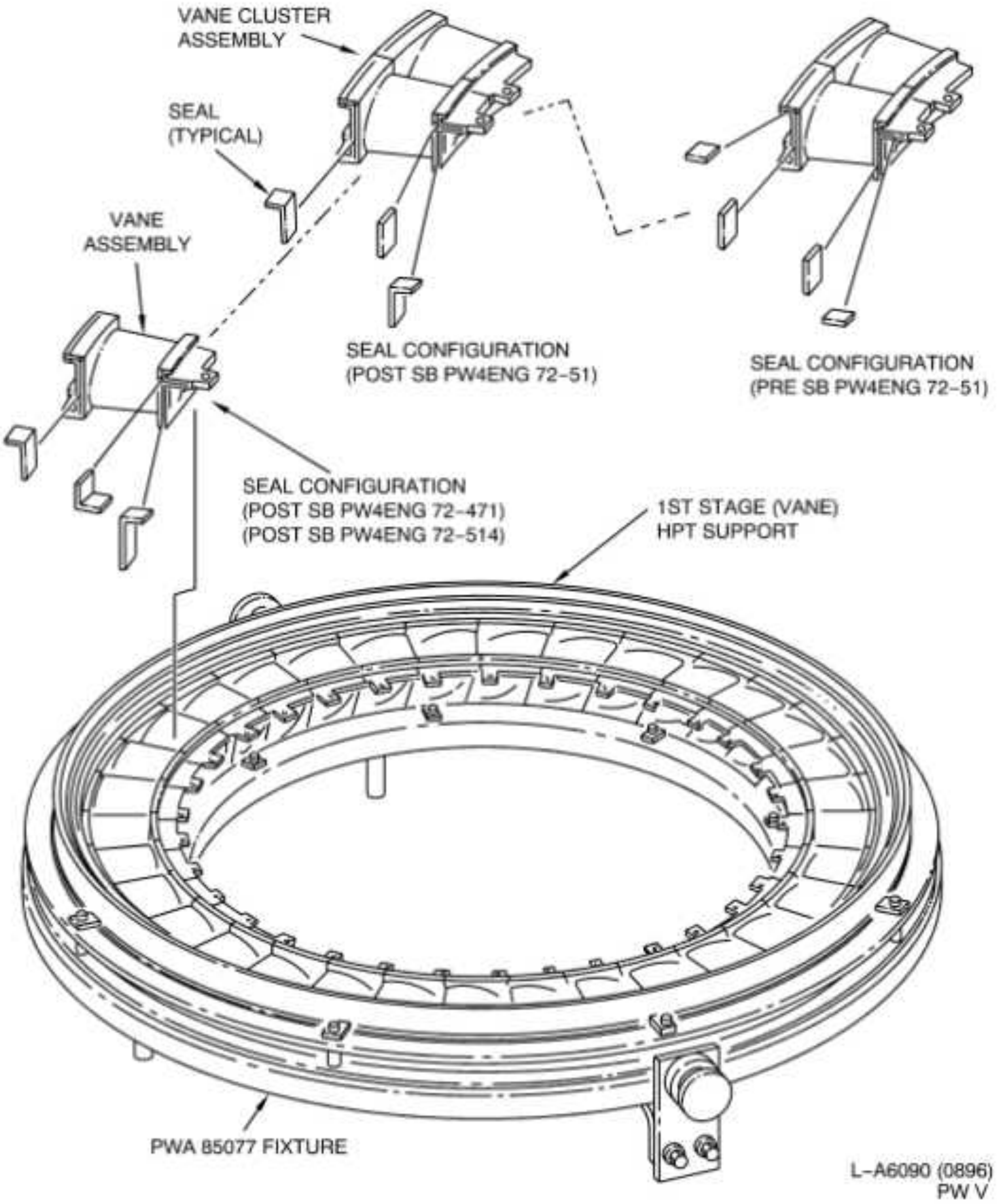

1
COMBUSTION CHAMBER CLAMP
9
COMBUSTION CHAMBER GUIDE (LOWER SEGMENT)
8
BOLT
7
BOLT
2
COMBUSTION CHAMBER GUIDE (UPPER SEGMENT)
4
SPACER
NUT
3
6
COMBUSTION CHAMBER GUIDE PLATE
5
NUT
PWA 85078 FIXTURE
L−A0680 (1288)
PW V

Combustion Chamber Guides
And Clamp Removal
Figure 302
(Task 72−51−00−030−003)


PWA 85078 FIXTURE
1
1ST STAGE HPT COOLING DUCT
5
SLOT
2
1ST STAGE HPT SUPPORT
2
1ST STAGE HPT SUPPORT
3
CLAMP
4
BOLT
L-A0676 (1288)
PW V

Stage 1 HPT Cooling Duct Removal
Figure 303
(Task 72-51-00-030-003)

TURBINE NOZZLE − REMOVAL−02


VANE CLUSTER ASSEMBLY
SEAL (TYPICAL)
VANE ASSEMBLY
SEAL CONFIGURATION (POST SB PW4ENG 72-51)
SEAL CONFIGURATION (PRE SB PW4ENG 72-51)
SEAL CONFIGURATION (POST SB PW4ENG 72-471) (POST SB PW4ENG 72-514)
1ST STAGE (VANE) HPT SUPPORT
PWA 85077 FIXTURE
L-A6090 (0896)
PW V

Stage 1 HPT Vane/Vane Cluster Assemblies Removal
Figure 304
(Task 72−51−00−030−003)

TURBINE NOZZLE - INSTALLATION-01

Task 72-51-00-430-001:

1. Install Inner Combustion Chamber

NOTE: See Figure 401 for part/assembly installation procedure sequence.

A. Prerequisites

(1) See Inspection/Check-01 (Task 72-51-00-990-001) for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows:

B. Equipment And Materials Required

Special Tools:
PWA 27918 Sling (Optional To PWA 80555)
PWA 28657 Sling, Strongback
PWA 29855-2 Pin (Three Required)
PWA 76154 Adapter (Two Required)
PWA 80555 Sling, Handling

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

C. Procedure

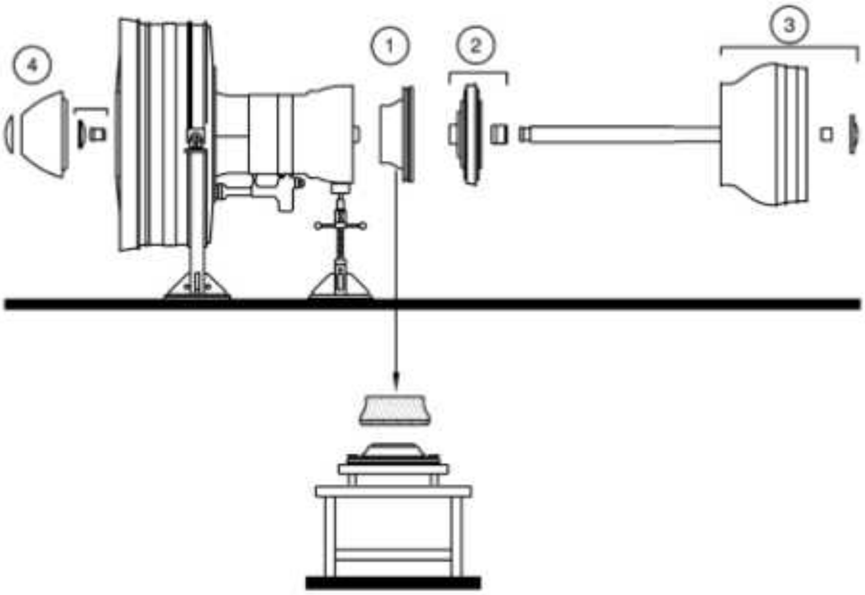
CAUTION: OUTER AND INNER COMBUSTION CHAMBER ASSEMBLIES WITH REVISED DILUTION HOLES (DECREASED EMISSIONS) MUST BE USED IN SETS WITH COMBUSTION CHAMBER GUIDE ASSEMBLIES (REFERENCE SB PW4ENG 72-187).

(1) Using hoist, connect PWA 80555 or PWA 27918 Sling (402/1) to cooling holes in inner combustion chamber (402/2). See Figure 402.

(2) Install three PWA 29855-2 Pins (402/6) approximately 120 degrees apart into the rear flange of the combustion chamber.

(3) Use a hoist to put the combustion chamber over the 1st stage HPT cooling duct (402/5) and vane assembly. Align the locating pin (402/4) in the duct with the locating pin hole (402/3) in the combustion chamber rear plate detail. Lower the combustion chamber onto the duct. Temporarily secure the combustion chamber to the cooling duct with three equally spaced workbolts.

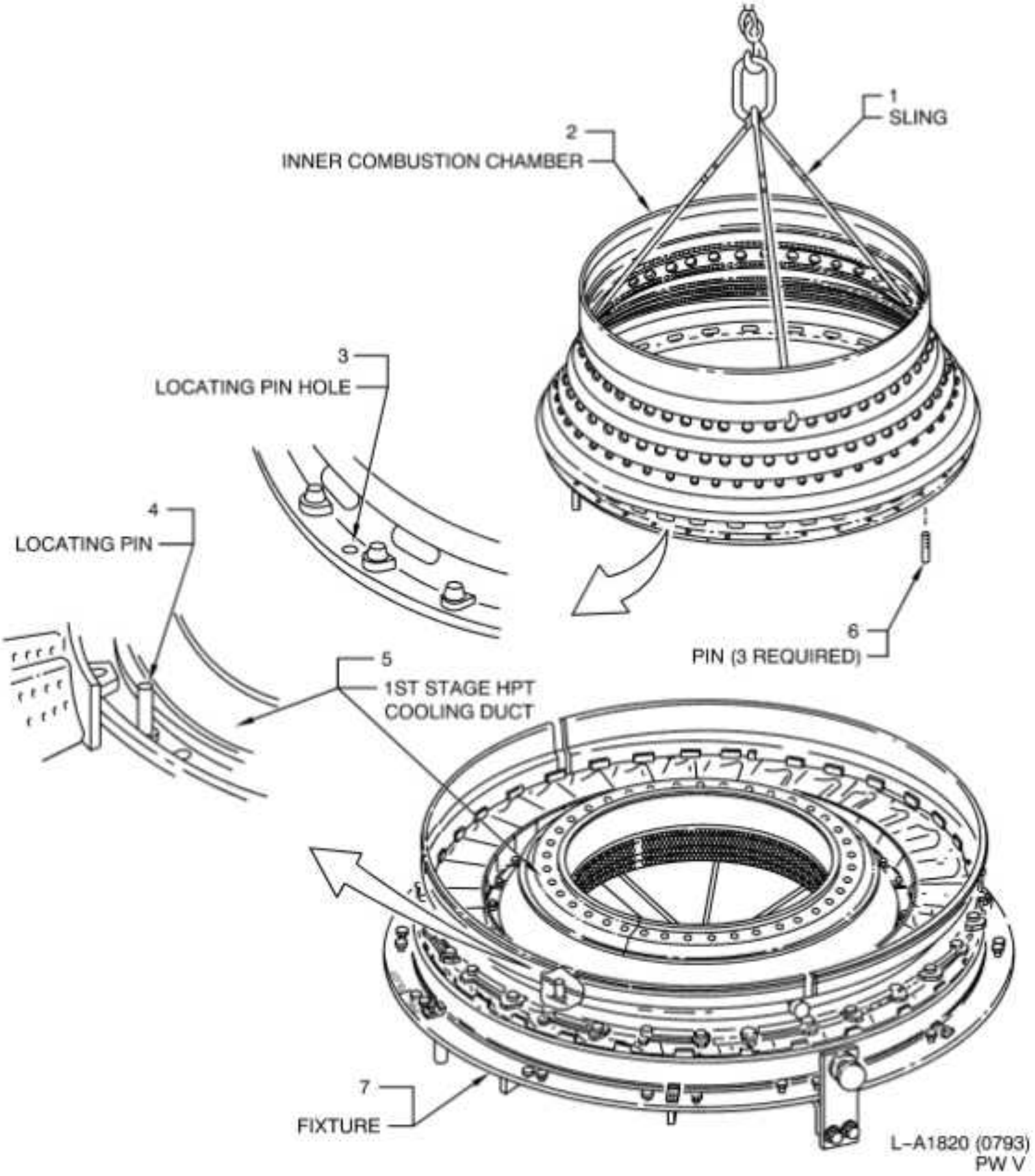
TURBINE NOZZLE − INSTALLATION−01



1. INSTALL TURBINE NOZZLE
2. INSTALL HIGH PRESSURE TURBINE
3. INSTALL LOW PRESSURE TURBINE AND TURBINE EXHAUST CASE WITH SHAFT
4. INSTALL COMPRESSOR INLET CONE

L−A1654 (0000)
PW V

Procedure Sequence
Figure 401
(Task 72−51−00−430−001)


1
SLING
2
INNER COMBUSTION CHAMBER
3
LOCATING PIN HOLE
4
LOCATING PIN
5
1ST STAGE HPT
COOLING DUCT
6
PIN (3 REQUIRED)
7
FIXTURE
L−A1820 (0793)
PW V

Inner Combustion
Chamber Installation
Figure 402
(Task 72−51−00−430−001)

TURBINE NOZZLE − INSTALLATION−01

(4) Using hoist, PWA 28657 Sling and two PWA 76154 Adapters attached to trunnion spools of Fixture (PWA 85078), trunnion assembly to front end down position.

(5) Remove the Pins (PWA 45548) and the workbolts. Position the 17 1st stage HPT duct segments (403/4) over the 1st stage HPT cooling air duct (403/9), with the oval slots in the duct segments toward the cooling duct. Align the bolthole in each duct segment with the round boltholes in the lugs of the vane clusters. Attach the duct segments with the 17 bolts (403/1) lubricated with Engine Oil (P03−001). Tighten the bolts by hand only. See Figure 403.

(6) Install the 17 1st stage HPT duct stops (403/3) into the slots between the duct segments. The bolthole in each stop must align with the elongated boltholes in the lugs of the vane clusters. Attach the duct stops with the bolts (403/2) lubricated with Engine Oil (P03−001). Tighten the bolts by hand only.

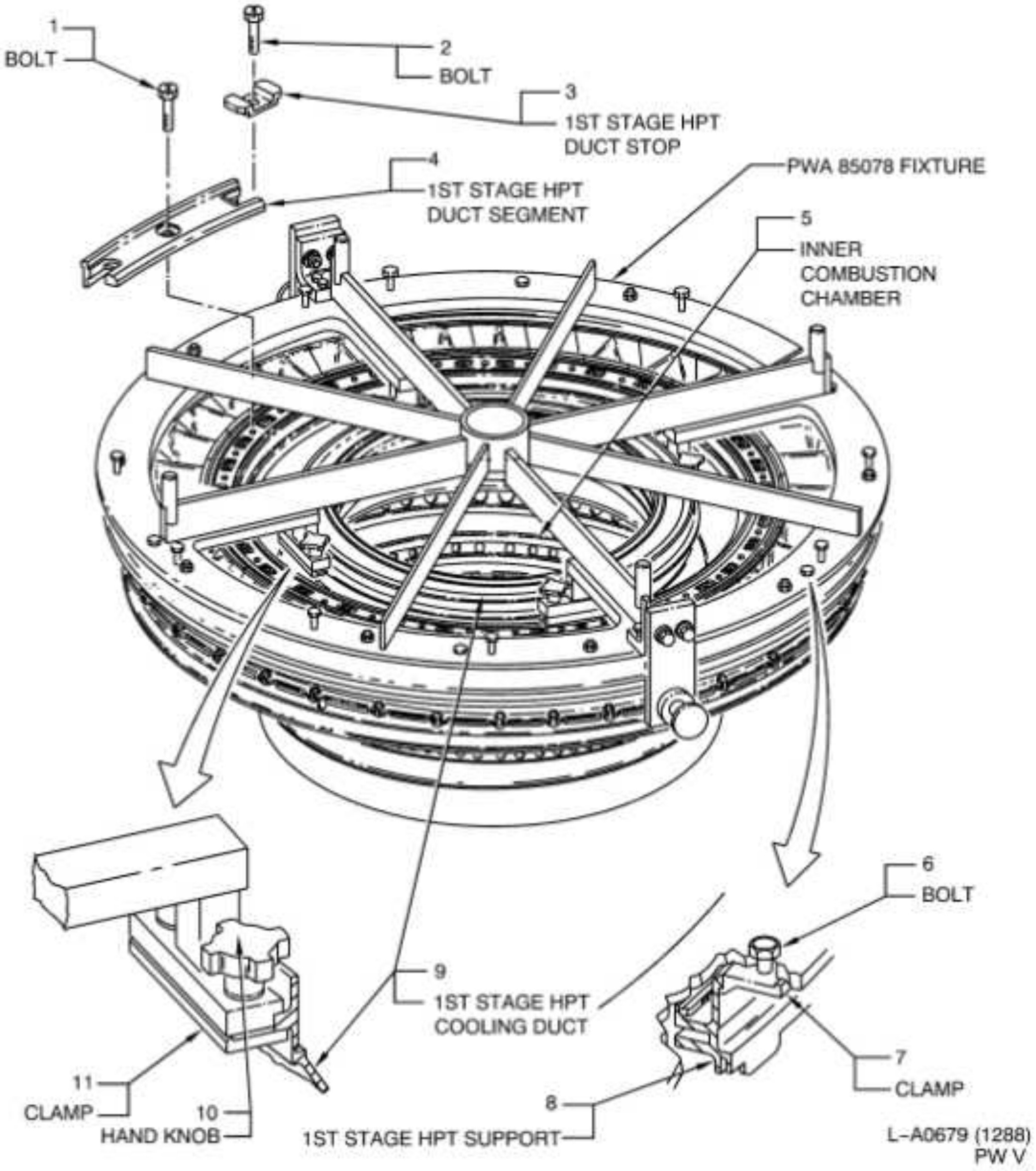
(7) Torque the 17 bolts (403/1) to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(8) Torque the 17 bolts (403/2) to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(9) Loosen bolts (403/6) and slide clamps (403/7) outward from 1st stage HPT support (403/8). Loosen hand knobs (403/10) and slide four clamps (403/11) outward from 1st stage HPT cooling duct (403/9).

(10) Using hoist, connect Sling (PWA 28657) with two Adapters (PWA 76154) to trunnion spools of Fixture (PWA 85078). Using hoist, remove fixture and trunnion to legs end down position. Lower fixture onto pallet. Remove hoist, sling and adapters.

TURBINE NOZZLE − INSTALLATION−01


1
BOLT
2
BOLT
3
1ST STAGE HPT DUCT STOP
4
1ST STAGE HPT DUCT SEGMENT
PWA 85078 FIXTURE
5
INNER COMBUSTION CHAMBER
6
BOLT
9
1ST STAGE HPT COOLING DUCT
7
CLAMP
11
CLAMP
10
HAND KNOB
8
1ST STAGE HPT SUPPORT
L−A0679 (1288)
PW V

Inner Combustion Chamber Installation
Figure 403
(Task 72−51−00−430−001)

TURBINE NOZZLE - INSTALLATION-02

Task 72-51-00-430-002:

1. Install 1st Stage HPT Vane/Vane Cluster Assemblies

NOTE: See Figure 401 for part/assembly installation procedure sequence.

A. Prerequisites

(1) See Inspection/Check-01 Task 72-51-00-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows:

(2) (Post SB PW4ENG 72-467 only) For assembly of the two piece Stage 1 (vane) support assembly, see 72-51-01 Assembly-01 Task 72-51-01-400-001.

B. Equipment And Materials Required

Special Tools:

PWA 28657	Sling
PWA 76154	Adapter (Two Required)

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-395	Beeswax
P05-396	Paraffin Wax Blend

C. Procedure
See Figure 402, Figure 403 and Figure 404.

(1) Install vane (feather) seals into the grooves in 1st stage HPT vane/vane cluster. Install seals in sets at locations shown in Figure 402. Apply Beeswax P05-395 or Paraffin Wax Blend P05-396 to sides of seals to secure in place. See Figure 402.

NOTE: Clustered vanes (Pre SB PW4ENG 72-471) and single vanes (Post SB PW4ENG 72-471) can be used together, two single vanes used in place of one clustered vane assembly. At the locations where the clusters and single vanes are adjacent, use a (feather) seal PN 50K320 at the OD. At the ID use the (feather) seal PN 50K186 at the front and (feather) seal PN 50K187 at the rear.

NOTE: Install vane clusters together and the single vanes together so that there are only two locations where single vanes and vane clusters are adjacent. This will minimize air leakage.

NOTE: See Figure 403, (Sheet 1) for Pre and Post SB PW4ENG 72−467 configuration 1st stage HPT vane support assemblies.

(2) (Reference 30) With the (feather) seals installed, position the the first vane, (or vane cluster) outer rear flange, into the 1st stage HPT vane support (403/2). Install the first vane positioning pin located on the front side of the rear outer flange, into the locating pin slot (403/5). Install the remaining vanes/vane cluster assemblies in the support in both directions.

NOTE: It will be easier to install the last vane or vane cluster in the assembly if it is located approximately 180 degrees from the locating pin slot in the vane support.

(3) Using feeler gage, ensure that all seals are installed between vanes/vane clusters.

(4) Secure vane front inner flanges to fixture using detail clamps.

(5) Using hoist, attach PWA 28657 Sling with two PWA 76154 Adapters to trunnion spools of Fixture (PWA 85077). Lift and trunnion vane and support assembly and position over 1st stage HPT cooling duct (403/1). See Figure 403.

(6) Locate slot (403/5) in 1st stage HPT support (403/2). Lower vane and support assembly onto Fixture (PWA 85078) with slot in support aligned with slot (scribed) line on fixture base.

(7) Secure rear OD of 1st stage HPT support (403/2) to fixture using detail clamps (403/3). Remove Fixture (PWA 85077), adapters and sling. Tighten bolts (403/4) to secure clamps.

TURBINE NOZZLE - INSTALLATION-02

CAUTION: OUTER AND INNER COMBUSTION CHAMBER ASSEMBLIES WITH REVISED DILUTION HOLES (DECREASED EMISSIONS) MUST BE USED IN SETS WITH COMBUSTION CHAMBER GUIDE ASSEMBLIES (REFERENCE SB PW4ENG 72-187).

(8) Position combustion chamber guide (upper segment) (404/3) and (lower segment) (404/5) over outer lugs of vanes. Locate instrumentation guide (borescope) detail (404/4) of combustion chamber guide (upper segment) approximately 93 degrees counterclockwise from locating pin in OD of cooling duct. See Figure 404.

(9) (Pre SB PW4ENG 72-542) Align bolt holes and Position 17 combustion chamber guide plates (404/2) between lugs of combustion chamber guide segments. Secure guide plates and guide segments with 34 bolts (404/1) and nuts (404/6). Install bolts with bolt head up and flat machined edge of bolt head toward OD of assembly. Tighten the bolts until the flanges touch. Do not torque the bolts.

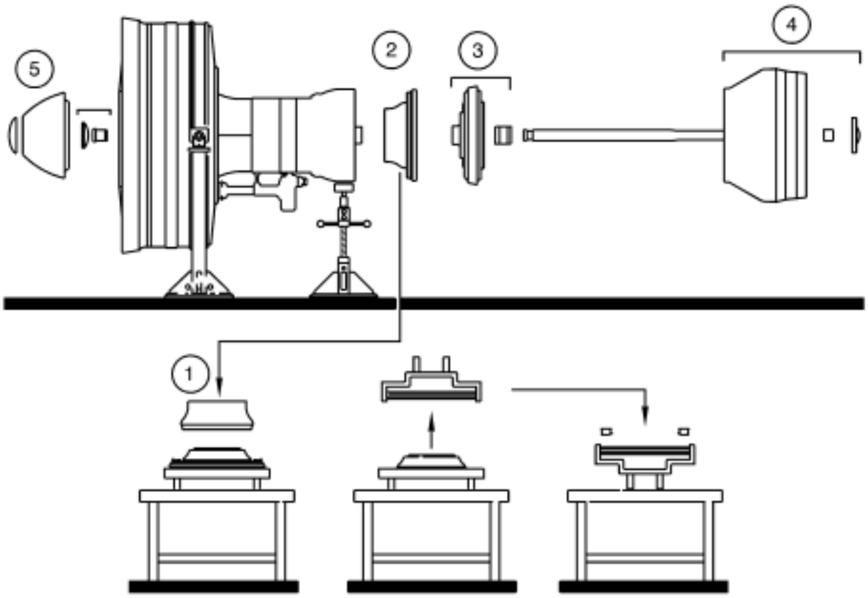
(10) (Post SB PW4ENG 72-542) Align bolt holes and Position 17 combustion chamber guide plates (404/2) between lugs of combustion chamber guide segments. Secure guide plates and guide segments with 34 bolts (404/1), threads lubricated with Engine Oil P03-001, and nuts (404/6). Install bolts with bolt head up. Tighten the bolts until the flanges touch. Do not torque the bolts.

NOTE: Bolts (404/1) will be torqued at engine assembly in 72-00-51, Installation-01 Task 72-00-51-420-001 or 72-00-51, Installation-02 Task 72-00-51-420-002 as necessary.

D. Postrequisites

(1) Install inner combustion chamber per Installation-01 Task 72-51-00-430-001.

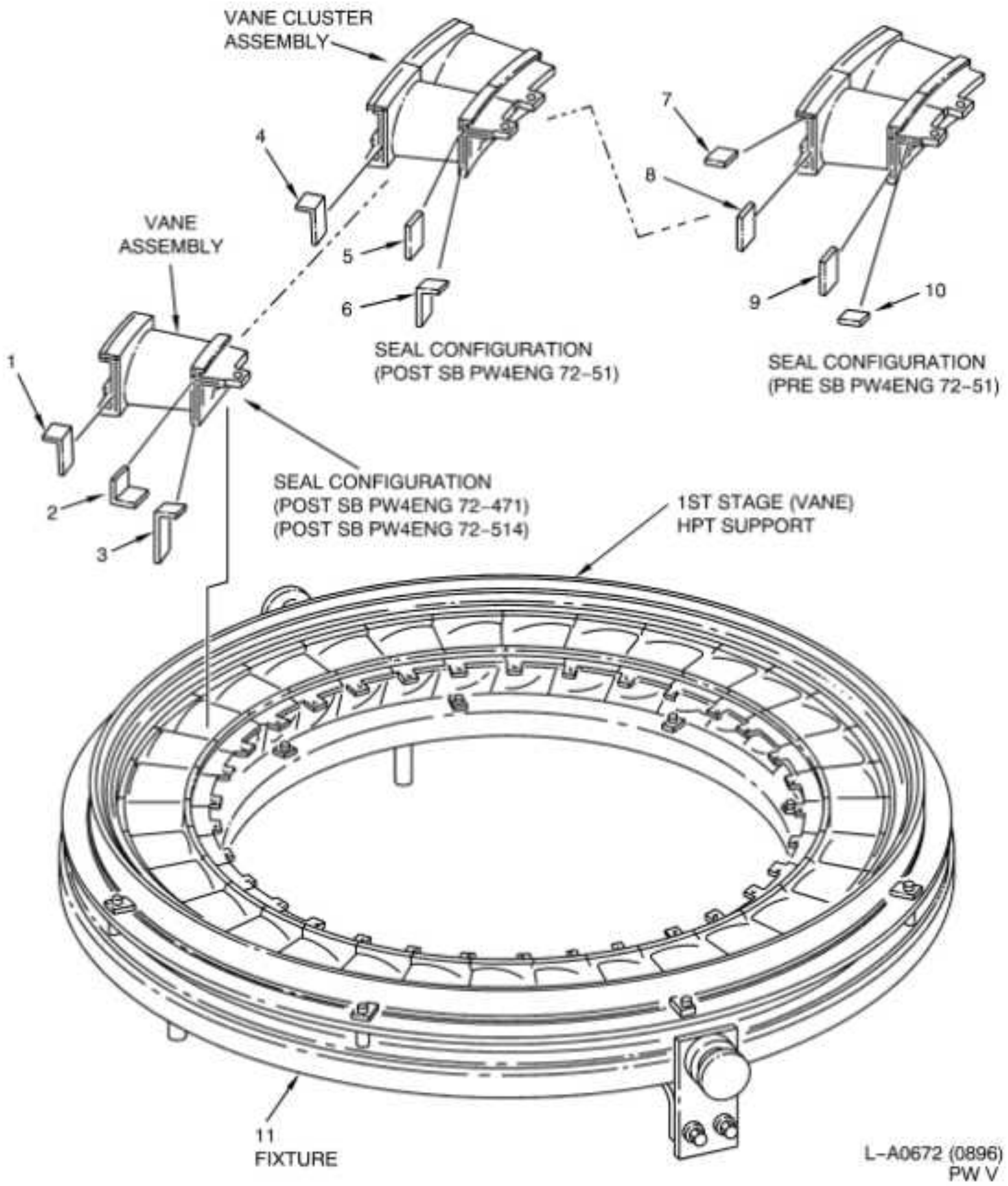
TURBINE NOZZLE - INSTALLATION-02



1. INSTALL INNER COMBUSTION CHAMBER
2. INSTALL TURBINE NOZZLE
3. INSTALL HIGH PRESSURE TURBINE
4. INSTALL LOW PRESSURE TURBINE AND TURBINE EXHAUST CASE WITH SHAFT
5. INSTALL COMPRESSOR INLET CONE

L-A1652 (0000)
PW V

Procedure Sequence
Figure 401
(Task 72-51-00-430-002)

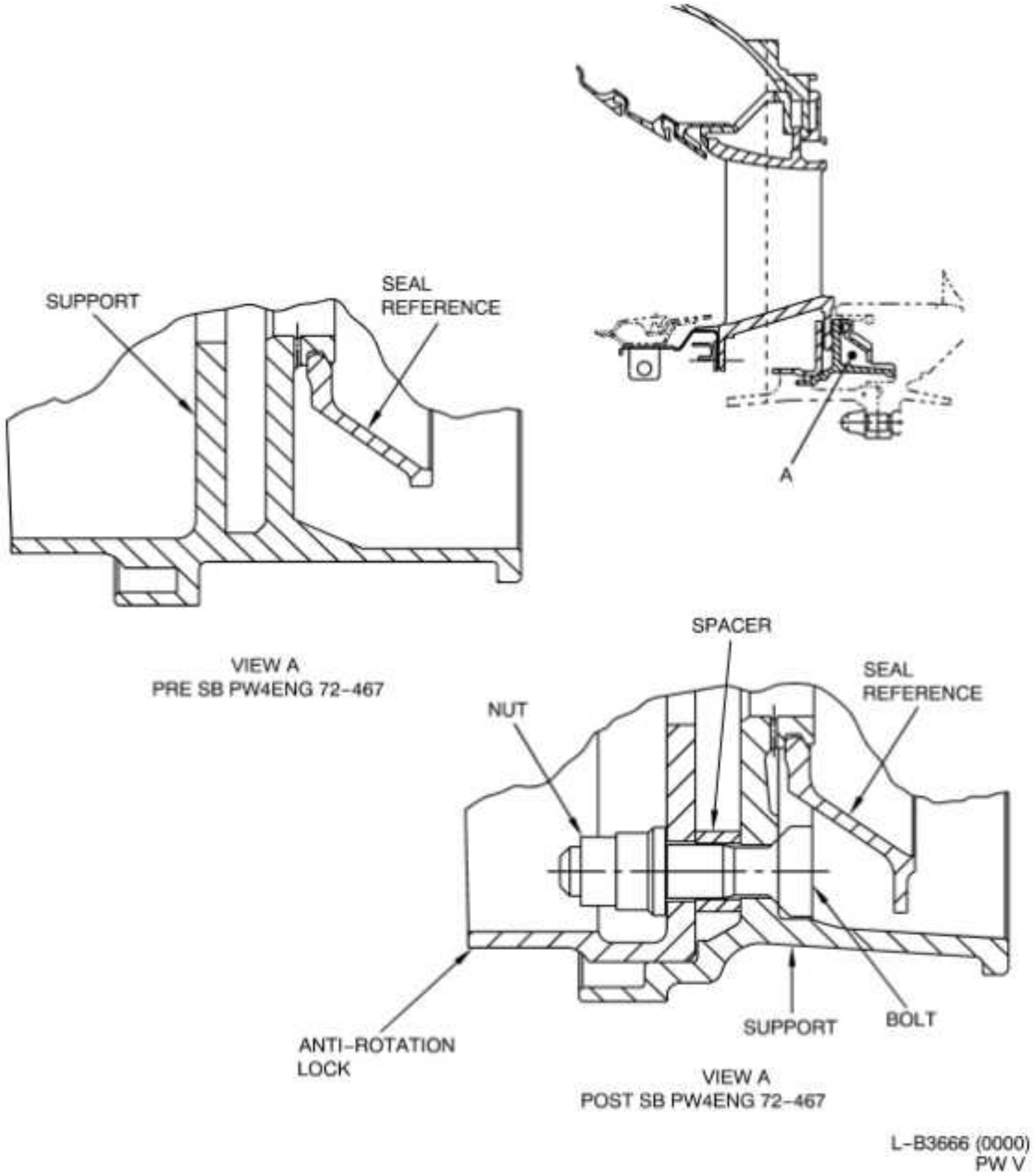

VANE CLUSTER ASSEMBLY
4
5
6
SEAL CONFIGURATION (POST SB PW4ENG 72-51)
7
8
9
10
SEAL CONFIGURATION (PRE SB PW4ENG 72-51)
VANE ASSEMBLY
1
2
3
SEAL CONFIGURATION (POST SB PW4ENG 72-471) (POST SB PW4ENG 72-514)
1ST STAGE (VANE) HPT SUPPORT
11
FIXTURE
L-A0672 (0896)
PW V

Stage 1 HPT Vane/Vane Cluster Assemblies
And (Feather) Seal Installation
Figure 402
(Task 72−51−00−430−002)

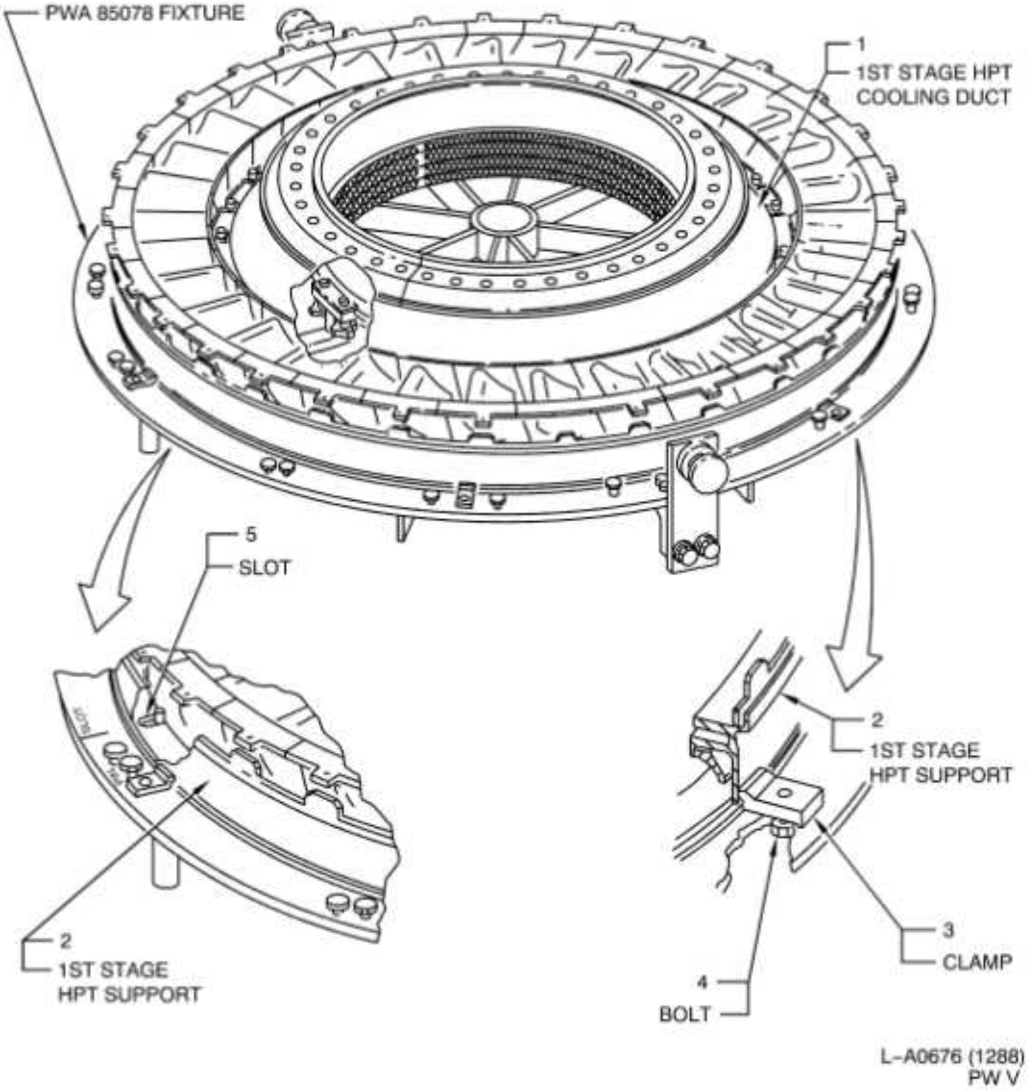
TURBINE NOZZLE − INSTALLATION−02

1. PN 50K320 Seal, 34 Required
2. PN 50K319 Seal, 34 Required
3. PN 50K186 Seal, 34 Required
4. PN 50K188 Seal, 17 Required
5. PN 50K187 Seal, 17 Required
6. PN 50K186 Seal, 17 Required
7. PN 50K106 Seal, 17 Required
8. PN 50K092 Seal, 17 Required
9. PN 50K083 Seal, 17 Required
10. PN 50K105 Seal, 17 Required
11. PWA 85077 Fixture

Key to Figure 402

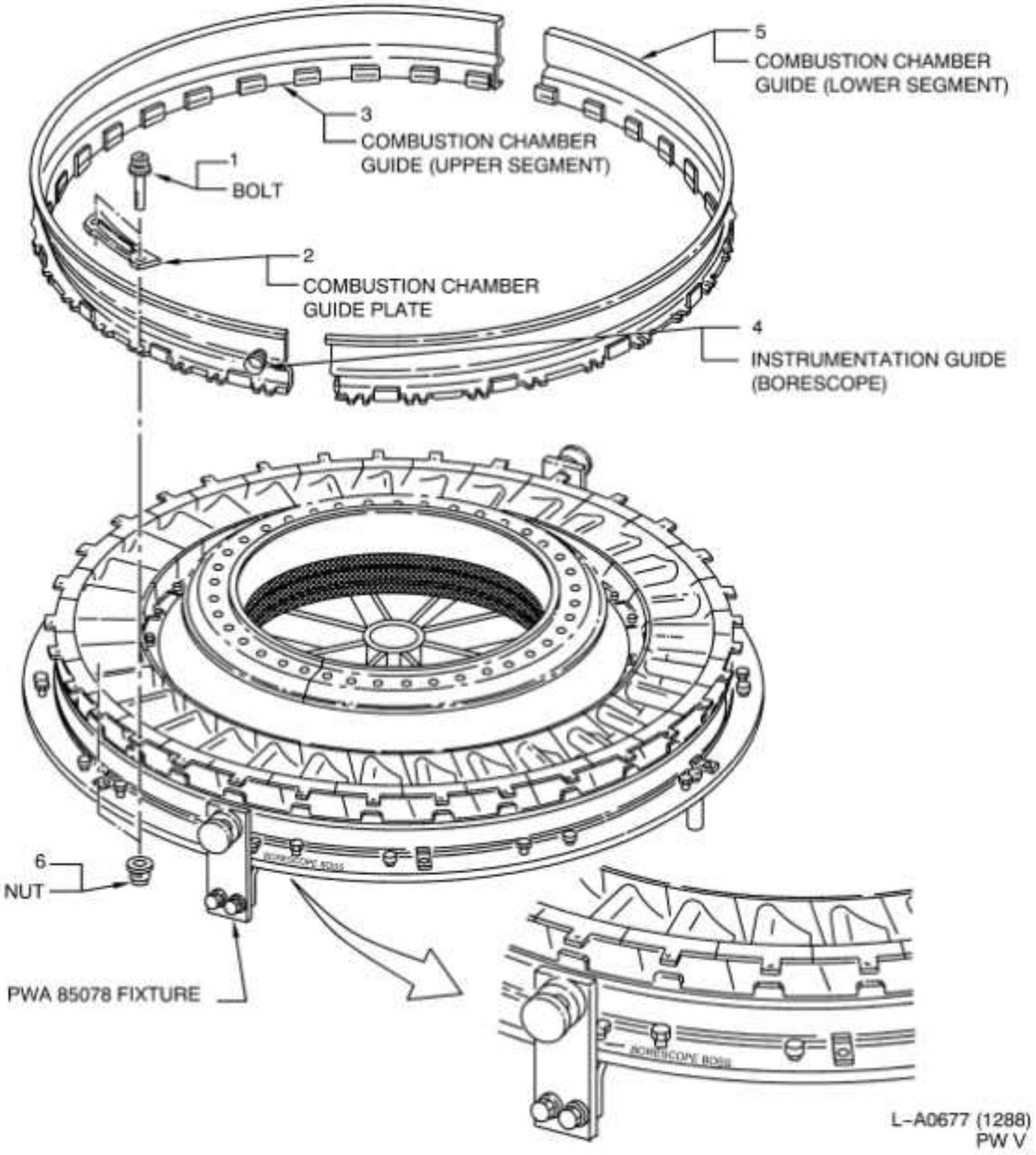

SUPPORT
SEAL REFERENCE
A
VIEW A
PRE SB PW4ENG 72-467
SPACER
SEAL REFERENCE
NUT
ANTI-ROTATION LOCK
SUPPORT
BOLT
VIEW A
POST SB PW4ENG 72-467
L-B3666 (0000)
PW V

First Stage HPT Vane Support Assembly
Figure 403 (Sheet 1)
(Task 72−51−00−430−002)


PWA 85078 FIXTURE
1
1ST STAGE HPT
COOLING DUCT
5
SLOT
2
1ST STAGE
HPT SUPPORT
2
1ST STAGE
HPT SUPPORT
3
CLAMP
4
BOLT
L−A0676 (1288)
PW V

Installation Of Vane And Support Assembly In PWA 85078 Fixture
Figure 403 (Sheet 2)
(Task 72−51−00−430−002)

TURBINE NOZZLE − INSTALLATION−02


5
COMBUSTION CHAMBER GUIDE (LOWER SEGMENT)
3
COMBUSTION CHAMBER GUIDE (UPPER SEGMENT)
1
BOLT
2
COMBUSTION CHAMBER GUIDE PLATE
4
INSTRUMENTATION GUIDE (BORESCOPE)
6
NUT
PWA 85078 FIXTURE
BORESCOPE BOSS
L-A0677 (1288)
PW V

Combustion Chamber Guides And Clamp Installation
Figure 404
(Task 72−51−00−430−002)

TURBINE NOZZLE - DISASSEMBLY-01

Task 72-51-00-030-001:

1. Disassemble Turbine Nozzle

A. Equipment And Materials Necessary

Special Tools:

PWA 27918 Sling (Optional To PWA 80555)
PWA 28657 Sling, Strongback
PWA 76154 Adapter (Two Necessary)
PWA 80555 Sling, Handling
PWA 85077 Fixture, Assembly
PWA 85078 Fixture, Holding
PWA 102145 Fixture, Removal

B. Procedure

Subtask 72-51-00-030-051:

(1) Using two PWA 76154 Adapters, attach hoist with PWA 28657 Sling to trunnion spools on PWA 85078 Fixture. Using hoist lift and trunnion fixture to position with support posts up.

(2) Loosen and retract clamps and position fixture over rear of turbine nozzle. Using detail clamps, secure 1st stage HPT cooling duct and 1st stage support to fixture. See Figure 501.

(3) Using hoist position turbine nozzle on bench, inner combustion chamber (501/5) end down.

(4) Remove bolts (501/2, 501/1) securing 17 1st stage HPT duct stops (501/3) and 1st stage HPT duct segments (501/4) to inner combustion chamber. Remove duct stops and duct segments.

(5) Using hoist, raise turbine nozzle to separate inner combustion chamber liner from 1st stage HPT cooling duct (501/9). If required, tap combustion chamber support flange with rawhide mallet to separate combustion chamber.

(6) Using hoist, sling and adapters, trunnion assembly and position fixture with support posts down on bench.

(7) Using PWA 80555 or PWA 27918 Sling position inner combustion on pallet.

TURBINE NOZZLE − DISASSEMBLY−01

Subtask 72−51−00−030−052:

(8) If applicable, remove bolt (502/8), nut (502/3) and spacer (502/4) securing combustion chamber clamp (502/1) to combustion chamber guides. See Figure 502.

(9) Remove bolts (502/7), nuts (502/5) and combustion chamber guide plates (502/6) securing combustion chamber guide (upper and lower segments) (502/2) and (502/9) to front outer flanges of vane clusters. Remove guides.

Subtask 72−51−00−030−053:

(10) Using two Adapters PWA 76154, attach hoist with Sling PWA 28657 to trunnion spools on PWA 85077 Fixture.

(11) Loosen and retract clamps and position fixture over turbine nozzle vanes and secure with detail clamps. See Figure 503.

(12) Remove clamps (503/3) securing 1st stage HPT support to Fixture PWA 85078.

(13) Using hoist and sling connected to Fixture PWA 85077, raise vane and support assembly and trunnion fixture to position with support posts down.

(14) Loosen and retract clamps and remove 1st stage HPT cooling duct (503/1) from fixture.

(15) Attach rear flange of the 1st stage HPT cooling duct (503/1) to PWA 102145 Removal Fixture and remove the HPT cooling duct deflector from the front of the HPT cooling duct.

Subtask 72−51−00−030−054:

(16) Carefully separate 1st stage HPT vane/vane cluster assemblies and remove the seals from the slots in the inner and outer vane platforms. See Figure 504.

(17) Loosen and retract clamps securing 1st stage HPT support to Fixture PWA 85077. Using hoist and sling, remove fixture from bench.

R
R

Subtask 72−51−00−030−055:

(18) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the Stage 1 HPT brush seal and support assembly (505/2) from the Stage 1 HPT cooing duct assembly (505/1). See Figure 505.

(a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
R In the following step, replace the Stage 1 HPT
R brush seal assembly with a new assembly as
R follows:

1 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
R If the 1st stage HPT inner airseal is replaced
R with a new or refurbished part.

2 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
R If the 1st stage HPT inner airseal was removed
R and re−installed on the 1st stage turbine hub
R regardless of the reason for the removal and
R re−installation.

NOTE: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
R The 1st stage HPT inner airseal is
R installed in 72−52−01, Assembly−01 (Task
R 72−52−01−440−001).

3 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
R When the match of the 1st stage HPT inner
R airseal and brush seal is changed. Such as in
R a module swap.

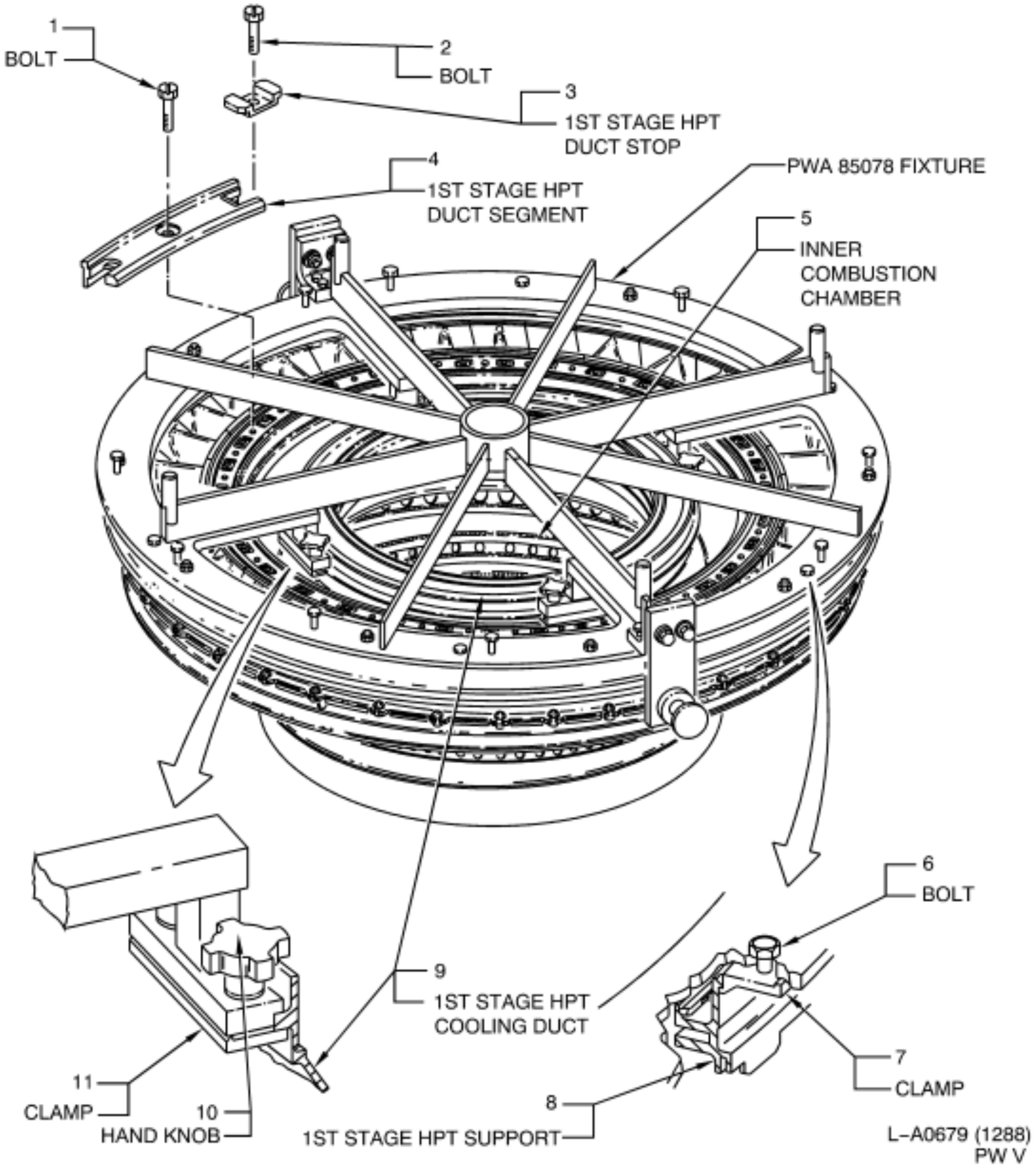
(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
R Remove the 24 bolts (505/3) that attach the brush
seal and support assembly to the cooling duct.

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
R Install 12, 0.250−28 jackscrews into the jackscrew
holes in the brush seal support. Evenly tighten the jackscrews to remove the brush seal and support assembly from the cooling duct. Remove the jackscrews from the support assembly.

C. Postrequisites

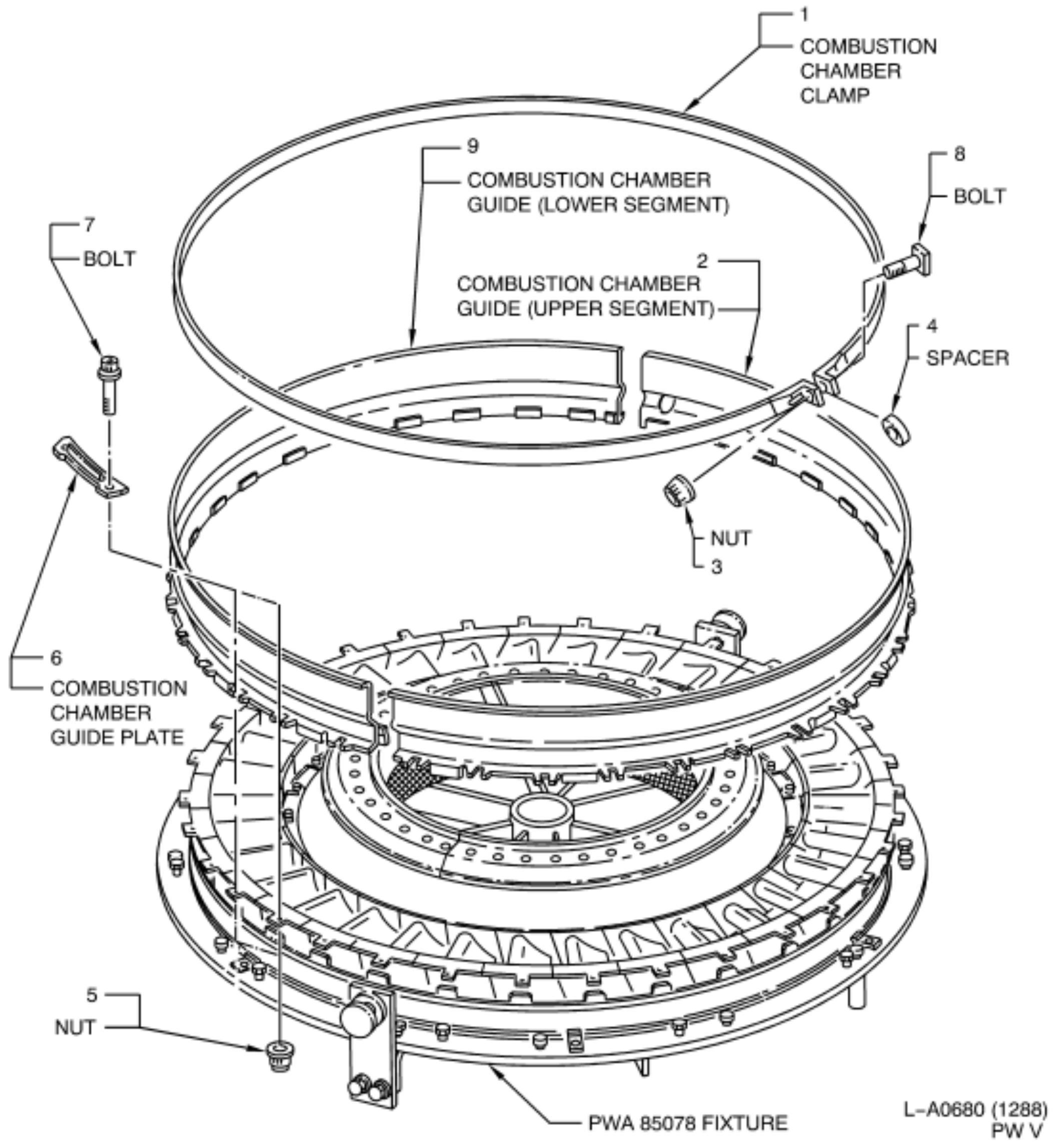
(1) (Post SB PW4ENG 72−467 only) If applicable, disassemble the Stage 1 (vane) HPT support assembly (PN 50K184). Refer to 72−51−01, Disassembly−01 (Task 72−51−01−030−001).

TURBINE NOZZLE - DISASSEMBLY-01

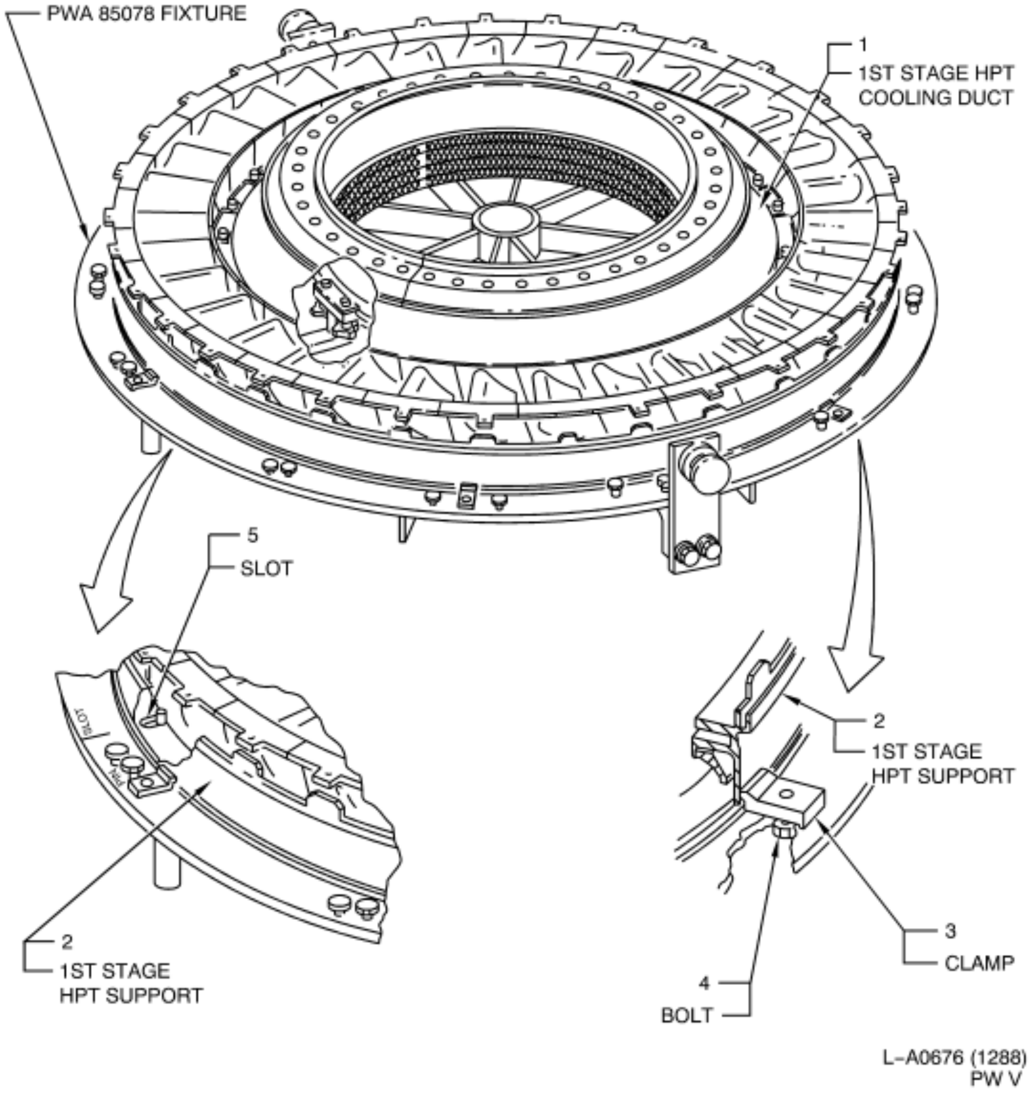

1
BOLT
2
BOLT
3
1ST STAGE HPT DUCT STOP
4
1ST STAGE HPT DUCT SEGMENT
PWA 85078 FIXTURE
5
INNER COMBUSTION CHAMBER
6
BOLT
9
1ST STAGE HPT COOLING DUCT
7
CLAMP
11
CLAMP
10
HAND KNOB
8
1ST STAGE HPT SUPPORT
L-A0679 (1288)
PW V

Inner Combustion Chamber Removal
Figure 501
(Task 72-51-00-030-001)

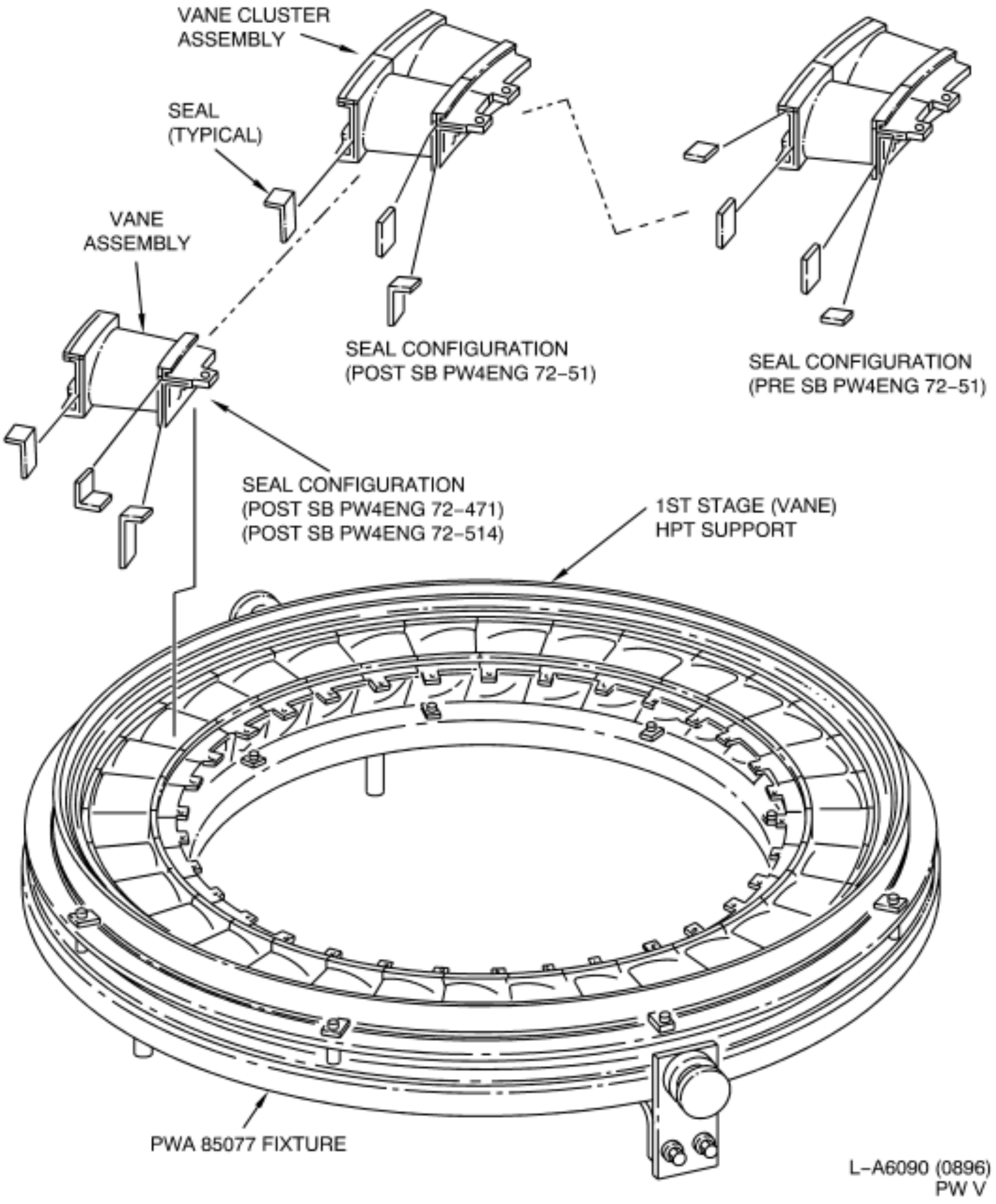
TURBINE NOZZLE − DISASSEMBLY−01


1
COMBUSTION CHAMBER CLAMP
9
COMBUSTION CHAMBER GUIDE (LOWER SEGMENT)
8
BOLT
7
BOLT
2
COMBUSTION CHAMBER GUIDE (UPPER SEGMENT)
4
SPACER
NUT
3
6
COMBUSTION CHAMBER GUIDE PLATE
5
NUT
PWA 85078 FIXTURE
L−A0680 (1288)
PW V

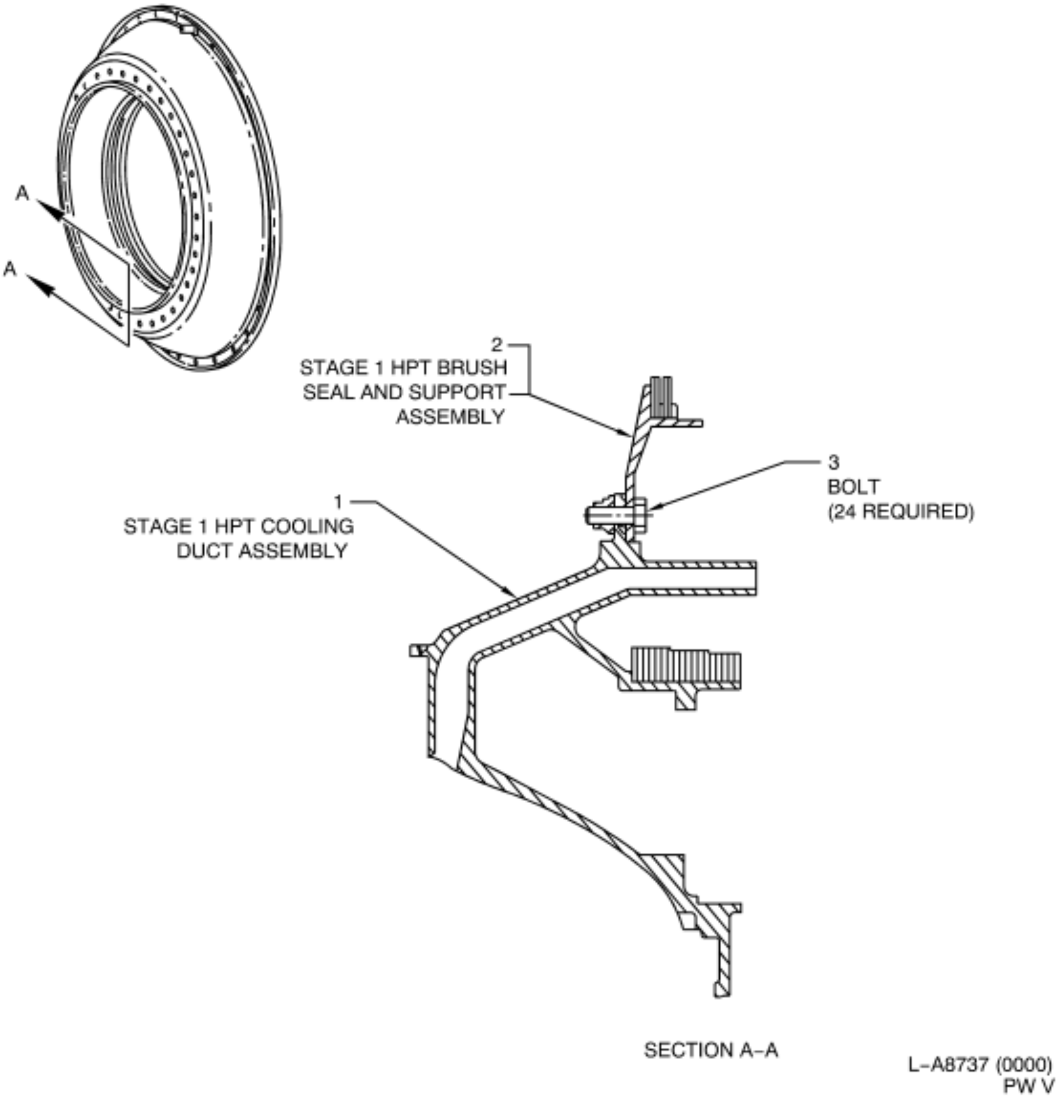
Combustion Chamber Guides And Clamp Removal
Figure 502
(Task 72−51−00−030−001)


PWA 85078 FIXTURE
1
1ST STAGE HPT COOLING DUCT
5
SLOT
SLOT
2
1ST STAGE HPT SUPPORT
2
1ST STAGE HPT SUPPORT
3
CLAMP
4
BOLT
L-A0676 (1288)
PW V

Stage 1 HPT Cooling Duct Removal
Figure 503
(Task 72-51-00-030-001)


VANE CLUSTER ASSEMBLY
SEAL (TYPICAL)
VANE ASSEMBLY
SEAL CONFIGURATION (POST SB PW4ENG 72-51)
SEAL CONFIGURATION (PRE SB PW4ENG 72-51)
SEAL CONFIGURATION (POST SB PW4ENG 72-471) (POST SB PW4ENG 72-514)
1ST STAGE (VANE) HPT SUPPORT
PWA 85077 FIXTURE
L-A6090 (0896)
PW V

Stage 1 HPT Vane/Vane Cluster Assembly Removal
Figure 504
(Task 72-51-00-030-001)


A
A
2
STAGE 1 HPT BRUSH SEAL AND SUPPORT ASSEMBLY
3
BOLT (24 REQUIRED)
1
STAGE 1 HPT COOLING DUCT ASSEMBLY
SECTION A−A
L−A8737 (0000)
PW V

Stage 1 HPT Brush Seal And Support Assembly Removal
Figure 505
(Task 72−51−00−030−001)

Previous Pageblock Return to Previous Menu Next Pageblock

TURBINE NOZZLE − INSPECTION/CHECK−01

Task 72−51−00−990−004:

1. General Inspection Requirements − Turbine Nozzle

A. Organization Of Individual Part Or Subassembly Inspection Data

(1) Specific inspection functions for all significant parts/subassemblies are provided in individual Inspection/Check sections. Application of each inspection function is shown in Inspection/Check−00 for part/subassembly. Section designations and function descriptions are as follows.

(2) Inspection/Check−00 section contains, where applicable:

(a) Part number(s) for which the inspection data is applicable.

(b) Service Bulletin numbers applicable to part number(s).

(c) Inspection/Check numbers, data categories and applicability data.

(3) Inspection/Check−01, Preinspection Preparation, contains, where applicable:

(a) General inspection comments, notes, CAUTIONS, etc., which supplement data contained in this section.

(b) Identification of mechanical disassembly required prior to inspection.

(c) Identification of any surface treatment or coating removal, or other actions required prior to inspection.

(d) Identification of part/subassembly cleaning required prior to inspection.

(4) Inspection/Check−02, Nondestructive Inspection, contains the following nondestructive inspection methods, part/subassembly special attention areas and damage limits (as applicable):

(a) Fluorescent Penetrant Method

(b) Eddy Current Method

(c) Magnetic Particle Method

(d) X−ray Method

(e) Ultrasonic Method

(f) Hardness Check

(g) Other − As specified.

(5) Inspection/Check−03, Visual Inspection contains, where applicable:

(a) Visual inspection requirements which can be accomplished with or without magnification or special lighting (as specified).

NOTE: Use of inspection tools may be required as a supplement to visual inspection process.

(b) Allowable blending for visual damage, which may be accomplished within the inspection area.

NOTE: Blending requirement will also be shown in applicable repairs.

(6) Inspection/Check−04, Dimensional Inspection, contains, where applicable:

(a) Dimensional inspection requirements other than visual inspection. The requirements will include applicable fits and clearances, and other dimensional inspections necessary to ensure the part integrity and proper functioning.

(7) Inspection/Check−05, Functional Check Inspection contains, where applicable:

(a) Procedures, limits, and equipment used with any required functional checks (oil flow, air flow, leak, etc.).

(8) Inspection/Check−06, Inspection Postrequisites contains, references to procedures required to return part/subassembly to serviceable condition. References include the following, as required.

(a) Reassembly

(b) Protective coatings, sealants and/or lubricant reapplication

B. Thorough and intelligent part/subassembly inspection is of major importance in achieving efficient engine operation and satisfactory service life. Inspection personnel should be thoroughly familiar with inspection procedures, inspection tooling, limits associated with normal and, where applicable, unusual operating conditions, limits associated with repairs, and with inspection procedures published in Standard Practices Manual.

C. During preliminary inspection of part/subassembly, comparison with mating or adjacent parts may provide indication of source of wear or damage. This procedure may indicate requirement for additional disassembly and inspection.

D. During inspection, records should be kept of deviations beyond serviceable limits to determine: (a) if part/subassembly will be repaired or replaced, and (b) if part is reparable, which repairs are required. Suitable documentation should accompany part/subassembly with results of this determination.

E. Inspection of individual part/subassembly dimensions which are also in Fits and Clearances will include Fits and Clearance Reference Numbers and will show new part/subassembly dimension unless specifically stated otherwise. Inspection Frequency Requirements (IFR) codes (for IFR Code A parts only) are included with Reference Number data. If acceptable dimensional deviations or results of repair affect Fits and Clearances, suitable documentation should accompany part/subassembly to ensure check of fit or clearance at final assembly.

NOTE: Parts/subassemblies which deviate dimensionally from new part/subassembly values may be acceptable provided required fit or clearance is achieved at final assembly.

F. Dimensional inspection requirements will be accompanied by part/subassembly constraint data if such constraint requirements are required during part/subassembly manufacture. Adherence to constraint requirements when inspecting service operated parts/subassemblies should be dictated by experience. It is recommended that parts/subassemblies which do not meet dimensional inspection requirements in free state be constrained and re−measured prior to initiation of any repair or re−use activity.

G. Dimensional inspections of one detail of a subassembly, prior to removal from subassembly, may produce incorrect data due to constraint forces from mating details. If questionable data is obtained, subassembly should be disassembled and inspections repeated.

H. Dimensional inspection limits in inspection text provide continued use (as is) and, if applicable, repair limits. Parts/subassemblies which exceed both limits and nonreparable parts/subassemblies which exceed (as is) limits are unserviceable.

I. Inspections required to verify integrity of repair are contained within repair procedure. Unless otherwise stated, repaired part is expected to meet all inspection requirements contained in inspection text for part/subassembly.

J. Parts/subassemblies which do not require repairs except for those provided in Standard Practices Manual are identified by Chapter/Section/Subject Number 72−51−99 in cleaning table (Cleaning−01) and nondestructive inspection table (Inspection/Check−02). Determination of serviceability for those parts listed in 72−51−99 is limited to cleaning, non−destructive inspection, and the following:

(1) Visually inspect parts/subassemblies for surface defects, deformations, cuts, improper threads or wrenching surfaces, incomplete or missing protective coatings or other damage which will prevent proper functioning and make part/subassembly unserviceable. Unserviceable parts/subassemblies should not be reinstalled. Repair unserviceable parts/subassemblies per Standard Practices Manual, as applicable.

(2) Parts/subassemblies with crack indications to any length or depth detected by listed nondestructive inspection are unserviceable, and should not be reinstalled.

K. When new part/subassembly is to be installed and it is important that it be identified as to engine number or position in engine, mark it by appropriate method described in Marking of Parts, 70−11, Standard Practices Manual.

L. In order to eliminate confusion and to maintain consistent terminology, various physical conditions which might be encountered during inspection of parts/subassemblies and explanation of unusual causes of such conditions are defined in Physical Inspection, 70−31, Standard Practices Manual.

M. If inspection reveals it necessary to replace fitted spacer, tag spacer to indicate that replacement must be made with spacer of correct classification at assembly.

N. If text refers to superficial or shallow imperfection, following definitions apply:

(1) A superficial imperfection is defined as a nick, dent, scratch, toolmark, etc., which disrupts the surface but does not appear to penetrate surface roughness texture.

(2) A shallow imperfection appears to penetrate surface finish texture, but does not have a dark bottom and would not cause a 0.007 inch (.178 mm) radius stylus to hesitate if passed over it.

TURBINE NOZZLE - INSPECTION/CHECK-03

Task 72-51-00-990-005:

1. Visual Inspection - Turbine Nozzle
    A. For inspection requirements applicable to installed (accessible) parts of Turbine Nozzle see 72-00-51, Inspection/Check-XX (Task 72-00-51-XXX-XXX).

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TURBINE NOZZLE − INSPECTION/CHECK−04

Task 72−51−00−990−001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (−) 0.512 = .005
(13.131) (13.005) (0.126)

0.527 (−) 0.508 = .019
(13.385) (12.903) (0.482)

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	IFR	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

	Ref. No.	IFR	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
	1	B	Inner Combustion Chamber Assembly (72-51-05) Stage 1 HPT (Blade) Cooling Duct Assembly (72-51-03) (See Figure 801)				
R			Chamber	26.856 (682.142)	26.864 (682.346)		
R			Duct	26.860 (682.244)	26.866 (682.396)	.016* (0.406)*	.014T* (0.356T)*

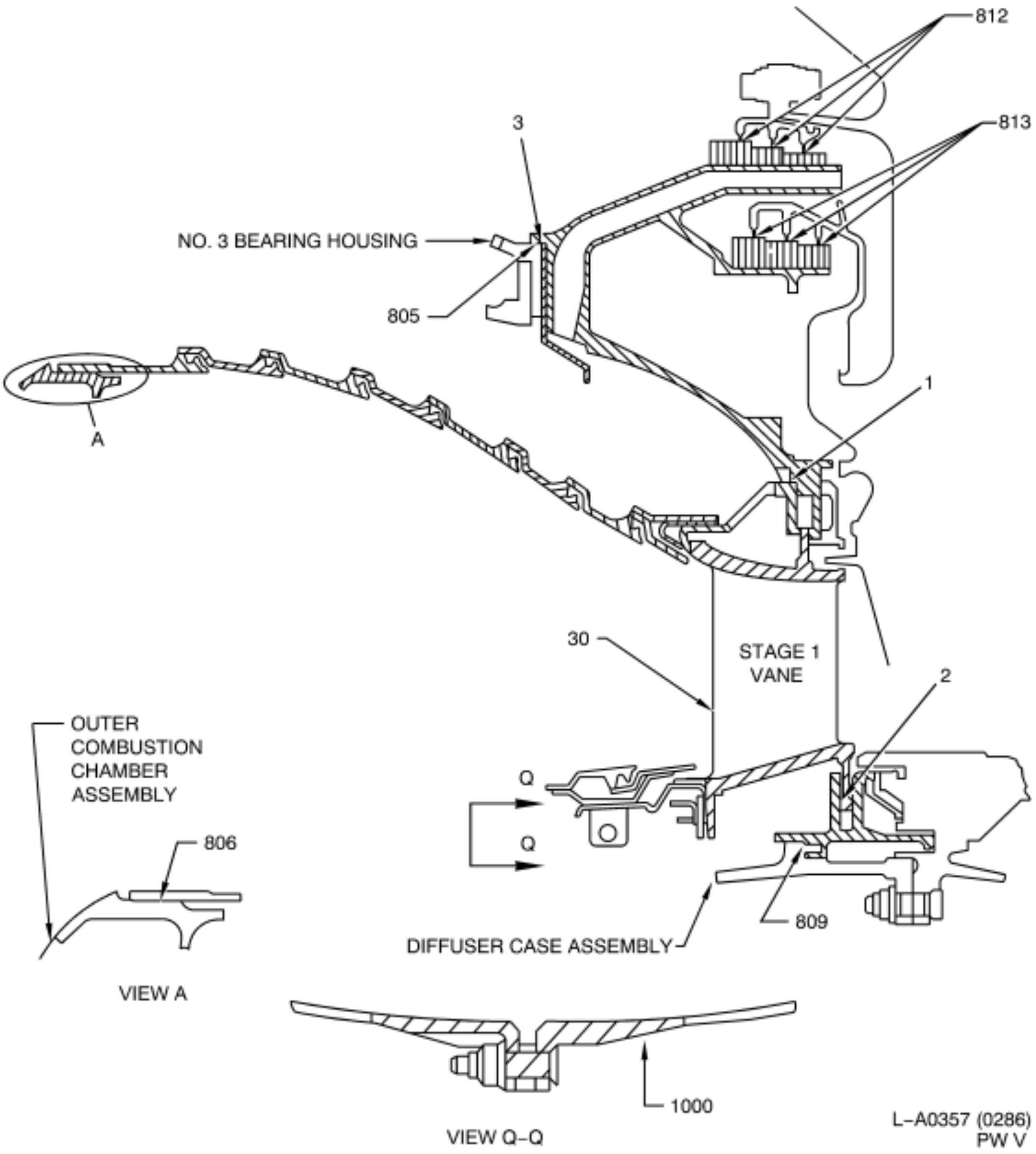
Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
2	B	Side Clearance Stage 1 HPT Vane Cluster Assembly (72−51−02) Stage 1 (Vane) HPT Support Assembly (72−51−01) (See Figure 801)				
		Vane	.191 (4.851)	.200 (5.080)		
		Support	.202 (5.131)	.206 (5.232)	.002 (0.05)	.015 (0.38)
3	B	HPT Cooling Duct Deflector (72−51−04) Stage 1 HPT (Blade) Cooling Duct Assembly (72−51−03) (See Figure 801)				
		Deflector	19.191 (487.451)	19.197 (487.604)		
		Support	19.198 (487.630)	19.202 (487.730)	.009L* (0.229L)*	.011T (0.28T)
4	B	Stage 1 HPT Brush Seal And Support Assembly (72−51−12) Stage 1 HPT (Blade) Cooling Duct Assembly (72−51−03) (See Figure 801 Sheet 2)				
		Brush Seal	16.190 (411.226)	16.194 (411.327)		
		Duct	16.174 (410.820)	16.178 (410.921)	.011T* (0.279T*)	.020T (0.508T)
805	B	Stage 1 HPT (Blade) Cooling Duct Assembly (72−51−03) No. 3 Bearing Housing (72−41−10) (See Figure 801)				
		Duct	19.198 (487.630)	19.202 (487.730)		
		Housing	19.193 (487.503)	19.197 (487.603)	.001T (0.025T)	.009T (0.229T)

	Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
	806	A	Inner Combustion Chamber Assembly (72−51−05) Outer Combustion Chamber Assembly (72−41−11) (See Figure 801)				
			Inner Chamber	23.233 (590.12)	23.243 (590.37)		
			Outer Chamber	23.224 (589.89)	23.234 (590.14)	.001 (0.03)	.019T (0.48T)
	808	B	Turbine Cooling Duct Sensing (Inner Airframe) Tube Assembly (72−41−23) Stage 1 HPT (Blade) Cooling Duct Assembly (72−51−03) (See Figure 802)				
R R			Tube	.373 (9.474)	.377 (9.576)		
R R			Duct	.378 (9.602)	.380 (9.652)	.001 (0.025)	.007 (0.178)
	809	B	Stage 1 (Vane) HPT Support Assembly (72−51−01) Diffuser Case Assembly (72−41−01) (See Figure 801)				
			Support	38.383 (974.93)	38.395 (975.23)		
			Case	38.377 (974.776)	38.383 (974.928)	.011* (0.28)*	.018T (0.46T)
	812		Stage 1 HPT (Inner Rotating) Air Seal (72−51−21) Stage 1 HPT (Blade) Cooling Duct Assembly (72−52−03) (See Figure 801)				
			Radial Gap Cold −		Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357		

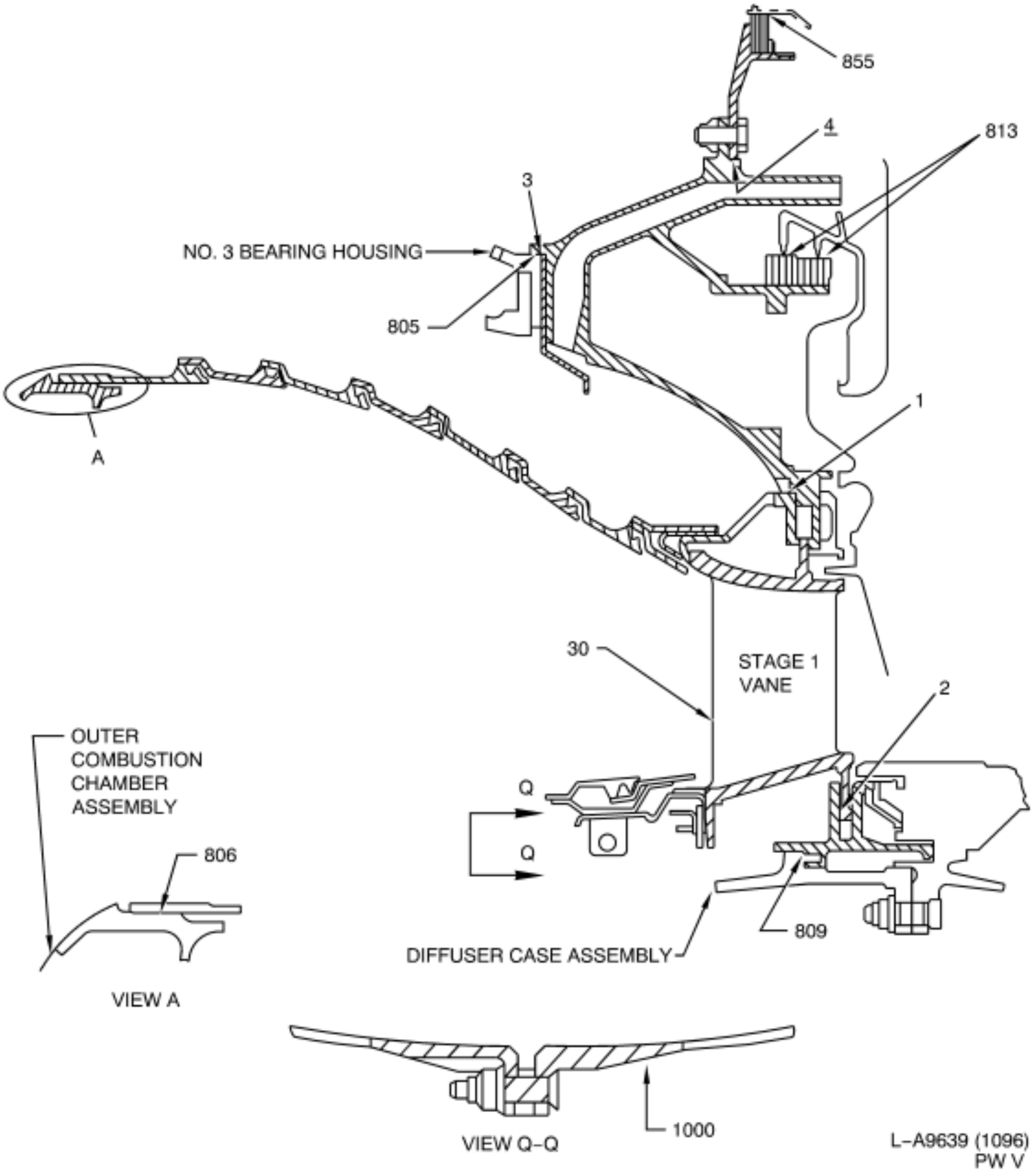
Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
813		Stage 1 HPT (Outer Rotating) Air Seal (72−51−20) Stage 1 HPT Blade Cooling Duct Assembly (72−51−03) (See Figure 801) Radial Gap Cold −	Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357			
855		HPT Brush Seal And Support Assembly (72−51−12) HPT Stage 1 Air Sealing Ring (72−52−17) (See Figure 801, Sheet 2) Radial Gap Cold −	Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357			

G. Special Assembly Procedures

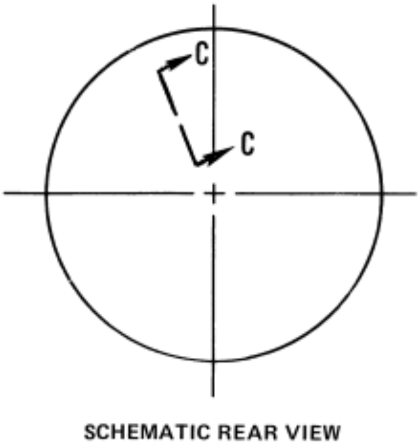
Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
30	A	Stage 1 HPT Vane Cluster Assembly (See Figure 801) See 72−51−00, Assembly−01 Task 72−51−00−400−001				
1000		Rear Burner Seal Clamp Fitting Procedure (See Figure 801) See 72−00−51, Installation−01 Task 72−00−51−420−001				

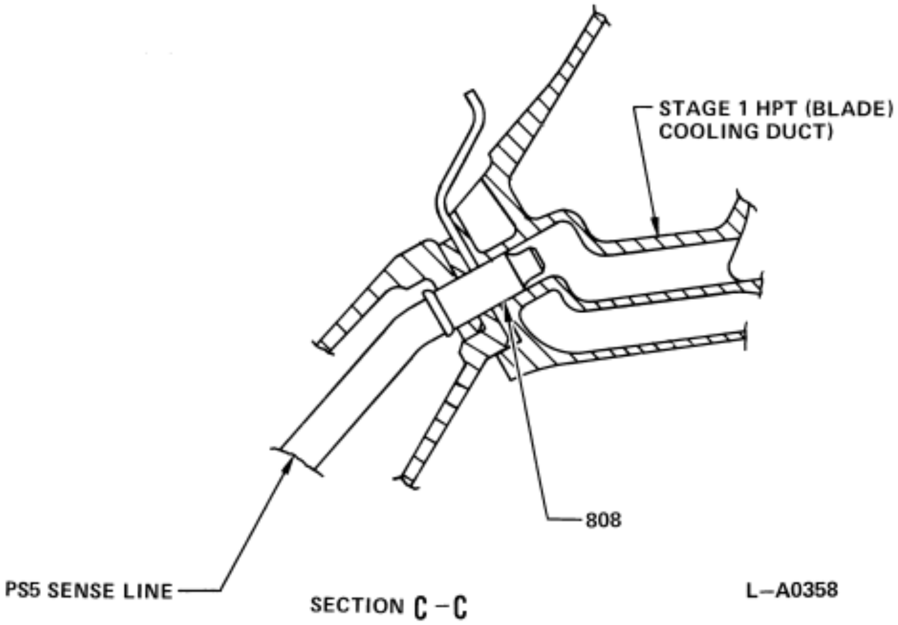

812
813
3
NO. 3 BEARING HOUSING
805
A
1
30
STAGE 1 VANE
2
OUTER COMBUSTION CHAMBER ASSEMBLY
Q
Q
806
809
DIFFUSER CASE ASSEMBLY
VIEW A
1000
VIEW Q−Q
L−A0357 (0286)
PW V

Turbine Nozzle
Figure 801 (Sheet 1)
(Task 72−51−00−990−001)


855
4
813
3
NO. 3 BEARING HOUSING
805
1
A
30
STAGE 1
VANE
2
OUTER
COMBUSTION
CHAMBER
ASSEMBLY
Q
Q
806
809
DIFFUSER CASE ASSEMBLY
VIEW A
1000
VIEW Q-Q
L-A9639 (1096)
PW V

(Phase III Configuration Obtained By SB Conversion)
Turbine Nozzle
Figure 801 (Sheet 2)
(Task 72−51−00−990−001)


C
C
SCHEMATIC REAR VIEW


STAGE 1 HPT (BLADE) COOLING DUCT)
808
PS5 SENSE LINE
SECTION C - C
L-A0358

Turbine Nozzle
Figure 802
(Task 72-51-00-990-001)

TURBINE NOZZLE − INSPECTION/CHECK−04

Task 72−51−00−990−006:

1. Specific Fits And Clearances

   A. General

      (1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

      (2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

      (3) Numbers in all columns shall be interpreted in inches, and (millimeters).

      (4) Letter "T" following limits indicates tight fit.

      (5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

      (6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

   B. Inspection Frequency Requirements

      (1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (-) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (-) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

	Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
	1	B	Inner Combustion Chamber Assembly (72−51−05) Stage 1 HPT (Blade) Cooling Duct Assembly (72−51−03) (See Figure 801)				
R R			Chamber	26.856 (682.142)	26.864 (682.346)		
R R			Duct	26.860 (682.244)	26.866 (682.396)	.016* (0.406)*	.014T* (0.356T)*
	2	B	Side Clearance Stage 1 HPT Vane Cluster Assembly (72−51−02) Stage 1 (Vane) HPT Support Assembly (72−51−01) (See Figure 801)				
			Vane	.191 (4.851)	.200 (5.080)		
			Support	.202 (5.131)	.206 (5.232)	.002 (0.05)	.015 (0.38)

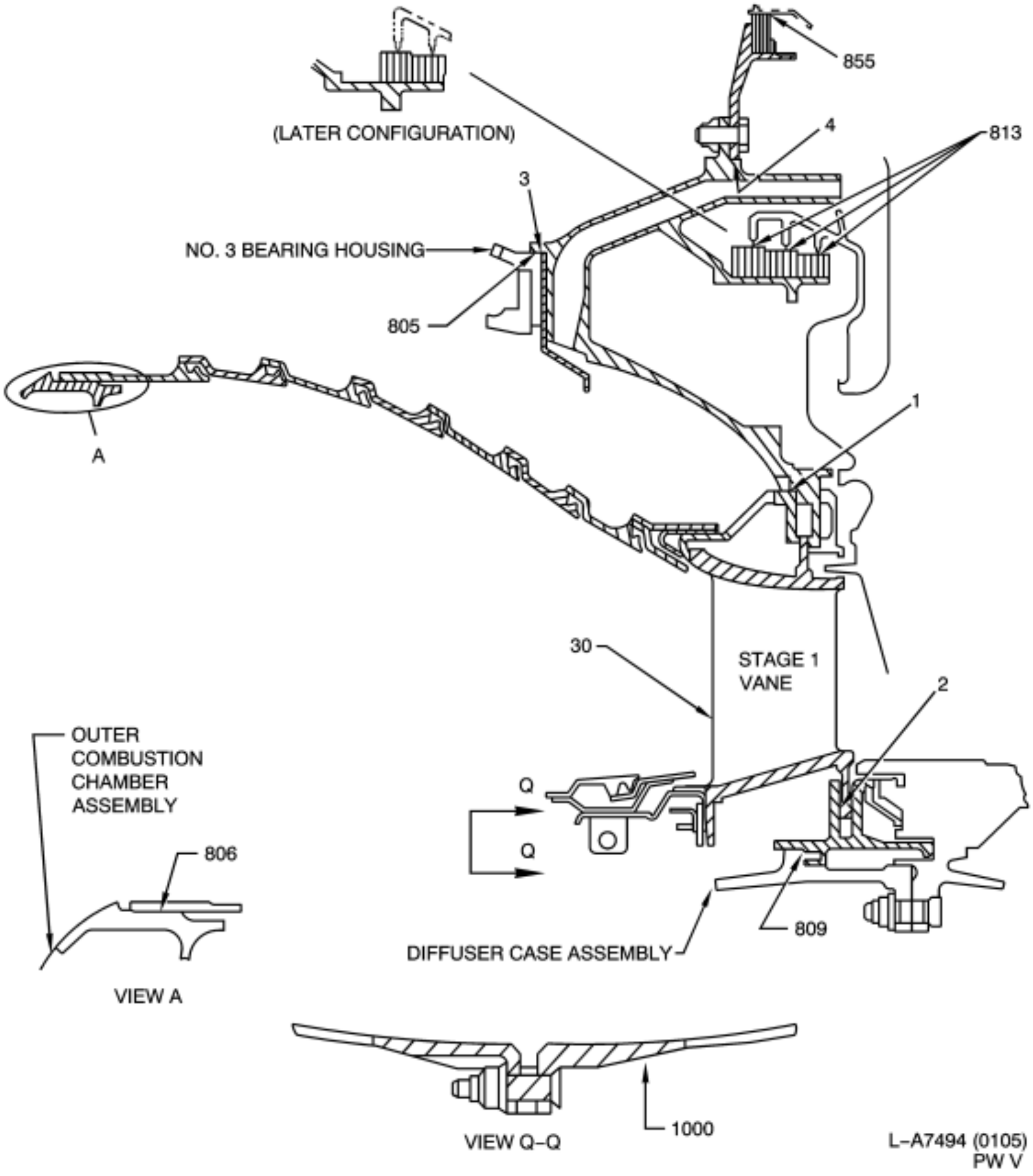
	Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
	3	B	HPT Cooling Duct Deflector (72−51−04)				
			Stage 1 HPT (Blade) Cooling Duct Assembly (72−51−03)				
			(See Figure 801)				
			Deflector	19.191	19.197		
				(487.451)	(487.604)		
			Support	19.198	19.202	.009L*	.011T
				(487.630)	(487.730)	(0.229L)*	(0.28T)
	4	B	Stage 1 HPT Brush Seal And Support Assembly (72−51−12)				
			Stage 1 HPT (Blade) Cooling Duct Assembly (72−51−03)				
			(See Figure 801)				
			Brush Seal	16.190	16.194		
				(411.226)	(411.327)		
			Duct	16.174	16.178	.011T*	.020T
				(410.820)	(410.921)	(0.279T)*	(0.508T)
	805	B	Stage 1 HPT (Blade) Cooling Duct Assembly (72−51−03)				
			No. 3 Bearing Housing (72−41−10)				
			(See Figure 801)				
			Duct	19.198	19.202		
				(487.630)	(487.730)		
			Housing	19.193	19.197	.001T	.009T
				(487.503)	(487.603)	(0.025T)	(0.229T)
	806	A	Inner Combustion Chamber Assembly (72−51−05)				
			Outer Combustion Chamber Assembly (72−41−11)				
			(See Figure 801)				
			Inner Chamber	23.233	23.243		
				(590.12)	(590.37)		
			Outer Chamber	23.224	23.234	.001	.019T
				(589.89)	(590.14)	(0.03)	(0.48T)
	808	B	Turbine Cooling Duct Sensing (Inner Airframe) Tube Assembly (72−41−23)				
			Stage 1 HPT (Blade) Cooling Duct Assembly (72−51−03)				
			(See Figure 802)				
R			Tube	.373	.377		
R				(9.474)	(9.576)		
R			Duct	.378	.380	.001	.007
R				(9.602)	(9.652)	(0.025)	(0.178)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
809	B	Stage 1 (Vane) HPT Support Assembly (72−51−01) Diffuser Case Assembly (72−41−01) (See Figure 801)				
		Support	38.383 (974.93)	38.395 (975.23)		
		Case	38.377 (974.776)	38.383 (974.928)	.011* (0.28)*	.018T (0.46T)
813		Stage 1 HPT (Outer Rotating) Air Seal (72−51−20) Stage 1 HPT Blade Cooling Duct Assembly (72−51−03) (See Figure 801)				
		Radial Gap Cold −		Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357.		
855		HPT Brush Seal And Support Assembly (72−51−12) HPT Stage 1 Air Sealing Ring (72−52−17) (See Figure 801)				
		Radial Gap Cold −		Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357.		

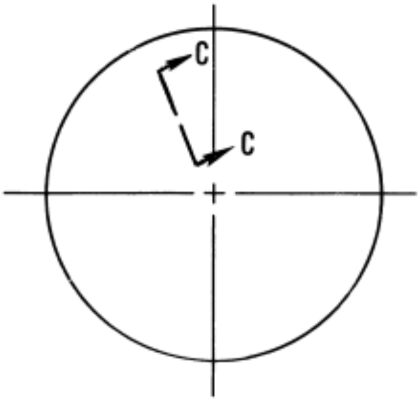
G. Special Assembly Procedures

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
30	A	Stage 1 HPT Vane Cluster Assembly (See Figure 801) See 72−51−00, Assembly−01 Task 72−51−00−400−001				
1000		Rear Burner Seal Clamp Fitting Procedure (See Figure 801) See 72−00−51, Installation−01 Task 72−00−51−420−001				

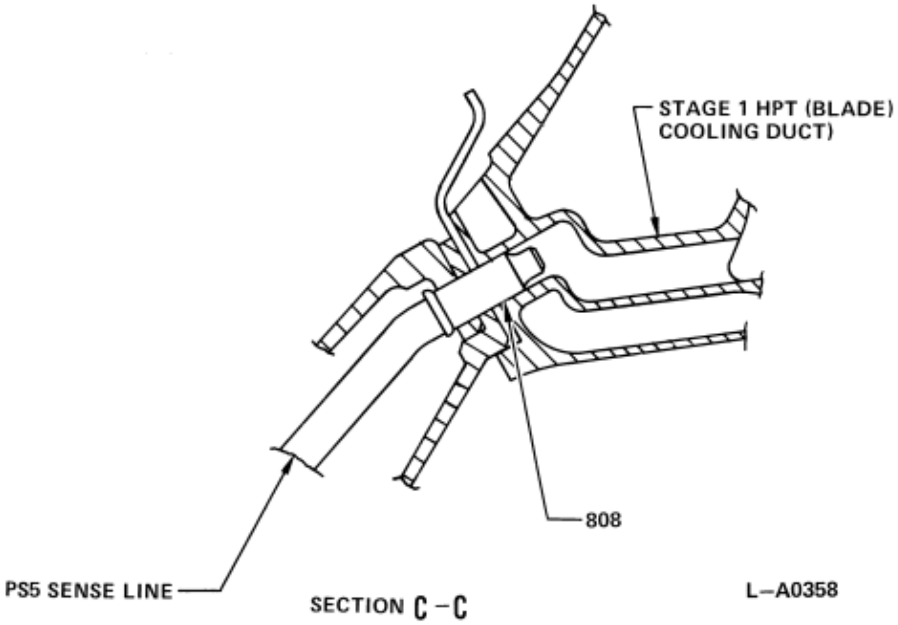
TURBINE NOZZLE - INSPECTION/CHECK-04


(LATER CONFIGURATION)
855
4
813
3
NO. 3 BEARING HOUSING
805
A
1
30
STAGE 1
VANE
2
OUTER
COMBUSTION
CHAMBER
ASSEMBLY
Q
Q
806
809
DIFFUSER CASE ASSEMBLY
VIEW A
1000
VIEW Q-Q
L-A7494 (0105)
PW V

Turbine Nozzle
Figure 801
(Task 72-51-00-990-006)



SCHEMATIC REAR VIEW


STAGE 1 HPT (BLADE) COOLING DUCT)
808
PS5 SENSE LINE

SECTION C - C

L-A0358

Turbine Nozzle
Figure 802
(Task 72-51-00-990-006)

TURBINE NOZZLE - ASSEMBLY-01

Task 72-51-00-400-001:

1. Assemble Turbine Nozzle

A. Prerequisites

(1) (Post SB PW4ENG 72-467) If applicable, assemble the Stage 1 (vane) HPT support assembly (PN 50K184). Refer to 72-51-01, Assembly-01 Task 72-51-01-400-001.

B. Equipment And Materials Necessary

Special Tools:

PWA 27918	Sling (Optional To PWA 80555)
PWA 28657	Sling, Strongback
PWA 76154	Adapter (Two Necessary)
PWA 80555	Sling, Handling
PWA 85077	Fixture, Assembly
PWA 85078	Fixture, Holding

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-395	Beeswax
P05-396	Paraffin Wax Blend

C. Procedure

Subtask 72-51-00-430-051:

(1) Using hoist, attach PWA 28657 Sling with two PWA 76154 Adapters to trunnion spools on PWA 85077 Fixture. Position fixture on bench with support posts down.

(2) Position 1st stage HPT support (1001/3) lug end down, into upper ring detail of Fixture (PWA 85077) and secure with detail clamps. See Figure 1001.

CAUTION: YOU MUST USE NON-CUTBACK SINGLE OR CLUSTER VANES, CUTBACK SINGLE OR CLUSTER VANES OR RESTAGGERED VANES IN COMPLETE SETS ONLY OR DAMAGE TO THE ENGINE CAN OCCUR.

(3) Install vane (feather) seals into grooves in 1st stage HPT vane/vane cluster. Install seals in sets at locations shown in Figure 1001. Apply Beeswax P05-395

or Paraffin Wax Blend P05−396 to sides of seals to secure in place.

NOTE: Clustered vanes (Pre SB PW4ENG 72−471) and single vanes (Post SB PW4ENG 72−471) can be used together, two single vanes used in place of one clustered vane assembly. At the locations where the clusters and single vanes are adjacent, use a (feather) seal PN 50K320 at the OD. At the ID use the (feather) seal PN 50K186 at the front and (feather) seal PN 50K187 at the rear.

NOTE: Install vane clusters together and the single vanes together so that there are only two locations where single vanes and clustered vanes are adjacent. This will minimize air leakage.

NOTE: See Figure 1002 (Sheet 1) for Pre and Post SB PW4ENG 72−467 configuration 1st stage (vane) support assemblies.

(4) (Reference 30) With the (feather) seals installed, position the the first vane, (or vane clusters) outer rear flange, into 1st stage HPT vane support (1002/3). Install the first vane positioning pin (1002/4) on front side of rear outer flange, into locating pin slot (1002/2). Install the remaining vanes, or vane clusters, clusters in the support in both directions.

NOTE: It will be easier to install the last vane or vane cluster, in the assembly if it is located approximately 180 degrees from the locating pin slot in the vane support.

(5) Using feeler gage, ensure that all seals are installed between vanes, or vane clusters.

(6) Secure vanes front inner flanges to fixture using detail clamps.

Subtask 72−51−00−430−052:

(7) Using hoist, attach Sling (PWA 28657) with two Adapters (PWA 76154) to trunnion spools on PWA 85078 Fixture. Position fixture on bench. See Figure 1003.

(8) Position 1st stage HPT cooling duct (1003/2), with large OD flange end down, onto inner ring detail of Fixture (PWA 85078). Position locating pin (1003/4) at scribed line 11° 28" to right of slot location scribed line on fixture base. Secure cooling duct outer airseal support flange to fixture using detail clamps.

CAUTION: THE PS4I HOLE IN THE HPT COOLING DUCT DEFLECTOR MUST BE ALIGNED WITH THE 0.378 − 0.380 INCH (9.602 − 9.652 mm) PS4I HOLE IN THE 1ST STAGE HPT COOLING DUCT. IF THE PS4I HOLE IS BLOCKED, AN INCORRECT PRESSURE READING WILL OCCUR.

(9) Align the boltholes and the PS4I hole, and position the HPT cooling duct deflector (1003/1), with the larger diameter down, over the flange of the cooling duct. Seat the deflector on the cooling duct.

NOTE: If necessary, standard pins can be used to align the boltholes of the deflector with the mating holes in the cooling duct.

(10) Using hoist, attach Sling (PWA 28657) with two Adapters (PWA 76154) to trunnion spools of Fixture (PWA 85077). Lift and trunnion vane and support assembly and position over cooling duct (1004/1). See Figure 1004.

(11) Locate slot (1004/7) in 1st stage HPT support (1004/2). Lower vane and support assembly onto Fixture (PWA 85078) with slot in support aligned with slot (scribed) line on fixture base.

(12) Secure rear OD of 1st stage HPT support (1004/2) to fixture using detail clamps (1004/3). Remove Fixture (PWA 85077), adapters and sling.

Subtask 72−51−00−430−053:

CAUTION: OUTER AND INNER COMBUSTION CHAMBER ASSEMBLIES WITH REVISED DILUTION HOLES (DECREASED EMISSIONS) MUST BE USED IN SETS WITH COMBUSTION CHAMBER GUIDE ASSEMBLIES (REFERENCE SB PW4ENG 72−187).

(13) (Post SB PW4ENG 72−558) Position combustion chamber guide (upper segment) (1005/3) and (lower segment) (1005/5) over outer lugs of vanes. Locate instrumentation guide detail (1005/4) of combustion

chamber guide (upper segment) approximately 93 degrees counterclockwise from locating pin in OD of 1st stage HPT cooling duct. See Figure 1005 (Sheet 1).

(14) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Position combustion chamber guide (upper segment) (1005/3) and (lower segment) (1005/5) over outer lugs of vanes. Locate instrumentation guide detail (1005/4) of combustion chamber guide (upper segment) approximately 93 degrees counterclockwise from locating pin in OD of 1st stage HPT cooling duct. See Figure 1005 (Sheet 2).

(15) Align boltholes and position 17 combustion chamber guide plates (1005/2) between lugs of combustion chamber guide segments. Secure guide plates and guides with 34 bolts (1005/1) and nuts (1005/6). Install bolts with boltheads up and flat machined edge of bolthead toward OD of assembly. Do not torque bolts.

NOTE: Bolts (1005/1) will be torqued at engine assembly in 72−00−51, Installation−01 (Task 72−00−51−420−001) or 72−00−51, Installation−02 (Task 72−00−51−420−002) as necessary.

Subtask 72−51−00−430−054:

(16) Use a hoist to connect PWA 80555 or PWA 27918 Sling (1006/1) to the cooling holes in the inner combustion chamber (1006/2).

(17) Install three PWA 29855−2 Pins (1006/6) approximately 120 degrees apart into the rear flange of the combustion chamber.

(18) Use a hoist to put the combustion chamber over the 1st stage HPT cooling duct (1006/5) and vane assembly. Align the locating pin (1006/4) in the duct with the locating pin hole (1006/3) in the combustion chamber rear plate detail. Lower the combustion chamber onto the duct. Temporarily attach the combustion chamber to the cooling duct with three equally spaced workbolts.

(19) Use a hoist and Sling (PWA 28657) attached to Fixture (PWA 85078) (1006/7) trunnion the assembly to front end down position. Remove the hoist and sling.

TURBINE NOZZLE - ASSEMBLY-01

(20) Remove the Pins (PWA 25855-2) and the workbolts. Position the 17 1st stage HPT duct segments (1007/4) over the 1st stage HPT cooling air duct (1007/9), with the oval slots in the duct segments toward the cooling duct. Align the bolthole in each duct segment with the round boltholes in the lugs of the vane clusters. Attach the duct segments with the 17 bolts (1007/1) lubricated with Engine Oil P03-001. Tighten the bolts by hand only. See Figure 1007.

(21) Install the 17 1st stage HPT duct stops (1007/3) into the slots between the duct segments. The bolthole in each stop must align with the elongated boltholes in the lugs of the vane clusters. Attach the duct stops with the bolts (1007/2) lubricated with Engine Oil P03-001. Tighten the bolts by hand only.

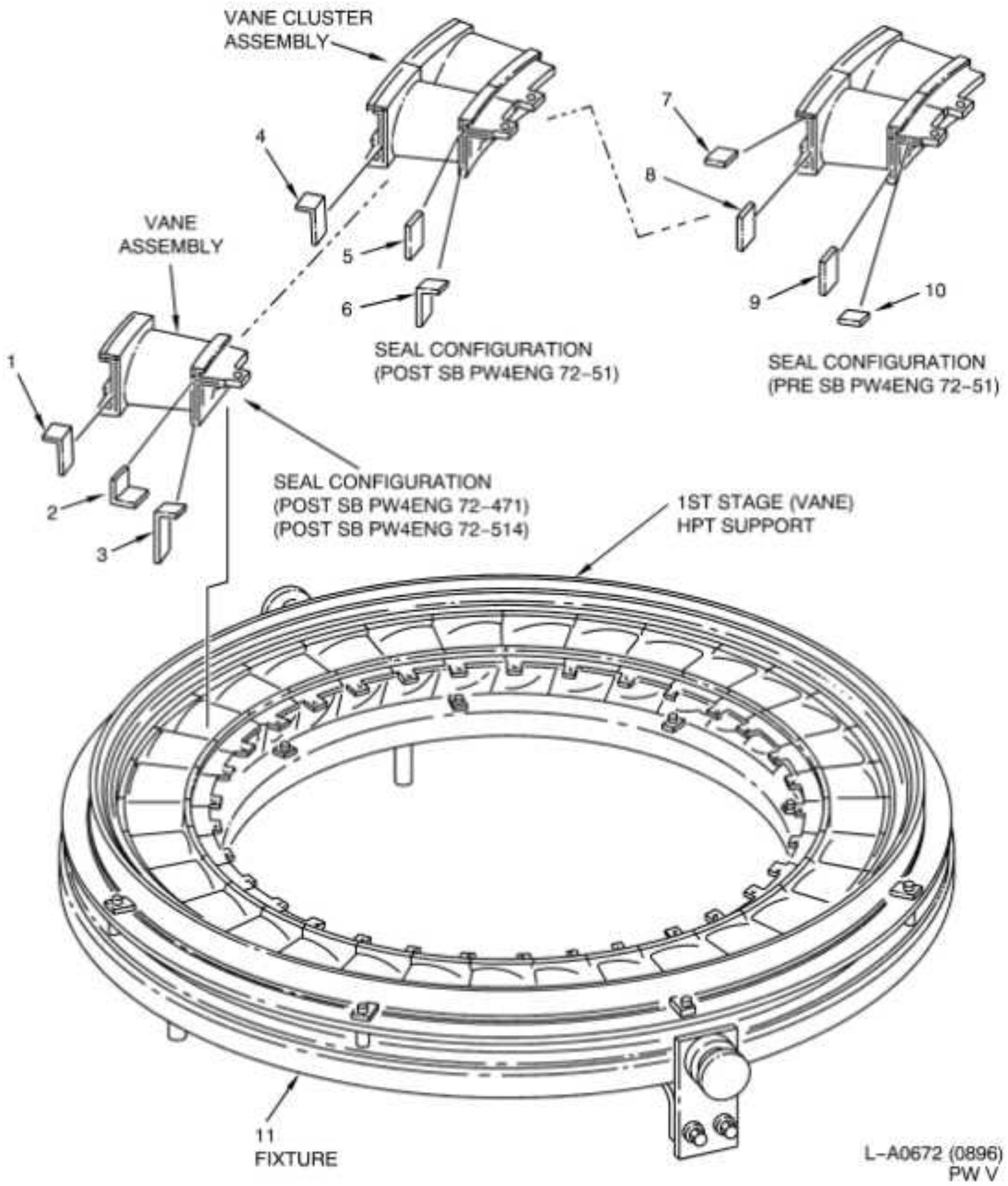
(22) Torque the 17 bolts (1007/1) to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(23) Torque the 17 bolts (1007/2) to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(24) Attach hoist, Sling (PWA 28657) and two Adapters (PWA 76154) to trunnion spools of Fixture (PWA 85078). Using hoist, position assembly on pallet.

(25) Loosen bolts (1007/6) and slide clamps (1007/7) outward from 1st stage HPT support (1007/8). Loosen hand knobs (1007/10) and slide four clamps (1007/11) outward from 1st stage HPT cooling duct (1007/9).

(26) Using hoist, remove fixture and trunnion to legs end down position. Lower fixture onto pallet. Remove hoist, sling and adapters from fixture.

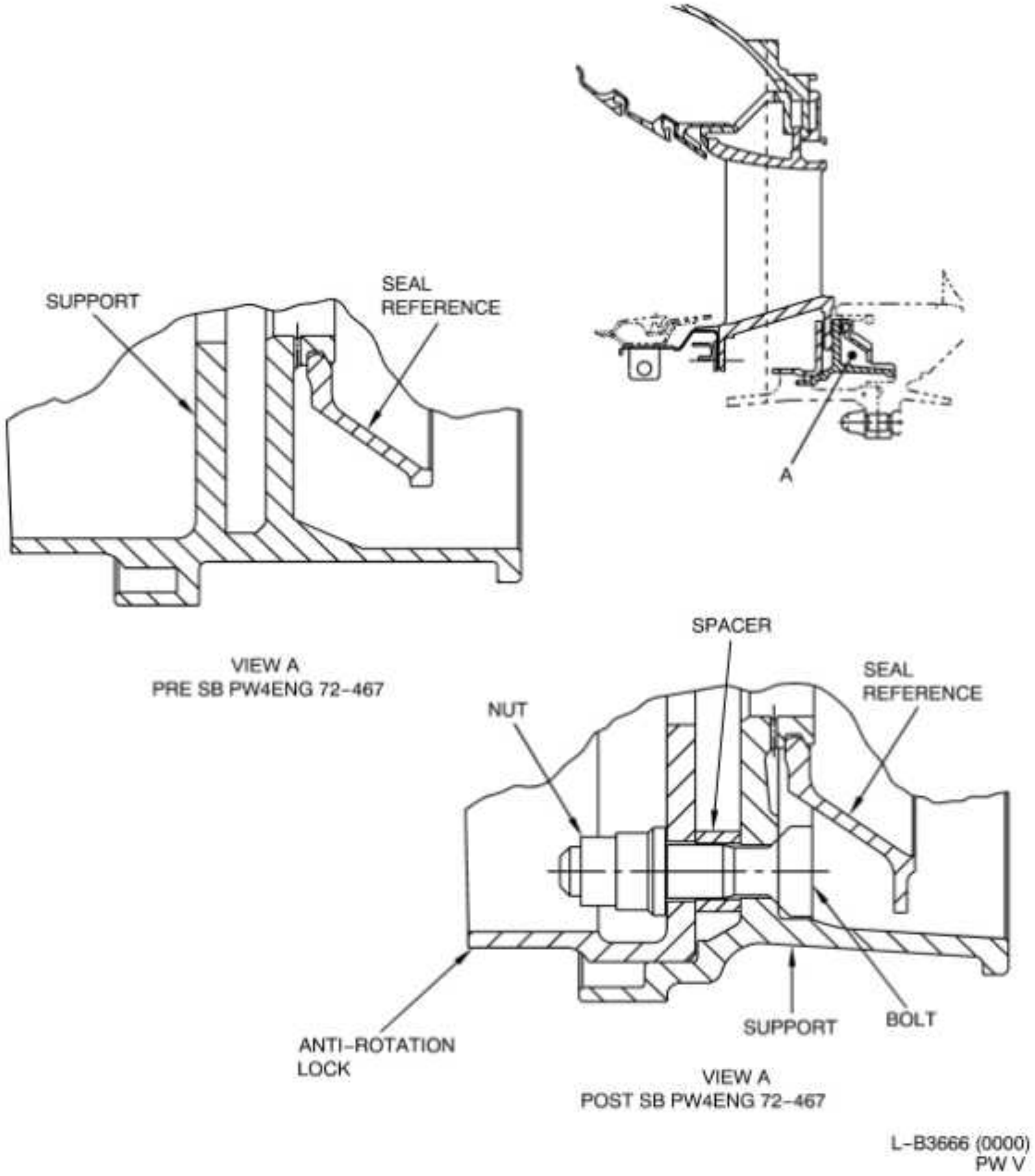

VANE CLUSTER ASSEMBLY
4
5
6
SEAL CONFIGURATION (POST SB PW4ENG 72-51)
7
8
9
10
SEAL CONFIGURATION (PRE SB PW4ENG 72-51)
VANE ASSEMBLY
1
2
3
SEAL CONFIGURATION (POST SB PW4ENG 72-471) (POST SB PW4ENG 72-514)
1ST STAGE (VANE) HPT SUPPORT
11
FIXTURE
L-A0672 (0896)
PW V

Stage 1 HPT Vane/Vane Cluster Assembly
And (Feather) Seal Installation
Figure 1001
(Task 72−51−00−400−001)

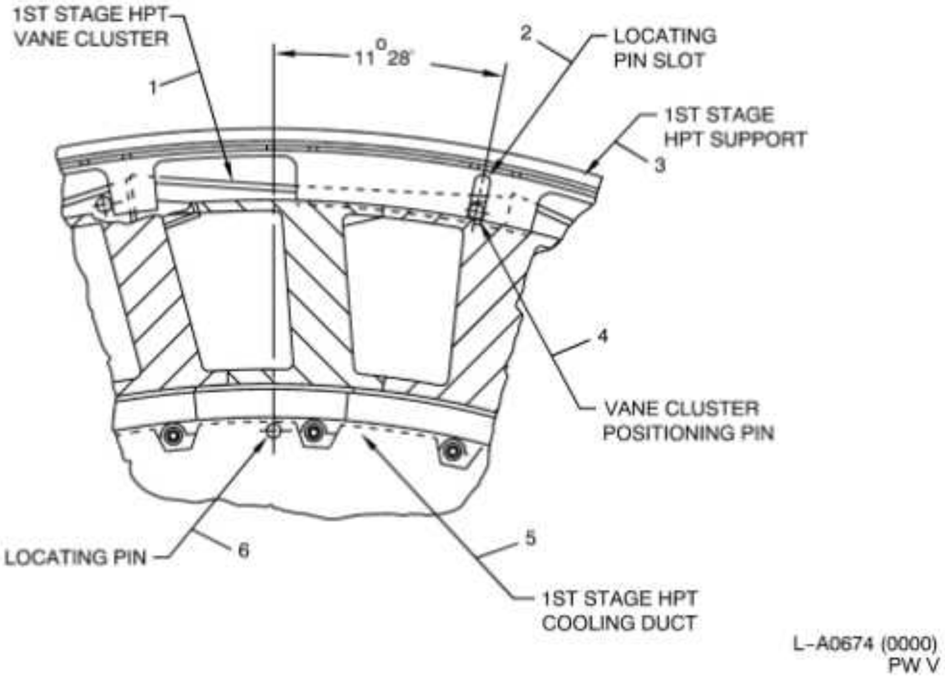
TURBINE NOZZLE − ASSEMBLY−01

1. PN 50K320 Seal, 34 Required
2. PN 50K319 Seal, 34 Required
3. PN 50K186 Seal, 34 Required
4. PN 50K188 Seal, 17 Required
5. PN 50K187 Seal, 17 Required
6. PN 50K186 Seal, 17 Required
7. PN 50K106 Seal, 17 Required
8. PN 50K092 Seal, 17 Required
9. PN 50K083 Seal, 17 Required
10. PN 50K105 Seal, 17 Required
11. PWA 85077 Fixture

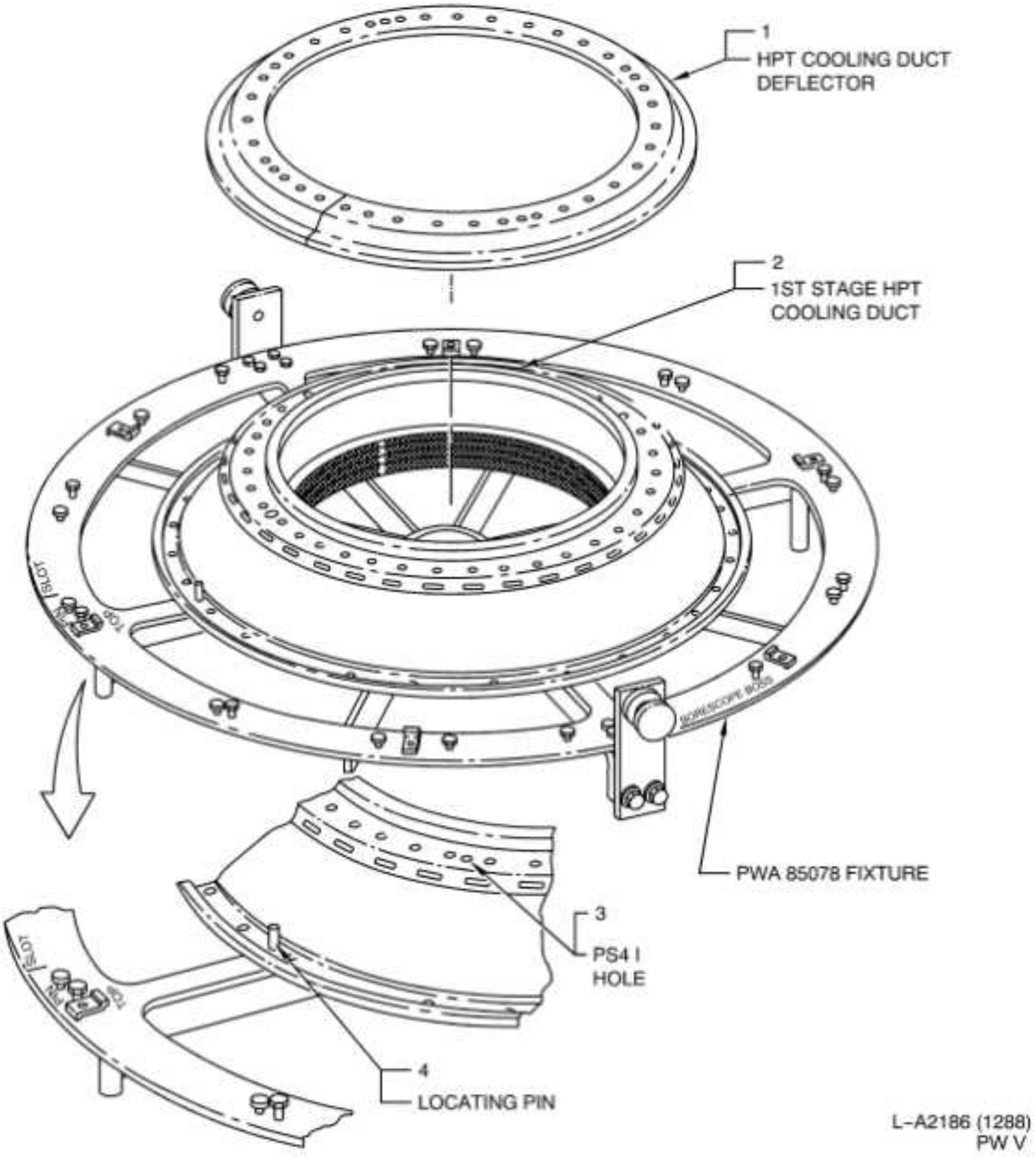
Key to Figure 1001


A
SUPPORT
SEAL REFERENCE
VIEW A
PRE SB PW4ENG 72-467
SPACER
NUT
SEAL REFERENCE
ANTI-ROTATION LOCK
SUPPORT
BOLT
VIEW A
POST SB PW4ENG 72-467
L-B3666 (0000)
PW V

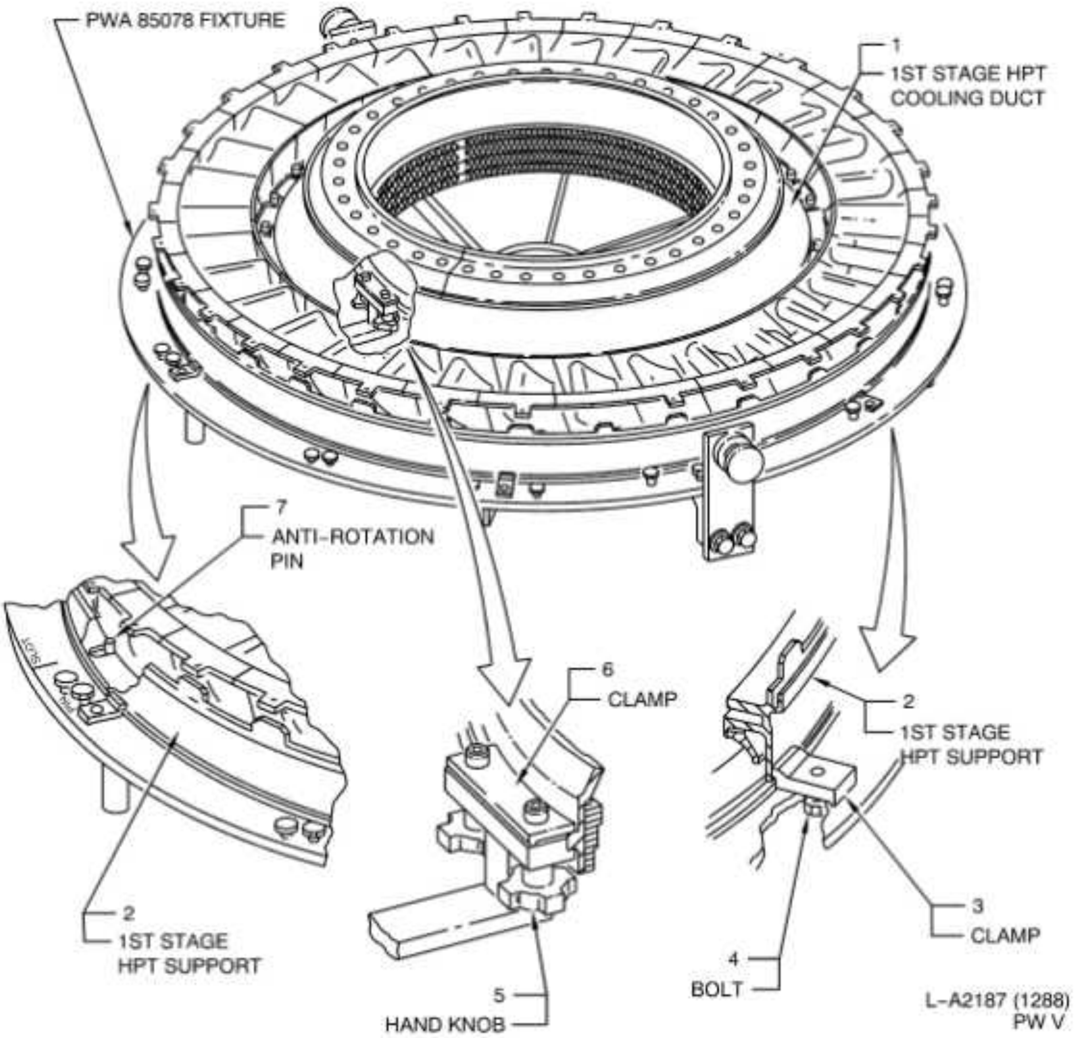
Stage 1 HPT Vane Support Assembly
Figure 1002 (Sheet 1)
(Task 72−51−00−400−001)


1ST STAGE HPT VANE CLUSTER
1
11°28'
2
LOCATING PIN SLOT
1ST STAGE HPT SUPPORT
3
4
VANE CLUSTER POSITIONING PIN
LOCATING PIN
6
5
1ST STAGE HPT COOLING DUCT
L-A0674 (0000)
PW V

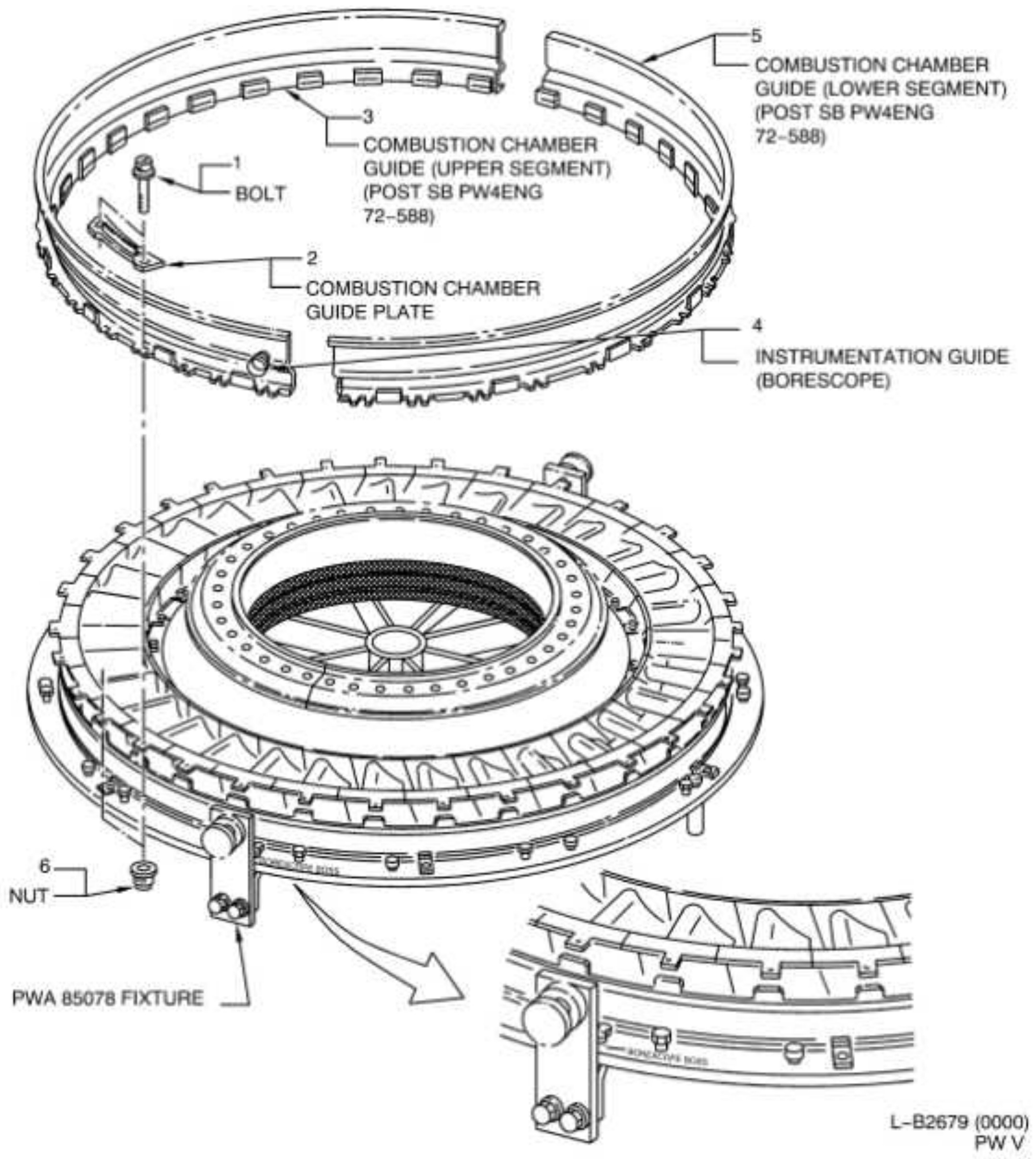
Stage 1 HPT Support And Cooling Duct Alignment
Figure 1002 (Sheet 2)
(Task 72-51-00-400-001)


1
HPT COOLING DUCT DEFLECTOR
2
1ST STAGE HPT COOLING DUCT
SLOT
TOP
BORESCOPE BOSS
PWA 85078 FIXTURE
3
PS4 I HOLE
SLOT
TOP
4
LOCATING PIN
L-A2186 (1288)
PW V

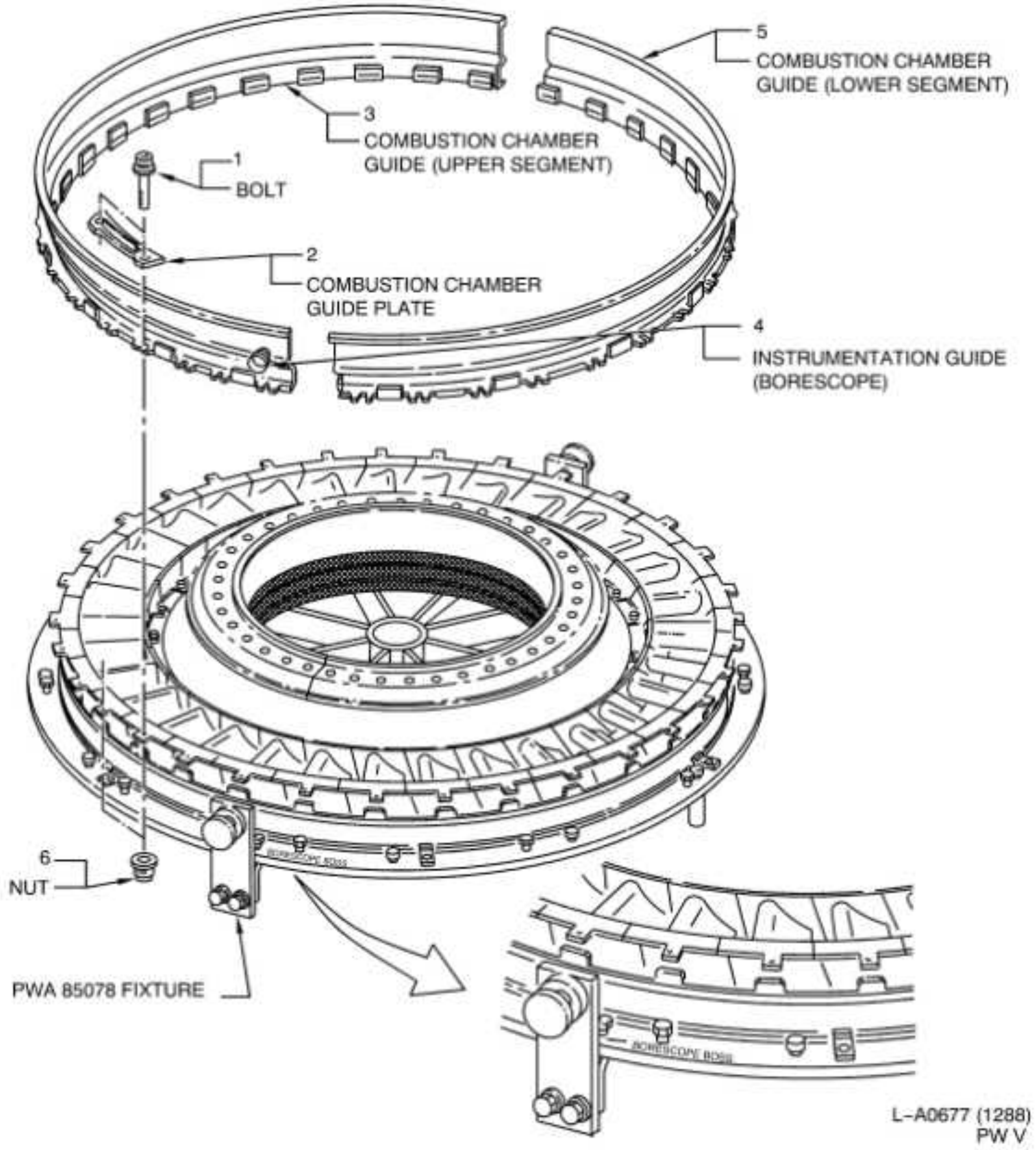
HPT Cooling Duct Deflector Installation
Figure 1003
(Task 72-51-00-400-001)


PWA 85078 FIXTURE
1
1ST STAGE HPT COOLING DUCT
7
ANTI-ROTATION PIN
6
CLAMP
2
1ST STAGE HPT SUPPORT
2
1ST STAGE HPT SUPPORT
3
CLAMP
4
BOLT
5
HAND KNOB
L-A2187 (1288)
PW V

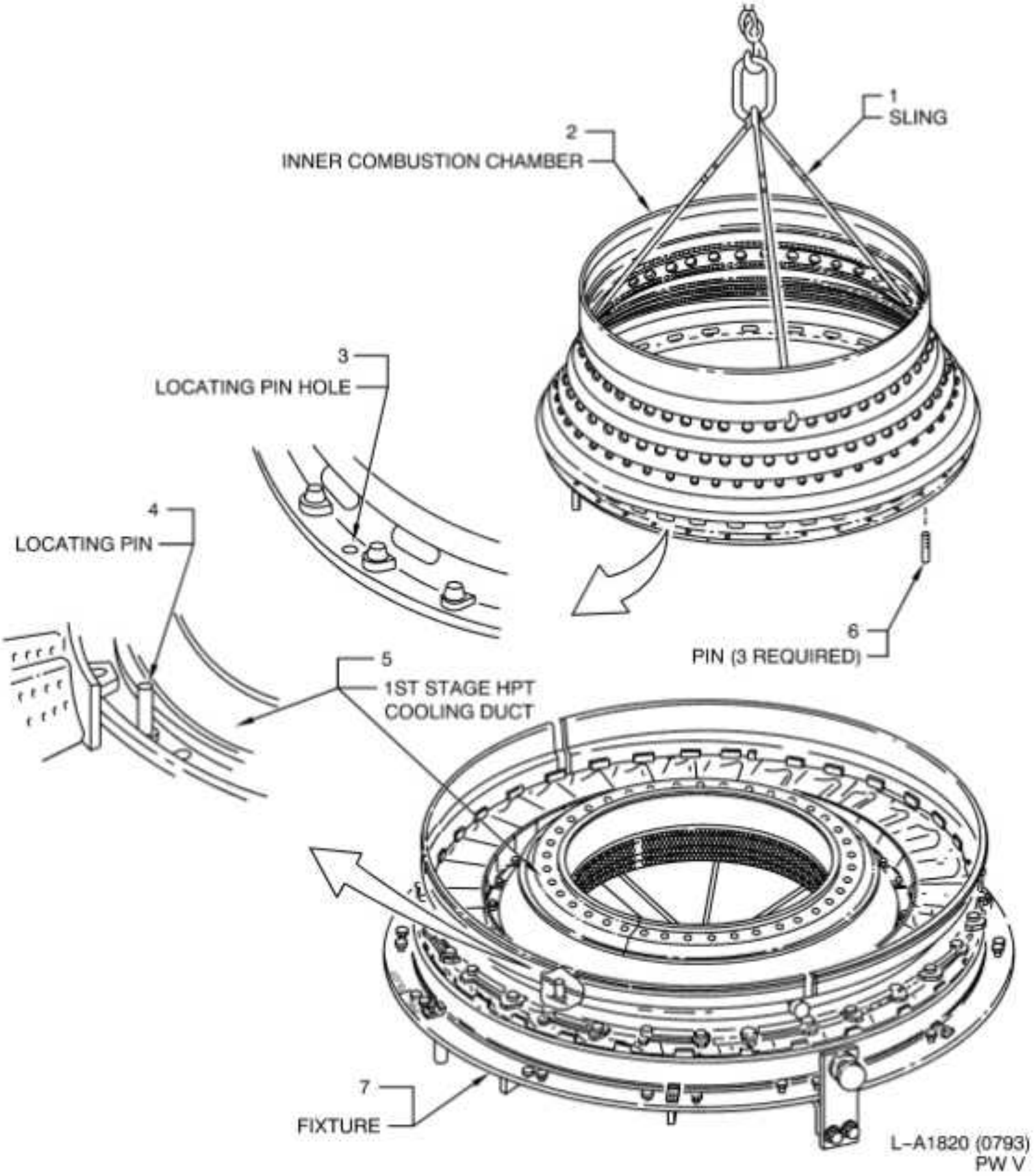
Installation Of Vane And Support Assembly In PWA 85078 Fixture
Figure 1004
(Task 72-51-00-400-001)


5
COMBUSTION CHAMBER GUIDE (LOWER SEGMENT) (POST SB PW4ENG 72-588)
3
COMBUSTION CHAMBER GUIDE (UPPER SEGMENT) (POST SB PW4ENG 72-588)
1
BOLT
2
COMBUSTION CHAMBER GUIDE PLATE
4
INSTRUMENTATION GUIDE (BORESCOPE)
6
NUT
PWA 85078 FIXTURE
L-B2679 (0000)
PW V

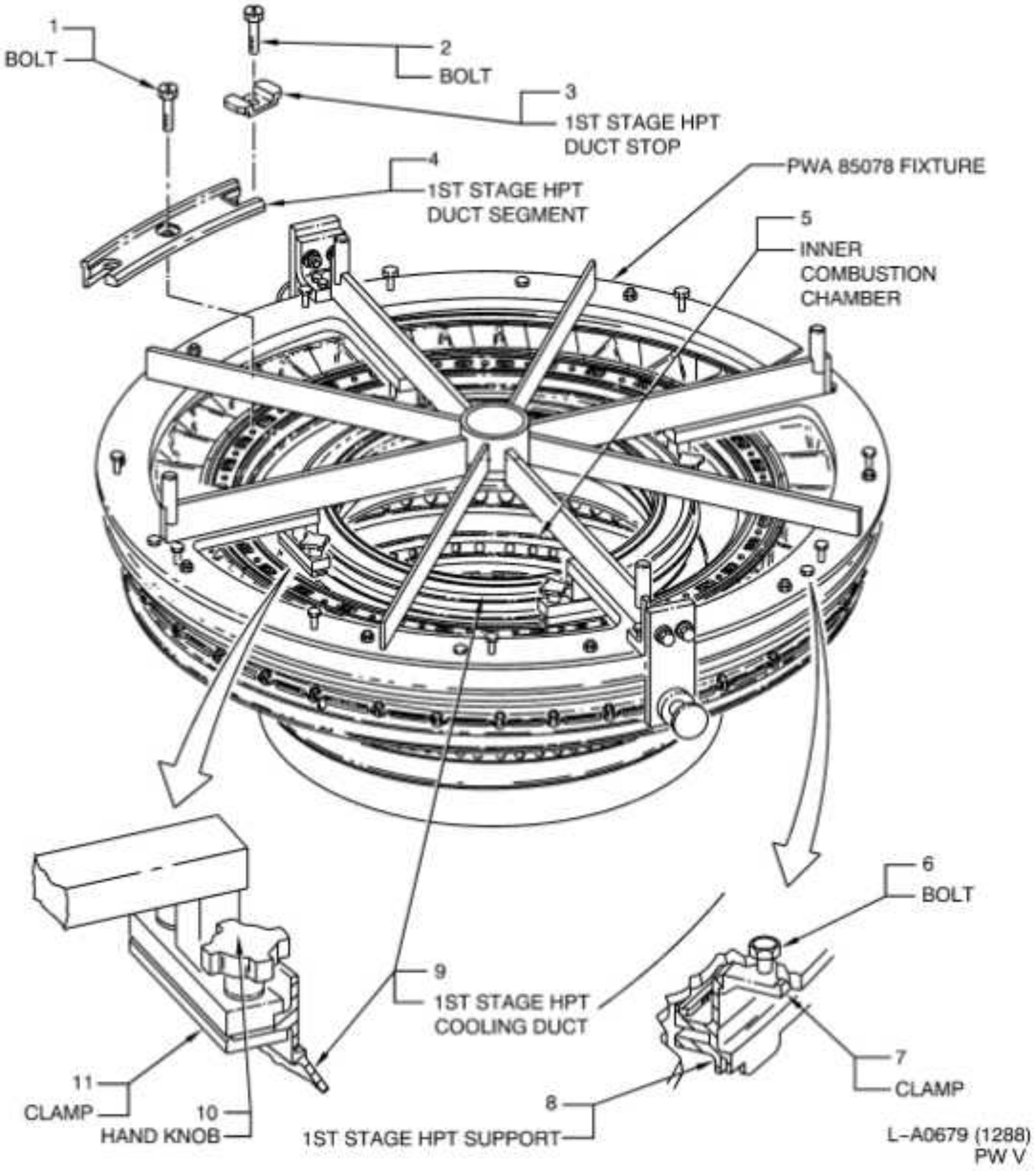
Combustion Chamber Guides And Clamp Installation
Figure 1005 (Sheet 1)
(Task 72−51−00−400−001)


5
COMBUSTION CHAMBER
GUIDE (LOWER SEGMENT)
3
COMBUSTION CHAMBER
GUIDE (UPPER SEGMENT)
1
BOLT
2
COMBUSTION CHAMBER
GUIDE PLATE
4
INSTRUMENTATION GUIDE
(BORESCOPE)
6
NUT
PWA 85078 FIXTURE
BORESCOPE BOSS
L-A0677 (1288)
PW V

Combustion Chamber Guides And Clamp Installation
Figure 1005 (Sheet 2)
(Task 72-51-00-400-001)


1
SLING
2
INNER COMBUSTION CHAMBER
3
LOCATING PIN HOLE
4
LOCATING PIN
5
1ST STAGE HPT
COOLING DUCT
6
PIN (3 REQUIRED)
7
FIXTURE
L-A1820 (0793)
PW V

Inner Combustion Chamber Installation
Figure 1006
(Task 72-51-00-400-001)


1
BOLT
2
BOLT
3
1ST STAGE HPT DUCT STOP
4
1ST STAGE HPT DUCT SEGMENT
PWA 85078 FIXTURE
5
INNER COMBUSTION CHAMBER
6
BOLT
9
1ST STAGE HPT COOLING DUCT
7
CLAMP
8
1ST STAGE HPT SUPPORT
11
CLAMP
10
HAND KNOB
L-A0679 (1288)
PW V

Stage 1 Duct Segments And Duct Stops Installation
Figure 1007
(Task 72-51-00-400-001)

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Pratt & Whitney
PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

Tab Separator - Turbine Nozzle

List of Effective Pages - Turbine Nozzle
See end of list.

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	006		MAR 15/93
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	404		JUN 15/97
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	407		SEP 15/99

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	R	805		DEC 15/05
	R	806		DEC 15/05
		807		MAR 15/98
		808		MAR 15/98
		809		DEC 15/97
		810		DEC 15/97
72-51-00				
72-51-00		801	CONFIG-2	DEC 15/97
INSP/CHK-04			4152-3 4156A-3	
			4158-3	
		802		DEC 15/97
	R	803		DEC 15/05
	R	804		DEC 15/05
	R	805		DEC 15/05
	R	806		DEC 15/05
		807		JUN 15/05
		808		JUN 15/05
72-51-00				
72-51-00		1001	ALL	SEP 15/99
ASSEMBLY-01		1002		SEP 15/99
		1003		SEP 15/99
		1004		SEP 15/99
		1005		JUN 15/99
		1006		JUN 15/99
		1007		JUN 15/99
		1008		JUN 15/99
		1009		JUN 15/99
		1010		JUN 15/99
		1011		JUN 15/99
		1012	4152 4156A 4158	JUN 15/99
		1013	4152-3 4156A-3	JUN 15/99
			4158-3	
		1014	ALL	JUN 15/99
		1015/1016		JUN 15/99
72-51-01				
72-51-01		501/502	ALL	DEC 15/02
DISASSY-01				
72-51-01				
72-51-01		1001	ALL	DEC 15/96
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		1004		DEC 15/96
		1005/1006		DEC 15/96
72-51-05				
72-51-05		501	CONFIG-1	SEP 15/02

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		4156A 4156A-3	
		4158 4158-3	
	502		SEP 15/02
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		4158 4158-3	
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	1004		SEP 15/04

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STAGE 1 (VANE) HPT SUPPORT ASSEMBLY - DISASSEMBLY-01

Task 72-51-01-030-001:

1. (Post SB PW4ENG 72-467) Disassemble The Stage 1 (Vane) HPT Support Assembly (PN 50K184) - Stage 1 (Vane) HPT Support Assembly - Deleted

A. Procedure

Subtask 72-51-01-030-002:

(1) This procedure has been deleted.

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STAGE 1 (VANE) HPT SUPPORT ASSEMBLY - ASSEMBLY-01

Task 72-51-01-400-001:

1. (Post SB PW4ENG 72-467) Assemble The Stage 1 (Vane) HPT Support Assembly (PN 50K184) - Stage 1 (Vane) HPT Support Assembly

A. Equipment And Materials Required

Special Tools:
PWA 29754 Control (Or Equivalent)
PWA 76156 Adapters (Two Necessary)
PWA 87012 Heater (Or Equivalent)
PWA 88643 Sling, Lifting (Optional to PWA 88673)
PWA 88673 Sling, Lifting (Optional to PWA 88643)
PWA 101533 Fixture, Assembly/Disassembly

B. Procedure

See Figures 1001 and 1002.

Subtask 72-51-01-430-001:

(1) Put the 1st stage HPT vane support (1001/5), larger OD end down, on blocks.

(2) Install 34 bolts (1001/4) into the larger boltholes in the support flange.

(3) Attach PWA 101533 Fixture to the vane support.

(4) Lift and turn the fixture with the support assembly, to the fixture end down position, and lower onto the workbench.

(5) Put 34 spacers (1001/3) on the bolts.

WARNING: BE CAREFUL WHEN YOU USE A HEATER TO ASSEMBLE PARTS. USE GLOVES WHEN YOU TOUCH OR LIFT THE HEATER OR THE PARTS. THE HEATER OR THE PARTS CAN BE HOT AND CAUSE BURNS.

CAUTION: THE HEATER THERMOCOUPLE MUST TOUCH THE SUPPORT OR OVERHEATING OF THE SUPPORT CAN OCCUR.

(6) Install a PWA 87012 Heater with a PWA 29754 Control on the support. Heat the support assembly to 300°F (148.9°C) maximum. Remove the heater and control.

(7) Align the boltholes and lower the anti-rotation lock (1001/2) onto the vane support.

(8) Install 34 nuts (1001/1), lubricated with Engine Oil (P03−001) onto the bolts. Torque the nuts to 85 − 95 lbf−in. (9.604 − 10.734 N.m).

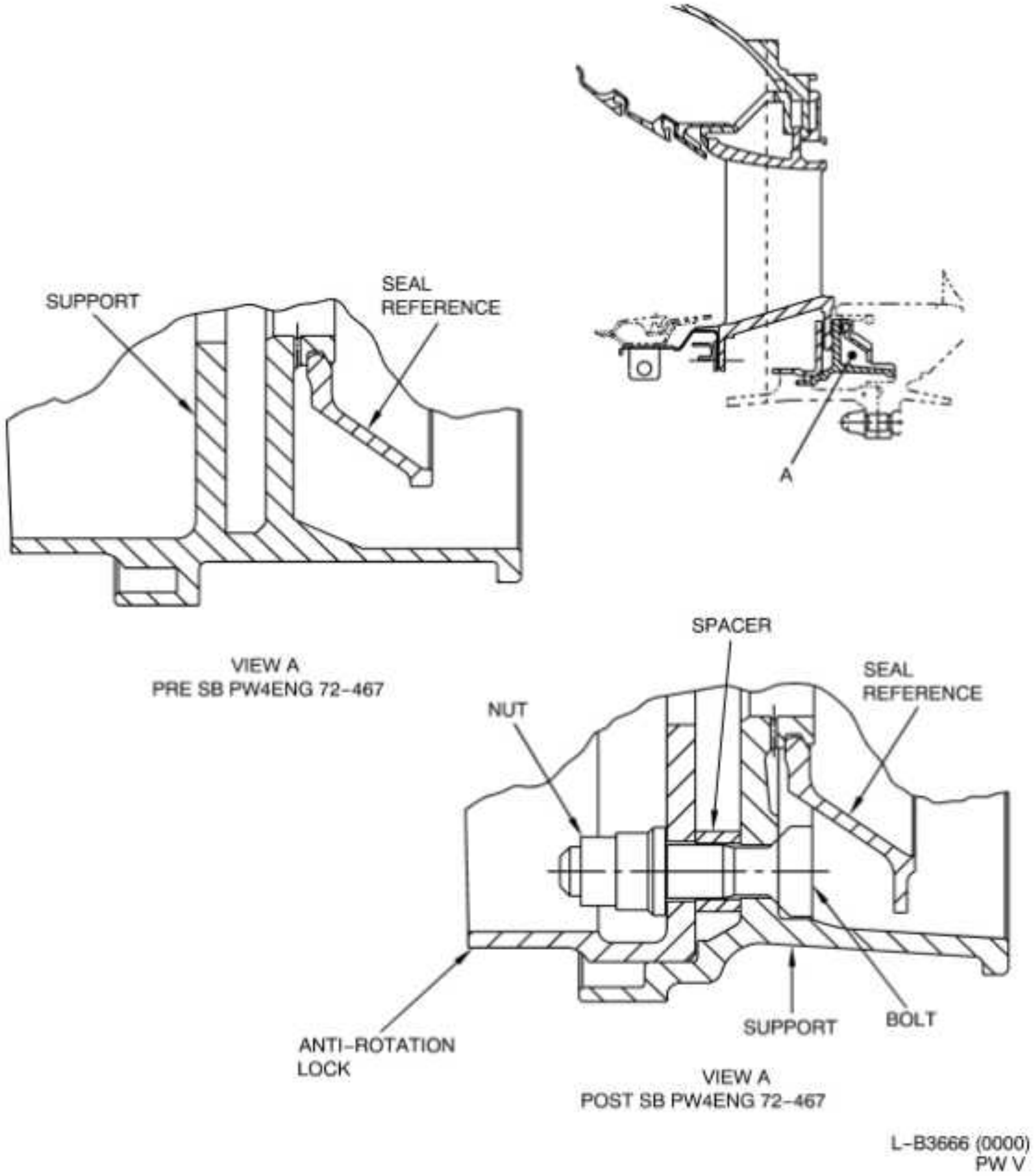
(9) After the parts have cooled, re−torque the nuts to 85 − 95 lbf−in. (9.604 − 10.734 N.m).

(10) Use the hoist, two PWA 76156 Adapters, and PWA 88643 or PWA 88673 Sling to lift and turn the assembly to put the anti−rotation lock end down. Release the fixture clamps. Remove the fixture, hoist, sling and adapters.

Subtask 72−51−01−430−002:

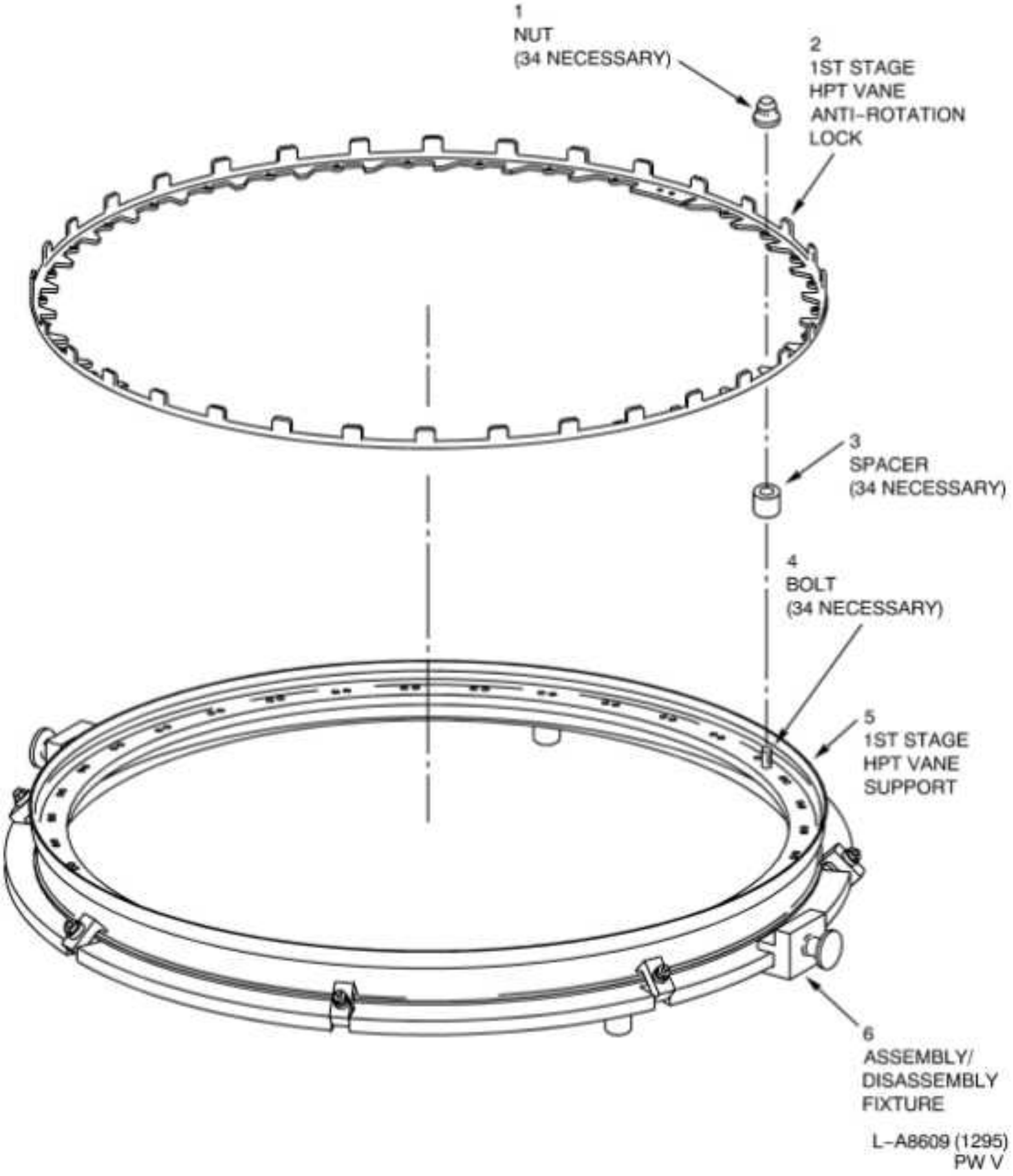
WARNING: BE CAREFUL WHEN YOU USE A HEATER TO ASSEMBLE PARTS. USE GLOVES WHEN YOU TOUCH OR LIFT THE HEATER OR THE PARTS. THE HEATER OR THE PARTS CAN BE HOT AND CAUSE BURNS.

(11) Install the 1st stage HPT seal support into the ID groove in the support assembly. Local heating of the seal to 500°F (260°C) maximum is permitted to help assemble the parts. See Figure 1002.

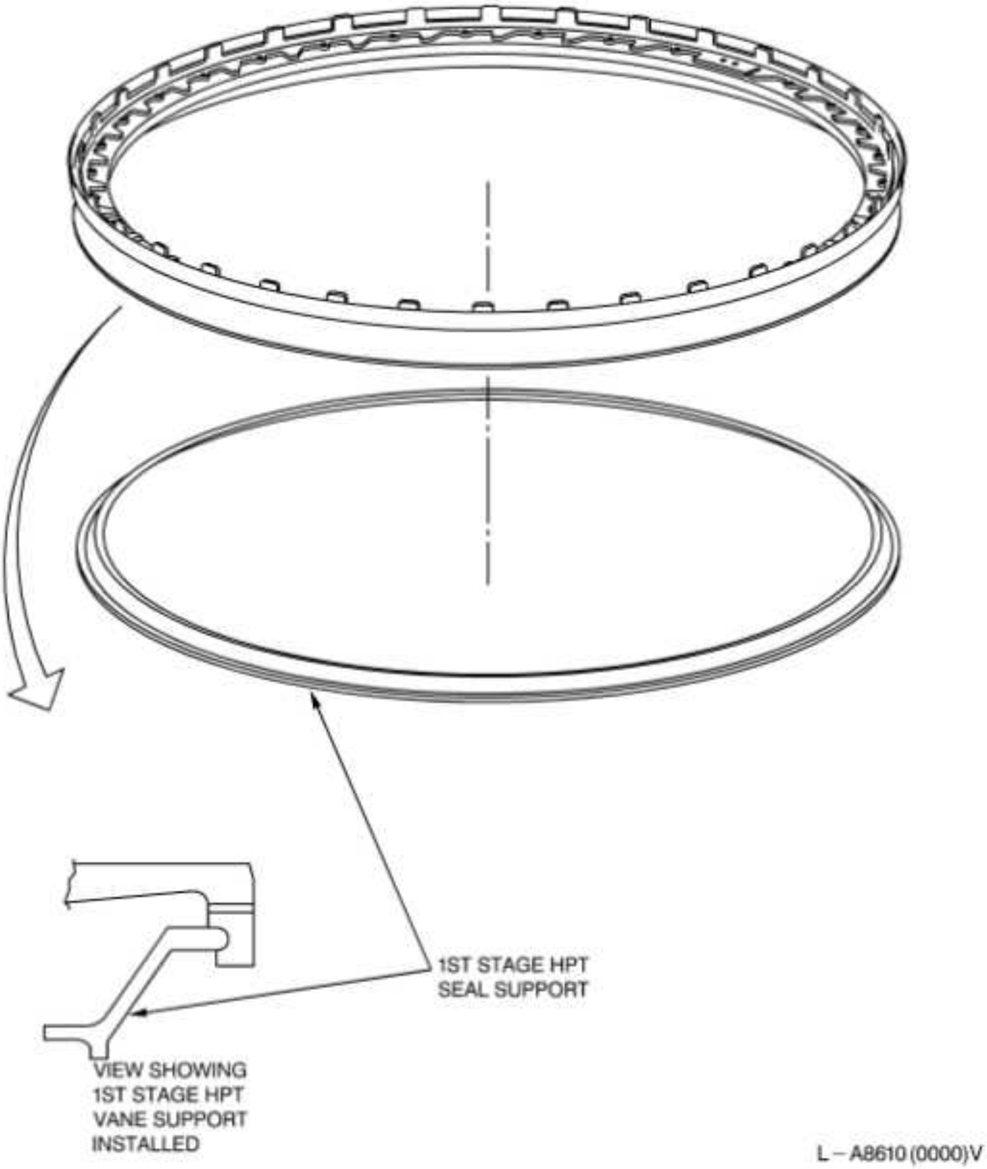

SUPPORT
SEAL REFERENCE
A
VIEW A
PRE SB PW4ENG 72-467
SPACER
SEAL REFERENCE
NUT
ANTI-ROTATION LOCK
SUPPORT
BOLT
VIEW A
POST SB PW4ENG 72-467
L-B3666 (0000)
PW V

Stage 1 HPT Vane Support Assembly
Figure 1001 (Sheet 1)
(Task 72−51−01−400−001)

STAGE 1 (VANE) HPT SUPPORT ASSEMBLY − ASSEMBLY−01


1
NUT
(34 NECESSARY)
2
1ST STAGE
HPT VANE
ANTI−ROTATION
LOCK
3
SPACER
(34 NECESSARY)
4
BOLT
(34 NECESSARY)
5
1ST STAGE
HPT VANE
SUPPORT
6
ASSEMBLY/
DISASSEMBLY
FIXTURE
L−A8609 (1295)
PW V

First Stage HPT Anti−Rotation Lock Installation
Figure 1001 (Sheet 2)
(Task 72−51−01−400−001)


1ST STAGE HPT
SEAL SUPPORT
VIEW SHOWING
1ST STAGE HPT
VANE SUPPORT
INSTALLED
L - A8610 (0000)V

First Stage HPT Seal Support Installation
Figure 1002
(Task 72-51-01-400-001)

Pratt & Whitney
PW4000 SERIES ENGINE MANUAL (PN 50A443)

TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 78 DATED DECEMBER 15, 2005

HIGHLIGHTS - TURBINE NOZZLE

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-51-00 INSP/CHK-04	804 806	Revised Reference Number 1 dimensions and increased the fit allowance. (CACTUS C5213-Q31233) Revised Reference Number 808 minimum and maximum dimensions and limits. (IEN03KCB76)	CONFIG-1 4152 4156A 4158
72-51-00 INSP/CHK-04	804 -805	Revised Reference Number 1 dimensions and increased the fit allowance. (CACTUS C5213-Q31233) Revised Reference Number 808 minimum and maximum dimensions and limits. (IEN03KCB76)	CONFIG-2 4152-3 4156A-3 4158-3

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CHAPTER 72

TURBINE NOZZLE

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Task 72-51-00-990-002: Turbine Nozzle - Description And Operation		001	
Removal-01		301	ALL
Task 72-51-00-030-002: Remove Inner Combustion Chamber		301	
Removal-02		301	ALL
Task 72-51-00-030-003: Remove 1st Stage HPT Vane/Vane Cluster Assemblies		301	
Installation-01		401	ALL
Task 72-51-00-430-001: Install Inner Combustion Chamber		401	
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Task 72-51-00-430-002: Install 1st Stage HPT Vane/Vane Cluster Assemblies		401	
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Task 72-51-00-030-001: Disassemble Turbine Nozzle		501	
Inspection/Check-01		801	ALL
Task 72-51-00-990-004: General Inspection Requirements - Turbine Nozzle		801	
Inspection/Check-03		801	ALL
Task 72-51-00-990-005: Visual Inspection - Turbine Nozzle		801	
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Inspection/Check-04		801	CONFIG-2 4152-3 4156A-3 4158-3
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Task 72-51-00-400-001: Assemble Turbine Nozzle		1001	

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Assembly-01		1001	ALL
Task 72-51-01-400-001: (Post SB PW4ENG 72-467) Assemble The Stage 1 HPT (Vane) Support Assembly (PN 50K184) - Stage 1 (Vane) HPT Support Assembly		1001	
INNER COMBUSTION CHAMBER ASSEMBLY	72-51-05		
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Task 72-51-05-040-001: Disassemble The Inner Combustion Chamber Assembly (Talon II Low Emission Burner)		501	4152 4152-3 4156A 4156A-3 4158 4158-3
Assembly-01		1001	CONFIG-1
Task 72-51-05-440-001: Assemble The Inner Combustion Chamber Assembly (Talon II Low Emission Burner)		1001	4152 4152-3 4156A 4156A-3 4158 4158-3

INNER COMBUSTION CHAMBER ASSEMBLY - DISASSEMBLY-01

Task 72-51-05-040-001:

1. Disassemble The Inner Combustion Chamber Assembly (Talon II Low Emission Burner)

   A. Prerequisites

      (1) Remove the inner combustion chamber assembly from the turbine nozzle by 72-51-00, Disassembly-01 (Task 72-51-00-030-002).

   B. Procedure

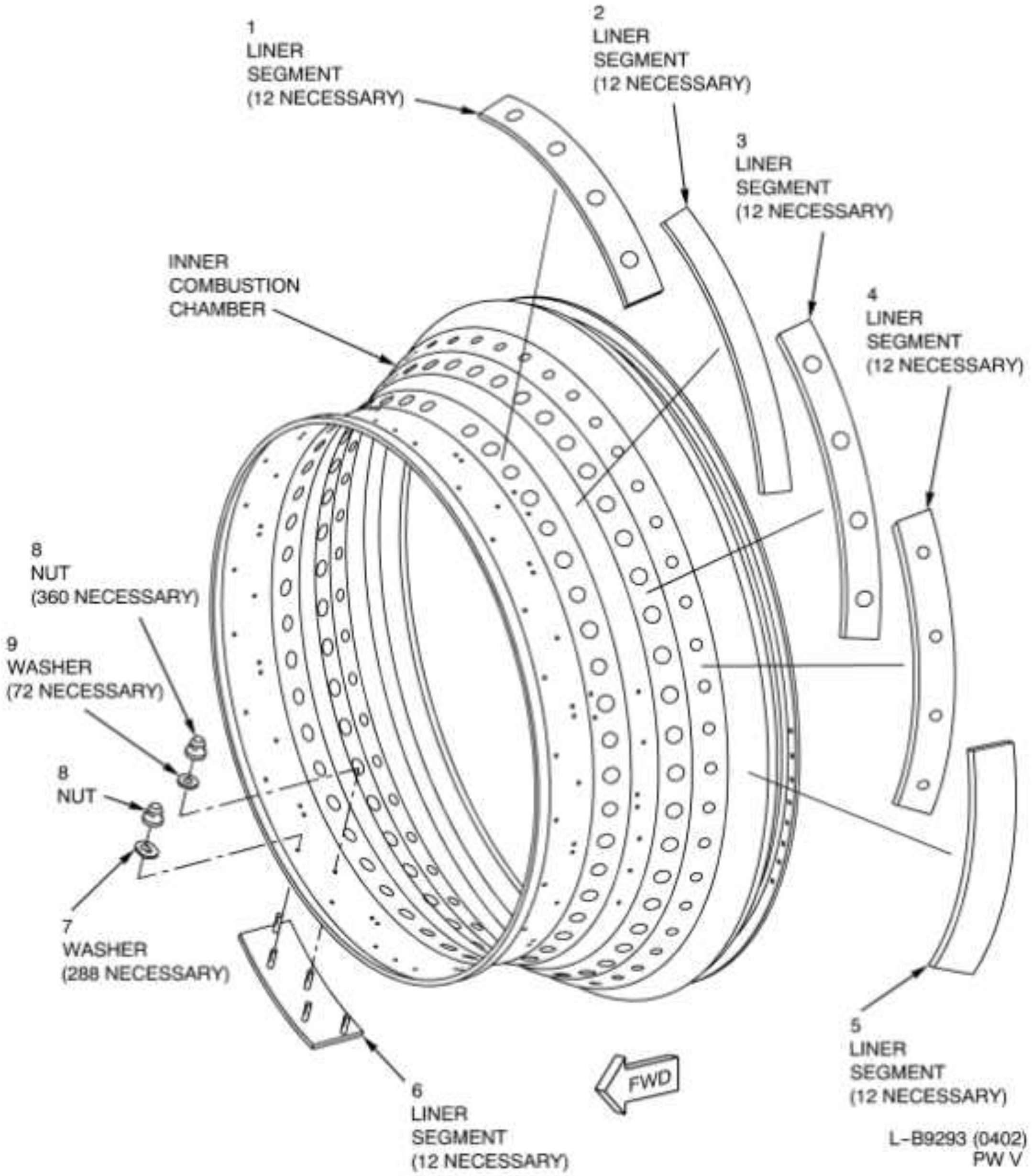
      NOTE: It is necessary to remove the liner segments that are installed closest to the inner combustion chamber front OD and then work rearward.

      (1) Remove the liner segments from the inner combustion chamber assembly as follows. See Figure 501.

         (a) Loosen and remove the nuts (501/8) and washers (501/7) and (501/9) as necessary for each liner segment. Discard all the nuts and the damaged washers.

         (b) Carefully remove each liner segment (501/1), (501/2), (501/3), (501/4), (501/5) and (501/6) from the inner combustion chamber.

INNER COMBUSTION CHAMBER ASSEMBLY − DISASSEMBLY−01


1
LINER
SEGMENT
(12 NECESSARY)
2
LINER
SEGMENT
(12 NECESSARY)
3
LINER
SEGMENT
(12 NECESSARY)
INNER
COMBUSTION
CHAMBER
4
LINER
SEGMENT
(12 NECESSARY)
8
NUT
(360 NECESSARY)
9
WASHER
(72 NECESSARY)
8
NUT
7
WASHER
(288 NECESSARY)
FWD
6
LINER
SEGMENT
(12 NECESSARY)
5
LINER
SEGMENT
(12 NECESSARY)
L-B9293 (0402)
PW V

Inner Combustion Chamber Liner Segment Removal
Figure 501
(Task 72−51−05−040−001)

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Task 72-51-05-440-001:

1. Assemble The Inner Combustion Chamber Assembly (Talon II Low Emission Burner)

R A. Equipment And Materials Necessary - None

B. Procedure
See Figure 1001.

R CAUTION: DO NOT USE ANY LUBRICATION ON THE THREADS.

(1) Install the liner segments to the rearmost inner combustion chamber location as follows.

R NOTE: Installation of the liner segments must begin at the rearmost combustion chamber location (large OD end) and continue forward.

R (a) Install the twelve liner segments (1001/5) to the combustion chamber and attach the segments to the chamber with one washer (1001/9), at the center stud location, and one nut (1001/8) for each liner segment installed.

R (b) Install washers (1001/7), with the washer dimple in the slot of the chamber wall, and nuts (1001/8) to the remaining studs of each of the liner segments.

R (c) Torque the liner segment nuts to 25 - 35 lb-in.
R (2.825 - 3.954 N.m).

(2) Install the liner segments to the 2nd rearmost inner combustion chamber location as follows.

R (a) Install the twelve liner segments (1001/4) to the combustion chamber and attach the segments to the chamber with one washer (1001/9), at the center stud location, and one nut (1001/8) for each liner segment installed.

R (b) Install washers (1001/7), with the washer dimple in the slot of the chamber wall, and nuts (1001/8) to the remaining studs of each of the liner segments.

R (c) Torque the liner segment nuts to 25 - 35 lb-in.
R (2.825 - 3.954 N.m).

(3) Install the liner segments to the 3rd rearmost inner combustion chamber location as follows.

R (a) Install the twelve liner segments (1001/3) to the combustion chamber and attach the segments to the chamber with one washer (1001/9), at the center stud location, and one nut (1001/8) for each liner segment installed.

R (b) Install washers (1001/7), with the washer dimple in the slot of the chamber wall, and nuts (1001/8) to the remaining studs of each of the liner segments.

R (c) Torque the liner segment nuts to 25 − 35 lb−in.
R (2.825 − 3.954 N.m).

(4) Install the liner segments to the 4th rearmost inner combustion chamber location as follows.

R (a) Install the twelve liner segments (1001/2) to the combustion chamber and attach the segments to the chamber with one washer (1001/9), at the center stud location, and one nut (1001/8) for each liner segment installed.

R (b) Install washers (1001/7), with the washer dimple in the slot of the chamber wall, and nuts (1001/8) to the remaining studs of each of the liner segments.

R (c) Torque the liner segment nuts to 25 − 35 lb−in.
R (2.825 − 3.954 N.m).

(5) Install the liner segments to the 5th rearmost inner combustion chamber location as follows.

R (a) Install the twelve liner segments (1001/1) to the combustion chamber and attach the segments to the chamber with one washer (1001/9), at the center stud location, and one nut (1001/8) for each liner segment installed.

R (b) Install washers (1001/7), with the washer dimple in the slot of the chamber wall, and nuts (1001/8) to the remaining studs of each of the liner segments.

R (c) Torque the liner segment nuts to 25 − 35 lb−in.
R (2.825 − 3.954 N.m).

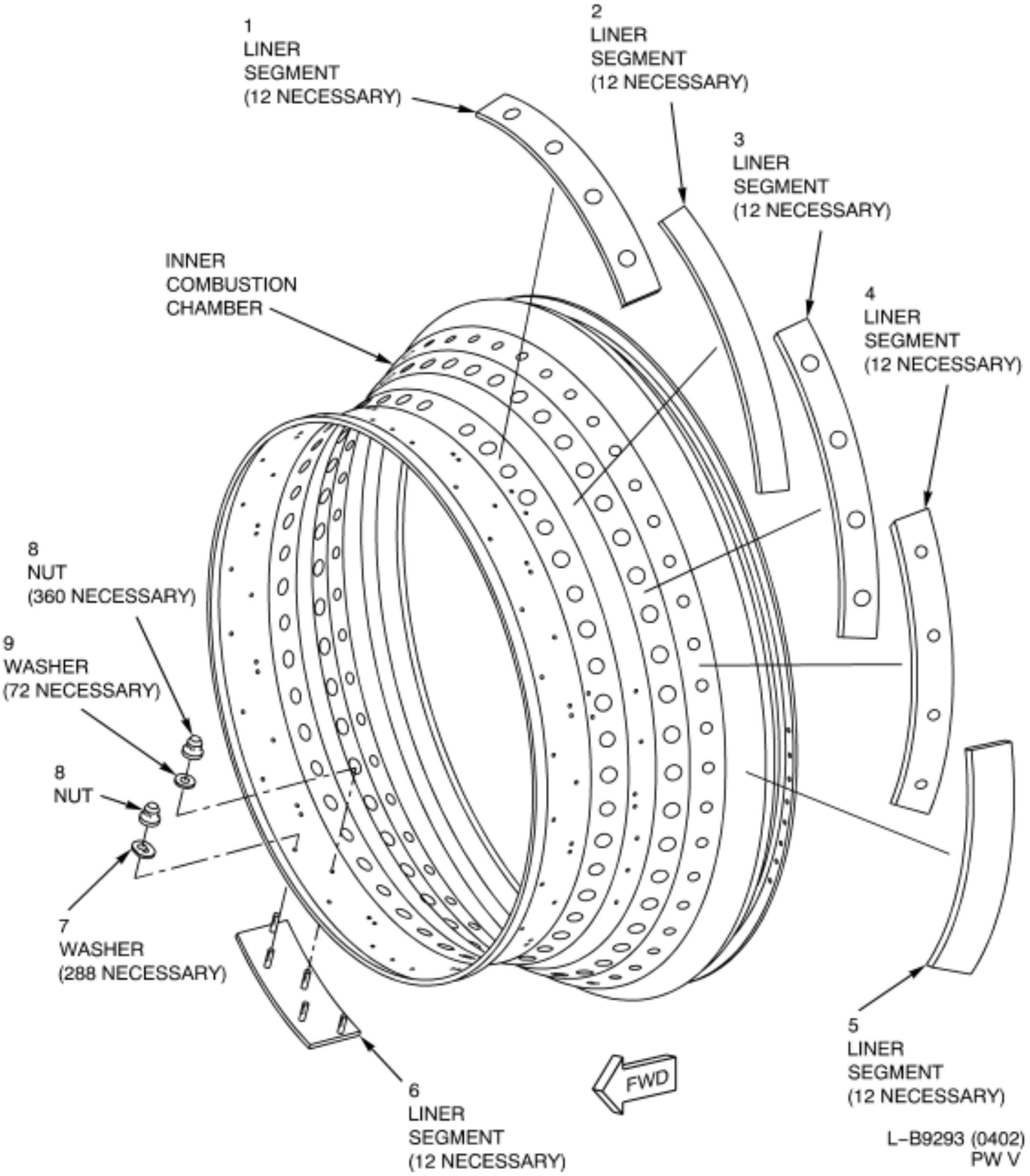
(6) Install the liner segments to the last remaining inner combustion chamber location (closest to the small OD) as follows.

R (a) Install the twelve liner segments (1001/6) to the combustion chamber and attach the segments to the chamber with one washer (1001/9), at the center stud location, and one nut (1001/8) for each liner segment installed.

R (b) Install washers (1001/7), with the washer dimple in the slot of the chamber wall, and nuts (1001/8) to the remaining studs of each of the liner segments.

R (c) Torque the liner segment nuts to 25 − 35 lb−in.
R (2.825 − 3.954 N.m).

INNER COMBUSTION CHAMBER ASSEMBLY − ASSEMBLY−01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LINER
SEGMENT
(12 NECESSARY)
2
LINER
SEGMENT
(12 NECESSARY)
3
LINER
SEGMENT
(12 NECESSARY)
INNER
COMBUSTION
CHAMBER
4
LINER
SEGMENT
(12 NECESSARY)
8
NUT
(360 NECESSARY)
9
WASHER
(72 NECESSARY)
8
NUT
7
WASHER
(288 NECESSARY)
5
LINER
SEGMENT
(12 NECESSARY)
FWD
6
LINER
SEGMENT
(12 NECESSARY)
L−B9293 (0402)
PW V

Inner Combustion Chamber Liner Segment Installation
Figure 1001
(Task 72−51−05−440−001)

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72−52−00	HIGH PRESSURE TURBINE (HPT) − CLEANING−04 • 72−52−00−100−004: Clean Stage 2 HPT Ring Segment And Vane Cluster Assembly − Deleted
72−52−00	HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−01 • 72−52−00−990−004: General Inspection Requirements − High Pressure Turbine (HPT)
72−52−00	HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−03 • 72−52−00−990−005: Visual Inspection − High Pressure Turbine (HPT)
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72−52−00	HIGH PRESSURE TURBINE (HPT) − ASSEMBLY−01 • 72−52−00−400−001: Assemble High Pressure Turbine
72−52−00	HIGH PRESSURE TURBINE (HPT) − STORAGE−01 • 72−52−00−530−001: Pack High Pressure Turbine • 72−52−00−540−001: Unpack High Pressure Turbine
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72−52−03	TURBINE CASE AND VANE ASSEMBLY − DISASSEMBLY−01 - 72−52−03−040−001: Disassemble Turbine Case And Vane Assembly
72−52−03	TURBINE CASE AND VANE ASSEMBLY − ASSEMBLY−01 - 72−52−03−440−001: Assemble Turbine Case And Vane Assembly
72−52−03	TURBINE CASE AND VANE ASSEMBLY − ASSEMBLY−02 - 72−52−03−440−002: Duct Segment Replacement − Turbine Case And Vane Assembly

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HIGH PRESSURE TURBINE (HPT) - HOW TO USE

Task 72-52-00-990-003:

1. Chapter/Section/Subject Numbering Outline

Figure 1.

NOTE: See the tab separated How To Use Manual section located at the beginning of this manual set for information concerning Data Location Guidelines and a complete Chapter/Section/Subject numbering outline for all manual sections.

A. The following is a complete listing of the individual Chapter/Section/Subject numbers and specific nomenclatures which have been assigned to the significant High Pressure Turbine (HPT) parts.

(1) Numbers which are not assigned are indicated in the list by one of the following terms:

UNASSIGNED - This designation is for numbers intentionally omitted and reserved for possible future use.

NOT USED - This designation is applied to numbers used in other related engine model programs which are not, at this time, applicable to the engine models represented by this manual.

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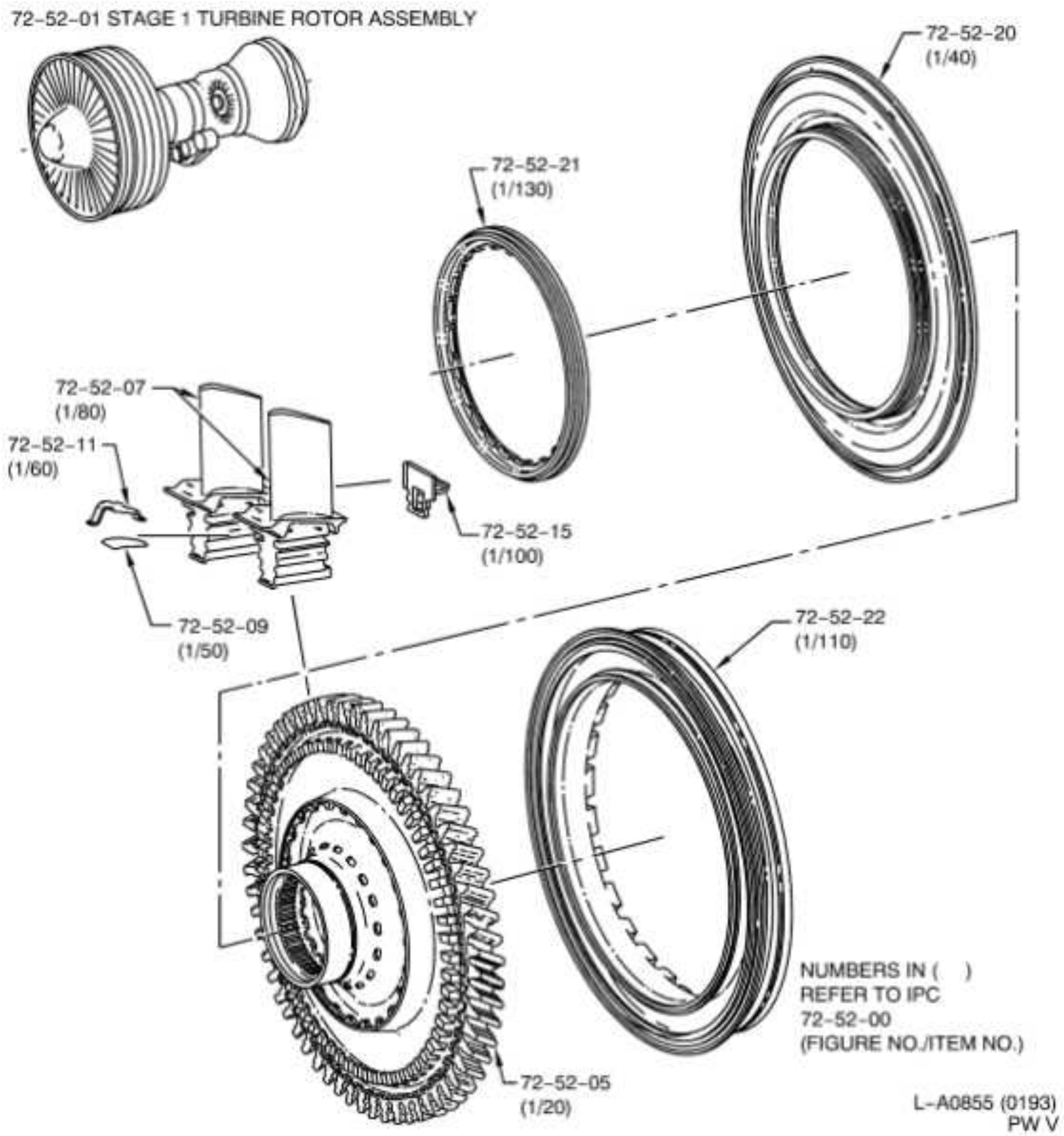
HIGH PRESSURE TURBINE (HPT) − HOW TO USE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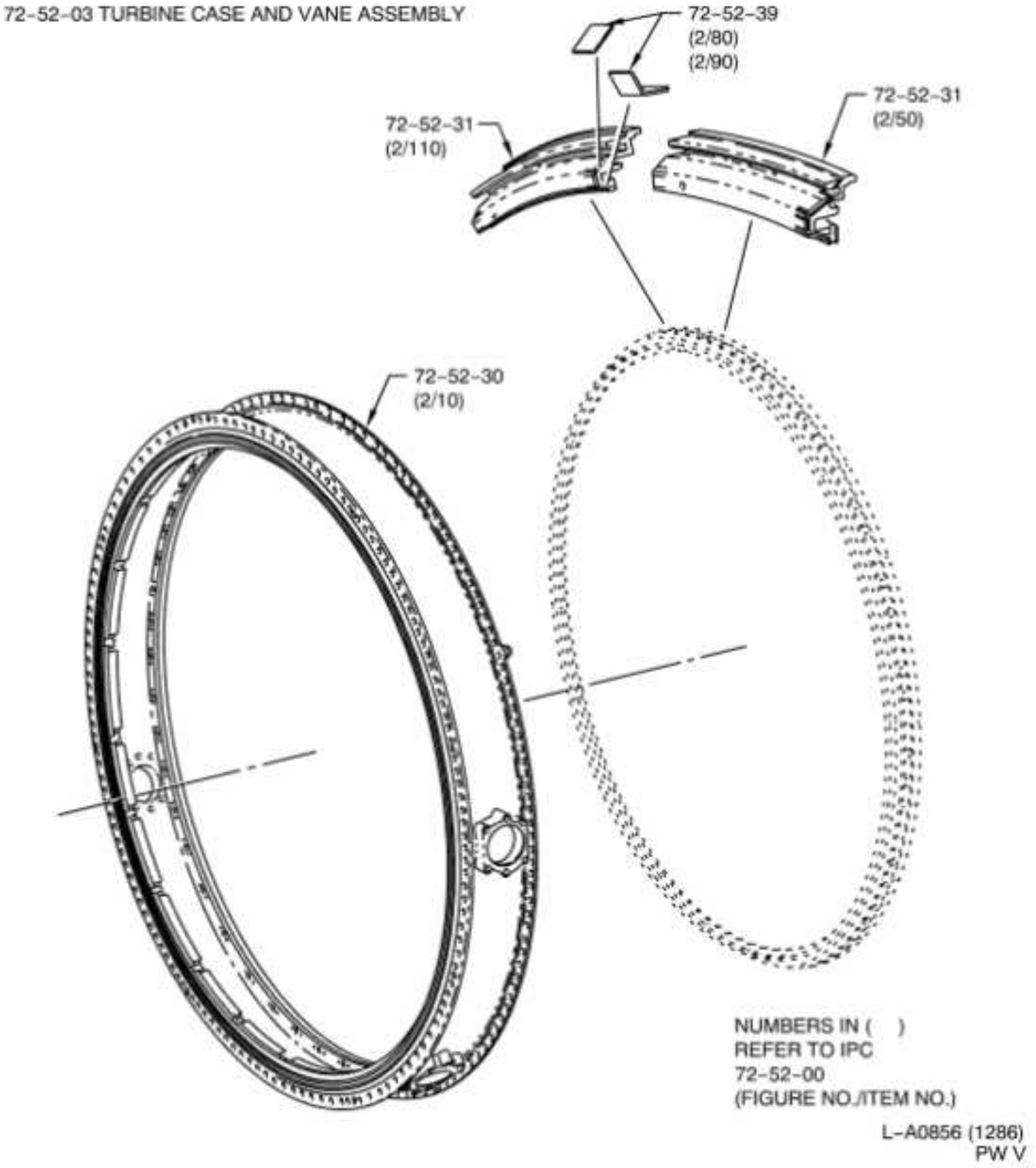
72-52-20
(1/40)
72-52-21
(1/130)
72-52-07
(1/80)
72-52-11
(1/60)
72-52-15
(1/100)
72-52-09
(1/50)
72-52-22
(1/110)
NUMBERS IN ( )
REFER TO IPC
72-52-00
(FIGURE NO./ITEM NO.)
72-52-05
(1/20)
L-A0855 (0193)
PW V

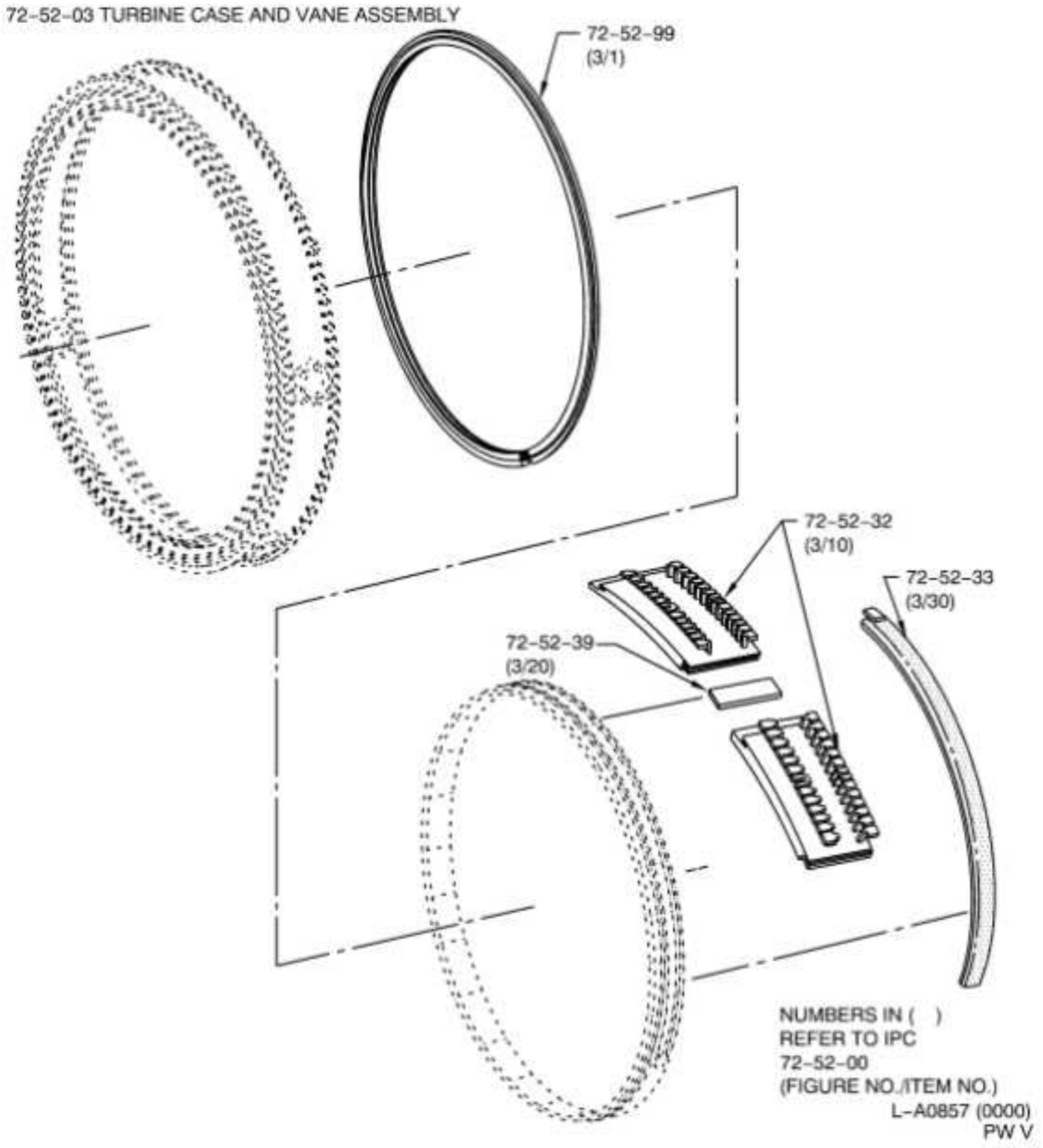
High Pressure Turbine (HPT)
Figure 1 (Sheet 1)
(Task 72−52−00−990−003)

HIGH PRESSURE TURBINE (HPT) − HOW TO USE


72-52-03 TURBINE CASE AND VANE ASSEMBLY
72-52-39
(2/80)
(2/90)
72-52-31
(2/110)
72-52-31
(2/50)
72-52-30
(2/10)
NUMBERS IN ( )
REFER TO IPC
72-52-00
(FIGURE NO./ITEM NO.)
L-A0856 (1286)
PW V

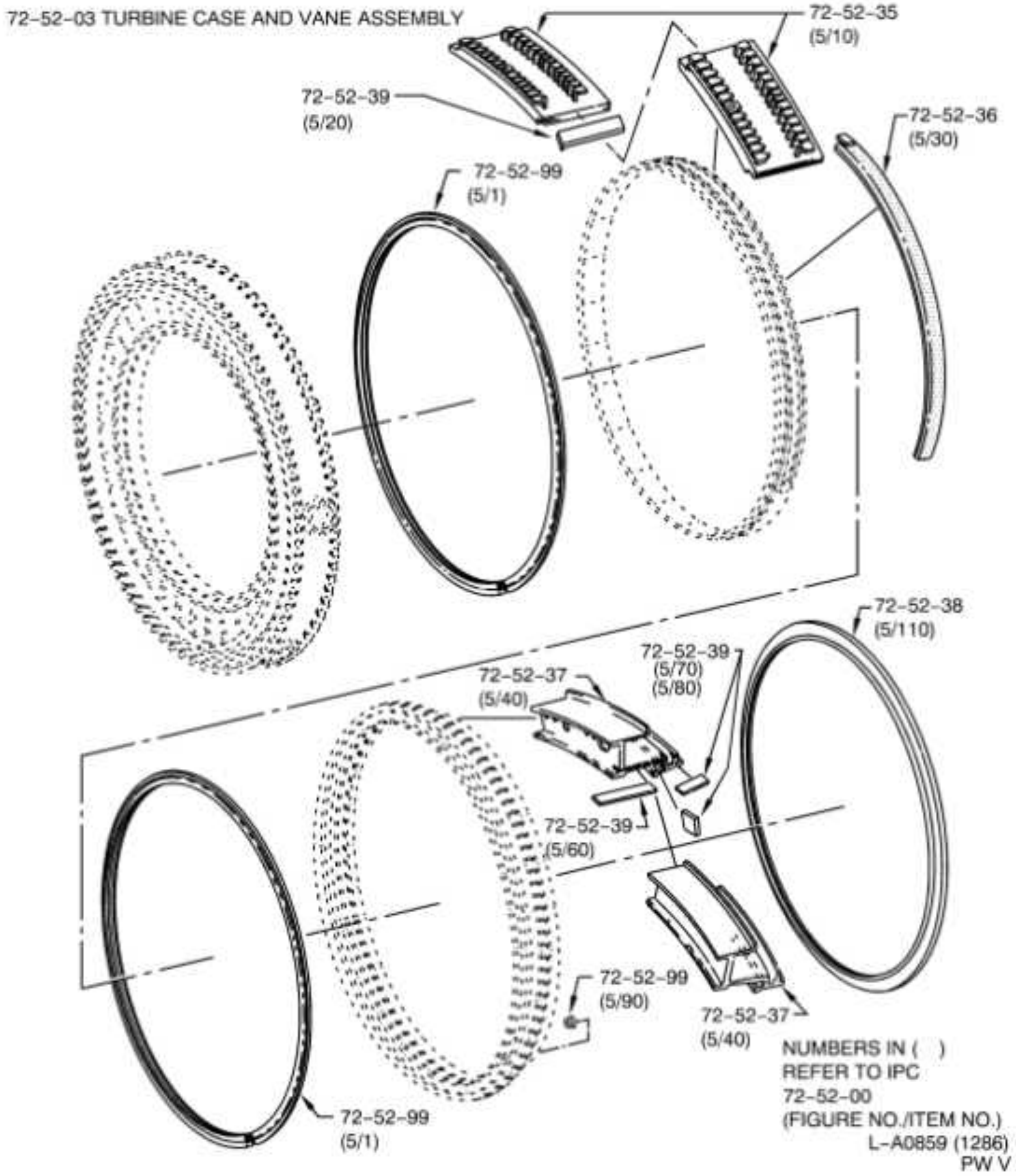
High Pressure Turbine (HPT)
Figure 1 (Sheet 2)
(Task 72−52−00−990−003)

HIGH PRESSURE TURBINE (HPT) - HOW TO USE


72-52-03 TURBINE CASE AND VANE ASSEMBLY
72-52-99
(3/1)
72-52-32
(3/10)
72-52-33
(3/30)
72-52-39
(3/20)
NUMBERS IN ( )
REFER TO IPC
72-52-00
(FIGURE NO./ITEM NO.)
L-A0857 (0000)
PW V

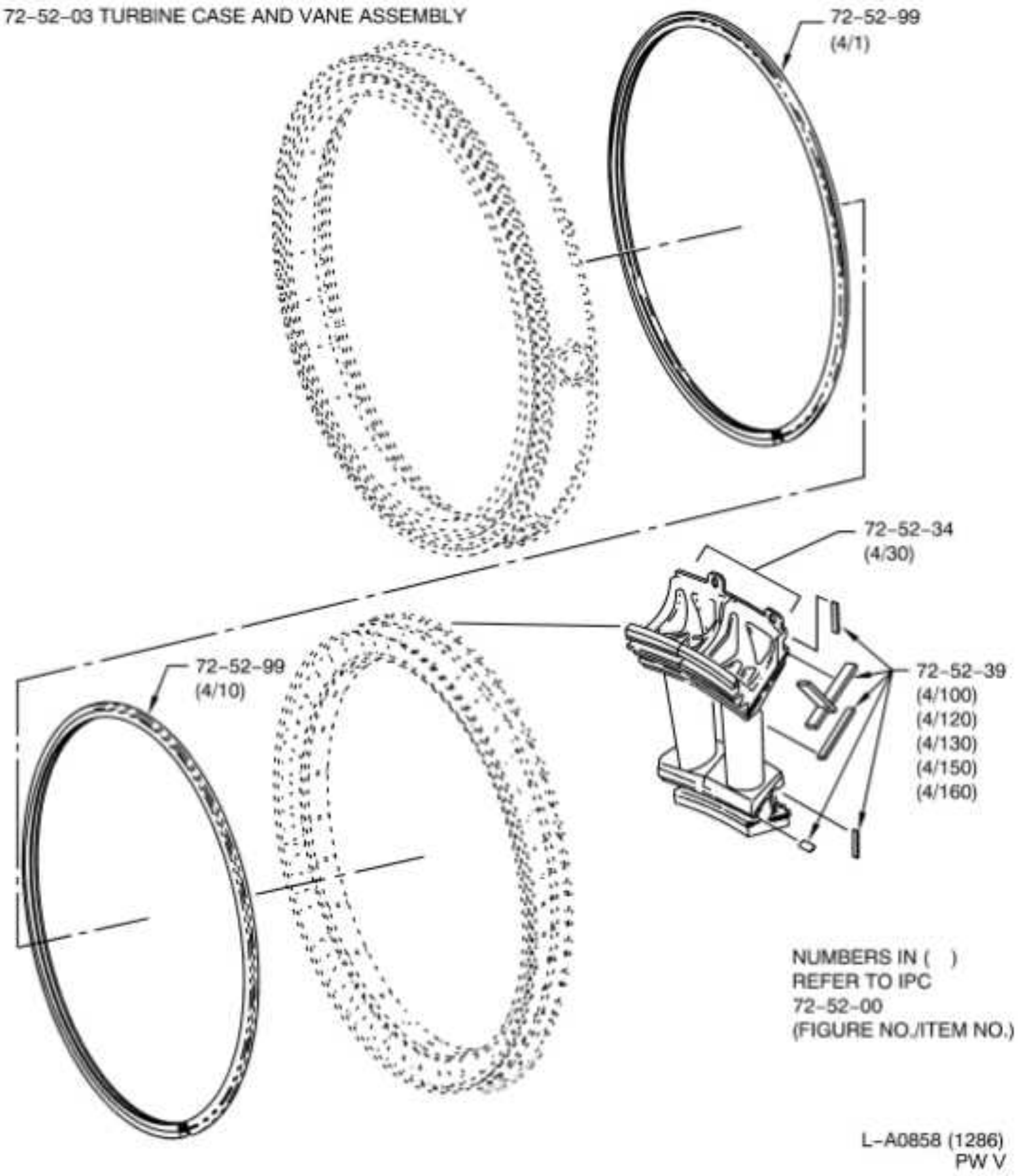
High Pressure Turbine (HPT)
Figure 1 (Sheet 3)
(Task 72-52-00-990-003)

HIGH PRESSURE TURBINE (HPT) − HOW TO USE


72-52-03 TURBINE CASE AND VANE ASSEMBLY
72-52-35
(5/10)
72-52-39
(5/20)
72-52-36
(5/30)
72-52-99
(5/1)
72-52-38
(5/110)
72-52-39
(5/70)
(5/80)
72-52-37
(5/40)
72-52-39
(5/60)
72-52-99
(5/90)
72-52-37
(5/40)
72-52-99
(5/1)
NUMBERS IN ( )
REFER TO IPC
72-52-00
(FIGURE NO./ITEM NO.)
L-A0859 (1286)
PW V

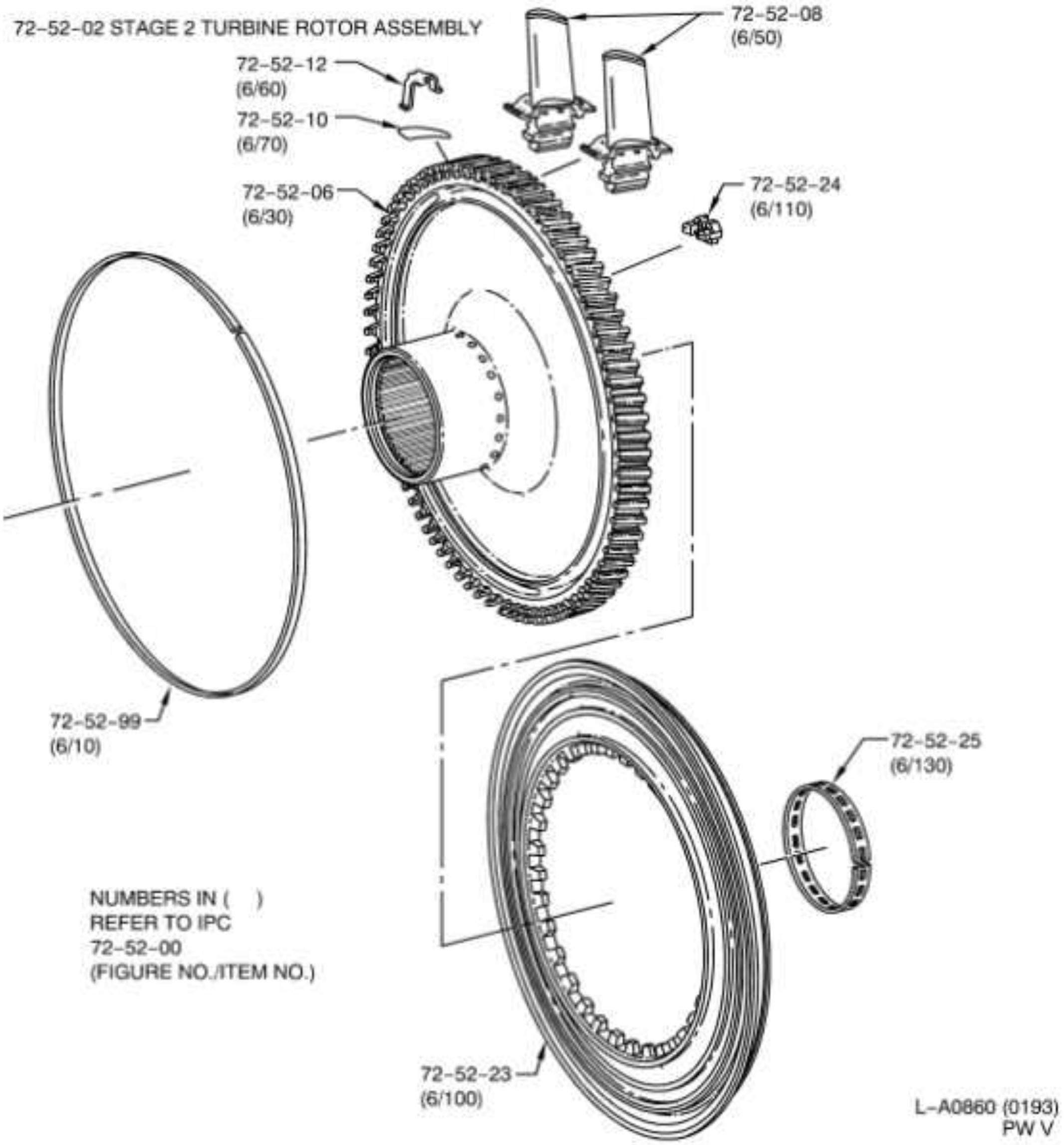
High Pressure Turbine (HPT)
Figure 1 (Sheet 4)
(Task 72−52−00−990−003)

HIGH PRESSURE TURBINE (HPT) − HOW TO USE


72−52−03 TURBINE CASE AND VANE ASSEMBLY
72−52−99
(4/1)
72−52−34
(4/30)
72−52−99
(4/10)
72−52−39
(4/100)
(4/120)
(4/130)
(4/150)
(4/160)
NUMBERS IN ( )
REFER TO IPC
72−52−00
(FIGURE NO./ITEM NO.)
L−A0858 (1286)
PW V

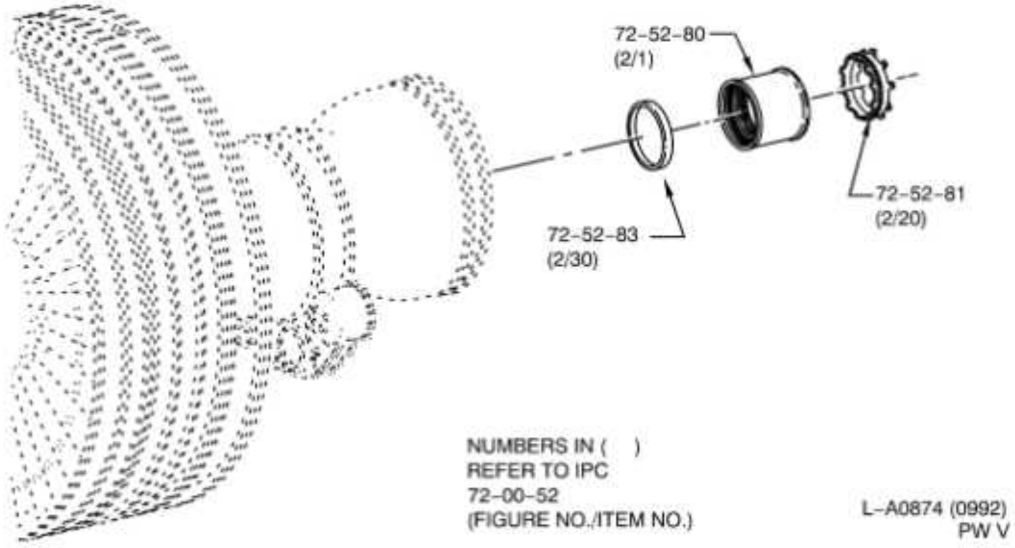
High Pressure Turbine (HPT)
Figure 1 (Sheet 5)
(Task 72−52−00−990−003)

HIGH PRESSURE TURBINE (HPT) − HOW TO USE


72-52-02 STAGE 2 TURBINE ROTOR ASSEMBLY
72-52-08
(6/50)
72-52-12
(6/60)
72-52-10
(6/70)
72-52-06
(6/30)
72-52-24
(6/110)
72-52-99
(6/10)
72-52-25
(6/130)
NUMBERS IN ( )
REFER TO IPC
72-52-00
(FIGURE NO./ITEM NO.)
72-52-23
(6/100)
L-A0860 (0193)
PW V

High Pressure Turbine (HPT)
Figure 1 (Sheet 6)
(Task 72−52−00−990−003)

]


72−52−80
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72−52−81
(2/20)
72−52−83
(2/30)
NUMBERS IN ( )
REFER TO IPC
72−00−52
(FIGURE NO./ITEM NO.)
L−A0874 (0992)
PW V

High Pressure Turbine (HPT)
Figure 1 (Sheet 7)
(Task 72−52−00−990−003)

Previous Pageblock Return to Previous Menu Next Pageblock

HIGH PRESSURE TURBINE (HPT) − DESCRIPTION AND OPERATION

Task 72−52−00−990−002:

1. High Pressure Turbine

A. General

See Figures 1 and 2.

(1) The high pressure turbine (HPT) provides the rotational driving force for the high pressure compressor (HPC). This is done by extracting some of the energy from the hot combustion gasses directed at the turbine rotors and transforming this energy into motional energy or work to drive the high pressure compressor. The high pressure turbine consists of 1st and 2nd stage turbine rotor assemblies, a case and vane assembly and an inner airseal. All of these items are housed within the turbine case. Both of the turbine rotors, 2nd stage vanes and inner airseal are air cooled, as well as the turbine case which employs an air operated automatic turbine rotor clearance control system.

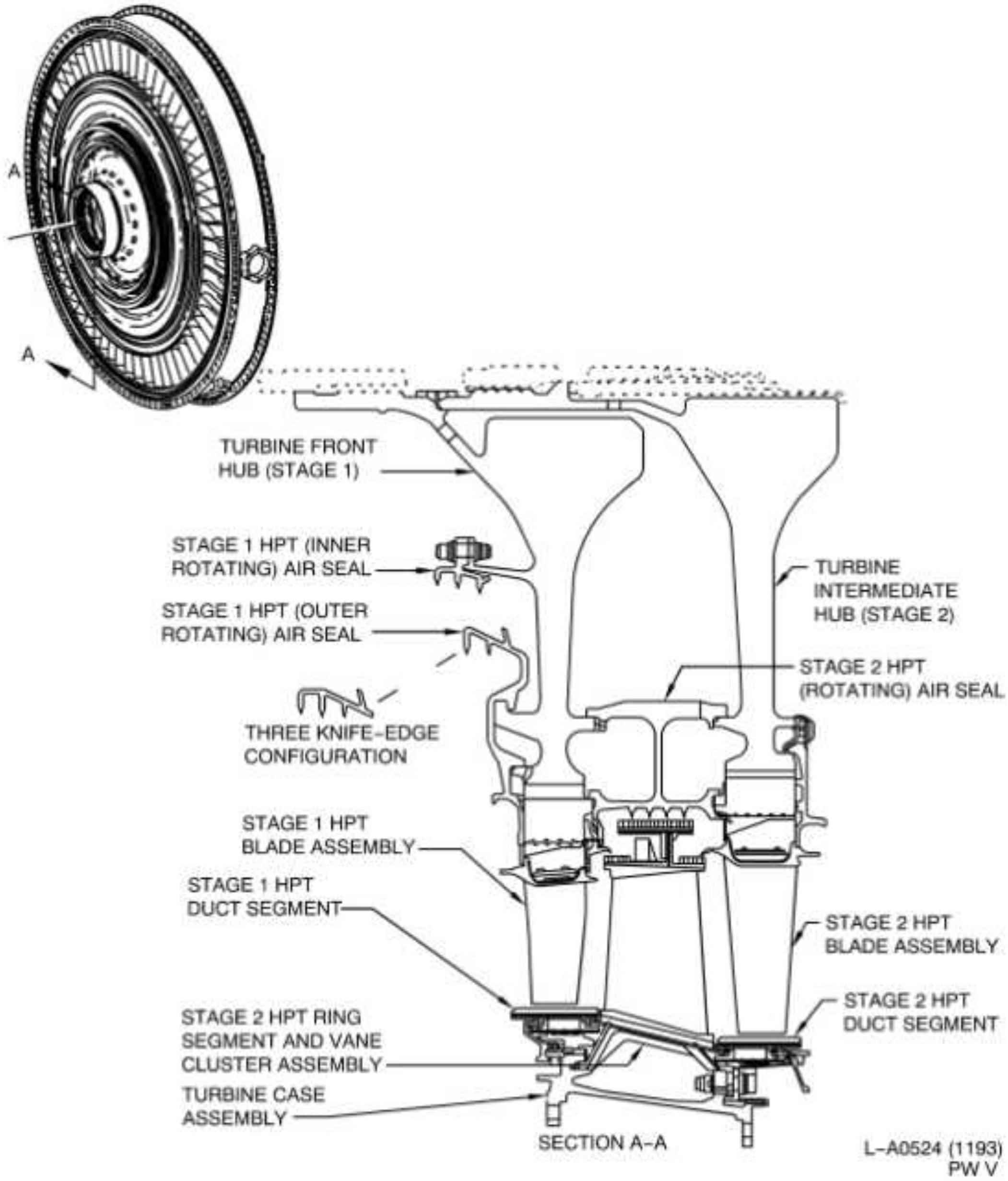
B. Stage 1 Turbine Rotor Assembly

(1) The 1st stage turbine rotor employs a nickel alloy hub and 60 single crystal material 1st stage turbine blades. Cooling air for the blades is metered by the cooling air duct in the turbine nozzle, through holes in the disk to the 1st stage rotor blades. Cooling air flows through blade passages for internal surface cooling and through a series of leading edge holes (showerhead holes) to provide film cooling for the airfoil external surfaces. See Figure 3 for typical blade internal cooling scheme.

(2) Blade tips are made of a hard material to lightly rub into the abradable ceramic, duct segments, (outer air seal) for efficient rotor sealing. Attached to the rotor hub on the forward side are two knife−edge seals, which mate with the 1st rotor cooling air duct seal lands, on the turbine nozzle group to seal the 1st stage blade cooling air supply. The Stage 2 HPT (rotating) airseal is attached to the rear of the turbine front hub. This rotating knife−edge seal is the 2nd stage vane inner gaspath seal and also functions as a spacer between the first and second rotors. The 1st stage rotor has an inner spline and mates directly to the rear compressor hub.

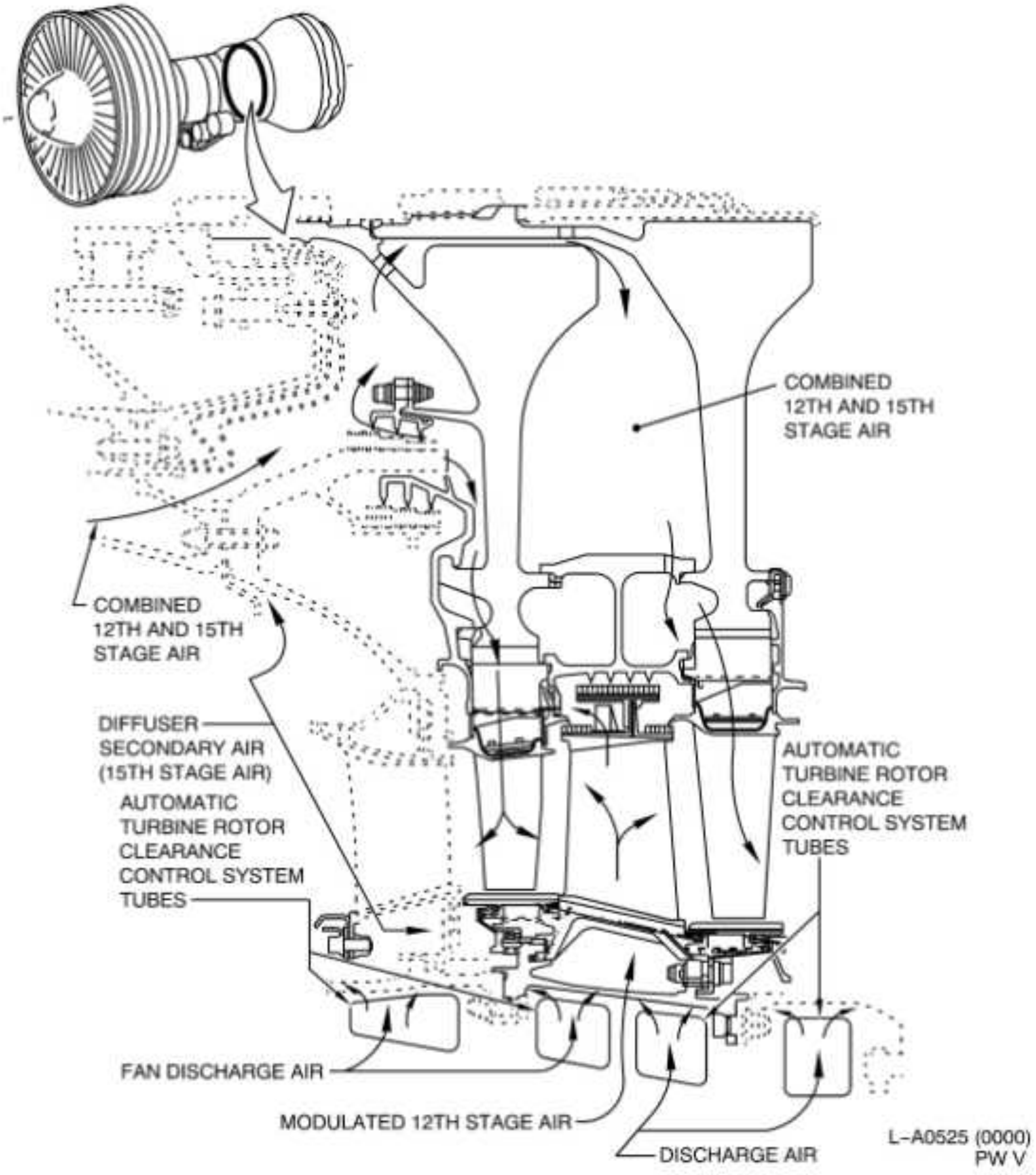
C. Turbine Case And Vane Assembly

HIGH PRESSURE TURBINE (HPT) − DESCRIPTION AND OPERATION


A
A
TURBINE FRONT HUB (STAGE 1)
STAGE 1 HPT (INNER ROTATING) AIR SEAL
STAGE 1 HPT (OUTER ROTATING) AIR SEAL
THREE KNIFE-EDGE CONFIGURATION
TURBINE INTERMEDIATE HUB (STAGE 2)
STAGE 2 HPT (ROTATING) AIR SEAL
STAGE 1 HPT BLADE ASSEMBLY
STAGE 1 HPT DUCT SEGMENT
STAGE 2 HPT BLADE ASSEMBLY
STAGE 2 HPT DUCT SEGMENT
STAGE 2 HPT RING SEGMENT AND VANE CLUSTER ASSEMBLY
TURBINE CASE ASSEMBLY
SECTION A-A
L-A0524 (1193)
PW V

High Pressure Turbine
Figure 1
(Task 72−52−00−990−002)

HIGH PRESSURE TURBINE (HPT) − DESCRIPTION AND OPERATION


COMBINED
12TH AND 15TH
STAGE AIR
COMBINED
12TH AND 15TH
STAGE AIR
DIFFUSER
SECONDARY AIR
(15TH STAGE AIR)
AUTOMATIC
TURBINE ROTOR
CLEARANCE
CONTROL SYSTEM
TUBES
AUTOMATIC
TURBINE ROTOR
CLEARANCE
CONTROL SYSTEM
TUBES
FAN DISCHARGE AIR
MODULATED 12TH STAGE AIR
DISCHARGE AIR
L−A0525 (0000)
PW V

High Pressure Turbine Cooling
(Typical)
Figure 2
(Task 72−52−00−990−002)

(1) The turbine case and vane assembly consists of the turbine case, 21 segments each of the 1st stage HPT duct segments, 2nd stage vane clusters and 2nd stage HPT duct segments. Extensive sealing, primarily feather seals are incorporated between the vane clusters, outer air seal supports, and duct segments to reduce leakage from the gaspath and cooling air passages. The 1st and 2nd stage HPT duct segments incorporate an abradable ceramic coating for efficient sealing. The 2nd stage vane cluster outer buttress is retained to the turbine case by a tongue and groove fit. The rear OD vane cluster buttress is bolted to the rear inner flange of the turbine case. Cooling air for the 2nd stage vanes comes from the 12th compressor stage through four externally routed tubes which mount to bosses on the turbine case. The airflow is modulated to reduce the cooling airflow at cruise conditions for improved performance. The segmented honeycomb Stage 2 HPT airseal inner land and rotor rimseal lands are mounted on the ID of each of the 2nd stage vane clusters, to seal the inner area of the vanes from gaspath leakage around the vanes. These seals are cooled with air that flows through the 2nd stage vanes and through nozzles mounted on the ID of the vanes. See Figure 4 for typical vane internal cooling scheme.

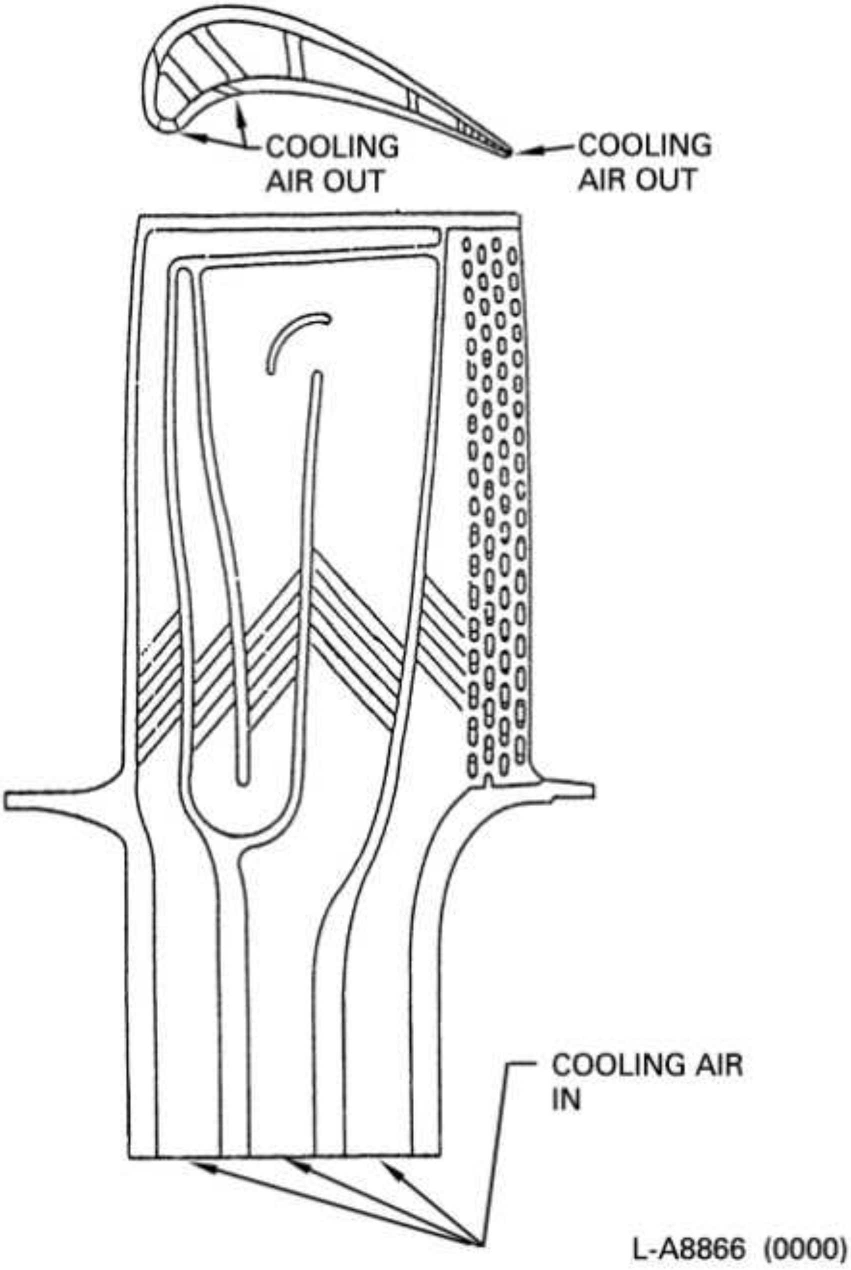
D. Stage 2 Turbine Rotor

(1) The 2nd stage turbine rotor uses a nickel alloy hub splined in tandem behind the turbine front hub (Stage 1) on the rear compressor hub. The second rotor has 82 directionally solidified shroudless turbine blades which are air cooled from a mixture of 12th stage compressor air and air from the diffuser case. Cooling air for the 2nd stage rotor blades is modulated to reduce flow at cruise conditions in order to improve performance. Cooling air flows through the blade internal cavity surfaces to cool the airfoil. Hardened blade tips (as on the 1st stage blades) are incorporated to abrade the ceramic outer airseal ducts for efficient tip sealing. A single rear side plate ring engages a segmented flange to retain the 2nd stage blades in the hub, the sideplate ring is then locked in place to prevent circumferential movement. See Figure 5 for typical blade internal cooling scheme.

E. Automatic Turbine Rotor Clearance Control System

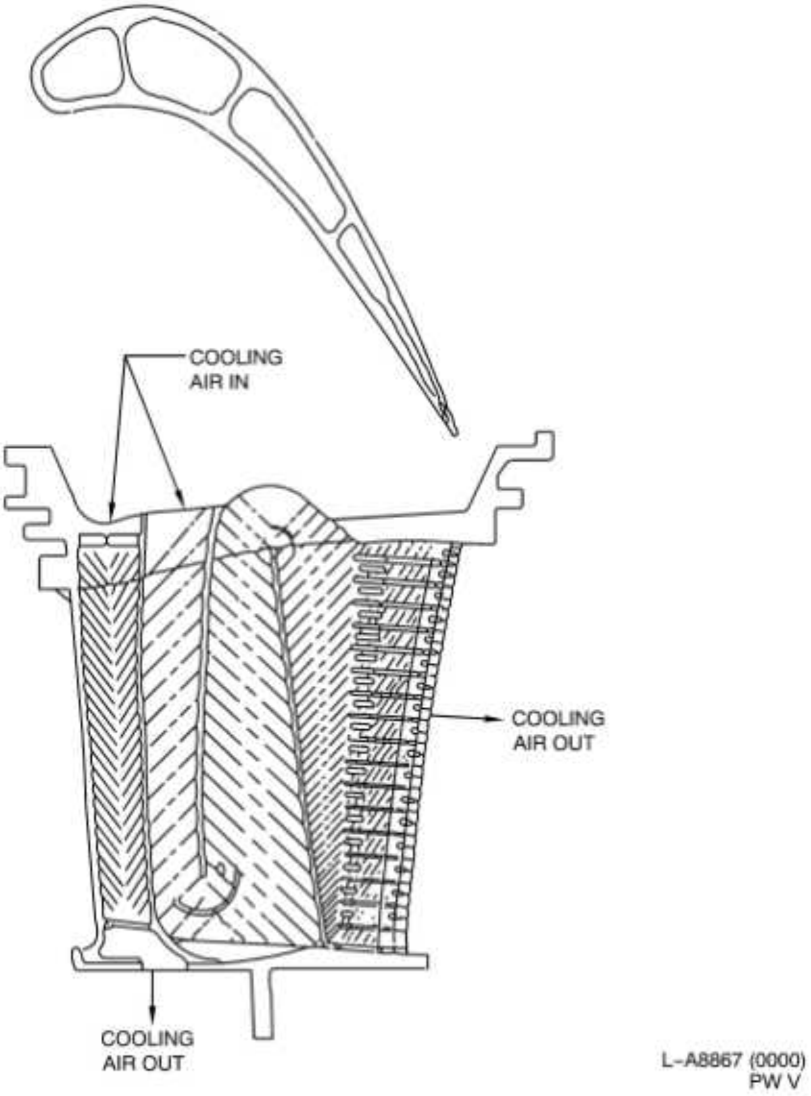
HIGH PRESSURE TURBINE (HPT) − DESCRIPTION AND OPERATION

(1) Automatic turbine rotor clearance control system tubes surround the external side of the turbine case and supply fan discharge air to cool the surface of the case during cruise power operation. This cooling results in shrinkage of the case, with decreased tip clearances between the blade tips and duct segments, resulting in an improved turbine efficiency.

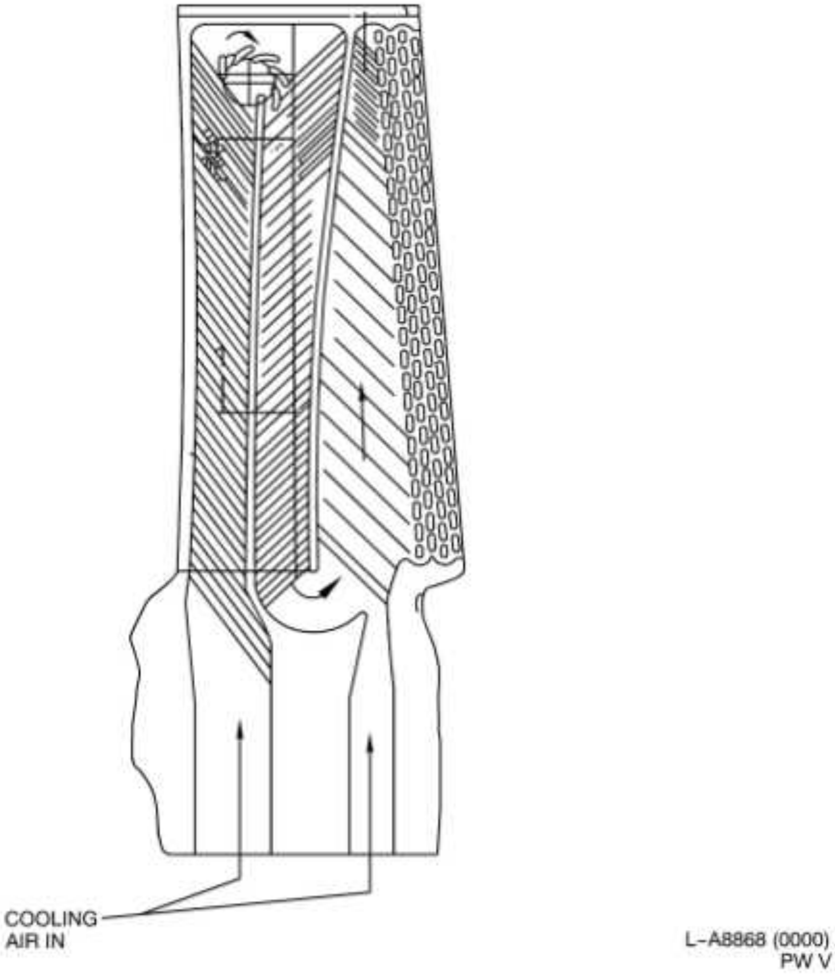

COOLING AIR OUT
COOLING AIR OUT
COOLING AIR IN
L-A8866 (0000)

First Stage HPT Blade Cooling Scheme
Figure 3
(Task 72-52-00-990-002)

HIGH PRESSURE TURBINE (HPT) − DESCRIPTION AND OPERATION


COOLING AIR IN
COOLING AIR OUT
COOLING AIR OUT
L-A8867 (0000)
PW V

Second Stage HPT Vane Cooling Scheme
Figure 4
(Task 72−52−00−990−002)


COOLING
AIR IN
L-A8868 (0000)
PW V

Second Stage HPT Blade Cooling Scheme
Figure 5
(Task 72−52−00−990−002)

Previous Pageblock   Return to Previous Menu   Next Pageblock

HIGH PRESSURE TURBINE (HPT) - DISASSEMBLY-01

Task 72-52-00-030-001:

1. Disassemble High Pressure Turbine

A. Equipment And Materials Required

Special Tools:

PWA 3755 Pump, Hydraulic (Optional to PWA 29389)
PWA 28657 Sling
PWA 29389 Pump, Hydraulic
PWA 75028 Gage
PWA 76154 Adapters (Two Required)
PWA 76156 Adapters (Two Required)
PWA 85086 Arm
PWA 85087 Eye, Lifting
PWA 85088 Fixture, Support (Optional to PWA 88719)
PWA 85107 Fixture, Build
PWA 85111 Fixture
PWA 85247 Bracket, Handling (Two Required)
PWA 85854 Fixture
PWA 87022 Stand, Support
PWA 87885 Cutter
PWA 88643 Sling (Optional to PWA 88673)
PWA 88673 Sling
PWA 88719 Stand

B. Procedure

Subtask 72-52-00-000-000:

(1) If necessary, remove nuts and screws that attach PWA 86058 Retainer to the rear flange of the turbine case. Remove the retainer.

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(2) Install PWA 85107 Fixture onto high pressure turbine. See Figure 501.

(a) If installed, remove rod and attached details, guide pilot, clamp and nuts from coupler. Remove nut and hydraulic cylinder. Remove plug.

(b) Remove 12 screws (501/11) securing plate (501/2) to piloting ring (501/8) of fixture. Remove retainer (501/10) and jaws (501/3).

(c) Loosen eight hand knobs (501/7) at center hub (501/9) of fixture and move piloting ring (501/8) rearward until it is flush with or above surface of center hub. Tighten eight hand knobs.

(d) Thread three .500−13 inch eyebolts into tapped holes in rear center hub of fixture. Attach standard three cable sling to eyebolts and position fixture onto rear of high pressure turbine.

(e) Secure outer flanges of fixture to high pressure turbine case using 26 detail screws (501/6) and spacers (501/5). Remove hoist and sling.

(f) Loosen eight hand knobs (501/7) at center hub and allow piloting ring (501/8) to slowly seat onto turbine rear hub. Tighten eight hand knobs to secure hub.

(g) Position four jaws (501/3) into center of fixture, locating lip of jaws in ID cutout of turbine hub. Lightly tighten screws (501/4) to secure jaws.

(h) Install retainer (501/10) into center of fixture to retain four jaws (501/4). Tighten four screw details of jaws.

(i) Install plate (501/2) to pilot ring (501/8) and secure with 12 screws (501/11).

(j) Thread the plug (501/1) into the plate (501/2).

(3) Using hoist, attach PWA 28657 Sling with two PWA 76156 Adapters to trunnion spools of fixture. Take up slack on sling cables.

(4) Using hoist, trunnion the high pressure turbine to rear end down position. Lower the assembly onto PWA 87022 Support Stand.

Subtask 72−52−00−030−052:

(5) Remove turbine hub lock. See Figure 502.

(a) Install spline (502/8) detail of PWA 85111 Fixture into ID of turbine intermediate hub (502/1).

(b) Align key (502/4) with keyway slot in spline and install flanged spline (502/5) into ID of turbine front hub (502/7).

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(c) Insert rod (502/2) through center of both spline details and thread into coupler (502/9) of PWA 85107 Fixture. Secure with nut (502/6).

(d) Connect PWA 75028 Gage and PWA 29389 Hydraulic Pump or PWA 3755 Hydraulic Pump to the hydraulic cylinder of PWA 85107 Fixture.

(e) Actuate the hydraulic pump and apply load of 18,000 lbf. (80,068 N) to seat turbine front and intermediate hubs.

NOTE: For a 30 ton hydraulic cylinder, a hydraulic pump output of 2,493 psig (17,188.6 kPa) will apply a load of 18,000 lbf. (80,068 N).

NOTE: For a 60 ton hydraulic cylinder, a hydraulic pump output of 1,358 psig (9,363.1 kPa) will apply a load of 18,000 lbf. (80,068 N).

(f) Using access holes in flange spline, carefully remove turbine hub lock (502/3).

(g) Disconnect the hydraulic pump from the hydraulic cylinder (502/11).

(h) Carefully remove the nut (502/6).

(i) Remove the rod (502/2) from the coupler (502/9).

(j) Remove the flanged spline (502/5), turbine hub lock (502/3), and spline (502/8).

(k) Remove the coupler (502/9) and the hydraulic cylinder (502/11).

(l) Remove the plug (502/10) from the plate at the bottom of the fixture.

HIGH PRESSURE TURBINE (HPT) − DISASSEMBLY−01

(6) FOR THESE MODELS: 4152, 4156A, 4158
Remove the 1st stage turbine rotor using PWA 85854 Fixture. See Figure 503.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove the engine bolts (503/3), washers (503/5), and nuts (503/6) that attach the 1st stage HPT airseal (503/1) to the turbine front hub (503/2). If you will not disassemble the rotor assembly, mark the class and the locations of the counterweights (503/4). Use Ink P05−026.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Install the knurled shaft (504/6) into the threaded hole in the center of PWA 85854 Fixture. See Figure 504.

(c) FOR THESE MODELS: 4152, 4156A, 4158
Use a hoist to align the boltholes and install the fixture on 1st stage HPT airseal (504/4).

(d) FOR THESE MODELS: 4152, 4156A, 4158
Attach the fixture to the airseal with 20 screws (504/1), washers (504/2), and nuts (504/3).

(e) FOR THESE MODELS: 4152, 4156A, 4158
Thread the hydraulic cylinder (504/8) into the plate (504/7). Connect the PWA 29389 Hydraulic Pump or PWA 3755 Hydraulic Pump to the hydraulic cylinder (504/8).

(f) FOR THESE MODELS: 4152, 4156A, 4158
Adjust the ram detail of PWA 85107 Fixture until it contacts the shaft (504/6).

(g) FOR THESE MODELS: 4152, 4156A, 4158
Operate the hydraulic pump to break the tight fit between the turbine hubs.

(h) FOR THESE MODELS: 4152, 4156A, 4158
Use a hoist to remove the rotor assembly. Remove shaft (504/6) from PWA 85854 Fixture. Put the rotor assembly on a pallet.

(i) FOR THESE MODELS: 4152, 4156A, 4158
Remove the screws (504/1), washers (504/2), and nuts (504/3) that attach the PWA 85854 Fixture to the turbine front hub. Remove the fixture from the hub.

(j) FOR THESE MODELS: 4152, 4156A, 4158
If you are not going to disassemble the rotor assembly, install the counterweights in their specified locations. Lubricate the engine bolts with Engine Oil P03−001. Install the airseal and counterweights with engine bolts, washers, and nuts. Tighten the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m). See Figure 503.

(7) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the 1st stage turbine rotor. See Figure 505.

(a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the twenty four (24) bolts (505/1) that attach the 1st stage HPT airseal (505/3), the HPT flange spacer (505/4) and the applicable number of counterweights (505/2) to the turbine front hub (505/5). If you will not disassemble the rotor assembly, mark the class and the locations of the counterweights (505/2). Use Ink P05−026.

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the inner airseal (505/3) and the flange spacer (505/4).

1 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the retaining ring of PWA 87390 Jackscrew Puller and move the puller jaws out.

2 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Position the puller on the turbine front hub (505/5).

3 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the puller locator plate in the hub.

4 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Move the puller jaws in and adjust the jackscrew until the puller lip of the jaws are behind the OD of the airseal.

5 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the puller ring over the jaws to keep the jaws in position.

6 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Turn the jackscrew and remove the airseal (505/3) and the spacer (505/4) from the hub.

HIGH PRESSURE TURBINE (HPT) − DISASSEMBLY−01

7 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Keep the airseal and the spacer in an applicable container to prevent damage.

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the knurled shaft (504/6) into the threaded hole in the center of PWA 85854 Fixture. See Figure 504.

(d) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Use a hoist to align the boltholes and install the fixture on turbine front hub (504/4).

(e) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Attach the fixture to the front turbine hub with twenty (20) screws (504/1). The washers (504/2) and nuts (504/3) are not needed for Phase III engines.

(f) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Thread the hydraulic cylinder (504/8) into the plate (504/7). Connect PWA 29389 Hydraulic Pump or PWA 3755 Hydraulic Pump to the hydraulic cylinder (504/8).

CAUTION: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(g) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Adjust the ram detail of PWA 85107 Fixture until it contacts the shaft (504/6).

(h) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Operate the hydraulic pump to break the tight fit between the turbine hubs.

(i) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Use a hoist to remove the 1st stage turbine rotor assembly. Remove the shaft (504/6) from PWA 85854 Fixture. Put the 1st stage turbine rotor assembly on a pallet.

(j) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the screws (504/1) that attach PWA 85854 Fixture to the turbine front hub. Remove the fixture from the hub.

(k) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
If you are not going to disassemble the rotor assembly, install the counterweights in their specified locations. Do not tighten the bolts. Keep the airseal and the flange spacer with rotor assembly.

Subtask 72−52−00−030−053:

(8) Remove turbine case and vane assembly.

(a) Position two PWA 85247 Brackets 180 degrees apart between front and rear flanges of turbine case. Position brackets with dowel pins protruding through boltholes in rear flange of case. Install seven screws through boltholes in front flange of turbine case and into brackets. Tighten screws to secure brackets.

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(b) Remove screws (501/6) and spacers (501/5) that secure the turbine case to PWA 85107 Fixture.

(c) Connect PWA 88643 or PWA 88673 Sling with two PWA 76154 Adapters to trunnion spools on PWA 85247 Brackets. Using hoist lift turbine case and trunnion to front end (smaller OD) down and place assembly on pallet. Remove hoist sling and brackets.

(9) Put a protective cardboard cover over the assembly to prevent damage to the vanes from unwanted materials. If necessary, you can use PWA 87885 Cutter to make the cardboard cover.

Subtask 72−52−00−030−054:

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(10) Remove the details of the PWA 85107 Fixture from the turbine intermediate hub (506/1). See Figure 506.

(a) Remove the hydraulic cylinder (506/4).

(b) Carefully remove the screws securing the plate (506/3) to the piloting ring (506/5). Remove the plate and the retainer (506/2) from the hub.

(c) Loosen the screws and remove the four jaws (506/6).

(11) Install PWA 85087 Eye onto the turbine intermediate hub (507/5). See Figure 507.

(a) Loosen the three locknuts (507/6). Turn the clamp assemblies (507/7) to align the pins so that they point toward the center of the lifting hub (507/4).

(b) Install the eye into the turbine hub. Turn the clamp assemblies into the turbine hub and align the pins so that they point toward the "LOCKED POSITION" marks on the hub (507/4). Hold the clamps in position and tighten the three locknuts (507/6) to hold the eye on the turbine hub.

(12) Remove the 2nd stage turbine rotor and put it on PWA 85088 Fixture or PWA 88719 Stand.

(a) Attach a hoist to PWA 85086 Arm. Remove the safety pin and knurled nut from the arm. Connect the arm to the PWA 85087 Eye and secure it with the knurled nut and safety pin.

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(b) Remove the 2nd stage turbine rotor assembly from PWA 85107 Fixture.

(c) Center the turbine intermediate hub and lower the rotor assembly onto the PWA 85088 Fixture or PWA 88719 Stand.

(d) Remove the hoist, arm, and eye.

HIGH PRESSURE TURBINE (HPT) − DISASSEMBLY−01

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(13) Using a hoist, attach the PWA 28657 Sling and two PWA 76156 Adapters, to the trunnion spools of the PWA 85107 Fixture. Using the hoist, remove the fixture from the stand. Remove the sling.

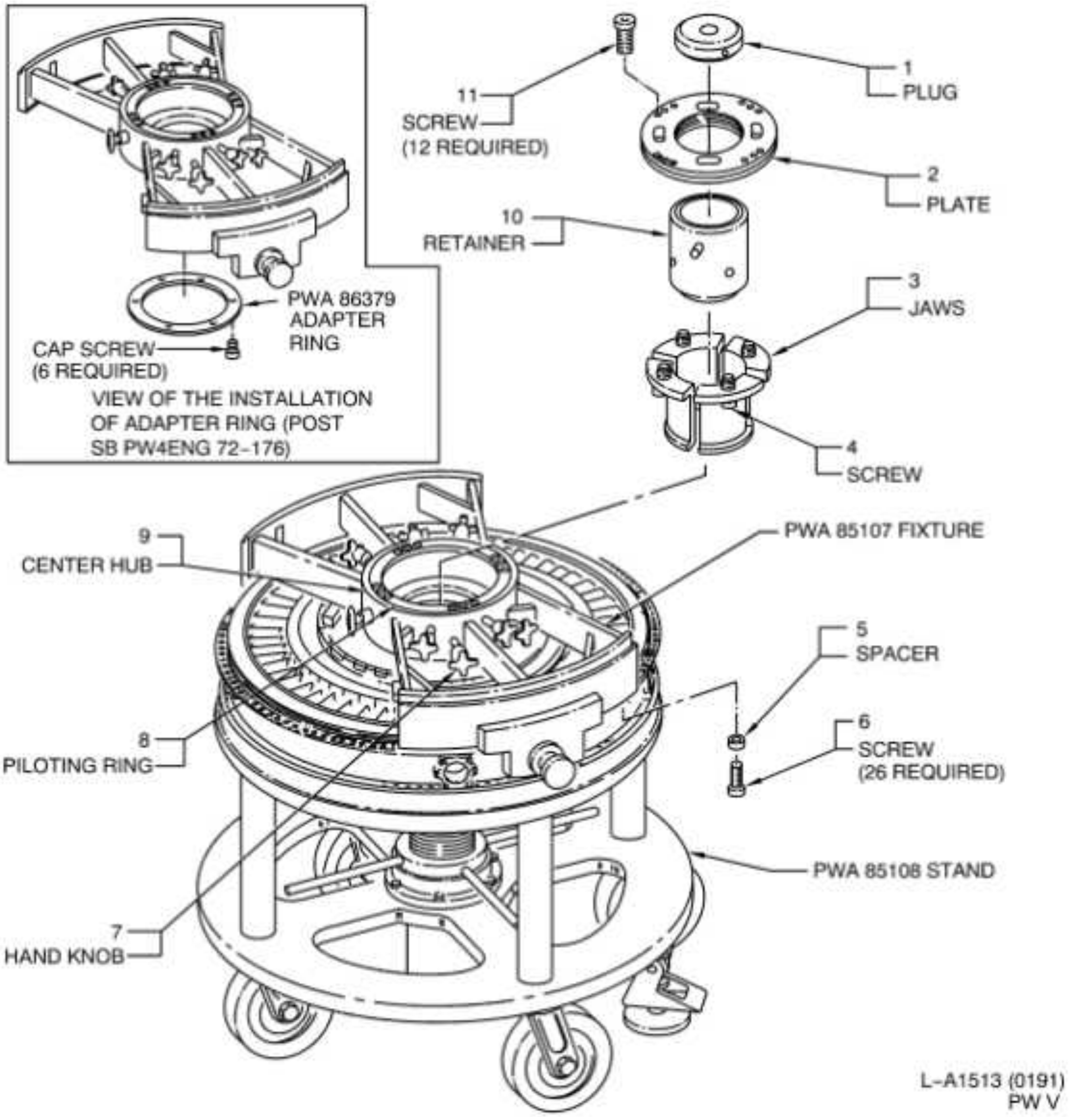
C. Postrequisites

(1) Disassemble 1st stage turbine rotor assembly per 72−52−01, Disassembly−01 Task 72−52−01−440−001.

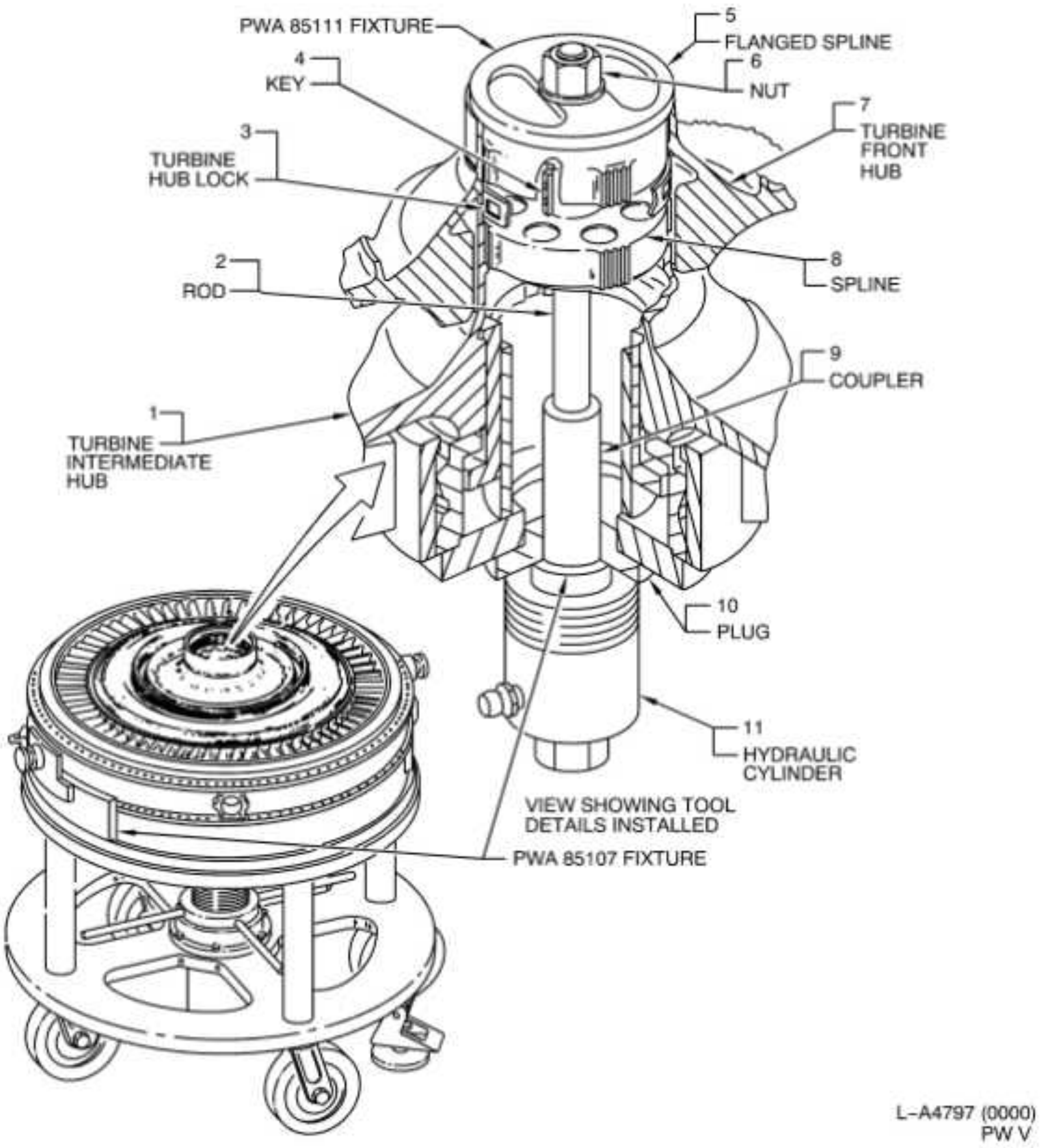
(2) Disassemble 2nd stage turbine rotor assembly per 72−52−02, Disassembly−01 Task 72−52−02−440−001.

(3) Disassemble turbine case and vane assembly per 72−52−03, Disassembly−01 Task 72−52−03−040−001.

HIGH PRESSURE TURBINE (HPT) − DISASSEMBLY−01

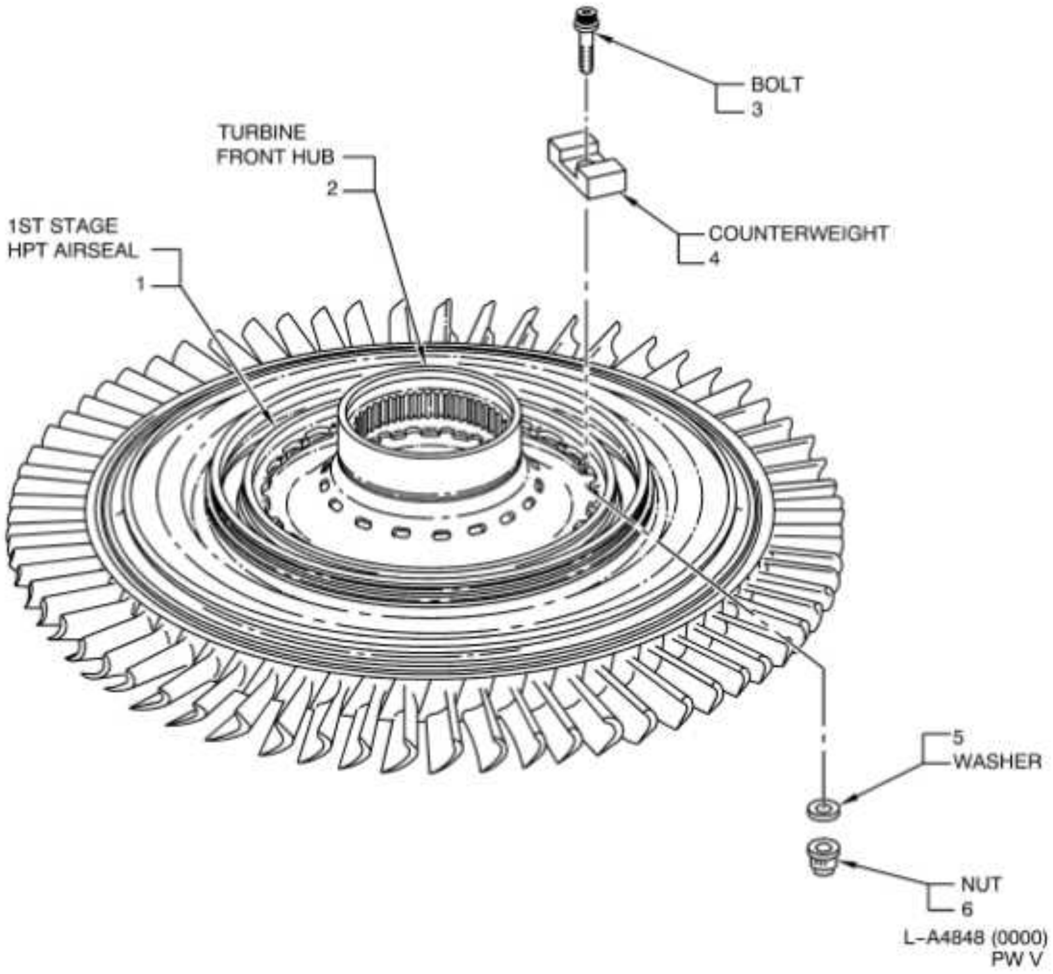

11
SCREW
(12 REQUIRED)
1
PLUG
2
PLATE
10
RETAINER
3
JAWS
4
SCREW
PWA 86379
ADAPTER
RING
CAP SCREW
(6 REQUIRED)
VIEW OF THE INSTALLATION
OF ADAPTER RING (POST
SB PW4ENG 72-176)
9
CENTER HUB
PWA 85107 FIXTURE
5
SPACER
6
SCREW
(26 REQUIRED)
8
PILOTING RING
PWA 85108 STAND
7
HAND KNOB
L-A1513 (0191)
PW V

Handling Fixture Installation
Figure 501
(Task 72−52−00−030−001)

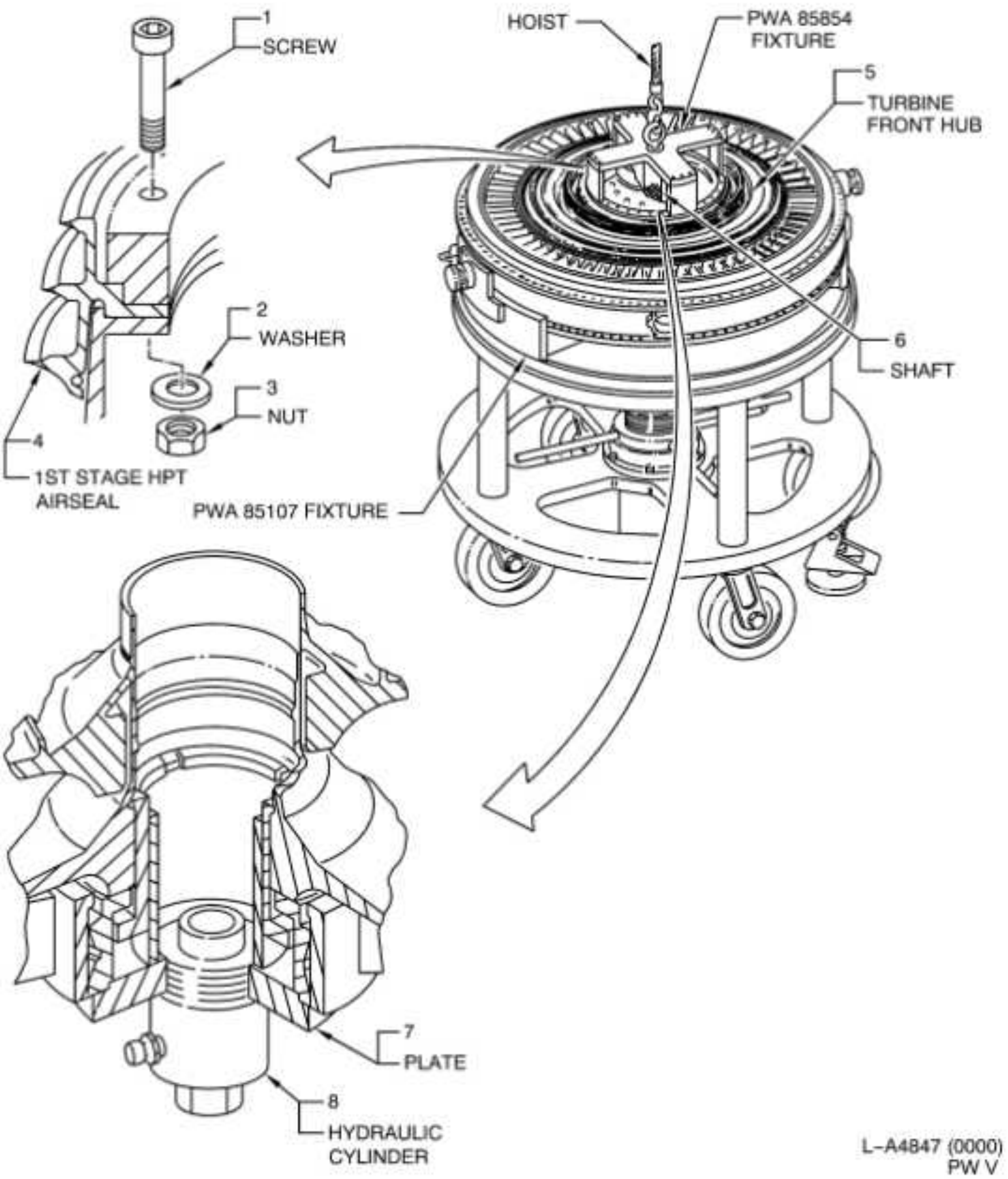

PWA 85111 FIXTURE
5
FLANGED SPLINE
6
NUT
4
KEY
7
TURBINE FRONT HUB
3
TURBINE HUB LOCK
8
SPLINE
2
ROD
9
COUPLER
1
TURBINE INTERMEDIATE HUB
10
PLUG
11
HYDRAULIC CYLINDER
VIEW SHOWING TOOL DETAILS INSTALLED
PWA 85107 FIXTURE
L−A4797 (0000)
PW V

Turbine Hub Lock Removal
Figure 502
(Task 72−52−00−030−001)

HIGH PRESSURE TURBINE (HPT) − DISASSEMBLY−01

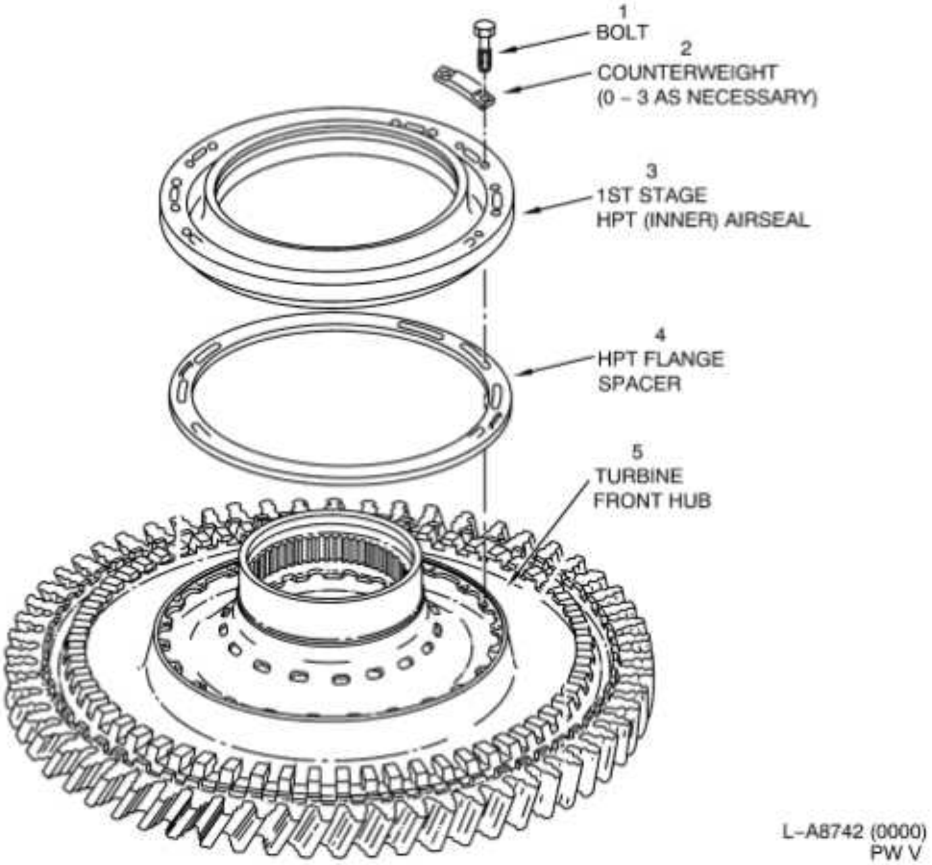

BOLT
3
TURBINE
FRONT HUB
2
1ST STAGE
HPT AIRSEAL
1
COUNTERWEIGHT
4
5
WASHER
NUT
6
L-A4848 (0000)
PW V

PWA 85854 Fixture Installation
Figure 503
(Task 72−52−00−030−001)


1
SCREW
HOIST
PWA 85854
FIXTURE
5
TURBINE
FRONT HUB
2
WASHER
3
NUT
6
SHAFT
4
1ST STAGE HPT
AIRSEAL
PWA 85107 FIXTURE
7
PLATE
8
HYDRAULIC
CYLINDER
L−A4847 (0000)
PW V

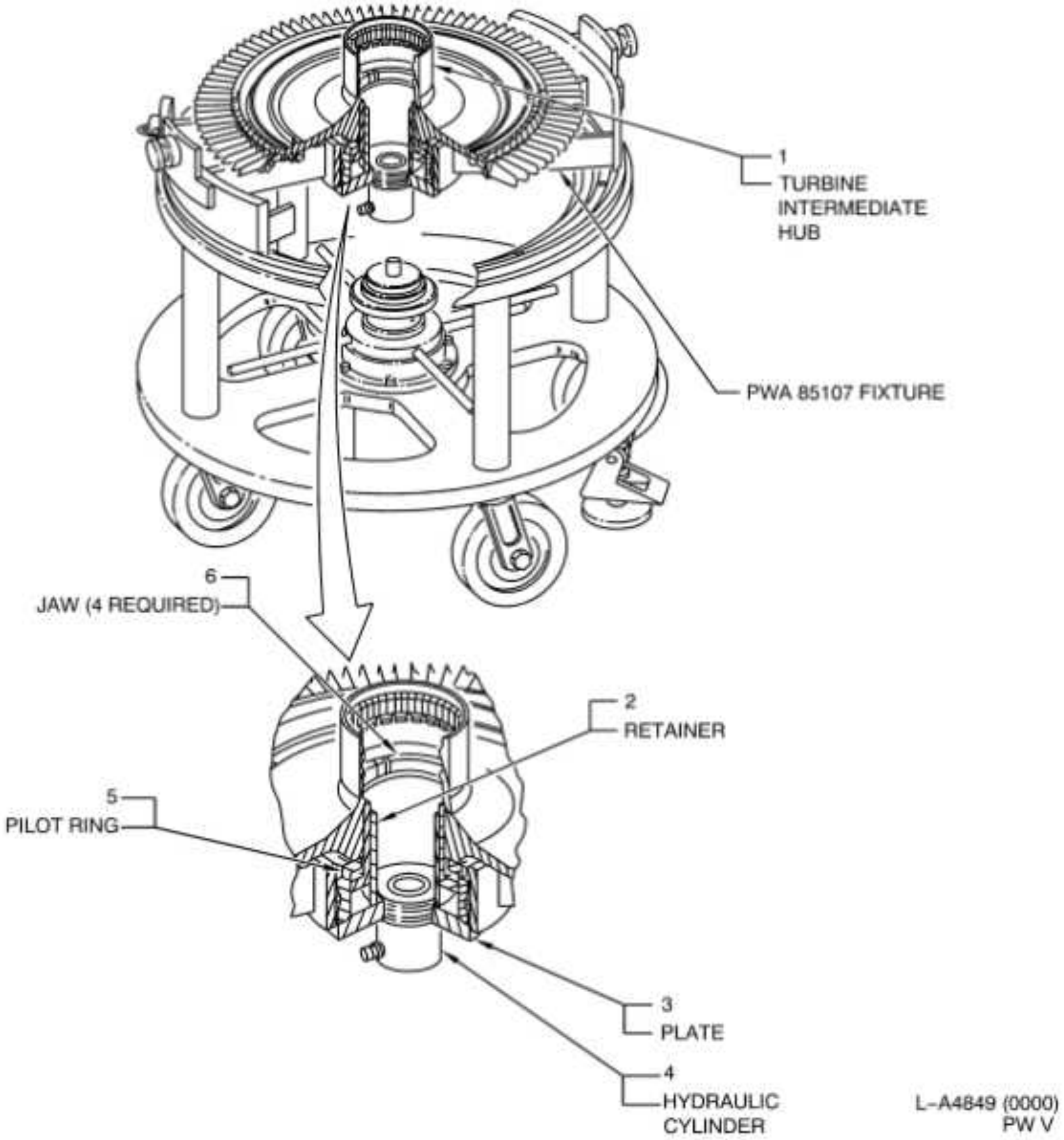
PWA 85854 Fixture Installation
Figure 504
(Task 72−52−00−030−001)

HIGH PRESSURE TURBINE (HPT) − DISASSEMBLY−01

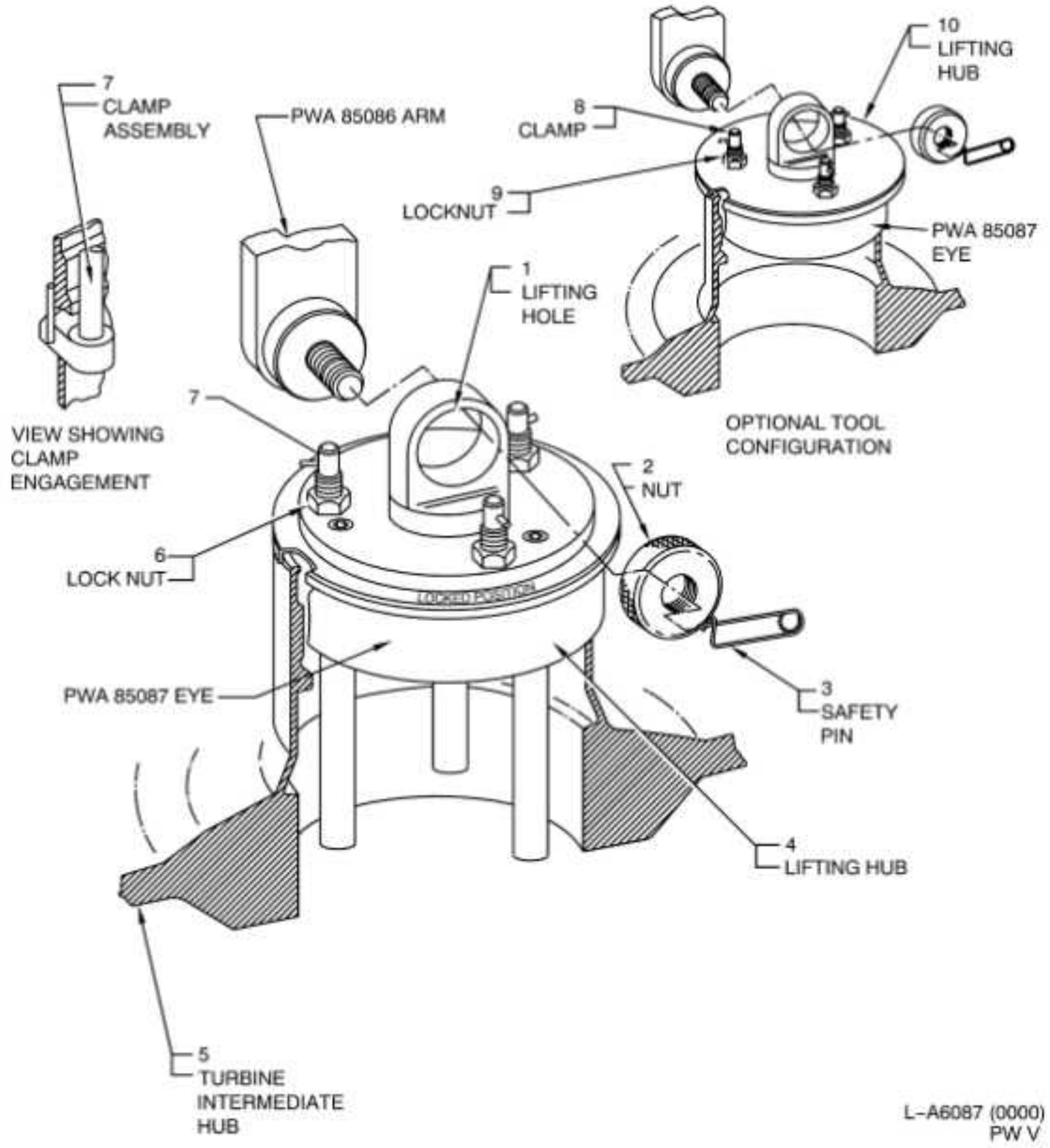

1
BOLT
2
COUNTERWEIGHT
(0 – 3 AS NECESSARY)
3
1ST STAGE
HPT (INNER) AIRSEAL
4
HPT FLANGE
SPACER
5
TURBINE
FRONT HUB
L−A8742 (0000)
PW V

First Stage HPT Airseal Removal
Figure 505
(Task 72−52−00−030−001)

HIGH PRESSURE TURBINE (HPT) − DISASSEMBLY−01


1
TURBINE
INTERMEDIATE
HUB
PWA 85107 FIXTURE
6
JAW (4 REQUIRED)
2
RETAINER
5
PILOT RING
3
PLATE
4
HYDRAULIC
CYLINDER
L−A4849 (0000)
PW V

High Pressure Turbine Disassembly
Figure 506
(Task 72−52−00−030−001)


7
CLAMP
ASSEMBLY
PWA 85086 ARM
8
CLAMP
10
LIFTING
HUB
9
LOCKNUT
PWA 85087
EYE
1
LIFTING
HOLE
VIEW SHOWING
CLAMP
ENGAGEMENT
7
OPTIONAL TOOL
CONFIGURATION
2
NUT
6
LOCK NUT
LOCKED POSITION
PWA 85087 EYE
3
SAFETY
PIN
4
LIFTING HUB
5
TURBINE
INTERMEDIATE
HUB
L−A6087 (0000)
PW V

Second Stage Turbine Rotor Removal
Figure 507
(Task 72−52−00−030−001)

HIGH PRESSURE TURBINE (HPT) - CLEANING-03

Task 72-52-00-100-003:

1. Clean Stage 2 HPT Blade Assembly - Deleted

   A. General

      (1) This cleaning procedure is deleted and moved to the 94 inch Cleaning, Inspection and Repair Manual, PN 51A357.

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HIGH PRESSURE TURBINE (HPT) - CLEANING-04

Task 72-52-00-100-004:

1. Clean Stage 2 HPT Ring Segment And Vane Cluster Assembly - Deleted

   A. General

      (1) This cleaning procedure is deleted and moved to the 94 inch Cleaning, Inspection and Repair Manual, PN 51A357.

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HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−01

Task 72−52−00−990−004:

1. General Inspection Requirements − High Pressure Turbine (HPT)

A. Organization Of Individual Part Or Subassembly Inspection Data

(1) Specific inspection functions for all significant parts/subassemblies are provided in individual Inspection/Check sections. Application of each inspection function is shown in Inspection/Check−00 for part/subassembly. Section designations and function descriptions are as follows.

(2) Inspection/Check−00 section contains, where applicable:

(a) Part number(s) for which the inspection data is applicable.

(b) Service Bulletin numbers applicable to part number(s).

(c) Inspection/Check numbers, data categories and applicability data.

(3) Inspection/Check−01, Preinspection Preparation, contains, where applicable:

(a) General inspection comments, notes, CAUTIONS, etc., which supplement data contained in this section.

(b) Identification of mechanical disassembly required prior to inspection.

(c) Identification of any surface treatment or coating removal, or other actions required prior to inspection.

(d) Identification of part/subassembly cleaning required prior to inspection.

(4) Inspection/Check−02, Nondestructive Inspection, contains the following nondestructive inspection methods, part/subassembly special attention areas and damage limits (as applicable):

(a) Fluorescent Penetrant Method

(b) Eddy Current Method

(c) Magnetic Particle Method

(d) X−ray Method

(e) Ultrasonic Method

(f) Hardness Check

(g) Other − As specified.

(5) Inspection/Check−03, Visual Inspection contains, where applicable:

(a) Visual inspection requirements which can be accomplished with or without magnification or special lighting (as specified).

NOTE: Use of inspection tools may be required as a supplement to visual inspection process.

(b) Allowable blending for visual damage, which may be accomplished within the inspection area.

NOTE: Blending requirement will also be shown in applicable repairs.

(6) Inspection/Check−04, Dimensional Inspection, contains, where applicable:

(a) Dimensional inspection requirements other than visual inspection. The requirements will include applicable fits and clearances, and other dimensional inspections necessary to ensure the part integrity and proper functioning.

(7) Inspection/Check−05, Functional Check Inspection contains, where applicable:

(a) Procedures, limits, and equipment used with any required functional checks (oil flow, air flow, leak, etc.).

(8) Inspection/Check−06, Inspection Postrequisites contains, references to procedures required to return part/subassembly to serviceable condition. References include the following, as required.

(a) Reassembly

(b) Protective coatings, sealants and/or lubricant reapplication

B. Thorough and intelligent part/subassembly inspection is of major importance in achieving efficient engine operation and satisfactory service life. Inspection personnel should be thoroughly familiar with inspection procedures, inspection tooling, limits associated with normal and, where applicable, unusual operating conditions, limits associated with repairs, and with inspection procedures published in Standard Practices Manual.

C. During preliminary inspection of part/subassembly, comparison with mating or adjacent parts may provide indication of source of wear or damage. This procedure may indicate requirement for additional disassembly and inspection.

D. During inspection, records should be kept of deviations beyond serviceable limits to determine: (a) if part/subassembly will be repaired or replaced, and (b) if part is reparable, which repairs are required. Suitable documentation should accompany part/subassembly with results of this determination.

E. Inspection of individual part/subassembly dimensions which are also in Fits and Clearances will include Fits and Clearance Reference Numbers and will show new part/subassembly dimension unless specifically stated otherwise. Inspection Frequency Requirements (IFR) codes (for IFR Code A parts only) are included with Reference Number data. If acceptable dimensional deviations or results of repair affect Fits and Clearances, suitable documentation should accompany part/subassembly to ensure check of fit or clearance at final assembly.

NOTE: Parts/subassemblies which deviate dimensionally from new part/subassembly values may be acceptable provided required fit or clearance is achieved at final assembly.

F. Dimensional inspection requirements will be accompanied by part/subassembly constraint data if such constraint requirements are required during part/subassembly manufacture. Adherence to constraint requirements when inspecting service operated parts/subassemblies should be dictated by experience. It is recommended that parts/subassemblies which do not meet dimensional inspection requirements in free state be constrained and re−measured prior to initiation of any repair or re−use activity.

G. Dimensional inspections of one detail of a subassembly, prior to removal from subassembly, may produce incorrect data due to constraint forces from mating details. If questionable data is obtained, subassembly should be disassembled and inspections repeated.

H. Dimensional inspection limits in inspection text provide continued use (as is) and, if applicable, repair limits. Parts/subassemblies which exceed both limits and nonreparable parts/subassemblies which exceed (as is) limits are unserviceable.

I. Inspections required to verify integrity of repair are contained within repair procedure. Unless otherwise stated, repaired part is expected to meet all inspection requirements contained in inspection text for part/subassembly.

J. Parts/subassemblies which do not require repairs except for those provided in Standard Practices Manual are identified by Chapter/Section/Subject Number 72−52−99 in cleaning table (Cleaning−01) and nondestructive inspection table (Inspection/Check−02). Determination of serviceability for those parts listed in 72−52−99 is limited to cleaning, non−destructive inspection, and the following:

   (1) Visually inspect parts/subassemblies for surface defects, deformations, cuts, improper threads or wrenching surfaces, incomplete or missing protective coatings or other damage which will prevent proper functioning and make part/subassembly unserviceable. Unserviceable parts/subassemblies should not be reinstalled. Repair unserviceable parts/subassemblies per Standard Practices Manual, as applicable.

   (2) Parts/subassemblies with crack indications to any length or depth detected by listed nondestructive inspection are unserviceable, and should not be reinstalled.

K. When new part/subassembly is to be installed and it is important that it be identified as to engine number or position in engine, mark it by appropriate method described in Marking of Parts, 70−11, Standard Practices Manual.

L. In order to eliminate confusion and to maintain consistent terminology, various physical conditions which might be encountered during inspection of parts/subassemblies and explanation of unusual causes of such conditions are defined in Physical Inspection, 70−31, Standard Practices Manual.

M. If inspection reveals it necessary to replace fitted spacer, tag spacer to indicate that replacement must be made with spacer of correct classification at assembly.

N. If text refers to superficial or shallow imperfection, following definitions apply:

    (1) A superficial imperfection is defined as a nick, dent, scratch, toolmark, etc., which disrupts the surface but does not appear to penetrate surface roughness texture.

    (2) A shallow imperfection appears to penetrate surface finish texture, but does not have a dark bottom and would not cause a 0.007 inch (.178 mm) radius stylus to hesitate if passed over it.

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HIGH PRESSURE TURBINE (HPT) - INSPECTION/CHECK-03

Task 72-52-00-990-005:

1. Visual Inspection - High Pressure Turbine (HPT)
    A. For inspection requirements applicable to installed (accessible) parts of high pressure turbine (HPT) see 72-00-52, Inspection/Check-XX (Task 72-00-52-220-XXX).
    B. Visually inspect the high pressure turbine for obvious surface defects and/or deformations which will preclude proper functioning of any of the parts. If defects are noted on any of the parts see the individual part section for damage limits.

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HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−04

Task 72−52−00−990−001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−04

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131)	(−)	0.512 (13.005)	=	.005 (0.126)
0.527 (13.385)	(−)	0.508 (12.903)	=	.019 (0.482)

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
810	B	HPC Drum Rotor Disk (Rear Hub) Assembly (72-35-08) Turbine Front Hub (Stage 1) (72-52-05) (See Figure 802)				
		HPC Hub	7.1455 (181.496)	7.1465 (181.521)		
		HPT Hub	7.1335 (181.191)	7.1355 (181.241)	.010T (0.254T)	.013T (0.330T)
811	B	Turbine Front Hub (Stage 1) (72-52-05) No. 3 Bearing Rear Cooling Duct Assembly (72-41-88) (See Figure 802)				
		Hub	7.988 (202.90)	7.998 (203.15)		
		Duct	8.098 (205.690)	8.102 (205.790)	.100 (2.54)	.114 (2.90)
812		Stage 1 HPT (Inner Rotating) Air Seal (72-52-21) Stage 1 HPT (Blade) Cooling Duct Assembly (72-51-03) (See Figure 802)				
		Radial Gap Cold -		Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357.		
813		Stage 1 HPT (Outer Rotating) Air Seal (72-52-20) Stage 1 HPT Blade Cooling Duct Assembly (72-51-03) (See Figure 802)				
		Radial Gap Cold -		Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357.		
814	B	HPC Drum Rotor Disk (Rear Hub) Assembly (72-35-08) Turbine Intermediate Hub (Stage 2) (72-52-06) (See Figure 802)				
		HPC Hub	6.5947 (167.506)	6.5957 (167.530)		
		HPT Hub	6.5827 (167.201)	6.5847 (167.251)	.007T* (0.178T)*	.013T (0.330T)

	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
815	B	Turbine Case Assembly (Prior To PN 50L542) (72−52−30)				
		Diffuser Case Assembly (72−41−01)				
		(See Figure 801, Sheet 1)				
		Turbine Case	38.833	38.845		
			(986.358)	(986.663)		
		Diffuser Case	38.827	38.833	.000	.018T
			(986.206)	(986.358)	(0.00)	(0.457T)
816	B	HPC Drum Rotor Disk (Rear Hub) Assembly				
		(72−35−08)				
		No. 3 Bearing (And HPT) Retaining Nut				
		(72−52−80)				
		(See Figure 802)				
		Hub	6.5947	6.5957		
			(167.506)	(167.530)		
		Nut	6.5967	6.5987	.001	.0052*
			(167.557)	(167.606)	(0.026)	(0.132)*
817	B	Turbine Case Assembly (72−52−30)				
		Rear Turbine (LPT) Case Assembly				
		(72−53−17)				
		(See Figure 801, Sheet 1)				
		Case	39.995	40.001		
			(1015.873)	(1016.025)		
		Rear Case	39.983	39.989	.006*	.025T*
			(1015.568)	(1015.721)	(0.152)*	(0.635T)*
844	B	HPC Drum Rotor Disk (Rear Hub) Assembly				
		(72−35−08)				
		Turbine Shaft Spacer (72−52−83)				
		(See Figure 802)				
		Disk (Hub)	6.5947	6.5957		
			(167.506)	(167.530)		
		Spacer	6.5967	6.5987	.001	.0052*
			(167.557)	(167.606)	(0.026)	(0.132)*
1710	B	Turbine Front Hub (Stage 1) (72−52−05)				
(1)		Turbine Intermediate (Rear) Hub (Stage 2) (72−52−06)				
		(See Figure 801, Sheet 1)				
		Stage 1 Hub	7.892	7.896		
		(PN 50L501	(200.457)	(200.558)		
		51L201, 51L601)				
		(Pre SB PW4ENG 72−451)				
		Stage 2 Hub	7.887	7.891	.001	.009
		(PN 50L602,	(200.330)	(200.431)	(0.025)	(0.229)

	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
(CONTINUED)						
		50L902)				
		(Pre SB PW4ENG 72-435)				
1710	B	Turbine Front Hub (Stage 1) (72-52-05)				
(2)		Turbine Intermediate (Rear) Hub (Stage 2) (72-52-06)				
		(See Figure 801, Sheet 1)				
		Stage 1 Hub	7.892	7.896		
		(PN 50L501	(200.457)	(200.558)		
		51L201,				
		51L601)				
		(Pre SB PW4ENG 72-451)				
		Stage 2 Hub	7.893	7.895	.003T	.003L
		(PN 52L002,	(200.483)	(200.533)	(0.0762T)	(0.0762L)
		52L602-001)				
		(Post SB PW4ENG 72-435)				
1710	B	Turbine Front Hub (Stage 1) (72-52-05)				
(3)		Turbine Intermediate (Rear) Hub (Stage 2) (72-52-06)				
		(See Figure 801, Sheet 1)				
		Stage 1 Hub	7.885	7.887		
		(PN 52L401,	(200.279)	(200.329)		
		(Post SB PW4ENG 72-451)				
		Stage 2 Hub	7.893	7.895	.006T	.010T
		(PN 52L002,	(200.483)	(200.533)	(0.153T)	(0.254T)
		50L602-001)				
		(Post SB PW4ENG 72-435)				
1710	B	Turbine Front Hub (Stage 1) (72-52-05)				
(4)		Turbine Intermediate (Rear) Hub (Stage 2) (72-52-06)				
		(See Figure 801, Sheet 1)				
		Stage 1 Hub	7.885	7.887		
		(PN 52L301)	(200.279)	(200.329)		
		(Post SB PW4ENG 72-451)				
		(Post SB PW4ENG 72-572)				
		Stage 2 Hub	7.893	7.895	.006T	.010T
		(PN	(200.483)	(200.533)	(0.153T)	(0.254T)
		50L602-022,				
		52L002-021,				
		52L802,				
		53L602,				
		50L602-024,				
		50L602-025)				
		(Post SB PW4ENG 72-435)				
		(Post SB PW4ENG 72-572)				

HIGH PRESSURE TURBINE (HPT) - INSPECTION/CHECK-04

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1710 (5)	B	Turbine Front Hub (Stage 1) (72-52-05) Turbine Intermediate (Rear) Hub (Stage 2) (72-52-06) (See Figure 801, Sheet 1)				
		Stage 1 Hub (PN 51L201-021) (Pre SB PW4ENG 72-451) (Post SB PW4ENG 72-572)	7.892 (200.457)	7.896 (200.558)		
		Stage 2 Hub (PN 50L602-021, 50L902-021, 50L602-023, 50L602-026, 50L902-022, 50L902-023) (Pre SB PW4ENG 72-435) (Post SB PW4ENG 72-572)	7.887 (200.330)	7.891 (200.431)	.001 (0.025)	.009 (0.229)
1710 (6)	B	Turbine Front Hub (Stage 1) (72-52-05) Turbine Intermediate (Rear) Hub (Stage 2) (72-52-06) (See Figure 801, Sheet 1)				
		Stage 1 Hub (PN 51L201-021) (Pre SB PW4ENG 72-451) (Post SB PW4ENG 72-572)	7.892 (200.457)	7.896 (200.558)		
		Stage 2 Hub (PN 50L602-022, 52L002-021, 52L802, 53L602, 50L602-024, 50L602-025) (Post SB PW4ENG 72-435) (Post SB PW4ENG 72-572)	7.893 (200.483)	7.895 (200.533)	.003T (0.0762T)	.003L (0.0762L)
1711 (1)	A	Stage 1 HPT (Inner Rotating) Airseal (72-52-21) Turbine Front Hub (Stage 1) (72-52-05) (See Figure 801, Sheet 2)				
		Airseal (PN 50L014)	15.062 (382.575)	15.068 382.727)		
		Hub	15.058 (382.474)	15.062 (382.574)	.010T (0.254T)	.000 (0.000)

HIGH PRESSURE TURBINE (HPT) - INSPECTION/CHECK-04

	Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
	1711 (2)	A	Stage 1 HPT (Inner Rotating) Airseal (72-52-21) Turbine Front Hub (Stage 1) (72-52-05) (See Figure 801, Sheet 2)				
			Airseal (PN 50L193, 50L659)	15.067 (382.702)	15.073 382.854)		
			Hub	15.058 (382.474)	15.062 (382.574)	.015T (0.38T)	.005T (0.13T)
	1712	A	Stage 1 HPT (Outer Rotating) Airseal (72-52-20) Turbine Front Hub (Stage 1) (72-52-05) (See Figure 801, Sheet 4)				
			Airseal	21.282 (540.563)	21.286 (540.664)		
R R			Hub	21.278 (540.462)	21.282 (540.562)	.008T (0.203T)	.001* (0.025)*
	1713	A	Stage 2 HPT (Rotating) Airseal (72-52-22) Turbine Front Hub (Stage 1) (72-52-05) (See Figure 801, Sheet 4)				
			Airseal	22.066 (560.477)	22.070 (560.578)		
			Hub	22.050 (560.070)	22.054 (560.171)	.020T (0.508T)	.007T* (0.178T)*
	1714	A	Stage 2 HPT (Rotating) Airseal (72-52-22) Turbine Front Hub (Stage 1) (72-52-05) (See Figure 801, Sheet 4)				
			Airseal	25.766 (654.456)	25.774 (654.660)		
			Hub	25.776 (654.710)	25.784 (654.914)	.002 (0.05)	0.021* (0.53)*
	1715 (1)	A	Stage 1 HPT (Outer Rotating) Airseal (72-52-20) PN 50L011, 50L248 Turbine Front Hub (Stage 1) (72-52-05) (See Figure 801, Sheet 4)				
			Airseal	24.298 (617.170)	24.302 (617.270)		
			Hub	24.298 (617.170)	24.302 (617.270)	.004T (0.10160T)	.004 (0.10160)

HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−04

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1715 (2)	A	Stage 1 HPT (Outer Rotating) Airseal (72−52−20) PN 50L485 Turbine Front Hub (Stage 1) (72−52−05) (See Figure 801, Sheet 4)				
		Airseal	24.288 (616.915)	24.292 (617.017)		
		Hub	24.298 (617.170)	24.302 (617.270)	.006 (0.152)	.020* (0.508)*
1716	A	Stage 2 HPT (Rotating) Airseal (72−52−22) Turbine Intermediate Hub (Stage 2) (72−52−06) (See Figure 801, Sheet 5)				
		Airseal	22.046 (559.969)	22.050 (560.070)		
		Hub	22.050 (560.070)	22.054 (560.171)	.002T* (0.051T)*	.010* (0.254)*
1717	A	Stage 2 HPT (Rotating) Airseal (72−52−22) Turbine Intermediate Hub (Stage 2) (72−52−06) (See Figure 801, Sheet 5)				
		Airseal	25.656 (651.662)	25.664 (651.866)		
		Hub	25.666 (651.916)	25.674 (652.120)	.000* (0.00)*	.020* (0.51)*
1718	B	Stage 2 HPT Blade Retaining Plate (72−52−23) Turbine Intermediate Hub (Stage 2) (72−52−06) (See Figure 801, Sheet 5)				
		Plate	23.686 (601.625)	23.690 (601.726)		
		Hub	23.678 (601.421)	23.684 (601.574)	.002T (0.051T)	.014T* (0.356T)*
1720	B	Stage 2 HPT Ring Segment And Vane Cluster Assembly (72−52−34) Turbine Case Assembly (72−52−30) (See Figure 801, Sheet 3)				
		Radial Fit −		Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357.		

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1721	B	Stage 1 HPT Duct Support (Segment) Assembly (72-52-31) Turbine Case Assembly (72-52-30) (See Figure 801, Sheet 2)				
		Support	.115 (2.921)	.119 (3.022)		
		Case	.115 (2.921)	.119 (3.022)	.004T (0.10160T)	.004 (0.10160)
1722	C	Pin (72-52-31) Stage 1 HPT Duct Support (Segment) Assembly (72-52-31) (See Figure 801, Sheet 2				
		Pin	**	**		
		Segment	.1075 (2.731)	.1095 (2.781)	.0015T (0.038T)	.0005T (0.013T)

NOTE: Select pin class to obtain .0005T (.013T) to .0015T (.038T) fit.

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1723	C	Pin (72-52-31) Stage 1 HPT Duct Support (Segment) Assembly (72-52-31) (See Figure 801, Sheet 2)				
		Pin	**	**		
		Segment	.1075 (2.731)	.1095 (2.781)	.0015T (0.038T)	.0005T (0.013T)

NOTE: Select pin class to obtain .0005T (.013T) to .0015T (.038T) fit.

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1724	C	Pin (72-52-37) Stage 2 HPT Duct Support (Segment) (72-52-37) (See Figure 801, Sheet 3)				
		Pin	**	**		
		Segment	.1075 (2.731)	.1095 (2.781)	.0015T (0.038T)	.0005T (0.013T)

NOTE: Select pin class to obtain .0005T (.013T) to .0015T (.038T) fit.

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1725	B	Gap Stage 2 HPT Ring Segment And Vane Cluster Assembly (See Figure 801, Sheet 2)				
		Gap (Pre SB PW4ENG 72-742)			0.028 (0.711)	
		Gap (Post SB PW4ENG 72-742)			0.026 (0.660)	
1726	B	Gap Stage 2 HPT Duct Support (Segment) (See Figure 801, Sheet 3)				
		Gap			0.027 (0.686)	
1727	B	Axial Gap, Stage 1 HPT (Outer Rotating) Airseal (72-52-20) Turbine Front Hub (Stage 1) (72-52-05) (See Figure 801, Sheet 4)				
		Airseal	.375 (9.52)	.385 (9.78)		
		Hub	.362 (9.145)	.368 (9.347)	.023T (0.58T)	.007T (0.18T)
1729	B	Axial Gap, Stage 2 HPT (Rotating) Airseal (72-52-22) Turbine Front Hub (Stage 1) (72-52-05) (See Figure 801, Sheet 4)				
		Airseal	.095 (2.413)	.099 (2.514)		
		Hub	.100 (2.540)	.104 (2.641)	.001T (0.025T)	.009T (0.229T)
1730	B	Axial Gap, Stage 2 HPT Blade Retaining Plate (72-52-23) Turbine Intermediate Hub (Stage 2) (72-52-06) (See Figure 801, Sheet 5)				
		Plate	.206 (5.233)	.210 (5.334)		
		Hub	.204 (5.182)	.208 (5.283)	.006T (0.152T)	.002 (0.051)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1731	B	Axial Gap, Stage 2 HPT Blade Retaining Plate (72-52-23) Turbine Intermediate Hub (Stage 2) (72-52-06) (See Figure 801, Sheet 5)				
		Plate	.202 (5.131)	.206 (5.232)		
		Hub	.204 (5.182)	.208 (5.283)	.002T (0.051T)	.006 (0.152)
1732	B	Axial Gap, Stage 2 HPT Blade Retaining Plate (72-52-23) Turbine Intermediate Hub (Stage 2) (72-52-06) (See Figure 801, Sheet 5)				
		Plate	.218 (5.538)	.222 (5.638)		
		Hub	.204 (5.182)	.208 (5.283)	.018T (0.457T)	.010T (0.254T)
1740 (1)	A	Stage 1 Turbine Rotor Assembly (See Figure 801, Sheet 1) Blade Tip Radial Clearance (Pre SB PW4ENG 72-695)			.071 (1.803)	.112* (2.84)*
1740 (2)	A	Stage 1 Turbine Rotor Assembly (See Figure 801, Sheet 1) Blade Tip Radial Clearance (Post SB PW4ENG 72-695)			.081 (2.057)	.112* (2.84)*
1740 (3)	A	Stage 1 Turbine Rotor Assembly (See Figure 801, Sheet 1) Blade Tip Radial Clearance (Post SB PW4ENG 72-712)			.071 (1.803)	.112* (2.84)*
1741	A	Stage 2 Turbine Rotor Assembly (See Figure 801, Sheet 1) Blade Tip Radial Clearance (PN 50L602, 50L602-001, 50L602-021, 50L602-022, 50L602-023, 50L602-024, 50L602-025, 50L602-026, 50L602-027)			.072 (1.83)	.107* (2.72)*

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)						
		(PN 50L902, 52L002, 50L902-021, 50L902-022, 53L602, 52L802, 52L002-021, 50L902-023)			.072 (1.83)	.117* (2.97)*
1742		Stage 1 Turbine Rotor Assembly (See Figure 801, Sheet 4) Seal Tip Radial Clearance -	Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In 72-52-15 And 72-52-34 Sections Of The PW4000 Series CIR, PN 51A357.			
1743		Stage 2 Turbine Rotor Assembly (See Figure 801, Sheet 5) Seal Tip Radial Clearance -	Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In 72-52-08 And 72-52-34 Sections Of The PW4000 Series CIR, PN 51A357.			
1744		Stage 2 HPT (Rotating) Airseal (See Figure 801, Sheet 5) Seal Tip Radial Clearance -	Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In 72-52-22 And 72-52-34 Sections Of The PW4000 Series CIR, PN 51A357.			

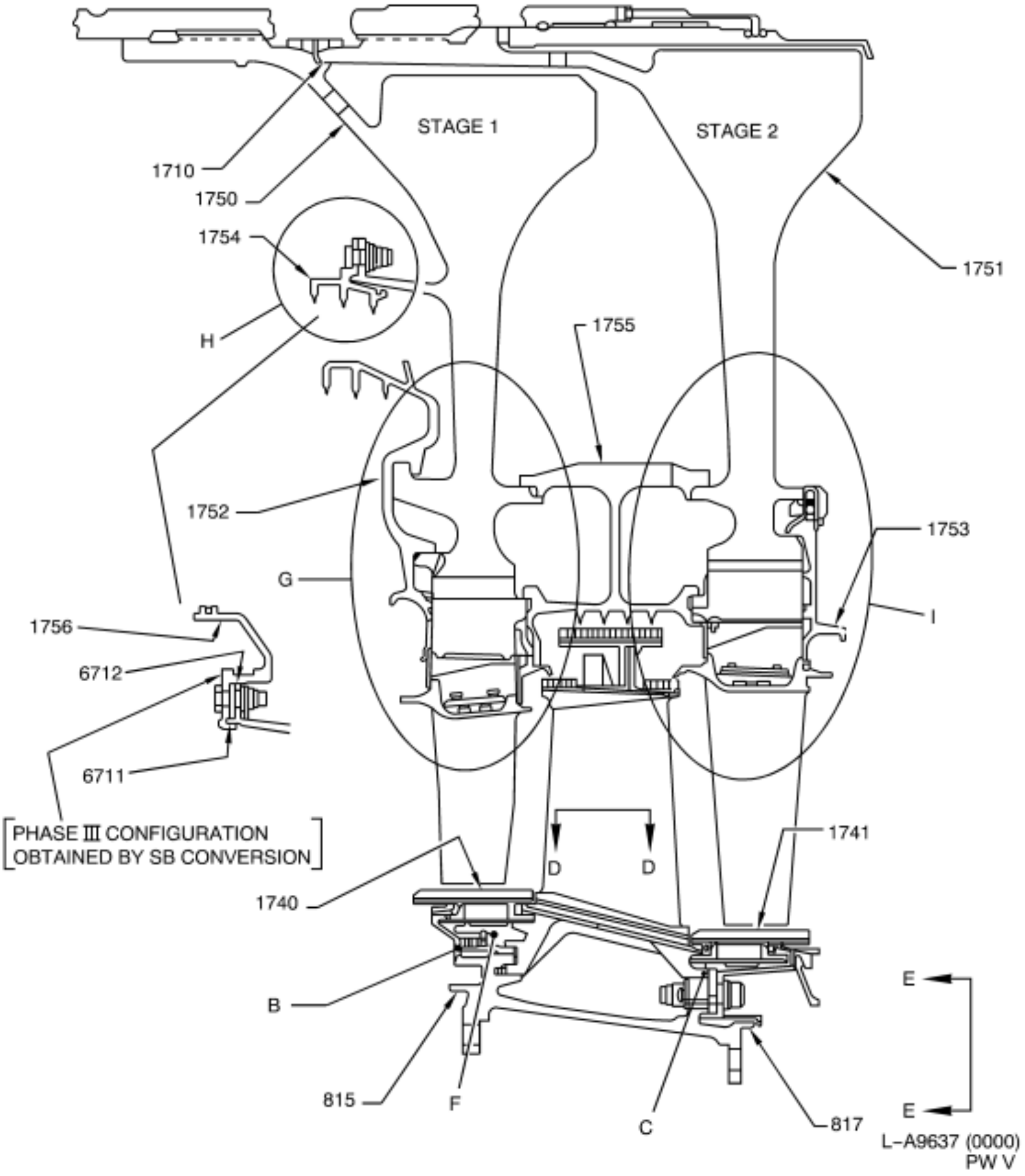
Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
6710	B	Stage 2 HPT Ring Segment And Vane Cluster Assembly (72−52−34) Turbine Case Assembly (72−52−30) (See Figure 801, Sheet 3)				
		Radial Fit −	Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357.			
6711	A	Stage 1 HPT Airsealing Ring (72−52−17) Front Hub (Stage 1) (72−52−05) (See Figure 801, Sheet 1)				
		Ring	15.226 (386.740)	15.232 (386.893)		
		Hub	15.232 (386.893)	15.236 (386.994)	.000 (0.000)	.010T (0.254T)
6712	A	HPT Flange Spacer (72−52−16) Stage 1 HPT Air Sealing Ring (72−52−17) (See Figure 801, Sheet 1)				
		Spacer	13.803 (350.597)	13.807 (350.697)		
		Ring	13.807 (350.698)	13.813 (350.850)	.020L* (0.508L)*	.010T (0.254T)

G. Disk, Hub Airseal Limits

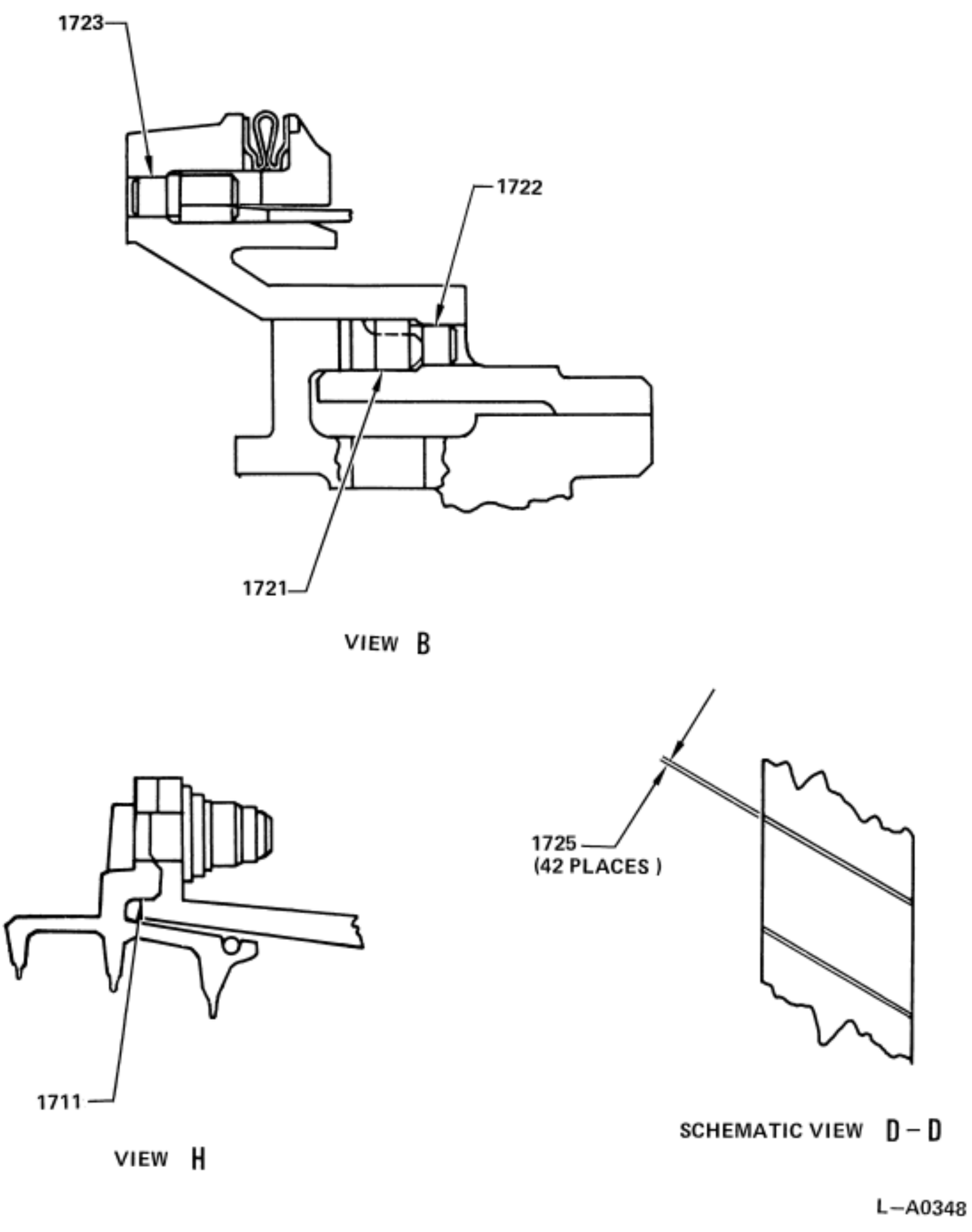
Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1750	A	Hub, Turbine Front (Stage 1) (See 5−10−00, Time Limits) (See Figure 801, Sheet 1)				
1751	A	Hub, Turbine Intermediate (Stage 2) (See 5−10−00, Time Limits) (See Figure 801, Sheet 1)				
1752	A	Airseal, Stage 1 HPT (Outer Rotating) (See 5−10−00, Time Limits) (See Figure 801, Sheet 1)				
1753	A	Plate, Stage 2 HPT Blade Retaining (See 5−10−00, Time Limits) (See Figure 801, Sheet 1)				
1754	A	Airseal, Stage 1 HPT (Inner Rotating) (See 5−10−00, Time Limits) (See Figure 801, Sheet 1)				
1755	A	Airseal, Stage 2 HPT (Rotating) (See 5−10−00, Time Limits) (See Figure 801, Sheet 1)				
1756	A	Ring, Stage 1 HPT Airsealing (See 5−10−00, Time Limits) (See Figure 801, Sheet 1)				

H. Spline Data

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
954	B	1. No. 3 Bearing Retaining Nut (72-52-80) Internal Spline (See Figure 802)				
		A. Effective Space Width	.0785 (1.994)	---		
		B. Actual Space Width	---	.0833 (2.116)		
		2. No. 3 Bearing Nut Lock (72-52-81) External Spline (See Figure 802)				
		A. Effective Tooth Thickness	---	.0750 (1.905)		
		B. Actual Tooth Thickness	.0704 (1.788)	---		
		3. Fit			.0035 (0.089)	---


STAGE 1
STAGE 2
1710
1750
1754
H
1751
1755
1752
1753
G
I
1756
6712
6711
PHASE III CONFIGURATION
OBTAINED BY SB CONVERSION
1741
D
D
1740
B
E
E
815
F
C
817
L−A9637 (0000)
PW V

High Pressure Turbine (HPT)
Figure 801 (Sheet 1)
(Task 72−52−00−990−001)

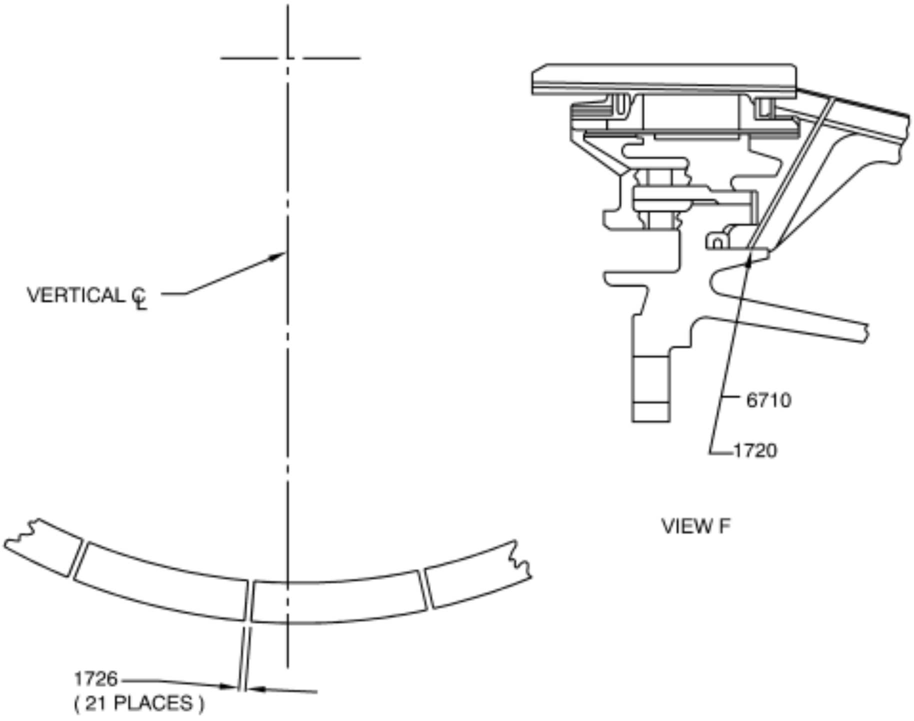

1723
1722
1721
1725
(42 PLACES)
1711
L-A0348

VIEW B

VIEW H

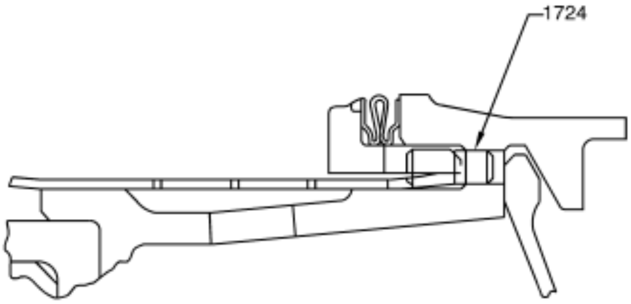
SCHEMATIC VIEW D-D

High Pressure Turbine (HPT)
Figure 801 (Sheet 2)
(Task 72-52-00-990-001)


VERTICAL ℄
6710
1720
1726
(21 PLACES)

SCHEMATIC VIEW E−E

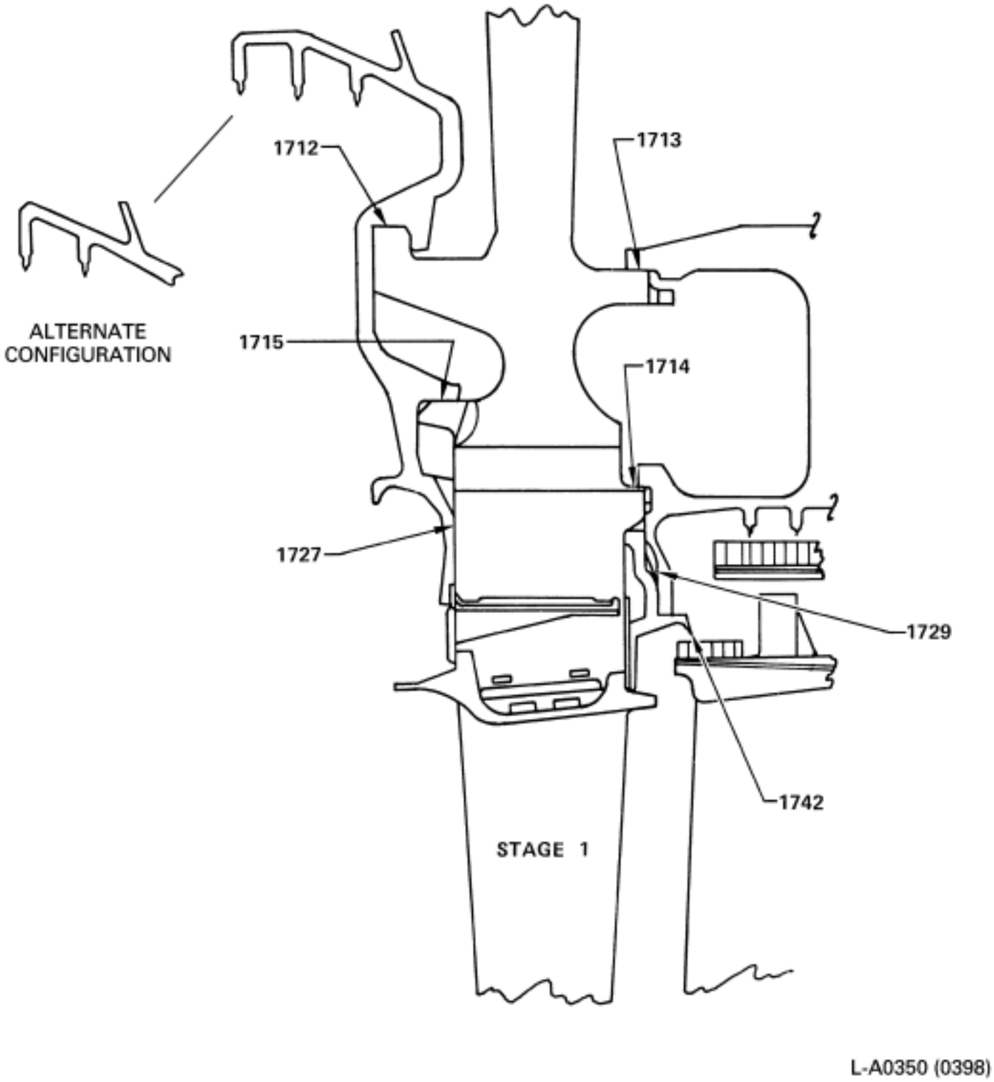
VIEW F


1724

VIEW C

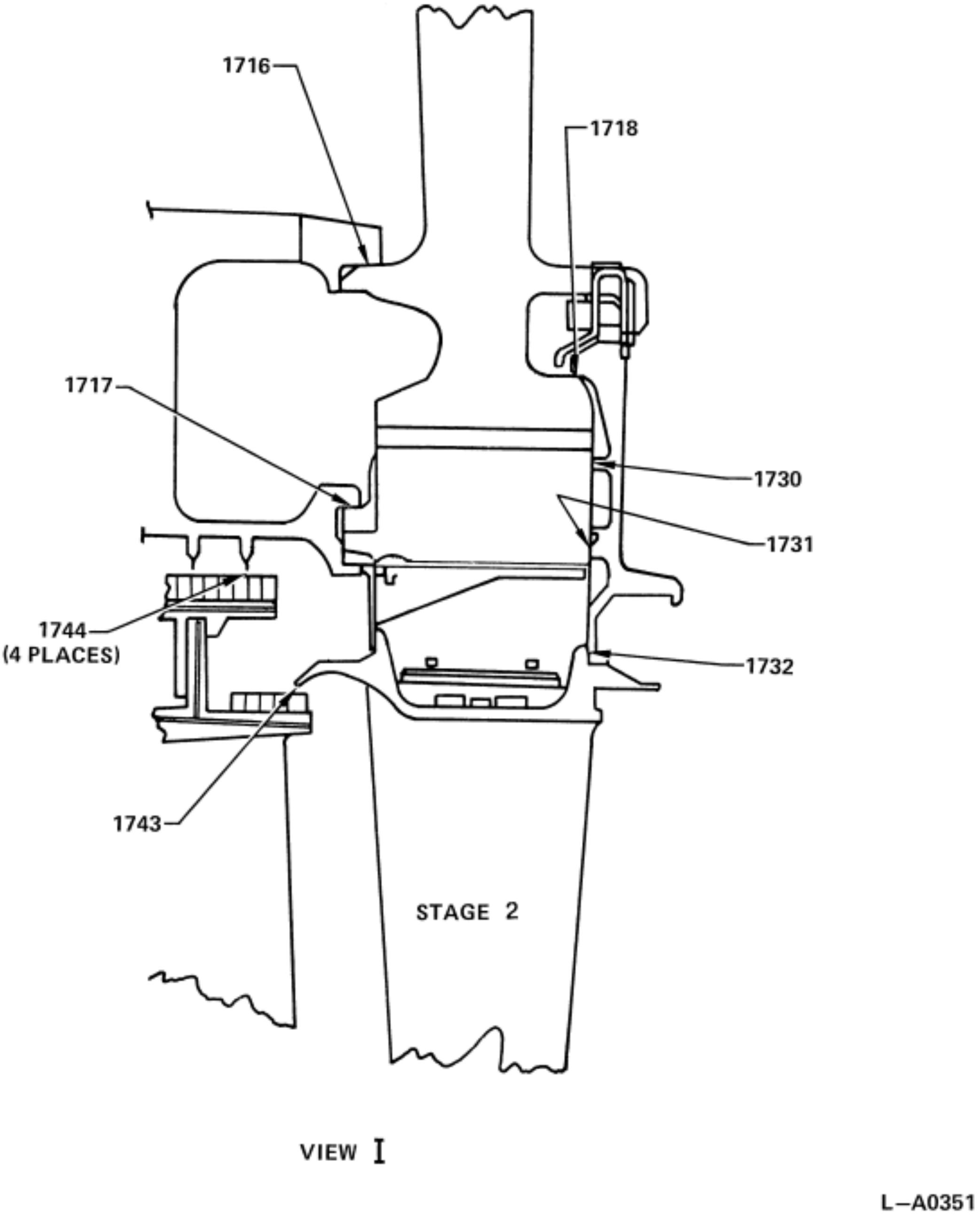
L−A0349 (0398)
PW V

High Pressure Turbine (HPT)
Figure 801 (Sheet 3)
(Task 72−52−00−990−001)

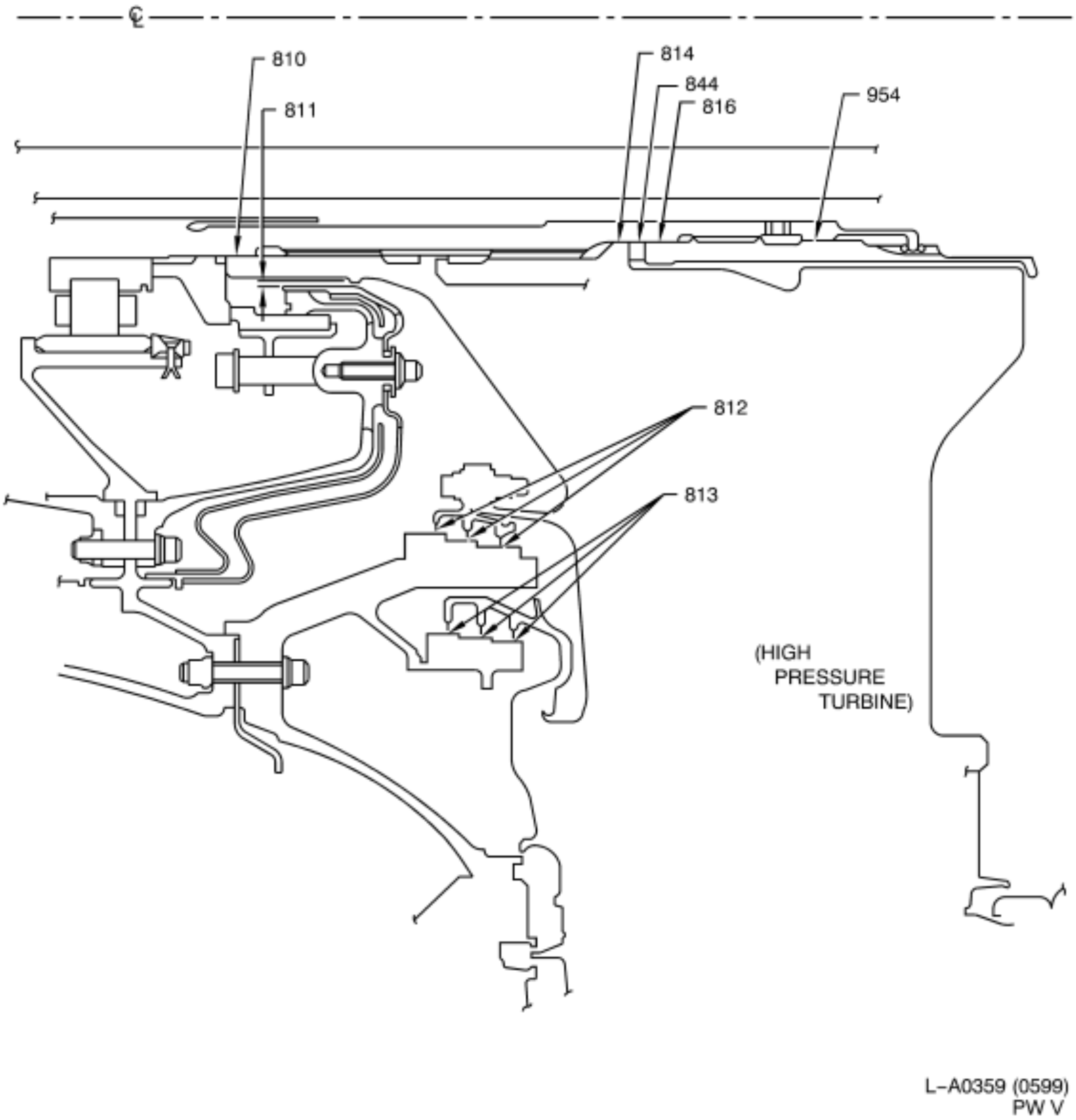

1712
1713
ALTERNATE CONFIGURATION
1715
1714
1727
1729
1742
STAGE 1
L-A0350 (0398)

High Pressure Turbine (HPT)
Figure 801 (Sheet 4)
(Task 72−52−00−990−001)

HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−04


1716
1718
1717
1730
1731
1744
(4 PLACES)
1732
1743
STAGE 2
VIEW I
L−A0351

High Pressure Turbine (HPT)
Figure 801 (Sheet 5)
(Task 72−52−00−990−001)


℄
810
811
814
844
816
954
812
813
(HIGH PRESSURE TURBINE)
L−A0359 (0599)
PW V

High Pressure Turbine (HPT)
Figure 802
(Task 72−52−00−990−001)

HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−04

Task 72−52−00−990−006:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are found in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (−) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (−) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
810	B	HPC Turbine Driveshaft (72−35−09) Turbine Front Hub (Stage 1) (72−52−05) (See Figure 802)				
		Driveshaft	7.1455 (181.496)	7.1465 (181.521)		
		HPT Hub	7.1335 (181.191)	7.1355 (181.241)	.010T (0.254T)	.013T (0.330T)
811	B	Turbine Front Hub (Stage 1) (72−52−05) No. 3 Bearing Rear Cooling Duct Assembly (72−41−88) (See Figure 802)				
		Hub	7.988 (202.90)	7.998 (203.15)		
		Duct	8.098 (205.690)	8.102 (205.790)	.100 (2.54)	.114 (2.90)
813		Stage 1 HPT (Outer Rotating) Air Seal (72−52−20) Stage 1 HPT Blade Cooling Duct Assembly (72−51−03) (See Figure 802)				
		Radial Gap Cold −		Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357.		
814	B	HPC Turbine Driveshaft (72−35−09) Turbine Intermediate Hub (Stage 2) (72−52−06) (See Figure 802)				
		Driveshaft	6.5947 (167.506)	6.5957 (167.530)		
		HPT Hub	6.5827 (167.201)	6.5847 (167.251)	.007T* (0.178T)*	.013T (0.330T)
815	B	Turbine Case Assembly (72−52−30) Diffuser Case Assembly (72−41−01) (See Figure 801, Sheet 1)				
		Turbine Case	38.833 (986.358)	38.845 (986.663)		
		Diffuser Case	38.827 (986.206)	38.833 (986.358)	.000 (0.00)	.018T (0.457T)

HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−04

	I		New Part Reference Dimensions		Limits	
Ref. No.	F R	Description	Min	Max	Min	Max
816	B	HPC Turbine Driveshaft (72−35−09) No. 3 Bearing (And HPT) Retaining Nut (72−52−80) (See Figure 802)				
		Driveshaft	6.5947 (167.506)	6.5957 (167.530)		
		Nut	6.5967 (167.557)	6.5987 (167.606)	.001 (0.026)	.0052* (0.132)*
817	B	Turbine Case Assembly (72−52−30) Rear Turbine (LPT) Case Assembly (72−53−17) (See Figure 801, Sheet 1)				
		Case	39.995 (1015.873)	40.001 (1016.025)		
		Rear Case	39.983 (1015.568)	39.989 (1015.721)	.006T* (0.152T)*	.025T (0.635T)
844	B	HPC Turbine Driveshaft (72−35−09) Turbine Shaft Spacer (72−52−83) (See Figure 802)				
		Driveshaft	6.5947 (167.506)	6.5957 (167.530)		
		Spacer	6.5967 (167.557)	6.5987 (167.606)	.001 (0.026)	.0052* (0.132)*
1710	B	Turbine Front Hub (Stage 1) (72−52−05) Turbine Intermediate (Rear) Hub (Stage 2) (72−52−06) (See Figure 801, Sheet 1)				
		Stage 1 Hub (PN 52L301)	7.885 (200.279)	7.887 (200.329)		
		Stage 2 Hub (PN 52L402, 52L802, 53L602)	7.893 (200.483)	7.895 (200.533)	.010T (0.254T)	.006T (0.153T)

HIGH PRESSURE TURBINE (HPT) - INSPECTION/CHECK-04

	Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
				Min	Max	Min	Max
	1712	A	Stage 1 HPT (Outer Rotating) Airseal (72-52-20)				
			Turbine Front Hub (Stage 1) (72-52-05)				
			(See Figure 801, Sheet 4)				
			Airseal	21.282 (540.563)	21.286 (540.664)		
R			Hub	21.278 (540.462)	21.282 (540.562)	.008T (0.203T)	.001* (0.025)*
	1713	A	Stage 2 HPT (Rotating) Airseal (72-52-22)				
			Turbine Front Hub (Stage 1) (72-52-05)				
			(See Figure 801, Sheet 4)				
			Airseal	22.066 (560.477)	22.070 (560.578)		
			Hub	22.050 (560.070)	22.054 (560.171)	.020T (0.508T)	.007T* (0.178T)*
	1714	A	Stage 2 HPT (Rotating) Airseal (72-52-22)				
			Turbine Front Hub (Stage 1) (72-52-05)				
			(See Figure 801, Sheet 4)				
			Airseal	25.766 (654.456)	25.774 (654.660)		
			Hub	25.776 (654.710)	25.784 (654.914)	.002 (0.05)	0.021* (0.53)*
	1715	A	Stage 1 HPT (Outer Rotating) Airseal (72-52-20) PN 50L485				
			Turbine Front Hub (Stage 1) (72-52-05)				
			(See Figure 801, Sheet 4)				
			Airseal	24.288 (616.915)	24.292 (617.017)		
			Hub	24.298 (617.170)	24.302 (617.270)	.006 (0.152)	.020* (0.508)*
	1716	A	Stage 2 HPT (Rotating) Airseal (72-52-22)				
			Turbine Intermediate Hub (Stage 2) (72-52-06)				
			(See Figure 801, Sheet 5)				
			Airseal	22.046 (559.969)	22.050 (560.070)		
			Hub	22.050 (560.070)	22.054 (560.171)	.002T* (0.051T)*	.010* (0.254)*

Ref. No.	IFR	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1717	A	Stage 2 HPT (Rotating) Airseal (72−52−22) Turbine Intermediate Hub (Stage 2) (72−52−06) (See Figure 801, Sheet 5)				
		Airseal	25.656 (651.662)	25.664 (651.866)		
		Hub	25.666 (651.916)	25.674 (652.120)	.000* (0.00)*	.020* (0.51)*
1718	B	Stage 2 HPT Blade Retaining Plate (72−52−23) Turbine Intermediate Hub (Stage 2) (72−52−06) (See Figure 801, Sheet 5)				
		Plate	23.686 (601.625)	23.690 (601.726)		
		Hub	23.678 (601.421)	23.684 (601.574)	.002T (0.051T)	.014T* (0.356T)*
1720	B	Stage 2 HPT Ring Segment And Vane Cluster Assembly (72−52−34) Turbine Case Assembly (72−52−30) (See Figure 801, Sheet 3)				
		Radial Fit −		Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In The Referenced Sections Of The PW4000 Series CIR, PN 51A357.		
1721	B	Stage 1 HPT Duct Support (Segment) Assembly (72−52−31) Turbine Case Assembly (72−52−30) (See Figure 801, Sheet 2)				
		Support	.115 (2.921)	.119 (3.022)		
		Case	.115 (2.921)	.119 (3.022)	.004T (0.10160T)	.004 (0.10160)
1722	C	Pin (72−52−31) Stage 1 HPT Duct Support (Segment) Assembly (72−52−31) (See Figure 801, Sheet 2				
		Pin	**	**		
		Segment	.1075 (2.731)	.1095 (2.781)	.0015T (0.038T)	.0005T (0.013T)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
NOTE:		Select pin class to obtain .0005T (.013T) to .0015T (.038T) fit.				
1723	C	Pin (72-52-31) Stage 1 HPT Duct Support (Segment) Assembly (72-52-31) (See Figure 801, Sheet 2)				
		Pin Segment	** .1075 (2.731)	** .1095 (2.781)	.0015T (0.038T)	.0005T (0.013T)
NOTE:		Select pin class to obtain .0005T (.013T) to .0015T (.038T) fit.				
1724	C	Pin (72-52-37) Stage 2 HPT Duct Support (Segment) (72-52-37) (See Figure 801, Sheet 3)				
		Pin Segment	** .1075 (2.731)	** .1095 (2.781)	.0015T (0.038T)	.0005T (0.013T)
NOTE:		Select pin class to obtain .0005T (.013T) to .0015T (.038T) fit.				
1725	B	Gap Stage 2 HPT Ring Segment And Vane Cluster Assembly (See Figure 801, Sheet 2)				
		Gap (Pre SB PW4ENG 72-742)			0.028 (0.711)	
		Gap (Post SB PW4ENG 72-742)			0.026 (0.660)	
1726	B	Gap Stage 2 HPT Duct Support (Segment) (See Figure 801, Sheet 3)				
		Gap			0.027 (0.686)	

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1727	B	Axial Gap, Stage 1 HPT (Outer Rotating) Airseal (72-52-20) Turbine Front Hub (Stage 1) (72-52-05) (See Figure 801, Sheet 4)				
		Airseal	.375 (9.52)	.385 (9.78)		
		Hub	.362 (9.145)	.368 (9.347)	.023T (0.58T)	.007T (0.18T)
1729	A	Axial Gap, Stage 2 HPT (Rotating) Airseal (72-52-22) Turbine Front Hub (Stage 1) (72-52-05) (See Figure 801, Sheet 4)				
		Airseal	.095 (2.413)	.099 (2.514)		
		Hub	.100 (2.540)	.104 (2.641)	.001T (0.025T)	.009T (0.229T)
1730	B	Axial Gap, Stage 2 HPT Blade Retaining Plate (72-52-23) Turbine Intermediate Hub (Stage 2) (72-52-06) (See Figure 801, Sheet 5)				
		Plate	.206 (5.233)	.210 (5.334)		
		Hub	.204 (5.182)	.208 (5.283)	.006T (0.152T)	.002 (0.051)
1731	B	Axial Gap, Stage 2 HPT Blade Retaining Plate (72-52-23) Turbine Intermediate Hub (Stage 2) (72-52-06) (See Figure 801, Sheet 5)				
		Plate	.202 (5.131)	.206 (5.232)		
		Hub	.204 (5.182)	.208 (5.283)	.002T (0.051T)	.006 (0.152)
1732	B	Axial Gap, Stage 2 HPT Blade Retaining Plate (72-52-23) Turbine Intermediate Hub (Stage 2) (72-52-06) (See Figure 801, Sheet 5)				
		Plate	.218 (5.538)	.222 (5.638)		
		Hub	.204 (5.182)	.208 (5.283)	.018T (0.457T)	.010T (0.254T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1740 (1)	A	Stage 1 Turbine Rotor Assembly (See Figure 801, Sheet 1) Blade Tip Radial Clearance (Pre SB PW4ENG 72-695)			.071 (1.803)	.112* (2.84)*
1740 (2)	A	Stage 1 Turbine Rotor Assembly (See Figure 801, Sheet 1) Blade Tip Radial Clearance (Post SB PW4ENG 72-695)			.081 (2.057)	.112* (2.84)*
1740 (3)	A	Stage 1 Turbine Rotor Assembly (See Figure 801, Sheet 1) Blade Tip Radial Clearance (Post SB PW4ENG 72-712)			.071 (1.803)	.112* (2.84)*
1741	A	Stage 2 Turbine Rotor Assembly (See Figure 801, Sheet 1) Blade Tip Radial Clearance (PN 53L602, 52L402, 52L802)			.072 (1.83)	.117* (2.97)*
1742		Stage 1 Turbine Rotor Assembly (See Figure 801, Sheet 4) Seal Tip Radial Clearance -	Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In Sections 72-52-15 And 72-52-34 Of The PW4000 Series CIR, PN 51A357.			
1743		Stage 2 Turbine Rotor Assembly (See Figure 801, Sheet 5) Seal Tip Radial Clearance -	Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In Sections 72-52-08 And 72-52-34 Of The PW4000 Series CIR, PN 51A357.			

HIGH PRESSURE TURBINE (HPT) - INSPECTION/CHECK-04

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1744		Stage 2 HPT (Rotating) Airseal (See Figure 801, Sheet 5) Seal Tip Radial Clearance -	Measurement Is Not Necessary At Assembly. Inspect The Detail Parts To The Limits Given In Sections 72-52-22 And 72-52-34 Of The PW4000 Series CIR, PN 51A357.			
1745 (1)	A	Stage 1 Turbine Rotor Assembly (See Figure 801, Sheet 1) Blade Tip Radial Clearance (New Duct Rubstrip) (Post SB PW4ENG 72-735) NOTE: Use these limits when you measure radial clearances for assemblies with case and vane assemblies that have new HPT duct segment (rubstrips).			0.066 (1.676)	0.081 (2.057)
1745 (2)	A	Stage 1 Turbine Rotor Assembly (See Figure 801, Sheet 1) Blade Tip Radial Clearance (Used Duct Rubstrip) (Post SB PW4ENG 72-735) NOTE: Use these limits when you measure radial clearances for assemblies with case and vane assemblies that have used HPT duct segment (rubstrips).			0.066 (1.676)	.112* (2.84)*
1746 (1)	A	Stage 2 Turbine Rotor Assembly (See Figure 801, Sheet 1) Blade Tip Radial Clearance (New Duct Rubstrip) (Post SB PW4ENG 72-735) NOTE: Use these limits when you measure radial clearances for assemblies with case and vane assemblies that have new HPT duct segment (rubstrips).			0.063 (1.600)	0.083 (2.108)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1746 (2)	A	Stage 2 Turbine Rotor Assembly (See Figure 801, Sheet 1) Blade Tip Radial Clearance (Used Duct Rubstrip) (Hub Assemblies, PN 53L602, 52L402, 52L802) (Post SB PW4ENG 72-735)			0.063 (1.600)	.117* (2.972)*
		NOTE: Use these limits when you measure radial clearances for assemblies with case and vane assemblies that have used HPT duct segment (rubstrips).				
6711	A	Stage 1 HPT Air Sealing Ring (72-52-17) Front Hub (Stage 1) (72-52-05) (See Figure 801, Sheet 1)				
		Ring	15.226 (386.740)	15.232 (386.893)		
		Hub	15.232 (386.893)	15.236 (386.994)	.000 (0.000)	.010T (0.254T)
6712	A	HPT Flange Spacer (72-52-16) Stage 1 HPT Air Sealing Ring (72-52-17) (See Figure 801, Sheet 1)				
		Spacer	13.803 (350.597)	13.807 (350.697)		
		Ring	13.807 (350.698)	13.813 (350.850)	.020L* (0.508L)*	.010T (0.254T)

G. Disk, Hub Airseal Limits

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1750	A	Hub, Turbine Front (Stage 1) (See 5-10-00, Time Limits) (See Figure 801, Sheet 1)				
1751	A	Hub, Turbine Intermediate (Stage 2) (See 5-10-00, Time Limits) (See Figure 801, Sheet 1)				

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1752	A	Airseal, Stage 1 HPT (Outer Rotating) (See 5-10-00, Time Limits) (See Figure 801, Sheet 1)				
1753	A	Plate, Stage 2 HPT Blade Retaining (See 5-10-00, Time Limits) (See Figure 801, Sheet 1)				
1755	A	Airseal, Stage 2 HPT (Rotating) (See 5-10-00, Time Limits) (See Figure 801, Sheet 1)				
1756	A	Ring, Stage 1 HPT Airsealing (See 5-10-00, Time Limits) (See Figure 801, Sheet 1)				

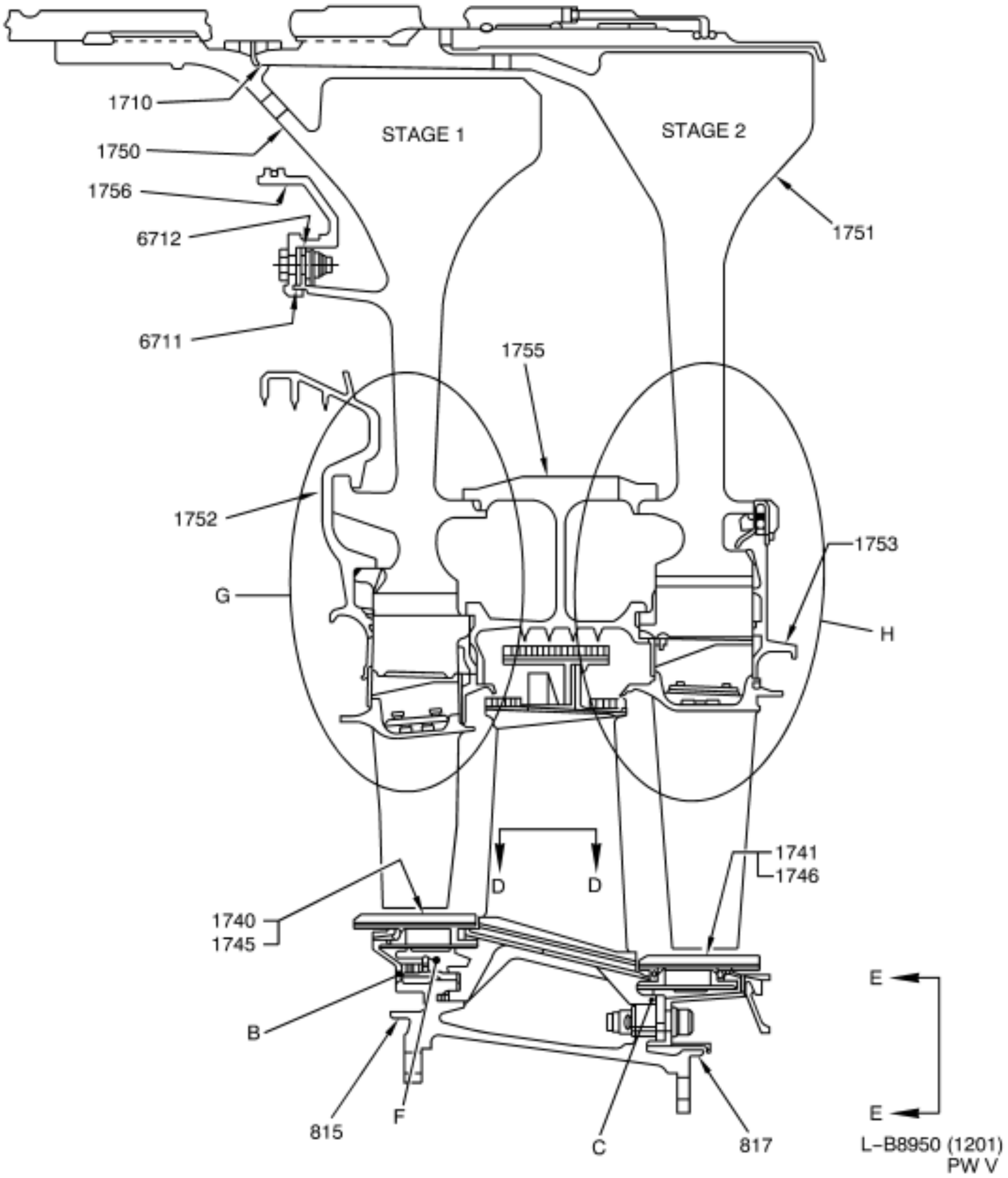
H. Spline Data

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
954	B	1. No. 3 Bearing Retaining Nut (72-52-80) Internal Spline (See Figure 802)				
		A. Effective Space Width	.0785 (1.994)	---		
		B. Actual Space Width	---	.0833 (2.116)		
		2. No. 3 Bearing Nut Lock (72-52-81) External Spline (See Figure 802)				
		A. Effective Tooth Thickness	---	.0750 (1.905)		
		B. Actual Tooth Thickness	.0704	---		

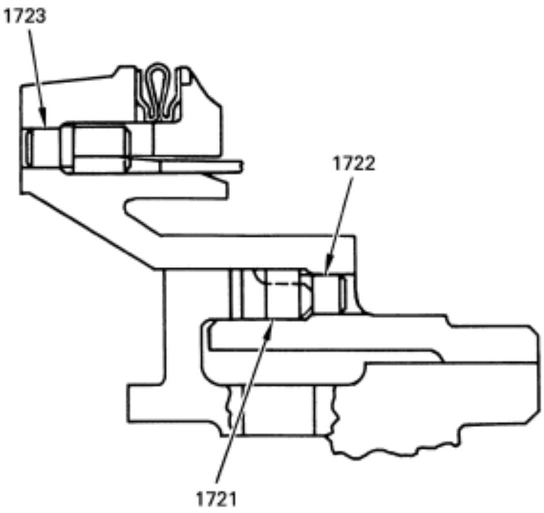
HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−04

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)						
			(1.788)			
3.		Fit			.0035 (0.089)	−−−

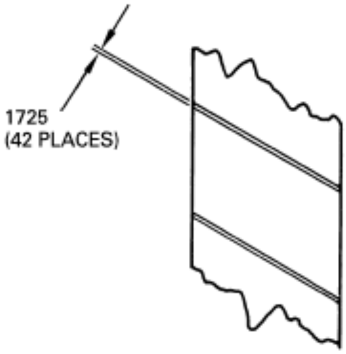
HIGH PRESSURE TURBINE (HPT) − INSPECTION/CHECK−04


STAGE 1
STAGE 2
1710
1750
1756
6712
6711
1755
1751
1752
1753
G
H
D
D
1741
1746
1740
1745
E
E
B
815
F
C
817
L−B8950 (1201)
PW V

High Pressure Turbine (HPT)
Figure 801 (Sheet 1)
(Task 72−52−00−990−006)



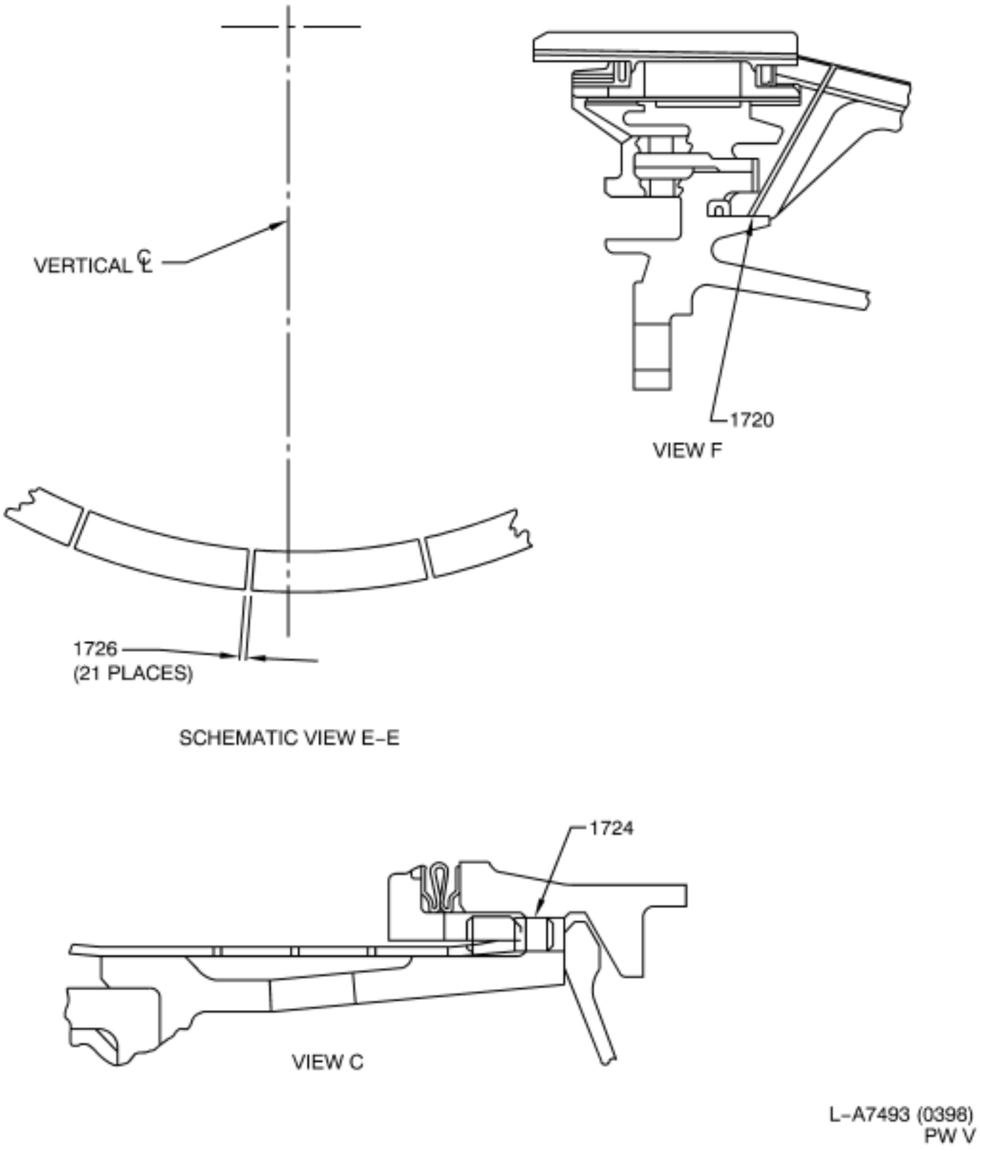
VIEW B



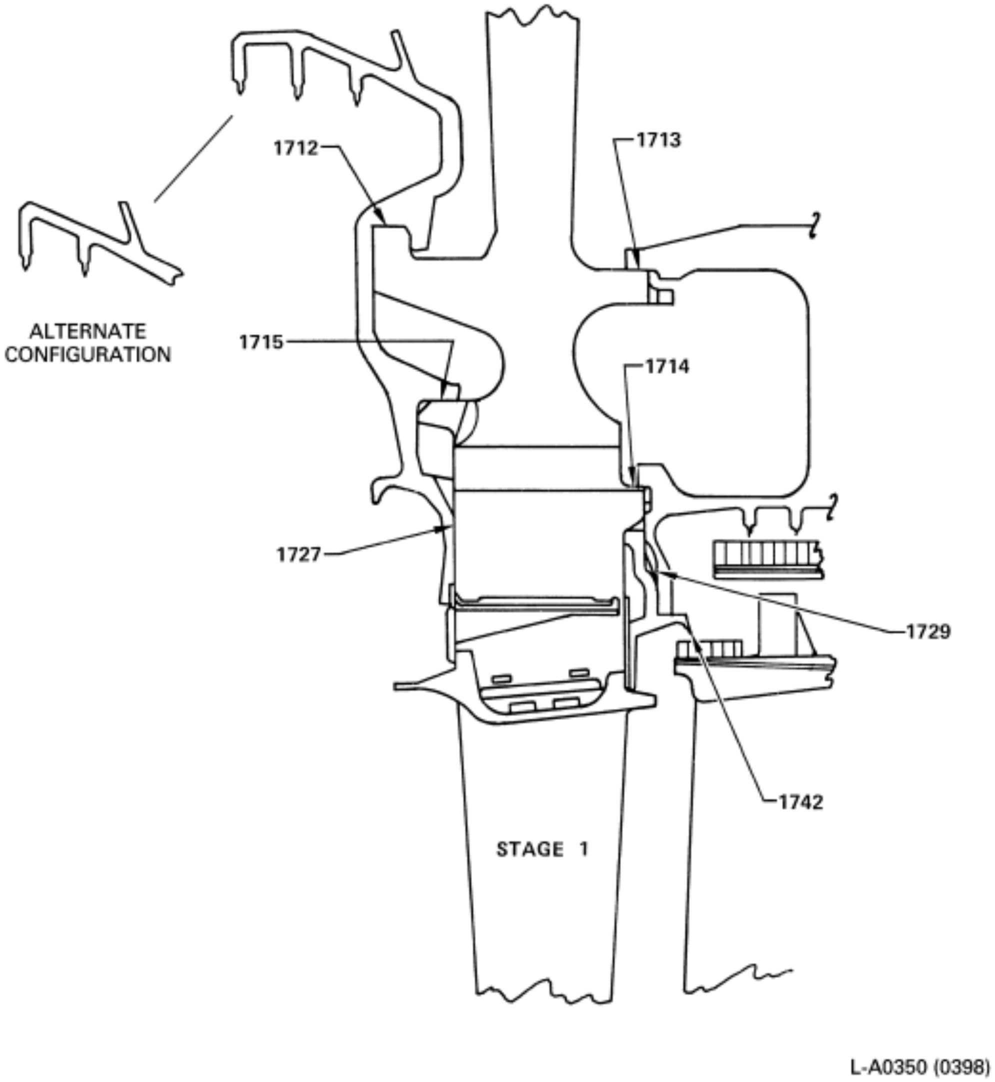
SCHEMATIC VIEW D - D

L-A7500 (0000)

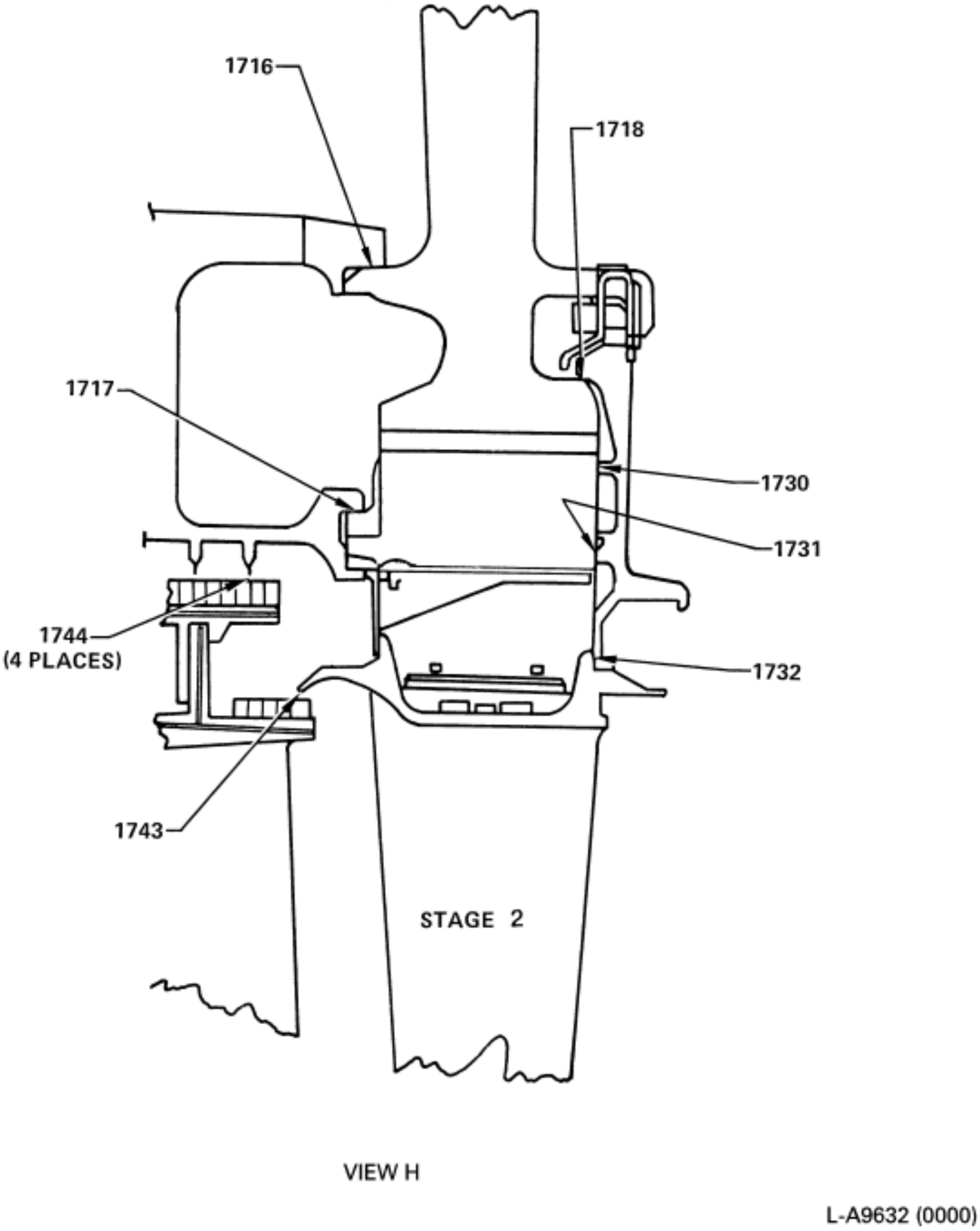
High Pressure Turbine (HPT)
Figure 801 (Sheet 2)
(Task 72−52−00−990−006)


VERTICAL ℄
1726
(21 PLACES)
SCHEMATIC VIEW E−E
1720
VIEW F
1724
VIEW C
L−A7493 (0398)
PW V

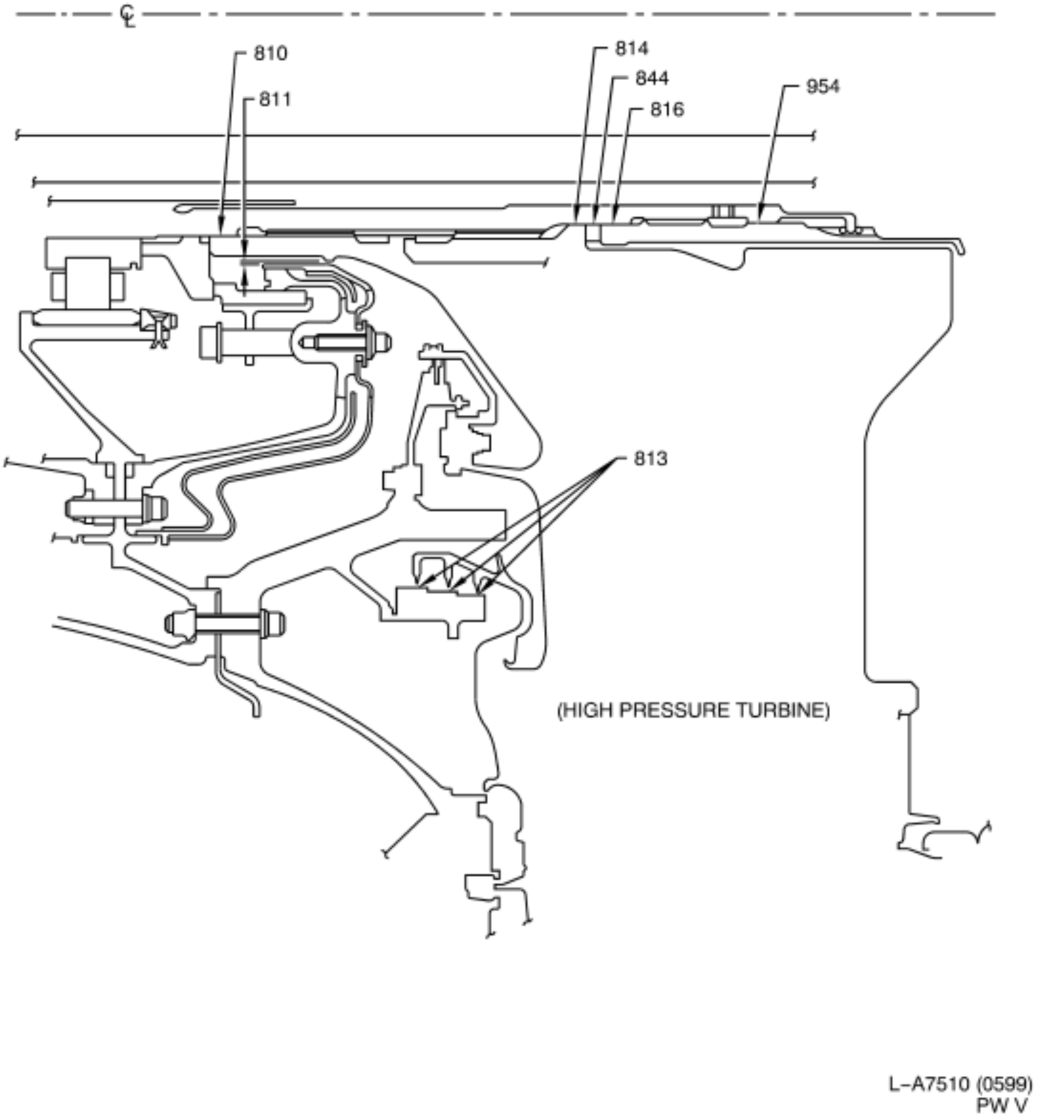
High Pressure Turbine (HPT)
Figure 801 (Sheet 3)
(Task 72−52−00−990−006)


1712
1713
ALTERNATE CONFIGURATION
1715
1714
1727
1729
1742
STAGE 1
L-A0350 (0398)

High Pressure Turbine (HPT)
Figure 801 (Sheet 4)
(Task 72−52−00−990−006)


1716
1718
1717
1730
1731
1744
(4 PLACES)
1732
1743
STAGE 2
VIEW H
L-A9632 (0000)

High Pressure Turbine (HPT)
Figure 801 (Sheet 5)
(Task 72−52−00−990−006)


℄
810
811
814
844
816
954
813
(HIGH PRESSURE TURBINE)
L−A7510 (0599)
PW V

High Pressure Turbine (HPT)
Figure 802
(Task 72−52−00−990−006)

HIGH PRESSURE TURBINE (HPT) - ASSEMBLY-01

Task 72-52-00-400-001:

1. Assemble High Pressure Turbine

A. Prerequisites

(1) See Inspection/Check-04 Task 72-52-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

(2) Assemble 1st stage turbine rotor assembly per 72-52-01, Assembly-01 Task 72-52-01-440-001.

(3) Assemble 2nd stage turbine rotor assembly per 72-52-02, Assembly-01 Task 72-52-02-440-001.

(4) Assemble turbine case and vane assembly per 72-52-03, Assembly-01 Task 72-52-03-440-001.

B. Equipment And Materials Necessary

Standard Tools:

Name	Manufacturer
Clements Cadillac Electric Flameless Heat Gun Model FT 1000	Clements Manufacturing Co. 6650 S. Narragansett Avenue Chicago, IL 60638

NOTE: The flameless torch specified above is optional to the heaters specified in the Special Tools list, and the optional flame torch.

Special Tools:

PWA 28657	Sling
PWA 29389	Pump, Hydraulic
PWA 29754	Control, Heater
PWA 75028	Gage
PWA 76154	Adapter (Two Necessary)
PWA 76156	Adapters (Two Necessary)
PWA 85083	Eye, Handling (Optional to PWA 85087)
PWA 85085	Plate, Trunnion (Optional to PWA 86080)
PWA 85086	Arm, Lifting (Two Necessary)
PWA 85087	Eye, Lifting
PWA 85107	Fixture, Build
PWA 85111	Fixture, Align

Special Tools:

(CONTINUED)

PWA 85112	Fixture, Retain (Optional)
PWA 85247	Bracket, Handling (Two Necessary)
PWA 85634	Fixture, Support
PWA 86023	Pin, Guide (Four Necessary)
PWA 86058	Retainer, Storage (Optional)
PWA 86080	Eye, Lifting
PWA 86208	Crimper, Manual
PWA 87022	Stand, Build
PWA 87487	Heater, Electrical
PWA 88643	Sling (Optional to PWA 88673)
PWA 88673	Sling (Optional to PWA 88643)

Consumable Materials:

Item No.	Designation
P05−395	Beeswax
P05−396	Paraffin Wax Blend
P08−010	Adhesive (EC−1300)
P08−005	Adhesive (PWA 36027)
P08−022	Adhesive (EC−1357)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Seal	1	72−52−00/6/1

C. General Assembly Requirements

(1) Where heating is required for assembly, use minimum temperature differential of 125°F (52°C) between parts being assembled. Do not exceed 300°F (149°C) on any part.

(2) Where heating is required for assembly, special heaters are specified in the following procedure. However, you can use an optional flameless torch or flame torch as specified in the following steps.

(3) In locations where heating of a component in an oven is not practical or only a flange of the component requires heating, the use of Clements Cadillac Quic Heat flameless torch, Model FT 1000 is recommended.

(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE FLAME WILL DAMAGE OR BURN NON−METAL PARTS.

CAUTION: DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

D. Procedure

CAUTION: (PRE SB PW4ENG 72-712) IF ONE OR MORE NEW 1ST OR 2ND STAGE DUCT SEGMENTS ARE INSTALLED, A MINIMUM OF 30 1ST AND/OR 2ND STAGE BLADES, AS APPLICABLE, MUST BE INSTALLED THAT HAVE ACCEPTABLE BLADE TIP ABRASIVE. FAILURE TO REPLACE BLADE TIP ABRASIVE PARTICLES WILL DECREASE ENGINE PERFORMANCE AND CAUSE MORE BLADE TIP WEAR THAN THE REPAIR LIMITS ALLOW.

CAUTION: (PRE SB PW4ENG 72-712) IF NO NEW DUCT SEGMENTS ARE INSTALLED AND ONE OR MORE 1ST OR 2ND STAGE DUCT SEGMENTS PRETRENCHED PER PW4000 Series CIR, PN 51A357 REPAIR-02, SECTION 72-52-32 OR 72-52-35 ARE INSTALLED, THE REQUIREMENTS FOR 30 BLADES WITH SUITABLE BLADE TIPS IS WAIVED.

CAUTION: (POST SB PW4ENG 72-712) IT IS RECCOMENDED A FULL SET OF 60 1ST STAGE BLADES ARE INSTALLED TO GET THE BEST PERFORMANCE, BUT IF THEY ARE NOT AVAILABLE, A MINIMUM OF 30 1ST STAGE BLADES WITH EXPOSED GRIT TIP ARE NECESSARY TO GIVE ADEQUATE SEAL CUTTING. THE BLADES MUST BE INSTALLED DIAMETRICALLY OPPOSED FROM EACH OTHER. FAILURE TO DO SO WILL DECREASE ENGINE PERFORMANCE AND CAUSE MORE BLADE TIP WEAR.

Subtask 72-52-00-430-060:

(1) Before you assemble the high pressure turbine it is necessary to find the 1st and 2nd stage blade tip clearances. See 72-52-00, Inspection/Check-04 Task 72-52-00-990-004, References 1740 and 1741 respectively, for blade tip clearances. See Figure 1001.

NOTE: Optional, blade tip clearance can be checked with the use of feeler stock after you complete the assembly of the High Pressure Turbine.

(a) Using pi tape or equivalent, measure OD of 1st and 2nd stage turbine rotor assemblies and record dimensions.

(b) Using pi tape or equivalent, measure ID of 1st and 2nd stage HPT duct segments. For used duct segments measurement must be taken in blade rub groove of ducts.

(c) Using dimensions determined above, calculate average blade tip clearance for 1st and 2nd stage rotor assemblies.

(d) Blade tip clearances must be in the limits specified in Reference 1740 for the 1st stage rotor and Reference 1741 for the 2nd stage rotor. See 72−52−00 Inspection/Check−04 (Task 72−52−00−990−004).

Subtask 72−52−00−430−051:

(2) Install PWA 85107 Fixture onto PWA 87022 Stand. See Figure 1002.

(a) Insure that locating plug (1002/1), with the triple step end up, is installed in center sleeve unit of stand. Completely lower center sleeve unit using jackscrew (1002/5).

(b) If required, remove threaded rod from coupler detail of PWA 85107 Fixture. Remove hydraulic cylinder, plate, and coupler. Remove center retainer and jaws.

(c) Using hoist, connect PWA 28657 Sling with two PWA 76156 Adapters to trunnion spools of PWA 85107 Fixture. Position fixture rear, smaller OD, end down onto stand.

(d) Adjust jackscrew of stand to support pilot ring (1002/2).

(e) For engines (Pre SB PW4ENG 72−176), remove the PWA 86379 Adapter Ring, if installed, from the pilot ring detail of PWA 85107 Fixture.

CAUTION: THE SCREWS THAT HOLD THE PWA 86379 ADAPTER RING MUST BE FLUSH WITH THE ADJACENT SURFACE OR DAMAGE TO THE PARTS CAN OCCUR.

(f) For engines (Post SB PW4ENG 72−176), install the PWA 86379 Adapter Ring, if not installed, on the pilot ring detail of PWA 85107 Fixture. Use six detail cap screws to hold the adapter ring.

NOTE: The turbine intermediate hub, (Post SB PW4ENG 72−176) has a shorter inner hub. The adapter is required with the fixture to set the axial run position on the HPT rotor.

(3) Set axial running position, 1.951 inch (49.555 mm) dimension on fixture.

(a) Lightly loosen eight hand knobs (1002/3) that hold the pilot ring.

(b) Use the jackscrew assembly of the stand to raise or lower the pilot ring of the fixture. Pull and release the T−handle (1002/4) to locate in the slot of the pilot ring.

(c) Secure pilot ring with hand knobs (1002/3).

(d) Pull T−handle locator pin to disengage it from pilot ring.

(e) Lower jackscrew of stand.

Subtask 72−52−00−430−052:

(4) Install PWA 85087 Eye into the front end of the turbine intermediate hub (1003/5). See Figure 1003.

(a) Loosen the three locknuts (1003/6). Turn the clamp assemblies (1003/7) to align the pins so that they point toward the center of the lifting hub (1003/4).

(b) Install the eye into the turbine hub. Turn the clamp assemblies into the turbine hub and align the pins so that they point toward the "LOCKED POSITION" marks on the lifting hub (1003/4). Hold the clamps in position and tighten the three locknuts (1003/6) to hold the eye on the turbine hub.

(5) Attach a hoist to PWA 85086 Arm. Remove the safety pin (1003/3) and knurled nut (1003/2) from the arm. Connect the arm to the lifting hole (1003/1) of the PWA 85087 Eye, and secure it with the knurled nut and safety pin.

CAUTION: SECOND STAGE TURBINE ROTORS THAT INCORPORATE TURBINE INTERMEDIATE HUB PN 50L902 REQUIRE INCREASED 2ND STAGE BLADE TIP CLEARANCE. REFERENCE SB PW4ENG 72−176.

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(6) Use the hoist to position the 2nd stage turbine rotor assembly onto PWA 85107 Fixture. Remove the eye and arm from the hub.

(7) Install details of PWA 85107 Fixture. See Figure 1004.

(a) Install four jaws (1004/9), with larger flange end down, through bore of hub. Engage upper flange of jaws with lip above hub bore. Lightly tighten detail modified screws to secure jaws.

(b) Lower the jack assembly of the stand.

(c) Align dowel pins between jaws and insert retainer (1004/2), with spring loaded pin end down into hub and center of jaws. Tighten the modified screws to attach the jaws.

(d) If required, thread plug (1004/7) into plate (1004/4). Align dowel pin with mating hole and install plate to pilot ring (1004/8). Secure plate with 12 screws.

(e) Insert coupler (1004/3), with threaded OD end down, through hub and hole in plug (1004/7).

(f) Install hydraulic cylinder (1004/5), with threaded−end up, onto coupler and attach it with a spacer and nut (1004/6).

(8) Install 2nd stage HPT airseal (1005/1) onto turbine intermediate hub. See Figure 1005.

(a) Locate channel formed by 2nd stage HPT covers (1005/6) and OD of turbine intermediate hub (1005/3).

(b) Install airseal into channel between hub OD and covers, with airseal overlap area (1005/5) positioned at any blade root (1005/4) location.

(c) Airseal must contact all hub OD (1005/2) locations, 82 places. Use PWA 86208 Crimper to crimp the airseal as necessary. Airseal may be crimped (1005/7) at any blade root (1005/2) location, as required, to provide hub OD contact.

Subtask 72−52−00−430−053:

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(9) Install turbine case and vane assembly onto PWA 85107 Fixture.

(a) Install two PWA 86023 Guide Pins into the threaded holes in each side of the outer ring segment details of PWA 85107 Fixture. See Figure 1004.

(b) With turbine case front flange (smaller ID) down, position two PWA 85247 Brackets 180 degrees apart between front and rear flanges of case. Position brackets with dowel pins protruding through bolthole in rear flange of case. Install seven screws through boltholes in front flange of turbine case and into brackets. Tighten screws.

(c) Connect PWA 88643 Sling or PWA 88673 Sling with two PWA 76154 Adapters to trunnion spools on PWA 85247 Brackets. Using hoist, lift assembly and trunnion to rear end (larger OD) down position. Lower assembly over rotor assembly and onto PWA 85107 Fixture.

(d) Disconnect hoist, sling and adapters. Allow brackets to remain in place.

(e) Remove PWA 86023 Guide Pins and secure the turbine case to the fixture with 26 screws and spacers.

Subtask 72−52−00−430−054:

(10) Position PWA 85634 Fixture on the workbench.

(11) Trunnion the front turbine hub to the front end down position. Use PWA 85087 Eye and PWA 86080Eye. See Figure 1006.

NOTE: See the following step to trunnion the hub with optional PWA 85083 Eye and PWA 85085 Plate.

(a) Loosen the three locknuts (1006/5) of PWA 85087 Eye. Turn the clamp assemblies (1006/9) to align the pins so that they point toward the center of the lifting hub.

(b) Install the eye into the turbine hub. Turn the clamp assemblies into the turbine hub and align the pins so that they point toward the "LOCKED POSITION" marks on the lifting hub (1006/4). Hold the clamps in position and tighten the three locknuts (1006/5) to hold the eye on the turbine hub.

(c) Attach a hoist to PWA 85086 Arm. Remove the safety pin (1006/3) and knurled nut (1006/2) from the arm. Connect the arm to the lifting hole (1006/1) of the PWA 85087 Eye, and secure it with the knurled nut and safety pin. Use the hoist to lift the assembly.

(d) Align the lifting hole of PWA 86080 Eye with the lifting hole of PWA 85087 Eye, and the posts (1006/6) with the mating holes in PWA 86080 Eye.

(e) Install the applicable (shorter) bolts (1006/7) to hold the PWA 86080 Eye.

(12) Optional, trunnion the front turbine hub to the front end down position. Use PWA 85083 Eye and PWA 85085 Plate. See Figure 1006.

(a) Rotate the outer sleeve (1006/12) and separate the outer sleeve from the inner ring (1006/10).

(b) Position the inner ring onto the turbine front hub with three jaws (1006/11) behind the step on the OD of the hub.

(c) Position the outer sleeve over the inner ring. Align the three dowel pins (1006/14) in the inner ring with the mating slots in the outer sleeve.

(d) Rotate the outer sleeve to position the dowel pins in the bottom of the slots. Align the scribed alignment marks (1006/13) on the outer sleeve with the scribed lines on the dowel pins.

(e) Attach a hoist to PWA 85086 Arm. Remove the safety pin and the knurled nut from the arm. Connect the arm to the lifting hole of the eye, and secure it to the eye with the knurled nut and safety pin. Use the hoist to lift the assembly.

(f) Position PWA 85085 Plate into the rear ID of the hub. Align the boltholes and thread two bolts (1006/15) into the detail nuts on the upper end of PWA 85083 Eye. Tighten the bolts to secure the plate.

(13) Attach a hoist to a second PWA 85086 Arm. Remove the safety pin and knurled nut from the arm. Connect the arm to the lifting hole of the eye or plate as applicable and secure it with the knurled nut and safety pin.

(14) Use the hoists to trunnion the hub to front end down position. Remove the lower arm and hoist. Lower the hub into the PWA 85634 Fixture. Remove the upper arm and hoist.

(15) Position 1st stage HPT seal (1007/1) into channel in upper OD of 2nd stage HPT airseal (1007/2) cut seal as required to obtain end gap of 0.025 − 0.225 inch (0.6 − 5.7 mm). Apply Beeswax P05−395 or Paraffin Wax Blend P05−396 or Adhesive P08−005 or Adhesive P08−010 or Adhesive P08−022, as required to maintain seal in position. Adhesive is not allowed outside of Area M as shown in Figure 1007.

(16) Attach a hoist with PWA 85086 Arm to PWA 86080 Eye or PWA 85085 Plate as applicable.

(17) Lift assembly and attach a second hoist and PWA 85086 Arm to PWA 85087 Eye or PWA 85083 Eye as applicable.

(18) Use both hoists to trunnion assembly to front, hub end up, position. Remove the lower hoist and arm and the PWA 86080 Eye or PWA 85085 Plate. Lower the hub onto a suitable support.

(19) Remove the hoist, arm, and lifting eye from the hub.

(20) Heat the front end of the hub as follows:

NOTE: Heating the turbine front hub is optional for hubs that are (Pre SB PW4ENG 72−451) but can be used based on the operators experience.

CAUTION: THE TEMPERATURE PROBE MUST TOUCH THE HUB OR OVERHEATING OF THE HUB CAN OCCUR.

(a) Put PWA 87487 Heater onto the front end of the hub. Connect PWA 29754 Heater Control to the heater and heat to 300°F (148.9°C).

(b) Remove the heater and control.

(21) Install PWA 85087 Eye or PWA 85083 Eye to the hub, and connect a hoist with PWA 85086 Arm to the eye as previously specified.

(22) Put the 1st stage turbine rotor assembly on the turbine intermediate hub. See Figure 1008.

(a) Connect a hoist with PWA 85086 Arm to the PWA 85087 Eye or PWA 85083 Eye.

(b) Use the hoist to position the turbine front hub (1008/2) over the turbine intermediate hub (1008/4). Position the rotor unbalance marks 180 degrees apart and lower the turbine front hub onto the turbine intermediate hub.

(c) Remove the hoist, arm, and eye.

(d) Align the mating turbine hub lock lugs (1008/9) on the ID of the turbine intermediate hub and the turbine front hub.

(e) Install the detail−4 spline of the PWA 85111 Align Fixture and align the splines with the splines of the intermediate hub.

(f) Align the key (1008/5) in the detail−3 flanged spline (1008/1) with the keyway in the detail−4 spline (1008/3). Install the flanged spline into the ID of the turbine front hub.

NOTE: You can turn the turbine front hub slightly to align the turbine hub lock lugs, and the key with the mating keyway. You must keep the rotational movement to a minimum.

(g) Press the flanged spline down until it touches the front face of the turbine front hub.

(h) Remove the flanged spline from the turbine front hub.

Subtask 72−52−00−430−055:

(23) Position the turbine hub lock (1008/8) over the mating lugs between the turbine front hub and intermediate hubs.

Subtask 72−52−00−430−056:

(24) Install the flanged spline (1008/1) into the turbine front hub and spline (1008/3).

(25) Remove the storage nut detail if installed and insert the rod (1008/7) through the center of both splines and thread it into the coupler (1008/6) of PWA 85107 Fixture.

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(26) Connect PWA 75028 Gage and PWA 29389 Hydraulic Pump or PWA 3755 Hydraulic Pump to hydraulic cylinder of PWA 85107 Fixture. Actuate hydraulic pump and apply load of 18,000 lbf. (80,068 N) to seat front and intermediate hubs.

NOTE: For a 30 ton hydraulic cylinder, a hydraulic pump output of 2,493 psig (17,188.6 kPa) will apply a load of 18,000 lbf. (80,068 N).

NOTE: For a 60 ton hydraulic cylinder, a hydraulic pump output of 1,358 psig (9,363.1 kPa) will apply a load of 18,000 lbf. (80,068 N).

Subtask 72-52-00-430-057:

(27) Using access holes in flanged spline detail, snap turbine hub lock into position over mating lugs in ID of hubs.

(28) Release hydraulic load. Unthread rod (1008/7) from coupler (1008/6). Remove flanged spline and spline.

(29) Insert rod through center of flanged splines. Thread storage nut detail onto end of rod to retain parts.

Subtask 72-52-00-430-058:

(30) Optional, install PWA 85112 Retaining Fixture.

(a) Rotate knurled nut to retract retainer details of fixture.

(b) Insert fixture into turbine hub ID and align retainer details of fixture with ID of turbine hub lock.

(c) Rotate knurled nut to expand fixture against turbine hub lock.

Subtask 72-52-00-430-061:

(31) If not previously accomplished, check 1st stage HPT blade tip clearance using feeler stock. Blade tip clearance must be in limits specified in 72-52-00, Inspection/Check-04 Task 72-52-00-990-004, Reference 1740.

Subtask 72-52-00-430-063:

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(32) Connect PWA 28657 Sling with two PWA 76156 Adapters to trunnion spools on PWA 85107 Fixture. Using hoist, lift assembly and trunnion to front (hub) end down position.

(33) Position the locating plug detail (triple step end up) into the center hub of PWA 87022 Stand.

(34) Lower high pressure turbine into stand, with turbine front hub on locating plug and front flange of turbine case on flange of stand.

(35) Adjust the center locating plug of the storage stand to maintain the running clearance of the turbine rotors. Secure the assembly in the stand.

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(36) Remove PWA 85107 Fixture from the HPT.

(37) Remove hoist, sling and adapters.

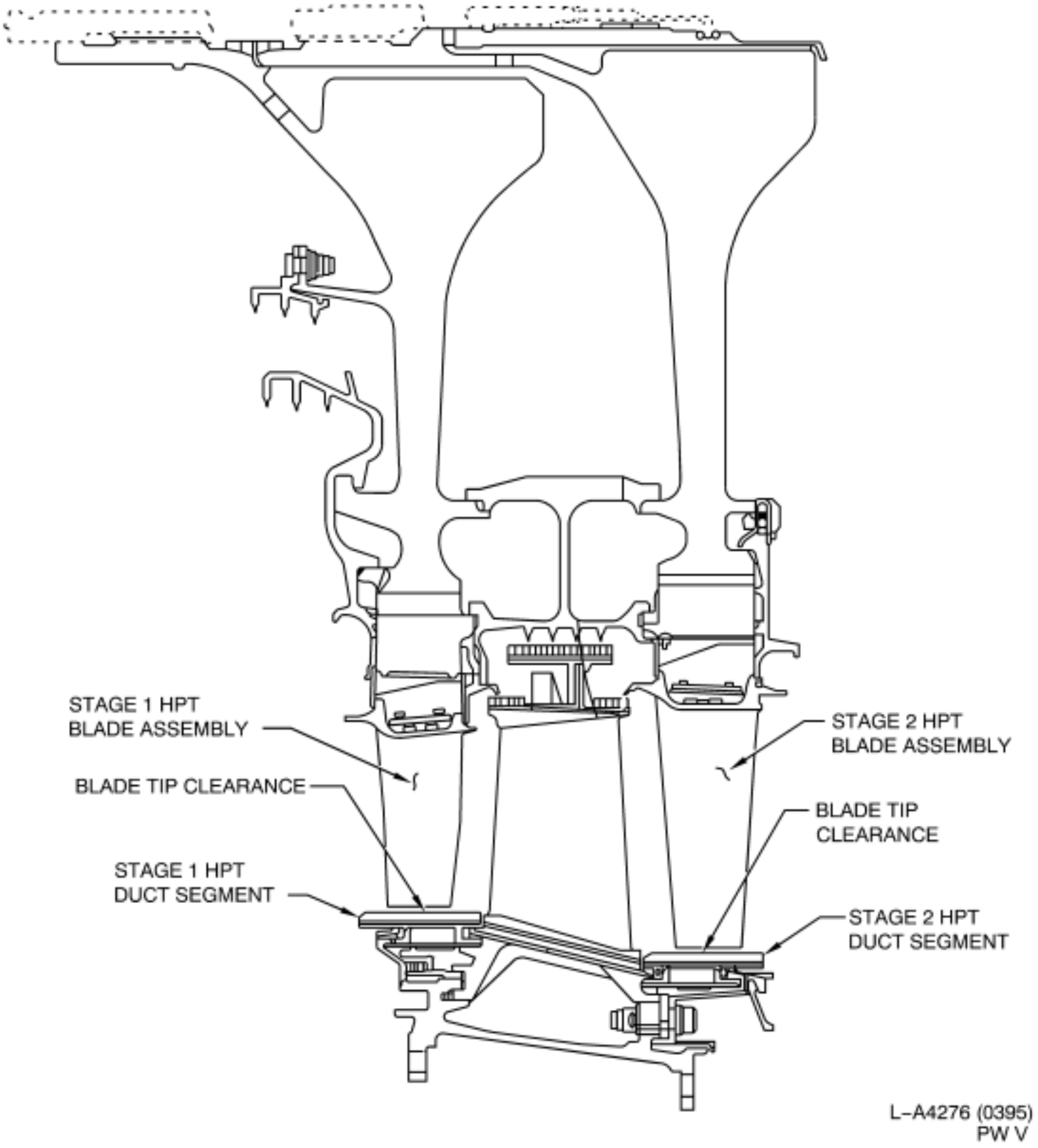
(38) If the turbine assembly will be moved while in PWA 87022 Stand, install PWA 86058 Retainer to prevent damage to the knife−edge seals. See Figure 1009.

(a) Put the retainer onto the rear flange of the turbine intermediate hub.

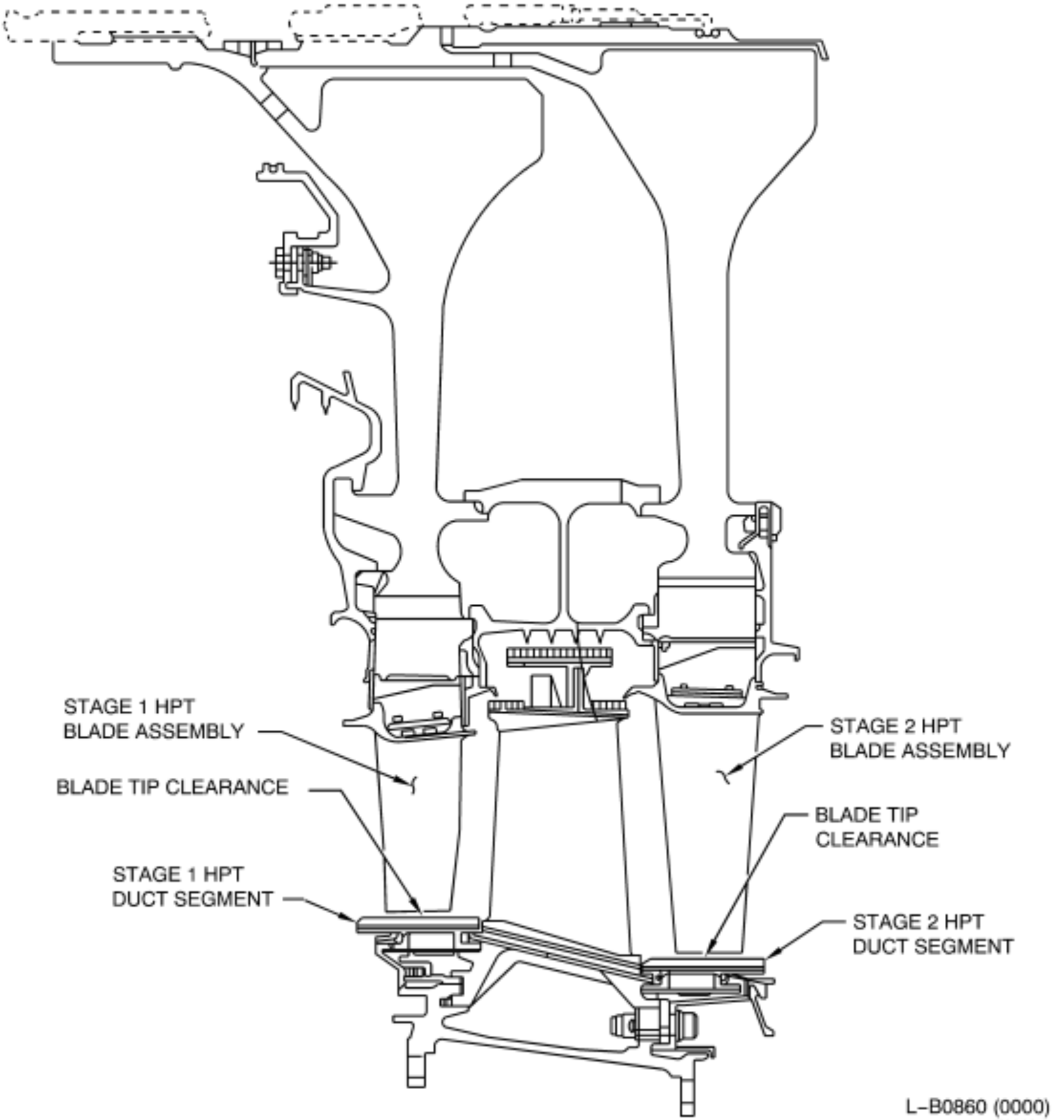
(b) Align the boltholes and secure the outer flange of the retainer with 14 detail screws and nuts.

Subtask 72−52−00−430−062:

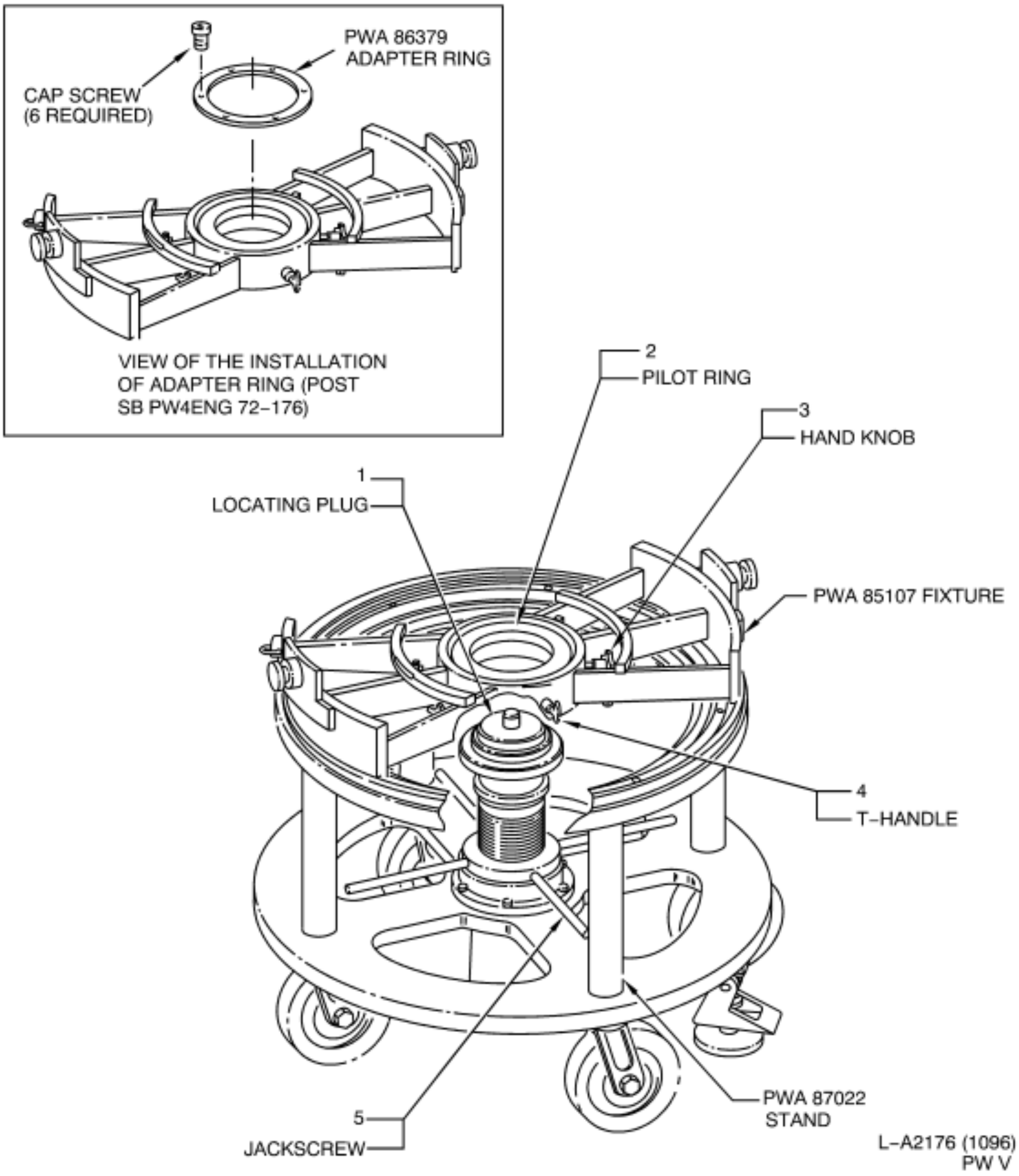
(39) If not previously accomplished, check 2nd stage HPT blade tip clearance using feeler stock. Blade tip clearance must be in limits specified in 72−52−00,
R Inspection/Check−04 Task 72−52−00−990−004, Reference
R 1741.


STAGE 1 HPT
BLADE ASSEMBLY
BLADE TIP CLEARANCE
STAGE 1 HPT
DUCT SEGMENT
STAGE 2 HPT
BLADE ASSEMBLY
BLADE TIP
CLEARANCE
STAGE 2 HPT
DUCT SEGMENT
L−A4276 (0395)
PW V

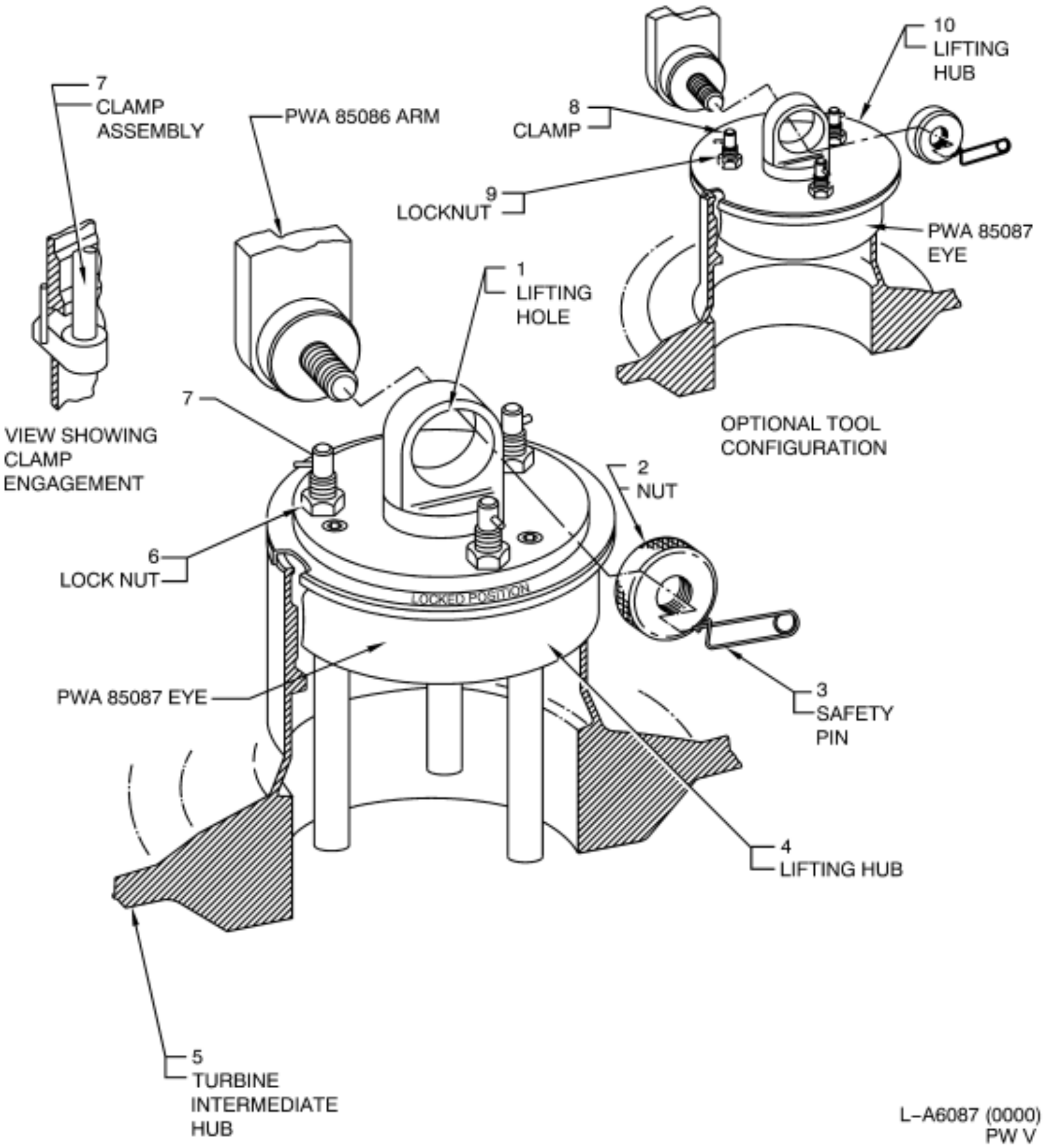
Blade Tip Clearance Check
Figure 1001 (Sheet 1)
(Task 72−52−00−400−001)


STAGE 1 HPT BLADE ASSEMBLY
BLADE TIP CLEARANCE
STAGE 1 HPT DUCT SEGMENT
STAGE 2 HPT BLADE ASSEMBLY
BLADE TIP CLEARANCE
STAGE 2 HPT DUCT SEGMENT
L-B0860 (0000)
PW V

Blade Tip Clearance Check
Figure 1001 (Sheet 2)
(Task 72-52-00-400-001)

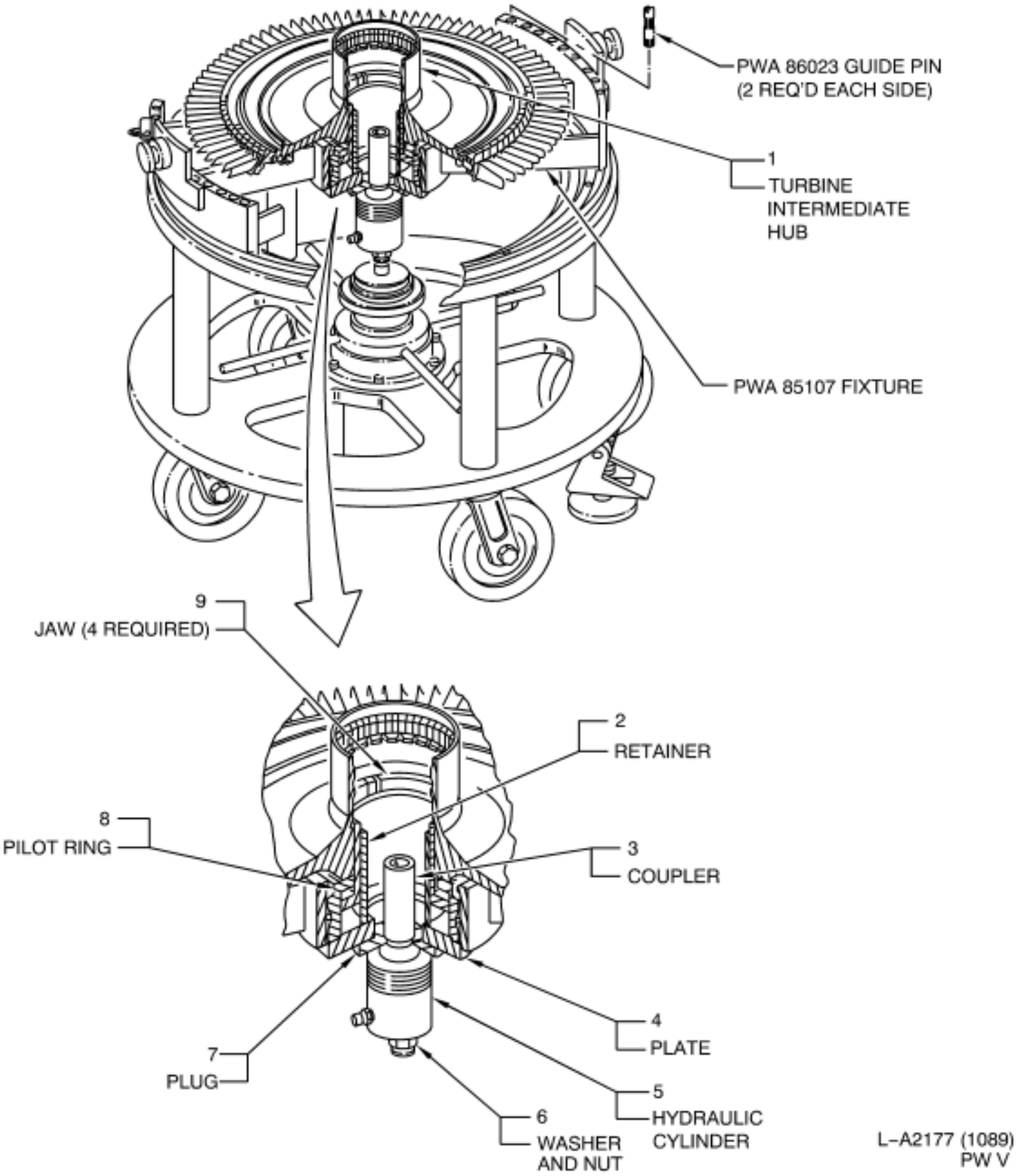

PWA 86379
ADAPTER RING
CAP SCREW
(6 REQUIRED)
VIEW OF THE INSTALLATION
OF ADAPTER RING (POST
SB PW4ENG 72-176)
2
PILOT RING
3
HAND KNOB
1
LOCATING PLUG
PWA 85107 FIXTURE
4
T-HANDLE
PWA 87022
STAND
5
JACKSCREW
L-A2176 (1096)
PW V

PWA 85107 Fixture Installation On PWA 87022 Stand
Figure 1002
(Task 72-52-00-400-001)

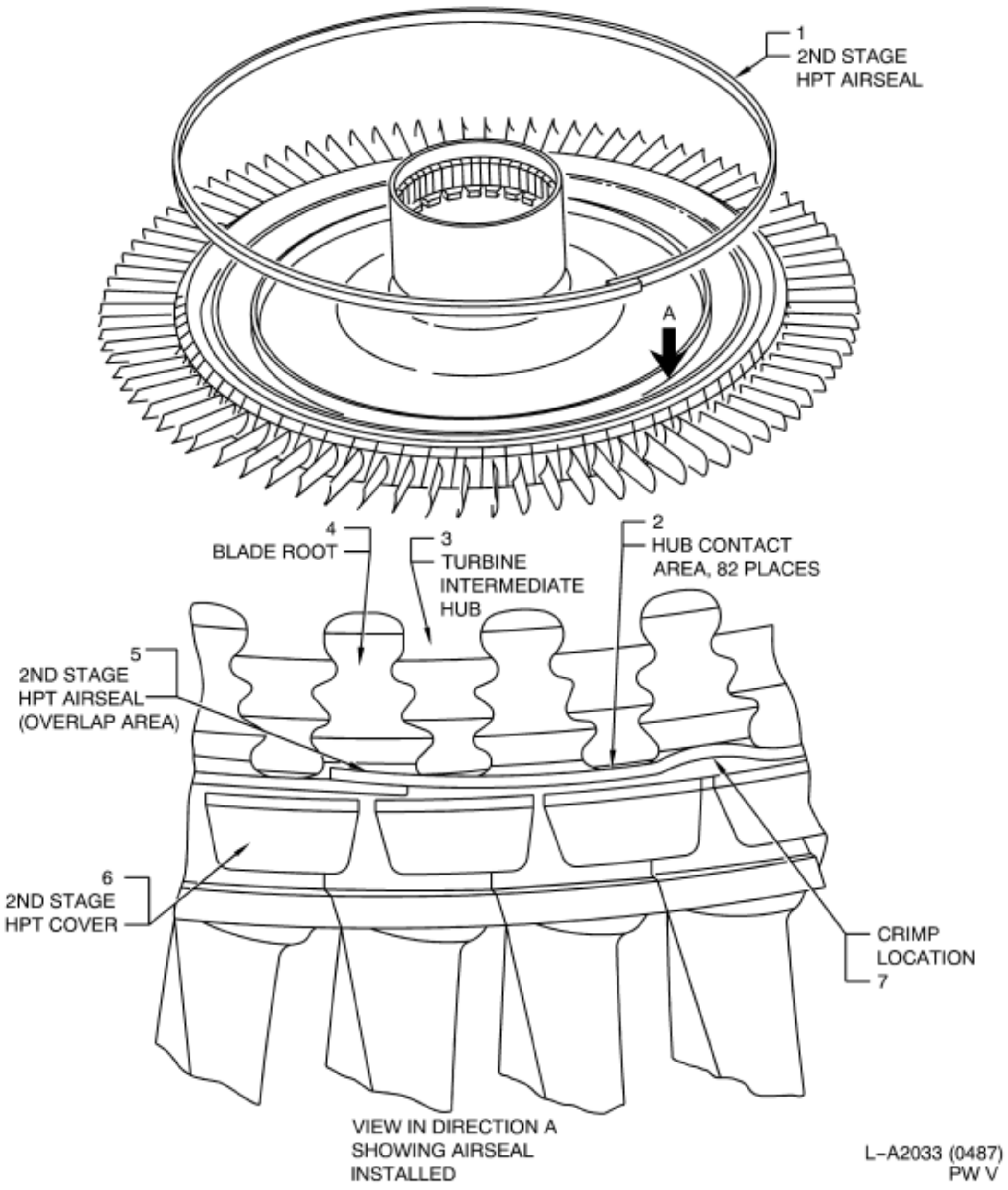

7 CLAMP ASSEMBLY
PWA 85086 ARM
8 CLAMP
10 LIFTING HUB
9 LOCKNUT
PWA 85087 EYE
1 LIFTING HOLE
7
VIEW SHOWING CLAMP ENGAGEMENT
OPTIONAL TOOL CONFIGURATION
2 NUT
6 LOCK NUT
LOCKED POSITION
PWA 85087 EYE
3 SAFETY PIN
4 LIFTING HUB
5 TURBINE INTERMEDIATE HUB
L-A6087 (0000)
PW V

Second Stage Turbine Rotor Assembly Installation
Figure 1003
(Task 72-52-00-400-001)

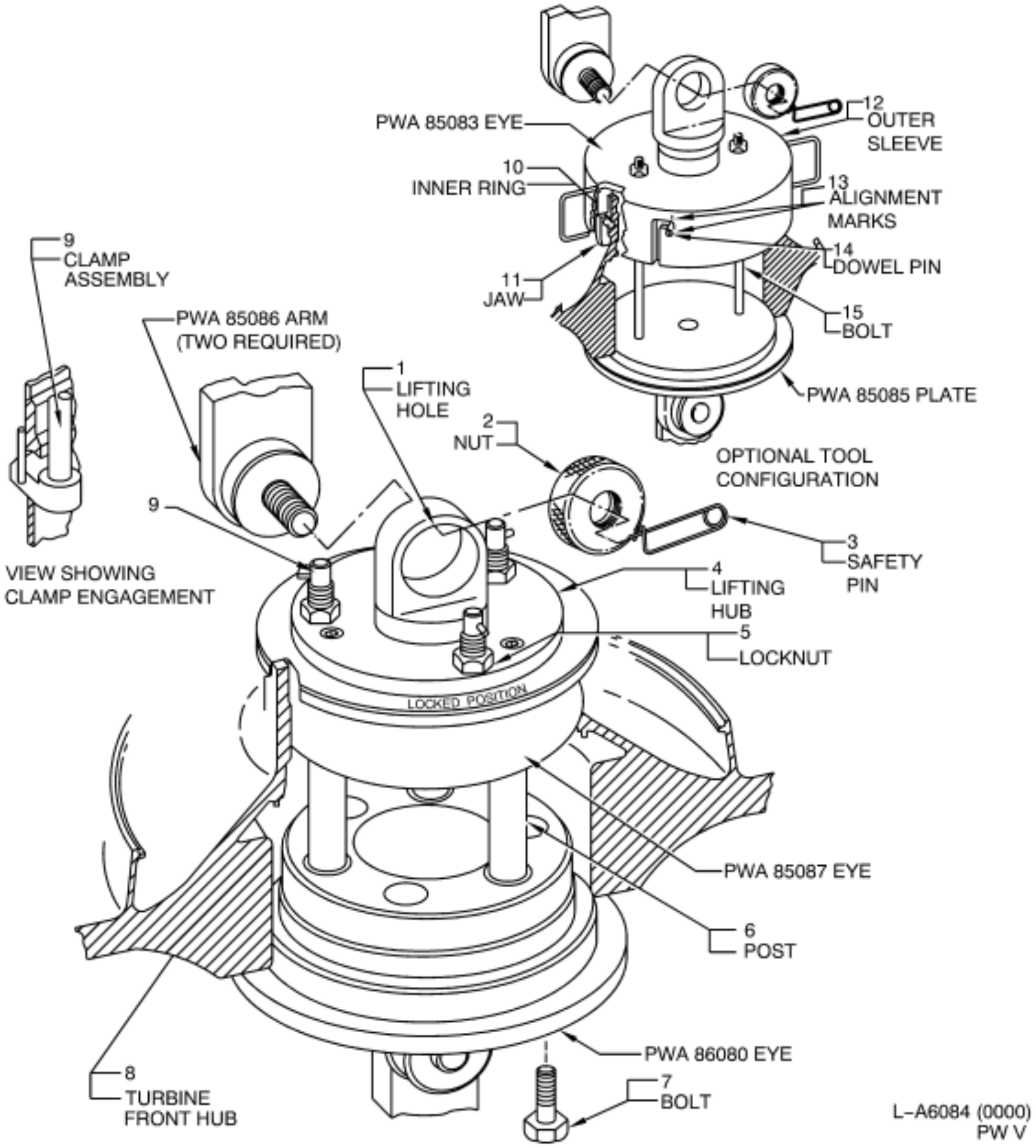
HIGH PRESSURE TURBINE (HPT) − ASSEMBLY−01


PWA 86023 GUIDE PIN
(2 REQ'D EACH SIDE)
1
TURBINE INTERMEDIATE HUB
PWA 85107 FIXTURE
9
JAW (4 REQUIRED)
2
RETAINER
8
PILOT RING
3
COUPLER
4
PLATE
7
PLUG
5
HYDRAULIC CYLINDER
6
WASHER AND NUT
L−A2177 (1089)
PW V

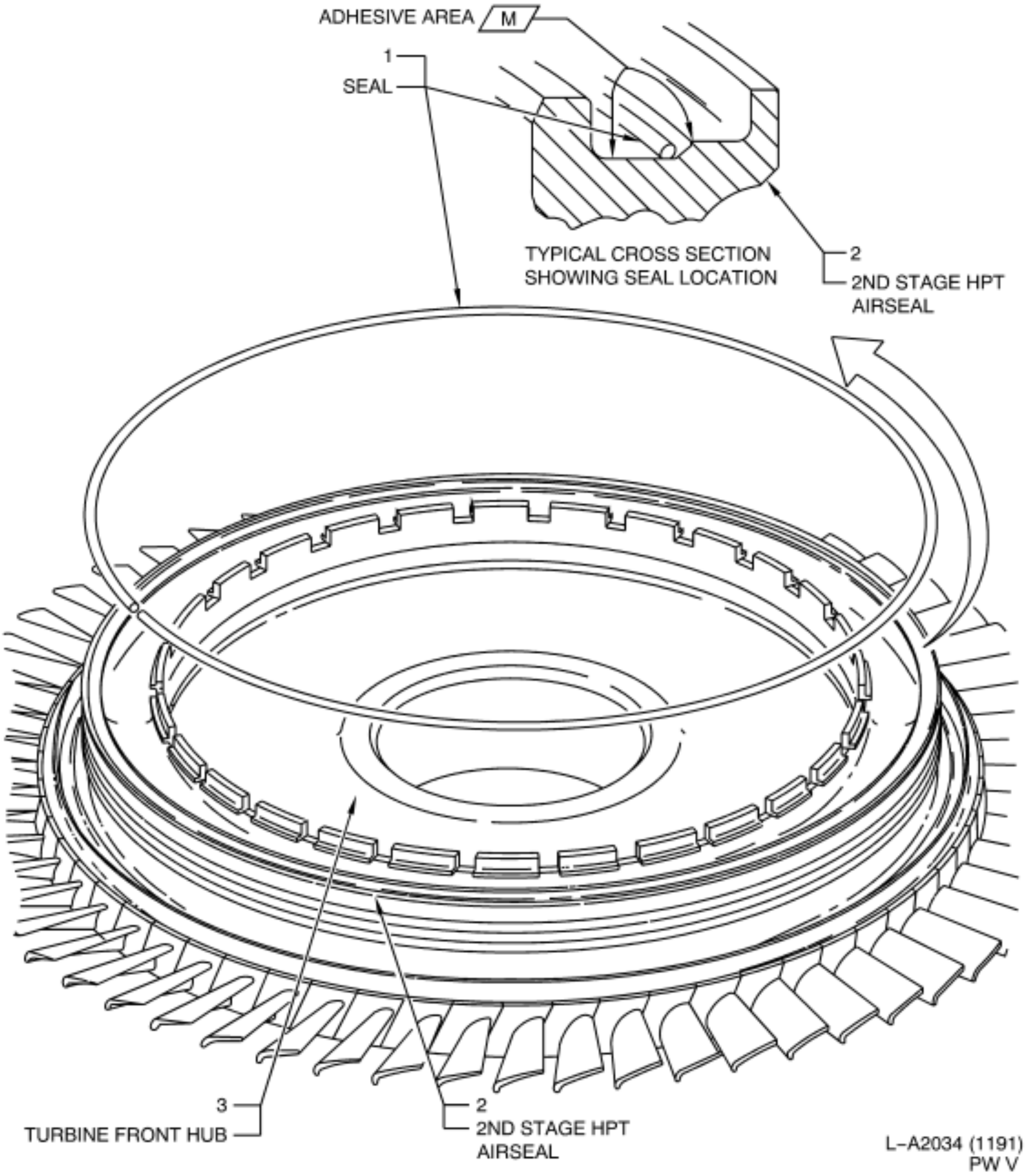
Second Stage Turbine Rotor Installation On Build Fixture
Figure 1004
(Task 72−52−00−400−001)


1
2ND STAGE
HPT AIRSEAL
A
4
BLADE ROOT
3
TURBINE
INTERMEDIATE
HUB
2
HUB CONTACT
AREA, 82 PLACES
5
2ND STAGE
HPT AIRSEAL
(OVERLAP AREA)
6
2ND STAGE
HPT COVER
CRIMP
LOCATION
7
VIEW IN DIRECTION A
SHOWING AIRSEAL
INSTALLED
L-A2033 (0487)
PW V

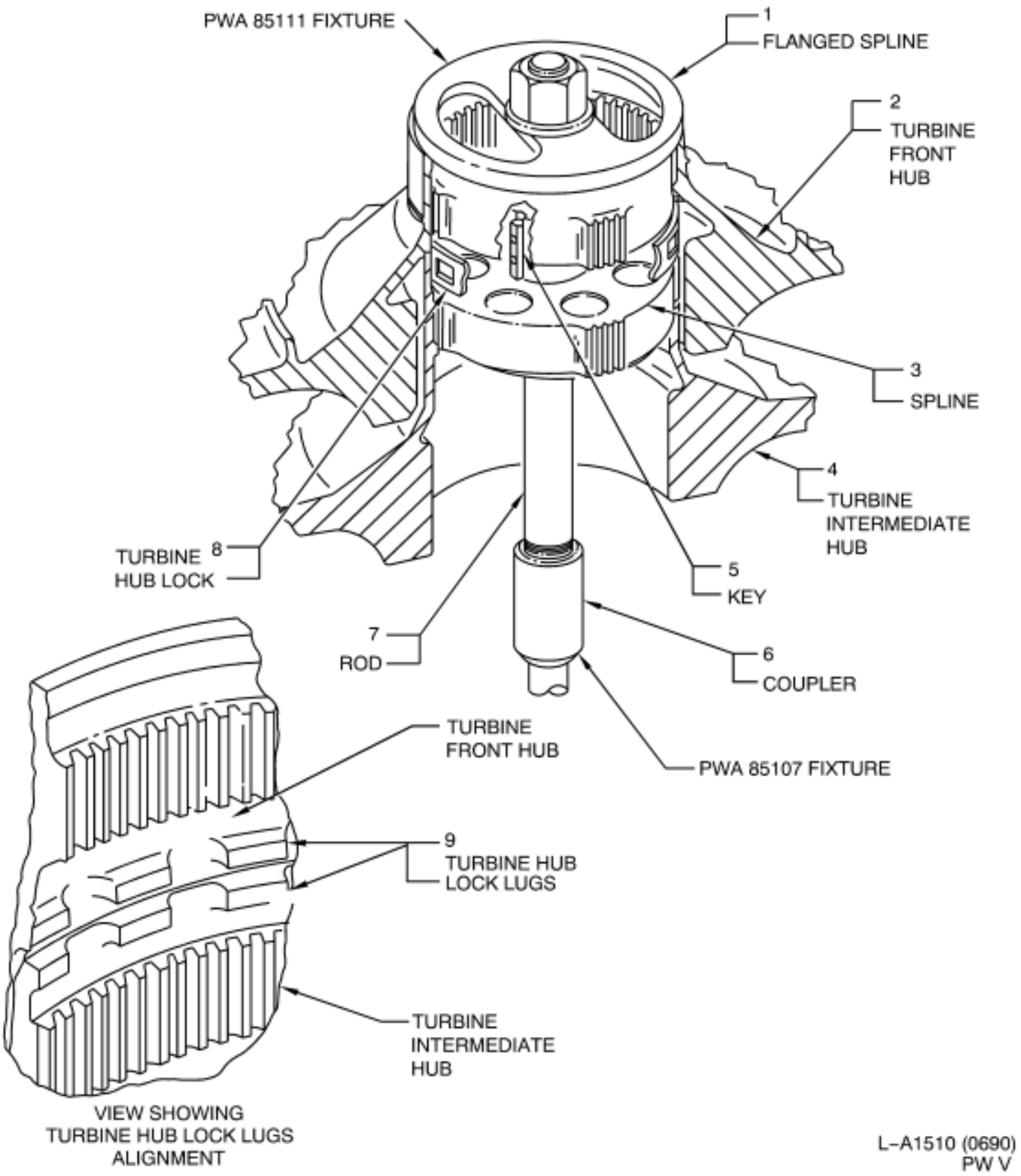
Second Stage HPT Airseal Installation
Figure 1005
(Task 72-52-00-400-001)


PWA 85083 EYE
12 OUTER SLEEVE
10 INNER RING
13 ALIGNMENT MARKS
14 DOWEL PIN
11 JAW
15 BOLT
PWA 85085 PLATE
9 CLAMP ASSEMBLY
PWA 85086 ARM (TWO REQUIRED)
1 LIFTING HOLE
2 NUT
OPTIONAL TOOL CONFIGURATION
9
3 SAFETY PIN
VIEW SHOWING CLAMP ENGAGEMENT
4 LIFTING HUB
5 LOCKNUT
LOCKED POSITION
PWA 85087 EYE
6 POST
PWA 86080 EYE
7 BOLT
8 TURBINE FRONT HUB
L−A6084 (0000)
PW V

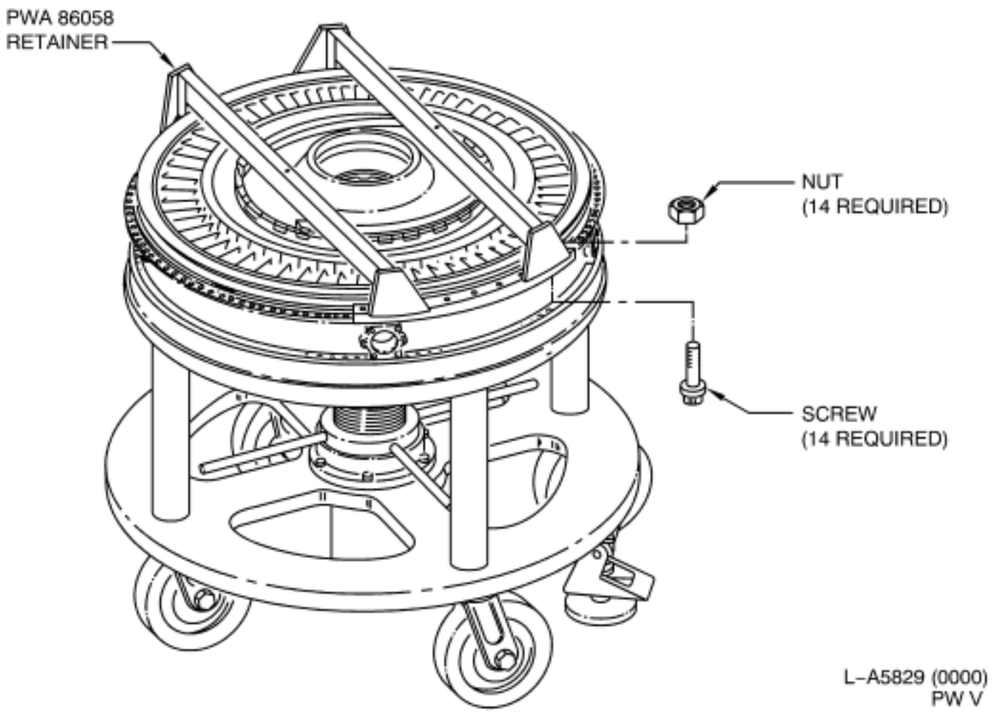
Turbine Front Hub Trunnioning
Figure 1006
(Task 72−52−00−400−001)


ADHESIVE AREA
M
1
SEAL
TYPICAL CROSS SECTION
SHOWING SEAL LOCATION
2
2ND STAGE HPT
AIRSEAL
3
TURBINE FRONT HUB
2
2ND STAGE HPT
AIRSEAL
L-A2034 (1191)
PW V

First Stage HPT Seal Installation
Figure 1007
(Task 72-52-00-400-001)


PWA 85111 FIXTURE
1
FLANGED SPLINE
2
TURBINE FRONT HUB
3
SPLINE
4
TURBINE INTERMEDIATE HUB
TURBINE HUB LOCK
8
5
KEY
7
ROD
6
COUPLER
TURBINE FRONT HUB
PWA 85107 FIXTURE
9
TURBINE HUB LOCK LUGS
TURBINE INTERMEDIATE HUB
VIEW SHOWING TURBINE HUB LOCK LUGS ALIGNMENT
L-A1510 (0690)
PW V

High Pressure Turbine Assembly
Figure 1008
(Task 72-52-00-400-001)


PWA 86058
RETAINER
NUT
(14 REQUIRED)
SCREW
(14 REQUIRED)
L−A5829 (0000)
PW V

PWA 86058 Retainer Installation
Figure 1009
(Task 72−52−00−400−001)

Previous Pageblock Return to Previous Menu Next Pageblock

HIGH PRESSURE TURBINE (HPT) - STORAGE-01

Task 72-52-00-530-001:

1. Pack High Pressure Turbine

A. Equipment And Materials Required

Special Tools:

PWA 28657	Sling
PWA 76156	Adapter
PWA 85107	Fixture

Consumable Materials:

Item No. Designation

NOTE: The following items not normally supplied by container manufacturer.

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-156	Seal, Lead
P15-001	Dehydrator

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lockwire, MS20995-C41		

Packaging Equipment:

NOTE: The following table lists assembly number, dimensions, and gross weight for high pressure turbine shipping container available from Pratt & Whitney. Further information can be obtained from:

Commercial Parts Support
Commercial Engine Business
Pratt & Whitney
400 Main St
East Hartford, CT 06108

Container Assembly No.	Dimensions	Approximate Gross Weight Including High Pressure Turbine
P60033	67 Inch (1701.800 mm) x 67 Inch (1701.800 mm) x 60.5 Inch (1536.700 mm)	1,592 lbs (722.12 Kg)

B. Procedure

(1) If necessary, remove nuts and screws that attach PWA 86058 Retainer to the rear flange of the turbine case. Remove the retainer.

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(2) Install PWA 85107 Fixture onto high pressure turbine. See Figure 1201.

(a) If installed, remove rod and attached details, guide pilot, clamp and nuts from coupler. Remove nut and hydraulic cylinder. Remove plug.

(b) Remove 12 screws (1201/10) securing plate (1201/1) to piloting ring (1201/7) of fixture. Remove retainer (1201/9) and jaws (1201/2).

(c) For engines (Pre SB PW4ENG 72−176), remove the PWA 86379 Adapter Ring, if installed, from the pilot ring detail of PWA 85107 Fixture.

CAUTION: THE SCREWS THAT HOLD THE PWA 86379 ADAPTER RING MUST BE FLUSH WITH THE ADJACENT SURFACE OR DAMAGE TO THE PARTS CAN OCCUR.

(d) For engines (Post SB PW4ENG 72−176), install the PWA 86379 Adapter Ring, if not installed, on the pilot ring detail of PWA 85107 Fixture. Use six detail cap screws to hold the adapter ring.

NOTE: The turbine intermediate hub, (Post SB PW4ENG 72−176) has a shorter inner hub. The adapter is required with the fixture to set the axial run position on the HPT rotor.

(e) Loosen eight hand knobs (1201/6) at center hub (1201/8) of fixture and move piloting ring (1201/7) rearward until it is flush with or above surface of center hub. Tighten eight hand knobs.

(f) Thread three .500−13 inch eyebolts into tapped holes in rear center hub of fixture. Attach standard three cable sling to eyebolts and position fixture onto rear of high pressure turbine.

(g) Secure outer flanges of fixture to high pressure turbine case using 26 detail screws (1201/5) and spacers (1201/4). Remove hoist and sling.

(h) Loosen eight hand knobs (1201/6) at center hub and allow piloting ring (1201/7) to slowly seat onto turbine rear hub. Tighten eight hand knobs to secure hub.

(i) Position four jaws (1201/2) into center of fixture, locating lip of jaws in ID cutout of turbine hub. Lightly tighten screws (1201/3) to secure jaws.

(j) Install retainer (1201/9) into center of fixture to retain four jaws (1201/2). Tighten four screw details of jaws.

(k) Install plate (1201/1) to pilot ring (1201/7) and secure with 12 screws (1201/10).

(3) Using hoist, attach PWA 28657 Sling with two PWA 76156 Adapters to trunnion spools of fixture. Take up slack on sling cables.

(4) Remove top half of P60033 Container Assembly.

(a) Actuate relief valve on side of container to release pressure before opening container.

(b) Loosen nuts securing container flange bolts, and rotate bolts 1/4 turn.

(c) Connect suitable sling to lifting rings on top cover of container. Using hoist, remove top cover of container.

(5) Using hoist position turbine, front end down, over P60033 Container Assembly. See Figure 1202.

(6) Align centers of bosses on turbine case with arrows marked on OD of lower support detail of container. Align dowel pins in support with boltholes in case.

(7) If installed, remove PWA 85112 Retaining Fixture from ID of turbine hubs.

(8) Ensure that segmented rubber retainer is in position in center of container lower support.

(9) Lower turbine onto lower support. Ensure that segmented rubber retainer in center of lower support pilots in ID of turbine front hub.

(10) Secure front flange of case to lower support with 26 flat washers (1202/8), lockwashers (1202/7) and cap screws (1202/6).

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(11) Remove PWA 85107 Fixture from turbine.

  (a) Remove 12 screws (1201/10) securing plate (1201/1) to fixture. Remove plate.

  (b) Remove retainer (1201/9) from ID of fixture.

  (c) Loosen screws (1201/3) and carefully remove four jaws (1201/2) from ID of fixture.

  (d) Using hoist and suitable sling, remove fixture from rear of turbine.

(12) Carefully install upper support (1202/4), into ID of turbine intermediate hub and seat on ID lip of hub.

(13) Secure upper support to lower support with bolt (1202/1), threads lubricated with Engine Oil P03−001, lockwasher (1202/2) and flat washer (1202/3) under bolthead. Torque bolt to 850 − 950 lb−in. (96.037 − 107.336 N.m).

(14) Connect hoist to lifting rings on top cover of container, and position top cover over bottom of container. Align dowel pins with dowel pin holes and lower top cover onto bottom half of container.

(15) Secure container using detail bolts and nuts.

(16) Install lockwire, MS20995−C41 through holes in cover flange and attach Lead Seal P05−156. Using bull dog pliers, compress seal on wire and cut off excess wire.

(17) Inspect condition of Dessicant P15−001 and replace as required.

Task 72−52−00−540−001:

2. Unpack High Pressure Turbine

A. Equipment And Materials Required

Special Tools:

PWA 28657	Sling
PWA 76156	Adapter
PWA 85107	Fixture
PWA 85112	Fixture, Retaining
PWA 87022	Stand, Storage

B. Procedure

(1) Break and remove lockwire and seal from container flange.

(2) Remove top half of P8320 Container Assembly.

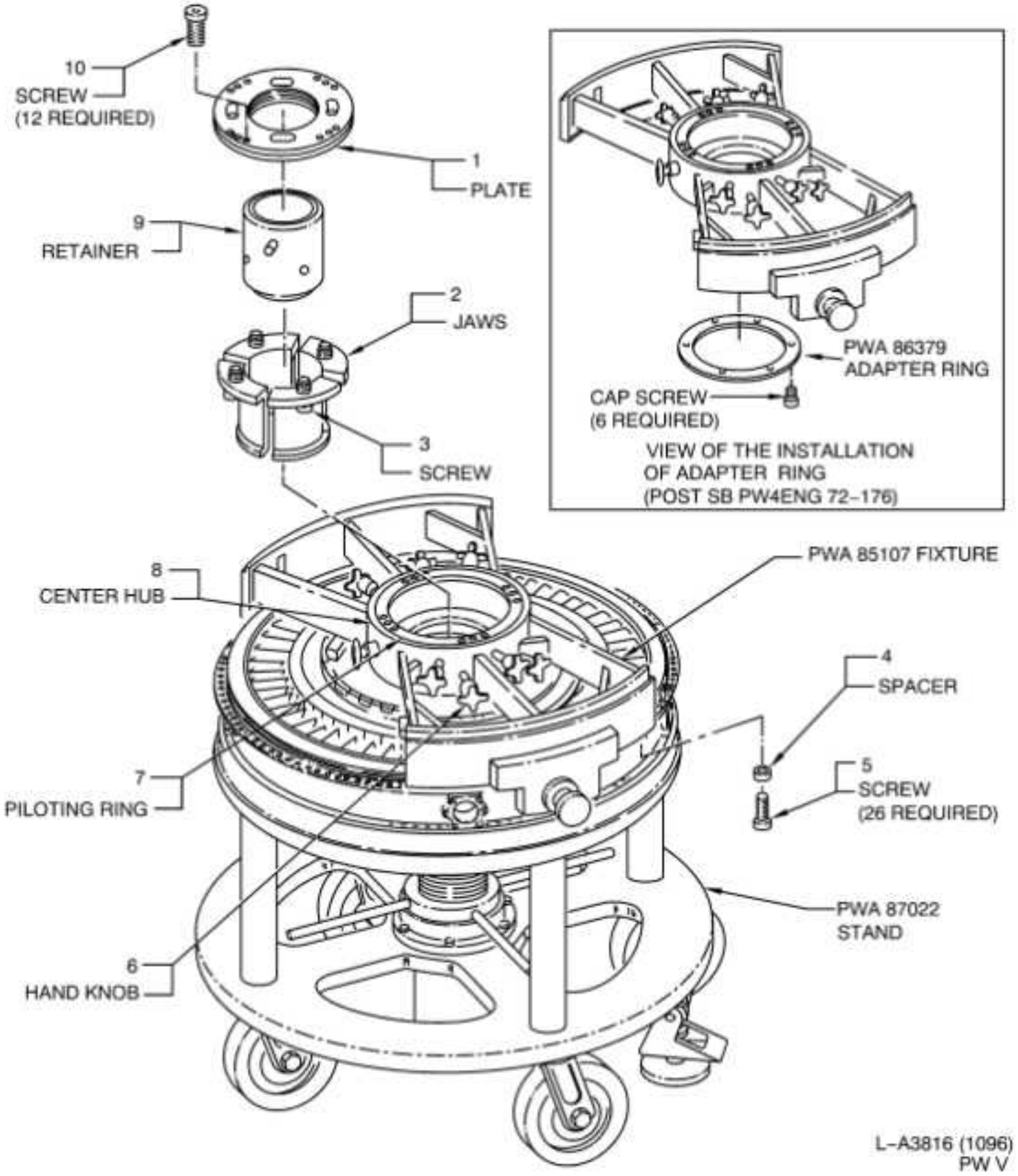
  (a) Actuate relief valve on side of container to release pressure before opening container.

  (b) Loosen nuts securing container flange bolts, and rotate bolts 1/4 turn.

  (c) Connect suitable sling to lifting rings on top cover of container. Using hoist, remove top cover of container.

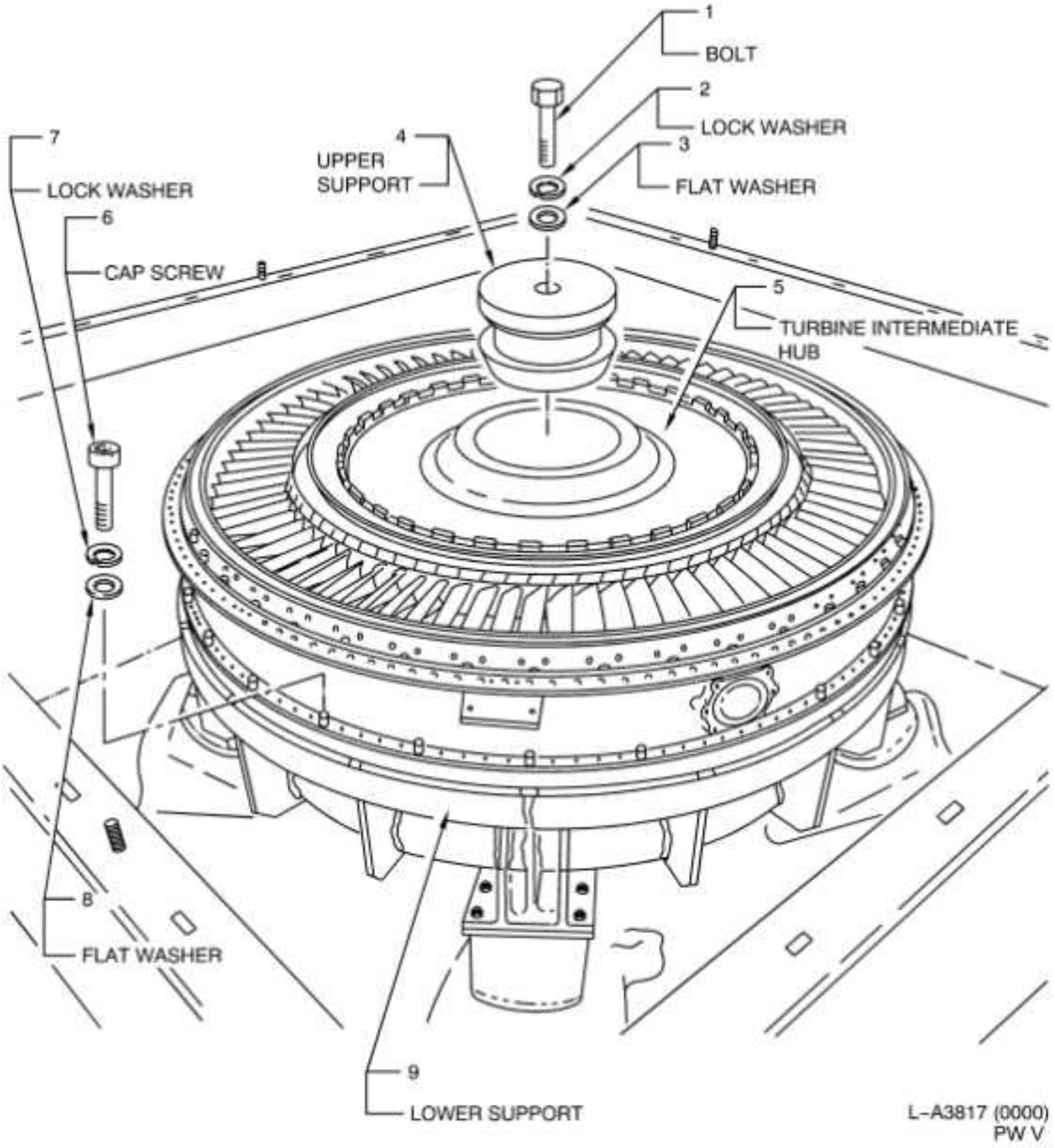
(3) Remove bolt (1202/1), lockwasher (1202/2) and flat washer (1202/3) securing upper support (1202/4) to lower support (1202/9) of container.

(4) Remove 26 cap screws (1202/6), lockwashers (1202/7) and flat washers (1202/8) securing turbine case to lower support.


10
SCREW
(12 REQUIRED)
1
PLATE
9
RETAINER
2
JAWS
3
SCREW
PWA 86379
ADAPTER RING
CAP SCREW
(6 REQUIRED)
VIEW OF THE INSTALLATION
OF ADAPTER RING
(POST SB PW4ENG 72-176)
PWA 85107 FIXTURE
8
CENTER HUB
4
SPACER
5
SCREW
(26 REQUIRED)
7
PILOTING RING
PWA 87022
STAND
6
HAND KNOB
L-A3816 (1096)
PW V

Handling Fixture Installation
Figure 1201
(Task 72-52-00-530-001)

HIGH PRESSURE TURBINE (HPT) − STORAGE−01


1
BOLT
2
LOCK WASHER
3
FLAT WASHER
4
UPPER SUPPORT
5
TURBINE INTERMEDIATE HUB
6
CAP SCREW
7
LOCK WASHER
8
FLAT WASHER
9
LOWER SUPPORT
L−A3817 (0000)
PW V

Pack And Unpack High Pressure Turbine
Figure 1202
(Task 72−52−00−530−001)

CAUTION: THE INNER PILOTING RING OF THE PWA 85107 FIXTURE DOES NOT HAVE A POSITIVE STOP FEATURE AND CAN FALL ACCIDENTALLY FROM THE FIXTURE.

(5) Install PWA 85107 Fixture onto high pressure turbine. See Figure 1201.

(a) If installed, remove rod and attached details, guide pilot, clamp, and nuts from coupler. Remove nut and hydraulic cylinder. Remove plug.

(b) Remove 12 screws (1201/10) securing plate (1201/1) to piloting ring (1201/7) of fixture. Remove retainer (1201/9) and jaws (1201/2).

(c) Loosen eight hand knobs (1201/6) at center hub (1201/8) of fixture and move piloting ring (1201/7) rearward until it is flush with or above surface of center hub. Tighten eight hand knobs.

(d) Thread three .500−13 inch eyebolts into tapped holes in rear center hub of fixture. Attach standard three cable sling to eyebolts and position fixture onto rear of high pressure turbine.

(e) Secure outer flanges of fixture to high pressure turbine case using 26 detail screws (1201/5) and spacers (1201/4). Remove hoist and sling.

(f) Loosen eight hand knobs (1201/6) at center hub and allow piloting ring (1201/7) to slowly seat onto turbine rear hub. Tighten eight hand knobs to secure hub.

(g) Position four jaws (1201/2) into center of fixture, locating lip of jaws in ID cutout of turbine hub. Lightly tighten screws (1201/3) to secure jaws.

(h) Install retainer (1201/9) into center of fixture to retain four jaws (1201/2). Tighten four screw details of jaws.

(i) Install plate (1201/1) to pilot ring (1201/7) and secure with 12 screws (1201/10).

(6) Using hoist, attach PWA 28657 Sling with two PWA 76156 Adapter to trunnion spools of fixture. Take up slack on sling cables.

(7) Using hoist, remove turbine from container. Ensure that segmented rubber retainer remains in position in center of container lower support.

NOTE: Do not store upper support (1202/4) in position in segmented rubber segment in center of container assembly or distortion of rubber segments may occur.

(8) Place turbine front end down into PWA 87022 Storage Stand. See Figure 1201.

(9) Adjust center plug of storage stand to maintain running distance (clearance) of turbine rotors and secure assembly in stand.

(10) Remove fixture from turbine.

- (a) Remove 12 screws (1201/10) securing plate (1201/1) to piloting ring (1201/7).
- (b) Remove retainer (1201/9) from ID of fixture.
- (c) Loosen screws (1201/3) and carefully remove four jaws (1201/2) from ID turbine intermediate hub.
- (d) Remove 26 screws (1201/5) and spacers (1201/4) securing fixture to rear flange of turbine case.

(11) Install PWA 85112 Retaining Fixture.

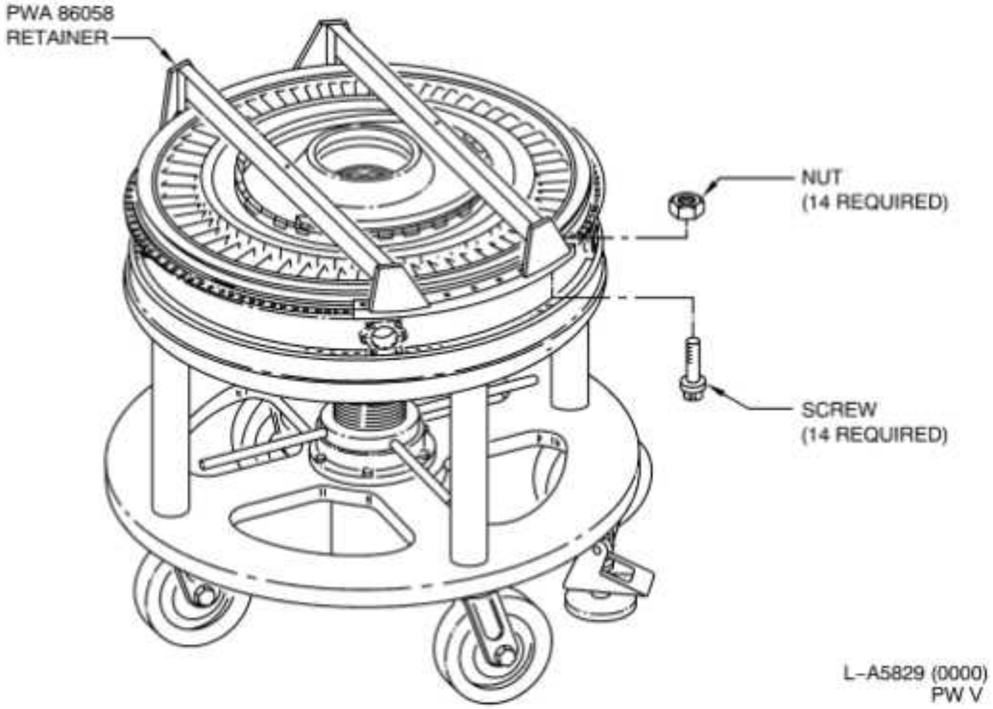
- (a) Rotate knurled nut to retract retainer details of fixture.
- (b) Insert fixture into turbine hub ID and align retainer details of fixture with ID of turbine hub lock.
- (c) Rotate knurled nut to expand fixture against turbine hub lock.

(12) If the turbine assembly will be moved while in PWA 87022 Stand, install PWA 86058 Retainer to prevent damage to the knife−edge seals. See Figure 1203.

(a) Put the retainer onto the rear flange of the turbine intermediate hub.

(b) Align the boltholes and secure the outer flange of the retainer with 14 detail screws and nuts.

HIGH PRESSURE TURBINE (HPT) − STORAGE−01


PWA 86058
RETAINER
NUT
(14 REQUIRED)
SCREW
(14 REQUIRED)
L−A5829 (0000)
PW V

PWA 86058 Retainer Installation
Figure 1203
(Task 72−52−00−540−001)

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Pratt & Whitney

PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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Task 72-52-01-040-001:

1. Disassemble 1st Stage Turbine Rotor Assembly

A. Equipment And Materials Required

Special Tools:

	PWA 25672	Control, Heater (Optional to PWA 29754)
	PWA 29754	Control, Heater
R R	PWA 78176	Socket, Special (First Stage HPT Airseal Bolts, Post SB PW4ENG 72-504)
	PWA 85083	Eye, Handling (Optional to PWA 85087)
	PWA 85085	Plate, Trunnioning (Optional to PWA 86080)
	PWA 85086	Arm, Lifting (Two Necessary)
	PWA 85087	Eye, Lifting
	PWA 85090	Fixture, Remove (Engines without SB PW4ENG 72-487)
	PWA 85091	Heater, Electrical
	PWA 85093	Puller, Knocker
	PWA 85094	Puller, Mechanical
	PWA 85634	Fixture, Support
	PWA 86080	Eye, Lifting
	PWA 86505	Wrench, Ratchet (Optional)
	PWA 87112	Fixture, Remove (Engines with SB PW4ENG 72-487 and all Phase III Engines)
	PWA 87121	Ring, Adapter (Optional to PWA 85634)
	PWA 87390	Jackscrew Puller (For engines with 1st Stage HPT (inner) airseal)
	PWA 87751	Adapter, Torque

Consumable Materials:

Item No.	Designation
P05-102	Ice, Dry

B. Procedure

(1) Trunnion the front turbine hub to the front end down position. Use PWA 85087 and PWA 86080 Eye. See Figure 501.

NOTE: See the following step to trunnion the hub with optional PWA 85083 Eye and PWA 85085 Plate.

(a) Loosen the three locknuts (501/5) of PWA 85087 Eye. Turn the clamp assemblies (501/9) to align the pins so that they point toward the center of the lifting hub (501/4).

(b) Install the eye into the turbine hub. Turn the clamp assemblies into the turbine hub and align the pins so that they point toward the "LOCKED POSITION" marks on the lifting hub (501/4). Hold the clamps in position and tighten the three locknuts (501/5) to hold the eye on the turbine hub.

(c) Attach a hoist to PWA 85086 Arm. Remove the safety pin (501/3) and knurled nut (501/2) from the arm. Connect the arm to the lifting hole (501/1) of the PWA 85087 Eye, and secure it with the knurled nut and safety pin. Use the hoist to lift the assembly.

(d) Align the lifting hole of PWA 86080 Eye with the lifting hole of PWA 85087 Eye, and the posts (501/6) with the mating holes in PWA 86080 Eye.

(e) Install the applicable (shorter) bolts (501/7) to hold the PWA 86080 Eye.

(f) Attach a hoist to a second PWA 85086 Arm. Remove the safety pin and knurled nut from the arm. Connect the arm to the PWA 86080 Eye and secure it with the knurled nut and safety pin.

(g) Trunnion the assembly to the front end down position.

(2) Optional, trunnion the front turbine hub to the front end down position. Use PWA 85083 Eye and PWA 85085 Plate. See Figure 501.

(a) Rotate the outer sleeve (501/12) and separate the outer sleeve from the inner ring (501/10).

(b) Position the inner ring onto the turbine front hub with three jaws (501/11) behind the step on the OD of the hub.

(c) Position the outer sleeve over the inner ring. Align the three dowel pins (501/14) in the inner ring with the mating slots in the outer sleeve.

(d) Rotate the outer sleeve to position the dowel pins in the bottom of the slots. Align the scribed alignment marks (501/13) on the outer sleeve with the scribed lines on the dowel pins.

R
R

(e) Attach a hoist to PWA 85086 Arm. Remove the safety pin and the knurled nut from the arm. Connect the arm to the lifting hole of the eye, and secure it to the eye with the knurled nut and safety pin. Use the hoist to lift the assembly.

(f) Position PWA 85085 Plate into the rear ID of the hub. Align the boltholes and thread two bolts (501/15) into the detail nuts on the upper end of PWA 85083 Eye. Tighten the bolts to secure the plate.

(g) Attach a hoist to a second PWA 85086 Arm. Remove the safety pin and knurled nut from the arm. Connect the arm to the lifting hole of the plate, and secure it with the knurled nut and safety pin.

(h) Trunnion the assembly to the front end down position.

(3) Remove the lower hoist and PWA 85086 Arm. Lower the assembly into PWA 85634 Fixture.

(4) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the lower hoist and the PWA 85086 Arm. Lower the assembly into the PWA 87121 Adapter Ring.

(5) Remove the upper lifting arm and hoist.

(6) Use PWA 85094 Puller to remove the 2nd stage HPT airseal (502/6). See Figure 502.

(a) Loosen the nuts (502/3) on eight pullers (502/4).

(b) Rotate the pullers clockwise to position the feet of the pullers toward the ID of puller.

(c) Position the puller over airseal. Use a suitable three cable sling.

(d) Rotate the puller feet counterclockwise until they contact the dowel pin stops.

(e) Evenly tighten nuts (502/3) while holding flats of studs to prevent rotation of the puller feet to remove airseal.

(f) Remove the puller. Remove the airseal from the turbine front hub (502/5).

STAGE 1 TURBINE ROTOR ASSEMBLY - DISASSEMBLY-01

(7) Remove airseal (503/2) and seals (503/3). See Figure 503.

(8) Position a suitable blade support over the blades to prevent them from dropping out during the following trunnioning procedure. Secure support to hub.

(9) Use a hoist to attach the PWA 85086 Arm to PWA 86080 Eye or PWA 85085 Plate.

(10) Use the hoist to lift the rotor assembly. Attach a second hoist and PWA 85086 Arm to PWA 85087 Eye or PWA 85083 as applicable.

(11) Use both hoists to trunnion the rotor assembly to rear end down position. Remove the lower hoist and arm. Lower the assembly over the work table.

(12) Carefully remove the blade support.

CAUTION: CARE SHOULD BE TAKEN TO ENSURE THAT ANY FORCE REQUIRED TO REMOVE BLADES FROM HUB BE APPLIED TO ROOT PLATFORM AREA OF BLADE AND NOT TO LEADING OR TRAILING EDGE OF AIRFOIL. AIRFOIL SECTIONS OF ALL BLADES CAN BE DAMAGED IF STRUCK.

CAUTION: BLADES ARE MADE OF PWA 1480 OR PWA 1484 SINGLE CRYSTAL MATERIAL. AVOID BLADE CONTACT WITH ANY LUBRICANTS OR BLADE CRACKS CAN OCCUR.

(13) Remove blades (504/1) from hub. Remove 1st stage HPT blade damper (504/3) and 1st stage blade seal (504/2) from cavity between blade roots. See Figure 504.

(14) Remove 1st stage HPT covers (504/4) from OD of hub.

(15) Position PWA 85091 Heater on bench. Connect PWA 25672 or PWA 29754 Heater Control to heater.

(16) Remove the PWA 86080 Eye or PWA 85085 Plate from the hub.

(17) Use the hoist and PWA 85086 Arm to put the turbine hub, front end up, onto the heater. Remove the hoist and arm.

(18) Remove the PWA 85087 Eye or PWA 85083 from the hub.

(19) FOR THESE MODELS: 4152, 4156A, 4158
Remove 1st stage HPT airseal (505/2). See Figure 505.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Use PWA 87751 Adapter with the proper wrench to remove the nuts (505/5) and washers (505/4). You can use the optional PWA 86505 Ratchet Wrench to remove the nuts. Remove the bolts (505/1) and counterweights as applicable.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Loosen hand knob detail of PWA 85093 Knocker Puller to open jaws. With hand knob facing outward, position jaw of puller around upper knife−edge seal. Tighten hand knob to attach puller to airseal. Use the slide hammer action and move the puller to several locations around airseal, remove airseal from turbine front hub. Remove puller from airseal.

(c) FOR THESE MODELS: 4152, 4156A, 4158
Store airseal in suitable protective container.

(20) FOR THESE MODELS: 4152, 4156A, 4158
Remove the 1st stage HPT airseal (506/6) from the turbine front hub (506/4) (Engines without SB PW4ENG 72−487). See Figure 506.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Position PWA 85090 Fixture on a work bench. Loosen and slide the clamp details (506/9) outward. Retract the jackscrews (506/5). Remove the clamps (506/8) from the fixture.

CAUTION: FOR THESE MODELS: 4152, 4156A, 4158
DO NOT DAMAGE KNIFE−EDGE SEALS OF THE AIRSEAL WHEN INSTALLING FIXTURE.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Loosen the bolts (506/2) that secure the ring (506/7) to base (506/1) and allow ring to seat on the airseal.

(c) FOR THESE MODELS: 4152, 4156A, 4158
Slide clamp (506/9) behind the airseal upper knife−edge seal land and secure with bolts (506/3).

(d) FOR THESE MODELS: 4152, 4156A, 4158
Attach clamps (506/8) to the ring and outer flange of the airseal.

(e) FOR THESE MODELS: 4152, 4156A, 4158
Seat jackscrews to apply preload to the airseal.

(f) FOR THESE MODELS: 4152, 4156A, 4158
Tighten the bolts (506/2) to secure the ring (506/7) to the fixture base.

CAUTION: FOR THESE MODELS: 4152, 4156A, 4158
MAKE SURE THAT THE TEMPERATURE PROBE IS IN CONTACT WITH THE TURBINE HUB OR THE HUB CAN BECOME TOO HOT.

(g) FOR THESE MODELS: 4152, 4156A, 4158
Heat parts to 300°F (148.9°C) maximum. Use Dry Ice P05−102 on the airseal to help to remove it from the turbine hub.

(h) FOR THESE MODELS: 4152, 4156A, 4158
With the parts heated, use the handles to rotate the fixture to disengage the airseal from the turbine hub.

(i) FOR THESE MODELS: 4152, 4156A, 4158
Loosen the jackscrews (506/5), bolts (506/2), and remove clamps (506/8). Loosen bolts (506/3) and slide clamps (506/9) outward from behind airseal upper knife−edge seal land. Use a hoist and suitable sling to remove the fixture from the airseal.

(21) FOR THESE MODELS: 4152, 4156A, 4158
Remove the 1st stage HPT airseal (506A/4) from the turbine front hub (506A/3) (Engines with SB PW4ENG 72−487). See Figure 506A.

(22) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the 1st stage HPT airseal (506A/4) from the turbine front hub (506A/3). See Figure 506A.

NOTE: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
The removal of the 1st stage HPT airseal will require the installation of a new brush seal assembly in 72−00−51, Installation−01 (Task 72−00−51−420−001) or 72−00−51, Installation−02 (Task 72−00−51−420−002) as applicable.

(a) Position PWA 87112 Fixture on a work bench. Remove the clamps (506A/6) from the fixture.

CAUTION: DO NOT DAMAGE KNIFE−EDGE SEALS OF THE AIRSEAL WHEN YOU INSTALL THE FIXTURE.

(b) Loosen the bolts (506A/2) that attach the ring (506A/5) to the plate (506A/1) and permit the ring to seat on the airseal. Make sure the ID of the plate (506A/1) is against the ID of the airseal.

(c) Attach the clamps (506A/6) to the ring and the outer flange of the airseal.

(d) Tighten the bolts (506A/2) to attach the ring (506A/5) to the fixture base.

CAUTION: MAKE SURE THAT THE TEMPERATURE PROBE IS IN CONTACT WITH THE TURBINE HUB OR THE HUB CAN BECOME TOO HOT.

(e) Heat the turbine hub equally to 300°F (148.9°C) maximum. Use Dry Ice P05−102 on the airseal to help to remove it from the turbine hub.

(f) With the turbine hub heated, apply light mallet pressure to the handles to turn the fixture and disengage the airseal from the turbine hub.

(g) Loosen the bolts (506A/2) and remove the clamps (506A/8). Use a hoist and sling to remove the fixture from the airseal.

(23) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the 1st stage HPT (inner) airseal and HPT flange spacer. See Figure 506B.

(a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
R Use the PWA 78176 Socket to remove the 24 bolts (506B/1) and the applicable number of counterweights (506B/2).

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the retaining ring of the PWA 87390 Jackscrew Puller and move the puller jaws out.

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Lift the puller and put it on the turbine front hub (506B/6).

(d) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install the plate locator plate of the puller in the hub. Move the puller jaws in and adjust the jackscrew until the puller lip of the puller jaw is behind the OD of the airseal.

(e) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Turn the jackscrew and remove the airseal (506A/3) and the spacer (506B/5) from the hub.

(f) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Remove the airseal damper (506B/4) from the seal (506B/3). It is not permitted to use this damper again. Discard the damper.

(g) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Keep the airseal and the spacer in an applicable container to prevent damage.

(24) Install PWA 85087 Eye into the front ID of the turbine front hub (507/6). See Figure 507.

NOTE: See the following step to install the optional PWA 85083 Eye.

(a) Loosen the three locknuts (507/5) of PWA 85087 Eye. Turn the clamp assemblies (507/7) to align the pins so that they point toward the center of the lifting hub (507/4).

(b) Install the eye into the turbine hub. Turn the clamp assemblies into the turbine hub and align the pins so that they point toward the "LOCKED POSITION" marks on the lifting hub. Hold the clamps in position and tighten the three locknuts (507/5) to hold the eye on the turbine hub.

(25) Optional, install PWA 85083 Eye into the front ID of the turbine front hub. See Figure 507.

(a) Rotate the outer sleeve (507/10) and separate the outer sleeve from the inner ring (507/8).

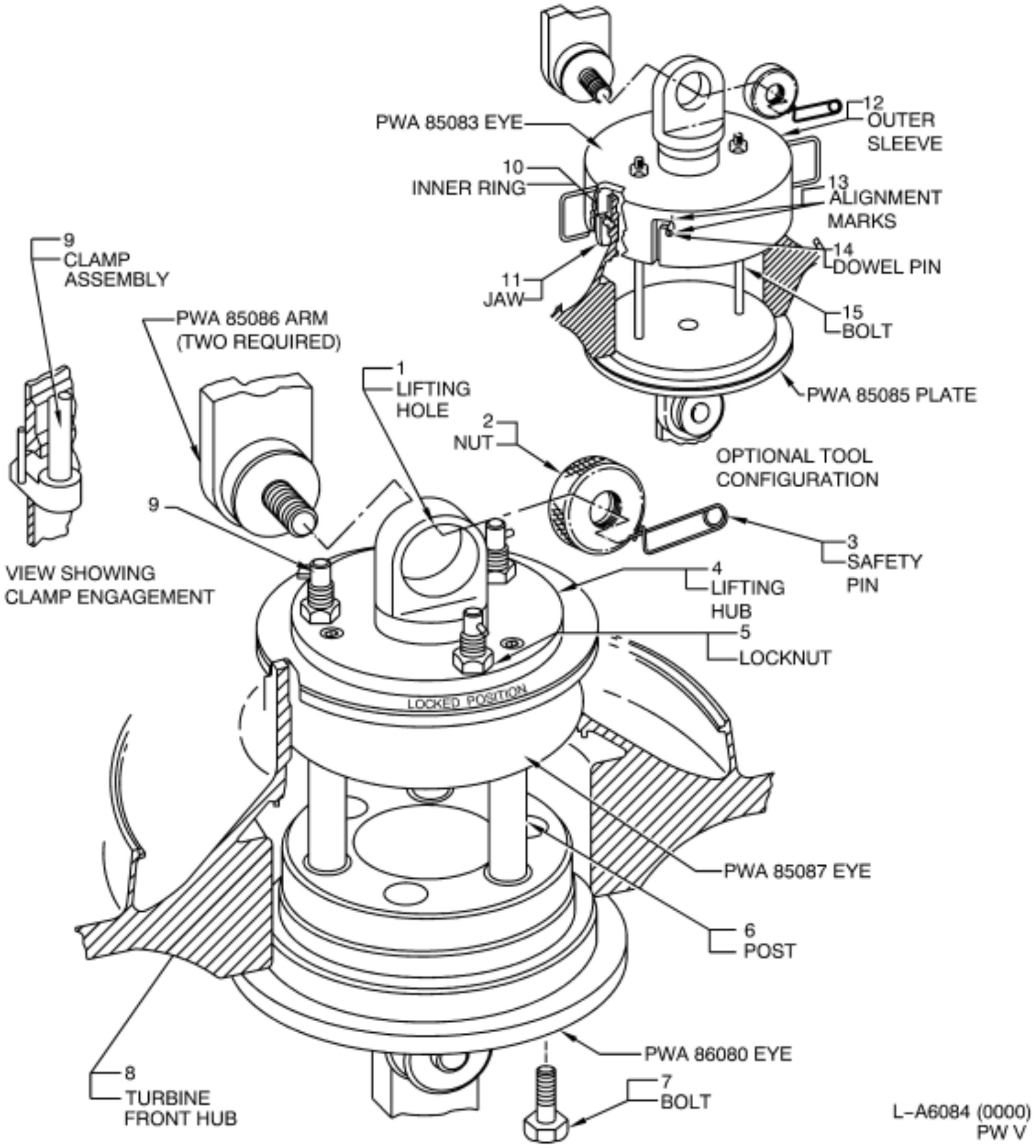
(b) Position the inner ring onto the turbine front hub with three jaws (507/9) behind the step on the OD of the hub.

(c) Position the outer sleeve over the inner ring. Align the three dowel pins (507/12) in the inner ring with the mating slots in the outer sleeve.

(d) Rotate the outer sleeve to position the dowel pins in the bottom of the slots. Align the scribed alignment mark (507/11) on the outer sleeve with the scribed line on the dowel pin.

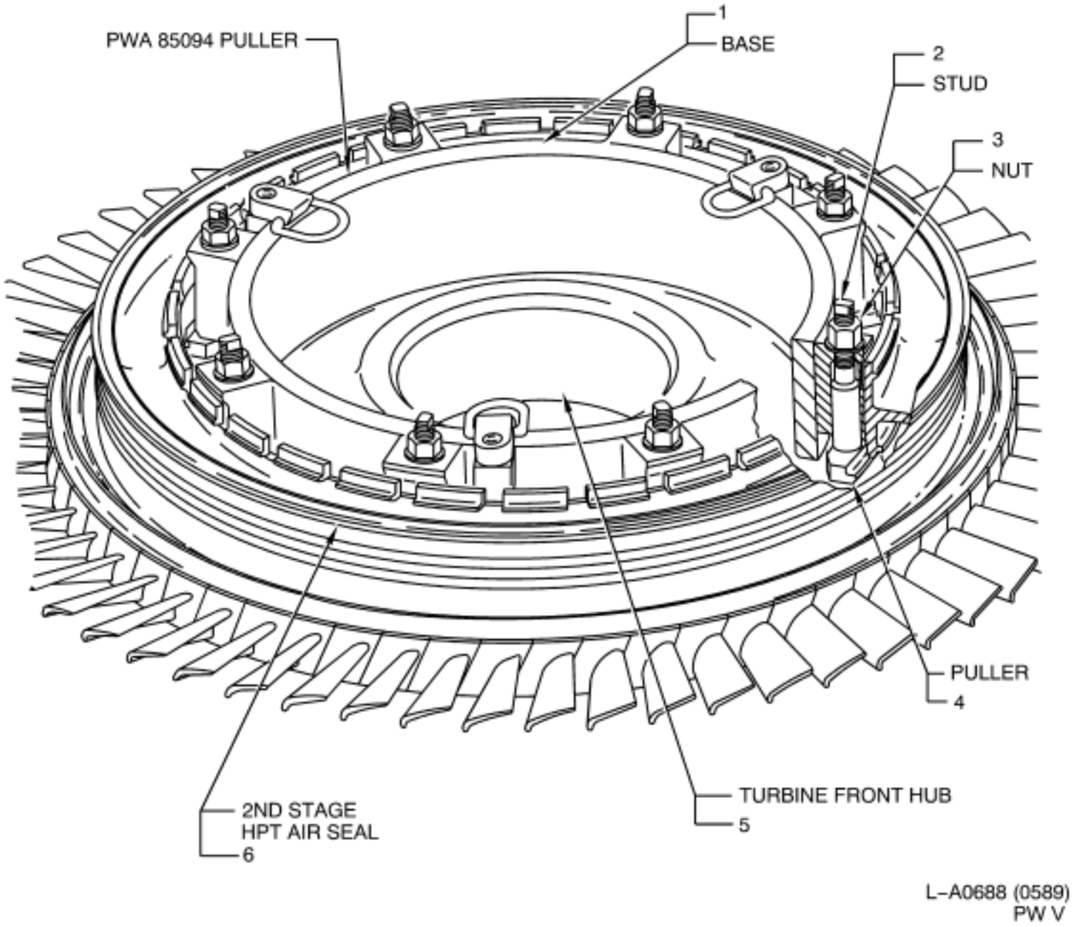
(26) Attach a hoist to PWA 85086 Arm. Remove the safety pin (507/3) and knurled nut (507/2) from the arm. Connect the arm to the lifting hole (507/1) of the PWA 85087 Eye or PWA 85083 and secure it with the knurled nut and safety pin.

(27) Use the hoist to remove the turbine hub from the heater and put it on a pallet. Remove the hoist, arm, and eye.


PWA 85083 EYE
12 OUTER SLEEVE
10 INNER RING
13 ALIGNMENT MARKS
14 DOWEL PIN
11 JAW
15 BOLT
PWA 85085 PLATE
OPTIONAL TOOL CONFIGURATION
9 CLAMP ASSEMBLY
PWA 85086 ARM (TWO REQUIRED)
1 LIFTING HOLE
2 NUT
9
3 SAFETY PIN
VIEW SHOWING CLAMP ENGAGEMENT
4 LIFTING HUB
5 LOCKNUT
LOCKED POSITION
PWA 85087 EYE
6 POST
PWA 86080 EYE
7 BOLT
8 TURBINE FRONT HUB
L−A6084 (0000)
PW V

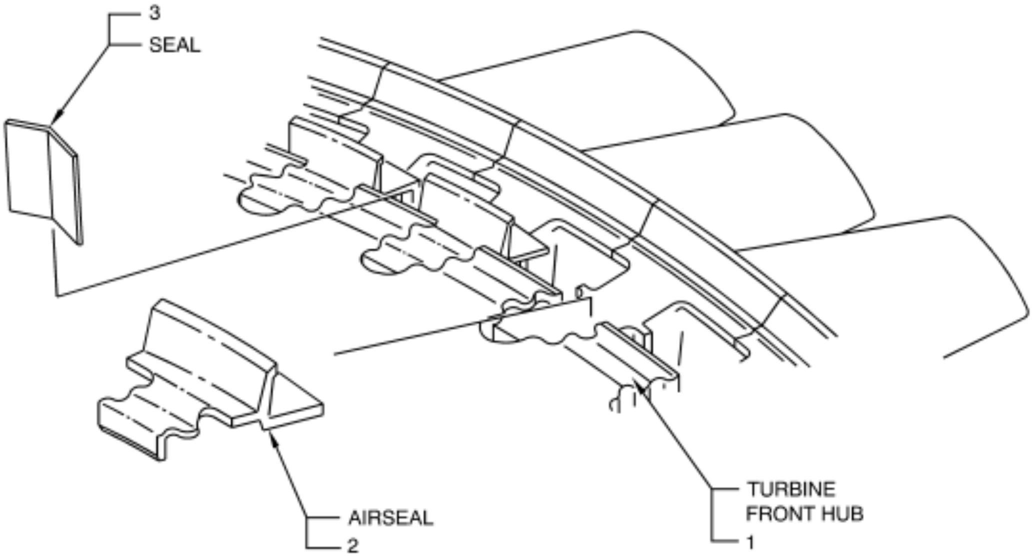
Turbine Rotor Trunnioning
Figure 501
(Task 72−52−01−040−001)

STAGE 1 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01


PWA 85094 PULLER
1
BASE
2
STUD
3
NUT
PULLER
4
TURBINE FRONT HUB
5
2ND STAGE
HPT AIR SEAL
6
L−A0688 (0589)
PW V

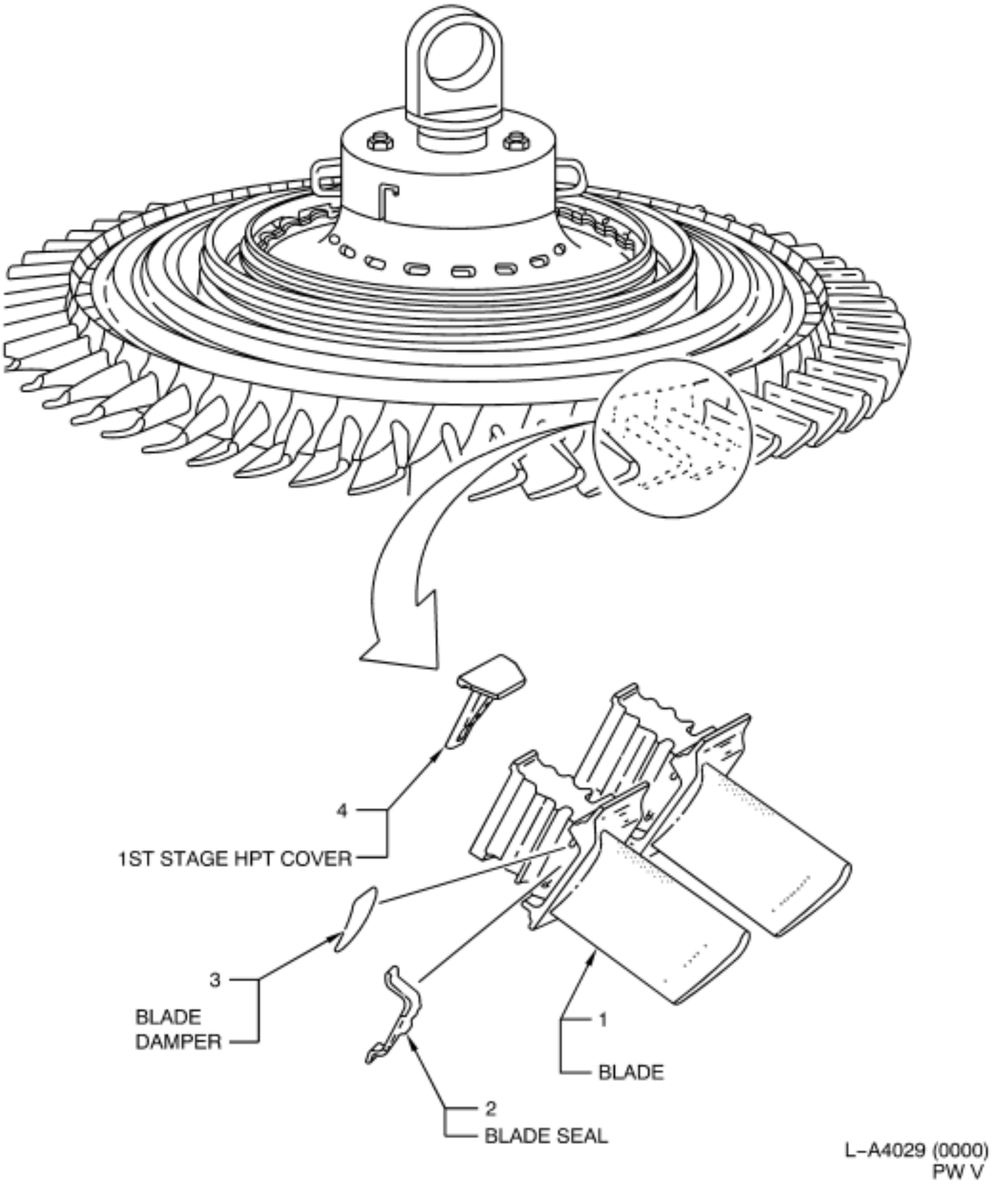
Second Stage HPT Airseal Removal
Figure 502
(Task 72−52−01−040−001)

STAGE 1 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01


3
SEAL
AIRSEAL
2
TURBINE
FRONT HUB
1

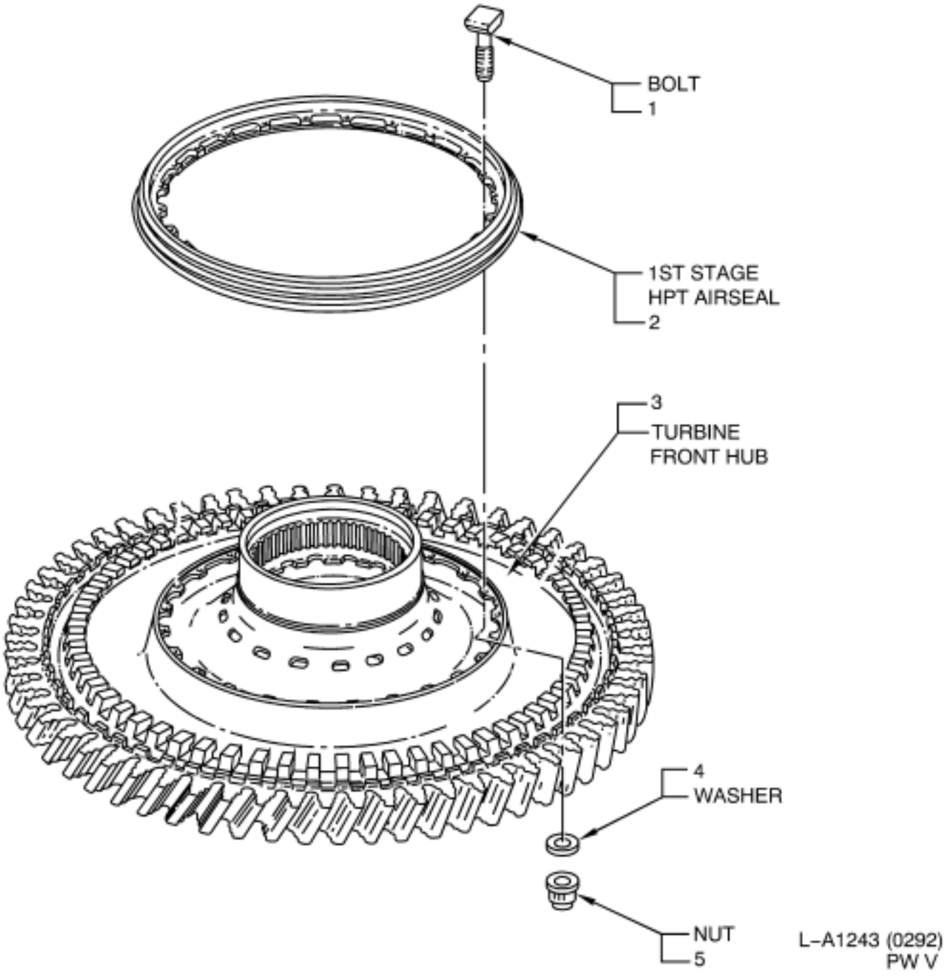
L−A0686 (0294)
PW V

First Stage Airseals And Seals Removal
Figure 503
(Task 72−52−01−040−001)


4
1ST STAGE HPT COVER
3
BLADE
DAMPER
2
BLADE SEAL
1
BLADE
L−A4029 (0000)
PW V

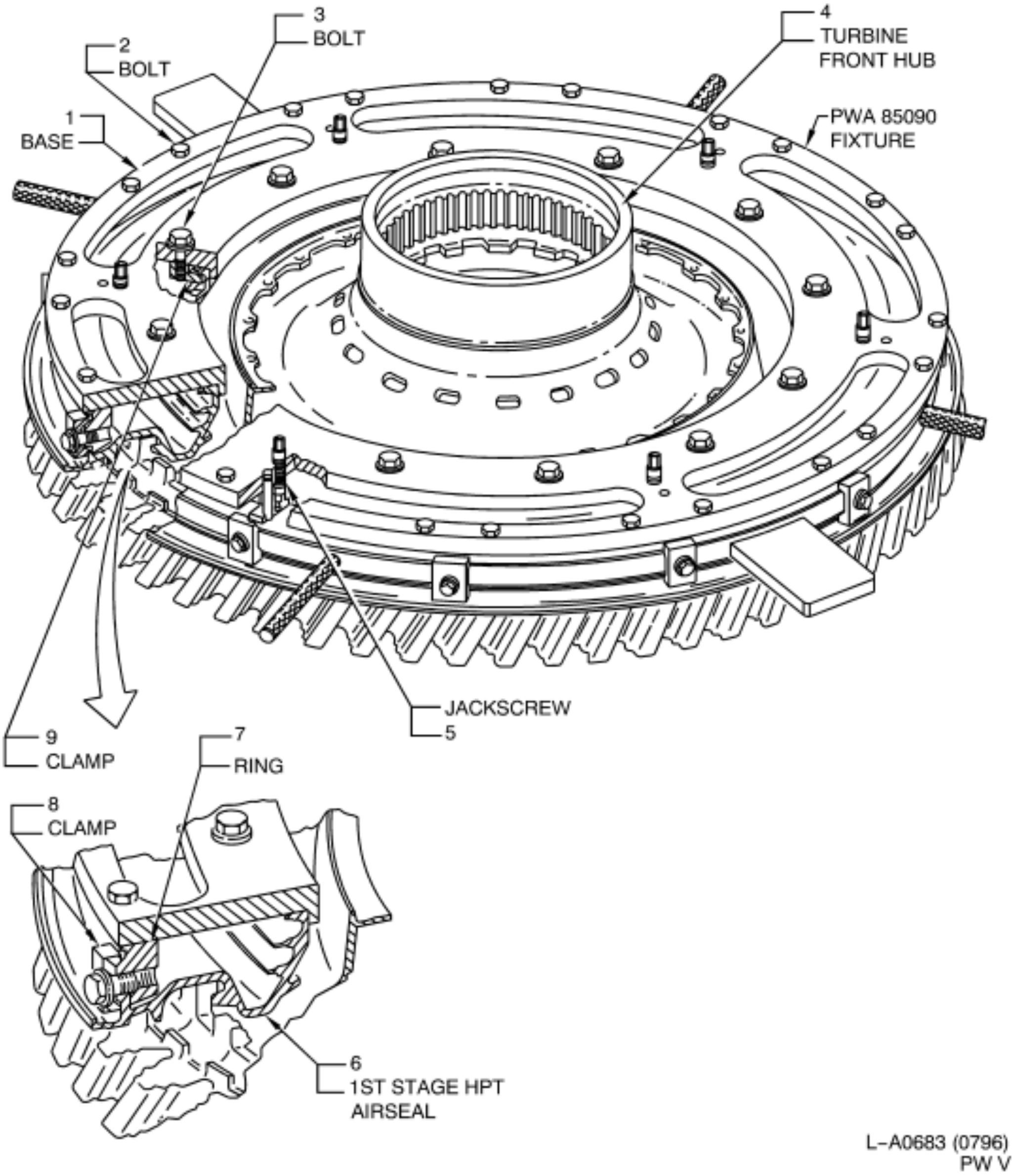
First Stage HPT Blades Removal
Figure 504
(Task 72−52−01−040−001)

STAGE 1 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01


BOLT
1
1ST STAGE
HPT AIRSEAL
2
3
TURBINE
FRONT HUB
4
WASHER
NUT
5
L−A1243 (0292)
PW V

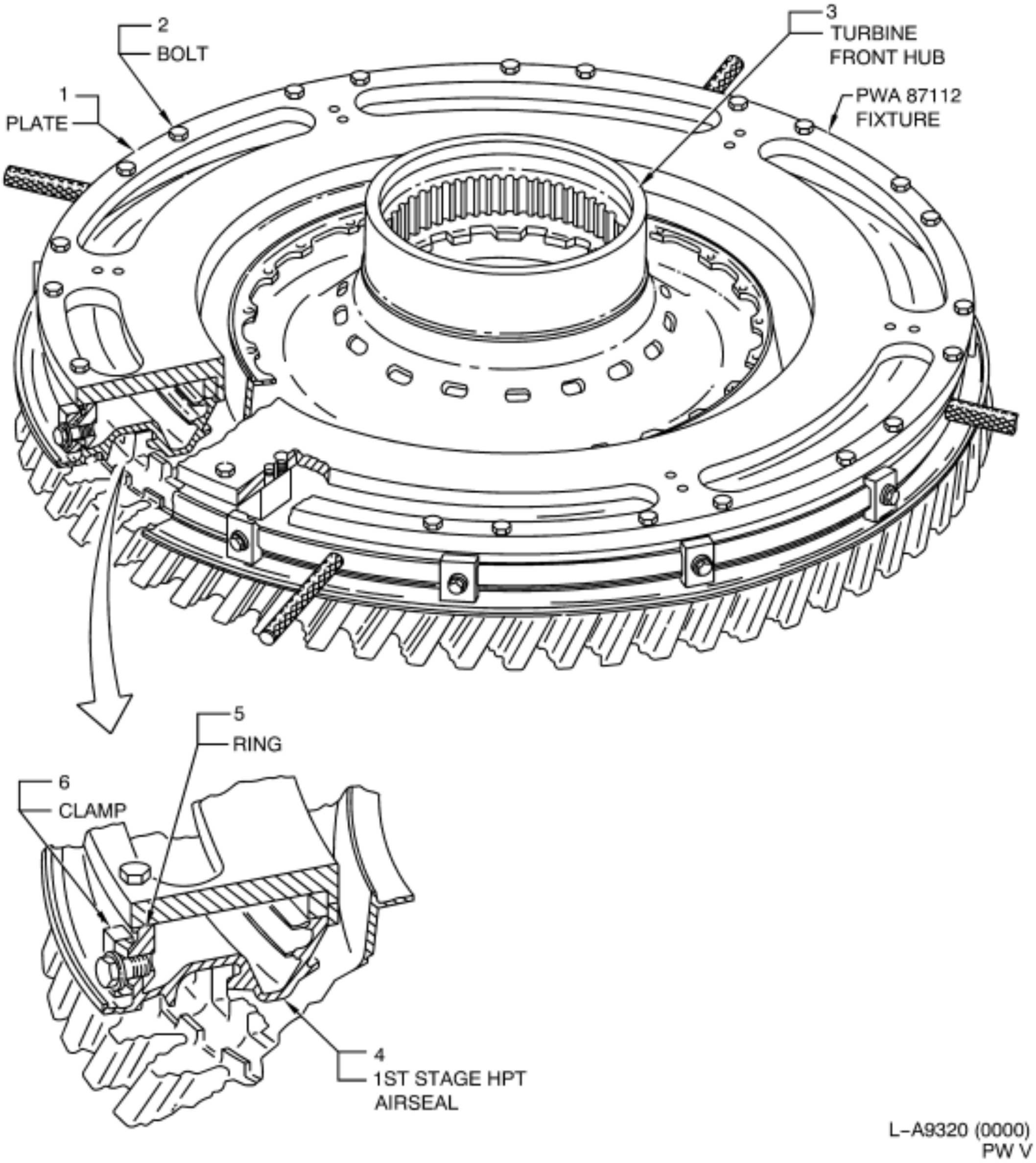
First Stage HPT Airseal Removal
Figure 505
(Task 72−52−01−040−001)

STAGE 1 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01


3
BOLT
2
BOLT
4
TURBINE
FRONT HUB
1
BASE
PWA 85090
FIXTURE
JACKSCREW
5
9
CLAMP
7
RING
8
CLAMP
6
1ST STAGE HPT
AIRSEAL
L−A0683 (0796)
PW V

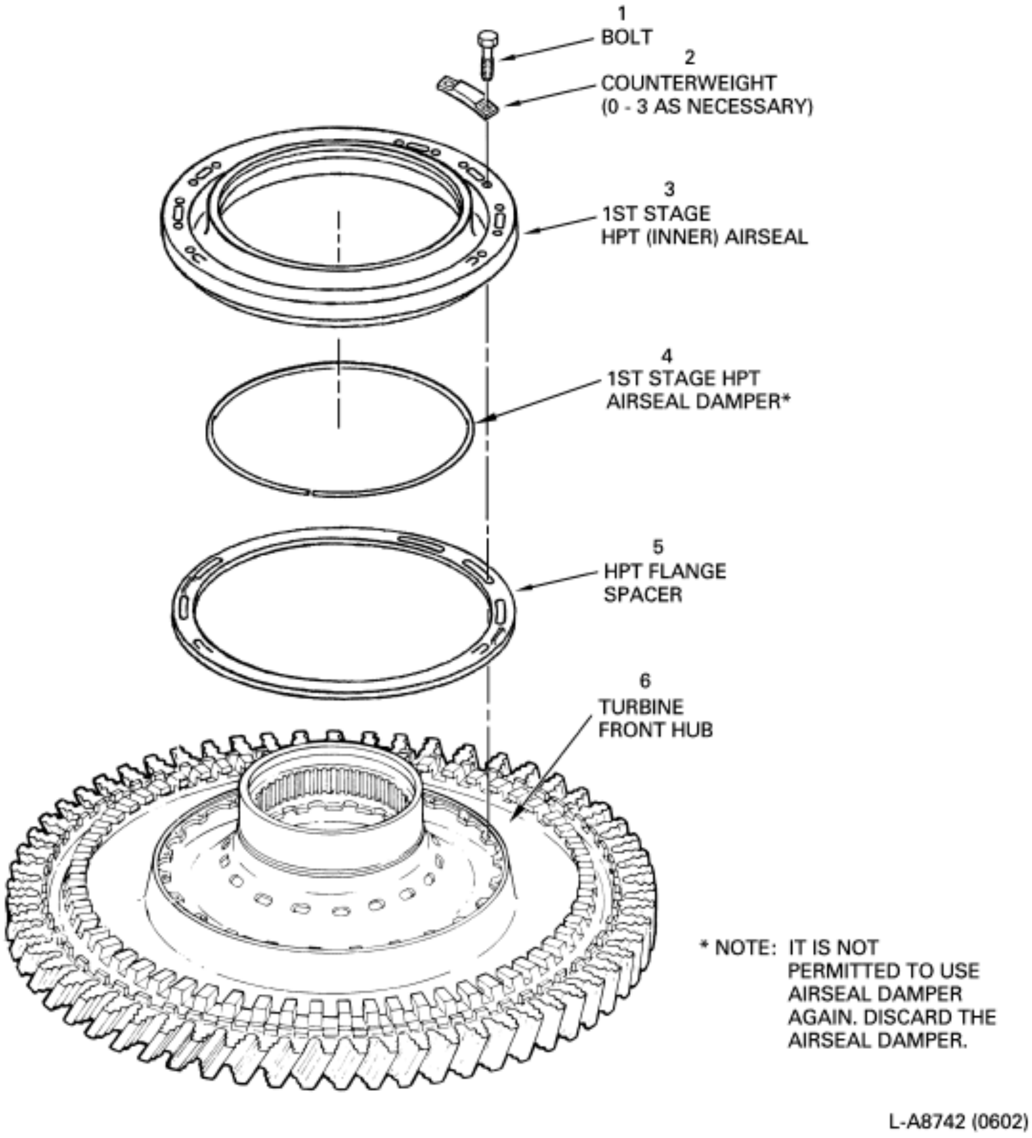
First Stage HPT Airseal Removal
Figure 506
(Task 72−52−01−040−001)

STAGE 1 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01

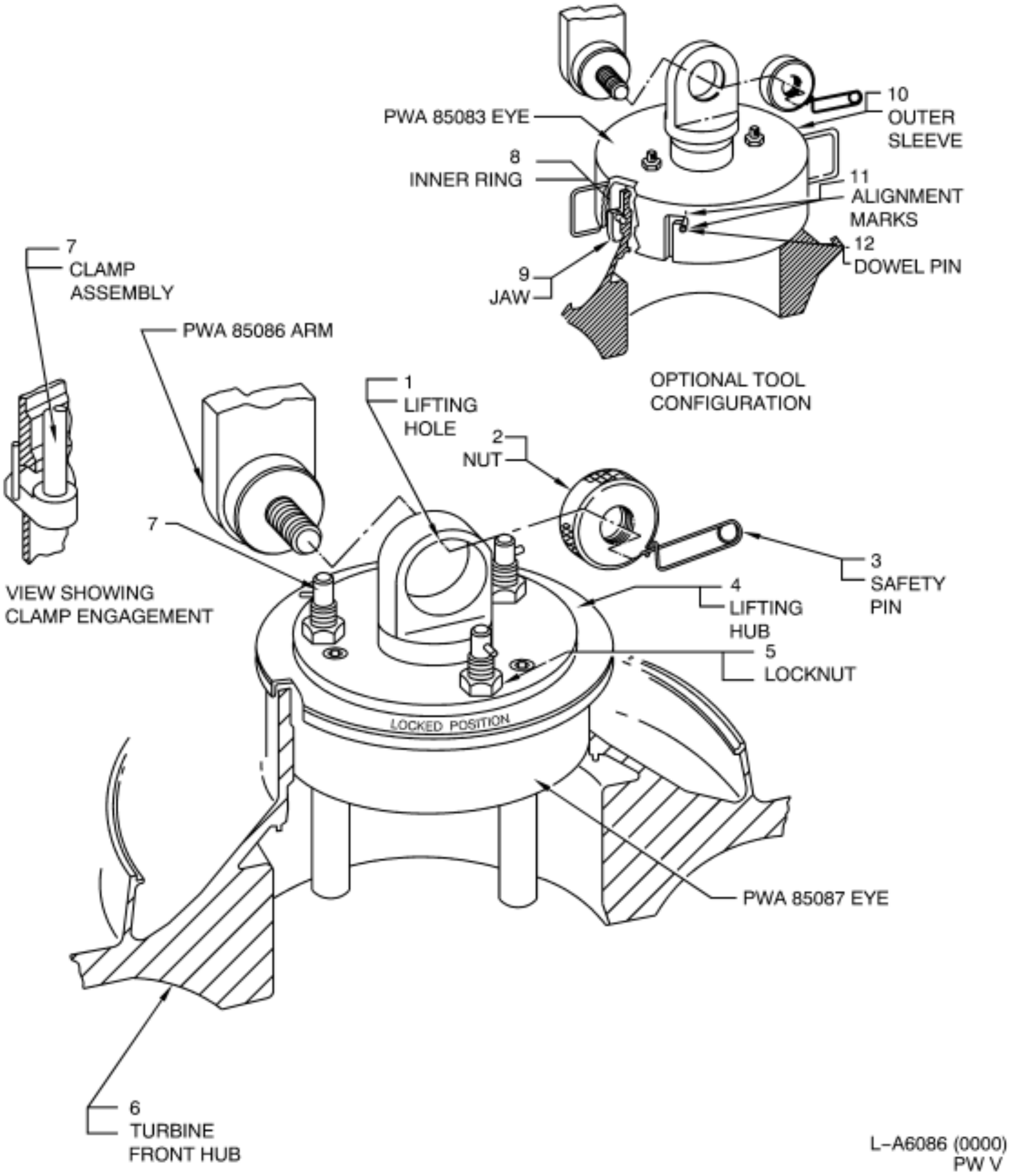

2
BOLT
1
PLATE
3
TURBINE FRONT HUB
PWA 87112 FIXTURE
5
RING
6
CLAMP
4
1ST STAGE HPT AIRSEAL
L−A9320 (0000)
PW V

First Stage HPT Airseal Removal
Figure 506A
(Task 72−52−01−040−001)

STAGE 1 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01


1
BOLT
2
COUNTERWEIGHT
(0 - 3 AS NECESSARY)
3
1ST STAGE
HPT (INNER) AIRSEAL
4
1ST STAGE HPT
AIRSEAL DAMPER*
5
HPT FLANGE
SPACER
6
TURBINE
FRONT HUB
* NOTE: IT IS NOT PERMITTED TO USE AIRSEAL DAMPER AGAIN. DISCARD THE AIRSEAL DAMPER.
L-A8742 (0602)

First Stage HPT Airseal Removal
Figure 506B
(Task 72−52−01−040−001)


PWA 85083 EYE
8
INNER RING
10
OUTER SLEEVE
11
ALIGNMENT MARKS
12
DOWEL PIN
9
JAW
7
CLAMP ASSEMBLY
PWA 85086 ARM
OPTIONAL TOOL CONFIGURATION
1
LIFTING HOLE
2
NUT
3
SAFETY PIN
7
VIEW SHOWING CLAMP ENGAGEMENT
4
LIFTING HUB
5
LOCKNUT
LOCKED POSITION
PWA 85087 EYE
6
TURBINE FRONT HUB
L−A6086 (0000)
PW V

Turbine Front Hub Lifting
Figure 507
(Task 72−52−01−040−001)

Previous Pageblock   Return to Previous Menu   Next Pageblock

STAGE 1 TURBINE ROTOR ASSEMBLY - ASSEMBLY-01

Task 72-52-01-440-001:

1. Assemble 1st Stage Turbine Rotor Assembly

A. Prerequisites

(1) See Inspection/Check-04 Task 72-52-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Necessary

Standard Tools:

Name	Manufacturer
Clements Cadillac Electric Flameless Heat Gun Model FT 1000	Clements Manufacturing Co. 6650 S. Narragansett Avenue Chicago, IL 60638

NOTE: The flameless torch specified above is optional to the heaters specified in the Special Tools list, and the optional flame torch.

Special Tools:

PWA 25672	Control, Heater (Optional to PWA 29754)
PWA 29754	Control, Heater
PWA 45548	Pin, Aligning
PWA 78176	Socket, Special (First Stage HPT Airseal Bolts, Post SB PW4ENG 72-504)
PWA 85081	Adapter, Moment Weight
PWA 85083	Eye, Handling (Optional to PWA 85087)
PWA 85085	Plate, Trunnion (Optional to PWA 86080)
PWA 85086	Arm, Lifting (Two Necessary)
PWA 85087	Eye, Lifting
PWA 85090	Fixture, Install (Engines without SB PW4ENG 72-487)
PWA 85091	Heater, Electrical
PWA 85289	Ring, Support
PWA 85561	Pin, Aligning (Two Necessary)
PWA 85634	Fixture, Support
PWA 86080	Eye, Lifting
PWA 86506	Wrench, Ratchet (Optional)
PWA 87112	Fixture, Install (Engines with SB PW4ENG 72-487 and all Phase III Engines)
PWA 87121	Ring, Adapter (Optional to PWA 85634)

Special Tools:

(CONTINUED)

	PWA 87751	Adapter, Torque
R	PWA 107120	Fixture, Lift (2nd Stage HPT Airseal)

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−026	Ink (PMC 4057−1)
P05−102	Ice, Dry
P05−395	Beeswax
P05−396	Paraffin Wax Blend
P08−010	Adhesive (EC−1300)
P08−022	Adhesive (EC−1357)

C. General Assembly Requirements

(1) Where heating is required for assembly, use minimum temperature differential of 125°F (52°C) between parts being assembled. Do not exceed 300°F (149°C) on any part.

(2) Where heating is required for assembly, special heaters are specified in the following procedure. However, you can use an optional flameless torch or flame torch as specified in the following steps.

(3) In locations where heating of a component in an oven is not practical or only a flange of the component requires heating, the use of Clements Cadillac electric flameless heat gun, Model FT 1000 is recommended.

(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE

FLAME WILL DAMAGE OR BURN NON−METAL PARTS. DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

D. Procedure

(1) FOR THESE MODELS: 4152, 4156A, 4158
Position 1st stage HPT airseal (1001/2) on bench with smaller ID knife−edge side down. Position 1st stage HPT airseal damper (1001/1) into groove in ID of airseal. Apply Beeswax P05−395 or Paraffin Wax Blend P05−396 or Adhesive P08−010 or Adhesive P08−022 as necessary to keep the seal in position. See Figure 1001.

(2) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Position the 1st stage HPT (inner) airseal on a bench with the larger diameter side down. Assemble a new 1st stage HPT airseal damper into the groove in the OD of the airseal. Form the airseal damper (by gently bending) into the groove. The damper must go into the groove freely. While unconstrained, the damper must be spring-loaded outward in the groove with less than 0.020 inch (0.508 mm) above the groove side walls. Must be free to move circumferentially. See Figure 1001A.

(3) FOR THESE MODELS: 4152, 4156A, 4158
Position 1st stage HPT airseal (1002/3) on bench with knife-edge seal side down. Position seals (1002/1) and (1002/2) into inner grooves on rear face of airseal and cut as necessary to get a gap of 0.025 - 0.225 inch (0.6 - 5.7 mm) between ends of seals. Apply Beeswax P05-395 or Paraffin Wax Blend P05-396 or Adhesive P08-010 or Adhesive P08-022 as necessary to keep the seals in position. See Figure 1002.

(4) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Position 1st stage HPT airseal (1002A/3) on bench with knife-edge seal side down. Position seals (1002A/1) and (1002A/2) into inner grooves on rear face of airseal and cut as necessary to get a gap of 0.025 - 0.225 inch (0.6 - 5.7 mm) between ends of seals. Apply Beeswax P05-395 or Paraffin Wax Blend P05-396 or Adhesive P08-010 or Adhesive P08-022 as necessary to keep the seals in position. See Figure 1002A.

(5) Position 2nd stage HPT airseal (1003/3) on bench with larger ID end up. Position seals (1003/1) and (1003/2) into grooves in front outer face of airseal. Cut seals as required to obtain gaps of 0.025 - 0.225 inch (0.6 - 5.7 mm) between ends of seals. Apply Beeswax P05-395 or Paraffin Wax Blend P05-396 or Adhesive P08-010 or Adhesive P08-022 as necessary to keep the seals in position. See Figure 1003.

NOTE: SB PW4ENG 72-637 increased the fillet radius in the wire seal pocket of the 2nd stage HPT airseal (1003/3) to reduce stress concentrations at the front OD snap diameter. The normal centrifugal loads on the wire seal (1003/1) during engine operation will cause the seal to move out radially in the oversized pocket and will result in proper sealing. The wire seal does not require compression at assembly.

(6) Install PWA 85087 Eye into the front ID of the turbine front hub (1004/6). See Figure 1004.

NOTE: See the following step to install the optional PWA 85083 Eye.

(a) Loosen the three locknuts (1004/5) of PWA 85087 Eye. Turn the clamp assemblies (1004/7) to align the pins so that they point toward the center of the lifting hub (1004/4).

(b) Install the eye into the turbine hub. Turn the clamp assemblies into the turbine hub and align the pins so that they point toward the "LOCKED POSITION" marks on the lifting hub. Hold the clamps in position and tighten the three locknuts (1004/5) to hold the eye on the turbine hub.

(7) Optional, install PWA 85083 Eye into the front ID of the turbine front hub. See Figure 1004.

(a) Rotate the outer sleeve (1004/10) and separate the outer sleeve from the inner ring (1004/8).

(b) Position the inner ring onto the turbine front hub with three jaws (1004/9) behind the step on the OD of the hub.

(c) Position the outer sleeve over the inner ring. Align the three dowel pins (1004/12) in the inner ring with the mating slots in the outer sleeve.

(d) Rotate the outer sleeve to position the dowel pins in the bottom of the slots. Align the scribed alignment mark (1004/11) on the outer sleeve with the scribed line on the dowel pin.

(8) Attach a hoist to PWA 85086 Arm. Remove the safety pin (1004/3) and knurled nut (1004/2) from the arm. Connect the arm to the lifting hole (1004/1) of the PWA 85087 Eye or PWA 85083 Eye, and secure it with the knurled nut and safety pin.

(9) Use the hoist, to position the turbine front hub, splined end up, on a work bench. Remove hoist and arm.

(10) Determine part stacking requirements.

(a) Check the unbalance amount on the 1st stage HPT airseal (1002/3), turbine front hub (1005/4) and 2nd stage HPT airseal (1003/3).

NOTE: The unbalance amount is located adjacent to the unbalance symbol (triangle) on each part.

(b) If unbalance amounts are approximately equal, assemble parts with unbalance locations approximately 120 degrees apart.

(c) If the unbalance amounts are not approximately equal, position the unbalance locations of the turbine front hub, 1st stage HPT airseal, and 2nd stage HPT airseal 180 degrees apart, so that the combined unbalance of these parts is kept to a minimum.

CAUTION: FOR THESE MODELS: 4152, 4156A, 4158
TURBINE FRONT HUB, WITH SHORTENED OUTER HUB TO AIRSEAL ENGAGEMENT LUGS, AND 1ST STAGE HPT AIRSEAL, WITH REDUCED AIRSEAL-TO-HUB OUTER LUG SNAP DIAMETER, (POST SB PW4ENG 72-314 OR PW4ENG 72-315) MUST BE USED IN SETS.

CAUTION: FOR THESE MODELS: 4152, 4156A, 4158
TURBINE FRONT HUB PN 51L201 MUST BE USED IN ENGINES THAT INCORPORATE THE INTENT OF (SB PW4ENG 72-315).

(11) FOR THESE MODELS: 4152, 4156A, 4158
Install 1st stage HPT airseal on the turbine front hub (Engines without SB PW4ENG 72-487). See Figure 1005.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Place PWA 85091 Heater, heating element up, on the work bench.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Attach a hoist to PWA 85086 Arm. Remove the safety pin and the knurled nut from the arm. Connect the arm to the lifting hole of the eye, and secure it to the eye with the knurled nut and safety pin.

(c) FOR THESE MODELS: 4152, 4156A, 4158
Use the hoist to put the turbine front hub, hub end up, on the heater. Remove the hoist, arm, and lifting eye.

CAUTION: FOR THESE MODELS: 4152, 4156A, 4158
MAKE SURE THAT THE TEMPERATURE PROBE IS IN CONTACT WITH THE TURBINE HUB OR THE HUB CAN BECOME TOO HOT.

(d) FOR THESE MODELS: 4152, 4156A, 4158
Connect PWA 29754 Heater Control or PWA 25672 Heater Control to the heater.

(e) FOR THESE MODELS: 4152, 4156A, 4158
Position PWA 85090 Fixture on bench. Loosen and slide the clamp details (1005/9) outward. Retract jackscrews (1005/5). Remove clamps (1005/8) from the fixture.

(f) FOR THESE MODELS: 4152, 4156A, 4158
Position the 1st stage HPT airseal (1005/6), knife−edge end up, over the turbine front hub. Rotate the airseal clockwise to engage the lugs of airseal with mating lugs on hub.

CAUTION: FOR THESE MODELS: 4152, 4156A, 4158
DO NOT DAMAGE KNIFE−EDGE SEALS OF AIRSEAL WHEN INSTALLING FIXTURE.

(g) FOR THESE MODELS: 4152, 4156A, 4158
Loosen bolts (1005/2) securing ring (1005/7) to base plate and allow ring to seat on airseal.

(h) FOR THESE MODELS: 4152, 4156A, 4158
Slide clamp (1005/9) behind airseal upper knife−edge seal land and secure with bolts (1005/3).

(i) FOR THESE MODELS: 4152, 4156A, 4158
Attach clamps (1005/8) to the ring and outer flange of the airseal.

(j) FOR THESE MODELS: 4152, 4156A, 4158
Seat the jackscrews (1005/5). Tighten the jackscrews one half turn to apply a preload to the airseal.

(k) FOR THESE MODELS: 4152, 4156A, 4158
Tighten bolts (1005/2) to secure the ring to the fixture base.

(l) FOR THESE MODELS: 4152, 4156A, 4158
Heat the turbine hub to 300°F (148.9°C) maximum for assembly with a minimum temperature differential of 200°F (111°C).

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
Dry Ice P05-102 can be used on the airseal to help assemble the airseal.

(m) FOR THESE MODELS: 4152, 4156A, 4158
Apply a downward pressure on the fixture and rotate the fixture to position the lugs of the airseal directly under the lugs of the hub.

(n) FOR THESE MODELS: 4152, 4156A, 4158
Visually check to make sure that the blade antirotation lugs of the airseal do not come into the blade slots. See Figure 1006. If the antirotation lugs are not aligned, slightly rotate the fixture, then visually check for correct alignment.

1 FOR THESE MODELS: 4152, 4156A, 4158
Install a 1st stage HPT blade into a blade root slot of hub.

2 FOR THESE MODELS: 4152, 4156A, 4158
Blade root, ID section must be flush or below adjacent surface of hub as shown in referenced figure. Repeat the procedure at four equally spaced blade slot locations.

3 FOR THESE MODELS: 4152, 4156A, 4158
If blade root ID section is above adjacent surface of hub, airseal may be repositioned on hub before parts cool.

4 FOR THESE MODELS: 4152, 4156A, 4158
Recheck seating of airseal. Refer to the previous steps. If blade root ID section is still above adjacent surface of hub root, airseal must be removed and the wire seal and airseal must be installed again.

CAUTION: FOR THESE MODELS: 4152, 4156A, 4158 DO NOT DAMAGE KNIFE−EDGE SEALS OF AIRSEAL WHEN REMOVING FIXTURE.

(o) FOR THESE MODELS: 4152, 4156A, 4158
Loosen jackscrews (1005/5), bolts (1005/2), and remove clamps (1005/8). Loosen bolts (1005/3) and slide clamps (1005/9) outward from behind airseal upper knife−edge seal land. Using hoist and suitable sling remove fixture from airseal.

(12) FOR THESE MODELS: 4152, 4156A, 4158
Install the 1st stage HPT airseal on the turbine front hub (Engines with SB PW4ENG 72−487). See Figure 1005A.

(13) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the 1st stage HPT airseal on the turbine front hub. See Figure 1005A.

(a) Put PWA 85091 Heater, heating element up, on the work bench.

(b) Attach a hoist to PWA 85086 Arm. Remove the safety pin and the knurled nut from the arm. Connect the arm to the lifting hole of the eye, and attach it to the eye with the knurled nut and safety pin.

(c) Use the hoist to put the turbine front hub, hub end up, on the heater. Remove the hoist, arm, and lifting eye.

CAUTION: MAKE SURE THAT THE TEMPERATURE PROBE IS IN CONTACT WITH THE TURBINE HUB OR THE HUB CAN BECOME TOO HOT.

(d) Connect PWA 29754 Heater Control or PWA 25672 Heater Control to the heater.

(e) Put the PWA 87112 Fixture on the bench. Remove the clamps (1005A/6) from the fixture.

(f) Put the 1st stage HPT airseal (1005A/4), knife−edge end up, over the turbine front hub. Turn the airseal clockwise to engage the lugs of the airseal with the lugs on the hub.

CAUTION: DO NOT DAMAGE THE KNIFE-EDGE SEALS OF THE AIRSEAL WHEN YOU INSTALL THE FIXTURE.

(g) Loosen the bolts (1005A/2) which attach the ring (1005A/5) to the plate (1005A/1) and permit the ring to seat on the airseal. Make sure the ID of the plate (1005A/1) is against the ID of the airseal.

(h) Attach the clamps (1005A/6) to the ring and the outer flange of the airseal.

(i) Tighten the bolts (1005A/2) to attach the ring to the fixture base.

(j) Heat the turbine hub to 300°F (148.9°C) maximum for assembly with a minimum temperature differential of 200°F (111°C).

NOTE: Dry Ice P05-102 can be used on the airseal to help assemble the airseal.

(k) Apply a downward pressure on the fixture and turn the fixture to align the lugs of the airseal directly under the lugs of the hub.

(l) Visually check to make sure that the blade antirotation lugs of the airseal do not come into the blade slots. See Figure 1006. If the antirotation lugs are not aligned, slightly turn the fixture, then make a visual check for correct alignment.

(m) Check to make sure the 1st stage HPT airseal is seated on the hub with a turbine blade. See Figure 1007.

1 Install a 1st stage HPT blade into a blade root slot of the hub.

2 The blade root ID section must be even with or below the adjacent surface of the hub as shown in the referenced figure. Do this procedure at four equally spaced blade slot locations.

3 If the blade root ID section is above the adjacent surface of the hub, the airseal can be moved on the hub before the parts cool.

4 Check the seat of the airseal again. Refer to the steps used before. If the blade root ID section is still above the adjacent surface of the hub root, the airseal must be removed and the wire seal and airseal must be installed again.

CAUTION: DO NOT DAMAGE THE KNIFE−EDGE SEALS OF THE AIRSEAL WHEN YOU REMOVE THE FIXTURE.

(n) Loosen the bolts (1005A/2) and remove the clamps (1005A/6). Use a hoist and the applicable sling to remove the fixture from the airseal.

(o) Check seating of 1st stage HPT airseal on hub with a turbine blade. See Figure 1007.

(14) FOR THESE MODELS: 4152, 4156A, 4158
Install 1st stage HPT airseal (1008/2) on turbine front hub (1008/3). See Figure 1008.

(a) FOR THESE MODELS: 4152, 4156A, 4158
Remove threaded pins (1008/8) from two PWA 85561 Alignment Pins. Position two blocks (1008/6) 180 degrees apart behind inner front flange of turbine front hub (1008/3). Position knurled nuts (1008/7) over blocks. Insert pins through front inner flange of hub and thread into nut and block. Tighten nut against rear side of flange to lock pin in position.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Align boltholes and position airseal over alignment pins and onto inner flange of turbine front hub.

(c) FOR THESE MODELS: 4152, 4156A, 4158
Install 24 bolts through airseal and into hub. Install washers (1008/4) and nuts (1008/5), lubricated with Engine Oil P03−001. You can use the optional PWA 86506 Ratchet Wrench to install the nuts. Use PWA 87751 Torque Adapter to torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(15) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the 1st stage HPT (inner) airseal and spacer to the turbine front hub. See Figure 1008A.

NOTE: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
The installation of the 1st stage HPT airseal will require the installation of a new brush seal assembly in 72−00−51, Installation−01 (Task 72−00−51−420−001) or 72−00−51, Installation−02 (Task 72−00−51−420−002) as applicable.

(a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Align the HPT flange spacer (1008A/3) and 1st stage HPT (inner) airseal (1008A/2) with each other and the bolt holes in the turbine front hub (1008A/4) with the use of the PWA 45548 Aligning Pin (1008A/5).

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Apply Engine Oil P03−001 to the threads of the 24 bolts (1008A/1). Install the bolts through the airseal, spacer and into the turbine front hub. Use a PWA 78176 Socket to torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

NOTE: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
You install the counterweights when you static balance the 1st stage turbine rotor assembly in 72−52−01, Assembly−02 Task 72−52−01−440−002.

(16) Trunnion the front turbine hub to the front end down position. Use PWA 85087 Eye and PWA 86080 Eye. See Figure 1009.

NOTE: See the following step to trunnion the hub with optional PWA 85083 Eye and PWA 85085 Plate.

(a) Loosen the three locknuts (1009/5) of PWA 85087 Eye. Turn the clamp assemblies (1009/9) to align the pins so that they point toward the center of the lifting hub (1009/4).

(b) Install the eye into the turbine hub. Turn the clamp assemblies into the turbine hub and align the pins so that they point toward the "LOCKED POSITION" marks on the lifting hub (1009/4). Hold the clamps in position and tighten the three locknuts (1009/5) to hold the eye on the turbine hub.

(c) Attach a hoist to PWA 85086 Arm. Remove the safety pin (1009/3) and knurled nut (1009/2) from the arm. Connect the arm to the lifting hole (1009/1) of the PWA 85087 Eye, and secure it with the knurled nut and safety pin. Use the hoist to lift the assembly.

(d) Align the lifting hole of PWA 86080 Eye with the lifting hole of PWA 85087 Eye, and the posts (1009/6) with the mating holes in PWA 86080 Eye.

(e) Install the applicable (shorter) bolts (1009/7) to hold the PWA 86080 Eye.

(f) Attach a hoist to a second PWA 85086 Arm. Remove the safety pin and knurled nut from the arm. Connect the arm to the PWA 86080 Eye and secure it with the knurled nut and safety pin.

(g) Trunnion the assembly to the front end down position.

(17) Optional, trunnion the front turbine hub to the front end down position. Use PWA 85083 Eye and PWA 85085 Plate. See Figure 1009.

(a) Rotate the outer sleeve (1009/12) and separate the outer sleeve from the inner ring (1009/10).

(b) Position the inner ring onto the turbine front hub with three jaws (1009/11) behind the step on the OD of the hub.

(c) Position the outer sleeve over the inner ring. Align the three dowel pins (1009/14) in the inner ring with the mating slots in the outer sleeve.

(d) Rotate the outer sleeve to position the dowel pins in the bottom of the slots. Align the scribed alignment marks (1009/13) on the outer sleeve with the scribed lines on the dowel pins.

(e) Attach a hoist to PWA 85086 Arm. Remove the safety pin and the knurled nut from the arm. Connect the arm to the lifting hole of the eye, and secure it to the eye with the knurled nut and safety pin. Use the hoist to lift the assembly.

(f) Position PWA 85085 Plate into the rear ID of the hub. Align the boltholes and thread two bolts (1009/15) into the detail nuts on the upper end of PWA 85083 Eye. Tighten the bolts to secure the plate.

(g) Attach a hoist to a second PWA 85086 Arm. Remove the safety pin and knurled nut from the arm. Connect the arm to the lifting hole of the plate, and secure it with the knurled nut and safety pin.

(h) Trunnion the assembly to the front end down position.

(18) Position PWA 85634 Support Fixture on bench.

(19) Remove the lower hoist and PWA 85086 Arm. Lower the assembly into PWA 85634 Support. Remove the hoist, and arm.

(20) Position the seal (1010/1) into the outer groove in the rear face of 1st stage HPT airseal (1010/2) and cut as required to obtain a gap of 0.025 − 0.225 inch (0.6 − 5.7 mm) between ends of the seal. Apply Beeswax P05−395 or Paraffin Wax Blend P05−396 or Adhesive P08−010 or Adhesive P08−022 as necessary to keep the seal in position. See Figure 1010.

CAUTION: THE 1ST STAGE HPT BLADE ROOT ID SECTION MUST BE FLUSH OR BELOW THE ADJACENT SURFACE OF THE HUB OR DAMAGE TO THE BLADES CAN OCCUR.

(21) Check the location of the 1st stage HPT airseal on the hub.

(a) Install a 1st stage HPT blade into a blade root slot of the hub.

(b) The blade root, ID section must be flush or below adjacent surface of hub.

(c) If the blade root ID section is above the adjacent surface of the hub, the airseal must be removed and be installed again.

(d) Repeat steps (a) through (c) at four equally spaced blade slot locations.

(22) Center 60 1st stage HPT covers (1011/2) along the OD surface of hub adjacent to blade slots. Use a rawhide mallet to tap the lower plate detail of the covers as required to seat inboard edge of the covers between the turbine front hub (1011/1) and 1st stage HPT airseal (1011/3). See Figure 1011.

(23) Position PWA 85289 Support Ring on bench.

(24) Using hoist, position hub into support ring.

CAUTION: IT IS RECOMMENDED A FULL SET OF 60 NEW OR REFURBISHED 1ST STAGE BLADES ARE INSTALLED TO GET THE BEST PERFORMANCE, BUT IF THEY ARE NOT AVAILABLE, A MINIMUM OF 30 NEW OR REFURBISHED 1ST STAGE BLADES ARE NECESSARY TO GIVE ADEQUATE SEAL CUTTING. THE PREFERRED TIP COATING FOR THE 30 MINIMUM REPLACEMENT BLADES IS THE EXPOSED GRIT CBN (PWA 293-1). THE BLADES MUST BE INSTALLED DIAMETRICALLY OPPOSED FROM EACH OTHER. FAILURE TO DO SO WILL DECREASE ENGINE PERFORMANCE AND CAUSE MORE BLADE TIP WEAR.

CAUTION: AT LEAST SIX BLADES WITH ANTIROTATION TANGS THAT ARE NOT REPAIRED MUST BE INSTALLED IN THE 1ST STAGE TURBINE ROTOR ASSEMBLY TO MAKE SURE THAT YOU HAVE THE ANTIROTATION PROPERTIES OF THE BLADES.

CAUTION: FIRST STAGE HPT BLADES WITH THERMAL BARRIER COATING (TBC) (POST SB PW4ENG 72-466) CAN ONLY BE USED IN ENGINES WITH A TURBINE NOZZLE THAT INCORPORATES A STAGE 1 HPT (BLADE) COOLING DUCT ASSEMBLY (POST SB PW4ENG 72-466) THAT WILL SUPPLY INCREASED AIRFLOW OR DAMAGE TO THE BLADES CAN OCCUR.

(25) Obtain 60 1st stage HPT blades. If one or more new or repaired 1st stage duct segments are installed, a minimum of 30 blades must have acceptable abrasive tips. See the following step for the abrasive tip

acceptance standard. The balance of the blades can have tip rub into the base metal, or missing tip coating to the base metal to any extent, but the blade length must be within the limits of Figure 1012. See 72-52-07, Inspection/Check-03, PW4000 Series CIR, PN 51A357, (Task 72-52-07-200-003) for blade length measurement. See Table 1001 for blade interchangeability requirements.

Use the table as follows:

1. Select the engine model.
2. Find the letter code(s) that are applicable in the Engine Model Column.
3. Find the part numbers corresponding to the letter codes.
4. You can install any blade that has a letter code, and you can intermix blades with the same letter code in the specified Engine Models for that column.

EXAMPLE: For Engine Model PW4158, Letter Codes A, B, and C are found. Therefore blades with Letter Code C (PN 50L431-001 and PN 51L231) can be installed and can be intermixed.

NOTE: When one or more new duct segments are installed, and the intent of the shop visit is not to zero time the HPT module, the requirement of replacing a minimum of (30) blades may be waived by pretrenching the duct segments in accordance with the PW4000 Series CIR, PN 51A357, Chapter/Section 72-52-32, Repair-02.

	ENGINE MODELS			
PART NUMBER	PW4152 PW4156	PW4156A PW4158	PW4050 (-3) PW4152 (-3) PW4156 (-3) PW4156A (-3) PW4158 (-3)	REFERENCE SERVICE BULLETIN
50L331	A			PW4ENG 72-156
50L331-001	A			PW4ENG 72-469
50L331-002	A			PW4ENG 72-466
50L331-003	A			PW4ENG 72-466
50L431	A	A		PW4ENG 72-154
50L431-001	A	C		PW4ENG 72-466

First Stage HPT Blade Interchangeability
Table 1001

(CONTINUED)

	ENGINE MODELS			
PART NUMBER	PW4152 PW4156	PW4156A PW4158	PW4050 (-3) PW4152 (-3) PW4156 (-3) PW4156A (-3) PW4158 (-3)	REFERENCE SERVICE BULLETIN
50L531	A			PW4ENG 72-71
50L531-001	A			PW4ENG 72-469
50L531-002	A			PW4ENG 72-466
50L531-003	A			PW4ENG 72-466
50L731	A	A		PW4ENG 72-233
51L231	A	C		PW4ENG 72-466
51L831	B	B		PW4ENG 72-496
51L631			D	

FOR THESE MODELS: PW4156A, PW4158 - Parts Coded A can be installed but it is not recommended because of the higher operating temperatures. Blades with the same letter code can be intermixed in the same 1st stage turbine rotor. If there is no letter code in the engine models column, that blade part number can not be installed in the engine models specified for that column.

First Stage HPT Blade Interchangeability
Table 1001 (Continued)

(26) Blade abrasive tip visual acceptance standard. See Figure 1013.

NOTE: You do not have to count individual abrasive grits.

(a) One void area (absence of grits) 1/4 inch (6.350 mm) wide across the tip is permitted as shown in Figure 1012, provided it is not within 1/4 inch (6.350) of the airfoil leading or trailing edge. The general lay of the void area must not be parallel to the platform leading or trailing edge.

(b) Imperfections in the tip coating 1/16 inch (1.587 mm) diameter or less between the grits and separated by 1/32 inch (0.794 mm) or more are acceptable. Four imperfections of 1/16 inch (1.587 mm) diameter or less to the base metal interface are acceptable. Holes caused by grits falling out are not considered imperfections.

(27) Optional, document blade serial numbers. Blades manufactered after April, 1995 contain a Pratt & Whitney issued, 10−digit serial number under the blade platform. See Figure 1014.

NOTE: This serial number is traceable to the manufacture of the blade. Pratt & Whitney recommends that the serial numbers be recorded at assembly and be retained by the operator for tracking and traceability purposes.

(28) Moment weigh blades using suitable moment weight scale and PWA 85081 Adapter.

NOTE: Blades can be either mass weighed or moment weighed to determine the order of diminishing weight. See the following step for the optional mass weight method.

(a) Position PWA 85081 Adapter with adjustable thumbscrew facing up, on extension arm of moment weight scale. Secure in place using socket head cap screws.

(b) Loosen thumbscrew clamp. Position blade convex side up and insert blade root in locating jaws of adapter. Slide blade into jaws until root end contacts dowel pin stop. Tighten thumbscrew to secure blade.

(c) Determine moment weight of blade.

(d) Remove blade from adapter. Mark moment weight on concave side of airfoil using non−etching Ink P05−026.

(e) Weigh and mark remaining blades.

(29) Optional, mass weigh and mark the blades.

(30) Lay out 60 1st stage HPT blades in order of diminishing moment weight.

(31) Number blades from 1 to 60 in order of heaviest to lightest.

(32) Arrange blades in following order: 1, 3, 5, − 57, 59; 2, 4, 6, − 58, 60.

STAGE 1 TURBINE ROTOR ASSEMBLY - ASSEMBLY-01

CAUTION: CARE SHOULD BE TAKEN TO ENSURE THAT ANY FORCE REQUIRED TO INSTALL BLADES IN A HUB BE APPLIED TO ROOT PLATFORM AREA OF BLADE AND NOT TO LEADING OR TRAILING EDGE OF AIRFOIL. AIRFOIL SECTIONS OF ALL BLADES CAN BE DAMAGED IF STRUCK.

(33) Install first blade in slot. See Figure 1015.

(34) Continue to install blades working in clockwise direction.

(35) Insert 1st stage HPT blade seal (1015/3), shorter end toward rear, into outer opening between blade roots. Use Beeswax P05-395 or Paraffin Wax Blend P05-396, as required to retain parts in position.

(36) Insert 1st stage HPT blade damper (1015/4), raised side up, through outer grooves between blade roots. Use a hoist and PWA 85086 Arm, to raise the assembly just enough to gently tap the blades to seat them in the hub. Lower the assembly down onto the support ring.

(37) Install 60 1st stage HPT airseals (1016/2) into outer portion of blade slot. See Figure 1016.

(38) Insert 60 1st stage HPT seals (1016/3) into opening between turbine hub and adjacent blades.

CAUTION: SECOND STAGE HPT AIRSEAL PN 50L195 CAN ONLY BE USED IN ENGINES THAT INCORPORATE THE INTENT OF (SB PW4ENG 72-315).

(39) Install 2nd stage HPT airseal (1017/1) onto turbine front hub (1017/2). See Figure 1017.

(a) Place PWA 85634 Fixture with large chamfered end up, on bench.

(b) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Place the PWA 87121 Adapter Ring with open end up, on the bench.

(c) Using hoist, position turbine hub into support fixture.

(d) Heat the turbine hub airseal mating ID flange to 300°F (148.9°C) maximum for assembly with a minimum temperature differential of 200°F (111°C).

R R R NOTE: You can use Dry Ice P05-102 on the airseal front ID flange to help install the airseal as specified in the following step.

R R R (e) Optional, use the PWA 107120 Lift Fixture to put the front flange of the airseal on dry ice as follows: See Figure 1018.

R R 1 Move the two jaws of the fixture in the outboard position.

R R 2 Attach a hoist to the center lift eye of the fixture.

R R 3 Lower the fixture on the rear surface of the airseal.

R R R 4 Move the jaws to the inboard position and tighten the hand knobs to hold the jaws in position.

R R 5 Use the hoist to put the airseal, front end down on Dry Ice P05-102.

CAUTION: MAKE SURE THAT THE ANTI-ROTATION LUGS IN THE AIRSEAL ARE ALIGNED WITH THE ANTI-ROTATION SLOTS IN THE TURBINE HUB OR DAMAGE TO THE PARTS CAN OCCUR.

R (f) With the airseal at the correct temperature, put the airseal, larger OD end down, over the turbine front hub. Align the anti-rotation slots (1017/3) in the ID of airseal with the antirotation lugs (1017/4) on the inner flange of the hub. Seat the airseal on the hub.

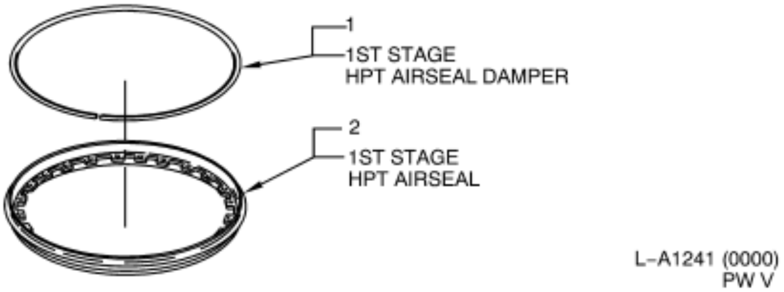
E. Postrequisites

(1) Balance 1st stage turbine rotor assembly by one of the following methods:

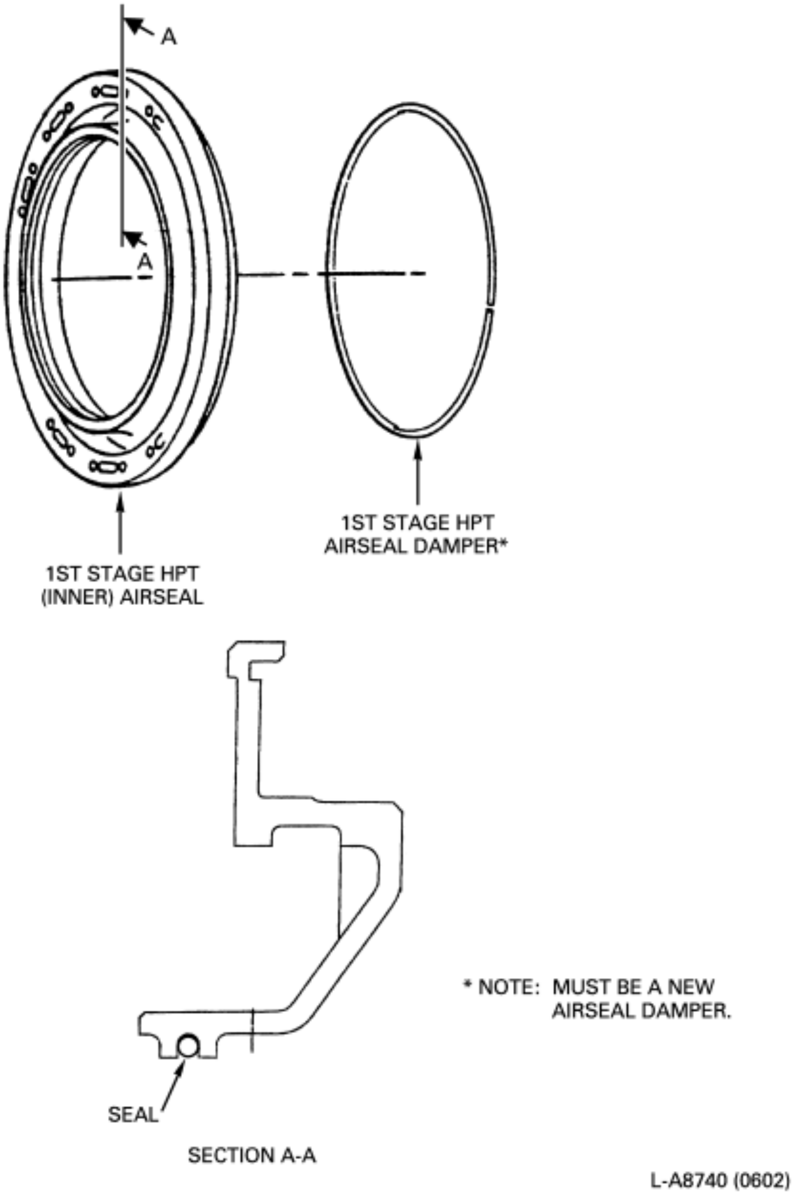
(a) For horizontal balance method refer to Assemby-02 (Task 72-52-01-440-002).

(b) For vertical balance method refer to Assembly-03 (Task 72-52-01-440-003).

STAGE 1 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01


1
1ST STAGE
HPT AIRSEAL DAMPER
2
1ST STAGE
HPT AIRSEAL
L−A1241 (0000)
PW V

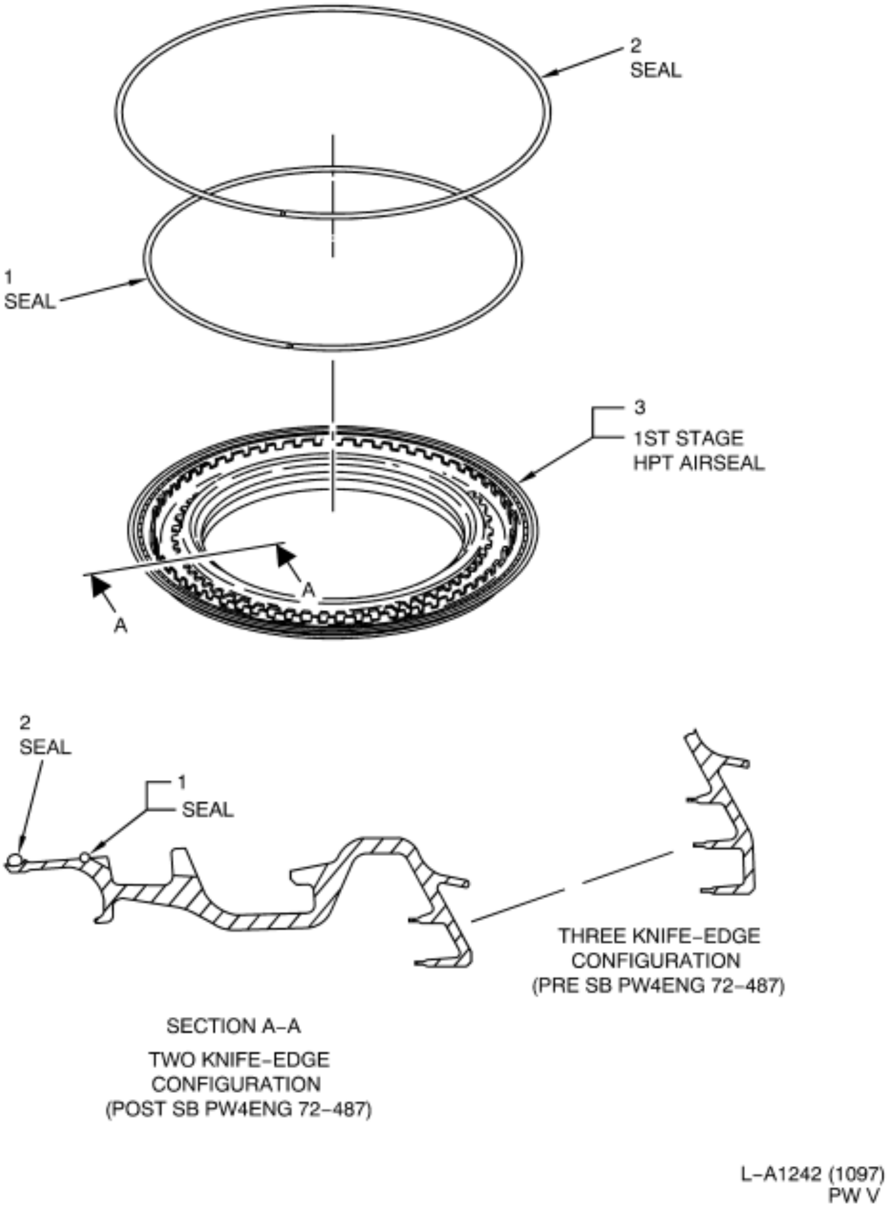
First Stage HPT Airseal Damper Installation
Figure 1001
(Task 72−52−01−440−001)


A
A
1ST STAGE HPT
AIRSEAL DAMPER*
1ST STAGE HPT
(INNER) AIRSEAL
SEAL
SECTION A-A
L-A8740 (0602)

* NOTE: MUST BE A NEW AIRSEAL DAMPER.

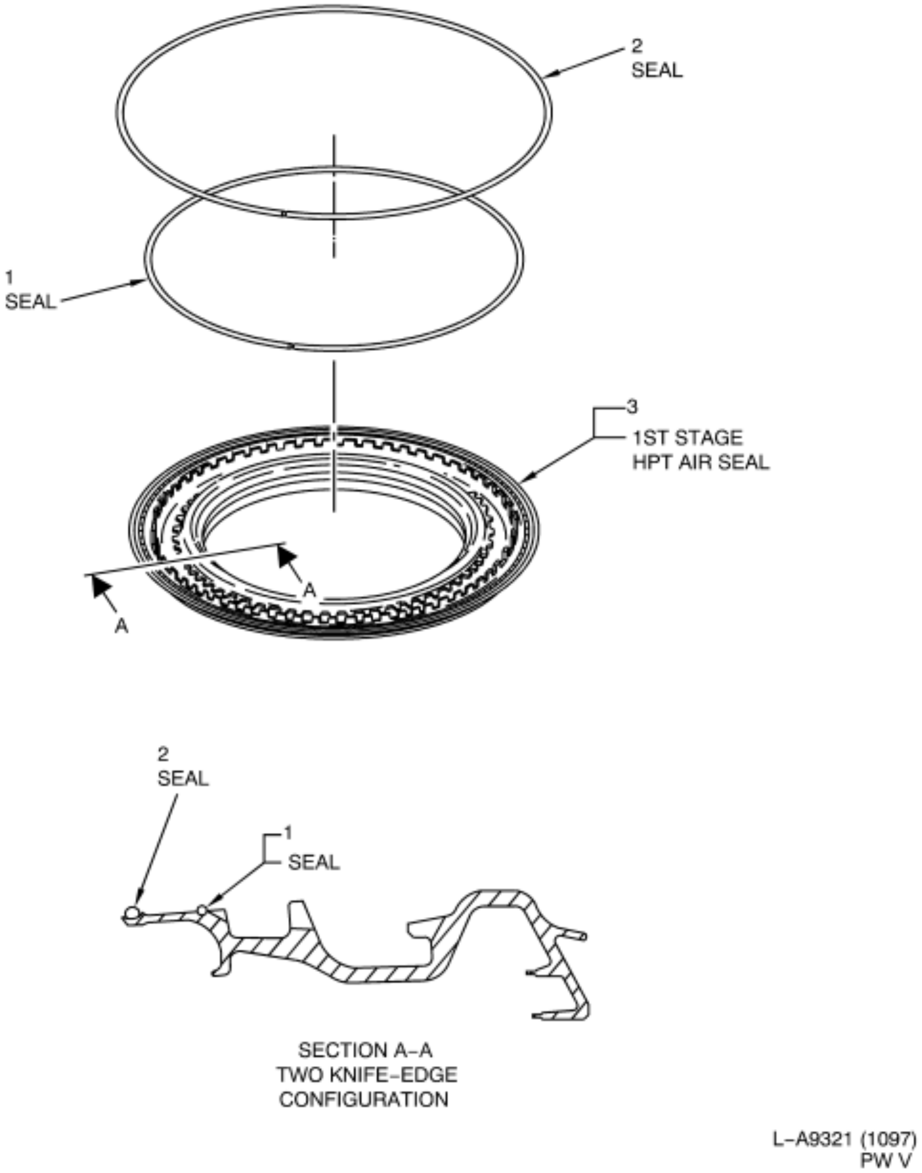
First Stage HPT Airseal Damper Installation
Figure 1001A
(Task 72−52−01−440−001)

STAGE 1 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01


2
SEAL
1
SEAL
3
1ST STAGE
HPT AIRSEAL
A
A
2
SEAL
1
SEAL
THREE KNIFE−EDGE
CONFIGURATION
(PRE SB PW4ENG 72−487)
SECTION A−A
TWO KNIFE−EDGE
CONFIGURATION
(POST SB PW4ENG 72−487)
L−A1242 (1097)
PW V

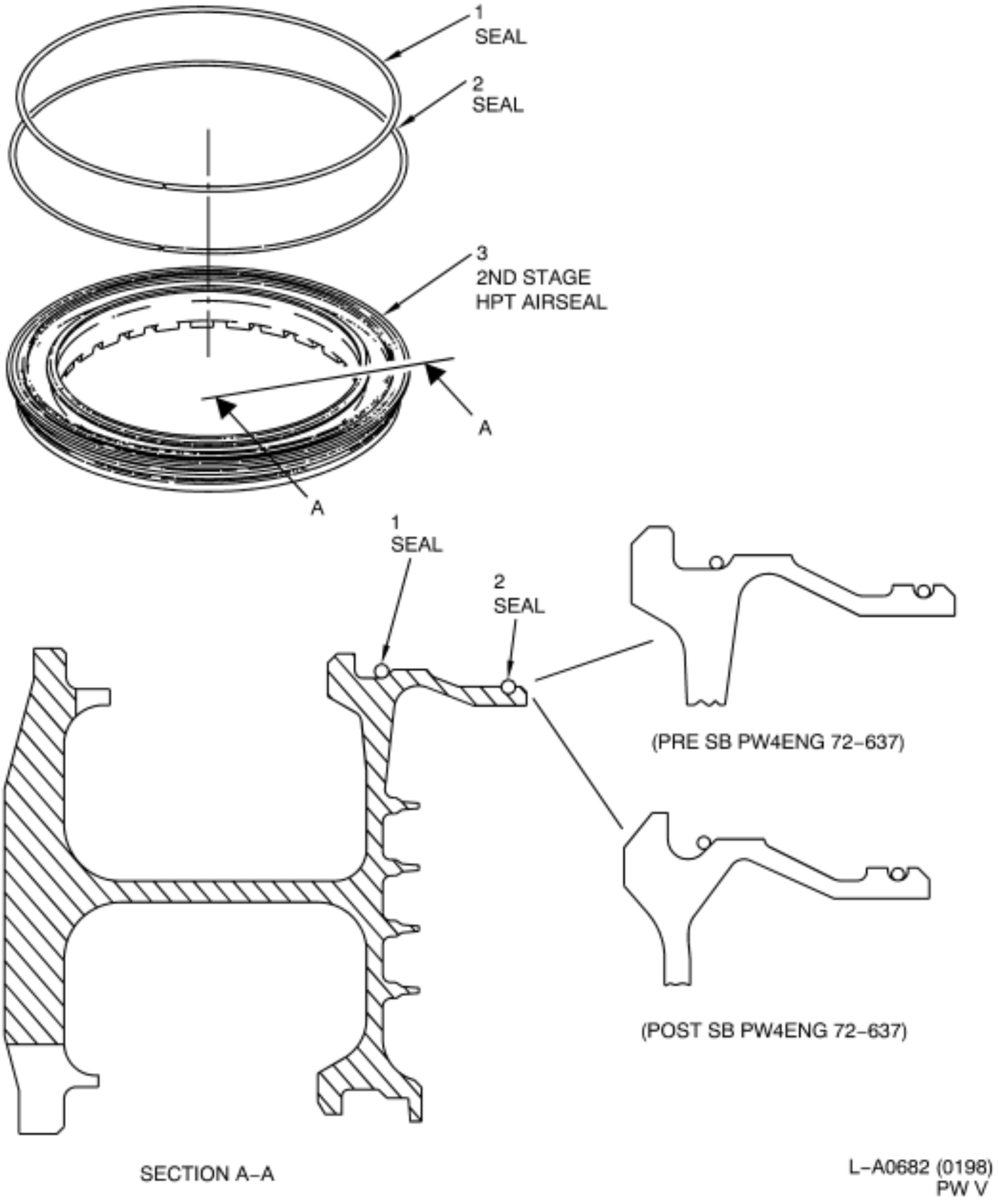
Seal Installation
Figure 1002
(Task 72−52−01−440−001)

STAGE 1 TURBINE ROTOR ASSEMBLY - ASSEMBLY-01

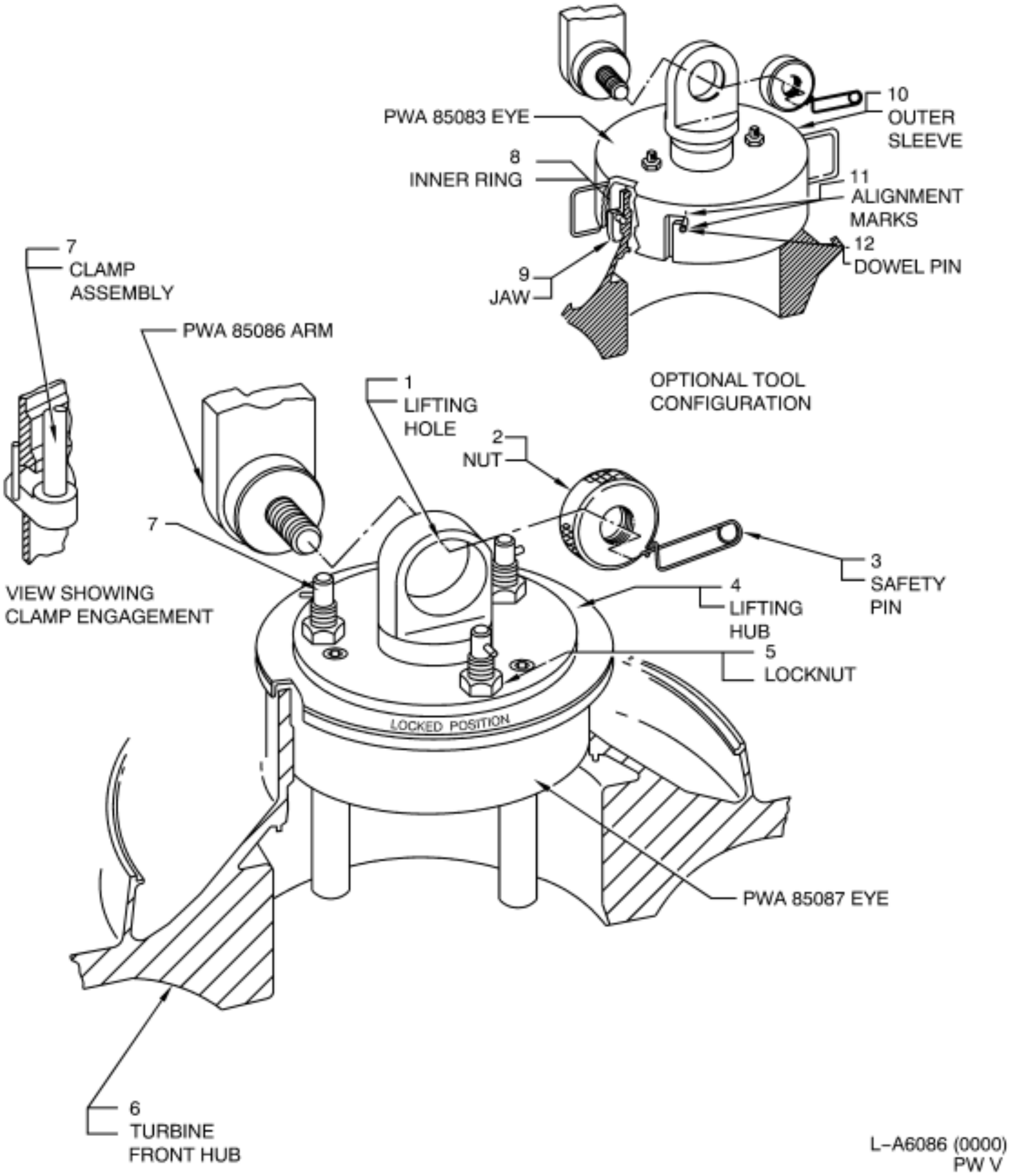

2
SEAL
1
SEAL
3
1ST STAGE
HPT AIR SEAL
A
A
2
SEAL
1
SEAL
SECTION A-A
TWO KNIFE-EDGE
CONFIGURATION
L-A9321 (1097)
PW V

Seal Installation
Figure 1002A
(Task 72-52-01-440-001)

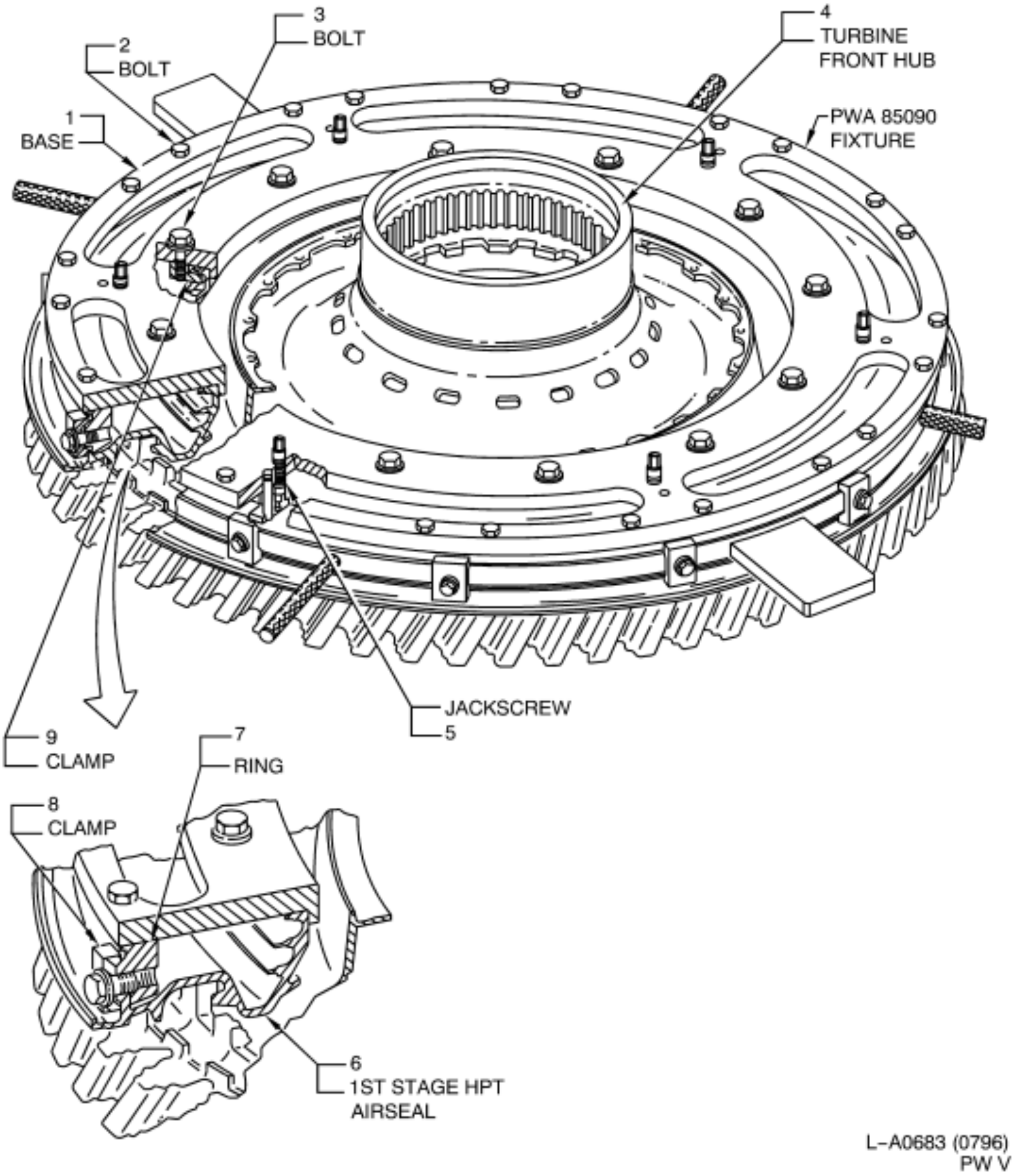
STAGE 1 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01


1
SEAL
2
SEAL
3
2ND STAGE
HPT AIRSEAL
A
A
1
SEAL
2
SEAL
(PRE SB PW4ENG 72−637)
(POST SB PW4ENG 72−637)
SECTION A−A
L−A0682 (0198)
PW V

Seal Installation
Figure 1003
(Task 72−52−01−440−001)

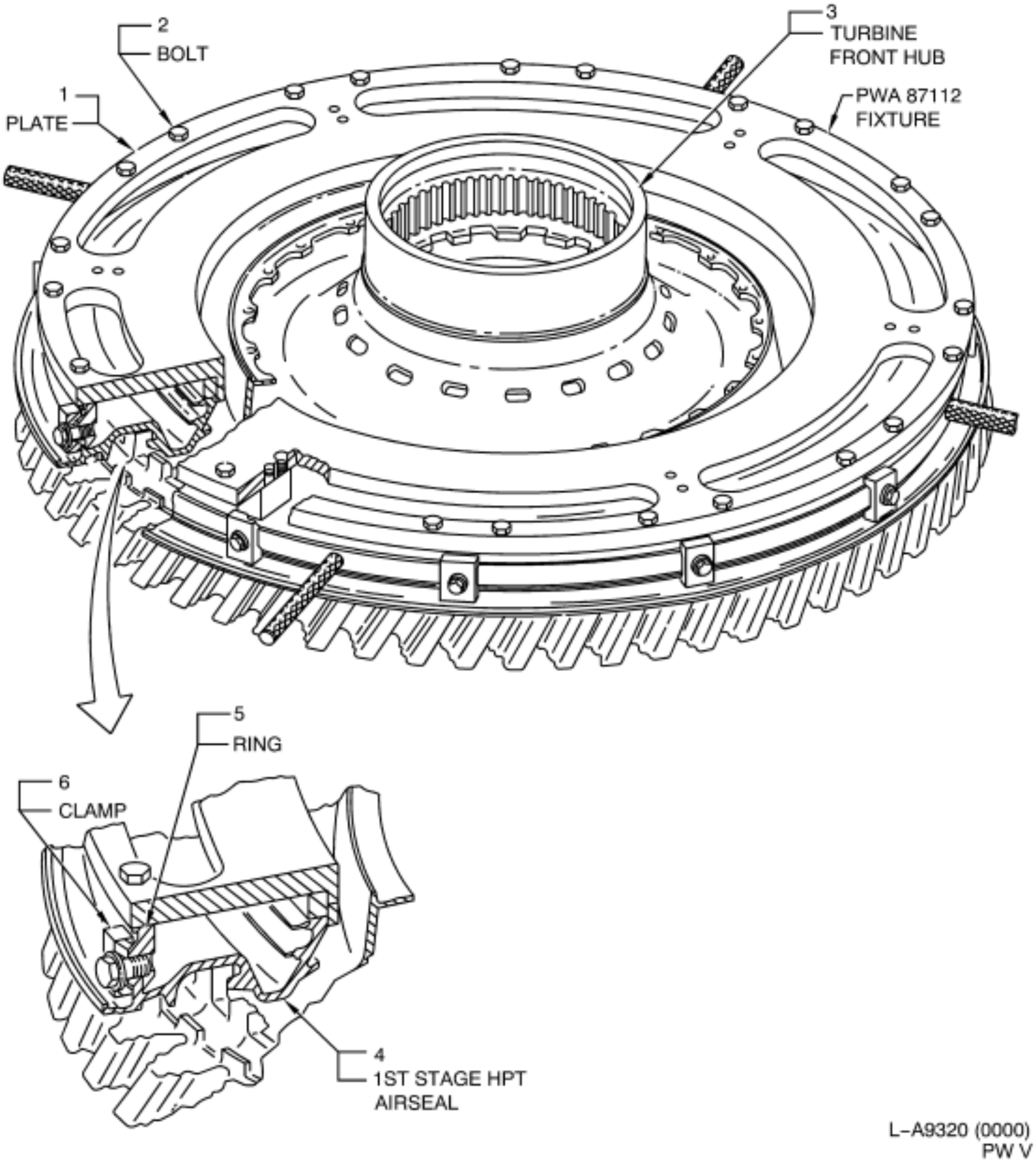

PWA 85083 EYE
10
OUTER
SLEEVE
8
INNER RING
11
ALIGNMENT
MARKS
12
DOWEL PIN
9
JAW
7
CLAMP
ASSEMBLY
PWA 85086 ARM
OPTIONAL TOOL
CONFIGURATION
1
LIFTING
HOLE
2
NUT
7
3
SAFETY
PIN
4
LIFTING
HUB
VIEW SHOWING
CLAMP ENGAGEMENT
5
LOCKNUT
LOCKED POSITION
PWA 85087 EYE
6
TURBINE
FRONT HUB
L−A6086 (0000)
PW V

Turbine Front Hub Lifting Eye Installation
Figure 1004
(Task 72−52−01−440−001)

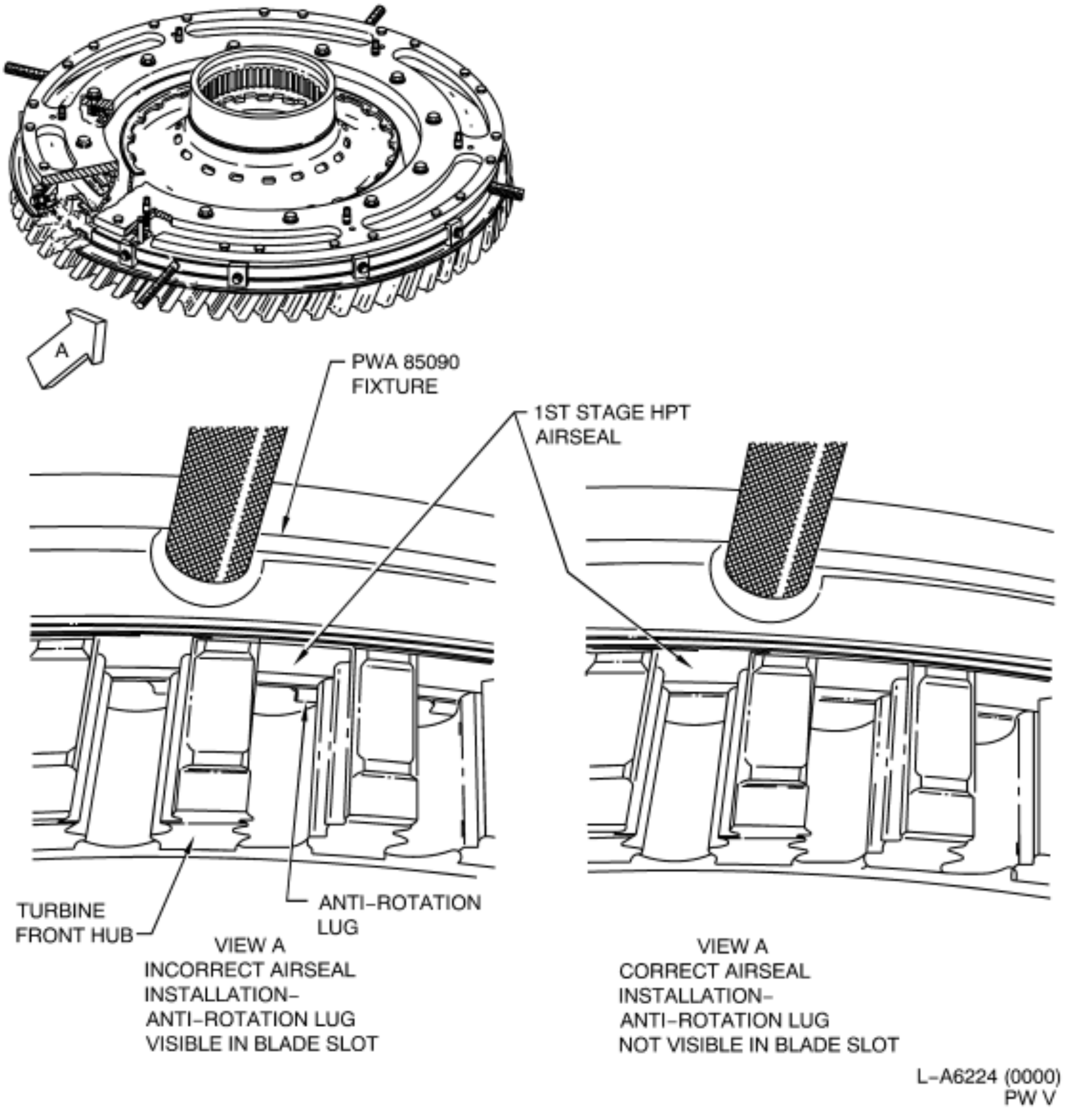

3
BOLT
4
TURBINE FRONT HUB
2
BOLT
PWA 85090 FIXTURE
1
BASE
JACKSCREW
5
9
CLAMP
7
RING
8
CLAMP
6
1ST STAGE HPT AIRSEAL
L-A0683 (0796)
PW V

First Stage HPT Airseal Installation
Figure 1005
(Task 72-52-01-440-001)

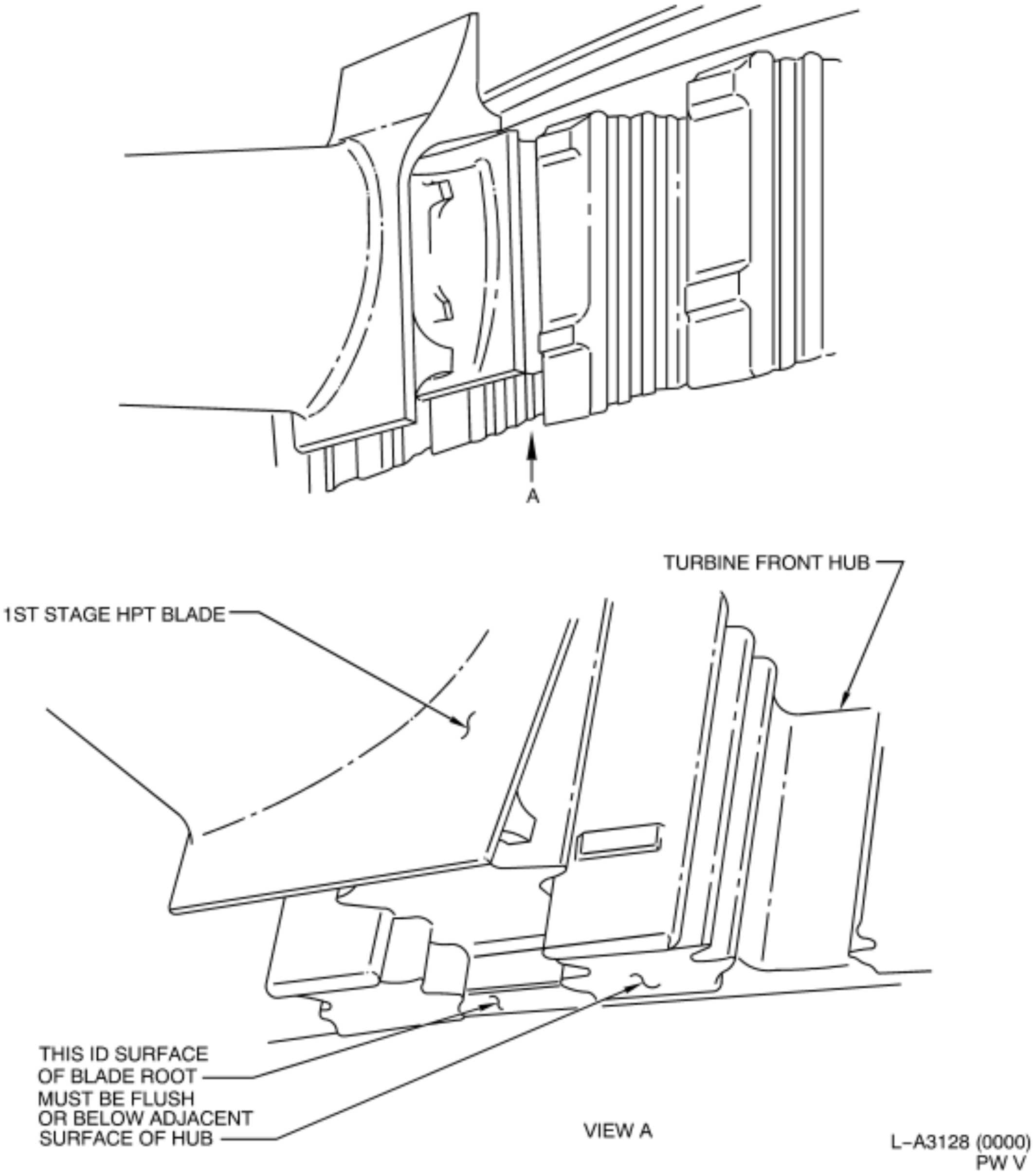
STAGE 1 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01


2
BOLT
1
PLATE
3
TURBINE
FRONT HUB
PWA 87112
FIXTURE
5
RING
6
CLAMP
4
1ST STAGE HPT
AIRSEAL
L-A9320 (0000)
PW V

First Stage HPT Airseal Installation
Figure 1005A
(Task 72−52−01−440−001)

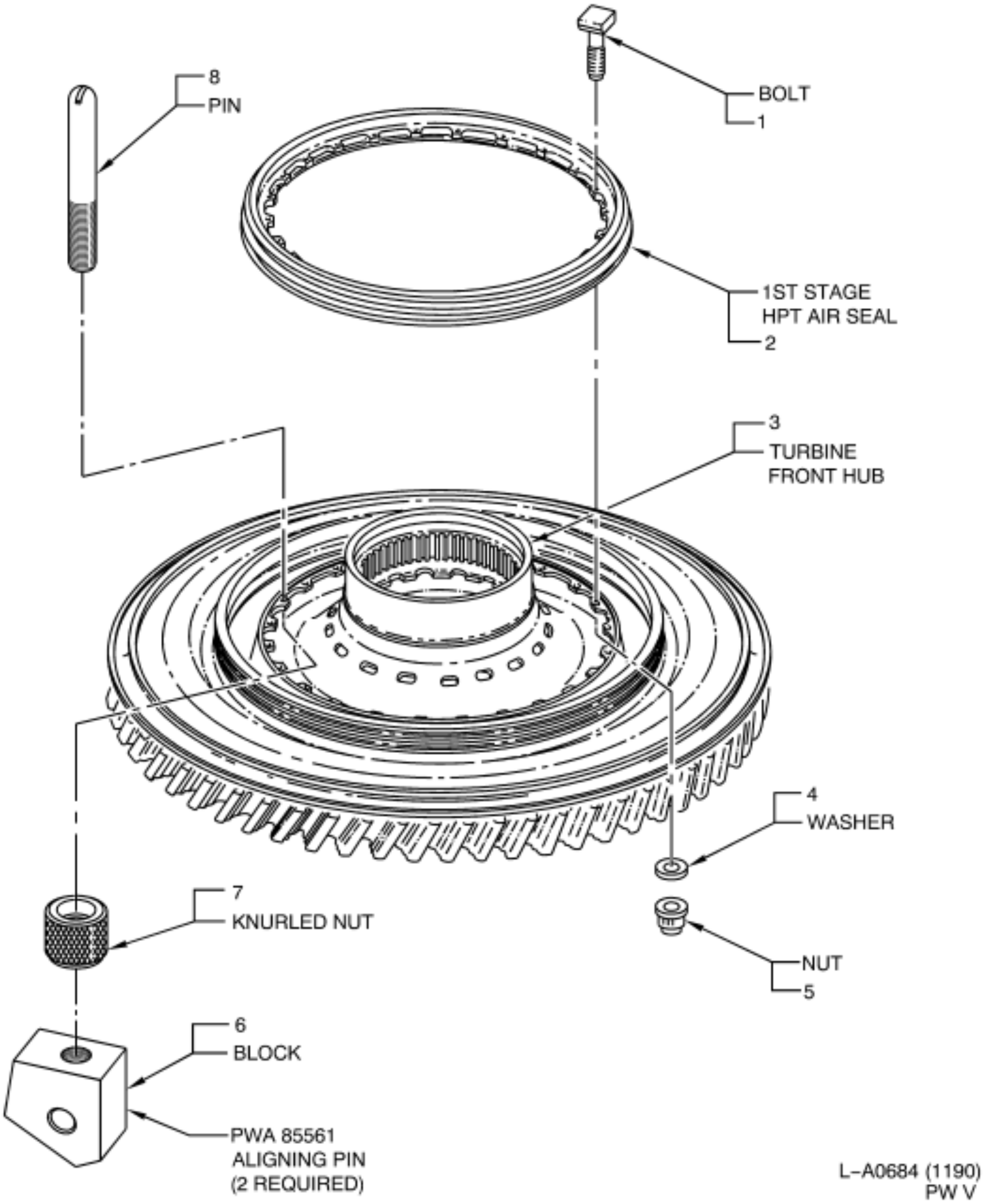

A
PWA 85090
FIXTURE
1ST STAGE HPT
AIRSEAL
TURBINE
FRONT HUB
ANTI-ROTATION
LUG
VIEW A
INCORRECT AIRSEAL
INSTALLATION-
ANTI-ROTATION LUG
VISIBLE IN BLADE SLOT
VIEW A
CORRECT AIRSEAL
INSTALLATION-
ANTI-ROTATION LUG
NOT VISIBLE IN BLADE SLOT
L-A6224 (0000)
PW V

First Stage HPT Airseal Position Inspection
Figure 1006
(Task 72-52-01-440-001)


A
TURBINE FRONT HUB
1ST STAGE HPT BLADE
THIS ID SURFACE
OF BLADE ROOT
MUST BE FLUSH
OR BELOW ADJACENT
SURFACE OF HUB
VIEW A
L−A3128 (0000)
PW V

First Stage HPT Airseal Seating Check
Figure 1007
(Task 72−52−01−440−001)

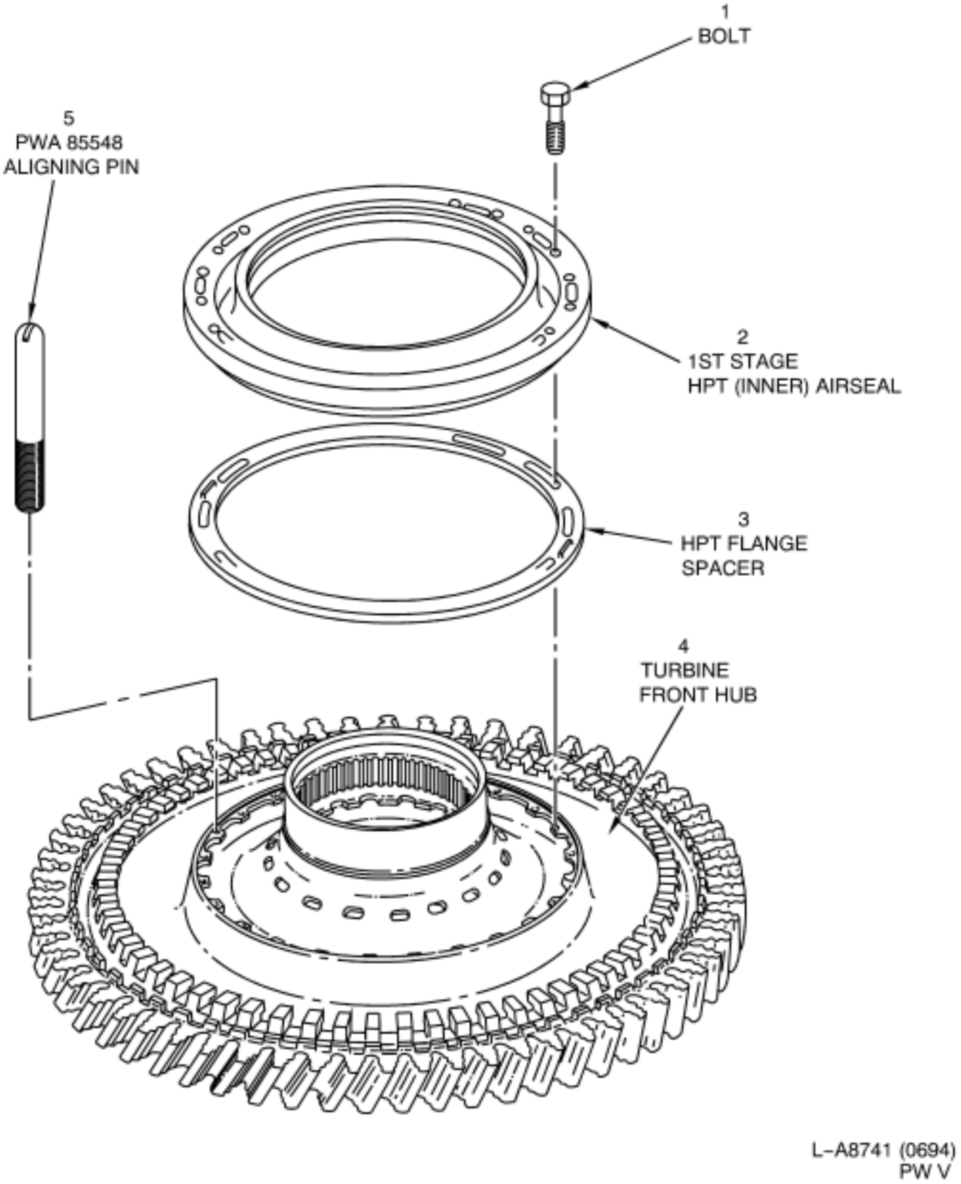
STAGE 1 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01


8
PIN
BOLT
1
1ST STAGE
HPT AIR SEAL
2
3
TURBINE
FRONT HUB
4
WASHER
7
KNURLED NUT
NUT
5
6
BLOCK
PWA 85561
ALIGNING PIN
(2 REQUIRED)
L−A0684 (1190)
PW V

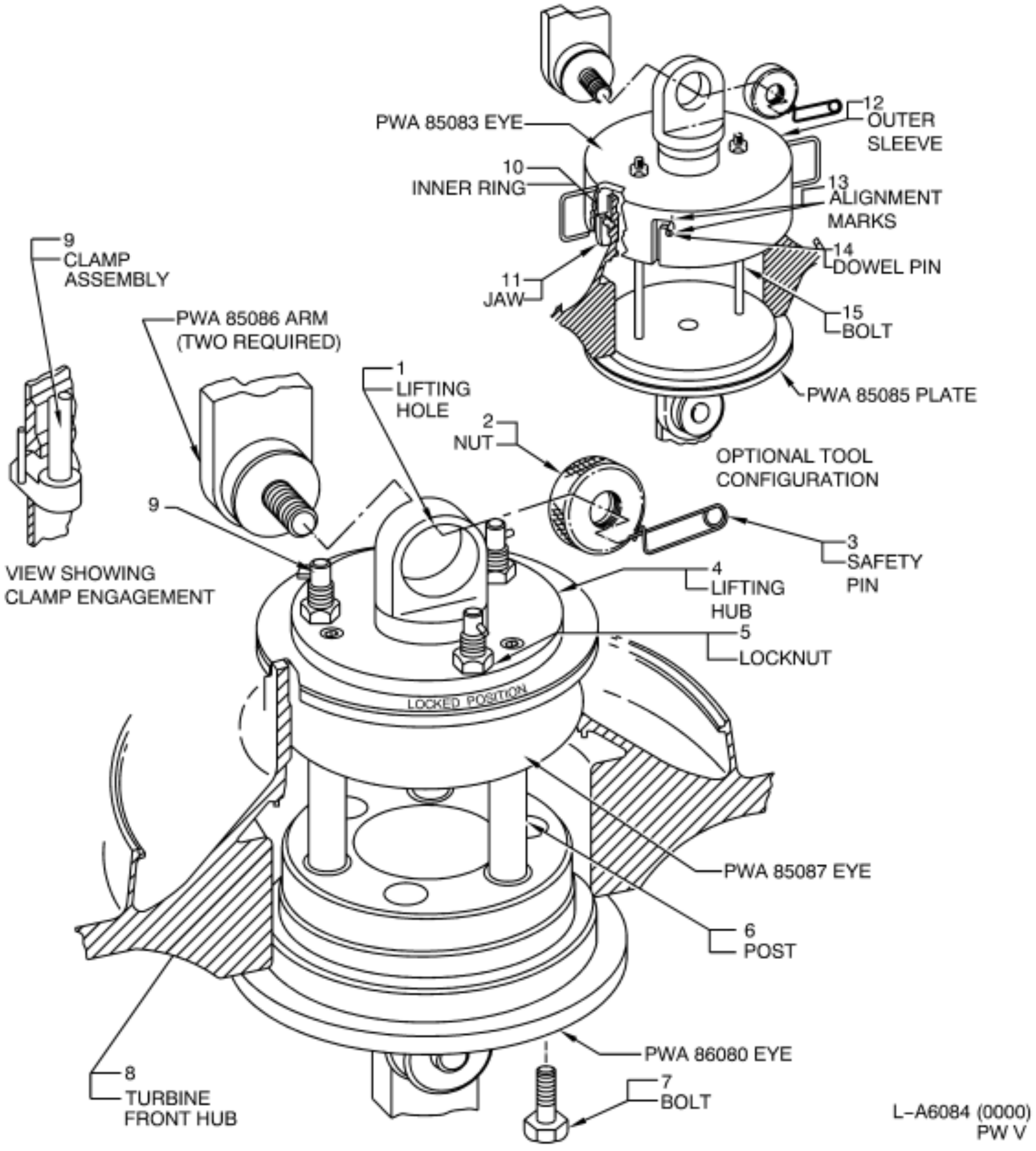
First Stage HPT Airseal Installation
Figure 1008
(Task 72−52−01−440−001)

R
R

STAGE 1 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01

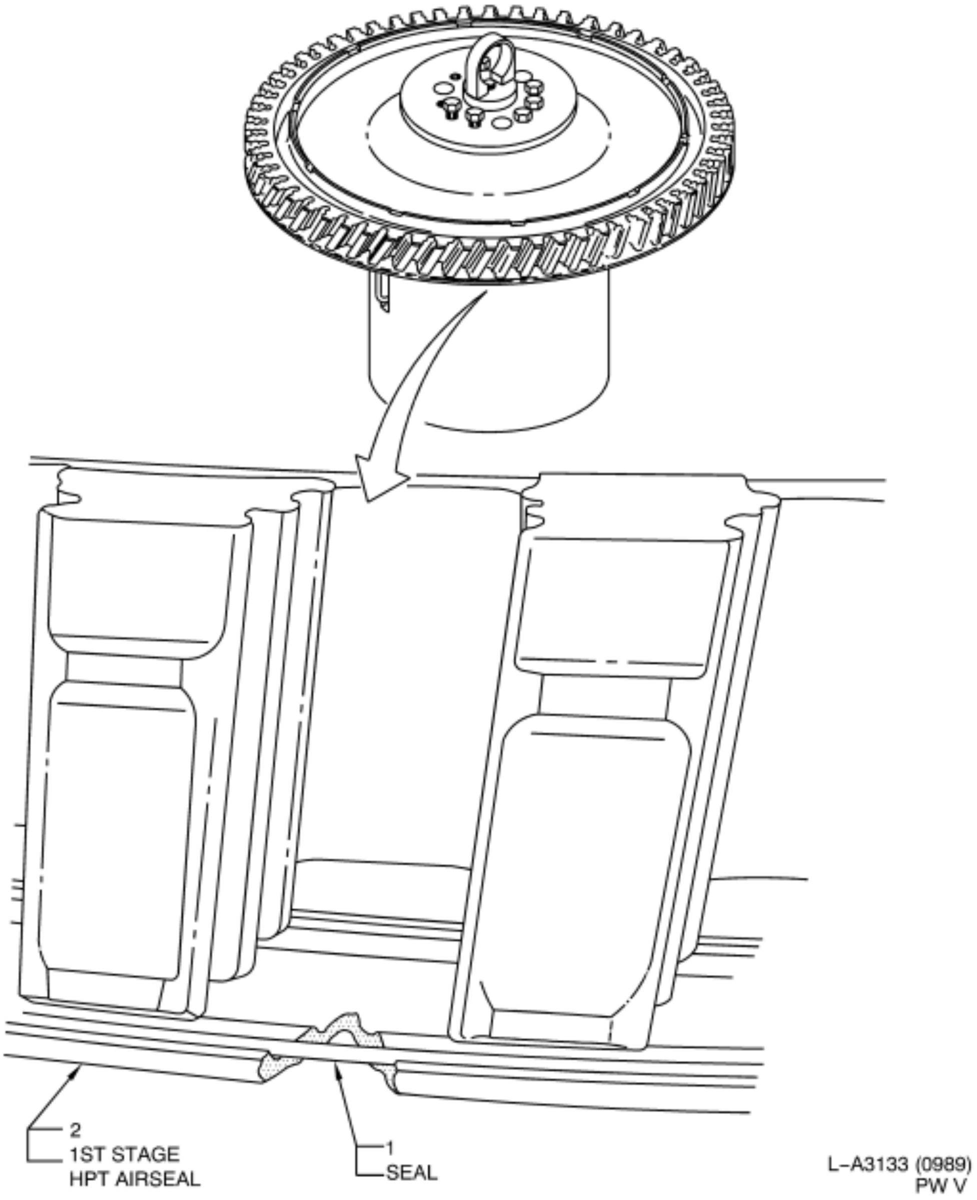

1
BOLT
5
PWA 85548
ALIGNING PIN
2
1ST STAGE
HPT (INNER) AIRSEAL
3
HPT FLANGE
SPACER
4
TURBINE
FRONT HUB
L−A8741 (0694)
PW V

First Stage HPT Airseal Installation
Figure 1008A
(Task 72−52−01−440−001)


PWA 85083 EYE
12 OUTER SLEEVE
10 INNER RING
13 ALIGNMENT MARKS
9 CLAMP ASSEMBLY
14 DOWEL PIN
11 JAW
15 BOLT
PWA 85086 ARM (TWO REQUIRED)
1 LIFTING HOLE
PWA 85085 PLATE
2 NUT
OPTIONAL TOOL CONFIGURATION
9
3 SAFETY PIN
VIEW SHOWING CLAMP ENGAGEMENT
4 LIFTING HUB
5 LOCKNUT
LOCKED POSITION
PWA 85087 EYE
6 POST
PWA 86080 EYE
8 TURBINE FRONT HUB
7 BOLT
L-A6084 (0000)
PW V

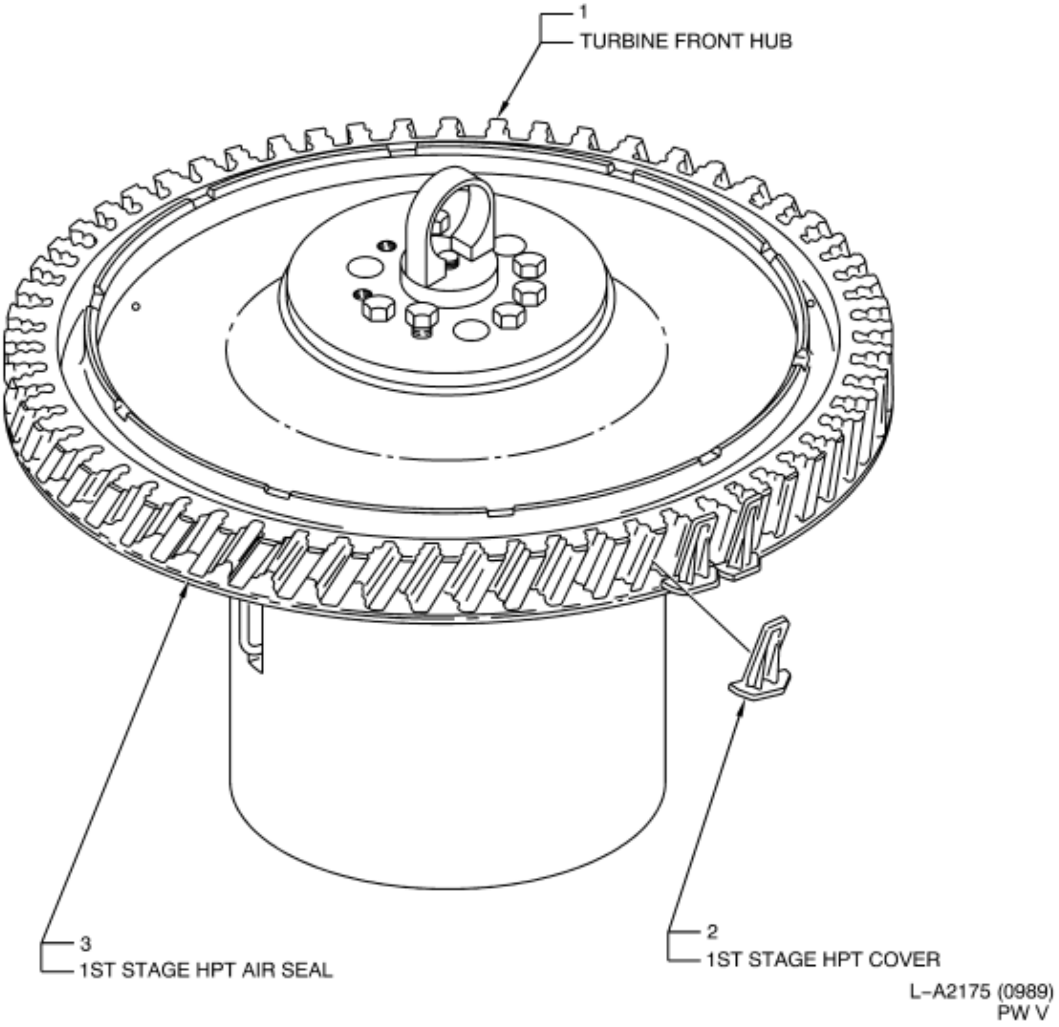
Turbine Front Hub Trunnioning
Figure 1009
(Task 72-52-01-440-001)

STAGE 1 TURBINE ROTOR ASSEMBLY - ASSEMBLY-01


2
1ST STAGE
HPT AIRSEAL
1
SEAL
L-A3133 (0989)
PW V

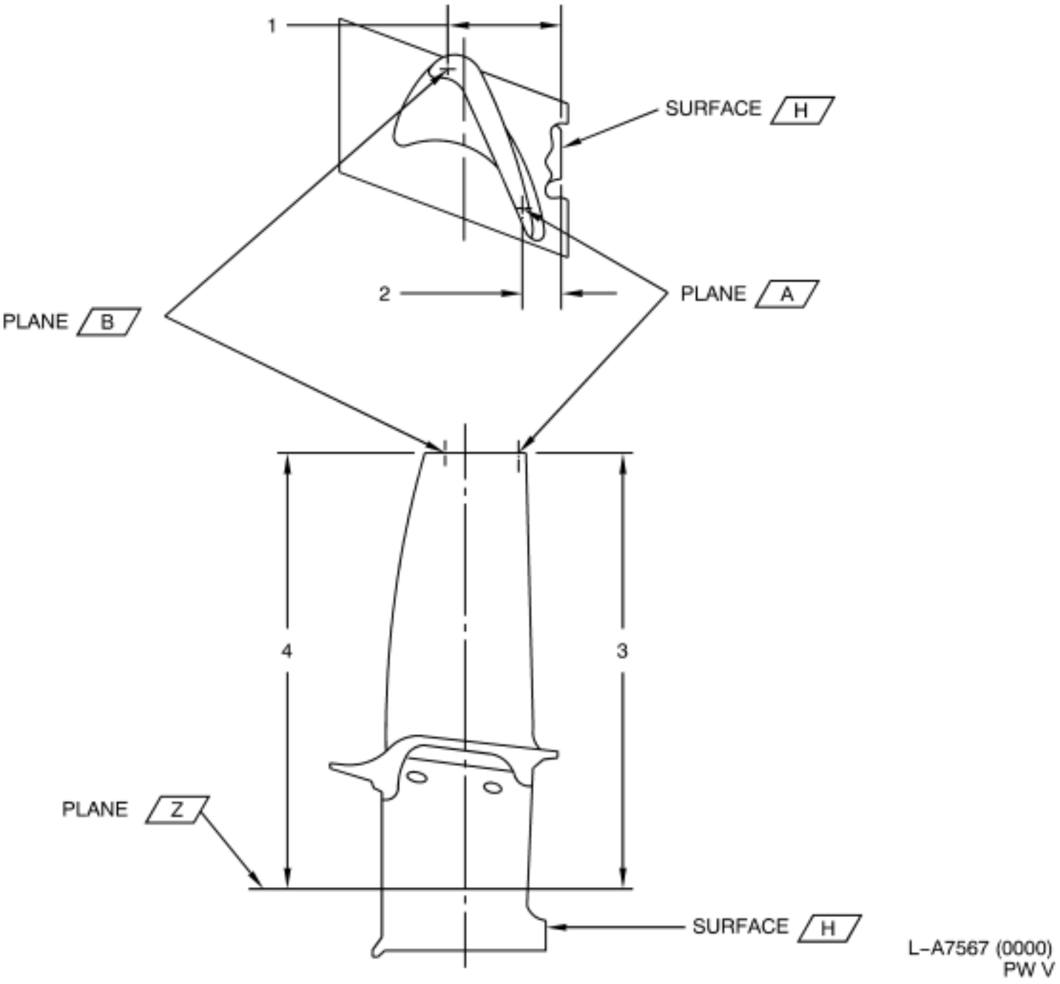
Outer Wire Seal Installation
Figure 1010
(Task 72-52-01-440-001)

STAGE 1 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01


1
TURBINE FRONT HUB
2
1ST STAGE HPT COVER
3
1ST STAGE HPT AIR SEAL
L−A2175 (0989)
PW V

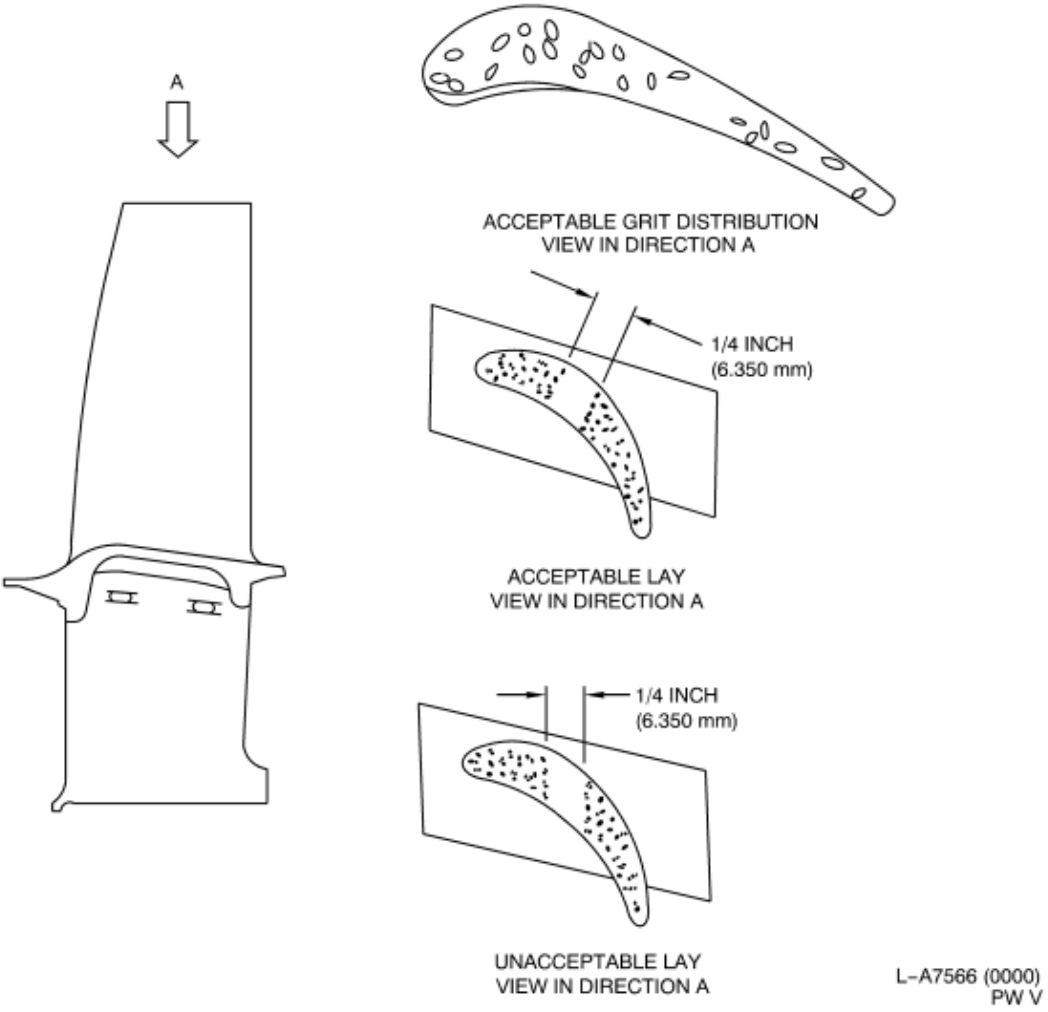
First Stage HPT Covers Installation
Figure 1011
(Task 72−52−01−440−001)

STAGE 1 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01


1
SURFACE H
2
PLANE A
PLANE B
4
3
PLANE Z
SURFACE H
L−A7567 (0000)
PW V

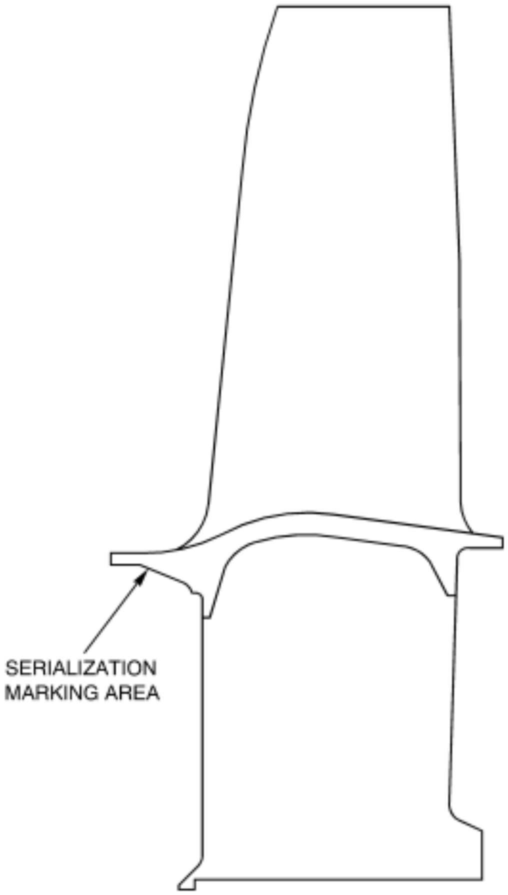
1. 1.110 Inches (28.194 mm), Reference
2. 0.300 Inch (7.620 mm), Reference
3. 4.225 Inches (107.315 mm) Minimum To Plane A
4. 4.230 Inches (107.442 mm) Minimum To Plane B

zBlade Length Inspection
Figure 1012
(Task 72−52−01−440−001)


A
ACCEPTABLE GRIT DISTRIBUTION
VIEW IN DIRECTION A
1/4 INCH
(6.350 mm)
ACCEPTABLE LAY
VIEW IN DIRECTION A
1/4 INCH
(6.350 mm)
UNACCEPTABLE LAY
VIEW IN DIRECTION A
L−A7566 (0000)
PW V

Blade Tip Abrasive Grit Inspection
Figure 1013
(Task 72−52−01−440−001)

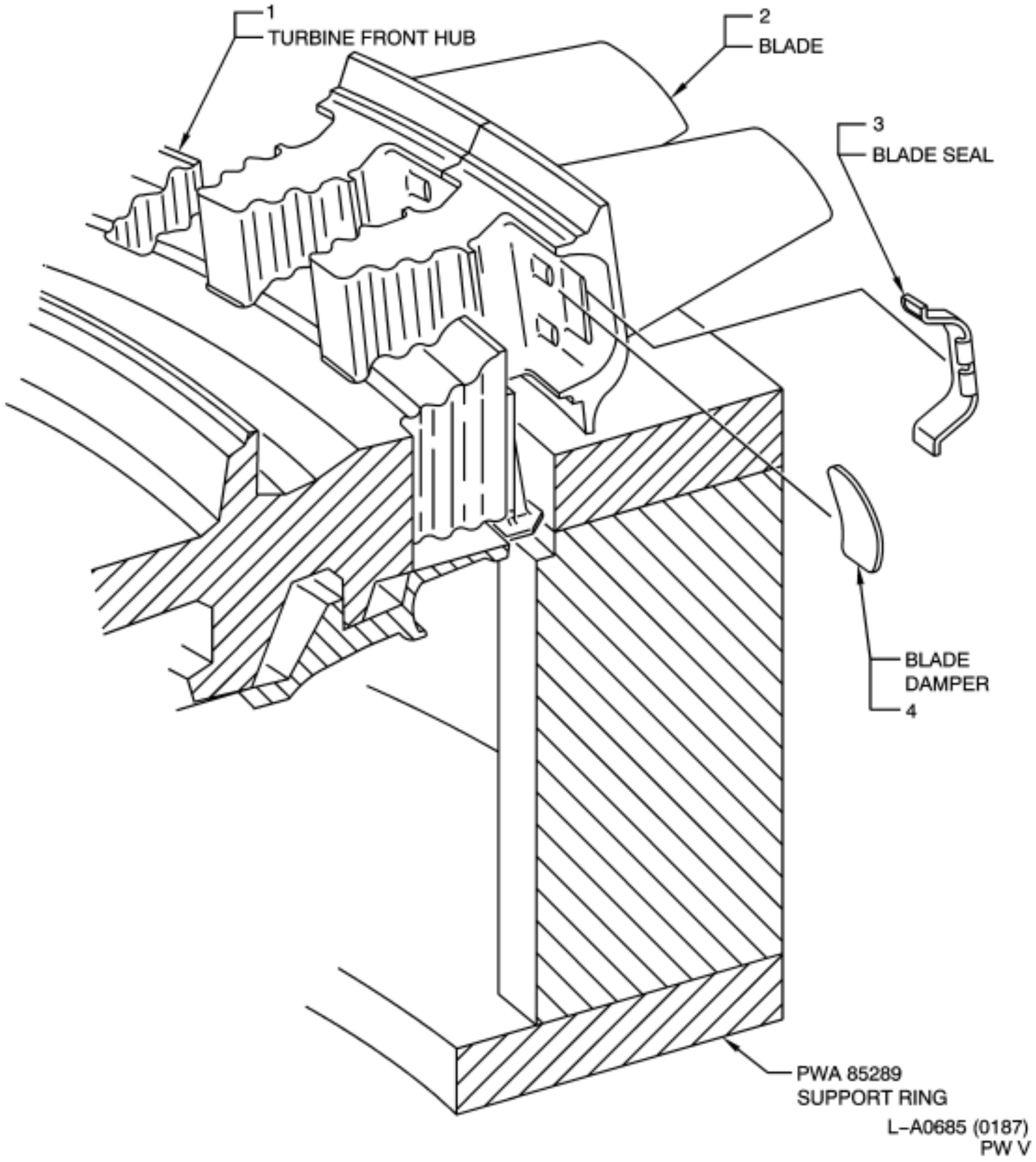
STAGE 1 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01


SERIALIZATION
MARKING AREA

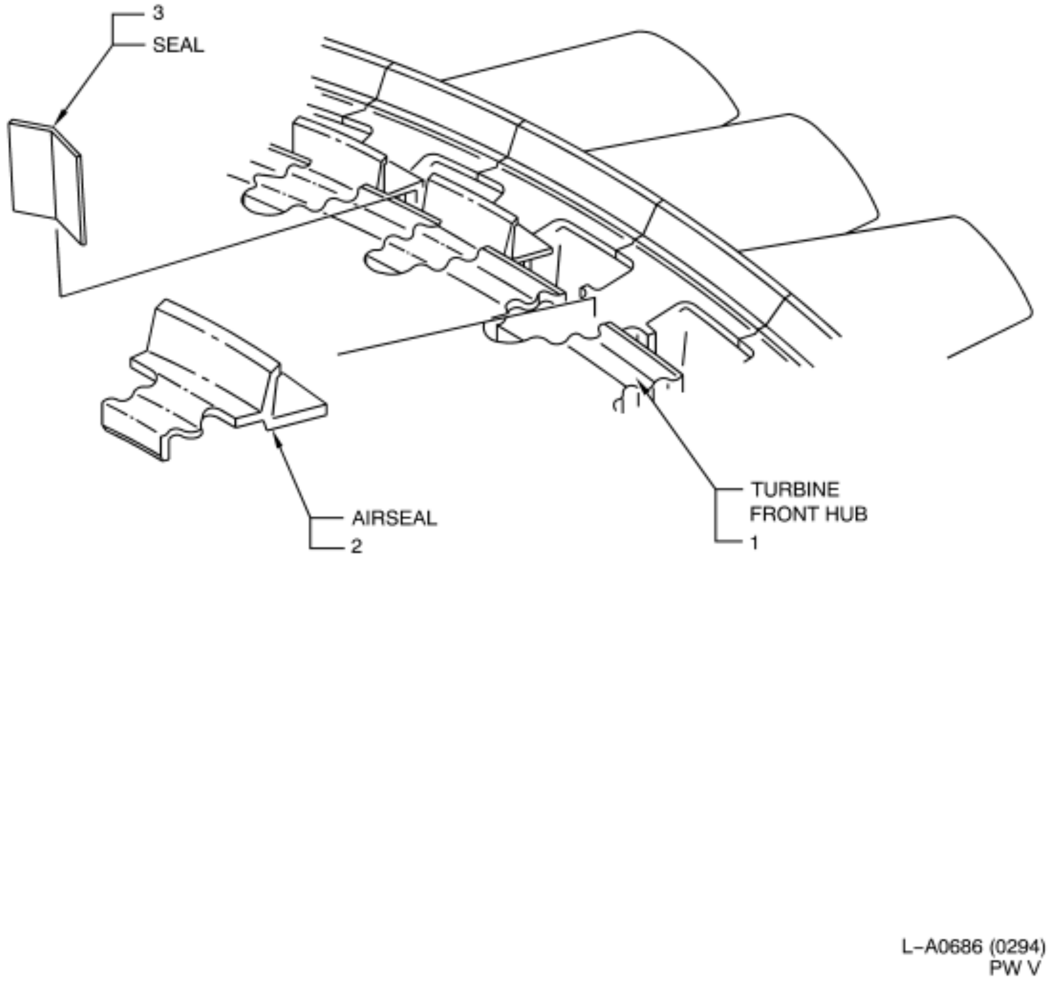
L−B2614 (0000)
PW V

First Stage HPT Blade Installation Serialization Marking Area
Figure 1014
(Task 72−52−01−440−001)

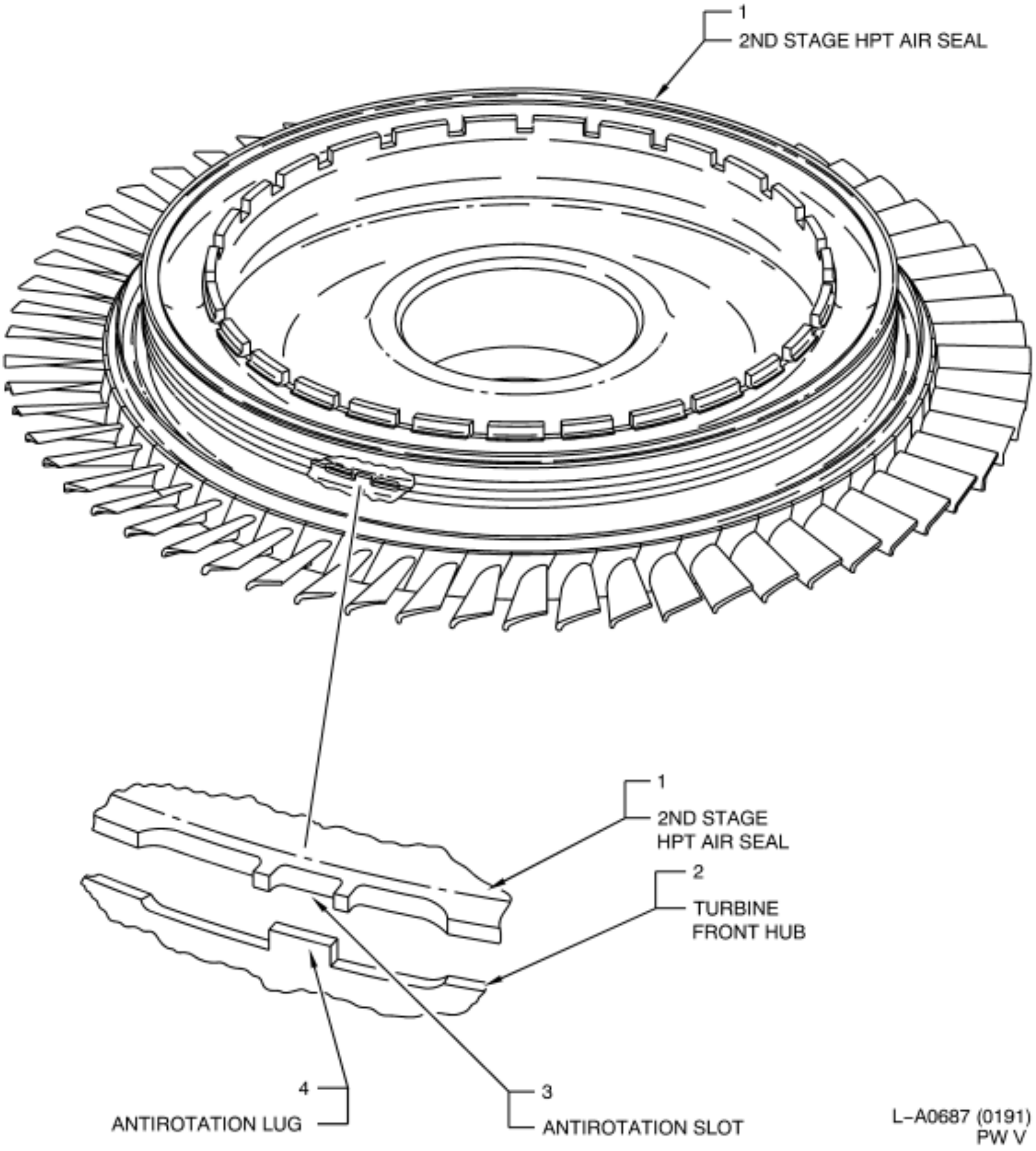
R
R


1
TURBINE FRONT HUB
2
BLADE
3
BLADE SEAL
BLADE
DAMPER
4
PWA 85289
SUPPORT RING
L−A0685 (0187)
PW V

First Stage HPT Blade Installation
Figure 1015
(Task 72−52−01−440−001)

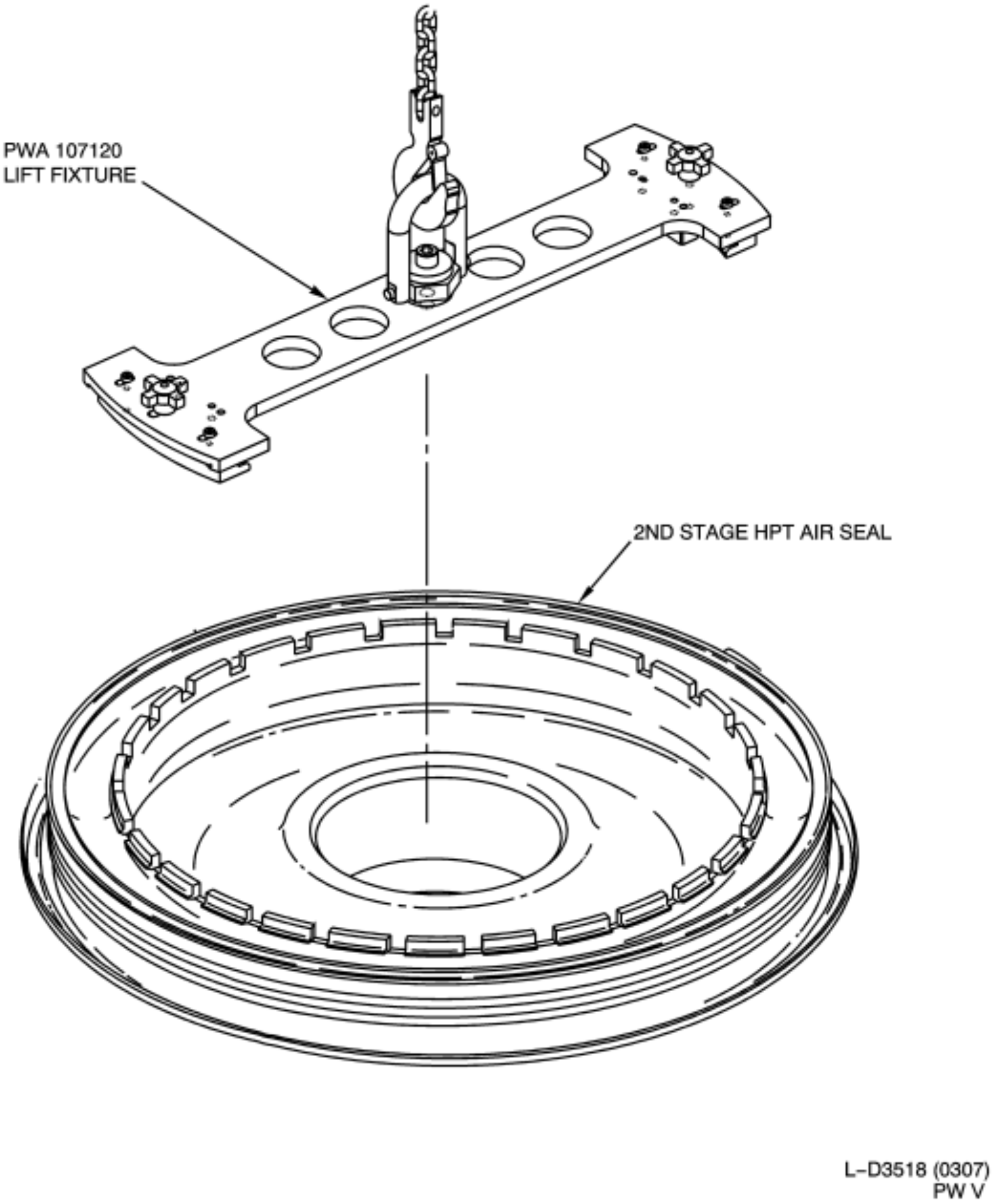

3
SEAL
AIRSEAL
2
TURBINE
FRONT HUB
1
L−A0686 (0294)
PW V

First Stage HPT Airseals And Seals Installation
Figure 1016
(Task 72−52−01−440−001)


1
2ND STAGE HPT AIR SEAL
1
2ND STAGE
HPT AIR SEAL
2
TURBINE
FRONT HUB
4
ANTIROTATION LUG
3
ANTIROTATION SLOT
L-A0687 (0191)
PW V

Second Stage HPT Airseal Installation
Figure 1017
(Task 72-52-01-440-001)

STAGE 1 TURBINE ROTOR ASSEMBLY - ASSEMBLY-01


PWA 107120
LIFT FIXTURE
2ND STAGE HPT AIR SEAL
L-D3518 (0307)
PW V

R PWA 107120 Fixture Installation
R Figure 1018
R (Task 72-52-01-440-001)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-52-01-440-002:

1. Static Balance Stage 1 Turbine Rotor Assembly

A. Prerequisites

(1) Assemble 1st stage turbine rotor assembly per Assembly-01 Task 72-52-01-440-001.

B. Equipment And Materials Necessary

Special Tools:

R R	PWA 78176	Socket, Special (First Stage HPT Airseal Bolts, Post SB PW4ENG 72-504)
	PWA 85084	Eye, Lifting
	PWA 85086	Arm, (Two Necessary)
	PWA 85095	Arbor, Balance
	PWA 85096	Stand, Assembly
	PWA 85097	Shroud
	PWA 85098	Weight, Calibration (Check Weight)
	PWA 85099	Stand, Storage
	PWA 86505	Wrench, Ratchet (Optional)
	PWA 86506	Wrench, Ratchet (Optional)
	PWA 87130	Weight, Calibration (Check Weight)
	PWA 87751	Adapter, Torque

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

C. Procedure

(1) Install the PWA 85095 Balance Arbor in the PWA 85096 Assembly Stand as follows:

(a) With a spanner wrench, tighten two lifting eyes on ends of arbor.

(b) Attach two PWA 85086 Arms to lifting eyes on arbor.

(c) Attach two hoists to arms and remove arbor from storage box.

(d) If necessary, remove the Detail-29 Check Weight from the shaft of the arbor.

(e) Trunnion arbor to front (drive) end down position. Remove lower lifting eye and arm.

(f) Remove bolts which attach the Detail-7 front (lower) retainer and remove retainer from arbor.

(g) Install the Detail-27 front safety ring over front (lower) expanding chuck and secure with three detail bolts.

(h) Remove quick release pin from PWA 85096 Stand. Lower arbor, front (drive) end down, into stand and secure with quick release pin. Remove lifting eye and arm.

(i) Using larger spanner wrench, remove nut (1001/1). Remove retainer (1001/2). See Figure 1001.

(j) If installed, remove nut (1001/3), spacer (1001/4) and ring.

(2) Install 1st stage turbine rotor assembly onto arbor.

(a) Install PWA 85084 Eye to rear of turbine rear hub.

1 Remove center bushing from eye.

2 Loosen three screws and slide locators radially inward.

3 Install eye into rear bore of hub.

4 Slide locators outward against ID of hub. Install center bushing into eye and tighten three screws to secure locators.

(b) Using hoist, connect standard three cable sling to lifting eyes of PWA 85084 Eye.

(c) Using hoist, install rotor onto arbor, aligning splines of hub with spline drives of arbor.

(d) Install spacer (1001/4) over rear (upper) expanding chuck and seat on shoulder of turbine hub.

(e) Make sure the safety ring (1001/7) is against shoulder of arbor.

STAGE 1 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02

CAUTION: DO NOT OPERATE THE HYDRAULIC CHUCK DETAIL OF THE PWA 85095 ARBOR UNLESS THE THREE EXPANDING DIAMETERS ARE HELD BY THE ARBOR PARTS OR THE TURBINE HUB. IF YOU DO OPERATE THE CHUCK WITHOUT THESE PARTS, YOU CAN DAMAGE THE ARBOR.

(f) Use the wrench supplied with the arbor to tighten and loosen the hydraulic chuck actuating screw a number of times. Do this to put the rotor in the center. Tighten the actuating screw one last time to keep the rotor in position. Install the nut (1001/3).

(g) Install the rear retainer (1001/2) on the nut (1001/3) and attach it with the nut (1001/1).

(3) Install rear lifting eye to upper end of arbor. Install hoist with PWA 85086 Arm to lifting eye.

(4) Take up slack in hoist. Remove quick release pin from stand. Remove assembly from stand.

(5) Install front lifting eye to lower end of arbor. Install PWA 85086 Arm to lifting eye. Attach second hoist to lower arm.

(6) Using hoists, trunnion arbor and rotor assembly to horizontal position. Install assembly into cradles of PWA 85099 Stand. Remove hoists and arms.

NOTE: Front and rear sleeves of arbor should be covered with suitable protective material to avoid possible damage during transport and storage when in PWA 85099 Stand.

(7) Move the arbor and rotor assembly to the balance machine.

(8) Open cover of PWA 85097 Shroud. Using two hoists and arms, install arbor onto rollers of balance machine. Remove hoists, arms and lifting eyes from ends of arbor.

(9) Connect arbor to balance machine with direct drive (U−Joint driver, size 187/2) or install drive belt to sand blasted area on front end of arbor.

(10) Operate the balance machine.

(a) Find the static unbalance of the rotor assembly while it turns at 900 rpm minimum.

(b) Get three unbalance readings. For balance machines that do not have an automatic recording feature, record the average angle and the average amount of unbalance.

(11) Remove the arbor and the rotor assembly from the balance machine as follows:

(a) Open the cover of the PWA 85097 Shroud.

(b) If a direct drive is used, use an approved pen to make index marks on the direct drive and the arbor so that they will be reassembled in the same relative position.

(c) Install the detail lifting eyes to the ends of the arbor.

(d) Connect two hoists with two PWA 85086 Lifting Arms to the lifting eyes.

(e) With the hoists, install the arbor and rotor assembly in the PWA 85099 Stand. Remove the hoists.

NOTE: Cover the front and rear sleeves of the arbor with an applicable material. This will prevent possible damage during transport.

(f) Connect two hoists, lift the assembly from the stand and trunnion it to the front, hub end down, position. Remove the lower hoist and lifting arm.

(g) Remove the ball lock pin from the PWA 85096 Stand. Align the bolt holes and lower the arbor into the stand. Attach the arbor with the ball lock pin. See Figure 1001.

(h) Remove the upper hoist and lifting arm from the arbor.

(i) Use an approved pen to make index marks on the arbor, rear retainer, and spacer so that these details will be reassembled in the same relative position. Make index marks on the arbor and the turbine front hub.

(j) Use the spanner wrench to remove the retaining nut (1001/1) which attaches the retainer (1001/2).

(k) With the larger spanner wrench, remove the nut (1001/3). Also remove the spacer.

(l) Install the PWA 85084 Lifting Eye to the rear of the turbine rear hub as follows:

   1 Remove the center bushing from the eye.

   2 Loosen the three screws and move the locators radially inward.

   3 Install the lifting eye into the rear bore of the hub.

   4 Move the locators outward against the ID of the hub. Install the center bushing into the lifting eye and tighten the three screws to attach the locators.

(m) With the hoist, connect a standard three cable sling to the eyes of the PWA 85084 Lifting Eye.

(n) Lift the rotor assembly from the balance arbor. Index (turn) the rotor assembly 180 degrees and lower the assembly on the arbor while you align the hub's splines with the drive splines on the arbor.

(o) Remove the sling, hoist and the PWA 85084 Lifting Eye.

(p) Align the index marks and install the spacer (1001/4) on the arbor and against the shoulder of the turbine hub. Make sure the safety ring (1001/7) is against the shoulder of the arbor.

(q) Use the wrench supplied with the arbor to tighten and loosen the hydraulic chuck actuating screw a number of times. Do this to put the rotor in the center. Tighten the actuating screw one last time to keep the rotor in position.

(r) Install the nut (1001/3). Tighten the nut with the spanner wrench.

(s) Install the rear retainer (1001/2) on the nut (1001/3) and attach the retainer with the nut (1001/1). Tighten the nut with the spanner wrench.

(12) Install the rear lifting eye to the upper end of the arbor. Install the hoist with the PWA 85086 Lifting Arm to the lifting eye.

(13) Make sure the hoist has the correct tension. Remove the quick release pin from the stand. Remove the assembly from the stand.

(14) Install the front lifting eye to the lower end of the arbor. Install the PWA 85086 Lifting Arm to the lifting eye. Attach a second hoist to the lower lifting arm.

(15) With a hoist, trunnion the arbor and rotor assembly to the horizontal position. Install the assembly into the cradles of the PWA 85099 Stand. Remove the hoists and lifting arms.

NOTE: Cover the front and rear sleeves of the arbor with an applicable material. This will prevent possible damage during transport and storage while it is in the PWA 85099 Stand.

(16) Move the arbor and rotor assembly to the balance machine.

(17) Open the cover of the PWA 85097 Shroud. With the two hoists and lifting arms, install the arbor on the rollers of the balance machine. Remove the hoists, lifting arms and lifting eyes from the ends of the arbor.

(18) Connect the arbor to the balance machine with the direct drive and align the index marks on the arbor and the direct drive or install the drive belt to the sand blasted area on the front end of the arbor.

(19) Operate the balance machine.

(a) Static balance the rotor assembly while it turns at 900 rpm minimum. The residual unbalance must not be more than 1.0 oz−in. (720.0 g.mm).

(b) For balance machines that have an automatic recording feature, get three unbalance readings. Average the readings. Use the machine to determine the unbalance amount and angle of the assembly.

(c) For balance machines that do not have an automatic recording feature, get three unbalance readings. Average and record the three unbalance readings. Use the average readings from the first and second balance runs to do a polar plot to get the assembly unbalance angle and amount.

(20) If the static unbalance is equal to 1.0 oz−in. (720.0 g.mm) or less continue as follows:

(a) Record the angle and the amount of unbalance.

(21) If the static unbalance is more than 1.0 oz−in. (720.0 g.mm), continue as follows:

(a) FOR THESE MODELS: 4152, 4156A, 4158
Install a maximum of ten counterweights over an arc of 180 degrees to correct any unbalance as follows: See Figure 1002.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158 (Pre SB PW4ENG 72−541) Use PN 50L088 counterweights. (Post SB PW4ENG 72−541) Use PN 50L924 counterweights.

1 FOR THESE MODELS: 4152, 4156A, 4158
Loosen and remove the bolt (1002/1), washer (1002/2), and nut (1002/3) at the counterweight locations with the optional PWA 86505 Ratchet Wrench.

2 FOR THESE MODELS: 4152, 4156A, 4158
Lubricate the threads of the bolts with Engine Oil P03-001.

3 FOR THESE MODELS: 4152, 4156A, 4158
Install the counterweights (1002/4) and attach in position with the bolts (1002/1) and nuts (1002/3) with the optional PWA 86506 Ratchet Wrench.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
Washers are not used under the nuts at the counterweight locations.

4 FOR THESE MODELS: 4152, 4156A, 4158
Torque the bolts with the PWA 87751 Adapter to 85 - 95 lb-in. (9.604 -10.734 N.m).

(b) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
(Pre SB PW4ENG 72-541) Install a maximum of three counterweights over an arc of 180 degrees to correct any unbalance as follows: See Figure 1003.

1 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Loosen and remove the bolts (1003/1) that attach the air seal ring to the flange of the turbine hub at the angular location of unbalance.

2 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Lubricate the threads of the bolts (1003/1) with Engine Oil P03-001.

3 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install the counterweights (1003/2) and attach in position with the bolts (1003/1).

4 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
R Use a PWA 78176 Socket to torque the bolts to 85 - 95 lb-in. (9.604 -10.734 N.m).

(c) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
(Post SB PW4ENG 72-541) Install a maximum of ten counterweights over an arc of 180 degrees to correct any unbalance as follows: See Figure 1003.

1 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Loosen and remove the bolts (1003/1) that attach the air seal ring to the flange of the turbine hub at the angular location of unbalance.

2 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Lubricate the threads of the bolts (1003/1) with Engine Oil P03-001.

3 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install the counterweights (1003/2) and attach in position with the bolts (1003/1).

4 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
R Use a PWA 78176 Socket to torque the bolts to 85 - 95 lb-in. (9.604 -10.734 N.m).

(d) Static balance the rotor assembly as described above until the residual unbalance is not more than 1.0 oz-in. (720.0 g.mm).

(e) Record the heavy angle and the amount of assembly unbalance.

(22) FOR THESE MODELS: 4152, 4156A, 4158
Optional process based on the experience of the operator, do a check of the balance machine by Figure 1002 as follows:

(a) FOR THESE MODELS: 4152, 4156A, 4158
Loosen and remove a nut (1002/3) and washer (1002/2) or counterweight (1002/4) with the PWA 87751 Torque Adapter or the PWA 86505 Ratchet Wrench which attach the air seal ring to the flange of the turbine hub as close as possible to the angle of residual unbalance.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Install the PWA 85098 Calibration Weight (Check Weight) at the location and attach with the removed washer (1002/2) or counterweight (1002/4) and nut (1002/3). Torque the nut to 85 - 95 lb-in. (9.604 -10.734 N.m).

(c) FOR THESE MODELS: 4152, 4156A, 4158
The check weight pulls 4.0 oz-in. (2880.0 g.mm).

(d) FOR THESE MODELS: 4152, 4156A, 4158
Do a check of the balance machine at 900 rpm minimum.

(e) FOR THESE MODELS: 4152, 4156A, 4158
The amount of unbalance should pull 4.0 oz−in. (2880.0 g.mm) plus the remaining residual unbalance ± 0.4 oz−in (288.0 g.mm).

(f) FOR THESE MODELS: 4152, 4156A, 4158
Remove the check weight.

(23) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Optional process based on the experience of the operator, do a check of the balance machine by Figure 1002 as follows:

(a) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Loosen and remove two adjacent bolts which attach the air seal ring to the flange of the turbine hub as close as possible to the angle of residual unbalance.

(b) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Install the PWA 87130 Calibration Weight (Check Weight) at the removed bolt locations and attach
R with the removed bolts. Use a PWA 78176 Socket to torque the bolts to 85 − 95 lb−in. (9.604 −10.734 N.m).

(c) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
The check weight pulls 4.0 oz−in. (2880.0 g.mm).

(d) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Do a check of the balance machine at 900 rpm minimum.

(e) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
The amount of unbalance should pull 4.0 oz−in. (2880.0 g.mm) plus the remaining residual unbalance ± 0.4 oz−in (288.0 g.mm).

(f) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Remove the check weight.

(24) Mark the unbalance symbol (triangle) and the amount of unbalance, adjacent to the unbalance symbol (triangle), on the rear side of the disk web at the location of heavy unbalance by SPOP 401 (Task 70-11-00-280-006), Standard Practices Manual, PN 585005. Use the shallow etch method.

NOTE: No burns, pitting or selective attack is permitted on the disk.

(25) Remove arbor and rotor assembly from balance machine and install in PWA 85099 Stand.

(a) Open cover of PWA 85097 Shroud.

(b) Install lifting eyes on ends of arbor.

(c) Connect two hoists with two PWA 85086 Arms to lifting eyes.

(d) Using hoists, install arbor and rotor assembly in PWA 85099 Stand. Remove hoists and arms.

NOTE: Front and rear sleeves of arbor should be covered with suitable protective material to avoid possible damage during transport in PWA 85099 Stand.

(26) Remove rotor assembly from arbor.

(a) Install two hoists with PWA 85086 Arms to lifting eyes on ends of arbor.

(b) Using hoists, lift assembly from stand and trunnion to front, hub, end down position. Remove lower hoist and trunnioning arm.

(c) Remove ball lock pin from stand. Align bolt holes and lower arbor into stand. Secure arbor with ball lock pin.

(d) Remove upper hoist and trunnioning arm from arbor.

(e) Remove retaining nut (1001/1) securing retainer (1001/2).

(f) Using larger spanner wrench, remove nut (1001/3). Remove spacer (1001/4).

(g) Install PWA 85084 Eye to rear of turbine rear hub.

1 Remove center bushing from eye.

2 Loosen three screws and slide locators radially inward.

3 Install eye into rear bore of hub.

4 Slide locators outward against ID of hub. Install center bushing into eye and tighten three screws to secure locators.

(h) Using hoist, connect standard three cable sling to lifting eyes of PWA 85084 Eye.

(i) Using hoist, install rotor assembly front end down in PWA 85634 Fixture. Remove PWA 85084 Eye.

(27) Remove arbor from stand.

(a) Install PWA 85086 Arm to upper lifting eye of arbor.

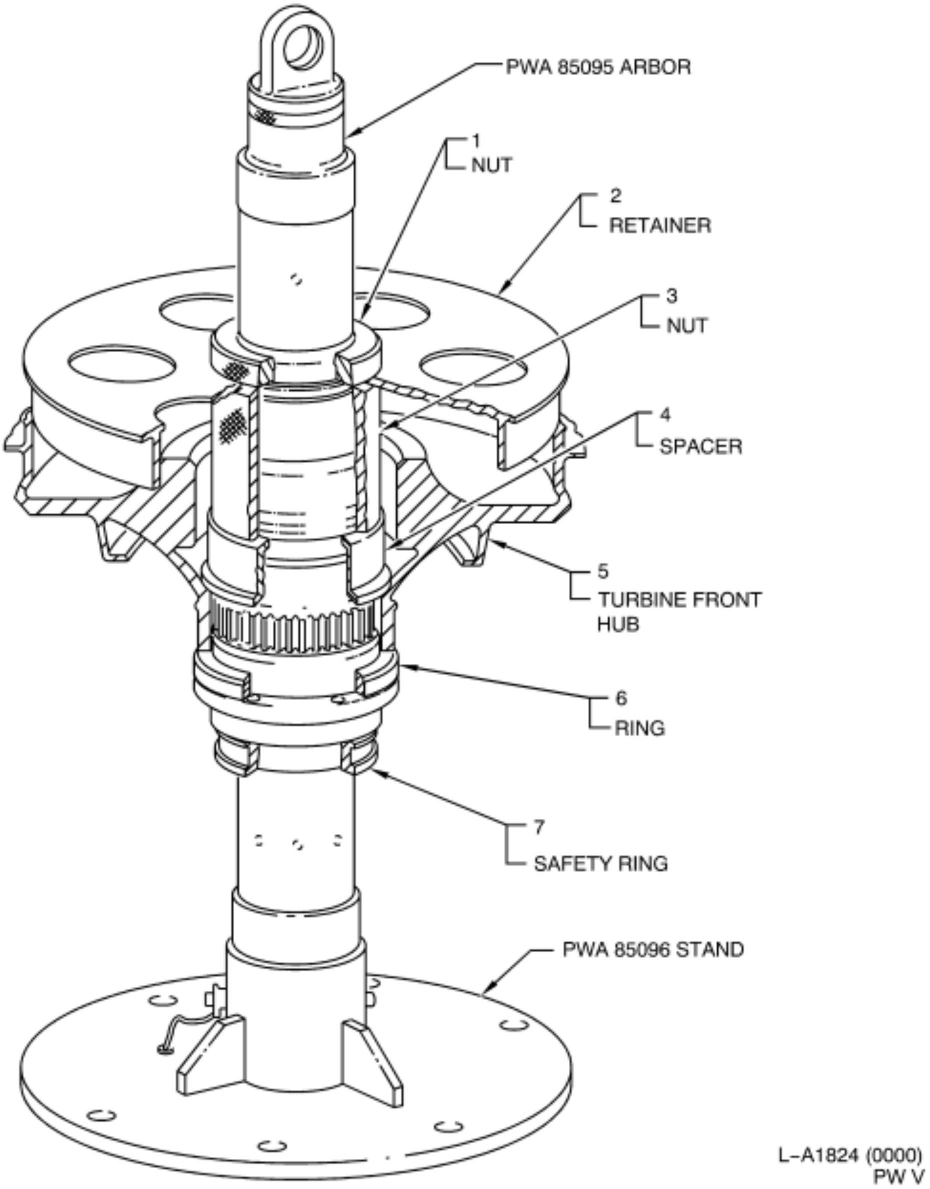
(b) Connect hoist to lifting eye. Take up slack in hoist.

(c) Remove ball lock pin from stand and remove arbor.

(d) Install lifting eye into lower end of arbor. Connect hoist and PWA 85086 Arm to lifting eye.

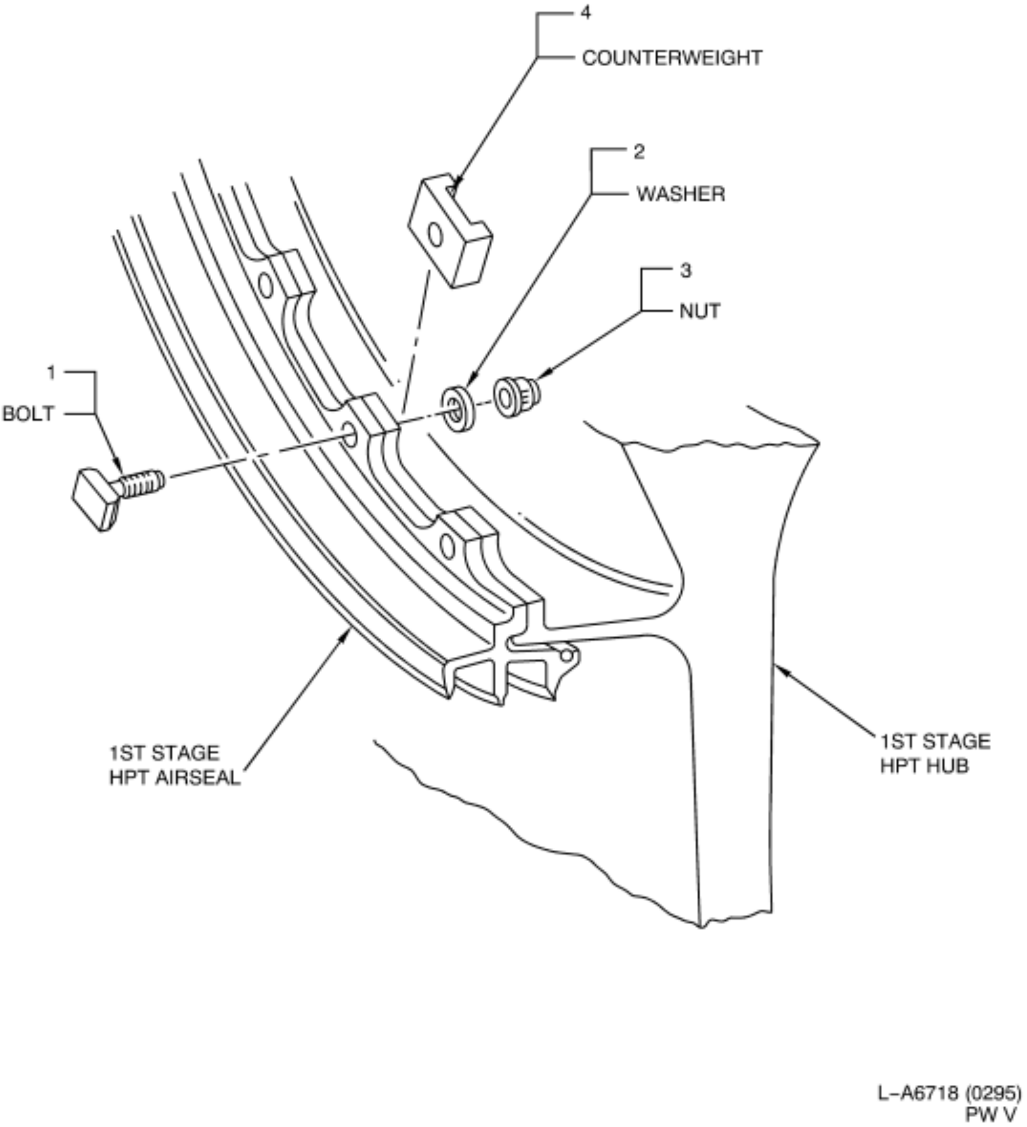
(e) Trunnion assembly to horizontal position and install arbor and details in storage box. Remove hoists and arms.

STAGE 1 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02

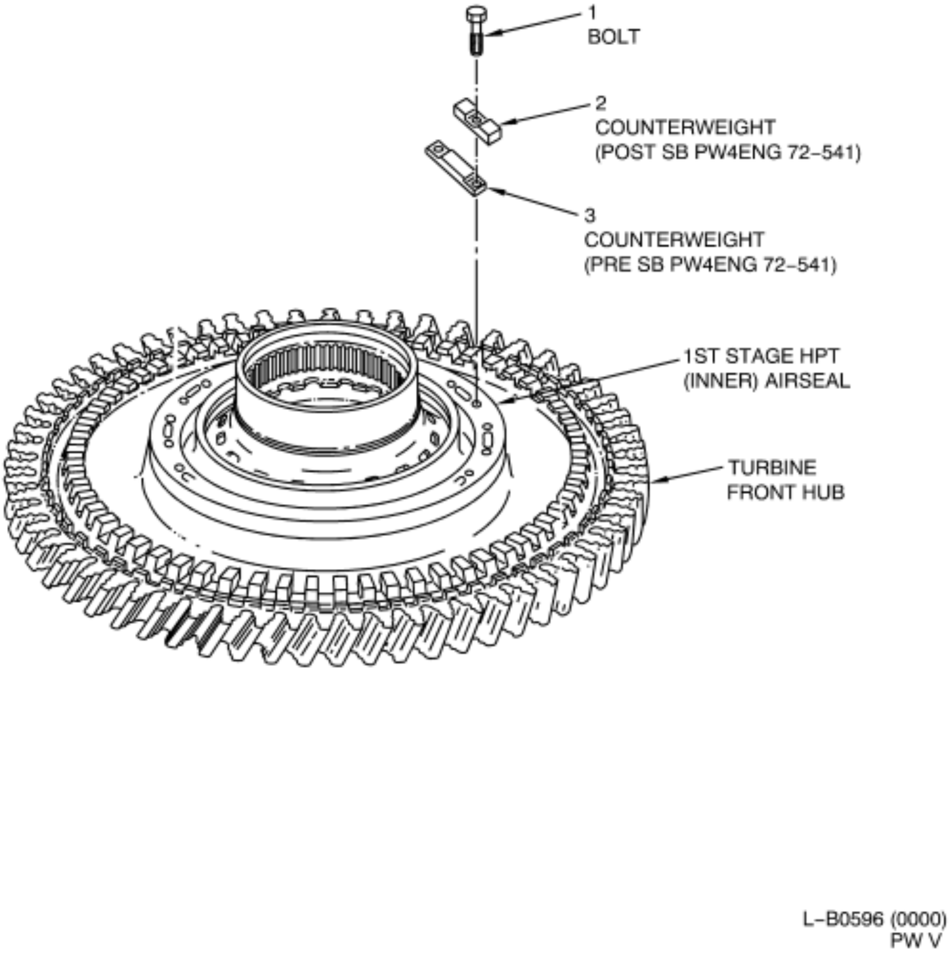

PWA 85095 ARBOR
1 NUT
2 RETAINER
3 NUT
4 SPACER
5 TURBINE FRONT HUB
6 RING
7 SAFETY RING
PWA 85096 STAND
L−A1824 (0000)
PW V

Balance Arbor Installation
Figure 1001
(Task 72−52−01−440−002)

STAGE 1 TURBINE ROTOR ASSEMBLY - ASSEMBLY-02


4
COUNTERWEIGHT
2
WASHER
3
NUT
1
BOLT
1ST STAGE
HPT AIRSEAL
1ST STAGE
HPT HUB
L-A6718 (0295)
PW V

Counterweight Installation
Figure 1002
(Task 72-52-01-440-002)


1
BOLT
2
COUNTERWEIGHT
(POST SB PW4ENG 72−541)
3
COUNTERWEIGHT
(PRE SB PW4ENG 72−541)
1ST STAGE HPT
(INNER) AIRSEAL
TURBINE
FRONT HUB
L−B0596 (0000)
PW V

Counterweight Installation
Figure 1003
(Task 72−52−01−440−002)

STAGE 1 TURBINE ROTOR ASSEMBLY - ASSEMBLY-03

Task 72-52-01-440-003:

1. Static Balance Stage 1 Turbine Rotor Assembly (Vertical Balance Method)

A. Prerequisites

(1) Assemble the 1st stage turbine rotor assembly. Refer to Assembly-01 Task 72-52-01-440-001.

B. Equipment And Materials Necessary

Special Tools:

R	PWA 78176	Socket, Special (First Stage HPT Airseal Bolts, Post SB PW4ENG 72-504)
	PWA 85084	Eye, Lifting
	PWA 85098	Weight, Calibration (Check Weight)
	PWA 86426	Arbor, Balance
	PWA 86505	Wrench, Ratchet (Optional)
	PWA 86506	Wrench, Ratchet (Optional)
	PWA 87130	Weight, Calibration (Check Weight)
	PWA 87751	Adapter

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

C. Procedure

(1) Install PWA 86426 Arbor onto the vertical balance machine.

(2) Install PWA 85084 Eye to rear of turbine hub.

(a) Remove the center bushing from the eye.

(b) Loosen three screws and the slide the locators radially inward.

(c) Install the eye into the rear bore of the hub.

(d) Slide the locators outward against the hub ID. Install the center bushing into the eye and tighten the three screws to secure the locators.

(3) Use a hoist to connect a standard three cable sling to the lifting eyes of PWA 85084 Eye. Use the hoist to install the rotor onto the arbor.

(4) Operate the balance machine.

  (a) Find the static unbalance of the rotor assembly while it turns at 900 rpm minimum.

  (b) Get three unbalance readings. For balance machines that do not have an automatic recording feature, record the average angle and the average amount of unbalance.

(5) Remove the rotor assembly from the balance machine as follows:

  (a) Remove the center bushing from the PWA 85084 Lifting Eye.

  (b) Loosen three screws and move the locators radially in.

  (c) Install the lifting eye into the rear bore of the hub.

  (d) Move the locators out against the hub ID. Install the center bushing into the lifting eye and tighten the three screws to attach the locators.

  (e) With the hoist, connect a standard three cable sling to the eyes of the PWA 85084 Lifting Eye.

  (f) Lift the rotor assembly from the balance arbor. Index (turn) the rotor assembly 180 degrees and lower the assembly on the arbor.

  (g) Remove the sling, hoist and the PWA 85084 Lifting Eye.

(6) Operate the balance machine.

  (a) Static balance the rotor assembly while it turns at 900 rpm minimum. The residual unbalance must not be more than 1.0 oz−in. (720.0 g.mm).

(b) For balance machines that have an automatic recording feature, get three unbalance readings. Average the readings. Use the machine to determine the unbalance amount and angle of the assembly.

(c) For balance machines that do not have an automatic recording feature, get three unbalance readings. Average and record the three unbalance readings. Use the average readings from the first and second balance runs to do a polar plot to get the assembly unbalance angle and amount.

(7) If the static unbalance is equal to 1.0 oz−in. (720.0 g.mm) or less continue as follows:

(a) Record the angle and the amount of unbalance.

(8) If the static unbalance is more than 1.0 oz−in. (720.0 g.mm), continue as follows:

(a) FOR THESE MODELS: 4152, 4156A, 4158
Install a maximum of ten counterweights over an arc of 180 degrees to correct any unbalance as follows: See Figure 1001.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 72−541) Use PN 50L088 counterweights. (Post SB PW4ENG 72−541) Use PN 50L924 counterweights.

1 FOR THESE MODELS: 4152, 4156A, 4158
Loosen and remove the bolt (1001/1), washer (1001/2), and nut (1001/3) at the counterweight locations with the optional PWA 86505 Ratchet Wrench.

2 FOR THESE MODELS: 4152, 4156A, 4158
Lubricate the threads of the bolts with Engine Oil P03−001.

3 FOR THESE MODELS: 4152, 4156A, 4158
Install the counterweights (1001/4) and attach in position with the bolts (1001/1) and nuts (1001/3) with the optional PWA 86506 Ratchet Wrench.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
Washers are not used under the nuts at the counterweight locations.

4 FOR THESE MODELS: 4152, 4156A, 4158
Torque the bolts with the PWA 87751 Adapter to 85 - 95 lb-in. (9.604 -10.734 N.m).

(b) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
(Pre SB PW4ENG 72-541) Install a maximum of three counterweights over an arc of 180 degrees to correct any unbalance as follows: See Figure 1002.

1 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Loosen and remove the bolts (1002/1) that attach the air seal ring to the flange of the turbine hub at the angular location of unbalance.

2 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Lubricate the threads of the bolts (1002/1) with Engine Oil P03-001.

3 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install the counterweights (1002/2) and attach in position with the bolts (1002/1).

4 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
R Use a PWA 78176 Socket to torque the bolts to 85 - 95 lb-in. (9.604 -10.734 N.m).

(c) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
(Post SB PW4ENG 72-541) Install a maximum of ten counterweights over an arc of 180 degrees to correct any unbalance as follows: See Figure 1002.

1 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Loosen and remove the bolts (1002/1) that attach the air seal ring to the flange of the turbine hub at the angular location of unbalance.

2 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Lubricate the threads of the bolts (1002/1) with Engine Oil P03-001.

3 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install the counterweights (1002/2) and attach in position with the bolts (1002/1).

4 FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
R Use a PWA 78176 Socket to torque the bolts to 85 - 95 lb-in. (9.604 -10.734 N.m).

(9) FOR THESE MODELS: 4152, 4156A, 4158
Optional process based on the experience of the operator, do a check of the balance machine by Figure 1001 as follows:

(a) FOR THESE MODELS: 4152, 4156A, 4158
Loosen and remove a nut (1001/3) and washer (1001/2) or counterweight (1001/4) with the PWA 87751 Torque Adapter or the PWA 86505 Ratchet Wrench which attach the air seal ring to the flange of the turbine hub as close as possible to the angle of residual unbalance.

(b) FOR THESE MODELS: 4152, 4156A, 4158
Install the PWA 85098 Calibration Weight (Check Weight) at the location and attach with the removed washer (1001/2) or counterweight (1001/4) and nut (1001/3). Torque the nut to 85 - 95 lb-in. (9.604 -10.734 N.m).

(c) FOR THESE MODELS: 4152, 4156A, 4158
The check weight pulls 4.0 oz-in. (2880.0 g.mm).

(d) FOR THESE MODELS: 4152, 4156A, 4158
Do a check of the balance machine at 900 rpm minimum.

(e) FOR THESE MODELS: 4152, 4156A, 4158
The amount of unbalance should pull 4.0 oz-in. (2880.0 g.mm) plus the remaining residual unbalance ± 0.4 oz-in (288.0 g.mm).

(f) FOR THESE MODELS: 4152, 4156A, 4158
Remove the check weight.

STAGE 1 TURBINE ROTOR ASSEMBLY - ASSEMBLY-03

(10) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Optional process based on the experience of the operator, do a check of the balance machine by Figure 1002 as follows:

(a) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Loosen and remove two adjacent bolts which attach the air seal ring to the flange of the turbine hub as close as possible to the angle of residual unbalance.

(b) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Install the PWA 87130 Calibration Weight (Check Weight) at the removed bolt locations and attach R with the removed bolts. Use a PWA 78176 Socket to torque the bolts to 85 - 95 lb-in. (9.604 -10.734 N.m).

(c) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
The check weight pulls 4.0 oz-in. (2880.0 g.mm).

(d) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Do a check of the balance machine at 900 rpm minimum.

(e) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
The amount of unbalance should pull 4.0 oz-in. (2880.0 g.mm) plus the remaining residual unbalance ± 0.4 oz-in (288.0 g.mm).

(f) FOR THESE MODELS: 4152-3, 4156A-3, 4158-3
Remove the check weight.

(11) Mark the unbalance symbol (triangle) and the amount of unbalance, adjacent to the unbalance symbol (triangle), on the rear side of the disk web at the location of heavy unbalance by SPOP 401 (Task 70-11-00-280-006), Standard Practices Manual, PN 585005. Use the shallow etch method.

NOTE: No burns, pitting or selective attack is permitted on the disk.

(12) Remove the rotor assembly from the balance machine.

(a) Remove the center bushing from the PWA 85084 Lifting Eye.

(b) Loosen three screws and move the locators radially in.

(c) Install the lifting eye into the rear bore of the hub.

(d) Move the locators out against the hub ID. Install the center bushing into the lifting eye and tighten the three screws to attach the locators.

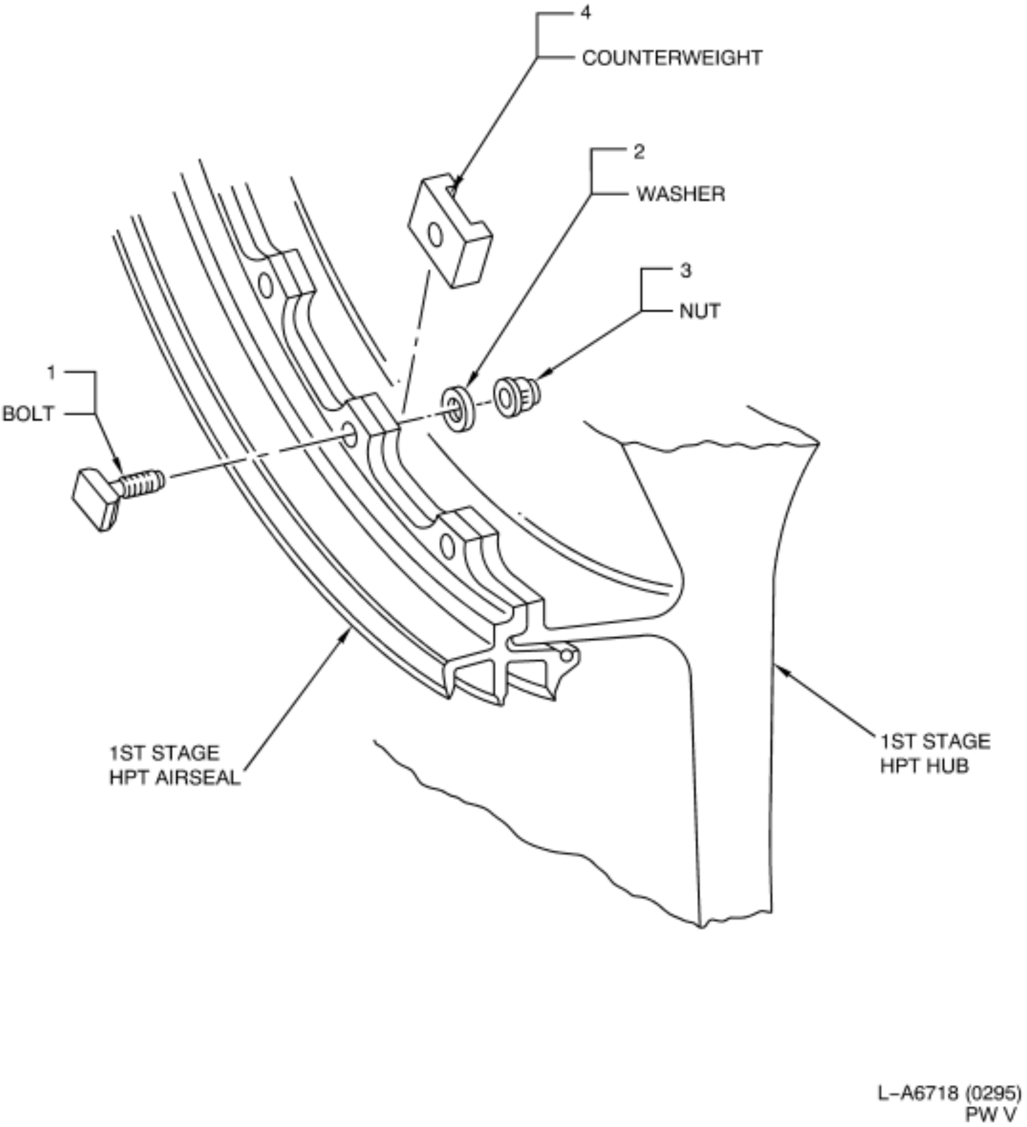
(e) With the hoist, connect a standard three cable sling to the eyes of the PWA 85084 Lifting Eye.

(f) Lift the rotor assembly from the balance arbor. Install the rotor assembly front end down, in the PWA 85634 Support Fixture.

(g) Remove the sling, hoist and the PWA 85084 Lifting Eye.

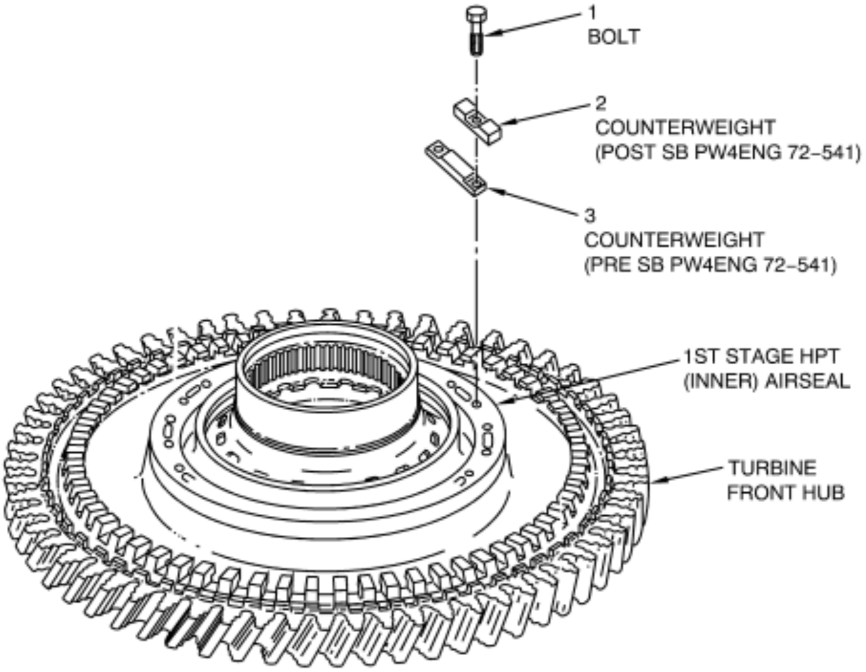
(13) Remove the arbor from the balance machine.

STAGE 1 TURBINE ROTOR ASSEMBLY - ASSEMBLY-03


4
COUNTERWEIGHT
2
WASHER
3
NUT
1
BOLT
1ST STAGE
HPT AIRSEAL
1ST STAGE
HPT HUB
L-A6718 (0295)
PW V

Counterweight Installation
Figure 1001
(Task 72-52-01-440-003)

R
R


1
BOLT
2
COUNTERWEIGHT
(POST SB PW4ENG 72−541)
3
COUNTERWEIGHT
(PRE SB PW4ENG 72−541)
1ST STAGE HPT
(INNER) AIRSEAL
TURBINE
FRONT HUB

L−B0596 (0000)
PW V

Counterweight Installation
Figure 1002
(Task 72−52−01−440−003)

Previous Pageblock Return to Previous Menu Next Pageblock

TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 84 DATED SEPTEMBER 1, 2007

HIGHLIGHTS - HIGH PRESSURE TURBINE (HPT)

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-52-00 INSP/CHK-04	809	Revised Reference No. 1712 limits for the turbine front hub. (PCR PW4000-0011, Reference IEN 03KB013)	CONFIG-1 4152 4156A 4158
72-52-00 INSP/CHK-04	807	Revised Reference No. 1712 limits for the turbine front hub. (PCR PW4000-0011, Reference IEN 03KB013)	CONFIG-2 4152-3 4156A-3 4158-3
72-52-01 ASSEMBLY-01	1002 1020 1043/ 1044	Added a PWA 107120 Fixture to lift the 2nd stage HPT airseal from the rear flange of the airseal. (TDS107120)	ALL

Previous Pageblock Return to Previous Menu Next Pageblock

STAGE 2 TURBINE ROTOR ASSEMBLY - DISASSEMBLY-01

Task 72-52-02-040-001:

1. Disassemble 2nd Stage Turbine Rotor Assembly

A. Equipment And Materials Required

Special Tools:
PWA 25672 Control, Heater (Optional to PWA 29754)
PWA 29754 Control, Heater
PWA 85086 Arm (Two Necessary)
PWA 85087 Eye, Lifting
PWA 85088 Fixture, Support (Optional to PWA 88719)
PWA 85089 Eye, Handling (Optional to PWA 86080)
PWA 85100 Heater, Electrical
PWA 85101 Fixture, Removal
PWA 86080 Eye, Lifting
PWA 88719 Stand

Consumable Materials:

Item No.	Designation
P05-102	Ice, Dry

B. Procedure

(1) Install PWA 85087 Eye into the front end of the turbine intermediate hub (501/5). See Figure 501.

  (a) Loosen the three locknuts (501/6). Turn the clamp assemblies (501/7) to align the pins so that they point toward the center of the lifting hub (501/4).

  (b) Install the eye into the turbine hub. Turn the clamp assemblies into the turbine hub and align the pins so that they point radially outward, toward the "LOCKED POSITION" marks on the hub (501/4). Hold the clamps in position and tighten the three locknuts (501/6) to hold the eye on the turbine hub.

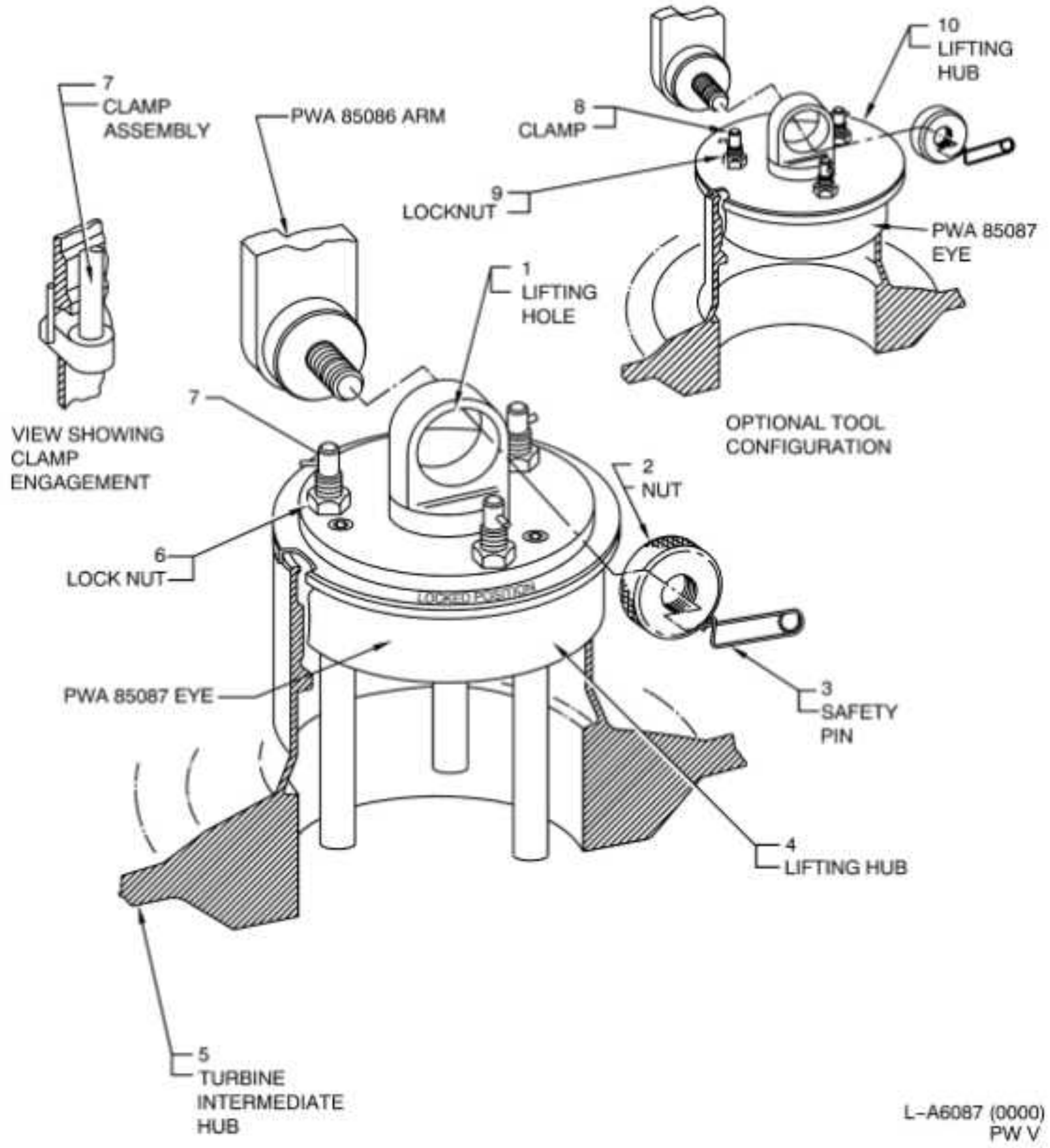
(2) Attach a hoist to PWA 85086 Arm. Remove the safety pin (501/3) and knurled nut (501/2) from the arm. Connect the arm to the lifting hole (501/1) of the Eye (PWA 85087), and secure it with the knurled nut and safety pin. Use the hoist to lift the assembly.

(3) If applicable, position the rotor assembly onto PWA 85088 Support Fixture or PWA 88719 Stand.

  (a) Use the hoist to install the rotor assembly, front end up, onto the support fixture. Remove the hoist and arm.

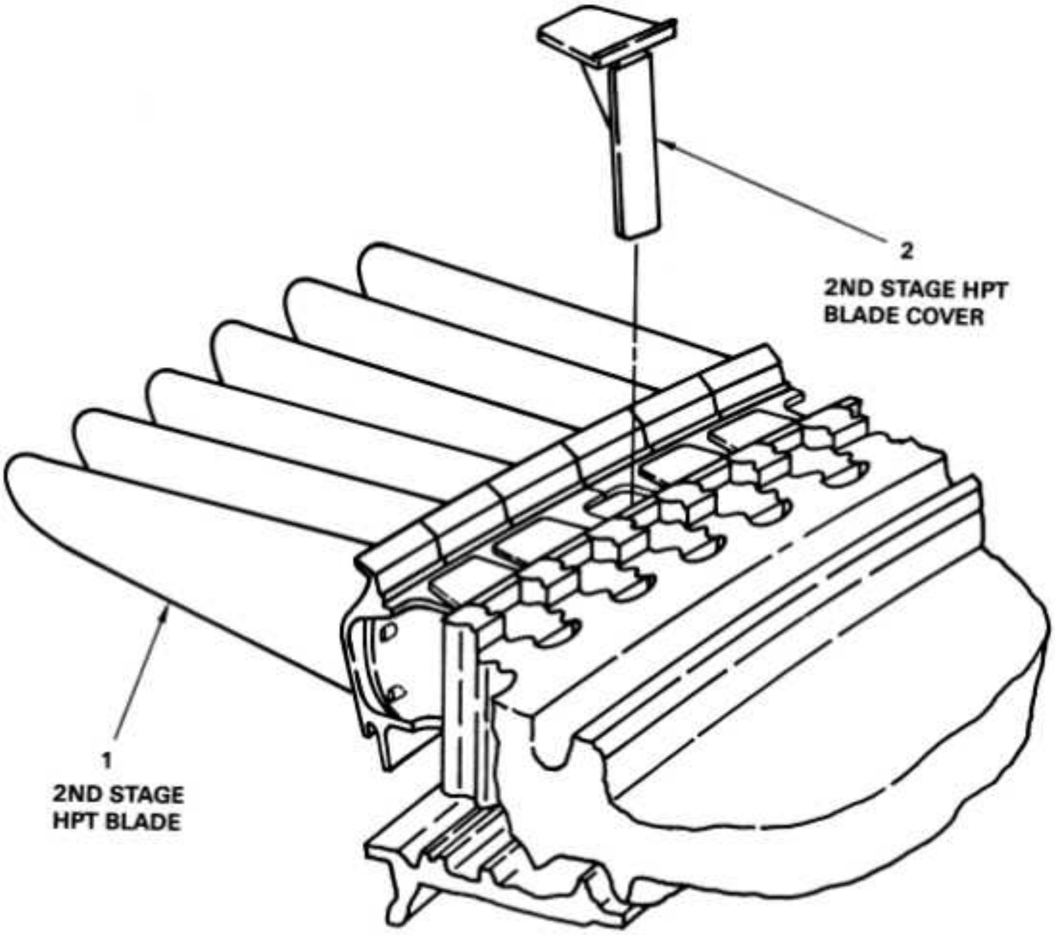
(4) Remove 2nd stage HPT blade covers (502/1). See Figure 502.

STAGE 2 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01


7
CLAMP
ASSEMBLY
PWA 85086 ARM
8
CLAMP
10
LIFTING
HUB
9
LOCKNUT
PWA 85087
EYE
1
LIFTING
HOLE
VIEW SHOWING
CLAMP
ENGAGEMENT
7
OPTIONAL TOOL
CONFIGURATION
2
NUT
6
LOCK NUT
LOCKED POSITION
PWA 85087 EYE
3
SAFETY
PIN
4
LIFTING HUB
5
TURBINE
INTERMEDIATE
HUB
L−A6087 (0000)
PW V

Stage 2 Turbine Rotor Assembly
Lifting And Trunnioning
Figure 501
(Task 72−52−02−040−001)

STAGE 2 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01


2
2ND STAGE HPT
BLADE COVER
1
2ND STAGE
HPT BLADE

L—A6719

Second Stage HPT Blade Covers, Removal
Figure 502
(Task 72−52−02−040−001)

(5) Position a suitable blade support over the blades to prevent them from dropping out during the following trunnioning procedure. Secure support to hub.

(6) Install PWA 86080 Eye and PWA 85086 Arms to trunnion the turbine intermediate hub to the front end down position. See Figure 503.

NOTE: See the following step to trunnion the turbine intermediate hub with optional PWA 85087 Eye (prior to Change A) and PWA 85089 Eye.

See the following step to install the optional Eye (PWA 85089).

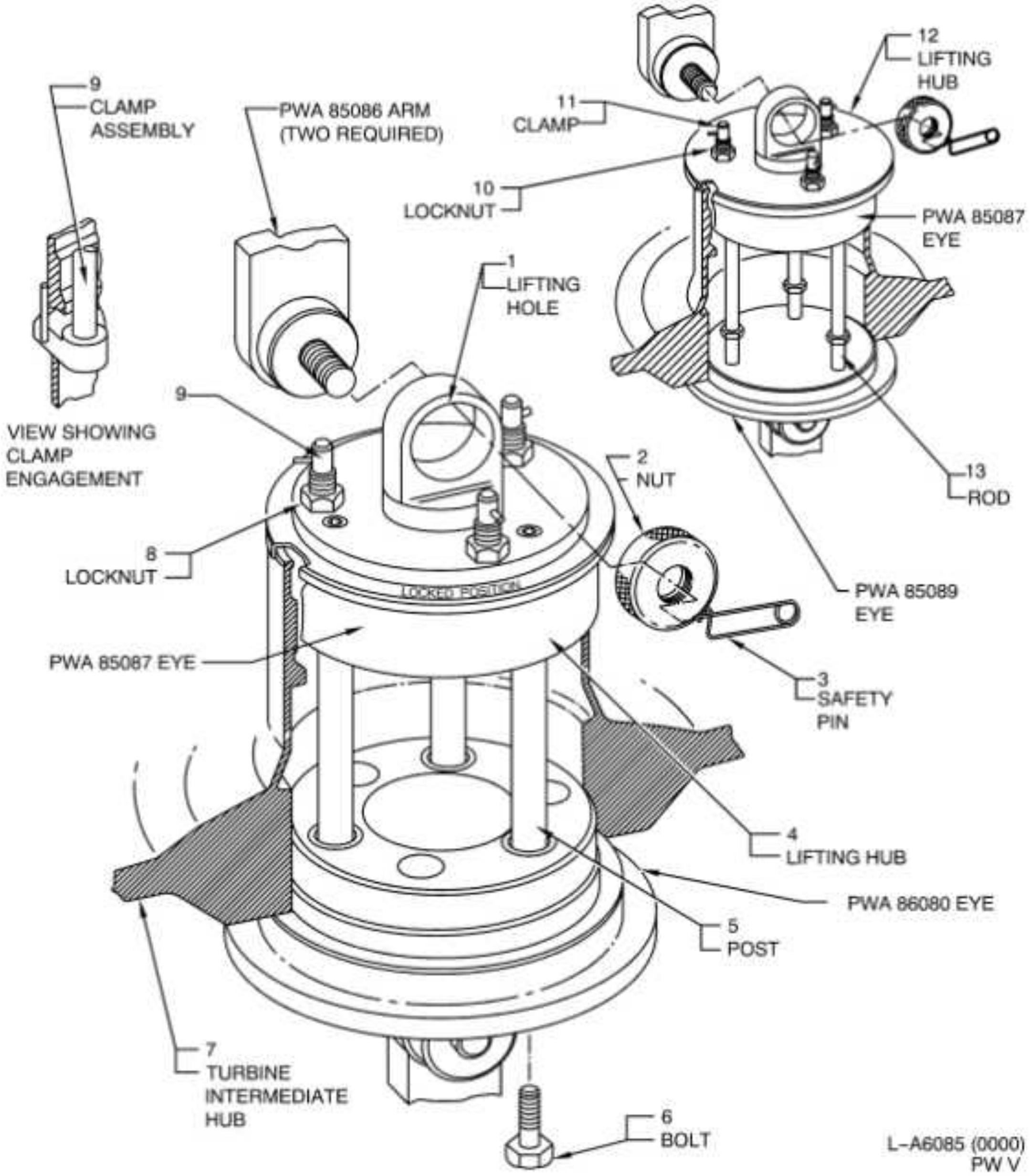
- (a) Attach a hoist to Arm (PWA 85086). Remove the safety pin (503/3) and knurled nut (503/2) from the arm. Connect the arm to the lifting hole (503/1) of the Eye (PWA 85087), and secure it with the knurled nut and safety pin. Use the hoist to lift the assembly.
- (b) Align the lifting hole of Eye (PWA 86080) with the lifting hole of Eye (PWA 85087), and the posts (503/5) with the mating holes in Eye (PWA 86080).
- (c) Install the applicable (longer) bolts to hold the Eye (PWA 86080).
- (d) Attach a hoist to Arm (PWA 85086). Remove the safety pin and knurled nut from the arm. Connect the arm to the lifting hole of the Eye (PWA 85087), and secure it with the knurled nut and safety pin.

(7) Optional, install PWA 85089 Eye, and PWA 85086 Arms to trunnion the turbine intermediate hub to the front end down position. See Figure 503.

- (a) Attach a hoist to Arm (PWA 85086). Remove the safety pin (503/3) and knurled nut (503/2) from the arm. Connect the arm to the lifting hole (503/1) of the Eye (PWA 85087), and secure it with the knurled nut and safety pin. Use the hoist to lift the assembly.
- (b) Align the lifting hole of Eye (PWA 85089) with the lifting hole of Eye (PWA 85087), and the rods (503/13) with the mating holes in Eye (PWA 85087).
- (c) Attach a hoist to second Arm (PWA 85086). Remove the safety pin and knurled nut from the arm. Connect the arm to the Eye (PWA 85089) and secure it with the knurled nut and safety pin.

(8) Use both hoists to trunnion the rotor assembly to front end down position. Remove the lower arm attached to eye on front end of the hub. Lower the assembly over the work table.

STAGE 2 TURBINE ROTOR ASSEMBLY - DISASSEMBLY-01


9
CLAMP
ASSEMBLY
PWA 85086 ARM
(TWO REQUIRED)
11
CLAMP
12
LIFTING
HUB
10
LOCKNUT
PWA 85087
EYE
1
LIFTING
HOLE
VIEW SHOWING
CLAMP
ENGAGEMENT
9
2
NUT
13
ROD
8
LOCKNUT
LOCKED POSITION
PWA 85089
EYE
PWA 85087 EYE
3
SAFETY
PIN
4
LIFTING HUB
PWA 86080 EYE
5
POST
7
TURBINE
INTERMEDIATE
HUB
6
BOLT
L-A6085 (0000)
PW V

Rear Lifting Eye Installation
Figure 503
(Task 72-52-02-040-001)

STAGE 2 TURBINE ROTOR ASSEMBLY – DISASSEMBLY-01

(9) Carefully remove the blade support.

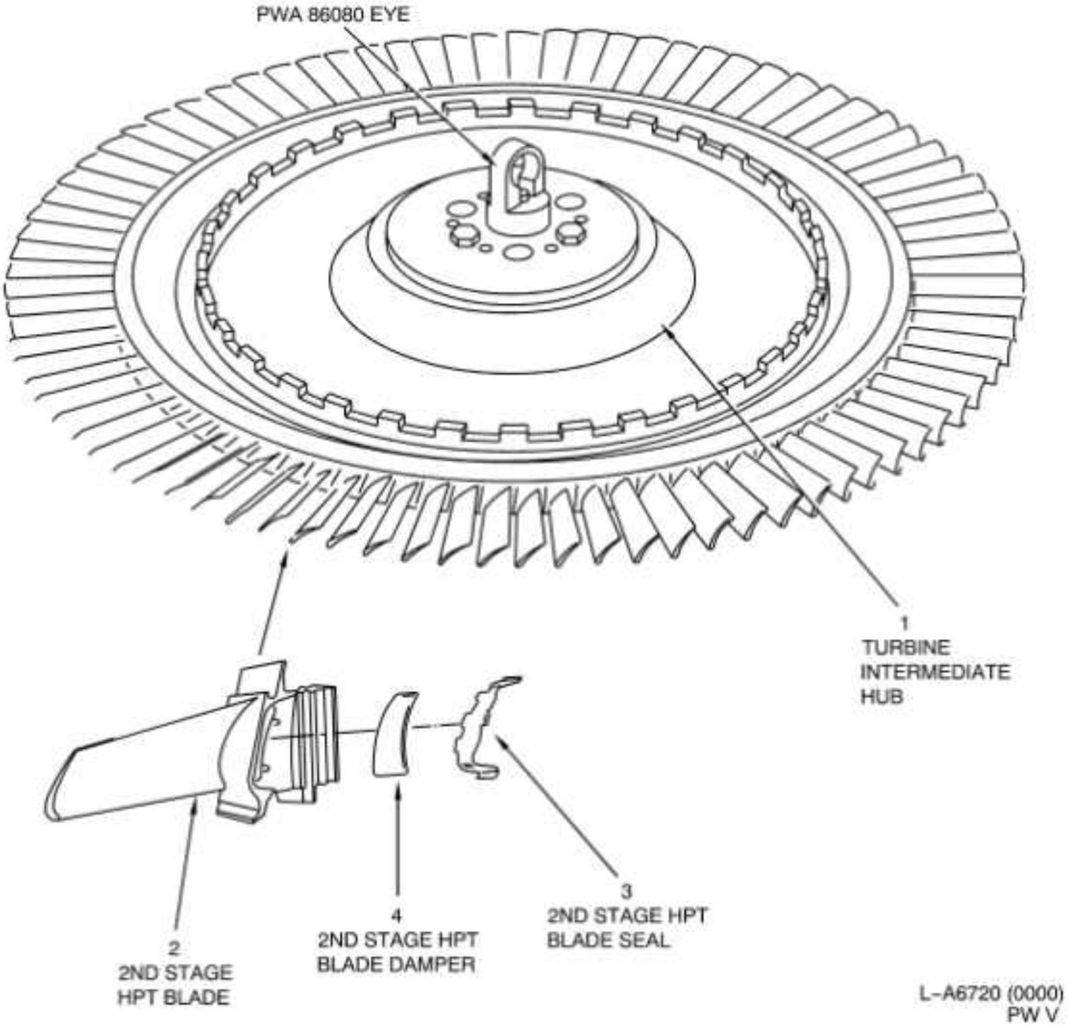
CAUTION: CARE SHOULD BE TAKEN TO ENSURE THAT ANY FORCE REQUIRED TO REMOVE BLADES FROM HUB BE APPLIED TO ROOT PLATFORM AREA OF BLADE AND NOT TO LEADING OR TRAILING EDGE OF AIRFOIL. AIRFOIL SECTIONS OF ALL BLADES CAN BE DAMAGED IF STRUCK.

(10) Remove 2nd stage HPT blades (504/2) dampers (504/4) and seals (504/3) from turbine intermediate hub (504/1). See Figure 504.
(11) Place PWA 85100 Heater, heating element up, on bench.
(12) Install hoist and Arm (PWA 85086) to eye on the turbine hub. Lift the assembly and lower it onto the Heater (PWA 85100).
(13) Bend 2nd stage HPC locks (505/2) and remove 2nd stage HPT keys (505/1) at four locations. Remove and discard locks. See Figure 505.
(14) Using suitable sling and hoist, position PWA 85101 Fixture over 2nd stage HPT blade retaining plate (506/3).
    (a) Loosen eight bolts (506/6) securing clamps on OD of lower ring.
    (b) Completely loosen 16 cap screws (506/2) securing lower ring (506/5) to ring (506/1).
    (c) Using detail handles, install outer ring details onto retaining plate (506/8). Rotate retaining rings counterclockwise until dowel pins (506/4) seat against lugs (506/3) on retaining plate.

    CAUTION: SIXTEEN CAP SCREWS SECURING UPPER AND LOWER RING DETAILS MUST BE LOOSE PRIOR TO SECURING CLAMPS OR DAMAGE TO RETAINING PLATE MAY RESULT.

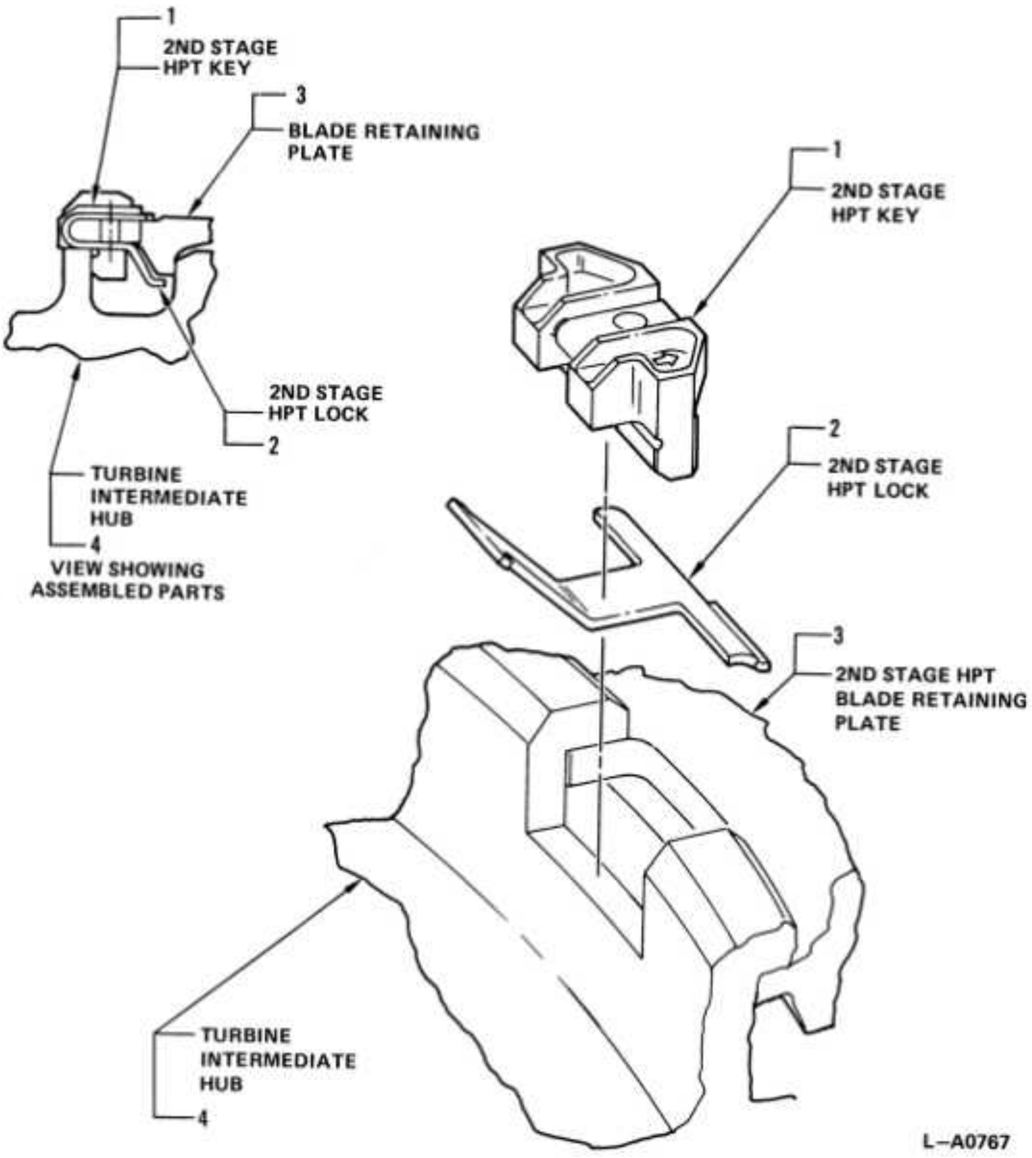
    (d) Tighten eight bolts (506/6) to secure clamps (506/7) and retaining plate OD flange to (lower) ring (506/5).

STAGE 2 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01


PWA 86080 EYE
1
TURBINE
INTERMEDIATE
HUB
2
2ND STAGE
HPT BLADE
4
2ND STAGE HPT
BLADE DAMPER
3
2ND STAGE HPT
BLADE SEAL
L−A6720 (0000)
PW V

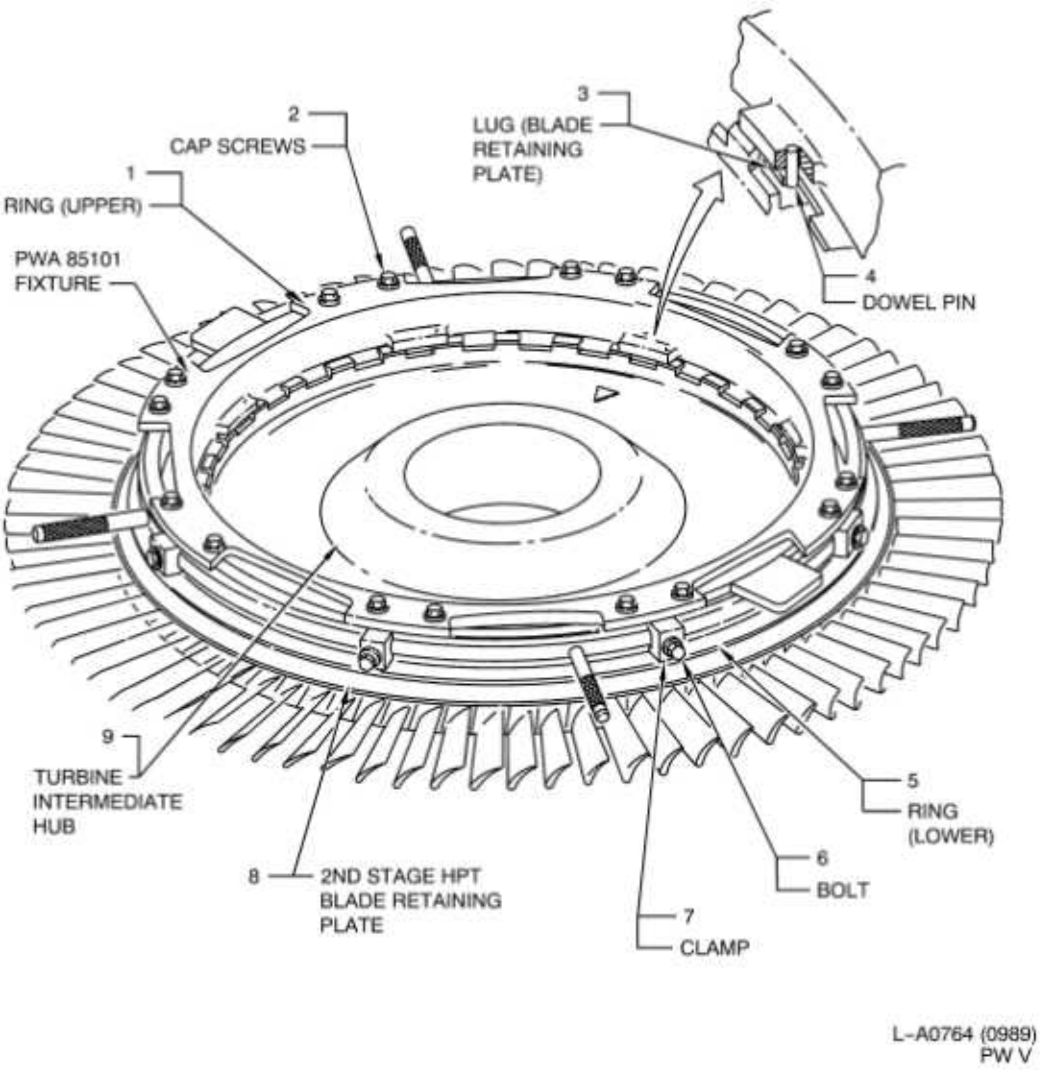
Second Stage HPT Blade, Damper
And Seals Removal
Figure 504
(Task 72−52−02−040−001)

STAGE 2 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01


1
2ND STAGE HPT KEY
3
BLADE RETAINING PLATE
2ND STAGE HPT LOCK
2
TURBINE INTERMEDIATE HUB
4
VIEW SHOWING ASSEMBLED PARTS
1
2ND STAGE HPT KEY
2
2ND STAGE HPT LOCK
3
2ND STAGE HPT BLADE RETAINING PLATE
TURBINE INTERMEDIATE HUB
4
L−A0767

Second Stage HPT Key Removal
Figure 505
(Task 72−52−02−040−001)

STAGE 2 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01


1 RING (UPPER)
2 CAP SCREWS
3 LUG (BLADE RETAINING PLATE)
4 DOWEL PIN
PWA 85101 FIXTURE
5 RING (LOWER)
6 BOLT
7 CLAMP
8 2ND STAGE HPT BLADE RETAINING PLATE
9 TURBINE INTERMEDIATE HUB
L-A0764 (0989)
PW V

Second Stage HPT Blade Retaining Plate Removal
Figure 506
(Task 72−52−02−040−001)

STAGE 2 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01

CAUTION: DO NOT TIGHTEN CAP SCREWS (506/2) UNTIL EIGHT CLAMPS (506/7) HAVE BEEN SECURED OR DAMAGE TO RETAINING PLATE MAY RESULT.

(e) Tighten 16 cap screws (506/2) until bottom of (upper) ring (506/1) contacts top of (lower) ring (506/5).

NOTE: Tightening cap screws secures inner and outer rings and provides axial load on retaining plate to facilitate removal of retaining plate.

CAUTION: TEMPERATURE PROBE MUST CONTACT HUB OR OVERHEATING OF PARTS MAY RESULT.

(15) Connect heater to PWA 29754 or PWA 25672 Heater Control to heater. Position probe insuring that it is in contact with hub. Put the cover detail of the heater over the hub.

(16) Heat the hub to approximately 300°F (148.9°C). Pour crushed Dry Ice (P05−102) through the openings between the fixture and the retaining plate as you heat the retaining plate. Add more dry ice as necessary until the hub is heated.

(17) Remove the cover detail of the heater. Tap the lugs on the fixture with a hammer to disengage the lugs on the plate from the lugs on the hub. Remove the fixture. Remove the retaining plate from the hub.

(18) Connect a hoist with Arm (PWA 85086) to Eye (PWA 86080) or (PWA 85089) on the rear of the hub.

(19) Lift the hub and attach a second hoist and Arm (PWA 85086) to eye on front end of hub.

(20) Trunnion assembly to rear end down position and remove the lower hoist, arm and Eye from the rear end of the hub. Lower the hub onto a pallet. Remove the hoist, and arm from the hub.

(21) Loosen locknuts that secure the clamps to turbine hub. Turn the clamps to disengage the hub and remove the Eye (PWA 85087) from the hub.

Previous Pageblock   Return to Previous Menu   Next Pageblock

STAGE 2 TURBINE ROTOR ASSEMBLY - ASSEMBLY-01

Task 72-52-02-440-001:

1. Assemble 2nd Stage Turbine Rotor Assembly

A. Prerequisites

(1) See Inspection/Check-04 Task 72-52-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Necessary

Standard Tools:

Name	Manufacturer
Clements Cadillac Electric Flameless Heat Gun Model FT 1000	Clements Manufacturing Co. 6650 S. Narragansett Avenue Chicago, IL 60638

NOTE: The flameless torch specified above is optional to the heaters specified in the Special Tools list, and the optional flame torch.

Special Tools:

PWA 25672	Control, Heater (Optional to PWA 29754)
PWA 29754	Control, Heater
PWA 85082	Adapter, Moment Weight
PWA 85086	Arm (Two Required)
PWA 85087	Eye, Lifting
PWA 85088	Fixture, Support (Optional to PWA 88719)
PWA 85089	Eye, Handling (Optional to PWA 86080)
PWA 85100	Heater, Electrical
PWA 85101	Fixture, Install
PWA 85288	Ring, Support
PWA 85702	Bender, Manual
PWA 86080	Eye, Lifting
PWA 88719	Stand

Consumable Materials:

Item No.	Designation
P05−026	Ink (PMC 4057−1)
P05−102	Ice, Dry
P05−395	Beeswax
P05−396	Paraffin Wax Blend
P08−010	Adhesive (EC−1300)
P08−022	Adhesive (EC−1357)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lock, 2nd Stage HPT	4	72−52−00/6/120
Seal	1	72−52−00/6/90

C. General Assembly Requirements

(1) Where heating is required for assembly, use minimum temperature differential of 125°F (52°C) between parts being assembled. Do not exceed 300°F (149°C) on any part.

(2) Where heating is required for assembly, special heaters are specified in the following procedure. However, you use an optional flameless torch or flame torch as specified in the following steps.

(3) In locations where heating of a component in an oven is not practical or only a flange of the component requires heating, the use of Clements Cadillac Electric Flameless Heat Gun, Model FT 1000 is recommended.

(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE

FLAME WILL DAMAGE OR BURN NON−METAL PARTS.

CAUTION: DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

D. Procedure

(1) Examine the turbine intermediate hub for the correct installed quantity of stage 2 HPT metering plugs that are installed in the correct part number hub. See PW4152 Series IPC, PN 50A445 for part number applicabilities.

(2) Install seal into 2nd stage HPT blade retaining plate. See Figure 1001.

STAGE 2 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01

(a) Position 2nd stage HPT blade retaining plate (1001/2), smaller OD side down, on bench.

(b) Position seal (1001/1) into seal groove (1001/3) in front face of plate. Cut seal to obtain gap of 0.025 − 0.225 inch (0.6 − 5.7 mm) between ends of seal.

(c) Secure seal in groove with Beeswax P05−395 or Paraffin Wax Blend P05−396 or Adhesive P08−010 or Adhesive P08−022 as necessary.

(3) Place PWA 85100 Heater, heating element up, on bench.

(4) Install PWA 85087 Eye and PWA 86080 Eye, and PWA 85086 Arms to trunnion the turbine intermediate hub to the front end down position. See Figure 1002.

NOTE: See the following step to trunnion the turbine intermediate hub with optional PWA 85087 Eye and PWA 85089 Eye.

(a) Loosen the three locknuts (1002/8) of PWA 85087 Eye. Turn the clamp assemblies (1002/9) to align the pins so that they point toward the center of the lifting hub (1002/4).

(b) Install the eye into the turbine hub. Turn the clamp assemblies into the turbine hub and align the pins so that they point toward the "LOCKED POSITION" marks on the lifting hub (1002/4). Hold the clamps in position and tighten the three locknuts (1002/8) to hold the eye on the turbine hub.

(c) Attach a hoist to PWA 85086 Arm. Remove the safety pin (1002/3) and knurled nut (1002/2) from the arm. Connect the arm to the lifting hole (1002/1) of the PWA 85087 Eye, and secure it with the knurled nut and safety pin. Use the hoist to lift the assembly.

(d) Align the lifting hole of PWA 86080 Eye with the lifting hole of PWA 85087 Eye, and the posts (1002/5) with the mating holes in PWA 86080 Eye.

(e) Install the applicable (longer) bolts to hold the PWA 86080 Eye.

(f) Attach a hoist to second PWA 85086 Arm. Remove the safety pin and knurled nut from the arm. Connect the arm to the PWA 86080 Eye and secure it with the knurled nut and safety pin.

(5) Optional, install PWA 85087 Eye and PWA 85089 Eye, and PWA 85086 Arms to trunnion the turbine intermediate hub to the front end down position. See Figure 1002.

(a) Loosen the three locknuts (1002/10) of PWA 85087 Eye. Turn the clamp assemblies (1002/11) to align the pins so that they point toward the center of the lifting hub (1002/12).

(b) Install the eye into the turbine hub. Turn the clamp assemblies into the turbine hub and align the pins so that the pins point outward. Hold the clamps in position and tighten the three locknuts (1002/10) to hold the eye on the turbine hub.

(c) Attach a hoist to PWA 85086 Arm. Remove the safety pin and knurled nut from the arm. Connect the arm to the lifting hole of the PWA 85087 Eye, and secure it with the knurled nut and safety pin. Use the hoist to lift the assembly.

(d) Insert the PWA 85089 Eye into the rear bore of the turbine hub. Align the lifting hole of PWA 85089 Eye with the lifting hole of PWA 85087 Eye, and the rods (1002/13) with the mating holes in PWA 85089 Eye. Thread three rods (1002/13) into PWA 85087 Eye to secure the eyes.

(e) Attach a hoist to second PWA 85086 Arm. Remove the safety pin and knurled nut from the arm. Connect the arm to the PWA 85089 Eye and secure it with the knurled nut and safety pin.

(6) Use both hoists to trunnion the assembly to front, hub end down, position. Remove the lower hoist, and arm.

(7) Lower the hub, splined end down, into the heater. Remove the hoist and arm.

(8) Remove the PWA 86080 Eye or PWA 85089 Eye from the turbine hub.

STAGE 2 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01

(9) Locate unbalance symbol (triangle) marked on rear side of hub between blade root slots. Transfer unbalance symbol onto center 1/3 of hub using Ink P05−026.

(10) Install 2nd stage HPT blade retaining plate (1003/8) onto turbine intermediate hub using PWA 85101 Fixture. See Figure 1003.

(a) If required, transfer unbalance mark to outer flange area of retaining plate using Ink P05−026.

(b) Position retaining plate, larger OD side down, on bench.

(c) Loosen eight bolts (1003/6) securing clamps (1003/7) on OD of lower ring.

(d) Completely loosen 16 cap screws (1003/2) securing lower ring (1003/5) to ring (1003/1).

(e) Using detail handles, install outer ring details onto retaining plate (1003/8). Rotate retaining rings counterclockwise until dowel pins (1003/4) seat against lugs (1003/3) on retaining plate.

CAUTION: SIXTEEN CAP SCREWS SECURING UPPER AND LOWER RING DETAILS MUST BE LOOSE PRIOR TO SECURING CLAMPS OR DAMAGE TO RETAINING PLATE MAY RESULT.

(f) Tighten eight bolts (1003/6) to secure clamps (1003/7) and retaining plate OD flange to (lower) ring (1003/5).

CAUTION: DO NOT TIGHTEN CAP SCREWS (1003/2) UNTIL EIGHT CLAMPS (1003/7) HAVE BEEN SECURED OR DAMAGE TO RETAINING PLATE MAY RESULT.

(g) Tighten 16 cap screws (1003/2) until bottom of (upper) ring (1003/1) contacts top of (lower) ring (1003/5).

NOTE: Tightening cap screws secures inner and outer rings and provides axial load on retaining plate to facilitate installation of retaining plate.

CAUTION: TEMPERATURE PROBE MUST CONTACT HUB OR OVERHEATING OF PARTS MAY RESULT.

(h) Connect PWA 25672 Heater Control or PWA 29754 Heater Control to heater. Position probe to contact hub. Put the cover detail of the heater over the hub. Heat hub to 300°F (148.9°C) maximum for assembly with minimum temperature differential of 200°F (111°C).

NOTE: Dry Ice P05−102 can be used on retaining plate to reduce interference fit.

(i) Remove the cover detail of the heater from the hub. Using handles, position fixture outer ring and retaining plate assembly over turbine intermediate hub (1004/5). Position unbalance mark on retaining plate 180 degrees from unbalance symbol on hub. Lower retaining plate, aligning lugs on retaining plate with mating slots in hub. See Figure 1004.

(j) Using handles, rotate outer ring clockwise until lugs (1004/3) on retaining plate are under mating lugs (1004/1) on hub. Rotate ring until dowel pin details (1004/2) are stopped against lugs on hub.

(k) Completely loosen 16 cap screws securing upper ring (1004/6) to lower ring (1004/4).

(l) Loosen eight bolts securing clamps to lower ring. Using handles, remove ring details from retaining plate.

(11) Install 2nd stage HPC locks and keys. See Figure 1005.

(a) Position four equally spaced 2nd stage HPT locks (1005/2), wider tabs first into openings between lugs of turbine intermediate hub (1005/4) and 2nd stage HPT blade retaining plate (1005/3).

(b) Position four 2nd stage HPT keys (1005/1) into grooves at lock locations. Install keys, smaller key detail first, into groove, with arrows on key pointing radially outward.

(c) Check position of locks per Figure 1006. Mating surfaces of Key N and Plate C must be flush within 0.010 inch (0.251 mm) to insure proper assembly.

(d) Firmly grip 2nd stage HPT lock using PWA 85702 Bender with curved jaw of bender toward ID of turbine hub. See Figure 1005 (Sheet 2). While pulling upward, bend lock around radius of key as far as possible without repositioning bender.

(e) Reposition bender with curved jaw toward OD of hub. See Figure 1005 (Sheet 2). Bend lock around key as far as possible without repositioning bender. Remove the bender.

(f) Using suitable aluminum drift, continue bending lock starting at radius of key and working outward along lock toward OD of hub.

(g) Inner surface of lock must be flush to 0.010 inch (0.254 mm) in relation to rear surface of key. A visual gap is produced at Location S (both sides). If no gap exists after bending lock, parts must be disassembled and new lock installed.

(12) Install PWA 86080 Eye into the rear bore of the turbine intermediate hub.

NOTE: See the following step to install the optional PWA 85089 Eye.

(a) Align the lifting hole of PWA 86080 Eye with the lifting hole of PWA 85087 Eye, and the posts with the mating holes in PWA 86080 Eye.

(b) Install the applicable (longer) bolts to hold the PWA 86080 Eye.

(c) Attach a hoist to PWA 85086 Arm. Remove the safety pin and knurled nut from the arm. Connect the arm to the PWA 86080 Eye and secure it with the knurled nut and safety pin.

(13) Optional, install PWA 85089 Eye into the rear bore of the turbine intermediate hub.

(a) Align the lifting hole of PWA 85089 Eye with the lifting hole of PWA 85087 Eye, and the rods with the mating holes in PWA 85087 Eye. Thread three rods into PWA 85087 to secure the eyes.

(b) Attach a hoist to PWA 85086 Arm. Remove the safety pin and knurled nut from the arm. Connect the arm to the PWA 85089 Eye and secure it with the knurled nut and safety pin.

(14) Lift the assembly and connect a hoist and second PWA 85086 Arm to the PWA 85087 Eye on the front of the hub. Trunnion the assembly to the front, hub, end up position.

(15) Remove the hoist, the lower PWA 85086 Arm, and the lower eye. Put PWA 85288 Support Ring with the smaller ID side down, on a suitable workbench. Lower the hub onto the ring. Remove the hoist and PWA 85086 Arm from the PWA 85087 Eye.

CAUTION: IT IS RECOMMENDED THAT A FULL SET OF 82 NEW OR REFURBISHED 2nd STAGE BLADES ARE INSTALLED TO GET THE BEST PERFORMANCE, BUT IF THEY ARE NOT AVAILABLE, A MINIMUM OF 30 2nd STAGE BLADES ARE NECESSARY TO GIVE ADEQUATE SEAL CUTTING. THE PREFERRED TIP COATING FOR THE 30 MINIMUM REPLACEMENT BLADES IS EXPOSED GRIT CBN, (PWA 293−1). THE REPLACEMENT BLADES MUST BE DIAMETERICALLY OPPOSED FROM EACH OTHER. FAILURE TO DO SO WILL CAUSE MORE TIP WEAR AND WILL DECREASE ENGINE PERFORMANCE.

(16) Obtain 82 2nd stage HPT blades. If one or more new 2nd stage duct segments are installed, a minimum of 30 blades must have acceptable abrasive tips. See the following step for the abrasive tip acceptance standard. The balance of the blades can have missing tip coating to the base metal to any extent, but can not have wear into the base metal. See Table 1001 for blade interchangeability requirements.

NOTE: When one or more new duct segments are installed, and the intent of the shop visit is not to zero time the HPT module, the requirement of replacing a minimum of (30) blades may be waived by pretrenching the duct segments in accordance with the PW4000 Series CIR, PN 51A357, Chapter/Section 72−52−32, Repair−02.

(17) Blade abrasive tip visual acceptance standard. See Figure 1007.

NOTE: You do not have to count individual abrasive grits.

(a) One void area (absence of grits) 1/4 inch (6.350 mm) wide across the tip is permitted as shown in Figure 1007, provided it is not within 1/4 inch (6.350) of the airfoil leading or trailing edge. The general lay of the void area must not be parallel to the platform leading or trailing edge.

(b) Imperfections in the tip coating 1/16 inch (1.587 mm) diameter or less between the grits and separated by 1/32 inch (0.794 mm) or more are acceptable. Four imperfections of 1/16 inch (1.587 mm) diameter or less to the base metal interface are acceptable. Holes caused by grits falling out are not considered imperfections.

	ENGINE MODELS		
PART NUMBER	PW4152 PW4156 PW4156A PW4158	PW4152 (-3) PW4156 (-3) PW4156A (-3) PW4158 (-3)	REFERENCE SERVICE BULLETIN
50L332	A		PW4ENG 72-106
50L732	B		PW4ENG 72-202
51L432	C		PW4ENG 72-257
51L332	C		PW4ENG 72-257
51L632	D		PW4ENG 72-362
51L732	C		PW4ENG 72-399
52L032		E	PW4ENG 72-572
53L032		E	PW4ENG 72-615
50L332-002	A		
50L732-002	B		
51L432-002	C		
51L332-002	C		
51L632-001	D		
53L822	C		
53L432		E	
53L032-001		E	
54L332-001		E	PW4ENG 72-723
54L332-002		E	PW4ENG 72-723
53L032-003		E	PW4ENG 72-723

Blades with the same letter code can be

Second Stage HPT Blade Interchangeability
Table 1001

PART NUMBER	ENGINE MODELS PW4152 PW4156 PW4156A PW4158	 PW4152 (−3) PW4156 (−3) PW4156A (−3) PW4158 (−3)	REFERENCE SERVICE BULLETIN

(CONTINUED)

intermixed in the same 2nd stage turbine rotor. If there is no letter code in the engine models column, that blade part number cannot be installed in the engine models specified for that column.

Use the table as follows:

1. Select the engine model.
2. Find the letter code(s) that are applicable in the Engine Model Column.
3. Find the part numbers corresponding to the letter codes.
4. You can install any blade that has a letter code, and you can intermix blades with the same letter code in the specified Engine Models for that column.
5. You can intermix blades with letter codes 'A' and 'C' in applicable engine models.
6. You can intermix blades with letter codes 'B' and 'C' in applicable engine models.
7. You can intermix blades with letter codes 'C' and 'D' in applicable engine models.

Second Stage HPT Blade Interchangeability
Table 1001 (Continued)

(18) Optional, document blade serial numbers. Blades manufactured after April, 1995 contain a Pratt & Whitney issued, 10−digit serial number under the blade platform. See Figure 1008.

NOTE: This serial number is traceable to the manufacture of the blade. Pratt & Whitney recommends that the serial numbers be recorded at assembly and be retained by the operator for tracking and traceability purposes.

(19) Moment weigh 2nd stage HPT blades.

NOTE: Blades can be either mass weighed or moment weighed to determine order of diminishing weight. See the following step for the optional mass weight method.

(a) Install PWA 85082 Adapter, with thumb screw facing up, onto extension arm of moment weight scale.

NOTE: The extension arm positions Z−plane of blade root at 12.790 inches (324.866 mm) from centerline of scale. Extension arm may be locally fabricated or supplied by manufacturer of scale.

(b) Loosen thumbscrew clamp. Position blade, concave side up, and insert root end of blade into locating jaws of adapter. Slide blade into adapter until leading edge of blade root contacts end stop on upper locating jaw. Tighten clamp to secure blade.

(c) Moment weigh blade. Mark moment weight of blade on concave side of airfoil using Ink P05−026.

R CAUTION: BEFORE YOU INSTALL THE BLADES TO THE ROTOR,
R DO A VISUAL INSPECTION OF THE BLADE ROOT
R COVER FOR PROPER ORIENTATION. REFER TO THE
R CIR PN 51A357, 72−52−08, INSPECTION/CHECK−03,
R CONFIG−1, CONFIG−2, AND CONFIG−3 AS
R APPLICABLE.

(20) Optional, mass weigh and mark the blades.

(21) Lay out 82 2nd stage HPT blades in order of diminishing moment weight.

(22) Number blades from 1 to 82 in order of heaviest to lightest.

(23) Arrange blades as follows: 1, 3, 5, − 79, 81; 2, 4, 6, − 80, 82.

CAUTION: CARE SHOULD BE TAKEN TO ENSURE THAT ANY FORCE REQUIRED TO INSTALL BLADES IN A HUB BE APPLIED TO ROOT PLATFORM AREA OF BLADE AND NOT TO LEADING OR TRAILING EDGE OF AIRFOIL. AIRFOIL SECTIONS OF ALL BLADES CAN BE DAMAGED IF STRUCK.

(24) Install first blade in slot of hub and onto PWA 85288 Ring.

(25) Continue to install blades working in counterclockwise direction.

(26) Install 2nd stage HPT blade seals (1009/4) into small outer cavity formed between adjacent blades. Use Beeswax P05-395 or Paraffin Wax Blend P05-396, as required to retain parts in position. See Figure 1009.

(27) Install 2nd stage HPT blade dampers (1009/3) into outer end of larger cavity formed between adjacent blades. Use Beeswax P05-395 or Paraffin Wax Blend P05-396 as required to retain parts in position.

(28) Connect a hoist and PWA 85086 Arm to the PWA 85087 Eye. Raise the assembly and remove the PWA 85288 Ring. Lower the hub onto PWA 85088 Fixture or PWA 88719 Stand. Remove the hoist, arm, and eye.

(29) Seat blades into hub.

(30) Install 2nd stage HPT blade covers, Class 1, (1009/1) into inner cavity between adjacent blades.

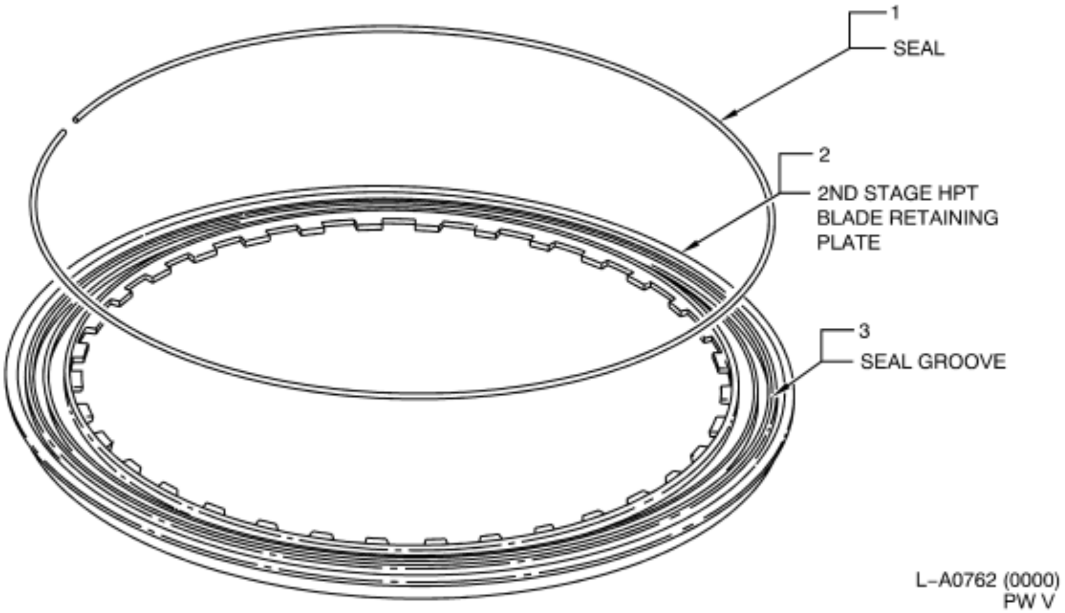
E. Postrequisites

(1) Balance 2nd stage turbine rotor assembly by one of the following methods.

(a) For horizontal balance method refer to Assembly-02 (Task 72-52-02-440-002).

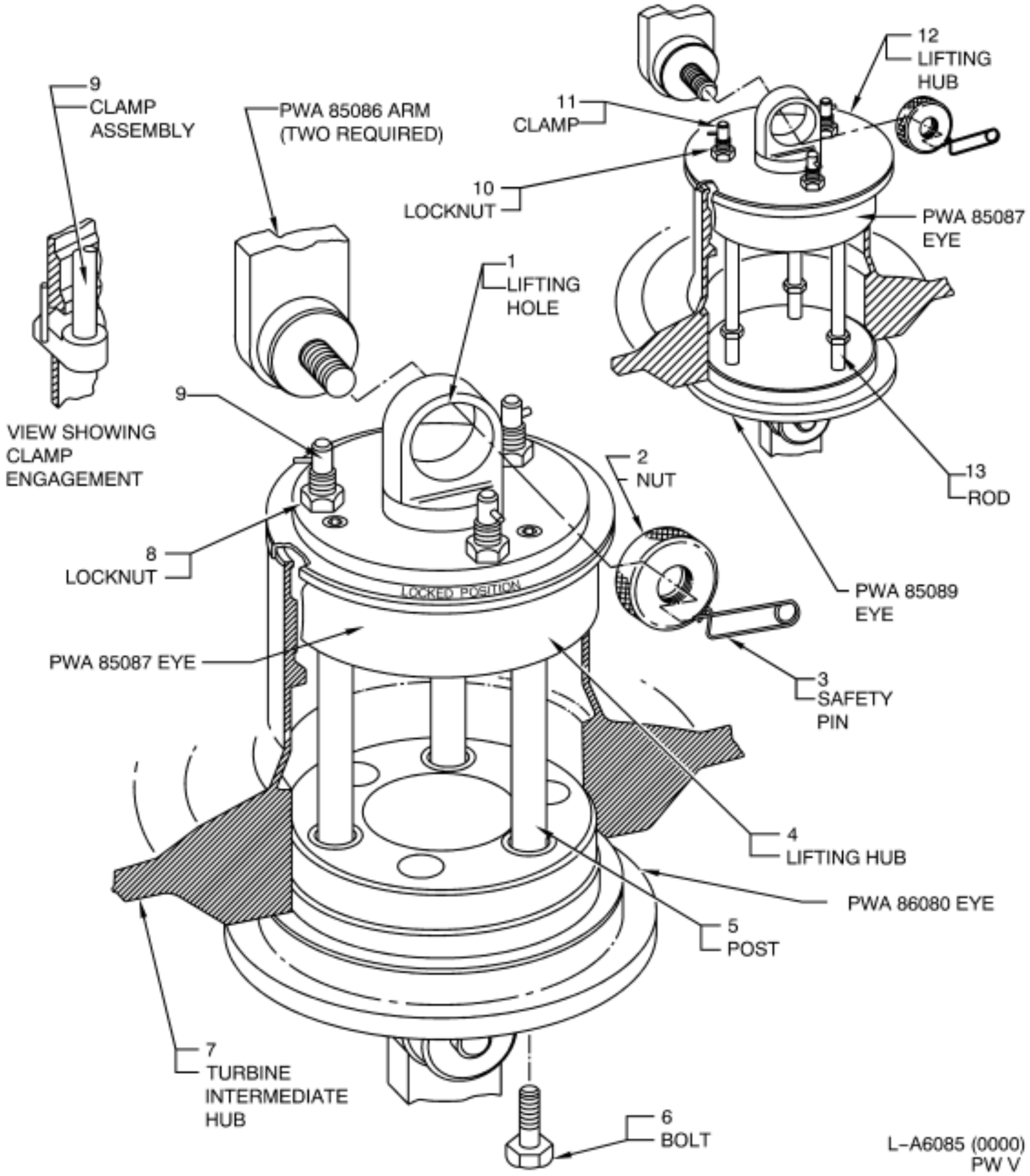
(b) For vertical balance method refer to Assembly-03 (Task 72-52-02-440-003).

STAGE 2 TURBINE ROTOR ASSEMBLY - ASSEMBLY-01


1
SEAL
2
2ND STAGE HPT BLADE RETAINING PLATE
3
SEAL GROOVE
L-A0762 (0000)
PW V

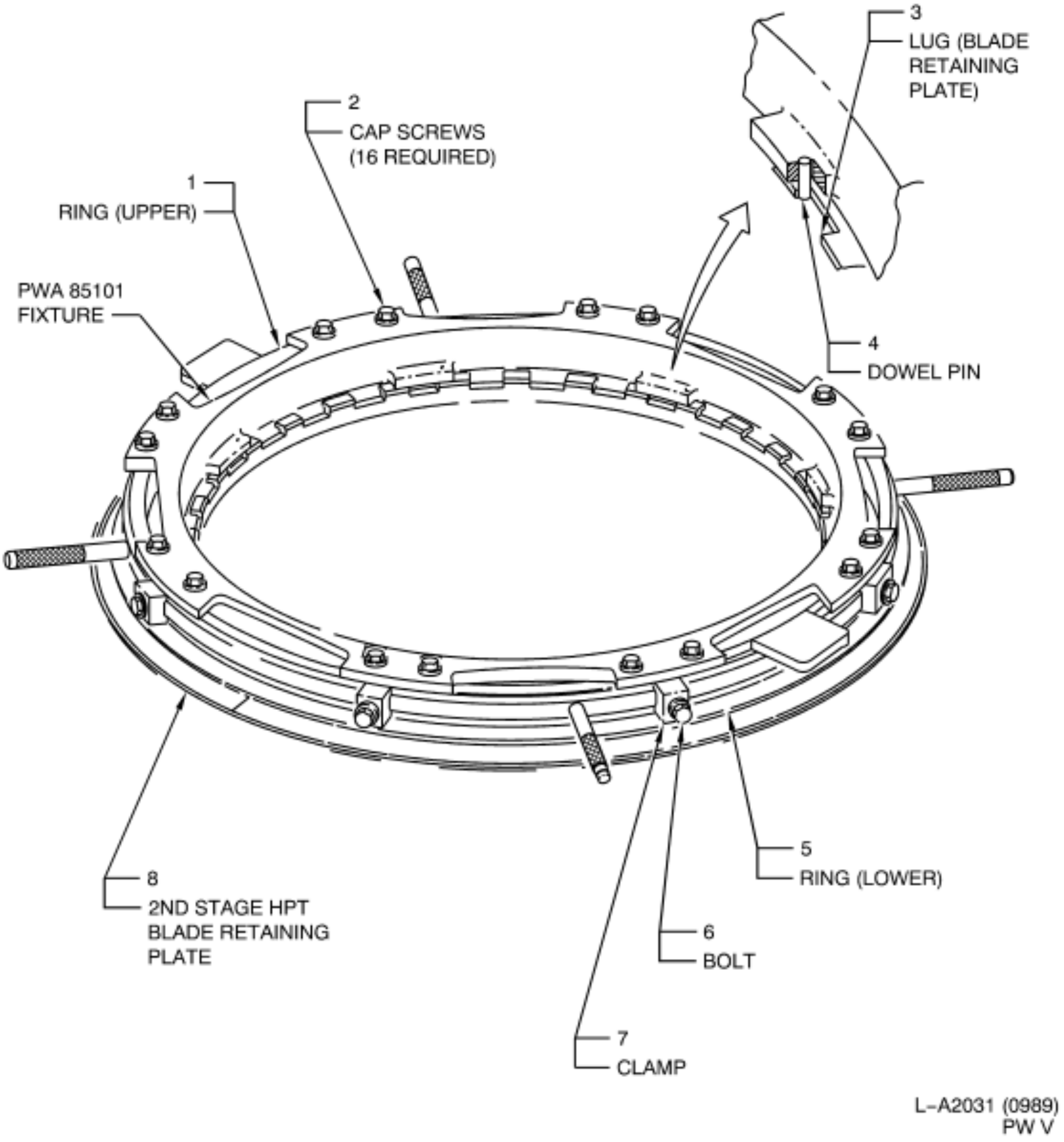
Seal Installation Or 2nd Stage HPT Blade Retaining Plate
Figure 1001
(Task 72-52-02-440-001)

STAGE 2 TURBINE ROTOR ASSEMBLY - ASSEMBLY-01


9
CLAMP
ASSEMBLY
PWA 85086 ARM
(TWO REQUIRED)
11
CLAMP
12
LIFTING
HUB
10
LOCKNUT
PWA 85087
EYE
1
LIFTING
HOLE
VIEW SHOWING
CLAMP
ENGAGEMENT
9
2
NUT
13
ROD
8
LOCKNUT
LOCKED POSITION
PWA 85089
EYE
PWA 85087 EYE
3
SAFETY
PIN
4
LIFTING HUB
PWA 86080 EYE
5
POST
7
TURBINE
INTERMEDIATE
HUB
6
BOLT
L-A6085 (0000)
PW V

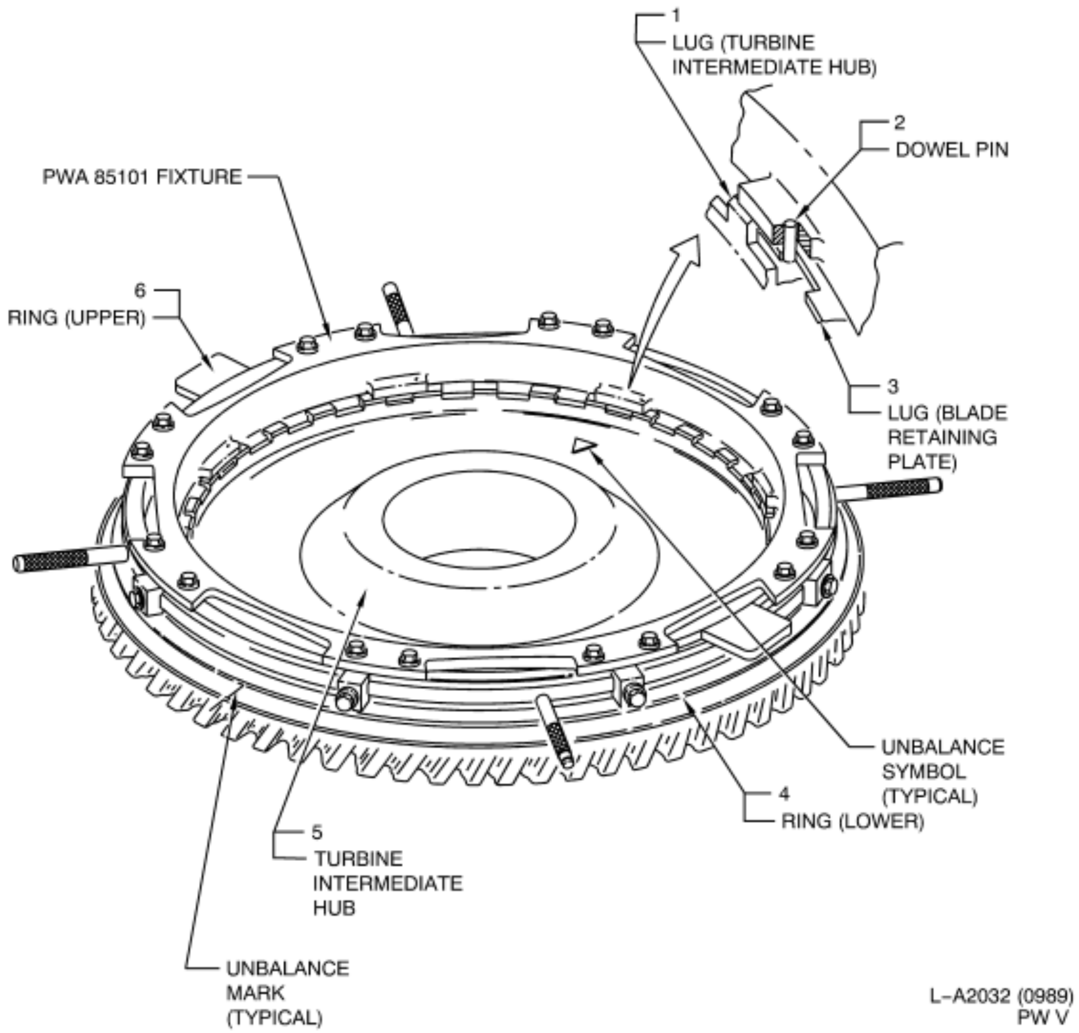
PWA 85087 And PWA 85089 Eye Installation
Figure 1002
(Task 72-52-02-440-001)

STAGE 2 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01


3
LUG (BLADE RETAINING PLATE)
2
CAP SCREWS (16 REQUIRED)
1
RING (UPPER)
PWA 85101 FIXTURE
4
DOWEL PIN
5
RING (LOWER)
8
2ND STAGE HPT BLADE RETAINING PLATE
6
BOLT
7
CLAMP
L−A2031 (0989)
PW V

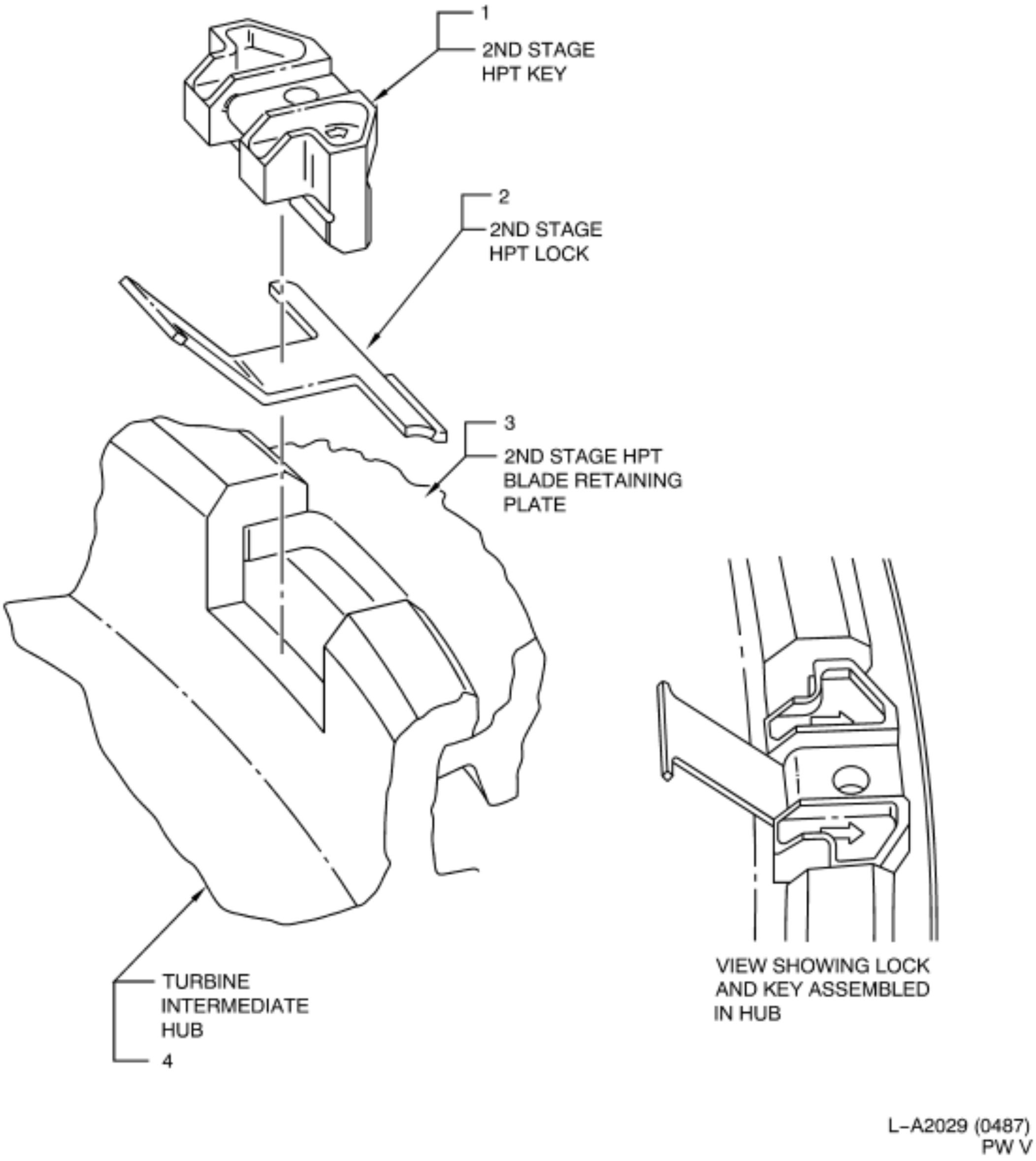
Second Stage HPT Blade Retaining Plate Installation
Figure 1003
(Task 72−52−02−440−001)

STAGE 2 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01

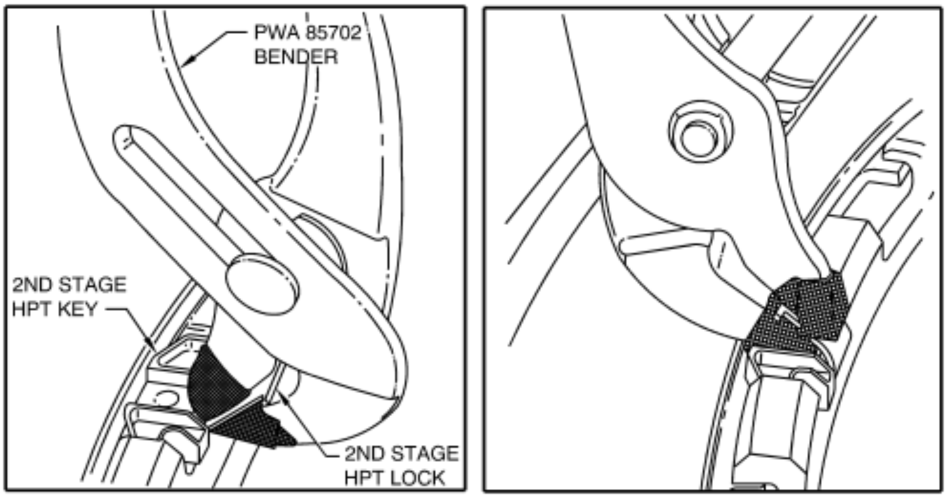

1
LUG (TURBINE INTERMEDIATE HUB)
2
DOWEL PIN
PWA 85101 FIXTURE
6
RING (UPPER)
3
LUG (BLADE RETAINING PLATE)
UNBALANCE SYMBOL (TYPICAL)
4
RING (LOWER)
5
TURBINE INTERMEDIATE HUB
UNBALANCE MARK (TYPICAL)
L−A2032 (0989)
PW V

Second Stage HPT Blade Retaining Plate Installation
Figure 1004
(Task 72−52−02−440−001)

STAGE 2 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01

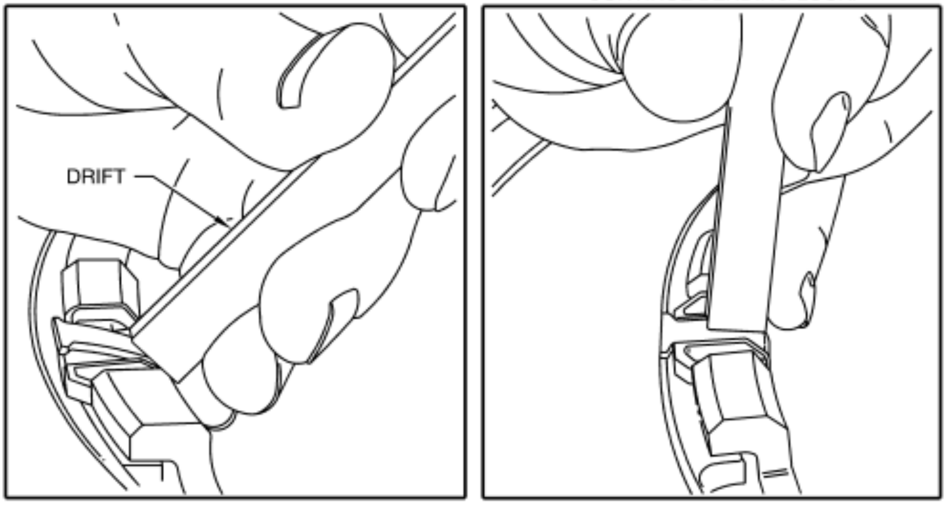

1
2ND STAGE HPT KEY
2
2ND STAGE HPT LOCK
3
2ND STAGE HPT BLADE RETAINING PLATE
TURBINE INTERMEDIATE HUB
4
VIEW SHOWING LOCK AND KEY ASSEMBLED IN HUB
L−A2029 (0487)
PW V

Second Stage HPT Key And Lock Installation
Figure 1005 (Sheet 1)
(Task 72−52−02−440−001)


PWA 85702
BENDER
2ND STAGE
HPT KEY
2ND STAGE
HPT LOCK

BEND LOCK OVER KEY
USING PLIERS.

REPOSITION PLIERS AND
CONTINUE BENDING LOCK.

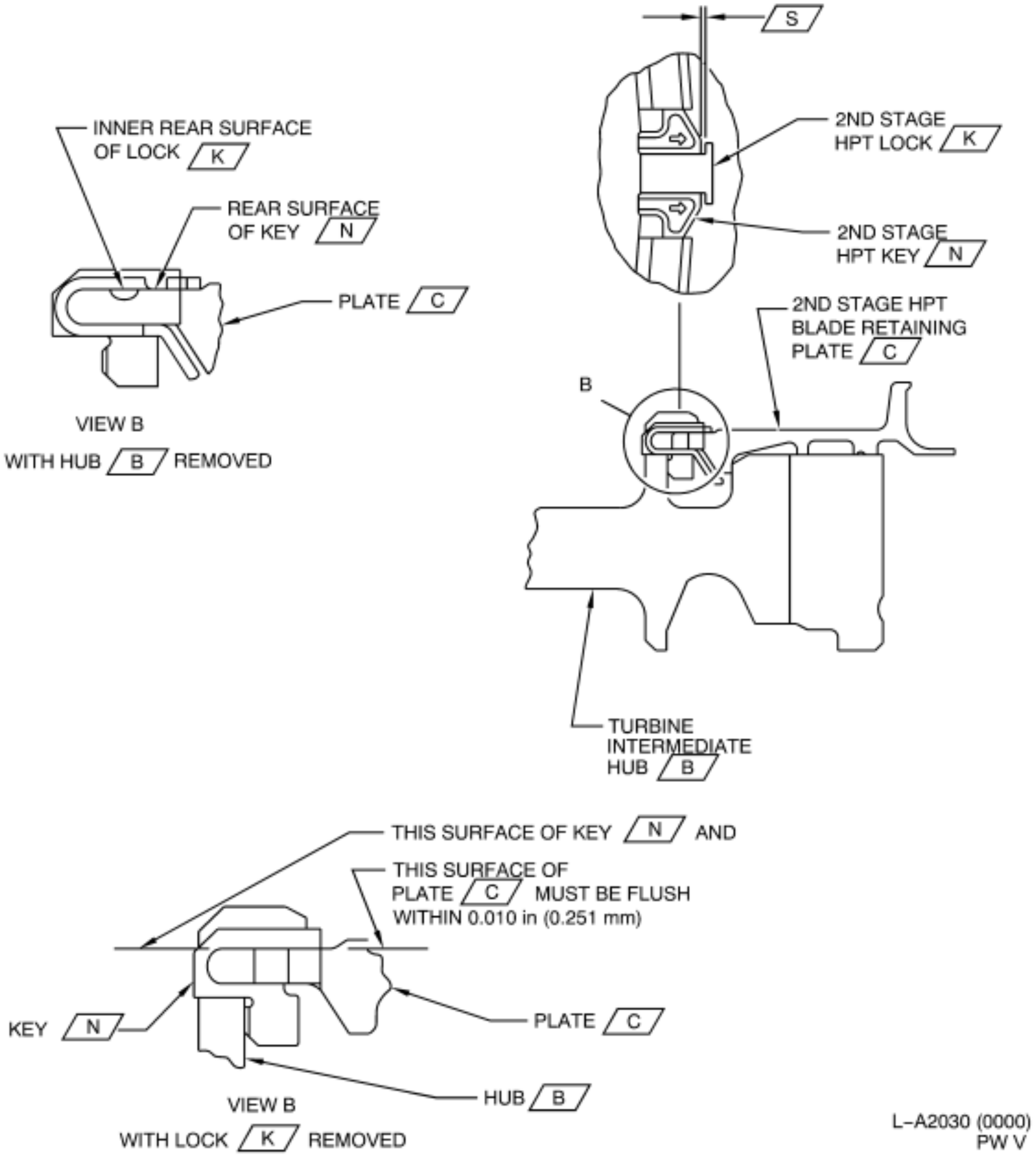


BEND LOCK OVER KEY
USING DRIFT.

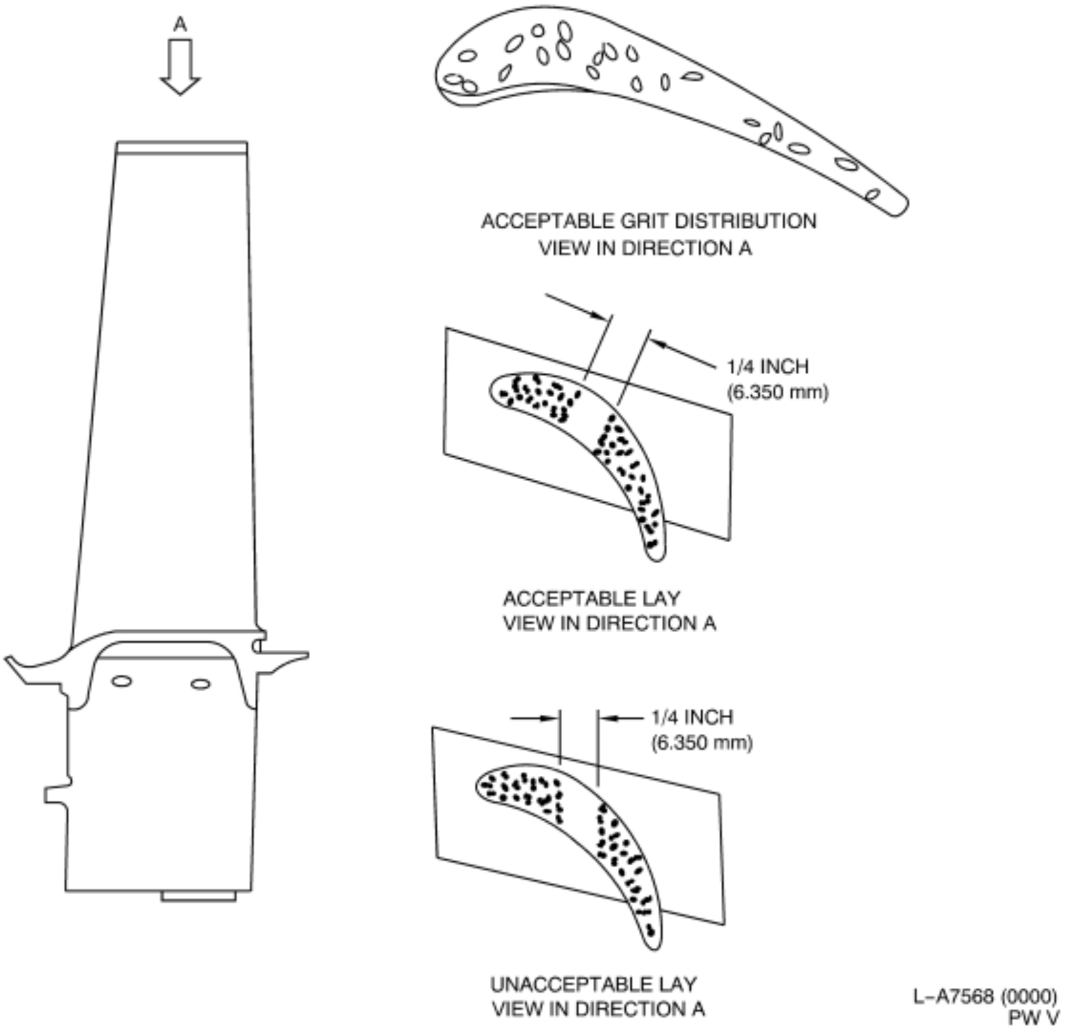
COMPLETE BENDING
OF LOCK USING DRIFT.

L−A3130 (0291)
PW V

Second Stage HPT Key And Lock Installation
Figure 1005 (Sheet 2)
(Task 72−52−02−440−001)

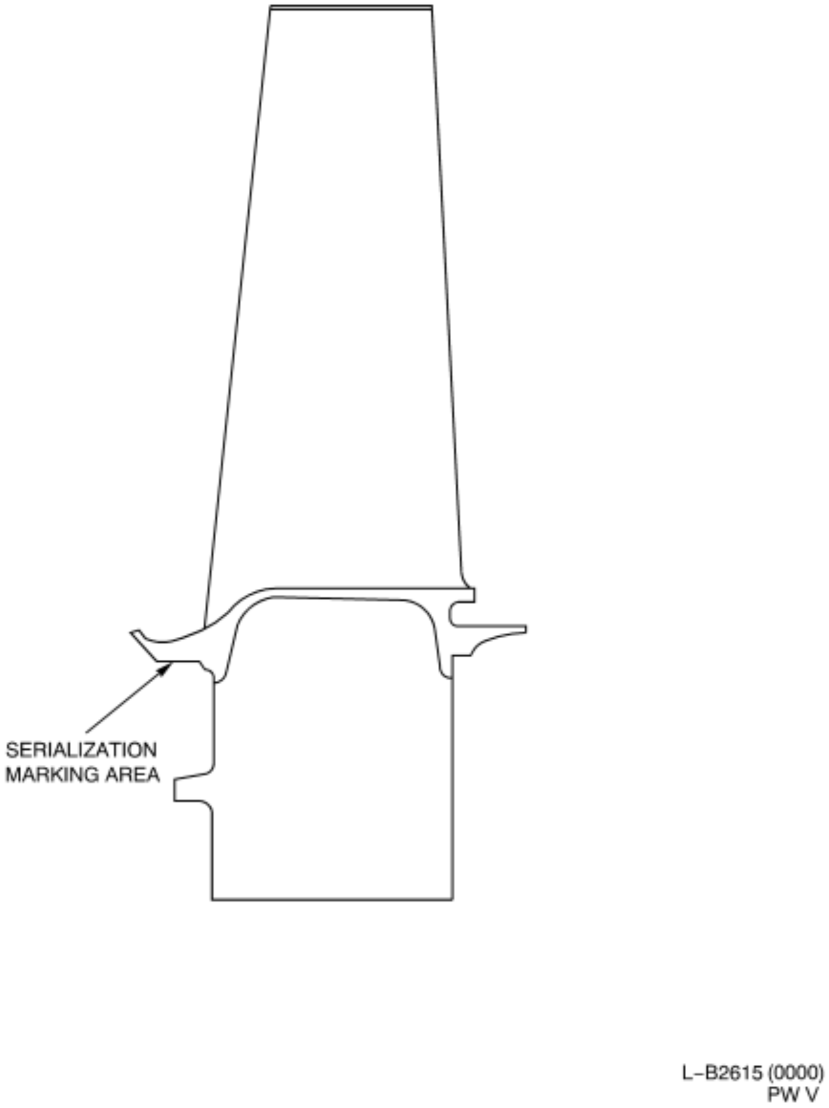

S
INNER REAR SURFACE OF LOCK K
REAR SURFACE OF KEY N
PLATE C
VIEW B
WITH HUB B REMOVED
2ND STAGE HPT LOCK K
2ND STAGE HPT KEY N
2ND STAGE HPT BLADE RETAINING PLATE C
B
TURBINE INTERMEDIATE HUB B
THIS SURFACE OF KEY N AND
THIS SURFACE OF PLATE C MUST BE FLUSH WITHIN 0.010 in (0.251 mm)
KEY N
PLATE C
HUB B
VIEW B
WITH LOCK K REMOVED
L−A2030 (0000)
PW V

Second Stage HPT Key Installation
Figure 1006
(Task 72−52−02−440−001)


A
ACCEPTABLE GRIT DISTRIBUTION
VIEW IN DIRECTION A
1/4 INCH
(6.350 mm)
ACCEPTABLE LAY
VIEW IN DIRECTION A
1/4 INCH
(6.350 mm)
UNACCEPTABLE LAY
VIEW IN DIRECTION A
L−A7568 (0000)
PW V

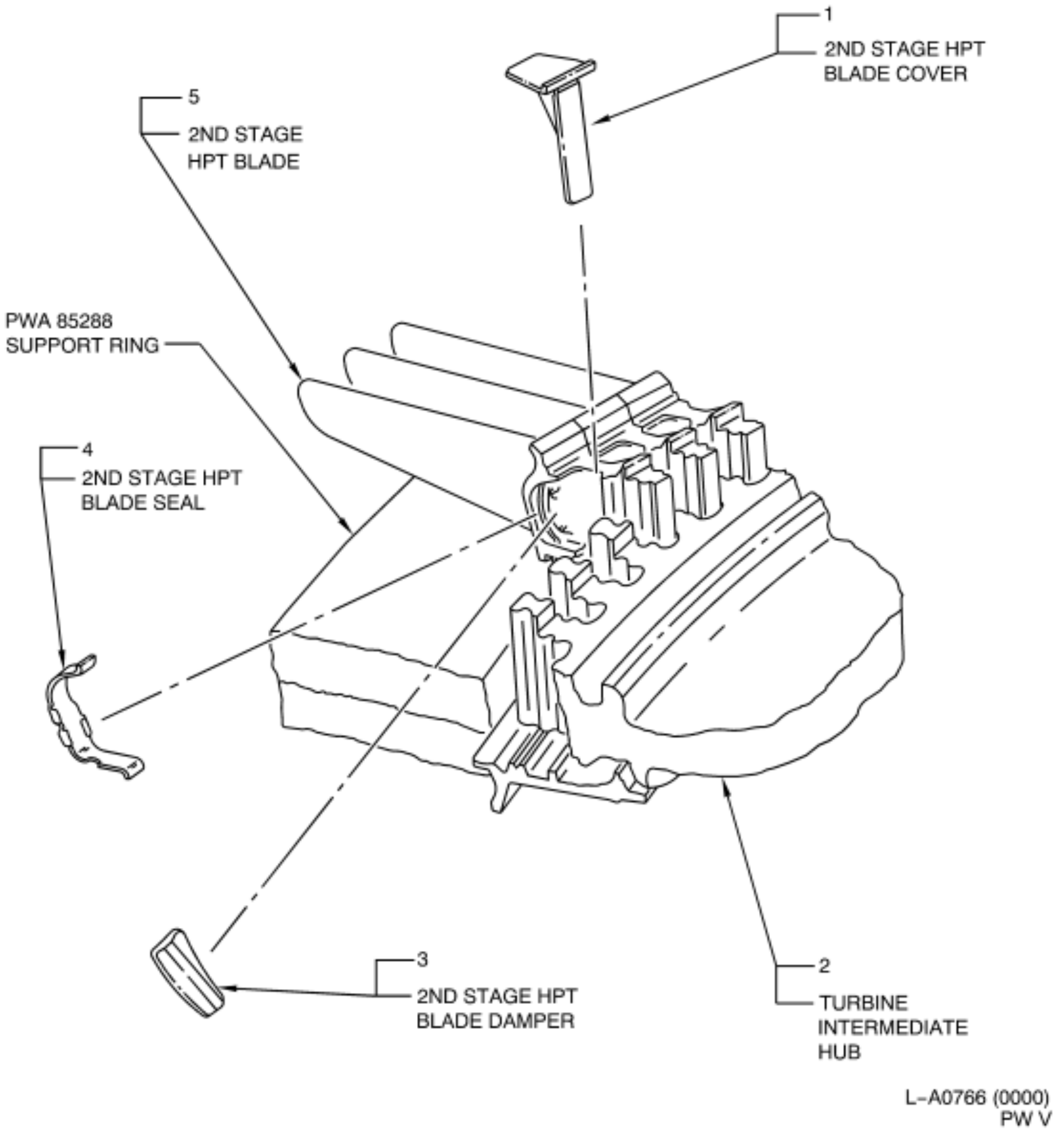
Blade Tip Abrasive Grit Inspection
Figure 1007
(Task 72−52−02−440−001)

STAGE 2 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01


SERIALIZATION
MARKING AREA
L−B2615 (0000)
PW V

Second Stage Blade Installation Serialization Marking Area
Figure 1008
(Task 72−52−02−440−001)

STAGE 2 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01


1
2ND STAGE HPT BLADE COVER
5
2ND STAGE HPT BLADE
PWA 85288 SUPPORT RING
4
2ND STAGE HPT BLADE SEAL
3
2ND STAGE HPT BLADE DAMPER
2
TURBINE INTERMEDIATE HUB
L−A0766 (0000)
PW V

Second Stage Blade Damper, Seal And Cover Installation
Figure 1009
(Task 72−52−02−440−001)

Task 72-52-02-440-002:

1. Static Balance Stage 2 Turbine Rotor Assembly

A. Prerequisites

(1) Assemble 2nd stage turbine rotor assembly per Assembly-01 Task 72-52-02-440-001.

B. Equipment And Materials Necessary

Standard Tools

Scale, Mass Weight

Special Tools:

PWA 85086	Arm (Two Necessary)
PWA 85095	Arbor, Balance
PWA 85097	Shroud
PWA 85099	Stand, Storage
PWA 86535	Fixture, Lift
PWA 88719	Stand, Support

Consumable Materials:

Item No.	Designation
P05-395	Beeswax
P05-396	Paraffin Wax Blend

C. Procedure

(1) If necessary, install the 2nd stage turbine rotor, rear end down on the PWA 88719 Support Stand as follows:

(a) Install the PWA 86535 Lift Fixture in the front bore of the hub.

(b) Lift the lock pin and engage the fixture on the hub and lock the fixture to the hub by moving the lock pin down below the shown "Locked" line. R

(c) With a hoist, install the rotor on the PWA 88719 Support Stand.

(2) Remove the PWA 85095 Arbor from the storage box as follows:

STAGE 2 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02

(a) With a spanner wrench, tighten the two lifting eyes on the ends of the arbor.

(b) Attach two PWA 85086 Lifting Arms to the lifting eyes on the arbor.

(c) Attach two hoists to the lifting arms and remove the arbor from its storage box.

(d) If necessary, remove the Detail−29 Check Weight from the shaft of the arbor.

(3) If necessary, remove the Detail−7 front retainer from the arbor as follows:

(a) Trunnion arbor to the front (drive) end down position. Remove the lower hoist.

(b) Remove the bolts which attach the Detail−7 front (lower) retainer and remove it from the arbor.

(c) Attach a hoist to the lower lifting arm and trunnion the arbor to the rear end down (drive end up) position. Remove the lower hoist and lifting arm.

(4) Install PWA 85095 Arbor into turbine rear hub. See Figure 1001.

(a) Remove the Detail−25 nut, the Detail−36 rear retainer, the Detail−35 nut and the Detail−23 rear spacer from the arbor.

(b) Install the Detail−9 front spacer on the arbor over the actuating chuck. Temporarily attach the spacer in position with standard 3.0 inch (76.200 mm) C−clamps.

(c) Lower arbor into turbine intermediate hub (1001/4) aligning splines in hub with two spline drives on arbor.

(d) Remove the hoist and lifting arm.

(e) Remove C−clamps which attach the spacer (1001/3).

(f) Install the Detail−7 front retainer (1001/2) and attach it with three bolts (1001/1). Tighten the bolts.

CAUTION: DO NOT OPERATE THE HYDRAULIC CHUCK DETAIL OF THE PWA 85095 ARBOR UNLESS THE THREE EXPANDING DIAMETERS ARE HELD BY THE ARBOR PARTS OR THE TURBINE HUB. IF YOU DO OPERATE THE CHUCK WITHOUT THESE PARTS, YOU CAN DAMAGE THE ARBOR.

(g) Use the wrench supplied with the arbor to tighten and loosen the hydraulic chuck actuating screw a number of times. Do this to put the rotor in the center. Tighten the actuating screw one last time to keep the rotor in position.

(h) Put the Detail−10 nut on the end of the arbor and against the shoulder in the ID of the hub. Tighten the nut with the larger spanner wrench.

(5) Connect PWA 85086 Arm to upper lifting eye of arbor. Attach hoist to arm and lift assembly from stand.

(6) Install lifting eye to lower end of arbor. Connect second PWA 85086 Arm and hoist to lifting eye.

(7) Using hoists, trunnion arbor and rotor assembly to horizontal position. Install assembly into PWA 85099 Stand. Remove hoists and arms.

NOTE: Front and rear sleeves of arbor should be covered with suitable protective material to avoid possible damage during transport and storage when in PWA 85099 Stand.

(8) Move the arbor and rotor assembly to the balance machine.

(9) Open cover of PWA 85097 Shroud. Connect two hoists, with PWA 85086 Arms to lifting eyes on ends of arbor. Using hoists, remove assembly from stand and install arbor onto rollers of balance machine.

(10) Remove hoists, arms, and lifting eyes from ends of arbor.

(11) Connect arbor to balance machine with direct drive (U−Joint driver size 187/2) or install drive belt to sand blasted area on front end of arbor.

(12) Operate the balance machine.

(a) Find the static unbalance of the rotor assembly while it turns at 900 rpm minimum.

(b) Get three unbalance readings. For balance machines that do not have an automatic recording feature, record the average angle and the average amount of unbalance.

(13) Remove the arbor and the rotor assembly from the balance machine as follows:

(a) Open the cover of the PWA 85097 Shroud.

(b) If a direct drive is used, use an approved pen to make index marks on the direct drive and the arbor so that they will be reassembled in the same relative position.

(c) Install the detail lifting eyes to the ends of the arbor.

(d) Connect two hoists with two PWA 85086 Lifting Arms to the lifting eyes.

(e) With the hoists, install the arbor and rotor assembly in the PWA 85099 Storage Stand. Remove the hoists.

NOTE: Cover the front and rear sleeves of the arbor with an applicable material. This will prevent possible damage during transport.

(f) Move the assembly to the support stand.

(g) Connect two hoists to the lifting arms, lift the assembly from the stand and trunnion the arbor to the rear end down (drive end up) position. Remove the lower lifting arm and hoist.

(h) Lower the arbor and the rotor assembly to the PWA 88719 Support Stand.

(i) Remove the upper hoist and lifting arm from the arbor.

(j) Use an approved pen to make index marks on the arbor and front retainer so that these details will be reassembled in the same relative position. Make index marks on the arbor and the turbine rear hub.

(k) Loosen and remove the three bolts that attach the Detail−7 front retainer. Remove the front retainer.

(l) Temporarily attach the Detail−9 front spacer in position with standard 3.0 inch (76.200 mm) C−clamps.

(m) Loosen and remove the Detail−10 nut from the end of the arbor.

(n) Loosen the hydraulic actuating screw to permit the removal of the arbor. Use the wrench supplied with the arbor to do this.

(o) Install the PWA 85086 Lifting Arm to the upper lifting eye on the arbor.

(p) With a hoist lift the balance arbor from the rotor assembly. Index (turn) the balance arbor 180 degrees and lower the arbor in the rotor assembly while you align the hub's splines with the drive splines on the arbor.

(q) Remove the hoist and lifting arm from the arbor.

(r) Remove the C−clamps which attach the spacer.

(s) Align the index marks and install the Detail−7 front retainer and attach it with three bolts. Tighten the bolts.

CAUTION: DO NOT OPERATE THE HYDRAULIC CHUCK DETAIL OF THE PWA 85095 ARBOR UNLESS THE THREE EXPANDING DIAMETERS ARE HELD BY THE ARBOR PARTS OR THE TURBINE HUB. IF YOU DO OPERATE THE CHUCK WITHOUT THESE PARTS, YOU CAN DAMAGE THE ARBOR.

(t) Use the wrench supplied with the arbor to tighten and loosen the hydraulic chuck actuating screw a number of times. Do this to put the rotor in the center. Tighten the actuating screw one last time to keep the rotor in position.

(u) Put the Detail−10 nut on the end of the arbor and against the shoulder in the ID of the hub. Tighten the nut with the larger spanner wrench.

(14) Connect the PWA 85086 Lifting Arm to the upper lifting eye of the arbor. Attach a hoist to the lifting arm and lift the assembly from the stand.

(15) Connect a second PWA 85086 Lifting Arm to the lower lifting eye.

(16) With a hoist, trunnion the arbor and rotor assembly to the horizontal position. Install the assembly in the PWA 85099 Storage Stand. Remove the hoists.

NOTE: Cover the front and rear sleeves of the arbor with an applicable material. This will prevent possible damage during transport while it is in the PWA 85099 Storage Stand.

(17) Move the arbor and rotor assembly to the balance machine.

(18) Open the cover of the PWA 85097 Shroud. With the two hoists and lifting arms, install the arbor on the rollers of the balance machine. Remove the hoists, lifting arms and lifting eyes from the ends of the arbor.

(19) Connect the arbor to the balance machine with the direct drive and align the index marks on the arbor and the direct drive or install the drive belt to the sand blasted area on the front end of the arbor.

(20) Operate the balance machine.

(a) Static balance the rotor assembly while it turns at 900 rpm minimum. The residual unbalance must not be more than 1.0 oz−in. (720.0 g.mm).

(b) For balance machines that have an automatic recording feature, get three unbalance readings. Average the readings. Use the machine to determine the unbalance amount and angle of the assembly.

(c) For balance machines that do not have an automatic recording feature, get three unbalance readings. Average and record the three unbalance readings. Use the average readings from the first and second balance runs to do a polar plot to get the assembly unbalance angle and amount.

(21) If the static unbalance is equal to 1.0 oz−in. (720.0 g.mm) or less continue as follows:

(a) Record the angle and the amount of unbalance.

(22) If the static unbalance is more than 1.0 oz−in. (720.0 g.mm), continue as follows:

(a) Replace the Class 1 second stage HPT covers with Class 2 or Class 3 covers opposite the heavy angle as necessary. Hold the blade platform and pull straight back to remove the cover.

NOTE: Second stage HPT Class 1 covers are initially installed at 82 locations.

(b) Static balance the rotor assembly as described above until the residual unbalance is not more than 1.0 oz−in. (720.0 g.mm).

(c) Record the heavy angle and the amount of assembly unbalance.

(23) Optional process based on the experience of the operator, do a check of the balance machine as follows:

(a) Pan weigh an amount of Beeswax P05−395 or Paraffin Wax Blend P05−396 equal to 0.2945 − 0.2955 oz (8349.0 − 8377.0 mg).

(b) Put the wax on the rear face of the plate in line with the outer edge of the Detail−7 front retainer as close as possible to the angle of residual unbalance.

NOTE: This point is equal to a radius of 13.560 in (344.424 mm).

(c) This amount of beeswax will pull 4.0 oz−in. (2880.0 g.mm).

(d) Do a check of the balance machine at 900 rpm minimum.

(e) The amount of unbalance should pull 4.0 oz−in. (2880.0 g.mm) plus the remaining residual unbalance ± 0.4 oz−in (288.0 g.mm).

(f) Remove the beeswax.

(24) Mark the unbalance symbol (triangle) and the amount of unbalance, adjacent to the unbalance symbol (triangle), on the rear side of the disk web at the location of heavy unbalance by SPOP 401 (Task 70−11−00−280−006), Standard Practices Manual, PN 585005. Use the shallow etch method.

NOTE: No burns, pitting or selective attack is permitted on the disk.

(25) Remove arbor and rotor assembly from balance machine and install in PWA 85099 Stand.

(a) Open cover on PWA 85097 Shroud.

(b) Install lifting eyes on ends of arbor.

(c) Connect two hoists with two PWA 85086 Arms to lifting eyes.

(d) Using hoists, install arbor into clamps of PWA 85099 Stand.

NOTE: Front and rear sleeves of arbor should be covered with suitable protective material R to avoid possible damage during transport and storage when in stand.

(26) Remove arbor and rotor assembly from transport fixture and install into PWA 85088 Fixture.

(a) Connect two hoists with two PWA 85086 Arms to lifting eyes on ends of arbor.

(b) Using hoists, remove assembly from stand and trunnion to rear end down (drive end up) position.

(c) Remove lower hoist and PWA 85086 Arm.

(d) Lower assembly and position turbine rear hub onto fixture.

(27) Remove arbor from turbine rear hub.

(a) Remove nut (1001/5) from lower end of arbor.

(b) Using wrench supplied with arbor, loosen hydraulic actuating screw to allow removal of arbor.

(c) Remove three bolts (1001/1) securing retainer (1001/2) to arbor. Remove retainer.

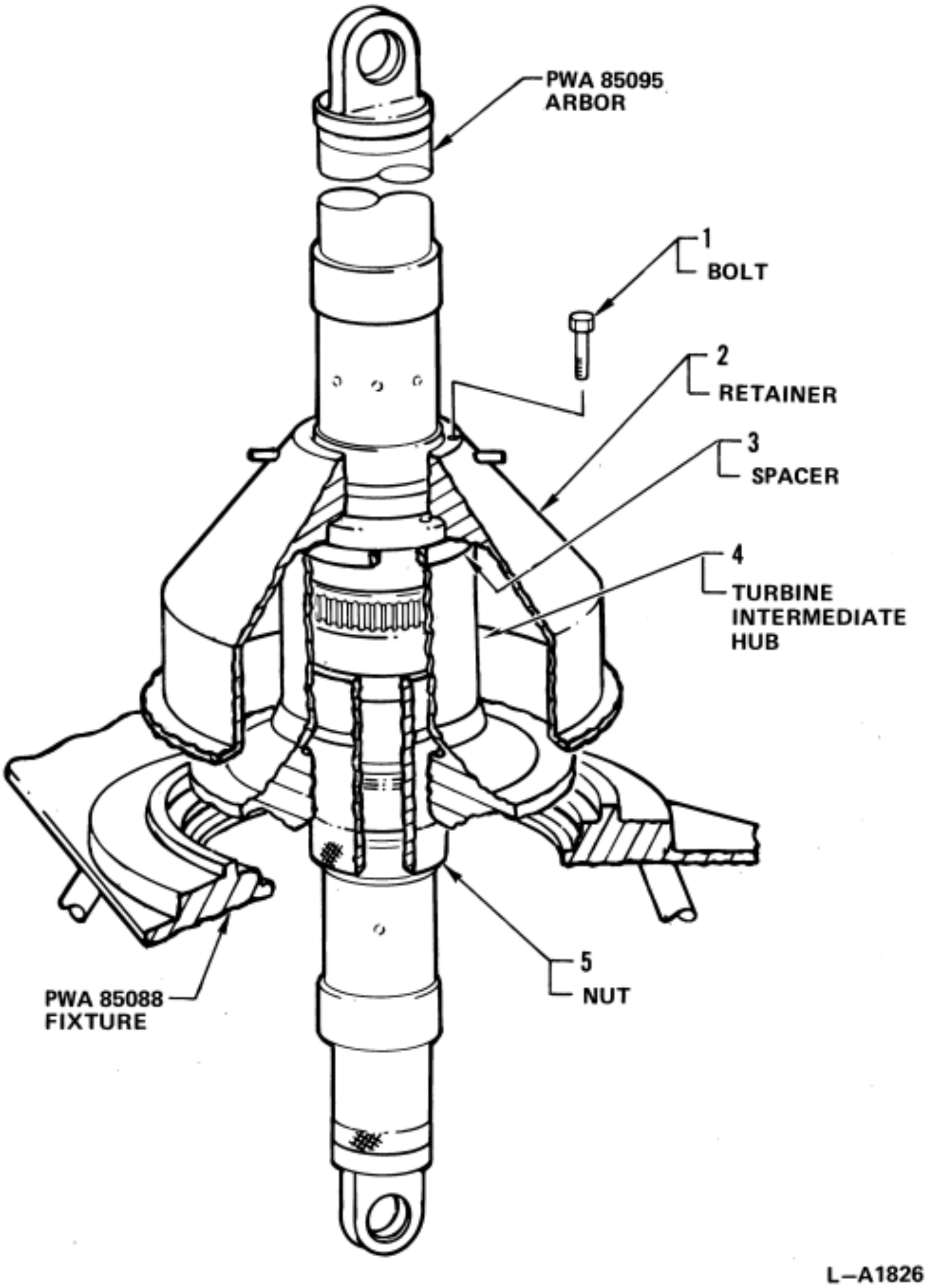
(d) Temporarily secure spacer (1001/3) to adjacent spacer using standard 3 inch (76.200 mm) C−clamp.

(e) Connect hoist, with PWA 85086 Arm to upper lifting eye of arbor. Using hoist, lift arbor from turbine rear hub.

(f) Remove C−clamps and remove spacer (1001/3).

(g) Connect hoist with PWA 85086 Arm to lower lifting eye on arbor.

(h) Using both hoists, trunnion arbor to horizontal position and install arbor in storage box. Remove hoists and arms.


PWA 85095
ARBOR
1
BOLT
2
RETAINER
3
SPACER
4
TURBINE
INTERMEDIATE
HUB
PWA 85088
FIXTURE
5
NUT
L-A1826

Balance Arbor Installation
Figure 1001
(Task 72-52-02-440-002)

STAGE 2 TURBINE ROTOR ASSEMBLY - ASSEMBLY-03

Task 72-52-02-440-003:

1. Static Balance Stage 2 Turbine Rotor Assembly (Vertical Balance Method)

A. Prerequisites

(1) Assemble 2nd stage turbine rotor assembly. Refer to Assembly-01 Task 72-52-02-440-001.

B. Equipment And Materials Necessary

Standard Tools

Scale, Mass Weight

Special Tools:

PWA 85088	Fixture, Support
PWA 86427	Arbor, Balance
PWA 86535	Fixture, Lift

Consumable Materials:

Item No.	Designation
P05-395	Beeswax
P05-396	Paraffin Wax Blend

C. Procedure

(1) Install PWA 86427 Arbor onto the vertical balance machine.

(2) Position PWA 86535 Lift Fixture in the front bore of the hub as follows:

(a) Lift the lock pin and engage the fixture on the hub and lock the fixture to the hub by moving the lock pin down below the shown "Locked" line. R

(b) With a hoist, install the rotor on the arbor. Align the splines of the hub with the spline drives of the arbor. Remove the lift fixture.

(3) Operate the balance machine.

(a) Find the static unbalance of the rotor assembly while it turns at 900 rpm minimum.

STAGE 2 TURBINE ROTOR ASSEMBLY − ASSEMBLY−03

(b) Get three unbalance readings. For balance machines that do not have an automatic recording feature, record the average angle and the average amount of unbalance.

(4) Remove the rotor assembly from the balance machine as follows:

(a) Install the PWA 86535 Lift Fixture in the front bore of the hub as follows:

1 Lift the lock pin and engage the fixture on the hub and lock the fixture to the hub by moving the lock pin down.

(b) With the hoist, lift the rotor assembly from the balance arbor. Index (turn) the rotor assembly 180 degrees and lower the assembly on the arbor.

(c) Remove the hoist and the PWA 86535 Lift Fixture.

(5) Operate the balance machine.

(a) Static balance the rotor assembly while it turns at 900 rpm minimum. The residual unbalance must not be more than 1.0 oz−in. (720.0 g.mm).

(b) For balance machines that have an automatic recording feature, get three unbalance readings. Average the readings. Use the machine to determine the unbalance amount and angle of the assembly.

(c) For balance machines that do not have an automatic recording feature, get three unbalance readings. Average and record the three unbalance readings. Use the average readings from the first and second balance runs to do a polar plot to get the assembly unbalance angle and amount.

(6) If the static unbalance is equal to 1.0 oz−in. (720.0 g.mm) or less continue as follows:

(a) Record the angle and the amount of unbalance.

(7) If the static unbalance is more than 1.0 oz−in. (720.0 g.mm), continue as follows:

(a) Replace the Class 1 second stage HPT covers with Class 2 or Class 3 covers opposite the heavy angle as necessary. Hold the blade platform and pull straight back to remove the cover.

NOTE: Second stage HPT Class 1 covers are initially installed at 82 locations.

(b) Static balance the rotor assembly as described above until the residual unbalance is not more than 1.0 oz−in. (720.0 g.mm).

(c) Record the heavy angle and the amount of assembly unbalance.

(8) Optional process based on the experience of the operator, do a check of the balance machine as follows:

(a) Pan weigh an amount of Beeswax P05−395 or Paraffin Wax Blend P05−396 equal to 0.2945 − 0.2955 oz (8349.0 − 8377.0 mg).

(b) Put the wax on the front face of the blade inward of the blade tang as close as possible to the angle of residual unbalance.

NOTE: This point is equal to a radius of 13.560 in (344.424 mm).

(c) This amount of beeswax will pull 4.0 oz−in. (2880.0 g.mm).

(d) Do a check of the balance machine at 900 rpm minimum.

(e) The amount of unbalance should pull 4.0 oz−in. (2880.0 g.mm) plus the remaining residual unbalance ± 0.4 oz−in (288.0 g.mm).

(f) Remove the beeswax.

(9) Mark the unbalance symbol (triangle) and the amount of unbalance, adjacent to the unbalance symbol (triangle), on the rear side of the disk web at the location of heavy unbalance by SPOP 401 (Task 70−11−00−280−006), Standard Practices Manual, PN 585005. Use the shallow etch method.

NOTE: No burns, pitting or selective attack is permitted on the disk.

(10) Remove the rotor assembly from the balance machine as follows:

(a) Install the PWA 86535 Lift Fixture in the front bore of the hub.

(b) Lift the lock pin and engage the fixture on the hub and lock the fixture to the hub by moving the lock pin down.

(c) With a hoist, install the rotor on the PWA 85088 Support Fixture.

(d) Remove the hoist and lift fixture.

(11) Remove the arbor from the balance machine.

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CHAPTER 72

HIGH PRESSURE TURBINE (HPT)

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Task 72-52-00-990-001: Specific Fits And Clearances		801	
Inspection/Check-04		801	CONFIG-2 4152-3 4156A-3 4158-3
Task 72-52-00-990-006: Specific Fits And Clearances		801	
Assembly-01		1001	ALL
Task 72-52-00-400-001: Assemble High Pressure Turbine		1001	
Storage-01		1201	ALL
Task 72-52-00-530-001: Pack High Pressure Turbine		1201	
Task 72-52-00-540-001: Unpack High Pressure Turbine		1205	
STAGE 1 TURBINE ROTOR ASSEMBLY	72-52-01		
Disassembly-01		501	ALL

SUBJECT	CHP/SEC/SUB	PAGE	EFFECTIVITY
STAGE 1 TURBINE ROTOR ASSEMBLY (CONTINUED)	72-52-01		
Task 72-52-01-040-001: Disassemble 1st Stage Turbine Rotor Assembly		501	
Assembly-01		1001	ALL
Task 72-52-01-440-001: Assemble 1st Stage Turbine Rotor Assembly		1001	
Assembly-02		1001	ALL
Task 72-52-01-440-002: Static Balance Stage 1 Turbine Rotor Assembly		1001	
Assembly-03		1001	ALL
Task 72-52-01-440-003: Static Balance Stage 1 Turbine Rotor Assembly (Vertical Balance Method)		1001	
STAGE 2 TURBINE ROTOR ASSEMBLY	72-52-02		
Disassembly-01		501	ALL
Task 72-52-02-040-001: Disassemble 2nd Stage Turbine Rotor Assembly		501	
Assembly-01		1001	ALL
Task 72-52-02-440-001: Assemble 2nd Stage Turbine Rotor Assembly		1001	
Assembly-02		1001	ALL
Task 72-52-02-440-002: Static Balance Stage 2 Turbine Rotor Assembly		1001	
Assembly-03		1001	ALL
Task 72-52-02-440-003: Static Balance Stage 2 Turbine Rotor Assembly (Vertical Balance Method)		1001	
TURBINE CASE AND VANE ASSEMBLY	72-52-03		
Disassembly-01		501	ALL
Task 72-52-03-040-001: Disassemble Turbine Case And Vane Assembly		501	
Assembly-01		1001	ALL
Task 72-52-03-440-001: Assemble Turbine Case And Vane Assembly		1001	
Assembly-02		1001	ALL
Task 72-52-03-440-002: Duct Segment Replacement - Turbine Case And Vane Assembly - Deleted		1001	

TURBINE CASE AND VANE ASSEMBLY - DISASSEMBLY-01

Task 72-52-03-040-001:

1. Disassemble Turbine Case And Vane Assembly
   A. Equipment And Materials Required

      Special Tools:

      PWA 76154 Adapter (Two Necessary)
      PWA 78024 Adapter, Driver
      PWA 85247 Brackets, Handling (Two Necessary)
      PWA 85290 Ring, Support (Optional to PWA 87003)
      PWA 86504 Adapter, Wrench
      PWA 87003 Ring, Support
      PWA 87005 Retainer, Holding
      PWA 87199 Puller, Jackscrews
      PWA 87753 Table, Rotary (Optional)
      PWA 88645 Sling, Lifting (Optional to PWA 88673)
      PWA 88673 Sling, Lifting (Optional to PWA 88643)

   B. Procedure
      (1) Position turbine case and vane assembly on workbench.
         (a) Position PWA 87003 or PWA 85290 Ring (chamfered end up) onto workbench.

            NOTE: The Ring (PWA 87003 or PWA 85290) can be positioned on an optional PWA 87753 Rotary Table to make the assembly procedure easier.

         (b) With turbine case front flange (smaller ID) down, position two PWA 85247 Brackets 180 degrees apart between front and rear flanges of case. Position brackets with dowel pins protruding through bolthole in rear flange of case. Install seven screws through boltholes in front flange of turbine case and into brackets. Tighten screws.
         (c) Connect PWA 88643 or PWA 88673 Sling with two PWA 76154 Adapters to trunnion spools on Brackets (PWA 85247). Using hoist, position turbine case with front end (smaller OD) down, over Ring (PWA 87003 or PWA 85290). Align boltholes and lower case onto ring, with bolt details of bracket in clearance cutouts of ring. Secure case to ring with eight detail screws.
         (d) Disconnect hoist, sling and adapters. Allow brackets to remain in place.

TURBINE CASE AND VANE ASSEMBLY − DISASSEMBLY−01

(2) Locate dowel pin hole on turbine case OD flange (bottom vertical centerline) as reference. Insure that all vanes assemblies, ducts and duct support segments are numbered consecutively starting at top vertical center line and proceding in clockwise direction as viewed from rear. See Figure 501 for location of parts marked No. 1. See Figure 502 for part marking areas.

(3) Inspect ID of 2nd stage HPT duct segments for damage. Duct segments exhibiting damage should not be reinstalled.

(4) Loosen 21 bolts (503/1) and 21 bolts (503/2) securing 2nd stage HPT duct support segments (502/4) and vanes to case using PWA 86504 Wrench. Use PWA 78024 Adapter, with a ratcheting box wrench (such as Snap−on GRES810) to remove the bolts. Remove 21 spacers (503/3). See Figure 503.

(5) Remove 2nd stage HPT seal, duct supports and duct segments from case and vane assembly. Use PWA 87199 Jackscrew Puller.

  (a) Remove the jackscrews from the storage locations and put them through the large hole in each HPT duct support so they are resting on the legs of the vane assemblies.

  (b) Open the puller and place it under the 2nd stage HPT seal and on top of the jackscrews. Lock the puller halves together with the ball lock pin.

  (c) Turn each jackscrew with equal pressure until the duct supports are loose. See Figure 504.

  (d) Position seal and duct assembly on bench, with 2nd stage HPT seal end down.

(6) Remove upper gasket (505/4) and (21) 2nd stage HPT duct segments (505/7) from duct supports. Remove seals (505/8) from slots between duct segments. Remove lower gasket (505/6). See Figure 505.

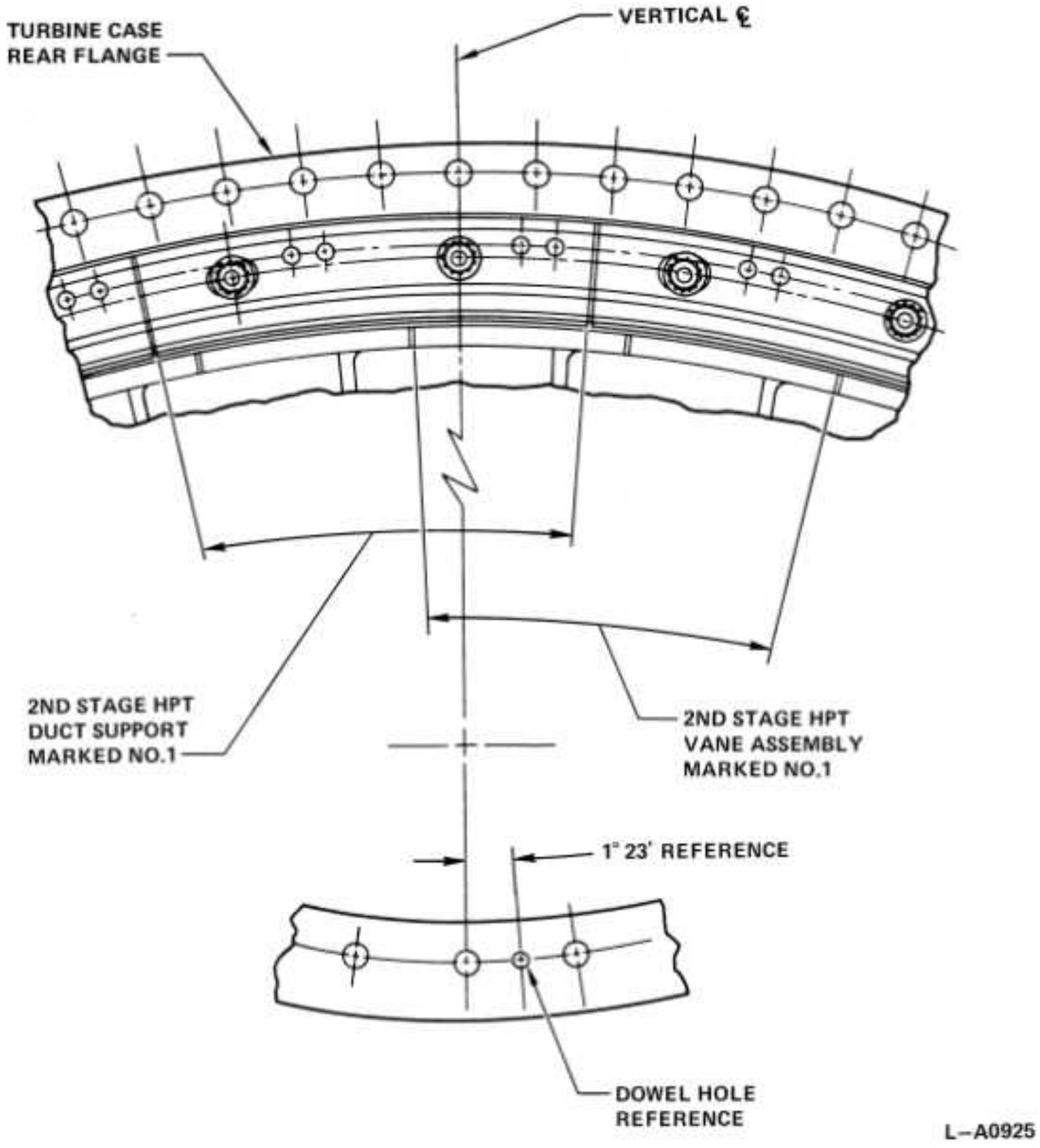
(7) Remove three 2nd stage HPT band segments (505/2) from ID of 2nd stage HPT duct supports.

(8) Remove 21 2nd stage HPT duct supports (505/2) from 2nd stage HPT seal (505/3). The 2nd stage duct supports should be kept together and inspected for wear. See 72−52−37, Inspection/Check−04 (Task 72−52−37−200−004).

(9) Remove the screws that secure the turbine case front flange to the Support (PWA 85290 or PWA 87003).

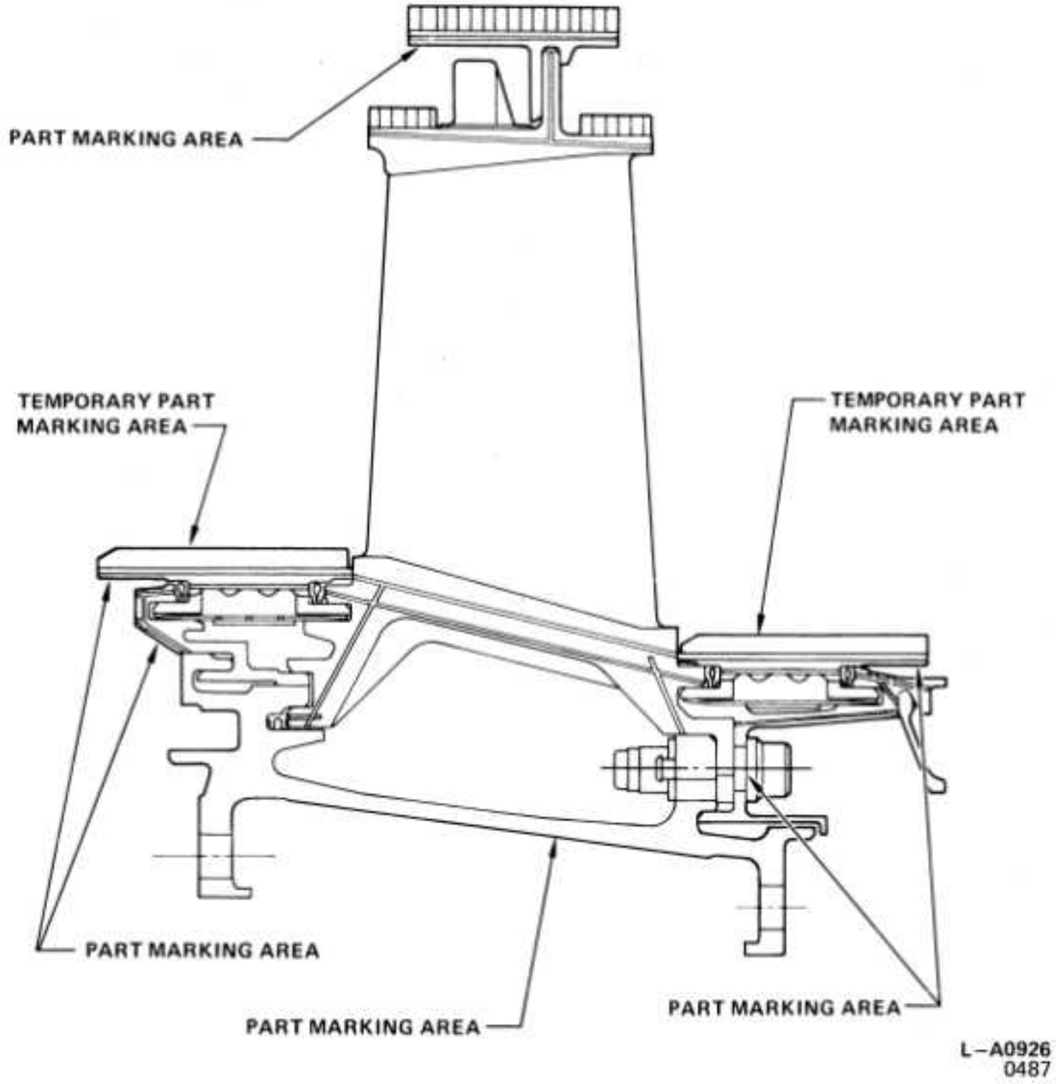
(10) Put a suitable support over the vanes to prevent them from dropping out during the following trunnioning procedure.

(11) Use a hoist to connect a Sling (PWA 88643 or PWA 88673) with two Adapters (PWA 76154) to the trunnion spools of Brackets (PWA 85247).


TURBINE CASE
REAR FLANGE
VERTICAL ℄
2ND STAGE HPT
DUCT SUPPORT
MARKED NO.1
2ND STAGE HPT
VANE ASSEMBLY
MARKED NO.1
1° 23' REFERENCE
DOWEL HOLE
REFERENCE
L−A0925

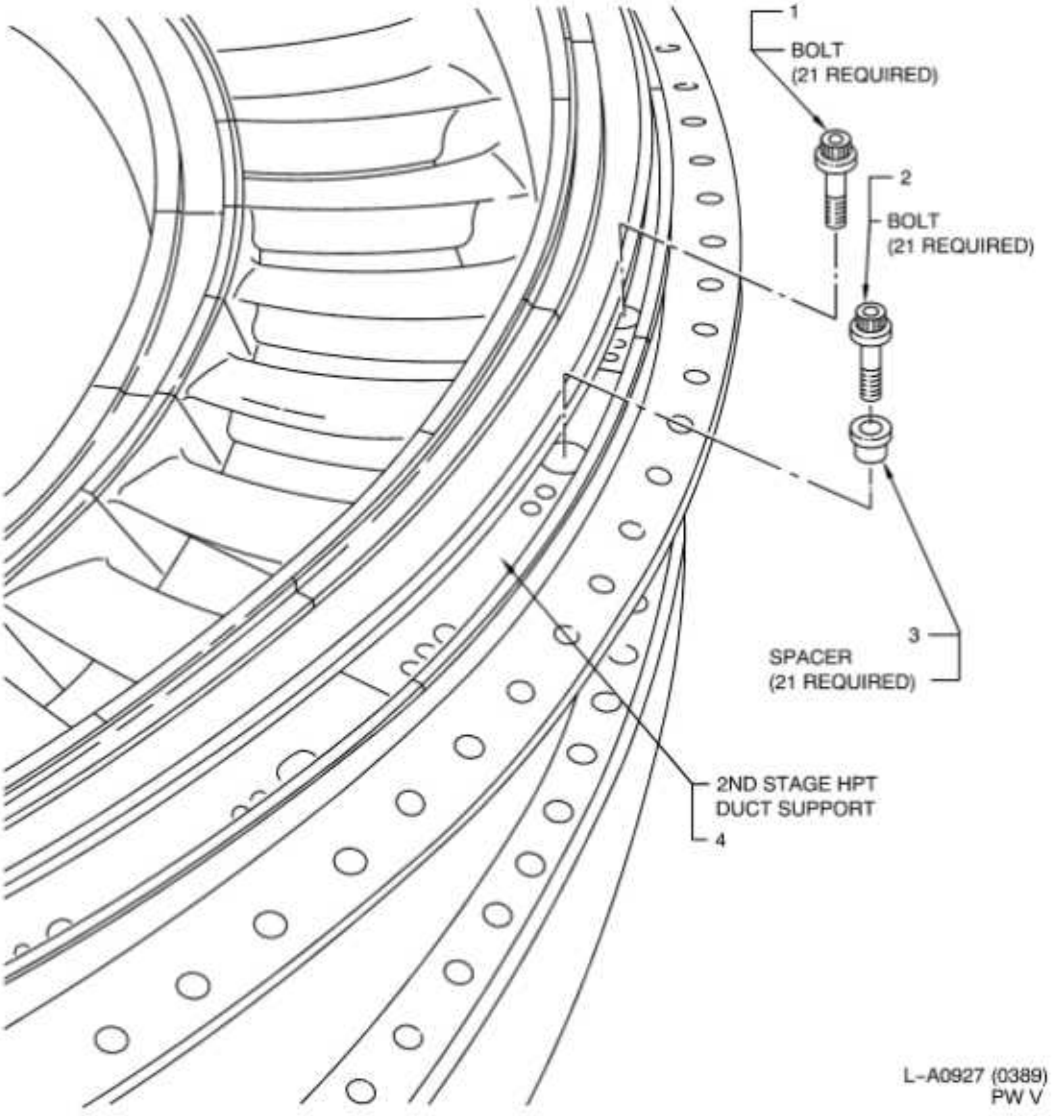
Second Stage HPT Vane, Duct And Duct Support Marking
Figure 501
(Task 72−52−03−040−001)

TURBINE CASE AND VANE ASSEMBLY - DISASSEMBLY-01

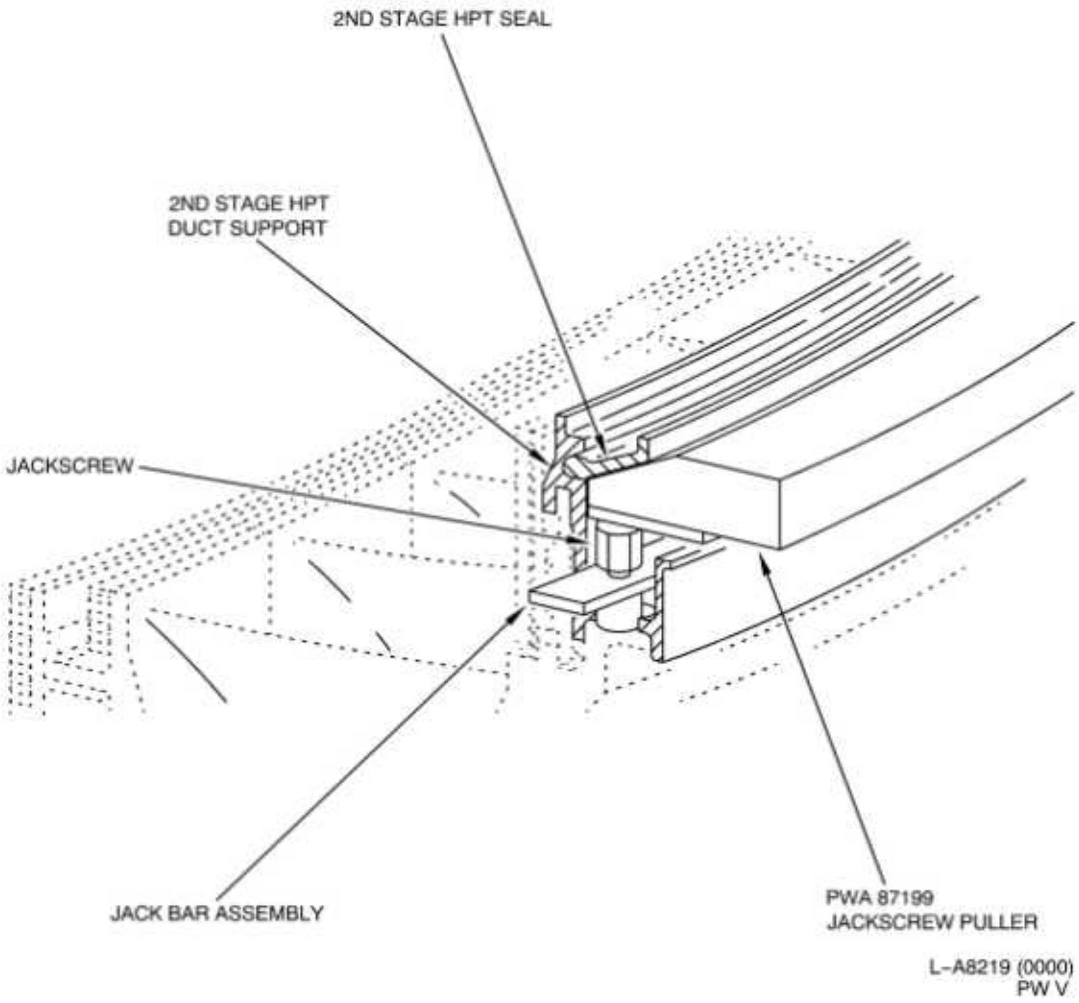

PART MARKING AREA
TEMPORARY PART MARKING AREA
TEMPORARY PART MARKING AREA
PART MARKING AREA
PART MARKING AREA
PART MARKING AREA
L-A0926
0487

Part Marking Areas
Figure 502
(Task 72-52-03-040-001)

TURBINE CASE AND VANE ASSEMBLY - DISASSEMBLY-01

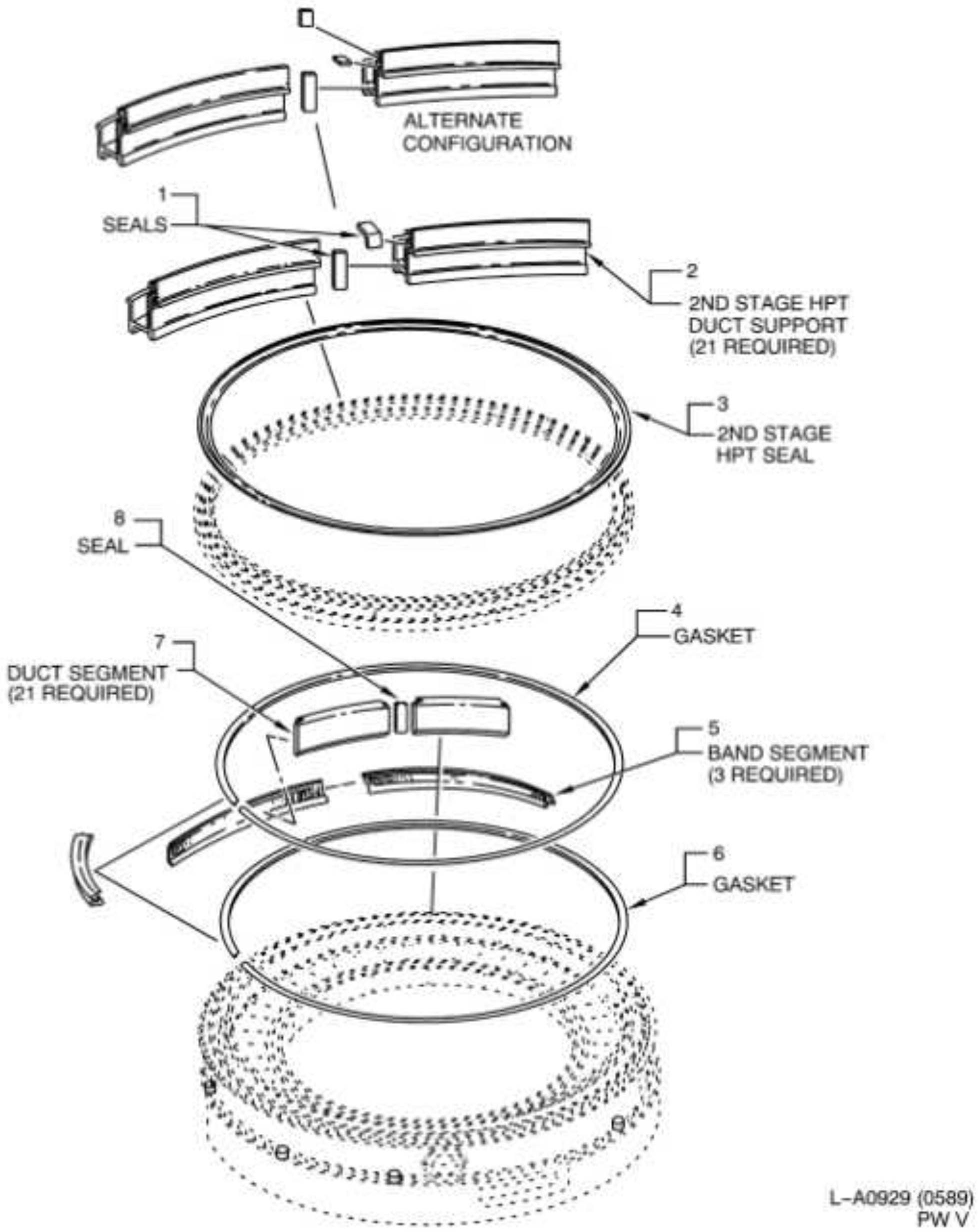

1
BOLT
(21 REQUIRED)
2
BOLT
(21 REQUIRED)
3
SPACER
(21 REQUIRED)
2ND STAGE HPT
DUCT SUPPORT
4
L-A0927 (0389)
PW V

Turbine Case And Vane Assembly Disassembly
Figure 503
(Task 72-52-03-040-001)


2ND STAGE HPT SEAL
2ND STAGE HPT DUCT SUPPORT
JACKSCREW
JACK BAR ASSEMBLY
PWA 87199 JACKSCREW PULLER
L-A8219 (0000)
PW V

Stage 2 HPT Seal, Duct Supports And Duct Segment Removal
Figure 504
(Task 72-52-03-040-001)

TURBINE CASE AND VANE ASSEMBLY − DISASSEMBLY−01


ALTERNATE CONFIGURATION
1
SEALS
2
2ND STAGE HPT DUCT SUPPORT (21 REQUIRED)
3
2ND STAGE HPT SEAL
8
SEAL
4
GASKET
7
DUCT SEGMENT (21 REQUIRED)
5
BAND SEGMENT (3 REQUIRED)
6
GASKET
L−A0929 (0589)
PW V

Second Stage HPT Ducts, Band Segments,
Supports And Seal Disassembly
Figure 505
(Task 72−52−03−040−001)

(12) Use the hoist to trunnion the case and vane assembly to the rear end down position. Lower the case onto a suitable support. Remove the hoist, sling and adapters. Carefully remove the temporary vane support.

(13) Remove 21 2nd stage HPT vane clusters. Install one PWA 87005 Retainer into the bolt holes of each vane cluster to prevent separation of the vane cluster at the feather seal joints. Remove seals from seal grooves between vane clusters. See Figure 506.

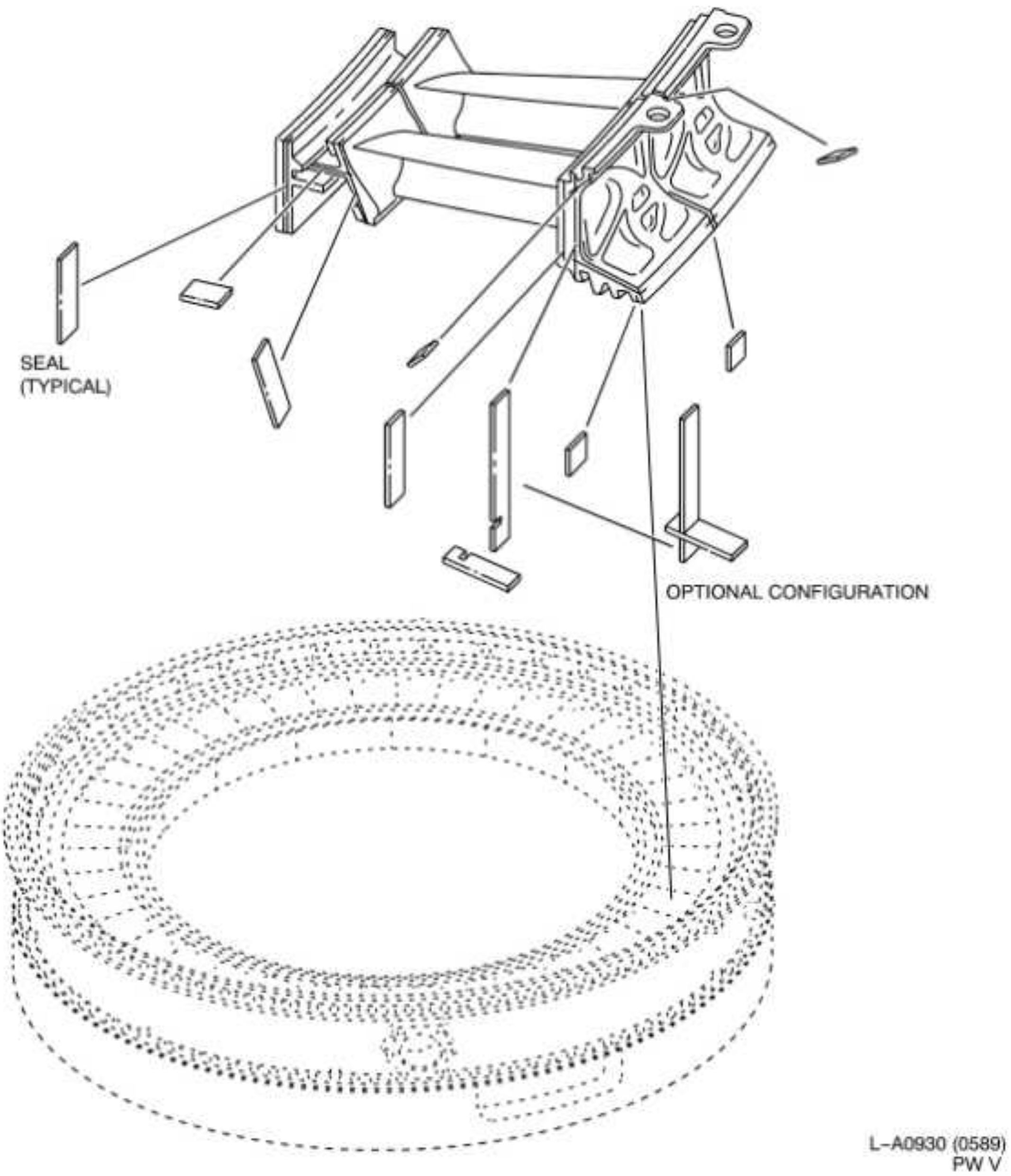
(14) Remove 21 1st stage HPT duct segments (507/2) from duct supports. Remove gasket (507/1) from duct segments. Remove 1st stage HPT duct seals (507/3) from seal grooves between duct segments.

(15) Remove three 1st stage HPT band segments (507/4) from ID of 2nd stage HPT duct supports.

(16) Remove gasket (507/5) from duct supports.

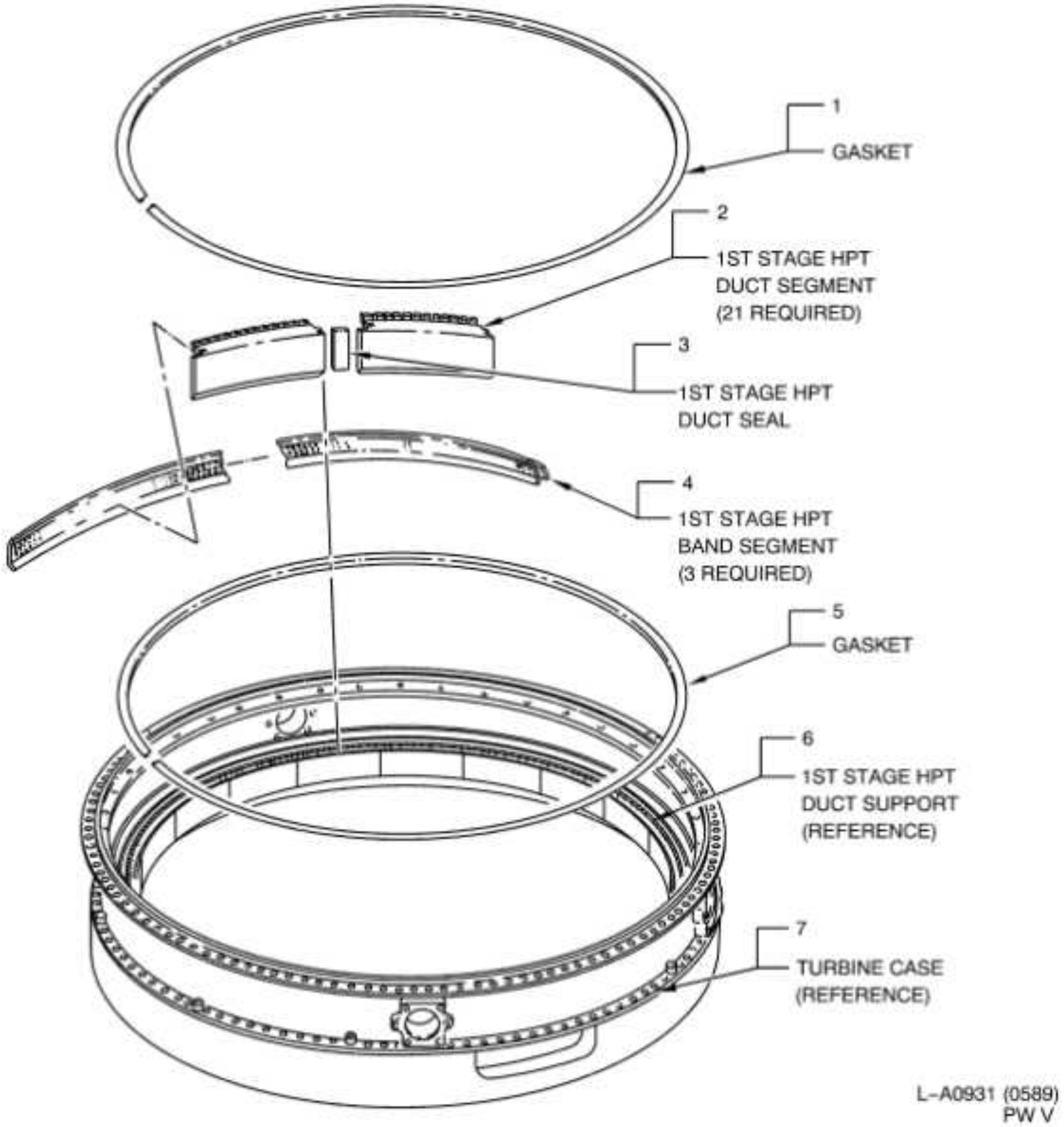
(17) Remove 21 1st stage HPT duct supports (508/3) from turbine case. Remove 21 each of 1st stage HPT duct support seals (508/1) and (508/2) from ends of duct supports.

(18) Connect hoist and Sling (PWA 88643 or PWA 88673) with two Adapters (PWA 76154) to the trunnion spools on the two installed (PWA 85247) Brackets. Use a hoist to put the turbine case on a pallet. Remove sling and adapters. Remove brackets from case.

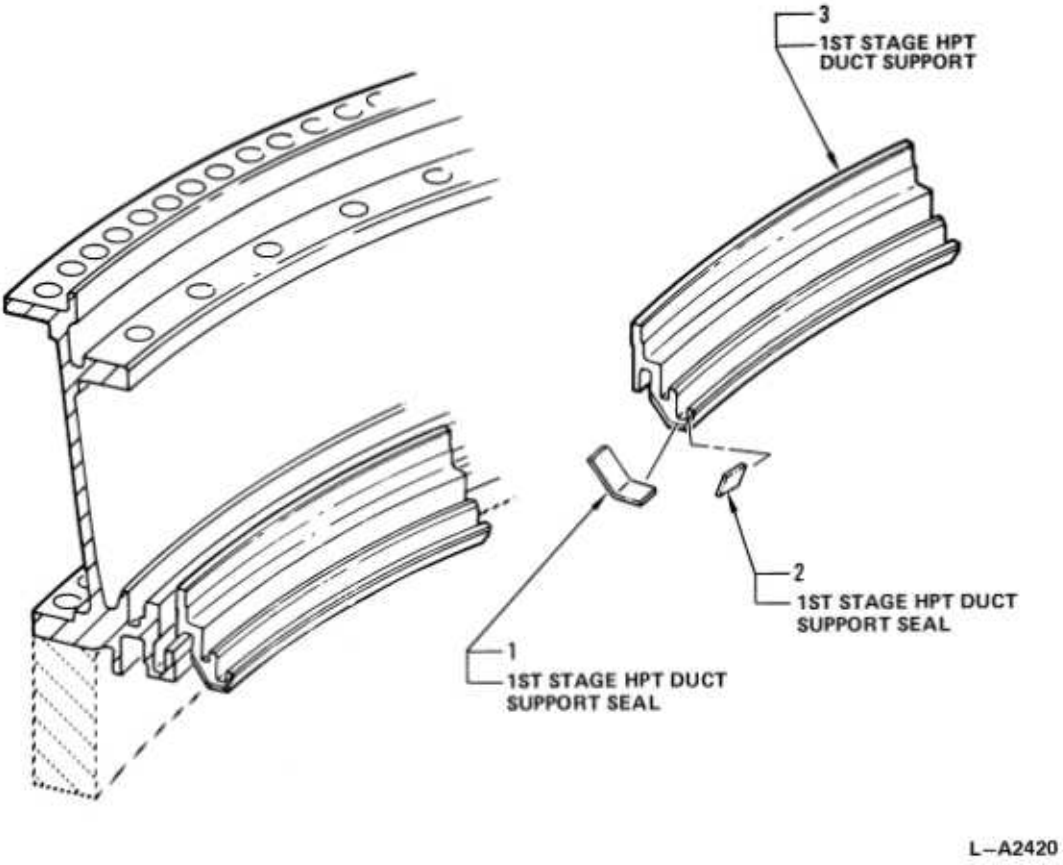

SEAL
(TYPICAL)
OPTIONAL CONFIGURATION
L−A0930 (0589)
PW V

Second Stage HPT Vane Clusters And Seals Disassembly
Figure 506
(Task 72−52−03−040−001)

TURBINE CASE AND VANE ASSEMBLY − DISASSEMBLY−01


1
GASKET
2
1ST STAGE HPT
DUCT SEGMENT
(21 REQUIRED)
3
1ST STAGE HPT
DUCT SEAL
4
1ST STAGE HPT
BAND SEGMENT
(3 REQUIRED)
5
GASKET
6
1ST STAGE HPT
DUCT SUPPORT
(REFERENCE)
7
TURBINE CASE
(REFERENCE)
L−A0931 (0589)
PW V

First Stage HPT Duct Segments Removal
Figure 507
(Task 72−52−03−040−001)


3
1ST STAGE HPT DUCT SUPPORT
2
1ST STAGE HPT DUCT SUPPORT SEAL
1
1ST STAGE HPT DUCT SUPPORT SEAL
L-A2420

First Stage HPT Duct
Support Removal
Figure 508
(Task 72-52-03-040-001)

Task 72-52-03-440-001:

1. Assemble Turbine Case And Vane Assembly

A. Prerequisites

(1) See Inspection/Check-04 Task 72-52-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:

PWA 76154	Adapter (Two Necessary)
PWA 78024	Adapter, Driver
PWA 85103	Fixture, Assembly
PWA 85104	Fixture, Assembly
PWA 85247	Brackets, Handling (Two Necessary)
PWA 85290	Ring, Support (Optional to PWA 87003)
PWA 85543	Pins, Aligning (Three Necessary)
PWA 86504	Adapter, Wrench
PWA 86595	Drift
PWA 87003	Ring, Support
PWA 87753	Table, Rotary (Optional)
PWA 87782	Gage, Mounting Distance (Optional)
PWA 87885	Cutter, Cover
PWA 88643	Sling (Optional to PWA 88673)
PWA 88673	Sling (Optional to PWA 88643)

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-395	Beeswax
P05-396	Paraffin Wax Blend

C. Procedure

CAUTION: DETAIL PARTS OF TURBINE CASE AND VANE ASSEMBLY MUST BE KEPT TOGETHER AS A SET. SEE FIGURE 1001 FOR PART MARKING AREAS. PARTS MUST BE ASSEMBLED CONSECUTIVELY CLOCKWISE AS VIEWED FROM REAR.

(1) Put PWA 87003 or PWA 85290 Support (chamfered end up) on a workbench or PWA 87753 Rotary Table.

NOTE: The HPT case and vane assembly can be assembled with a PWA 87003 or PWA 85290 Support Ring. The Support Ring (PWA 87003) provides torque screws to pre-load the 1st stage duct support segments and band segments. This prevents them from moving radially outward during the following assembly procedure.

(2) Position turbine case on the support ring.

NOTE: For engines that incorporate a 2nd stage HPT borescope provision, you must use a HPT case assembly that has a hole to accept the locating pin of vane at the 8 o'clock position (Reference SB PW4ENG 72-157).

(a) With turbine case front flange (smaller ID) down, position two PWA 85247 Brackets 180 degrees apart between front and rear flanges of case. Position brackets with dowel pins protruding through bolthole in rear flange of case. Install seven screws through boltholes in front flange of turbine case and into brackets. Tighten screws.

(b) Connect PWA 88643 or PWA 88673 Sling with two PWA 76154 Adapters to trunnion spools on PWA 85247 Brackets.

(c) Use a hoist to put the turbine case, with the front flange (smaller OD) down, over the support ring. For Support Ring (PWA 87003), align the offset bolthole in the front flange of the case with the scribed line on the outer surface of the ring. Align the boltholes and lower the case onto the ring. Secure the case to the ring support with detail bolts and nuts as applicable.

CAUTION: PRE AND POST SB PW4ENG 72-313 1ST STAGE HPT DUCT SUPPORTS AND SEALS (SHEET MELTAL) MUST BE USED IN SETS.

(3) Install 1st stage HPT duct supports into turbine case.

(a) Locate the positioning groove in the front ID flange of the turbine case as shown in Figure 1002.

(b) Position the 1st stage HPT duct support (1002/3) marked No. 1 into the inner groove of the turbine case. The center locating pin (1002/2) in the support must engage the locating pin slot in the front ID flange of the turbine case as shown.

NOTE: Support marked No. 1 incorporates three square locating pins. The remaining supports incorporate one square locating pin.

(c) Assemble 1st stage duct support seals into seal grooves between adjacent supports. Install remaining 20 supports into case in numerical order and in clockwise direction as viewed by operator. Use Beeswax P05−395 or Paraffin Wax Blend P05−396, as required to retain seals in position. See Figure 1003 for seal locations.

(d) For Support Ring (PWA 87003), tighten the 21 adjustable torque thumbscrews until the screws will not turn anymore. See Figure 1004.

(e) Install three 1st stage HPT band segments (1005/4) into inner groove in 1st stage HPT duct supports (1005/6) engaging seven cutouts in each band segments into pins of supports. Ensure that tabs on ends of all band segments are on outside of adjacent segments.

(f) Install gasket (1005/5) onto ID face of 1st stage HPT duct supports.

(4) Install 1st stage HPT duct segments.

CAUTION: USE EXTREME CARE WHEN HANDLING DUCT SEGMENTS TO AVOID FLAKING OR CHIPPING CERAMIC COATING.

CAUTION: IF ONE OR MORE NEW DUCT SEGMENTS ARE INSTALLED, NEW OR ACCEPTABLE BLADE TIP ABRASIVE PARTICLES ARE REQUIRED ON
R 30 OF 60 1ST STAGE BLADES. FAILURE TO REPLACE BLADE TIP ABRASIVE PARTICLES WILL DECREASE ENGINE PERFORMANCE AND

CAUSE MORE BLADE TIP WEAR THAN THE REPAIR LIMITS ALLOW.

CAUTION: IF NO NEW DUCT SEGMENTS ARE INSTALLED AND ONE OR MORE 1ST OR 2ND STAGE DUCT SEGMENTS PRETRENCHED BY CHAPTER/SECTION 72-52-32 OR 72-52-35, REPAIR-02, PW4000 Series CIR, PN 51A357, ARE INSTALLED, R THE REQUIREMENTS FOR 30 BLADES WITH SUITABLE BLADE TIPS IS WAIVED.

CAUTION: PRE AND POST SB PW4ENG 72-313 DUCT SEGMENTS, 2ND STAGE HPT RING SEGMENT AND VANE CLUSTER ASSEMBLIES, AND SEALS (SHEET METAL) MUST BE USED IN SETS.

(a) If you put back the duct segments you used before: make sure that all duct segments have the same mating number as the serial number of the detail case.

(b) Obtain 1st stage HPT duct (1005/2) marked No. 1. Align slot in foot detail of duct with dowel pin in rear groove of duct support marked No. 1 and install duct segment (chamfered end down) into outer groove in duct support (1005/6). Using hand pressure only, partially seat duct segment. See Figure 1006 for duct positioning.

(c) Assemble 1st stage duct seals (1005/3) into seal grooves between adjacent duct segments. Use Beeswax P05-395 or Paraffin Wax Blend P05-396, as required to retain seals in position. Install and seat remaining duct segments No. 21 through No. 2, in sequence, in counterclockwise direction into duct supports per previous step.

NOTE: Installing duct segments in counterclockwise direction aids in aligning locating pin slots in ducts with locating pins in supports.

(d) Install gasket (1005/1) into groove at rear of duct segments.

TURBINE CASE AND VANE ASSEMBLY − ASSEMBLY−01

CAUTION: PRE AND POST SB PW4ENG 72−313 2ND STAGE HPT RING SEGMENT AND VANE CLUSTER ASSEMBLIES, DUCT SEGMENTS, AND SEALS (SHEET METAL) MUST BE USED IN SETS.

CAUTION: PRE AND POST SB PW4ENG 72−315 2ND STAGE HPT RING SEGMENT AND VANE CLUSTER ASSEMBLIES, AND SEALS (SHEET METAL) MUST BE USED IN SETS.

(5) Install 2nd stage HPT vanes into PWA 85103 Fixture. See Figure 1007 and Figure 1008.

NOTE: Second stage HPT vane cluster assemblies must be used in sets with (orifice) plate/gasket assemblies and gaskets during engine assembly. The plate/gasket assemblies and gaskets will be installed on the turbine case tube pads in 72−00−53, Installation−03 Task 72−00−53−420−003.

(a) Connect hoist to hoist rings and position fixture onto bench.

(b) Loosen bolts and remove top ring clamp (1008/1) from fixture.

(c) Install vane marked No. 1 over fixture base (1008/2) with vane front inner buttress on base plate and outer buttress on bench.

CAUTION: SECOND STAGE HPT RING SEGMENT AND VANE CLUSTERS ASSEMBLIES AND SEALS MUST BE USED IN SETS.

(d) Assemble 2nd stage HPT seals into seal grooves between adjacent vanes. Install remaining 20 vanes into fixture in numerical order in clockwise direction as viewed by operator. Install remaining seals between vanes of cluster assemblies. Use Beeswax P05−395 or Paraffin Wax Blend P05−396, as required to retain seals in position. See Figure 1007 for seal locations.

NOTE: Engines incorporating a 2nd stage HPT borescope provision, at 8 o'clock location, requires a vane assembly with a borescope provision located at the 13 vane cluster position. (Post SB PW4ENG 72−157).

(e) Push all vanes up against fixture outer snap diameter.

(f) (Reference 1725) Check gap between adjacent vane clusters at outer platform of vanes. Temporarily shim as required to obtain 0.028 inch (0.711 mm) minimum gap between vane clusters.

(g) Position ring clamp (1008/1) over fixture post details and vane inner buttresses. Rotate ring clamp clockwise tighten screws to secure vanes.

(6) Install gasket into outer front groove in turbine case.

(7) Install vane assembly into turbine case.

(a) Connect suitable three cable sling to hoist rings on PWA 85103 Fixture.

(b) Using hoist, position vane assembly over turbine case. Locate turbine vane marked No. 1 as shown in Figure 1009.

(c) Align boltholes in vane lugs with boltholes in turbine case and lower vane assembly gussets into circumferential grooves in duct and duct support segments. Tap vanes into position.

(d) Install 0.3125−24 workbolts, threads lubricated with Engine Oil P03−001, into boltholes of all vane assemblies and engage nuts in case.

(e) Loosen bolts and remove ring clamp (1008/1) of fixture. Lower base (1008/2) onto bench. Remove hoist and sling.

(f) Repeat following procedure until all vane assemblies are seated. Progressively tap OD shroud faces of vane assembly and tighten down workbolts until bolthead face makes contact with case flange. Continue this procedure until all vanes are seated against case flange.

(8) Assemble 2nd stage HPT seal, duct supports and duct segments into PWA 85104 Fixture . See Figure 1010.

(a) Using Sling (PWA 88643) or (PWA 88673), and two Adapters (PWA 76154) connected to trunnion spools, position Fixture (PWA 85104) onto suitable rotary build table.

(b) Loosen and retract six outer clamp details (1010/10).

(c) Install 2nd stage HPT seal (1010/8) (larger diameter down) into machined step in fixture.

(d) Obtain 2nd stage HPT duct supports. Used supports must be installed in set. See Chapter/Section 72−52−37, Inspection/Check−04 in the PW4000 Series CIR, PN 51A357.

NOTE: When you assemble used supports in sets, the closer the wear dimensions are matched, the less air leakage will be present.

(e) Position 2nd stage HPT duct support (1010/5) or (1010/7) as applicable, marked No. 1 into inner diameter of outer 2nd stage HPT seal and onto top machined step of pilot ring detail. Centralize duct support relative to one hand knob (1010/9).

(f) Assemble 2nd stage HPT duct support seals per Figure 1010 into seal grooves between adjacent duct supports. Assemble seals into seal grooves and install remaining 20 duct supports in numerical order in counterclockwise direction as viewed by operator. Use Beeswax P05−395 or Paraffin Wax Blend P05−396 as required to retain seals in position. See Figure 1010 for seal locations.

(g) (Reference 1726) Check gap between adjacent duct supports. Adjust supports as required to obtain a gap of 0.027 inch (0.686 mm) minimum between supports. See Figure 1009, (Sheet 2).

(h) Install three 2nd stage HPT band segments (1011/4), with sloted edge down, into inner channel of previously installed duct supports. Engage slots in band segments with pins in supports. Ensure that small plates on ends of band segments are on outside of adjacent segments.

(i) Install gasket (1011/5) onto top surface of duct support inner lip.

CAUTION: USE EXTREME CARE WHEN HANDLING DUCT SEGMENTS TO AVOID FLAKING OR CHIPPING CERAMIC COATING.

CAUTION: IF ONE OR MORE NEW OR REPAIRED DUCT SEGMENTS ARE INSTALLED, NEW OR ACCEPTABLE BLADE TIP ABRASIVE PARTICLES
R ARE REQUIRED ON 30 OF 82 2ND STAGE BLADES. FAILURE TO REPLACE BLADE TIP ABRASIVE PARTICLES WILL DECREASE ENGINE PERFORMANCE AND CAUSE MORE BLADE TIP WEAR THAN THE REPAIR LIMITS ALLOW.

(j) If you put back the duct segments you used before: make sure that all duct segments have the same mating number as the serial number of the detail case.

(k) Position 2nd stage HPT duct segment (1011/2), with chamfered end up, onto previously installed 2nd stage HPT duct support marked No. 1. Install duct segment with locating pin (1012/3) in duct support engaged in locating pin slot (1012/1) between feet details of duct. Tap duct segment as necessary to seat. See Figure 1012.

(l) Install and seat remaining duct segments No. 21 through No. 2 in sequence, in counterclockwise direction into duct supports per previous step.

NOTE: Installing duct segments in counterclockwise direction aids in aligning locating pin slots in duct segments with locating pins in supports.

(m) Assemble 2nd stage HPT duct seals (1011/3) into grooves between adjacent ducts. Install remaining 20 ducts in numerical order in counterclockwise direction as viewed by operator. Lightly clamp duct segments using hand knobs. Use Beeswax P05−395 or Paraffin Wax Blend P05−396, as required to retain seals in position.

(n) Install gasket (1011/1) into circumferential ID groove in upper flange of duct segments. Use Beeswax P05−395 or Paraffin Wax Blend P05−396, as required to retain gasket in position.

(o) (Post PW4ENG 72−462) Install gasket (1011/6) on the ID face of the support segments and the front OD formed by the 2nd stage HPT band segments. Use Beeswax P05−395 or Paraffin Wax Blend P05−396, as required to retain seal in position.

(p) Slide six detail clamps (1010/10) inward and tighten bolts to secure 2nd stage HPT seal (1010/8) to fixture.

(q) Position PWA 87880 Clamp around the outside diameter of the duct supports and tighten the clamps. The assembly can now be trunnioned and the seal, duct supports and duct segments will stay in position.

(9) Remove 21 workbolts (1013/1) from the vane cluster right vanes (1013/2). See Figure 1013.

(10) Thread three PWA 85543 Aligning Pins into equally spaced boltholes in rear flange of HPT case.

(11) Using Sling (PWA 88643) or (PWA 88673) and two Adapters (PWA 76154) connected to trunnion spools on fixture, trunnion assembly to front end down position.

(12) Position duct assembly over turbine case locating duct support marked No. 1 as shown in Figure 1009. Position boltholes in duct support over aligning pins and lower duct support assembly onto turbine case inner flange.

(13) Remove the PWA 85104 Fixture.

(14) Remove alignment pins.

CAUTION: DO NOT USE A DRIFT TO ALIGN BOLTHOLES IN 2ND STAGE HPT DUCT SUPPORTS WITH BOLTHOLES IN THE TURBINE CASE AND THE VANE OD FLANGES. THE USE OF A DRIFT CAN DAMAGE THE NUT PLATES ON THE TURBINE CASE REAR INNER FLANGE.

(15) Install 21 bolts (1014/1) lubricated with Engine Oil P03−001 through holes in the 2nd stage HPT duct

supports. Thread the bolts into the case nuts. Use PWA 78024 Adapter, with a ratcheting box wrench (such as Snap−on GRES810), to tighten the bolts until they touch the duct supports. See Figure 1014.

(16) Remove 21 workbolts from the larger diameter holes in the duct supports.

(17) Install 21 spacers (1014/2), flanged end up, into the larger holes in the duct supports (1014/3).

(18) Install 21 bolts (1014/2), lubricated with Engine Oil P03−001, through the spacers and into the case nuts. Use PWA 78024 Adapter, with a ratcheting box wrench (such as Snap−on GRES810), to tighten the bolts until contact is made with the spacer face.

(19) Use PWA 86595 Drift, as required, to seat the vanes and vane supports in the case. See Figure 1015.

(20) Loosen the 21 adjustable torque thumbscrews details of Support Ring (PWA 87003).

(21) (Reference 1725) Check gap between adjacent vane clusters at outer platform of vanes. See Figure 1009, (Sheet 2).

(22) Remove the screws and nuts as applicable that secure the case to the support ring. Connect Sling (PWA 88643) or (PWA 88673) with two PWA 76154 Adapters to the trunnion spools on PWA 85247 Brackets. Lift the assembly from the support ring. Position a suitable support on workbench under the vane front inner platform, Surface K.

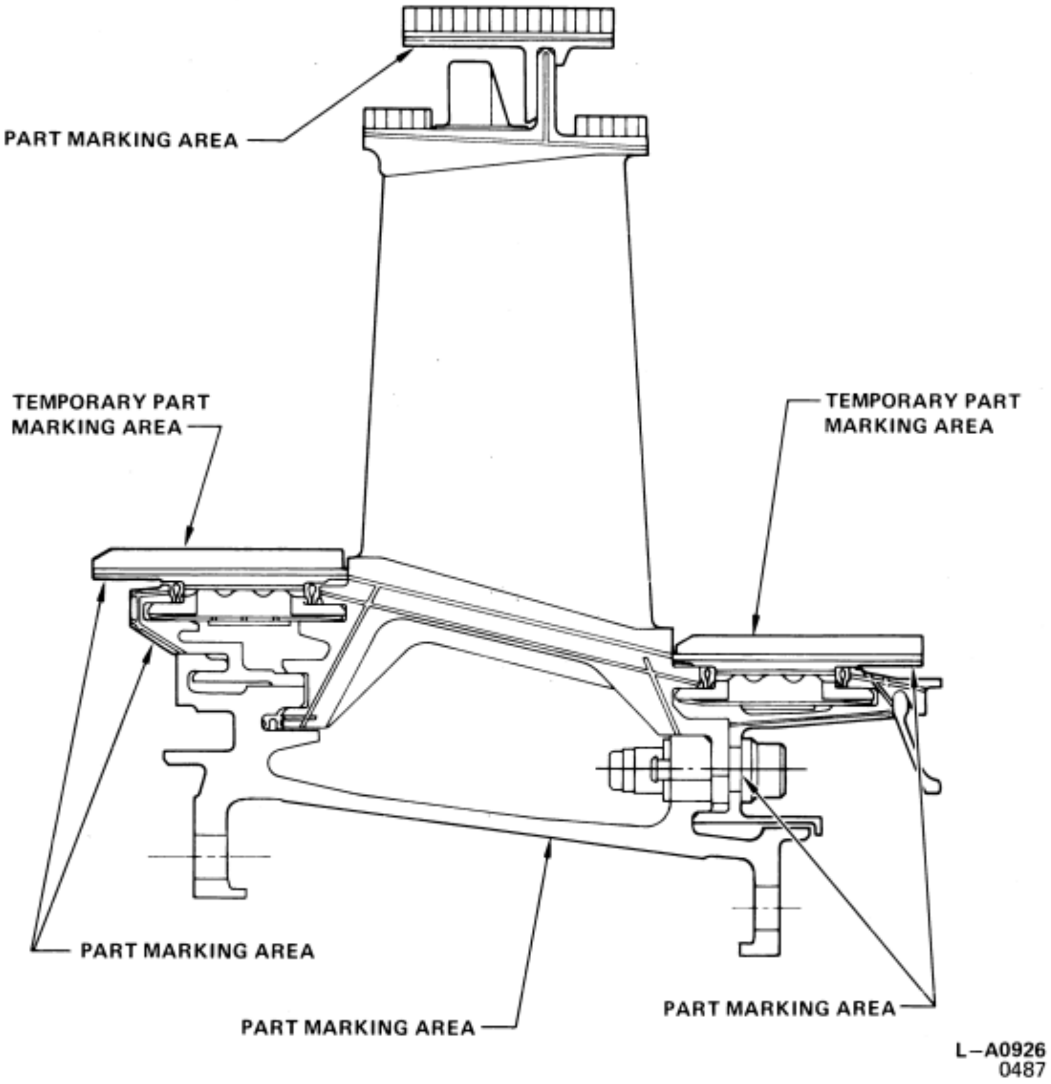
CAUTION: WHEN USING PWA 85106 WRENCH ADAPTER THE ACTUAL TORQUE WRENCH READING WILL BE LESS THAN THAT STATED BELOW. SEE STANDARD TORQUES IN 70−52, STANDARD PRACTICES MANUAL, PN 585005.

(23) With the assembly supported on Surface K and the vanes seated on Surfaces J and L, torque the bolts (1014/1). Use PWA 86504 Wrench Adapter. Torque bolts (1014/1) to 180 − 200 lb−in (20.337 − 22.597 N.m). Loosen each bolt to 0 lb−in. (0 N.m), and retorque to 180 − 200 lb−in. (20.337 − 22.597 N.m).

(24) Use standard tools or optional PWA 87782 Gage to check the seating of parts. Refer to the requirements of Figure 1016.

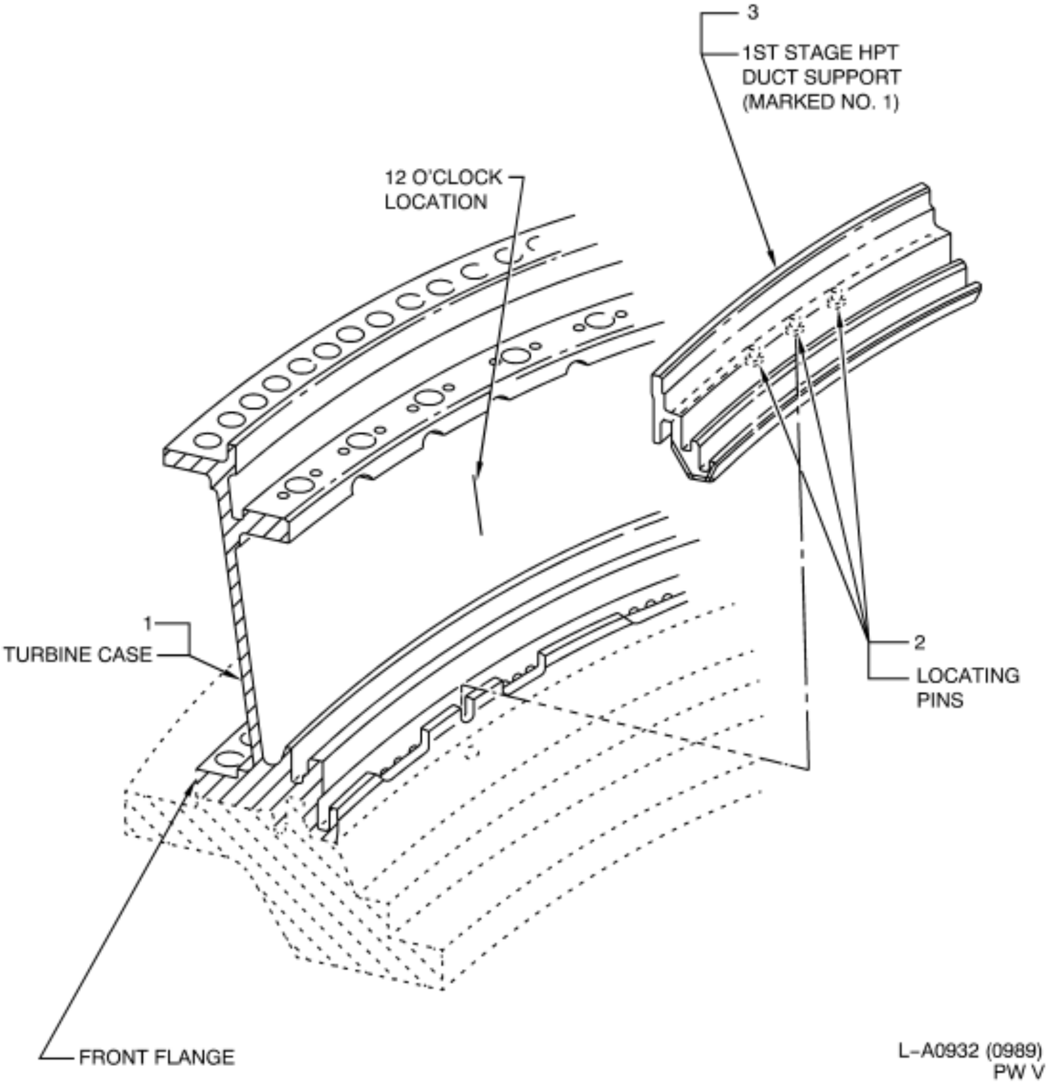
(25) Remove shims as required.

(26) Put a protective cardboard cover over the assembly to prevent damage to the vanes from unwanted materials. If necessary, you can use PWA 87885 Cutter to make the cardboard cover.

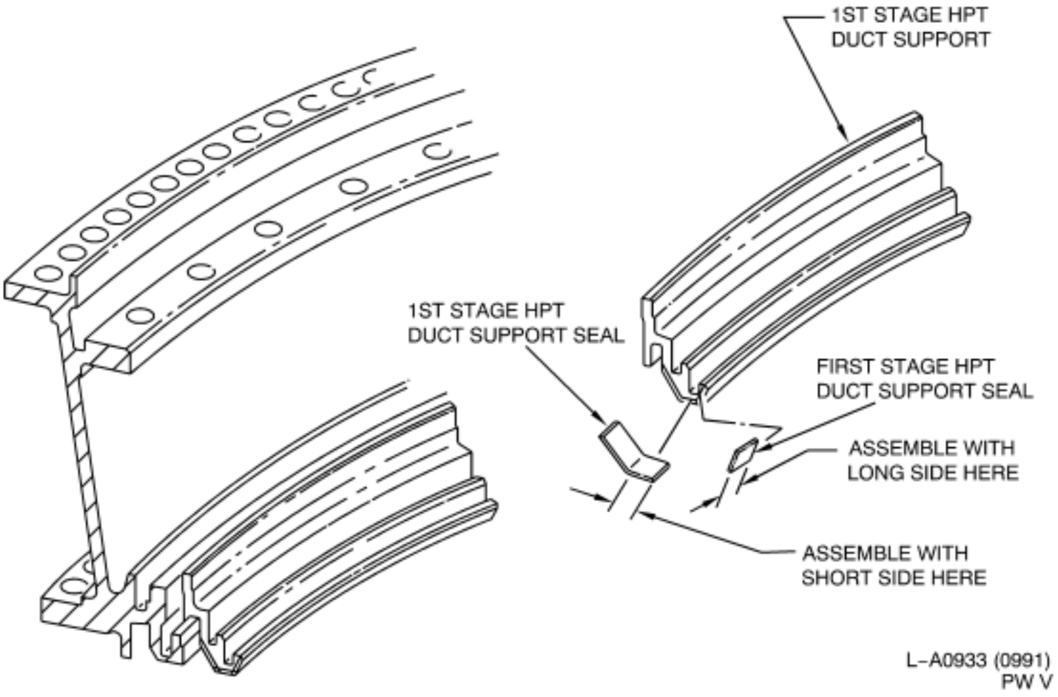

PART MARKING AREA
TEMPORARY PART MARKING AREA
TEMPORARY PART MARKING AREA
PART MARKING AREA
PART MARKING AREA
PART MARKING AREA
L−A0926
0487

Part Marking Areas
Figure 1001
(Task 72−52−03−440−001)

TURBINE CASE AND VANE ASSEMBLY - ASSEMBLY-01

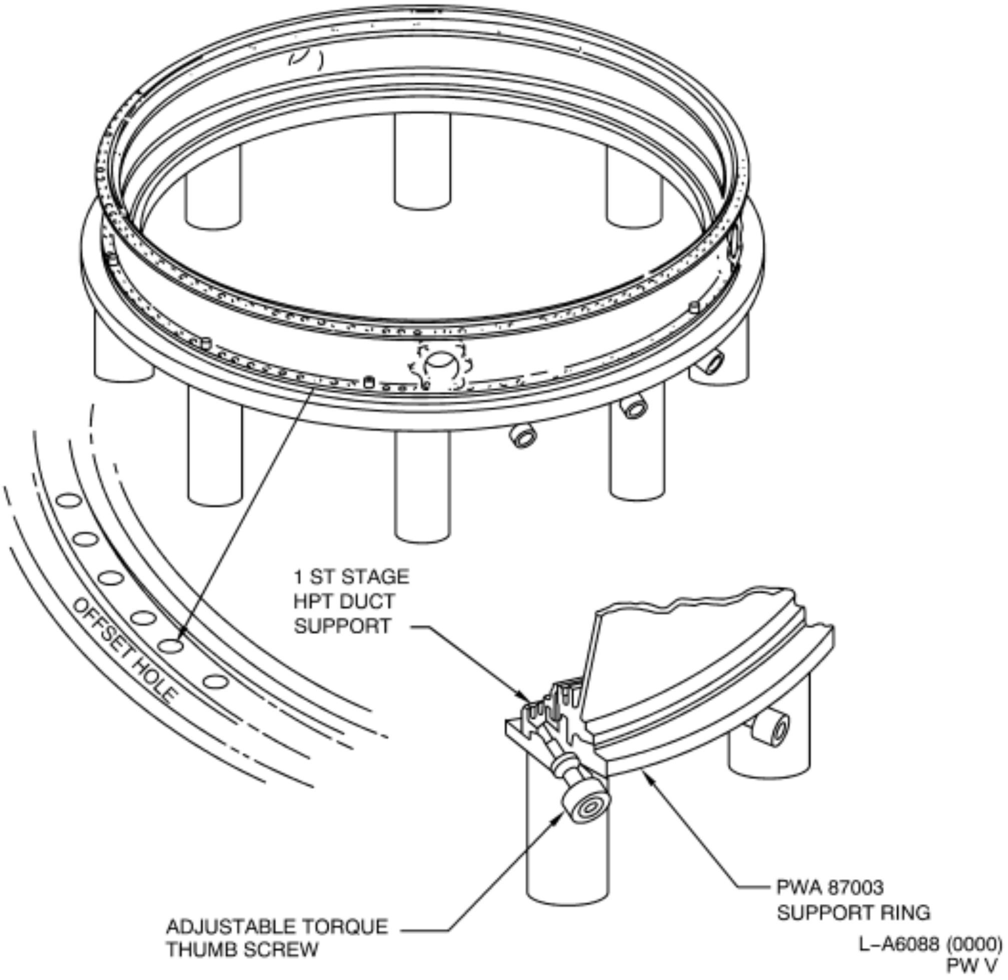

3
1ST STAGE HPT DUCT SUPPORT (MARKED NO. 1)
12 O'CLOCK LOCATION
1
TURBINE CASE
2
LOCATING PINS
FRONT FLANGE
L-A0932 (0989)
PW V

First Stage HPT Duct Supports Installation
Figure 1002
(Task 72-52-03-440-001)


1ST STAGE HPT DUCT SUPPORT
1ST STAGE HPT DUCT SUPPORT SEAL
FIRST STAGE HPT DUCT SUPPORT SEAL
ASSEMBLE WITH LONG SIDE HERE
ASSEMBLE WITH SHORT SIDE HERE
L-A0933 (0991)
PW V

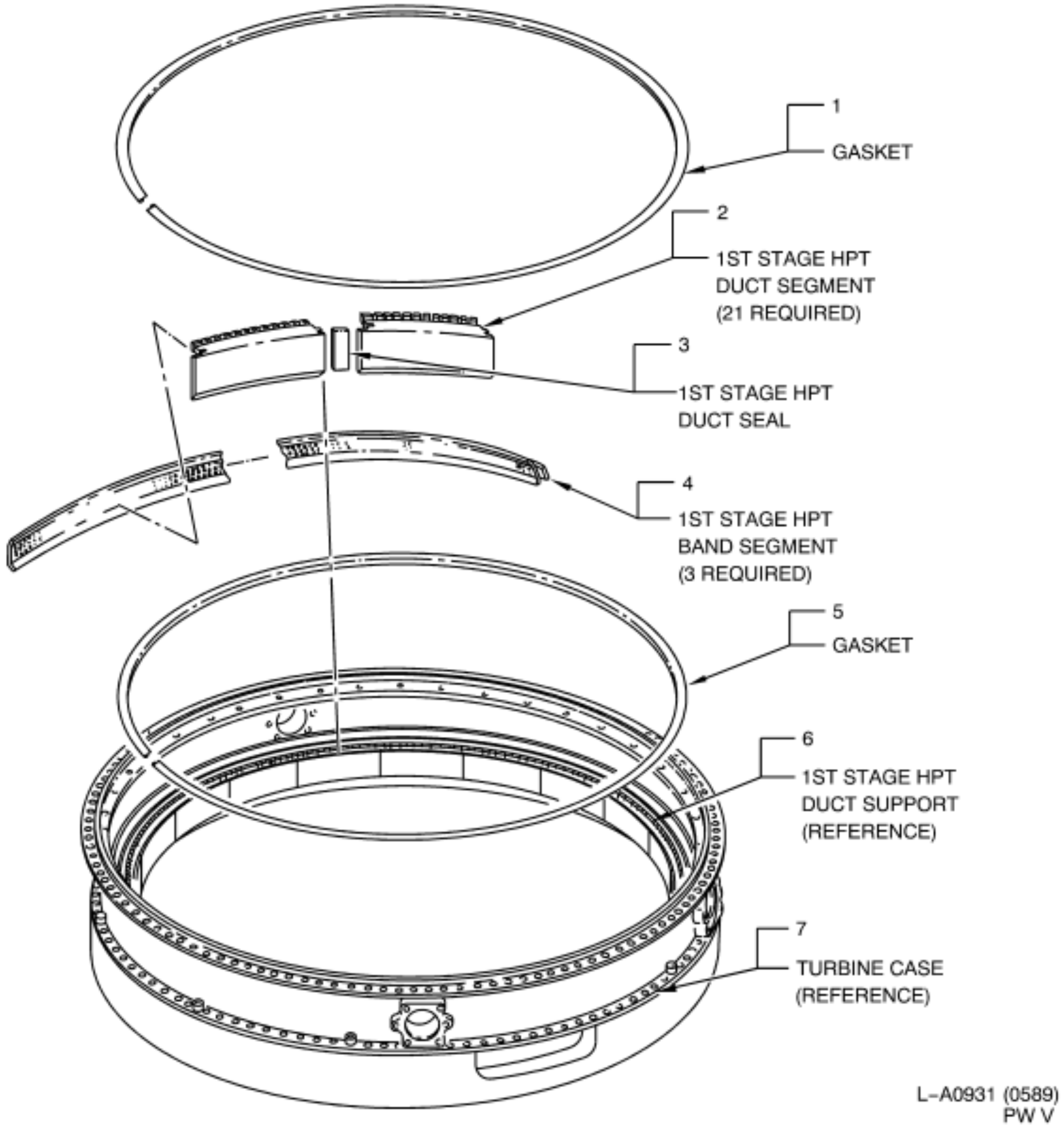
First Stage HPT Duct Supports Installation
Figure 1003
(Task 72-52-03-440-001)

TURBINE CASE AND VANE ASSEMBLY - ASSEMBLY-01

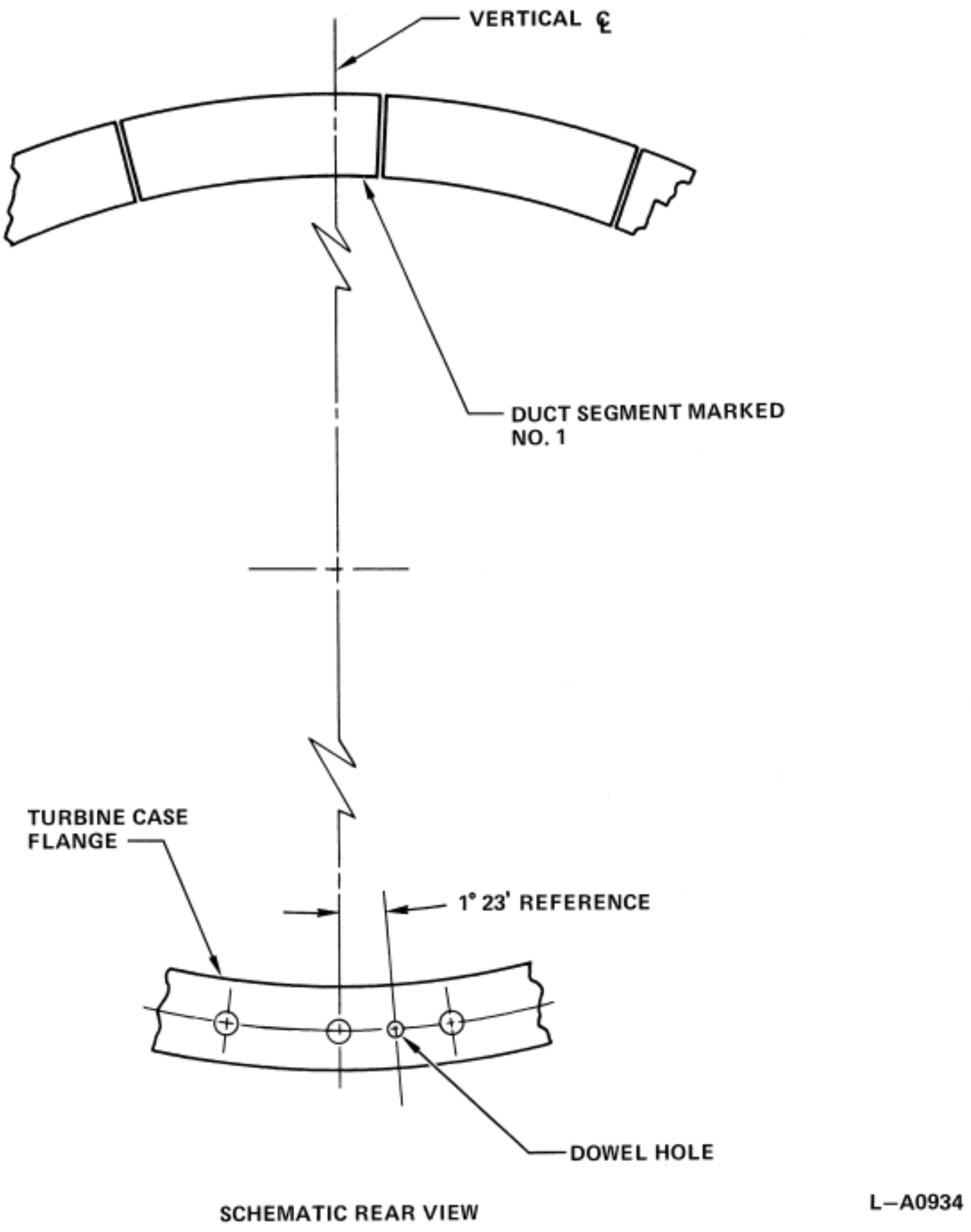

1 ST STAGE
HPT DUCT
SUPPORT
OFFSET HOLE
PWA 87003
SUPPORT RING
ADJUSTABLE TORQUE
THUMB SCREW
L-A6088 (0000)
PW V

PWA 87003 Support Ring
Figure 1004
(Task 72-52-03-440-001)

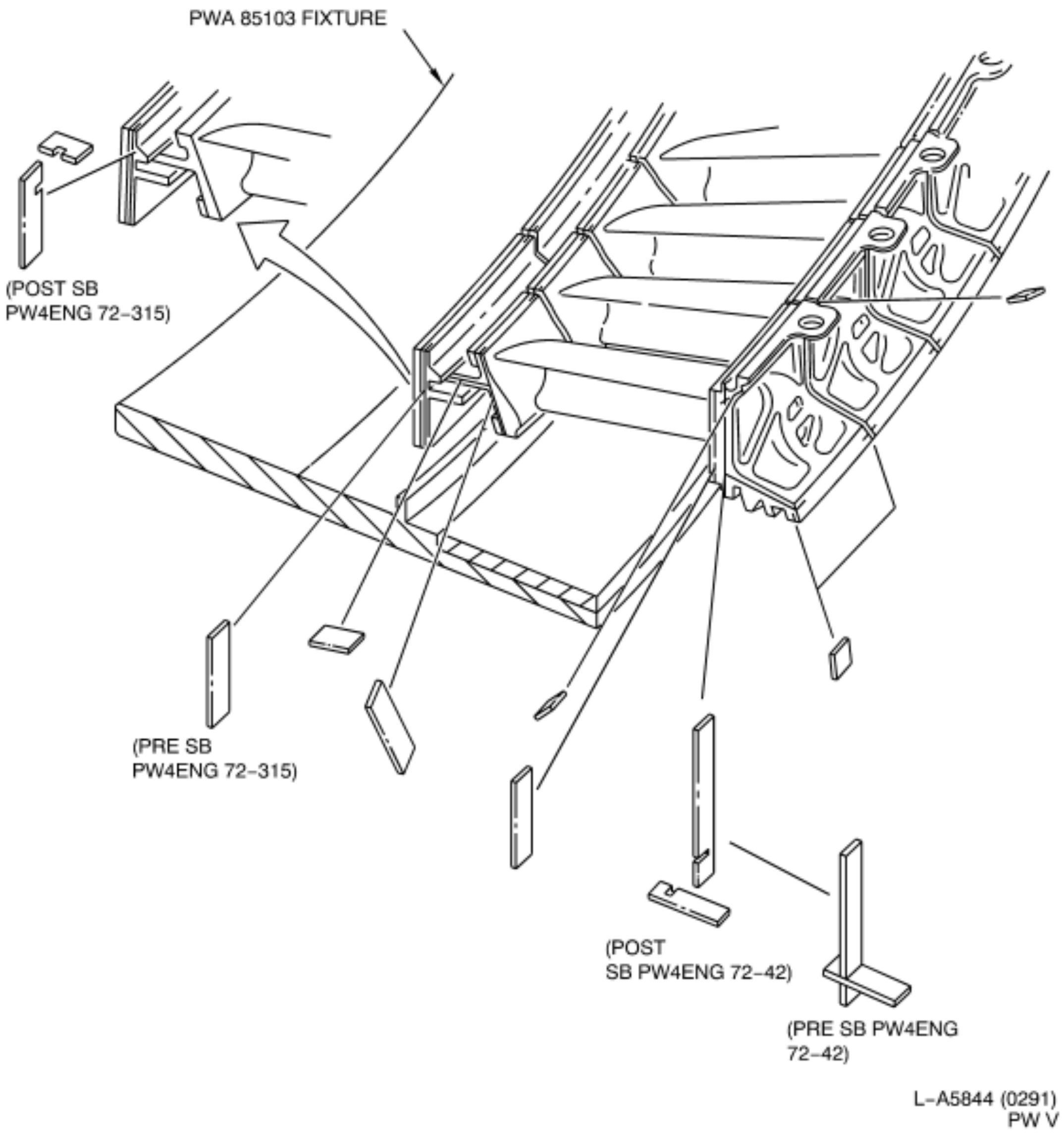
TURBINE CASE AND VANE ASSEMBLY - ASSEMBLY-01


1
GASKET
2
1ST STAGE HPT
DUCT SEGMENT
(21 REQUIRED)
3
1ST STAGE HPT
DUCT SEAL
4
1ST STAGE HPT
BAND SEGMENT
(3 REQUIRED)
5
GASKET
6
1ST STAGE HPT
DUCT SUPPORT
(REFERENCE)
7
TURBINE CASE
(REFERENCE)
L-A0931 (0589)
PW V

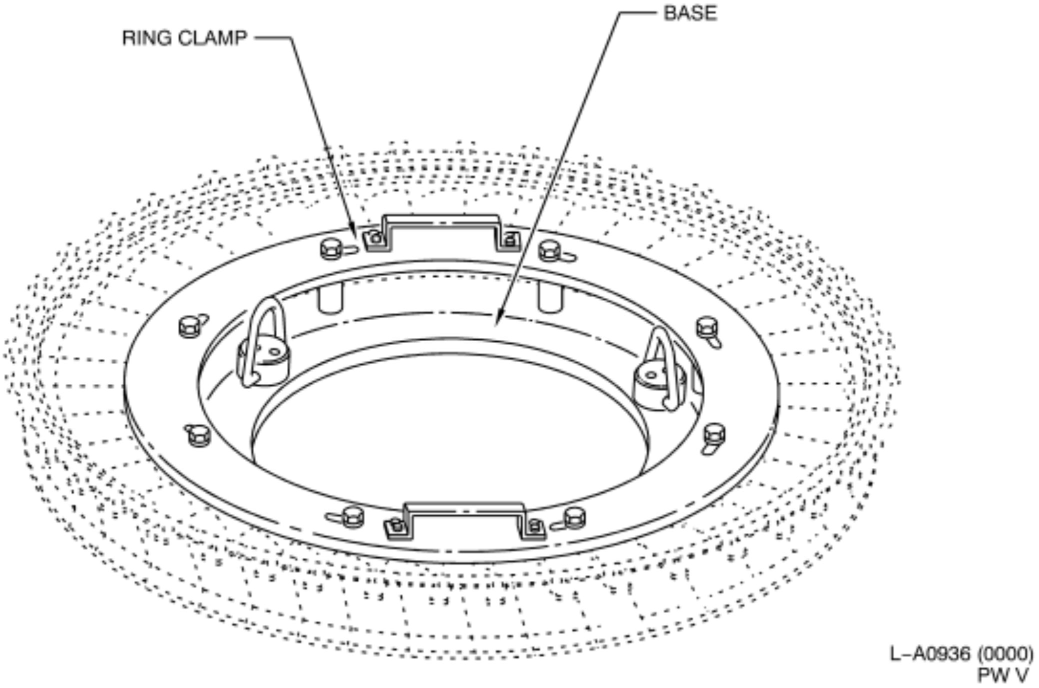
First Stage HPT Duct Segments Installation
Figure 1005
(Task 72-52-03-440-001)


VERTICAL ℄
DUCT SEGMENT MARKED NO. 1
TURBINE CASE FLANGE
1° 23' REFERENCE
DOWEL HOLE
SCHEMATIC REAR VIEW
L−A0934

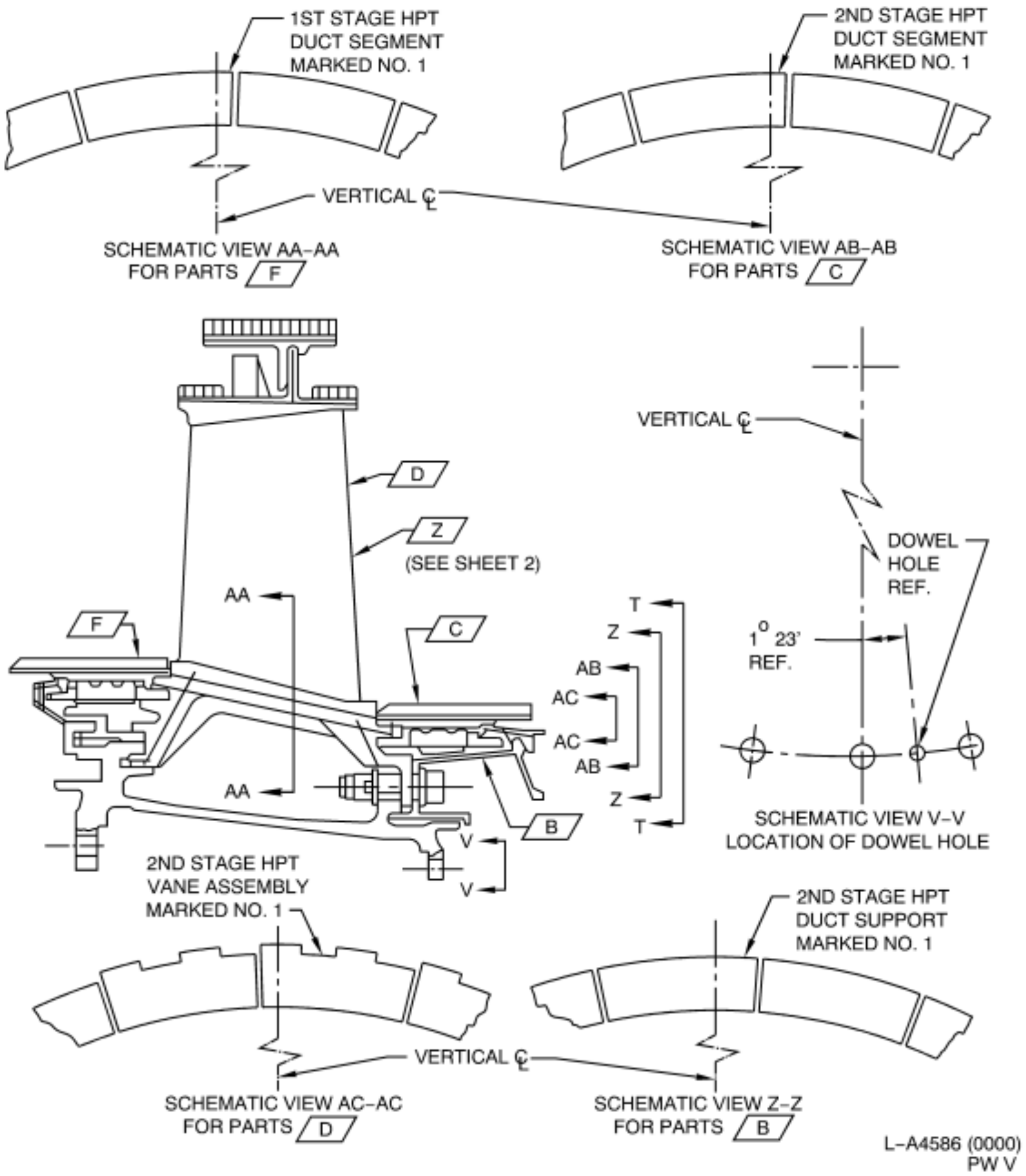
First Stage HPT Duct Location
Figure 1006
(Task 72−52−03−440−001)


PWA 85103 FIXTURE
(POST SB
PW4ENG 72−315)
(PRE SB
PW4ENG 72−315)
(POST
SB PW4ENG 72−42)
(PRE SB PW4ENG
72−42)
L−A5844 (0291)
PW V

Second Stage HPT Seal Installation
Figure 1007
(Task 72−52−03−440−001)

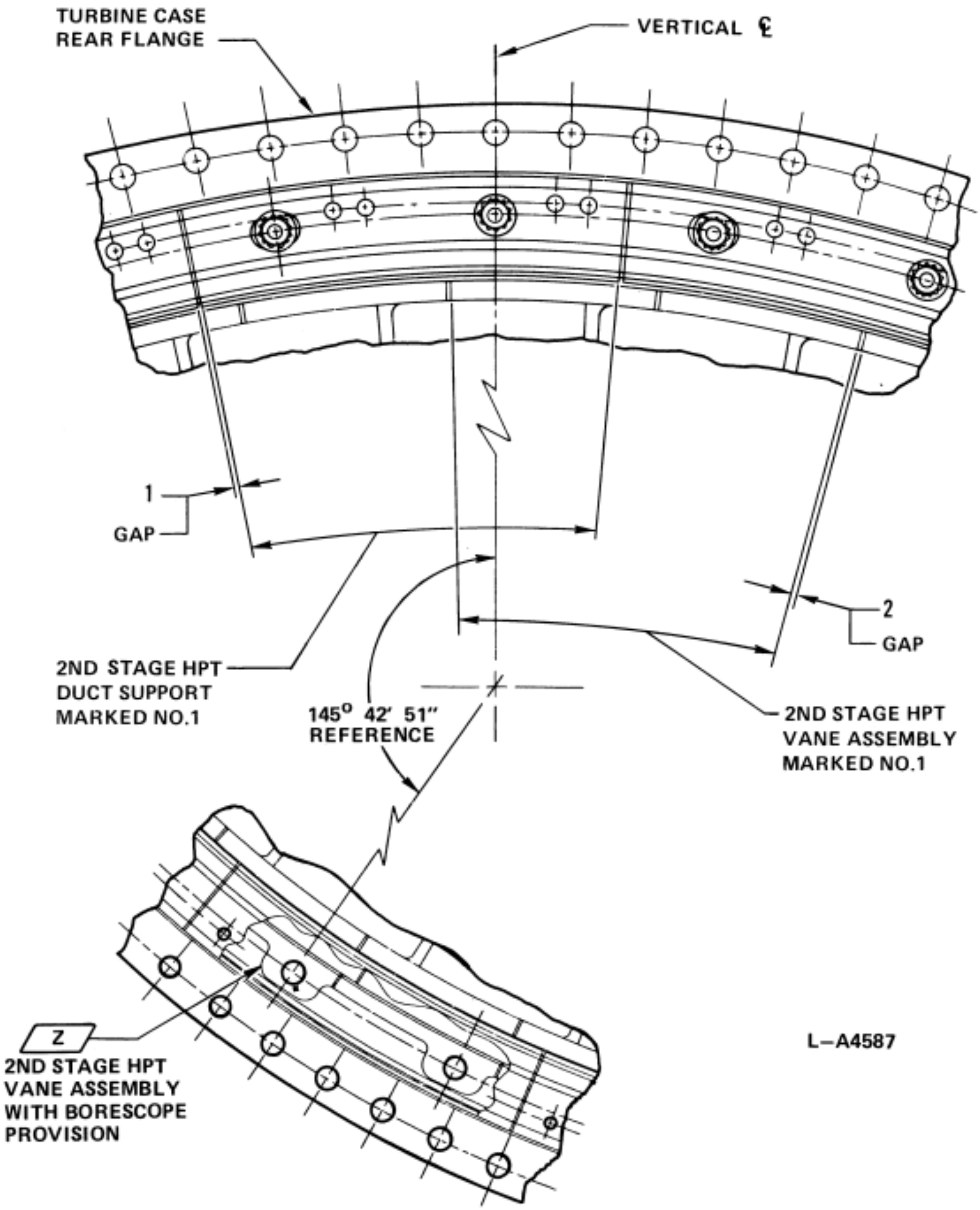

RING CLAMP
BASE
L−A0936 (0000)
PW V

Second Stage HPT Vanes Assembled In PWA 85103 Fixture
Figure 1008
(Task 72−52−03−440−001)

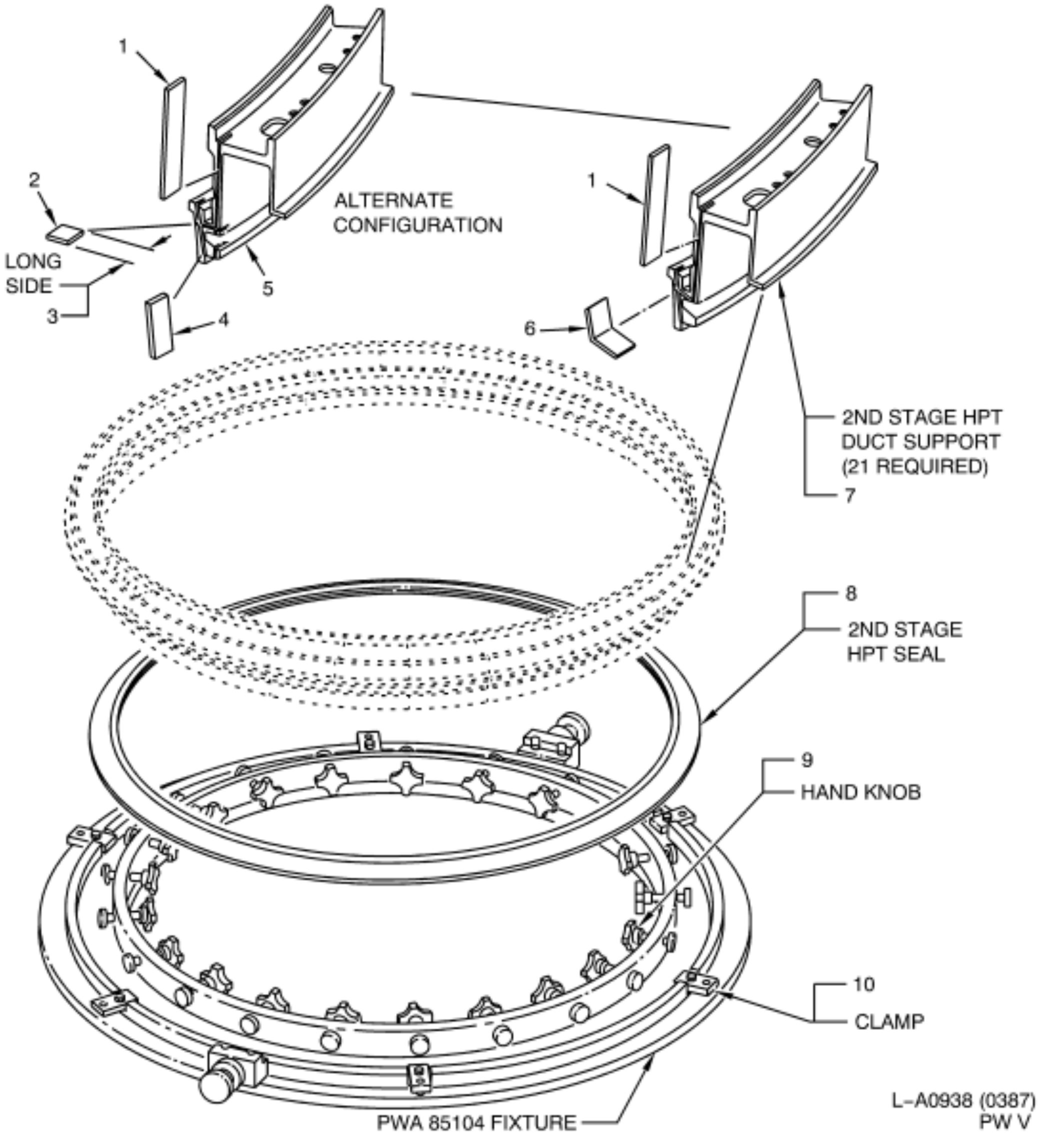

1ST STAGE HPT DUCT SEGMENT MARKED NO. 1
2ND STAGE HPT DUCT SEGMENT MARKED NO. 1
VERTICAL ℄
SCHEMATIC VIEW AA-AA
FOR PARTS F
SCHEMATIC VIEW AB-AB
FOR PARTS C
D
Z
(SEE SHEET 2)
AA
F
C
AA
VERTICAL ℄
DOWEL HOLE REF.
T
Z
AB
AC
AC
AB
Z
T
1° 23' REF.
B
V
V
SCHEMATIC VIEW V-V
LOCATION OF DOWEL HOLE
2ND STAGE HPT VANE ASSEMBLY MARKED NO. 1
2ND STAGE HPT DUCT SUPPORT MARKED NO. 1
VERTICAL ℄
SCHEMATIC VIEW AC-AC
FOR PARTS D
SCHEMATIC VIEW Z-Z
FOR PARTS B
L-A4586 (0000)
PW V

Turbine Case And Vane Assembly Detail Part Position Requirements
Figure 1009 (Sheet 1)
(Task 72-52-03-440-001)

TURBINE CASE AND VANE ASSEMBLY - ASSEMBLY-01


TURBINE CASE
REAR FLANGE
VERTICAL ℄
1
GAP
2
GAP
2ND STAGE HPT
DUCT SUPPORT
MARKED NO.1
145° 42′ 51″
REFERENCE
2ND STAGE HPT
VANE ASSEMBLY
MARKED NO.1
Z
2ND STAGE HPT
VANE ASSEMBLY
WITH BORESCOPE
PROVISION
L-A4587

Turbine Case And Vane Assembly Detail Part Position Requirements
Figure 1009 (Sheet 2)
(Task 72-52-03-440-001)

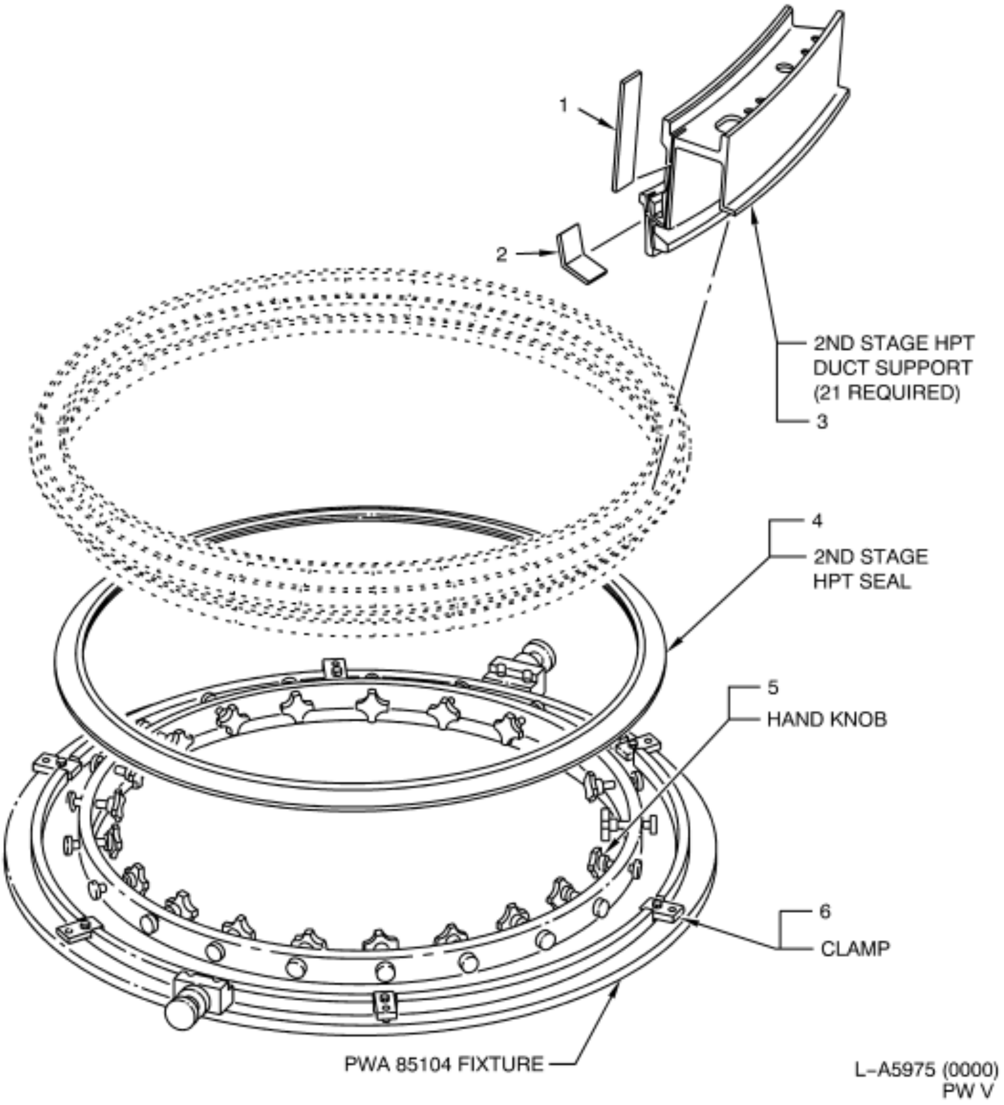

1
2
LONG SIDE
3
4
5
ALTERNATE CONFIGURATION
1
6
2ND STAGE HPT DUCT SUPPORT (21 REQUIRED)
7
8
2ND STAGE HPT SEAL
9
HAND KNOB
10
CLAMP
PWA 85104 FIXTURE
L−A0938 (0387)
PW V

Second Stage HPT Seal And Duct Support Assembly
Figure 1010 (Sheet 1)
(Task 72−52−03−440−001)

TURBINE CASE AND VANE ASSEMBLY − ASSEMBLY−01

1. Second Stage HPT Duct Support Seal PN 50L066
2. Second Stage HPT Duct Support Seal PN 50L068, 21 Necessary (Pre SB PW4ENG 72−34)
3. Assemble Seal With Long Side Positioned As Shown
4. Second Stage HPT Duct Support Seal PN 50L067, 21 Necessary (Pre SB PW4ENG 72−34)
5. Second Stage HPT Duct Support PN 50L007, 21 Necessary
6. Second Stage HPT Duct Support Seal PN 50L289, 21 Necessary (Post SB PW4ENG 72−34)
7. Second Stage HPT Duct Support PN 50L678, 21 Necessary (Post SB PW4ENG 72−462)
8. Second Stage HPT Seal
9. Hand Knob
10. Clamp

Key to Figure 1010 (Sheet 1)

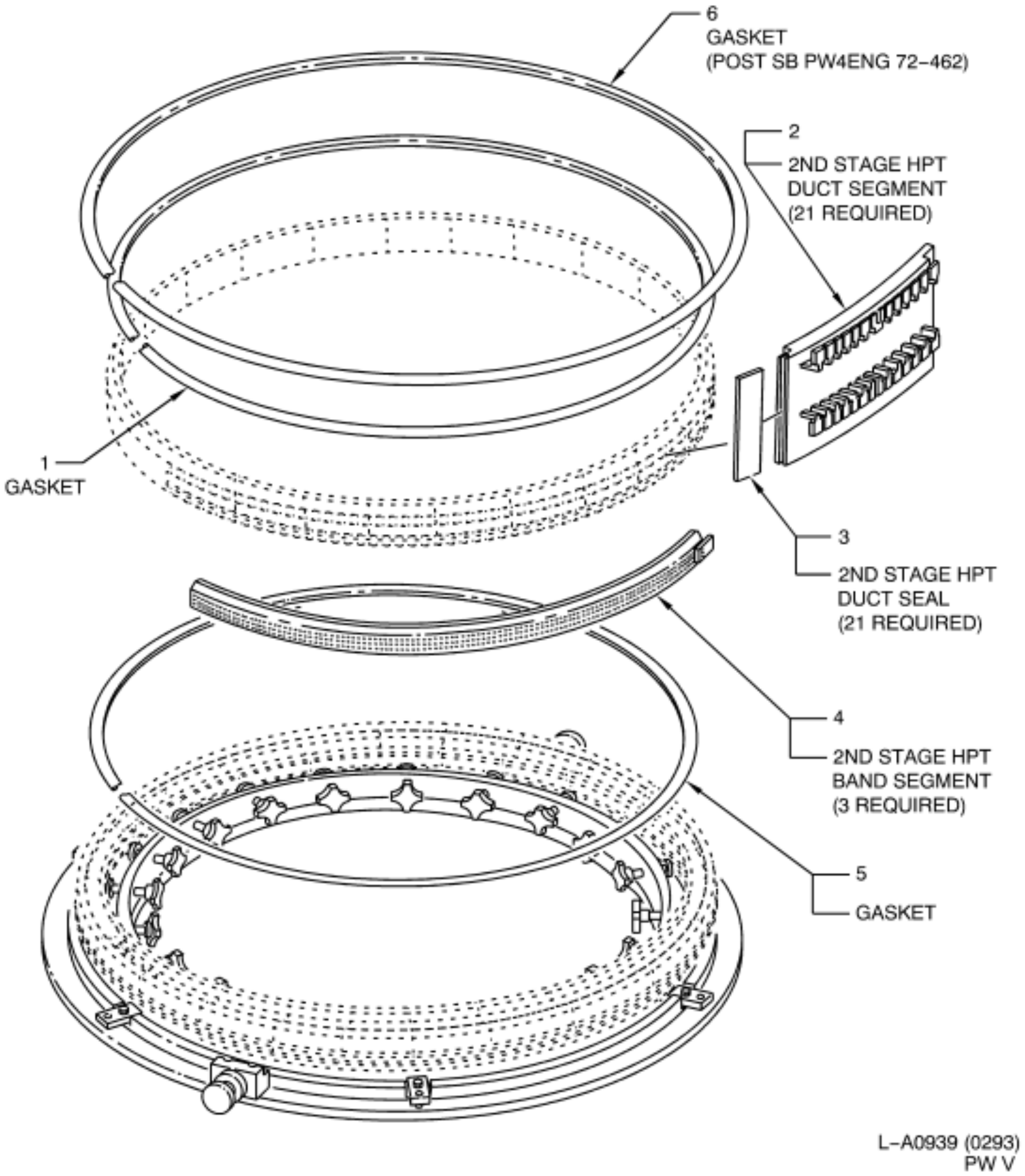

1
2
2ND STAGE HPT
DUCT SUPPORT
(21 REQUIRED)
3
4
2ND STAGE
HPT SEAL
5
HAND KNOB
6
CLAMP
PWA 85104 FIXTURE
L−A5975 (0000)
PW V

Second Stage HPT Seal And Duct Support Assembly
Figure 1010 (Sheet 2)
(Task 72−52−03−440−001)

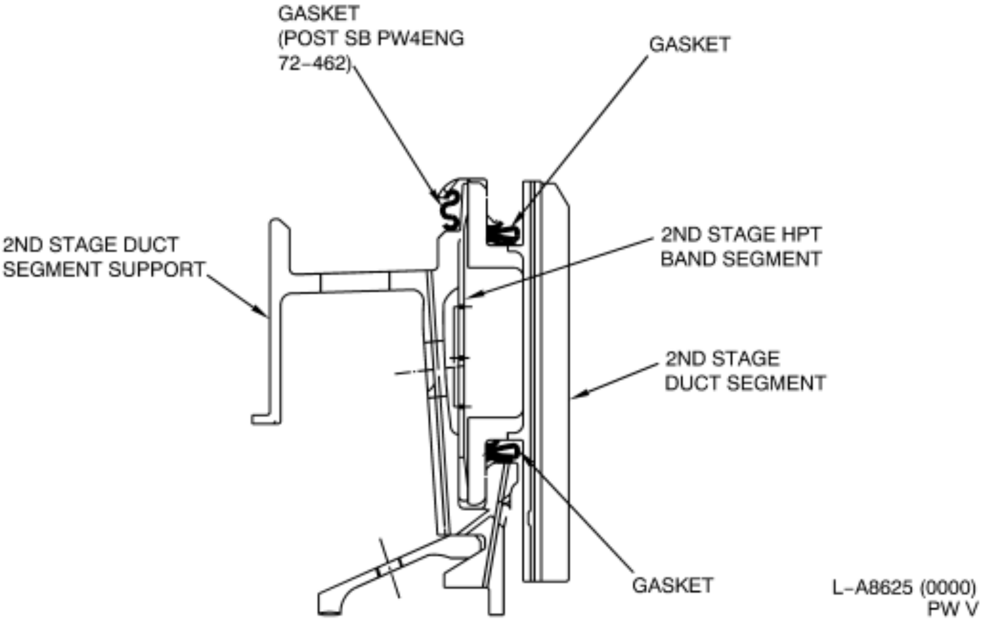
TURBINE CASE AND VANE ASSEMBLY − ASSEMBLY−01

1. Second Stage HPT Duct Support Seal PN 50L066
2. Second Stage HPT Duct Support Seal PN 50L289, 21 Necessary
3. Second Stage HPT Duct Support Seal PN 50L678, 21 Necessary
4. Second Stage HPT Seal
5. Hand Knob
6. Clamp

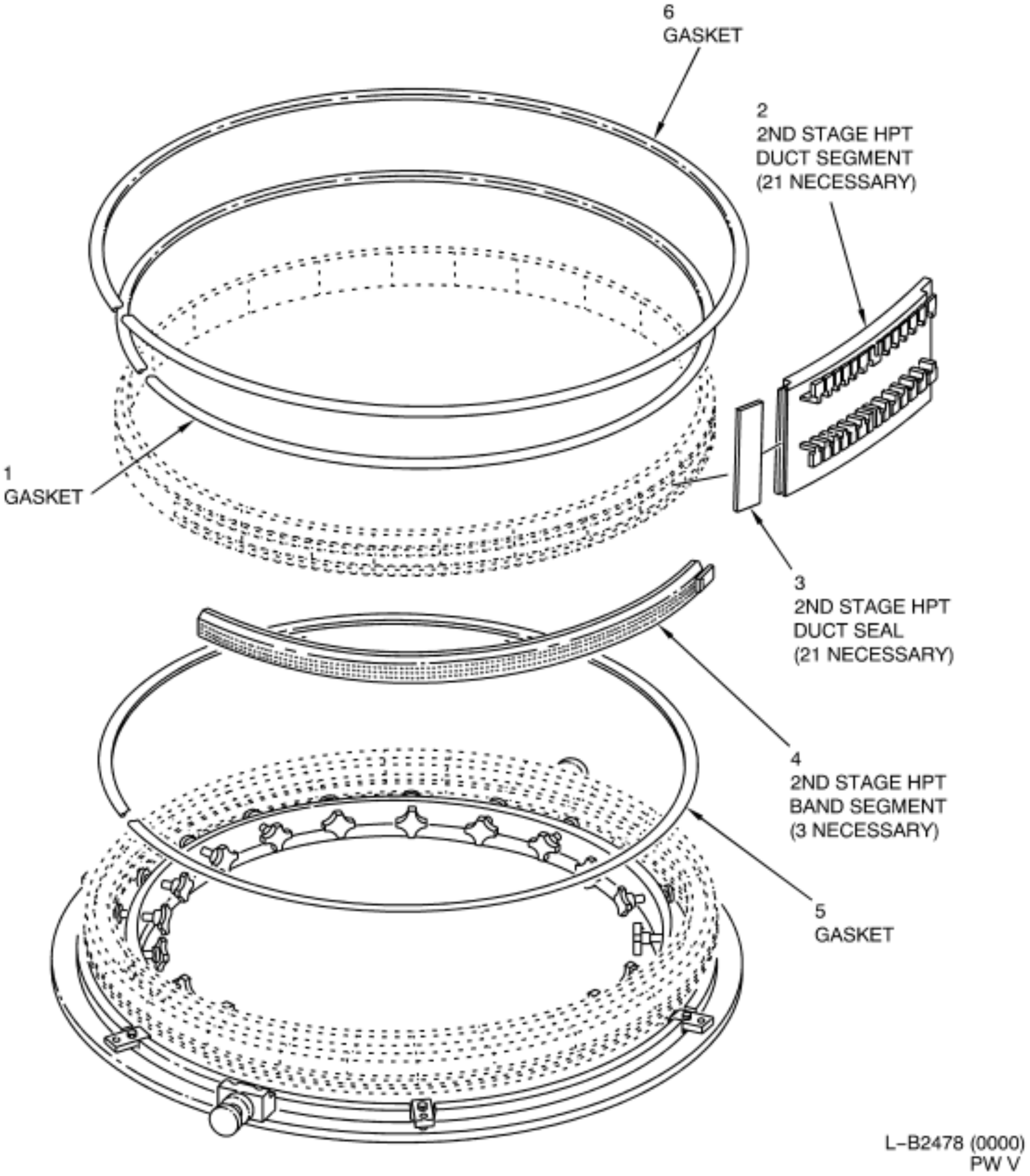
Key to Figure 1010 (Sheet 2)


6
GASKET
(POST SB PW4ENG 72−462)
2
2ND STAGE HPT
DUCT SEGMENT
(21 REQUIRED)
1
GASKET
3
2ND STAGE HPT
DUCT SEAL
(21 REQUIRED)
4
2ND STAGE HPT
BAND SEGMENT
(3 REQUIRED)
5
GASKET
L−A0939 (0293)
PW V

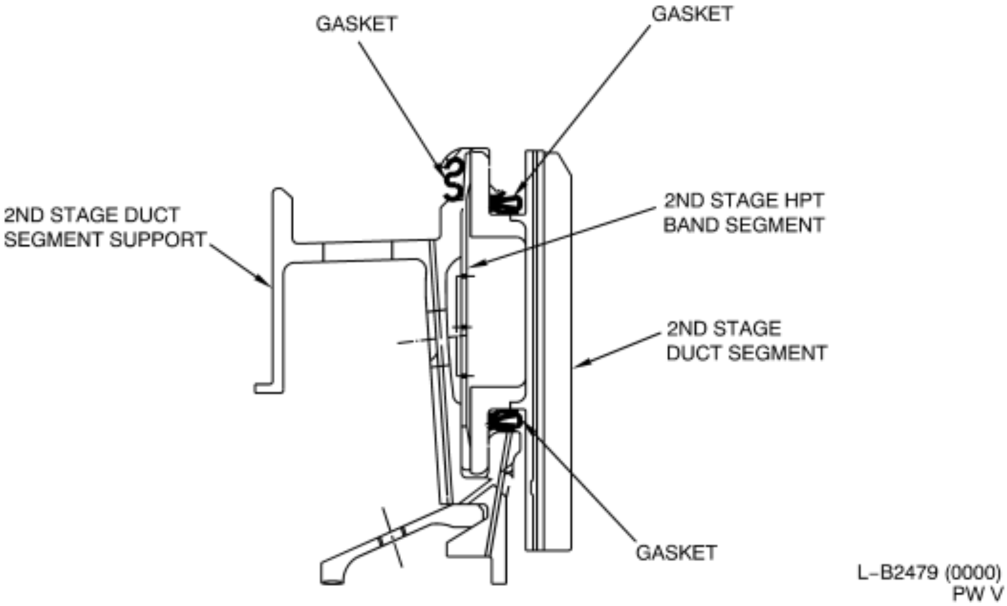
Second Stage HPT Duct Segments Assembly
Figure 1011 (Sheet 1)
(Task 72−52−03−440−001)


GASKET
(POST SB PW4ENG
72−462)
GASKET
2ND STAGE DUCT
SEGMENT SUPPORT
2ND STAGE HPT
BAND SEGMENT
2ND STAGE
DUCT SEGMENT
GASKET
L−A8625 (0000)
PW V

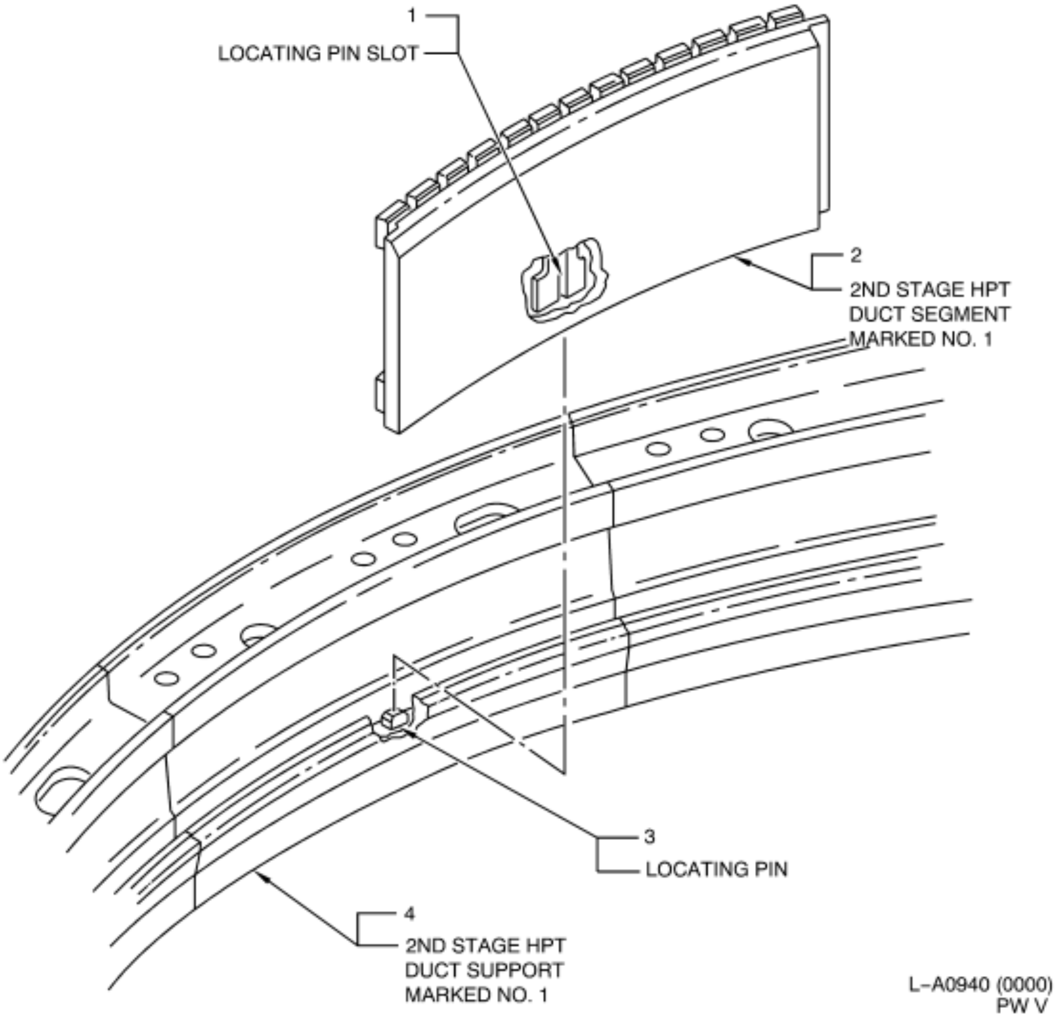
Second Stage HPT Duct Segments Assembly
Figure 1011 (Sheet 2)
(Task 72−52−03−440−001)


6
GASKET
2
2ND STAGE HPT
DUCT SEGMENT
(21 NECESSARY)
1
GASKET
3
2ND STAGE HPT
DUCT SEAL
(21 NECESSARY)
4
2ND STAGE HPT
BAND SEGMENT
(3 NECESSARY)
5
GASKET
L-B2478 (0000)
PW V

Second Stage HPT Duct Segments Assembly
Figure 1011 (Sheet 3)
(Task 72-52-03-440-001)

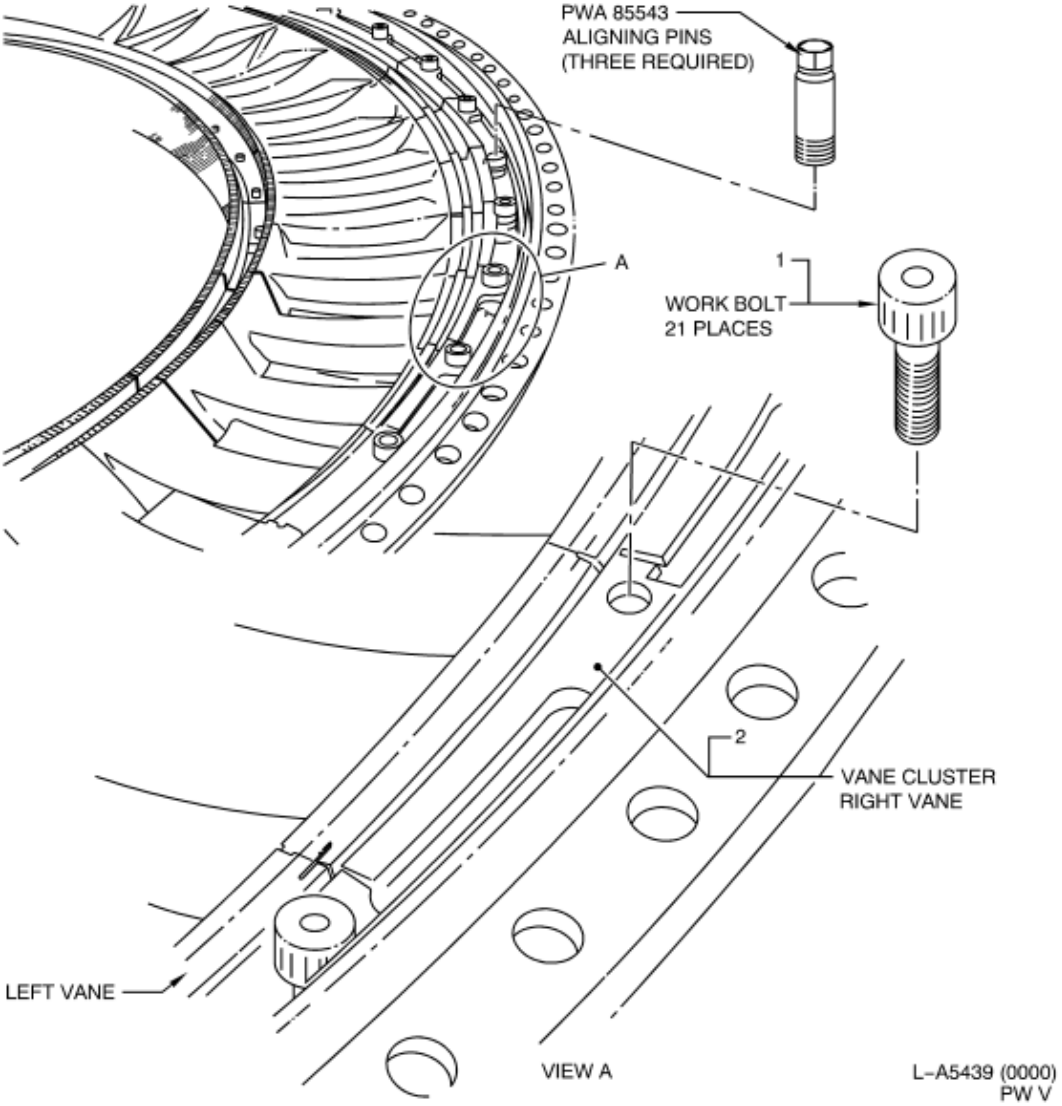

GASKET
GASKET
2ND STAGE DUCT SEGMENT SUPPORT
2ND STAGE HPT BAND SEGMENT
2ND STAGE DUCT SEGMENT
GASKET
L-B2479 (0000)
PW V

Second Stage HPT Duct Segments Assembly
Figure 1011 (Sheet 4)
(Task 72-52-03-440-001)

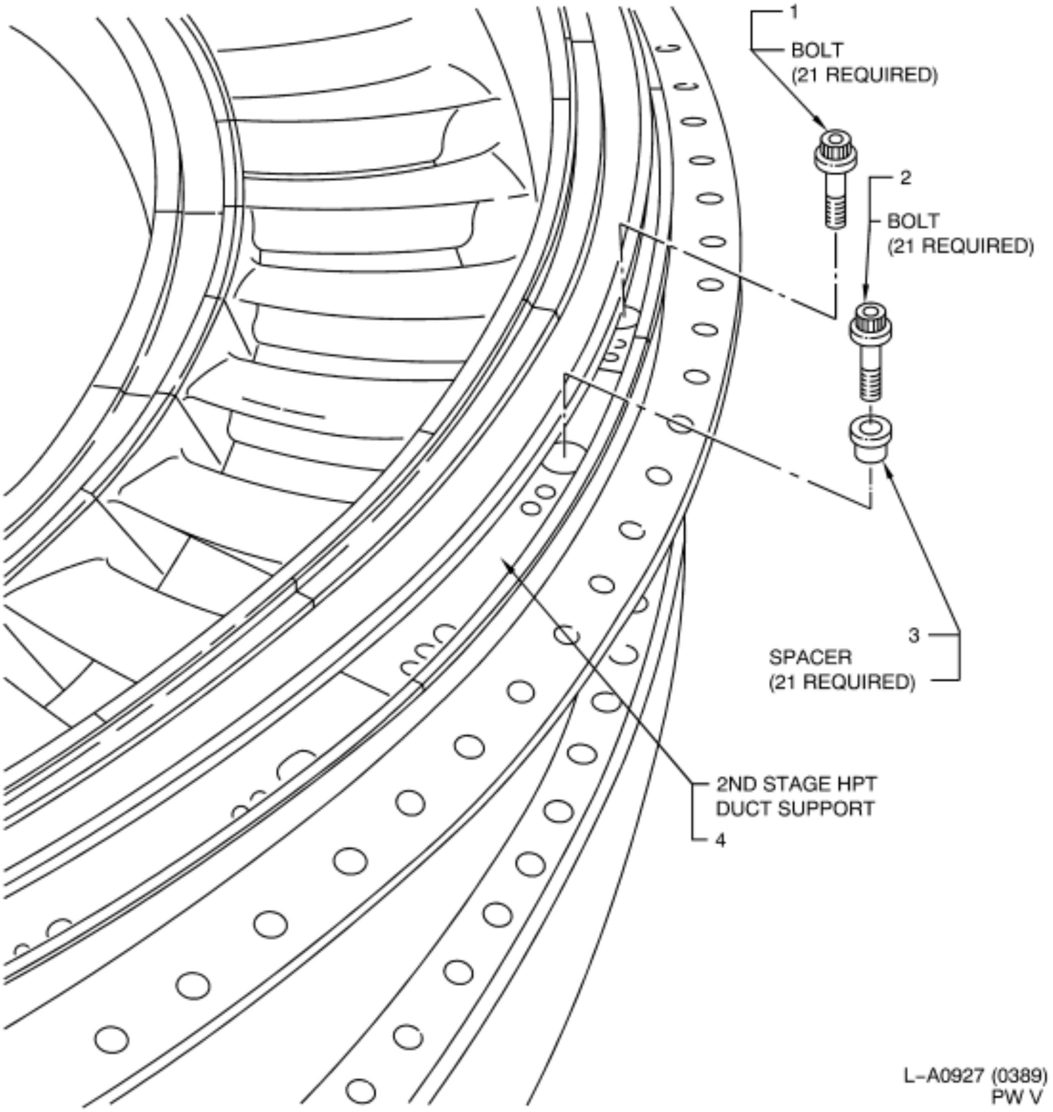

1
LOCATING PIN SLOT
2
2ND STAGE HPT
DUCT SEGMENT
MARKED NO. 1
3
LOCATING PIN
4
2ND STAGE HPT
DUCT SUPPORT
MARKED NO. 1
L-A0940 (0000)
PW V

Second Stage HPT Duct Segment Installation
Figure 1012
(Task 72-52-03-440-001)

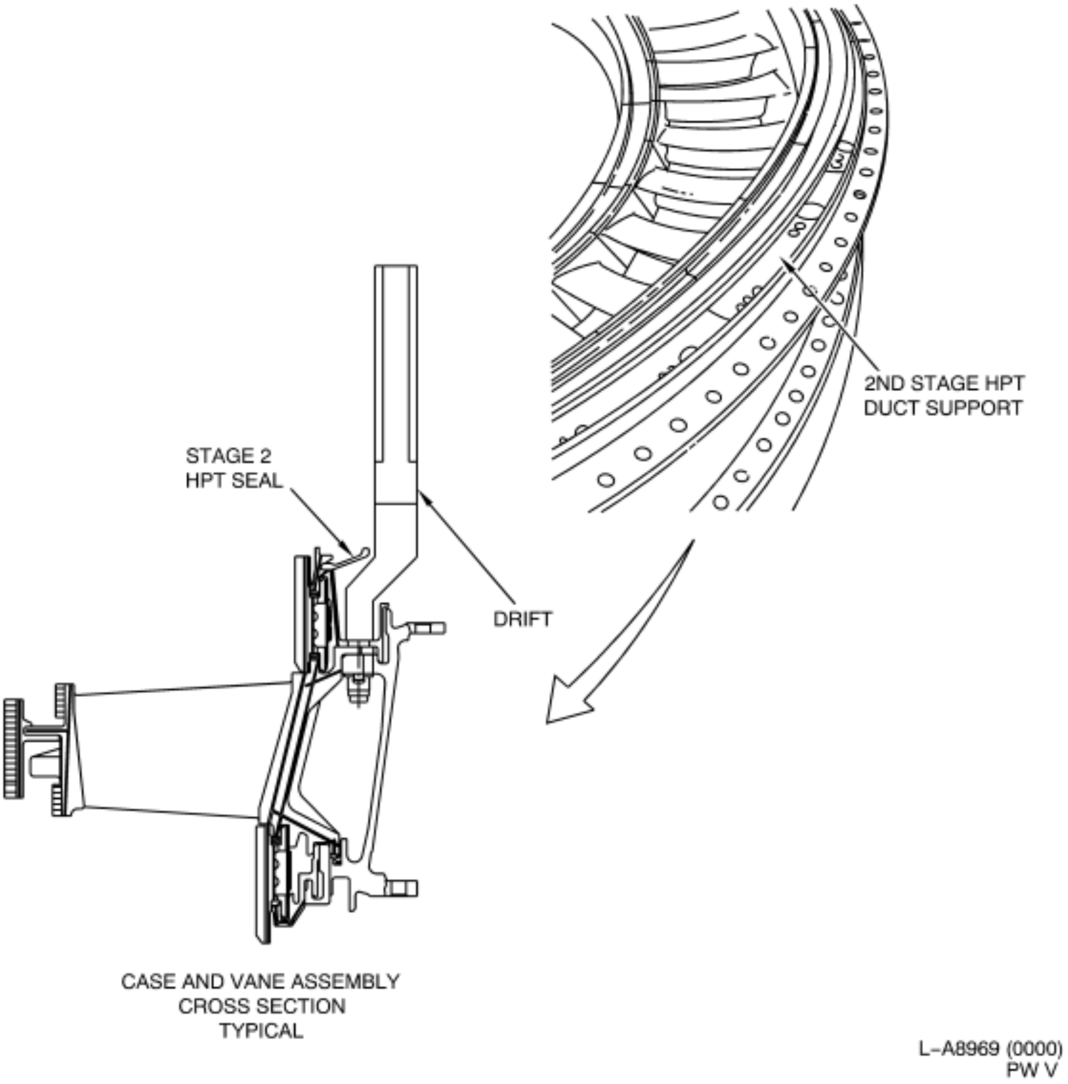
TURBINE CASE AND VANE ASSEMBLY - ASSEMBLY-01


PWA 85543
ALIGNING PINS
(THREE REQUIRED)
A
1
WORK BOLT
21 PLACES
2
VANE CLUSTER
RIGHT VANE
LEFT VANE
VIEW A
L-A5439 (0000)
PW V

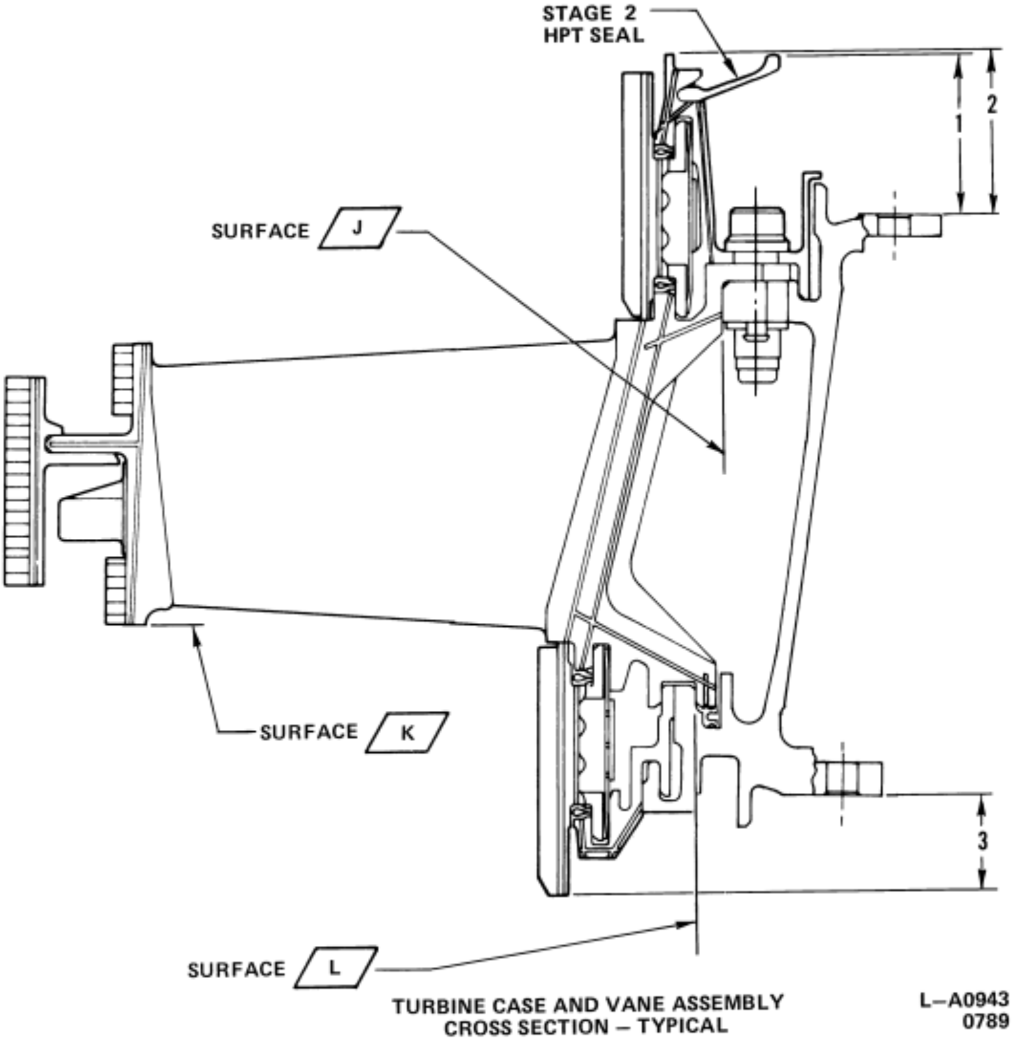
Vane Cluster Workbolt Removal
Figure 1013
(Task 72-52-03-440-001)


1
BOLT
(21 REQUIRED)
2
BOLT
(21 REQUIRED)
3
SPACER
(21 REQUIRED)
2ND STAGE HPT
DUCT SUPPORT
4
L-A0927 (0389)
PW V

Second Stage HPT Vane Assembly Installation
Figure 1014
(Task 72-52-03-440-001)


2ND STAGE HPT
DUCT SUPPORT
STAGE 2
HPT SEAL
DRIFT
CASE AND VANE ASSEMBLY
CROSS SECTION
TYPICAL
L−A8969 (0000)
PW V

Vanes And Vane Support Seating
Figure 1015
(Task 72−52−03−440−001)


STAGE 2
HPT SEAL
1
2
SURFACE J
SURFACE K
3
SURFACE L
TURBINE CASE AND VANE ASSEMBLY
CROSS SECTION – TYPICAL
L–A0943
0789

1. 1.269 - 1.316 Inches (32.23 - 33.43 mm) Dimension Applies When 2nd Stage HPT Seal Is Held Forward.
2. 1.299 - 1.327 Inches (32.99 - 33.71 mm)
3. 0.891 Inch (22.631 mm) Maximum

Part Seating Inspection
Figure 1016
(Task 72-52-03-440-001)

TURBINE CASE AND VANE ASSEMBLY - ASSEMBLY-02

Task 72-52-03-440-002:

1. Duct Segment Replacement - Turbine Case And Vane Assembly

This Assembly Has Been Deleted.

Return to Previous Menu

72−53−00

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	HIGHLIGHTS
	TABLE OF CONTENTS
72−53−00	LOW PRESSURE TURBINE (LPT) − HOW TO USE • 72−53−00−990−003: Chapter/Section/Subject Numbering Outline
72−53−00	LOW PRESSURE TURBINE (LPT) − DESCRIPTION AND OPERATION • 72−53−00−990−002: Low Pressure Turbine
72−53−00	LOW PRESSURE TURBINE (LPT) − REMOVAL−01 • 72−53−00−020−001: Remove Turbine Exhaust Case From Low Pressure Turbine
72−53−00	LOW PRESSURE TURBINE (LPT) − INSTALLATION−01 • 72−53−00−420−001: Install Turbine Exhaust Case To Low Pressure Turbine
72−53−00	LOW PRESSURE TURBINE (LPT) − DISASSEMBLY−01 • 72−53−00−030−001: Remove Low Pressure Turbine Shaft And External Parts
72−53−00	LOW PRESSURE TURBINE (LPT) − DISASSEMBLY−02 • 72−53−00−030−002: Disassemble Low Pressure Turbine
72−53−00	LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−01 • 72−53−00−990−004: General Inspection Requirements − Low Pressure Turbine (LPT)
72−53−00	LOW PRESSURE TURBINE − INSPECTION/CHECK−03 • 72−53−00−990−005: Visual Inspection − Low Pressure Turbine (LPT)
72−53−00	LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−04 • 72−53−00−990−001: Specific Fits And Clearances
72−53−00	LOW PRESSURE TURBINE (LPT) − ASSEMBLY−01 • 72−53−00−400−001: Assemble Low Pressure Turbine
72−53−00	LOW PRESSURE TURBINE (LPT) − ASSEMBLY−02

	- 72−53−00−400−002: Prepare Low Pressure Turbine For Balancing
72−53−00	LOW PRESSURE TURBINE (LPT) − ASSEMBLY−03 - 72−53−00−400−003: Balance Low Pressure Turbine
72−53−00	LOW PRESSURE TURBINE (LPT) − ASSEMBLY−04 - 72−53−00−400−004: Final Assemble Low Pressure Turbine
72−53−00	LOW PRESSURE TURBINE (LPT) − ASSEMBLY−05 - 72−53−00−400−005: Install Low Pressure Turbine External Parts
72−53−00	LOW PRESSURE TURBINE (LPT) − ASSEMBLY−06 - 72−53−00−400−006: Install Front Compressor Drive Turbine Shaft
72−53−00	LOW PRESSURE TURBINE (LPT) − ASSEMBLY−07 - 72−53−00−400−007: Balance The Low Pressure Turbine With The Turbine Shaft Installed (Prepare The Turbine And Shaft Assembly For Balance)
72−53−00	LOW PRESSURE TURBINE (LPT) − ASSEMBLY−08 - 72−53−00−400−008: Balance Low Pressure Turbine With Shaft (Balance Procedure)
72−53−00	LOW PRESSURE TURBINE (LPT) − ASSEMBLY−09 - 72−53−00−400−009: Balance The Low Pressure Turbine With The Turbine Shaft Installed (Remove The Turbine From The Turbine Shaft And/Or Install Counterweights On The Front Plane)
72−53−00	LOW PRESSURE TURBINE (LPT) − ASSEMBLY−10 - 72−53−00−400−010: Balance Low Pressure Turbine Assembly Balance Arbor (PWA 85457)
72−53−00	LOW PRESSURE TURBINE (LPT) − ASSEMBLY−11 - 72−53−00−400−011: Semi−Dynamic Balance Low Pressure Turbine With Shaft (Balance Procedure)
72−53−00	LOW PRESSURE TURBINE (LPT) − ASSEMBLY−12 - 72−53−00−400−012: Dynamic Balance The Low Pressure Turbine With Shaft (Balance Procedure)
72−53−00	LOW PRESSURE TURBINE (LPT) − STORAGE−01 - 72−53−00−530−001: Pack Low Pressure Turbine (LPT) - 72−53−00−540−001: Unpack Low Pressure Turbine (LPT)
72−53−00	LOW PRESSURE TURBINE (LPT) − STORAGE−02 - 72−53−00−530−002: Pack Low Pressure Turbine (LPT) With Shaft

	- 72−53−00−540−002: Unpack Low Pressure Turbine (LPT) With Shaft
72−53−03	STAGE 3 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01 - 72−53−03−040−001: Disassemble 3rd Stage Turbine Rotor Assembly
72−53−03	STAGE 3 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01 - 72−53−03−440−001: Assemble 3rd Stage Turbine Rotor Assembly
72−53−03	STAGE 3 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02 - 72−53−03−440−002: Balance Stage 3 Turbine Rotor Assembly (Disk And Blades)
72−53−03	STAGE 3 TURBINE ROTOR ASSEMBLY − ASSEMBLY−03 - 72−53−03−440−003: Final Assemble 3rd Stage Turbine Rotor Assembly
72−53−04	STAGE 4 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01 - 72−53−04−040−001: Disassemble 4th Stage Turbine Rotor Assembly
72−53−04	STAGE 4 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01 - 72−53−04−440−001: Assemble 4th Stage Turbine Rotor Assembly
72−53−04	STAGE 4 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02 - 72−53−04−440−002: Balance Stage 4 Turbine Rotor Assembly
72−53−04	STAGE 4 TURBINE ROTOR ASSEMBLY − ASSEMBLY−03 - 72−53−04−440−003: Final Assemble 4th Stage Turbine Rotor Assembly
72−53−05	STAGE 5 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01 - 72−53−05−040−001: Disassemble 5th Stage Turbine Rotor Assembly
72−53−05	STAGE 5 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01 - 72−53−05−440−001: Assemble 5th Stage Turbine Rotor Assembly
72−53−05	STAGE 5 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02 - 72−53−05−440−002: Balance Stage 5 Turbine Rotor Assembly
72−53−05	STAGE 5 TURBINE ROTOR ASSEMBLY − ASSEMBLY−03 - 72−53−05−440−003: Final Assemble 5th Stage Turbine Rotor Assembly
72−53−06	STAGE 6 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01 - 72−53−06−040−001: Disassemble 6th Stage Turbine Rotor Assembly

72−53−06	STAGE 6 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01 • 72−53−06−440−001: Assemble 6th Stage Turbine Rotor Assembly
72−53−06	STAGE 6 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02 • 72−53−06−440−002: Balance Stage 6 Turbine Rotor Assembly
72−53−06	STAGE 6 TURBINE ROTOR ASSEMBLY − ASSEMBLY−03 • 72−53−06−440−003: Final Assemble 6th Stage Turbine Rotor Assembly

LOW PRESSURE TURBINE (LPT) - HOW TO USE

Task 72-53-00-990-003:

1. Chapter/Section/Subject Numbering Outline

See Figure 1.

NOTE: See the tab separated How To Use Manual section located at the beginning of this manual set for information concerning Data Location Guidelines and a complete Chapter/Section/Subject numbering outline for all manual sections.

A. The following is a complete listing of the individual Chapter/Section/Subject numbers and specific nomenclatures which have been assigned to the significant Low Pressure Turbine (LPT) parts.

(1) Numbers which are not assigned are indicated in the list by one of the following terms:

UNASSIGNED -	This designation is for numbers intentionally omitted and reserved for possible future use.
NOT USED -	This designation is applied to numbers used in other related engine model programs which are not, at this time, applicable to the engine models represented by this manual.

LOW PRESSURE TURBINE (LPT) − HOW TO USE

LOW PRESSURE TURBINE (LPT)	72−53−00
UNASSIGNED	72−53−01 and 72−53−02
STAGE 3 TURBINE ROTOR ASSEMBLY	72−53−03
STAGE 4 TURBINE ROTOR ASSEMBLY	72−53−04
STAGE 5 TURBINE ROTOR ASSEMBLY	72−53−05
STAGE 6 TURBINE ROTOR ASSEMBLY	72−53−06
STAGE 3 LPT BLADE	72−53−07
STAGE 4 LPT BLADE	72−53−08
STAGE 5 LPT BLADE	72−53−09
STAGE 6 LPT BLADE	72−53−10
NOT USED	72−53−11
NOT USED	72−53−12
STAGE 3 LPT DISK	72−53−13
STAGE 4 LPT DISK ASSEMBLY	72−53−14
STAGE 5 REAR TURBINE HUB	72−53−15
STAGE 6 LPT DISK ASSEMBLY	72−53−16
REAR TURBINE (LPT) CASE ASSEMBLY	72−53−17
STAGE 3 LPT (INNER) DUCT ASSEMBLY	72−53−18
STAGE 3 LPT (INNER) SEALING RING ASSEMBLY	72−53−19
STAGE 3 LPT (INNER) SEALING RING SUPPORT ASSEMBLY	72−53−20
STAGE 3 LPT (INNER) SEALING RING DAMPER	72−53−21
NOT USED	72−53−22
STAGE 3 LPT VANE CLUSTER ASSEMBLY	72−53−23
STAGE 4 LPT VANE CLUSTER ASSEMBLY	72−53−24

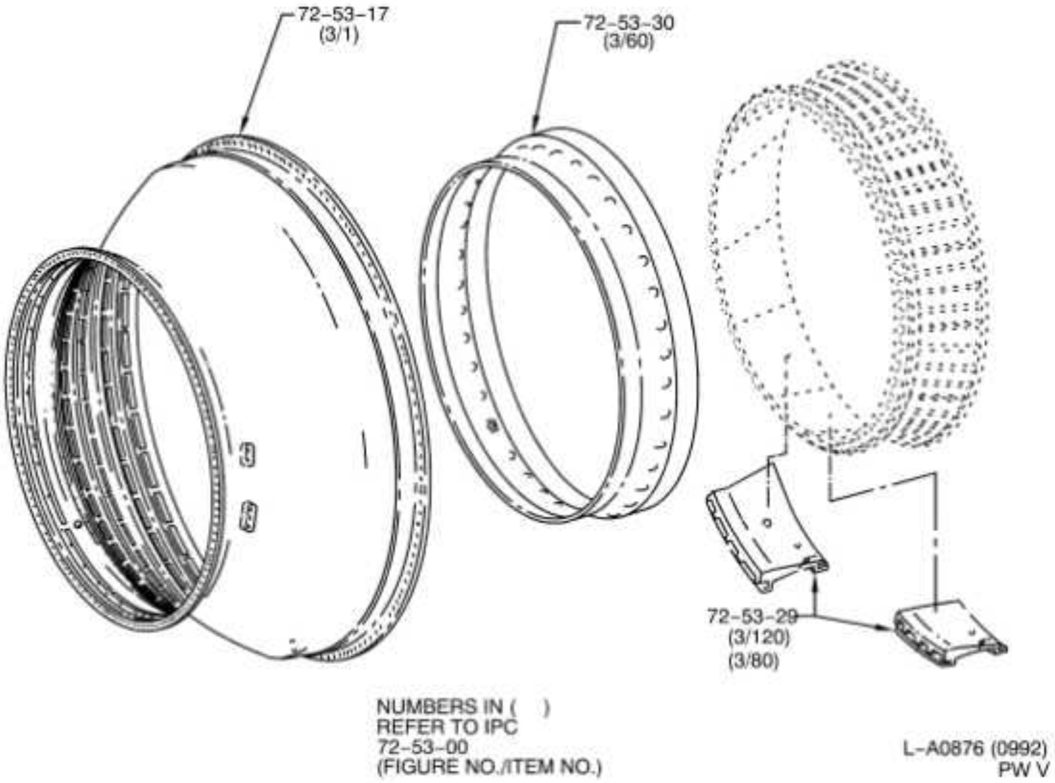
LOW PRESSURE TURBINE (LPT) − HOW TO USE

STAGE 5 LPT VANE CLUSTER ASSEMBLY	72−53−25
STAGE 6 LPT VANE CLUSTER ASSEMBLY	72−53−26
STAGE 3 LPT VANE SEALS	72−53−27
NOT USED	72−53−28
STAGE 3 LPT (OUTER) DUCT SEGMENT ASSEMBLY	72−53−29
STAGE 3 LPT (OUTER) DUCT ASSEMBLY	72−53−30
STAGE 3 LPT (OUTER VANE) DUCT ASSEMBLY	72−53−31
STAGE 3 LPT (OUTER) AIRSEALING RING SEGMENT ASSEMBLY	72−53−32
STAGE 4 LPT (OUTER) AIRSEALING RING SEGMENT ASSEMBLY	72−53−33
STAGE 5 LPT (OUTER) AIRSEALING RING SEGMENT ASSEMBLY	72−53−34
STAGE 6 LPT (OUTER) AIRSEALING RING SEGMENT ASSEMBLY	72−53−35
NOT USED	72−53−36
STAGE 6 LPT (OUTER) AIRSEALING RING FLANGE	72−53−37
STAGE 3 LPT (INNER ROTATING) AIRSEAL	72−53−38
STAGE 3 LPT (OUTER ROTATING) AIRSEAL	72−53−39
STAGE 4 LPT (ROTATING) AIRSEAL	72−53−40
STAGE 5 LPT (ROTATING) AIRSEAL	72−53−41
NOT USED	72−53−42
TURBINE TIERODS	72−53−43
TURBINE TIEROD NUT	72−53−44
NOT USED	72−53−45 and 72−53−46

LOW PRESSURE TURBINE (LPT) − HOW TO USE

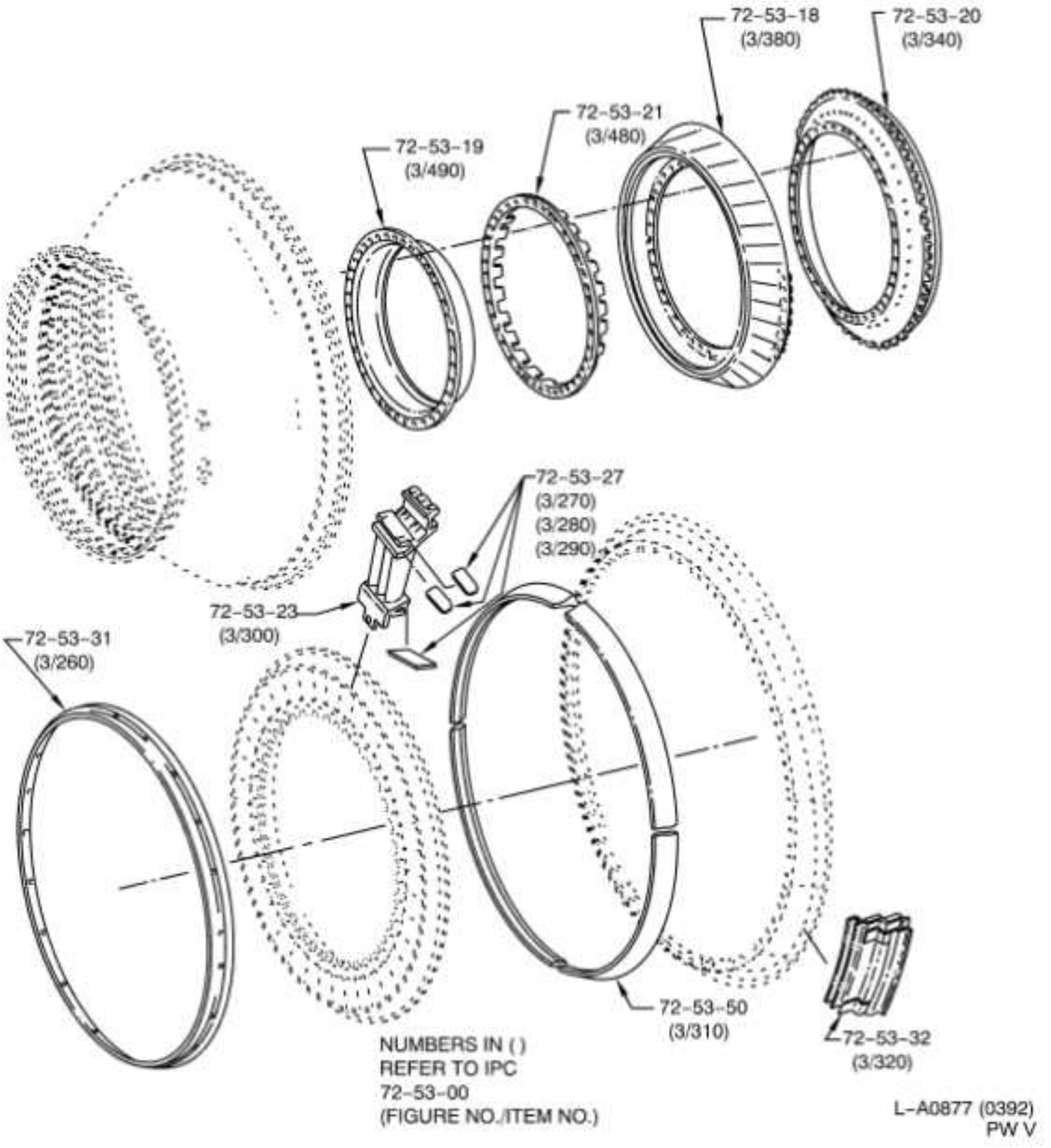
NOT USED	72−53−47 through 72−53−49
TURBINE CASE (STAGE 3 AIRSEALING RING) HEAT SHIELD ASSEMBLY	72−53−50
TURBINE CASE (STAGE 4 VANE) HEAT SHIELD ASSEMBLY	72−53−51
TURBINE CASE (STAGE 4 AIRSEALING RING) HEAT SHIELD ASSEMBLY	72−53−52
TURBINE CASE (STAGE 5 VANE) HEAT SHIELD ASSEMBLY	72−53−53
TURBINE CASE (STAGE 5 AIRSEALING RING) HEAT SHIELD ASSEMBLY	72−53−54
TURBINE CASE (STAGE 6 VANE) HEAT SHIELD ASSEMBLY	72−53−55
NOT USED	72−53−56 through 72−53−75
UNASSIGNED	72−53−76 through 72−53−79
FRONT COMPRESSOR DRIVE TURBINE (LPT) SHAFT	72−53−80
TURBINE SHAFT SPACER	72−53−81
TURBINE (SHAFT) TIEROD	72−53−82
TIEROD NUT	72−53−83
NO. 4 BEARING (INNER RACE) RETAINING PLATE	72−53−84
STAGE 6 LPT AIRSEAL	72−53−85
NOT USED	72−53−86 through 72−53−90
UNASSIGNED	72−53−91 through 72−53−98
LOW PRESSURE TURBINE (LPT) MISCELLANEOUS PARTS	72−53−99

LOW PRESSURE TURBINE (LPT) − HOW TO USE

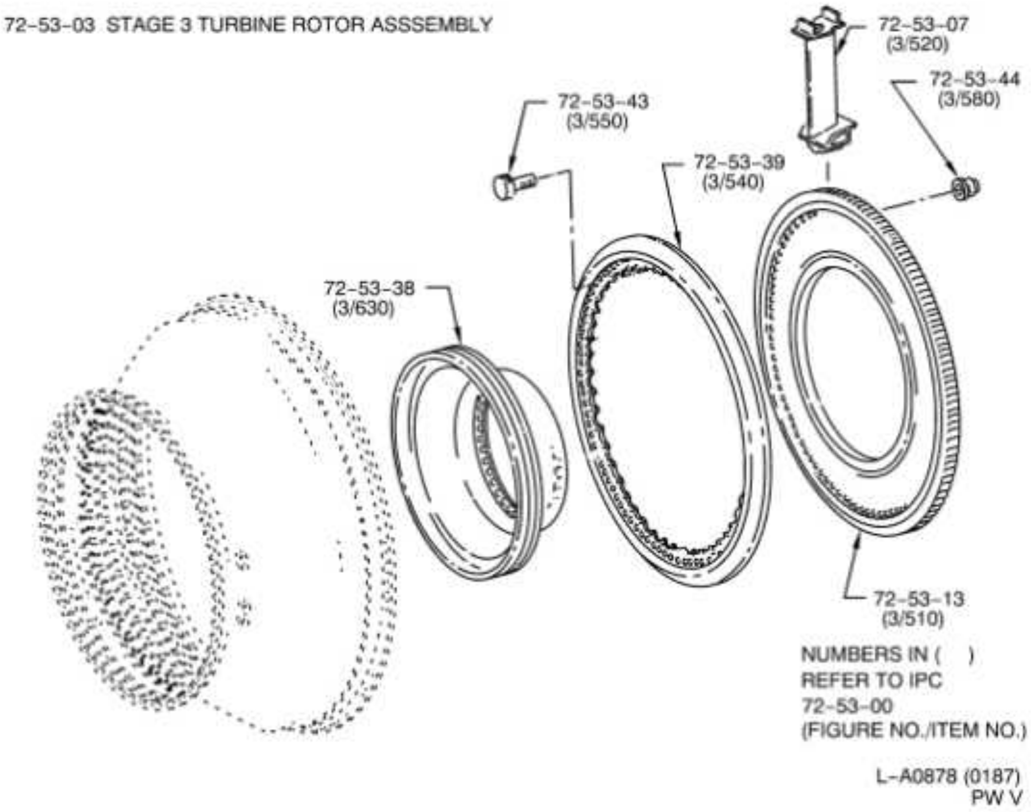

72−53−17
(3/1)
72−53−30
(3/60)
72−53−29
(3/120)
(3/80)
NUMBERS IN ( )
REFER TO IPC
72−53−00
(FIGURE NO./ITEM NO.)
L−A0876 (0992)
PW V

Low Pressure Turbine (LPT)
Figure 1 (Sheet 1)
(Task 72−53−00−990−003)

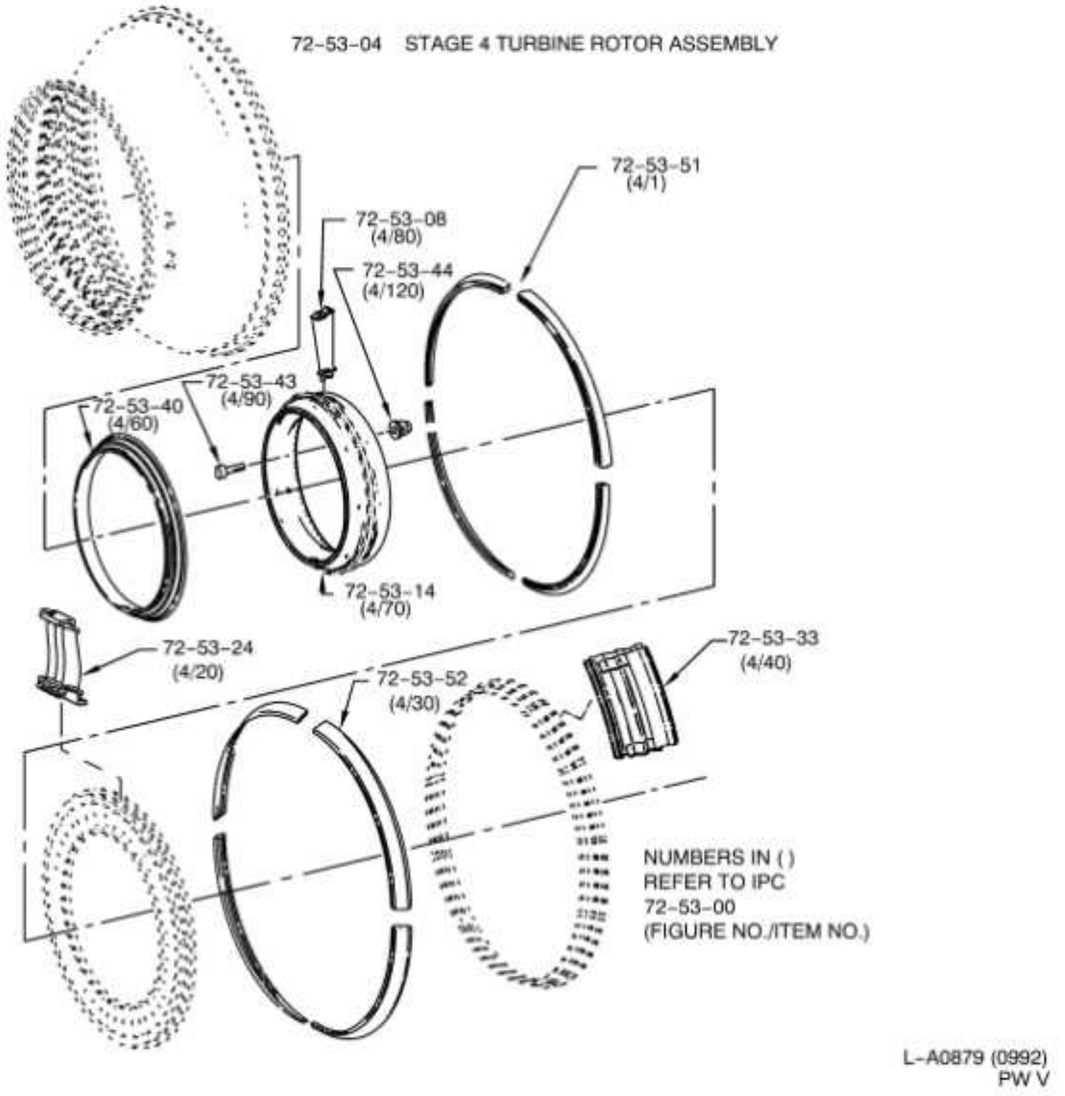
LOW PRESSURE TURBINE (LPT) − HOW TO USE


72-53-18
(3/380)
72-53-20
(3/340)
72-53-21
(3/480)
72-53-19
(3/490)
72-53-27
(3/270)
(3/280)
(3/290)
72-53-23
(3/300)
72-53-31
(3/260)
72-53-50
(3/310)
72-53-32
(3/320)
NUMBERS IN ( )
REFER TO IPC
72-53-00
(FIGURE NO./ITEM NO.)
L-A0877 (0392)
PW V

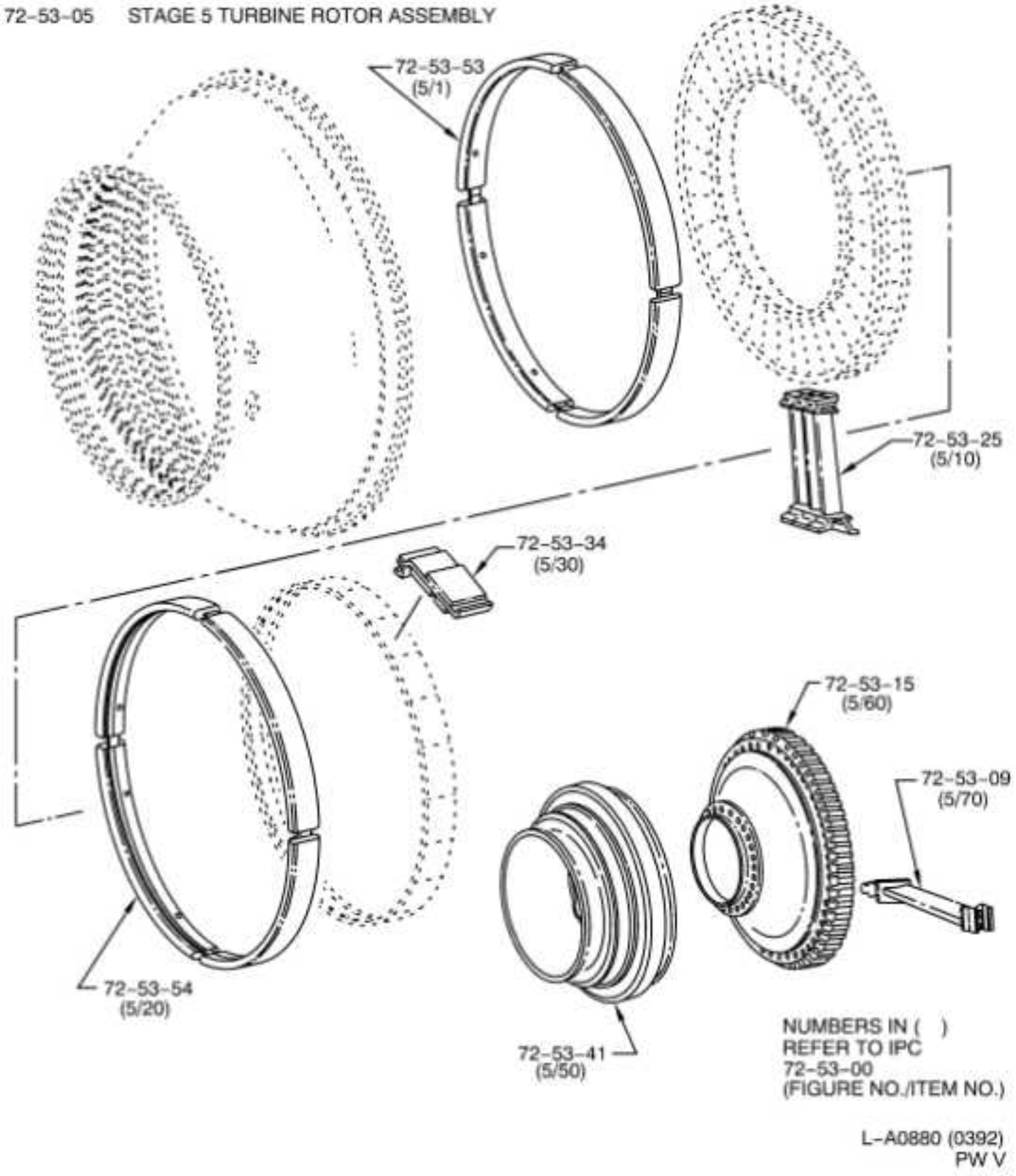
Low Pressure Turbine (LPT)
Figure 1 (Sheet 2)
(Task 72−53−00−990−003)


72-53-03 STAGE 3 TURBINE ROTOR ASSSEMBLY
72-53-07 (3/520)
72-53-44 (3/580)
72-53-43 (3/550)
72-53-39 (3/540)
72-53-38 (3/630)
72-53-13 (3/510)
NUMBERS IN ( ) REFER TO IPC 72-53-00 (FIGURE NO./ITEM NO.)
L-A0878 (0187)
PW V

Low Pressure Turbine (LPT)
Figure 1 (Sheet 3)
(Task 72−53−00−990−003)

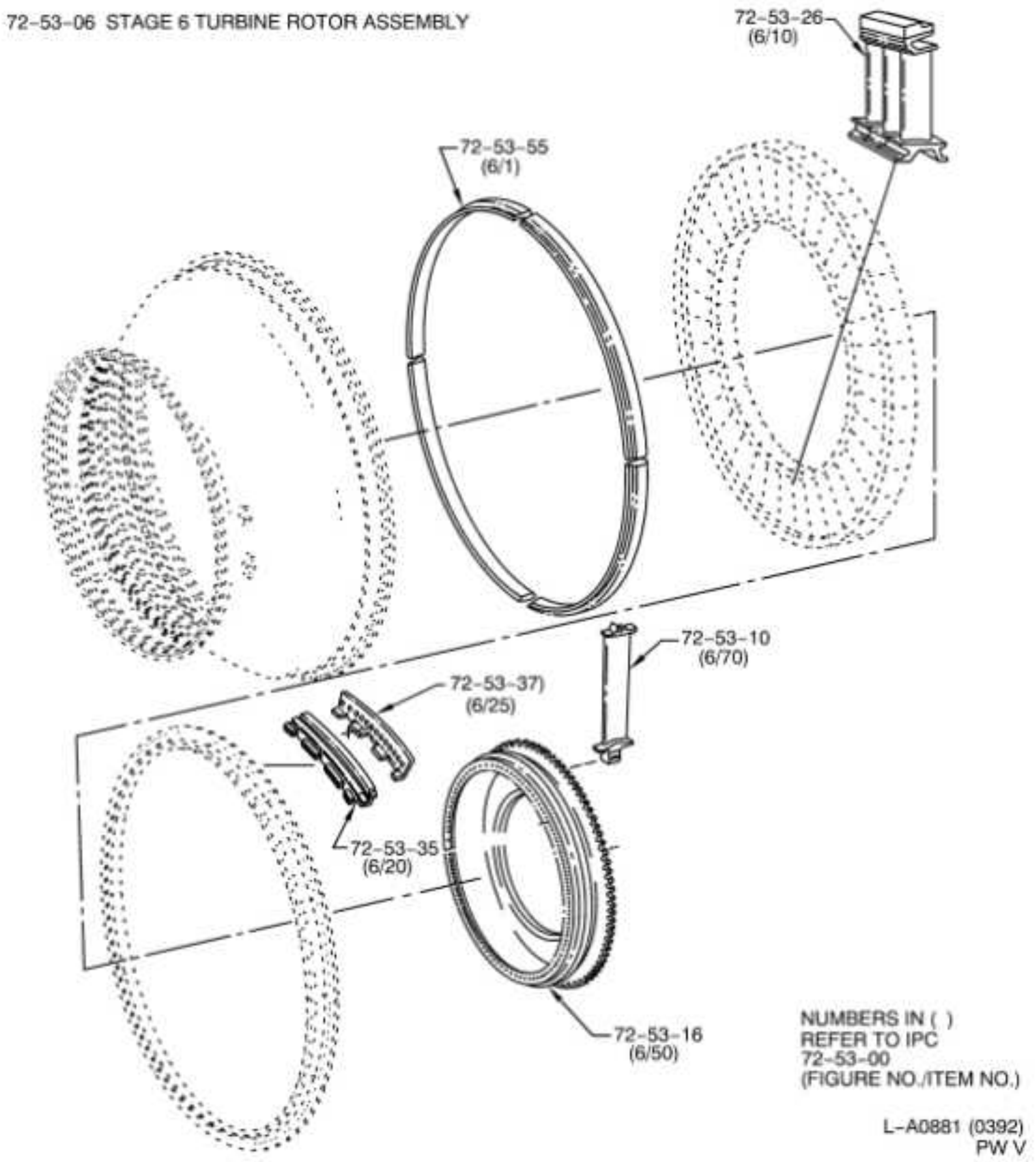

72-53-04 STAGE 4 TURBINE ROTOR ASSEMBLY
72-53-51 (4/1)
72-53-08 (4/80)
72-53-44 (4/120)
72-53-43 (4/90)
72-53-40 (4/60)
72-53-14 (4/70)
72-53-24 (4/20)
72-53-52 (4/30)
72-53-33 (4/40)
NUMBERS IN ( ) REFER TO IPC 72-53-00 (FIGURE NO./ITEM NO.)
L-A0879 (0992)
PW V

Low Pressure Turbine (LPT)
Figure 1 (Sheet 4)
(Task 72−53−00−990−003)


72-53-05 STAGE 5 TURBINE ROTOR ASSEMBLY
72-53-53
(5/1)
72-53-25
(5/10)
72-53-34
(5/30)
72-53-15
(5/60)
72-53-09
(5/70)
72-53-54
(5/20)
72-53-41
(5/50)
NUMBERS IN ( )
REFER TO IPC
72-53-00
(FIGURE NO./ITEM NO.)
L-A0880 (0392)
PW V

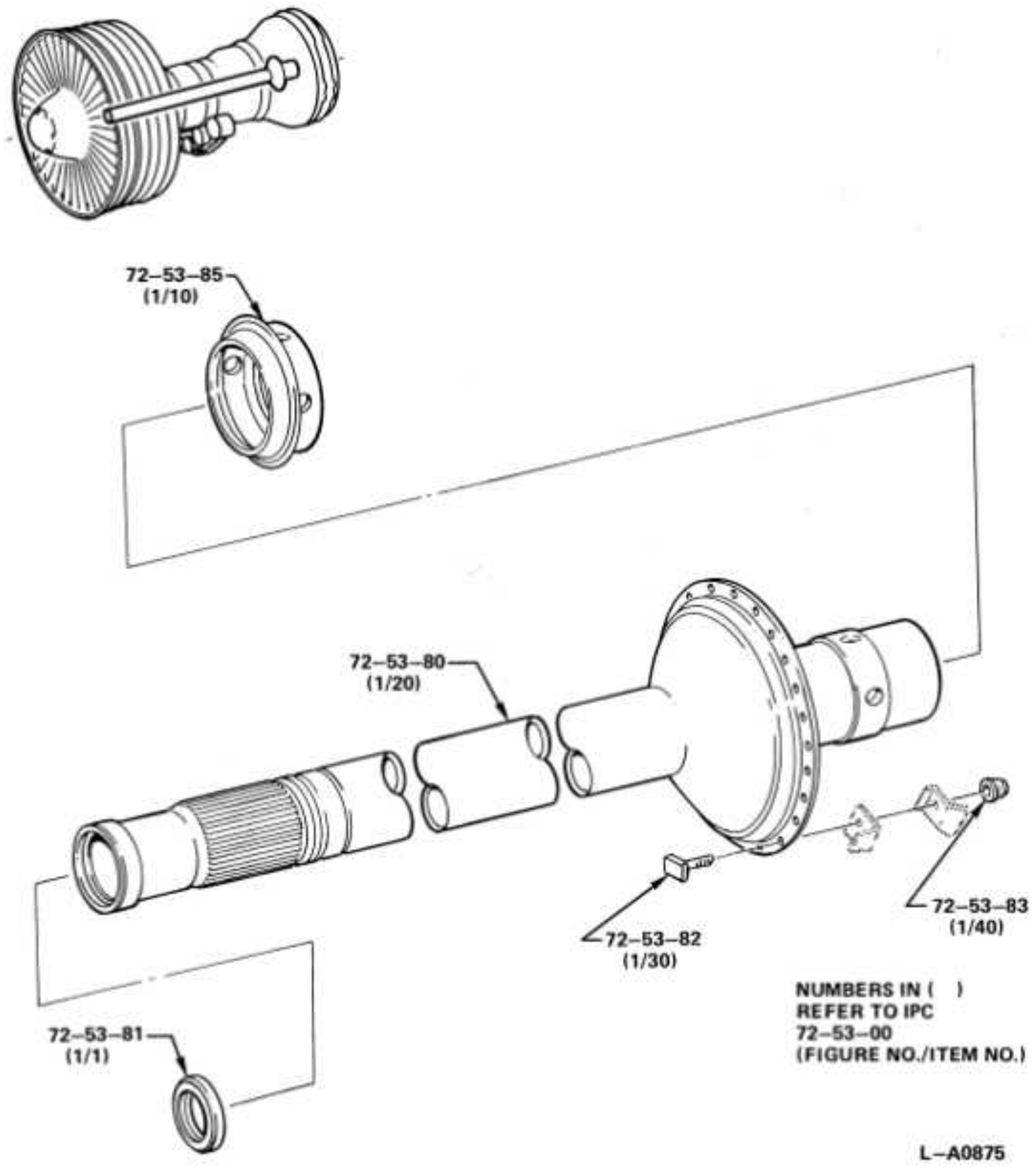
Low Pressure Turbine (LPT)
Figure 1 (Sheet 5)
(Task 72−53−00−990−003)

LOW PRESSURE TURBINE (LPT) − HOW TO USE

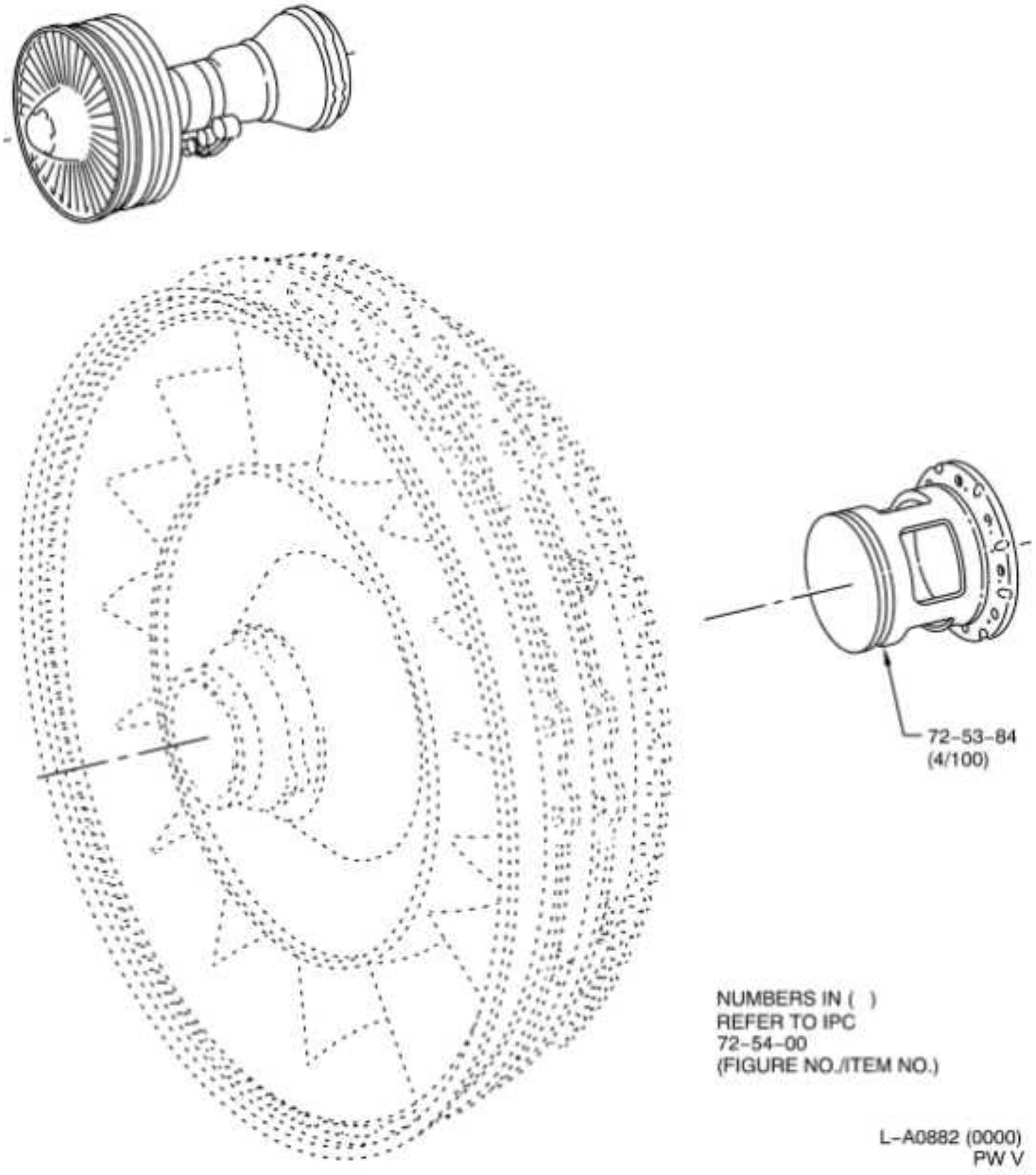

72-53-06 STAGE 6 TURBINE ROTOR ASSEMBLY
72-53-26
(6/10)
72-53-55
(6/1)
72-53-10
(6/70)
72-53-37)
(6/25)
72-53-35
(6/20)
72-53-16
(6/50)
NUMBERS IN ( )
REFER TO IPC
72-53-00
(FIGURE NO./ITEM NO.)
L-A0881 (0392)
PW V

Low Pressure Turbine (LPT)
Figure 1 (Sheet 6)
(Task 72−53−00−990−003)

LOW PRESSURE TURBINE (LPT) − HOW TO USE


72−53−85
(1/10)
72−53−80
(1/20)
72−53−83
(1/40)
72−53−82
(1/30)
NUMBERS IN ( )
REFER TO IPC
72−53−00
(FIGURE NO./ITEM NO.)
72−53−81
(1/1)
L−A0875

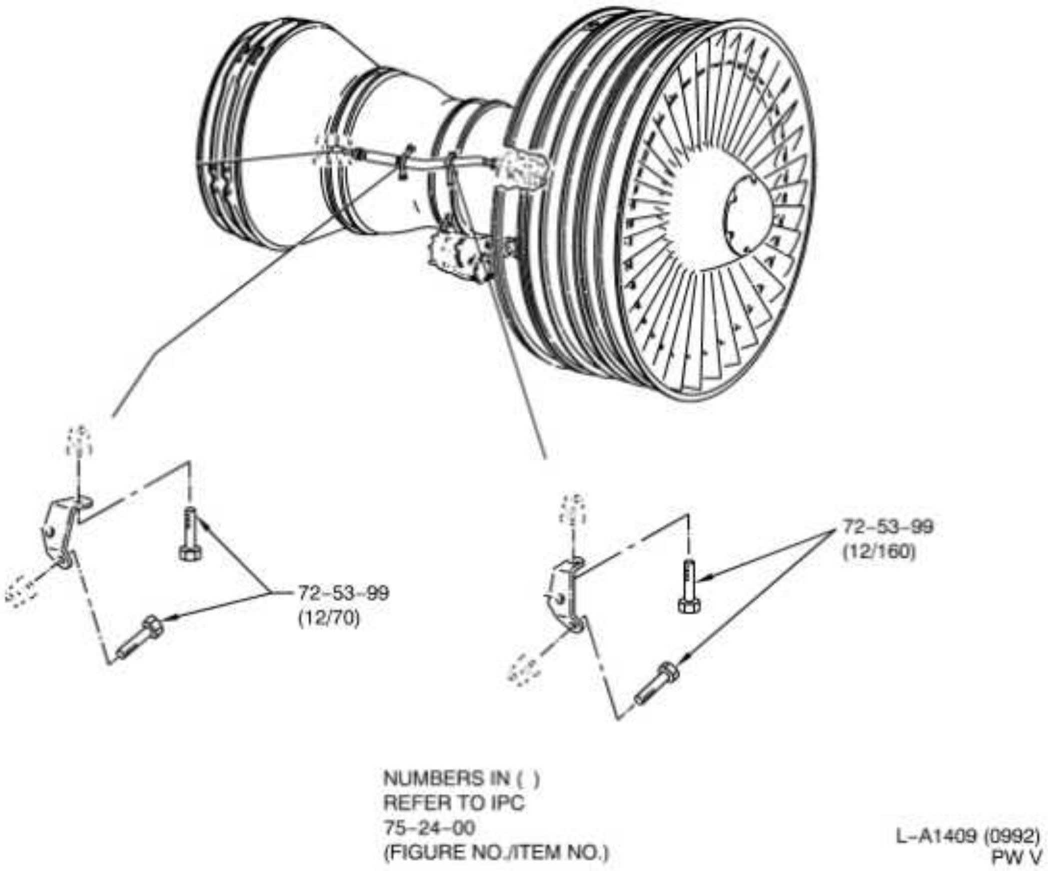
Low Pressure Turbine (LPT)
Figure 1 (Sheet 7)
(Task 72−53−00−990−003)


72−53−84
(4/100)
L−A0882 (0000)
PW V

NUMBERS IN ( )
REFER TO IPC
72−54−00
(FIGURE NO./ITEM NO.)

Low Pressure Turbine (LPT)
Figure 1 (Sheet 8)
(Task 72−53−00−990−003)

LOW PRESSURE TURBINE (LPT) − HOW TO USE


72−53−99
(12/70)
72−53−99
(12/160)
NUMBERS IN ( )
REFER TO IPC
75−24−00
(FIGURE NO./ITEM NO.)
L−A1409 (0992)
PW V

Low Pressure Turbine (LPT)
Figure 1 (Sheet 9)
(Task 72−53−00−990−003)

Previous Pageblock Return to Previous Menu Next Pageblock

LOW PRESSURE TURBINE (LPT) - DESCRIPTION AND OPERATION

Task 72-53-00-990-002:

1. Low Pressure Turbine

A. General

See Figure 1.

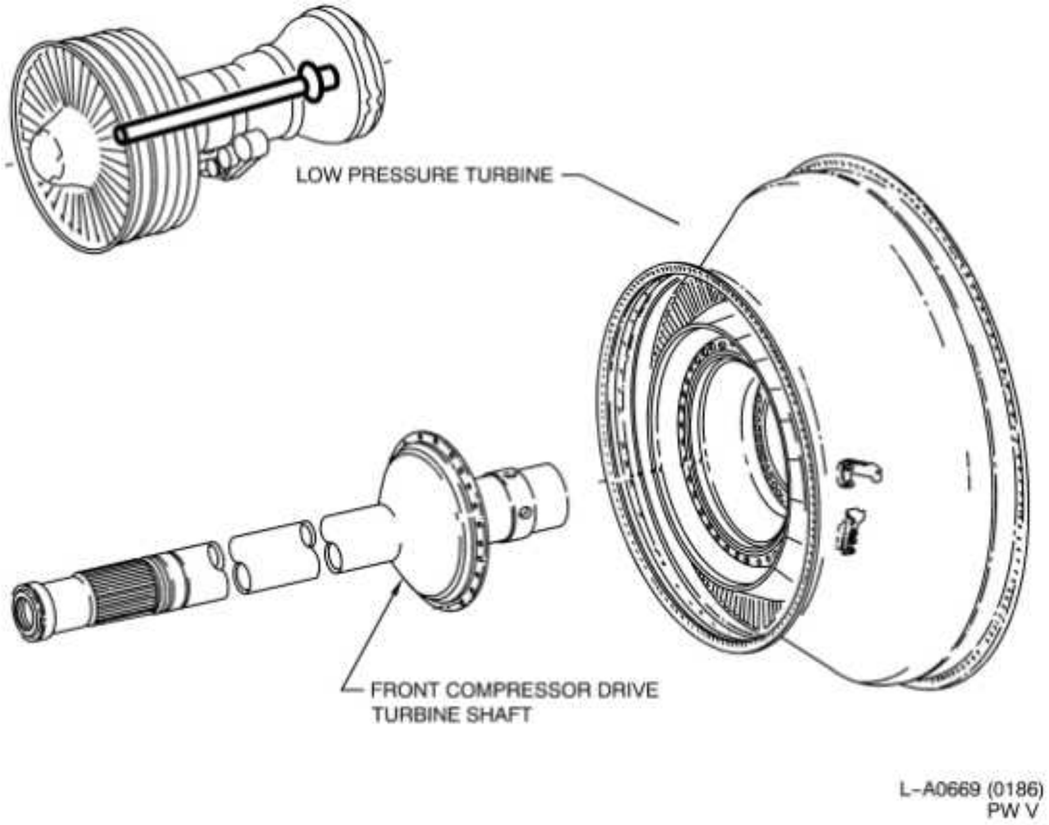
(1) The low pressure turbine (LPT) provides the rotational driving force for the low pressure compressor. This is done in the same manner as the high pressure turbine, by extracting some of the thrust energy from the combustion gases, directed by the stator vanes, at the rotor stages and transforming this energy into motional energy or work. This work energy produced by the low pressure turbine is used to drive the low pressure compressor through a turbine shaft, running through the center of the engine.

(2) The low pressure turbine consists of four rotor stages and four stator vane stages. Cooling air is provided to the low pressure turbine to reduce and regulate temperatures at the forward ID case wall (to the 4th vane hook), the blade root disk rim and fir tree areas and the inner rotor cavity areas. An automatic turbine rotor clearance control system is incorporated to increase the operating efficiency at cruise conditions. This is accomplished by cooling and shrinking the case with fan discharge air to provide optimum blade tip and seal clearances. A removable plug located at 4:30 o'clock position provides access for borescope inspection of the high pressure turbine 2nd stage, and the 3rd stage of the low pressure turbine. See Figures 2 and 3.

B. Low Pressure Turbine Rotors

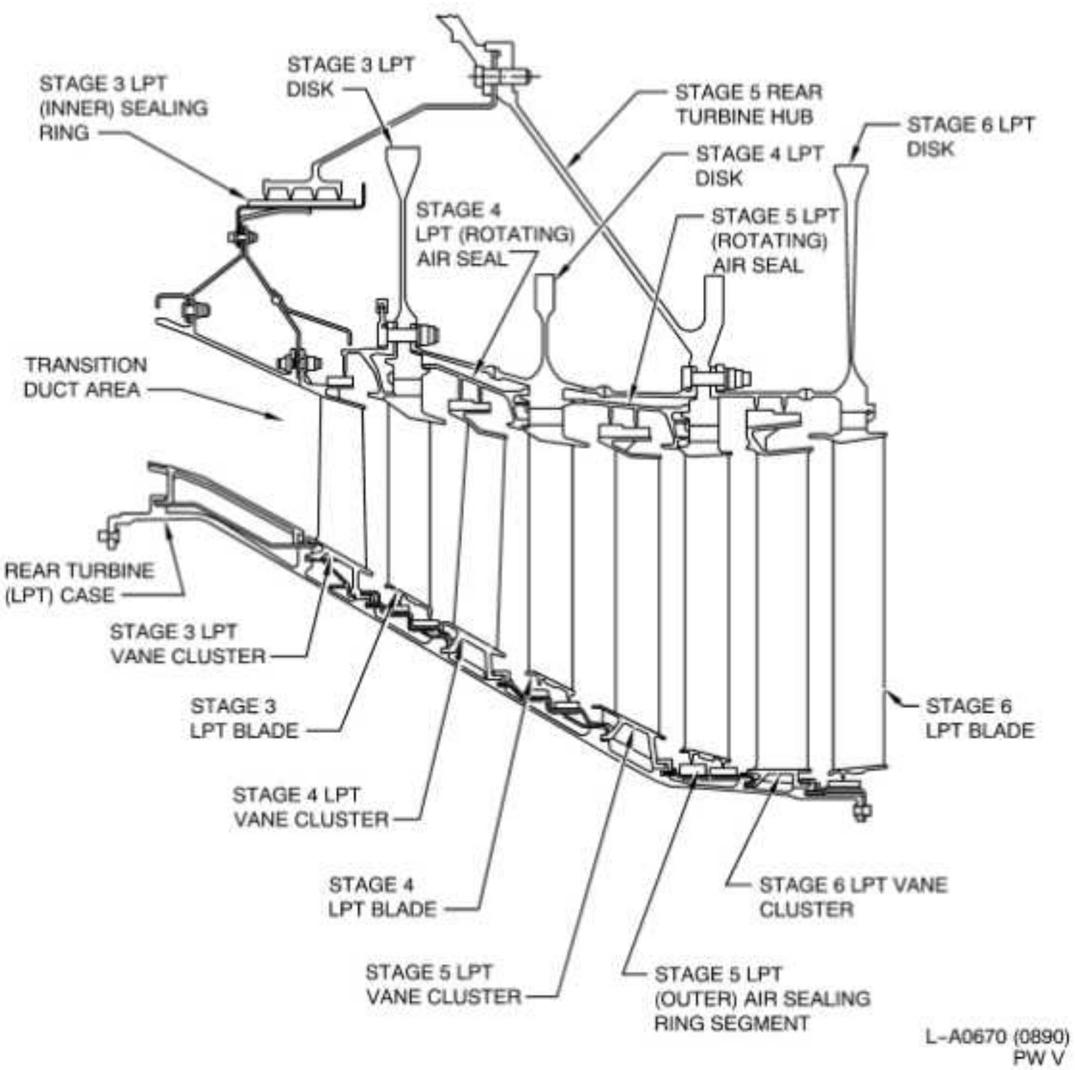
(1) The low pressure turbine rotors are of a cantilevered rotor design, with the 5th stage rear turbine hub is the primary rotating structural member. The 5th stage hub provides a bolted attachment provisions for the front compressor drive turbine shaft at the ID and the 4th and 6th stage LPT disks near the OD. The 4th stage disk is a cantilevered disk, mounted forward of the 5th stage hub with a bolted attachment to the 3rd stage disk. The 6th stage turbine rotor is cantilevered to the rear from the 5th stage hub.

LOW PRESSURE TURBINE (LPT) − DESCRIPTION AND OPERATION

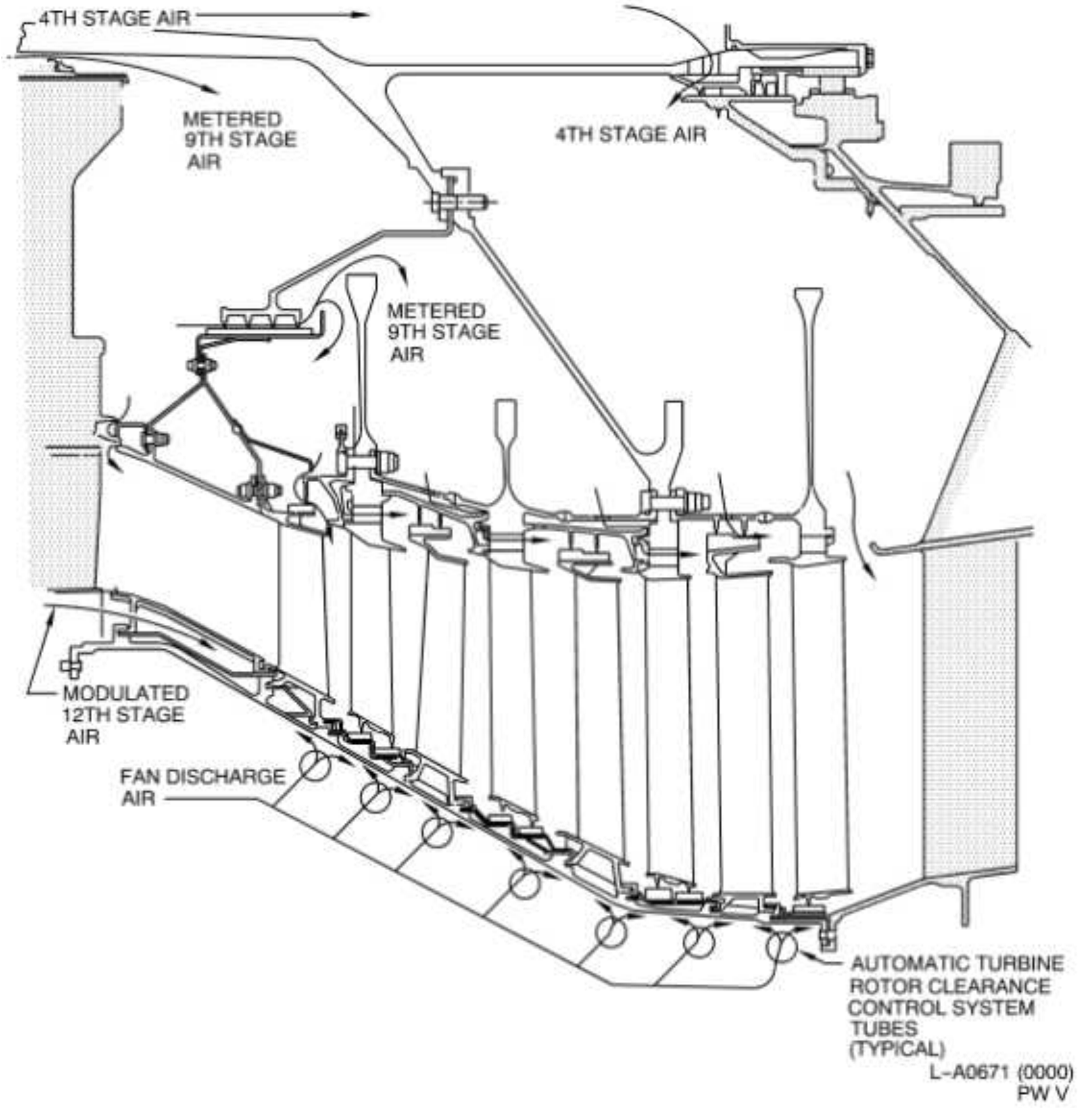

LOW PRESSURE TURBINE
FRONT COMPRESSOR DRIVE TURBINE SHAFT
L-A0669 (0186)
PW V

Low Pressure Turbine
Figure 1
(Task 72−53−00−990−002)

LOW PRESSURE TURBINE (LPT) − DESCRIPTION AND OPERATION


STAGE 3 LPT (INNER) SEALING RING
STAGE 3 LPT DISK
STAGE 5 REAR TURBINE HUB
STAGE 6 LPT DISK
STAGE 4 LPT DISK
STAGE 4 LPT (ROTATING) AIR SEAL
STAGE 5 LPT (ROTATING) AIR SEAL
TRANSITION DUCT AREA
REAR TURBINE (LPT) CASE
STAGE 3 LPT VANE CLUSTER
STAGE 3 LPT BLADE
STAGE 6 LPT BLADE
STAGE 4 LPT VANE CLUSTER
STAGE 4 LPT BLADE
STAGE 6 LPT VANE CLUSTER
STAGE 5 LPT VANE CLUSTER
STAGE 5 LPT (OUTER) AIR SEALING RING SEGMENT
L-A0670 (0890)
PW V

Low Pressure Turbine
Figure 2
(Task 72−53−00−990−002)


4TH STAGE AIR
METERED 9TH STAGE AIR
4TH STAGE AIR
METERED 9TH STAGE AIR
MODULATED 12TH STAGE AIR
FAN DISCHARGE AIR
AUTOMATIC TURBINE ROTOR CLEARANCE CONTROL SYSTEM TUBES (TYPICAL)
L-A0671 (0000)
PW V

Low Pressure Turbine Airflow System
Figure 3
(Task 72−53−00−990−002)

LOW PRESSURE TURBINE (LPT) − DESCRIPTION AND OPERATION

(2) Between the 3rd and 4th, and 4th and 5th stage turbine rotor assemblies are rotating knife−edge airseals which are locked in place by the disks. The airseal knife−edges along with the integral knife−edges on the 6th stage disk align with an abradable honeycomb vane inner seal land to form the vane inner seal. This seal prevents gaspath leakage around the ID of the vanes.

(3) The 3rd stage rotor blades are coated with an aluminized coating, and remaining stages are uncoated. Outer shrouds of the turbine blades incorporate interlocking hardfaced notches, and double knife−edge seals except for the 6th stage which has a single knife−edge. These knife−edges align with abradable honeycomb (outer) airseal land segments installed in the turbine case.

LOW PRESSURE TURBINE (LPT) - REMOVAL-01

Task 72-53-00-020-001:

1. Remove Turbine Exhaust Case From Low Pressure Turbine

NOTE: See Figure 301 for part/assembly removal sequence.

A. Prerequisites

(1) Remove The Low Pressure Turbine And Turbine Exhaust Case With Shaft. Refer to 72-00-53, Removal-08 (Task 72-00-53-020-002).

B. Equipment And Materials Necessary

Standard Tools:
0.190-32 Jackscrews (12 necessary)

Special Tools:

PWA 3755	Pump, Hydraulic (Optional To PWA 29389)
PWA 25040	Bracket, Support (Optional To PWA 85195 Bracket For Engines With Exhaust Nozzle Removed)
PWA 25041	Bracket, Support (Optional To PWA 85195 Bracket For Engines With Exhaust Nozzle Removed)
PWA 28374	Guide (Optional To PWA 85850)
PWA 28414	Bracket, Support (Optional To PWA 85195 For Engine Horizontal Support)
PWA 28657	Sling, Strongback
PWA 29243	Bracket, Support (2 Necessary) (Optional To PWA 85195 Brackets For Engine Horizontal Support)
PWA 29389	Pump, Hydraulic
PWA 75284	Puller, Knocker
PWA 75995	Support And Guide (Optional To PWA 102178)
PWA 76154	Adapter (2 necessary)
PWA 85195	Bracket Support (Optional To PWA 25040, PWA 25041, PWA 28414, PWA 29243)
PWA 85305	Pins, Aligning (2 necessary)
PWA 85431	Puller, Hydraulic
PWA 85432	Puller, Hydraulic
PWA 85434	Puller, Jackscrew
PWA 85583	Fixture, Support
PWA 85850	Guide (Optional To PWA 28374)
PWA 86438	Adapter
PWA 102178	Support, Rear (Optional To PWA 75995)

C. Procedure

LOW PRESSURE TURBINE (LPT) − REMOVAL−01

(1) Install PWA 85195, PWA 29243, PWA 25040 and PWA 25041, or PWA 28414 Support Brackets to turbine exhaust case at 3 and 9 o'clock locations. See Figure 302.

NOTE: PWA 29243 or PWA 28414 Brackets may be used in place of PWA 85195 Brackets for horizontal support only.

NOTE: PWA 25040 and PWA 25041 Brackets may be used in place of PWA 85195 Brackets on engines with exhaust nozzle removed.

(a) Position brackets between case rails and align holes.

NOTE: If applicable, install PWA 25040 Bracket at 3 o'clock and PWA 25041 Bracket at 9 o'clock positions.

(b) For PWA 85195 Brackets or PWA 25040 and PWA 25041 Brackets, install pin from rear through flange and bracket. Secure pin with safety pin as necessary.

(c) For other brackets, insert pin through flanges and bracket and install bushings through flanges and into bracket. Secure pins with nuts.

(2) Attach PWA 28657 Sling, two PWA 76154 Adapters and hoist to spools on exhaust case at 3 and 9 o'clock.

(3) Remove No. 4 bearing retaining plate (303/3). See Figure 303.

(a) Remove bolts (303/4) securing retaining plate to front compressor drive turbine shaft (303/1).

(b) Rotate knurled nut detail of PWA 75284 Knocker Puller to retract jaws. Install puller onto retaining plate with jaws in line with slots in retaining plate wall. Tighten knurled nut to secure jaws in retaining plate. Using slide hammer, remove retaining plate from shaft. Remove puller.

(c) Discard packing (303/2).

(4) Install PWA 75995 Support, PWA 86438 Adapter, and PWA 28374 Guide to the front compressor drive turbine shaft (304/7) and the exhaust case. See Figure 304.

NOTE: See the step that follows to install the optional support and guide tools.

(a) Align the boltholes and put the PWA 75995 Support against the turbine shaft. Install the support with eight screws (304/5).

(b) Install the PWA 28374 Guide on the support shaft and put it against the turbine shaft.

(c) Install the PWA 85696 Adapter on the support shaft and move it toward the exhaust case. Align the boltholes and install the adapter with five screws (304/6).

(5) Install the optional PWA 102178 Support and PWA 85850 Guide to the front compressor drive turbine shaft (304/7) and the exhaust case. See Figure 304.

(a) Align the boltholes and put the support (304/3) against the turbine shaft. Install the support with eight screws (304/1).

(b) Install the PWA 85850 Guide on the shaft and put it against the turbine shaft.

(c) Install the adapter (304/4) on the support (304/3) and move it toward the exhaust case. Align the boltholes and install the adapter with five screws (304/2).

(6) Position 12 to 16 brass shims equally spaced over 90 - 100 degree arc. Place shims just to rear of knife-edge seal between 6th stage blade outer shrouds and 6th stage air sealing ring segments.

(7) Adjust the sling and hoist attached to the spools on the exhaust case to support the case when separating it from the low pressure turbine.

(8) Remove Flange P bolts, nuts and brackets securing turbine exhaust case to turbine case. Refer to 72-00-54, Removal-20 (Task 72-00-54-020-005).

(9) Install two PWA 85305 Aligning Pins, 180 degrees apart, in Flange P.

(a) Locate smaller .190−32 threaded bolthole in the exhaust case and secure plate to rear of exhaust case using detail screw.

(b) Insert two aligning pins through boltholes in turbine case flange and thread into tapped holes in plate.

(10) Using twelve 0.190−32 Jackscrews, remove turbine exhaust case from snap diameter of low pressure turbine case.

(11) Move turbine exhaust case rearward approximately 12 inches (304.8 mm).

(12) Install PWA 85583 Fixture to rear flange of turbine rear case. See Figure 305.

(a) Center flange segment (305/5) to rear flange of turbine rear case (305/7) at 12 o'clock location. Secure flange segment to case with six bolts (305/6).

(b) Loosen two jamnuts (305/4). Adjust nut (305/1) to support ID of 6th stage LPT disk (305/3) to maintain proper positioning of low pressure turbine rotor.

(13) Slide turbine exhaust case rearward.

CAUTION: WHEN REMOVING THE TURBINE EXHAUST CASE AND POSITIONING IT ONTO THE PALLET, CARE MUST BE TAKEN NOT TO DAMAGE FRONT END SEAL RING.

(14) Provide suitable support on pallet to protect front end seal. Lower turbine exhaust case, front end down, onto pallet.

(15) Remove adapters, sling and two brackets at 3 and 9 o'clock locations on turbine exhaust case. Remove alignment pins from turbine rear case flange.

(16) Remove tools from front compressor drive turbine shaft and turbine exhaust case. See Figure 306 and Figure 307.

(a) Remove five screws (306/1) that attach the adapter to the inner flange of the exhaust case. Remove the adapter. See Figure 306.

(b) Remove the PWA 28374 or PWA 85850 Guide from the support. See Figure 307.

(c) Remove eight screws (307/1) that attach the PWA 75995 or PWA 102178 Support to the front compressor drive turbine shaft (307/2). Remove the support.

NOTE: Threaded holes near the end of the support can be used with a lifting eye and hoist to hold the support.

CAUTION: ENSURE THAT NO. 4 BEARING INNER AND OUTER RACES ARE KEPT TOGETHER.

(17) Remove No. 4 bearing (rear) seal spacer (308/5) and inner race (308/6) from front compressor drive turbine shaft (308/1) using PWA 85431 Puller. See Figure 308.

(a) Remove jaw retaining ring from puller and slide three jaws outward.

(b) Position puller on end of front compressor drive turbine shaft. Secure inner locating ring to turbine shaft with three detail screws.

(c) Slide three jaws inward behind puller lip of No. 4 bearing seal spacer (308/5). Install retaining ring over jaws and seat on lugs of jaws.

(d) Attach PWA 29389 or PWA 3755 Hydraulic Pump to hydraulic cylinder on puller.

(e) Actuate pump to remove inner race and spacer from turbine shaft.

(f) Disconnect hydraulic pump. Remove retaining ring and slide jaws outward. Remove bolts securing locating ring to turbine shaft. Remove puller from engine.

(g) Remove bearing inner race and spacer from turbine shaft and store parts in suitable container.

(18) Remove No. 4 bearing (front) seal spacer (308/3) and No. 4 bearing (carbon) face seal (308/4) using PWA 85434 Puller.

(a) Rotate outer plate to centralize three puller legs between arms of inner plate. Slide three puller legs inward.

(b) Position puller on end of front compressor drive turbine shaft. Secure inner plate to turbine shaft with three detail screws.

(c) Slide three puller legs outward to engage puller lip in ID of No. 4 bearing (front) seal spacer. It may be necessary to turn jackscrew to align puller lip on jaws with puller groove in spacer. Rotate outer plate detail to align puller legs with three arms of inner plate detail to secure puller.

(d) Turn center jackscrew to remove seal and spacer.

(e) Rotate outer plate to centralize three puller legs between arms of inner plate. Loosen screws and slide jaws inward. Remove screws securing inner plate to turbine shaft and remove puller from shaft.

(f) Remove (carbon) face seal and seal spacer from turbine shaft and store parts in suitable containers.

(19) Remove 6th stage LPT airseal (308/2) from LPT (rear hub) (308/1) using PWA 85432 Puller.

(a) Remove jaw retaining ring from puller and slide four jaws outward.

(b) Position puller on end of front compressor drive turbine shaft. Secure inner locating ring to turbine shaft with two detail screws.

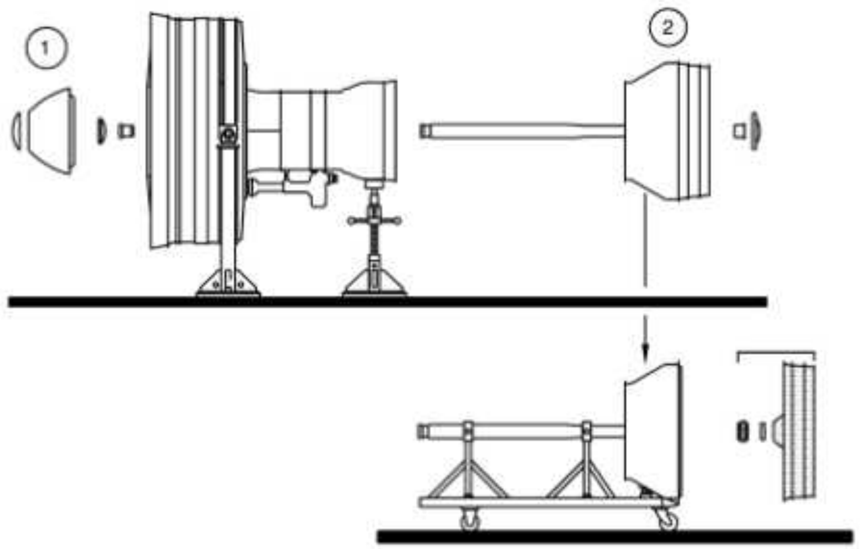
(c) Slide four jaws inward, engaging puller legs in four holes in side of airseal. Install retaining ring over jaws and seal on lugs of jaws.

(d) Attach PWA 29389 or PWA 3755 Hydraulic Pump to hydraulic cylinder on puller.

(e) Actuate pump to remove airseal from turbine shaft.

(f) Disconnect hydraulic pump. Remove retaining ring and slide jaws outward. Remove bolts securing locating ring to turbine shaft. Remove puller from engine.

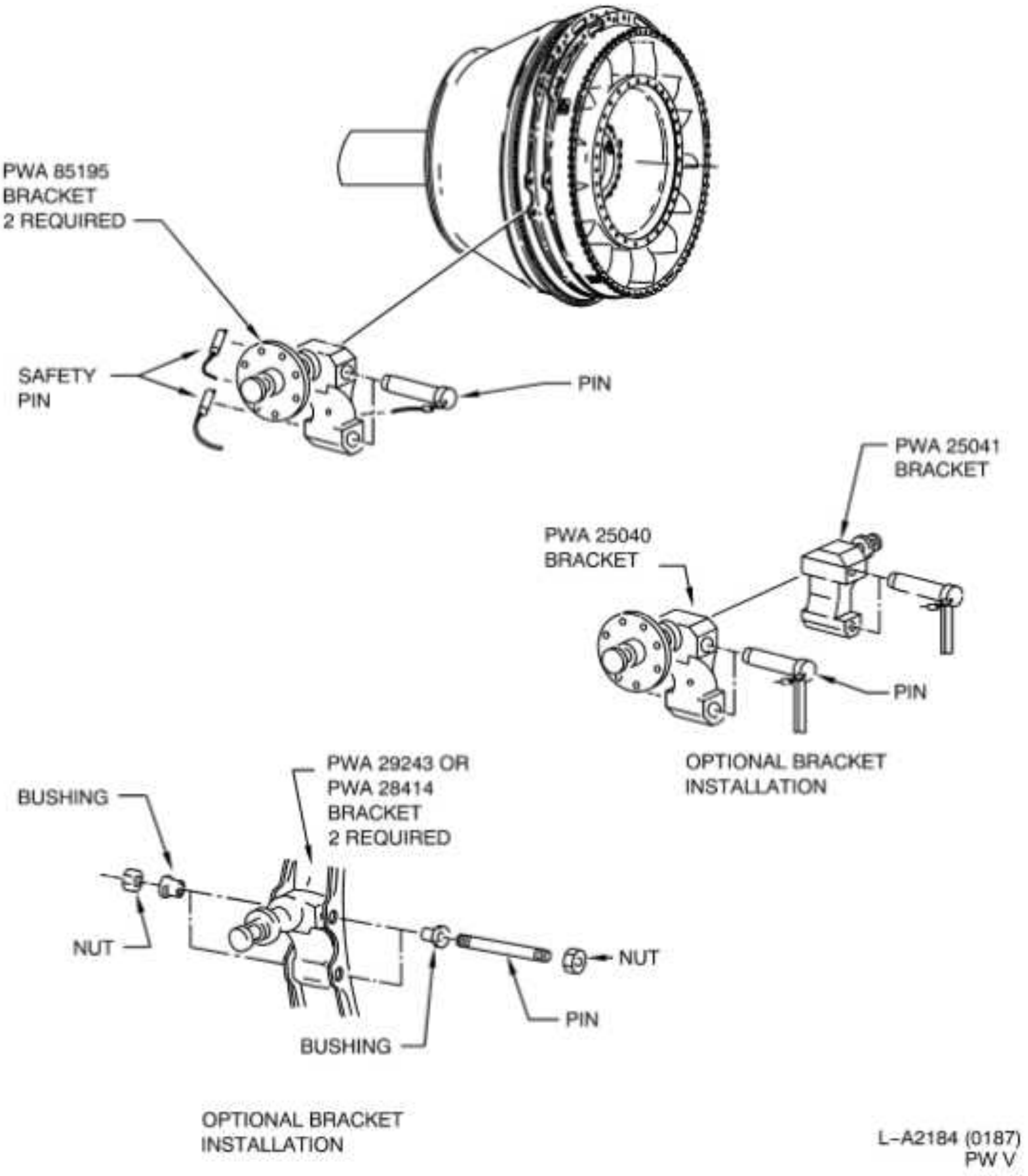
(g) Remove airseal from turbine shaft and store in suitable container.



1. REMOVE COMPRESSOR INLET CONE
2. REMOVE LOW PRESSURE TURBINE AND TURBINE EXHAUST CASE WITH SHAFT

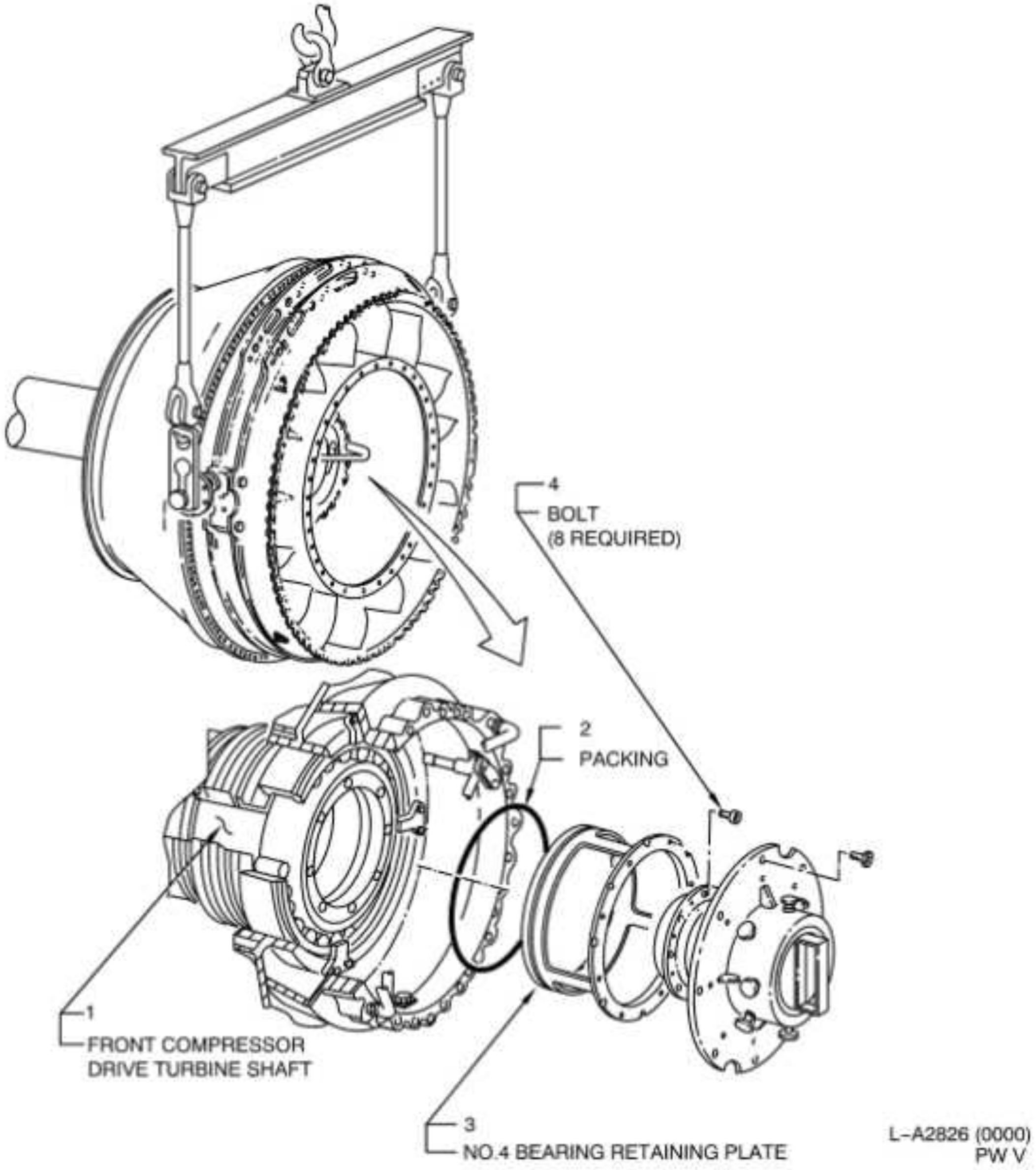
L-A2021 (0000)
PW V

Procedure Sequence
Figure 301
(Task 72−53−00−020−001)

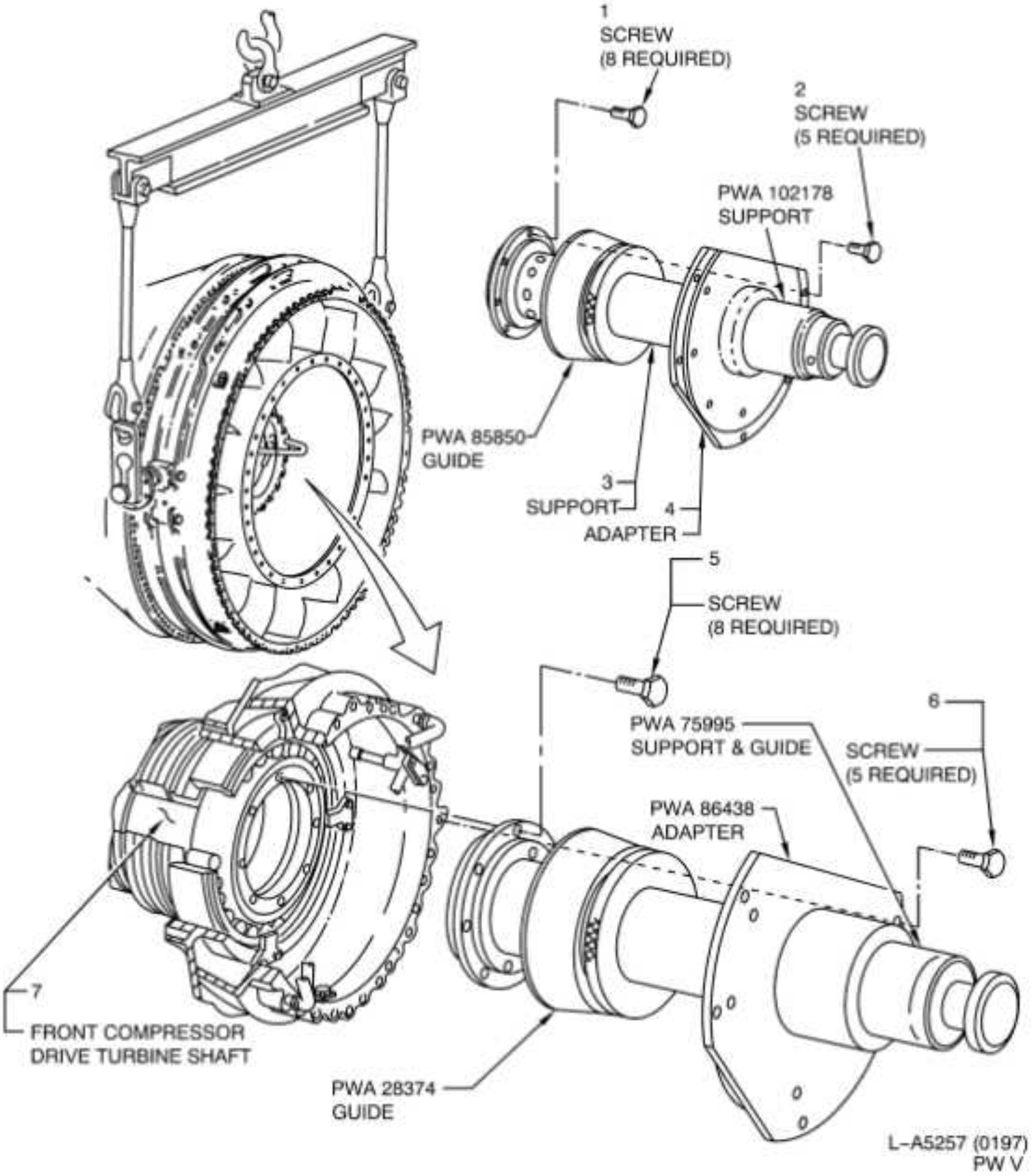

PWA 85195
BRACKET
2 REQUIRED
SAFETY
PIN
PIN
PWA 25041
BRACKET
PWA 25040
BRACKET
PIN
OPTIONAL BRACKET
INSTALLATION
BUSHING
PWA 29243 OR
PWA 28414
BRACKET
2 REQUIRED
NUT
NUT
PIN
BUSHING
OPTIONAL BRACKET
INSTALLATION
L−A2184 (0187)
PW V

Turbine Exhaust Case Removal
Figure 302
(Task 72−53−00−020−001)

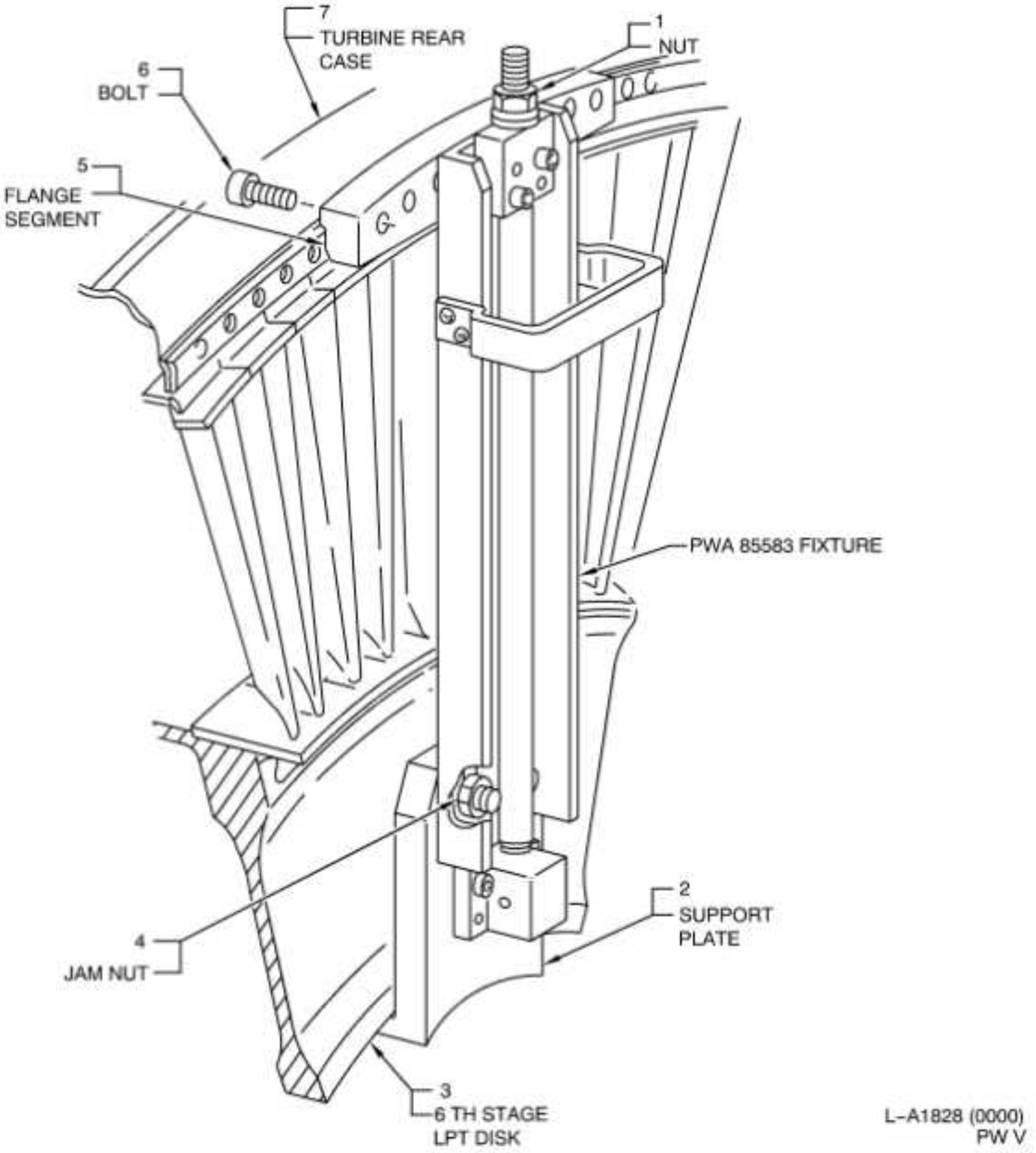
LOW PRESSURE TURBINE (LPT) − REMOVAL−01


4
BOLT
(8 REQUIRED)
2
PACKING
1
FRONT COMPRESSOR
DRIVE TURBINE SHAFT
3
NO.4 BEARING RETAINING PLATE
L−A2826 (0000)
PW V

Turbine Exhaust Case Removal
Figure 303
(Task 72−53−00−020−001)

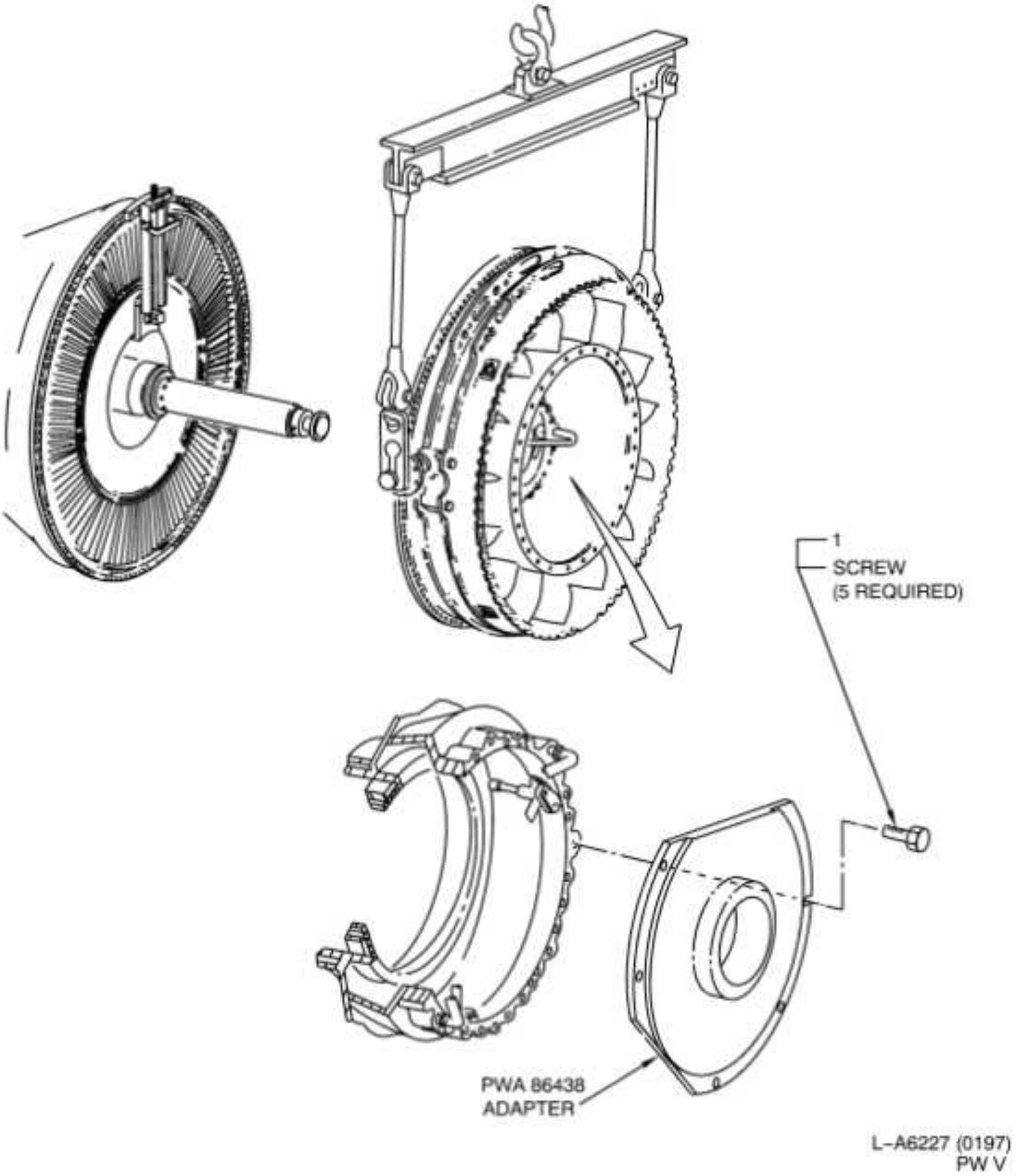

1
SCREW
(8 REQUIRED)
2
SCREW
(5 REQUIRED)
PWA 102178
SUPPORT
PWA 85850
GUIDE
3
SUPPORT
4
ADAPTER
5
SCREW
(8 REQUIRED)
6
PWA 75995
SUPPORT & GUIDE
SCREW
(5 REQUIRED)
PWA 86438
ADAPTER
7
FRONT COMPRESSOR
DRIVE TURBINE SHAFT
PWA 28374
GUIDE
L−A5257 (0197)
PW V

Support Installation
Figure 304
(Task 72−53−00−020−001)


7
TURBINE REAR CASE
1
NUT
6
BOLT
5
FLANGE SEGMENT
PWA 85583 FIXTURE
2
SUPPORT PLATE
4
JAM NUT
3
6 TH STAGE LPT DISK
L−A1828 (0000)
PW V

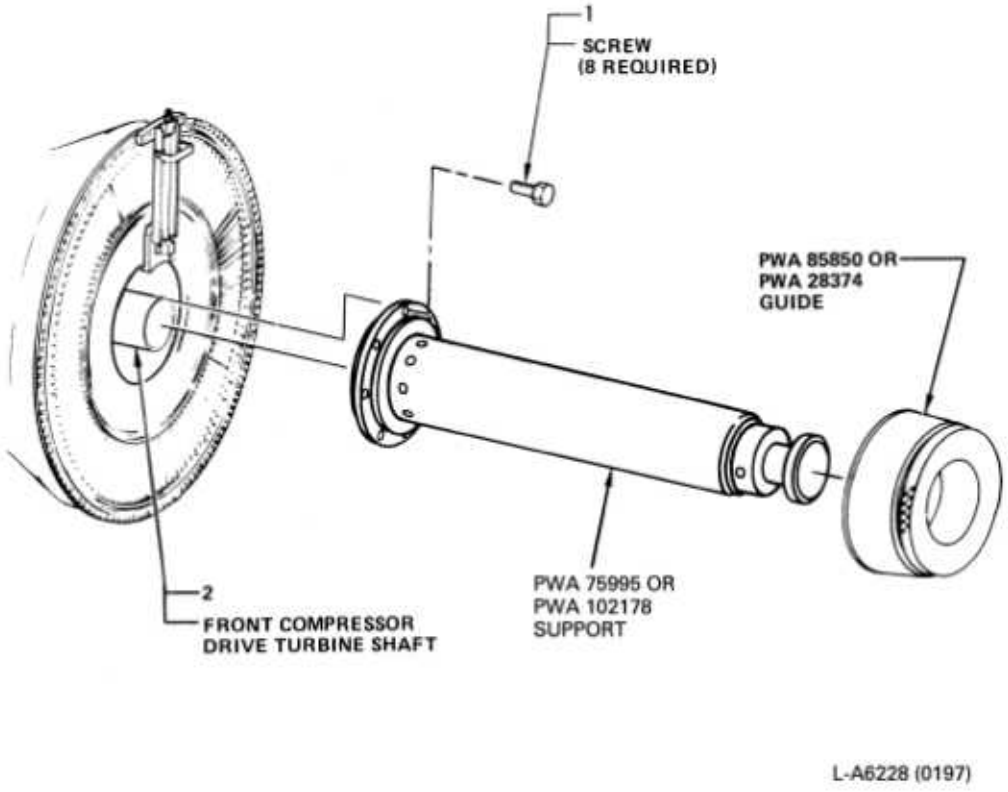
LPT Rotor Support Fixture Installation
Figure 305
(Task 72−53−00−020−001)

LOW PRESSURE TURBINE (LPT) − REMOVAL−01

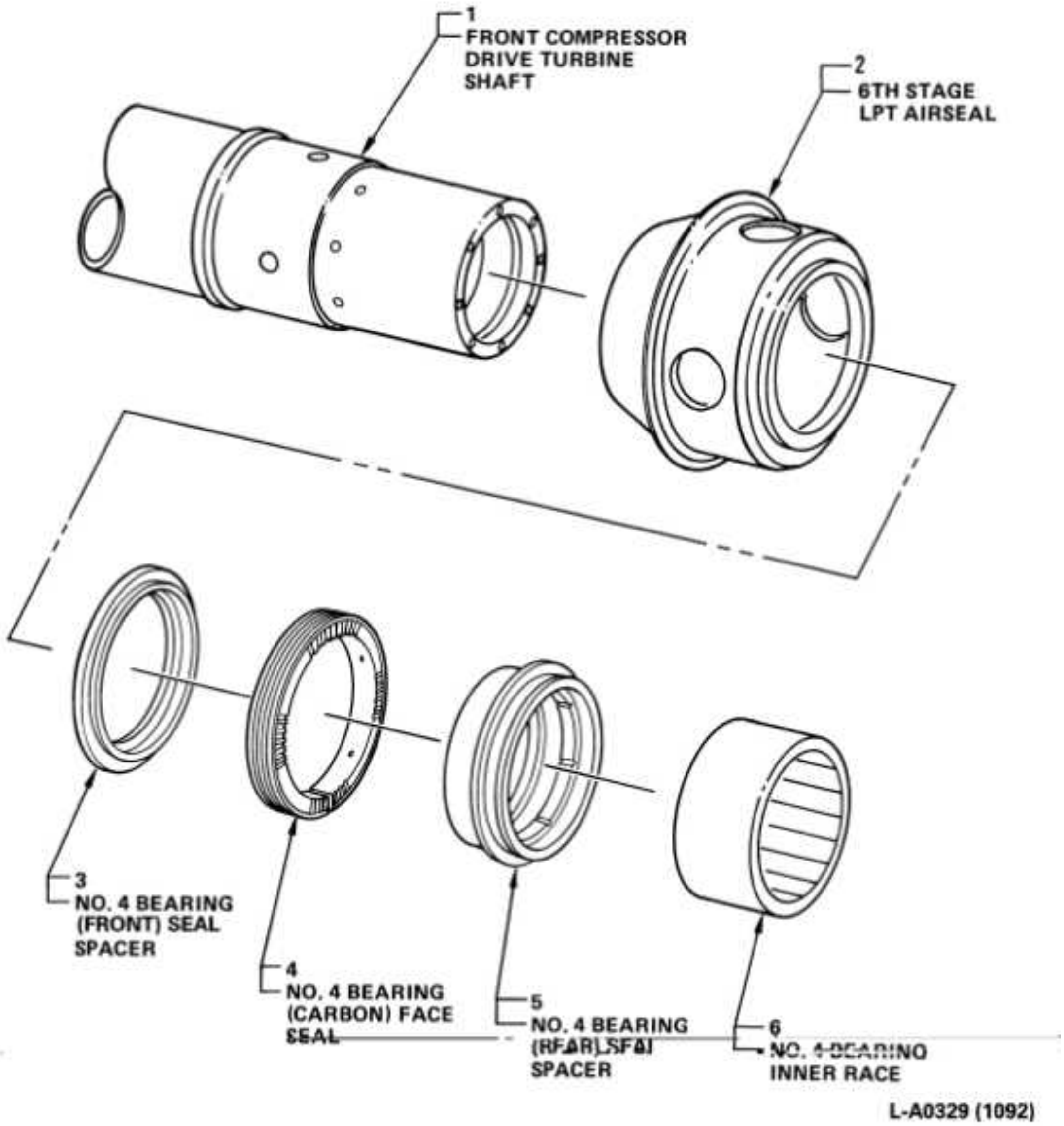

1
SCREW
(5 REQUIRED)
PWA 86438
ADAPTER
L−A6227 (0197)
PW V

Adapter Removal
Figure 306
(Task 72−53−00−020−001)

LOW PRESSURE TURBINE (LPT) − REMOVAL−01


1
SCREW
(8 REQUIRED)
PWA 85850 OR
PWA 28374
GUIDE
2
FRONT COMPRESSOR
DRIVE TURBINE SHAFT
PWA 75995 OR
PWA 102178
SUPPORT
L-A6228 (0197)

Support And Guide Removal
Figure 307
(Task 72−53−00−020−001)


1
FRONT COMPRESSOR DRIVE TURBINE SHAFT
2
6TH STAGE LPT AIRSEAL
3
NO. 4 BEARING (FRONT) SEAL SPACER
4
NO. 4 BEARING (CARBON) FACE SEAL
5
NO. 4 BEARING (REAR) SEAL SPACER
6
NO. 4 BEARING INNER RACE
L-A0329 (1092)

Turbine Exhaust Case Removal
Figure 308
(Task 72−53−00−020−001)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-53-00-420-001:

1. Install Turbine Exhaust Case To Low Pressure Turbine

NOTE: See Figure 401 for part/assembly installation sequence.

A. Prerequisites

(1) See 72-53-00, Inspection/Check-01 Task 72-53-00-990-001 for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:

	PWA 25040	Bracket, Support (Optional To PWA 85195 Bracket For Engines With Exhaust Nozzle Removed)
	PWA 25041	Bracket, Support (Optional To PWA 85195 Bracket For Engines With Exhaust Nozzle Removed)
	PWA 28374	Guide (Optional To PWA 85850)
	PWA 28414	Bracket, Support (Optional To PWA 85195 For Engine Horizontal Support)
	PWA 28657	Sling, Strongback
	PWA 29243	Bracket, Support (2 Necessary) (Optional To PWA 85195 Brackets For Engine Horizontal Support)
	PWA 75995	Support And Guide (Optional To PWA 102178)
	PWA 76154	Adapter (2 Necessary)
	PWA 85195	Bracket, Support (2 Necessary)
	PWA 85305	Pins, Aligning (2 Necessary)
	PWA 85452	Eye, Lifting (Optional To PWA 28657)
R R	PWA 85453	Drift, Install (Optional to PWA 106326)
	PWA 85850	Guide (Optional To PWA 28374)
	PWA 86438	Adapter
	PWA 102178	Support Rear (Optional To PWA 75995 And PWA 86438)
R R	PWA 106326	Drift, Install (No. 4 Bearing Inner Race, Seals, And Spacers)

LOW PRESSURE TURBINE (LPT) − INSTALLATION−01

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72−54−00/4/90

C. Procedure

(1) Ensure that No. 4 bearing (carbon) face seal gap dimensional requirement (Reference 829) is met.

(2) (Reference 1003) Install No. 4 bearing inner race, face seal (carbon) and seal spacers (front) and (rear). See Figure 402 and Figure 403.

NOTE: All parts must be within ± 10°F (± 5.6°C) when making all measurements.

(a) Stack 6th stage LPT airseal (402/2), No. 4 bearing (front) seal spacer (402/3), No. 4 bearing (rear) seal spacer (402/5) and No. 4 bearing inner race (402/6) on bench. Ensure that zero clearance is maintained between mating faces. Measure overall stacking dimension and record as Dimension N.

(b) Measure dimension from 6th stage airseal shoulder Face P, to rear face of front compressor drive turbine shaft (402/1). Record as Dimension R.

(c) Dimension N − Dimension R must equal 0.005 − 0.020 inch (0.13 − 0.51 mm).

(d) Position 6th stage LPT airseal (403/2) on front compressor drive turbine shaft (403/1). Seat airseal onto shoulder of rear hub using PWA 85453
R or PWA 106326 Drift and mallet.

(e) Install No. 4 bearing (front) seal spacer (403/3), (carbon) face seal (403/4) and (rear) seal spacer (403/5) onto front compressor drive turbine shaft (403/1). Seat parts using PWA 85453
R or PWA 106326 Drift and mallet.

(f) Heat No. 4 bearing inner race (403/6). See Standard Practices Manual, PN 585005.

(g) Install No. 4 bearing inner race onto front compressor drive turbine shaft (403/1). Using PWA 85453 or PWA 106326 Drift, seat inner race and previously installed spacers. R

(h) Measure Dimension S from rear face of No. 4 bearing inner race to rear face of front compressor drive turbine shaft (402/1). See Figure 402.

(i) Dimension S must equal Dimension N - Dimension R plus 0.000 or minus 0.001 inch (plus 0.000 or minus 0.025 mm).

(j) If Dimension S is not within limits, remove bearing inner race, spacers and seals from turbine shaft and repeat steps (d) through (i).

(3) Install PWA 85195 Support Brackets, PWA 29243 Support Brackets, PWA 25040 Support Brackets and PWA 25041 Support Brackets, or PWA 28414 Support Brackets to turbine exhaust case at 3 and 9 o'clock locations. See Figure 404.

NOTE: PWA 29243 Brackets or PWA 28414 Brackets may be used in place of PWA 85195 Brackets for horizontal support only.

NOTE: PWA 25040 and PWA 25041 Brackets may be used in place of PWA 85195 Brackets on engines with exhaust nozzle removed.

(a) Position brackets between case rails and align holes.

NOTE: If applicable, install PWA 25040 Bracket at 3 o'clock and PWA 25041 Bracket at 9 o'clock positions.

(b) For PWA 85195 Brackets or PWA 25040 Brackets and PWA 25041 Brackets, install pin from rear through flange and bracket. Secure pin with safety pin as required.

(c) For other brackets, insert pin through flanges and bracket and install bushings through flanges and into bracket. Secure pins with nuts.

(4) Attach hoist to PWA 28657 Sling. Using two PWA 76154 Adapters attach sling to spools of brackets on case. Raise case from pallet and trunnion to horizontal position.

(5) Install two PWA 85305 Aligning Pins, 180 degrees apart, in Flange P.

(a) Locate smaller .190−32 threaded bolt hole in exhaust case and secure plate to rear of exhaust case using detail screw.

(b) Insert two aligning pins through bolt holes in turbine case flange and thread into tapped holes in plate.

(6) Install PWA 102178 Support and PWA 85850 Guide or PWA 75995 Support, PWA 86438 Adapter and PWA 28374 Guide onto turbine shaft and turbine exhaust case. See Figure 405 and Figure 406.

(a) Align boltholes and insert flanged end of support (support and guide) (405/2) into ID of front compressor drive turbine shaft (405/3). Secure flange to turbine shaft with eight screws (405/1). Install guide over shaft.

(b) Align boltholes and install support (adapter) (406/3) into inner flange of turbine exhaust case. Secure flange to case with five screws (406/2).

(7) Move exhaust case into position at rear of turbine case. Adjust hoist as required and slide support (adapter) (406/3) onto to support (support and guide) (406/1).

(8) Remove PWA 85583 Fixture from low pressure turbine. See Figure 407.

(a) Loosen jamnuts (407/4) and nut (407/1) as required to lower support plate (407/2) from 6th stage LPT disk (407/3).

(b) Remove bolts (407/6) securing flange segment (407/5) to turbine rear case (407/7). Remove fixture.

(9) Slide exhaust case forward, mating bearing rollers on exhaust case with inner race on turbine shaft. Seat exhaust case front flange against turbine exhaust case rear flange.

(10) Install several bolts and nuts equally spaced and evenly tighten nuts to seat snap diameter. Remove aligning pins.

(11) Remove brass shims supporting low pressure turbine rotor. Shims are between 6th stage blade outer shrouds and 6th stage air sealing ring segments.

(12) Install Flange P bolts, brackets and nuts. Refer to 72−00−54, Removal−20 (Task 72−00−54−420−005).

(13) Remove hoist, sling and adapters from turbine exhaust case.

(14) Remove PWA 75995 Support, PWA 86438 Adapter and PWA 28374 Guide from the front compressor drive turbine shaft and the turbine exhaust case. See Figure 408.

NOTE: See the step that follows to remove the optional support and guide tools.

(a) Remove five screws (408/6) that secure the PWA 86438 Adapter to the exhaust case. Remove the adapter.

(b) Remove the PWA 28374 Guide from the support.

(c) Remove eight screws (408/5) that secure the PWA 75995 Support to the turbine shaft (408/7). Remove the support.

NOTE: A lifting eye can be used with the support to help to remove it from the turbine shaft.

(15) Remove the optional PWA 102178 Support and PWA 85850 Guide from the front compressor drive turbine shaft and the turbine exhaust case.

(a) Remove five screws (408/2) that secure the adapter (408/4) to the exhaust case. Remove the adapter.

(b) Remove the PWA 85850 Guide from the support.

(c) Remove eight screws (408/1) that secure the support (408/3) to the turbine shaft (408/7). Remove the support.

NOTE: A lifting eye can be used with the support to help to remove it from the turbine shaft.

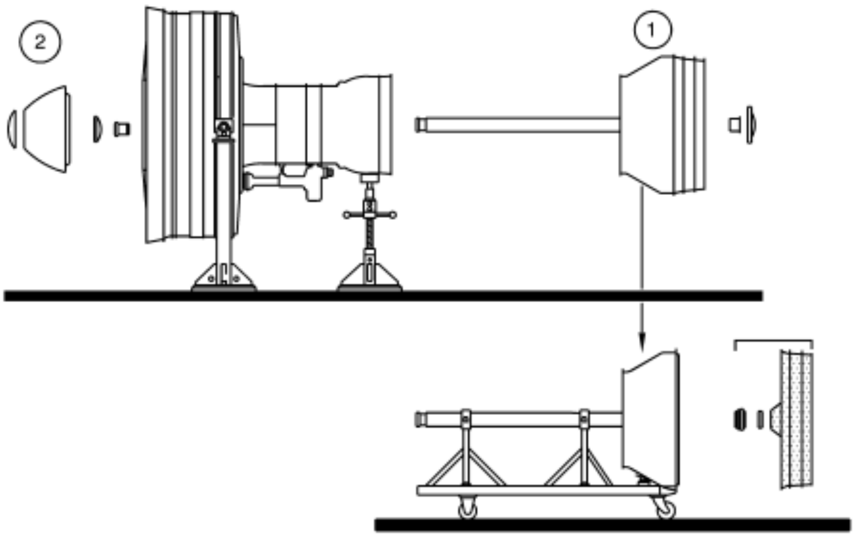
(16) Lubricate new packing (409/2) with Engine Oil P03−001 and install packing into groove in front diameter of No. 4 bearing retaining plate (409/3). Align boltholes and install retaining plate into rear inner diameter of front compressor drive turbine shaft (409/1). Secure retaining plate using eight work bolts (409/4). Do not torque bolts. See Figure 409.

(17) Remove support brackets from turbine exhaust case at 3 and 9 o'clock locations.

D. Postrequisites

(1) Install The Low Pressure Turbine And Turbine Exhaust Case With Shaft. Refer to 72−00−53, Installation−08 (Task 72−00−53−420−002).

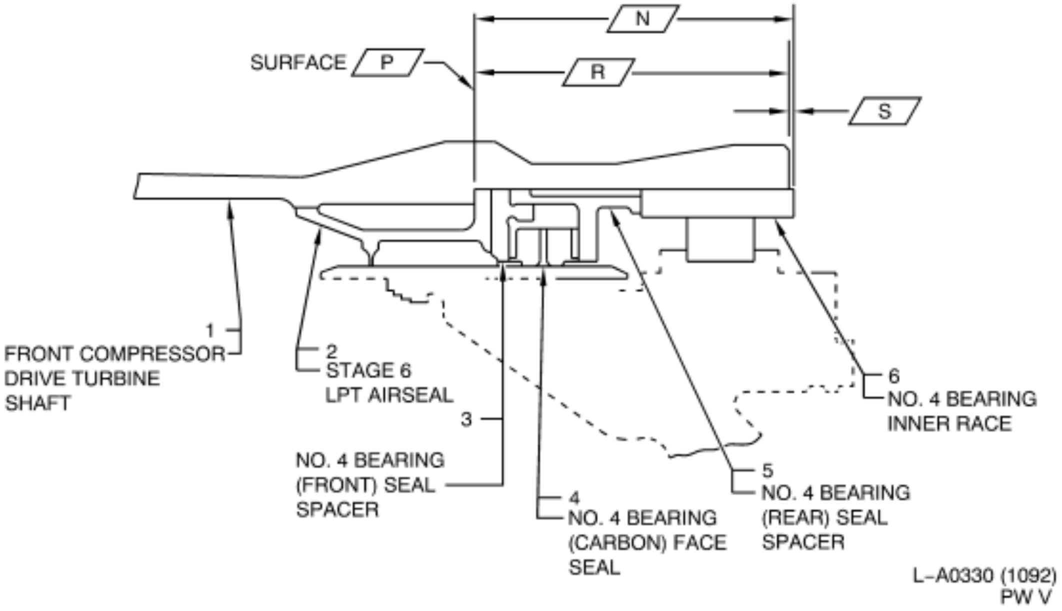
LOW PRESSURE TURBINE (LPT) − INSTALLATION−01



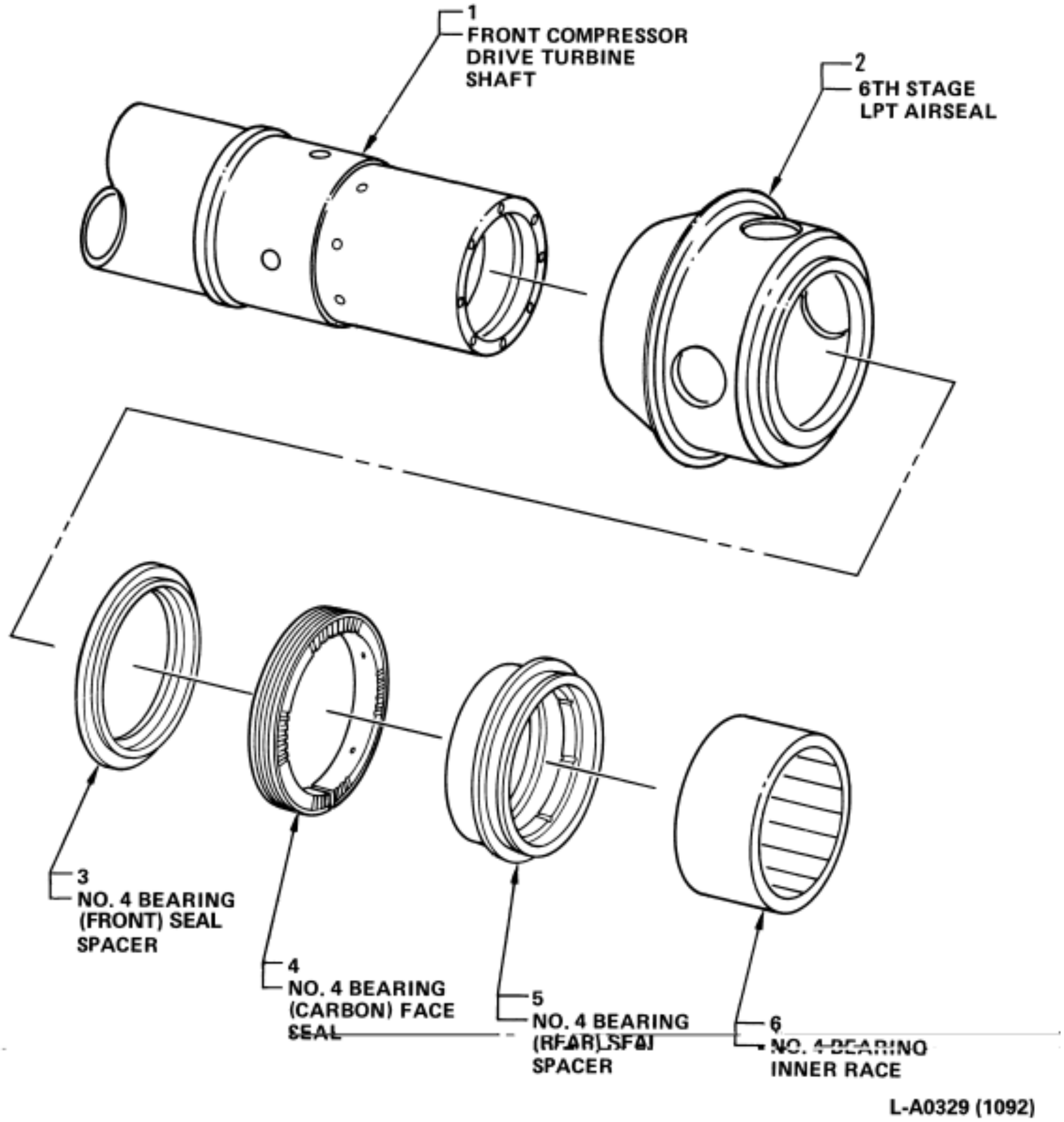
1. INSTALL LOW PRESSURE TURBINE AND TURBINE EXHAUST CASE WITH SHAFT
2. INSTALL COMPRESSOR INLET CONE

L−A2022 (0000)
PW V

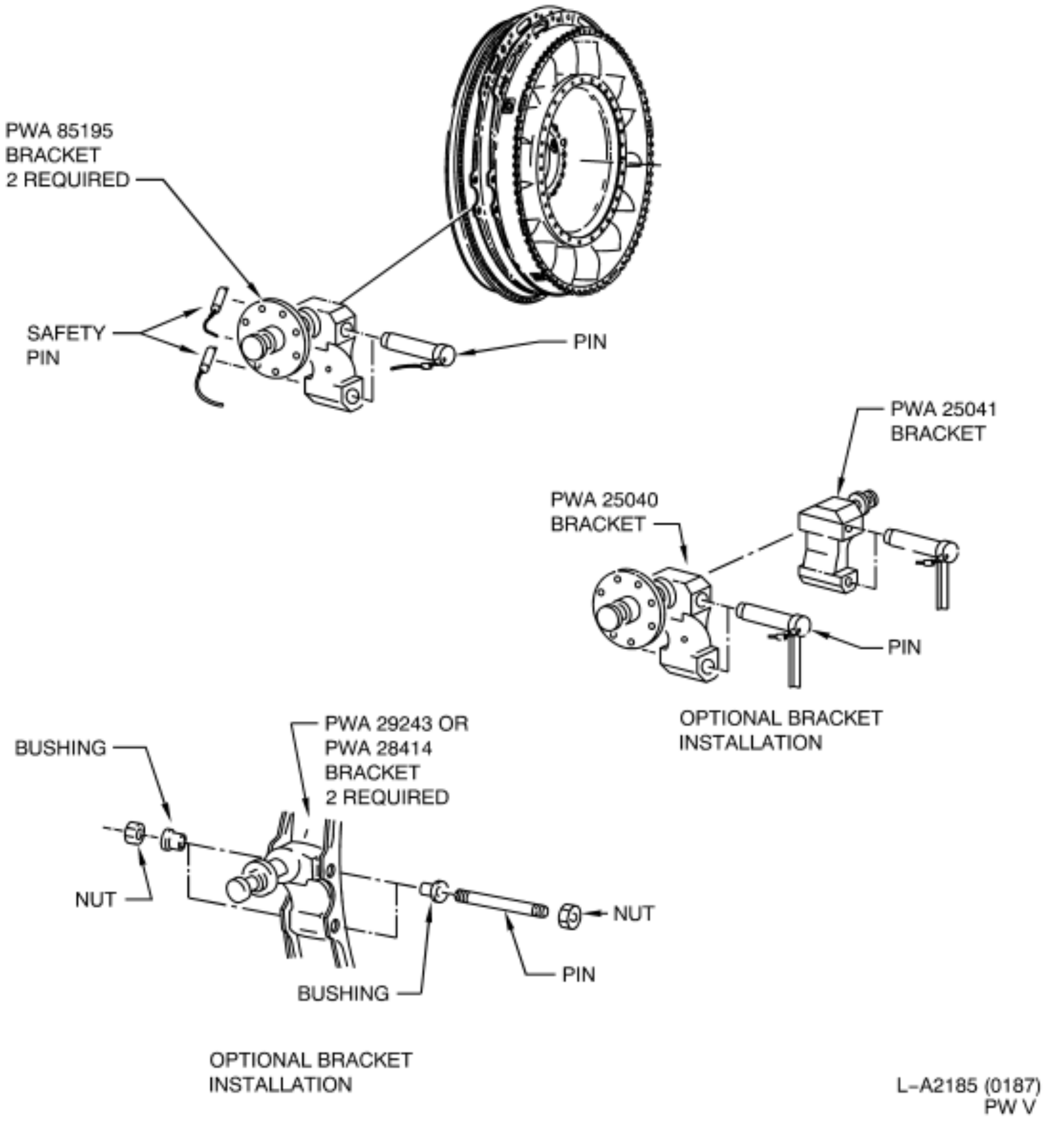
Procedure Sequence
Figure 401
(Task 72−53−00−420−001)


N
SURFACE P
R
S
1
FRONT COMPRESSOR DRIVE TURBINE SHAFT
2
STAGE 6 LPT AIRSEAL
3
NO. 4 BEARING (FRONT) SEAL SPACER
4
NO. 4 BEARING (CARBON) FACE SEAL
5
NO. 4 BEARING (REAR) SEAL SPACER
6
NO. 4 BEARING INNER RACE
L−A0330 (1092)
PW V

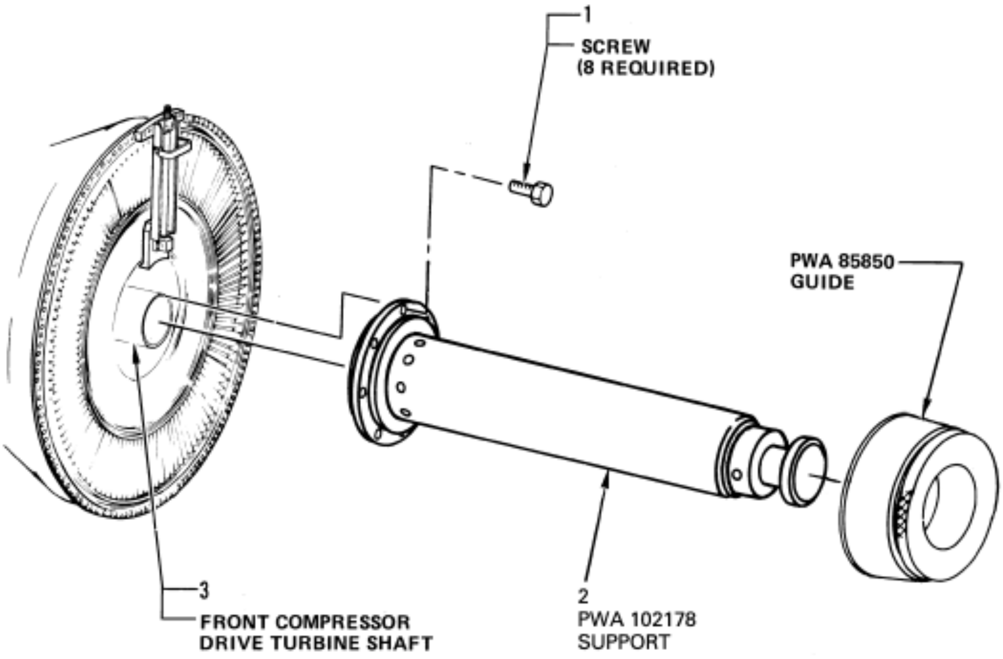
Turbine Exhaust Case Seating Check
Figure 402
(Task 72−53−00−420−001)


1
FRONT COMPRESSOR DRIVE TURBINE SHAFT
2
6TH STAGE LPT AIRSEAL
3
NO. 4 BEARING (FRONT) SEAL SPACER
4
NO. 4 BEARING (CARBON) FACE SEAL
5
NO. 4 BEARING (REAR) SEAL SPACER
6
NO. 4 BEARING INNER RACE
L-A0329 (1092)

Turbine Exhaust Case Installation
Figure 403
(Task 72-53-00-420-001)

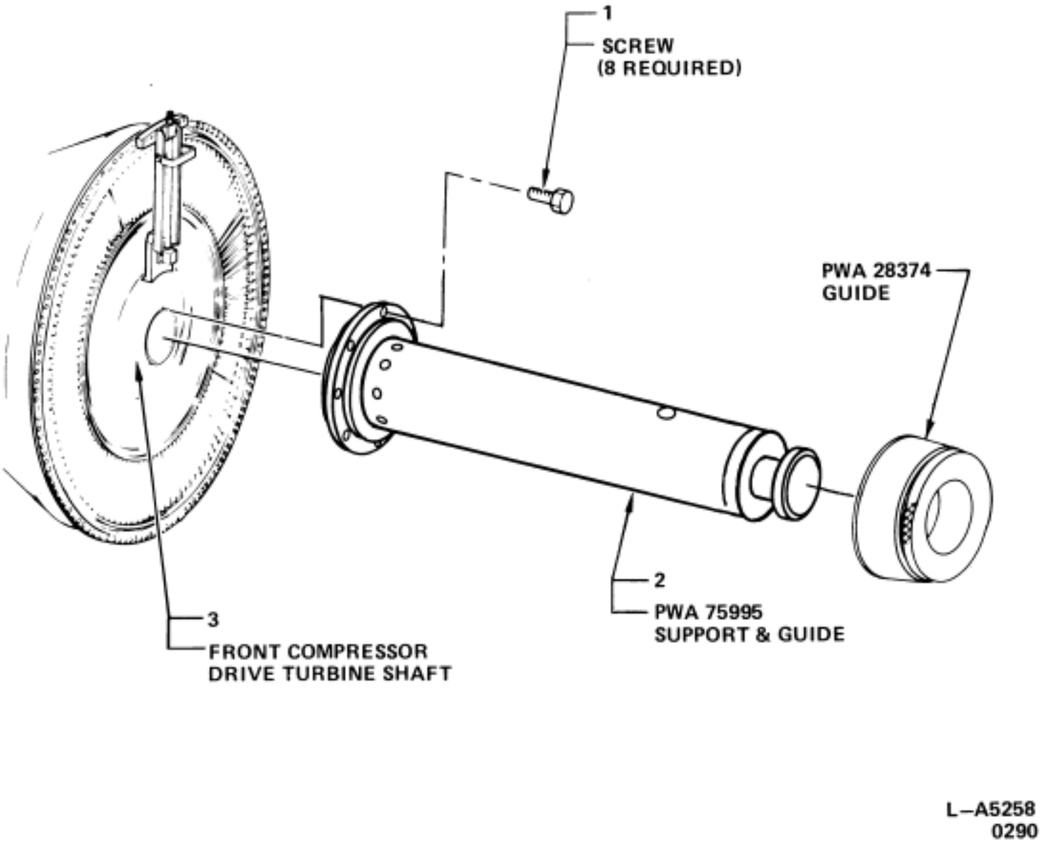

PWA 85195
BRACKET
2 REQUIRED
SAFETY
PIN
PIN
PWA 25041
BRACKET
PWA 25040
BRACKET
PIN
OPTIONAL BRACKET
INSTALLATION
BUSHING
PWA 29243 OR
PWA 28414
BRACKET
2 REQUIRED
NUT
NUT
PIN
BUSHING
OPTIONAL BRACKET
INSTALLATION
L−A2185 (0187)
PW V

Exhaust Case Support Brackets Installation
Figure 404
(Task 72−53−00−420−001)

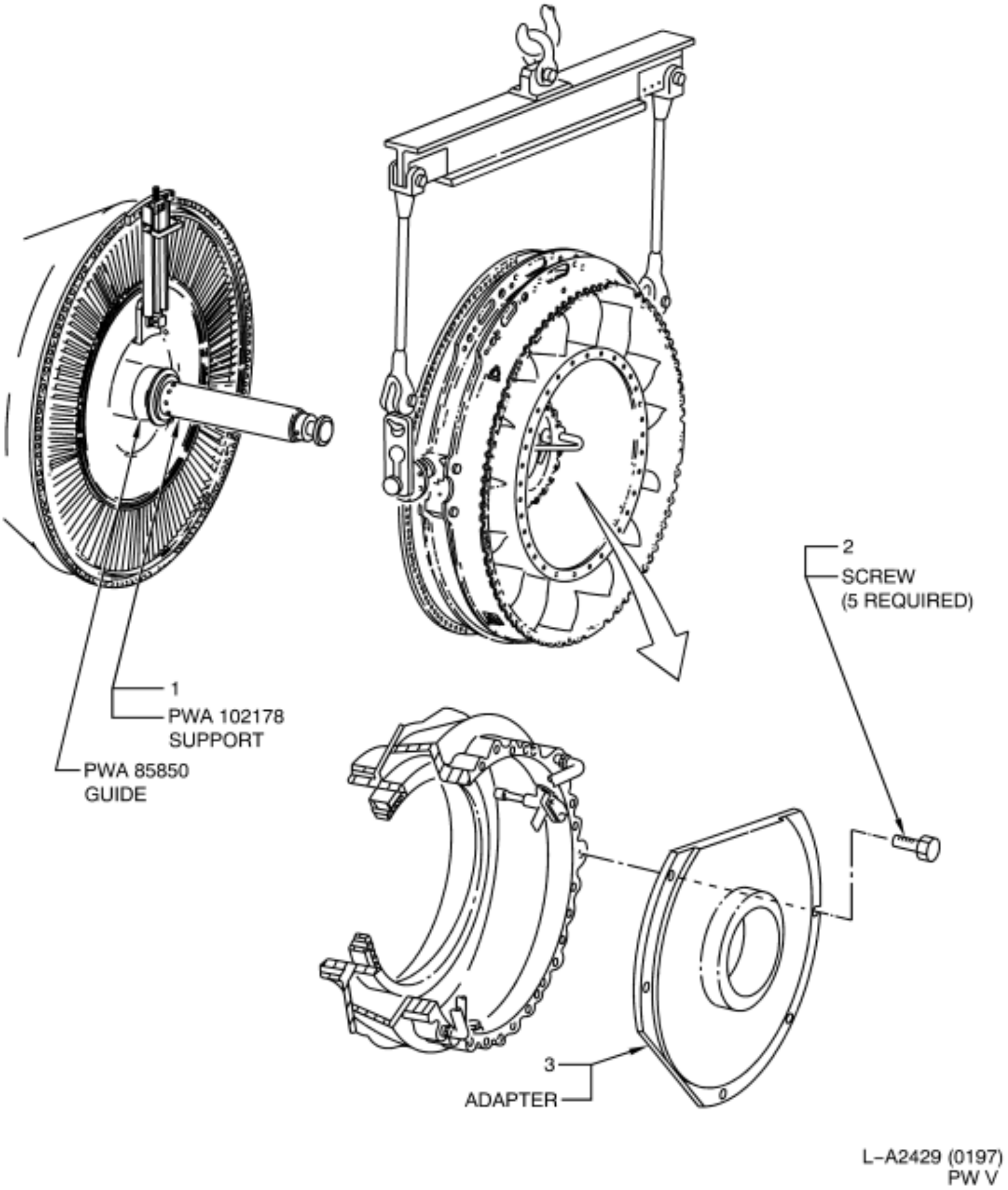

1
SCREW
(8 REQUIRED)
PWA 85850
GUIDE
3
FRONT COMPRESSOR
DRIVE TURBINE SHAFT
2
PWA 102178
SUPPORT

L-A2428 (0197)

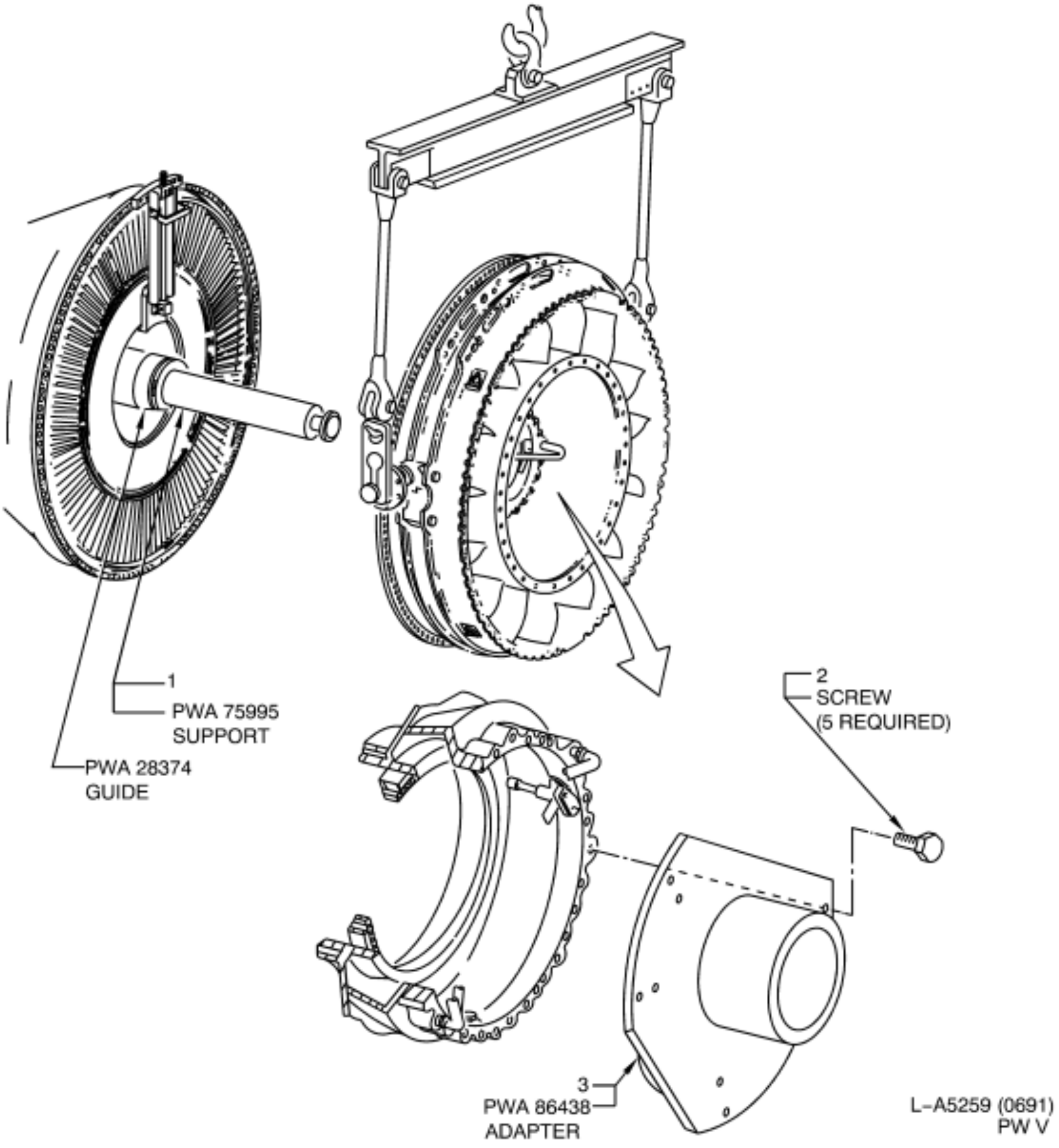
Rear Support Installation
Figure 405 (Sheet 1)
(Task 72−53−00−420−001)


1
SCREW
(8 REQUIRED)
PWA 28374
GUIDE
3
FRONT COMPRESSOR
DRIVE TURBINE SHAFT
2
PWA 75995
SUPPORT & GUIDE
L-A5258
0290

Rear Support Installation (Optional Tools)
Figure 405 (Sheet 2)
(Task 72-53-00-420-001)

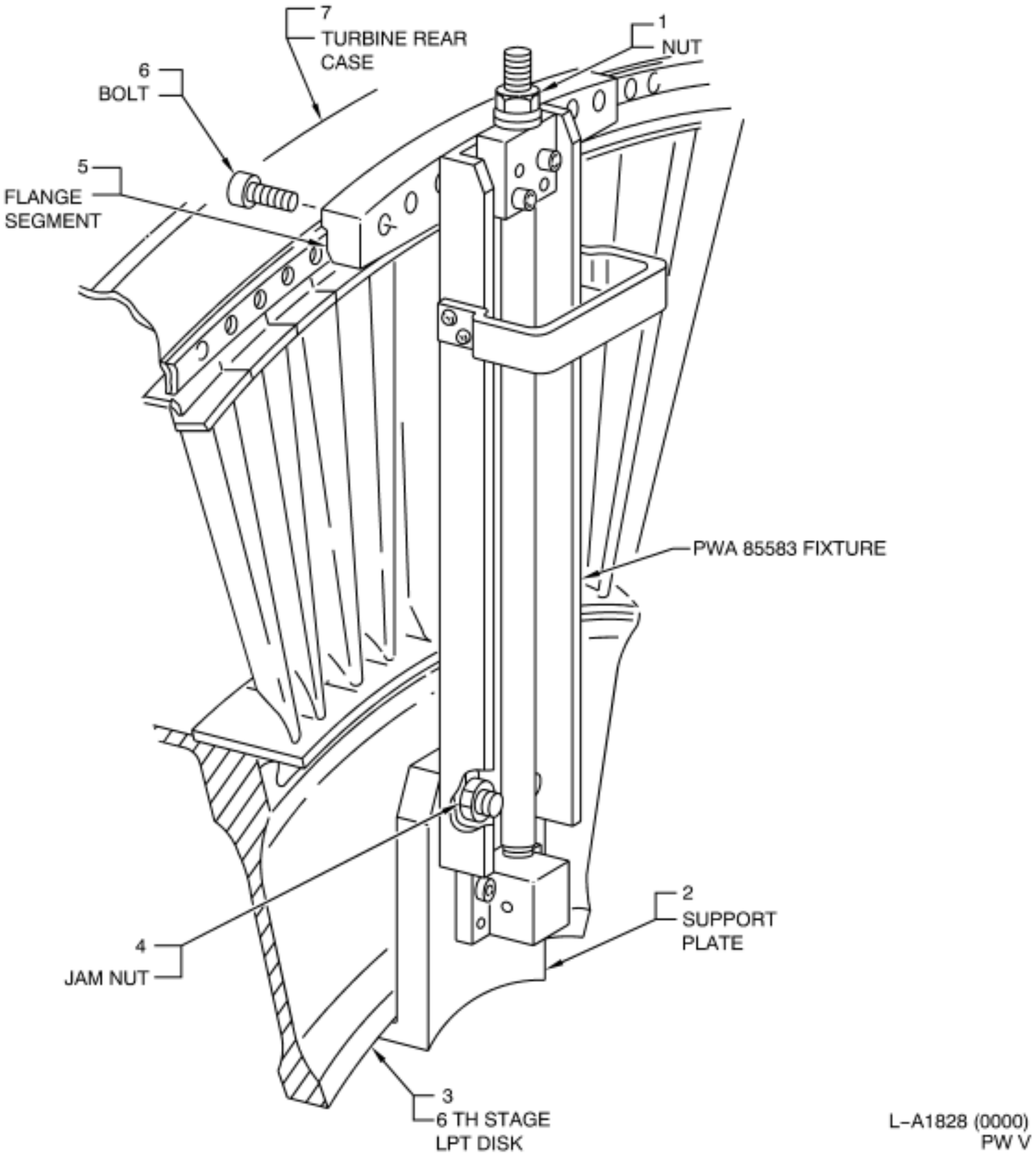

2
SCREW
(5 REQUIRED)
1
PWA 102178
SUPPORT
PWA 85850
GUIDE
3
ADAPTER
L-A2429 (0197)
PW V

Rear Support Installation
Figure 406 (Sheet 1)
(Task 72-53-00-420-001)

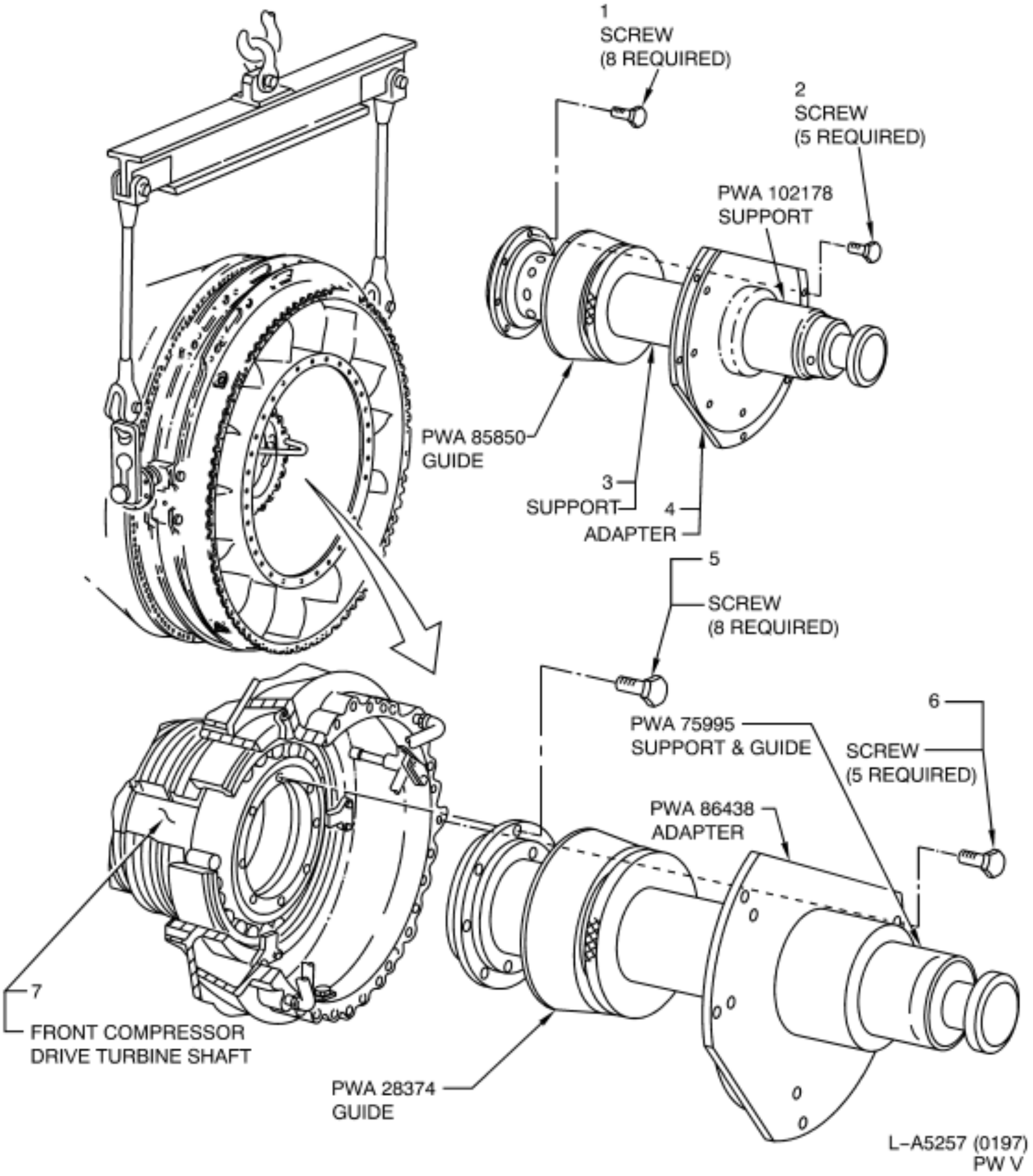

1
PWA 75995
SUPPORT
PWA 28374
GUIDE
2
SCREW
(5 REQUIRED)
3
PWA 86438
ADAPTER
L−A5259 (0691)
PW V

Rear Support Installation (Optional Tools)
Figure 406 (Sheet 2)
(Task 72−53−00−420−001)

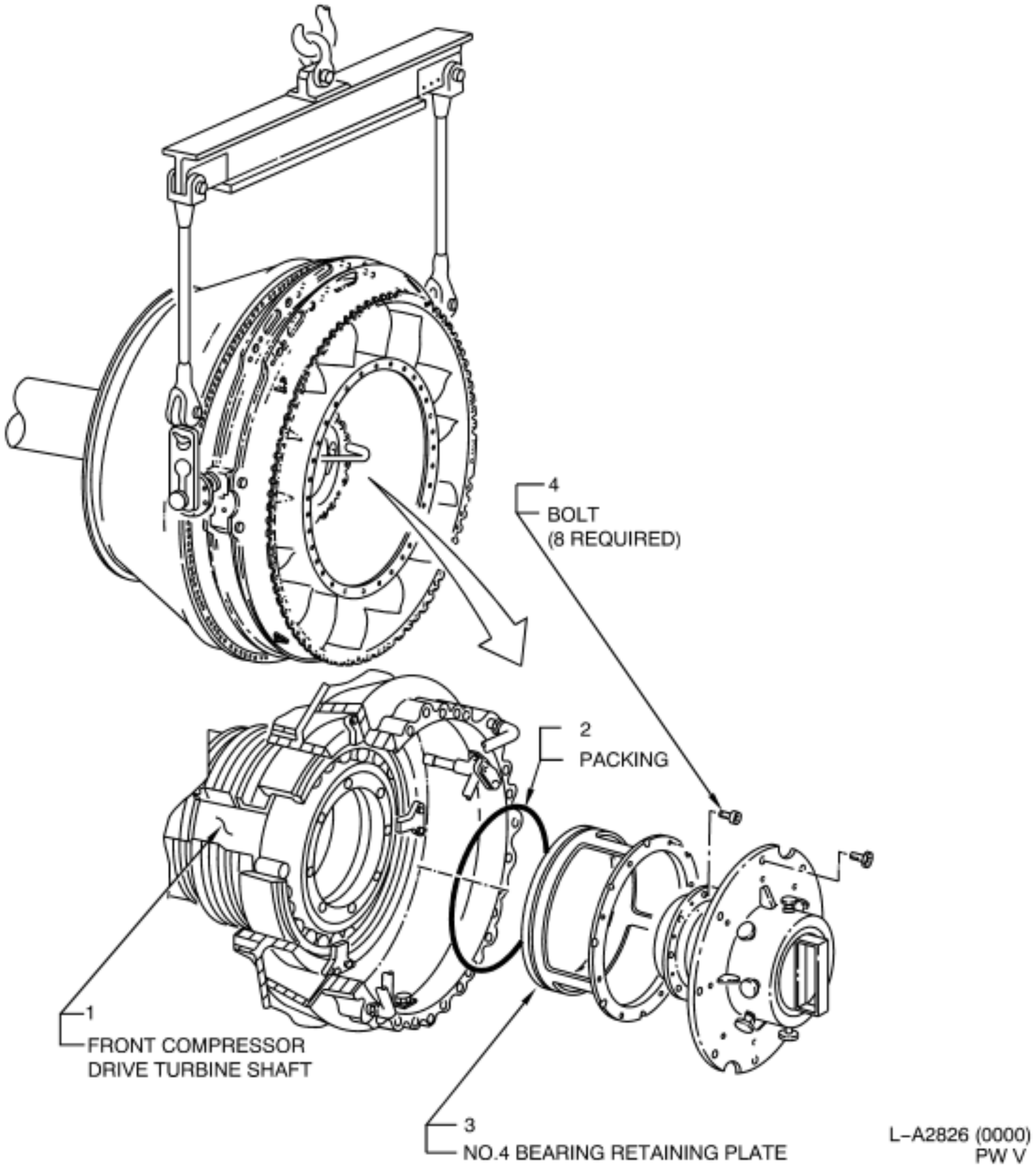
LOW PRESSURE TURBINE (LPT) − INSTALLATION−01


7
TURBINE REAR CASE
1
NUT
6
BOLT
5
FLANGE SEGMENT
PWA 85583 FIXTURE
2
SUPPORT PLATE
4
JAM NUT
3
6 TH STAGE LPT DISK
L−A1828 (0000)
PW V

LPT Rotor Support Fixture Removal
Figure 407
(Task 72−53−00−420−001)


1
SCREW
(8 REQUIRED)
2
SCREW
(5 REQUIRED)
PWA 102178
SUPPORT
PWA 85850
GUIDE
3
SUPPORT
4
ADAPTER
5
SCREW
(8 REQUIRED)
6
SCREW
(5 REQUIRED)
PWA 75995
SUPPORT & GUIDE
PWA 86438
ADAPTER
7
FRONT COMPRESSOR
DRIVE TURBINE SHAFT
PWA 28374
GUIDE
L-A5257 (0197)
PW V

Support Removal
Figure 408
(Task 72-53-00-420-001)


4
BOLT
(8 REQUIRED)
2
PACKING
1
FRONT COMPRESSOR
DRIVE TURBINE SHAFT
3
NO.4 BEARING RETAINING PLATE
L−A2826 (0000)
PW V

Turbine Exhaust Case Installation
Figure 409
(Task 72−53−00−420−001)

LOW PRESSURE TURBINE (LPT) - DISASSEMBLY-01

Task 72-53-00-030-001:

1. Remove Low Pressure Turbine Shaft And External Parts

A. Equipment And Materials Necessary

Standard Tools:

Name	Manufacturer
Clements Cadillac Electric Flameless Heat Gun Model FT 1000	Clements Manufacturing Co. 6650 S. Narragansett Avenue Chicago, IL 60638-5112

NOTE: The flameless torch specified above is optional to the heaters specified in the special tools list, and the optional flame torch.

Special Tools:

PWA 28657	Sling, Strongback
PWA 29390	Pump, Hydraulic
PWA 29956	Eye, Handling
PWA 85086	Arm, Lifting
PWA 85221	Adapter, Lift And Trunnion
PWA 85331	Retainer, Rear
PWA 85332	Fixture, Handling (Optional To PWA 86026)
PWA 85333	Pusher/Puller, Hydraulic
PWA 85558	Adapter, Hydraulic Cylinder
PWA 85635	Adapter Lift
PWA 85820	Stand, Storage (Optional)
PWA 86026	Fixture, Handling (Optional To PWA 85332)
PWA 86206	Adapter, Lift And Trunnion (2 Necessary)

Consumable Materials:

Item No.	Designation
P05-102	Ice, Dry

B. General Assembly Requirements

(1) Where heating is required for disassembly, use minimum temperature differential of 125°F (52°C) between parts being assembled. Do not exceed 300°F (149°C) on any part.

(2) Where heating is required for disassembly, special heaters are specified in the following procedure. However, you can use an optional flameless torch or flame torch as specified in the following steps.

(3) If only a flange of the component requires heating, the use of Clements Cadillac Electric Flameless Heat Gun, Model FT 1000 is recommended.

(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE FLAME WILL DAMAGE OR BURN NON−METAL PARTS.

CAUTION: DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

C. Procedure
See Figure 501.

(1) Remove turbine case brackets.

(a) Remove lockwire, bolts (501/3) and (501/4), and brackets and (501/2) and (501/5).

(b) For cases with brackets (501/6) and (501/7) that are secured with bolts (Pre SB PW4ENG 72−336), remove lockwire, bolts (501/4) and brackets.

NOTE: Cases that are (Post SB PW4ENG 72−336) have brackets that are riveted to the case. Do not remove these brackets.

(2) Loosen all of the LPT shaft tierod nuts, then remove any one nut. If necessary, the tierod nuts can be flame torch heated as follows:

NOTE: Tierod nuts that are removed by torch heating are not serviceable and can not be re−installed.

(a) Continually monitor the temperature of each nut being heated. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon. Additional monitoring of the adjacent disk and shaft will insure that the rotating structure is not overheated.

(b) Move the torch around the nut to evenly heat it in the area shown in Figure 502.

(c) Apply only enough heat to expand and loosen the tight tierod nut.

(d) Tierod nuts removed by this torch heating can not be re−installed.

(3) Install PWA 85332 Handling Fixture (Optional to PWA 86026 Handling Fixture.

NOTE: See the following step for installation of PWA 86026 Fixture.

(a) Install locator (detail−11) onto tierod where tierod nut has been removed.

(b) Position handling fixture using PWA 85635 Lift Adapter, while locator is installed on one tierod. Locator aligns LPT with fixture.

(c) Slide lockring rearward using two T−handle rods, to expand clamps. Secure lockring with four screws, so that clamps interface with turbine rear hub bore.

(4) Install PWA 86026 Handling Fixture (Optional to PWA 85332 Handling Fixture. See Figure 502.

(a) Install the locator (502/4) on the tierod (502/5) where the tierod nut has been removed.

(b) Measure 5th stage hub flange with template (detail−18). If flange thickness is approximately 0.680 inch (17.272 mm), then install spacer (detail−17). If flange thickness is approximately 0.813 inch (20.650 mm), then spacer is not used.

(c) Position handling fixture using PWA 85635 Lift Adapter, while locator is installed on one tierod. Locator aligns LPT with fixture.

(d) Move the fixture forward until it touches the rear face of the 5th stage hub.

(e) Use a steel rod in the two 0.625 inch (15.875 mm) diameter through holes of the fixture body to align the slots with the tierods in the 5th stage hub. Tighten the four screws (502/3), one at a time, until the four supports (502/2) are correctly engaged at the 5th stage hub bore. Ensure that the detail arms (502/1) are engaged in the step provided in the fixture body.

(5) Install PWA 85331 Rear Retainer. See Figure 503.

(a) Lift retainer, using eyebolts installed in two 0.500−13 tapped holes on rear side of retainer.

(b) Position retainer over previously installed handling fixture and secure to case with 48 screws (503/1) and washers (503/2).

(c) Lock axial position of LPT rotor by tightening eight hand knobs (503/3) against handling fixture.

(6) Using hoist, attach PWA 28657 Sling and two PWA 86206Lift And Trunnion Adapters to rear retainer at spools labeled − LPT WITHOUT SHAFT.

(7) Remove front PWA 85456 or PWA 85996 Retainer.

(8) Remove 23 nuts securing shaft to hub. Remove previously installed locator from tierod.

(9) Position PWA 85558 Adapter to rear face of shaft, and attach with eight screws.

(10) Install PWA 85333 Hydraulic Pusher to rear PWA 85331 Retainer and PWA 85558 Adapter. Attach PWA 29390 Hydraulic Pump to pusher.

(11) Optional, use Dry Ice P05−102 on the ID of the turbine rear hub to decrease the interference fit with the turbine shaft.

(12) Actuate hydraulic pump to remove shaft.

(13) Remove hydraulic pusher from handling fixture.

(14) Remove PWA 85558 Adapter from rear face of turbine shaft.

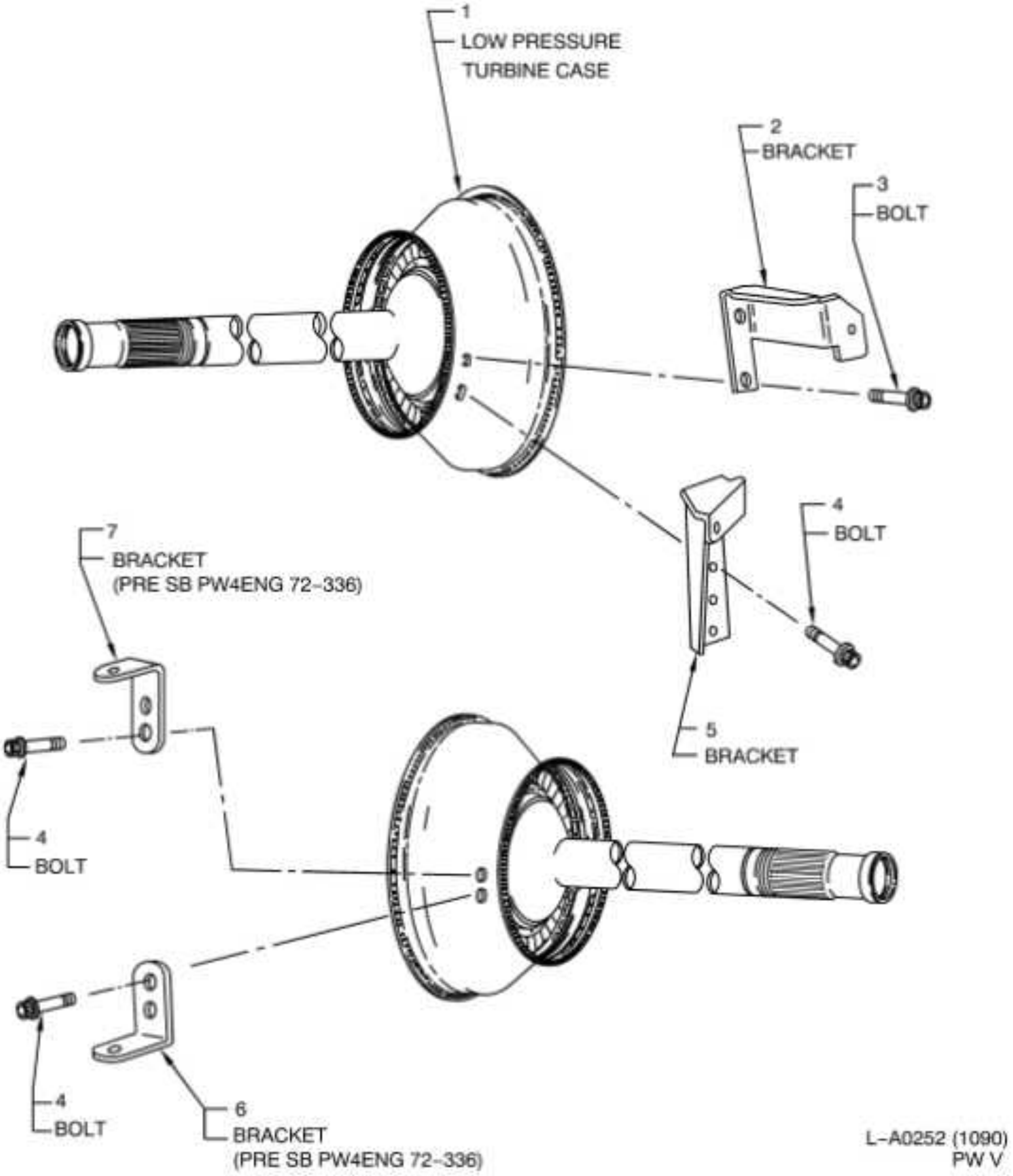
LOW PRESSURE TURBINE (LPT) − DISASSEMBLY−01

(15) Use PWA 29956 Handling EyeLifting Arm, PWA 85086 Lifting Arm, and PWA 85221 Lift And Trunnion Adapter in handling shaft. Optional PWA 85820 Storage Stand can be used to store shaft.

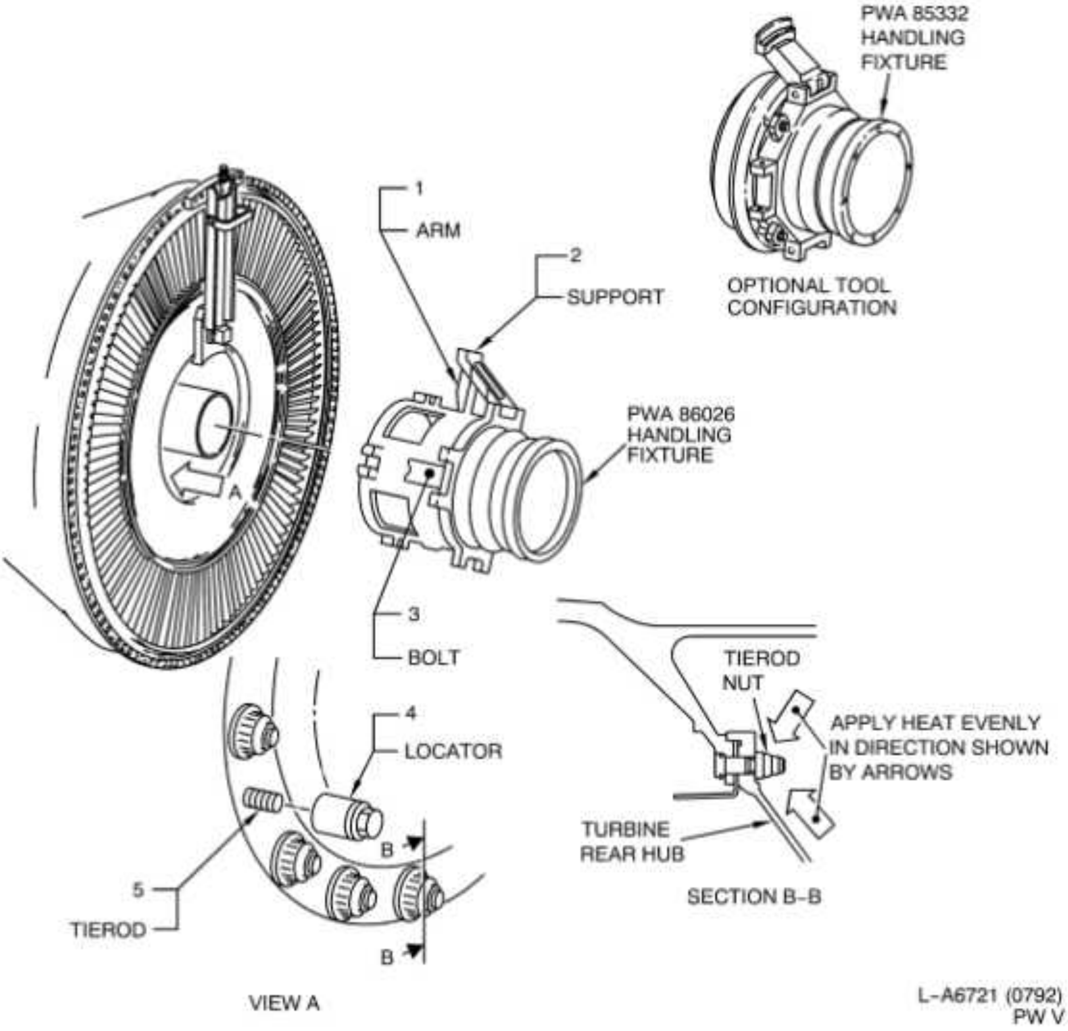
(16) Trunnion low pressure turbine to rear end down position onto two suitable pallets.

(17) Using suitable drift straighten tierod locks (504/1) and remove turbine tierods (504/2). Discard locks. See Figure 504.

LOW PRESSURE TURBINE (LPT) − DISASSEMBLY−01

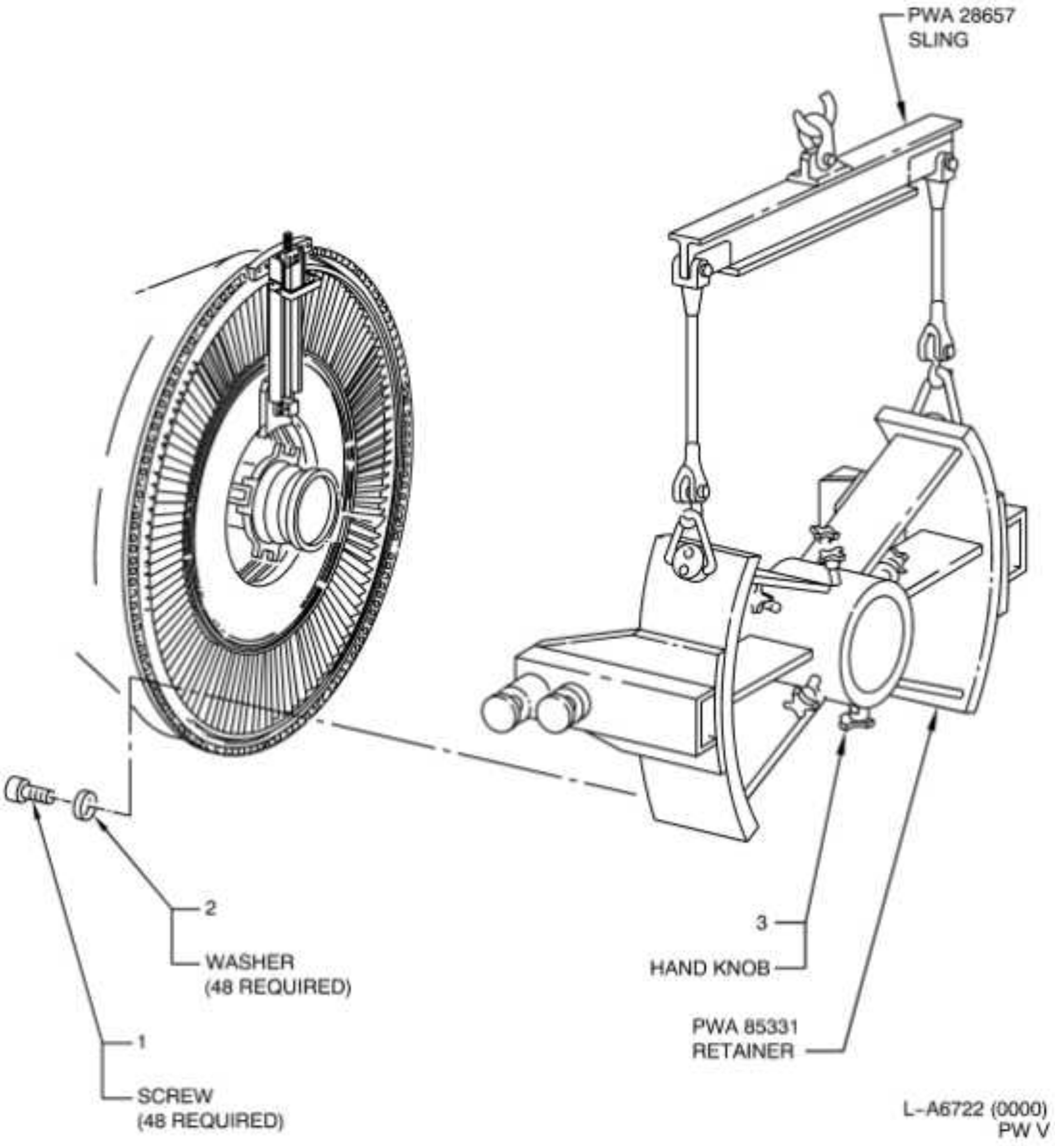

1
LOW PRESSURE TURBINE CASE
2
BRACKET
3
BOLT
4
BOLT
5
BRACKET
7
BRACKET (PRE SB PW4ENG 72-336)
4
BOLT
4
BOLT
6
BRACKET (PRE SB PW4ENG 72-336)
L-A0252 (1090)
PW V

External Parts Removal
Figure 501
(Task 72−53−00−030−001)

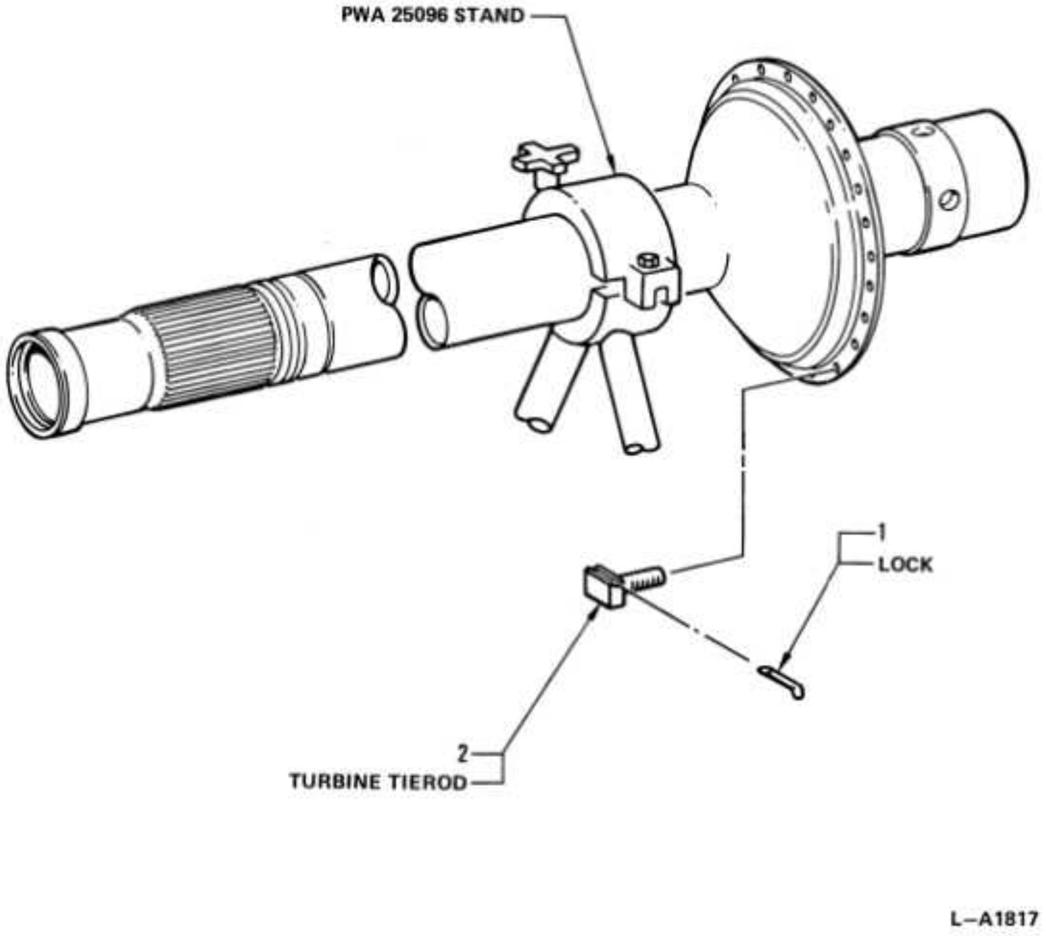

PWA 85332
HANDLING
FIXTURE
OPTIONAL TOOL
CONFIGURATION
1
ARM
2
SUPPORT
PWA 86026
HANDLING
FIXTURE
A
3
BOLT
TIEROD
NUT
APPLY HEAT EVENLY
IN DIRECTION SHOWN
BY ARROWS
4
LOCATOR
B
TURBINE
REAR HUB
SECTION B-B
5
TIEROD
B
VIEW A
L-A6721 (0792)
PW V

Handling Fixture Installation
Figure 502
(Task 72−53−00−030−001)

LOW PRESSURE TURBINE (LPT) - DISASSEMBLY-01


PWA 28657
SLING
2
WASHER
(48 REQUIRED)
1
SCREW
(48 REQUIRED)
3
HAND KNOB
PWA 85331
RETAINER
L-A6722 (0000)
PW V

Rear Retainer Installation
Figure 503
(Task 72-53-00-030-001)


PWA 25096 STAND
1
LOCK
2
TURBINE TIEROD
L-A1817

Turbine Tierod Removal
Figure 504
(Task 72-53-00-030-001)

Previous Pageblock Return to Previous Menu Next Pageblock

LOW PRESSURE TURBINE (LPT) - DISASSEMBLY-02

Task 72-53-00-030-002:

1. Disassemble Low Pressure Turbine

A. Prerequisites

(1) Remove low pressure turbine external parts per Disassembly-01 Task 72-53-00-030-001.

B. Equipment And Materials Required

Special Tools:

PWA 28657	Sling, Strongback
PWA 29918	Stand, Build/Disassembly (Optional To PWA 87913)
PWA 85086	Arm, Lifting (2 Required)
PWA 85214	Adapter, Lifting
PWA 85215	Adapter, Lifting
PWA 85220	Adapter, Lift And Trunnion
PWA 85223	Pusher, Jackscrew
PWA 85224	Pusher, Jackscrew
PWA 85225	Puller, Jackscrew
PWA 85258	Puller, Jackscrew
PWA 85331	Retainer, Rear
PWA 85385	Support, Rear
PWA 85386	Support, Front
PWA 85392	Support, Front And Rear
PWA 85592	Eye, Lifting
PWA 85594	Adapter, Lift And Trunnion
PWA 85638	Fixture, Build (Optional to PWA 87097)
PWA 86081	Puller, Knocker
PWA 86206	Adapter, Lift And Trunnion (2 Required)
PWA 87097	Fixture, Build
PWA 87913	Stand, Build/Disassembly
PWA 88586	Puller, Hydraulic (Optional to PWA 85225)

C. Procedure

Subtask 72-53-00-030-051:

(1) Remove 3rd stage LPT airseal (501/1) using PWA 85258 Jackscrew Puller. See Figure 501.

(a) Remove two ball lock pins (501/5), loosen four screws (501/6) and retract puller plates (501/4). Rotate locking lugs (501/8) to face inward.

(b) Insert puller into airseal. Adjust screws (501/2) as required to seat ring (501/3) on ID flange of turbine rear hub. Rotate locking lugs (501/8) to position lug under rear face of hub flange.

(c) Extend puller plates (501/4) outward to position radius of puller plates against mating radius in upper ID of airseal. Reinstall two ball lock pins (501/5). Tighten four screws (501/6) to secure puller plates.

CAUTION: TIGHTEN THE SCREWS (501/2) IN SMALL INCREMENTS TO PREVENT DAMAGE TO THE NYLON PAD DETAILS OF THE SCREWS. IF THE SCREWS GO THROUGH THE PADS, THEY WILL DAMAGE THE AIRSEAL.

(d) Tighten the screws (501/2) to separate the airseal from the hub. Tighten the screws in small increments in a pattern sequence to prevent distortion of the airseal.

(e) Loosen knurled nuts (501/7) and rotate locking lugs (501/8) to face inward. Remove ball lock pins (501/5), loosen screws (501/6) and retract puller plates (501/4). Remove puller from airseal.

(f) Remove airseal from turbine rear hub and place in suitable protective container.

(2) Remove 39 bolts (502/1) securing the Stage 3 (inner) sealing ring assembly (502/3) and damper (502/2). Remove damper from sealing ring. Remove the three straight headed pins (502/4). See Figure 502.

(3) Using hoist, attach PWA 28657 Sling and two PWA 86206 Lift And Trunnion Adapters to rear retainer at spools labeled "LPT WITHOUT SHAFT". Lift assembly and trunnion to front end down position.

(4) Install LPT onto PWA 87097 or PWA 85638 Build Stand and PWA 29918 or PWA 87913 Stand. See Figure 503.

(a) Lower the LPT, front end downward, keep one to two inches (25.400 − 50.800 mm) of clearance between the front flange of the case and the fixture.

(b) Move the rest blocks (503/2) identified "assembly" under the third stage disk.

(c) Install the case to the fixture with 10 screws (503/3).

(d) Move the four clamps (503/1) identified "disassembly" over the third stage disk.

(5) Remove bolts securing retainer to flange of case. Remove retainer from LPT assembly. Loosen knobs clamping handling fixture. Remove PWA 85332 Handling Fixture or PWA 86026 Handling Fixture.

Subtask 72−53−00−030−052:

(6) Remove 6th stage turbine rotor assembly. See Figure 504.

(a) Remove any clip−on trim balance counterweights from the outer shroud of the 6th stage LPT blades. Discard the counterweights.

(b) Remove 40 nuts (504/1) and spacers (504/2), and counterweights as applicable, securing front flange of 6th stage disk to turbine rear hub.

(c) Position contoured block of PWA 85223 Jackscrew Pusher against 6th stage disk web and stepped block against lip of turbine hub bore. Using wrench, hold block at flat surfaces of shaft detail while turning nut with second wrench to separate disk from hub. Remove pusher.

(d) Secure PWA 85592 Eye to bore of 6th stage LPT disk with lifting eye side up.

(e) Attach hoist to PWA 85592 Lifting Eye. Lift rotor assembly and position disk, front end down on PWA 85386 Support. Remove hoist and eye.

(7) Remove 12 screws (505/2) securing 6th stage LPT air sealing ring segments (505/3) to rear turbine case. Remove ring segments from case. See Figure 505.

Subtask 72−53−00−030−053:

(8) Remove 6th stage vane clusters (506/2) from rear turbine case. See Figure 506.

(a) Remove 36 vane clusters from turbine case.

(b) Remove four turbine case heat shields (506/1) from turbine case, which are installed just above the 5th stage turbine rotor (506/3).

Subtask 72−53−00−030−054:

(9) Remove 5th stage turbine rotor assembly using PWA 85225 Jackscrew Puller. See Figure 507 (Sheet 1).

(a) Slide the two rod details of the puller towards the center of the channel. Turn the feet towards the center of the channel.

(b) Position the puller onto the rear flange of the turbine case, and two rod details located in the bore of the turbine hub. Align the boltholes and attach the channel to the case flange with workbolts and nuts.

(c) Turn the feet and slide rods outward to position the feet under the turbine hub bore. The dowel pins in the rod detail should point radially outward.

(d) Hold the dowel pins and tighten the jamnuts evenly to remove the 5th stage rotor assembly.

(e) Attach the PWA 85594 Adapter to bore of turbine rear hub with lifting eye side upward.

(f) Connect hoist with PWA 85086 Arm to lifting eye of the adapter. Using hoist, lift rotor assembly and attach PWA 85592 Eye to front (lower) ID bore of hub with lifting eye side downward. Using second hoist, connect PWA 85086 Arm to lifting eye of lower adapter.

(g) Using both hoists, lift and trunnion rotor assembly to rear end down position. Remove lower hoist, arm and adapter. Lower assembly onto suitable support. Remove hoist, arm and adapter.

(10) Remove 5th stage turbine rotor assembly using PWA 88586 Hydraulic Puller (Optional to PWA 85225). See Figure 507 (Sheet 2).

NOTE: The "I" beam fits on the "LPT CASE REAR" side only. See the metal stamped notes on the "I" beam to make sure the tool is installed correctly.

(a) If necessary, put the hydraulic cylinder to the side of the detail−1 base assembly that is stamped "LPT CASE REAR". Install the detail rod and puller through the base assembly and the hydraulic cylinder and attach with the spacer and jamnut.

(b) Attach an applicable sling and hoist to the lift eyes of the base assembly and lift the PWA 88586 Hydraulic Puller. Turn the detail−10 puller jaw radially inward.

(c) Lower the puller to the rear face of the LPT rear case. Turn the detail−10 puller jaw radially outward under the flange of the 5th stage hub and blade assembly.

(d) Attach the hose of a hydraulic pump to the hydraulic cylinder.

(e) Actuate the hydraulic cylinder and begin to disengage the hub and blade assembly.

(f) Release the hydraulic pressure and rotate the puller on the LPT rear case. Repeat the procedure as necessary until the 5th stage hub and blade assembly disengages from the 4th stage disk.

(g) Attach the PWA 85594 Adapter to bore of turbine rear hub with lifting eye side upward.

(h) Connect hoist with PWA 85086 Arm to lifting eye of the adapter. Using hoist, lift rotor assembly and attach PWA 85592 Eye to front (lower) ID bore of hub with lifting eye side downward. Using second hoist, connect PWA 85086 Arm to lifting eye of lower adapter.

(i) Using both hoists, lift and trunnion rotor assembly to rear end down position. Remove lower hoist, arm and adapter. Lower assembly onto suitable support. Remove hoist, arm and adapter.

(11) Remove (13) 5th stage LPT air sealing ring segments (508/1) from groove in rear turbine case. See Figure 508.

(12) Remove four turbine case heat shields (508/2) from rear turbine case.

Subtask 72−53−00−030−055:

(13) Remove 5th stage vane clusters (509/1) from rear turbine case. See Figure 509.

(a) Remove 38 vane clusters from turbine case.

(b) Remove four turbine case heat shields (509/2) from turbine case, which are installed just above 4th stage turbine rotor (509/3).

Subtask 72−53−00−030−056:

(14) Remove 4th stage turbine rotor assembly. See Figure 510.

(a) Remove 40 nuts (510/1) and washers (510/3) securing front flange of 4th stage LPT disk (510/2) to 3rd stage LPT disk (510/4).

(b) Position pusher (511/5) of PWA 85224 Jackscrew Pusher against web of 3rd stage disk (511/6) and locator (511/2) against web and bore of 4th stage LPT disk (511/1). See Figure 511.

(c) While holding locator (511/2) at wrench flats (511/3) on shaft, turn nut (511/4) to separate disks. Remove pusher.

(15) Install 4th stage rotor assembly on PWA 85392 Support.

(a) Align boltholes in base with tierods and position PWA 85215 Lifting Adapter onto rear flange of 4th stage LPT disk. Install four detail hand knobs to tierods to secure adapter to disk.

LOW PRESSURE TURBINE (LPT) − DISASSEMBLY−02

(b) Connect hoist to lifting eye of adapter. Using hoist position rotor assembly, front end down, on PWA 85392 Support.

(16) Remove (11) (Pre SB PW4ENG 72−41) or (22) (Post SB PW4ENG 72−41) 4th stage LPT air sealing ring segments (512/1) from turbine case. See Figure 512.

(17) Remove four turbine case heat shields (512/2) from turbine case.

Subtask 72−53−00−030−057:

(18) Remove 4th stage vane clusters (513/3). See Figure 513.

(a) Remove 44 vane clusters from turbine case.

(b) Remove the four heat shields (513/1) installed on case rail.

(c) Remove four turbine case heat shields (513/2) from turbine case, which are installed just above the 3rd stage turbine rotor.

Subtask 72−53−00−030−058:

(19) Remove 3rd stage turbine rotor assembly.

(a) Remove four clamps from third stage disk.

(b) Align boltholes in base with tierods and position PWA 85215 Adapter onto rear of 3rd stage LPT disk with lifting eye side up. Secure adapter to disk with four detail hand knobs.

(c) Connect hoist with PWA 85086 Arm to lifting eye of adapter. Using hoist, lift rotor assembly and secure PWA 85214 Adapter to bore of disk with lifting eye side down. Using second hoist, connect PWA 85086 Arm to lifting eye of lower adapter.

(d) Using both hoists, lift and trunnion rotor to rear end down position. Remove lower hoist, arm and adapter. Lower disk onto PWA 85385 Support. Remove hoist, arm and adapter.

(20) Remove (13) (Pre SB PW4ENG 72−41) or (26) (Post SB PW4ENG 72−41) 3rd stage LPT air sealing ring segments (514/1) from turbine case. See Figure 514.

(21) Remove four turbine case heat shields (514/2) from turbine case.

Subtask 72−53−00−030−059:

(22) Remove 3rd stage LPT vane clusters (515/3). See Figure 515.

- (a) Remove 39 nuts (515/2) which secure inner lugs of 3rd stage LPT vane clusters (515/3) to 3rd stage LPT duct assembly studs (515/4).
- (b) Remove (39) 3rd stage vane clusters from turbine case. Remove seals (515/7), (515/8) and (515/9) from seal grooves in platform and feet of vanes.
- (c) Remove 3rd stage LPT duct (515/1) from turbine case.

(23) Remove 3rd stage LPT sealing ring support (515/5), duct assembly, from build fixture (515/6).

(24) Remove 3rd stage LPT duct from sealing ring support.

Subtask 72−53−00−030−060:

(25) Remove (12) 3rd stage LPT duct segments (516/2) from turbine case. Remove 3rd stage LPT duct seals (516/1) from grooves in duct segments. See Figure 516.

(26) Remove instrumentation boss plug (517/5) from instrumentation boss hole (517/4) in turbine case. If necessary, use PWA 86081 Puller to remove plug. See Figure 517.

(27) Remove 3rd stage LPT duct (517/1) from turbine case.

(28) Attach PWA 85220 Adapter to rear flange of turbine rear case.

- (a) Retract four quick release pins from boltholes in base of adapter.
- (b) Connect hoist to lifting eye in center of adapter base.

(c) Using hoist, position outer curved groove in base over rear flange of case. Align boltholes and secure adapter to case with four quick release pins.

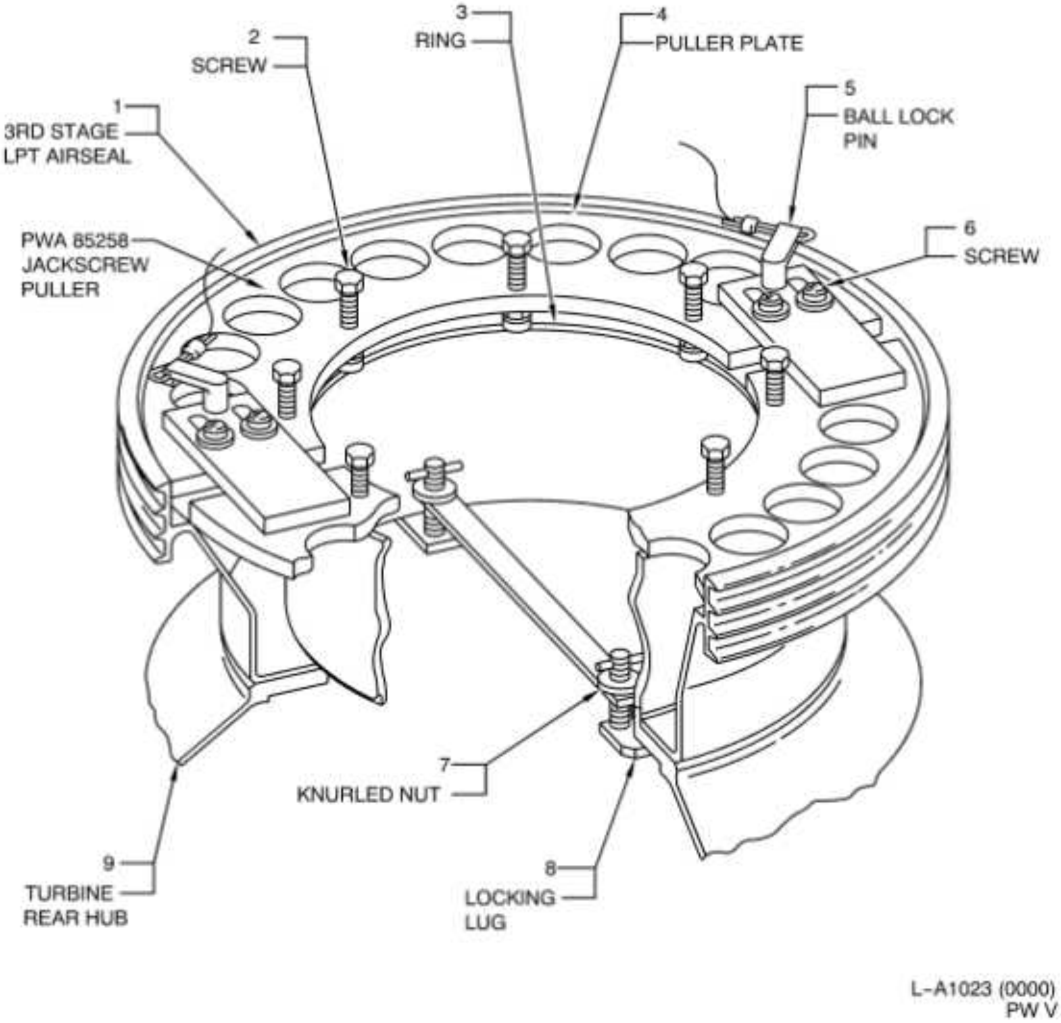
(29) Remove ten screws securing front flange of turbine case to fixture.

(30) Using hoist, place case, front end down, on pallet. Remove hoist and adapter.

Subtask 72−53−00−030−061:

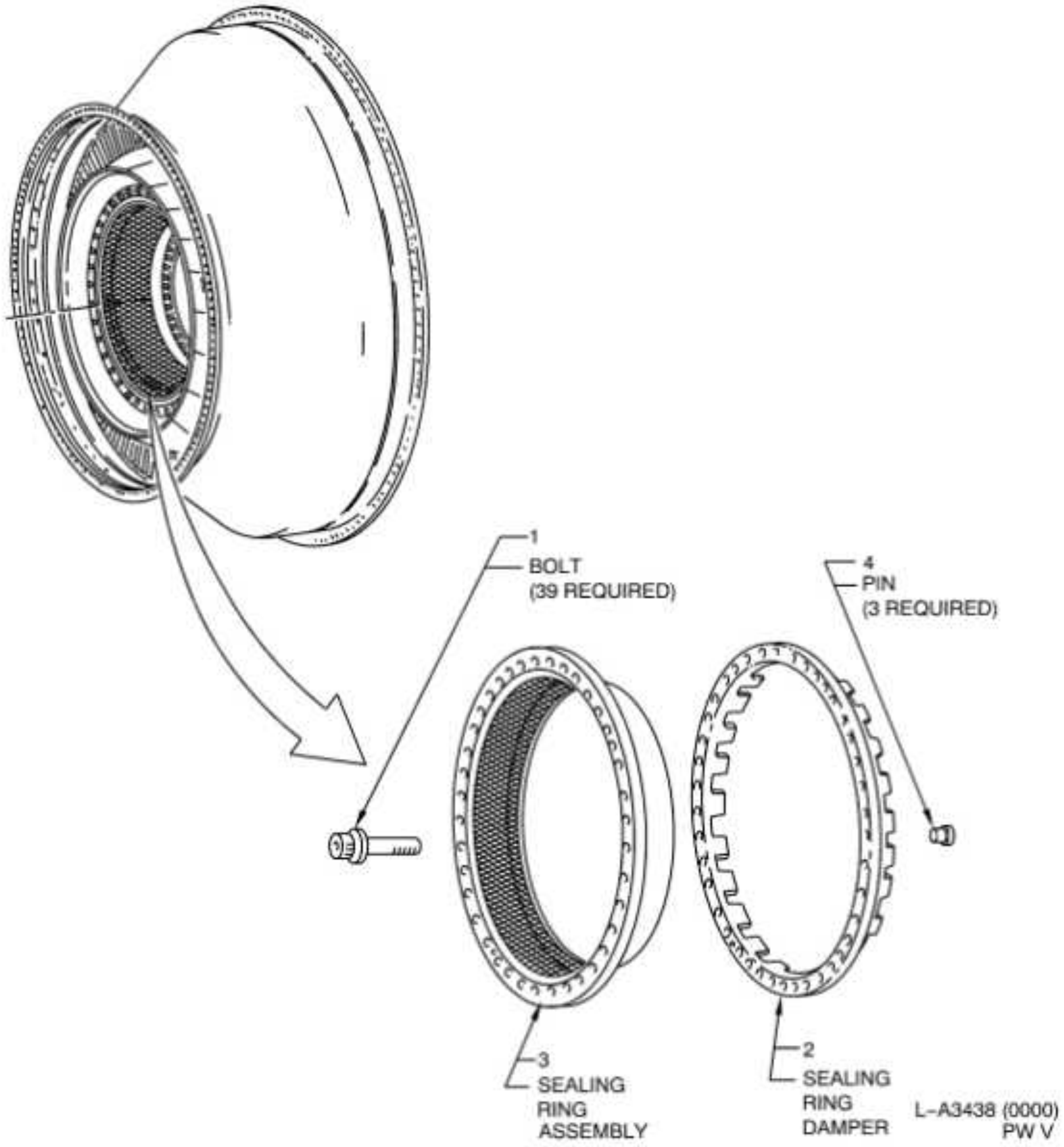
(31) Remove two bolts (518/1) and nuts (518/3) securing identification plate (518/2) to bracket on front (lower) flange of turbine rear case. Keep identification plate with low pressure turbine. See Figure 518.

LOW PRESSURE TURBINE (LPT) - DISASSEMBLY-02


3
RING
4
PULLER PLATE
2
SCREW
5
BALL LOCK
PIN
1
3RD STAGE
LPT AIRSEAL
6
SCREW
PWA 85258
JACKSCREW
PULLER
7
KNURLED NUT
9
TURBINE
REAR HUB
8
LOCKING
LUG
L-A1023 (0000)
PW V

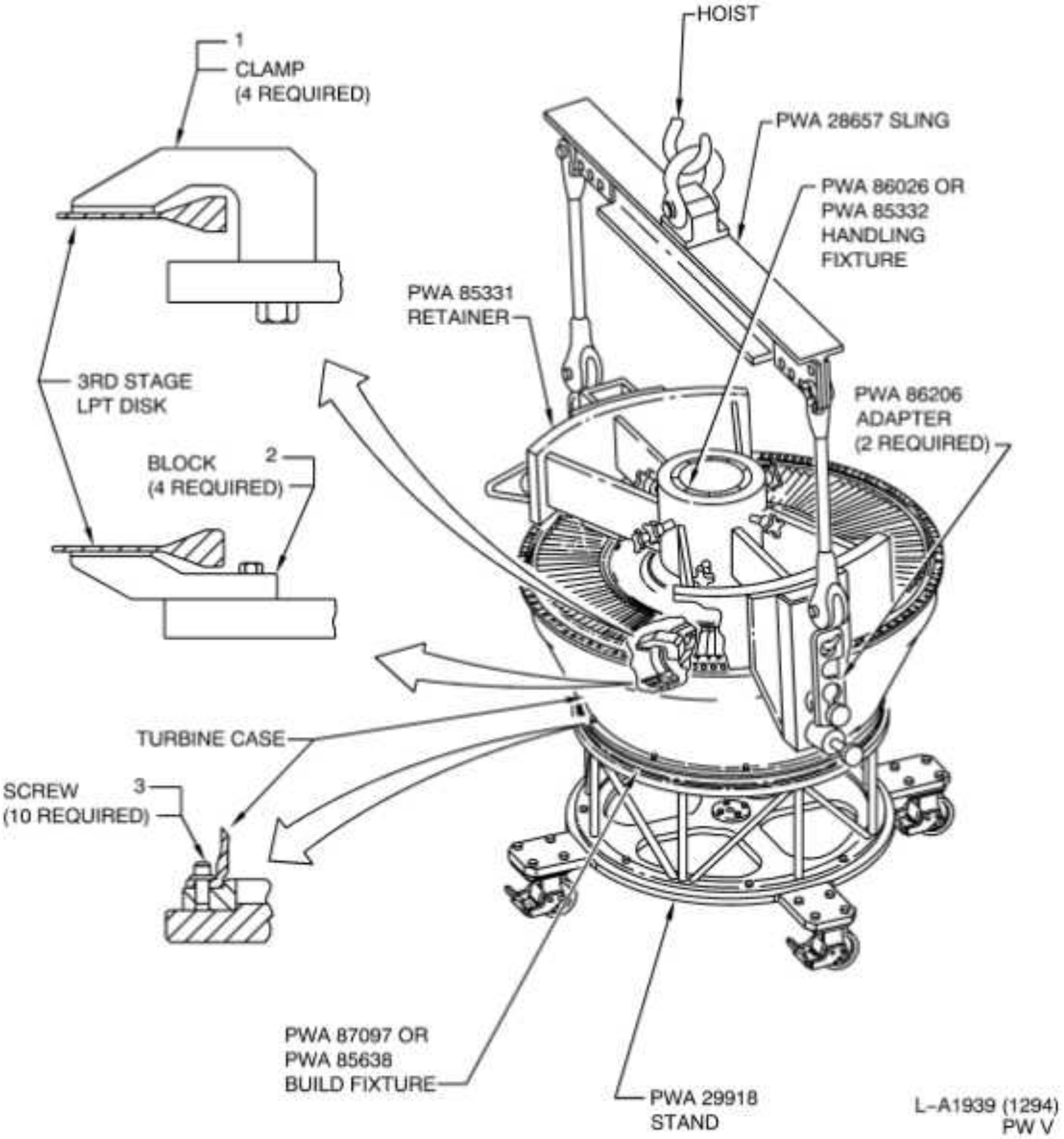
Third Stage LPT Airseal Removal
Figure 501
(Task 72-53-00-030-002)

LOW PRESSURE TURBINE (LPT) - DISASSEMBLY-02


1
BOLT
(39 REQUIRED)
4
PIN
(3 REQUIRED)
3
SEALING
RING
ASSEMBLY
2
SEALING
RING
DAMPER
L-A3438 (0000)
PW V

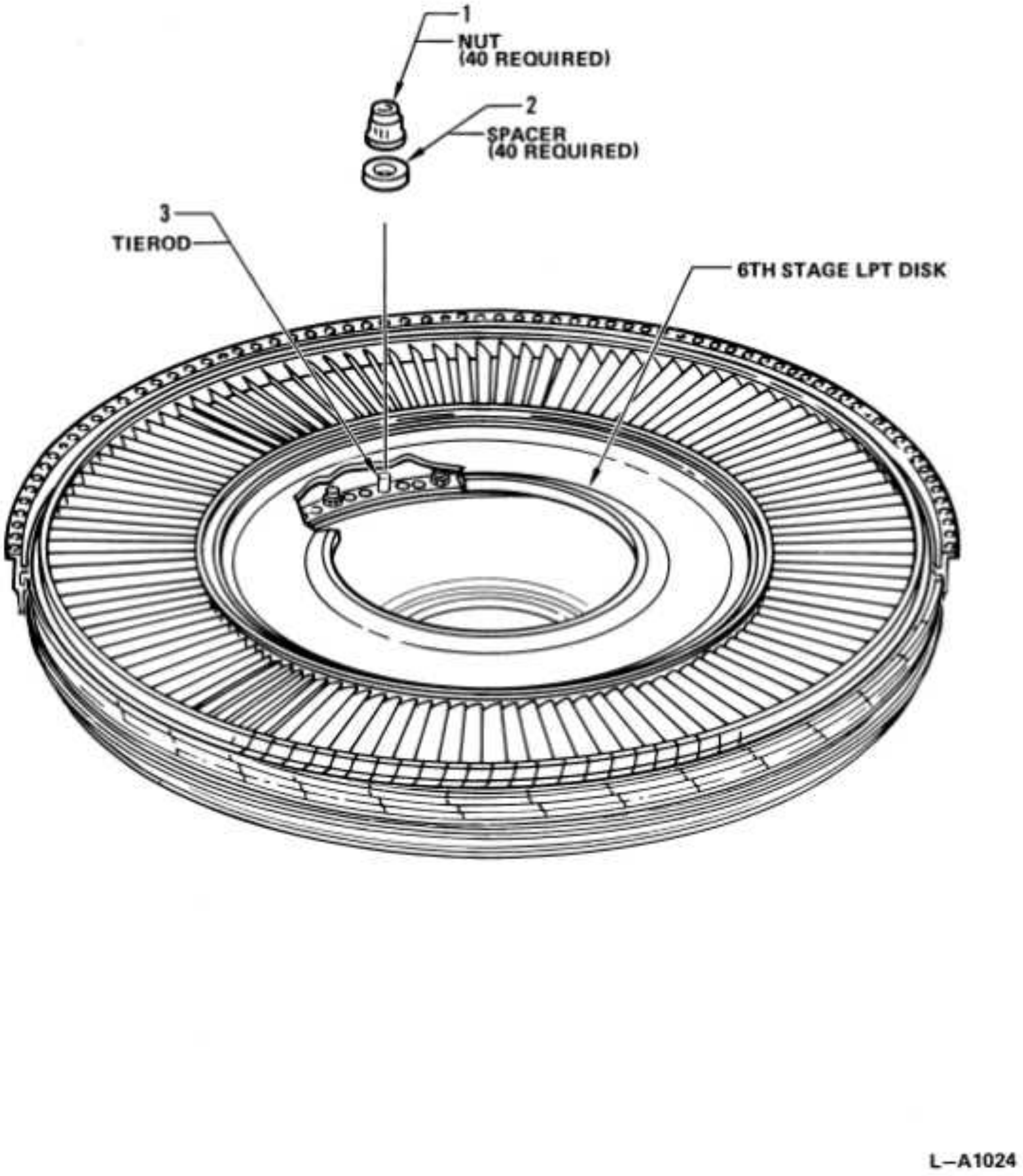
Stage 3 LPT (Inner) Sealing Ring Assembly Removal
Figure 502
(Task 72-53-00-030-002)

LOW PRESSURE TURBINE (LPT) - DISASSEMBLY-02

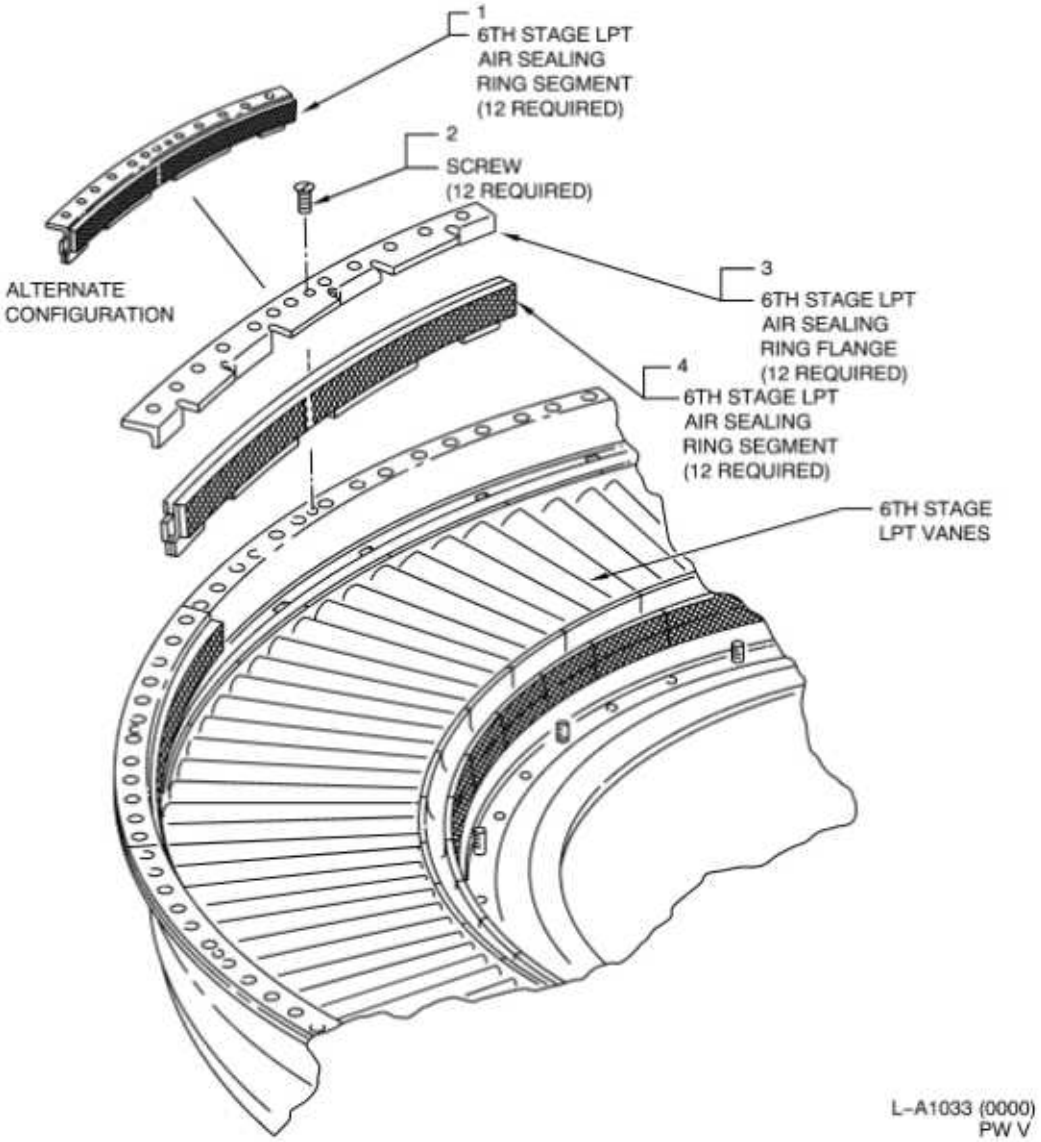

HOIST
1
CLAMP
(4 REQUIRED)
PWA 28657 SLING
PWA 86026 OR
PWA 85332
HANDLING
FIXTURE
PWA 85331
RETAINER
3RD STAGE
LPT DISK
PWA 86206
ADAPTER
(2 REQUIRED)
BLOCK
(4 REQUIRED)
2
TURBINE CASE
SCREW
(10 REQUIRED)
3
PWA 87097 OR
PWA 85638
BUILD FIXTURE
PWA 29918
STAND
L-A1939 (1294)
PW V

Low Pressure Turbine Disassembly
Figure 503
(Task 72-53-00-030-002)

LOW PRESSURE TURBINE (LPT) − DISASSEMBLY−02

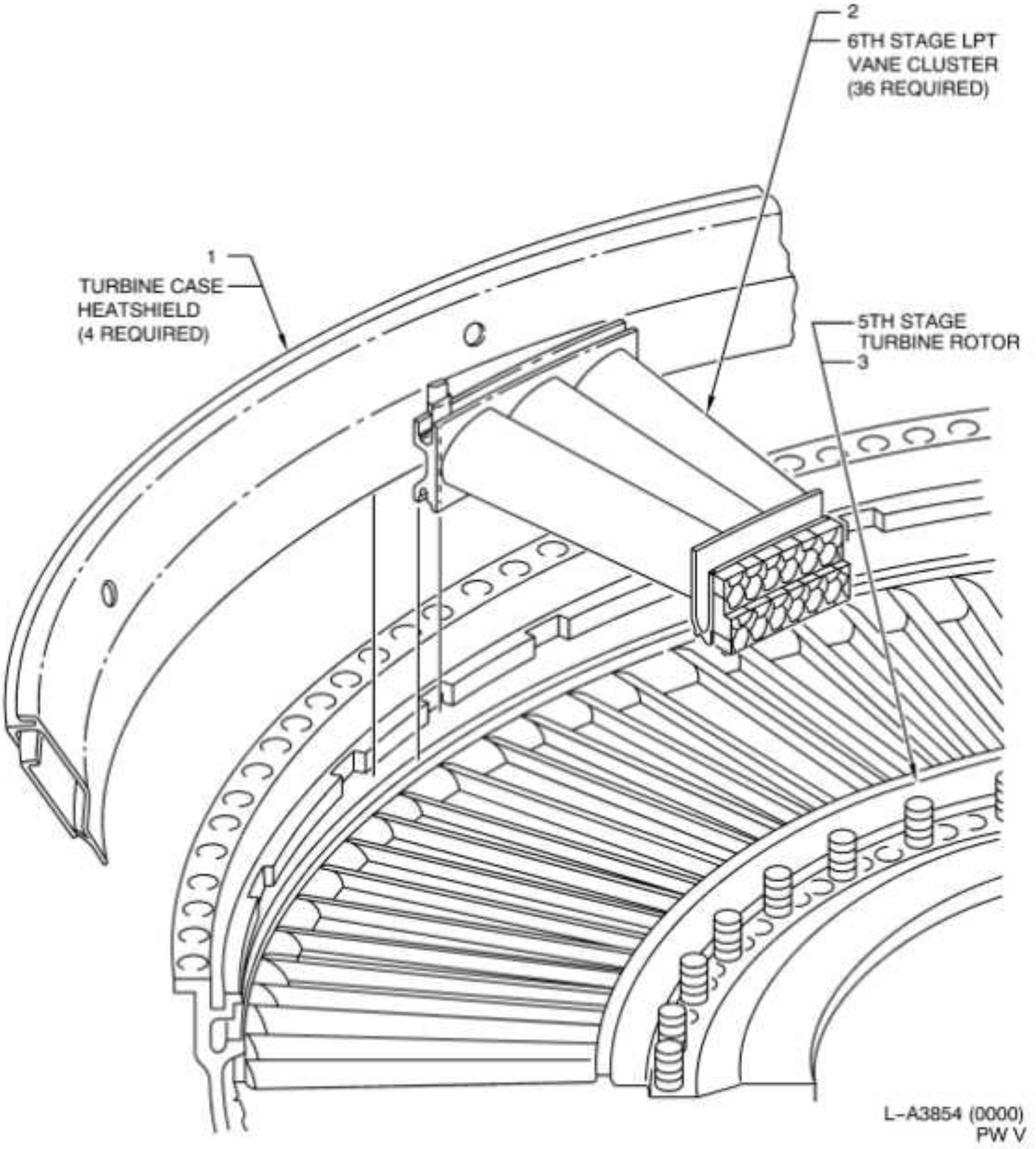

1
NUT
(40 REQUIRED)
2
SPACER
(40 REQUIRED)
3
TIEROD
6TH STAGE LPT DISK
L−A1024

Sixth Stage Turbine Rotor Assembly Removal
Figure 504
(Task 72−53−00−030−002)

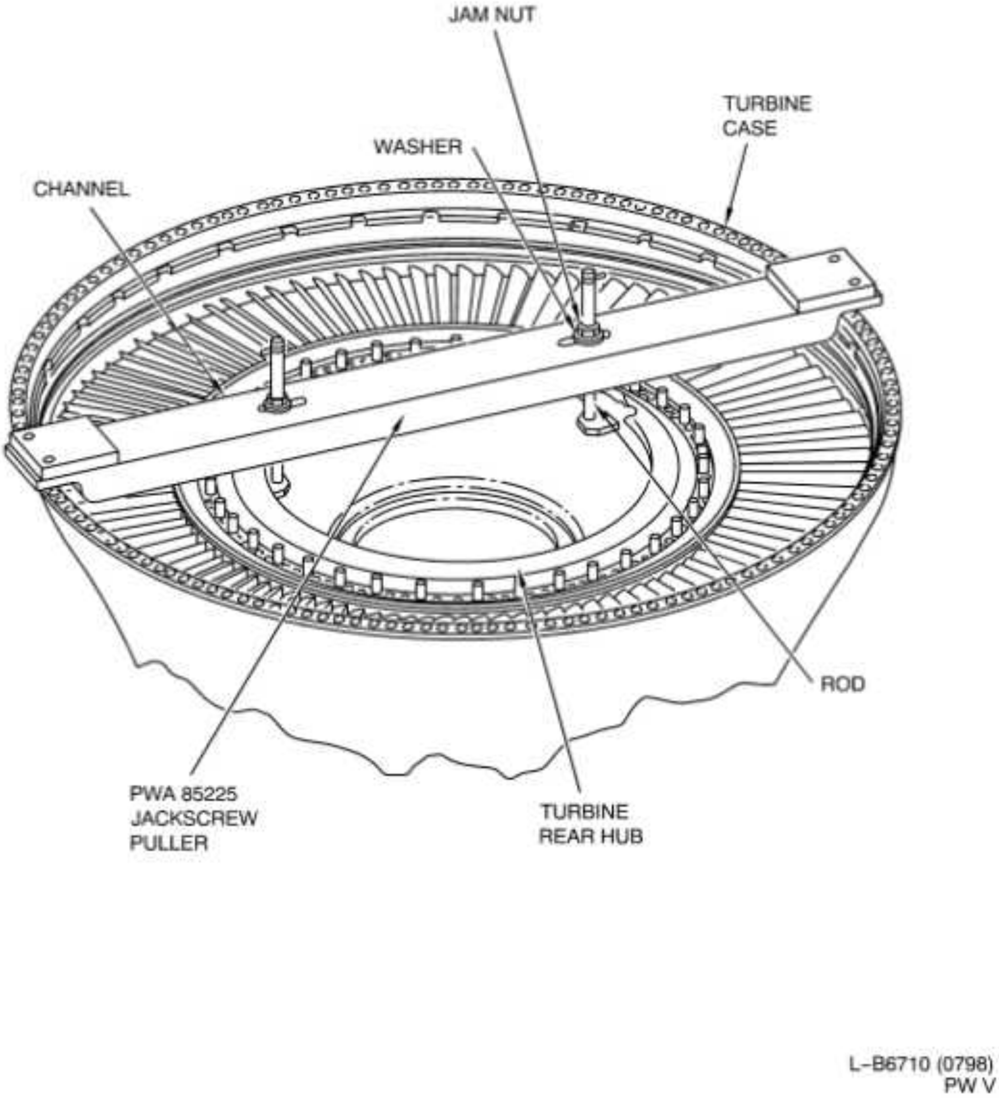

1
6TH STAGE LPT
AIR SEALING
RING SEGMENT
(12 REQUIRED)
2
SCREW
(12 REQUIRED)
ALTERNATE
CONFIGURATION
3
6TH STAGE LPT
AIR SEALING
RING FLANGE
(12 REQUIRED)
4
6TH STAGE LPT
AIR SEALING
RING SEGMENT
(12 REQUIRED)
6TH STAGE
LPT VANES
L−A1033 (0000)
PW V

Sixth Stage LPT Air Sealing Ring Segments Removal
Figure 505
(Task 72−53−00−030−002)

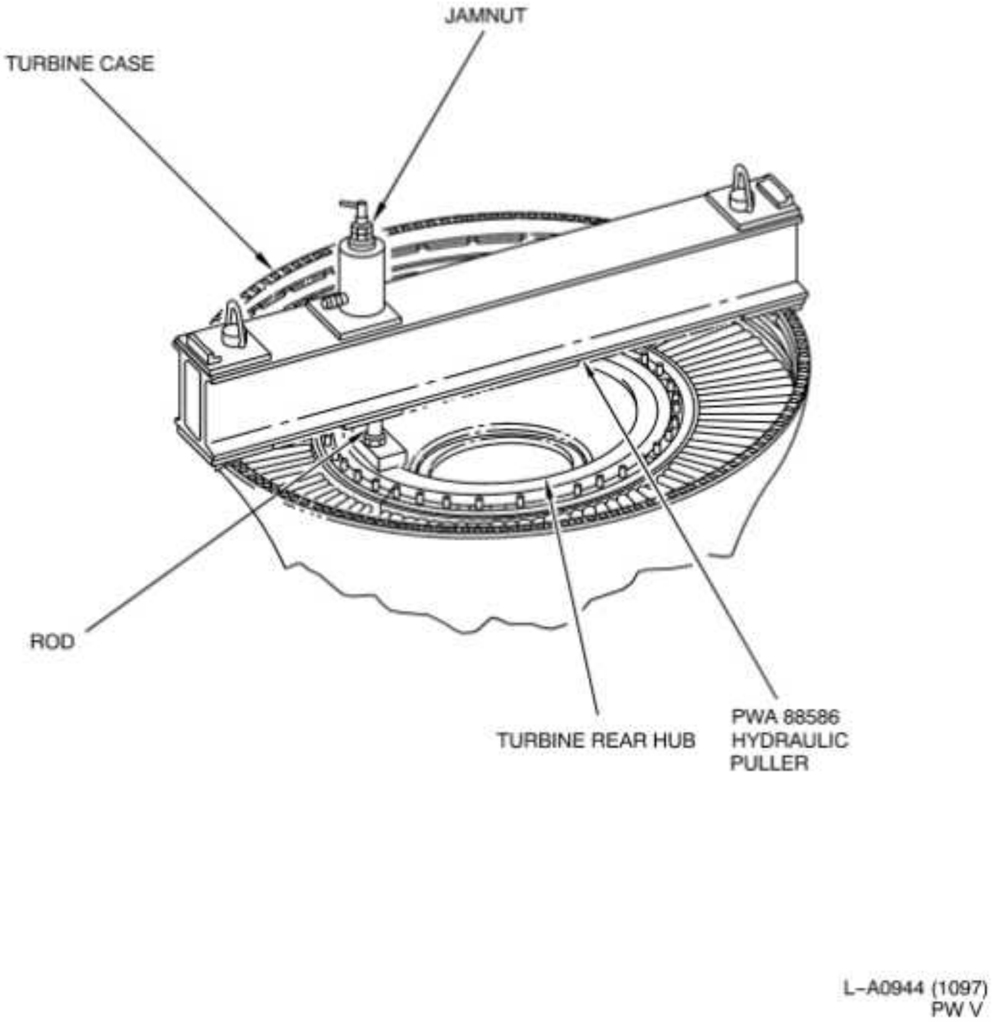
LOW PRESSURE TURBINE (LPT) − DISASSEMBLY−02


2
6TH STAGE LPT VANE CLUSTER (36 REQUIRED)
1
TURBINE CASE HEATSHIELD (4 REQUIRED)
5TH STAGE TURBINE ROTOR
3
L−A3854 (0000)
PW V

Sixth Stage LPT Vane Clusters Removal
Figure 506
(Task 72−53−00−030−002)

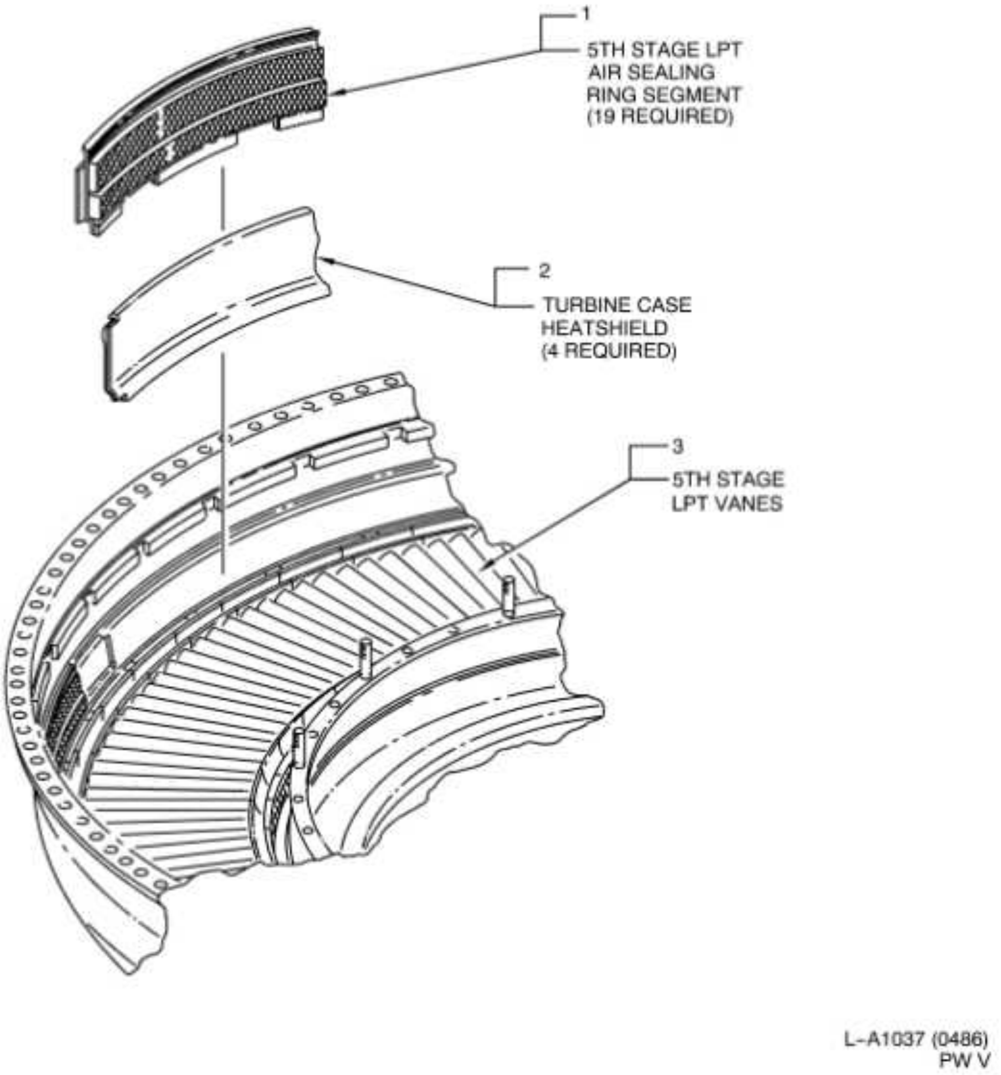

JAM NUT
TURBINE CASE
WASHER
CHANNEL
ROD
PWA 85225 JACKSCREW PULLER
TURBINE REAR HUB
L−B6710 (0798)
PW V

Fifth Stage Turbine Rotor Assembly Removal (PWA 85225)
Figure 507 (Sheet 1)
(Task 72−53−00−030−002)

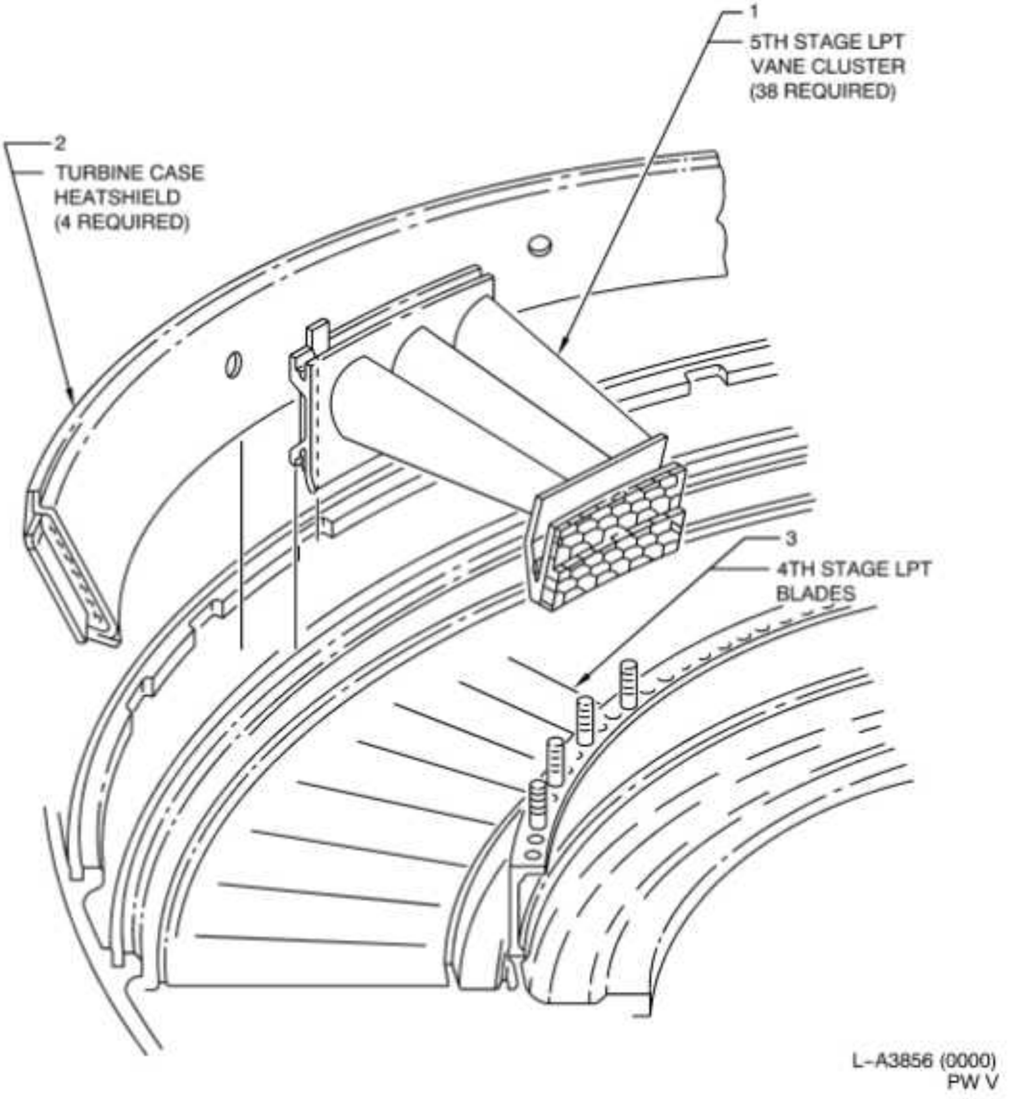

JAMNUT
TURBINE CASE
ROD
TURBINE REAR HUB
PWA 88586 HYDRAULIC PULLER
L−A0944 (1097)
PW V

Fifth Stage Turbine Rotor Assembly Removal (PWA 88586)
Figure 507 (Sheet 2)
(Task 72−53−00−030−002)

LOW PRESSURE TURBINE (LPT) − DISASSEMBLY−02

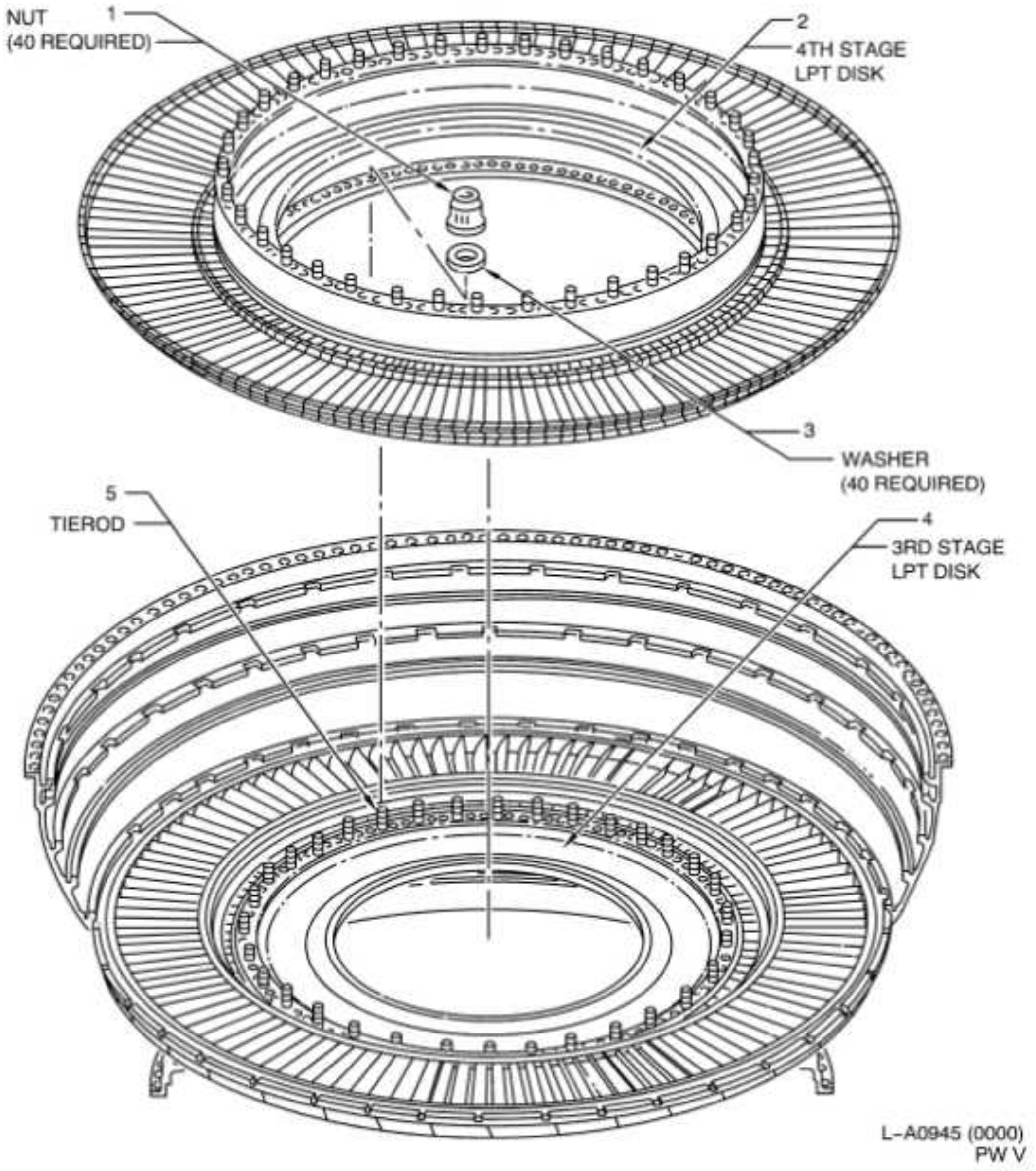

1
5TH STAGE LPT
AIR SEALING
RING SEGMENT
(19 REQUIRED)
2
TURBINE CASE
HEATSHIELD
(4 REQUIRED)
3
5TH STAGE
LPT VANES
L-A1037 (0486)
PW V

Fifth Stage LPT Air Sealing Ring Segments Removal
Figure 508
(Task 72−53−00−030−002)


1
5TH STAGE LPT
VANE CLUSTER
(38 REQUIRED)
2
TURBINE CASE
HEATSHIELD
(4 REQUIRED)
3
4TH STAGE LPT
BLADES
L-A3856 (0000)
PW V

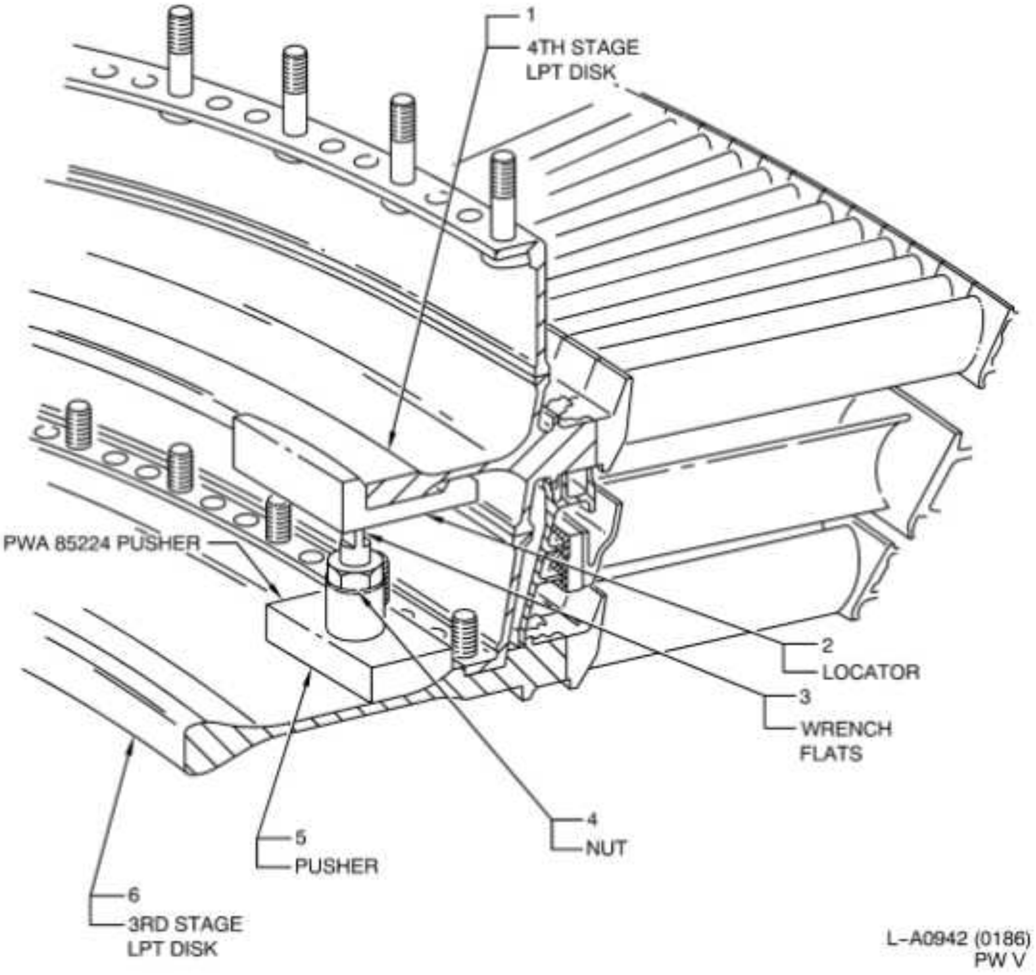
Fifth Stage LPT Vane Clusters Removal
Figure 509
(Task 72−53−00−030−002)

LOW PRESSURE TURBINE (LPT) − DISASSEMBLY−02


NUT
(40 REQUIRED)
1
2
4TH STAGE
LPT DISK
3
WASHER
(40 REQUIRED)
5
TIEROD
4
3RD STAGE
LPT DISK
L−A0945 (0000)
PW V

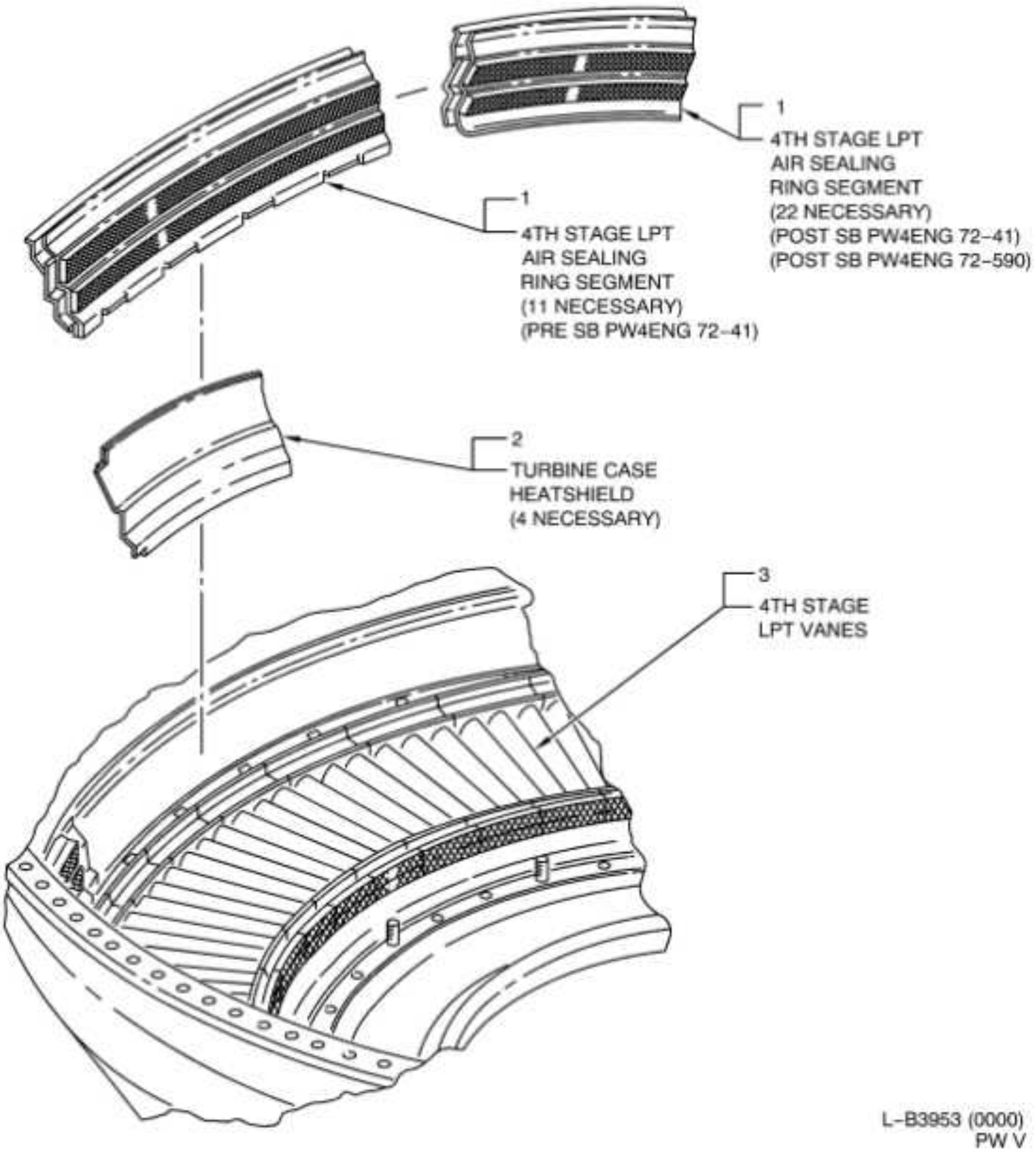
Fourth Stage Turbine Rotor Assembly Removal
Figure 510
(Task 72−53−00−030−002)

LOW PRESSURE TURBINE (LPT) − DISASSEMBLY−02


1
4TH STAGE
LPT DISK
PWA 85224 PUSHER
2
LOCATOR
3
WRENCH
FLATS
4
NUT
5
PUSHER
6
3RD STAGE
LPT DISK
L−A0942 (0186)
PW V

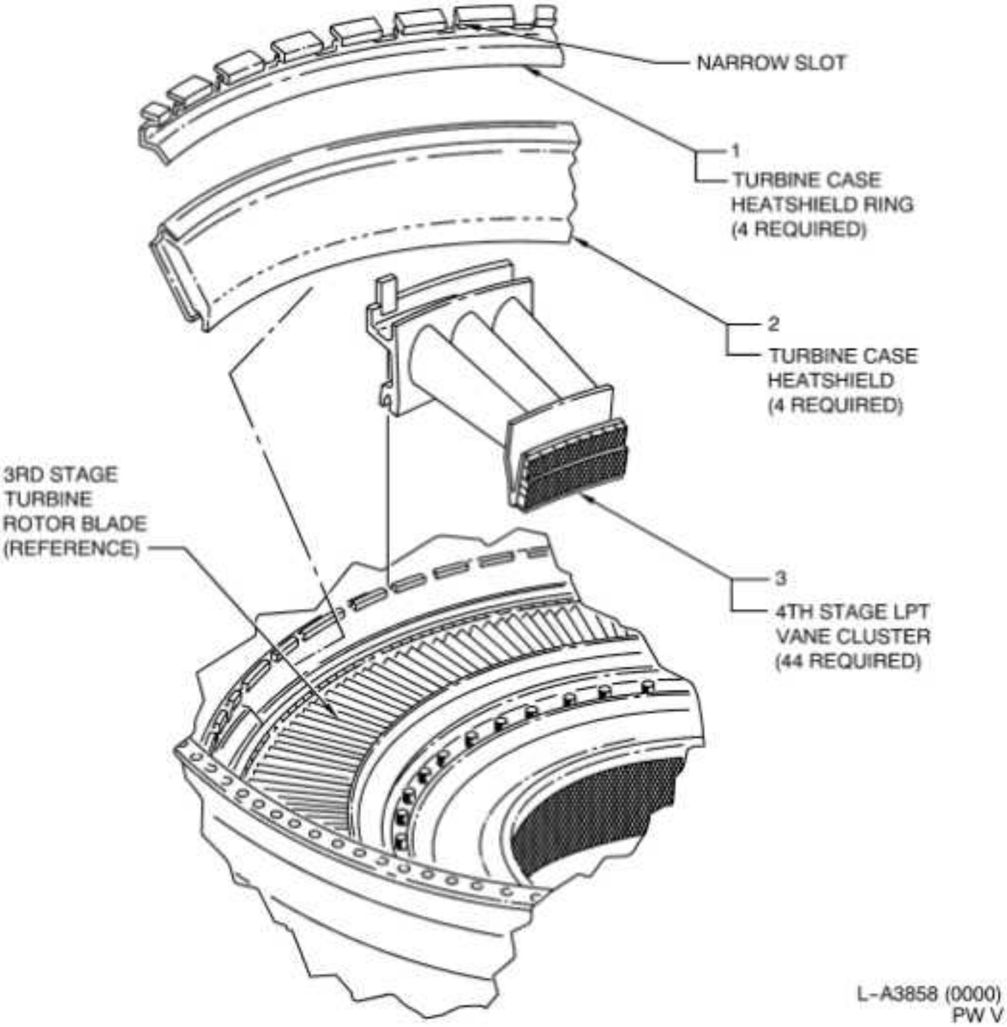
Fourth Stage Turbine Rotor Assembly Removal
Figure 511
(Task 72−53−00−030−002)

LOW PRESSURE TURBINE (LPT) − DISASSEMBLY−02

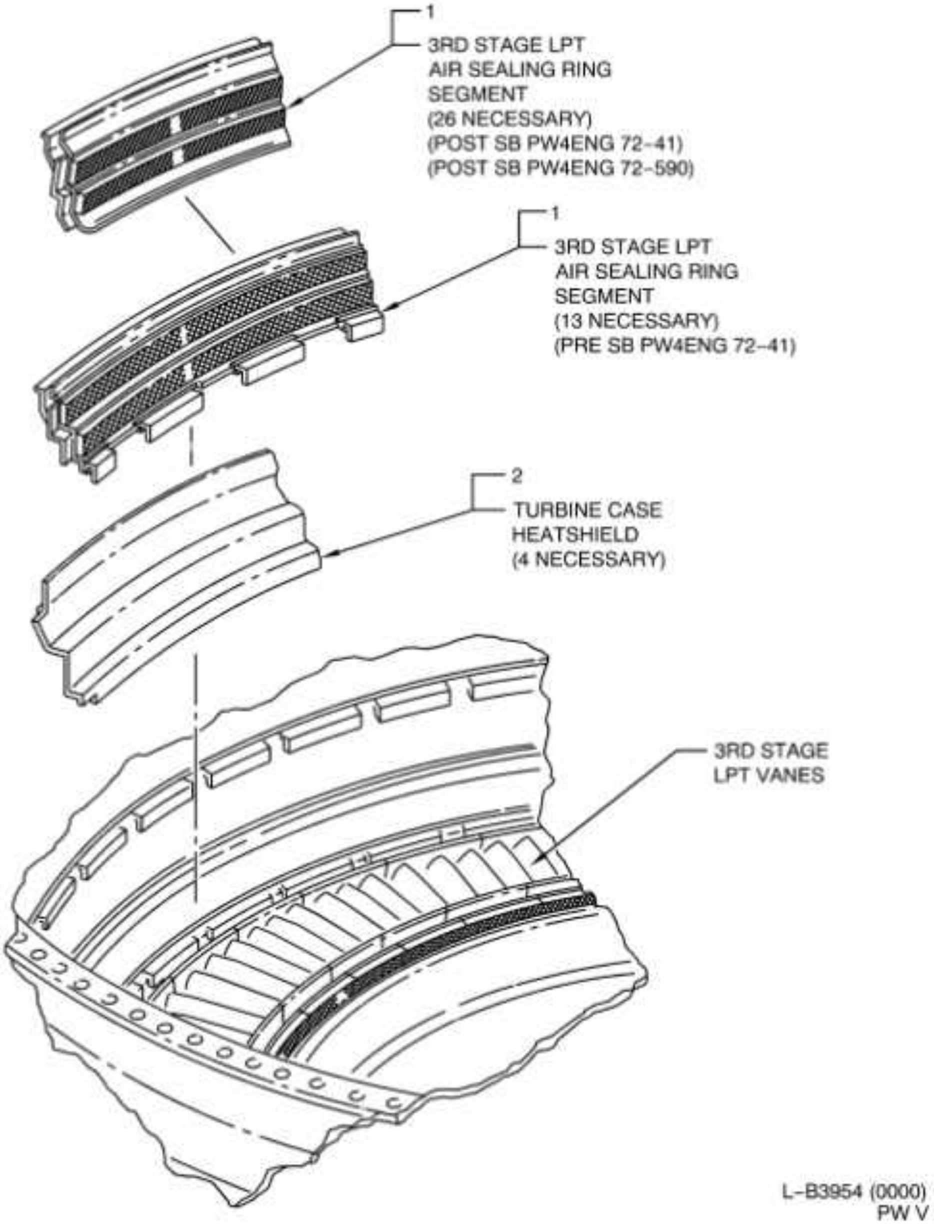

1
4TH STAGE LPT
AIR SEALING
RING SEGMENT
(22 NECESSARY)
(POST SB PW4ENG 72-41)
(POST SB PW4ENG 72-590)
1
4TH STAGE LPT
AIR SEALING
RING SEGMENT
(11 NECESSARY)
(PRE SB PW4ENG 72-41)
2
TURBINE CASE
HEATSHIELD
(4 NECESSARY)
3
4TH STAGE
LPT VANES
L-B3953 (0000)
PW V

Fourth Stage LPT Air Sealing Ring Segments Removal
Figure 512
(Task 72−53−00−030−002)

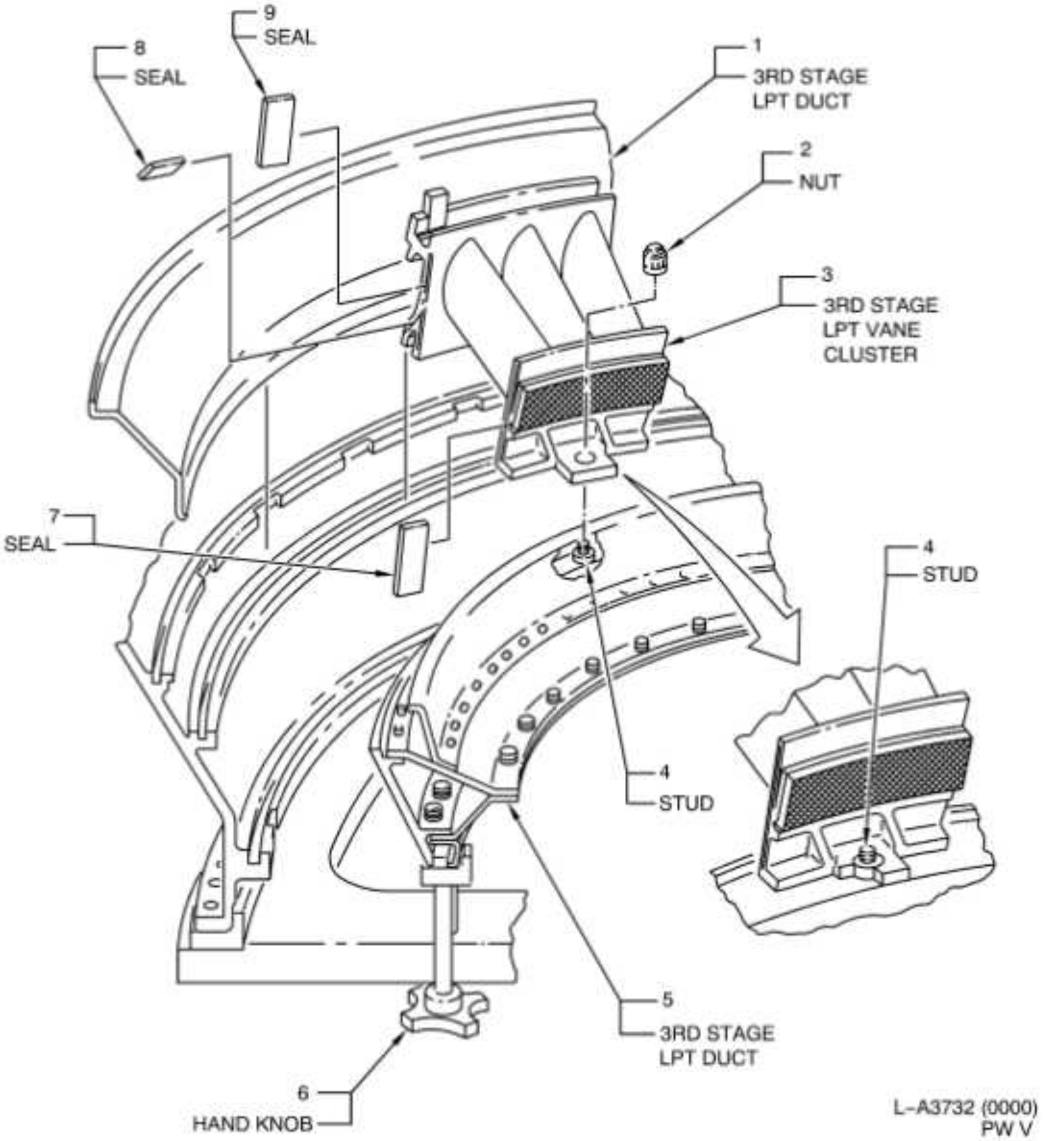
LOW PRESSURE TURBINE (LPT) − DISASSEMBLY−02


NARROW SLOT
1
TURBINE CASE HEATSHIELD RING (4 REQUIRED)
2
TURBINE CASE HEATSHIELD (4 REQUIRED)
3RD STAGE TURBINE ROTOR BLADE (REFERENCE)
3
4TH STAGE LPT VANE CLUSTER (44 REQUIRED)
L−A3858 (0000)
PW V

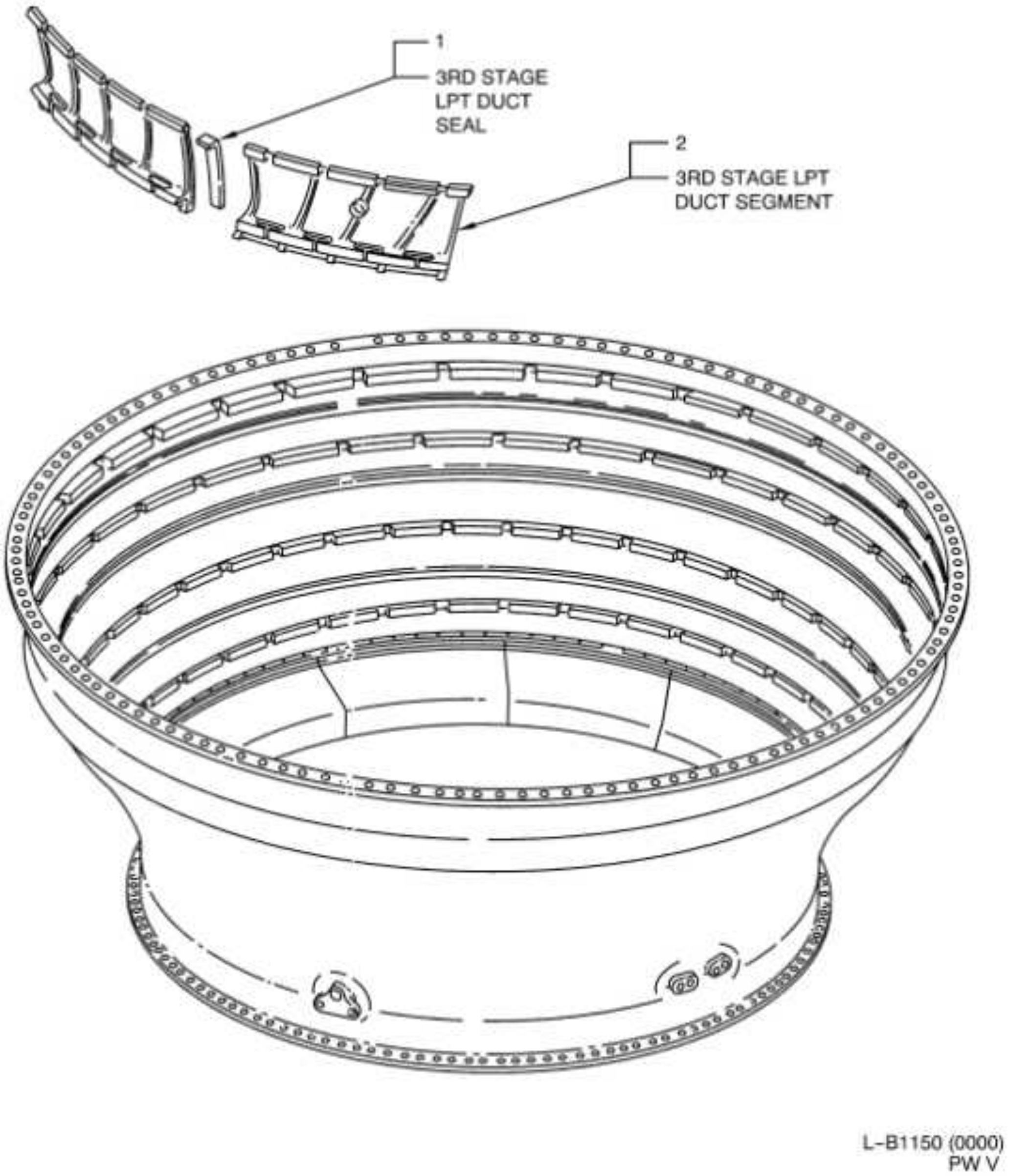
Fourth Stage LPT Vane Clusters Removal
Figure 513
(Task 72−53−00−030−002)


1
3RD STAGE LPT
AIR SEALING RING
SEGMENT
(26 NECESSARY)
(POST SB PW4ENG 72-41)
(POST SB PW4ENG 72-590)
1
3RD STAGE LPT
AIR SEALING RING
SEGMENT
(13 NECESSARY)
(PRE SB PW4ENG 72-41)
2
TURBINE CASE
HEATSHIELD
(4 NECESSARY)
3RD STAGE
LPT VANES
L-B3954 (0000)
PW V

Third Stage Air Sealing Ring Segments Removal
Figure 514
(Task 72−53−00−030−002)

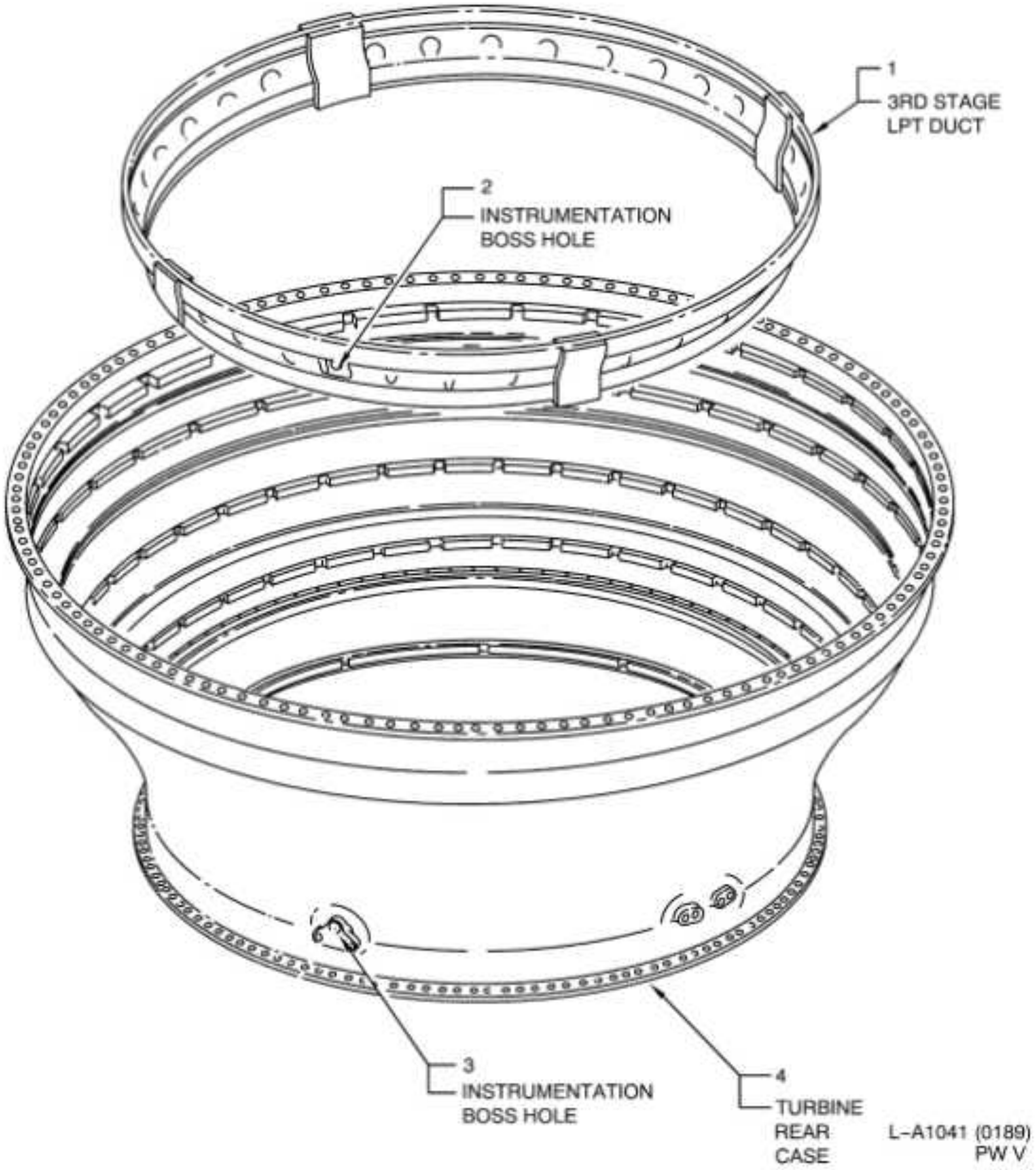

9
SEAL
8
SEAL
1
3RD STAGE
LPT DUCT
2
NUT
3
3RD STAGE
LPT VANE
CLUSTER
7
SEAL
4
STUD
4
STUD
5
3RD STAGE
LPT DUCT
6
HAND KNOB
L−A3732 (0000)
PW V

Third Stage LPT Vane Clusters Removal
Figure 515
(Task 72−53−00−030−002)

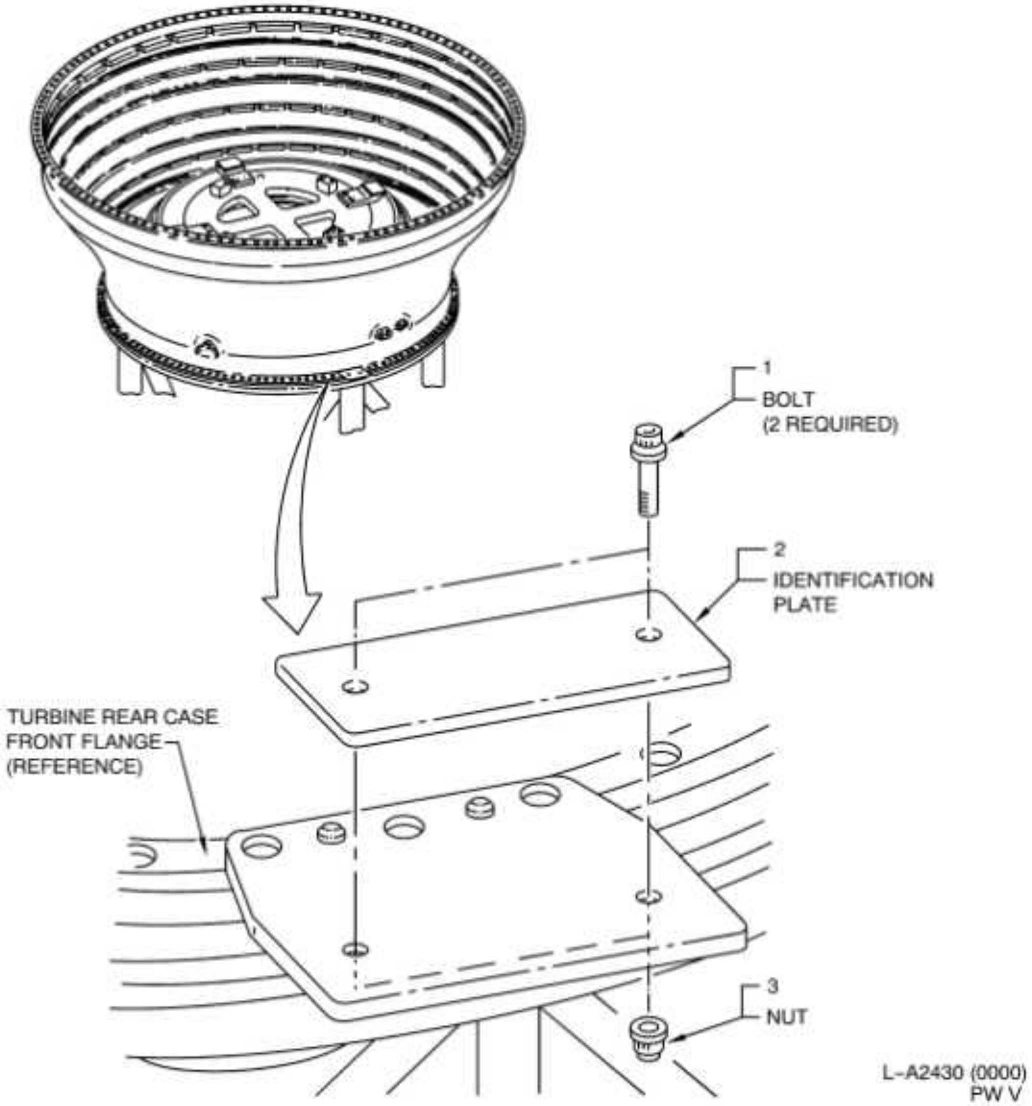

1
3RD STAGE
LPT DUCT
SEAL
2
3RD STAGE LPT
DUCT SEGMENT
L-B1150 (0000)
PW V

Third Stage LPT Duct Segments Removal
Figure 516
(Task 72−53−00−030−002)

LOW PRESSURE TURBINE (LPT) − DISASSEMBLY−02


1
3RD STAGE
LPT DUCT
2
INSTRUMENTATION
BOSS HOLE
3
INSTRUMENTATION
BOSS HOLE
4
TURBINE
REAR
CASE
L−A1041 (0189)
PW V

Third Stage LPT Duct Removal
Figure 517
(Task 72−53−00−030−002)


1
BOLT
(2 REQUIRED)
2
IDENTIFICATION
PLATE
TURBINE REAR CASE
FRONT FLANGE
(REFERENCE)
3
NUT
L-A2430 (0000)
PW V

Identification Plate Removal
Figure 518
(Task 72−53−00−030−002)

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LOW PRESSURE TURBINE (LPT) - INSPECTION/CHECK-01

Task 72-53-00-990-004:

1. General Inspection Requirements - Low Pressure Turbine (LPT)

A. Organization Of Individual Part Or Subassembly Inspection Data

(1) Specific inspection functions for all significant parts/ subassemblies are provided in individual Inspection/ Check sections. Application of each inspection function is shown in Inspection/Check-00 for part/subassembly. Section designations and function descriptions are as follows.

(2) Inspection/Check-00 section contains, where applicable:

(a) Part number(s) for which the inspection data is applicable.

(b) Service Bulletin numbers applicable to part number(s).

(c) Inspection/Check numbers, data categories and applicability data.

(3) Inspection/Check-01, Preinspection Preparation, contains, where applicable:

(a) General inspection comments, notes, CAUTIONS, etc., which supplement data contained in this section.

(b) Identification of mechanical disassembly required prior to inspection.

(c) Identification of any surface treatment or coating removal, or other actions required prior to inspection.

(d) Identification of part/subassembly cleaning required prior to inspection.

(4) Inspection/Check-02, Nondestructive Inspection, contains the following nondestructive inspection methods, part/subassembly special attention areas and damage limits (as applicable):

(a) Fluorescent Penetrant Method

(b) Eddy Current Method

(c) Magnetic Particle Method

(d) X−ray Method

(e) Ultrasonic Method

(f) Hardness Check

(g) Other − As specified.

(5) Inspection/Check−03, Visual Inspection contains, where applicable:

(a) Visual inspection requirements which can be accomplished with or without magnification or special lighting (as specified).

NOTE: Use of inspection tools may be required as a supplement to visual inspection process.

(b) Allowable blending for visual damage, which may be accomplished within the inspection area.

NOTE: Blending requirement will also be shown in applicable repairs.

(6) Inspection/Check−04, Dimensional Inspection, contains, where applicable:

(a) Dimensional inspection requirements other than visual inspection. The requirements will include applicable fits and clearances, and other dimensional inspections necessary to ensure the part integrity and proper functioning.

(7) Inspection/Check−05, Functional Check Inspection contains, where applicable:

(a) Procedures, limits, and equipment used with any required functional checks (oil flow, air flow, leak, etc.).

(8) Inspection/Check−06, Inspection Postrequisites contains, references to procedures required to return part/ subassembly to serviceable condition. References include the following, as required.

(a) Reassembly

(b) Protective coatings, sealants and/or lubricant reapplication

B. Thorough and intelligent part/subassembly inspection is of major importance in achieving efficient engine operation and satisfactory service life. Inspection personnel should be thoroughly familiar with inspection procedures, inspection tooling, limits associated with normal and, where applicable, unusual operating conditions, limits associated with repairs, and with inspection procedures published in Standard Practices Manual.

C. During preliminary inspection of part/subassembly, comparison with mating or adjacent parts may provide indication of source of wear or damage. This procedure may indicate requirement for additional disassembly and inspection.

D. During inspection, records should be kept of deviations beyond serviceable limits to determine: (a) if part/subassembly will be repaired or replaced, and (b) if part is reparable, which repairs are required. Suitable documentation should accompany part/subassembly with results of this determination.

E. Inspection of individual part/subassembly dimensions which are also in Fits and Clearances will include Fits and Clearance Reference Numbers and will show new part/subassembly dimension unless specifically stated otherwise. Inspection Frequency Requirements (IFR) codes (for IFR Code A parts only) are included with Reference Number data. If acceptable dimensional deviations or results of repair affect Fits and Clearances, suitable documentation should accompany part/subassembly to ensure check of fit or clearance at final assembly.

NOTE: Parts/subassemblies which deviate dimensionally from new part/subassembly values may be acceptable provided required fit or clearance is achieved at final assembly.

F. Dimensional inspection requirements will be accompanied by part/subassembly constraint data if such constraint requirements are required during part/subassembly manufacture. Adherence to constraint requirements when inspecting service operated parts/subassemblies should be dictated by experience. It is recommended that parts/subassemblies which do not meet dimensional inspection requirements in free state be constrained and re−measured prior to initiation of any repair or re−use activity.

G. Dimensional inspections of one detail of a subassembly, prior to removal from subassembly, may produce incorrect data due to constraint forces from mating details. If questionable data is obtained, subassembly should be disassembled and inspections repeated.

H. Dimensional inspection limits in inspection text provide continued use (as is) and, if applicable, repair limits. Parts/subassemblies which exceed both limits and nonreparable parts/subassemblies which exceed (as is) limits are unserviceable.

I. Inspections required to verify integrity of repair are contained within repair procedure. Unless otherwise stated, repaired part is expected to meet all inspection requirements contained in inspection text for part/subassembly.

J. Parts/subassemblies which do not require repairs except for those provided in Standard Practices Manual are identified by Chapter/Section/Subject Number 72−53−99 in cleaning table (Cleaning−01) and nondestructive inspection table (Inspection/Check−02). Determination of serviceability for those parts listed in 72−53−99 is limited to cleaning, non−destructive inspection, and the following:

(1) Visually inspect parts/subassemblies for surface defects, deformations, cuts, improper threads or wrenching surfaces, incomplete or missing protective coatings or other damage which will prevent proper functioning and make part/subassembly unserviceable. Unserviceable parts/subassemblies should not be reinstalled. Repair unserviceable parts/subassemblies per Standard Practices Manual, as applicable.

(2) Parts/subassemblies with crack indications to any length or depth detected by listed nondestructive inspection are unserviceable, and should not be reinstalled.

K. When new part/subassembly is to be installed and it is important that it be identified as to engine number or position in engine, mark it by appropriate method described in Marking of Parts, 70−11, Standard Practices Manual.

L. In order to eliminate confusion and to maintain consistent terminology, various physical conditions which might be encountered during inspection of parts/subassemblies and explanation of unusual causes of such conditions are defined in Physical Inspection, 70−31, Standard Practices Manual.

M. If inspection reveals it necessary to replace fitted spacer, tag spacer to indicate that replacement must be made with spacer of correct classification at assembly.

N. If text refers to superficial or shallow imperfection, following definitions apply:

  (1) A superficial imperfection is defined as a nick, dent, scratch, toolmark, etc., which disrupts the surface but does not appear to penetrate surface roughness texture.

  (2) A shallow imperfection appears to penetrate surface finish texture, but does not have a dark bottom and would not cause a 0.007 inch (.178 mm) radius stylus to hesitate if passed over it.

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LOW PRESSURE TURBINE - INSPECTION/CHECK-03

Task 72-53-00-990-005:

1. Visual Inspection - Low Pressure Turbine (LPT)
   A. For inspection requirements applicable to installed (accessible) parts of low pressure turbine (LPT) see 72-00-53, Inspection/Check-XX (Task 72-00-53-220-XXX).

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LOW PRESSURE TURBINE (LPT) - INSPECTION/CHECK-04

Task 72-53-00-990-001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (−) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (−) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
769	B	Front Compressor Drive Turbine (LPT) Shaft (72−53−80) Turbine Shaft Coupling Assembly (72−32−01) (See Figure 802)				
		Shaft	5.2995 (134.608)	5.3005 (134.632)		
		Coupling	5.2975 (134.557)	5.2985 (134.581)	.001T (0.026T)	.003T (0.076T)
771	B	Front Compressor Drive Turbine (LPT) Shaft (72−53−80) Turbine Shaft Coupling Assembly (72−32−01) (See Figure 802)				
		Shaft	5.6995 (144.768)	5.7005 (144.792)		
		Coupling	5.6975 (144.717)	5.6985 (144.741)	.003T (0.076T)	.001T (0.026T)
817	B	Turbine Case Assembly (72−52−30) Rear Turbine (LPT) Case Assembly (72−53−17)				
		Case	39.995 (1015.873)	40.001 (1016.025)		
		Rear Case	39.983 (1015.568)	39.989 (1015.721)	.025T* (0.635T)*	.006* (0.152)*
818	A	Stage 5 Rear Turbine Hub (72−53−15) Front Compressor Drive Turbine (LPT) Shaft (72−53−80) (See Figure 803)				
		Hub	13.349 (339.065)	13.353 (339.166)		
		Shaft	13.343 (338.913)	13.347 (339.013)	.002T (0.051T)	.010T (0.254T)
818	A	Stage 5 Rear Turbine Hub (72−53−15) (PN 51N505 Only) Front Compressor Drive Turbine (LPT) Shaft (72−53−80) (See Figure 803)				
		Hub	13.349 (339.065)	13.353 (339.166)		
		Shaft	13.343 (338.913)	13.347 (339.013)	.000* (0.000)*	.010T (0.254T)

LOW PRESSURE TURBINE (LPT) - INSPECTION/CHECK-04

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
819	B	Front Compressor Drive Turbine (LPT) Shaft (72-53-80) Stage 6 LPT Airseal (72-53-85) (See Figure 803)				
		Shaft	6.8595 (174.232)	6.8605 (174.256)		
		Airseal	6.857 (174.168)	6.859 (174.218)	.0005T (0.013T)	.0035T (0.088T)
820	B	Front Compressor Drive Turbine (LPT) Shaft (72-53-80) Stage 6 LPT Airseal (72-53-85) (See Figure 803)				
		Shaft	6.4999 (165.0975)	6.5005 (165.1127)		
		Airseal	6.497 (165.024)	6.499 (165.074)	.0009T (0.023T)	.0035T (0.088T)
821	B	Front Compressor Drive Turbine (LPT) Shaft (72-53-80) No. 4 Bearing Seal (Front) Spacer (72-54-80) (See Figure 803)				
		Shaft	6.4999 (165.0975)	6.5005 (165.1127)		
		Front Spacer	6.510 (165.35)	6.530 (165.86)	.0095 (0.24)	.0301 (0.76)
822	B	Front Compressor Drive Turbine (LPT) Shaft (72-53-80) No. 4 Bearing Seal (Rear) Spacer (72-54-82) (See Figure 803)				
		Shaft	6.4999 (165.0975)	6.5005 (165.1127)		
		Rear Spacer	6.5005 (165.1127)	6.5011 (165.1279)	.0000 (0.000)	.0012 (0.030)

LOW PRESSURE TURBINE (LPT) - INSPECTION/CHECK-04

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
824	A	Front Compressor Drive Turbine (LPT) Shaft (72-53-80) No. 4 Bearing (72-54-14) (See Figure 803)				
		Shaft	6.4999 (165.0975)	6.5005 (165.1127)		
		Bearing	6.4982 (165.0543)	6.4990 (165.0746)	.0009T (0.023T)	.0023T (0.058T)
825	B	No. 4 Bearing (Inner Race) Retaining Plate (72-53-84) Front Compressor Drive Turbine (LPT) Shaft (72-53-80) (See Figure 803)				
		Plate	5.502 (139.751)	5.504 (139.801)		
		Shaft	5.498 (139.650)	5.502 (139.750)	.006* (0.152)*	.006T (0.152T)
826	B	Rear Turbine (LPT) Case Assembly (72-53-17) Turbine Exhaust Case Assembly (72-54-01) (See Figure 804)				
		Rear Turbine Case	57.560 (1462.024)	57.564 (1462.125)		
		Exhaust Case	57.552 (1461.821)	57.560 (1462.024)	.064* (1.626)*	.012T (0.30T)
827	B	Turbine Shaft Spacer (72-53-81) Front Compressor Drive Turbine (LPT) Shaft (72-53-80) (See Figure 802)				
		Spacer	4.999 (126.975)	5.001 (127.025)		
		Shaft	4.997 (126.924)	4.999 (126.974)	.000T (0.000T)	.004T (0.101T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
842	B	No. 4 Bearing (Inner Race) Retaining Plate (72-53-84) Front Compressor Drive Turbine (LPT) Shaft (72-53-80) (See Figure 803)				
		Plate	5.444 (138.278)	5.446 (138.328)		
		Shaft	5.448 (138.380)	5.452 (138.480)	.002 (0.051)	.014* (0.356)*
843	A	Stage 6 LPT Airseal (72-53-85) Turbine Exhaust Case Assembly (72-54-01) (See Figure 803)				
		Airseal	8.118 (206.198)	8.122 (206.298)		
		Case	8.159 (207.239)	8.161 (207.289)	.037 (0.940)	.055* (1.400)*
848	A	Stage 5 Rear Turbine Hub (72-53-15) Stage 3 LPT (Inner Rotating) Airseal (72-53-38) (See Figure 801, Sheet 2)				
		Hub	13.349 (339.065)	13.353 (339.166)		
		Airseal	13.345 (338.963)	13.347 (339.013)	.011T* (0.279T)*	.002T (0.051T)
848	A	Stage 5 Rear Turbine Hub (72-53-15) (PN 51N505 Only) Stage 3 LPT (Inner Rotating) Airseal (72-53-38) (See Figure 801, Sheet 2)				
		Hub	13.349 (339.065)	13.353 (339.166)		
		Airseal	13.345 (338.963)	13.347 (339.013)	.011T* (0.279T)*	.000* (0.000)*
		FOR THESE MODELS: 4152, 4156A, 4158				
849	A	Stage 3 LPT (Inner Rotating) Airseal (See Figure 801, Sheet 2) Radial				
		Clearance (PN 50N007 Airseal)			.065 (1.651)	.071 (1.803)
		Clearance (PN 50N381 Airseal)			.054 (1.372)	.060 (1.524)

NOTE: Use Reference Number 849 radial clearance for

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)						
		converted phase III engine, identified by CN after engine SN.				
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
854	A	Stage 3 LPT (Inner Rotating) Airseal (See Figure 801, Sheet 2)				
		Radial Clearance (PN 50N529-01 Airseal) (Pre SB PW4ENG 72-634)			.037 (0.940)	.043 (1.092)
		Radial Clearance (PN 50N382-01 Airseal) (Post SB PW4ENG 72-634)			.054 (1.372)	.060 (1.524)

NOTE: Reference Number 854 radial clearance applies to phase III engines as built by P&W. For converted phase III engine (CN) refer to Reference Number 849.

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1151	A	Stage 3 LPT (Outer Rotating) Airseal (72-53-39) Stage 3 LPT Disk (72-53-13) (See Figure 801, Sheet 3)				
		Airseal	30.928 (785.572)	30.932 (785.672)		
		Disk	30.918 (785.318)	30.922 (785.418)	.022T* (0.56T)*	.003T* (0.08T)*
1151	A	Stage 3 LPT (Outer Rotating) Airseal (72-53-39) Stage 3 LPT Disk (72-53-13) (PN 50N803 Only) (See Figure 801, Sheet 3)				
		Airseal	30.928 (785.572)	30.932 (785.672)		
		Disk	30.918 (785.318)	30.922 (785.418)	.019T* (0.483T)*	.003T* (0.08T)*
		FOR THESE MODELS: 4152, 4156A, 4158				
1152	A	Stage 3 LPT Disk (72-53-13) Stage 4 LPT Disk Assembly (72-53-14) (See Figure 801, Sheet 3)				
		Disk	28.918 (734.518)	28.922 (734.618)		
		Disk Assembly	28.912 (734.365)	28.916 (734.466)	.012T* (0.305T)*	.005L* (0.127L)*

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1153	A	Stage 4 LPT (Rotating) Airseal (72-53-40) Stage 3 LPT Disk (72-53-13) (See Figure 801, Sheet 3)				
		Airseal	31.534 (800.964)	31.538 (801.065)		
		Disk	31.538 (801.066)	31.542 (801.166)	.010T* (0.254T)*	.008 (0.203)
1153	A	Stage 4 LPT (Rotating) Airseal (72-53-40) Stage 3 LPT Disk (72-53-13) (PN 50N803 Only) (See Figure 801, Sheet 3)				
		Airseal	31.534 (800.964)	31.538 (801.065)		
		Disk	31.538 (801.066)	31.542 (801.166)	.005T* (0.127T)*	.008 (0.203)
		FOR THESE MODELS: 4152, 4156A, 4158				
1154	A	Stage 4 LPT (Rotating) Airseal (72-53-40) Stage 4 LPT Disk Assembly (72-53-14) (See Figure 801, Sheet 3)				
		Airseal	33.037 (839.140)	33.041 (839.241)		
		Disk Assembly	33.023 (838.785)	33.027 (838.885)	.024T* (0.610T)*	.010T (0.254T)
1155	A	Stage 5 LPT (Rotating) Airseal (72-53-41) Stage 4 LPT Disk Assembly (72-53-14) (See Figure 801, Sheet 3)				
		Airseal	33.238 (844.246)	33.242 (844.346)		
		Disk Assembly	33.242 (844.347)	33.246 (844.448)	.006T* (0.153T)*	.008L (0.203L)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
		FOR THESE MODELS: 4152, 4156A, 4158				
1156	A	Stage 5 LPT (Rotating) Airseal (72-53-41) (PN 50N162) Stage 5 Rear Turbine Hub (72-53-15) (See Figure 801, Sheet 4)				
		Airseal	33.760 (857.504)	33.764 (857.605)		
		Hub	33.754 (857.352)	33.758 (857.453)	.016T* (0.41T)*	.002T (0.051T)
		FOR THESE MODELS: 4152, 4156A, 4158				
1157	A	Stage 5 Rear Turbine Hub (72-53-15) Stage 4 LPT Disk Assembly (72-53-14) (See Figure 801, Sheet 4)				
		Hub	31.162 (791.515)	31.166 (791.616)		
		Disk Assembly	31.156 (791.363)	31.160 (791.464)	.012T* (0.305T)*	.003L* (0.076L)*
1158	A	Stage 6 LPT Disk Assembly (72-53-16) Stage 5 Turbine Rear Hub (72-53-15) (See Figure 801, Sheet 4)				
		Disk	32.927 (836.346)	32.931 (836.447)		
		Hub	32.913 (835.991)	32.917 (836.091)	.024T* (0.61T)*	.004T* (0.10T)*
1158	A	Stage 6 LPT Disk Assembly (72-53-16) Stage 5 Turbine Rear Hub (72-53-15) (PN 51N505 Only) (See Figure 801, Sheet 4)				
		Disk	32.927 (836.346)	32.931 (836.447)		
		Hub	32.913 (835.991)	32.917 (836.091)	.023T* (0.584T)*	.004T* (0.10T)*
1159	A	Stage 3 LPT Blade (See Figure 801, Sheet 6)				
		Radial Clearance			.0245 (0.622)	.0635 (1.613)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1160	A	Stage 3 LPT Blade (See Figure 801, Sheet 6) Radial Clearance			.0205 (0.521)	.0655 (1.664)
1161	A	Stage 4 LPT Blade (See Figure 801, Sheet 6) Radial Clearance			.0205 (0.521)	.0595 (1.511)
1162	A	Stage 4 LPT Blade (See Figure 801, Sheet 6) Radial Clearance (50N415-01, 50N345-01)			.0265 (0.673)	.0695 (1.765)
		Radial Clearance (50N526-01)			.0275 (0.698)	.0725 (1.842)
1163	A	Stage 5 LPT Blade (See Figure 801, Sheet 5) Radial Clearance			.021 (0.533)	.060 (1.524)
1164	A	Stage 5 LPT Blade (See Figure 801, Sheet 5) Radial Clearance			.013 (0.330)	.054 (1.372)
1165	A	Stage 6 LPT Blade Stage 6 LPT Air Sealing Ring Segment Assembly (72-53-35) (See Figure 801, Sheet 5)				
		Radial Clearance With Ring Segment PN 50N292-01 (Pre SB PW4ENG 72-593)			.033 (0.838)	.074 (1.880)
		Radial Clearance With Ring Segment PN 50N528-01			.033	.074

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)						
		(Post SB PW4ENG 72−593)			(0.838)	(1.880)
		Radial Clearance				
		With Ring Segment PN 51N067−01			.053	.094
		(Post SB PW4ENG 72−769)			(1.346)	(2.388)
1166	A	Stage 3 LPT (Outer Rotating) Airseal				
		(See Figure 801, Sheet 3)				
		Radial				
		Clearance PN 50N283			.103 (2.616)	.117 (2.972)
		Radial				
		Clearance PN 50N473			.103 (2.616)	.117 (2.972)
		Radial				
		Clearance PN 50N773−01			.103	.117
		(Post SB PW4ENG 72−85)			(2.616)	(2.972)
		(Post SB PW4ENG 72−354)				
		Radial				
		Clearance PN 51N373−01			.102 (2.591)	.118 (2.997)
		Radial				
		Clearance PN 52N573−01			.103 (2.616)	.117 (2.972)
		Radial				
		Clearance PN 52N673−01			.102 (2.591)	.118 (2.997)
1167	A	Stage 4 LPT (Rotating) Airseal				
		(See Figure 801, Sheet 3)				
		Radial				
		Clearance PN 50N009			.046	.070
		(Pre SB PW4ENG 72−236			(1.168)	(1.778)
		Radial				
		Clearance PN 50N478			.046	.070
		(Pre SB PW4ENG 72−634)			(1.168)	(1.778)
		Post SB PW4ENG A72−707)				
		Radial				
		Clearance PN 50N346			.050	.070
		(Post SB PW4ENG 72−634)			(1.270)	(1.778)
		Radial				
		Clearance PN 51N038			.081	.105
		(Post SB PW4ENG A72−707)			(2.057)	(2.667)
		Radial				

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)						
		Clearance PN 50N478-001 (Post SB PW4ENG A72-707)			.081 (2.057)	.105 (2.667)
1168	A	Stage 4 LPT (Rotating) Airseal (See Figure 801, Sheet 3)				
		Radial Clearance PN 50N009 (Post SB PW4ENG 72-236)			.048 (1.219)	.070 (1.778)
		Radial Clearance PN 50N478 (Pre SB PW4ENG 72-634)			.048 (1.219)	.070 (1.778)
		Radial Clearance PN 50N346 (Post SB PW4ENG 72-634)			.052 (1.321)	.070 (1.778)
		Radial Clearance PN 51N038 (Post SB PW4ENG A72-707)			.083 (2.108)	.105 (2.667)
		Radial Clearance PN 50N478-001 (Post SB PW4ENG A72-707)			.083 (2.108)	.105 (2.667)
1169	A	Stage 5 LPT (Rotating) Airseal (See Figure 801, Sheet 4)				
		Radial Clearance PN 50N162			.082 (2.083)	.098 (2.489)
		Radial Clearance PN 50N324			.082 (2.083)	.098 (2.489)
		Radial Clearance PN 50N419			.078 (1.981)	.098 (2.489)
1170	A	Stage 5 LPT (Rotating) Airseal (See Figure 801, Sheet 4)				
		Radial Clearance PN 50N162 (Pre SB PW4ENG 72-236)			.082 (2.083)	.098 (2.489)
		Radial Clearance PN 50N324			.082 (2.083)	.098 (2.489)
		Radial Clearance PN 50N419			.078 (1.981)	.098 (2.489)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1171	A	Stage 6 LPT (Rotating) Airseal (Stage 6 LPT Disk Assembly) (See Figure 801, Sheet 4)				
		Radial Clearance			.062 (1.575)	.0815* (2.07*)
1172	A	Stage 6 LPT (Rotating) Airseal (Stage 6 LPT Disk Assembly) (See Figure 801, Sheet 4)				
		Radial Clearance			.065 (1.651)	.079 (2.007)
1174	B	Instrumentation (Borescope) Boss Plug (72-53-17) Rear Turbine (LPT) Case Assembly (72-53-17) (See Figure 801, Sheet 7)				
		Plug	.561 (14.250)	.562 (14.274)		
		Case	.565 (14.351)	.571 (14.503)	.003 (0.076)	.010 (0.254)
1175	B	Instrumentation (Borescope) Boss Plug (72-53-17) Stage 3 LPT (Outer) Duct Segment Assembly (72-53-29) (See Figure 801, Sheet 7)				
		Plug	.432 (10.973)	.438 (11.125)		
		Duct Segment	.440 (11.176)	.444 (11.277)	.002 (0.05)	.012 (0.30)
1176	B	Pin (72-53-29) Stage 3 LPT (Outer) Duct Segment Assembly (72-53-29) (See Figure 801, Sheet 7)				
		Pin	.18825 (4.7816)	.18875 (4.7942)		
		Duct Segment	.187 (4.750)	.188 (4.775)	.00175T (0.044T)	.00025T (0.007T)

LOW PRESSURE TURBINE (LPT) - INSPECTION/CHECK-04

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1182	A	Stage 3 LPT (Outer Rotating) Airseal (ID) (See Figure 801, Sheet 3) ·Stage 3 LPT (Outer Rotating) Airseal (ID) See 72-53-39, Inspection/Check-04 ·Stage 3 LPT (Inner) Sealing Ring Support Assembly See 72-53-20, Inspection/Check-04				
		Radial Clearance			.028* (0.71)*	.113 (2.870)
		FOR THESE MODELS: 4152, 4156A, 4158				
1187	A	Stage 5 LPT (Rotating) Airseal (72-53-41) (PN 50N347, 50N324) Stage 5 Rear Turbine Hub (72-53-15) (See Figure 801, Sheet 4)				
		Airseal	33.772 (857.809)	33.776 (857.910)		
		Hub	33.754 (857.352)	33.758 (857.453)	.028T* (0.71T)*	.014T (0.356T)
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
1188 (1)	A	Stage 3 LPT Disk (72-53-13) Stage 4 LPT Disk Assembly (72-53-14) (See Figure 801, Sheet 3)				
		Disk	28.918 (734.518)	28.922 (734.618)		
		Disk Assembly (Pre SB PW4ENG 72-634)	28.900 (734.060)	28.904 (734.161)	.024T* (0.610T)*	.007T* (.178T)*
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
1188 (2)	A	Stage 3 LPT Disk (72-53-13) Stage 4 LPT Disk Assembly (72-53-14) (See Figure 801, Sheet 3)				
		Disk	28.918 (734.518)	28.922 (734.618)		
		Disk Assembly (Post SB PW4ENG 72-634)	28.912 (734.365)	28.916 (734.466)	.012T* (0.305T)*	.005L* (.127L)*

	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
1189	A	Stage 4 LPT (Rotating) Airseal (72-53-40)				
(1)		Stage 4 LPT Disk Assembly (72-53-14)				
		(See Figure 801, Sheet 3)				
		Airseal	33.037	33.041		
			(839.140)	(839.241)		
		Disk Assembly	33.005	33.009	.036T	.028T
		(Pre SB	(838.327)	(838.428)	(0.914T)	(0.711T)
		PW4ENG 72-634)				
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
1189	A	Stage 4 LPT (Rotating) Airseal (72-53-40)				
(2)		Stage 4 LPT Disk Assembly (72-53-14)				
		(See Figure 801, Sheet 3)				
		Airseal	33.037	33.041		
		(Post SB	(839.140)	(839.241)		
		PW4ENG 72-634)				
		Disk Assembly	33.023	33.027	.024T	.010T
		(Post SB	(838.784)	(838.886)	(0.610T)	(0.254T)
		PW4ENG 72-634)				
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
1190	A	Stage 5 LPT (Rotating) Airseal (72-53-41)				
R (1)		Stage 5 Rear Turbine Hub (72-53-15) (PN 51N305, 51N405,				
R		and 51N505)				
		(See Figure 801, Sheet 4)				
		Airseal	33.772	33.776		
			(857.809)	(857.910)		
		Hub	33.750	33.754	.029T*	.018T
		(Pre SB	(857.250)	(857.351)	(0.737T)*	(0.457T)
		PW4ENG 72-634)				
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
1190	A	Stage 5 LPT (Rotating) Airseal				
(2)		(72-53-41)				
		Stage 5 Rear Turbine Hub (72-53-15)				
		(See Figure 801, Sheet 4)				
		Airseal	33.772	33.776		
			(857.809)	(857.910)		
		Hub	33.754	33.758	.022T	.014T
		(Post SB	(857.352)	(857.453)	(0.559T)	(0.356T)
		PW4ENG 72-634)				

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
1191 (1)	A	Stage 5 Rear Turbine Hub (72-53-15) (PN 51N505 Only) Stage 4 LPT Disk Assembly (72-53-14) (See Figure 801, Sheet 4)				
		Hub	31.162 (791.515)	31.166 (791.616)		
		Disk Assembly (Pre SB PW4ENG 72-634)	31.134 (790.804)	31.138 (790.905)	.034T* (0.864T)*	.017T* (.432T)*
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
1191 (2)	A	Stage 5 Rear Turbine Hub (72-53-15) Stage 4 LPT Disk Assembly (72-53-14) (See Figure 801, Sheet 4)				
		Hub	31.162 (791.515)	31.166 (791.616)		
		Disk Assembly (Post SB PW4ENG 72-634)	31.156 (791.362)	31.160 (791.464)	.012T* (0.305T)*	.002T (.051T)
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
1192	A	Stage 4 LPT (Rotating) Airseal (72-53-40) Stage 4 LPT Disk Assembly (72-53-14) (See Figure 801, Sheet 3)				
		Airseal (Post SB PW4ENG A72-707)	33.024 (838.810)	33.028 (838.911)		
		Disk Assembly (Pre SB PW4ENG 72-634)	33.005 (838.327)	33.009 (838.428)	.023T (0.584T)	.015T (0.381T)
2000	B	Bolt Turnbuckle Rod End Bearing (See Figure 806)				
		Bolt	.186 (4.725)	.189 (4.800)		
		Bearing	.1895 (4.814)	.1915 (4.864)	.0005 (0.013)	.0055 (0.139)
2001	B	Radial Clearance (See Figure 806) Rod End Spherical Bearing			.000 (0.000)	.0005 (0.0127)

G. Disk, Hub, Airseal Limits

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1220	A	Disk, Stage 3 LPT (See Figure 801, Sheet 1) See 5-10-00, Time Limits				
1221	A	Disk, Stage 4 LPT (See Figure 801, Sheet 1) See 5-10-00, Time Limits				
1222	A	Hub, Stage 5 Turbine Rear (See Figure 801, Sheet 1) See 5-10-00, Time Limits				
1223	A	Disk, Stage 6 LPT (See Figure 801, Sheet 1) See 5-10-00, Time Limits				
1224	A	Airseal, Stage 3 LPT (Outer Rotating) (See Figure 801, Sheet 1) See 5-10-00, Time Limits				
1225	A	Airseal, Stage 4 LPT (Rotating) (See Figure 801, Sheet 1) See 5-10-00, Time Limits				
1226	A	Airseal, Stage 5 LPT (Rotating) (See Figure 801, Sheet 1) See 5-10-00, Time Limits				
2025	A	Front Compressor Drive Turbine (LPT) Shaft (See Figure 802) See 5-10-00, Time Limits				
2026	A	Airseal, Stage 3 LPT (Inner Rotating) (See Figure 801, Sheet 1) See 5-10-00, Time Limits				

H. Spline Data

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
951	B	1. Turbine Shaft Coupling Assembly Internal Spline (Straight, Uncrowned, Portion Of Spline) (See Figure 801, Sheet 1)				
		A. Effective Space Width	.1309 (3.325)	---		
		B. Actual Space Width	---	.1341 (3.406)		
	B	2. Front Compressor Drive Turbine (LPT) Shaft (72-53-80) External Spline (See Figure 801, Sheet 1)				
		A. Effective Tooth Thickness	---	.1294 (3.287)		
		B. Actual Tooth Thickness	.1262 (3.205)	---		
		3. Fit			.0015 (0.038)	---

I. Special Torques

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limit Min	Limit Max
		FOR THESE MODELS: 4152, 4156A, 4158				
977	A	Tierod Nut (See Figure 803) See 72-53-00, Assembly-06 (Task 72-53-00-400-006)				
978	A	Perimeter Bolts And Nuts At P Flange (See Figure 804) See 72-53-00, Installation-01 (Task 72-53-00-420-001)				

LOW PRESSURE TURBINE (LPT) - INSPECTION/CHECK-04

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limit Min	Limit Max
		FOR THESE MODELS: 4152, 4156A, 4158				
982	A	Tierod Nut (See Figure 803) See 72-53-00, Assembly-06 (Task 72-53-00-400-006)				
		FOR THESE MODELS: 4152-3, 4156A-3, 4158-3				
983	A	Tierod Nut (See Figure 803) See 72-53-00, Assembly-01 (Task 72-53-00-400-006)				

J. Special Assembly Procedures

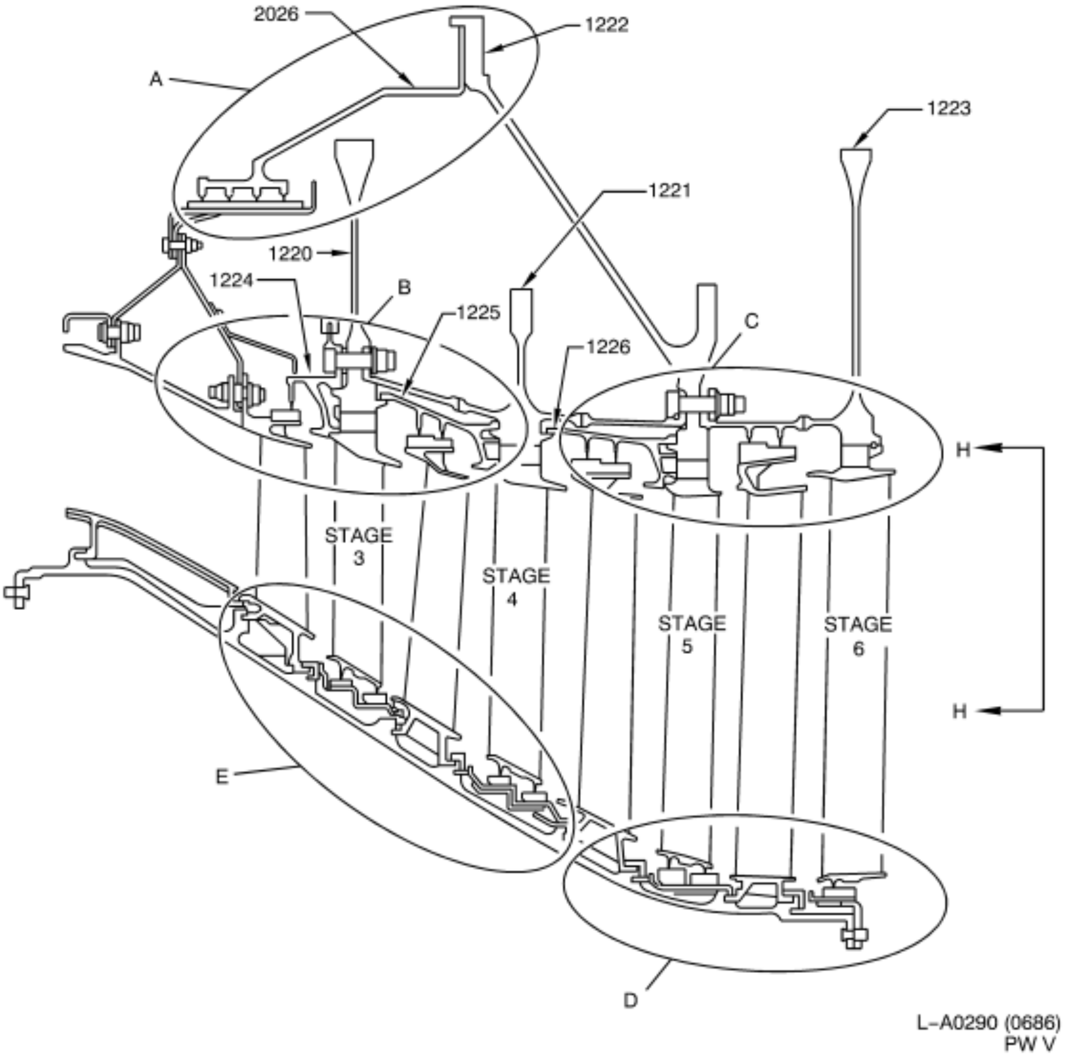
LOW PRESSURE TURBINE (LPT) - INSPECTION/CHECK-04

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1003	A	Bottoming Procedure Stage 6 LPT Airseal And No. 4 Bearing Seal Spacers On Front Compressor Drive Turbine (LPT) Shaft (See Figure 803) See 72-53-00, Installation-01 Task 72-53-00-420-001				
1181	C	Pin (72-53-22) Stage 3 LPT (Inner) Sealing Ring Assembly (72-53-19) (See Figure 801, Sheet 2) See 72-53-00, Assembly-04 Task 72-53-00-400-004				
1250	A	Tierod Nut (See Figure 801, Sheet 3) See 72-53-00, Assembly-01 Task 72-53-00-400-001				
		FOR THESE MODELS: 4152, 4156A, 4158				
1251	A	Tierod Nut (See Figure 801, Sheet 4) See 72-53-00, Assembly-01 Task 72-53-00-400-001 See 72-53-00, Assembly-04 Task 72-53-00-400-004 See 72-53-00, Assembly-08 Task 72-53-00-400-008 See 72-53-00, Assembly-11 Task 72-53-00-400-011 See 72-53-00, Assembly-12 Task 72-53-00-400-012				
		FOR THESE MODELS: 4152, 4156A, 4158				
1252	A	Tierod Nut (See Figure 801, Sheet 4) See 72-53-00, Assembly-01 Task 72-53-00-400-001 See 72-53-00, Assembly-04 Task 72-53-00-400-004 See 72-53-00, Assembly-08 Task 72-53-00-400-008 See 72-53-00, Assembly-11 Task 72-53-00-400-011				

(CONTINUED)
See 72−53−00, Assembly−12
Task 72−53−00−400−012

FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
1253 A Tierod Nut
(See Figure 801, Sheet 4)
See 72−53−00, Assembly−01
Task 72−53−00−400−001
See 72−53−00, Assembly−04
Task 72−53−00−400−004
See 72−53−00, Assembly−08
Task 72−53−00−400−008
See 72−53−00, Assembly−11
Task 72−53−00−400−011
See 72−53−00, Assembly−12
Task 72−53−00−400−012

LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−04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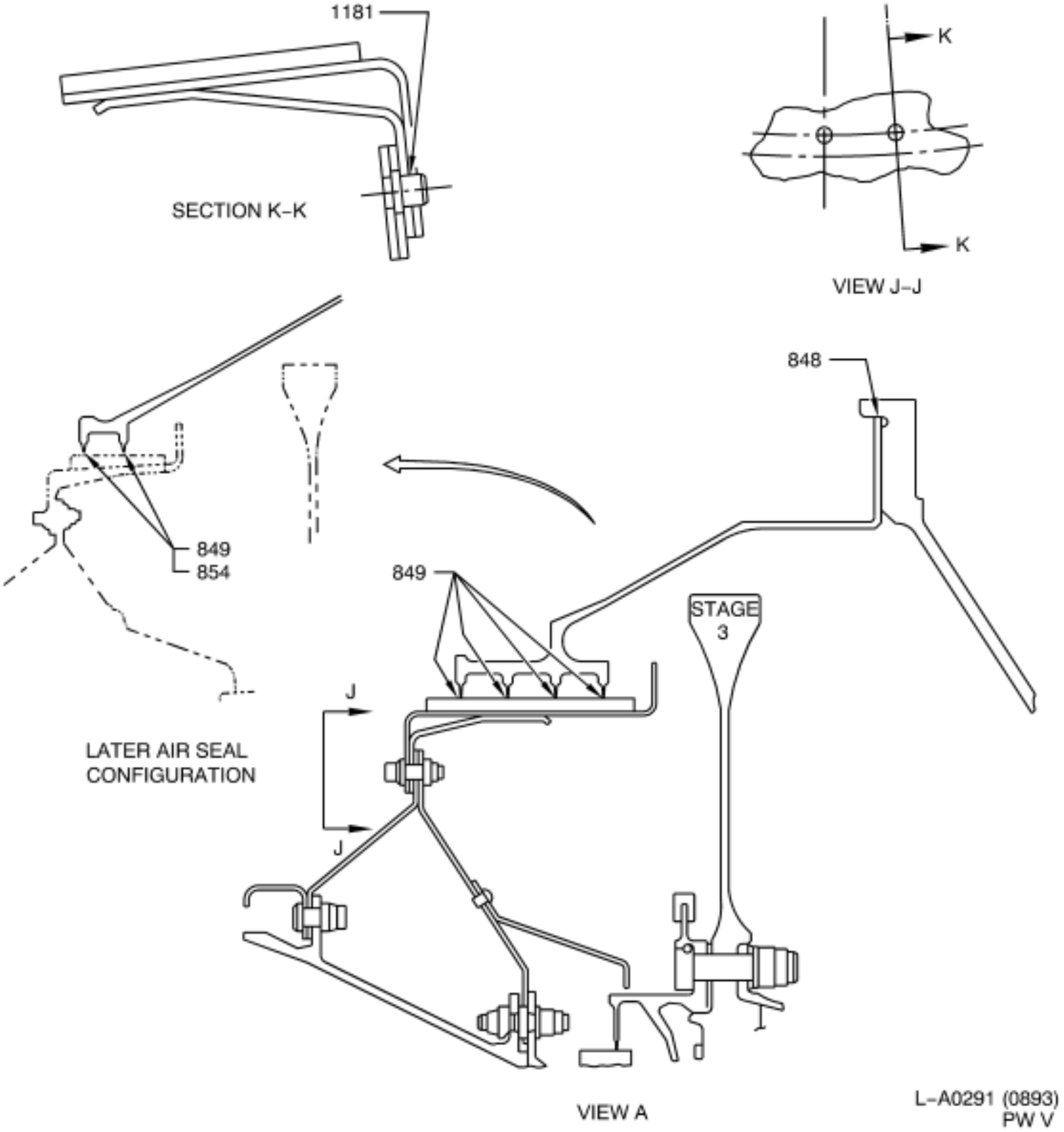
A
1223
1221
1220
1224
B
1225
C
1226
H
STAGE 3
STAGE 4
STAGE 5
STAGE 6
H
E
D
L−A0290 (0686)
PW V

Low Pressure Turbine (LPT)
Figure 801 (Sheet 1)
(Task 72−53−00−990−001)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VIEW J−J
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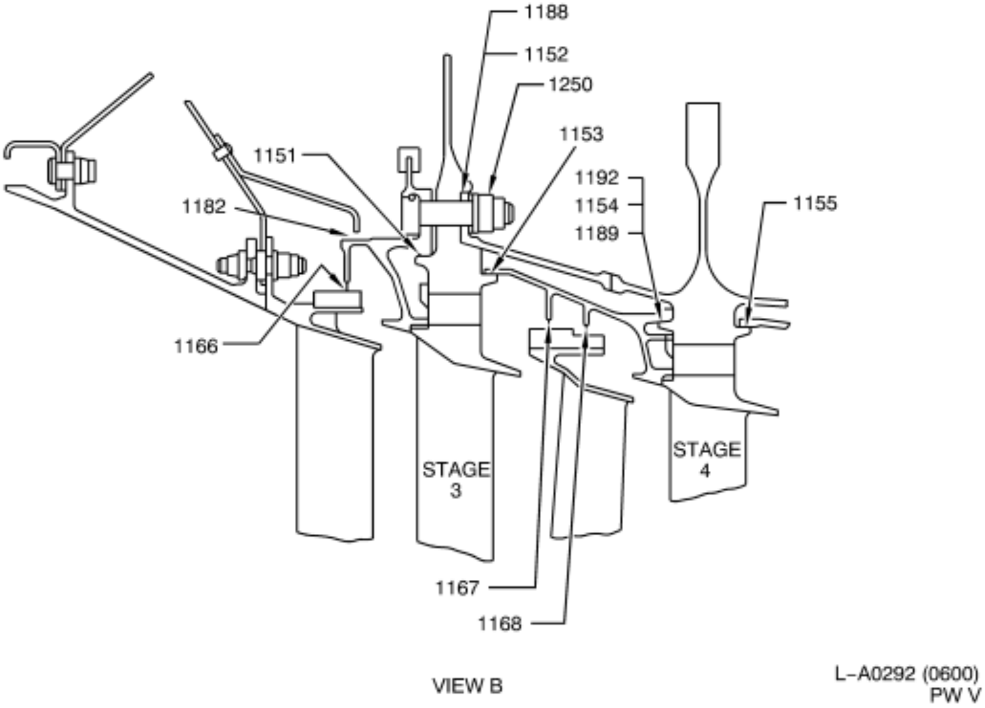
849
854
849
STAGE 3
J
J
LATER AIR SEAL CONFIGURATION
VIEW A
L−A0291 (0893)
PW V

Low Pressure Turbine (LPT)
Figure 801 (Sheet 2)
(Task 72−53−00−990−001)


1188
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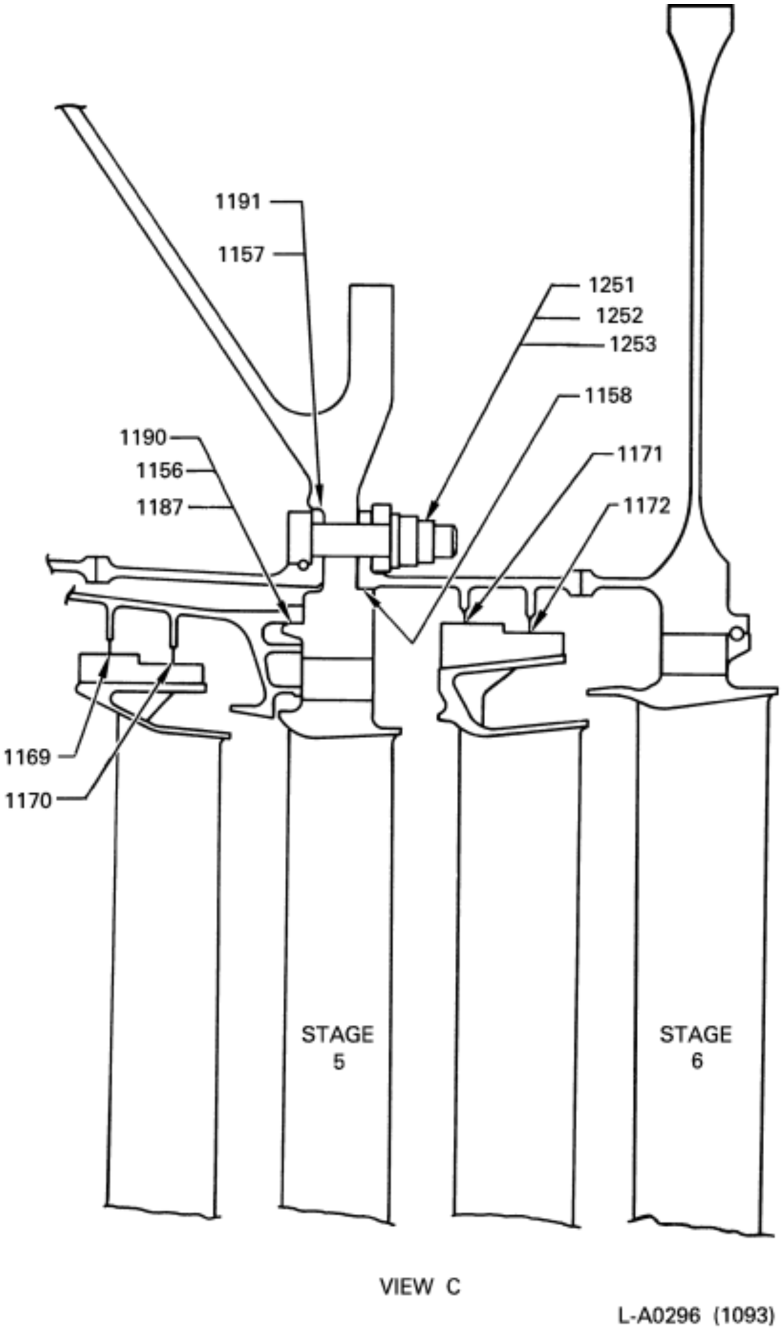
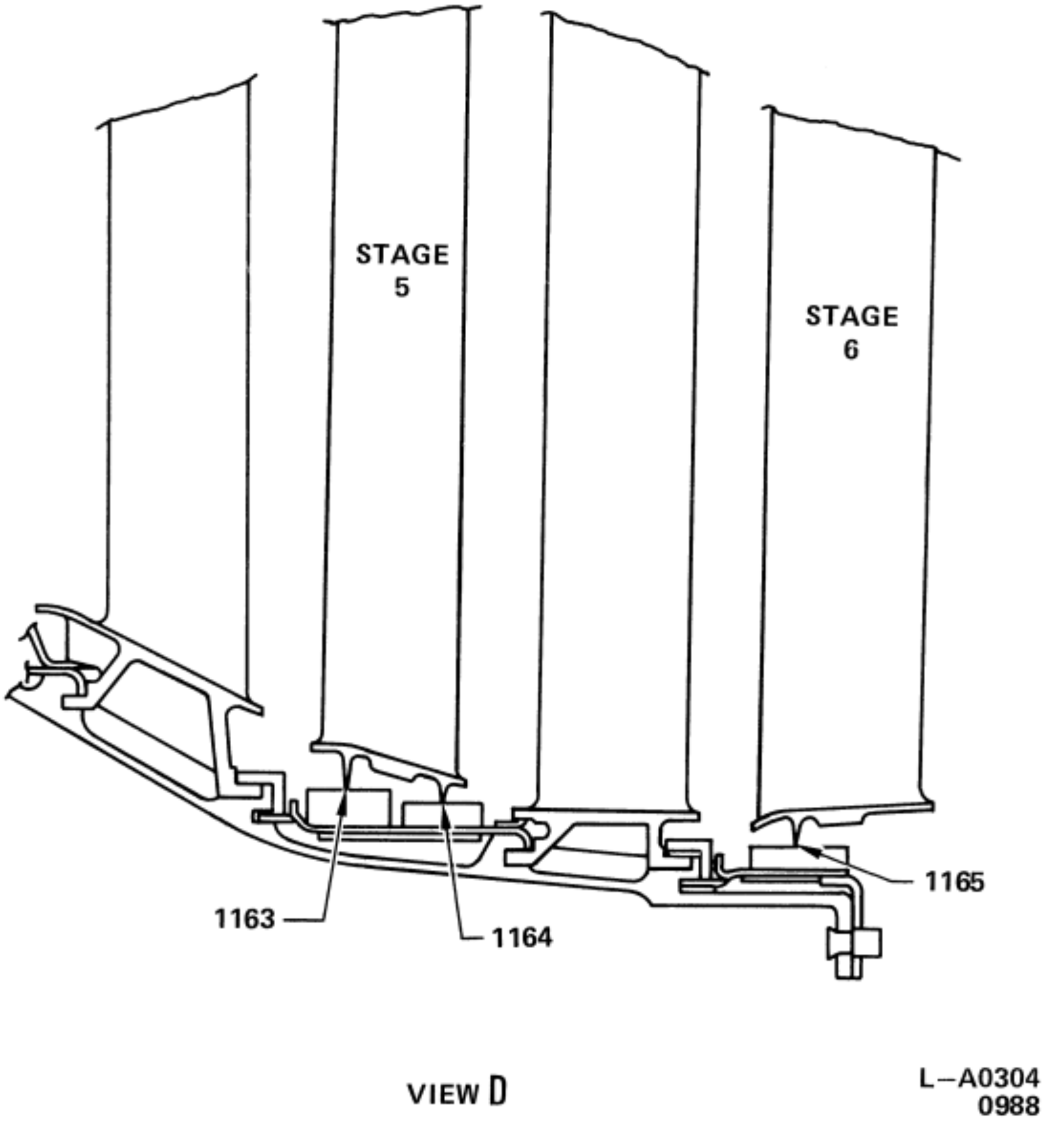
1189
1155
1182
1166
STAGE 3
STAGE 4
1167
1168
VIEW B
L−A0292 (0600)
PW V

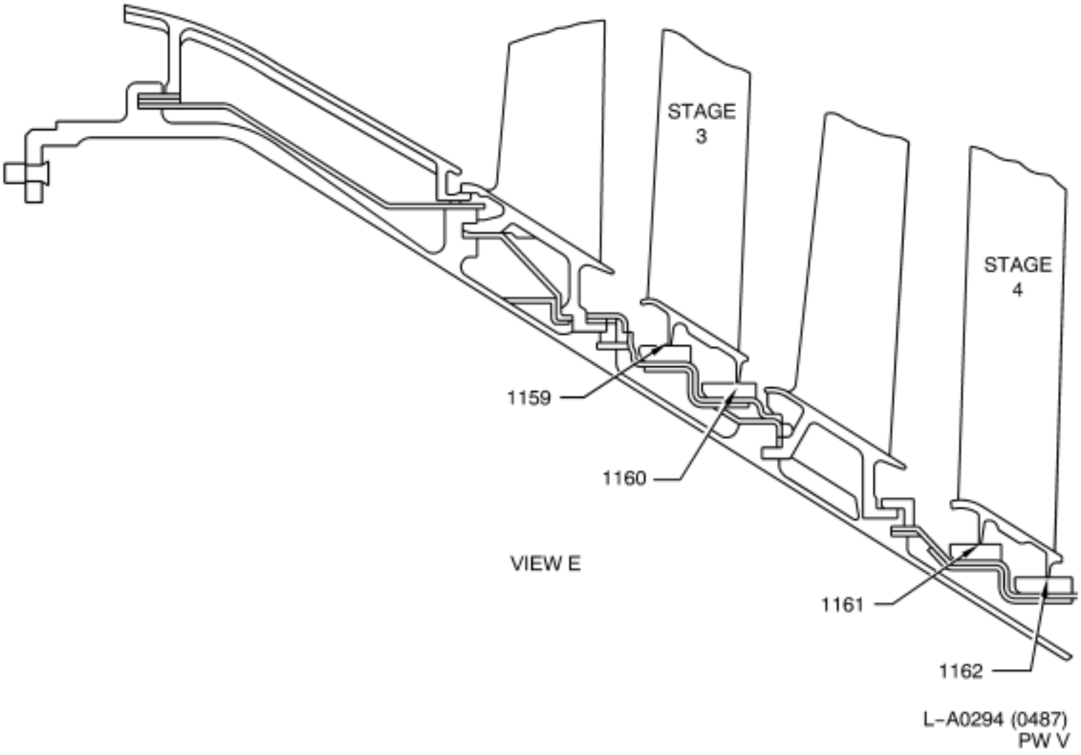
Low Pressure Turbine (LPT)
Figure 801 (Sheet 3)
(Task 72−53−00−990−001)


1191
1157
1251
1252
1253
1158
1190
1156
1187
1171
1172
1169
1170
STAGE 5
STAGE 6
VIEW C
L-A0296 (1093)

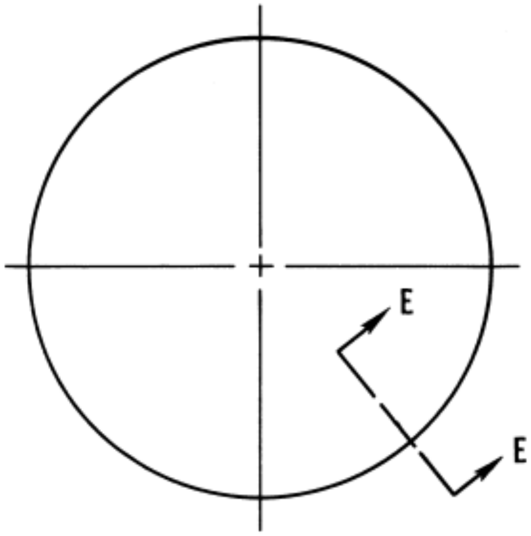
Low Pressure Turbine (LPT)
Figure 801 (Sheet 4)
(Task 72-53-00-990-001)


STAGE 5
STAGE 6
1163
1164
1165
VIEW D
L−A0304
0988

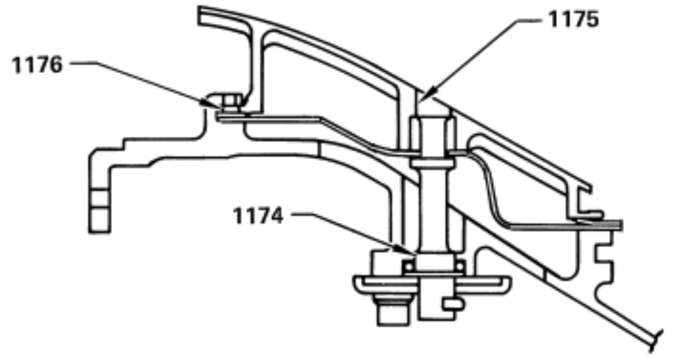
Low Pressure Turbine (LPT)
Figure 801 (Sheet 5)
(Task 72−53−00−990−001)


STAGE 3
STAGE 4
1159
1160
VIEW E
1161
1162
L−A0294 (0487)
PW V

Low Pressure Turbine (LPT)
Figure 801 (Sheet 6)
(Task 72−53−00−990−001)



SCHEMATIC VIEW H − H

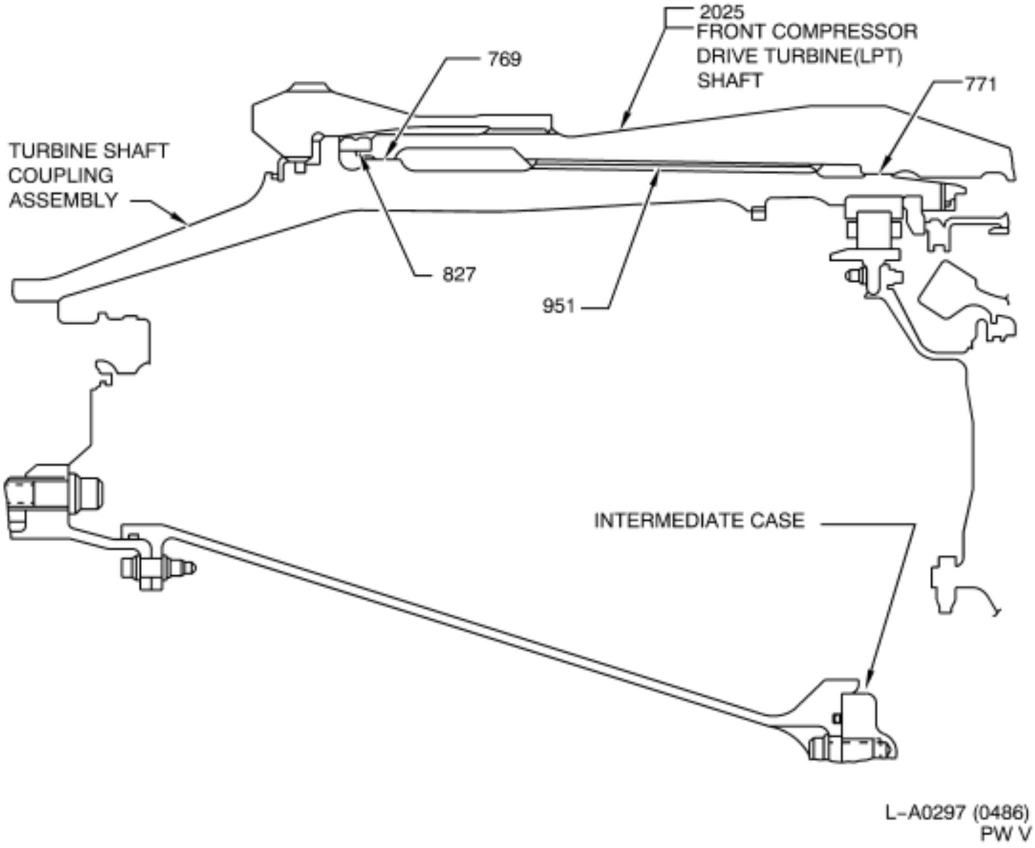


SECTION E − E (ROTATED)

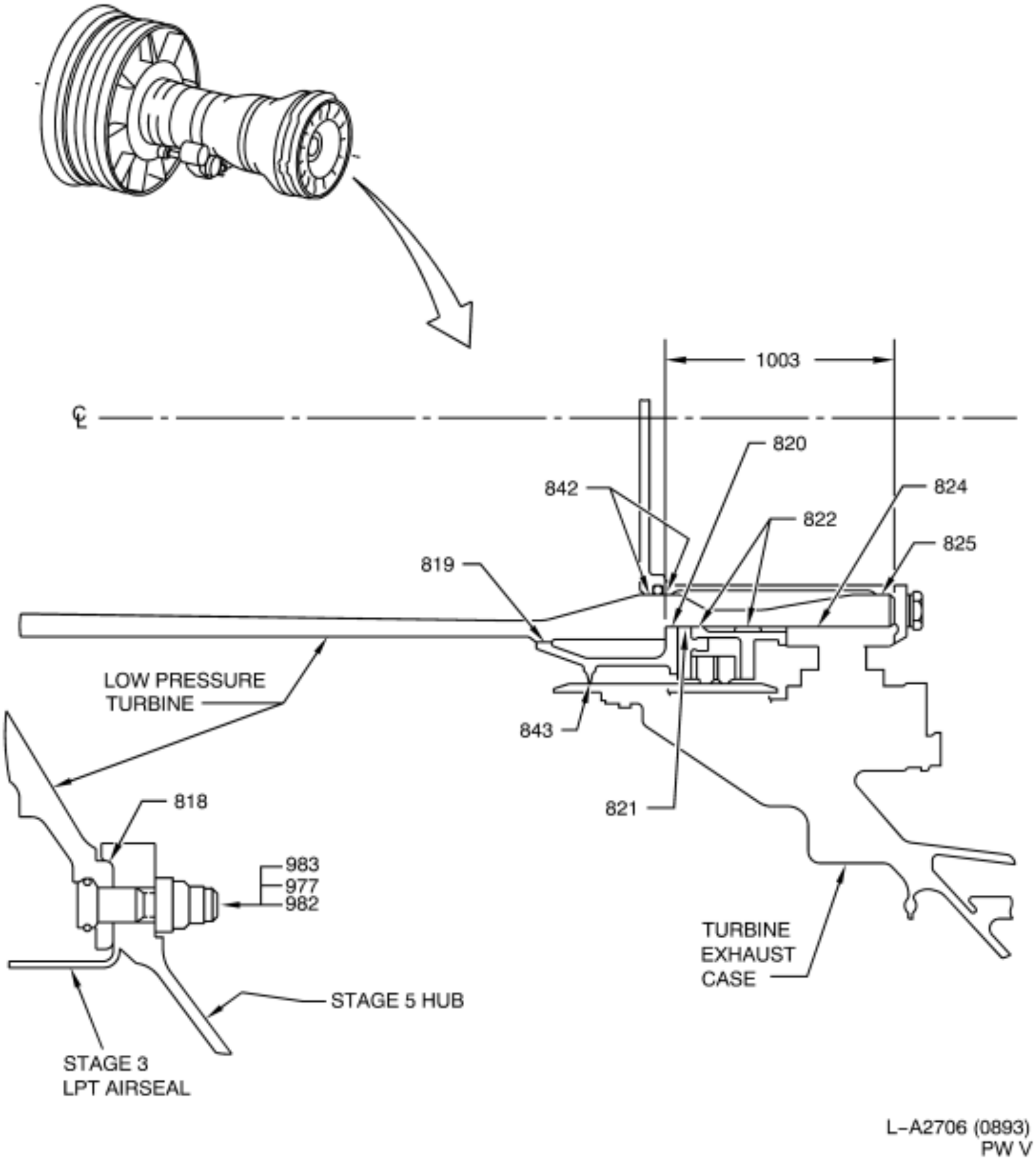
L−A0295

Low Pressure Turbine (LPT)
Figure 801 (Sheet 7)
(Task 72−53−00−990−001)

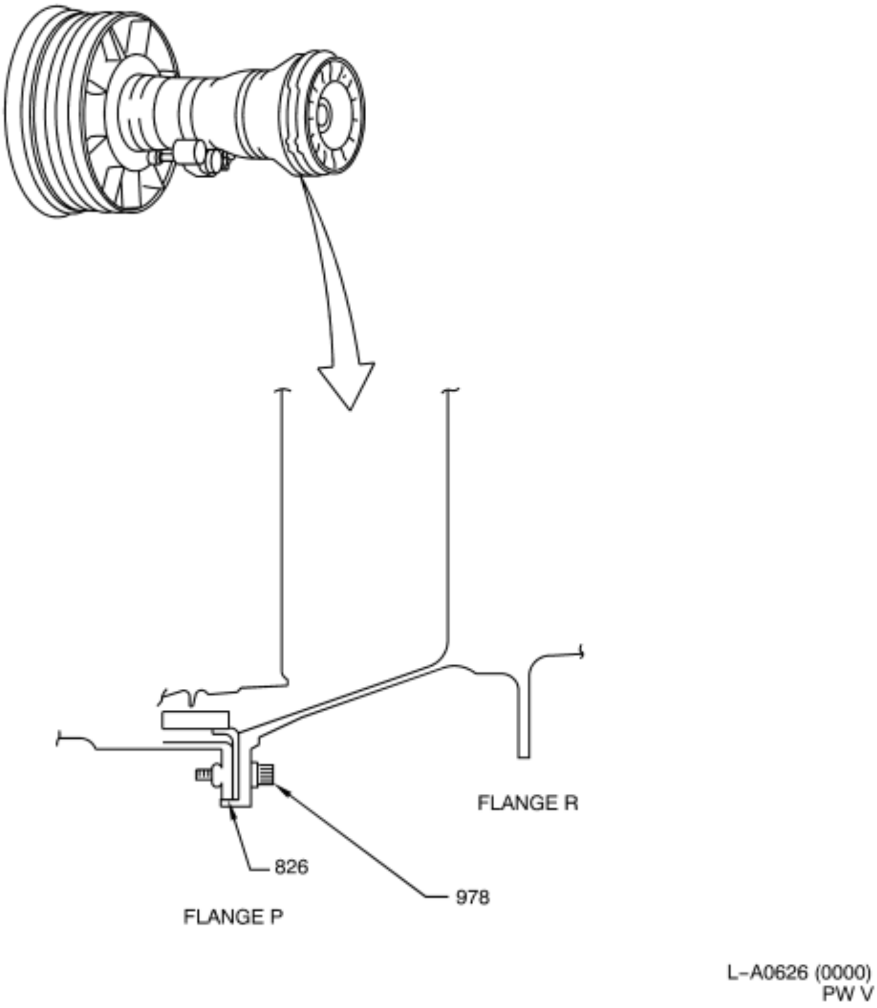
LOW PRESSURE TURBINE (LPT) − INSPECTION/CHECK−04


2025
FRONT COMPRESSOR DRIVE TURBINE(LPT) SHAFT
769
771
TURBINE SHAFT COUPLING ASSEMBLY
827
951
INTERMEDIATE CASE
L−A0297 (0486)
PW V

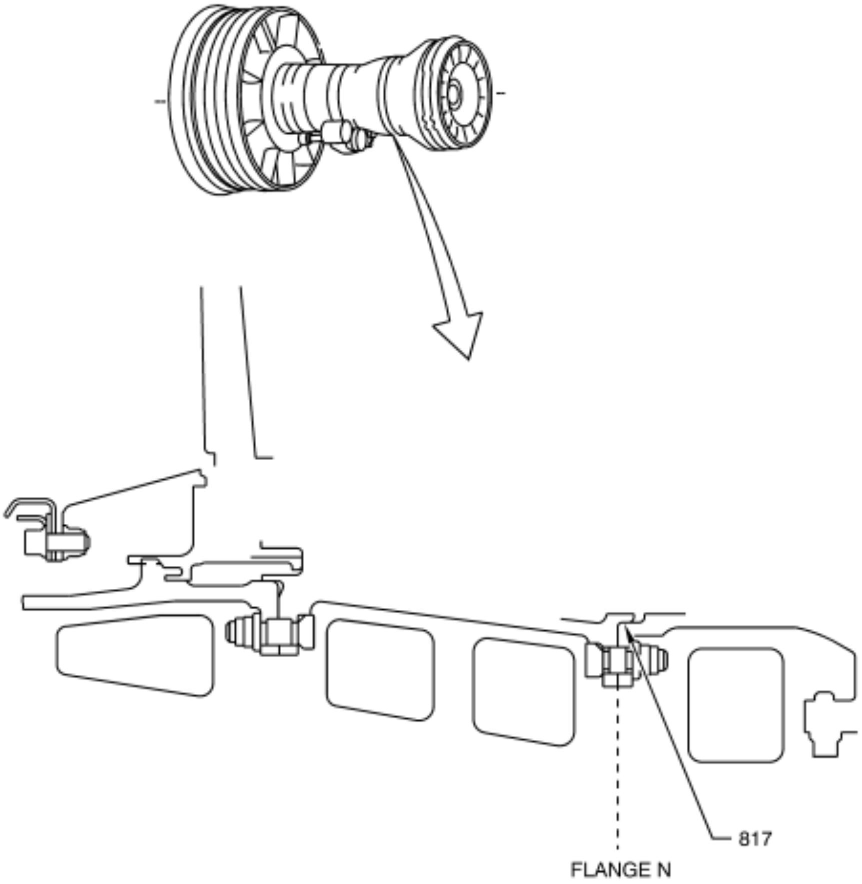
Low Pressure Turbine (LPT)
Figure 802
(Task 72−53−00−990−001)


1003
℄
820
842
824
822
825
819
LOW PRESSURE TURBINE
843
821
818
983
977
982
TURBINE EXHAUST CASE
STAGE 5 HUB
STAGE 3 LPT AIRSEAL
L−A2706 (0893)
PW V

Low Pressure Turbine (LPT)
Figure 803
(Task 72−53−00−990−001)

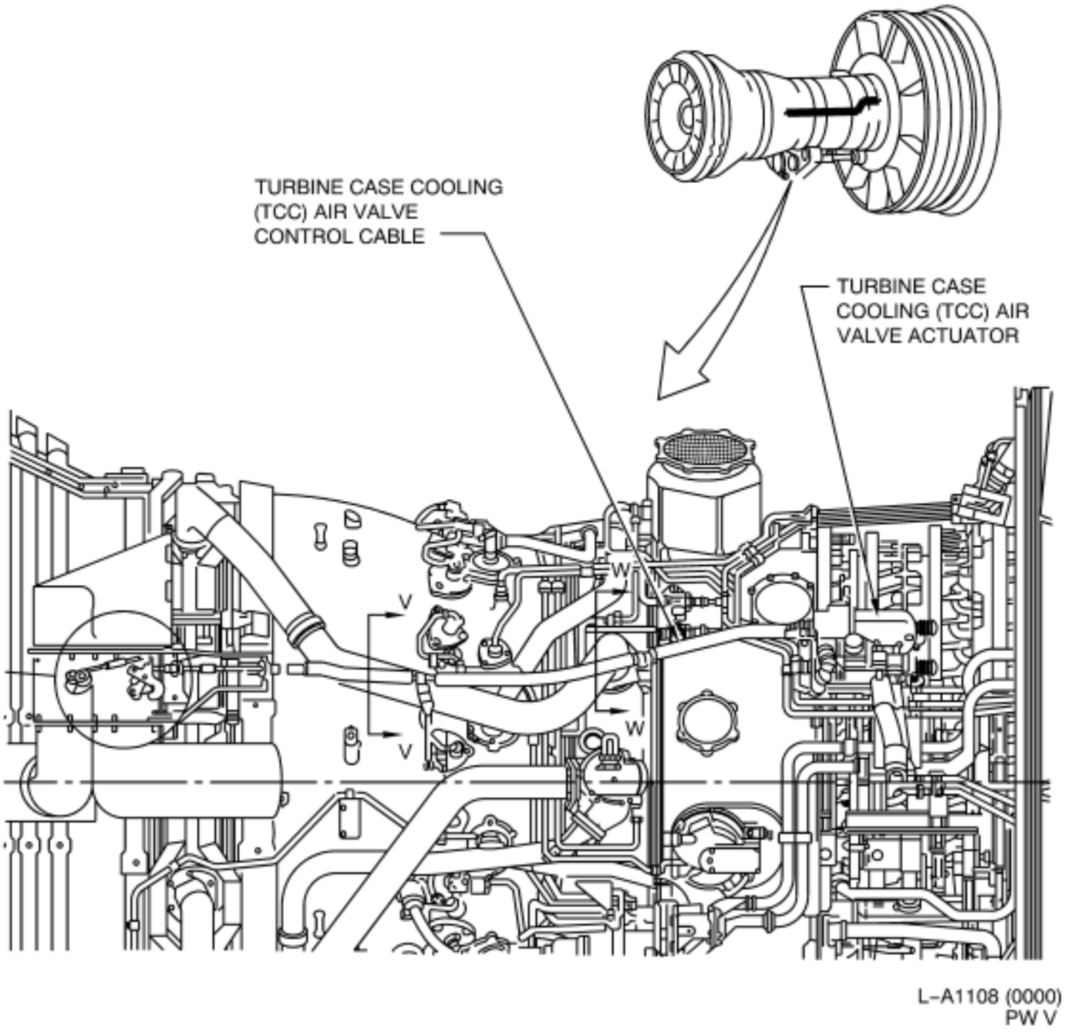

FLANGE R
826
978
FLANGE P
L−A0626 (0000)
PW V

Low Pressure Turbine (LPT)
Figure 804
(Task 72−53−00−990−001)

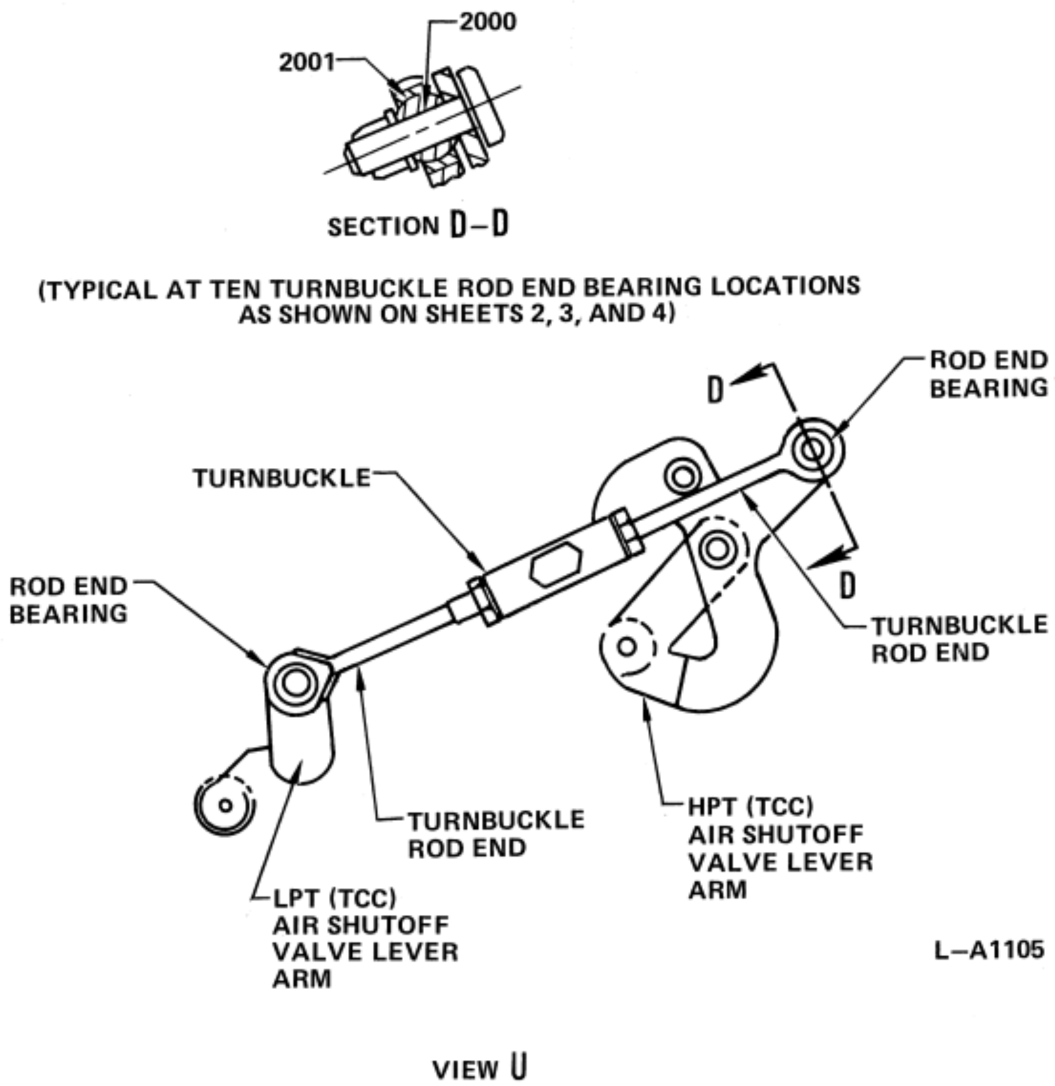


L−A0300 (0000)
PW V

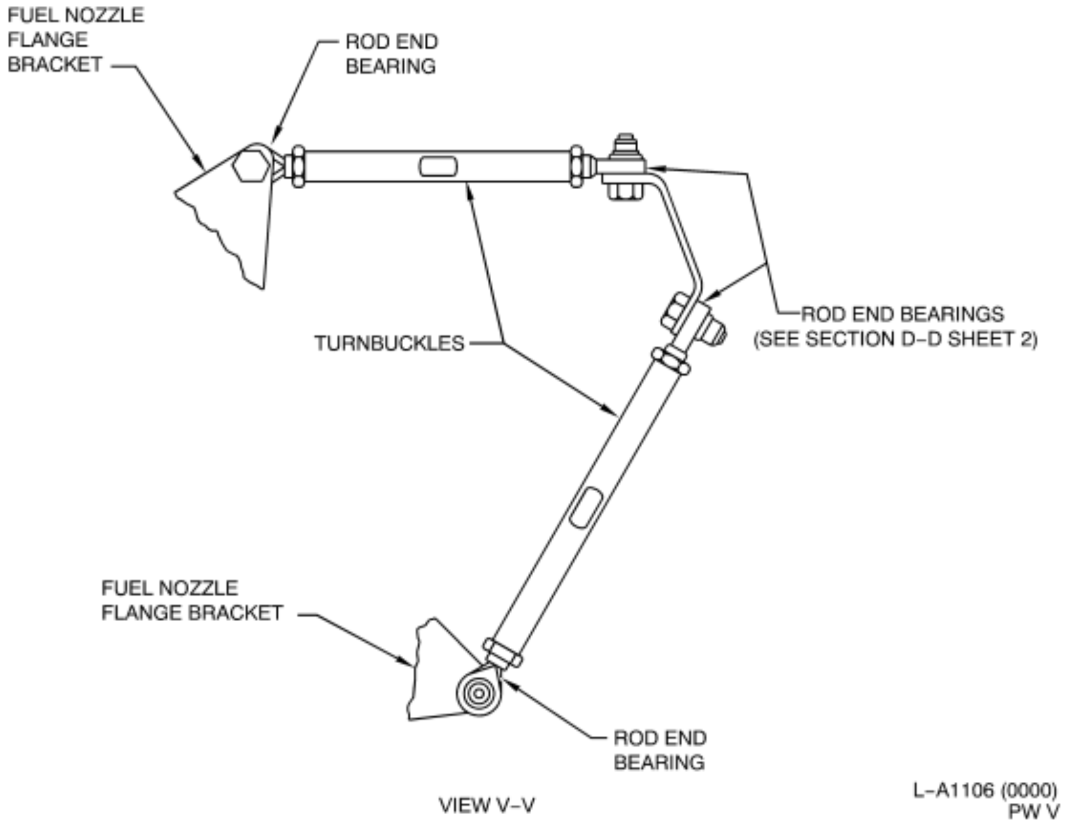
Low Pressure Turbine (LPT)
Figure 805
(Task 72−53−00−990−001)


TURBINE CASE COOLING (TCC) AIR VALVE CONTROL CABLE
TURBINE CASE COOLING (TCC) AIR VALVE ACTUATOR
V
V
W
W
L−A1108 (0000)
PW V

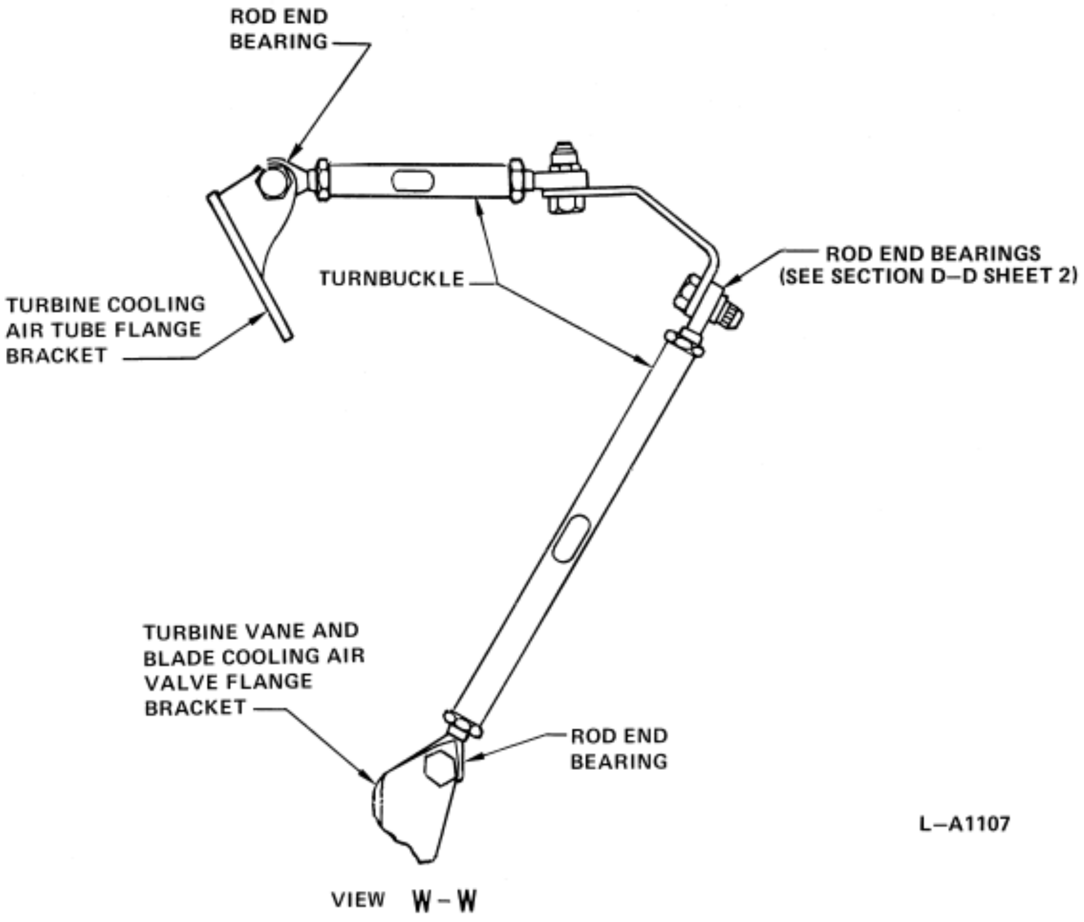
Turbine Case Cooling (TCC) Actuation System
Figure 806 (Sheet 1)
(Task 72−53−00−990−001)


2000
2001
SECTION D-D
(TYPICAL AT TEN TURNBUCKLE ROD END BEARING LOCATIONS AS SHOWN ON SHEETS 2, 3, AND 4)
D
ROD END BEARING
TURNBUCKLE
ROD END BEARING
D
TURNBUCKLE ROD END
TURNBUCKLE ROD END
HPT (TCC) AIR SHUTOFF VALVE LEVER ARM
LPT (TCC) AIR SHUTOFF VALVE LEVER ARM
L-A1105
VIEW U

Turbine Case Cooling (TCC) Actuation System
Figure 806 (Sheet 2)
(Task 72-53-00-990-001)


FUEL NOZZLE FLANGE BRACKET
ROD END BEARING
TURNBUCKLES
ROD END BEARINGS (SEE SECTION D−D SHEET 2)
FUEL NOZZLE FLANGE BRACKET
ROD END BEARING
VIEW V−V
L−A1106 (0000) PW V

Turbine Case Cooling (TCC) Actuation System
Figure 806 (Sheet 3)
(Task 72−53−00−990−001)


ROD END BEARING
TURBINE COOLING AIR TUBE FLANGE BRACKET
TURNBUCKLE
ROD END BEARINGS (SEE SECTION D−D SHEET 2)
TURBINE VANE AND BLADE COOLING AIR VALVE FLANGE BRACKET
ROD END BEARING
L−A1107
VIEW W − W

Turbine Case Cooling (TCC) Actuation System
Figure 806 (Sheet 4)
(Task 72−53−00−990−001)

Previous Pageblock   Return to Previous Menu   Next Pageblock

Task 72-53-00-400-001:

1. Assemble Low Pressure Turbine

A. Prerequisites

(1) See Inspection/Check-04 Task 72-53-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

(2) Assemble 3rd stage turbine rotor assembly per 72-53-03, Assembly-01 Task 72-53-03-440-001.

(3) Assemble 4th stage turbine rotor assembly per 72-53-04, Assembly-01 Task 72-53-04-440-001.

(4) Assemble 5th stage turbine rotor assembly per 72-53-05, Assembly-01 Task 72-53-05-440-001.

(5) Assemble 6th stage turbine rotor assembly per 72-53-06, Assembly-01 Task 72-53-06-440-001.

B. Equipment And Materials Necessary

Standard Tools:

Name	Manufacturer
Clements Cadillac Electric Flameless Heat Gun, Model FT 1000	Clements Manufacturing Co. 6650 S. Narragansett Avenue Chicago, IL 60638

NOTE: The flameless torch specified above is optional to the heaters specified in the special tools list, and the optional flame torch.

Special Tools:

PWA 29754	Control, Heater
PWA 29918	Stand, Build/Disassembly (Optional To PWA 87913)
PWA 85086	Arm, Trunnion (2 Required)
PWA 85214	Adapter, Lifting
PWA 85215	Adapter, Lifting
PWA 85220	Adapter
PWA 85231	Fixture, Angle Of Turn
PWA 85232	Fixture, Angle Of Turn

Special Tools:

(CONTINUED)

PWA 85235	Retainer, Airseal (Set)
PWA 85236	Retainer, Airseal (Set)
PWA 85237	Retainer, Airseal (Set)
PWA 85239	Protector, Plastic
PWA 85318	Heater, Electrical
PWA 85563	Heater, Electrical
PWA 85592	Eye, Lift
PWA 85594	Adapter, Lift And Trunnion
PWA 85607	Retainer, Duct Segment (12 Required)
PWA 85638	Fixture, Build (Optional to PWA 87097)
PWA 85704	Pusher, Installation
PWA 86216	Pin, Alignment
PWA 87004	Retainer, Clamping
PWA 87097	Fixture, Build
PWA 87913	Stand, Build/Disassembly

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−102	Ice, Dry
P05−395	Beeswax
P05−396	Paraffin Wax Blend
P06−023	Lubricant

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lock, Turbine Tierod	40	72−53−00/3/560
Lock, Turbine Blade	128	72−53−00/6/80

C. General Assembly Requirements

(1) Where heating is required for assembly, use minimum temperature differential of 125°F (52°C) between parts being assembled. Do not exceed 300°F (149°C) on any part.

(2) Where heating is required for assembly, special heaters are specified in the following procedure. However, you can use an optional flameless torch or flame torch as specified in the following steps.

(3) In locations where heating of a component in an oven is not practical or only a flange of the component requires heating, the use of Clements Cadillac Electric Flameless Heat Gun, Model FT 1000 is recommended.

(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE FLAME WILL DAMAGE OR BURN NON−METAL PARTS.

CAUTION: DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

D. Procedure

Subtask 72−53−00−430−051:

(1) Put PWA 87097 Build Fixture or PWA 85638 Build Fixture on PWA 29918 Stand or PWA 87913 Stand, using sui sling and hoist. Attach the fixture to the stand with the detail washers and cap screws.

(2) Attach PWA 85220 Adapter to rear flange of turbine rear case.

(a) Retract four quick release pins from boltholes in base of adapter.

(b) Connect hoist to lifting eye in center of adapter base.

(c) Using hoist, position outer curved groove in base over rear flange of case. Align boltholes and secure adapter to case with four quick release pins.

(3) Remove four blocks (1001/5) and lower hand knobs of PWA 87097 Build Stand or PWA 85638 Build Stand.

(4) Using hoist and PWA 85220 Adapter, align boltholes and position turbine rear case (1001/4), smaller flange end down, onto PWA 87097 Fixture or PWA 85638 Fixture. Secure case to fixture with 10 detail washers and screws. See Figure 1001.

(5) Install 3rd stage LPT duct (1001/1) into turbine rear case, aligning instrumentation boss hole (1001/2) in duct with mating hole (1001/3) in turbine case. Use PWA 86216 Alignment Pin to align the two respective holes.

(6) Install 3rd stage LPT duct segments into turbine rear case. See Figure 1002.

CAUTION: THIRD STAGE LPT DUCT SEGMENTS MUST BE INSTALLED IN SETS.

(a) Install 3rd stage LPT duct seals (1002/1) into seal slots between adjacent duct segments. Use Beeswax P05−395 or Paraffin Wax Blend P05−396, as required to retain seals in position.

(b) Install (13) 3rd stage LPT duct segments (1002/2) into turbine case, inserting locating pins into locating pin slots in fixture. Install duct segment with instrumentation hole at location of mating instrumentation hole in turbine case. Use PWA 86216 Alignment Pin to align the three respective holes.

(c) Hold duct segments against turbine case wall and install PWA 85607 Retainer over each segment and into groove in case. Remove the PWA 86216 Alignment Pin from the case.

(7) Install instrumentation (borescope) boss plug and related details.

NOTE: When plug, spring tension washer and stop are properly assembled and installed to turbine case, plug should be loaded inward, by spring washer, to seat in case boss.

(a) Place spring tension washer (1002/4) into recess of instrumentation plug stop (1002/5); so that OD of washer contacts stop and conical surface of washer tapers away from stop toward center.

(b) Insert instrumentation boss plug (1002/7) into stop and washer from washer side.

(c) Secure plug to stop with cotter pin (1002/8).

(d) Install gasket (1002/3) onto plug so that split will face inward.

(e) Install instrumentation plug stop (cover).

1 For engines incorporating the intent of SB PW4ENG 72−194, which have the new silver plated bolts (MS9715−06), install bolts (1002/6) with no lubricant. Secure plug, stop, washer, and gasket to instrumentation boss on case with two bolts. Torque bolts to 75 −85 lb−in. (8.474 − 9.604 N.m).

2 For engines incorporating the intent of SB PW4ENG 72−194, but which have used bolts, and engines not incorporating the intent of SB PW4ENG 72−194, apply Lubricant P06−023 to bolts (1002/6). Secure plug, stop, washer, and gasket to instrumentation boss on case with (two) bolts. Torque bolts to 54 − 60 lb−in. (6.101 − 6.779 N.m).

(f) Lockwire bolts securing plug to case.

(8) Assemble 3rd stage LPT duct onto 3rd stage LPT sealing ring support. See Figure 1003.

(a) Position sealing ring support (1003/3), with smaller OD end down, on workbench.

(b) Align boltholes and position duct (1003/2) onto support.

(c) Install several equally spaced .190−32 workbolts (1003/1) to secure duct assembly to sealing ring support. Tighten bolts to secure parts.

(9) Using hoist and suitable sling, lift and trunnion duct and support assembly to front end, smaller OD, down position.

(10) Position the 3rd stage LPT duct (1004/1) assembly into turbine rear case (1004/2) and seat on fixture supports (1004/5). Adjust hand knobs (1004/4) as required to support duct. See Figure 1004.

(11) Install four blocks (1004/3), that are marked "ASSEMBLY", to the fixture. Use two detail bolts to hold each block.

(12) Install 3rd stage LPT duct (1005/1), smaller ID end down, into 3rd stage vane foot groove in ID flange of turbine case. See Figure 1005.

(13) Install 39 each of 3rd stage LPT seal (1005/8) and (1005/9) into seal slots between adjacent vanes (1005/3). Use Beeswax P05−395 or Paraffin Wax Blend P05−396, as required to retain seals in position.

NOTE: Vane clusters with thicker anti−rotation locks (Post SB PW4ENG 72−473) can only be used in low pressure turbine cases with deeper anti−rotation lock slots (Post SB PW4ENG 72−473). Vane clusters with thinner locks (Pre SB PW4ENG 72−473) can be physically put into the LPT case (Post SB PW4ENG 72−473). If you do this you could have a loss of performance due to leakage around the vane locks.

(14) Install 39 3rd stage LPT seals (1005/7) into seal slots between adjacent vanes. Seals are only required at locations where adjacent vane clusters both have mating seal slot. Use Beeswax P05−395 or Paraffin Wax Blend P05−396, as required to retain seals in position.

(15) Install PWA 85704 Installation Pusher, if necessary. See Figure 1006.

(16) Align bolthole in lug of vane cluster with stud (1005/4) in rear flange of duct assembly. Position front foot of vane cluster into groove in ID of turbine case. Install remaining 38 vanes. Adjust hand knobs (1005/6) to locate feet of vanes on duct (1005/5). Seat vanes in turbine case groove using PWA 85704 Installation Pusher and mallet. Remove airseal retainers as necessary.

(17) Install 39 nuts (1005/2) lubricated with Engine Oil P03−001, onto studs (1005/4). Ensure that vane clusters are properly engaged on studs (1005/4) and seated on duct (1005/5). Torque nuts to 180 − 200 lb−in. (20.337 − 22.597 N.m).

Subtask 72−53−00−430−053:

(18) Install four turbine case heat shields (1007/2) into ID of turbine case just rearward of 3rd stage vanes. Insert front flange, smaller radius, of heat shield into groove in ID flange of turbine case. See Figure 1007.

NOTE: Install the initial heat shield at the 6 o'clock position. The heat shield must be new or not damaged. The three heat shields remaining must be in serviceable limits. See the applicable Inspection/Check in PW4000 Series CIR, PN 51A357.

(19) Install (26) 3rd stage LPT air sealing ring segments (1007/1) over heat shields. Insert tabs at front of ring segments into groove in ID of turbine case. Engage vane cluster lugs into segment holes. Hole ring segment against turbine case wall. Install one PWA 85235 Retainer over each ring segment and into groove in turbine case. Make sure you hang the streamer loose end out of the turbine case.

NOTE: Make distance between end of airsealing ring segments and heat shield one inch (25.400 mm) minimum at four places.

(20) Install 3rd stage turbine rotor assembly into build fixture. See Figure 1008.

(a) Secure PWA 85214 Adapter to bore of disk with lifting eye side up. Connect hoist with PWA 85086 Arm to lifting eye of adapter.

(b) Using hoist, lift rotor assembly. Align boltholes and position PWA 85215 Adapter to lower (rear) side of disk with lifting eye side down. Install four hand knobs to tierods to secure disk.

(c) Connect second hoist and PWA 85086 Arm to lifting eye of PWA 85215 Adapter. Using both hoists, lift and trunnion rotor to front end down position. Remove lower hoist, arm and adapter.

(d) Lower disk (1008/1) into turbine case. Pilot disk bore on outer face of towers (1008/2) and seat tierod heads on support face of blocks (1008/3).

(e) Remove hoist, arm and adapter.

Subtask 72−53−00−430−054:

(21) Install four turbine case heat shields (1009/2) into ID of turbine case just rearward of 3rd stage turbine rotor blades. Insert front flange smaller radius, of heat shield into groove in ID flange of turbine case. Install four turbine case heat shield ring segments (1009/1) onto ID flange of case. See Figure 1009.

(22) Install (44) 4th stage LPT vane clusters (1009/3) into turbine case. Align slot in rear foot of vane clusters with slots in turbine case ID flange. Insert front foot of vane clusters into groove in turbine case. Seat vanes in turbine case groove using PWA 85704 Installation Pusher and mallet. Remove airseal retainers as necessary.

NOTE: Vane clusters with thicker anti−rotation locks (Post SB PW4ENG 72−473) can only be used in low pressure turbine cases with deeper anti−rotation lock slots (Post SB PW4ENG 72−473). Vane clusters with thinner locks (Pre SB PW4ENG 72−473) can be physically put into the LPT case (Post SB PW4ENG 72−473). If you do this you could have a loss of performance due to leakage around the vane locks.

Subtask 72−53−00−430−055:

(23) Install four turbine case heat shields (1010/2) into ID of turbine case just rearward of 4th stage LPT vanes (1010/3). Insert front flange, smaller radius, of heat shield into groove in ID flange of turbine case. See Figure 1010.

NOTE: Install the initial heat shield at the 6 o'clock position. The heat shield must be new or not damaged. The three heat shields remaining must be in serviceable limits. See the applicable Inspection/Check in PW4000 Series CIR, PN 51A357.

(24) Install (22) 4th stage LPT air sealing ring segments (1010/1) into groove in ID flange of turbine case. Engage vane cluster lugs into segment holes. Hold ring segment against turbine case wall. Install one PWA 85236 Retainer over each ring segment and into groove

in turbine case. Make sure you hang the streamer loose end out of the turbine case.

NOTE: Make distance between end of airsealing ring segments and heat shield one inch (25.400 mm) minimum at four places.

(25) Optional, position disk onto PWA 85318 Heater.

NOTE: You can use the optional flameless torch or flame torch as previously specified to heat the disk flange.

(a) If disk is stored front end, smaller ID, end down, attach PWA 85594 Fixture. Using hoist lift assembly and position disk onto heater.

(b) If disk is stored rear end larger ID, down, attach PWA 85215 Adapter and PWA 85594 Adapter with two PWA 85086 Trunnion Arms. Using hoist lift and trunnion assembly to front end down position. Lower disk onto heater. Attach power supply of PWA 29754 Heater Control to junction box on heater. Attach thermocouple connector to cable assembly of heater control. Ensure that thermocouple probe contacts disk flange.

(26) Position four PWA 87004 Retainers equally spaced around the 4th stage LPT disk. Install the arm detail of the retainer between the blades and attach the hook end to the rear of the 4th stage LPT airseal (1011/8). Tighten the thumbscrew to hold the retainer in position. See Figure 1011.

CAUTION: TEMPERATURE OF DISK MUST NOT EXCEED 400°F (204.4°C) OR DAMAGE TO PARTS MAY OCCUR.

(27) Use the PWA 85318 Heater, or the optional flameless torch or flame torch, to heat the front (Smaller ID) flange of the disk. Heat the disk to obtain a minimum temperature difference of 250°F (138.8°C) between mating parts.

(28) Position rotor assembly over 3rd stage LPT disk. Vector stack 4th stage rotor by placing unbalance symbol (triangle) on 4th stage LPT disk 180 degrees from unbalance symbol (triangle) on 3rd stage LPT disk. Align boltholes in disk with tierods (1011/6) in 3rd stage LPT disk and lower assembly onto 3rd stage LPT disk. Remove hoist and fixture.

(29) Install 40 washers (1011/3) onto tierods.

(30) Install 40 nuts (1011/2), lubricated with Engine Oil P03−001, to tierods.

(31) Install PWA 85231 Angle−Of−Turn Fixture to 4th stage LPT disk. See Figure 1012.

(a) Loosen four clamps (1012/1).

(b) Align bushings (1012/5) with (tierod) nuts (1012/10) and plate (1012/4), stamped markings up, over rear flange of 4th stage LPT disk (1012/2). Secure with four clamps (1012/1).

(c) Place temporary index mark on plate (1012/4) and 4th stage disk.

(d) Locate torque sequence numbers (1012/8) on plate. Pilot wrench (1012/3) into bushing (1012/5) at torque sequence No. 1 and insert socket (1012/11) over (tierod) nut (1012/10).

(32) (Reference 1250) Torque the tierod nuts with the use of a 0.500 inch (12.700 mm) square drive torque wrench installed in PWA 85231 Fixture.

(a) Apply initial torque of 140 − 160 lb−in. (15.818 − 18.078 N.m) to each nut in numerical sequence per torque sequence numbers (1012/8) stamped on plate.

CAUTION: THE FOLLOWING TORQUING PROCEDURE MUST BE ACCOMPLISHED WITH MAXIMUM TEMPERATURE DIFFERENTIAL OF 40°F (22.2°C) BETWEEN MATING PARTS.

(b) With a maximum temperature differential of 40°F (22.2°C) between the mating parts, loosen one pair of nuts.

(c) Measure the torque necessary to turn the nut. If the measured torque is less than 50 lb-in. (5.649 N.m), then tighten to a torque of 45 lb-in. (5.084 N.m) plus or minus 5 lb-in. (0.565 N.m) and continue with step (e).

(d) If the measured torque is more than 50 lb-in. (5.649 N.m), find the torque necessary to turn the nut, add 15 lb-in. (1.695 N.m) plus or minus 5 lb-in. (0.565 N.m) to this torque and tighten the nut using the total torque. Total torque cannot exceed 100 lb-in. (11.298 N.m).

(e) Set indicator dial (1012/9) to zero with index mark (1012/7) on fixture plate (1012/4). Tighten thumbscrew (1012/6) to set the indicator dial. Apply 57 - 61 degree angle of turn.

(f) Do the torque procedure again, steps (b) through (e), as applicable on all the tierod nuts. Use the torque sequence numbers (1012/8) stamped on the fixture.

(g) Remove the wrenches (1012/3). Loosen the four clamps (1012/1). Remove the plate (1012/4) from 4th stage disk.

(33) Remove the four PWA 87004 Retainers.

Subtask 72-53-00-430-056:

(34) Install four turbine case heat shields (1013/2) into ID of turbine case above 4th stage LPT blades (1013/3). See Figure 1013.

(35) Install (38) 5th stage LPT vane clusters (1013/1) into turbine case. Align slots in rear foot of vane clusters with slots in turbine case ID flange. Insert front foot of vane clusters into groove in turbine case. Seat vanes in turbine case groove using PWA 85704 Installation Pusher and mallet. Remove airseal retainers as necessary.

NOTE: Vane clusters with thicker anti-rotation locks (Post SB PW4ENG 72-473) can only be used in low pressure turbine cases with deeper anti-rotation lock slots (Post SB PW4ENG 72-473). Vane clusters with thinner locks (Pre SB PW4ENG 72-473) can be physically put into the LPT case

(Post SB PW4ENG 72-473). If you do this you could have a loss of performance due to leakage around the vane locks.

Subtask 72-53-00-430-057:

(36) Install four turbine case heat shields (1014/2) into ID of turbine case rearward of 5th stage LPT vanes. Insert front flange, smaller radius of heat shield into groove of turbine case. See Figure 1014.

NOTE: Install the initial heat shield at the 6 o'clock position. The heat shield must be new or not damaged. The three heat shields remaining must be in serviceable limits. See the applicable Inspection/Check in PW4000 Series CIR, PN 51A357.

(37) Install (19) 5th stage LPT air sealing ring segments (1014/1) over heat shields and insert lugs at front of ring segments into groove in ID of turbine case. Engage vane cluster lugs into segment holes. Hold ring segment against turbine case wall. Install one PWA 85237 Retainer over each ring segment and into groove in turbine case. Make sure you hang the streamer loose end out of the turbine case.

(38) Optional, position PWA 85563 Heater onto rear flange of 4th stage LPT disk. Attach power supply of PWA 29754 Heater Control to junction box on heater. Attach thermocouple connector to cable assembly of heater control. Ensure that thermocouple probe contacts disk flange.

NOTE: You can use the optional flameless torch or flame torch as previously specified to heat the disk flange.

CAUTION: TEMPERATURE OF DISK MUST NOT EXCEED 400°F (204.4°C) OR DAMAGE TO PARTS MAY OCCUR.

(39) Use the PWA 85563 Heater, or the optional flameless torch or flame torch, to heat the rear flange of the 4th stage disk. Heat the disk to obtain a minimum temperature difference of 250°F (138.8°C) between mating parts.

(40) Using hoist, position PWA 85594 Trunnion Adapter and PWA 85592 Lift Eye with two PWA 85086 Trunnion Arms onto turbine rear hub. Trunnion rotor assembly to front (hub), end down position.

(41) Using hoist, position 5th stage rotor assembly over 4th stage LPT disk. Vector stack 5th stage rotor assembly by placing axial runout symbol (1015/2) on turbine rear hub (1015/1) 180 degrees from axial runout symbol (1015/7) on 4th stage LPT disk (1015/6). Align boltholes in disk with tierods (1015/5) in 4th stage LPT disk. Lower assembly onto disk. Seat disk. Remove hoist and fixture. See Figure 1015.

Subtask 72-53-00-430-058:

(42) Install four turbine case heat shields (1016/1) into ID of turbine case rearward of 5th stage LPT rotor (1016/3). See Figure 1016.

(43) Install (36) 6th stage LPT vane clusters (1016/2) into turbine case. Align slot in rear foot of vane cluster with slot in turbine case flange. Insert foot of vane cluster into groove in ID of turbine case. Seat vanes in turbine case groove using PWA 85704 Installation Pusher and mallet. Remove airseal retainers as necessary.

NOTE: Vane clusters with thicker anti-rotation locks (Post SB PW4ENG 72-473) can only be used in low pressure turbine cases with deeper anti-rotation lock slots (Post SB PW4ENG 72-473). Vane clusters with thinner locks (Pre SB PW4ENG 72-473) can be physically put into the LPT case (Post SB PW4ENG 72-473). If you do this you could have a loss of performance due to leakage around the vane locks.

(44) Remove installation pusher.

Subtask 72-53-00-430-059:

R (45) Install the 6th stage air seal segment (1017/3) to the
R case as follows: See Figure 1017.

R (a) Lightly apply Engine Oil P03-001 to the threads of
R the 12 screws (1017/1).

R (b) Install the air seal segments (1017/3) to case, engage the vane cluster lugs into the segment holes and install with (12) 6th stage LPT air sealing ring flanges (1017/2), with the ends staggered.

R NOTE: Pre and Post SB PW4ENG 72-769 6th stage air seal segments are interchangeable in full sets with the following exception. Old "rubbed-in" air sealing ring segment assemblies and new are interchangeable.

R NOTE: Old seal assemblies that are not "rubbed-in" can not be intermixed with new air sealing ring segment assemblies introduced by SB PW4ENG 72-769.

R (c) Secure the flanges to the case with (12) screws (1017/1), at the countersunk hole locations.

R (d) Secure the flanges to the case with (12) screws (1017/1), at the countersunk hole locations.

R (e) Torque the screws to 22 - 36 lb-in. (2.486 - 4.067 N.m).

(46) Cool the front flange of the 6th stage LPT disk with Dry Ice P05-102.

(47) Attach PWA 85592 Lifting Adapter to 6th stage turbine rotor.

(a) Loosen hand knobs and slide clamp details toward center of adapter.

(b) Position base, stepped side up, through 6th stage disk bore. Raise base and seat against front face of disk bore. Slide clamps outward to seat against disk bore and tighten hand knobs to secure adapter to disk.

(48) Attach hoist to lifting eye on adapter. Using hoist, position 6th stage LPT disk (1018/2) over turbine rear hub (1018/5).

CAUTION: MAKE SURE THAT EIGHT 6TH STAGE LPT SEALS ARE INSTALLED ON THE FRONT FLANGE OF THE 6TH STAGE LPT DISK. OPERATION OF THE ENGINE WITHOUT THE SEALS INSTALLED WILL CAUSE VERY HIGH TEMPERATURES WHICH CAN DECREASE THE DISK LIFE.

(49) Vector stack 6th stage rotor assembly onto turbine rear hub with axial runout symbols (dot within circle) 180 degrees apart. Align boltholes and seat disk onto hub. Remove hoist and lifting adapter. See Figure 1018.

(50) Remove hoist and trunnion adapter.

(51) Lubricate threads of 40 tierods (1018/6) and washer face of nuts (1018/1) with Engine Oil P03−001. Omit lubrication of disk surface.

(52) Install 40 spacers (1019/3) and nuts (1019/1) onto tierods.

(53) Install PWA 85232 Angle−Of−Turn Fixture onto 6th stage turbine disk. See Figure 1019.

  (a) Aligning bushings (1019/6) with nuts (1019/11) and position plate (1019/4), stamped markings up, over 6th stage LPT disk (1019/3).

  (b) Place temporary index marks on plate (1019/4) and 6th stage disk.

  (c) Locate torque sequence numbers (1019/8) on plate. Pilot wrench (1019/1) into bushing (1019/6) at location No. 1 and install socket (1019/10) onto nut (1019/5).

  (d) (Reference 1251, 1252, or 1253) Torque nuts using 0.500 inch square drive torque wrench installed in PWA 85232 Fixture.

    1 Apply initial torque of 140 − 160 lb−in. (15.818 − 18.078 N.m) to each nut in numerical sequence per torque sequence numbers (1019/8) stamped on plate.

LOW PRESSURE TURBINE (LPT) - ASSEMBLY-01

CAUTION: THE FOLLOWING TORQUING PROCEDURE MUST BE ACCOMPLISHED WITH MAXIMUM TEMPERATURE DIFFERENTIAL OF 40°F (22.2°C) BETWEEN MATING PARTS.

2 Loosen the nuts in pairs.

3 Measure the torque necessary to turn the nut. If the measured torque is less than 50 lb-in. (5.469 N.m), then tighten to a torque of 45 lb-in. (5.084 N.m) plus or minus 5 lb-in. (0.565 N.m) and continue with the angle of turn.

4 If the measured torque is more than 50 lb-in. (5.649 N.m), find the torque necessary to turn the nut, add 15 lb-in. (1.695 N.m) plus or minus 5 lb-in. (0.565 N.m) to this torque. The total torque cannot be more than 100 lb-in. (11.298 N.m).

5 Apply the final angle of turn:

a (Reference 1251) (Pre SB PW4ENG 72-256) For engines with the 5th stage turbine hub PN 50N405, set the indicator dial (1019/9) to zero with the index mark (1019/7) on the fixture plate. Tighten the thumbscrew (1019/5) to set the indicator dial. Apply a 62 - 66 degree angle of turn.

b (Reference 1252) (Post SB PW4ENG 72-256) For engines with 5th stage turbine hub PN 50N505, set the indicator dial (1019/9) to zero, with with the index mark (1019/7) on the fixture plate. Tighten the thumbscrew (1019/5) to set the indicator dial. Apply a 64 - 68 degree angle of turn.

c (Reference 1253) For engines with 5th stage turbine hub PN 51N305 and subsequent, set the indicator dial (1019/9) to zero, with the index mark (1019/7) on the fixture plate. Tighten the thumbscrew (1019/5) to set the indicator dial. Apply a 52 - 56 degree angle of turn.

NOTE: Use Reference 1253 for Phase-3 engines as built by P&W that have

R
R

5th stage turbine hub PN 51N305 and subsequent.

6 Do this torque procedure, steps 2 through 5, again as applicable on all tierod nuts. Use the torque sequence numbers stamped on the fixture.

(e) Remove the angle of turn fixture.

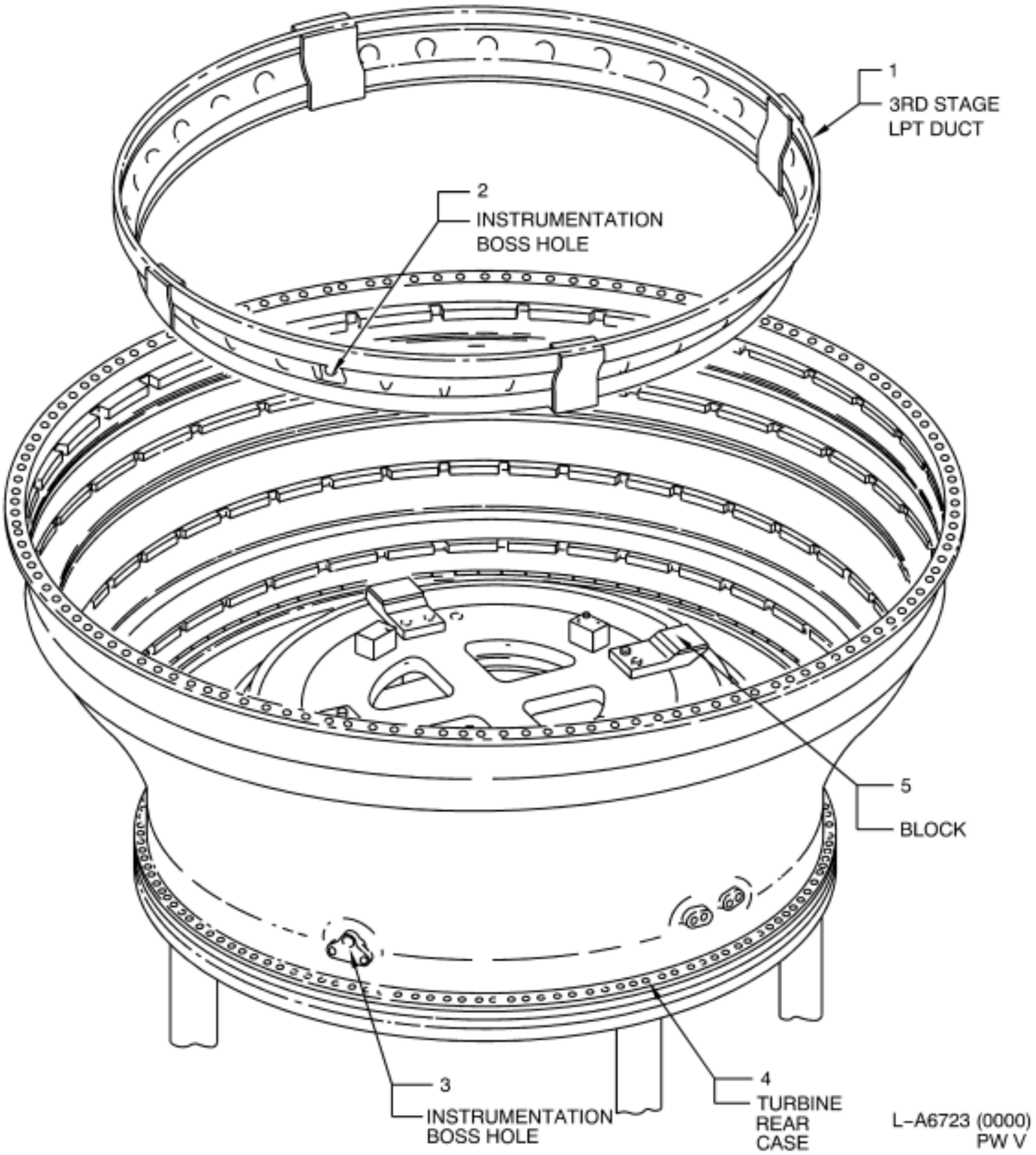
(54) Position PWA 85239 Protector over rear flange of turbine case.

E. Postrequisites

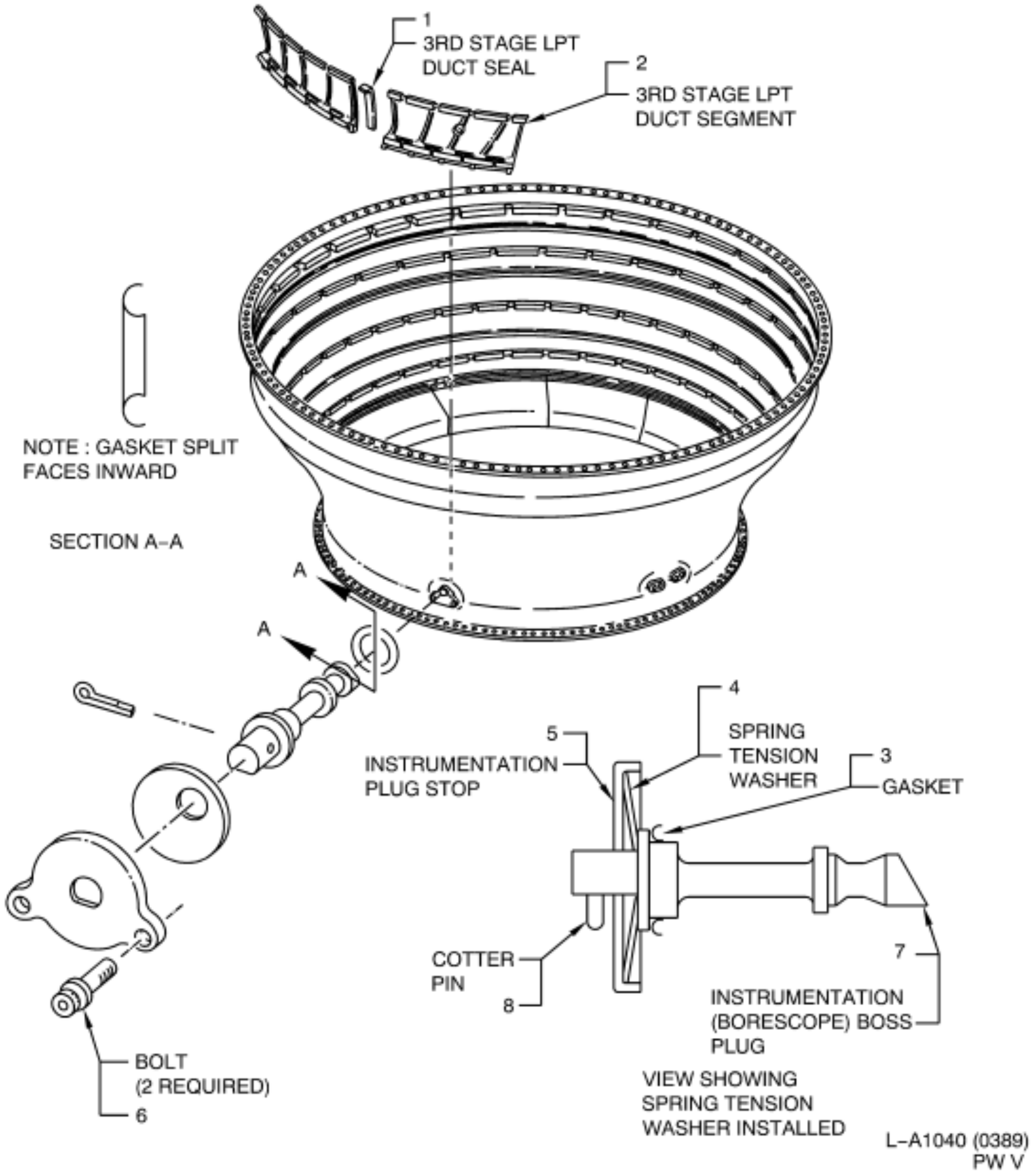
(1) Prepare low pressure turbine for balancing per Assembly−02 (Task 72−53−00−400−002).

(2) Balance low pressure turbine per Assembly−03 (Task 72−53−00−400−003).

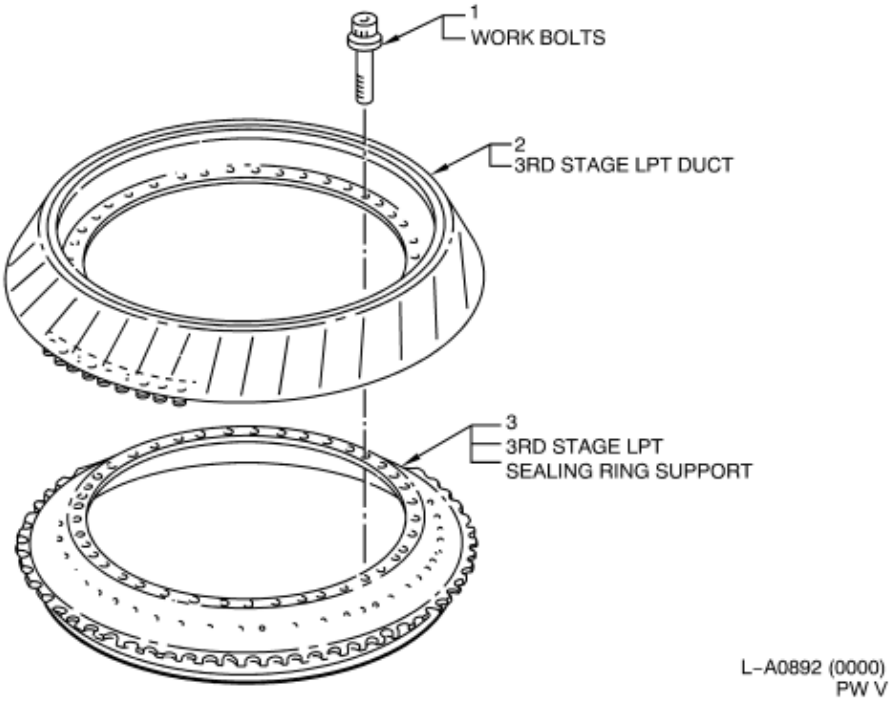
(3) Final assemble low pressure turbine per Assembly−04 (Task 72−53−00−400−004).


1
3RD STAGE
LPT DUCT
2
INSTRUMENTATION
BOSS HOLE
5
BLOCK
3
INSTRUMENTATION
BOSS HOLE
4
TURBINE
REAR
CASE
L-A6723 (0000)
PW V

Third Stage LPT Duct Installation
Figure 1001
(Task 72-53-00-400-001)

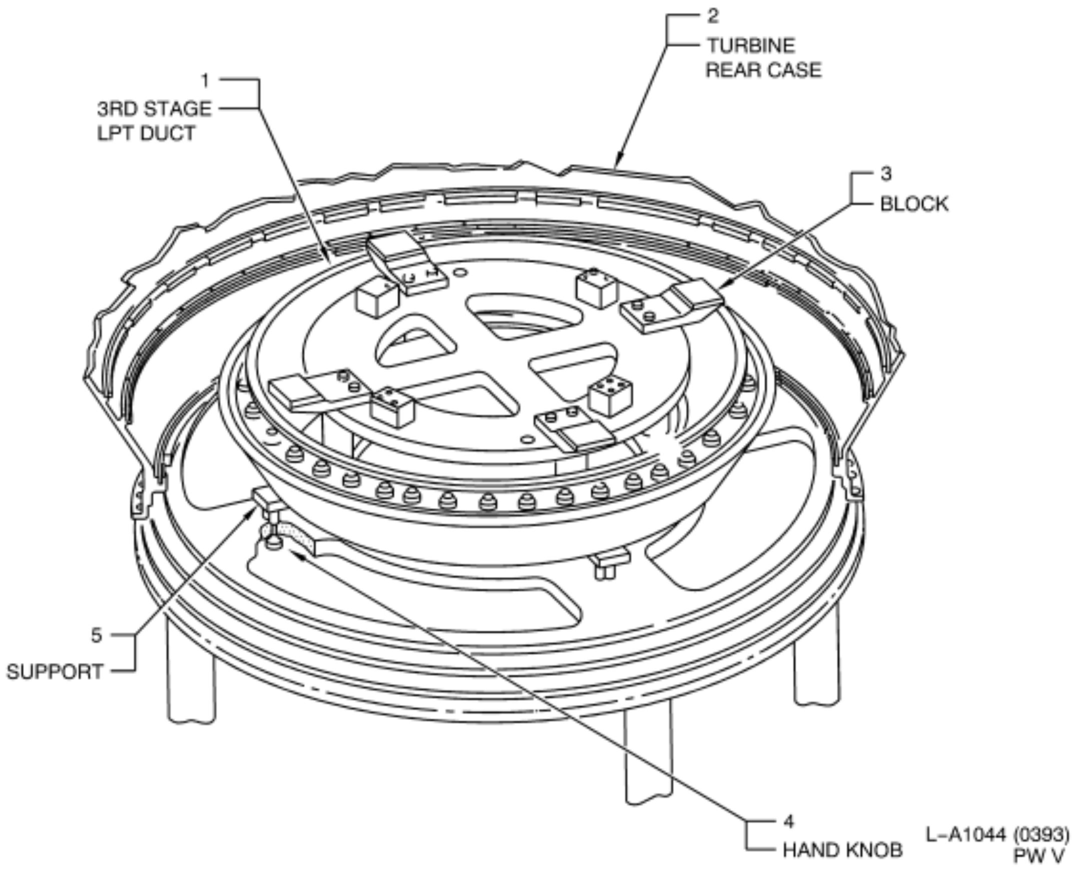

1
3RD STAGE LPT
DUCT SEAL
2
3RD STAGE LPT
DUCT SEGMENT
NOTE : GASKET SPLIT
FACES INWARD
SECTION A-A
A
A
4
SPRING
TENSION
WASHER
5
INSTRUMENTATION
PLUG STOP
3
GASKET
COTTER
PIN
8
7
INSTRUMENTATION
(BORESCOPE) BOSS
PLUG
VIEW SHOWING
SPRING TENSION
WASHER INSTALLED
BOLT
(2 REQUIRED)
6
L-A1040 (0389)
PW V

Third Stage LPT Duct Segments Installation
Figure 1002
(Task 72-53-00-400-001)


1
WORK BOLTS
2
3RD STAGE LPT DUCT
3
3RD STAGE LPT
SEALING RING SUPPORT
L−A0892 (0000)
PW V

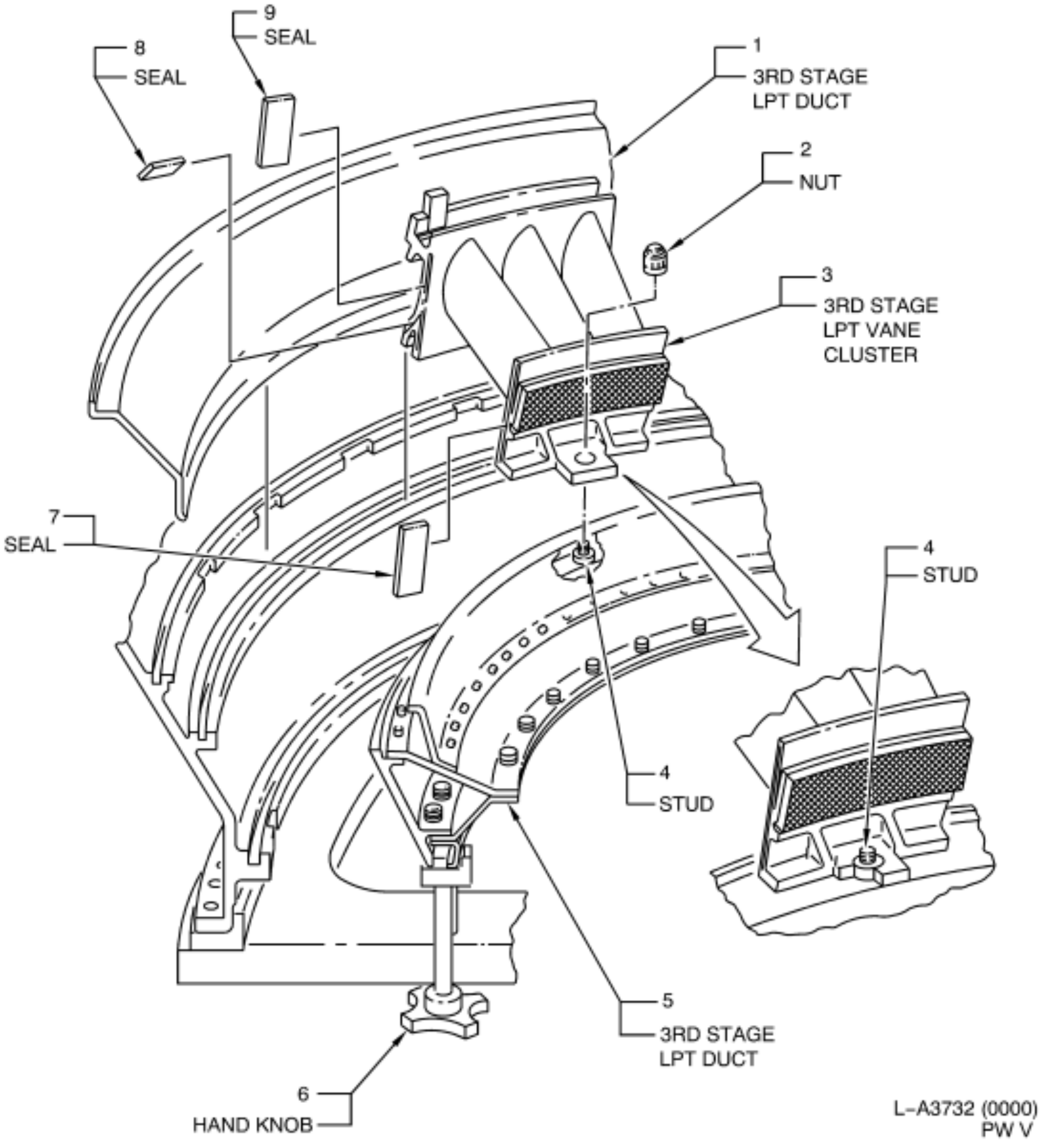
Third Stage LPT Duct And Sealing Ring Support Assembly
Figure 1003
(Task 72−53−00−400−001)

LOW PRESSURE TURBINE (LPT) − ASSEMBLY−01

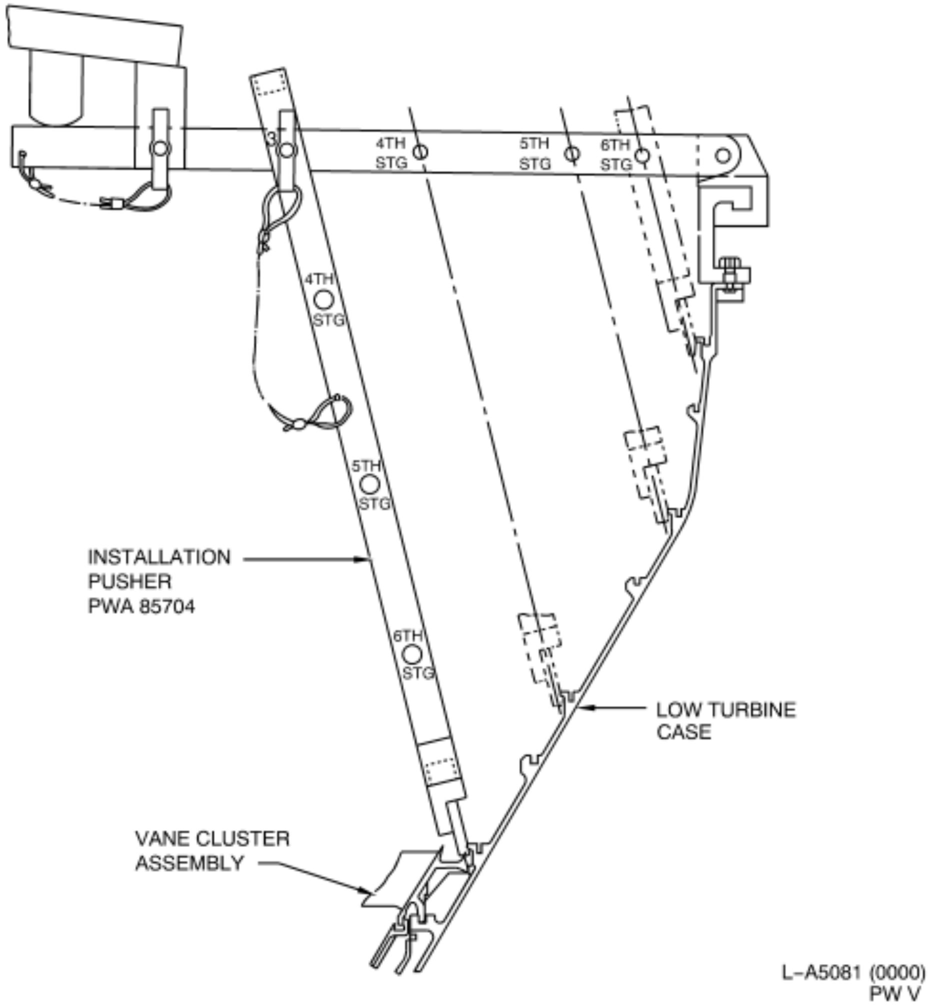

1
3RD STAGE
LPT DUCT
2
TURBINE
REAR CASE
3
BLOCK
5
SUPPORT
4
HAND KNOB
L−A1044 (0393)
PW V

Third Stage LPT Duct Installation
Figure 1004
(Task 72−53−00−400−001)

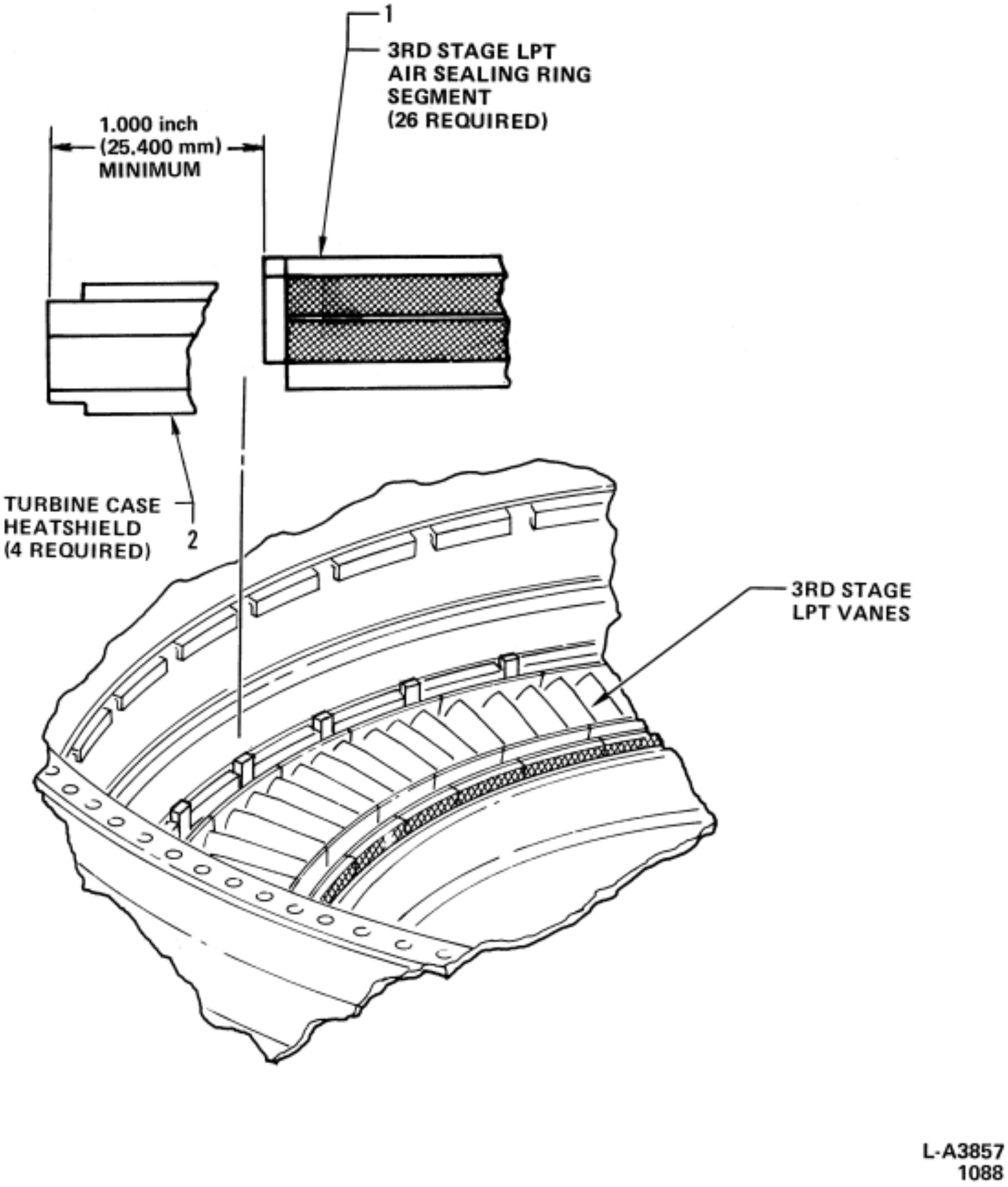
R
R


9
SEAL
8
SEAL
1
3RD STAGE
LPT DUCT
2
NUT
3
3RD STAGE
LPT VANE
CLUSTER
7
SEAL
4
STUD
4
STUD
5
3RD STAGE
LPT DUCT
6
HAND KNOB
L−A3732 (0000)
PW V

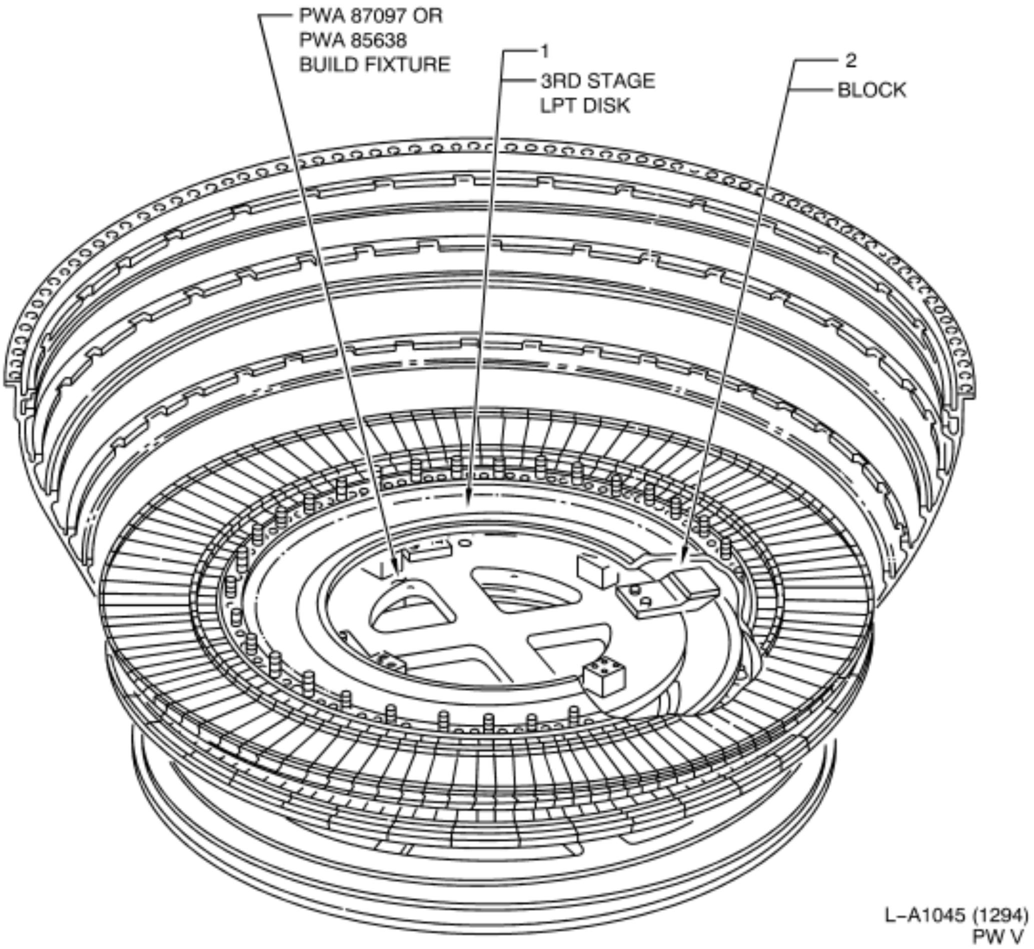
Third Stage LPT Vane Clusters Installation
Figure 1005
(Task 72−53−00−400−001)


3
4TH STG
5TH STG
6TH STG
4TH STG
5TH STG
6TH STG
INSTALLATION PUSHER PWA 85704
LOW TURBINE CASE
VANE CLUSTER ASSEMBLY
L-A5081 (0000)
PW V

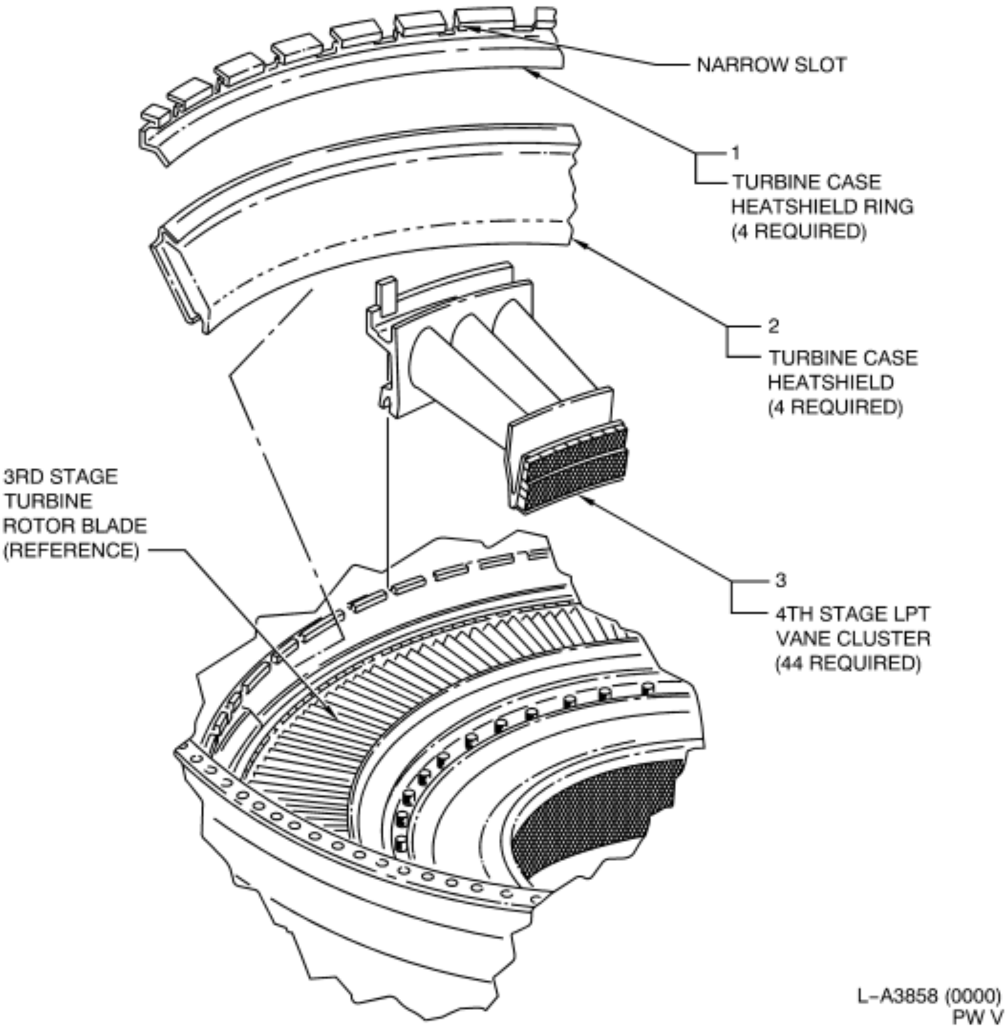
Vane Cluster Installation Pusher
Figure 1006
(Task 72-53-00-400-001)


1
3RD STAGE LPT
AIR SEALING RING
SEGMENT
(26 REQUIRED)
1.000 inch
(25.400 mm)
MINIMUM
TURBINE CASE
HEATSHIELD
(4 REQUIRED)
2
3RD STAGE
LPT VANES
L-A3857
1088

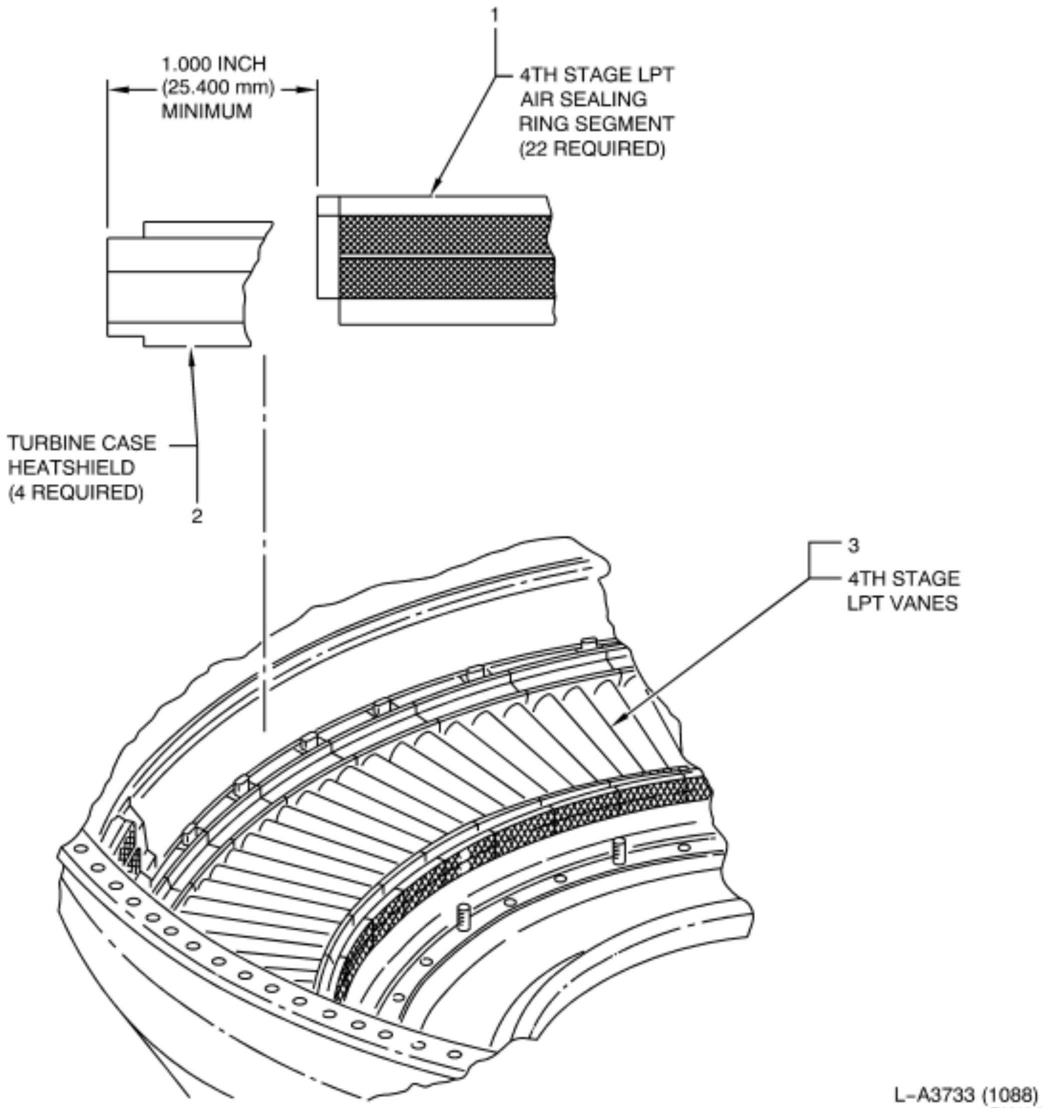
Third Stage Air Sealing Ring Segment Installation
Figure 1007
(Task 72−53−00−400−001)


PWA 87097 OR
PWA 85638
BUILD FIXTURE
1
3RD STAGE
LPT DISK
2
BLOCK
L-A1045 (1294)
PW V

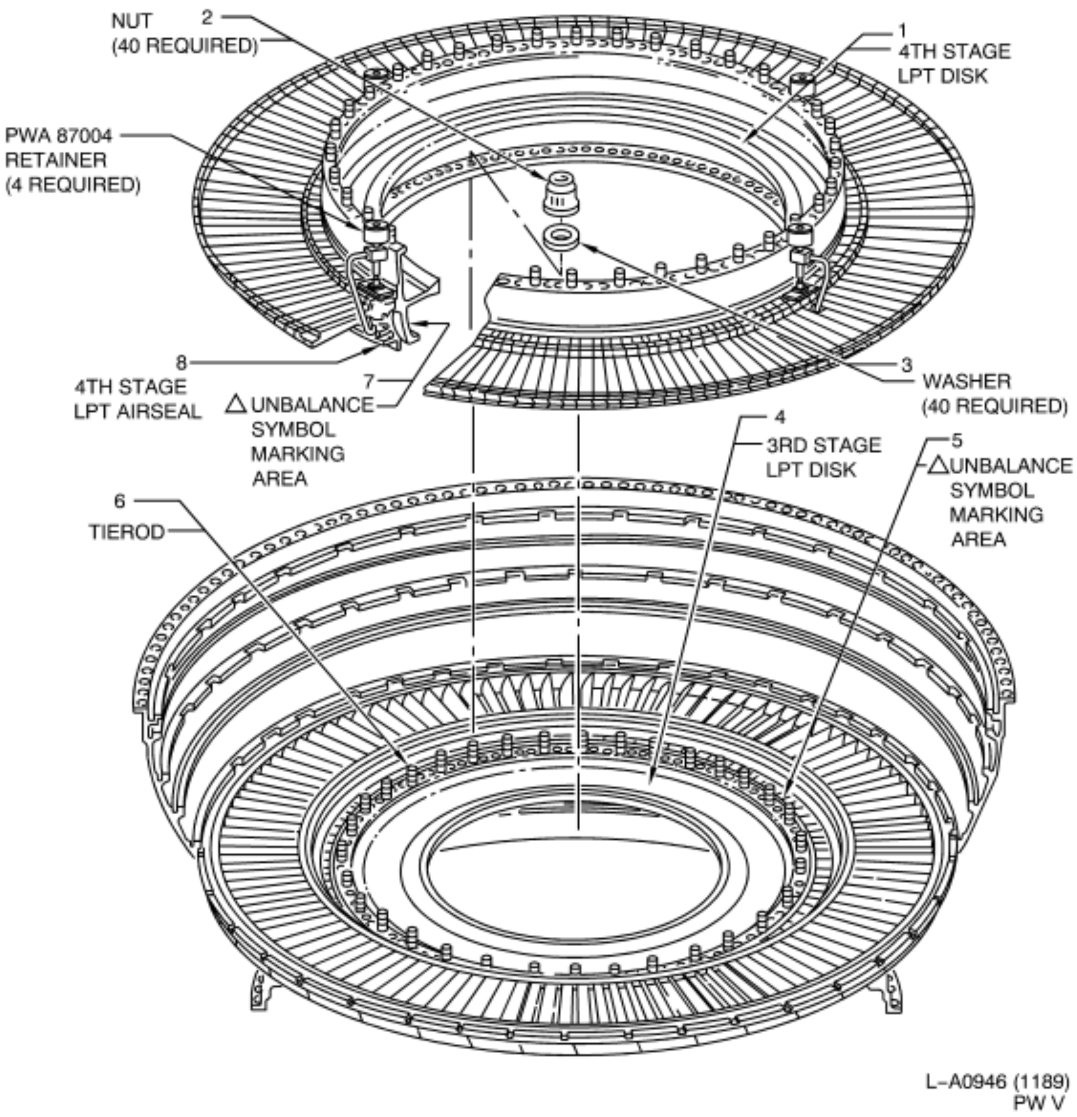
Third Stage LPT Rotor Assembly Installation
Figure 1008
(Task 72-53-00-400-001)


NARROW SLOT
1
TURBINE CASE
HEATSHIELD RING
(4 REQUIRED)
2
TURBINE CASE
HEATSHIELD
(4 REQUIRED)
3RD STAGE
TURBINE
ROTOR BLADE
(REFERENCE)
3
4TH STAGE LPT
VANE CLUSTER
(44 REQUIRED)
L-A3858 (0000)
PW V

Fourth Stage LPT Vane Clusters Installation
Figure 1009
(Task 72-53-00-400-001)

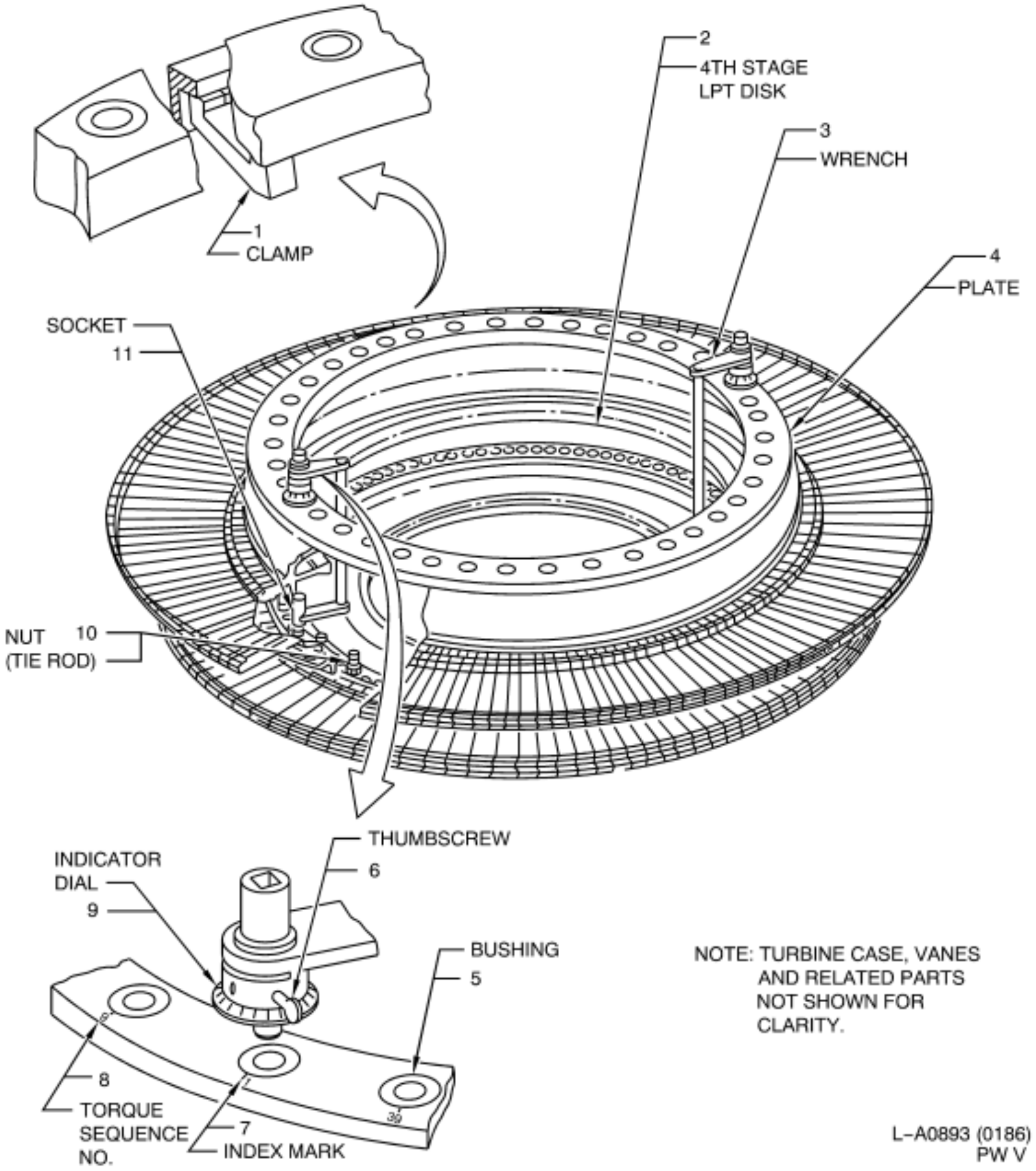

1
1.000 INCH
(25.400 mm)
MINIMUM
4TH STAGE LPT
AIR SEALING
RING SEGMENT
(22 REQUIRED)
TURBINE CASE
HEATSHIELD
(4 REQUIRED)
2
3
4TH STAGE
LPT VANES
L-A3733 (1088)
PW V

Fourth Stage LPT Air Sealing Ring Segments Installation
Figure 1010
(Task 72-53-00-400-001)

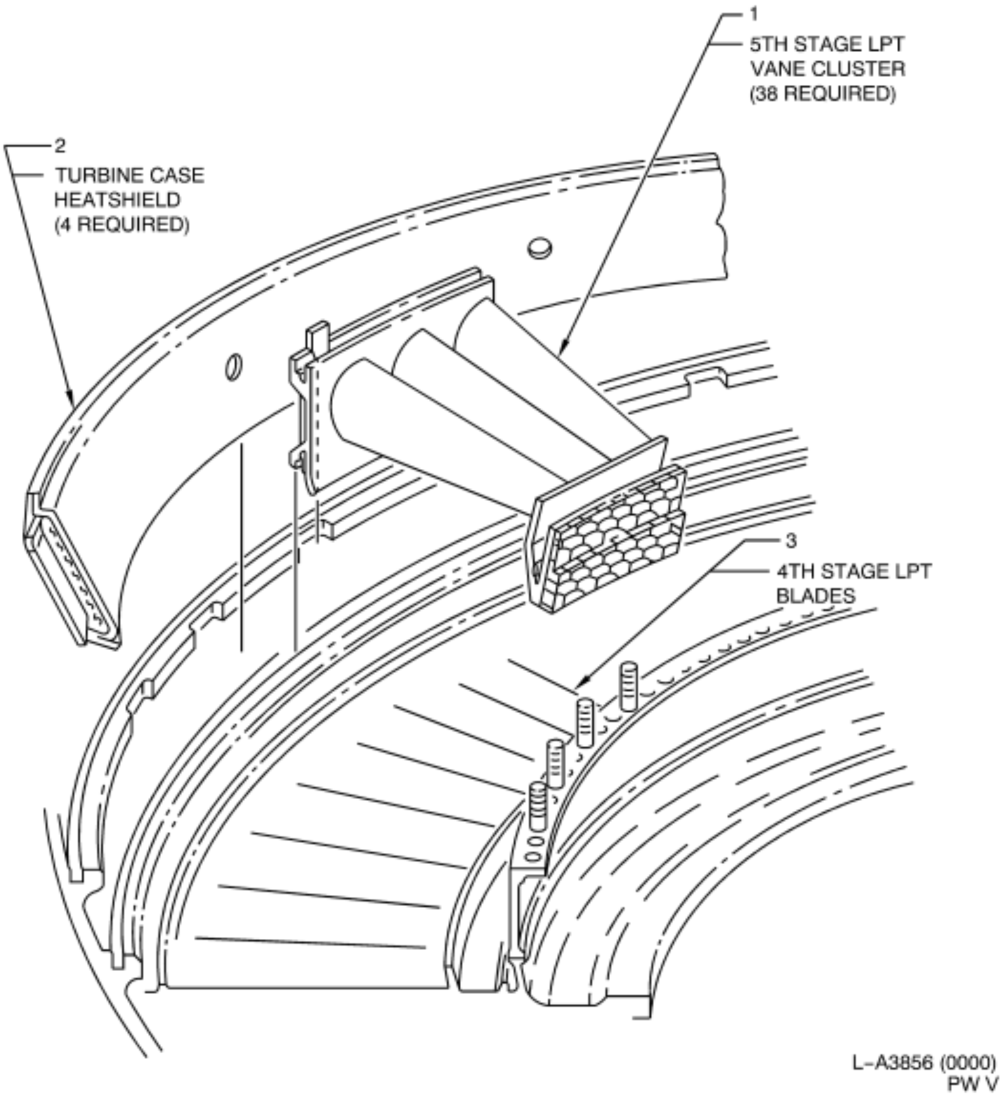

NUT 2
(40 REQUIRED)
1
4TH STAGE
LPT DISK
PWA 87004
RETAINER
(4 REQUIRED)
8
4TH STAGE
LPT AIRSEAL
7
△UNBALANCE
SYMBOL
MARKING
AREA
3
WASHER
(40 REQUIRED)
4
3RD STAGE
LPT DISK
5
△UNBALANCE
SYMBOL
MARKING
AREA
6
TIEROD
L−A0946 (1189)
PW V

Fourth Stage Turbine Rotor Assembly Installation
Figure 1011
(Task 72−53−00−400−001)

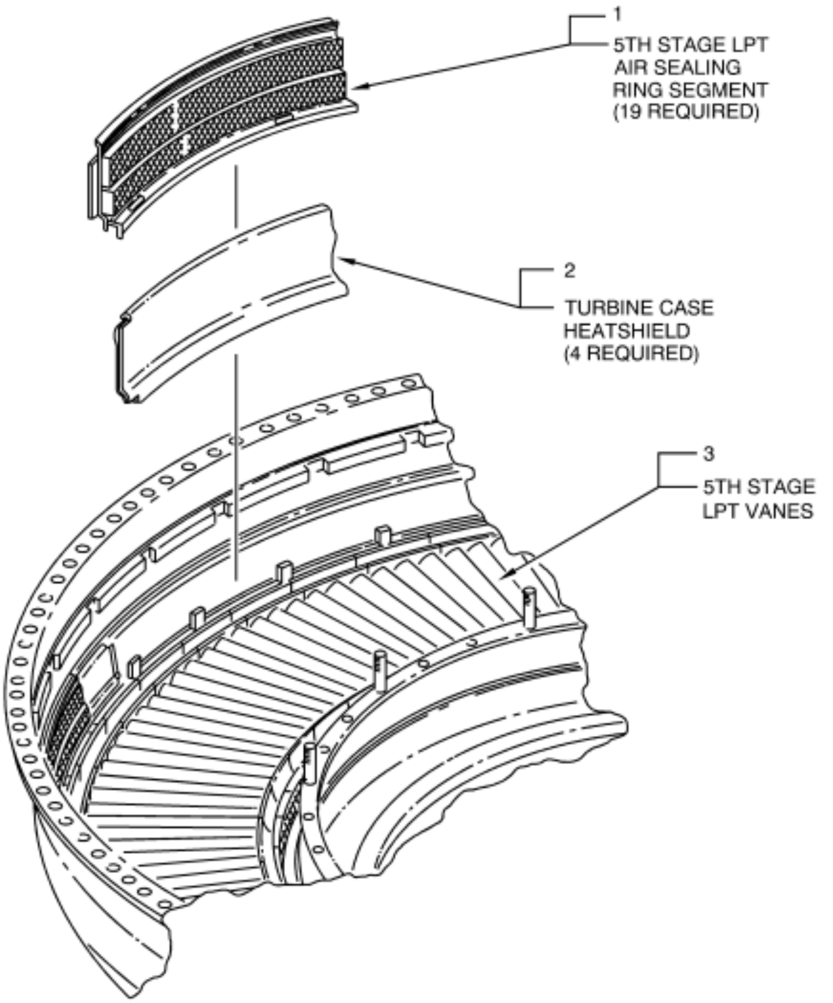
LOW PRESSURE TURBINE (LPT) − ASSEMBLY−01


1
CLAMP
2
4TH STAGE
LPT DISK
3
WRENCH
4
PLATE
SOCKET
11
NUT
(TIE ROD)
10
THUMBSCREW
6
INDICATOR
DIAL
9
BUSHING
5
8
TORQUE
SEQUENCE
NO.
7
INDEX MARK
39
NOTE: TURBINE CASE, VANES AND RELATED PARTS NOT SHOWN FOR CLARITY.
L−A0893 (0186)
PW V

PWA 85231 Angle Of Turn Fixture Installation
Figure 1012
(Task 72−53−00−400−001)

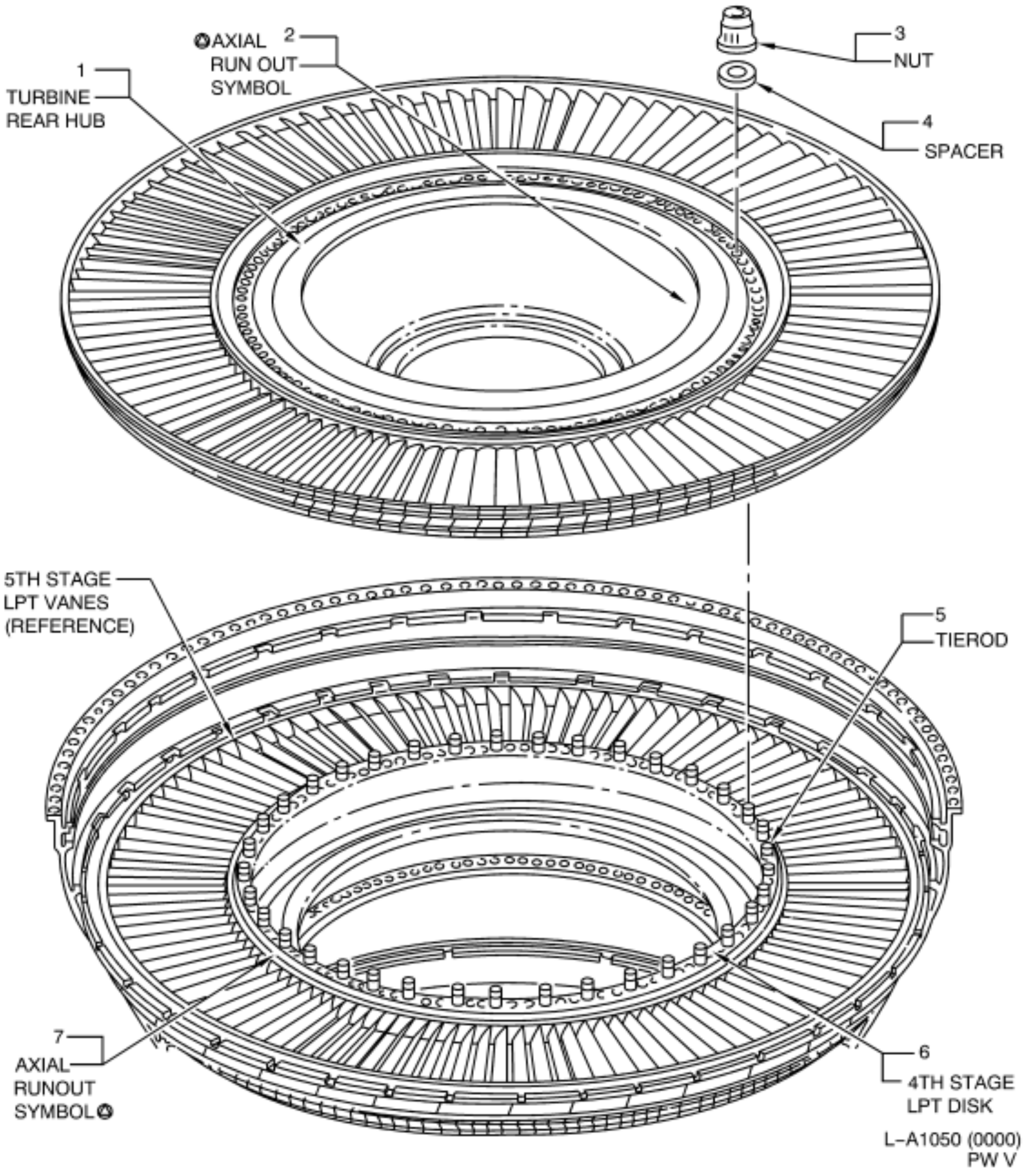

1
5TH STAGE LPT VANE CLUSTER (38 REQUIRED)
2
TURBINE CASE HEATSHIELD (4 REQUIRED)
3
4TH STAGE LPT BLADES
L−A3856 (0000)
PW V

Fifth Stage LPT Vane Clusters Installation
Figure 1013
(Task 72−53−00−400−001)

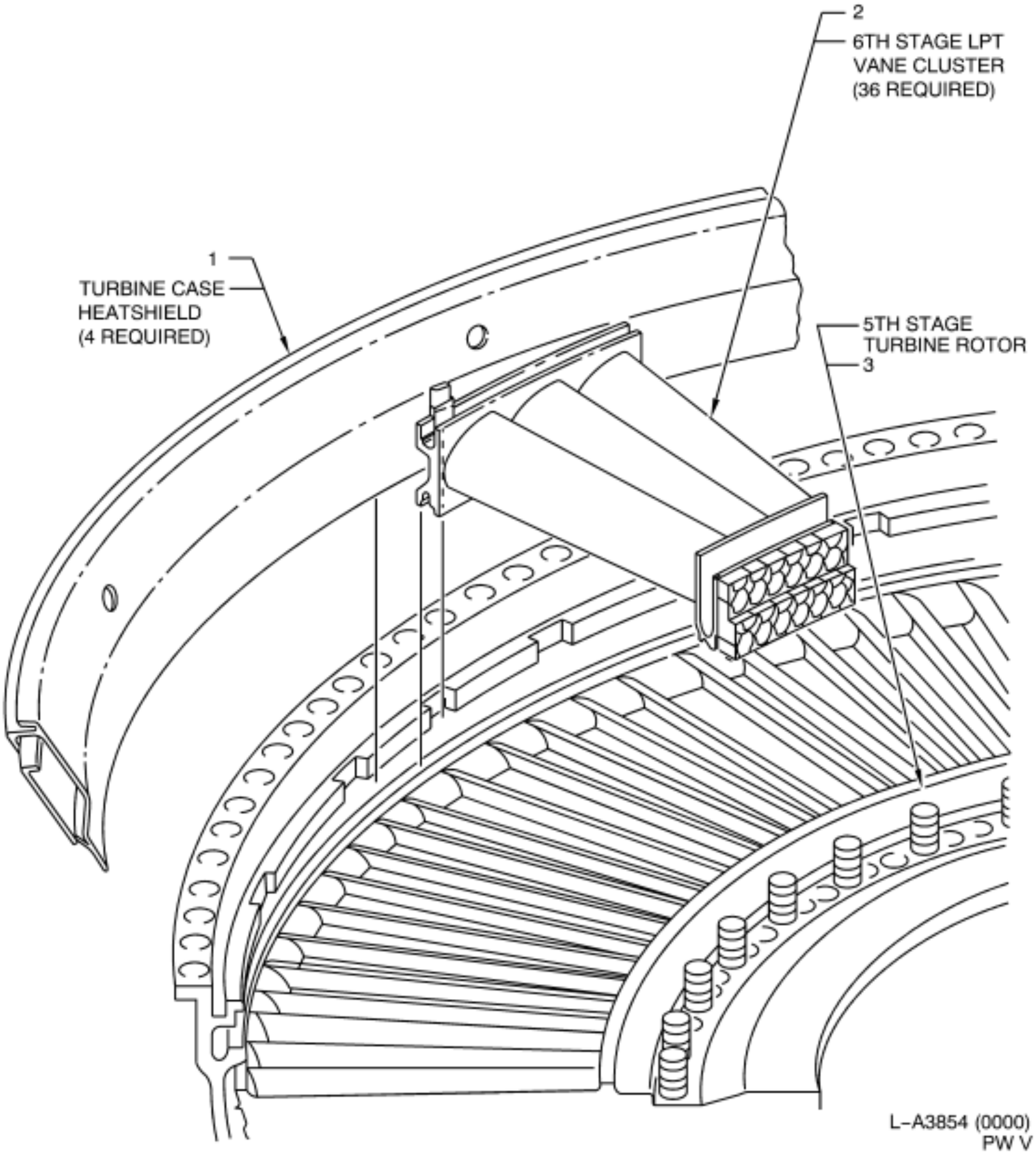

1
5TH STAGE LPT AIR SEALING RING SEGMENT (19 REQUIRED)
2
TURBINE CASE HEATSHIELD (4 REQUIRED)
3
5TH STAGE LPT VANES

L-A3855 (0000)
PW V

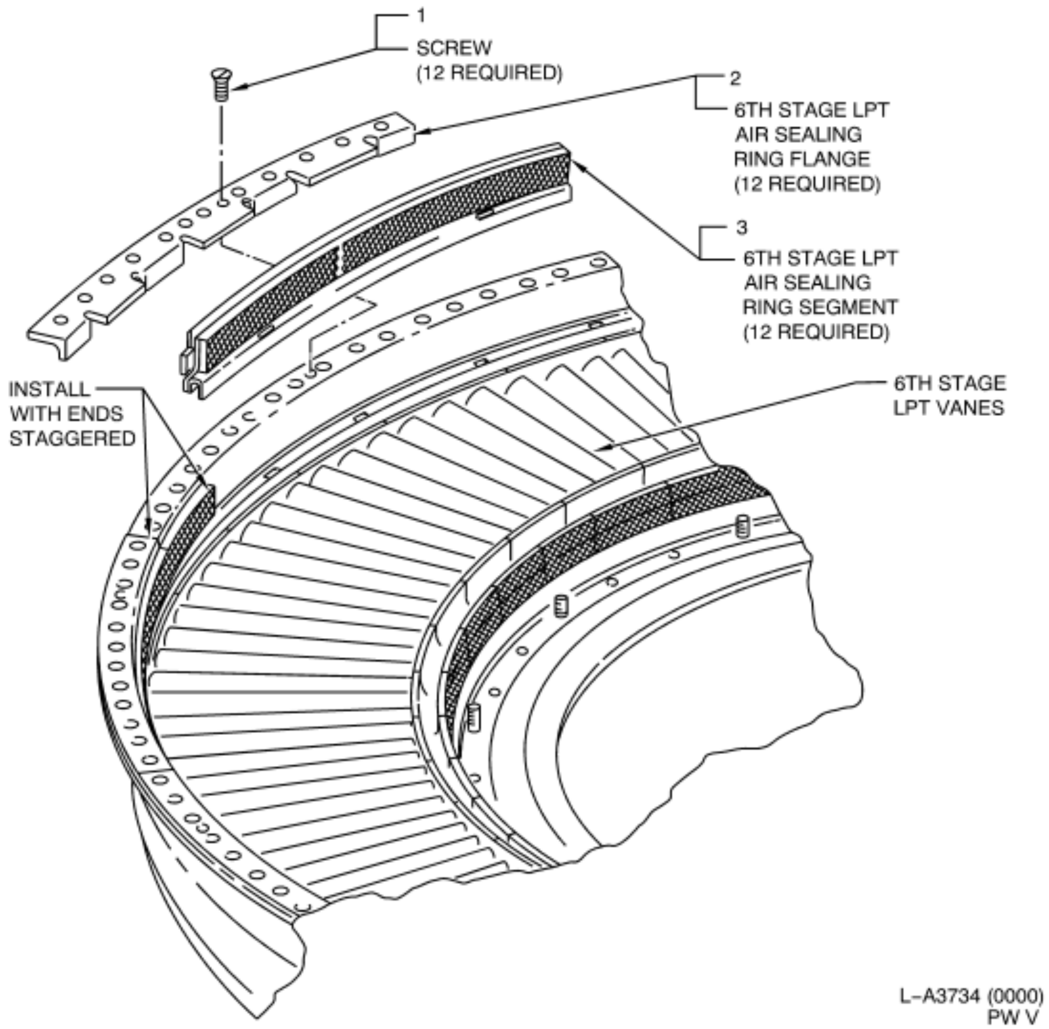
Fifth Stage LPT Air Sealing Ring Segments Installation
Figure 1014
(Task 72-53-00-400-001)


1
TURBINE
REAR HUB
2
AXIAL
RUN OUT
SYMBOL
3
NUT
4
SPACER
5TH STAGE
LPT VANES
(REFERENCE)
5
TIEROD
7
AXIAL
RUNOUT
SYMBOL
6
4TH STAGE
LPT DISK
L-A1050 (0000)
PW V

Fifth Stage Turbine Rotor Assembly Installation
Figure 1015
(Task 72-53-00-400-001)

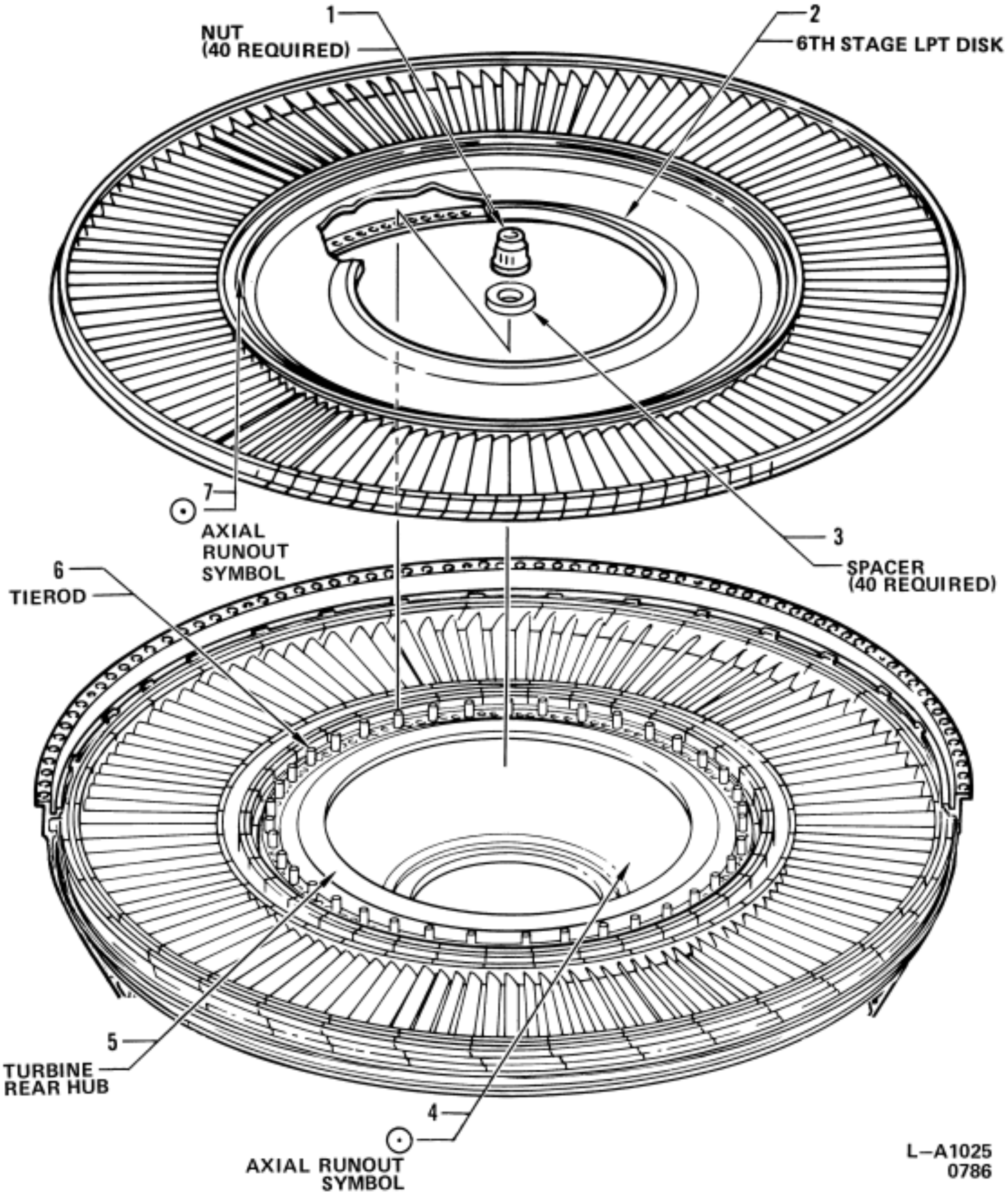

2
6TH STAGE LPT
VANE CLUSTER
(36 REQUIRED)
1
TURBINE CASE
HEATSHIELD
(4 REQUIRED)
5TH STAGE
TURBINE ROTOR
3
L−A3854 (0000)
PW V

Sixth Stage LPT Vane Clusters Installation
Figure 1016
(Task 72−53−00−400−001)

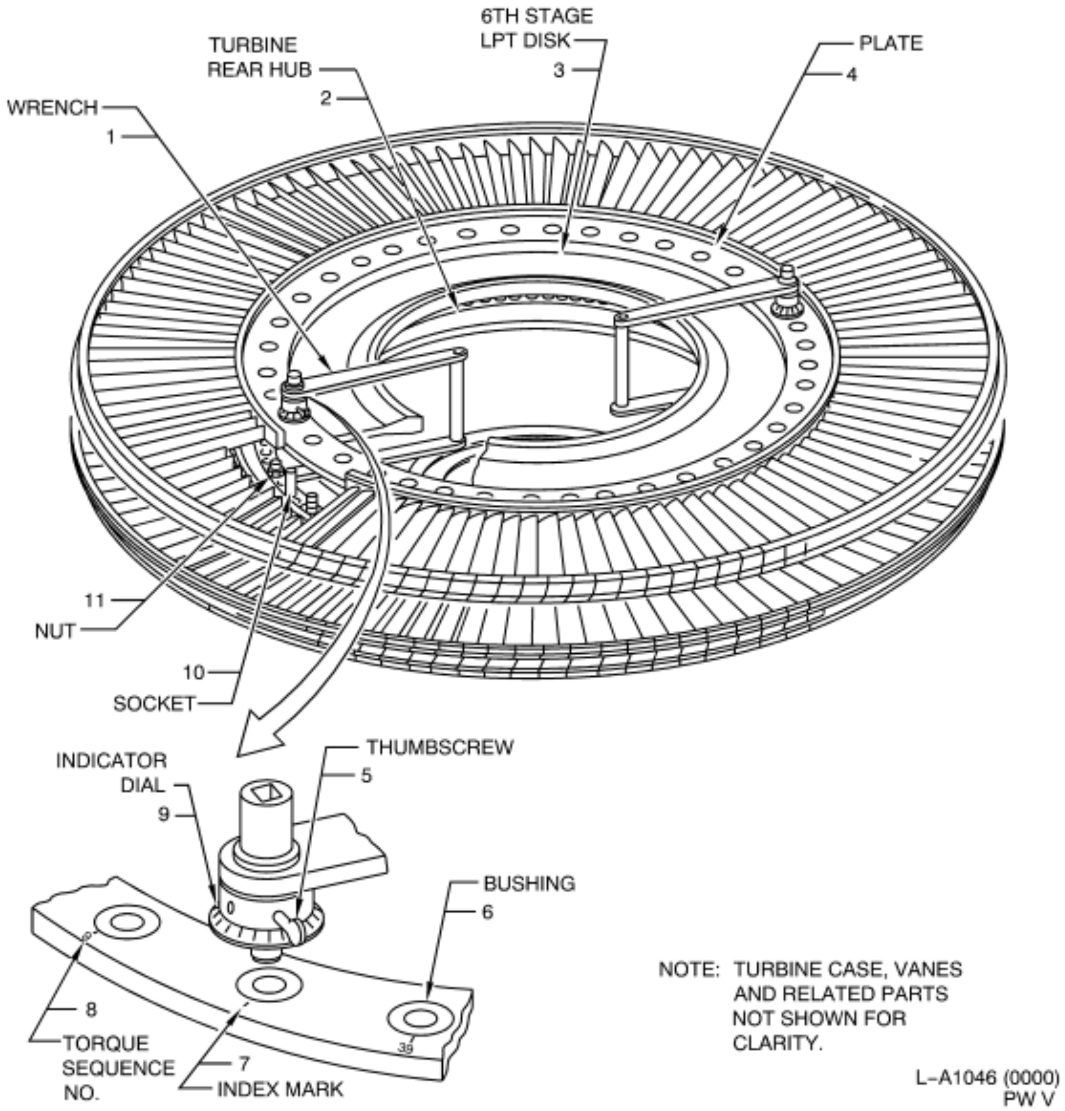

1
SCREW
(12 REQUIRED)
2
6TH STAGE LPT
AIR SEALING
RING FLANGE
(12 REQUIRED)
3
6TH STAGE LPT
AIR SEALING
RING SEGMENT
(12 REQUIRED)
6TH STAGE
LPT VANES
INSTALL
WITH ENDS
STAGGERED
L-A3734 (0000)
PW V

Sixth Stage LPT Air Sealing Ring Segments Installation
Figure 1017
(Task 72-53-00-400-001)

LOW PRESSURE TURBINE (LPT) - ASSEMBLY-01


1
NUT
(40 REQUIRED)
2
6TH STAGE LPT DISK
7
AXIAL
RUNOUT
SYMBOL
3
SPACER
(40 REQUIRED)
6
TIERDOD
5
TURBINE
REAR HUB
4
AXIAL RUNOUT
SYMBOL
L-A1025
0786

Sixth Stage Turbine Rotor Assembly Installation
Figure 1018
(Task 72-53-00-400-001)


6TH STAGE
LPT DISK
3
TURBINE
REAR HUB
2
PLATE
4
WRENCH
1
11
NUT
10
SOCKET
INDICATOR
DIAL
9
THUMBSCREW
5
BUSHING
6
8
TORQUE
SEQUENCE
NO.
7
INDEX MARK
0
39
L−A1046 (0000)
PW V

NOTE: TURBINE CASE, VANES AND RELATED PARTS NOT SHOWN FOR CLARITY.

PWA 85232 Angle Of Turn Fixture Installation
Figure 1019
(Task 72−53−00−400−001)

Previous Pageblock   Return to Previous Menu   Next Pageblock

LOW PRESSURE TURBINE (LPT) - ASSEMBLY-02

Task 72-53-00-400-002:

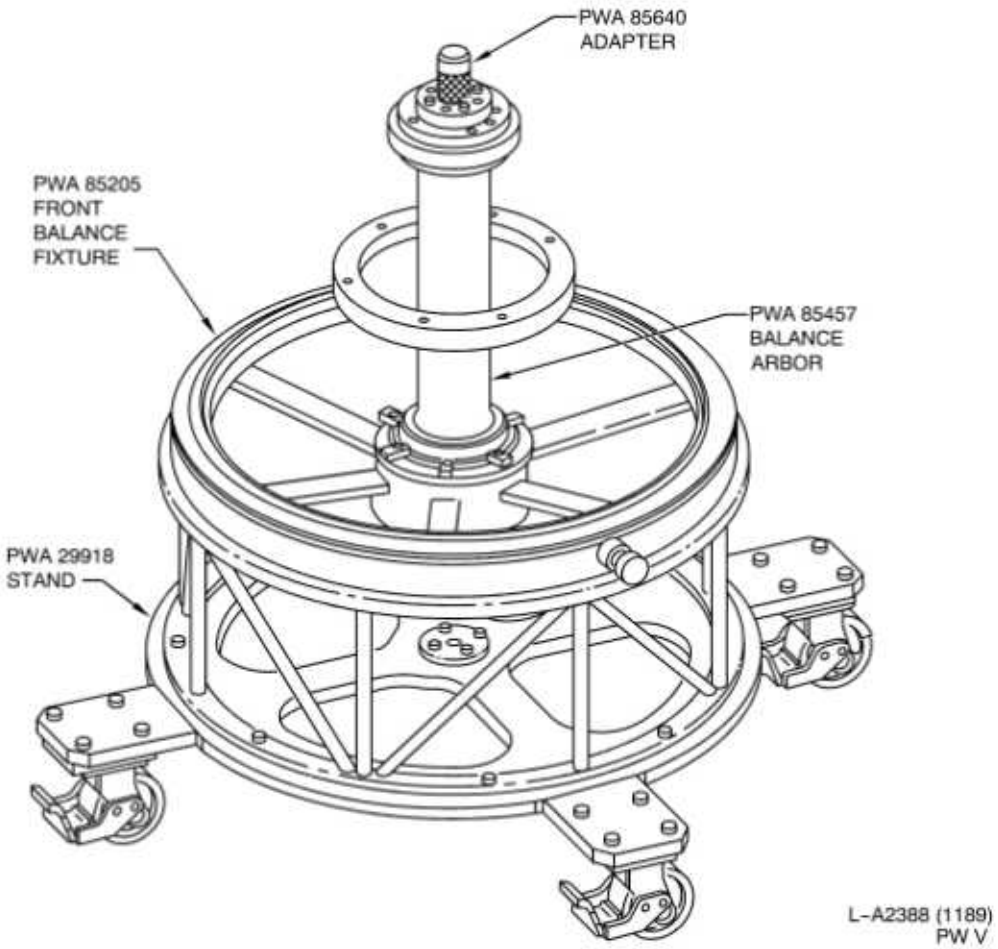
1. Prepare Low Pressure Turbine For Balancing
   A. Prerequisites
      (1) See Inspection/Check-04 (Task 72-53-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.
      (2) Assemble low pressure turbine per Assembly-01 (Task 72-53-00-400-001).
   B. Equipment And Materials Required

      Special Tools:
      PWA 28657 Sling
      PWA 29390 Hydraulic Pump
      PWA 29918 Stand, Build/Disassembly (Optional To PWA 87913)
      PWA 85205 Front Balance Fixture
      PWA 85331 Rear Retainer
      PWA 85332 Handling Fixture (Optional To PWA 86026)
      PWA 85333 Pusher/Puller
      PWA 85457 Balance Arbor
      PWA 85640 Adapter
      PWA 85766 Rear Balance Fixture
      PWA 86026 Handling Fixture (Optional To PWA 85332)
      PWA 86206 Adapter, Lift And Trunnion (2 Required)
      PWA 87913 Stand, Build/Disassembly

   C. Procedure

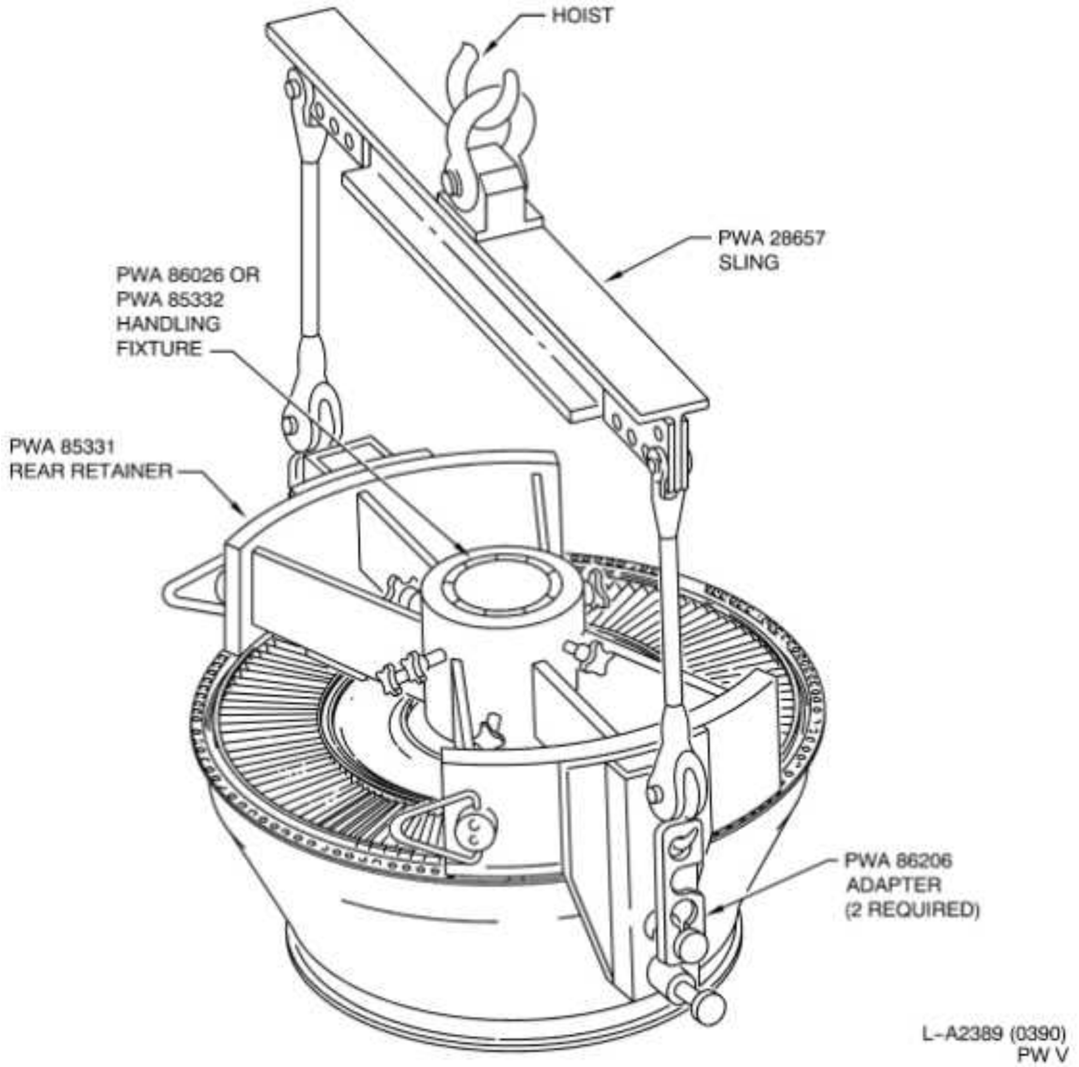
   Subtask 72-53-00-430-060:
      (1) Install PWA 85205 Front Balance Fixture onto PWA 29918 or PWA 87913 Stand, so that OD snap on fixture engages stand. See Figure 1001.
      (2) If present, remove Protector (PWA 85239) from rear flange of turbine case.
      (3) Install PWA 85457 Balance Arbor to Front Balance Fixture (PWA 85205).
         (a) Install detail lift eyes, as necessary.
         (b) Position arbor in fixture with guide pin facing up.
         (c) Secure arbor to fixture with six bearing clamps.
      (4) Install PWA 85640 Adapter to rear face of arbor with four detail bolts.
      (5) Install handling fixture. See Figure 1002.
         (a) Install PWA 85332 (Optional to PWA 86026) Handling Fixture.
            1 Position handling fixture using suitable tooling, while locator is installed in one tierod hole to align module with fixture.

LOW PRESSURE TURBINE (LPT) - ASSEMBLY-02


PWA 85640
ADAPTER
PWA 85205
FRONT
BALANCE
FIXTURE
PWA 85457
BALANCE
ARBOR
PWA 29918
STAND
L-A2388 (1189)
PW V

Low Turbine Balance Tools
Figure 1001
(Task 72-53-00-400-002)

LOW PRESSURE TURBINE (LPT) - ASSEMBLY-02


HOIST
PWA 28657
SLING
PWA 86026 OR
PWA 85332
HANDLING
FIXTURE
PWA 85331
REAR RETAINER
PWA 86206
ADAPTER
(2 REQUIRED)
L-A2389 (0390)
PW V

Low Turbine Handling Tools
Figure 1002
(Task 72-53-00-400-002)

      2 Slide lockring rearward using two detail T-handle rods, to expand clamps. Secure lockring with four screws, so that clamps interface with turbine rear hub bore.
   (b) Install PWA 86026 Handling Fixture (Optional to PWA 85332).
      1 Install locator (detail-8) onto tierod where tierod nut has been removed.
      2 Measure 5th stage hub flange with template (detail-18). If flange thickness is approximately 0.680 inch (17.272 mm), then install spacer (detail-17). If flange thickness is approximately 0.813 inch (20.650 mm), then spacer is not used.
      3 Position handling fixture using PWA 85635 Lift Adapter, while locator is installed on one tierod. Locator aligns LPT with fixture.
      4 Tighten four hex head bolts to engage supports and arms into 5th stage hub.

(6) Install PWA 85331 Rear Retainer.
   (a) Lift retainer using two .500-13 lift holes marked FOR LIFTING TOOL VERTICAL ONLY.
   (b) Position retainer over previously installed handling fixture and secure to case with 48 screws and washers.
   (c) Lock axial position of LPT rotor by tightening eight hand knobs against handling fixture.

(7) Use a hoist to attach PWA 28657 Sling and two PWA 86206 Lift And Trunnion Adapters to rear retainer at spools labeled LPT WITHOUT SHAFT.

(8) Remove the bolts and washers that hold the turbine rear case (front flange) to the build fixture.

(9) Carefully lift the assembly 1.0 - 2.0 inches (25. - 51. mm). Remove the bolts and four blocks from the fixture immediately below the 3rd stage LPT disk.

(10) Lift the assembly from the stand.

(11) Lower the LPT module over the arbor.

(12) Install PWA 85333 Pusher/Puller. See Figure 1003.
   (a) Attach PWA 29390 Hydraulic Pump.
   (b) Actuate (to extend) cylinder and thread into Adapter (PWA 85640).
   (c) Secure Pusher/Puller to rear face of handling fixture with eight detail bolts.

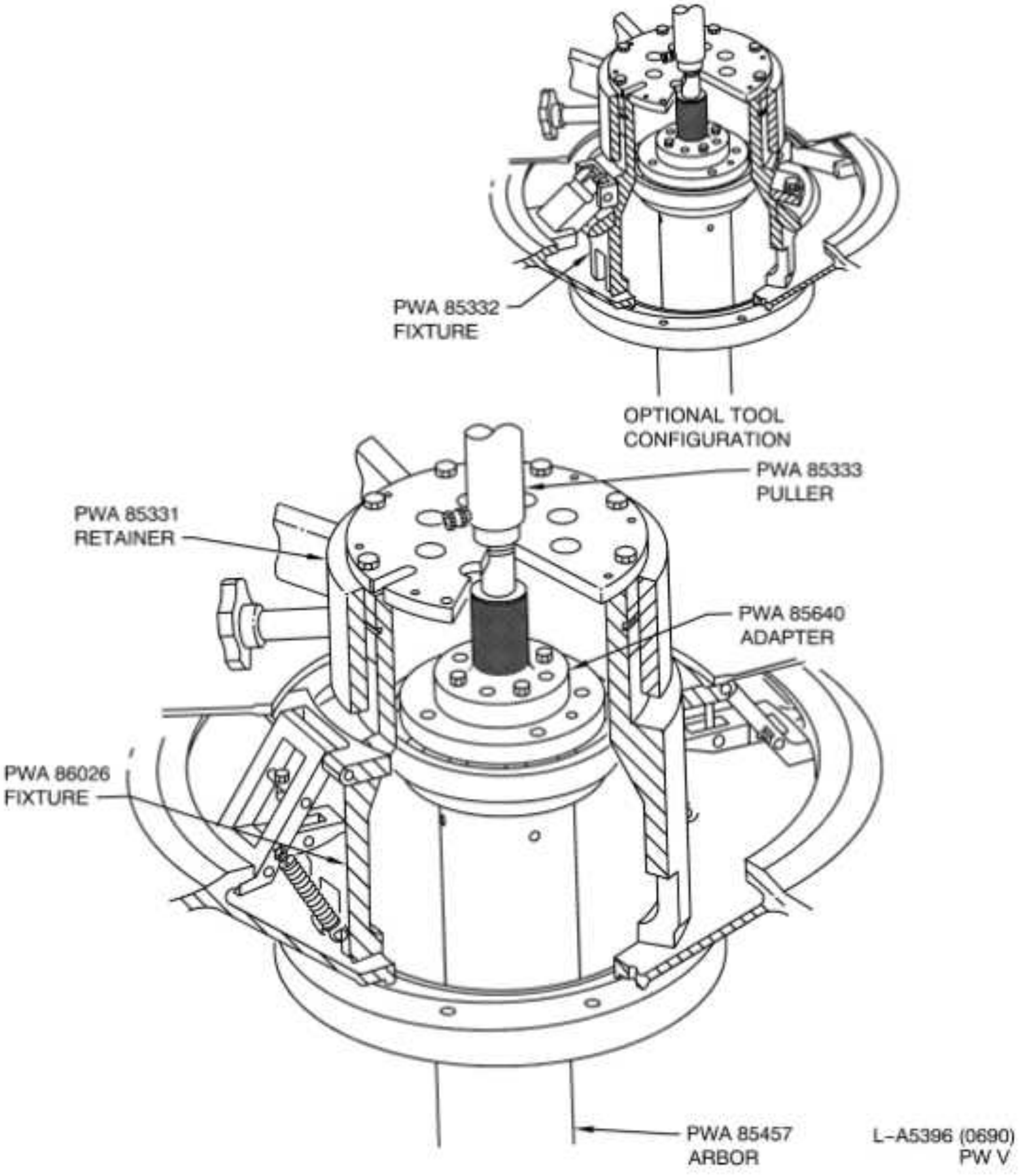
(13) Heat arbor, by suitable means, to relieve tight fit of locating snap.

(14) Actuate pusher/puller to seat hub on arbor plate.

(15) Secure the LPT hub to arbor using the detail bolts and washers.

(16) Allow arbor to return to room temperature.

LOW PRESSURE TURBINE (LPT) − ASSEMBLY−02


PWA 85332
FIXTURE
OPTIONAL TOOL
CONFIGURATION
PWA 85333
PULLER
PWA 85331
RETAINER
PWA 85640
ADAPTER
PWA 86026
FIXTURE
PWA 85457
ARBOR
L-A5396 (0690)
PW V

Arbor Installation Tools
Figure 1003
(Task 72−53−00−400−002)

(17) Remove Pusher/Puller from handling fixture.
  (a) Relieve hydraulic pressure and disconnect pump.
  (b) Remove eight bolts which secure pusher/puller and store in adjacent threaded holes.
  (c) Unthread cylinder from adapter.

(18) Remove Adapter (PWA 85640) from arbor.
  (a) Remove four bolts and store in adjacent threaded holes.

(19) Remove Rear Retainer (PWA 85331) from LPT.
  (a) Remove bolts securing retainer to rear flange of turbine case.
  (b) Loosen hand knobs clamping handling fixture.
  (c) Remove retainer from LPT using two .500-13 lift holes marked FOR LIFTING TOOL VERITICAL ONLY.

(20) Remove Handling Fixture (PWA 86026 or PWA 85332) from LPT.
  (a) Unclamp handling fixture by removing four bolts securing clamp ring.
  (b) Remove fixture using hoist and suitable tooling.

(21) Secure front balance fixture to turbine case with twenty-six detail bolts.

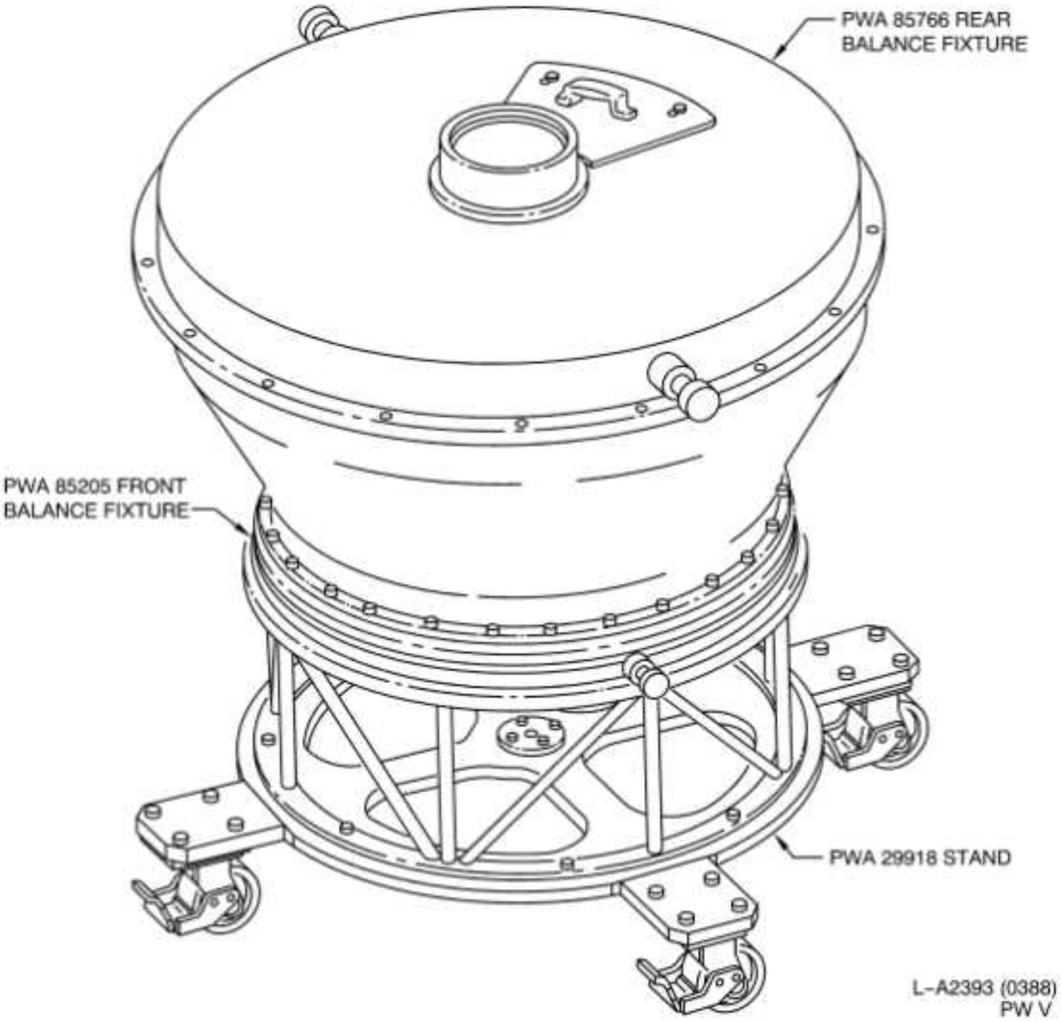
CAUTION: DO NOT CLAMP BALANCE BEARING WITH LOCK BOLTS. ERRONEOUS BALANCE INDICATION WILL RESULT FROM CLAMPING BEARING TO REAR BALANCE FIXTURE.

(22) Install PWA 85766 Rear Balance Fixture. See Figure 1004.
  (a) Position the four lock bolts so that the arbor bearing will not interfere. Secure bolts in this position with nuts.
  (b) Align dowel pin clearance hole and secure fixture to rear flange of turbine with detail bolts and washers.

NOTE: Do not secure bearing with lockbolts.

D. Postrequisites

(1) Balance low pressure turbine per Assembly-03 (Task 72-53-00-400-003).


PWA 85766 REAR BALANCE FIXTURE
PWA 85205 FRONT BALANCE FIXTURE
PWA 29918 STAND
L-A2393 (0388)
PW V

Balance Tools
Figure 1004
(Task 72-53-00-400-002)

LOW PRESSURE TURBINE (LPT) - ASSEMBLY-03

Task 72-53-00-400-003:

1. Balance Low Pressure Turbine

NOTE: It is not necessary to do Assembly-03 Task 72-53-00-400-003 balance of the low pressure turbine if the balance procedure of Assembly-12 Task 72-53-00-400-012 is done with the low pressure turbine shaft and the Stage 3 low pressure turbine rotating air seal that has a balance counterweight flange. See Assembly-12 Task 72-53-00-400-012. If Assembly-12 Task 72-53-00-400-012 is not done, balance of the low pressure turbine must be done by Assembly-03 Task 72-53-00-400-003.

A. Prerequisites

(1) See Inspection/Check-04 Task 72-53-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

(2) Prepare low pressure turbine for balancing per Assembly-02 Task 72-53-00-400-002.

B. Equipment And Materials Necessary

Special Tools:

PWA 28657	Sling (2 Necessary)
PWA 76154	Adapter (4 Necessary)
PWA 85211	Weight, Balance
PWA 85234	Riveter
PWA 85686	Weight, Calibration (Front) (Check Weight)
PWA 85687	Weight, Calibration (Rear) (Check Weight)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Rivet	A/R	72-53-00/3/460

C. Procedure

Subtask 72-53-00-430-061:

(1) Using two PWA 28657 Slings, four PWA 76154 Adapters and hoists, lift low pressure turbine at trunnion spools and front and rear balance fixtures, and trunnion assembly to horizontal position. Remove arbor lift eyes.

(2) Place LPT assembly on pedestals of Gisholt balance machine or equivalent. Remove slings and hoists.

(3) Attach the direct drive to the forward end of the balance arbor.

(4) Operate the dynamic balance machine.

  (a) Find the dynamic unbalance of the low pressure turbine assembly while it turns at 900 rpm minimum.

  (b) Get three unbalance readings. For balance machines that do not have an automatic recording feature, record the average angle and the average amount of unbalance.

(5) Prepare to rotate (turn) the balance arbor as follows:

  (a) Make a reference mark on the direct drive and the balance arbor with a Marker P05-045 to identify the original location.

(6) Remove the low pressure turbine assembly from the balance machine.

(7) Remove the balance arbor from the low pressure turbine assembly. See Assembly-04, Task 72-53-00-400-004.

(8) Turn the balance arbor 180 degrees from the original location and install the balance arbor to the low pressure turbine assembly. See Assembly-02, Task 72-53-00-400-002.

(9) Install the low pressure turbine assembly in the balance machine.

(10) Attach the direct drive to the forward end of the balance arbor.

(11) Dynamic balance the low pressure turbine assembly. See Figure 1001.

(a) Find the dynamic unbalance of the low pressure turbine assembly while the assembly turns at 900 rpm minimum.

(b) The initial unbalance must not be more than 25 oz−in. (18000.0 g.mm) for Plane W and 25 oz−in. (18000.0 g.mm) for Plane X. However, if the unbalance vectors are within 30 degrees, then the initial unbalance must not be more than 12.5 oz−in. (9000.0 g.mm) for Plane W and 12.5 oz−in. (9000.0 g.mm) for Plane X.

NOTE: If initial unbalance exceeds permissible amount, strip rotor and inspect for fits, burrs, runout and unbalance in individual components.

(c) For balance machines that have an automatic recording feature, get three unbalance readings. Average the readings. Use the machine to determine the unbalance amount and angle of the assembly.

(d) For balance machines that do not have an automatic recording feature, get three unbalance readings. Average and record the three unbalance readings. Use the average readings from the first and second balance runs to do a polar plot to get the assembly unbalance angle and amount.

(12) Balance the assembly to get a remaining unbalance of 0.5 oz−in. (360.0 g.mm) maximum in the front, Plane W, plane.

(a) Residual unbalance must not be more than 0.5 oz−in. (360.0 g.mm) in the front plane (the tierod flange of the 3rd stage airseal).

1 Correct unbalance at front, Plane W, by adding any combination of counterweights PN 584943, PN 584944 or PN 534492, up to four maximum, within ± 20 degrees of unbalance vector.

2 It is permissible to fine trim front plane with up to two additional counterweights at any angular location.

3 Install rivets through counterweights and rivet holes in 3rd stage LPT airseal (1001/2). Secure rivets using PWA 85234 Riveter .

(13) Balance the assembly to get a remaining unbalance of 0.5 oz−in. (360.0 g.mm) maximum in the rear, Plane X, plane.

(a) Residual unbalance must not be more than 0.5 oz−in. (360.0 g.mm) in the rear plane (the 6th stage disk).

1 Correct the residual unbalance in the rear plane by adding any class of the PWA 85211 Balance Weight up to a maximum of four in ± 20 degrees of the unbalance vector.

2 Fine trim the rear plane by the replacement of any of the four PWA 85211 Balance Weight.

3 Install the balance weights to the tierods that attach the 6th stage disk.

NOTE: Do not remove the tierod nuts.

(14) Record the angle and the amount of assembly unbalance in the front and rear planes.

(15) Optional process based on the experience of the operator, do a check of the dynamic balance machine as follows:

(a) Install the front plane PWA 85686 Calibration Weight (Check Weight) to the rivet hole in the 3rd stage airseal flange as close as possible to the heavy angle.

NOTE: Do not install a check weight at a location where a counterweight is installed.

(b) Turn the dynamic balance machine at 900 rpm minimum. Check the machine, with the check weight installed in the front plane.

1 The check weight on the front plane pulls 4.04 oz−in. (2909.0 g.mm).

2 Read the angle and the amount of assembly unbalance in the front plane.

3 The amount of unbalance in the front plane should agree in ± 0.4 oz−in. (288.0 g.mm) or less with the amount recorded when the assembly was balanced.

4 Remove the check weight from the front plane.

(c) Install the rear plane PWA 85687 Calibration Weight (Check Weight) to a tierod, as close as possible to the heavy angle, that attaches the 6th stage disk. Do not remove the tierod nut.

(d) Turn the dynamic balance machine at 900 rpm minimum. Check the machine, with the check weight installed in the rear plane.

1 The check weight on the rear plane pulls 4.0 oz−in. (2880. g.mm).

2 Read the angle and the amount of assembly unbalance in the rear plane.

3 The amount of unbalance in the rear plane should agree in ± 0.4 oz−in. (288.0 g.mm) or less with the amount recorded when the assembly was balanced.

4 Remove the check weight from the rear plane.

(16) For balance machines with electronic calibration, use the manufacturer's instructions to do a check of the dynamic balance machine.

(17) Disconnect direct drive from forward end of balance arbor (or remove drive belt from forward end of arbor).

(18) After balancing, LPT assembly shall not be disassembled except with requirement for subsequent rebalance.

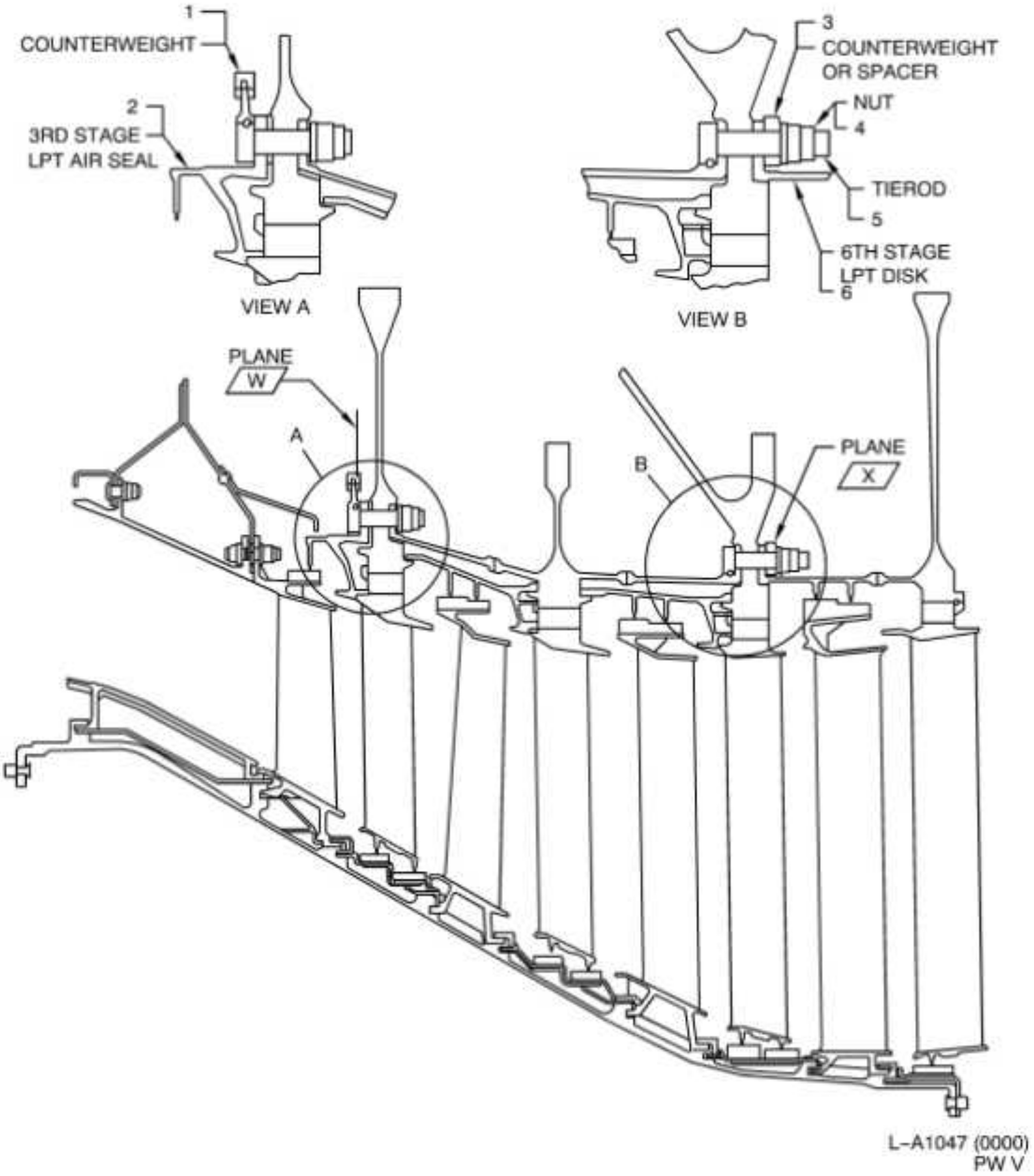
(19) Attach two PWA 28657 Slings and hoists to trunnion spools on front and rear balance fixtures. Lift assembly from balance machine, trunnion to vertical, (front end down) position and place into PWA 29918 Stand.

(20) Remove slings and hoists.

D. Postrequisites

LOW PRESSURE TURBINE (LPT) - ASSEMBLY-03

(1) Final assemble low pressure turbine per Assembly-04 Task 72-53-00-400-004.


1
COUNTERWEIGHT
2
3RD STAGE
LPT AIR SEAL
VIEW A
3
COUNTERWEIGHT
OR SPACER
NUT
4
TIEROD
5
6TH STAGE
LPT DISK
6
VIEW B
PLANE
W
A
B
PLANE
X
L-A1047 (0000)
PW V

Low Pressure Turbine Balancing
Figure 1001
(Task 72-53-00-400-003)

LOW PRESSURE TURBINE (LPT) - ASSEMBLY-04

Task 72-53-00-400-004:

1. Final Assemble Low Pressure Turbine

A. Prerequisites

(1) See Inspection/Check-04 (Task 72-53-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

(2) Balance low pressure turbine per Assembly-03 (Task 72-53-00-400-003).

B. Equipment And Materials Necessary

Special Tools:

PWA 28657	Sling (2 Necessary)
PWA 29390	Hydraulic Pump
PWA 76154	Adapter (2 Necessary)
PWA 85232	Fixture
PWA 85331	Retainer, Rear
PWA 85332	Fixture, Handling (Optional To PWA 86026)
PWA 85333	Pusher/Puller
PWA 85576	Stand, Storage
PWA 85640	Adapter
PWA 86026	Fixture, Handling (Optional To PWA 85332)
PWA 86206	Adapter, Lift And Trunnion (2 Necessary)

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

C. Procedure

Subtask 72-53-00-430-062:

(1) Remove PWA 85766Rear Balance Fixture.

(a) Using hoist, attach PWA 28657 Sling to trunnion spools on fixture with two PWA 76154 Adapters.

(b) Remove screws securing fixture to rear turbine case flange.

(c) Using hoist, remove fixture from case.

(2) Remove PWA 85211 Counterweights and install engine counterweights. See Figure 1001.

(a) Remove temporary counterweights from tierods. Remove tierod nut and spacer from temporary counterweight locations.

(b) Assemble same class engine counterweight to tierod at temporary counterweight locations.

(c) Treat threads of tierod and washer face of nut with, Engine Oil P03−001. Omit lubrication of disk. Install counterweights and nuts to secure counterweights.

(d) Install PWA 85232 Angle Of Turn Fixture onto 6th stage disk. Align bushings (1001/6) with tierod nuts (1001/11) and position plate (1001/4), stamped markings up, over disk.

(e) (Reference 1251, 1252, or 1253) Torque nuts at the counterweight locations with the use of a 0.500 inch square drive torque wrench installed in the socket over the dial indicator.

1 Apply initial torque of 140 − 160 lb−in. (15.818 − 18.078 N.m) to each nut.

CAUTION: THE FOLLOWING TORQUING PROCEDURE MUST BE ACCOMPLISHED WITH MAXIMUM TEMPERATURE DIFFERENTIAL OF 40°F (22.2°C) BETWEEN MATING PARTS.

2 Loosen the nuts at the counterweight location.

3 Measure the torque necessary to turn the nut. If the measured torque is less than 50 lb−in. (5.469 N.m), then tighten to a torque of 45 lb−in. (5.084 N.m) plus or minus 5 lb−in. (0.565 N.m) and continue with the angle of turn.

4 If the measured torque is more than 50 lb−in. (5.649 N.m), find the torque necessary to turn the nut, add 15 lb−in. (1.695 N.m) plus or minus 5 lb−in. (0.565 N.m) to this torque. The total torque cannot be more than 100 lb−in. (11.298 N.m).

LOW PRESSURE TURBINE (LPT) − ASSEMBLY−04

5 Apply the final angle of turn:

a (Reference 1251) (Pre SB PW4ENG 72−256) For engines with the 5th stage turbine hub PN 50N405, set the indicator dial (1019/9) to zero with the index mark (1019/7) on the fixture plate. Tighten the thumbscrew (1019/5) to set the indicator dial. Apply a 62 − 66 degree angle of turn.

b (Reference 1252) (Post SB PW4ENG 72−256) For engines with 5th stage turbine hub PN 50N505, set the indicator dial (1019/9) to zero, with with the index mark (1019/7) on the fixture plate. Tighten the thumbscrew (1019/5) to set the indicator dial. Apply a 64 − 68 degree angle of turn.

c (Reference 1253) For engines with 5th stage turbine hub PN 51N305 and subsequent, set the indicator dial (1019/9) to zero, with the index mark (1019/7) on the fixture plate. Tighten the thumbscrew (1019/5) to set the indicator dial. Apply a 52 − 56 degree angle of turn.

NOTE: Use Reference 1253 for Phase−3 engines as built by P&W that have 5th stage turbine hub PN 51N305 and subsequent.

6 Do this torque procedure, steps 1 through 5, again as applicable on all tierod nuts. Use the torque sequence numbers stamped on the fixture.

(f) Remove the angle of turn fixture.

(3) Remove the bolts and washers securing turbine hub to arbor. Return these details to arbor after its removal.

(4) Install PWA 85640 Adapter to rear face of arbor with four detail bolts.

(5) Install handling fixture.

(a) Install PWA 85332 Handling Fixture (Optional to PWA 86026).

1 Position handling fixture using suitable lifting tool, while locator is installed in one tierod hole to align module with fixture.

2 Slide lockring rearward using two Handle T rods, to expand clamps. Secure lockring with four screws, so that clamps interface with turbine rear hub bore.

(b) Install PWA 86026 Handling Fixture (Optional to PWA 85332).

1 Install locator (detail−8) onto tierod where tierod nut has been removed.

2 Measure 5th stage hub flange with template (detail−18). If flange thickness is approximately 0.680 inch (17.272 mm), then install spacer (detail−17). If flange thickness is approximately 0.813 inch (20.650 mm), then spacer is not used.

3 Position handling fixture using PWA 85635 Lift Adapter, while locator is installed on one tierod. Locator aligns LPT with fixture.

4 Tighten four hex head bolts to engage supports and arms into 5th stage hub.

(6) Install PWA 85331 Rear Retainer.

(a) Lift retainer, using eyebolts installed in two 0.500−13 lift holes marked FOR LIFTING TOOL VERTICALLY ONLY.

(b) Position retainer over previously installed handling fixture and secure to case with 48 screws and washers.

(c) Lock axial position of LPT rotor by tightening eight hand knobs against handling fixture.

(7) Using hoist, attach PWA 28657 Sling and two PWA 86206 Lift And Trunnion Adapters to rear retainer at spools labeled LPT WITHOUT SHAFT. See Figure 1002.

(8) Remove twenty−six bolts securing front balance fixture to case.

(9) Install PWA 85333 Pusher/Puller.

- (a) Attach PWA 29390 Hydraulic Pump.
- (b) Actuate (to extend) cylinder and thread into PWA 85640 Adapter.
- (c) Secure Pusher/Puller to rear face of handling fixture with eight detail bolts.

(10) Actuate hydraulic pump to press LPT free of arbor, while maintaining tension on sling with hoist.

(11) Lift assembly from stand and trunnion to vertical, rear end down position. Remove hoist and lifting tools.

(12) Remove balance arbor from front balance fixture.

- (a) Attach detail lift eye.
- (b) Disengage six bearing clamps.
- (c) Using hoist return arbor to detail storage box.

(13) Remove front balance fixture from stand.

- (a) Using hoist, attach Sling (PWA 28657) to trunnion spools on fixture with two Adapters (PWA 76154).
- (b) Remove fixture.

(14) Return assembly to stand.

(15) Install classified pins (1003/5) into 3rd stage LPT sealing ring (1003/2) and 3rd stage sealing ring damper (1003/3). See Figure 1003.

- (a) Position damper onto sealing ring with three equally spaced (smaller) holes in each part aligned.
- (b) Determine hole size at each of three hole locations.
- (c) (Reference 1181) Select classified pin for each hole location to obtain fit of 0.000 inch (0.000 mm) loose to 0.002 inch (0.051 mm) tight.

(d) Install classified pins into sealing ring and damper.

(16) Install the sealing ring (1003/2), the damper (1003/3), and the classified pins (1003/5) (as an assembly) into the 3rd stage LPT duct (1003/4), by engaging three pinheads into three equally spaced (larger) holes in the duct. Secure with 39 bolts (1003/1), lubricated with Engine Oil P03−001.

NOTE: If workbolts are used, remove workbolts from duct assembly.

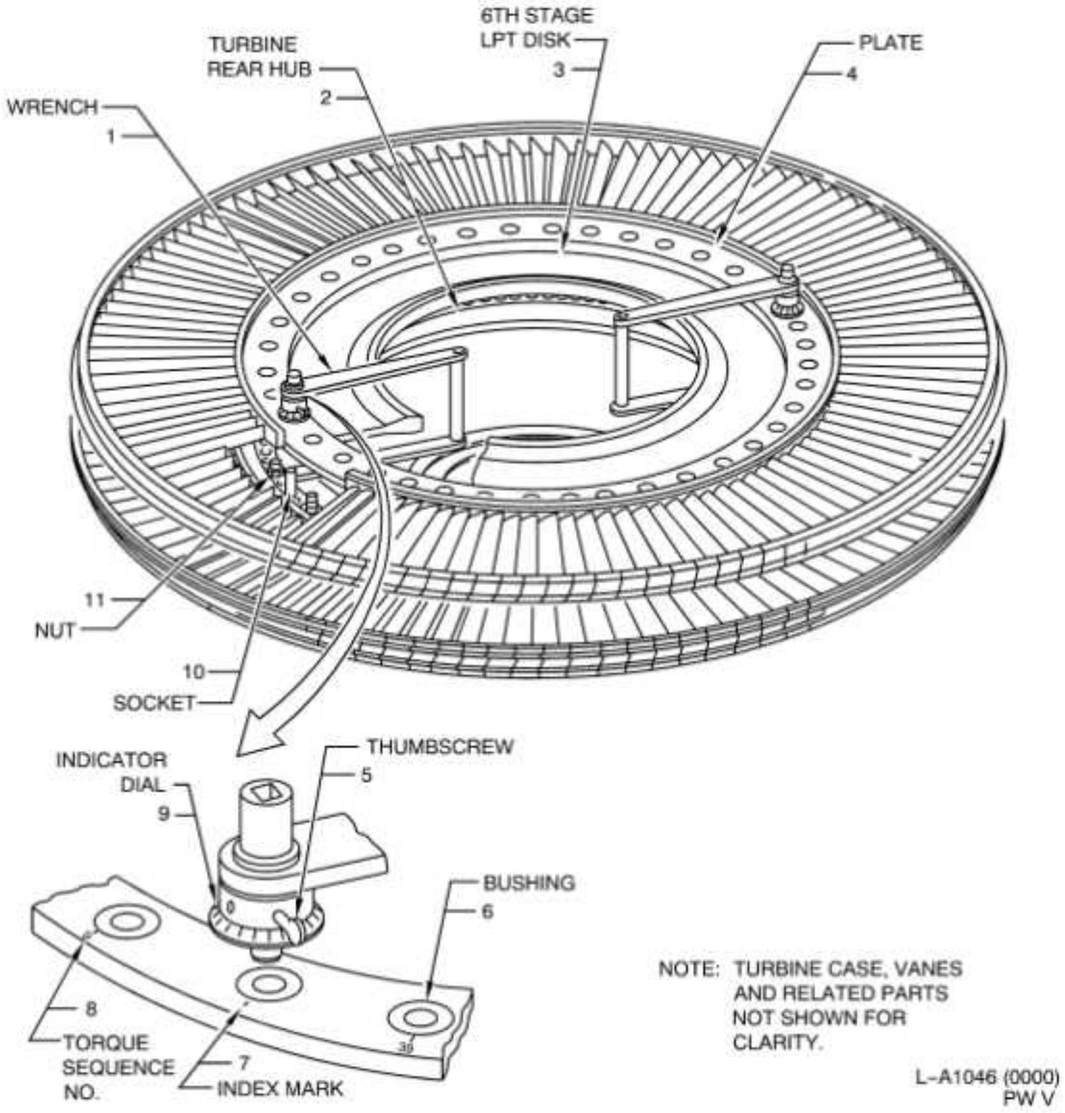
NOTE: If a 3rd stage LPT airseal (50N007) with four knife−edge seals is used then the longer 3rd stage LPT sealing ring (50N266) is necessary.

(17) Torque bolts (1003/1) to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(18) Lift assembly from stand and trunnion to vertical, front end down position.

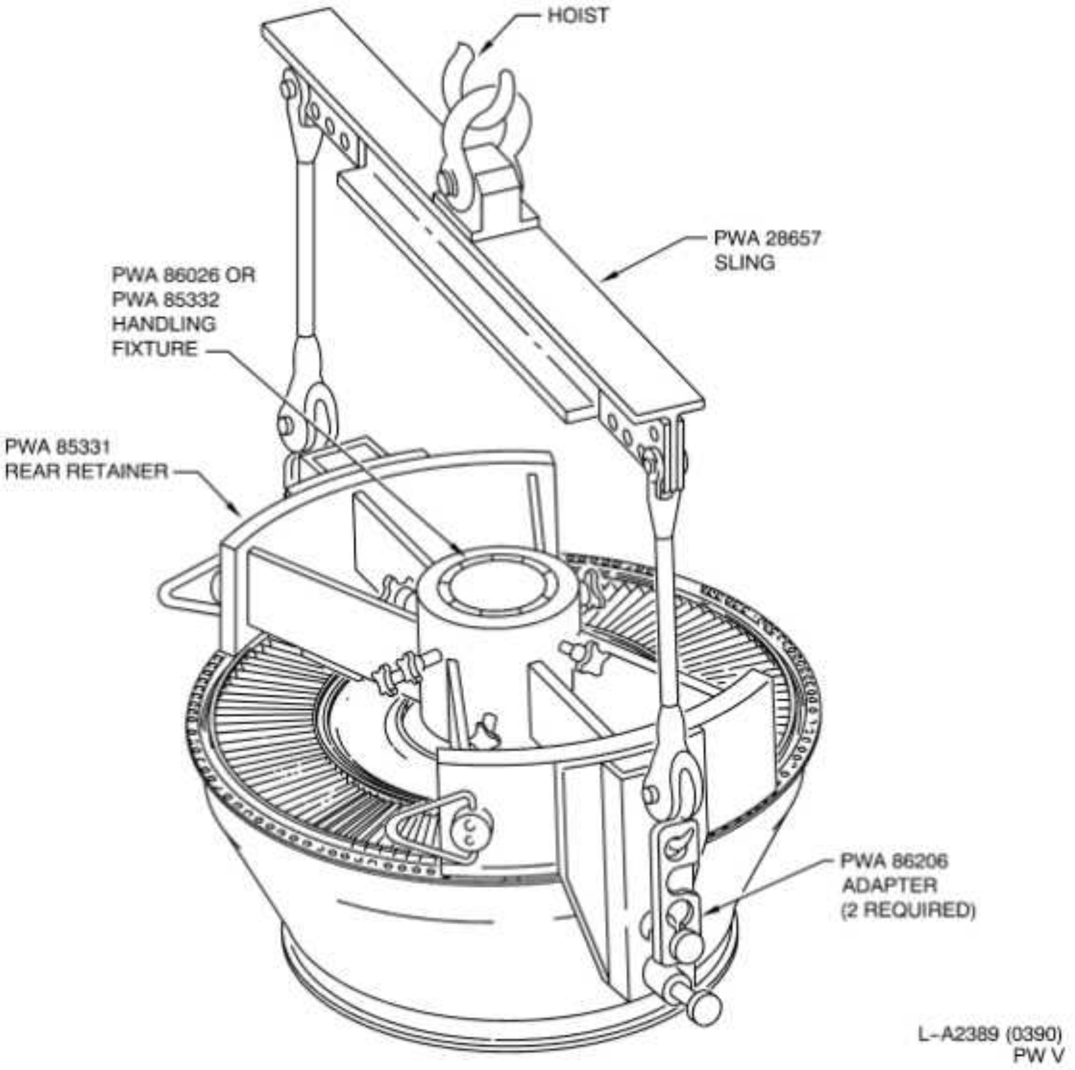
(19) Return assembly to Stand (PWA 29918) or PWA 85576 Storage Stand .

(20) Position identification plate (1004/2) onto bracket on front (lower) flange of turbine rear case. Secure plate with two bolts (1004/1), with threads lubricated with Engine Oil P03−001, and nuts (1004/3). Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 1004.


6TH STAGE LPT DISK
3
TURBINE REAR HUB
2
PLATE
4
WRENCH
1
11
NUT
10
SOCKET
INDICATOR DIAL
9
THUMBSCREW
5
BUSHING
6
8
TORQUE SEQUENCE NO.
7
INDEX MARK
39
L-A1046 (0000)
PW V

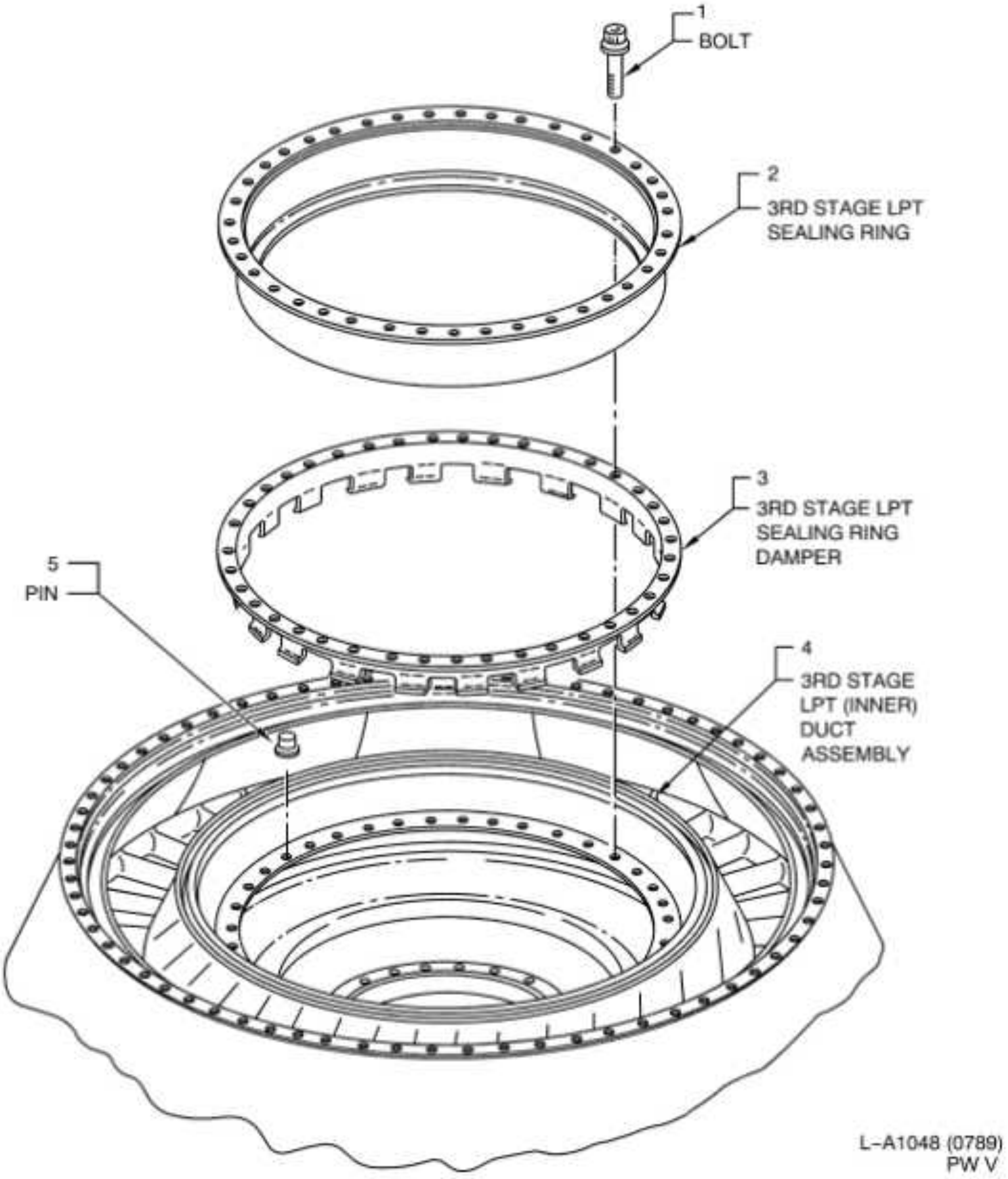
NOTE: TURBINE CASE, VANES AND RELATED PARTS NOT SHOWN FOR CLARITY.

PWA 85232 Angle Of Turn Fixture Installation
Figure 1001
(Task 72−53−00−400−004)

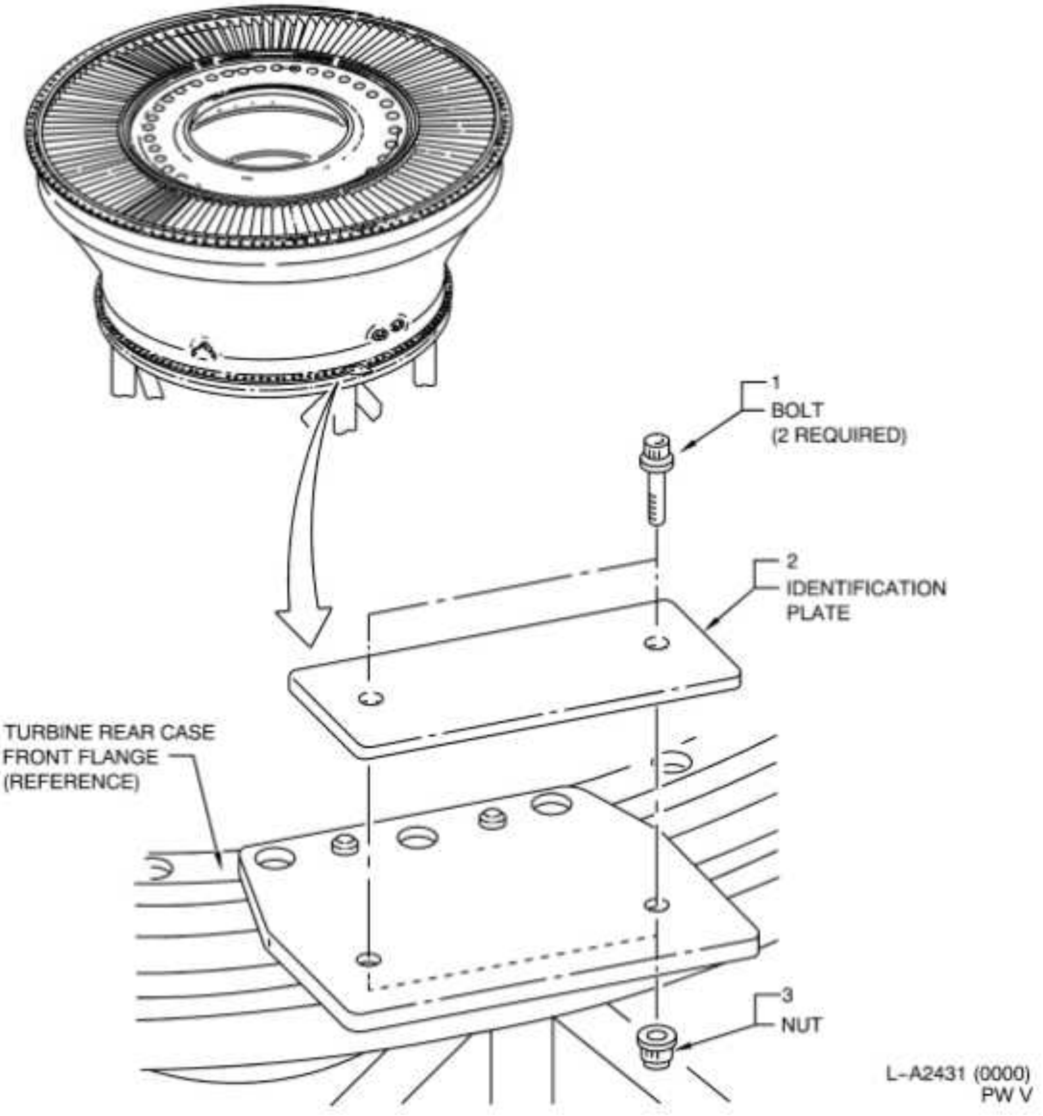

HOIST
PWA 28657 SLING
PWA 86026 OR PWA 85332 HANDLING FIXTURE
PWA 85331 REAR RETAINER
PWA 86206 ADAPTER (2 REQUIRED)
L-A2389 (0390)
PW V

Handling Tools
Figure 1002
(Task 72-53-00-400-004)

LOW PRESSURE TURBINE (LPT) − ASSEMBLY−04


1
BOLT
2
3RD STAGE LPT
SEALING RING
3
3RD STAGE LPT
SEALING RING
DAMPER
5
PIN
4
3RD STAGE
LPT (INNER)
DUCT
ASSEMBLY
L−A1048 (0789)
PW V

Third Stage LPT Sealing Ring And Damper Installation
Figure 1003
(Task 72−53−00−400−004)


1
BOLT
(2 REQUIRED)
2
IDENTIFICATION
PLATE
TURBINE REAR CASE
FRONT FLANGE
(REFERENCE)
3
NUT
L-A2431 (0000)
PW V

Identification Plate Installation
Figure 1004
(Task 72−53−00−400−004)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-53-00-400-005:

1. Install Low Pressure Turbine External Parts

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Lockwire, AS3214-02				

B. Procedure
See Figure 1001.

NOTE: All brackets to be installed are located on low pressure turbine case (1001/1) at approximately 3.4 inches (86.360 mm) from front flange of low turbine case.

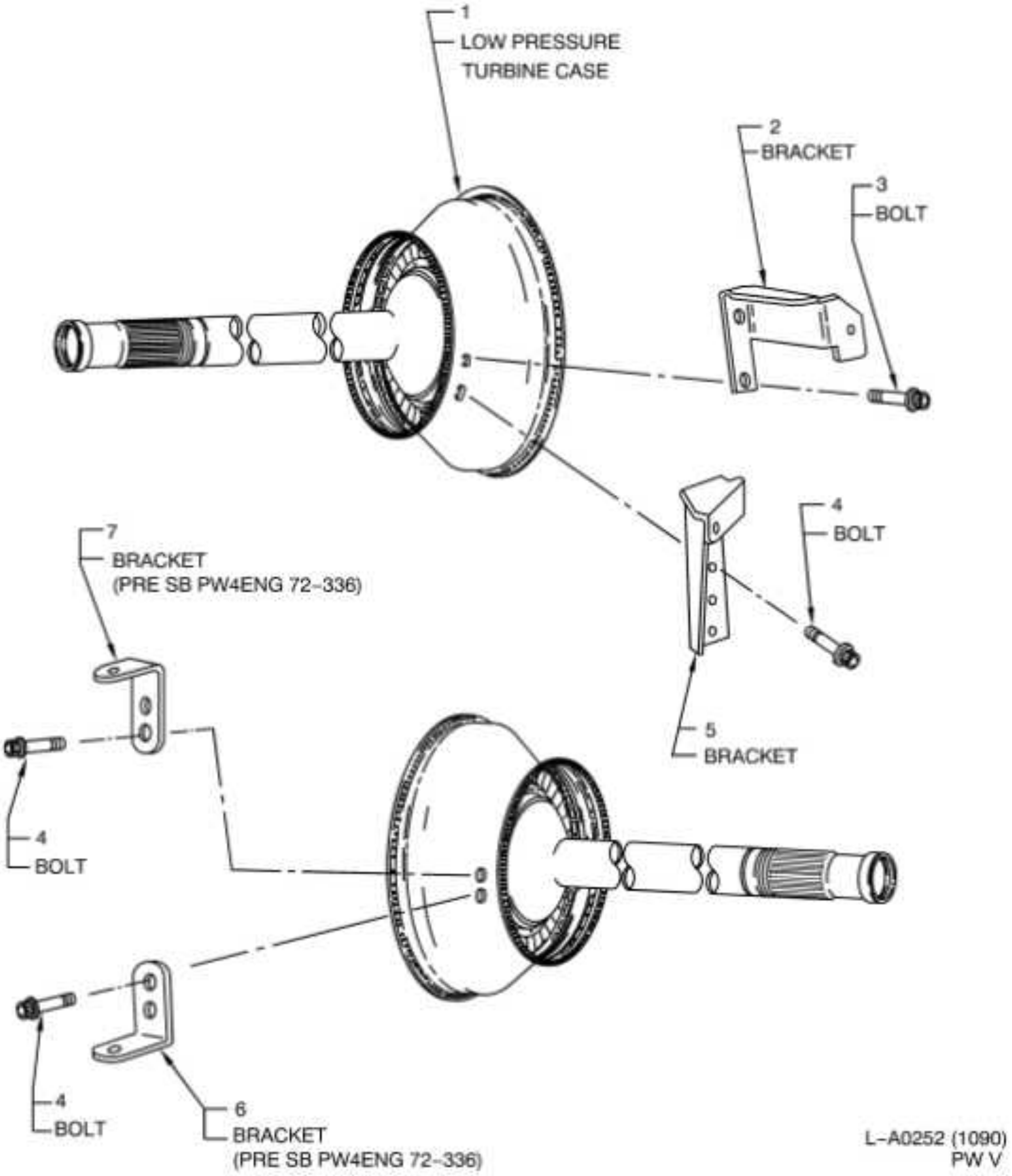
(1) For cases with welded on bracket bosses (Pre SB PW4ENG 72-336), position bracket (1001/2) on boss on case at approximately 2:30 o'clock position (as viewed from front). Secure bracket using bolts (1001/3), lubricated with Engine Oil (P03-001). Torque bolts to 75 - 85 lb-in. (8.474 - 9.604 N.m). Lockwire bolts.

NOTE: Cases that are (Post SB PW4ENG 72-336) incorporate brackets that are riveted to the case.

(2) Position bracket (1001/5) on boss on case at approximately 3:30 o'clock position (as viewed from front). Secure bracket using bolts (1001/4), lubricated with Engine Oil (P03-001). Torque bolts to 75 - 85 lb-in. (8.474 - 9.604 N.m). Lockwire bolts.

(3) Position brackets (1001/6) and (1001/7), and locate as shown on boss on case at approximately 9:30 o'clock position (as viewed from front). Secure bracket using bolts (1001/4) lubricated with Engine Oil (P03-001). Torque bolts to 75 - 85 lb-in. (8.474 - 9.604 N.m). Lockwire bolts.

LOW PRESSURE TURBINE (LPT) − ASSEMBLY−05


1
LOW PRESSURE TURBINE CASE
2
BRACKET
3
BOLT
4
BOLT
5
BRACKET
7
BRACKET (PRE SB PW4ENG 72-336)
4
BOLT
4
BOLT
6
BRACKET (PRE SB PW4ENG 72-336)
L-A0252 (1090)
PW V

External Parts Installation
Figure 1001
(Task 72−53−00−400−005)

Previous Pageblock Return to Previous Menu Next Pageblock

LOW PRESSURE TURBINE (LPT) - ASSEMBLY-06

Task 72-53-00-400-006:

1. Install Front Compressor Drive Turbine Shaft

NOTE: This procedure is not applicable if you balance the low pressure turbine module with the turbine shaft installed. See Assembly-07 Task 72-53-00-400-007 to install the turbine shaft prior to balancing the turbine module and shaft assembly.

A. Prerequisites

(1) See Inspection/Check-04 Task 72-53-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

(2) Balance low pressure turbine per Assembly-03 Task 72-53-00-400-003.

B. Equipment And Materials Necessary

Standard Tools:

Name	Manufacturer
Clements Cadillac Electric Flameless Heat Gun Model FT 1000	Clements Manufacturing Co. 6650 S. Narragansett Avenue Chicago, IL 60638

NOTE: The flameless heat gun specified above is optional to the heaters specified in the special tools list, and the optional flame torch.

Special Tools:

PWA 25096	Stand, LPT Transportation And Storage (Optional To PWA 87330)
PWA 28657	Sling, Strongback
PWA 29390	Pump, Hydraulic
PWA 29754	Control, Heater
PWA 29956	Eye, Handling
PWA 76270	Stand (Optional To PWA 87330)
PWA 85221	Adapter, Lift And Trunnion
PWA 85233	Fixture, Angle-Of-Turn (Optional To PWA 88114)
PWA 85240	Bender, Manual
PWA 85319	Heater, Electrical
PWA 85333	Pusher/Puller, Hydraulic

Special Tools:

(CONTINUED)

PWA 85456	Retainer, Front (Optional To PWA 85996)
PWA 85558	Adapter, Hydraulic Cylinder
PWA 85562	Sleeve, Support (Used With PWA 25096 Or PWA 76270 Stand)
PWA 85996	Retainer, Front (Optional To PWA 85456)
PWA 86206	Adapter, Lift And Trunnion (2 Necessary)
PWA 88114	Fixture, Angle Of Turn
PWA 87330	Stand, Storage
PWA 87347	Sleeve, Support (Used With PWA 87330 Stand)

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Lock, Turbine	24	72−53−00/1/50

C. General Assembly Requirements

(1) Where heating is required for assembly, use minimum temperature differential of 125°F (52°C) between parts being assembled. Do not exceed 300°F (149°C) on any part.

(2) Where heating is required for assembly, special heaters are specified in the following procedure. However, you can use an optional flameless heat gun or flame torch as specified in the following steps.

(3) In locations where heating of a component in an oven is not practical or only a flange of the component requires heating, the use of Clements Cadillac Quic Heat flameless heat gun, Model FT 1000 is recommended.

(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

LOW PRESSURE TURBINE (LPT) − ASSEMBLY−06

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE FLAME WILL DAMAGE OR BURN NON−METAL PARTS.

CAUTION: DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

LOW PRESSURE TURBINE (LPT) − ASSEMBLY−06

D. Procedure

CAUTION: IF A 3RD STAGE LPT AIRSEAL (50N007) WITH FOUR KNIFE−EDGE SEALS IS USED THEN THE LONGER 3RD STAGE LPT SEALING RING (50N266) IS NECESSARY.

(1) Install 3rd stage LPT airseal (1001/1) to turbine rear hub (1001/2). See Figure 1001.

CAUTION: TEMPERATURE OF AIRSEAL MUST NOT EXCEED 400°F (204.4°C) OR DAMAGE TO PART MAY OCCUR.

(a) Heat airseal to obtain minimum temperature differance of 250°F (139°C) between mating parts.

(b) If required, install LPT shaft on PWA 25096 Stand, PWA 76270 Stand or PWA 87330 Stand. Install PWA 85562 Support Sleeve into the shaft support cradles of PWA 25096 Stand, PWA 76270 Stand or PWA 87347 Support Sleeve into the shaft support cradles of PWA 87330 Stand. Position details−1 and −2 forward and details−3 and −5 rearward with details−2 and −3 down. Tighten the set screws to attach the sleeve to the stand. Use PWA 29956 Handling Eye and PWA 85221 Adapter, to put the shaft in the stand. Secure shaft to stand.

(c) Find the position of the axial high point symbols (Letter H within circle), on front compressor drive turbine rear hub (1001/2) and the airseal (1001/1).

(d) If necessary, mark the residual (or high point symbol) unbalance on the turbine rear hub and the airseal as follows:

1 Use a shallow electrolytic etch mark. See 70−11 and SPOP 401 Task 70−11−00−280−006 Standard Practices Manual, PN 585005.

(e) Install the airseal to the turbine rear hub with the axial high point symbols (Letter H in a circle) 180 degrees apart. Align the bolt holes in the air seal with the bolt holes in the turbine rear hub and seat the airseal to the hub.

(2) Install turbine tierods (1002/2) onto front compressor drive turbine shaft.

(a) Install 24 tierods (1002/2) into shaft flange. Position tierod head so that lock slot faces inward.

(b) Install 24 tierod locks (1002/1), engaging slot in tierod and undercut on shaft OD, with prebent angle as shown in Figure 1002.

(c) Bend tierod locks to requirements of Figure 1002 using PWA 85240 Bender.

(3) Optional, install PWA 85319 Heater. See Figure 1003.

NOTE: You can use the optional flameless heat gun or flame torch as previously specified to heat the shaft flange.

(a) Position heater over LPT shaft against rear conical surfaces of shaft.

(b) Secure heater to shaft with three swivel head screw details of heater.

(4) Install low pressure turbine to turbine shaft. See Figure 1004.

(a) Using hoist install PWA 28657 Sling and two PWA 86206 Lift And Trunnion Adapters to rear retainer at spools labeled "LPT WITHOUT SHAFT".

(b) Lift assembly from stand, and trunnion to horizontal position.

(c) Position assembly to rear of shaft. Loosen clamps of stand and rotate shaft as required to put the axial high point symbol on the shaft 180 degrees from the axial high point symbol of the 3rd stage LPT air seal.

(d) Position PWA 85558 Adapter to rear face of shaft, and attach with eight screws.

(e) Install PWA 85333 Hydraulic Puller to PWA 85026 Handing Fixture or PWA 85332 Handing Fixture and PWA 85558 Adapter. Attach PWA 29390 Hydraulic Pump.

NOTE: If applicable, route heater cord through slot in pusher/puller plate.

(f) For heating the shaft with PWA 85319 Heater procede as follows:

  1 Connect PWA 29754 Heater Control to junction box of heater.

  2 Attach thermocouple connector to heater control.

  CAUTION: TEMPERATURE OF TURBINE SHAFT MUST NOT EXCEED 400°F (204.4°C) OR DAMAGE TO PART MAY OCCUR.

(g) Use the PWA 85319 Heater, or the optional flameless heat gun or flame torch, to heat the shaft flange. Heat the flange to obtain a minimum temperature difference of 250° (138.8°) between mating parts.

(h) Actuate hydraulic pump to seat shaft.

(i) Disconnect heater, if applicable, and allow parts to return to room temperature.

(j) Align the center hole in PWA 85456 Front Retainer or PWA 85996 Front Retainer (1005/3) with the dowel pin hole in the turbine case. Attach the retainer to the front flange of the case at 6 and 12 o'clock locations with four bolts (1005/2) and nuts (1005/1). Attach the clamps of the retainer to the front compressor drive turbine shaft with two bolts (1005/4). See Figure 1005.

(k) Relieve hydraulic pressure, and remove puller from handling fixture.

(l) Remove PWA 85558 Adapter from rear face of turbine shaft.

(m) Lubricate the threads of six turbine shaft tierods with Engine Oil P03−001, equally spaced (60 degrees apart) to make three opposite pairs.

  CAUTION: OPTIONAL NUT PART NUMBERS ARE OF DIFFERENT WEIGHT GROUPS. USE 24 NUTS OF THE SAME PART NUMBER IF POSSIBLE. IF THIS IS NOT POSSIBLE, INSTALL NUTS OF

THE SAME PART NUMBER EQUALLY SPACED FROM EACH OTHER.

(n) Lubricate the washer face of six turbine tierod nuts with Engine Oil P03−001 and based upon the engine model and the applicable service bulletins, determine if washers are necessary for assembly under the tierod nuts. See Figure 1006. Lubricate all necessary washers with Engine Oil P03−001.

(o) Install six tierod nuts and washers, if necessary for the engine configuration as determined from Figure 1006, onto the equally spaced tierods. Use an opposite pattern sequence to torque the six tierod nuts to 1,000 lb−in. (112.985 N.m).

(p) Treat the threads of the remaining 18 turbine shaft tierods and the washer face of the tierod nuts with Engine Oil P03−001. Lubricate 18 turbine tierod washers, if necessary for the engine assembly configuration as determined from Figure 1006, with Engine Oil P03−001.

(q) Install the remaining 18 tierod washers, if necessary as determined from Figure 1006, and the tierod nuts onto the LPT shaft tierods. Apply an initial seating torque of 550 − 650 lb−in. (62.142 − 73.440 N.m). Use an opposite pattern sequence to complete the initial torque on all the tierods.

(r) Slide chocks at rear of PWA 25096 Stand inward to contact case OD. Adjust shaft position, as necessary, so that front face of Flange P rests against rear face of chock. Secure shaft with two detail clamps.

NOTE: Chocks are used as a safety device and do not support any part of the assembly.

(s) Loosen eight hand knobs of PWA 85331 Rear Retainer. Remove 48 screws securing retainer to rear flange of turbine case. Remove fixture, hoist and sling.

(t) Remove PWA 86026 Handling Fixture or PWA 85332 Handling Fixture.

(u) Remove heater which is clamped to turbine shaft.

(v) Position the PWA 85233 Angle−Of−Turn Fixture or PWA 88114 Angle−Of−Turn Fixture, to the rear face of the turbine shaft. Secure the fixture with four detail screws for PWA 85233 Fixture, or eight detail screws for PWA 88114 Fixture.

CAUTION: FOR THESE MODELS: 4152, 4156A, 4158 THE FOLLOWING TORQUEING PROCEDURE MUST BE ACCOMPLISHED WITH MAXIMUM TEMPERATURE DIFFERENTIAL OF 40°F (22.2°C) BETWEEN THE NUTS AND THE TIERODS.

(w) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 72−256 and with 5th stage hub PN 50N405 prior to letter change "N") (Reference 977) For engines without the revised LPT airfoils, the new 5th stage turbine hub, and the new 5th stage airseal). Apply final torque to 24 turbine shaft tierod nuts.

1 FOR THESE MODELS: 4152, 4156A, 4158
Loosen one pair of nuts (180 degrees apart), then retighten to seating torque of 80 − 90 lb−in. (9.039 − 10.169 N.m).

2 FOR THESE MODELS: 4152, 4156A, 4158
Set the indicator dial, on the fixture, to zero with the index mark on the fixture plate. Tighten the thumbscrew to set the indicator dial. Apply 60 − 64 degree angle of turn.

3 FOR THESE MODELS: 4152, 4156A, 4158
Apply steps 1 and 2 to all remaining pairs of nuts in the torque sequence indicated on the fixture.

4 FOR THESE MODELS: 4152, 4156A, 4158
As an option to improve LPT module and shaft balance characteristics, you can do the following: Loosen and reseat one pair of tierod nuts as indicated in step 1 above, then do steps 2 and 3 again to apply the final torque to all of the tierod nuts.

CAUTION: FOR THESE MODELS: 4152, 4156A, 4158 THE FOLLOWING TORQUEING PROCEDURE MUST BE ACCOMPLISHED WITH MAXIMUM TEMPERATURE DIFFERENTIAL OF 40°F (22.2°C) BETWEEN THE NUTS AND THE TIERODS.

(x) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 72−256 and Pre SB PW4ENG 72−256 with 5th stage hub PN 50N405 change Letter N or subsequent) (Reference 982) For engines with the revised LPT airfoils, the new 5th stage turbine hub, and the new 5th stage airseal. Apply final torque to 24 turbine shaft tierod nuts.

1 FOR THESE MODELS: 4152, 4156A, 4158
Loosen one pair of nuts (180 degrees apart).

2 FOR THESE MODELS: 4152, 4156A, 4158
Measure the torque necessary to turn the nut through the locking feature of the nut. Make sure the nut is not in contact with the disk face.

3 FOR THESE MODELS: 4152, 4156A, 4158
If the measured torque is less than 50 lb−in. (5.649 N.m), then tighten to a seating torque of 40 − 50 lb−in. (4.519 − 5.649 N.m) and continue with step 5.

4 FOR THESE MODELS: 4152, 4156A, 4158
If the measured torque is more than 50 lb−in. (5.649 N.m), find the torque necessary to turn the nut. Add 10 − 20 lb−in. (1.130 − 2.260 N.m) to this torque and tighten the nut using the total torque. The total torque must not be more than 200 lb−in. (22.597 N.m).

5 FOR THESE MODELS: 4152, 4156A, 4158
Set the indicator dial, on the fixture, to zero with the index mark on the fixture plate. Tighten the thumbscrew to set the indicator dial. Apply 59 − 63 degree angle of turn.

6 FOR THESE MODELS: 4152, 4156A, 4158
Do the torque procedure steps 1 through 5 again on all remaining pairs of nuts. Use the torque sequence numbers stamped on the fixture.

7 FOR THESE MODELS: 4152, 4156A, 4158
As an option to improve LPT module and shaft balance characteristics, you can do the following: Loosen one pair of tierod nuts as indicated in step 1 above, then do steps 2 through 6 to complete the seating and reapplication of the final torque on all of the tierod nuts.

CAUTION: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3 THE FOLLOWING TORQUEING PROCEDURE MUST BE ACCOMPLISHED WITH MAXIMUM TEMPERATURE DIFFERENTIAL OF 40°F (22.2°C) BETWEEN THE NUTS AND THE TIERODS.

(y) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3 (Post SB PW4ENG 72−505) (Reference 983) Apply the final torque to the 24 turbine shaft tierod nuts.

1 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Loosen one pair of nuts (180 degrees apart).

2 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Measure the torque necessary to turn the nut through the locking feature of the nut. Make sure the nut is not in contact with the disk face. Add 10 − 20 lb−in. (1.130 − 2.260 N.m) to this torque and use the total torque to seat the nut. The total torque must not be more than 200 lb−in. (22.597 N.m).

3 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Set the indicator dial, on the fixture, to zero with the index mark on the fixture plate. Tighten the thumbscrew to set the indicator dial. Apply 58 − 62 degree angle of turn.

4 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Do torque procedure steps 1 through 3 again on all remaining pairs of nuts. Use the torque sequence numbers stamped on the fixture.

5 FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
As an option to improve LPT module and shaft balance characteristics, you can do the following: Loosen one pair of tierod nuts as indicated in step 1 above, then do steps 2, 3 and 4 to complete the seating and reapplication of the final torque on all of the tierod nuts.

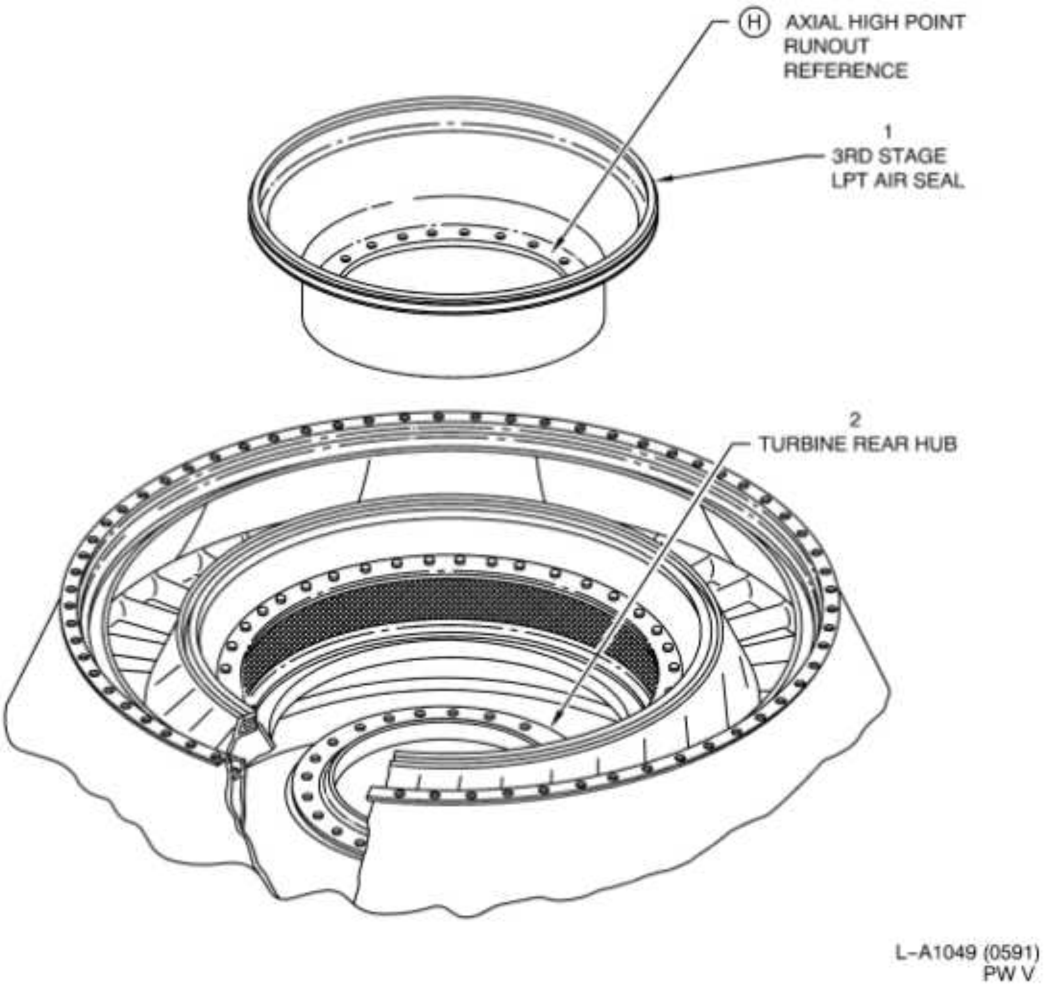
(z) Remove the angle of turn fixture and anti−torque adapter, if applicable.

E. Postrequisites

(1) Optional, dynamic balance the low pressure turbine with shaft assembly by Assemlby−07 Task 72−53−00−400−007, or semi−dynamically balance the low pressure turbine with shaft assembly to Assembly−11 Task 72−53−00−400−011.

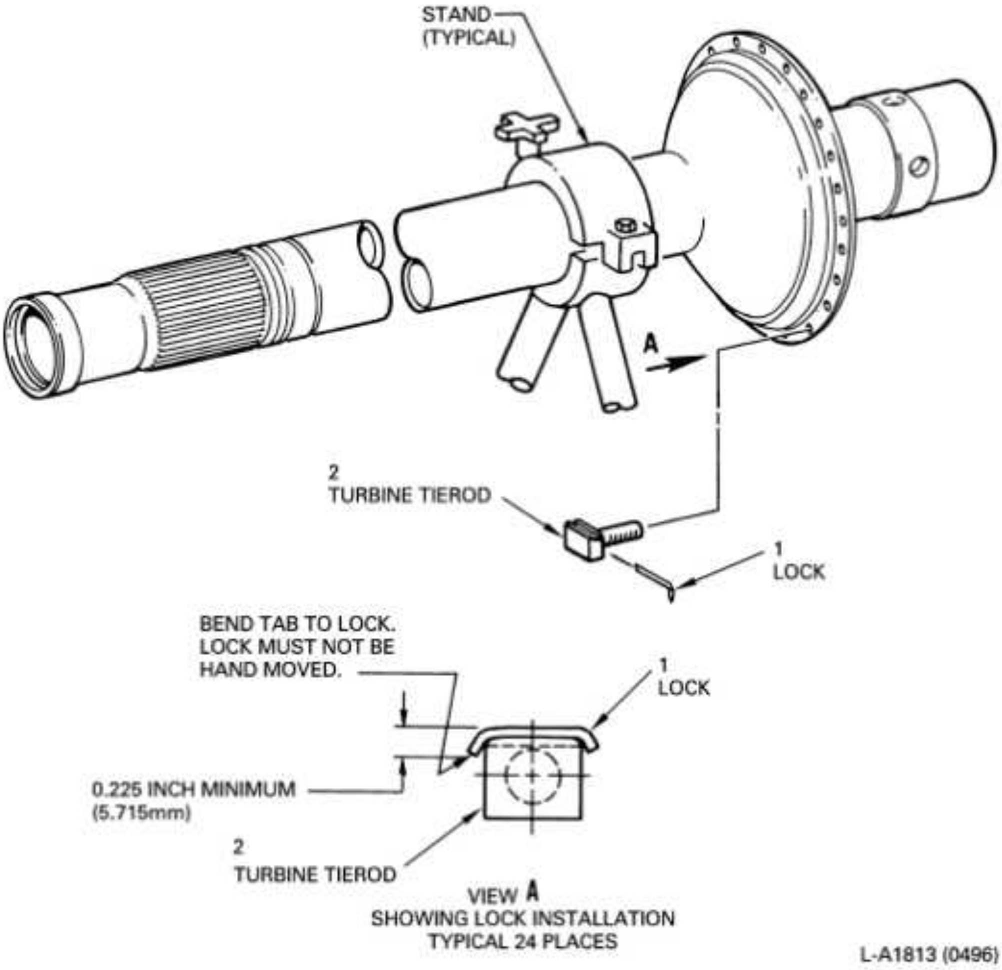
NOTE: Dynamic and semi−dynamic balance procedures are optional balance procedures that are provided for use based on the operators experience to obtain an optimized low pressure turbine balance.

LOW PRESSURE TURBINE (LPT) - ASSEMBLY-06

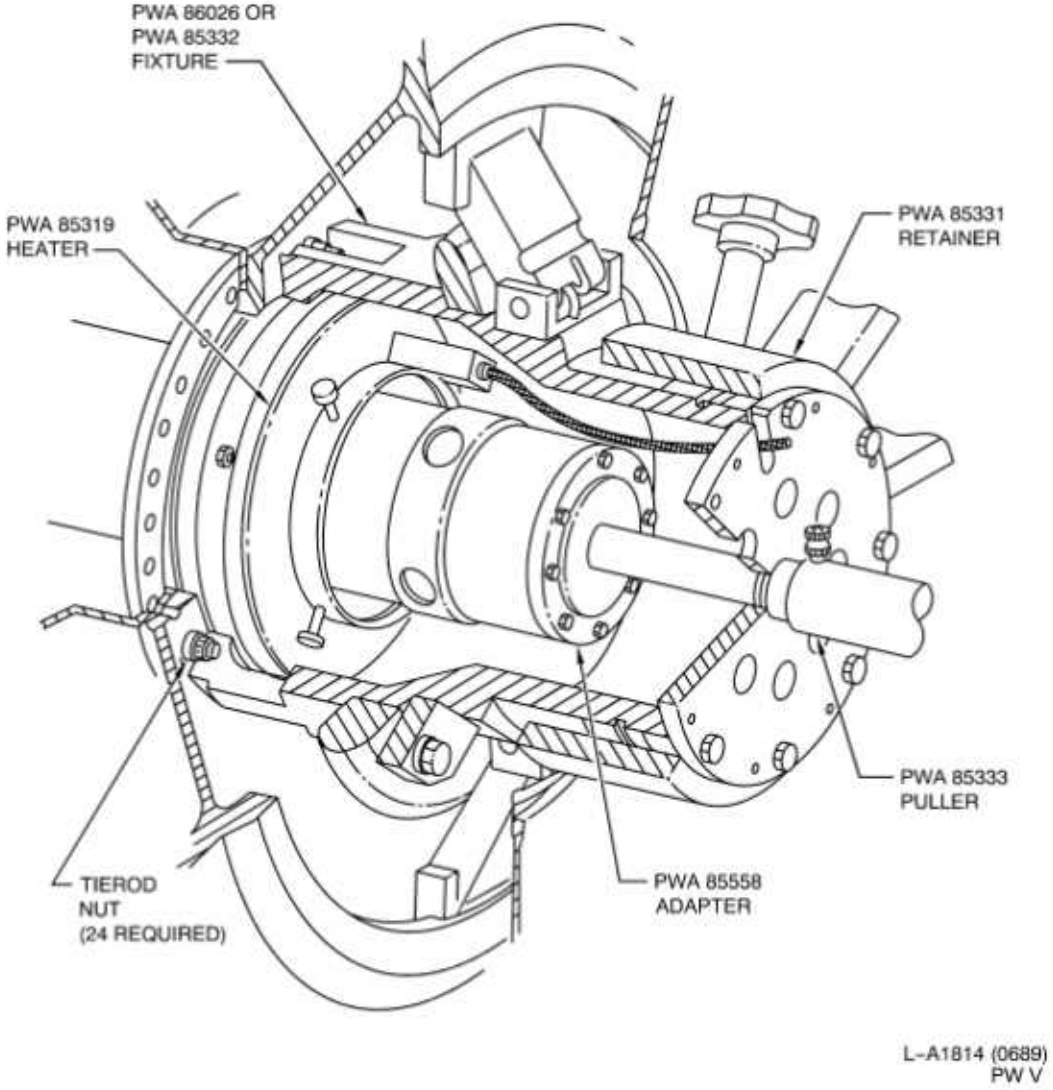

(H) AXIAL HIGH POINT RUNOUT REFERENCE
1
3RD STAGE LPT AIR SEAL
2
TURBINE REAR HUB
L-A1049 (0591)
PW V

Third Stage LPT Airseal Installation
Figure 1001
(Task 72-53-00-400-006)

LOW PRESSURE TURBINE (LPT) − ASSEMBLY−06

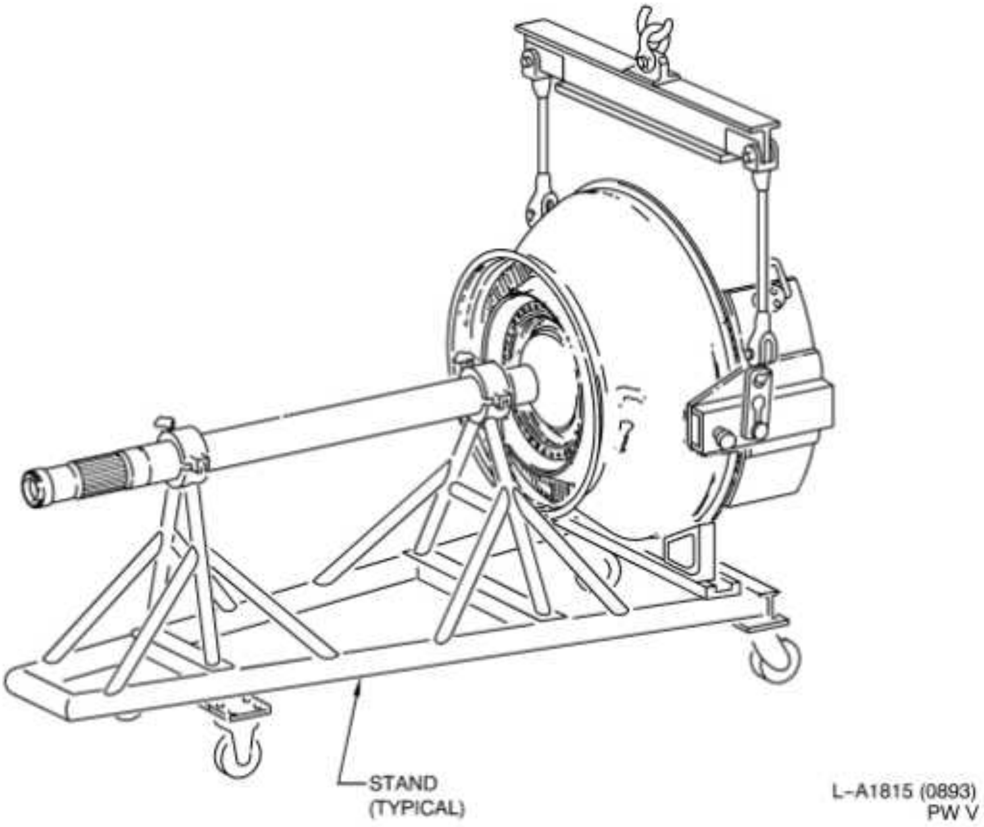

STAND (TYPICAL)
A
2 TURBINE TIEROD
1 LOCK
BEND TAB TO LOCK. LOCK MUST NOT BE HAND MOVED.
1 LOCK
0.225 INCH MINIMUM (5.715mm)
2 TURBINE TIEROD
VIEW A
SHOWING LOCK INSTALLATION
TYPICAL 24 PLACES
L-A1813 (0496)

Turbine Tierod Installation
Figure 1002
(Task 72−53−00−400−006)

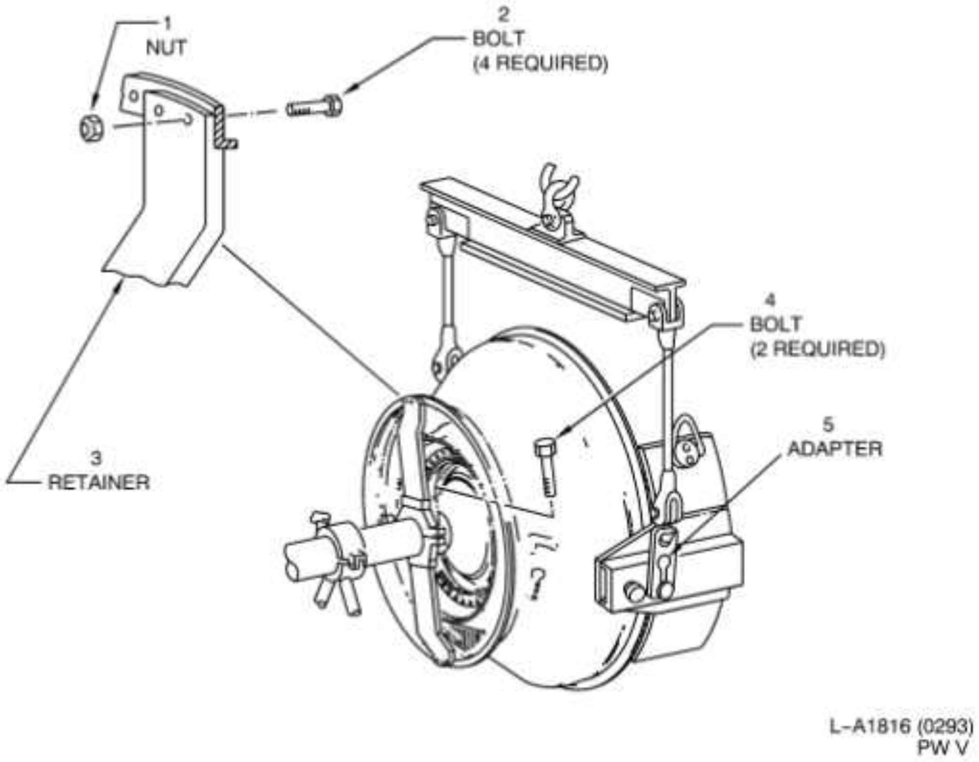

PWA 86026 OR
PWA 85332
FIXTURE
PWA 85319
HEATER
PWA 85331
RETAINER
PWA 85333
PULLER
PWA 85558
ADAPTER
TIEROD
NUT
(24 REQUIRED)
L-A1814 (0689)
PW V

Front Compressor Drive Turbine Shaft Installation
Figure 1003
(Task 72−53−00−400−006)

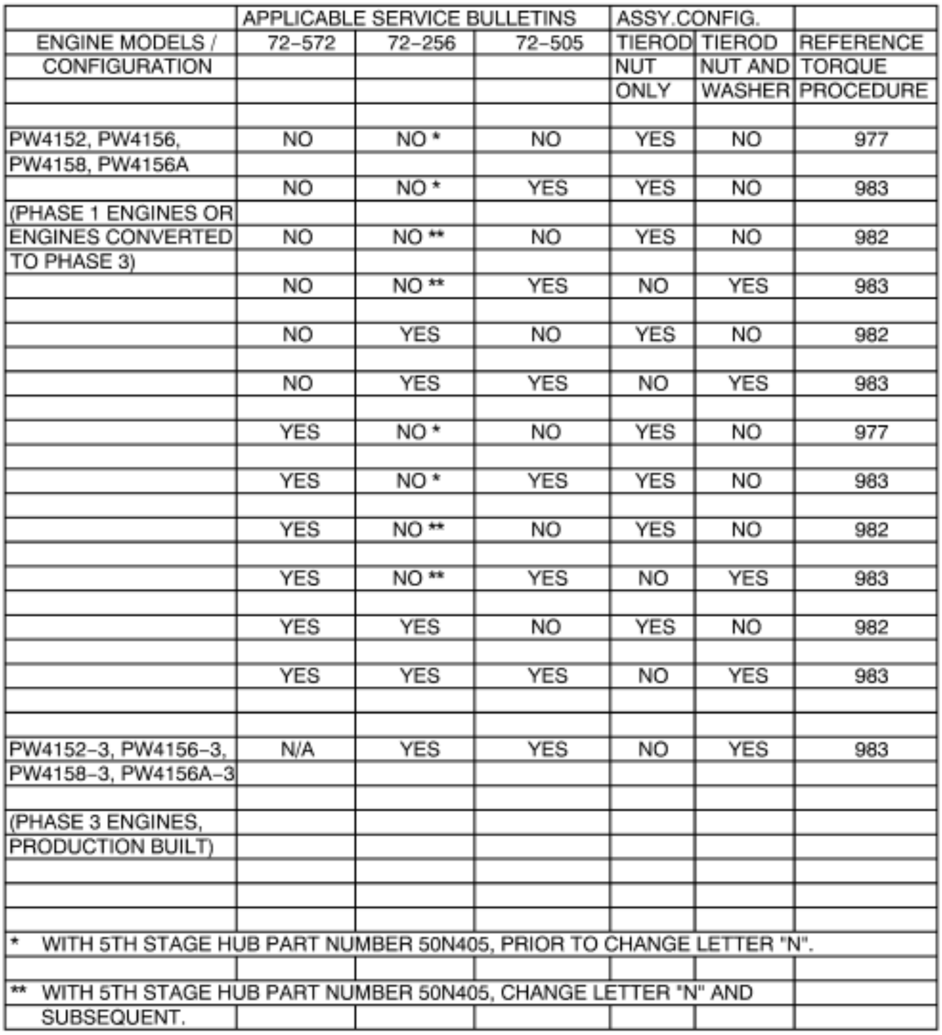
LOW PRESSURE TURBINE (LPT) − ASSEMBLY−06


STAND
(TYPICAL)
L-A1815 (0893)
PW V

Front Compressor Drive Turbine Shaft Installation
Figure 1004
(Task 72−53−00−400−006)


1
NUT
2
BOLT
(4 REQUIRED)
4
BOLT
(2 REQUIRED)
5
ADAPTER
3
RETAINER
L-A1816 (0293)
PW V

Low Pressure Turbine Front Retainer Installation
Figure 1005
(Task 72−53−00−400−006)



	APPLICABLE SERVICE BULLETINS			ASSY.CONFIG.		
ENGINE MODELS / CONFIGURATION	72-572	72-256	72-505	TIEROD NUT ONLY	TIEROD NUT AND WASHER	REFERENCE TORQUE PROCEDURE
PW4152, PW4156,	NO	NO *	NO	YES	NO	977
PW4158, PW4156A						
	NO	NO *	YES	YES	NO	983
(PHASE 1 ENGINES OR						
ENGINES CONVERTED	NO	NO **	NO	YES	NO	982
TO PHASE 3)						
	NO	NO **	YES	NO	YES	983
	NO	YES	NO	YES	NO	982
	NO	YES	YES	NO	YES	983
	YES	NO *	NO	YES	NO	977
	YES	NO *	YES	YES	NO	983
	YES	NO **	NO	YES	NO	982
	YES	NO **	YES	NO	YES	983
	YES	YES	NO	YES	NO	982
	YES	YES	YES	NO	YES	983
PW4152-3, PW4156-3,	N/A	YES	YES	NO	YES	983
PW4158-3, PW4156A-3						
(PHASE 3 ENGINES,						
PRODUCTION BUILT)						
* WITH 5TH STAGE HUB PART NUMBER 50N405, PRIOR TO CHANGE LETTER "N".						
** WITH 5TH STAGE HUB PART NUMBER 50N405, CHANGE LETTER "N" AND SUBSEQUENT.						

L-B2967 (0000)
PW V

LPT Module/Shaft Tierod Nut And Washer Installation
Figure 1006
(Task 72-53-00-400-006)

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LOW PRESSURE TURBINE (LPT) - ASSEMBLY-07

Task 72-53-00-400-007:

1. Balance The Low Pressure Turbine With The Turbine Shaft Installed (Prepare The Turbine And Shaft Assembly For Balance)

NOTE: This is an optional balance procedure that can be used, based on the operators experience, to obtain an optimized low pressure turbine balance.

A. Prerequisites

(1) Balance the low pressure turbine module. Refer to Assembly-03 Task 72-53-00-400-003. The residual unbalance must not exceed 0.5 oz-in. (360 g.mm) total.

(2) Locate the turbine shaft front plane residual unbalance amount and location. These are marked on the front OD of the shaft. The location is indicated by a symbol (the Letter L within a circle). If the symbol is not present, balance the shaft again. Refer to 72-53-80, Repair-16 Task 72-53-80-300-016.

B. Equipment And Materials Necessary

Standard Tools:

Name	Manufacturer
Clements Cadillac Electric Flameless Heat Gun, Model FT 1000	Clements Manufacturing Co. 6650 S. Narragansett Avenue Chicago, IL 60638

NOTE: The flameless heat gun specified above is optional to the heaters specified in the Special Tools list, and the optional flame torch.

Special Tools:

PWA 21350-58	Bearing, Rear
PWA 21350-35	Bearing, Balance
PWA 21350-59	Bearing, Balance (Optional To PWA 21350-35)
PWA 28657	Sling
PWA 29754	Control, Heater
PWA 29952	Retainer, Bearing
PWA 29956	Eye, Handling
PWA 76154	Adapter (2 Necessary)
PWA 85221	Adapter, Lift And Trunnion
PWA 85233	Fixture, Angle Of Turn (Optional To PWA

Special Tools:

(CONTINUED)

	88114)
PWA 85319	Heater, Electrical
PWA 85766	Fixture, Rear Balance
PWA 85879	Positioner, Bearing (Optional to PWA 87245)
PWA 86206	Adapter (2 Necessary)
PWA 86416	Fixture, Balance (Optional To PWA 87355)
PWA 87245	Adapter (Used With PWA PWA 88118)
PWA 87258	Stand, Build
PWA 87262	Sleeve, Guide (Used With PWA 87258 Stand)
PWA 87355	Fixture, Balance
PWA 87752	Stand, Build (Optional To PWA 87258)
PWA 87819	Spacer, Shaft
PWA 88114	Fixture, Angle Of Turn
PWA 88118	Sleeve, Bearing (Used With PWA 21350−35 Bearing)
PWA 88120	Adapter, Anti−Torque
PWA 88133	Adapter, Balance

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−045	Marker, Pen (PMC 4092)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Rivet	A/R	72−53−00/3/460

C. General Assembly Requirements

(1) Where heating is required for assembly, use minimum temperature differential of 125°F (52°C) between parts being assembled. Do not exceed 300°F (149°C) on any part.

(2) Where heating is required for assembly, special heaters are specified in the following procedure. However, you can use an optional flameless torch or flame torch as specified in the following steps.

(3) In locations where heating of a component in an oven is not practical or only a flange of the component requires heating, the use of Clements Cadillac Electric Flameless Heat Gun, Model FT 1000 is recommended.

(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE FLAME WILL DAMAGE OR BURN NON−METAL PARTS.

CAUTION: DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

D. Procedure

NOTE: After you balance the LPT and shaft assembly, you can not disassemble it unless you balance it again.

Subtask 72−53−00−430−063:

(1) Put the PWA 87819 Spacer on the center pedestal (shaft holder) of the PWA 87752 Build Stand. See Figure 1001.

(2) If it is not there, install PWA 86416 Front Balance Fixture or PWA 87355 Front Balance Fixture in the build stand. See Figure 1001.

  (a) Lock the wheels of the build stand.

  (b) Open the hydraulic valve to lower the shaft holder.

  (c) Lock the shaft guide in the outboard position with the ball lock pins.

  (d) Attach hoists to the lifting eyes at the front and rear of the fixture. Use the hoists to trunnion the fixture to the front (tube end) down position. Remove the lower hoist and lifting eye. Lower the fixture into the build stand.

(3) Install PWA 21350−35 Balance Bearing (Front) and PWA 88118 Bearing Sleeve.

  NOTE: See the following step to install the optional PWA 21350−59 Bearing.

  (a) If necessary, use PWA 88133 Balance Adapter to balance the PWA 88118 Balance Bearing Sleeve before it is used initially; or for subsequent recheck balance of the sleeve.

(b) If necessary, assemble the PWA 21350−35 Bearing on the PWA 88118 Sleeve. Put the sleeve, flanged end down, on a bench. Heat the bearing and install it onto the sleeve until it touches the sleeve shoulder. Install the retaining ring detail into the groove on the sleeve.

(c) Put the bearing and sleeve assembly in hot Engine Oil P03−001 to increase its temperature.

(d) Assemble the bearing and sleeve assembly on the front end of the turbine shaft. Install PWA 87245 Adapter onto the turbine shaft and push the balance sleeve until it touches the step of the shaft.

(4) Optional, install PWA 21350−59 Balance Bearing on the turbine shaft.

(a) Put the PWA 21350−59 Balance Bearing (Front) in hot Engine Oil P03−001 to increase its temperature.

(b) Install the balance bearing on the front of the turbine shaft. Put a PWA 85879 Positioner over the turbine shaft and the balance bearing and push the positioner until it touches the end of the turbine shaft, then remove the positioner. See Figure 1002.

(5) Install a PWA 85221 Adapter on the front end of the turbine shaft. Connect a hoist to the adapter.

(6) Install a PWA 29956 Eye to the rear face of the turbine shaft. Connect a hoist to the eye.

(7) Open the two clamps of the stand. Use the two hoists to to lift and trunnion the shaft to the front end down position. Remove the lower hoist and adapter. Lower the shaft into the build stand and the front balance fixture. Remove the hoist and eye. See Figure 1003.

(a) Use a non−etching Marker P05−045 to mark the location of the runout (high point) on the rear OD of the turbine shaft.

Subtask 72−53−00−430−064:

(8) Actuate the hydraulic cylinder to adjust the height of the turbine shaft as required. The rear face of the turbine shaft tierod flange must be 12 inch (304.800 mm) above the balance fixture surface.

CAUTION: IF A 3RD STAGE LPT AIRSEAL (PN 50N007) WITH FOUR KNIFE−EDGE SEALS IS USED, THEN THE LONGER 3RD STAGE LPT SEALING RING (PN 50N266) IS NECESSARY.

(9) Install the 3rd stage LPT airseal to the turbine rear hub.

(a) Determine the position of the axial high point runout symbols (Letter H within a circle) on the turbine shaft and the 3rd stage LPT (rotating) airseal.

(b) Use a non−etching Marker P05−045 to mark the location of the axial high point runout on the rear OD of the airseal.

(c) Use a non−etching Marker P05−045 to mark the location of the axial high point runout on the rear OD of the turbine shaft.

NOTE: The turbine shaft and the airseal will be assembled with the the axial high point runout symbols approximately 180 degrees apart.

CAUTION: THE TEMPERATURE OF THE AIRSEAL MUST NOT EXCEED 400°F (204.4°C) OR DAMAGE TO THE PART CAN OCCUR.

(d) Heat the airseal in an oven to obtain a minimum temperature differance of 250°F (139°C) between mating parts.

(10) Put the PWA 85319 Heater on the rear conical surface of the turbine shaft.

(a) Connect PWA 29754 Heater Control to the junction box of the heater.

(b) Attach the thermocouple connector to the heater control.

CAUTION: TEMPERATURE OF THE TURBINE SHAFT MUST NOT EXCEED 400°F (204.4°C) OR DAMAGE TO THE PART CAN OCCUR.

(c) Heat the shaft to obtain a minimum temperature differance of 250°F (139°C) between the mating parts.

(11) Install the low pressure turbine to the turbine shaft. See Figure 1004.

(a) Use a hoist to install a PWA 28657 Sling and two PWA 86206 Adapters to the rear retainer at the trunnion spools labeled "LPT WITHOUT SHAFT".

(b) Lift the assembly from the stand, and trunnion to vertical, front end down, position. Position the assembly over the turbine shaft.

CAUTION: THIS IS A RAPID ASSEMBLY PROCEDURE. THE TIEROD NUTS MUST BE TIGHTENED QUICKLY OR THE TURBINE SHAFT WILL NOT FULLY SEAT ON THE TURBINE HUB.

(c) Disconnect and remove the heater from the turbine shaft.

(d) Determine the position of the axial high point symbols (Letter H within a circle) on the turbine shaft and 3rd stage (rotating) airseal. Align the tierods with the nearest tierod holes in the airseal, and assemble the heated airseal on the turbine shaft with the axial high point symbol of the airseal approximately 180 degrees from the axial high point symbol on the turbine shaft.

NOTE: If they are there, you can use the alignment marks on the airseal and shaft that were made during the disassembly of the the LPT module from the turbine shaft.

CAUTION: ASSURE THAT THE AIRSEAL CLEARS THE HONEYCOMB RING ASSEMBLY OR DAMAGE TO THE KNIFE−EDGES CAN OCCUR.

(e) Align the tierods in the turbine shaft with the tierod holes in the turbine hub and carefully lower the turbine module about halfway onto the tierods.

NOTE: You can install the turbine shaft at any location with respect to the low pressure module and 3rd stage airseal.

(f) Align the dowel pin in the front flange of the turbine case with the dowel pin hole in the front balance fixture. Lower the turbine module onto the turbine shaft and balance fixture. Remove the hoist, sling, and adapters.

(g) Lubricate the threads of six turbine shaft tierods with Engine Oil P03−001, equally spaced (60 degrees apart) to make three opposite pairs.

CAUTION: OPTIONAL NUT PART NUMBERS ARE OF DIFFERENT WEIGHT GROUPS. USE 24 NUTS OF THE SAME PART NUMBER IF POSSIBLE. IF THIS IS NOT POSSIBLE, INSTALL NUTS OF THE SAME PART NUMBER EQUALLY SPACED FROM EACH OTHER.

(h) Lubricate the washer face of six turbine tierod nuts with Engine Oil P03−001 and based upon the engine model and the applicable service bulletins, determine if washers are necessary for assembly under the tierod nuts. See Figure 1005. Lubricate all necessary washers with Engine Oil P03−001.

(i) Install six tierod nuts and washers, if necessary for the engine configuration as determined from Figure 1005, onto the equally spaced tierods. Use an opposite pattern sequence to torque the six tierod nuts to 1,000 lb−in. (112.985 N.m).

(j) Install 28 screws, with washers, through the front outer diameter flange of the turbine case into the front balance fixture.

(k) Treat the threads of the remaining 18 turbine shaft tierods and the washer face of the tierod nuts with Engine Oil P03−001. Lubricate 18 turbine tierod washers, if necessary for the engine assembly configuration as deteremined from the Figure 1005, with Engine Oil P03−001.

(l) Install the remaining 18 tierod washers, if necessary as determined from Figure 1005, and the tierod nuts onto the LPT shaft tierods. Apply an initial seating torque of 550 − 650 lb−in. (62.142 − 73.440 N.m). Use an opposite pattern sequence to complete the initial torque on all the tierods.

(m) Remove the PWA 85331 Retainer.

1 Loosen eight hand knobs of the retainer.

2 Remove 48 screws that hold the retainer to the rear flange of the turbine case.

3 Install two eyebolts into the two 0.500−13 tapped holes on rear side of retainer labeled "FOR LIFTING TOOL VERTICAL ONLY".

4 Use a hoist to connect a suitable sling to the eyebolts.

5 Use the hoist to remove the retainer. Remove the hoist, sling, and eyebolts.

(n) Remove the PWA 86026 Handling Fixture or PWA 85332 Handling Fixture. See Figure 1006.

1 Remove the four bolts that attach the clamp ring.

2 Use a hoist and suitable sling to remove the fixture.

(o) Position the PWA 85233 Angle−Of−Turn Fixture or PWA 88114 Angle−Of−Turn Fixture, to the rear face of the turbine shaft. For PWA 85233 Fixture, attach the fixture with four detail screws (1007/3). See Figure 1007. For PWA 88114 Fixture, attach the fixture with eight detail screws.

(p) For PWA 88114 Angle−Of−Turn Fixture, install PWA 88120 Anti−Torque Adapter as follows:

1 Put the flange of the adapter on the LPT case and the adapter arm between the antirotation lug of the angle−of turn fixture.

2 Attach the adapter to the LPT case with eight detail screws and nut assemblies.

(q) Depending upon the engine configuration and the applicable service bulletins, apply the final torque on all 24 tierod nuts using the applicable procedure (Reference 977, Reference 982 or Reference 983) as determined from Figure 1005 as specified as follows:

CAUTION: THE FOLLOWING TORQUEING PROCEDURE MUST BE ACCOMPLISHED WITH A MAXIMUM TEMPERATURE DIFFERENTIAL OF 40 DEGREES F (22.2 DEGREES C) BETWEEN THE NUTS AND THE TIERODS.

1 (Reference 977) Apply the final torque to 24 turbine shaft tierod nuts as follows:

a Loosen one pair of nuts (180 degrees apart). Torque to a seating torque of 80 − 90 lb−in. (9.039 − 10.169 N.m).

b Set the indicator dial (1007/8) to zero, with index mark (1007/6) on fixture plate. Tighten the thumbscrew (1007/4) to set the indicator dial. Apply 60 − 64 degrees angle of turn.

c Repeat steps a and b on all remaining pairs of nuts in the torque sequence stamped on the fixture.

d As an option to improve the LPT module and shaft balance characteristics, do the following: Loosen and reseat one pair of tierod nuts as indicated in step a above. Then repeat steps b and c above to reapply the final torque to all the tierod nuts.

CAUTION: THE FOLLOWING TORQUEING PROCEDURE MUST BE ACCOMPLISHED WITH A MAXIMUM TEMPERATURE DIFFERENTIAL OF 40 DEGREES F (22.2 DEGREES C) BETWEEN THE NUTS AND THE TIERODS.

2 (Reference 982) Apply the final torque to 24 turbine shaft tierod nuts as follows:

a Loosen one pair of nuts (180 degrees apart).

b Measure the torque necessary to overcome the locking feature of the nut. Make sure the nut is not in contact with the disk face.

c If the measured torque is less than 50 lb−in. (5.649 N.m), then tighten to a seating torque of 40 − 50 lb−in. (4.519 − 5.649 N.m) and continue to step e.

d If the measured torque is more than 50 lb−in. (5.649 N.m), find the torque necessary to turn the nut. Add 10 − 20 lb−in. (1.130 − 2.260 N.m) to this torque and tighten the nut using the total torque. The total torque must not be more than 200 lb−in. (22.60 N.m).

e Set the indicator dial (1007/8) to zero, with the index mark (1007/6) on the fixture plate. Tighten the thumbscrew (1007/4) to set the indicator dial. Apply 59 − 63 degrees angle of turn.

f Repeat steps a through e on all remaining pairs of nuts in the torque sequence stamped on the fixture.

g As an option to improve the LPT module and shaft balance characteristics, do the following:: Loosen and reseat one pair of tierod nuts, 180 degrees apart, as indicated in step a above. Then repeat steps b through f above to complete the seating and reapply the final torque to all the tierod nuts.

CAUTION: THE FOLLOWING TORQUEING PROCEDURE MUST BE ACCOMPLISHED WITH A MAXIMUM TEMPERATURE DIFFERENTIAL OF 40 DEGREES F (22.2 DEGREES C) BETWEEN THE NUTS AND THE TIERODS.

3 (Reference 983) Apply the final torque to 24 turbine shaft tierod nuts as follows:

a Loosen one pair of nuts (180 degrees apart).

b Measure the torque necessary to overcome the locking feature of the nut. Make sure the nut is not in contact with the disk face. Add 10 − 20 lb−in. (1.130 − 2.260 N.m) to this torque and tighten the nut with the total torque. The total torque must not be more than 200 lb−in. (22.60 N.m).

c Set the indicator dial (1007/8) to zero, with the index mnark (1007/6) on the fixture plate. Tighten the thumbscrew (1007/4) to set the indicator dial. Apply 58 − 62 degrees angle of turn.

d Repeat steps a through c on all remaining pairs of nuts in the sequence stamped on the fixture.

e As an option to improve the LPT module and shaft balance characteristics, do the following: Loosen one pair of tierod nuts, 180 degrees apart, as indicated in step a above. Then repeat steps b through d above to complete the seating and reapply the final torque to all the tierod nuts.

(r) Remove the angle of turn fixture and the antitorque adapter, if applicable.

(12) Install the 6th stage LPT airseal onto the rear of the turbine shaft. See Figure 1008.

(13) Put the PWA 85881 Spacer on the rear of the LPT shaft.

(14) Install the PWA 21350−58 Rear Balance Bearing on the rear of the turbine shaft.

(15) Put PWA 29952 Retaining Plate on the rear of the LPT and secure with four detail bolts.

CAUTION: MAKE SURE THAT THE REAR BALANCE BEARING TEMPERATURE IS COOLED TO WITHIN 10°F (5.5°C) OF THE AMBIENT TEMPERATURE BEFORE YOU INSTALL THE REAR BALANCE FIXTURE OR DAMAGE TO THE TOOLS CAN OCCUR.

(16) Put PWA 85766 Rear Balance Fixture on the rear of the LPT as follows: See Figure 1009.

(a) Loosen the four detail lock bolts.

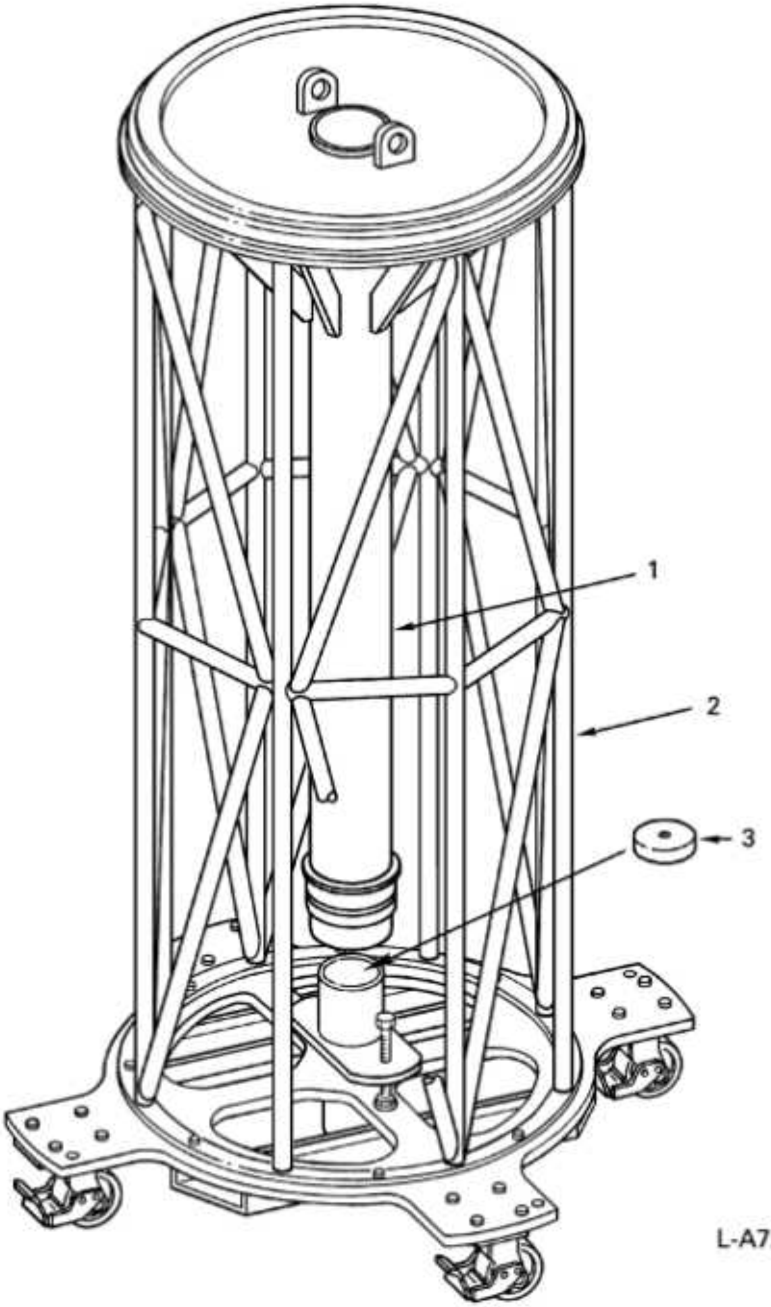
(b) Use a hoist to connect a PWA 28657 Sling , with two PWA 76154 Adapters, to the trunnion spools of the rear balance fixture. Use the hoist to position the fixture over the turbine assembly.

(c) Align the locating pin in the rear flange of the turbine case with the mating hole in the balance fixture. Lower the fixture onto the turbine case. Remove the hoist, sling and adapters. Secure the rear flange of the case with 22 detail cap screws and washers.

(d) Secure the four detail lock bolts.

E. Postrequisites

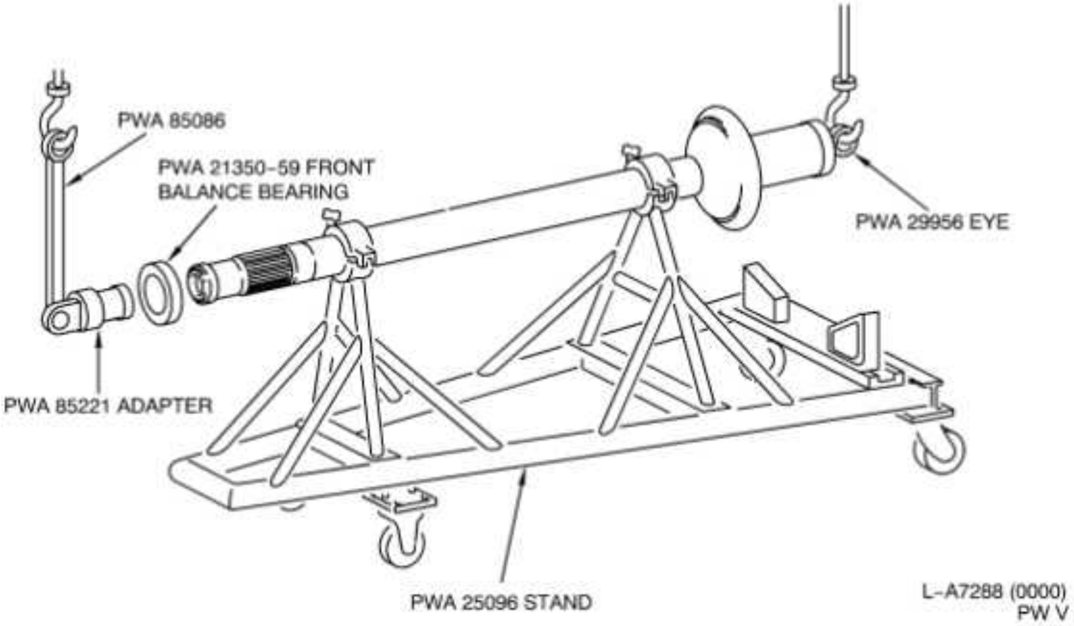
(1) Balance the low pressure turbine with shaft assembly. Refer to Assembly−12 Task 72−53−00−400−012.



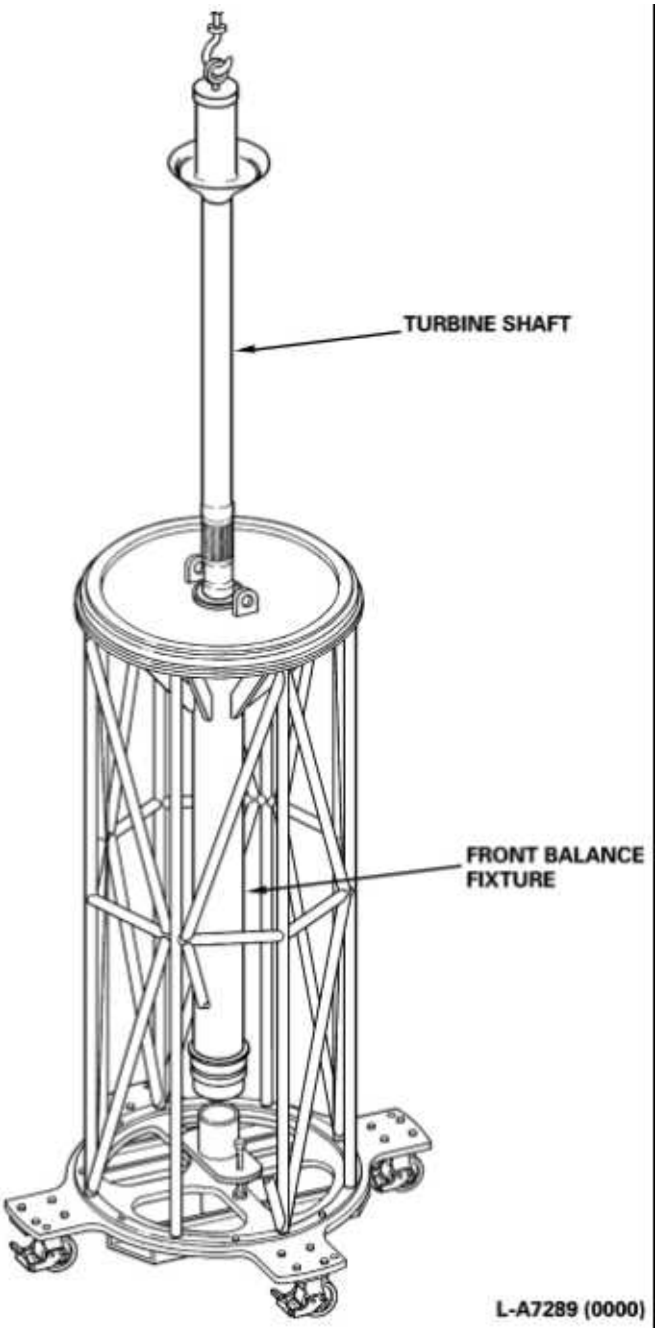
L-A7287 (0393)

1. PWA 86416 Or PWA 87355 Front Balance Fixture
2. PWA 87752 Build Stand
3. PWA 87819 Shaft Spacer

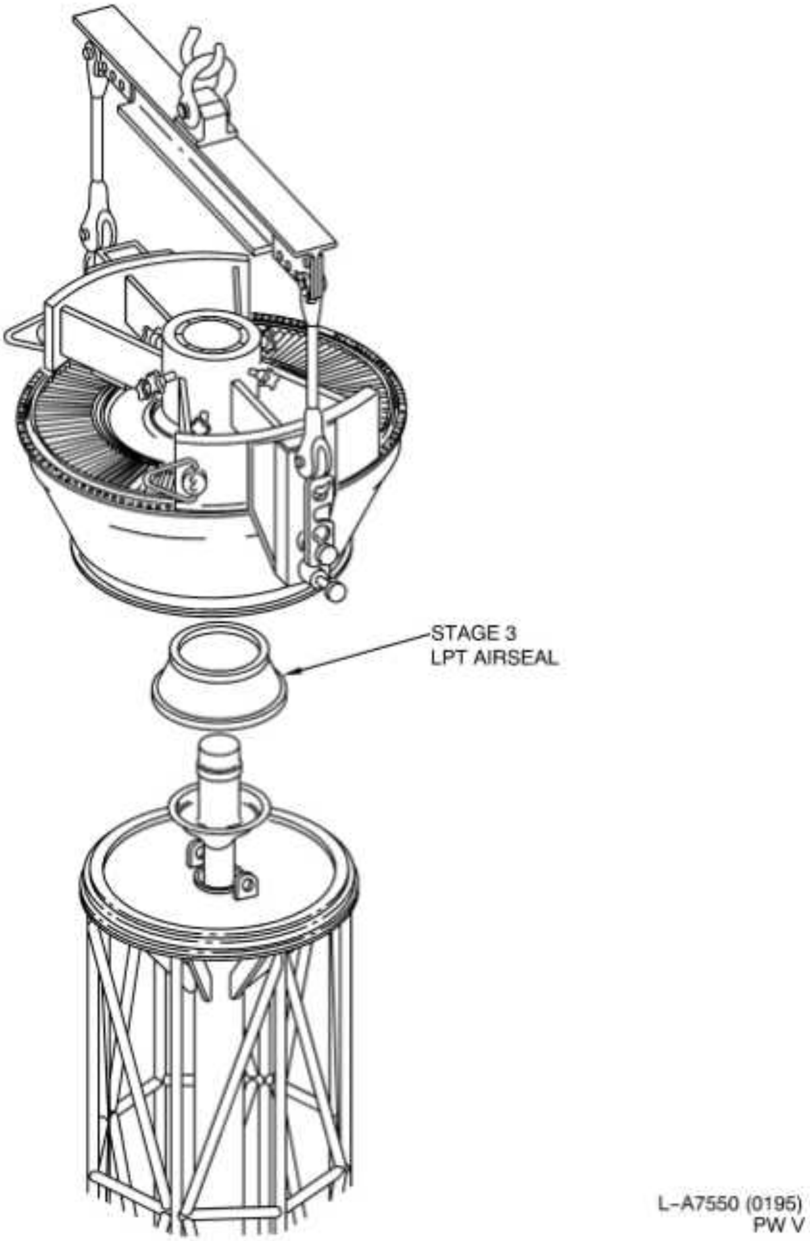
Front Balance Fixture Installation
Figure 1001
(Task 72−53−00−400−007)


PWA 85086
PWA 21350-59 FRONT
BALANCE BEARING
PWA 29956 EYE
PWA 85221 ADAPTER
PWA 25096 STAND
L-A7288 (0000)
PW V

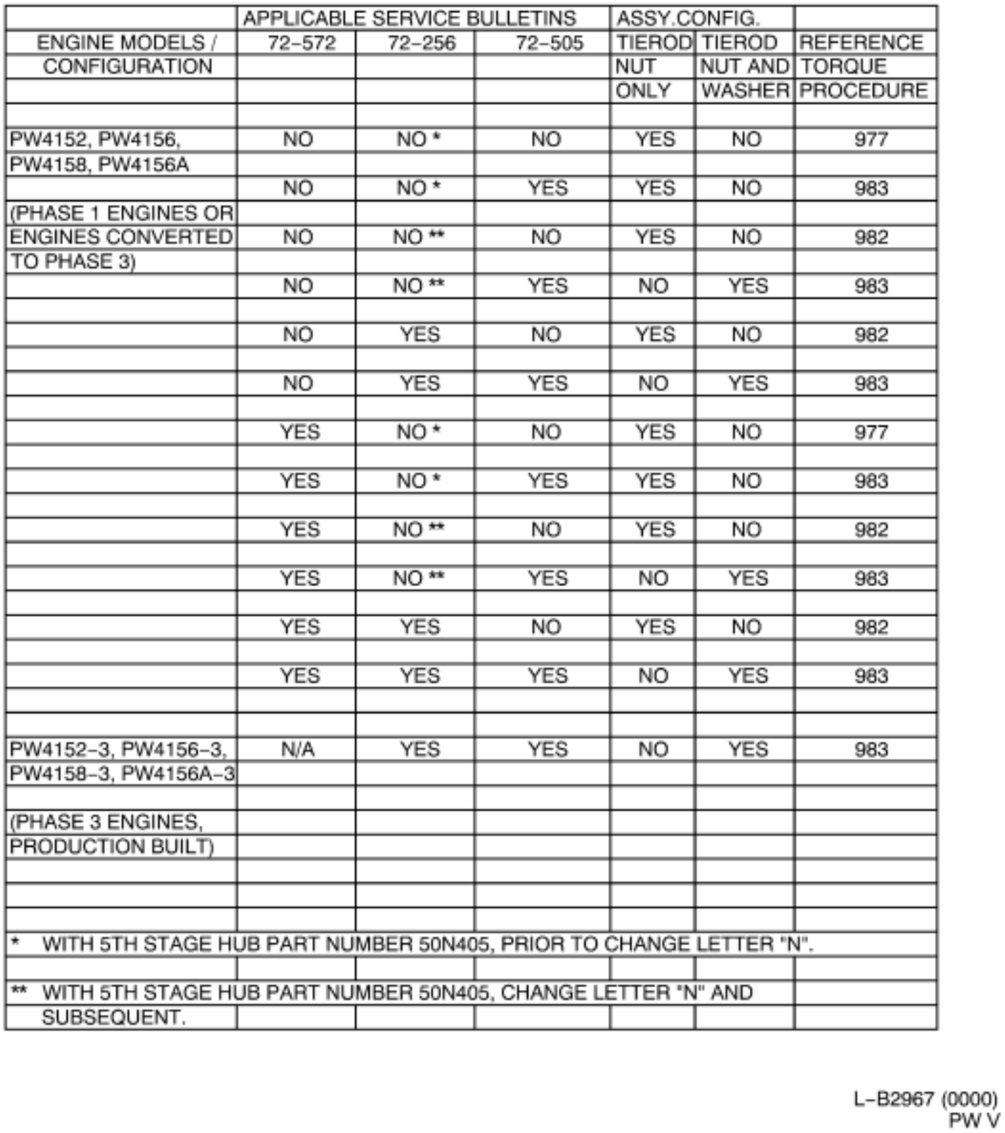
Turbine Shaft Tooling
Figure 1002
(Task 72−53−00−400−007)


TURBINE SHAFT
FRONT BALANCE FIXTURE
L-A7289 (0000)

Turbine Shaft Installation In The Build Stand
Figure 1003
(Task 72−53−00−400−007)


STAGE 3
LPT AIRSEAL
L−A7550 (0195)
PW V

Front Compressor Drive Turbine Module Installation
Figure 1004
(Task 72−53−00−400−007)

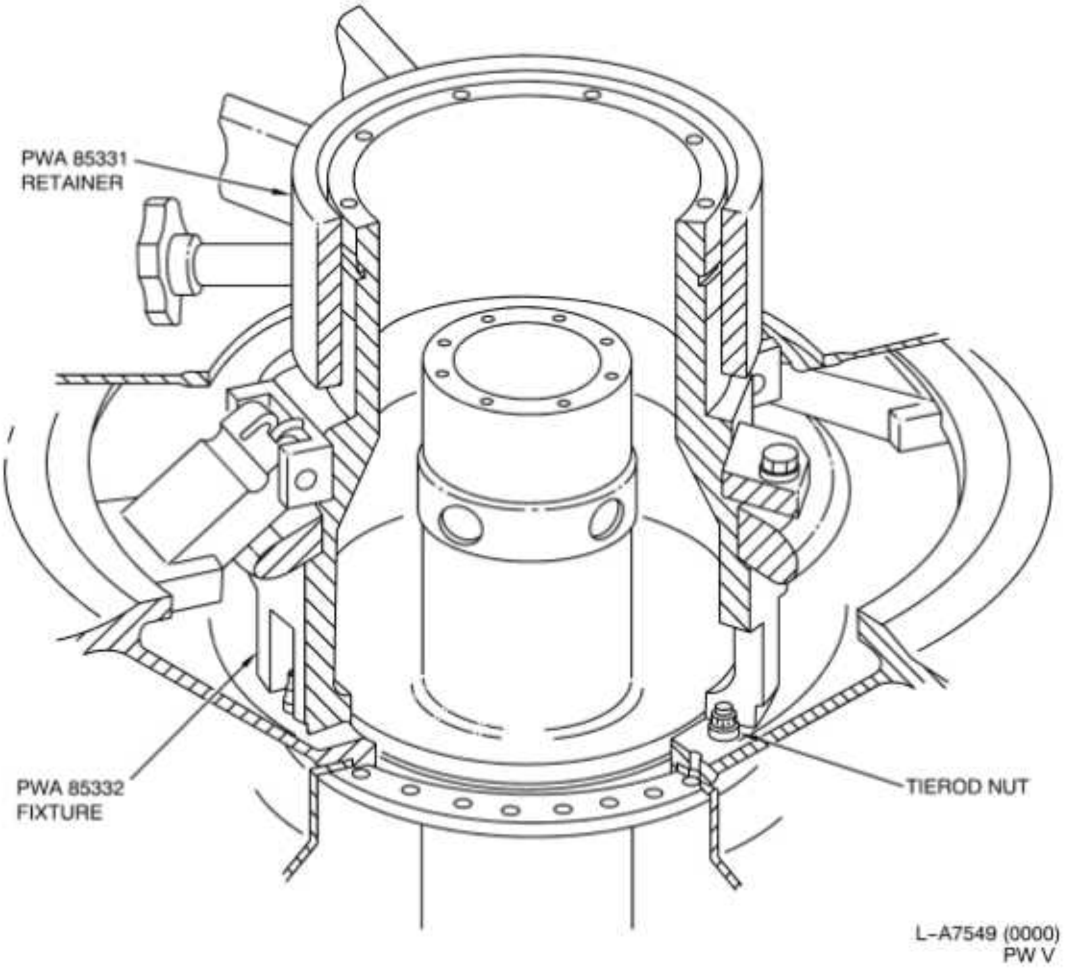


ENGINE MODELS / CONFIGURATION	APPLICABLE SERVICE BULLETINS 72-572	72-256	72-505	ASSY.CONFIG. TIEROD NUT ONLY	TIEROD NUT AND WASHER	REFERENCE TORQUE PROCEDURE
PW4152, PW4156, PW4158, PW4156A (PHASE 1 ENGINES OR ENGINES CONVERTED TO PHASE 3)	NO	NO *	NO	YES	NO	977
	NO	NO *	YES	YES	NO	983
	NO	NO **	NO	YES	NO	982
	NO	NO **	YES	NO	YES	983
	NO	YES	NO	YES	NO	982
	NO	YES	YES	NO	YES	983
	YES	NO *	NO	YES	NO	977
	YES	NO *	YES	YES	NO	983
	YES	NO **	NO	YES	NO	982
	YES	NO **	YES	NO	YES	983
	YES	YES	NO	YES	NO	982
	YES	YES	YES	NO	YES	983
PW4152-3, PW4156-3, PW4158-3, PW4156A-3 (PHASE 3 ENGINES, PRODUCTION BUILT)	N/A	YES	YES	NO	YES	983

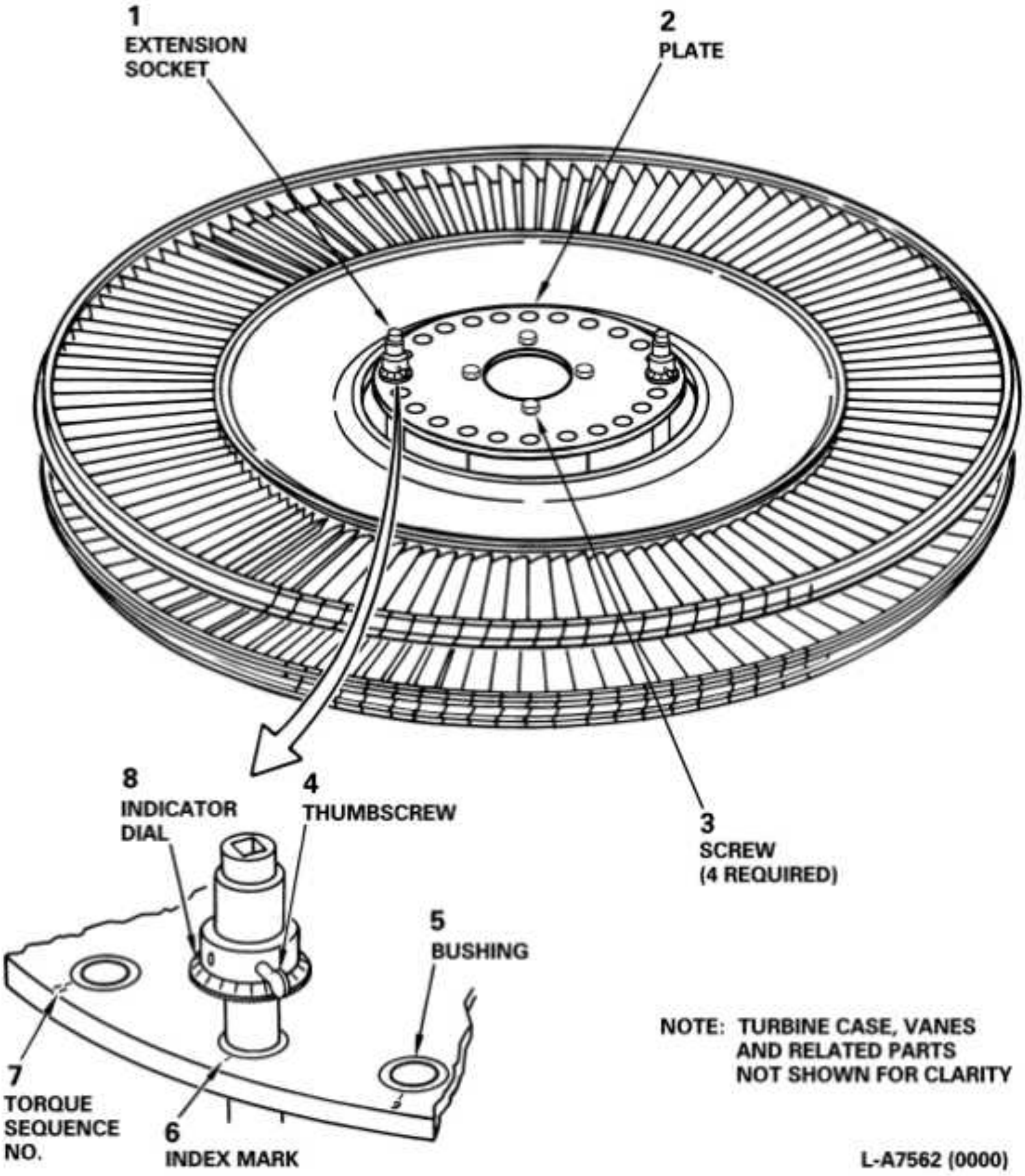
* WITH 5TH STAGE HUB PART NUMBER 50N405, PRIOR TO CHANGE LETTER "N".

** WITH 5TH STAGE HUB PART NUMBER 50N405, CHANGE LETTER "N" AND SUBSEQUENT.

LPT Module/Shaft Tierod Nut And Washer Installation
Figure 1005
(Task 72−53−00−400−007)

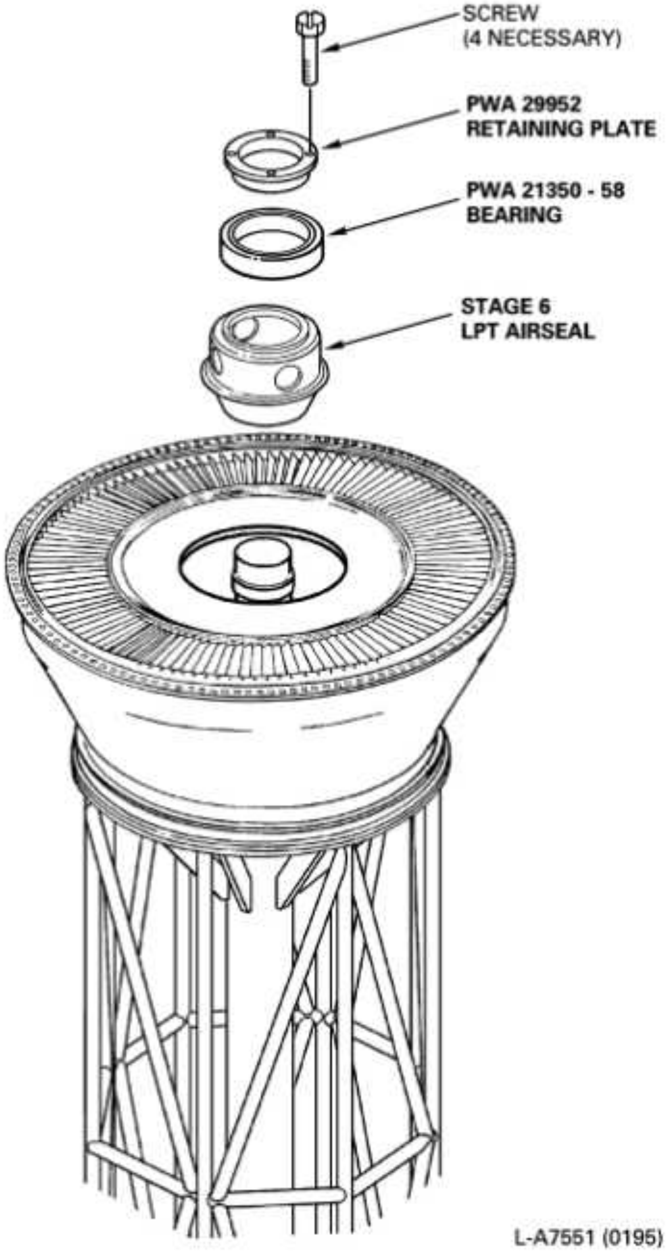

PWA 85331
RETAINER
PWA 85332
FIXTURE
TIEROD NUT
L−A7549 (0000)
PW V

Front Compressor Drive Turbine Shaft Installation
Figure 1006
(Task 72−53−00−400−007)


1
EXTENSION SOCKET
2
PLATE
8
INDICATOR DIAL
4
THUMBSCREW
3
SCREW (4 REQUIRED)
5
BUSHING
NOTE: TURBINE CASE, VANES AND RELATED PARTS NOT SHOWN FOR CLARITY
7
TORQUE SEQUENCE NO.
6
INDEX MARK
L-A7562 (0000)

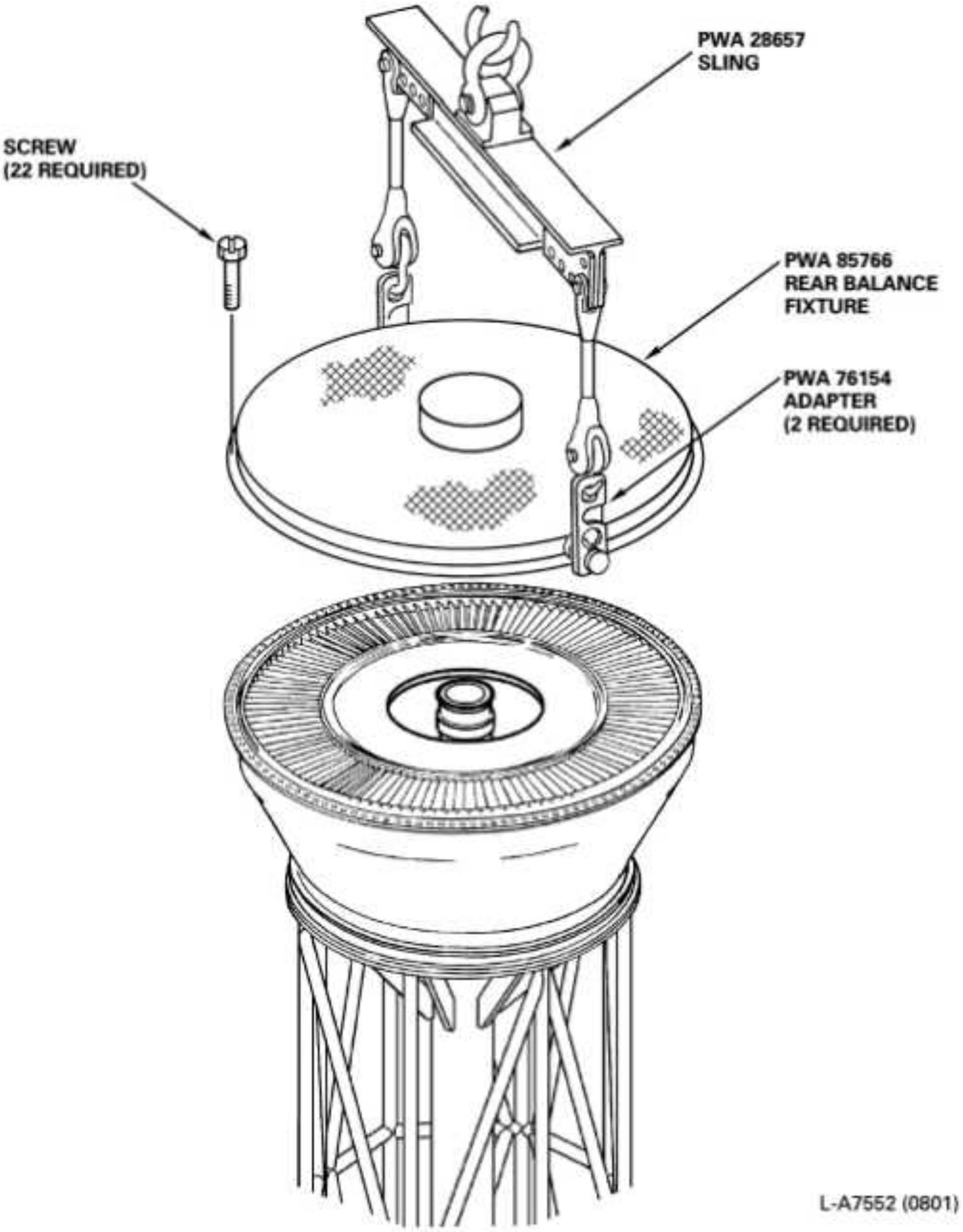
PWA 85233 Angle Of Turn Fixture Installation
Figure 1007
(Task 72−53−00−400−007)

LOW PRESSURE TURBINE (LPT) − ASSEMBLY−07


SCREW
(4 NECESSARY)
PWA 29952
RETAINING PLATE
PWA 21350 - 58
BEARING
STAGE 6
LPT AIRSEAL
L-A7551 (0195)

Sixth Stage LPT Airseal And Rear Balance Bearing Installation
Figure 1008
(Task 72−53−00−400−007)

LOW PRESSURE TURBINE (LPT) − ASSEMBLY−07


PWA 28657
SLING
SCREW
(22 REQUIRED)
PWA 85766
REAR BALANCE
FIXTURE
PWA 76154
ADAPTER
(2 REQUIRED)
L-A7552 (0801)

Rear Balance Fixture Installation
Figure 1009
(Task 72−53−00−400−007)

LOW PRESSURE TURBINE (LPT) - ASSEMBLY-08

Task 72-53-00-400-008:

1. Balance Low Pressure Turbine With Shaft (Balance Procedure)

This Procedure Has Been Deleted

LOW PRESSURE TURBINE (LPT) - ASSEMBLY-09

Task 72-53-00-400-009:

1. Balance The Low Pressure Turbine With The Turbine Shaft Installed (Remove The Turbine From The Turbine Shaft And/Or Install Counterweights On The Front Plane)

NOTE: This procedure is required if you must remove the turbine module to install counterweights to the front plane, or if you must reposition the turbine shaft relative to the 5th stage hub.

A. Prerequisites

(1) Balance the low pressure turbine with the turbine shaft installed. Refer to Assembly-12 (Task 72-53-00-400-012).

B. Equipment And Materials Required

Special Tools:
PWA 26147 Adapter (2 Required, Optional to PWA 85608)
PWA 28657 Sling
PWA 29390 Pump, Hydraulic
PWA 29952 Retainer, Bearing
PWA 85234 Riveter
PWA 85258 Puller, Jackscrew
PWA 85331 Retainer, Rear
PWA 85332 Fixture, Handling (Optional To PWA 86026)
PWA 85333 Pusher/Puller, Hydraulic
PWA 85558 Adapter, Hydraulic Cylinder
PWA 86026 Fixture, Handling (Optional To PWA 85332)
PWA 86206 Adapters (2 Required)

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-045	Marker, Pen (PMC 4092)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Rivet	A/R	72-53-00	3	460

C. Procedure

NOTE: After you balance the LPT and shaft assembly, you can not disassemble it unless you balance it again.

Subtask 72−53−00−430−073:

(1) Loosen all of the LPT shaft tierod nuts, then remove any one nut.

(2) Install PWA 85332 (Optional to PWA 86026) Handling Fixture.

NOTE: See the following step for installation of PWA 86026 Fixture.

(a) Install the locator, Detail−11 onto the tierod where the tierod nut has been removed.

(b) Use a hoist and suitable sling to install the handling fixture.

NOTE: The locator aligns the LPT with the fixture.

(c) Slide the lockring rearward with the two T−handle rod details to expand the clamps. Secure the lockring with four screws, so that the clamps interface with the turbine rear hub bore.

(d) Remove the hoist and sling.

(3) Install PWA 86026 Handling Fixture (Optional to PWA 85332). See Figure 1001.

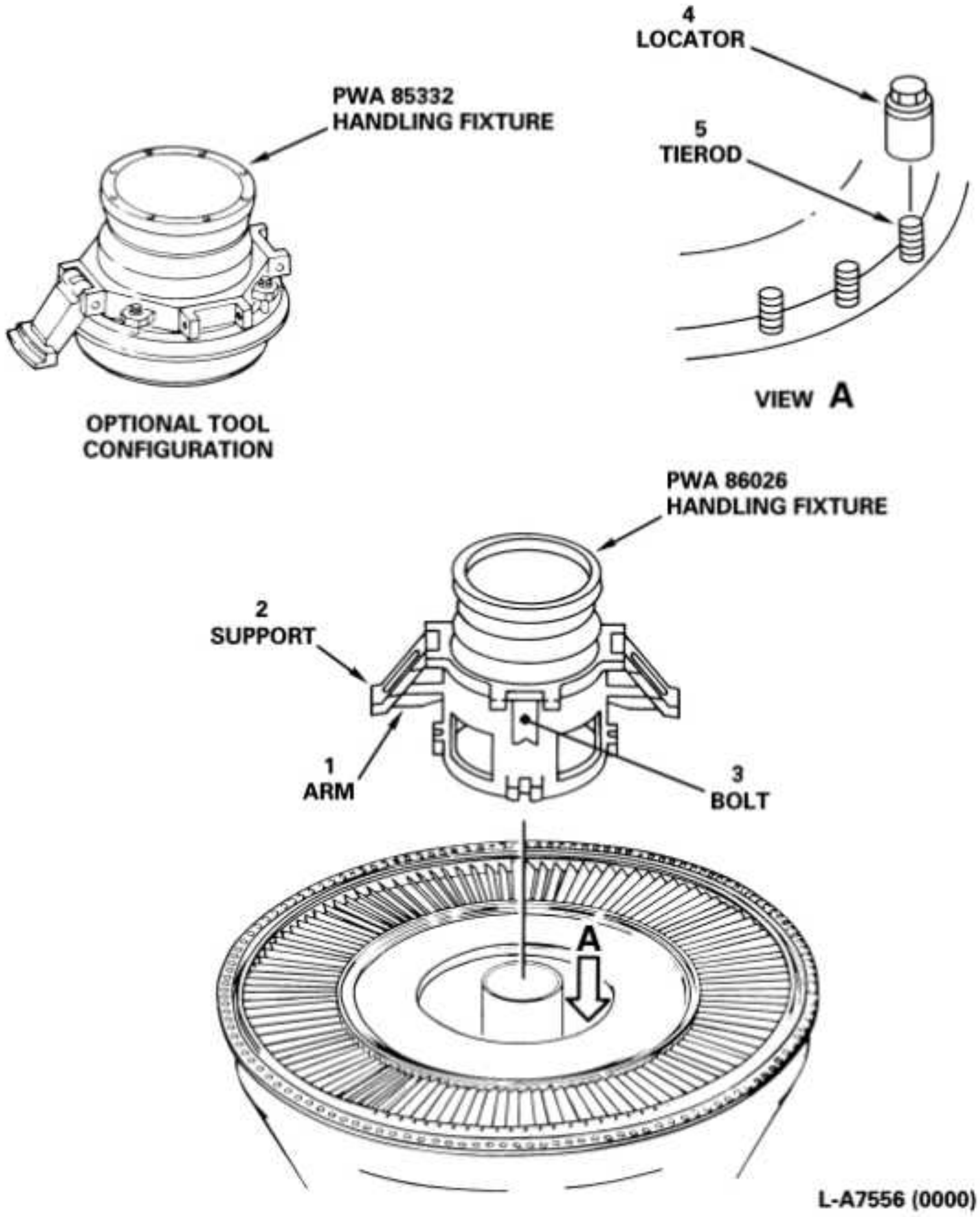
(a) Remove any one tierod nut and install the locator (1001/4) on the tierod (1001/5).

(b) Measure the 5th stage hub flange with the template, detail−18. If the flange thickness is approximately 0.680 inch (17.272 mm), then install the spacer, detail−17. If the flange thickness is approximately 0.813 inch (20.650 mm), the spacer is not used.

(c) Use a hoist and suitable sling to install the handling fixture.

NOTE: The locator aligns the LPT with the fixture.

(d) Move the fixture forward until it touches the rear face of the 5th stage hub.


4
LOCATOR
PWA 85332
HANDLING FIXTURE
5
TIEROD
VIEW A
OPTIONAL TOOL
CONFIGURATION
PWA 86026
HANDLING FIXTURE
2
SUPPORT
1
ARM
3
BOLT
A
L-A7556 (0000)

Handling Fixture Installation
Figure 1001
(Task 72−53−00−400−009)

(e) Use a steel rod in the two 0.625 inch (15.875 mm) diameter through holes of the fixture body to align the slots with the tierods in the 5th stage hub. Tighten the four screws (1001/3), one at a time, until the four supports (1001/2) are correctly engaged at the 5th stage hub bore. Ensure that the detail arms (1001/1) are engaged in the step provided in the fixture body.

(f) Remove the lift adapter.

(4) Install PWA 85331 Rear Retainer. See Figure 1002.

(a) Install two eyebolts into the two 0.500−13 tapped holes on rear side of retainer labeled "FOR LIFTING TOOL VERTICAL ONLY". Use a hoist to connect a suitable sling to the eyebolts.

(b) Put the retainer over the handling fixture and install it to the case with 48 screws (1002/1) and washers (1002/2).

(c) Remove the hoist, sling, and eyebolts.

(d) Lock the axial position of the LPT rotor by tightening the eight hand knobs (1002/3) against the handling fixture.

(5) Use a hoist to attach a PWA 28657 Sling and two PWA 86206 Adapters to the retainer at the spools labeled "LPT WITHOUT SHAFT".

(6) Remove the remaining 23 nuts that hold the shaft to the hub. Remove the locator detail from the tierod.

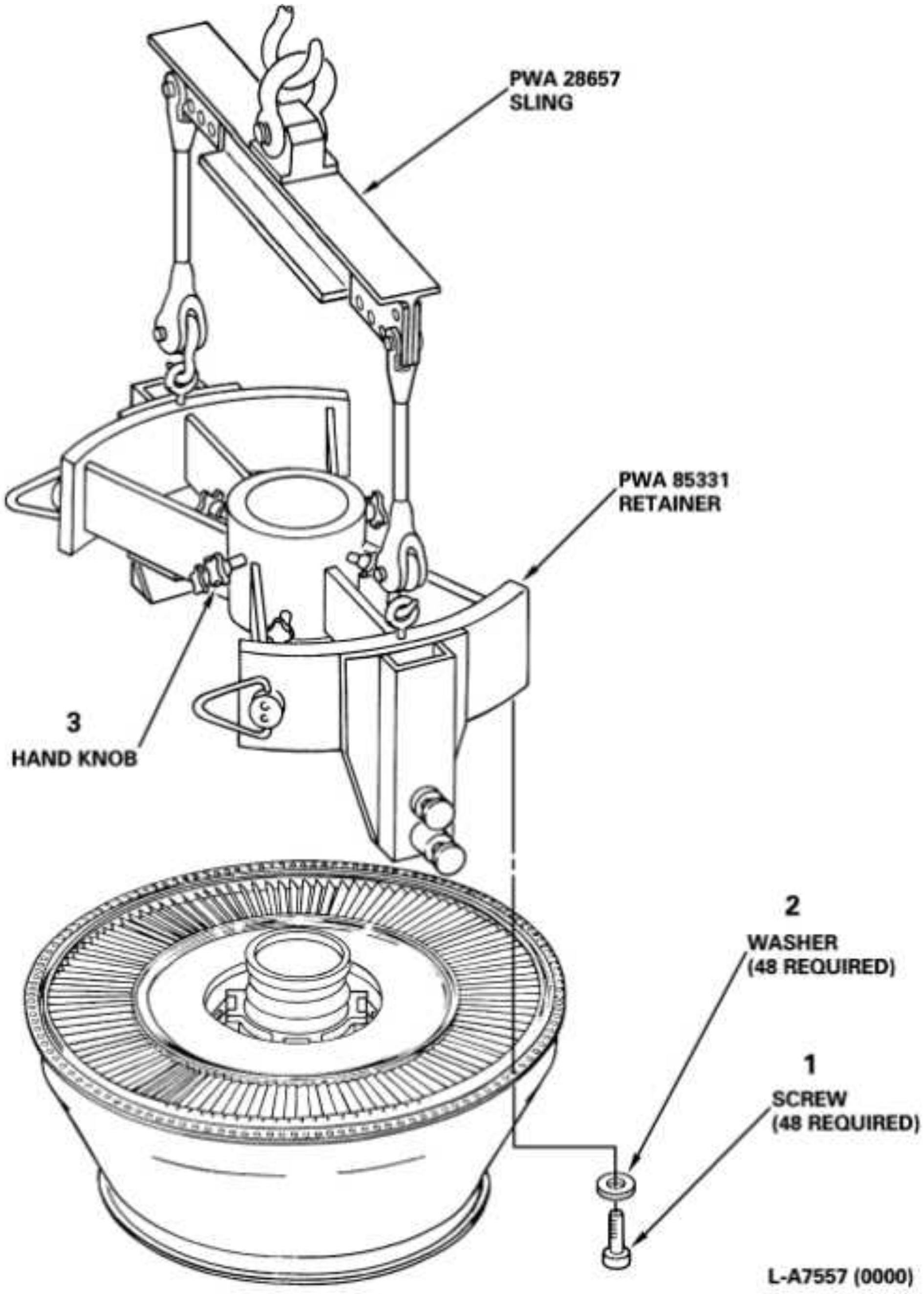
(7) Put the PWA 85558 Adapter to the rear face of the shaft and attach it with eight screws. See Figure 1003.

(8) Install PWA 85333 Hydraulic Pusher to PWA 85331 Retainer and PWA 85558 Adapter. Attach PWA 29390 Hydraulic Pump to the pusher.

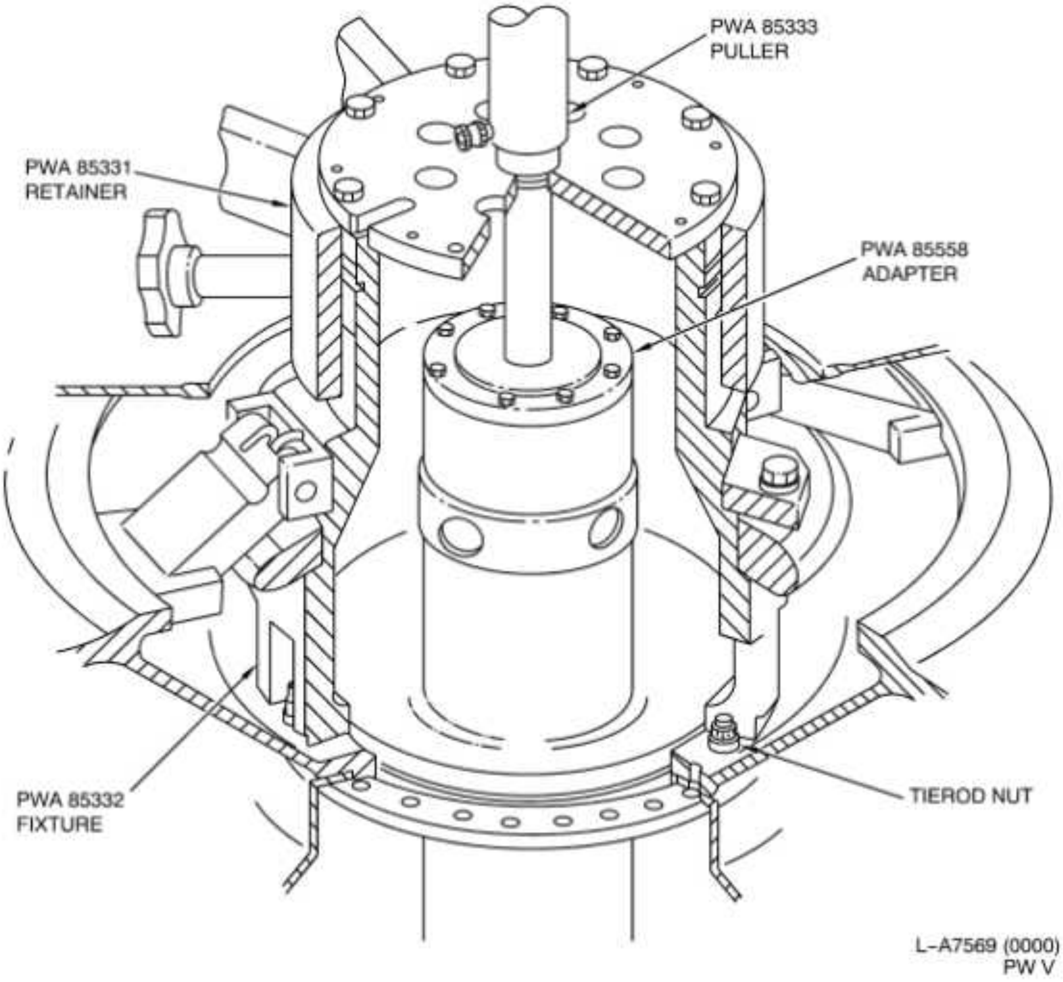
(9) Remove the bolts that hold the turbine case front flange to the front balance fixture.

(10) Actuate the hydraulic pump to remove the turbine assembly from the turbine shaft.

LOW PRESSURE TURBINE (LPT) - ASSEMBLY-09


PWA 28657
SLING
PWA 85331
RETAINER
3
HAND KNOB
2
WASHER
(48 REQUIRED)
1
SCREW
(48 REQUIRED)
L-A7557 (0000)

Rear Retainer Installation
Figure 1002
(Task 72-53-00-400-009)


PWA 85333
PULLER
PWA 85331
RETAINER
PWA 85558
ADAPTER
PWA 85332
FIXTURE
TIEROD NUT
L-A7569 (0000)
PW V

Front Compressor Drive Turbine Shaft Removal
Figure 1003
(Task 72-53-00-400-009)

(11) Remove the hydraulic pump and pusher from the retainer. Remove the PWA 85558 Adapter from the rear end of the turbine Shaft.

(12) Use the hoist to put the turbine assembly on two suitable stands. Leave the hoist connected to the rear fixture. See Figure 1003.

Subtask 72−53−00−430−074:

(13) Remove the 3rd stage LPT airseal (1004/4) with a PWA 85258 Jackscrew Puller. See Figure 1004.

(a) Remove the two ball lock pins (1004/8), loosen the four screws (1004/9) and retract the puller plates (1004/7). Rotate locking lugs (1004/1) to face inward.

(b) Insert the puller into the airseal. Adjust the screws (1004/5) as required to seat the ring on the ID flange of the turbine rear hub. Rotate the locking lugs to position the lug under the rear face of the hub flange.

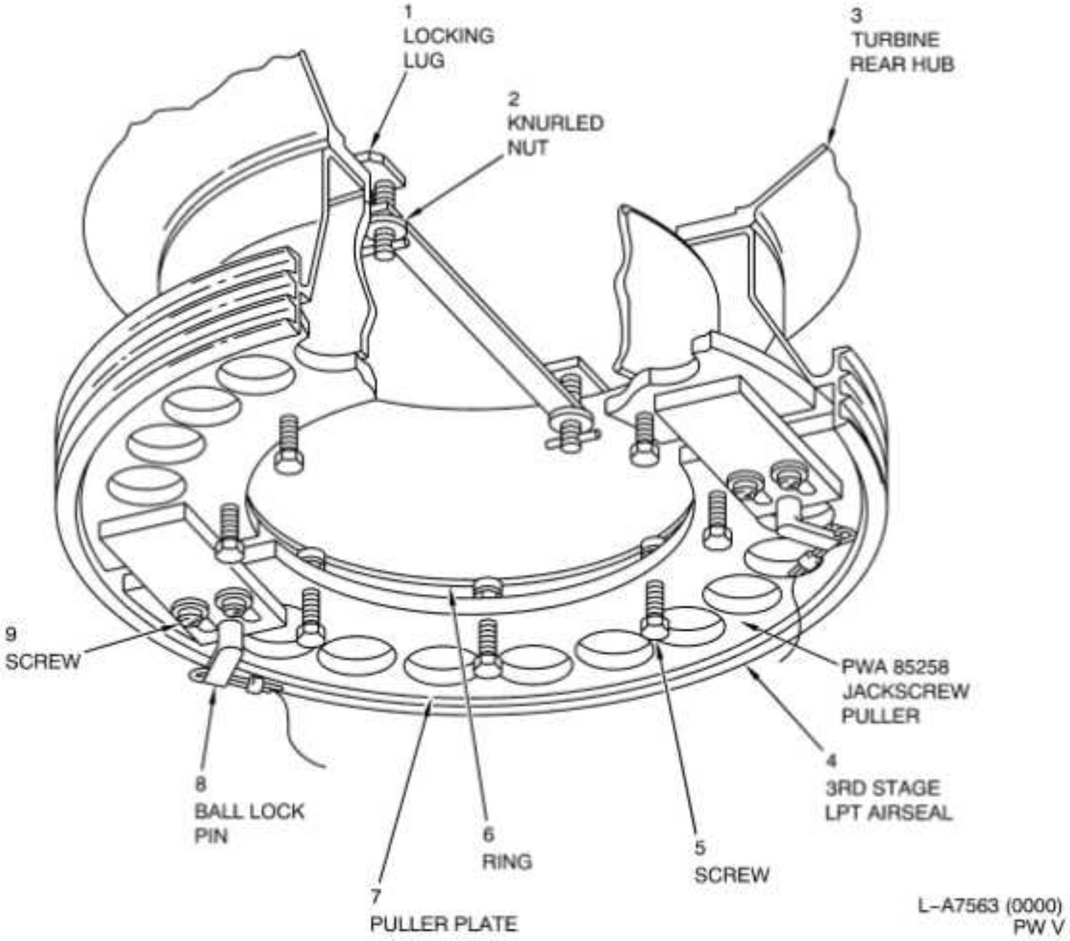
(c) Extend the puller plates (1004/7) outward to position the radius of the puller plates against the mating radius in the ID of the airseal. Reinstall the two ball lock pins (1004/8). Tighten four screws (1004/6) to secure the puller plates.

CAUTION: TIGHTEN THE SCREWS IN SMALL INCREMENTS IN A PATTERN SEQUENCE TO PREVENT DAMAGE TO THE NYLON PAD DETAILS OF THE SCREWS. IF THE SCREWS GO THROUGH THE DETAIL PADS, THEY WILL DAMAGE THE AIRSEAL.

(d) Tighten the screws (1004/5) in small increments in a pattern sequence to remove the airseal from the hub.

(e) Loosen the knurled nuts (1004/2) and rotate the locking lugs (1004/1) to face inward. Remove the ball lock pins, loosen screws (1004/9), and retract the puller plates. Remove the puller from the airseal.

(f) Remove the airseal from the turbine rear hub and place it in suitable protective container.


1
LOCKING
LUG
2
KNURLED
NUT
3
TURBINE
REAR HUB
9
SCREW
PWA 85258
JACKSCREW
PULLER
4
3RD STAGE
LPT AIRSEAL
8
BALL LOCK
PIN
6
RING
5
SCREW
7
PULLER PLATE
L−A7563 (0000)
PW V

Third Stage LPT Airseal Removal
Figure 1004
(Task 72−53−00−400−009)

(14) Remove 39 bolts that secure the Stage 3 (inner) sealing ring and damper assembly. See Figure 1005.

Subtask 72−53−00−430−075:

CAUTION: DO NOT REMOVE THE PREVIOUSLY INSTALLED NON−COLORED COUNTERWEIGHTS.

(15) Install colored (painted) counterweights as required to the 3rd stage airseal.

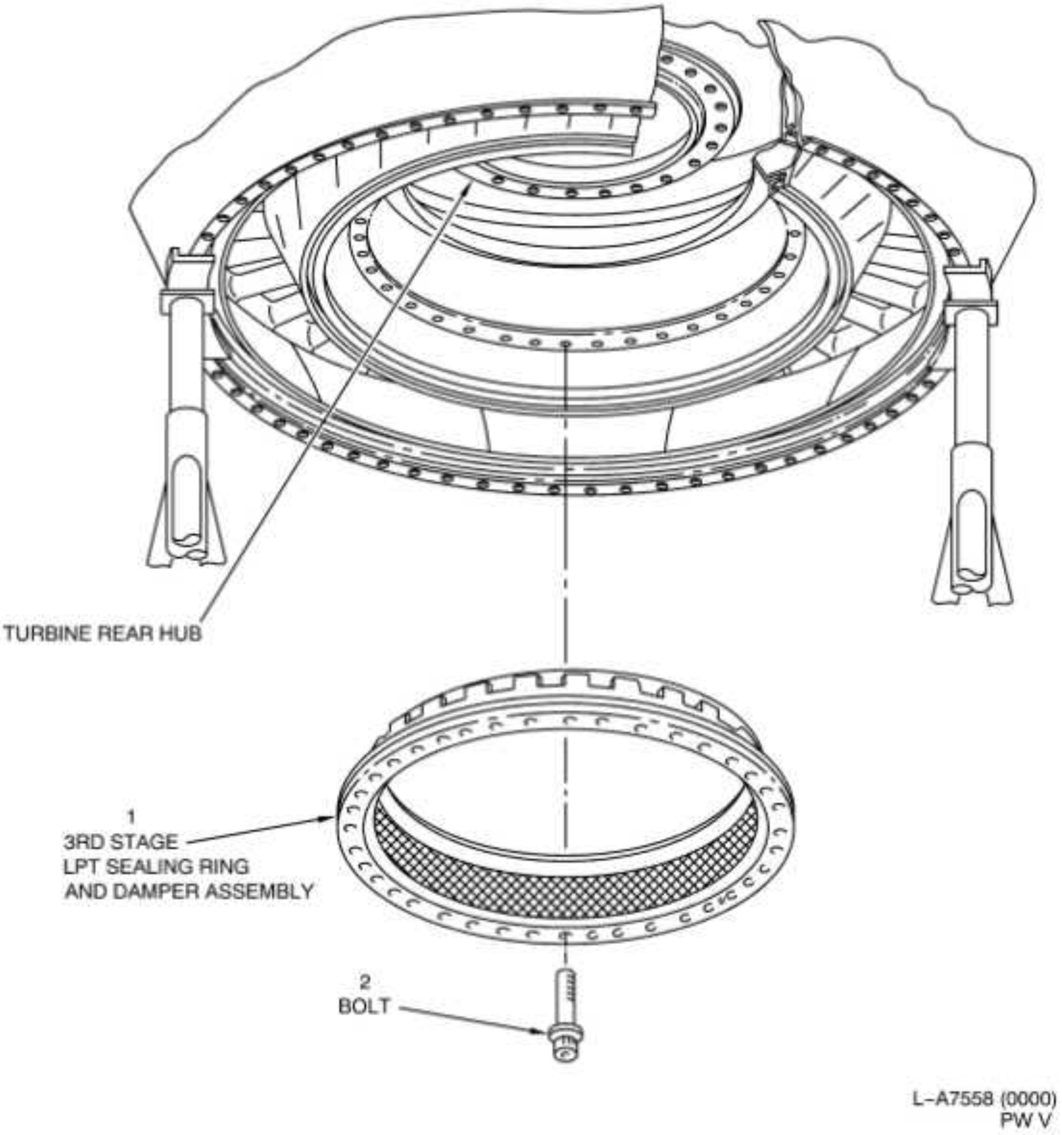
(a) Align the wax that was added to the airseal (behind the airseal) with a corresponding location on the airseal scalloped flange. Mark the location with a Pen (P05−045). Remove the beeswax from the airseal.

(b) Weigh the beeswax to determine the correct counterweight part number.

(c) Determine the weight of the counterweight as follows:

1 Multiply the weight of the wax by 0.40. The result is the total adjusted weight (plus the rivet if required) to be added to the scalloped flange of the 3rd stage airseal.

2 See Table 1001 to select the counterweight part number. Use the closest adjusted weight to obtain the counterweight part number.


TURBINE REAR HUB
1
3RD STAGE
LPT SEALING RING
AND DAMPER ASSEMBLY
2
BOLT
L−A7558 (0000)
PW V

Third Stage LPT Sealing Ring And Damper
Assembly Installation
Figure 1005
(Task 72−53−00−400−009)

Adjusted Weight oz. (mg)	Part Number	Class
.016 oz (454. mg)	50N409	1
.028 oz (794. mg)	50N409	2
.040 oz (1134. mg)	50N409	3
.155 oz (4394. mg)	50N407	1
.185 oz (5245. mg)	50N407	2
.214 oz (6067. mg)	50N407	3
.201 oz (5698. mg)	50N407	4
.387 oz (10971. mg)	50N408	1
.421 oz (11935. mg)	50N408	2
.455 oz (12899. mg)	50N408	3
.487 oz (13806. mg)	50N408	4
.521 oz (14770. mg)	50N408	5
.416 oz (11793. mg)	50N408	6

Counterweight Selection
Table 1001

(d) Install the applicable counterweight with rivets (heads rearward) to the correct rivet hole in the scalloped flange of the 3rd stage airseal. Use a PWA 85234 Riveter to flare the counterweight rivets to 0.125 inch (3.175 mm) minimum.

(16) Install the Stage 3 (inner) sealing ring assembly.

(a) Align the three larger holes in the ring with the mating pins and install the ring in the sealing ring damper. Secure with bolts lubricated with Engine Oil (P05-001).

(b) Tighten the bolts on each side of one of the three pins, then, loosen the bolts approximately 1/4 turn Repeat at the other two pin locations.

NOTE: Loosening the bolts at the pin locations will allow the ring assembly to seat at the other pin locations.

(c) Torque all of the bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(17) Reinstall the LPT module onto the turbine shaft. Refer to Subtask 72-53-00-430-064 in Assembly-07 (Task 72-53-00-400-007).

(18) Balance the low pressure turbine and shaft assembly again and correct the unbalance as necessary until the assembly is within the unbalance limits. Refer to Subtask 72-53-00-430-065 in Assembly-12 (Task 72-53-00-400-012).

LOW PRESSURE TURBINE (LPT) - ASSEMBLY-10

Task 72-53-00-400-010:

1. Balance Low Pressure Turbine Assembly Balance Arbor (PWA 85457)
   A. Prerequisites
      (1) See Inspection/Check-01 (Task 72-09-51-200-004) for balance arbor bearing inspection.
   B. Equipment And Materials Required

      Special Tools:
      PWA 8170-31 Housing
      PWA 21350-35 Bearing, Balance (Two Required)
      PWA 85457 Arbor, Balance
      PWA 85604 Drift, Seating
      PWA 85605 Drift, Seating
      PWA 85620 Pedestal, Support
      PWA 85625 Puller, Jackscrew

   C. Procedure
      See Figure 1001.

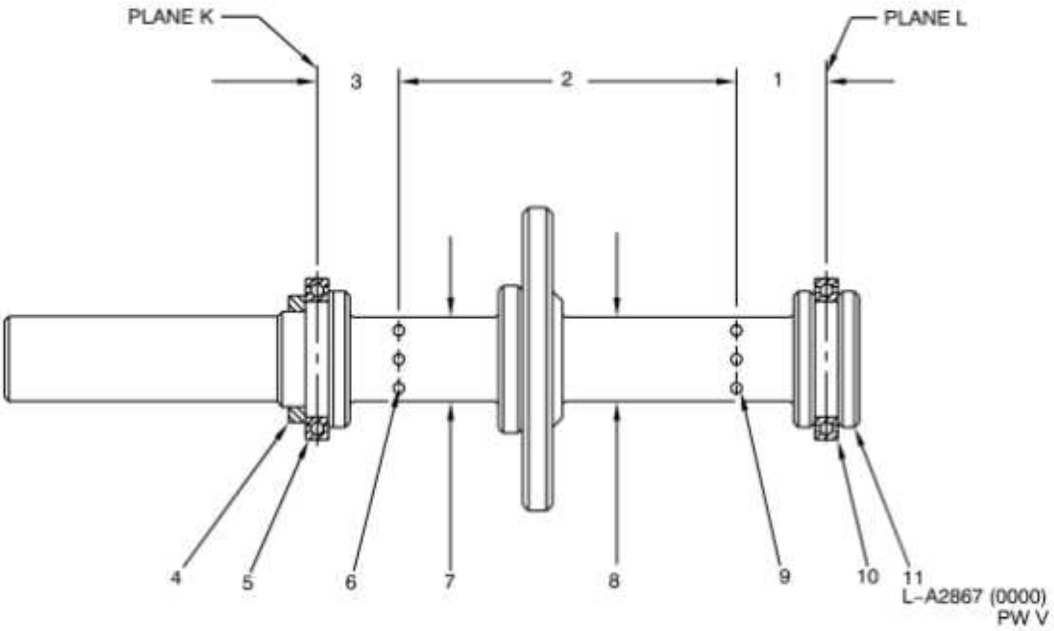
      NOTE: This procedure will result in a balance arbor that has been balanced to correct for its own unbalance.

      New balance arbor should be balanced prior to use.

      Balance arbor should be rebalanced after 20 units (or less, as experience indicates) to ensure correct balancing of subsequent turbine assemblies.

   Subtask 72-53-00-910-001:
      (1) Install PWA 21350-35 Balance Bearings onto PWA 85457 Balance Arbor.
         (a) With arbor positioned on PWA 85620 Stand, place two balance bearings (detail-17) into hot oil tank at 250°F (121°C) for 20 minutes.
         (b) Remove bearing from hot oil tank and using PWA 85604 Drift and mallet, seat front bearing on arbor. Drift to remain in position until temperature has normalized. Secure bearing.
         (c) Remove bearing from hot oil tank and using PWA 85605 Drift and mallet, seat rear bearing on arbor. Drift to remain in position until temperature has normalized. Secure bearing.
      (2) Install PWA 8170-31 Housing to balance machine and secure with plate and cap screws, at both cradles.
      (3) Install balance arbor (PWA 85457) with bearings onto adapters previously installed. Install end drive.
      (4) Dynamically balance arbor as follows:

LOW PRESSURE TURBINE (LPT) - ASSEMBLY-10


PLANE K
PLANE L
3
2
1
4
5
6
7
8
9
10
11
L-A2867 (0000)
PW V

LPT Balance Arbor - PWA 85457
Figure 1001
(Task 72-53-00-400-010)

LOW PRESSURE TURBINE (LPT) − ASSEMBLY−10

1. 4.64 Inch (117.856 mm) Reference
2. 14.75 Inch (374.650 mm) Reference
3. 4.05 Inch (102.870 mm) Reference
4. Front Bearing Retainer
5. Front Balance Bearing
6. Threaded Set Screw Holes For Adding Or Removing Weight For Balancing Arbor (Front Plane)
7. 4.56 Inch (115.824 mm) Diameter Reference
8. 4.75 Inch (120.650 mm) Diameter Reference
9. Threaded Set Screw Holes For Adding Or Removing Weight For Balancing Arbor (Rear Plane)
10. Rear Balance Bearing
11. Rear Bearing Retainer

Key To Figure 1001

(a) Calibrate balance arbor at 900 rpm to 0.040 oz−in. (29 g.mm) by adding or removing set screws as required at front and rear locations of arbor.

NOTE: Set screws must not protrude above arbor surface.

(5) Remove balance arbor from balancing machine.
(6) Using PWA 85625 Puller, remove front balance bearing from arbor, if necessary.
(7) Using PWA 85625 Puller, remove rear balance bearing from arbor, if necessary.

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-53-00-400-011:

1. Semi-Dynamic Balance Low Pressure Turbine With Shaft (Balance Procedure)

NOTE: This is an optional semi-dynamic balance procedure that is provided for use based on the operators experience to obtain an optimized low pressure turbine balance. This procedure is optional to the dynamic balance procedure specified in Assembly-07 Task 72-53-00-400-007.

A. Prerequisites

(1) Install the turbine shaft to the low turbine module. Refer to Assembly-07 Task 72-53-00-400-007.

B. Equipment And Materials Required

Special Tools:

PWA 25096	Stand (Optional To PWA 87330)
PWA 28657	Sling
PWA 76154	Adapter (2 Required)
PWA 76270	Stand (Optional To PWA 87330)
PWA 85211	Weight, Balance (Rear Plane)
PWA 85221	Adapter, Lift And Trunnion
PWA 85232	Fixture, Angle Of Turn
PWA 85456	Retainer
PWA 85562	Sleeve, Support (Used With PWA 25096 Or PWA 76270 Stand)
PWA 85687	Weight, Calibration (For Balance Machines Without Electronic Calibration)
PWA 85883	Puller, Bearing (Optional To PWA 87261)
PWA 86420	Puller, Jackscrew (No. 4 Balance Bearing)
PWA 87261	Puller, Bearing
PWA 87330	Stand, Storage
PWA 87347	Sleeve, Support (Used With PWA 87330 Stand)
PWA 87382	Pulley, Drive
PWA 87752	Stand, Build
PWA 101545	Adapter, Drive

LOW PRESSURE TURBINE (LPT) − ASSEMBLY−11

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−045	Marker, Pen (PMC 4092)
P05−222	Tape (PMC 4278−1)
P05−223	Tape (PMC 4251)
P05−395	Beeswax
P05−396	Paraffin Wax Blend

C. Procedure

NOTE: After you balance the LPT and shaft assembly, you can not disassemble it unless you balance it again.

Subtask 72−53−00−430−076:

(1) Use a hoist to connect a PWA 28657 Sling, with two PWA 76154 Adapters, to the trunnion spools of the rear balance fixture. Lift the assembly from the build stand.

(2) Install a PWA 85221 Adapter to the front end of the turbine shaft. Connect a hoist to the adapter.

(3) Use both hoists to trunnion the assembly to the horizontal position.

(4) Place the turbine assembly on pedestals of a horizontal balance machine. Remove the hoist, sling, and adapters from the rear balance fixture. Remove the hoist and adapter from the front of the turbine shaft. See Figure 1001.

(5) Attach the drive belt to the front end of the turbine shaft.

(6) Put wax in the front ID of the turbine shaft to "null" out the shaft unbalance at the front end of the shaft. See Figure 1001.

(a) Locate the shaft unbalance and amount on the shaft OD in the recess just forward of the splines. The angular location is marked by a diamond symbol. The weight in oz. is marked next to the diamond symbol.

(b) Pan weigh an amount of Beeswax P05−395 or Paraffin Wax Blend P05−396 equal to the amount specified on the shaft OD.

(c) Put the wax at the same angular location and as close as possible to the front ID of the turbine shaft, about 1/2 inch (12.700 mm) from the shaft end. See Figure 1001.

(d) Trace the location of the wax with a Marker P05−045.

NOTE: The location of the wax will be used to reinstall the wax in the same location if you need to re−balance the turbine following installation of counterweights.

(7) Locate the "O" mark at the front end of the turbine shaft. Install Tape P05−222, with a small square of Silver Tape P05−223, around the shaft front journal, with the silver tape aligned with the "O" mark. Position the (timing) strobe light over the tape.

(8) An optional method to turn the turbine shaft is to use PWA 101545 Drive Adapter.

(a) Install the PWA 101545 Drive Adapter on the end of the turbine shaft.

(b) Remove the two hex nuts that attach the threaded puck to the chuck of the drive adapter and remove the threaded puck. Remove the master and put it back into the container.

(c) Install the threaded puck to the internal threads of the shaft. Thread the puck in the shaft until the outer face of the puck is in line with the outer most thread in the shaft.

(d) Install the drive adapter on the end of the shaft and align the "0" on the OD of the chuck with the "0" line marked on the end of the shaft. This is the "0" reference for balancing. Align the two holes in the end face with the two studs in the threaded puck.

(e) Rotate the threaded puck as necessary to allow the studs to pass through the chuck. Push the drive adapter on the shaft to engage the spline on the shaft. Make sure the internal guide assembly touches the end face of the step in the end of the shaft.

(f) Attach the chuck to the threaded puck with the two hex nuts. Tighten the nuts.

NOTE: The two studs of the threaded puck must not be above the outer face of the chuck when the drive adapter is fully installed on the shaft.

(g) Attach the balance machine to the PWA 101545 Drive Adapter.

(9) One more optional method to turn the turbine shaft is to use PWA 101545 Drive Adapter with PWA 87382 Drive Pulley.

(a) Install the PWA 87382 Drive Pulley to the end face of the drive adapter and align the holes in the drive pulley with the threaded holes in the drive adapter.

(b) Attach the pulley to the drive adapter with the eight bolts. Tighten the bolts.

(c) Attach a drive belt to the OD of the drive pulley.

Subtask 72−53−00−430−077:

(10) Calibrate balance machine to pull 4.0 oz−in. (2880 g.mm).

(a) For balance machines without electronic calibration, do a check of the static balance machine.

1 Install a PWA 85687 Calibration Weight, to a tierod, as close as possible to the heavy angle on the rear plane. Do not put the calibration weight on a tierod that has a counterweight. The calibration weight produces 4 oz−in. (2880 g.mm) of force when installed on the tierod.

2 The angle should agree with the residual unbalance within ± 30 degrees. The amount should agree within ± 0.4 oz−in. (288. g.mm) with the residual unbalance amount plus the pull value of the calibration weight.

3 Remove the calibration weight.

(b) For balance machines with electronic calibration, use the manufacturer's instructions to do a check of the static balance machine.

(11) Semi−dynamic Balance LPT assembly at 900 rpm minimum. Use the front (Plane W) and rear (Plane X). Record the unbalance and direction. See Figure 1002.

(12) The initial unbalance must not exceed 25 oz−in. (18000 g.mm). If necessary, the turbine shaft and/or the Stage 3 LPT airseal can be removed and rotated with respect to the turbine rotor to obtain the initial unbalance limit. Refer to Assembly−09 Task 72−53−00−400−009 to remove and rotate the turbine shaft and/or airseal.

Subtask 72−53−00−430−078:

(13) If the initial unbalance is within 25.0 oz−in. (18000. g.mm), you can balance the assembly by adding counterweights to the rear plane only to obtain the requirement of 1.0 oz−in. (720. g.mm).

CAUTION: DO NOT REMOVE ANY OF THE INSTALLED LPT MODULE (NON−COLORED) COUNTERWEIGHTS THAT WERE INSTALLED IN ASSEMBLY−04 TASK 72−53−00−400−004.

(a) If necessary, correct the unbalance at the rear, Plane X, with temporary spin−on PWA 85211 Balance Weights (counterweights). Thread the counterweights onto the 6th stage LPT disk tierods. Do not remove the tierod nuts.

(b) Add up to four counterweights maximum within ± 20 degrees of the unbalance vector. Fine trim by replacement of any of the four temporary spin on counterweights.

(c) If the unbalance is within the limits of 1.0 oz−in. (720. g.mm) the assembly is acceptable.

1 Calibrate the balance machine. Refer to Subtask 72-53-00-430-079.

2 Remove the assembly from the balance machine. Refer to Subtask 72-53-00-430-080.

3 Remove the temporary spin on counterweights and install colored (painted) engine parts as required. Refer to Subtask 72-53-00-430-081.

4 Remove the balance tooling and put the assembly in the storage stand. Refer to Subtask 72-53-00-430-082.

(d) If the unbalance is not within the balance limit, you can rotate the shaft and/or Stage 3 LPT airseal with respect to the turbine rotor and repeat the preceding procedure. Refer to Assembly-09 Task 72-53-00-400-009 to remove and rotate the turbine shaft and/or airseal.

Subtask 72-53-00-430-079:

(14) Calibrate balance machine to pull 4.0 oz-in. (2880 g.mm).

(a) For balance machines without electronic calibration, do a check of the static balance machine.

1 Install a PWA 85687 Calibration Weight, to a tierod, as close as possible to the heavy angle on the rear plane. Do not put the calibration weight on a tierod that has a counterweight. The calibration weight produces 4 oz-in. (2880 g.mm) of force when installed on the tierod.

2 The angle should agree with the residual unbalance within ± 30 degrees. The amount should agree within ± 0.4 oz-in. (288. g.mm) with the residual unbalance amount plus the pull value of the calibration weight.

3 Remove the calibration weight.

(b) For balance machines with electronic calibration, use the manufacturer's instructions to do a check of the static balance machine.

Subtask 72−53−00−430−080:

(15) Disconnect the drive belt from the forward end of the turbine shaft.

(16) If the turbine module must be removed from the turbine shaft add the following reference marks:

(a) Use a Marker P05−045 to make an alignment reference line across the turbine shaft flange and the 3rd stage airseal.

(b) Use a Marker P05−045 to make an alignment reference line across the 5th stage hub and the adjacent turbine shaft.

(17) Use a hoist to connect a PWA 28657 Sling, with two PWA 76154 Adapters, to the trunnion spools on the rear balance fixture.

(18) If the turbine module must be removed from the turbine shaft, use a Pen P05−045 to mark the outline of the temporary wax at the front ID of the turbine shaft. Remove the wax and put it in a suitable container.

NOTE: The wax must be removed before you install the lifting adapter to the front end of the turbine shaft. The wax must be put back in the same location if the assembly is balanced again.

(19) Install a PWA 85221 Lifting Adapter on the front end of the turbine shaft. Connect a second hoist to the adapter.

(20) Use both hoists to lift and trunnion the turbine assembly to the vertical, front end down, position. Remove the lower hoist and adapter from the turbine shaft. Lower the assembly into the PWA 87752 Build Stand.

(21) Remove the screws that hold the rear balance fixture to the turbine case. Use the hoist to remove the fixture. Remove the hoist, sling, and adapters.

(22) Remove the screws that hold the PWA 29952 Retaining Plate to the rear of the turbine shaft. Remove the retaining plate.

(23) Remove the rear balance bearing and spacer.

(a) Engage the locator detail of PWA 86420 Puller into the rear of the turbine shaft.

(b) Engage the three jaws through the openings in the bearing spacer. Move the jaws into position so that they touch the inner race of the bearing. Lock the jaws in position with the detail ring.

(c) Turn the bolt in a clockwise direction to remove the bearing and spacer.

(d) Remove the puller.

(24) If counterweights are not required, put the turbine and shaft assembly in the storage stand. Refer to Subtask 72−53−00−430−082. If counterweights are required in the rear plane only, refer to Subtask 72−53−00−430−081.

Subtask 72−53−00−430−081:

(25) If necessary, remove PWA 85211 Counterweights and install engine counterweights.

(a) Remove the temporary spin−on counterweights from tierods. Remove the tierod nut and spacer from the temporary counterweight locations.

(b) Assemble the same class colored (painted) engine counterweight to the tierod at the temporary counterweight locations.

(c) Treat the threads of the tierod and washer face of the nut with Engine Oil P03−001. Install the counterweights and nuts.

(d) Install PWA 85232 Angle Of Turn Fixture onto the 6th stage LPT disk. Align the bushings (1003/4) with the tierod nuts and position the plate (1003/2), with the stamped markings up, over the disk. See Figure 1003.

(e) (Reference 1251, 1252, or 1253) Torque nuts at the counterweight locations. Use a 0.500 inch square drive torque wrench installed in the socket over the dial indicator.

1 Apply initial torque of 140 − 160 lb−in. (15.818 − 18.078 N.m) to each nut.

CAUTION: THE FOLLOWING TORQUING PROCEDURE MUST BE ACCOMPLISHED WITH MAXIMUM TEMPERATURE DIFFERENTIAL OF 40°F (22.2°C) BETWEEN MATING PARTS.

2 Loosen the nuts at the counterweight location.

3 Measure the torque necessary to turn the nut. If the measured torque is less than 50 lb−in. (5.469 N.m), then tighten to a torque of 45 lb−in. (5.084 N.m) plus or minus 5 lb−in. (0.565 N.m) and continue with the angle of turn.

4 If the measured torque is more than 50 lb−in. (5.649 N.m), find the torque necessary to turn the nut, add 15 lb−in. (1.695 N.m) plus or minus 5 lb−in. (0.565 N.m) to this torque. The total torque cannot be more than 100 lb−in. (11.298 N.m).

5 Apply the final angle of turn:

a (Reference 1251) (Pre SB PW4ENG 72−256) For engines with the 5th stage turbine hub PN 50N405, set the indicator dial (1003/7) to zero with the index mark (1003/5) on the fixture plate. Tighten the thumbscrew (1003/3) to set the indicator dial. Apply a 62 − 66 degree angle of turn.

NOTE: Use Reference 1251 for Phase−3 engines with CN after the engine SN (Post SB PW4ENG 72−572) that have 5th stage turbine hub PN 50N405.

b (Reference 1252) (Post SB PW4ENG 72−256) For engines with 5th stage turbine hub PN 50N505, set the indicator dial (1003/7) to zero, with the index mark (1003/5) on the fixture plate. Tighten the thumbscrew (1003/3) to set the indicator dial. Apply a 64 − 68 degree angle of turn.

NOTE: Use Reference 1252 for Phase−3 engines with CN after the engine SN (Post SB PW4ENG 72−572) that have 5th stage turbine hub PN 50N505.

c (Reference 1253) For engines with 5th stage turbine hub PN 51N305 and subsequent, set the indicator dial (1003/7) to zero, with the index mark (1003/5) on the fixture plate. Tighten the thumbscrew (1003/3) to set the indicator dial. Apply a 52 − 56 degree angle of turn.

NOTE: Use Reference 1253 for Phase−3 engines as built by P&W that have 5th stage turbine hub PN 51N305 and subsequent.

d Do this torque procedure, steps 1 through 5, again as applicable on all nuts at counterweight locations. Use the torque sequence numbers stamped on the fixture.

(f) Remove the angle of turn fixture.

(26) Balance the turbine and shaft assembly again, and correct the unbalance as necessary until the assembly is within the unbalance limits. Refer to (Subtask 72−53−00−430−076).

NOTE: If the unbalance limits can not be met, you can remove and replace the turbine shaft, or remove the turbine shaft and rotate it with respect to the turbine module. If you remove the turbine shaft, you must rebalance the LPT module and shaft assembly until the unbalance limits are met.

Subtask 72−53−00−430−082:

(27) Put the balanced turbine module with the shaft in the PWA 25096 Stand, PWA 76270 Stand or PWA 87330 Stand.

(a) Use a hoist to install a PWA 28657 Sling and two PWA 86206 Adapters to the rear retainer at the trunnion spools labeled "LPT WITH SHAFT".

(b) Remove the bolts that hold the front flange of the turbine case to the balance fixture.

(c) Install the PWA 85456 Retainer to the front flange of the turbine case. See Figure 1004.

1 Lift the assembly from the stand.

2 Align the center hole in the retainer with the dowel pin (case 6 o'clock position) in the turbine case. Use the four detail bolts (1004/2) and nuts (1004/1) to hold the retainer details to the front flange of the turbine case at the 6 and 12 o'clock locations.

3 Install two bolts (1004/3) to hold the retainer to the turbine shaft.

(d) Install PWA 85221 Adapter to the front end of the turbine shaft. Attach a second hoist to the eye.

(e) Lift the assembly from the stand and trunnion to the horizontal position.

(f) If they are not there, install PWA 85562 Support Sleeve into the shaft support cradles of PWA 25096 Stand, PWA 76270 Stand or PWA 87347 Support Sleeve into the shaft support cradles of PWA 87330 Stand. Put details−1 and −2 at the forward cradle and the details−3 and −4 at the rear cradle. Tighten the set screws to attach the sleeves to the cradles. See Figure 1005.

(g) Use the hoists to put the assembly in the stand.

(h) Slide the chocks at the rear of the stand inward to contact the case OD. Adjust the shaft position, as necessary, so that the front face of the rear, Flange P, rests against the rear face of the chock. Secure the shaft to the stand with the detail clamps.

NOTE: The chocks are used as safety device and do not support any portion of the assembly.

(i) Remove the hoist and adapter from the front end of the turbine shaft. Remove the hoist, sling, and adapters from the rear retainer.

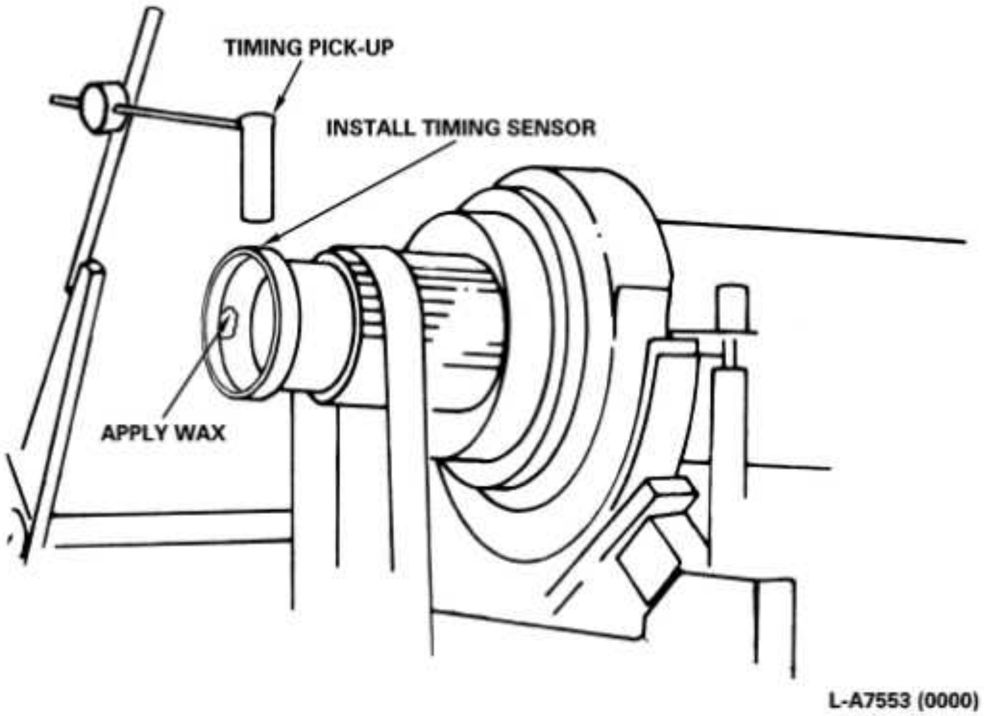
(28) Use a PWA 85883 Puller or PWA 87261 Puller to remove the front balance bearing.

(a) Engage the adapter assembly in the front end of the turbine shaft.

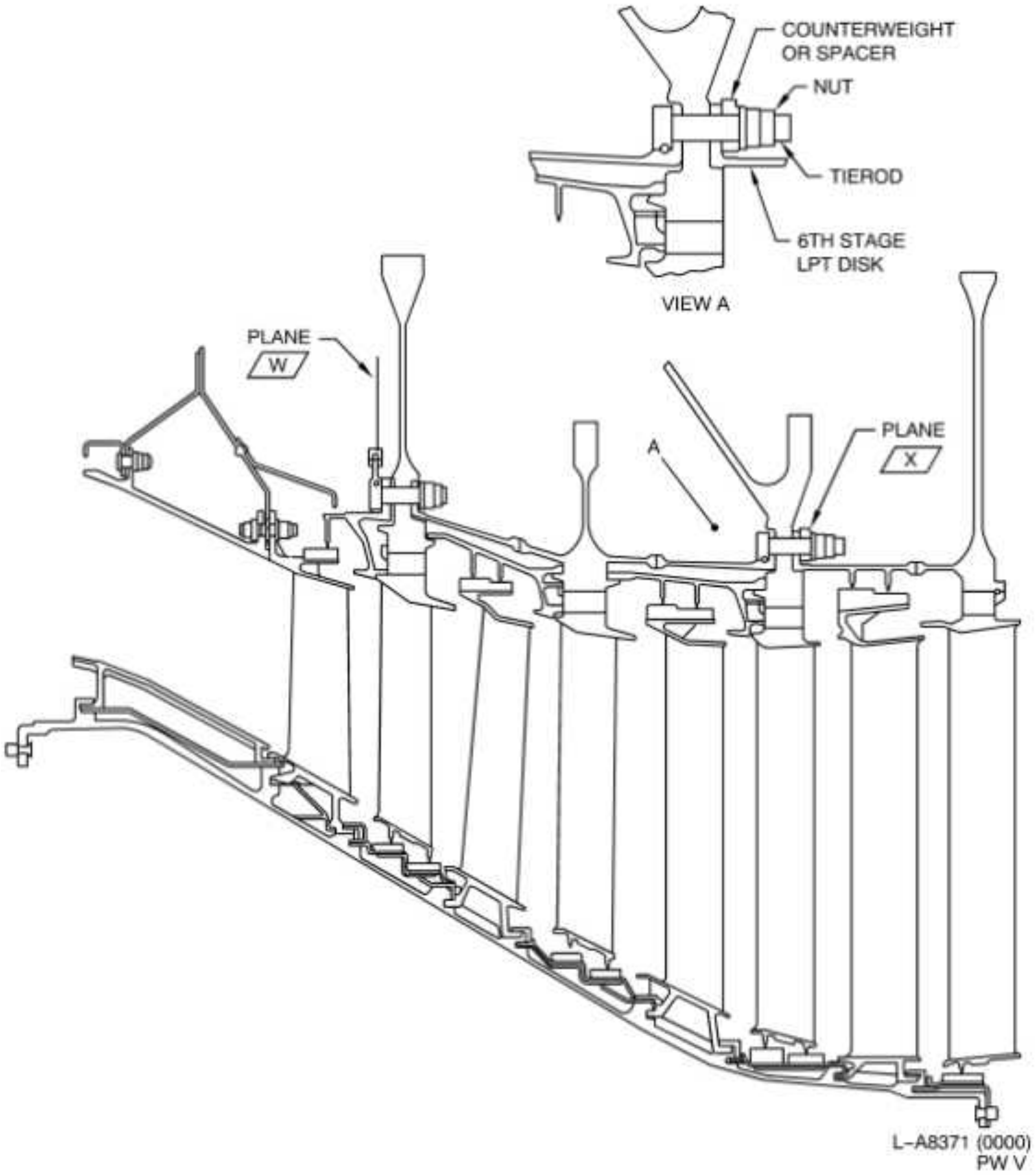
(b) Move the jaws into position so that they touch the inner race of the bearing.

(c) Lock the jaws in position with the detail ring.

(d) Turn the bolt in a clockwise direction to remove the bearing.

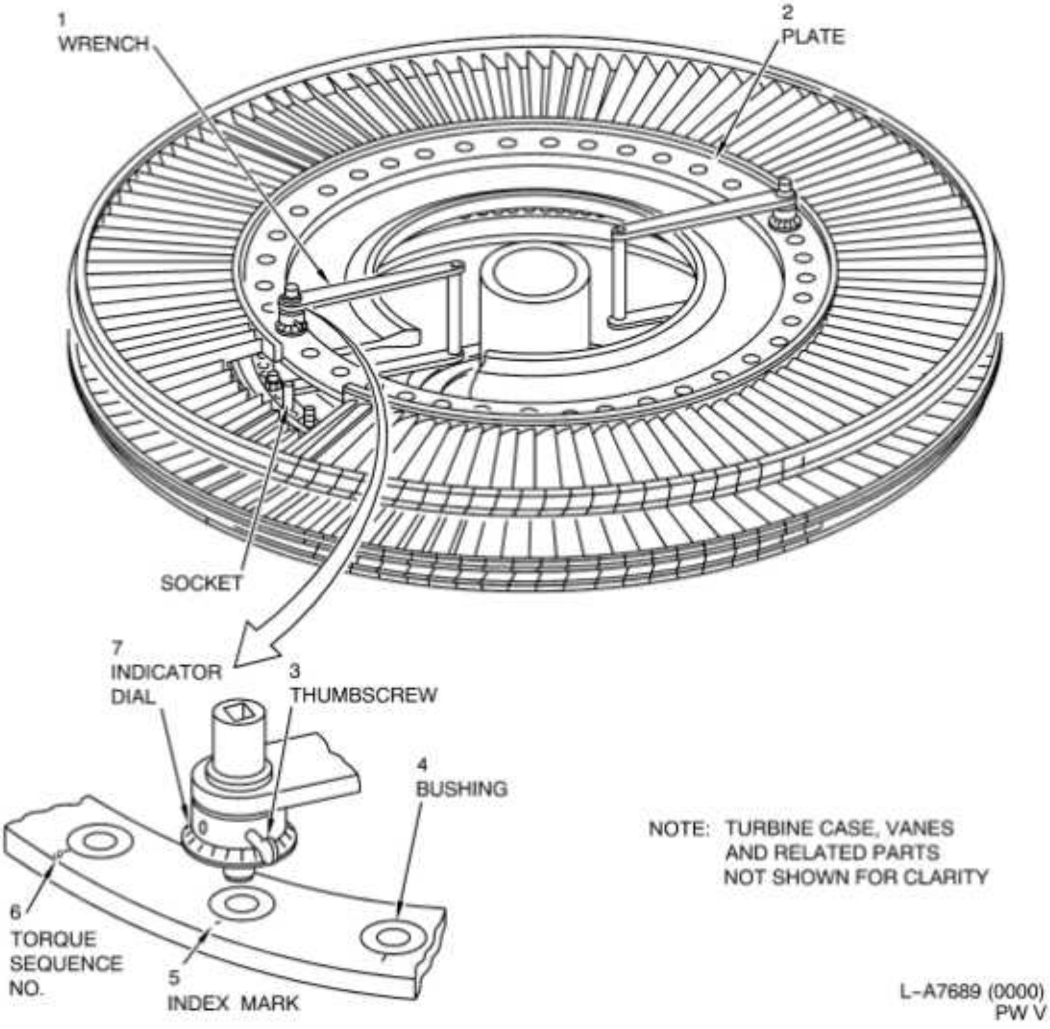

TIMING PICK-UP
INSTALL TIMING SENSOR
APPLY WAX
L-A7553 (0000)

Balance Machine Tooling
Figure 1001
(Task 72−53−00−400−011)


COUNTERWEIGHT OR SPACER
NUT
TIEROD
6TH STAGE LPT DISK
VIEW A
PLANE
W
A
PLANE
X
L−A8371 (0000)
PW V

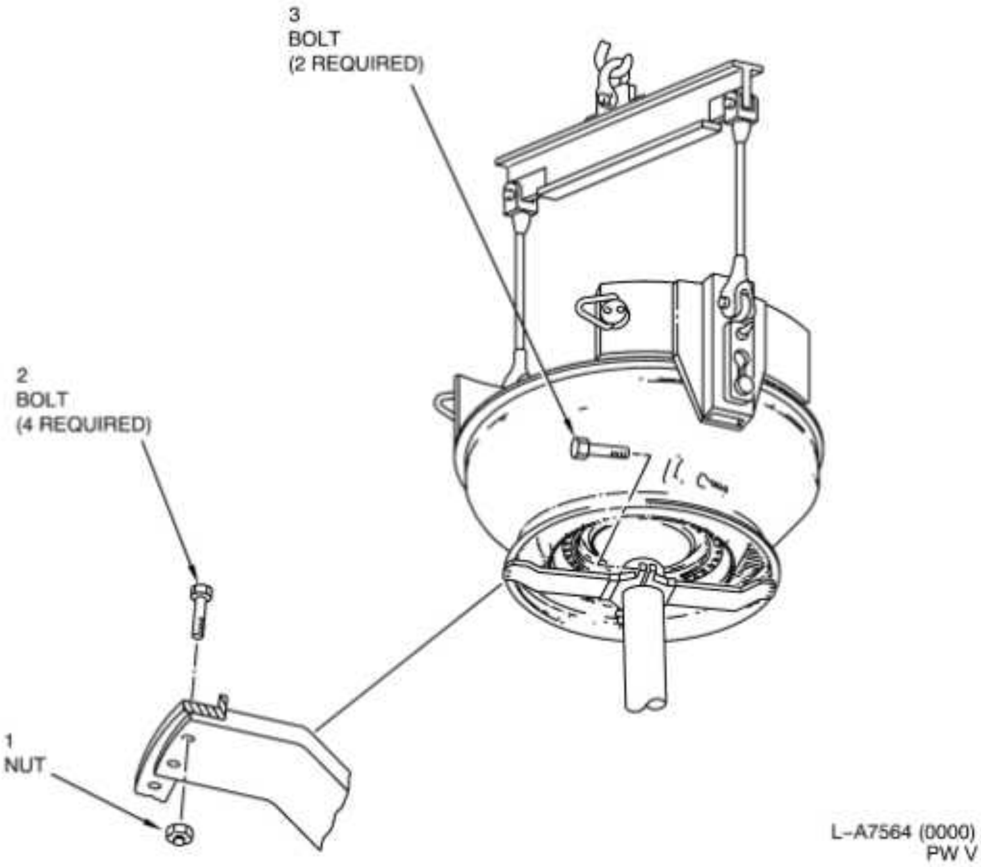
Low Pressure Turbine Balancing
Figure 1002
(Task 72−53−00−400−011)

LOW PRESSURE TURBINE (LPT) − ASSEMBLY−11

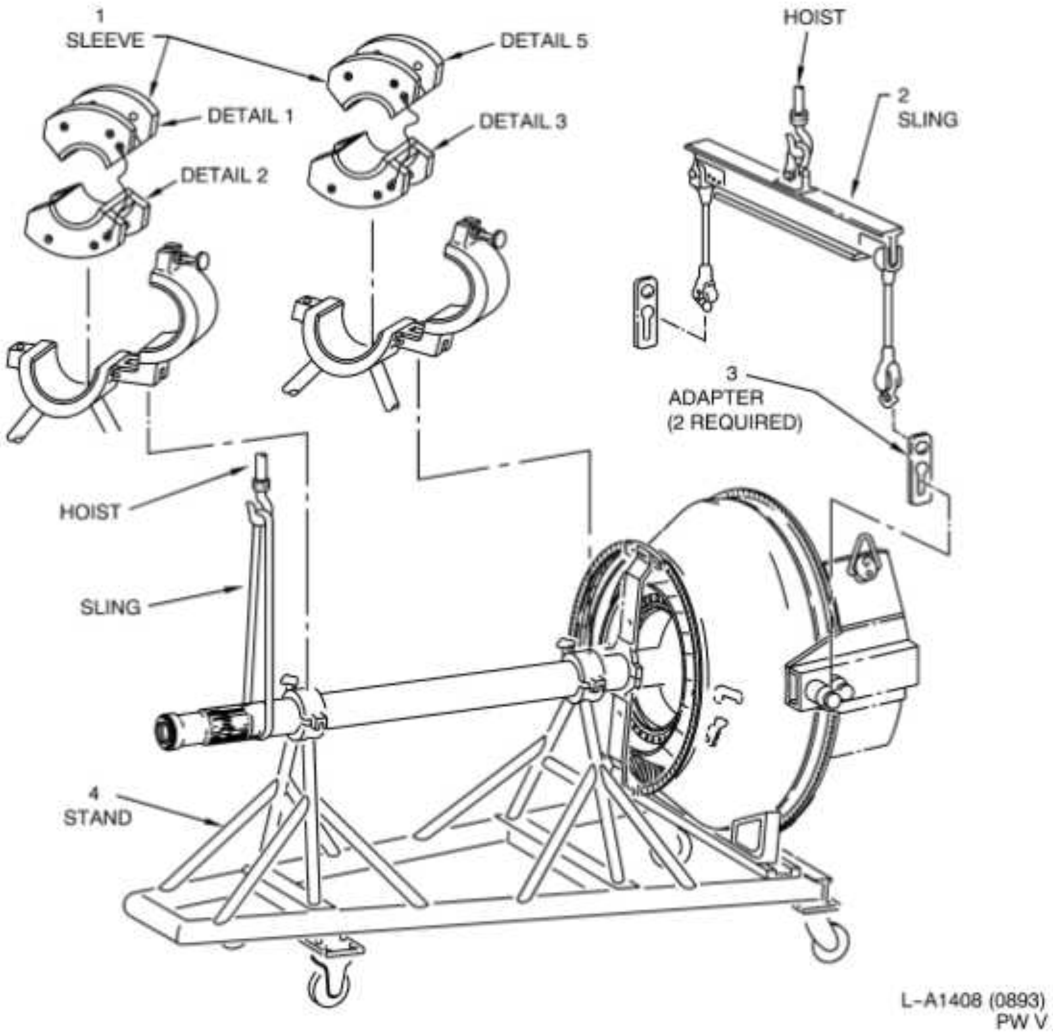

1
WRENCH
2
PLATE
SOCKET
7
INDICATOR
DIAL
3
THUMBSCREW
4
BUSHING
6
TORQUE
SEQUENCE
NO.
5
INDEX MARK
NOTE: TURBINE CASE, VANES
AND RELATED PARTS
NOT SHOWN FOR CLARITY
L-A7689 (0000)
PW V

PWA 85232 Angle Of Turn Fixture Installation
Figure 1003
(Task 72−53−00−400−011)

LOW PRESSURE TURBINE (LPT) − ASSEMBLY−11


3
BOLT
(2 REQUIRED)
2
BOLT
(4 REQUIRED)
1
NUT
L−A7564 (0000)
PW V

PWA 85456 Retainer Installation
Figure 1004
(Task 72−53−00−400−011)


1
SLEEVE
DETAIL 5
DETAIL 1
DETAIL 3
DETAIL 2
HOIST
2
SLING
3
ADAPTER
(2 REQUIRED)
HOIST
SLING
4
STAND
L-A1408 (0893)
PW V

1. PWA 85562 Sleeve (Used With PWA 25096 Or PWA 76270 Stand) Or PWA 87347 Sleeve (Used With PWA 87330 Stand)
2. PWA 28657 Sling
3. PWA 76154 Adapter, Two Required
4. PWA 25096, PWA 76270 Or PWA 87330 Stand

Installation Of Low Pressure Turbine In Stand
Figure 1005
(Task 72−53−00−400−011)

Previous Pageblock   Return to Previous Menu   Next Pageblock

Task 72-53-00-400-012:

1. Dynamic Balance The Low Pressure Turbine With Shaft (Balance Procedure)

NOTE: This is a dynamic balance procedure that is provided for use based on the operators experience to obtain an optimized low pressure turbine balance. This procedure can be done in place of the Assembly-03 Task 72-53-00-400-003 balance of the low pressure turbine. If this procedure is not done, Assembly-03 Task 72-53-00-400-003 must be done.

NOTE: It is necessary to have a stage 3 LPT rotating airseal, with a balancing counterweight flange, installed in the module to do this balance procedure.

A. Prerequisites

(1) Install the turbine shaft to the low turbine module. Refer to Assembly-07 Task 72-53-00-400-007.

B. Equipment And Materials Necessary

Special Tools:

PWA 25096	Stand, Storage (Optional To PWA 87330)
PWA 25527	Stand, Storage (Optional To PWA 87330 For Moving The Turbine With The Balance Fixture Installed)
PWA 28375	Riveter
PWA 28657	Sling
PWA 76154	Adapter (2 Required)
PWA 76270	Stand (Optional To PWA 87330)
PWA 76855	Pump, Hydraulic
PWA 85211	Weight, Balance (Rear Plane)
PWA 85221	Adapter, Lift And Trunnion
PWA 85232	Fixture, Angle Of Turn
PWA 85456	Retainer
PWA 85562	Sleeve, Support (Used With PWA 25096 Or PWA 76270 Stand)
PWA 85687	Weight, Calibration (Rear) (Check Weight)
PWA 85883	Puller,Bearing (Optional To PWA 87261)
PWA 86420	Puller, Jackscrew (No. 4 Balance Bearing)
PWA 86302	Bender, Hydraulic
PWA 86549	Ring, Adapter
PWA 86622	Weight, Calibration (Front) (Check Weight)
PWA 87261	Puller, Bearing

Special Tools:

(CONTINUED)

PWA 87330	Stand, Storage/Transport
PWA 87346	Post, Support
PWA 87347	Sleeve, Support (Used With PWA 87330 Stand)
PWA 87382	Pulley, Drive
PWA 87752	Stand, Build
PWA 101545	Adapter, Drive

Consumable Materials:

Item No.	Designation
P03−001	Oil, Engine (PWA 521B)
P05−045	Marker, Pen (PMC 4092)
P05−222	Tape (PMC 4278−1)
P05−223	Tape (PMC 4251)
P05−395	Beeswax
P05−396	Paraffin Wax Blend

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Counterweight	0 − 6	72−53−00/3/590
Counterweight	0 − 6	72−53−00/3/600
Counterweight	0 − 6	72−53−00/3/610
Rivet	0 − 6	72−53−00/3/620
Counterweight	0 − 10	72−53−00/6/100
Counterweight	0 − 4	72−53−00/6/110

C. Procedure

NOTE: After you balance the LPT and shaft assembly, you can not disassemble it unless you balance it again.

Subtask 72−53−00−430−083:

(1) Use a hoist to connect a PWA 28657 Sling, with two PWA 76154 Adapters, to the trunnion spools of the rear balance fixture. Lift the assembly from the build stand.

(2) Install a PWA 85221 Adapter to the front end of the turbine shaft. Connect a hoist to the adapter.

(3) Use both hoists to trunnion the assembly to the horizontal position.

(4) If necessary, you can move the turbine with PWA 87330 Stand.

NOTE: See the following step to move the the turbine with the PWA 25527 Stand.

(a) Use the detail ball lock pins to attach PWA 87346 Support Post to the longer end of the PWA 87330 Stand.

(b) Put the turbine assembly over the stand, and align the shaft and rear balance fixture rear diameter with the mating stand and post cradles.

(c) Lower the turbine assembly onto the stand and support post. Close the clamps, and tighten the hand knobs.

(d) Remove the hoists, slings, and adapters.

(5) If necessary, you can move the turbine with PWA 25527 Stand.

(a) Put the turbine assembly over the stand.

(b) Install PWA 86416 Adapter Ring on the front balance fixture, with the two bolts, so that the ring touches the cradle on the stand.

(c) Lower the turbine assembly onto the stand. Remove the hoists, slings, and adapters.

(6) If necessary, remove the assembly from the stand. Use a hoist to connect a PWA 28657 Sling, with two PWA 76154 Adapters, to the trunnion spools of the rear balance fixture; and connect a hoist to the adapter at the front end of the turbine shaft.

(7) Place the turbine assembly on pedestals of a horizontal balance machine. Remove the hoist, sling, and adapters from the rear balance fixture. Remove the hoist and adapter from the front of the turbine shaft.

(8) Attach the drive belt to the front end of the turbine shaft. See Figure 1001.

(9) Put wax in the front ID of the turbine shaft to "null" out the shaft unbalance at the front end of the shaft. See Figure 1001.

(a) Locate the shaft unbalance and amount on the shaft OD in the recess just forward of the splines. The angular location is marked by a symbol (the Letter L within a circle). The weight in oz. is marked next to this symbol.

(b) Pan weigh an amount of Beeswax P05−395 or Paraffin Wax Blend P05−396 equal to the amount specified on the shaft OD.

(c) Put the wax at the same angular location and as close as possible to the front ID of the turbine shaft, about 1/2 inch (12.700 mm) from the shaft end as shown in the referenced figure.

(d) Trace the location of the wax with a Marker P05−045.

NOTE: The location of the wax will be used to reinstall the wax in the same location if you need to rebalance the turbine following installation of counterweights.

(10) Locate the "O" mark at the front end of the turbine shaft. Install Tape P05−222 around the shaft front journal. Install a small square of Silver Tape P05−223 on the Tape P05−222 aligned with the "O" mark at the front end of the turbine shaft. Position the (timing) strobe light over the silver tape.

(11) An optional method to turn the turbine shaft is to use PWA 101545 Drive Adapter.

(a) Install the PWA 101545 Drive Adapter on the end of the turbine shaft.

(b) Remove the two hex nuts that attach the threaded puck to the chuck of the drive adapter and remove the threaded puck. Remove the master and put it back into the container.

(c) Install the threaded puck to the internal threads of the shaft. Thread the puck in the shaft until the outer face of the puck is in line with the outer most thread in the shaft.

(d) Install the drive adapter on the end of the shaft and align the "0" on the OD of the chuck with the "0" line marked on the end of the shaft. This is the "0" reference for balancing. Align the two holes in the end face with the two studs in the threaded puck.

(e) Rotate the threaded puck as necessary to allow the studs to pass through the chuck. Push the drive adapter on the shaft to engage the spline on the shaft. Make sure the internal guide assembly touches the end face of the step in the end of the shaft.

(f) Attach the chuck to the threaded puck with the two hex nuts. Tighten the nuts.

NOTE: The two studs of the threaded puck must not be above the outer face of the chuck when the drive adapter is fully installed on the shaft.

(g) Attach the balance machine to the PWA 101545 Drive Adapter.

(12) One more optional method to turn the turbine shaft is to use PWA 101545 Drive Adapter with PWA 87382 Drive Pulley.

(a) Install the PWA 87382 Drive Pulley to the end face of the drive adapter and align the holes in the drive pulley with the threaded holes in the drive adapter.

(b) Attach the pulley to the drive adapter with the eight bolts. Tighten the bolts.

(c) Attach a drive belt to the OD of the drive pulley.

Subtask 72−53−00−430−084:

(13) Operate the dynamic balance machine.

(a) Find the dynamic unbalance of the low pressure turbine and shaft assembly while it turns at 900 rpm minimum.

(b) Get three unbalance readings. For balance machines that do not have an automatic recording feature, record the average angle and the average amount of unbalance.

(14) Remove the PWA 101545 Drive Adapter and the PWA 87382 Drive Pulley from the shaft as follows:

(a) Make a reference mark on the drive adapter, the drive pulley and the shaft with a Marker P05−045 to identify the original location.

(b) Remove the drive belt from the OD of the drive pulley. Remove the bolts that attach the drive pulley to the drive adapter.

(c) Remove the two nuts that attach the chuck of the drive adapter to the threaded puck. Remove the chuck, turn it 180 degrees from the original location and install it on the shaft. Attach the chuck to the threaded puck with the two nuts.

(d) Install the drive pulley 180 degrees from the original location, align the bolt holes and attach with the eight detail bolts. Tighten the bolts.

(e) Attach a drive belt to the OD of the PWA 87382 Drive Pulley.

(15) Dynamic balance the low pressure turbine and shaft assembly. See Figure 1002 and Figure 1004.

(a) Find the dynamic unbalance of the low pressure turbine and shaft assembly while the assembly turns at 900 rpm minimum.

(b) The initial unbalance must not exceed 25.0 oz−in. (18000.0 g.mm) in Plane AS and 25.0 oz−in. (18000.0 g.mm) in Plane AT, OR must not be more than 12.5 oz−in. (9000.0 g.mm) in Plane AS and 12.5 oz−in. (9000.0 g.mm) in Plane AT if the unbalance vectors are within 30 degrees of each other.

(c) If necessary, to get the initial balance requirements, the turbine shaft and the Stage 3 LPT airseal can be rotated in 90 degree increments until you get the initial unbalance requirements. Refer to Assembly−09 Task 72−53−00−400−009 to remove and rotate the turbine shaft and/or airseal.

(d) For balance machines that have an automatic recording feature, get three unbalance readings. Average the readings. Use the machine to determine the unbalance amount and angle of the assembly.

(e) For balance machines that do not have an automatic recording feature, get three unbalance readings. Average and record the three unbalance readings. Use the average readings from the first and second balance runs to do a polar plot to get the assembly unbalance angle and amount.

(16) Balance the assembly to get a remaining unbalance of 1.0 oz−in. (720.0 g.mm) maximum in the front, Plane AS, and the rear, Plane AT.

(a) Residual unbalance must not be more than 1.0 oz−in. (720.0 g.mm) maximum in the front, Plane AS.

NOTE: If applicable, the counterweights installed during the optional balance procedure for the low pressure turbine assembly per 72−53−00, Assembly−03 Task 72−53−00−400−004 ARE NOT to be removed.

1 Correct the residual unbalance in the front plane, Plane AS, by adding any combination of counterweights up to a maximum of six in ± 45 degrees of the unbalance vector.

2 Install the counterweights and rivets to the rivet holes in the 3rd stage airseal flange and hold in position with Pressure Sensitive Sealing Tape P05−323.

(b) Residual unbalance must not be more than 1.0 oz−in. (720.0 g.mm) maximum in the rear, Plane AT.

NOTE: If applicable, the counterweights installed during the optional balance procedure for the low pressure turbine assembly per 72−53−00, Assembly−03 Task 72−53−00−400−004 ARE NOT to be removed.

1 Correct the residual unbalance in the rear plane, Plane AT, by adding any class of the PWA 85211 Balance Weight (1002/4) up to a maximum of four in ± 20 degrees of the unbalance vector.

2 Install the balance weights (1002/4) to the tierods (1002/3) that attach the 6th stage disk.

NOTE: Do not remove the tierod nuts (1002/2).

Subtask 72−53−00−430−085:

(17) If necessary, trim balance clip on counterweights can be added to the 6th stage blade tips to fine trim the residual unbalance of 1.0 oz−in. (720.0 g.mm) maximum in the rear plane.

NOTE: Trim balance clip−on counterweights pull approximately 4.3 oz−in. (3096 g.mm). Clip on counterweights do not have a significant affect on the balance on the front plane.

(a) If necessary, correct by adding up to a maximum of ten PN 50N401 balance correction weights (clip−on), OR up to a maximum of four PN 50N411 balance correction weights (clip−on), at the outer end of the 6th stage LPT blades (1002/5). The total trim balance weights must not be more than 10 weights maximum.

(b) If applicable, position clip−on counterweight to the flat outboard end of the 6th stage blade. Engage the leg of the counterweight with the leading edge of the blade. See Figure 1003.

CAUTION: THE LEG OF THE COUNTERWEIGHT MUST BE ENGAGED WITH THE LEADING EDGE OF THE BLADE WHEN YOU BEND THE LOCKING FLAP.

(c) If necessary, use PWA 76855 Hydraulic Pump with PWA 86302 Bender to attach the clip−on counterweight. Position the bender tool to the counterweight and apply slight pressure, pulling toward the operator to hold the weight in position. Bend the locking flap to hold the counterweight in position.

(18) Record the angle and the amount of assembly unbalance in the front and rear planes.

Subtask 72−53−00−430−087:

(19) Optional process based on the experience of the operator, do a check of the dynamic balance machine as follows:

(a) Install the front plane PWA 86622 Calibration Weight (Check Weight) to the rivet hole in the 3rd stage airseal flange as close as possible to the heavy angle.

NOTE: Do not install a check weight at a location where a counterweight is installed.

(b) Turn the dynamic balance machine at 900 rpm minimum. Check the machine, with the check weight installed in the front plane.

1 The check weight on the front plane pulls 4.0 oz−in. (2880.0 g.mm).

2 Read the angle and the amount of assembly unbalance in the front plane.

3 The amount of unbalance in the front plane should agree in ± 0.4 oz−in. (288.0 g.mm) or less with the amount recorded when the assembly was balanced.

4 Remove the check weight from the front plane.

(c) Install the rear plane PWA 85687 Calibration Weight (Check Weight) to a tierod, as close as possible to the heavy angle, that attaches the 6th stage disk. Do not remove the tierod nut.

(d) Turn the dynamic balance machine at 900 rpm minimum. Check the machine, with the check weight installed in the rear plane.

1 The check weight on the rear plane pulls 4.0 oz−in. (2880.0 g.mm).

2 Read the angle and the amount of assembly unbalance in the rear plane.

3 The amount of unbalance in the rear plane should agree in ± 0.4 oz−in. (288.0 g.mm) or less with the amount recorded when the assembly was balanced.

4 Remove the check weight from the rear plane.

(e) For balance machines with electronic calibration, use the manufacturer's instructions to do a check of the dynamic balance machine.

Subtask 72−53−00−430−088:

(20) Disconnect the drive belt from the forward end of the turbine shaft.

(21) Use a hoist to connect a PWA 28657 Sling, with two PWA 76154 Adapters, to the trunnion spools on the rear balance fixture.

(22) Install a PWA 85221 Lifting Adapter on the front end of the turbine shaft. Connect a second hoist to the adapter.

(23) Use both hoists to lift and trunnion the turbine assembly to the vertical, front end down, position. Remove the lower hoist and adapter from the turbine shaft. Lower the assembly into the PWA 87752 Build Stand.

(24) Remove the screws that hold the rear balance fixture to the turbine case. Use the hoist to remove the fixture. Remove the hoist, sling, and adapters.

(25) Remove the screws that hold the PWA 29952 Retaining Plate to the rear of the turbine shaft. Remove the retaining plate.

(26) Remove the rear balance bearing and spacer.

  (a) Engage the locator detail of PWA 86420 Puller into the rear of the turbine shaft.

  (b) Engage the three jaws through the openings in the bearing spacer. Move the jaws into position so that they touch the inner race of the bearing. Lock the jaws in position with the detail ring.

  (c) Turn the bolt in a clockwise direction to remove the bearing and spacer.

  (d) Remove the puller.

(27) If rear plane counterweights are not required, put the turbine and shaft assembly in the storage stand. Refer to Subtask 72−53−00−430−090. If counterweights are required, procede as follows:

  (a) If counterweights are required in the front, Plane AS, they will be installed after the turbine is put on the storage stand. Refer to Subtask 72−53−00−430−091.

  (b) If counterweights are required in the rear, Plane X, refer to Subtask 72−53−00−430−089.

Subtask 72−53−00−430−089:

(28) If necessary, remove PWA 85211 Counterweights and install engine counterweights.

  (a) Remove the temporary spin−on counterweights from tierods. Remove the tierod nut and spacer from the temporary counterweight locations.

  (b) Assemble the same class colored (painted) engine counterweight to the tierod at the temporary counterweight locations.

  (c) Treat the threads of the tierod and washer face of the nut with Engine Oil P03−001. Install the counterweights and nuts.

(d) Install PWA 85232 Angle Of Turn Fixture onto the 6th stage LPT disk. Align the bushings (1005/4) with the tierod nuts and position the plate (1005/2), with the stamped markings up, over the disk. See Figure 1005.

(e) (Reference 1251, 1252, or 1253) Torque nuts at the counterweight locations. Use a 0.500 inch square drive torque wrench installed in the socket over the dial indicator.

1 Apply initial torque of 140 - 160 lb-in. (15.818 - 18.078 N.m) to each nut.

CAUTION: THE FOLLOWING TORQUING PROCEDURE MUST BE ACCOMPLISHED WITH MAXIMUM TEMPERATURE DIFFERENTIAL OF 40°F (22.2°C) BETWEEN MATING PARTS.

2 Loosen the nuts at the counterweight location.

3 Measure the torque necessary to turn the nut. If the measured torque is less than 50 lb-in. (5.469 N.m), then tighten to a torque of 45 lb-in. (5.084 N.m) plus or minus 5 lb-in. (0.565 N.m) and continue with the angle of turn.

4 If the measured torque is more than 50 lb-in. (5.649 N.m), find the torque necessary to turn the nut, add 15 lb-in. (1.695 N.m) plus or minus 5 lb-in. (0.565 N.m) to this torque. The total torque cannot be more than 100 lb-in. (11.298 N.m).

5 Apply the final angle of turn:

a (Reference 1251) (Pre SB PW4ENG 72-256) For engines with the 5th stage turbine hub PN 50N405, set the indicator dial (1005/7) to zero with the index mark (1005/5) on the fixture plate. Tighten the thumbscrew (1005/3) to set the indicator dial. Apply a 62 - 66 degree angle of turn.

NOTE: Use Reference 1251 for Phase -3 engines with CN after the engine SN (Post SB PW4ENG 72-504) that have 5th stage turbine hub PN 50N405.

b (Reference 1252) (Post SB PW4ENG 72-256) For engines with 5th stage turbine hub PN 50N505, set the indicator dial (1005/7) to zero, with with the index mark (1005/5) on the fixture plate. Tighten the thumbscrew (1005/3) to set the indicator dial. Apply a 64 - 68 degree angle of turn.

NOTE: Use Reference 1252 for Phase -3 engines with CN after the engine SN (Post SB PW4ENG 72-504) that have 5th stage turbine hub PN 50N505.

c (Reference 1253) For engines with 5th stage turbine hub PN 51N305 and subsequent, set the indicator dial (1005/7) to zero, with the index mark (1005/5) on the fixture plate. Tighten the thumbscrew (1005/3) to set the indicator dial. Apply a 52 - 56 degree angle of turn.

NOTE: Use Reference 1253 for Phase -3 engines as built by P&W that have 5th stage turbine hub PN 51N305 and subsequent.

6 Do this torque procedure, steps 1 through 5, again as applicable on all nuts at counterweight locations. Use the torque sequence numbers stamped on the fixture.

(f) Remove the angle of turn fixture.

Subtask 72-53-00-430-090:

(29) Put the balanced turbine module with the shaft in the PWA 25096 Stand, PWA 76270 Stand or PWA 87330 Stand.

(a) Use a hoist to install a PWA 28657 Sling and two PWA 86206 Adapters to the rear retainer at the trunnion spools labeled "LPT WITH SHAFT".

(b) Remove the bolts that hold the front flange of the turbine case to the balance fixture.

(c) Install the PWA 85456 Retainer to the front flange of the turbine case. See Figure 1006.

1 Lift the assembly from the stand.

2 Align the center hole in the retainer with the dowel pin (case 6 o'clock position) in the turbine case. Use the four detail bolts (1006/2) and nuts (1006/1) to hold the retainer details to the front flange of the turbine case at the 6 and 12 o'clock locations.

3 Install two bolts (1006/3) to hold the retainer to the turbine shaft.

(d) Install PWA 85221 Adapter to the front end of the turbine shaft. Attach a second hoist to the eye.

(e) Lift the assembly from the stand and trunnion to the horizontal position.

(f) If they are not there, install PWA 85562 Support Sleeve into the shaft support cradles of PWA 25096 Stand, PWA 76270 Stand or PWA 87347 Support Sleeve into the shaft support cradles of PWA 87330 Stand. Put details−1 and −2 at the forward cradle and the details−3 and −4 at the rear cradle. Tighten the set screws to attach the sleeves to the cradles. See Figure 1007.

(g) Use the hoists to put the assembly in the stand.

(h) Slide the chocks at the rear of the stand inward to contact the case OD. Adjust the shaft position, as necessary, so that the front face of the rear, Flange P, rests against the rear face of the chock. Secure the shaft to the stand with the detail clamps.

NOTE: The chocks are used as safety devices and do not support any portion of the assembly.

(i) Remove the hoist and adapter from the front end of the turbine shaft. Remove the hoist, sling, and adapters from the rear retainer.

R (j) Remove the tape or wax to that was used cancel
R out the shaft unbalance at the front ID of the
R shaft.

(30) Use a PWA 85883 or PWA 87261 Puller to remove the front balance bearing.

(a) Engage the adapter assembly in the front end of the turbine shaft.

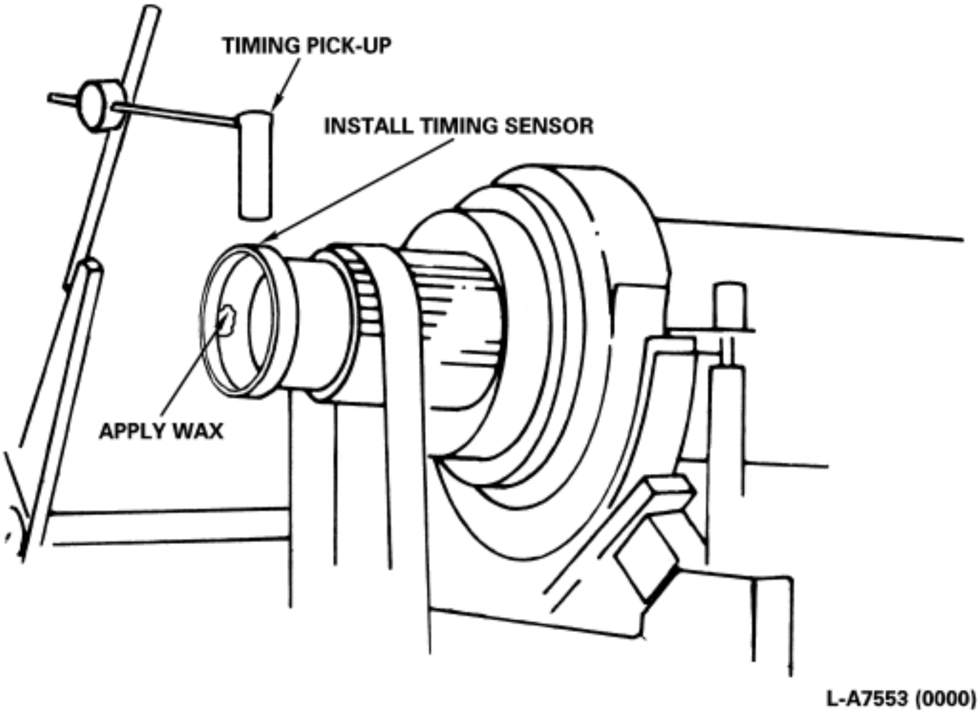
(b) Move the jaws into position so that they touch the inner race of the bearing.

(c) Lock the jaws in position with the detail ring.

(d) Turn the bolt in a clockwise direction to remove the bearing.

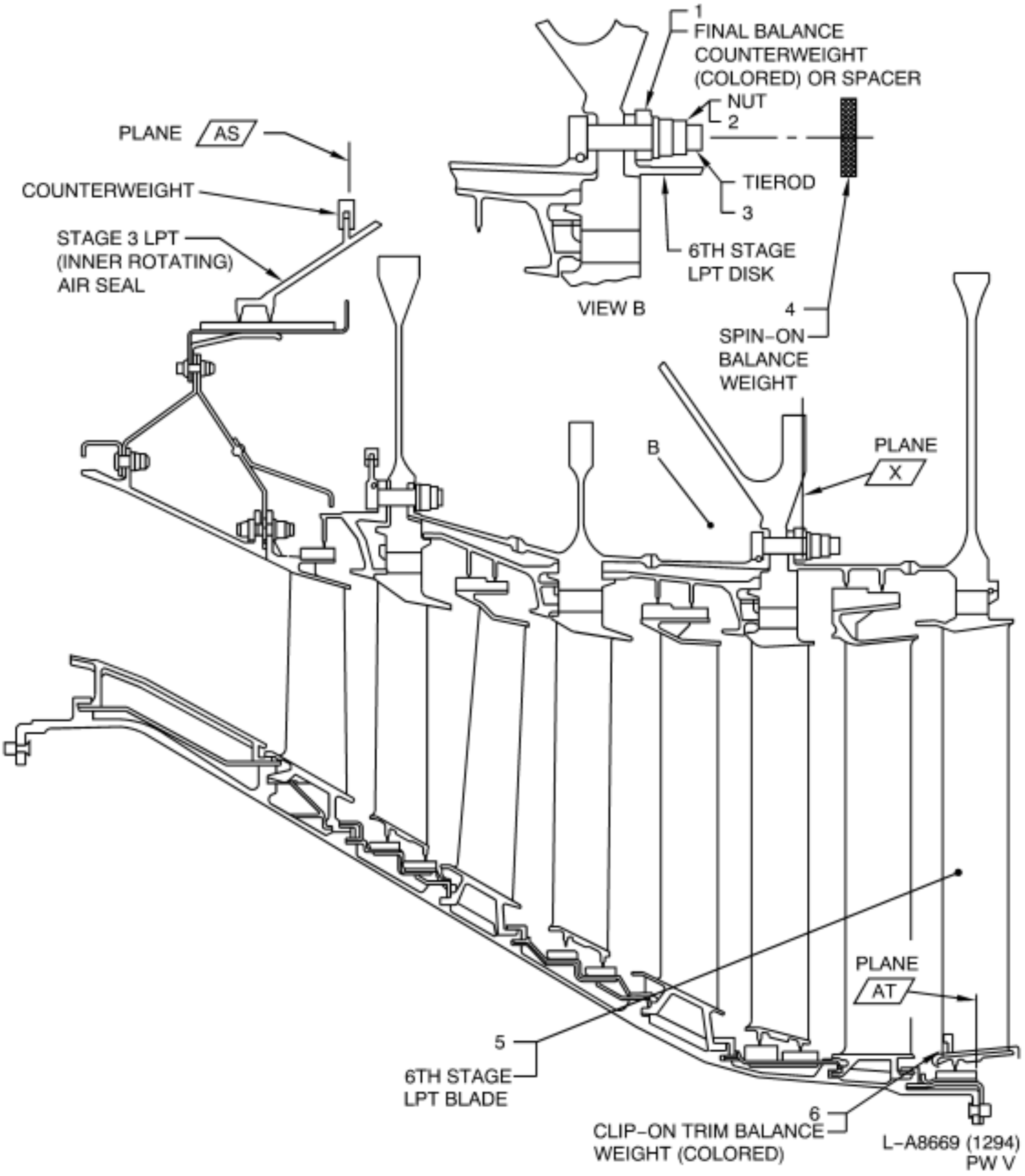
Subtask 72−53−00−430−091:

(31) As necessary, attach the applicable counterweights with rivets to the correct rivet hole(s) in the scalloped counterweight flange of the Stage 3 LPT (rotating) airseal. Use PWA 28375 Riveter to flare the rivets.

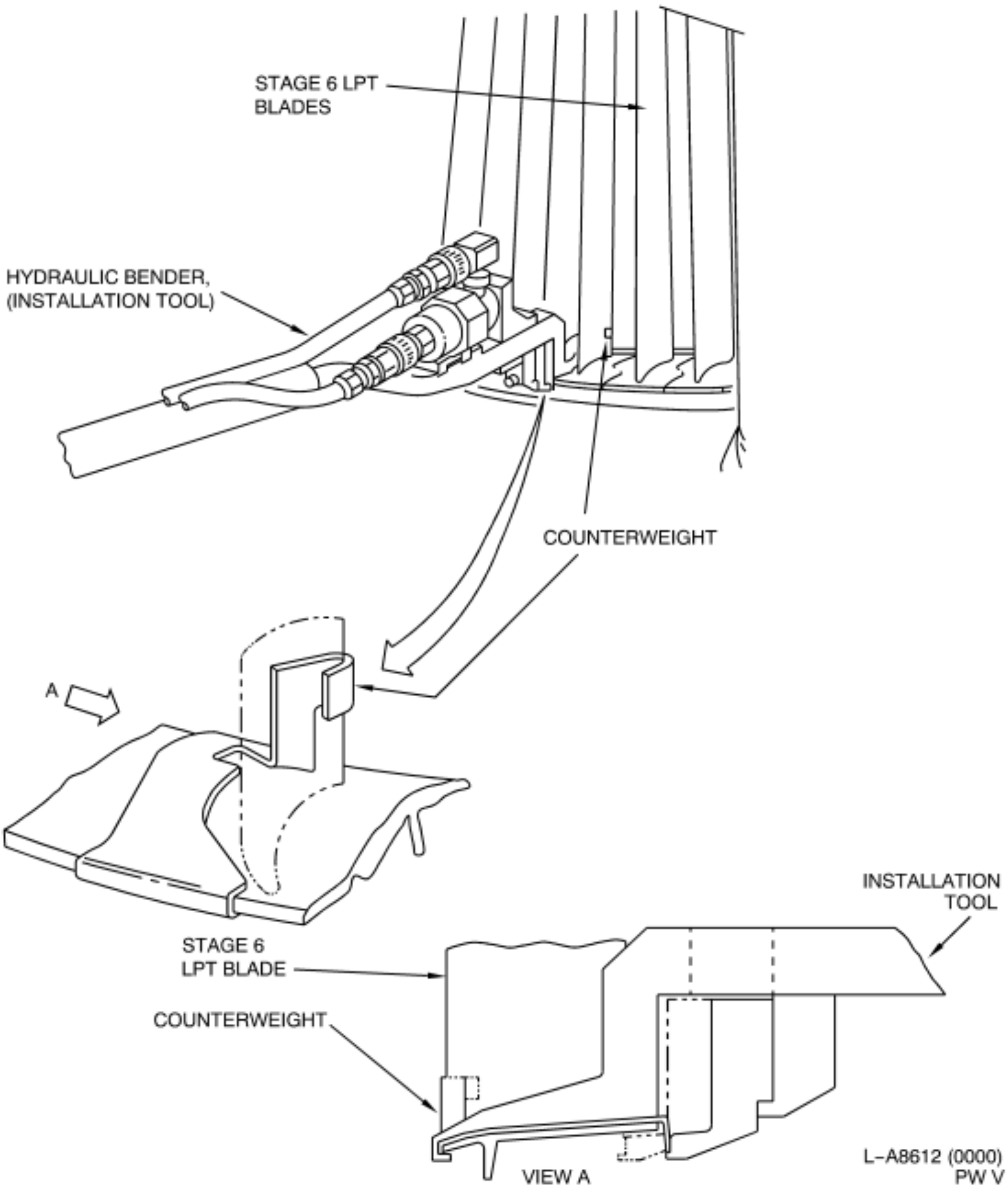

TIMING PICK-UP
INSTALL TIMING SENSOR
APPLY WAX
L-A7553 (0000)

Balance Machine Tooling
Figure 1001
(Task 72−53−00−400−012)

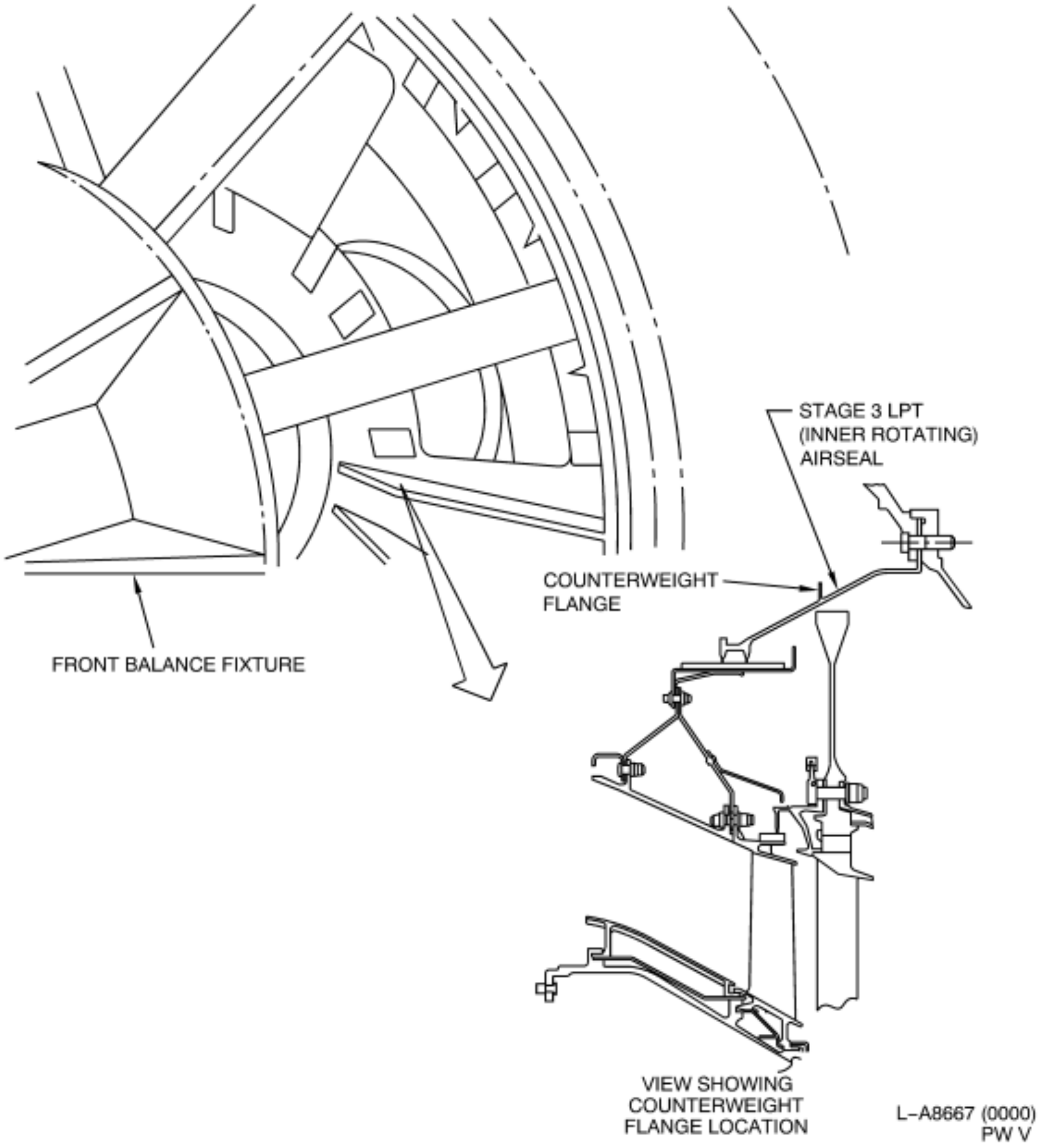
LOW PRESSURE TURBINE (LPT) − ASSEMBLY−12


1
FINAL BALANCE COUNTERWEIGHT (COLORED) OR SPACER
NUT
2
TIEROD
3
6TH STAGE LPT DISK
VIEW B
4
SPIN−ON BALANCE WEIGHT
PLANE
AS
COUNTERWEIGHT
STAGE 3 LPT (INNER ROTATING) AIR SEAL
B
PLANE
X
PLANE
AT
5
6TH STAGE LPT BLADE
6
CLIP−ON TRIM BALANCE WEIGHT (COLORED)
L−A8669 (1294)
PW V

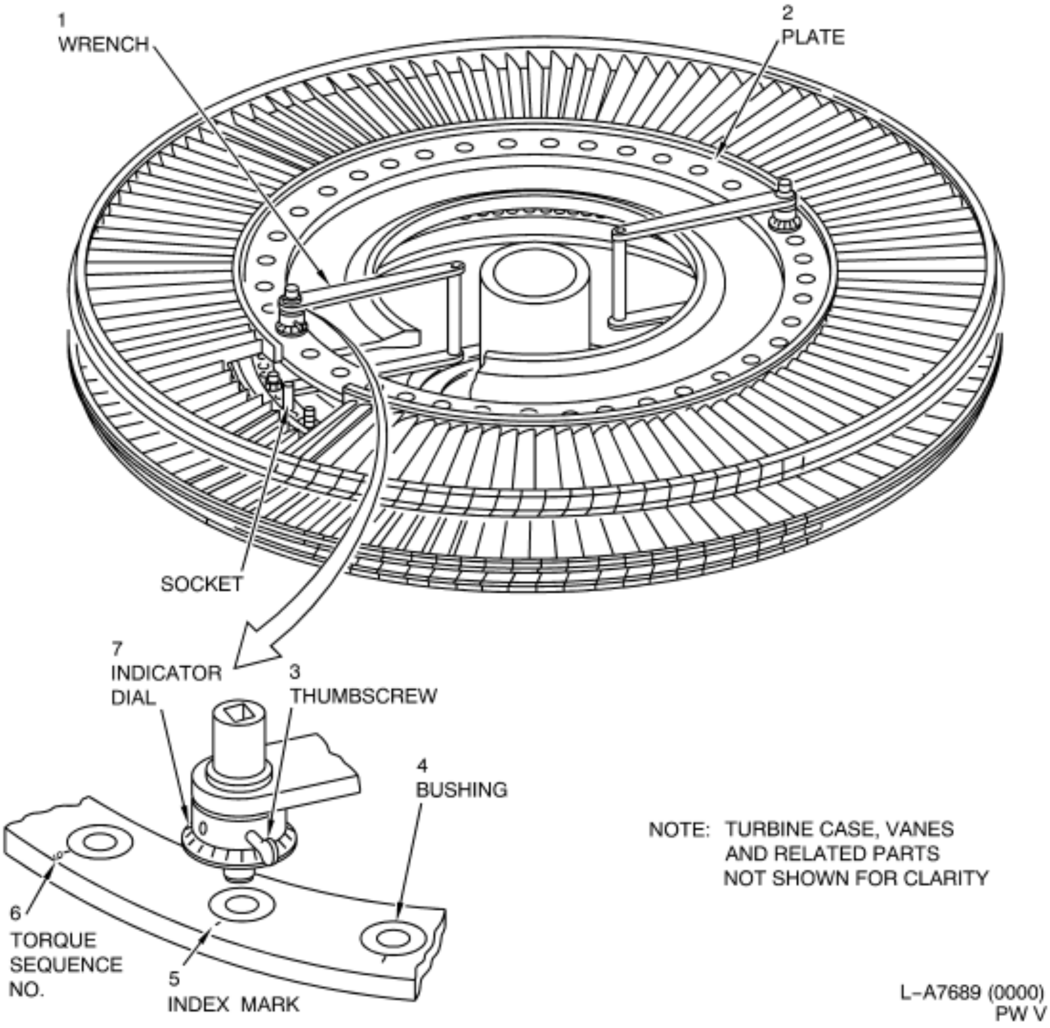
Low Pressure Turbine Balancing
Figure 1002
(Task 72−53−00−400−012)


STAGE 6 LPT BLADES
HYDRAULIC BENDER, (INSTALLATION TOOL)
COUNTERWEIGHT
A
INSTALLATION TOOL
STAGE 6 LPT BLADE
COUNTERWEIGHT
VIEW A
L-A8612 (0000)
PW V

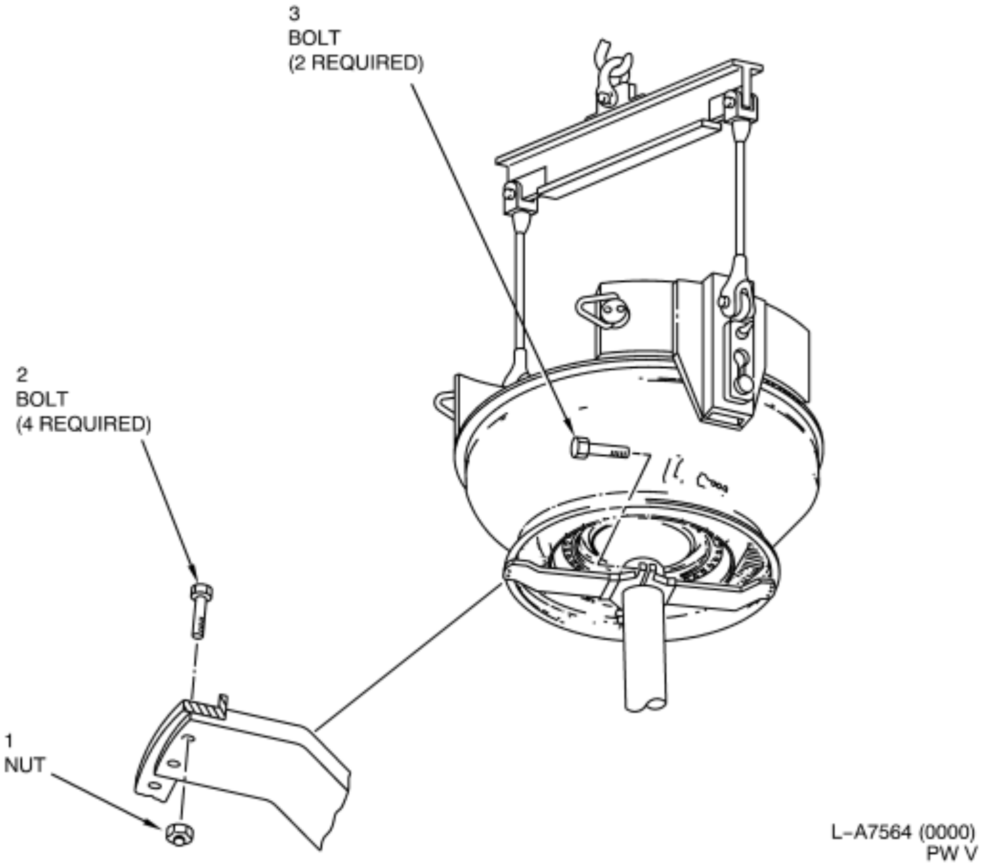
Stage 6 LPT Blade Clip-On Counterweight Installation
Figure 1003
(Task 72-53-00-400-012)


STAGE 3 LPT
(INNER ROTATING)
AIRSEAL
COUNTERWEIGHT
FLANGE
FRONT BALANCE FIXTURE
VIEW SHOWING
COUNTERWEIGHT
FLANGE LOCATION
L-A8667 (0000)
PW V

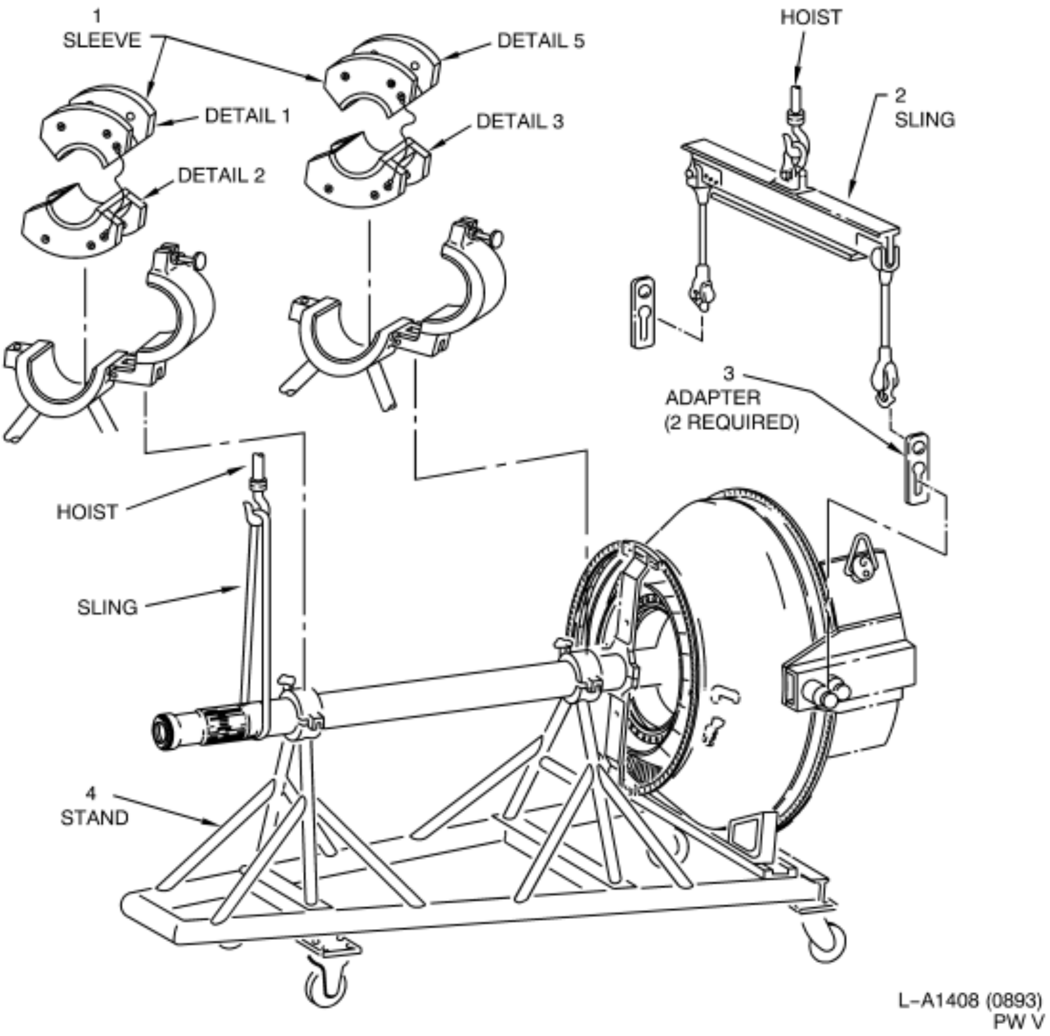
Balance Machine Tooling
Figure 1004
(Task 72-53-00-400-012)


1
WRENCH
2
PLATE
SOCKET
7
INDICATOR
DIAL
3
THUMBSCREW
4
BUSHING
6
TORQUE
SEQUENCE
NO.
5
INDEX MARK
NOTE: TURBINE CASE, VANES
AND RELATED PARTS
NOT SHOWN FOR CLARITY
L-A7689 (0000)
PW V

PWA 85232 Angle Of Turn Fixture Installation
Figure 1005
(Task 72-53-00-400-012)


3
BOLT
(2 REQUIRED)
2
BOLT
(4 REQUIRED)
1
NUT
L−A7564 (0000)
PW V

PWA 85456 Retainer Installation
Figure 1006
(Task 72−53−00−400−012)


1
SLEEVE
DETAIL 5
DETAIL 1
DETAIL 3
DETAIL 2
HOIST
2
SLING
3
ADAPTER
(2 REQUIRED)
HOIST
SLING
4
STAND
L−A1408 (0893)
PW V

1. PWA 85562 Sleeve (Used With PWA 25096 Or PWA 76270 Stand) Or PWA 87347 Sleeve (Used With PWA 87330 Stand)
2. PWA 28657 Sling
3. PWA 76154 Adapter, Two Required
4. PWA 25096, PWA 76270 Or PWA 87330 Stand

Installation Of Low Pressure Turbine In Stand
Figure 1007
(Task 72−53−00−400−012)

Previous Pageblock   Return to Previous Menu   Next Pageblock

LOW PRESSURE TURBINE (LPT) - STORAGE-01

Task 72-53-00-530-001:

1. Pack Low Pressure Turbine (LPT)

A. Equipment And Materials Required

Special Tools:
PWA 28657 Sling
PWA 85331 Retainer, Rear
PWA 85332 Fixture, Handling (Optional To PWA 86206)
PWA 85635 Adapter, Lifting
PWA 86026 Fixture, Handling
PWA 86206 Adapter (2 Required, Used With PWA 85331)

Consumable Materials:

NOTE: The following items not normally supplied by the container manufacturer.

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-156	Seal, Lead
P15-001	Dehydrater

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION	FIGURE	ITEM
Lockwire, MS20995-C41				

Packing Equipment:

NOTE: The following table lists assembly number, dimensions and gross weight for low pressure turbine shipping container available from Pratt & Whitney. Further information can be obtained from:

Commercial Parts Support
Commercial Engine Business
Pratt & Whitney
400 Main St.
East Hartford, CT 06108

Container Assembly No.	Dimensions	Approximate Gross Weight Including Low Pressure Turbine
P60039	73 Inch (1854.200 mm) x 73 Inch (1854.200 mm) x 61 Inch (1549.400 mm)	2,166 lbs (982.48 Kg)

B. Procedure

(1) If applicable, install PWA 85332 (Optional to PWA 86026) Handling Fixture. See Figure 1201.

NOTE: See the following step for installation of the optional Handling Fixture (PWA 86026).

(a) Place the Fixture (PWA 85332) front (lug end) down, on the work table. Attach the plate detail of PWA 85635 Lifting Adapter to the fixture with the four bolts provided. If it is not there, install an eyebolt in the 0.500−13 tapped hole in the arm. Attach a hoist to the eyebolt and a hoist to the shackle detail of the lifting adapter.

(b) Install the conical locator into one of the tierod holes in the ID flange of the 5th stage turbine rear hub.

NOTE: The locator aligns the tierod holes in the turbine hub with the handling fixture.

(c) Lift the fixture and put it over the turbine rear hub. Align locator detail in the turbine hub with a lug detail in the handling fixture body. Lower the fixture until it touches the rear face of the 5th stage rear turbine hub.

(d) Use two Handle T rods, to slide the lockring rearward to expand the clamps. Attach the lockring with four screws, so that the clamps interface with turbine rear hub bore.

(e) Remove the lifting adapter from the handling fixture. Remove the hoists.

(2) Install PWA 86026 Handling Fixture (Optional to PWA 85332).

(a) Install the conical locator into one of the tierod holes in the ID flange of the 5th stage turbine rear hub.

NOTE: the locator aligns the tierod holes in the turbine hub with the handling fixture.

(b) Place the Fixture (PWA 86026) front (lug end) down, on the work table. Attach the plate detail of PWA 85635 Lifting Adapter to the fixture with the four bolts provided. If it is not there, install an eyebolt in the 0.500−13 tapped hole in the arm. Attach a hoist to the eyebolt and a hoist to the shackle detail of the lifting adapter.

(c) Use the template detail to measure the 5th stage hub flange thickness. If the flange thickness is 0.680 inch (17.272 mm), install the detail−17 spacer to the Fixture (PWA 86026). If the flange thickness is 0.813 inch (20.650 mm) the detail−17 spacer is not necessary.

(d) Lift the fixture and put it over the turbine rear hub. Align the locator detail in the turbine hub with a lug detail in the handling fixture body. Lower the fixture until it touches the rear face of the 5th stage rear turbine hub.

(e) Tighten the four detail hex head screws, one at a time until the four detail supports are correctly engaged at the turbine hub bore and the four detail arms are correctly engaged in the step provided in the detail body.

(f) Remove the lifting adapter from the handling fixture. Remove the hoists.

(3) Install PWA 85331 Rear Retainer (1202/2). See Figure 1202.

(a) Use a hoist to connect a suitable sling to the two eyebolts installed in two 0.500−13 lift holes marked "FOR LIFTING TOOL VERTICALLY ONLY".

(b) Lift and position the retainer over the previously installed handling fixture and attach it to the case with 48 screws (1202/5) and washers (1202/4).

(c) Lock the axial position of LPT rotor by tightening eight hand knobs (1202/3) against the handling fixture.

(4) Use a hoist to attach Sling PWA 28657 and two PWA 86206 Adapters to the rear retainer at spools labeled LPT WITHOUT SHAFT. See Figure 1002.

(5) Remove the top half of P60039 Container Assembly. See Figure 1203.

  (a) Open the manual pressure relief valve on the cover to relieve any pressure from the container.

  (b) Loosen the nuts on the "T" head bolts to permit the "T" heads to be rotated 90 degrees and pass through the slots in the cover flange.

  NOTE: Do not remove the lockwashers and nuts from the bolts.

  (c) Install nylon lifting straps to the lifting eyes of the cover. Use two hoists to remove the top cover from the container. Remove the hoists from the straps.

(6) Use the hoist to position the turbine, front end down, over P60039 Container Assembly. Align the two dowel pins in the lower support (1203/5) of the container with the boltholes in the lower flange of the LPT case.

(7) Attach the case to the container with 26 detail flat washers, lock washers, and bolts (1203/4).

(8) Remove the Retainer (PWA 85331). See Figure 1202.

  (a) Loosen eight hand knobs (1202/3) of the retainer (1202/2).

  (b) Remove 48 washers (1202/4) and bolts (1202/5) that attach the retainer to the rear flange of the turbine case.

  (c) Install two eyebolts into the two 0.500−13 tapped holes on rear side of retainer labeled "FOR LIFTING TOOL VERTICAL ONLY".

  (d) Use a hoist to connect a suitable sling to the eyebolts.

  (e) Use the hoist to remove the retainer. Remove the hoist, sling, and eyebolts.

(9) Remove the Handling Fixture (PWA 85332). See Figure 1201.

NOTE: See the following step for removal of the optional Handling Fixture (PWA 86026).

(a) Attach the plate detail of PWA 85635 Lifting Adapter to the fixture with the four bolts provided. If it is not there, install an eyebolt in the 0.500−13 tapped hole in the arm. Attach a hoist to the eyebolt and a hoist to the shackle detail of the lifting adapter.

(b) Remove the four screws that attach the detail lockring.

(c) Use two Handle T rods, to slide the lockring forward to retract the clamp details.

(d) Remove the lifting adapter from the handling fixture. Remove the hoists.

(10) Remove the Handling Fixture (PWA 86026). See Figure 1201.

(a) Attach the plate detail of Lifting Adapter (PWA 85635) to the fixture with the four bolts provided. If it is not there, install an eyebolt in the 0.500−13 tapped hole in the arm. Attach a hoist to the eyebolt and a hoist to the shackle detail of the lifting adapter.

(b) Loosen the four detail hex head screws, one at a time to retract the four detail supports to remove the fixture from the turbine hub.

(c) Remove the lifting adapter from the handling fixture. Remove the hoists.

(11) Use a suitable sling to lift and put the upper support (1202/3) of the container over the turbine case rear flange. Align the bolthole in the center of the upper and lower support plates. Attach the supports with the detail lock washer (1203/2) and bolt (1203/1) threads lubricated with Engine Oil (P03−001). Torque the bolt to 2300 − 2400 lb−in. (259.865 − 271.164 N.m).

(12) Connect a hoist to the lifting rings on the top cover of the container, and position the top cover over the

bottom of the container. Align the dowel pins with the dowel pin holes and lower the top cover onto bottom half of the container.

(13) Attach the top cover to the bottom half with the detail bolts and nuts.

(14) Install lockwire, MS20995−C41 through holes in the cover flange and attach a Lead Seal (P05−156). Use a bull dog pliers to compress the seal on the wire and cutoff the excess wire.

(15) Inspect the condition of Dehydrater (P15−001) and replace as required.

Task 72−53−00−540−001:

2. Unpack Low Pressure Turbine (LPT)

A. Equipment And Materials Required

Special Tools:
PWA 28657 Sling
PWA 85331 Retainer,Rear
PWA 85332 Fixture, Handling (Optional To PWA 86206)
PWA 85576 Stand, Storage
PWA 85635 Adapter, Lifting
PWA 86026 Fixture, Handling
PWA 86206 Adapter (2 Required, Used With PWA 85331)

B. Procedure

(1) Break and remove the lockwire and seal from the container flange.

(2) Remove the top half of P60039 Container Assembly. See Figure 1203.

(a) Open the manual pressure relief valve on the cover to relieve any pressure from the container.

(b) Loosen the nuts on the "T" head bolts to permit the "T" heads to be rotated 90 degrees and pass through the slots in the cover flange.

NOTE: Do not remove the lockwashers and nuts from the bolts.

(c) Install nylon lifting straps to the lifting eyes of the cover. Use two hoists to remove the top cover from the container. Remove the hoists from the straps.

(3) Loosen and remove the center bolt (1203/1) and lockwasher (1203/2) which attach the upper support (1203/3) to the low pressure turbine and the lower support. Attach two nylon lifting straps to two of the four spokes 180 degrees apart on the upper support. Use a hoist to carefully raise and remove the upper support from the low pressure turbine assembly. Place the removed upper support on a bench or table and remove the hoists.

(4) If applicable, install PWA 85332 (Optional to PWA 86026) Handling Fixture. See Figure 1201.

NOTE: See the following step for installation of the optional Handling Fixture (PWA 86026).

(a) Place the Fixture (PWA 85332) front (lug end) down, on the work table. Attach the plate detail of PWA 85635 Lifting Adapter to the fixture with the four bolts provided. If it is not there, install an eyebolt in the 0.500−13 tapped hole in the arm. Attach a hoist to the eyebolt and a hoist to the shackle detail of the lifting adapter.

(b) Install the conical locator into one of the tierod holes in the ID flange of the 5th stage turbine rear hub.

NOTE: The locator aligns the tierod holes in the turbine hub with the handling fixture.

(c) Lift the fixture and put it over the turbine rear hub. Align the locator detail in the turbine hub with a lug detail in the handling fixture body. Lower the fixture until it touches the rear face of the 5th stage rear turbine hub.

(d) Use two Handle T rods, to slide the lockring rearward to expand the clamps. Attach the lockring with four screws, so that the clamps interface with turbine rear hub bore.

(e) Remove the lifting adapter from the handling fixture. Remove the hoists.

(5) Install PWA 86026 Handling Fixture (Optional to PWA 85332).

(a) Place the Fixture (PWA 86026) front (lug end) down, on the work table. Attach the plate detail of Lifting Adapter (PWA 85635) to the fixture with the four bolts provided. If it is not there, install an eyebolt in the 0.500−13 tapped hole in the arm. Attach a hoist to the eyebolt and a hoist to the shackle detail of the lifting adapter.

(b) Use the template detail to measure the 5th stage hub flange thickness. If the flange thickness is 0.680 inch (17.272 mm), install the detail−17 spacer to the Fixture (PWA 86026). If the flange thickness is 0.813 inch (20.650 mm) the detail−17 spacer is not necessary.

(c) Install the conical locator into one of the tierod holes in the ID flange of the 5th stage turbine rear hub.

NOTE: The locator aligns the tierod holes in the turbine hub with the handling fixture.

(d) Lift the fixture and put it over the turbine rear hub. Align the locator detail in the turbine hub with a lug detail in the handling fixture body. Lower the fixture until it touches the rear face of the 5th stage rear turbine hub.

(e) Tighten the four detail hex head screws, one at a time until the four detail supports are correctly engaged at the turbine hub bore and the four detail arms are correctly engaged in the step provided in the detail body.

(6) Install PWA 85331 Rear Retainer. See Figure 1202.

(a) Use a hoist to connect a suitable sling to the two eyebolts installed in two 0.500−13 lift holes marked "FOR LIFTING TOOL VERTICALLY ONLY".

(b) Lift and position the retainer over the previously installed handling fixture and attach it to the case with 48 screws (1202/5) and washers (1202/4).

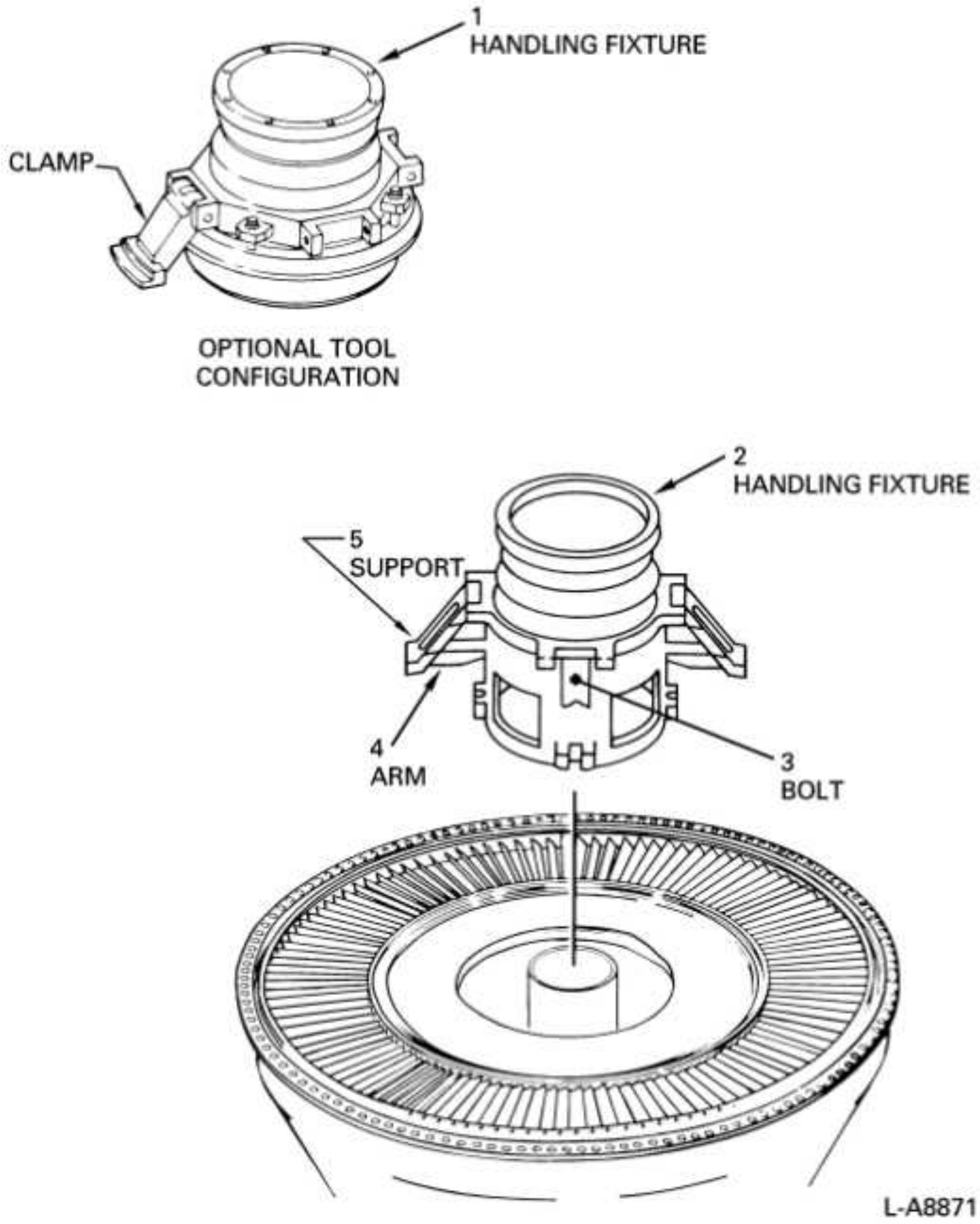
(c) Lock axial position of LPT rotor by tightening eight hand knobs (1202/3) against the handling fixture.

(7) Remove the 26 bolts, lockwashers, and flat washers (1203/4) that attach the case flange to the container lower support (1203/5).

(8) Use a hoist to attach Sling (PWA 28657) and two PWA 86206 Adapters to the rear retainer at spools labeled LPT WITHOUT SHAFT.

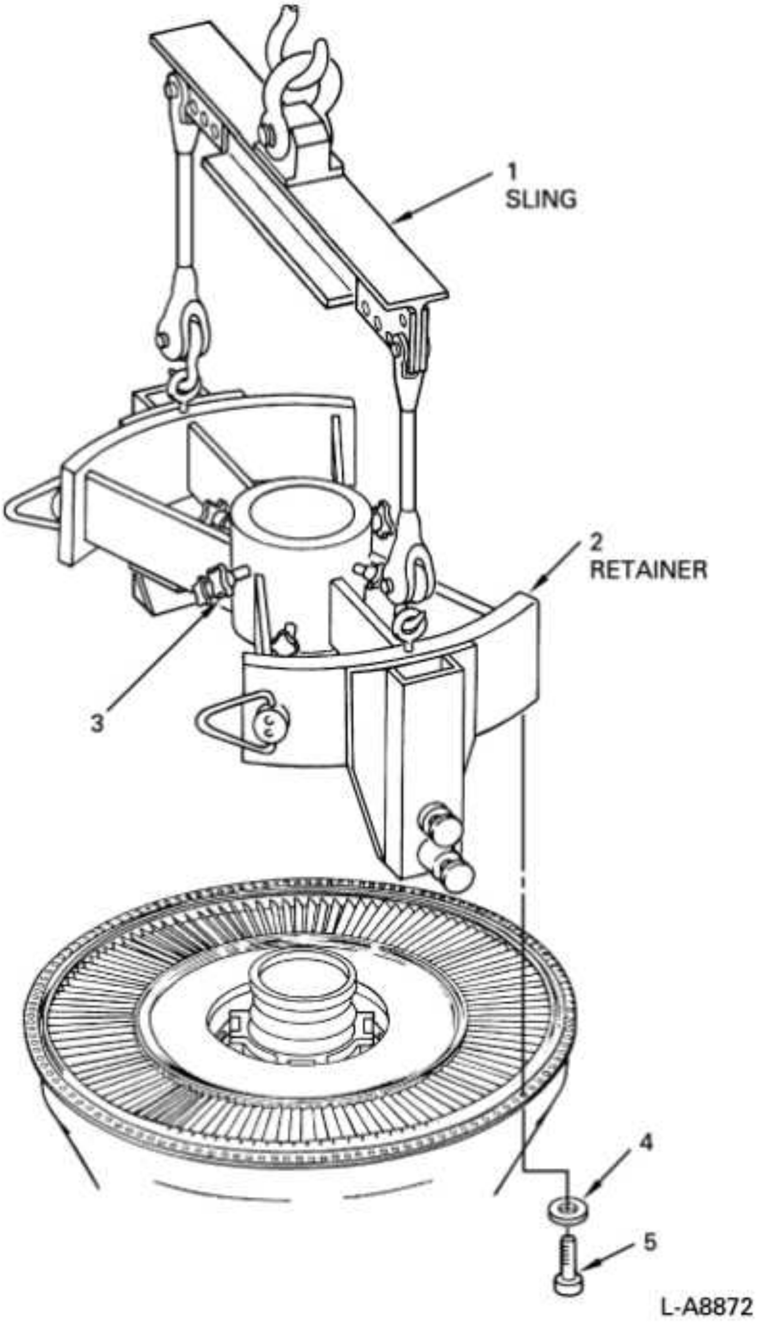
(9) Use the hoist to carefully lift the assembly from the container and position it in PWA 85576 Storage Stand.

(10) Remove the hoist and sling and adapters from the retainer.


1
HANDLING FIXTURE
CLAMP
OPTIONAL TOOL CONFIGURATION
2
HANDLING FIXTURE
5
SUPPORT
4
ARM
3
BOLT
L-A8871

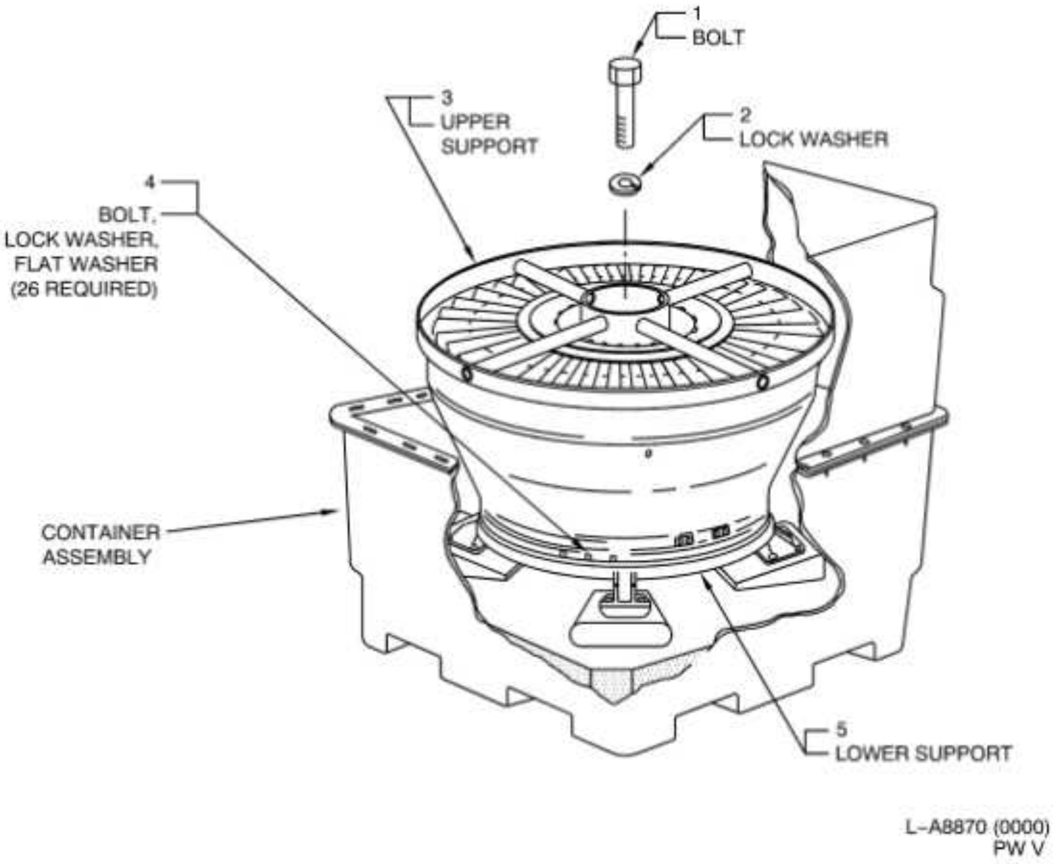
1. PWA 85332 Handling Fixture
2. PWA 86026 Handling Fixture
3. Bolt
4. Arm
5. Support

Handling Fixture Installation
Figure 1201
(Task 72-53-00-530-001)



1. PWA 28657 Sling
2. PWA 85331 Retainer
3. Hand Knob
4. Washer, 48 Required
5. Screw, 48 Required

Rear Retainer Installation
Figure 1202
(Task 72-53-00-530-001)


1
BOLT
3
UPPER SUPPORT
2
LOCK WASHER
4
BOLT, LOCK WASHER, FLAT WASHER (26 REQUIRED)
CONTAINER ASSEMBLY
5
LOWER SUPPORT
L−A8870 (0000)
PW V

Pack And Unpack Low Pressure Turbine
Figure 1203
(Task 72−53−00−530−001)

LOW PRESSURE TURBINE (LPT) - STORAGE-02

Task 72-53-00-530-002:

1. Pack Low Pressure Turbine (LPT) With Shaft

A. Equipment And Materials Required

Special Tools:
PWA 28657 Sling
PWA 76154 Adapters (Two Required)

Consumable Materials:

NOTE: The following items not normally supplied by container manufacturer.

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-156	Seal, Lead
P15-001	Dehydrater

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Lockwire, MS20995-C41				

Packaging Equipment:

NOTE: The following table lists assembly number, dimensions, and gross weight for low pressure turbine shipping container available from Pratt & Whitney. Further information can be obtained from:

Commercial Parts Support
Commercial Engine Business
Pratt & Whitney
400 Main St.
East Hartford, CT 06108

Container Assembly No.	Dimensions	Approximate Gross Weight Including Low Pressure Turbine
P60043	134.3 Inch (3411.220 mm) x 87.6 Inch (2225.040 mm) x 64.0 Inch (1625.600 mm)	3,671 lbs (1665.14 Kg)

B. Procedure

(1) If it is there, remove the Retainer (PWA 85331) from the low pressure turbine. See Figure 1201.

  (a) Loosen the eight hand knobs (1201/4) of the retainer (1201/5).

  (b) Remove 48 screws (1201/7) and washers (1201/6) that hold the retainer to the rear flange of the turbine case.

  (c) Use a hoist to connect a suitable sling to the hoist ring details of the fixture.

  (d) Use the hoist to remove the retainer. Remove the hoist and sling.

  (e) Remove the bolts (1201/2) that attach the Adapter (PWA 85430 or PWA 86424) (1201/1) to the turbine shaft. Remove the adapter.

(2) Remove the top half of P60043 Container Assembly.

  (a) Open the manual pressure relief valve on the cover to relieve any pressure from the container.

  (b) Loosen the nuts on the "T" head bolts to permit the "T" heads to be rotated 90 degrees and pass through the slots in the cover flange.

  NOTE: Do not remove the lockwashers and nuts.

  (c) Install nylon lifting straps to the lifting eyes of the cover. Use two hoists to remove the top cover from the container. Remove the hoists from the straps.

(3) Install the rear retainer detail of P60043 Shipping Container to the low pressure turbine (LPT).

  (a) Use a hoist to connect PWA 28657 Sling, and two PWA 76154 Adapters to the trunnion spools of the rear retainer (1202/8). Lift the retainer and put it to the rear of the LPT. See Figure 1202.

  (b) Retract the cap screws (1203/2)in the center hub (1203/3) of the retainer. See Figure 1203.

LOW PRESSURE TURBINE (LPT) − STORAGE−02

(c) Align the boltholes and put the retainer onto the turbine case. Use 38 cap screws, lock washers, and flat washers (1203/8) to attach the retainer to the rear outer flange of the turbine case. Tighten the screws.

(d) Align the boltholes and put the center hub detail (1203/3) into the turbine shaft. Install the hub to the shaft with eight cap screws (1202/4). Torque the screws to 7 lb−ft (9.5 N.m).

(e) Align the boltholes and attach the hub detail to the retainer with six cap screws and lock washers (1203/5). Do not tighten the screws.

(f) Tighten the six screws (1203/2) and jam nuts (1203/1) to retain the axial position of the turbine rotor.

(g) Tighten the previously installed screws (1203/5) that attach the center hub to the retainer.

(4) Remove Fixture (PWA 85583) from the low pressure turbine. See Figure 1204.

(a) Loosen jamnuts (1204/4) and nut (1204/8) as required to lower support plate (1204/6) from 6th stage LPT disk (1204/7).

(b) Remove bolts (1204/2) that attach the flange segment (1204/1) to turbine rear case (1204/3). Remove the fixture.

(5) Thread the adapter into the front end of the turbine shaft. Use the ball lock pin (1202/2) to attach the lifting arm to the adapter. See Figure 1202.

(6) Attach a second hoist to the lifting arm at the front end of the turbine shaft.

(7) Open the turbine shaft clamp details of the storage stand and the container. Use both hoists lift the turbine and lower it into the container. Align the turbine shaft with the turbine shaft clamp and the boltholes in the rear retainer with the boltholes in the container frame. Install the rear retainer to the container frame with eight cap screws (1203/7). Torque the screws to 50 lb−ft (67.8 N.m).

LOW PRESSURE TURBINE (LPT) − STORAGE−02

(8) Close the turbine shaft clamp (1202/12). Tighten the swing bolt nut.

(9) Remove the hoist and lifting arm at the front end of the turbine shaft. If necessary, rotate the clevis (detail−42) (1202/3) to remove the ball lock pin.

(10) Use the ball lock pin (1202/2) to install the bracket (1202/6) to the adapter at the front end of the turbine shaft. If necessary, rotate the clevis (1202/3) and bracket (1202/6) to align the two counterbored holes in the bracket with the two mating cap screws (1202/1) in the end of the "A" frame. Tighten the bolts to 425 lb−ft (576.2 N.m). Tighten the jamnuts (1202/5) to 425 lb−ft (576.2 N.m).

CAUTION: YOU MUST REPLACE THE FRONT RETAINER (PWA 85456 or PWA 85996) WITH THE FRONT RETAINER DETAIL OF THE CONTAINER WHICH HAS A PROTECTIVE COATING TO PREVENT CORROSION.

(11) Remove the retainer from the front flange of the turbine rear case and the front compressor drive turbine shaft.

(a) Remove two bolts that attach the upper and lower details of retainer.

(b) Remove four bolts and nuts that attach the upper and lower retainer details to low pressure turbine case.

(12) Install the front retainer detail of the container to the front flange of the turbine case and the turbine shaft. See Figure 1202.

(a) Align the center hole in front retainer (1202/10) with the dowel pin hole in the turbine case.

(b) Attach the retainer to the front flange of the turbine case at 6 and 12 o'clock locations with four bolts and nuts (1202/9).

(c) Attach the clamps of the retainer to the turbine shaft with two bolts (1202/11).

(13) Remove the hoist, sling, and adapters from the rear retainer assembly.

(14) Connect a hoist to the lifting rings on the top cover of the container, and position the top cover over the bottom half of the container. Align the dowel pins with the dowel pin holes and lower the top cover onto the bottom half of the container.

(15) Attach the container with the detail bolts and nuts.

(16) Install lockwire, MS20995−C41 through holes in cover flange and attach Lead Seal (P05−156). Use a bull dog pliers to compress seal on wire and cut off excess wire.

(17) Inspect the condition of Dehydrater (P15−001) and replace as required.

Task 72−53−00−540−002:

2. Unpack Low Pressure Turbine (LPT) With Shaft

A. Equipment And Materials Required

Special Tools:
PWA 25096 Stand, Storage (Optional To PWA 87330)
PWA 28657 Sling, Strongback, Handling
PWA 76154 Adapter (Two Required)
PWA 76270 Stand (Optional To PWA 87330)
PWA 85456 Retainer (Optional To PWA 85996)
PWA 85562 Sleeve, Support (Used With PWA 25096 Or PWA 76270)
PWA 85583 Retainer
PWA 85996 Retainer, Front
PWA 87330 Stand, Storage
PWA 87347 Sleeve, Support (Used With PWA 87330)

B. Procedure

(1) Break and remove the lockwire and seal from the container flange.

(2) Remove the top half of P60043 Container Assembly.

  (a) Open the manual pressure relief valve on the cover to relieve any pressure from the container.

  (b) Loosen the nuts on the "T" head bolts to permit the "T" heads to be rotated 90 degrees and pass through the slots in the cover flange.

  NOTE: Do not remove the lockwashers and nuts.

(c) Install nylon lifting straps to the lifting eyes of the cover. Use two hoists to remove the top cover from the container. Remove the hoists from the straps.

(3) Loosen the jam nuts (1202/5) and cap screws (1202/1) at the end of the "A" frame. Retract the screws from the bracket. Rotate the bracket and clevis (detail−42) (1202/3) as required to remove ball lock pin (1202/2) from the bracket (1202/6). See Figure 1202.

(4) Use the ball lock pin (1202/2) to attach the lifting arm (1202/7) to the clevis (1202/3). Attach a hoist to the lifting arm. Take up slack on the hoist.

(5) Remove the eight cap screws (1203/7) that attach the rear retainer to the frame of the container. See Figure 1203.

(6) Connect a hoist and PWA 28657 Sling with two PWA 76154 Adapters to the trunnion spools of the rear retainer.

(7) Loosen the nut and rotate the swing bolt to open the turbine shaft clamp (1202/12). See Figure 1202.

(8) Use both hoists to remove the turbine from the container.

(9) Install PWA 85562 Support Sleeve into the shaft support cradles of PWA 25096, PWA 76270 Stand or PWA 87347 Support Sleeve into the shaft support cradles of PWA 87330 Stand. Position details−1 and −2 forward and details−3 and −5 rearward with details−2 and −3 down. Tighten the set screws to attach the sleeve to the stand. See Figure 1205.

(10) Place the low pressure turbine in the storage stand. Tighten clamps around the turbine shaft and slide chocks inward to contact the rear flange of the turbine case.

NOTE: Chocks are utilized as a safety device and do not support any portion of assembly.

(11) Remove hoist from the front end of the turbine shaft. Remove the ball lock pin (1202/2) and lifting arm (1202/7) from the clevis (1202/3). Remove the adapter (1202/4) from the shaft. See Figure 1202.

(12) Remove the retainer (1206/3) from the front flange of the turbine rear case and the front compressor drive turbine shaft. See Figure 1206.

(a) Remove two bolts (1206/4) that attach the upper and lower details of retainer.

(b) Remove bolts (1206/2) and nuts (1206/1) that attach the upper and lower retainer details to low pressure turbine case.

(13) Install PWA 85456 or PWA 85996 Retainer to the front flange of the turbine case and the turbine shaft.

(a) Align the center hole in the front retainer (1206/3) with the dowel pin hole in the turbine case.

(b) Attach the retainer to the front flange of the turbine case at 6 and 12 o'clock locations with four bolts (1206/2) and nuts (1206/1).

(c) Attach the clamps of retainer to the front compressor drive turbine shaft with two bolts (1206/4).

(14) Install PWA 85583 Fixture to rear flange of turbine rear case.

(a) Center the flange segment (1204/1) to the rear flange of the turbine rear case (1204/3) at 12 o'clock location. Attach the flange segment to the case with six bolts (1204/2).

(b) Loosen two jamnuts (1204/8). Adjust nut (1204/4) to support the ID of 6th stage LPT disk (1204/7) to maintain the proper position of the low pressure turbine rotor. Tighten the jamnuts (1204/8).

(15) Remove the rear retainer (1202/6) from the turbine. See Figure 1203.

(a) Remove the six bolts (1203/5) that attach the hub (1203/3) to the rear retainer (1203/6).

(b) Remove the eight cap screws (1203/4) that attach the hub (1203/3) to the turbine shaft. Remove the hub.

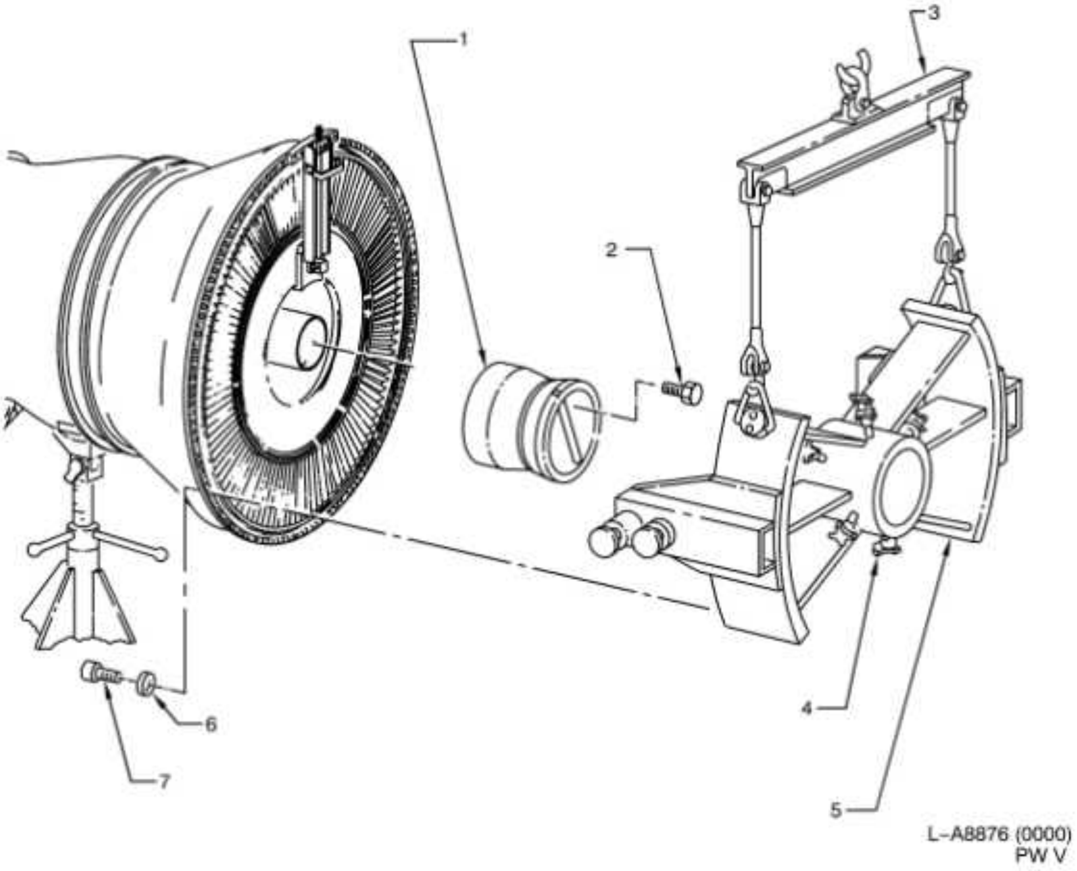
LOW PRESSURE TURBINE (LPT) − STORAGE−02

(c) Remove the 38 bolts, lockwashers, and flat washers (1203/8) that attach the rear retainer to the turbine case.

(d) Remove the retainer, adapters, and sling.

(16) Lubricate the spline area at the front end of the turbine shaft with Engine Oil (P03−001). If the shaft is not coated in the area forward or rearward of the spline, lubricate these areas also.

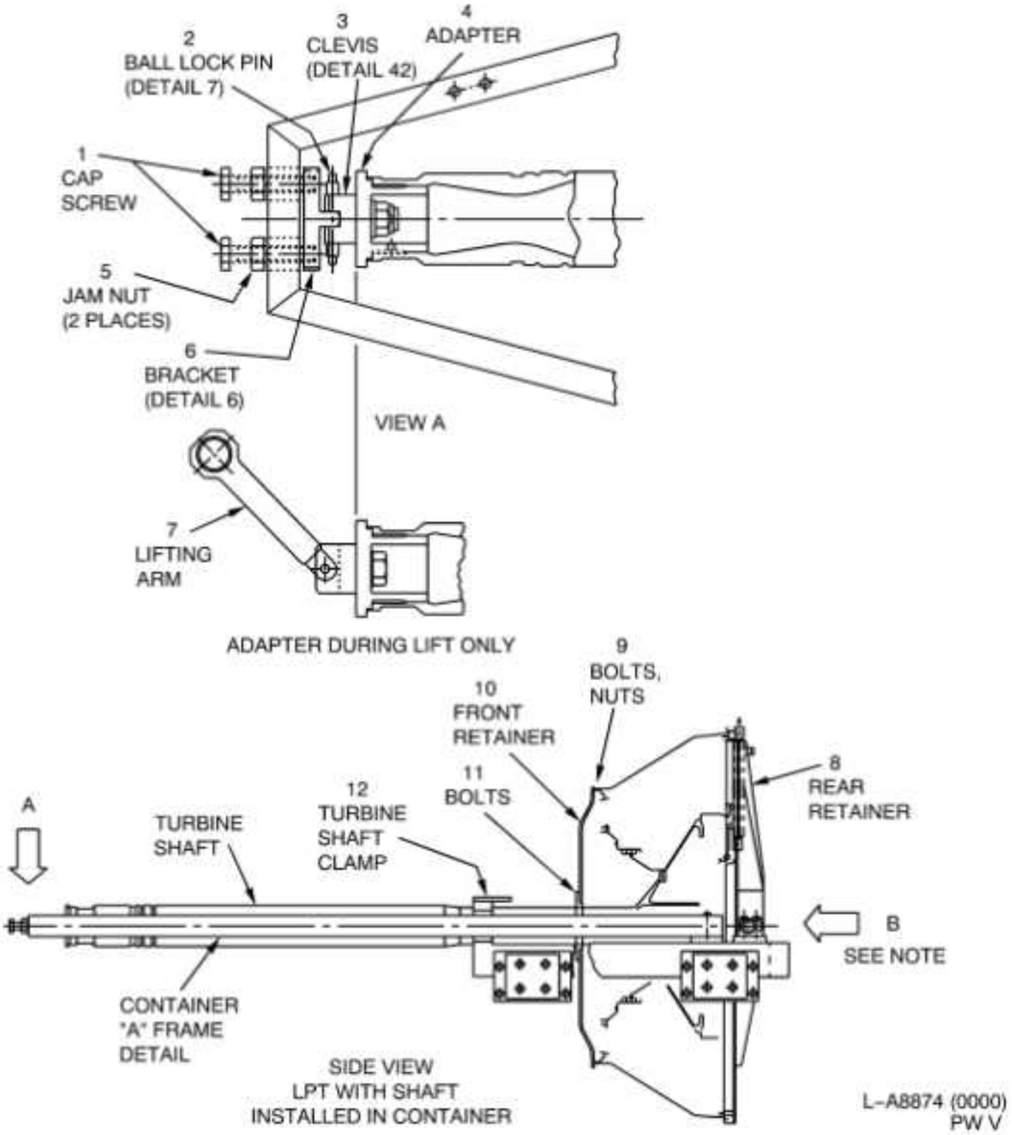
LOW PRESSURE TURBINE (LPT) − STORAGE−02



1. PWA 85430 0r PWA 86424 Adapter
2. Bolt, Eight Required
3. PWA 28657 Sling
4. Hand Knob, Eight Places
5. PWA 85331 Retainer
6. Washer, 48 Required
7. Screw, 48 Required

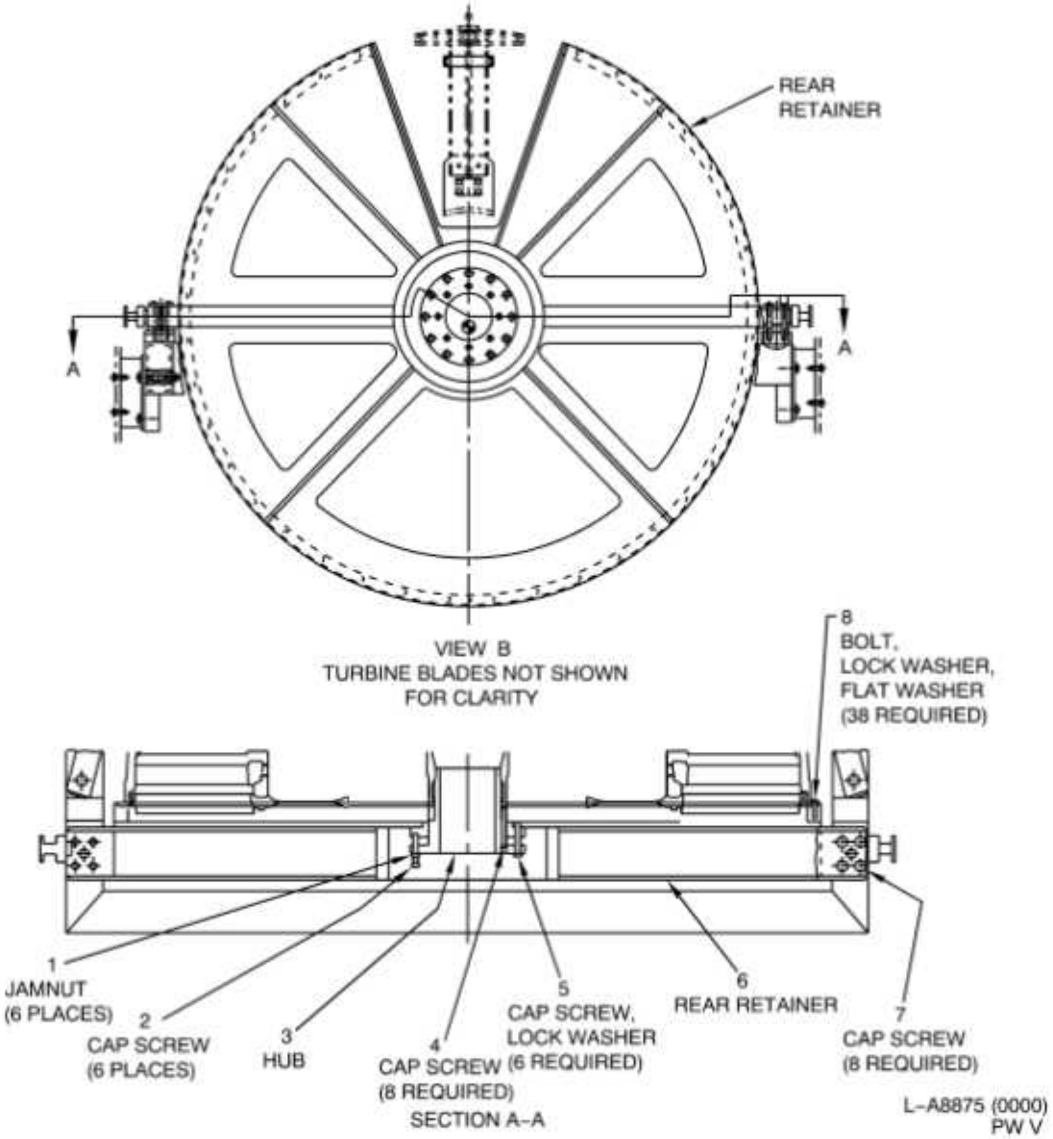
Handling Fixture Removal/Installation
Figure 1201
(Task 72−53−00−530−002)

LOW PRESSURE TURBINE (LPT) - STORAGE-02

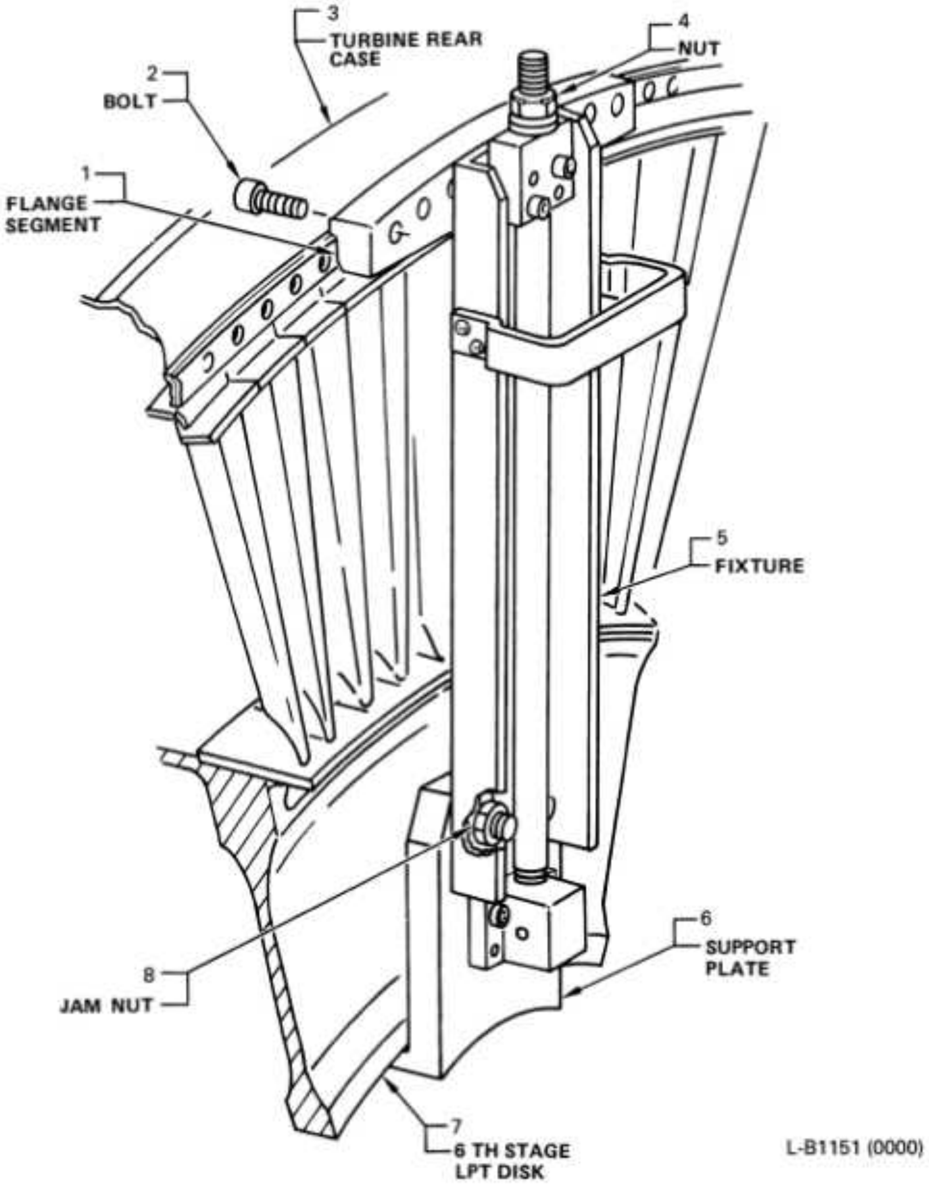

2
BALL LOCK PIN
(DETAIL 7)
3
CLEVIS
(DETAIL 42)
4
ADAPTER
1
CAP
SCREW
5
JAM NUT
(2 PLACES)
6
BRACKET
(DETAIL 6)
VIEW A
7
LIFTING
ARM
ADAPTER DURING LIFT ONLY
9
BOLTS,
NUTS
10
FRONT
RETAINER
8
REAR
RETAINER
11
BOLTS
12
TURBINE
SHAFT
CLAMP
A
TURBINE
SHAFT
B
SEE NOTE
CONTAINER
"A" FRAME
DETAIL
SIDE VIEW
LPT WITH SHAFT
INSTALLED IN CONTAINER
L-A8874 (0000)
PW V

NOTE: See Figure 1203 for View In Direction B.

Low Pressure Turbine Assembly Shipping Equipment
Figure 1202
(Task 72-53-00-530-002)

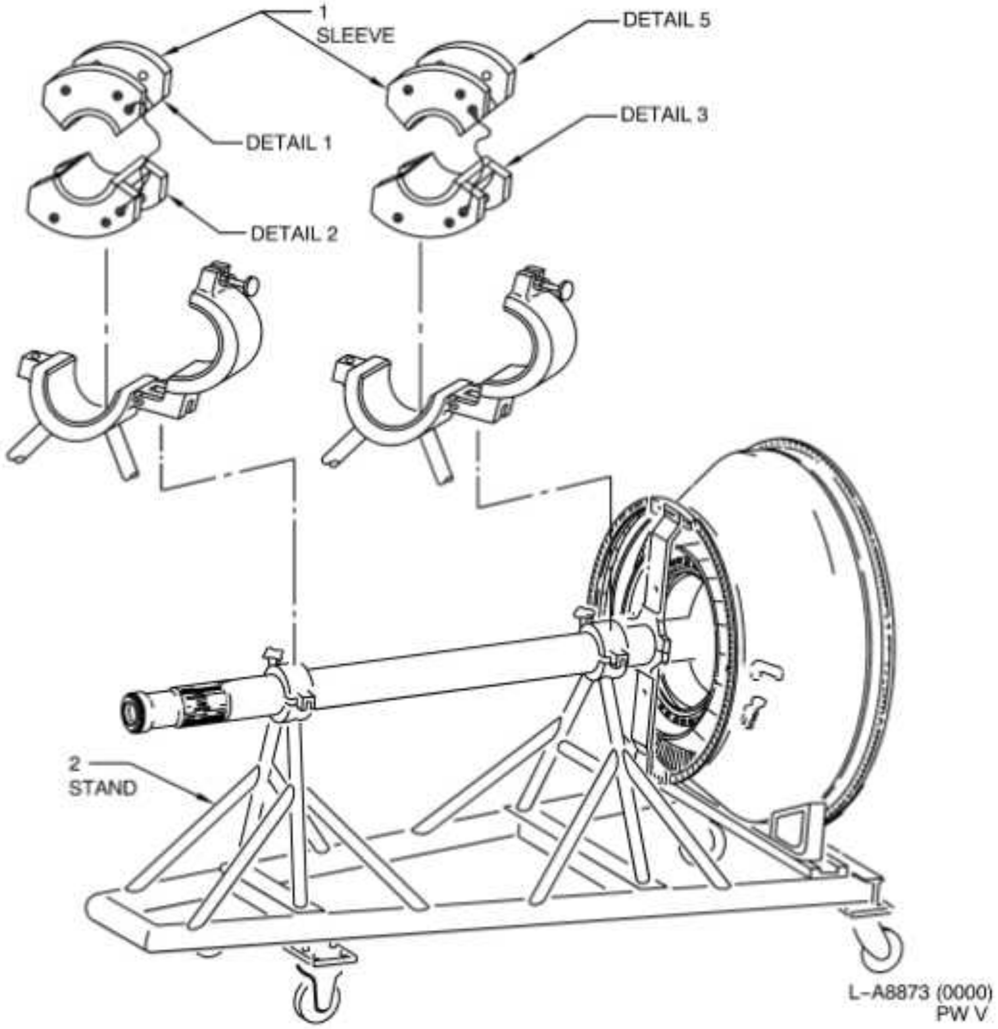

REAR RETAINER
A
A
VIEW B
TURBINE BLADES NOT SHOWN FOR CLARITY
8
BOLT, LOCK WASHER, FLAT WASHER (38 REQUIRED)
1
JAMNUT (6 PLACES)
2
CAP SCREW (6 PLACES)
3
HUB
4
CAP SCREW (8 REQUIRED)
5
CAP SCREW, LOCK WASHER (6 REQUIRED)
6
REAR RETAINER
7
CAP SCREW (8 REQUIRED)
SECTION A-A
L-A8875 (0000)
PW V

Low Pressure Turbine Assembly Shipping Equipment
Figure 1203
(Task 72-53-00-530-002)


3
TURBINE REAR CASE
4
NUT
2
BOLT
1
FLANGE SEGMENT
5
FIXTURE
6
SUPPORT PLATE
8
JAM NUT
7
6 TH STAGE LPT DISK
L-B1151 (0000)

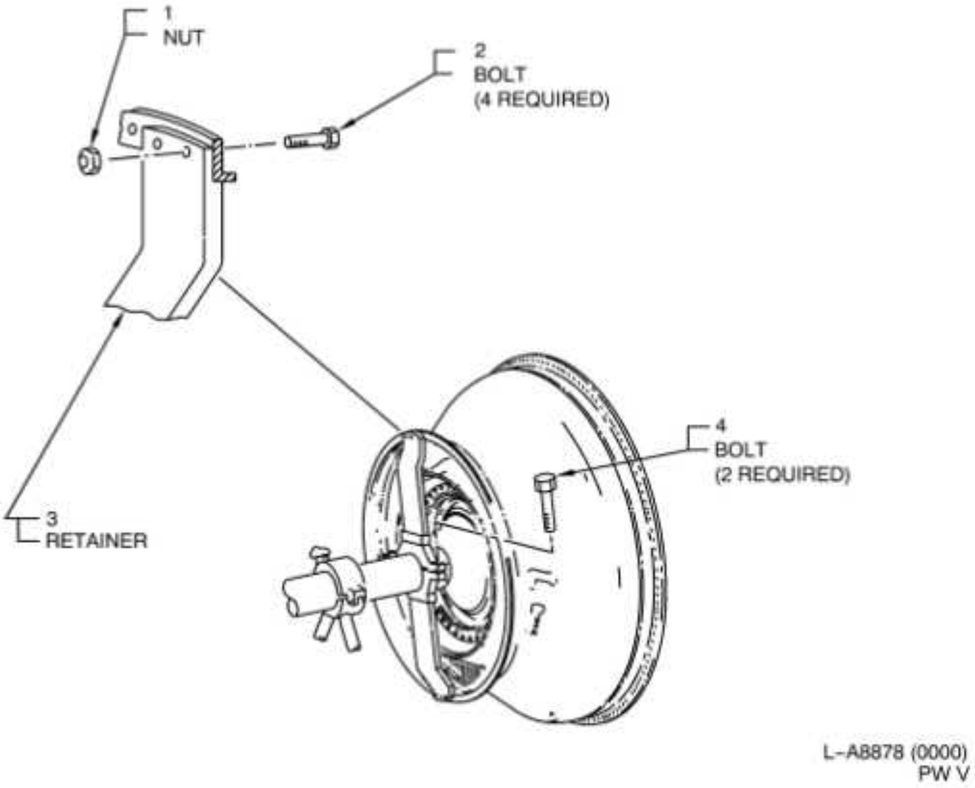
LPT Rotor Support Fixture Removal
Figure 1204
(Task 72−53−00−530−002)

LOW PRESSURE TURBINE (LPT) − STORAGE−02


1
SLEEVE
DETAIL 5
DETAIL 1
DETAIL 3
DETAIL 2
2
STAND
L−A8873 (0000)
PW V

1. PWA 85562 Sleeve (Used With PWA 25096 Or PWA 76270 Stand) Or PWA 87347 Sleeve (Used With PWA 87330 Stand)
2. PWA 25096, PWA 76270 Or PWA 87330 Stand

Low Pressure Turbine Storage Stand
Figure 1205
(Task 72−53−00−530−002)


1
NUT
2
BOLT
(4 REQUIRED)
3
RETAINER
4
BOLT
(2 REQUIRED)
L-A8878 (0000)
PW V

Low Pressure Turbine Front Retainer Removal
Figure 1206
(Task 72−53−00−530−002)

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Pratt & Whitney

PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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REVISION NO. 85 DATED JANUARY 1, 2008

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Task 72-53-00-540-001:			

SUBJECT	CHP/SEC/SUB	PAGE	EFFECTIVITY
LOW PRESSURE TURBINE (LPT) (CONTINUED)	72-53-00		
Unpack Low Pressure Turbine (LPT)		1206	
Storage-02		1201	ALL
Task 72-53-00-530-002: Pack Low Pressure Turbine (LPT) With Shaft		1201	
Task 72-53-00-540-002: Unpack Low Pressure Turbine (LPT) With Shaft		1205	
STAGE 3 TURBINE ROTOR ASSEMBLY	72-53-03		
Disassembly-01		501	ALL
Task 72-53-03-040-001: Disassemble 3rd Stage Turbine Rotor Assembly		501	
Assembly-01		1001	ALL
Task 72-53-03-440-001: Assemble 3rd Stage Turbine Rotor Assembly		1001	
Assembly-02		1001	ALL
Task 72-53-03-440-002: Balance Stage 3 Turbine Rotor Assembly (Disk And Blades)		1001	
Assembly-03		1001	ALL
Task 72-53-03-440-003: Final Assemble 3rd Stage Turbine Rotor Assembly		1001	
STAGE 4 TURBINE ROTOR ASSEMBLY	72-53-04		
Disassembly-01		501	ALL
Task 72-53-04-040-001: Disassemble 4th Stage Turbine Rotor Assembly		501	
Assembly-01		1001	ALL
Task 72-53-04-440-001: Assemble 4th Stage Turbine Rotor Assembly		1001	
Assembly-02		1001	ALL
Task 72-53-04-440-002: Balance Stage 4 Turbine Rotor Assembly		1001	
Assembly-03		1001	ALL
Task 72-53-04-440-003: Final Assemble 4th Stage Turbine Rotor Assembly		1001	
STAGE 5 TURBINE ROTOR ASSEMBLY	72-53-05		
Disassembly-01		501	ALL
Task 72-53-05-040-001: Disassemble 5th Stage Turbine Rotor Assembly		501	
Assembly-01		1001	ALL

SUBJECT	CHP/SEC/SUB	PAGE	EFFECTIVITY
STAGE 5 TURBINE ROTOR ASSEMBLY (CONTINUED)	72-53-05		
Task 72-53-05-440-001: Assemble 5th Stage Turbine Rotor Assembly		1001	
Assembly-02		1001	ALL
Task 72-53-05-440-002: Balance Stage 5 Turbine Rotor Assembly		1001	
Assembly-03		1001	ALL
Task 72-53-05-440-003: Final Assemble 5th Stage Turbine Rotor Assembly		1001	
STAGE 6 TURBINE ROTOR ASSEMBLY	72-53-06		
Disassembly-01		501	ALL
Task 72-53-06-040-001: Disassemble 6th Stage Turbine Rotor Assembly		501	
Assembly-01		1001	ALL
Task 72-53-06-440-001: Assemble 6th Stage Turbine Rotor Assembly		1001	
Assembly-02		1001	ALL
Task 72-53-06-440-002: Balance Stage 6 Turbine Rotor Assembly		1001	
Assembly-03		1001	ALL
Task 72-53-06-440-003: Final Assemble 6th Stage Turbine Rotor Assembly		1001	

Previous Pageblock Return to Previous Menu Next Pageblock

STAGE 3 TURBINE ROTOR ASSEMBLY - DISASSEMBLY-01

Task 72-53-03-040-001:

1. Disassemble 3rd Stage Turbine Rotor Assembly

A. Equipment And Materials Required

Special Tools:

PWA 85086 Arm (2 Required)
PWA 85214 Adapter, Lifting
PWA 85215 Adapter, Lifting
PWA 85226 Puller, Jackscrew
PWA 85385 Support, Rear

B. Procedure

(1) Place PWA 85385 Support on bench.

(2) Secure PWA 85214 Adapter to bore of 3rd stage LPT disk with lifting eye side up. Using hoist, position disk onto Fixture PWA 85385. Remove hoist and adapter.

(3) Unbend and remove 40 tierod locks (501/1) from turbine tierods (501/2). Discard tierod locks. Remove turbine tierods. Discard the tierods.

(4) Remove the 3rd stage airseal (501/3) from the disk (501/5) with PWA 85226 Jackscrew Puller.

  (a) Put the split rings below the airseal and connect the rings with the nuts provided.

  (b) Put the circular plate on the disk to engage the six (6) pick studs in the split rings.

  (c) Put the six (6) flanged nuts on the jack studs.

  (d) Tighten the nuts equally until the airseal is removed from the disk.

  (e) Put the airseal in a suitable container.

  (f) Remove the forty (40) washers (501/4) from the tierod holes.

(5) Trunnion rotor to front end down position.

  (a) Secure Adapter PWA 85214 to bore of disk with lifting eye side up. Connect hoist with PWA 85086 Arm to lifting eye of adapter.

(b) Using hoist, lift rotor assembly. Align boltholes and position PWA 85215 Adapter to lower (rear) side of disk with lifting eye side down. Install four cap screws through tierod holes in disk and into base of adapter and secure with hand knobs.

(c) Connect second hoist and PWA 85086 to lifting eye of Adapter PWA 85215. Using both hoists, lift and trunnion rotor to front end down position. Remove lower hoist, arm, and adapter. Lower disk onto suitable support and remove hoist, arm, and adapter.

CAUTION: TAP ONLY ON ROOT PLATFORM. AIRFOIL SECTIONS ARE EASILY DAMAGED.

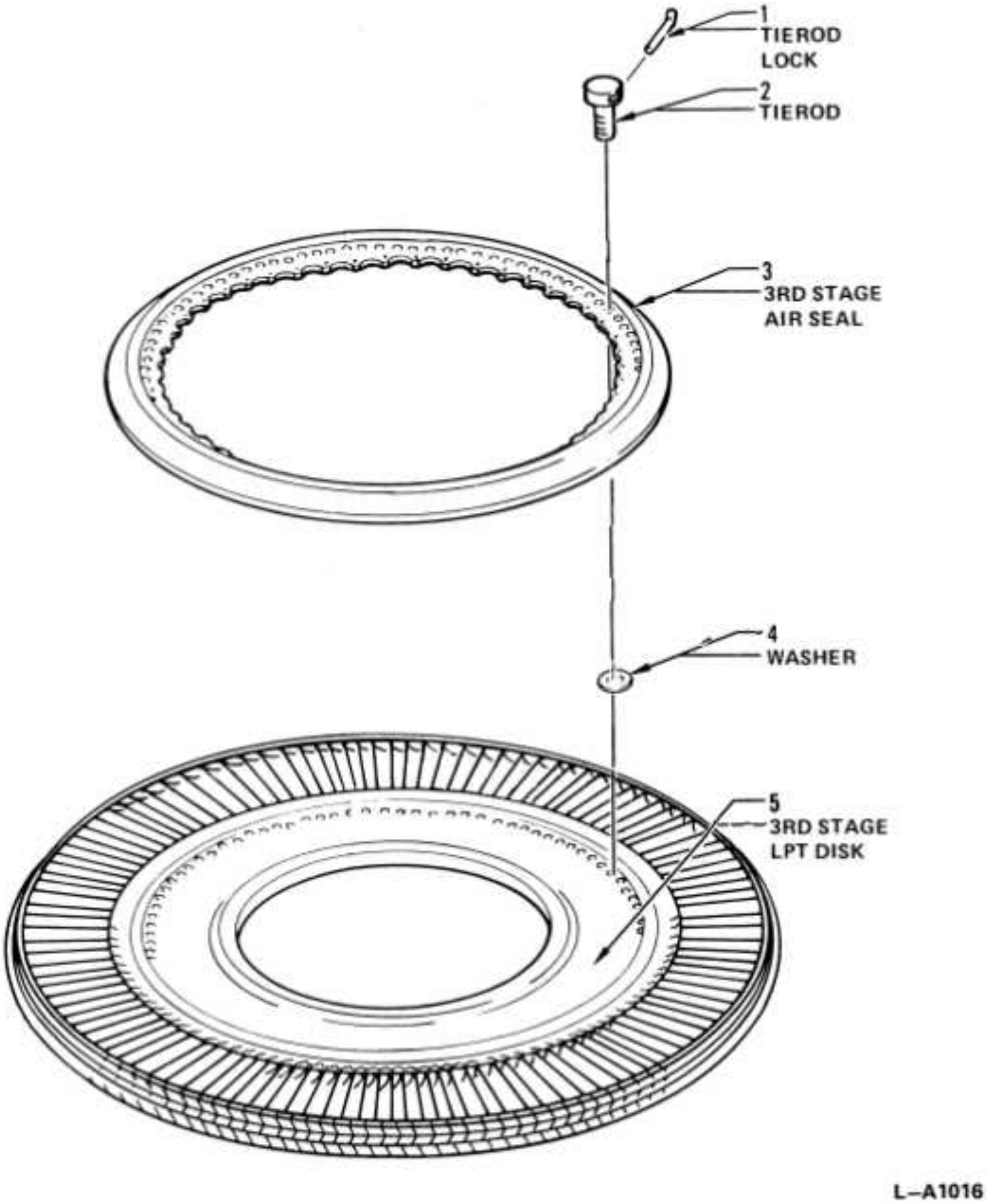
(6) Remove blades from disk blade slots.

(a) Using fiber drift or plastic mallet and working back and forth around disk, tap blade root platforms to remove blades from disk.

(b) Place blades into suitable, identified container.

(7) Reinstall Adapter PWA 85215 to rear face of disk per previous step. Connect hoist and Arm PWA 85086 to lifting eye of adapter. Using hoist, place disk on pallet. Remove hoist, arm and adapter.

STAGE 3 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01


1
TIEROD
LOCK
2
TIEROD
3
3RD STAGE
AIR SEAL
4
WASHER
5
3RD STAGE
LPT DISK
L−A1016

Third Stage Turbine Rotor Assembly Disassembly
Figure 501
(Task 72−53−03−040−001)

Task 72−53−03−440−001:

1. Assemble 3rd Stage Turbine Rotor Assembly

A. Prerequisites

R (1) Refer to 72−53−00, Inspection/Check−04 (Task
R 72−53−00−990−001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:

PWA 85086 Arm (Two Required)
PWA 85214 Adapter, Lifting
PWA 85215 Adapter, Lift And Trunnion
PWA 85385 Fixture, Support

C. Procedure

(1) Weigh all blades using a precision scale. Mark weight of each blade on the surface of the airfoil. Use temporary marking non−etching ink.

(2) Lay blades out on bench in order of decreasing weight.

(3) Number the blades from 1 to 128 in order of heaviest to lightest. Use temporary marking non−etching ink to mark blade number.

(4) Put the blades in the following sequence: 1, 128, 3, 126, 5, 124, ... 63, 66; 2, 127, 4, 125, 6, 123, ... 64, 65.

NOTE: This sequence alternates heavy blades next to light blades and balances blades of similar weights 180 degrees across the rotor. This method results in an equal distribution of heavy and light blades.

(5) Position PWA 85385 Support, smaller ID end down onto bench or rotary table.

(6) Position disk, rear face down, onto PWA 85385 Support.

(a) If disk is stored rear face down, attach PWA 85214 Adapter to bore of disk, with lifting eye side up. Using hoist, position disk onto Fixture PWA 85385. Remove hoist and adapter.

(b) If disk is stored front face down, attach Adapter PWA 85214, to bore of disk, with lifting eye side down. Attach PWA 85215 Adapter to upper face of disk, with lifting eye side up. Using hoists and two PWA 85086 Arms, lift and trunnion disk to rear end down position. Remove lower arm and adapter, and place disk on fixture PWA 85385.

(7) Install blade No. 1 into any disk blade slot. Install blade with trailing edge (longest side) down approximately half way into slot. Hold first blade by hand, exerting pressure in a counterclockwise direction and insert the next blade, in the order specified in the previous step, into the adjacent counterclockwise slot, approximately half way into slot. See Figure 1001 for a schematic view of the blade installation sequence.

(8) Continue installing blades this way until all blades are inserted into disk blade slots.

CAUTION: TAP ONLY ON ROOT PLATFORM. AIRFOIL SECTIONS ARE EASILY DAMAGED.

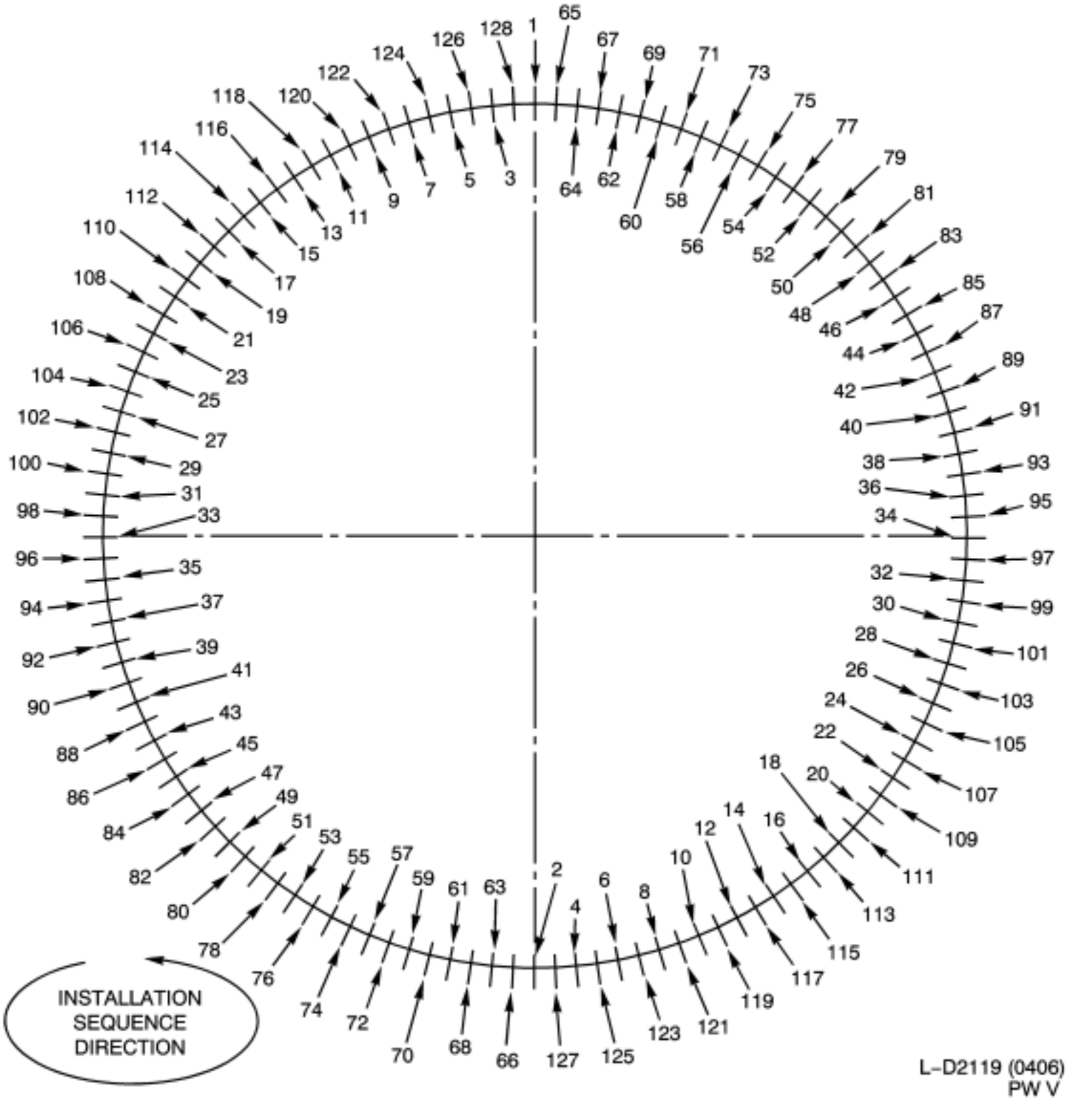
(9) Using fiber drift or plastic mallet and working back and forth around disk, tap blade platforms, as necessary, to align blade shrouds.

CAUTION: DO NOT DAMAGE BLADE TANGS.

(10) Tap blades to seat blade tang against disk. Use fiber drift or plastic mallet.

D. Postrequisite Procedures

R (1) Static balance rotor assembly.Refer to 72-52-03,
R Assembly-02 (Task 72-52-03-440-002).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INSTALLATION SEQUENCE DIRECTION
L−D2119 (0406)
PW V

NOTE: Schematic Of Blades Installation As Viewed From The Front Side Of The Disk.

Third Stage Turbine Rotor Assembly (Blade Installation Schematic)
Figure 1001
(Task 72−53−03−440−001)

STAGE 3 TURBINE ROTOR ASSEMBLY - ASSEMBLY-02

Task 72-53-03-440-002:

1. Balance Stage 3 Turbine Rotor Assembly (Disk And Blades)

A. Prerequisites

(1) Assemble stage 3 turbine rotor assembly by Assembly-01 (Task 72-53-03-440-001).

B. Equipment And Materials Necessary

Standard Tools:

Drift, Fiber
Hammer, Soft Face or Plastic

Special Tools:

PWA 25648	Screw Set, Holding (2 Necessary)
PWA 32492	Screw Set (2 Necessary)
PWA 80258	Plug Set, Locating
PWA 85190	Adapter, Locating (Optional To PWA 87086)
PWA 85192	Washer Set, Holding
PWA 85207	Weight, Calibration (Check Weight)
PWA 85214	Adapter, Lifting
PWA 85340	Plug Set, Holding
PWA 85385	Support
PWA 87086	Adapter, Balance
PWA 87213	Pin, Alignment (4 Necessary)
PWA 101395	Drift, Removal/Installation
PWA 103649	Air Cylinder, Balance
PWA 104240	Adapter, Balance (Optional To PWA 85190 Or PWA 87086)

Consumable Materials:

	Item No.	Designation
R	P05-323	Tape, Pressure Sensitive Sealing

C. Procedure

(1) Prepare the static balance locating adapter as follows:

(a) Use a hoist and sling and attach the PWA 85190 Locating Adapter or PWA 87086 Balance Adapter to the spindle of the balance machine with the four detail bolts. See Figure 1001.

1 Use an opposite bolt pattern and tighten the four bolts equally. Torque the bolts to 50 lb−in. (5.649 N.m) maximum.

CAUTION: SCREWS ARE IN SETS IN RELATION TO MASS WEIGHT. YOU MUST PUT SCREWS OF ONE SET DIAMETRICALLY OPPOSITE EACH OTHER. SCREWS OF ONE SET SHOULD NOT BE INTERCHANGED WITH SCREWS OF ANOTHER SET.

(b) Install PWA 80258 Locating Plugs in four locations on adapter marked 3LPT. Attach the plug set to the balance adapter with two PWA 32492 Screw Sets.

(c) Insert four PWA 85340 Hold Down Plugs in the four threaded holes on the balance adapter marked 3LPT. Tighten the holding plugs hand tight.

(d) Adjust the four locating plugs for a loose fit. Turn the four plugs to align the zero (0) (marked on the adjusting collar) with the scribed radial lines passing through the center of the balance adapter.

NOTE: Set zero (0) toward center of balance adapter.

(e) Thread four PWA 87213 Alignment Pins into the hold down plugs.

(2) Optional − Prepare the air cylinder and static balance adapter as follows:

(a) Use a hoist and sling and attach the PWA 103649 Balance Air Cylinder to the spindle of the balance machine with the six detail bolts.

1 Use an opposite bolt pattern and tighten the six bolts equally. Torque the bolts to 50 lb−in. (5.649 N.m) maximum.

(b) Use a hoist and sling and attach the PWA 104240 Balance Adapter to the air cylinder with the six detail bolts. See Figure 1001.

1 Use an opposite bolt pattern and tighten the six bolts equally. Torque the bolts to 50 lb−in. (5.649 N.m) maximum.

(c) Turn the center bolt on the diaphragm fully clockwise (finger tight) to secure the diaphragm to the piston of the air cylinder.

1 If the balance machine is equipped with air controls, turn the air control to "unclamp". If the balance machine is not equipped with air controls, attach an air hose to the fitting on the OD of the air cylinder.

(3) Install the rotor assembly on the PWA 85190 or PWA 87086 balance adapter and adjust the locating plugs for proper fit. See Figure 1002.

(a) Put the PWA 85214 Lifting Adapter to the bore of the disk, with the lift eye up. Move the two detail clamps under the disk and tighten the hand knobs.

(b) Attach a hoist to the lift eye of the adapter and lift the assembly. Put the assembly on the balance adapter. Align the tierod holes with the alignment pins on the holding plugs.

(c) Do not remove the hoist from the lift eye or the adapter from the assembly at this time.

(d) Adjust the locating plug set for a light interference fit with the outside diameter of the rotor assembly.

(e) Carefully remove the assembly from the balance adapter. Do not disturb the setting on the locating plug set.

(f) Set the locating plugs for the proper fit. The four locating plugs must be set to the same numerical marking after adjusting for proper fit.

(g) Tighten the four screws that attach the locating plugs to the balance adapter.

NOTE: Do not disturb the numeric position of the locating plugs while you tighten the screws.

R (h) Mark one hold down plug for reference. Use a
R marker given in Section 70-11-00 in the Standard
R Practices Manual, PN 585005.

(i) Put the assembly on the balance adapter. Align the tierod holes with the alignment pins on the holding plugs.

R R R (j) Mark the disk in line with referenced mark on hold down plug. Use a marker given in Section 70−11−00 in the Standard Practices Manual, PN 585005.

(k) Make sure that the rotor assembly is tightly engaged against the four locating plugs. Remove the alignment pins.

CAUTION: SCREWS ARE IN SETS IN RELATION TO MASS WEIGHT. YOU MUST PUT SCREWS OF ONE SET DIAMETRICALLY OPPOSITE EACH OTHER. SCREWS OF ONE SET SHOULD NOT BE INTERCHANGED WITH SCREWS OF ANOTHER SET.

(l) Attach the rotor assembly with a PWA 85192 Washer Set and two PWA 25648 Screw Sets. Tierod holes must be centered over hold down plugs to prevent interference with screw installation.

(4) Optional − Install the rotor assembly on the PWA 104240 Balance Adapter as follows:

(a) Lower the rotor assembly on the adapter and attach the rotor to the adapter with the two special shoulder screws. Tighten the screws.

(b) Turn the air control to "clamp", or remove the air hose from the OD of the cylinder to secure the rotor to the adapter.

(5) Operate the balance machine.

(a) Find the static unbalance of the rotor assembly while it turns at 900 rpm minimum.

(b) Get three unbalance readings. For balance machines that do not have an automatic recording feature, record the average angle and the average amount of unbalance.

(6) Turn the rotor assembly on the balance adapter 180 degrees from the original balance location as follows:

(a) Remove the screw sets and the washer set that attaches the rotor assembly to the adapter.

(b) Put the four PWA 87213 Alignment Pins in the threaded holes of the four holding plugs.

(c) Put the PWA 85214 Lifting Adapter to the bore of the disk, with the lift eye up. Move the two detail clamps under the disk and tighten the hand knobs.

(d) Attach the hoist to the lift eye and carefully lift the rotor off the adapter, turn it 180 degrees.

(e) Put the assembly on the balance adapter. Align the tierod holes with the alignment pins on the holding plugs.

(f) Make sure that the rotor assembly is tightly engaged against the four locating plugs. Remove the alignment pins.

(g) Attach the rotor assembly with a PWA 85192 Washer Set and two PWA 25648 Screw Sets.

1 Matching screws must be used at diametrically opposite positions.

2 Tierod holes must be centered over hold down plugs to prevent interference with screw installation.

(7) Operate the balance machine.

(a) Static balance the rotor assembly while it turns at 900 rpm minimum. The residual unbalance must not be more than 1.0 oz−in. (720.0 g.mm).

(b) For balance machines that have an automatic recording feature, get three unbalance readings. Average the readings. Use the machine to determine the unbalance amount and angle of the assembly.

(c) For balance machines that do not have an automatic recording feature, get three unbalance readings. Average and record the three unbalance readings. Use the average readings from the first and second balance runs to do a polar plot to get the assembly unbalance angle and amount.

STAGE 3 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02

(8) If the static unbalance is equal to 1.0 oz−in. (720.0 g.mm) or less continue as follows:

(a) Record the angle and the amount of unbalance.

(b) If necessary, remove all ink markings of unbalance symbols (triangle) that were done before.

(9) If the static unbalance is more than 1.0 oz−in. (720.0 g.mm), continue as follows:

NOTE: It is desirable to reduce residual unbalance to lowest value possible in practical amount of time.

(a) Use the PWA 85214 Lifting Adapter to remove the rotor assembly from the balance adapter. Put the assembly on the PWA 85385 Rear Support.

CAUTION: LIGHTLY HIT THE BLADE ROOT ONLY. YOU CAN EASILY DAMAGE THE AIRFOILS OR THE PLATFORMS OF THE BLADES IF THEY ARE HIT.

(b) Make a pyramid of the blades that must be removed. Lightly hit the blade root platforms with a PWA 101395 Installation Drift or a fiber drift and a soft face hammer to remove the blades.

CAUTION: BE VERY CAREFUL WHEN YOU SEAT THE BLADES OR DAMAGE TO THE BLADE TANGS CAN OCCUR.

(c) Lock the blade shrouds and engage the root of the blades into the disk. Lightly tap the blades with a PWA 101395 Installation Drift or a fiber drift and a soft face hammer to touch the blade tang against the disk.

(d) Put the assembly on the balance adapter.

(e) Static balance the rotor assembly as described above until the residual unbalance is not more than 1.0 oz−in. (720.0 g.mm).

(f) Record the heavy angle and the amount of assembly unbalance.

(g) Make a record of the last blade positions.

(10) Optional process based on the experience of the operator, do a check of the balance machine by Figure 1002 as follows:

- (a) Install the PWA 85207 Calibration Weight (Check Weight) in one of the tiebolt holes on the front flange bolt circle as close as possible to the angle of residual unbalance.
- (b) Attach the check weight to the disk with Pressure Sensitive Sealing Tape P05−323.
- (c) The check weight pulls 2.0 oz−in. (1440.0 g.mm).
- (d) Do a check of the balance machine at 900 rpm minimum.
- (e) The amount of unbalance should pull 2.0 oz−in. (1440.0 g.mm) plus the remaining residual unbalance ± 0.4 oz−in. (288.0 g.mm).
- (f) Remove the check weight.

R (11) Mark the unbalance symbol (triangle), as shown on
R reference Figure 1002, at location of heavy unbalance.
R Use a marker given in Section 70−11−00 in the Standard
R Practices Manual, PN 585005.

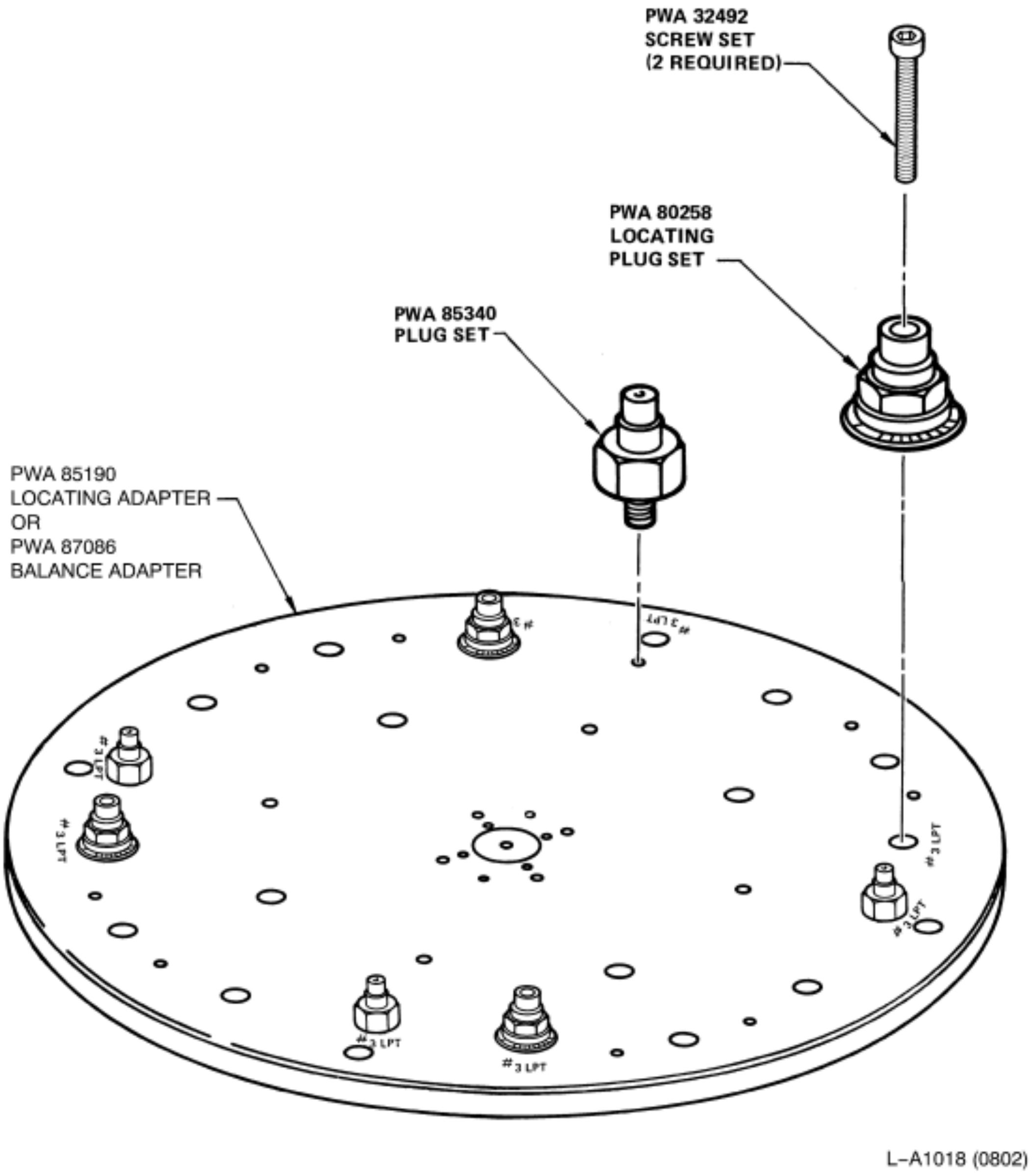
(12) Using hoist and PWA 85214 Lifting Adapter remove rotor assembly from balance fixture.

R (13) Mark the unbalance symbol (triangle) on rear side of
R disk web. Use a marker given in Section 70−11−00 in
R the Standard Practices Manual, PN 585005.

(14) Place rotor assembly on PWA 85385 Support, rear face down. Remove adapter.

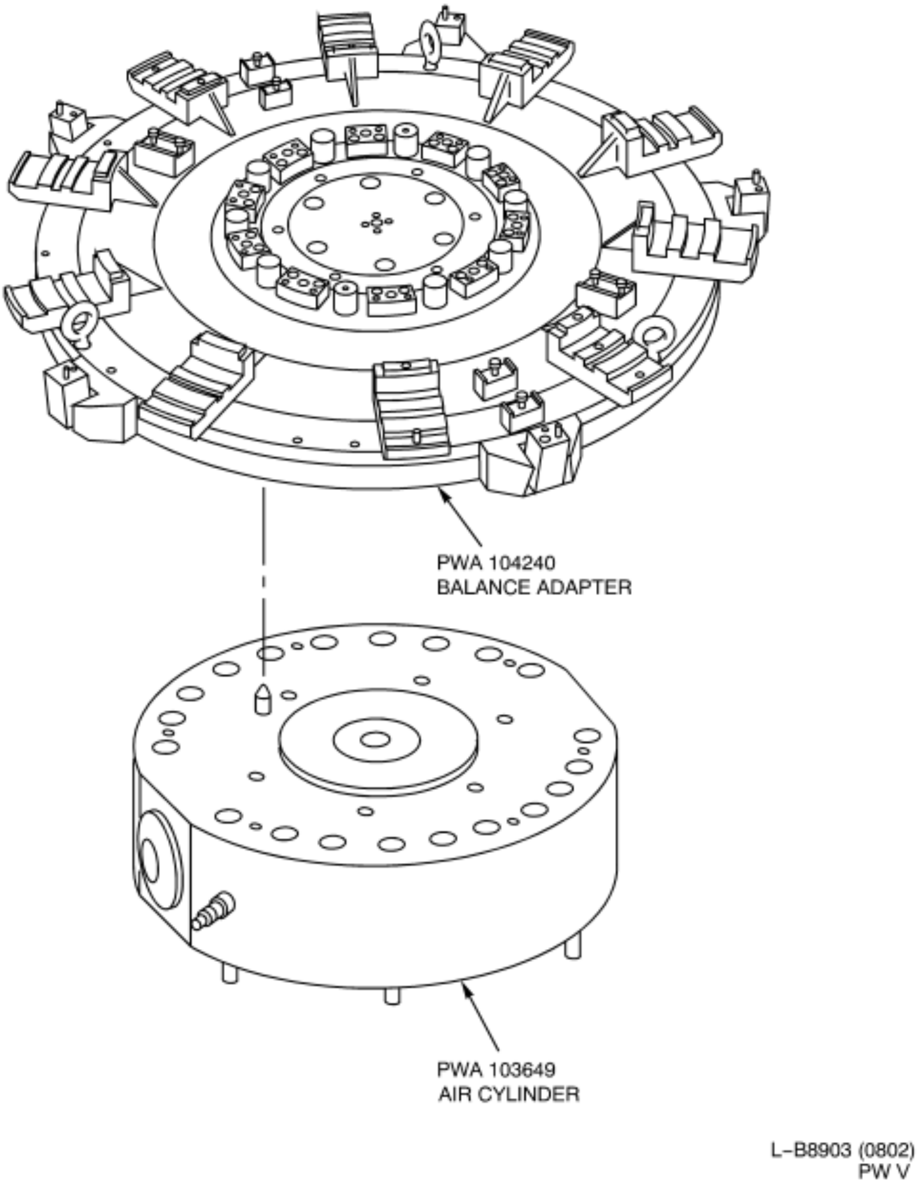
D. Postrequisites

(1) Final assemble stage 3 turbine rotor assembly by Assembly−03 (Task 72−53−03−440−003).

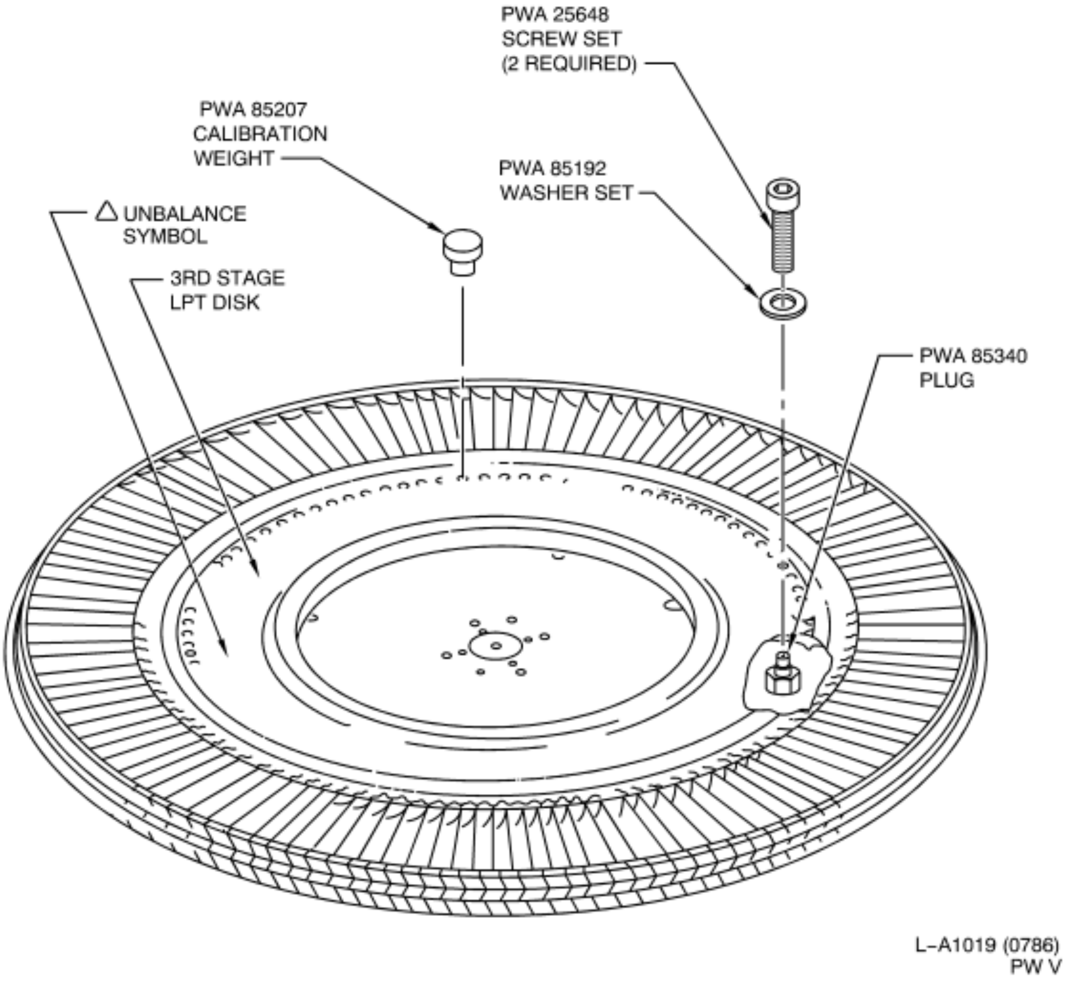

PWA 32492
SCREW SET
(2 REQUIRED)
PWA 80258
LOCATING
PLUG SET
PWA 85340
PLUG SET
PWA 85190
LOCATING ADAPTER
OR
PWA 87086
BALANCE ADAPTER
#3 LPT
L-A1018 (0802)

Third Stage Turbine Rotor Assembly Balance Set-Up
Figure 1001 (Sheet 1)
(Task 72-53-03-440-002)

STAGE 3 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02


PWA 104240
BALANCE ADAPTER
PWA 103649
AIR CYLINDER
L−B8903 (0802)
PW V

Third Stage Turbine Rotor Assembly Balance Set−Up
Figure 1001 (Sheet 2)
(Task 72−53−03−440−002)


PWA 25648
SCREW SET
(2 REQUIRED)
PWA 85207
CALIBRATION
WEIGHT
PWA 85192
WASHER SET
△ UNBALANCE
SYMBOL
3RD STAGE
LPT DISK
PWA 85340
PLUG
L-A1019 (0786)
PW V

Third Stage Turbine Rotor Assembly Balance Set-Up
Figure 1002
(Task 72-53-03-440-002)

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STAGE 3 TURBINE ROTOR ASSEMBLY - ASSEMBLY-03

Task 72-53-03-440-003:

1. Final Assemble 3rd Stage Turbine Rotor Assembly

A. Prerequisites

(1) See Inspection/Check-04 Task 72-53-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

(2) Balance 3rd stage turbine rotor assembly per Assembly-02 Task 72-53-03-440-002.

B. Equipment And Materials Required

Special Tools:

PWA 85214 Fixture, Lifting
PWA 85228 Bender, Manual

Consumable Materials:

Item No.	Designation
P05-102	Ice, Dry

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Tierod	40	72-53-00/3/550
Lock	40	72-53-00/3/560

C. Procedure

(1) Install 40 turbine tierods (1001/2) through airseal (1001/3). See Figure 1001.

NOTE: Do not reuse tierods; Use new tierods.

(2) Install 40 tierod locks (1001/1) to secure turbine tierod (1001/2) to 3rd stage airseal (1001/3). Bend tierod locks using PWA 85228 Bender. Inspect tierod locks per requirements of Figure 1002.

(3) Use Dry Ice P05-102 to chill the air seal and tierod assembly.

(4) Install PWA 85214 Lifting Fixture onto 3rd stage turbine rotor.

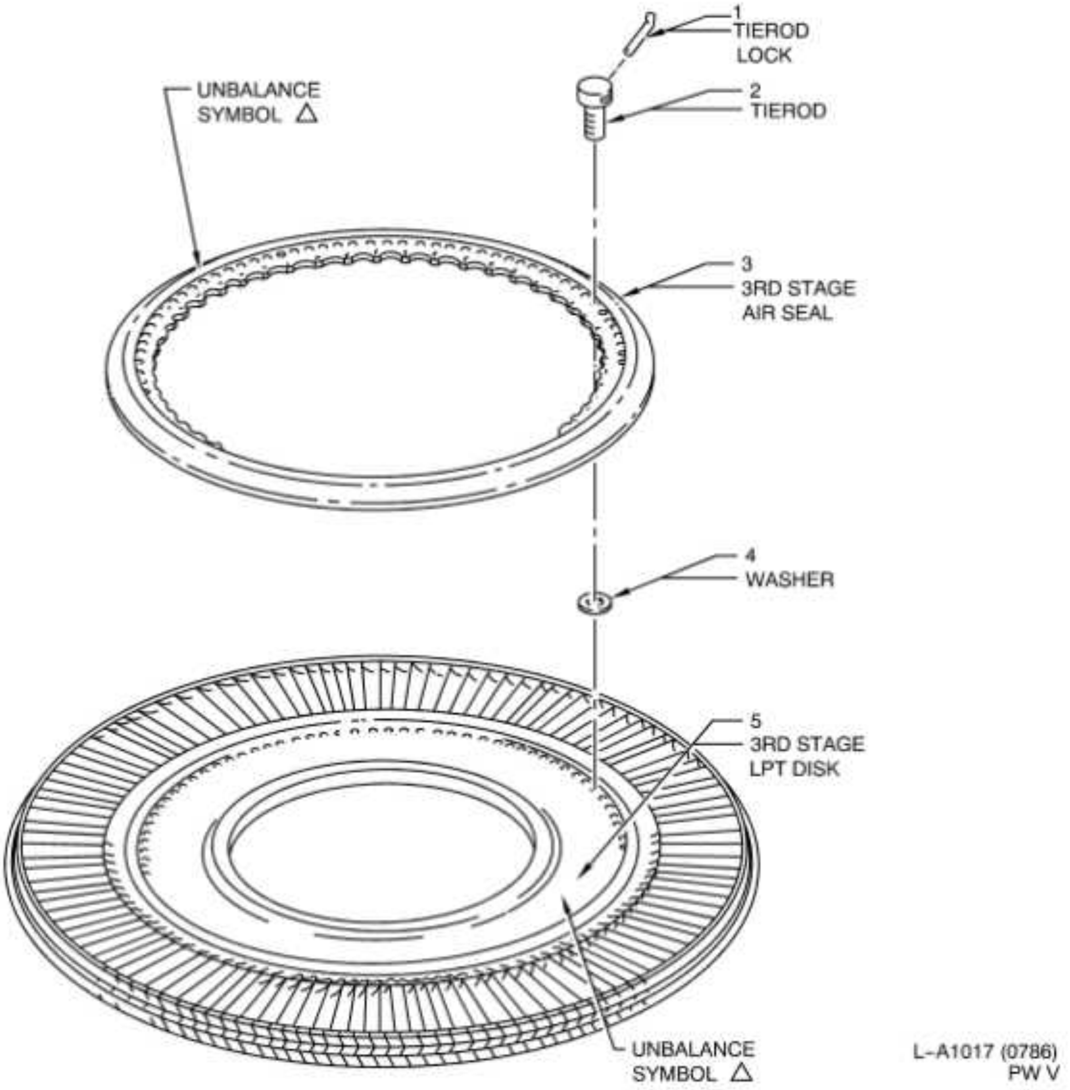
(5) Remove assembly from dry ice and position 40 washers (1001/4), equally spaced, on tierods in 3rd stage airseal.

(6) Locate triangular unbalance marks on airseal (1001/3) and disk (1001/5). With unbalance mark on airseal 180 degrees from unbalance mark on disk, align boltholes and seat disk on airseal.

WARNING: ENSURE THAT AIRSEAL IS TIGHT ON DISK BEFORE LIFTING, TO PREVENT IT'S BECOMING UNSEATED OR DROPPING FROM DISK.

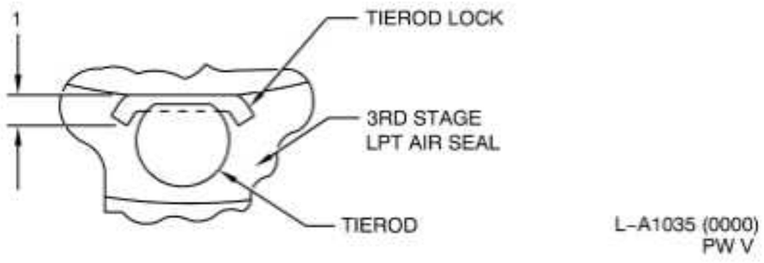
(7) Using hoist, position rotor assembly, airseal down, on suitable support. Remove lift fixture.

STAGE 3 TURBINE ROTOR ASSEMBLY − ASSEMBLY−03


1
TIEROD
LOCK
2
TIEROD
UNBALANCE
SYMBOL △
3
3RD STAGE
AIR SEAL
4
WASHER
5
3RD STAGE
LPT DISK
UNBALANCE
SYMBOL △
L-A1017 (0786)
PW V

Third Stage Turbine Rotor Assembly
Figure 1001
(Task 72−53−03−440−003)

STAGE 3 TURBINE ROTOR ASSEMBLY − ASSEMBLY−03


1
TIEROD LOCK
3RD STAGE
LPT AIR SEAL
TIEROD
L−A1035 (0000)
PW V

1. 0.225 Inch (5.715 mm) Minimum

Tierod Lock Inspection
Figure 1002
(Task 72−53−03−440−003)

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STAGE 4 TURBINE ROTOR ASSEMBLY - DISASSEMBLY-01

Task 72-53-04-040-001:

1. Disassemble 4th Stage Turbine Rotor Assembly

A. Equipment And Materials Required

Special Tools:

PWA 85086 Arm, Lifting (Two Required)
PWA 85215 Adapter, Lifting
PWA 85227 Puller, Jackscrew
PWA 85392 Support
PWA 85594 Adapter, Lift And Trunnion

B. Procedure
See Figure 501.

(1) Using PWA 85215 Lift Adapter position rotor onto bench or rotary table.

(2) Unbend tierod locks (501/3) securing 40 turbine tierods (501/2) to rear ID flange of 4th stage LPT disk (501/4). Discard locks. Remove turbine tierods. Discard the turbine tierods.

(3) Trunnion rotor to rear end down position on PWA 85392 Support on bench or rotary table.

(a) Attach PWA 85215 Lifting Adapter to rear (upper) flange of disk with lifting eye side up. Connect hoist with PWA 85086 Arm to lifting eye of adapter.

(b) Using hoist, lift rotor assembly and secure PWA 85594 Adapter to front (lower) flange of disk with lifting eye side down.

(c) Connect second hoist with PWA 85086 Arm to lifting eye of lower adapter. Using both hoists, lift and trunnion rotor assembly to rear end down position. Remove lower hoist, arm and adapter. Lower disk onto PWA 85392 Support. Remove hoist and arm.

(4) Remove 4th stage LPT airseal (501/1) using PWA 85227 Puller.

(a) Loosen flange nut and open split halves of puller plates.

(b) Place plate halves, with stud side up, around and under base of lower knife−edge seal. Secure plate halves with swing bolt and flange nut.

(c) Align boltholes in upper plate with studs in lower plate and seat upper plate on upper flange of disk. Install washers and jamnuts to studs.

(d) Using suitable tightening sequence, to prevent distortion of airseal, tighten jamnuts to remove airseal.

(e) Remove puller from airseal. Place airseal in suitable container.

(5) Trunnion rotor assembly to front end down position on support.

(a) Secure Adapter PWA 85215 to rear (upper) flange of disk with lifting eye side up. Connect hoist with Arm PWA 85086 to lifting eye of adapter.

(b) Using hoist, lift rotor assembly. Secure Adapter PWA 85594 to front (lower) flange of disk with lifting eye side down.

(c) Connect second hoist with Arm PWA 85086 to lifting eye of lower adapter. Using both hoists, lift and trunnion rotor assembly to front end down position. Remove lower hoist, arm and adapter. Lower disk onto support PWA 85392. Remove hoist and arm.

CAUTION: TAP ONLY ON ROOT PLATFORM. AIRFOIL SECTIONS ARE EASILY DAMAGED.

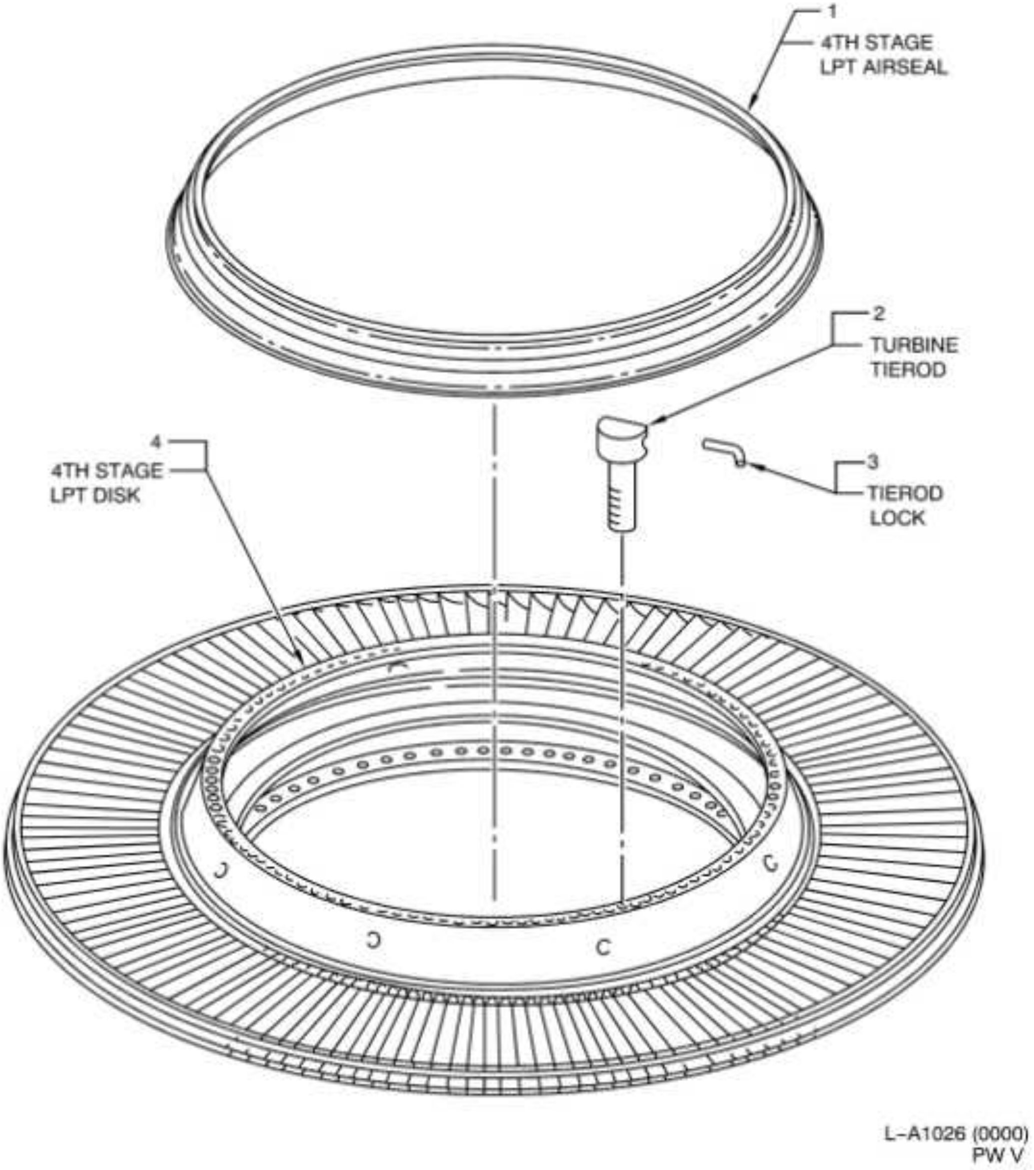
(6) Remove blades from disk blade slots.

(a) Using fiber drift or plastic mallet and working back and forth around disk, tap blade root platforms to remove blades from disk.

(b) Place blades into suitable, identified container.

(7) Reconnect hoist and place disk on pallet. Remove hoist and adapter.

STAGE 4 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01


1
4TH STAGE
LPT AIRSEAL
2
TURBINE
TIEROD
3
TIEROD
LOCK
4
4TH STAGE
LPT DISK
L-A1026 (0000)
PW V

Fourth Stage LPT Airseal And Turbine Tierod Removal
Figure 501
(Task 72−53−04−040−001)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-53-04-440-001:

1. Assemble 4th Stage Turbine Rotor Assembly

A. Prerequisites

(1) See Inspection/Check-04 Task 72-53-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:

PWA 85086 Arm, Lifting (Two Required)
PWA 85215 Adapter, Lifting
PWA 85392 Support
PWA 85594 Adapter, Lift And Trunnion

C. Procedure
See Figure 1001.

(1) Weigh all blades using a precision scale. Mark weight of each blade on the surface of the airfoil. Use temporary marking non-etching ink. R

(2) Lay blades out on bench in order of decreasing weight.

(3) Number the blades from 1 to 130 in order of heaviest to lightest. Use temporary marking non-etching ink to mark blade number.

(4) Put the blades in the following sequence: 1, 130, 3, 128, 5, 126, ... 63, 68, 65; 2, 129, 4, 127, 6, 125, ... 64, 67, 66.

NOTE: This sequence alternates heavy blades next to light blades and balances blades of similar weights 180 degrees across the rotor. This method results in an equal distribution of heavy and light blades.

(5) Position disk, rear flange down, onto PWA 85392 Support on bench or rotary table.

(a) If disk is stored rear flange down, attach PWA 85594 Adapter to front (upper) flange of disk with lifting eye side up. Using hoist, position disk onto PWA 85392 Support. Remove hoist and adapter.

(b) If disk is stored rear flange up, attach PWA 85215 Adapter to rear (upper) flange of disk with lifting eye side up. Attach hoist with PWA 85086 Arm to lifting eye of adapter. Secure Adapter PWA 85594 to front (lower) flange of disk with lifting eye side down. Connect second hoist with PWA 85086 Arm, to lifting eye of adapter. Using hoists lift and trunnion disk to rear flange down position. Remove lower hoist, arm and adapter and place disk onto PWA 85392 Support. Remove hoist, arm and adapter.

(6) Install blade No. 1 into any disk blade slot. Install blade with trailing edge (longest side) down approximately half way into slot. Hold first blade by hand, exerting pressure in a counterclockwise direction and insert the next blade, in the order specified in the previous step, into the adjacent counterclockwise slot, approximately half way into slot. See Figure 1002 for a schematic view of the blade installation sequence.

(7) Continue installing blades this way until all blades are inserted into disk blade slots.

CAUTION: TAP ONLY ON ROOT PLATFORM. AIRFOIL SECTIONS ARE EASILY DAMAGED.

(8) Using fiber drift or plastic mallet and working back and forth around disk, tap blade platforms, as necessary, to align blade shrouds.

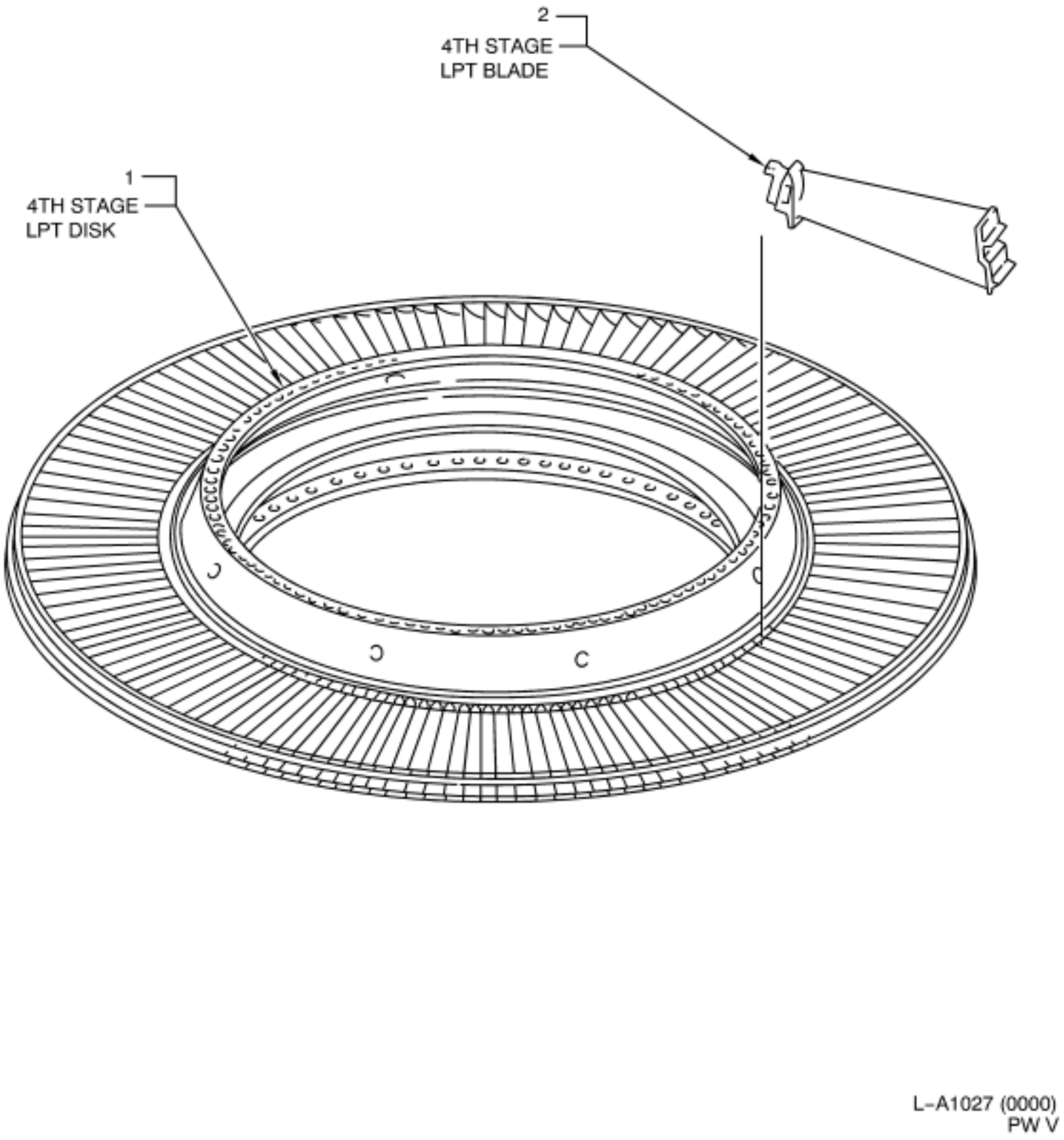
CAUTION: DO NOT DAMAGE BLADE TANGS.

(9) Tap blades to seat blade tang against disk. Use fiber drift or plastic mallet.

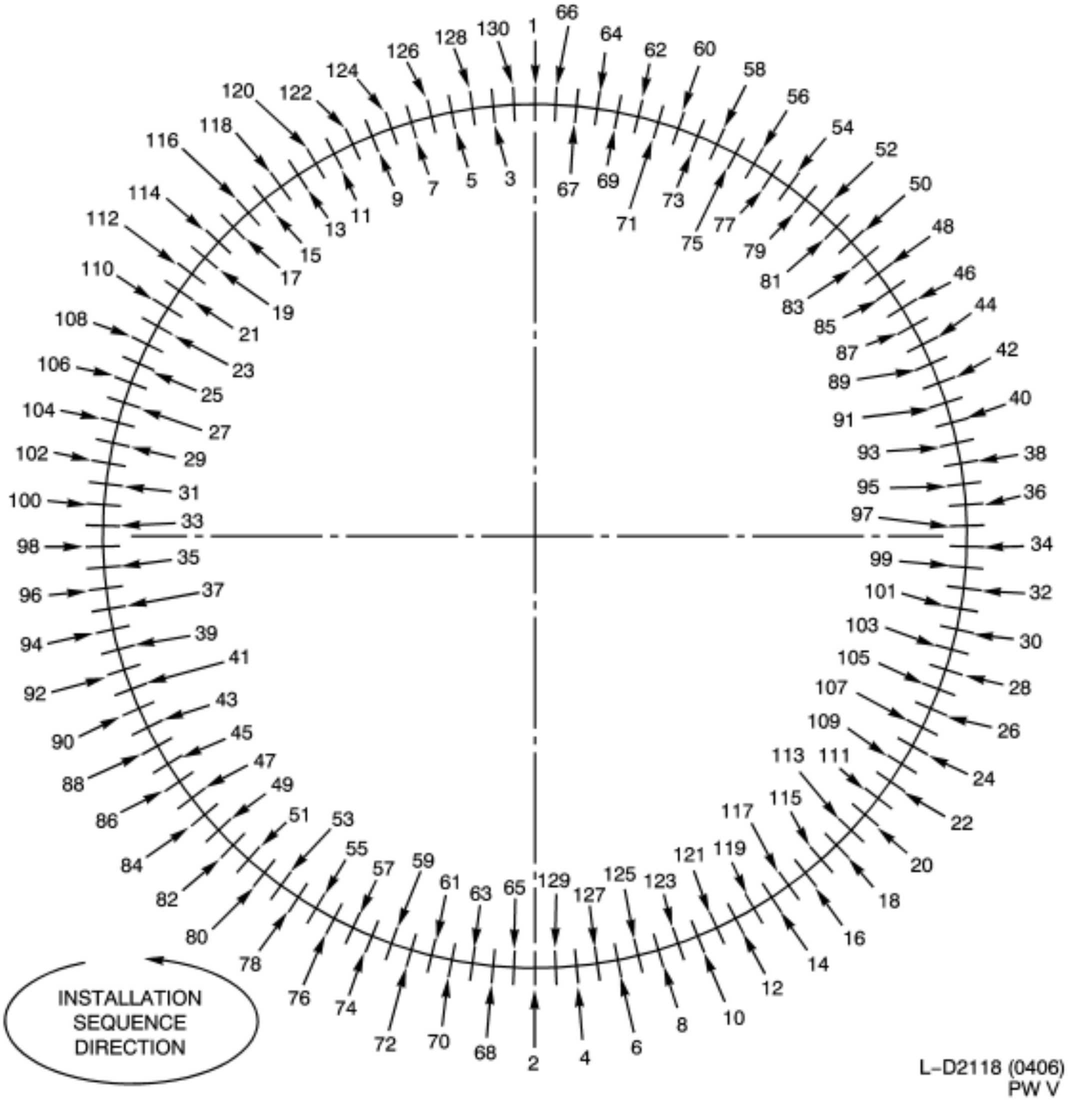
D. Postrequisite Procedures

(1) Static balance rotor assembly per Assembly−02 (Task 72−53−04−440−002).

STAGE 4 TURBINE ROTOR ASSEMBLY − ASSEMBLY−01


2
4TH STAGE
LPT BLADE
1
4TH STAGE
LPT DISK
L−A1027 (0000)
PW V

Fourth Stage LPT Blades Installation
Figure 1001
(Task 72−53−04−440−001)


INSTALLATION SEQUENCE DIRECTION
L-D2118 (0406)
PW V

NOTE: Schematic Of Blades Installation As Viewed From The Front Side Of The Disk.

Fourth Stage LPT Blades Installation (Blade Installation Schematic)
Figure 1002
(Task 72-53-04-440-001)

STAGE 4 TURBINE ROTOR ASSEMBLY - ASSEMBLY-02

Task 72-53-04-440-002:

1. Balance Stage 4 Turbine Rotor Assembly

A. Prerequisites

(1) Assemble stage 4 turbine rotor assembly by Assembly-01 (Task 72-53-04-440-001).

B. Equipment And Materials Necessary

Standard Tools:

Drift, Fiber
Hammer, Soft Face or Plastic

Special Tools:

PWA 25648	Screw Set, Holding (2 Necessary)
PWA 32492	Screw Set (2 Necessary)
PWA 80258	Plug Set, Locating
PWA 85190	Adapter, Locating (Optional To PWA 87086)
PWA 85191	Plug Set, Holding
PWA 85192	Washer Set, Holding
PWA 85207	Weight, Calibration (Check Weight)
PWA 85594	Adapter, Lifting
PWA 87086	Adapter, Balance
PWA 87213	Pin, Alignment (4 Necessary)
PWA 101395	Drift, Removal/Installation
PWA 103649	Air Cylinder, Balance
PWA 104241	Adapter, Balance (Optional To PWA 85190 Or PWA 87086)

Consumable Materials:

Item No.	Designation
P05-026	Ink (PMC 4057-1)
P05-045	Marker (PMC 4092-1 or PMC 4092-2)
P05-323	Tape, Pressure Sensitive Sealing

C. Procedure

(1) Prepare the static balance locating adapter as follows:

(a) Use a hoist and sling and attach the PWA 85190 Locating Adapter or the PWA 87086 Balance Adapter to the spindle of the balance machine with the four detail bolts. See Figure 1001.

1 Use an opposite bolt pattern and tighten the four bolts equally. Torque the bolts to 50 lb−in. (5.649 N.m) maximum.

R (b) Install the PWA 85191 Holding Plug Set in the four threaded holes on the balance adapter marked 4LPT. Tighten the holding plugs hand tight.

(c) Put the four PWA 87213 Alignment Pins in the threaded holes of the four holding plugs.

CAUTION: SCREWS ARE IN SETS IN RELATION TO MASS WEIGHT. YOU MUST PUT SCREWS OF ONE SET DIAMETRICALLY OPPOSITE EACH OTHER. SCREWS OF ONE SET SHOULD NOT BE INTERCHANGED WITH SCREWS OF ANOTHER SET.

(d) Install the PWA 80258 Locating Plugs in the four locations on the adapter marked 4LPT. Attach the plug set to the balance adapter with the two PWA 32492 Screw Sets.

(e) Adjust the four locating plugs for a loose fit. Turn the four plugs to align the zero (0) (marked on the adjusting collar) with the scribed radial lines passing through the center of the balance adapter.

NOTE: Set zero (0) toward the center of the balance adapter.

(2) Optional − Prepare the air cylinder and static balance adapter as follows:

(a) Use a hoist and sling and attach the PWA 103649 Balance Air Cylinder to the spindle of the balance machine with the six detail bolts.

1 Use an opposite bolt pattern and tighten the six bolts equally. Torque the bolts to 50 lb−in. (5.649 N.m) maximum.

(b) Use a hoist and sling and attach the PWA 104241 Balance Adapter to the air cylinder with the six detail bolts. See Figure 1001.

1 Use an opposite bolt pattern and tighten the six bolts equally. Torque the bolts to 50 lb−in. (5.649 N.m) maximum.

(c) Turn the center bolt on the diaphragm fully clockwise (finger tight) to secure the diaphragm to the piston of the air cylinder.

(d) Install the detail slide clamps (marked LPT−4) onto the shoulder bolts and move the clamps inward toward the machine spindle.

(e) Turn the center cap screw on the air cylinder valve one full turn counter−clockwise.

(f) Turn the valve housing to ID and turn the center cap screw clockwise to tighten.

1 If the balance machine is equipped with air controls, turn the air control to "unclamp". If the balance machine is not equipped with air controls, attach an air hose to the fitting on the OD of the air cylinder.

(3) Install the rotor assembly on the PWA 85190 or PWA 87086 balance adapter and adjust the locating plugs for proper fit. See Figure 1002.

(a) Put the PWA 85214 Lifting Adapter to the bore of the disk, with the lift eye up. Move the two detail clamps under the disk and tighten the hand knobs.

(b) Attach a hoist to the lift eye of the adapter and lift the assembly. Put the assembly on the balance adapter. Align the tierod holes with the alignment pins on the holding plugs.

(c) Do not remove the hoist from the lift eye or the adapter from the assembly at this time.

(d) Adjust the locating plug set for a light interference fit with the outside diameter of the rotor assembly.

(e) Carefully remove the assembly from the balance adapter. Do not disturb the setting on the locating plug set.

(f) Set the locating plugs for the proper fit. The four locating plugs must be set to the same numerical marking after adjusting for proper fit.

(g) Tighten the four screws that attach the locating plugs to the balance adapter.

NOTE: Do not disturb the numeric position of the locating plugs while you tighten the screws.

(h) Mark one hold down plug for reference with a Marker P05−045.

(i) Put the assembly on the balance adapter. Align the tierod holes with the alignment pins on the holding plugs.

(j) Mark the disk in line with referenced mark on hold down plug with a Marker P05−045.

(k) Make sure that the rotor assembly is tightly engaged against the four locating plugs. Remove the alignment pins.

CAUTION: SCREWS ARE IN SETS IN RELATION TO MASS WEIGHT. YOU MUST PUT SCREWS OF ONE SET DIAMETRICALLY OPPOSITE EACH OTHER. SCREWS OF ONE SET SHOULD NOT BE INTERCHANGED WITH SCREWS OF ANOTHER SET.

(l) Attach the rotor assembly with a PWA 85192 Washer Set and two PWA 25648 Screw Sets. Tierod holes must be centered over hold down plugs to prevent interference with screw installation.

(4) Optional − Install the rotor assembly on the PWA 104241 Balance Adapter as follows:

(a) Lower the rotor assembly on the adapter, make sure to engage the two locating pins into the bolt circle of the disk.

(b) Reach through the bore of the disk and move the slide clamps radially outward.

(c) Turn the air control to "clamp", or remove the air hose from the OD of the cylinder to secure the rotor to the adapter.

(5) Operate the balance machine.

(a) Find the static unbalance of the rotor assembly while it turns at 900 rpm minimum.

(b) Get three unbalance readings. For balance machines that do not have an automatic recording feature, record the average angle and the average amount of unbalance.

(6) Turn the rotor assembly on the balance adapter 180 degrees from the original balance location as follows:

(a) Remove the screw sets and the washer set that attaches the rotor assembly to the adapter.

(b) Put the four PWA 87213 Alignment Pins in the threaded holes of the four holding plugs.

(c) Put the PWA 85214 Lifting Adapter to the bore of the disk, with the lift eye up. Move the two detail clamps under the disk and tighten the hand knobs.

(d) Attach the hoist to the lift eye and carefully lift the rotor off the adapter, turn it 180 degrees.

(e) Put the assembly on the balance adapter. Align the tierod holes with the alignment pins on the holding plugs.

(f) Make sure that the rotor assembly is tightly engaged against the four locating plugs. Remove the alignment pins.

(g) Attach the rotor assembly with a PWA 85192 Washer Set and two PWA 25648 Screw Sets.

1 Matching screws must be used at diametrically opposite positions.

2 Tierod holes must be centered over hold down plugs to prevent interference with screw installation.

(7) Operate the balance machine.

(a) Static balance the rotor assembly while it turns at 900 rpm minimum. The residual unbalance must not be more than 1.0 oz−in. (720.0 g.mm).

(b) For balance machines that have an automatic recording feature, get three unbalance readings. Average the readings. Use the machine to determine the unbalance amount and angle of the assembly.

(c) For balance machines that do not have an automatic recording feature, get three unbalance readings. Average and record the three unbalance readings. Use the average readings from the first and second balance runs to do a polar plot to get the assembly unbalance angle and amount.

(8) If the static unbalance is equal to 1.0 oz−in. (720.0 g.mm) or less continue as follows:

(a) Record the angle and the amount of unbalance.

(b) If necessary, remove all ink markings of unbalance symbols (triangle) that were done before.

(9) If the static unbalance is more than 1.0 oz−in. (720.0 g.mm), continue as follows:

NOTE: It is desirable to reduce residual unbalance to lowest value possible in practical amount of time.

(a) Use the PWA 85214 Lifting Adapter to remove the rotor assembly from the balance adapter. Put the assembly on the PWA 85385 Rear Support.

CAUTION: LIGHTLY HIT THE BLADE ROOT ONLY. YOU CAN EASILY DAMAGE THE AIRFOILS OR THE PLATFORMS OF THE BLADES IF THEY ARE HIT.

(b) Make a pyramid of the blades that must be removed. Lightly hit the blade root platforms with a PWA 101395 Installation Drift or a fiber drift and a soft face hammer to remove the blades.

CAUTION: BE VERY CAREFUL WHEN YOU SEAT THE BLADES OR DAMAGE TO THE BLADE TANGS CAN OCCUR.

(c) Lock the blade shrouds and engage the root of the blades into the disk. Lightly tap the blades with a PWA 101395 Installation Drift or a fiber drift and a soft face hammer to touch the blade tang against the disk.

(d) Put the assembly on the balance adapter.

(e) Static balance the rotor assembly as described above until the residual unbalance is not more than 1.0 oz−in. (720.0 g.mm).

(f) Record the heavy angle and the amount of assembly unbalance.

(g) Make a record of the last blade positions.

(10) Optional process based on the experience of the operator, do a check of the balance machine by Figure 1002 as follows:

(a) Install the PWA 85207 Calibration Weight (Check Weight) in one of the tiebolt holes on the front flange bolt circle as close as possible to the angle of residual unbalance.

(b) Attach the check weight to the disk with Pressure Sensitive Sealing Tape P05−323.

(c) The check weight pulls 2.0 oz−in. (1440.0 g.mm).

(d) Do a check of the balance machine at 900 rpm minimum.

(e) The amount of unbalance should pull 2.0 oz−in. (1440.0 g.mm) plus the remaining residual unbalance ± 0.4 oz−in. (288.0 g.mm).

(f) Remove the check weight.

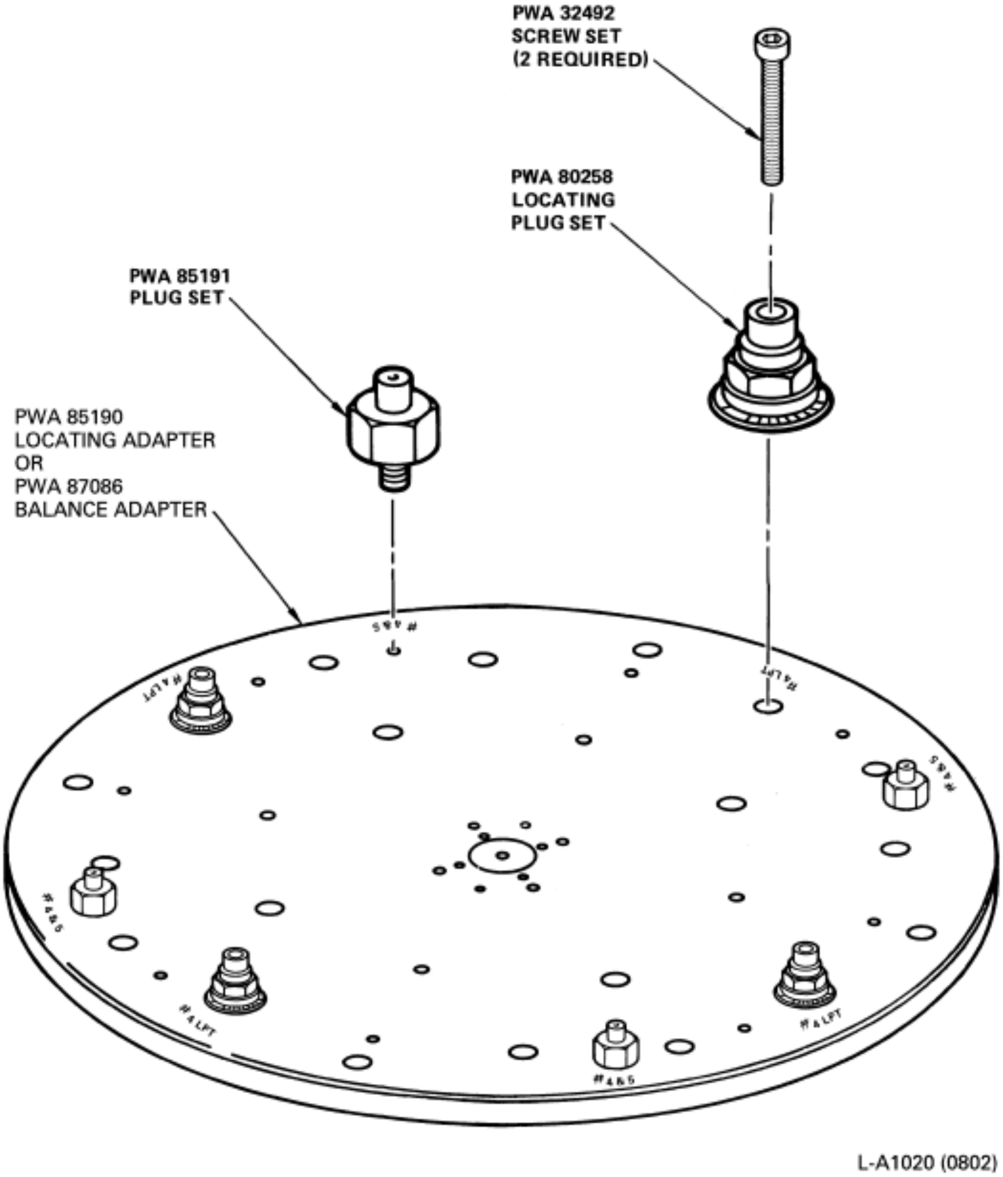
(11) Ink mark unbalance symbol (triangle) using Ink P05−026, as shown on reference Figure 1002, at heavy unbalance.

(12) Using hoist and PWA 85594 Adapter, remove rotor assembly from balance fixture.

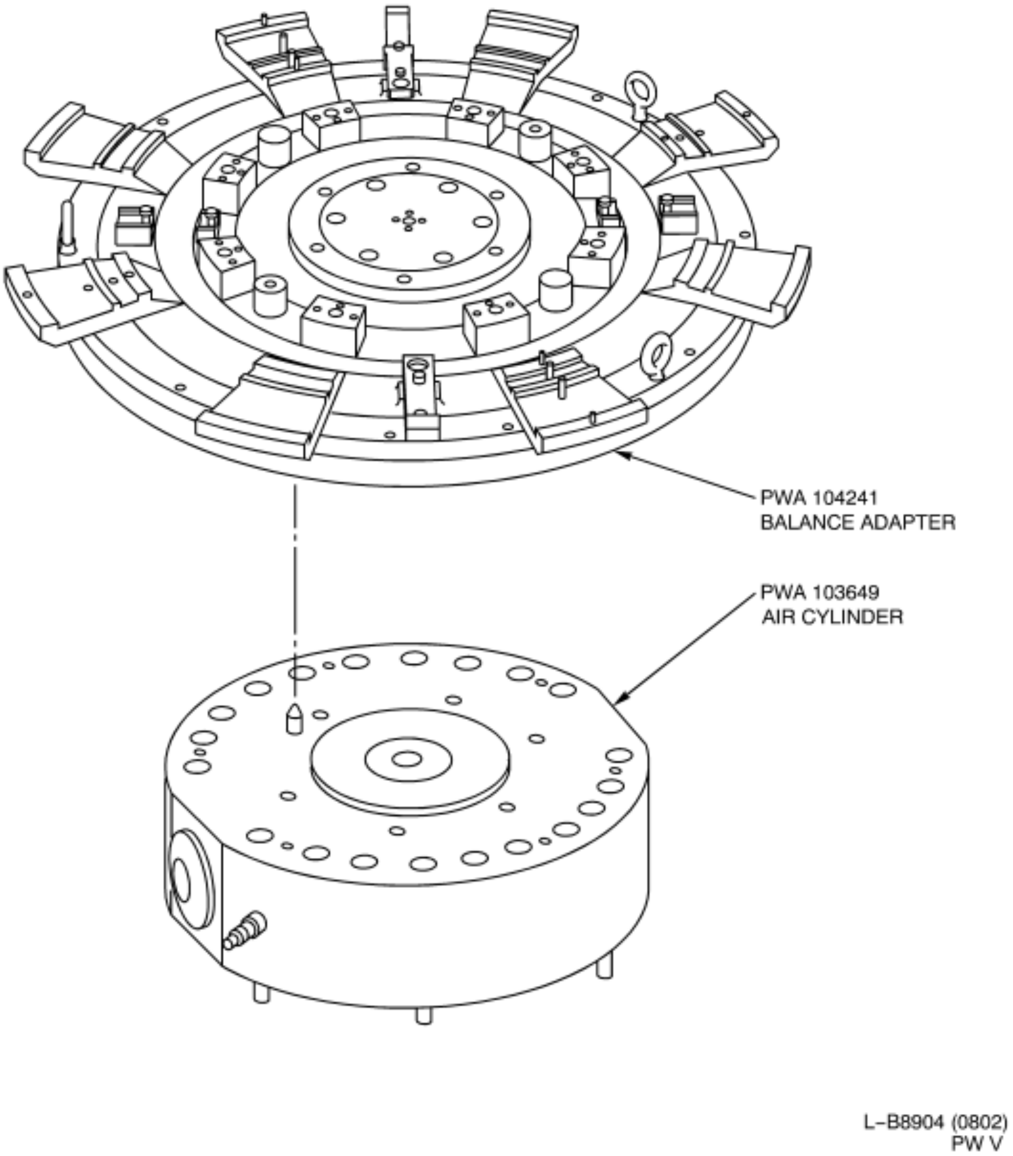
(13) Store rotor assembly, rear flange down. Remove adapter.

D. Postrequisites

(1) Final assemble stage 4 turbine rotor assembly by Assembly−03 (Task 72−53−04−440−003).

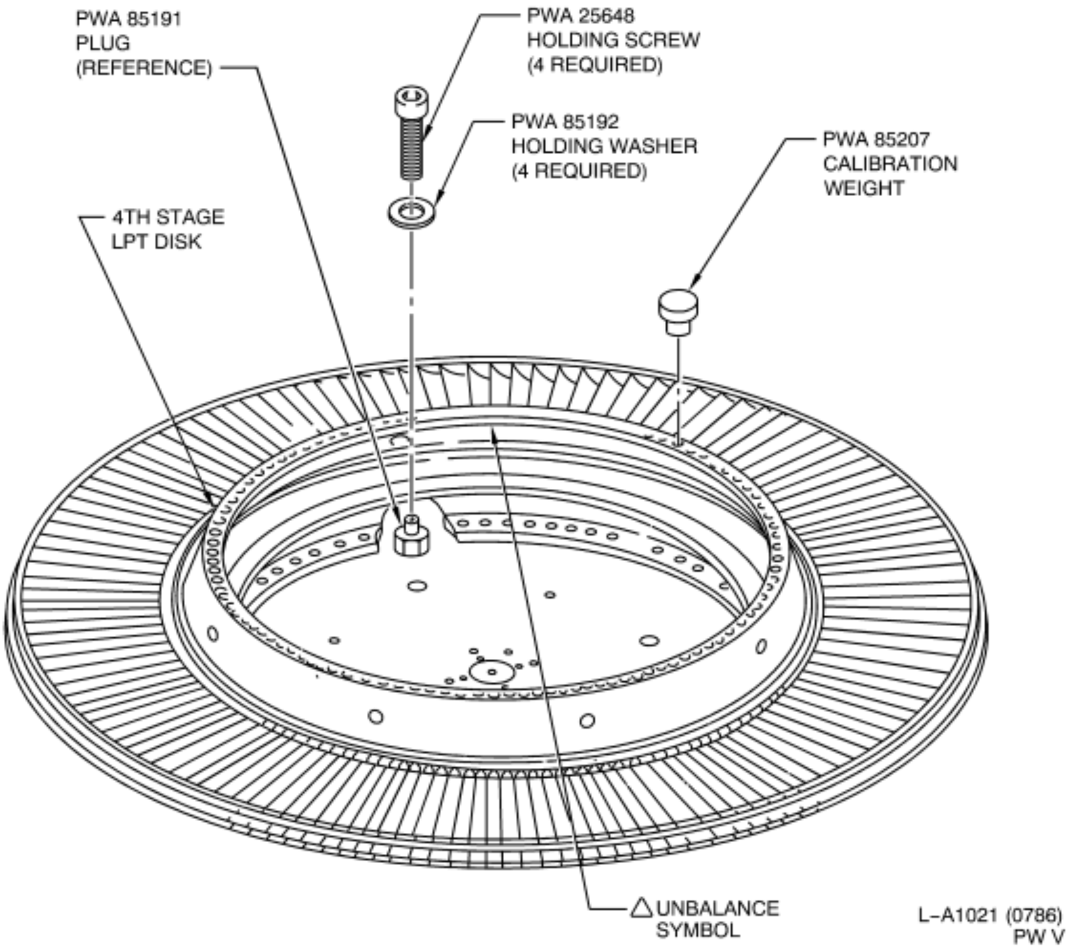

PWA 32492
SCREW SET
(2 REQUIRED)
PWA 80258
LOCATING
PLUG SET
PWA 85191
PLUG SET
PWA 85190
LOCATING ADAPTER
OR
PWA 87086
BALANCE ADAPTER
#4&5
#4 LPT
#4&5
#4 LPT
#4&5
#4 LPT
#4&5
#4 LPT
L-A1020 (0802)

Fourth Stage Turbine Rotor Assembly Balance Set-Up
Figure 1001 (Sheet 1)
(Task 72-53-04-440-002)


PWA 104241
BALANCE ADAPTER
PWA 103649
AIR CYLINDER
L−B8904 (0802)
PW V

Fourth Stage Turbine Rotor Assembly Balance Set−Up
Figure 1001 (Sheet 2)
(Task 72−53−04−440−002)

STAGE 4 TURBINE ROTOR ASSEMBLY - ASSEMBLY-02


PWA 85191
PLUG
(REFERENCE)
PWA 25648
HOLDING SCREW
(4 REQUIRED)
PWA 85192
HOLDING WASHER
(4 REQUIRED)
PWA 85207
CALIBRATION
WEIGHT
4TH STAGE
LPT DISK
△ UNBALANCE
SYMBOL
L-A1021 (0786)
PW V

Fourth Stage Turbine Rotor Assembly Balance Set-Up
Figure 1002
(Task 72-53-04-440-002)

Task 72-53-04-440-003:

1. Final Assemble 4th Stage Turbine Rotor Assembly

A. Prerequisites

(1) See Inspection/Check-04 (Task 72-53-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

(2) Balance 4th stage turbine rotor assembly per Assembly-02 (Task 72-53-04-440-002).

B. Equipment And Materials Necessary

Standard Tools:

Name	Manufacturer
Clements Cadillac Flameless Torch Model FT 1000	Clements Manufacturing Co. 6650 S. Narraganset Avenue Chicago, IL 60638

NOTE: The flameless torch specified above is optional to the heaters specified in the special tools list, and the optional flame torch.

Special Tools:

PWA 29754	Control, Heater
PWA 85086	Arm, Lifting (2 Required)
PWA 85215	Adapter, Lift And Trunnion
PWA 85229	Bender, Manual (Optional To PWA 103631)
PWA 85320	Heater, Electrical
PWA 85594	Adapter, Lift And Trunnion
PWA 103631	Bender, Manual (Optional To PWA 85229)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Tierod, Turbine	40	72-53-00/4/90
Lock, Turbine Tierod	40	72-53-00/4/100

C. General Assembly Requirements

(1) Where heating is required for assembly, use minimum temperature differential of 125°F (52°C) between parts being assembled. Do not exceed 300°F (149°C) on any part.

(2) Where heating is required for assembly, special heaters are specified in the following procedure. However, you can use an optional flameless torch or flame torch as specified in the following steps.

(3) In locations where heating of a component in an oven is not practical or only a flange of the component requires heating, the use of Clements Cadillac Quic Heat flameless torch, Model FT 1000 is recommended.

(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE FLAME WILL DAMAGE OR BURN NON−METAL PARTS.

CAUTION: DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

D. Procedure
See Figure 1001.

(1) Optional, position PWA 85320 Heater on 4th stage disk.

NOTE: You can use the optional flameless torch or flame torch as previously specified to heat the disk.

(a) Remove ball lock pins and raise four support pins to upper positions. Secure support pins with ball lock pins.

(b) Using handles, carefully lift and centralize heater on front face of disk. Ensure that heater seats properly on face of disk.

(c) Connect PWA 29754Heater Control to junction box of heater.

(d) Connect thermocouple connector to heater control.

CAUTION: TEMPERATURE OF DISK MUST NOT EXCEED 400°F (204.4°C) OR DAMAGE TO PART MAY OCCUR.

(2) Use the PWA 85320 Heater, or the optional flameless torch or flame torch, to heat the disk. Heat the disk to obtain a minimum temperature difference of 250°F (138.8°C) between mating parts. If applicable, remove the heater.

STAGE 4 TURBINE ROTOR ASSEMBLY - ASSEMBLY-03

(3) Chill 4th stage airseal (1001/3).

CAUTION: BLADES THAT HAVE BLENDED BLADE ROOT TANGS CAN NOT BE INSTALLED AGAINST THE AIRSEAL ANTIROTATION LUGS (REFERENCE 72-53-08, REPAIR-10, TASK 72-53-08-300-010).

(4) Locate unbalance marks on airseal and disk. Place unbalance mark on airseal 180 degrees clockwise from unbalance mark on disk.

WARNING: ENSURE THAT AIRSEAL IS TIGHT ON DISK BEFORE TRUNNIONING, TO PREVENT IT'S BECOMING UNSEATED OR DROPPING FROM DISK.

(5) Attach PWA 85594 Adapter to front (upper) flange of disk, with lifting eye side up. Attach hoist with PWA 85086 Arm to lifting eye of adapter. Secure PWA 85215 Adapter to rear (lower) flange of disk with lifting eye side down. Connect second hoist with PWA 85086 Arm to lifting eye of adapter. Using hoists, lift and trunnion disk to front end down position. Remove lower hoist, arm and adapter, and place rotor onto bench. Remove upper hoist, arm and adapter.

(6) Install 40 turbine tierods into rear ID flange of 4th stage LPT disk.

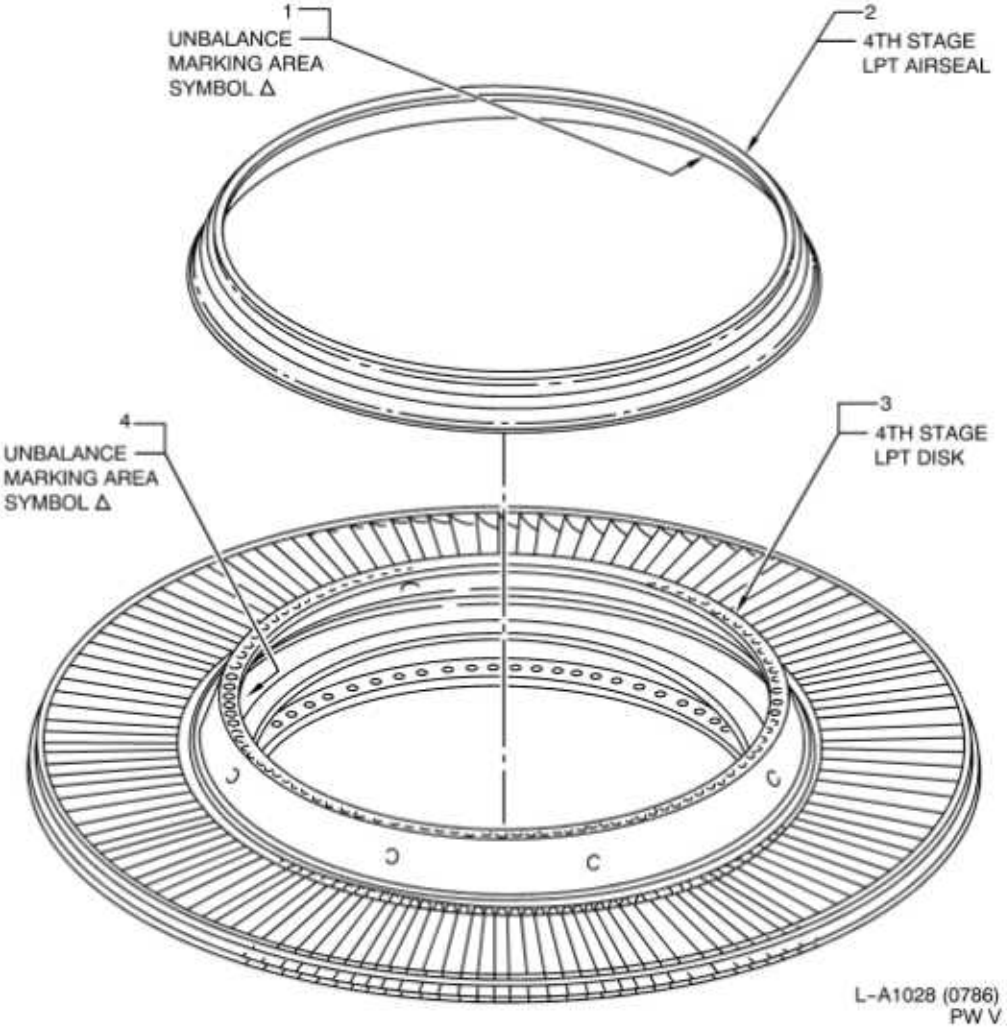
NOTE: Do not reuse tierods; Use new tierods.

(a) With flat side of bolthead facing outward, insert tierods, boltheads down, through 40 equally spaced boltholes in rear flange of disk.

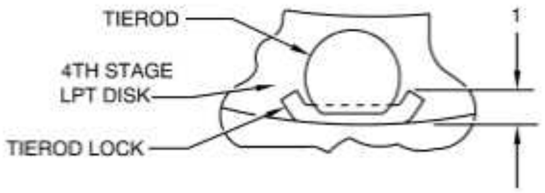
(b) Install 40 tierod locks into grooves between tierods and rear ID flange of disk. Bend the tierod locks with the use of PWA 85229 Manual Bender or PWA 103631 Manual Bender.

(c) Inspect tierod locks per dimension specified in Figure 1002.

STAGE 4 TURBINE ROTOR ASSEMBLY - ASSEMBLY-03


1
UNBALANCE MARKING AREA SYMBOL Δ
2
4TH STAGE LPT AIRSEAL
4
UNBALANCE MARKING AREA SYMBOL Δ
3
4TH STAGE LPT DISK
L-A1028 (0786)
PW V

Fourth Stage LPT Airseal Installation
Figure 1001
(Task 72-53-04-440-003)


TIERSOD
4TH STAGE
LPT DISK
TIEROD LOCK
1

L−A1036 (0000)
PW V

1. 0.225 Inch (5.715 mm) Minimum

Tierod Lock Inspection
Figure 1002
(Task 72−53−04−440−003)

Previous Pageblock Return to Previous Menu Next Pageblock

STAGE 5 TURBINE ROTOR ASSEMBLY - DISASSEMBLY-01

Task 72-53-05-040-001:

1. Disassemble 5th Stage Turbine Rotor Assembly
   A. Equipment And Materials Required

      Special Tools:
      PWA 85086 Arm (Two Required)
      PWA 85566 Puller, Knocker
      PWA 85592 Eye, Lifting
      PWA 85594 Adapter, Lift And Trunnion

   B. Procedure
      (1) Install PWA 85592 Eye Lifting to turbine rear hub.
      (2) Using hoist, position assembly onto suitable support. Remove hoist and lifting adapter.
      (3) Remove 5th stage airseal using PWA 85566 Puller.
         (a) With hand knob outward, position puller jaws over rim of airseal and seat on upper face of airseal.
         (b) Tighten hand knob to secure puller in place.
         (c) Using sliding hammer and relocating puller around airseal as required, remove airseal from hub.
         (d) Remove puller from airseal.
      (4) Install PWA 85594 Trunnion Adapter to turbine hub.
      (5) Using hoist and two PWA 85086 Arms, trunnion assembly to front end down position and lower onto suitable support.

      CAUTION: TAP ONLY ON ROOT PLATFORM. AIRFOIL SECTIONS ARE EASILY DAMAGED.

      (6) Remove blades from hub blade slots.
         (a) Using fiber drift or plastic mallet and working back and forth around hub, tap blade root platforms to remove blades from hub.
         (b) Place blades into suitable, identified container.
      (7) Reconnect hoist to trunnion adapter. Trunnion hub to rear end down position and place hub on pallet. Remove hoist and adapter.

STAGE 5 TURBINE ROTOR ASSEMBLY - ASSEMBLY-01

Task 72-53-05-440-001:

1. Assemble 5th Stage Turbine Rotor Assembly

A. Prerequisites

(1) See 72-53-00, Inspection/Check-04 (Task 72-53-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:

PWA 85592 Eye, Lifting

C. Procedure

R (1) Weigh all blades using a precision scale. Mark weight of each blade on the surface of the airfoil. Use temporary marking non-etching ink.

(2) Lay blades out on bench in order of decreasing weight.

(3) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 72-256) Number the blades from 1 to 118 in order of heaviest to lightest. Use temporary marking non-etching ink to mark blade number.

(4) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 72-256) Number the blades from 1 to 126 in order of heaviest to lightest. Use temporary marking non-etching ink to mark blade number.

(5) FOR THESE MODELS: 4152, 4156A, 4158
(Pre SB PW4ENG 72-256) Put the blades in the following sequence: 1, 118, 3, 116, 5, 114, ... 57, 62, 59; 2, 117, 4, 115, 6, 113, ... 58, 61, 60.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
This sequence alternates heavy blades next to light blades and balances blades of similar weights 180 degrees across the rotor. This method results in an equal distribution of heavy and light blades.

(6) FOR THESE MODELS: 4152, 4156A, 4158
(Post SB PW4ENG 72−256) Put the blades in the following sequence: 1, 126, 3, 124, 5, 122, ... 61, 66, 63; 2, 125, 4, 123, 6, 121, ... 62, 65, 64.

NOTE: FOR THESE MODELS: 4152, 4156A, 4158
This sequence alternates heavy blades next to light blades and balances blades of similar weights 180 degrees across the rotor. This method results in an equal distribution of heavy and light blades.

(7) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Number the blades from 1 to 126 in order of heaviest to lightest. Use temporary marking non−etching ink to mark blade number.

(8) FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
Put the blades in the following sequence: 1, 126, 3, 124, 5, 122, ... 61, 66, 63; 2, 125, 4, 123, 6, 121, ... 62, 65, 64.

NOTE: FOR THESE MODELS: 4152−3, 4156A−3, 4158−3
This sequence alternates heavy blades next to light blades and balances blades of similar weights 180 degrees across the rotor. This method results in an equal distribution of heavy and light blades.

(9) Position hub, rear face down, onto suitable support on bench or rotary table. Using PWA 85592 Lifting Eye.

(10) Install blade No. 1 into any hub blade slot. Install blade with trailing edge (longest side) down approximately half way into slot. Hold first blade by hand, exerting pressure in a counterclockwise direction and insert the next blade, in the order specified in the previous step, into the adjacent counterclockwise slot, approximately half way into slot. See Figure 1001 or Figure 1002 as applicable for a schematic view of the blade installation sequence.

(11) Continue installing blades this way until all blades are inserted into hub blade slots.

R
R

CAUTION: TAP ONLY ON ROOT PLATFORM. AIRFOIL SECTIONS ARE EASILY DAMAGED.

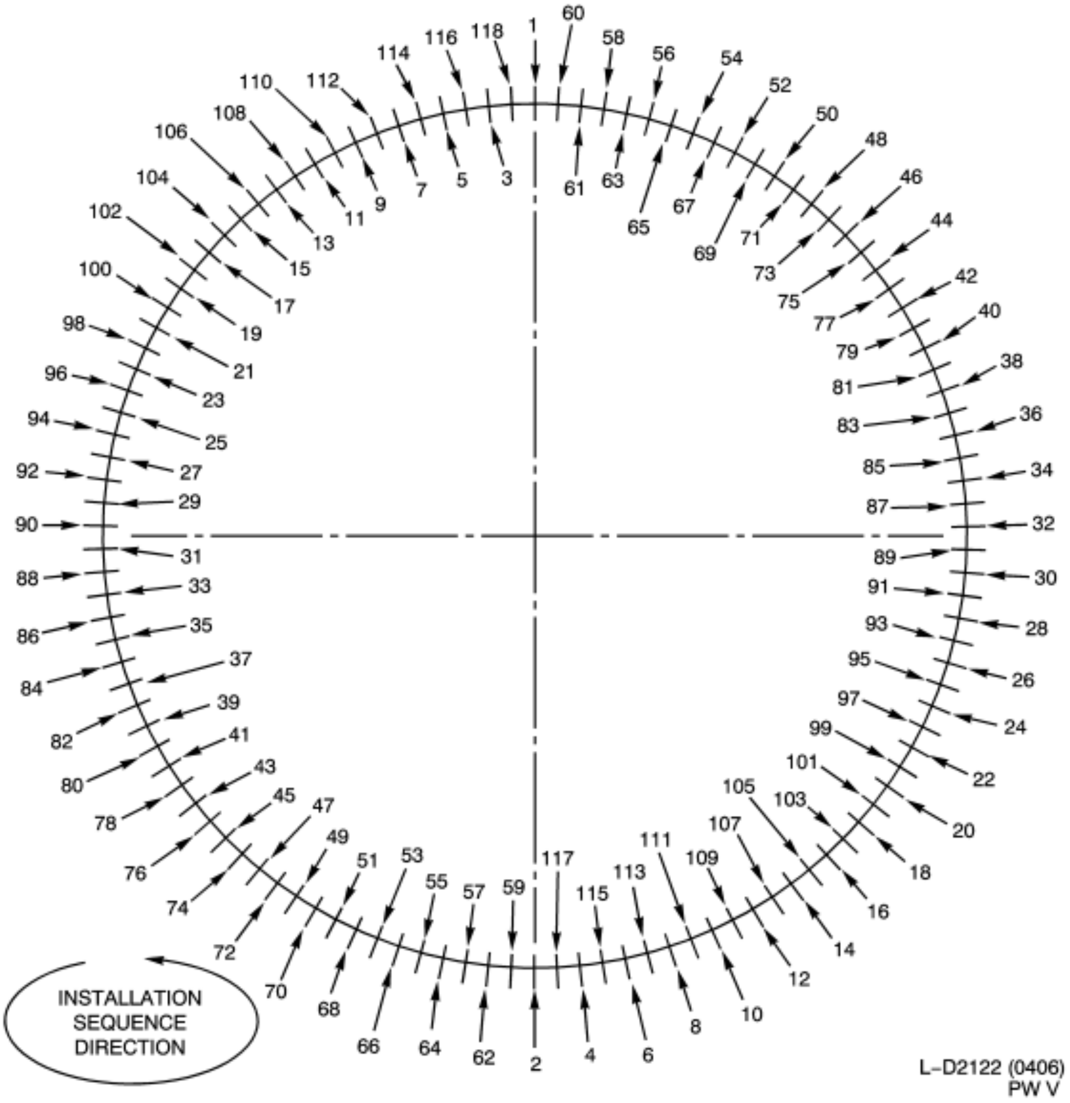
(12) Using fiber drift or plastic mallet and working back and forth around hub, tap blade platforms, as necessary, to align blade shrouds.

CAUTION: DO NOT DAMAGE BLADE TANGS.

(13) Tap blades to seat blade tang against hub. Use fiber drift or plastic mallet.

D. Postrequisite Procedures

(1) Static balance the 5th stage turbine rotor assembly by 72-53-05, Assembly-02 Task 72-53-05-440-002.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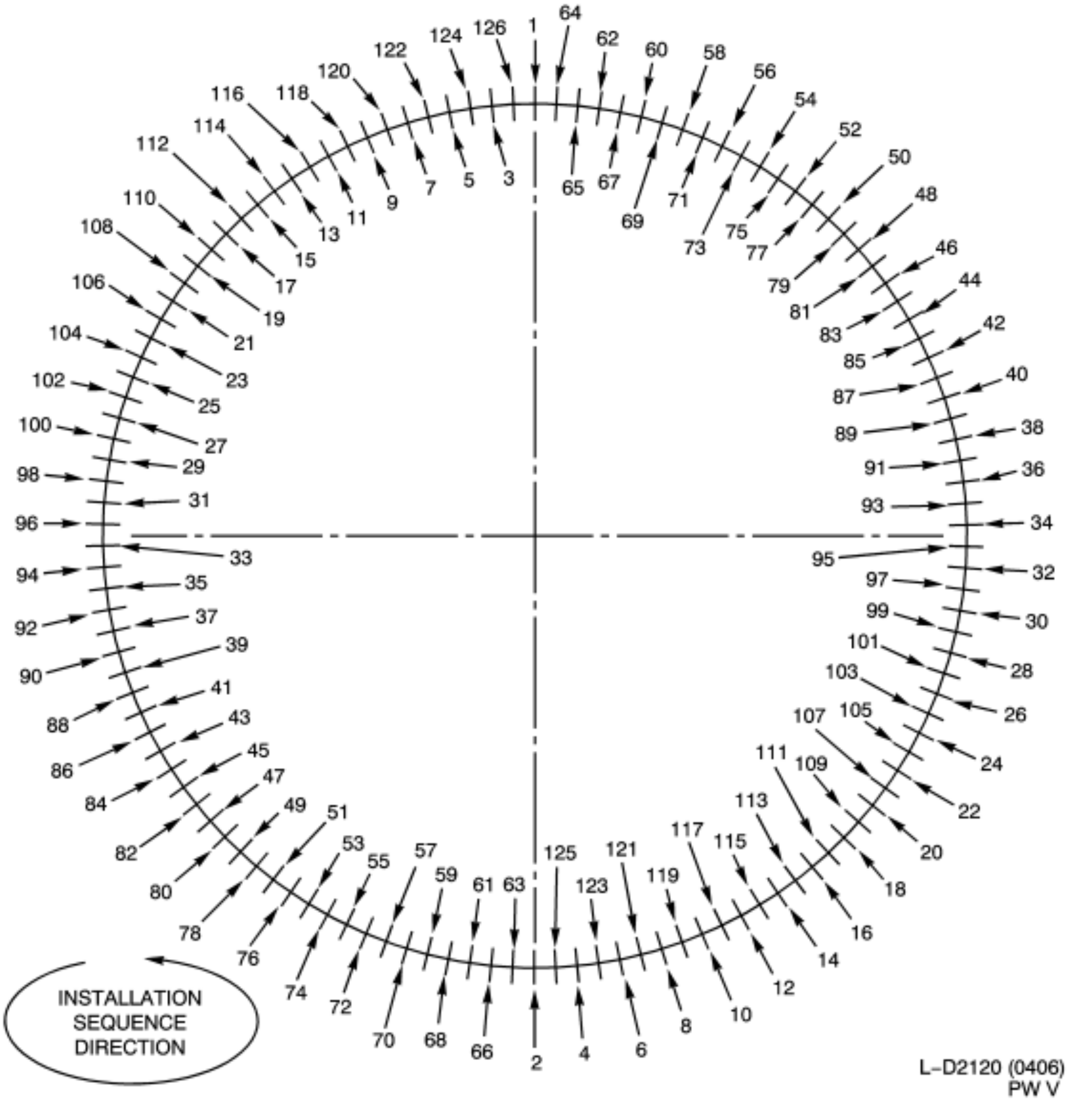
INSTALLATION SEQUENCE DIRECTION
L-D2122 (0406)
PW V

NOTE: Schematic Of Blades Installation As Viewed From The Front Side Of The Hub.

Fifth Stage LPT Blades Installation Schematic (Pre SB PW4ENG 72-256)
Figure 1001
(Task 72-53-05-440-001)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116
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122
123
124
125
126
INSTALLATION SEQUENCE DIRECTION
L−D2120 (0406)
PW V

NOTE: Schematic Of Blades Installation As Viewed From The Front Side Of The Hub.

Fifth Stage LPT Blades Installation
Schematic (Post SB PW4ENG 72−256)
Figure 1002
(Task 72−53−05−440−001)

STAGE 5 TURBINE ROTOR ASSEMBLY - ASSEMBLY-02

Task 72-53-05-440-002:

1. Balance Stage 5 Turbine Rotor Assembly

A. Prerequisites

(1) Assemble stage 5 turbine rotor assembly by Assembly-01 (Task 72-53-05-440-001).

B. Equipment And Materials Necessary

Standard Tools:

Drift, Fiber
Hammer, Soft Face or Plastic

Special Tools:

PWA 25648	Screw Set, Holding (2 Necessary)
PWA 32492	Screw Set (2 Necessary)
PWA 80258	Plug Set, Locating
PWA 85190	Adapter, Locating (Optional To PWA 87086)
PWA 85192	Washer Set, Holding
PWA 85208	Weight, Calibration (Check Weight)
PWA 85340	Plug Set, Holding
PWA 85592	Adapter, Lifting
PWA 87086	Adapter, Balance
PWA 87213	Pin, Alignment (4 Necessary)
PWA 101395	Drift, Removal/Installation
PWA 103649	Air Cylinder, Balance
PWA 104240	Adapter, Balance (Optional To PWA 85190 Or PWA 87086)

Consumable Materials:

Item No.	Designation
P05-026	Ink (PMC 4057-1)
P05-045	Marker (PMC 4092-1 or PMC 4092-2)
P05-323	Tape, Pressure Sensitive Sealing

C. Procedure

(1) Prepare the static balance locating adapter as follows:

(a) Use a hoist and sling and attach the PWA 85190 Locating Adapter or the PWA 87086 Balance Adapter to the spindle of the balance machine with the four detail bolts. See Figure 1001.

1 Use an opposite bolt pattern and tighten the four bolts equally. Torque the bolts to 50 lb−in. (5.649 N.m) maximum.

(b) Install the PWA 85340 Holding Plug Set in the four threaded holes on the balance adapter marked 5LPT. Tighten the holding plugs hand tight.

(c) Put the four PWA 87213 Alignment Pins in the threaded holes of the four holding plugs.

CAUTION: SCREWS ARE IN SETS IN RELATION TO MASS WEIGHT. YOU MUST PUT SCREWS OF ONE SET DIAMETRICALLY OPPOSITE EACH OTHER. SCREWS OF ONE SET SHOULD NOT BE INTERCHANGED WITH SCREWS OF ANOTHER SET.

(d) Install the PWA 80258 Locating Plugs in the four locations on the adapter marked 5LPT. Attach the plug set to the balance adapter with the two PWA 32492 Screw Sets.

(e) Adjust the four locating plugs for a loose fit. Turn the four plugs to align the zero (0) (marked on the adjusting collar) with the scribed radial lines passing through the center of the balance adapter.

NOTE: Set zero (0) toward the center of the balance adapter.

(2) Optional − Prepare the air cylinder and static balance adapter as follows:

(a) Use a hoist and sling and attach the PWA 103649 Balance Air Cylinder to the spindle of the balance machine with the six detail bolts.

1 Use an opposite bolt pattern and tighten the six bolts equally. Torque the bolts to 50 lb−in. (5.649 N.m) maximum.

(b) Use a hoist and sling and attach the PWA 104240 Balance Adapter to the air cylinder with the six detail bolts. See Figure 1001.

1 Use an opposite bolt pattern and tighten the six bolts equally. Torque the bolts to 50 lb−in. (5.649 N.m) maximum.

(c) Turn the center bolt on the diaphragm fully clockwise (finger tight) to secure the diaphragm to the piston of the air cylinder.

1 If the balance machine is equipped with air controls, turn the air control to "unclamp". If the balance machine is not equipped with air controls, attach an air hose to the fitting on the OD of the air cylinder.

(3) Install the rotor assembly on the PWA 85190 or PWA 87086 balance adapter and adjust the locating plugs for proper fit. See Figure 1002.

(a) Put the PWA 85592 Lifting Adapter to the bore of the disk, with the lift eye up. Move the two detail clamps under the disk and tighten the hand knobs.

(b) Attach a hoist to the lift eye of the adapter and lift the assembly. Put the assembly on the balance adapter. Align the tierod holes with the alignment pins on the holding plugs.

(c) Do not remove the hoist from the lift eye or the adapter from the assembly at this time.

(d) Adjust the locating plug set for a light interference fit with the outside diameter of the rotor assembly.

(e) Carefully remove the assembly from the balance adapter. Do not disturb the setting on the locating plug set.

(f) Set the locating plugs for the proper fit. The four locating plugs must be set to the same numerical marking after adjusting for proper fit.

(g) Tighten the four screws that attach the locating plugs to the balance adapter.

NOTE: Do not disturb the numeric position of the locating plugs while you tighten the screws.

(h) Mark one hold down plug for reference with a Marker P05−045.

(i) Put the assembly on the balance adapter. Align the tierod holes with the alignment pins on the holding plugs.

(j) Mark the disk in line with referenced mark on hold down plug with a Marker P05−045.

(k) Make sure that the rotor assembly is tightly engaged against the four locating plugs. Remove the alignment pins.

CAUTION: SCREWS ARE IN SETS IN RELATION TO MASS WEIGHT. YOU MUST PUT SCREWS OF ONE SET DIAMETRICALLY OPPOSITE EACH OTHER. SCREWS OF ONE SET SHOULD NOT BE INTERCHANGED WITH SCREWS OF ANOTHER SET.

(l) Attach the rotor assembly with a PWA 85192 Washer Set and two PWA 25648 Screw Sets. Tierod holes must be centered over hold down plugs to prevent interference with screw installation.

(4) Optional − Install the rotor assembly on the PWA 104240 Balance Adapter as follows:

(a) Lower the rotor assembly on the adapter and attach the rotor to the adapter with the two special shoulder screws.

(b) Turn the air control to "clamp", or remove the air hose from the OD of the cylinder to secure the rotor to the adapter.

(5) Operate the balance machine.

(a) Find the static unbalance of the rotor assembly while it turns at 900 rpm minimum.

(b) Get three unbalance readings. For balance machines that do not have an automatic recording feature, record the average angle and the average amount of unbalance.

(6) Turn the rotor assembly on the balance adapter 180 degrees from the original balance location as follows:

(a) Remove the screw sets and the washer set that attaches the rotor assembly to the adapter.

STAGE 5 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02

(b) Put the four PWA 87213 Alignment Pins in the threaded holes of the four holding plugs.

(c) Put the PWA 85592 Lifting Adapter to the bore of the disk, with the lift eye up. Move the two detail clamps under the disk and tighten the hand knobs.

(d) Attach the hoist to the lift eye and carefully lift the rotor off the adapter, turn it 180 degrees.

(e) Put the assembly on the balance adapter. Align the tierod holes with the alignment pins on the holding plugs.

(f) Make sure that the rotor assembly is tightly engaged against the four locating plugs. Remove the alignment pins.

(g) Attach the rotor assembly with a PWA 85192 Washer Set and two PWA 25648 Screw Sets.

1 Matching screws must be used at diametrically opposite positions.

2 Tierod holes must be centered over hold down plugs to prevent interference with screw installation.

(7) Operate the balance machine.

(a) Static balance the rotor assembly while it turns at 900 rpm minimum. The residual unbalance must not be more than 1.0 oz−in. (720.0 g.mm).

(b) For balance machines that have an automatic recording feature, get three unbalance readings. Average the readings. Use the machine to determine the unbalance amount and angle of the assembly.

(c) For balance machines that do not have an automatic recording feature, get three unbalance readings. Average and record the three unbalance readings. Use the average readings from the first and second balance runs to do a polar plot to get the assembly unbalance angle and amount.

STAGE 5 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02

(8) If the static unbalance is equal to 1.0 oz−in. (720.0 g.mm) or less continue as follows:

(a) Record the angle and the amount of unbalance.

(b) If necessary, remove all ink markings of unbalance symbols (triangle) that were done before.

(9) If the static unbalance is more than 1.0 oz−in. (720.0 g.mm), continue as follows:

NOTE: It is desirable to reduce residual unbalance to lowest value possible in practical amount of time.

(a) Use the PWA 85592 Lifting Adapter to remove the rotor assembly from the balance adapter.

CAUTION: LIGHTLY HIT THE BLADE ROOT ONLY. YOU CAN EASILY DAMAGE THE AIRFOILS OR THE PLATFORMS OF THE BLADES IF THEY ARE HIT.

(b) Make a pyramid of the blades that must be removed. Lightly hit the blade root platforms with a PWA 101395 Installation Drift or a fiber drift and a soft face hammer to remove the blades.

CAUTION: BE VERY CAREFUL WHEN YOU SEAT THE BLADES OR DAMAGE TO THE BLADE TANGS CAN OCCUR.

(c) Lock the blade shrouds and engage the root of the blades into the disk. Lightly tap the blades with a PWA 101395 Installation Drift or a fiber drift and a soft face hammer to touch the blade tang against the disk.

(d) Put the assembly on the balance adapter.

(e) Static balance the rotor assembly as described above until the residual unbalance is not more than 1.0 oz−in. (720.0 g.mm).

(f) Record the heavy angle and the amount of assembly unbalance.

(g) Make a record of the last blade positions.

STAGE 5 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02

(10) Optional process based on the experience of the operator, do a check of the balance machine by Figure 1002 as follows:

  (a) Install the PWA 85208 Calibration Weight (Check Weight) in one of the tiebolt holes on the front flange bolt circle as close as possible to the angle of residual unbalance.

  (b) Attach the check weight to the disk with Pressure Sensitive Sealing Tape P05−323.

  (c) The check weight pulls 2.0 oz−in. (1440.0 g.mm).

  (d) Do a check of the balance machine at 900 rpm minimum.

  (e) The amount of unbalance should pull 2.0 oz−in. (1440.0 g.mm) plus the remaining residual unbalance ± 0.4 oz−in. (288.0 g.mm).

  (f) Remove the check weight.

(11) Ink mark unbalance symbol (triangle) using Ink P05−026, as shown on reference Figure 1002, at heavy unbalance.

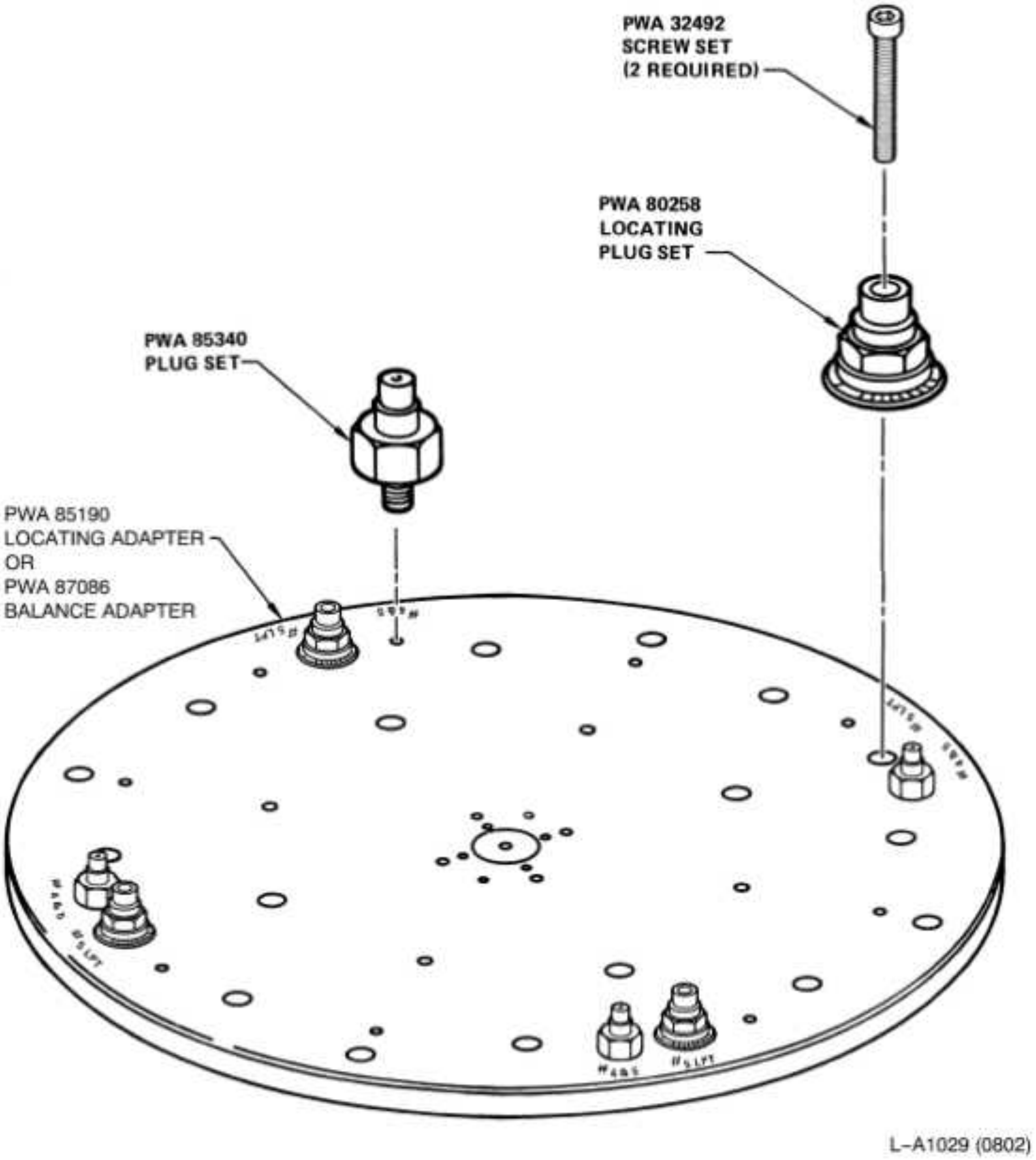
(12) Using hoist and PWA 85592 Adapter, remove rotor assembly from balance fixture.

(13) Store rotor assembly, rear flange down. Remove adapter.

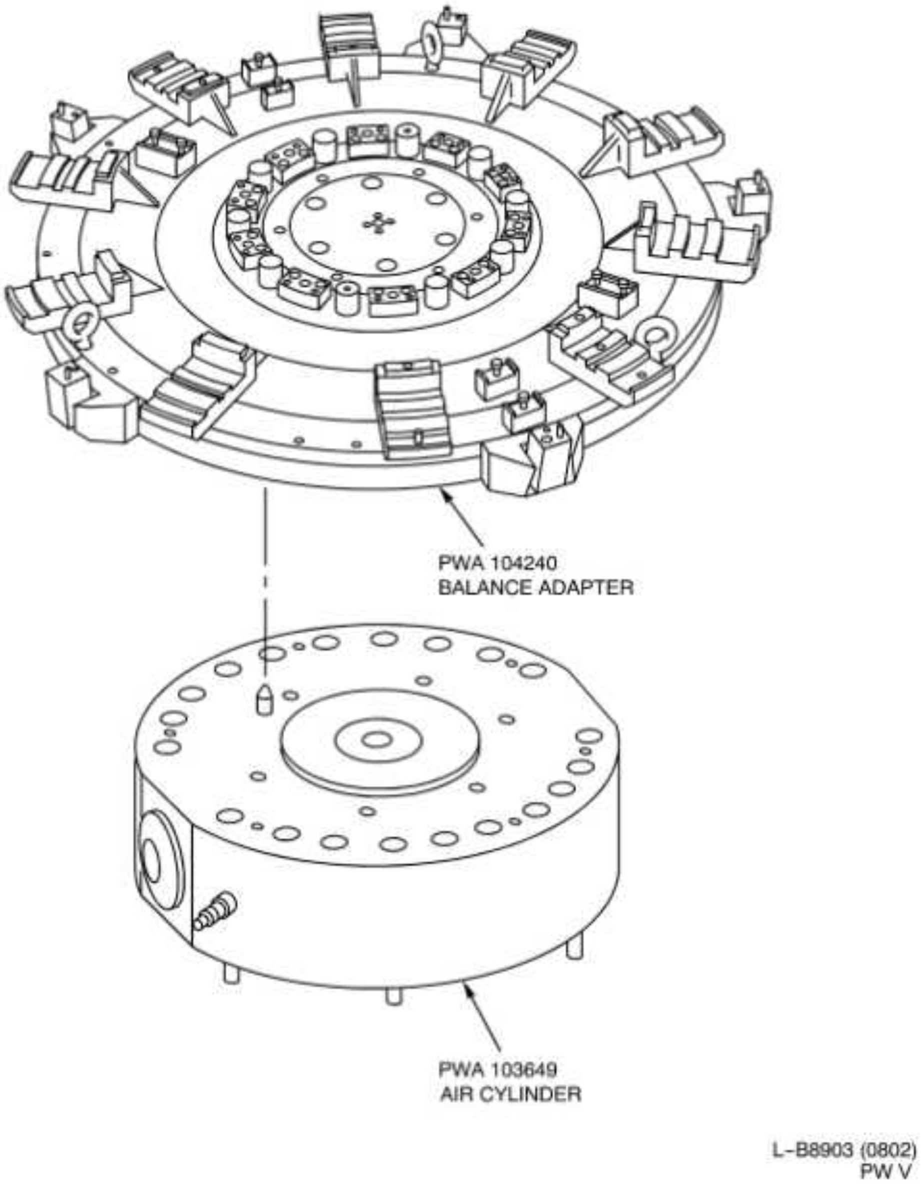
D. Postrequisites

(1) Final assemble stage 5 turbine rotor assembly by Assembly−03 (Task 72−53−05−440−003).

STAGE 5 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02

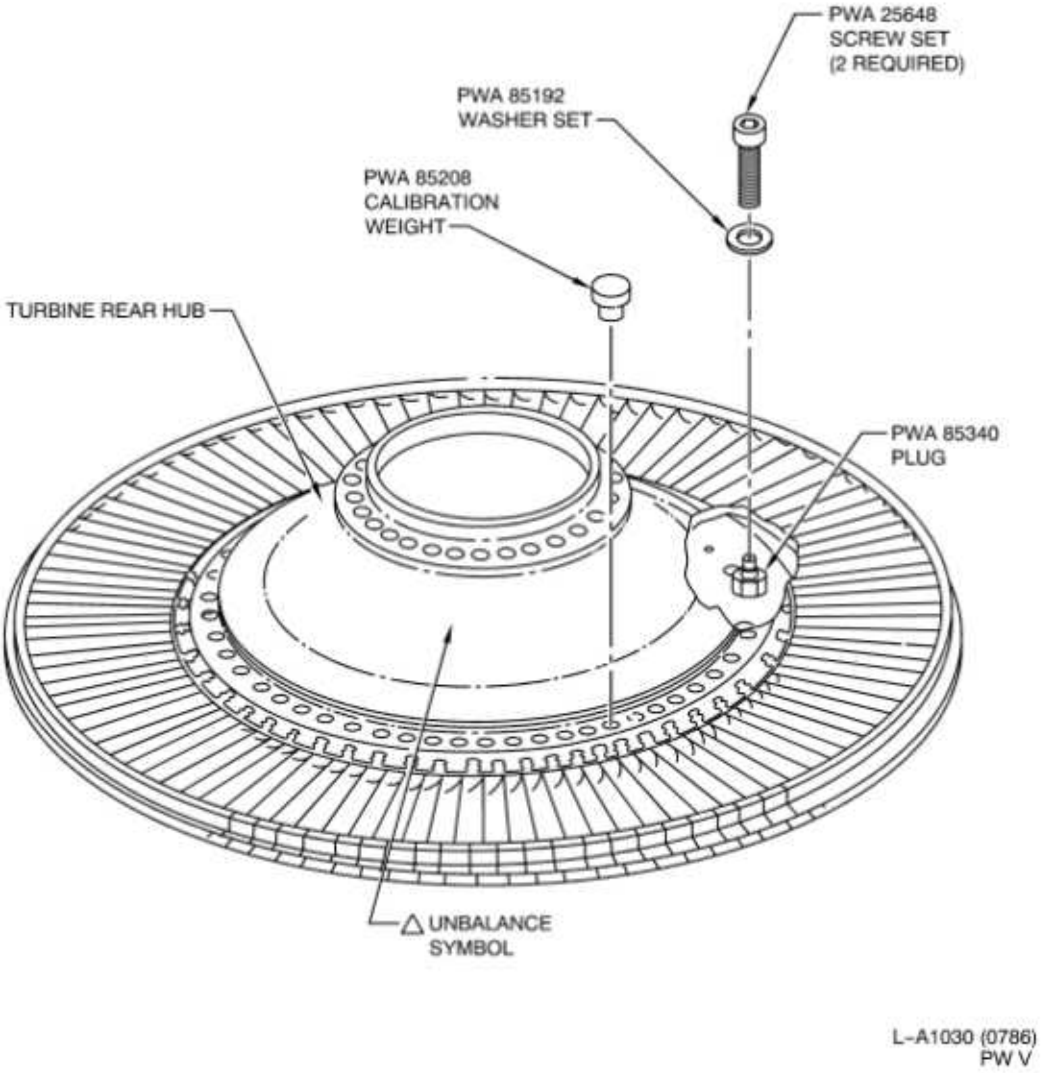

PWA 32492
SCREW SET
(2 REQUIRED)
PWA 80258
LOCATING
PLUG SET
PWA 85340
PLUG SET
PWA 85190
LOCATING ADAPTER
OR
PWA 87086
BALANCE ADAPTER
#5 LPT
#4&5
#5 LPT
#4&5
#4&5
#5 LPT
#4&5
#5 LPT
L−A1029 (0802)

Fifth Stage Turbine Rotor Assembly Balance Set−Up
Figure 1001 (Sheet 1)
(Task 72−53−05−440−002)


PWA 104240
BALANCE ADAPTER
PWA 103649
AIR CYLINDER
L−B8903 (0802)
PW V

Fifth Stage Turbine Rotor Assembly Balance Set−Up
Figure 1001 (Sheet 2)
(Task 72−53−05−440−002)

STAGE 5 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02


PWA 25648
SCREW SET
(2 REQUIRED)
PWA 85192
WASHER SET
PWA 85208
CALIBRATION
WEIGHT
TURBINE REAR HUB
PWA 85340
PLUG
△ UNBALANCE
SYMBOL
L−A1030 (0786)
PW V

Fifth Stage Turbine Rotor Assembly Balance Set−Up
Figure 1002
(Task 72−53−05−440−002)

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STAGE 5 TURBINE ROTOR ASSEMBLY - ASSEMBLY-03

Task 72-53-05-440-003:

1. Final Assemble 5th Stage Turbine Rotor Assembly

A. Prerequisites

(1) See Inspection/Check-04 Task 72-53-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

(2) Balance 5th stage turbine rotor assembly per Assembly-02 Task 72-53-05-440-002.

B. Equipment And Materials Necessary

Standard Tools:

Name	Manufacturer
Clements Cadillac Flameless Torch Model FT 1000	Clements Manufacturing Co. 6650 S. Narraganset Avenue Chicago, IL 60638

NOTE: The flameless torch specified above is optional to the heaters specified in the special tools list, and the optional flame torch.

Special Tools:

PWA 29754	Control, Heater
PWA 85320	Heater, Electrical
PWA 85592	Adapter, Lifting

C. General Assembly Requirements

(1) Where heating is required for assembly, use minimum temperature differential of 125°F (52°C) between parts being assembled. Do not exceed 300°F (149°C) on any part.

(2) Where heating is required for assembly, special heaters are specified in the following procedure. However, you can use an optional flameless torch or flame torch as specified in the following steps.

(3) In locations where heating of a component in an oven is not practical or only a flange of the component requires heating, the use of Clements Cadillac Quic Heat flameless torch, Model FT 1000 is recommended.

(4) Alternate, flame torch heating method for tight fitting disks hubs, and shafts:

WARNING: WEAR GLOVES WHEN YOU HANDLE HOT PARTS TO AVOID BURNS.

CAUTION: HEAT PARTS EVENLY. DO NOT EXCEED THE MAXIMUM TEMPERATURE LIMITS IN ANY LOCAL AREA. IF THE TEMPERATURE IS MORE THAN THE MAXIMUM LIMIT, IT WILL CAUSE DAMAGE TO THE PART.

CAUTION: DO NOT PERMIT THE FLAME TO COME IN CONTACT WITH ANY NON−METAL PART. THE FLAME WILL DAMAGE OR BURN NON−METAL PARTS.

CAUTION: DO NOT USE A TORCH HEAD THAT HAS A PENCIL POINT FLAME.

(a) Use a flame torch that has a maximum output of 80,000 BTU an hour, with a torch head that has a soft, equally spread, lapping flame.

CAUTION: DO NOT USE ANY MARKING METHOD THAT LEAVES A DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT.

(b) Use the flame torch as follows:

1 Continually monitor the temperature of the part. Use a temperature indicator such as a digital pyrometer or heat sensitive crayon.

NOTE: The digital pyrometer is a more effective temperature indicator and is preferred. However, the heat sensitive crayon can be used.

2 Evenly heat the part in the snap diameter area by part rotation or move the torch around the part.

3 Continually monitor the temperature of the part.

4 Apply only enough heat to expand the tight diameters as needed.

D. Procedure
See Figure 1001.

(1) Optional, position PWA 85320 Heater on turbine rear hub.

NOTE: You can use the optional flameless torch or flame torch as previously specified to heat the disk.

(a) Remove ball lock pins and raise four support pins to lower positions. Secure support pins with ball lock pins.

(b) Using handles, carefully lift and centralize heater on front face of hub. Ensure that heater seats properly on face of hub.

(c) Connect PWA 29754 Heater Control to junction box of heater.

(d) Connect thermocouple connector to heater control.

CAUTION: TEMPERATURE OF DISK MUST NOT EXCEED 400°F (204.4°C) OR DAMAGE TO PARTS MAY OCCUR.

(2) Use the PWA 85320 Heater, or the optional flameless torch or flame torch, to heat the disk. Heat the disk to obtain a minimum temperature difference of 250°F (138.8°C) between mating parts. If applicable, remove the heater.

(3) Chill 5th stage LPT airseal.

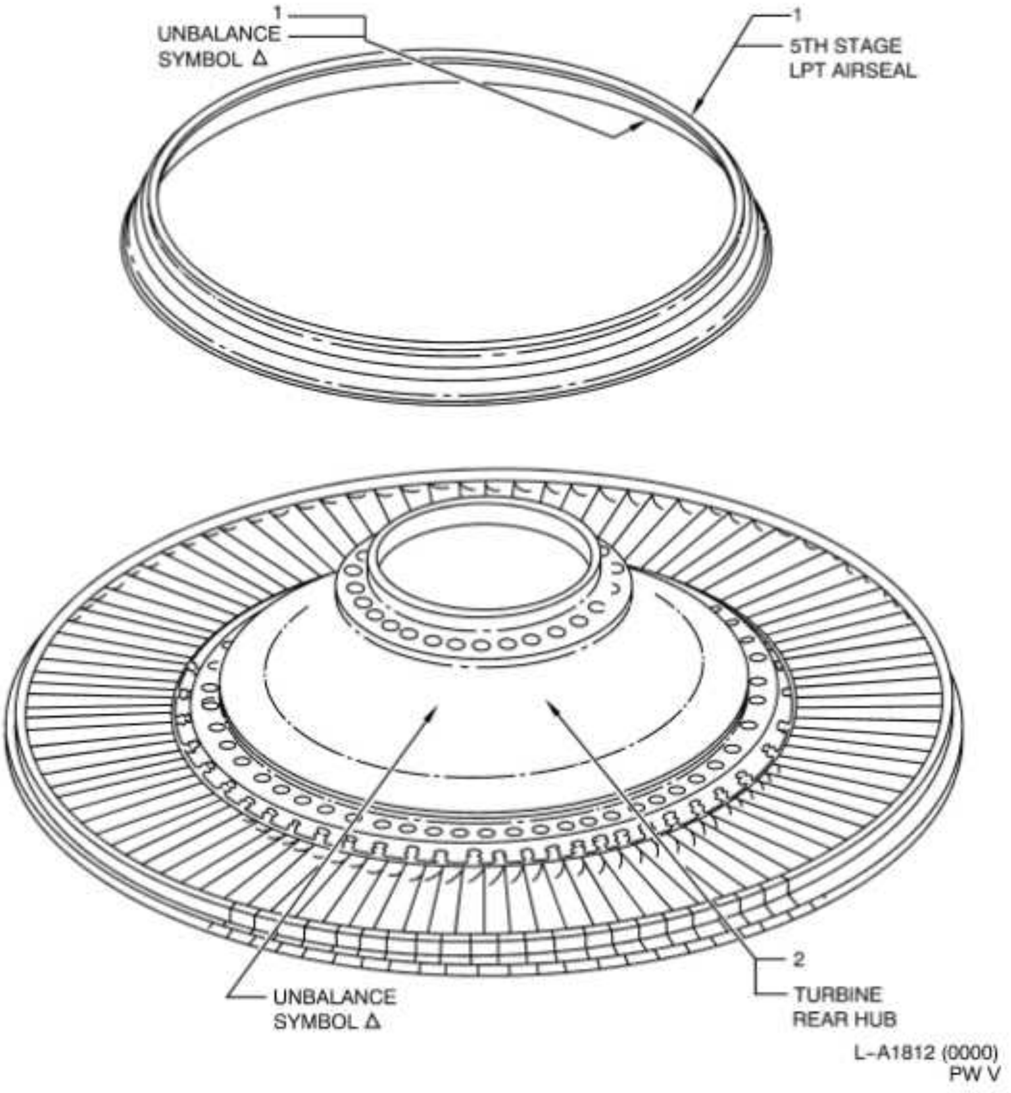
STAGE 5 TURBINE ROTOR ASSEMBLY − ASSEMBLY−03

CAUTION: BLADES THAT HAVE BLENDED BLADE ROOT TANGS CAN NOT BE INSTALLED AGAINST THE AIRSEAL ANTI−ROTATION LUGS (REFERENCE 72−53−09, REPAIR−10, TASK 72−53−09−300−010).

(4) Locate triangular unbalance marks on airseal (1001/1) and hub (1001/2). Install airseal onto disk with unbalance mark on airseal 180 degrees from unbalance mark on hub and mating tabs on airseal between lugs of blades.

(5) Using hoist and PWA 85592 Lifting Adapter, store rotor assembly on suitable support. Remove hoist and lifting adapter.

STAGE 5 TURBINE ROTOR ASSEMBLY − ASSEMBLY−03


1
UNBALANCE SYMBOL Δ
1
5TH STAGE LPT AIRSEAL
UNBALANCE SYMBOL Δ
2
TURBINE REAR HUB
L-A1812 (0000)
PW V

Fifth Stage LPT Airseal Installation
Figure 1001
(Task 72−53−05−440−003)

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STAGE 6 TURBINE ROTOR ASSEMBLY - DISASSEMBLY-01

Task 72-53-06-040-001:

1. Disassemble 6th Stage Turbine Rotor Assembly

A. Equipment And Materials Required

Special Tools:

PWA 85086 Arm, Lifting (Two Required)
PWA 85592 Eye, Lifting
PWA 85594 Adapter, Lift And Trunnion
PWA 86354 Extractor, Lock

B. Procedure

(1) Install PWA 85592 Lifting Eye onto 6th stage LPT disk.

(a) Loosen hand knobs and retract clamp details.

(b) Position base detail through ID of disk bore.

(c) Position clamp details to seat against ID and rear face of disk.

(d) Tighten hand knobs to secure adapter to disk.

(2) Connect hoist to lifting eye and position rotor assembly front, knife-edge, end down on workbench. Remove hoist.

R R (3) Use PWA 86354 Extractor to unbend and remove 128 turbine blade locks.

(a) Install the starting jaws into the extractor. Bend the locks to an open position.

NOTE: The starting jaw has an 20 degree angled jaw face.

(b) Remove the starting jaws and install the finishing jaw. Bend the locks straight for removal. Discard the locks.

NOTE: The finishing jaw has a flat jaw face.

(4) Install PWA 85594 Lift And Trunnion Adapter to disk. Install two PWA 85086 Lifting Arms.

STAGE 6 TURBINE ROTOR ASSEMBLY − DISASSEMBLY−01

(5) Using hoist, lift and trunnion rotor assembly to rear end down position. Lower assembly onto suitable support to allow removal of blades.

CAUTION: TAP ONLY ON ROOT PLATFORM. AIRFOIL SECTIONS ARE EASILY DAMAGED.

(6) Remove blades from disk blade slots.

(a) Using fiber drift or plastic mallet and working back and forth around disk, tap blade root platforms to remove blades from disk.

(b) Place blades into suitable, identified container.

(7) Reconnect hoist to trunnion adapter and place disk on pallet. Remove lift tooling. Place suitable protector around knife−edge airseals.

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Task 72-53-06-440-001:

1. Assemble 6th Stage Turbine Rotor Assembly

A. Prerequisites

(1) See Inspection/Check-04 Task 72-53-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:

PWA 85386 Support, Front
PWA 85592 Eye, Lifting

C. Procedure

(1) Weigh all blades using precision scale. Mark weight
R of each blade on the surface of the airfoil. Use temporary marking non-etching ink.

(2) Lay blades out on bench in order of decreasing weight.

(3) Number the blades from 1 to 128 in order of heaviest to lightest. Use temporary marking non-etching ink to mark blade number.

(4) Put the blades in the following order: 1, 128, 3, 126, 5, 124, ... 63, 66; 2, 127, 4, 125, 6, 123, ... 64, 65.

NOTE: This sequence alternates heavy blades next to light blades and balances blades of similar weights 180 degrees across the rotor. This method results in an equal distribution of heavy and light blades.

CAUTION: MAKE SURE THAT EIGHT 6TH STAGE LPT SEALS ARE INSTALLED ON THE FRONT FLANGE OF THE 6TH STAGE LPT DISK. OPERATION OF THE ENGINE WITHOUT THE SEALS INSTALLED WILL CAUSE VERY HIGH TEMPERATURES WHICH CAN DECREASE THE DISK LIFE.

(5) Position disk with flange down, using PWA 85592 Lifting Eye and hoist onto PWA 85386 Front Support. Support Ring places on bench or rotary table.

(6) Install blade No. 1 into any disk blade slot. Install blade with trailing edge (longest side) up approximately half way into slot. Hold first blade by hand, exerting pressure in counterclockwise direction and insert the next blade, in the order specified in the previous step, into the adjacent counterclockwise slot, approximately half way into slot. See Figure 1001 for a schematic view of the blades installation sequence.

(7) Continue installing blades this way until all blades are inserted into disk blade slots.

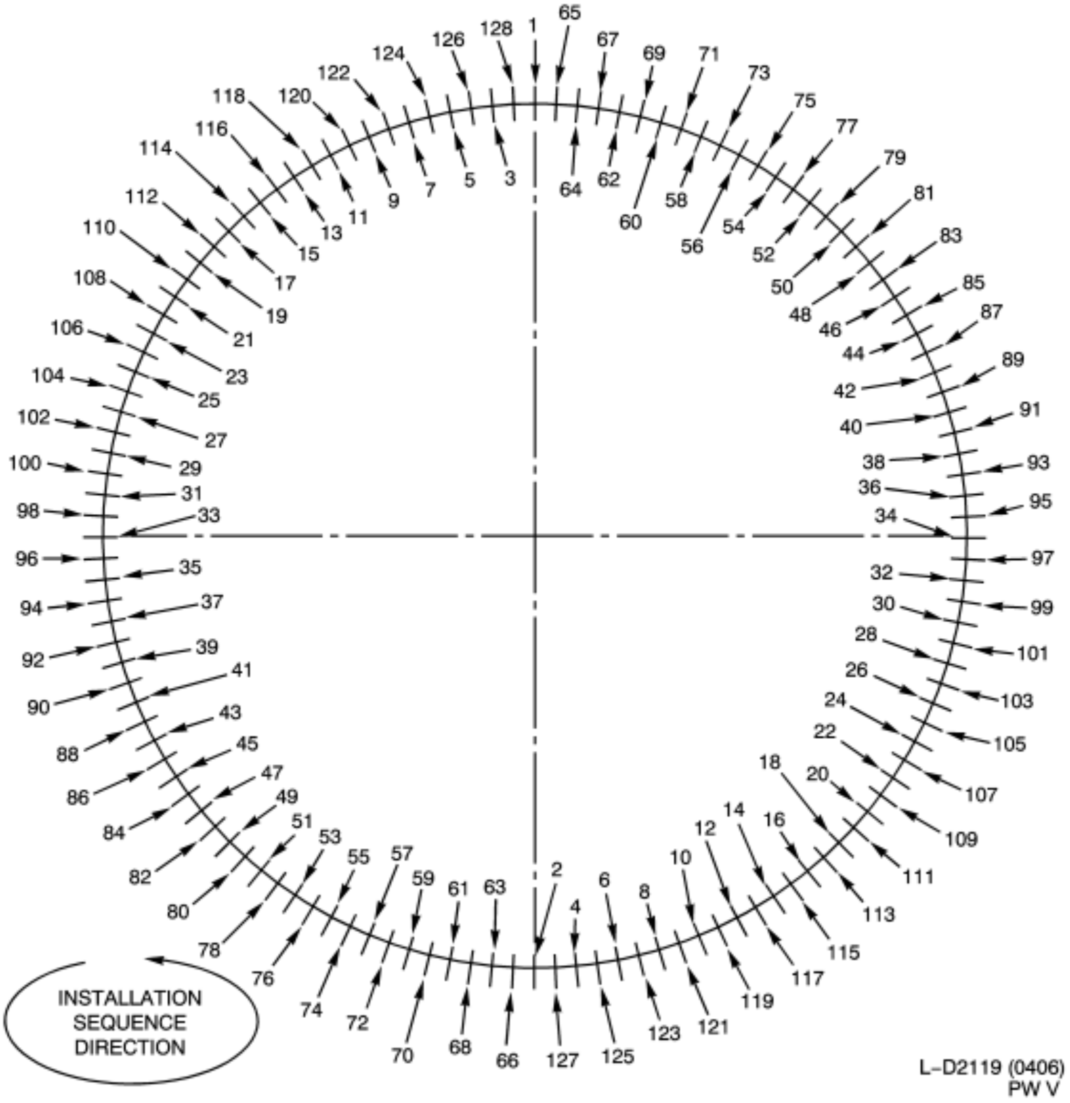
CAUTION: TAP ONLY ON ROOT PLATFORM. AIRFOIL SECTIONS ARE EASILY DAMAGED.

(8) Using fiber drift or plastic mallet and working back and forth around disk, tap blade platforms, as necessary, to align blade shrouds.

(9) Tap blades into blade slots until blade lock radius in lug at rear of blade platform aligns with mating blade lock radius in disk. Use fiber drift or plastic mallet.

D. Postrequisites

(1) Static balance 6th stage rotor assembly per Assembly−02 Task 72−53−06−440−002.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126
127
128
INSTALLATION
SEQUENCE
DIRECTION
L-D2119 (0406)
PW V

NOTE: Schematic Of Blades Installation As Viewed From The Rear Side Of The Disk.

Sixth Stage LPT Blades Installation (Blade Installation Schematic)
Figure 1001
(Task 72-53-06-440-001)

STAGE 6 TURBINE ROTOR ASSEMBLY - ASSEMBLY-02

Task 72-53-06-440-002:

1. Balance Stage 6 Turbine Rotor Assembly

A. Prerequisites

(1) Assemble stage 6 turbine rotor assembly by Assembly-01 (Task 72-53-06-440-001).

B. Equipment And Materials Necessary

Standard Tools:

Drift, Fiber
Hammer, Soft Face or Plastic

Special Tools:

PWA 25648	Screw Set, Holding (2 Necessary)
PWA 32492	Screw Set (2 Necessary)
PWA 80258	Plug Set, Locating
PWA 85190	Adapter, Locating (Optional To PWA 87086)
PWA 85191	Plug Set, Holding
PWA 85192	Washer Set, Holding
PWA 85208	Weight, Calibration (Check Weight)
PWA 85592	Adapter, Lifting
PWA 87086	Adapter, Balance
PWA 87213	Pin, Alignment (4 Necessary)
PWA 101395	Drift, Removal/Installation
PWA 103649	Air Cylinder, Balance
PWA 104240	Adapter, Balance (Optional To PWA 85190 Or PWA 87086)

Consumable Materials:

Item No.	Designation
P05-026	Ink (PMC 4057-1)
P05-045	Marker (PMC 4092-1 or PMC 4092-2)
P05-323	Tape, Pressure Sensitive Sealing

C. Procedure

(1) Prepare the static balance locating adapter as follows:

(a) Use a hoist and sling and attach the PWA 85190 Locating Adapter or the PWA 87086 Balance Adapter to the spindle of the balance machine with the four detail bolts. See Figure 1001.

1 Use an opposite bolt pattern and tighten the four bolts equally. Torque the bolts to 50 lb−in. (5.649 N.m) maximum.

(b) Install the PWA 85191 Holding Plug Set in the four threaded holes on the balance adapter marked 6LPT. Tighten the holding plugs hand tight.

(c) Put the four PWA 87213 Alignment Pins in the threaded holes of the four holding plugs.

CAUTION: SCREWS ARE IN SETS IN RELATION TO MASS WEIGHT. YOU MUST PUT SCREWS OF ONE SET DIAMETRICALLY OPPOSITE EACH OTHER. SCREWS OF ONE SET SHOULD NOT BE INTERCHANGED WITH SCREWS OF ANOTHER SET.

(d) Install the PWA 80258 Locating Plugs in the four locations on the adapter marked 6LPT. Attach the plug set to the balance adapter with the two PWA 32492 Screw Sets.

(e) Adjust the four locating plugs for a loose fit. Turn the four plugs to align the zero (0) (marked on the adjusting collar) with the scribed radial lines passing through the center of the balance adapter.

NOTE: Set zero (0) toward the center of the balance adapter.

(2) Optional − Prepare the air cylinder and static balance adapter as follows:

(a) Use a hoist and sling and attach the PWA 103649 Balance Air Cylinder to the spindle of the balance machine with the six detail bolts.

1 Use an opposite bolt pattern and tighten the six bolts equally. Torque the bolts to 50 lb−in. (5.649 N.m) maximum.

(b) Use a hoist and sling and attach the PWA 104240 Balance Adapter to the air cylinder with the six detail bolts. See Figure 1001.

1 Use an opposite bolt pattern and tighten the six bolts equally. Torque the bolts to 50 lb−in. (5.649 N.m) maximum.

(c) Turn the center bolt on the diaphragm fully clockwise (finger tight) to secure the diaphragm to the piston of the air cylinder.

(d) Install the detail slide clamps (marked LPT−6) onto the shoulder bolts and move the clamps inward toward the machine spindle.

(e) Turn the center cap screw on the air cylinder valve one full turn counter−clockwise.

(f) Turn the valve housing to OD and turn the center cap screw clockwise to tighten.

1 If the balance machine is equipped with air controls, turn the air control to "unclamp". If the balance machine is not equipped with air controls, attach an air hose to the fitting on the OD of the air cylinder.

(3) Install the rotor assembly on the PWA 85190 or PWA 87086 balance adapter and adjust the locating plugs for proper fit. See Figure 1002.

(a) Put the PWA 85592 Lifting Adapter to the bore of the disk, with the lift eye up. Move the two detail clamps under the disk and tighten the hand knobs.

(b) Attach a hoist to the lift eye of the adapter and lift the assembly. Put the assembly on the balance adapter. Align the tierod holes with the alignment pins on the holding plugs.

(c) Do not remove the hoist from the lift eye or the adapter from the assembly at this time.

(d) Adjust the locating plug set for a light interference fit with the outside diameter of the rotor assembly.

(e) Carefully remove the assembly from the balance adapter. Do not disturb the setting on the locating plug set.

(f) Set the locating plugs for the proper fit. The four locating plugs must be set to the same numerical marking after adjusting for proper fit.

(g) Tighten the four screws that attach the locating plugs to the balance adapter.

NOTE: Do not disturb the numeric position of the locating plugs while you tighten the screws.

(h) Mark one hold down plug for reference with a Marker P05−045.

(i) Put the assembly on the balance adapter. Align the tierod holes with the alignment pins on the holding plugs.

(j) Mark the disk in line with referenced mark on hold down plug with a Marker P05−045.

(k) Make sure that the rotor assembly is tightly engaged against the four locating plugs. Remove the alignment pins.

CAUTION: SCREWS ARE IN SETS IN RELATION TO MASS WEIGHT. YOU MUST PUT SCREWS OF ONE SET DIAMETRICALLY OPPOSITE EACH OTHER. SCREWS OF ONE SET SHOULD NOT BE INTERCHANGED WITH SCREWS OF ANOTHER SET.

(l) Attach the rotor assembly with a PWA 85192 Washer Set and two PWA 25648 Screw Sets. Tierod holes must be centered over hold down plugs to prevent interference with screw installation.

(4) Optional − Install the rotor assembly on the PWA 104240 Balance Adapter as follows:

(a) Lower the rotor assembly on the adapter, make sure to engage the two locating pins into the bolt circle of the disk.

(b) Reach through the bore of the disk and move the slide clamps radially outward.

(c) Turn the air control to "clamp", or remove the air hose from the OD of the cylinder to secure the rotor to the adapter.

(5) Operate the balance machine.

(a) Find the static unbalance of the rotor assembly while it turns at 900 rpm minimum.

(b) Get three unbalance readings. For balance machines that do not have an automatic recording feature, record the average angle and the average amount of unbalance.

(6) Turn the rotor assembly on the balance adapter 180 degrees from the original balance location as follows:

(a) Remove the screw sets and the washer set that attaches the rotor assembly to the adapter.

(b) Put the four PWA 87213 Alignment Pins in the threaded holes of the four holding plugs.

(c) Put the PWA 85592 Lifting Adapter to the bore of the disk, with the lift eye up. Move the two detail clamps under the disk and tighten the hand knobs.

(d) Attach the hoist to the lift eye and carefully lift the rotor off the adapter, turn it 180 degrees.

(e) Put the assembly on the balance adapter. Align the tierod holes with the alignment pins on the holding plugs.

(f) Make sure that the rotor assembly is tightly engaged against the four locating plugs. Remove the alignment pins.

(g) Attach the rotor assembly with a PWA 85192 Washer Set and two PWA 25648 Screw Sets.

1 Matching screws must be used at diametrically opposite positions.

2 Tierod holes must be centered over hold down plugs to prevent interference with screw installation.

(7) Operate the balance machine.

(a) Static balance the rotor assembly while it turns at 900 rpm minimum. The residual unbalance must not be more than 1.0 oz−in. (720.0 g.mm).

(b) For balance machines that have an automatic recording feature, get three unbalance readings. Average the readings. Use the machine to determine the unbalance amount and angle of the assembly.

(c) For balance machines that do not have an automatic recording feature, get three unbalance readings. Average and record the three unbalance readings. Use the average readings from the first and second balance runs to do a polar plot to get the assembly unbalance angle and amount.

(8) If the static unbalance is equal to 1.0 oz−in. (720.0 g.mm) or less continue as follows:

(a) Record the angle and the amount of unbalance.

(b) If necessary, remove all ink markings of unbalance symbols (triangle) that were done before.

(9) If the static unbalance is more than 1.0 oz−in. (720.0 g.mm), continue as follows:

NOTE: It is desirable to reduce residual unbalance to lowest value possible in practical amount of time.

(a) Use the PWA 85592 Lifting Adapter to remove the rotor assembly from the balance adapter.

CAUTION: LIGHTLY HIT THE BLADE ROOT ONLY. YOU CAN EASILY DAMAGE THE AIRFOILS OR THE PLATFORMS OF THE BLADES IF THEY ARE HIT.

(b) Make a pyramid of the blades that must be removed. Lightly hit the blade root platforms with a PWA 101395 Installation Drift or a fiber drift and a soft face hammer to remove the blades.

CAUTION: BE VERY CAREFUL WHEN YOU SEAT THE BLADES OR DAMAGE TO THE BLADE TANGS CAN OCCUR.

(c) Lock the blade shrouds and engage the root of the blades into the disk. Lightly tap the blades with a PWA 101395 Installation Drift or a fiber drift and a soft face hammer to touch the blade tang against the disk.

STAGE 6 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02

(d) Put the assembly on the balance adapter.

(e) Static balance the rotor assembly as described above until the residual unbalance is not more than 1.0 oz−in. (720.0 g.mm).

(f) Record the heavy angle and the amount of assembly unbalance.

(g) Make a record of the last blade positions.

(10) Optional process based on the experience of the operator, do a check of the balance machine by Figure 1002 as follows:

(a) Install the PWA 85208 Calibration Weight (Check Weight) in one of the tiebolt holes on the front flange bolt circle as close as possible to the angle of residual unbalance.

(b) Attach the check weight to the disk with Pressure Sensitive Sealing Tape P05−323.

(c) The check weight pulls 2.0 oz−in. (1440.0 g.mm).

(d) Do a check of the balance machine at 900 rpm minimum.

(e) The amount of unbalance should pull 2.0 oz−in. (1440.0 g.mm) plus the remaining residual unbalance ± 0.4 oz−in. (288.0 g.mm).

(f) Remove the check weight.

(11) Ink mark unbalance symbol (triangle) on the rotor assembly using Ink P05−026 at heavy unbalance.

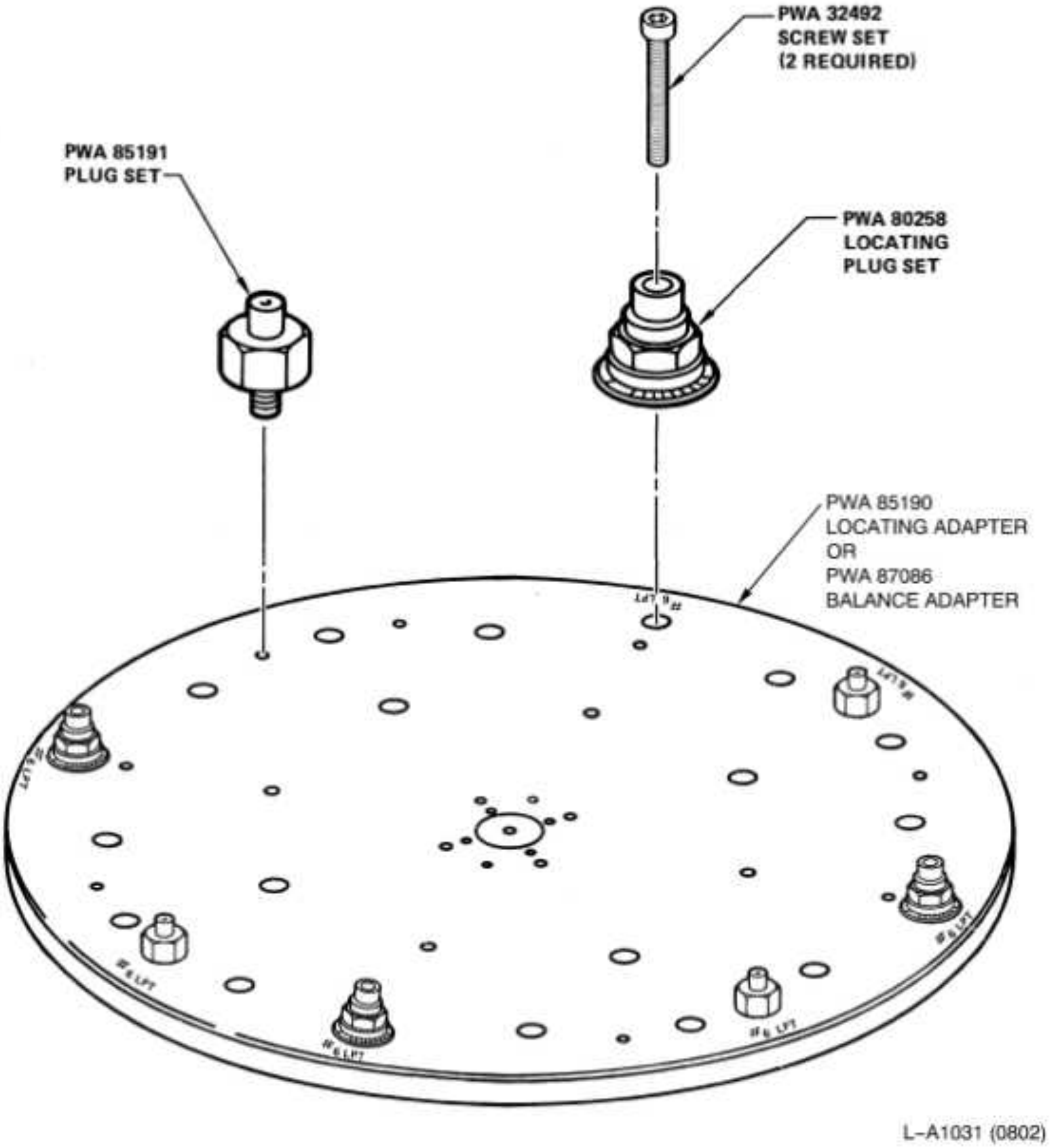
(12) Using hoist and PWA 85592 Adapter, remove rotor assembly from balance fixture.

(13) Store rotor assembly, front flange down. Remove adapter.

D. Postrequisites

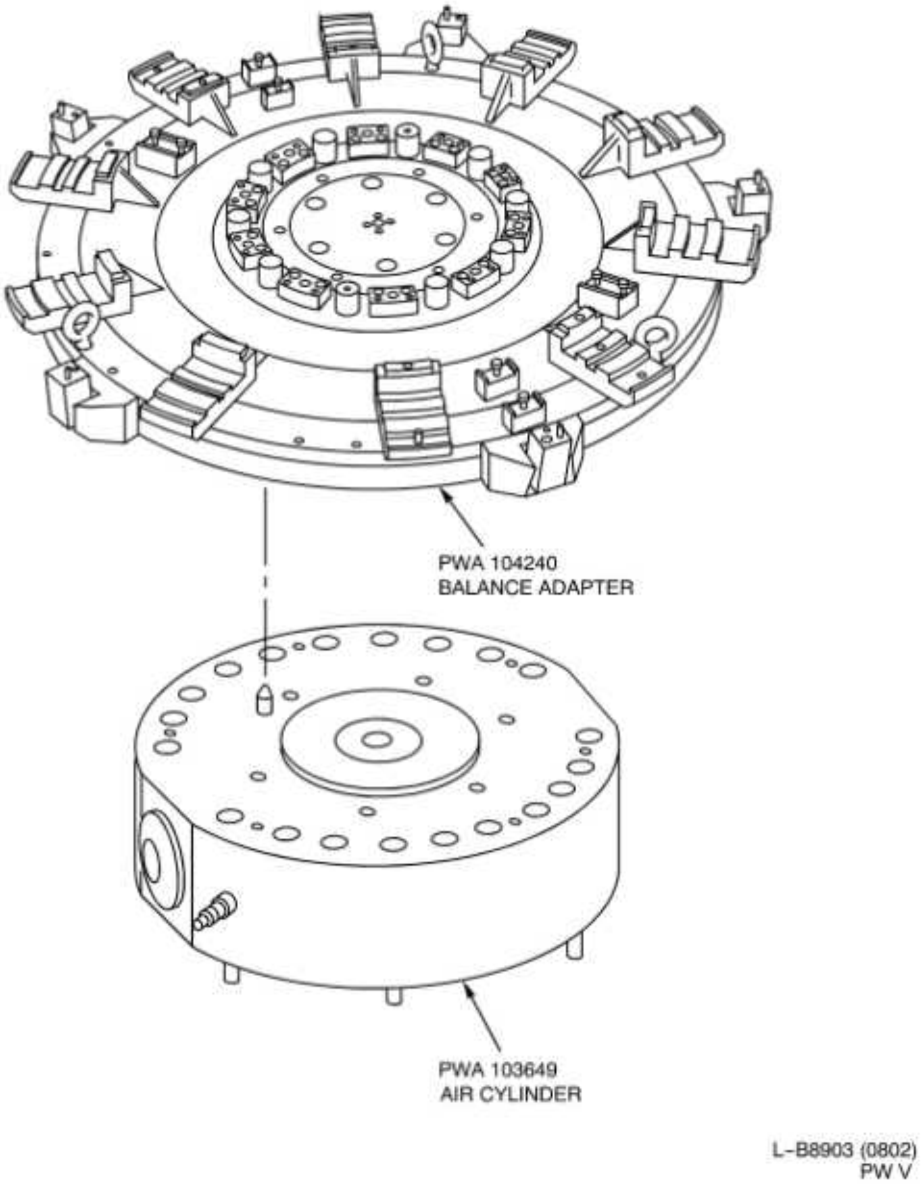
(1) Final assemble stage 6 turbine rotor assembly by Assembly−03 (Task 72−53−06−440−003).

STAGE 6 TURBINE ROTOR ASSEMBLY - ASSEMBLY-02


PWA 32492
SCREW SET
(2 REQUIRED)
PWA 85191
PLUG SET
PWA 80258
LOCATING
PLUG SET
PWA 85190
LOCATING ADAPTER
OR
PWA 87086
BALANCE ADAPTER
#6 LPT
L-A1031 (0802)

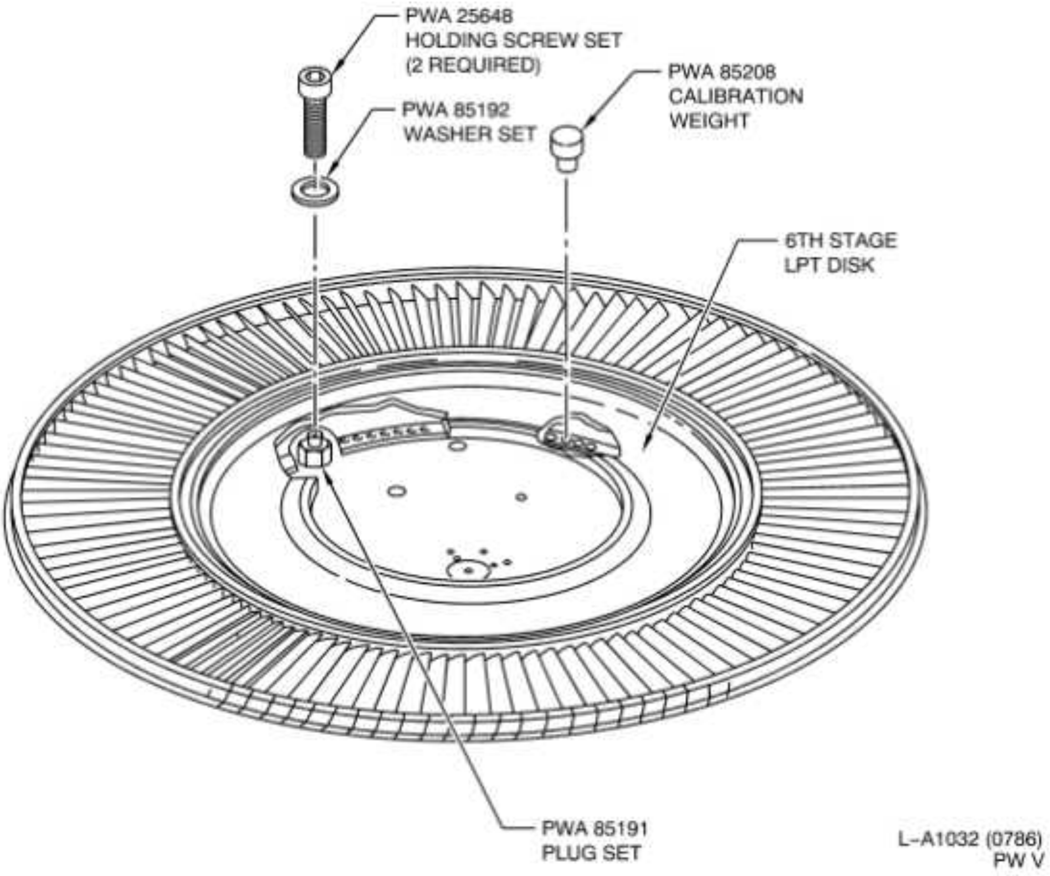
Sixth Stage Turbine Rotor Assembly Balance Set-Up
Figure 1001 (Sheet 1)
(Task 72-53-06-440-002)

STAGE 6 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02


PWA 104240
BALANCE ADAPTER
PWA 103649
AIR CYLINDER
L-B8903 (0802)
PW V

Sixth Stage Turbine Rotor Assembly Balance Set−Up
Figure 1001 (Sheet 2)
(Task 72−53−06−440−002)

STAGE 6 TURBINE ROTOR ASSEMBLY − ASSEMBLY−02


PWA 25648
HOLDING SCREW SET
(2 REQUIRED)
PWA 85192
WASHER SET
PWA 85208
CALIBRATION
WEIGHT
6TH STAGE
LPT DISK
PWA 85191
PLUG SET
L−A1032 (0786)
PW V

Sixth Stage Turbine Rotor Assembly Balance Set−Up
Figure 1002
(Task 72−53−06−440−002)

Previous Pageblock Return to Previous Menu Next Pageblock

STAGE 6 TURBINE ROTOR ASSEMBLY - ASSEMBLY-03

Task 72-53-06-440-003:

1. Final Assemble 6th Stage Turbine Rotor Assembly
   - A. Prerequisites
     - (1) See Inspection/Check-04 (Task 72-53-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.
     - (2) Balance 6th stage turbine rotor assembly per Assembly-02 (Task 72-53-06-440-002).
   - B. Equipment And Materials Required

Special Tools:

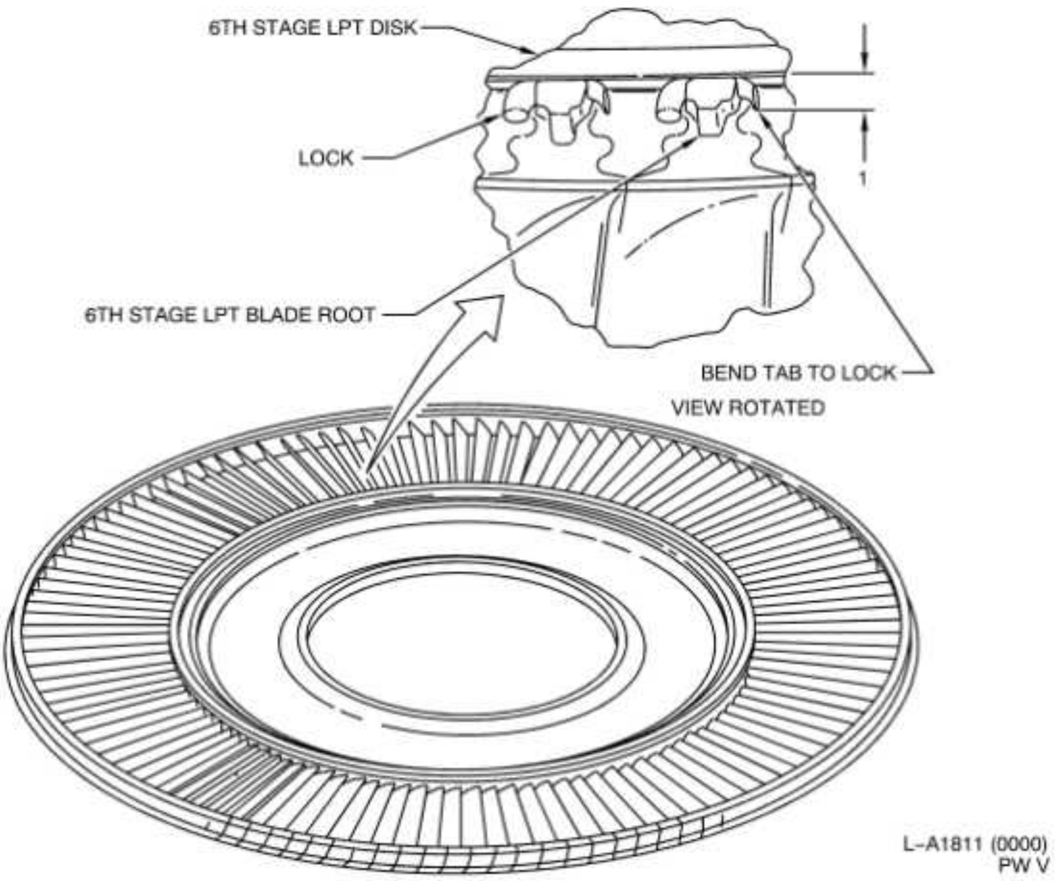
PWA 85386 Support, Front
PWA 85592 Eye, Lifting
PWA 85900 Bender, Pneumatic
PWA 85961 Bender, Pneumatic

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Lock	128	72-53-00	6	80

   - C. Procedure
     - (1) Using hoist and PWA 85592 Lifting Eye position rotor, flange down, onto PWA 85386 Front Support. Remove hoist.
     - (2) Install blade locks into grooves between mating lugs at rear of blade root platform and disk.
     - (3) Prebend blade locks to requirements of Figure 1001. Use PWA 85961 Bender. Apply final bend with PWA 85900 Bender.
     - (4) Reconnect hoist to lifting eye. Lift assembly and store rotor assembly front end down on (PWA 85386) Front Support.

STAGE 6 TURBINE ROTOR ASSEMBLY - ASSEMBLY-03


6TH STAGE LPT DISK
LOCK
1
6TH STAGE LPT BLADE ROOT
BEND TAB TO LOCK
VIEW ROTATED
L-A1811 (0000)
PW V

1. 0.150 Inch (3.810 mm) Minimum

Blade Lock Installation
Figure 1001
(Task 72-53-06-440-003)

Return to Previous Menu

72−54−00

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	HIGHLIGHTS
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72−54−00	TURBINE EXHAUST CASE − HOW TO USE • 72−54−00−990−003: Chapter/Section/Subject Numbering Outline
72−54−00	TURBINE EXHAUST CASE − DESCRIPTION/OPERATION−00 • 72−54−00−990−006: Turbine Exhaust Case
72−54−00	TURBINE EXHAUST CASE − DISASSEMBLY−01 • 72−54−00−030−001: Disassemble Turbine Exhaust Case
72−54−00	TURBINE EXHAUST CASE − INSPECTION/CHECK−01 • 72−54−00−990−004: General Inspection Requirements − Turbine Exhaust Case
72−54−00	TURBINE EXHAUST CASE − INSPECTION/CHECK−03 • 72−54−00−990−005: Visual Inspection − Turbine Exhaust Case
72−54−00	TURBINE EXHAUST CASE − INSPECTION/CHECK−04 • 72−54−00−990−001: Specific Fits And Clearances
72−54−00	TURBINE EXHAUST CASE − ASSEMBLY−01 • 72−54−00−400−001: Assemble Turbine Exhaust Case

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TURBINE EXHAUST CASE − HOW TO USE

Task 72−54−00−990−003:

1. Chapter/Section/Subject Numbering Outline

See Figure 1.

NOTE: See the tab separated How To Use Manual section located at the beginning of this manual set for information concerning Data Location Guidelines and a complete Chapter/Section/Subject numbering outline for all manual sections.

A. The following is a complete listing of the individual Chapter/Section/Subject numbers and specific nomenclatures which have been assigned to the significant Turbine Exhaust Case parts.

(1) Numbers which are not assigned are indicated in the list by one of the following terms:

UNASSIGNED − This designation is for numbers intentionally omitted and reserved for possible future use.

NOT USED − This designation is applied to numbers used in other related engine model programs which are not, at this time, applicable to the engine models represented by this manual.

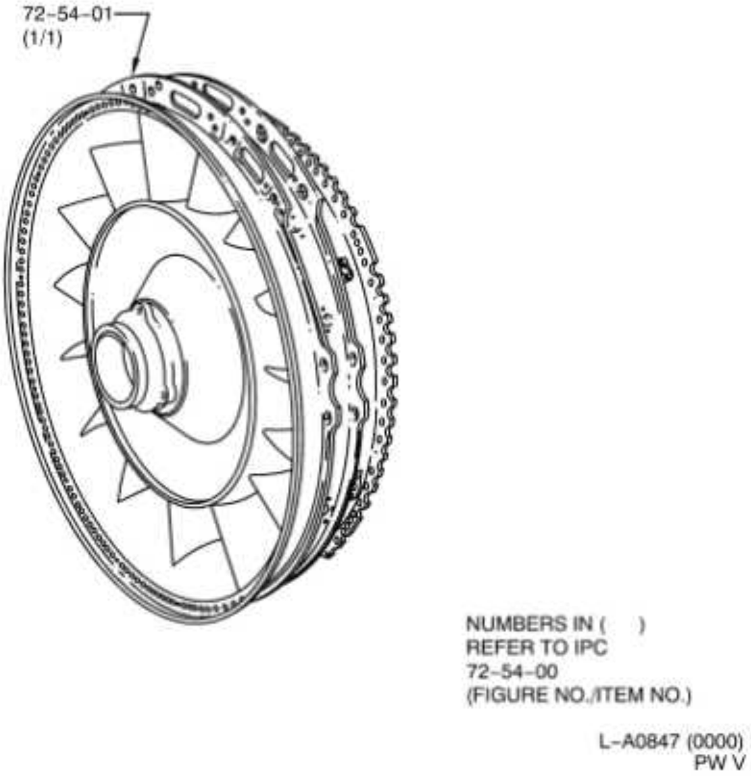
TURBINE EXHAUST CASE − HOW TO USE

TURBINE EXHAUST CASE	72−54−00
TURBINE EXHAUST CASE ASSEMBLY	72−54−01
NOT USED	72−54−02 and 72−54−03
UNASSIGNED	72−54−04 and 72−54−05
NOT USED	72−54−06
NO. 4 BEARING OIL PRESSURE TUBE ASSEMBLY	72−54−07
NO. 4 BEARING OIL SCAVENGE (OUTER) TUBE ASSEMBLY	72−54−08
NO. 4 BEARING OIL SCAVENGE (INNER) TUBE ASSEMBLY	72−54−09
NO. 4 BEARING (OIL) NOZZLE	72−54−10
NO. 4 BEARING TRANSFER TUBE (OIL NOZZLE TO BEARING HOUSING)	72−54−11
NO. 4 BEARING (PRESSURE AND SCAVENGE) TUBE GUIDES	72−54−12
NO. 4 BEARING (OUTER RACE) RETAINING PLATE	72−54−13
NO. 4 ROLLER BEARING	72−54−14
NO. 4 BEARING PRESSURE AND SCAVENGE TUBE HEAT SHIELD ASSEMBLIES	72−54−15
UNASSIGNED	72−54−16
UNASSIGNED	72−54−17
UNASSIGNED	72−54−18
TRANSFER TUBE (DAMPER TUBE TO FRONT NOZZLE)	72−54−19
NO. 4 BEARING DAMPER SUPPLY TUBE ASSEMBLY	72−54−20
FRONT NO. 4 BEARING NOZZLE ASSEMBLY	72−54−21
NOT USED	72−54−22
EEC PT4.95 MANIFOLD ASSEMBLY	72−54−23

TURBINE EXHAUST CASE − HOW TO USE

AVERAGE PRESSURE AND TEMPERATURE PROBE ASSEMBLY	72−54−24
THERMOCOUPLE HOUSING ASSEMBLY	72−54−25
NOT USED	72−54−26 through 72−54−34
NO. 4 BEARING SHIELD	72−54−35
NOT USED	72−54−36 through 72−54−40
UNASSIGNED	72−54−41 through 72−54−78
NOT USED	72−54−79
NO. 4 BEARING SEAL (FRONT) SPACER	72−54−80
NO. 4 BEARING (CARBON) FACE SEAL	72−54−81
NO. 4 BEARING SEAL (REAR) SPACER	72−54−82
NO. 4 BEARING COVER ASSEMBLY	72−54−83
NO. 4 BEARING (COVER) HEAT SHIELD ASSEMBLY	72−54−84
NOT USED	72−54−85
NOT USED	72−54−86 through 72−54−89
UNASSIGNED	72−54−90 and 72−54−91
NOT USED	72−54−92 and 72−54−93
UNASSIGNED	72−54−94 through 72−54−98
TURBINE EXHAUST CASE MISCELLANEOUS PARTS	72−54−99

TURBINE EXHAUST CASE − HOW TO USE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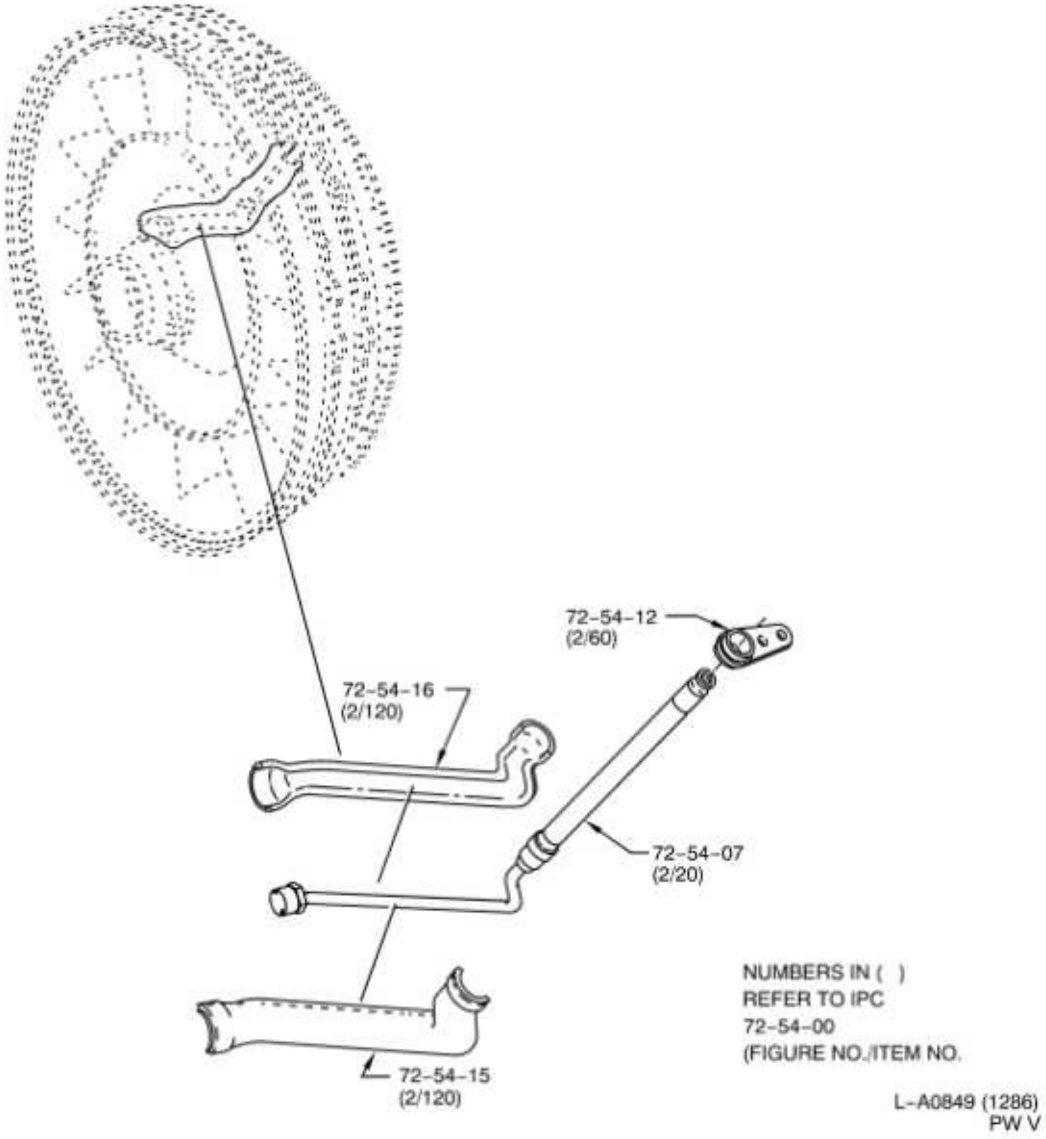
(1/1)
NUMBERS IN ( )
REFER TO IPC
72−54−00
(FIGURE NO./ITEM NO.)
L−A0847 (0000)
PW V

Turbine Exhaust Case
Figure 1 (Sheet 1)
(Task 72−54−00−990−003)

TURBINE EXHAUST CASE − HOW TO USE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72-54-16
(2/120)
72-54-07
(2/20)
72-54-15
(2/120)
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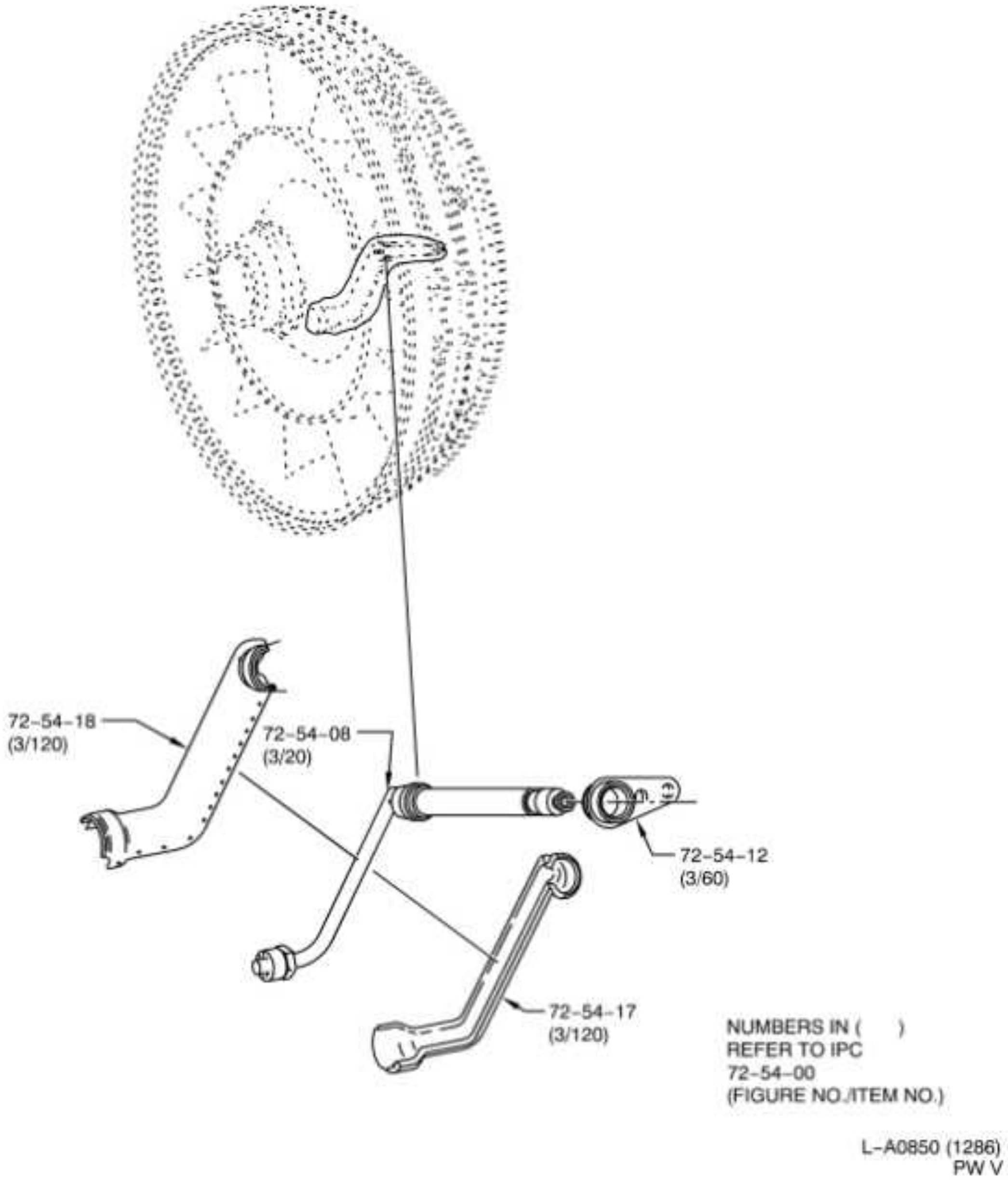
REFER TO IPC
72-54-00
(FIGURE NO./ITEM NO.
L-A0849 (1286)
PW V

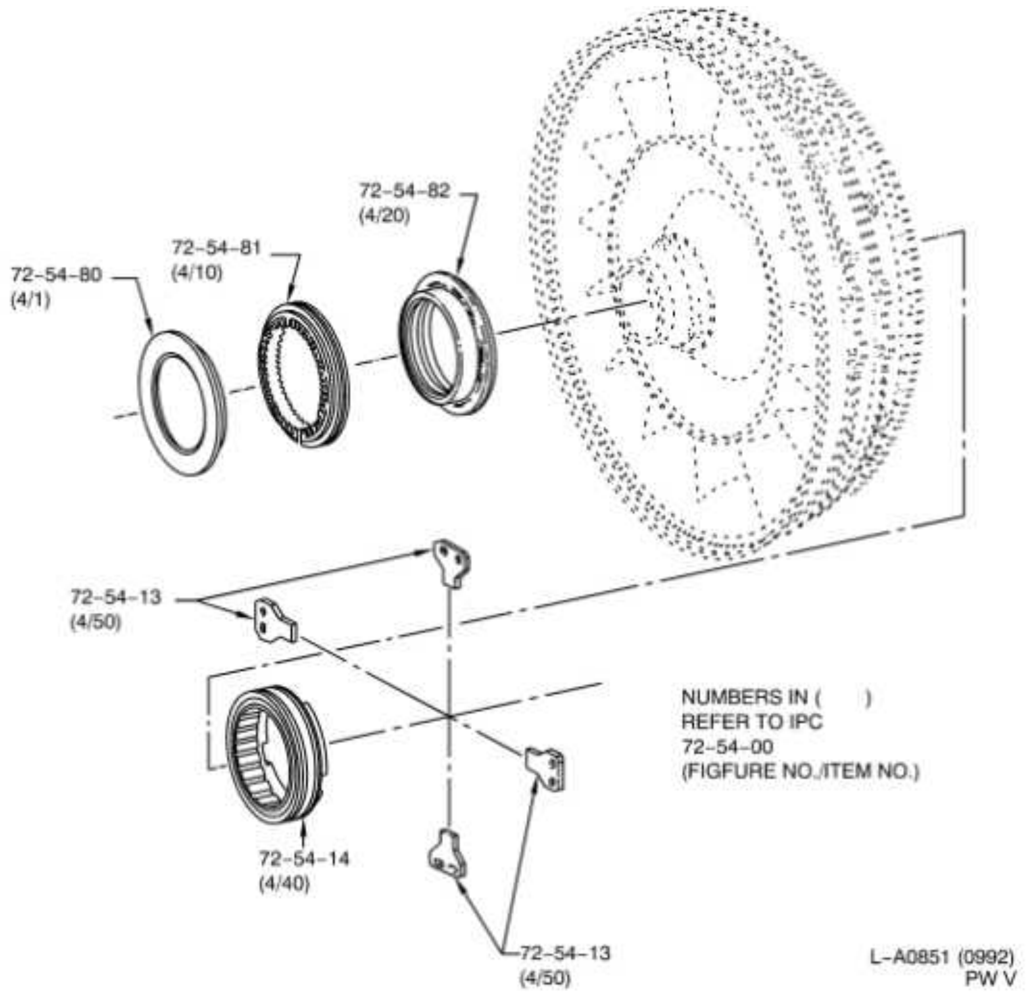
Turbine Exhaust Case
Figure 1 (Sheet 2)
(Task 72−54−00−990−003)

TURBINE EXHAUST CASE − HOW TO USE


72−54−18
(3/120)
72−54−08
(3/20)
72−54−12
(3/60)
72−54−17
(3/120)
NUMBERS IN ( )
REFER TO IPC
72−54−00
(FIGURE NO./ITEM NO.)
L−A0850 (1286)
PW V

Turbine Exhaust Case
Figure 1 (Sheet 3)
(Task 72−54−00−990−003)

TURBINE EXHAUST CASE - HOW TO USE


72-54-82
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72-54-81
(4/10)
72-54-80
(4/1)
72-54-13
(4/50)
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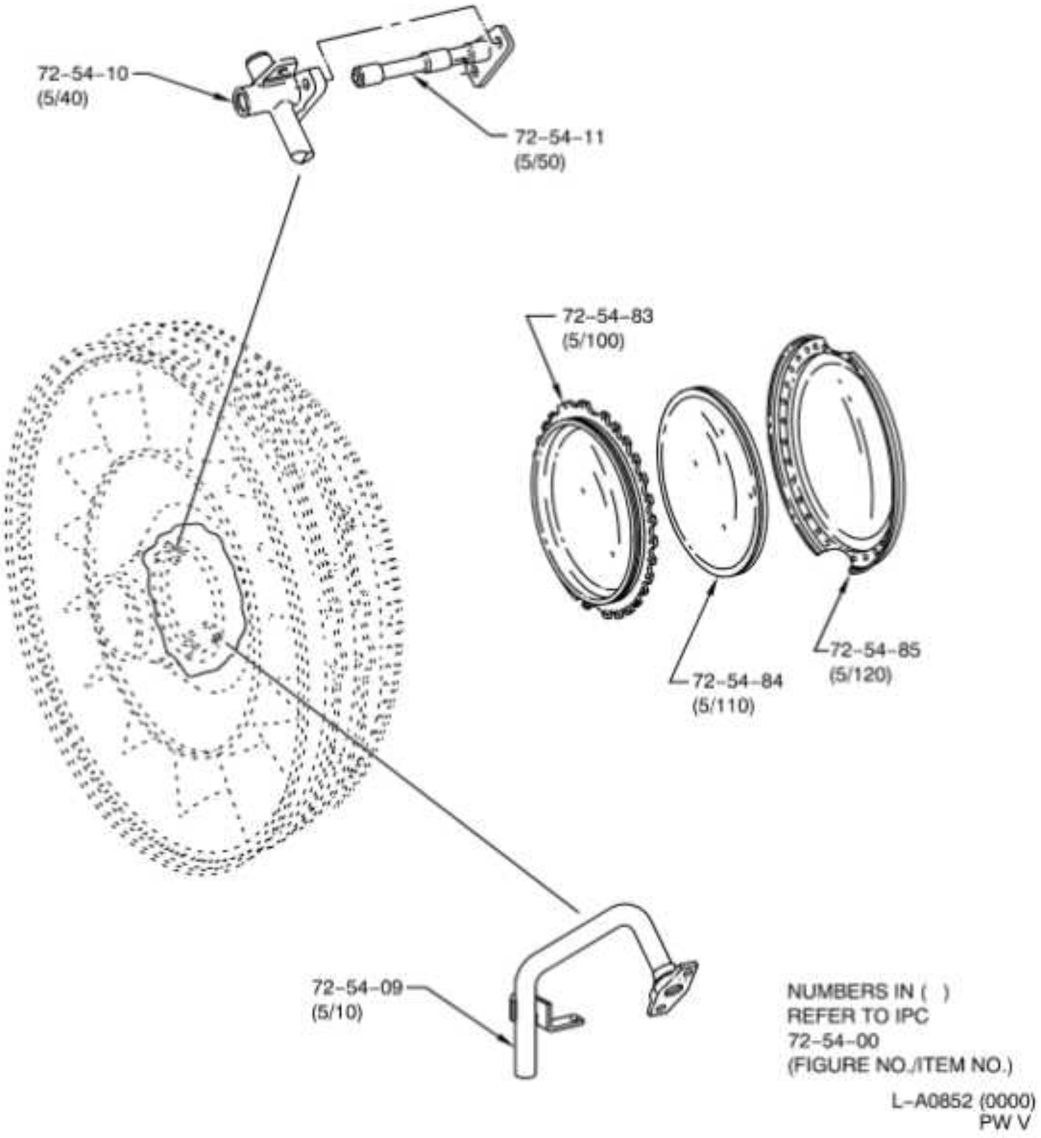
REFER TO IPC
72-54-00
(FIGFURE NO./ITEM NO.)
72-54-14
(4/40)
72-54-13
(4/50)
L-A0851 (0992)
PW V

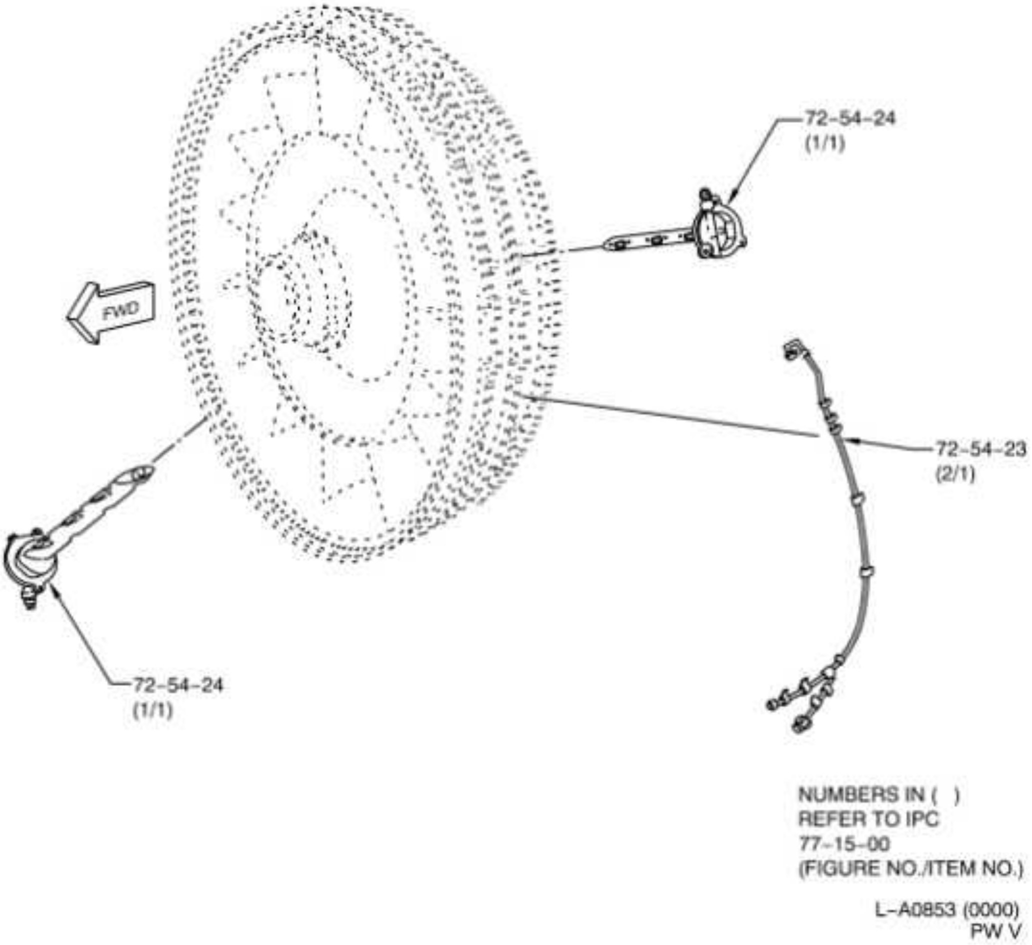
Turbine Exhaust Case
Figure 1 (Sheet 4)
(Task 72-54-00-990-003)

TURBINE EXHAUST CASE − HOW TO USE


72-54-10
(5/40)
72-54-11
(5/50)
72-54-83
(5/100)
72-54-84
(5/110)
72-54-85
(5/120)
72-54-09
(5/10)
NUMBERS IN ( )
REFER TO IPC
72-54-00
(FIGURE NO./ITEM NO.)
L-A0852 (0000)
PW V

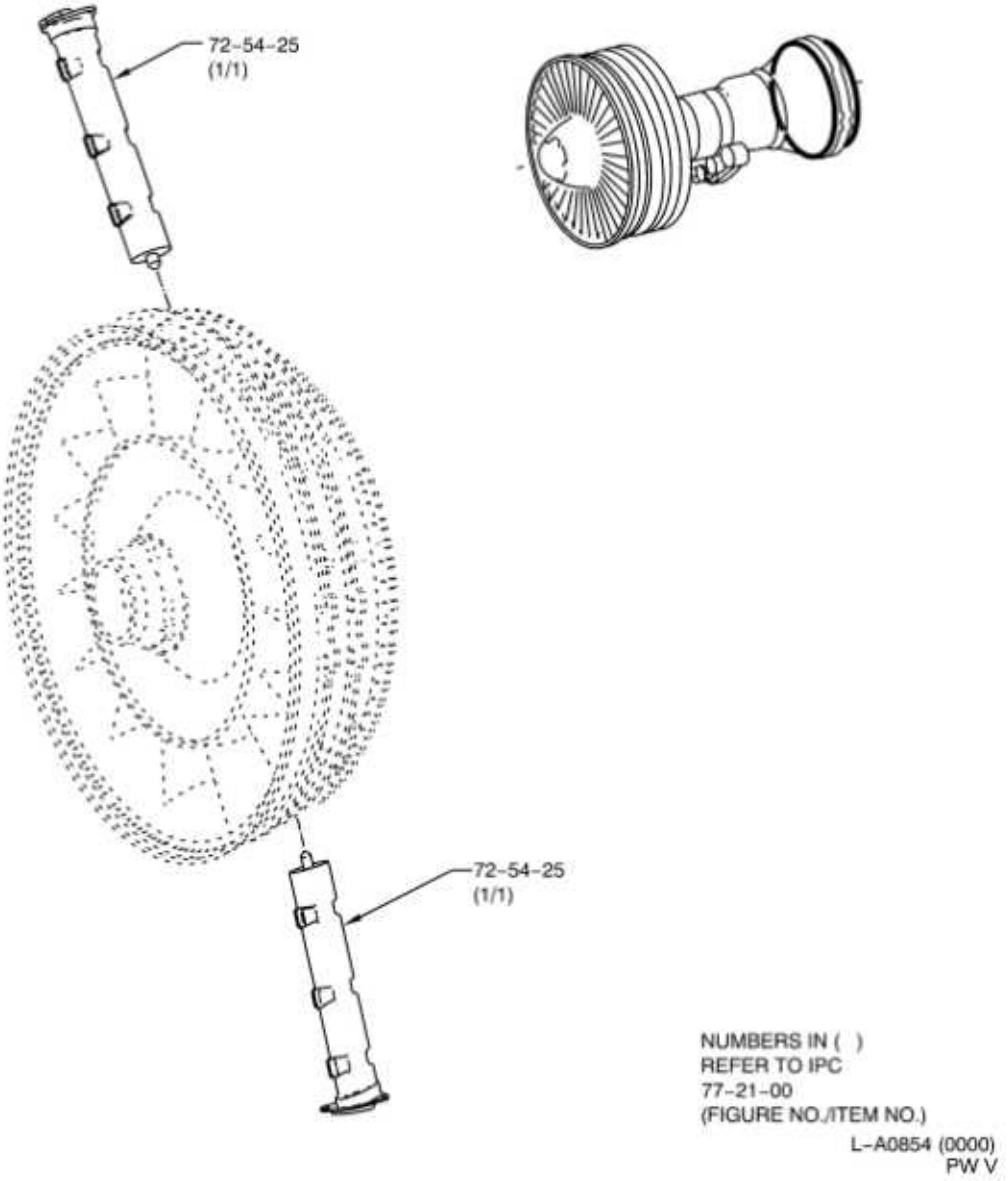
Turbine Exhaust Case
Figure 1 (Sheet 5)
(Task 72−54−00−990−003)

TURBINE EXHAUST CASE - HOW TO USE


72-54-24
(1/1)
FWD
72-54-23
(2/1)
72-54-24
(1/1)
NUMBERS IN ( )
REFER TO IPC
77-15-00
(FIGURE NO./ITEM NO.)
L-A0853 (0000)
PW V

Turbine Exhaust Case
Figure 1 (Sheet 6)
(Task 72-54-00-990-003)

TURBINE EXHAUST CASE − HOW TO USE


72−54−25
(1/1)
72−54−25
(1/1)
NUMBERS IN ( )
REFER TO IPC
77−21−00
(FIGURE NO./ITEM NO.)
L−A0854 (0000)
PW V

Turbine Exhaust Case
Figure 1 (Sheet 7)
(Task 72−54−00−990−003)

Previous Pageblock Return to Previous Menu Next Pageblock

TURBINE EXHAUST CASE - DESCRIPTION/OPERATION-00

Task 72-54-00-990-006:

1. Turbine Exhaust Case

See Figure 1 and Figure 2.

A. General Operation

(1) The turbine exhaust case assembly is a main structural support member of the engine and provides a housing for the rear (LPT) shaft bearing (No. 4 bearing). This structural case provides the aft attachment point for the power plant to the aircraft pylon (strut). Rear ground handling tool attachment points are also located on this case.

(2) The turbine exhaust case is the transition duct for the exhaust gas flow from divergent (through the turbines) to convergent (through the exhaust nozzle).

B. Description

(1) The turbine exhaust case is constructed of greek ascoloy stainless steel material and is welded together as a concentric inner cone segment and outer duct ring joined by fifteen airfoil shaped radial struts. Two circumferential rails on the OD of the case provide structural stiffness to the outer duct and provide mounting points for the rear of the engine, on the aircraft strut and for ground handling.

(2) Provisions are made in the rear mount rails for the attachment of the engine (lower) aft mount links to carry engine vertical, side and torsional loads to the airframe structure.

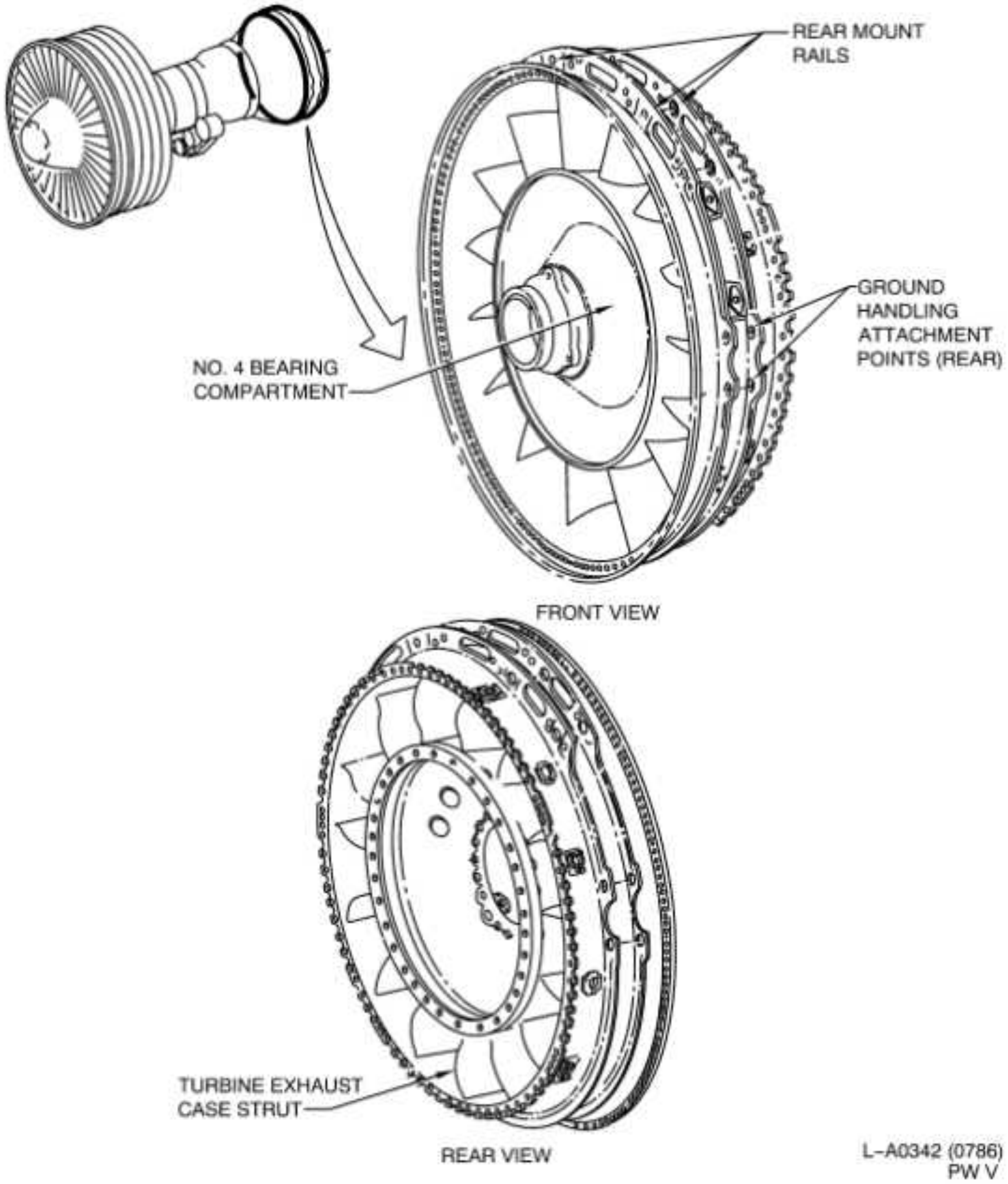
(3) The engine rear ground handling provisions consist of two holes through the rear mount rail on the horizontal centerline.

(4) Probes are installed between the exhaust case struts at four locations. At two locations probes measure gaspath total temperature (TT4.95). At the other two locations, probes measure gaspath total temperature and total gaspath pressure.

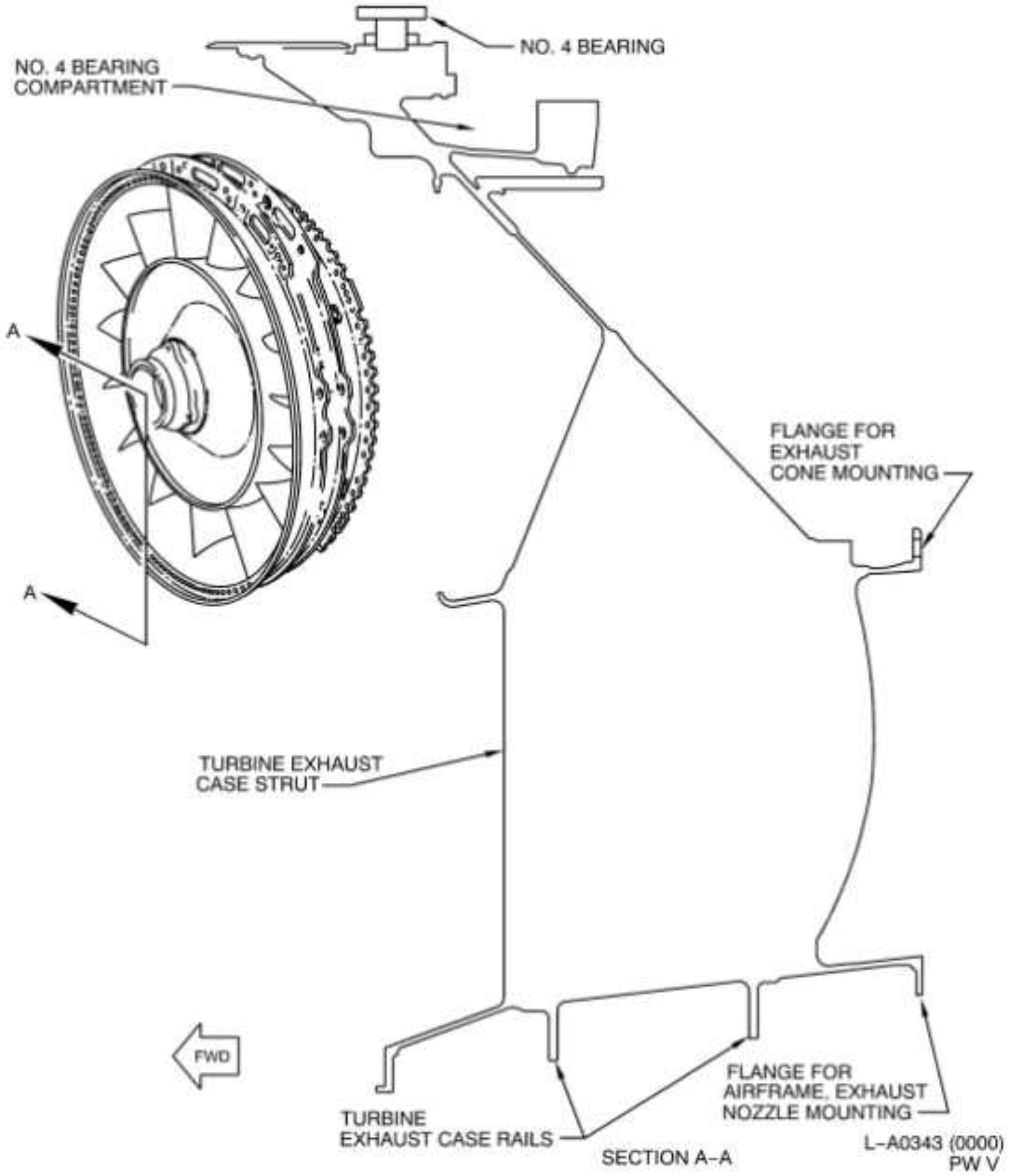
TURBINE EXHAUST CASE − DESCRIPTION/OPERATION−00

(5) The inner cone portion of the case provides support for the No. 4 bearing, with load forces transmitted from the bearing, through the struts to the outer case structure. No. 4 bearing oil pressure and scavenge tubes are routed within case struts at the 1:30 and 2:30 o'clock locations respectively.

TURBINE EXHAUST CASE − DESCRIPTION/OPERATION−00


REAR MOUNT RAILS
GROUND HANDLING ATTACHMENT POINTS (REAR)
NO. 4 BEARING COMPARTMENT
FRONT VIEW
TURBINE EXHAUST CASE STRUT
REAR VIEW
L−A0342 (0786)
PW V

Turbine Exhaust Case
Figure 1
(Task 72−54−00−990−006)


NO. 4 BEARING
NO. 4 BEARING COMPARTMENT
A
A
FLANGE FOR EXHAUST CONE MOUNTING
TURBINE EXHAUST CASE STRUT
FWD
FLANGE FOR AIRFRAME, EXHAUST NOZZLE MOUNTING
TURBINE EXHAUST CASE RAILS
SECTION A-A
L-A0343 (0000)
PW V

Turbine Exhaust Case
Figure 2
(Task 72-54-00-990-006)

Previous Pageblock Return to Previous Menu Next Pageblock

TURBINE EXHAUST CASE - DISASSEMBLY-01

Task 72-54-00-030-001:

1. Disassemble Turbine Exhaust Case

A. Equipment And Materials Required

Special Tools:

PWA 25039	Stand
PWA 25040	Bracket, Support (Optional to PWA 85195 Bracket for engines with exhaust nozzle removed)
PWA 25041	Bracket, Support (Optional to PWA 85195 Bracket for engines with exhaust nozzle removed)
PWA 28657	Sling, Handling
PWA 76154	Adapter (2 Required)
PWA 85195	Bracket, Support (2 Required)
PWA 85446	Puller, Jackscrew

B. Procedure

NOTE: Turbine exhaust case group is positioned on pallet front end down.

Subtask 72-54-00-030-051:

(1) Install PWA 85195 Support Brackets to turbine exhaust case at 3 and 9 o'clock locations.

NOTE: See following step for optional bracket installation.

(a) Position bracket between case rails and align holes with bushings.

(b) Install pins from rear through bushings and bracket.

(c) Secure pins with safety pins.

(d) Repeat procedure for opposite bracket location.

(2) Install PWA 25040 and PWA 25041 Brackets to turbine exhaust case at 3 and 9 o'clock locations.

(a) Align boltholes and position PWA 25040 Bracket on left side (9 o'clock position) between case rails. Secure bracket to case with detail ball lock pin.

R
R

(b) Align boltholes and position PWA 25040 Bracket on right side (3 o'clock position) between case rails. Secure bracket to case with detail ball lock pin.

(3) Install turbine exhaust case in PWA 25039 Build Stand.

(a) Move vertical upright in desired position on rail and secure.

(b) Attach PWA 28657 Sling to hoist. Attach sling to outer spools of brackets on turbine exhaust case with two PWA 76154 Adapters.

(c) Lift and position turbine exhaust case on build stand cradling inner spools of brackets. Remove sling and adapters.

(d) Install ball lock pin in left bracket flange.

(e) Secure clamp on top of vertical support to retain spools.

Subtask 72−54−00−030−052:

(4) (Pre SB PW4ENG 79−76) Remove No. 4 bearing (oil) pressure tube. See Figure 501.

(a) Remove lockwire (501/12) securing heat shields to the No. 4 oil pressure tube (501/7).

(b) Separate and remove heat shields (501/8) and (501/11) from tube.

(c) Remove lockwire and bolts (501/6) securing No. 4 bearing tube guide (501/5) to case.

(d) Disconnect nut securing tube (501/7) to adapter (501/10) in inner rear flange of exhaust case.

(e) Remove thrust wire (501/2) securing nut (501/1) to tube (501/7). Remove nut.

(f) Remove lockwire and bolts (501/3) securing No. 4 bearing pressure tube shield (501/4) to exhaust case at 10:30 o'clock position as viewed from rear.

(g) Move tube (501/7) radially inward and remove tube from case. Remove optional fiberglass wear wrap if necessary.

(h) Remove adapter (501/10) and packing (501/9). Discard packing.

(5) (Post SB PW4ENG 79-76) Remove No. 4 bearing (oil) pressure tube. See Figure 502.

(a) Remove the No. 4 pressure tube (502/10) from the turbine exhaust case at the 4:30 o'clock position.

1 Remove two bolts (502/1) that attach the tube shield (502/16) and bracket (502/2) to the turbine exhaust case.

2 Remove the tube shield (502/16), bracket (502/2), thrust wire (502/18) and nut (502/17) from the outboard end of the pressure tube.

3 Remove the bolt (502/6) and nut (502/12) that attach the tube to the bracket (502/8).

4 Remove the tube nut from the adapter (502/14) and move the tube radially inward and remove the pressure tube from the case.

(b) Cut the restraining straps (502/3) and remove the insulation slide clamp (502/13) and shield sets (502/9) and (502/4) from the tube.

(c) Remove the optional fiberglass wear wrap from the tube if necessary.

(d) Remove bolts (502/5) and bracket (502/8) from the turbine exhaust case.

(e) Remove adapter (502/14) and packing (502/15). Discard the packing.

Subtask 72-54-00-030-053:

(6) (Pre SB PW4ENG 72-472) Remove the No. 4 bearing (oil) nozzle and No. 4 bearing packing transfer tube from boss in the exhaust case (No. 4 bearing compartment) at 1:30 o'clock position. See Figure 503.

(a) Remove bolts (503/8) and key washers (503/6) and (503/7) securing No. 4 bearing packing transfer tube (503/5) to No. 4 bearing nozzle (503/4). Remove tube.

(b) Remove bolts (503/1) and key washers (503/2) and (503/3) securing No. 4 bearing nozzle (503/4) to exhaust case. Remove nozzle.

Subtask 72-54-00-030-058:

(7) (Post SB PW4ENG 72-472) Remove the No. 4 bearing (oil) nozzle and front No. 4 bearing nozzle. See Figure 504.

(a) Remove the bolts and key washer (504/1) that attach the front No. 4 bearing nozzle to the No. 4 bearing support flange at the 12 o'clock position. Discard the key washer.

(b) Move the packing transfer tube (504/15) into the elbow of the No. 4 bearing damper supply tube (504/12). Remove the nozzle.

(c) Remove the packing transfer tube from the damper supply tube. Discard the two packings (504/14).

(d) Remove the bolts and key washers (504/16) and (504/17) that attach the No. 4 bearing damper supply tube (504/12) to the No. 4 bearing oil nozzle (504/11). Remove the tube.

(e) Remove the bolts and key washers (504/16) and (504/17) that attach the No. 4 bearing nozzle (504/11) to the exhaust case. Remove the nozzle.

Subtask 72-54-00-030-054:

(8) (Pre SB PW4ENG 79-76) Remove No. 4 bearing scavenge tube (outer). See Figure 505.

(a) Remove lockwire (505/8) laced through eyelets in heat shield.

(b) Separate and remove heat shields (505/9) and (505/12) from the No. 4 bearing scavenge tube (505/7).

(c) Remove lockwire and bolts (505/6) securing No. 4 bearing tube guide (505/5) to case.

(d) Remove thrust wire (505/2) securing nut (505/1) to tube (505/7). Remove nut.

(e) Move tube (505/7) radially inward and remove tube from case. Remove optional fiberglass wear wrap if necessary.

(f) Remove adapter (505/10) from exhaust case inner flange at 7:30 o'clock location. Discard packing (505/11).

(9) (Post SB PW4ENG 79-76) Remove No. 4 bearing scavenge tube (outer). See Figure 506.

(a) Remove the No. 4 scavenge tube (506/10) from the turbine exhaust case at the 4:00 o'clock position.

1 Remove two bolts (506/1) that attach the tube shield (506/16) and bracket (506/2) to the turbine exhaust case.

2 Remove the tube shield (506/16), bracket (506/2), thrust wire (506/18) and nut (506/17) from the outboard end of the pressure tube.

3 Remove the bolt (506/6) and nut (506/12) that attach the tube to the bracket (506/8).

4 Remove the tube nut from the adapter (506/14) and move the tube radially inward and remove the scavenge tube from the case.

(b) Cut the restraining straps (506/3) and remove the insulation slide clamp (506/13) and shield sets (506/9) and (506/4) from the tube.

(c) Remove the optional fiberglass wear wrap from the tube if necessary.

(d) Remove bolts (506/5) and bracket (506/8) from the turbine exhaust case.

(e) Remove adapter (506/14) and packing (506/15). Discard the packing.

TURBINE EXHAUST CASE - DISASSEMBLY-01

(10) For engines that do not incorporate the reduced weight exhaust case (Pre SB PW4ENG 72-456) remove the No. 4 bearing housing rear heat shields. See Figure 507.

(a) Remove the retaining strap (507/3) from the (rear outer) heat shield (507/2).

(b) Remove the (rear outer) heat shield (507/2) and the two (filler) heat shield segments (507/1).

(c) Remove the two No. 4 bearing (front) heat shields (507/4) from the OD of the No. 4 bearing housing.

(11) For engines that incorporate the reduced weight exhaust case (Post SB PW4ENG 72-456) remove the No. 4 bearing housing rear heat shields.

(a) Remove the retaining strap (507/6) from the No. 4 bearing (rear outer) heat shield (507/5).

(b) Remove the (rear outer) heat shield from the No. 4 bearing housing.

(c) Remove the two No. 4 bearing (front) heat shields (507/7) from the OD of the No. 4 bearing housing.

Subtask 72-54-00-030-055:

(12) Remove No. 4 bearing outer race and rollers. See Figure 508.

(a) Remove bolts (508/6) and key washers (508/4) and (508/5) securing the No. 4 bearing retaining plates (508/3) to rear face of exhaust case inner flange.

(b) Position four legs of PWA 85446 Jackscrew Puller into slots in bearing outer race and rotate to secure legs in puller groove of bearing.

(c) Hold center handle of puller and turn large jacking nut to remove outer race from exhaust case. Remove puller. Remove two seal rings (508/1).

CAUTION: BEARING INNER RACE IS INSTALLED ON FRONT COMPRESSOR DRIVE TURBINE SHAFT. ENSURE THAT ALL BEARING DETAILS ARE KEPT TOGETHER. MIXING OF BEARING DETAILS MAY CAUSE DAMAGE TO BEARING.

(d) Place No. 4 bearing outer race and rollers into suitable container.

(13) For engines without the revised TT4.95 cable and PT4.95 sensing manifold for increased engine core clearance (Pre SB PW4ENG 72-134), remove thermocouple box and cable assembly (EGT TT4.95). See Figure 509 (Sheet 1), Figure 509 (Sheet 2)and Figure 510.

(a) Remove four nuts (509/1) and (509/2) and washers (509/4 and 509/3) securing harness to thermocouple connections. Remove harness ends from thermocouple and reinstall washers and nuts on thermocouple connections. Comply with this step at four thermocouple locations.

(b) Remove bolts (509/5) and nuts (509/6) securing harness to all brackets and adjacent PT4.95 manifold clamps.

(c) Remove four bolts securing inner front bracket (510/4) and inner rear bracket (510/8) to outer support (510/5) at approximately 7 o'clock position on exhaust case. Remove inner brackets. See Figure 510.

(d) Remove two bolts (510/7) securing rear of outer support to bracket on Flange T. Remove support.

(e) Remove four nuts (510/2) securing box and cable assembly cover (510/3) to bracket (510/1) on Flange P. Remove box and cable assembly.

(14) For engines with the revised TT4.95 cable and PT4.95 sensing manifold for increased engine core clearance (Post SB PW4ENG 72-134), remove the thermocouple box and cable assembly (EGT TT4.95). See Figure 511.

(a) Remove the four nuts and lockwashers that attach the cable leads to the thermocouple terminal studs. Remove the cable leads from the studs. Install the lockwashers and nuts on the studs. Do this step at the four thermocouple locations. See Views A, C, E, and I.

(b) Remove the nut, bolt, and clamps that attach the bottom two leads to the EEC PT4.95 manifold at the 4:30 o'clock thermocouple. See View C.

(c) Remove the nut, bolt, and clamp that attach the top two leads to the bracket on the EEC PT4.95 tube at the 10 o'clock thermocouple. See View E.

(d) Remove the nut, bolt, spacer, and clamp that attach the bottom two leads to the bracket at the 7 o'clock thermocouple. See View I.

(e) Remove the bolts and nut that attach the positioning plate to the support bracket at approximately the 5 o'clock position. Remove the positioning plate. See View D.

(f) Remove the bolts that attach the front positioning plate to the front support bracket. Remove the positioning plate. See View J.

(g) Remove the bolts that attach the rear positioning plate to the rear support bracket. Remove the positioning plate. See View J.

(h) Remove the lockwire and bolt that attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position. See View E.

(i) Remove the bolts and nuts that attach the cable clamps to all brackets and adjacent PT4.95 tube/manifold clamps.

(j) Remove the nuts that attach the box and cable assembly to the bracket on Flange P. Remove the box and cable assembly from the engine. See View J.

(15) For engines with the one piece EEC PT4.95 manifold assembly (512/1) (Pre SB PW4ENG 72−134), remove the EEC PT4.95 manifold assembly as follows. See Figure 512.

TURBINE EXHAUST CASE - DISASSEMBLY-01

(a) Remove the lockwire. Disconnect the two manifold nuts (512/7) at the probe adapters.

(b) Remove the bolts (512/4), nuts (512/3), and clamps (512/2) that attach the manifold. Remove the manifold.

(c) Remove the plug (512/5) and washer (512/6) from the manifold. Install the covers.

(16) For engines with the three piece EEC PT4.95 manifold (Post SB PW4ENG 72-134), remove the two EEC PT4.95 manifold assemblies (513/1 and 513/2) and the EEC PT4.95 tube assembly (513/3) as follows. See Figure 513.

(a) Remove the lockwire. Disconnect the tube and manifold nuts (513/9) at the probes and from each other.

(b) Remove the bolts (513/6), nuts (513/5), and clamps (513/4) that attach the manifolds and tubes. Remove the two manifolds (513/1 and 513/2) and the tube (513/3).

(c) Remove the plug (513/8) and washer (513/7) from the manifold (513/2). Install the covers.

(17) Remove TT4.95 exhaust gas temperature thermocouple and thermocouple housing assembly from exhaust case at 1 o'clock position. See Figure 514.

(a) Remove lockwire and bolts (514/1) securing thermocouple (514/4) to thermocouple housing assembly (514/5) and exhaust case. Remove bracket (514/3) and thermocouple from thermocouple housing.

(b) Remove bolt (514/2) securing thermocouple housing to exhaust case. Remove thermocouple housing from case.

(18) Remove TT4.95 exhaust gas temperature thermocouple and thermocouple housing assembly from exhaust case at 6:30 o'clock position. See Figure 515.

(a) Remove lockwire and bolts (515/4) securing thermocouple (515/2) to thermocouple housing and exhaust case. Remove bracket (515/3) and thermocouple from thermocouple housing.

(b) Remove bolt (515/5) securing thermocouple housing to exhaust case. Remove thermocouple housing from case.

(19) Remove TT4.95 exhaust gas temperature thermocouple and average pressure and temperature probe from exhaust case at 4:30 o'clock position. See Figure 516.

(a) Remove lockwire and bolts (516/5) securing thermocouple (516/2) to average pressure and temperature probe and exhaust case. Remove bracket (516/4) and thermocouple from probe.

(b) Remove bolt (516/3) securing average pressure and temperature probe (516/1) to exhaust case. Remove probe from case.

(20) Remove TT4.95 exhaust gas temperature thermocouple and average pressure and temperature probe from exhaust case at 10 o'clock position. See Figure 517.

(a) Remove lockwire and bolts (517/3) securing thermocouple (517/4) to average pressure and temperature probe and exhaust case. Remove thermocouple from probe.

(b) Remove bolt (517/2) securing average pressure and temperature probe (517/1) to exhaust case. Remove probe from case.

Subtask 72−54−00−030−057:

(21) Drill out rivet/plugs in the outer case wall at the 13 strut locations as specified in Figure 518. Do not damage the case parent metal.

NOTE: If the rivet/plugs are not there, you must drill purge and drain holes. Refer to 72−54−01, Repair−25 (Task 72−54−01−300−025).

Subtask 72−54−00−030−056:

(22) Remove turbine exhaust case from build stand.

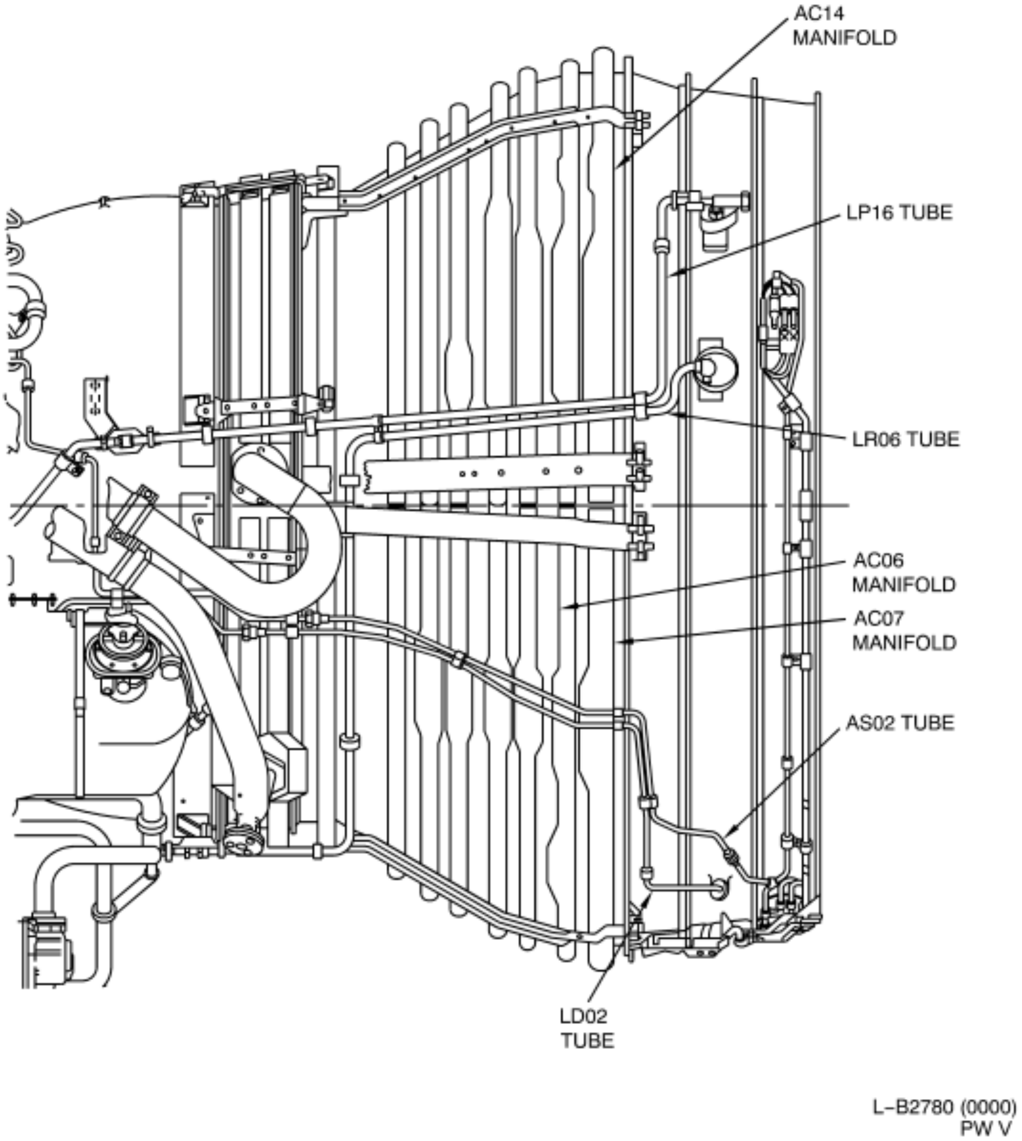
TURBINE EXHAUST CASE − DISASSEMBLY−01

(a) Remove ball lock pin from left bracket flange.

(b) Open clamp securing flange brackets to vertical supports of build stand.

R (c) Attach PWA 28657 Sling to hoist. Attach sling to outer spools of brackets on turbine exhaust case with PWA 76154 Adapters.

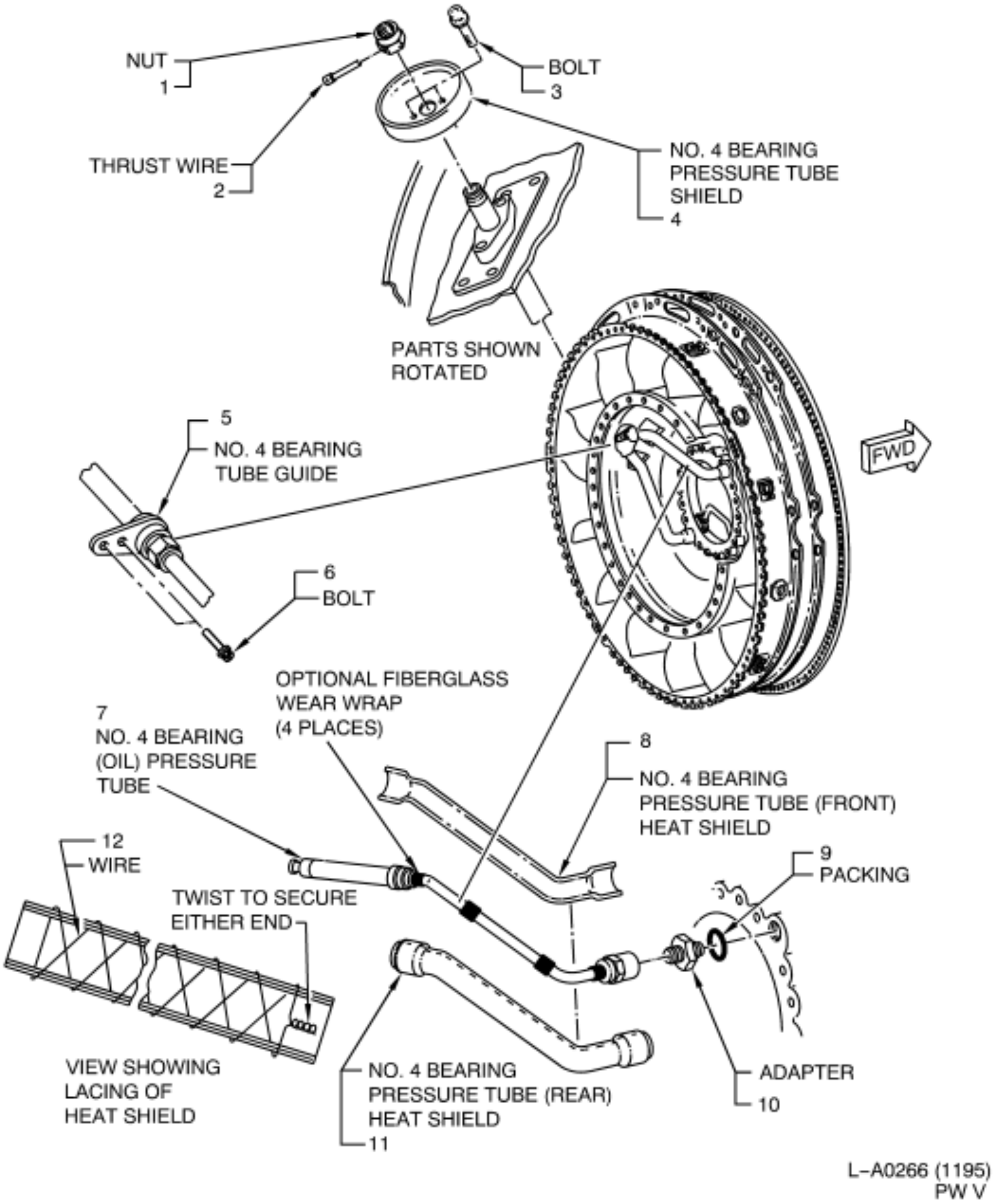
(d) Lift and trunnion case to rear end down position and lower onto pallet. Remove hoist, sling, adapters and brackets from case.


AC14
MANIFOLD
LP16 TUBE
LR06 TUBE
AC06
MANIFOLD
AC07
MANIFOLD
AS02 TUBE
LD02
TUBE
L−B2780 (0000)
PW V

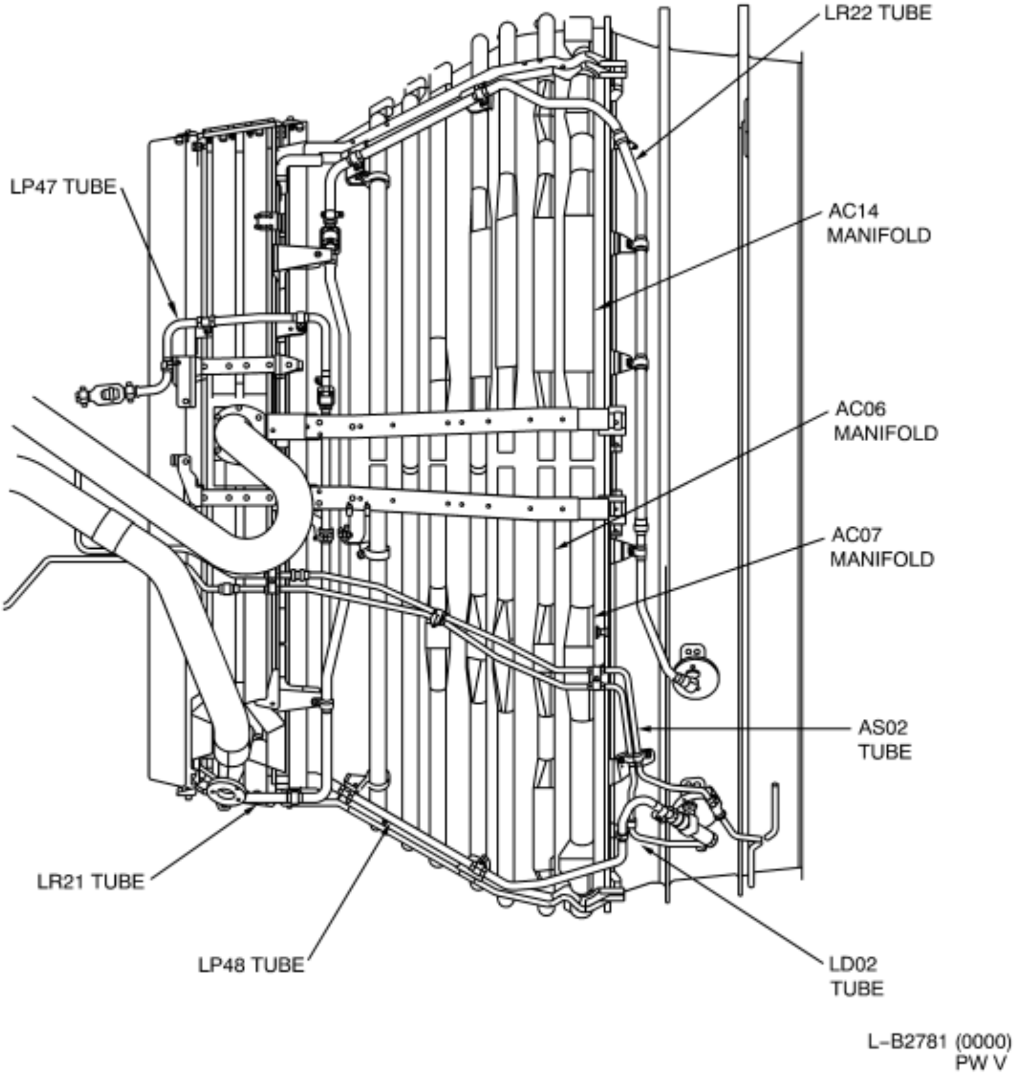
Routing Of No. 4 Bearing Pressure And
Scavenge Tubes (Pre SB PW4ENG 79−76)
Figure 501 (Sheet 1)
(Task 72−54−00−030−001)

R
R

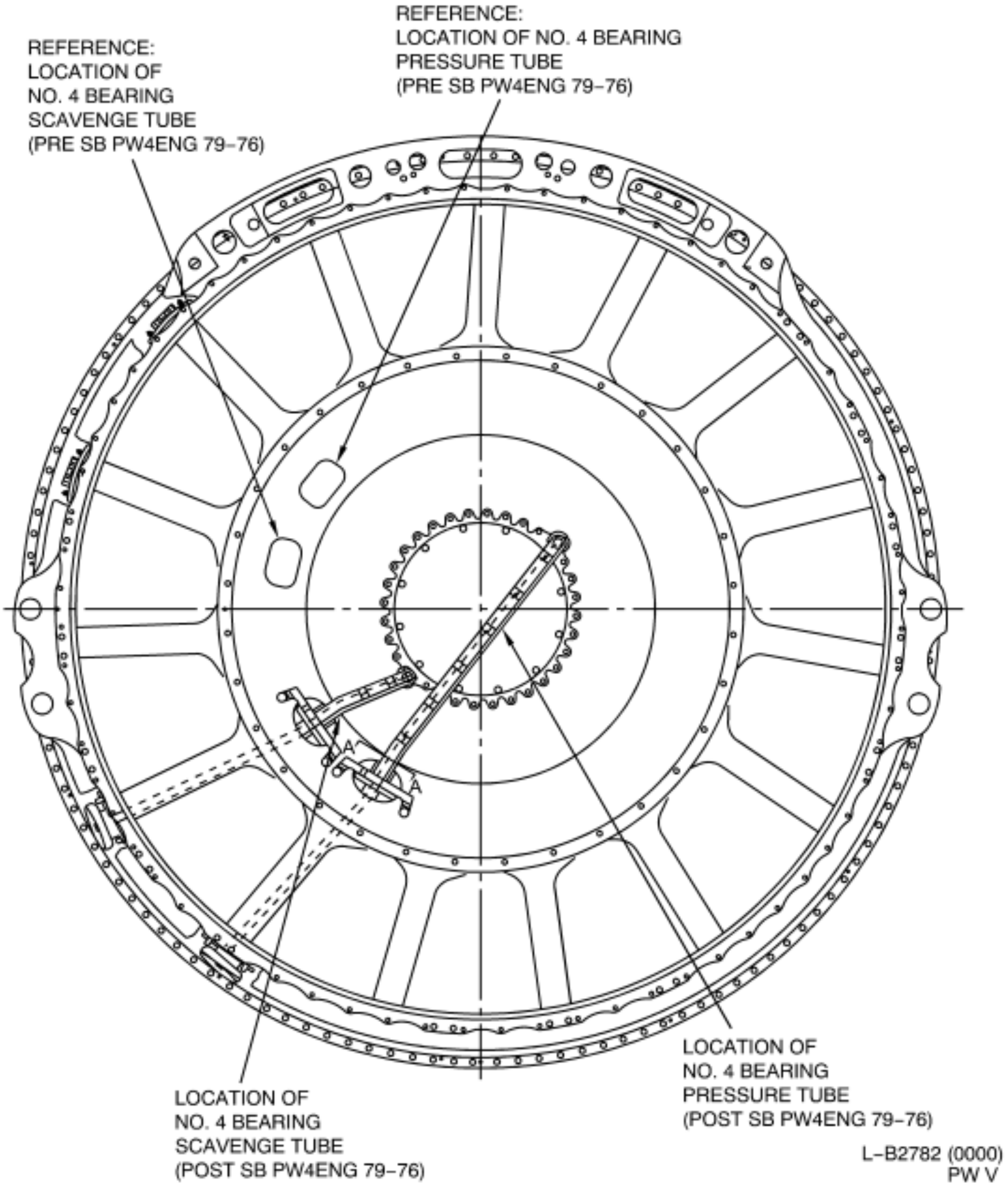
TURBINE EXHAUST CASE - DISASSEMBLY-01


NUT
1
BOLT
3
THRUST WIRE
2
NO. 4 BEARING PRESSURE TUBE SHIELD
4
PARTS SHOWN ROTATED
5
NO. 4 BEARING TUBE GUIDE
FWD
6
BOLT
OPTIONAL FIBERGLASS WEAR WRAP (4 PLACES)
7
NO. 4 BEARING (OIL) PRESSURE TUBE
8
NO. 4 BEARING PRESSURE TUBE (FRONT) HEAT SHIELD
12
WIRE
TWIST TO SECURE EITHER END
9
PACKING
VIEW SHOWING LACING OF HEAT SHIELD
NO. 4 BEARING PRESSURE TUBE (REAR) HEAT SHIELD
11
ADAPTER
10
L-A0266 (1195)
PW V

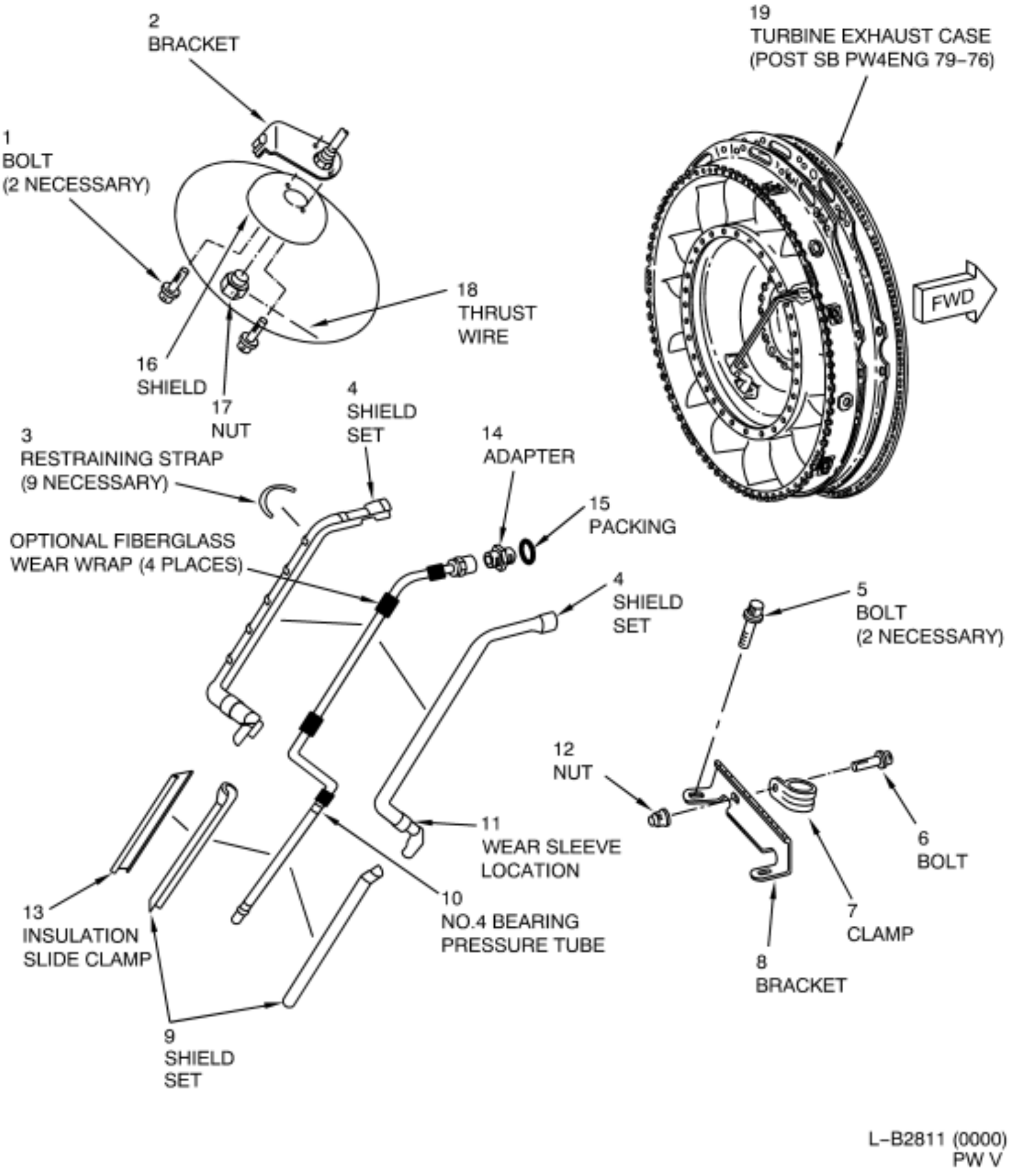
No. 4 Bearing Pressure Tube Removal (Pre SB PW4ENG 79-76)
Figure 501 (Sheet 2)
(Task 72-54-00-030-001)


LR22 TUBE
LP47 TUBE
AC14 MANIFOLD
AC06 MANIFOLD
AC07 MANIFOLD
AS02 TUBE
LR21 TUBE
LP48 TUBE
LD02 TUBE
L-B2781 (0000)
PW V

Routing Of No. 4 Bearing Pressure And
Scavenge Tubes (Post SB PW4ENG 79-76)
Figure 502 (Sheet 1)
(Task 72-54-00-030-001)

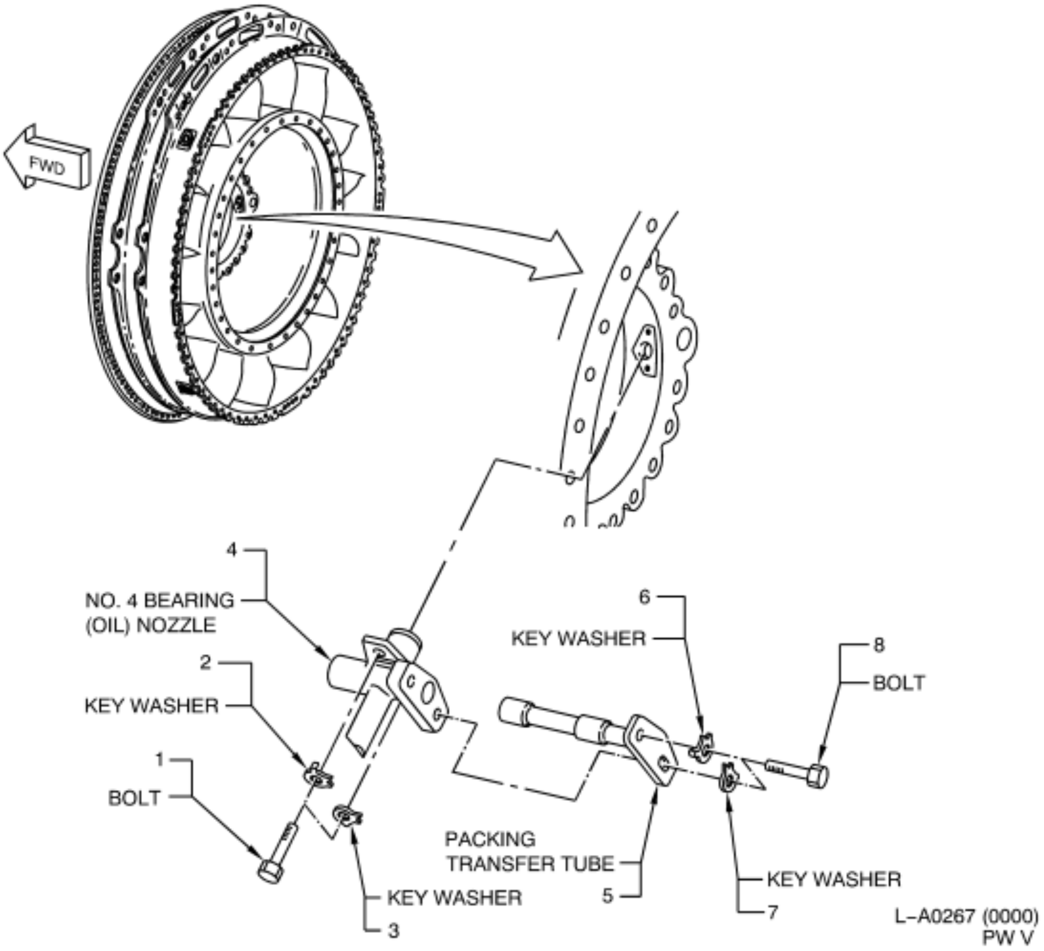

REFERENCE:
LOCATION OF NO. 4 BEARING
PRESSURE TUBE
(PRE SB PW4ENG 79-76)
REFERENCE:
LOCATION OF
NO. 4 BEARING
SCAVENGE TUBE
(PRE SB PW4ENG 79-76)
A
A
LOCATION OF
NO. 4 BEARING
PRESSURE TUBE
(POST SB PW4ENG 79-76)
LOCATION OF
NO. 4 BEARING
SCAVENGE TUBE
(POST SB PW4ENG 79-76)
L-B2782 (0000)
PW V

Routing Of No. 4 Bearing Pressure And
Scavenge Tubes (Post SB PW4ENG 79-76)
Figure 502 (Sheet 2)
(Task 72-54-00-030-001)

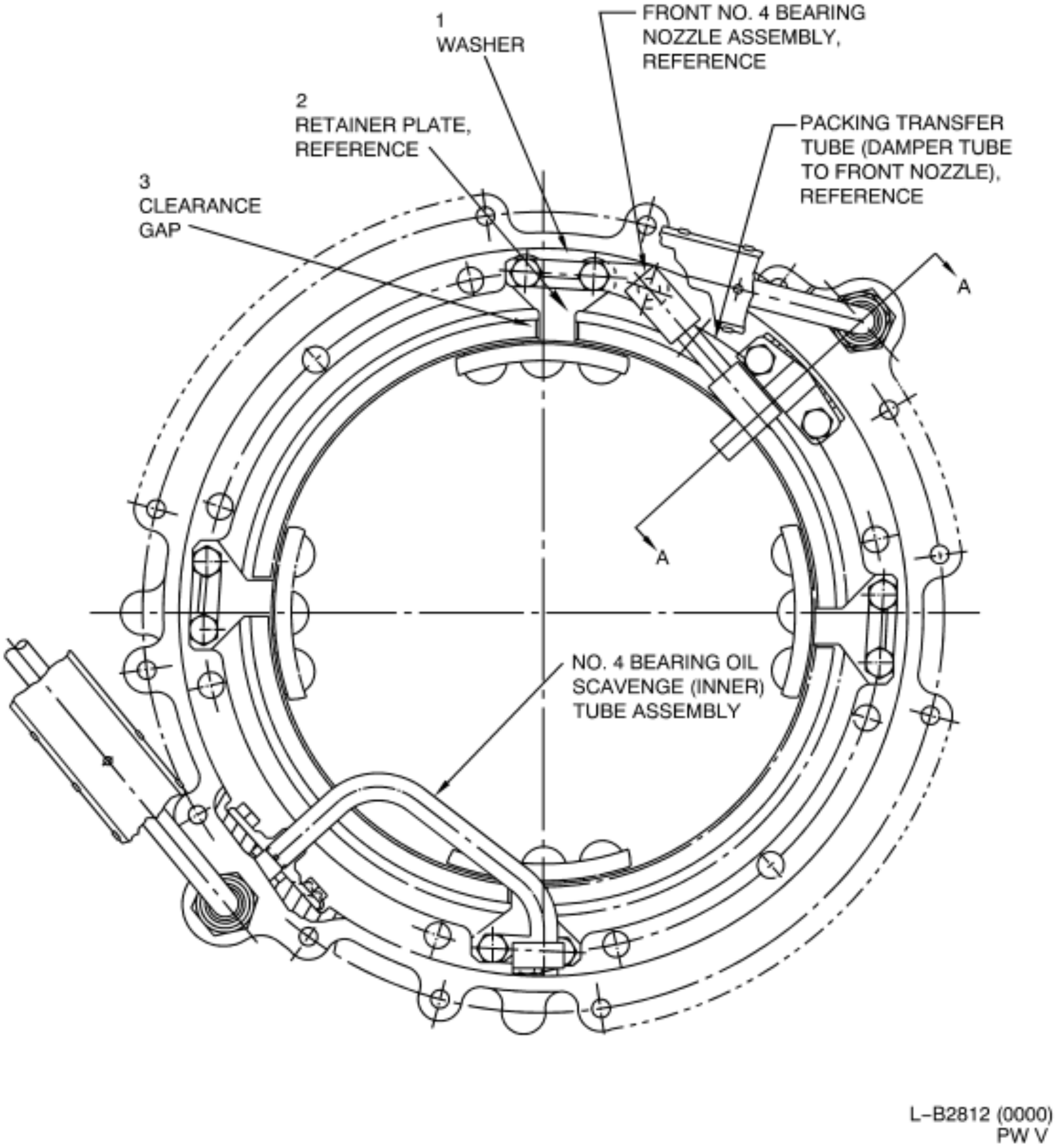

2
BRACKET
19
TURBINE EXHAUST CASE
(POST SB PW4ENG 79-76)
1
BOLT
(2 NECESSARY)
FWD
18
THRUST
WIRE
16
SHIELD
17
NUT
4
SHIELD
SET
3
RESTRAINING STRAP
(9 NECESSARY)
14
ADAPTER
15
PACKING
OPTIONAL FIBERGLASS
WEAR WRAP (4 PLACES)
4
SHIELD
SET
5
BOLT
(2 NECESSARY)
12
NUT
6
BOLT
11
WEAR SLEEVE
LOCATION
7
CLAMP
13
INSULATION
SLIDE CLAMP
10
NO.4 BEARING
PRESSURE TUBE
8
BRACKET
9
SHIELD
SET
L-B2811 (0000)
PW V

No. 4 Bearing Pressure Tube Removal (Post SB PW4ENG 79-76)
Figure 502 (Sheet 3)
(Task 72-54-00-030-001)

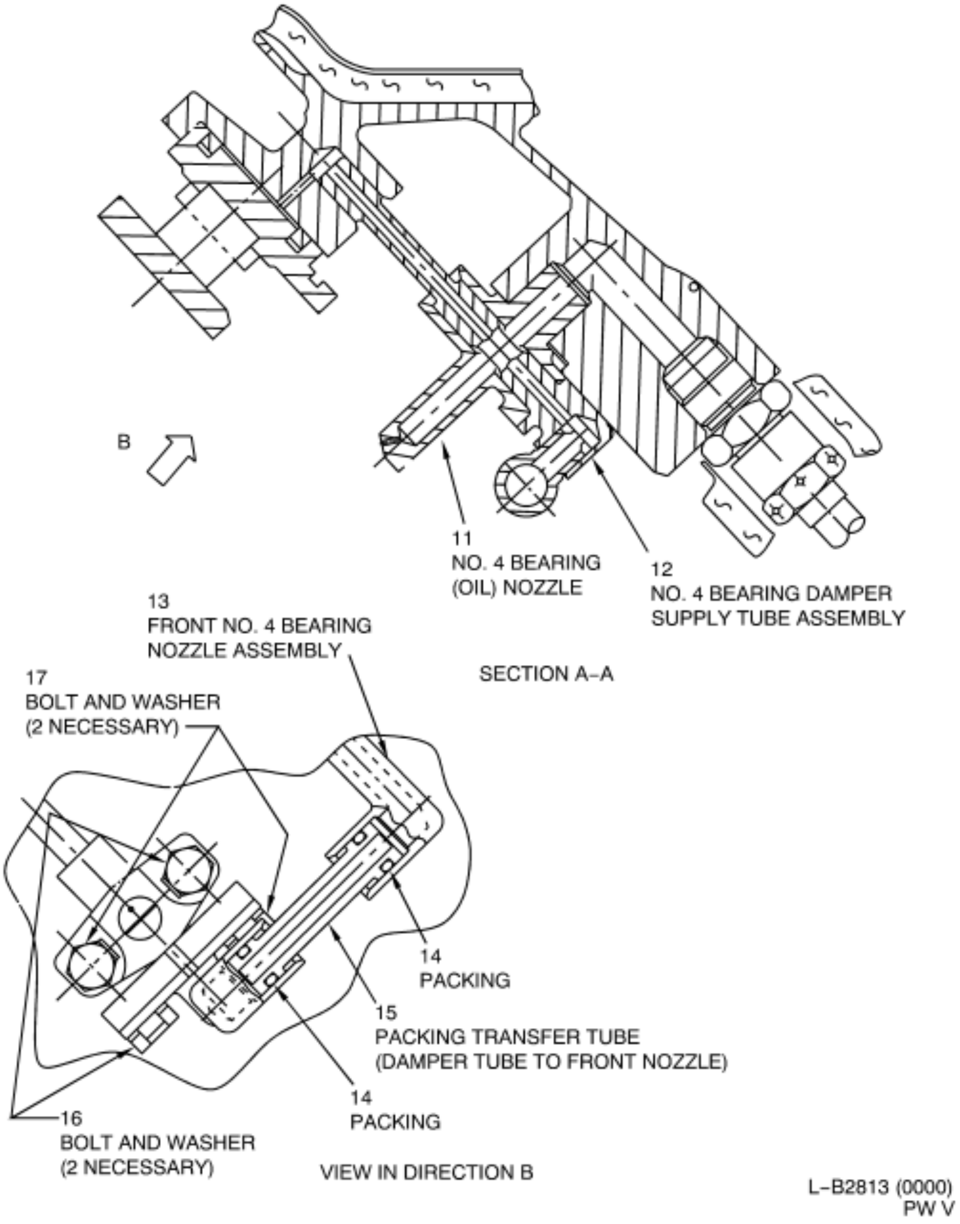
TURBINE EXHAUST CASE - DISASSEMBLY-01


FWD
4
NO. 4 BEARING
(OIL) NOZZLE
2
KEY WASHER
1
BOLT
6
KEY WASHER
8
BOLT
PACKING
TRANSFER TUBE
5
KEY WASHER
3
KEY WASHER
7
L-A0267 (0000)
PW V

No. 4 Bearing (Oil) Nozzle Removal (Pre SB PW4ENG 72-472)
Figure 503
(Task 72-54-00-030-001)

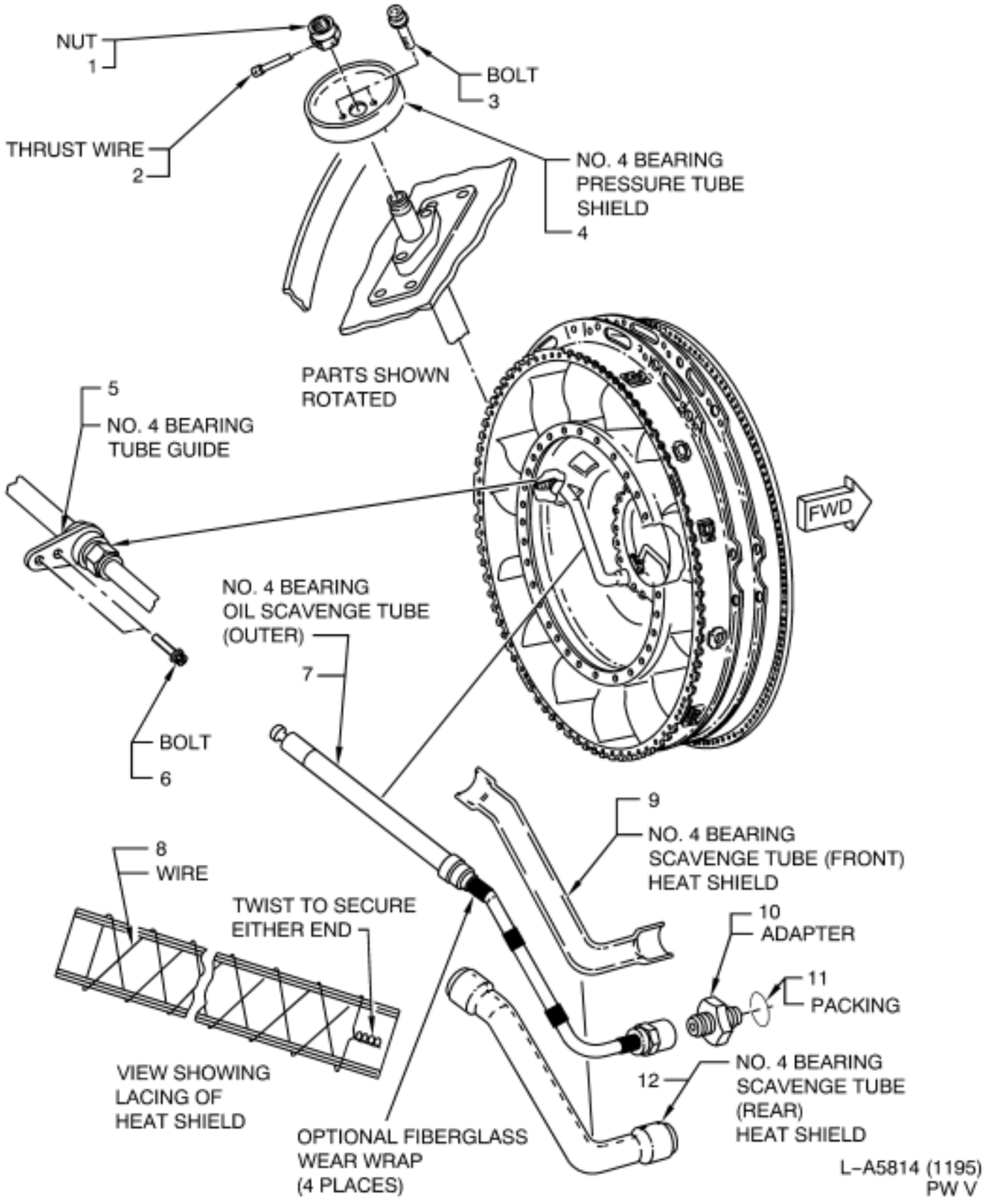

1
WASHER
FRONT NO. 4 BEARING
NOZZLE ASSEMBLY,
REFERENCE
2
RETAINER PLATE,
REFERENCE
PACKING TRANSFER
TUBE (DAMPER TUBE
TO FRONT NOZZLE),
REFERENCE
3
CLEARANCE
GAP
A
A
NO. 4 BEARING OIL
SCAVENGE (INNER)
TUBE ASSEMBLY
L-B2812 (0000)
PW V

No. 4 Bearing (Oil) Nozzles Removal (Post SB PW4ENG 72-472)
Figure 504 (Sheet 1)
(Task 72-54-00-030-001)


B
11
NO. 4 BEARING
(OIL) NOZZLE
12
NO. 4 BEARING DAMPER
SUPPLY TUBE ASSEMBLY
13
FRONT NO. 4 BEARING
NOZZLE ASSEMBLY
SECTION A-A
17
BOLT AND WASHER
(2 NECESSARY)
14
PACKING
15
PACKING TRANSFER TUBE
(DAMPER TUBE TO FRONT NOZZLE)
14
PACKING
16
BOLT AND WASHER
(2 NECESSARY)
VIEW IN DIRECTION B
L-B2813 (0000)
PW V

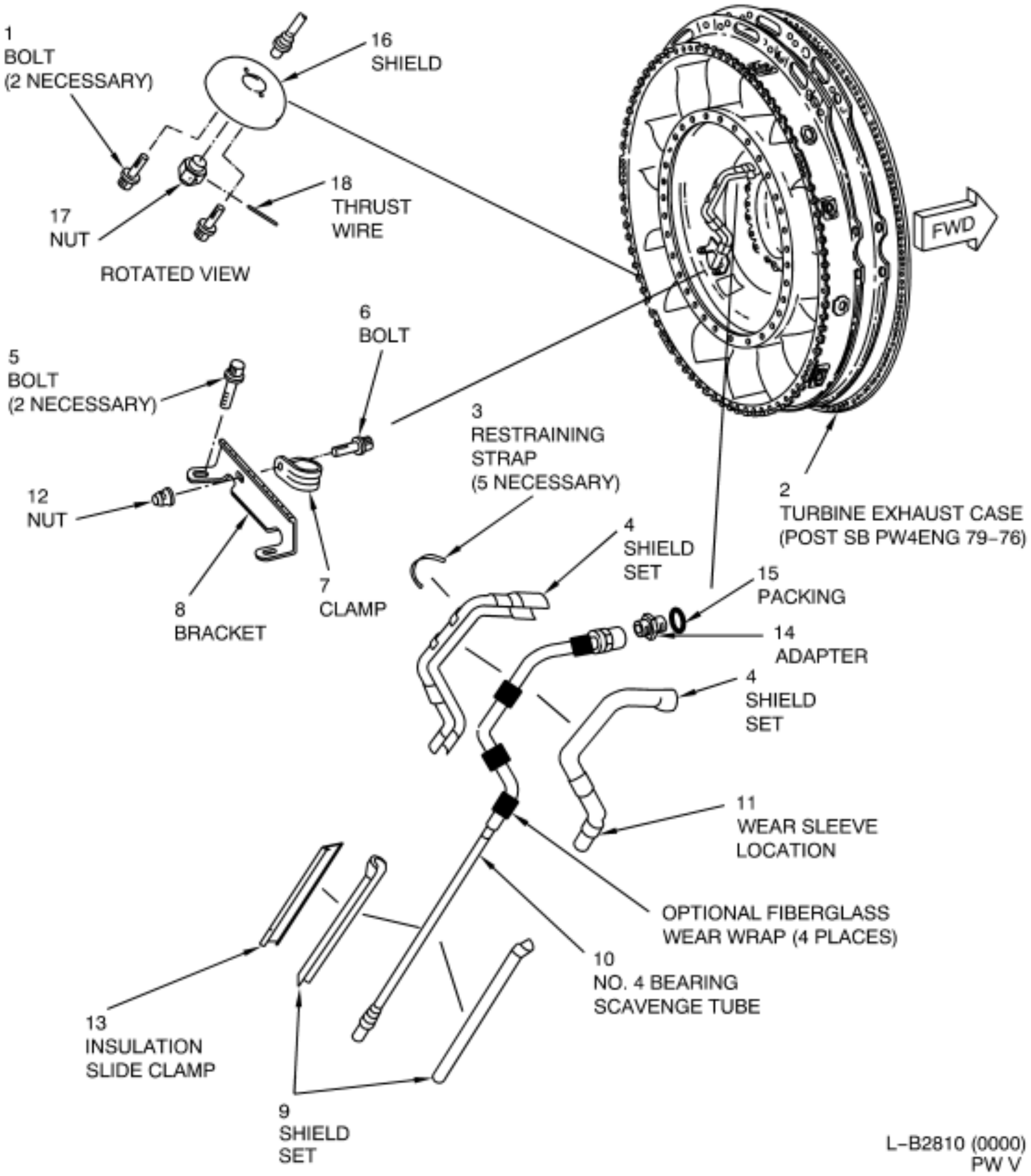
No. 4 Bearing (Oil) Nozzles Removal (Post SB PW4ENG 72-472)
Figure 504 (Sheet 2)
(Task 72-54-00-030-001)

TURBINE EXHAUST CASE - DISASSEMBLY-01

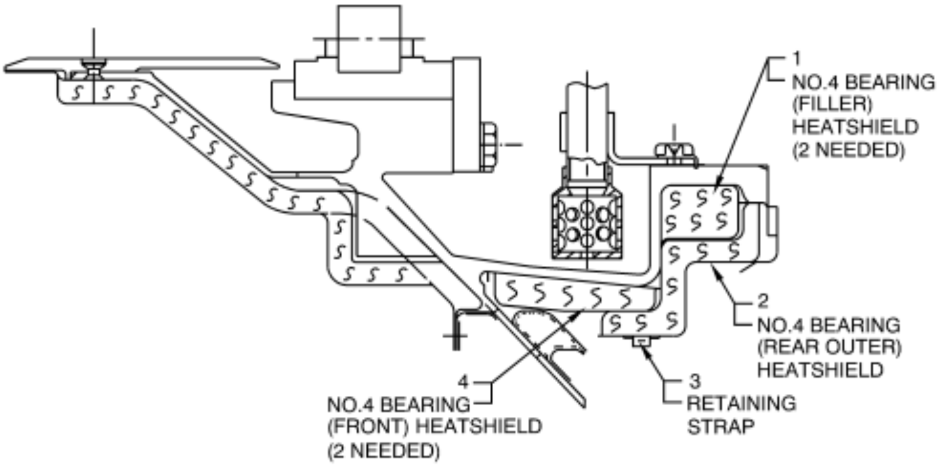

NUT
1
BOLT
3
THRUST WIRE
2
NO. 4 BEARING PRESSURE TUBE SHIELD
4
PARTS SHOWN ROTATED
5
NO. 4 BEARING TUBE GUIDE
FWD
NO. 4 BEARING OIL SCAVENGE TUBE (OUTER)
7
BOLT
6
9
NO. 4 BEARING SCAVENGE TUBE (FRONT) HEAT SHIELD
8
WIRE
TWIST TO SECURE EITHER END
10
ADAPTER
11
PACKING
VIEW SHOWING LACING OF HEAT SHIELD
12
NO. 4 BEARING SCAVENGE TUBE (REAR) HEAT SHIELD
OPTIONAL FIBERGLASS WEAR WRAP (4 PLACES)
L-A5814 (1195)
PW V

No. 4 Bearing Scavenge Tube Removal (Pre SB PW4ENG 79-76)
Figure 505
(Task 72-54-00-030-001)

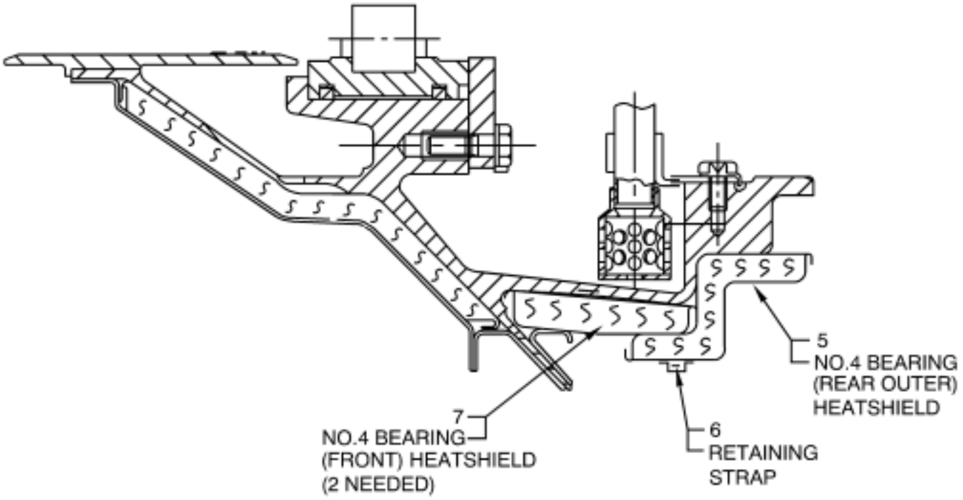
TURBINE EXHAUST CASE - DISASSEMBLY-01


1
BOLT
(2 NECESSARY)
16
SHIELD
17
NUT
18
THRUST
WIRE
ROTATED VIEW
6
BOLT
5
BOLT
(2 NECESSARY)
12
NUT
3
RESTRAINING
STRAP
(5 NECESSARY)
8
BRACKET
7
CLAMP
4
SHIELD
SET
FWD
2
TURBINE EXHAUST CASE
(POST SB PW4ENG 79-76)
15
PACKING
14
ADAPTER
4
SHIELD
SET
11
WEAR SLEEVE
LOCATION
OPTIONAL FIBERGLASS
WEAR WRAP (4 PLACES)
10
NO. 4 BEARING
SCAVENGE TUBE
13
INSULATION
SLIDE CLAMP
9
SHIELD
SET
L-B2810 (0000)
PW V

No. 4 Bearing Scavenge Tube Removal (Post SB PW4ENG 79-76)
Figure 506
(Task 72-54-00-030-001)


1
NO.4 BEARING
(FILLER)
HEATSHIELD
(2 NEEDED)
2
NO.4 BEARING
(REAR OUTER)
HEATSHIELD
3
RETAINING
STRAP
4
NO.4 BEARING
(FRONT) HEATSHIELD
(2 NEEDED)

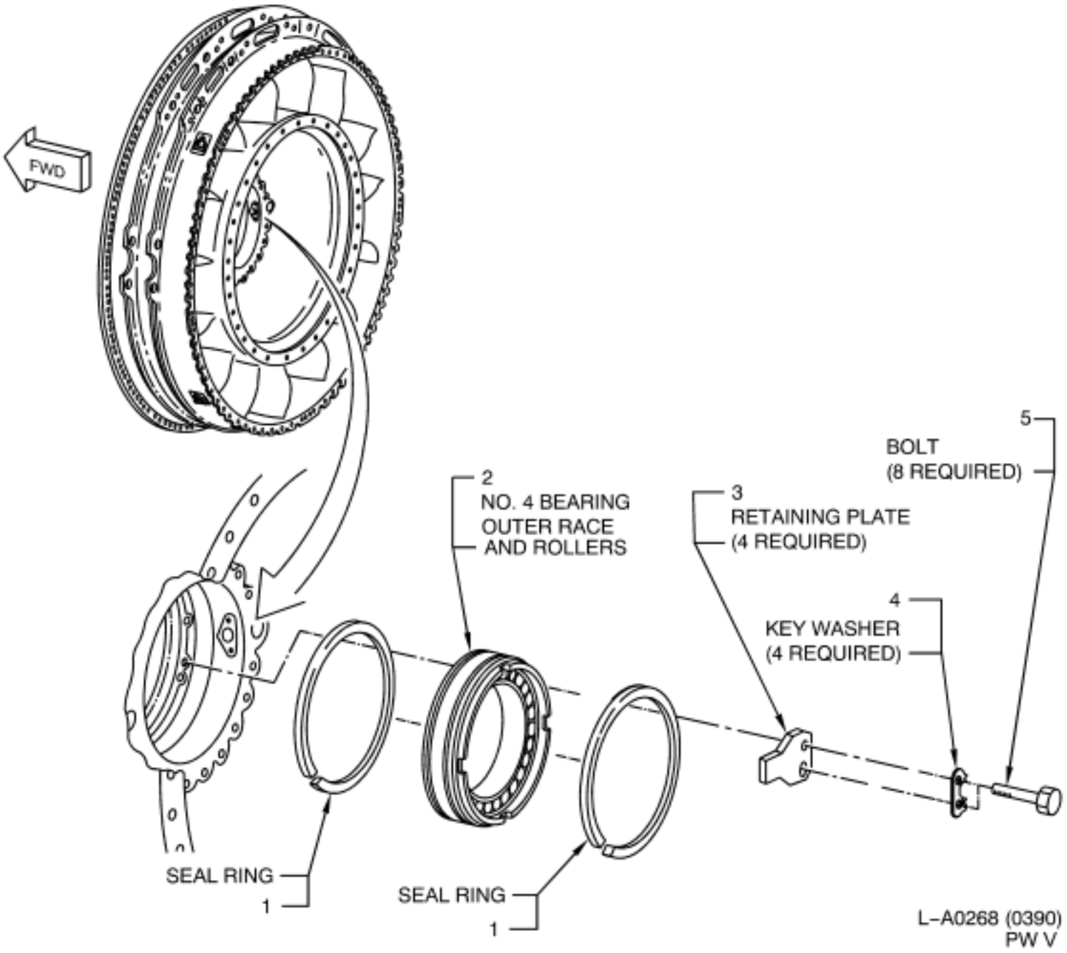
CONFIGURATION PRE SB PW4ENG 72-456


5
NO.4 BEARING
(REAR OUTER)
HEATSHIELD
6
RETAINING
STRAP
7
NO.4 BEARING
(FRONT) HEATSHIELD
(2 NEEDED)

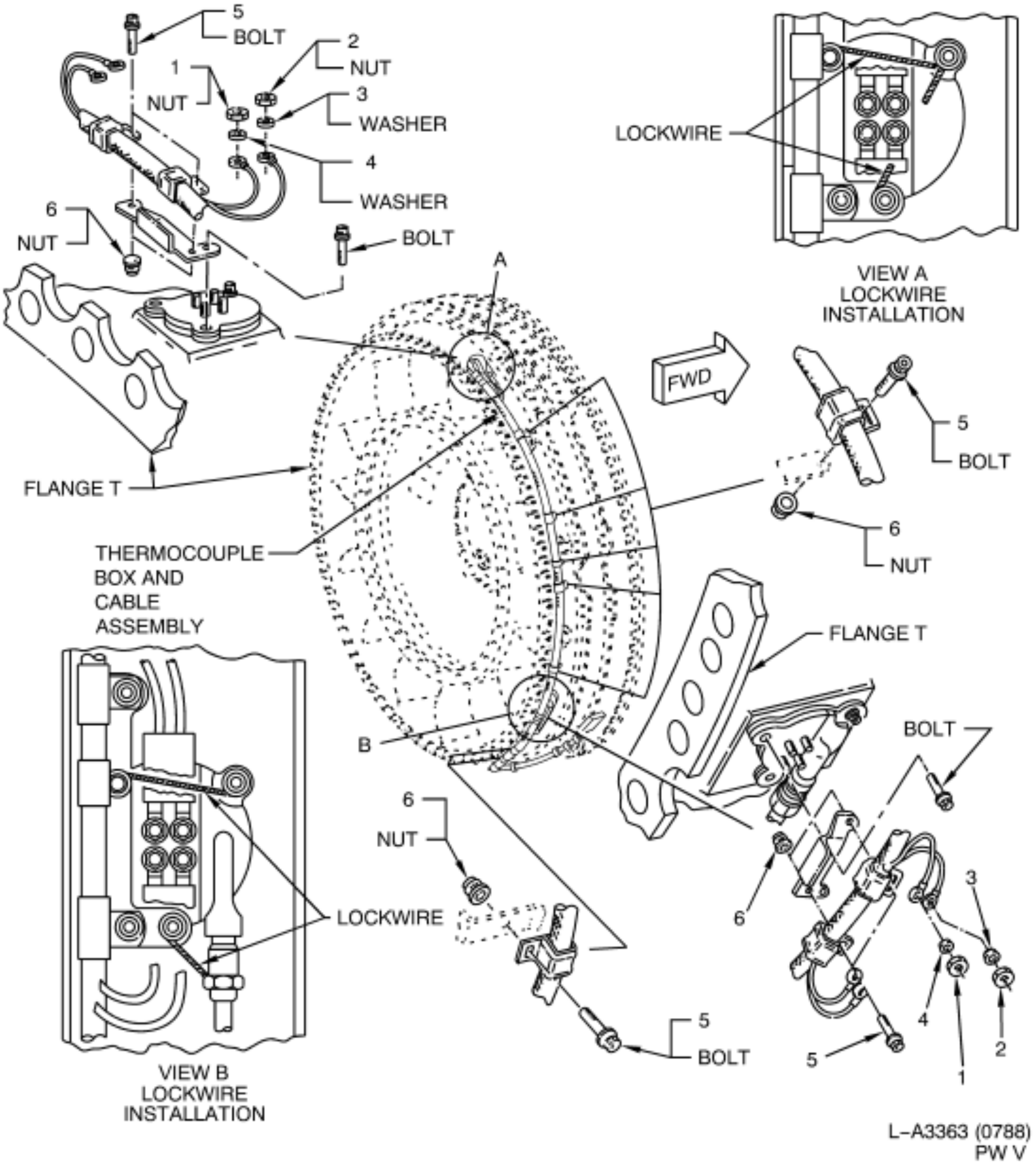
LIGHTWEIGHT CASE
CONFIGURATION POST SB PW4ENG 72-456

L-A8688 (0000)
PW V

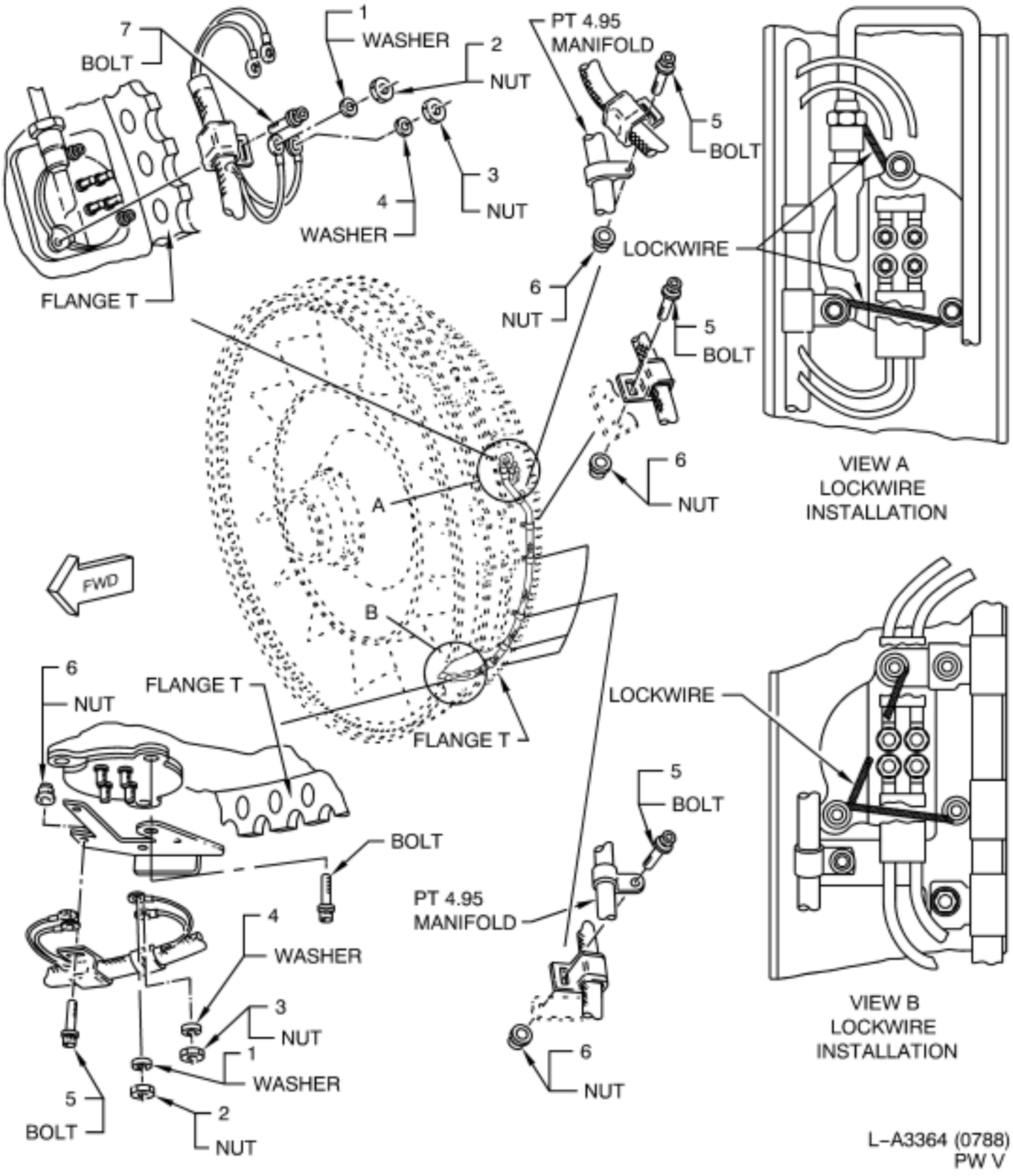
No. 4 Bearing Housing Rear Heat Shields Removal
Figure 507
(Task 72-54-00-030-001)


FWD
5
BOLT
(8 REQUIRED)
2
NO. 4 BEARING
OUTER RACE
AND ROLLERS
3
RETAINING PLATE
(4 REQUIRED)
4
KEY WASHER
(4 REQUIRED)
SEAL RING
1
SEAL RING
1
L-A0268 (0390)
PW V

No. 4 Bearing Outer Race Removal
Figure 508
(Task 72-54-00-030-001)

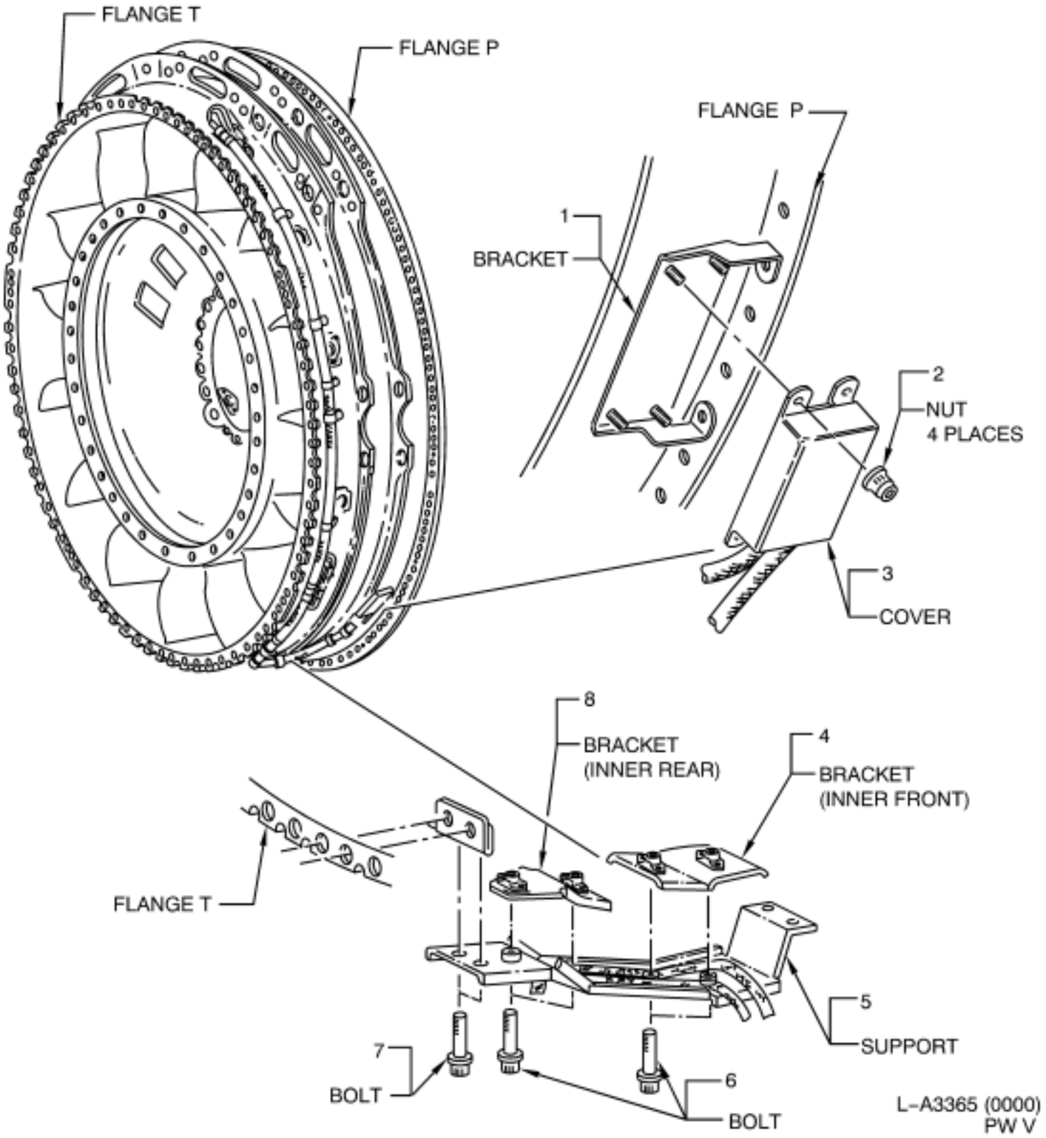

5
BOLT
2
NUT
1
NUT
3
WASHER
4
WASHER
6
NUT
BOLT
A
LOCKWIRE
VIEW A
LOCKWIRE
INSTALLATION
FWD
5
BOLT
6
NUT
FLANGE T
THERMOCOUPLE
BOX AND
CABLE
ASSEMBLY
FLANGE T
BOLT
B
6
NUT
LOCKWIRE
3
6
4
2
1
5
5
BOLT
VIEW B
LOCKWIRE
INSTALLATION
L-A3363 (0788)
PW V

Thermocouple Box And Cable Assembly Removal
(EGT TT4.95) (Pre SB PW4ENG 72-134)
Figure 509 (Sheet 1)
(Task 72-54-00-030-001)

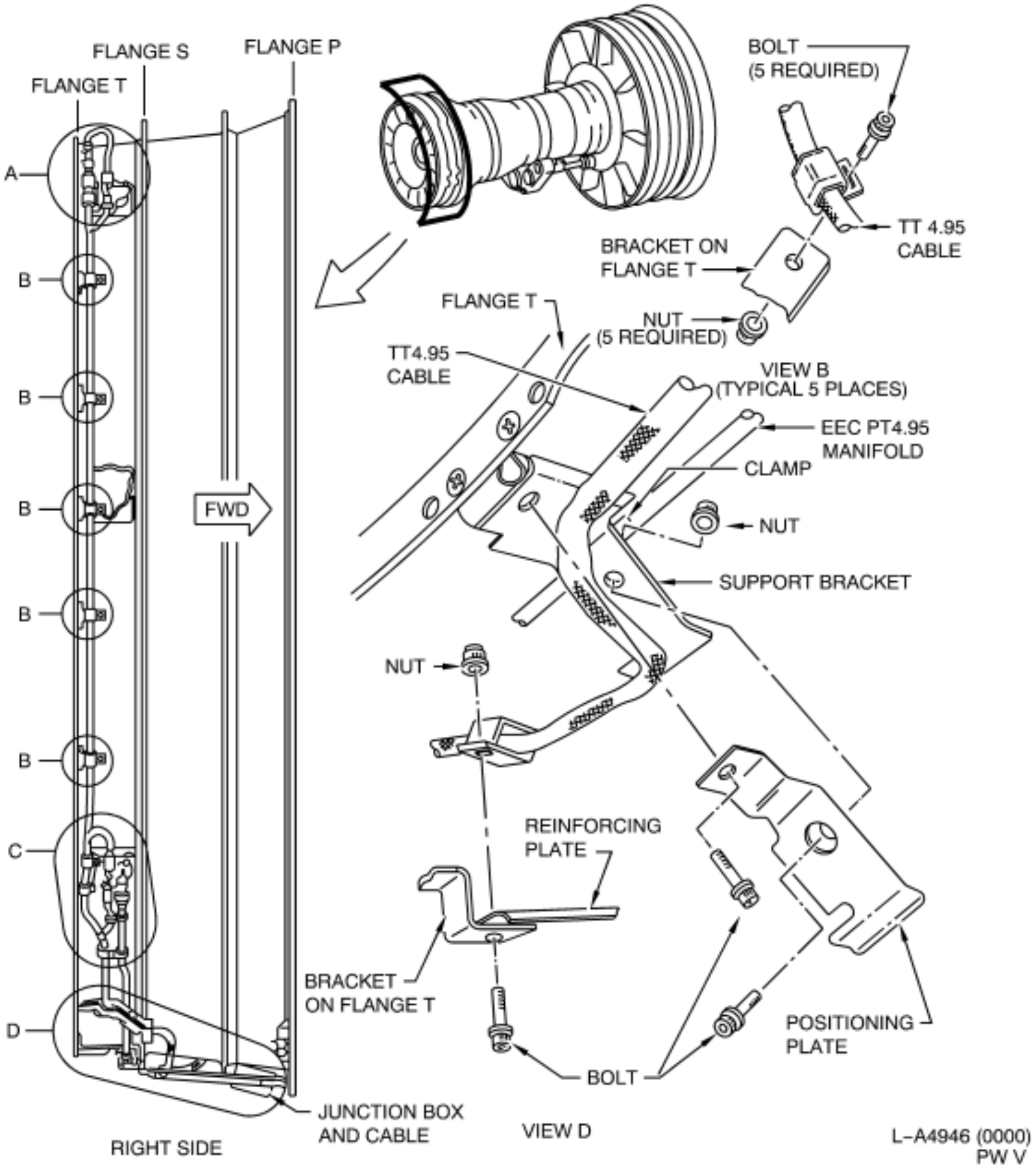

7
BOLT
1
WASHER
2
NUT
PT 4.95
MANIFOLD
5
BOLT
3
NUT
4
WASHER
FLANGE T
LOCKWIRE
6
NUT
5
BOLT
6
NUT
A
VIEW A
LOCKWIRE
INSTALLATION
FWD
B
6
NUT
FLANGE T
FLANGE T
LOCKWIRE
5
BOLT
BOLT
PT 4.95
MANIFOLD
4
WASHER
3
NUT
1
WASHER
6
NUT
5
BOLT
2
NUT
VIEW B
LOCKWIRE
INSTALLATION
L-A3364 (0788)
PW V

Thermocouple Box And Cable Assembly Removal
(EGT TT4.95) (Pre SB PW4ENG 72-134)
Figure 509 (Sheet 2)
(Task 72-54-00-030-001)

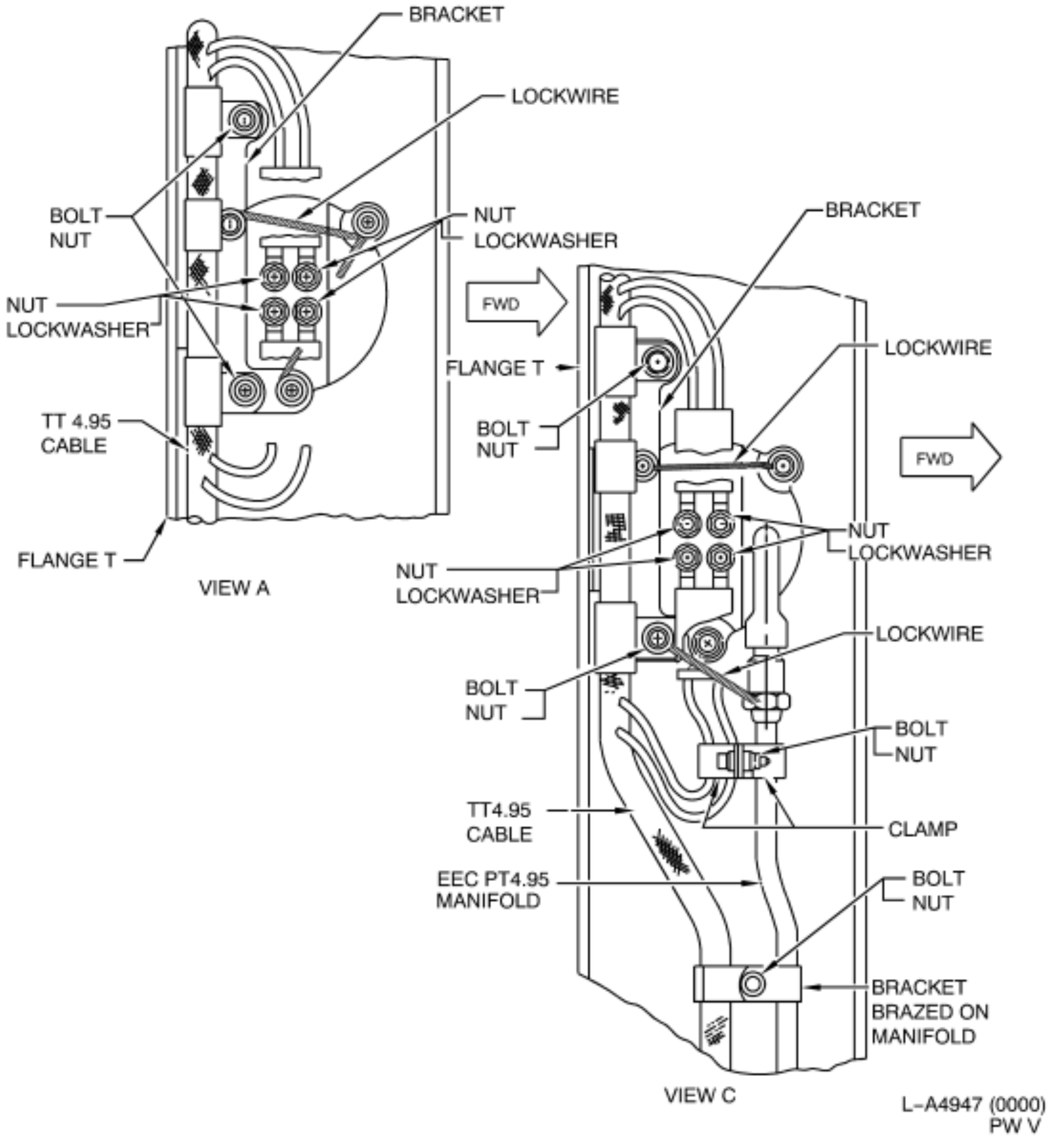
TURBINE EXHAUST CASE - DISASSEMBLY-01


FLANGE T
FLANGE P
FLANGE P
1
BRACKET
2
NUT
4 PLACES
3
COVER
8
BRACKET
(INNER REAR)
4
BRACKET
(INNER FRONT)
FLANGE T
5
SUPPORT
7
BOLT
6
BOLT
L-A3365 (0000)
PW V

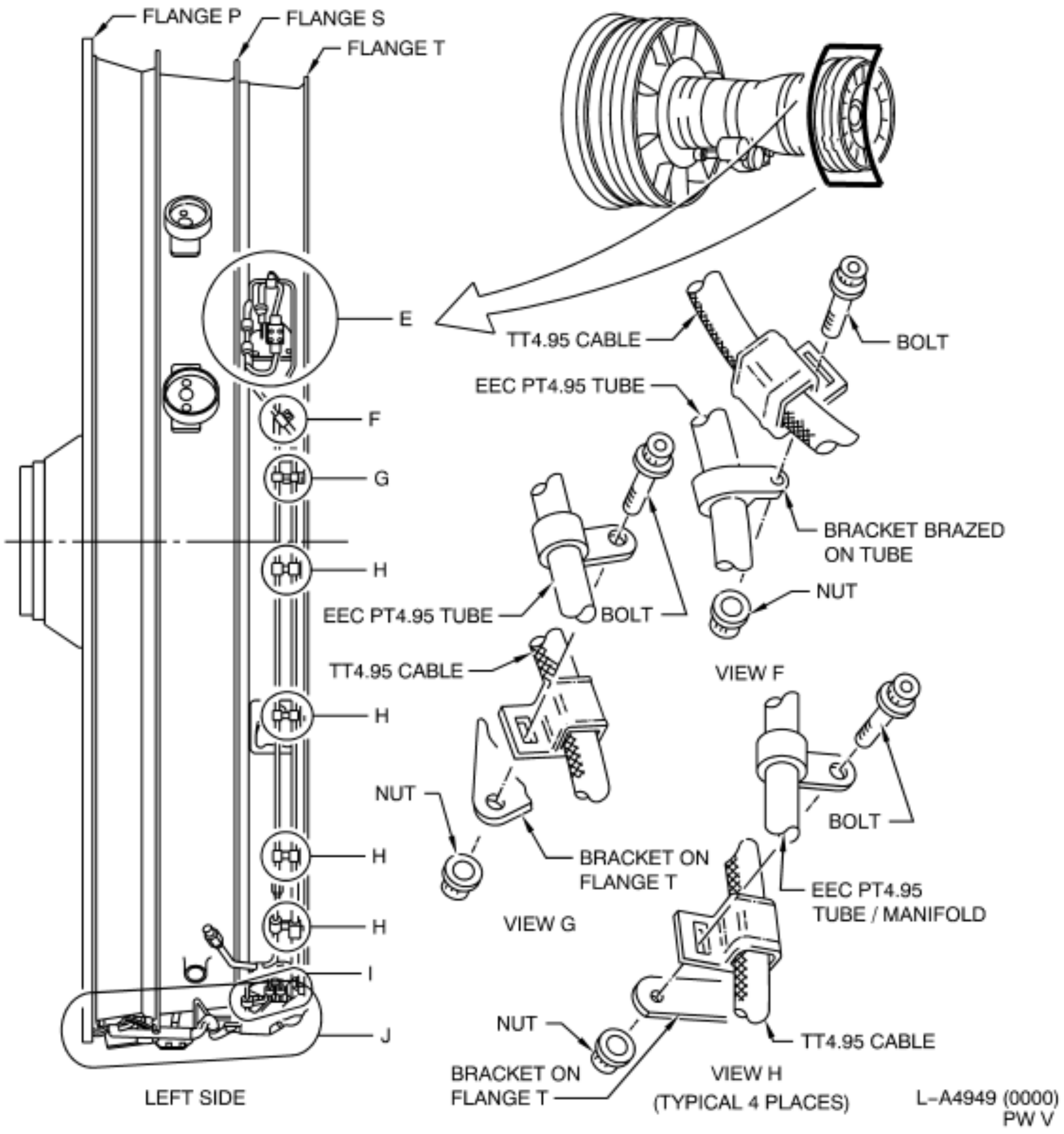
Thermocouple Box And Cable Assembly Removal
(EGT TT4.95) (Pre SB PW4ENG 72-134)
Figure 510
(Task 72-54-00-030-001)


FLANGE S
FLANGE P
FLANGE T
A
B
B
B
B
B
C
D
FWD
RIGHT SIDE
JUNCTION BOX AND CABLE
BOLT (5 REQUIRED)
TT 4.95 CABLE
BRACKET ON FLANGE T
FLANGE T
NUT (5 REQUIRED)
TT4.95 CABLE
VIEW B (TYPICAL 5 PLACES)
EEC PT4.95 MANIFOLD
CLAMP
NUT
SUPPORT BRACKET
NUT
REINFORCING PLATE
BRACKET ON FLANGE T
BOLT
POSITIONING PLATE
VIEW D
L-A4946 (0000)
PW V

Thermocouple Box And Cable Assembly Removal
(EGT TT4.95) (Post SB PW4ENG 72-134)
Figure 511 (Sheet 1)
(Task 72-54-00-030-001)

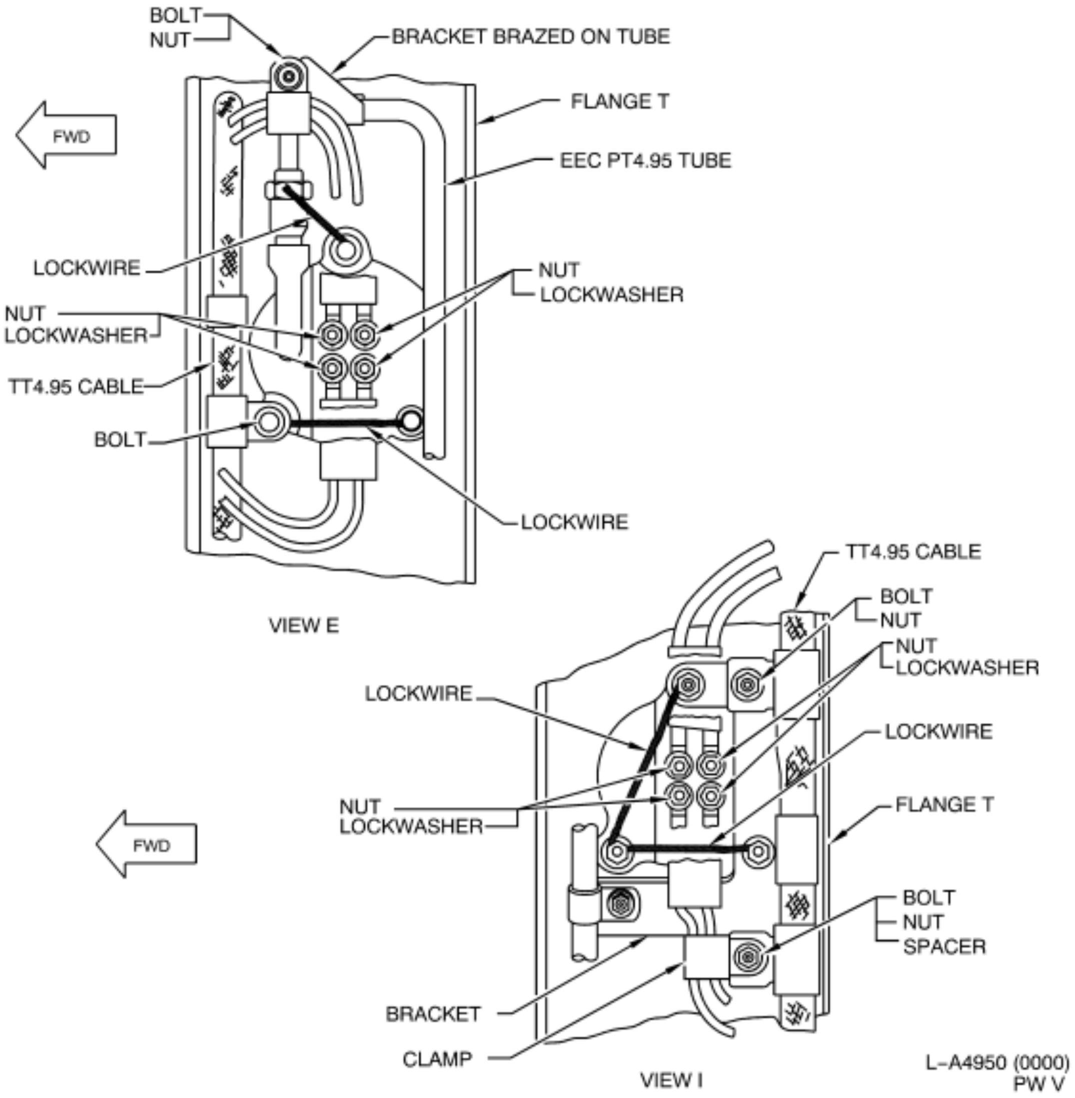

BRACKET
LOCKWIRE
BOLT
NUT
NUT
LOCKWASHER
NUT
LOCKWASHER
TT 4.95
CABLE
FLANGE T
VIEW A
FWD
FLANGE T
BRACKET
LOCKWIRE
BOLT
NUT
FWD
NUT
LOCKWASHER
NUT
LOCKWASHER
LOCKWIRE
BOLT
NUT
BOLT
NUT
CLAMP
TT4.95
CABLE
EEC PT4.95
MANIFOLD
BOLT
NUT
BRACKET
BRAZED ON
MANIFOLD
VIEW C
L-A4947 (0000)
PW V

Thermocouple Box And Cable Assembly Removal
(EGT TT4.95) (Post SB PW4ENG 72-134)
Figure 511 (Sheet 2)
(Task 72-54-00-030-001)

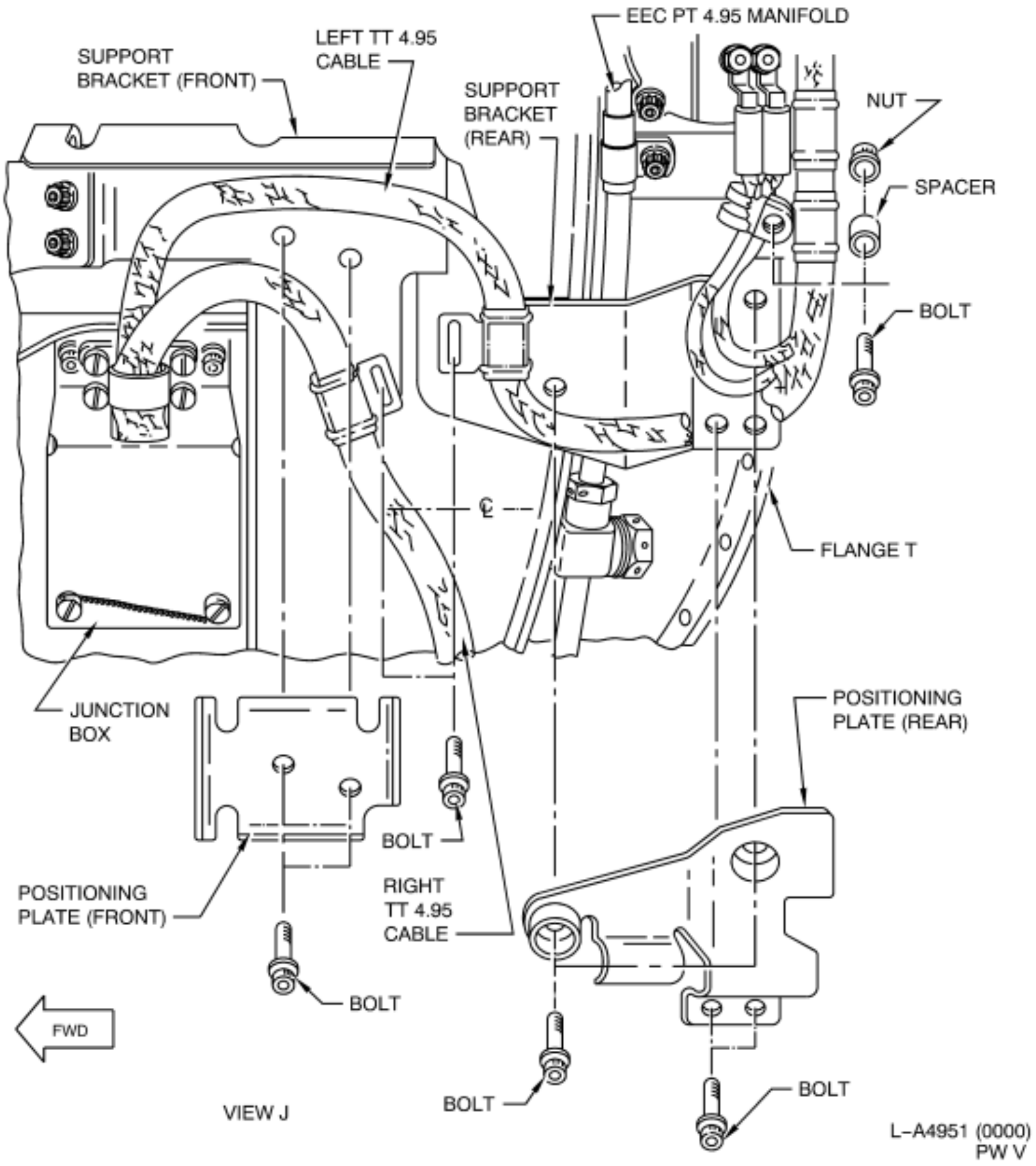

FLANGE P
FLANGE S
FLANGE T
E
F
G
H
H
H
H
I
J
LEFT SIDE
TT4.95 CABLE
BOLT
EEC PT4.95 TUBE
BRACKET BRAZED ON TUBE
NUT
EEC PT4.95 TUBE
BOLT
VIEW F
TT4.95 CABLE
NUT
BRACKET ON FLANGE T
VIEW G
BOLT
EEC PT4.95 TUBE / MANIFOLD
NUT
TT4.95 CABLE
BRACKET ON FLANGE T
VIEW H (TYPICAL 4 PLACES)
L-A4949 (0000)
PW V

Thermocouple Box And Cable Assembly Removal
(EGT TT4.95) (Post SB PW4ENG 72-134)
Figure 511 (Sheet 3)
(Task 72-54-00-030-001)

R
R

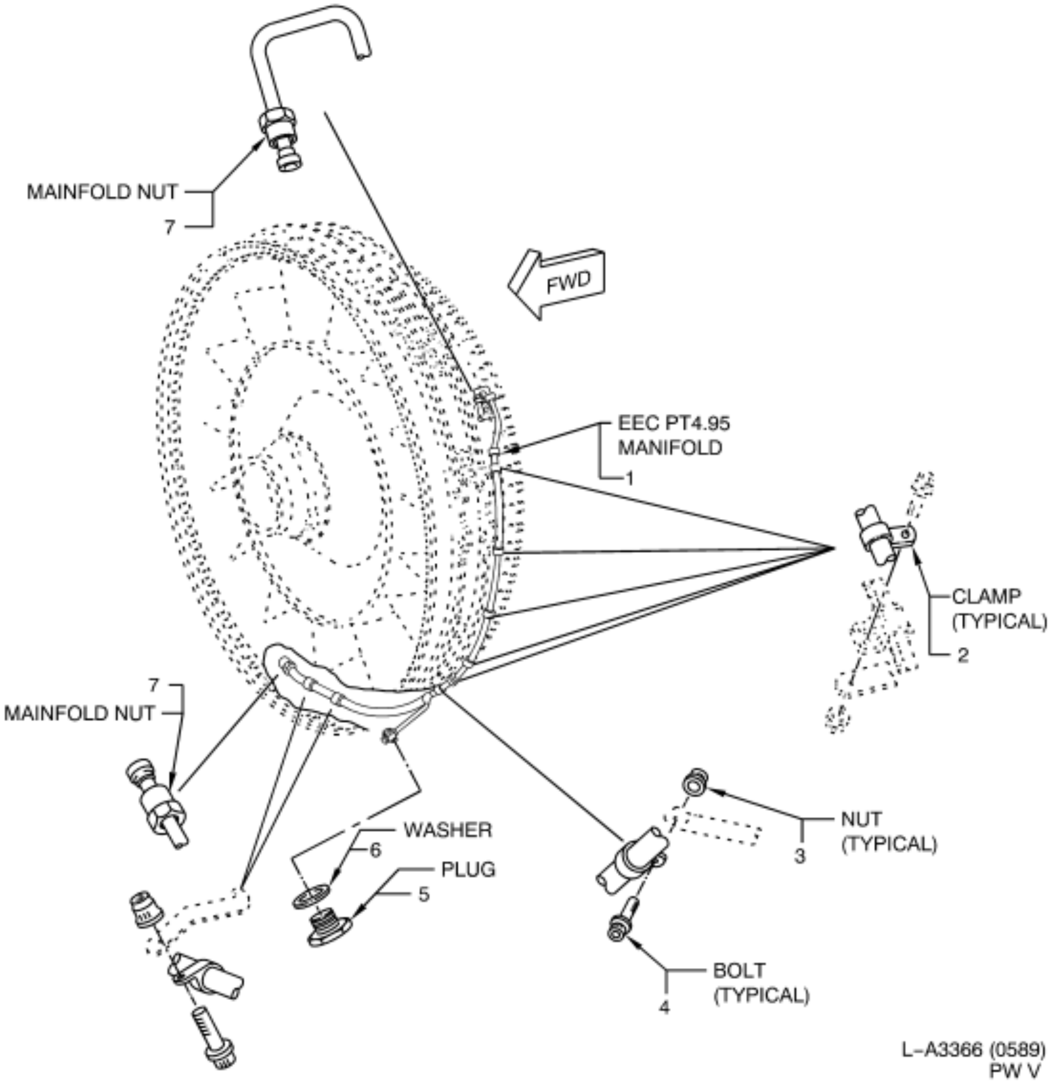

BOLT
NUT
BRACKET BRAZED ON TUBE
FWD
FLANGE T
EEC PT4.95 TUBE
LOCKWIRE
NUT
LOCKWASHER
NUT
LOCKWASHER
TT4.95 CABLE
BOLT
LOCKWIRE
VIEW E
TT4.95 CABLE
BOLT
NUT
NUT
LOCKWASHER
LOCKWIRE
LOCKWIRE
FLANGE T
NUT
LOCKWASHER
FWD
BOLT
NUT
SPACER
BRACKET
CLAMP
VIEW I
L-A4950 (0000)
PW V

Thermocouple Box And Cable Assembly Removal
(EGT TT4.95) (Post SB PW4ENG 72-134)
Figure 511 (Sheet 4)
(Task 72-54-00-030-001)

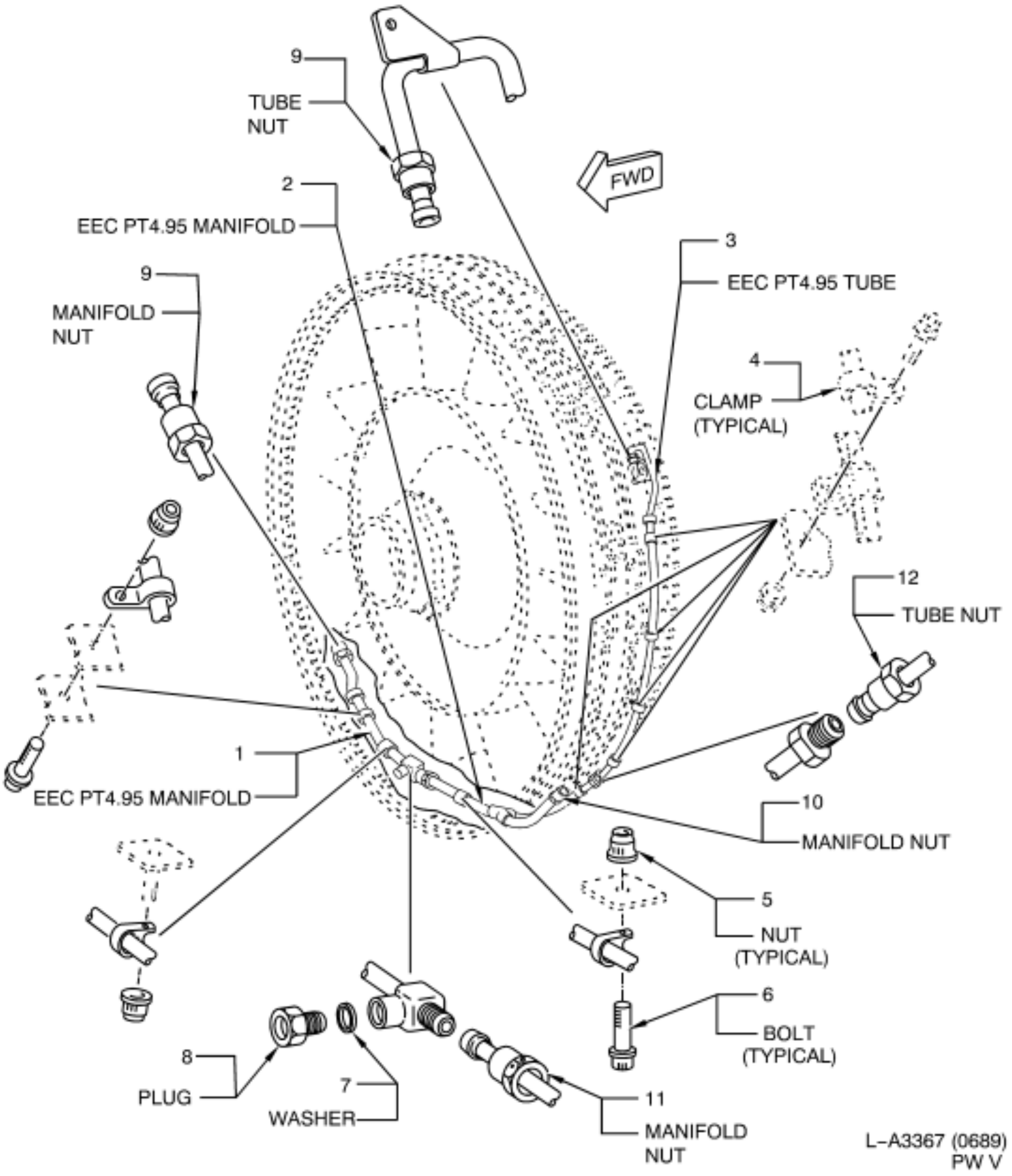

EEC PT 4.95 MANIFOLD
LEFT TT 4.95 CABLE
SUPPORT BRACKET (FRONT)
SUPPORT BRACKET (REAR)
NUT
SPACER
BOLT
FLANGE T
JUNCTION BOX
POSITIONING PLATE (REAR)
BOLT
POSITIONING PLATE (FRONT)
RIGHT TT 4.95 CABLE
BOLT
FWD
VIEW J
BOLT
BOLT
L-A4951 (0000)
PW V

Thermocouple Box And Cable Assembly Removal
(EGT TT4.95) (Post SB PW4ENG 72-134)
Figure 511 (Sheet 5)
(Task 72-54-00-030-001)

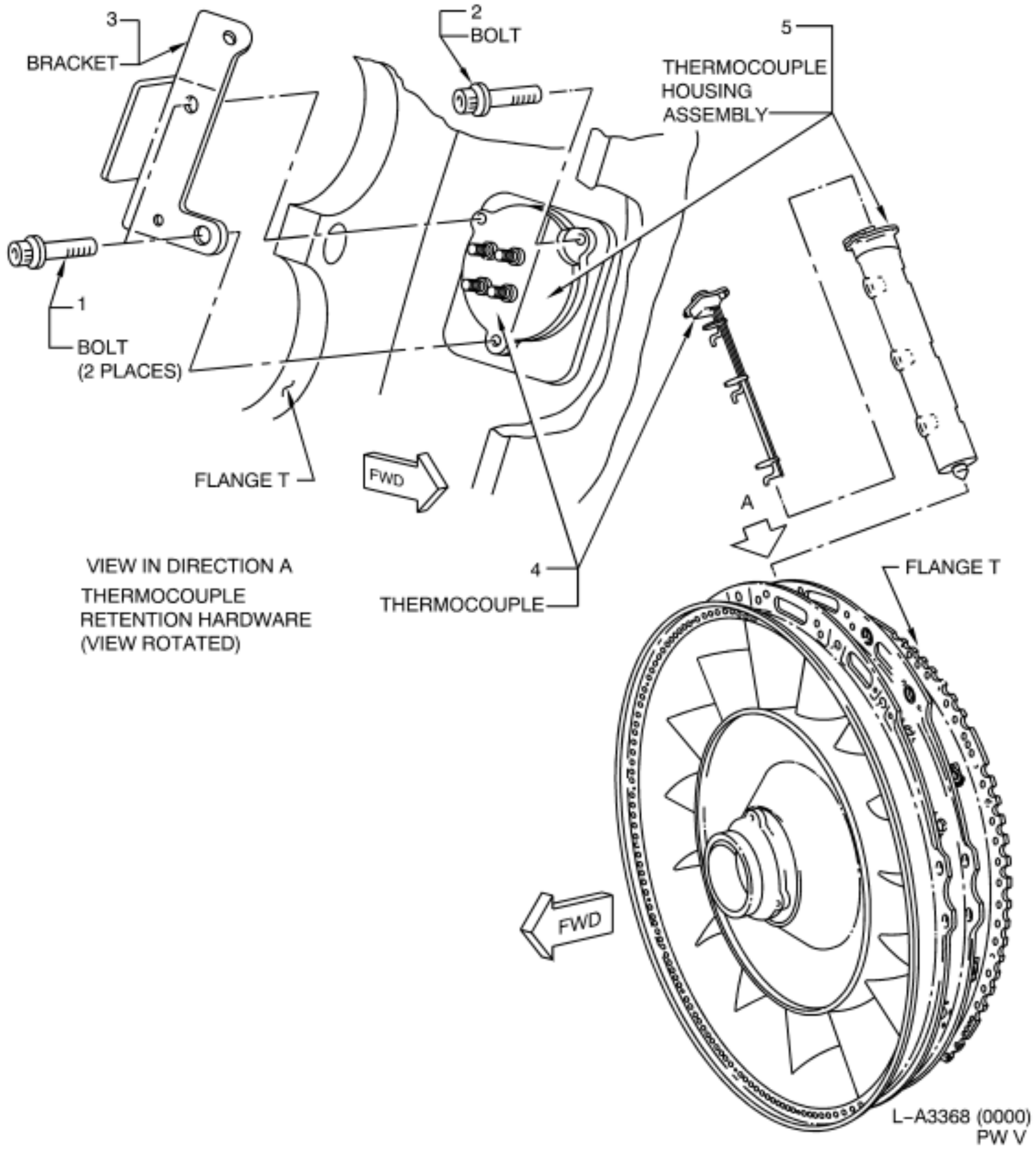
R
R


MAINFOLD NUT
7
FWD
EEC PT4.95
MANIFOLD
1
CLAMP
(TYPICAL)
2
7
MAINFOLD NUT
WASHER
6
PLUG
5
NUT
(TYPICAL)
3
BOLT
(TYPICAL)
4
L-A3366 (0589)
PW V

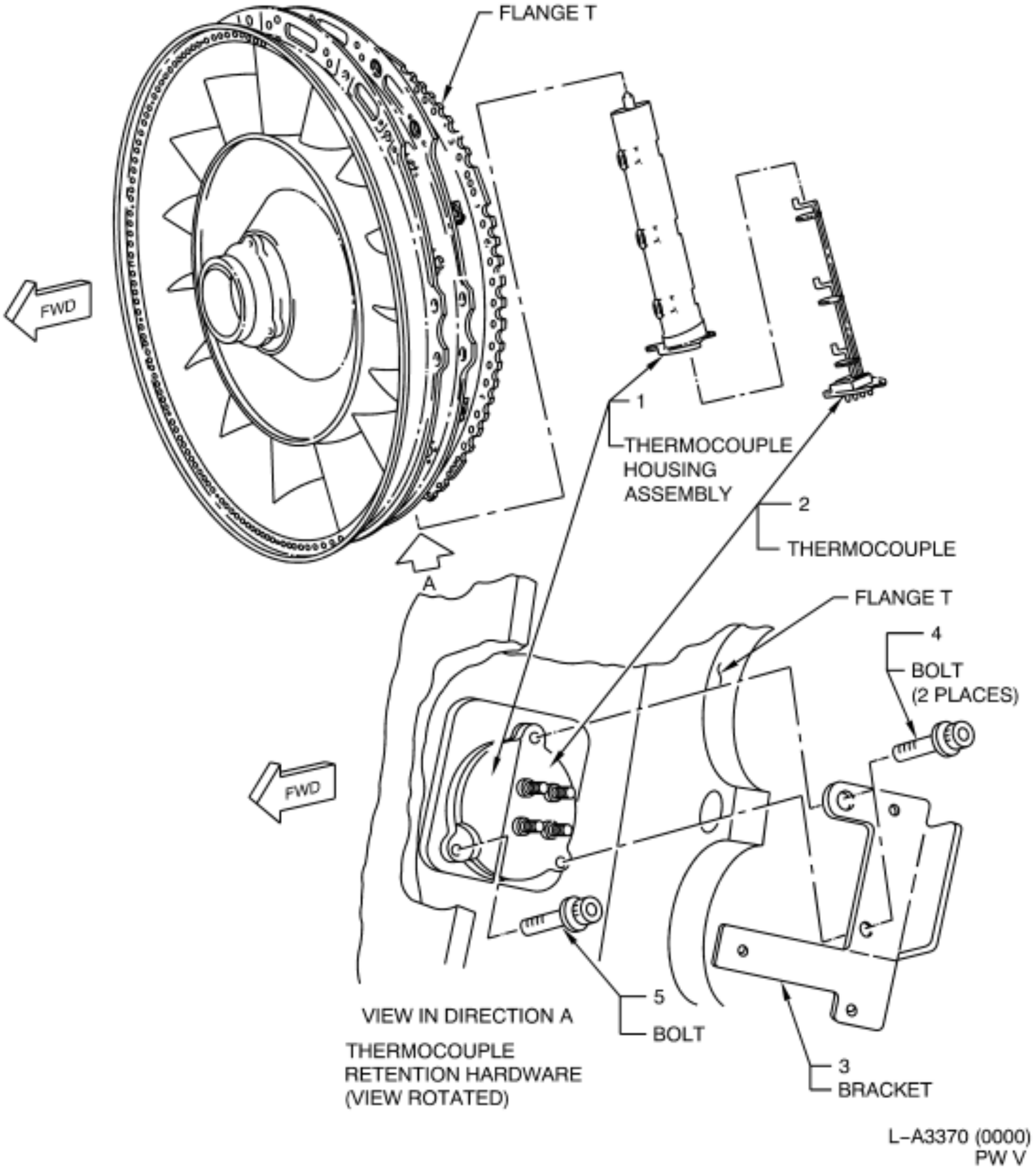
EEC PT4.95 Manifold Assembly Removal (Pre SB PW4ENG 72-134)
Figure 512
(Task 72-54-00-030-001)


9
TUBE NUT
2
EEC PT4.95 MANIFOLD
FWD
9
MANIFOLD NUT
3
EEC PT4.95 TUBE
4
CLAMP (TYPICAL)
12
TUBE NUT
1
EEC PT4.95 MANIFOLD
10
MANIFOLD NUT
5
NUT (TYPICAL)
6
BOLT (TYPICAL)
8
PLUG
7
WASHER
11
MANIFOLD NUT
L-A3367 (0689)
PW V

EEC PT4.95 Manifolds And Tube Assembly
Removal (Post SB PW4ENG 72-134)
Figure 513
(Task 72-54-00-030-001)

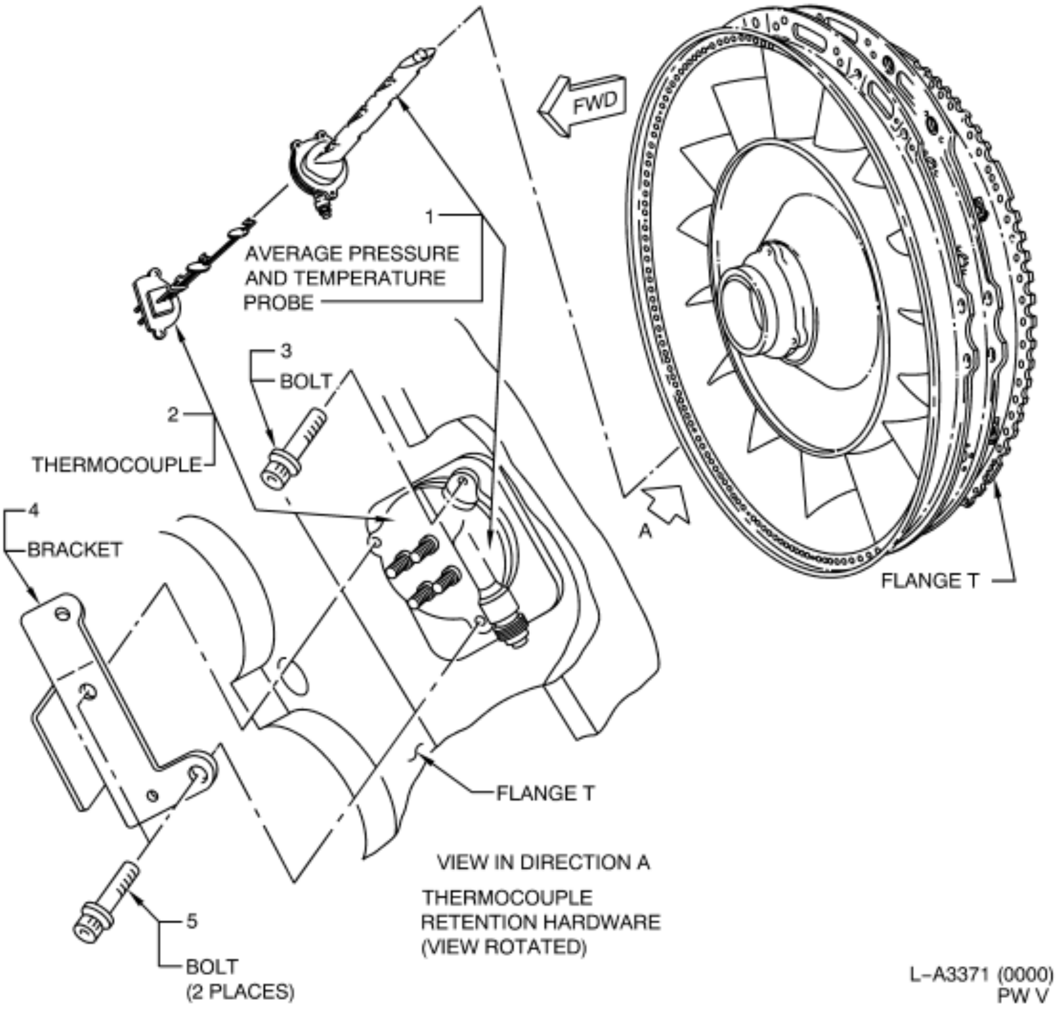

3
BRACKET
2
BOLT
5
THERMOCOUPLE
HOUSING
ASSEMBLY
1
BOLT
(2 PLACES)
FLANGE T
FWD
A
VIEW IN DIRECTION A
THERMOCOUPLE
RETENTION HARDWARE
(VIEW ROTATED)
4
THERMOCOUPLE
FLANGE T
FWD
L-A3368 (0000)
PW V

Thermocouple And Thermocouple Housing Assemblies Removal
Figure 514
(Task 72-54-00-030-001)


FLANGE T
FWD
1
THERMOCOUPLE HOUSING ASSEMBLY
2
THERMOCOUPLE
A
FLANGE T
4
BOLT (2 PLACES)
FWD
5
BOLT
3
BRACKET
VIEW IN DIRECTION A
THERMOCOUPLE RETENTION HARDWARE (VIEW ROTATED)
L−A3370 (0000)
PW V

Thermocouple And Thermocouple Housing Assemblies Removal
Figure 515
(Task 72−54−00−030−001)

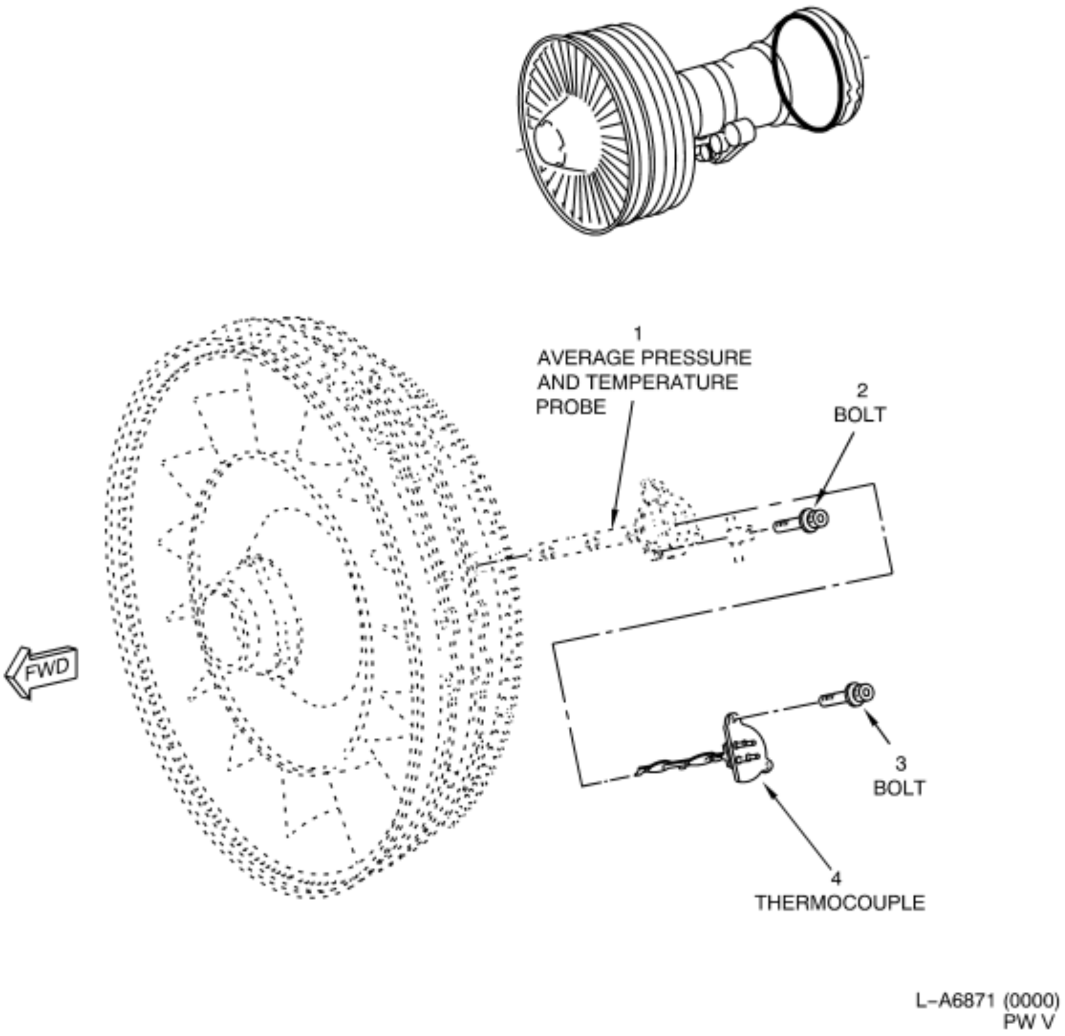
TURBINE EXHAUST CASE - DISASSEMBLY-01


FWD
1
AVERAGE PRESSURE AND TEMPERATURE PROBE
3
BOLT
2
THERMOCOUPLE
4
BRACKET
A
FLANGE T
FLANGE T
VIEW IN DIRECTION A
THERMOCOUPLE RETENTION HARDWARE (VIEW ROTATED)
5
BOLT (2 PLACES)
L-A3371 (0000)
PW V

Thermocouple And Average Pressure And
Temperature Probe Assemblies Removal
Figure 516
(Task 72-54-00-030-001)

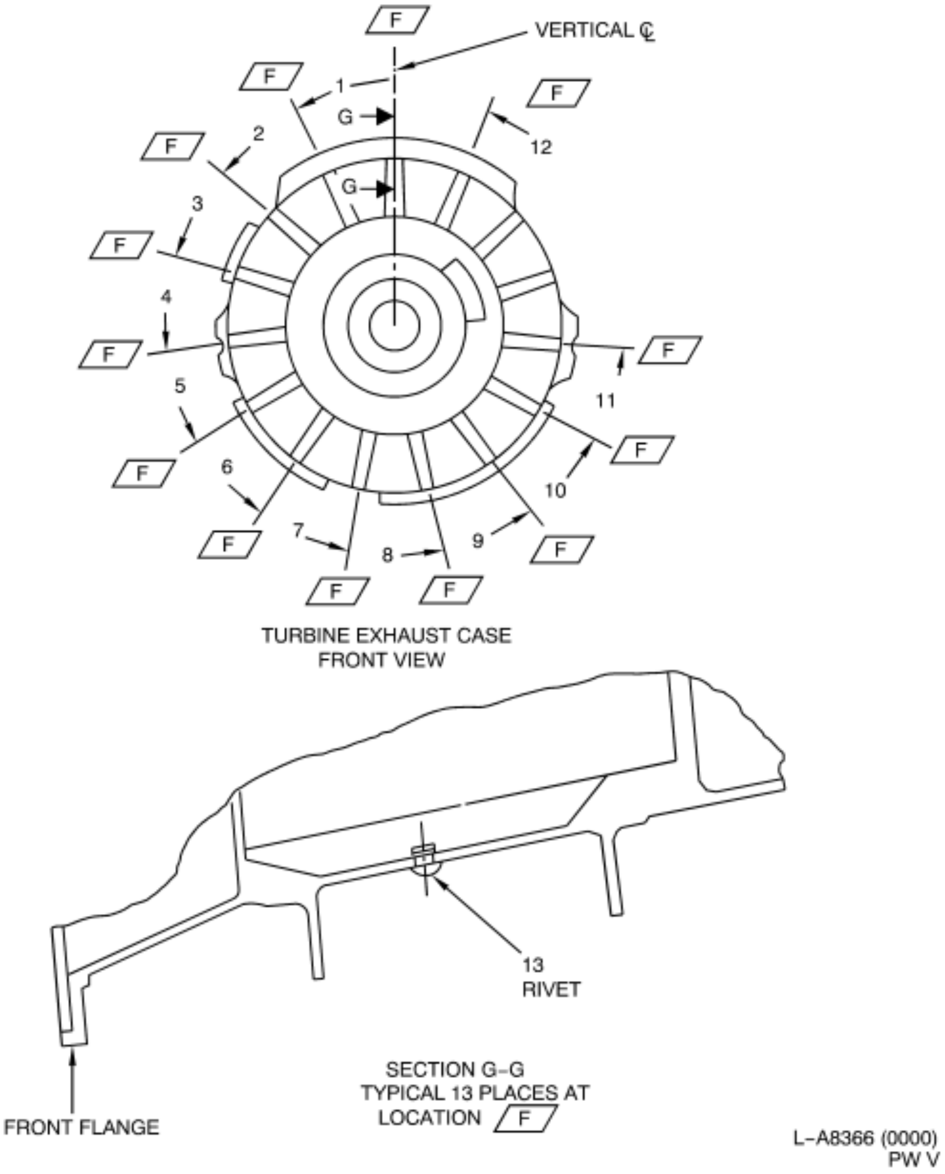
R
R

TURBINE EXHAUST CASE - DISASSEMBLY-01


1
AVERAGE PRESSURE
AND TEMPERATURE
PROBE
2
BOLT
3
BOLT
4
THERMOCOUPLE
FWD
L-A6871 (0000)
PW V

Thermocouple And Average Pressure And
Temperature Probe Assemblies Removal
Figure 517
(Task 72-54-00-030-001)

R
R


VERTICAL ℄
F
G
1
2
3
4
5
6
7
8
9
10
11
12
TURBINE EXHAUST CASE
FRONT VIEW
13
RIVET
FRONT FLANGE
SECTION G-G
TYPICAL 13 PLACES AT
LOCATION F
L-A8366 (0000)
PW V

Rivet/Plug Locations
Figure 518
(Task 72-54-00-030-001)

TURBINE EXHAUST CASE − DISASSEMBLY−01

1. 24°
2. 48°
3. 72°
4. 96°
5. 120°
6. 144°
7. 168°
8. 192°
9. 216°
10. 240°
11. 264°
12. 336°

Key to Figure 518

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TURBINE EXHAUST CASE − INSPECTION/CHECK−01

Task 72−54−00−990−004:

1. General Inspection Requirements − Turbine Exhaust Case

A. Organization Of Individual Part Or Subassembly Inspection Data

(1) Specific inspection functions for all significant parts/subassemblies are provided in individual Inspection/Check sections. Application of each inspection function is shown in Inspection/Check−00 for part/subassembly. Section designations and function descriptions are as follows.

(2) Inspection/Check−00 section contains, where applicable:

(a) Part number(s) for which the inspection data is applicable.

(b) Service Bulletin numbers applicable to part number(s).

(c) Inspection/Check numbers, data categories and applicability data.

(3) Inspection/Check−01, Preinspection Preparation, contains, where applicable:

(a) General inspection comments, notes, CAUTIONS, etc., which supplement data contained in this section.

(b) Identification of mechanical disassembly required prior to inspection.

(c) Identification of any surface treatment or coating removal, or other actions required prior to inspection.

(d) Identification of part/subassembly cleaning required prior to inspection.

(4) Inspection/Check−02, Nondestructive Inspection, contains the following nondestructive inspection methods, part/subassembly special attention areas and damage limits (as applicable):

(a) Fluorescent Penetrant Method

(b) Eddy Current Method

(c) Magnetic Particle Method

(d) X−ray Method

(e) Ultrasonic Method

(f) Hardness Check

(g) Other − As specified.

(5) Inspection/Check−03, Visual Inspection contains, where applicable:

(a) Visual inspection requirements which can be accomplished with or without magnification or special lighting (as specified).

NOTE: Use of inspection tools may be required as a supplement to visual inspection process.

(b) Allowable blending for visual damage, which may be accomplished within the inspection area.

NOTE: Blending requirement will also be shown in applicable repairs.

(6) Inspection/Check−04, Dimensional Inspection, contains, where applicable:

(a) Dimensional inspection requirements other than visual inspection. The requirements will include applicable fits and clearances, and other dimensional inspections necessary to ensure the part integrity and proper functioning.

(7) Inspection/Check−05, Functional Check Inspection contains, where applicable:

(a) Procedures, limits, and equipment used with any required functional checks (oil flow, air flow, leak, etc.).

(8) Inspection/Check−06, Inspection Postrequisites contains, references to procedures required to return part/subassembly to serviceable condition. References include the following, as required.

(a) Reassembly

(b) Protective coatings, sealants and/or lubricant reapplication

B. Thorough and intelligent part/subassembly inspection is of major importance in achieving efficient engine operation and satisfactory service life. Inspection personnel should be thoroughly familiar with inspection procedures, inspection tooling, limits associated with normal and, where applicable, unusual operating conditions, limits associated with repairs, and with inspection procedures published in Standard Practices Manual.

C. During preliminary inspection of part/subassembly, comparison with mating or adjacent parts may provide indication of source of wear or damage. This procedure may indicate requirement for additional disassembly and inspection.

D. During inspection, records should be kept of deviations beyond serviceable limits to determine: (a) if part/subassembly will be repaired or replaced, and (b) if part is reparable, which repairs are required. Suitable documentation should accompany part/subassembly with results of this determination.

E. Inspection of individual part/subassembly dimensions which are also in Fits and Clearances will include Fits and Clearance Reference Numbers and will show new part/subassembly dimension unless specifically stated otherwise. Inspection Frequency Requirements (IFR) codes (for IFR Code A parts only) are included with Reference Number data. If acceptable dimensional deviations or results of repair affect Fits and Clearances, suitable documentation should accompany part/subassembly to ensure check of fit or clearance at final assembly.

NOTE: Parts/subassemblies which deviate dimensionally from new part/subassembly values may be acceptable provided required fit or clearance is achieved at final assembly.

TURBINE EXHAUST CASE − INSPECTION/CHECK−01

F. Dimensional inspection requirements will be accompanied by part/subassembly constraint data if such constraint requirements are required during part/subassembly manufacture. Adherence to constraint requirements when inspecting service operated parts/subassemblies should be dictated by experience. It is recommended that parts/subassemblies which do not meet dimensional inspection requirements in free state be constrained and re−measured prior to initiation of any repair or re−use activity.

G. Dimensional inspections of one detail of a subassembly, prior to removal from subassembly, may produce incorrect data due to constraint forces from mating details. If questionable data is obtained, subassembly should be disassembled and inspections repeated.

H. Dimensional inspection limits in inspection text provide continued use (as is) and, if applicable, repair limits. Parts/subassemblies which exceed both limits and nonreparable parts/subassemblies which exceed (as is) limits are unserviceable.

I. Inspections required to verify integrity of repair are contained within repair procedure. Unless otherwise stated, repaired part is expected to meet all inspection requirements contained in inspection text for part/subassembly.

J. Parts/subassemblies which do not require repairs except for those provided in Standard Practices Manual are identified by Chapter/Section/Subject Number 72−54−99 in cleaning table (Cleaning−01) and nondestructive inspection table (Inspection/Check−02). Determination of serviceability for those parts listed in 72−54−99 is limited to cleaning, nondestructive inspection, and the following:

(1) Visually inspect parts/subassemblies for surface defects, deformations, cuts, improper threads or wrenching surfaces, incomplete or missing protective coatings or other damage which will prevent proper functioning and make part/subassembly unserviceable. Unserviceable parts/subassemblies should not be reinstalled. Repair unserviceable parts/subassemblies per Standard Practices Manual, as applicable.

(2) Parts/subassemblies with crack indications to any length or depth detected by listed nondestructive inspection are unserviceable, and should not be reinstalled.

TURBINE EXHAUST CASE − INSPECTION/CHECK−01

K. When new part/subassembly is to be installed and it is important that it be identified as to engine number or position in engine, mark it by appropriate method described in Marking of Parts, 70−11, Standard Practices Manual.

L. In order to eliminate confusion and to maintain consistent terminology, various physical conditions which might be encountered during inspection of parts/subassemblies and explanation of unusual causes of such conditions are defined in Physical Inspection, 70−31, Standard Practices Manual.

M. If inspection reveals it necessary to replace fitted spacer, tag spacer to indicate that replacement must be made with spacer of correct classification at assembly.

N. If text refers to superficial or shallow imperfection, following definitions apply:

   (1) A superficial imperfection is defined as a nick, dent, scratch, toolmark, etc., which disrupts the surface but does not appear to penetrate surface roughness texture.

   (2) A shallow imperfection appears to penetrate surface finish texture, but does not have a dark bottom and would not cause a 0.007 inch (.178 mm) radius stylus to hesitate if passed over it.

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TURBINE EXHAUST CASE − INSPECTION/CHECK−03

Task 72−54−00−990−005:

1. Visual Inspection − Turbine Exhaust Case
   A. For inspection requirements applicable to installed (accessible) parts of turbine exhaust case see:
      −72−00−54, Inspection/Check−03 (Task 72−00−54−210−001) for EGT (TT4.95) Thermocouple Housing
      −72−00−54, Inspection/Check−04 (Task 72−00−54−210−002) for Exhaust Gas Average Pressure (And Thermocouple Housing) PT4.95 Probe
      −72−00−54, Inspection/Check−05 (Task 72−00−54−210−003) for EGT (TT4.95) Thermocouple
      −72−00−54, Inspection/Check−06 (Task 72−00−54−210−004) for EGT (TT4.95) Box And Cable.

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TURBINE EXHAUST CASE - INSPECTION/CHECK-04

Task 72-54-00-990-001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (−) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (−) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
40	B	End Clearance, No. 4 Roller Bearing (72−54−14) Turbine Exhaust Case Assembly (72−54−01) (See Figure 801)				
		Bearing	1.765 (44.83)	1.785 (45.34)		
		Case	1.791 (45.49)	1.811 (46.00)	.006 (0.15)	.046 (1.17)
41	B	No. 4 Roller Bearing (72−54−14) Turbine Exhaust Case Assembly (72−54−01) (See Figure 801)				
		Bearing	9.136 (232.055)	9.137 (232.079)		
		Case	9.146 (232.309)	9.147 (232.333)	.009 (0.229)	.011 (0.279)

TURBINE EXHAUST CASE − INSPECTION/CHECK−04

	Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
	42	B	Side Clearance,				
			No. 4 Roller Bearing (Outer Race)				
R			Seal Ring				
			No. 4 Roller Bearing (72−54−14)				
			(See Figure 802)				
			Seal Ring	.140 (3.556)	.142 (3.606)		
			Bearing	.149 (3.785)	.151 (3.835)	.007 (0.178)	.011 (0.279)
	43	B	Gap,				
			No. 4 Roller Bearing (Outer Race) Seal				
R			Ring				
			(See Figure 802)				
			Gap			.025 (0.64)	.040 (1.02)
			Ring Installed In Ring Gage				
			9.146 (232.309) Diameter (Ring Gage)				
			Gap			.025 (0.64)	.043 (1.09)
			Ring Installed In Exhaust Case Assembly				
			9.146 (232.309) 9.147 (232.333)				
			Diameter (ID, Exhaust Case)				
	44	B	No. 4 Bearing (Oil) Nozzle (72−54−10)				
			Turbine Exhaust Case Assembly				
			(72−54−01)				
			(See Figure 802)				
			Nozzle	.5285 (13.424)	.5295 (13.449)		
			Case	.5300 (13.462)	.5325 (13.525)	.0005 (0.013)	.0040 (0.101)
	45	B	No. 4 Bearing Transfer Tube (Oil				
			Nozzle To Bearing Housing (72−54−11)				
			No. 4 Bearing Oil Nozzle (72−54−10)				
			(See Figure 802)				
			Tube	.3785 (9.614)	.3795 (9.639)		
			Nozzle	.3800 (9.652)	.3825 (9.715)	.0005 (0.013)	.0040 (0.101)

TURBINE EXHAUST CASE − INSPECTION/CHECK−04

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
46	B	No. 4 Bearing Transfer Tube (Oil Nozzle To Bearing Housing) (72−54−11) Turbine Exhaust Case (72−54−01) (See Figure 802)				
		Tube	.3785 (9.614)	.3795 (9.639)		
		Case	.3800 (9.652)	.3825 (9.715)	.0005 (0.013)	.0040 (0.101)
47	B	No. 4 Bearing Oil Pressure Tube Assembly (72−54−07) No. 4 Bearing (Pressure And Scavenge) Tube Guides (72−54−12) (See Figure 803)				
		Tube	.739 (18.771)	.741 (18.821)		
		Guide	.749 (19.025)	.751 (19.075)	.008 (0.204)	.012 (0.304)
48	C	Bushing (72−54−01) Turbine Exhaust Case Assembly (72−54−01) (See Figure 803 and Figure 804)				
		Bushing	.821 (20.854)	.822 (20.878)		
		Case	.819 (20.803)	.821 (20.853)	.000T (0.000T)	.003T (0.076T)
49	B	No. 4 Bearing Oil Pressure Tube Assembly (72−54−07) Turbine Exhaust Case Assembly (72−54−01) (See Figure 803)				
		Tube	.573 (14.555)	.575 (14.605)		
		Case	.583 (14.809)	.584 (14.833)	.008 (0.204)	.019* (0.483)*

R
R

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
50	B	No. 4 Bearing Scavenge (Outer) Tube Assembly (72–54–08) No. 4 Bearing (Pressure And Scavenge) Tube Guides (72–54–12) (See Figure 804)				
		Tube	.739 (18.771)	.741 (18.821)		
		Guide	.749 (19.025)	.751 (19.075)	.008 (0.204)	.012 (0.304)
51	B	No. 4 Bearing Scavenge (Outer) Tube Assembly (72–54–08) Turbine Exhaust Case Assembly (72–54–01) (See Figure 804)				
		Tube	.573 (14.555)	.575 (14.605)		
		Case	.583 (14.809)	.584 (14.833)	.008 (0.204)	.019* (0.483)*
52	C	Sleeve Bushing (72–54–01) Turbine Exhaust Case Assembly (72–54–01) (See Figure 805)				
		Bushing	1.4115 (35.8521)	1.4120 (35.8648)		
		Case	1.409 (35.789)	1.411 (35.839)	.0005T (0.013T)	.003T (0.076T)
53	C	Sleeve Bushing (72–54–01) Turbine Exhaust Case Assembly (72–54–01) (See Figure 805)				
		Bushing	1.4115 (35.8521)	1.4120 (35.8648)		
		Case	1.409 (35.789)	1.411 (35.839)	.0005T (0.013T)	.003T (0.076T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
54	C	Sleeve Bushing (72−54−01) Turbine Exhaust Case Assembly (72−54−01) (See Figure 805)				
		Bushing	1.4115 (35.8521)	1.4120 (35.8648)		
		Case	1.409 (35.789)	1.411 (35.839)	.0005T (0.013T)	.003T (0.076T)
55	B	Thermocouple Housing Assembly (72−54−25)/Average Pressure Temperature Probe (72−54−24) Turbine Exhaust Case Assembly (72−54−01) (See Figure 806)				
		Housing/Probe	2.089 (53.061)	2.095 (53.213)		
		Case	2.097 (53.264)	2.103 (53.416)	.002 (0.05)	.019* (0.483)*
56	B	Thermocouple Housing Assembly (72−54−25)/Average Pressure And Temperature Probe (72−54−24) Turbine Exhaust Case Assembly (72−54−01) (See Figure 806)				
		Housing/Probe	.466 (11.837)	.469 (11.912)		
		Case	.473 (12.014)	.479 (12.167)	.004 (0.102)	.018* (0.457)*
821	B	Front Compressor Drive Turbine (LPT) Shaft (72−53−80) No. 4 Bearing Seal (Front) Spacer (72−54−80) (See Figure 807)				
		Shaft	6.4999 (165.0975)	6.5005 (165.1127)		
		Spacer	6.510 (165.35)	6.530 (165.86)	.0095 (0.24)	.0301 (0.76)

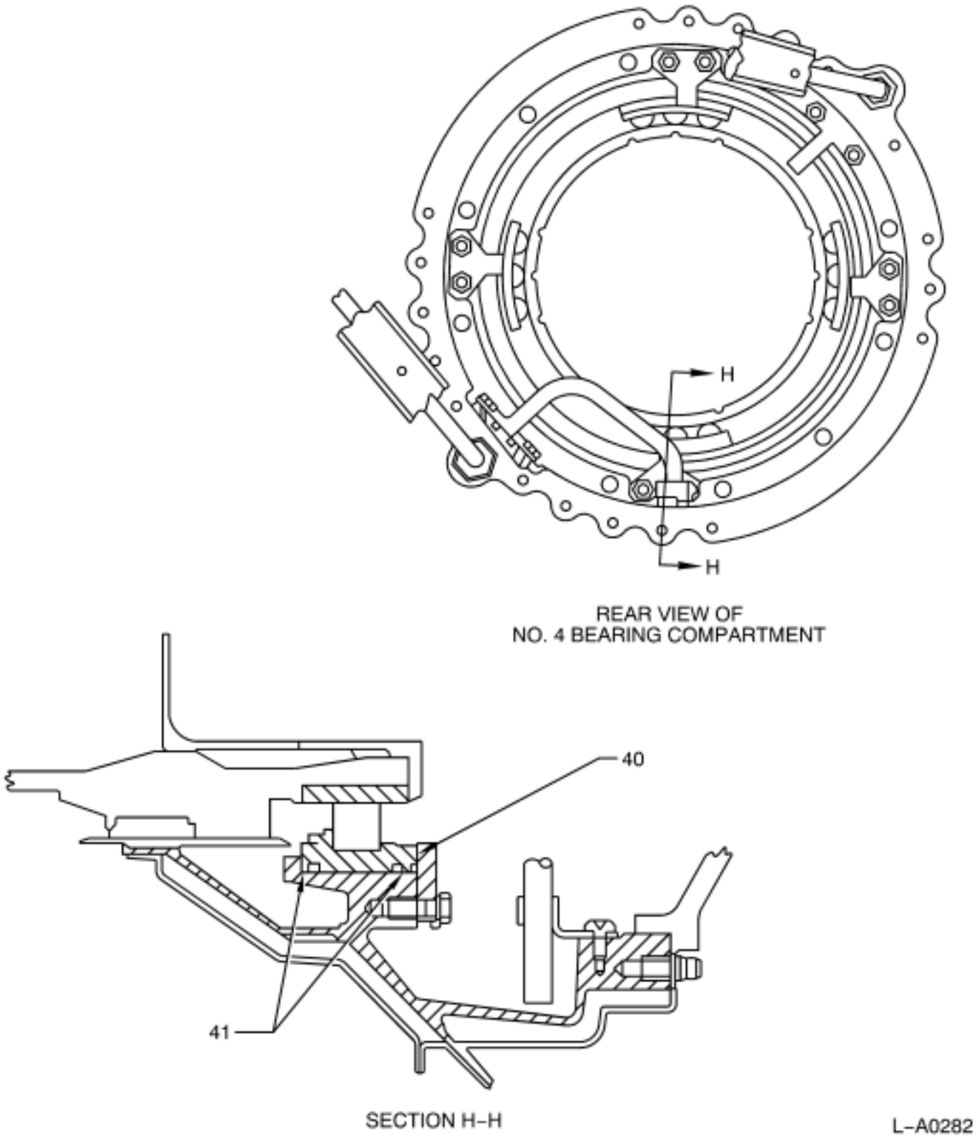
TURBINE EXHAUST CASE - INSPECTION/CHECK-04

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
822	B	Front Compressor Drive Turbine (LPT) Shaft (72-53-80) No. 4 Bearing Seal (Rear) Spacer (72-54-82) (See Figure 807)				
		Shaft	6.4999 (165.0975)	6.5005 (165.1127)		
		Spacer	6.5005 (165.1127)	6.5011 (165.1279)	.0000 (0.000)	.0012 (0.030)
823	B	No. 4 Bearing Seal (Rear) Spacer (72-54-82) No. 4 Bearing Seal (Front) Spacer (72-54-80) (See Figure 807)				
		Rear Spacer	6.7945 (172.581)	6.7955 (172.605)		
		Front Spacer	6.7975 (172.657)	6.7985 (172.681)	.0020 (0.051)	.0040 (0.101)
824	A	Front Compressor Drive Turbine (LPT) Shaft (72-53-80) No. 4 Bearing (72-54-14) (See Figure 807)				
		Shaft	6.4999 (165.0975)	6.5005 (165.1127)		
		Bearing	6.4982 (165.0543)	6.4990 (165.0746)	.0009T (0.023T)	.0023T (0.058T)
826	B	Rear Turbine (LPT) Case Assembly (72-53-17) Turbine Exhaust Case Assembly (72-54-01) (See Figure 808)				
		LPT Case	57.560 (1462.024)	57.564 (1462.125)		
		Exhaust Case	57.552 (1461.821)	57.560 (1462.024)	.064* (1.626)*	.012T (0.30T)

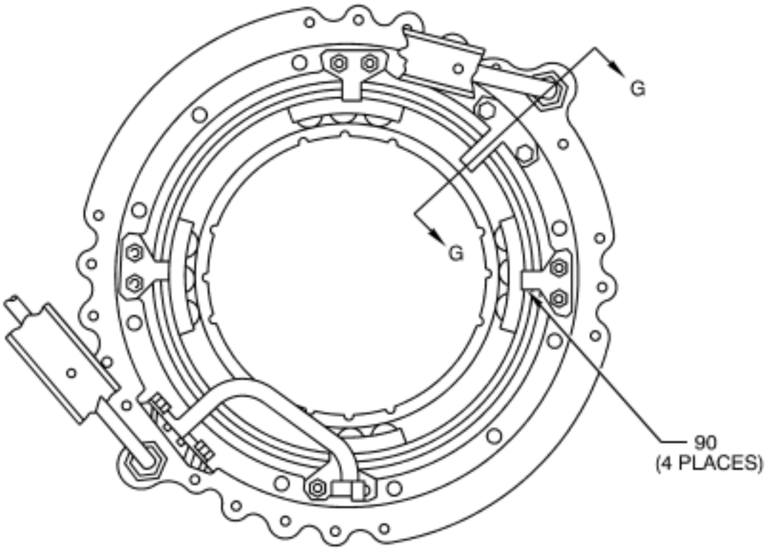
Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
829	A	Gap, No. 4 Bearing (Carbon) Face Seal Ring (72-54-81) (See Figure 807)				
		Gap			.020 (0.51)	.030 (0.76)
		Seal Ring Installed In Ring Gage 8.160 (207.264) Diameter (Ring Gage)				
		Gap			.017 (0.43)	.033 (0.84)
		Seal Ring Installed In Exhaust Case Assembly 8.159 (207.239) 8.161 (207.289) Diameter (Case)				
841	B	No. 4 Bearing Cover Assembly(72-54-83) Turbine Exhaust Case Assembly (72-54-01) (See Figure 807)				
		Cover	10.876 (276.251)	10.878 (276.301)		
		Case	10.880 (276.352)	10.884 (276.453)	.002 (0.051)	.008 (0.202)
843	A	Stage 6 LPT Airseal (72-53-85) Turbine Exhaust Case Assembly (72-54-01) (See Figure 807)				
		Airseal	8.118 (206.198)	8.122 (206.298)		
		Case	8.159 (207.239)	8.161 (207.289)	.037 (0.940)	.055* (1.400)*

G. Special Assembly Procedures

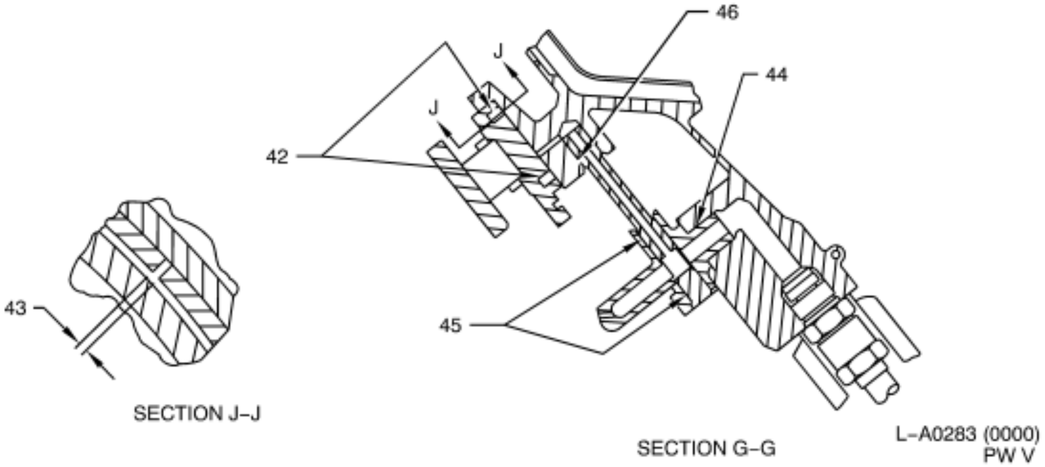
Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
90	A	Gap, No. 4 Bearing (Outer Race) Retaining Plate To No. 4 Roller Bearing (See Figure 802) See 72-54-00, Assembly-01 Task 72-54-00-400-001				


H
H
REAR VIEW OF
NO. 4 BEARING COMPARTMENT
40
41
SECTION H-H
L-A0282 (0000)
PW V

Turbine Exhaust Case Assembly
Figure 801
(Task 72-54-00-990-001)


G
G
90
(4 PLACES)

REAR VIEW OF
NO. 4 BEARING COMPARTMENT

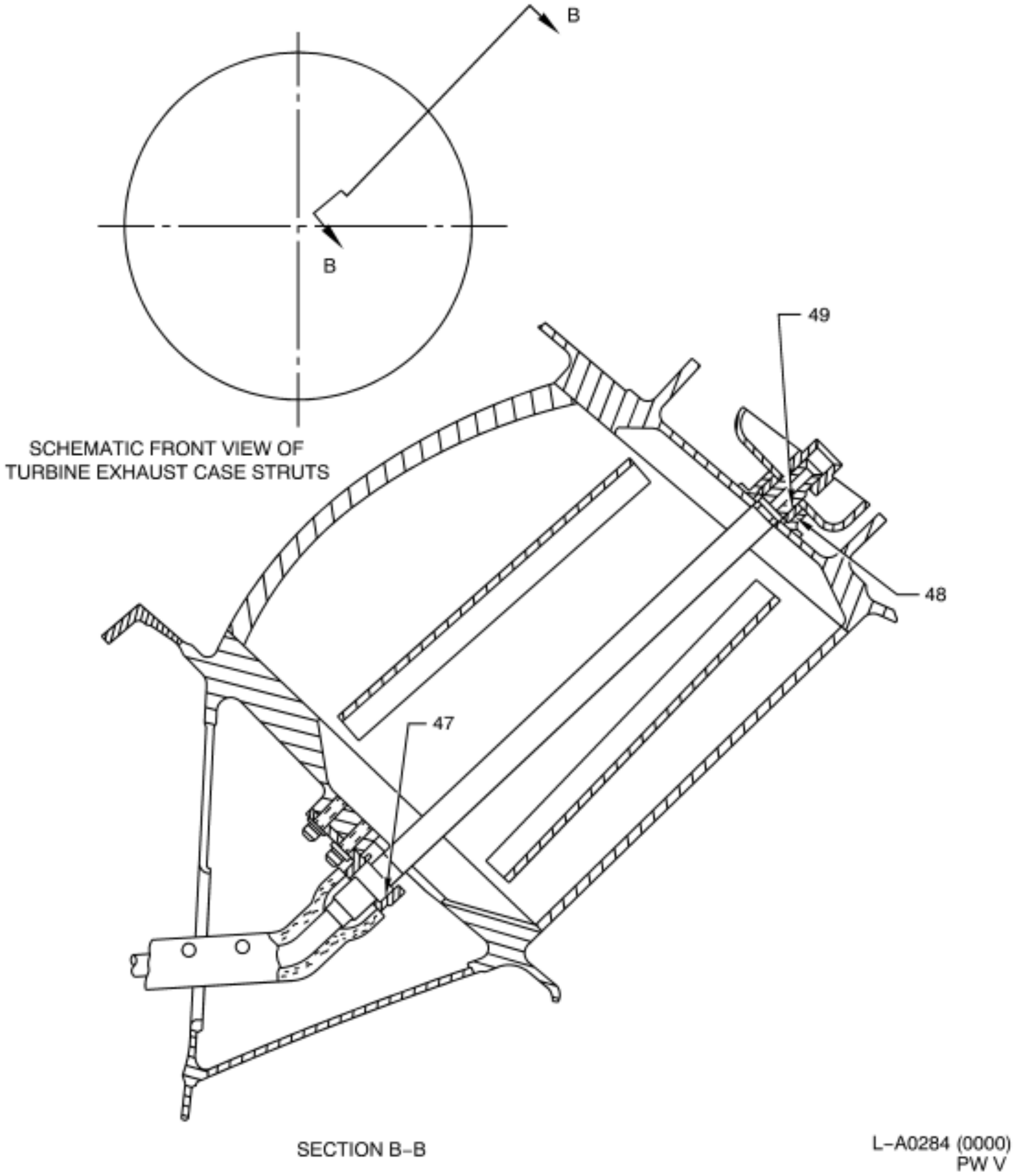

46
J
44
J
42
43
45
L−A0283 (0000)
PW V

SECTION J–J

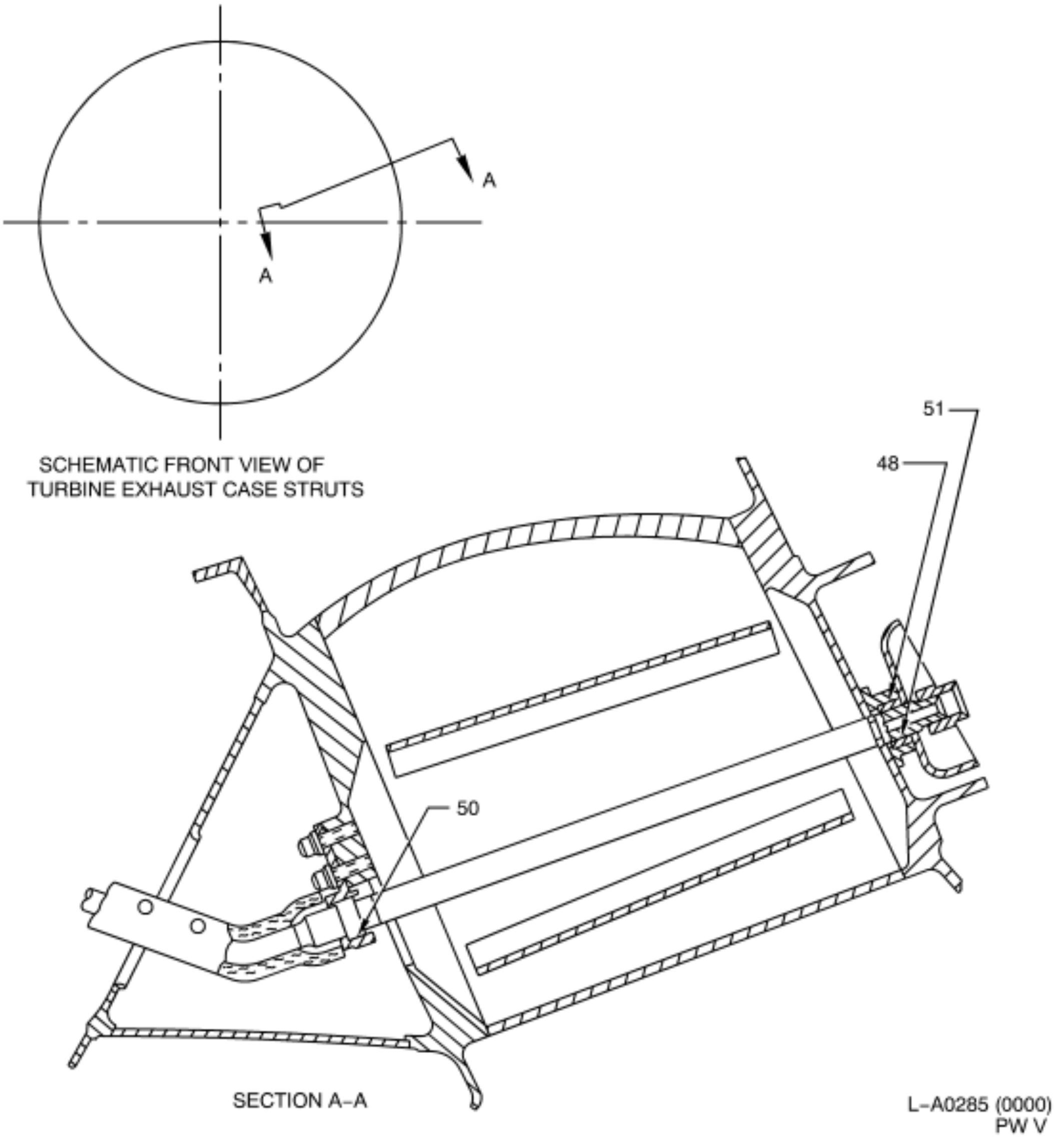
SECTION G–G

Turbine Exhaust Case Assembly
Figure 802
(Task 72−54−00−990−001)

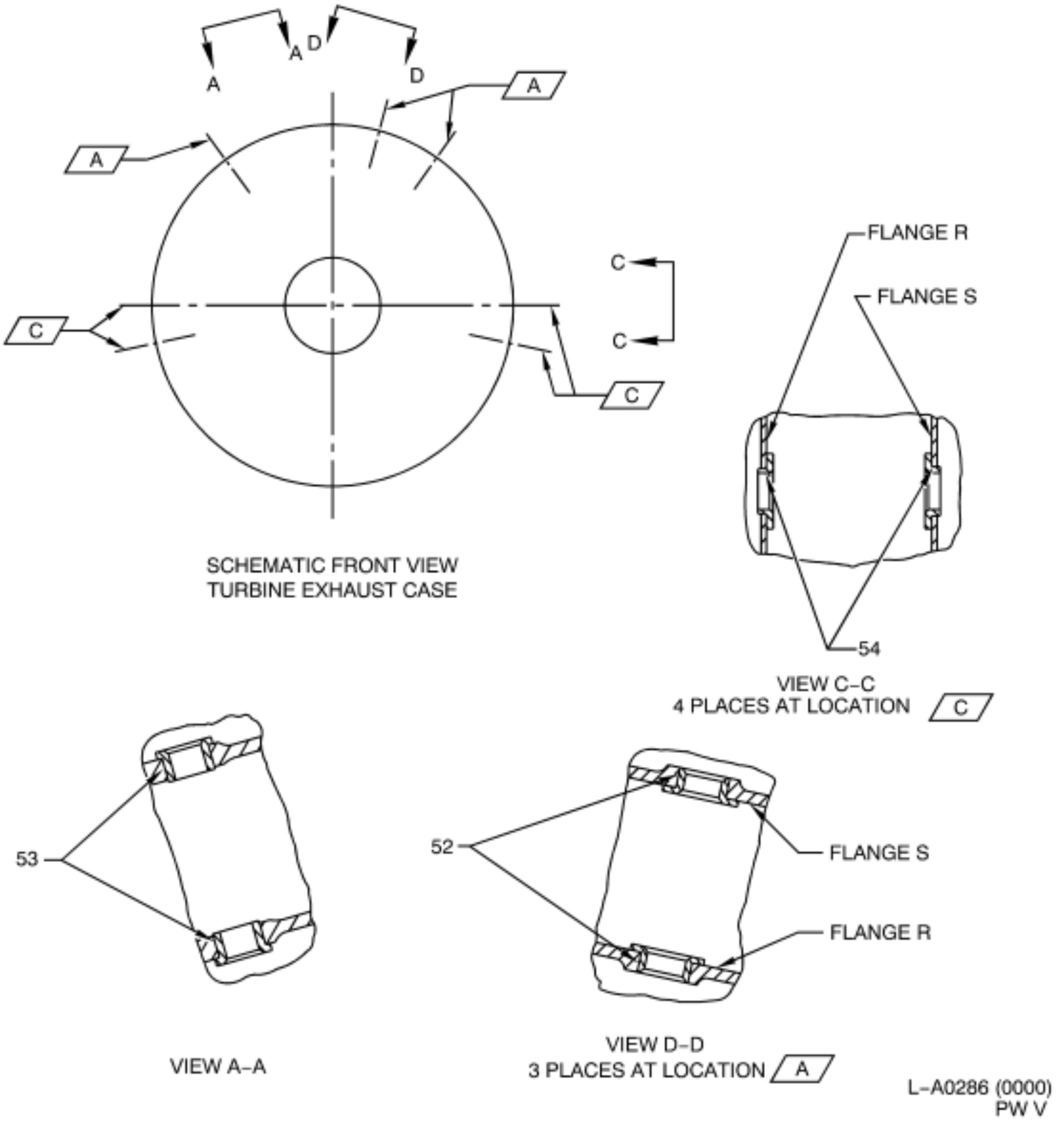
TURBINE EXHAUST CASE - INSPECTION/CHECK-04


B
B
SCHEMATIC FRONT VIEW OF
TURBINE EXHAUST CASE STRUTS
49
48
47
SECTION B-B
L-A0284 (0000)
PW V

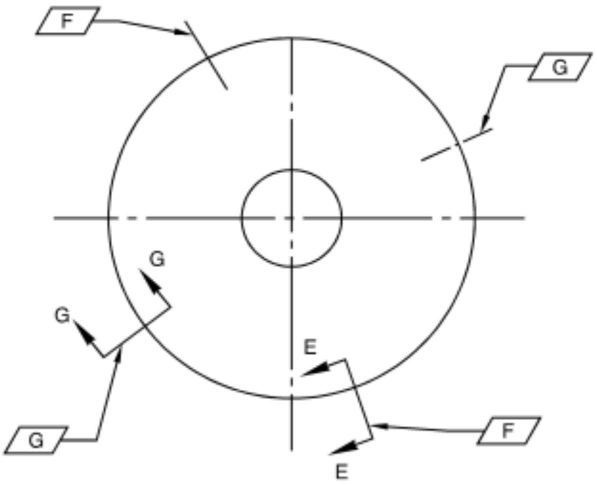
Turbine Exhaust Case Assembly
Figure 803
(Task 72-54-00-990-001)


A
A
SCHEMATIC FRONT VIEW OF
TURBINE EXHAUST CASE STRUTS
51
48
50
SECTION A−A
L−A0285 (0000)
PW V

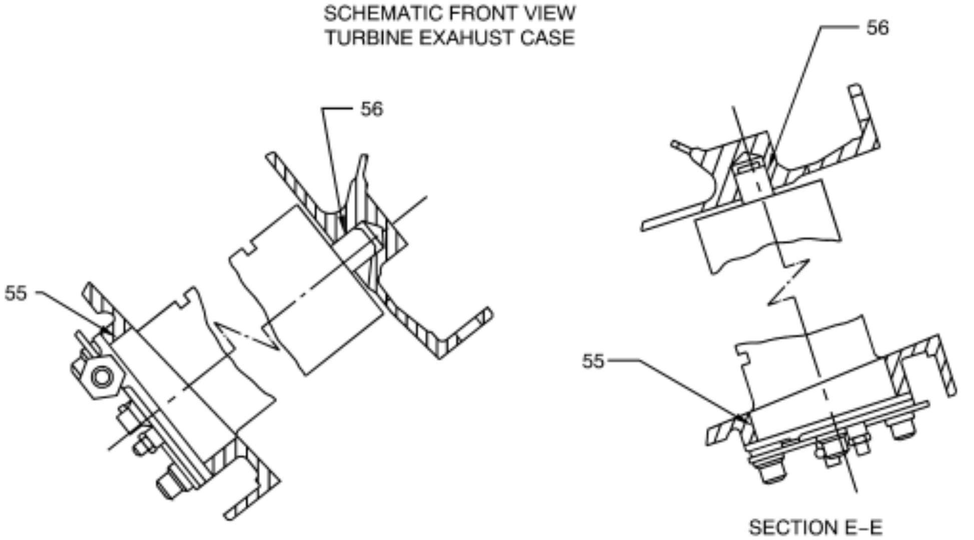
Turbine Exhaust Case Assembly
Figure 804
(Task 72−54−00−990−001)


A
A
D
D
A
A
C
C
C
C
SCHEMATIC FRONT VIEW
TURBINE EXHAUST CASE
FLANGE R
FLANGE S
54
VIEW C-C
4 PLACES AT LOCATION C
53
VIEW A-A
52
FLANGE S
FLANGE R
VIEW D-D
3 PLACES AT LOCATION A
L-A0286 (0000)
PW V

Turbine Exhaust Case Assembly
Figure 805
(Task 72-54-00-990-001)



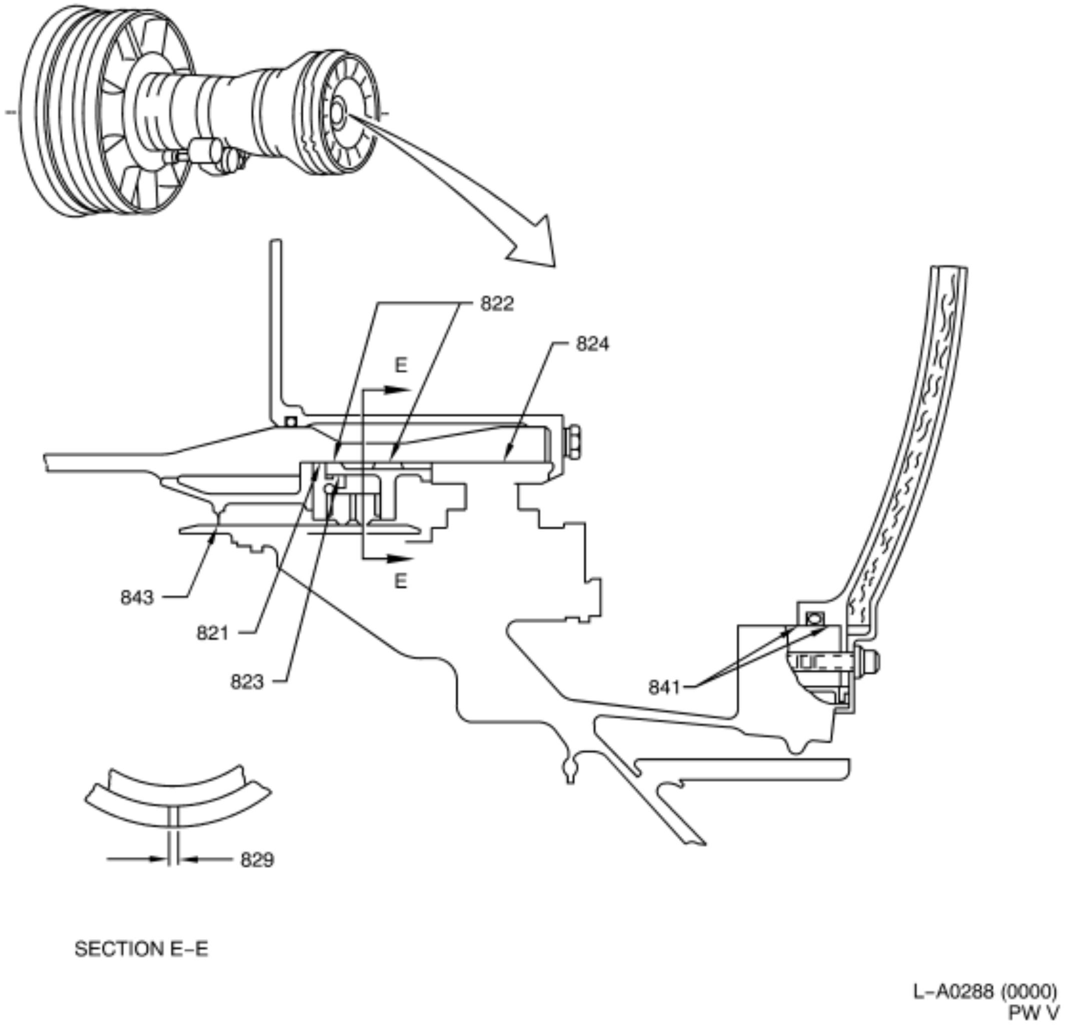
SCHEMATIC FRONT VIEW
TURBINE EXAHUST CASE


56
56
55
55
L-A0287 (0000)
PW V

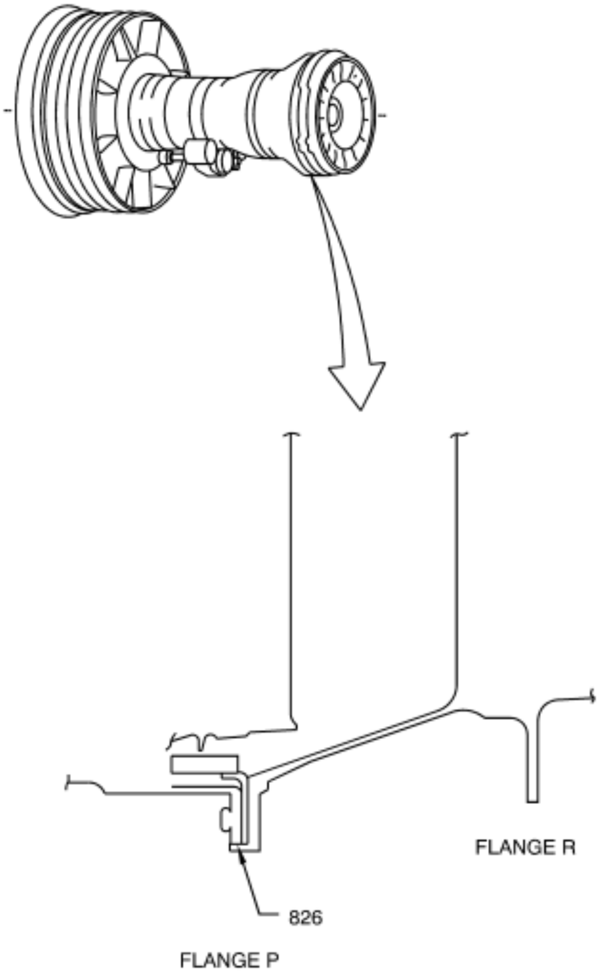
SECTION G-G
2 PLACES AT LOCATION G

SECTION E-E
2 PLACES AT LOCATION F

Turbine Exhaust Case Assembly
Figure 806
(Task 72-54-00-990-001)


822
824
E
E
843
821
823
841
829
SECTION E−E
L−A0288 (0000)
PW V

Turbine Exhaust Case Assembly
Figure 807
(Task 72−54−00−990−001)



L−A0289 (0000)
PW V

Turbine Exhaust Case Assembly
Figure 808
(Task 72−54−00−990−001)

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Task 72–54–00–400–001:

1. Assemble Turbine Exhaust Case

A. Prerequisites

(1) See Inspection/Check–04 Task 72–54–00–990–001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Standard Tools:

Name	Manufacturer
Cherry Max Rivet Gun and head for 1/4 inch (6.350 mm) max. rivets	Cherry Division of Textron, Inc., 1224 East Warner Ave., Box 2157, Santa Ana, CA 92707–0157

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

CTE 5070	Airflow Cart (Optional to CTE 6070)
CTE 6070	Airflow Cart
PWA 25039	Stand
PWA 25040	Bracket, Support (Optional to PWA 85195 Bracket for engines with exhaust nozzle removed)
PWA 25041	Bracket, Support (Optional to PWA 85195 Bracket for engines with exhaust nozzle removed)
PWA 28657	Sling, Handling
PWA 76154	Adapter (2 Required)
PWA 85195	Bracket, Support (2 Required)
PWA 85501	Adapter

TURBINE EXHAUST CASE - ASSEMBLY-01

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-136	Fiberglass Wrap (Optional)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-023	Silver Goop (PWA 36001)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72-54-00/5/1
Key Washer	4	72-54-00/4/60
Key Washer	4	72-54-00/4/70
Key Washer	3	72-54-00/5/20
Key Washer	2	72-54-00/5/60
Key Washer	2	72-54-00/5/70
Packing	1	72-54-00/2/1
Packing	1	72-54-00/3/1
Thrust Wire	1	72-54-00/2/110
Thrust Wire	1	72-54-00/3/110

Lockwire, PN MS9226-03
Rivet, PN 50P308

C. Assemble Turbine Exhaust Case

Subtask 72-54-00-430-051:

(1) Install PWA 85195 Support Brackets to turbine exhaust case at 3 and 9 o'clock locations.

NOTE: See following step for optional bracket installation.

(a) Position bracket between case rails and align holes with bushings.

(b) Install pins from rear through bushings and bracket.

(c) Secure pins with safety pins.

(d) Repeat procedure for opposite bracket location.

(2) Install PWA 25040 Brackets and PWA 25041 Brackets to turbine exhaust case at 3 and 9 o'clock locations.

NOTE: Do not use the PWA 25040 Brackets and PWA 25041 Brackets in place of PWA 85195 Brackets if the brackets are not removed prior to the exhaust nozzle installation.

(a) Align boltholes and position PWA 25040 Bracket on left side (9 o'clock position) between case rails. Secure bracket to case with detail ball lock pin.

(b) Align boltholes and position PWA 25040 Bracket on right side (3 o'clock position) between case rails. Secure bracket to case with detail ball lock pin.

(3) Install turbine exhaust case in PWA 25039 Build Stand.

(a) Move vertical upright in desired position on rail and secure.

(b) Attach PWA 28657 Sling to hoist. Attach sling to outer spools of brackets on turbine exhaust case with two PWA 76154 Adapters.

(c) Lift and position turbine exhaust case on build stand cradling inner spools of brackets. Remove sling and adapters.

(d) Install ball lock pin in left bracket flange.

(e) Secure clamp on top of vertical support to retain spools.

Subtask 72−54−00−430−052:

(4) Install No. 4 bearing outer race and rollers.

CAUTION: BEARING INNER RACE IS INSTALLED ON FRONT COMPRESSOR DRIVESHAFT. ENSURE THAT ALL BEARING DETAILS ARE KEPT TOGETHER. MIXING OF BEARING DETAILS MAY CAUSE DAMAGE TO BEARING.

(a) Remove No. 4 bearing outer race and rollers from container.

(b) Install two seal rings (1001/1) into grooves in OD of bearing outer race. See Figure 1001. Position the seal ring gaps within Area E, 180 degrees from the No. 4 bearing (oil) nozzle, as shown in Figure 1002.

(c) Align four slots in rear face of bearing outer race with slots in exhaust case inner flange rear face and install bearing outer race with rollers into No. 4 bearing support flange in exhaust case.

(d) Secure outer race using four retaining plates (1001/3) (chamfered side out), eight bolts (1001/5) lubricated with Engine Oil P03−001, and key washers (1001/4). Omit the retaining plate located at the 12 o'clock position until after the No. 4 bearing front nozzle is installed.

(e) (Reference 90) Make sure that the clearance between the retaining plate and the grooves in the bearing outer race is in the limit specified in Index 2, Figure 1002.

(f) With retaining plate gaps within limits given in previous step, torque bolts to 75 − 85 lb−in. (8.474 − 9.604 N.m). Recheck gap per previous step.

(g) Bend tabs of washers to secure bolts.

Subtask 72−54−00−430−053:

(5) (Pre SB PW4ENG 79−76) Install No. 4 bearing oil scavenge (inner) tube (1004/8) and (outer) tube (1004/15). See Figure 1004.

(a) Install adapter (1004/1), lubricated with Engine Oil P03−001, and new packing (1004/2) into threaded hole in rear inner flange of exhaust case at 7:30 o'clock position. Torque adapter to 150 − 170 lb−in. (16.948 − 19.207 N.m).

(b) Install new gasket (1004/3) in groove in recess in exhaust case rear inner diameter.

(c) Align boltholes in flange of No. 4 bearing oil scavenge tube (1004/8) with boltholes in recessed pad in exhaust case rear inner diameter. Align bolthole in detail tube bracket with bolthole in exhaust case rear inner diameter. Secure tube using three bolts (1004/6) lubricated with Engine Oil P03−001 and key washers (1004/7). Torque bolts to 32 − 36 lb−in. (3.616 − 4.067 N.m). Bend tabs of key washers.

(d) No. 4 bearing scavenge tube option to prevent possible wear to the No. 4 bearing scavenge tube (1004/15), a fiberglass tape wear Wrap P05−136, (1004/19) is provided as an option.

(e) Install No. 4 bearing tube guide (1004/13) onto scavenge tube (1004/15). Install scavenge tube, straight end, into opening in exhaust case inner wall and through strut at approximately 10:30 o'clock location as viewed from the rear. Handtighten tube nut detail lubricated with Engine Oil P03−001, to secure tube to adapter (1004/1) on rear inner flange of exhaust case at 7:30 o'clock location as viewed from rear.

(f) Secure tube guide to boss on inner wall of exhaust case using two bolts (1004/14) lubricated with Engine Oil P03−001. Torque bolts to 75 − 85 lb−in. (8.474 − 9.604 N.m). Safety the bolts using Lockwire P05−289.

(g) Torque the nut on the inboard end of the scavenge tube to the adapter (1004/1) to 320 − 350 lb−in. (36.155 − 39.545 N.m) and safety the nut to the adapter with Lockwire P05−289.

(h) Position the nut (1004/9) onto the outboard end of scavenge tube (1004/15). Safety the nut to tube using thrust wire (1004/10).

(i) Position No. 4 bearing scavenge tube heat shields (1004/16) and (1004/17) around inboard end of tube. Secure heat shields using lockwire PN MS 9226−03 laced through eyelets in heat shield. See 70−53, Standard Practices Manual, PN 585005.

(6) (Post SB PW4ENG 79−76) Install No. 4 bearing oil scavenge (inner) tube (1005/8) and (outer) tube (1005/9). See Figure 1005.

(a) Install adapter (1005/1), lubricated with Engine Oil P03−001, and new packing (1005/2) into threaded hole in rear inner flange of exhaust case at 7:30 o'clock position. Torque adapter to 150 − 170 lb−in. (16.948 − 19.207 N.m).

(b) Install new gasket (1005/3) in groove in recess in exhaust case rear inner diameter.

(c) Align boltholes in flange of No. 4 bearing oil scavenge tube (1005/8) with boltholes in recessed pad in exhaust case rear inner diameter. Align bolthole in detail tube bracket with bolthole in exhaust case rear inner diameter. Secure tube using three bolts (1005/6) lubricated with Engine Oil P03−001 and key washers (1005/7). Torque bolts to 32 − 36 lb−in. (3.616 − 4.067 N.m). Bend tabs of key washers.

(d) No. 4 bearing scavenge tube option to prevent possible wear to the No. 4 bearing scavenge tube (1005/9), a fiberglass tape wear Wrap P05−136, (1005/23) is provided as an option.

(e) Install the shield set (1005/10) and the heat shield insulation slide clamp (1005/11) on the elliptical section of the No. 4 scavenge tube (1005/9).

NOTE: The shield is installed on the section of the tube that goes through the strut of the turbine exhaust case.

(f) Install the shield set (1005/12) on the No. 4 scavenge tube as follows.

1 Place the two halves over the round section of tube.

2 Install one restraining strap (1005/13) through the loops on the section of the shield that overlaps the shield set (1005/10).

3 Put the loop clamp (1005/14) on the wear sleeve of the shield set and secure temporarily with a work bolt and nut.

4 Make tight the shield set on the tube by pulling the strap tight. Cut off excess strap material.

(g) Attach bracket (1005/15) to the turbine exhaust case with two bolts (1005/16). Torque the bolts to 75 − 85 lb−in. (8.474 − 9.604 N.m).

(h) Install the No. 4 scavenge tube through the strut at the 4:00 o'clock position.

1 Attach the tube nut to the adapter (1005/1), handtight.

NOTE: The shield may be separated to attach the tube nut to the adapter.

2 Remove the work bolt and replace with bolt (1005/17) and nut (1005/18) and attach to the bracket (1005/15).

3 Torque the nut on the inboard end of the scavenge tube to the adapter (1005/1) to 225 − 250 lb−in. (25.422 − 28.246 N.m). Safety the tube nut with Lockwire P05−289.

4 Torque the bolt (1005/17) that attaches the clamp (1005/17) to the bracket (1005/15) to 32 − 36 lb−in. (3.616 − 4.067 N.m).

5 Install the four additional straps (1005/13) to hold the shield in place.

6 Make tight the shield set on the tube by pulling the straps tight. Cut off excess strap material.

7 Position the nut (1005/19) onto the outboard end of the scavenge tube and safety the nut with thrust wire (1005/20).

8 Attach the tube shield (1005/21) to the turbine exhaust case at the 4:00 o'clock position, pushing it on over the nut (1005/19).

9 Install two bolts (1005/22) to retain shield and torque to 32 - 36 lb-in. (3.616 - 4.067 N.m). Safety the bolts with Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(7) For engines that do not incorporate the reduced weight exhaust case (Pre SB PW4ENG 72-456) install the No. 4 bearing compartment rear heat shields. See Figure 1003.

(a) Put the two No. 4 bearing (front) heat shields (1003/4) around the OD of the No. 4 bearing housing.

(b) Align the clearance radii of the No. 4 bearing (filler) heat shield (1003/1) with the mating scalloped contour of the No. 4 bearing housing, and install the No. 4 bearing (rear outer) heat shield (1003/2) over the rear inner heat shields and (filler) heat shields.

(c) Install the retaining strap (1003/3) through the four loops in the (rear outer) heat shield and insert the end in the buckle and pull to tighten the strap.

(8) For engines that incorporate the reduced weight exhaust case (Post SB PW4ENG 72-456), install the No. 4 bearing compartment rear heat shields. See Figure 1003.

(a) Put the two No 4 bearing (front) heat shields (1003/7) around the OD of the No. 4 bearing housing.

(b) Align the clearance radii of the No. 4 bearing (rear outer) heat shield (1003/5) with their mating tube bosses and install the (rear outer) heat shield over the (front) heat shields.

(c) Install the retaining strap (1008/6) through the four loops in the (rear outer) heat shield and insert the end in the buckle, and pull to tighten the strap.

Subtask 72−54−00−430−061:

(9) Install No. 4 bearing (oil) nozzle and No. 4 bearing damper supply tube. See Figure 1006.

(a) Install the No. 4 bearing nozzle (1006/11) in the port in the pad on the exhaust case rear inner diameter at the 1:30 o'clock position. Install the nozzle with two bolts (1006/16) and (1006/17), with threads lubricated with Engine Oil P03−001, and two washers (1006/16) and (1006/17).

(b) Install the No. 4 bearing damper supply tube (1006/12) through the 0.380 inch (9.652 mm) diameter hole in the nozzle (1006/11) and into the port in the exhaust case rear flange. Install the damper tube with two bolts (1006/16) and (1006/17), with threads lubricated with Engine Oil P03−001, and washers (1006/16) and (1006/17). Torque the bolts that attach the nozzle to the exhaust case and bolts that attach the damper supply tube to the nozzle to 75 − 85 lb−in. (8.474 − 9.604 N.m). Bend the tabs of washers.

Subtask 72−54−00−430−062:

(10) Install No. 4 bearing front nozzle assembly and the packing transfer tube (damper tube to front nozzle). See Figure 1006.

(a) Lubricate two packings (1006/14) with Engine Oil P03−001. Install the packings in the grooves of the packing transfer tube (1006/15). Insert one end of the tube into the port in the front No. 4 bearing nozzle (1006/13).

(b) Align the boltholes in the flange of the front nozzle with the two retainer plate boltholes at the 12 o'clock position and insert the nozzle through the hole in the No. 4 bearing support flange at the 1:30 o'clock position. Insert the end of the transfer tube in the port in the elbow of the No. 4 bearing damper supply tube. Put the retaining plate (1006/2), chamfered side out, on the retainer plate pad (under the nozzle flange). Put the key washer (1006/1) over the oil nozzle flange, and install two bolts, with threads lubricated with Engine Oil P03−001.

(c) (Reference 90) Make sure that the clearance gap (1006/3) between the retaining plate and the grooves in the bearing outer race is in the limit specified in Index 2, Figure 1002. Torque the bolts that attach the retainer plate to 75 − 85 lb−in. (8.474 − 9.604 N.m). Bend the tabs of washer (1006/1).

Subtask 72−54−00−430−055:

(11) (Pre SB PW4ENG 79−76) Install No. 4 bearing (oil) pressure tube. See Figure 1007.

(a) Install adapter (1007/10), lubricated with Engine Oil P03−001, and new packing (1007/9) into threaded hole in rear inner flange of exhaust case at 1:30 o'clock position. Torque adapter to 150 − 170 lb−in. (16.948 − 19.207 N.m).

(b) No. 4 bearing pressure tube option to prevent possible wear to the No. 4 bearing pressure tube (1007/7), a fiberglass tape wear Wrap P05−136, (1007/13) is provided as an option.

(c) Install No. 4 bearing tube guide (1007/5) onto No. 4 bearing pressure tube (1007/7). Install pressure tube, straight end, into opening in exhaust case inner wall and through strut at approximately 1:30 o'clock location as viewed from front. Handtighten tube nut detail, lubricated with Engine Oil P03−001, to secure tube to adapter (1007/10) on rear inner flange of exhaust case at 1:30 o'clock as viewed from rear.

(d) Secure tube guide to boss on inner wall of exhaust case using two bolts (1007/6) lubricated with Engine Oil P03−001. Torque bolts to 75 − 85 lb−in. (8.474 − 9.604 N.m). Safety the bolts using Lockwire P05−289.

(e) Torque tube nut detail to 320 − 350 lb−in. (36.155 − 39.545 N.m). Safety the tube nut with Lockwire P05−289.

(f) Position No. 4 bearing pressure tube shield (1007/4) onto boss on exhaust case outer wall at approximately 1:30 o'clock location as viewed from front. Secure tube shield using two bolts (1007/3). Torque bolts to 32 - 36 lb-in. (3.616 - 4.067 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(g) Position nut (1007/1) onto outboard end of pressure tube (1007/7). Secure nut to tube using thrust wire (1007/2).

(h) Position No. 4 bearing pressure tube heat shields (1007/8) and (1007/11) around inboard end of tube. Secure heat shields using lockwire PN MS9226-03 (1007/12) laced through eyelets in heat shield. See 70-53, Standard Practices Manual, PN 585005.

(12) (Post SB PW4ENG 79-76) Install No. 4 bearing (oil) pressure tube. See Figure 1005 (Sheets 2 and 3) and Figure 1008.

(a) Install adapter (1008/5), lubricated with Engine Oil P03-001, and new packing (1008/6) into threaded hole in rear inner flange of exhaust case at 1:30 o'clock position. Torque adapter to 150 - 170 lb-in. (16.948 - 19.207 N.m).

(b) No. 4 bearing pressure tube option to prevent possible wear to the No. 4 bearing pressure tube (1008/14), a fiberglass tape wear Wrap P05-136, (1008/17) is provided as an option.

(c) Install the shield set (1008/15) and the heat shield insulation slide clamp (1008/16) on the
R elliptical section of the No. 4 pressure tube (1008/14).

NOTE: The shield is installed on the section of the tube that goes through the strut of the turbine exhaust case.

(d) Install the shield set (1008/7) on the No. 4 pressure tube as follows.

1 Place the two halves over the round section of tube.

2 Install one restraining strap (1008/18) through the loops on the section of the shield that overlaps the shield set (1008/15).

3 Make tight the shield set on the tube by pulling the strap tight. Cut off excess strap material.

4 Put the loop clamp (1008/10) on the wear sleeve of the shield set and secure temporarily with a work bolt and nut.

(e) Attach bracket (1008/11) to the turbine exhaust case with two bolts (1008/8). Torque the bolts to 75 − 85 lb−in. (8.474 − 9.604 N.m).

(f) Install the No. 4 pressure tube through the strut at the 4:30 o'clock position.

1 Attach the tube nut to the adapter (1008/5), handtight.

NOTE: The shield may be separated to attach the tube nut to the adapter.

2 Remove the work bolt and replace with bolt (1008/9) and nut (1008/12) and attach to the bracket (1008/11).

3 Torque the tube nut to the adapter (1008/5) to 225 − 250 lb−in. (25.422 − 28.246 N.m). Safety the tube nut with Lockwire P05−289.

4 Torque the bolt (1008/9) that attaches the clamp (1008/10) to the bracket (1008/11) to 32 − 36 lb−in. (3.616 − 4.067 N.m).

5 Install the four additional straps (1008/18) to hold the shield in place.

6 Make tight the shield set on the tube by pulling the straps tight. Cut off excess strap material.

7 Install bracket (1008/2) over the outboard end of the tube.

8 Position the nut (1008/4) on the outboard end of the tube and secure the nut to the tube with thrust wire (1008/19).

9 Attach the tube shield (1008/3) to the turbine exhaust case at the 4:30 o'clock position, pushing it on over the nut (1008/4). Line up the shield with the bracket (1008/2).

10 Install two bolts (1008/1) to retain shield and bracket and torque to 32 - 36 lb-in. (3.616 - 4.067 N.m). Safety the bolts with Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292.

(13) Install brackets to rear flange of exhaust case. See Figure 1009 for bracket locations. Lubricate threads of screws with Engine Oil P03-001. Secure brackets with screws and nuts. Torque screws to 36 - 40 lb-in. (4.067 - 4.519 N.m).

Subtask 72-54-00-430-058:

(14) Airflow check No. 4 bearing oil nozzle. See Figure 1006 (Sheet 3).

(a) Secure PWA 85501 Adapter to No. 4 bearing pressure tube located on outside of exhaust case at 10 o'clock position.

(b) Secure air inlet hose from CTE 5070 Airflow Cart or CTE 6070 to larger threaded hole of adapter.

(c) Secure pressure sensing line to remaining threaded hole on side of adapter.

(d) Airflow check nozzle at 10 psig (68.9 kPa). Airflow rate must be 6 - 20 lb/hr (2.72 - 9.07 kg/hr) for engines (Pre and Post SB PW4ENG 72-472).

(e) After airflow rate limits have been met, remove adapter and airflow cart from exhaust case.

(f) Make sure that the oil passage is not blocked.

Subtask 72−54−00−430−057:

(15) Install thermocouple housing assembly (1010/5) and thermocouple (1010/4) into exhaust case boss at approximately 1 o'clock position. See Figure 1010.

(a) Align boltholes and install thermocouple housing into exhaust case boss. Install one bolt (1010/2) threads lubricated with Silver Goop P06−023, at upper front (scalloped) bolthole location. Handtighten bolt.

(b) Align boltholes and install thermocouple (1010/4) into thermocouple housing. Position bracket (1010/3) over thermocouple and install two bolts (1010/1), threads lubricated with Silver Goop P06−023. Handtighten bolts.

(c) Torque all bolts to 54 − 60 lb−in. (6.101 − 6.779 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(16) Install thermocouple housing assembly (1011/1) and thermocouple (1011/2) into exhaust case boss at approximately 6:30 o'clock position. See Figure 1011.

(a) Align boltholes and install thermocouple housing into exhaust case boss. Install one bolt (1011/5), threads lubricated with Silver Goop P06−023, at lower front (scalloped) bolthole location. Handtighten bolt.

(b) Align boltholes and install thermocouple into thermocouple housing. Position bracket (1011/3) over thermocouple and install two bolts (1011/4), threads lubricated with Silver Goop P06−023. Handtighten bolts.

(c) Torque all bolts to 54 − 60 lb−in. (6.101 − 6.779 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(17) Install average pressure and temperature probe (1012/1) and thermocouple (1012/2) into exhaust case boss at approximately 4:30 o'clock position. See Figure 1012.

(a) Align boltholes and install probe (1012/1) into exhaust case boss. Install one bolt (1012/3), threads lubricated with Silver Goop P06-023, at upper front (scalloped) bolthole location. Handtighten bolt.

(b) Align boltholes and install thermocouple (1012/2) into probe (1012/1). Position bracket (1012/4) over thermocouple and install two bolts (1012/5), threads lubricated with Silver Goop P06-023. Handtighten bolts.

(c) Torque all bolts to 54 - 60 lb-in. (6.101 - 6.779 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(18) Install average pressure and temperature probe (1013/1) and thermocouple (1013/2) into exhaust case boss at approximately 10 o'clock position. See Figure 1013.

(a) Align boltholes and install probe (1013/1) into exhaust case boss. Install one bolt (1013/4), threads lubricated with Silver Goop P06-023, at lower front (scalloped) bolthole location. Handtighten bolt.

(b) Align boltholes and install thermocouple (1013/2) into probe (1013/1). Install two bolts (1013/3), threads lubricated with Silver Goop P06-023. Handtighten bolts.

NOTE: Bolts will be torqued after thermocouple cable installation.

(19) For engines with the one piece EEC PT4.95 manifold assembly (1014/1) (Pre SB PW4ENG 72-134) install the EEC PT4.95 manifold assembly as follows. See Figure 1014.

CAUTION: DO NOT USE ANY LUBRICANTS ON THE EEC PT4.95 MANIFOLDS, TUBES, OR ADAPTERS. CONTAMINATION OF THE EEC CAN RESULT.

(a) Remove the covers. Install the manifold (1014/1) to the probes at 4:30 and 10 o'clock positions. Tighten the manifold nuts (1014/7) by hand.

(b) Install the eight clamps (1014/2) that attach the manifold to the exhaust case brackets. Attach the bottom three clamps (1014/2) with three bolts (1014/4), lubricated with Engine Oil P03-001, and nuts (1014/3). Torque the clamp bolts (1014/4) to 36 - 40 lb-in. (4.067 - 4.519 N.m).

NOTE: Attach the remaining clamps (1014/2) with the installation of the (TT4.95) thermocouple box and cable assembly.

(c) Torque the manifold nuts (1014/7) to 135 - 150 lb-in. (15.253 - 16.948 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(d) Install the washer (1014/6) and plug (1014/5) to the manifold. Torque the plug (1014/5) to 40 - 50 lb-in. (4.519 - 5.649 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the plug.

(20) For engines with the three piece EEC PT4.95 manifold (Post SB PW4ENG 72-134), install the two EEC PT4.95 manifold assemblies (1015/1 and 1015/2) and the EEC PT4.95 tube assembly (1015/3) as follows. See Figure 1015.

CAUTION: DO NOT USE ANY LUBRICANTS ON THE EEC PT4.95 MANIFOLDS, TUBES, OR ADAPTERS. CONTAMINATION OF THE EEC CAN RESULT.

(a) Remove the covers. Install the two manifolds (1015/1 and 1015/2) and the tube (1015/3) to the probe adapters and to each other. Tighten the tube and manifold nuts (1015/9) by hand.

(b) Install the eight clamps (1015/4) that attach the manifolds and tube to the exhaust case brackets. Attach the bottom three clamps (1015/4) with the two bolts (1015/6), lubricated with Engine Oil P03-001, and three nuts (1015/5). Torque the bolts (1015/6) and three nuts (1015/5) to 36 - 40 lb-in. (4.067 - 4.519 N.m).

NOTE: Attach the remaining clamps (1015/4) with the installation of the (TT4.95) thermocouple box and cable assembly.

(c) Torque the manifold nut and tube nut (1015/9) to the probe adapters to 135 - 150 lb-in. (15.253 - 16.948 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nuts.

(d) Torque the manifold nut (1015/11) at the 6 o'clock position to 270 - 300 lb-in. (30.506 - 33.895 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(e) Torque the tube nut (1015/12) at the 8 o'clock position to 135 - 150 lb-in. (15.253 - 16.948 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the nut.

(f) Install the washer (1015/7) and plug (1015/8) to the manifold. Torque the plug (1015/8) to 40 - 50 lb-in. (4.519 - 5.649 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the plug..

(21) Install thermocouple box and cable assembly (EGT TT4.95) for engines without the revised TT4.95 cable and PT4.95 sensing manifold for increased engine core clearance (Pre SB PW4ENG 72-134). See Figure 1016 (Sheets 1 and 2) and Figure 1017.

CAUTION: USE OF LUBRICANTS ON PT4.95 EEC MANIFOLD ASSEMBLY TUBES, ADAPTERS, OR PACKINGS COULD RESULT IN CONTAMINATION OF EEC.

(a) Remove nuts (1017/1) and (1017/2) and washers (1017/4) and (1017/3) from thermocouples (four locations) and attach TT4.95 harness leads to thermocouple and reinstall washers and nuts.

1 (Reference 2273) Torque alumel (larger) nuts to 18 - 22 lb-in. (2.034 - 2.486 N.m).

2 (Reference 2273) Torque chromel (smaller) nuts to 15 - 18 lb-in. (1.695 - 2.034 N.m).

(b) For average pressure and temperature probe located at 10 o'clock position, remove work bolt (1017/7) at lower front (scalloped) bolthole location. Secure cable clamp with engine bolt, threads lubricated with Engine Oil P03−001. Tighten all three bolts to 54 − 60 lb−in. (6.101 − 6.779 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts.

(c) Secure cable clamps to brackets and to clamps on adjacent PT4.95 manifold. Secure with bolts (1017/5) threads lubricated with Engine Oil P03−001, and nuts (1017/6). Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(d) Position cables over support (1017/5) as shown in Figure 1017. Install rear end of support to bracket on Flange T. Secure support with two bolts (1017/7), threads lubricated with Engine Oil P03−001. Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). Temporarily secure opposite end of support to Flange P with workbolts and nuts.

(e) Install bracket (inner front) (1017/4) and (inner rear) (1017/8) to support over cables as shown in referenced figure. Secure brackets with bolts (1017/6), threads lubricated with Engine Oil P03−001. Torque bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(f) Install box and cable assembly cover (1017/3) to bracket (1017/1) on Flange P. Lubricate threads of bracket studs with Engine Oil P03−001, and secure junction box to bracket with nuts. Torque nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m).

(22) Install thermocouple box and cable assembly (EGT TT4.95) for engines with the revised TT4.95 cable and PT4.95 sensing manifold for increased engine core clearance (Post SB PW4ENG 72−134). See Figure 1018.

(a) Install the box and cable assembly to the bracket on Flange P. Lubricate the threads on the bracket studs with Engine Oil P03−001, and attach the junction box to the bracket with nuts. Torque the nuts to 32 − 36 lb−in. (3.616 − 4.067 N.m). See View J.

(b) Remove the nuts and lockwashers from the thermocouple terminal studs at the four thermocouple locations. Install the thermocouple cable leads to the thermocouple studs. Install the lockwashers and nuts (stepped washer face next to the lockwasher) handtight only. See Views A, C, E, and I.

(c) Attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position with a bolt, threads lubricated with Silver Goop P06−023. Torque the three bolts to 54 − 60 lb−in. (6.101 − 6.779 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 to safety the bolts. See View E.

(d) Clamp the top two thermocouple leads at the 10 o'clock thermocouple to the bracket brazed on the EEC PT4.95 tube. Attach the clamp with bolt, threads lubricated with Engine Oil P03−001, and a nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View E.

(e) Install the cable clamps to the brackets adjacent to the thermocouples. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Views A and C.

(f) Install the cable clamps and the EEC PT4.95 tube/ manifold clamps to the brackets on Flange T at five locations. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Views G and H.

(g) Install the cable clamps to the brackets on Flange T at five locations. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, and nuts. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View B.

(h) Install the cable clamp to the bracket brazed on the EEC PT4.95 manifold at the 4:30 o'clock position. Attach the clamp with bolt, threads lubricated with Engine Oil P03−001, and a nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View C.

(i) Clamp the bottom two thermocouple leads at the 4:30 o'clock thermocouple to the EEC PT4.95 manifold, 1/2 inch (12.700 mm) from the manifold nut. Attach the leads with two clamps, bolt, threads lubricated with Engine Oil P03−001, and a nut. Torque the nut to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View C.

(j) Install the cable clamp to the bracket brazed on the EEC PT4.95 tube. Attach the clamp with bolt, threads lubricated with Engine Oil P03−001 and nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View F.

(k) Install the cable clamps, and a clamp on the bottom two thermocouple leads, to the bracket adjacent to the thermocouple at the 7 o'clock position. Attach the clamps with bolts, threads lubricated with Engine Oil P03−001, nuts and spacer. Install the spacer between the lead clamp and the cable clamp. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View I.

(l) Make a loop in the thermocouple cable adjacent to the 7 o'clock thermocouple. Attach the cable clamp, nearest to the loop, to the rear support bracket with a bolt, threads lubricated with Engine Oil P03−001. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View J.

(m) Install the rear positioning plate with the rear spacer inside the cable/thermocouple lead loop and the front spacer inside the cable adjacent to the cable clamp. Attach the positioning plate to the rear support bracket with four bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View J.

(n) Make a loop in the thermocouple cable adjacent to the junction box. Attach the cable clamp, nearest to the loop, to the front support bracket with a bolt, threads lubricated with Engine Oil P03−001. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View J.

(o) Install the front positioning plate on the two cables with the spacers, inboard, between the cables. Attach the plate to the front support bracket with two bolts, threads lubricated with Engine Oil P03−001. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519). See View J.

NOTE: The cables installed below the positioning plate will be compressed by the plate when torquing the bolts.

(p) Install the positioning plate on the thermocouple cable at approximately the 5 o'clock position. Install the cable to the left of the inner spacer and to the right of the outer spacer on the plate. Attach the positioning plate and the clamp on the EEC PT4.95 manifold to the support bracket with two bolts, threads lubricated with Engine Oil P03−001, and a nut. Torque the bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View D.

NOTE: The cable installed below the positioning plate will be compressed by the plate when torquing the bolts.

(q) Install the cable clamp to the inboard side of the reinforcing plate at the 5:30 o'clock position. Attach the clamp to the plate with a bolt, threads lubricated with Engine Oil P03−001, and a nut. Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m). See View D.

(r) Align the thermocouple cable leads attached to the studs on the thermocouple so they are parallel to one another. Torque the nuts at each thermocouple as follows:

1 (Reference 2273) Torque the alumel nuts (larger studs) to 18 − 22 lb−in. (2.034 − 2.486 N.m).

2 (Reference 2273) Torque the chromel nuts (smaller studs) to 15 − 18 lb−in. (1.695 − 2.034 N.m).

NOTE: After the nuts are torqued, make sure that the cable leads DO NOT CONTACT the adjacent bolt heads or lockwire.

Subtask 72−54−00−430−060:

(23) Use a Cherrymax rivet gun and head to install rivets PN 50P308 into the purge/drain holes at the 13 strut locations as shown in Figure 1019. See 70−43−00, Standard Practices Manual, PN 585005. If rivets were previously installed, it is permitted for some residual rivet material to remain inside the strut internal cavity.

Subtask 72−54−00−430−059:

(24) Remove turbine exhaust case from build stand.

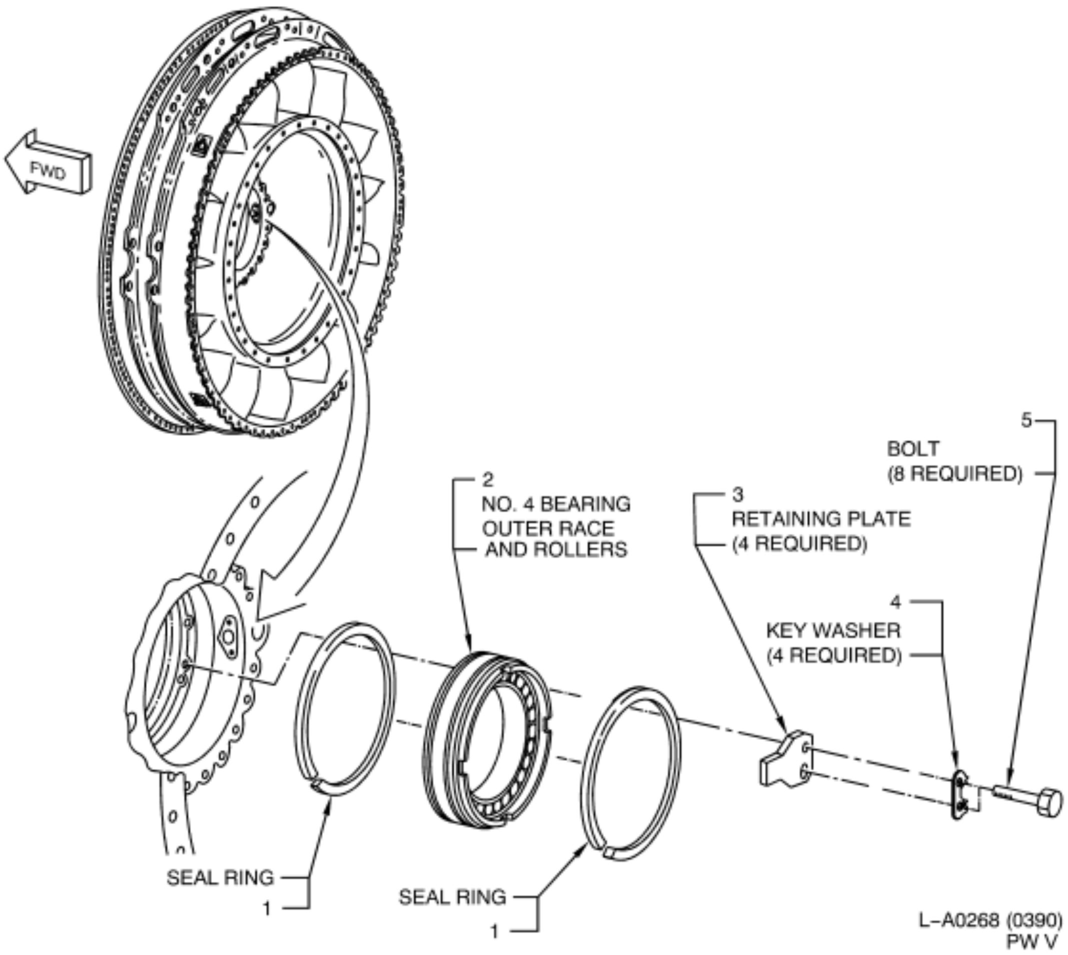
  (a) Remove ball lock pin from left bracket flange.

  (b) Open clamp securing flange brackets to vertical supports of build stand.

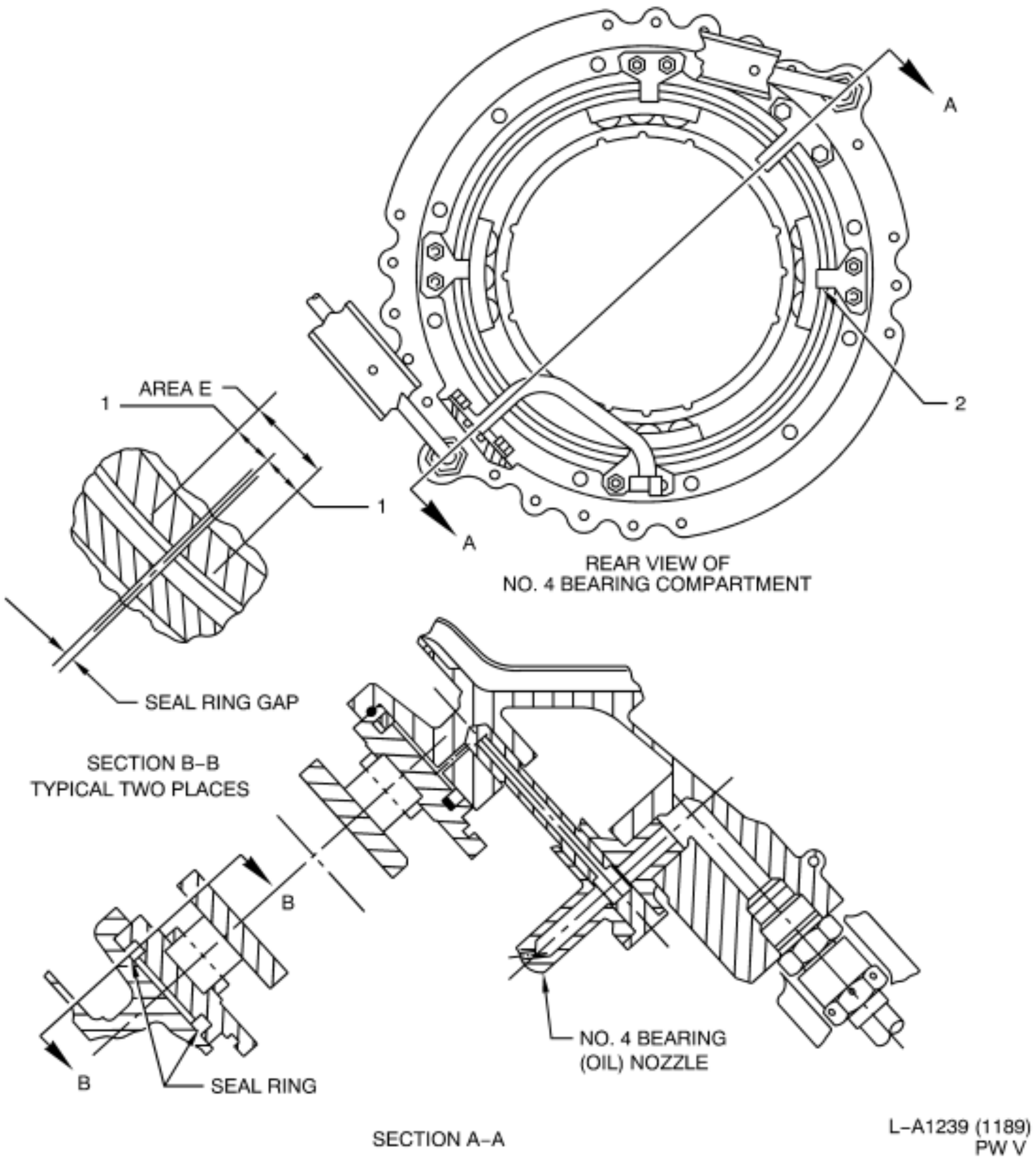
  (c) Attach PWA 28657 Sling to hoist. Attach sling to outer spools of brackets on turbine exhaust case with PWA 76154 Adapters.

  (d) Lift and trunnion case to rear end down position and lower onto pallet. Remove hoist, sling, adapters and brackets from case.

TURBINE EXHAUST CASE - ASSEMBLY-01


FWD
5
BOLT
(8 REQUIRED)
2
NO. 4 BEARING
OUTER RACE
AND ROLLERS
3
RETAINING PLATE
(4 REQUIRED)
4
KEY WASHER
(4 REQUIRED)
SEAL RING
1
SEAL RING
1
L-A0268 (0390)
PW V

No. 4 Bearing Outer Race Installation
Figure 1001
(Task 72-54-00-400-001)

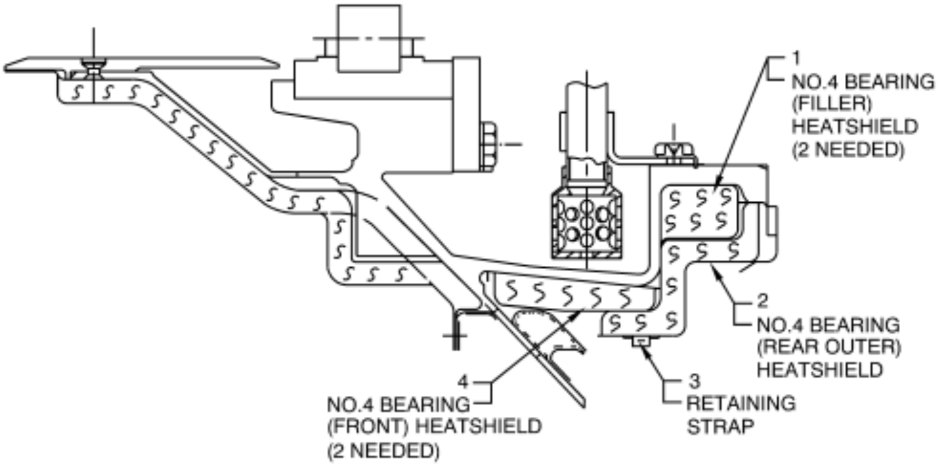

A
2
AREA E
1
1
A
REAR VIEW OF
NO. 4 BEARING COMPARTMENT
SEAL RING GAP
SECTION B-B
TYPICAL TWO PLACES
B
B
SEAL RING
NO. 4 BEARING
(OIL) NOZZLE
SECTION A-A
L-A1239 (1189)
PW V

No. 4 Bearing Outer Race Installation
Figure 1002
(Task 72-54-00-400-001)

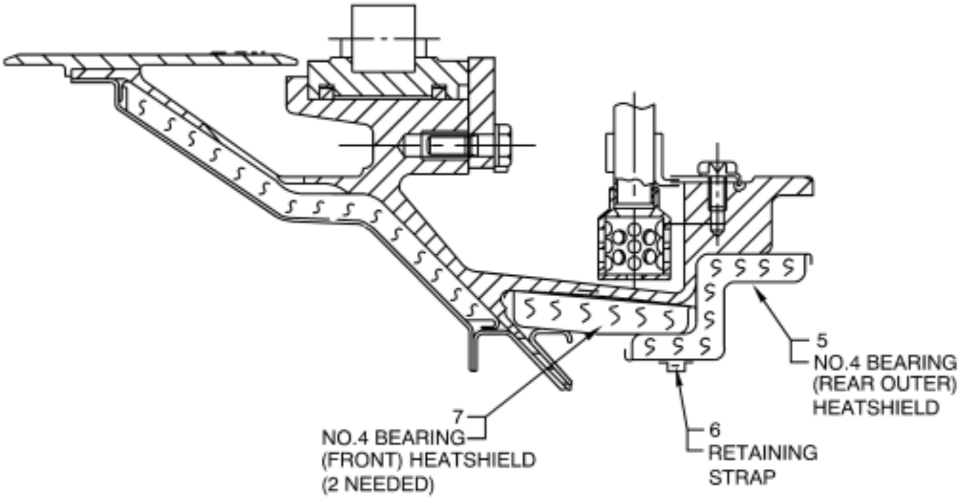
TURBINE EXHAUST CASE − ASSEMBLY−01

1. 0.500 Inch (12.700 mm) Maximum
2. (Reference 90) 0.010 − 0.050 Inch (0.254 − 1.270 mm), Four Locations

Key to Figure 1002


1
NO.4 BEARING
(FILLER)
HEATSHIELD
(2 NEEDED)
2
NO.4 BEARING
(REAR OUTER)
HEATSHIELD
3
RETAINING
STRAP
4
NO.4 BEARING
(FRONT) HEATSHIELD
(2 NEEDED)

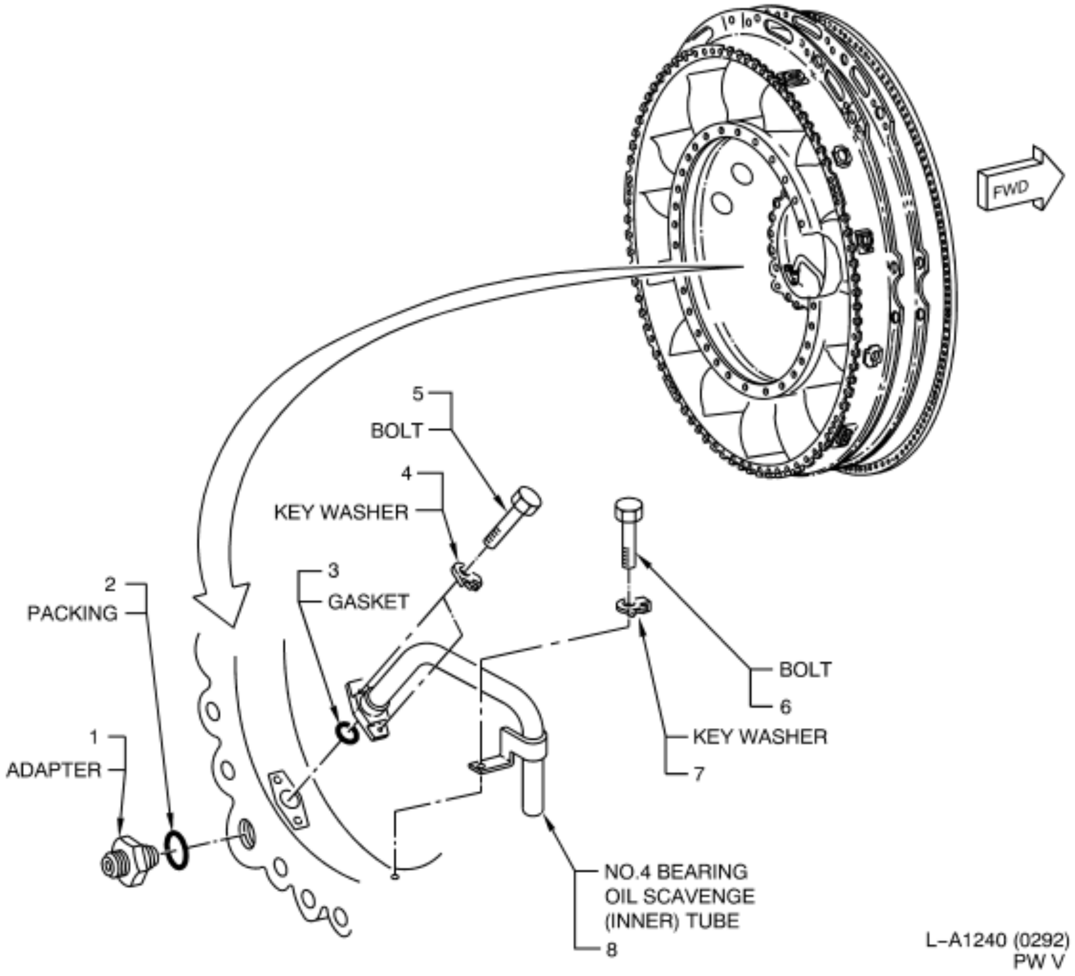
CONFIGURATION PRE SB PW4ENG 72-456


5
NO.4 BEARING
(REAR OUTER)
HEATSHIELD
6
RETAINING
STRAP
7
NO.4 BEARING
(FRONT) HEATSHIELD
(2 NEEDED)

LIGHTWEIGHT CASE
CONFIGURATION POST SB PW4ENG 72-456

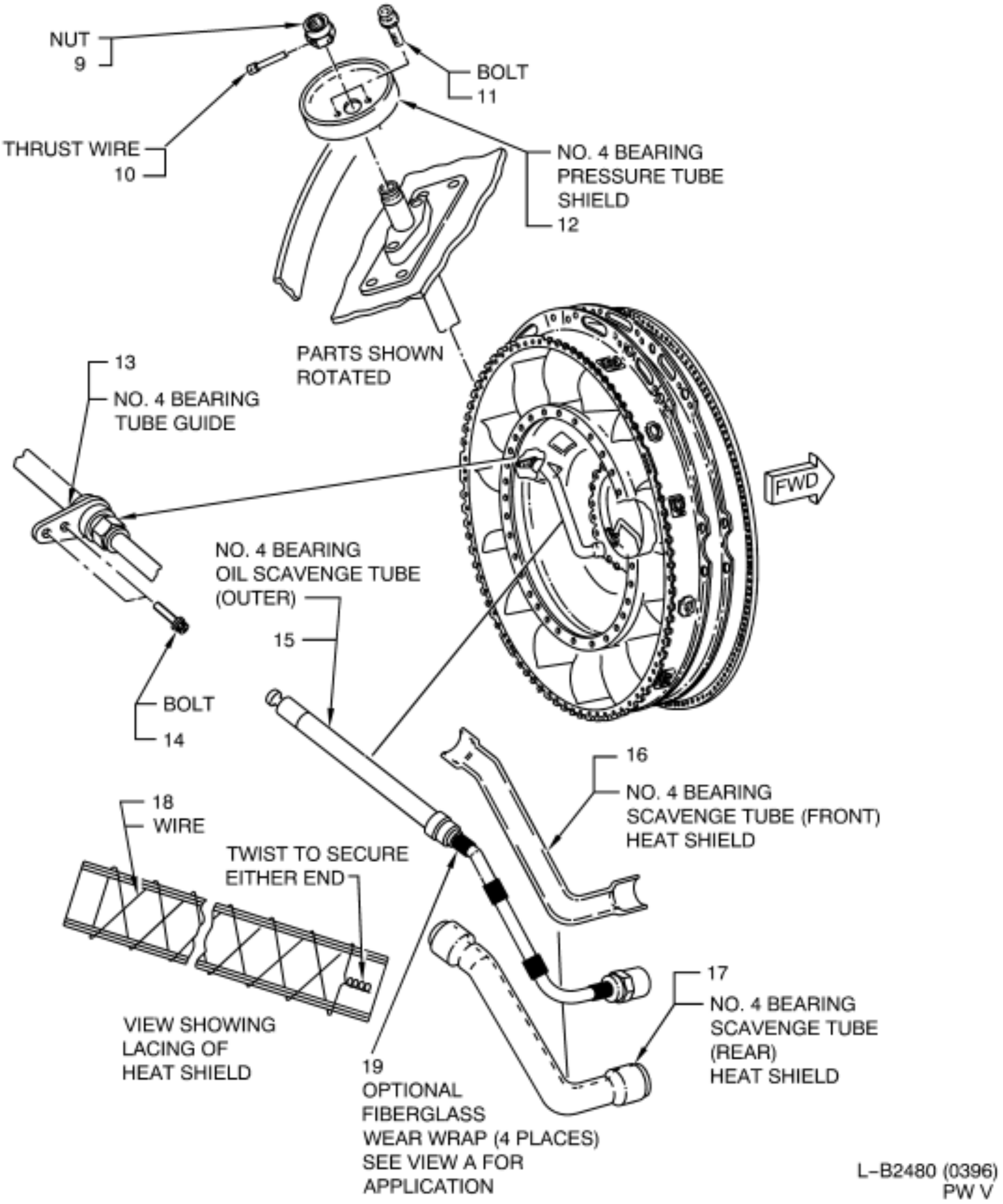
L-A8688 (0000)
PW V

Install No. 4 Bearing Rear Inner Heat Shields
Figure 1003
(Task 72-54-00-400-001)


FWD
5
BOLT
4
KEY WASHER
3
GASKET
2
PACKING
1
ADAPTER
BOLT
6
KEY WASHER
7
NO.4 BEARING
OIL SCAVENGE
(INNER) TUBE
8
L-A1240 (0292)
PW V

No. 4 Bearing Scavenge Tubes Installation
Figure 1004 (Sheet 1)
(Task 72-54-00-400-001)

TURBINE EXHAUST CASE - ASSEMBLY-01


NUT
9
BOLT
11
THRUST WIRE
10
NO. 4 BEARING
PRESSURE TUBE
SHIELD
12
13
NO. 4 BEARING
TUBE GUIDE
PARTS SHOWN
ROTATED
FWD
NO. 4 BEARING
OIL SCAVENGE TUBE
(OUTER)
15
BOLT
14
16
NO. 4 BEARING
SCAVENGE TUBE (FRONT)
HEAT SHIELD
18
WIRE
TWIST TO SECURE
EITHER END
17
NO. 4 BEARING
SCAVENGE TUBE
(REAR)
HEAT SHIELD
VIEW SHOWING
LACING OF
HEAT SHIELD
19
OPTIONAL
FIBERGLASS
WEAR WRAP (4 PLACES)
SEE VIEW A FOR
APPLICATION
L-B2480 (0396)
PW V

No. 4 Bearing Scavenge Tubes Installation (Pre SB PW4ENG 79-76)
Figure 1004 (Sheet 2)
(Task 72-54-00-400-001)

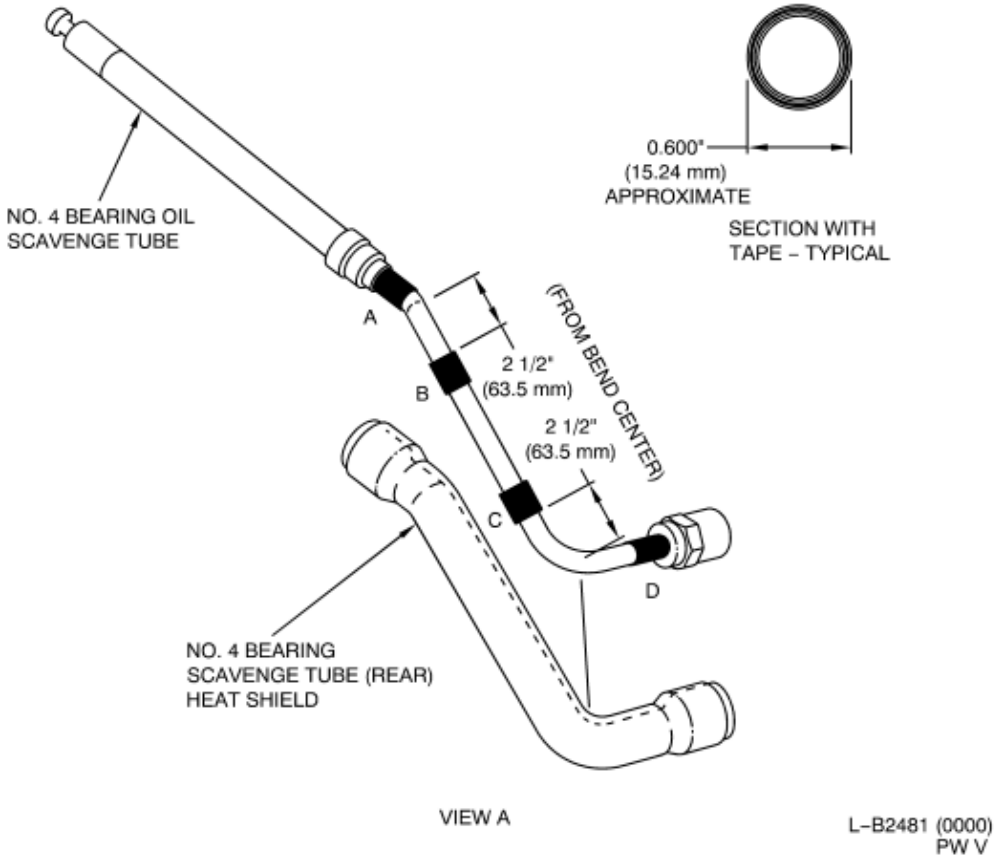
TURBINE EXHAUST CASE - ASSEMBLY-01

1. WRAP 1.00 INCH (25.400 mm) WIDE FIBERGLASS TAPE, P05-136, AT FOUR (4) LOCATIONS:

   -A & D AT TUBE ENDS AS SHOWN

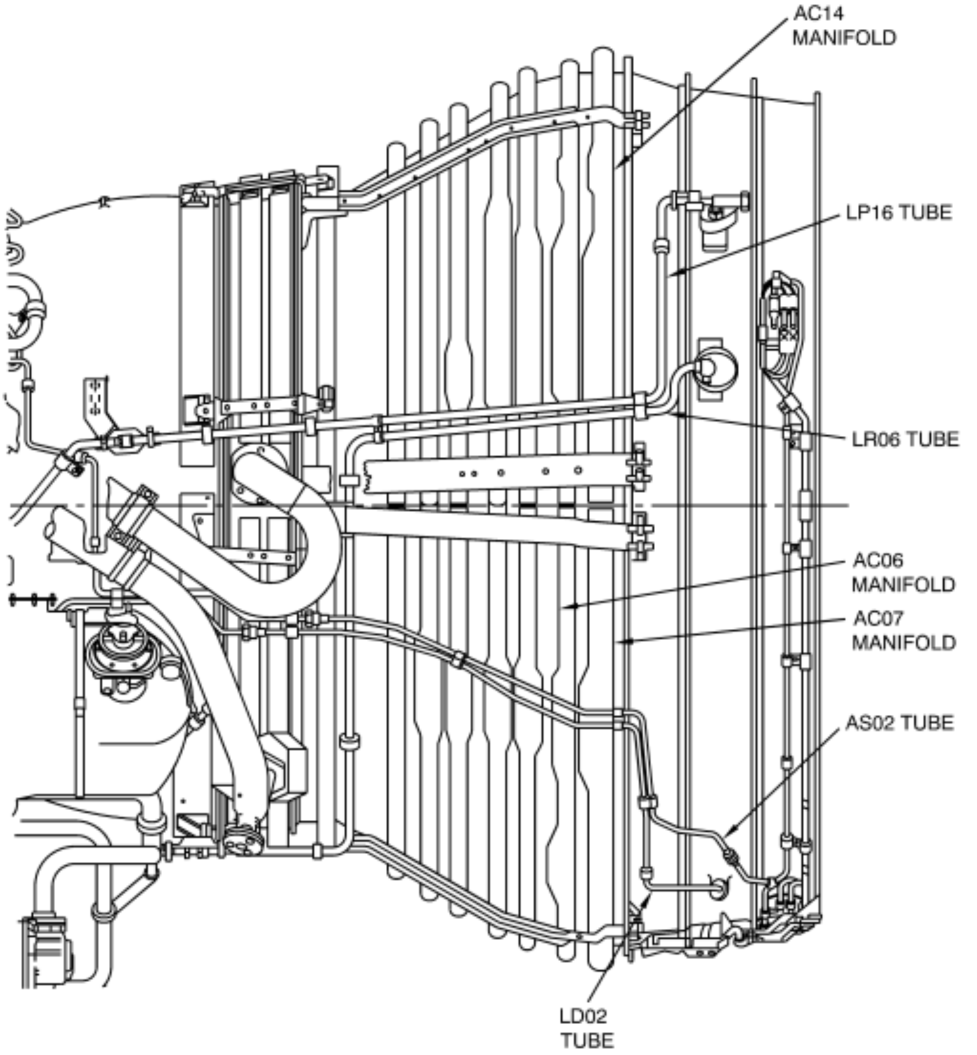
   -B & C AT STRAIGHT SECTION AS SHOWN

2. WRAP TAPE TO BE 0.600 INCH DIAMETER (15.240 mm) AND ABOUT 0.100 INCH (2.54 mm) HEIGHT ABOVE TUBE SURFACE.


0.600"
(15.24 mm)
APPROXIMATE
SECTION WITH
TAPE - TYPICAL
NO. 4 BEARING OIL
SCAVENGE TUBE
A
B
2 1/2"
(63.5 mm)
(FROM BEND CENTER)
2 1/2"
(63.5 mm)
C
D
NO. 4 BEARING
SCAVENGE TUBE (REAR)
HEAT SHIELD
VIEW A
L-B2481 (0000)
PW V

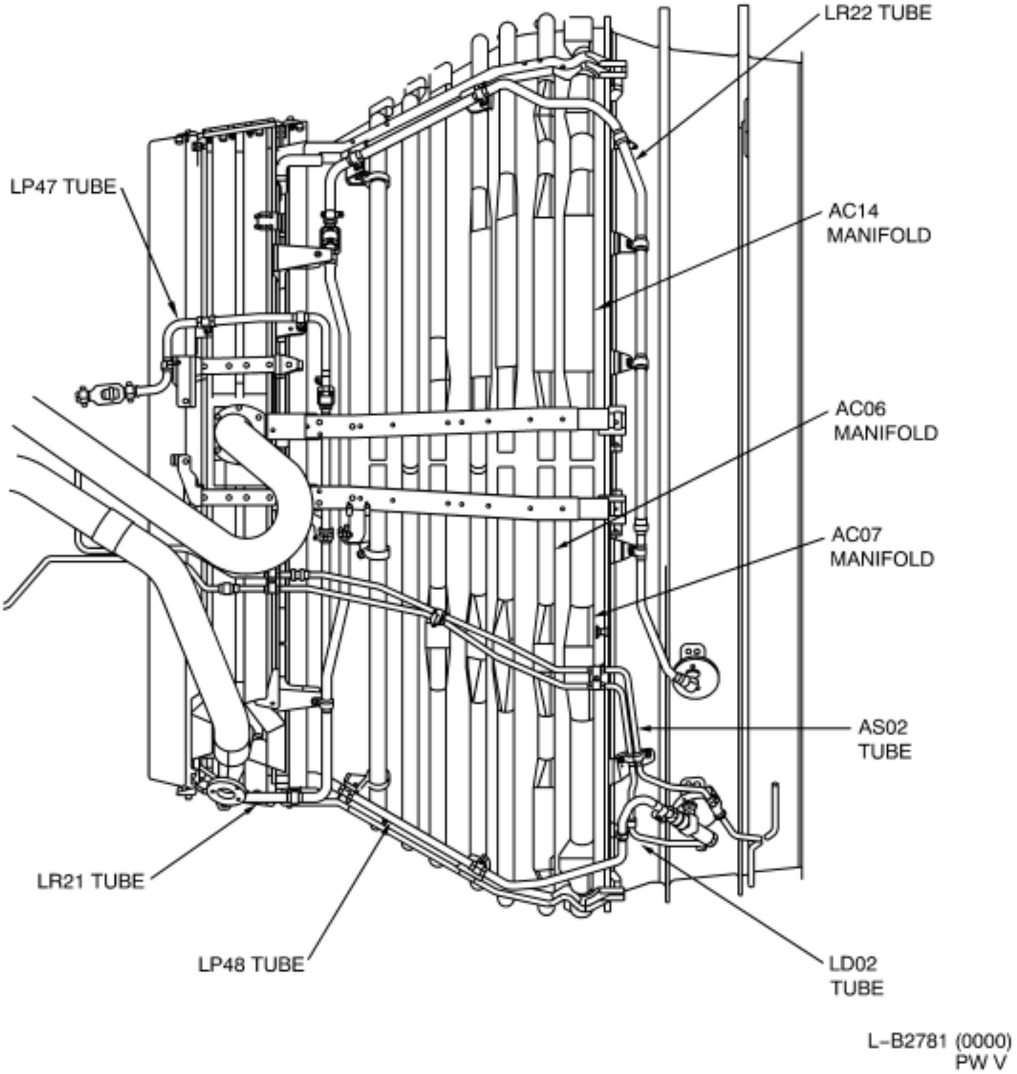
No. 4 Bearing Scavenge Tube Installation Optional Chafing Wear Prevention (Pre SB PW4ENG 79-76)
Figure 1004 (Sheet 3)
(Task 72-54-00-400-001)

TURBINE EXHAUST CASE − ASSEMBLY−01

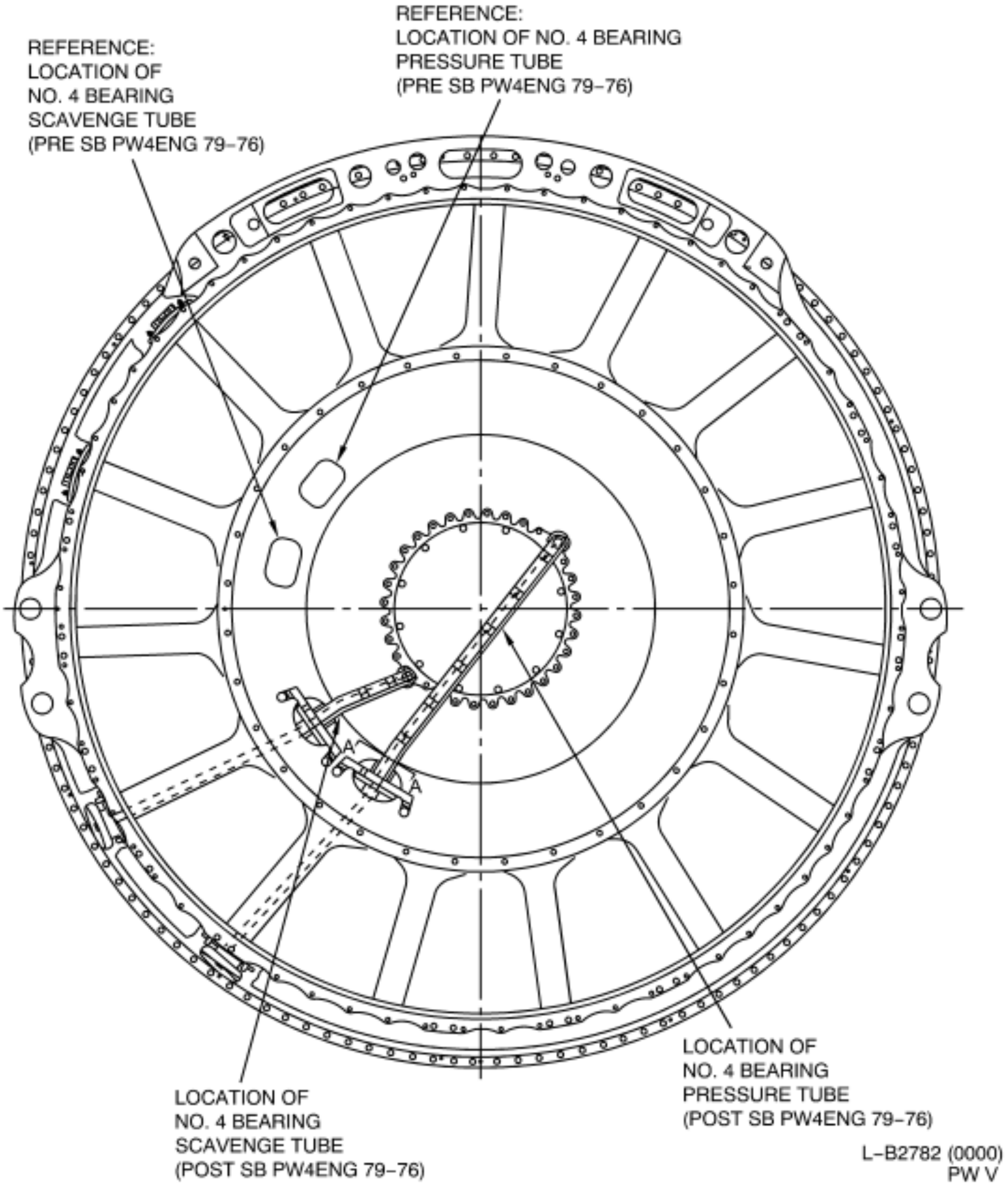

AC14
MANIFOLD
LP16 TUBE
LR06 TUBE
AC06
MANIFOLD
AC07
MANIFOLD
AS02 TUBE
LD02
TUBE

L−B2780 (0000)
PW V

Routing Of The No. 4 Bearing Scavenge
And Pressure Tubes (Pre SB PW4ENG 79−76)
Figure 1005 (Sheet 1)
(Task 72−54−00−400−001)

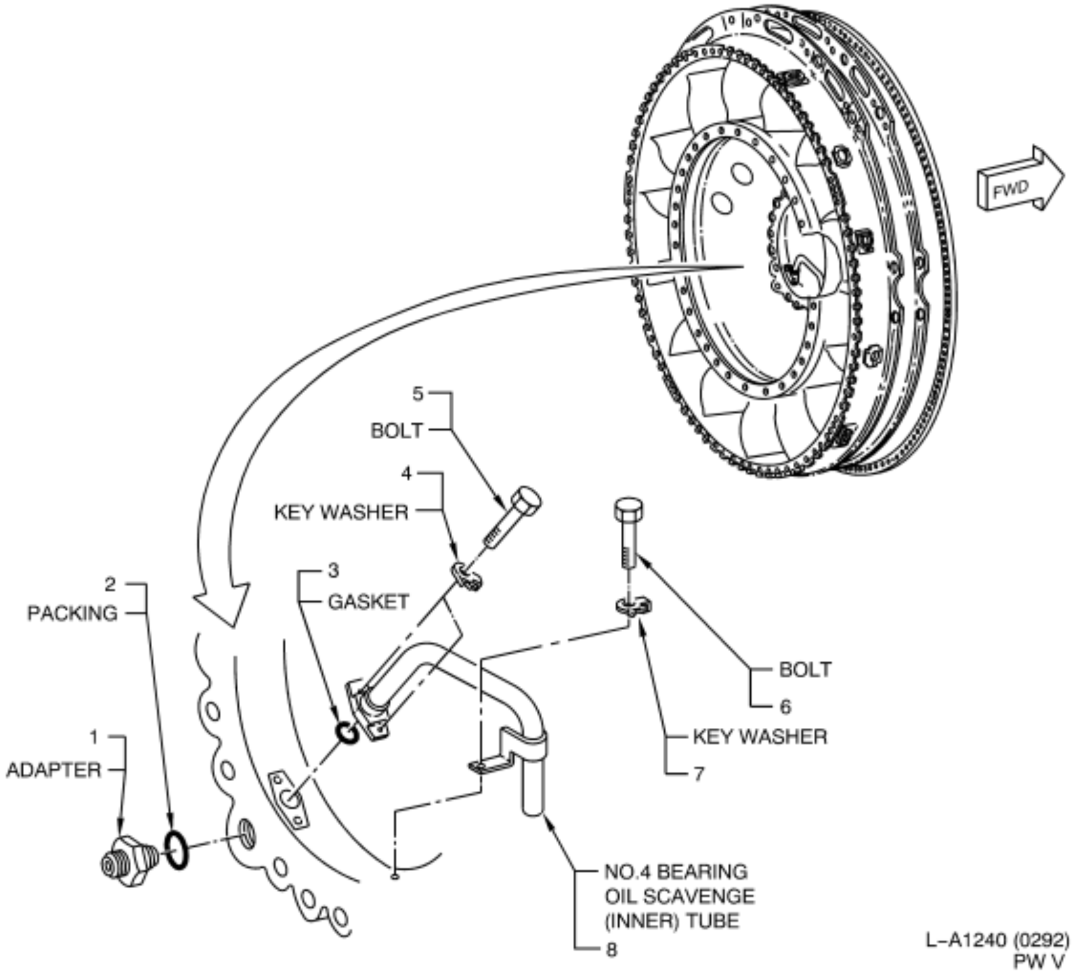

LR22 TUBE
LP47 TUBE
AC14 MANIFOLD
AC06 MANIFOLD
AC07 MANIFOLD
AS02 TUBE
LR21 TUBE
LP48 TUBE
LD02 TUBE
L-B2781 (0000)
PW V

Routing Of The No. 4 Bearing Scavenge
And Pressure Tubes (Post SB PW4ENG 79-76)
Figure 1005 (Sheet 2)
(Task 72-54-00-400-001)

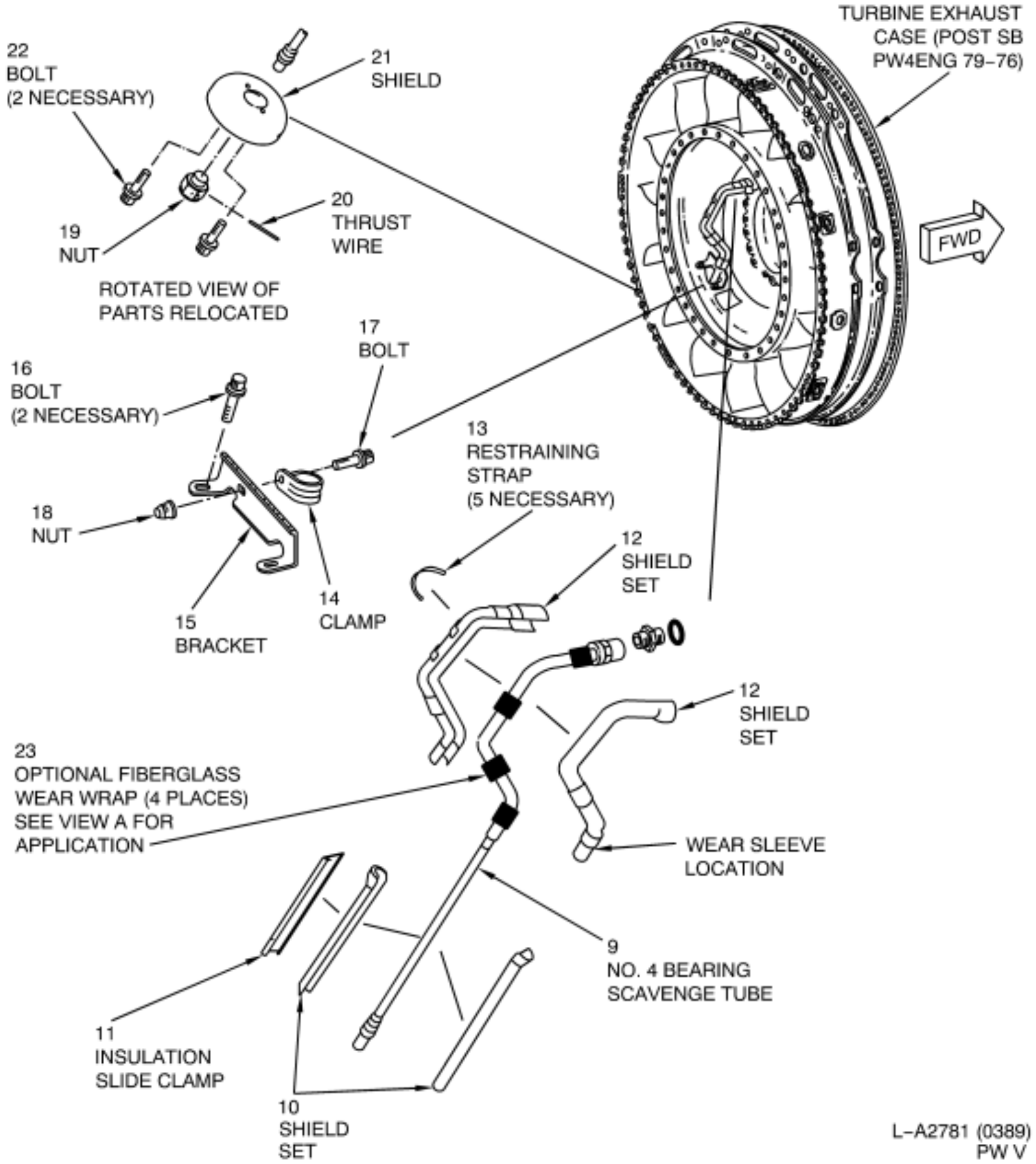

REFERENCE:
LOCATION OF NO. 4 BEARING
PRESSURE TUBE
(PRE SB PW4ENG 79-76)
REFERENCE:
LOCATION OF
NO. 4 BEARING
SCAVENGE TUBE
(PRE SB PW4ENG 79-76)
A
A
LOCATION OF
NO. 4 BEARING
PRESSURE TUBE
(POST SB PW4ENG 79-76)
LOCATION OF
NO. 4 BEARING
SCAVENGE TUBE
(POST SB PW4ENG 79-76)
L-B2782 (0000)
PW V

Routing Of The No. 4 Bearing Scavenge
And Pressure Tubes (Post SB PW4ENG 79-76)
Figure 1005 (Sheet 3)
(Task 72-54-00-400-001)

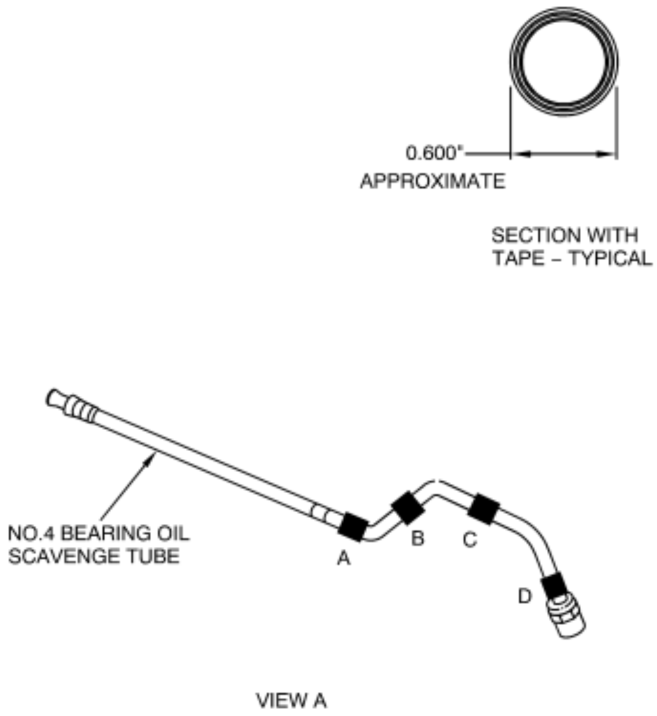
TURBINE EXHAUST CASE - ASSEMBLY-01


FWD
5
BOLT
4
KEY WASHER
2
PACKING
3
GASKET
BOLT
6
KEY WASHER
7
1
ADAPTER
NO.4 BEARING
OIL SCAVENGE
(INNER) TUBE
8
L-A1240 (0292)
PW V

No. 4 Bearing Scavenge Tubes Installation
Figure 1005 (Sheet 4)
(Task 72-54-00-400-001)


22
BOLT
(2 NECESSARY)
21
SHIELD
TURBINE EXHAUST
CASE (POST SB
PW4ENG 79-76)
20
THRUST
WIRE
19
NUT
ROTATED VIEW OF
PARTS RELOCATED
FWD
17
BOLT
16
BOLT
(2 NECESSARY)
13
RESTRAINING
STRAP
(5 NECESSARY)
18
NUT
12
SHIELD
SET
15
BRACKET
14
CLAMP
12
SHIELD
SET
23
OPTIONAL FIBERGLASS
WEAR WRAP (4 PLACES)
SEE VIEW A FOR
APPLICATION
WEAR SLEEVE
LOCATION
9
NO. 4 BEARING
SCAVENGE TUBE
11
INSULATION
SLIDE CLAMP
10
SHIELD
SET
L-A2781 (0389)
PW V

Installation Of The No. 4 Bearing
Scavenge Tube (Post SB PW4ENG 79-76)
Figure 1005 (Sheet 5)
(Task 72-54-00-400-001)



1. WRAP 1.00 INCH (25.400 mm) WIDE FIBERGLASS TAPE, P05−136, AT FOUR (4) LOCATIONS:

   −A & D AT TUBE ENDS AS SHOWN

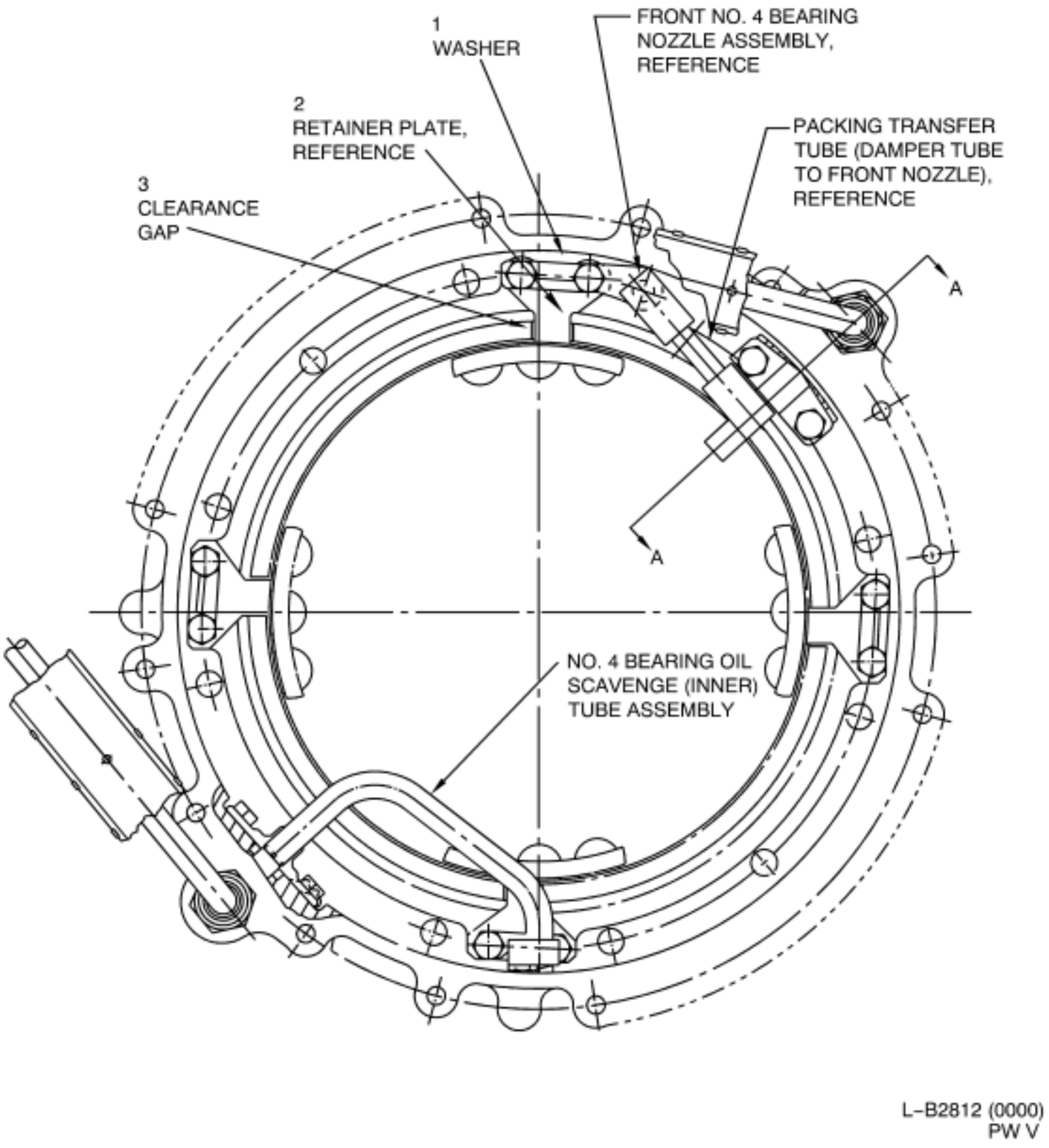
   −B & C − CENTERED ON STRAIGHT SECTIONS AS SHOWN

2. WRAP TAPE TO BE 0.600 INCH DIAMETER (15.240 mm) AND ABOUT 0.100 INCH (2.54 mm) HEIGHT ABOVE TUBE SURFACE.

0.600"
APPROXIMATE
SECTION WITH
TAPE − TYPICAL
NO.4 BEARING OIL
SCAVENGE TUBE
A
B
C
D
VIEW A

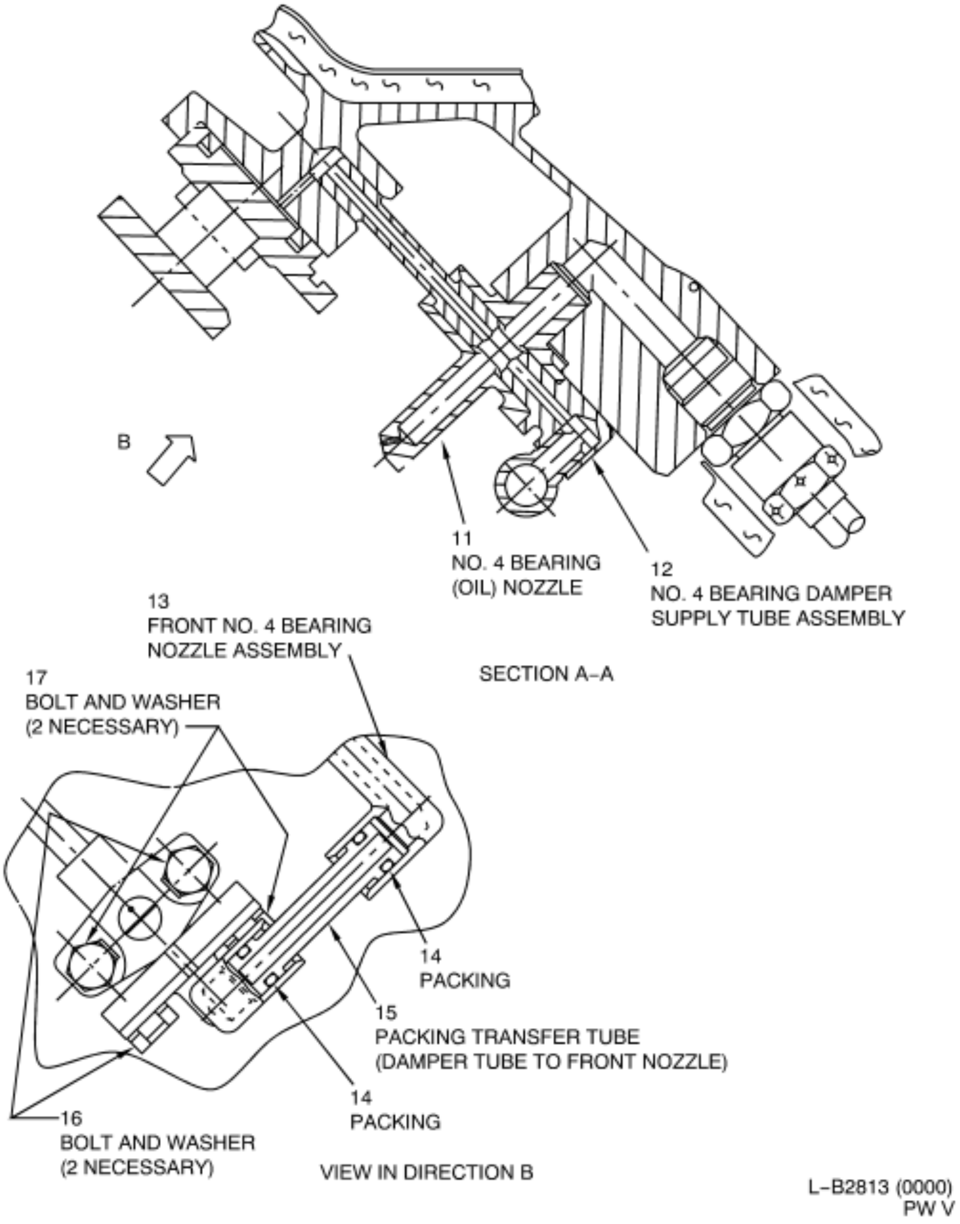
L−B2798 (0000)
PW V

No. 4 Bearing Scavenge Tube Installation Optional Chafing Wear Prevention (Post SB PW4ENG 79−76)
Figure 1005 (Sheet 6)
(Task 72−54−00−400−001)

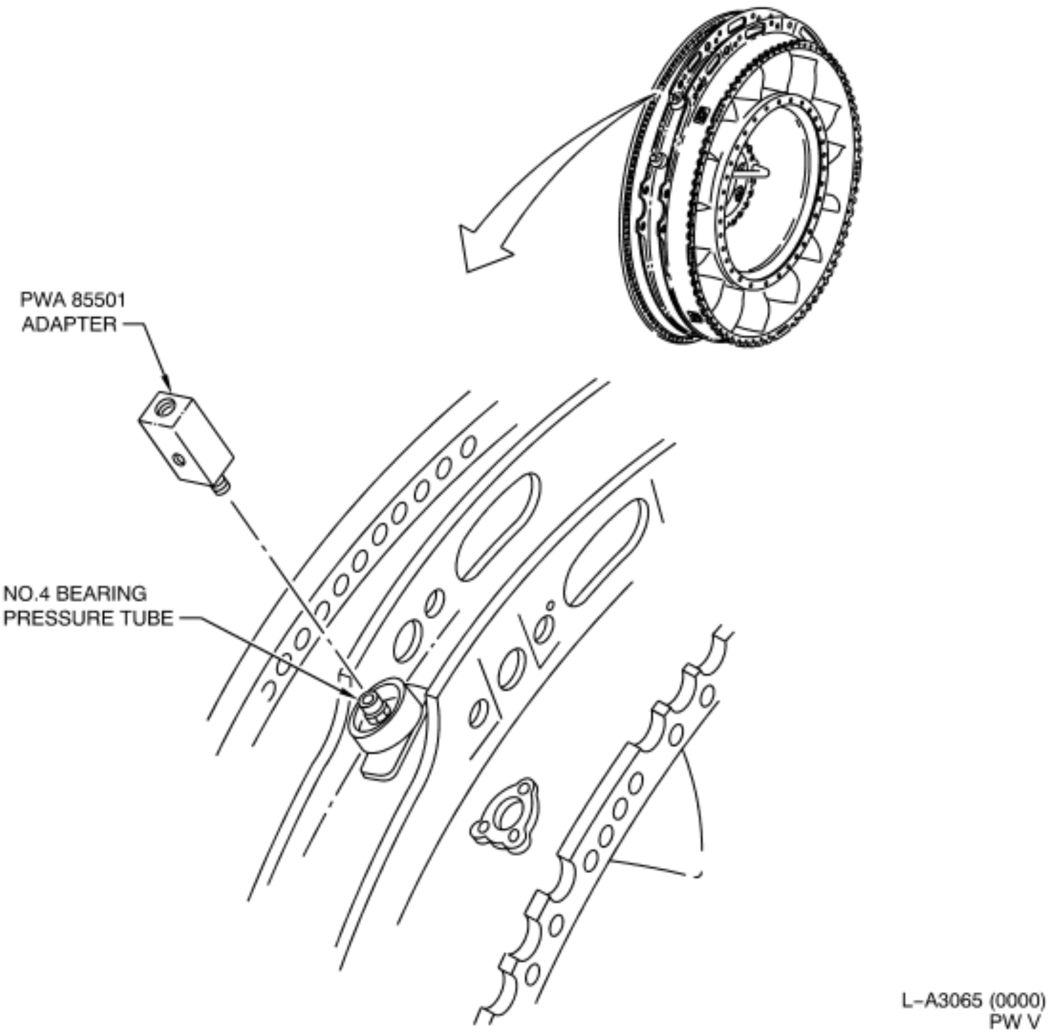

1
WASHER
FRONT NO. 4 BEARING
NOZZLE ASSEMBLY,
REFERENCE
2
RETAINER PLATE,
REFERENCE
PACKING TRANSFER
TUBE (DAMPER TUBE
TO FRONT NOZZLE),
REFERENCE
3
CLEARANCE
GAP
A
A
NO. 4 BEARING OIL
SCAVENGE (INNER)
TUBE ASSEMBLY
L-B2812 (0000)
PW V

No. 4 Bearing (Oil) Nozzle And Front Nozzle Installation
Figure 1006 (Sheet 1)
(Task 72-54-00-400-001)

TURBINE EXHAUST CASE - ASSEMBLY-01

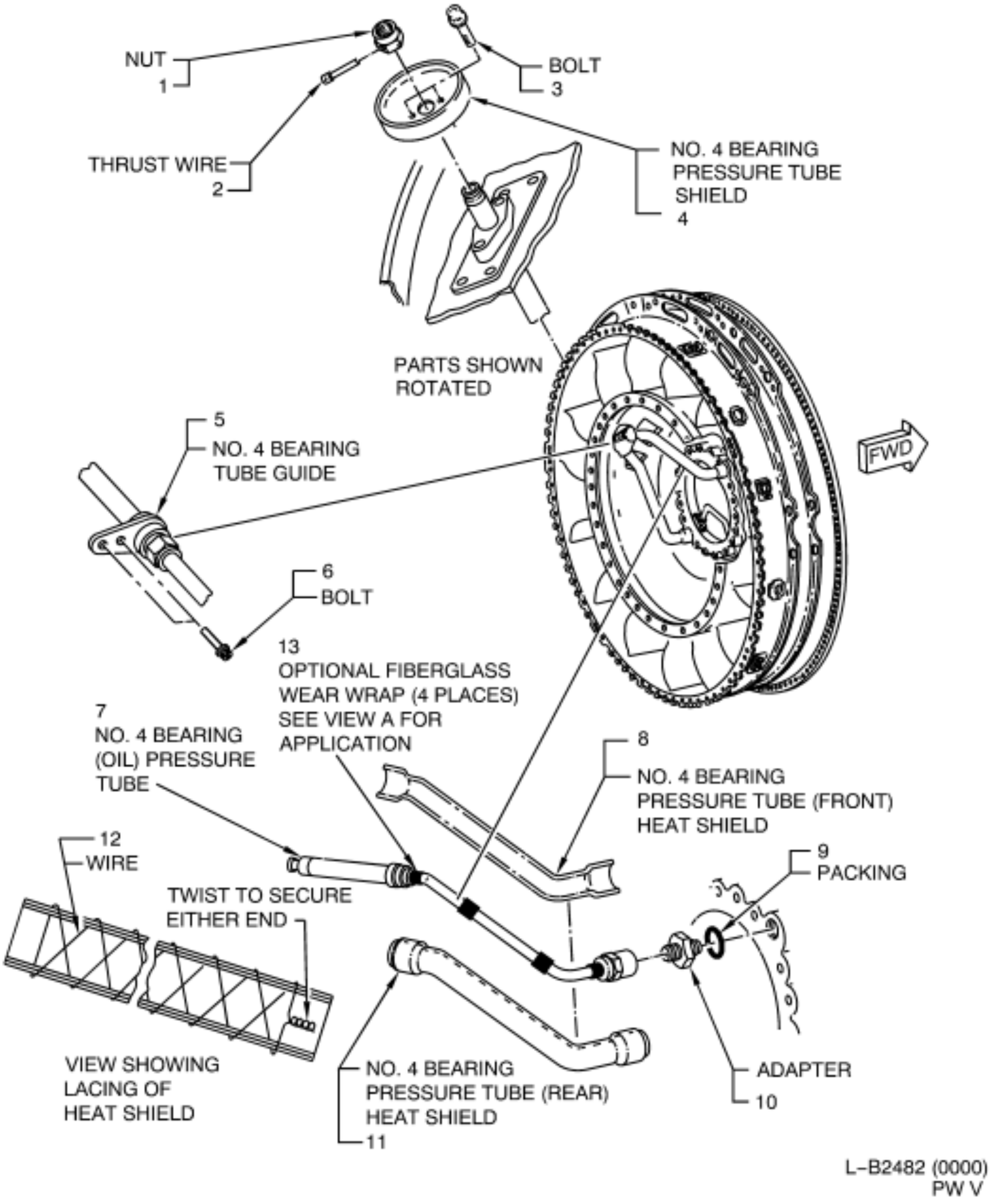

B
11
NO. 4 BEARING
(OIL) NOZZLE
12
NO. 4 BEARING DAMPER
SUPPLY TUBE ASSEMBLY
13
FRONT NO. 4 BEARING
NOZZLE ASSEMBLY
SECTION A-A
17
BOLT AND WASHER
(2 NECESSARY)
14
PACKING
15
PACKING TRANSFER TUBE
(DAMPER TUBE TO FRONT NOZZLE)
14
PACKING
16
BOLT AND WASHER
(2 NECESSARY)
VIEW IN DIRECTION B
L-B2813 (0000)
PW V

No. 4 Bearing (Oil) Nozzle And Front Nozzle Installation
Figure 1006 (Sheet 2)
(Task 72-54-00-400-001)


PWA 85501
ADAPTER
NO.4 BEARING
PRESSURE TUBE
L-A3065 (0000)
PW V

No. 4 Bearing Oil Nozzle Pressure Check
Figure 1006 (Sheet 3)
(Task 72-54-00-400-001)

TURBINE EXHAUST CASE - ASSEMBLY-01


NUT
1
BOLT
3
THRUST WIRE
2
NO. 4 BEARING PRESSURE TUBE SHIELD
4
PARTS SHOWN ROTATED
5
NO. 4 BEARING TUBE GUIDE
FWD
6
BOLT
13
OPTIONAL FIBERGLASS WEAR WRAP (4 PLACES) SEE VIEW A FOR APPLICATION
7
NO. 4 BEARING (OIL) PRESSURE TUBE
8
NO. 4 BEARING PRESSURE TUBE (FRONT) HEAT SHIELD
12
WIRE
TWIST TO SECURE EITHER END
9
PACKING
VIEW SHOWING LACING OF HEAT SHIELD
NO. 4 BEARING PRESSURE TUBE (REAR) HEAT SHIELD
11
ADAPTER
10
L-B2482 (0000)
PW V

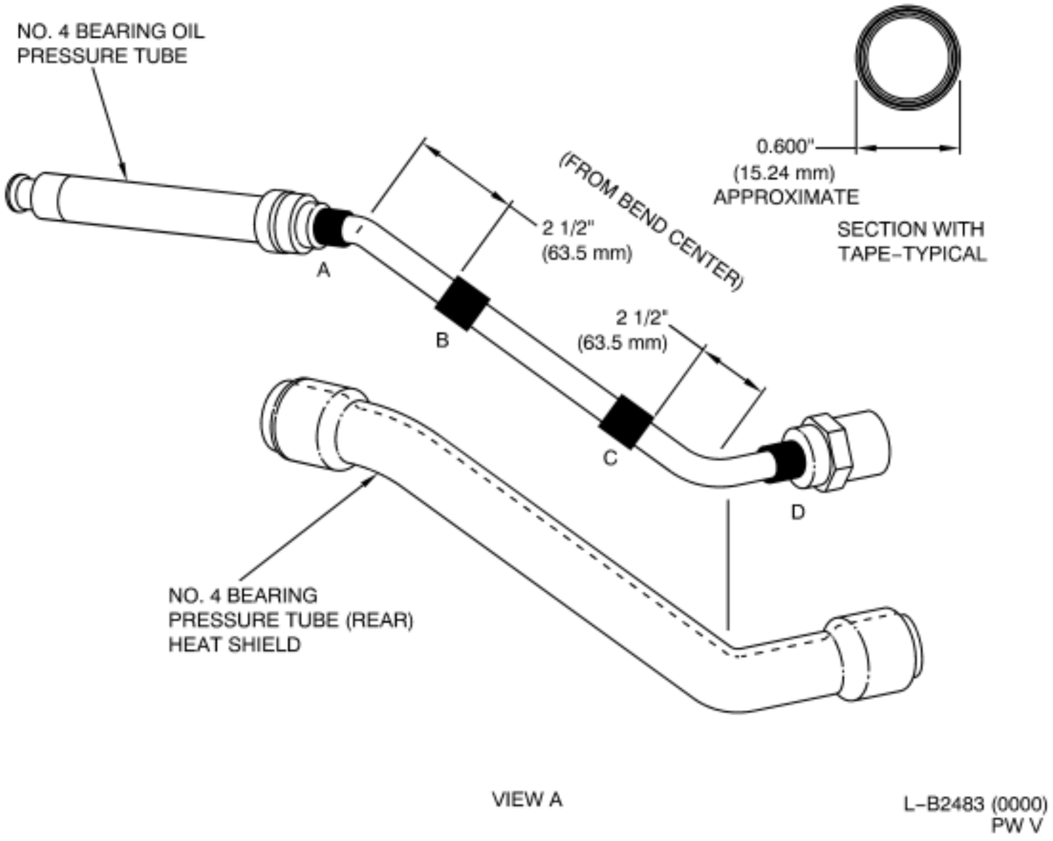
No. 4 Bearing Pressure Tube Installation (Pre SB PW4ENG 79-76)
Figure 1007 (Sheet 1)
(Task 72-54-00-400-001)

1. WRAP 1.00 INCH (25.400 mm) WIDE FIBERGLASS TAPE, P05-136, AT FOUR (4) LOCATIONS:

   -A & D AT TUBE ENDS AS SHOWN

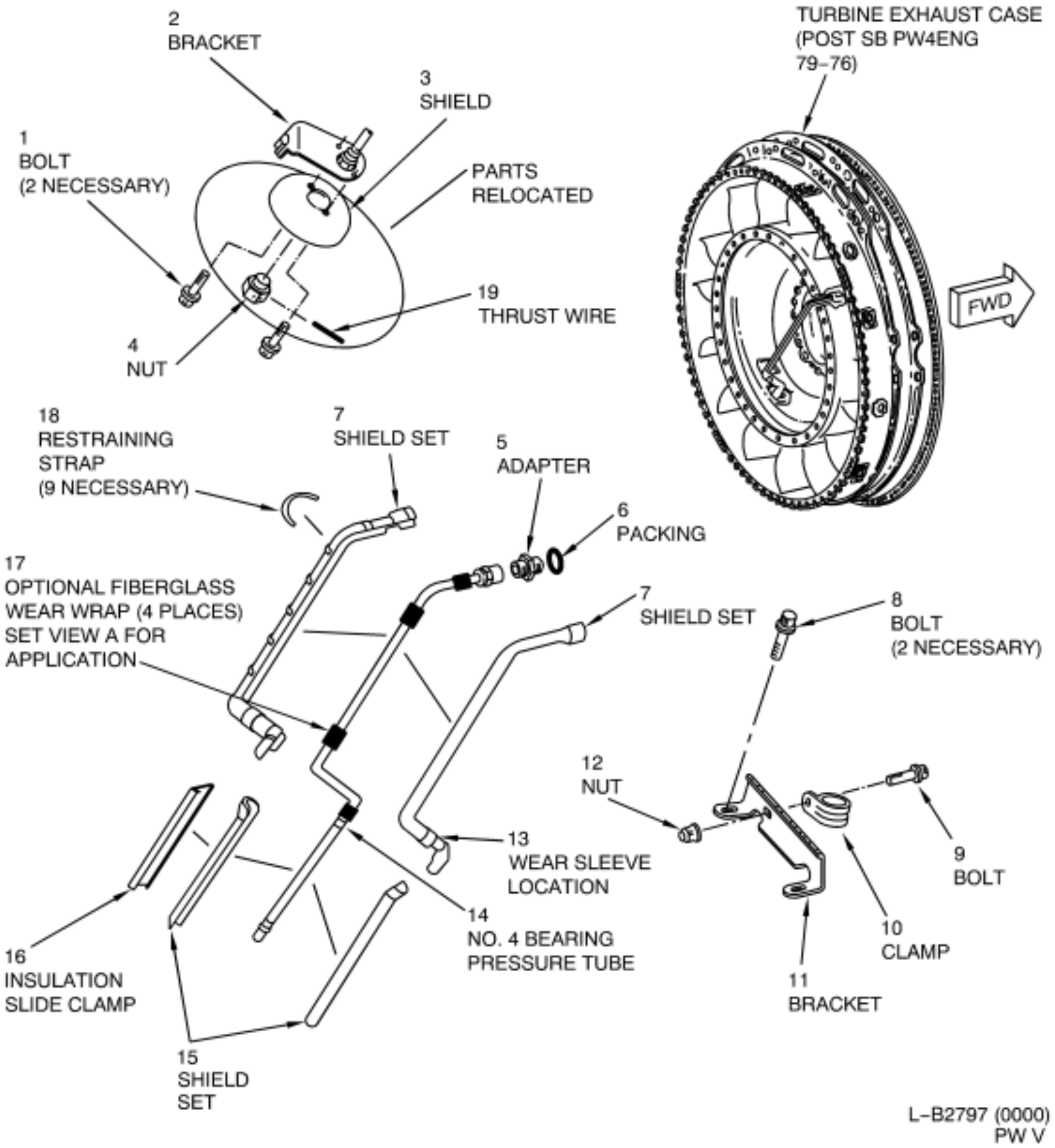
   -B & C AT STRAIGHT SECTION AS SHOWN

2. WRAP TAPE TO BE 0.600 INCH DIAMETER (15.240 mm) AND ABOUT 0.100 INCH (2.54 mm) HEIGHT ABOVE TUBE SURFACE.


NO. 4 BEARING OIL PRESSURE TUBE
2 1/2" (63.5 mm)
(FROM BEND CENTER)
0.600" (15.24 mm) APPROXIMATE
SECTION WITH TAPE-TYPICAL
A
B
2 1/2" (63.5 mm)
C
D
NO. 4 BEARING PRESSURE TUBE (REAR) HEAT SHIELD
VIEW A
L-B2483 (0000)
PW V

No. 4 Bearing Pressure Tube Installation (Pre SB PW4ENG 79-76) Optional Chafing Wear Protection
Figure 1007 (Sheet 2)
(Task 72-54-00-400-001)

TURBINE EXHAUST CASE - ASSEMBLY-01


2
BRACKET
3
SHIELD
1
BOLT
(2 NECESSARY)
PARTS
RELOCATED
19
THRUST WIRE
4
NUT
TURBINE EXHAUST CASE
(POST SB PW4ENG
79-76)
FWD
18
RESTRAINING
STRAP
(9 NECESSARY)
7
SHIELD SET
5
ADAPTER
6
PACKING
17
OPTIONAL FIBERGLASS
WEAR WRAP (4 PLACES)
SET VIEW A FOR
APPLICATION
7
SHIELD SET
8
BOLT
(2 NECESSARY)
12
NUT
13
WEAR SLEEVE
LOCATION
9
BOLT
14
NO. 4 BEARING
PRESSURE TUBE
10
CLAMP
11
BRACKET
16
INSULATION
SLIDE CLAMP
15
SHIELD
SET
L-B2797 (0000)
PW V

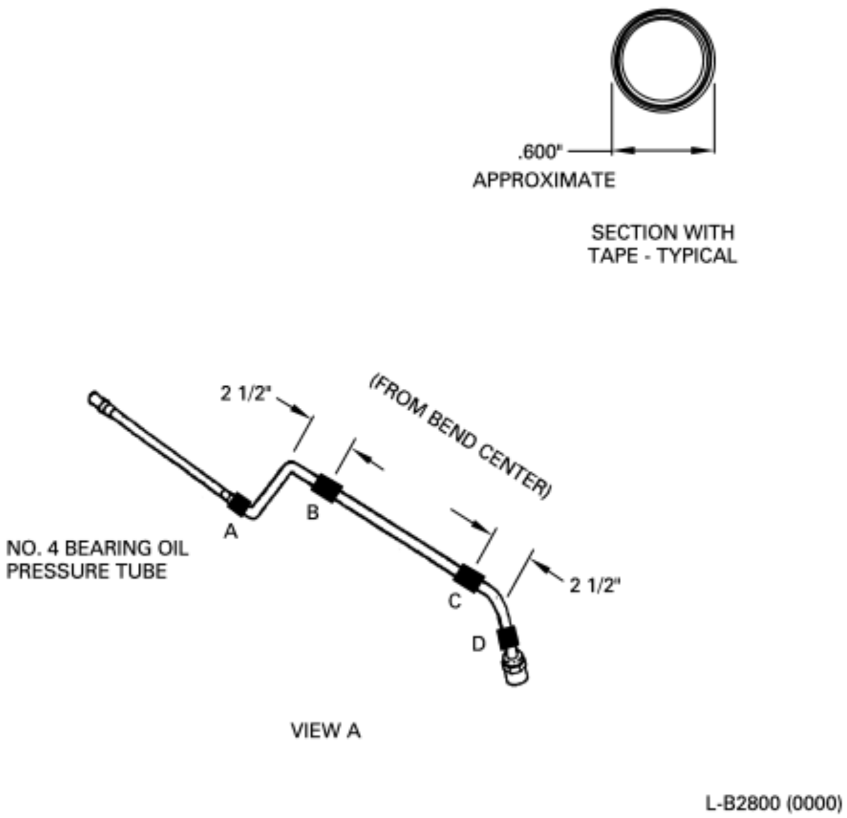
Installation Of The No. 4 Bearing
Pressure Tube (Post SB PW4ENG 79-76)
Figure 1008 (Sheet 1)
(Task 72-54-00-400-001)

1. WRAP 1.00 INCH (25.400 mm) WIDE FIBERGLASS TAPE, P05-136, AT FOUR (4) LOCATIONS:

   -A & D AT TUBE ENDS AS SHOWN

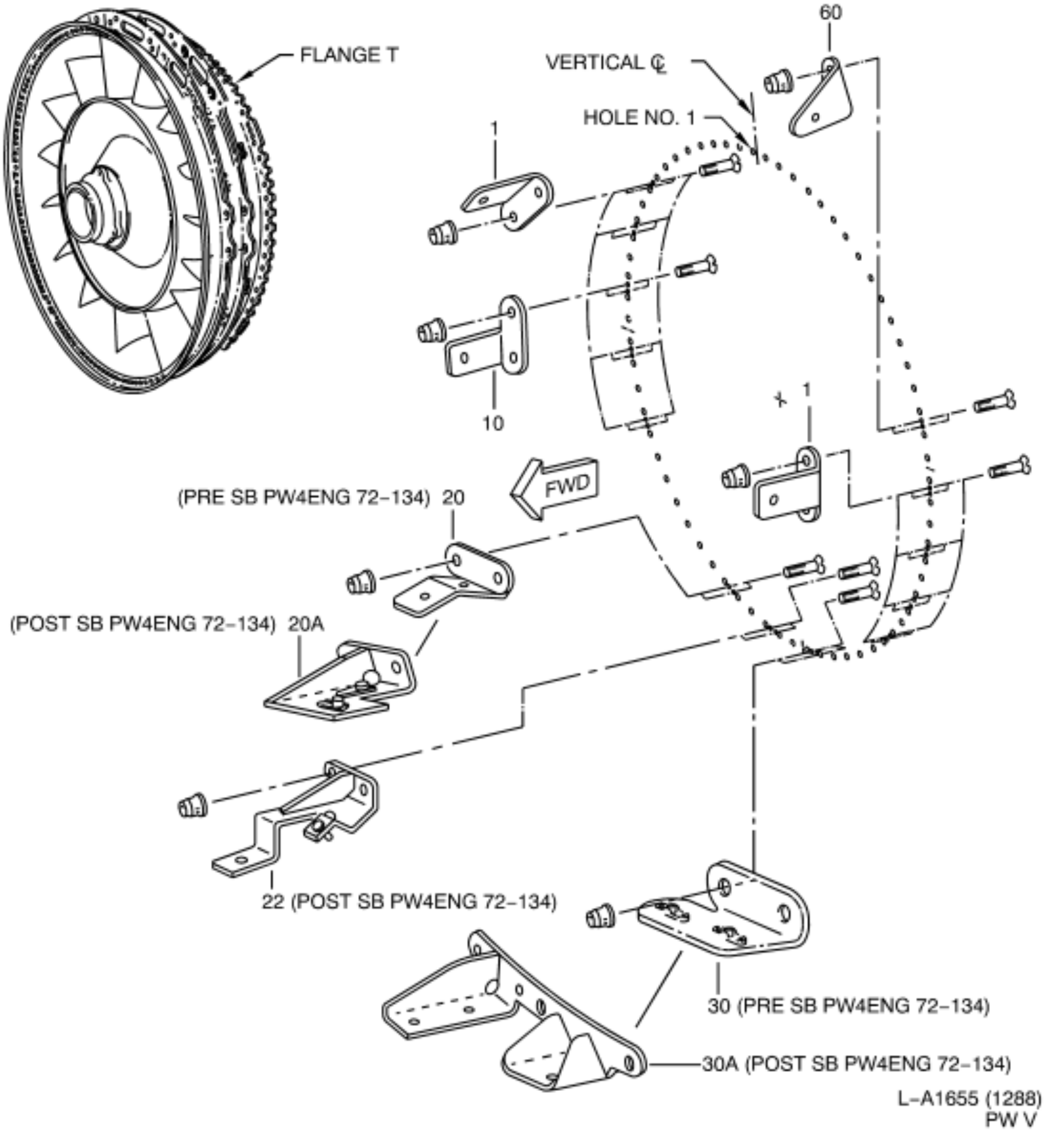
   -B & C AT STRAIGHT SECTION AS SHOWN

2. WRAP TAPE TO BE 0.600 INCH DIAMETER (15.240 mm) AND ABOUT 0.100 INCH (2.54 mm) HEIGHT ABOVE TUBE SURFACE.


.600"
APPROXIMATE
SECTION WITH
TAPE - TYPICAL
2 1/2"
(FROM BEND CENTER)
A
B
C
D
2 1/2"
NO. 4 BEARING OIL
PRESSURE TUBE
VIEW A
L-B2800 (0000)

No. 4 Bearing Pressure Tube Installation Optional Chafing Wear Prevention (Post SB PW4ENG 79−76)
Figure 1008 (Sheet 2)
(Task 72−54−00−400−001)

TURBINE EXHAUST CASE - ASSEMBLY-01


FLANGE T
VERTICAL ℄
HOLE NO. 1
60
1
10
X 1
FWD
(PRE SB PW4ENG 72-134) 20
(POST SB PW4ENG 72-134) 20A
22 (POST SB PW4ENG 72-134)
30 (PRE SB PW4ENG 72-134)
30A (POST SB PW4ENG 72-134)
L-A1655 (1288)
PW V

Flange T Bracket Locations
Figure 1009
(Task 72-54-00-400-001)

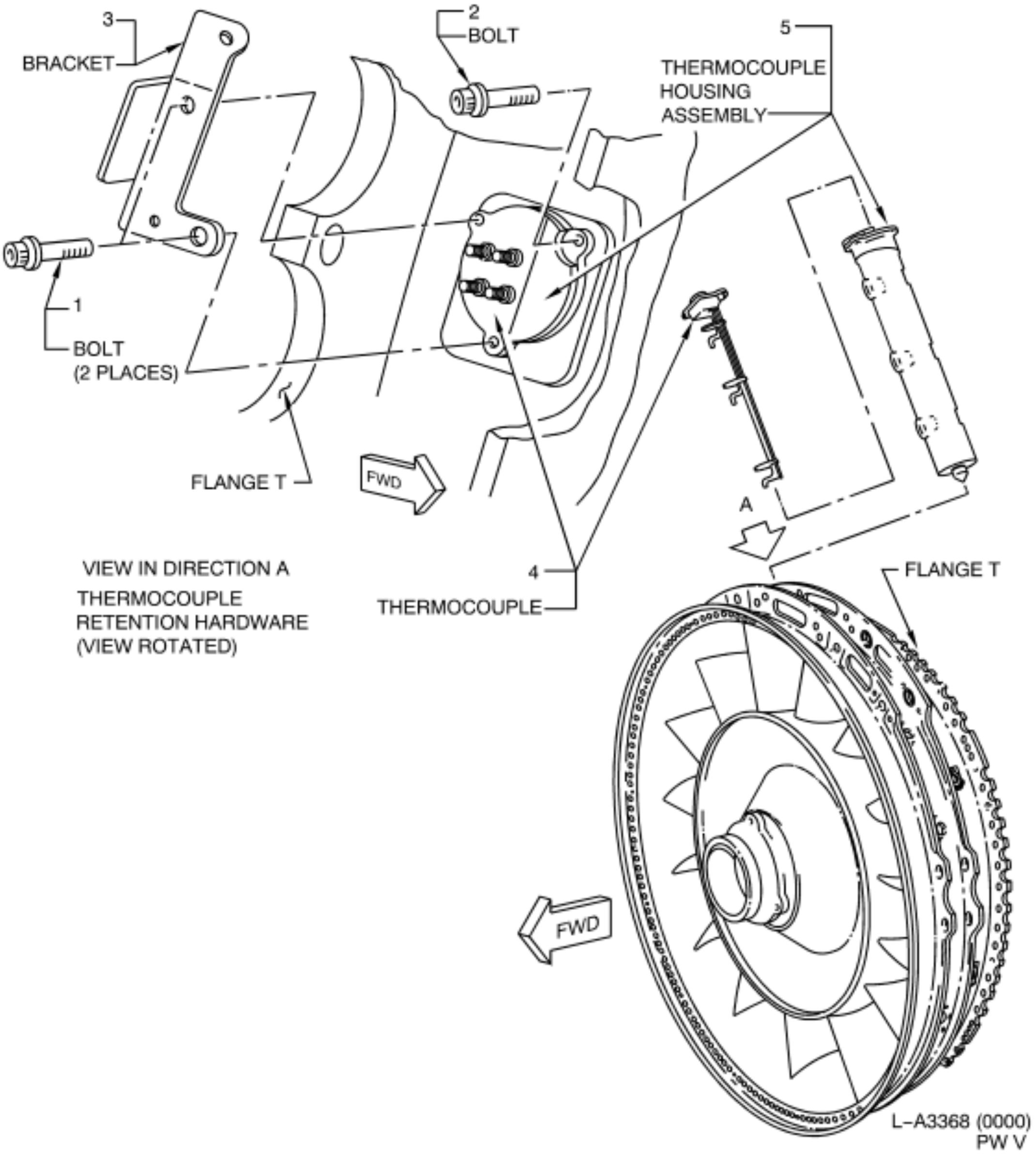
Bracket Index No.	Hole Location	Flange Side	Angle Faces
1	9 and 10	Front	Front
1	12 and 13	Front	Front
1	18 and 19	Front	Front
1	21 and 22	Front	Front
1	41 and 42	Front	Front
1	44 and 45	Front	Front
1	47 and 48	Front	Front
1	50 and 51	Front	Front
10	15 and 16	Front	Front
20 (Pre SB PW4ENG 72-134)	29 and 30	Front	Front
20 (Pre SB PW4ENG 72-134)	32 and 33	Front	Front
20A (Post SB PW4ENG 72-134)	29 and 30	Front	Front
22 (Post SB PW4ENG 72-134)	32 and 33	Front	Front
30 (Pre SB PW4ENG 72-134)	35 and 36	Front	Front
30A (Post SB PW4ENG 72-134) (Align larger boltholes in flange at 36 and 37 with larger holes in bracket)	35 and 36	Front	Front
60	53 and 54	Front	Front

NOTE: Holes are numbered clockwise from rear. The smaller boltholes, countersunk at rear face of flange, are not counted as bolthole location in above table.

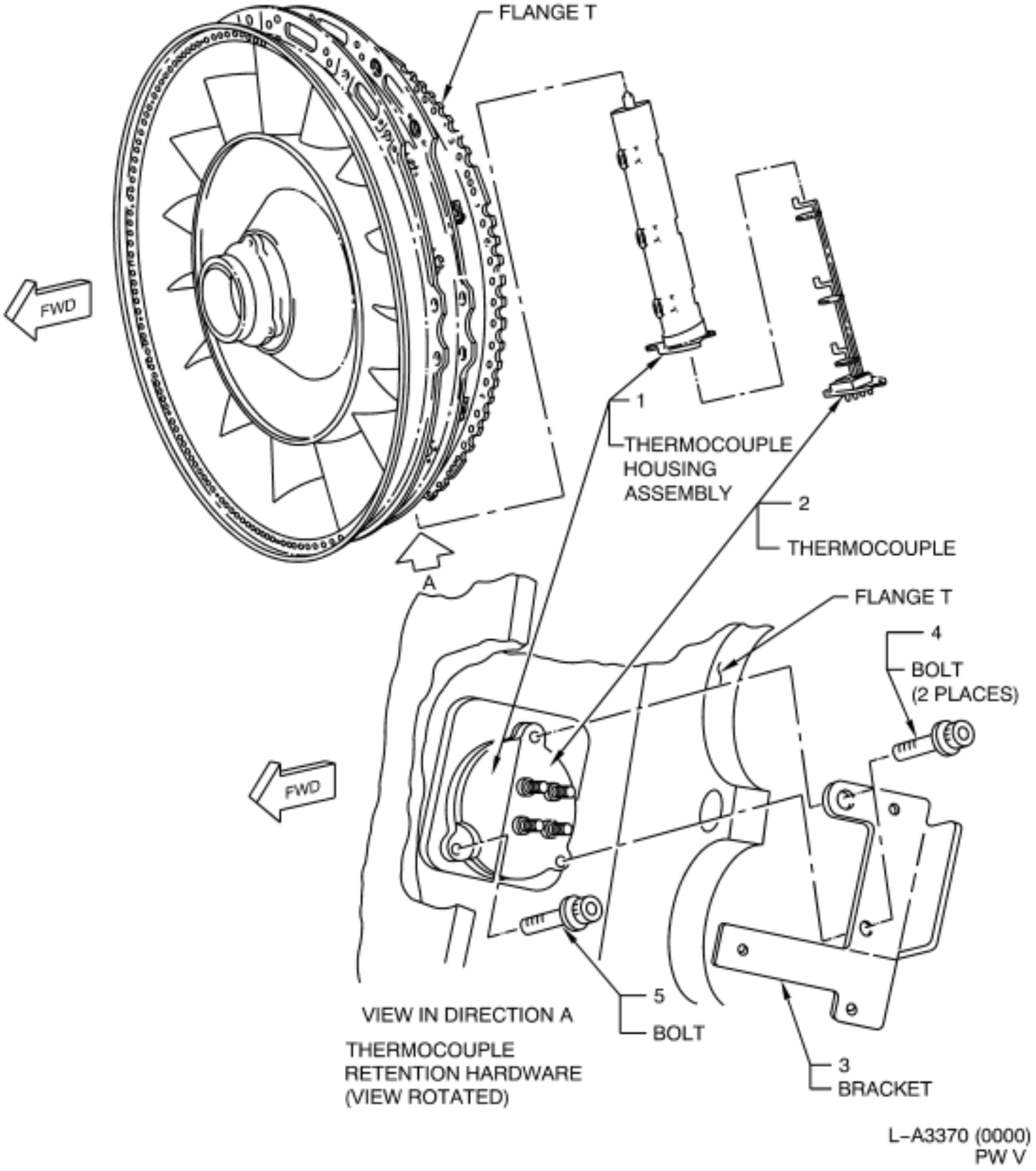
Brackets are installed at smaller countersunk, bolthole locations between larger flange boltholes.

Key to Figure 1009

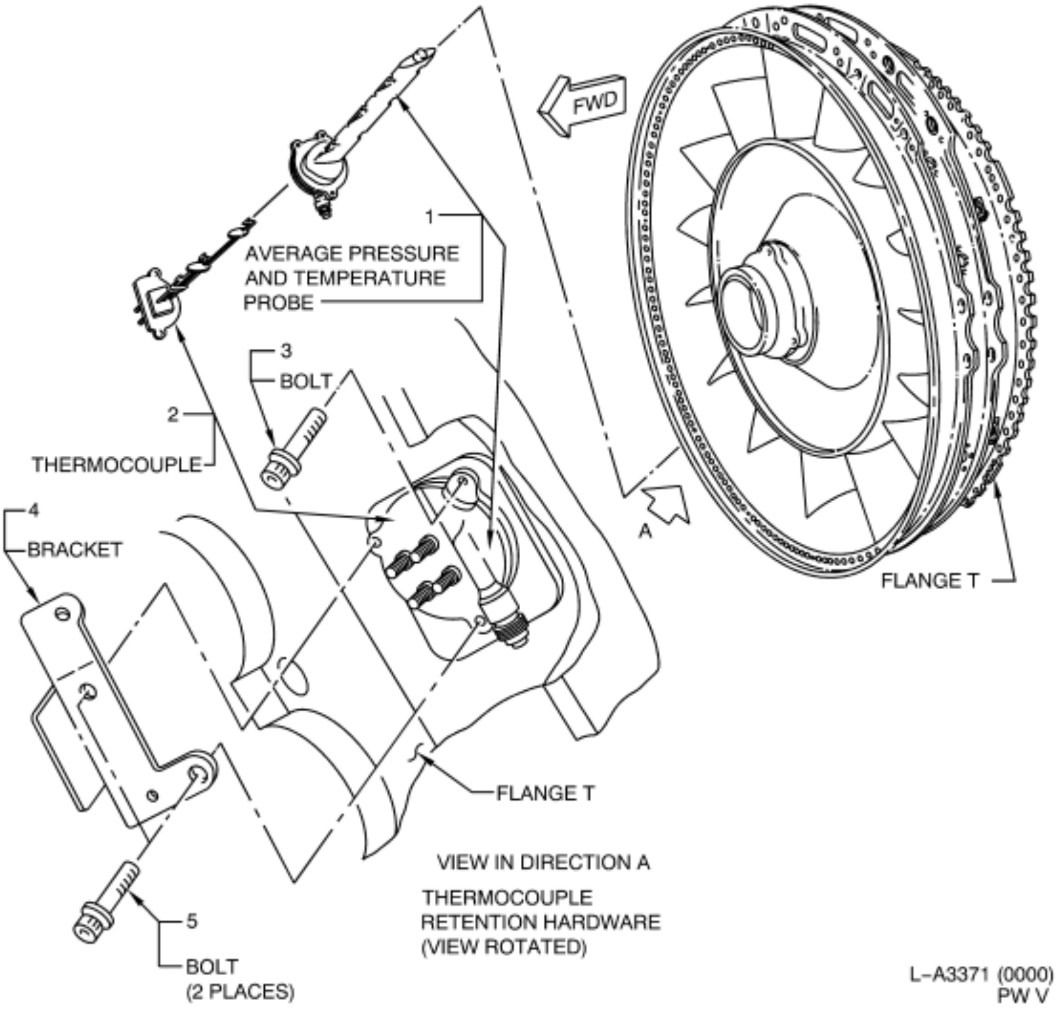
TURBINE EXHAUST CASE - ASSEMBLY-01


3
BRACKET
2
BOLT
5
THERMOCOUPLE
HOUSING
ASSEMBLY
1
BOLT
(2 PLACES)
FLANGE T
FWD
A
VIEW IN DIRECTION A
THERMOCOUPLE
RETENTION HARDWARE
(VIEW ROTATED)
4
THERMOCOUPLE
FLANGE T
FWD
L-A3368 (0000)
PW V

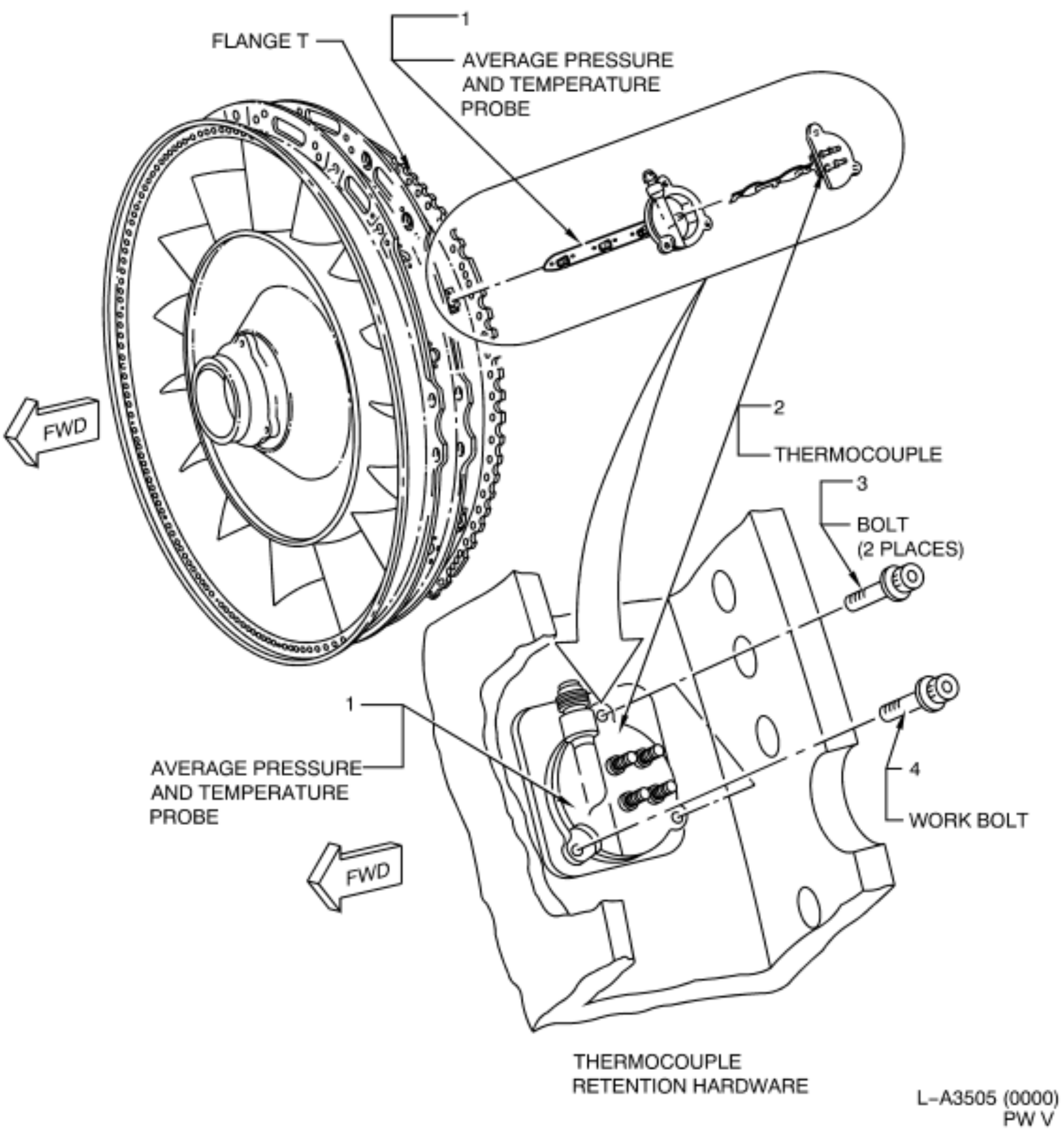
Thermocouple And Thermocouple Housing Assembly Installation
Figure 1010
(Task 72-54-00-400-001)


FLANGE T
FWD
1
THERMOCOUPLE HOUSING ASSEMBLY
2
THERMOCOUPLE
A
FLANGE T
4
BOLT (2 PLACES)
FWD
5
BOLT
3
BRACKET
VIEW IN DIRECTION A
THERMOCOUPLE RETENTION HARDWARE (VIEW ROTATED)
L−A3370 (0000)
PW V

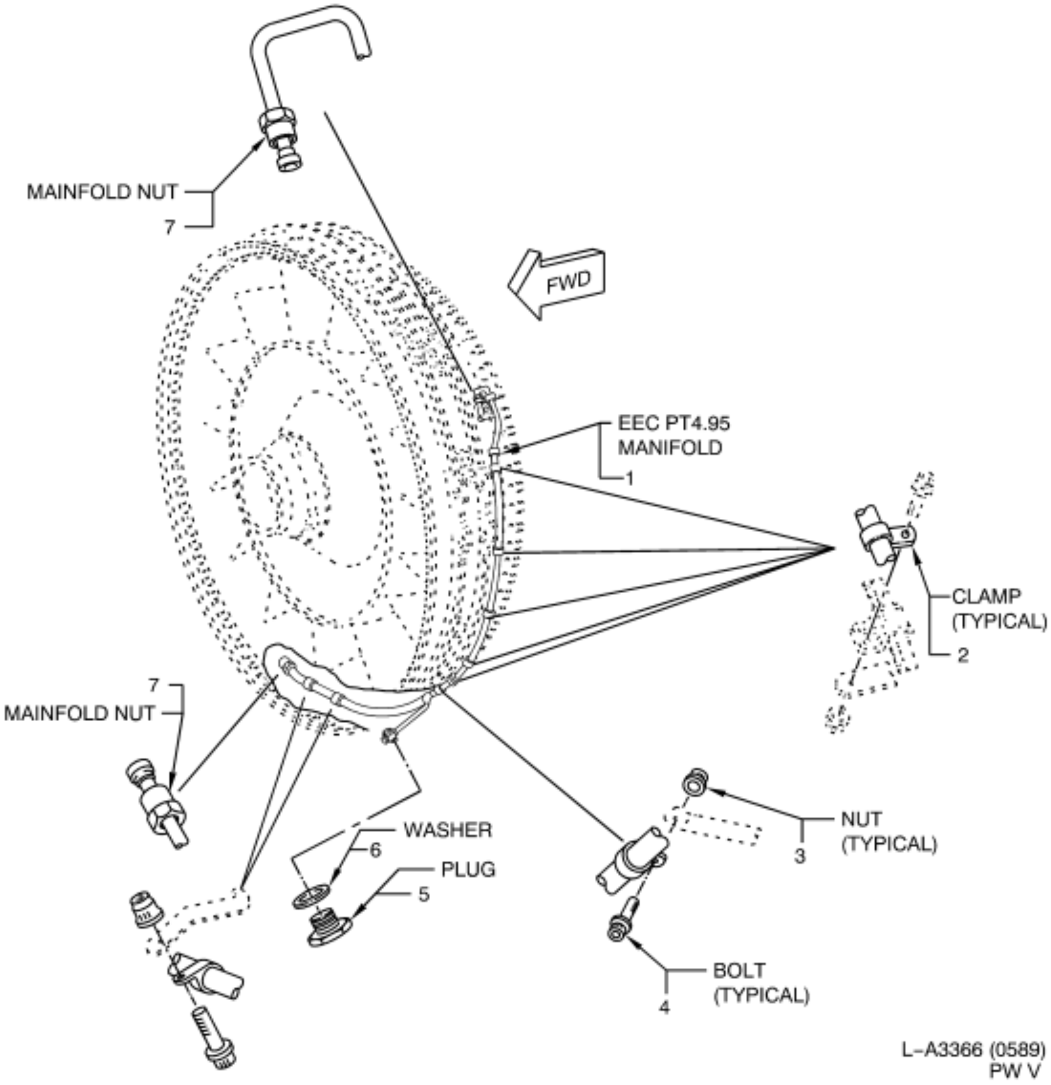
Thermocouple And Thermocouple Housing Assembly Installation
Figure 1011
(Task 72−54−00−400−001)


FWD
1
AVERAGE PRESSURE AND TEMPERATURE PROBE
3
BOLT
2
THERMOCOUPLE
4
BRACKET
A
FLANGE T
FLANGE T
VIEW IN DIRECTION A
THERMOCOUPLE RETENTION HARDWARE (VIEW ROTATED)
5
BOLT (2 PLACES)
L-A3371 (0000)
PW V

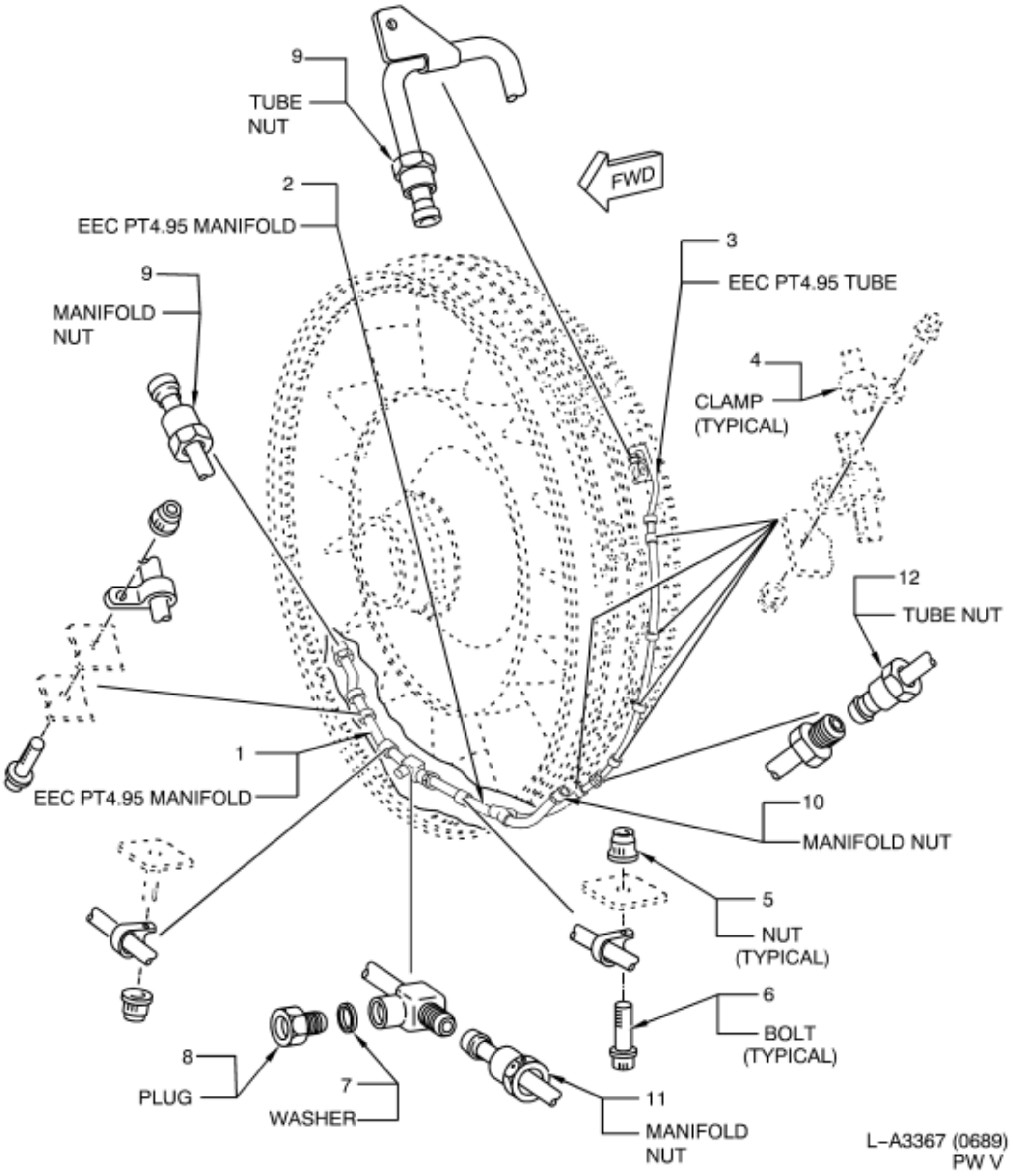
Average Pressure And Temperature Probe And Thermocouple Installation
Figure 1012
(Task 72-54-00-400-001)


FLANGE T
1
AVERAGE PRESSURE AND TEMPERATURE PROBE
FWD
2
THERMOCOUPLE
3
BOLT (2 PLACES)
1
AVERAGE PRESSURE AND TEMPERATURE PROBE
FWD
4
WORK BOLT
THERMOCOUPLE RETENTION HARDWARE
L-A3505 (0000)
PW V

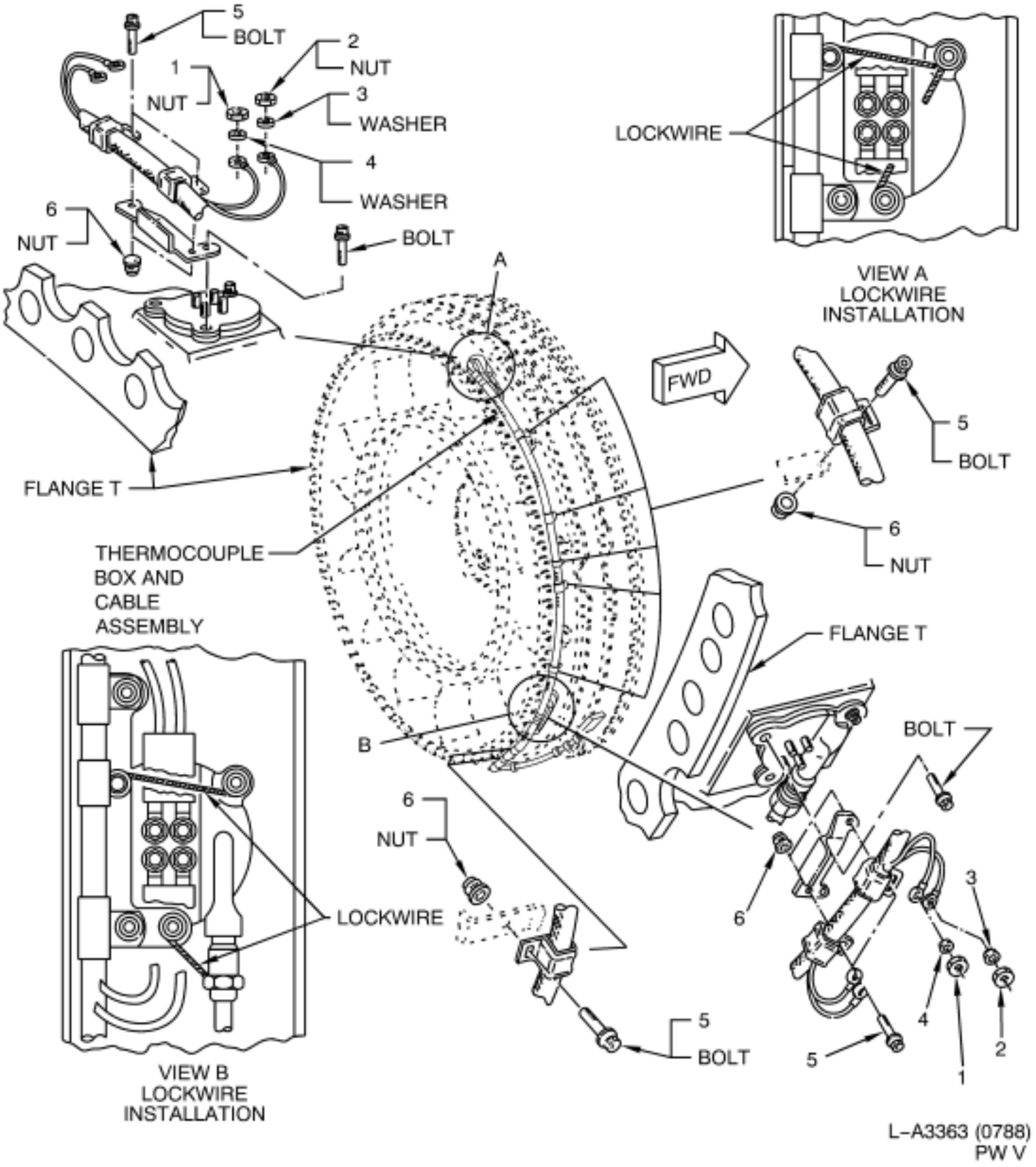
Average Pressure And Temperature Probe And Thermocouple Installation
Figure 1013
(Task 72-54-00-400-001)


MAINFOLD NUT
7
FWD
EEC PT4.95
MANIFOLD
1
CLAMP
(TYPICAL)
2
7
MAINFOLD NUT
WASHER
6
PLUG
5
NUT
(TYPICAL)
3
BOLT
(TYPICAL)
4
L-A3366 (0589)
PW V

EEC PT4.95 Manifold Assembly Installation (Pre SB PW4ENG 72-134)
Figure 1014
(Task 72-54-00-400-001)

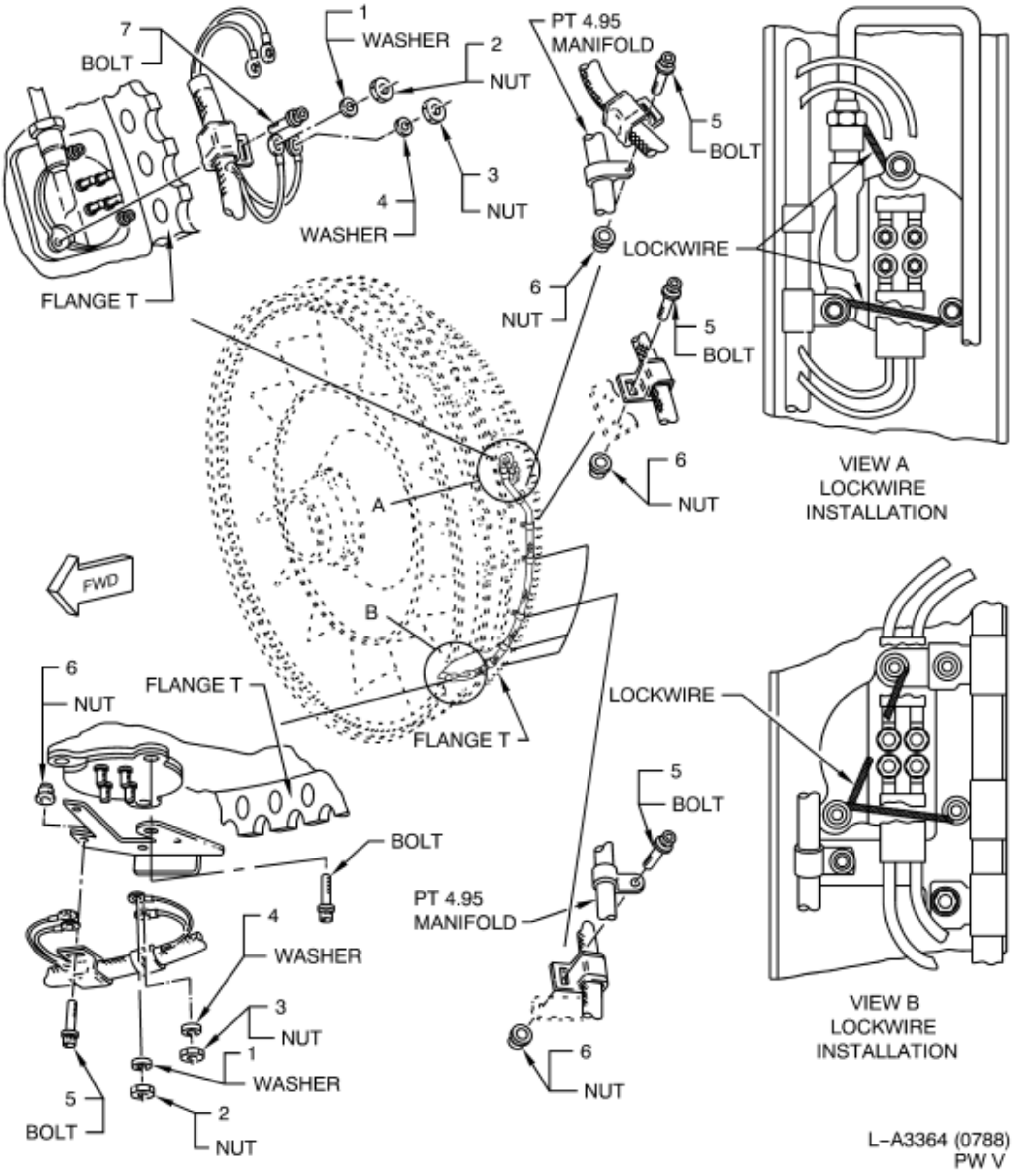

9
TUBE NUT
FWD
2
EEC PT4.95 MANIFOLD
3
EEC PT4.95 TUBE
9
MANIFOLD NUT
4
CLAMP (TYPICAL)
12
TUBE NUT
1
EEC PT4.95 MANIFOLD
10
MANIFOLD NUT
5
NUT (TYPICAL)
6
BOLT (TYPICAL)
8
PLUG
7
WASHER
11
MANIFOLD NUT
L−A3367 (0689)
PW V

EEC PT4.95 Manifold Assembly Installation (Post SB PW4ENG 72−134)
Figure 1015
(Task 72−54−00−400−001)


5
BOLT
2
NUT
1
NUT
3
WASHER
4
WASHER
6
NUT
BOLT
A
LOCKWIRE
VIEW A
LOCKWIRE
INSTALLATION
FWD
5
BOLT
6
NUT
FLANGE T
THERMOCOUPLE
BOX AND
CABLE
ASSEMBLY
FLANGE T
BOLT
B
6
NUT
LOCKWIRE
6
3
4
2
1
5
5
BOLT
VIEW B
LOCKWIRE
INSTALLATION
L-A3363 (0788)
PW V

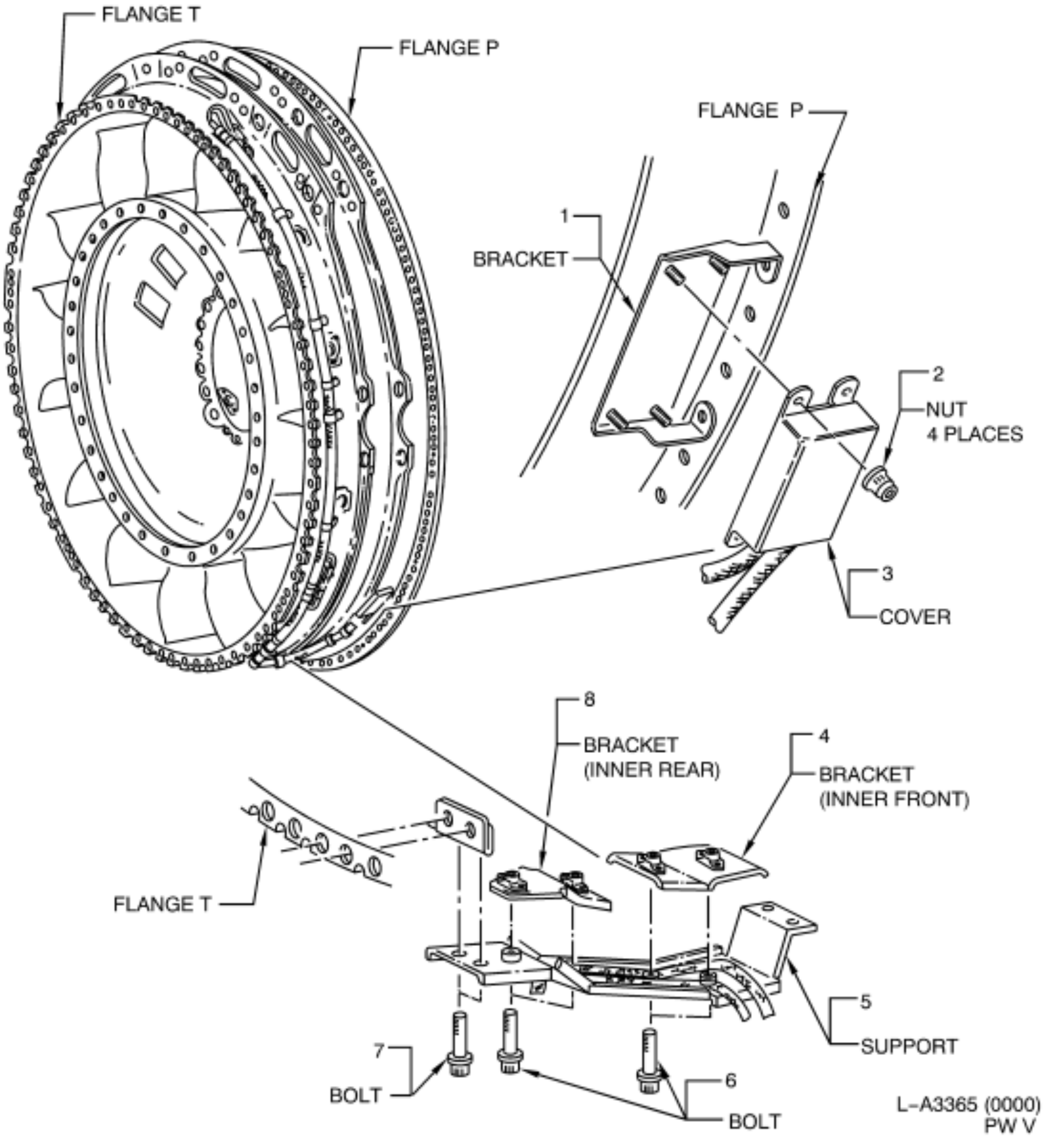
Thermocouple Box And Cable Assembly Installation
(EGT TT4.95) (Pre SB PW4ENG 72-134)
Figure 1016 (Sheet 1)
(Task 72-54-00-400-001)

TURBINE EXHAUST CASE - ASSEMBLY-01

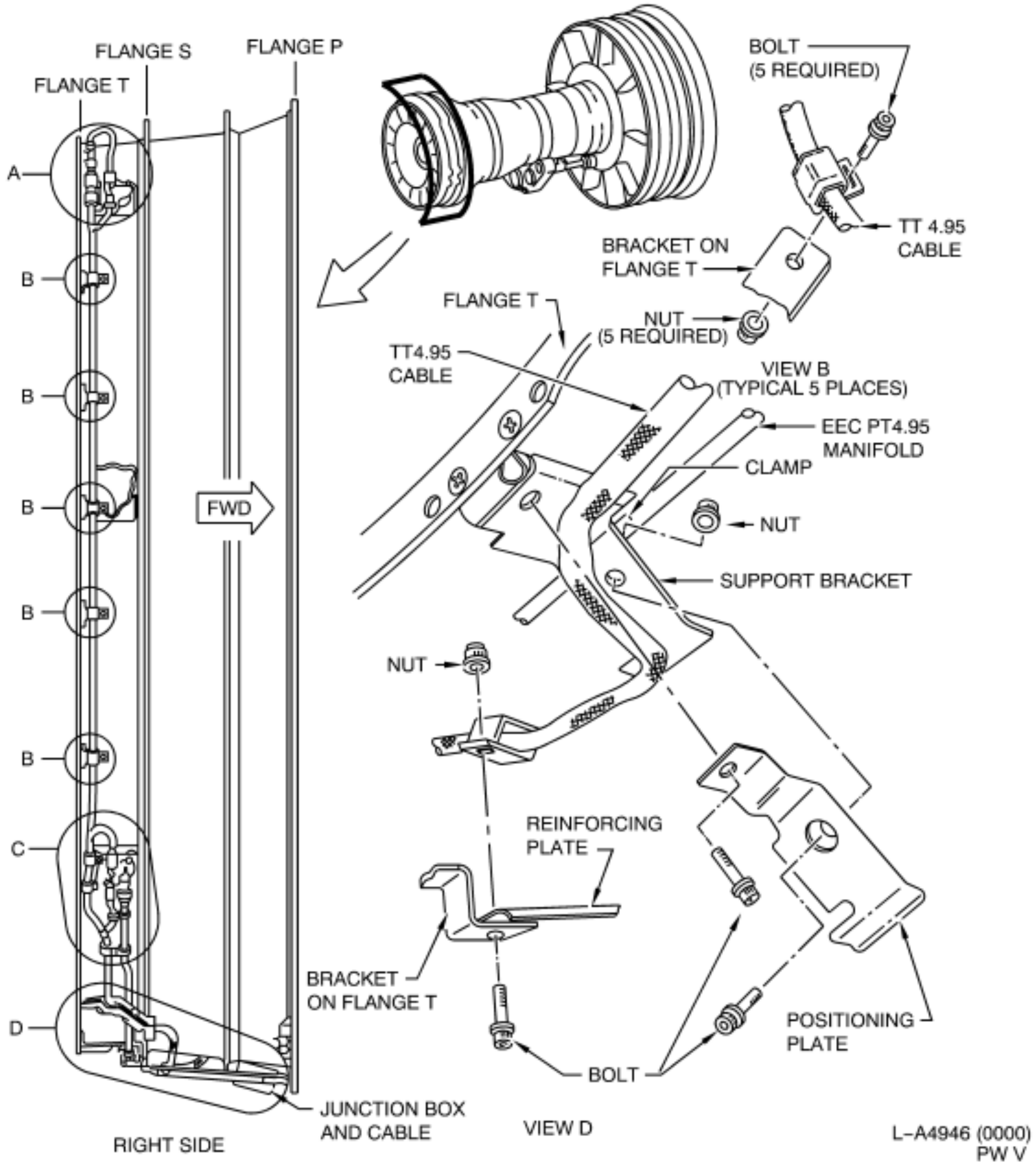

7
BOLT
1
WASHER
2
NUT
PT 4.95
MANIFOLD
5
BOLT
3
NUT
4
WASHER
FLANGE T
LOCKWIRE
6
NUT
5
BOLT
A
6
NUT
VIEW A
LOCKWIRE
INSTALLATION
FWD
B
6
NUT
FLANGE T
LOCKWIRE
FLANGE T
5
BOLT
BOLT
PT 4.95
MANIFOLD
4
WASHER
3
NUT
1
WASHER
6
NUT
5
BOLT
2
NUT
VIEW B
LOCKWIRE
INSTALLATION
L-A3364 (0788)
PW V

Thermocouple Box And Cable Assembly Installation
(EGT TT4.95) (Pre SB PW4ENG 72-134)
Figure 1016 (Sheet 2)
(Task 72-54-00-400-001)

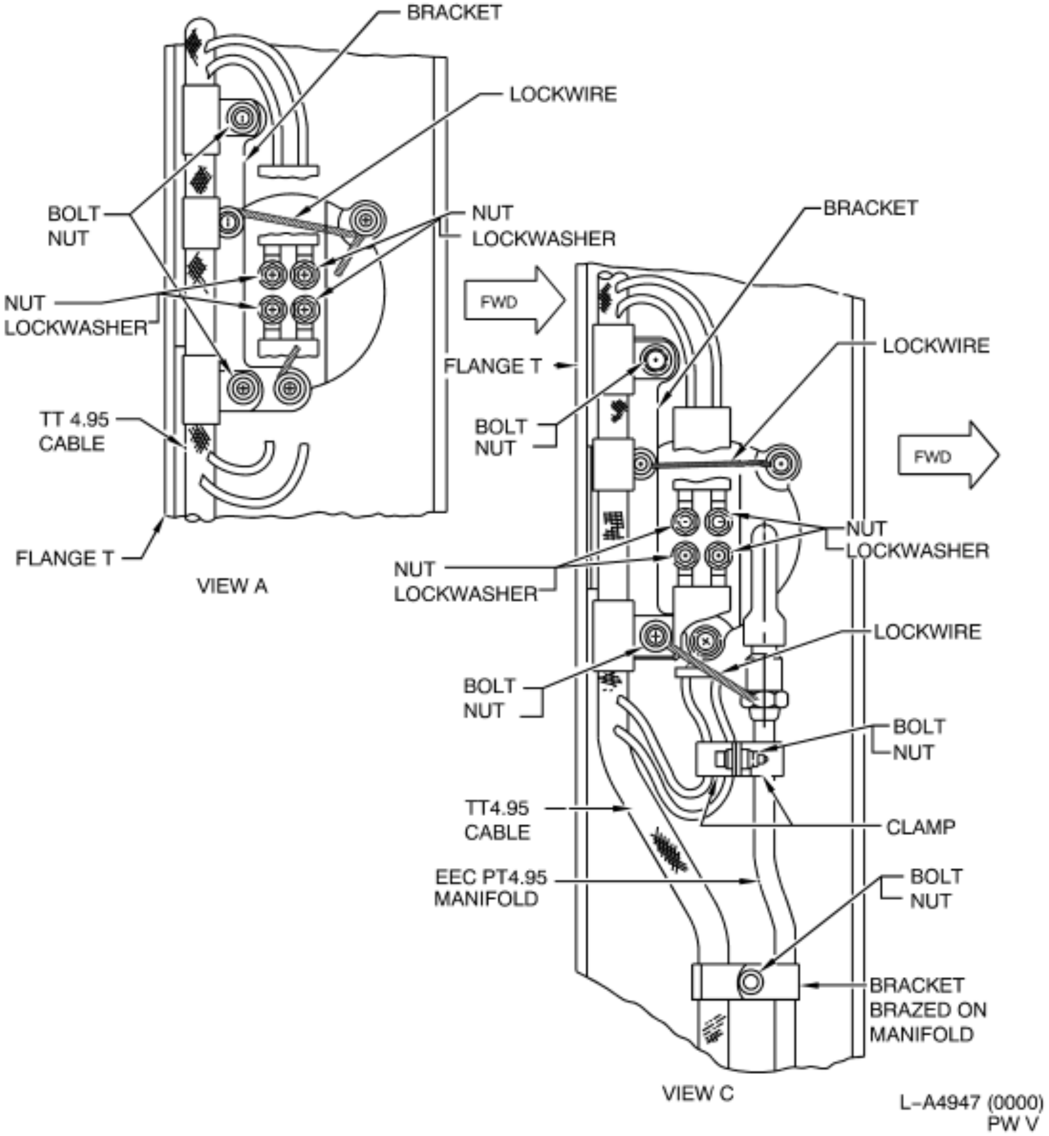
TURBINE EXHAUST CASE - ASSEMBLY-01


FLANGE T
FLANGE P
FLANGE P
1
BRACKET
2
NUT
4 PLACES
3
COVER
8
BRACKET
(INNER REAR)
4
BRACKET
(INNER FRONT)
FLANGE T
5
SUPPORT
7
BOLT
6
BOLT
L-A3365 (0000)
PW V

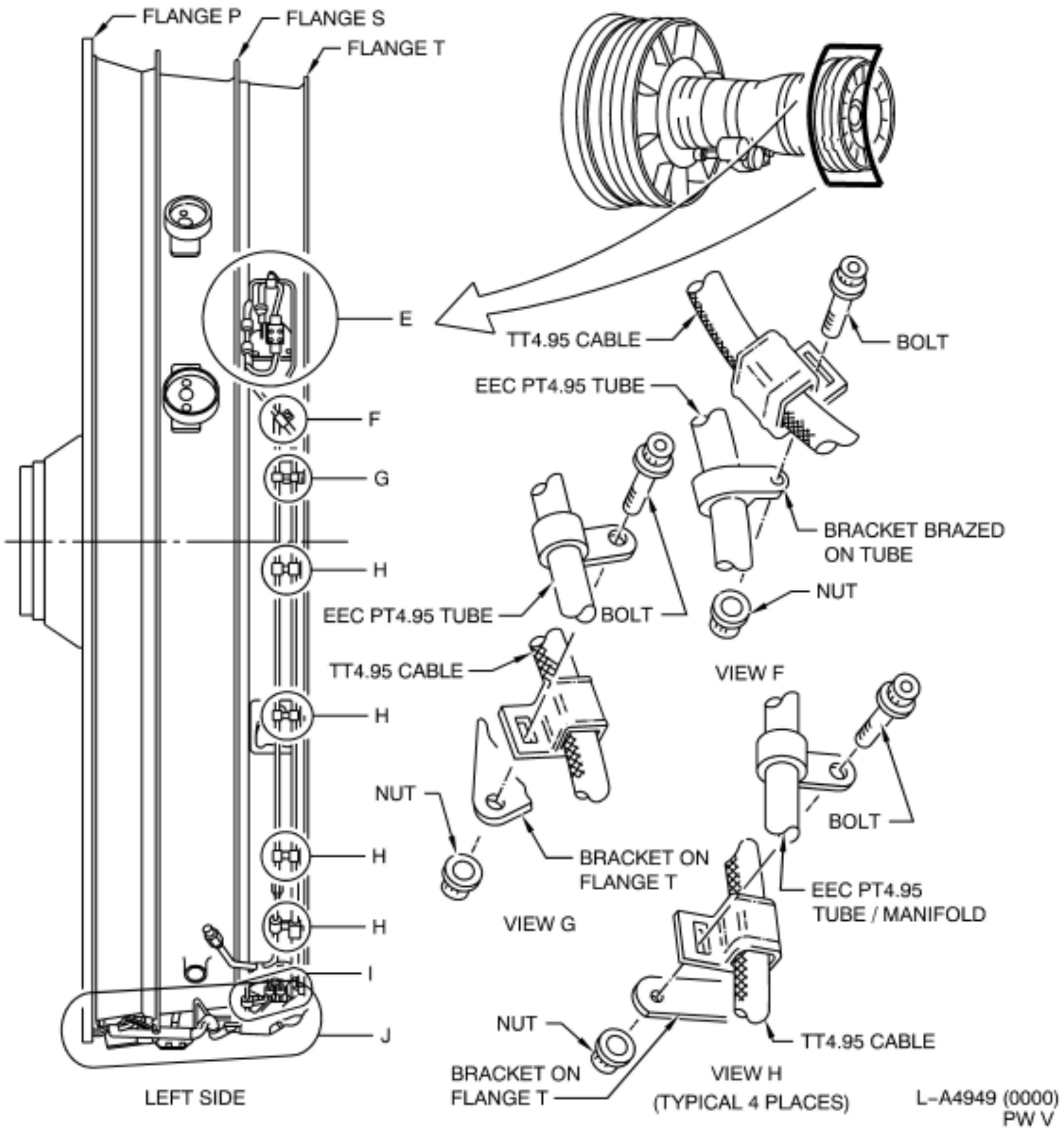
Thermocouple Box And Cable Assembly Installation
(EGT TT4.95) (Pre SB PW4ENG 72-134)
Figure 1017
(Task 72-54-00-400-001)


FLANGE S
FLANGE P
FLANGE T
A
B
B
B
B
B
C
D
FWD
RIGHT SIDE
JUNCTION BOX AND CABLE
BOLT (5 REQUIRED)
TT 4.95 CABLE
BRACKET ON FLANGE T
FLANGE T
NUT (5 REQUIRED)
TT4.95 CABLE
VIEW B (TYPICAL 5 PLACES)
EEC PT4.95 MANIFOLD
CLAMP
NUT
SUPPORT BRACKET
NUT
REINFORCING PLATE
BRACKET ON FLANGE T
BOLT
POSITIONING PLATE
VIEW D
L-A4946 (0000)
PW V

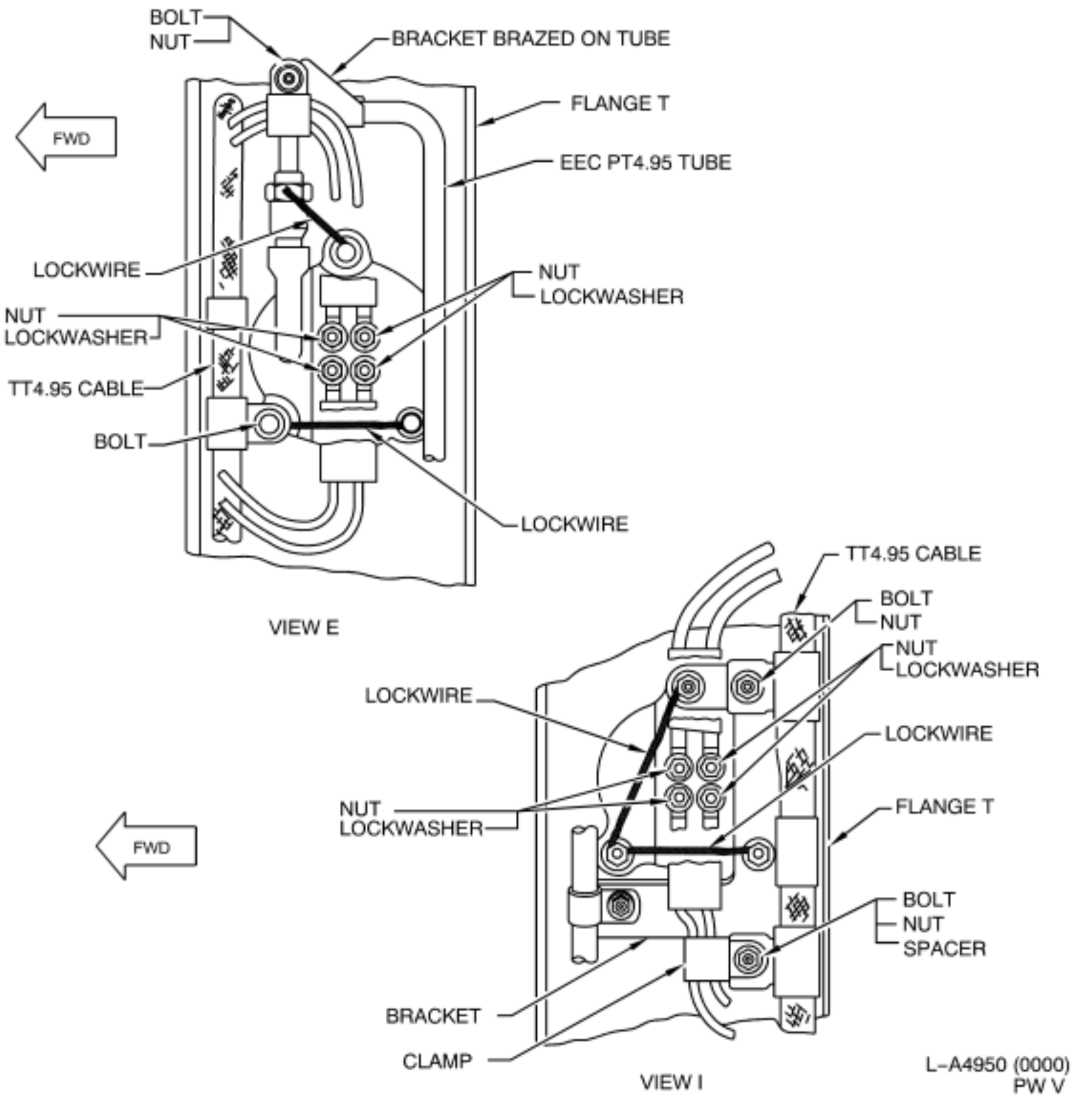
Thermocouple Box And Cable Assembly Installation
(EGT TT4.95) (Post SB PW4ENG 72-134)
Figure 1018 (Sheet 1)
(Task 72-54-00-400-001)


BRACKET
LOCKWIRE
BOLT
NUT
NUT
LOCKWASHER
NUT
LOCKWASHER
TT 4.95
CABLE
FLANGE T
VIEW A
FWD
FLANGE T
BRACKET
LOCKWIRE
BOLT
NUT
FWD
NUT
LOCKWASHER
NUT
LOCKWASHER
LOCKWIRE
BOLT
NUT
BOLT
NUT
CLAMP
TT4.95
CABLE
EEC PT4.95
MANIFOLD
BOLT
NUT
BRACKET
BRAZED ON
MANIFOLD
VIEW C
L-A4947 (0000)
PW V

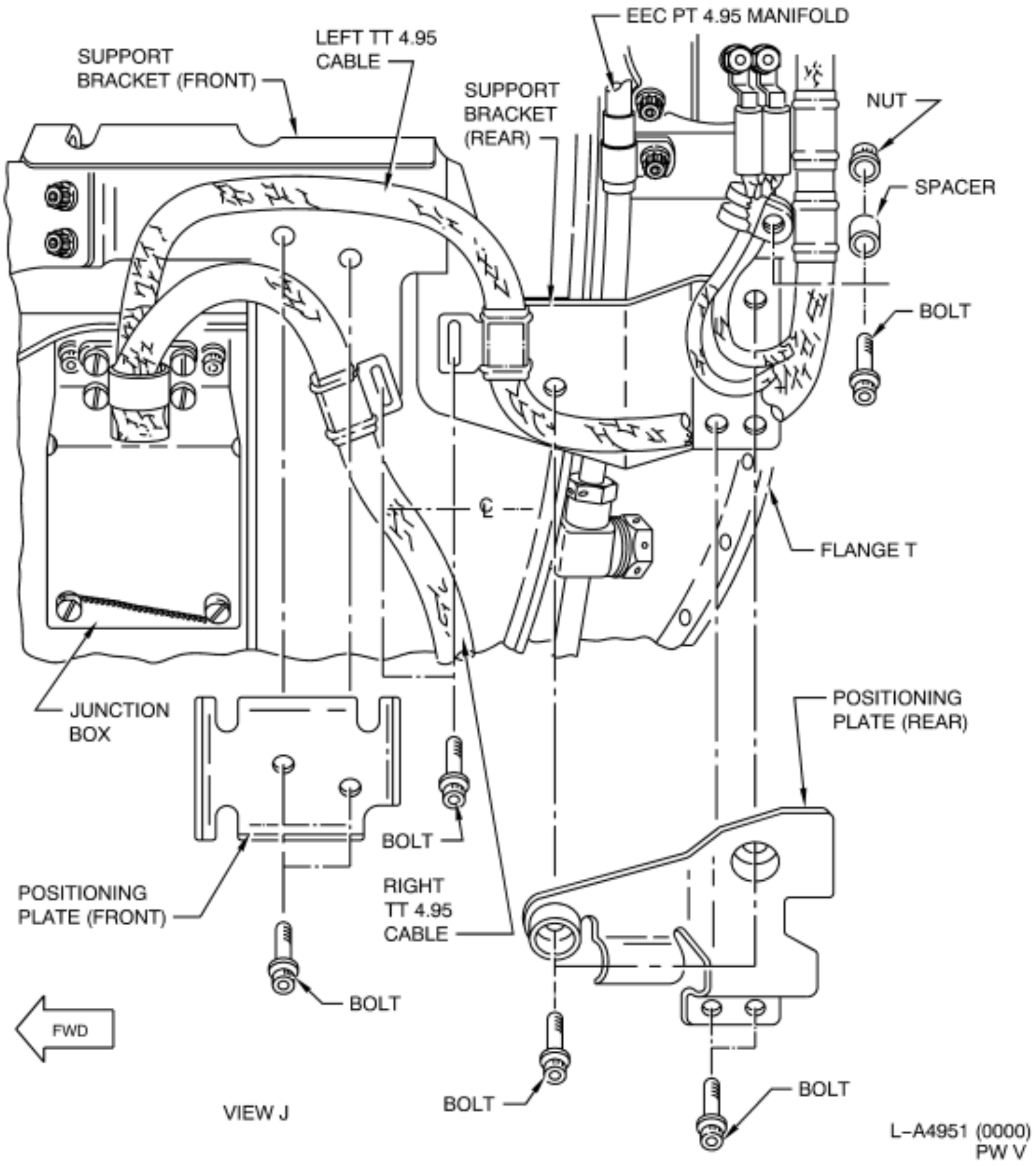
Thermocouple Box And Cable Assembly Installation
(EGT TT4.95) (Post SB PW4ENG 72-134)
Figure 1018 (Sheet 2)
(Task 72-54-00-400-001)


FLANGE P
FLANGE S
FLANGE T
E
F
G
H
H
H
H
I
J
LEFT SIDE
TT4.95 CABLE
BOLT
EEC PT4.95 TUBE
BRACKET BRAZED ON TUBE
NUT
VIEW F
EEC PT4.95 TUBE
BOLT
TT4.95 CABLE
NUT
BRACKET ON FLANGE T
VIEW G
BOLT
EEC PT4.95 TUBE / MANIFOLD
NUT
TT4.95 CABLE
BRACKET ON FLANGE T
VIEW H
(TYPICAL 4 PLACES)
L-A4949 (0000)
PW V

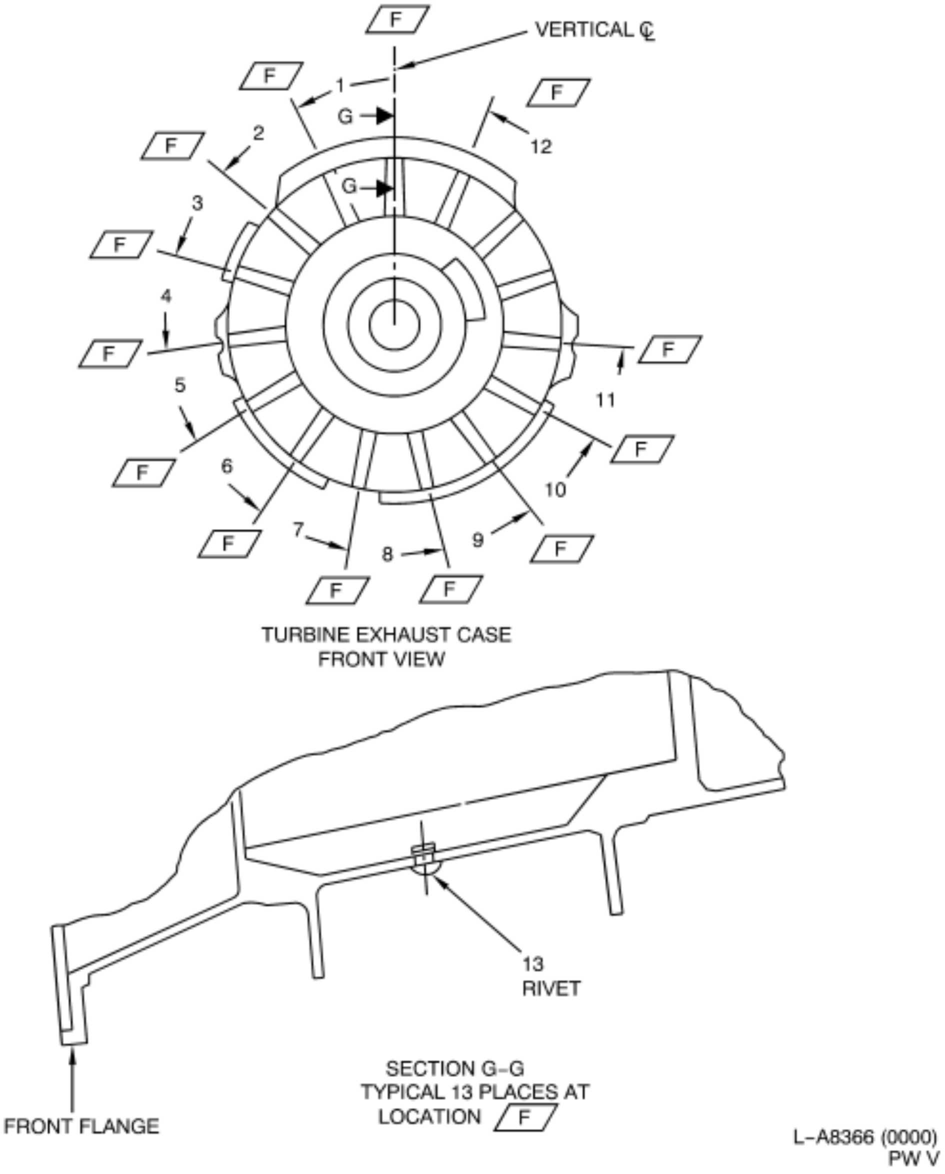
Thermocouple Box And Cable Assembly Installation
(EGT TT4.95) (Post SB PW4ENG 72-134)
Figure 1018 (Sheet 3)
(Task 72-54-00-400-001)


BOLT
NUT
BRACKET BRAZED ON TUBE
FWD
FLANGE T
EEC PT4.95 TUBE
LOCKWIRE
NUT
LOCKWASHER
NUT
LOCKWASHER
TT4.95 CABLE
BOLT
LOCKWIRE
VIEW E
TT4.95 CABLE
BOLT
NUT
NUT
LOCKWASHER
LOCKWIRE
LOCKWIRE
FLANGE T
NUT
LOCKWASHER
FWD
BOLT
NUT
SPACER
BRACKET
CLAMP
VIEW I
L-A4950 (0000)
PW V

Thermocouple Box And Cable Assembly Installation
(EGT TT4.95) (Post SB PW4ENG 72-134)
Figure 1018 (Sheet 4)
(Task 72-54-00-400-001)


EEC PT 4.95 MANIFOLD
LEFT TT 4.95 CABLE
SUPPORT BRACKET (FRONT)
SUPPORT BRACKET (REAR)
NUT
SPACER
BOLT
℄
FLANGE T
JUNCTION BOX
POSITIONING PLATE (REAR)
BOLT
RIGHT TT 4.95 CABLE
POSITIONING PLATE (FRONT)
BOLT
FWD
VIEW J
BOLT
BOLT
L-A4951 (0000)
PW V

Thermocouple Box And Cable Assembly Installation
(EGT TT4.95) (Post SB PW4ENG 72-134)
Figure 1018 (Sheet 5)
(Task 72-54-00-400-001)


F
VERTICAL ℄
F
1
F
G
12
F
2
G
3
F
4
F
F
11
5
F
F
6
10
F
7
9
F
8
F
F
TURBINE EXHAUST CASE
FRONT VIEW
13
RIVET
FRONT FLANGE
SECTION G−G
TYPICAL 13 PLACES AT
LOCATION F
L−A8366 (0000)
PW V

Rivet/Plug Locations
Figure 1019
(Task 72−54−00−400−001)

TURBINE EXHAUST CASE − ASSEMBLY−01

1. 24°
2. 48°
3. 72°
4. 96°
5. 120°
6. 144°
7. 168°
8. 192°
9. 216°
10. 240°
11. 264°
12. 336°

Key to Figure 1019

Pratt & Whitney

PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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		509		JUN 15/04
		510		JUN 15/04
		511		JUN 15/04
		512		JUN 15/04
		513		JUN 15/04
		514		JUN 15/04
		515		JUN 15/04
		516		JUN 15/04
		517		JUN 15/04
		518		JUN 15/04
		519		JUN 15/04
		520		JUN 15/04
		521		JUN 15/04
		522		JUN 15/04

		523		JUN 15/04
		524		JUN 15/04
		525		JUN 15/04
		526		JUN 15/04
		527		JUN 15/04
		528		JUN 15/04
		529		JUN 15/04
		530		JUN 15/04
		531		JUN 15/04
		532		JUN 15/04
		533		JUN 15/04
		534		JUN 15/04
		535		JUN 15/04
		536		JUN 15/04
		537		JUN 15/04
		538		JUN 15/04
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72-54-00				
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		804		DEC 15/97
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	R	806		MAR 15/06
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		808		DEC 15/04
		809		DEC 15/97
		810		DEC 15/97
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		812		DEC 15/97
		813		DEC 15/97
		814		DEC 15/97
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		1005		MAR 15/02
		1006		MAR 15/02
		1007		MAR 15/02
		1008		MAR 15/02
		1009		MAR 15/02
		1010		MAR 15/02
		1011		SEP 15/05
		1012		SEP 15/05
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		1019		DEC 15/98
		1020		DEC 15/98
		1021		JUN 15/04
		1022		JUN 15/04
		1023		DEC 15/97
		1024		DEC 15/97
		1025		DEC 15/98
		1026		DEC 15/98

1027	DEC 15/98
1028	DEC 15/98
1029	DEC 15/98
1030	DEC 15/98
1031	DEC 15/98
1032	DEC 15/98
1033	DEC 15/98
1034	DEC 15/98
1035	DEC 15/98
1036	DEC 15/98
1037	DEC 15/98
1038	DEC 15/98
1039	DEC 15/98
1040	DEC 15/98
1041	DEC 15/98
1042	DEC 15/98
1043	DEC 15/97
1044	DEC 15/97
1045	DEC 15/97
1046	DEC 15/97
1047	DEC 15/97
1048	DEC 15/97
1049	DEC 15/97
1050	DEC 15/97
1051	DEC 15/97
1052	DEC 15/97
1053	DEC 15/97
1054	DEC 15/97
1055	DEC 15/97
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REVISION NO. 79 DATED MARCH 15, 2006

HIGHLIGHTS − TURBINE EXHAUST CASE

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CHAPTER 72

TURBINE EXHAUST CASE

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72−61−00	MAIN GEARBOX − ASSEMBLY−04 • 72−61−00−400−004: Assemble Main Oil Filter, Housing And Pressure Relief Valves Assembly
72−61−00	MAIN GEARBOX − ASSEMBLY−05 • 72−61−00−400−005: Assemble The Lube Oil Tank And Deaerator Assembly
72−61−00	MAIN GEARBOX − ASSEMBLY−06 • 72−61−00−400−006: Install The EEC Rotor And Stator And The Lubrication And Scavenge Oil Pump And Brackets On The Main Gearbox
72−61−00	MAIN GEARBOX − ASSEMBLY−07 • 72−61−00−400−007: Install The Magnetic Chip Detector Assemblies In The Main Gearbox, Lubrication And Scavenge Oil Pump, And Lube Oil Tank
72−61−00	MAIN GEARBOX − STORAGE−01 • 72−61−00−530−001: Pack The Main Gearbox • 72−61−00−540−001: Unpack The Main Gearbox
72−61−00	MAIN GEARBOX − TESTING−01 • 72−61−00−790−001: Leak Check The Main Gearbox
72−61−01	DEOILER GEARSHAFT AND BEARINGS ASSEMBLY − DISASSEMBLY−01 • 72−61−01−040−001: Disassemble Deoiler Gearshaft And Bearings Assembly

72−61−01	DEOILER GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01 • 72−61−01−440−001: Assemble Deoiler Gearshaft And Bearings Assembly
72−61−02	GEARBOX DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − DISASSEMBLY−01 • 72−61−02−040−001: Disassemble Gearbox Drive Gearshaft And Bearings Assembly
72−61−02	GEARBOX DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01 • 72−61−02−440−001: Assemble Gearbox Drive Gearshaft And Bearings Assembly
72−61−03	STARTER DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − DISASSEMBLY−01 • 72−61−03−040−001: Disassemble Starter Drive Gearshaft And Bearings Assembly
72−61−03	STARTER DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01 • 72−61−03−440−001: Assemble Starter Drive Gearshaft And Bearings Assembly
72−61−04	FUEL PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − DISASSEMBLY−01 • 72−61−04−040−001: Disassemble Fuel Pump Drive Gearshaft And Bearings Assembly
72−61−04	FUEL PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01 • 72−61−04−440−001: Assemble Fuel Pump Drive Gearshaft And Bearings Assembly
72−61−05	REAR HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − DISASSEMBLY−01 • 72−61−05−040−001: Disassemble Rear Hydraulic Pump Drive Gearshaft And Bearings Assembly
72−61−05	REAR HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01 • 72−61−05−440−001: Assemble Rear Hydraulic Pump Drive Gearshaft And Bearings Assembly
72−61−06	IDG DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − DISASSEMBLY−01 • 72−61−06−040−001: Disassemble IDG Drive Gearshaft And Bearings Assembly
72−61−06	IDG DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01 • 72−61−06−440−001: Assemble IDG Drive Gearshaft And Bearings Assembly
72−61−07	

	FRONT HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − DISASSEMBLY−01 • 72−61−07−040−001: Disassemble Front Hydraulic Pump Drive Gearshaft And Bearing Assembly
72−61−07	FRONT HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01 • 72−61−07−440−001: Assemble Front Hydraulic Pump Drive Gearshaft And Bearings Assembly
72−61−08	SCAVENGE PUMP DRIVE GEARSHAFT AND BEARING ASSEMBLY − DISASSEMBLY−01 • 72−61−08−040−001−002: Disassemble Scavenge Pump Drive Gearshaft And Bearing Assembly (Pre SB PW4ENG 72−114 And Post SB PW4ENG 72−463) • 72−61−08−040−001−001: Disassemble Scavenge Pump Drive Gearshaft And Bearing Inner Race Assembly (Post SB PW4ENG 72−114)
72−61−08	SCAVENGE PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01 • 72−61−08−440−001−002: Assemble Scavenge Pump Drive Gearshaft And Bearing Assembly (Pre SB PW4ENG 72−114) • 72−61−08−440−001−001: Assemble Scavenge Pump Drive Gearshaft And Bearing Inner Race Assembly (Post SB PW4ENG 72−114) • 72−61−08−440−001−003: Assemble Scavenge Pump Drive Gearshaft And Bearing Assembly (Post SB PW4ENG 72−463)
72−61−09	EEC/PMA ALTERNATOR DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − DISASSEMBLY−01 • 72−61−09−040−001: Disassemble EEC/PMA Alternator Drive Gearshaft And Bearings Assembly
72−61−09	EEC/PMA ALTERNATOR DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01 • 72−61−09−440−001: Assemble EEC/PMA Alternator Drive Gearshaft And Bearings Assembly
72−61−37	SCAVENGE PUMP DRIVE IDLER GEARSHAFT AND BEARINGS ASSEMBLY − DISASSEMBLY−01 • 72−61−37−040−001: Disassemble Scavenge Pump Drive Idler Gearshaft And Bearings Assembly
72−61−37	SCAVENGE PUMP DRIVE IDLER GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01 • 72−61−37−440−001: Assemble Scavenge Pump Drive Idler Gearshaft And Bearings Assembly
72−61−40	SCAVENGE PUMP DRIVE IDLER GEARSHAFT AND BEARINGS ASSEMBLY − DISASSEMBLY−01 • 72−61−40−040−001: Disassemble Scavenge Pump Drive Idler

	Gearshaft And Bearings Assembly
72−61−40	SCAVENGE PUMP DRIVE IDLER GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01 • 72−61−40−440−001: Assemble Scavenge Pump Drive Idler Gearshaft And Bearings Assembly
72−61−71	OIL CHECK VALVE ASSEMBLY − DISASSEMBLY−01 • 72−61−71−040−001: Disassemble Oil Check Valve Assembly
72−61−71	OIL CHECK VALVE ASSEMBLY − ASSEMBLY−01 • 72−61−71−440−001: Assemble Oil Check Valve Assembly

Previous Pageblock Return to Previous Menu Next Pageblock

MAIN GEARBOX - HOW TO USE

Task 72-61-00-990-003:

1. Chapter/Section/Subject Numbering Outline

See Figure 1.

NOTE: See the tab separated How To Use Manual section located at the beginning of this manual set for information concerning Data Location Guidelines and a complete Chapter/Section/Subject numbering outline for all manual sections.

A. The following is a complete listing of the individual Chapter/Section/Subject numbers and specific nomenclatures which have been assigned to the significant main gearbox parts.

(1) Numbers which are not assigned are indicated in the list by one of the following terms:

UNASSIGNED - This designation is for numbers intentionally omitted and reserved for possible future use.

NOT USED - This designation is applied to numbers in other related engine model programs which are not, at this time, applicable to the engine models represented by this manual.

MAIN GEARBOX	72-61-00
DEOILER IMPELLER, GEARSHAFT, AND BEARINGS ASSEMBLY	72-61-01
GEARBOX DRIVE GEARSHAFT AND BEARINGS ASSEMBLY	72-61-02
STARTER DRIVE GEARSHAFT AND BEARINGS ASSEMBLY	72-61-03
FUEL PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY	72-61-04
REAR HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY	72-61-05
IDG DRIVE GEARSHAFT AND BEARINGS ASSEMBLY	72-61-06
FRONT HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY	72-61-07
SCAVENGE PUMP DRIVE GEARSHAFT AND BEARING ASSEMBLY	72-61-08

MAIN GEARBOX − HOW TO USE

EEC/PMA ALTERNATOR DRIVE GEARSHAFT AND BEARINGS ASSEMBLY	72−61−09
GEARBOX HOUSING ASSEMBLY	72−61−10
GEARBOX (DEOILER) SPUR GEARSHAFT ASSEMBLY	72−61−11
GEARBOX (DEOILER) BEARING HOUSING ASSEMBLY	72−61−12
GEARBOX BEARINGS	72−61−13
GEARBOX DEOILER IMPELLER SUPPORT	72−61−14
GEARBOX DEOILER IMPELLER ASSEMBLY	72−61−15
GEARBOX DEOILER IMPELLER LOCK	72−61−16
GEARBOX IDLER SHAFT BOSS ASSEMBLY	72−61−17
GEARBOX DEOILER HOUSING ASSEMBLY	72−61−18
FACE (OIL) SEAL ASSEMBLIES	72−61−19
GEARBOX IDLER SHAFT	72−61−20
GEARBOX (IDLER) SPUR GEAR	72−61−21
GEARBOX (DRIVE) SPUR GEARSHAFT	72−61−22
GEARBOX DRIVE SHAFT HOUSING ASSEMBLY	72−61−23
GEARBOX (STARTER DRIVE) GEARSHAFT ASSEMBLY	72−61−24
GEARBOX (STARTER DRIVE) COUPLING	72−61−25
GEARBOX (STARTER DRIVE) BEARING HOUSING ASSEMBLY	72−61−26
GEARBOX (FUEL PUMP DRIVE) SPUR GEARSHAFT ASSEMBLY	72−61−27
GEARBOX (FUEL PUMP DRIVE) BEARING HOUSING ASSEMBLY	72−61−28
GEARBOX (REAR HYDRAULIC PUMP DRIVE) SPUR GEARSHAFT	72−61−29
GEARBOX (REAR HYDRAULIC PUMP DRIVE) BEARING HOUSING ASSEMBLY	72−61−30
GEARBOX (IDG DRIVE) SPUR GEARSHAFT ASSEMBLY	72−61−31
GEARBOX (IDG DRIVE) BEARING HOUSING ASSEMBLY	72−61−32

MAIN GEARBOX − HOW TO USE

GEARBOX (FRONT HYDRAULIC PUMP DRIVE) BEARING HOUSING ASSEMBLY	72−61−33
GEARBOX (FRONT HYDRAULIC PUMP DRIVE) SPUR GEARSHAFT	72−61−34
GEARBOX (FRONT HYDRAULIC PUMP DRIVE) BEARING SUPPORT	72−61−35
FRONT HYDRAULIC PUMP DRIVE BEARINGS SLEEVE SPACER	72−61−36
NOT USED	72−61−37 and 72−61−38
NOT USED	72−61−39
SCAVENGE PUMP DRIVE IDLER GEARSHAFT AND BEARINGS ASSEMBLY	72−61−40
GEARBOX (SCAVENGE PUMP DRIVE) SPUR GEARSHAFT	72−61−41
GEARBOX (SCAVENGE PUMP DRIVE) BEARING HOUSING ASSEMBLY	72−61−42
COVER (MANUAL CRANK)	72−61−43
SCAVENGE PUMP SPUR GEARSHAFT	72−61−44
GEARBOX (EEC/PMA ALTERNATOR DRIVE) SPUR GEARSHAFT	72−61−45
GEARBOX (EEC/PMA ALTERNATOR DRIVE) BEARING SPACER	72−61−46
GEARBOX GENERATOR (EEC/PMA ALTERNATOR) HOUSING ASSEMBLY	72−61−47
GEARBOX BEARING SEAL SEAT	72−61−48
EEC/PMA ALTERNATOR ROTOR SLEEVE SPACER	72−61−49
NOT USED	72−61−50
GEARBOX PRESSURE MANIFOLD ASSEMBLY	72−61−51
NOT USED	72−61−52
GEARBOX NOZZLE ASSEMBLY	72−61−53
GEARBOX NOZZLE BUSHING	72−61−54

MAIN GEARBOX − HOW TO USE

GEARBOX (EEC/PMA ALTERNATOR) NOZZLE	72−61−55
GEARBOX DRIVESHAFT NOZZLE	72−61−56
GEARBOX DRIVESHAFT PRESSURE TUBE ASSEMBLY	72−61−57
GEARBOX (FRONT HYDRAULIC PUMP DRIVE) NOZZLE	72−61−58
FRONT HYDRAULIC PUMP DRIVE OIL METERING PLUG	72−61−59
MAIN OIL FILTER HOUSING ASSEMBLY	72−61−60
RELIEF VALVE HOUSING (PRESSURE REGULATOR)	72−61−61
PRESSURE (REGULATOR) RELIEF VALVE	72−61−62
RELIEF VALVE PLUG AND SPRING	72−61−63
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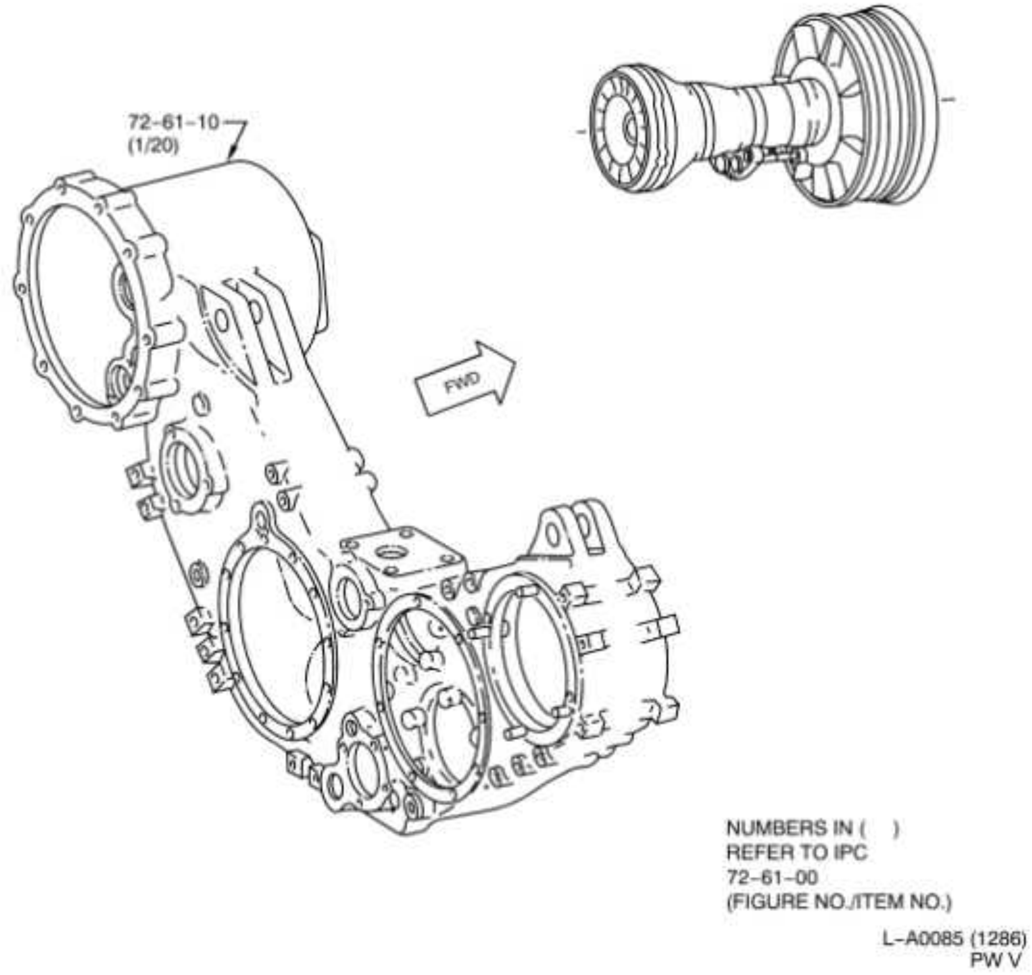
PRESSURE RELIEF VALVE (FILTER ELEMENT)	72−61−65
PACKING TRANSFER TUBES	72−61−66
UNASSIGNED	72−61−67
GEARBOX LUG	72−61−68
OIL TANK DEAERATOR ASSEMBLY	72−61−69
GEARBOX SEALING SLEEVE	72−61−70
OIL CHECK VALVE ASSEMBLY	72−61−71
OIL CHECK VALVE HOUSING	72−61−72
LUBE OIL TANK ASSEMBLY	72−61−73
OIL TANK HEAT SHIELD ASSEMBLY	72−61−74
OIL TANK SUMP ASSEMBLY	72−61−75
NOT USED	72−61−76
UNASSIGNED	72−61−77
OIL TANK BREATHER TUBE	72−61−78
UNASSIGNED	72−61−79

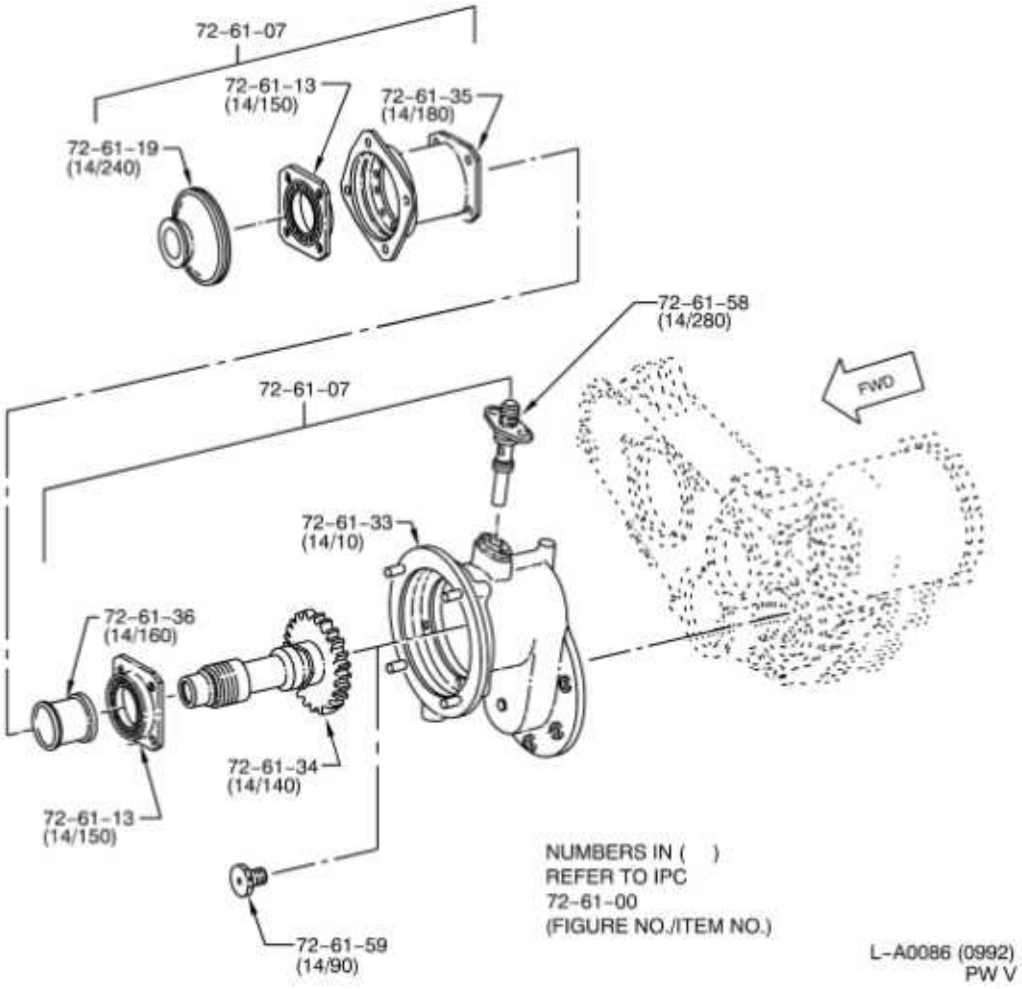
MAIN GEARBOX − HOW TO USE

GEARBOX DRIVESHAFT	72−61−80
GEARBOX DRIVESHAFT (FRONT) HOUSING/HOUSING AND STRAINER ASSEMBLY	72−61−81
UNASSIGNED	72−61−82
GEARBOX DRIVESHAFT HOUSING SUPPORT LINK SHOULDERED BOLT	72−61−83
GEARBOX SUPPORT LINK	72−61−84
GEARBOX SUPPORT LINK SPHERICAL BEARING	72−61−85
GEARBOX SUPPORT LINK UPPER HOLLOW PINS	72−61−86
GEARBOX SUPPORT LINK LOWER HOLLOW PINS	72−61−87
GEARBOX SUPPORT LINK UPPER BOLTS	72−61−88
GEARBOX SUPPORT LINK LOWER BOLTS	72−61−89
GEARBOX SUPPORT LINK UPPER PIN SPACERS	72−61−90
GEARBOX SUPPORT LINK LOWER PIN SPACERS	72−61−91
GEARBOX IDLER SHAFT ADAPTER ASSEMBLY	72−61−92
NOT USED	72−61−93 through 72−61−96
UNASSIGNED	72−61−97 through 72−61−98
MAIN GEARBOX MISCELLANEOUS PARTS	72−61−99

MAIN GEARBOX − HOW TO USE


72−61−10
(1/20)
FWD
NUMBERS IN ( )
REFER TO IPC
72−61−00
(FIGURE NO./ITEM NO.)
L−A0085 (1286)
PW V

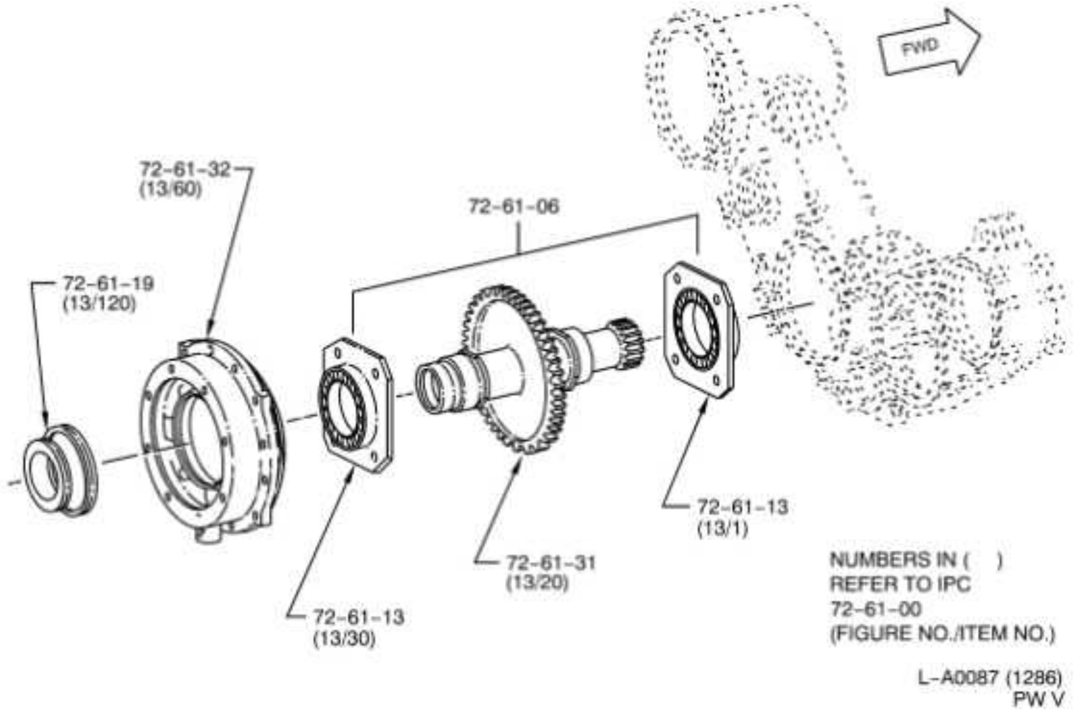
Main Gearbox
Figure 1 (Sheet 1)
(Task 72−61−00−990−003)


72-61-07
72-61-13
(14/150)
72-61-35
(14/180)
72-61-19
(14/240)
72-61-58
(14/280)
FWD
72-61-07
72-61-33
(14/10)
72-61-36
(14/160)
72-61-34
(14/140)
72-61-13
(14/150)
72-61-59
(14/90)
L-A0086 (0992)
PW V

NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)

Main Gearbox
Figure 1 (Sheet 2)
(Task 72-61-00-990-003)

MAIN GEARBOX − HOW TO USE


FWD
72-61-32
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72-61-19
(13/120)
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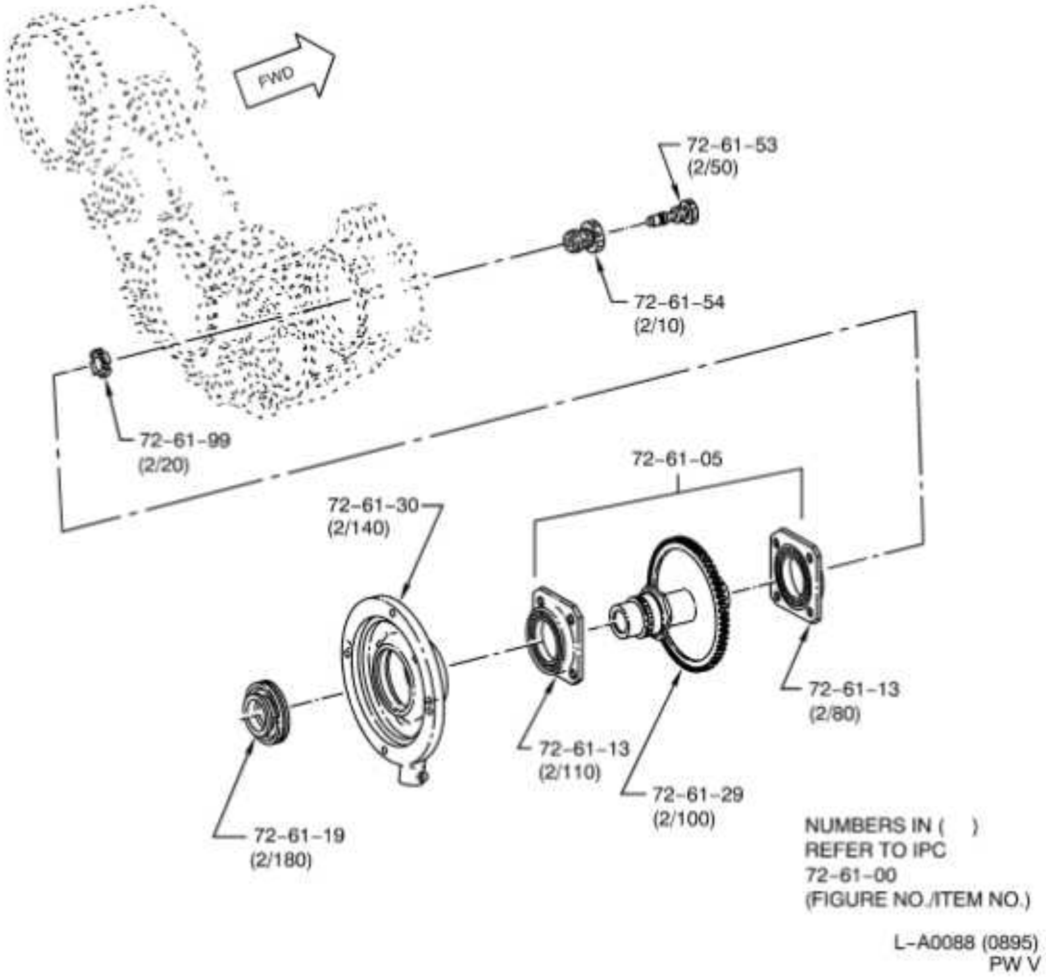
72-61-31
(13/20)
72-61-13
(13/30)
NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)
L-A0087 (1286)
PW V

Main Gearbox
Figure 1 (Sheet 3)
(Task 72−61−00−990−003)

MAIN GEARBOX - HOW TO USE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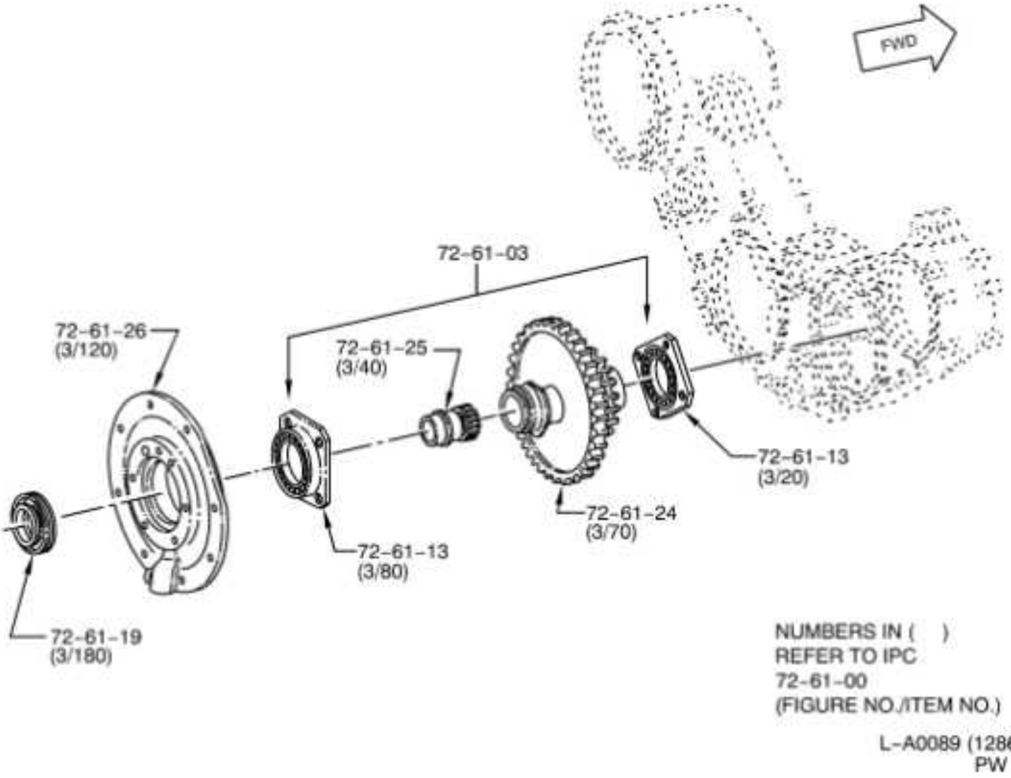
(2/50)
72-61-54
(2/10)
72-61-99
(2/20)
72-61-05
72-61-30
(2/140)
72-61-13
(2/80)
72-61-13
(2/110)
72-61-29
(2/100)
72-61-19
(2/180)
NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)
L-A0088 (0895)
PW V

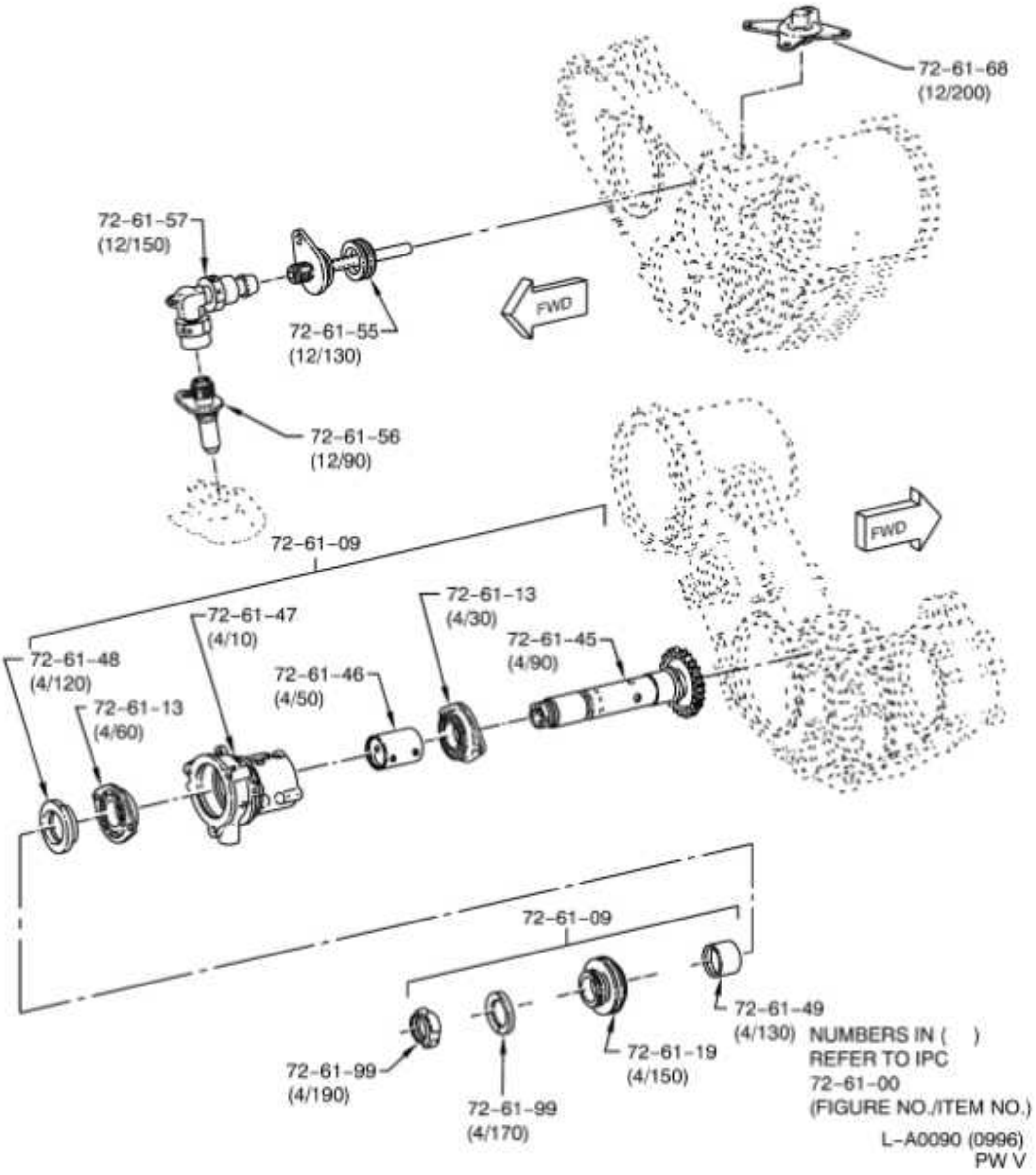
Main Gearbox
Figure 1 (Sheet 4)
(Task 72-61-00-990-003)

MAIN GEARBOX − HOW TO USE


FWD
72-61-03
72-61-26
(3/120)
72-61-25
(3/40)
72-61-13
(3/20)
72-61-24
(3/70)
72-61-13
(3/80)
72-61-19
(3/180)
NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)
L-A0089 (1286)
PW V

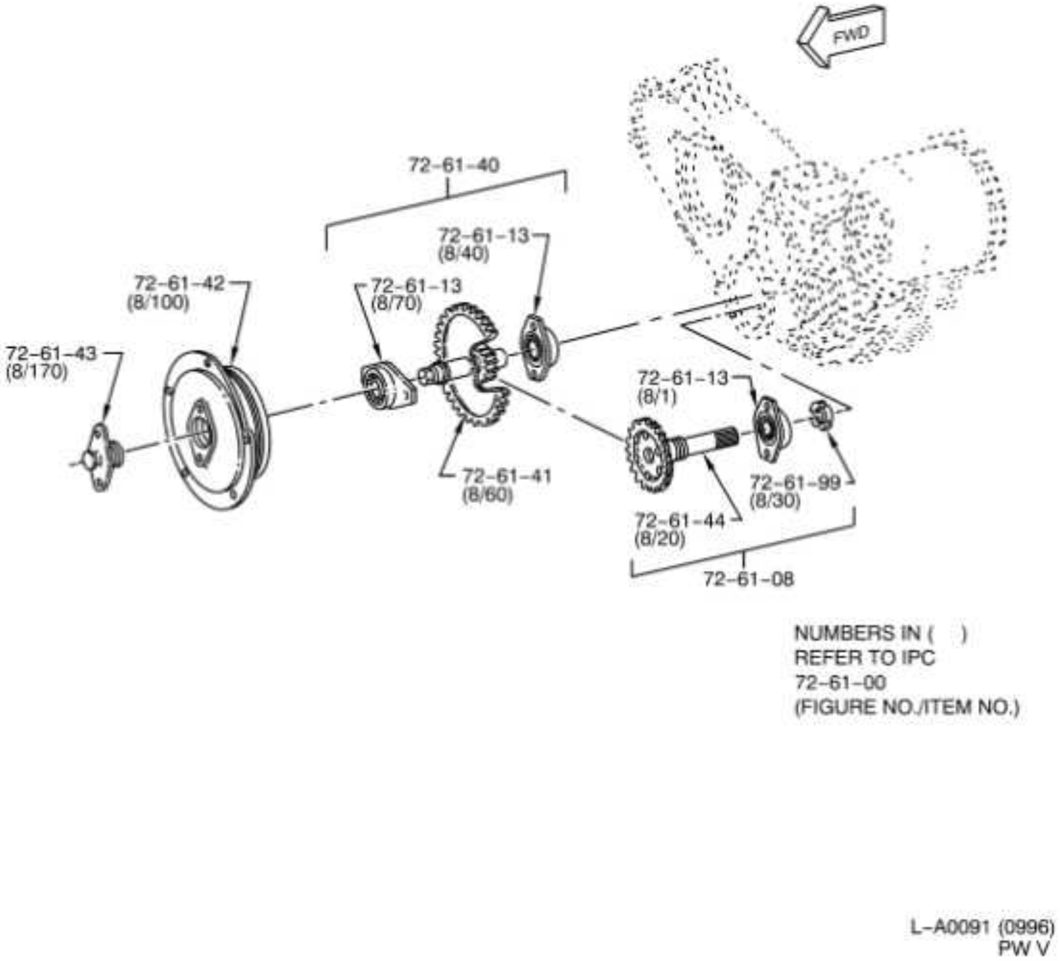
Main Gearbox
Figure 1 (Sheet 5)
(Task 72−61−00−990−003)

MAIN GEARBOX − HOW TO USE


72-61-68
(12/200)
72-61-57
(12/150)
72-61-55
(12/130)
FWD
72-61-56
(12/90)
72-61-09
FWD
72-61-13
(4/30)
72-61-47
(4/10)
72-61-45
(4/90)
72-61-48
(4/120)
72-61-46
(4/50)
72-61-13
(4/60)
72-61-09
72-61-49
(4/130)
NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)
72-61-19
(4/150)
72-61-99
(4/190)
72-61-99
(4/170)
L-A0090 (0996)
PW V

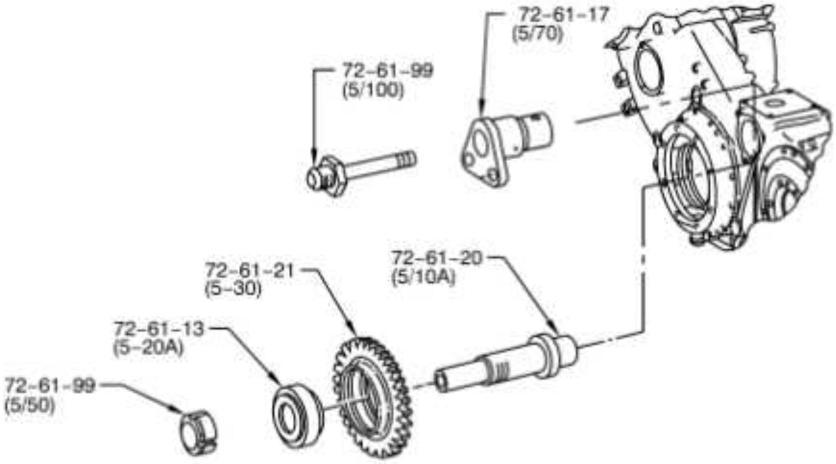
Main Gearbox
Figure 1 (Sheet 6)
(Task 72−61−00−990−003)

MAIN GEARBOX - HOW TO USE


FWD
72-61-40
72-61-13
(8/40)
72-61-42
(8/100)
72-61-13
(8/70)
72-61-43
(8/170)
72-61-13
(8/1)
72-61-41
(8/60)
72-61-99
(8/30)
72-61-44
(8/20)
72-61-08
NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)
L-A0091 (0996)
PW V

Main Gearbox
Figure 1 (Sheet 7)
(Task 72-61-00-990-003)

MAIN GEARBOX − HOW TO USE


72-61-17
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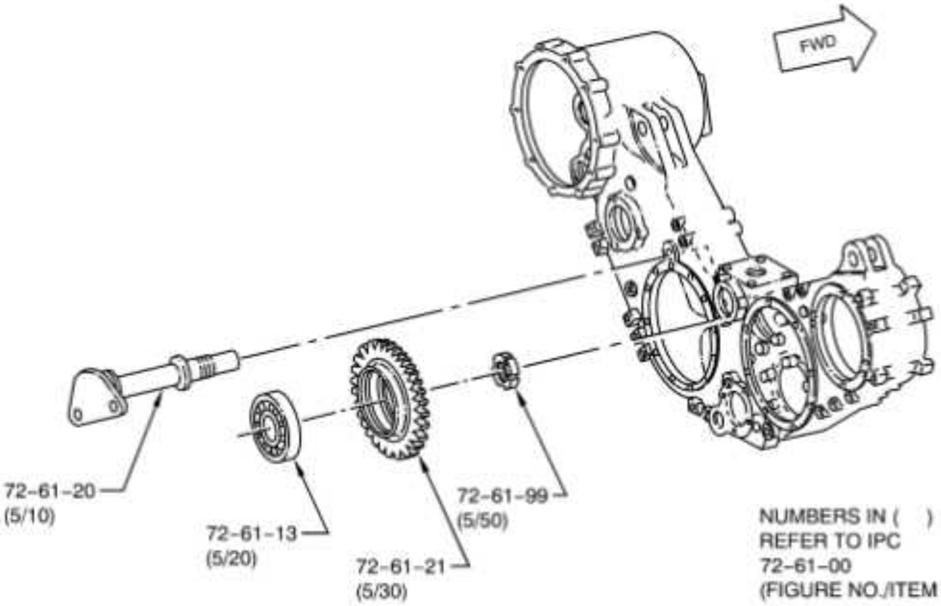
72-61-99
(5/100)
72-61-21
(5-30)
72-61-20
(5/10A)
72-61-13
(5-20A)
72-61-99
(5/50)

(POST SB PW4ENG 72-491)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72-61-20
(5/10)
72-61-13
(5/20)
72-61-21
(5/30)
72-61-99
(5/50)

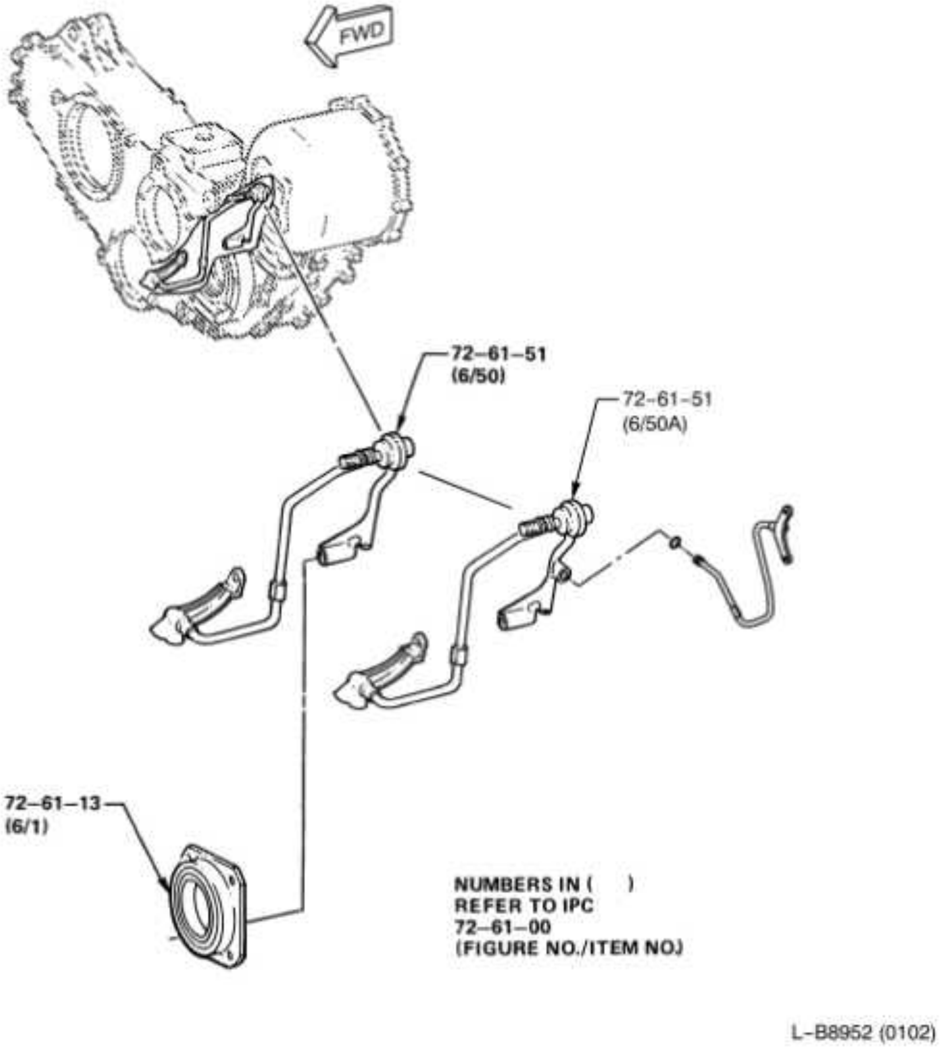
(PPE SB PW4ENG 72-491)

NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)

L-A0092 (0895)
PW V

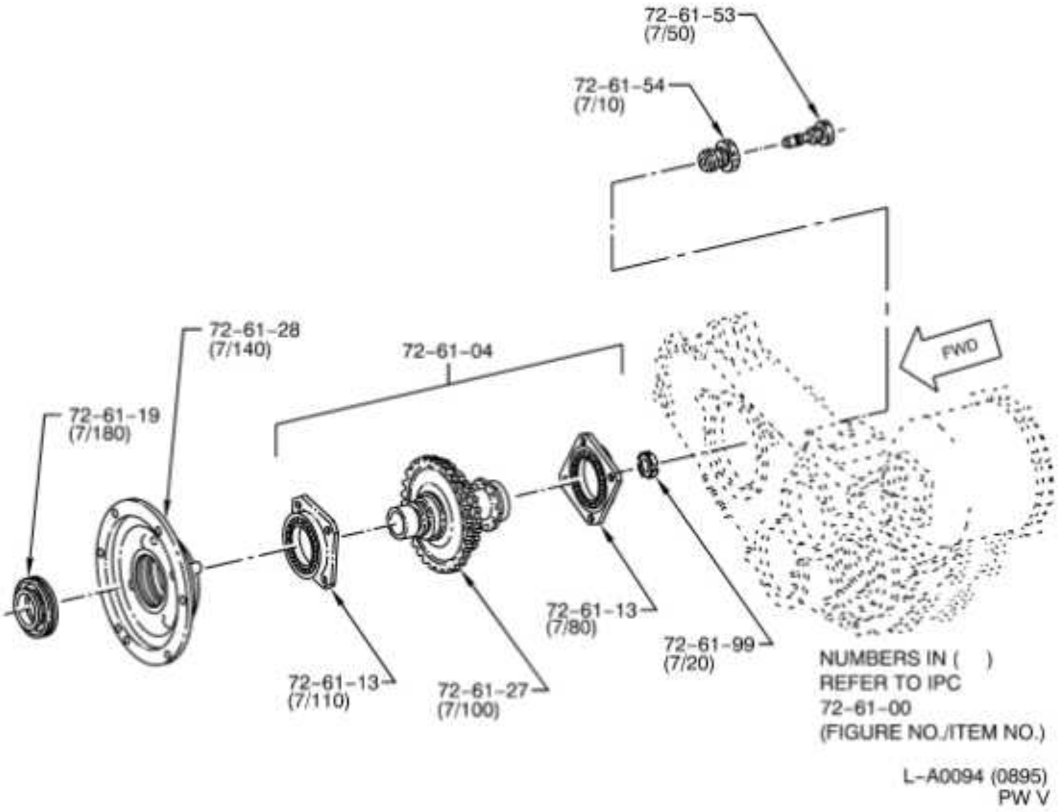
Main Gearbox
Figure 1 (Sheet 8)
(Task 72−61−00−990−003)

MAIN GEARBOX − HOW TO USE


FWD
72−61−51
(6/50)
72-61-51
(6/50A)
72−61−13
(6/1)
NUMBERS IN ( )
REFER TO IPC
72−61−00
(FIGURE NO./ITEM NO.)
L-B8952 (0102)

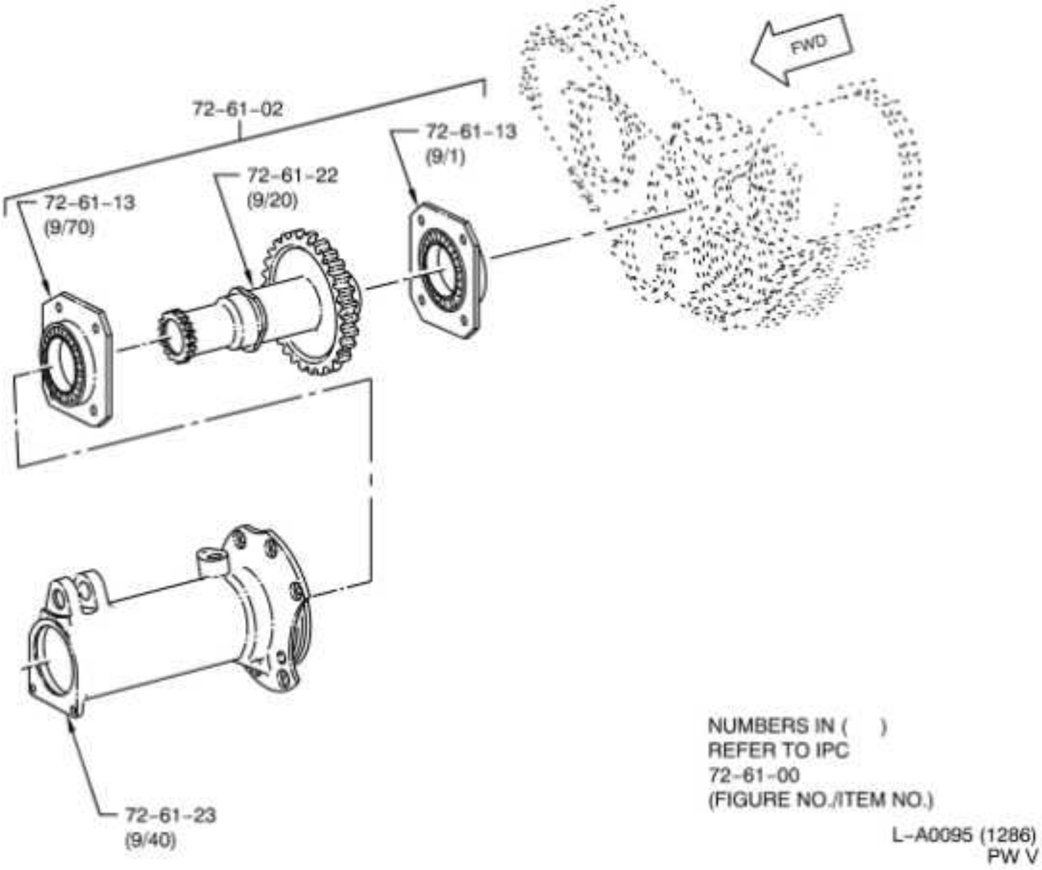
Main Gearbox
Figure 1 (Sheet 9)
(Task 72−61−00−990−003)

MAIN GEARBOX - HOW TO USE


72-61-53
(7/50)
72-61-54
(7/10)
72-61-28
(7/140)
72-61-04
72-61-19
(7/180)
FWD
72-61-13
(7/80)
72-61-99
(7/20)
72-61-13
(7/110)
72-61-27
(7/100)
NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)
L-A0094 (0895)
PW V

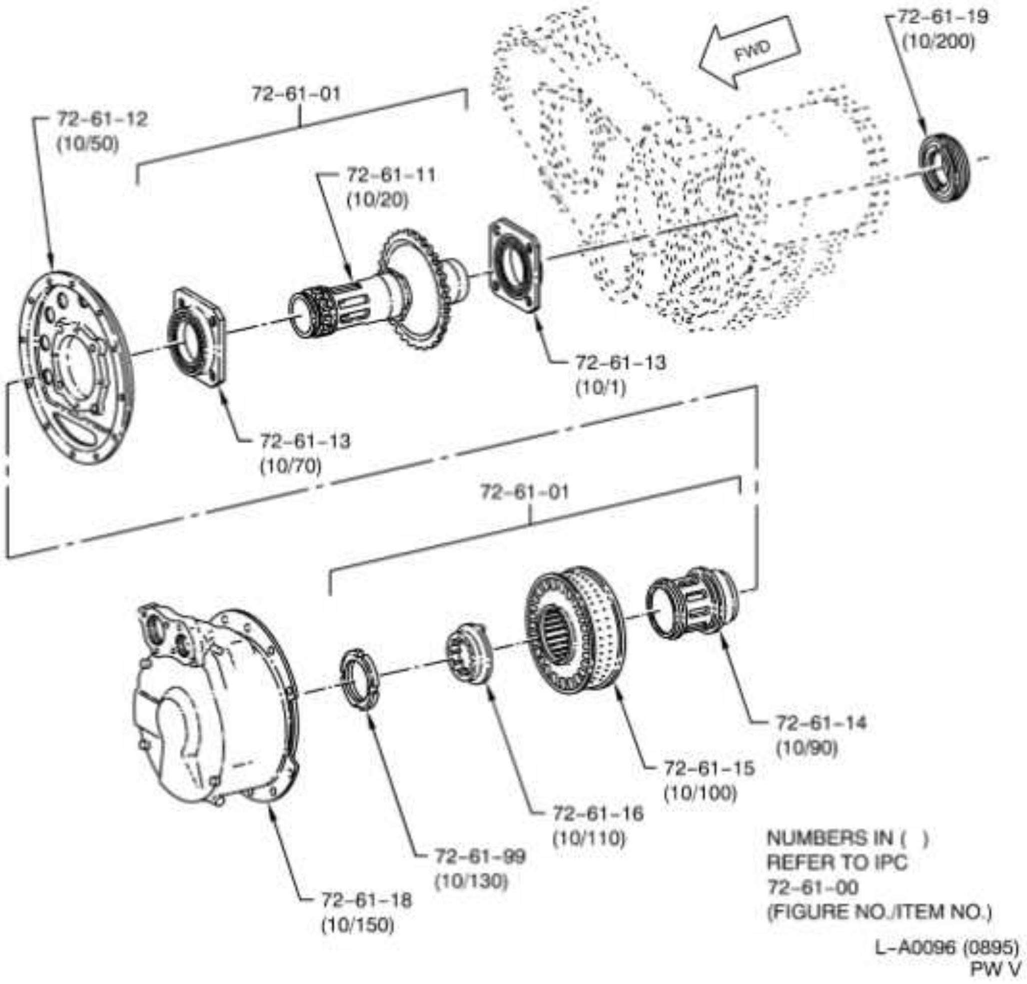
Main Gearbox
Figure 1 (Sheet 10)
(Task 72-61-00-990-003)

MAIN GEARBOX − HOW TO USE


FWD
72-61-02
72-61-13
(9/1)
72-61-22
(9/20)
72-61-13
(9/70)
72-61-23
(9/40)
NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)
L-A0095 (1286)
PW V

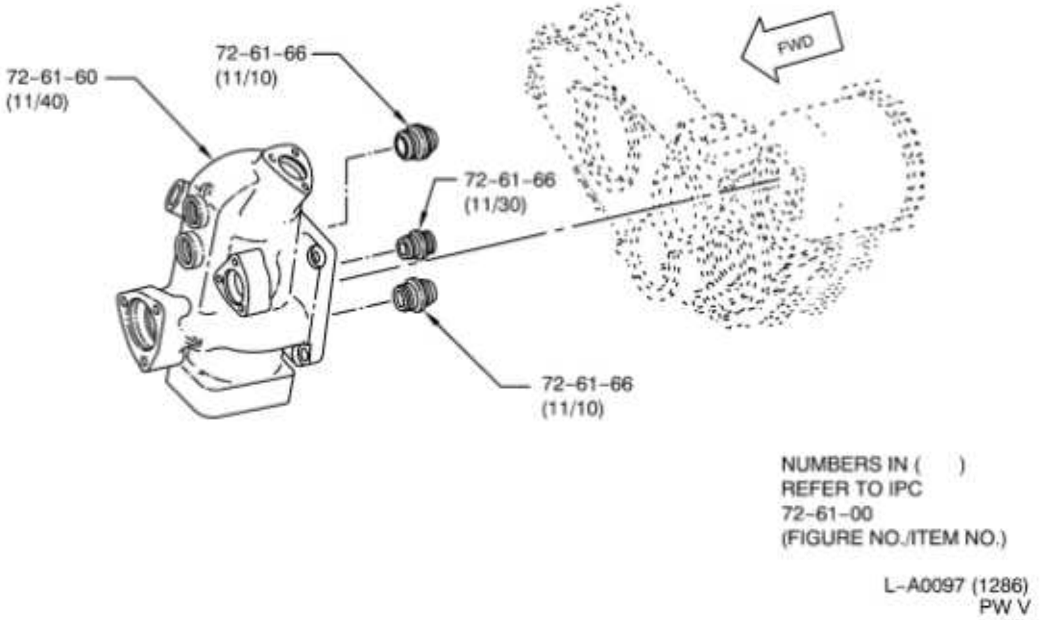
Main Gearbox
Figure 1 (Sheet 11)
(Task 72−61−00−990−003)

MAIN GEARBOX − HOW TO USE


72−61−19
(10/200)
FWD
72−61−01
72−61−12
(10/50)
72−61−11
(10/20)
72−61−13
(10/1)
72−61−13
(10/70)
72−61−01
72−61−14
(10/90)
72−61−15
(10/100)
72−61−16
(10/110)
72−61−99
(10/130)
72−61−18
(10/150)
NUMBERS IN ( )
REFER TO IPC
72−61−00
(FIGURE NO./ITEM NO.)
L−A0096 (0895)
PW V

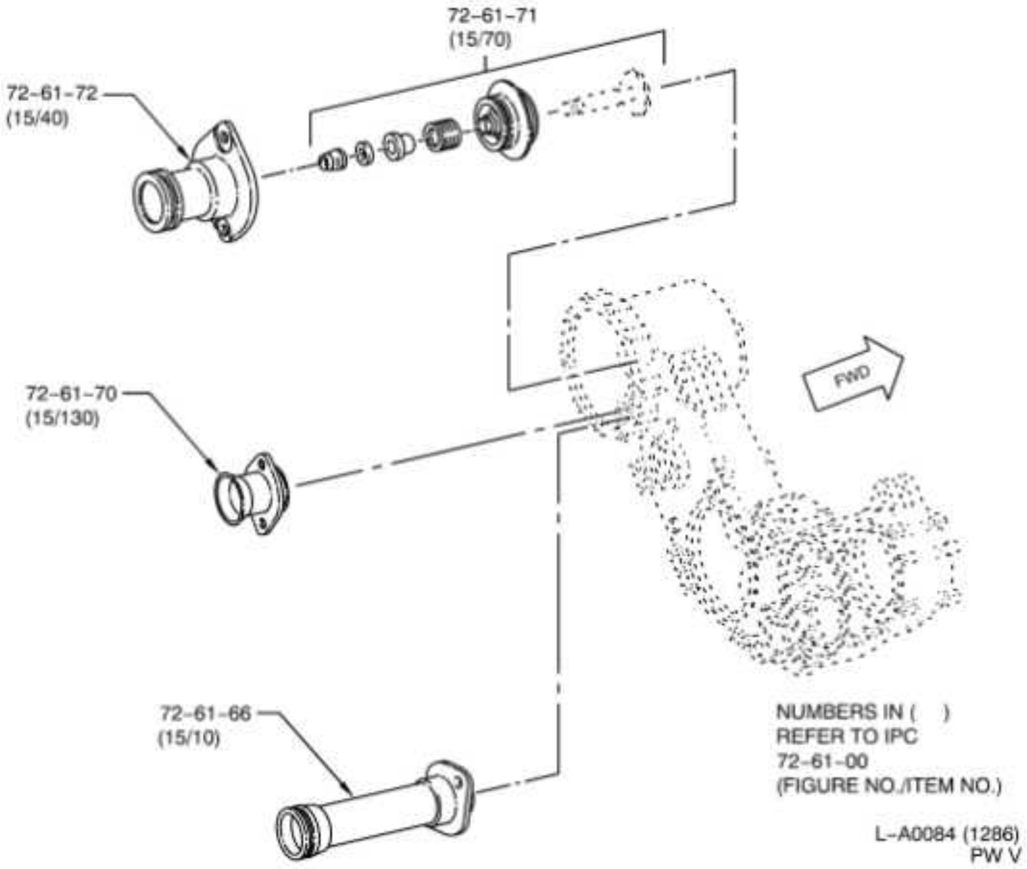
Main Gearbox
Figure 1 (Sheet 12)
(Task 72−61−00−990−003)

MAIN GEARBOX − HOW TO USE


72-61-60
(11/40)
72-61-66
(11/10)
FWD
72-61-66
(11/30)
72-61-66
(11/10)
NUMBERS IN ( )
REFER TO IPC
72-61-00
(FIGURE NO./ITEM NO.)
L-A0097 (1286)
PW V

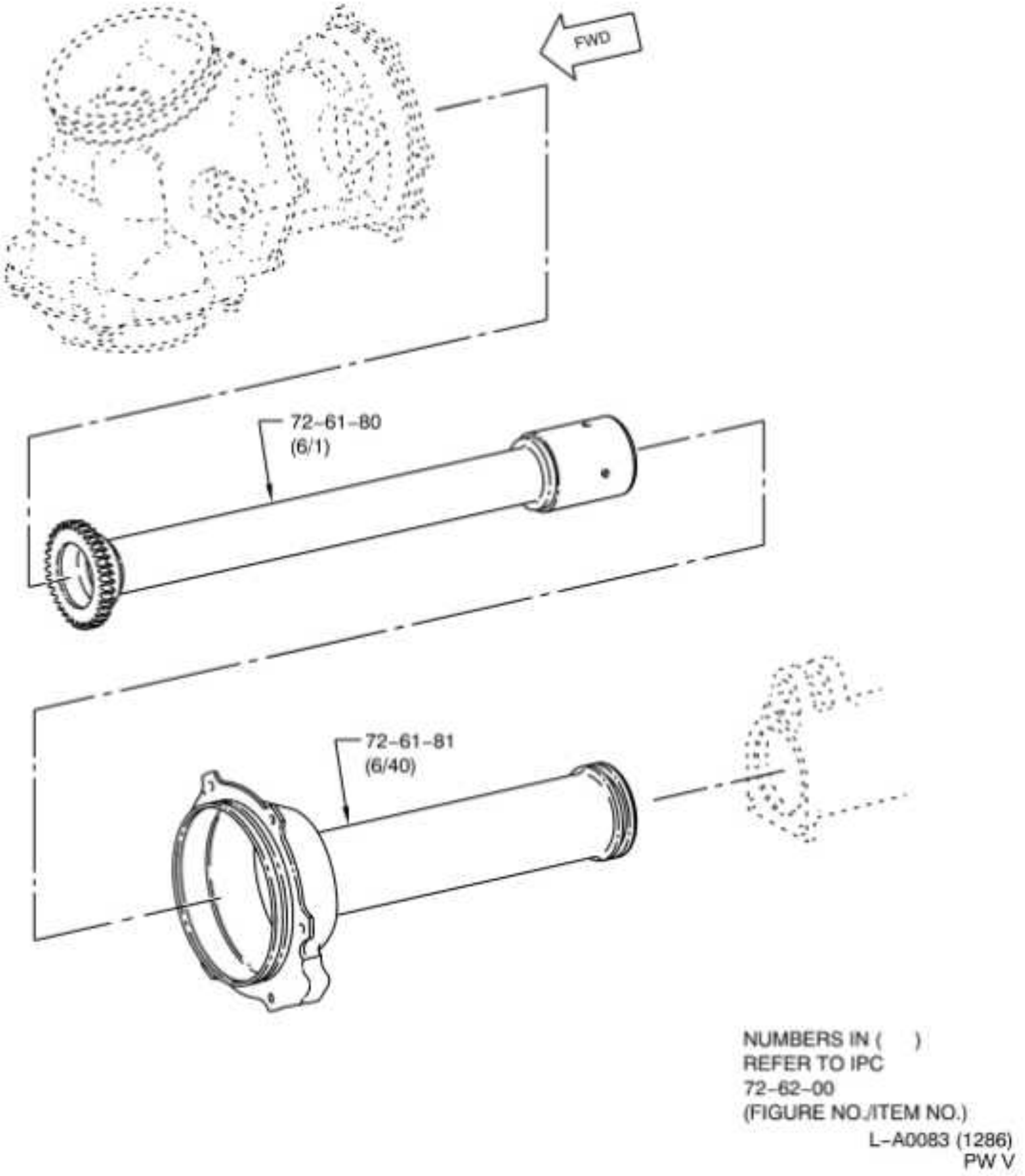
Main Gearbox
Figure 1 (Sheet 13)
(Task 72−61−00−990−003)

MAIN GEARBOX − HOW TO USE


72−61−71
(15/70)
72−61−72
(15/40)
FWD
72−61−70
(15/130)
72−61−66
(15/10)
NUMBERS IN ( )
REFER TO IPC
72−61−00
(FIGURE NO./ITEM NO.)
L−A0084 (1286)
PW V

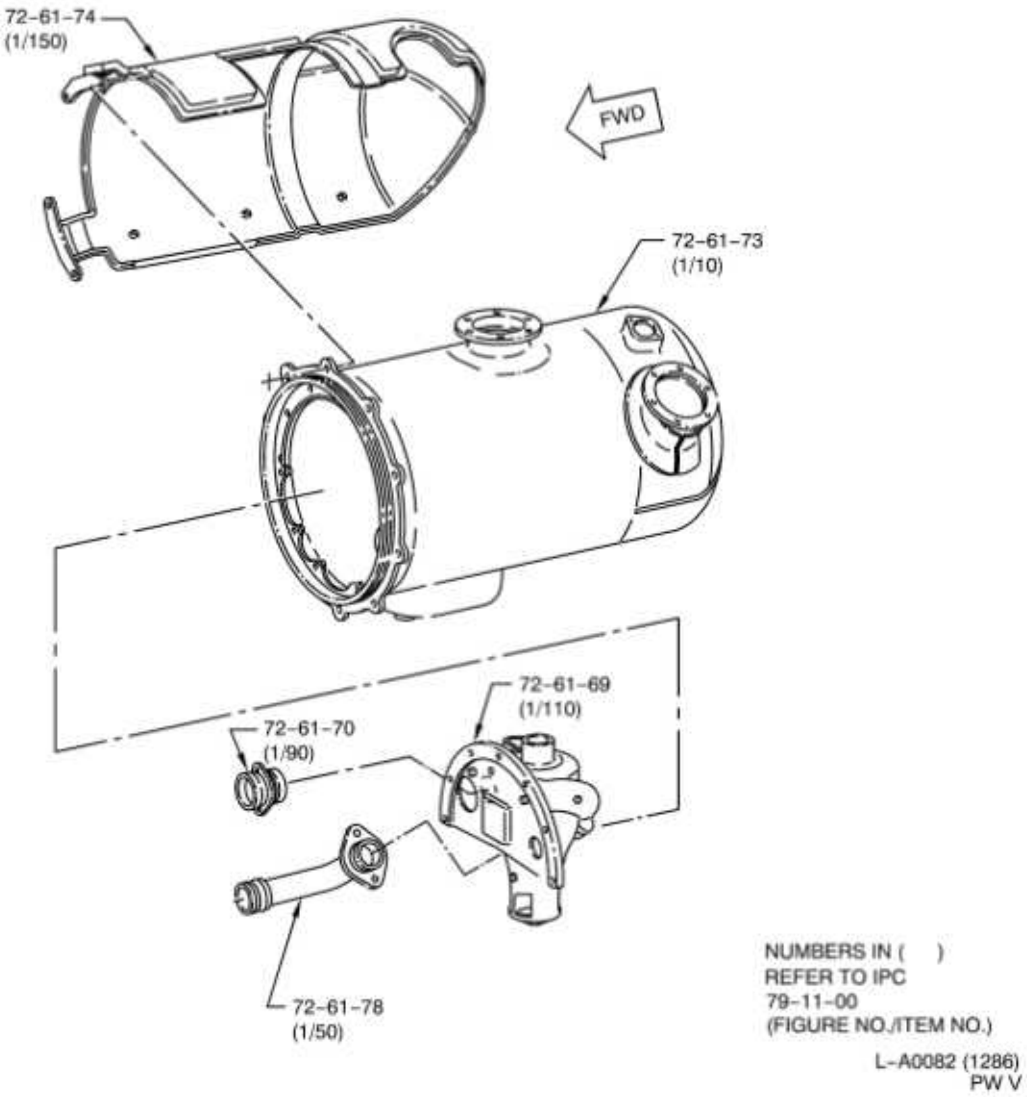
Main Gearbox
Figure 1 (Sheet 14)
(Task 72−61−00−990−003)

MAIN GEARBOX − HOW TO USE


FWD
72-61-80
(6/1)
72-61-81
(6/40)
NUMBERS IN ( )
REFER TO IPC
72-62-00
(FIGURE NO./ITEM NO.)
L-A0083 (1286)
PW V

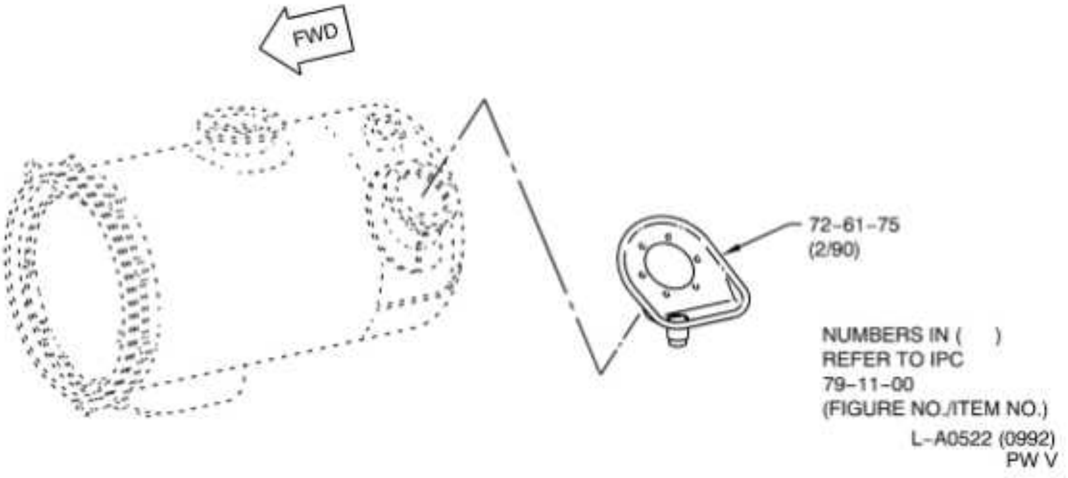
Main Gearbox
Figure 1 (Sheet 15)
(Task 72−61−00−990−003)

MAIN GEARBOX - HOW TO USE


72-61-74
(1/150)
FWD
72-61-73
(1/10)
72-61-69
(1/110)
72-61-70
(1/90)
72-61-78
(1/50)
NUMBERS IN ( )
REFER TO IPC
79-11-00
(FIGURE NO./ITEM NO.)
L-A0082 (1286)
PW V

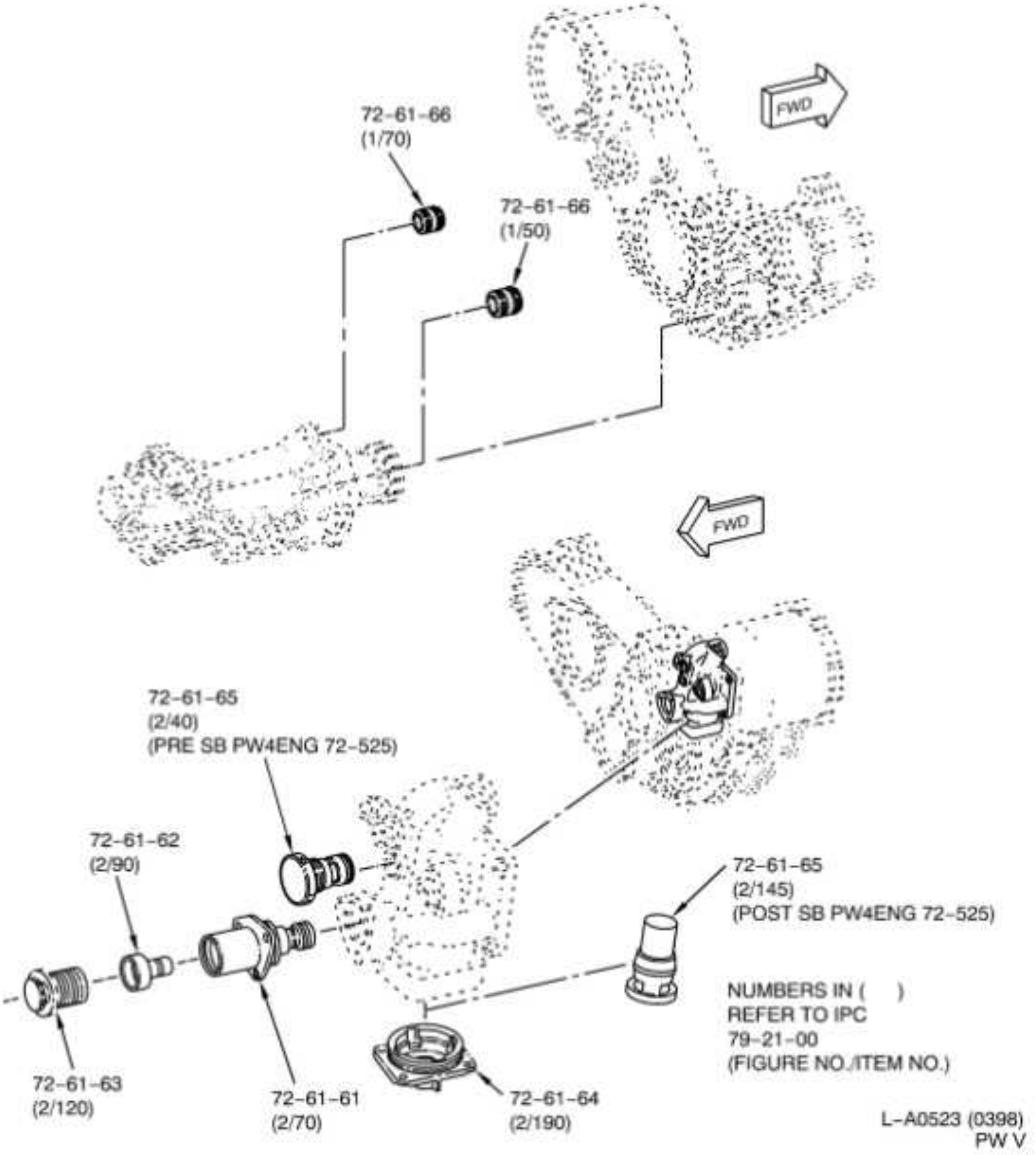
Main Gearbox
Figure 1 (Sheet 16)
(Task 72-61-00-990-003)

MAIN GEARBOX − HOW TO USE


FWD
72-61-75
(2/90)
NUMBERS IN ( )
REFER TO IPC
79-11-00
(FIGURE NO./ITEM NO.)
L-A0522 (0992)
PW V

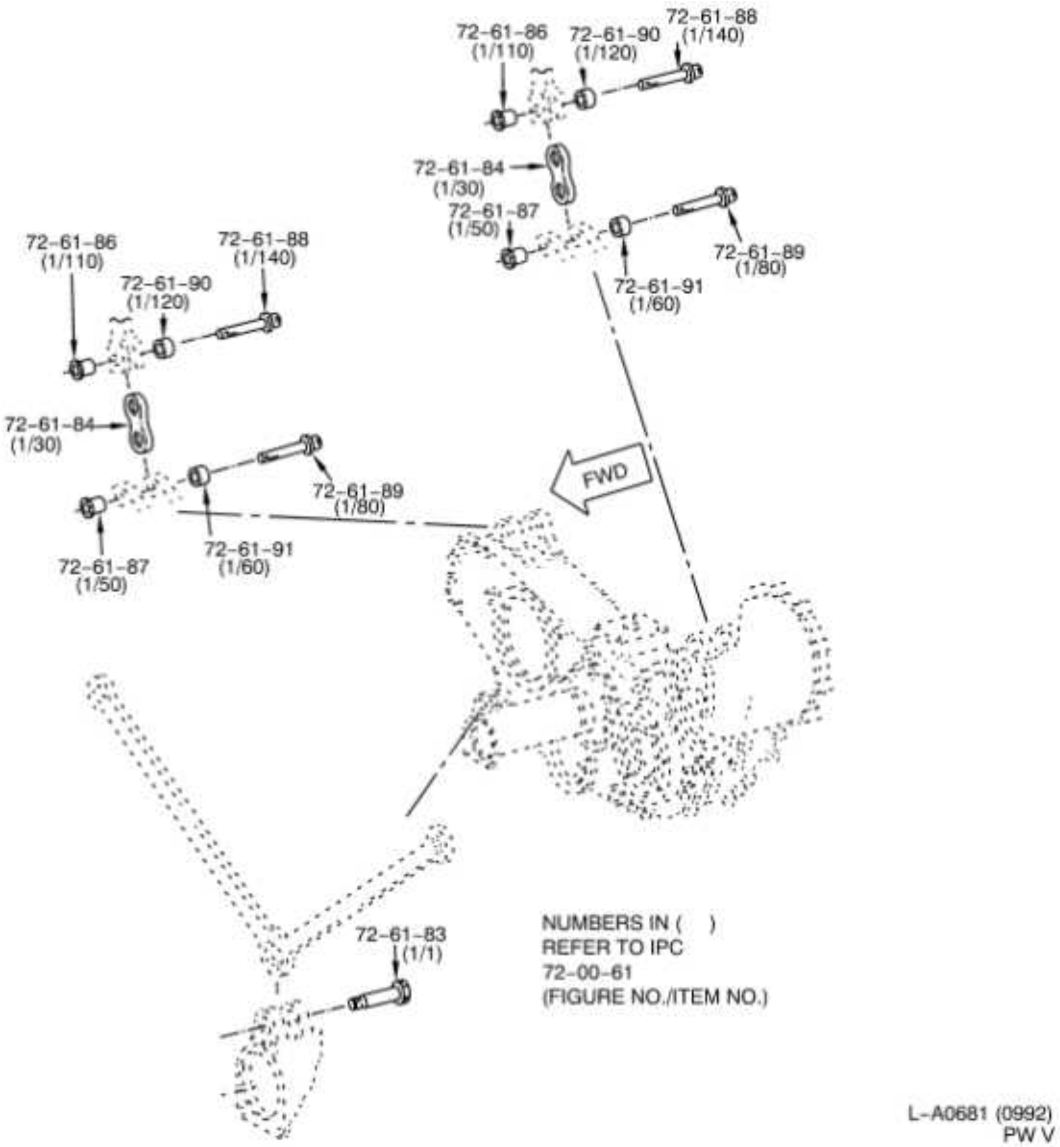
Main Gearbox
Figure 1 (Sheet 17)
(Task 72−61−00−990−003)

MAIN GEARBOX − HOW TO USE


72-61-66
(1/70)
72-61-66
(1/50)
FWD
FWD
72-61-65
(2/40)
(PRE SB PW4ENG 72-525)
72-61-62
(2/90)
72-61-65
(2/145)
(POST SB PW4ENG 72-525)
NUMBERS IN ( )
REFER TO IPC
79-21-00
(FIGURE NO./ITEM NO.)
72-61-63
(2/120)
72-61-61
(2/70)
72-61-64
(2/190)
L-A0523 (0398)
PW V

Main Gearbox
Figure 1 (Sheet 18)
(Task 72−61−00−990−003)

MAIN GEARBOX - HOW TO USE


72-61-86
(1/110)
72-61-90
(1/120)
72-61-88
(1/140)
72-61-84
(1/30)
72-61-87
(1/50)
72-61-89
(1/80)
72-61-91
(1/60)
72-61-86
(1/110)
72-61-88
(1/140)
72-61-90
(1/120)
72-61-84
(1/30)
72-61-89
(1/80)
72-61-91
(1/60)
72-61-87
(1/50)
FWD
72-61-83
(1/1)
NUMBERS IN ( )
REFER TO IPC
72-00-61
(FIGURE NO./ITEM NO.)
L-A0681 (0992)
PW V

Main Gearbox
Figure 1 (Sheet 19)
(Task 72-61-00-990-003)

Previous Pageblock Return to Previous Menu Next Pageblock

MAIN GEARBOX − DESCRIPTION/OPERATION−00

Task 72−61−00−990−002:

1. General

See Figure 1 andFigure 2.

A. The main gearbox transmits power from the engine to the accessories mounted on the gearbox. It provides specific speeds, torques and mounting provisions required for the accessories to perform their various functions.

B. The main gearbox is located at the bottom of the HPC rear case and immediately in front of the diffuser case. See Figure 1. It is attached utilizing a three point system. Two points of this system are widely spaced, transverse−pin supported ball joints between the gearbox and the engine cases at K Flange. The third support point consists of a vertical link with a single ball joint attachment on the gearbox driveshaft housing and two ball joint attachments on the HPC rear case. The ball joint attachments are free to move upon their support pins to allow for engine diameter thermal growth without imposing loads on the gearbox mounting system.

C. The main gearbox consists of a cast aluminum housing incorporating a gear train and mounting pads for airframe and engine accessories. Drive pads on the rear face of the housing are furnished for the integrated drive generator system, for the starter, for the engine hydraulic pump and for the main oil/scavenge pump. The electronic engine control generator drive pad and the breather pad are also on the rear face See Figure 2. The front face of the housing has pads for mounting the fuel pump/fuel metering unit in tandem, and the front hydraulic pump. With the oil tank mounted directly into the gearbox housing from the rear , the main oil filter is installed on a pad on the front face.

D. The power to drive the accessories is obtained from the high pressure compressor. A towershaft in the intermediate case is geared to the front of the HPC shaft and drives through the bevel gears in the angle gearbox to the gearbox driveshaft and the main gearbox. General lubrication of the gears, bearings and gearshaft splines is accomplished by use of oil jets and oil splash.

MAIN GEARBOX − DESCRIPTION/OPERATION−00

E. All accessory drive components are plug−in units. The pad seals are spring loaded carbon which bear on a polished carburized surface. With the sole exception of the fuel pump, all accessory mount pads were designed with a pad cavity drain boss. The fuel pump/fuel metering unit combination has its cavity drain in the fuel pump housing.

F. Starter Drive

(1) The direction of rotation is counterclockwise. Starter drive coupling splines are not lubricated.

G. Integrated Drive Generator

(1) The direction of rotation is counterclockwise. The drive incorporates lubricated spline feature. The drive splines are lubricated by a stream of oil which is scooped into the center of the shaft, passes through the splines, and is discharged through seventeen radial holes in the shaft into the gearbox cavity.

H. Rear Hydraulic Pump Drive

(1) The direction of rotation is counterclockwise. The drive shaft has positive oil lubrication introduced to the center of the shaft at the opposite end of the shaft by an oil nozzle. After passing through the splines, the oil is discharged into the main gearbox cavity through twelve radial holes in the driveshaft.

I. Engine Fuel Pump/Fuel Metering Unit drive

(1) The direction of rotation is clockwise. The drive shaft has positive oil lubrication introduced to the center of the shaft at the opposite end of the shaft by an oil nozzle. After passing through the splines, the oil is discharged into the main gearbox cavity through twelve radial holes in the drive shaft.

J. Electronic Engine Control Generator Drive

(1) The direction of rotation is counterclockwise.

K. Engine Main Oil/Scavenge Pump Drive

(1) The direction of rotation is counterclockwise.

L. Main Gearbox Bearings

(1) In all main gearbox locations, the bearings are roller bearings. In locations where accessory drive shafts are supported, the outer races are flanged. Only the idler gear has the bearing inner race clamped. The flanged bearings have double shouldered inner races and single shouldered outer races. Lubrication and cooling is accomplished by mist oil.

M. Main Gearbox Seals

(1) The gearbox seal assemblies are spring loaded carbon face seals retained in an aluminum housing. The entire seal assembly is repairable/replaceable.

N. Gearbox Main Oil Pressure/Scavenge Pumps

(1) The main oil pressure pump and the five scavenge pumps are all assembled in one housing and that housing is mounted on the rear face of the main gearbox housing. The main oil pump is a single stage, positive displacement gear pump that delivers a variable oil flow proportional to the engine rotor speed/engine operating condition. Oil from the No. 1/1.5/2 bearing compartment, the No. 3 bearing compartment and the angle and main gearboxes is scavenged back to the oil tank through the designated scavenge pumps. Combined breather air/scavenge oil from the No. 4 bearing compartment is returned to the oil tank through the scavenge pump.

O. Engine De−Oiler

(1) The deoiler is mounted on the front face of the main gearbox housing just to the left of and below the engine oil tank. Breather air from the Nos. 1/1.5/2 and 3 bearing compartments is passed through the deoiler, the entrapped oil is removed from the air and returned to the oil tank and the breather air is vented overboard through the turbine exhaust case.

P. Engine Oil Filter

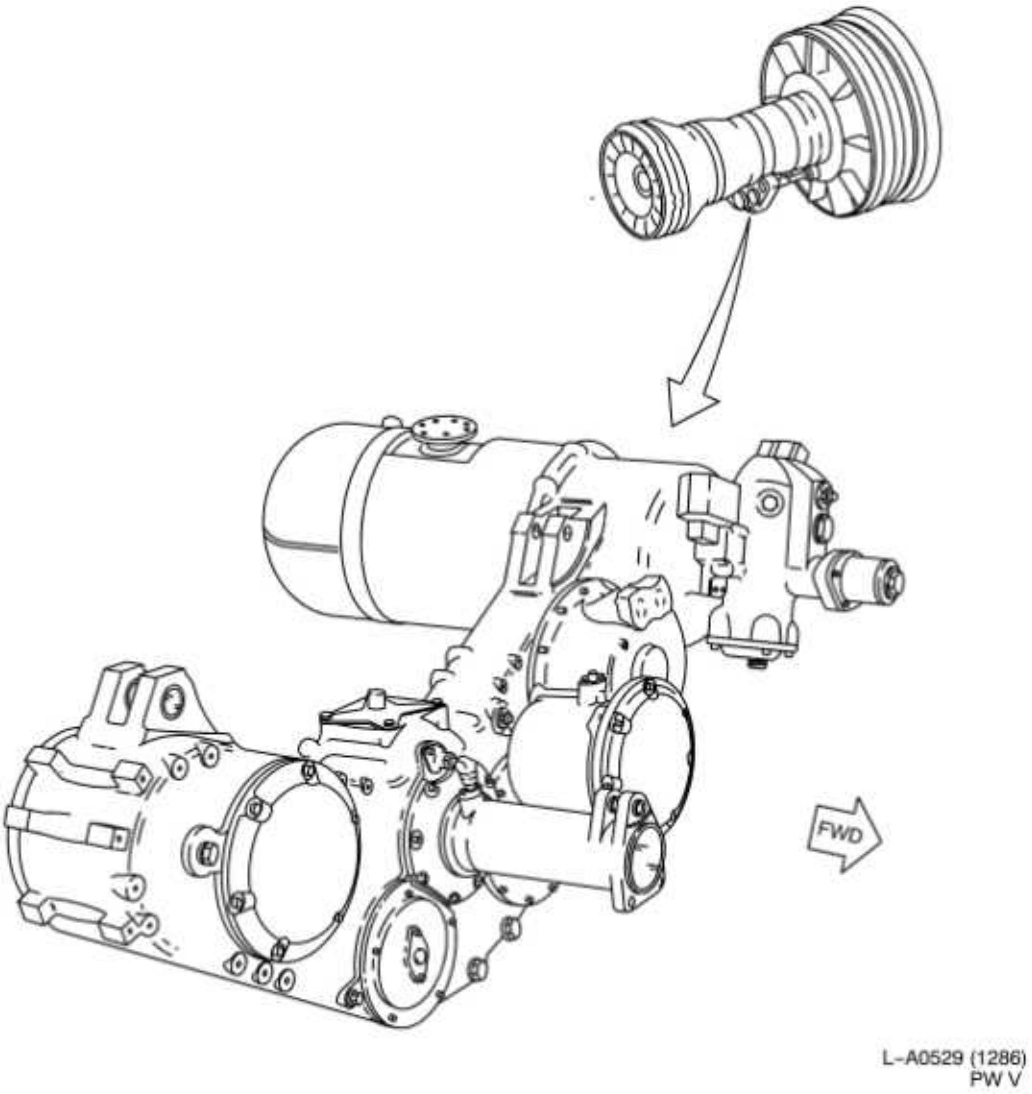
(1) The main oil filter housing is mounted on the front face of the main gearbox housing at the forward end of the engine oil tank. The filter installed in the housing is a 15 micron nominal disposable type filter. The housing has a bypass feature in the event of a plugged filter to allow for uninterrupted oil flow.

MAIN GEARBOX − DESCRIPTION/OPERATION−00

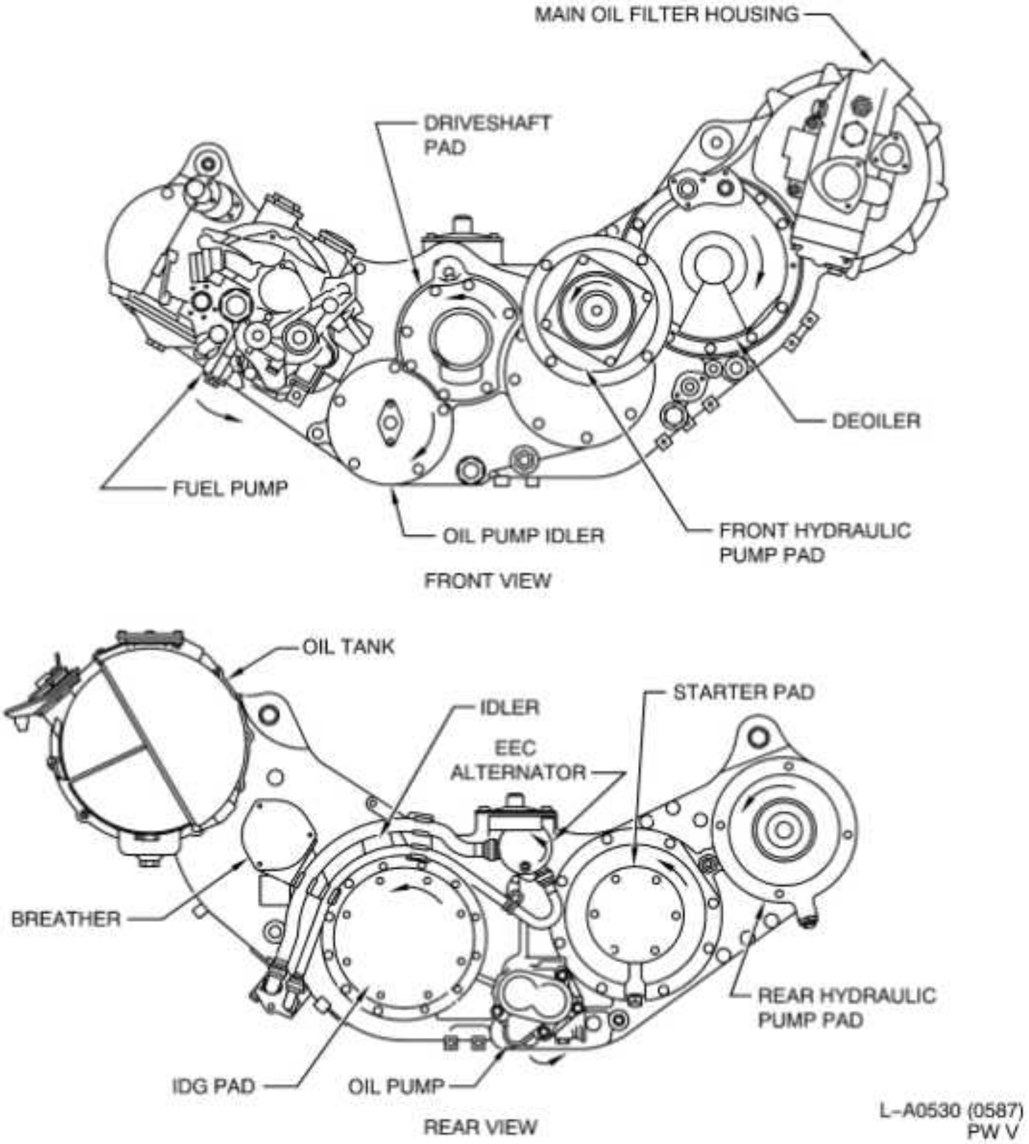
Q. Front Hydraulic Pump Drive

(1) The direction of rotation is counterclockwise. The drive shaft has positive oil lubrication introduced to the center of the shaft at the opposite end of the shaft by an oil nozzle. After passing through the splines, the oil is discharged into the main gearbox cavity through twelve radial holes in the driveshaft.

MAIN GEARBOX − DESCRIPTION/OPERATION−00



Main Gearbox
Figure 1
(Task 72−61−00−990−002)


MAIN OIL FILTER HOUSING
DRIVESHAFT PAD
DEOILER
FUEL PUMP
OIL PUMP IDLER
FRONT HYDRAULIC PUMP PAD
FRONT VIEW
OIL TANK
IDLER
STARTER PAD
EEC ALTERNATOR
BREATHER
REAR HYDRAULIC PUMP PAD
IDG PAD
OIL PUMP
REAR VIEW
L-A0530 (0587)
PW V

Main Gearbox Accessory Drives
Figure 2
(Task 72−61−00−990−002)

Previous Pageblock Return to Previous Menu Next Pageblock

MAIN GEARBOX - DISASSEMBLY-01

Task 72-61-00-030-001:

1. Disassemble The Lube Oil Tank From The Main Gearbox

A. Equipment And Materials Required

Special Tools:

PWA 75599	Build Stand
PWA 85123	Fixture (Optional to PWA 86056 Fixture)
PWA 85241	Arm
PWA 85242	Adapter, Holding
PWA 85327	Adapter
PWA 86056	Fixture
PWA 88231	Puller, Jackscrew

B. Procedure

Subtask 72-61-00-030-051:

CAUTION: IF LUBE OIL TANK IS INSTALLED, GEARBOX ASSEMBLY MUST BE POSITIONED IN BUILD STAND WITH REAR FACE (OIL TANK SIDE) UP. SEE FIGURE 501. ASSEMBLY MUST NOT BE ROTATED IN BUILD STAND PRIOR TO OIL TANK REMOVAL. TANK WILL BE DAMAGED BY CONTACTING BUILD STAND BASE IF ASSEMBLY IS ROTATED.

(1) Install gearbox housing in PWA 75599 Build Stand. See Figure 501.

(a) Insert shaft of PWA 85327 Adapter through hole in rear post of stand.

(b) Align boltholes in post details of PWA 86056 Fixture or PWA 85123 Fixture with boltholes in four ground handling points of gearbox. Secure post details to gearbox using bolts (501/2)

(c) Attach PWA 85242 Adapter to gearbox mounting lugs and secure with two pins (501/1).

(d) Attach PWA 85241Arm to fixture and secure with four detail screws.

(e) Attach hoist to arm and trunnion gearbox to horizontal position.

MAIN GEARBOX − DISASSEMBLY−01

(f) Position gearbox between posts of stand. Align boltholes in PWA 85242 Adapter with boltholes in mounting pad of stand and secure with detail bolts.

(g) Remove screws securing arm to fixture. Remove arm.

(h) Slide PWA 85327 Adapter forward, aligning boltholes and secure PWA 85237 Adapter to fixture with four bolts (501/3).

Subtask 72−61−00−030−068:

(2) Remove lube oil tank. See Figure 502 and Figure 504.

CAUTION: TO PREVENT DAMAGE TO THE GEARBOX HOUSING, MAKE SURE ALL THE OIL TANK TO GEARBOX ATTACHMENT BOLTS ARE REMOVED BEFORE INSTALLING PWA 88231 PULLER.

(a) (Pre SB PW4ENG 79−74) Remove the six (6) bolts (502/9) and nuts (502/12) that attach the cover (502/10) to the flange of the hole at the top of the lube oil tank (502/3).

(b) (Post SB PW4ENG 79−74) Remove the six (6) bolts (502/9) and nuts (502/12) that attach the cover (502/10) and the oil tank heat shield bracket (502/13) to the flange of the hole at the top of the lube oil tank (502/4).

(c) Remove the ten bolts (502/1) that attach the oil tank heat shield (502/2), bracket (pre SB PW4ENG 79−48) (502/4), bracket (502/6), bracket (Post SB PW4ENG 72−491) (502/8), and lube oil tank (502/3) to oil tank flange on rear left side of gearbox housing. The bracket must stay with the gearbox. Use PWA 88231 Puller to carefully remove oil tank from gearbox. Discard packing (502/5) from oil tank front diameter.

(d) Loosen screw detail of oil tank clamp (502/7) and remove clamp and oil tank heat shield (502/2) from oil tank.

(e) Use PWA 88231 Puller to carefully remove oil tank from gearbox. Discard the packing (502/7) from the oil tank front diameter. See Figure 503.

(f) Remove two bolts (504/10) securing oil check valve housing (504/2) or (504/2A) to internal mounting flange in oil tank housing (504/6). Remove housing. Discard packing (504/1) and, if applicable, gasket. Remove oil check valve assembly (504/4). Discard packings (504/3) and (504/5).

(g) Remove two bolts (504/9) securing sealing sleeve (504/8) to center bore in internal mounting flange in oil tank housing. Remove sealing sleeve. Discard packing (504/7).

(h) Remove two bolts (504/12) securing transfer tube (504/13) to lower bore in internal mounting flange in oil tank housing. Remove transfer tube. Discard packings (504/11).

C. Postrequisites

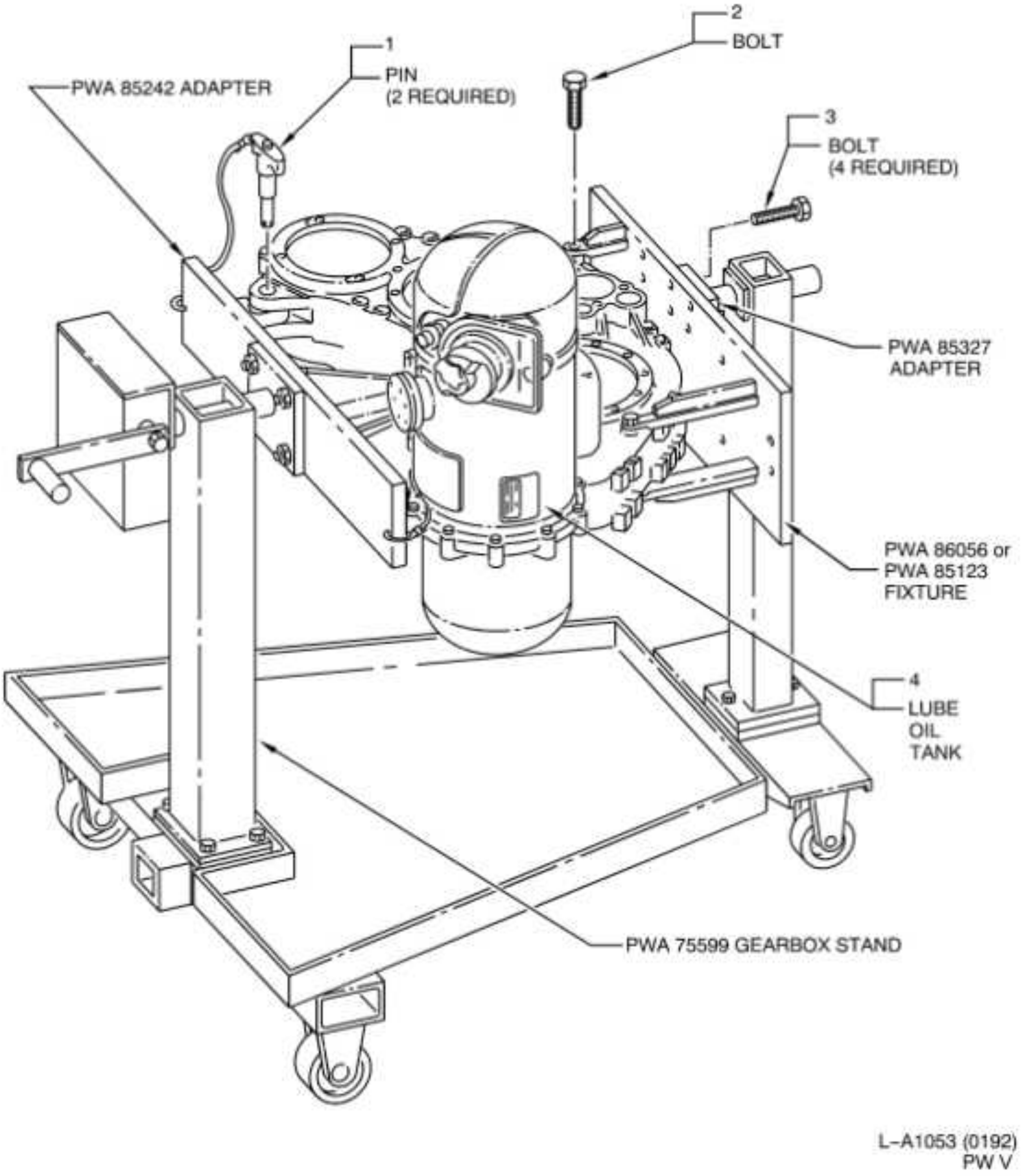
(1) Remove the EEC alternator rotor and stator, the lubrication and scavenge oil pump, and the brackets from the main gearbox. Refer to Disassembly-06 (Task 72-61-00-030-006).

(2) Remove the magnetic chip detector assemblies from the lube oil tank, the lubrication and scavenge oil pump, and the main gearbox. Refer to Disassembly-07 (Task 72-61-00-030-007).

(3) Disassemble front hydraulic pump drive and IDG drive gearshaft from main gearbox per Disassembly-02 (Task 72-61-00-030-002).

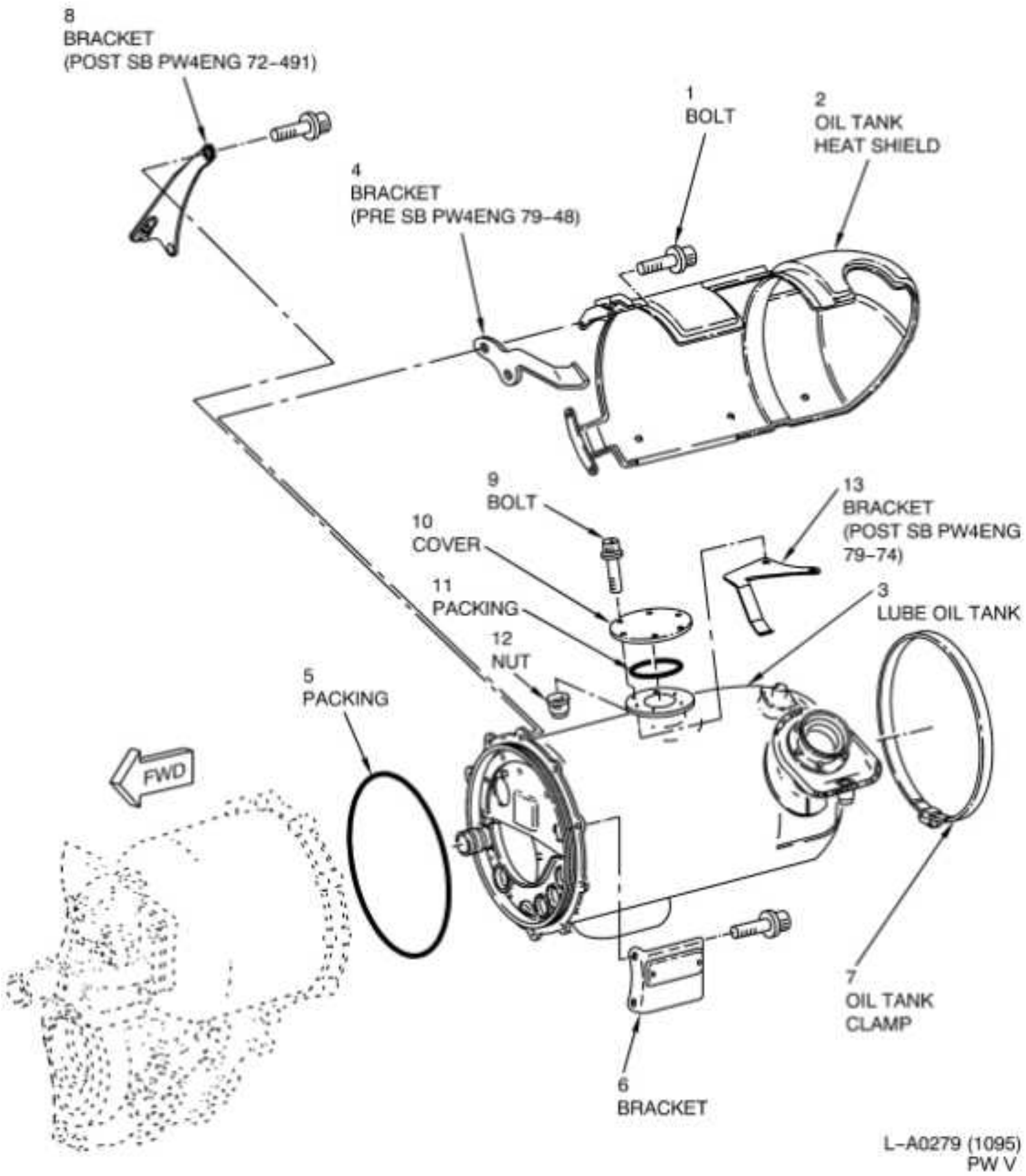
(4) Disassemble main gearbox per Disassembly-03 (Task 72-61-00-030-003).

MAIN GEARBOX – DISASSEMBLY-01


PWA 85242 ADAPTER
1
PIN
(2 REQUIRED)
2
BOLT
3
BOLT
(4 REQUIRED)
PWA 85327
ADAPTER
PWA 86056 or
PWA 85123
FIXTURE
4
LUBE
OIL
TANK
PWA 75599 GEARBOX STAND
L-A1053 (0192)
PW V

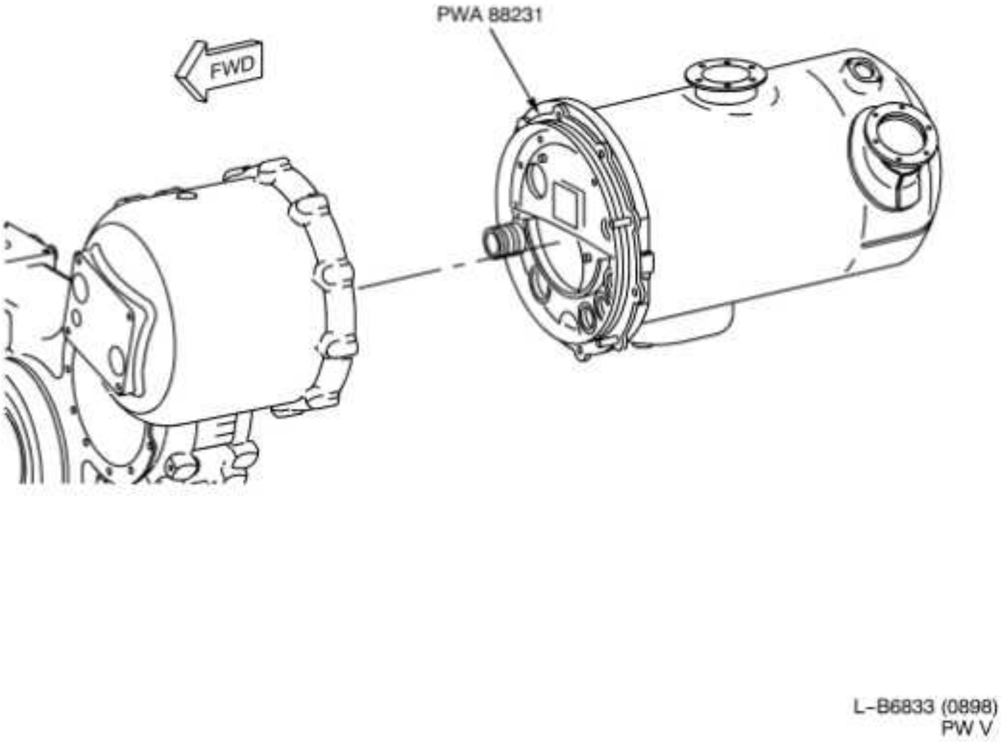
Installation Of Main Gearbox To Build Stand
Figure 501
(Task 72-61-00-030-001)

MAIN GEARBOX − DISASSEMBLY−01

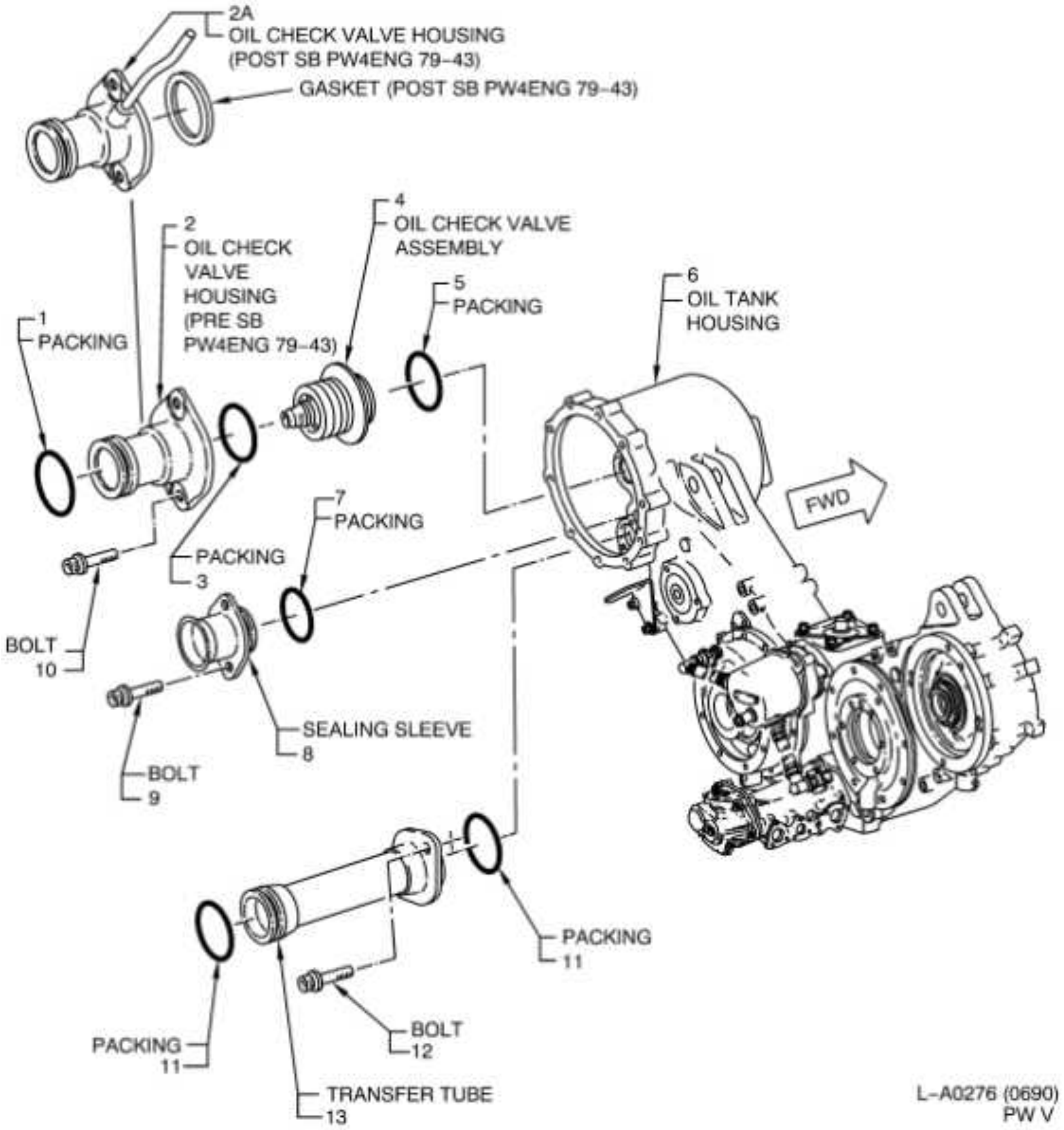

8
BRACKET
(POST SB PW4ENG 72-491)
1
BOLT
2
OIL TANK
HEAT SHIELD
4
BRACKET
(PRE SB PW4ENG 79-48)
9
BOLT
10
COVER
13
BRACKET
(POST SB PW4ENG
79-74)
11
PACKING
3
LUBE OIL TANK
12
NUT
5
PACKING
FWD
7
OIL TANK
CLAMP
6
BRACKET
L-A0279 (1095)
PW V

Lube Oil Tank Removal
Figure 502
(Task 72−61−00−030−001)

MAIN GEARBOX − DISASSEMBLY−01


PWA 88231
FWD
L−B6833 (0898)
PW V

Lube Oil Tank Removal (PWA 88231)
Figure 503
(Task 72−61−00−030−001)


2A
OIL CHECK VALVE HOUSING
(POST SB PW4ENG 79-43)
GASKET (POST SB PW4ENG 79-43)
2
OIL CHECK
VALVE
HOUSING
(PRE SB
PW4ENG 79-43)
4
OIL CHECK VALVE
ASSEMBLY
5
PACKING
6
OIL TANK
HOUSING
1
PACKING
FWD
7
PACKING
PACKING
3
BOLT
10
SEALING SLEEVE
8
BOLT
9
PACKING
11
BOLT
12
PACKING
11
TRANSFER TUBE
13
L-A0276 (0690)
PW V

Lube Oil Tank Removal
Figure 504
(Task 72-61-00-030-001)

Previous Pageblock Return to Previous Menu Next Pageblock

MAIN GEARBOX - DISASSEMBLY-02

Task 72-61-00-030-002:

1. Disassemble Front Hydraulic Pump Drive And IDG Drive Gearshaft From Main Gearbox

A. Prerequisites

(1) Remove the oil tank from the main gearbox. Refer to Disassembly-01 (Task 72-61-00-030-001).

(2) Remove the EEC alternator rotor and stator, the lubrication and scavenge oil pump, and the brackets from the main gearbox. Refer to Disassembly-06 (Task 72-61-00-030-006).

(3) Remove the magnetic chip detector assemblies from the lube oil tank, the lubrication and scavenge oil pump, and the main gearbox. Refer to Disassembly-07 (Task 72-61-00-030-007).

B. Equipment And Materials Necessary

Standard Tools:

0.250-28 Jackscrews (2 Necessary)

Special Tools:

PWA 85203	Puller

C. Procedure

Subtask 72-61-00-030-066:

(1) Remove front hydraulic pump drive cover, gearshaft and bearings assembly. See Figure 501 and Figure 502.

(a) For those engines not using a front hydraulic pump, remove nuts (501/1) securing front hydraulic pump drive cover to gearbox. Remove cover (501/2) and gasket (501/3). Remove nut (501/4) and washer (501/5). Remove plug (501/6). Discard packing (501/7). Remove bolt (501/9). Discard packing (501/8).

(b) Remove two bolts (502/3) securing nozzle (502/4) to boss on top of bearing housing (502/2). Remove nozzle. Discard packings (502/5) and (502/6).

(c) Remove four bolts (502/12) securing bearing support (502/1) to bearing housing (502/2). Remove bearing support and gearshaft assembly from housing. Discard packing (502/11).

(d) Remove eight bolts (502/10) and washers (502/9) securing housing (502/2) to front hydraulic pump drive pad (502/7). Remove bearing housing from gearbox using two 0.250−28 Jackscrews, if applicable.

(e) Discard packing (502/8) from rear flange of bearing housing.

Subtask 72−61−00−030−067:

(2) Remove IDG drive cover, gearshaft and bearings assembly. See Figure 503 and Figure 504.

(a) For those engines not using an IDG, remove bolts (503/1) and washers (503/2) securing IDG drive pad cover to gearbox. Remove cover (503/3) and gasket (503/4). Remove nut (503/5) and washer (503/6). Remove plug (503/7). Discard packing (503/8). Remove bolt (503/10). Discard packing (503/9).

(b) Remove lockwire and plug (504/10) from port on bottom of bearing housing (504/6). Discard packing (504/9). Remove bushing (504/11) from port. Discard packing (504/8).

(c) Remove retaining ring (504/1) securing face (oil) seal (504/2) to bore in bearing housing (504/6). Using PWA 85203 Puller, remove seal. Discard packing (504/3).

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

(d) Remove twelve bolts (504/4) and washers (504/5) securing bearing housing (504/6) to IDG drive pad (504/12). Separate and remove bearing housing from gearbox using three 0.250−28 Jackscrews, if applicable. Discard packing (504/7).

NOTE: Roller bearing outer race is secured to inside of bearing housing assembly and will be removed from location on gearshaft as housing is withdrawn.

(e) Remove four bolts (504/14) securing bearing outer race (504/15) to boss on rear side of bearing housing. Remove outer race.

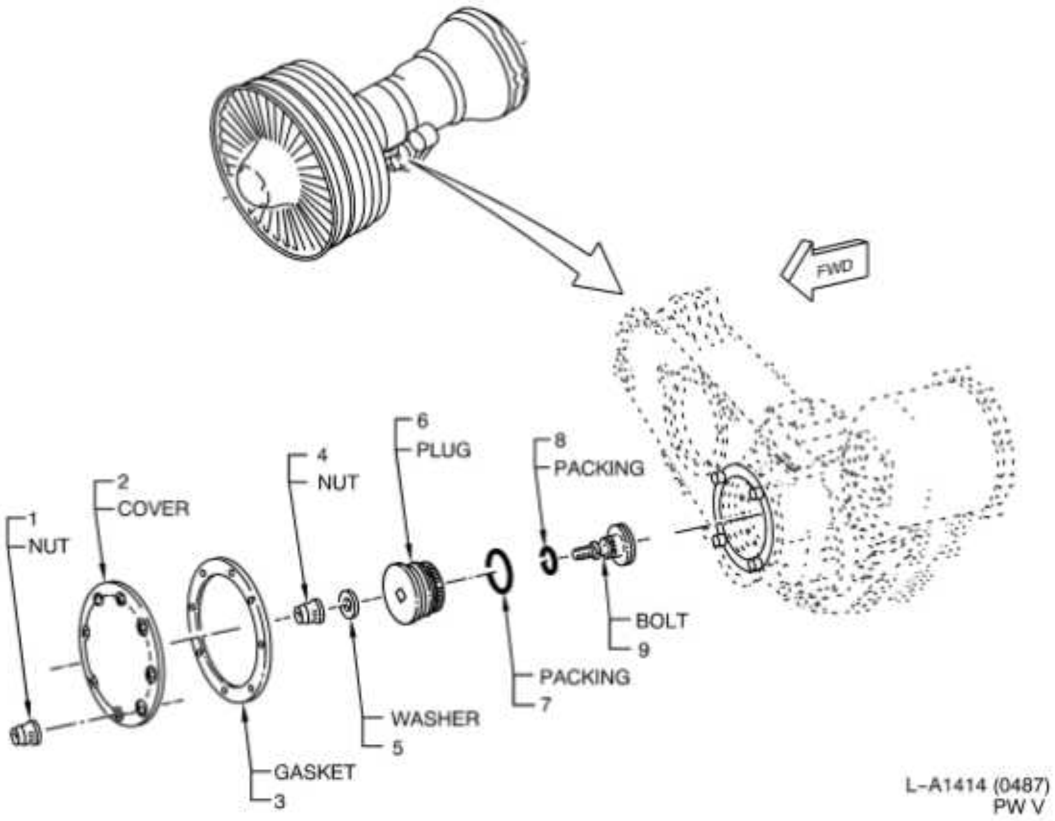
(f) Remove IDG drive gearshaft and bearings assembly (504/13) from gearbox.

(g) Place gearshaft and bearings assembly in suitable protective container.

D. Postrequisites

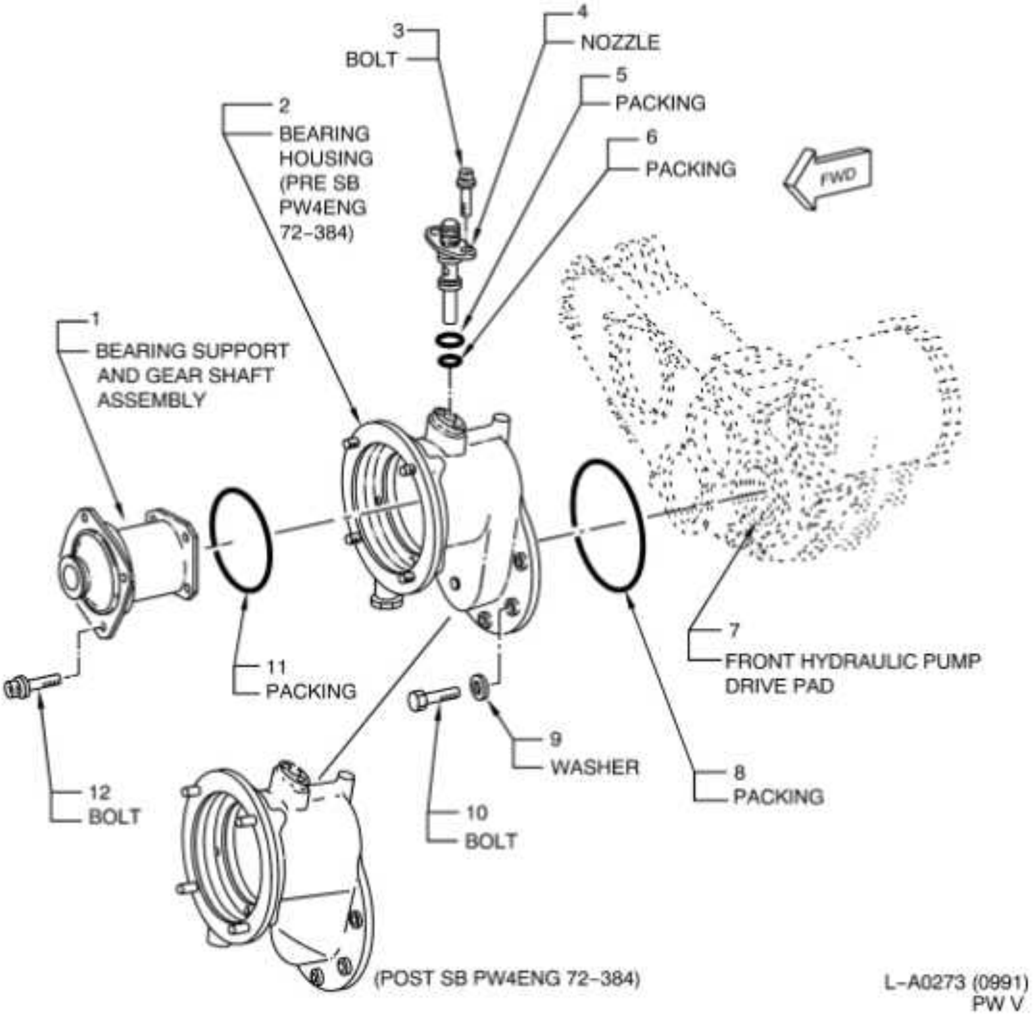
(1) Disassemble main gearbox per Disassembly−03 (Task 72−61−00−030−003).

MAIN GEARBOX - DISASSEMBLY-02


FWD
1
NUT
2
COVER
3
GASKET
4
NUT
5
WASHER
6
PLUG
7
PACKING
8
PACKING
9
BOLT
L-A1414 (0487)
PW V

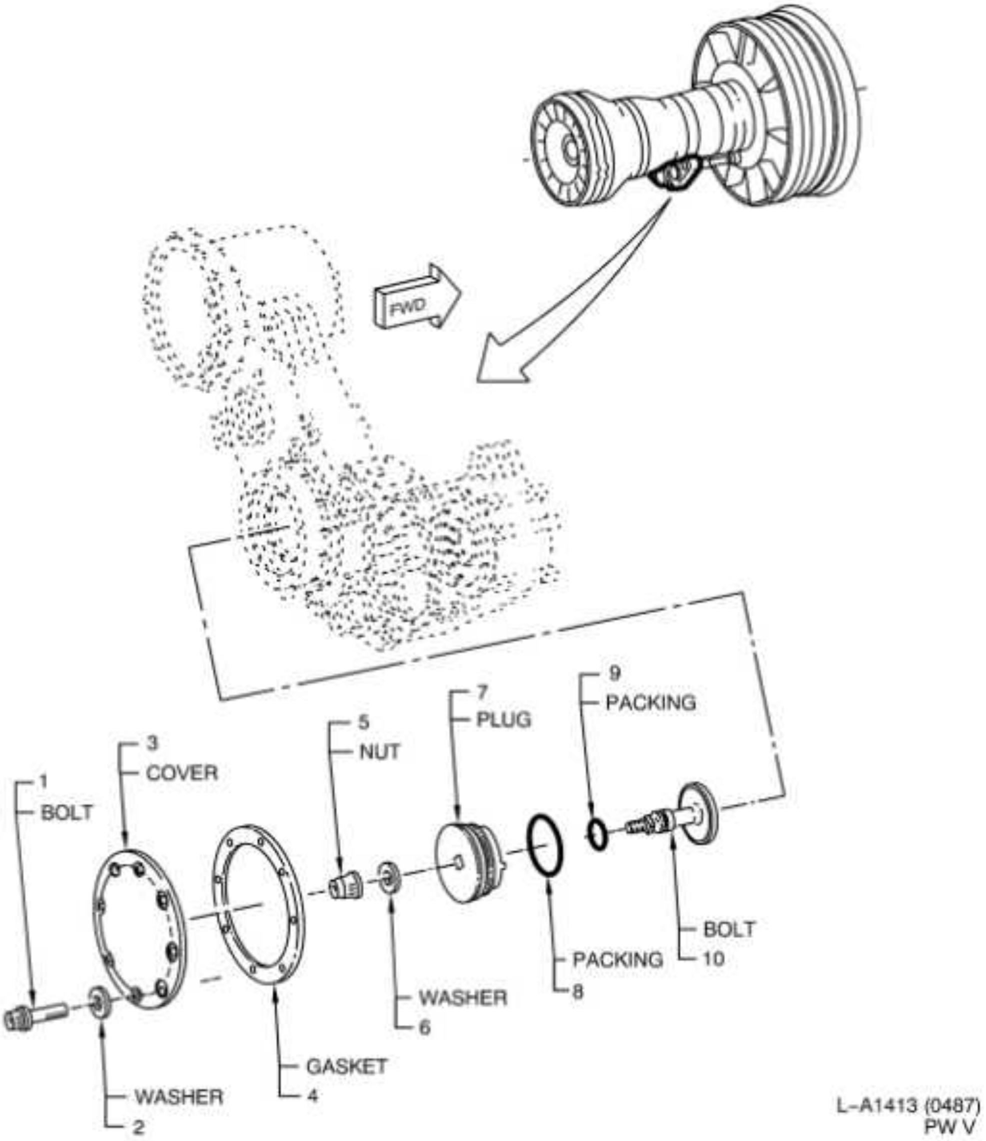
Front Hydraulic Pump Drive Cover, Plug, And Bolt Removal
Figure 501
(Task 72-61-00-030-002)

MAIN GEARBOX - DISASSEMBLY-02


3 BOLT
4 NOZZLE
5 PACKING
6 PACKING
FWD
2 BEARING HOUSING (PRE SB PW4ENG 72-384)
1 BEARING SUPPORT AND GEAR SHAFT ASSEMBLY
7 FRONT HYDRAULIC PUMP DRIVE PAD
11 PACKING
9 WASHER
8 PACKING
12 BOLT
10 BOLT
(POST SB PW4ENG 72-384)
L-A0273 (0991)
PW V

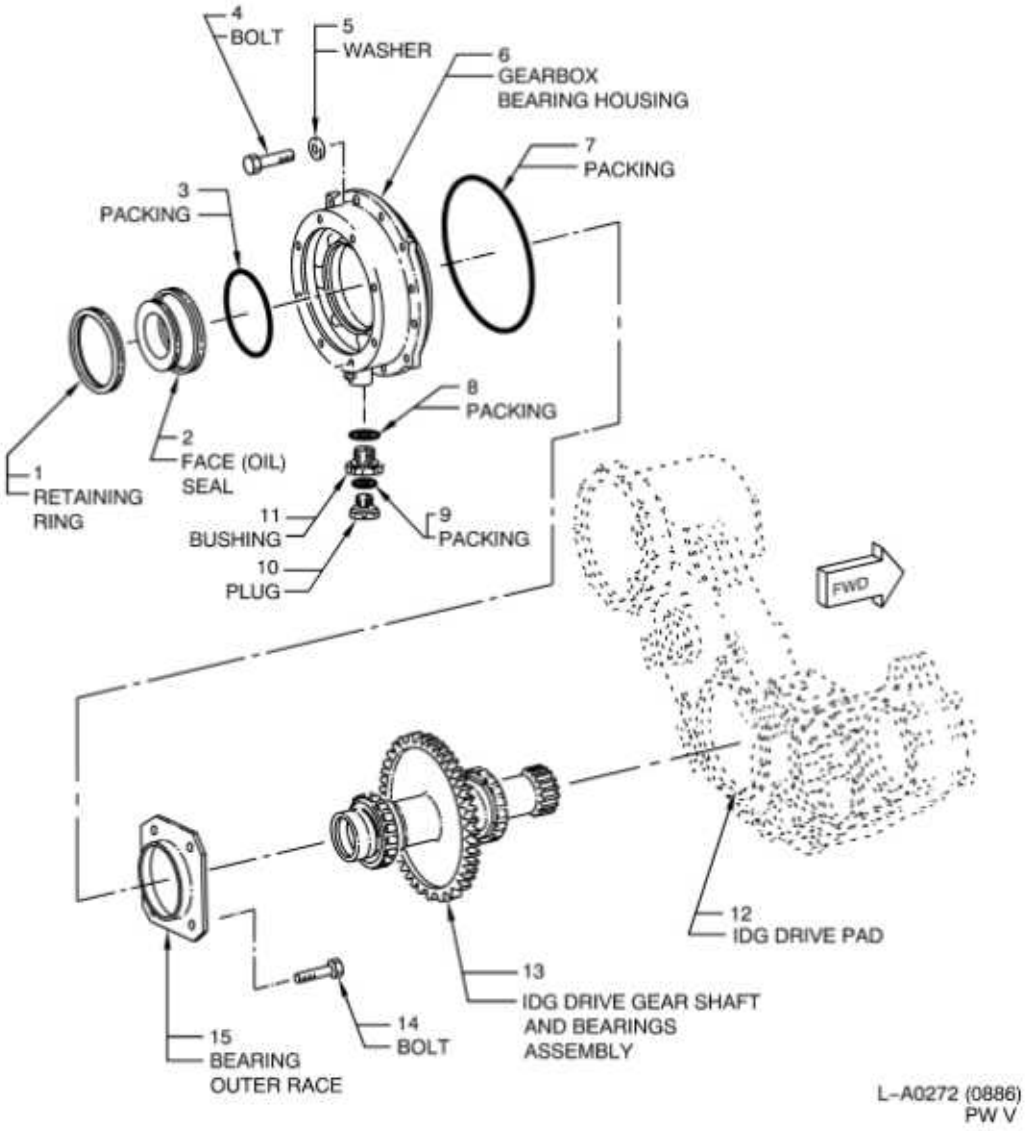
Front Hydraulic Pump Drive Gearshaft And Bearings Assembly Removal
Figure 502
(Task 72-61-00-030-002)

MAIN GEARBOX − DISASSEMBLY−02


FWD
1
BOLT
2
WASHER
3
COVER
4
GASKET
5
NUT
6
WASHER
7
PLUG
8
PACKING
9
PACKING
10
BOLT
L−A1413 (0487)
PW V

IDG Drive Cover, Plug And Bolt Removal
Figure 503
(Task 72−61−00−030−002)

MAIN GEARBOX - DISASSEMBLY-02


4
BOLT
5
WASHER
6
GEARBOX
BEARING HOUSING
7
PACKING
3
PACKING
8
PACKING
2
FACE (OIL)
SEAL
1
RETAINING
RING
11
BUSHING
9
PACKING
10
PLUG
FWD
12
IDG DRIVE PAD
13
IDG DRIVE GEAR SHAFT
AND BEARINGS
ASSEMBLY
14
BOLT
15
BEARING
OUTER RACE
L-A0272 (0886)
PW V

IDG Drive Gearshaft And Bearings Assembly Removal
Figure 504
(Task 72-61-00-030-002)

MAIN GEARBOX − DISASSEMBLY−03

Task 72−61−00−030−003:

1. Disassemble Main Gearbox

A. Prerequisites

(1) Remove the oil tank from the main gearbox. Refer to Disassembly−01 (Task 72−61−00−030−001).

(2) Remove the EEC alternator rotor and stator, the lubrication and scavenge oil pump, and the brackets from the main gearbox. Refer to Disassembly−06 (Task 72−61−00−030−006).

(3) Remove the magnetic chip detector assemblies from the lube oil tank, the lubrication and scavenge oil pump, and the main gearbox. Refer to Disassembly−07 (Task 72−61−00−030−007).

(4) Disassemble front hydraulic pump drive and IDG drive gearshaft from main gearbox per Disassembly−02 (Task 72−61−00−030−002).

B. Equipment And Materials Necessary

Standard Tools:

0.250−28 Jackscrews (3 Required)
No. 10 Torq−Set Drive

Name	Manufacturer
Clements Cadillac Electric Flameless Heat Gun Model FT 1000	Clements Manufacturing Co. 6650 S. Narragansett Avenue Chicago, IL 60638

Special Tools:

PWA 85204	Puller (Optional to PWA 88110)
PWA 85284	Drift
PWA 85285	Wrench (Optional to PWA 86149 Wrench)
PWA 85286	Base
PWA 85372	Wrench
PWA 85768	Knocker, Puller
PWA 86149	Wrench
PWA 88110	Puller
PWA 88736	Knocker, Puller
PWA 102799	Puller, Jackscrew

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Consumable Materials:

Item No.	Designation
P05−102	Dry Ice

C. Procedure

Subtask 72−61−00−030−052:

(1) Remove probe and drain plugs from drain ports in lower front face of gearbox housing. See Figure 501.

(a) Remove lockwire from plugs/probe (501/3), (501/7) and (501/11). Remove plugs/probe (501/3), (501/7) and (501/11). Discard packings (501/4), (501/8) and (501/12).

(b) Remove bushings (501/1), (501/5), (501/9) and (501/13) from drain ports. Discard packings (501/2), (501/6), (501/10) and (501/14).

Subtask 72−61−00−030−062:

(2) Remove starter drive gearshaft and bearings assembly. See Figure 502.

(a) Remove lockwire and plug (502/14) from port on bottom of bearing housing (502/3). Discard packing (502/13). Remove bushing (502/12) from port. Discard packing (502/11).

(b) Remove retaining ring (502/17) securing face (oil) seal (502/16) to bore in bearing housing (502/3). Using PWA 88110 Puller or PWA 85204 Puller, remove seal from housing. Discard packing (502/15).

(c) Remove eight bolts (502/1) and washers (502/2) securing bearing housing (502/3) to starter drive pad (502/7). Separate and remove bearing housing using three 0.250−28 Jackscrews, if applicable. Remove packing (502/4) from bearing housing and discard packing.

NOTE: Roller bearing outer race is secured to inside of bearing housing and will be removed from location on gearshaft as housing is withdrawn.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

(d) Remove four bolts (502/5) securing bearing outer race (502/10) to boss on rear side of bearing housing. Remove outer race.

(e) Remove starter drive gearshaft and bearings assembly (502/9) from gearbox.

(f) Remove four bolts (502/6) securing bearing outer race (502/8) to boss on inside front wall of gearbox directly behind starter drive pad (502/7).

(g) Place gearshaft and bearings assembly in suitable protective container.

Subtask 72−61−00−030−053:

(3) Remove gearbox (fuel pump drive) spur gearshaft assembly. See Figure 503.

(a) Remove retaining ring (503/18) securing face (oil) seal (503/17) to bearing housing (503/1). Using PWA 88110 Puller or PWA 85204 Puller, remove seal from bearing housing. Discard packing (503/16).

(b) Remove one screw (503/19) securing bearing housing (503/1) to fuel pump drive pad (503/15) on left side of front face of gearbox housing. Separate and remove bearing housing using three 0.250−28 Jackscrews, if applicable. Invert the housing and place on workbench. Discard packing (503/2).

NOTE: Bearing outer race is secured to inside of bearing housing assembly and will be removed from location on gearshaft as bearing housing is withdrawn.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. BEARING INNER RACE AND ROLLERS ARE INSTALLED ON GEARSHAFT. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

(c) Remove four bolts (503/4) securing bearing outer race (front) (503/3) to bearing housing. Remove outer race.

(d) Remove fuel pump drive gearshaft and bearings assembly (503/6) from gearbox and place on bench.

(e) Remove bolts (503/5) securing bearing outer race (rear) (503/7) to fuel pump drive pad on inside rear wall of gearbox. Remove outer race.

(f) Place gearshaft and bearings assembly in protective container.

(g) Remove lockwire and nozzle (503/13) installed in bushing (503/10) on rear side of gearbox. Discard packings (503/11) and (503/12).

(h) Using PWA 85372 Wrench, remove nut (503/8) on inside rear wall of gearbox that secures bushing (503/10) in nozzle bore (503/14). Remove bushing from gearbox. Discard packing (503/9) and nut (503/8).

Subtask 72−61−00−030−054:

(4) Remove gearbox nozzles and gearbox drive gearshaft and bearings assembly. See Figure 504 and Figure 505.

(a) Loosen the coupling nut detail and disconnect driveshaft pressure tube (504/6) from nozzle (EEC alternator) (504/5).

(b) Remove seven bolts (505/7) and washers (505/6) securing gearbox driveshaft housing (505/8) to gearbox drive pad (505/2). Separate and remove driveshaft housing using three 0.250−28 Jackscrews, if applicable.

(c) Place housing on workbench.

(d) Loosen coupling nut and disconnect driveshaft pressure tube (504/6) from driveshaft nozzle (504/7). Remove pressure tube.

(e) Remove bolt (504/10) securing driveshaft nozzle (504/7) to boss on upper rear of gearbox driveshaft housing (504/9). Remove nozzle. Discard packing (504/8).

(f) Remove bolt (504/1) securing nozzle (EEC alternator) (504/5) to pad on gearbox above gearbox driveshaft housing. Remove nozzle. Discard packings (504/2) and (504/3).

(g) Invert housing (505/8). Discard packing (505/5).

NOTE: Roller bearing outer race is secured to inside of driveshaft housing assembly and will be removed from location on gearshaft as gearbox driveshaft housing (505/8) is withdrawn.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

(h) Remove gearbox drive gearshaft and bearings assembly (505/1) from gearbox.

(i) Remove four bolts (505/3) securing bearing outer race (505/4) to rear flange of driveshaft housing. Remove outer race.

(j) Place gearshaft and bearings assembly in suitable protective container.

Subtask 72−61−00−030−056:

(5) (Pre SB PW4ENG 72−114) Remove scavenge pump drive idler gearshaft and bearings assembly. See Figure 506.

(a) Remove two bolts (506/10) and washers (506/9) securing cover (manual crank) (506/8) to (scavenge pump drive) bearing housing (506/11). Remove cover using PWA 85768 Puller Knocker. Discard packing (506/7).

(b) Remove five bolts (506/13) and five washers (506/14) securing gearbox bearing housing (506/11) to scavenge pump drive pad (506/3). Carefully separate and remove bearing housing, invert and place on workbench. Discard packing (506/15).

NOTE: Roller bearing outer race is secured to inside of bearing housing assembly and will be removed from location on gearshaft as housing is withdrawn.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

(c) With a No. 10 Torq−Set Drive, remove two bolts (506/16) that attach the bearing outer race (506/12) to the boss on the rear side of the bearing housing. Remove the outer race.

(d) Carefully separate and remove scavenge pump drive idler gearshaft and bearings assembly (506/4) from gearbox.

NOTE: Roller bearing outer race is secured to inside of gearbox housing assembly and will remain in gearbox as gearshaft and bearings (506/4) assembly is withdrawn.

(e) Remove two screws (506/17), located under idler gear, securing bearing outer race (506/18) to rear wall of gearbox housing. Remove bearing outer race.

(f) Place gearshaft and bearings assembly in protective container.

Subtask 72−61−00−030−057:

(6) (Pre SB PW4ENG 72−114) Remove scavenge pump drive gearshaft and bearings assembly. See Figure 506.

(a) Using holes in gear as required, remove two screws (506/6) securing bearing detail of scavenge pump drive gearshaft and bearing assembly (506/5) with a No. 10 Torq−Set Drive. Remove gearshaft and bearing assembly from scavenge pump drive gearshaft bore (506/2).

(b) Place gearshaft and bearing assembly in suitable labeled container.

Subtask 72−61−00−030−076:

(7) (Post SB PW4ENG 72−114) Remove scavenge pump drive gearshaft and bearing assembly together with scavenge pump drive idler gearshaft and bearings assembly. See Figure 507.

(a) Remove two bolts (507/23) and washers (507/22) securing cover (manual crank) (507/21) to (scavenge pump drive) bearing housing (507/19) assembly. With PWA 85768 Knocker, remove cover. Discard packing (507/20).

(b) Remove five bolts (507/10) and five washers (507/9) securing bearing housing assembly (507/19) to scavenge pump drive pad (507/14). Carefully separate and remove bearing housing, invert and place on workbench. Discard packing (507/8).

NOTE: Roller bearing outer race is secured to inside of bearing housing assembly and will be removed from location on gearshaft as housing is withdrawn.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

(c) With a No. 10 Torq−Set Drive, remove two screws (507/6) that attach the guide (507/7) and the bearing outer race (507/18) to boss on rear side of bearing housing. Remove the guide and the outer race.

(d) Using PWA 85372 Wrench, enter gearbox from rear. Remove nut (507/11) on scavenge pump drive gearshaft (507/16). Discard the nut (507/11).

(e) If applicable, remove sleeve (507/12).

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER. FOLLOWING REMOVAL, KEEP ALL DETAILS TOGETHER IN A CONTAINER.

(f) Remove ring (507/13).

NOTE: The ring is a detail of the bearing.

(g) With a No. 10 Torq−Set Drive, remove two screws (507/17) securing drive gear bearing outer race (507/15).

(h) Entering gearbox through scavenge pump drive pad (507/14), carefully pull up on both the scavenge pump drive idler gearshaft and bearing assembly (507/5) and the scavenge pump drive gearshaft and bearing assembly (507/16) at the same time.

NOTE: The idler gearshaft bearing outer race will stay in the gearbox. The drive gearshaft bearing assembly will stay with the gearshaft.

(i) Carefully remove both gearshaft and bearing assemblies.

(j) Remove the bearing outer race and rollers (507/15) from the drive gearshaft (507/16).

(k) With a No. 10 Torq−Set Drive, remove two screws (507/4) securing idler gear bearing outer race (507/3) to rear wall of gearbox housing.

Subtask 72−61−00−030−077:

(8) (Post SB PW4ENG 72−463) Remove scavenge pump drive idler gearshaft and bearings assembly. See Figure 508.

(a) Remove two bolts (508/12) and washers (508/11) securing cover (manual crank) (508/10) to (scavenge pump drive) bearing housing (508/8). Remove cover using PWA 85768 Puller Knocker. Discard packing (508/9).

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(b) Remove five bolts (508/13) and five washers (508/14) securing gearbox bearing housing (508/8) to scavenge pump drive pad (508/3). Carefully separate and remove bearing housing, invert and place on workbench. Discard packing (508/15).

NOTE: Roller bearing outer race is secured to inside of bearing housing assembly and will be removed from location on gearshaft as housing is withdrawn.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

(c) With a No. 10 Torq−Set Drive, remove two screws (508/6) that attach the bearing outer race (508/7) to the boss on the rear side of the bearing housing. Remove the outer race.

(d) Carefully separate and remove scavenge pump drive idler gearshaft and bearings assembly (508/16) from gearbox.

NOTE: Roller bearing outer race is secured to inside of gearbox housing assembly and will remain in gearbox as gearshaft and bearings (508/16) assembly is withdrawn.

(e) Remove two screws (508/17) located under idler gear, securing bearing outer race (508/18) to rear wall of gearbox housing. Remove bearing outer race.

(f) Place gearshaft and bearings assembly in protective container.

Subtask 72−61−00−030−078:

(9) (Post SB PW4ENG 72−463) Remove scavenge pump drive gearshaft and bearings assembly. See Figure 508.

(a) Using holes in gear as required, remove two screws (508/5) securing bearing detail of scavenge pump drive gearshaft and bearing assembly (508/4) with a No. 10 Torq−Set Drive. Remove gearshaft and bearing assembly from scavenge pump drive gearshaft bore (508/2).

(b) Place gearshaft and bearing assembly in suitable labeled container.

Subtask 72−61−00−030−058:

(10) Remove deoiler gearshaft and bearings assembly. See Figure 509.

(a) Remove 11 bolts (509/13) and washers (509/12) securing deoiler housing (509/11) to deoiler pad (509/6). With PWA 102799 Jackscrew Puller, remove housing, and discard packing (509/10).

(b) Carefully separate and remove deoiler gearshaft and bearings assembly (509/9) from gearbox. Remove packing (509/8) from bearing housing (509/4). Discard packing.

NOTE: Roller bearing outer race (509/7) is secured to inside of gearbox housing assembly and will remain in gearbox as gearshaft and bearings assembly (509/9) is withdrawn.

(c) (Engines With The Alternate Lubrication Configuration) Remove the bolt (515/27), nut (515/30) and clamp (515/28) that attaches the oil supply tube to the bracket (515/29). See Figure 515 (Sheet 2).

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. INNER RACE AND ROLLERS OF THIS BEARING ARE INSTALLED ON DEOILER GEARSHAFT. MAKE CERTAIN THAT ALL DETAILS OF BEARING ARE KEPT TOGETHER IN CONTAINER FOLLOWING REMOVAL.

(d) (Engines With The Alternate Lubrication Configuration) Remove the four bolts (509/5) that attach the bearing outer race (509/7) and the flange end of the oil supply tube (515/26) to inside rear wall of the gearbox behind the deoiler pad (509/6).

(e) (Engines With The Alternate Lubrication Configuration) Remove the oil supply tube from the gearbox and discard the packing (515/25). Remove the outer race.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. INNER RACE AND ROLLERS OF THIS BEARING ARE INSTALLED ON DEOILER GEARSHAFT. MAKE CERTAIN THAT ALL DETAILS OF BEARING ARE KEPT TOGETHER IN CONTAINER FOLLOWING REMOVAL.

(f) (Engines Without The Alternate Lubrication Configuration) Remove the four bolts (509/5) that attach the bearing outer race (509/7) to the inside rear wall of gearbox behind the deoiler pad (509/6). Remove the outer race.

(g) Place the gearshaft and bearings assembly in a suitable protective container.

(h) Remove the retaining ring (509/1) securing the face (oil) seal (509/2) to bore in rear of gearbox behind deoiler pad. Using PWA 88110 Puller or PWA 85204 Puller, remove seal from gearbox. Discard the packing (509/3).

Subtask 72−61−00−030−059:

(11) Remove main oil filter and pressure relief valve assembly. See Figure 510.

(a) Remove four bolts (510/9) and washers (510/8) securing main oil filter and pressure relief valve assembly (510/7) to main oil filter pad (510/5). Remove assembly from gearbox.

(b) For engines that are (Pre SB PW4ENG 79−43) Remove two transfer tubes (510/2) and one transfer tube (510/4) from oil filter housing. Remove packings (510/1) and (510/3) from transfer tubes. Discard packings.

(c) For engines that are (Post SB PW4ENG 79−43) Remove two transfer tubes (510/4) and (510/6) and the antisiphon tube assembly (510/2A). Discard the packings (510/1) and (510/3).

Subtask 72−61−00−030−060−001:

(12) (Pre SB PW4ENG 72−491) Remove the gearbox idler spur gear. See Figure 511 (Sheet 1).

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(a) Remove two bolts (511/1) securing idler shaft (511/2) to idler shaft bore (511/10). Withdraw idler shaft from gearbox sufficiently to install spacer detail of PWA 86149 Wrench under flange of gearshaft. Secure gearshaft and spacer to gearbox with detail bolts.

(b) Using PWA 86149 Wrench, remove nut (511/9) securing spur gear (idler) and bearing assembly to idler shaft (511/2) between spur gear and inside front wall of gearbox housing. Discard the nut (511/9).

(c) Remove detail bolts securing idler shaft and spacer to gearbox. Withdraw idler shaft sufficiently to remove spur gear and bearing assembly (511/6, 511/7, and 511/8) from gearshaft. Remove idler shaft (511/2) from gearbox housing. Remove bearing ring (511/4) from idler shaft. Discard packing (511/3).

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER.

(d) Remove retaining ring (511/5) from spur gear (511/7).

(e) Remove bearing inner race (511/8).

(f) Install spur gear and bearing assembly (511/6) and (511/7), retaining ring groove end down, onto PWA 85286 Base. Using PWA 85284 Drift and arbor press, separate bearing outer race and rollers (511/6) from spur gear. Remove bearing outer race.

(g) Place bearing details (511/4, 511/6, and 511/8) in suitable protective container.

Subtask 72−61−00−030−060−002:

(13) (Post SB PW4ENG 72−491) Remove gearbox idler spur gear. See Figure 511 (Sheet 2).

(a) Remove two bolts (511/25) that hold the boss assembly (511/21) to the gearbox.

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(b) Remove lock plate (511/24) and boss assembly (511/21) from the gearbox. Discard packing (511/3).

(c) Remove oil supply adapter assembly (511/23) from the boss assembly (511/21). Discard packing (511/22).

(d) Remove gearbox idler shaft and gear assembly through the idler shaft bore (511/10) in the rear of the gearbox.

(e) Hold the gearbox idler shaft (511/20) in a vise. Tighten on the flats of the shaft.

(f) Use PWA 86149 Wrench to remove the bearing retaining nut (511/9) from the gearbox idler shaft (511/20). Discard the nut (511/9).

(g) Remove spur gear and bearing assembly from the idler shaft (511/20).

(h) Remove the bearing retaining ring (511/5) from the spur gear (511/7).

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER.

(i) Install spur gear and bearing assembly, retaining ring groove end down, into PWA 85286 Base. Use PWA 85284 Drift and an arbor press to remove the bearing (511/26) from the spur gear (511/7).

(j) Place bearing in a protective container.

Subtask 72−61−00−030−060−003:

(14) (Post SB PW4ENG 72−664) Remove gearbox idler spur gear. See Figure 511 (Sheet 3).

(a) Remove two bolts (511/25) that hold the boss assembly (511/21) to the gearbox.

(b) Remove lock plate (511/24) and boss assembly (511/21) from the gearbox. Discard packing (511/3).

(c) Remove oil supply adapter assembly (511/23) from the boss assembly (511/21). Discard packing (511/22).

(d) Remove gearbox idler shaft and gear assembly through the idler shaft bore (511/10) in the rear of the gearbox.

(e) Hold the gearbox idler shaft (511/20) in a vise. Tighten on the flats of the shaft.

(f) Use PWA 86149 Wrench to remove the bearing retaining nut (511/9) from the gearbox idler shaft (511/20). Discard the nut (511/9).

(g) Remove spur gear and bearing assembly from the idler shaft (511/20).

(h) Remove the bearing retaining ring (511/5) from the spur gear (511/38).

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER.

(i) Install spur gear and bearing assembly, retaining ring groove end down, into PWA 85286 Base. Use PWA 85284 Drift and an arbor press to remove the bearing (511/36) and pin (511/37) from the spur gear (511/38).

(j) Place bearing in a protective container.

Subtask 72−61−00−030−061:

(15) Remove EEC alternator drive gearshaft and bearings assembly. See Figure 512.

(a) For engines that are (Pre SB PW4ENG 75−59) Remove the three bolts (512/1), washers (512/2), and bracket (512/6), securing the EEC alternator drive gearshaft and bearings assembly (512/3) to the EEC alternator drive pad (512/4). Remove the assembly from the gearbox and discard the packing (512/5).

(b) For engines that are (Post SB PW4ENG 75−59) Remove the three bolts (512/1) and manifold (512/7) (Pre SB PW4ENG 72−375) securing the EEC alternator drive gearshaft and bearing assembly (512/3) to the EEC alternator drive pad (512/4). Remove the assembly from the gearbox and discard the packing (512/5).

Subtask 72−61−00−030−063:

(16) Remove rear hydraulic pump drive cover, gearshaft and bearings assembly. See Figure 513 and Figure 514.

(a) For those engines not using a rear hydraulic pump, remove nuts (513/1) securing rear hydraulic pump drive pad cover to gearbox. Remove cover (513/2) and gasket (513/3). Remove nut (513/4) and washer (513/5). Remove plug (513/6). Discard packing (513/7). Remove bolt (513/9). Discard packing (513/8).

(b) Remove lockwire and plug (514/18) from port on bottom of bearing housing (514/15). Discard packing (514/19). Remove bushing (514/17) from port. Discard packing (514/16).

(c) Remove retaining ring (514/23) securing face (oil) seal (514/22) to bore in bearing housing (514/15) using PWA 88110 Puller or PWA 85204 Puller, remove seal (514/22) from housing. Discard packing (514/21).

(d) Remove two screws (514/20) securing bearing housing (514/15) to rear hydraulic pump drive pad (514/1). Separate and remove bearing housing using three 0.250−28 Jackscrews, if applicable. Discard packing (514/14).

NOTE: Roller bearing outer race is secured to inside of bearing housing and will be removed from location on gearshaft as housing is withdrawn.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

(e) Remove four bolts (514/9) securing bearing outer race (514/13) to boss on rear side of bearing housing. Remove outer race.

(f) Remove rear hydraulic pump drive gearshaft and bearings assembly (514/12) from gearbox.

(g) Remove four bolts (514/10) securing bearing outer race (514/11) to boss on inside front wall of gearbox directly behind rear hydraulic pump drive pad (514/1). Remove outer race.

(h) Place gearshaft and bearings assembly in protective container.

(i) Remove lockwire and nozzle (514/2) installed in bushing (514/5) on left front face of gearbox. Discard packings (514/3) and (514/4).

(j) Using PWA 85372 Wrench, remove nut (514/8) that secures bushing (514/5) in nozzle port (514/7) from inside front wall of gearbox. Remove bushing. Remove packing (514/6). Discard the nut (514/8).

Subtask 72−61−00−030−064:

(17) Remove the gearbox pressure manifold (Non−Alternate Lubrication Configuration). See Figure 515 (Sheet 1).

(a) Remove nut (515/1) and washer (515/2) securing bushing (515/3) to stud detail of gearbox pressure manifold (515/13) located above front hydraulic pump drive boss (515/5). Discard packing (515/4).

(b) Remove bolt (515/10), nut (515/12) and clamp (515/9) securing manifold to bracket (515/11).

(c) Remove bolt (515/8) securing manifold, bracket (515/11) and bearing outer race to inside front wall of gearbox.

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(d) Remove bolt (515/14) securing curved support detail of manifold and bearing outer race to inside rear wall of gearbox.

(e) Remove manifold from gearbox. Discard packing (515/7) and gasket (515/6).

(18) Remove the gearbox pressure manifold (Alternate Lubrication Configuration). See Figure 515 (Sheet 2).

(a) Remove the nut (515/1) and washer (515/2) that attach the bushing (515/3) to the stud detail of the gearbox pressure manifold (515/24) located above the front hydraulic pump drive boss (515/5). Discard packing (515/4).

(b) Remove the bolt (515/10), nut (515/12) and clamp (515/9) that attaches the manifold to the bracket (515/11).

(c) Remove the bolt (515/8) that attaches the manifold, bracket (515/11) and bearing outer race to the inside front wall of the gearbox.

(d) Remove the bolt (515/14) that attaches the curved support detail of the manifold and bearing outer race to the inside rear wall of the gearbox.

(e) Remove the manifold from the gearbox. Discard the packing (515/7) and gasket (515/6).

Subtask 72−61−00−030−065:

(19) Remove bearing outer races and gearbox strainer element. See Figure 516.

(a) Remove three remaining bolts (516/1) securing bearing outer race (516/2) to boss on inner rear wall of gearbox directly behind gearbox drive bore (516/3).

(b) Remove three remaining bolts (516/10) securing bracket (516/9) and bearing outer race (516/8) to boss on inner front wall of gearbox directly behind IDG bore (516/7). Remove outer race and bracket.

(20) Remove gearbox strainer element. See Figure 517.

(a) Remove two bolts (517/2) securing gearbox strainer element (517/3) to inside bottom (sump) of gearbox housing (517/1).

(b) Remove strainer element from gearbox.

(21) Remove the gearbox from PWA 85242 Adapter. Support the gearbox with slings and a hoist. Remove the gearbox from PWA 86056 Fixture or PWA 85123 Fixture, PWA 85327 Adapter and PWA 75599 Build Stand. Put it on a pallet.

CAUTION: DO NOT USE PRY BARS OR SCREW DRIVER TYPE TOOLS TO REMOVE THE GEARBOX LUG FROM THE MAIN GEARBOX. YOU CAN DAMAGE THE GEARBOX HOUSING SO THAT IT CAN NOT BE REPAIRED.

(22) (Pre SB PW4ENG 72−538) Remove the gearbox lug. See Figure 518.

(a) Remove the four (4) bolts that attach the gearbox lug to the main gearbox.

(b) Position a heat gun into the main gearbox housing and heat the surface below the gearbox lug.

(c) Put Dry Ice P05−102 over the gearbox lug.

(d) Heat the gearbox housing and cool the gearbox lug, at the same time, for fifteen (15) minutes.

(e) Remove the heat gun and dry ice.

(f) With brass drifts and hammers, hammer the drifts in a up direction against the gearbox lug post.

(g) First hit one side of the gearbox lug post, then hit the other side to force the gearbox lug out of the gearbox housing.

NOTE: Two (2) persons are necessary to do this procedure and it must be done fast.

(h) If the gearbox lug does not move, do steps (b) through (g) again, as necessary.

(23) (Post SB PW4ENG 72−538) Remove the gearbox lug. See Figure 518.

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(a) Remove the four (4) bolts that attach the gearbox lug to the main gearbox.

(b) Use PWA 88736 Puller to remove the gearbox lug from the gearbox lug from the main gearbox.

D. Postrequisites

(1) Disassemble main oil filter, housing and pressure relief valves assembly per Disassembly-04 Task 72-61-00-030-004.

(2) Disassemble lube oil tank, deaerator and baffle assembly per Disassembly-05 Task 72-61-00-030-005.

(3) Disassemble deoiler gearshaft and bearings assembly per 72-61-01, Disassembly-01 Task 72-61-01-040-001.

(4) Disassemble gearbox drive gearshaft and bearings assembly per 72-61-02, Disassembly-01 Task 72-61-02-040-001.

(5) Disassemble starter drive gearshaft and bearings assembly per 72-61-03, Disassembly-01 Task 72-61-03-040-001.

(6) Disassemble fuel pump drive gearshaft and bearings assembly per 72-61-04, Disassembly-01 Task 72-61-04-040-001.

(7) Disassemble rear hydraulic pump drive gearshaft and bearings assembly per 72-61-05, Disassembly-01 Task 72-61-05-040-001.

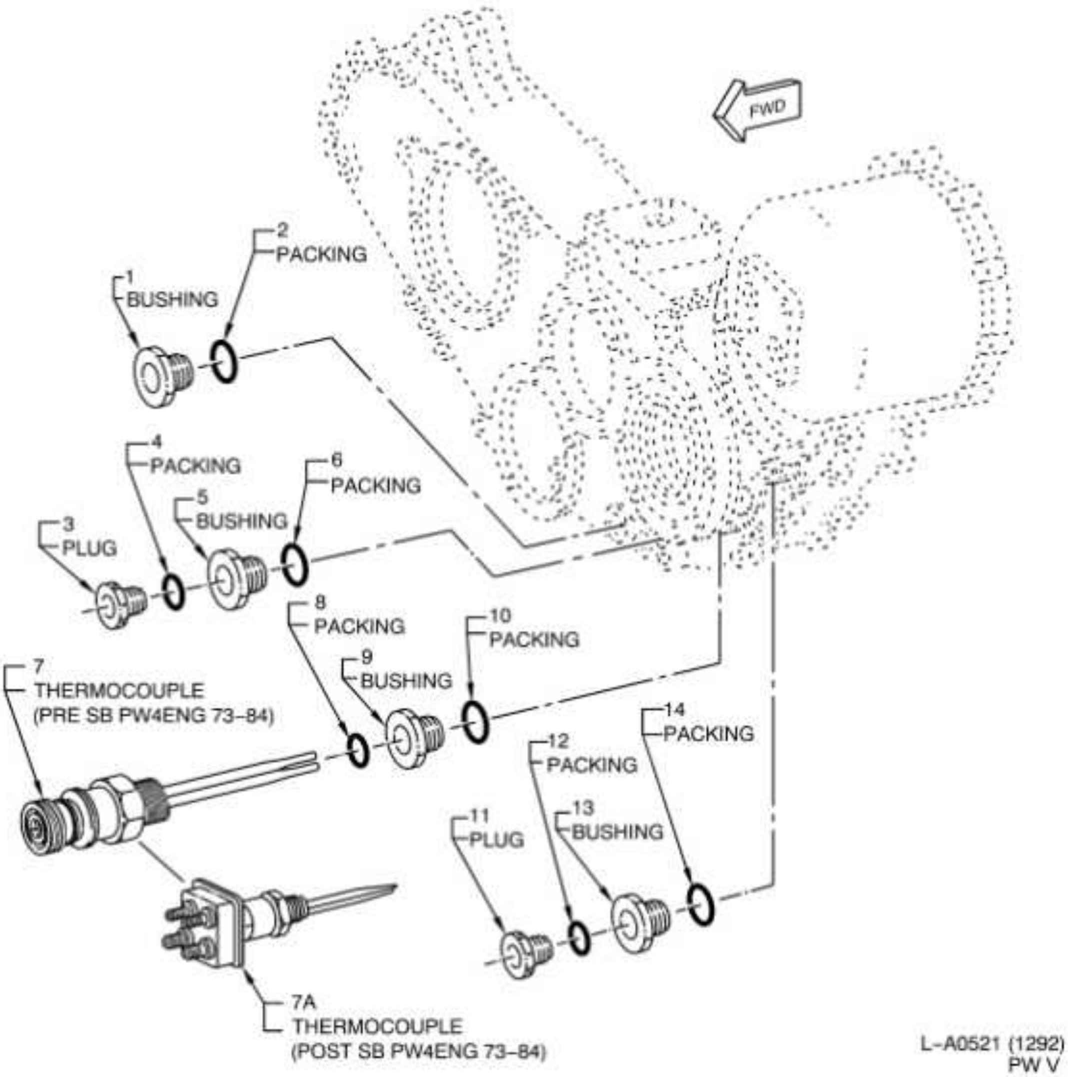
(8) Disassemble scavenge pump drive gearshaft and bearing assembly per 72-61-08, Disassembly-01 Task 72-61-08-040-001-001.

(9) Disassemble EEC alternator drive gearshaft and bearings assembly per 72-61-09, Disassembly-01 Task 72-61-09-040-001.

(10) Disassemble scavenge pump drive idler gearshaft and bearings assembly per 72-61-40, Disassembly-01 Task 72-61-40-040-001.

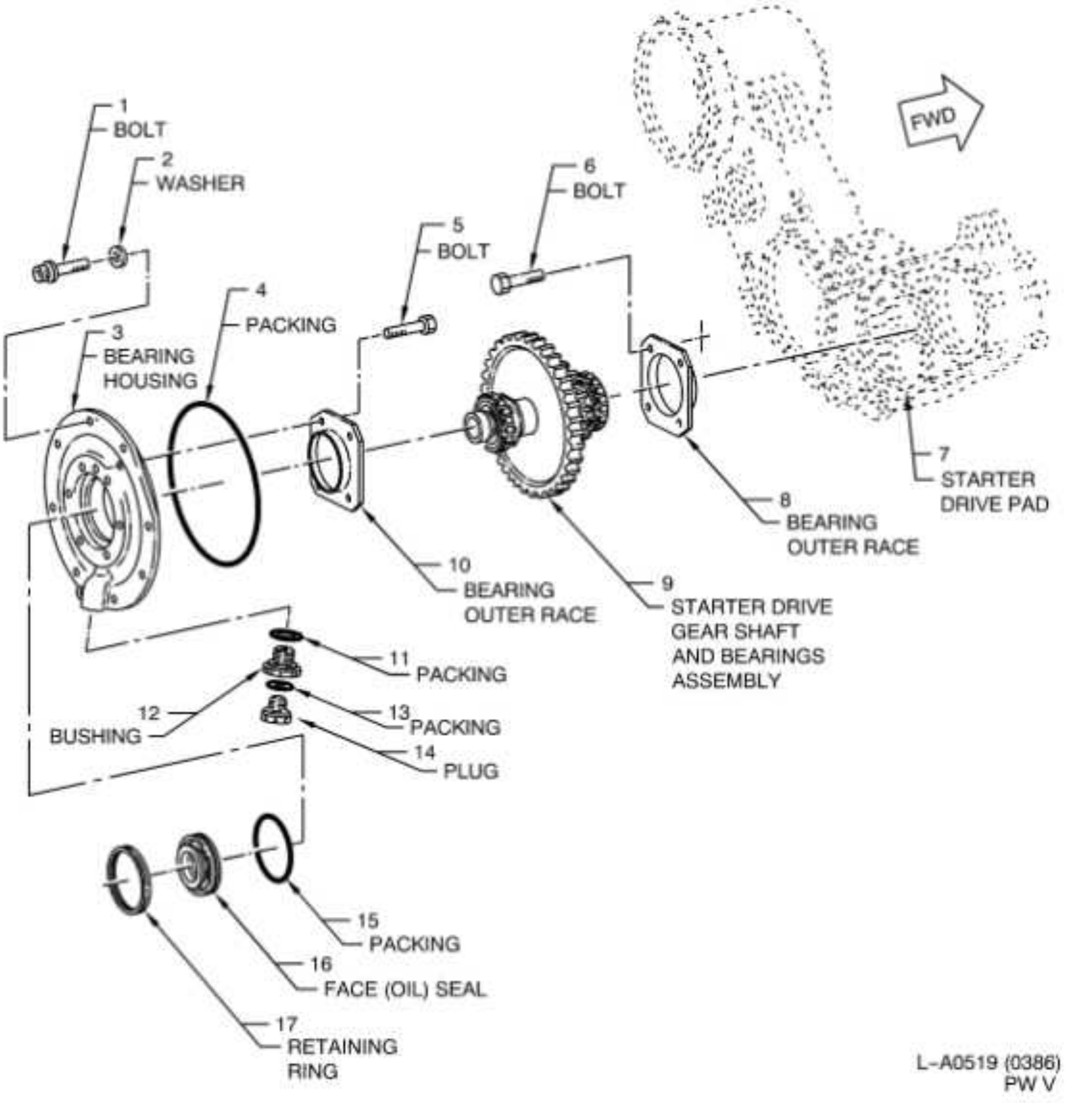
(11) Disassemble the front hydraulic pump drive gearshaft and bearings assembly. Refer to 72-61-07, Disassembly-01 Task 72-61-07-040-001.

MAIN GEARBOX − DISASSEMBLY−03


FWD
2
PACKING
1
BUSHING
4
PACKING
6
PACKING
5
BUSHING
3
PLUG
8
PACKING
10
PACKING
9
BUSHING
7
THERMOCOUPLE
(PRE SB PW4ENG 73-84)
14
PACKING
12
PACKING
11
PLUG
13
BUSHING
7A
THERMOCOUPLE
(POST SB PW4ENG 73-84)
L-A0521 (1292)
PW V

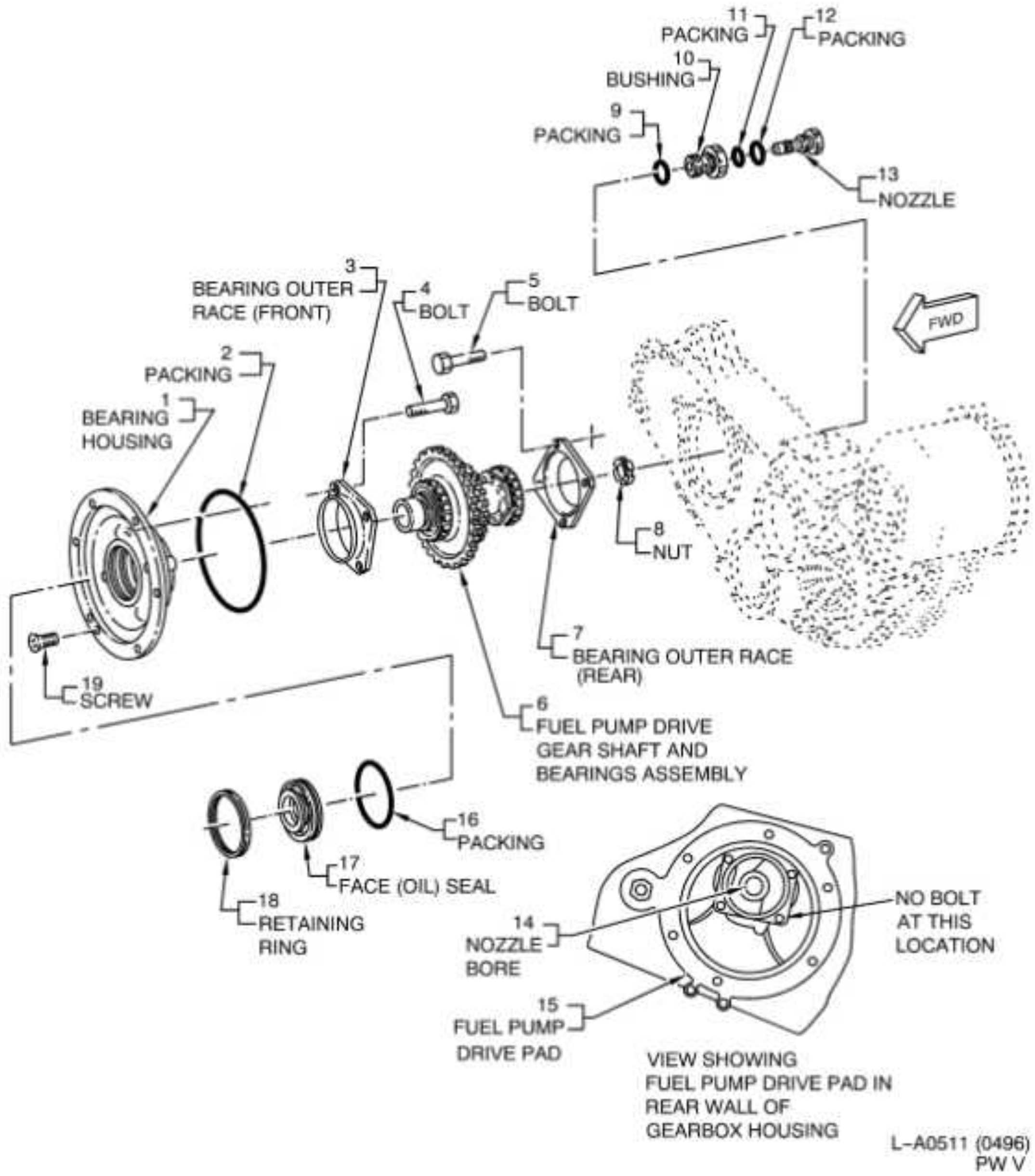
Probe And Drain Plug Removal
Figure 501
(Task 72−61−00−030−003)

MAIN GEARBOX − DISASSEMBLY−03


FWD
1 BOLT
2 WASHER
3 BEARING HOUSING
4 PACKING
5 BOLT
6 BOLT
7 STARTER DRIVE PAD
8 BEARING OUTER RACE
9 STARTER DRIVE GEAR SHAFT AND BEARINGS ASSEMBLY
10 BEARING OUTER RACE
11 PACKING
12 BUSHING
13 PACKING
14 PLUG
15 PACKING
16 FACE (OIL) SEAL
17 RETAINING RING
L−A0519 (0386)
PW V

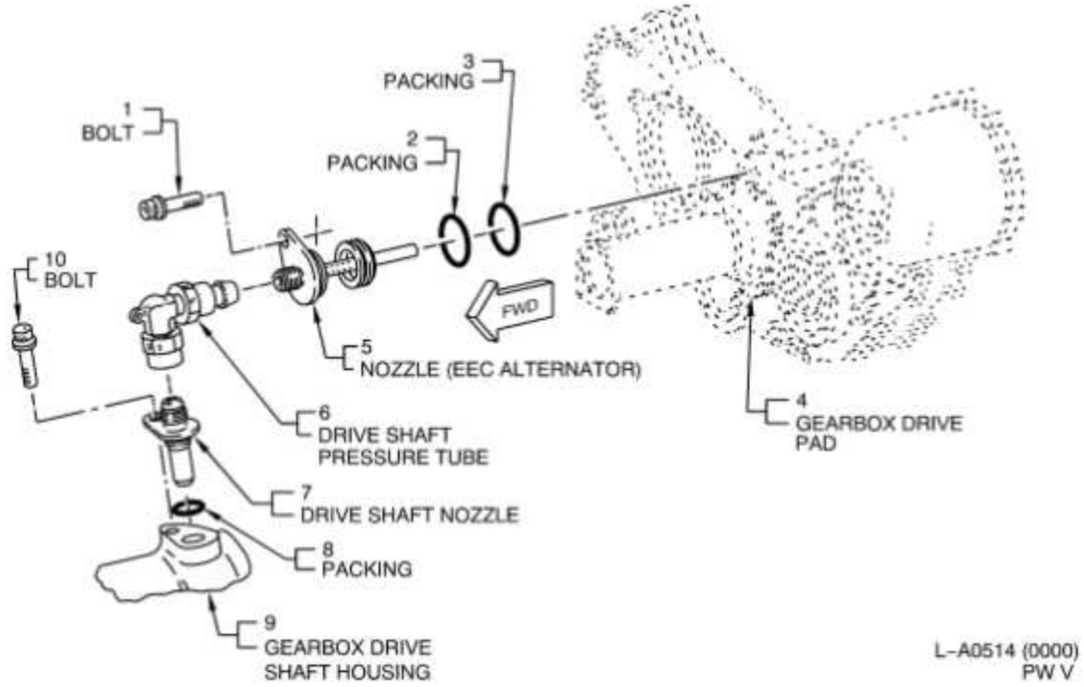
Starter Drive Gearshaft And Bearings Assembly Removal
Figure 502
(Task 72−61−00−030−003)

MAIN GEARBOX − DISASSEMBLY−03


11 PACKING
12 PACKING
10 BUSHING
9 PACKING
13 NOZZLE
3 BEARING OUTER RACE (FRONT)
4 BOLT
5 BOLT
FWD
2 PACKING
1 BEARING HOUSING
8 NUT
7 BEARING OUTER RACE (REAR)
19 SCREW
6 FUEL PUMP DRIVE GEAR SHAFT AND BEARINGS ASSEMBLY
16 PACKING
17 FACE (OIL) SEAL
18 RETAINING RING
NO BOLT AT THIS LOCATION
14 NOZZLE BORE
15 FUEL PUMP DRIVE PAD
VIEW SHOWING FUEL PUMP DRIVE PAD IN REAR WALL OF GEARBOX HOUSING
L-A0511 (0496)
PW V

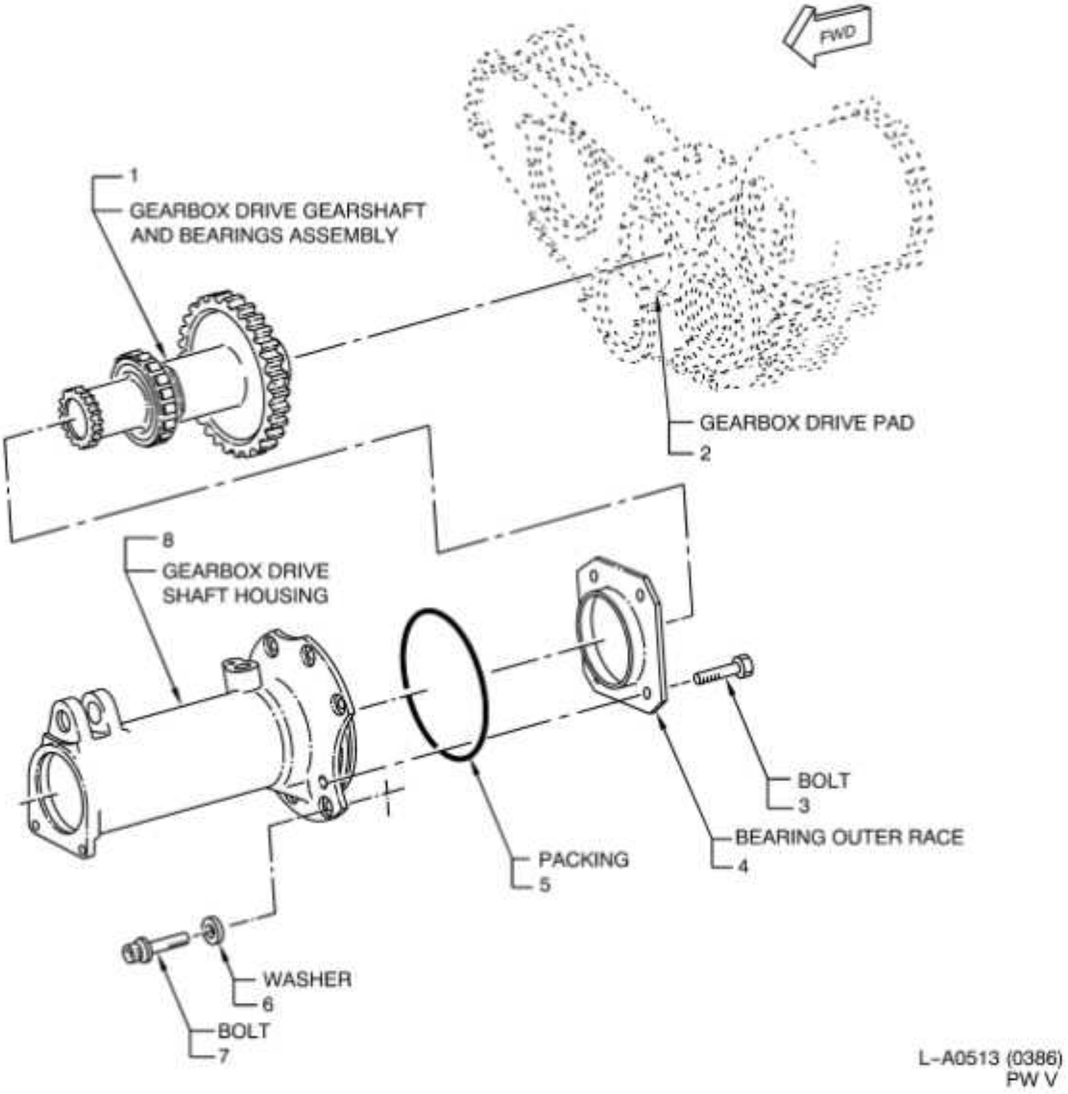
Gearbox (Fuel Pump Drive) Spur Gearshaft Assembly Removal
Figure 503
(Task 72−61−00−030−003)

MAIN GEARBOX - DISASSEMBLY-03


3 PACKING
1 BOLT
2 PACKING
10 BOLT
FWD
5 NOZZLE (EEC ALTERNATOR)
6 DRIVE SHAFT PRESSURE TUBE
4 GEARBOX DRIVE PAD
7 DRIVE SHAFT NOZZLE
8 PACKING
9 GEARBOX DRIVE SHAFT HOUSING
L-A0514 (0000)
PW V

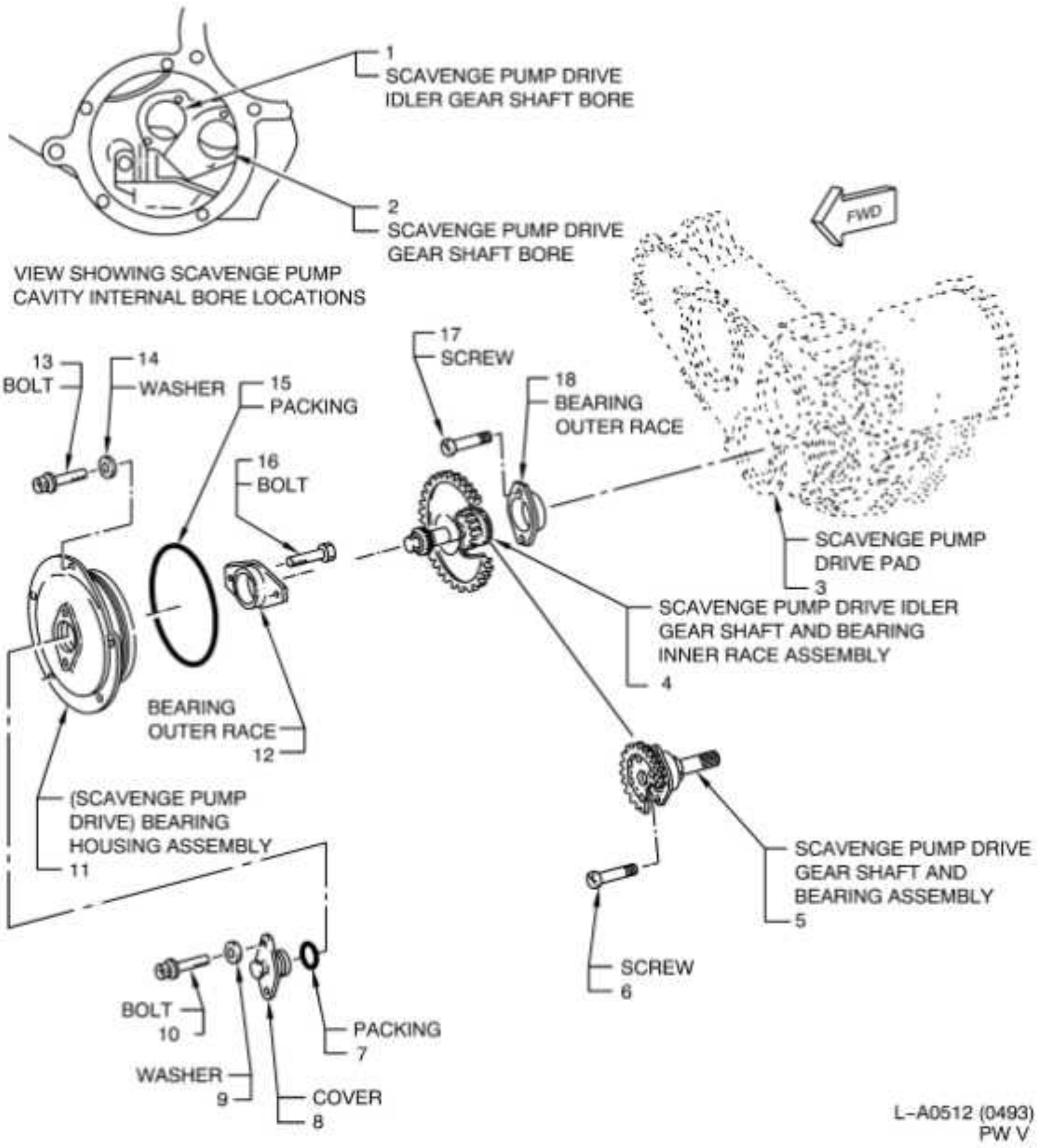
Gearbox Nozzle Removal
Figure 504
(Task 72-61-00-030-003)

MAIN GEARBOX − DISASSEMBLY−03

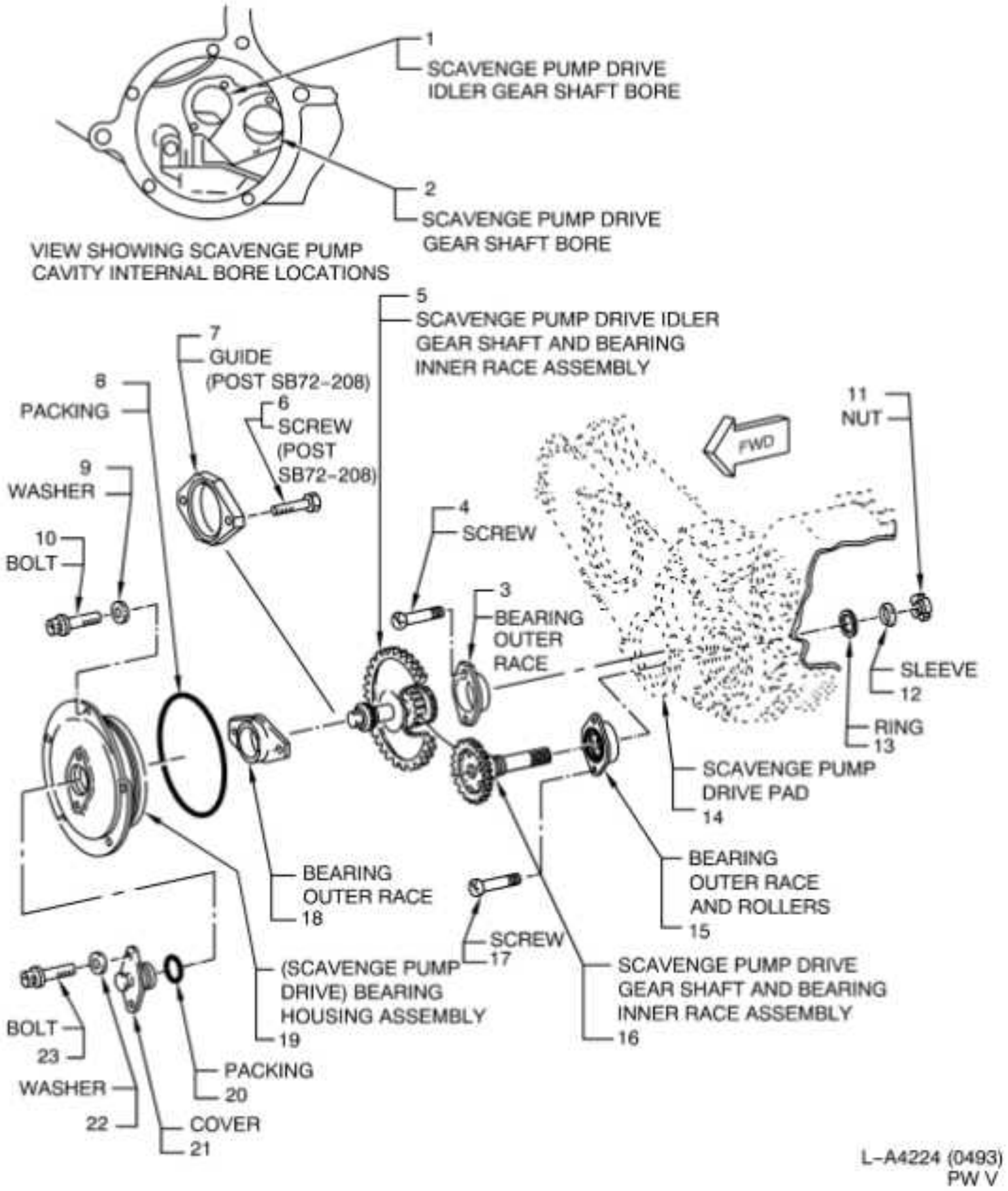

FWD
1
GEARBOX DRIVE GEARSHAFT AND BEARINGS ASSEMBLY
GEARBOX DRIVE PAD
2
8
GEARBOX DRIVE SHAFT HOUSING
BOLT
3
BEARING OUTER RACE
4
PACKING
5
WASHER
6
BOLT
7
L-A0513 (0386)
PW V

Gearbox Driveshaft And Bearings Assembly Removal
Figure 505
(Task 72−61−00−030−003)

MAIN GEARBOX − DISASSEMBLY−03

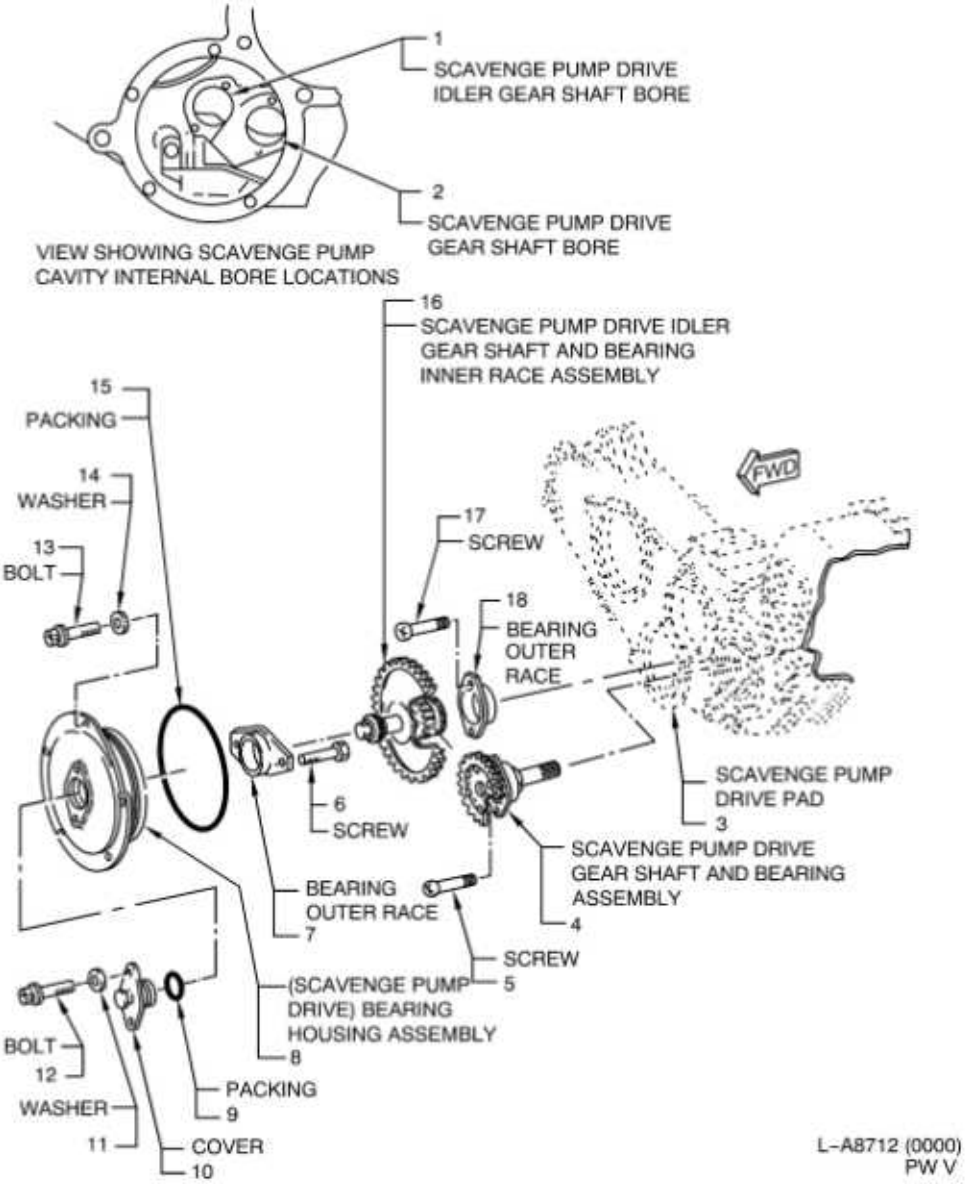

1
SCAVENGE PUMP DRIVE IDLER GEAR SHAFT BORE
2
SCAVENGE PUMP DRIVE GEAR SHAFT BORE
VIEW SHOWING SCAVENGE PUMP CAVITY INTERNAL BORE LOCATIONS
FWD
13 BOLT
14 WASHER
15 PACKING
16 BOLT
17 SCREW
18 BEARING OUTER RACE
SCAVENGE PUMP DRIVE PAD 3
SCAVENGE PUMP DRIVE IDLER GEAR SHAFT AND BEARING INNER RACE ASSEMBLY 4
BEARING OUTER RACE 12
(SCAVENGE PUMP DRIVE) BEARING HOUSING ASSEMBLY 11
SCAVENGE PUMP DRIVE GEAR SHAFT AND BEARING ASSEMBLY 5
SCREW 6
BOLT 10
WASHER 9
COVER 8
PACKING 7
L−A0512 (0493)
PW V

Removal Of The Scavenge Pump Drive And Idler Gearshaft
And Bearings Assembly (Pre SB PW4ENG 72−114)
Figure 506
(Task 72−61−00−030−003)


1
SCAVENGE PUMP DRIVE IDLER GEAR SHAFT BORE
2
SCAVENGE PUMP DRIVE GEAR SHAFT BORE
VIEW SHOWING SCAVENGE PUMP CAVITY INTERNAL BORE LOCATIONS
5
SCAVENGE PUMP DRIVE IDLER GEAR SHAFT AND BEARING INNER RACE ASSEMBLY
7
GUIDE (POST SB72-208)
8
PACKING
6
SCREW (POST SB72-208)
9
WASHER
10
BOLT
11
NUT
FWD
4
SCREW
3
BEARING OUTER RACE
SLEEVE
12
RING
13
SCAVENGE PUMP DRIVE PAD
14
BEARING OUTER RACE
18
BEARING OUTER RACE AND ROLLERS
15
SCREW
17
(SCAVENGE PUMP DRIVE) BEARING HOUSING ASSEMBLY
19
SCAVENGE PUMP DRIVE GEAR SHAFT AND BEARING INNER RACE ASSEMBLY
16
BOLT
23
WASHER
22
PACKING
20
COVER
21
L-A4224 (0493)
PW V

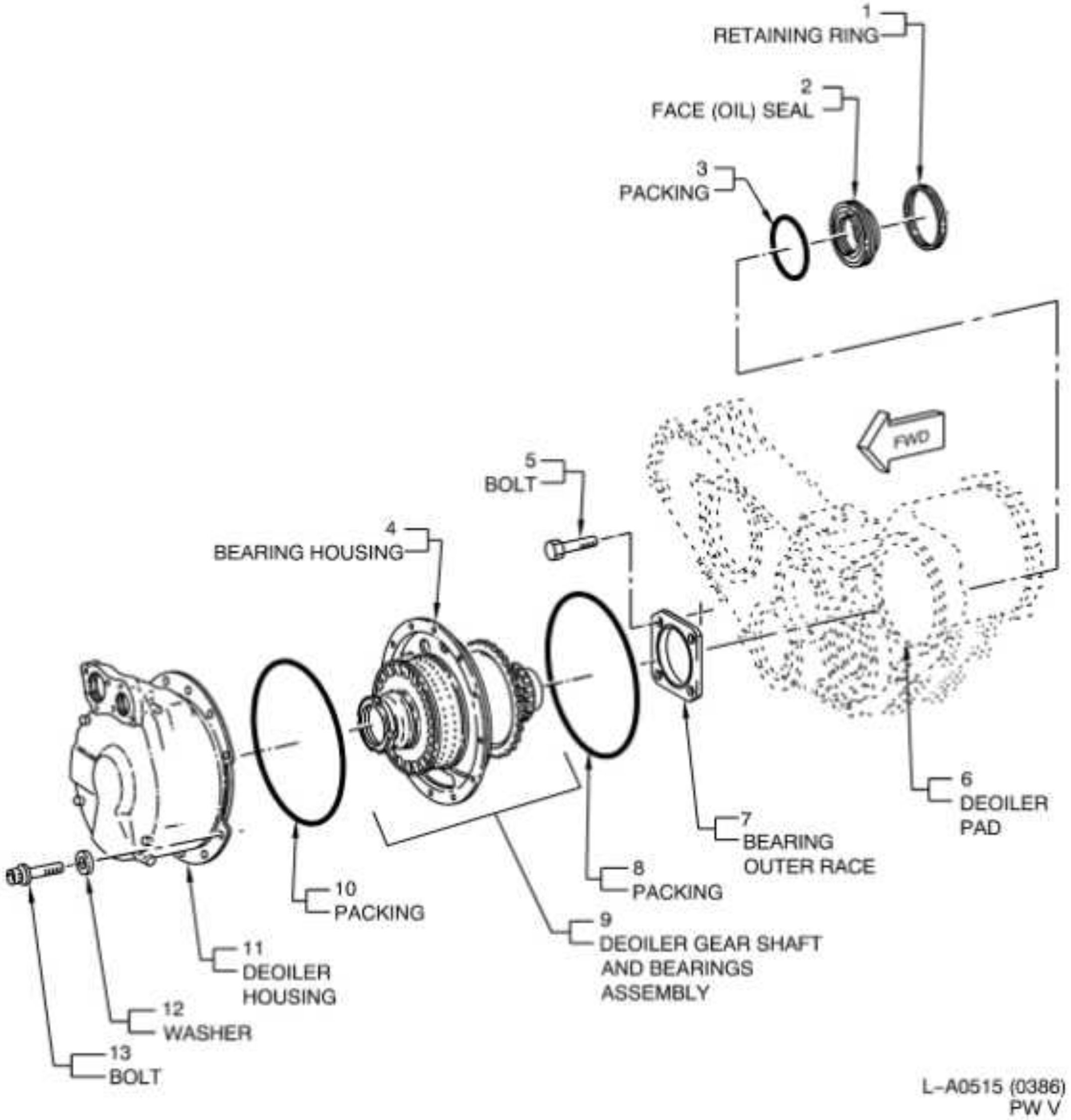
Removal Of The Scavenge Pump Drive And Idler Gearshaft And Bearings Assemblies (Post SB PW4ENG 72−114)
Figure 507
(Task 72−61−00−030−003)

MAIN GEARBOX − DISASSEMBLY−03

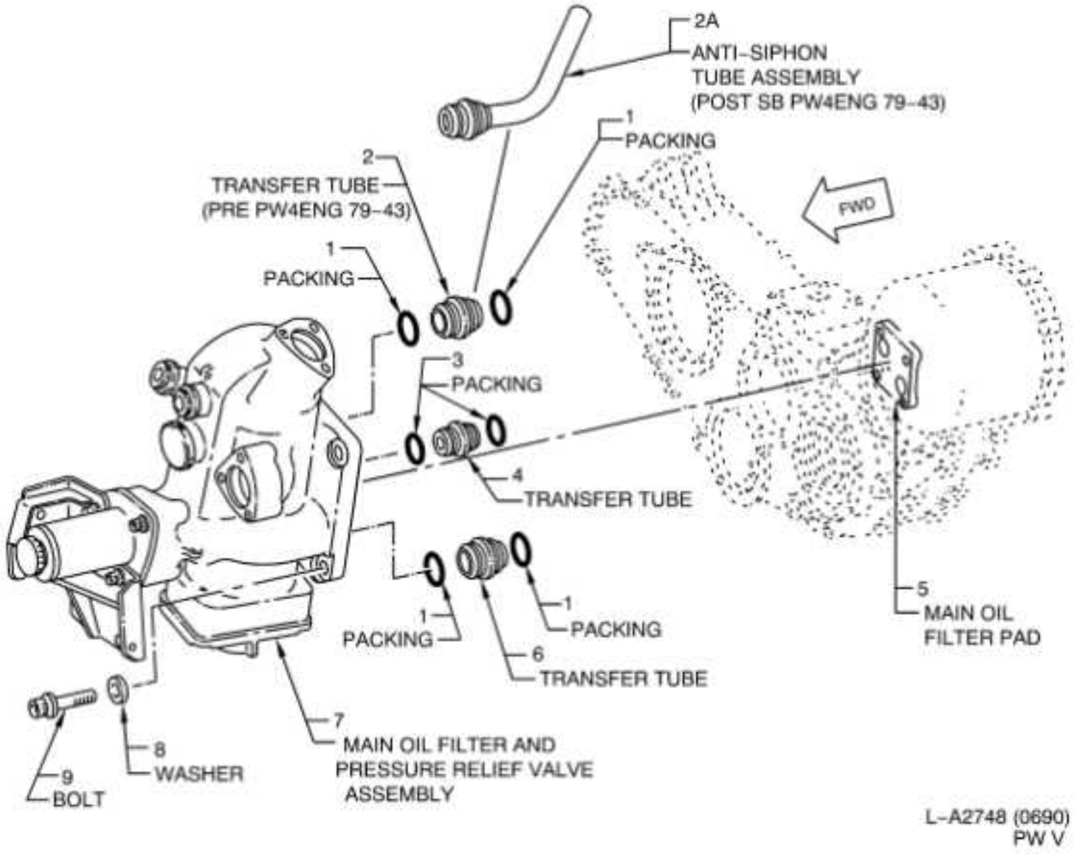

1
SCAVENGE PUMP DRIVE IDLER GEAR SHAFT BORE
2
SCAVENGE PUMP DRIVE GEAR SHAFT BORE
VIEW SHOWING SCAVENGE PUMP CAVITY INTERNAL BORE LOCATIONS
16
SCAVENGE PUMP DRIVE IDLER GEAR SHAFT AND BEARING INNER RACE ASSEMBLY
15
PACKING
14
WASHER
13
BOLT
FWD
17
SCREW
18
BEARING OUTER RACE
SCAVENGE PUMP DRIVE PAD
3
6
SCREW
SCAVENGE PUMP DRIVE GEAR SHAFT AND BEARING ASSEMBLY
4
BEARING OUTER RACE
7
SCREW
5
(SCAVENGE PUMP DRIVE) BEARING HOUSING ASSEMBLY
8
BOLT
12
WASHER
11
PACKING
9
COVER
10
L−A8712 (0000)
PW V

Removal Of The Scavenge Pump Drive And Idler Gearshaft
And Bearings Assemblies (Post SB PW4ENG 72−463)
Figure 508
(Task 72−61−00−030−003)

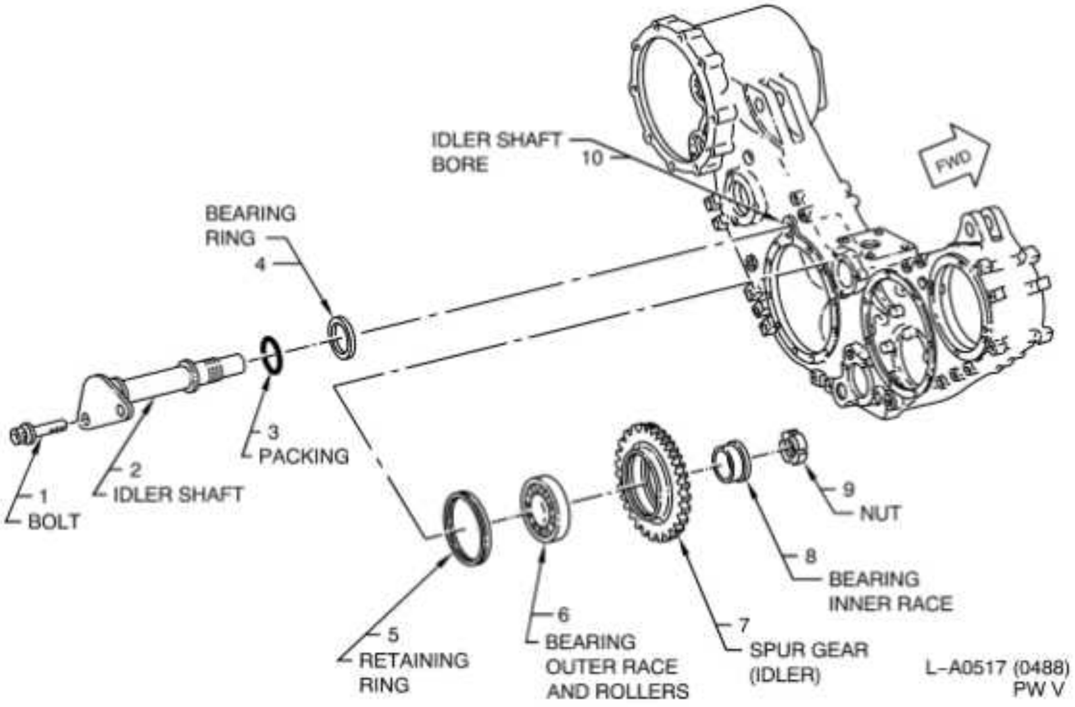
MAIN GEARBOX - DISASSEMBLY-03


1
RETAINING RING
2
FACE (OIL) SEAL
3
PACKING
FWD
5
BOLT
4
BEARING HOUSING
6
DEOILER
PAD
7
BEARING
OUTER RACE
8
PACKING
9
DEOILER GEAR SHAFT
AND BEARINGS
ASSEMBLY
10
PACKING
11
DEOILER
HOUSING
12
WASHER
13
BOLT
L-A0515 (0386)
PW V

Deoiler Gearshaft And Bearings Assembly Removal
Figure 509
(Task 72-61-00-030-003)

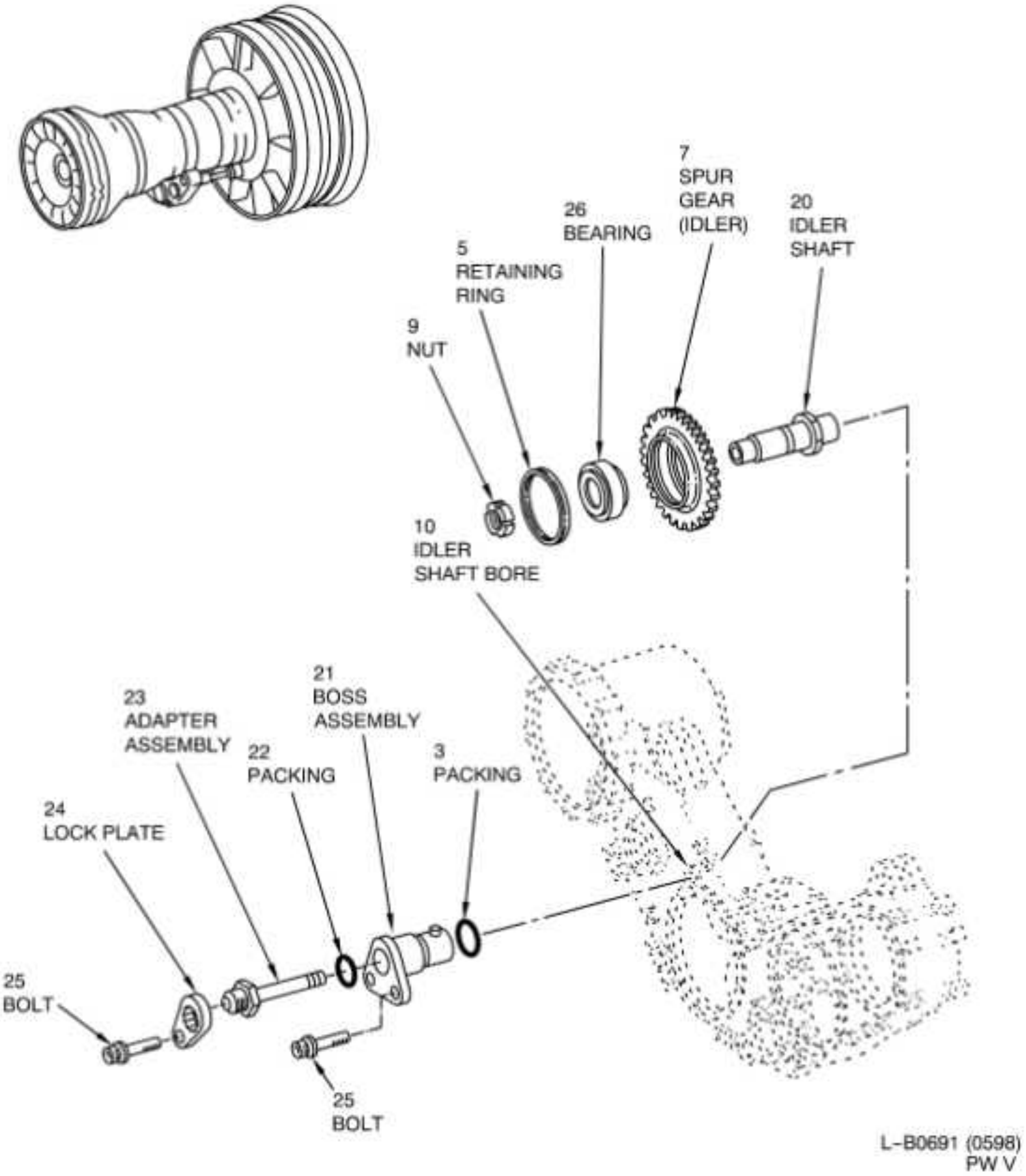

2A
ANTI-SIPHON TUBE ASSEMBLY (POST SB PW4ENG 79-43)
1
PACKING
FWD
2
TRANSFER TUBE (PRE PW4ENG 79-43)
1
PACKING
3
PACKING
4
TRANSFER TUBE
5
MAIN OIL FILTER PAD
1
PACKING
1
PACKING
6
TRANSFER TUBE
7
MAIN OIL FILTER AND PRESSURE RELIEF VALVE ASSEMBLY
8
WASHER
9
BOLT
L-A2748 (0690)
PW V

Main Oil Filter And Pressure Relief Valve Removal
Figure 510
(Task 72−61−00−030−003)


IDLER SHAFT BORE
10
BEARING RING
4
3
PACKING
2
IDLER SHAFT
1
BOLT
FWD
9
NUT
8
BEARING INNER RACE
7
SPUR GEAR (IDLER)
6
BEARING OUTER RACE AND ROLLERS
5
RETAINING RING
L−A0517 (0488)
PW V

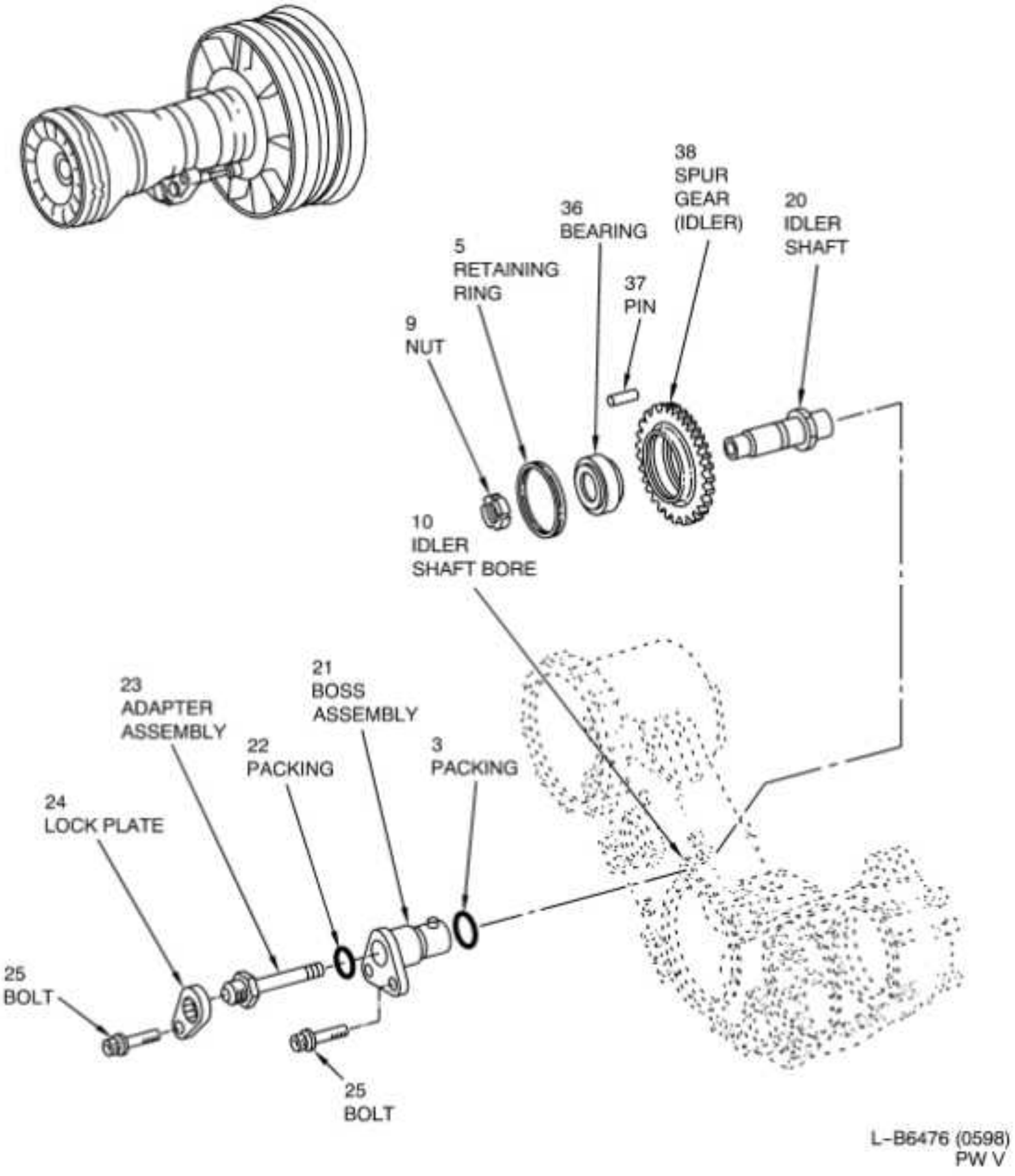
Gearbox Idler Spur Gear Removal (Pre SB PW4ENG 72−491)
Figure 511 (Sheet 1)
(Task 72−61−00−030−003)

MAIN GEARBOX − DISASSEMBLY−03


7
SPUR
GEAR
(IDLER)
26
BEARING
20
IDLER
SHAFT
5
RETAINING
RING
9
NUT
10
IDLER
SHAFT BORE
21
BOSS
ASSEMBLY
23
ADAPTER
ASSEMBLY
22
PACKING
3
PACKING
24
LOCK PLATE
25
BOLT
25
BOLT
L−B0691 (0598)
PW V

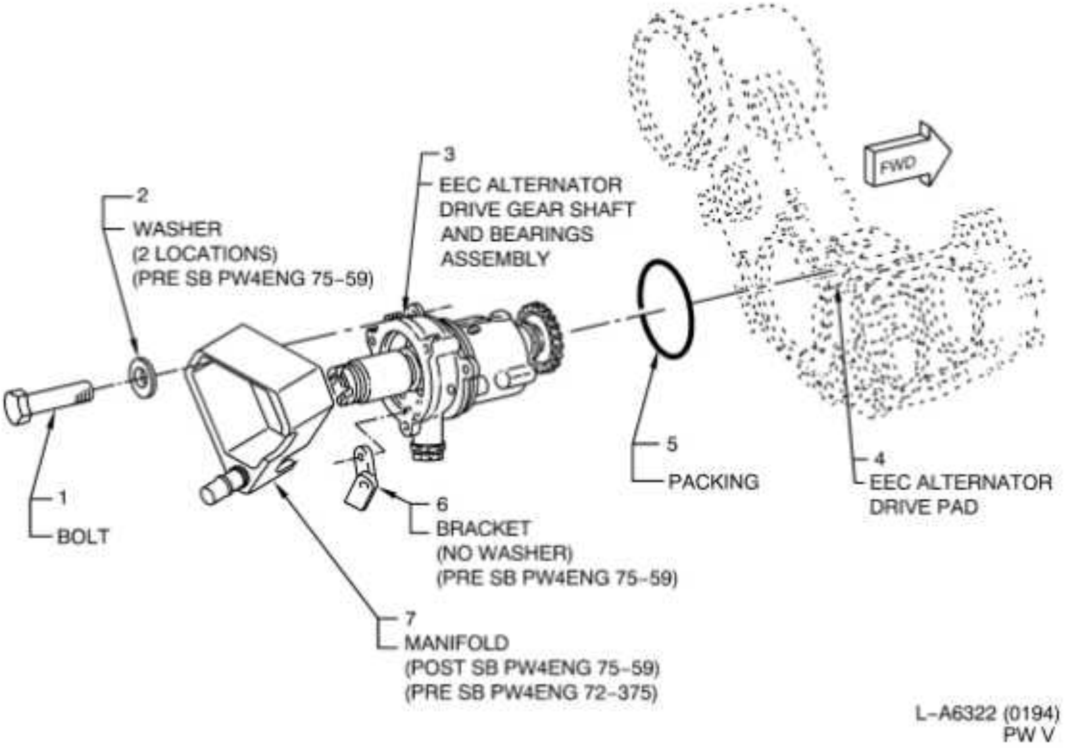
Gearbox Idler Spur Gear Removal (Post SB PW4ENG 72−491)
Figure 511 (Sheet 2)
(Task 72−61−00−030−003)

MAIN GEARBOX - DISASSEMBLY-03

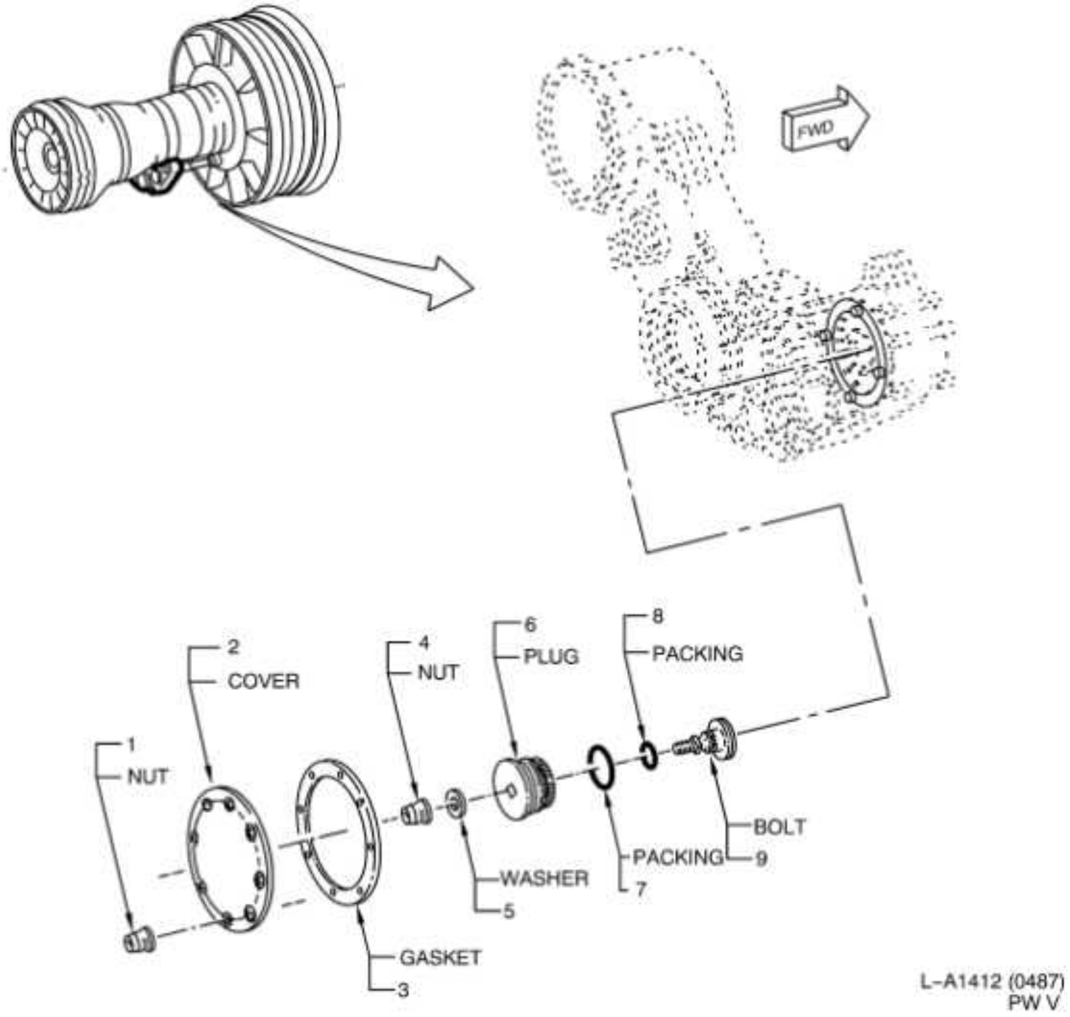

38
SPUR
GEAR
(IDLER)
36
BEARING
20
IDLER
SHAFT
5
RETAINING
RING
37
PIN
9
NUT
10
IDLER
SHAFT BORE
21
BOSS
ASSEMBLY
23
ADAPTER
ASSEMBLY
22
PACKING
3
PACKING
24
LOCK PLATE
25
BOLT
25
BOLT
L-B6476 (0598)
PW V

Gearbox Idler Spur Gear Removal (Post SB PW4ENG 72-664)
Figure 511 (Sheet 3)
(Task 72-61-00-030-003)

MAIN GEARBOX − DISASSEMBLY−03

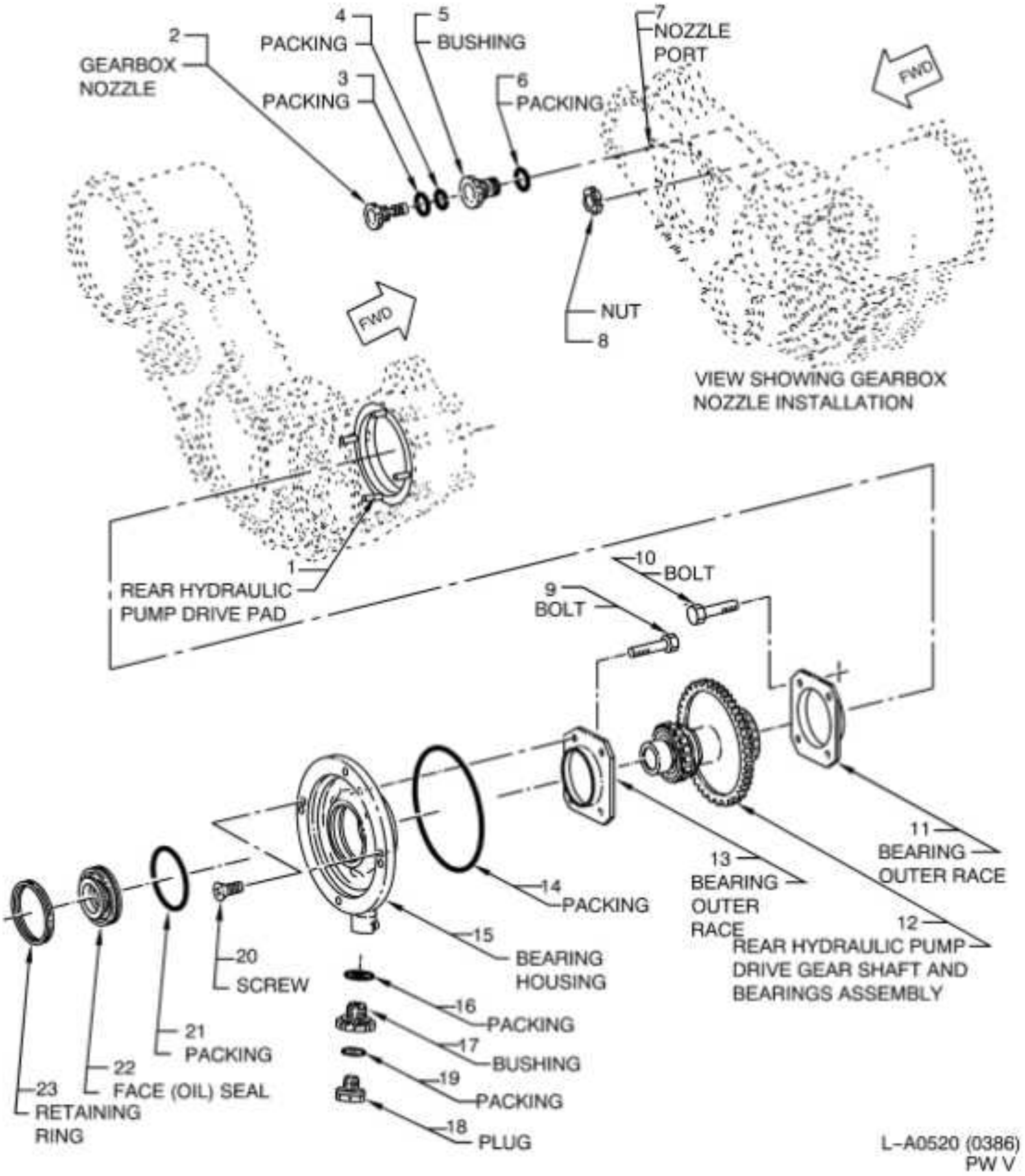

3
EEC ALTERNATOR DRIVE GEAR SHAFT AND BEARINGS ASSEMBLY
2
WASHER (2 LOCATIONS) (PRE SB PW4ENG 75-59)
FWD
1
BOLT
5
PACKING
4
EEC ALTERNATOR DRIVE PAD
6
BRACKET (NO WASHER) (PRE SB PW4ENG 75-59)
7
MANIFOLD (POST SB PW4ENG 75-59) (PRE SB PW4ENG 72-375)
L-A6322 (0194)
PW V

EEC Alternator Drive Gearshaft And Bearings Assembly Removal
Figure 512
(Task 72−61−00−030−003)


FWD
2
COVER
4
NUT
6
PLUG
8
PACKING
1
NUT
BOLT
PACKING
9
7
WASHER
5
GASKET
3
L-A1412 (0487)
PW V

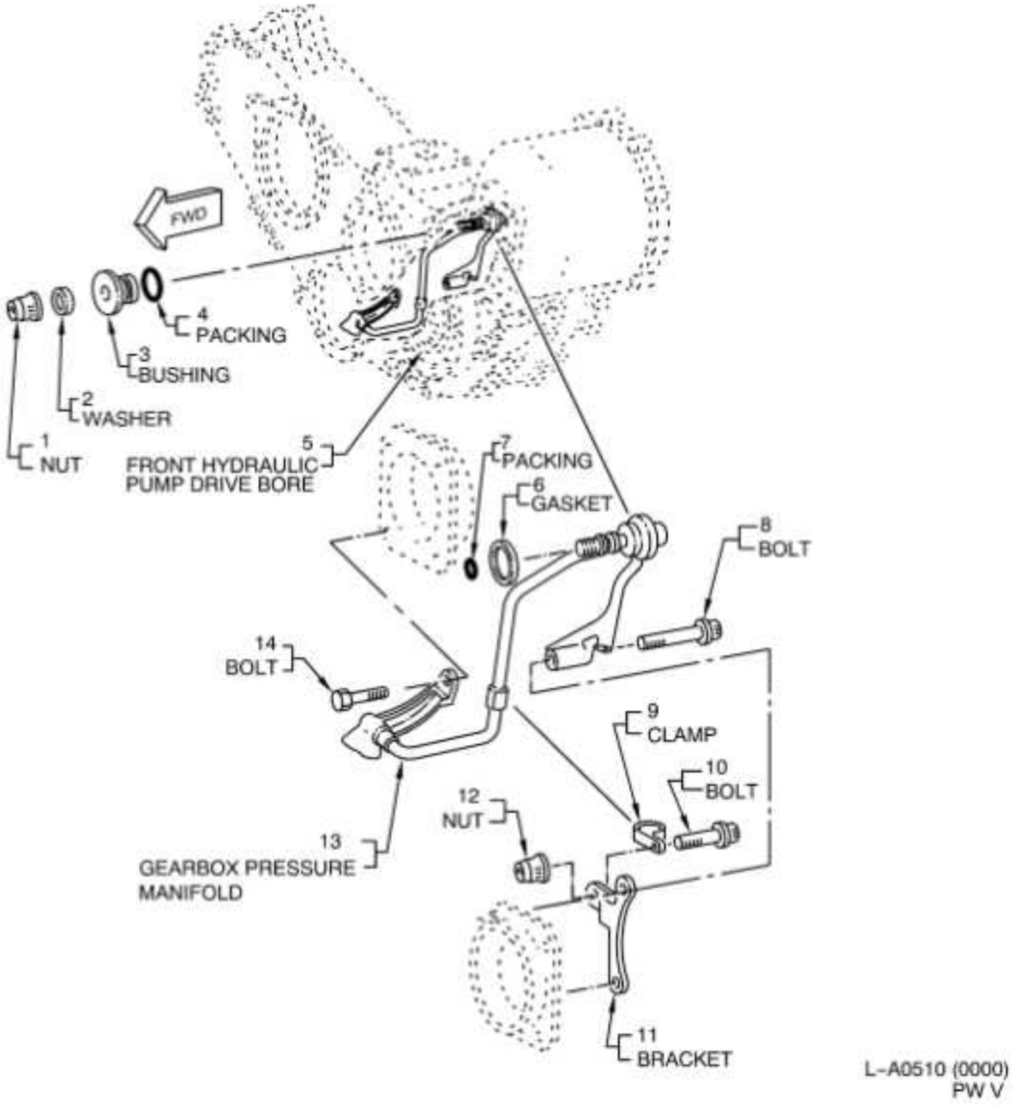
Rear Hydraulic Pump Drive Cover, Plug And Bolt Removal
Figure 513
(Task 72−61−00−030−003)

MAIN GEARBOX − DISASSEMBLY−03

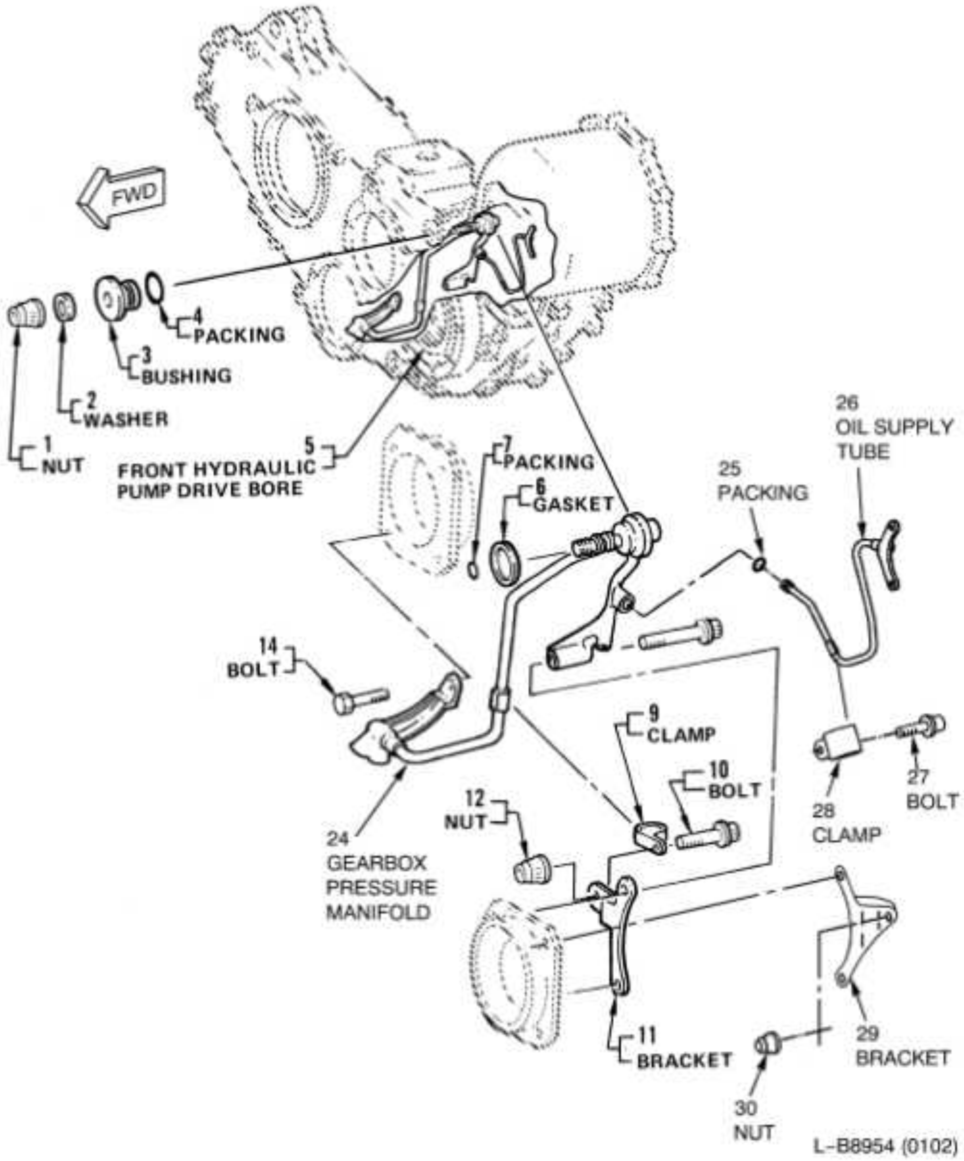

2
GEARBOX NOZZLE
4
PACKING
3
PACKING
5
BUSHING
6
PACKING
7
NOZZLE PORT
FWD
NUT
8
FWD
VIEW SHOWING GEARBOX NOZZLE INSTALLATION
1
REAR HYDRAULIC PUMP DRIVE PAD
10
BOLT
9
BOLT
11
BEARING OUTER RACE
13
BEARING OUTER RACE
12
REAR HYDRAULIC PUMP DRIVE GEAR SHAFT AND BEARINGS ASSEMBLY
14
PACKING
15
BEARING HOUSING
20
SCREW
16
PACKING
17
BUSHING
19
PACKING
18
PLUG
21
PACKING
22
FACE (OIL) SEAL
23
RETAINING RING
L−A0520 (0386)
PW V

Rear Hydraulic Pump Drive Gearshaft And Bearings Assembly Removal
Figure 514
(Task 72−61−00−030−003)

MAIN GEARBOX - DISASSEMBLY-03

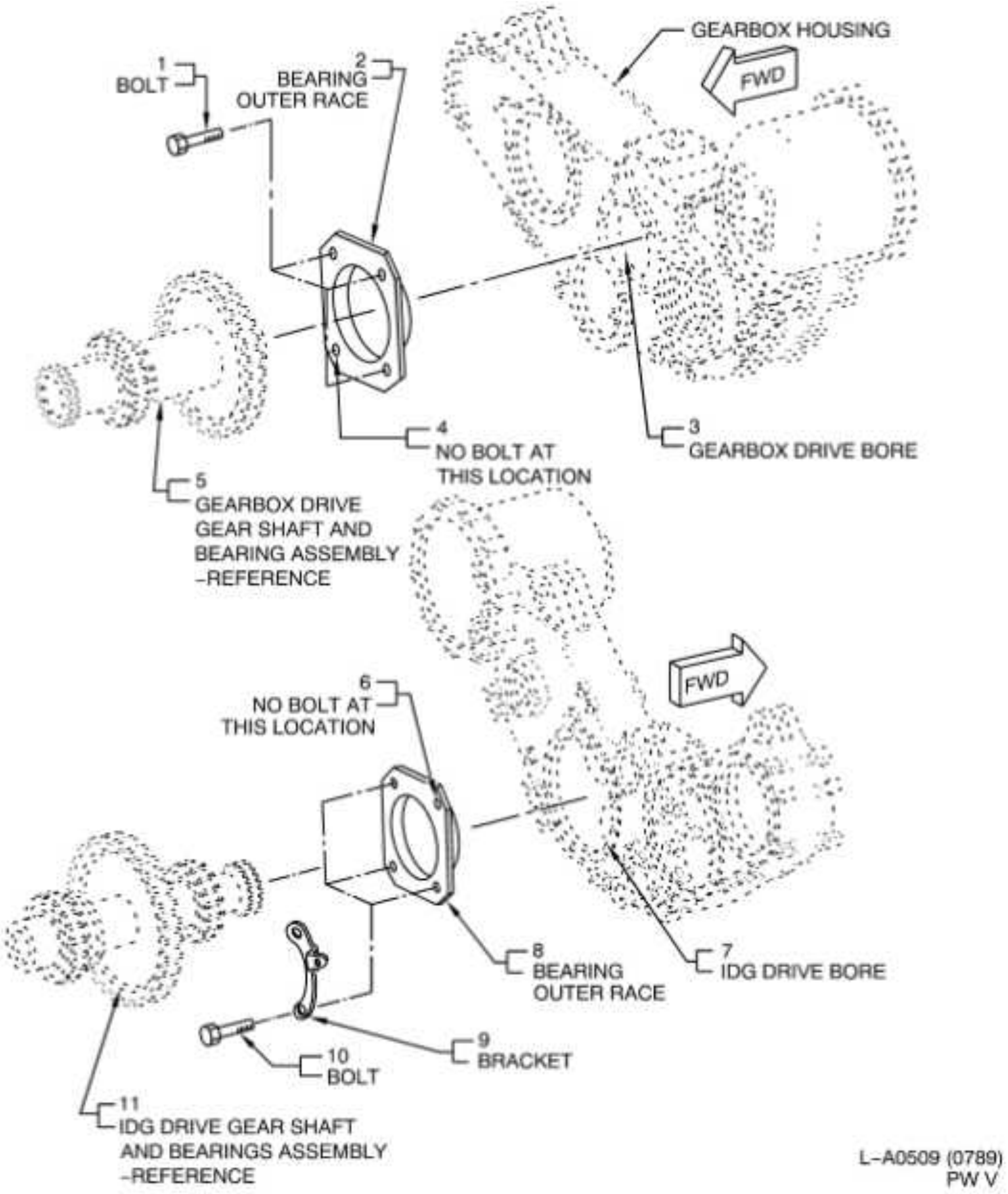

FWD
1 NUT
2 WASHER
3 BUSHING
4 PACKING
5 FRONT HYDRAULIC PUMP DRIVE BORE
7 PACKING
6 GASKET
8 BOLT
14 BOLT
9 CLAMP
10 BOLT
12 NUT
13 GEARBOX PRESSURE MANIFOLD
11 BRACKET
L-A0510 (0000)
PW V

Gearbox Pressure Manifold Removal
Figure 515 (Sheet 1)
(Task 72-61-00-030-003)

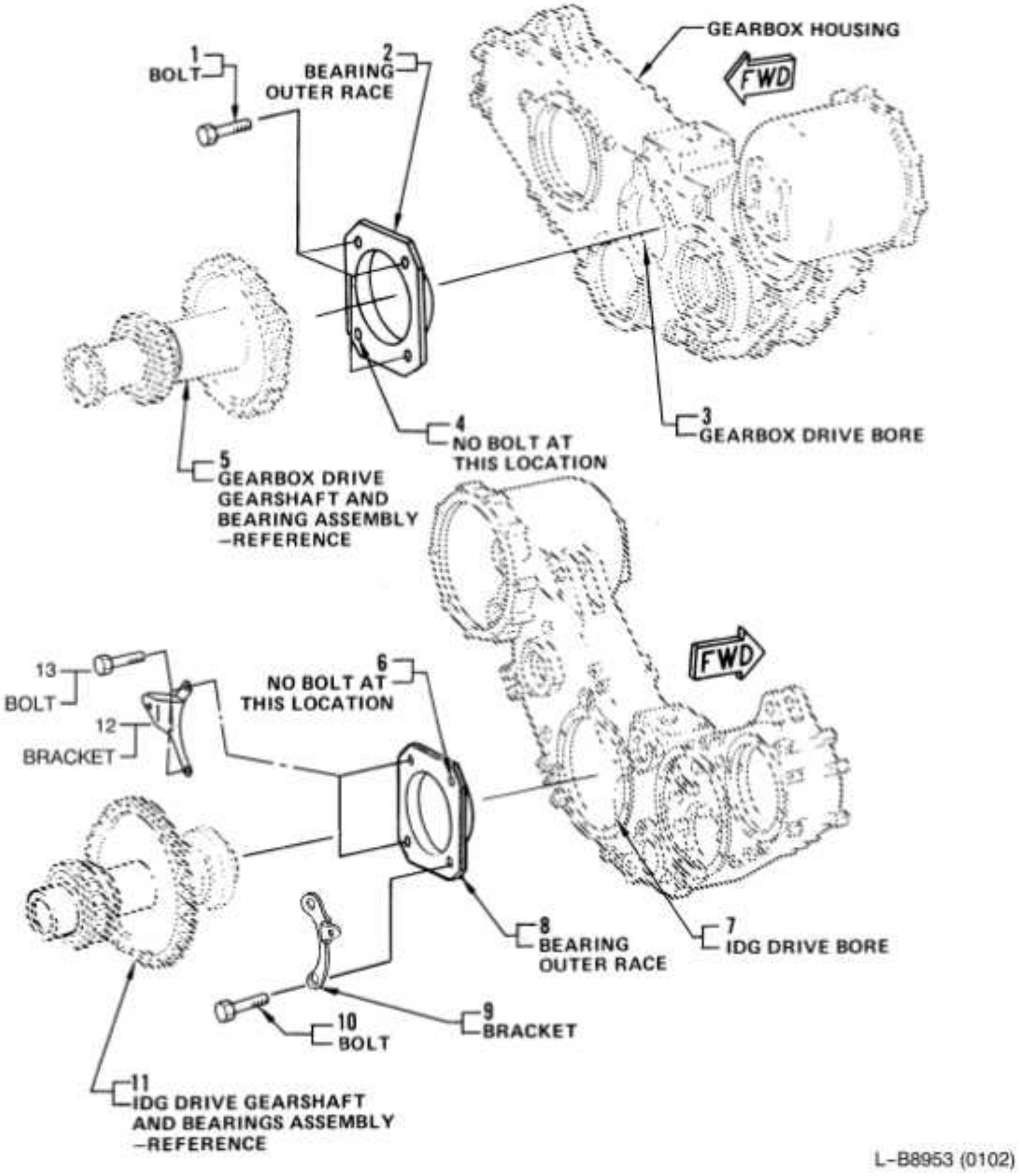

FWD
4 PACKING
3 BUSHING
2 WASHER
1 NUT
5 FRONT HYDRAULIC PUMP DRIVE BORE
7 PACKING
6 GASKET
25 PACKING
26 OIL SUPPLY TUBE
14 BOLT
9 CLAMP
10 BOLT
27 BOLT
28 CLAMP
12 NUT
24 GEARBOX PRESSURE MANIFOLD
11 BRACKET
29 BRACKET
30 NUT
L−B8954 (0102)

Gearbox Pressure Manifold Removal
(Alternate Lubrication Configuration)
Figure 515 (Sheet 2)
(Task 72−61−00−030−003)

MAIN GEARBOX − DISASSEMBLY−03

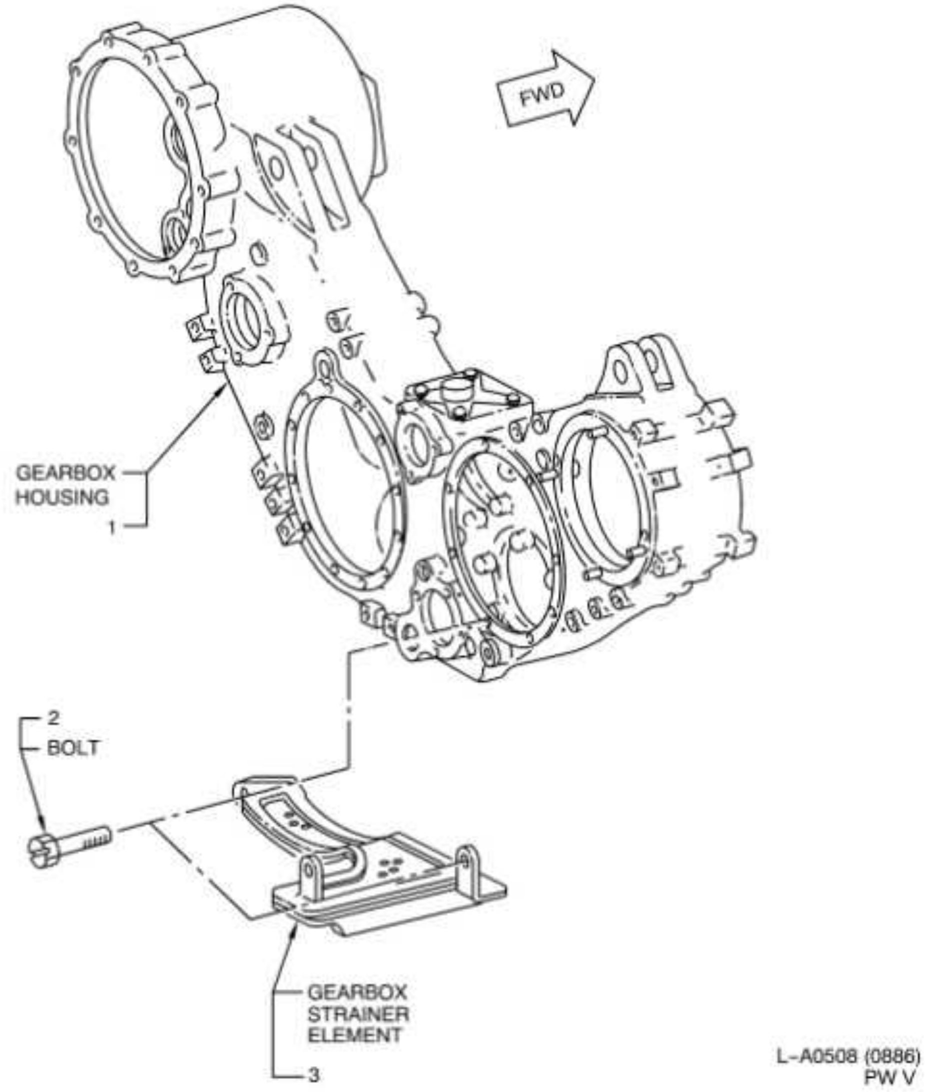

GEARBOX HOUSING
FWD
1 BOLT
2 BEARING OUTER RACE
3 GEARBOX DRIVE BORE
4 NO BOLT AT THIS LOCATION
5 GEARBOX DRIVE GEAR SHAFT AND BEARING ASSEMBLY -REFERENCE
FWD
6 NO BOLT AT THIS LOCATION
7 IDG DRIVE BORE
8 BEARING OUTER RACE
9 BRACKET
10 BOLT
11 IDG DRIVE GEAR SHAFT AND BEARINGS ASSEMBLY -REFERENCE
L-A0509 (0789)
PW V

Bearing Outer Races Removal
Figure 516 (Sheet 1)
(Task 72−61−00−030−003)

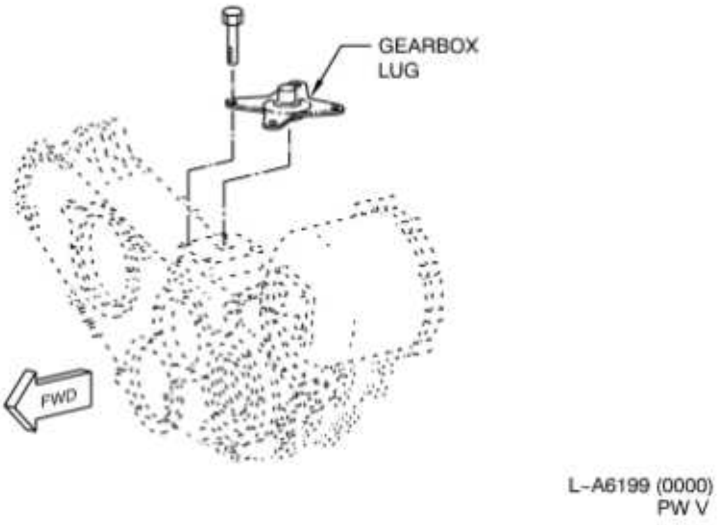

1 BOLT
2 BEARING OUTER RACE
GEARBOX HOUSING
FWD
3 GEARBOX DRIVE BORE
4 NO BOLT AT THIS LOCATION
5 GEARBOX DRIVE GEARSHAFT AND BEARING ASSEMBLY -REFERENCE
13 BOLT
12 BRACKET
6 NO BOLT AT THIS LOCATION
FWD
8 BEARING OUTER RACE
7 IDG DRIVE BORE
9 BRACKET
10 BOLT
11 IDG DRIVE GEARSHAFT AND BEARINGS ASSEMBLY -REFERENCE
L-B8953 (0102)

Bearing Outer Races Removal (Alternate Lubrication Configuration)
Figure 516 (Sheet 2)
(Task 72-61-00-030-003)

MAIN GEARBOX − DISASSEMBLY−03


FWD
GEARBOX HOUSING
1
2
BOLT
GEARBOX STRAINER ELEMENT
3
L-A0508 (0886)
PW V

Gearbox Strainer Element Removal
Figure 517
(Task 72−61−00−030−003)


GEARBOX LUG
FWD
L-A6199 (0000)
PW V

Removal Of The Gearbox Lug
Figure 518
(Task 72-61-00-030-003)

MAIN GEARBOX - DISASSEMBLY-04

Task 72-61-00-030-004:

1. Disassemble Main Oil Filter, Housing And Pressure Relief Valves Assembly

   A. Equipment And Materials Required - None

   B. Procedure

   See Figures 501 and 502.

Subtask 72-61-00-030-071:

(1) (Pre PW4ENG 72-524) Position main oil filter housing (501/3), large mounting flange side down, on bench. See Figure 501 (Sheet 1).

(a) Remove lockwire and pressure relief valve (filter element) (501/19) from port in main oil filter housing (501/3) located just above pressure (regulator) relief valve pad (501/16). Discard packings (501/17) and (501/18).

(b) Remove inserts (501/1) from ports in face of main oil filter housing. Discard packings (501/2).

(c) Remove lockwire, plug (501/12), and insert (501/10) from bottom port in main oil strainer cover (501/15). Discard packings (501/9) and (501/11).

(d) Remove four bolts (501/13) and washers (501/14) securing main oil strainer cover (501/15) to main oil filter housing (501/3). Remove cover and filter element (501/4) from housing. Remove filter element. Discard packing (501/8).

(e) Remove spring (501/5) from cover. Remove screw (501/6) securing key washer (501/7) to cover. Remove key washer and discard.

(2) (Post SB PW4ENG 72-524 and Pre SB PW4ENG 79-79) Position main oil filter housing (501/3), large mounting flange side down, on bench. See Figure 501 (Sheet 2).

(a) Remove lockwire and pressure relief valve (filter element) (501/19) from port in main oil filter housing (501/3) located just above pressure (regulator) relief valve pad (501/16). Discard packings (501/17) and (501/18).

MAIN GEARBOX − DISASSEMBLY−04

(b) Remove inserts (501/1) from ports in face of main oil filter housing. Discard packings (501/2).

(c) Remove lockwire, plug (501/12), and insert (501/10) from bottom port in main oil strainer cover (501/15). Discard packings (501/9) and (501/11).

(d) Remove lockwire, if necessary, the four nuts (501/29) or (501/30) and the washers (501/14) that secure the main oil strainer cover (501/15) to main oil filter housing (501/3). Remove cover and filter element (501/4) from housing. Remove filter element. Discard packing (501/8). Discard the four self−locking nuts (501/29) and keep the nuts (501/30) with the wire holes.

(e) Remove spring (501/5) from cover. Remove screw (501/6) securing key washer (501/7) to cover. Remove key washer and discard.

(3) (Post SB PW4ENG 72−524 and SB PW4ENG 79−79) Position main oil filter housing (501/3), large mounting flange side down, on the work bench. See Figure 501 (Sheet 3).

(a) Remove the lockwire and the pressure relief valve (filter element) (501/19) from the port in the main oil filter housing (501/3) located just above the pressure (regulator) relief valve pad (501/16). Discard the packings (501/17) and (501/18).

(b) Remove the inserts (501/1) from the ports in the face of the main oil filter housing. Discard the packings (501/2).

(c) Remove the lockwire, plug (501/12), and insert (501/10) from the bottom port in the main oil strainer cover (501/21). Discard the packings (501/9) and (501/11).

(d) Remove the lockwire, and if necessary, the four nuts (501/29) or (501/30) and the washers (501/14) that secure the main oil strainer cover (501/21) to the main oil filter housing (501/3). Remove the cover and the filter element (501/4) from the housing. Remove the filter element. Discard the packing (501/8). Discard the four self−locking nuts (501/29) and keep the nuts (501/30) with the wire holes.

MAIN GEARBOX − DISASSEMBLY−04

(e) Remove the spring (501/5) from the cover (501/21). Remove the two screws (501/22) and the two washers (501/20) securing the spring retainer (501/23) to the cover (501/21).

(4) (Post SB PW4ENG 72−525) Position main oil filter housing (501/3), large mounting flange side down, on bench. See Figure 501 (Sheet 4).

(a) Remove lockwire and plug (501/43) from port in main oil filter housing (501/3) located just above pressure (regulator) relief valve pad (501/16). Discard packings (501/17) and (501/18).

(b) Remove inserts (501/1) from ports in face of main oil filter housing. Discard packings (501/2).

(c) Remove lockwire and plug (501/12), from bottom port in main oil strainer cover (501/42). Discard packing (501/11).

(d) Remove four nuts (501/29) and washers (501/14) securing main oil strainer cover (501/42) to main oil filter housing (501/3). Remove cover and filter element (501/39) from housing. Remove filter element. Discard packing (501/8). Discard the four self−locking nuts (501/29).

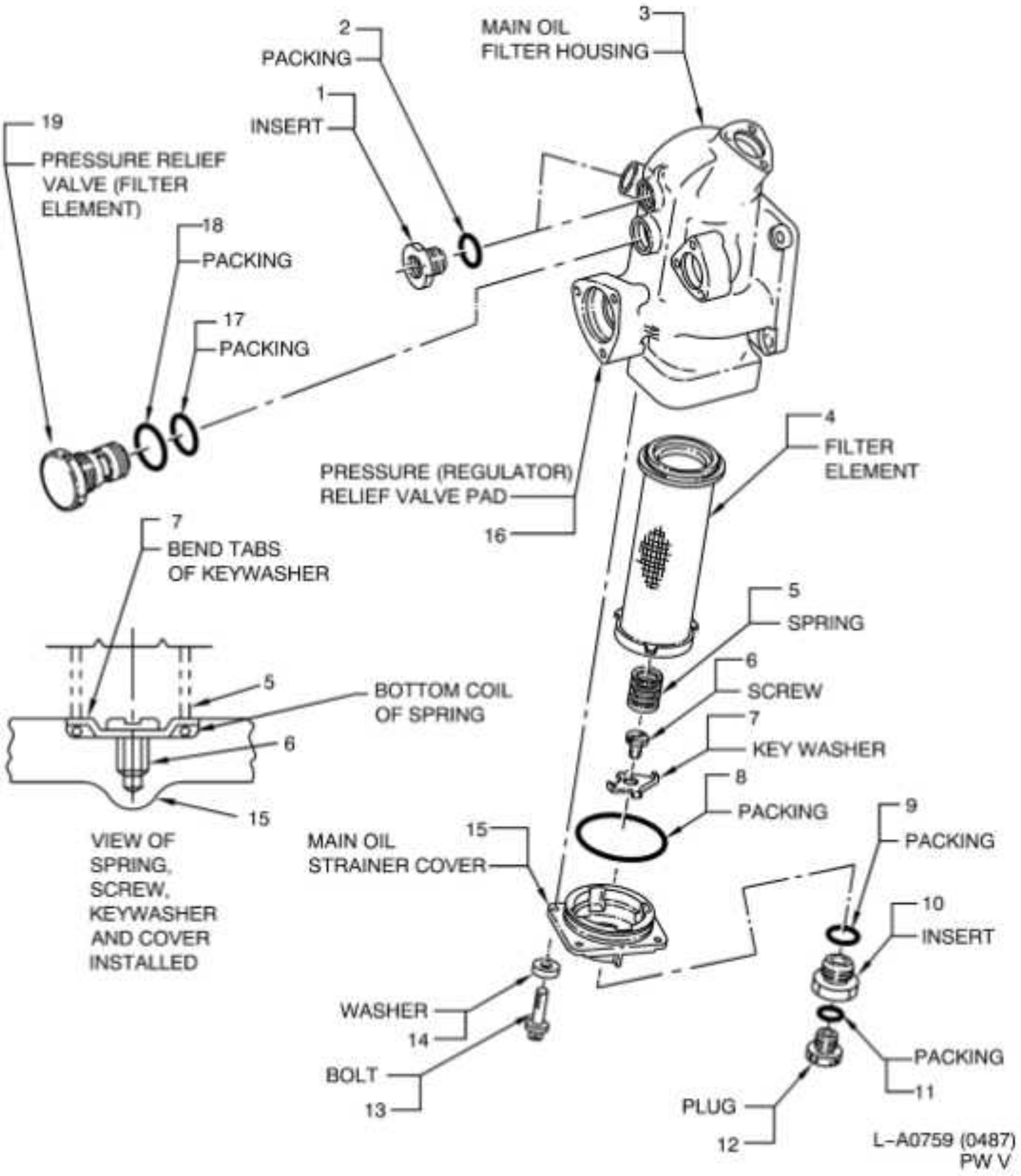
(e) Remove retaining ring (501/40) from pressure relief valve (501/41) and remove pressure relief valve from cover (501/42).

CAUTION: PRESSURE RELIEF VALVE IS SPRING LOADED. EXERCISE CARE WHEN REMOVING.

(5) Remove lockwire and carefully remove relief valve plug (502/1) from relief valve housing (502/8). Discard packing (502/2). See Figure 502.

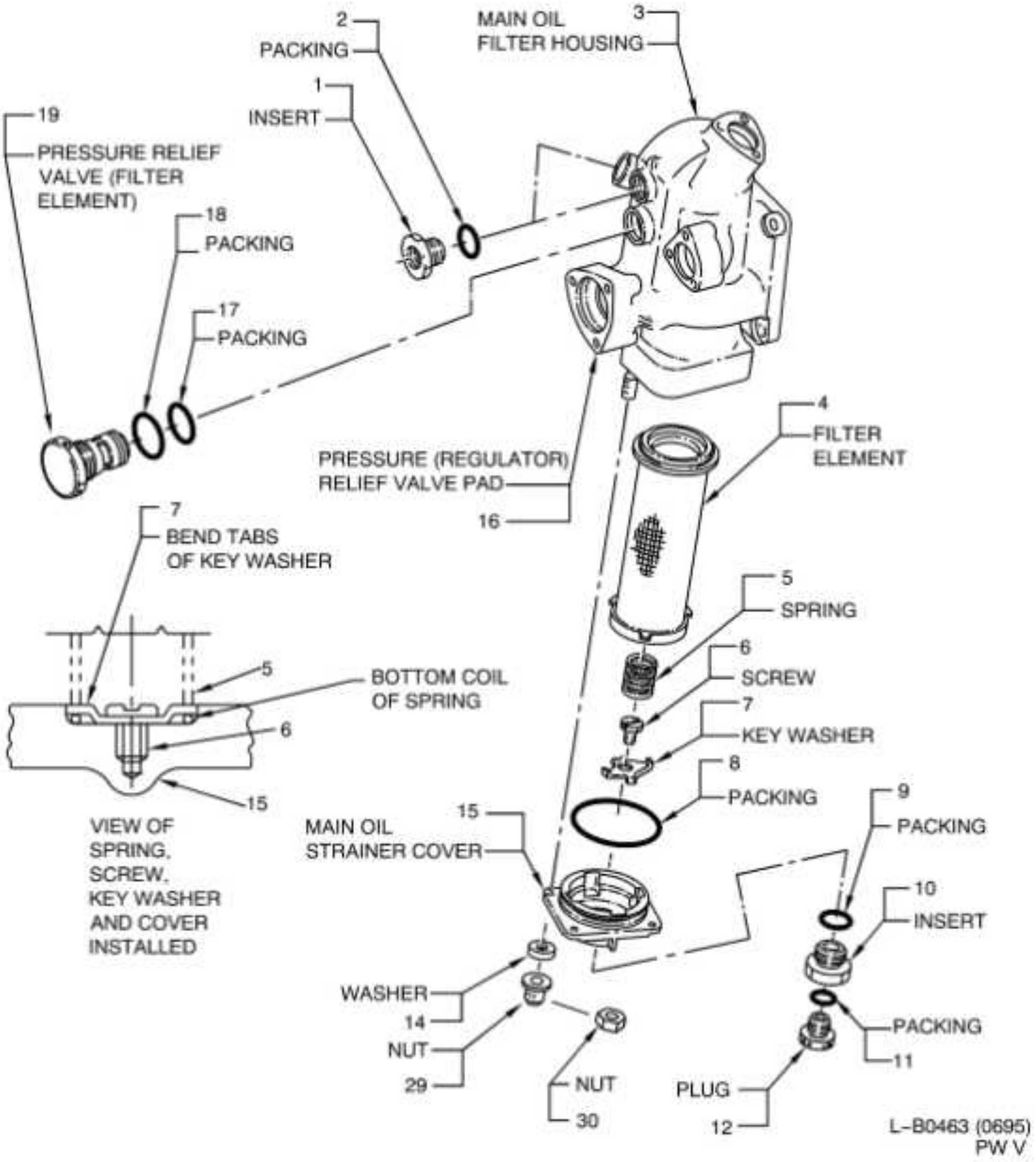
(6) Remove spring (502/3) and pressure relief valve (502/4) from relief valve housing (502/8). Discard packing (502/5).

(7) Remove three bolts (502/6) securing relief valve housing and bracket (502/7) to pressure relief pad (502/12) on front face of main oil filter housing (502/11). Remove bracket and relief valve housing. Discard packings (502/9) and (502/10).

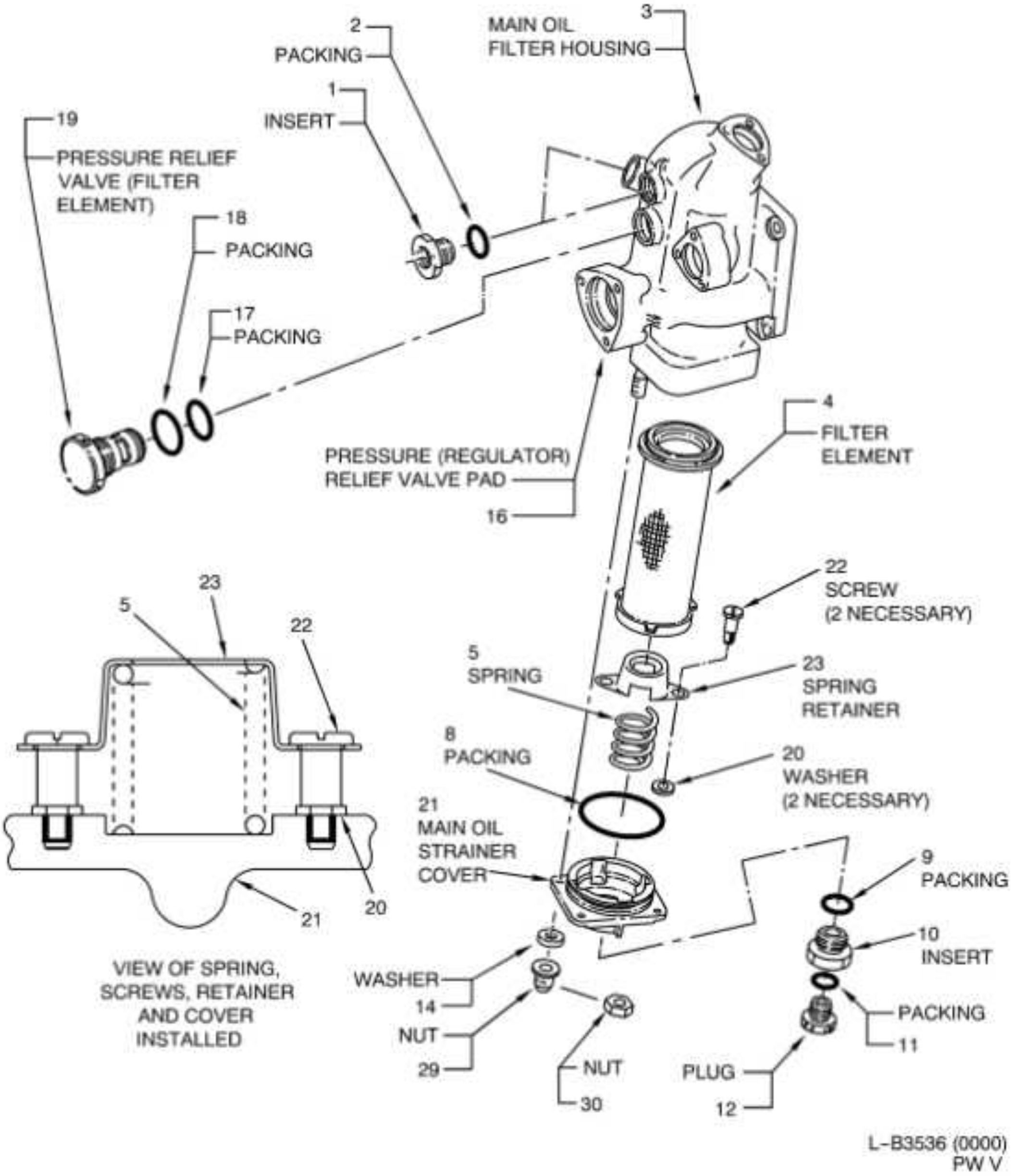

2
PACKING
MAIN OIL FILTER HOUSING
3
1
INSERT
19
PRESSURE RELIEF VALVE (FILTER ELEMENT)
18
PACKING
17
PACKING
4
FILTER ELEMENT
PRESSURE (REGULATOR) RELIEF VALVE PAD
16
7
BEND TABS OF KEYWASHER
5
SPRING
6
SCREW
7
KEY WASHER
5
BOTTOM COIL OF SPRING
6
15
8
PACKING
VIEW OF SPRING, SCREW, KEYWASHER AND COVER INSTALLED
15
MAIN OIL STRAINER COVER
9
PACKING
10
INSERT
WASHER
14
BOLT
13
PACKING
11
PLUG
12
L-A0759 (0487)
PW V

Main Oil Filter And Housing Assembly Disassembly
(Pre SB PW4ENG 72-524)
Figure 501 (Sheet 1)
(Task 72-61-00-030-004)

MAIN GEARBOX − DISASSEMBLY−04

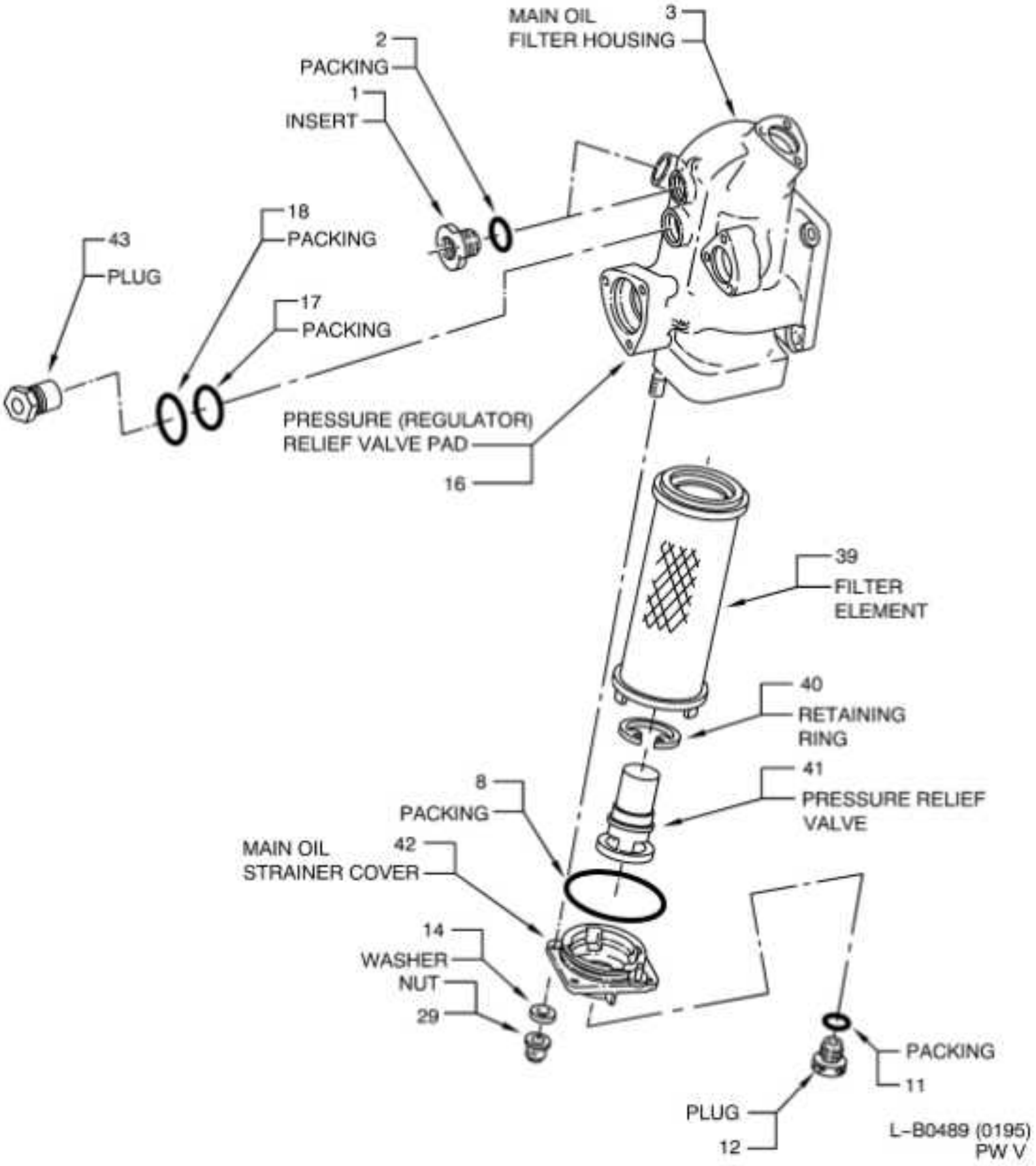

2
PACKING
MAIN OIL FILTER HOUSING
3
1
INSERT
19
PRESSURE RELIEF VALVE (FILTER ELEMENT)
18
PACKING
17
PACKING
4
FILTER ELEMENT
PRESSURE (REGULATOR) RELIEF VALVE PAD
16
7
BEND TABS OF KEY WASHER
5
SPRING
6
SCREW
5
BOTTOM COIL OF SPRING
6
7
KEY WASHER
8
PACKING
15
VIEW OF SPRING, SCREW, KEY WASHER AND COVER INSTALLED
15
MAIN OIL STRAINER COVER
9
PACKING
10
INSERT
WASHER
14
NUT
29
NUT
30
PLUG
12
PACKING
11
L−B0463 (0695)
PW V

Main Oil Filter And Housing Assembly Disassembly
(Post SB PW4ENG 72−524 And Pre SB PW4ENG 79−79)
Figure 501 (Sheet 2)
(Task 72−61−00−030−004)


2
PACKING
3
MAIN OIL FILTER HOUSING
1
INSERT
19
PRESSURE RELIEF VALVE (FILTER ELEMENT)
18
PACKING
17
PACKING
PRESSURE (REGULATOR) RELIEF VALVE PAD
16
4
FILTER ELEMENT
22
SCREW (2 NECESSARY)
23
5
22
5
SPRING
23
SPRING RETAINER
8
PACKING
20
WASHER (2 NECESSARY)
21
MAIN OIL STRAINER COVER
21
20
9
PACKING
10
INSERT
VIEW OF SPRING, SCREWS, RETAINER AND COVER INSTALLED
WASHER
14
NUT
29
NUT
30
PLUG
12
PACKING
11
L-B3536 (0000)
PW V

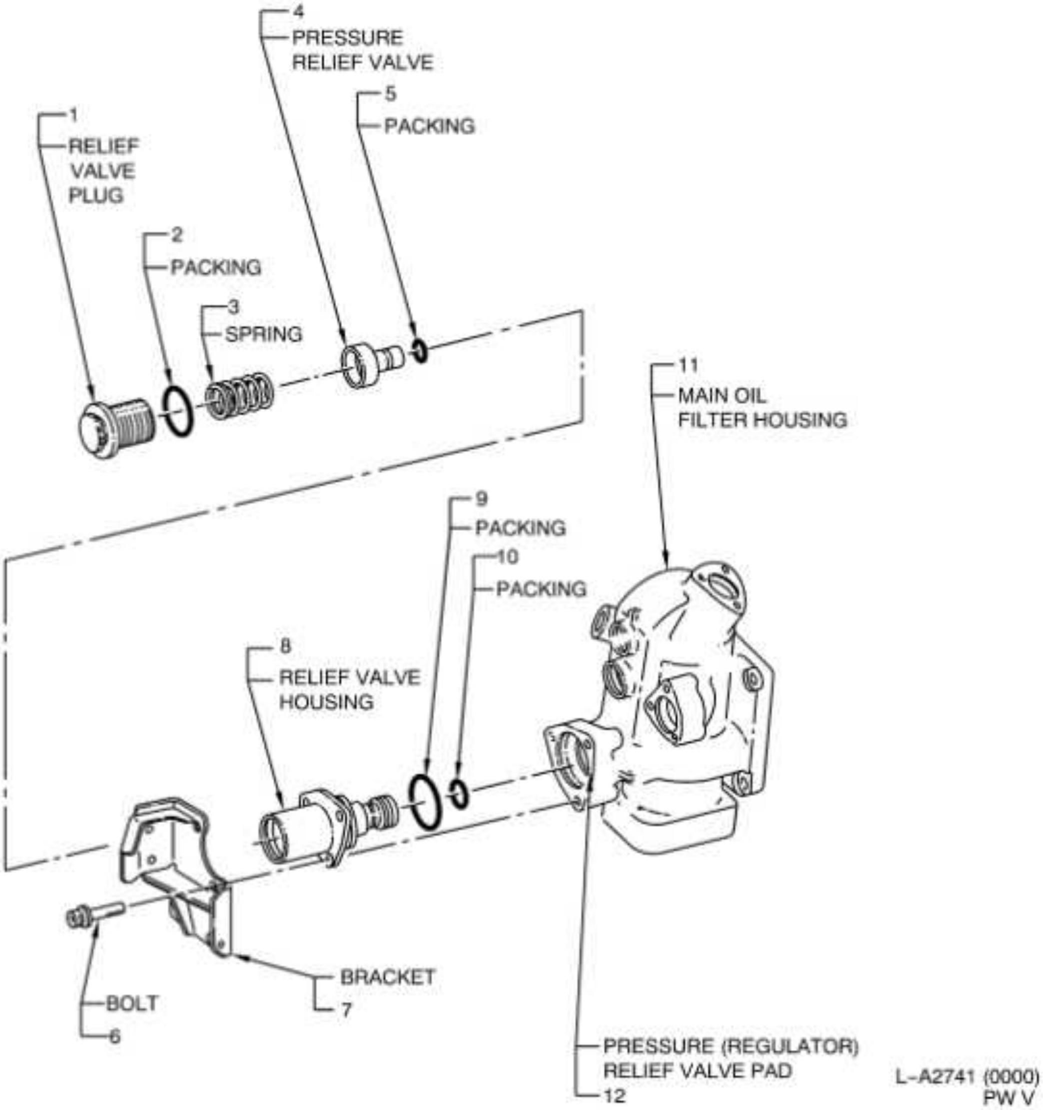
Main Oil Filter And Housing Assembly Disassembly
(Post SB PW4ENG 72-524, SB PW4ENG 79-79 And Pre SB PW4ENG 72-525)
Figure 501 (Sheet 3)
(Task 72-61-00-030-004)

MAIN GEARBOX − DISASSEMBLY−04


MAIN OIL FILTER HOUSING
3
2
PACKING
1
INSERT
18
PACKING
43
PLUG
17
PACKING
PRESSURE (REGULATOR) RELIEF VALVE PAD
16
39
FILTER ELEMENT
40
RETAINING RING
41
PRESSURE RELIEF VALVE
8
PACKING
MAIN OIL STRAINER COVER
42
14
WASHER
NUT
29
PACKING
11
PLUG
12
L−B0489 (0195)
PW V

Main Oil Filter And Housing Assembly Disassembly
(Post SB PW4ENG 72−525)
Figure 501 (Sheet 4)
(Task 72−61−00−030−004)

MAIN GEARBOX - DISASSEMBLY-04


4
PRESSURE RELIEF VALVE
5
PACKING
1
RELIEF VALVE PLUG
2
PACKING
3
SPRING
11
MAIN OIL FILTER HOUSING
9
PACKING
10
PACKING
8
RELIEF VALVE HOUSING
BRACKET
7
BOLT
6
PRESSURE (REGULATOR) RELIEF VALVE PAD
12
L-A2741 (0000)
PW V

Pressure (Regulator) Relief Valve Removal
Figure 502
(Task 72-61-00-030-004)

Previous Pageblock   Return to Previous Menu   Next Pageblock

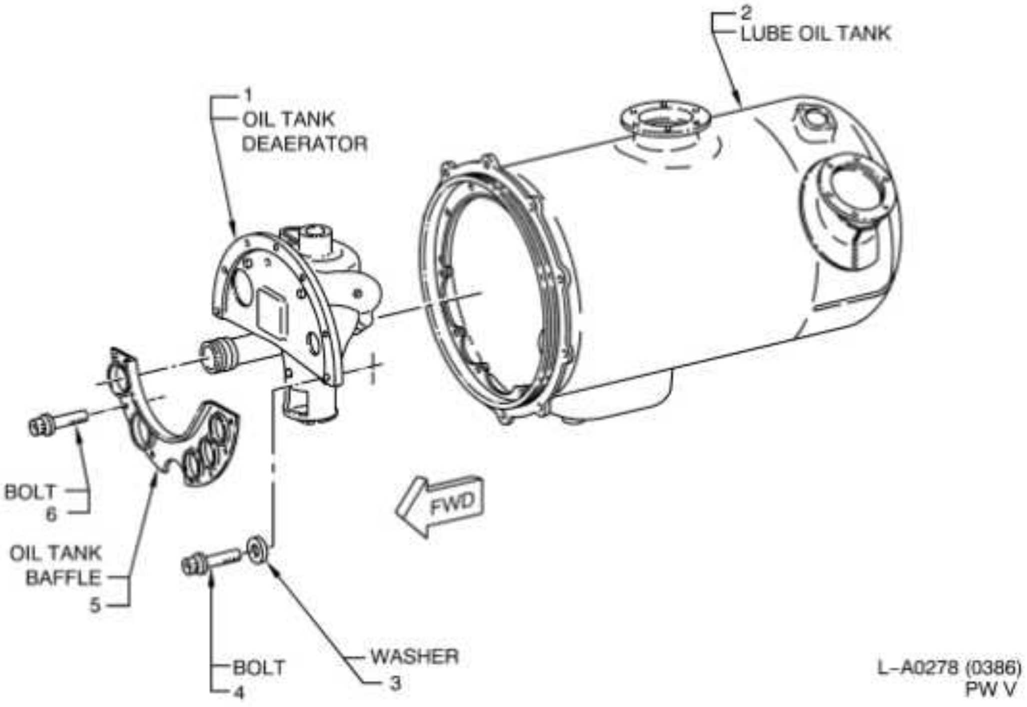
MAIN GEARBOX - DISASSEMBLY-05

Task 72-61-00-030-005:

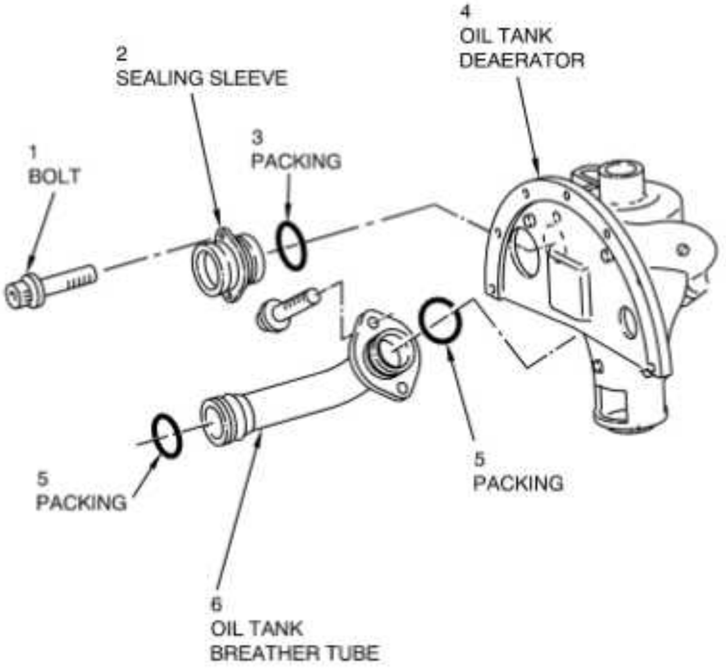
1. Disassemble The Lube Oil Tank And Deaerator Assembly
   - A. Prerequisites
     - (1) Remove the oil tank sight gage. Refer to 72-00-61, Removal-31 (Task 72-00-61-050-013).
   - B. Equipment And Materials Required - None
   - C. Procedure

Subtask 72-61-00-030-072:

- (1) Remove the deaerator assembly as follows. See Figure 501.
  - (a) Remove the bolts (501/6) that attach the oil tank baffle (501/5) to the flange of the lube oil tank (called oil tank) (501/2). Remove the baffle.
  - (b) Remove the bolts (501/4) and washers (501/3) that attach the deaerator (501/1) to the oil tank (501/2).
- (2) Remove the oil tank breather tube assembly (502/6), (Pre SB PW4ENG 79-34 and Post SB PW4ENG 79-81). See Figure 502.
  - (a) Remove the two bolts that attach the breather tube to the oil tank deaerator (502/4). Remove the tube.
  - (b) Discard two packings (502/5).
- (3) Remove the oil tank breather tube assembly (502/7), (Post SB PW4ENG 79-34 and Pre SB PW4ENG 79-81).
  - (a) Remove the bolts that attach the clamps to the bracket.
  - (b) Remove the bolts that attach the bracket and tube to the deaerator (502/4).
  - (c) Remove the breather tube assembly (502/7).
  - (d) Discard the packing (502/5) at each end of the tube.
- (4) Remove the two bolts (502/1) that attach the sealing sleeve (502/2) to the oil tank deaerator (502/4). Remove the sealing sleeve. Discard the packing (502/3).
- (5) If it is necessary to use the oil tank cap and related parts from this oil tank on another oil tank, remove the oil tank cap and related parts. This procedure is for an oil tank with either no remote filler or post SB PW4ENG 79-47. See Figure 503.
  - (a) Remove the oil tank cap (503/1):
    - 1 Lift the handle. Turn the cap counterclockwise. Remove the cap.
    - 2 Remove the lockwire and bolt (503/4) that hold the oil tank cap lanyard (503/3).
    - 3 Discard the packing (503/2).
  - (b) Remove the filler neck valve (503/5):
    - 1 Remove the lockwire and remaining bolts (503/4).

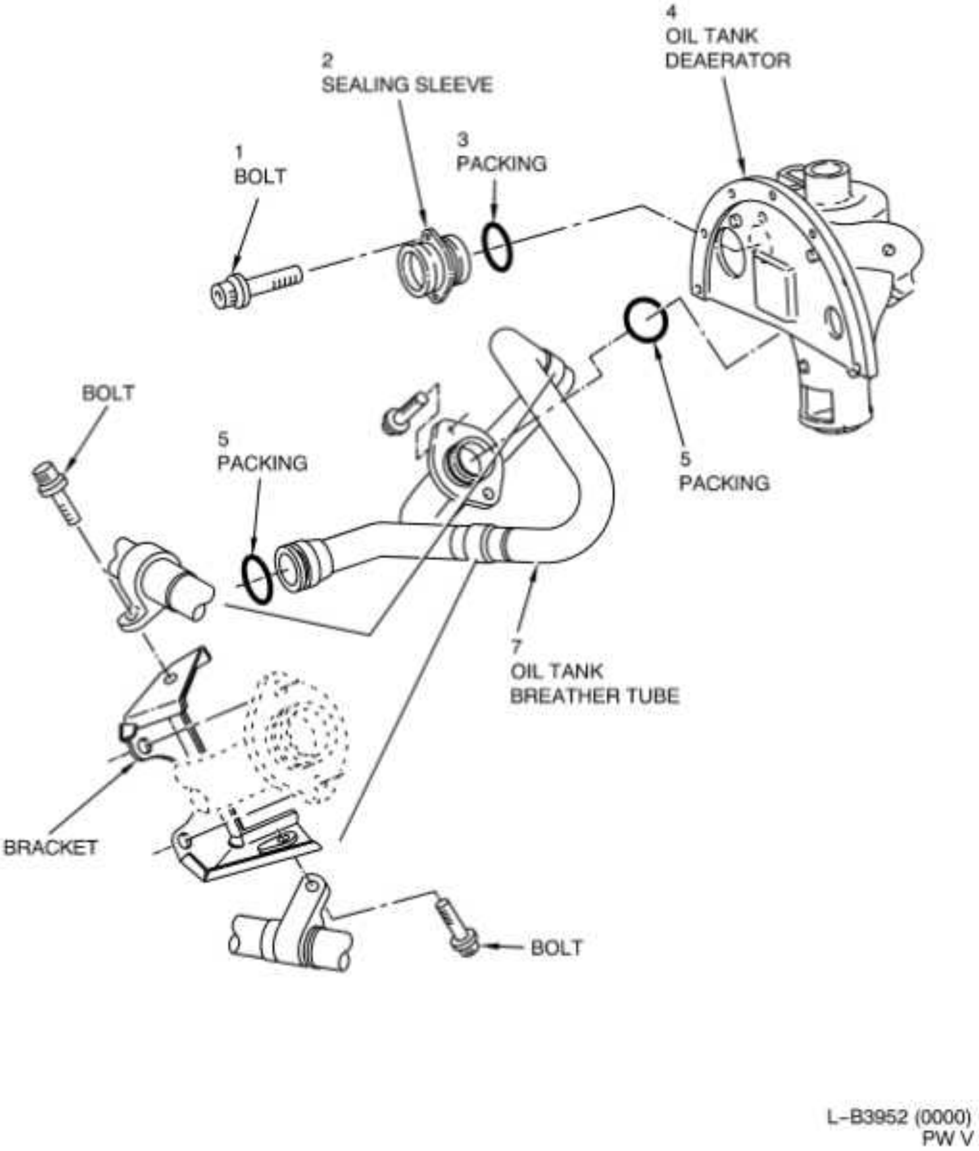

2
LUBE OIL TANK
1
OIL TANK
DEAERATOR
FWD
BOLT
6
OIL TANK
BAFFLE
5
BOLT
4
WASHER
3
L-A0278 (0386)
PW V

Lube Oil Tank Baffle And Deaerator Removal
Figure 501
(Task 72-61-00-030-005)

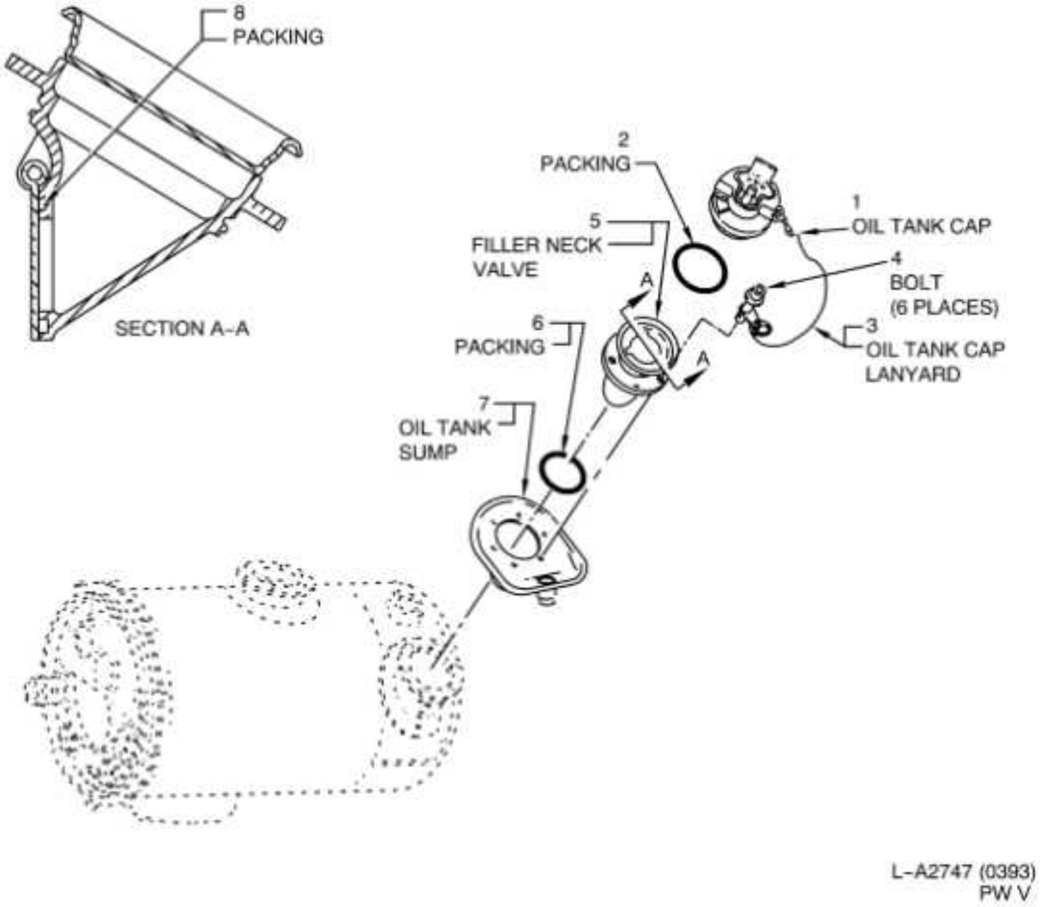

4
OIL TANK
DEAERATOR
2
SEALING SLEEVE
3
PACKING
1
BOLT
5
PACKING
5
PACKING
6
OIL TANK
BREATHER TUBE

L-B3951 (0000)
PW V

Lube Oil Tank Deaerator Disassembly
(Pre SB PW4ENG 79-34 And Post SB PW4ENG 79-81)
Figure 502 (Sheet 1)
(Task 72-61-00-030-005)


4
OIL TANK
DEAERATOR
2
SEALING SLEEVE
1
BOLT
3
PACKING
BOLT
5
PACKING
5
PACKING
7
OIL TANK
BREATHER TUBE
BRACKET
BOLT
L−B3952 (0000)
PW V

Lube Oil Tank Deaerator Disassembly
(Pre SB PW4ENG 79−34 And Post SB PW4ENG 79−81)
Figure 502 (Sheet 2)
(Task 72−61−00−030−005)


8
PACKING
SECTION A-A
2
PACKING
5
FILLER NECK
VALVE
1
OIL TANK CAP
4
BOLT
(6 PLACES)
3
OIL TANK CAP
LANYARD
A
A
6
PACKING
7
OIL TANK
SUMP
L-A2747 (0393)
PW V

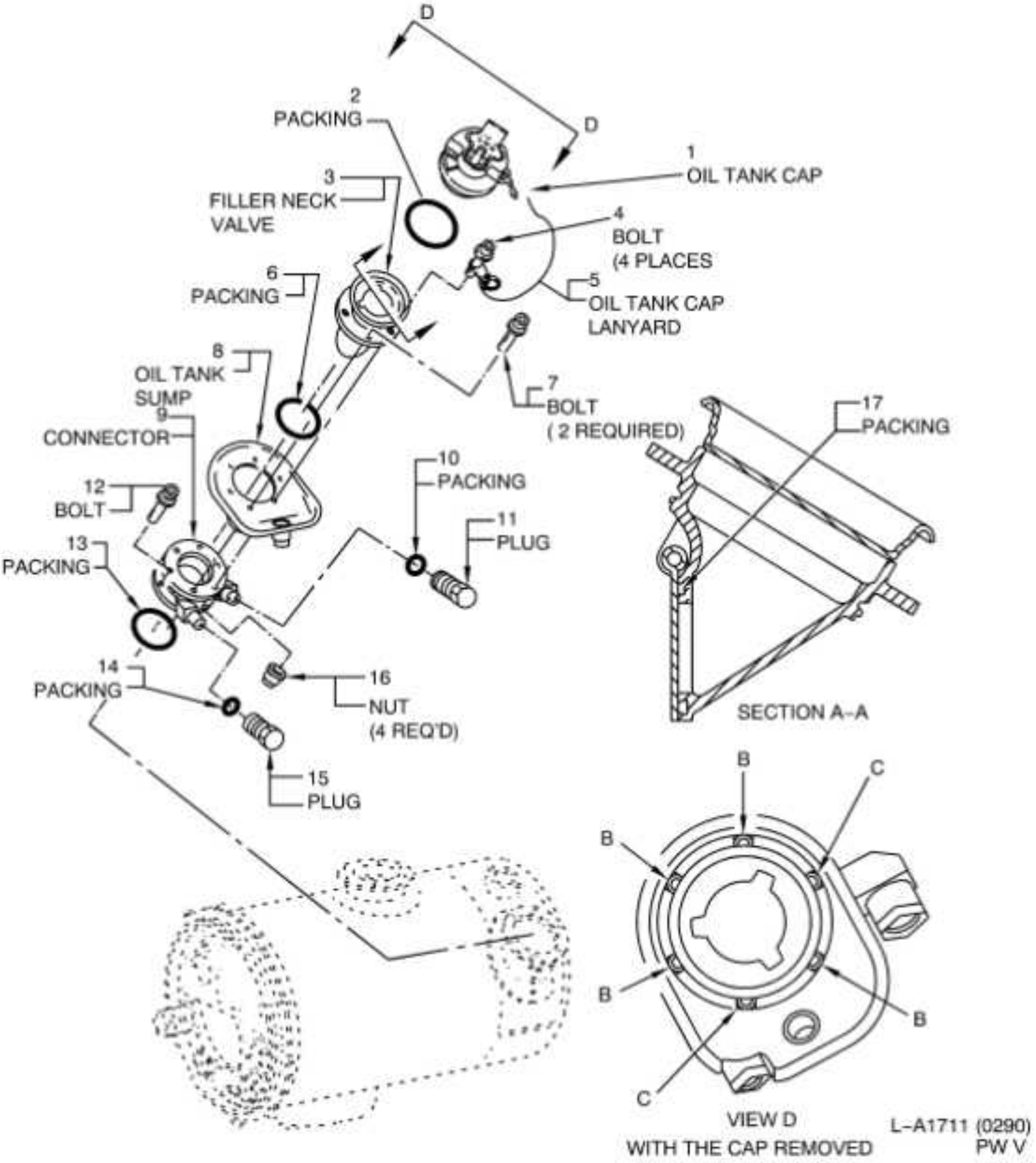
Removal Of The Oil Tank Cap And Related Parts
(No Remote Filler Or Post SB PW4ENG 79-47)
Figure 503
(Task 72-61-00-030-005)

MAIN GEARBOX − DISASSEMBLY−05

        2 Remove the filler neck valve.
        3 Discard the packing (503/6).
        4 Examine the packing (503/8) under the valve. If the packing is cut or deteriorated, discard it.
    (c) Remove the oil tank sump (503/7).

(6) If it is necessary to use the oil tank cap and related parts from this oil tank on another oil tank, remove the oil tank cap and related parts. This procedure is for an oil tank with a remote filler, pre SB PW4ENG 79−47. See Figure 504.
    (a) Remove the oil tank cap (504/1):
        1 Lift the handle. Turn the cap counterclockwise. Remove the cap.
        2 Remove the bolt (504/4) and nut (504/1) that hold the oil tank cap lanyard (504/5).
        3 Discard the packing (504/2).
    (b) Remove the filler neck valve (504/3):
        1 Remove the lockwire and the remaining bolts (504/4 and 504/7) and nuts (504/16).
        2 Remove the filler neck valve.
        3 Discard the packing (504/6).
        4 Examine the packing (504/17) under the valve. If the packing is cut or deteriorated, discard it.
    (c) Remove the oil tank sump (504/8).
    (d) Remove the connector (504/9) (remote filler):
        1 Remove the lockwire and bolts (504/12).
        2 Remove the connector.
        3 Discard the packing (504/13).
        4 If applicable, remove the plugs (504/11 and 504/15) and packings (504/10 and 504/14). Discard the packings.

(7) To protect the oil tank, install covers on the holes.


D
D
2
PACKING
1
OIL TANK CAP
3
FILLER NECK
VALVE
4
BOLT
(4 PLACES
6
PACKING
5
OIL TANK CAP
LANYARD
8
OIL TANK
SUMP
7
BOLT
(2 REQUIRED)
9
CONNECTOR
17
PACKING
10
PACKING
12
BOLT
11
PLUG
13
PACKING
16
NUT
(4 REQ'D)
14
PACKING
SECTION A-A
15
PLUG
B
C
B
B
B
C
VIEW D
WITH THE CAP REMOVED
L-A1711 (0290)
PW V

Removal Of The Oil Tank Cap And Related Parts
(With Remote Filler)
Figure 504
(Task 72−61−00−030−005)

Previous Pageblock   Return to Previous Menu   Next Pageblock

MAIN GEARBOX - DISASSEMBLY-06

Task 72-61-00-030-006:

1. Disassemble The EEC Alternator, Lubrication And Scavenge Oil Pump, And The Brackets From The Main Gearbox

A. Prerequisites

(1) Remove the lube oil tank from the main gearbox. Refer to Disassembly-01 Task 72-61-00-030-001.

B. Equipment And Materials Required

Special Tools:

PWA 85238	Wrench (Optional to PWA 86603)
PWA 85931	Puller
PWA 85749	Adapter, Torque
PWA 86551	Puller
PWA 86603	Adapter, Holding
PWA 88774	Jackscrew (2 Necessary)

C. Procedure

Subtask 72-61-00-030-069:

(1) Remove lubrication and scavenge oil pump. See Figure 501.

(a) Loosen and remove bolts (501/8) and washers (501/7) that attach the lubrication and scavenge oil pump (501/9) to lubrication and scavenge pump pad (501/5) on rear face of gearbox. Use two (2) PWA 88774 Jackscrews to break the pump away from the gearbox. Disengage tubes from oil pump and remove pump from gearbox. Remove the two transfer tubes (501/1) and (501/3) and discard packings (501/2) and (501/4). Discard packings on oil pump (501/6).

(b) Install protective closures on pump.

Subtask 72-61-00-030-070:

(2) Remove EEC alternator rotor and stator (Pre SB PW4ENG 72-375). See Figure 502, Figure 503 and Figure 504.

(a) Disconnect electrical connectors from EEC alternator stator cables at bracket on lower left side of gearbox.

(b) Remove bolts (502/4) and (502/5) and plate (502/4) securing EEC stator cables to bracket.

(c) Remove clamp and bolt (502/1) securing cable to bracket below alternator. Remove cables from spring clips (502/2) and (502/3) on rear face of gearbox.

(d) Remove the three bolts (503/1) and if equipped, washer (503/3) and heat shield (503/2) securing the EEC alternator stator (503/4) to the pad on the upper center, rear face, of the gearbox. Remove the stator and discard packing (503/5).

(e) Remove nut (503/6) securing EEC alternator rotor (503/8) to gearshaft (503/9) with PWA 85238 Wrench or PWA 86603 Adapter. Discard the nut (503/6).

1 Loosen both jamnuts (504/4) and retract wrench detail (504/5) from body of adapter. Insert handle (504/3), lug end facing outward, over mating lug of wrench detail (504/5).

2 Align boltholes and position body (504/2) over EEC gearshaft and onto gearshaft housing (504/1) pad. Engage lugs of wrench detail with mating slots in gearshaft. Secure body (504/2) with three detail screws (504/6).

3 Seat wrench detail (504/5) firmly on gearshaft and secure with jamnuts (504/4).

4 Engage lugs of handle (504/6) with mating lugs in nut (504/7). Rotate handle to loosen nut.

(f) Remove EEC alternator rotor lock (503/7) and rotor (503/8) from gearshaft.

1 To remove the rotor (503/8), use PWA 85931 Puller.

(3) Remove the EEC alternator rotor and stator (Post SB PW4ENG 72−375). See Figure 505, Figure 506, Figure 507 and Figure 508.

(a) Using PWA 85749 Torque Adapter, disconnect the harness from the EEC alternator stator cables at a bracket on the lower left side of gearbox.

MAIN GEARBOX - DISASSEMBLY-06

(b) Remove the bolts (505/3), (505/4) and plate (505/5) that attach EEC stator cables to bracket. Remove the plate (505/5) and both cable connectors from bracket.

(c) Remove the cables from spring clips (505/1) and (505/2) from brackets on the rear face of gearbox.

(d) Remove the nut (506/4) that attaches the EEC alternator rotor (506/5) to the gearshaft (506/6) with PWA 86603 Adapter as follows. Discard the nut (506/4).

1 Loosen both jamnuts (507/4). While you hold the body (507/2), loosen the wrench detail (507/5).

2 Install the handle (507/3), lug end facing outward, over the mating lug of wrench detail (507/5).

3 Align boltholes and postion body (507/2) over EEC gearshaft (506/6) and onto the gearshaft housing pad.

4 Engage lugs of wrench detail with mating slots in gearshaft. Attach the body (507/2) with three detail screws (507/6).

5 Seat the wrench detail (507/5) firmly on the gearshaft and tighten the jamnuts (507/4).

6 Engage the lugs of handle (507/3) with the mating lugs in the nuts (507/7). Turn the handle to loosen the nut using a standard 1/2 inch drive.

NOTE: This must be done in several steps as the handle movement is limited. The handle must be removed and postioned again to the nut.

7 Remove the screws (507/6) that attach the wrench to the gearbox and remove wrench.

(e) Remove the nut (507/7) that attaches EEC alternator rotor to the gearshaft.

(f) Remove the rotor (508/5) from the gearshaft (508/6) with PWA 86551 Puller as follows.

1 Retract the hex bolt (508/2) on the rotor puller. Loosen the two socket head screws (508/3) and install the jaws (508/1) in the puller groove on the rotor (508/5).

2 Install the ring (508/4) around the jaws (508/1) and against the shoulder of the jaws.

3 Tighten the two socket head screws (508/3).

4 Tighten the hex head bolt (508/2) until the rotor is removed from the gearshaft (508/6).

NOTE: The puller and rotor can turn when the hex bolt (508/2) is tightened. To prevent the rotor from turning, you can install a rod or punch into one of the holes in the puller jaws and hold while the hex bolt is tightened.

5 Loosen the hex bolt (508/2) and the two socket head screws (508/3). Remove the ring (508/4) from the puller and remove the puller from the rotor.

6 Remove the rotor (508/5) from the gearshaft (508/6).

Subtask 72−61−00−030−073:

(4) Remove brackets. See Figure 509.

(a) Remove the following brackets and bolts from front face of gearbox.

Bracket	Bolt (Quantity)	Nut (Quantity)
2	1 (3)	
3	4 (2)	
6	5 (2)	7 (2)
8	9 (2)	
17 or	16 (2)	
17A	16 (2)	
19	18 (2)	20 (2)

MAIN GEARBOX − DISASSEMBLY−06

(b) Remove the following brackets and bolts from rear face of gearbox.

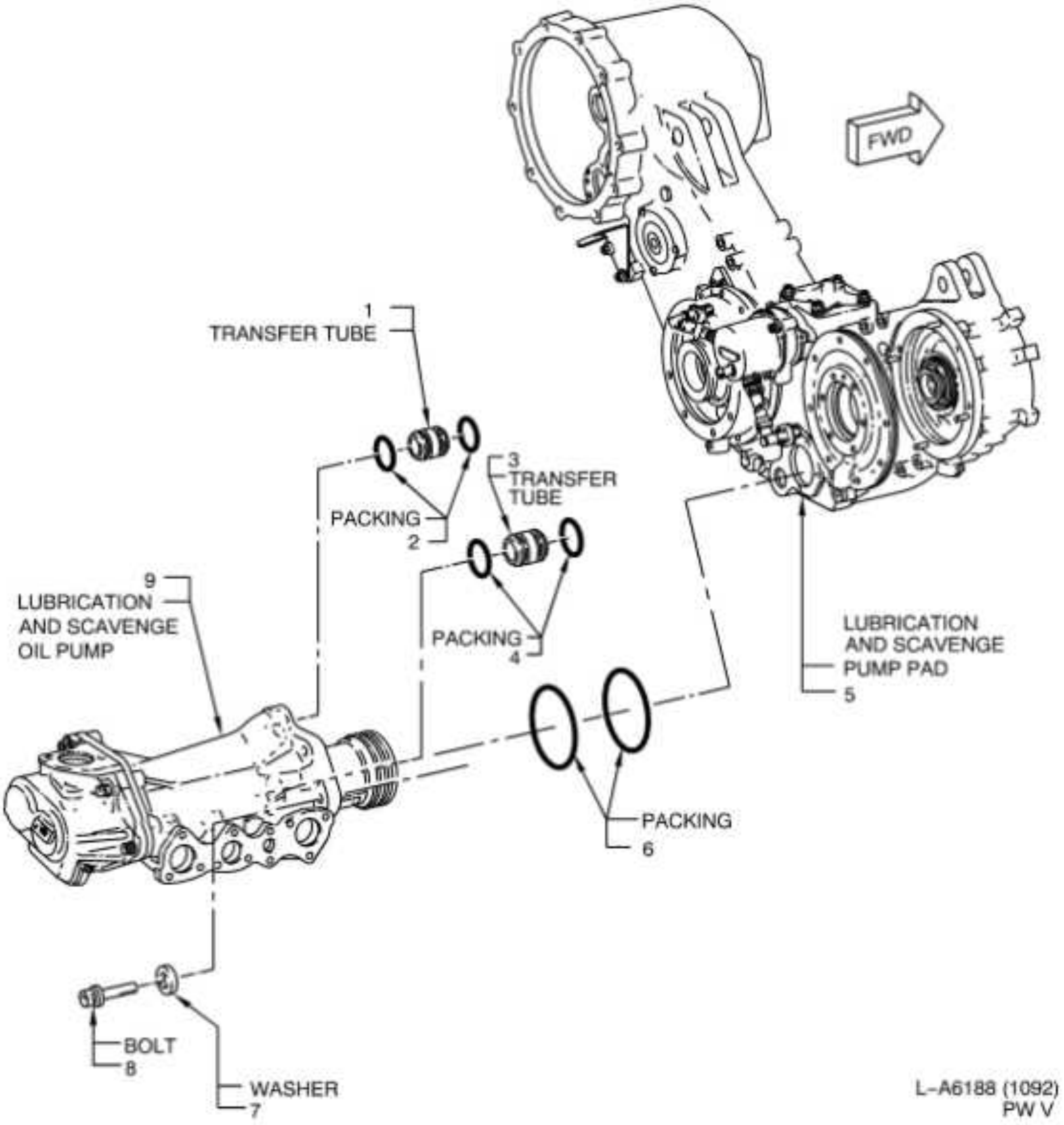
Bracket	Bolt (Quantity)	Nut (Quantity)
11 or	10 (2)	
11A	10 (2)	
13	12 (1)	
14	15 (3)	
20	22 (2)	21 (2)

D. Postrequisites

(1) Remove the magnetic chip detector assemblies from the lube oil tank, the lubrication and scavenge oil pump, and the main gearbox. Refer to Disassembly−07 (Task 72−61−00−030−007).

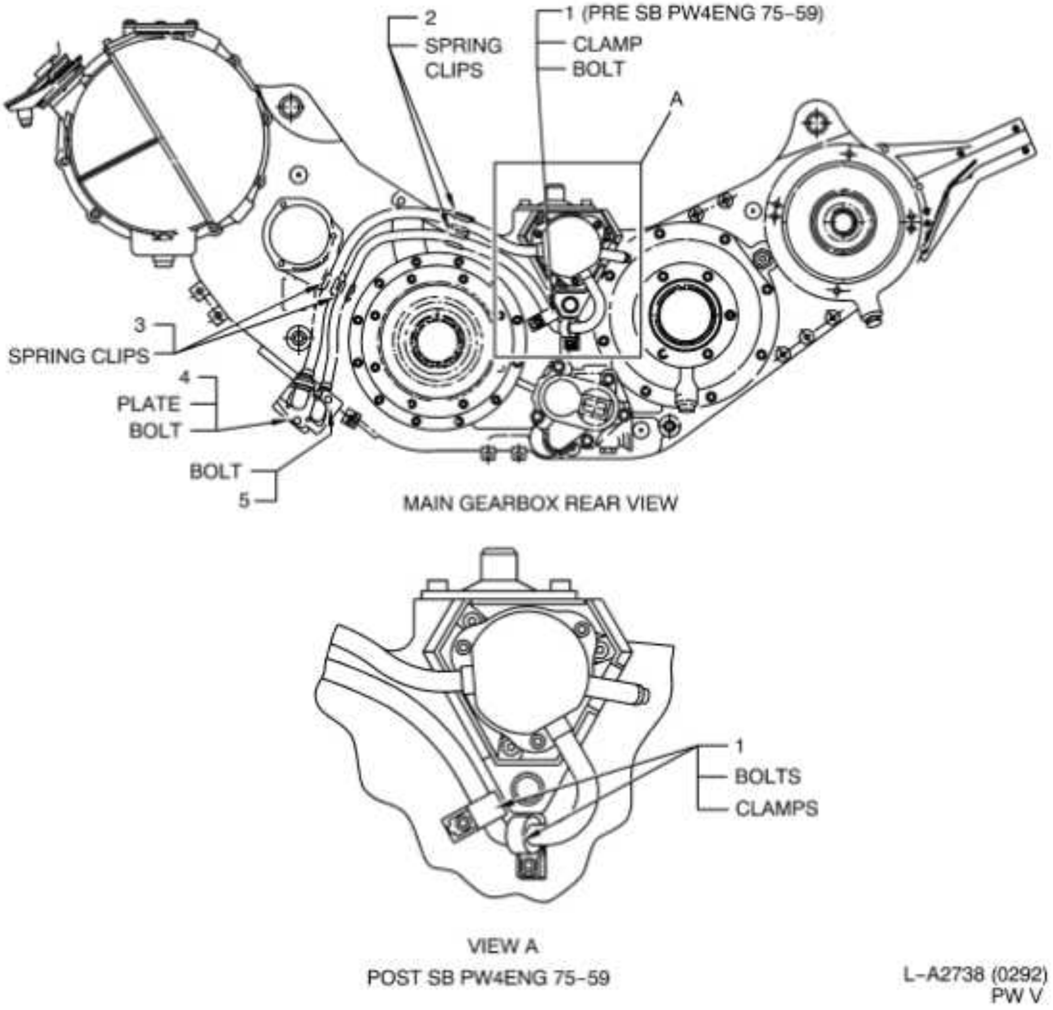
(2) Disassemble front hydraulic pump drive and IDG drive gearshaft from main gearbox per Disassembly−02 (Task 72−61−00−030−002).

(3) Disassemble main gearbox per Disassembly−03 (Task 72−61−00−030−003).

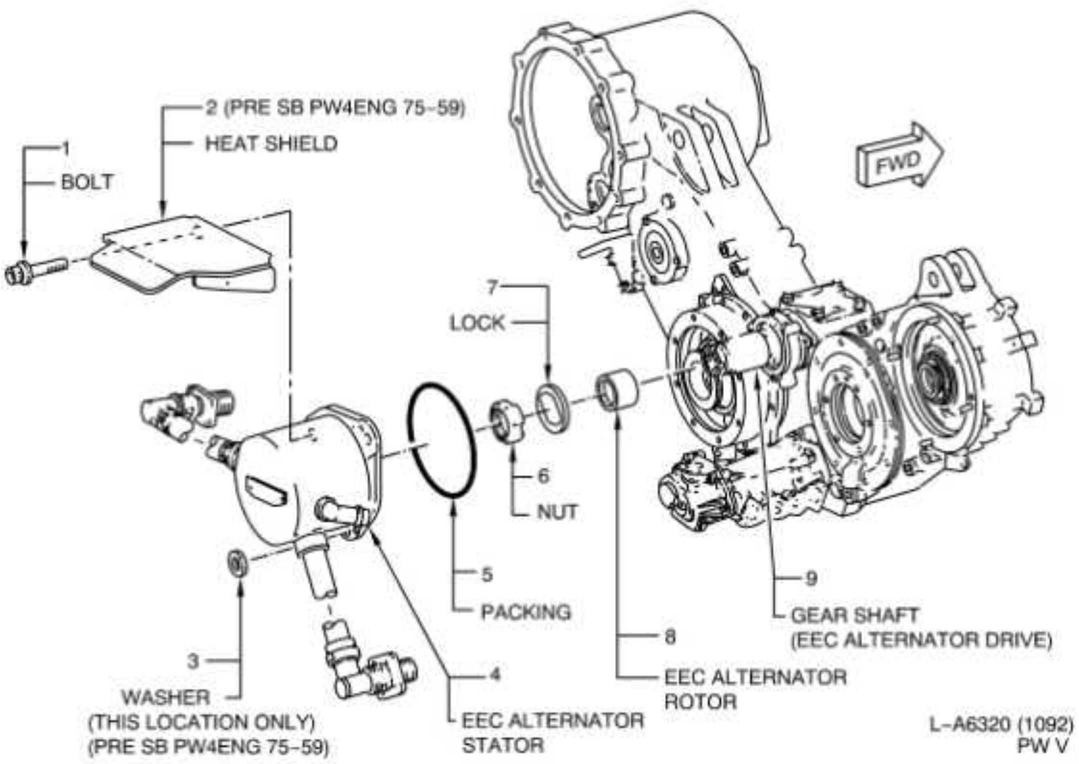

FWD
1
TRANSFER TUBE
3
TRANSFER TUBE
PACKING
2
9
LUBRICATION AND SCAVENGE OIL PUMP
PACKING
4
LUBRICATION AND SCAVENGE PUMP PAD
5
PACKING
6
BOLT
8
WASHER
7
L-A6188 (1092)
PW V

Lubrication And Scavenge Oil Pump Removal
Figure 501
(Task 72-61-00-030-006)

MAIN GEARBOX - DISASSEMBLY-06

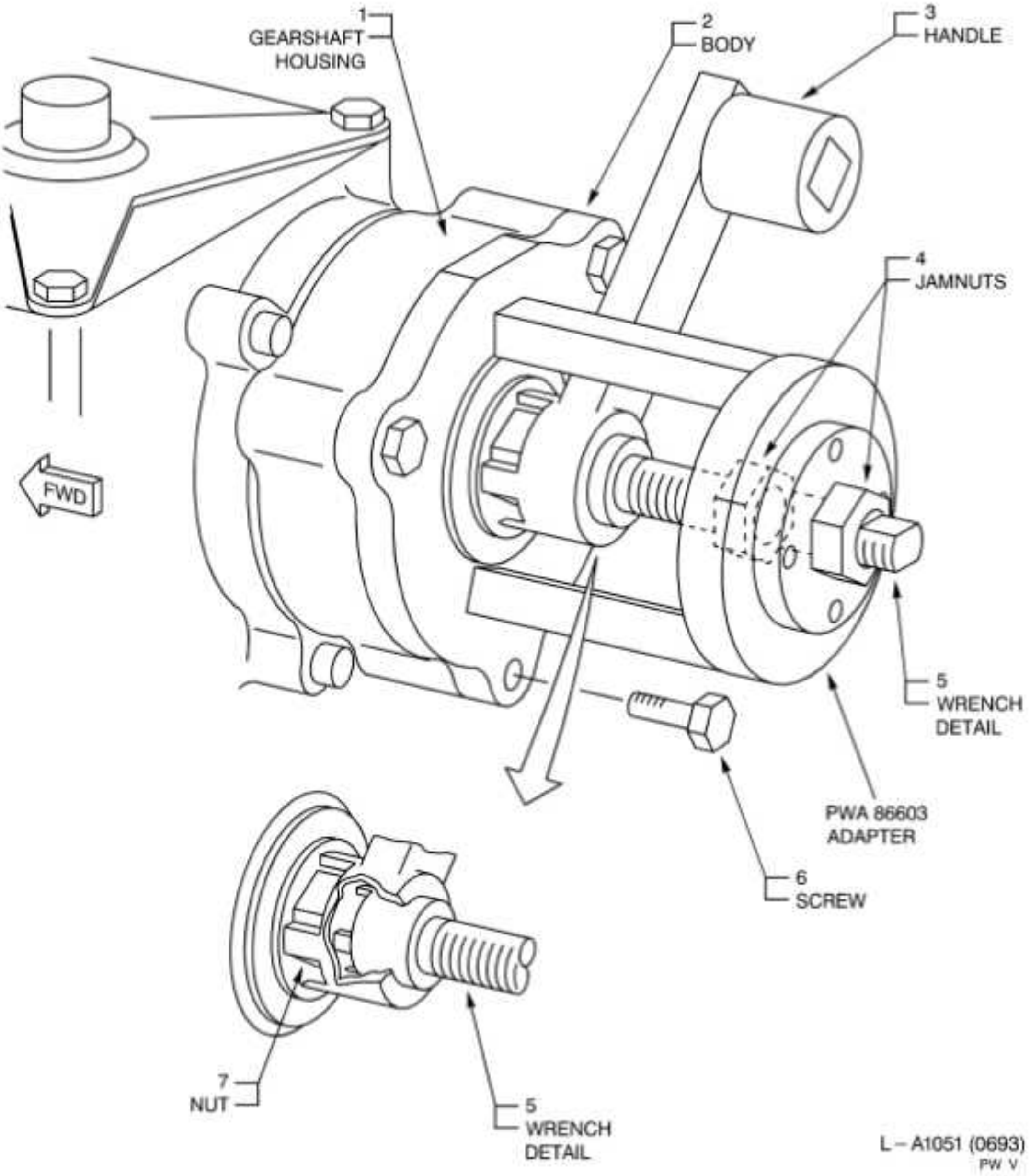

2
SPRING
CLIPS
1 (PRE SB PW4ENG 75-59)
CLAMP
BOLT
A
3
SPRING CLIPS
4
PLATE
BOLT
BOLT
5
MAIN GEARBOX REAR VIEW
1
BOLTS
CLAMPS
VIEW A
POST SB PW4ENG 75-59
L-A2738 (0292)
PW V

EEC Alternator Stator (Pre SB PW4ENG 72-375)
Figure 502
(Task 72-61-00-030-006)


2 (PRE SB PW4ENG 75-59)
HEAT SHIELD
1
BOLT
FWD
7
LOCK
6
NUT
5
PACKING
9
GEAR SHAFT
(EEC ALTERNATOR DRIVE)
8
EEC ALTERNATOR
ROTOR
4
EEC ALTERNATOR
STATOR
3
WASHER
(THIS LOCATION ONLY)
(PRE SB PW4ENG 75-59)
L-A6320 (1092)
PW V

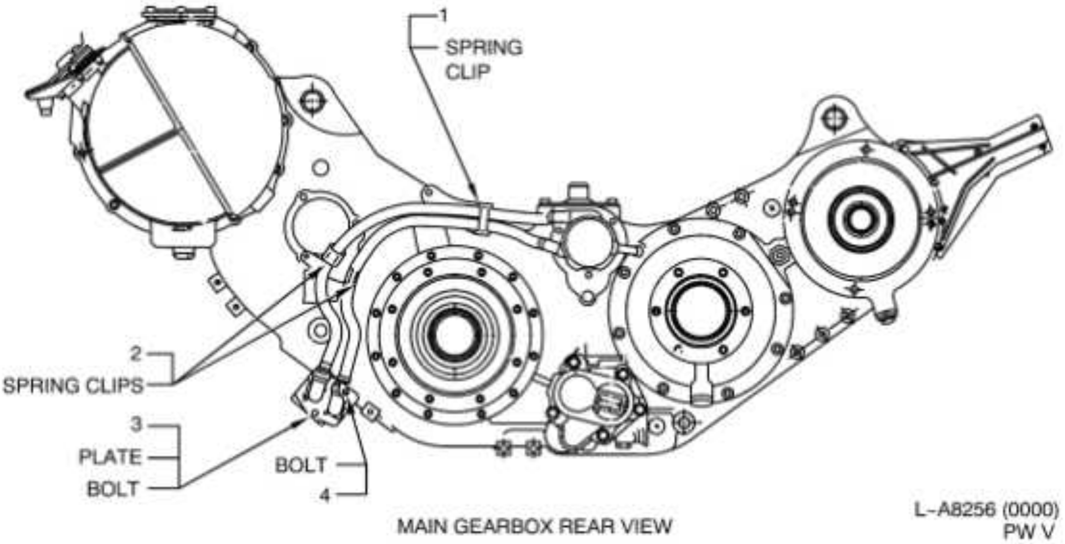
EEC Alternator Rotor And Stator Removal (Pre SB PW4ENG 72-375)
Figure 503
(Task 72-61-00-030-006)

MAIN GEARBOX − DISASSEMBLY−06

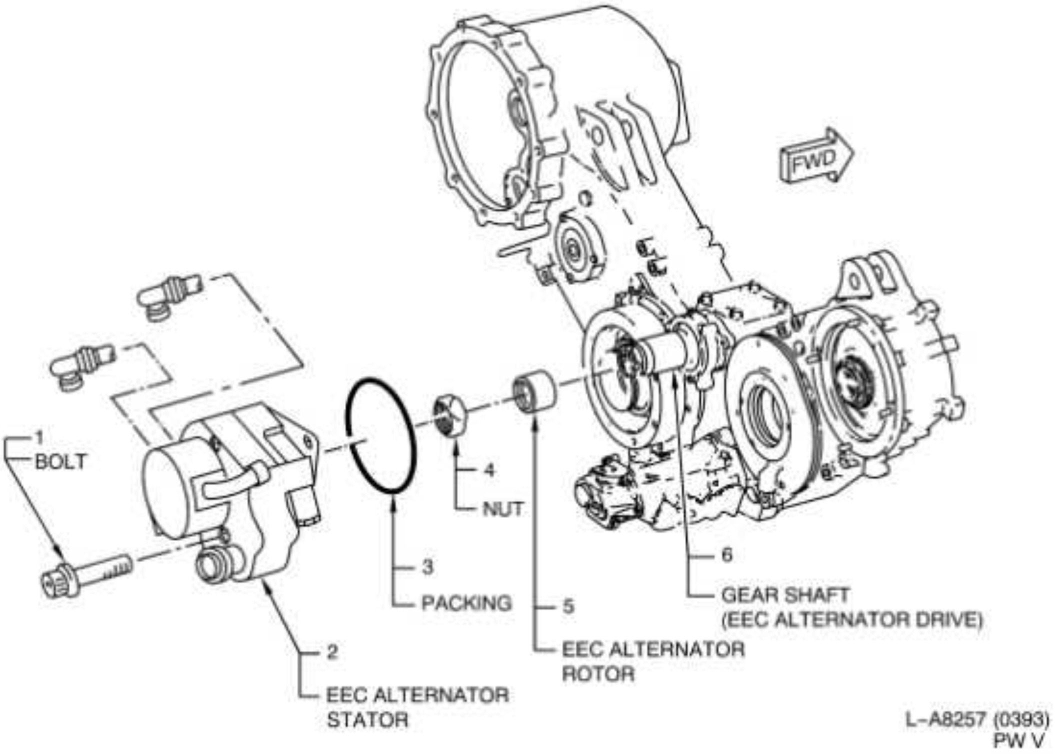

1
GEARSHAFT HOUSING
2
BODY
3
HANDLE
4
JAMNUTS
FWD
5
WRENCH DETAIL
PWA 86603 ADAPTER
6
SCREW
7
NUT
5
WRENCH DETAIL
L − A1051 (0693)
PW V

PWA 86603 Adapter Installation
Figure 504
(Task 72−61−00−030−006)

MAIN GEARBOX − DISASSEMBLY−06

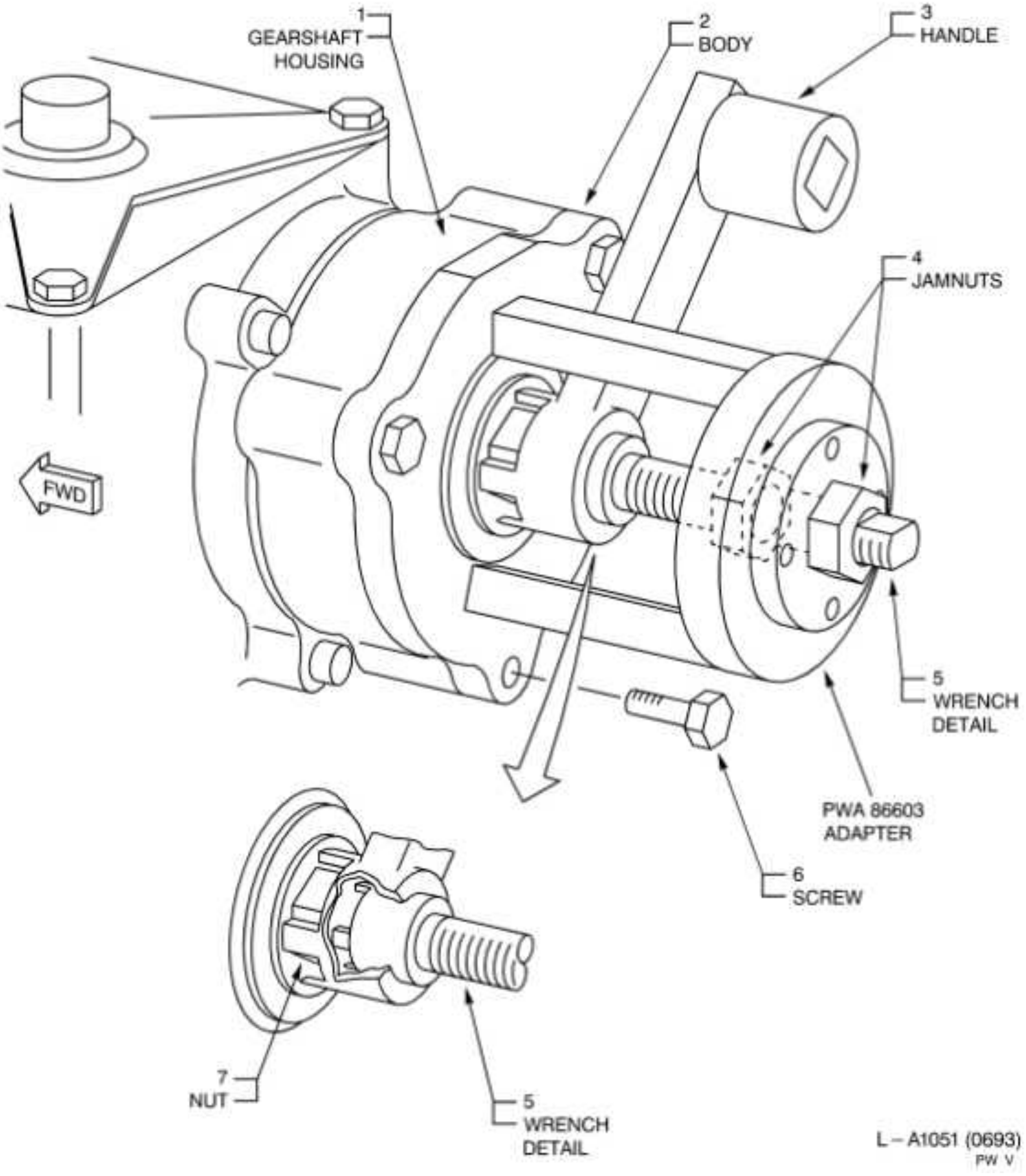

1
SPRING CLIP
2
SPRING CLIPS
3
PLATE
BOLT
BOLT
4
MAIN GEARBOX REAR VIEW
L−A8256 (0000)
PW V

EEC Alternator Stator (Post SB PW4ENG 72−375)
Figure 505
(Task 72−61−00−030−006)

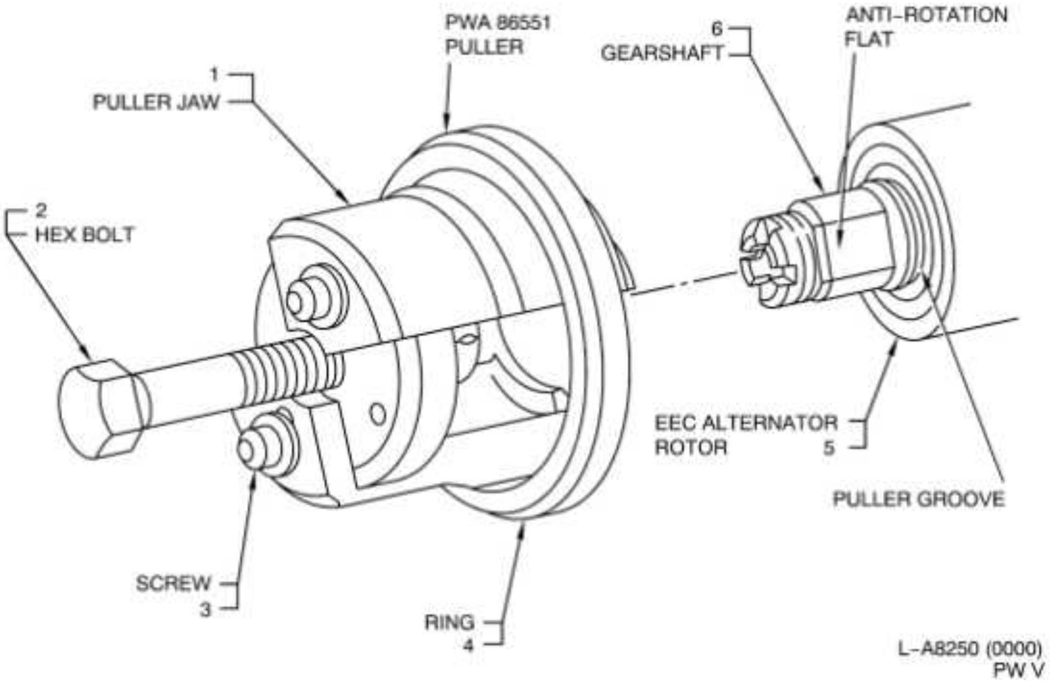

FWD
1
BOLT
2
EEC ALTERNATOR STATOR
3
PACKING
4
NUT
5
EEC ALTERNATOR ROTOR
6
GEAR SHAFT (EEC ALTERNATOR DRIVE)
L-A8257 (0393)
PW V

EEC Alternator Rotor And Stator Removal (Post SB PW4ENG 72-375)
Figure 506
(Task 72-61-00-030-006)

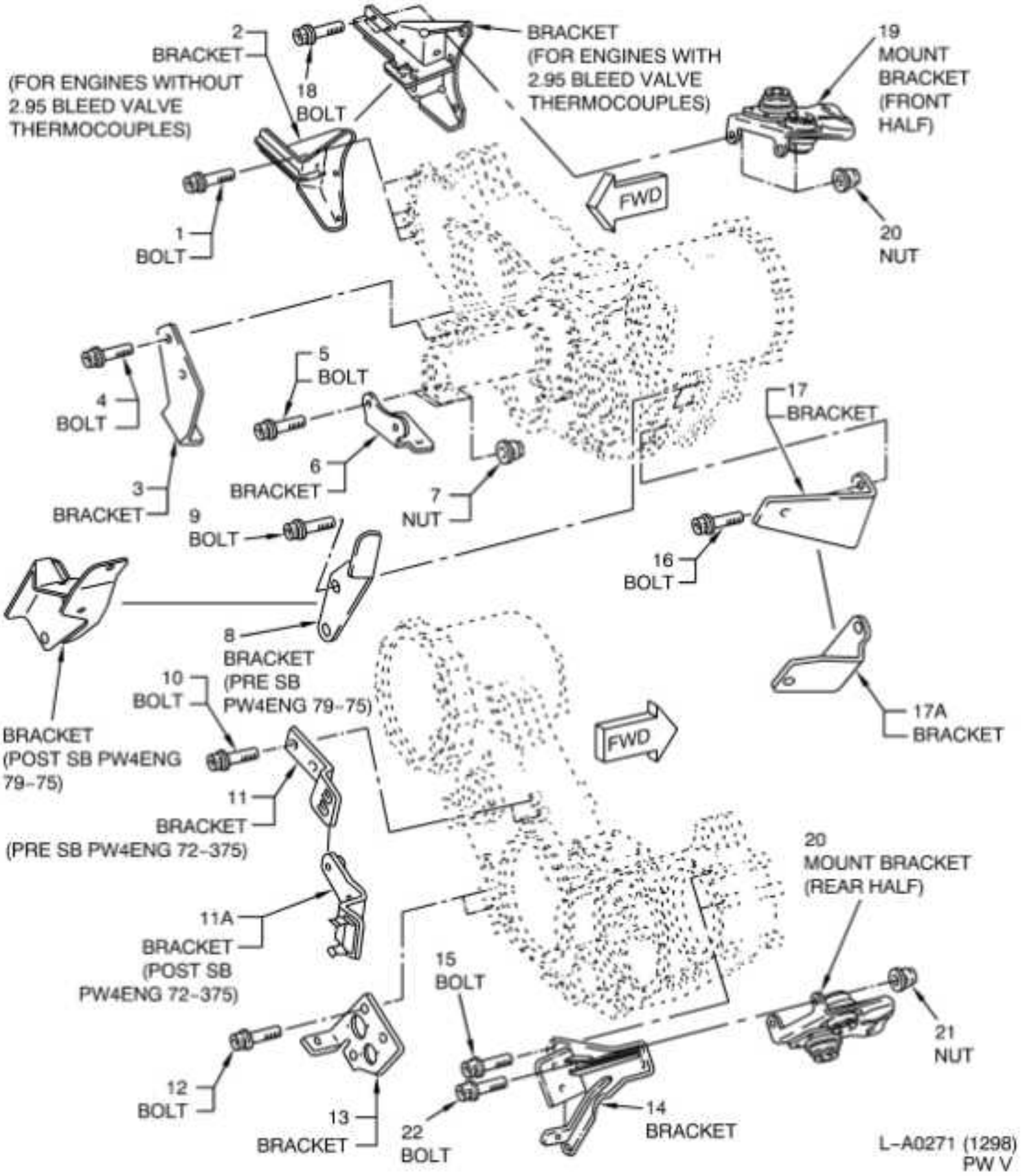
MAIN GEARBOX − DISASSEMBLY−06


1
GEARSHAFT HOUSING
2
BODY
3
HANDLE
4
JAMNUTS
FWD
5
WRENCH DETAIL
PWA 86603 ADAPTER
6
SCREW
7
NUT
5
WRENCH DETAIL
L − A1051 (0693)
PW V

PWA 86603 Adapter Installation
Figure 507
(Task 72−61−00−030−006)


PWA 86551
PULLER
6
GEARSHAFT
ANTI-ROTATION
FLAT
1
PULLER JAW
2
HEX BOLT
EEC ALTERNATOR
ROTOR
5
PULLER GROOVE
SCREW
3
RING
4
L-A8250 (0000)
PW V

Installation Of PWA 86551 Puller To Alternator Rotor
Figure 508
(Task 72-61-00-030-006)


2
BRACKET
(FOR ENGINES WITHOUT 2.95 BLEED VALVE THERMOCOUPLES)
18
BOLT
BRACKET
(FOR ENGINES WITH 2.95 BLEED VALVE THERMOCOUPLES)
19
MOUNT BRACKET (FRONT HALF)
FWD
1
BOLT
20
NUT
4
BOLT
5
BOLT
3
BRACKET
6
BRACKET
7
NUT
17
BRACKET
9
BOLT
16
BOLT
8
BRACKET (PRE SB PW4ENG 79-75)
10
BOLT
BRACKET (POST SB PW4ENG 79-75)
17A
BRACKET
FWD
11
BRACKET (PRE SB PW4ENG 72-375)
20
MOUNT BRACKET (REAR HALF)
11A
BRACKET (POST SB PW4ENG 72-375)
15
BOLT
21
NUT
12
BOLT
13
BRACKET
22
BOLT
14
BRACKET
L-A0271 (1298)
PW V

Bracket Removal
Figure 509
(Task 72−61−00−030−006)

MAIN GEARBOX - DISASSEMBLY-07

Task 72-61-00-030-007:

1. Remove The Magnetic Chip Detector Assemblies From The Main Gearbox

   A. General

      (1) To remove the full magnetic plug assembly, first remove the plug, then remove the valve.

   B. Equipment And Materials Necessary - None

   C. Procedure

      CAUTION: INSTALL PROTECTIVE COVERS OVER ALL OPENINGS AS SOON AS POSSIBLE TO PREVENT ENGINE DAMAGE.

      CAUTION: DO NOT TRY TO REMOVE THE MAGNETIC CHIP DETECTOR AS AN ASSEMBLY. THE MAGNETIC CHIP DETECTOR PROBE MUST BE REMOVED FROM THE VALVE TO PREVENT DAMAGE TO THE PART.

      (1) Remove the magnetic chip detectors from the engine oil tank. See Figure 501.

         (a) Remove the PN 50R499 magnetic chip detector from the engine oil tank as follows:

            1 Remove the lockwire or safety cable from the valve (501/4).

            2 Push the magnetic probe (501/5) in and turn it counterclockwise to disengage it from the valve.

            3 Remove the probe from the valve.

            4 Remove the packing (501/3) from the probe. Discard the packing.

            5 Remove the valve from the engine oil tank.

            6 Install the magnetic probe into the valve.

            7 Remove the packing (501/2) from the small OD end of the valve. Discard the packing.

            8 Remove the packing (501/1) from the washer face of the valve. Discard the packing.

MAIN GEARBOX − DISASSEMBLY−07

9 Remove the probe from the valve again.

(b) Remove the PN 50R485 magnetic chip detector from the engine oil tank as follows:

1 Remove the lockwire or safety cable from the valve (501/7).

2 Push the magnetic probe (501/9) in and turn it counterclockwise to disengage it from the valve.

3 Remove the probe from the valve.

4 Remove the packing (501/8) from the probe. Discard the packing.

5 Remove the valve from the engine oil tank.

6 Install the magnetic probe into the valve.

7 Remove the packing (501/6) from the small OD end of the valve. Discard the packing.

8 Remove the packing (501/1) from the washer face of the valve. Discard the packing.

9 Remove the probe from the valve again.

(c) Remove the PN 50R423 (option) magnetic chip detector from the engine oil tank as follows:

1 Remove the lockwire or safety cable from the valve (501/10) or (501/13).

2 Push the magnetic probe (501/12) or (501/16) in and turn it counterclockwise to disengage it from the valve.

3 Remove the probe from the valve.

4 Remove the packing (501/11) or (501/15) from the magnetic probe. Discard the packing.

5 Remove the valve from the engine oil tank.

6 If applicable, remove the packing (501/14) from the ID of the valve. Discard the packing.

7 Remove the packing (501/1) from the washer face of the valve. Discard the packing.

(d) Remove the PN 50R374 magnetic chip detector from the engine oil tank as follows:

1 Remove the lockwire or safety cable from the valve (501/17).

2 Push the magnetic probe (501/19) in and turn it counterclockwise to disengage it from the valve.

3 Remove the probe from the valve.

4 Remove the packing (501/18) from the magnetic probe. Discard the packing.

5 Remove the valve from the engine oil tank.

6 Remove the packing (501/1) from the washer face of the valve. Discard the packing.

CAUTION: INSTALL PROTECTIVE COVERS OVER ALL OPENINGS AS SOON AS POSSIBLE TO PREVENT ENGINE DAMAGE.

CAUTION: DO NOT TRY TO REMOVE THE MAGNETIC CHIP DETECTOR AS AN ASSEMBLY. THE MAGNETIC CHIP DETECTOR PROBE MUST BE REMOVED FROM THE VALVE TO PREVENT DAMAGE TO THE PART.

(2) Remove the magnetic chip detectors from the lubrication and scavenge oil pump. See Figure 502.

(a) Remove the PN 50R342 magnetic chip detectors from the lubrication and scavenge oil pump as follows:

1 Remove the lockwire or safety cable from the valve (502/2).

2 Push the magnetic probe (502/4) in and turn it counterclockwise to disengage it from the valve.

3 Remove the probe from the valve.

4 Remove the packing (502/3) from the probe. Discard the packing.

5 Remove the valve from the lubrication and scavenge oil pump.

6 Remove the packing (502/1) from the washer face of the valve. Discard the packing.

7 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

(b) Remove the PN 50R348 magnetic chip detectors from the lubrication and scavenge oil pump as follows:

1 Remove the lockwire or safety cable from the valve (502/8).

2 Push the magnetic probe (502/5) in and turn it counterclockwise to disengage it from the valve.

3 Remove the probe from the valve.

4 Remove the packing (502/6) from the probe. Discard the packing.

5 Remove the valve from the lubrication and scavenge oil pump.

6 Remove the packing (502/7) from the ID of the valve. Discard the packing.

7 Remove the packing (502/1) from the washer face of the valve. Discard the packing.

8 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

(c) Remove the PN 50R492 magnetic chip detectors from the lubrication and scavenge oil pump as follows:

1 Remove the lockwire or safety cable from the valve (502/10).

2 Push the magnetic probe (502/12) in and turn it counterclockwise to disengage it from the valves.

3 Remove the probe from the valve.

MAIN GEARBOX - DISASSEMBLY-07

4 Remove the packing (502/11) from the probe. Discard the packing.

5 Remove the valve from the lubrication and scavenge oil pump.

6 Install the magnetic probe (502/12) into the valve (502/10).

7 Remove the packing (502/9) from the small OD end of the valve. Discard the packings.

8 Remove the packing (502/1) from the washer face of the valve. Discard the packing.

9 Remove the magnetic probe from the valve again.

10 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

(d) Remove the PN 50R491 magnetic chip detectors from the lubrication and scavenge oil pump as follows:

1 Remove the lockwire or safety cable from the valve (502/16).

2 Push the magnetic probe (502/13) in and turn it counterclockwise to disengage it from the valve.

3 Remove the probe from the valve.

4 Remove the packing (502/14) from the probe. Discard the packing.

5 Remove the valve from the lubrication and scavenge oil pump.

6 Remove the packing (502/15) from the ID of the valve. Discard the packing.

7 Remove the packing (502/1) from the washer face of the valve. Discard the packing.

8 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

(e) Remove the PN 50R501 magnetic chip detectors from the lubrication and scavenge oil pump as follows:

1 Remove the lockwire or safety cable from the valve (502/18).

2 Push the magnetic probe (502/20) in and turn it counterclockwise to disengage it from the valves.

3 Remove the probe from the valve.

4 Remove the packing (502/19) from the probe. Discard the packing.

5 Remove the valve from the lubrication and scavenge oil pump.

6 Install the magnetic probe (502/20) into the valve (502/18).

7 Remove the packing (502/17) from the small OD end of the valve. Discard the packings.

8 Remove the packing (502/1) from the washer face of the valve. Discard the packing.

9 Remove the magnetic probe from the valve again.

10 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

CAUTION: INSTALL PROTECTIVE COVERS OVER ALL OPENINGS AS SOON AS POSSIBLE TO PREVENT ENGINE DAMAGE.

CAUTION: DO NOT TRY TO REMOVE THE MAGNETIC CHIP DETECTOR AS AN ASSEMBLY. THE MAGNETIC PROBE MUST BE REMOVED FROM THE VALVE TO PREVENT DAMAGE TO THE PART.

(3) Remove the magnetic chip detector from the center front side of the main gearebox assembly. See Figure 503.

(a) Remove the PN 50R341 magnetic chip detector from the main gearbox assembly as follows:

1 Remove the lockwire or safety cable from the valve (503/2).

MAIN GEARBOX − DISASSEMBLY−07

2 Push the magnetic probe (503/4) in and turn it counterclockwise to disengage it from the valve.

3 Remove the probe from the valve.

4 Remove the packing (503/3) from the probe. Discard the packing.

5 Remove the valve from the main gearbox assembly.

6 Remove the packing (503/1) from the washer face of the valve. Discard the packing.

(b) Remove the PN 50R347 magnetic chip detector from the main gearbox assembly:

1 Remove the lockwire or safety cable from the valve (503/5).

2 Push the magnetic probe (503/8) in and turn it counterclockwise to disengage it from the valve.

3 Remove the probe from the valve.

4 Remove the packing (503/7) from the probe. Discard the packing.

5 Remove the valve from the main gearbox assembly.

a Hold the bushing with a wrench so it does not turn.

b Remove the valve from the bushing.

6 Remove the packing (503/6) from the ID of the valve. Discard the packing.

7 Remove the packing (503/1) from the washer face of the valve. Discard the packing.

(c) Remove the PN 50R485 magnetic chip detector from the main gearbox assembly as follows:

1 Remove the lockwire or safety cable from the valve (503/10).

2 Push the magnetic probe (503/12) in and turn it counterclockwise to disengage it from the valve.

3 Remove the probe from the valve.

4 Remove the packing (503/11) from the probe. Discard the packing.

5 Remove the valve from the main gearbox assembly as follows:

   a Hold the bushing with a wrench so it does not turn.

   b Remove the valve from the bushing.

6 Install the magnetic probe into the valve.

7 Remove the packing (503/9) from the small OD end of the valve. Discard the packing.

8 Remove the packing (503/1) from the washer face of the valve. Discard the packing.

9 Remove the probe from the valve again.

(d) Remove the PN 50R484 magnetic chip detector from the center front side of the main gearbox assembly as follows:

1 Remove the lockwire or safety cable from the valve (503/13).

2 Push the magnetic probe (503/16) in and turn it counterclockwise to disengage it from the valve.

3 Remove the probe from the valve.

4 Remove the packing (503/15) from the probe. Discard the packing.

5 Remove the valve from the main gearbox as follows:

   a Hold the bushing with a wrench so it does not turn.

b Remove the valve from the bushing.

6 Remove the packing (503/14) from the ID of the valve. Discard the packing.

7 Remove the packing (503/1) from the washer face of the valve. Discard the packing.

(e) Remove the PN 50R499 magnetic chip detector from the center front side of the main gearbox assembly as follows:

1 Remove the lockwire or safety cable from the valve (503/18).

2 Push the magnetic probe (503/20) in and turn it counterclockwise to disengage it from the valve.

3 Remove the probe from the valve.

4 Remove the packing (503/19) from the probe. Discard the packing.

5 Remove the valve from the main gearbox assembly as follows:

a Hold the bushing with a wrench so it does not turn.

b Remove the valve from the bushing.

6 Install the magnetic probe into the valve.

7 Remove the packing (503/17) from the small OD end of the valve. Discard the packing.

8 Remove the packing (503/1) from the washer face of the valve. Discard the packing.

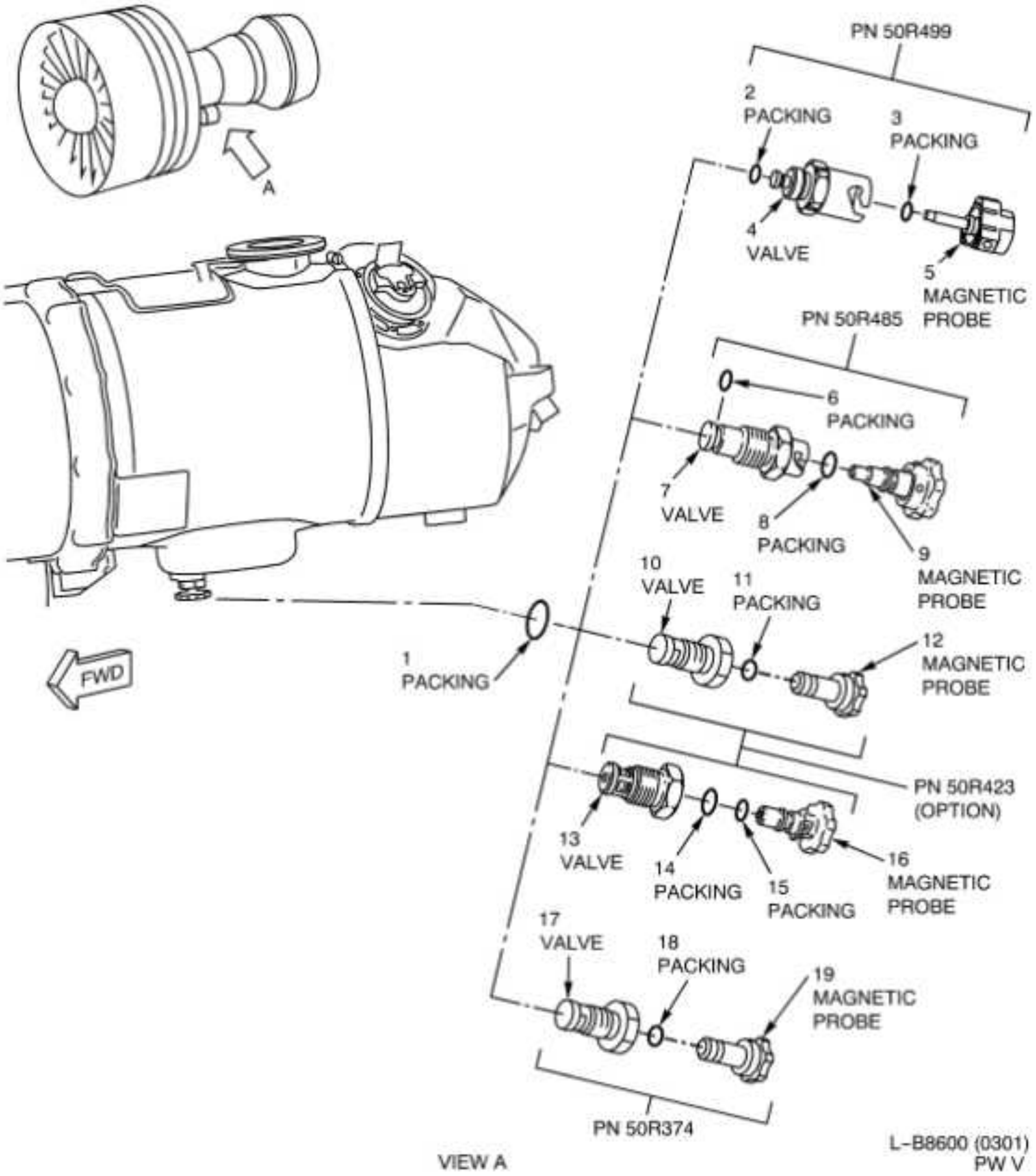
9 Remove the probe from the valve again.

D. Postrequisites

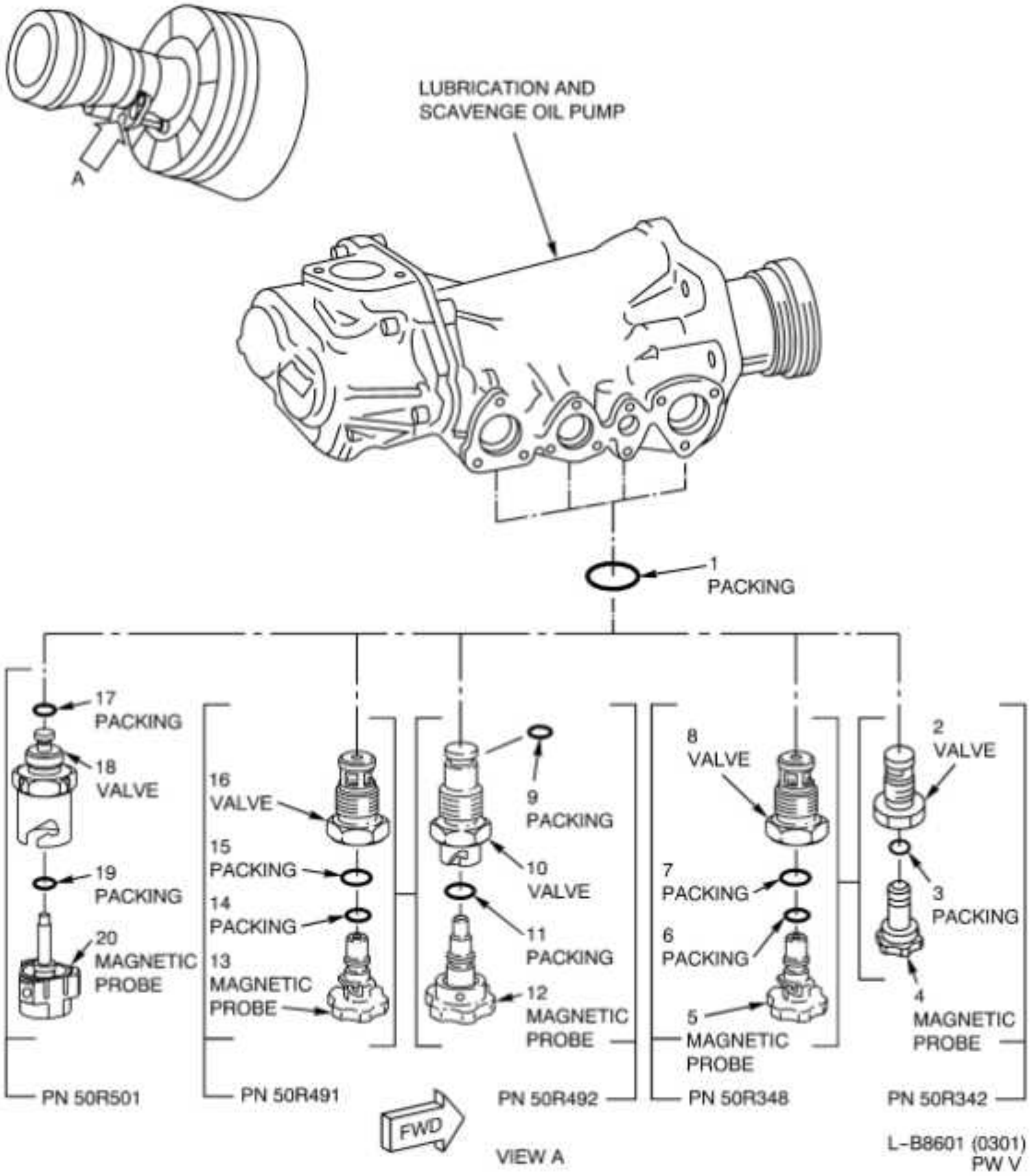
(1) Disassemble the front hydraulic pump drive and IDG drive gearshaft from the main gearbox. Refer to Disassembly-02 (Task 72-61-00-030-002).

MAIN GEARBOX - DISASSEMBLY-07

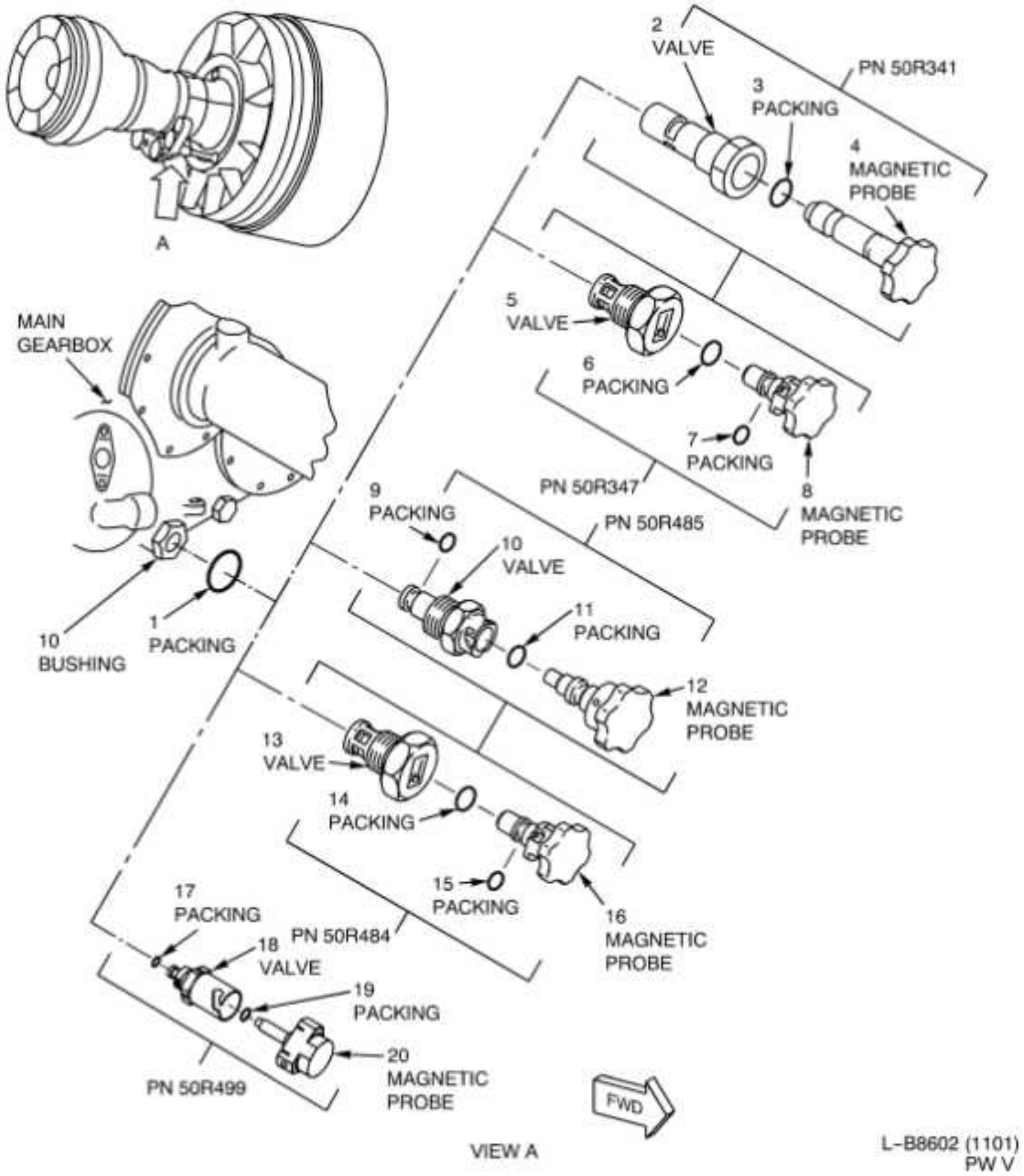
(2) Disassemble the main gearbox per Disassembly-03 (Task 72-61-00-030-003).


PN 50R499
2
PACKING
3
PACKING
4
VALVE
5
MAGNETIC
PROBE
A
PN 50R485
6
PACKING
7
VALVE
8
PACKING
9
MAGNETIC
PROBE
10
VALVE
11
PACKING
12
MAGNETIC
PROBE
1
PACKING
FWD
PN 50R423
(OPTION)
13
VALVE
14
PACKING
15
PACKING
16
MAGNETIC
PROBE
17
VALVE
18
PACKING
19
MAGNETIC
PROBE
PN 50R374
VIEW A
L-B8600 (0301)
PW V

Main Oil Tank Chip Detectors
Figure 501
(Task 72-61-00-030-007)


A
LUBRICATION AND SCAVENGE OIL PUMP
1 PACKING
17 PACKING
18 VALVE
19 PACKING
20 MAGNETIC PROBE
PN 50R501
16 VALVE
15 PACKING
14 PACKING
13 MAGNETIC PROBE
PN 50R491
9 PACKING
10 VALVE
11 PACKING
12 MAGNETIC PROBE
PN 50R492
8 VALVE
7 PACKING
6 PACKING
5 MAGNETIC PROBE
PN 50R348
2 VALVE
3 PACKING
4 MAGNETIC PROBE
PN 50R342
FWD
VIEW A
L-B8601 (0301)
PW V

Lubrication And Scavenge Oil Pump Chip Detectors
Figure 502
(Task 72−61−00−030−007)


A
MAIN GEARBOX
10 BUSHING
1 PACKING
2 VALVE
PN 50R341
3 PACKING
4 MAGNETIC PROBE
5 VALVE
6 PACKING
7 PACKING
8 MAGNETIC PROBE
PN 50R347
9 PACKING
PN 50R485
10 VALVE
11 PACKING
12 MAGNETIC PROBE
13 VALVE
14 PACKING
15 PACKING
16 MAGNETIC PROBE
17 PACKING
PN 50R484
18 VALVE
19 PACKING
20 MAGNETIC PROBE
PN 50R499
FWD
VIEW A
L-B8602 (1101)
PW V

Main Gearbox Chip Detectors
Figure 503
(Task 72-61-00-030-007)

Previous Pageblock Return to Previous Menu Next Pageblock

MAIN GEARBOX − INSPECTION/CHECK−01

Task 72−61−00−990−004:

1. General Inspection Requirements − Main Gearbox

   A. Organization Of Individual Part Or Subassembly Inspection Data

      (1) Specific inspection functions for all significant parts/subassemblies are provided in individual Inspection/Check sections. Application of each inspection function is shown in Inspection/Check−00 for part/subassembly. Section designations and function descriptions are as follows.

      (2) Inspection/Check−00 section contains, where applicable:

         (a) Part number(s) for which the inspection data is applicable.

         (b) Service Bulletin numbers applicable to part number(s).

         (c) Inspection/Check numbers, data categories and applicability data.

      (3) Inspection/Check−01, Preinspection Preparation, contains, where applicable:

         (a) General inspection comments, notes, CAUTIONS, etc., which supplement data contained in this section.

         (b) Identification of mechanical disassembly required prior to inspection.

         (c) Identification of any surface treatment or coating removal, or other actions required prior to inspection.

         (d) Identification of part/subassembly cleaning required prior to inspection.

      (4) Inspection/Check−02, Nondestructive Inspection, contains the following nondestructive inspection methods, part/subassembly special attention areas and damage limits (as applicable):

         (a) Fluorescent Penetrant Method

         (b) Eddy Current Method

(c) Magnetic Particle Method

(d) X−ray Method

(e) Ultrasonic Method

(f) Hardness Check

(g) Other − As specified.

(5) Inspection/Check−03, Visual Inspection contains, where applicable:

(a) Visual inspection requirements which can be accomplished with or without magnification or special lighting (as specified).

NOTE: Use of inspection tools may be required as a supplement to visual inspection process.

(b) Allowable blending for visual damage, which may be accomplished within the inspection area.

NOTE: Blending requirement will also be shown in applicable repairs.

(6) Inspection/Check−04, Dimensional Inspection, contains, where applicable:

(a) Dimensional inspection requirements other than visual inspection. The requirements will include applicable fits and clearances, and other dimensional inspections necessary to ensure the part integrity and proper functioning.

(7) Inspection/Check−05, Functional Check Inspection contains, where applicable:

(a) Procedures, limits, and equipment used with any required functional checks (oil flow, air flow, leak, etc.).

(8) Inspection/Check−06, Inspection Postrequisites contains, references to procedures required to return part/ subassembly to serviceable condition. References include the following, as required.

(a) Reassembly

(b) Protective coatings, sealants and/or lubricant reapplication

B. Thorough and intelligent part/subassembly inspection is of major importance in achieving efficient engine operation and satisfactory service life. Inspection personnel should be thoroughly familiar with inspection procedures, inspection tooling, limits associated with normal and, where applicable, unusual operating conditions, limits associated with repairs, and with inspection procedures published in Standard Practices Manual.

C. During preliminary inspection of part/subassembly, comparison with mating or adjacent parts may provide indication of source of wear or damage. This procedure may indicate requirement for additional disassembly and inspection.

D. During inspection, records should be kept of deviations beyond serviceable limits to determine: (a) if part/subassembly will be repaired or replaced, and (b) if part is reparable, which repairs are required. Suitable documentation should accompany part/subassembly with results of this determination.

E. Inspection of individual part/subassembly dimensions which are also in Fits and Clearances will include Fits and Clearance Reference Numbers and will show new part/subassembly dimension unless specifically stated otherwise. Inspection Frequency Requirements (IFR) codes (for IFR Code A parts only) are included with Reference Number data. If acceptable dimensional deviations or results of repair affect Fits and Clearances, suitable documentation should accompany part/subassembly to ensure check of fit or clearance at final assembly.

NOTE: Parts/subassemblies which deviate dimensionally from new part/subassembly values may be acceptable provided required fit or clearance is achieved at final assembly.

F. Dimensional inspection requirements will be accompanied by part/subassembly constraint data if such constraint requirements are required during part/subassembly manufacture. Adherence to constraint requirements when inspecting service operated parts/subassemblies should be dictated by experience. It is recommended that parts/subassemblies which do not meet dimensional inspection requirements in free state be constrained and re−measured prior to initiation of any repair or re−use activity.

G. Dimensional inspections of one detail of a subassembly, prior to removal from subassembly, may produce incorrect data due to constraint forces from mating details. If questionable data is obtained, subassembly should be disassembled and inspections repeated.

H. Dimensional inspection limits in inspection text provide continued use (as is) and, if applicable, repair limits. Parts/subassemblies which exceed both limits and nonreparable parts/subassemblies which exceed (as is) limits are unserviceable.

I. Inspections required to verify integrity of repair are contained within repair procedure. Unless otherwise stated, repaired part is expected to meet all inspection requirements contained in inspection text for part/subassembly.

J. Parts/subassemblies which do not require repairs except for those provided in Standard Practices Manual are identified by Chapter/Section/Subject Number 72−61−99 in cleaning table (Cleaning−01) and nondestructive inspection table (Inspection/Check−02). Determination of serviceability for those parts listed in 72−61−99 is limited to cleaning, non−destructive inspection, and the following:

  (1) Visually inspect parts/subassemblies for surface defects, deformations, cuts, improper threads or wrenching surfaces, incomplete or missing protective coatings or other damage which will prevent proper functioning and make part/subassembly unserviceable. Unserviceable parts/subassemblies should not be reinstalled. Repair unserviceable parts/subassemblies per Standard Practices Manual, as applicable.

  (2) Parts/subassemblies with crack indications to any length or depth detected by listed nondestructive inspection are unserviceable, and should not be reinstalled.

MAIN GEARBOX − INSPECTION/CHECK−01

K. When new part/subassembly is to be installed and it is important that it be identified as to engine number or position in engine, mark it by appropriate method described in Marking of Parts, 70−11, Standard Practices Manual.

L. In order to eliminate confusion and to maintain consistent terminology, various physical conditions which might be encountered during inspection of parts/subassemblies and explanation of unusual causes of such conditions are defined in Physical Inspection, 70−31, Standard Practices Manual.

M. If inspection reveals it necessary to replace fitted spacer,tag spacer to indicate that replacement must be made with spacer of correct classification at assembly.

N. If text refers to superficial or shallow imperfection, following definitions apply:

(1) A superficial imperfection is defined as a nick, dent, scratch, toolmark, etc., which disrupts the surface but does not appear to penetrate surface roughness texture.

(2) A shallow imperfection appears to penetrate surface finish texture, but does not have a dark bottom and would not cause a 0.007 inch (.178 mm) radius stylus to hesitate if passed over it.

MAIN GEARBOX − INSPECTION/CHECK−03

Task 72−61−00−990−005:

1. Visual Inspection − Main Gearbox
   - A. For inspection requirements applicable to installed (accessible) parts of Main Gearbox, see 72−00−61, Inspection/Check−05 (Task 72−00−61−200−001).

MAIN GEARBOX - INSPECTION/CHECK-04

Task 72-61-00-990-001:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

MAIN GEARBOX − INSPECTION/CHECK−04

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (−) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (−) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

F. Fits And Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
540	B	Lubrication And Scavenge Pump (CMM) Gearbox Housing Assembly (72−61−10) (See Figure 806)				
		Pump	3.482 (88.443)	3.484 (88.493)		
		Housing	3.4865 (88.558)	3.4875 (88.582)	.0025 (0.064)	.0062* (0.157*)
541 (1)	B	Gearbox (EEC Alternator Drive) Spur Gearshaft (72−61−45) EEC Generator Rotor (CMM) (See Figure 807)				
		Gearshaft	.7877 (20.0076)	.7880 (20.0152)		
		Rotor (Pre SB PW4ENG 72−375)	.7882 (20.0203)	.7886 (20.0304)	.0002 (0.0051)	.0009 (0.0228)

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	I		New Part Reference Dimensions		Limits	
Ref. No.	F R	Description	Min	Max	Min	Max
541 (2)	B	Gearbox (EEC Alternator Drive) Spur Gearshaft (72−61−45) EEC Generator Rotor (CMM) (See Figure 807)				
		Gearshaft	.7877 (20.0076)	.7880 (20.0152)		
		Rotor (Post SB PW4ENG 72−375)	.7872 (19.9949)	.7877 (20.0075)	.0000 (0.0000)	.0008T (0.0203T)
542	B	EEC Generator Stator (CMM) Gearbox Generator (EEC Alternator) Housing Assembly (72−61−47) (See Figure 807)				
		Stator	3.180 (80.772)	3.181 (80.797)		
		Housing	3.1815 (80.811)	3.1825 (80.835)	.0005 (0.013)	.0025 (0.063)
543	B	Gearbox (EEC Alternator Drive) Spur Gearshaft (72−61−45) EEC Generator Rotor (CMM) (See Figure 808)				
		Gearshaft (Post SB PW4ENG 72−375)	.7837 (19.9060)	.7840 (19.9136)		
		Rotor (Post SB PW4ENG 72−375)	.7832 (19.8933)	.7837 (19.9059)	.0000 (0.0000)	.0008T (0.0203T)
786	B	Gearbox Driveshaft Housing Support Link Bolt (72−61−83) Gearbox Driveshaft Housing Assembly (72−61−23) (See Figure 808, Sheet 2)				
		Bolt	.6232 (15.8293)	.6237 (15.8419)		
		Housing	.6239 (15.848)	.6249 (15.872)	.0002 (0.006)	.0017 (0.043)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
788	B	Gearbox Lug (72-61-68) Spherical Bearing (72-41-91) (See Figure 808, Sheet 2)				
		Lug	.9985 (25.3619)	.9990 (25.3746)		
		Bearing	.9995 (23.3873)	1.000 (25.4000)	.0005 (0.013)	.0015 (0.038)
832	B	Gearbox Support Link Upper Pin Spacers (OD) (72-61-90) Gearbox Support Clevis (72-41-92) (See Figure 808, Sheet 3)				
		Spacer	1.124 (28.550)	1.125 (28.575)		
		Clevis	1.126 (28.601)	1.128 (28.651)	.001 (0.026)	.004 (0.101)
833	B	Gearbox Support Link Upper Hollow Pin (72-61-86) To: -Gearbox Support Clevis (72-41-92)/ -Gearbox Support Link Spherical Bearing (ID) (72-61-85)/ -Gearbox Mount Link Upper Pin Spacer (ID) (72-61-90) (See Figure 808, Sheet 3)				
		Pin	.9985 (25.3619)	.9990 (25.3746)		
		-Clevis,/ -Bearing,/ -Spacer	.9995 (25.3873)	1.0000 (25.4000)	.0005 (0.013)	.0015 (0.038)
834	B	Gearbox Support Link Spherical Bearing (72-61-85) Gearbox Support Link (72-61-84) (See Figure 808, Sheet 3)				
		Spacer	1.4995 (38.088)	1.5005 (38.112)		
		Link	1.5015 (38.139)	1.5025 (38.163)	.001 (0.026)	.003 (0.076)

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Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
835	B	Gearbox Support Link Lower Pin Spacers (OD) (72-61-91) Gearbox Housing Lug (72-61-10) (See Figure 808, Sheet 3)				
		Spacers	1.127 (28.626)	1.128 (28.651)		
		Lug	1.129 (28.677)	1.131 (28.727)	.001 (0.026)	.004 (0.101)
836	B	Gearbox Support Link Lower Hollow Pins (72-61-87) To -Gearbox Housing Lug (72-61-10)/ -Gearbox Support Link Spherical Bearing (ID) (72-61-85)/ -Gearbox Housing Lug Lower Pin Spacer (ID) (72-61-91) (See Figure 808, Sheet 3)				
		Pin	.9985 (25.3619)	.9990 (25.3746)		
		Lug,/ Bearing,/ Spacer	.9995 (25.3873)	1.0000 (25.4000)	.0000 (0.000)	.0025 (0.064)
1020	B	Gearbox (Front Hydraulic Pump Drive) Bearing Housing Assembly (72-61-33) Gearbox Housing Assembly (72-61-10) (See Figure 805, Sheet 1 or 2)				
		Pump Housing	6.9985 (177.762)	6.9995 (177.787)		
		Gearbox Housing	7.0000 (177.800)	7.0015 (177.838)	.0005 (0.013)	.0048* (0.122*)
1021	B	Gearbox (Front Hydraulic Pump Drive) Spur Gearshaft (72-61-34) Front Hydraulic Pump Drive Bearings Sleeve Spacer (72-61-36) (See Figure 805, Sheet 1 or 2)				
		Gearshaft	2.1655 (55.0037)	2.1660 (55.0164)		
		Spacer	2.1671 (55.045)	2.1690 (55.092)	.0011 (0.028)	.0035 (0.088)

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Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1022	B	Gearbox (Front Hydraulic Pump Drive)				
		Spur Gearshaft (72−61−34)				
		Roller Bearing (72−61−13)				
		Gearshaft	2.1655	2.1660		
			(55.0037)	(55.0164)		
		Bearing	2.1650	2.1654	.0010T	.0001T
			(54.9910)	(55.0011)	(0.0254T)	(0.0026T)
1023	B	Roller Bearing (72−61−13)				
		Gearbox (Front Hydraulic Pump Drive)				
		Bearing Support (72−61−35)				
		(See Figure 805, Sheet 1 or 2)				
		Bearing	3.5430	3.5434		
			(89.9922)	(90.0023)		
		Housing	3.5436	3.5446	.0002	.0016
			(90.008)	(90.032)	(0.006)	(0.040)
1024	B	Gearbox (Front Hydraulic Pump Drive)				
		Bearing Support (72−61−35)				
		Gearbox (Front Hydraulic Pump Drive)				
		Bearing Housing Assembly (72−61−33)				
		(See Figure 805, Sheet 1 or 2)				
		Support	5.6285	5.6295		
			(142.964)	(142.989)		
		Housing	5.6300	5.6315	.0005	.0030
			(143.002)	(143.040)	(0.013)	(0.076)
1025	B	Roller Bearing (72−61−13)				
		Gearbox Housing Assembly (72−61−10)				
		(See Figure 805, Sheet 1)				
		Bearing	4.5273	4.5277		
			(114.9935)	(115.0035)		
		Housing	4.5279	4.5289	.0002	.0016
		(Pre SB	(115.009)	(115.034)	(0.006)	(0.040)
		PW4ENG 72−574)				
1026	A	Gearbox (IDG Drive) Spur Gearshaft				
		Assembly (72−61−31)				
		Roller Bearing (72−61−13)				
		(See Figure 805, Sheet 1)				
		Gearshaft	2.9539	2.9544		
		(Pre SB	(75.0291)	(75.0417)		
		PW4ENG 72−574)				
		Bearing	2.9525	2.9529	.0019T	.0010T
			(74.9935)	(75.0036)	(0.0482T)	(0.0254T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1027	B	Face (Oil Seal) Assembly (72−61−19) Gearbox (Front Hydraulic Pump Drive) Bearing Support (72−61−35) (See Figure 805, Sheet 1 or 2)				
		Seal	5.221 (132.614)	5.226 (132.740)		
		Support	5.228 (132.792)	5.232 (132.892)	.002 (0.051)	.011 (0.279)
1028	B	Face (Oil) Seal Assembly (72−61−19) Gearbox Housing Assembly (72−61−10) (See Figure 805, Sheet 1)				
		Seal	4.618 (117.298)	4.623 (117.424)		
		Housing (Pre SB PW4ENG 72−574)	4.6240 (117.450)	4.6252 (117.480)	.0010 (0.025)	.0072 (0.183)
1800	B	Gearbox (Deoiler) Spur Gearshaft Assembly (72−61−11) Gearbox Deoiler Impeller Support (72−61−14) (See Figure 801, Sheet 2)				
		Gearshaft	2.160 (54.864)	2.161 (54.889)		
		Support	2.159 (54.839)	2.160 (54.864)	.002T (0.050T)	.000 (0.000)
1801	B	Gearbox (Deoiler) Spur Gearshaft Assembly (72−61−11) Gearbox Deoiler Impeller Support (72−61−14) (See Figure 801, Sheet 2)				
		Gearshaft	2.1655 (55.0037)	2.1660 (55.0164)		
		Impeller	2.1640 (54.966)	2.1655 (55.003)	.002T (0.050T)	.000 (0.000)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1802	A	Gearbox (Deoiler) Spur Gearshaft Assembly (72-61-11) Roller Bearing (72-61-13) (See Figure 801, Sheet 2)				
		Gearshaft	2.1655 (55.0037)	2.1660 (55.0164)		
		Bearing	2.1650 (54.9910)	2.1654 (55.0011)	.0010T (0.0254T)	.0001T (0.0026T)
1803	A	Gearbox (Deoiler) Spur Gearshaft Assembly (72-61-11) Roller Bearing (72-61-13) (See Figure 801, Sheet 2)				
		Gearshaft	2.1664 (55.0266)	2.1669 (55.0392)		
		Bearing	2.1650 (54.9910)	2.1654 (55.0011)	.0019T (0.0482T)	.0010T (0.0254T)
1804	B	Roller Bearing (72-61-13) Gearbox (Deoiler) Bearing Housing Assembly (72-61-12) (See Figure 801, Sheet 2)				
		Bearing	3.5430 (89.9922)	3.5434 (90.0023)		
		Housing	3.5436 (90.008)	3.5446 (90.032)	.0002 (0.006)	.0016 (0.040)
1805	B	Roller Bearing (72-61-13) Gearbox Housing Assembly (72-61-10) (See Figure 801, Sheet 2)				
		Bearing	3.5430 (89.9922)	3.5434 (90.0023)		
		Housing	3.5436 (90.008)	3.5446 (90.032)	.0002 (0.006)	.0035* (0.089*)
1806	B	Gearbox (Deoiler) Bearing Housing Assembly (72-61-12) Gearbox Housing Assembly (72-61-10) (See Figure 801, Sheet 2)				
		Housing	9.0985 (231.102)	9.0995 (231.127)		
		Gearbox Hsg.	9.1000 (231.1400)	9.1015 (231.1781)	.0005 (0.013)	.0061* (0.155*)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1807	B	Gearbox Deoiler Impeller Assembly (72-61-15) Gearbox Deoiler Impeller Support (72-61-14) (See Figure 801, Sheet 2)				
		Impeller	3.146 (79.909)	3.147 (79.933)		
		Support	3.148 (79.960)	3.149 (79.984)	.001) (0.026	.003 (0.076)
1808	B	Gearbox Deoiler Impeller Support (72-61-14) Gearbox Deoiler Impeller Assembly (72-61-15) (See Figure 801, Sheet 2)				
		Support	2.687 (68.250)	2.688 (68.275)		
		Impeller	2.689 (68.301)	2.690 (68.326)	.001 (0.026)	.003 (0.076)
1809	A	Roller Bearing (72-61-13) Gearbox (Idler) Spur Gear (72-61-21) (See Figure 801, Sheet 2)				
		Bearing	2.0469 (51.9913)	2.0472 (51.9988)		
		Gear	2.0456 (51.9583)	2.0463 (51.9760)	.0016T (0.040T)	.0006T (0.016T)
1810	B	Gearbox Idler Shaft (72-61-20) Roller Bearing (72-61-13) (See Figure 801, Sheet 2)				
		Shaft	.7865 (19.9771)	.7870 (19.9898)		
		Bearing	.7872 (19.9949)	.7874 (19.9999)	.0002 (0.0051)	.0009 (0.0228)
1811	B	Gearbox Idler Shaft (72-61-20) Gearbox Housing Assembly (72-61-10) (See Figure 801, Sheet 2)				
		Shaft	1.0585 (26.886)	1.0595 (26.911)		
		Housing	1.0600 (26.924)	1.0615 (26.962)	.0005 (0.013)	.0030 (0.076)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812	B	Gearbox Idler Shaft (72−61−20) Gearbox Housing Assembly (72−61−10) (See Figure 801, Sheet 2)				
		Shaft	.623 (15.825)	.624 (15.849)		
		Housing	.624 (15.850)	.626 (15.900)	.000 (0.000)	.003 (0.076)
1813	B	Roller Bearing (72−61−13) Gearbox Housing Assembly (72−61−10) (See Figure 801, Sheet 3 and Figure 805, Sheet 2)				
		Bearing	4.5273 (114.9935)	4.5277 (115.0035)		
		Housing	4.5279 (115.009)	4.5289 (115.034)	.0002 (0.006)	.0038* (0.097*)
1814	B	Roller Bearing (72−61−13) Gearbox Housing Assembly (72−61−10) (See Figure 801, Sheet 3)				
		Bearing	3.5430 (89.9922)	3.5434 (90.0023)		
		Housing	3.5436 (90.008)	3.5446 (90.032)	.0002 (0.006)	.0031* (0.079*)
1815	A	Gearbox (Drive) Spur Gearshaft (72−61−22) Roller Bearing (72−61−13) (See Figure 801, Sheet 3)				
		Gearshaft	2.1664 (55.0266)	2.1669 (55.0392)		
		Bearing	2.1650 (54.9910)	2.1654 (55.0011)	.0019T (0.0482T)	.0010T (0.0254T)
1816	B	Roller Bearing (72−61−13) Gearbox Driveshaft Housing Assembly (72−61−23) (See Figure 801, Sheet 3)				
		Bearing	3.5430 (89.9922)	3.5434 (90.0023)		
		Housing	3.5436 (90.008)	3.5446 (90.032)	.0002 (0.006)	.0016 (0.040)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1817	A	Gearbox (Drive) Spur Gearshaft (72−61−22) Roller Bearing (72−61−13) (See Figure 801, Sheet 3)				
		Gearshaft	2.1664 (55.0266)	2.1669 (55.0392)		
		Bearing	2.1650 (54.9910)	2.1654 (55.0011)	.0019T (0.0482T)	.0010T (0.0254T)
1818	B	Gearbox Driveshaft Housing Assembly (72−61−23) Gearbox Housing Assembly (72−61−10) (See Figure 801, Sheet 3)				
		Shaft Hsg.	5.9985 (152.362)	5.9995 (152.387)		
		Gearbox Hsg.	6.0000 (152.400)	6.0015 (152.438)	.0005 (0.013)	.005* (0.127*)
1819	B	Roller Bearing (72−61−13) Gearbox Housing Assembly (72−61−10) (See Figure 801, Sheet 4)				
		Bearing	3.5430 (89.9922)	3.5434 (90.0023)		
		Housing	3.5436 (90.008)	3.5446 (90.032)	.0002 (0.006)	.0031* (0.079*)
1820	A	Gearbox (Starter Drive) Gearshaft Assembly (72−61−24) Roller Bearing (72−61−13) (See Figure 801, Sheet 4)				
		Gearshaft	2.1664 (55.0266)	2.1669 (55.0392)		
		Bearing	2.1650 (54.9910)	2.1654 (55.0011)	.0019T (0.0482T)	.0010T (0.0254T)
1821	B	Gearshaft (Starter Drive) Bearing Housing Assembly (72−61−26) Gearbox Housing Assembly (72−61−10) (See Figure 801, Sheet 4)				
		Bearing Hsg.	9.0985 (231.102)	9.0995 (231.127)		
		Gearbox Hsg.	9.1000 (231.140)	9.1015 (231.178)	.0005 (0.013)	.0059* (0.150*)

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Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1822	A	Gearbox (Starter Drive) Gearshaft Assembly (72-61-24) Roller Bearing (72-61-13) (See Figure 801, Sheet 4)				
		Gearshaft	2.1664 (55.0266)	2.1669 (55.0392)		
		Bearing	2.1650 (54.9910)	2.1654 (55.0011)	.0019T (0.0482T)	.0010T (0.0254T)
1823	B	Roller Bearing (72-61-13) Gearbox (Starter Drive) Bearing Housing Assembly (72-61-26) (See Figure 801, Sheet 4)				
		Bearing	3.5430 (89.9922)	3.5434 (90.0023)		
		Housing	3.5436 (90.008)	3.5446 (90.032)	.0002 (0.006)	.0016 (0.040)
1824	B	Face (Oil) Seal Assembly (72-61-19) Gearbox (Starter Drive) Bearing Housing Assembly (72-61-26) (See Figure 801, Sheet 4)				
		Seal	3.3570 (85.268)	3.3640 (85.445)		
		Housing	3.3650 (85.471)	3.3662 (85.501)	.0010 (0.026)	.0092 (0.234)
1825	B	Roller Bearing (72-61-13) Gearbox Housing Assembly (72-61-10) (See Figure 801, Sheet 5)				
		Bearing	3.5430 (89.9922)	3.5434 (90.0023)		
		Housing	3.5436 (90.008)	3.5446 (90.032)	.0002 (0.006)	.0031* (0.079*)
1826	A	Gearbox (Fuel Pump Drive) Spur Gearshaft Assembly (72-61-27) Roller Bearing (72-61-13) (See Figure 801, Sheet 5)				
		Gearshaft	2.1664 (55.0266)	2.1669 (55.0392)		
		Bearing	2.1650 (54.9910)	2.1654 (55.0011)	.0019T (0.0482T)	.0010T (0.0254T)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1827	B	Face (Oil) Seal Assembly (72−61−19) Gearbox (Fuel Pump Drive) Bearing Housing Assembly (72−61−28) (See Figure 801, Sheet 5)				
		Seal	3.3570	3.3640		
			(85.268)	(85.445)		
		Housing	3.3650	3.3662	.001	.0092
			(85.471)	(85.501)	(0.026)	(0.234)
1828	A	Gearbox (Fuel Pump Drive) Spur Gearshaft Assembly (72−61−27) Roller Bearing (72−61−13) (See Figure 801, Sheet 5)				
		Gearshaft	2.1664	2.1669		
			(55.0266)	(55.0392)		
		Bearing	2.1650	2.1654	.0019T	.0010T
			(54.9910)	(55.0011)	(0.0482T)	(0.0254T)
1829	B	Roller Bearing (72−61−13) Gearbox (Fuel Pump Drive) Bearing Housing Assembly (72−61−28) (See Figure 801, Sheet 5)				
		Bearing	3.5430	3.5434		
			(89.9922)	(90.0023)		
		Housing	3.5436	3.5446	.0002	.0016
			(90.008)	(90.032)	(0.006)	(0.040)
1830	B	Gearbox (Fuel Pump Drive) Bearing Housing Assembly (72−61−28) Gearbox Housing Assembly (72−61−10) (See Figure 801, Sheet 5)				
		Bearing Hsg.	6.4985	6.4995		
			(165.062)	(165.087)		
		Gearbox Hsg.	6.5000	6.5015	.0005	.005*
			(165.100)	(165.138)	(0.013)	(0.127*)
1831	A	Gearbox (Rear Hydraulic Pump Drive) Spur Gearshaft (72−61−29) Roller Bearing (72−61−13) (See Figure 801, Sheet 5)				
		Gearshaft	2.1664	2.1669		
			(55.0266)	(55.0392)		
		Bearing	2.1650	2.1654	.0019T	.0010T
			(54.9910)	(55.0011)	(0.0482T)	(0.0254T)

	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
1832	B	Roller Bearing (72-61-13)				
		Gearbox Housing Assembly (72-61-10)				
		(See Figure 801, Sheet 5)				
		Bearing	3.5430	3.5434		
			(89.9922)	(90.0023)		
		Housing	3.5436	3.5446	.0002	.0027*
			(90.008)	(90.032)	(0.006)	(0.069*)
1833	A	Gearbox (Rear Hydraulic Pump Drive)				
		Spur Gearshaft (72-61-29)				
		Roller Bearing (72-61-13)				
		(See Figure 801, Sheet 5)				
		Gearshaft	2.1664	2.1669		
			(55.0266)	(55.0392)		
		Bearing	2.1650	2.1654	.0019T	.0010T
			(54.9910)	(55.0011)	(0.0482T)	(0.0254T)
1834	B	Roller Bearing (72-61-13)				
		Gearbox (Rear Hydraulic Pump Drive)				
		Bearing Housing Assembly (72-61-30)				
		(See Figure 801, Sheet 5)				
		Bearing	3.5430	3.5434		
			(89.9922)	(90.0023)		
		Housing	3.5436	3.5446	.0002	.0016
			(90.008)	(90.032)	(0.006)	(0.040)
1835	B	Face Seal Assembly (72-61-19)				
		Gearbox (Rear Hydraulic Pump Drive)				
		Bearing Housing Assembly (72-61-30)				
		(See Figure 801, Sheet 5)				
		Seal	3.3570	3.3640		
			(85.268)	(85.445)		
		Housing	3.3650	3.3662	.0010	.0092
			(85.471)	(85.501)	(0.026)	(0.234)
1836	B	Gearbox (Rear Hydraulic Pump Drive)				
		Bearing Housing Assembly (71-61-30)				
		Gearbox Housing Assembly (72-61-10)				
		(See Figure 801, Sheet 5)				
		Bearing Hsg.	7.1785	7.1795		
			(182.334)	(182.359)		
		Gearbox Hsg.	7.1800	7.1815	.0005	.0054*
			(182.372)	(182.410)	(0.013)	(0.137*)

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1837	B	Roller Bearing (72−61−13) Gearbox (Scavenge Pump Drive) Bearing Housing Assembly (72−61−42) (See Figure 804)				
		Bearing	1.6533 (41.9939)	1.6535 (41.9989)		
		Housing	1.6537 (42.0040)	1.6545 (42.0243)	.0002 (0.006)	.0012 (0.030)
1838	A	Gearbox (Scavenge Pump Drive) Spur Gearshaft (72−61−41) Roller Bearing (72−61−13) (See Figure 804)				
		Gearshaft	.7878 (20.0102)	.7883 (20.0228)		
		Bearing	.7872 (19.9949)	.7874 (19.9999)	.0004T (0.0102T)	.0011T (0.0279T)
1839	B	Gearbox (Scavenge Pump Drive) Bearing Housing Assembly (72−61−42) Gearbox Housing (72−61−10) (See Figure 804)				
		Bearing Hsg.	5.9985 (152.362)	5.9995 (152.387)		
		Gearbox Hsg.	6.0000 (152.400)	6.0015 (152.438)	.0005 (0.013)	.0030 (0.076)
1840	A	Scavenge Pump Spur Gearshaft (72−61−44) Roller Bearing (72−61−13) (See Figure 804)				
		Gearshaft	.7875 (20.0025)	.7880 (20.0152)		
		Bearing	.7872 (19.9949)	.7874 (19.9999)	.0008T (0.0203T)	.0001T (0.0026T)
1841	A	Gearbox (Scavenge Pump Drive) Spur Gearshaft Assembly (72−61−41) Roller Bearing (72−61−13) (See Figure 804)				
		Gearshaft	.7878 (20.0102)	.7883 (20.0228)		
		Bearing	.7872 (19.9949)	.7874 (19.9999)	.0004T (0.0102T)	.0011T (0.0279T)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1842	B	Roller Bearing (72−61−13) Gearbox Housing Assembly (72−61−10) (See Figure 804)				
		Bearing	1.6533	1.6535		
			(41.9939)	(41.9989)		
		Housing	1.6537	1.6545	.0002	.0018*
			(42.0040)	(42.0243)	(0.006)	(0.046*)
1843	B	Roller Bearing (72−61−13) Gearbox Housing (72−61−10) (See Figure 804)				
		Bearing	1.6533	1.6535		
			(41.9939)	(41.9989)		
		Housing	1.6537	1.6545	.0002	.0017*
			(42.0040)	(42.0243)	(0.006)	(0.043*)
1844	C	Gearbox Lug (72−61−68) Gearbox Housing Assembly (72−61−10) (See Figure 803)				
		Lug	1.5047	1.5055		
			(38.2194)	(38.2397)		
		Housing	1.5005	1.5017	.005T	.003T
			(38.113)	(38.143)	(0.127T)	(0.077T)
1845	A	Gearbox (EEC Alternator Drive) Spur Gearshaft (72−61−45) Roller Bearing (72−61−13) (See Figure 803)				
		Gearshaft	.7883	.7888		
			(20.0229)	(20.0355)		
		Bearing	.7872	.7874	.0016T	.0009T
			(19.9949)	(19.9999)	(0.0406T)	(0.0229T)
1846	B	Gearbox (EEC Alternator Drive) Spur Gearshaft (72−61−45) Gearshaft (EEC Alternator Drive) Bearing Spacer (72−61−46) (See Figure 803)				
		Gearshaft	.7883	.7888		
			(20.229)	(20.0355)		
		Spacer	.7899	.7918	.0011	.0035
			(20.064)	(20.111)	(0.028)	(0.088)

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
1847	A	Gearbox (EEC Alternator Drive) Spur Gearshaft (72−61−45) Roller Bearing (72−61−13) (See Figure 803)				
		Gearshaft	.7883 (20.0229)	.7888 (20.03550)		
		Bearing	.7872 (19.9949)	.7874 (19.9999)	.0016T (0.0406T)	.0009T (0.0229T)
1848	B	Gearbox (EEC Alternator Drive) Spur Gearshaft (72−61−45) Gearbox Bearing Seal Seat (72−61−48) (See Figure 803)				
		Gearshaft	.7877 (20.0076)	.7880 (20.0152)		
		Seat	.7881 (20.018)	.7898 (20.060)	.0001 (0.003)	.0021 (0.053)
1849	B	Gearbox Generator (EEC Alternator) Housing Assembly (72−61−47) Gearbox Housing Assembly (72−61−10) (See Figure 803)				
		Generator Housing	2.9900 (75.9460)	2.9905 (75.9587)		
		Gearbox Housing	2.9910 (75.972)	2.9930 (76.022)	.0005 (0.013)	.0034* (0.086*)
		FOR THESE MODELS: 4152, 4156A, 4158				
1850 (1)	B	Gearbox (EEC Alternator Drive) Spur Gearshaft (72−61−45) EEC Generator (Alternator) Rotor Lock Assembly (72−61−50) (See Figure 803)				
		Gearshaft	.672 (17.069)	.673 (17.094)		
		Lock (Pre SB PW4ENG 72−375)	.674 (17.120)	.675 (17.145)	.001 (0.026)	.003 (0.076)

Ref. No.	IFR	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
		FOR THESE MODELS: 4152, 4156A, 4158				
1850 (2)	B	Gearbox (EEC Alternator Drive) Spur Gearshaft (72−61−45) EEC Generator (Alternator) Rotor Lock Assembly (72−61−50) (See Figure 803)				
		Gearshaft	.685 (17.399)	.686 (17.424)		
		Lock (Post SB PW4ENG 72−375)	.691 (17.552)	.693 (17.602)	.005 (0.127)	.008 (0.203)
		FOR THESE MODELS: 4152−3, 4156A−3, 4158−3				
1850	B	Gearbox (EEC Alternator Drive) Spur Gearshaft (72−61−45) EEC Generator (Alternator) Rotor Lock Assembly (72−61−50) (See Figure 803)				
		Gearshaft	.685 (17.399)	.686 (17.424)		
		Lock	.691 (17.552)	.693 (17.602)	.005 (0.127)	.008 (0.203)
1851	B	Pressure (Regulator) Relief Valve (72−61−62) Relief Valve Housing (Pressure Regulator) (72−61−61) (See Figure 801, Sheet 2)				
		Valve	.8100 (20.5740)	.8107 (20.5917)		
		Housing	.8117 (20.6172)	.8125 (20.6375)	.0010 (0.026)	.0025 (0.063)
1852	B	Roller Bearing (72−61−13) Gearbox Generator (EEC Alternator) Housing Assembly (72−61−47) (See Figure 803)				
		Bearing	1.6533 (41.9939)	1.6535 (41.9989)		
		Housing	1.6537 (42.0040)	1.6545 (42.0243)	.0002 (0.006)	.0012 (0.030)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1853	B	Roller Bearing (72−61−13) Gearbox Generator (EEC Alternator) Housing Assembly (72−61−47) (See Figure 803)				
		Bearing	1.6533 (41.9939)	1.6535 (41.9989)		
		Housing	1.6537 (42.0040)	1.6545 (42.0243)	.0002 (0.006)	.0012 (0.030)
1854	B	Face (Oil) Seal Assembly (72−61−19) Gearbox Housing Assembly (72−61−10) (See Figure 801, Sheet 2)				
		Seal	3.3570 (85.268)	3.3640 (85.445)		
		Housing	3.3650 (85.471)	3.3662 (85.501)	.001 (0.026)	.0104* (0.264*)
1855	B	Face (Oil) Seal Assembly (72−61−19) Gearbox Generator (EEC Alternator) Housing Assembly (72−61−47) (See Figure 803)				
		Seal	3.111 (79.020)	3.116 (79.146)		
		Housing	3.118 (79.198)	3.123 (79.324)	.002 (0.05)	.012 (0.30)
1856 (1)	B	Gearbox Idler Shaft (72−61−20) Roller Bearing (72−61−13) (See Figure 801, Sheet 2)				
		Shaft	.7865 (19.9771)	.7870 (19.9898)		
		Bearing (Pre SB PW4ENG 72−491)	.7877 (20.0076)	.7885 (20.0279)	.0007 (0.018)	.002 (0.050)
1856 (2)	B	Gearbox Idler Shaft (72−61−20) Roller Bearing (72−61−13) (See Figure 801, Sheet 2)				
		Shaft	.7865 (19.9771)	.7870 (19.9898)		
		Bearing (Post SB PW4ENG 72−491)	.7880 (20.0152)	.7885 (20.0279)	.001 (0.026)	.002 (0.050)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1857 (1)	B	Gearbox Idler Shaft (72−61−20) Gearbox (Idler) Shaft Boss Assembly (72−61−17) (See Figure 801, Sheet 2)				
		Shaft	.6185 (15.7099)	.6190 (15.7226)		
		Boss Assembly (Pre SB PW4ENG 72−491)	.6185 (15.710)	.6205 (15.760)	.0005 (0.013)	.0020 (0.050)
1857 (2)	B	Gearbox Idler Shaft (72−61−20) Gearbox (Idler) Shaft Boss Assembly (72−61−17) (See Figure 801, Sheet 2)				
		Shaft	.6185 (15.7099)	.6190 (15.7226)		
		Boss Assembly (Post SB PW4ENG 72−491)	.6195 (15.736)	.6205 (15.760)	.0005T (0.013T)	.0020 (0.050)
1858	A	Roller Bearing (72−61−13) Gearbox (Idler) Spur Gear (72−61−21) (See Figure 801, Sheet 2)				
		Bearing (Pre SB PW4ENG 72−664)	2.0468 (51.9888)	2.0473 (52.0014)		
		Gear (Pre SB PW4ENG 72−664)	2.0456 (51.9583)	2.0463 (51.9760)	.0017T (0.043T)	.0005T (0.013T)
1859	B	Gearbox (IDG Drive) Bearing Housing Assembly (72−61−32) Gearbox Housing Assembly (72−61−10) (See Figure 805, Sheet 2)				
		Bearing Housing	9.0985 (231.102)	9.0995 (231.127)		
		Gearbox Housing (Post SB PW4ENG 72−574)	9.1000 (231.140)	9.1015 (231.178)	.0005 (0.013)	.0059* (0.150*)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
1860	B	Face (Oil) Seal Assembly (72−61−19) Gearbox (IDG Drive) Bearing Housing Assembly (72−61−32) (See Figure 805, Sheet 2)				
		Seal	4.618 (117.298)	4.623 (117.424)		
		Housing (Post SB PW4ENG 72−574)	4.6240 (117.450)	4.6252 (117.480)	.0010 (0.025)	.0072 (0.183)
1861	B	Roller Bearing (72−61−13) Gearbox Housing Assembly (72−61−10) (See Figure 805, Sheet 2)				
		Bearing	4.5273 (114.9935)	4.5277 (115.0035)		
		Housing (Post SB PW4ENG 72−574)	4.5279 (115.009)	4.5289 (115.034)	.0002 (0.006)	.0016 (0.040)
1862	A	Gearbox (IDG Drive) Spur Gearshaft Assembly (72−61−31) Roller Bearing, Front (72−61−13) (See Figure 805, Sheet 2)				
		Gearshaft (Post SB PW4ENG 72−574)	2.9539 (75.0291)	2.9544 (75.0417)		
		Bearing	2.9525 (74.9935)	2.9529 (75.0036)	.0019T (0.0482T)	.0010T (0.0254T)
1863	A	Gearbox (IDG Drive) Spur Gearshaft Assembly (72−61−31) Roller Bearing, Rear (72−61−13) (See Figure 805, Sheet 2)				
		Gearshaft (Post SB PW4ENG 72−574)	2.9539 (75.0291)	2.9544 (75.0417)		
		Bearing	2.9525 (74.9935)	2.9529 (75.0036)	.0019T (0.0482T)	.0010T (0.0254T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1864	A	Roller Bearing (72−61−13) Gearbox (Idler) Spur Gear (72−61−21) (See Figure 801, Sheet 2)				
		Bearing (Post SB PW4ENG 72−664)	2.0468 (51.9888)	2.0473 (52.0014)		
		Gear (Post SB PW4ENG 72−664)	2.0451 (51.9456)	2.0456 (51.9582)	.0022T (0.056T)	.0012T (0.030T)

G. Spring Loads

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1980	A	Main Oil Strainer (Filter) Cover Assembly Helical Compression Spring (72−61−64) (Pre SB PW4ENG 72−525 only) (See Figure 802)				
			0.980 Inches (24.892 mm)		40.125 lbs (18.20 kg)	45.375 lbs (20.58 kg)
1981	A	Pressure Regulator Relief Valve Helical Compression Spring (72−61−63) (See Figure 801, Sheet 2)				
			3.478 Inches (88.341 mm)		45.250 lbs (20.53 kg)	53.8125 lbs (24.41 kg)
			2.662 Inches (67.615 mm)		188.0625 lbs (85.30 kg)	207.8125 lbs (94.26 kg)

H. Spline Data

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
560	B	1. Scavenge Pump Gearshaft (CCM) Internal Spline (See Figure 806)				
		A. Effective Space Width	.0491 (1.247)	−−−		
		B. Actual				

MAIN GEARBOX − INSPECTION/CHECK−04

	I		New Part Reference			
Ref.	F		Dimensions		Limits	
No.	R	Description	Min	Max	Min	Max
(CONTINUED)						
		Space Width	---	.0509 (1.293)		
		2. Scavenge Pump Spur Gearshaft (72−61−44) External Spline (See Figure 806)				
		A. Effective Tooth Thickness	---	.0476 (1.209)		
		B. Actual Tooth Thickness	.0458 (1.163)	---		
		3. Fit			.0015 (0.038)	---
955	B	1. Gearbox Drive Coupling (72−62−13) Internal Spline (See Figure 808, Sheet 1)				
		A. Effective Space Width	.1309 (3.325)	---		
		B. Actual Space Width	---	.1344 (3.414)		
		2. Gearbox Driveshaft (72−61−80) External Spline (See Figure 808, Sheet 1)				
		A. Effective Tooth Thickness	---	.1274 (3.236)		
		B. Actual Tooth Thickness	.1239 (3.147)	---		

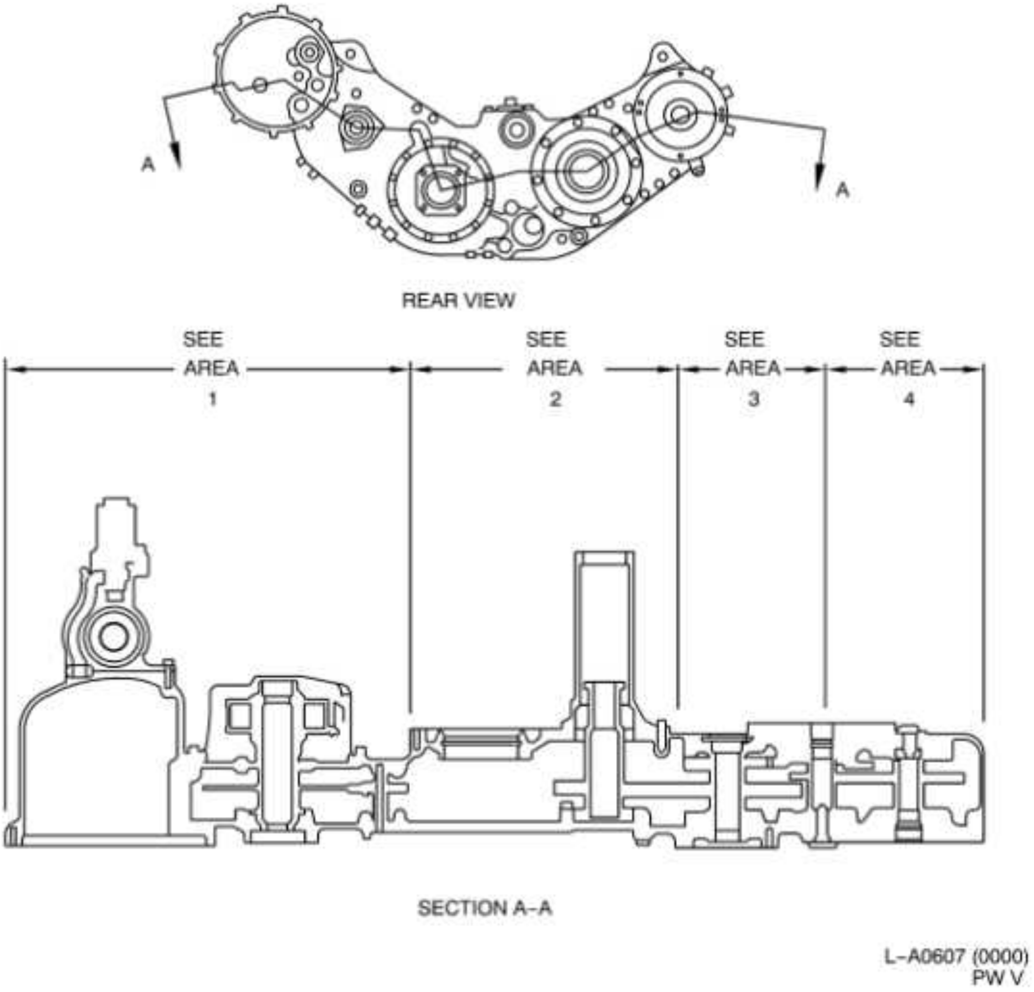
MAIN GEARBOX - INSPECTION/CHECK-04

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)						
		3. Fit			.0035 (0.089)	---
956	B	1. Gearbox Driveshaft (72-61-80) Internal Spline (See Figure 808, Sheet 1)				
		A. Effective Space Width	.0979 (2.487)	---		
		B. Actual Space Width	---	.1009 (2.563)		
		2. Gearbox Drive Spur Gearshaft (72-61-22) External Spline (See Figure 801, Sheet 1)				
		A. Effective Tooth Thickness	---	.0944 (2.398)		
		B. Actual Tooth Thickness	.0915 (2.324)	---		
		3. Fit			.0035 (0.089)	---
1970	B	1. Gearbox Deoiler Impeller Lock (72-61-16) Internal Spline (See Figure 801, Sheet 2)				
		A. Effective Space Width	.0785 (1.994)	---		
		B. Actual Space Width	---	.0817 (2.075)		

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
(CONTINUED)						
		2. Gearbox (Deoiler) Spur Gearshaft Assembly (72-61-11) External Spline (See Figure 801, Sheet 2)				
		A. Effective Tooth Thickness	---	.0778 (1.956)		
		B. Actual Tooth Thickness	.0739 (1.877)	---		
		3. Fit			.0015 (0.038)	---
1971	B	1. Gearbox (Starter Drive) Gearshaft Assembly (72-61-24) Internal Spline (See Figure 801, Sheet 4)				
		A. Effective Space Width	.0785 (1.994)	---		
		B. Actual Space Width	---	.0806 (2.047)		
		2. Gearbox (Starter Drive) Coupling (72-61-25) External Spline				
		A. Effective Tooth Thickness	---	.0750 (1.905)		
		B. Actual Tooth Thickness	.0729 (1.852)	---		
		3. Fit			.0035 (0.089)	---

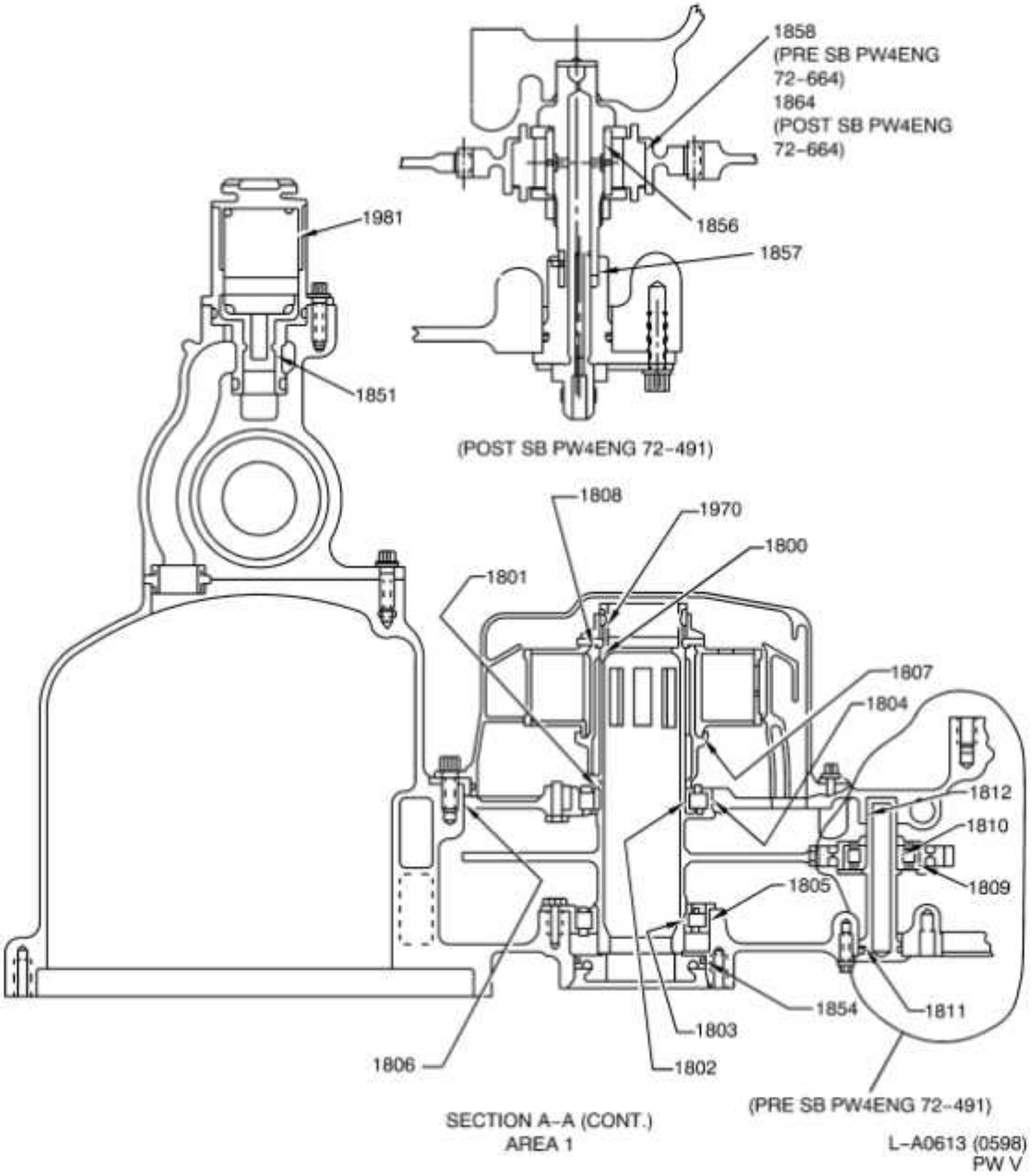
I. Special Torques

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
570	A	EEC Generator (Alternator) Rotor Lock Retaining Nut (See Figure 807) See 72-61-00, Assembly-03 Task 72-61-00-400-003				
571		Thermocouple Locknut See 72-61-00, Assembly-03 Task 72-61-00-400-003				
572		Thermocouple Nut See 72-61-00, Assembly-03 Task 72-61-00-400-003				
1120	A	Gearbox (Front Hydraulic Pump Drive) Spur Gearshaft Bearing Retaining Nut (See Figure 805, Sheet 1 or 2) See 72-61-07, Assembly-01 Task 72-61-07-440-001				
1121		Oil Tank Heat Shield Hose Clamp Screw (See Figure 809) See 72-61-00, Assembly-01 Task 72-61-00-400-003				
2151		Oil Tank Heat Shield Hose Clamp Screw (See Figure 809) See 72-61-00, Assembly-01 Task 72-61-00-400-003				


A
A
REAR VIEW
SEE AREA 1
SEE AREA 2
SEE AREA 3
SEE AREA 4
SECTION A-A
L-A0607 (0000)
PW V

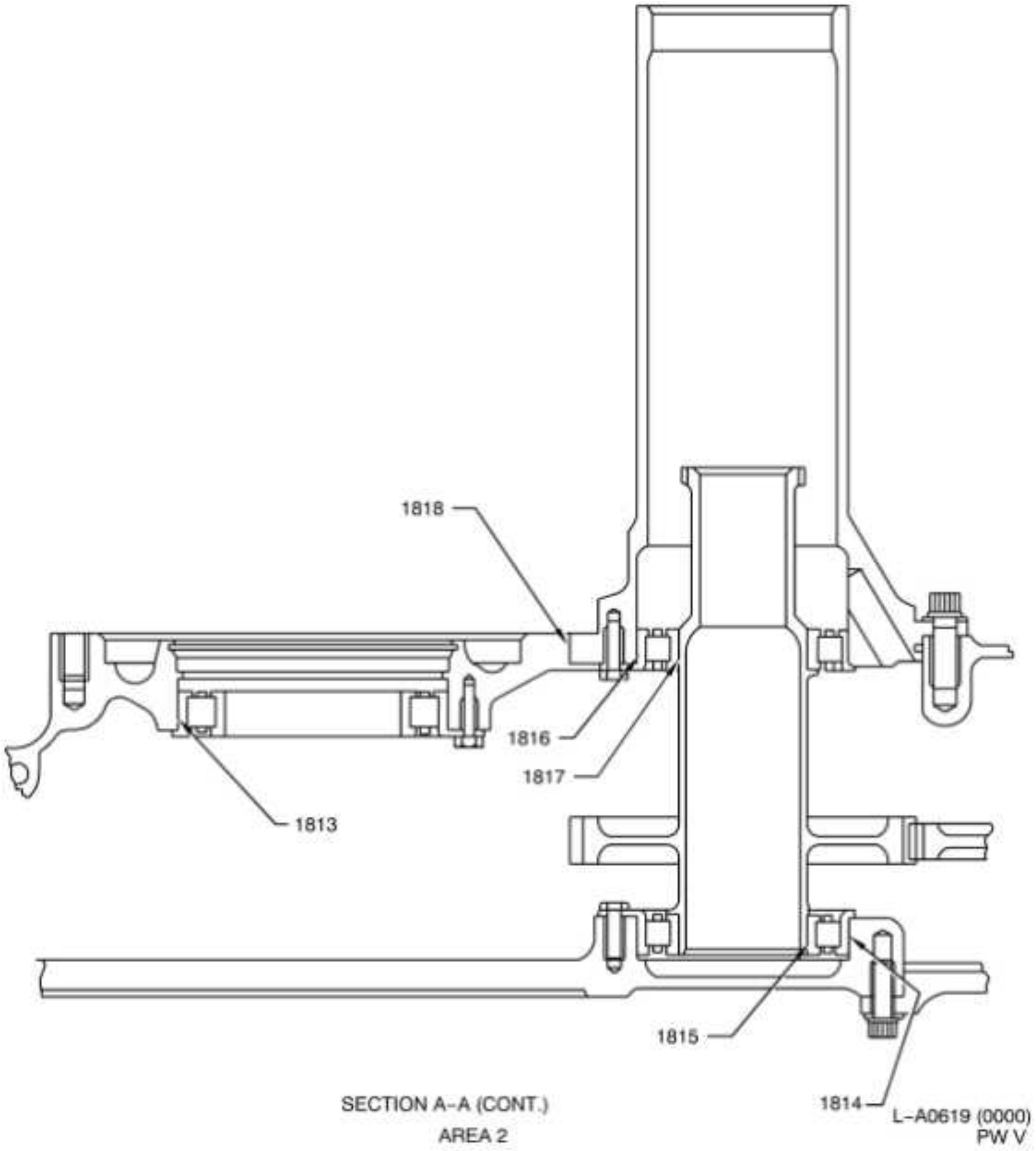
Main Gearbox
Figure 801 (Sheet 1)
(Task 72−61−00−990−001)

MAIN GEARBOX − INSPECTION/CHECK−04


1858
(PRE SB PW4ENG 72-664)
1864
(POST SB PW4ENG 72-664)
1856
1857
1981
1851
(POST SB PW4ENG 72-491)
1808
1970
1800
1801
1807
1804
1812
1810
1809
1805
1854
1811
1803
1802
1806
(PRE SB PW4ENG 72-491)
SECTION A-A (CONT.)
AREA 1
L-A0613 (0598)
PW V

Main Gearbox
Figure 801 (Sheet 2)
(Task 72−61−00−990−001)

MAIN GEARBOX − INSPECTION/CHECK−04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1813
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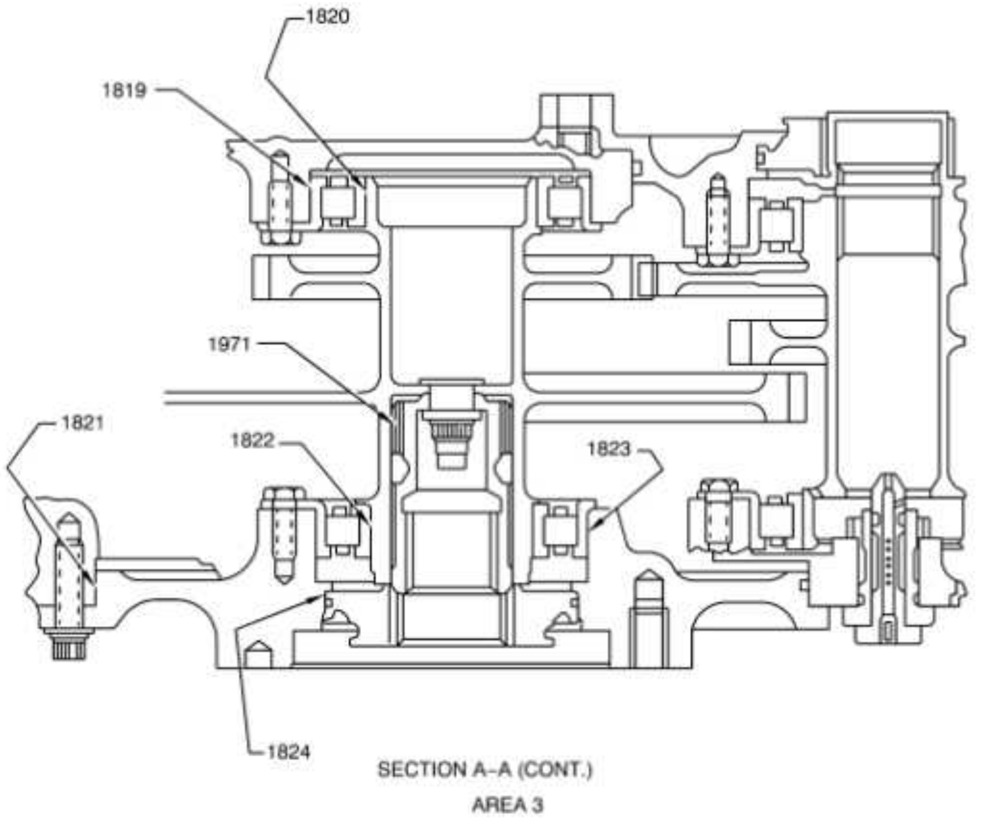
SECTION A−A (CONT.)
AREA 2
L−A0619 (0000)
PW V

Main Gearbox
Figure 801 (Sheet 3)
(Task 72−61−00−990−001)

MAIN GEARBOX − INSPECTION/CHECK−04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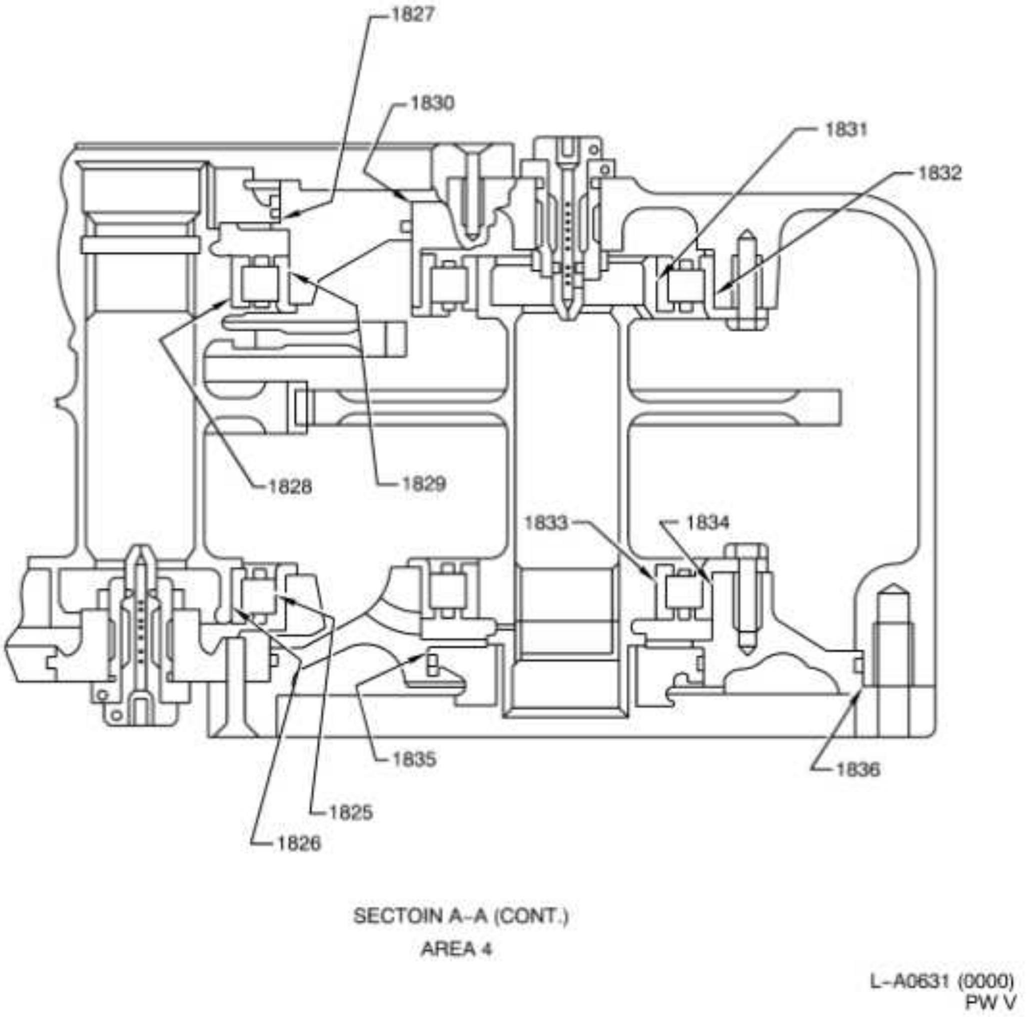
1819
1971
1821
1822
1823
1824
SECTION A-A (CONT.)
AREA 3

L-A0625 (0000)
PW V

Main Gearbox
Figure 801 (Sheet 4)
(Task 72−61−00−990−001)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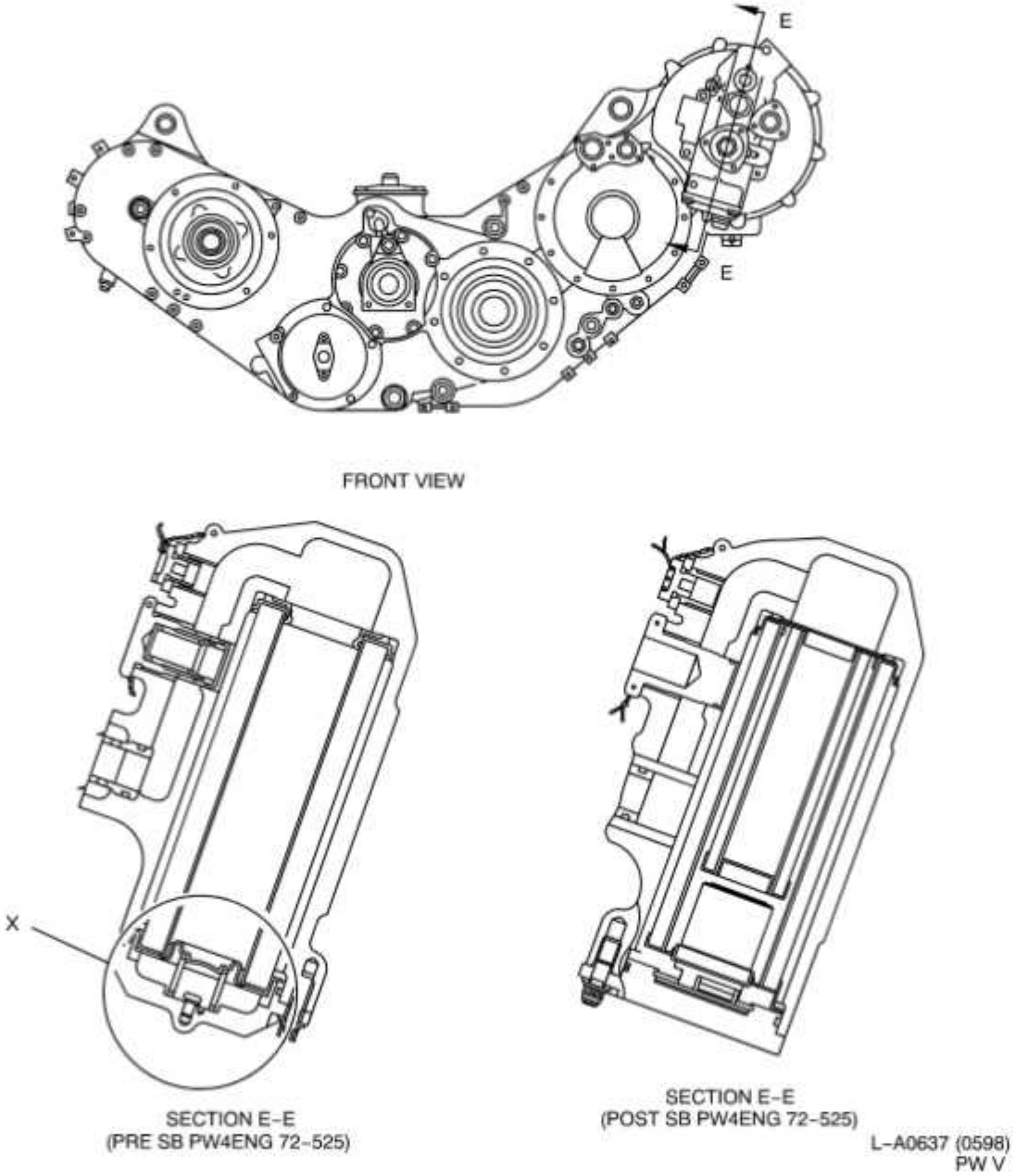
1835
1836
1825
1826
SECTOIN A-A (CONT.)
AREA 4
L-A0631 (0000)
PW V

Main Gearbox
Figure 801 (Sheet 5)
(Task 72−61−00−990−001)



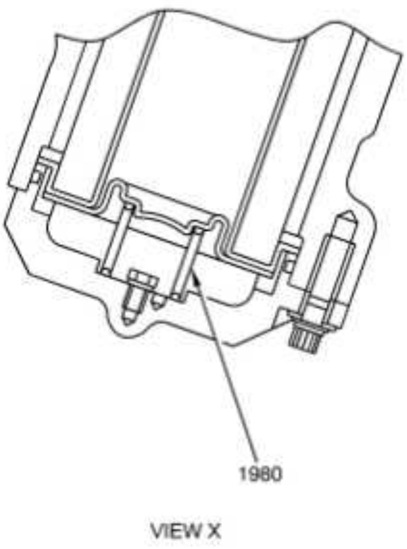
FRONT VIEW

SECTION E-E
(PRE SB PW4ENG 72-525)

SECTION E-E
(POST SB PW4ENG 72-525)

L-A0637 (0598)
PW V

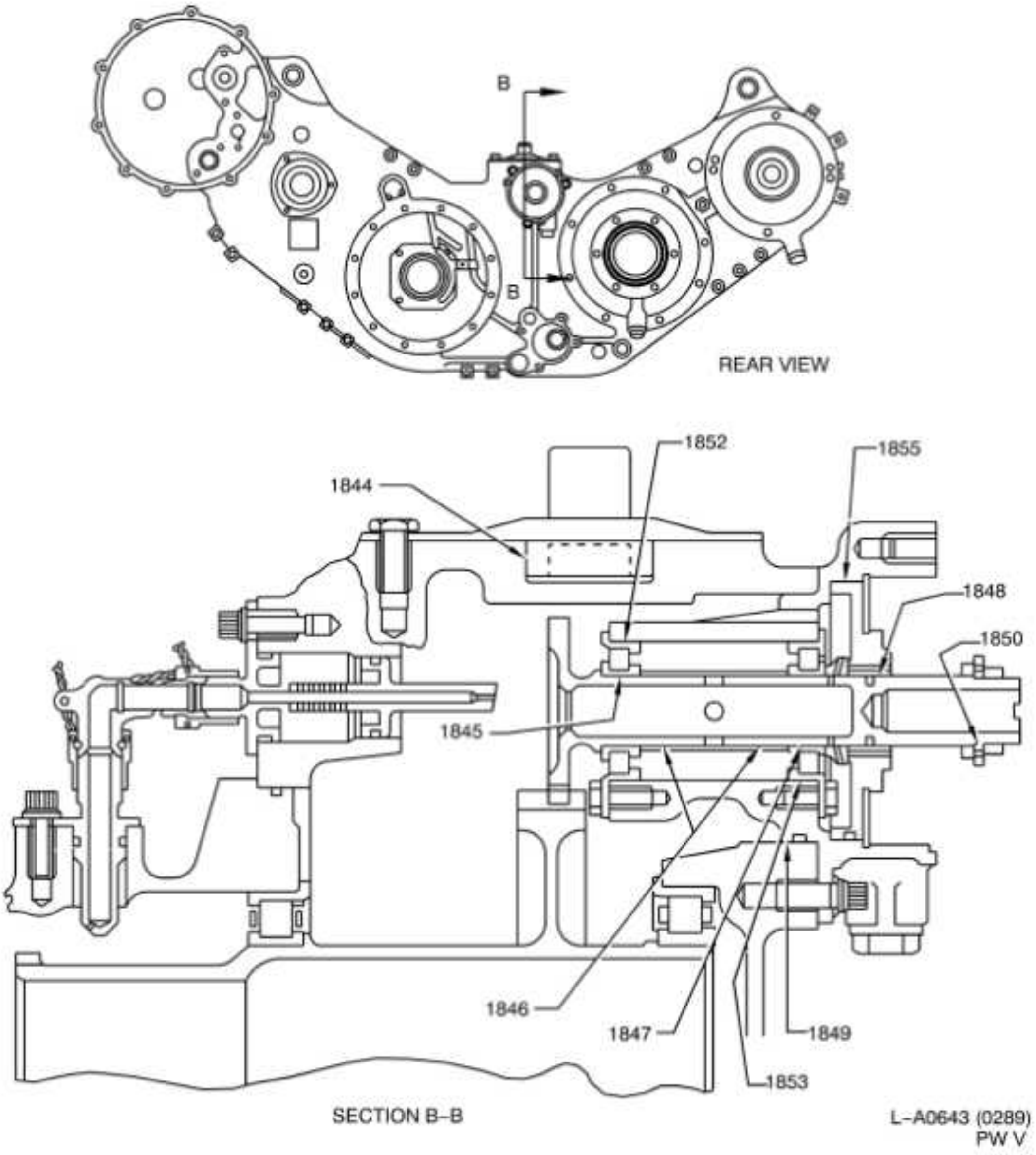
Main Gearbox
Figure 802 (Sheet 1)
(Task 72−61−00−990−001)


1980
VIEW X

L−B6436 (0598)
PW V

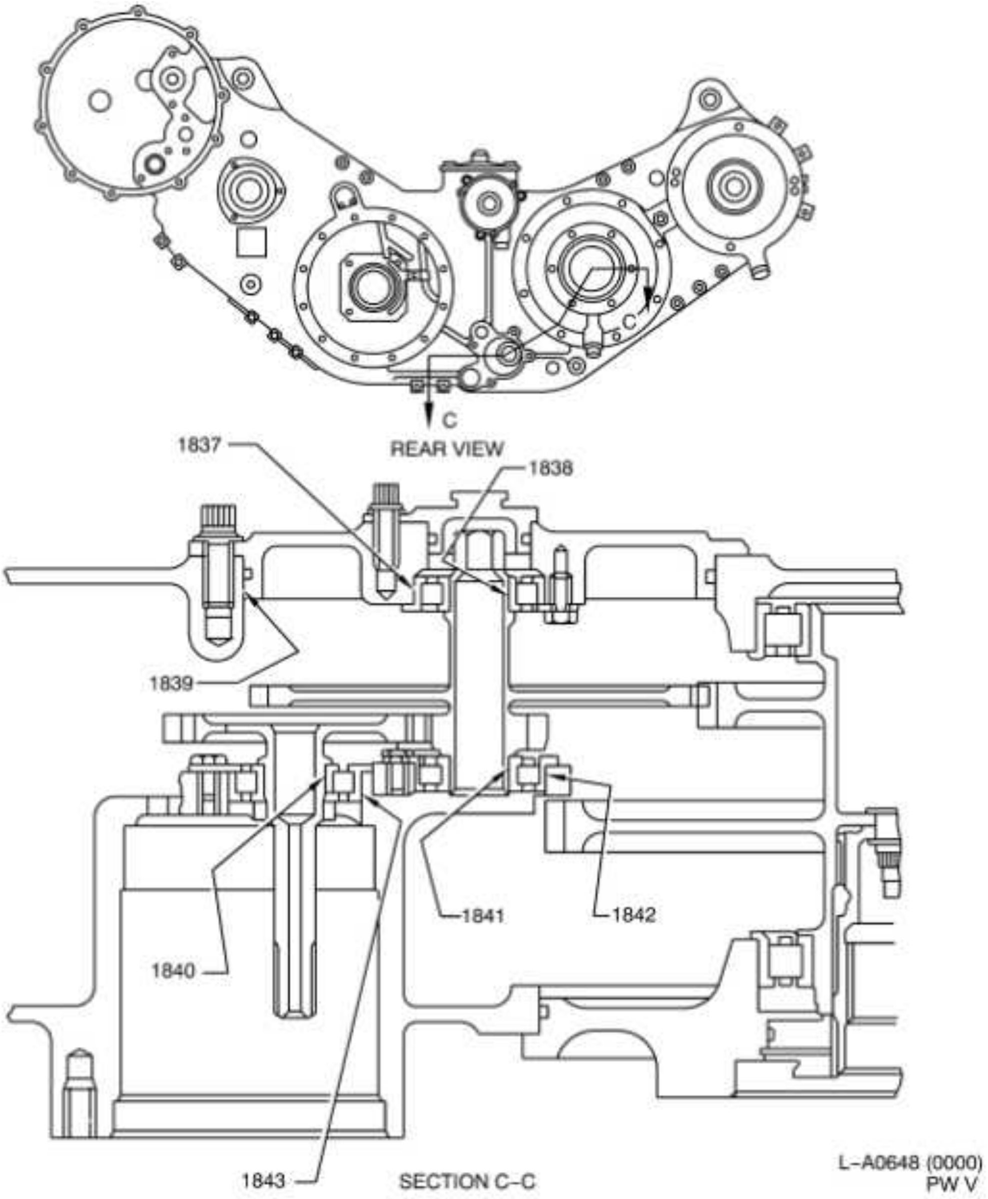
Main Gearbox
Figure 802 (Sheet 2)
(Task 72−61−00−990−001)

MAIN GEARBOX − INSPECTION/CHECK−04


B
B
REAR VIEW
1852
1855
1844
1848
1850
1845
1846
1847
1849
1853
SECTION B–B
L–A0643 (0289)
PW V

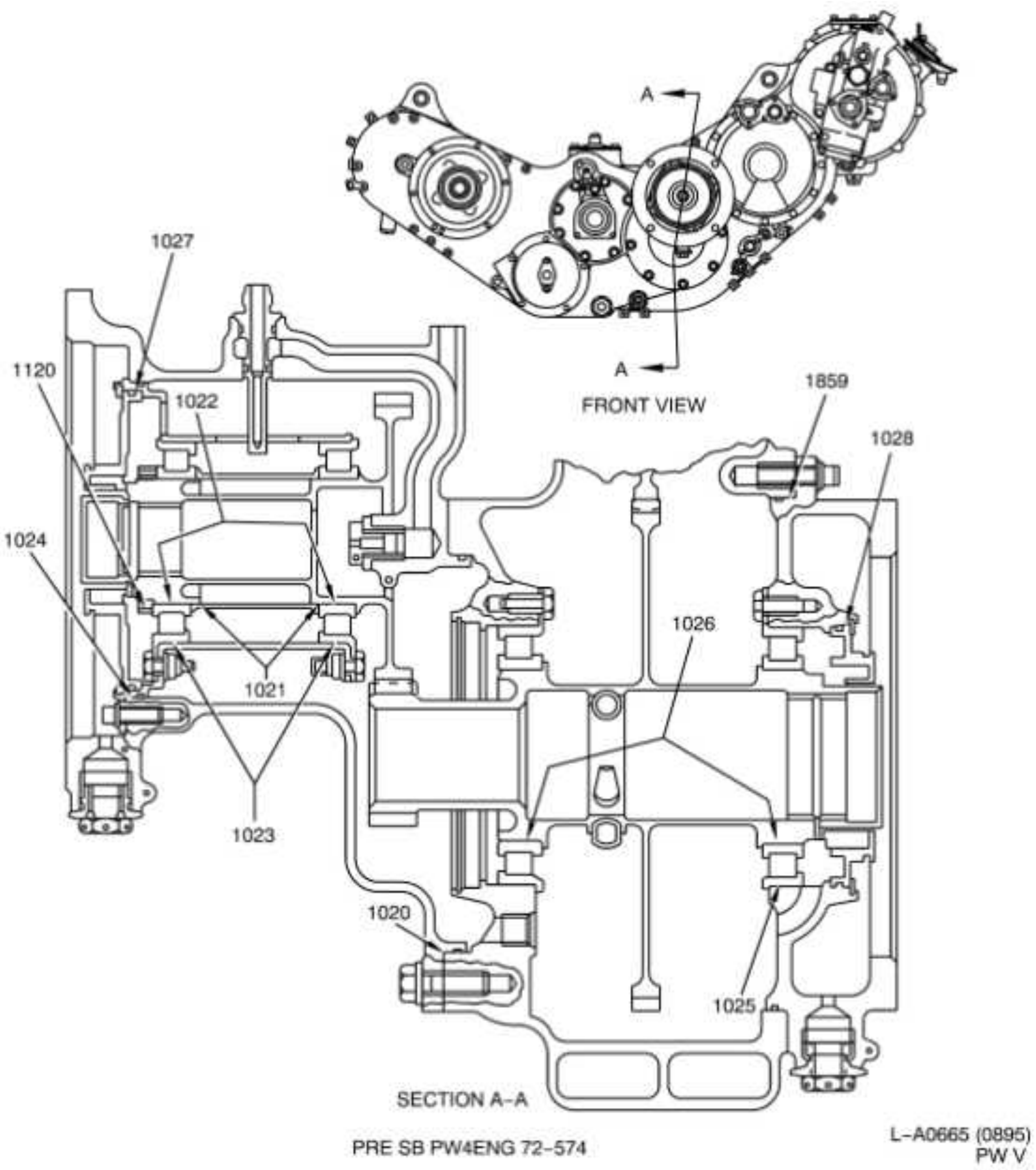
Main Gearbox
Figure 803
(Task 72−61−00−990−001)

MAIN GEARBOX − INSPECTION/CHECK−04

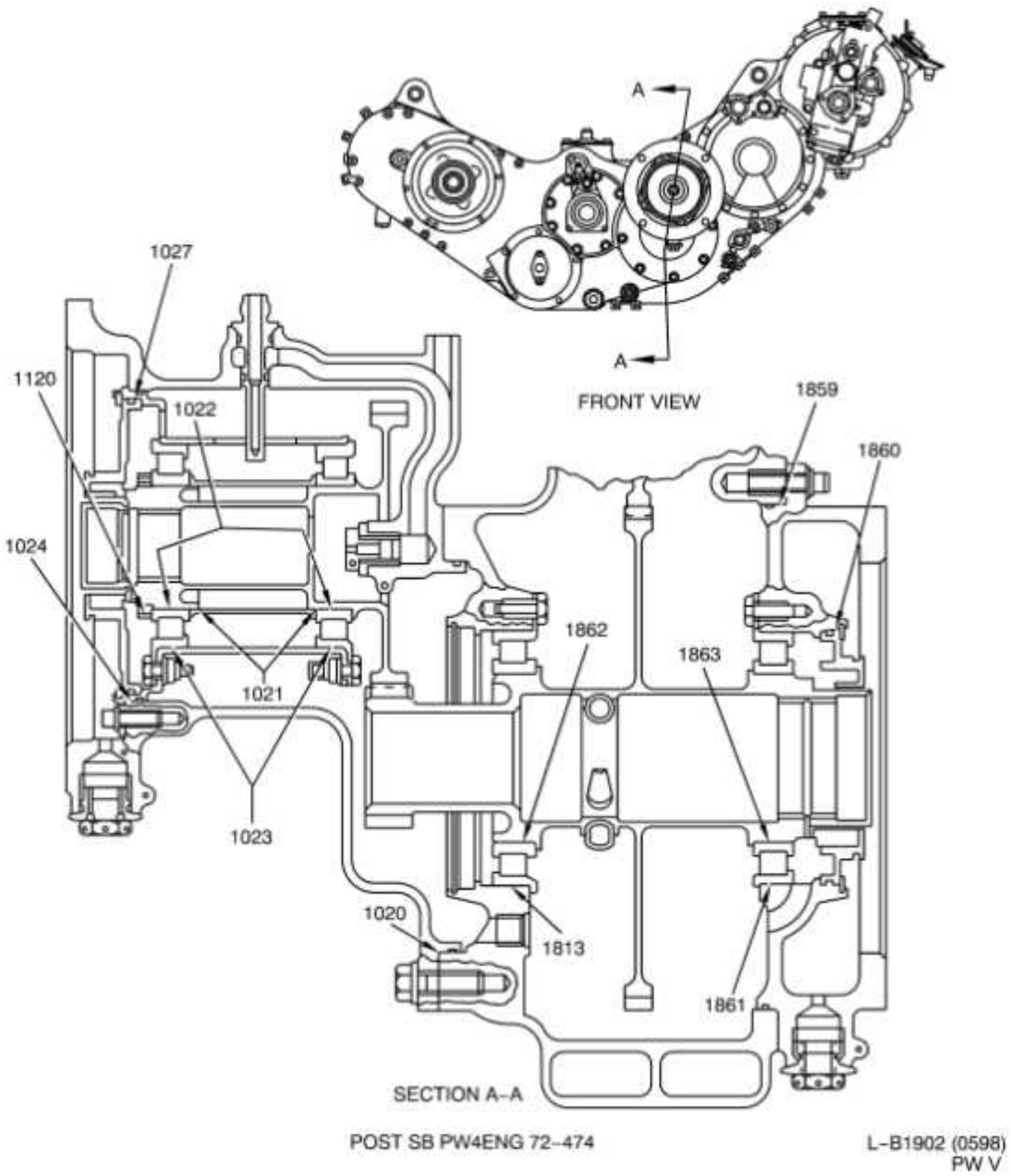

C
C
C
REAR VIEW
1837
1838
1839
1840
1841
1842
1843
SECTION C–C
L–A0648 (0000)
PW V

Main Gearbox
Figure 804
(Task 72−61−00−990−001)

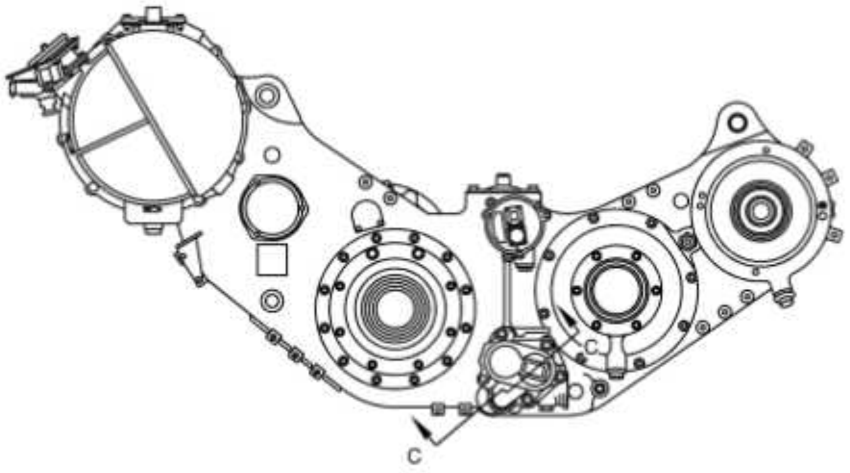
MAIN GEARBOX − INSPECTION/CHECK−04


A
FRONT VIEW
A
1027
1120
1022
1024
1021
1023
1020
1859
1028
1026
1025
SECTION A-A
PRE SB PW4ENG 72-574
L-A0665 (0895)
PW V

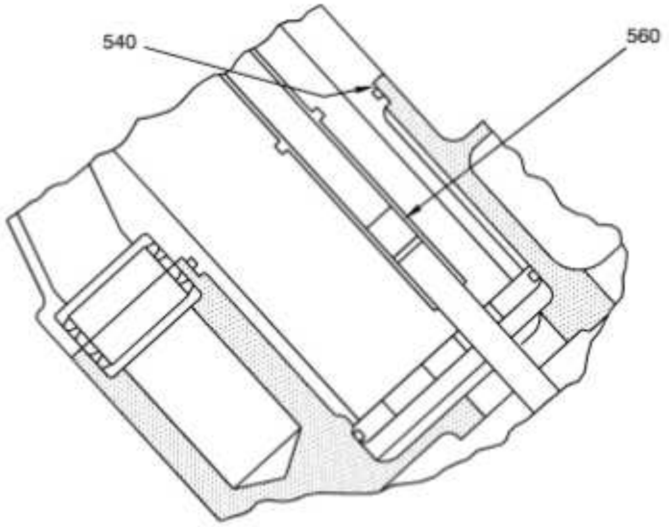
Main Gearbox (Pre SB PW4ENG 72−574)
Figure 805 (Sheet 1)
(Task 72−61−00−990−001)


A
A
FRONT VIEW
1027
1120
1022
1024
1021
1023
1859
1860
1862
1863
1020
1813
1861
SECTION A–A
POST SB PW4ENG 72–474
L–B1902 (0598)
PW V

Main Gearbox (Post SB PW4ENG 72−574)
Figure 805 (Sheet 2)
(Task 72−61−00−990−001)



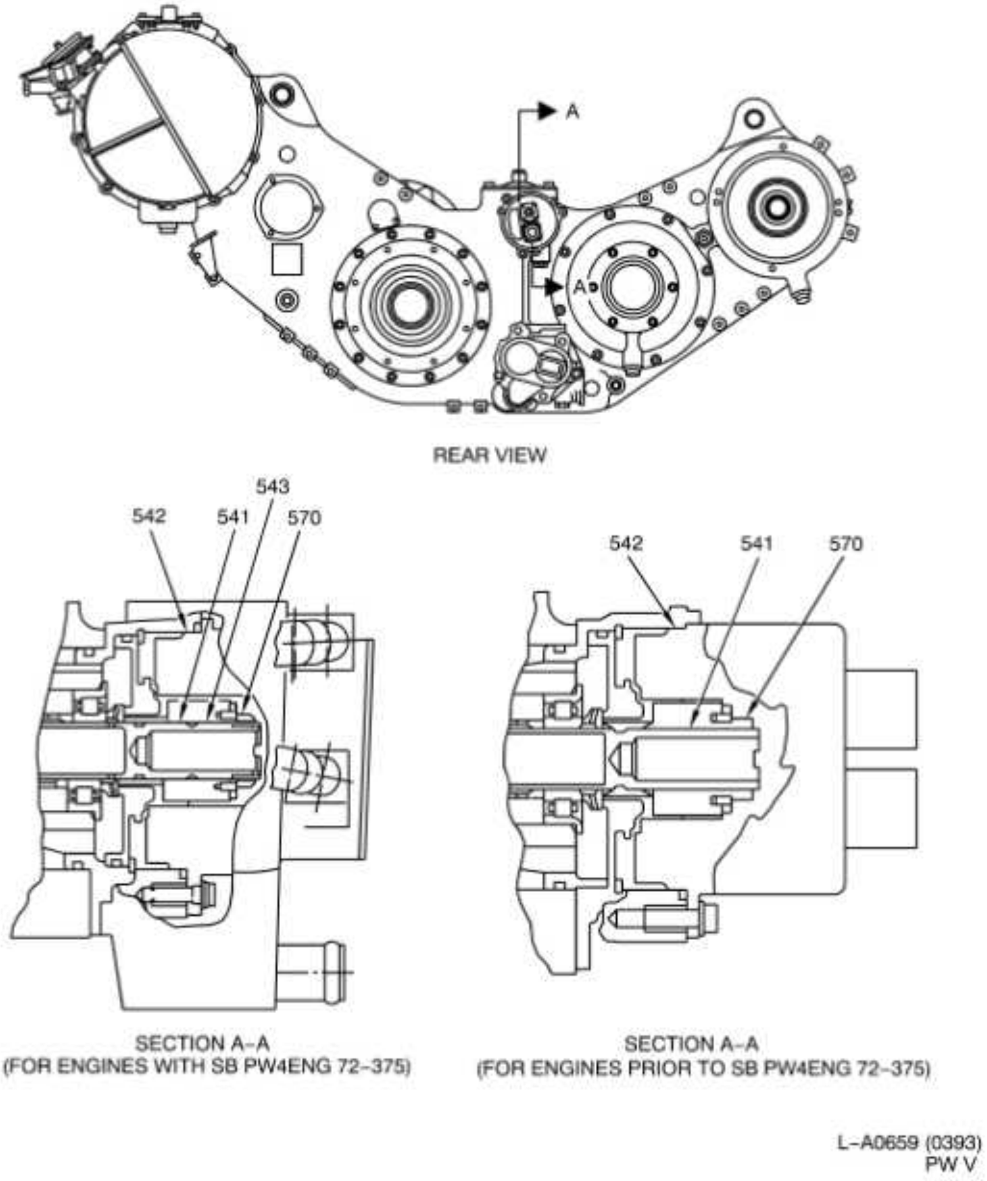
REAR VIEW



SECTION C-C

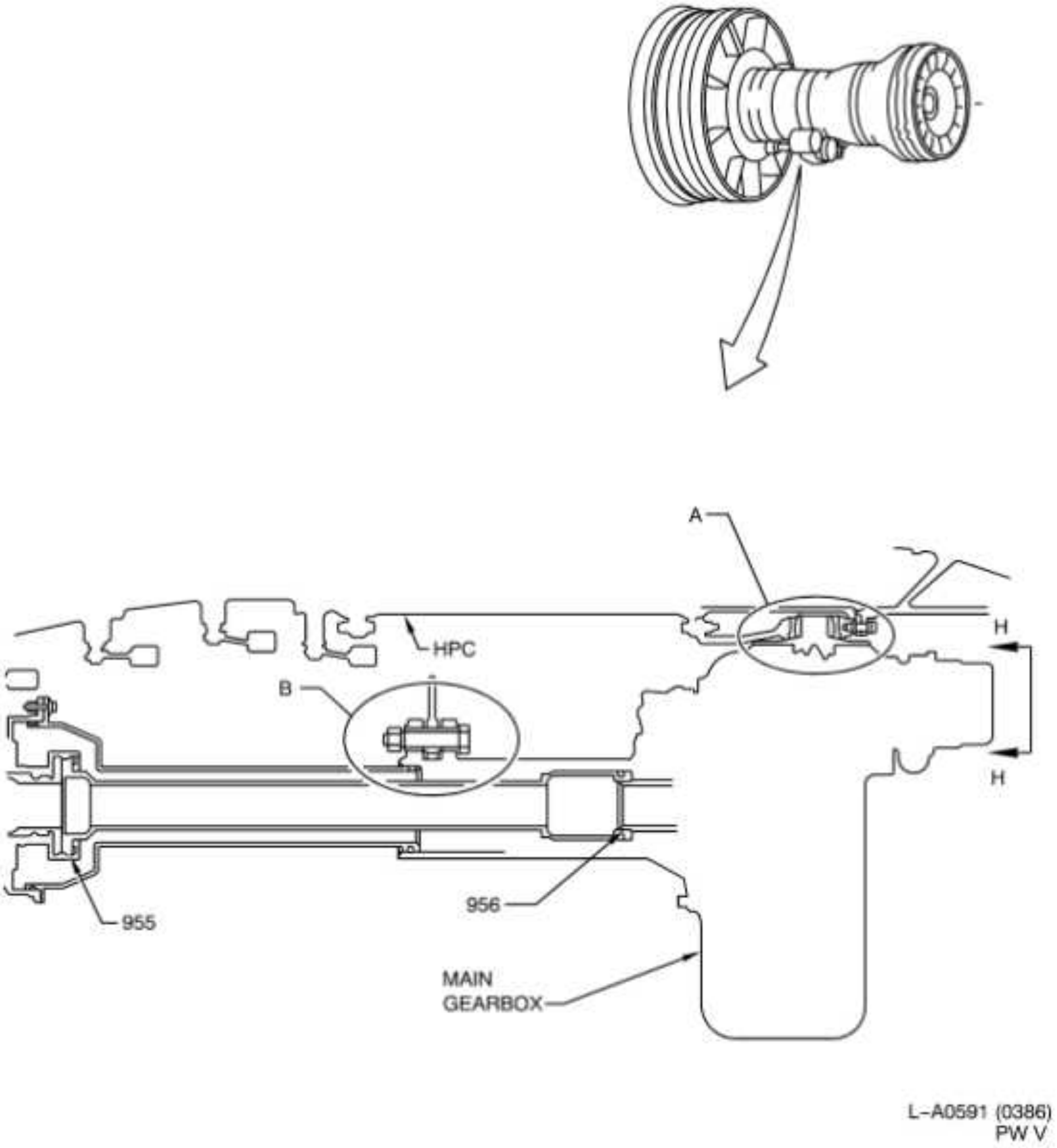
L-A0653 (1291)
PW V

Main Gearbox
Figure 806
(Task 72-61-00-990-001)

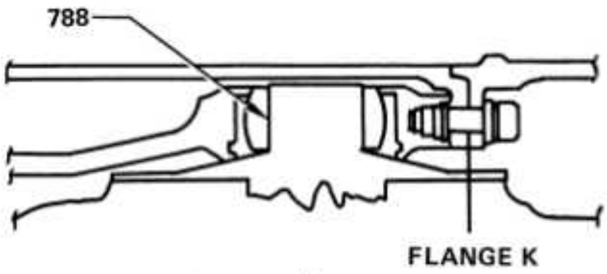

A
A
REAR VIEW
543
542
541
570
SECTION A-A
(FOR ENGINES WITH SB PW4ENG 72-375)
542
541
570
SECTION A-A
(FOR ENGINES PRIOR TO SB PW4ENG 72-375)
L-A0659 (0393)
PW V

Main Gearbox
Figure 807
(Task 72−61−00−990−001)

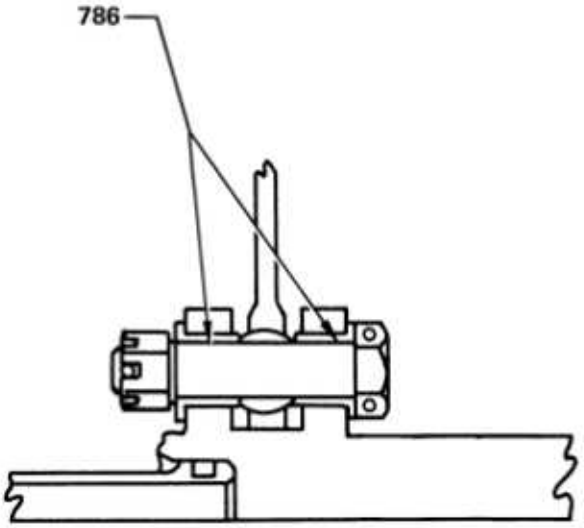
MAIN GEARBOX − INSPECTION/CHECK−04


A
HPC
B
H
H
955
956
MAIN GEARBOX
L−A0591 (0386)
PW V

Main Gearbox
Figure 808 (Sheet 1)
(Task 72−61−00−990−001)

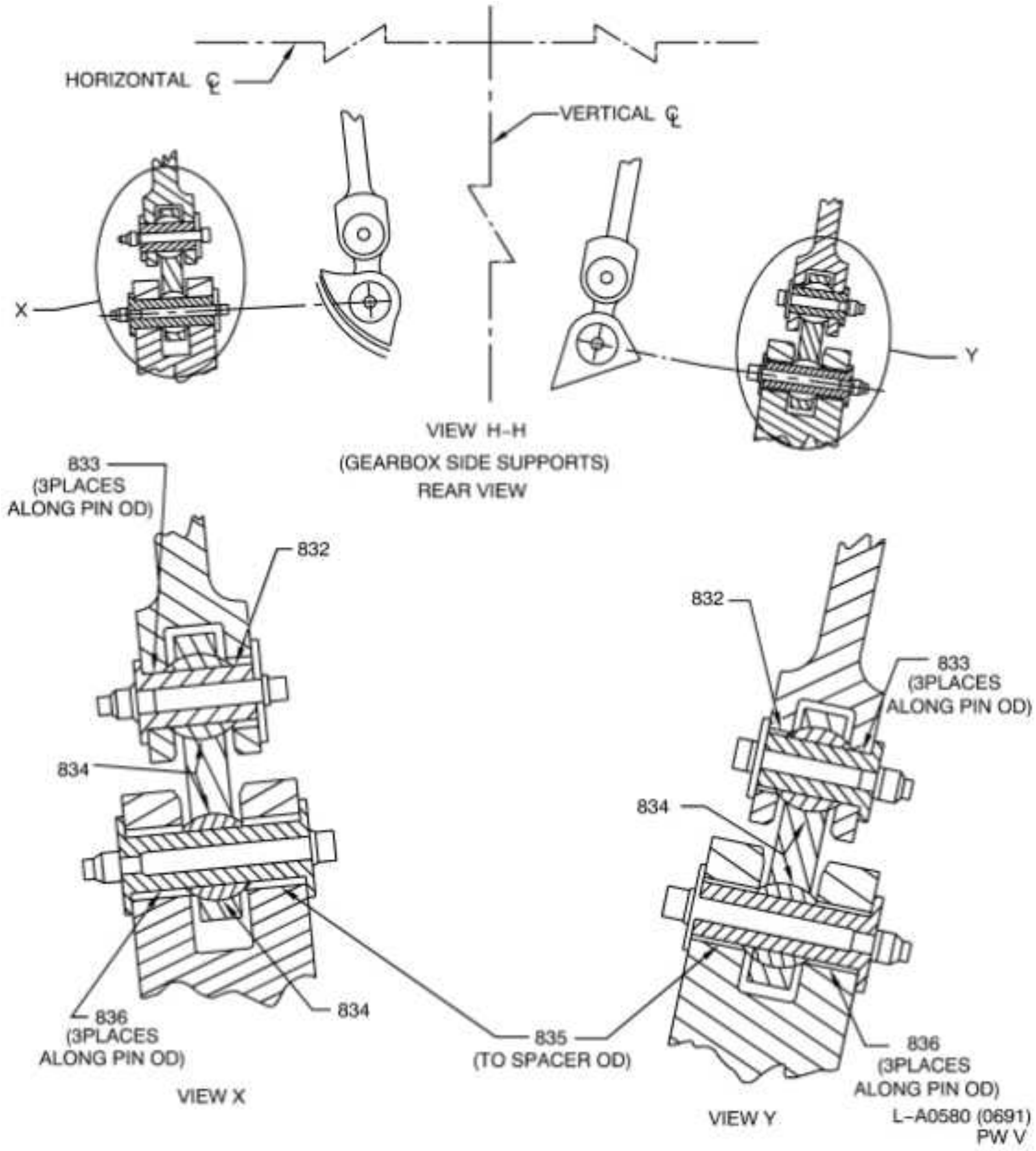

788
FLANGE K

VIEW A

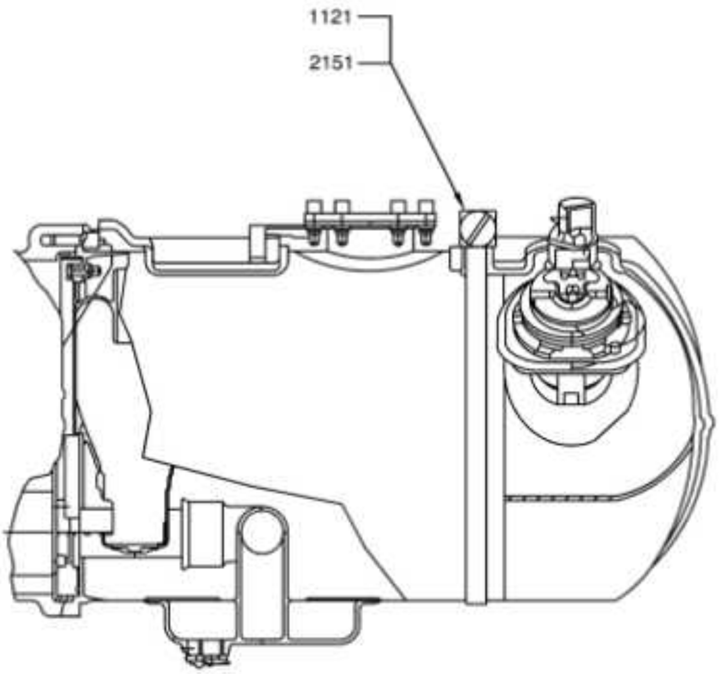


VIEW B

Main Gearbox
Figure 808 (Sheet 2)
(Task 72-61-00-990-001)


HORIZONTAL ℄
VERTICAL ℄
X
Y
VIEW H-H
(GEARBOX SIDE SUPPORTS)
REAR VIEW
833
(3PLACES
ALONG PIN OD)
832
834
836
(3PLACES
ALONG PIN OD)
834
835
(TO SPACER OD)
VIEW X
832
833
(3PLACES
ALONG PIN OD)
834
836
(3PLACES
ALONG PIN OD)
VIEW Y
L-A0580 (0691)
PW V

Main Gearbox
Figure 808 (Sheet 3)
(Task 72−61−00−990−001)



L−B4186 (1096)
PW V

Main Gearbox Oil Tank Heat Shield Hose Clamp Screw
Figure 809
(Task 72−61−00−990−001)

MAIN GEARBOX − ASSEMBLY−01

Task 72−61−00−400−001:

1. Assemble Main Gearbox

A. Prerequisites

(1) See 72−61−00, Inspection/Check−04 Task 72−61−00−990−001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

(2) Assemble main oil filter, housing and pressure relief valves assembly per 72−61−00, Assembly−04 Task 72−61−00−400−004.

(3) Assemble lube oil tank, deaerator and baffle assembly per 72−61−00, Assembly−05 Task 72−61−00−400−005.

(4) Assemble deoiler gearshaft and bearings assembly per 72−61−01, Assembly−01 Task 72−61−01−440−001.

(5) Assemble gearbox drive gearshaft and bearings assembly per 72−61−02, Assembly−01 Task 72−61−02−440−001.

(6) Assemble starter drive gearshaft and bearings assembly per 72−61−03, Assembly−01 Task 72−61−03−440−001.

(7) Assemble fuel pump drive gearshaft and bearings assembly per 72−61−04, Assembly−01 Task 72−61−04−440−001.

(8) Assemble rear hydraulic pump drive gearshaft and bearings assembly per 72−61−05, Assembly−01 Task 72−61−05−440−001.

(9) Assemble scavenge pump drive gearshaft and bearing assembly per 72−61−08, Assembly−01 Task 72−61−08−440−001−001 or 72−61−08, Assembly−01 Task 72−61−08−440−001−002.

(10) Assemble EEC alternator drive gearshaft and bearings assembly per 72−61−09, Assembly−01 Task 72−61−09−440−001.

(11) Assemble scavenge pump drive idler gearshaft and bearings assembly per 72−61−40, Assembly−01 Task 72−61−40−440−001.

MAIN GEARBOX - ASSEMBLY-01

(12) Assemble the front hydraulic pump drive gearshaft and bearings assembly. Refer to 72-61-07, Assembly-01 Task 72-61-07-440-001.

B. Equipment And Materials Required

Standard Tools:

No. 10 Torq-Set Drive

Special Tools:

PWA 75599	Build Stand
PWA 80130	Gage, Force
PWA 85123	Fixture (Optional to PWA 86056 Fixture)
PWA 85241	Arm
PWA 85242	Adapter
PWA 85285	Wrench (Optional to PWA 86149 Wrench)
PWA 85327	Adapter
PWA 85338	Drift
PWA 85339	Base
PWA 85372	Wrench
PWA 86056	Fixture
PWA 86149	Wrench

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire
P06-007	Jelly, Petroleum
P06-054	Paste, Anti-Seize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72-61-00/6/40
Gasket	1	72-61-00/17/60
Packing	1	72-61-00/2/1
Nut	1	72-61-00/2/20
Packing	1	72-61-00/2/30
Packing	1	72-61-00/2/40
Packing	1	72-61-00/2/130
Packing	1	72-61-00/2/170
Packing	1	72-61-00/2/200
Packing	1	72-61-00/2/220
Packing	1	72-61-00/3/110

MAIN GEARBOX - ASSEMBLY-01

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
(CONTINUED)		
Packing	1	72-61-00/3/170
Packing	1	72-61-00/3/200
Packing	1	72-61-00/3/220
Packing	1	72-61-00/4/1
Packing	1	72-61-00/5/1
Nut	1	72-61-00/5/50
Packing	1	72-61-00/6/30
Packing	1	72-61-00/6/90
Packing	1	72-61-00/6/170
Packing	1	72-61-00/7/1
Nut	1	72-61-00/7/20
Packing	1	72-61-00/7/30
Packing	1	72-61-00/7/40
Packing	1	72-61-00/7/130
Packing	1	72-61-00/7/170
Nut	1	72-61-00/8/30
Packing	1	72-61-00/8/90
Packing	1	72-61-00/8/160
Packing	1	72-61-00/9/30
Packing	1	72-61-00/10/40
Packing	1	72-61-00/10/140
Packing	1	72-61-00/11/1
Packing	1	72-61-00/11/20
Packing	1	72-61-00/12/80
Packing	1	72-61-00/12/110
Packing	1	72-61-00/12/120
Packing	1	72-61-00/17/1
Packing	1	72-61-00/17/30
Lockwire, AS3214-02		

C. Procedure

Subtask 72-61-00-430-051:

(1) Install gearbox housing in build stand. See Figure 1001.

(a) Attach the gearbox lug to the gearbox with four bolts. Torque the bolts to 125 - 140 lb-in. (14.123 - 15.818 N.m).

(b) Insert shaft of PWA 85327 Adapter through hole in rear post of stand.

(c) Align boltholes in post details of PWA 86056 Fixture or PWA 85123 Fixture with boltholes in four ground handling points of gearbox. Secure post details to gearbox using bolts (1001/2).

(d) Attach PWA 85242 Adapter to gearbox mounting lugs and secure with two pins (1001/1).

(e) Attach PWA 85241 Arm to fixture and secure with four detail screws.

(f) Attach hoist to arm and trunnion gearbox to horizontal position.

(g) Position gearbox between posts of stand. Align boltholes in PWA 85242 Adapter with boltholes in mounting pad of stand and secure with detail bolts.

(h) Remove screws securing arm to fixture. Remove arm.

(i) Slide PWA 85327 Adapter forward and align bolt holes and secure PWA 85237 Adapter to fixture with four bolts (1001/3).

Subtask 72−61−00−430−052:

(2) Insert gearbox strainer element (1002/3) through suitable opening in gearbox housing (1002/1) and position in sump in bottom center of housing. Align boltholes and secure strainer with two bolts (1002/2) lubricated with Engine Oil P03−001. Torque bolts to 27 − 30 lb−in. (3.051 − 3.390 N.m). See Figure 1002.

(3) (Engines Without The Alternate Lubrication Configuration) Install the gearbox pressure manifold assembly. See Figure 1003 (Sheet 1) and Figure 1004 (Sheet 1).

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER. MATING NUMBERS ARE MARKED ON DETAIL PARTS OF BEARING.

(a) Obtain mating bearing outer race (1003/2) from spur gear end of gearbox drive gearshaft and bearings assembly (1003/5). Align boltholes and position outer race inside gearbox housing to pad at rear of gearbox drive bore (1003/3). Secure outer race using three new bolts (1003/1) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70−41−03−380−034). Refer to Section 70−41−03 in the Standard Practices Manual, PN 585005. Do not install bolt in hole at lower right bolt hole location (1003/4). Torque bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(b) Obtain mating bearing outer race (1003/8) from small spur gear end of IDG drive gearshaft and bearings assembly (1003/11). Align boltholes and position outer race inside gearbox housing to pad at rear of IDG drive bore (1003/7). Position bracket (1003/9) to boltholes on right side of bearing outer race. Secure outer race using three new bolts (1003/10) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70−41−03−380−034). Refer to Section 70−41−03 in the Standard Practices Manual, PN 585005. Do not install bolt in hole at upper right bolt hole location (1003/6). Torque bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(c) Install gasket (1004/6) over threaded stud detail of gearbox pressure manifold (1004/13).

(d) Lubricate packings (1004/4) and (1004/7) with Engine Oil P03−001.

(e) Install packing (1004/7) to groove in stud detail of pressure manifold. Install packing (1004/4) to groove in bushing (1004/3).

(f) Position manifold inside gearbox. Insert stud detail of manifold through bore in boss on front side of gearbox directly over front hydraulic pump drive bore (1004/5). Install bushing (1004/3), with packing installed, over pressure manifold stud detail and into bore in front side of gearbox housing. Install washer (1004/2) and nut (1004/1), lubricated with Engine Oil P03−001, onto stud detail of manifold. Do not torque nut.

(g) Install a new bolt (1004/8) or bolt which has the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034), through lug detail of manifold and the bracket (1004/11) installed before and bearing outer race. Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Do not torque bolt.

(h) Secure manifold to bracket (1004/11) using clamp (1004/9), bolt (1004/10), lubricated with Engine Oil P03-001, and nut (1004/12). Do not torque bolt.

(i) Align boltholes and secure curved bracket detail of manifold with boltholes in previously installed bearing outer race in rear of gearbox housing. Secure manifold and bearing outer race using a new bolt (1004/14) or bolt which has the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034). Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Torque bolt to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(j) Torque bolt (1004/10) securing clamp to bracket to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(k) Torque bolt (1004/8) securing manifold lug to gearbox housing to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(l) Torque nut (1004/1) securing bushing to stud detail of manifold to 85 - 95 lb-in. (9.6 - 10.7 N.m).

(4) (Engines With The Alternate Lubrication Configuration) Install the gearbox pressure manifold assembly. See Figure 1003 (Sheet 2) and Figure 1004 (Sheet 2).

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER. MATING NUMBERS ARE MARKED ON DETAIL PARTS OF BEARING.

(a) Obtain the mating bearing outer race (1003/2) from the spur gear end of the gearbox drive gearshaft and bearings assembly (1003/5). Align the boltholes and position the outer race inside the gearbox housing to the pad at the rear of gearbox drive bore (1003/3). Secure the outer race using three bolts (1003/1). Do not install a bolt in hole at lower right bolt hole location (1003/4). Torque the bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(b) Obtain the mating bearing outer race (1003/8) from the small spur gear end of the IDG drive gearshaft and bearings assembly (1003/11). Align the boltholes and position the outer race inside the gearbox housing to the pad at the rear of the IDG drive bore (1003/7). Position the bracket (1003/9) to the boltholes on the right side of the bearing outer race. Position the bracket (1003/12) to the boltholes on left side of the bearing outer race. Secure the outer race and brackets with three bolts (1003/10 and 1003/13). Do not install a bolt in hole at the upper right bolt hole location (1003/6). Torque the bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(c) Install the gasket (1004/6) over the threaded stud detail of the gearbox pressure manifold (1004/24).

(d) Lubricate the packings (1004/4) and (1004/7) with Engine Oil P03−001.

(e) Install the packing (1004/7) to the groove in the stud detail of the pressure manifold. Install the packing (1004/4) to the groove in the bushing (1004/3).

(f) Position the manifold inside the gearbox. Insert the stud detail of the manifold through the bore in the boss on the front side of the gearbox directly over the front hydraulic pump drive bore (1004/5). Install the bushing (1004/3), with the packing installed, over the pressure manifold stud detail and into the bore in the front side of the gearbox housing. Install the washer (1004/2) and nut (1004/1), lubricated with Engine Oil P03−001, onto the stud detail of the manifold. Do not torque the nut.

(g) Install the bolt (1004/8) through the lug detail of the manifold, the previously installed bracket (1004/11) and the bearing outer race. Do not torque the bolt.

(h) Secure the manifold to the bracket (1004/11) with the clamp (1004/9), bolt (1004/10), lubricated with Engine Oil P03-001, and nut (1004/12). Do not torque the bolt.

(i) Align the boltholes and attach the curved bracket detail of the manifold with the boltholes in the previously installed bearing outer race in the rear of gearbox housing. Secure the manifold and bearing outer race with the bolt (1004/14). Torque the bolt to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(j) Apply Engine Oil P03-001 to the packing (1004/25) and install the packing to the end of the oil supply tube (1004/26). Install the packing end of the supply tube to the port on the side of the manifold. Attach the tube to the bracket (1004/29) with the bolt (1004/27), threads lubricated with Engine Oil P03-001, clamp (1004/28) and nut (1004/30).

(k) Torque the bolt (1004/10) that attaches the clamp to the bracket to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(l) Torque the bolt (1004/8) that attaches the manifold lug to the gearbox housing to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(m) Torque the nut (1004/1) that attaches the bushing to the stud detail of the manifold to 85 - 95 lb-in. (9.6 - 10.7 N.m).

Subtask 72-61-00-430-053:

(5) Install fuel pump drive gearshaft and bearings assembly. See Figure 1005.

(a) Install packing (1005/9), lubricated with Engine Oil P03-001, into groove in gearbox nozzle bushing (1005/10). Insert bushing, with hex head toward rear side of gearbox, into gearbox nozzle bore (1005/14). Using PWA 85372 Wrench, install bushing with new nut (1005/8) lubricated with Engine Oil P03-001. Torque nut to 300 - 350 lb-in. (34 - 39 N.m).

(b) Install packings (1005/12) and (1005/11), lubricated with Engine Oil P03-001, into grooves in nozzle (1005/13). Insert nozzle, lubricated with Engine Oil P03-001, with hex head toward rear side of gearbox, into previously installed bushing (1005/10). Torque nozzle to 90 - 100 lb-in. (10.169 - 11.298 N.m).

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER. MATING NUMBERS ARE MARKED ON DETAIL PARTS OF BEARING.

(c) Align boltholes and position mating bearing outer race (1005/7) onto pad in rear wall of gearbox housing directly behind fuel pump drive pad (1005/15). Secure outer race using three new bolts (1005/5) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034). Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Torque bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER. MATING NUMBERS ARE MARKED ON DETAIL PARTS OF BEARING.

(d) Align boltholes and position mating bearing outer race (1005/3) onto pad in rear side of bearing housing (1005/1). Secure outer race using four new bolts (1005/4) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034). Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Torque bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(e) Insert fuel pump drive gearshaft and bearings assembly (1005/6), smaller spur gear toward rear, through bore in fuel pump drive pad (1005/15). Mate roller bearing on gearshaft with previously installed bearing outer race.

(f) Install packing (1005/2), lubricated with Engine Oil P03-001, into groove in bearing housing (1005/1). Align boltholes in housing with boltholes in fuel pump drive pad (1005/15). Align bearing outer race in housing with mating bearing on gearshaft and seat housing on fuel pump drive pad. Install new screw (1005/19) or screw which has the antigalling compound replaced by

SPOP 139 (Task 70-41-03-380-034), into chamfered bolthole in outer flange of housing. Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Torque screw to 27 - 30 lb-in. (3.051 - 3.390 N.m).

(g) Install packing (1005/16), lubricated with Engine Oil P03-001, into OD groove in face (oil) seal (1005/17). Install seal, carbon seal towards gearshaft, into bore in gearbox bearing housing (1005/1). Secure seal in bearing housing using retaining ring (1005/18).

NOTE: Before installing carbon seal, work seal thoroughly in engine oil to ensure free movement of carbon element. Carbon seal ring must have free axial movement without detectable binding throughout its full travel in seal carrier after immersion in engine oil, just prior to installation in gearbox assembly.

Subtask 72-61-00-430-054:

(6) (Pre SB PW4ENG 72-114) Install scavenge pump drive gearshaft and bearing assembly. See Figure 1006.

(a) Insert scavenge pump drive gearshaft and bearing assembly (1006/5), gearshaft end first, through scavenge pump drive pad (1006/3) and into scavenge pump drive gearshaft bore (1006/2) in internal pad of gearbox. Secure bearing using two screws (1006/6) or screws which have the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034). Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Use a No. 10 Torq-Set Drive, torque screws to 27 - 30 lb-in. (3.051 - 3.390 N.m).

Subtask 72-61-00-430-055:

CAUTION: USE THE CORRECT PART NUMBERS. INTERCHANGEABILITY IS AFFECTED.

(7) (Pre SB PW4ENG 72-114) Install scavenge pump drive idler gearshaft and bearings assembly. See Figure 1006.

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER. MATING NUMBERS ARE MARKED ON DETAIL PARTS OF BEARING.

(a) Align boltholes and position bearing outer race (1006/18) into scavenge pump drive idler gearshaft bore (1006/1). Secure bearing outer race using two new screws (1006/17) or screws which have the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034). Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Use a No. 10 Torq-Set Drive, torque screws to 27 - 30 lb-in. (3.051 - 3.390 N.m).

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER. MATING NUMBERS ARE MARKED ON DETAIL PARTS OF BEARING.

(b) Attach the bearing outer race (1006/12) to the bearing housing assembly (1006/11) with two new bolts (1006/16) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034). Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Torque the bolts to 27 - 30 lb-in. (3.051 - 3.390 N.m).

(c) Insert scavenge pump drive idler gearshaft and bearings assembly (1006/4), with smaller spur gear end toward rear, through bore in scavenge pump drive pad (1006/3). Mate roller bearing on gearshaft with bearing outer race and mesh smaller spur gear with previously installed scavenge pump drive gearshaft.

CAUTION: CORRECT INSTALLATION OF THE (SCAVENGE PUMP DRIVE) BEARING HOUSING ASSEMBLY IS VERY IMPORTANT. INCORRECT INSTALLATION OF THE HOUSING ASSEMBLY CAN DAMAGE THE ROLLERS OF THE BEARING.

(d) Install the (scavenge pump drive) bearing housing assembly (1006/11).

1 Lubricate with Engine Oil P03-001 a new packing (1006/15).

2 Install the packing in the packing groove of the bearing housing assembly.

3 Fill each cage of the front roller bearing on the idler gearshaft (1006/4) with Petroleum Jelly P06−007. The rollers must touch the inner race.

4 Do these three steps together:

a Very carefully install the bearing housing assembly on the scavenge pump drive pad (1006/3).

b Point a light into the center hole of the bearing housing assembly.

c Look into the hole to make sure that the rollers are engaged in the outer race.

5 Attach the bearing housing assembly to the gearbox with five washers (1006/14) and five new bolts (1006/13) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70−41−03−380−034). Refer to Section 70−41−03 in the Standard Practices Manual, PN 585005. Torque the bolts to 125 − 140 lb−in. (14.123 − 15.818 N.m).

(e) Install packing (1006/7), lubricated with Engine Oil P03−001, into groove in OD of cover (1006/8). Align boltholes and install cover into bore in center of bearing housing. Secure cover using two new bolts (1006/10) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70−41−03−380−034). Refer to Section 70−41−03 in the Standard Practices Manual, PN 585005. Torque bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

Subtask 72−61−00−430−075:

CAUTION: USE THE CORRECT PART NUMBERS.
INTERCHANGEABILITY IS AFFECTED.

(8) (Post SB PW4ENG 72−114) Install scavenge pump drive gearshaft and bearing assembly together with the scavenge pump drive idler gearshaft and bearings assembly. See Figure 1007.

(a) Carefully install the bearing outer race and rollers (1007/15) on the scavenge pump drive gearshaft (1007/16).

(b) Insert scavenge pump drive gearshaft and inner race assembly (1007/16), shaft end first, through scavenge pump drive pad (1007/14) and into scavenge pump drive gearshaft bore (1007/2) in internal pad of gearbox.

(c) Using a No. 10 Torq-Set Drive, secure the bearing outer race and rollers with two new screws (1007/17) or screws which have the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034). Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Torque the screws to 27 - 30 lb-in. (3.051 - 3.390 N.m).

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER. MATING NUMBERS ARE MARKED ON DETAIL PARTS OF BEARING.

(d) Align boltholes and position scavenge pump drive idler gearshaft bearing outer race (1007/3) into scavenge pump drive idler gearshaft bore (1007/1). Secure bearing outer race with two new screws (1007/4) or screws which have the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034). Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Use a No. 10 Torq-Set Drive. Torque screws to 27 - 30 lb-in. (3.051 - 3.390 N.m).

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER. MATING NUMBERS ARE MARKED ON DETAIL PARTS OF BEARING.

(e) Install the guide (1007/7). See Figure 1008 for installation.

1 Place the guide (1007/7), non-chamfered end first, on the flat face of the bearing outer race (1007/18).

2 Attach the guide and the bearing outer race (1007/18) to the bearing housing (1007/19).

a Apply Anti-Seize Paste P06-054 to the threads of two screws (1007/6). Remove the unwanted paste.

b Attach the guide and the outer race to the bearing housing with the two screws.

c Use a No. 10 Torq−Set Drive.

d Torque to 27 − 30 lb−in. (3.051 − 3.390 N.m).

(f) Insert scavenge pump drive idler gearshaft and bearings assembly (1007/5), with smaller spur gear end toward rear, through bore in scavenge pump drive pad (1007/14).

(g) Pull up on scavenge pump drive gearshaft (1007/16) so that inner race and rollers of idler gearshaft (1007/5) can clear the scavenge pump drive gearshaft. Mesh idler and oil pump drive gears. Seat idler and oil pump drive gearshafts. Mesh idler large gear with adjacent starter drive gear.

(h) Remove any raised material on sleeve (1007/12) with a file or fine stone. From rear of gearbox, install scavenge pump drive gearshaft bearing ring (1007/13) and sleeve (1007/12).

NOTE: The ring is a detail of the bearing inner race. See Figure 1009.

CAUTION: CORRECT INSTALLATION OF THE (SCAVENGE PUMP DRIVE) BEARING HOUSING ASSEMBLY IS VERY IMPORTANT. INCORRECT INSTALLATION OF THE HOUSING ASSEMBLY CAN DAMAGE THE ROLLERS OF THE BEARING.

(i) Install the gearbox (scavenge pump drive) bearing housing assembly (1007/19).

1 Lubricate with Engine Oil P03−001 a new packing (1007/8).

2 Install the packing in the packing groove of the bearing housing assembly.

3 Fill each cage of the front roller bearing on the idler gearshaft (1007/5) with Petroleum Jelly P06−007. The rollers must touch the inner race.

4 Do these three steps together:

a Very carefully install the bearing housing assembly on the scavenge pump drive pad (1007/14).

b Point a light into the center hole of the bearing housing assembly.

c Look into the hole to make sure that the rollers are engaged in the outer race.

d Attach the bearing housing assembly to the gearbox with five washers (1007/9) and five new bolts (1007/10) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70−41−03−380−034). Refer to Section 70−41−03 in the Standard Practices Manual, PN 585005. Torque the bolts to 125 − 140 lb−in. (14.123 − 15.818 N.m).

(j) Insert new nut (1007/11) from rear of gearbox and install on scavenge pump drive gearshaft (1007/16), fingertight.

(k) Insert wrench through hole in bearing housing assembly (1007/19) and install over wrenching flats at outboard end of idler gear (1007/5).

(l) While applying counter−torque with the idler gear wrench, torque nut (1007/11) to 500 − 600 lb−in. (57 − 68 N.m), using PWA 85372 Wrench.

(m) Install packing (1007/20), lubricated with Engine Oil P03−001, into groove in OD of cover (1007/21). Align boltholes and install cover into bore in center of bearing housing. Secure cover using two new bolts (1007/23) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70−41−03−380−034). Refer to Section 70−41−03 in the Standard Practices Manual, PN 585005. Torque bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

Subtask 72−61−00−430−076:

CAUTION: USE THE CORRECT PART NUMBERS.
INTERCHANGEABILITY IS AFFECTED.

(9) (Post SB PW4ENG 72−463) Install the scavenge pump drive gearshaft and bearing assembly. See Figure 1010.

(a) Install the gearshaft and bearing assembly (1010/4), shaft end first, through the scavenge pump drive pad (1010/3) and into the scavenge pump drive gearshaft bore (1010/2).

(b) Attach the assembly to the surface in the gearbox with two new screws (1010/5)or screws which have the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034), through the bearing outer race. Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Use a No. 10 Torq-set Drive, torque the screws to 27 - 30 lb-in. (3.051 - 3.390 N.m).

Subtask 72-61-00-430-077:

CAUTION: USE THE CORRECT PART NUMBERS. INTERCHANGEABILITY IS AFFECTED.

(10) (Post SB PW4ENG 72-463) Install the scavenge pump drive idler gearshaft and bearing assembly. See Figure 1010.

CAUTION: YOU MUST KEEP TOGETHER ALL THE DETAILS OF A BEARING. THE MATING NUMBERS ARE MARKED ON THE DETAIL PARTS OF THE BEARING.

(a) Attach the bearing outer race (1010/18) to the scavenge pump drive idler gearshaft bore (1010/1) with two new screws (1010/17) or screws which have the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034). Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Use a No. 10 Torq-set Drive, torque the screws to 27 - 30 lb-in. (3.051 - 3.390 N.m).

(b) Attach the bearing outer race (1010/7) to the (scavenge pump drive) bearing housing assembly (1010/8) with two new screws (1010/6) or screws which have the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034). Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Use a No. 10 Torq-set Drive, torque the screws to 27 - 30 lb-in. (3.051 - 3.390 N.m).

(c) Apply Engine Oil P03-001 to a packing (1010/15). Install the packing in the groove in the (scavenge pump drive) bearing housing assembly (1010/8).

(d) Install the scavenge pump drive idler gearshaft and bearing inner race assembly (1010/16), small gear first, in the bearing outer race (1010/18).

(e) Carefully install the bearing housing assembly (1010/8) over the scavenge pump drive idler gearshaft and bearing inner race assembly (1010/16).

(f) Attach the bearing housing assembly (1010/8) to the gearbox. Use five washers (1010/14) and five new bolts (1010/13) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70−41−03−380−034). Refer to Section 70−41−03 in the Standard Practices Manual, PN 585005. Torque the bolts to 125 − 140 lb−in. (14.123 − 15.818 N.m).

(g) Apply Engine Oil P03−001 to a packing (1010/9). Install the packing in the groove in the cover (1010/10). Attach the cover to the bearing housing (1010/8). Use two washers (1010/11) and two new bolts (1010/12) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70−41−03−380−034). Refer to Section 70−41−03 in the Standard Practices Manual, PN 585005. Torque the bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

Subtask 72−61−00−430−056:

(11) Install gearbox nozzles and gearbox drive gearshaft and bearings assembly. See Figure 1011 and Figure 1012.

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER. MATING NUMBERS ARE MARKED ON DETAIL PARTS OF BEARING.

(a) Align boltholes and install bearing outer race (1011/4) into rear ID of gearbox driveshaft housing (1011/8). Secure outer race using four new bolts (1011/3) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70−41−03−380−034). Refer to Section 70−41−03 in the Standard Practices Manual, PN 585005. Torque bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(b) Insert gearbox drive gearshaft and bearings assembly (1011/1), large spur gear end toward rear, through bore in gearbox drive pad (1011/2). Mate roller bearing with previously installed bearing outer race in rear wall of gearbox.

(c) Install packing (1011/5) lubricated with Engine Oil P03-001, into groove in rear OD of gearbox drive shaft housing (1011/8).

(d) Install packing (1012/2) and (1012/3) lubricated with Engine Oil P03-001, into grooves in gearbox (EEC alternator) nozzle (1012/5). Install nozzle into port above and to left of gearbox drive pad (1012/4). Secure nozzle using a new bolt (1012/1) or bolt which has the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034). Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Torque bolt to 62 - 72 lb-in. (7.005 - 8.135 N.m). See Figure 1012.

(e) Install packing (1012/8) lubricated with Engine Oil P03-001, into groove in driveshaft nozzle (1012/7). Install nozzle into port in boss at upper rear of gearbox driveshaft housing (1012/9). Secure nozzle using bolt (1012/10) lubricated with Engine Oil P03-001. Torque bolt to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(f) Apply Anti-Seize Paste P06-054 to the two tube nut threads of gearbox driveshaft pressure tube (1012/6). Remove the unwanted paste.

(g) Connect gearbox driveshaft pressure tube (1012/6), lockwire lug toward front, to fitting on nozzle (1012/7).

(h) Mate roller bearing outer race in housing (1011/8) with rollers on gearbox drive gearshaft. Align pressure tube (1012/6) and boltholes and seat housing on gearbox drive pad (1011/2). Secure housing using seven new bolts (1011/7) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034), and washers (1011/6). Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Torque bolts to 225 - 250 lb-in. (25.422 - 28.246 N.m).

(i) Torque tube nuts of pressure tube (1012/6) to 270 − 300 lb−in. (30.506 − 33.895 N.m).

(j) Install protective cover into opening at front end of housing (1011/8).

Subtask 72−61−00−430−059−001:

(12) (Pre SB PW4ENG 72−491) Install gearbox (idler) spur gear. See Figure 1013.

(a) Position spur gear (1013/7), stepped ID end down, into recess in PWA 85339 Base.

(b) Position bearing (1013/6) over bearing bore in gear.

(c) Position PWA 85338 Drift over outer race, with larger ID of drift over piloting pin detail of base.

(d) Using PWA 80130 Force Gage and arbor press, apply load of 1500 lb. (680.39 kg) to seat bearing.

(e) Remove gage and drift. Remove gear from base.

(f) Install retaining ring (1013/5) in groove in gear ID to secure outer race.

(g) Install packing (1013/3), lubricated with Engine Oil P03−001, into groove in flanged end of gearbox idler shaft (1013/2).

(h) Install bearing ring (1013/4) on the idler shaft. Seat the ring against the shaft shoulder.

(i) Insert gearbox idler shaft (1013/2) through idler shaft bore (1013/10) in rear of gearbox.

(j) Install the bearing inner race (1013/8) inside the spur gear and bearing assembly flanged side away from the retaining ring.

(k) Install spur gear (1013/7), over threaded end of idler shaft, with bearing retaining ring (1013/5) toward rear wall of gearbox. Secure gear with new nut (1013/9).

(l) Align boltholes and insert spacer detail of PWA 86149 Wrench under flange of idler shaft. Secure idler shaft and spacer to gearbox with detail bolts. Using PWA 86149 Wrench, torque nut (1013/9) to 300 - 350 lb-in. (34 - 39 N.m).

(m) Remove detail bolts securing gearshaft and spacer. Remove spacer.

(n) Insert the end of the idler shaft into the bore in the front inner wall of the gearbox. Attach the shaft with two bolts (1013/1), threads lubricated with Anti-Sseize Paste P06-054. Remove the unwanted paste. Torque the bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m). (Pre SB PW4ENG 79-78) Safety the bolts with Lockwire P05-289.

Subtask 72-61-00-430-059-002:

(13) (Post SB PW4ENG 72-491) Install gearbox (idler) spur gear. See Figure 1013.

(a) Position spur gear (1013/7), stepped ID end down, into recess in PWA 85339 Base.

(b) Position bearing (1013/26) over bearing bore in gear.

(c) Position PWA 85338 Drift over outer race, with larger ID of drift over piloting pin detail of base.

(d) Use PWA 80130 Force Gage and an arbor press to apply a load of 1500 lb. (680.39 kg) to seat bearing.

(e) Remove gage and drift. Remove gear from base.

(f) Install retaining ring (1013/5) in groove in gear ID to hold outer race.

(g) Hold the gearbox idler shaft (1013/20) in a vise. Tighten on the flats of the shaft. Lubricate the shaft OD and the bearing ID with Engine Oil P03-001.

(h) Install the spur gear and bearing assembly on the gearbox idler shaft (1013/20), with the bearing outer race retaining ring towards the threads.

CAUTION: WHEN PWA 86149 WRENCH IS USED, THE ACTUAL TORQUE WRENCH READING WILL BE LESS THAN THAT STATED BELOW. SEE STANDARD PRACTICES MANUAL, PN 585005.

(i) Install a new bearing retaining nut (1013/9) to hold the spur gear to the idler shaft.

(j) Hold the assembly in a vise and apply a torque of 525 − 575 lb−in. (59.316 − 64.966 N.m) to the retaining nut. Use PWA 86149 Wrench or PWA 85285 Wrench.

(k) Remove the assembly from the vise. Hold the assembly with the shaft horizontal and turn the gear with your hand. The gear must turn freely.

(l) If the gear does not turn freely do as follows:

1 Remove and discard the bearing retaining nut.

2 Remove the gear from the shaft and examine the shaft and bearing for the cause.

3 If there is any damage replace the part.

4 If you do not find any damage, replace the bearing with a new bearing. Install a new bearing retaining nut.

5 Do again the bearing and retaining nut assembly and torque procedure. The gear must turn freely.

(m) Insert the gearbox idler shaft and gear assembly through the idler shaft bore (1013/10) in the rear of the gearbox.

NOTE: Make sure that the bearing retaining ring is rearward when the assembly is installed in the gearbox.

(n) Install the packing (1013/3), lubricated with Engine Oil P03−001, into the groove in the flanged end of the gearbox idler shaft boss assembly (1013/21).

(o) Install the gearbox idler shaft boss assembly (1013/21) to the gearbox idler shaft and assembly, previously installed in the gearbox. Align the slot in the shaft (1013/20) with the pin in the boss assembly (1013/21).

(p) Install the packing (1013/22), lubricated with Engine Oil P03-001, into the groove adjacent to the hex section of the oil supply adapter assembly (1013/23).

(q) Install the adapter assembly (1013/23) into the flange of the boss assembly (1013/21). Torque range for the fitting is 85 - 190 lb-in. (9.6 - 21.5 N.m). Adjust torque within these limits so that the lock plate (1013/24) can be installed around the hex of the oil supply fitting with the bolt hole in alignment with one of the boss flange holes.

(r) Install two bolts (1013/25), threads lubricated with Anti-Seize Paste P06-054 to hold the assembly to the gearbox. Remove the unwanted paste. Torque the bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m). (Pre SB PW4ENG 79-78) Safety the bolts with Lockwire P05-289.

Subtask 72-61-00-430-059-003:

(14) (Post SB PW4ENG 72-664) Install gearbox (idler) spur gear. See Figure 1013 (Sheet 3).

(a) Position spur gear (1013/38), stepped ID end down, into recess in PWA 85339 Base.

(b) Position bearing (1013/36) over bearing bore in gear. Align the slot in the bearing with the slot in the gear.

(c) Position PWA 85338 Drift over outer race, with larger ID of drift over piloting pin detail of base.

(d) Use PWA 80130 Force Gage and an arbor press to apply a load of 1500 lb. (680.39 kg) to seat bearing.

(e) Remove gage and drift. Remove gear from base.

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(f) Install the pin (1013/37) into the hole, formed by the slot in the gear and the slot in the bearing. The pin should slide in without force.

NOTE: If the pin does not slide in, the slot in the bearing and the slot in the gear are not aligned correctly. If this occurs, remove the bearing from the gear and install the bearing to the gear again.

(g) Install bearing retaining ring (1013/5) in groove in gear ID to hold outer race and the pin.

(h) Hold the gearbox idler shaft (1013/20) in a vise. Tighten on the flats of the shaft. Lubricate the shaft OD and the bearing ID with Engine Oil P03-001.

(i) Install the spur gear and bearing assembly on the gearbox idler shaft (1013/20), with the bearing outer race retaining ring towards the threads.

(j) Install a new bearing retaining nut (1013/9) to hold the spur gear to the idler shaft.

R CAUTION: WHEN PWA 86149 WRENCH IS USED, THE
R REQUIRED TORQUE WRENCH INDICATION WILL
R BE LESS THAN THAT STATED BELOW. REFER TO
R STANDARD PRACTICES MANUAL, PN 585005,
R SECTION 70-52-00, STANDARD TORQUES.

(k) Hold the assembly in a vise and apply a torque of 525 - 575 lb-in. (59.316 - 64.966 N.m) to the retaining nut. Use PWA 86149 Wrench or PWA 85285 Wrench.

R (l) Force Engine Oil P03-001 through the hole in the
R idler shaft inner diameter until you see oil at
R the bearing thrust washer, which is below the
R retaining ring (1013/20) location.

R (m) Remove the assembly from the vise.

R (n) Hold the assembly with the idler shaft horizontal and turn the gear with your hand. The gear must turn freely.

R (o) If the gear does not turn freely do as follows:

1 Remove and discard the bearing retaining nut.

2 Remove the gear from the idler shaft and examine the shaft and bearing for the cause.

3 If there is any damage replace the part.

R 4 Put the idler shaft in a vise. Put the vise clamps on the flats of the shaft. Lubricate the shaft outer diameter and the bearing inner diameter with Engine Oil P03-001.

R 5 If you do not find any damage, replace the bearing with a new bearing.

R CAUTION: WHEN PWA 86149 WRENCH IS USED, THE REQUIRED TORQUE WRENCH INDICATION WILL BE LESS THAN THAT STATED BELOW. REFER TO STANDARD PRACTICES MANUAL, PN 585005, SECTION 70-52-00, STANDARD TORQUES.

R 6 Install a new bearing retaining nut. Torque the nut to 525 - 575 lbf-in (59.317 - 64.966 N.m). Use PWA 86149 Wrench or PWA 85285 Wrench to torque the nut.

R 7 Force Engine Oil P03-001 through the hole in the idler shaft inner diameter until you see oil at the bearing thrust washer, which is below retaining ring (1013/20) location.

R 8 Remove the assembly from the vise.

R 9 Hold the assembly with the idler shaft horizontal and turn the gear with your hand. The gear must turn freely.

R (p) Insert the gearbox idler shaft and gear assembly through the idler shaft bore (1013/10) in the rear of the gearbox.

NOTE: Make sure that the bearing retaining ring is rearward when the assembly is installed in the gearbox.

R (q) Install the packing (1013/3), lubricated with Engine Oil P03-001, into the groove in the flanged end of the gearbox idler shaft boss assembly (1013/21).

R (r) Install the gearbox idler shaft boss assembly (1013/21) to the gearbox idler shaft and assembly, previously installed in the gearbox. Align the slot in the shaft (1013/20) with the pin in the boss assembly (1013/21).

R (s) Install the packing (1013/22), lubricated with Engine Oil P03-001, into the groove adjacent to the hex section of the oil supply adapter assembly (1013/23).

R (t) Install the adapter assembly (1013/23) into the flange of the boss assembly (1013/21). Torque range for the fitting is 85 - 190 lb-in. (9.6 - 21.5 N.m). Adjust torque within these limits so that the lock plate (1013/24) can be installed around the hex of the oil supply fitting with the bolt hole in alignment with one of the boss flange holes.

R (u) Install the two bolts (1013/25), threads lubricated with Anti-Seize Paste P06-054 to hold the assembly to the gearbox. Remove the unwanted paste. Torque the bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m). (Pre SB PW4ENG 79-78) Safety the bolts with Lockwire P05-289.

Subtask 72-61-00-430-057:

(15) Install deoiler gearshaft and bearings assembly. See Figure 1014.

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER. MATING NUMBERS ARE MARKED ON DETAIL PARTS OF BEARING.

(a) Align boltholes and install bearing outer race (1014/7) into bore in rear wall of gearbox housing behind deoiler pad (1014/6). Secure the outer race and if applicable the oil supply tube flange (1004/26) with four new bolts (1014/5) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034). Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Torque the bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(b) (Engines With The Alternate Lubrication Configuration) Tighten the clamp bolt (1004/27) that attaches the oil supply tube (1004/26) to the bracket (1004/29). Torque the bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Install packing (1014/8), lubricated with Engine Oil P03−001, into groove in OD of bearing housing (1014/4).

(d) Mate roller bearing on gearshaft with previously installed bearing outer race on bearing housing detail (1014/4). Align boltholes in bearing housing with boltholes in deoiler pad (1014/6), and mate bearing on end of gearshaft with outer race in rear wall of gearbox housing. Seat bearing housing on deoiler pad.

(e) Install packing (1014/10), lubricated with Engine Oil P03−001, into groove in gearbox deoiler housing (1014/11). Align boltholes and position housing over deoiler gearshaft and seat on deoiler pad. Secure housing using eleven washers (1014/12) and new bolts (1014/13) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70−41−03−380−034). Refer to Section 70−41−03 in the Standard Practices Manual, PN 585005. Torque bolts to 125 − 140 lb−in. (14.123 − 15.818 N.m).

(f) Install packing (1014/3), lubricated with Engine Oil P03−001, into groove in OD of face (oil) seal (1014/2). Install seal, carbon seal towards gearshaft, into mating bore in rear of gearbox housing. Secure seal using retaining ring (1014/1).

NOTE: Before installing carbon seal, work seal thoroughly in engine oil to ensure free movement of carbon element. Carbon seal ring must have free axial movement without detectable binding throughout its full travel in seal carrier after immersion in engine oil, just prior to installation in gearbox assembly.

Subtask 72-61-00-430-058:

(16) Install main oil filter and pressure relief valve assembly. See Figure 1015.

(a) For engines that are pre SB PW4ENG 79-43, install the transfer tubes.

1 Install two packings (1015/1), lubricated with Engine Oil P03-001, into grooves in two larger packing transfer tubes (1015/2) and (1015/6).

2 Seat transfer tubes in two larger bores in main oil filter pad (1015/5) on right front side of gearbox.

3 Install two packings (1015/3), lubricated with Engine Oil P03-001, into grooves in smaller packing transfer tube (1015/4).

4 Seat transfer tube in remaining bore in main oil filter pad.

(b) For engines that are post SB PW4ENG 79-43, install the anti-siphon tube assembly and transfer tubes.

1 Apply Engine Oil P03-001 to four packings (1015/3) and (1015/1). Install the packings on transfer tubes (1015/4) and (1015/6), respectively.

2 Install the transfer tubes in the two lower holes in the main-oil-filter and pressure-relief-valve assembly (called main oil filter).

3 Find the correct position of the anti-siphon tube assembly (1015/2A) as follows.

a With no packings installed, put the eccentric flange of the tube assembly in the mating counterbore of the main oil filter.

b The fit of the main oil filter and the tube assembly is correct if the tube cannot turn much.

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c With the main oil filter pointed in the installed position, see the position of the tube assembly.

d Remove the tube assembly.

4 Apply Engine Oil P03-001 to two packings.

5 Install the packings on the tube assembly.

6 Install the tube assembly in the front of the gearbox. The position of the tube assembly is the same as when it was installed in the main oil filter.

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER MAIN-OIL-FILTER AND PRESSURE-RELIEFVALVE ASSEMBLY. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 79-43.

(c) Install the main oil filter.

1 Align boltholes and position main oil filter and pressure relief valve assembly (1015/7) onto main oil filter pad (1015/5).

NOTE: While you install the main oil filter and pressure relief valve assembly, it may be necessary to turn the anti-siphon tube a little to correctly engage the eccentrically shaped tube with its mating hole in the main oil filter housing.

2 Secure main oil filter to gearbox using four new bolts (1015/9) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034) and washers (1015/8). Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005.

3 Do a check of the position of the anti-siphon tube assembly. The end of the tube assembly must be approximately 0.25 inch (6.350 mm) from the top of the gearbox housing.

4 Torque bolts to 125 - 140 lb-in. (14.123 - 15.818 N.m).

Subtask 72−61−00−430−060:

(17) Install EEC alternator drive gearshaft and bearings assembly. See Figure 1016.

(a) Apply a thin layer of Engine Oil P03−001 to the ID of the mating bore in the main gearbox.

(b) Install packing (1016/5), lubricated with Engine Oil P03−001, into groove in OD of EEC alternator housing.

(c) Insert EEC alternator drive gearshaft and bearings assembly (1016/3), spur gear end first, into bore in EEC alternator drive pad (1016/4). Mesh gears and seat housing on drive pad.

(d) (Pre SB PW4ENG 75−59) Secure the assembly to gearbox with three new bolts (1016/1) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70−41−03−380−034) and two washers (1016/2) and a bracket (1016/6). Refer to Section 70−41−03 in the Standard Practices Manual, PN 585005.

(e) (Post SB PW4ENG 75−59) Secure a manifold (1016/7) and assembly to gearbox with three bolts (1016/1).

(f) (Post SB PW4ENG 72−375) Attach the housing to the gearbox with three new bolts (1016/1) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70−41−03−380−034). Refer to Section 70−41−03 in the Standard Practices Manual, PN 585005.

(g) Torque the bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(h) Do a check of the clearance between the gearshaft housing and the main gearbox. Use a 0.003 inch (0.076 mm) feeler gage. If it is possible to put the gage between the housing and the main gearbox, the housing is not correctly installed. Do a check of the torque on the mounting bolts. If the bolts are at maximum torque, but the housing is not correctly installed, remove the gearshaft and bearings assembly and install the assembly again.

Subtask 72−61−00−430−061:

(18) Install starter drive gearshaft and bearings assembly. See Figure 1017.

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER. MATING NUMBERS ARE MARKED ON DETAIL PARTS OF BEARING.

(a) Align boltholes and position mating bearing outer race (1017/8) into bore in rear side of front wall of gearbox housing behind starter drive pad (1017/7).Secure outer race using four new bolts (1017/6) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70−41−03−380−034). Refer to Section 70−41−03 in the Standard Practices Manual, PN 585005. Torque bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER. MATING NUMBERS ARE MARKED ON DETAIL PARTS OF BEARING.

(b) Align boltholes and position mating bearing outer race (1017/10) into bore in rear side of bearing housing (1017/3). Secure outer race using four new bolts (1017/5) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70−41−03−380−034). Refer to Section 70−41−03 in the Standard Practices Manual, PN 585005. Torque bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(c) Insert starter drive gearshaft and bearings assembly (1017/9), smaller spur gear first, through bore in starter drive pad (1017/7). Mesh mating gears and mate roller bearing on gearshaft with bearing outer race in front wall of gearbox.

(d) Install packing (1017/4), lubricated with Engine Oil P03−001, into groove in OD of bearing housing (1017/3).

(e) Mate roller bearing outer race in bearing housing (1017/3) with rollers on gearshaft. Align boltholes and seat bearing housing on starter drive pad (1017/7). Secure bearing housing using eight new bolts (1017/1) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70−41−03−380−034) and washers (1017/2). Refer to Section 70−41−03 in the Standard Practices Manual, PN 585005. Torque bolts to 125 − 140 lb−in. (14.123 − 15.818 N.m).

(f) Install packing (1017/15), lubricated with Engine Oil P03−001, into groove in OD of face (oil) seal (1017/16). Install seal into bore in bearing housing (1017/3), seating carbon seal on sealing face of gearshaft. Install retaining ring (1017/17) into groove in bearing housing to secure seal.

NOTE: Before installing carbon seal, work seal thoroughly in engine oil to ensure free movement of carbon element. Carbon seal ring must have free axial movement without detectable binding throughout its full travel in seal carrier after immersion in engine oil, just prior to installation in gearbox assembly.

(g) Install packing (1017/11), lubricated with Engine Oil P03−001, onto bushing (1017/12). Install bushing, lubricated with Engine Oil P03−001, into port in bottom of bearing housing. Torque bushing to 250 − 275 lb−in. (20.246 − 31.071 N.m).

(h) Install packing (1017/13), lubricated with Engine Oil P03−001, onto plug (1017/14). Install plug, lubricated with Engine Oil P03−001, into bushing (1017/12). Torque plug to 110 − 120 lb−in. (12.428 − 13.558 N.m). Lockwire plug.

Subtask 72−61−00−430−062:

(19) Install rear hydraulic pump gearshaft and bearings assembly. See Figure 1018.

(a) Lubricate packings (1018/6), and threads on new nut (1018/8) with Engine Oil P03-001. Install packing (1018/6) into groove in bushing (1018/5). Install bushing into nozzle port (1018/7) in front, left, side of gearbox. Using PWA 85372 Wrench, secure bushing with nut (1018/8). Torque nut to 300 - 350 lb-in. (34 - 39 N.m).

(b) Install packings (1018/3) and (1018/4), lubricated with Engine Oil P03-001, into grooves in gearbox nozzle (1018/2). Install nozzle, lubricated with Engine Oil P03-001, into previously installed adapter (1018/5). Torque nozzle to 90 - 100 lb-in. (10.169 - 11.298 N.m).

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER. MATING NUMBERS ARE MARKED ON DETAIL PARTS OF BEARING.

(c) Align boltholes and position bearing outer race (1018/11) into bore in rear side of front wall of gearbox behind rear hydraulic pump drive pad (1018/1). Secure outer race using four bolts (1018/10). Torque bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER. MATING NUMBERS ARE MARKED ON DETAIL PARTS OF BEARING.

(d) Align boltholes and position bearing outer race (1018/13) into bearing outer race bore in bearing housing (1018/15). Secure outer race using four new bolts (1018/9) or bolts which have the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034). Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Torque bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(e) Insert rear hydraulic pump drive gearshaft and bearings assembly (1018/12) spur gear end first, through bore in rear hydraulic pump drive pad (1018/1). Mesh mating gears and mate roller bearing on gearshaft with previously installed bearing outer race in rear side, front wall, of gearbox.

MAIN GEARBOX - ASSEMBLY-01

(f) Install packing (1018/14), lubricated with Engine Oil P03-001, into OD groove in bearing housing (1018/15).

(g) Mate roller bearing outer race in bearing housing (1018/15) with rollers on gearshaft. Position bearing housing over studs projecting from rear hydraulic pump drive pad and seat bearing housing on pad (1018/1). Install two new screws (1018/20) or screws which have the antigalling compound replaced by SPOP 139 (Task 70-41-03-380-034), into smaller chamfered holes in outer flange of bearing housing. Refer to Section 70-41-03 in the Standard Practices Manual, PN 585005. Torque screws to 27 - 30 lb-in. (3.051 - 3.390 N.m).

(h) Install packing (1018/21), lubricated with Engine Oil P03-001, into groove in OD of face (oil) seal (1018/22). Install seal into bore in bearing housing (1018/15), seating carbon seal on sealing face of gearshaft. Install retaining ring (1018/23) into groove in bearing housing to secure seal.

NOTE: Before installing carbon seal, work seal thoroughly in engine oil to ensure free movement of carbon element. Carbon seal ring must have free axial movement without detectable binding throughout its full travel in seal carrier after immersion in engine oil, just prior to installation in gearbox assembly.

(i) Lubricate packing (1018/16) and threads of bushing (1018/17) with Engine Oil P03-001. Install bushing into port in bottom of bearing housing. Torque bushing to 250 - 275 lb-in. (28.246 - 31.071 N.m).

(j) Lubricate packing (1018/19) and threads of plug (1018/18) with Engine Oil P03-001. Install plug into bushing in port in bottom of bearing housing. Torque plug to 110 - 120 lb-in. (12.428 - 13.558 N.m).

(k) For those engines not utilizing a rear hydraulic pump, install the rear hydraulic pump drive bolt, plug and cover. See Figure 1019.

1 Install packing (1019/8), lubricated with Engine Oil P03-001, in groove of bolt (1019/9), lubricated with Engine Oil P03-001, nearest bolthead. Install bolt and packing assembly in gearshaft, seating bolthead in groove in gearshaft internal splines.

2 Install packing (1019/7), lubricated with Engine Oil P03-001, in groove of plug (1019/6), lubricated with Engine Oil P03-001. Install plug over bolt, plugging gearshaft opening.

3 Install washer (1019/5) and nut (1019/4), lubricated with Engine Oil P03-001, over bolt. Torque nut to 36 - 40 lb-in. (4.067 - 4.519 N.m).

4 Install gasket (1019/3) and cover (1019/2), over rear hydraulic pump pad studs. Secure with four hydraulic pump nuts (1019/1). Torque nuts, lubricated with Engine Oil P03-001, to 275 - 300 lb-in. (31.071 - 33.895 N.m).

D. Postrequisites

(1) Assemble front hydraulic pump drive and IDG drive gearshaft to main gearbox per 72-61-00, Assembly-02 (Task 72-61-00-400-002).

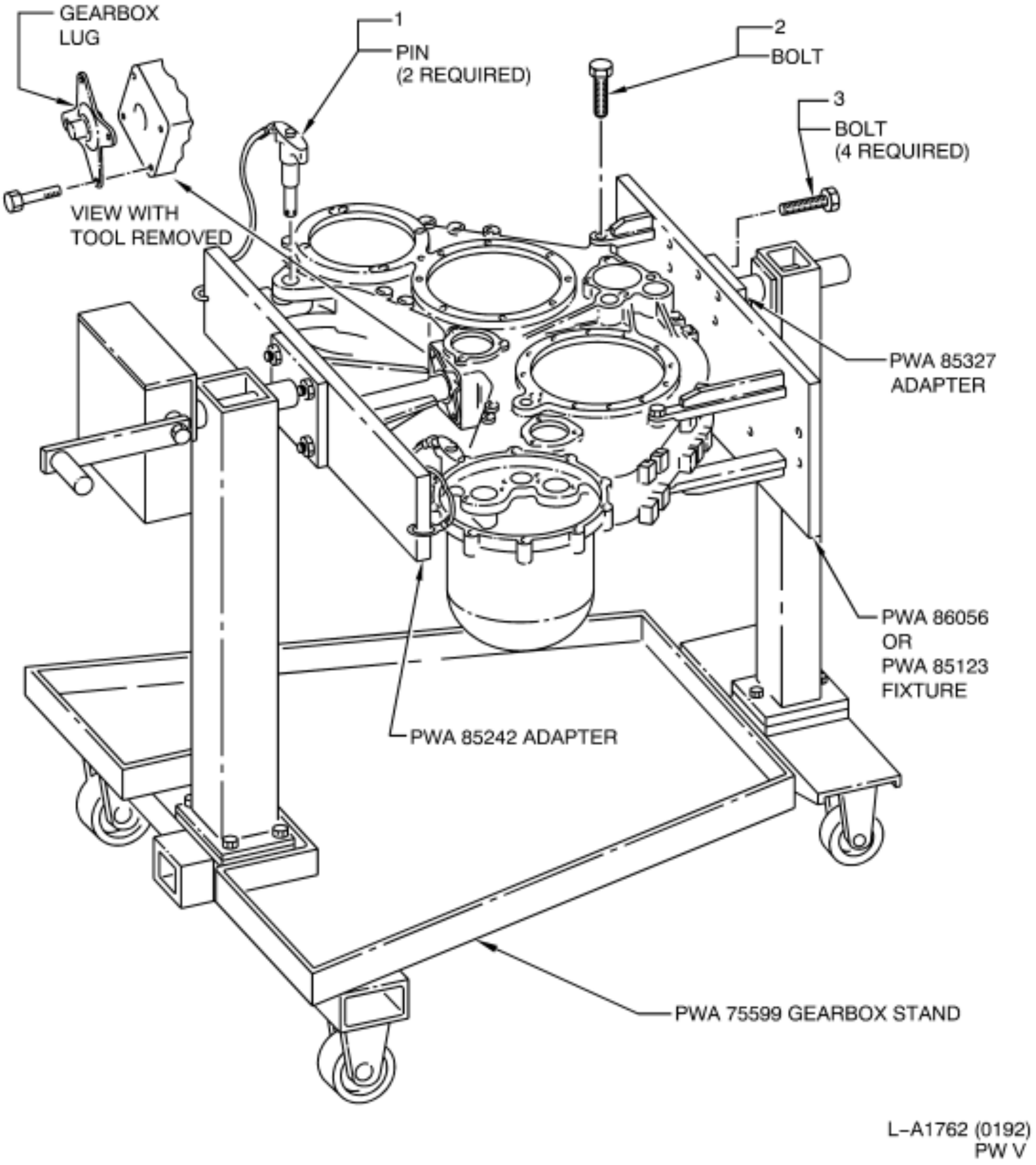
(2) Install the drain plugs and lube oil tank on the main gearbox. Refer to 72-61-00, Assembly-03 (Task 72-61-00-400-003).

(3) Install the magnetic chip detector assemblies in the main gearbox, lube oil tank, and lubrication and scavenge oil pump. Refer to 72-61-00, Assembly-07 (Task 72-61-00-400-007).

(4) Do a leak check of the main gearbox. Refer to 72-61-00, Testing-01 (Task 72-61-00-790-001).

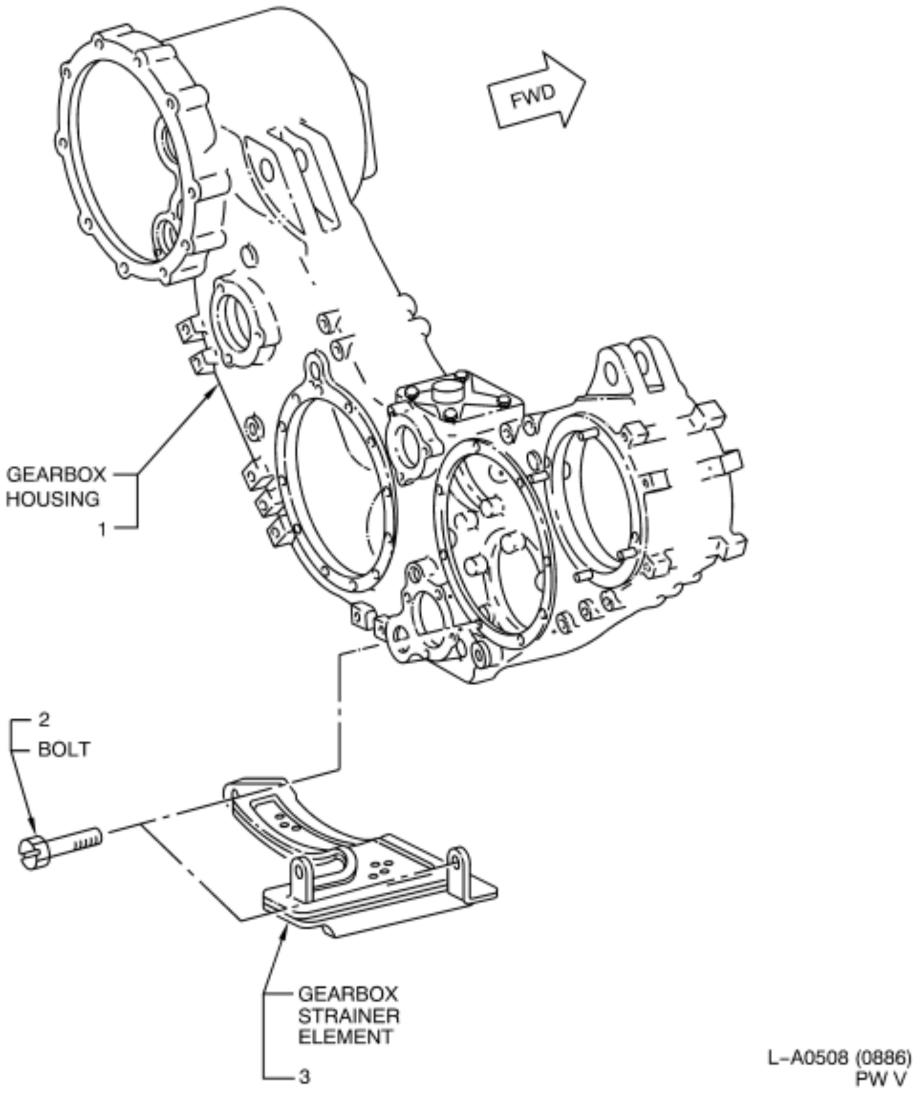
(5) Install the brackets, EEC alternator rotor and stator, and the lubrication and scavenge oil pump on the main gearbox. Refer to 72-61-00, Assembly-06 (Task 72-61-00-400-006).

MAIN GEARBOX − ASSEMBLY−01


GEARBOX LUG
1
PIN
(2 REQUIRED)
2
BOLT
3
BOLT
(4 REQUIRED)
VIEW WITH TOOL REMOVED
PWA 85327 ADAPTER
PWA 86056 OR PWA 85123 FIXTURE
PWA 85242 ADAPTER
PWA 75599 GEARBOX STAND
L−A1762 (0192)
PW V

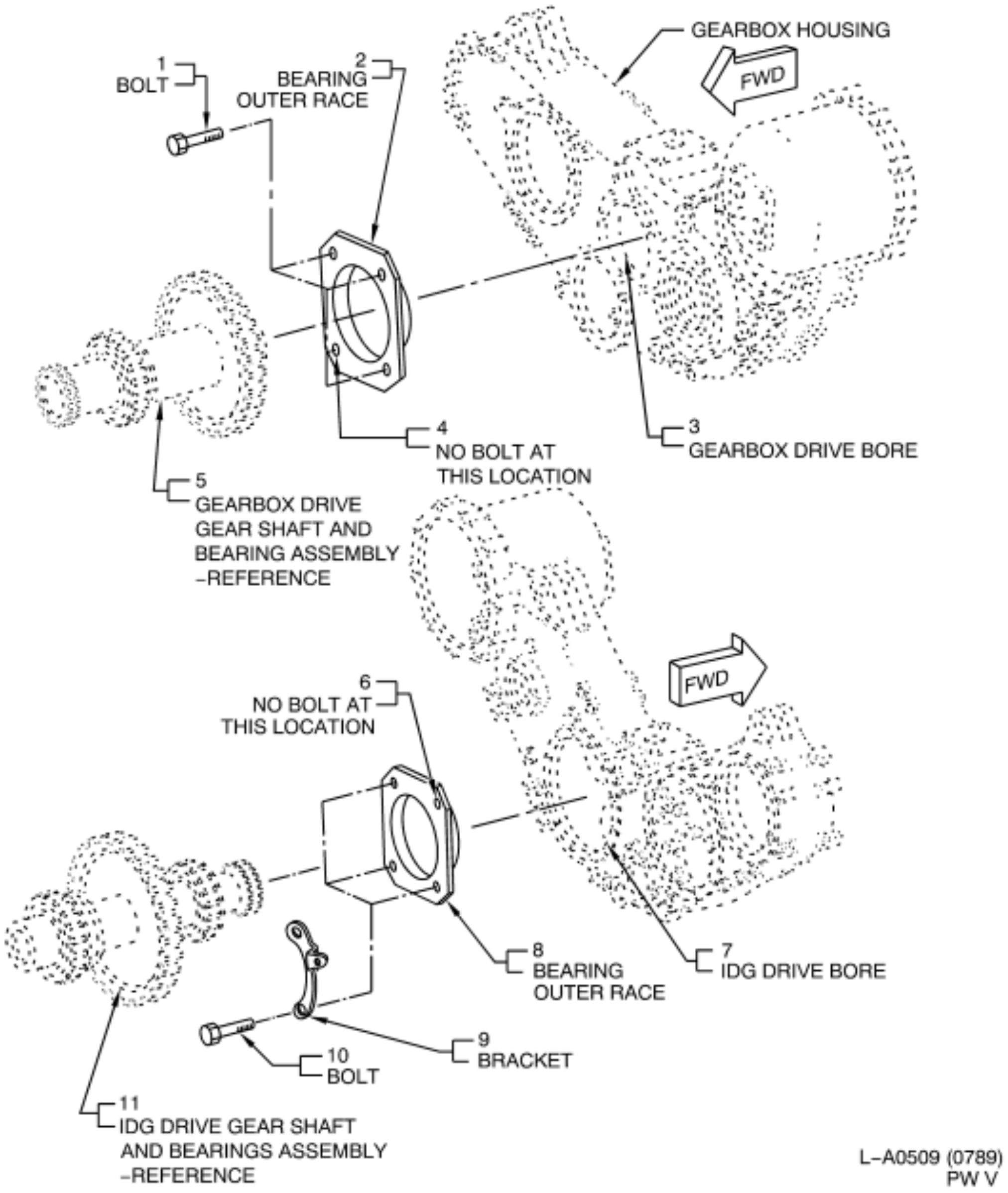
Installation Of Main Gearbox To Build Stand
Figure 1001
(Task 72−61−00−400−001)

MAIN GEARBOX − ASSEMBLY−01

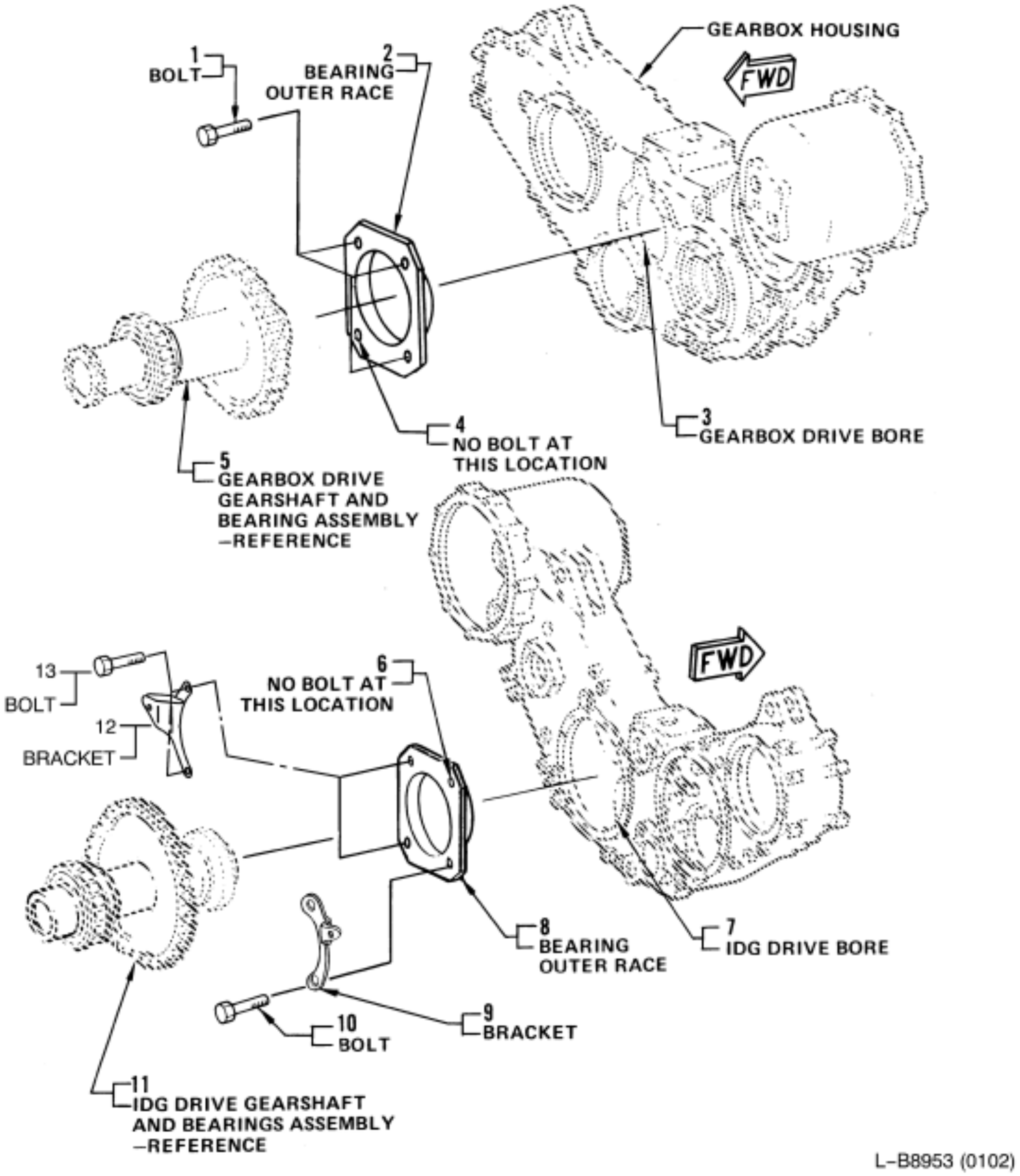

FWD
GEARBOX
HOUSING
1
2
BOLT
GEARBOX
STRAINER
ELEMENT
3
L−A0508 (0886)
PW V

Gearbox Strainer Element Installation
Figure 1002
(Task 72−61−00−400−001)

MAIN GEARBOX - ASSEMBLY-01

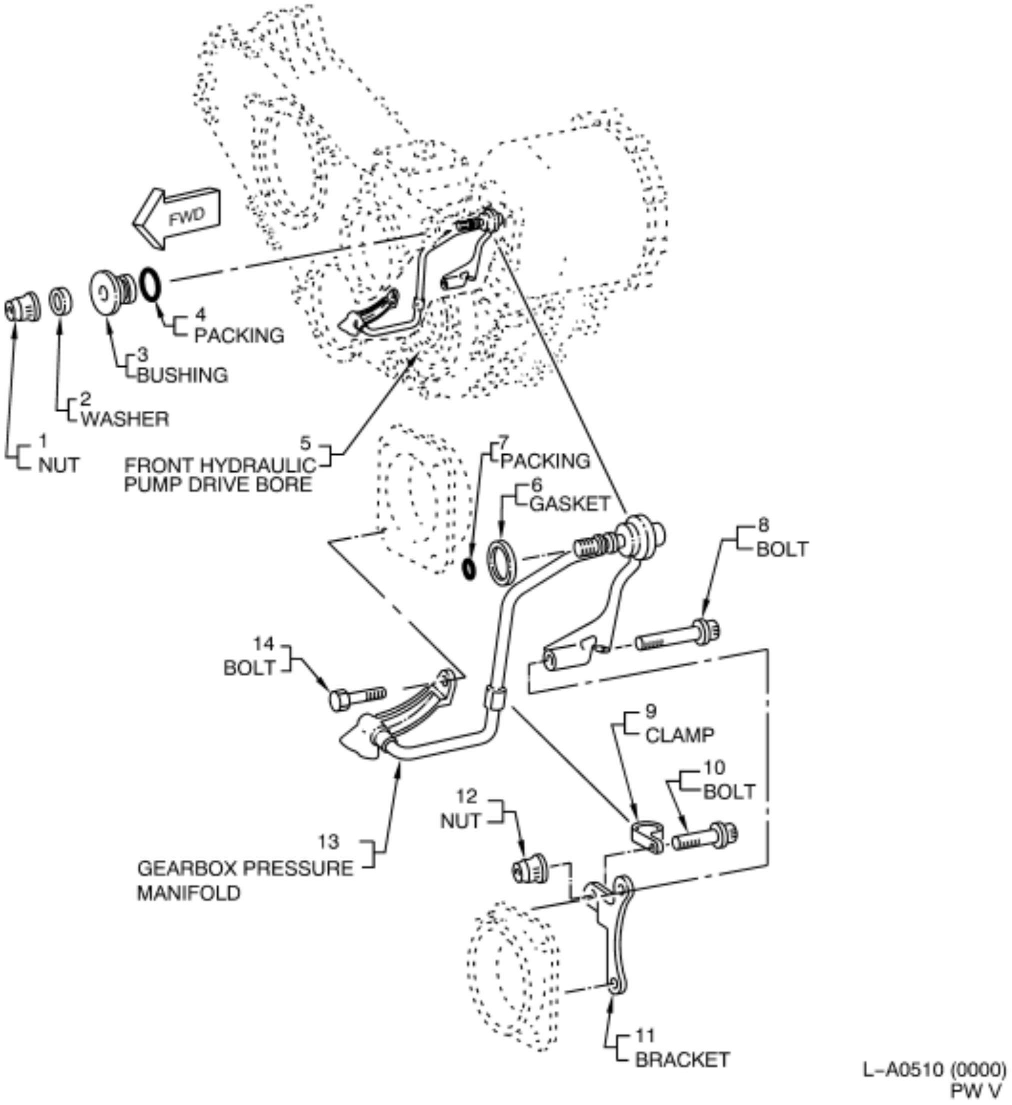

GEARBOX HOUSING
FWD
1 BOLT
2 BEARING OUTER RACE
4 NO BOLT AT THIS LOCATION
3 GEARBOX DRIVE BORE
5 GEARBOX DRIVE GEAR SHAFT AND BEARING ASSEMBLY -REFERENCE
FWD
6 NO BOLT AT THIS LOCATION
8 BEARING OUTER RACE
7 IDG DRIVE BORE
9 BRACKET
10 BOLT
11 IDG DRIVE GEAR SHAFT AND BEARINGS ASSEMBLY -REFERENCE
L-A0509 (0789)
PW V

Bearing Outer Races Installation
Figure 1003 (Sheet 1)
(Task 72-61-00-400-001)

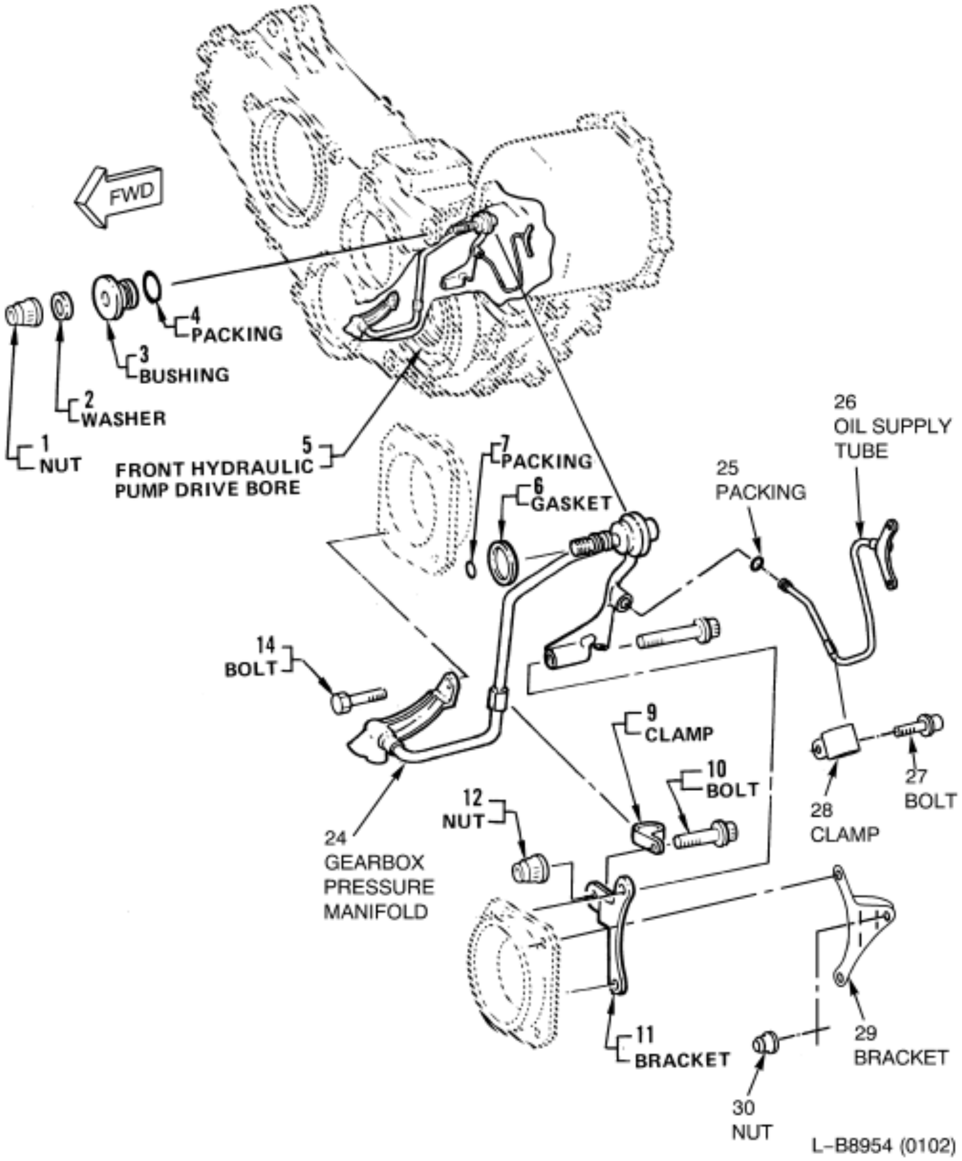

GEARBOX HOUSING
FWD
1
BOLT
2
BEARING
OUTER RACE
4
NO BOLT AT
THIS LOCATION
3
GEARBOX DRIVE BORE
5
GEARBOX DRIVE
GEARSHAFT AND
BEARING ASSEMBLY
-REFERENCE
FWD
13
BOLT
12
BRACKET
6
NO BOLT AT
THIS LOCATION
8
BEARING
OUTER RACE
7
IDG DRIVE BORE
9
BRACKET
10
BOLT
11
IDG DRIVE GEARSHAFT
AND BEARINGS ASSEMBLY
-REFERENCE
L-B8953 (0102)

Bearing Outer Races Installation
(Alternate Lubrication Configuration)
Figure 1003 (Sheet 2)
(Task 72-61-00-400-001)

MAIN GEARBOX - ASSEMBLY-01

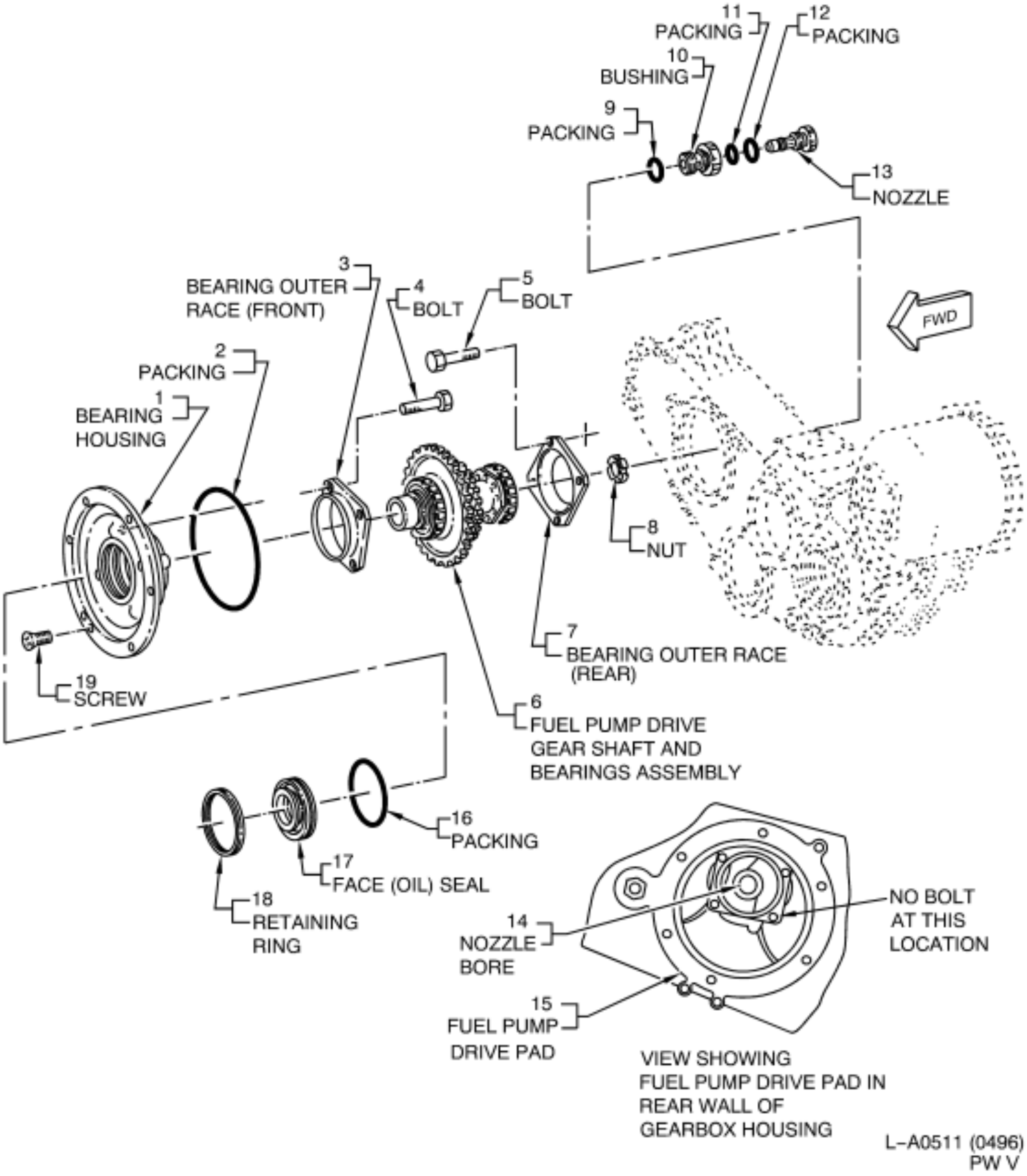

FWD
1 NUT
2 WASHER
3 BUSHING
4 PACKING
5 FRONT HYDRAULIC PUMP DRIVE BORE
7 PACKING
6 GASKET
8 BOLT
14 BOLT
9 CLAMP
10 BOLT
12 NUT
13 GEARBOX PRESSURE MANIFOLD
11 BRACKET
L-A0510 (0000)
PW V

Gearbox Pressure Manifold Installation
Figure 1004 (Sheet 1)
(Task 72-61-00-400-001)

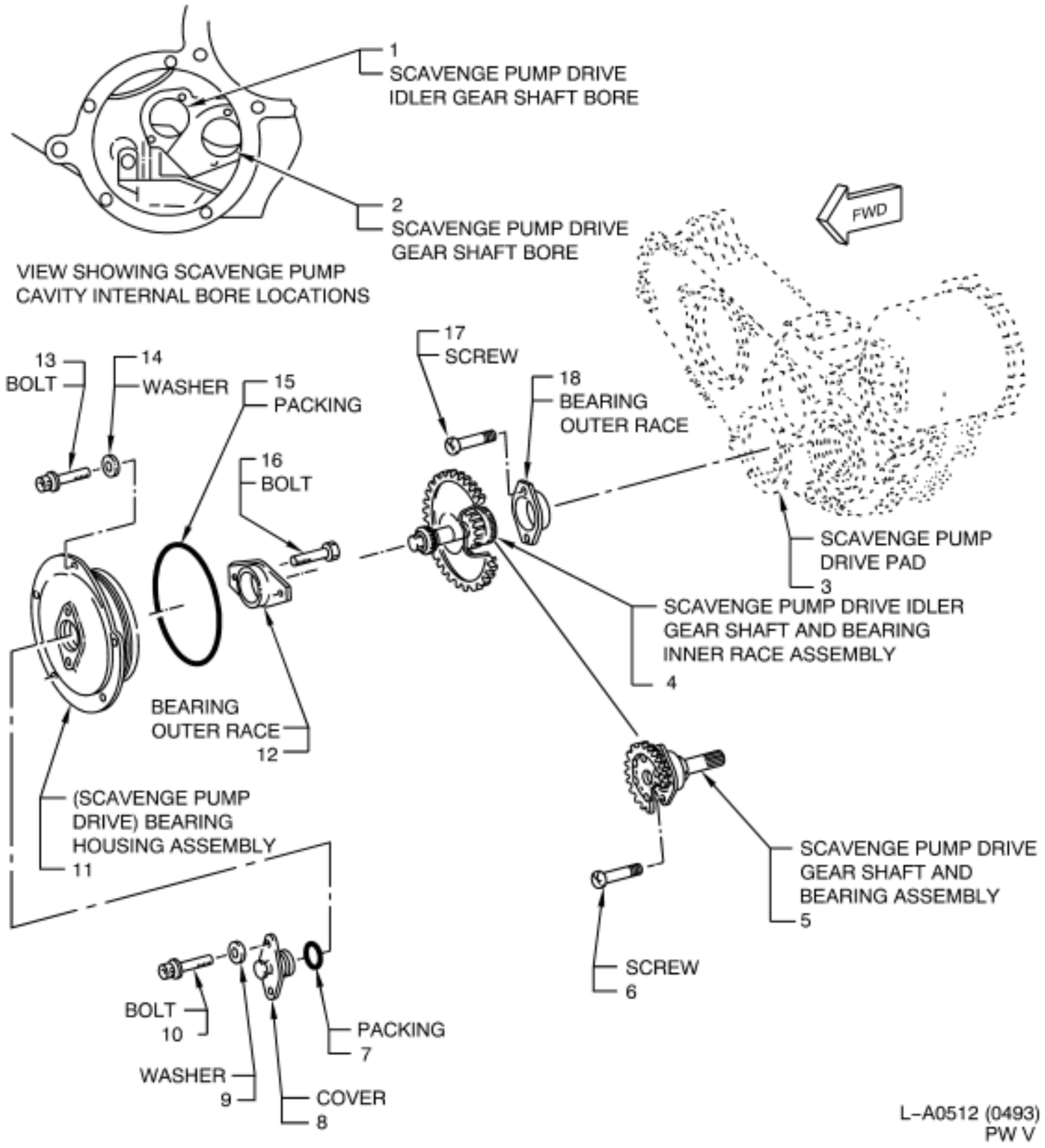

FWD
1 NUT
2 WASHER
3 BUSHING
4 PACKING
5 FRONT HYDRAULIC PUMP DRIVE BORE
7 PACKING
6 GASKET
25 PACKING
26 OIL SUPPLY TUBE
14 BOLT
9 CLAMP
10 BOLT
27 BOLT
28 CLAMP
12 NUT
24 GEARBOX PRESSURE MANIFOLD
11 BRACKET
29 BRACKET
30 NUT
L-B8954 (0102)

Gearbox Pressure Manifold Installation
(Alternate Lubrication Configuration)
Figure 1004 (Sheet 2)
(Task 72-61-00-400-001)

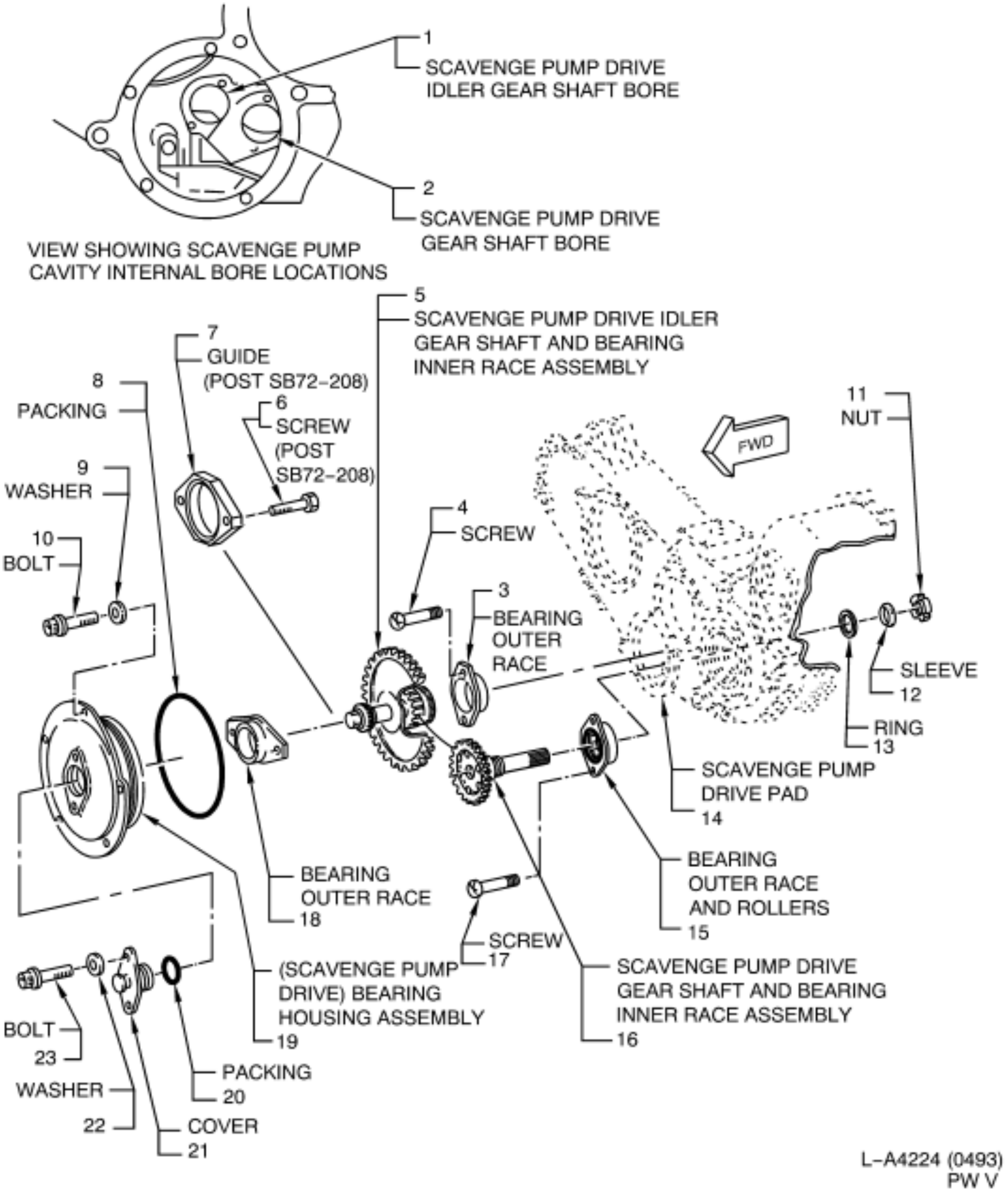
MAIN GEARBOX − ASSEMBLY−01


11
PACKING
12
PACKING
10
BUSHING
9
PACKING
13
NOZZLE
3
BEARING OUTER RACE (FRONT)
4
BOLT
5
BOLT
FWD
2
PACKING
1
BEARING HOUSING
8
NUT
7
BEARING OUTER RACE (REAR)
19
SCREW
6
FUEL PUMP DRIVE GEAR SHAFT AND BEARINGS ASSEMBLY
16
PACKING
17
FACE (OIL) SEAL
18
RETAINING RING
14
NOZZLE BORE
NO BOLT AT THIS LOCATION
15
FUEL PUMP DRIVE PAD
VIEW SHOWING FUEL PUMP DRIVE PAD IN REAR WALL OF GEARBOX HOUSING
L-A0511 (0496)
PW V

Fuel Pump Drive Gearshaft And Bearings Assembly Installation
Figure 1005
(Task 72−61−00−400−001)

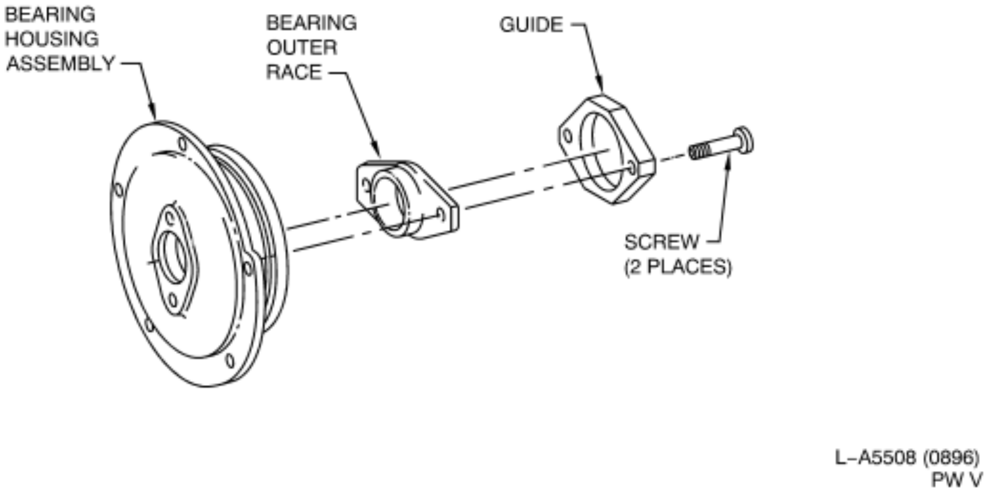

1
SCAVENGE PUMP DRIVE IDLER GEAR SHAFT BORE
2
SCAVENGE PUMP DRIVE GEAR SHAFT BORE
VIEW SHOWING SCAVENGE PUMP CAVITY INTERNAL BORE LOCATIONS
FWD
13
BOLT
14
WASHER
15
PACKING
16
BOLT
17
SCREW
18
BEARING OUTER RACE
SCAVENGE PUMP DRIVE PAD
3
SCAVENGE PUMP DRIVE IDLER GEAR SHAFT AND BEARING INNER RACE ASSEMBLY
4
BEARING OUTER RACE
12
(SCAVENGE PUMP DRIVE) BEARING HOUSING ASSEMBLY
11
SCAVENGE PUMP DRIVE GEAR SHAFT AND BEARING ASSEMBLY
5
SCREW
6
BOLT
10
WASHER
9
COVER
8
PACKING
7
L-A0512 (0493)
PW V

Installation Of The Scavenge Pump Drive And Idler Gearshaft And Bearings Assemblies (Pre SB PW4ENG 72-114)
Figure 1006
(Task 72-61-00-400-001)

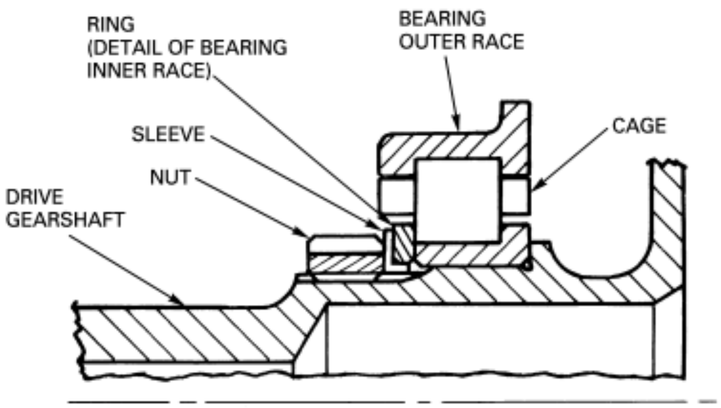

1
SCAVENGE PUMP DRIVE IDLER GEAR SHAFT BORE
2
SCAVENGE PUMP DRIVE GEAR SHAFT BORE
VIEW SHOWING SCAVENGE PUMP CAVITY INTERNAL BORE LOCATIONS
5
SCAVENGE PUMP DRIVE IDLER GEAR SHAFT AND BEARING INNER RACE ASSEMBLY
7
GUIDE (POST SB72-208)
8
PACKING
6
SCREW (POST SB72-208)
11
NUT
FWD
9
WASHER
4
SCREW
10
BOLT
3
BEARING OUTER RACE
SLEEVE
12
RING
13
SCAVENGE PUMP DRIVE PAD
14
BEARING OUTER RACE AND ROLLERS
15
BEARING OUTER RACE
18
SCREW
17
(SCAVENGE PUMP DRIVE) BEARING HOUSING ASSEMBLY
19
SCAVENGE PUMP DRIVE GEAR SHAFT AND BEARING INNER RACE ASSEMBLY
16
BOLT
23
WASHER
22
PACKING
20
COVER
21
L-A4224 (0493)
PW V

Installation Of The Scavenge Pump Drive And Idler Gearshaft And Bearings Assemblies (Post SB PW4ENG 72-114)
Figure 1007
(Task 72-61-00-400-001)

MAIN GEARBOX − ASSEMBLY−01

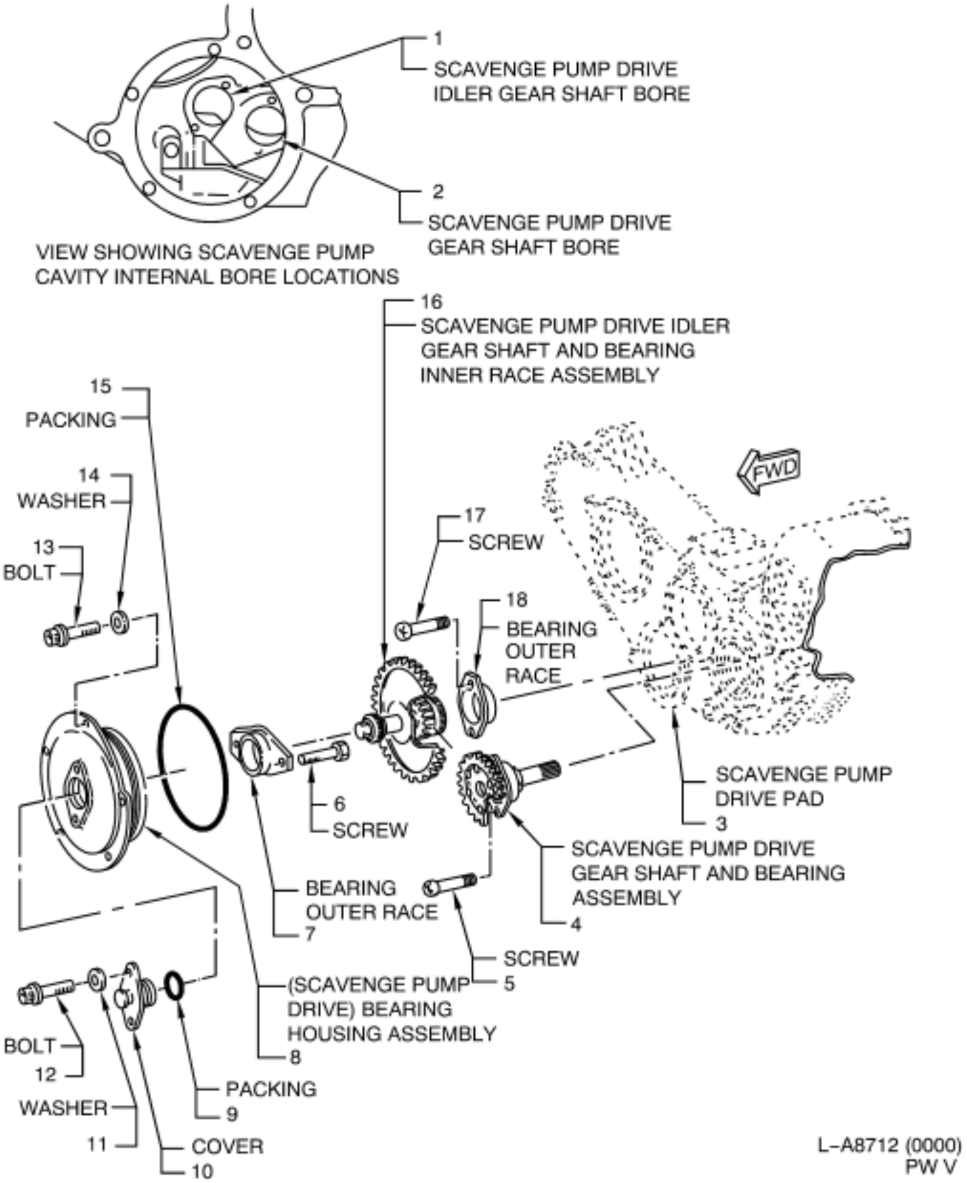

BEARING HOUSING ASSEMBLY
BEARING OUTER RACE
GUIDE
SCREW (2 PLACES)
L−A5508 (0896)
PW V

Installation Of Guide And Bearing Outer Race On Bearing Housing Assembly (Post SB PW4ENG 72−208)
Figure 1008
(Task 72−61−00−400−001)


RING
(DETAIL OF BEARING
INNER RACE)
BEARING
OUTER RACE
SLEEVE
CAGE
NUT
DRIVE
GEARSHAFT

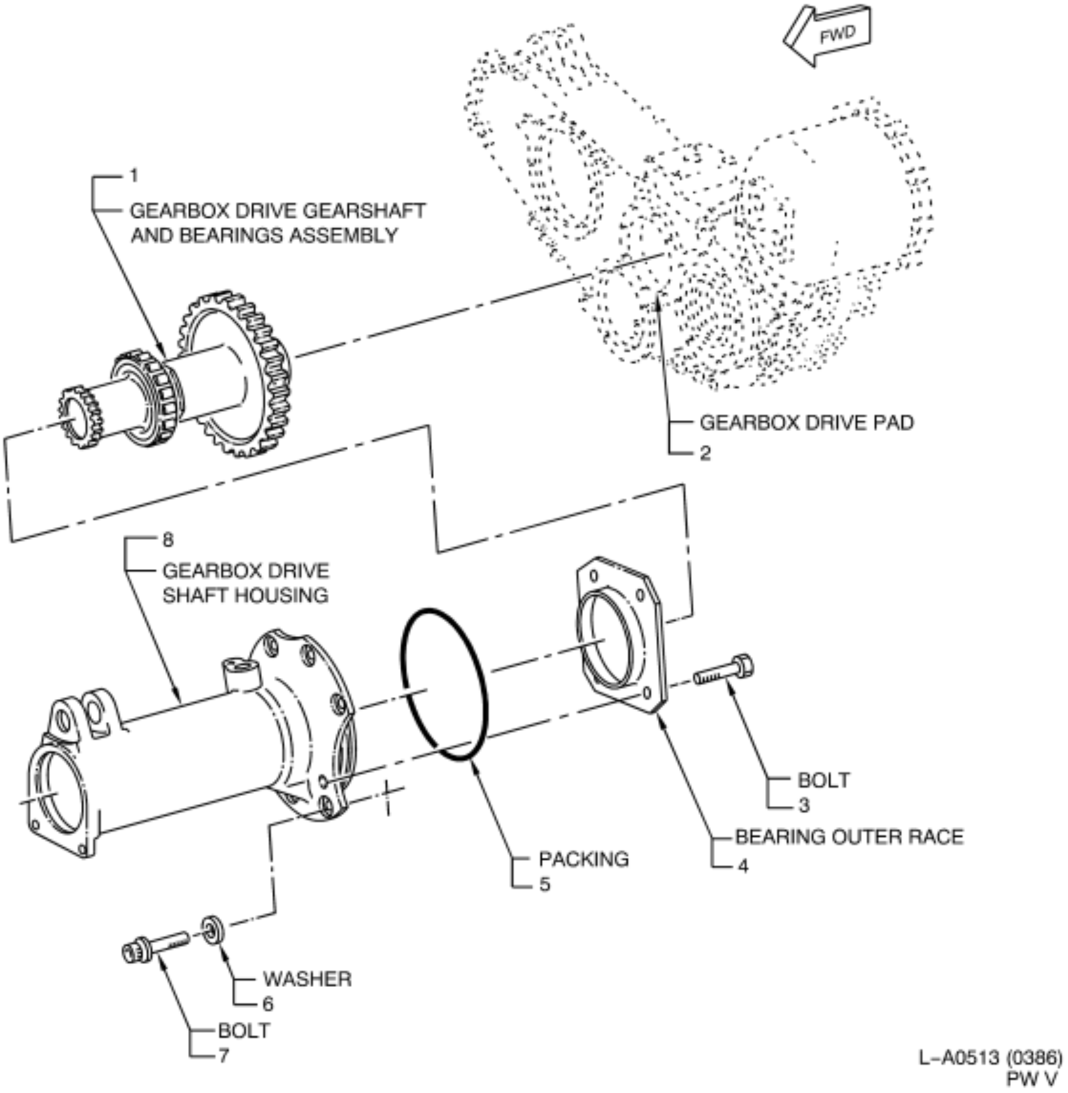
L-B0926 (0000)

Scavenge Pump Drive Gearshaft And Bearing Assembly, Sleeve Installed
Figure 1009
(Task 72−61−00−400−001)

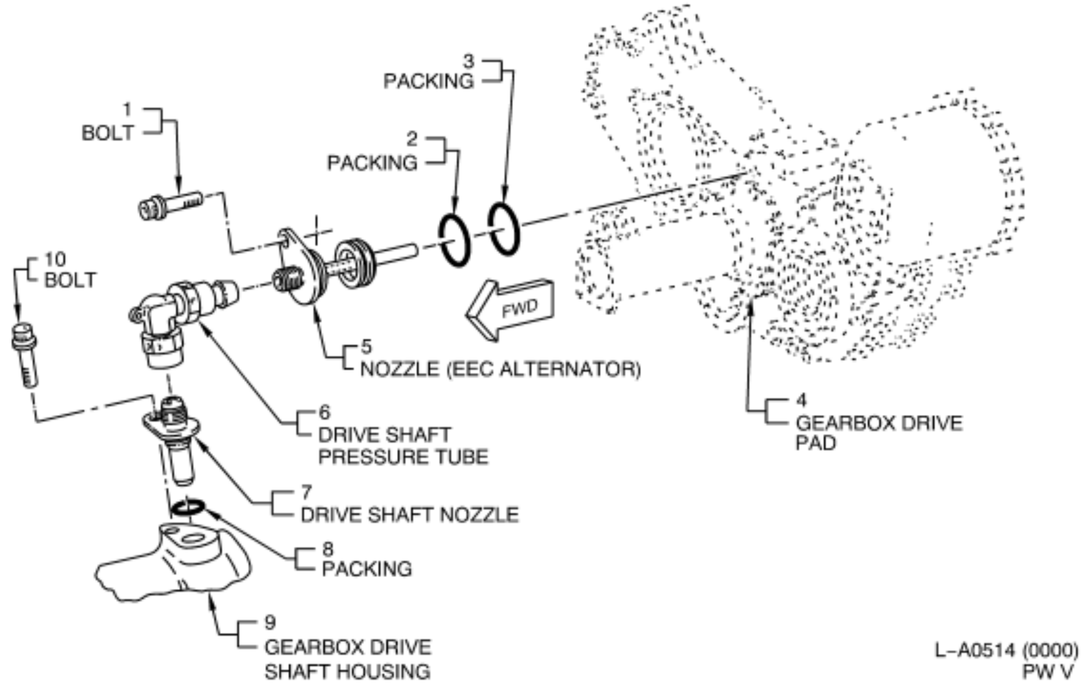

1
SCAVENGE PUMP DRIVE IDLER GEAR SHAFT BORE
2
SCAVENGE PUMP DRIVE GEAR SHAFT BORE
VIEW SHOWING SCAVENGE PUMP CAVITY INTERNAL BORE LOCATIONS
16
SCAVENGE PUMP DRIVE IDLER GEAR SHAFT AND BEARING INNER RACE ASSEMBLY
15
PACKING
14
WASHER
13
BOLT
FWD
17
SCREW
18
BEARING OUTER RACE
6
SCREW
SCAVENGE PUMP DRIVE PAD
3
SCAVENGE PUMP DRIVE GEAR SHAFT AND BEARING ASSEMBLY
4
BEARING OUTER RACE
7
SCREW
5
(SCAVENGE PUMP DRIVE) BEARING HOUSING ASSEMBLY
8
BOLT
12
PACKING
9
WASHER
11
COVER
10
L-A8712 (0000)
PW V

Installation Of The Scavenge Pump Drive Gearshaft
And Bearing Assembly (Post SB PW4ENG 72-463)
Figure 1010
(Task 72-61-00-400-001)

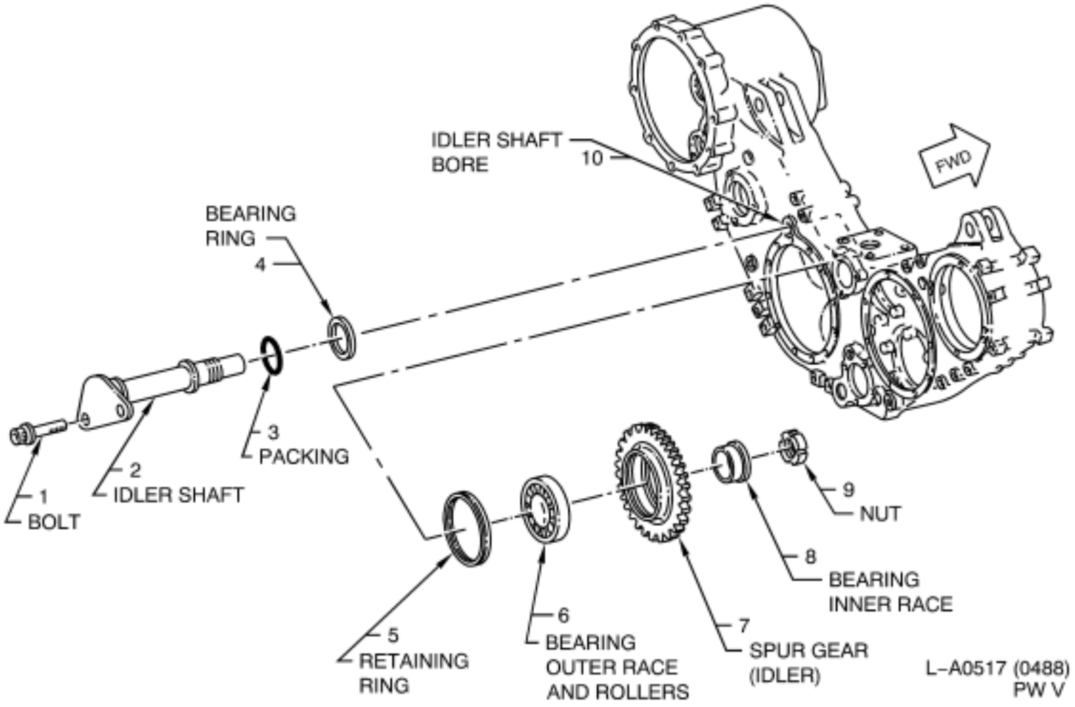
MAIN GEARBOX − ASSEMBLY−01


FWD
1
GEARBOX DRIVE GEARSHAFT AND BEARINGS ASSEMBLY
GEARBOX DRIVE PAD
2
8
GEARBOX DRIVE SHAFT HOUSING
BOLT
3
BEARING OUTER RACE
4
PACKING
5
WASHER
6
BOLT
7
L−A0513 (0386)
PW V

Gearbox Drive Gearshaft And Bearings Assembly Installation
Figure 1011
(Task 72−61−00−400−001)

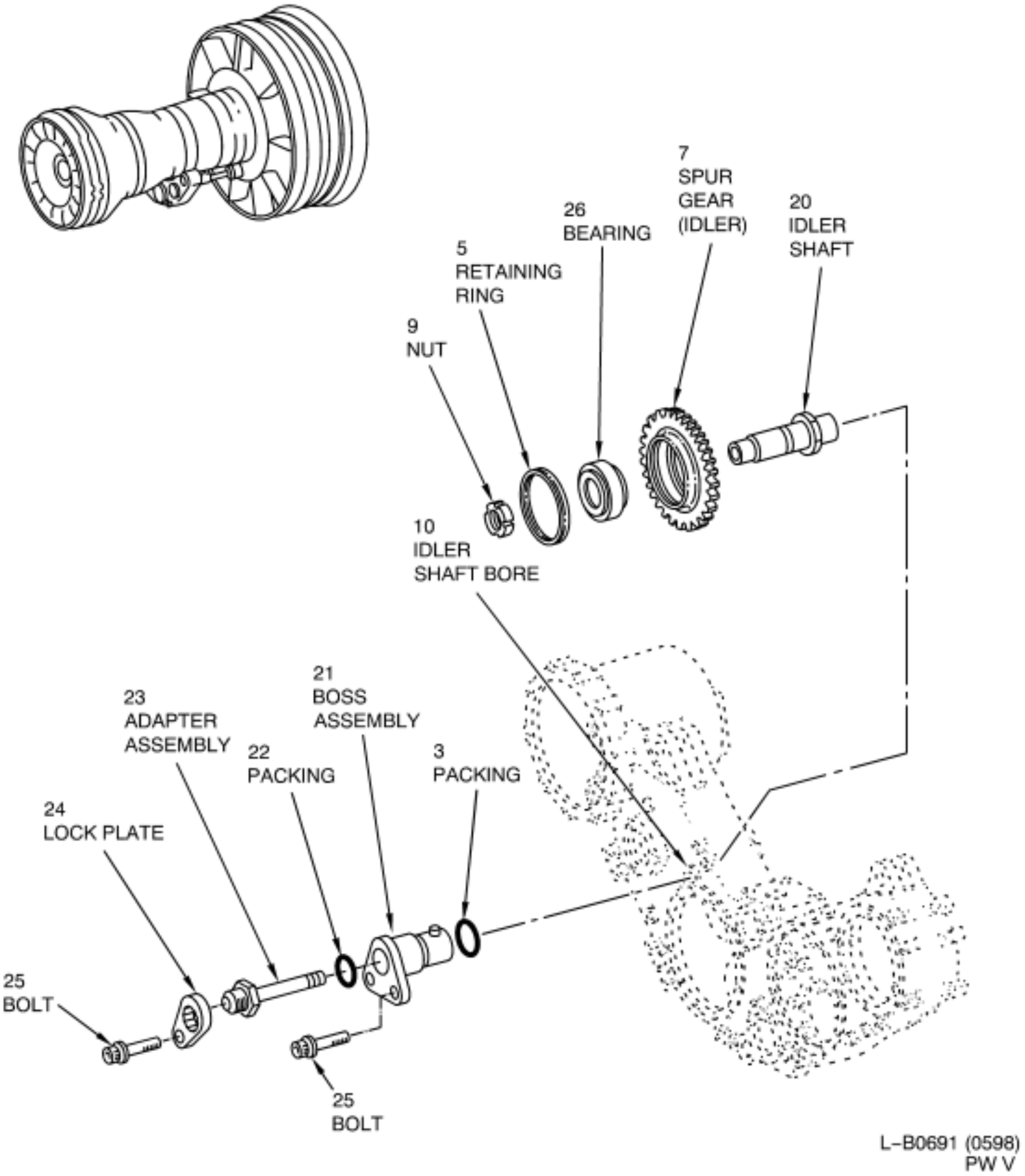

1
BOLT
2
PACKING
3
PACKING
4
GEARBOX DRIVE PAD
5
NOZZLE (EEC ALTERNATOR)
6
DRIVE SHAFT PRESSURE TUBE
7
DRIVE SHAFT NOZZLE
8
PACKING
9
GEARBOX DRIVE SHAFT HOUSING
10
BOLT
FWD
L−A0514 (0000)
PW V

Gearbox Nozzle Installation
Figure 1012
(Task 72−61−00−400−001)


IDLER SHAFT BORE
10
FWD
BEARING RING
4
3
PACKING
2
IDLER SHAFT
1
BOLT
9
NUT
8
BEARING INNER RACE
5
RETAINING RING
6
BEARING OUTER RACE AND ROLLERS
7
SPUR GEAR (IDLER)
L-A0517 (0488)
PW V

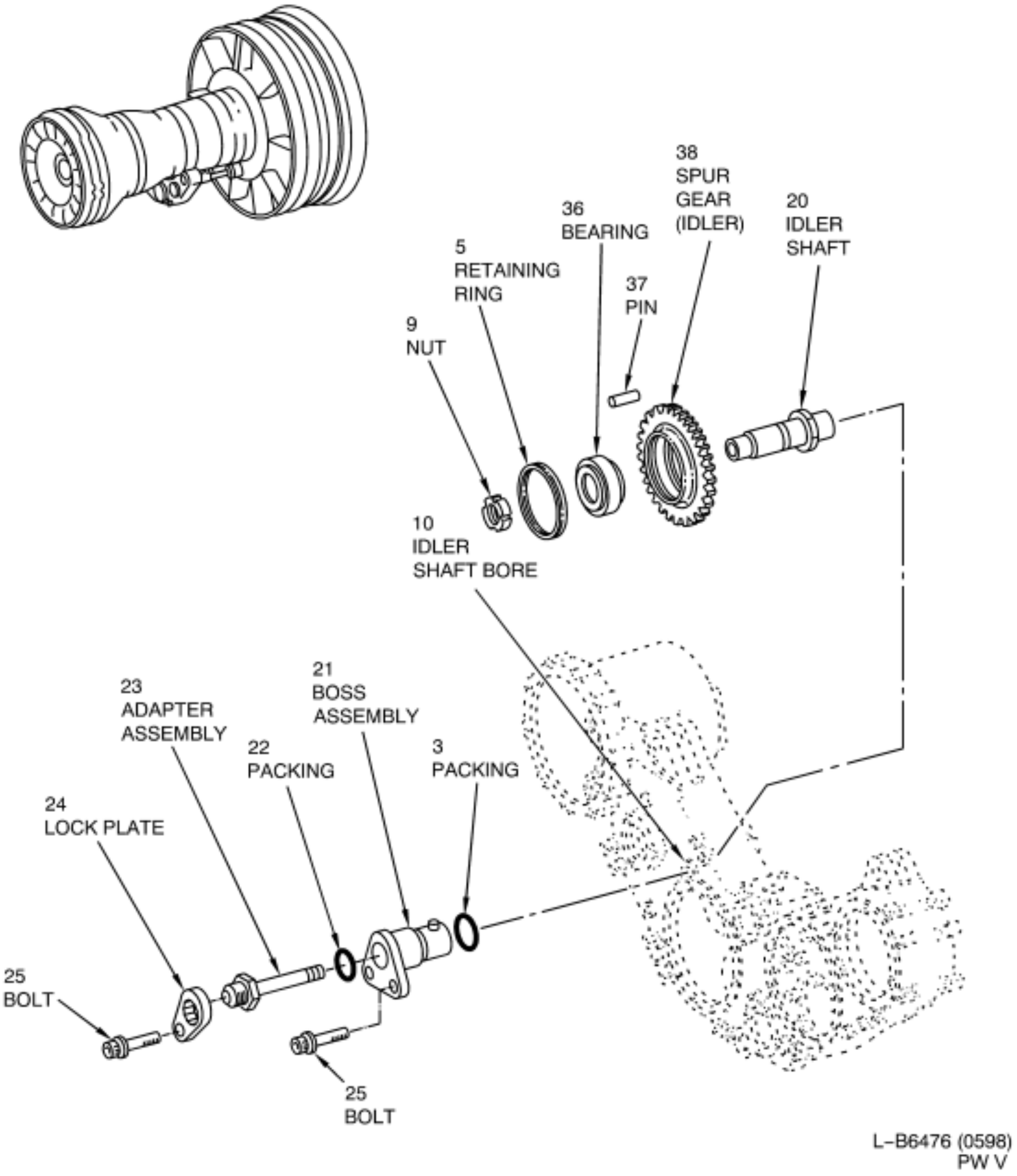
Gearbox Idler Spur Gear (Pre SB PW4ENG 72-491)
Figure 1013 (Sheet 1)
(Task 72-61-00-400-001)

MAIN GEARBOX - ASSEMBLY-01


7
SPUR
GEAR
(IDLER)
26
BEARING
20
IDLER
SHAFT
5
RETAINING
RING
9
NUT
10
IDLER
SHAFT BORE
21
BOSS
ASSEMBLY
23
ADAPTER
ASSEMBLY
22
PACKING
3
PACKING
24
LOCK PLATE
25
BOLT
25
BOLT
L-B0691 (0598)
PW V

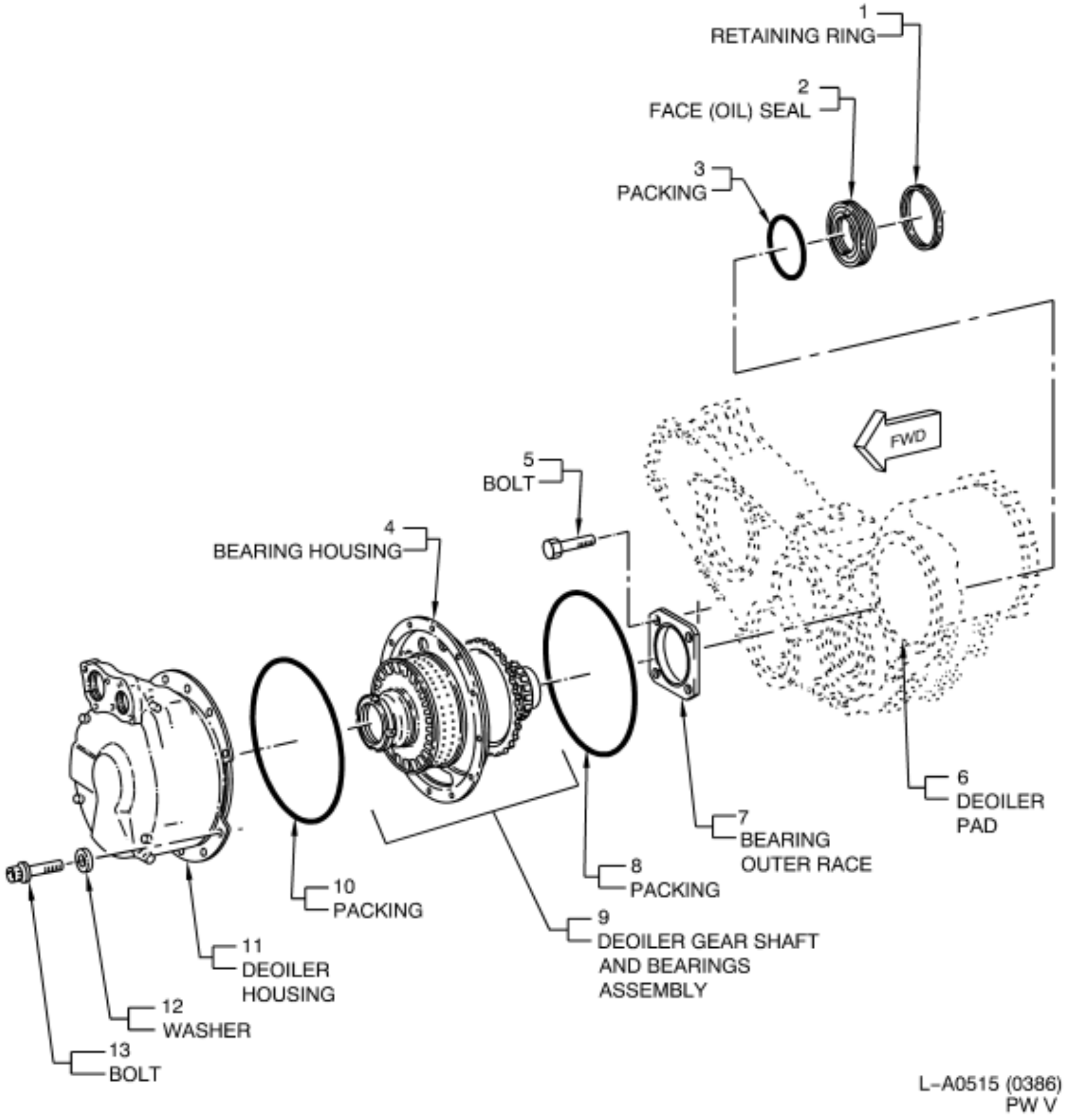
Gearbox Idler Spur Gear (Post SB PW4ENG 72-491)
Figure 1013 (Sheet 2)
(Task 72-61-00-400-001)

MAIN GEARBOX - ASSEMBLY-01

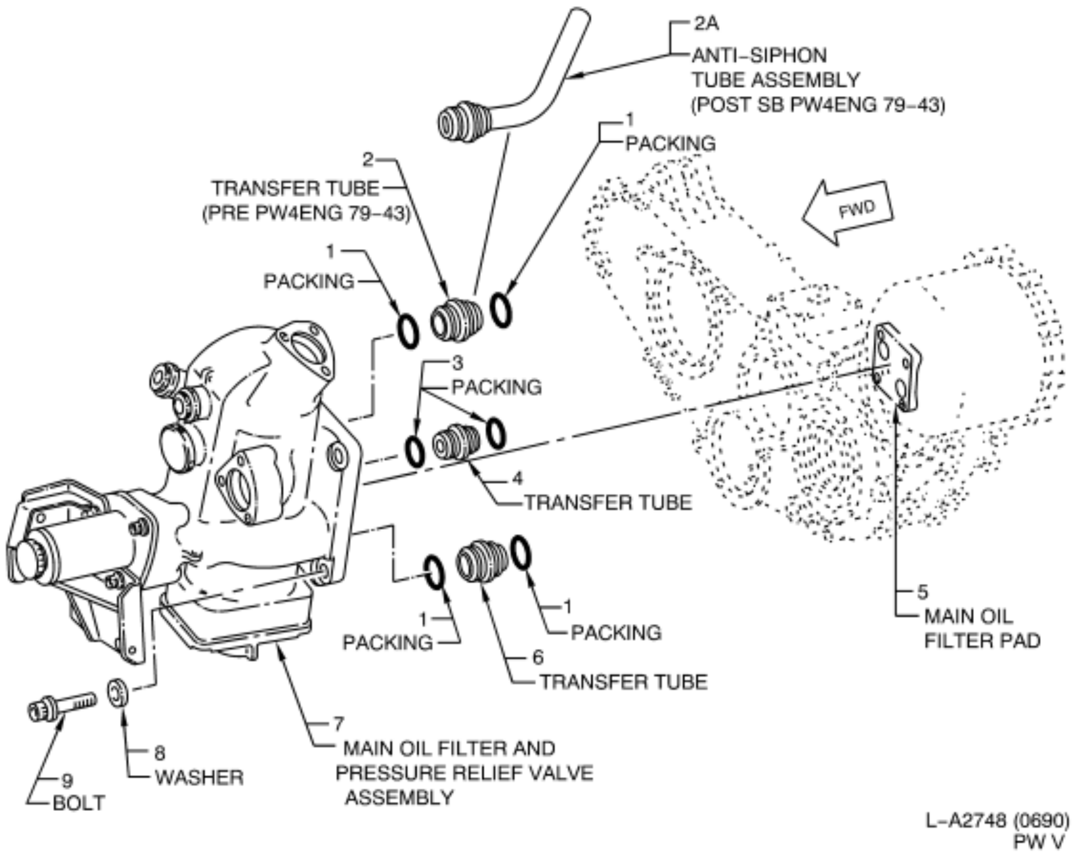

38
SPUR
GEAR
(IDLER)
36
BEARING
20
IDLER
SHAFT
5
RETAINING
RING
37
PIN
9
NUT
10
IDLER
SHAFT BORE
21
BOSS
ASSEMBLY
23
ADAPTER
ASSEMBLY
22
PACKING
3
PACKING
24
LOCK PLATE
25
BOLT
25
BOLT
L-B6476 (0598)
PW V

Gearbox Idler Spur Gear (Post SB PW4ENG 72-644)
Figure 1013 (Sheet 3)
(Task 72-61-00-400-001)

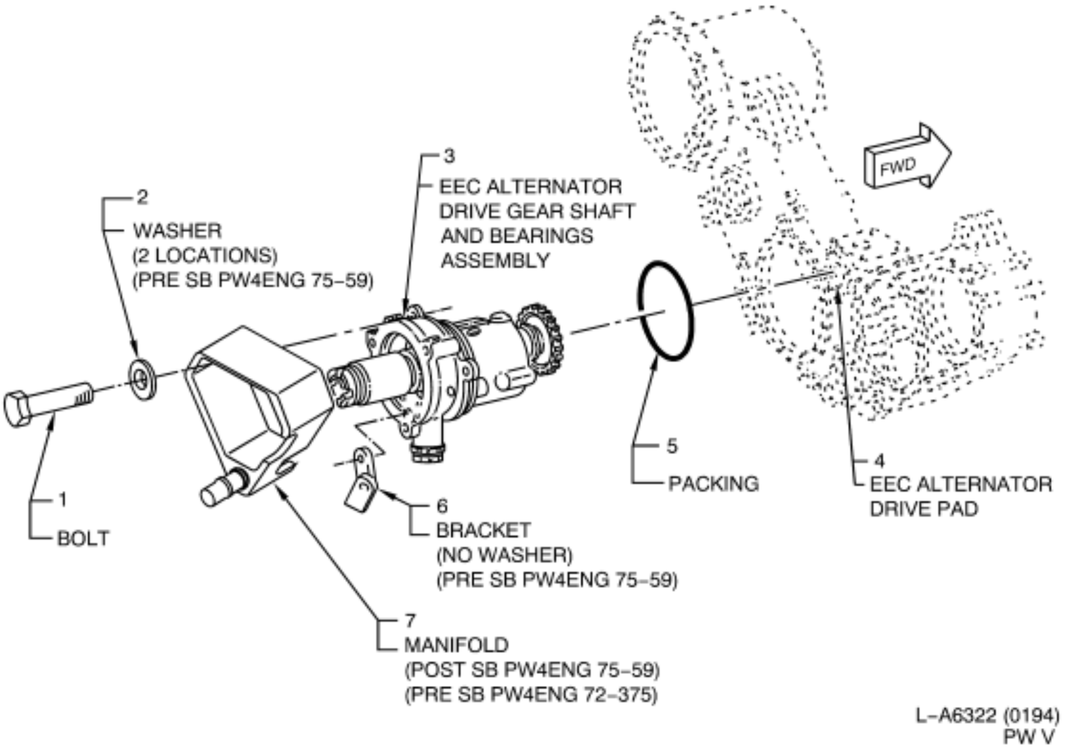
MAIN GEARBOX − ASSEMBLY−01


1
RETAINING RING
2
FACE (OIL) SEAL
3
PACKING
FWD
5
BOLT
4
BEARING HOUSING
6
DEOILER
PAD
7
BEARING
OUTER RACE
8
PACKING
9
DEOILER GEAR SHAFT
AND BEARINGS
ASSEMBLY
10
PACKING
11
DEOILER
HOUSING
12
WASHER
13
BOLT
L−A0515 (0386)
PW V

Deoiler Gearshaft And Bearings Assembly Installation
Figure 1014
(Task 72−61−00−400−001)

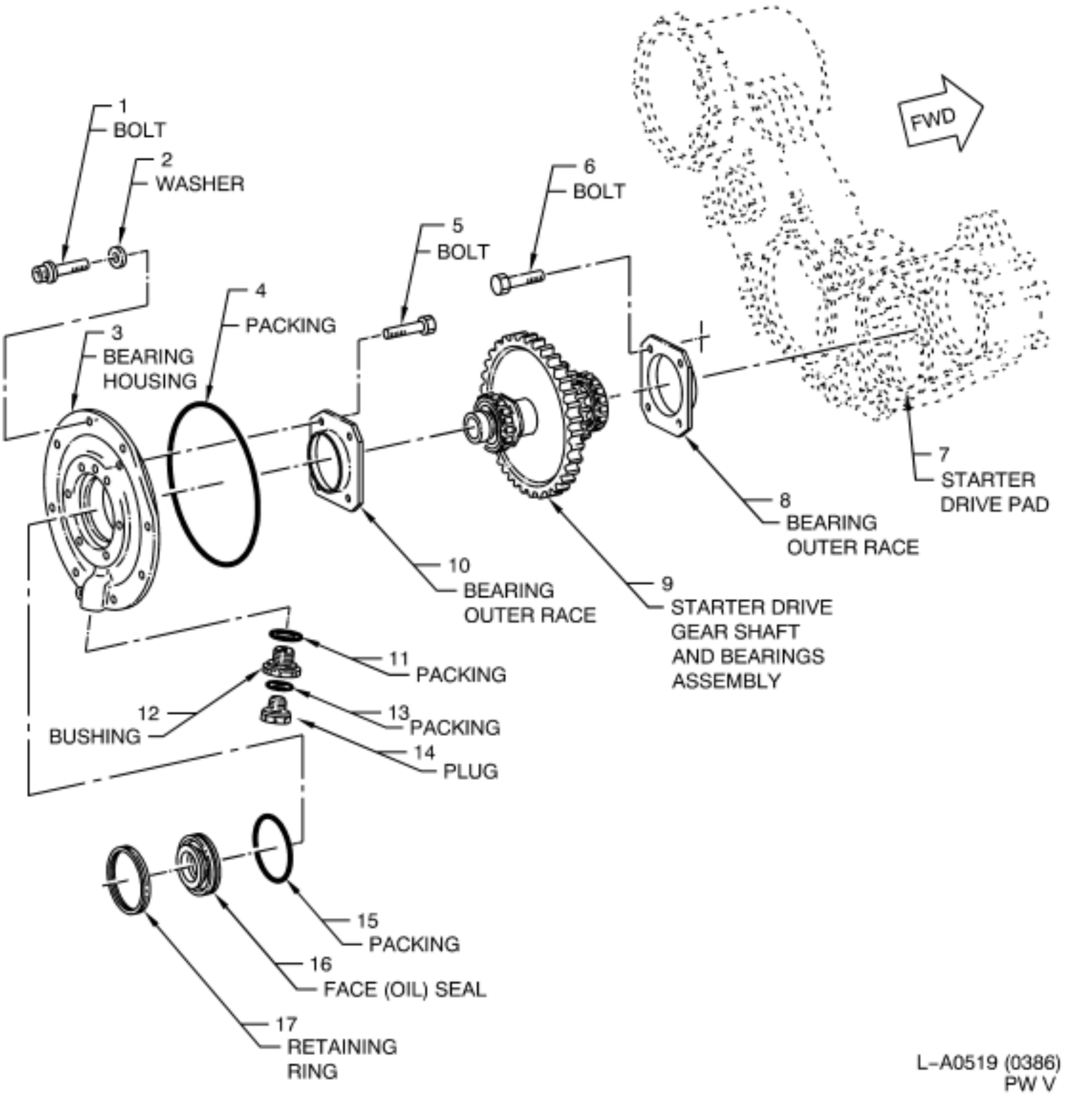

2A
ANTI−SIPHON
TUBE ASSEMBLY
(POST SB PW4ENG 79−43)
1
PACKING
FWD
2
TRANSFER TUBE
(PRE PW4ENG 79−43)
1
PACKING
3
PACKING
4
TRANSFER TUBE
5
MAIN OIL
FILTER PAD
1
PACKING
1
PACKING
6
TRANSFER TUBE
7
MAIN OIL FILTER AND
PRESSURE RELIEF VALVE
ASSEMBLY
8
WASHER
9
BOLT
L−A2748 (0690)
PW V

Main Oil Filter And Pressure Relief Valve Installation
Figure 1015
(Task 72−61−00−400−001)


2
WASHER
(2 LOCATIONS)
(PRE SB PW4ENG 75−59)
3
EEC ALTERNATOR
DRIVE GEAR SHAFT
AND BEARINGS
ASSEMBLY
FWD
1
BOLT
5
PACKING
4
EEC ALTERNATOR
DRIVE PAD
6
BRACKET
(NO WASHER)
(PRE SB PW4ENG 75−59)
7
MANIFOLD
(POST SB PW4ENG 75−59)
(PRE SB PW4ENG 72−375)
L−A6322 (0194)
PW V

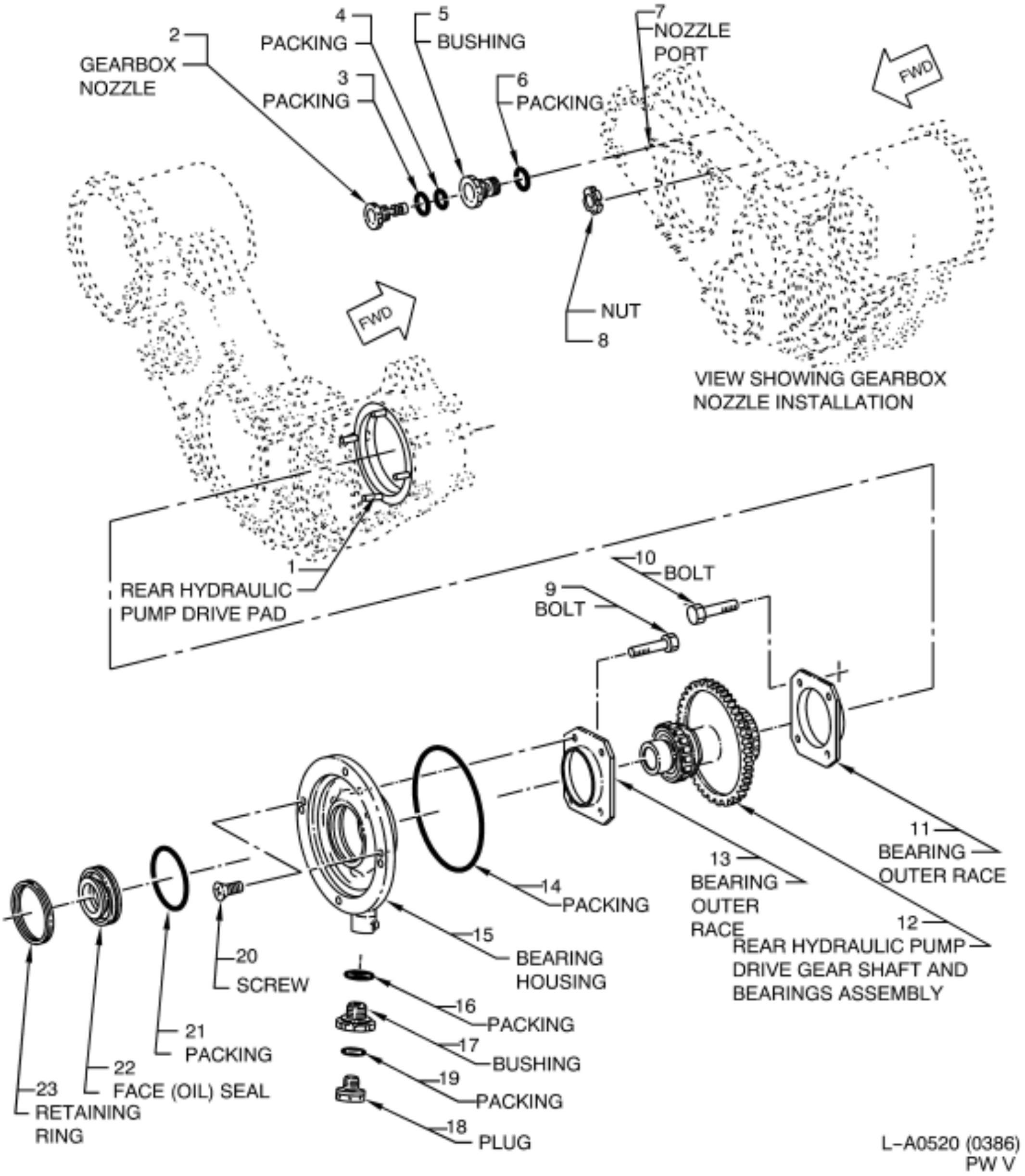
EEC Alternator Drive Gearshaft And Bearings Assembly
Figure 1016
(Task 72−61−00−400−001)

MAIN GEARBOX - ASSEMBLY-01

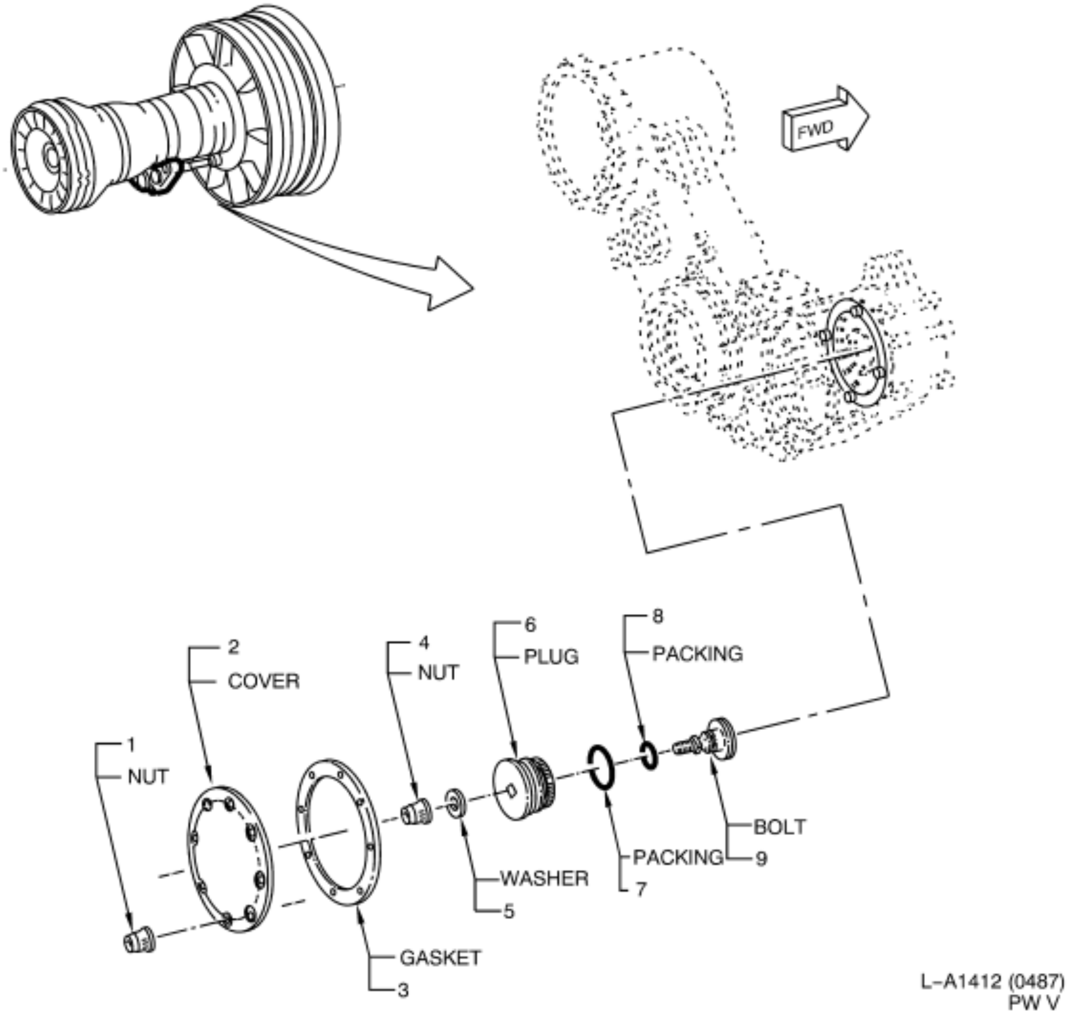

1
BOLT
2
WASHER
6
BOLT
FWD
5
BOLT
4
PACKING
3
BEARING HOUSING
7
STARTER DRIVE PAD
8
BEARING OUTER RACE
10
BEARING OUTER RACE
9
STARTER DRIVE GEAR SHAFT AND BEARINGS ASSEMBLY
11
PACKING
12
BUSHING
13
PACKING
14
PLUG
15
PACKING
16
FACE (OIL) SEAL
17
RETAINING RING
L-A0519 (0386)
PW V

Starter Drive Gearshaft And Bearings Assembly Installation
Figure 1017
(Task 72-61-00-400-001)

MAIN GEARBOX - ASSEMBLY-01


2 GEARBOX NOZZLE
4 PACKING
3 PACKING
5 BUSHING
6 PACKING
7 NOZZLE PORT
FWD
FWD
NUT 8
VIEW SHOWING GEARBOX NOZZLE INSTALLATION
1 REAR HYDRAULIC PUMP DRIVE PAD
10 BOLT
9 BOLT
11 BEARING OUTER RACE
13 BEARING OUTER RACE
12 REAR HYDRAULIC PUMP DRIVE GEAR SHAFT AND BEARINGS ASSEMBLY
14 PACKING
15 BEARING HOUSING
20 SCREW
21 PACKING
22 FACE (OIL) SEAL
23 RETAINING RING
16 PACKING
17 BUSHING
19 PACKING
18 PLUG
L-A0520 (0386)
PW V

Rear Hydraulic Pump Drive Gearshaft
And Bearings Assembly Installation
Figure 1018
(Task 72-61-00-400-001)


FWD
1
NUT
2
COVER
3
GASKET
4
NUT
5
WASHER
6
PLUG
7
PACKING
8
PACKING
9
BOLT
L-A1412 (0487)
PW V

Rear Hydraulic Pump Drive Plug, Bolt And Cover Installation
Figure 1019
(Task 72-61-00-400-001)

MAIN GEARBOX - ASSEMBLY-02

Task 72-61-00-400-002:

1. Assemble Front Hydraulic Pump Drive And IDG Drive Gearshaft To Main Gearbox

A. Prerequisites

(1) See Inspection/Check-04 (Task 72-61-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

(2) Assemble main gearbox per Assembly-01 (Task 72-61-00-400-001).

(3) Assemble IDG drive gearshaft and bearings assembly per 72-61-06 (Task 72-61-06-440-001).

(4) Assemble front hydraulic pump drive gearshaft and bearings assembly per 72-61-07 (Task 72-61-07-440-001).

B. Equipment And Materials Necessary

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72-61-00/17/60
Gasket	1	72-61-00/17/160
Packing	1	72-61-00/13/50
Packing	1	72-61-00/13/110
Packing	1	72-61-00/13/140
Packing	1	72-61-00/13/160
Packing	1	72-61-00/14/1
Packing	1	72-61-00/14/170
Packing	1	72-61-00/14/260
Packing	1	72-61-00/14/270
Packing	1	72-61-00/17/1
Packing	1	72-61-00/17/30
Packing	1	72-61-00/17/100
Packing	1	72-61-00/17/130
Lockwire, AS3214-02		

MAIN GEARBOX − ASSEMBLY−02

C. Procedure

Subtask 72−61−00−430−064:

(1) Install IDG drive gearshaft and bearings assembly. See Figure 1001.

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER. MATING NUMBERS ARE MARKED ON DETAIL PARTS OF BEARING.

(a) Align boltholes and position bearing outer race (1001/15) into bore in rear side of bearing housing (1001/6). Secure outer race using four bolts (1001/14). Torque bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(b) Insert IDG drive gearshaft and bearings assembly (1001/13), smaller spur gear end first, through bore in IDG drive pad (1001/12). Mesh mating gears and mate roller bearing on gearshaft with previously installed bearing outer race in front wall of gearbox.

(c) Install packing (1001/7), lubricated with Engine Oil P03−001, into groove in OD of bearing housing (1001/6).

(d) Mate previously installed roller bearing outer race in bearing housing with rollers on gearshaft. Align boltholes and seat bearing housing on IDG drive pad (1001/12). Secure bearing housing with 12 washers (1001/5) and bolts (1001/4). Torque bolts to 125 − 140 lb−in. (14.123 − 15.818 N.m).

(e) Install packing (1001/3), lubricated with Engine Oil P03−001, into groove in OD of face (oil) seal (1001/2).

(f) Install seal into seal bore in bearing housing (1001/6), seating carbon seal on sealing face of gearshaft. Install retaining ring (1001/1) into groove in bearing housing to secure seal.

(g) Lubricate packing (1001/8) and threads of bushing (1001/11) with Engine Oil P03−001. Install bushing into port in bottom of bearing housing. Torque bushing to 250 − 275 lb−in. (28.246 − 31.071 N.m).

(h) Lubricate packing (1001/9) and threads of plug (1001/10) with Engine Oil P03−001. Install plug into installed bushing (1001/11). Torque plug to 110 − 120 lb−in. (12.428 − 13.558 N.m). Lockwire plug.

(i) For those engines not utilizing an IDG, install the IDG drive bolt, plug and cover. See Figure 1002.

1 Lubricate packing (1002/9) and bolt (1002/10) with Engine Oil P03−001. Install packing in groove of bolt nearest bolthead. Install bolt and packing assembly in gearshaft, seating bolthead in groove in gearshaft internal splines.

2 Install packing (1002/8) lubricated with Engine Oil P03−001, in groove of plug (1002/7), lubricated with Engine Oil P03−001. Install plug over bolt, plugging gearshaft opening.

3 Install washer (1002/6) and nut (1002/5), lubricated with Engine Oil P03−001, over bolt. Torque nut to 85 − 95 lb−in. (9.604 − 10.734 N.m).

4 Install gasket (1002/4) and cover (1002/3) and secure with eight washers (1002/2) and eight bolts (1002/1). Torque bolts to 225 − 250 lb−in. (25.422 − 28.246 N.m).

Subtask 72−61−00−430−065:

(2) Install front hydraulic pump drive gearshaft and bearings assembly. See Figure 1003.

(a) Install packing (1003/8), lubricated with Engine Oil P03−001, into groove in rear OD of bearing housing (1003/2).

(b) Align boltholes in rear flange of bearing housing with boltholes in front hydraulic pump drive pad (1003/7). Seat housing on drive pad. Secure assembly with eight washers (1003/9) and bolts (1003/10). Torque bolts to 225 − 250 lb−in. (25.422 − 28.246 N.m).

MAIN GEARBOX - ASSEMBLY-02

(3) Install new packing (1003/11), lubricated with Engine Oil P03-001, into groove in OD of bearing support (1003/1).

(4) Align boltholes and install gearshaft and bearing support assembly, slot up, in bearing housing (1003/2). Secure bearing support with four bolts (1002/12). Torque bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(5) Install new packings (1003/5) and (1003/6), lubricated with Engine Oil P03-001, into grooves in nozzle (1003/4). Aligning boltholes, install nozzle in port in boss at top of bearing housing (1003/2). Secure nozzle with two bolts (1003/3). Torque bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(a) For those engines not utilizing a front hydraulic pump, install the front hydraulic pump drive bolt, plug and cover. See Figure 1004.

1 Install packing (1004/8) lubricated with Engine Oil P03-001, in groove of bolt (1004/9) lubricated with Engine Oil P03-001, nearest bolthead. Install bolt and packing assembly in gearshaft, seating head of bolt in groove in gearshaft internal splines.

2 Install packing (1004/7) lubricated with Engine Oil P03-001, in groove of plug (1004/6) lubricated with Engine Oil P03-001. Install plug over bolt, plugging gearshaft opening.

3 Install washer (1004/5) and nut (1004/4) lubricated with Engine Oil P03-001, over bolt. Torque nut to 36 - 40 lb-in. (4.067 - 4.519 N.m).

4 Install gasket (1004/3) and cover (1004/2) over bearing housing studs. Secure with four hydraulic pump nuts (1004/1) treated with Engine Oil P03-001. Torque nuts to 275 - 300 lb-in. (31.071 - 33.895 N.m).

D. Postrequisites

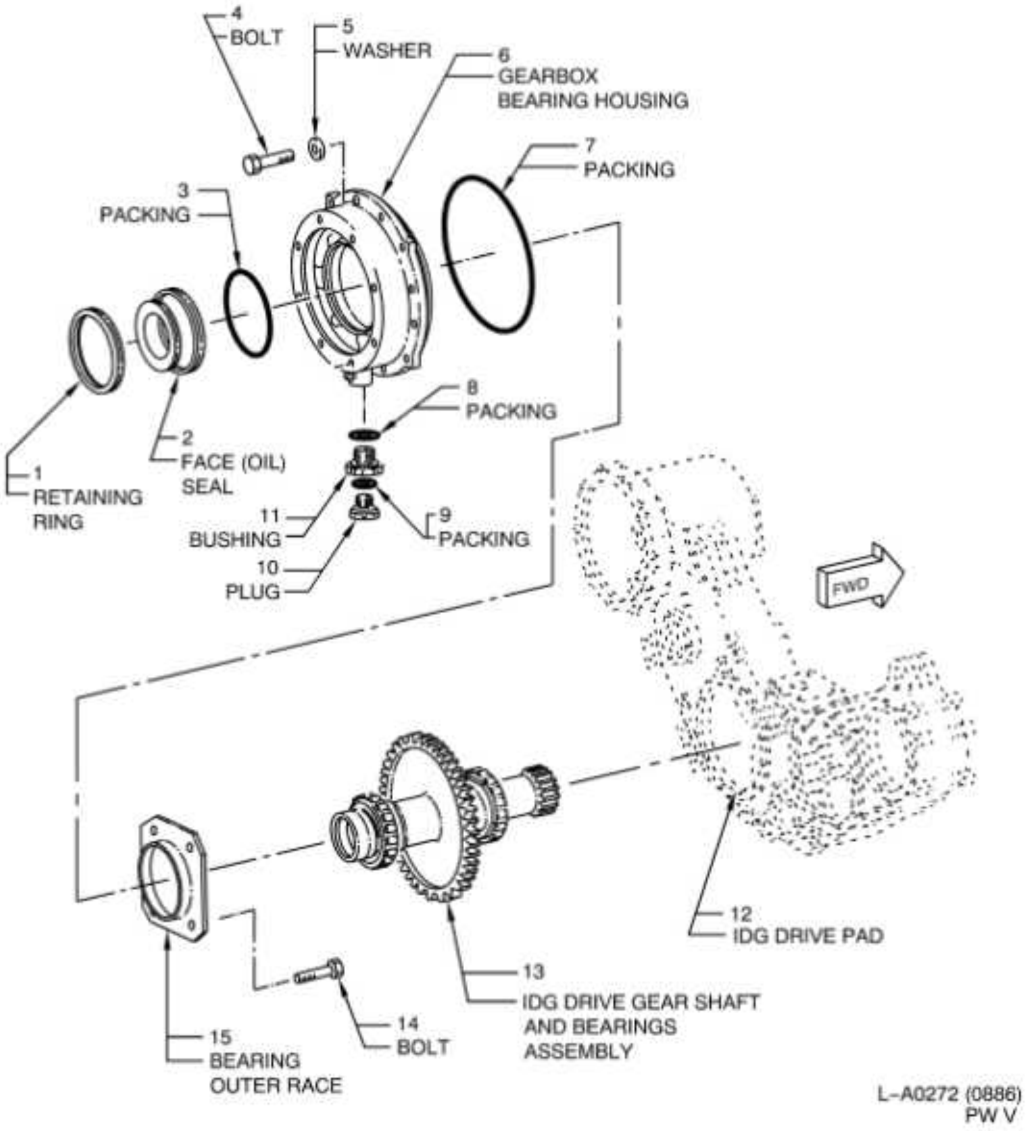
(1) Install the drain plugs and lube oil tank on the main gearbox. Refer to Assembly-03 (Task 72-61-00-400-003).

(2) Install the magnetic chip detector assemblies in the main gearbox, lube oil tank, and lubrication and scavenge oil pump. Refer to Assembly−07 (Task 72−61−00−400−007).

(3) Do a leak check of the main gearbox. Refer to Testing−01 (Task 72−61−00−790−001).

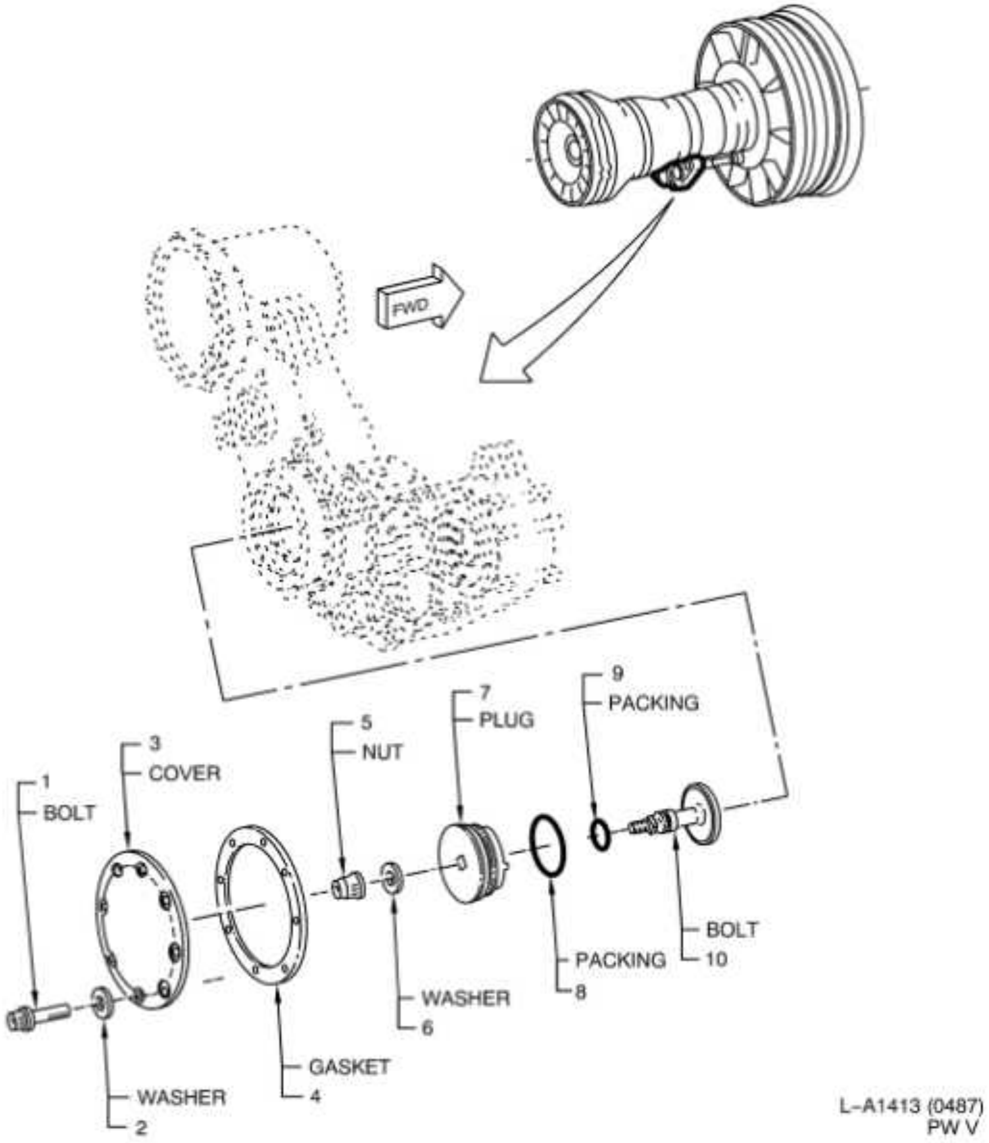
(4) Install the brackets, EEC alternator rotor and stator, and the lubrication and scavenge oil pump on the main gearbox. Refer to Assembly−06 (Task 72−61−00−400−006).

MAIN GEARBOX − ASSEMBLY−02


4
BOLT
5
WASHER
6
GEARBOX
BEARING HOUSING
7
PACKING
3
PACKING
8
PACKING
2
FACE (OIL)
SEAL
1
RETAINING
RING
11
BUSHING
9
PACKING
10
PLUG
FWD
12
IDG DRIVE PAD
13
IDG DRIVE GEAR SHAFT
AND BEARINGS
ASSEMBLY
14
BOLT
15
BEARING
OUTER RACE
L−A0272 (0886)
PW V

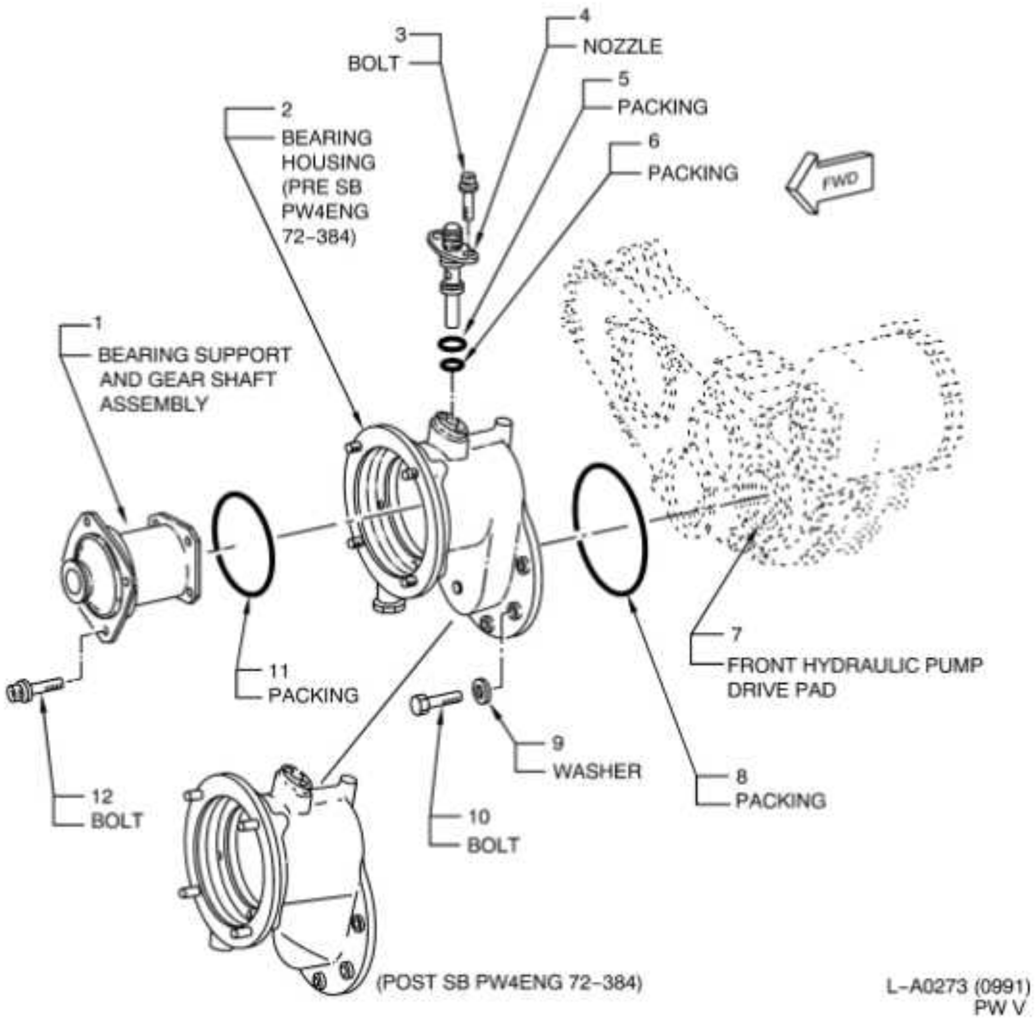
IDG Drive Gearshaft And Bearings Assembly Installation
Figure 1001
(Task 72−61−00−400−002)

MAIN GEARBOX − ASSEMBLY−02

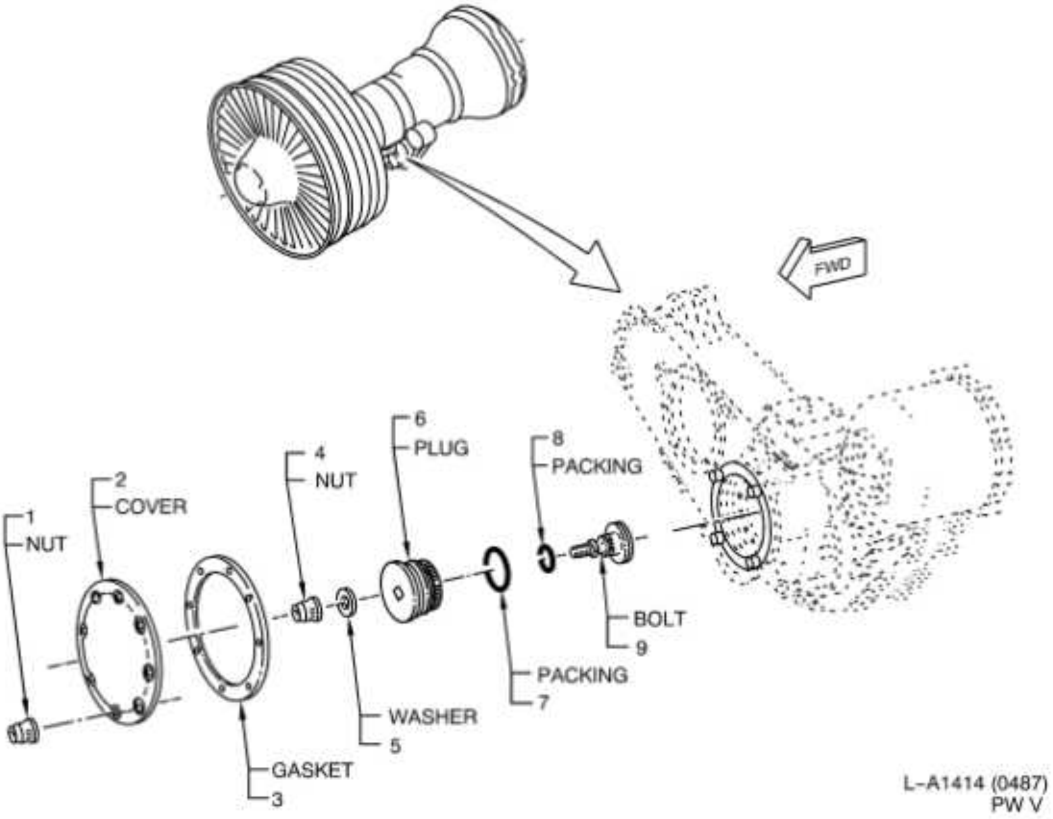

FWD
1
BOLT
3
COVER
5
NUT
7
PLUG
9
PACKING
BOLT
10
PACKING
8
WASHER
6
GASKET
4
WASHER
2
L-A1413 (0487)
PW V

IDG Drive Bolt, Plug And Cover Installation
Figure 1002
(Task 72−61−00−400−002)

MAIN GEARBOX − ASSEMBLY−02


3
BOLT
4
NOZZLE
5
PACKING
6
PACKING
FWD
2
BEARING HOUSING (PRE SB PW4ENG 72-384)
1
BEARING SUPPORT AND GEAR SHAFT ASSEMBLY
7
FRONT HYDRAULIC PUMP DRIVE PAD
11
PACKING
9
WASHER
8
PACKING
12
BOLT
10
BOLT
(POST SB PW4ENG 72-384)
L-A0273 (0991)
PW V

Front Hydraulic Pump Drive Assembly Installation
Figure 1003
(Task 72−61−00−400−002)


FWD
1
NUT
2
COVER
3
GASKET
4
NUT
5
WASHER
6
PLUG
7
PACKING
8
PACKING
9
BOLT
L-A1414 (0487)
PW V

Front Hydraulic Pump Drive Bolt, Plug And Cover Installation
Figure 1004
(Task 72-61-00-400-002)

MAIN GEARBOX - ASSEMBLY-03

Task 72-61-00-400-003:

1. Assemble Drain Plugs And Lube Oil Tank Assembly To The Main Gearbox

A. Prerequisites

(1) See Inspection/Check-04 (Task 72-61-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

(2) Assemble main gearbox per Assembly-01 (Task 72-61-00-400-001).

(3) Assemble front hydraulic pump drive and IDG drive gearshaft to main gearbox per Assembly-02 (Task 72-61-00-400-002).

(4) Assemble lube oil tank and deaerator assembly per Assembly-05 (Task 72-61-00-400-005).

B. Equipment And Materials Necessary

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 Or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
P06-002	Petrolatum, White (PMC 9609)
R P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Gasket	1	72-61-00/15/105
Packing	1	72-61-00/12/1
Packing	1	72-61-00/12/40
Packing	1	72-61-00/12/60

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
(CONTINUED)		
Packing	1	72−61−00/15/50
Packing	1	72−61−00/15/60
Packing	1	72−61−00/15/30
Packing	1	72−61−00/15/120
Packing	1	72−61−00/15/1
Packing	1	79−11−00/1/20

C. Procedure

Subtask 72−61−00−430−063:

(1) Install drain plugs and bushings in gearbox housing. See Figure 1001.

(a) Lubricate packing (1001/2) and threads of bushing (1001/1) with Engine Oil P03−001. Assemble packing onto bushing and install bushing into magnetic plug port in lower center of gearbox. Torque bushing to 375 − 425 lb−in. (42.369 − 48.019 N.m).

(b) Lubricate packing (1001/6) and threads of bushing (1001/5) with Engine Oil P03−001. Assemble packing onto bushing. Install bushing into drain port in front of gearbox as shown in referenced figure. Torque bushing to 250 − 275 lb−in. (28.246 − 31.071 N.m).

(c) Lubricate packing (1001/4) and threads of plug (1001/3) with Engine Oil P03−001. Assemble packing onto plug and install plug into previously installed bushing (1001/5). Torque plug to 110 − 120 lb−in. (12.428 − 13.558 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 the plug.

(d) Lubricate packing (1001/10) and threads of bushing (1001/9) with Engine Oil P03−001. Assemble packing onto bushing. Install bushing into drain port in lower front side of gearbox as shown in referenced figure. Torque bushing to 250 − 275 lb−in. (28.246 − 31.071 N.m).

R
R

(e) Lubricate packing (1001/8) and threads of probe (1001/7) with Engine Oil P03-001. Assemble packing onto probe. Install probe into previously installed bushing (1001/9). Torque probe to 110 - 120 lb-in. (12.428 - 13.558 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 the probe.

(f) (Post SB PW4ENG 73-84) Install a new packing lubricated with Engine Oil P03-001 on removed EEC oil temperature thermocouple probe (1001/7A). Lubricate the threads of the probe with Engine Oil P03-001 and insert in bushing.

NOTE: Make sure the packing is installed in the groove on the concave end of the adapter and this end of the adapter is installed into the main gearbox assembly.

(g) Torque nuts on thermocouple as follows:

1 (Reference 571) Remove the lockwire between the body nut (adapter) and coupling nut. Loosen the coupling nut from the body nut (adapter). Torque the body nut (to the housing) to 95 - 100 lb-in. (10.734 - 11.298 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 from the body nut (adapter) to the gearbox lug.

2 Turn the probe so the two larger studs are on the bottom and slightly outward from the engine centerline. See the figure.

3 (Reference 572) Torque the coupling to 95 - 100 lb-in. (10.734 - 11.298 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 from the coupling nut to the body nut (adapter).

(h) Lubricate packing (1001/14) and threads of bushing (1001/13) with Engine Oil P03-001. Assemble packing onto bushing. Install bushing into drain port in front side of gearbox as shown in referenced figure. Torque bushing to 250 - 275 lb-in. (28.246 - 31.071 N.m).

MAIN GEARBOX − ASSEMBLY−03

(i) Lubricate packing (1001/12) and threads of plug (1001/11) with Engine Oil P03−001. Assemble packing onto plug. Install plug into previously installed bushing (1001/13). Torque plug to 150 − 170 lb−in. (16.948 − 19.207 N.m). Install the Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 the plug.

Subtask 72−61−00−430−069:

CAUTION: DO NOT TRUNNION GEARBOX WITH LUBE OIL TANK INSTALLED OR DAMAGE TO TANK WILL RESULT.

(2) Install lube oil tank assembly. See Figure 1002 and Figure 1003.

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER OIL CHECK VALVE ASSEMBLY. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 79−43.

(a) Install packings (1002/3) and (1002/5), lubricated with Engine Oil P03−001, into smaller and larger grooves respectively of oil check valve assembly (1002/4). Install oil check valve assembly, larger OD, into upper bore in oil tank housing (1002/6). For gearboxes that are Post SB PW4ENG 79−43, install a gasket on the oil check valve assembly.

(b) Install packing (1002/1), lubricated with Engine Oil P03−001, into groove in oil check valve housing (1002/2) or (1002/2A). Align boltholes and install housing over previously installed oil check valve assembly, tube up. Secure housing
R with two bolts (1002/10), treated with Antiseize
R Paste P06−054. Wipe off unwanted paste. Torque bolts to 54 − 60 lb−in. (6.101 − 6.779 N.m).

(c) Install packing (1002/7), lubricated with Engine Oil P03−001, onto groove in sealing sleeve (1002/8). Install sealing sleeve into center bore in pad in oil tank housing. Secure sealing sleeve
R with two bolts (1002/9), treated with Antiseize
R Paste P06−054. Wipe off unwanted paste. Torque bolts to 54 − 60 lb−in. (6.101 − 6.779 N.m).

MAIN GEARBOX - ASSEMBLY-03

(d) Install two packings (1002/11), lubricated with Engine Oil P03-001, into grooves in transfer packing tube (1002/13). Align boltholes and install tube (flanged end in) into lower bore in pad in oil tank housing. Secure tube with two
R bolts (1002/12), treated with Antiseize Paste
R P06-054. Wipe off unwanted paste. Torque bolts to 54 - 60 lb-in. (6.101 - 6.779 N.m).

(e) Install packing (1003/5), lubricated with Engine Oil P03-001, into groove in front OD of lube oil tank (1003/8).

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER LUBE OIL TANK. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 79-43.

(f) Align tubes in oil tank and gearbox with their mating sealing sleeves and seat oil tank on gearbox oil tank flange. Position oil tank heat shield (1003/1) to rear side of oil tank mounting flange to cover top and inboard side of oil tank. Align boltholes in mounting lugs of heat shield with boltholes in oil tank mounting flange. Secure bracket (Pre SB PW4ENG 79-48) (1003/3), oil tank, bracket (1003/6), bracket (Post SB PW4ENG 72-491) (1003/9) and heat shield with ten bolts (1003/2), lubricated with Engine Oil P03-001. Torque bolts to 180 - 200 lb-in. (20.337 - 22.597 N.m).

CAUTION: MAKE SURE THAT THE TUBES IN THE OIL TANK CORRECTLY ENGAGE THE TUBES FROM THE GEARBOX. INCORRECT ENGAGEMENT OF THE TUBES CAN CAUSE AN IN-FLIGHT SHUTDOWN.

(g) Make sure that the oil tank is correctly installed as follows.

1 Look in the hole at the top of the oil tank.

2 With a mirror, do a check to be sure that the tubes inside the oil tank are engaged with the tubes from the main gearbox. Pay particular attention to the engagement of the breather tube (1003/4) with its mating tube.

(h) Position oil tank clamp (1003/7) around oil tank and groove in oil tank heat shield (1003/1). Secure clamp with detail screw, lubricated with Petrolatum White P06−002. (Reference 1121 and 2151) Torque screw to 15 − 18 lb−in. (1.695 − 2.034 N.m).

(i) Install packing (1003/12), lubricated with Engine Oil P03−001, onto the groove in cover (1003/11) and install the cover to the flange of the hole at the top of the oil tank.

(j) (Pre SB PW4ENG 79−74) Attach the cover (1003/11) to the tank flange with six (6) bolts (1003/10) and nuts (1003/13). Torque nuts to 30 − 35 lb−in. (3.390 − 3.954 N.m).

(k) (Post SB PW4ENG 79−74) Install the oil tank heat shield bracket (1003/14) to the bottom of the flange at the top of the oil tank. Attach the cover (1003/11) and bracket (1003/14) to the tank flange with six (6) bolts (1003/10) and nuts (1003/13). Torque nuts to 30 − 35 lb−in. (3.390 − 3.954 N.m).

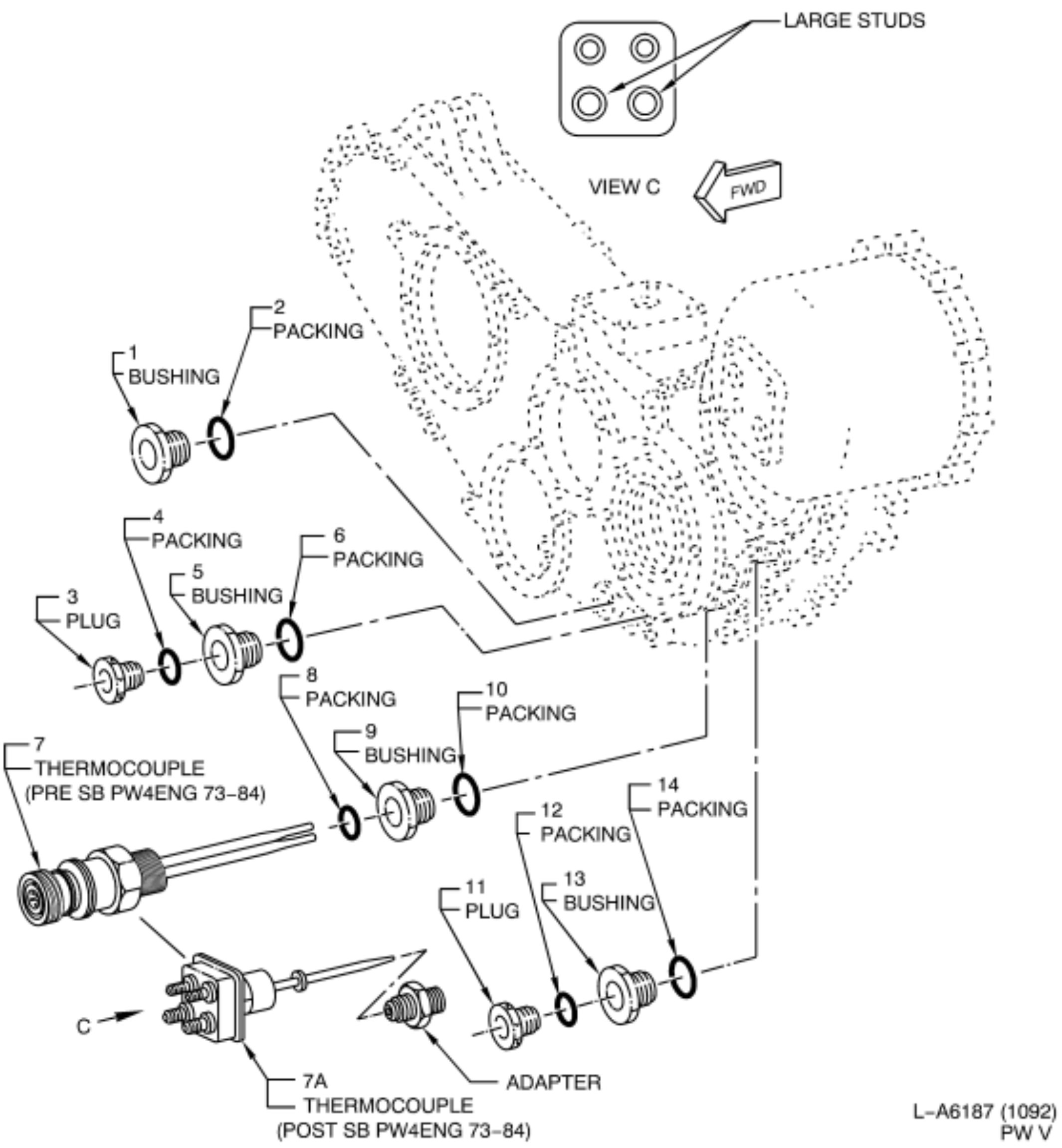
D. Postrequisites

(1) Install the magnetic plug assemblies in the main gearbox, lube oil tank, and lubrication and scavenge oil pump. Refer to Assembly−07 (Task 72−61−00−400−007).

(2) Do a leak check of the gearbox. Refer to Testing−01 (Task 72−61−00−790−001).

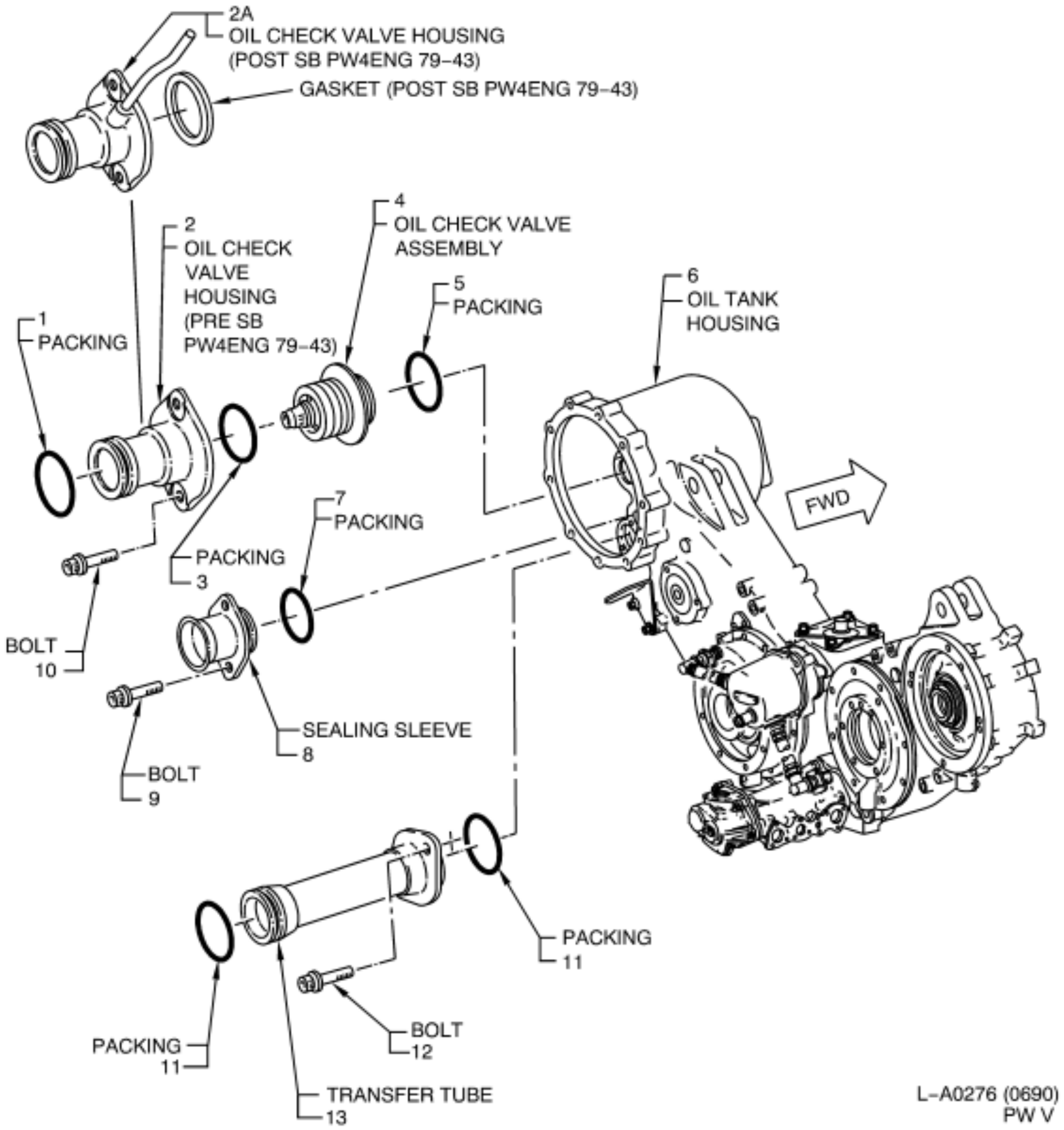
(3) Install the brackets, the EEC alternator rotor and stator, and the lubrication and scavenge oil pump on the main gearbox. Refer to Assembly−06 (Task 72−61−00−400−006).

MAIN GEARBOX – ASSEMBLY-03

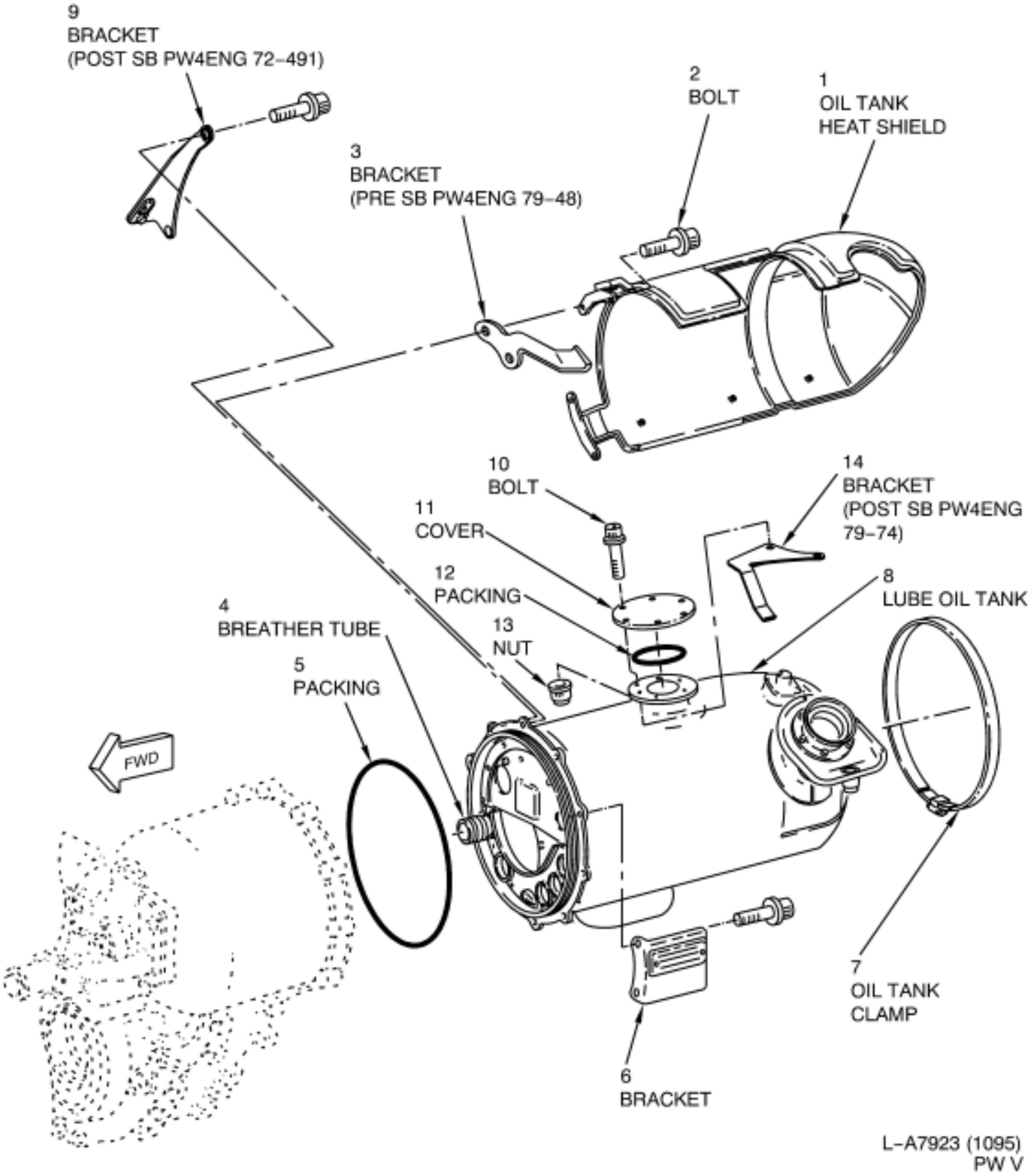

LARGE STUDS
VIEW C
FWD
2
PACKING
1
BUSHING
4
PACKING
6
PACKING
5
BUSHING
3
PLUG
8
PACKING
10
PACKING
9
BUSHING
7
THERMOCOUPLE
(PRE SB PW4ENG 73-84)
14
PACKING
12
PACKING
13
BUSHING
11
PLUG
C
ADAPTER
7A
THERMOCOUPLE
(POST SB PW4ENG 73-84)
L-A6187 (1092)
PW V

Drain Plugs, Probe, And Bushings Installation In Gearbox Housing
Figure 1001
(Task 72-61-00-400-003)

MAIN GEARBOX − ASSEMBLY−03


2A
OIL CHECK VALVE HOUSING
(POST SB PW4ENG 79−43)
GASKET (POST SB PW4ENG 79−43)
2
OIL CHECK
VALVE
HOUSING
(PRE SB
PW4ENG 79−43)
4
OIL CHECK VALVE
ASSEMBLY
5
PACKING
6
OIL TANK
HOUSING
1
PACKING
FWD
PACKING
3
7
PACKING
BOLT
10
SEALING SLEEVE
8
BOLT
9
PACKING
11
BOLT
12
PACKING
11
TRANSFER TUBE
13
L−A0276 (0690)
PW V

Lube Oil Tank Assembly Installation
Figure 1002
(Task 72−61−00−400−003)


9
BRACKET
(POST SB PW4ENG 72-491)
2
BOLT
1
OIL TANK
HEAT SHIELD
3
BRACKET
(PRE SB PW4ENG 79-48)
10
BOLT
14
BRACKET
(POST SB PW4ENG
79-74)
11
COVER
12
PACKING
8
LUBE OIL TANK
4
BREATHER TUBE
13
NUT
5
PACKING
FWD
7
OIL TANK
CLAMP
6
BRACKET
L-A7923 (1095)
PW V

Lube Oil Tank Assembly Installation
Figure 1003
(Task 72-61-00-400-003)

MAIN GEARBOX - ASSEMBLY-04

Task 72-61-00-400-004:

1. Assemble Main Oil Filter, Housing And Pressure Relief Valves Assembly

A. Prerequisites

(1) See Inspection/Check-04 Task 72-61-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	2	72-61-00/11/100
Packing	1	79-21-00/2/20
Packing	1	79-21-00/2/30
Packing	1	79-21-00/2/50
Packing	1	79-21-00/2/60
Packing	1	79-21-00/2/80
Packing	1	79-21-00/2/110
Packing	1	79-21-00/2/180
Nut Option	4	79-21-00/2/220A
Packing	1	79-21-00/2/230
Packing	1	79-21-00/2/250

C. Procedure
See Figure 1001 and Figure 1002.

MAIN GEARBOX − ASSEMBLY−04

Subtask 72−61−00−430−070:

(1) Position main oil filter housing (1001/11), large mounting flange side down, on bench. See Figure 1001.

(2) Install new packings (1001/9) and (1001/10), lubricated with Engine Oil P03−001, into grooves in relief valve housing (1001/8).

(3) Align bolt holes and install pressure relief valve housing (1001/8) in bore in pressure relief valve pad (1001/12).

(4) Position bracket (1001/7) over relief valve housing. Secure housing and bracket with three bolts (1001/6). Torque bolts to 125 − 140 lb−in. (14.123 − 15.818 N.m).

(5) Install new packing (1001/5), lubricated with Engine Oil P03−001, in groove in pressure relief valve (1001/4).

(6) Install pressure relief valve (1001/4), smaller OD end down, in bore in pressure relief valve housing (1001/8). Install spring (1001/3) in valve.

(7) Install new packing (1001/2), lubricated with Engine Oil P03−001, on relief valve plug (1001/1).

(8) Install plug, lubricated with Engine Oil P03−001, over spring (1001/3) and in pressure relief valve housing (1002/8). Torque plug to 650 − 750 lb−in. (73.440 − 84.738 N.m). Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 plug.

(9) (Pre SB PW4ENG 72−524) Assemble the main oil filter housing, filter element and cover as follows. See Figure 1002 (Sheet 1) and Figure 1002 (Sheet 2).

    (a) Position main oil filter housing (1002/3), large mounting flange side down, on bench.

    (b) Align bolt hole and position key washer (1002/7) in center of cover (1002/15) with tab of key washer in mating hole in cover. Secure key washer with screw (1002/6), lubricated with Engine Oil P03−001. Torque screw to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Install spring (1002/5) on key washer (1002/7). Bend tabs of washer out between coils of spring.

(d) Install new packing (1002/8), lubricated with Engine Oil P03−001, into groove in OD of main oil strainer cover (1002/15).

(e) Install filter element (1002/4), into opening in bottom of cover (1002/15), and align tabs of filter element with slots in ID of cover. Align bolt holes and install cover with filter element into main oil filter housing (1002/3).

NOTE: For this configuration, the oil filter element removable plug in the outboard end cap must be installed before installing the filter element into the cover.

(f) Install the cover (1002/15) as follows.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: INCORRECT INSTALLATION OF THE COVER CAN CAUSE DAMAGE TO THE PACKING.

CAUTION: DO NOT USE THE COVER RETAINING BOLTS TO PULL THE COVER INTO THE HOUSING. TO DO SO CAN CAUSE DAMAGE TO THE PACKING.

(g) With the cover (1002/15) in position on the housing (1002/3), carefully push the cover on the housing until the flange of the cover touches the housing.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: BE SURE TO TORQUE THE COVER RETAINING BOLTS TO THE TORQUE SPECIFIED.

(h) Attach the cover (1002/15) with four washers (1002/14) and bolts (1002/13). Torque bolts to 125 − 140 lb−in. (14.123 − 15.818 N.m).

(10) (Post SB PW4ENG 72−524 and Pre SB PW4ENG 79−79) Assemble the main oil filter housing, filter element and cover as follows. See Figure 1002 (Sheets 3) and Figure 1002 (Sheet 4).

MAIN GEARBOX − ASSEMBLY−04

(a) Position main oil filter housing (1002/3), large mounting flange side down, on bench.

(b) Align bolt hole and position key washer (1002/7) in center of cover (1002/15) with tab of key washer in mating hole in cover. Secure key washer with screw (1002/6), lubricated with Engine Oil P03−001. Torque screw to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(c) Install spring (1002/5) on key washer (1002/7). Bend tabs of washer out between coils of spring.

(d) Install new packing (1002/8), lubricated with Engine Oil P03−001, into groove in OD of main oil strainer cover (1002/15).

(e) Install filter element (1002/4) into opening in bottom of cover (1002/15), and align tabs of filter element with slots in ID of cover. Align bolt holes and install cover with filter element into main oil filter housing (1002/3).

NOTE: For this configuration, the oil filter element removable plug in the outboard end cap must be installed before installing the filter element into the cover.

(f) Install the cover (1002/15) as follows.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: INCORRECT INSTALLATION OF THE COVER CAN CAUSE DAMAGE TO THE PACKING.

CAUTION: DO NOT USE THE COVER RETAINING NUTS TO PULL THE COVER INTO THE HOUSING. TO DO SO CAN CAUSE DAMAGE TO THE PACKING.

(g) With the cover (1002/15) in position over the studs in the housing (1002/3), carefully push the cover on the housing until the flange of the cover touches the housing.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: DO NOT INSTALL THE REMOVED LOCK NUTS; USE NEW NUTS. THE LOCK PROPERTY OF THE NUT DECREASES WITH USE. IF THE NUT BACKS OUT BECAUSE OF THE DECREASE IN LOCK PROPERTY, OIL LOSS AND AN IN−FLIGHT−SHUTDOWN CAN RESULT.

CAUTION: BE SURE TO TORQUE THE COVER RETAINING NUTS TO THE TORQUE SPECIFIED.

(h) Attach the cover (1002/15) to the housing.

1 If self−locking nuts are used, attach the cover to the housing with four (4) washers (1002/14) and nuts (1002/29). Lubricate the threads with Engine Oil P03−001. Torque nuts to 150 − 170 lb−in. (16.948 − 19.207 N.m).

2 If hex nuts with lockwire provisions are used, attach the cover to the housing with four (4) washers (1002/14) and nuts (1002/30). Lubricate the threads with Engine Oil P03−001. Torque nuts to 125 − 150 lb−in. (14.123 − 16.948 N.m). Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 the nuts.

(11) (Post SB PW4ENG 72−524 and SB PW4ENG 79−79) Assemble the main oil filter housing, filter element and cover as follows. See Figure 1002 (Sheets 5) Figure 1002 (Sheets 6).

(a) Position main oil filter housing (1002/3), large mounting flange side down, on bench.

(b) Install the spring (1002/5) in the spring retainer (1002/23).

(c) Install two screws (1002/22) through the spring retainer screw holes and then install two washers (1002/20) on the ends of the two screws.

(d) Lubricate the threads of the two screws (1002/22) with Engine Oil P03−001.

(e) With the spring (1002/5) in place in the spring retainer (1002/23), thread the two screws (1002/22) into the main oil strainer cover (1002/21). Torque the two screws to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(f) Install new packing (1002/8), lubricated with Engine Oil P03−001, into groove in OD of main oil strainer cover (1002/21).

(g) Install filter element (1002/4) into opening in bottom of cover (1002/21), and align tabs of filter element with slots in ID of cover. Align bolt holes and install cover with filter element into main oil filter housing (1002/3).

NOTE: For this configuration, the oil filter element removable plug in the outboard end cap must be removed before installing the filter element into the cover.

(h) Install the cover (1002/21) as follows.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: INCORRECT INSTALLATION OF THE COVER CAN CAUSE DAMAGE TO THE PACKING.

CAUTION: DO NOT USE THE COVER RETAINING NUTS TO PULL THE COVER INTO THE HOUSING. TO DO SO CAN CAUSE DAMAGE TO THE PACKING.

(i) With the cover (1002/21) in position over the studs in the housing (1002/3), carefully push the cover on the housing until the flange of the cover touches the housing.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: DO NOT INSTALL THE REMOVED LOCK NUTS; USE NEW NUTS. THE LOCK PROPERTY OF THE NUT DECREASES WITH USE. IF THE NUT BACKS OUT BECAUSE OF THE DECREASE

IN LOCK PROPERTY, OIL LOSS AND AN IN−FLIGHT−SHUTDOWN CAN RESULT.

CAUTION: BE SURE TO TORQUE THE COVER RETAINING NUTS TO THE TORQUE SPECIFIED.

(j) Attach the cover (1002/21) to the housing.

1 If self−locking nuts are used, attach the cover to the housing with four (4) washers (1002/14) and nuts (1002/29). Lubricate the threads with Engine Oil P03−001. Torque nuts to 150 − 170 lb−in. (16.948 − 19.207 N.m).

2 If hex nuts with lockwire provisions are used, attach the cover to the housing with four (4) washers (1002/14) and nuts (1002/30). Lubricate the threads with Engine Oil P03−001. Torque nuts to 125 − 150 lb−in. (14.123 − 16.948 N.m). Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 the nuts.

(12) Install new packing (1002/9), lubricated with Engine Oil P03−001, onto insert (1002/10).

(13) Install insert, lubricated with Engine Oil P03−001, into opening in bottom of cover (1002/15 or 1002/21, as appropriate). Torque insert to 200 − 225 lb−in. (22.597 − 25.422 N.m).

(14) Install new packing (1002/11), lubricated with Engine Oil P03−001, onto plug (1002/12).

(15) Install plug (1002/12), lubricated with Engine Oil P03−001, into previously installed insert (1002/10). Torque plug to 110 − 120 lb−in. (12.428 − 13.558 N.m). Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 plug.

(16) Install packings (1002/2), lubricated with Engine Oil P03−001, onto two inserts (1002/1). Install inserts, lubricated with Engine Oil P03−001, into two upper ports in main oil filter housing (1002/3). Torque inserts to 200 − 225 lb−in. (22.597 − 25.422 N.m).

(17) Install packings (1002/17) and (1002/18), lubricated with Engine Oil P03−001, into grooves in pressure relief valve (filter element) (1002/19). Install valve, threads lubricated with Engine Oil P03−001, onto port just above pressure (regulator) relief valve pad (1002/16). Torque valve to 525 − 625 lb−in. (959.317 − 70.615 N.m). Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 valve.

(18) (Post SB PW4ENG 72−525) Assemble the main oil filter housing, filter element and cover as follows. See Figure 1002 (Sheets 7) Figure 1002 (Sheets 8).

(a) Position main oil filter housing (1002/3), large mounting flange side down, on bench.

(b) Install pressure relief valve (1002/41) in center of cover (1002/42) and attach with retaining ring (1002/40).

(c) Install new packing (1002/8), lubricated with Engine Oil P03−001, into groove in OD of main oil strainer cover (1002/42).

(d) Remove the protective closure from the end of the filter element (1002/39).

(e) Install the filter element (1002/39) over the pressure relief valve (1002/41) in cover (1002/42). Align tabs of filter element with slots in ID of cover. Align bolt holes and dowel pin in cover with studs and dowel pin hole in main oil filter housing (1002/3), then install cover with filter element into main oil filter housing.

NOTE: For this configuration, the oil filter element removable plug in the outboard end cap must be removed before installing the filter element into the cover.

(f) Install the cover (1002/42) as follows.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: INCORRECT INSTALLATION OF THE COVER CAN CAUSE DAMAGE TO THE PACKING.

CAUTION: DO NOT USE THE COVER RETAINING NUTS TO PULL THE COVER INTO THE HOUSING. TO DO SO CAN CAUSE DAMAGE TO THE PACKING.

(g) With the cover (1002/42) in position over the studs and dowel pin hole in the housing, carefully push the cover on the housing until the flange of the cover touches the housing.

CAUTION: INCORRECT INSTALLATION OF THIS PART CAUSED AN IN−FLIGHT−SHUTDOWN.

CAUTION: DO NOT INSTALL THE REMOVED LOCK NUTS; USE NEW NUTS. THE LOCK PROPERTY OF THE NUT DECREASES WITH USE. IF THE NUT BACKS OUT BECAUSE OF THE DECREASE IN LOCK PROPERTY, OIL LOSS AND AN IN−FLIGHT−SHUTDOWN CAN RESULT.

CAUTION: BE SURE TO TORQUE THE COVER RETAINING NUTS TO THE TORQUE SPECIFIED.

(h) Attach the cover (1002/42) to the housing.

1 If self−locking nuts are used, attach the cover to the housing with four (4) washers (1002/14) and nuts (1002/29). Lubricate the threads with Engine Oil P03−001. Torque nuts to 150 − 170 lb−in. (16.948 − 19.207 N.m).

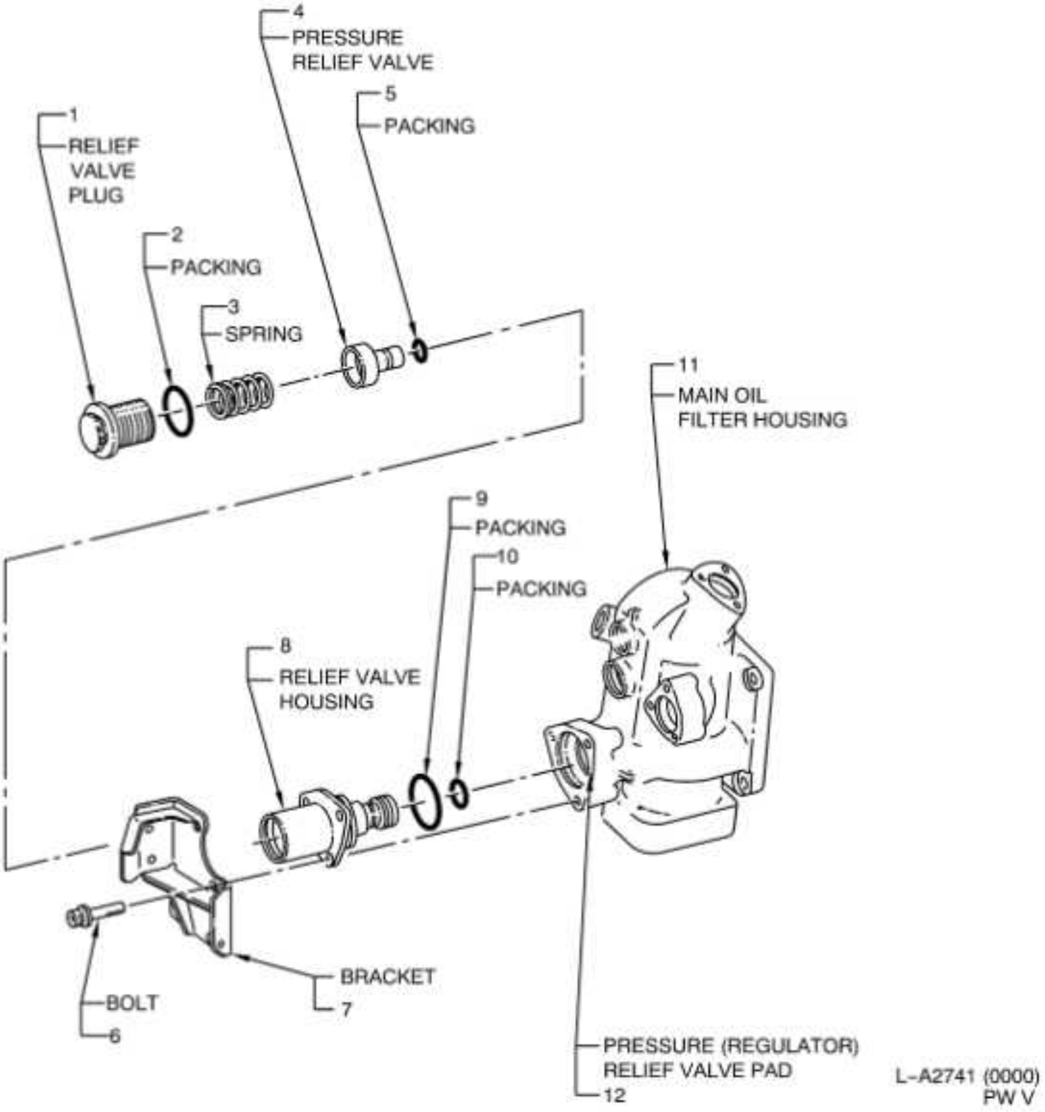
2 If hex nuts with lockwire provisions are used, attach the cover to the housing with four (4) washers (1002/14) and nuts (1002/30). Lubricate the threads with Engine Oil P03−001. Torque nuts to 125 − 150 lb−in. (14.123 − 16.948 N.m). Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 the nuts.

(19) (Post SB PW4ENG 72−525) Install new packing (1002/11), lubricated with Engine Oil P03−001, onto plug (1002/12).

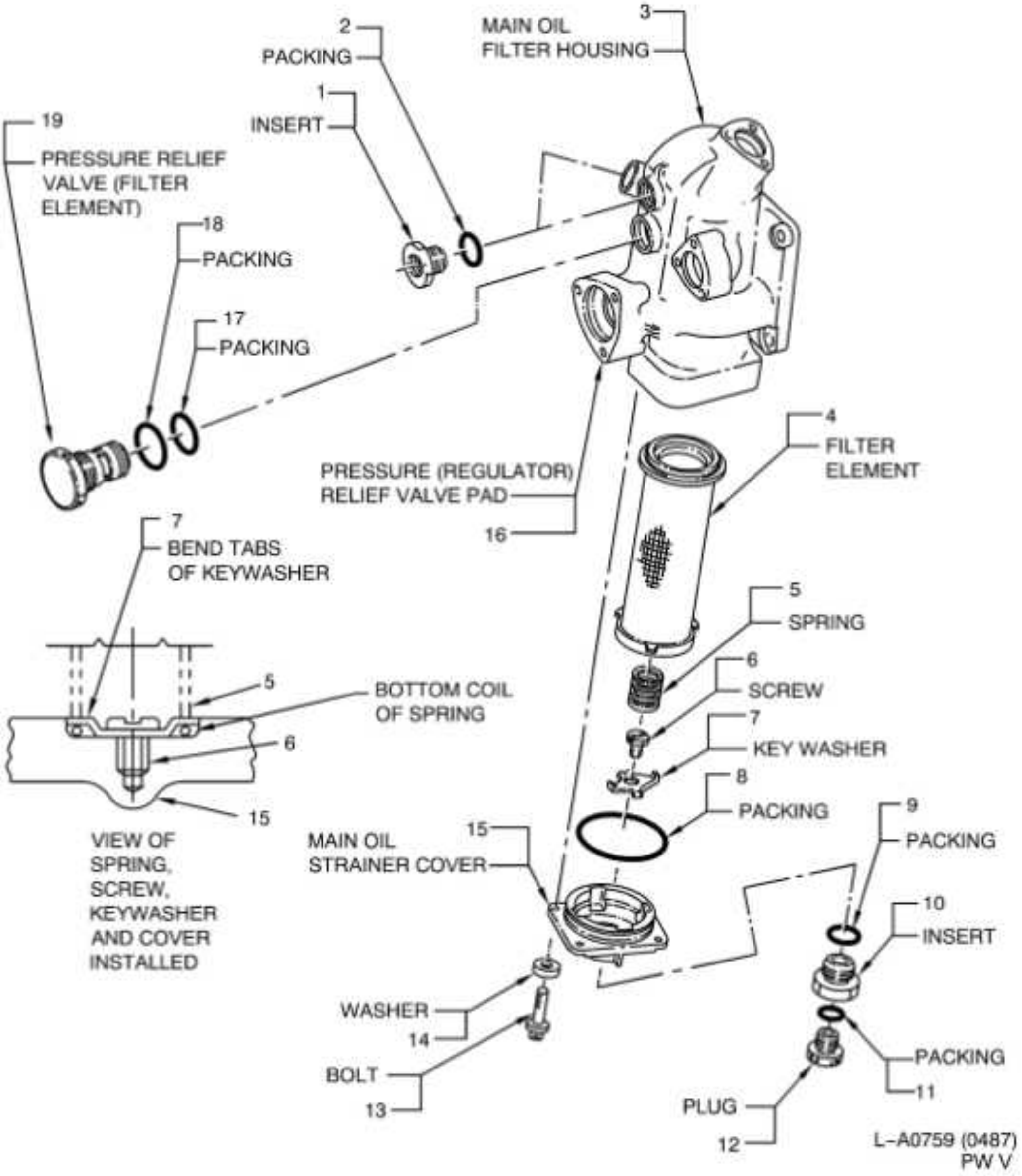
(20) (Post SB PW4ENG 72−525) Install plug (1002/12), lubricated with Engine Oil P03−001, into threaded hole in bottom of cover (1002/42). Torque plug to 110 − 120 lb−in. (12.428 − 13.558 N.m). Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 plug.

(21) (Post PW4ENG 72−525) Install packings (1002/2), lubricated with Engine Oil P03−001, onto two inserts (1002/1). Install inserts, lubricated with Engine Oil P03−001, into two upper ports in main oil filter housing (1002/3). Torque inserts to 200 − 225 lb−in. (22.597 − 25.422 N.m).

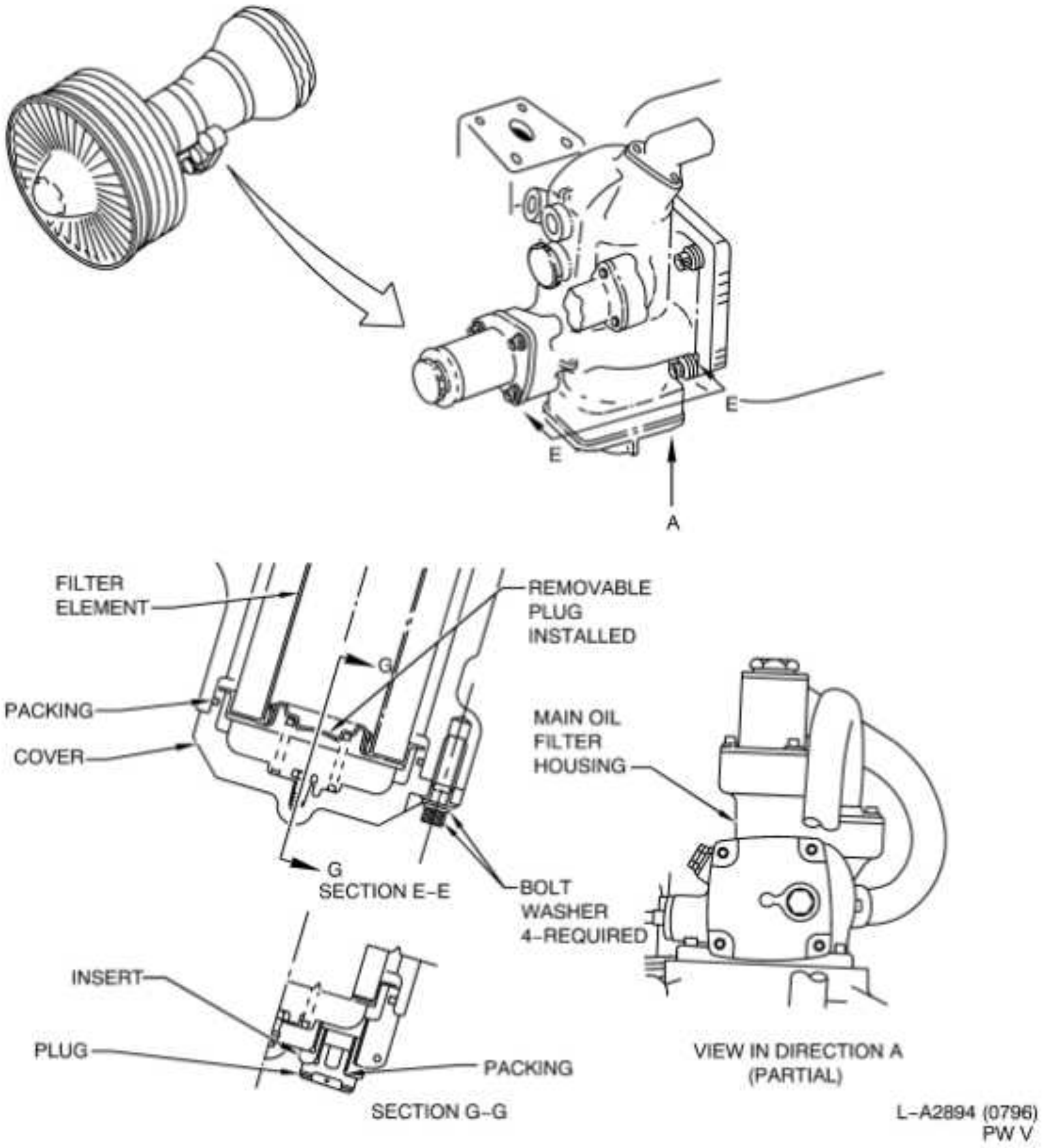
(22) (Post PW4ENG 72−525) Install packings (1002/17) and (1002/18), lubricated with Engine Oil P03−001, into grooves in plug (1002/43). Install plug, threads lubricated with Engine Oil P03−001, in port just above pressure (regulator) relief valve pad (1002/16). Torque plug to 525 − 625 lb−in. (59.317 − 70.615 N.m). Lockwire P05−289 or Safety Cable P05−291 and Safety Cable Ferrule P05−292 plug.


4
PRESSURE RELIEF VALVE
5
PACKING
1
RELIEF VALVE PLUG
2
PACKING
3
SPRING
11
MAIN OIL FILTER HOUSING
9
PACKING
10
PACKING
8
RELIEF VALVE HOUSING
BRACKET
7
BOLT
6
PRESSURE (REGULATOR) RELIEF VALVE PAD
12
L-A2741 (0000)
PW V

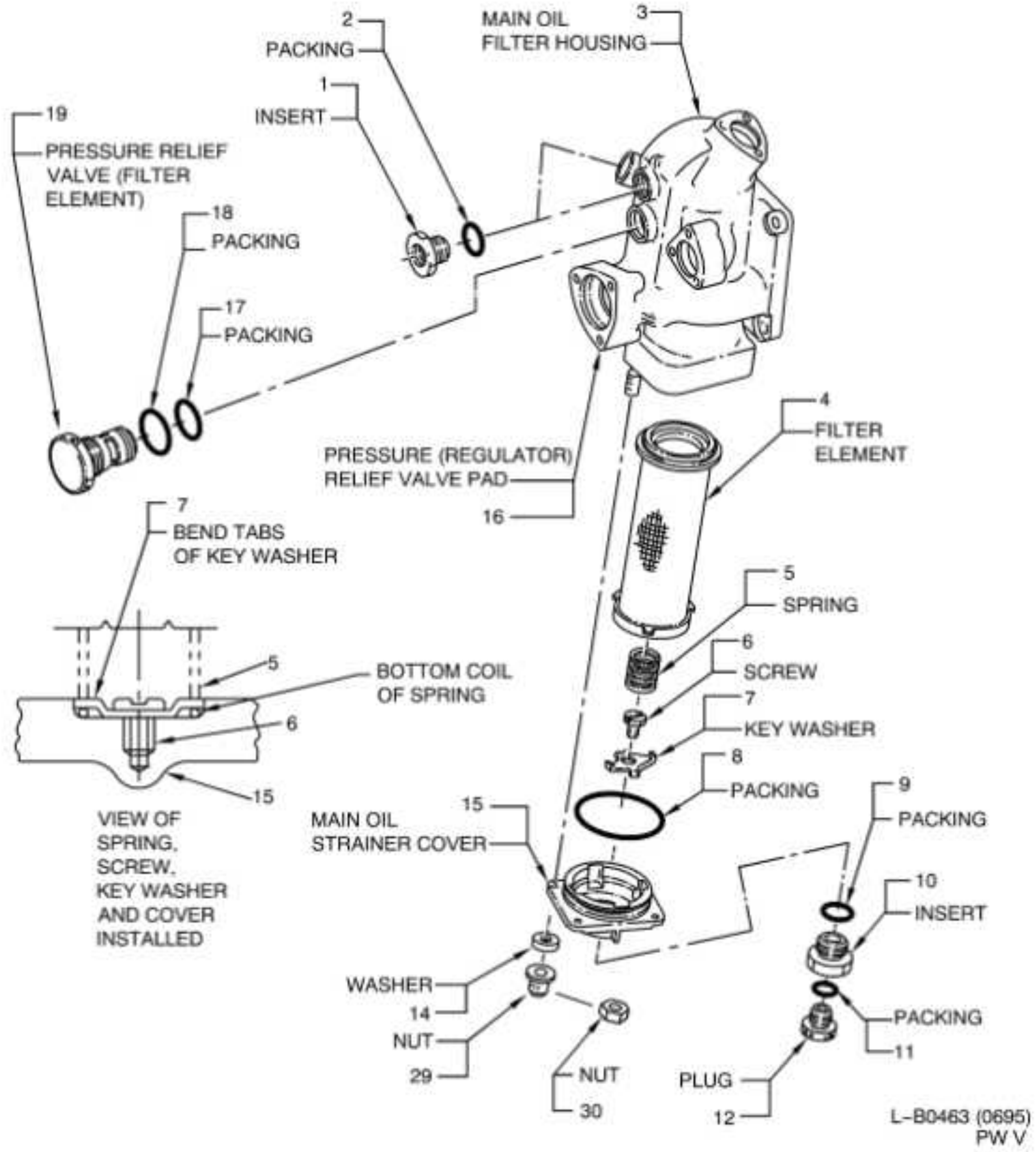
Pressure Relief Valve Installation
Figure 1001
(Task 72−61−00−400−004)


2
PACKING
MAIN OIL FILTER HOUSING
3
1
INSERT
19
PRESSURE RELIEF VALVE (FILTER ELEMENT)
18
PACKING
17
PACKING
4
FILTER ELEMENT
PRESSURE (REGULATOR) RELIEF VALVE PAD
16
7
BEND TABS OF KEYWASHER
5
SPRING
6
SCREW
5
BOTTOM COIL OF SPRING
7
KEY WASHER
6
8
PACKING
15
VIEW OF SPRING, SCREW, KEYWASHER AND COVER INSTALLED
15
MAIN OIL STRAINER COVER
9
PACKING
10
INSERT
WASHER
14
BOLT
13
PACKING
11
PLUG
12
L-A0759 (0487)
PW V

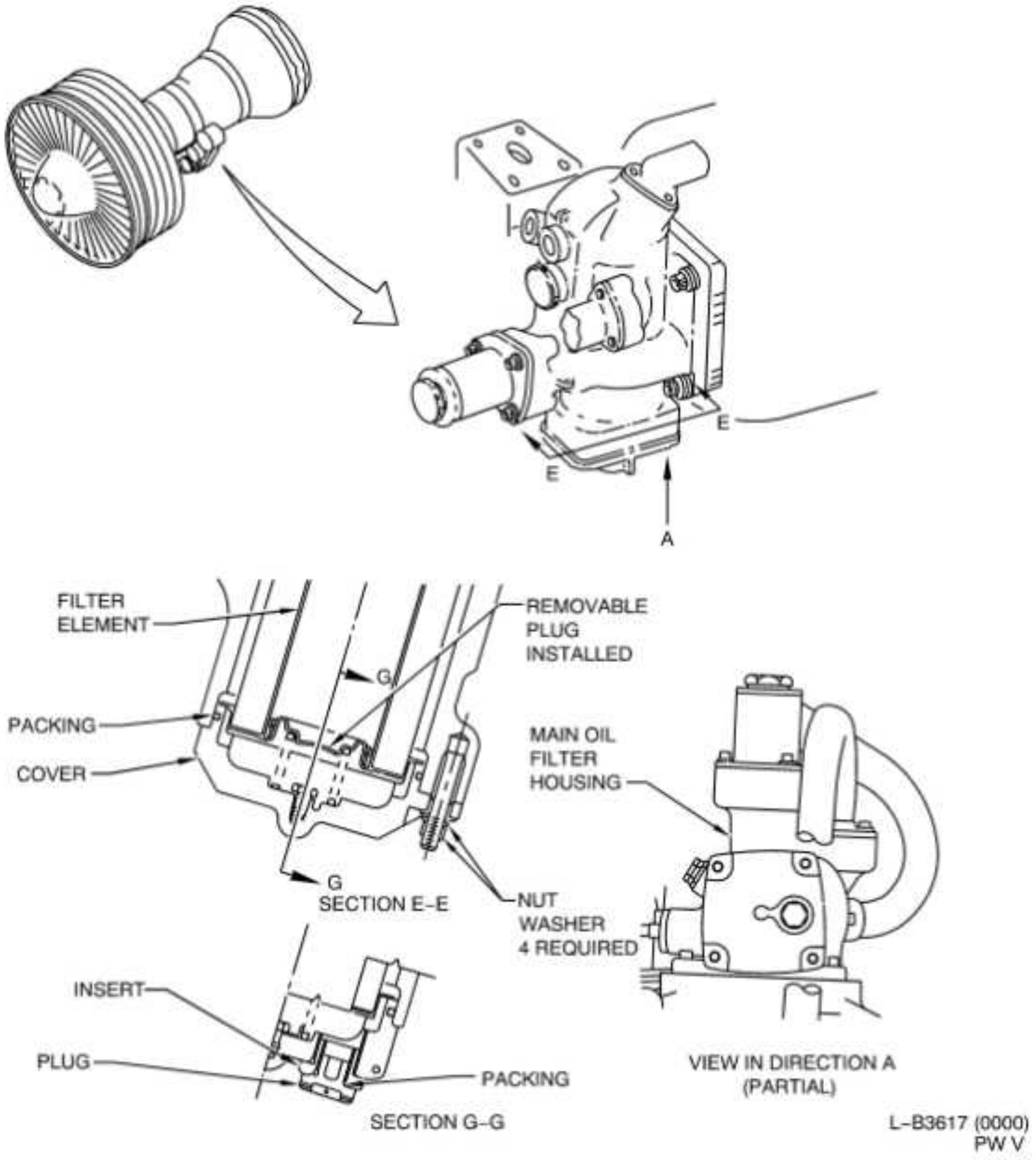
Main Oil Filter, Housing And Pressure Relief
Valve Assembly (Pre SB PW4ENG 72-524)
Figure 1002 (Sheet 1)
(Task 72-61-00-400-004)


E
E
A
FILTER ELEMENT
REMOVABLE PLUG INSTALLED
G
PACKING
COVER
G
SECTION E–E
BOLT
WASHER
4–REQUIRED
MAIN OIL FILTER HOUSING
INSERT
PLUG
PACKING
SECTION G–G
VIEW IN DIRECTION A (PARTIAL)
L–A2894 (0796)
PW V

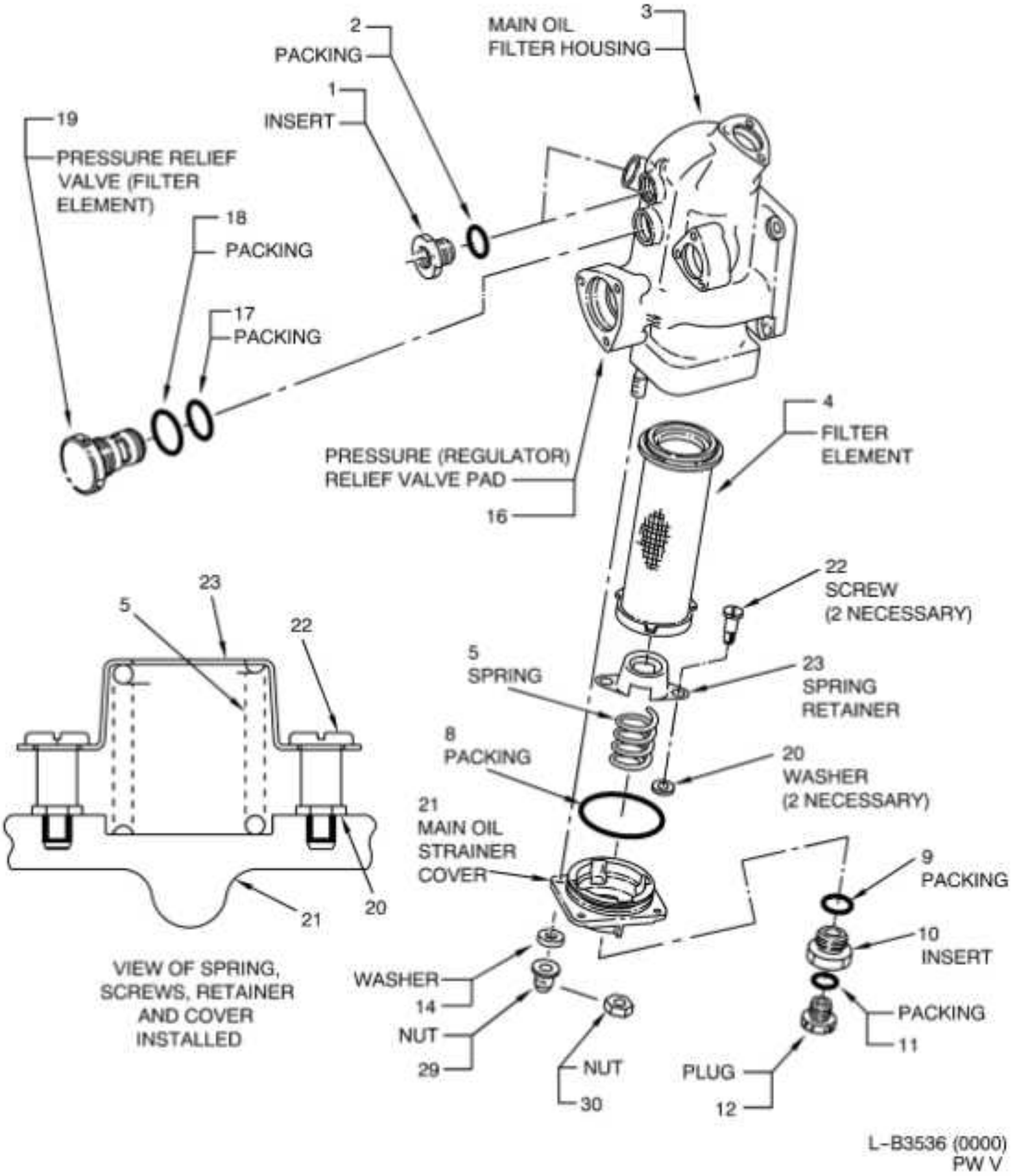
Main Oil Filter, Housing And Pressure Relief
Valve Assembly (Pre SB PW4ENG 72−524)
Figure 1002 (Sheet 2)
(Task 72−61−00−400−004)


2
PACKING
MAIN OIL FILTER HOUSING
3
1
INSERT
19
PRESSURE RELIEF VALVE (FILTER ELEMENT)
18
PACKING
17
PACKING
PRESSURE (REGULATOR) RELIEF VALVE PAD
16
4
FILTER ELEMENT
7
BEND TABS OF KEY WASHER
5
SPRING
6
SCREW
7
KEY WASHER
8
PACKING
5
BOTTOM COIL OF SPRING
6
15
VIEW OF SPRING, SCREW, KEY WASHER AND COVER INSTALLED
MAIN OIL STRAINER COVER
15
9
PACKING
10
INSERT
WASHER
14
NUT
29
NUT
30
PLUG
12
PACKING
11
L-B0463 (0695)
PW V

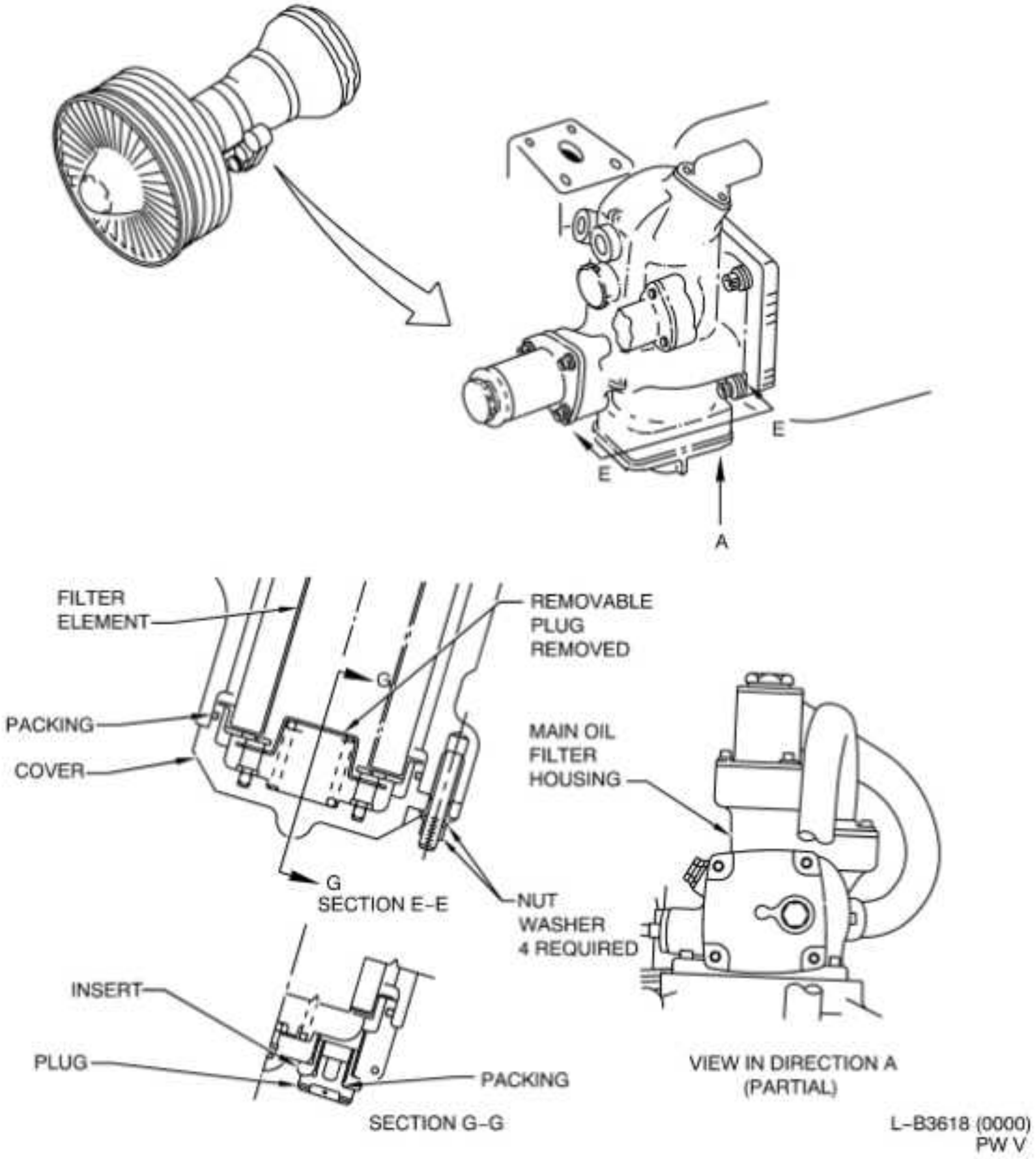
Main Oil Filter, Housing And Pressure Relief Valve
Assembly (Post SB PW4ENG 72-524 And Pre SB PW4ENG 79-79)
Figure 1002 (Sheet 3)
(Task 72-61-00-400-004)


E
E
A
FILTER ELEMENT
REMOVABLE PLUG INSTALLED
G
PACKING
COVER
MAIN OIL FILTER HOUSING
G
SECTION E–E
NUT
WASHER
4 REQUIRED
INSERT
PLUG
PACKING
SECTION G–G
VIEW IN DIRECTION A
(PARTIAL)
L–B3617 (0000)
PW V

Main Oil Filter, Housing And Pressure Relief Valve
Assembly (Post SB PW4ENG 72−524 And Pre SB PW4ENG 79−79)
Figure 1002 (Sheet 4)
(Task 72−61−00−400−004)

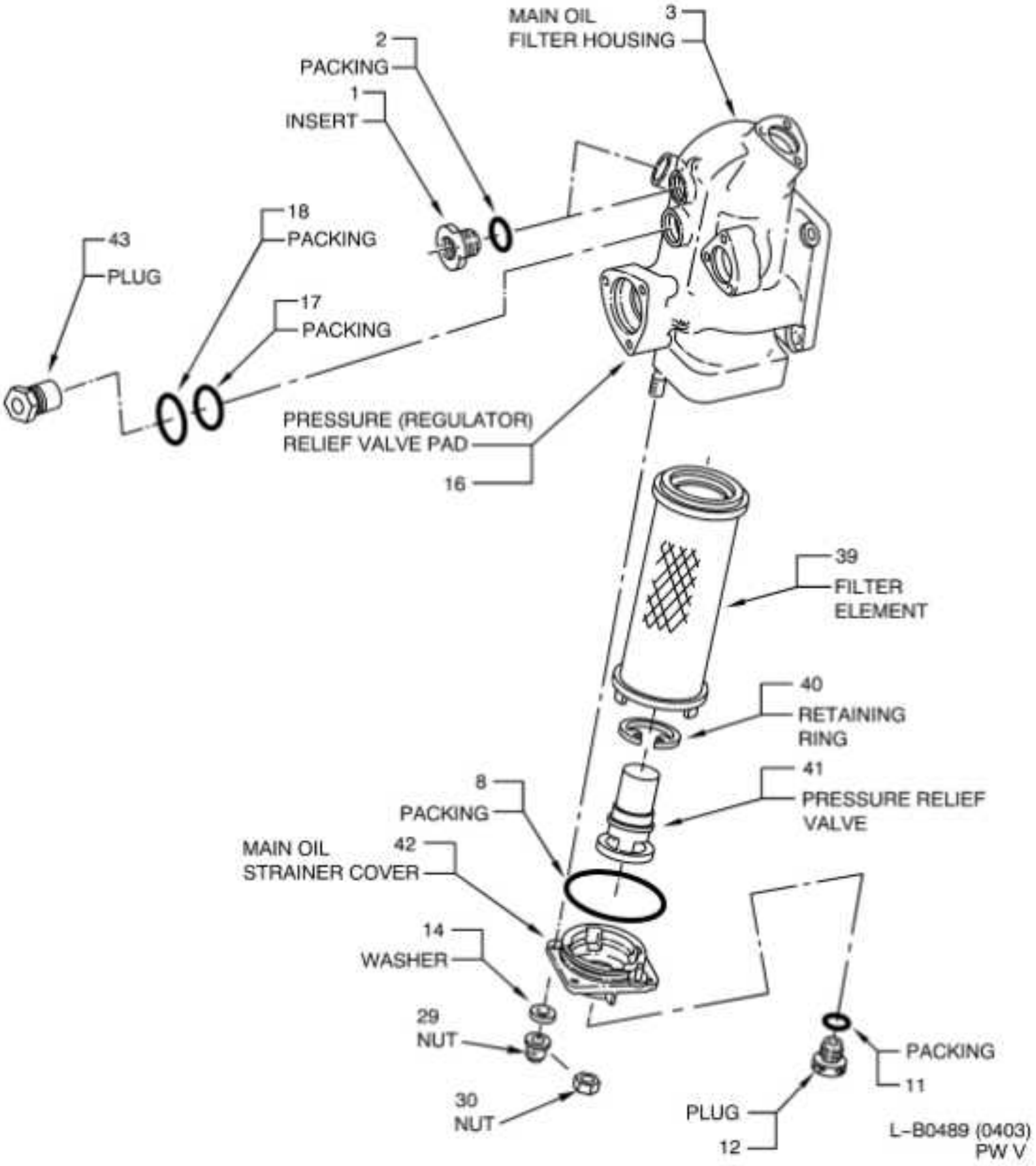

2
PACKING
3
MAIN OIL FILTER HOUSING
1
INSERT
19
PRESSURE RELIEF VALVE (FILTER ELEMENT)
18
PACKING
17
PACKING
PRESSURE (REGULATOR) RELIEF VALVE PAD
16
4
FILTER ELEMENT
23
5
22
22
SCREW (2 NECESSARY)
5
SPRING
23
SPRING RETAINER
8
PACKING
20
WASHER (2 NECESSARY)
21
MAIN OIL STRAINER COVER
21
20
9
PACKING
10
INSERT
VIEW OF SPRING, SCREWS, RETAINER AND COVER INSTALLED
WASHER
14
NUT
29
NUT
30
PLUG
12
PACKING
11
L-B3536 (0000)
PW V

Main Oil Filter, Housing And Cover Assembly (Post SB PW4ENG 72−524, SB PW4ENG 79−79 And Pre SB PW4ENG 72−525)
Figure 1002 (Sheet 5)
(Task 72−61−00−400−004)

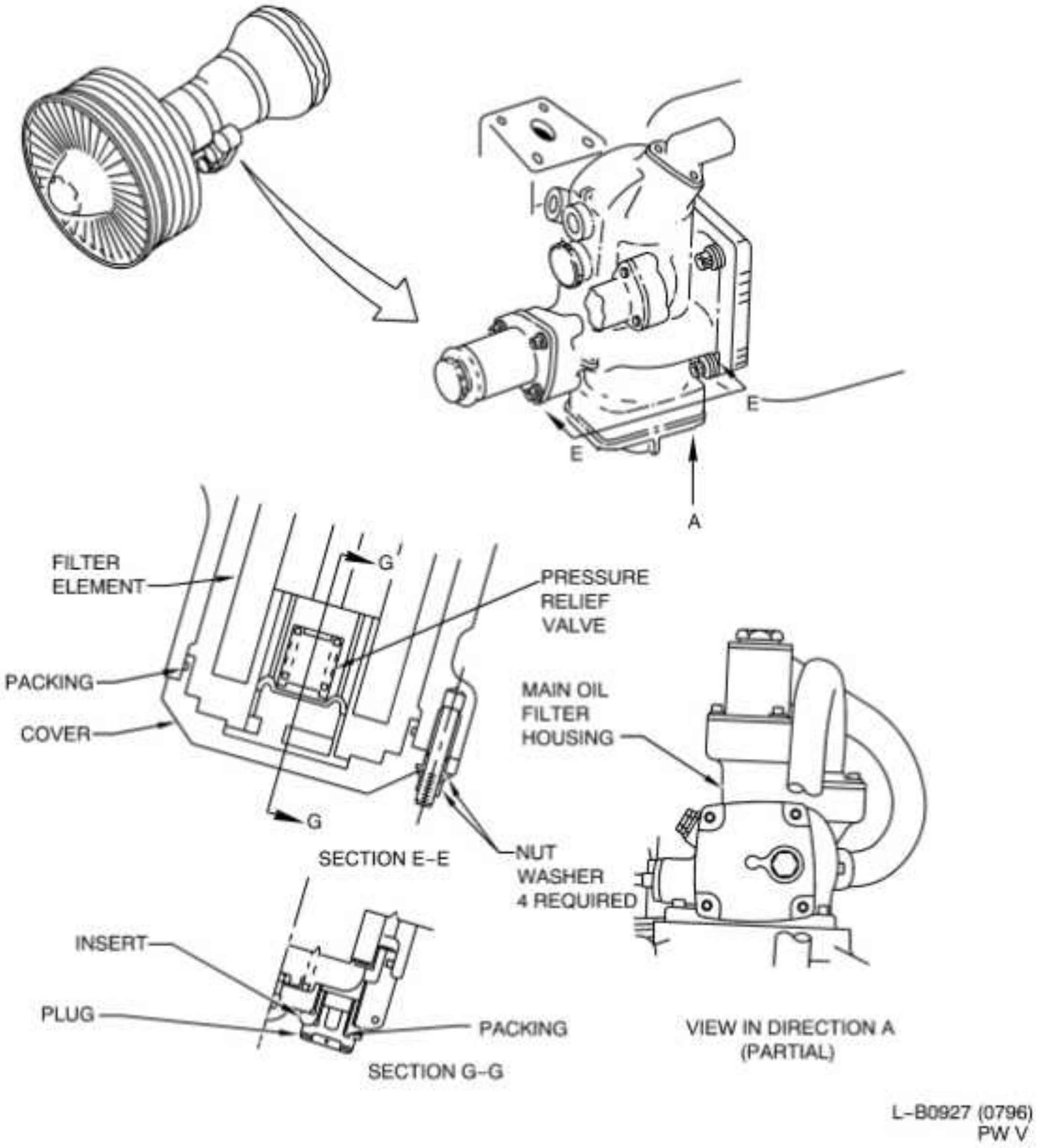

E
E
A
FILTER ELEMENT
REMOVABLE PLUG REMOVED
G
PACKING
COVER
MAIN OIL FILTER HOUSING
G
SECTION E−E
NUT
WASHER
4 REQUIRED
INSERT
PLUG
PACKING
SECTION G−G
VIEW IN DIRECTION A (PARTIAL)
L−B3618 (0000)
PW V

Main Oil Filter, Housing And Cover Assembly (Post SB PW4ENG 72−524, SB PW4ENG 79−79 And Pre SB PW4ENG 72−525)
Figure 1002 (Sheet 6)
(Task 72−61−00−400−004)

MAIN GEARBOX − ASSEMBLY−04


MAIN OIL FILTER HOUSING 3
2 PACKING
1 INSERT
18 PACKING
43 PLUG
17 PACKING
PRESSURE (REGULATOR) RELIEF VALVE PAD 16
39 FILTER ELEMENT
40 RETAINING RING
41 PRESSURE RELIEF VALVE
8 PACKING
MAIN OIL STRAINER COVER 42
14 WASHER
29 NUT
30 NUT
PACKING 11
PLUG 12
L-B0489 (0403)
PW V

Main Oil Filter, Housing And Cover Assembly (Post SB PW4ENG 72−525)
Figure 1002 (Sheet 7)
(Task 72−61−00−400−004)


E
E
A
G
FILTER ELEMENT
PRESSURE RELIEF VALVE
PACKING
COVER
MAIN OIL FILTER HOUSING
G
SECTION E−E
NUT
WASHER
4 REQUIRED
INSERT
PLUG
PACKING
SECTION G−G
VIEW IN DIRECTION A (PARTIAL)
L−B0927 (0796)
PW V

Main Oil Filter, Housing And Cover Assembly (Post SB PW4ENG 72−525)
Figure 1002 (Sheet 8)
(Task 72−61−00−400−004)

Task 72-61-00-400-005:

1. Assemble The Lube Oil Tank And Deaerator Assembly

A. Prerequisites

(1) See Inspection/Check-04 Task 72-61-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
	P05-289	Lockwire
R	P05-291	Cable, Safety (Optional)
R	P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

	PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
	Packing	2	79-11-00/1/40
	Packing	1	79-11-00/1/80
	Packing	1	79-11-00/2/100
	Packing	1	79-11-00/2/105
	Packing	1	79-11-00/3/10
	Packing	1	79-11-00/4/1
	Packing	1	79-11-00/4/60
R	Packing	1	79-11-00/4/80

C. Procedure

Subtask 72-61-00-430-071:

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER BREATHER TUBE ASSEMBLY, DEAERATOR, BAFFLE, AND OIL TANK. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 79-43.

(1) Install the oil tank breather tube assembly as follows. See Figure 1001.

(a) (Pre SB PW4ENG 79-34 and Post SB PW4ENG 79-81):

MAIN GEARBOX - ASSEMBLY-05

1 Apply Engine Oil P03-001 to two packings (1001/5).

2 Install a packing at each end of the tube (1001/6).

3 Install the flanged end of the tube in the rear of the oil tank deaerator (1001/4).

4 Attach the tube to the deaerator with two bolts. Torque the bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(b) (Post SB PW4ENG 79-34 and Pre SB PW4ENG 79-81):

1 Apply Engine Oil P03-001 to two packings (1001/5).

2 Install a packing at each end of the tube (1001/7).

3 Install the flanged end of the tube in the rear of the oil tank deaerator (1001/4).

4 Install the bracket on the tube assembly.

5 Loosely attach the bracket and tube assembly to the deaerator with two bolts.

6 Install clamps on the tube assembly.

7 Apply Engine Oil P03-001 to the threads of two clamp bolts.

8 Loosely attach the clamps to the bracket with the bolts.

9 Find the correct position of the tube assembly. To do this, align the tube assembly with the mating holes in the gearbox housing. Adjust the tube assembly as necessary.

10 Torque the bolts that attach the tube assembly to the deaerator to 62 - 72 lb-in. (7.005 - 8.135 N.m). Torque the clamp-bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

(2) Install the sealing sleeve (1001/2):

(a) Apply Engine Oil P03−001 to a packing (1001/3).

(b) Install the packing on the sleeve.

(c) Install the sleeve in the hole of the deaerator (1001/4) that is behind the front hole of the deaerator.

(d) Attach the sleeve to the deaerator with two bolts (1001/1). Torque the bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(3) Install the oil tank deaerator (1002/1) as follows. See Figure 1002.

(a) Attach the deaerator to the inner flange of the oil tank (1002/2) with seven washers (1002/3) and seven bolts (1002/4). Torque the bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(4) Install the oil tank baffle (1002/5):

(a) Apply Engine Oil P03−001 to seven bolts (1002/6).

(b) Attach the baffle to the inner flange of the oil tank with the seven bolts. Torque the bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(5) If not installed, install the oil tank cap (1003/1) and related parts. This procedure is for an oil tank with either no remote filler or post SB PW4ENG 79−47. See Figure 1003.

(a) Align the oil tank sump (1003/7) on the oil tank boss.

(b) Install the filler neck valve (1003/5):

1 Look under the valve of the filler neck valve. If there is no packing (1003/8) there, install one that is lubricated with Engine Oil P03−001.

2 Apply Engine Oil P03−001 to a packing (1003/6) and the threads of six bolts (1003/4).

3 Put one of the bolts in the hole of the oil tank cap lanyard (1003/3).

4 Attach the filler neck valve and the oil tank sump to the oil tank with the six bolts. Torque the bolts to 32 - 36 lb-in. (3.616 -
R 4.067 N.m). Install the Lockwire P05-289 or
R Safety Cable P05-291 and Safety Cable Ferrule
R P05-292.

(c) Install the oil tank cap (1003/1):

1 Apply Engine Oil P03-001 to a packing (1003/2). Install the packing on the oil tank cap.

2 Put the cap in the filler neck valve. Turn the cap clockwise to CLOSE.

(6) If not installed, install the oil tank cap (1004/1) and related parts. The procedure is for an oil tank with a remote filler and pre SB PW4ENG 79-47. See Figure 1004.

(a) Install the connector (remote filler) (1004/9):

1 Apply Engine Oil P03-001 to a packing (1004/13) and the the threads of four bolts (1004/12).

2 Install the packing on the connector.

3 Attach the connector to the oil tank with the four bolts. Torque the bolts to 32 - 36 lb-in.
R (3.616 - 4.067 N.m). Install the Lockwire
R P05-289 or Safety Cable P05-291 and Safety
R Cable Ferrule P05-292.

4 If applicable, install the plugs (1004/11 and 1004/15):

a Apply Engine Oil P03-001 to two packings (1004/10 and 1004/14) and the threads of the two plugs.

b Put the packings on the plugs.

c Install the plugs. Torque plug (1004/11) to 200 - 225 lb-in. (22.597 - 25.422 N.m). Torque plug (1004/15) to 110 - 120 lb-in.
R (12.428 - 13.558 N.m). Install the Lockwire
R P05-289 or Safety Cable P05-291 and Safety
R Cable Ferrule P05-292.

(b) Install the filler neck valve (1004/3):

1 Align the oil tank sump (1004/8) on the connector.

2 Apply Engine Oil P03-001 to a packing (1004/6) and the threads of two bolts (1004/7) and four bolts (1004/4).

3 Install the packing on the filler neck valve.

4 Put one of the bolts in the hole of the oil tank cap lanyard (1004/5).

5 Attach the filler neck valve, oil tank sump, and connector to the oil tank with the two long bolts at Locations C.

6 Attach the filler neck valve and oil tank sump to the connector with the four short bolts and nuts (1004/16) at Locations B.

7 Torque the short bolts to 36 - 40 lb-in. (4.067 - 4.519 N.m).

8 Torque the long bolts to 32 - 36 lb-in. (3.616 - 4.067 N.m). (Pre SB PW4ENG 79-78) Safety the
R bolts with Lockwire P05-289 or Safety Cable
R P05-291 and Safety Cable Ferrule P05-292.

(c) Install the oil tank cap (1004/1):

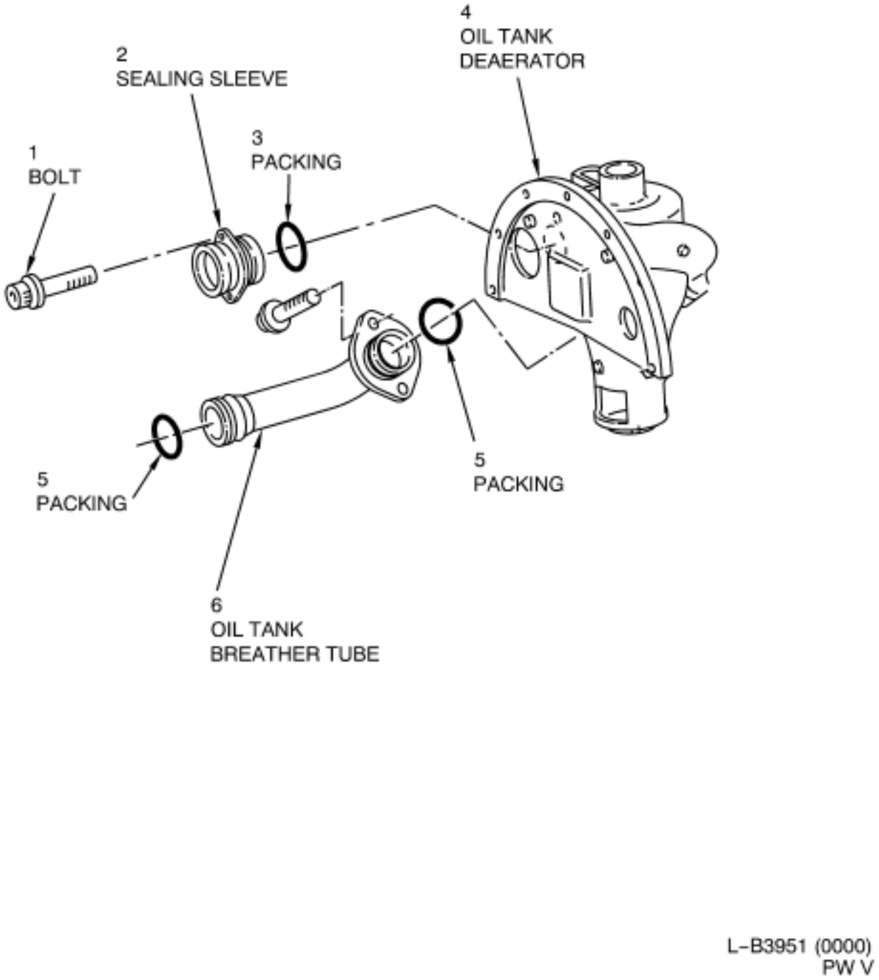
1 Apply Engine Oil P03-001 to a packing (1003/2). Install the packing on the oil tank cap.

2 Put the cap in the filler neck valve. Turn the cap clockwise to CLOSE.

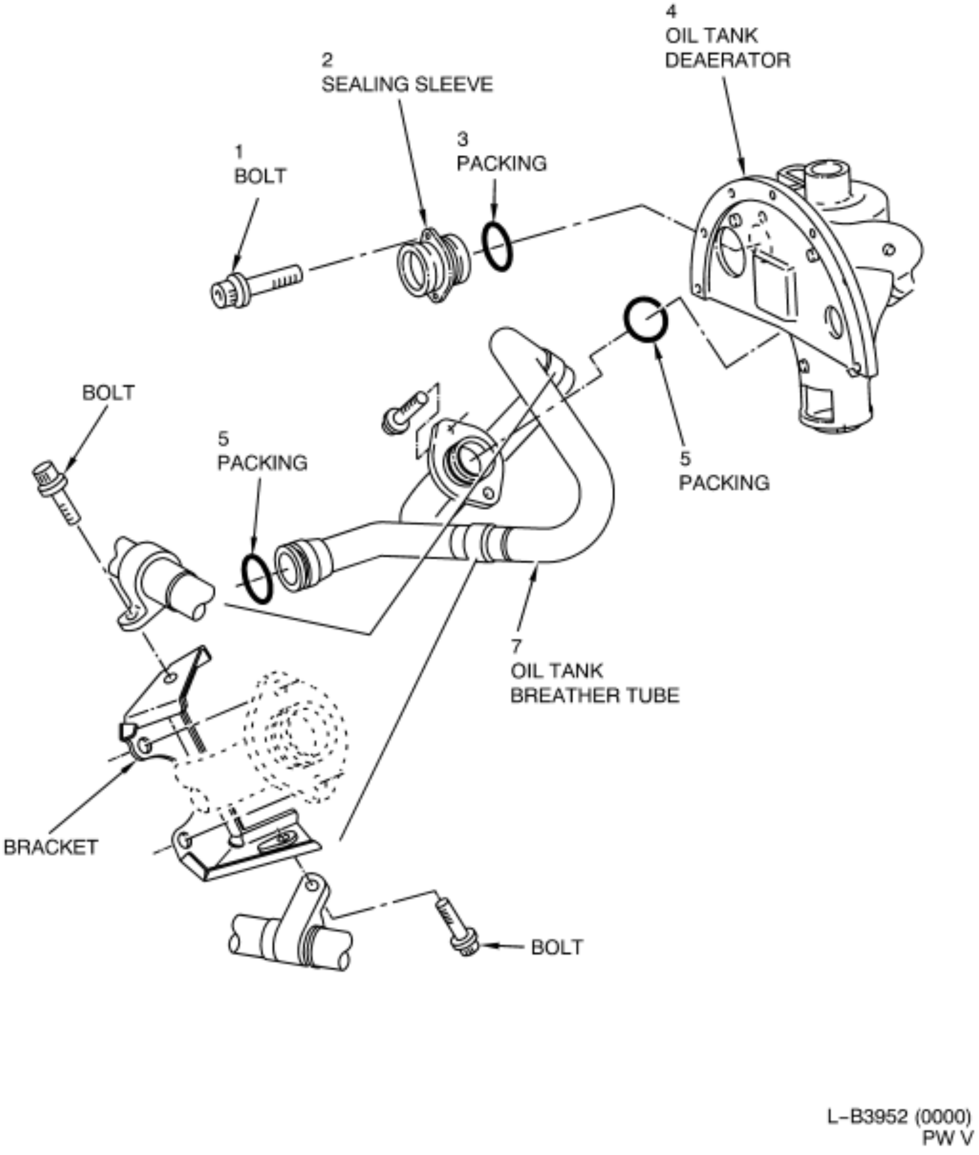
D. Postrequisites

(1) Install the oil tank sight gage. Refer to 72-00-61, Installation-31 Task 72-00-61-450-013.

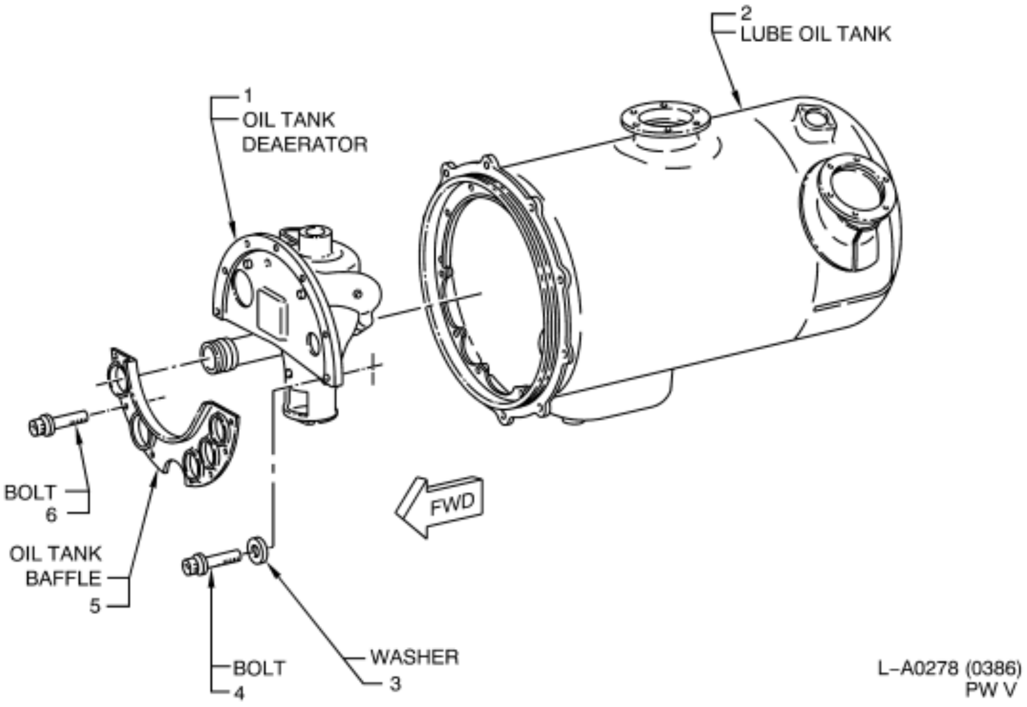
MAIN GEARBOX − ASSEMBLY−05


4
OIL TANK
DEAERATOR
2
SEALING SLEEVE
3
PACKING
1
BOLT
5
PACKING
5
PACKING
6
OIL TANK
BREATHER TUBE
L−B3951 (0000)
PW V

Oil Tank Breather Tube Assembly (Pre SB PW4ENG 79−34 And Post SB PW4ENG 79−81)
Figure 1001 (Sheet 1)
(Task 72−61−00−400−005)

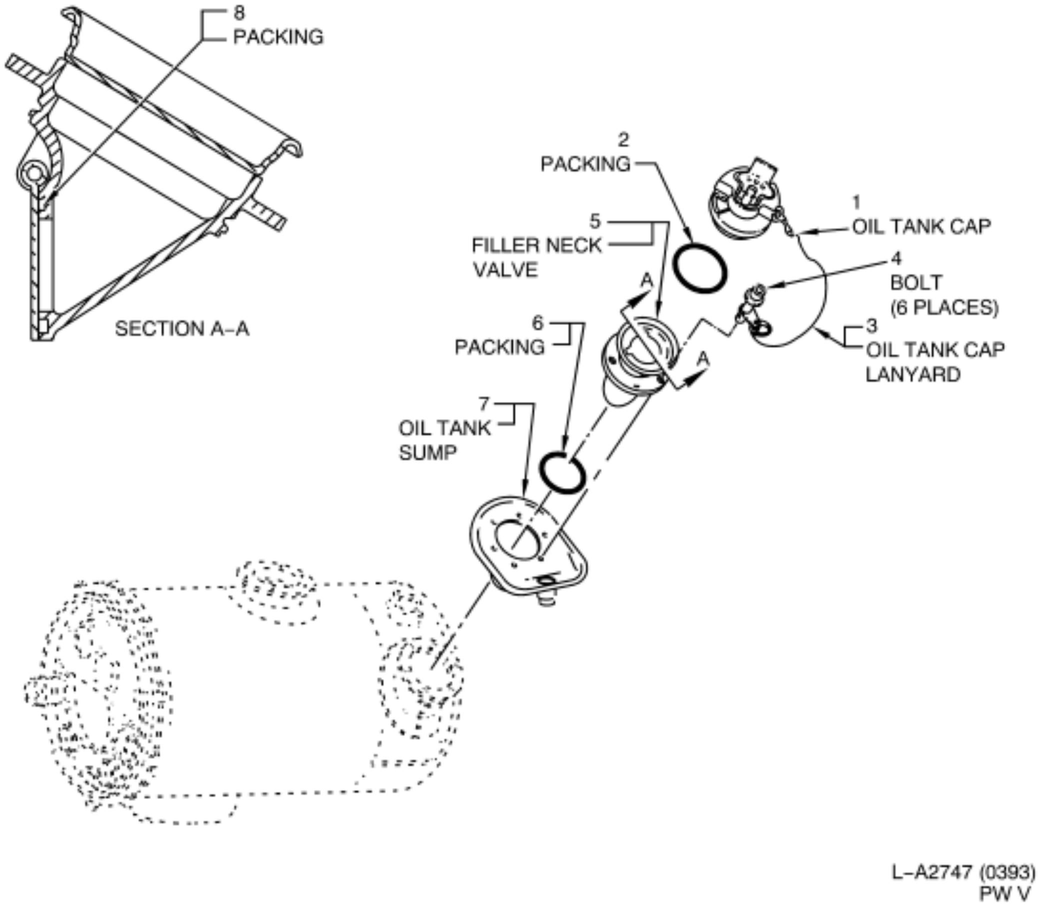

4
OIL TANK
DEAERATOR
2
SEALING SLEEVE
3
PACKING
1
BOLT
BOLT
5
PACKING
5
PACKING
7
OIL TANK
BREATHER TUBE
BRACKET
BOLT
L-B3952 (0000)
PW V

Oil Tank Breather Tube Assembly (Pre SB
PW4ENG 79-34 And Post SB PW4ENG 79-81)
Figure 1001 (Sheet 2)
(Task 72-61-00-400-005)


2
LUBE OIL TANK
1
OIL TANK
DEAERATOR
BOLT
6
OIL TANK
BAFFLE
5
FWD
BOLT
4
WASHER
3
L-A0278 (0386)
PW V

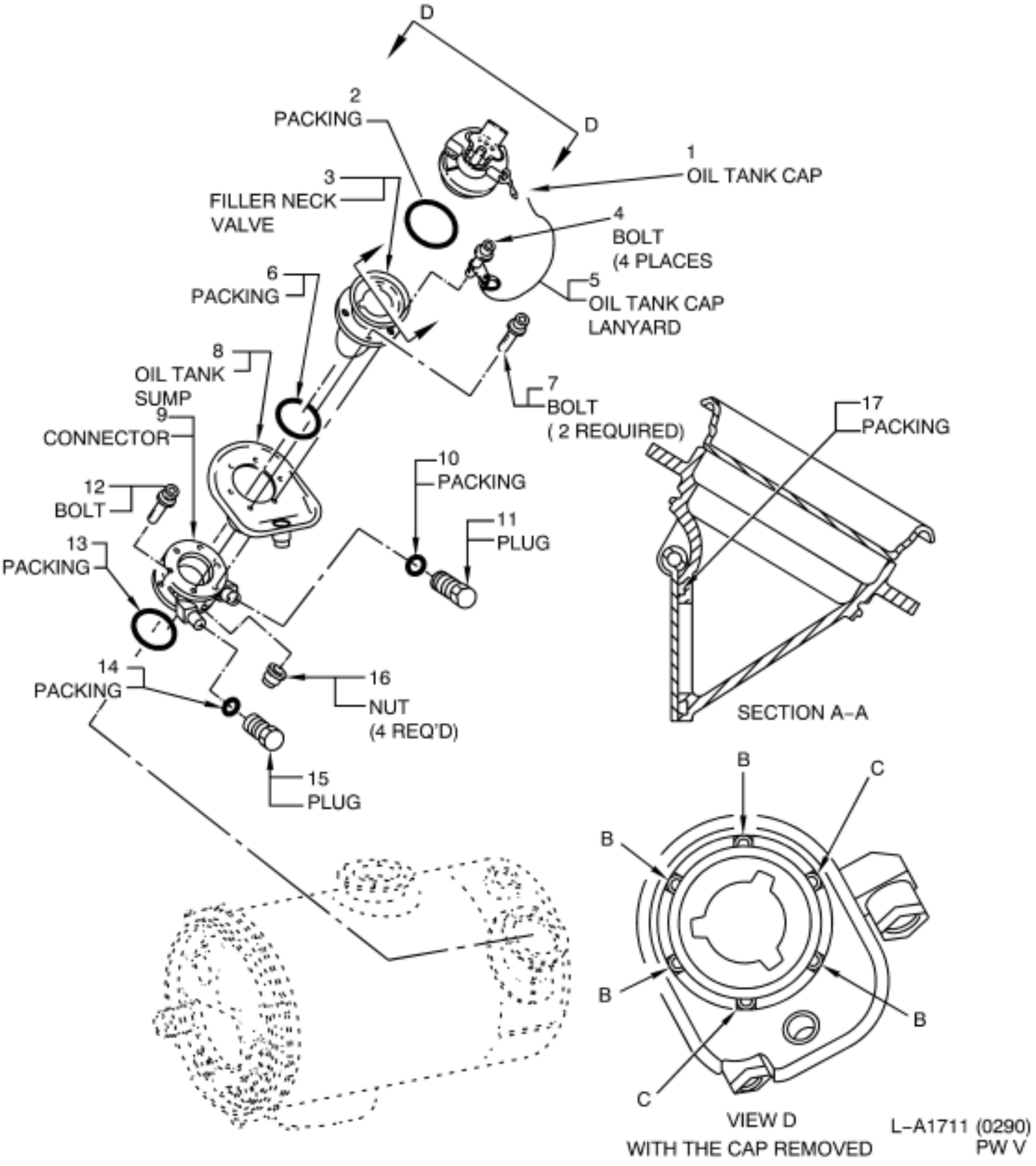
Oil Tank Deaerator And Oil Tank Baffle Installation
Figure 1002
(Task 72-61-00-400-005)

MAIN GEARBOX - ASSEMBLY-05


8
PACKING
SECTION A-A
2
PACKING
5
FILLER NECK
VALVE
A
6
PACKING
7
OIL TANK
SUMP
1
OIL TANK CAP
4
BOLT
(6 PLACES)
3
OIL TANK CAP
LANYARD
A
L-A2747 (0393)
PW V

Installation Of The Oil Tank Cap And Related Parts
(Either No Remote Filler Or Post PW4ENG 79-47)
Figure 1003
(Task 72-61-00-400-005)

R


D
D
2
PACKING
3
FILLER NECK
VALVE
1
OIL TANK CAP
4
BOLT
(4 PLACES
5
OIL TANK CAP
LANYARD
6
PACKING
8
OIL TANK
SUMP
9
CONNECTOR
7
BOLT
(2 REQUIRED)
17
PACKING
12
BOLT
10
PACKING
11
PLUG
13
PACKING
14
PACKING
16
NUT
(4 REQ'D)
15
PLUG
SECTION A-A
B
C
B
B
B
C
VIEW D
WITH THE CAP REMOVED
L-A1711 (0290)
PW V

Installation Of The Oil Tank Cap And Related
Parts (Pre SB PW4ENG 79-47, With A Remote Filler)
Figure 1004
(Task 72-61-00-400-005)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-61-00-400-006:

1. Install The EEC Rotor And Stator And The Lubrication And Scavenge Oil Pump And Brackets On The Main Gearbox

A. Prerequisites

(1) See Inspection/Check-04 (Task 72-61-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque the retaining nut as follows.

(2) Assemble the main gearbox. Refer to Assembly-01 (Task 72-61-00-400-001).

(3) Assemble the front hydraulic pump drive and IDG drive gearshaft to the main gearbox. Refer to Assembly-02 (Task 72-61-00-400-002).

(4) Assemble the drain plugs and lube oil tank assembly to the main gearbox. Refer to Assembly-03 (Task 72-61-00-400-003).

(5) Install the magnetic chip detector assemblies in the main gearbox, lube oil tank, and lubrication and scavenge oil pump. Refer to Assembly-07 (Task 72-61-00-400-007).

(6) Do a leak check of the main gearbox. Refer to Testing-01 (Task 72-61-00-790-001).

B. Equipment And Materials Necessary

Special Tools:

PWA 85238	Wrench (Optional To PWA 86603)
PWA 86603	Adapter, Holding

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P06-002	Petrolatum, White (PMC 9609)
P06-021	Antigalling Compound (PWA 550)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Nut	1	72−61−00/4/190
Packing	1	73−23−00/2/1
Packing	2	79−21−00/1/30
Packing	2	79−21−00/1/40
Packing	2	79−21−00/1/60

C. Procedure

Subtask 72−61−00−430−068:

CAUTION: DO NOT TURN THE GEARBOX TO PUT THE OIL TANK UNDER THE GEARBOX. TO DO SO WILL CAUSE DAMAGE TO THE OIL TANK.

(1) Install brackets. See Figure 1001.

(a) Install the brackets that follow on the front face of the gearbox.

Bracket	Bolt (Quantity)	Nut (Quantity)	Torque lb-in. (N.m)	Material Treatment
2	1 (3)		85 − 95 (9.604 − 10.734)	P03−001
3	4 (2)		85 − 95 (9.604 − 10.734)	P03−001
6	5 (2)	7 (2)	85 − 95 (9.604 − 10.734	P03−001
8	9 (2)		85 − 95 (9.604 − 10.734)	P03−001
17	16 (2)		85 − 95 (9.604 − 10.734)	P03−001
or				
17A	16 (2)		85 − 95 (9.604 − 10.734)	P03−001
19	18 (2)	20 (2)	85 − 95 (9.604 − 10.734)	P03−001

CAUTION: YOU MUST USE EEC GENERATOR STATOR PN 50R351 WITH BRACKETS PN 50R349−01 AND PN 52T618−01.

CAUTION: YOU MUST USE EEC GENERATOR STATOR PN 50R293 WITH BRACKETS PN 50R339 AND PN 52T098.

(b) Install the following brackets on rear face of gearbox.

Bracket	Bolt (Quantity)	Torque lb−in. (N.m)	Material Treatment	Nut (Quantity)
*11	10 (2)	62 − 72 (7.005 − 8.135)	None	
or				
**11A	10 (2)	62 − 72 (7.005 − 8.135)	None	
13	12 (2)	62 − 72 (7.005 − 8.135)	None	
14	15 (3)	85 − 95 (9.604 − 10.734)	None	
20	22 (2)	85 − 95 (9.604 − 10.734)	P03−001	21 (2)

*(Pre SB PW4ENG 72−375)
**(Post SB PW4ENG 72−375)

Subtask 72−61−00−430−067:

(2) Install EEC alternator rotor and stator (Pre SB PW4ENG 72−375). See Figure 1002.

(a) Remove protective closures.

CAUTION: ENSURE ROTOR IS FULLY SEATED ON GEARSHAFT.

(b) Install EEC alternator rotor (1002/8) on gearshaft (1002/9).

(c) Install EEC alternator rotor lock (1002/7) over gearshaft aligning ID flats on lock with flats on shaft and seat against rotor, engaging pins on lock with holes in rotor.

(d) Lubricate new nut (1002/6) with Engine Oil P03−001. Secure rotor and lock to gearshaft with nut.

(e) (Reference 570) Torque nut (1003/7) using PWA 86603 Adapter or PWA 85238 Wrench. See Figure 1003.

1 Loosen both jamnuts (1003/4) and retract wrench detail (1003/5) from body of wrench. Insert lug end of handle (1003/3) over mating lug end of wrench detail (1003/5).

2 Align boltholes and position body (1003/2) over EEC gearshaft and onto gearshaft housing (1003/1) pad. Engage lugs of wrench detail with slots in gearshaft. Secure body (1003/2) with three screws (1003/6).

3 Seat wrench detail (1003/5) firmly on gearshaft and secure with jamnuts.

CAUTION: WHEN YOU USE THE ADAPTER OR WRENCH THE ACTUAL TORQUE WRENCH READING WILL BE LESS THAN THAT STATED BELOW. SEE STANDARD PRACTICES MANUAL, 70−52.

4 Engage lugs of handle with mating lugs in nut. Using handle, torque nut to 675 − 800 lb−in. (76.265 − 90.388 N.m).

(f) Lubricate packing (1002/5) with Petrolatum White P06−002, and install on EEC alternator stator (1002/4).

(g) Align boltholes in stator with boltholes on gearbox, and carefully install stator over rotor.

(h) Secure EEC alternator stator to gearbox as follows:

1 (Pre SB PW4ENG 75−59) Align boltholes in the heat shield (1002/2) with the boltholes at top of the stator flange. Secure the heat shield and stator to the gearbox with one washer (1002/3) and three bolts (1002/1).

2 (Post SB PW4ENG 75−59) Secure stator to gearbox with three bolts (1002/1).

(i) Torque bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(j) Do a check of the clearance between the stator and the EEC drive gearshaft housing mount flange. Use a 0.003 inch (0.076 mm) feeler gage. If it is possible to put the gage between the stator and the housing the stator is not correctly installed. Do a check of the torque of the stator bolts. If the bolts are at the maximum torque and the stator is not correctly installed, remove the stator and install it again. Do the check again.

(k) Secure lower alternator cable as follows:

1 (Pre SB PW4ENG 75−59) Install a clamp (1004/1) on lower cable and secure to bracket below alternator with bolt, threads lubricated with Engine Oil P03−001.

2 (Post SB PW4ENG 75−59) Install clamps (1004/1) on lower cable and secure to legs on cooling manifold, below the alternator with bolts, threads lubricated with Engine Oil P03−001.

3 Torque bolt or bolts to 36 − 40 lb−in. (4.067 − 4.519 N.m). See Figure 1004.

(l) Insert ends of cable in bracket on lower left side of gearbox. With plate spacers facing bracket, secure cable ends with plate and two bolts (1004/4) and (1004/5). Lubricate threads of bolt (1004/5) with Antigalling Compound P06−021. Torque bolt to 62 − 72 lb−in. (7.005 − 8.135 N.m). Lubricate threads of other bolt (1004/4) with Engine Oil P03−001. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

(m) Secure cables to spring clips (1004/2) and (1004/3).

(3) Install EEC alternator rotor and stator (Post SB PW4ENG 72−375). See Figure 1005.

(a) Remove protection covers.

CAUTION: MAKE SURE THE ROTOR IS FULLY AGAINST (SEATED) THE GEARSHAFT. DO NOT USE INDUCTION HEATING TO ASSEMBLE THE PMA ROTOR ASSEMBLY. INDUCTION HEATING CAN DAMAGE THE MAGNETIC MATERIAL IN THE ROTOR.

(b) Install the EEC alternator rotor (1005/5) on the gearshaft (1005/6).

CAUTION: WHEN USING THE FOLLOWING ADAPTER THE ACTUAL TORQUE WRENCH READING WILL BE LESS THAN THAT STATED BELOW. SEE STANDARD TORQUES, STANDARD PRACTICES SECTION.

(c) (Reference 570) Lubricate the nut with Engine Oil P03−001, and install the new nut (1005/4) to the gearshaft (1005/6). Torque the nut with PWA 86603 Adapter as follows. See Figure 1006.

1 Loosen both jamnuts (1006/4). While you hold the body (1006/2), loosen the wrench detail (1006/5).

2 Install the handle (1006/3), lug end facing outward, over the mating lug of wrench detail (1006/5).

3 Align boltholes and position wrench body (1006/2) over EEC gearshaft and onto the gearshaft housing (1006/1) pad.

4 Engage lugs of wrench detail with mating slots in gearshaft. Attach the body (1006/2) with three detail screws (1006/6).

5 Seat the wrench detail (1006/5) firmly on the gearshaft and tighten the jamnuts (1006/4).

6 Engage the lugs of handle (1006/3) with the mating lugs in the nut (1006/7).

MAIN GEARBOX − ASSEMBLY−06

7 Using a standard 1/2 inch drive, torque the nut to 675 − 800 lb−in. (76.265 − 90.388 N.m), loosen to 0 torque, then torque again to 675 − 800 lb−in. (76.265 − 90.388 N.m).

NOTE: This must be done in several steps because the handle movement is limited. The handle must be removed and repositioned to the nut.

8 Remove the screws (1006/6) that attach the wrench to the gearbox and remove the adapter.

(d) Lubricate packing (1005/3) with Petrolatum White P06−002, and install on EEC alternator stator.

(e) Align boltholes in stator with boltholes on the gearbox, and carefully install stator over rotor.

(f) Attach the stator to the gearbox with three bolts, threads lubricated with Antigalling Compound P06−021, and tighten by hand.

(g) Torque the bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(h) Do a check of the clearance between the stator and the EEC drive gearshaft housing mount flange. Use a 0.003 inch (0.076 mm) feeler gage. If it is possible to put the gage between the stator and the housing the stator is not correctly installed. Do a check of the torque of the stator bolts. If the bolts are at the maximum torque and the stator is not correctly installed, remove the stator and install it again. Do the check again.

(i) Install cable connectors to the bracket on the lower left side of gearbox as follows. See Figure 1007.

1 Install ends of cable in bracket on lower left side of gearbox. With plate spacers facing bracket, install the retaining plate over connector flanges. Attach the retaining plate to the bracket with two bolts (1007/3) and (1007/4).

2 Lubricate threads of bolt (1007/4) with Antigalling Compound P06−021. Torque the bolt to 62 − 72 lb−in. (7.005 − 8.135 N.m).

3 Lubricate threads of bolt (1007/3) with Engine Oil P03−001. Torque bolt to 36 − 40 lb−in. (4.067 − 4.519 N.m).

4 Install the cables to spring clips (1007/1) and (1007/2).

Subtask 72−61−00−430−066:

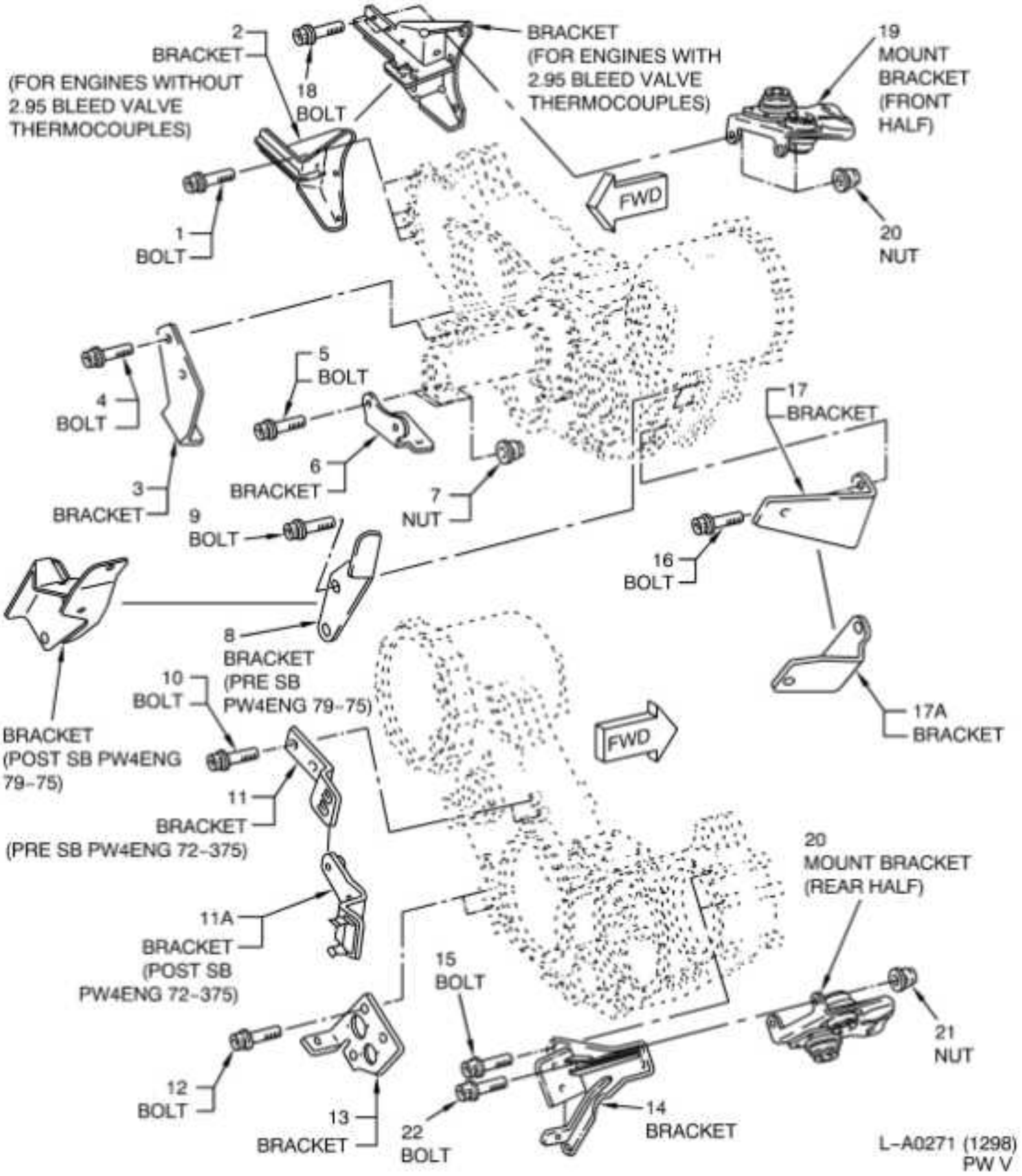
(4) Install lubrication and scavenge oil pump. See Figure 1008.

(a) Lubricate packings (1008/2) and (1008/4) with Engine Oil P03−001, and install packings to grooves on transfer tubes (1008/1) and (1008/3) respectively. Install transfer tubes to respective ports on lubrication and scavenge oil pump (1008/9).

(b) Lubricate two packings (1008/6) with Engine Oil P03−001, and install packings to grooves on oil pump.

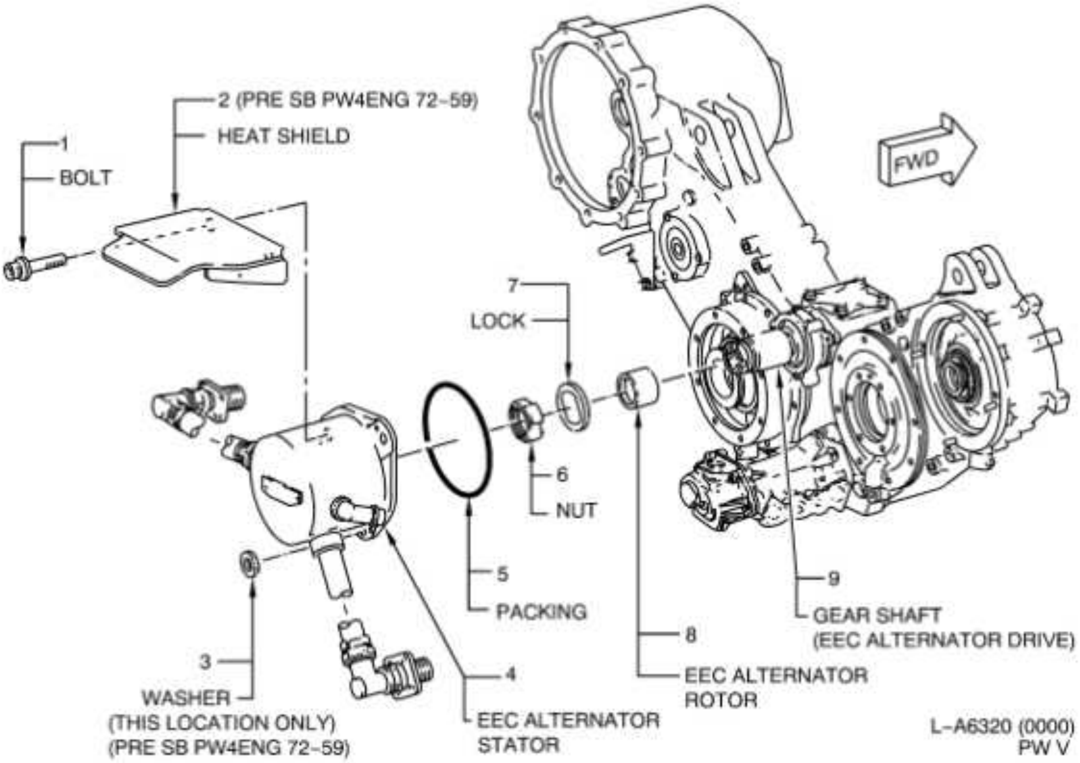
(c) Install oil pump to gearbox lubrication and scavenge pump pad (1008/5), mating gear splines and aligning transfer tubes with their respective ports. Secure oil pump with washers (1008/7) and bolts (1008/8), lubricated with Engine Oil P03−001. Torque bolts to 125 − 140 lb−in. (14.123 − 15.818 N.m).

MAIN GEARBOX − ASSEMBLY−06


2
BRACKET
(FOR ENGINES WITHOUT 2.95 BLEED VALVE THERMOCOUPLES)
18
BOLT
BRACKET
(FOR ENGINES WITH 2.95 BLEED VALVE THERMOCOUPLES)
19
MOUNT BRACKET (FRONT HALF)
FWD
20
NUT
1
BOLT
5
BOLT
4
BOLT
3
BRACKET
6
BRACKET
7
NUT
17
BRACKET
9
BOLT
16
BOLT
8
BRACKET
(PRE SB PW4ENG 79-75)
10
BOLT
BRACKET
(POST SB PW4ENG 79-75)
FWD
17A
BRACKET
11
BRACKET
(PRE SB PW4ENG 72-375)
20
MOUNT BRACKET
(REAR HALF)
11A
BRACKET
(POST SB PW4ENG 72-375)
15
BOLT
21
NUT
12
BOLT
13
BRACKET
22
BOLT
14
BRACKET
L-A0271 (1298)
PW V

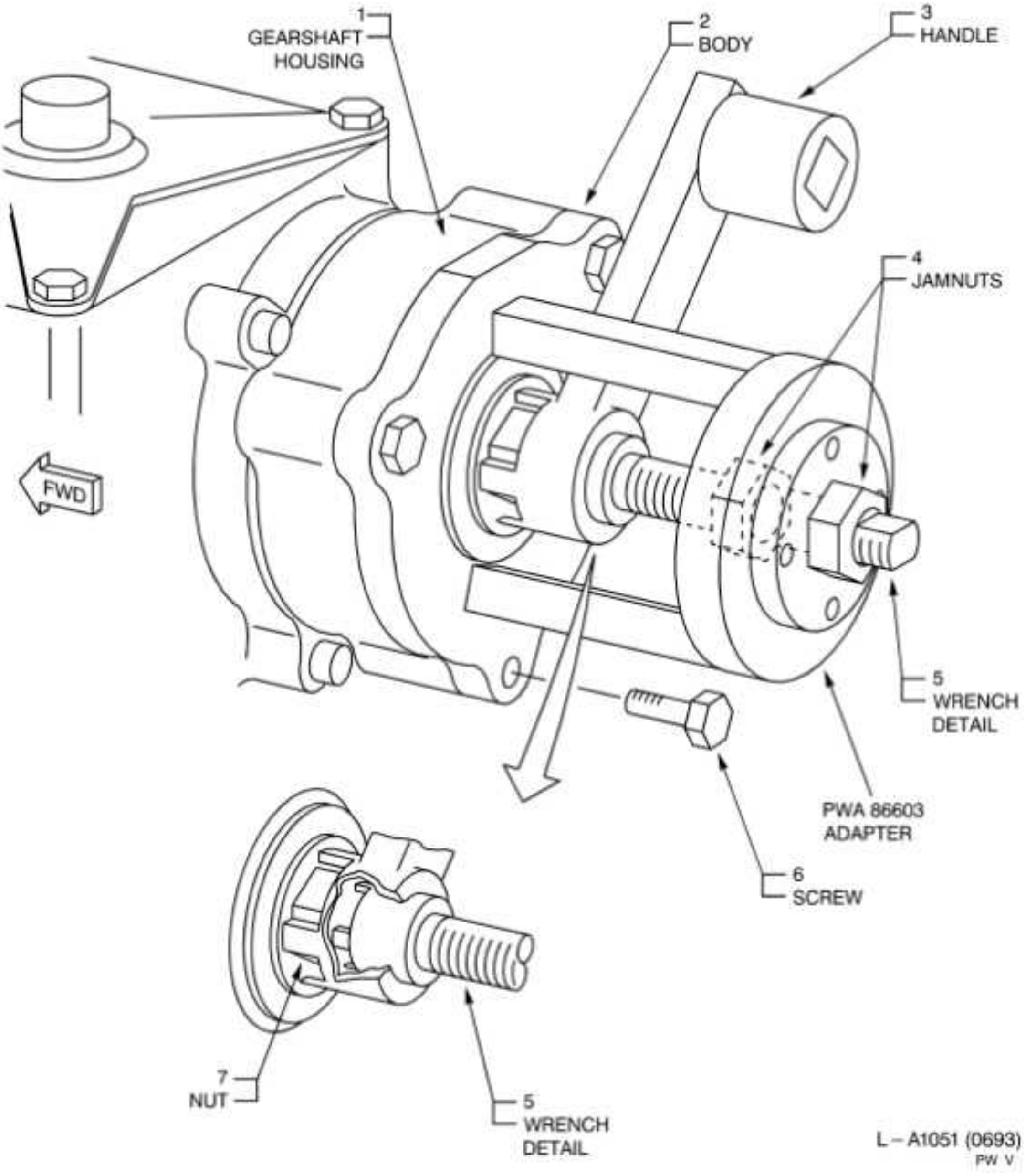
Location Of Brackets
Figure 1001
(Task 72−61−00−400−006)

MAIN GEARBOX − ASSEMBLY−06

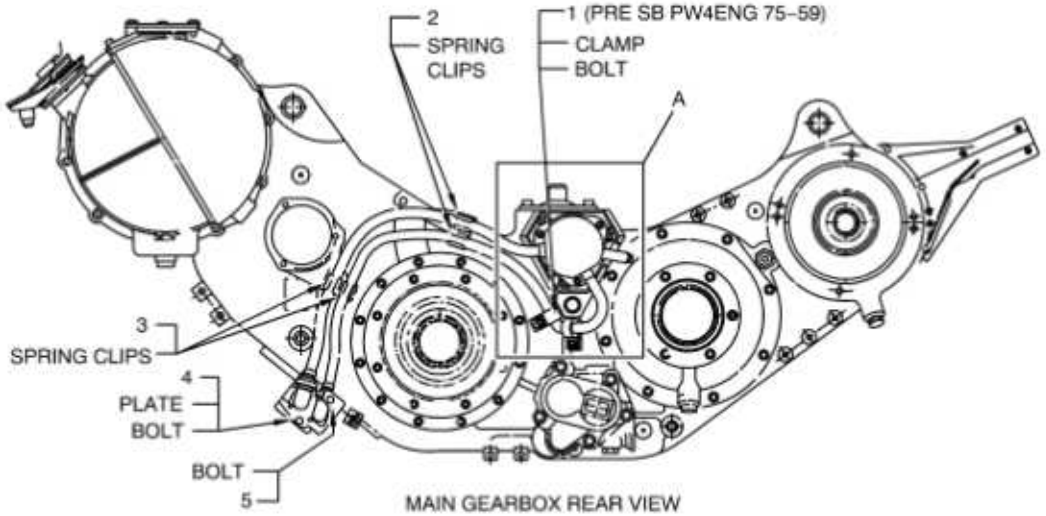

2 (PRE SB PW4ENG 72-59)
HEAT SHIELD
1
BOLT
FWD
7
LOCK
6
NUT
5
PACKING
9
GEAR SHAFT
(EEC ALTERNATOR DRIVE)
8
EEC ALTERNATOR
ROTOR
3
WASHER
(THIS LOCATION ONLY)
(PRE SB PW4ENG 72-59)
4
EEC ALTERNATOR
STATOR
L-A6320 (0000)
PW V

EEC Alternator Rotor And Stator Installation (Pre SB PW4ENG 72−375)
Figure 1002
(Task 72−61−00−400−006)

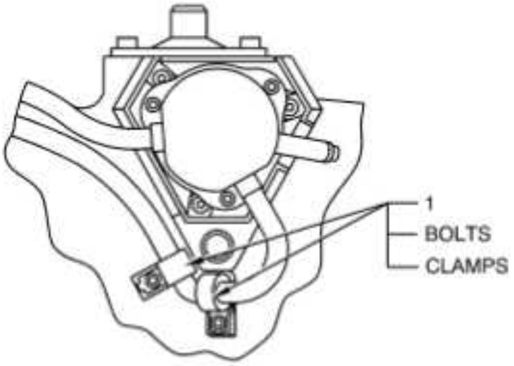
MAIN GEARBOX − ASSEMBLY−06


1
GEARSHAFT HOUSING
2
BODY
3
HANDLE
4
JAMNUTS
FWD
5
WRENCH DETAIL
PWA 86603 ADAPTER
6
SCREW
7
NUT
5
WRENCH DETAIL
L − A1051 (0693)
PW V

EEC Alternator Rotor Nut Torquing
Figure 1003
(Task 72−61−00−400−006)


2
SPRING
CLIPS
1 (PRE SB PW4ENG 75-59)
CLAMP
BOLT
A
3
SPRING CLIPS
4
PLATE
BOLT
BOLT
5

MAIN GEARBOX REAR VIEW

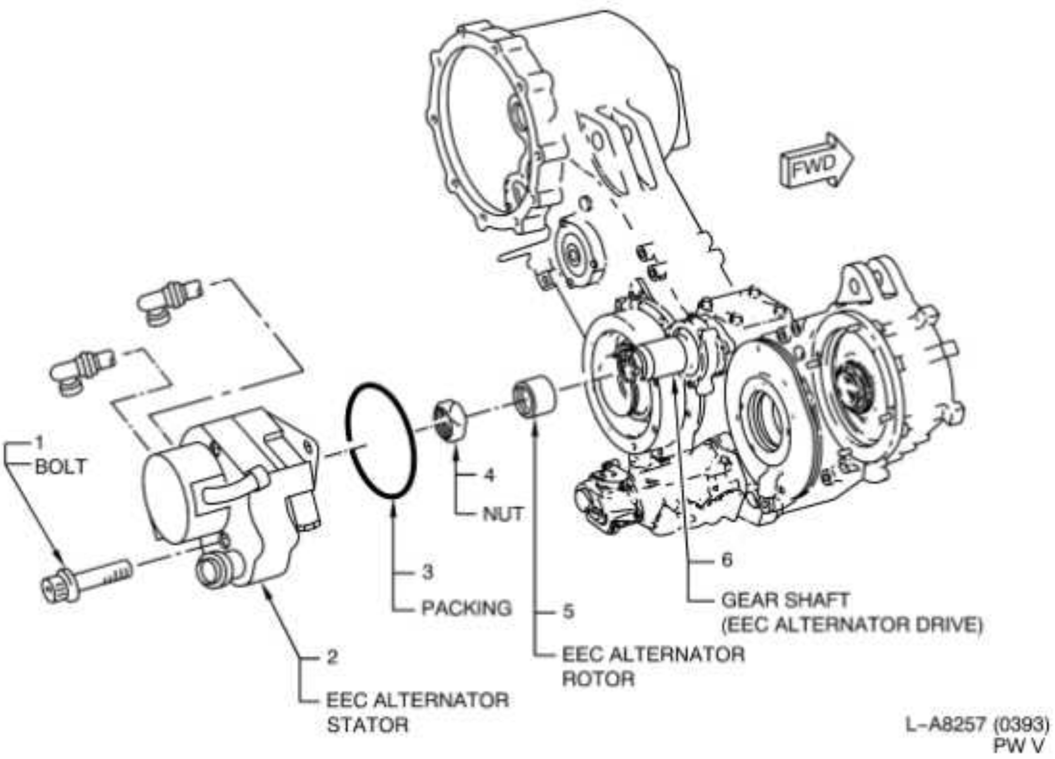

1
BOLTS
CLAMPS

VIEW A
POST SB PW4ENG 75-59

L-A2738 (0292)
PW V

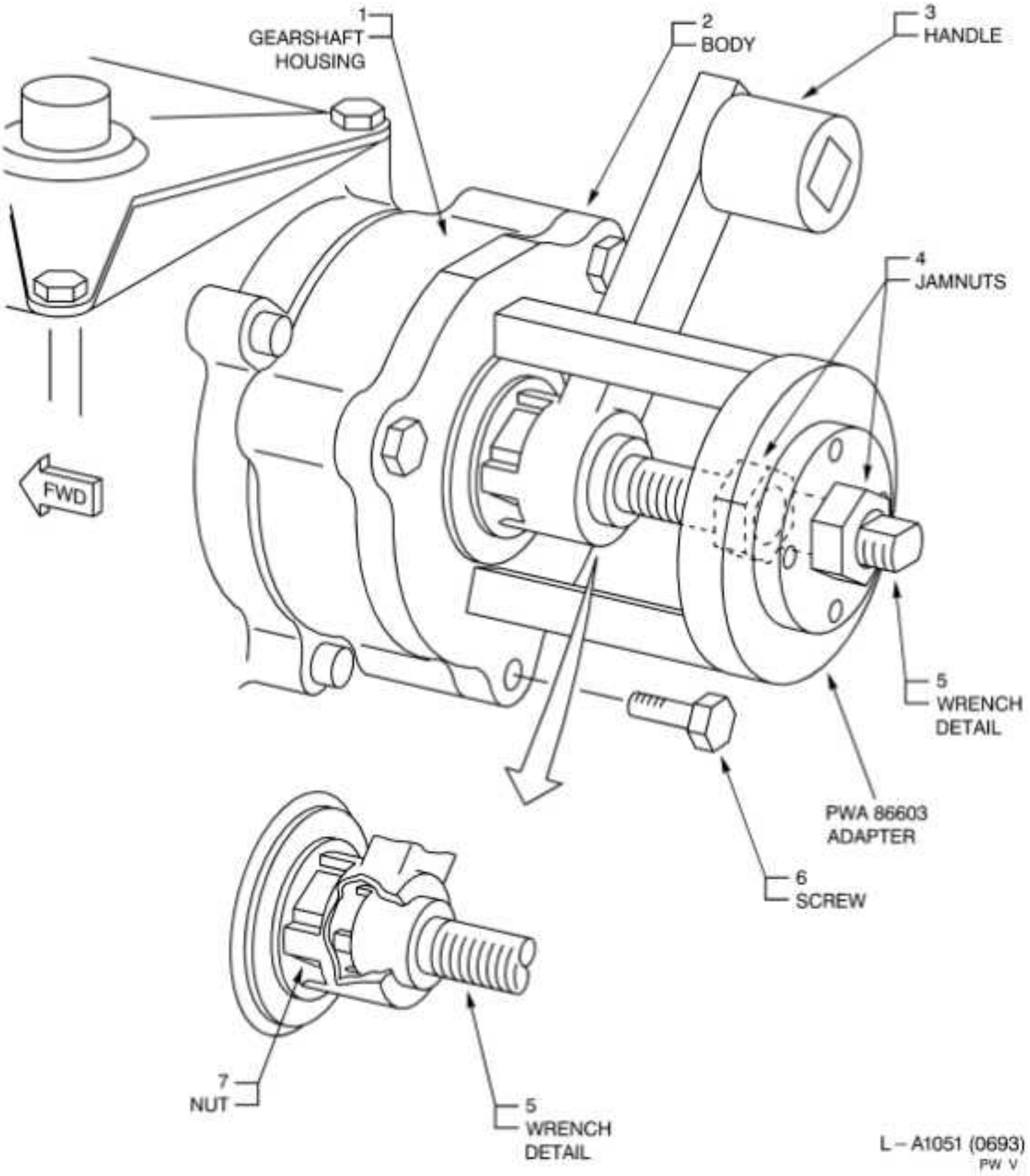
EEC Cables Installation (Pre SB PW4ENG 72-375)
Figure 1004
(Task 72-61-00-400-006)

MAIN GEARBOX − ASSEMBLY−06

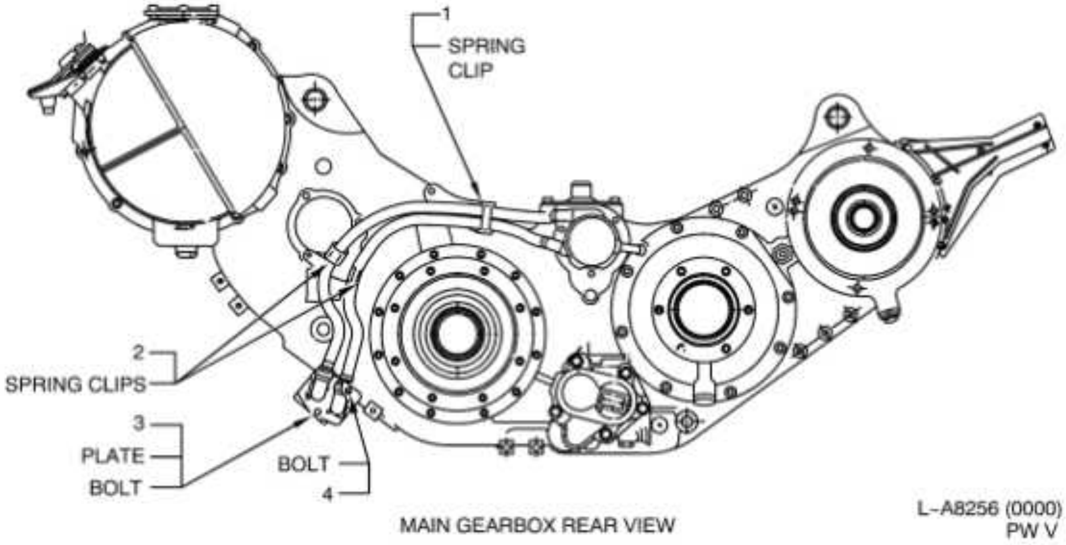

FWD
1
BOLT
2
EEC ALTERNATOR STATOR
3
PACKING
4
NUT
5
EEC ALTERNATOR ROTOR
6
GEAR SHAFT (EEC ALTERNATOR DRIVE)
L−A8257 (0393)
PW V

EEC Alternator Rotor And Stator Installation (Post SB PW4ENG 72−375)
Figure 1005
(Task 72−61−00−400−006)

MAIN GEARBOX − ASSEMBLY−06

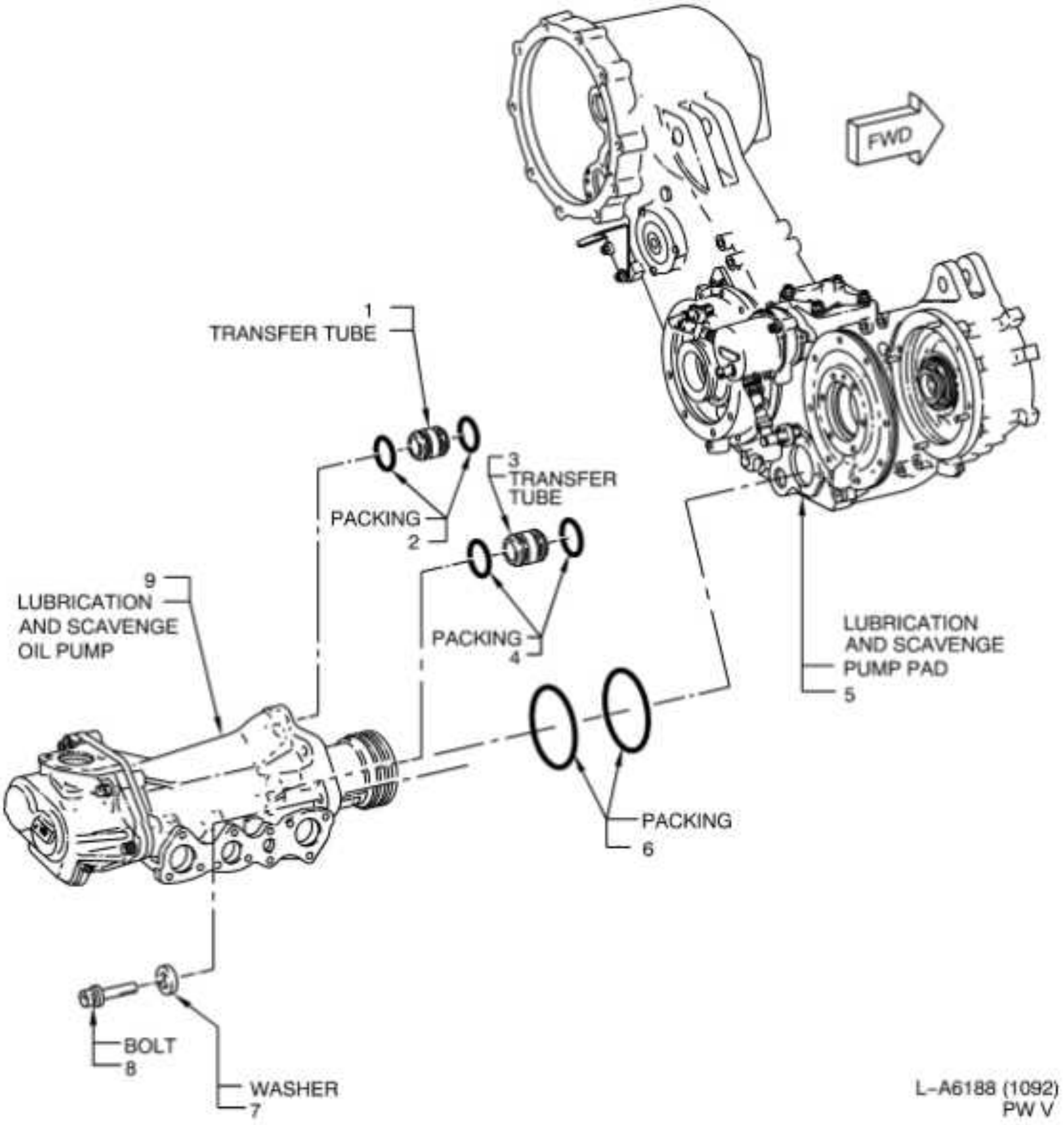

1 GEARSHAFT HOUSING
2 BODY
3 HANDLE
4 JAMNUTS
5 WRENCH DETAIL
PWA 86603 ADAPTER
6 SCREW
FWD
7 NUT
5 WRENCH DETAIL
L − A1051 (0693)
PW V

EEC Alternator Rotor Nut Torquing
Figure 1006
(Task 72−61−00−400−006)


1
SPRING
CLIP
2
SPRING CLIPS
3
PLATE
BOLT
BOLT
4
MAIN GEARBOX REAR VIEW
L-A8256 (0000)
PW V

EEC Cables Installation (Post SB PW4ENG 72−375)
Figure 1007
(Task 72−61−00−400−006)

MAIN GEARBOX − ASSEMBLY−06


1
TRANSFER TUBE
3
TRANSFER
TUBE
PACKING
2
9
LUBRICATION
AND SCAVENGE
OIL PUMP
PACKING
4
FWD
LUBRICATION
AND SCAVENGE
PUMP PAD
5
PACKING
6
BOLT
8
WASHER
7
L−A6188 (1092)
PW V

Lubrication And Scavenge Oil Pump Installation
Figure 1008
(Task 72−61−00−400−006)

Task 72-61-00-400-007:

1. Install The Magnetic Chip Detector Assemblies In The Main Gearbox, Lubrication And Scavenge Oil Pump, And Lube Oil Tank

A. General

(1) To install a full magnetic plug assembly, first install the valve, then install the plug.

B. Equipment And Materials Necessary

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72-61-00/12/270
Packing	AR	72-61-00/12/287
Packing	AR	72-61-00/12/287A
Packing	AR	72-61-00/12/289
Packing	AR	72-61-00/12/292
Packing	AR	72-61-00/12/292A
Packing	AR	72-61-00/12/293
Packing	AR	72-61-00/12/303
Packing	AR	72-61-00/12/306
Packing	1	79-11-00/2/1
Packing	AR	79-11-00/2/14
Packing	AR	79-11-00/2/18
Packing	AR	79-11-00/2/19
Packing	AR	79-11-00/2/23
Packing	AR	79-11-00/2/23A
Packing	AR	79-11-00/2/25
Packing	AR	79-11-00/2/33
Packing	AR	79-11-00/2/35
Packing	4	79-21-00/1/80
Packing	AR	79-21-00/1/97

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
(CONTINUED)		
Packing	AR	79−21−00/1/99
Packing	AR	79−21−00/1/102
Packing	AR	79−21−00/1/103
Packing	AR	79−21−00/1/113
Packing	AR	79−21−00/1/117

C. Installation Of The Magnetic Chip Detectors

CAUTION: REMOVE THE PROTECTIVE COVERS FROM THE OPENINGS AS NECESSARY TO PREVENT ENGINE DAMAGE.

CAUTION: DO NOT TRY TO INSTALL THE CHIP DETECTOR AS AN ASSEMBLY. YOU MUST REMOVE THE MAGNETIC PROBE FROM THE VALVE TO PREVENT DAMAGE TO THE PARTS.

(1) Install the magnetic chip detector to the engine oil tank. See Figure 1001.

(a) Install the PN 50R499 magnetic chip detector to the engine oil tank as follows:

1 If necessary, install the magnetic probe (1001/15) into the valve (1001/4) to get access to the packing grooves.

2 Apply Engine Oil P03−001 to the new packing (1001/2).

3 Install the new packing to the small OD end of the valve.

4 Apply Engine Oil P03−001 to the new packing (1001/1).

5 Install the new packing to the washer face of the valve.

6 Remove the magnetic probe from the valve.

7 Install the valve into the engine oil tank.

8 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

9 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

10 Apply Engine Oil P03−001 to the new packing (1001/3).

11 Install the new packing to the groove on the magnetic probe.

12 Install the magnetic probe into the valve.

13 Push the magnetic probe in and turn it clockwise until it locks.

14 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

(b) Install the PN 50R485 magnetic chip detector to the engine oil tank as follows:

1 If necessary, install the magnetic probe (1001/9) into the valve (1001/7) to get access to the packing grooves.

2 Apply Engine Oil P03−001 to the new packing (1001/6).

3 Install the new packing to the small OD end of the valve.

4 Apply Engine Oil P03−001 to the new packing (1001/1).

5 Install the new packing to the washer face of the valve.

6 Remove the magnetic probe from the valve.

7 Install the valve into the engine oil tank.

8 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

9 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

10 Apply Engine Oil P03−001 to the new packing (1001/8).

11 Install the new packing to the groove on the magnetic probe.

12 Install the magnetic probe into the valve.

13 Push the magnetic probe in and turn it clockwise until it locks.

14 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

(c) Install the PN 50R423 (option 1) magnetic chip detector to the engine oil tank as follows:

1 Apply Engine Oil P03−001 to the new packing (1001/1).

2 Install the new packing to the washer face of the valve (1001/10).

3 Install the valve into the engine oil tank.

4 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

5 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

6 Apply Engine Oil P03−001 to the new packing (1001/11).

7 Install the new packing to the groove on the magnetic probe (1001/12).

8 Install the magnetic probe into the valve.

9 Push the magnetic probe in and turn it clockwise until it locks.

10 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

(d) Install the PN 50R423 (option 2) magnetic chip detector to the engine oil tank as follows:

1 Apply Engine Oil P03−001 to the new packing (1001/1).

2 Install the new packing to the washer face of the valve (1001/13).

3 Apply Engine Oil P03−001 to the new packing (1001/14).

4 Install the new packing to the ID of the valve.

5 Install the valve into the engine oil tank.

6 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

7 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

8 Apply Engine Oil P03−001 to the new packing (1001/15).

9 Install the new packing to the groove on the magnetic probe (1001/16).

10 Install the magnetic probe into the valve.

11 Push the magnetic probe in and turn it clockwise until it locks.

12 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

(e) Install the PN 50R374 magnetic chip detector to the engine oil tank as follows:

1 Apply Engine Oil P03−001 to the new packing (1001/1).

2 Install the new packing to the washer face of the valve (1001/17).

3 Install the valve into the engine oil tank.

4 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

5 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

6 Apply Engine Oil P03−001 to the new packing (1001/18).

7 Install the new packing to the groove on the magnetic probe (1001/19).

8 Install the magnetic probe into the valve.

9 Push the magnetic probe in and turn it clockwise until it locks.

10 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

CAUTION: REMOVE THE PROTECTIVE COVERS FROM THE OPENINGS AS NECESSARY TO PREVENT ENGINE DAMAGE.

CAUTION: DO NOT TRY TO INSTALL THE CHIP DETECTOR AS AN ASSEMBLY. YOU MUST REMOVE THE MAGNETIC PROBE FROM THE VALVE TO PREVENT DAMAGE TO THE PARTS.

(2) Install the four magnetic chip detectors to the lubrication and scavenge oil pump. See Figure 1002.

(a) Install the PN 50R342 magnetic chip detector to the lubrication and scavenge oil pump as follows:

1 Apply Engine Oil P03−001 to the new packing (1002/1).

2 Install the new packing to the washer face of the valve (1002/2).

3 Install the valve into the engine oil tank.

4 Torque the valve to 90 − 100 lb−in. (10.169 − 11.298 N.m).

5 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

6 Apply Engine Oil P03−001 to the new packing (1002/3).

7 Install the new packing to the groove on the magnetic probe (1002/4).

8 Install the magnetic probe into the valve.

9 Push the magnetic probe in and turn it clockwise until it locks.

10 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

11 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

(b) Install the PN 50R348 magnetic chip detector to the lubrication and scavenge oil pump as follows:

1 Apply Engine Oil P03−001 to the new packing (402/1).

2 Install the new packing to the washer face of the valve (1002/8).

3 Apply Engine Oil P03−001 to the new packing (1002/7).

4 Install the new packing to the ID of the valve.

5 Install the valve into the lubrication and scavenge oil pump.

MAIN GEARBOX − ASSEMBLY−07

6 Torque the valve to 90 − 100 lb−in. (10.169 − 11.298 N.m).

7 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

8 Apply Engine Oil P03−001 to the new packing (1002/6).

9 Install the new packing to the groove on the magnetic probe (1002/5).

10 Install the magnetic probe into the valve.

11 Push the magnetic probe in and turn it clockwise until it locks.

12 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

13 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

(c) Install the PN 50R492 magnetic chip detector to the lubrication and scavenge oil pump as follows:

1 If necessary, install the magnetic probe (1002/2) into the valve (1002/10) to get access to the packing grooves.

2 Apply Engine Oil P03−001 to the new packing (1002/9).

3 Install the new packing to the small OD end of the valve.

4 Apply Engine Oil P03−001 to the new packing (1002/1).

5 Install the new packing to the washer face of the valve.

6 Remove the magnetic probe from the valve.

7 Install the valve into the lubrication and scavenge oil pump.

8 Torque the valve to 90 − 100 lb−in. (10.169 − 11.298 N.m).

9 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

10 Apply Engine Oil P03−001 to the new packing (1002/11).

11 Install the new packing to the groove on the magnetic probe.

12 Install the magnetic probe into the valve.

13 Push the magnetic probe in and turn it clockwise until it locks.

14 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

15 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

(d) Install the PN 50R491 magnetic chip detector to the lubrication and scavenge oil pump as follows:

1 Apply Engine Oil P03−001 to the new packing (1002/1).

2 Install the new packing to the washer face of the valve (1002/16).

3 Apply Engine Oil P03−001 to the new packing (1002/15).

4 Install the new packing to the ID of the valve.

5 Install the valve into the lubrication and scavenge oil pump.

6 Torque the valve to 90 − 100 lb−in. (10.169 − 11.298 N.m).

7 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

8 Apply Engine Oil P03−001 to the new packing (1002/14).

9 Install the new packing to the groove on the magnetic probe (1002/13).

10 Install the magnetic probe into the valve.

11 Push the magnetic probe in and turn it clockwise until it locks.

12 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

13 Do this procedure again for the remaining three locations on the lubrication and scavenge oil pump.

(e) Install the PN 50R501 magnetic chip detector to the lubrication and scavenge oil pump as follows:

1 If necessary, install the magnetic probe (1002/20) into the valve (1002/18) to get access to the packing grooves.

2 Apply Engine Oil P03−001 to the new packing (1002/17).

3 Install the new packing to the small OD end of the valve.

4 Apply Engine Oil P03−001 to the new packing (1002/1).

5 Install the new packing to the washer face of the valve.

6 Remove the magnetic probe from the valve.

7 Install the valve into the lubrication and scavenge oil pump.

8 Torque the valve to 90 − 100 lb−in. (10.169 − 11.298 N.m).

9 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

10 Apply Engine Oil P03−001 to the new packing (1002/19).

11 Install the new packing to the groove on the magnetic probe.

12 Install the magnetic probe into the valve.

13 Push the magnetic probe in and turn it clockwise until it locks.

14 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

CAUTION: REMOVE THE PROTECTIVE COVERS FROM THE OPENINGS AS NECESSARY TO PREVENT ENGINE DAMAGE.

CAUTION: DO NOT TRY TO INSTALL THE CHIP DETECTOR AS AN ASSEMBLY. YOU MUST REMOVE THE MAGNETIC PROBE FROM THE VALVE TO PREVENT DAMAGE TO THE PARTS.

(3) Install the magnetic chip detector to the center front side of the main gearbox assembly. See Figure 1003.

(a) Install the PN 50R341 magnetic chip detector to the center front side of the main gearbox assembly as follows:

1 Apply Engine Oil P03−001 to the new packing (1003/1).

2 Install the new packing to the washer face of the valve (1003/2).

3 Install the valve into the center front side of the main gearbox assembly.

4 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

5 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

6 Apply Engine Oil P03−001 to the new packing (1003/3).

7 Install the new packing to the groove on the magnetic probe (1003/4).

8 Install the magnetic probe into the valve.

9 Push the magnetic probe in and turn it clockwise until it locks.

10 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

(b) Install the PN 50R347 magnetic chip detector to the center front side of the main gearbox assembly as follows:

1 Apply Engine Oil P03−001 to the new packing (1003/1).

2 Install the new packing to the washer face of the valve (1003/5).

3 Apply Engine Oil P03−001 to the new packing (1003/6).

4 Install the new packing to the ID of the valve.

5 Install the valve into the center front side of the main gearbox assembly.

6 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

MAIN GEARBOX − ASSEMBLY−07

7 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

8 Apply Engine Oil P03−001 to the new packing (1003/7).

9 Install the new packing to the groove on the magnetic probe (1003/8).

10 Install the magnetic probe into the valve.

11 Push the magnetic probe in and turn it clockwise until it locks.

12 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

(c) Install the PN 50R485 magnetic chip detector to the center front side of the main gearbox assembly as follows:

1 If necessary, install the magnetic probe (1003/12) into the valve (1003/10) to get access to the packing grooves.

2 Apply Engine Oil P03−001 to the new packing (1003/9).

3 Install the new packing to the small OD end of the valve.

4 Apply Engine Oil P03−001 to the new packing (1003/1).

5 Install the new packing to the washer face of the valve.

6 Remove the magnetic probe from the valve.

7 Install the valve into the center front side of the main gearbox assembly.

8 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

9 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

10 Apply Engine Oil P03−001 to the new packing (1003/11).

11 Install the new packing to the groove on the magnetic probe.

12 Install the magnetic probe into the valve.

13 Push the magnetic probe in and turn it clockwise until it locks.

14 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

(d) Install the PN 50R484 magnetic chip detector to the center front side of the main gearbox assembly as follows:

1 Apply Engine Oil P03−001 to the new packing (1003/1).

2 Install the new packing to the washer face of the valve (1003/13).

3 Apply Engine Oil P03−001 to the new packing (1003/14).

4 Install the new packing to the ID of the valve.

5 Install the valve into the center front side of the main gearbox assembly.

6 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

7 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

8 Apply Engine Oil P03−001 to the new packing (1003/15).

9 Install the new packing to the groove on the magnetic probe (1003/16).

10 Install the magnetic probe into the valve.

11 Push the magnetic probe in and turn it clockwise until it locks.

12 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

(e) Install the PN 50R499 magnetic chip detector to the center front side of the main gearbox assembly as follows:

1 If necessary, install the magnetic probe (1003/20) into the valve (1003/18) to get access to the packing grooves.

2 Apply Engine Oil P03−001 to the new packing (1003/17).

3 Install the new packing to the small OD end of the valve.

4 Apply Engine Oil P03−001 to the new packing (1003/1).

5 Install the new packing to the washer face of the valve.

6 Remove the magnetic probe from the valve.

7 Install the valve into the center front side of the main gearbox assembly.

8 Torque the valve to 200 − 225 lb−in. (22.597 − 25.422 N.m).

9 Safety the valve with Lockwire P05−289 or Safety Cable P05−291 and Ferrule P05−292.

10 Apply Engine Oil P03−001 to the new packing (403/19).

11 Install the new packing to the groove on the magnetic probe.

12 Install the magnetic probe into the valve.

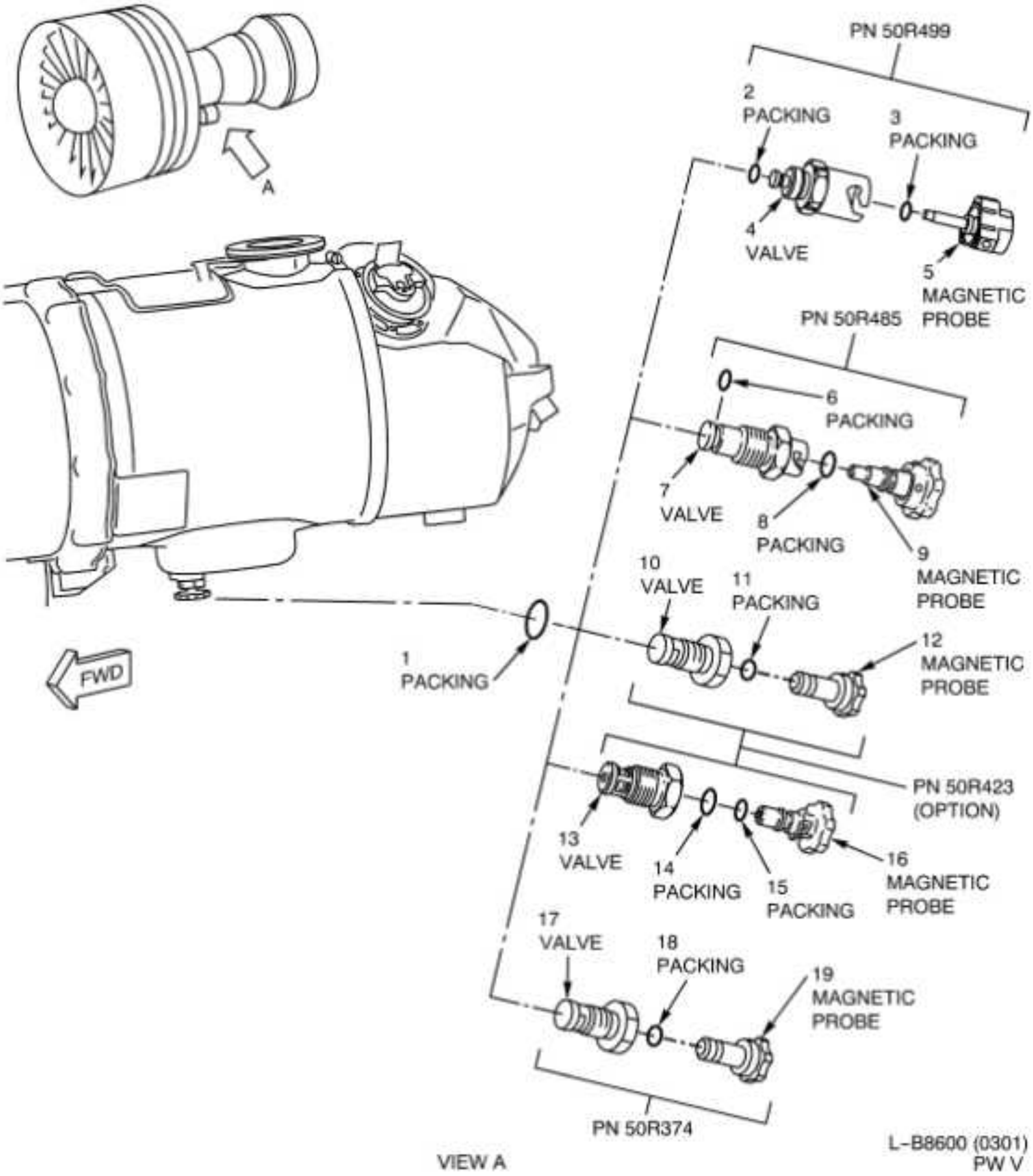
13 Push the magnetic probe in and turn it clockwise until it locks.

14 Pull on the magnetic probe to make sure it is locked.

NOTE: The probe is correctly installed when you align the red mark on the magnetic probe with the red mark on the valve.

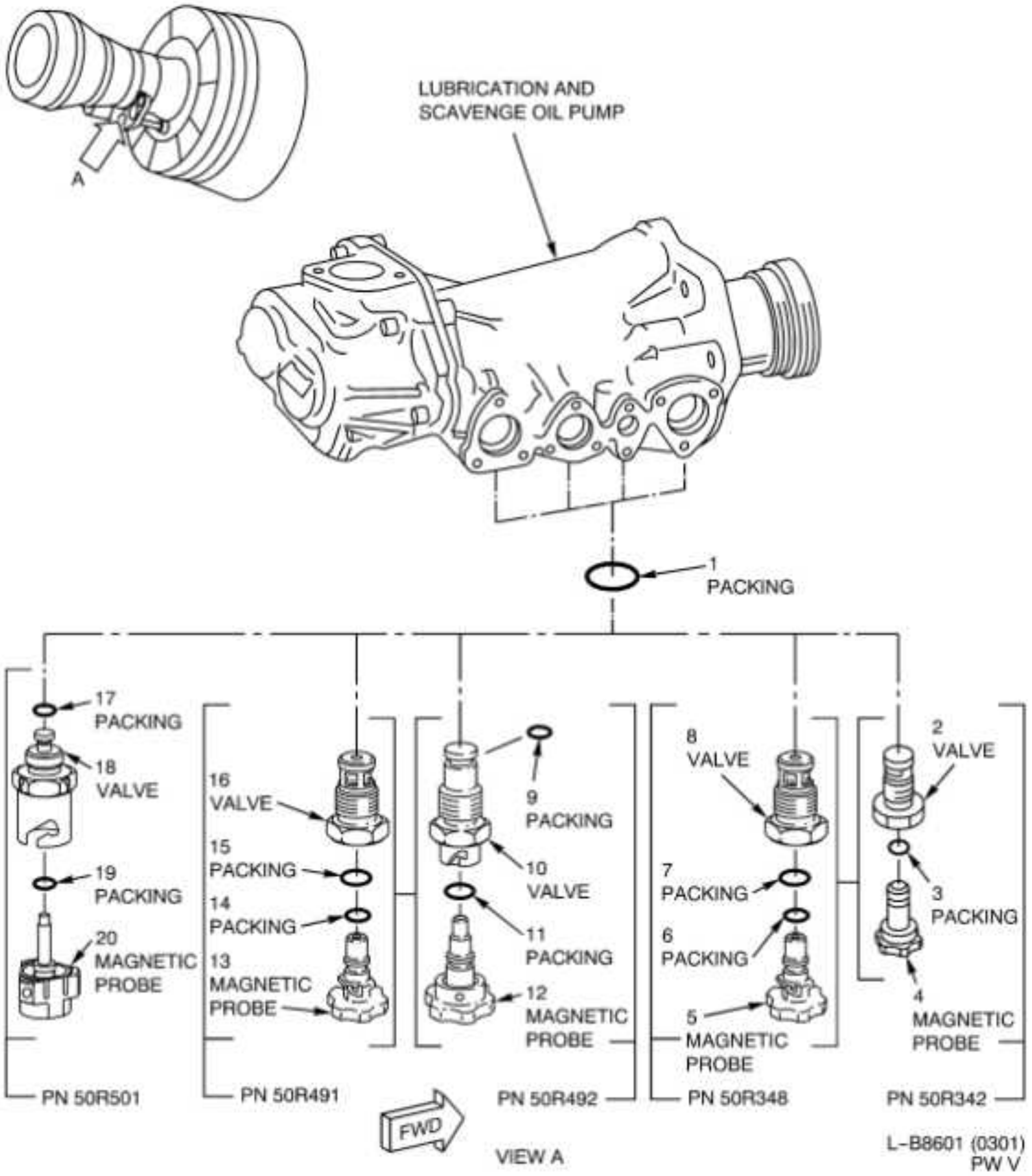
D. Postrequisites

(1) Do a leak check of the main gearbox. Refer to Testing-01 (Task 72-61-00-790-001).

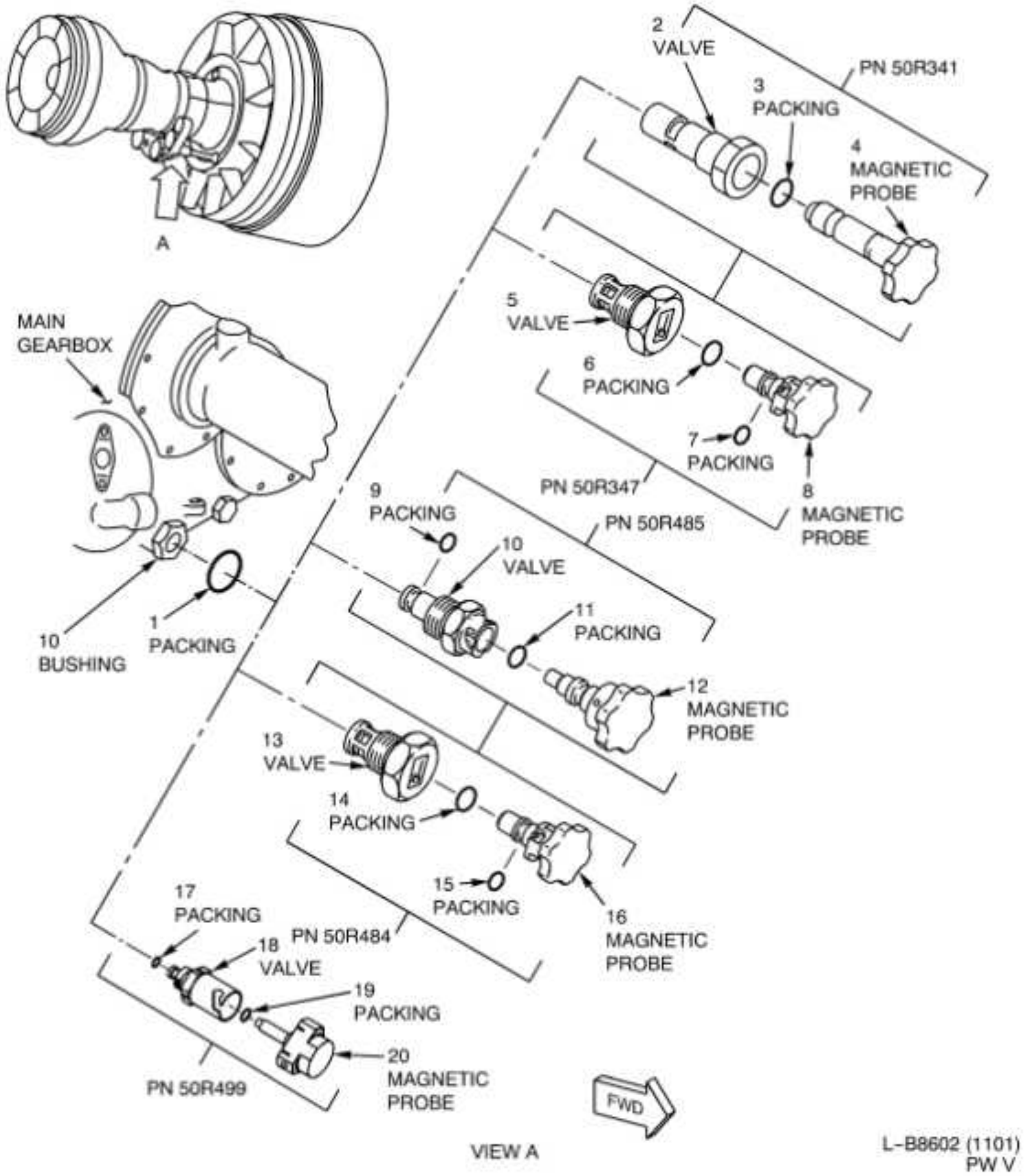

A
FWD
PN 50R499
2
PACKING
3
PACKING
4
VALVE
5
MAGNETIC
PROBE
PN 50R485
6
PACKING
7
VALVE
8
PACKING
9
MAGNETIC
PROBE
10
VALVE
11
PACKING
12
MAGNETIC
PROBE
1
PACKING
PN 50R423
(OPTION)
13
VALVE
14
PACKING
15
PACKING
16
MAGNETIC
PROBE
17
VALVE
18
PACKING
19
MAGNETIC
PROBE
PN 50R374
VIEW A
L-B8600 (0301)
PW V

Main Oil Tank Chip Detectors
Figure 1001
(Task 72−61−00−400−007)

MAIN GEARBOX − ASSEMBLY−07


A
LUBRICATION AND SCAVENGE OIL PUMP
1 PACKING
17 PACKING
18 VALVE
19 PACKING
20 MAGNETIC PROBE
PN 50R501
16 VALVE
15 PACKING
14 PACKING
13 MAGNETIC PROBE
PN 50R491
9 PACKING
10 VALVE
11 PACKING
12 MAGNETIC PROBE
PN 50R492
8 VALVE
7 PACKING
6 PACKING
5 MAGNETIC PROBE
PN 50R348
2 VALVE
3 PACKING
4 MAGNETIC PROBE
PN 50R342
FWD
VIEW A
L-B8601 (0301)
PW V

Lubrication And Scavenge Oil Pump Chip Detectors
Figure 1002
(Task 72−61−00−400−007)


A
MAIN GEARBOX
10 BUSHING
1 PACKING
2 VALVE
PN 50R341
3 PACKING
4 MAGNETIC PROBE
5 VALVE
6 PACKING
7 PACKING
8 MAGNETIC PROBE
PN 50R347
9 PACKING
PN 50R485
10 VALVE
11 PACKING
12 MAGNETIC PROBE
13 VALVE
14 PACKING
15 PACKING
16 MAGNETIC PROBE
17 PACKING
18 VALVE
PN 50R484
19 PACKING
20 MAGNETIC PROBE
PN 50R499
FWD
VIEW A
L-B8602 (1101)
PW V

Main Gearbox Chip Detectors
Figure 1003
(Task 72−61−00−400−007)

Previous Pageblock Return to Previous Menu Next Pageblock

MAIN GEARBOX - STORAGE-01

Task 72-61-00-530-001:

1. Pack The Main Gearbox

A. Prerequisites

(1) Remove the main gearbox. Refer to 72-00-61, Removal-01 (Task 72-00-61-020-001) or Removal-33 (Task 72-00-61-020-003).

(2) Remove the lubrication and scavenge oil pump. Refer to 72-00-61, Removal-32 (Task 72-00-61-050-014).

(3) Remove the EEC alternator stator. Refer to 72-00-61, Removal-10 (Task 72-00-61-050-007).

(4) Remove the EEC alternator rotor. Refer to 72-00-61, Removal-09 (Task 72-00-61-050-006).

NOTE: Removal of the oil tank is optional. To remove the oil tank, refer to 72-00-61, Removal-28 (Task 72-00-61-050-012).

B. Equipment And Materials Required

Special Tools:
P60041 Shipping Equipment Assembly

C. Procedure

See Figures 1201 and 1202.

(1) If applicable, remove the bolts that attach the cover of the container. Remove the cover.

(2) With a hoist and two slings, lift the detail support of P60041 Shipping Equipment Assembly. Attach the support to the main gearbox clevises with the detail ball lock pins.

(3) With the detail screws, attach the covers to the bores shown in the referenced figure. Install the plugs and and cap where shown.

NOTE: If the oil tank is installed, do not install the cover for that bore.

MAIN GEARBOX − STORAGE−01

(4) With the hoist and slings, lift the assembly. Lower the assembly into the detail frame. Attach the support to the detail frame with the detail washers, lockwashers, and screws.

(5) With the detail bolts, attach the cover of the container.

Task 72−61−00−540−001:

2. Unpack The Main Gearbox

A. Equipment And Materials Required − None

B. Procedure

See Figures 1201 and 1202.

(1) Before you remove the bolts that attach the cover of the container, release the pressure inside the container. Use the detail pressure relief valve.

(2) Remove the bolts that attach the cover of the container. Remove the cover.

(3) Remove the eight bolts and washers that attach the detail support to the detail frame of the shipping equipment assembly.

(4) With a hoist and two slings, lift the detail support and main gearbox out of the detail frame. Put the assembly on a pallet.

(5) Remove the detail covers and plugs from the main gearbox.

(6) Remove the three ball lock pins that attach the main gearbox to the detail support. Remove the detail support from the main gearbox.

(7) Attach the detail support to the detail frame. Remove the hoist and slings.

C. Postrequisites

(1) Install the EEC alternator rotor. Refer to 72−00−61, Installation−09 (Task 72−00−61−450−006).

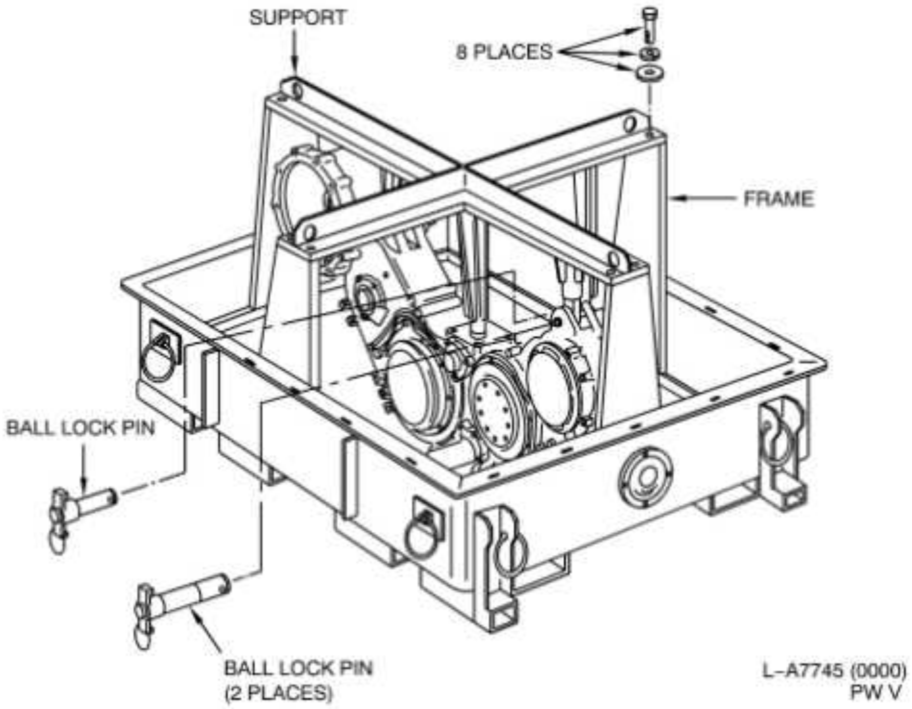
(2) Install the EEC alternator stator. Refer to 72−00−61, Installation−10 (Task 72−00−61−450−007).

MAIN GEARBOX - STORAGE-01

(3) Install the lubrication and scavenge oil pump. Refer to 72-00-61, Installation-32 (Task 72-00-61-450-014).

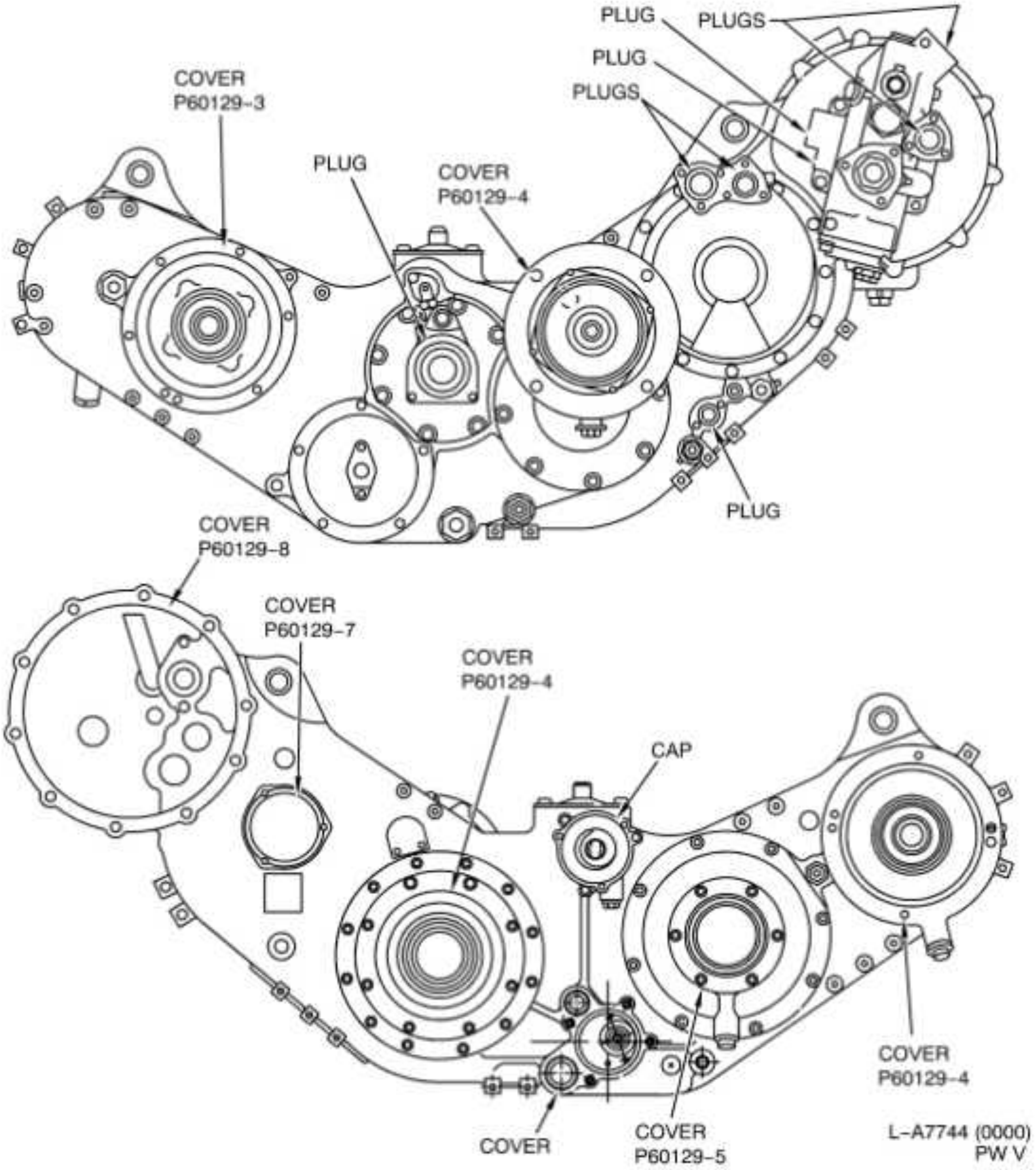
(4) If the oil tank was removed, install the oil tank. Refer to 72-00-61, Installation-28 (Task 72-00-61-450-012).

(5) Install the main gearbox. Refer to 72-00-61, Installation-01 (Task 72-00-61-420-001) or Installation-33 Task 72-00-61-420-003).


SUPPORT
8 PLACES
FRAME
BALL LOCK PIN
BALL LOCK PIN
(2 PLACES)
L−A7745 (0000)
PW V

Pack/Unpack The Main Gearbox
Figure 1201
(Task 72−61−00−530−001)

MAIN GEARBOX − STORAGE−01


PLUG
PLUGS
PLUG
PLUGS
COVER
P60129-3
PLUG
COVER
P60129-4
PLUG
COVER
P60129-8
COVER
P60129-7
COVER
P60129-4
CAP
COVER
P60129-4
COVER
COVER
P60129-5
L-A7744 (0000)
PW V

Pack/Unpack The Main Gearbox
Figure 1202
(Task 72−61−00−530−001)

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MAIN GEARBOX - TESTING-01

Task 72-61-00-790-001:

1. Leak Check The Main Gearbox

A. Equipment And Materials Necessary

Special Tools:

CTE 5070	Cart, Airflow (Optional To CTE 6070)
CTE 6070	Cart, Airflow
PWA 85937	Cover (3 Necessary)
PWA 85938	Cover
PWA 85939	Cover
PWA 85940	Cover
PWA 85941	Cover
PWA 85942	Cover
PWA 85943	Cover
PWA 85944	Cover
PWA 85945	Cover
PWA 85946	Cover
PWA 85947	Cover
PWA 85948	Cover
PWA 85949	Cover
PWA 85951	Plug (Optional To Engine Part)
PWA 85953	Plug (Optional To Engine Part) (2 Places)
PWA 85954	Cover

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-007	Fluid, Leak Check (PMC 9569 Or PMC 2277)

B. Procedure

See Figure 1301.

CAUTION: DO NOT TURN THE GEARBOX TO PUT THE OIL TANK UNDER THE GEARBOX. TO DO SO WILL CAUSE DAMAGE TO THE OIL TANK.

CAUTION: DO NOT TRUNNION THE GEARBOX WITH THE LUBE OIL TANK INSTALLED. THERE IS INSUFFICIENT CLEARANCE UNDER THE STAND. DAMAGE TO THE OIL TANK WILL RESULT.

(1) Install the tools at locations shown in the referenced figure.

(a) For those tools with packings, lubricate the packings with Engine Oil P03-001 before you install the packings on the tools.

WARNING: BEFORE YOU DO THE CHECK, MAKE SURE THAT ALL COVERS AND PLUGS ARE TIGHTENED. IF THEY ARE NOT TIGHT, THEY CAN CAUSE INJURY DURING THE CHECK.

(2) Connect CTE 6070 Cart or CTE 5070 Cart to PWA 85939 Cover.

(3) Pressurize the main gearbox and oil tank at 10 psig (68.9 kPa).

(4) Apply Leak Check Fluid P05-007 all around the mating surfaces shown in the figure.

(5) No leaks are permitted. If there are leaks, examine the tightness of the bolts, the position of the housings and seals, etc. Correct them. Examine for leaks again. If there are still leaks, it is possible that repairs are necessary.

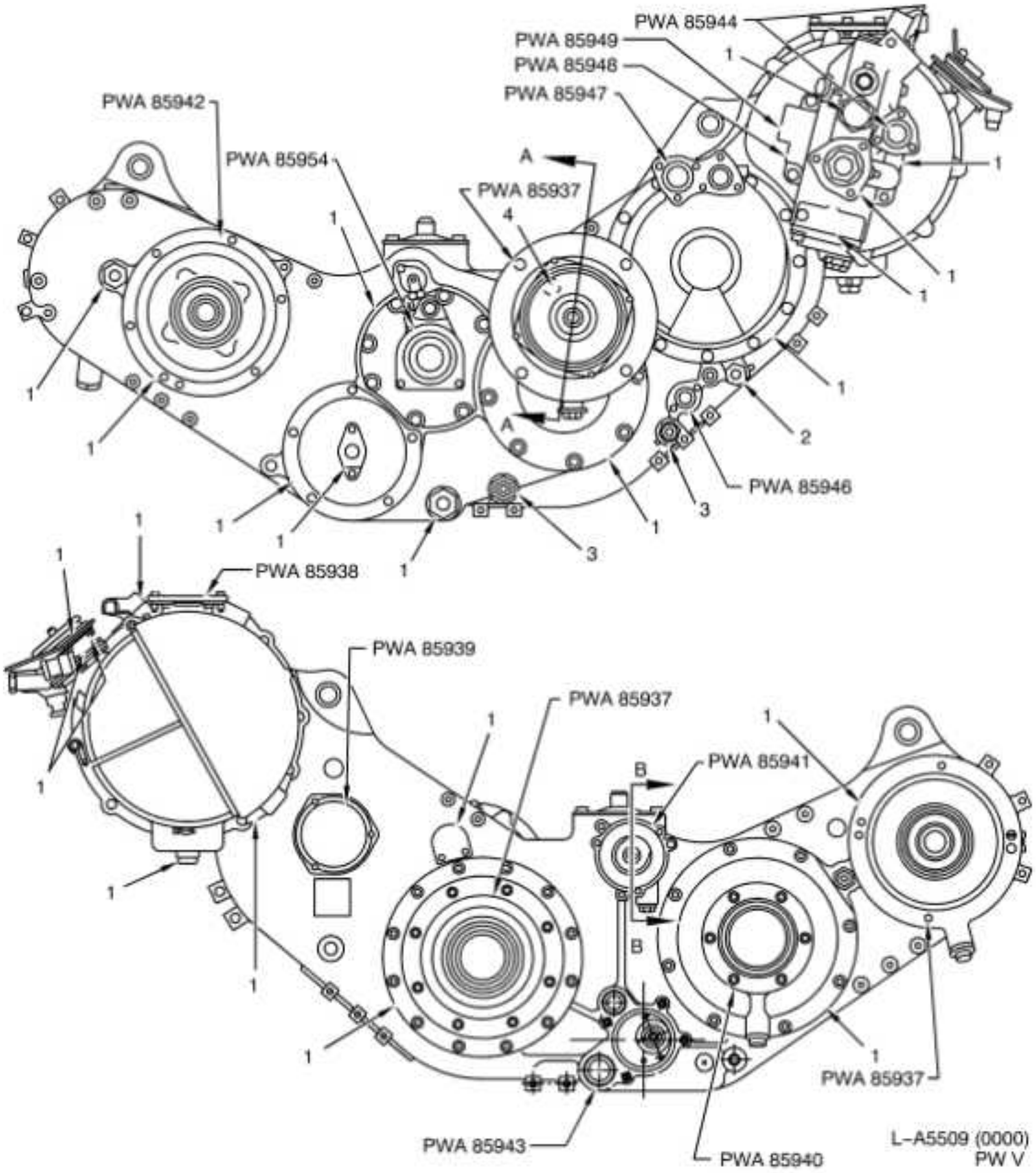
(6) Remove all leak check tools.

(a) Make sure that all detail nuts, washers, and bolts are stored with their covers.

(b) If tools (painted red) were installed in plug locations, remove them and replace with packings and plugs that are engine parts. See Assembly-03 (Task 72-61-00-790-001).

C. Postrequisites

(1) Install the EEC rotor and stator, the lubrication and scavenge oil pump, and the brackets on the main gearbox. Refer to Assembly-06 (Task 72-61-00-400-006).


PWA 85944
PWA 85949
PWA 85948
PWA 85947
PWA 85942
PWA 85954
A
PWA 85937
4
1
2
3
PWA 85946
PWA 85938
PWA 85939
PWA 85937
PWA 85941
B
PWA 85937
PWA 85943
PWA 85940
L−A5509 (0000)
PW V

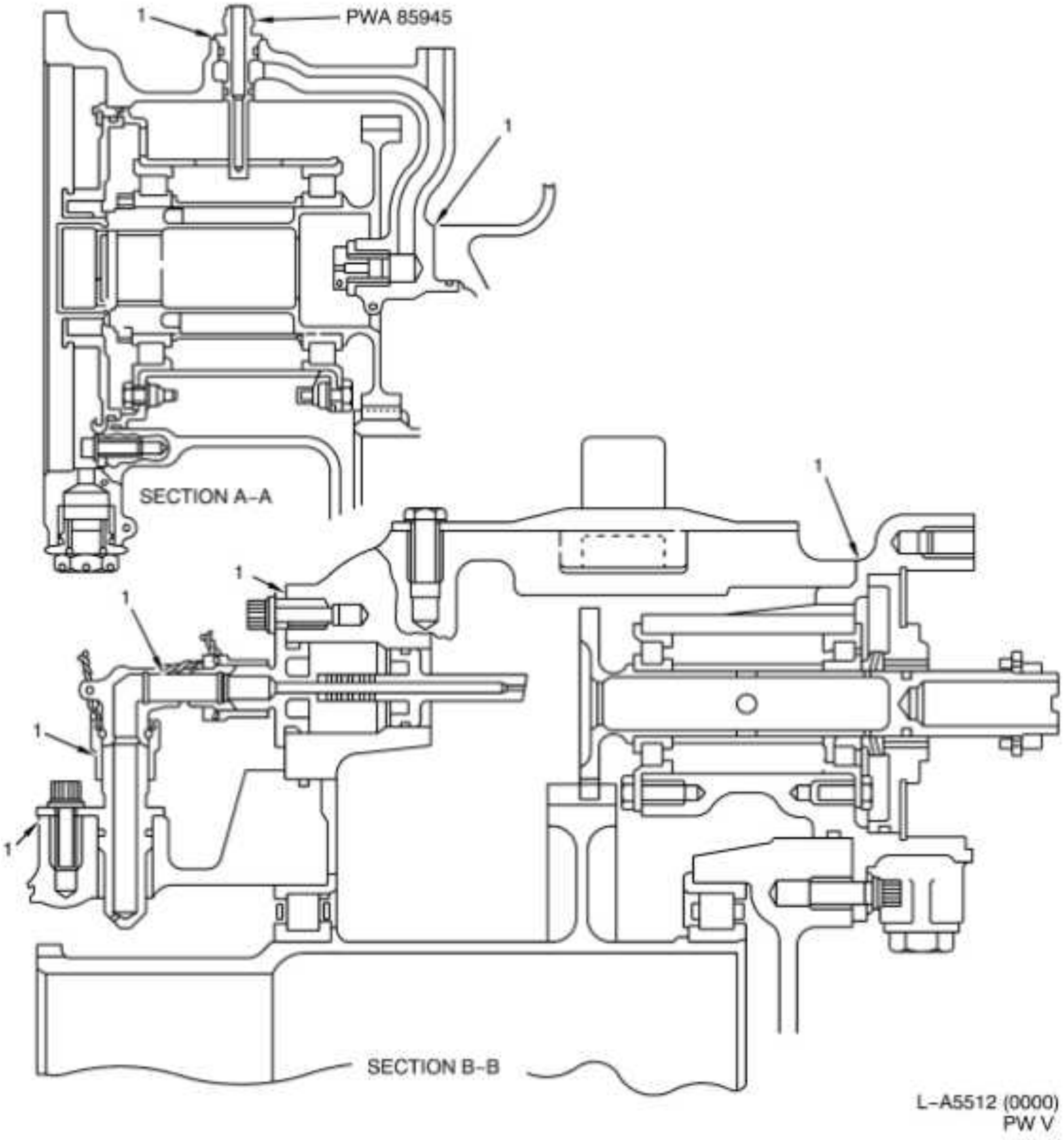
Locations Of Leak Check Tools And Inspection Areas
Figure 1301 (Sheet 1)
(Task 72−61−00−790−001)

MAIN GEARBOX − TESTING−01

1. Apply Leak Check Fluid (P05−007) At The Mating Surfaces. Examine For Bubbles.
2. PWA 85951 Plug, Optional To The Engine Plug
3. PWA 85953 Plug, Optional To The Engine Plug
4. Apply Leak Check Fluid (P05−007) At The Bushing And Nut That Attach The Gearbox Pressure Manifold Assembly. They Are Behind The Front Hydraulic Pump Drive Bearing Housing Assembly.

Key to Figure 1301 (Sheet 1)

MAIN GEARBOX − TESTING−01


1
PWA 85945
1
SECTION A-A
1
1
1
1
1
1
SECTION B-B
L-A5512 (0000)
PW V

1. Apply Leak Check Fluid (P05−007) At The Mating Surfaces. Examine For Bubbles.

Locations Of Leak Check Tools And Inspection Areas
Figure 1301 (Sheet 2)
(Task 72−61−00−790−001)

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Pratt & Whitney
PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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72-61-71			
72-61-71	1001	ALL	SEP 15/93
ASSEMBLY-01	1002		SEP 15/93

DEOILER GEARSHAFT AND BEARINGS ASSEMBLY - DISASSEMBLY-01

Task 72-61-01-040-001:

1. Disassemble Deoiler Gearshaft And Bearings Assembly

A. Equipment And Materials Necessary

Special Tools:

PWA 12126	Base
PWA 85277	Drift
PWA 85279	Drift
PWA 85373	Wrench
PWA 85378	Holder
PWA 85384	Puller, Jackscrew
PWA 86345	Plate

B. Procedure

(1) Secure the PWA 85378 Holder in a vise. Position the spur gearshaft (501/5), spur gear end down, into the holder with the dowel pins in the holder engaged in the gearteeth. Using the PWA 85373 Wrench, remove the nut (501/11) from the gearshaft. Discard the nut. See Figure 501.

(2) Remove the spacer (501/10) and the deoiler impeller lock (501/9) from the gearshaft. Remove the deoiler impeller (501/8) from the gearshaft.

(3) Remove the deoiler impeller support (501/7) from the gearshaft using PWA 85384 Puller.

(a) Remove the retaining ring securing the jaws.

(b) Retract the jackscrew as required and install the base of the puller into the gearshaft.

(c) Position the puller jaws behind the shoulder of the impeller support and secure with the retaining ring.

(d) Using a standard wrench, turn the jackscrew to separate the support from the gearshaft.

(4) Carefully separate and remove the bearing housing (501/1) from the gearshaft, and place the housing, flange side down, on a bench.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER.

(5) Remove the four bolts (501/3) securing the bearing outer race (501/2) to the bearing housing. Remove the outer race.

(6) Position the PWA 86345 Plate around and under the inner race of the bearing (501/6). Place the assembly, with gearshaft splined end down, into the PWA 12126 Base.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER.

(7) Install the PWA 85277 Drift into the gearshaft. Using an arbor press, drift off the bearing inner race from the gearshaft.

(8) Place the bearing in a suitable labeled container.

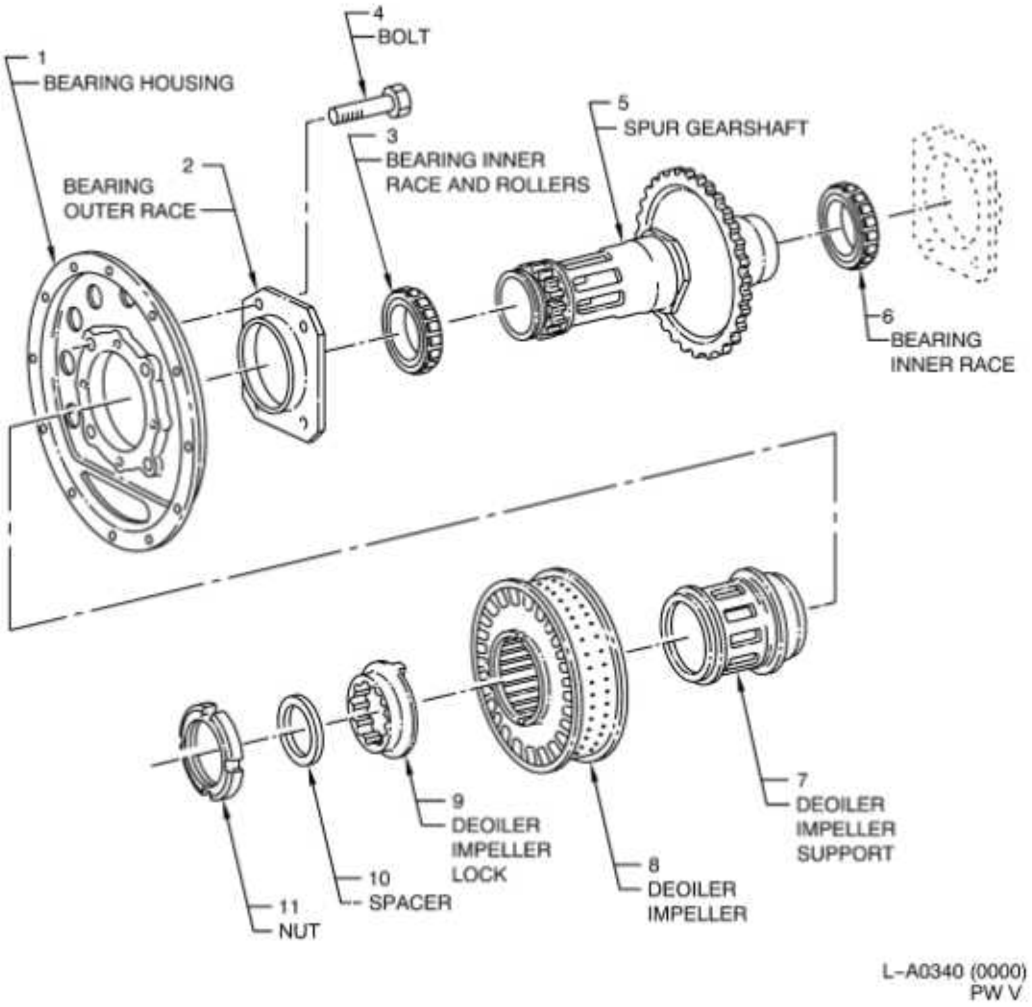
(9) Remove the gearshaft from the base and position the split halves of the PWA 86345 Plate around and under the bearing inner race (501/3). Place the assembly, with large spur gear end down, into the base (PWA 12126).

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING IS INSTALLED IN BEARING HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

(10) Install the PWA 85279 Drift into the gearshaft. Using an arbor press, drift off the bearing inner race from the gearshaft. Remove the gearshaft and plate from the base.

(11) Place the bearing in a suitable labeled container.

DEOILER GEARSHAFT AND BEARINGS ASSEMBLY - DISASSEMBLY-01


1
BEARING HOUSING
2
BEARING OUTER RACE
4
BOLT
3
BEARING INNER RACE AND ROLLERS
5
SPUR GEARSHAFT
6
BEARING INNER RACE
7
DEOILER IMPELLER SUPPORT
8
DEOILER IMPELLER
9
DEOILER IMPELLER LOCK
10
SPACER
11
NUT
L-A0340 (0000)
PW V

Deoiler Gearshaft And Bearings Assembly
Figure 501
(Task 72-61-01-040-001)

DEOILER GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01

Task 72-61-01-440-001:

1. Assemble Deoiler Gearshaft And Bearings Assembly

A. Prerequisites

(1) See Inspection/Check-04 (Task 72-61-00-990-001) for interface fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Necessary

Special Tools:
PWA 80130 Force Gage
PWA 85355 Drift
PWA 85356 Drift
PWA 85373 Wrench
PWA 85378 Holder
PWA 85856 Holder
PWA 85857 Drift

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Nut	1	72-61-00/10/130

C. Procedure

(1) Heat bearing inner race and rollers (1001/3) and (1001/6) per Standard Practices Manual, 70-00.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER.

(2) Position spur gearshaft (1001/5), splined end down, on PWA 85856 Holder. Using arbor press, PWA 85356 Drift, and PWA 80130 Force Gage, install bearing inner race and rollers (1001/6) onto smaller ID end of gearshaft. Seat bearing using 1500 lb. (680.39 Kg) load.

(3) Position gearshaft, splined end up, on PWA 85856 Holder. Using arbor press, PWA 80130 Force Gage, and PWA 85355 Drift, install bearing inner race and rollers (1001/3) onto splined end of gearshaft. Seat bearing using 1500 lb. (680.39 Kg) load.

(4) Place bearing housing (1001/1), flanged end down, on bench. Align boltholes and install bearing outer race (1001/2) into bore in bearing housing. Secure outer race using four new bolts (1001/4) or bolts which have
R the antigalling compound replaced by SPOP 139 (Task
R 70−41−03−380−034). Refer to Section 70−41−03 in the
R Standard Practices Manual, PN 585005. Torque bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(5) Position gearshaft, splined end up, on suitable support. Position bearing housing (1001/1), flange side up, over gearshaft. Lower bearing housing onto gearshaft, mating bearing outer race with bearing rollers installed on gearshaft.

(6) Place the gearshaft, splined end up, on PWA 85856 Holder.

(7) Position deoiler impeller support (1001/7), flange seat facing up, over gearshaft. Use PWA 85857 Drift and an arbor press to seat the support on the bearing inner race.

(8) Position deoiler impeller (1001/8), slotted ID end up, over gearshaft. Seat impeller in retaining flange of support (1001/7). Do a dimensional check of the assembly to be sure that the deoiler impeller is correctly installed. Do the check at three locations that are at an equal distance from each other.

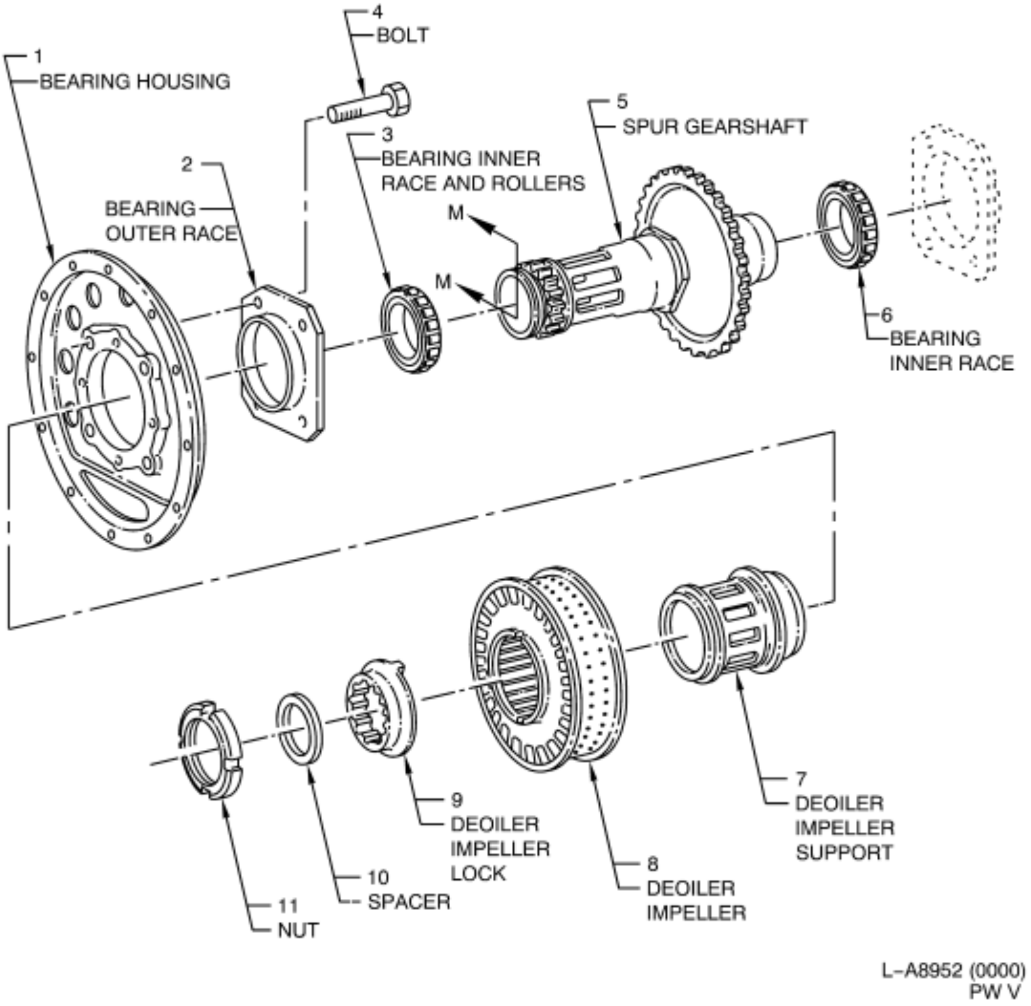
(9) Align splines and two lugs in deoiler impeller lock (1001/9) with splines on gearshaft and slots in ID of impeller (1001/8). Seat the lock on the gearshaft.

(10) Install spacer (1001/10) on gearshaft.

(11) Secure PWA 85378 Holder in vise. Position spur gearshaft (1001/5), spur gear end down, into holder with dowel pin details of holder engaged in gearteeth. Install a new nut (1001/11). Using PWA 85373 Wrench, torque nut to 1175 − 1250 lb−in. (133 − 141 N.m).

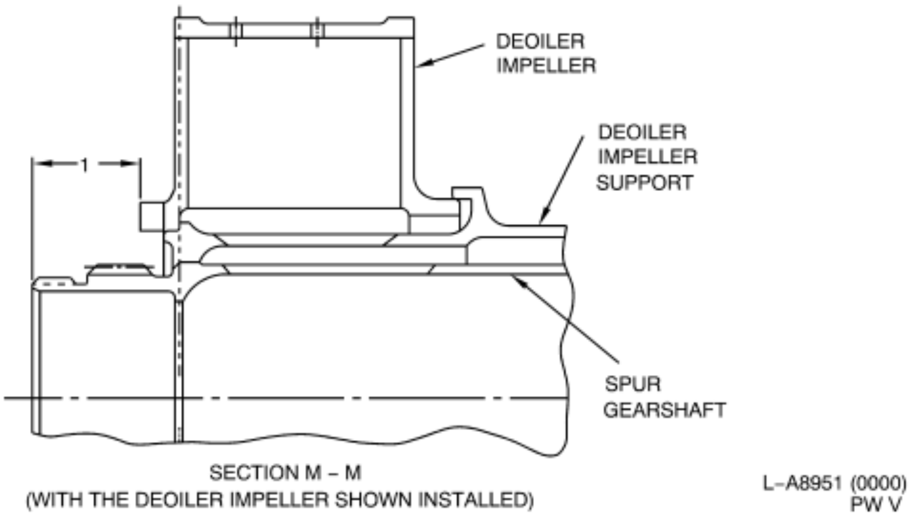
(12) Remove wrench and deoiler gearshaft assembly from holder.

DEOILER GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01


4
BOLT
1
BEARING HOUSING
5
SPUR GEARSHAFT
3
BEARING INNER
RACE AND ROLLERS
2
BEARING
OUTER RACE
M
M
6
BEARING
INNER RACE
9
DEOILER
IMPELLER
LOCK
7
DEOILER
IMPELLER
SUPPORT
10
SPACER
8
DEOILER
IMPELLER
11
NUT
L−A8952 (0000)
PW V

Deoiler Gearshaft And Bearings Assembly
Figure 1001 (Sheet 1)
(Task 72−61−01−440−001)

DEOILER GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01


1
DEOILER IMPELLER
DEOILER IMPELLER SUPPORT
SPUR GEARSHAFT
SECTION M – M
(WITH THE DEOILER IMPELLER SHOWN INSTALLED)
L–A8951 (0000)
PW V

1. Measurements Must Be Within 0.010 Inch (0.254 mm) Total

Deoiler Gearshaft And Bearings Assembly (Dimensional Check)
Figure 1001 (Sheet 2)
(Task 72−61−01−440−001)

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TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 85 DATED JANUARY 1, 2008

HIGHLIGHTS - MAIN GEARBOX

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-61-00 ASSEMBLY-01	1023 -1025	Added steps to lubricate the idler gear bearing inner diameter. (CACTUSC3337-G29581) Relocated material. (Editorial)	ALL

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GEARBOX DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − DISASSEMBLY−01

Task 72−61−02−040−001:

1. Disassemble Gearbox Drive Gearshaft And Bearings Assembly

A. Equipment And Materials Necessary

Specials Tools:

PWA 12126	Base
PWA 85278	Drift
PWA 86345	Plate
PWA 88245	Drift

B. Procedure

(1) Install the split halves of the PWA 86345 Plate around and under the bearing inner race and rollers (501/3). Place the assembly, with smaller spur gear end down, into the PWA 12126 Base. See Figure 501.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING IS INSTALLED IN GEARBOX HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN CONTAINER FOLLOWING REMOVAL.

(2) Install the PWA 88245 Drift into the gearshaft. Using an arbor press, drift off the bearing inner race from the gearshaft.

(3) Remove the gearshaft and install the split halves of the PWA 86345 Plate around and under the bearing inner race and rollers (501/1). Place the assembly, with large spur gear end down, into the base.

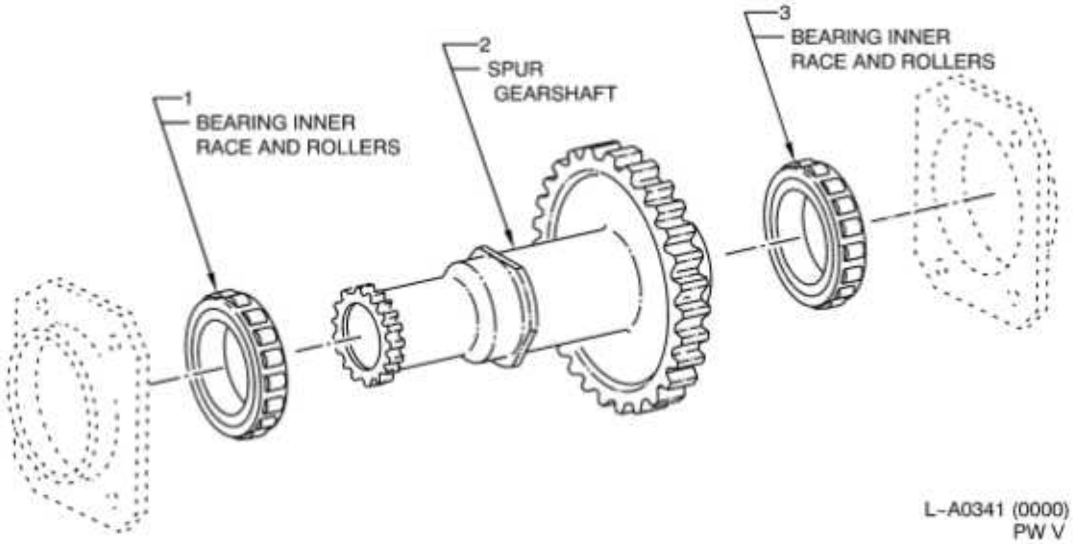
CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING IS INSTALLED IN GEARBOX DRIVESHAFT HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN CONTAINER FOLLOWING REMOVAL.

(4) Install the PWA 85278 Drift into the gearshaft. Using an arbor press, drift off the bearing inner race and rollers from the gearshaft.

(5) Remove the gearshaft from the base.

(6) Place the gearshaft and bearings in a suitable, labeled container.

GEARBOX DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - DISASSEMBLY-01


1
BEARING INNER RACE AND ROLLERS
2
SPUR GEARSHAFT
3
BEARING INNER RACE AND ROLLERS
L-A0341 (0000)
PW V

Gearbox (Drive) Spur Gearshaft Assembly
Figure 501
(Task 72-61-02-040-001)

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GEARBOX DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01

Task 72-61-02-440-001:

1. Assemble Gearbox Drive Gearshaft And Bearings Assembly

A. Prerequisites

(1) See Inspection/Check-04 (Task 72-61-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:
PWA 80130 Force Gage
PWA 85350 Drift
PWA 85856 Holder
PWA 86164 Drift

C. Procedure

(1) Heat bearing inner races and rollers (1001/1 and 1001/3) per Standard Practices Manual, 70-00. See Figure 1001.

(2) Place gearbox spur gearshaft (1001/2), small spur gear end down, on PWA 85856 Holder.

CAUTION: KEEP ALL DETAILS OF THE PARTICULAR BEARING TOGETHER.

(3) Remove bearing inner race and rollers (1001/3) from heat source and install bearing onto gearshaft. Using PWA 86164 Drift and PWA 80130 Force Gage, apply load of 1500 lb. (680.39 Kg) to seat bearing on gearshaft.

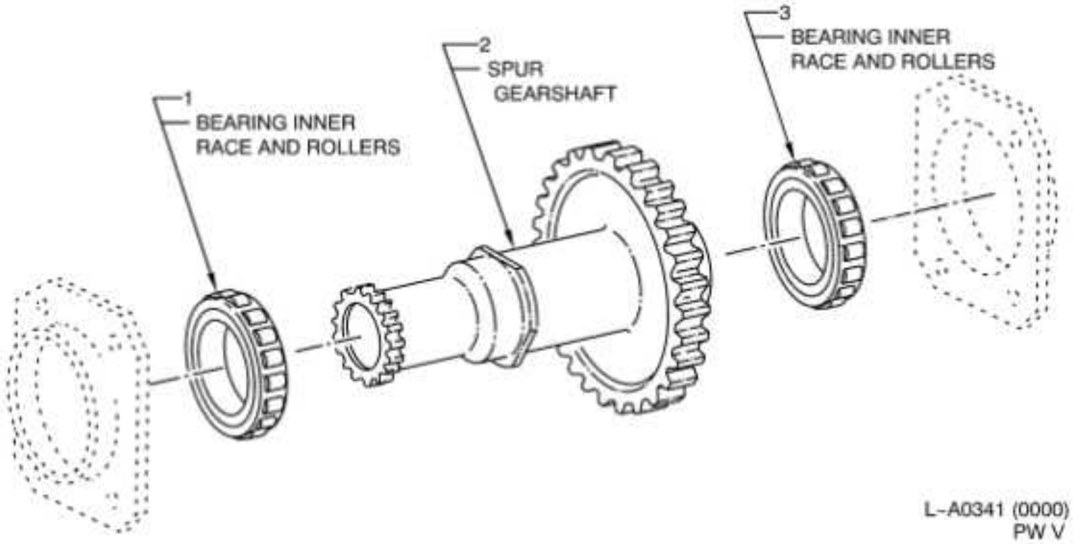
(4) Remove gearshaft and place it, large spur gear end down, on (PWA 85856) Holder.

CAUTION: KEEP ALL DETAILS OF THE PARTICULAR BEARING TOGETHER.

(5) Remove bearing inner race and rollers (1001/1) from heat source. Install bearing onto gearshaft. Using PWA 85350 Drift, and (PWA 80130) Force Gage, apply load of 1500 lb. (680.39 Kg) to seat bearing on gearshaft.

(6) Place the gearshaft and bearings assembly in a correct container with a label.

GEARBOX DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01


1
BEARING INNER RACE AND ROLLERS
2
SPUR GEARSHAFT
3
BEARING INNER RACE AND ROLLERS
L-A0341 (0000)
PW V

Gearbox Drive Gearshaft And Bearings Assembly
Figure 1001
(Task 72-61-02-440-001)

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CHAPTER 72

MAIN GEARBOX

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STARTER DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - DISASSEMBLY-01

Task 72-61-03-040-001:

1. Disassemble Starter Drive Gearshaft And Bearings Assembly

A. Equipment And Materials Necessary

Special Tools:

PWA 12126	Base
PWA 26377	Holder
PWA 85279	Drift
PWA 85502	Puller
PWA 86345	Plate
PWA 102419	Drift

B. Procedure
See Figure 501.

(1) Install the starter drive gearshaft and bearings assembly, smaller spline gear down, onto a suitable support.

(2) Insert the spline drive of the PWA 26377 Holder into the internal splines of the coupling (501/4). Insert a standard wrench into the adapter detail of the holder to prevent rotation. Remove the nut (501/2) securing the coupling to the gearshaft. Remove the washer (501/3) or (501/3A) and coupling. If necessary remove the coupling using the PWA 85502 Puller. Insert the pin detail of the puller into the puller hole in the rear ID of the coupling and remove the coupling from the gearshaft.

(3) Position the split halves of the PWA 86345 Plate around and under the bearing inner race and rollers (501/6) at the smaller spur gear end of the gearshaft. Place the assembly, with larger spur gear end down, into the PWA 12126 Base.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING IS INSTALLED IN HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

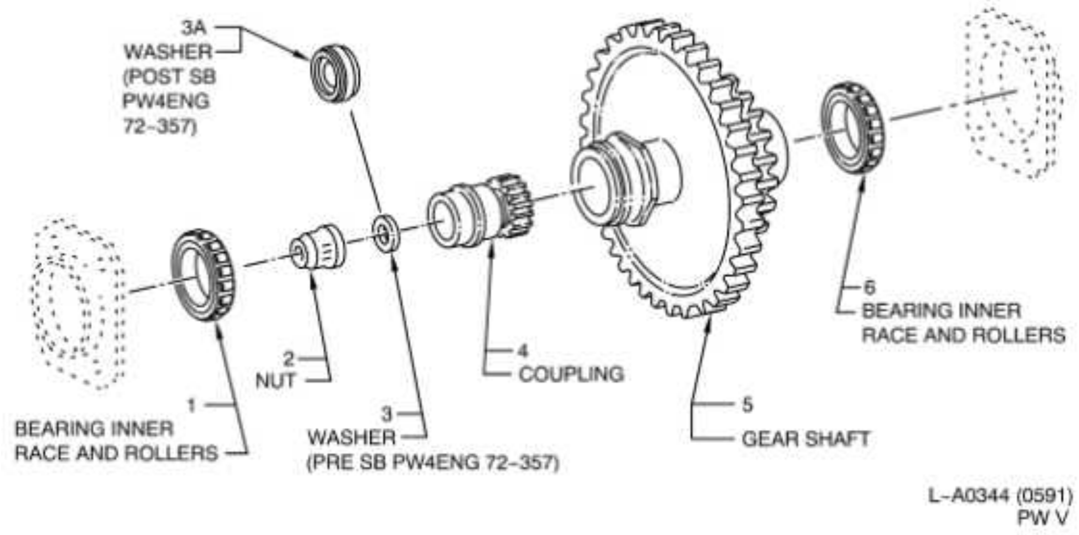
(4) Using the PWA 85279 Drift and an arbor press, separate the gearshaft from the bearing. Place the bearing race and rollers in a container. Remove the gearshaft from the base.

(5) Position the split halves of the PWA 86345 Plate around and under the remaining bearing inner race and rollers (501/1) at the larger spur gear end of the gearshaft. Install the gearshaft and plate in the PWA 12126 Base.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING IS INSTALLED IN GEARBOX BEARING HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

(6) Using the PWA 102419 Drift and an arbor press, separate the gearshaft from the bearing. Place the bearing inner race and rollers in a container. Remove the gearshaft from the base.

STARTER DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − DISASSEMBLY−01


3A
WASHER
(POST SB
PW4ENG
72-357)
6
BEARING INNER
RACE AND ROLLERS
2
NUT
4
COUPLING
1
BEARING INNER
RACE AND ROLLERS
3
WASHER
(PRE SB PW4ENG 72-357)
5
GEAR SHAFT
L-A0344 (0591)
PW V

Starter Drive Gearshaft And Bearings Assembly
Figure 501
(Task 72−61−03−040−001)

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STARTER DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01

Task 72-61-03-440-001:

1. Assemble Starter Drive Gearshaft And Bearings Assembly

A. Prerequisites

(1) See Inspection/Check-04 Task 72-61-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Material Required

Special Tools:

PWA 26377	Holder
PWA 80130	Force Gage
PWA 85357	Drift
PWA 85358	Drift
PWA 85856	Holder

Consumable Material:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P06-059	Lubricant, Fluorinated Grease (PWA 36230)

C. Procedure
See Figure 1001.

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER GEARSHAFT. INTERCHANGEABILITY IS AFFECTED. REFER TO (SB PW4ENG 72-357).

CAUTION: BEFORE YOU APPLY FLUORINATED GREASE LUBRICANT TO THE STARTER DRIVE COUPLING, MAKE SURE THE STARTER DRIVE COUPLING SPLINES AND STARTER DRIVE GEARSHAFT SPLINES ARE CLEAN AND NOT DAMAGED. APPLY FLUORINATED GREASE LUBRICANT TO THE STARTER DRIVE COUPLING SPLINES TO REDUCE WEAR AND INCREASE SERVICE LIFE OF THE PARTS.

STARTER DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01

(1) Install gearshaft (1001/5), smaller spur gear end down, on suitable support. Lubricate the ID and OD splines of the coupling with Fluorinated Grease Lubricant P06−059. Align the splines and install the coupling (1001/4), splined end down, into the gearshaft. Secure the coupling with the washer (1001/3) or (1001/3A) and the nut (1001/2) lubricated with Engine Oil P03−001.

(2) Insert splined drive of PWA 26377 Holder into internal splines of coupling. Insert standard wrench into adapter detail of holder to prevent rotation. Torque nut to 290 − 325 lb−in. (32.766 − 36.720 N.m). Remove holder.

(3) Heat bearing inner races and rollers (1001/1) and (1001/6) by 70−00, Standard Practices Manual, PN 585005.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING WILL BE INSTALLED IN GEARBOX HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER.

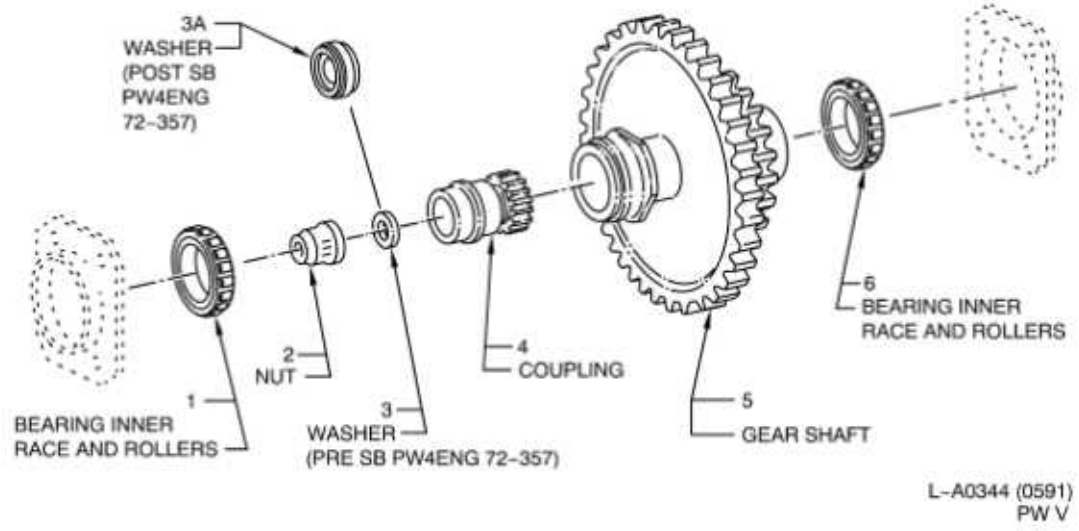
(4) Place gearshaft on PWA 85856 Holder, smaller spur gear end down. Remove bearing inner race and rollers (1001/1) from heat source and position it over bearing journal of gearshaft. Using PWA 85358 Drift and PWA 80130 Force Gage, apply load of 1500 lb. (680.39 kg) to seat bearing on gearshaft.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING WILL BE INSTALLED IN GEARBOX BEARING HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER.

(5) Remove and invert the gearshaft on the holder. Remove bearing inner race and rollers (1001/6) from heat source and position it over bearing journal of gearshaft. Using PWA 85357 Drift and PWA 80130 Force Gage, apply load of 1500 lb. (680.39 kg) to seat bearing on gearshaft.

(6) Place gearshaft and bearing assembly in a correct container with a label.

STARTER DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01


3A
WASHER
(POST SB
PW4ENG
72-357)
1
BEARING INNER
RACE AND ROLLERS
2
NUT
3
WASHER
(PRE SB PW4ENG 72-357)
4
COUPLING
5
GEAR SHAFT
6
BEARING INNER
RACE AND ROLLERS
L-A0344 (0591)
PW V

Starter Drive Gearshaft And Bearings Assembly
Figure 1001
(Task 72-61-03-440-001)

FUEL PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - DISASSEMBLY-01

Task 72-61-04-040-001:

1. Disassemble Fuel Pump Drive Gearshaft And Bearings Assembly

A. Equipment And Materials Necessary

Special Tools:

PWA 12126	Base
PWA 85282	Drift
PWA 85283	Drift
PWA 85444	Plate
PWA 86345	Plate

B. Procedure
See Figure 501.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING IS INSTALLED IN GEARBOX HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

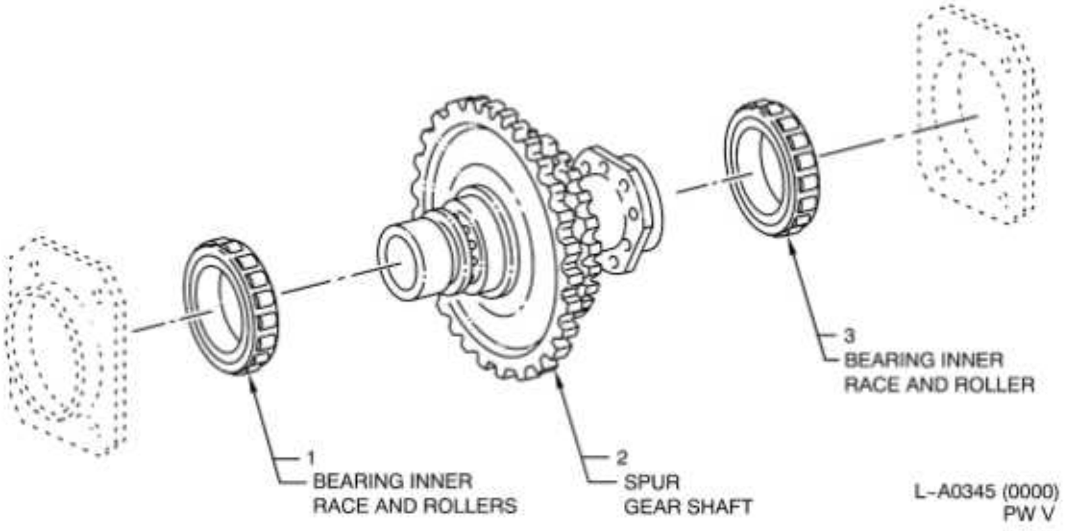
(1) Position the split halves of the PWA 86345 Plate under the bearing inner race and rollers (501/3). Position the spur gearshaft (501/2), larger spur gear end down, into the PWA 12126 Base. Using the PWA 85283 Drift and an arbor press, separate the gearshaft from the bearing. Remove the gearshaft from the base. Place the bearing in a suitable, labeled container.

CAUTION: ALL DETAILS OF PARTICULAR MUST BEARING BE KEPT TOGETHER. OUTER RACE OF THIS BEARING IS INSTALLED IN GEARBOX BEARING HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

(2) Position detail jaws of the PWA 85444 Plate under the bearing inner race (501/1). Tighten th ecap screws to secure the jaws. Positon the assembly, with smaller spur gear end down, into the PWA 12126 Base. Install the PWA 85282 Drift into the gearshaft. Using an arbor press, separate the gearshaft from the bearing.

(3) Place the gearshaft and bearings in a suitable, labeled container.

FUEL PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - DISASSEMBLY-01


3
BEARING INNER
RACE AND ROLLER
1
BEARING INNER
RACE AND ROLLERS
2
SPUR
GEAR SHAFT
L-A0345 (0000)
PW V

Fuel Pump Drive Gearshaft And Bearings Assembly
Figure 501
(Task 72-61-04-040-001)

FUEL PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01

Task 72-61-04-440-001:

1. Assemble Fuel Pump Drive Gearshaft And Bearings Assembly

A. Prerequisites

(1) See Inspection/Check-04 (Task 72-61-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:
PWA 80130 Force Gage
PWA 85269 Drift
PWA 85352 Drift
PWA 85856 Holder

C. Procedure

See Figure 1001.

(1) Heat bearing inner races and rollers (1001/1) and (1001/3) per Standard Practices Manual, 70-00.

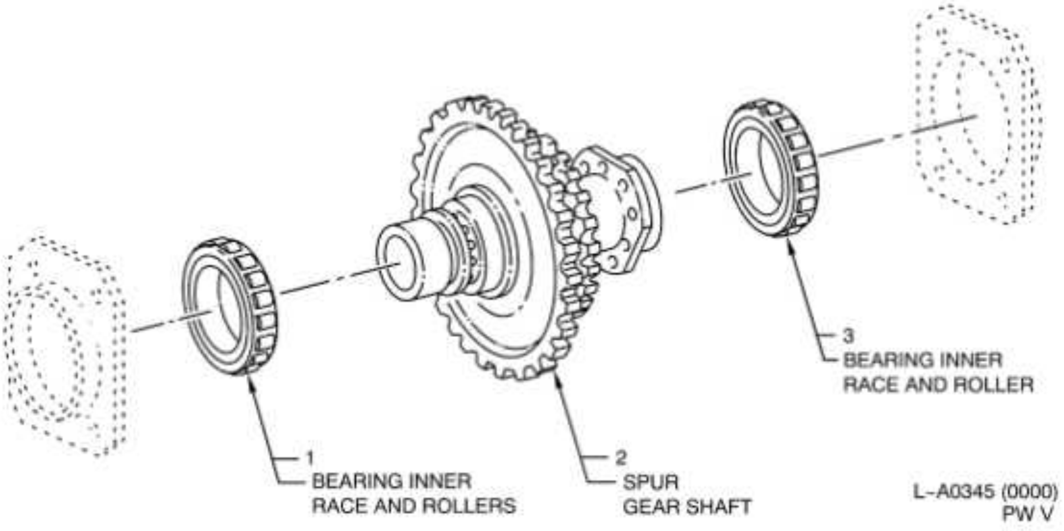
CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING WILL BE INSTALLED IN GEARBOX BEARING HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER.

(2) Place gearshaft (1001/2), smaller spur gear end down, on PWA 85856 Holder. Remove bearing inner race and rollers (1001/1) from heat source and position it over bearing journal of gearshaft. Using PWA 85352 Drift and PWA 80130 Force Gage, apply load of 1500 lb. (680.39 Kg) to seat bearing on gearshaft.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING WILL BE INSTALLED IN GEARBOX HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER.

(3) Remove and invert gearshaft on the holder. Remove bearing inner race and rollers (1001/3) from heat source and position it over bearing journal of gearshaft. Using PWA 85269 Drift and PWA 80130 Force Gage, apply

FUEL PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01


3
BEARING INNER
RACE AND ROLLER
1
BEARING INNER
RACE AND ROLLERS
2
SPUR
GEAR SHAFT
L-A0345 (0000)
PW V

Fuel Pump Drive Gearshaft and Bearings Assembly
Figure 1001
(Task 72−61−04−440−001)

load of 1500 lb. (680.39 kg) to seat bearing on gearshaft.

(4) Place gearshaft and bearings assembly in a correct container with a label.

Previous Pageblock Return to Previous Menu Next Pageblock

REAR HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - DISASSEMBLY-01

Task 72-61-05-040-001:

1. Disassemble Rear Hydraulic Pump Drive Gearshaft And Bearings Assembly

A. Equipment And Materials Necessary

Special Tools:

PWA 12126	Base
PWA 85282	Drift
PWA 85283	Drift
PWA 86345	Plate

B. Procedure
See Figure 501.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING IS INSTALLED IN GEARBOX HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

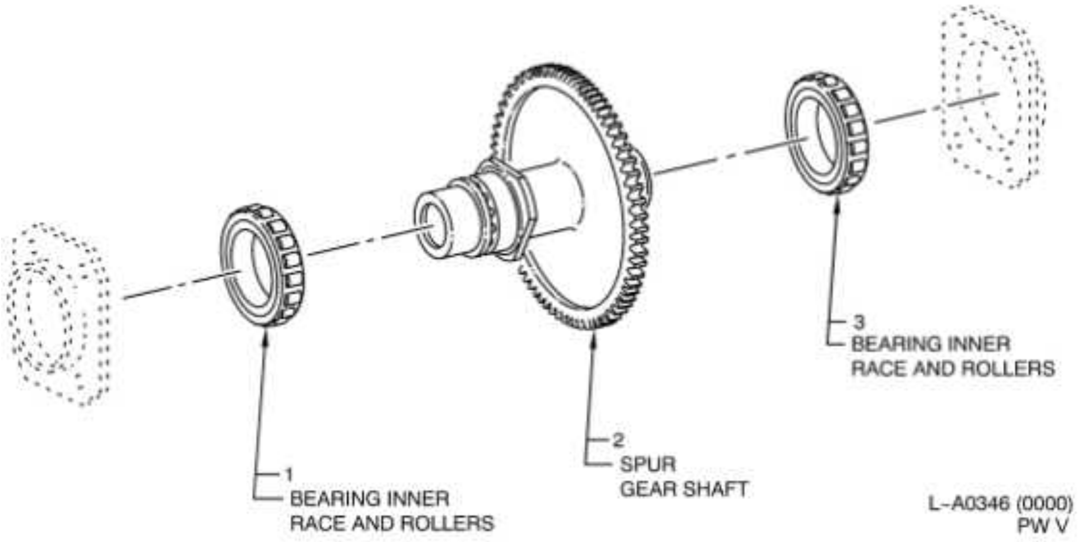
(1) Position the split halves of the PWA 86345 Plate under the bearing inner race and rollers (501/3). Position the spur gearshaft (501/2), smaller OD end down, into the PWA 12126 Base. Using the PWA 85283 Drift and an arbor press, separate the gearshaft from the bearing.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING IS INSTALLED IN GEARBOX BEARING HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN CONTAINER FOLLOWING REMOVAL.

(2) Reverse the gearshaft in the base positioning the halves of the plate under the bearing inner race and rollers (501/1). Using the PWA 85282 Drift and an arbor press, separate the gearshaft from the bearing.

(3) Place the gearshaft and bearings in a suitable, labeled container.

REAR HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - DISASSEMBLY-01


1
BEARING INNER
RACE AND ROLLERS
2
SPUR
GEAR SHAFT
3
BEARING INNER
RACE AND ROLLERS
L-A0346 (0000)
PW V

Rear Hydraulic Pump Drive Gearshaft And Bearings Assembly
Figure 501
(Task 72-61-05-040-001)

REAR HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01

Task 72-61-05-440-001:

1. Assemble Rear Hydraulic Pump Drive Gearshaft And Bearings Assembly

A. Prerequisites

(1) See Inspection/Check-04 (Task 72-61-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:
PWA 80130 Force Gage
PWA 85269 Drift
PWA 85345 Drift
PWA 85856 Holder

C. Procedure

See Figure 1001.

(1) Heat bearing inner races and rollers (1001/1) and (1001/3) per Standard Practices Manual, 70-00.

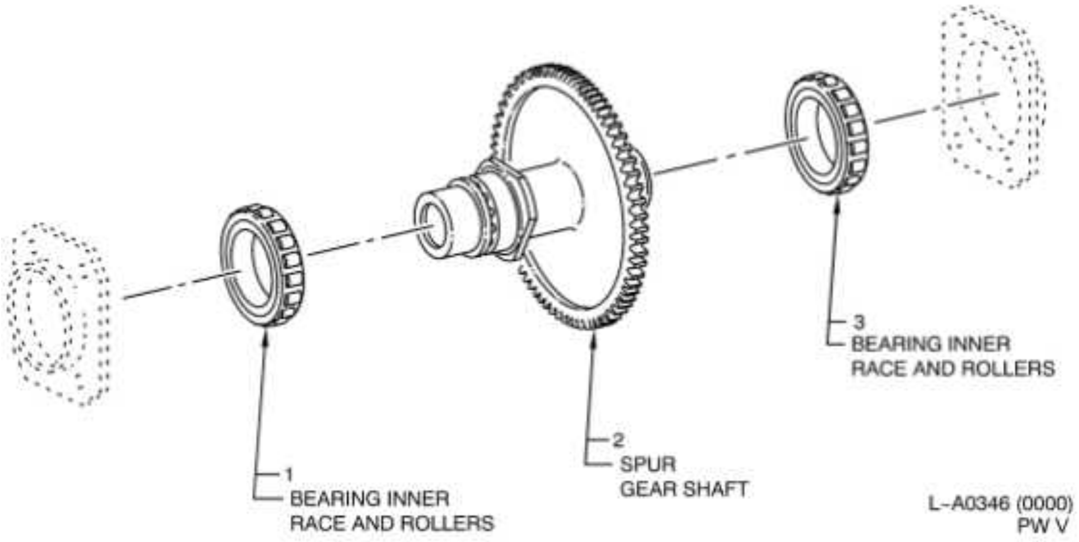
CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING WILL BE INSTALLED IN GEARBOX HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER.

(2) Place gearshaft (1001/2), smaller ID end down, on PWA 85856 Holder. Remove bearing inner race and rollers (1001/3) from heat source and position it over bearing journal of gearshaft. Using PWA 85269 Drift and PWA 80130 Force Gage, apply load of 1500 lb. (680.39 kg) to seat bearing on gearshaft.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING WILL BE INSTALLED IN GEARBOX BEARING HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER.

(3) Turn gearshaft and place on (PWA 85856) Holder. Remove bearing inner race and rollers (1001/1) from heat source and position it over bearing journal of gearshaft.

REAR HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01


1
BEARING INNER RACE AND ROLLERS
2
SPUR GEAR SHAFT
3
BEARING INNER RACE AND ROLLERS
L-A0346 (0000)
PW V

Rear Hydraulic Pump Drive Gearshaft And Bearings Assembly
Figure 1001
(Task 72-61-05-440-001)

Using PWA 85345 Drift and PWA 85130 Force Gage, apply load of 1500 lb. (680.39 kg) to seat bearing on gearshaft.

(4) Place gearshaft and bearing assembly in a correct container with a label.

IDG DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - DISASSEMBLY-01

Task 72-61-06-040-001:

1. Disassemble IDG Drive Gearshaft And Bearings Assembly
   A. Equipment And Materials Required

      Special Tools:
      PWA 12126 Base
      PWA 85275 Drift, (Rear Bearing) Disassembly (Optional to PWA 85663 Drift)
      PWA 85276 Plate
      PWA 85277 Drift, (Front Bearing) Disassembly
      PWA 85663 Drift, (Rear Bearing) Disassembly

   B. Procedure
      See Figure 501.
      (1) Place PWA 12126 Base on workbench.
      (2) Position split halves of PWA 85276 Plate around and under bearing inner race and rollers (501/1). Position gearshaft, splined end down, into Base (PWA 12126), seating Plate (PWA 85276) in recess of base.
      (3) Using PWA 85275 or PWA 85663 Drift and arbor press, separate gearshaft from bearing. Remove drift.

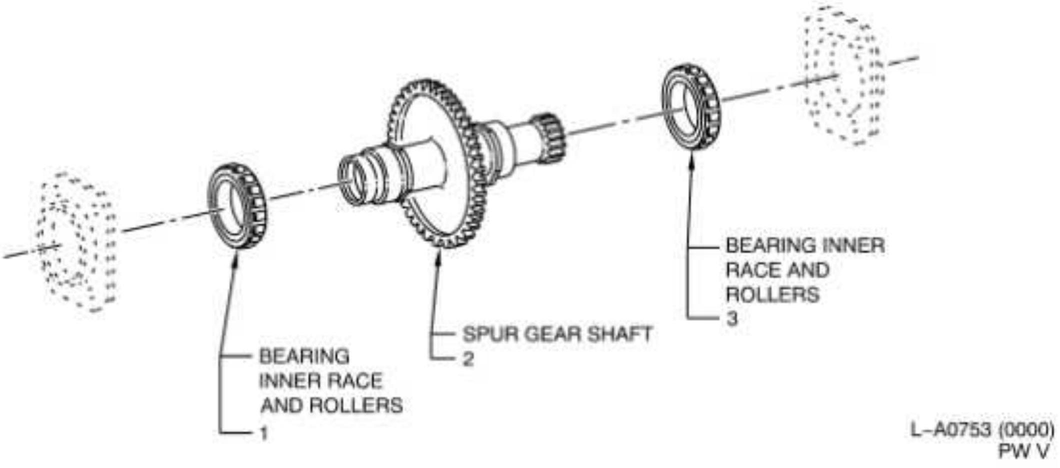
      CAUTION: ALL DETAILS OF BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING IS INSTALLED IN GEARBOX BEARING HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN CONTAINER FOLLOWING REMOVAL.

      (4) Place bearing in suitable labeled container.

      CAUTION: ALL DETAILS OF BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING IS INSTALLED IN GEARBOX HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN CONTAINER FOLLOWING REMOVAL.

      (5) Reverse gearshaft in base, positioning halves of Plate (PWA 85276) around and under inner race and rollers (501/3). Using PWA 85277 Drift and arbor press, separate gearshaft from bearing.

IDG DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - DISASSEMBLY-01


BEARING INNER RACE AND ROLLERS
1
SPUR GEAR SHAFT
2
BEARING INNER RACE AND ROLLERS
3
L-A0753 (0000)
PW V

IDG Drive Gearshaft And Bearings Assembly
Figure 501
(Task 72-61-06-040-001)

IDG DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01

Task 72-61-06-440-001:

1. Assemble IDG Drive Gearshaft And Bearings Assembly

A. Prerequisites

(1) See Inspection/Check-04 (Task 72-61-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:
PWA 80130 Force Gage
PWA 85353 Drift, (Front Bearing) Assembly
PWA 85354 Drift, (Rear Bearing) Assembly
PWA 85856 Holder
PWA 85664 Drift, (Rear Bearing) Assembly

C. Procedure

See Figure 1001.

(1) Heat bearing inner races and rollers (1001/1) and (1001/3) per Standard Practices Manual, 70-00.

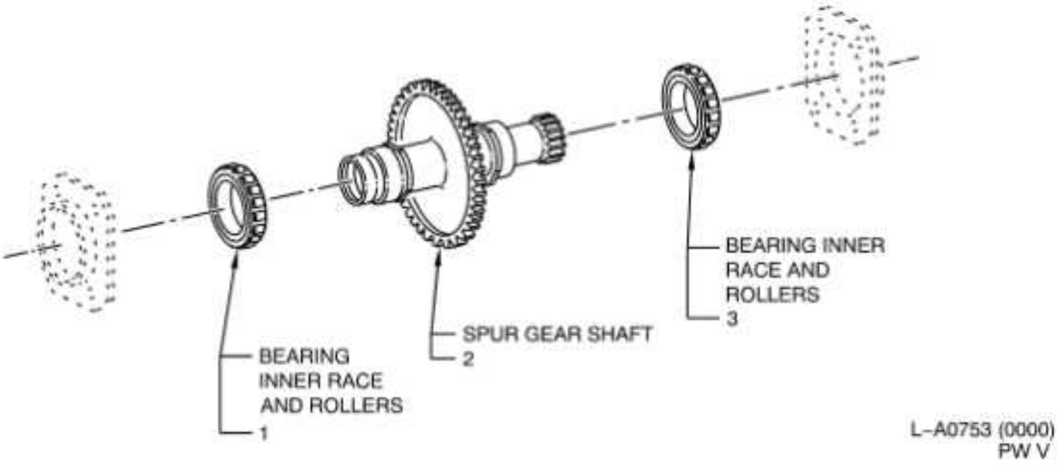
CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING WILL BE INSTALLED IN GEARBOX BEARING HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER.

(2) Place gearshaft (1001/2), spur gear end down, on PWA 85856 Holder. Remove bearing inner race and rollers (1001/1) from heat source and position it over bearing journal of gearshaft. Using PWA 85354 or PWA 85664 Drift and PWA 81030 Force Gage, apply load of 1500 lb. (680.39 kg) to seat bearing on gearshaft.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING WILL BE INSTALLED IN GEARBOX HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER.

(3) Turn the gearshaft. Place it on the holder. Remove bearing inner race and rollers (1001/3) from heat source and position it over bearing journal of gearshaft. Using PWA 85353 Drift and PWA 80130 Force Gage, apply

IDG DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01


BEARING INNER RACE AND ROLLERS
1
SPUR GEAR SHAFT
2
BEARING INNER RACE AND ROLLERS
3
L-A0753 (0000)
PW V

IDG Drive Gearshaft And Bearings Assembly
Figure 1001
(Task 72-61-06-440-001)

load of 1500 lb. (680.39 kg) to seat bearing on gearshaft.

(4) Place gearshaft and bearings assembly in a correct container with a label.

FRONT HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - DISASSEMBLY-01

Task 72-61-07-040-001:

1. Disassemble Front Hydraulic Pump Drive Gearshaft And Bearing Assembly

A. Equipment And Materials Required

Special Tools:
PWA 12126 Base
PWA 85204 Puller (Optional to PWA 88110)
PWA 85282 Drift
PWA 85374 Wrench
PWA 85379 Holder
PWA 86345 Plate, Disassembly
PWA 88110 Puller

B. Procedure

See Figures 501 and 502.

(1) Remove retaining ring (501/13) securing face (oil) seal (501/12) to bearing support (501/10). Using either PWA 88110 or PWA 85204 Puller, remove seal from support. Discard packing (501/11).

(2) Remove lockwire, oil metering plug (501/1) and insert (501/13) from boss in inside rear wall of bearing housing. Discard packings (501/12) and (501/14).

(3) Remove lockwire, plug (501/9), and bushing (501/7) from port in bottom of bearing housing. Discard packings (501/8) and (501/6).

(4) Secure PWA 85379 Holder in vise. Place gearshaft/bearing support assembly, spur gear end down, into PWA 85379 Holder, with dowel pins in holder engaged in gear teeth. Using PWA 85374 Wrench, remove nut (502/12) from gearshaft. Discard the nut (502/12).

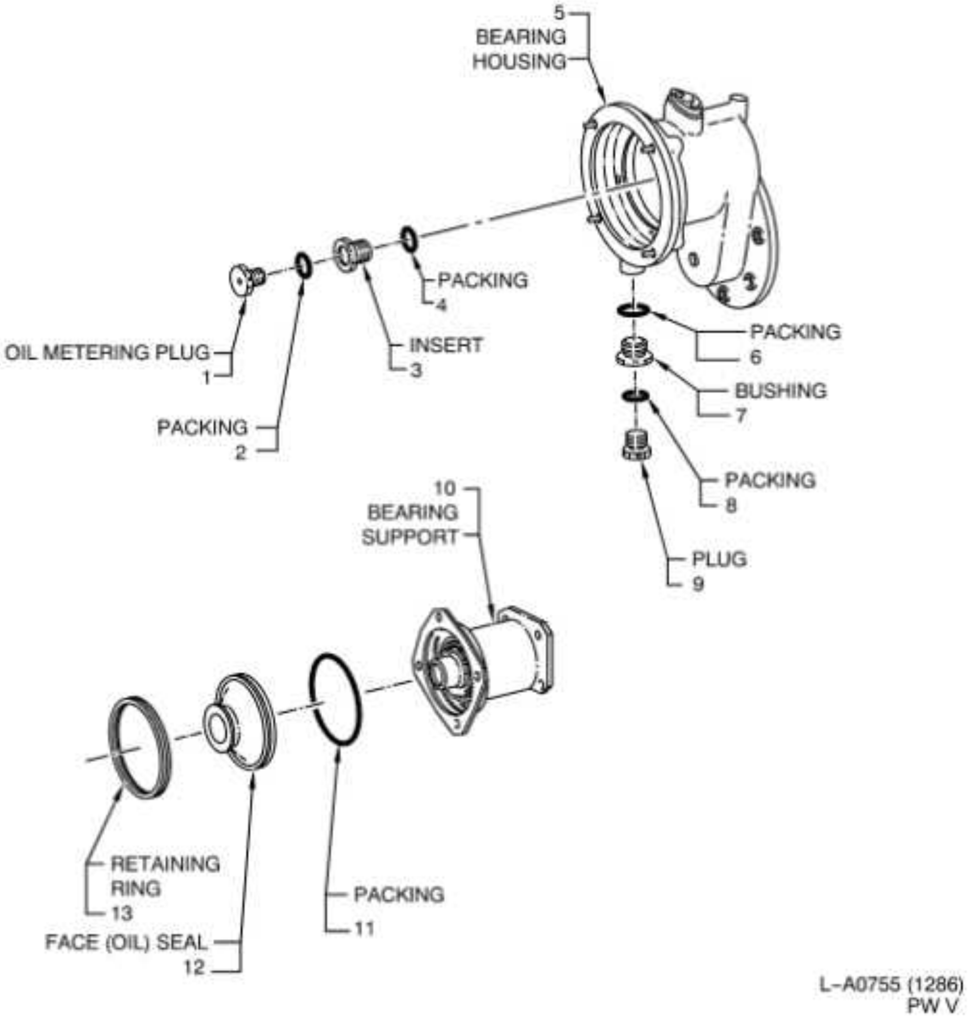
CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING IS INSTALLED IN BEARING SUPPORT. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

(5) Place split halves of PWA 86345 Plate under bearing outer race (502/7). Position gearshaft and bearings assembly, gear end down, into PWA 12126 Base. Using PWA 85282 Drift and arbor press, push gearshaft out of bearing. Remove bearing inner race and rollers (502/11).

(6) Remove four bolts (502/1) and nuts (502/3) securing bearing outer race (502/10) to bearing support. Remove bearing outer race.

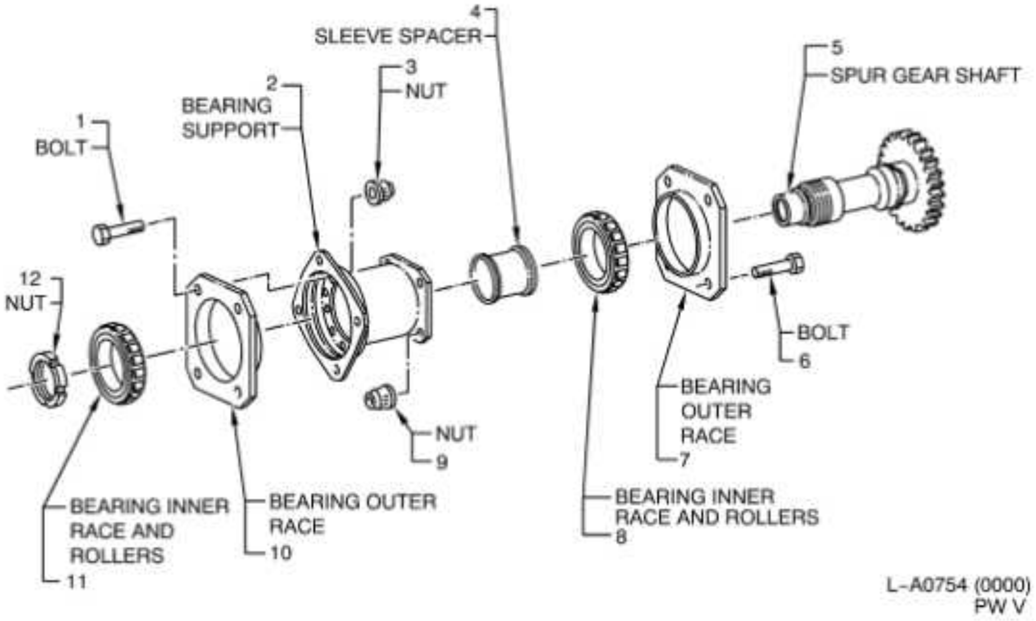
(7) Place bearing in suitable, labeled container.

FRONT HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - DISASSEMBLY-01


5
BEARING
HOUSING
PACKING
4
OIL METERING PLUG
1
INSERT
3
PACKING
2
PACKING
6
BUSHING
7
PACKING
8
PLUG
9
10
BEARING
SUPPORT
RETAINING
RING
13
FACE (OIL) SEAL
12
PACKING
11
L-A0755 (1286)
PW V

Front Hydraulic Pump Drive Gearshaft And Bearings Assembly
Figure 501
(Task 72-61-07-040-001)

FRONT HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - DISASSEMBLY-01


4
SLEEVE SPACER
5
SPUR GEAR SHAFT
2
BEARING SUPPORT
3
NUT
1
BOLT
12
NUT
BOLT
6
BEARING OUTER RACE
7
NUT
9
BEARING INNER RACE AND ROLLERS
8
BEARING INNER RACE AND ROLLERS
11
BEARING OUTER RACE
10
L-A0754 (0000)
PW V

Front Hydraulic Pump Drive Gearshaft And Bearings Assembly
Figure 502
(Task 72-61-07-040-001)

FRONT HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − DISASSEMBLY−01

(8) Remove front hydraulic pump drive bearing sleeve spacer (502/4).

(9) Carefully separate and remove bearing support (502/2) from spur gearshaft (502/5) ensuring that gearshaft will not suddenly drop out of bearing outer race.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING IS INSTALLED IN BEARING SUPPORT. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

(10) Move bearing inner race and rollers (502/8) to outer bearing journal on gearshaft. Reposition split halves of PWA 86345 Plate under bearing inner race and rollers. Position gearshaft, spur gear end down, into (PWA 12126) Base. Using (PWA 85282) Drift and arbor press, push gearshaft out of bearing. Remove bearing and gearshaft from base.

(11) Remove four bolts (502/6) and nuts (502/9) securing bearing outer race (502/7) to bearing support (502/2). Remove outer race.

(12) Place bearings in suitable, labeled container.

FRONT HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01

Task 72-61-07-440-001:

1. Assemble Front Hydraulic Pump Drive Gearshaft And Bearings Assembly

A. Prerequisites

(1) See Inspection/Check-04 (Task 72-61-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:
PWA 80130 Force Gage
PWA 85345 Drift
PWA 85374 Wrench
PWA 85379 Holder
PWA 85856 Holder
PWA 86017 Spacer

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

		PARTS CATALOG REFERENCE		
PART NAME	QUANTITY	SECTION	FIGURE	ITEM
Packing	1	72-61-00	14	60
Packing	1	72-61-00	14	80
Packing	1	72-61-00	14	100
Packing	1	72-61-00	14	120
Nut	1	72-61-00	14	220
Packing	1	72-61-00	14	230

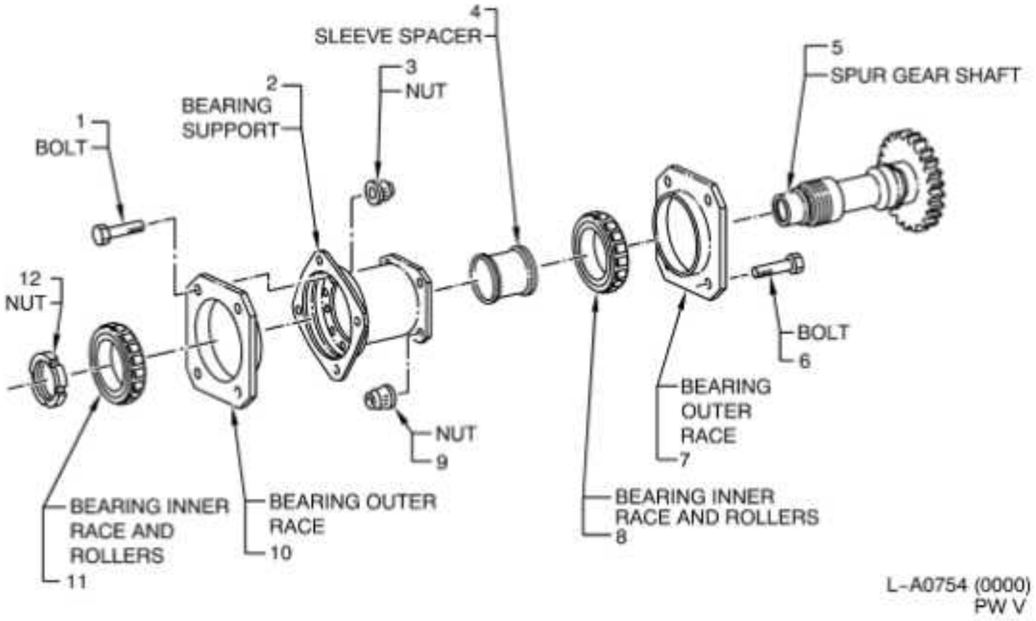
Lockwire, AS3214-02

C. Procedure

See Figures 1001 and 1002.

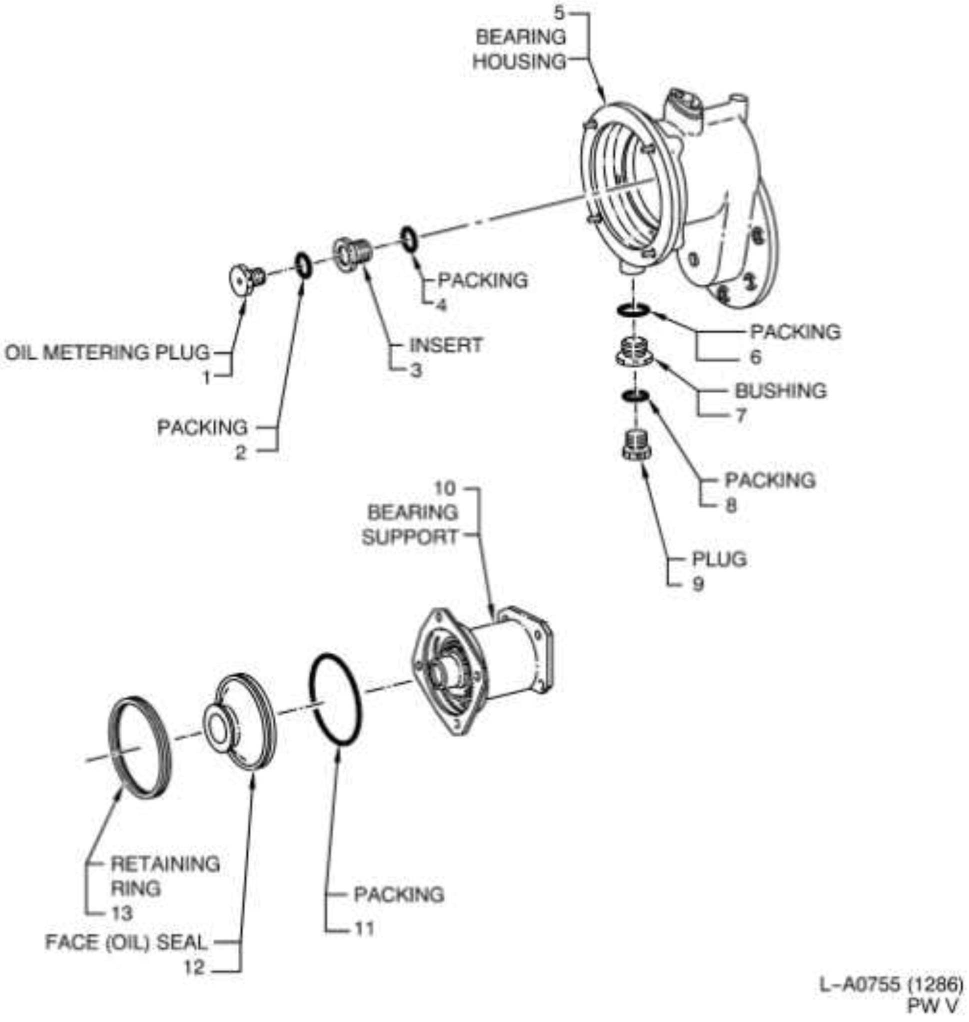
(1) Heat bearing inner race and rollers (1001/8) and (1001/11) per Standard Practices Manual, 70-00.

FRONT HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01


4
SLEEVE SPACER
5
SPUR GEAR SHAFT
2
BEARING SUPPORT
3
NUT
1
BOLT
12
NUT
BOLT
6
BEARING OUTER RACE
7
NUT
9
BEARING INNER RACE AND ROLLERS
11
BEARING OUTER RACE
10
BEARING INNER RACE AND ROLLERS
8
L-A0754 (0000)
PW V

Front Hydraulic Pump Drive Gearshaft And Bearings Assembly
Figure 1001
(Task 72-61-07-440-001)

FRONT HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01


5
BEARING HOUSING
PACKING 4
OIL METERING PLUG 1
INSERT 3
PACKING 2
PACKING 6
BUSHING 7
PACKING 8
10 BEARING SUPPORT
PLUG 9
RETAINING RING 13
PACKING 11
FACE (OIL) SEAL 12
L-A0755 (1286)
PW V

Front Hydraulic Pump Drive Gearshaft And Bearings Assembly
Figure 1002
(Task 72-61-07-440-001)

FRONT HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01

CAUTION: KEEP ALL DETAILS OF A PARTICULAR BEARING TOGETHER.

(2) Place spur gearshaft (1001/5), spur gear end down, on PWA 85856 Holder. Remove inner race and rollers (1001/8) from heat source and place on lower bearing journal of gearshaft. Using PWA 86017 Spacer, PWA 85345 Drift, PWA 80130 Force Gage, and arbor press, apply load of 1500 lbf. (6672.3 N) to seat bearing on gearshaft.

(3) Align boltholes and install mating bearing outer race (1001/7) onto flange of bearing support (1001/2). Lubricate four bolts (1001/6) with Engine Oil (P03−001). Secure the outer race with the four bolts and nuts (1001/9). Torque bolts to 85 − 95 lb−in. (9.604 − 10.734 N.m).

(4) Carefully install bearing support (1001/2) over gearshaft, mating bearing rollers on gearshaft with outer race installed on bearing support.

(5) Install sleeve spacer (1001/4) over gearshaft and seat on previously installed bearing inner race.

CAUTION: KEEP ALL DETAILS OF A PARTICULAR BEARING TOGETHER.

(6) Align boltholes and install bearing outer race (1001/10) into bore in bearing support. Lubricate four bolts (1001/1) with Engine Oil (P03−001). Secure the outer race with the four bolts and nuts (1001/3). Torque bolts to 85 − 90 lb−in. (9.604 − 10.734 N.m).

(7) Remove bearing inner race and rollers (1001/11) from heat source. Install bearing on bearing journal of gearshaft, mating bearing rollers with bearing outer race installed in bearing support. Position PWA 85345 Drift over bearing inner race. Using (PWA 80130) Force Gage and arbor press, apply load of 1500 lbf (6672.3 N) to seat bearing on gearshaft. Remove tools.

(8) Install new nut (1002/12) on gearshaft to secure bearing. Tighten nut fingertight.

FRONT HYDRAULIC PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01

(9) (Reference 1120) Secure PWA 85379 Holder in vise. Place gearshaft/bearing support assembly, spur gear end down, into PWA 85379 Holder, with dowel pins in holder engaged in gearteeth. Using PWA 85374 Wrench, torque nut (1001/12) to 1500 − 1700 lb−in. (169.477 − 192.074 N.m). Loosen nut to 0 lb−in. (0 N.m). Retorque nut to 1500 − 1700 lb−in. (169.477 − 192.074 N.m).

(10) Install new packing (1002/4) lubricated with Engine Oil (P03−001), onto insert (1002/3). Install insert, lubricated with Engine Oil (P03−001), into port in rear wall of bearing housing (1002/5). Torque insert to 110 − 120 lb−in. (12.428 − 13.558 N.m).

(11) Install new packing (1002/2) lubricated with Engine Oil (P03−001), onto oil metering plug (1002/1). Install plug, lubricated with Engine Oil (P03−001), into previously installed insert (1002/3). Torque plug to 40 − 50 lb−in. (4.519 − 5.649 N.m). Lockwire the plug.

(12) Install new packing (1002/11), lubricated with Engine Oil (P03−001), into groove in OD of face (oil) seal (1002/12). Carefully install seal into bore in bearing support (1002/10). Secure seal with retaining ring (1002/13).

(13) Install new packing (1002/6), lubricated with Engine Oil (P03−001), onto bushing (1002/7). Install bushing, lubricated with Engine Oil (P03−001), into port in bottom OD of bearing housing. Torque bushing to 250 − 275 lb−in. (28.246 − 31.071 N.m).

(14) Install new packing (1002/8), lubricated with Engine Oil (P03−001), onto plug (1002/9). Install plug, lubricated with Engine Oil (P03−001), into previously installed bushing (1002/7). Torque plug to 110 − 120 lb−in. (12.428 − 13.558 N.m). Lockwire plug.

Previous Pageblock Return to Previous Menu Next Pageblock

SCAVENGE PUMP DRIVE GEARSHAFT AND BEARING ASSEMBLY - DISASSEMBLY-01

Task 72-61-08-040-001-002:

1. Disassemble Scavenge Pump Drive Gearshaft And Bearing Assembly (Pre SB PW4ENG 72-114 And Post SB PW4ENG 72-463)

   A. Equipment And Materials Required

      Special Tools:
      PWA 12126 Base
      PWA 85272 Drift
      PWA 85274 Plate
      PWA 85372 Wrench
      PWA 85377 Holder (Optional To PWA 88642)
      PWA 88642 Holder

   B. Procedure
      See Figure 501.

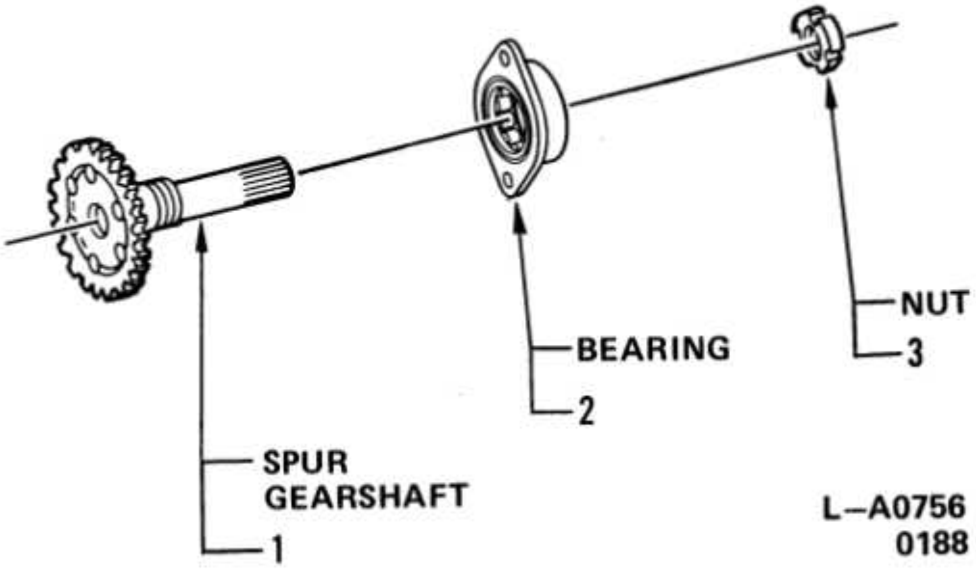
      CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER AS A SET.

      (1) Secure PWA 88642 or PWA 85377 Holder in vise. Position scavenge pump spur gearshaft and bearing assembly, spur gear end down, onto holder, with dowel pins of holder through holes in spur gear. Using PWA 85372 Wrench, remove nut (501/3) from scavenge pump drive gearshaft (501/1). Remove gearshaft from holder. Discard the nut (501/3).
      (2) Place split halves of PWA 85274 Plate around and under bearing (501/2). Position gearshaft, gear end down, into PWA 12126 Base.

      NOTE: Use PWA 85274 Plate, Change Letter A, with a gearshaft that is (Pre SB PW4ENG 72-114). Use PWA 85274 Plate, Change Letter B, with a gearshaft that is (Post SB PW4ENG 72-463).

      (3) Insert pin detail of PWA 85272 Drift into gearshaft. Using arbor press, drift off bearing from gearshaft.
      (4) Place gearshaft and bearing in suitable, labeled container.

SCAVENGE PUMP DRIVE GEARSHAFT AND BEARING ASSEMBLY − DISASSEMBLY−01


NUT
3
BEARING
2
SPUR
GEARSHAFT
1
L−A0756
0188

Scavenge Pump Drive Gearshaft And Bearing Assembly
(Pre SB PW4ENG 72−114 And Post SB PW4ENG 72−463)
Figure 501
(Task 72−61−08−040−001−002)

SCAVENGE PUMP DRIVE GEARSHAFT AND BEARING ASSEMBLY − DISASSEMBLY−01

Task 72−61−08−040−001−001:

2. Disassemble Scavenge Pump Drive Gearshaft And Bearing Inner Race Assembly (Post SB PW4ENG 72−114)

A. Equipment And Materials Required

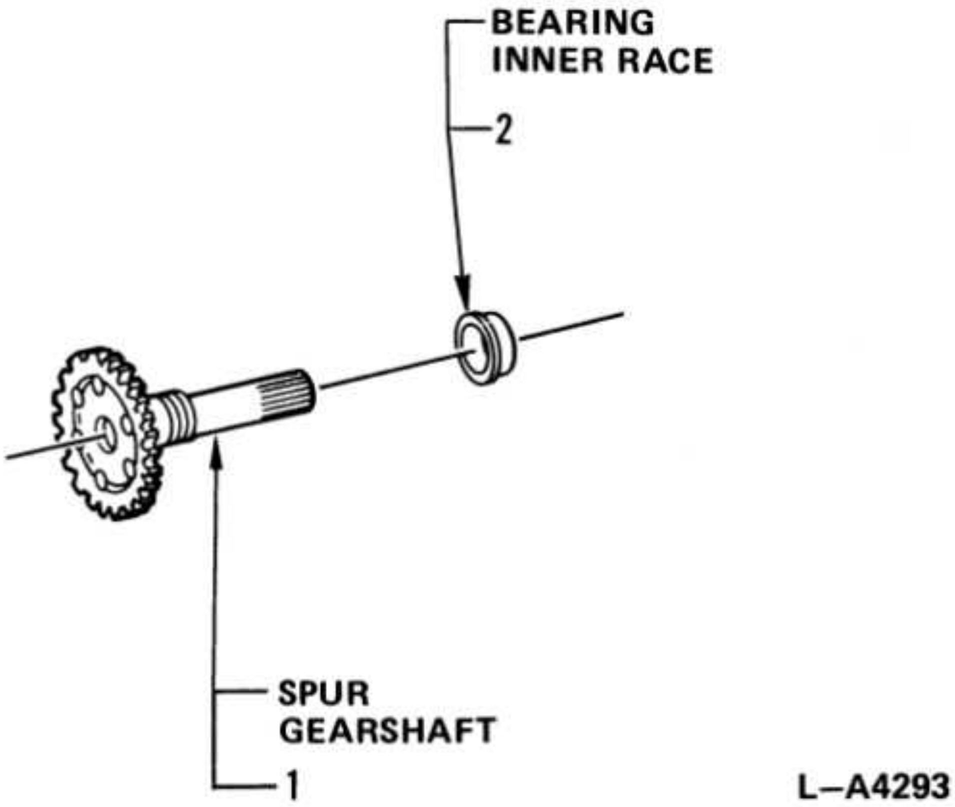
Special Tools:
PWA 12126 Base
PWA 85272 Drift
PWA 85274 Plate

B. Procedure
See Figure 502.

CAUTION: ALL DETAILS OF A PARTICULAR BEARING MUST BE KEPT TOGETHER AS A SET.

(1) Place split halves of PWA 85274 Plate, Change Letter B, around and under bearing inner race (502/2). Position gearshaft (502/1) gear end down, into PWA 12126 Base.
(2) Insert pin detail of PWA 85272 Drift into gearshaft. Using arbor press, drift off bearing inner race from gearshaft.
(3) Place gearshaft and all details of bearing assembly in suitable, labeled container.

SCAVENGE PUMP DRIVE GEARSHAFT AND BEARING ASSEMBLY – DISASSEMBLY-01


BEARING INNER RACE
2
SPUR GEARSHAFT
1
L–A4293

Scavenge Pump Drive Gearshaft And Bearing Inner Race Assembly
(Post SB PW4ENG 72-114)
Figure 502
(Task 72-61-08-040-001-001)

Task 72-61-08-440-001-002:

1. Assemble Scavenge Pump Drive Gearshaft And Bearing Assembly (Pre SB PW4ENG 72-114)

A. Prerequisites

(1) See Inspection/Check-04 Task 72-61-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Necessary

Special Tools:

PWA 80130	Gage, Force
PWA 85267	Base (Optional To PWA 88683)
PWA 85349	Drift
PWA 85372	Wrench
PWA 85377	Holder (Optional To PWA 88642)
PWA 88642	Holder
PWA 88683	Base

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Nut	1	72-61-00/8/30

C. Procedure
See Figure 1001.

CAUTION: BE SURE TO USE THE CORRECT PART NUMBERS. INTERCHANGEABILITY IS AFFECTED.

CAUTION: IT IS VERY IMPORTANT THAT YOU FOLLOW THE STEPS IN THE SEQUENCE SHOWN IN THE FIGURES. YOU MUST INSTALL THE BEARING ON THE SHAFT AND TORQUE THE BEARING RETAINING NUT ON THE BENCH. IF YOU DO NOT OBEY THE INSTRUCTIONS OR ASSEMBLY AND TORQUE THE RETAINING NUT WHILE IN A GEARBOX, AN IN-FLIGHT-SHUTDOWN CAN OCCUR.

(1) Heat bearing inner race (1001/2) by Chapter/Section 70-00 of the Standard Practices Manual, PN 585005.

(2) Place scavenge pump spur gearshaft (1001/1), spur gear end down, into PWA 85267 or PWA 88683 Base.

(3) Install bearing ring (1001/2) on gearshaft to seat against shoulder of gearshaft.

NOTE: The ring is a detail of the bearing inner race.

(4) Install bearing outer race and rollers (1001/3) on gearshaft, mating number down.

(5) Remove bearing inner race from heat source. Using PWA 85349 Drift and PWA 80130 Force Gage, apply load of 1500 lb. (680.39 kg) to seat inner race on gearshaft. Remove drift and force gage.

(6) Install new nut (1001/5) on gearshaft to secure bearing. Tighten nut fingertight.

(7) Secure PWA 88642 Holder or PWA 85377 Holder in vise. Position scavenge pump spur gearshaft and bearing assembly, spur gear end down, onto holder with dowel pins of holder through holes in spur gear. Using PWA 85372 Wrench, torque nut to 500 - 600 lb-in. (57 - 68 N.m).

(8) Place gearshaft and bearing in suitable container.

Task 72-61-08-440-001-001:

2. Assemble Scavenge Pump Drive Gearshaft And Bearing Inner Race Assembly (Post SB PW4ENG 72-114)

A. Prerequisites

(1) See Inspection/Check-04 Task 72-61-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Necessary

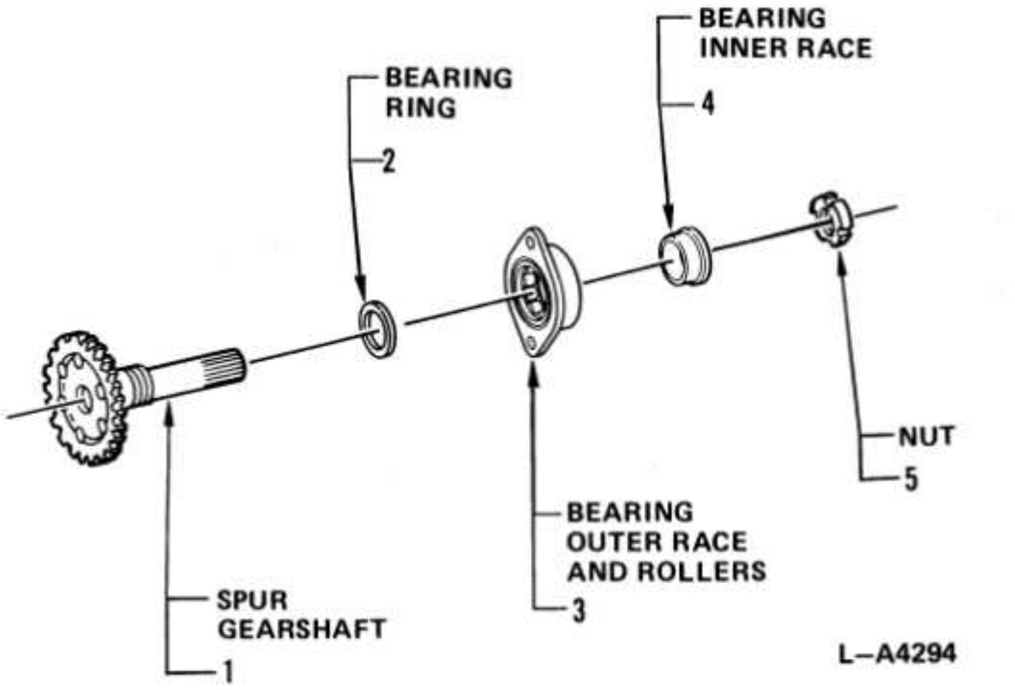
Special Tools:

PWA 80130	Gage, Force
PWA 85267	Base (Optional To PWA 88683)
PWA 85349	Drift
PWA 88683	Base

C. Procedure

See Figure 1002.

SCAVENGE PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01


BEARING INNER RACE
4
BEARING RING
2
NUT
5
BEARING OUTER RACE AND ROLLERS
3
SPUR GEARSHAFT
1
L-A4294

Scavenge Pump Drive Gearshaft And
Bearing Assembly (Pre SB PW4ENG 72-114)
Figure 1001
(Task 72-61-08-440-001-002)

SCAVENGE PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01

CAUTION: BE SURE TO USE THE CORRECT PART NUMBERS. INTERCHANGEABILITY IS AFFECTED.

CAUTION: IT IS VERY IMPORTANT THAT YOU FOLLOW THE STEPS IN THE SEQUENCE SHOWN IN THE FIGURES. YOU MUST INSTALL THE BEARING ON THE SHAFT AND TORQUE THE BEARING RETAINING NUT ON THE BENCH. IF YOU DO NOT OBEY THE INSTRUCTIONS OR ASSEMBLY AND TORQUE THE RETAINING NUT WHILE IN A GEARBOX, AN IN-FLIGHT-SHUTDOWN CAN OCCUR.

(1) Heat bearing inner race (1002/2) by Chapter/Section 70-00 of the Standard Practices Manual, PN 585005.

(2) Place gearshaft (1002/1), spur gear end down, into PWA 85267 or PWA 88683 Base.

(3) Remove bearing inner race from heat source. Install inner race, mating number down, on gearshaft.

(4) Using PWA 85349 Drift and PWA 80130 Force Gage, apply a load of 1500 lb. (680.39 kg) to seat inner race on gearshaft.

(5) Place gearshaft and inner race assembly in suitable, labeled container.

Task 72-61-08-440-001-003:

3. Assemble Scavenge Pump Drive Gearshaft And Bearing Assembly (Post SB PW4ENG 72-463)

A. Prerequisites

(1) See Inspection/Check-04 Task 72-61-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Necessary

SCAVENGE PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01

Special Tools:

PWA 80130	Gage, Force
PWA 85267	Base (Optional To PWA 88683)
PWA 85349	Drift
PWA 85372	Wrench
PWA 85377	Holder (Optional To PWA 88642)
PWA 88642	Holder
PWA 88683	Base

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Nut	1	72−61−00/8/30

C. Procedure
See Figure 1003.

CAUTION: BE SURE TO USE THE CORRECT PART NUMBERS. INTERCHANGEABILITY IS AFFECTED.

CAUTION: IT IS VERY IMPORTANT THAT YOU FOLLOW THE STEPS IN THE SEQUENCE SHOWN IN THE FIGURES. YOU MUST INSTALL THE BEARING ON THE SHAFT AND TORQUE THE BEARING RETAINING NUT ON THE BENCH. IF YOU DO NOT OBEY THE INSTRUCTIONS OR ASSEMBLY AND TORQUE THE RETAINING NUT WHILE IN A GEARBOX, AN IN−FLIGHT−SHUTDOWN CAN OCCUR.

(1) Heat bearing inner race (1003/2) by Chapter/Section 70−00 of the Standard Practices Manual, PN 585005.

(2) Place scavenge pump spur gearshaft (1003/1), spur gear end down, into PWA 85267 or PWA 88683 Base.

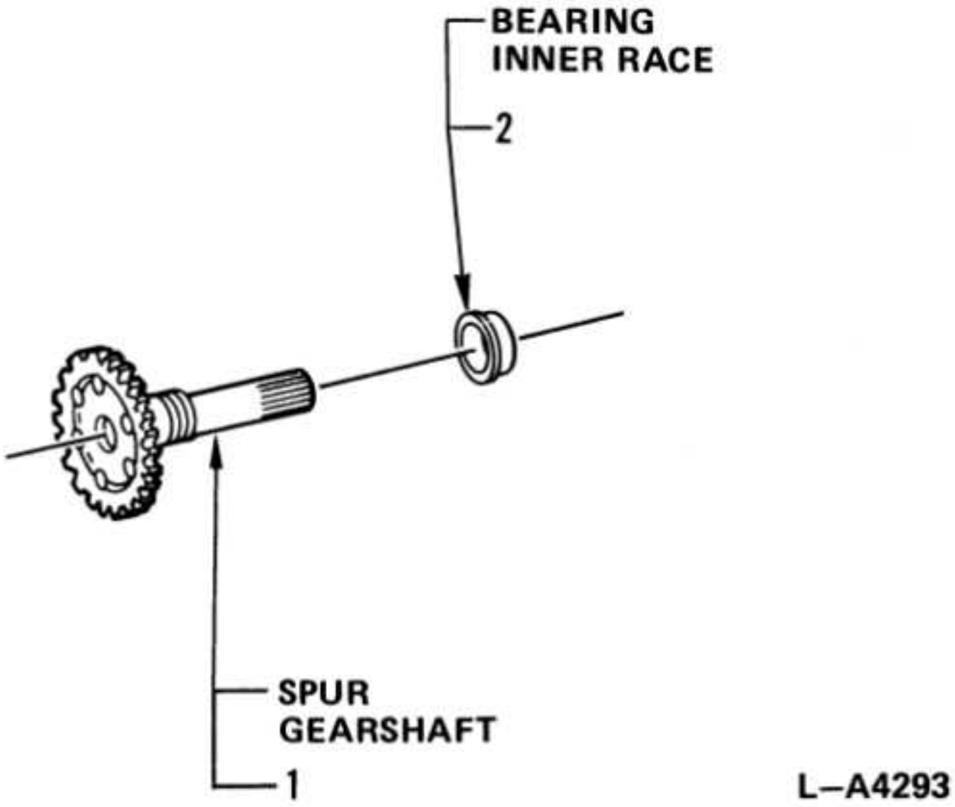
(3) Remove bearing inner race from heat source. Using PWA 85349 Drift and PWA 80130 Force Gage, apply load of 1500 lb. (680.39 kg) to seat inner race, flange side down, on gearshaft. Remove drift and force gage.

(4) Install bearing outer race and rollers (1003/3) on gearshaft, mating numbers down.

(5) Install bearing ring (1003/4) on gearshaft to seat against roller.

NOTE: The ring is a detail of the bearing inner race.

SCAVENGE PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01


BEARING INNER RACE
2
SPUR GEARSHAFT
1
L−A4293

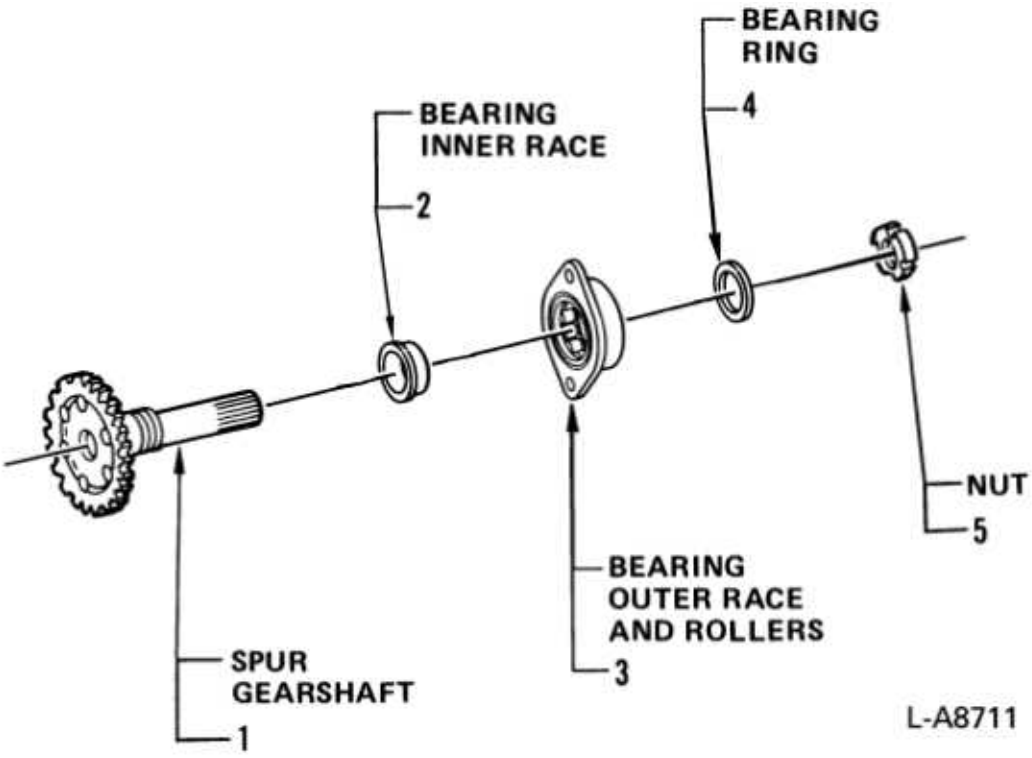
Scavenge Pump Drive Gearshaft (Post SB PW4ENG 72−114)
Figure 1002
(Task 72−61−08−440−001−001)

SCAVENGE PUMP DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01

(6) Apply Engine Oil P03−001 to the threads of the new nut (1003/5). Install the nut on gearshaft to secure bearing. Tighten nut fingertight.

(7) Secure PWA 88642 Holder or PWA 85377 Holder in vise. Position scavenge pump spur gearshaft and bearing assembly, spur gear end down, onto holder with dowel pins of holder through holes in spur gear. Using PWA 85372 Wrench, torque nut to 500 − 600 lb−in. (57 − 68 N.m).

(8) Place gearshaft and bearing in suitable container.


BEARING RING
4
BEARING INNER RACE
2
NUT
5
BEARING OUTER RACE AND ROLLERS
3
SPUR GEARSHAFT
1
L-A8711

Scavenge Pump Drive Gearshaft And
Bearing Assembly (Post SB PW4ENG 72-463)
Figure 1003
(Task 72-61-08-440-001-003)

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EEC/PMA ALTERNATOR DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - DISASSEMBLY-01

Task 72-61-09-040-001:

1. Disassemble EEC/PMA Alternator Drive Gearshaft And Bearings Assembly

A. Equipment And Materials Required

Special Tools:
PWA 12126 Base
PWA 85273 Drift
PWA 85274 Plate
PWA 85723 Puller
PWA 86086 Puller

B. Procedure

See Figure 501.

(1) Remove retaining ring (501/13) securing face (oil) seal (501/12) to generator housing (501/3). Using PWA 85723 Puller, remove seal from housing. Discard packing (501/11).

(2) Remove EEC/PMA Alternator rotor sleeve spacer (501/10). Discard packing (501/9) from gearshaft.

(3) Remove bearing seal seat (501/1) with PWA 86086 Puller.

(4) For engines that have not incorporated SB PW4ENG 72-206:

  (a) Remove two bolts (501/19) securing bearing outer race (501/18) to generator housing.

(5) For engines that have incorporated SB PW4ENG 72-206:

  (a) Remove the bolt (501/19) that attaches the bearing outer race (501/18) to the generator housing.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER.

(6) Place split halves of PWA 85274 Plate under mounting flange of housing (501/3). Position gearshaft and bearings assembly, gear end down, into PWA 12126 Base. Using PWA 85273 Drift and arbor press, push gearshaft out of bearing. Remove bearing inner race and rollers (501/2). Remove bearing outer race (501/18) from housing. Place bearing in suitable labeled container.

EEC/PMA ALTERNATOR DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − DISASSEMBLY−01

(7) Carefully separate and remove generator housing (501/3) from spur gearshaft (501/7) ensuring that gearshaft will not suddenly drop out of its bearing outer race. Remove gearshaft and bearing inner race from base. Remove bearing spacer (501/4) from gearshaft.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER.

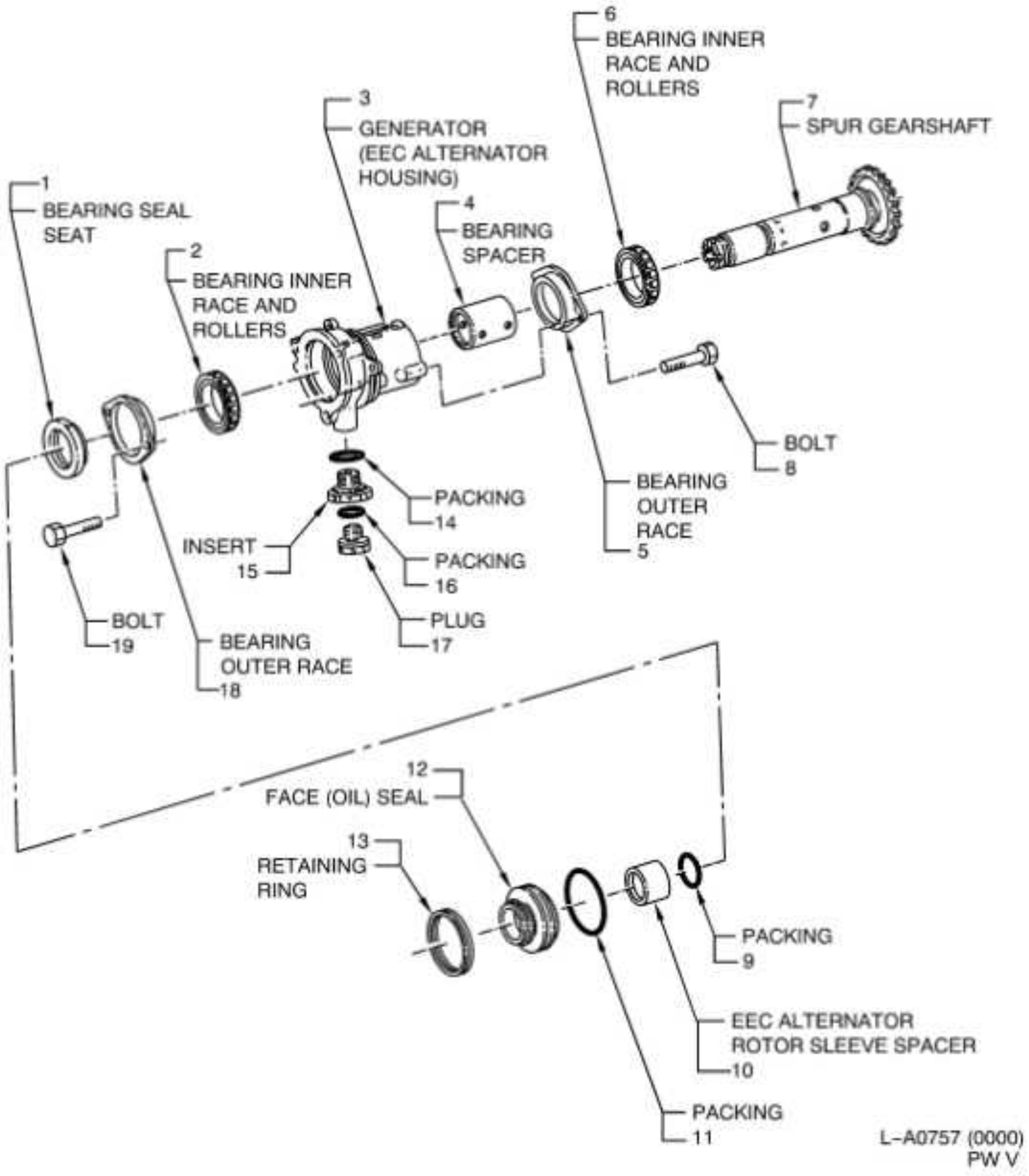
(8) Place split halves of PWA 85274 Plate under bearing inner race and rollers (501/6). Position spur gearshaft (501/7), gear end down, into PWA 12126 Base. Using PWA 85273 Drift and arbor press, push gearshaft out of bearing.

(9) Remove two bolts (501/8) securing bearing (501/5) outer race to gearshaft housing. Remove bearing outer race.

(10) Place gearshaft and bearings in suitable, labeled container.

(11) Remove lockwire, plug (501/17), and insert (501/15) from port on bottom of generator housing (501/3). Discard packings (501/14) and (501/16).

EEC/PMA ALTERNATOR DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − DISASSEMBLY−01


6
BEARING INNER RACE AND ROLLERS
7
SPUR GEARSHAFT
3
GENERATOR (EEC ALTERNATOR HOUSING)
1
BEARING SEAL SEAT
4
BEARING SPACER
2
BEARING INNER RACE AND ROLLERS
BOLT
8
BEARING OUTER RACE
5
PACKING
14
INSERT
15
PACKING
16
BOLT
19
PLUG
17
BEARING OUTER RACE
18
12
FACE (OIL) SEAL
13
RETAINING RING
PACKING
9
EEC ALTERNATOR ROTOR SLEEVE SPACER
10
PACKING
11
L−A0757 (0000)
PW V

EEC/PMA Alternator Drive Gearshaft And Bearings Assembly
Figure 501
(Task 72−61−09−040−001)

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EEC/PMA ALTERNATOR DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01

Task 72-61-09-440-001:

1. Assemble EEC/PMA Alternator Drive Gearshaft And Bearings Assembly

A. Prerequisites

(1) See Inspection/Check-04 Task 72-61-00-990-001 for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:

PWA 80130	Gage, Force
PWA 85267	Base (Optional To PWA 88683)
PWA 85348	Drift, Assembly
PWA 86087	Drift, Hand
PWA 88683	Base

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72-61-00/4/80
Packing	1	72-61-00/4/140
Packing	1	72-61-00/4/200
Packing	1	72-61-00/4/220
Lockwire, AS3214-02		

C. Procedure
See Figure 1001.

(1) Heat bearing inner race and rollers (1001/2) and (1001/6) per Standard Practices Manual, PN 585005, 70-00.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER.

(2) Place gearshaft (1001/7), spur gear end down, into PWA 85267 Base or PWA 88683 Base. Remove inner race and rollers detail of bearing (1001/6) from heat source and place on lower bearing journal of gearshaft. Using PWA 85348 Drift, PWA 80130 Force Gage and arbor press, apply load of 1500 lb. (680.39 kg) to seat bearing on gearshaft. Remove drift.

(3) Align boltholes and install mating bearing outer race (1001/5) into generator housing (1001/3). Secure outer race with two bolts (1001/8). Torque bolts to 27 − 30 lb−in. (3.051 − 3.390 N.m).

(4) Carefully install gearshaft into generator housing, mating bearing rollers with outer race installed in housing.

(5) Install bearing spacer (1001/4) over gearshaft and seat on bearing inner race.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER.

(6) Install the bearing outer race and retaining bolt(s) as follows:

(a) Align the boltholes and install the bearing outer race (1001/18) into the generator housing.

(b) Secure the outer race with bolt(s) (1001/19). Torque the bolt(s) to 27 − 30 lb−in. (3.051 − 3.390 N.m).

NOTE: For Pre SB PW4ENG 72−206 engines, use two bolts (1001/19). For Post SB PW4ENG 72−206 and Pre SB PW4ENG 72−375 engines, use one bolt (1001/19). For Post SB PW4ENG 72−375 engines, use two bolts (1001/19).

(7) Remove bearing inner race and rollers (1001/2) from heat source. Install bearing on bearing journal of gearshaft, mating bearing rollers with outer race installed in generator housing. Using PWA 85348 Drift and PWA 80130 Force Gage, apply load of 1500 lb. (680.39 kg) to seat bearing on gearshaft

EEC/PMA ALTERNATOR DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01

CAUTION: TO AVOID THE INCORRECT INSTALLATION OF THE BEARING SEAL SEAT (1001/1) ON THE GEARSHAFT, THE SMALLER RADIAL SURFACE OF THE SEAL SEAT SHOULD TOUCH THE BEARING INNER RACE (1001/2). SEE Figure 1002.

(8) Position bearing seal seat (1001/1) over gearshaft and seat on bearing inner race. If necessary, use PWA 86087 Drift.

(9) Install new packing (1001/9), lubricated with Engine Oil P03−001, onto groove on gearshaft.

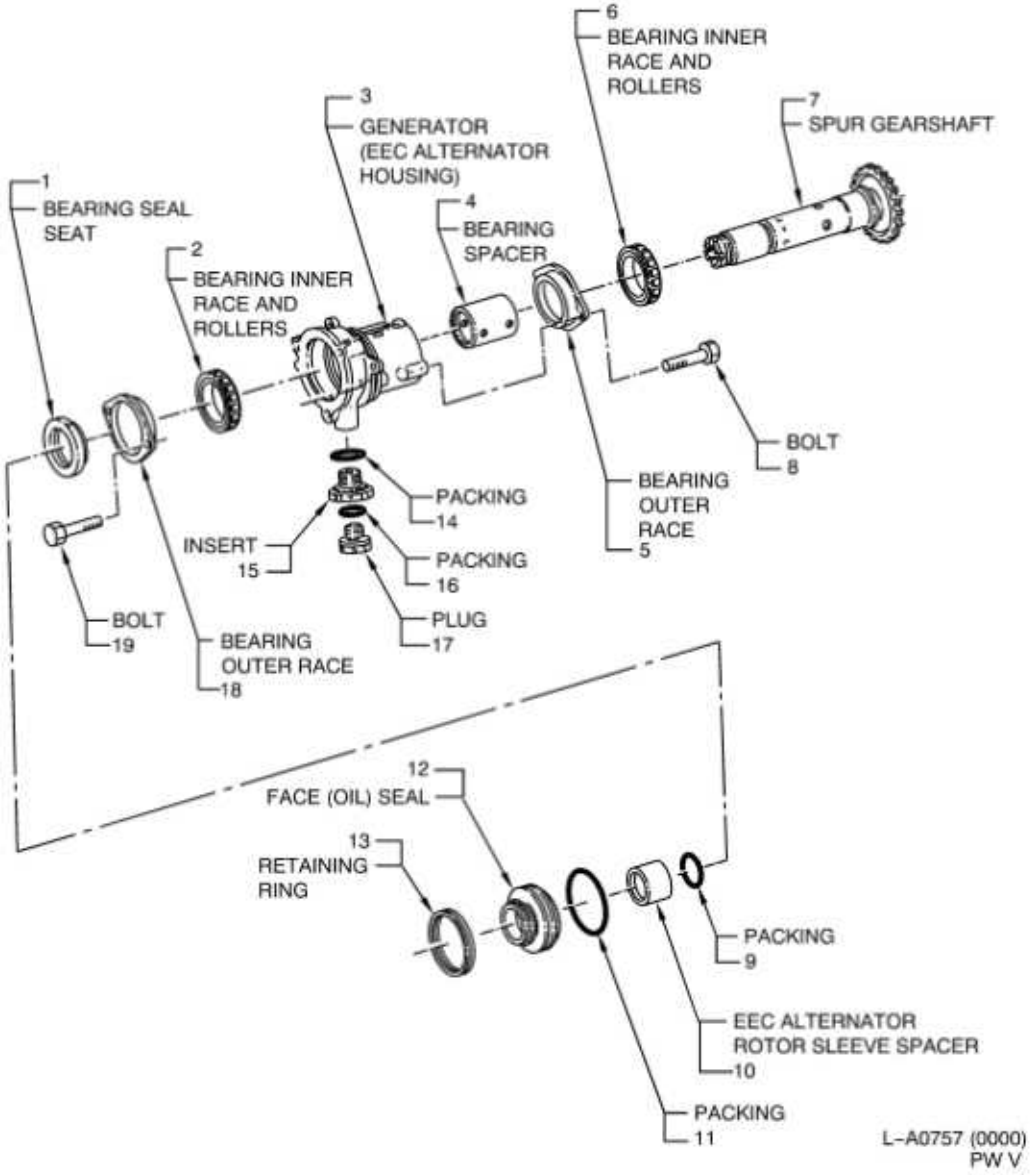
(10) Install EEC/PMA alternator rotor sleeve spacer (1001/10) over gearshaft and seat on bearing seal seat. If necessary, use PWA 86087 Drift.

(11) Install new packing (1001/11), lubricated with Engine Oil P03−001, into groove in face (oil) seal (1001/12). Carefully install carbon seal sealing face down over gearshaft and into bore in generator housing. Secure seal in housing with retaining ring (1001/13).

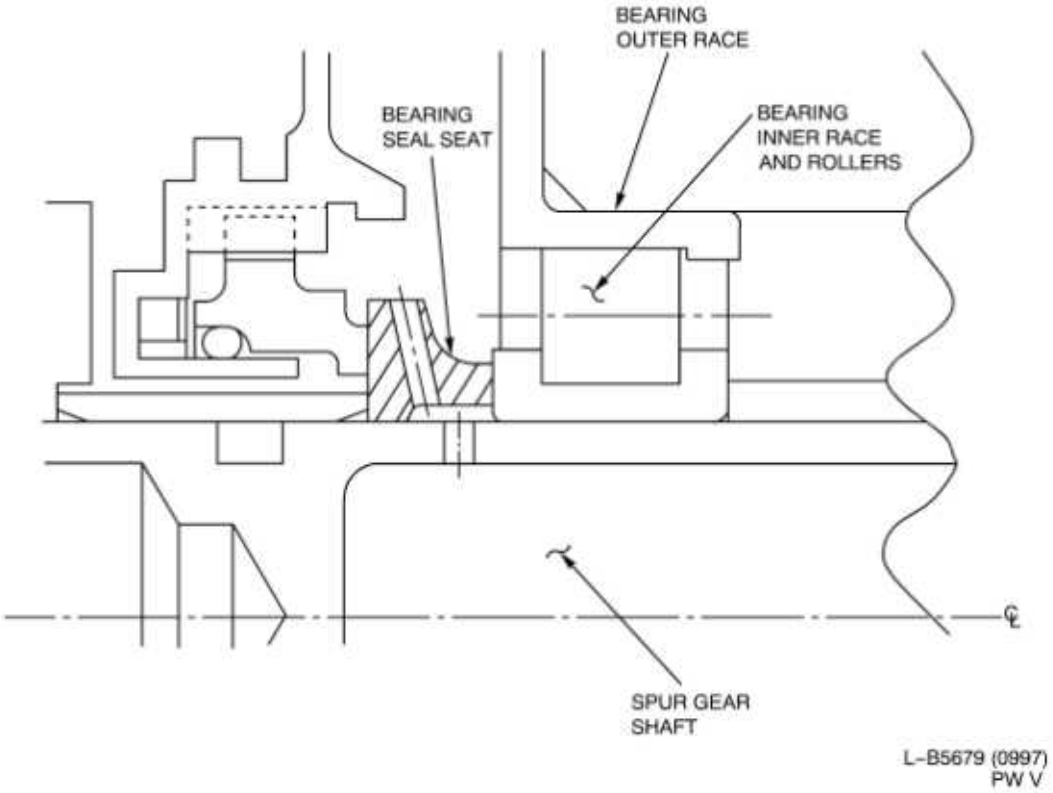
(12) Install new packing (1001/14) lubricated with Engine Oil P03−001, onto insert (1001/15). Install insert lubricated with Engine Oil P03−001, into port in OD of generator housing. Torque insert to 150 − 170 lb−in. (16.948 − 19.207 N.m).

(13) Install new packing (1001/16) lubricated with Engine Oil P03−001, onto plug (1001/17). Install plug lubricated with Engine Oil P03−001, into previously installed insert in OD of generator housing. Torque plug to 65 − 75 lb−in. (7.344 − 8.474 N.m). Lockwire plug.

EEC/PMA ALTERNATOR DRIVE GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01


6
BEARING INNER RACE AND ROLLERS
3
GENERATOR (EEC ALTERNATOR HOUSING)
7
SPUR GEARSHAFT
1
BEARING SEAL SEAT
4
BEARING SPACER
2
BEARING INNER RACE AND ROLLERS
BOLT
8
BEARING OUTER RACE
5
PACKING
14
INSERT
15
PACKING
16
PLUG
17
BOLT
19
BEARING OUTER RACE
18
12
FACE (OIL) SEAL
13
RETAINING RING
PACKING
9
EEC ALTERNATOR ROTOR SLEEVE SPACER
10
PACKING
11
L−A0757 (0000)
PW V

EEC/PMA Alternator Drive Gearshaft And Bearings Assembly
Figure 1001
(Task 72−61−09−440−001)


BEARING
OUTER RACE
BEARING
SEAL SEAT
BEARING
INNER RACE
AND ROLLERS
℄
SPUR GEAR
SHAFT
L-B5679 (0997)
PW V

EEC/PMA Alternator Drive Gearshaft And Bearings
Assembly - Bearing Seal Seat Installation
Figure 1002
(Task 72-61-09-440-001)

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SCAVENGE PUMP DRIVE IDLER GEARSHAFT AND BEARINGS ASSEMBLY - DISASSEMBLY-01

Task 72-61-37-040-001:

1. Disassemble Scavenge Pump Drive Idler Gearshaft And Bearings Assembly

NOTE: This Section Has Been Relocated To 26-61-40

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SCAVENGE PUMP DRIVE IDLER GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01

Task 72-61-37-440-001:

1. Assemble Scavenge Pump Drive Idler Gearshaft And Bearings Assembly

NOTE: This Section Has Been Relocated To 72-61-40

SCAVENGE PUMP DRIVE IDLER GEARSHAFT AND BEARINGS ASSEMBLY - DISASSEMBLY-01

Task 72-61-40-040-001:

1. Disassemble Scavenge Pump Drive Idler Gearshaft And Bearings Assembly

   A. Equipment And Materials Required

      Special Tools:
      PWA 12126 Base
      PWA 85270 Drift
      PWA 85271 Drift
      PWA 85274 Plate

   B. Procedure
      See Figure 501.

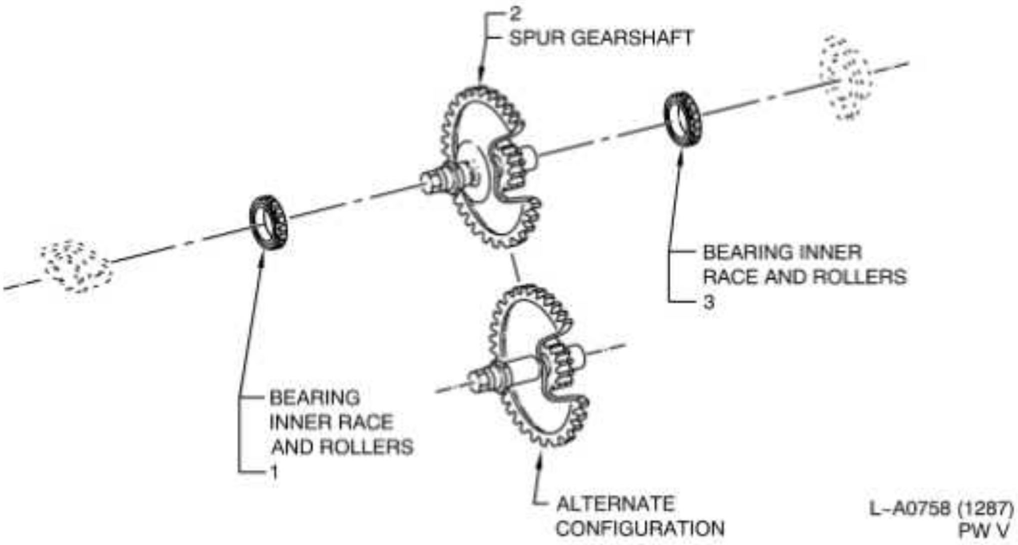
      CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING IS INSTALLED IN GEARBOX BEARING HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

      (1) Place split halves of PWA 85274 Plate under bearing inner race and rollers (501/1). For gearshafts that are pre SB PW4ENG 72-114, use plate, Change Letter A. For gearshafts that are post SB PW4ENG 72-114, use plate, Change Letter B. Position spur gearshaft (501/2), smaller spur gear end down, into PWA 12126 Base. Using PWA 85270 Drift and arbor press, push gearshaft out of bearing.

      CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING IS INSTALLED IN GEARBOX HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER IN A CONTAINER FOLLOWING REMOVAL.

      (2) Reverse gearshaft in base, positioning halves of Plate (PWA 85274) under inner race and rollers (501/3). Using PWA 85271 Drift and arbor press, push gearshaft out of bearing.
      (3) Place gearshaft and bearings in suitable, labeled container.

SCAVENGE PUMP DRIVE IDLER GEARSHAFT AND BEARINGS ASSEMBLY – DISASSEMBLY-01


2
SPUR GEARSHAFT
BEARING INNER
RACE AND ROLLERS
3
BEARING
INNER RACE
AND ROLLERS
1
ALTERNATE
CONFIGURATION
L-A0758 (1287)
PW V

Scavenge Pump Drive Idler Gearshaft And Bearings Assembly
Figure 501
(Task 72-61-40-040-001)

SCAVENGE PUMP DRIVE IDLER GEARSHAFT AND BEARINGS ASSEMBLY - ASSEMBLY-01

Task 72-61-40-440-001:

1. Assemble Scavenge Pump Drive Idler Gearshaft And Bearings Assembly

A. Prerequisites

(1) See Inspection/Check-04 (Task 72-61-00-990-001) for fits and clearances. Special torques and special assembly procedures appear where necessary in the following text and are identified by a reference number. For example: (Reference 1234) Torque retaining nut as follows.

B. Equipment And Materials Required

Special Tools:
PWA 80130 Gage, Force
PWA 85359 Drift
PWA 85360 Drift
PWA 85856 Holder

C. Procedure

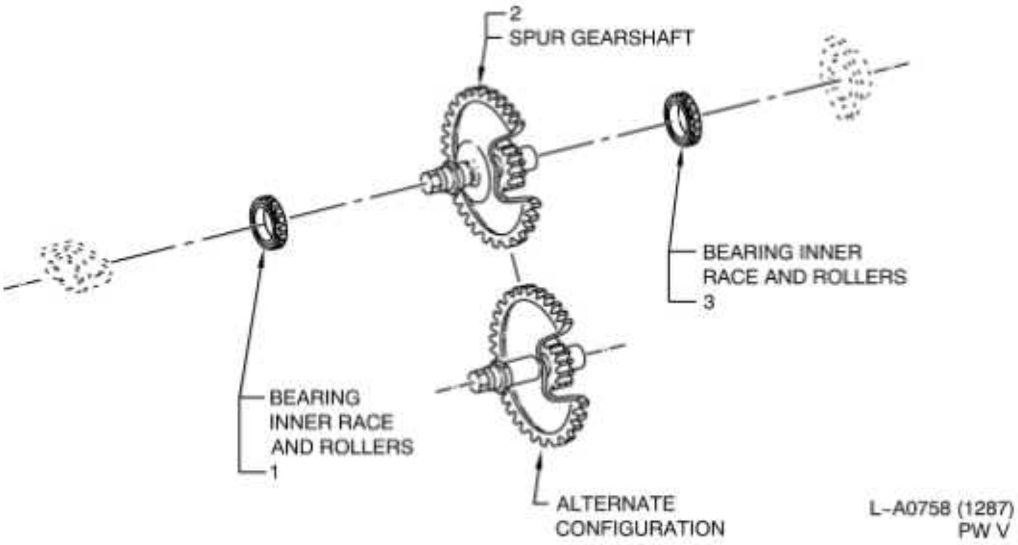
See Figure 1001.

(1) Heat bearing inner races and rollers (1001/1) and (1001/3) per Standard Practices Manual, 70-00.

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING WILL BE INSTALLED IN GEARBOX BEARING HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER.

(2) Place gearshaft (1001/2), smaller spur gear end down, on PWA 85856 Holder. Remove bearing inner race and rollers (1001/1) from heat source and position it over bearing journal of gearshaft. Using PWA 85359 Drift and PWA 80130 Force Gage, apply load of 1500 lb. (680.39 kg) to seat bearing on gearshaft.

SCAVENGE PUMP DRIVE IDLER GEARSHAFT AND BEARINGS ASSEMBLY – ASSEMBLY-01


2
SPUR GEARSHAFT
BEARING INNER RACE AND ROLLERS
3
BEARING INNER RACE AND ROLLERS
1
ALTERNATE CONFIGURATION
L-A0758 (1287)
PW V

Scavenge Pump Drive Idler Gearshaft And Bearings Assembly
Figure 1001
(Task 72-61-40-440-001)

SCAVENGE PUMP DRIVE IDLER GEARSHAFT AND BEARINGS ASSEMBLY − ASSEMBLY−01

CAUTION: ALL DETAILS OF PARTICULAR BEARING MUST BE KEPT TOGETHER. OUTER RACE OF THIS BEARING WILL BE INSTALLED IN GEARBOX BEARING HOUSING. MAKE CERTAIN THAT ALL DETAILS ARE KEPT TOGETHER.

(3) Invert gearshaft. Remove bearing inner race and rollers (1001/3) from heat source and position it over bearing journal of gearshaft. Using PWA 85360 Drift and PWA 80130 Force Gage, apply load of 1500 lb. (680.39 kg) to seat bearing on gearshaft.

(4) Place gearshaft and bearings assembly in a correct container with a label.

Previous Pageblock Return to Previous Menu Next Pageblock

OIL CHECK VALVE ASSEMBLY - DISASSEMBLY-01

Task 72-61-71-040-001:

1. Disassemble Oil Check Valve Assembly

   A. Equipment And Materials Required - None

   B. Procedure

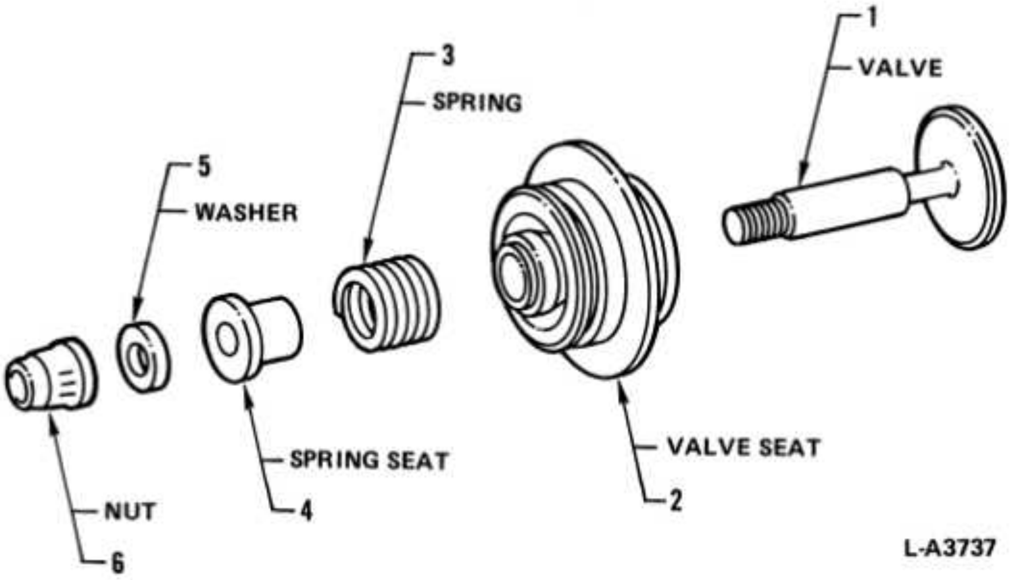
      See Figure 501.

      (1) Unscrew nut (501/6) and remove from valve (501/1).

      (2) Remove washer (501/5), spring seat (501/4), and spring (501/3).

      (3) Push valve (501/1) out of valve seat (501/2).

OIL CHECK VALVE ASSEMBLY − DISASSEMBLY−01


1
VALVE
3
SPRING
5
WASHER
SPRING SEAT
4
VALVE SEAT
2
NUT
6
L-A3737

Oil Check Valve Assembly
Figure 501
(Task 72−61−71−040−001)

Previous Pageblock Return to Previous Menu Next Pageblock

OIL CHECK VALVE ASSEMBLY - ASSEMBLY-01

Task 72-61-71-440-001:

1. Assemble Oil Check Valve Assembly

A. Equipment And Materials Required

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)

B. Procedure

See Figure 1001.

(1) Install valve (1001/5) in valve seat (1001/2).

(2) Install spring (1001/3) over valve stem.

(3) Install spring seat (1001/4) in spring.

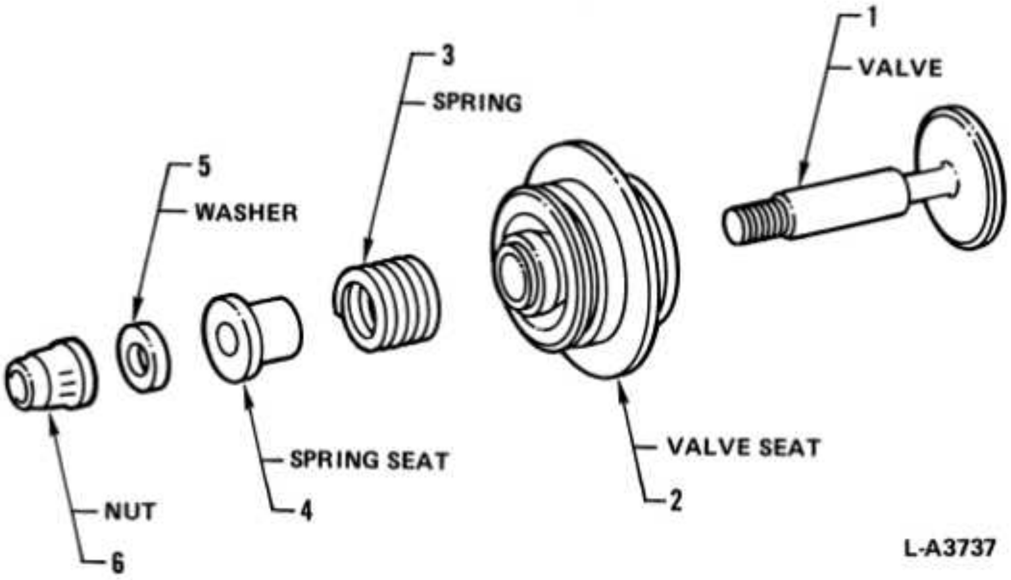
(4) Install washer (1001/5) over valve stem.

(5) Lubricate threads of valve stem with Engine Oil (P03-001).

(6) For assemblies that are pre SB PW4ENG 79-43, install nut (1001/6) on valve stem and torque to 85 - 95 lb-in. (9.604 - 10.734 N.m).

(7) For assemblies that are post SB PW4ENG 79-43, install the nut (1001/6) on the valve stem and torque to 36 - 40 lb-in. (4.067 - 4.519 N.m).

OIL CHECK VALVE ASSEMBLY − ASSEMBLY−01


1
VALVE
3
SPRING
5
WASHER
SPRING SEAT
4
VALVE SEAT
2
NUT
6
L-A3737

Oil Check Valve Assembly
Figure 1001
(Task 72−61−71−440−001)

Return to Previous Menu

72−62−00

	LIST OF EFFECTIVE PAGES
	HIGHLIGHTS
	TABLE OF CONTENTS
72−62−00	ANGLE GEARBOX − HOW TO USE MANUAL • 72−62−00−990−003: Chapter/Section/Subject Numbering Outline
72−62−00	ANGLE GEARBOX − DESCRIPTION AND OPERATION • 72−62−00−990−002: General
72−62−00	ANGLE GEARBOX − DISASSEMBLY−01 • 72−62−00−030−001: Disassemble Angle Gearbox
72−62−00	ANGLE GEARBOX − INSPECTION/CHECK−01 • 72−62−00−990−004: General Inspection Requirements − Angle Gearbox
72−62−00	ANGLE GEARBOX − INSPECTION/CHECK−03 • 72−62−00−990−005: Visual Inspection − Angle Gearbox
72−62−00	ANGLE GEARBOX − INSPECTION/CHECK−04 • 72−62−00−990−006: Specific Fits And Clearances
72−62−00	ANGLE GEARBOX − ASSEMBLY−01 • 72−62−00−400−001: Assemble Angle Gearbox Assembly
72−62−00	ANGLE GEARBOX − ASSEMBLY−02 • 72−62−00−400−002: Determine Angle Gearbox Spacers
72−62−00	ANGLE GEARBOX − ASSEMBLY−03 • 72−62−00−400−003: Assemble Cover, Bearing And Baffle
72−62−00	ANGLE GEARBOX − ASSEMBLY−04 • 72−62−00−400−004: Assemble Angle Gearbox Bevel Gearshaft Assembly And Gearbox Driveshaft housing Assembly.
72−62−00	ANGLE GEARBOX − ASSEMBLY−05 • 72−62−00−400−005: Assemble Angle Gearbox Bevel Gear Assembly And Angle Gearbox Housing Assembly

ANGLE GEARBOX - HOW TO USE MANUAL

Task 72-62-00-990-003:

1. Chapter/Section/Subject Numbering Outline

See Figure 1.

NOTE: See the tab separated How To Use Manual section located at the beginning of this manual set for information concerning Data Location Guidelines and a complete Chapter/Section/Subject numbering outline for all manual sections.

A. The following is a complete listing of the individual Chapter/Section/Subject numbers and specific nomenclatures which have been assigned to the significant angle gearbox parts.

(1) Numbers which are not assigned are indicated in the list by one of the following terms:

UNASSIGNED - This designation is for numbers intentionally omitted and reserved for possible future use.

NOT USED - This designation is applied to numbers used in other related engine model programs which are not, at this time, applicable to the engine models represented by this manual.

ANGLE GEARBOX	72-62-00
ANGLE GEARBOX HOUSING ASSEMBLY	72-62-01
ANGLE GEARBOX BEVEL GEAR ASSEMBLY	72-62-02
ANGLE GEARBOX BEVEL GEARSHAFT ASSEMBLY	72-62-03
ANGLE GEARBOX BEARINGS	72-62-04
UNASSIGNED	72-62-05 through 72-62-07
RING SPACERS	72-62-08
UNASSIGNED	72-62-09
ANGLE GEARBOX COVER ASSEMBLY	72-62-10
UNASSIGNED	72-62-11

ANGLE GEARBOX − HOW TO USE MANUAL

GEARBOX DRIVESHAFT HOUSING ASSEMBLY .... 72−62−12

GEARBOX DRIVE COUPLING .... 72−62−13

UNASSIGNED .... 72−62−14

ANGLE GEARBOX (FRONT OIL) NOZZLE ASSEMBLY .... 72−62−15

OIL TRANSFER TUBE ASSEMBLY .... 72−62−16

ANGLE GEARBOX (REAR OIL) NOZZLE ASSEMBLY .... 72−62−17

ANGLE GEARBOX (COUPLING OIL) NOZZLE .... 72−62−18

ANGLE GEARBOX BAFFLE .... 72−62−19

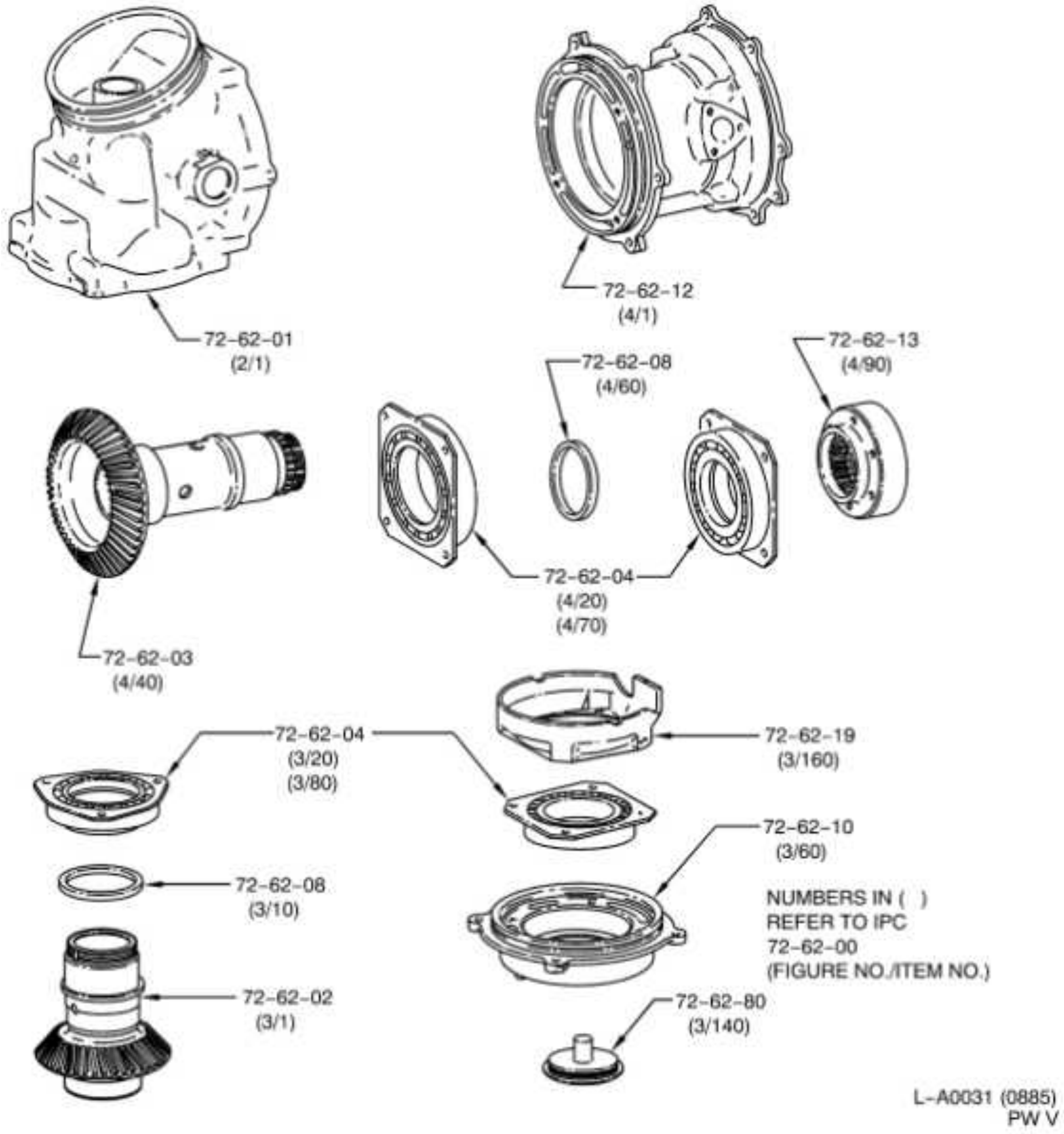
UNASSIGNED .... 72−62−20 through 72−62−79

PLUG (GEARBOX COVER) .... 72−62−80

UNASSIGNED .... 72−62−81 through 72−62−98

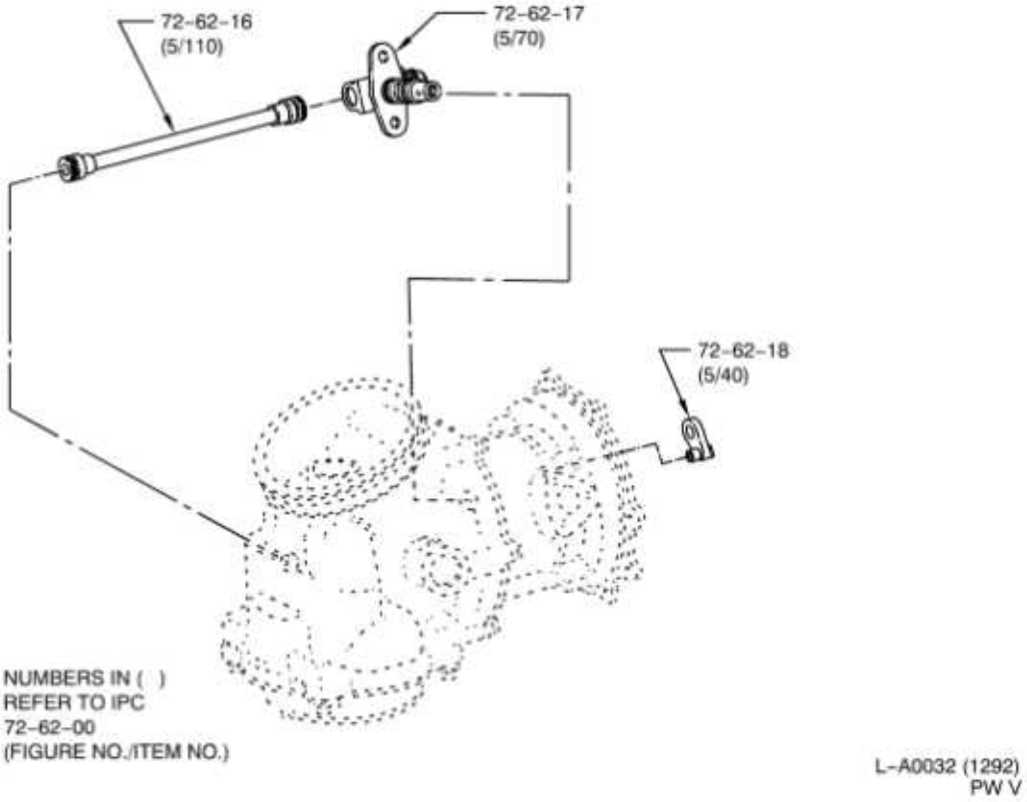
ANGLE GEARBOX MISCELLANEOUS PARTS .... 72−62−99

ANGLE GEARBOX − HOW TO USE MANUAL


72−62−12
(4/1)
72−62−01
(2/1)
72−62−08
(4/60)
72−62−13
(4/90)
72−62−04
(4/20)
(4/70)
72−62−03
(4/40)
72−62−04
(3/20)
(3/80)
72−62−19
(3/160)
72−62−10
(3/60)
72−62−08
(3/10)
NUMBERS IN ( )
REFER TO IPC
72−62−00
(FIGURE NO./ITEM NO.)
72−62−02
(3/1)
72−62−80
(3/140)
L−A0031 (0885)
PW V

Angle Gearbox
Figure 1 (Sheet 1)
(Task 72−62−00−990−003)

ANGLE GEARBOX − HOW TO USE MANUAL


72−62−16
(5/110)
72−62−17
(5/70)
72−62−18
(5/40)
NUMBERS IN ( )
REFER TO IPC
72−62−00
(FIGURE NO./ITEM NO.)
L−A0032 (1292)
PW V

Angle Gearbox
Figure 1 (Sheet 2)
(Task 72−62−00−990−003)

Previous Pageblock Return to Previous Menu Next Pageblock

ANGLE GEARBOX - DESCRIPTION AND OPERATION

Task 72-62-00-990-002:

1. General

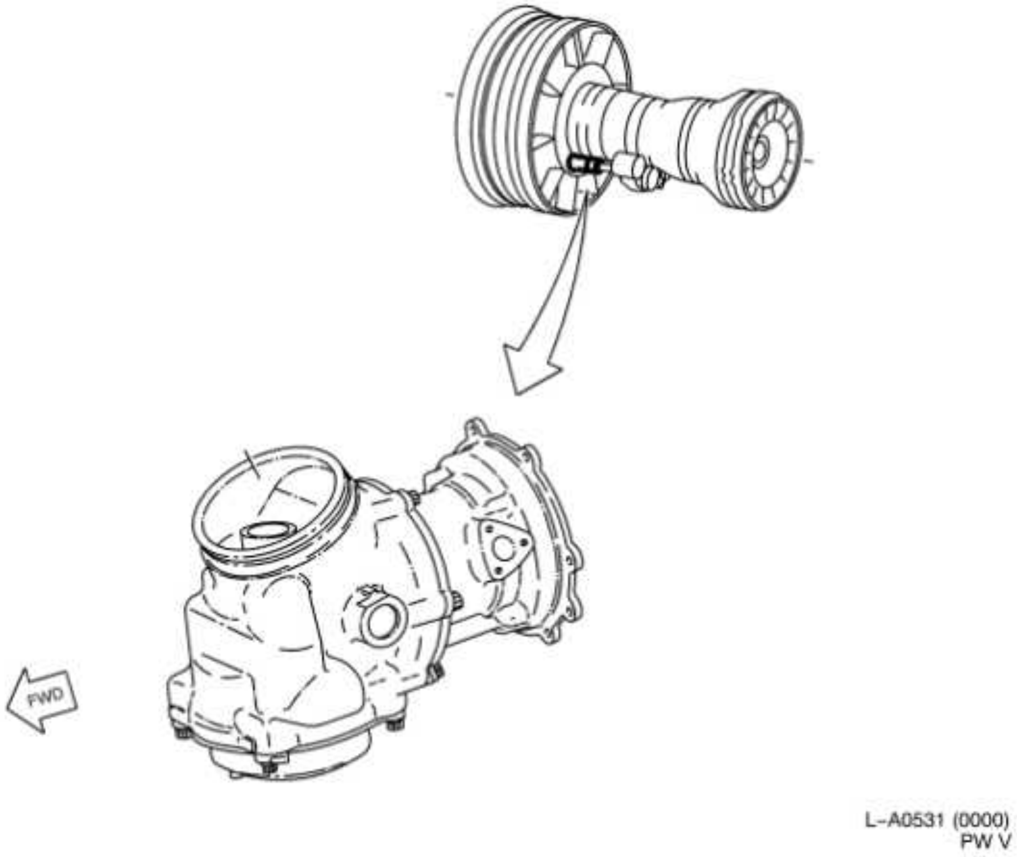
See Figures 1 and 2.

A. The angle gearbox transmits the power from the engine rotor to the main gearbox and from the starter on the main gearbox to the engine rotor. The angle gearbox housing is a cast aluminum housing that contains a bevel gear set that transmits the power from the towershaft to the layshaft. The general lubrication of the gears and bearings is accomplished by oil splash and by pressure oil supplied through three jets directed at the bearings and splines.

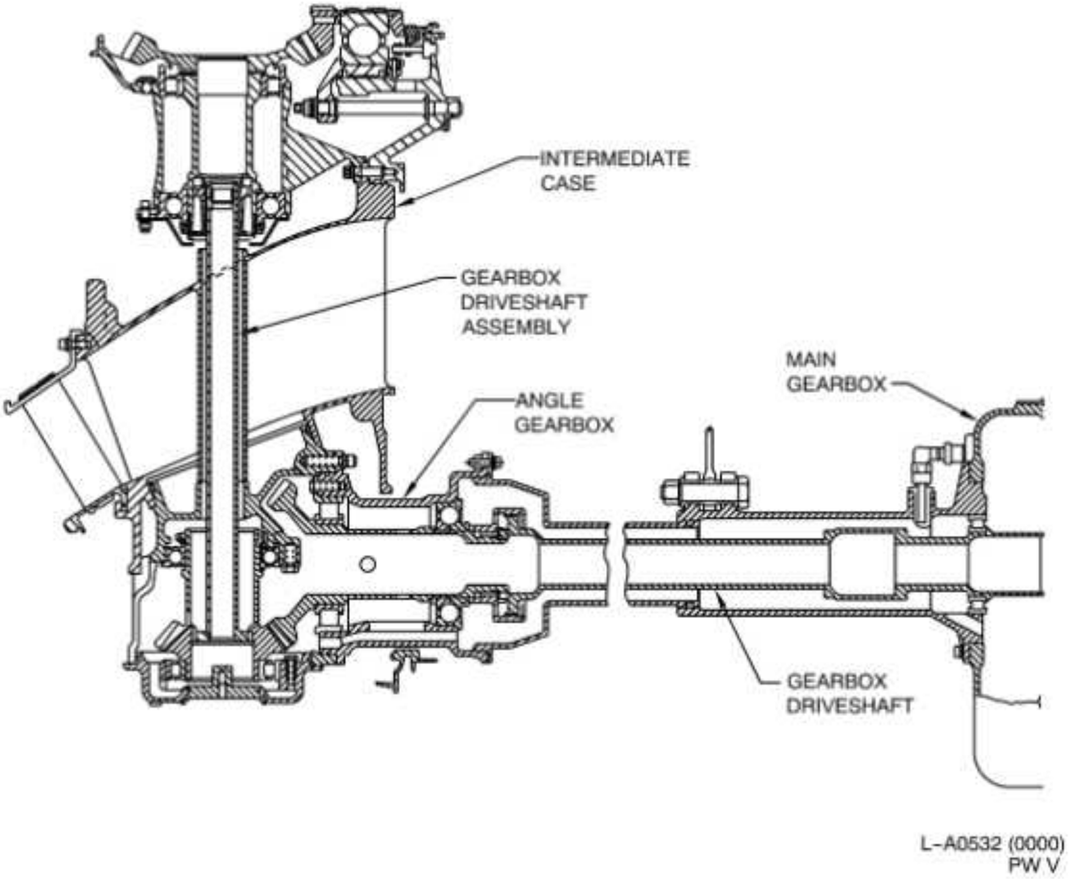
B. The angle gearbox is located between the intermediate case OD wall and the fan exit guide vane ID attachment at the bottom of the intermediate case.

C. The angle gearbox oil scavenge pump is located in the main oil/scavenge pump module mounted at the bottom rear of the main gearbox housing.

ANGLE GEARBOX − DESCRIPTION AND OPERATION



Angle Gearbox
Figure 1
(Task 72−62−00−990−002)


INTERMEDIATE CASE
GEARBOX DRIVESHAFT ASSEMBLY
MAIN GEARBOX
ANGLE GEARBOX
GEARBOX DRIVESHAFT
L−A0532 (0000)
PW V

Intermediate Case And
Gearboxes Crossection
Figure 2
(Task 72−62−00−990−002)

ANGLE GEARBOX - DISASSEMBLY-01

Task 72-62-00-030-001:

1. Disassemble Angle Gearbox

A. Equipment And Materials Required

Special Tools:

PWA 12126	Base
PWA 21500	Adapter
PWA 85413	Base
PWA 85414	Wrench
PWA 85415	Puller
PWA 85416	Plate
PWA 85417	Base
PWA 85418	Wrench
PWA 85419	Puller
PWA 85420	Plate
PWA 85421	Drift
PWA 85422	Drift
PWA 85443	Base
PWA 102112	Cradle, Support
PWA 102113	Puller, Jacscrew
PWA 102114	Pusher, Jackscrew

B. Procedure
See Figure 501.

Subtask 72-62-00-030-051:

(1) Remove two bolts securing angle gearbox (front Oil) nozzle assembly. Remove two bolts securing angle gearbox (rear oil) nozzle assembly. Carefully remove transfer tube and nozzles.

R NOTE: If the angle gearbox is the source of the metal in the system and there are pieces larger than a flake (such as a geartooth, washer, bolt, bearing part, etc.) then all liberated angle gearbox pieces larger than a flake must be found. If there are pieces larger than a flake that are not found, then the main gearbox must also be removed and disassembled sufficiently until the missing pieces are found. Refer to Section 72-00-00, Inspection/Check-04 (Task 72-00-00-280-054) for the definition of a flake.

ANGLE GEARBOX − DISASSEMBLY−01

R NOTE: If necessary, a Pratt & Whitney recommended
R cleaner to flush the gearbox can be found in
R Section 72−61−00, Cleaning−01 of the PW4000
R Series CIR, PN 51A357.

(2) Remove transfer tube from nozzles. Discard all packings.

(3) Remove bolt securing angle gearbox (coupling oil) nozzle adjacent to coupling. Remove nozzle and discard packing.

(4) Remove four bolts and washers securing angle gearbox cover assembly. Remove cover assembly. Discard packing.

(5) If necessary, remove the plug that is installed in the angle gearbox housing, approximately 180 degrees from the oil nozzle assembly.

(6) Remove the three bolts and washers (Pre SB PW4ENG 75−45 engines) or bracket (Post SB PW4ENG 75−45 engines) that attach the cover to the housing. Remove the cover and discard the packing.

Subtask 72−62−00−490−001:

(7) Prepare the support cradle for the removal of the cover assembly as follows.

- (a) Attach the PWA 102112 Support Cradle to the work bench.
- (b) Put the angle gearbox assembly on the support cradle with the mount lugs in the arms of the cradle.
- (c) If necessary, install the detail−2 plate to the base of the cradle and attach it with the detail screw and knob assembly.

Subtask 72−62−00−030−056:

(8) Remove the angle gearbox cover assembly as follows.

- (a) Remove the four bolts and washers that attach the angle gearbox cover assembly.

(b) Move the three detail jaws of the PWA 102113 Jackscrew Puller towards the center of the plate and tighten the knobs to hold the jaws in position.

(c) Install the three detail jaws of the puller in the opening of the angle gearbox cover assembly with the jackscrew in the slot of the detail−2 plate attached to the base of the cradle. Move the three detail jaws outward to engage the inner surface of the cover assembly. Tighten the knobs to lock the jaws in position.

(d) Turn the detail jackscrew of the puller with a wrench to remove the cover assembly. Remove the cover assembly from the jackscrew puller.

1 Remove and discard the packing from the groove of the cover assembly.

(e) If necessary, remove the detail−2 plate from the base of the cradle and attach it with the detail screw to the storage location on the base.

Subtask 72−62−00−030−052:

(9) Cut the lockwire and remove six bolts and washers securing the gearbox driveshaft housing assembly to the angle gearbox housing assembly. Put the angle gearbox on a work bench.

(a) Lower the PWA 102114 Pusher onto the gearbox so that the two detail "V" blocks are positioned on the two large pins that protude from the gearbox. If necessary, turn the detail jackscrew by hand so the detail ring will fit behind the flange of the housing. Make sure the two detail pins in the ring fit into the holes in the housing flange.

(b) Use a standard wrench to turn the detail jackscrew and dissassemble the two angle gearbox housings from one another.

(c) Separate the two assemblies and remove the PWA 102114 Pusher.

(d) Discard the packings.

ANGLE GEARBOX − DISASSEMBLY−01

Subtask 72−62−00−030−053:

(10) Install driveshaft housing in PWA 85413 Base bevel gear down.

(11) Unbend key washer. Install PWA 85414 Wrench with breaker bar to nut securing coupling on driveshaft. Loosen and remove nut and washer. Discard washer. Remove coupling.

(12) Install PWA 85415 Puller to grooves on ball bearing inner race. Remove inner race. Remove housing from driveshaft. Reinstall puller and remove remaining half of inner race. If necessary, use puller to remove spacer.

(13) Place two halves of PWA 85416 Plate under roller bearing inner race. Place driveshaft and plates on PWA 85443 Base. Using PWA 85422 Drift and arbor press remove shaft from bearing inner race.

(14) Unbend key washer tab and remove four bolts securing outer race and balls to housing. Remove outer race and balls. Discard key washers.

(15) Trunnion housing. Unbend key washer tabs, remove four bolts securing outer race (roller bearing) to housing. Remove outer race from housing. Discard key washers.

Subtask 72−62−00−030−054:

(16) Position angle gearbox housing assembly bottom end up. Unbend key washer tabs and remove three bolts securing bevel gear assembly to housing. Remove gear assembly. Discard key washer.

(17) Attach PWA 21500 Adapter to a workbench. Attach PWA 85417 Base to the adapter.

(18) Install gear assembly onto the base. Unbend key washer. Install PWA 85418 Wrench to retaining nut. Loosen and remove nut and washer. Discard washer.

(19) Install PWA 85419 Puller to inner race. Remove inner race. Remove outer race and balls. Reinstall puller to remove lower inner race. Remove spacer. Remove gear from base.

ANGLE GEARBOX − DISASSEMBLY−01

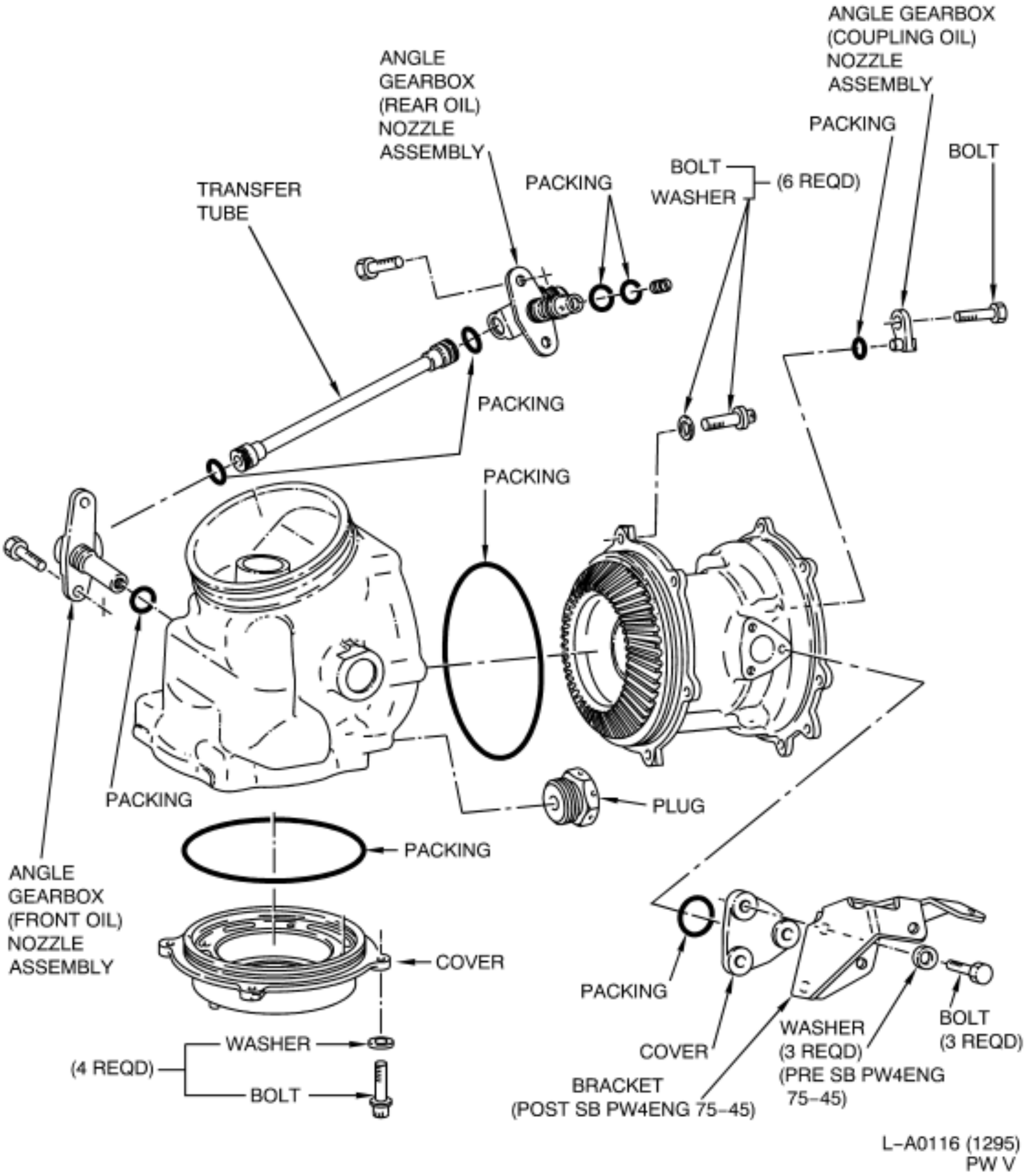
(20) Place two halves of PWA 85420 Plate under roller bearing inner race. Place shaft and plates on PWA 12126 Base. Using PWA 85421 Drift and arbor press, remove shaft from bearing inner race.

Subtask 72−62−00−030−055:

(21) Unbend key washer tabs and remove four bolts securing bearing to angle gearbox cover assembly. Lift off baffle from bearing retaining flange. Remove bearing from cover. Discard key washers.

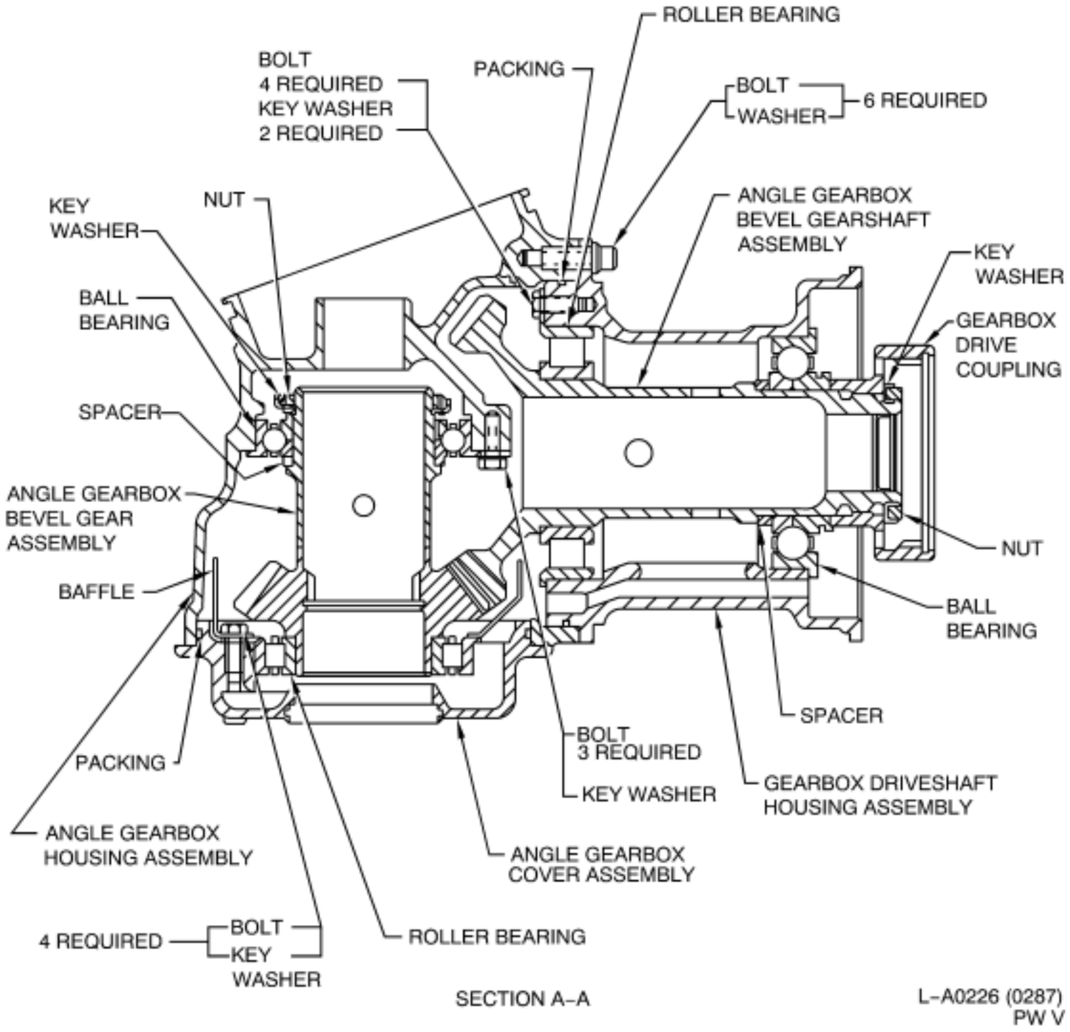
(22) Remove bolts and washers securing cover to cover assembly. Remove cover and discard packing.

ANGLE GEARBOX - DISASSEMBLY-01


ANGLE GEARBOX (COUPLING OIL) NOZZLE ASSEMBLY
ANGLE GEARBOX (REAR OIL) NOZZLE ASSEMBLY
PACKING
BOLT
TRANSFER TUBE
PACKING
BOLT
WASHER
(6 REQD)
PACKING
PACKING
PACKING
PLUG
PACKING
ANGLE GEARBOX (FRONT OIL) NOZZLE ASSEMBLY
COVER
WASHER
(4 REQD)
BOLT
PACKING
COVER
BRACKET (POST SB PW4ENG 75-45)
WASHER (3 REQD) (PRE SB PW4ENG 75-45)
BOLT (3 REQD)
L-A0116 (1295)
PW V

Angle Gearbox Disassembly
Figure 501 (Sheet 1)
(Task 72-62-00-030-001)

ANGLE GEARBOX - DISASSEMBLY-01


ROLLER BEARING
BOLT
4 REQUIRED
KEY WASHER
2 REQUIRED
PACKING
BOLT
WASHER
6 REQUIRED
KEY
WASHER
NUT
ANGLE GEARBOX
BEVEL GEARSHAFT
ASSEMBLY
KEY
WASHER
BALL
BEARING
GEARBOX
DRIVE
COUPLING
SPACER
ANGLE GEARBOX
BEVEL GEAR
ASSEMBLY
NUT
BAFFLE
BALL
BEARING
SPACER
BOLT
3 REQUIRED
KEY WASHER
PACKING
GEARBOX DRIVESHAFT
HOUSING ASSEMBLY
ANGLE GEARBOX
HOUSING ASSEMBLY
ANGLE GEARBOX
COVER ASSEMBLY
4 REQUIRED
BOLT
KEY
WASHER
ROLLER BEARING
SECTION A-A
L-A0226 (0287)
PW V

Angle Gearbox Disassembly
Figure 501 (Sheet 2)
(Task 72-62-00-030-001)

Previous Pageblock Return to Previous Menu Next Pageblock

ANGLE GEARBOX − INSPECTION/CHECK−01

Task 72−62−00−990−004:

1. General Inspection Requirements − Angle Gearbox

   A. Organization Of Individual Part Or Subassembly Inspection Data

      (1) Specific inspection functions for all significant parts/subassemblies are provided in individual Inspection/Check sections. Application of each inspection function is shown in Inspection/Check−00 for part/subassembly. Section designations and function descriptions are as follows.

      (2) Inspection/Check−00 section contains, where applicable:

         (a) Part number(s) for which the inspection data is applicable.

         (b) Service Bulletin numbers applicable to part number(s).

         (c) Inspection/Check numbers, data categories and applicability data.

      (3) Inspection/Check−01, Preinspection Preparation, contains, where applicable:

         (a) General inspection comments, notes, CAUTIONS, etc., which supplement data contained in this section.

         (b) Identification of mechanical disassembly required prior to inspection.

         (c) Identification of any surface treatment or coating removal, or other actions required prior to inspection.

         (d) Identification of part/subassembly cleaning required prior to inspection.

      (4) Inspection/Check−02, Nondestructive Inspection, contains the following nondestructive inspection methods, part/subassembly special attention areas and damage limits (as applicable):

         (a) Fluorescent Penetrant Method

         (b) Eddy Current Method

  - (c) Magnetic Particle Method
  - (d) X−ray Method
  - (e) Ultrasonic Method
  - (f) Hardness Check
  - (g) Other − As specified.

(5) Inspection/Check−03, Visual Inspection contains, where applicable:

  - (a) Visual inspection requirements which can be accomplished with or without magnification or special lighting (as specified).

    NOTE: Use of inspection tools may be required as a supplement to visual inspection process.

  - (b) Allowable blending for visual damage, which may be accomplished within the inspection area.

    NOTE: Blending requirement will also be shown in applicable repairs.

(6) Inspection/Check−04, Dimensional Inspection, contains, where applicable:

  - (a) Dimensional inspection requirements other than visual inspection. The requirements will include applicable fits and clearances, and other dimensional inspections necessary to ensure the part integrity and proper functioning.

(7) Inspection/Check−05, Functional Check Inspection contains, where applicable:

  - (a) Procedures, limits, and equipment used with any required functional checks (oil flow, air flow, leak, etc.).

(8) Inspection/Check−06, Inspection Postrequisites contains, references to procedures required to return part/ subassembly to serviceable condition. References include the following, as required.

  - (a) Reassembly

(b) Protective coatings, sealants and/or lubricant reapplication

B. Thorough and intelligent part/subassembly inspection is of major importance in achieving efficient engine operation and satisfactory service life. Inspection personnel should be thoroughly familiar with inspection procedures, inspection tooling, limits associated with normal and, where applicable, unusual operating conditions, limits associated with repairs, and with inspection procedures published in Standard Practices Manual.

C. During preliminary inspection of part/subassembly, comparison with mating or adjacent parts may provide indication of source of wear or damage. This procedure may indicate requirement for additional disassembly and inspection.

D. During inspection, records should be kept of deviations beyond serviceable limits to determine: (a) if part/subassembly will be repaired or replaced, and (b) if part is reparable, which repairs are required. Suitable documentation should accompany part/subassembly with results of this determination.

E. Inspection of individual part/subassembly dimensions which are also in Fits and Clearances will include Fits and Clearance Reference Numbers and will show new part/subassembly dimension unless specifically stated otherwise. Inspection Frequency Requirements (IFR) codes (for IFR Code A parts only) are included with Reference Number data. If acceptable dimensional deviations or results of repair affect Fits and Clearances, suitable documentation should accompany part/subassembly to ensure check of fit or clearance at final assembly.

NOTE: Parts/subassemblies which deviate dimensionally from new part/subassembly values may be acceptable provided required fit or clearance is achieved at final assembly.

F. Dimensional inspection requirements will be accompanied by part/subassembly constraint data if such constraint requirements are required during part/subassembly manufacture. Adherence to constraint requirements when inspecting service operated parts/subassemblies should be dictated by experience. It is recommended that parts/subassemblies which do not meet dimensional inspection requirements in free state be constrained and re−measured prior to initiation of any repair or re−use activity.

G. Dimensional inspections of one detail of a subassembly, prior to removal from subassembly, may produce incorrect data due to constraint forces from mating details. If questionable data is obtained, subassembly should be disassembled and inspections repeated.

H. Dimensional inspection limits in inspection text provide continued use (as is) and, if applicable, repair limits. Parts/subassemblies which exceed both limits and nonreparable parts/subassemblies which exceed (as is) limits are unserviceable.

I. Inspections required to verify integrity of repair are contained within repair procedure. Unless otherwise stated, repaired part is expected to meet all inspection requirements contained in inspection text for part/subassembly.

J. Parts/subassemblies which do not require repairs except for those provided in Standard Practices Manual are identified by Chapter/Section/Subject Number 72−62−99 in cleaning table (Cleaning−01) and nondestructive inspection table (Inspection/Check−02). Determination of serviceability for those parts listed in 72−62−99 is limited to cleaning, non−destructive inspection, and the following:

(1) Visually inspect parts/subassemblies for surface defects, deformations, cuts, improper threads or wrenching surfaces, incomplete or missing protective coatings or other damage which will prevent proper functioning and make part/subassembly unserviceable. Unserviceable parts/subassemblies should not be reinstalled. Repair unserviceable parts/subassemblies per Standard Practices Manual, as applicable.

(2) Parts/subassemblies with crack indications to any length or depth detected by listed nondestructive inspection are unserviceable, and should not be reinstalled.

ANGLE GEARBOX − INSPECTION/CHECK−01

K. When new part/subassembly is to be installed and it is important that it be identified as to engine number or position in engine, mark it by appropriate method described in Marking of Parts, 70−11, Standard Practices Manual.

L. In order to eliminate confusion and to maintain consistent terminology, various physical conditions which might be encountered during inspection of parts/subassemblies and explanation of unusual causes of such conditions are defined in Physical Inspection, 70−31, Standard Practices Manual.

M. If inspection reveals it necessary to replace fitted spacer, tag spacer to indicate that replacement must be made with spacer of correct classification at assembly.

N. If text refers to superficial or shallow imperfection, following definitions apply:

  (1) A superficial imperfection is defined as a nick, dent, scratch, toolmark, etc., which disrupts the surface but does not appear to penetrate surface roughness texture.

  (2) A shallow imperfection appears to penetrate surface finish texture, but does not have a dark bottom and would not cause a 0.007 inch (.178 mm) radius stylus to hesitate if passed over it.

Previous Pageblock Return to Previous Menu Next Pageblock

ANGLE GEARBOX − INSPECTION/CHECK−03

Task 72−62−00−990−005:

1. Visual Inspection − Angle Gearbox
   A. For inspection requirements applicable to installed (accessible) parts of Angle Gearbox see 72−00−62, Inspection/Check−02 (Task 72−00−62−210−001).

Previous Pageblock Return to Previous Menu Next Pageblock

ANGLE GEARBOX − INSPECTION/CHECK−04

Task 72−62−00−990−006:

1. Specific Fits And Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in inches, and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or parts concerned. Chapter/section/subject number identification for each part or assembly is included in parenthesis for reference purposes. Additional inspection information is provided in the specific manual sections identified.

(6) Fits and clearances requirement which affect an engine accessory or component have the designation CMM in parenthesis following the part nomenclature. This designation is used for components which are not assigned an Engine Manual chapter/section/subject number. Information concerning these parts is located in the appropriate Component Maintenance Manual (CMM).

B. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

C. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements. Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair. Definitions for these codes are as follows:

IFR Code	Definition
A	Clearance or fit is calculated from part measurements at each assembly of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part assembly.
B	Clearance or fit is estimated at each assembly of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if estimating procedure indicates that clearance or fit can be outside specified tolerance.
C	Clearance or fit is not subject to change in normal engine operation.

D. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the Minimum and Maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

E. Limits

(1) Limits applicable to any combination of new or used parts.

(a) This column provides the acceptable (minimum − maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b) The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c) Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE: In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows:

0.517 (13.131) (−) 0.512 (13.005) = .005 (0.126)

0.527 (13.385) (−) 0.508 (12.903) = .019 (0.482)

EXAMPLE 2

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE: In Example 2 limits represent less restrictive values as indicated by the asterisk(*).

(2) Limits for selective application to engines scheduled for partial refurbishment.

(a) A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
1812		Bearing	0.508 (12.903)	0.512 (13.005)		
		Support	0.517 (13.131)	0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					[.005 [(0.13)	.022] (0.56)]

NOTE: In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

F. Part Dimensions

(1) Detail part dimensions that measure outside the Reference dimensions of the Table Of Limits are permissible if the related Fit/or Clearance with the mating part is in limits. The part must also be in limits for any allowable growth/or shrinkage.

G. Fits And Clearances

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
108	B	Angle Gearbox Ball Bearing (72−62−04) Angle Gearbox Housing Assembly (72−62−01) (See Figure 801)				
		Bearing	3.9367 (99.9922)	3.9371 (100.0023)		
		Housing	3.9373 (100.008)	3.9385 (100.037)	.0002 (0.006)	.0023* (0.058)*

Ref. No.	I F R	Description	New Part Reference Dimensions		Limits	
			Min	Max	Min	Max
109	A	Angle Gearbox Bevel Gear Assembly (72−62−02) Angle Gearbox Ball Bearing (72−62−04) (See Figure 801)				
		Gear	2.5592 (65.0037)	2.5597 (65.0163)		
		Bearing	2.5587 (64.9910)	2.5591 (65.0011)	.0010T (0.0254T)	.0001T (0.0026T)
110	B	Angle Gearbox Bevel Gear Assembly (72−62−02) Ring Spacer (72−62−08) (See Figure 801)				
		Gear	2.5592 (65.0037)	2.5597 (65.0163)		
		Spacer	2.5598 (65.019)	2.5613 (65.057)	.0001 (0.003)	.0021 (0.053)
111	B	Angle Gearbox Roller Bearing (72−62−04) Angle Gearbox Cover Assembly (72−62−10) (See Figure 801)				
		Bearing	3.9367 (99.9922)	3.9371 (100.0023)		
		Cover	3.9373 (100.008)	3.9385 (100.037)	.0002 (0.006)	.0018 (0.045)
112	B	Plug (Angle Gearbox Cover) (72−62−80) Angle Gearbox Cover Assembly (72−62−10) (See Figure 801)				
		Plug	2.488 (63.196)	2.490 (63.246)		
		Cover	2.492 (63.297)	2.496 (63.398)	.002 (0.051)	.008 (0.203)
113	A	Angle Gearbox Bevel Gear Assembly (72−62−02) Angle Gearbox Roller Bearing (72−62−04) (See Figure 801)				
		Gear	2.5601 (65.0266)	2.5606 (65.0392)		
		Bearing	2.5587 (64.9910)	2.5591 (65.0011)	.0019T (0.0482T)	.0010T (0.0254T)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
114	B	Gearbox Drive Shaft Housing Assembly (72−62−12) Angle Gearbox Housing Assembly (72−62−01) (See Figure 801)				
		Shaft Hsg.	6.4075 (162.751)	6.4087 (162.780)		
		Gearbox Hsg.	6.4082 (162.769)	6.4110 (162.839)	.0005T (0.013T)	.0035* (0.089)*
115	B	Angle Gearbox Ball Bearing (72−62−04) Gearbox Drive Shaft Housing Assembly (72−62−12) (See Figure 801)				
		Bearing	4.3304 (109.9922)	4.3308 (110.0023)		
		Housing	4.3310 (110.008)	4.3322 (110.037)	.0002 (0.006)	.0018 (0.045)
116	B	Angle Gearbox Bevel Gearshaft Assembly (72−62−03) Gearbox Drive Coupling (72−62−13) (See Figure 801)				
		Gearshaft	2.3623 (60.0025)	2.3628 (60.0151)		
		Coupling	2.3608 (59.965)	2.3623 (60.002)	.002T (0.050T)	.000 (0.000)
117	A	Angle Gearbox Bevel Gearshaft Assembly (72−62−03) Angle Gearbox Ball Bearing (72−62−04) (See Figure 801)				
		Gearshaft	2.3623 (60.0025)	2.3628 (60.0151)		
		Bearing	2.3618 (59.9898)	2.3622 (59.9998)	.0010T (0.0254T)	.0001T (0.0026T)
118	B	Angle Gearbox Bevel Gearshaft Assembly (72−62−03) Ring Spacer (72−62−08) (See Figure 801)				
		Gearshaft	2.3623 (60.0025)	2.3628 (60.0151)		
		Ring	2.3629 (60.018)	2.3644 (60.055)	.0001 (0.003)	.0021 (0.053)

ANGLE GEARBOX − INSPECTION/CHECK−04

	Ref. No.	I F R	Description	New Part Reference Dimensions Min	Max	Limits Min	Max
	119	A	Angle Gearbox Bevel Gearshaft Assembly (72−62−03) Angle Gearbox Roller Bearing (72−62−04) (See Figure 801)				
			Gearshaft	2.7569 (70.0253)	2.7574 (70.0379)		
			Bearing	2.7555 (69.9897)	2.7559 (69.9998)	.0019T (0.0482T)	.0010T (0.0254T)
	120	B	Roller Bearing (72−62−04) Gearbox Drive Shaft Housing Assembly (72−62−12) (See Figure 801)				
			Bearing	4.7241 (119.9922)	4.7245 (120.0023)		
			Housing	4.7247 (120.008)	4.7259 (120.037)	.0002 (0.006)	.0018 (0.045)
	121	B	Angle Gearbox Housing Assembly (72−62−01) Compressor Intermediate Case Assembly (72−34−01) (See Figure 801)				
			Housing	5.998 (152.350)	6.000 (152.400)		
			Case	6.001 (152.426)	6.005 (152.527)	.001 (0.026)	.007 (0.177)
R	122	B	Pin, Hollow (Angle Gearbox Mounting) (72−34−51) Bushing (72−34−52) (See Figure 802)				
R			Pin	1.0015 (25.4381)	1.0020 (25.4508)		
R			Bushing	1.0025 (25.464)	1.0040 (25.501)	.0005 (0.013)	.0025 (0.063)
	123	B	Angle Gearbox Cover Assembly (72−62−10) Angle Gearbox Housing Assembly (72−62−01) (See Figure 801)				
			Cover	6.1215 (155.487)	6.1227 (155.516)		
			Housing	6.1232 (155.530)	6.1250 (155.575)	.0005 (0.013)	.0035 (0.088)

Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
141	B	Pin, Hollow (Angle Gearbox Mounting) (72-34-51) Bushing (ID), Angle Gearbox Housing (72-62-01) (See Figure 802)				
		Pin	1.0015 (25.4381)	1.0020 (25.4508)		
		Bushing	.999 (25.375)	1.001 (25.425)	.0005T (0.013T)	.0030T (0.076T)

H. Spline Data

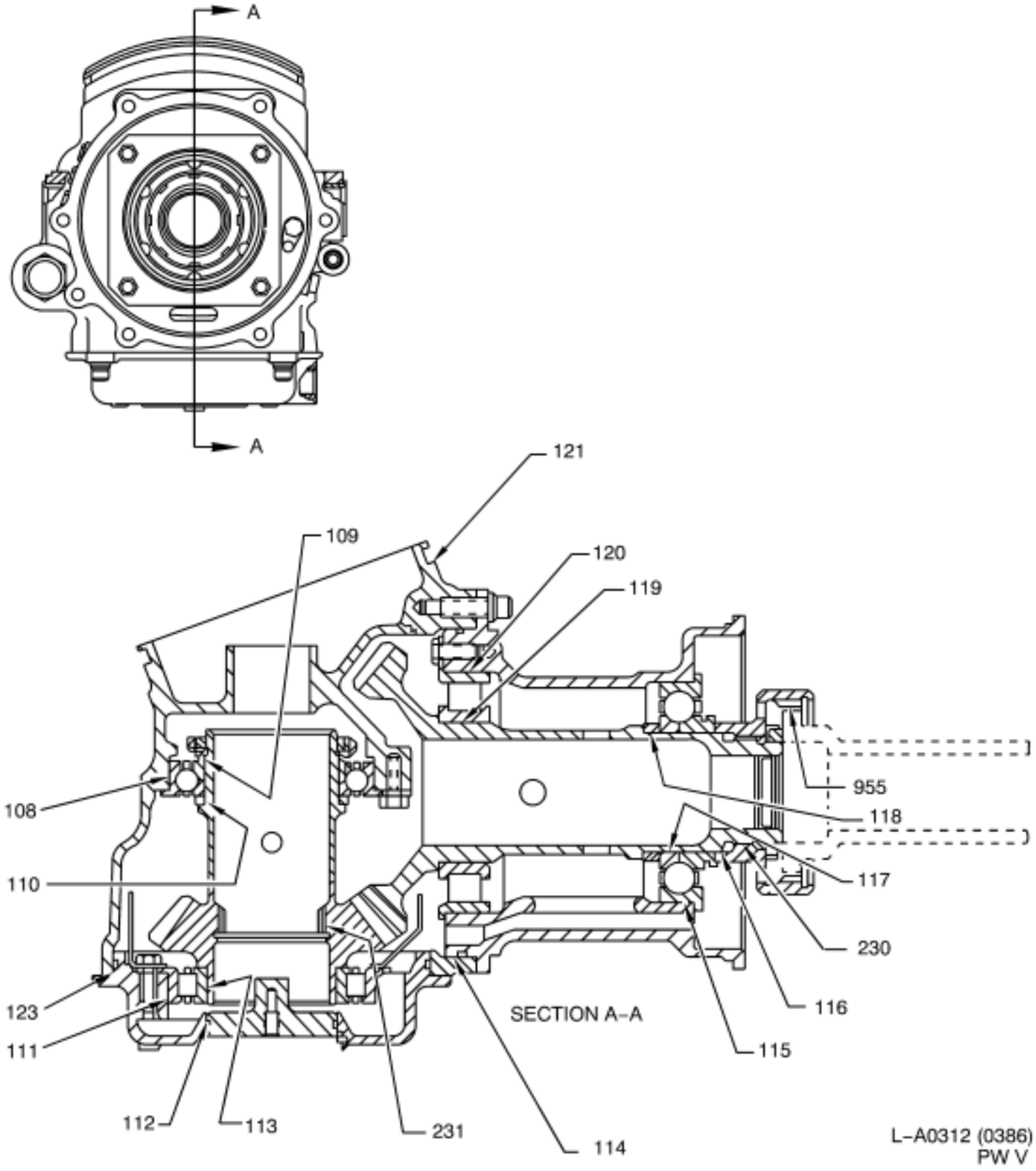
Ref. No.	I F R	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
230	B	1. Gearbox Drive Coupling (72-62-13) Internal Spline (See Figure 801)				
		A. Effective Space Width	.0982 (2.494)	---		
		B. Actual Space Width	---	.1012 (2.570)		
		2. Angle Gearbox Bevel Gearshaft Assembly (72-62-03) External Spline (See Figure 801)				
		A. Effective Tooth Thickness	---	.0967 (2.456)		
		B. Actual Tooth Thickness	.0937 (2.380)	---		
		3. Fit			.0015 (0.038)	---

ANGLE GEARBOX − INSPECTION/CHECK−04

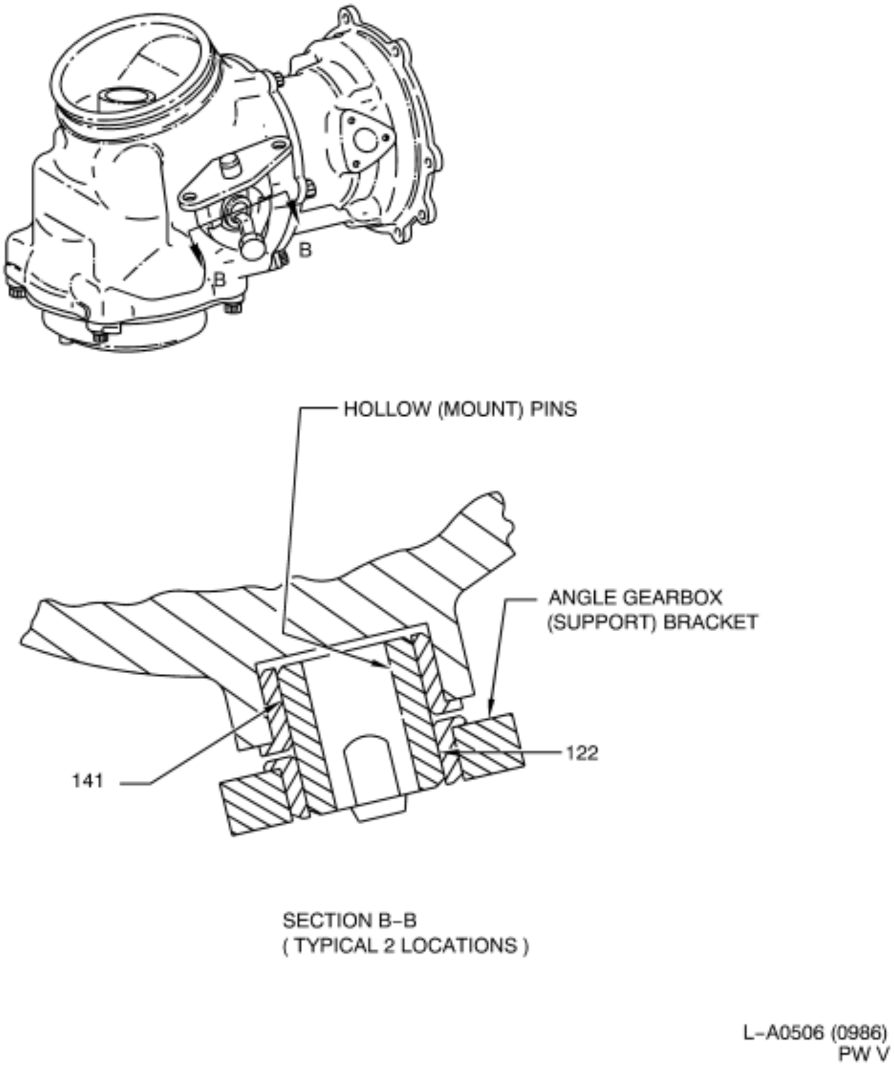
Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
231	B	1. Angle Gearbox Bevel Gear Assembly (72−62−02) Internal Spline (See Figure 801)				
		A. Effective Space Width	.0915 (2.324)	−−−		
		B. Actual Space Width	−−−	.0946 (2.403)		
		2. Gearbox Driveshaft Assembly (72−34−53) External Spline (See Figure 801)				
		A. Effective Tooth Thickness	−−−	.0875 (2.222)		
		B. Actual Tooth Thickness	.0845 (2.146)	−−−		
		3. Fit			.004 (0.102)	−−−
955	B	1. Gearbox Drive Coupling (72−62−13) Internal Spline (See Figure 801)				
		A. Effective Space Width	.1309 (3.325)	−−−		
		B. Actual Space Width	−−−	.1344 (3.414)		
		2. Gearbox Drive Shaft (72−61−80) External Spline (See Figure 801)				
		A. Effective				

ANGLE GEARBOX − INSPECTION/CHECK−04

Ref. No.	IFR	Description	New Part Reference Dimensions Min	New Part Reference Dimensions Max	Limits Min	Limits Max
(CONTINUED)						
		Tooth Thickness	---	.1274 (3.236)		
		B. Actual Tooth Thickness	.1239 (3.147)	---		
		3. Fit			.0035 (0.089)	---


A
A
121
109
120
119
108
955
118
110
117
230
123
116
111
SECTION A-A
115
112
113
231
114
L-A0312 (0386)
PW V

Angle Gearbox
Figure 801
(Task 72-62-00-990-006)


B
B
HOLLOW (MOUNT) PINS
ANGLE GEARBOX
(SUPPORT) BRACKET
122
141
SECTION B−B
(TYPICAL 2 LOCATIONS)
L−A0506 (0986)
PW V

Angle Gearbox
Figure 802
(Task 72−62−00−990−006)

ANGLE GEARBOX - ASSEMBLY-01

Task 72-62-00-400-001:

1. Assemble Angle Gearbox Assembly

A. Prerequisites

(1) Assemble cover, bearing and baffle. See Assembly-03 Task 72-62-00-400-003.

(2) Assemble angle gearbox bevel gearshaft assembly and gearbox driveshaft housing assembly. See Assembly-04 Task 72-62-00-400-004.

(3) Assemble angle gearbox bevel gear assembly and angle gearbox housing assembly. See Assembly-05 Task 72-62-00-400-005.

B. Equipment And Materials Required

Standard Tools:

Bergen Mechanical Crimper (Optional) Model M303, M305 or M307

Special Tools:

PWA 85448	Fixture, Backlash
PWA 88697	Fixture, Backlash
PWA 102112	Cradle Support

Consumable Materials:

Item No.	Designation
P03-001	Oil, Engine (PWA 521B)
P05-289	Lockwire (AS3214-02)
P05-291	Cable, Safety (Optional)
P05-292	Ferrule, Safety Cable (Optional)
R P06-054	Paste, Anti-Seize (PWA 36246)
P09-016	Compound, Anaerobic Retaining (PWA 549-2)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Packing	1	72-62-00/5/1
Packing	1	72-62-00/5/60
Packing	2	72-62-00/5/100
Packing	1	72-62-00/5/130
Packing	1	72-62-00/5/170
Packing	1	72-62-00/5/180

C. Procedure
See Figure 1001 and Figure 1002.

Subtask 72-62-00-430-058:

(1) Assemble the angle gearbox housing assembly to the gearbox driveshaft housing assembly with six bolts, threads lubricated with Anti-Seize Paste P06-054 and washers. Remove the unwanted paste. Tighten and torque bolts to 125 - 140 lb-in. (14.123 - 15.818 N.m). Install the Lockwire P05-289 or Safety Cable P05-291 and Safety Cable Ferrule P05-292 to safety the bolts.

(2) Assemble cover with baffle and bearing to bottom of gearbox housing assembly. Secure cover with four bolts, threads lubricated with Anti-Seize Paste P06-054 and washers. Remove the unwanted paste. Tighten and torque bolts to 125 - 140 lb-in. (14.123 - 15.818 N.m).

Subtask 72-62-00-430-059:

(3) Install packing lubricated with Engine Oil P03-001, to groove on angle gearbox (coupling oil) nozzle.

(4) Insert nozzle into coupling end of gearbox and secure with bolt, threads lubricated with Anti-Seize Paste P06-054. Remove the unwanted paste. Tighten and torque bolt to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(5) If necessary, apply Retaining Compound P09-016 to the threads of the plug. Install the plug to the angle gearbox housing as shown in Figure 1001 (Sheet 2). Torque the plug to 100 - 150 lb-in. (11.298 - 16.948 N.m).

(6) Install packing lubricated with Engine Oil P03-001, to groove on cover.

(7) Insert cover into opening on left side of driveshaft housing. Secure with three bolts, lubricated with Engine Oil P03-001, and washers (Pre SB PW4ENG 75-45 engines) or bracket (Post SB PW4ENG 75-45 engines). Torque the bolts to 62 - 72 lb-in (7.005 - 8.135 N.m).

(8) Install packing lubricated with Engine Oil P03-001, to each end of transfer tube assembly. Install two packings, lubricated with Engine Oil P03-001, to (rear oil) nozzle assembly. Install packing, lubricated with Engine Oil P03-001, to (front oil) nozzle assembly.

(9) Install each end of transfer tube into front and rear nozzle assemblies. Insert nozzles and tube assembly into driveshaft housing (right side of gearbox). Secure nozzles with two bolts, lubricated with
R Anti-Seize Paste P06-054. Remove the unwanted paste. Tighten and torque bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m).

(10) Install the angle gearbox in the PWA 102112 Support Cradle as follows. See Figure 1002.

  (a) Attach the support cradle (PWA 102112) to the work bench. Put the detail support in the vertical position.

  (b) Put the angle gearbox assembly on the support cradle with the mount lugs in the arms of the cradle. Put the gearbox driveshaft housing on the vertical detail support.

  (c) If necessary, remove the detail screw and loosen the hand knob that attaches the detail-2 plate in the upright position on the base of the cradle. Attach the plate to the storage location on the base.

(11) Install PWA 88697 Fixture on the angle gearbox as follows. See Figure 1002.

  (a) Remove the detail hand knob, thrust bearing, hex nut, jaws, and plunger that are at one end of the detail center rod.

ANGLE GEARBOX - ASSEMBLY-01

(b) Install the detail force gage and center rod subassembly on top of the gearbox.

(c) Install the detail plunger and jaws on the center rod and against the vertical gearshaft.

(d) Install the detail hex nut on the center rod. While you hold the detail jaws and plunger against the gearshaft, turn the detail nut clockwise to expand the jaws against the ID of the gearshaft splines.

(e) Install the detail bracket over the center rod. With the detail pin in the jaws aligned with the slot in the bracket, attach the bracket to the angle gearbox.

(f) Install the detail thrust bearing and hand knob on the center rod. Turn the hand knob until the force gage shows a load of 28 - 32 lb (124.5 - 142.3 N) force.

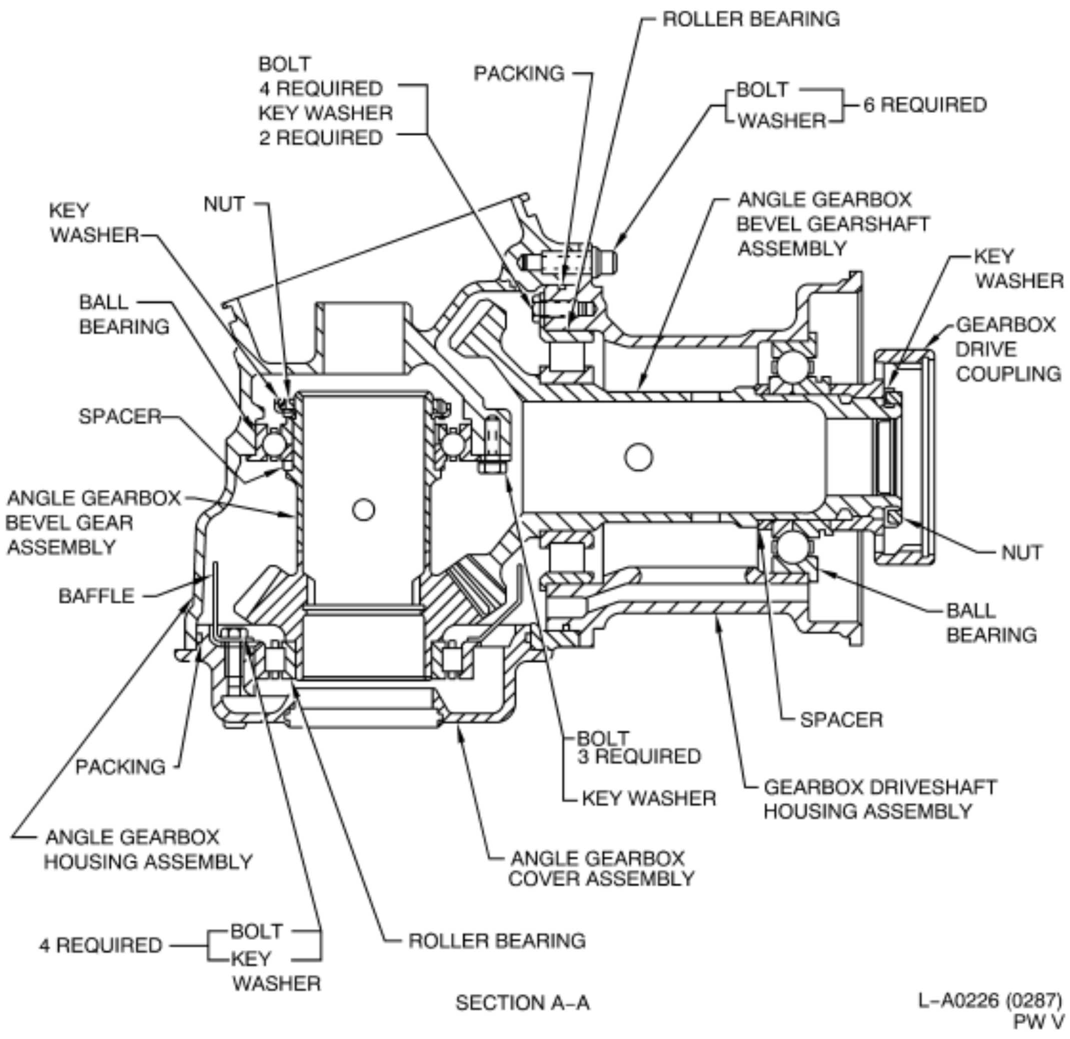
(g) Tighten the detail screw of the bracket to lock the detail pin in position in the slot.

(12) Attach plate of PWA 85448 Fixture to angle gearbox with six bolts. Slide ring assembly onto coupling outer diameter and secure in place with jaws. Lock in place using nuts. Tighten knob on force gage to exert 28 - 32 lb (124.5 - 142.3 N) force to bearing and gear.

(13) Measure the backlash at the pin. If the gear set in the angle gearbox is Pre SB PW4ENG 72-278, the backlash must be 0.0124 - 0.0262 inch (0.31 - 0.67 mm). If the gear set in the angle gearbox is Post SB PW4ENG 72-278, the backlash must be 0.0116 - 0.0226 inch (0.30 - 0.57 mm).

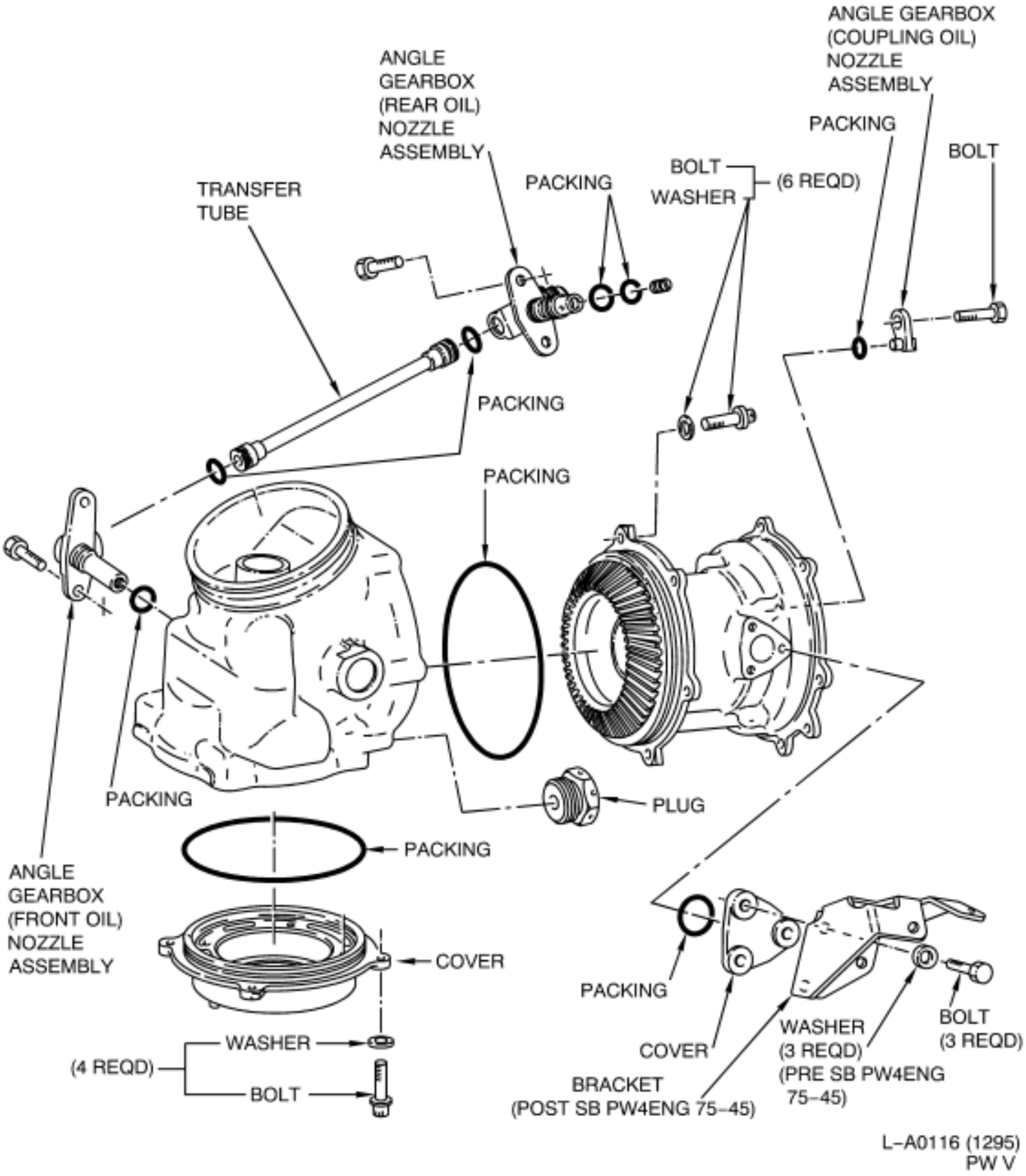
(14) Remove tooling and install protective closures.

R
R


ROLLER BEARING
BOLT
4 REQUIRED
KEY WASHER
2 REQUIRED
PACKING
BOLT
WASHER
6 REQUIRED
KEY
WASHER
NUT
ANGLE GEARBOX
BEVEL GEARSHAFT
ASSEMBLY
BALL
BEARING
KEY
WASHER
GEARBOX
DRIVE
COUPLING
SPACER
ANGLE GEARBOX
BEVEL GEAR
ASSEMBLY
NUT
BAFFLE
BALL
BEARING
SPACER
BOLT
3 REQUIRED
PACKING
KEY WASHER
GEARBOX DRIVESHAFT
HOUSING ASSEMBLY
ANGLE GEARBOX
HOUSING ASSEMBLY
ANGLE GEARBOX
COVER ASSEMBLY
4 REQUIRED
BOLT
KEY
WASHER
ROLLER BEARING
SECTION A-A
L-A0226 (0287)
PW V

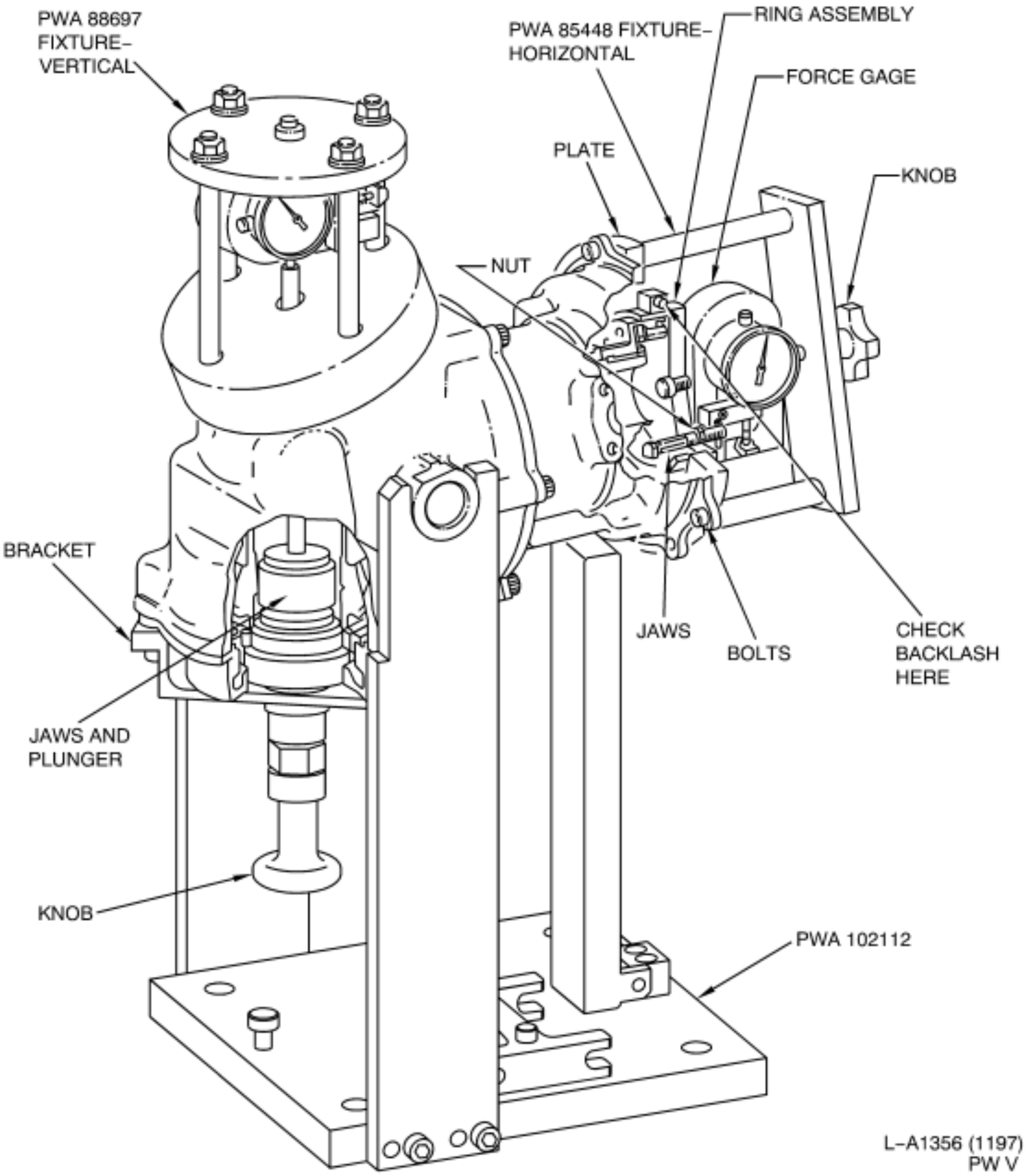
Assemble Angle Gearbox Assembly
Figure 1001 (Sheet 1)
(Task 72-62-00-400-001)

ANGLE GEARBOX − ASSEMBLY−01


ANGLE GEARBOX (COUPLING OIL) NOZZLE ASSEMBLY
ANGLE GEARBOX (REAR OIL) NOZZLE ASSEMBLY
PACKING
BOLT
WASHER
(6 REQD)
TRANSFER TUBE
PACKING
BOLT
PACKING
PACKING
PACKING
PLUG
PACKING
ANGLE GEARBOX (FRONT OIL) NOZZLE ASSEMBLY
COVER
WASHER
(4 REQD)
BOLT
PACKING
COVER
WASHER (3 REQD) (PRE SB PW4ENG 75−45)
BOLT (3 REQD)
BRACKET (POST SB PW4ENG 75−45)
L−A0116 (1295)
PW V

Assemble Angle Gearbox Assembly
Figure 1001 (Sheet 2)
(Task 72−62−00−400−001)

ANGLE GEARBOX - ASSEMBLY-01


PWA 88697 FIXTURE-VERTICAL
PWA 85448 FIXTURE-HORIZONTAL
RING ASSEMBLY
FORCE GAGE
PLATE
KNOB
NUT
BRACKET
JAWS
BOLTS
CHECK BACKLASH HERE
JAWS AND PLUNGER
KNOB
PWA 102112
L-A1356 (1197)
PW V

Angle Gearbox Backlash Measurement
Figure 1002
(Task 72-62-00-400-001)

Previous Pageblock Return to Previous Menu Next Pageblock

Task 72-62-00-400-002:

1. Determine Angle Gearbox Spacers

A. Equipment And Materials Necessary

Special Tools:
PWA 85447 Weight And Holder
PWA 85454 Change Letter C Thickness Gage

Consumable Materials:

	Item No.	Designation
R	P06-054	Paste, Antiseize (PWA 36246)

B. Procedure

Subtask 72-62-00-430-060:

(1) Determine Spacer C. See Figure 1001.

(a) Measure Dimension G on the bevel gear assembly. Write the dimension.

(b) Measure Dimension H. Use PWA 85447 Weight. See Figure 1002.

1 Put the detail rest (No. 1) on a surface plate.

2 Put Bearing R, puller groove up, on the detail rest.

3 Put the weight and holder, three legs down, on the bearing.

4 Look through the slots in the detail rest. Measure and write Dimension H.

(c) Measure Dimension P. Use PWA 85454 Change Letter C Gage.

1 Install PWA 85454 Change Letter C Gage, detail-1, in the angle gearbox housing assembly. Attach it to the housing assembly with the detail bolts and washers.

2 Zero out the indicator, detail-9.

3 Install details−4, −5 and −14 into the gearbox driveshaft housing assembly.

4 Install the gearbox driveshaft housing assembly into the angle gearbox housing assembly. Apply
R Antiseize Paste P06−054 to six bolts. Wipe off
R unwanted paste. Attach the housing assemblies together with six washers and the six bolts. Tighten and torque the bolts to 125 − 140 lb−in. (14.123 − 15.818 N.m).

5 Adjust the window openings in details−5 and −14 to be able to see the indicator detail−9.

6 Keep close contact between details−1 and −14.

7 Depress spring loaded indicator rod detail−4 to the stop pin detail−7. Rotate the indicator in a clockwise direction over arc on detail−1. Read the difference from the basic setting. Add or subtract, as necessary, this number from 1.7500 inch (44.450 mm). Note the indicator direction. The resulting number Equals P.

(d) Determine J. Refer to the formula below.

FORMULA (INCHES)
J = P + (F − 1.7500) − (G + H) +/− .001
F = See Figure 1003 (F = 3.4500 at assembly at 70 Degrees F).
G = Shoulder−to−shoulder dimension on the bevel gear assembly
H = Dimension on Bearing R with a 9 − 13 pound force applied in Directions K and L. See Figure 1002.
P = 1.7500 inch ± the indicator reading

FORMULA (METRIC)
J = P + (F − 44.450 mm) − (G + H) +/− 0.025
F = See Figure 1003 (F = 87.630 at assembly at 21.15 Degrees C.
G = Shoulder−to−shoulder dimension on the bevel gear assembly
H = Dimension on Bearing R with a 40.0 − 57.8 N force applied in Directions K and L. See Figure 1002.
P = 44.450 mm ± the indicator reading

Subtask 72−62−00−430−061:

(2) Determine Spacer B. See Figure 1001 and Figure 1004.

(a) Measure Dimension M on the bevel gearshaft assembly. Write the dimension.

(b) Measure and write Dimension D. Use Weight PWA 85447. D = Dimension on Bearing N with a 9 − 13 pound force applied in Directions M and N. See Figure 1002.

1 Put the detail rest (No. 2) on a surface plate.

2 Put Bearing N, puller groove up, on the detail rest.

3 Put the weight and holder, four legs down, on the bearing.

4 Look through the slots in the detail rest. Measure and write Dimension D.

(c) Measure and record Dimensions V and W

(d) Determine E. Refer to the formula that follows.

FORMULA (INCHES)
E = (R + S) − (A + M + D) +/− .001
a = See Figure 1005 (A = 3.2200 at assembly at 70 Degrees F).
M = Shoulder−to−shoulder dimension on the bevel gearshaft assembly
D = Dimension on Bearing N with a 9 − 13 pound force applied in the Directions M and N.
R = Dimension stamped on detail−1
S = Dimension V minus Dimension W.

FORMULA (METRIC)
E = (R + S) − (A + M + D) +/− 0.025
a = See Figure 1005 (A = 81.788 at assembly at 21.15 Degrees C.
M = Shoulder−to−shoulder dimension on the bevel gearshaft assembly
D = Dimension on Bearing N with a 40.0 − 57.8 N force applied in the Directions M and N.
R = Dimension stamped on detail−1
S = Dimension V minus Dimension W.

Subtask 72-62-00-430-062:

(3) Grind the spacers to Values J and E. One face of the spacer must be flat within 0.0002 inch (0.0051 mm). The other face must be parallel within 0.0002 inch (0.0051 mm).

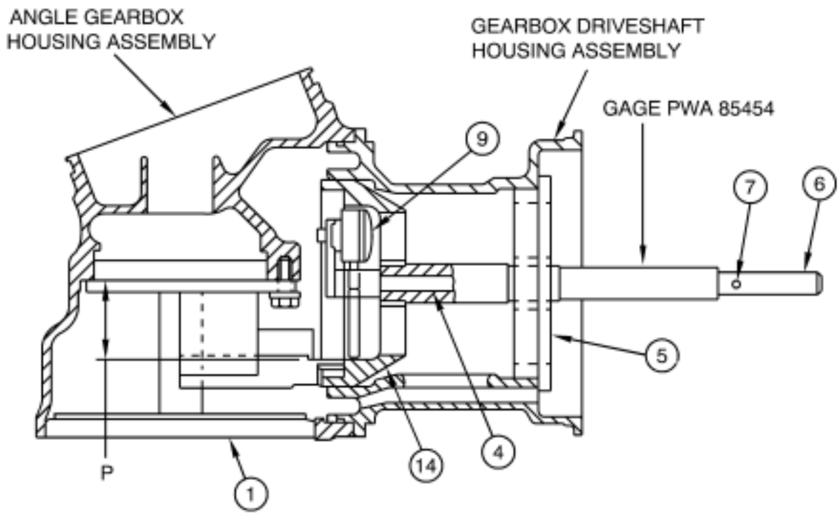
C. Postrequisites

(1) Assemble cover, bearing and baffle. See Assembly-03 (Task 72-62-00-400-003).

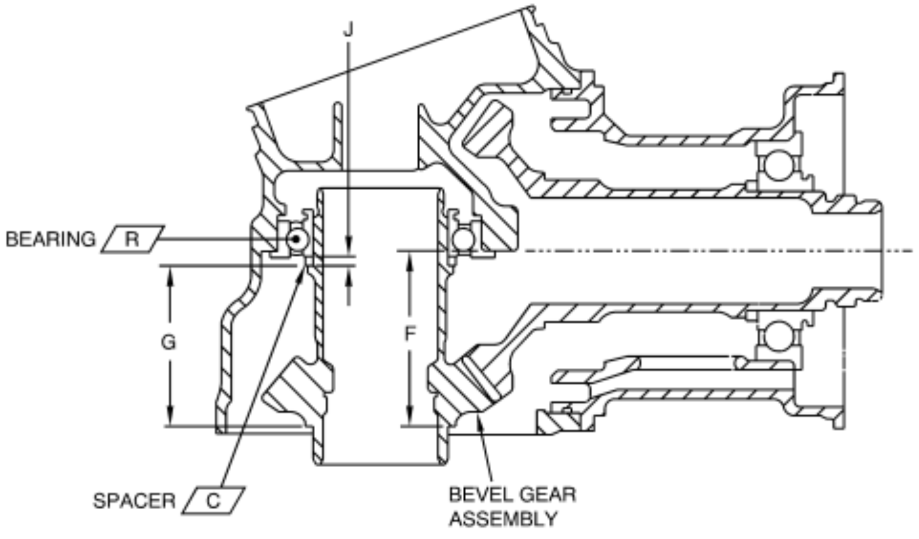
(2) Assemble angle gearbox bevel gearshaft assembly and gearbox driveshaft housing assembly. See Assembly-04 (Task 72-62-00-400-004).

(3) Assemble angle gearbox bevel gear assembly and angle gearbox housing assembly. See Assembly-05 (Task 72-62-00-400-005).

(4) Assemble angle gearbox. See Assembly-01 (Task 72-62-00-400-001).


ANGLE GEARBOX HOUSING ASSEMBLY
GEARBOX DRIVESHAFT HOUSING ASSEMBLY
GAGE PWA 85454
9
7
6
5
P
1
14
4

VIEW WITH TOOL INSTALLED

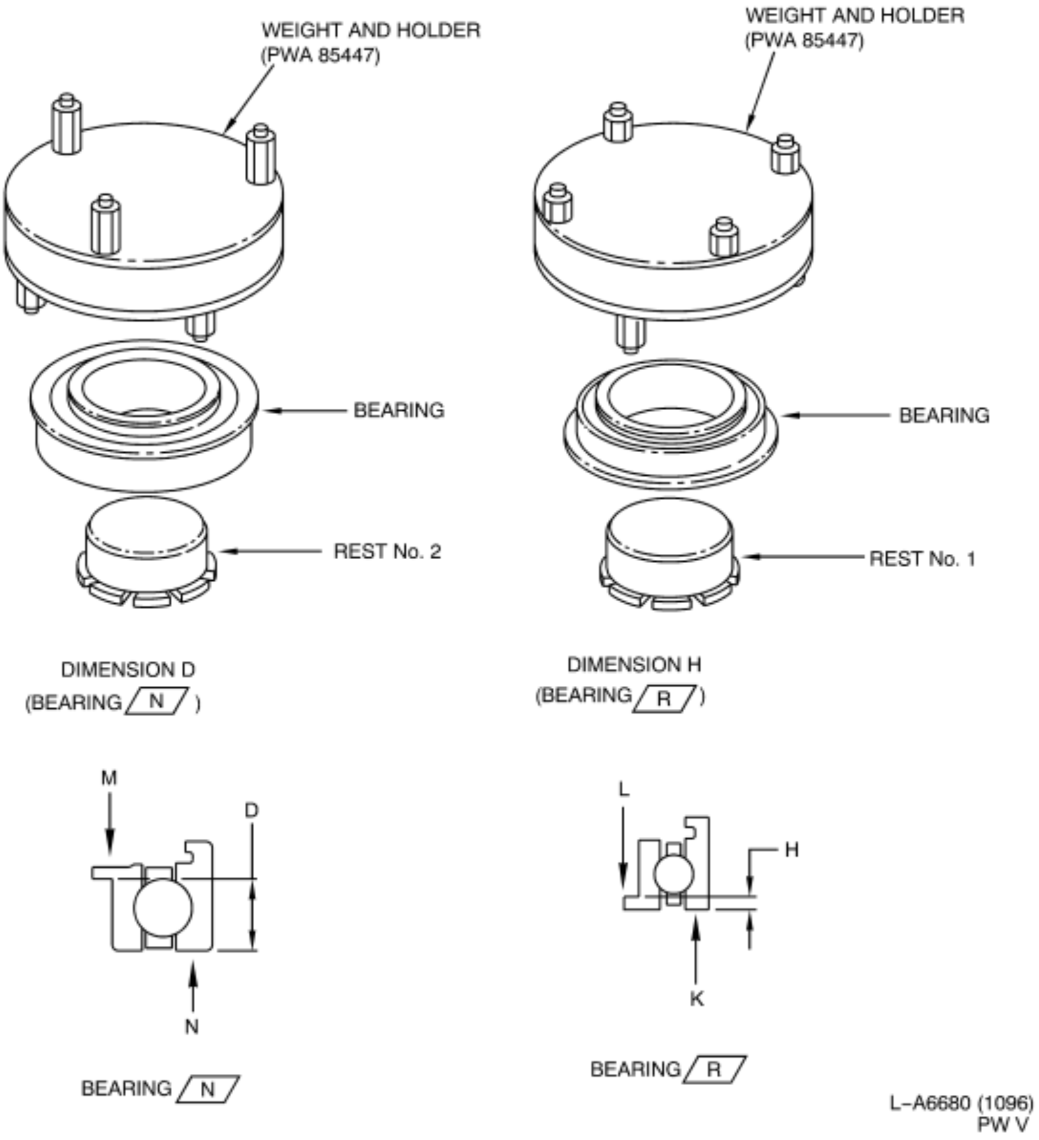

J
BEARING
R
G
F
SPACER
C
BEVEL GEAR ASSEMBLY

VIEW WITH GEARS INSTALLED

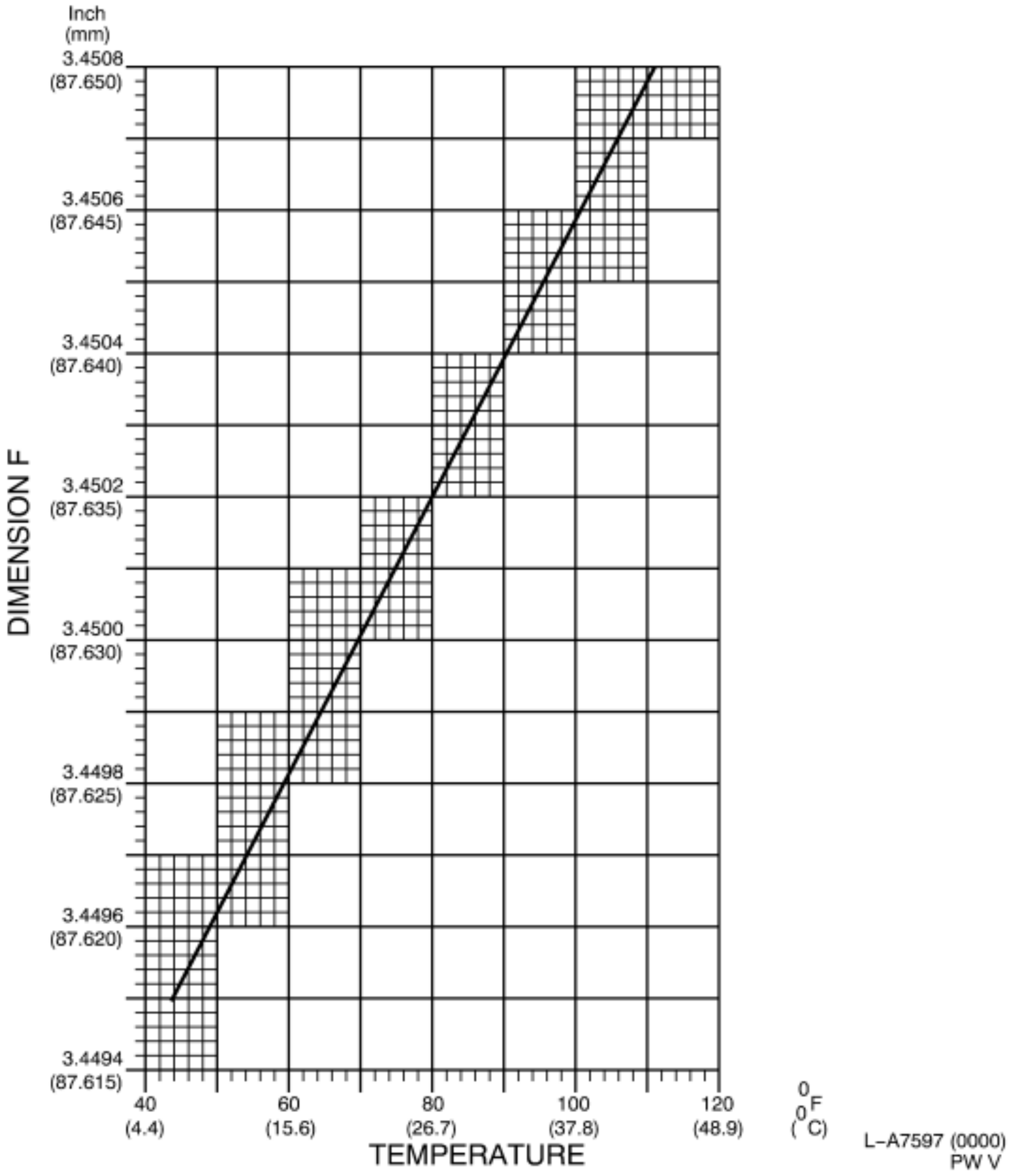
L−B4297 (1096)
PW V

Determine Spacer C
Figure 1001
(Task 72−62−00−400−002)

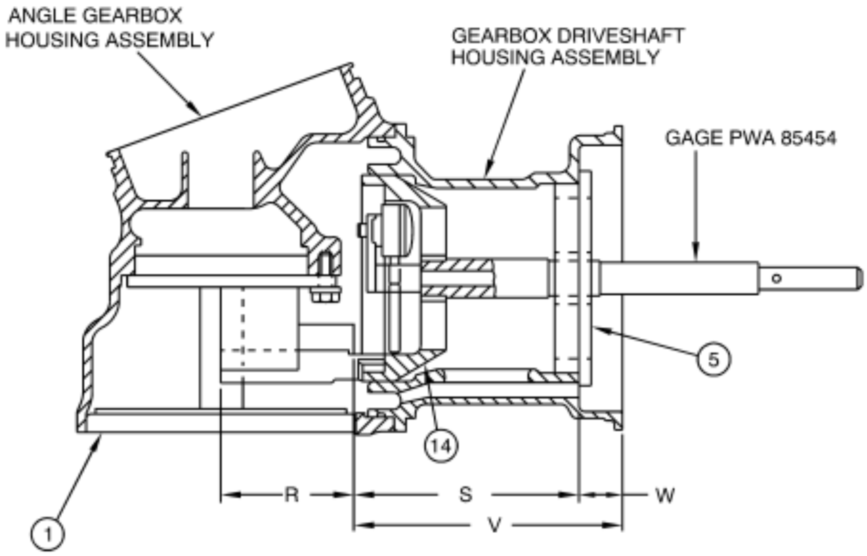
ANGLE GEARBOX - ASSEMBLY-02


WEIGHT AND HOLDER
(PWA 85447)
BEARING
REST No. 2
DIMENSION D
(BEARING N)
M
D
N
BEARING N
WEIGHT AND HOLDER
(PWA 85447)
BEARING
REST No. 1
DIMENSION H
(BEARING R)
L
H
K
BEARING R
L-A6680 (1096)
PW V

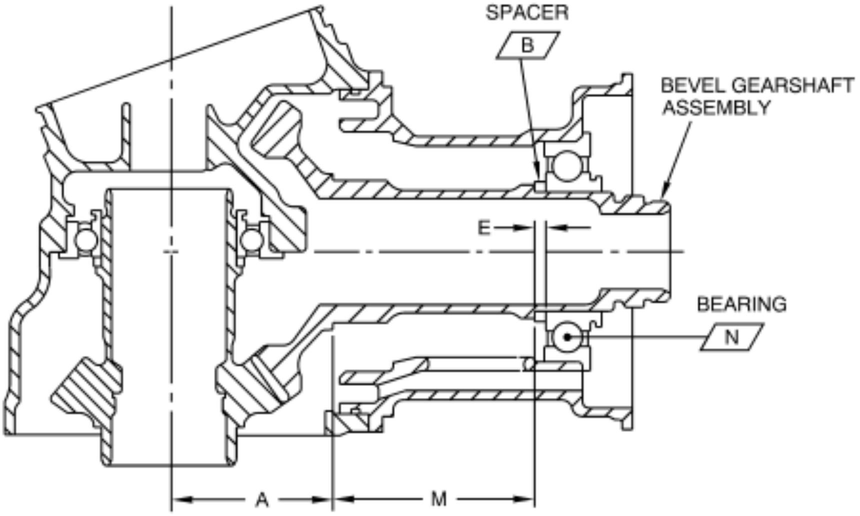
Use PWA 85447
Figure 1002
(Task 72-62-00-400-002)



Temperature Conversion Chart For Dimension F
Figure 1003
(Task 72−62−00−400−002)


ANGLE GEARBOX HOUSING ASSEMBLY
GEARBOX DRIVESHAFT HOUSING ASSEMBLY
GAGE PWA 85454
5
14
1
R
S
W
V

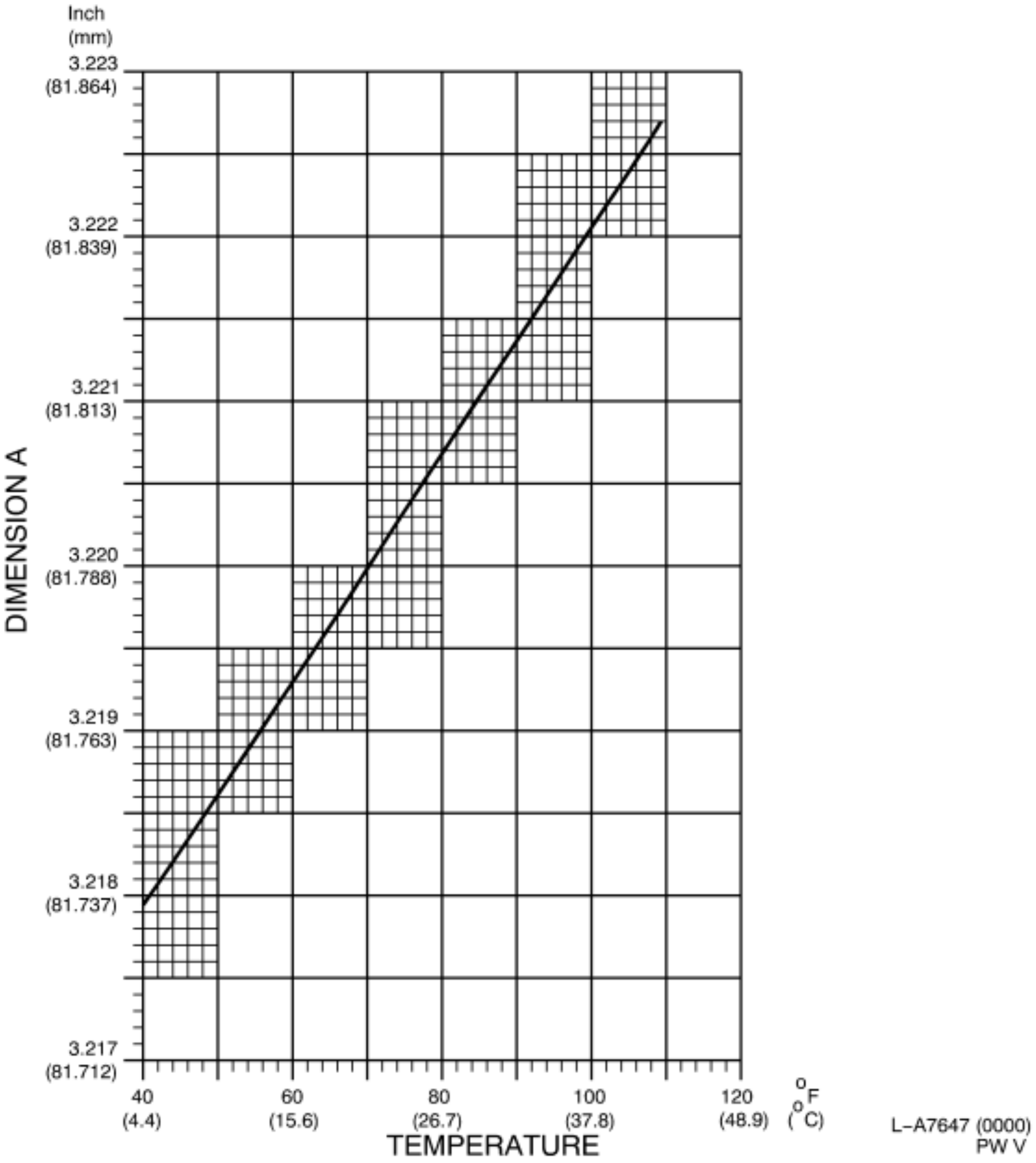
VIEW WITH TOOL INSTALLED


SPACER
B
BEVEL GEARSHAFT ASSEMBLY
E
BEARING
N
A
M

VIEW WITH GEARS INSTALLED

L-B4298 (1096)
PW V

Determine Spacer B
Figure 1004
(Task 72-62-00-400-002)



Temperature Conversion Chart For Dimension A
Figure 1005
(Task 72−62−00−400−002)

ANGLE GEARBOX - ASSEMBLY-03

Task 72-62-00-400-003:

1. Assemble Cover, Bearing And Baffle

A. Equipment And Materials Necessary

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
R	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	4	72-62-00/3/170
Packing	1	72-62-00/3/100
Packing	1	72-62-00/3/190

B. Procedure
See Figure 1001.

Subtask 72-62-00-430-051:

(1) Put the cover assembly on a bench, packing groove up.

(2) Put the bearing outer race in the cover assembly.

(3) Put the baffle on the bearing outer race. Refer to the referenced figure for correct orientation of the baffle.

(4) Attach the baffle and bearing outer race to the cover assembly.

R (a) Apply Antiseize Paste P06-054 to four bolts. Wipe
R off unwanted paste.

(b) Attach the baffle and bearing to the cover assembly with four key washers and the four bolts.

(c) Tighten and torque the bolts to 62 - 72 lb-in. (7.005 - 8.135 N.m). Bend the tabs of the key washers.

(5) Apply Engine Oil P03-001 to a packing. Install the packing in the groove in the cover assembly.

(6) Attach the packing cover to the cover assembly.

  (a) Apply Engine Oil P03−001 to a packing.

  (b) Put the packing in the groove of the packing cover.

R R (c) Apply Antiseize Paste P06−054 to two bolts. Wipe off unwanted paste.

  (d) Attach the packing cover to the cover assembly with two washers and the two bolts. Tighten and torque the bolts to 62 − 72 lb−in. (7.005 − 8.135 N.m).

(7) Put a cover over the assembly to protect it until you install it.

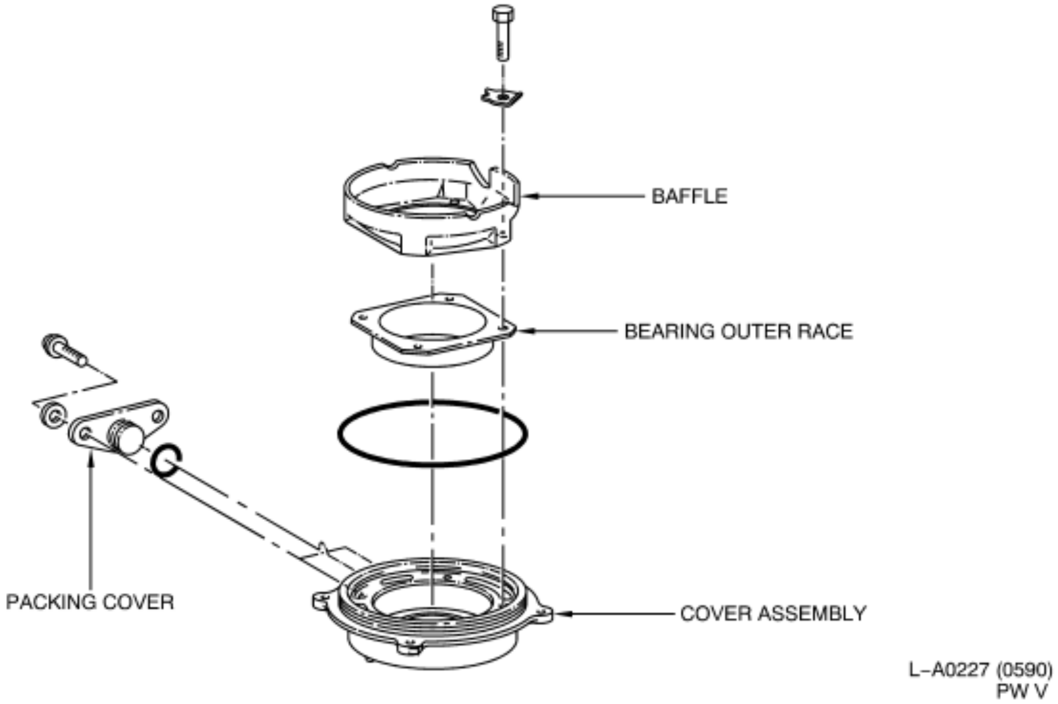
C. Postrequisites

(1) Assemble angle gearbox bevel gearshaft assembly and gearbox driveshaft housing assembly. See Assembly−04 (Task 72−62−00−400−004).

(2) Assemble angle gearbox bevel gear assembly and angle gearbox housing assembly. See Assembly−05 (Task 72−62−00−400−005).

(3) Assemble angle gearbox. See Assembly−01 (Task 72−62−00−400−001).

ANGLE GEARBOX - ASSEMBLY-03


BAFFLE
BEARING OUTER RACE
PACKING COVER
COVER ASSEMBLY
L-A0227 (0590)
PW V

Cover, Bearing, And Baffle Assembly
Figure 1001
(Task 72-62-00-400-003)

Previous Pageblock Return to Previous Menu Next Pageblock

ANGLE GEARBOX - ASSEMBLY-04

Task 72-62-00-400-004:

1. Assemble Angle Gearbox Bevel Gearshaft Assembly And Gearbox Driveshaft housing Assembly.

A. Prerequisites

(1) Determine spacer thickness. See Assembly-02 (Task 72-62-00-400-002).

B. Equipment And Materials Necessary

Special Tools:
PWA 85413 Base
PWA 85414 Wrench
PWA 85424 Drift
PWA 85924 Drift

Consumable Materials:

	Item No.	Designation
	P03-001	Oil, Engine (PWA 521B)
R	P06-054	Paste, Antiseize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	1	72-62-00/4/100
Key Washer	2	72-62-00/4/150
Key Washer	2	72-62-00/4/160
Packing	1	72-62-00/4/120

C. Procedure
See Figure 1001.

Subtask 72-62-00-430-052:

(1) Place driveshaft housing (1001/1) on bench with the bolt hole flange up. Insert roller bearing outer race (1001/2) into housing, aligning bolt holes.

R (2) Install four bolts, threads lubricated with Antiseize
R Paste P06-054, to secure bearing. Wipe off unwanted
R paste. Tighten and torque bolts to 62 - 72 lb-in.
(7.005 - 8.135 N.m). Bend tabs of key washer to secure bolts.

NOTE: Place key washers so that they are horizontal in flight position.

(3) Trunnion housing so that the bolt hole flange is down. Install ball bearing and outer race (1001/3) into housing, aligning bolt holes.

R (4) Install four bolts, threads lubricated with Antiseize
R Paste P06-054, with key washers to secure bearing.
R Wipe off unwanted paste. Tighten and torque bolts to
62 - 72 lb-in. (7.005 - 8.135 N.m).

Subtask 72-62-00-430-053:

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER GEARSHAFT. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 72-278.

(5) Place bevel gear (1001/7) on PWA 85413 Base, gear teeth down.

(6) Install the roller bearing inner race (1001/6) onto bevel gear, mating number down. Using PWA 85424 Drift with arbor press, push bearing down to seat on gear shoulder.

(7) Install spacer (1001/5) over gear to rest on shoulder.

NOTE: Spacer thickness should have been previously determined per Assembly-02 (Task 72-62-00-400-002).

(8) Install ball bearing inner race front (1001/4) over shaft to rest against spacer. Use PWA 85924 Drift with arbor press to seat race.

(9) Position housing and bearing over bevel gear and slowly engage bearings.

(10) Install ball bearing inner race rear (1001/11), puller groove up, over bevel gear and, using PWA 85924 Drift with arbor press, seat the inner race.

Subtask 72-62-00-430-054:

(11) Install coupling (1001/10), engaging splines of coupling with splines on gear.

(12) Install key washer (1001/8) and nut (1001/9) to retain coupling. Using PWA 85414 Wrench, torque nut to 2800 - 3000 lb-in. (316.357 - 338.955 N.m) using standard torque wrench. Loosen to zero. Retorque nut to 2800 - 3000 lb-in. (316.357 - 338.955 N.m). Bend key washer tabs.

(13) Install packing, lubricated with Engine Oil P03-001, to groove in housing.

(14) Cover the assembly until needed for angle gearbox assembly.

D. Postrequisites

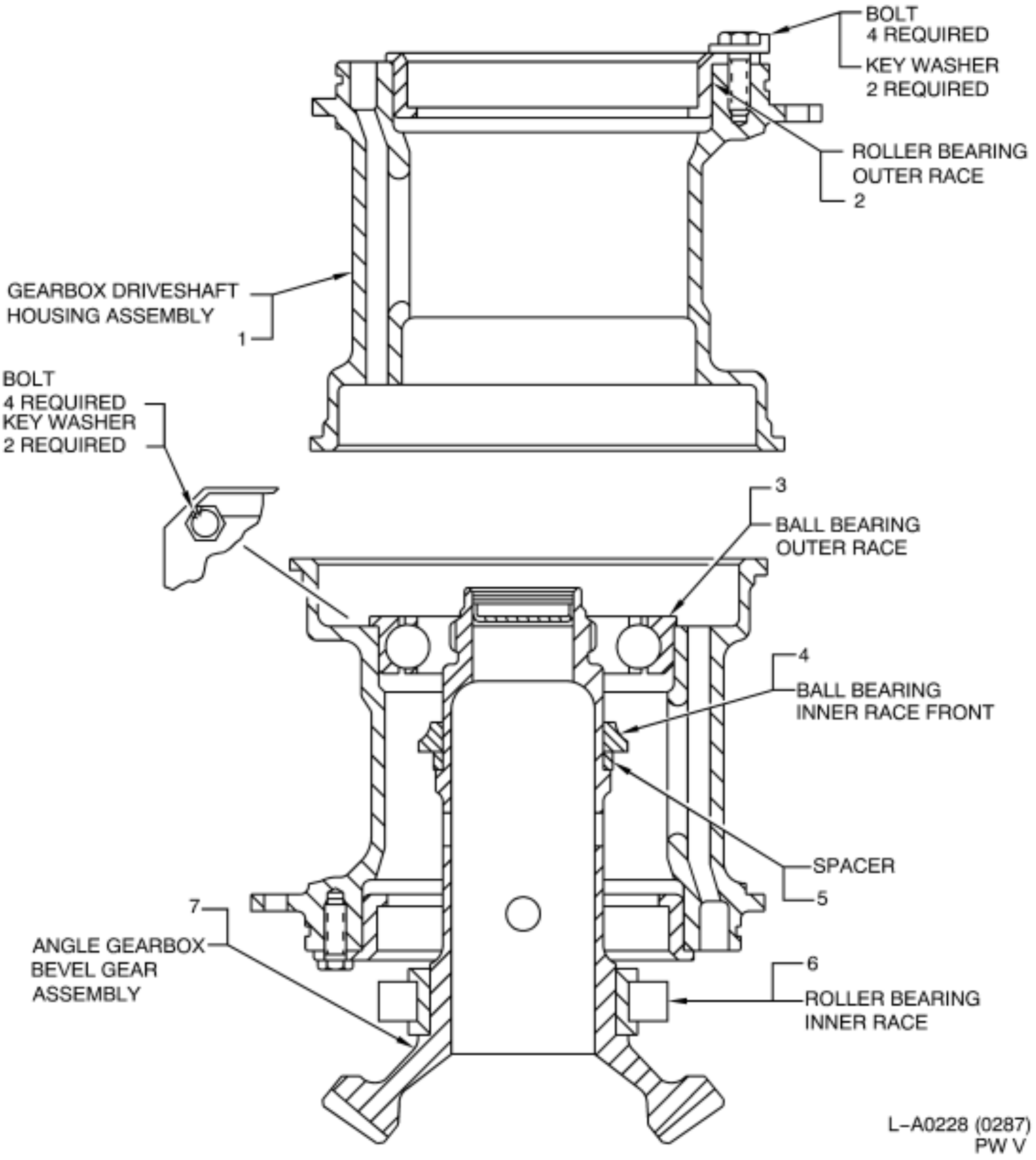
(1) Determine angle gearbox spacers. See Assembly-02 (Task 72-62-00-400-002).

(2) Assemble cover, bearing and baffle. See Assembly-03 (Task 72-62-00-400-003).

(3) Assemble angle gearbox bevel gear assembly and angle gearbox housing assembly. See Assembly-05 (Task 72-62-00-400-005).

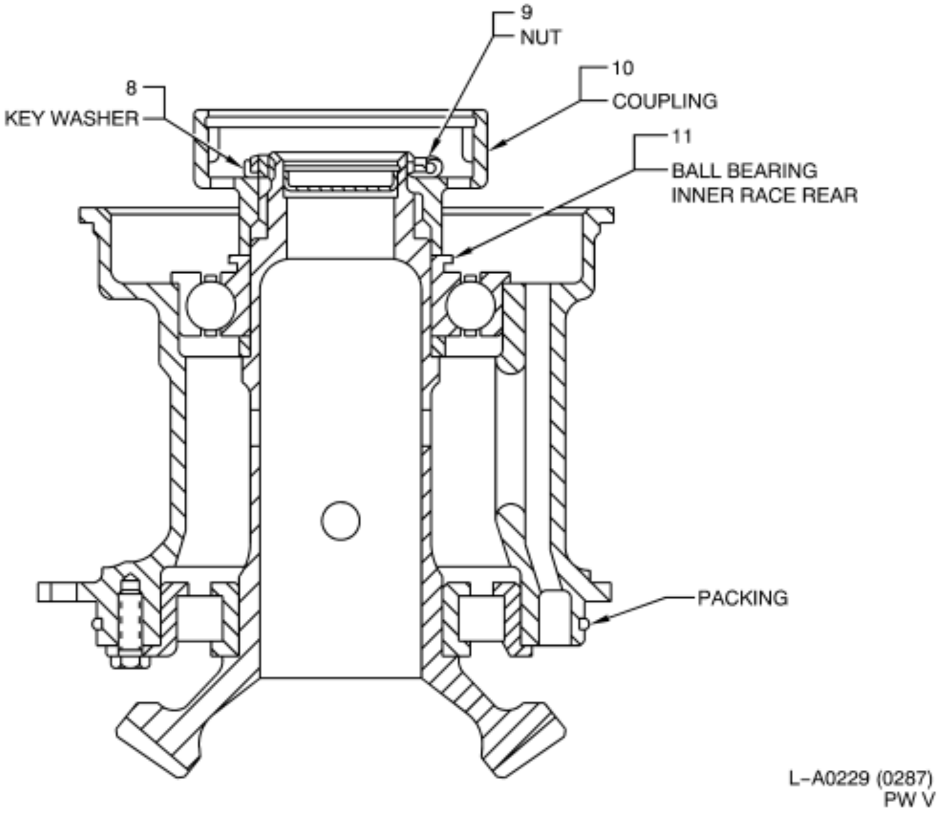
(4) Assemble angle gearbox. See Assembly-01 (Task 72-62-00-400-001).

ANGLE GEARBOX − ASSEMBLY−04


BOLT
4 REQUIRED
KEY WASHER
2 REQUIRED
ROLLER BEARING
OUTER RACE
2
GEARBOX DRIVESHAFT
HOUSING ASSEMBLY
1
BOLT
4 REQUIRED
KEY WASHER
2 REQUIRED
3
BALL BEARING
OUTER RACE
4
BALL BEARING
INNER RACE FRONT
SPACER
5
7
ANGLE GEARBOX
BEVEL GEAR
ASSEMBLY
6
ROLLER BEARING
INNER RACE
L−A0228 (0287)
PW V

Bevel Gear And Driveshaft Housing Assembly
Figure 1001 (Sheet 1)
(Task 72−62−00−400−004)

ANGLE GEARBOX − ASSEMBLY−04


9
NUT
10
COUPLING
8
KEY WASHER
11
BALL BEARING
INNER RACE REAR
PACKING
L−A0229 (0287)
PW V

Bevel Gear And Driveshaft Housing Assembly
Figure 1001 (Sheet 2)
(Task 72−62−00−400−004)

Task 72-62-00-400-005:

1. Assemble Angle Gearbox Bevel Gear Assembly And Angle Gearbox Housing Assembly

A. Prerequisites

(1) Determine spacer thickness. See Assembly-02 Task 72-62-00-400-002.

B. Equipment And Materials Required

Special Tools:

PWA 21500	Adapter
PWA 85417	Base
PWA 85418	Wrench
PWA 85423	Drift

Consumable Materials:

	Item No.	Designation
R	P05-232	Crayon, Metal Marking (PMC 4058)
	P06-054	Paste, Anti-seize (PWA 36246)

Expendable Parts:

PART NAME	QUANTITY	PARTS CATALOG REFERENCE SECTION/FIGURE/ITEM
Key Washer	1	72-62-00/3/30
Key Washer	1	72-62-00/3/180

C. Procedure
See Figure 1001.

Subtask 72-62-00-430-055:

(1) Attach PWA 21500 Adapter to a workbench. Attach PWA 85417 Base to the adapter.

CAUTION: BE SURE TO USE THE CORRECT PART NUMBER GEAR. INTERCHANGEABILITY IS AFFECTED. REFER TO SB PW4ENG 72-278.

(2) Place angle gearbox bevel gear assembly (1001/2) on the base, gearteeth up. Install inner race and rollers (1001/1) to gear. Using PWA 85423 Drift and arbor press, seat bearing against gear shoulder.

Subtask 72-62-00-430-056:

(3) Turn gear and bearing to gearteeth down. Install spacer (1001/5) over shaft to rest on gear shoulder.

NOTE: Spacer thickness should have been previously determined by Assembly-02 (Task 72-62-00-400-002).

(4) Install bottom inner race of ball bearing (1001/6) to rest against spacer. Use PWA 85423 Drift and an arbor press to seat race. Install outer race and balls to rest on just installed inner race. Install upper inner race (puller groove up) and using PWA 85423 Drift and an arbor press seat race on bearing.

(5) Install the key washer (1001/4) and nut (1001/3) to retain the bearing. Make a mark on the key washer and a mark on the bevel gear assembly in line with each other with a Metal Marking Crayon P05-232. With PWA 85418 Wrench torque the nut (1001/3) to 1280 - 1920 lb-in. (144.621 - 216.931 N.m). Loosen to zero. Torque the nut (1001/3) again to 1280 - 1920 lb-in. (144.621 - 261.931 N.m), then turn 14 - 18 degree angle of turn with a standard torque wrench. Make sure the crayon marks are aligned.

(a) If the crayon marks do not align, loosen the nut and install a new key washer and do the torque procedure again.

(b) If the marks are aligned, make two dimples, 180 degrees apart, in the side of the key washer (1001/4) with a round bottom drift. Make sure the dimples extend into the wrench slots of the nut. Refer to Section 70-53-00 in the Standard Practices Manual, PN 585005.

Subtask 72-62-00-430-057:

(6) Place angle gearbox housing assembly on bench bottom end up.

(7) Install bevel gear and bearings into housing aligning bolt holes in bearing flange with holes in housing.

ANGLE GEARBOX - ASSEMBLY-05

(8) Install three bolts, threads lubricated with Antiseize Paste P06-054, with key washer to secure bearing to housing. Wipe off unwanted paste. Tighten and torque bolts 125 - 140 lb-in. (14.123 - 15.818 N.m). Bend tabs of key washer to secure bolts.

NOTE: Place center bolt of key washer facing rearward.

(9) Cover assembly until needed for angle gearbox assembly.

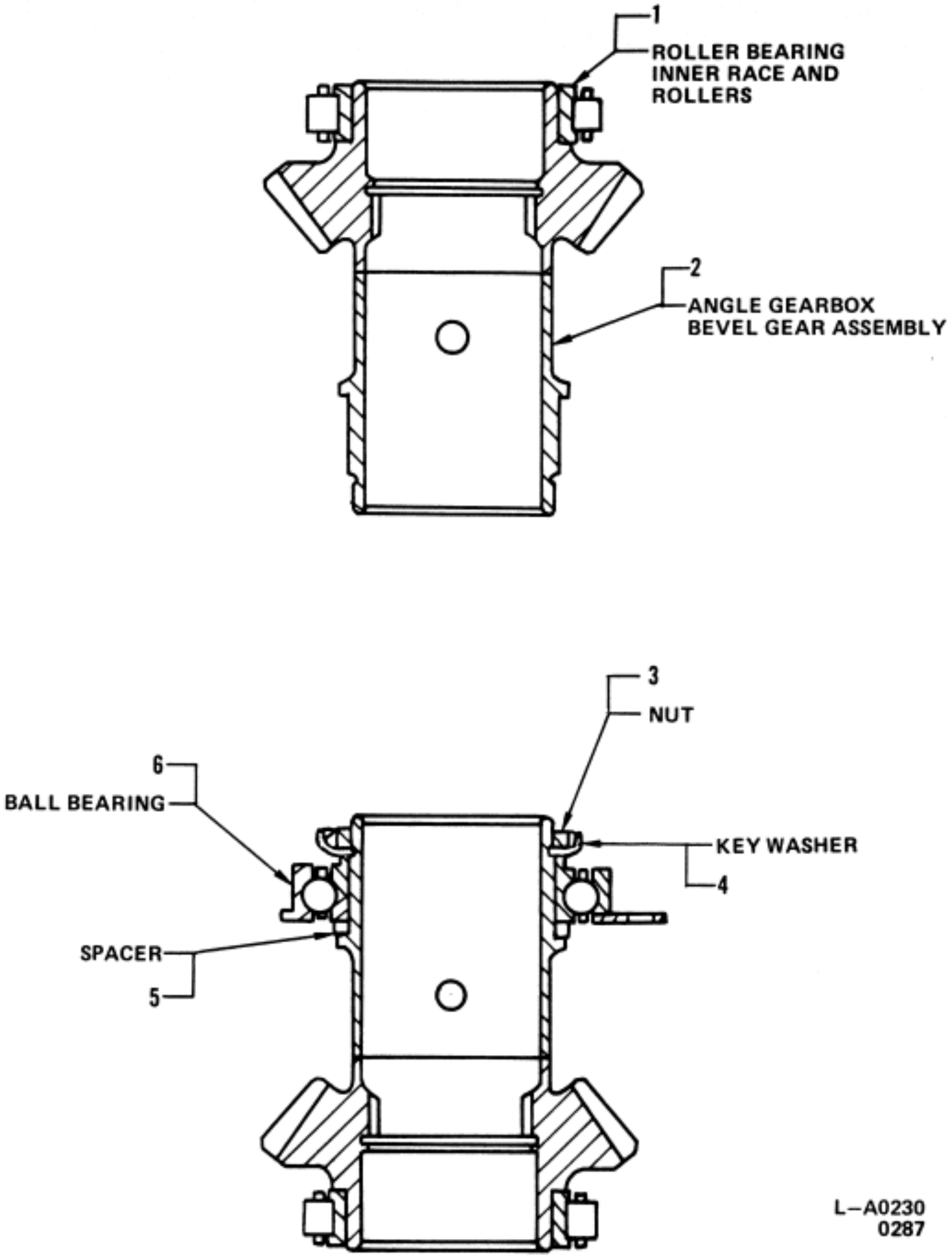
D. Postrequisites

(1) Determine angle gearbox spacers. See Assembly-02 Task 72-62-00-400-002.

(2) Assemble cover, bearing and baffle. See Assembly-03 Task 72-62-00-400-003.

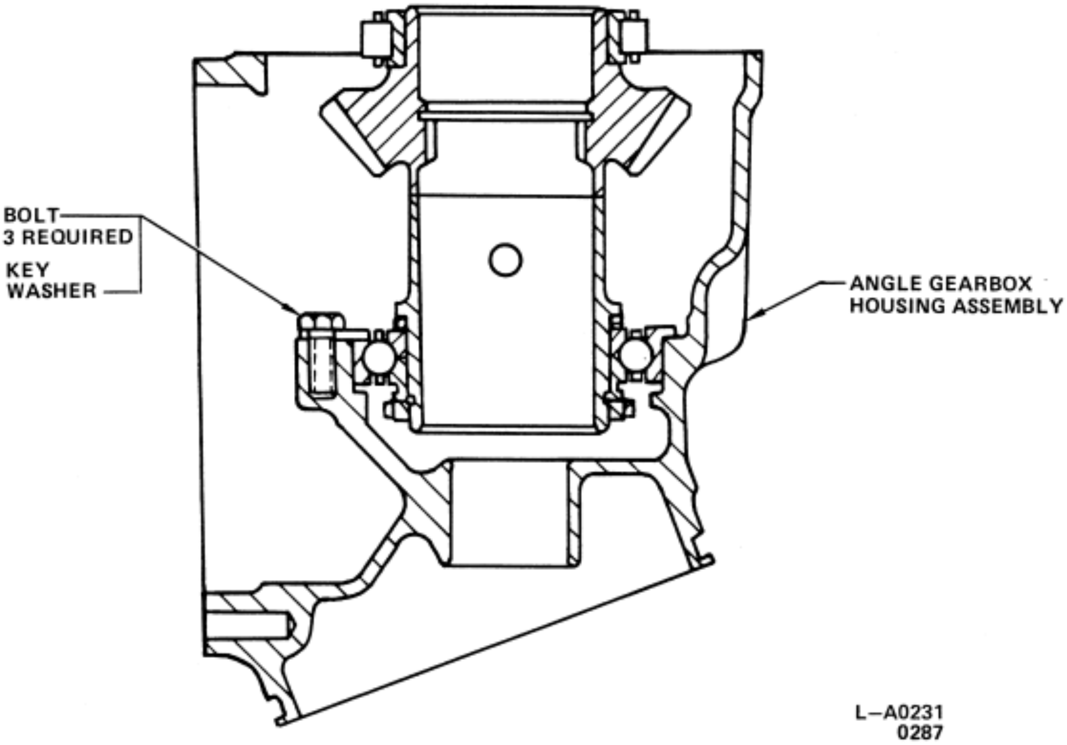
(3) Assemble angle gearbox bevel gearshaft assembly and gearbox driveshaft housing assembly. See Assembly-04 Task 72-62-00-400-004.

(4) Assemble angle gearbox. See Assembly-01 Task 72-62-00-400-001 .


1
ROLLER BEARING INNER RACE AND ROLLERS
2
ANGLE GEARBOX BEVEL GEAR ASSEMBLY
3
NUT
6
BALL BEARING
KEY WASHER
4
SPACER
5
L-A0230
0287

Bevel Gear Assembly And Housing Assembly
Figure 1001 (Sheet 1)
(Task 72-62-00-400-005)

ANGLE GEARBOX − ASSEMBLY−05


BOLT
3 REQUIRED
KEY
WASHER
ANGLE GEARBOX
HOUSING ASSEMBLY
L−A0231
0287

Bevel Gear Assembly And Housing Assembly
Figure 1001 (Sheet 2)
(Task 72−62−00−400−005)

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Pratt & Whitney

PW4000 SERIES ENGINE MANUAL (PN 50A443)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

Tab Separator - Angle Gearbox

List of Effective Pages - Angle Gearbox
See end of list.

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		1007/1008		MAR 15/98
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		1004		DEC 15/05
		1005		DEC 15/05
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		1007		DEC 15/05
		1008		DEC 15/05
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		1003		DEC 15/05
		1004		DEC 15/05
		1005/1006		DEC 15/05
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		1004		DEC 15/05
		1005/1006		JUN 15/99

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TO: RECIPIENTS OF PW4152, PW4152-3, PW4156A, PW4156A-3,
PW4158, PW4158-3 ENGINE MANUAL, PART NUMBER 50A443

REVISION NO. 83 DATED MAY 1, 2007

HIGHLIGHTS - ANGLE GEARBOX

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
72-62-00 ASSEMBLY-05	1001 -1002	Changed P05-023 Crayon to P05-232 Metal Marking Crayon. (PSAF06KC844) Corrected Task Reference and Section numbers. (Editorial)	ALL

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CHAPTER 72

ANGLE GEARBOX

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